West Virginia
Purchasing Division
2019 Washington Street, East
Charleston, WV 25305
Telephone: 304-558-2306
General Fax: 304-558-6026
Bid Fax: 304-558-3970

The following documentation is an electronically-submitted vendor response to an advertised solicitation from the *West Virginia Purchasing Bulletin* within the Vendor Self-Service portal at *wvOASIS.gov*. As part of the State of West Virginia's procurement process, and to maintain the transparency of the bid-opening process, this documentation submitted online is publicly posted by the West Virginia Purchasing Division at *WVPurchasing.gov* with any other vendor responses to this solicitation submitted to the Purchasing Division in hard copy format.

wvOASIS

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Welcome, Lu Anne Cottrill

Procurement | Budgeting | Accounts Receivable | Accounts Payable

Solicitation Response(SR) | **Dept:** 0313 | **ID:** ESR07282000000000481 | **Ver.:** 1 | **Function:** New | **Phase:** Final | **Modified by** batch , 07/29/2020

Header 1

List View

General Information | Contact | Default Values | Discount | Document Information

Procurement Folder:	713506	**SO Doc Code:**	CRFQ
Procurement Type:	Central Master Agreement	**SO Dept:**	0313
Vendor ID:	VS0000027265	**SO Doc ID:**	DEP2100000002
Legal Name:	Christina Traynor	**Published Date:**	7/14/20
Alias/DBA:	Environmental Risk Solutions LLC	**Close Date:**	7/29/20
Total Bid:	$66,500.00	**Close Time:**	13:30
Response Date:	07/28/2020	**Status:**	Closed
Response Time:	15:11	**Solicitation Description:**	Open-end contract for Environmental Risk Assessment
		Total of Header Attachments:	1
		Total of All Attachments:	1

	Purchasing Division 2019 Washington Street East Post Office Box 50130 Charleston, WV 25305-0130	**State of West Virginia** **Solicitation Response**

Proc Folder : 713506

Solicitation Description : Open-end contract for Environmental Risk Assessment

Proc Type : Central Master Agreement

Date issued	Solicitation Closes	Solicitation Response	Version
	2020-07-29 13:30:00	SR 0313 ESR07282000000000481	1

VENDOR

VS0000027265

Christina Traynor

Environmental Risk Solutions LLC

Solicitation Number: CRFQ 0313 DEP2100000002

Total Bid : $66,500.00 **Response Date:** 2020-07-28 **Response Time:** 15:11:46

Comments:

FOR INFORMATION CONTACT THE BUYER

Joseph E Hager III

(304) 558-2306

joseph.e.hageriii@wv.gov

Signature on File	FEIN #	DATE

All offers subject to all terms and conditions contained in this solicitation

Line	Comm Ln Desc	Qty	Unit Issue	Unit Price	Ln Total Or Contract Amount
1	Risk or hazard assessment	700.00000	HOUR	$95.000000	$66,500.00

Comm Code	Manufacturer	Specification	Model #
77101501			

Extended Description : Environmental Risk Assessor Open end contract for service, bid sheet represents an estimated number of hours for bidding purposes to establish a contracted set price per hour.

Comments: Delivery days assumes an average of 30 days to provide review services on a specific project.

ENVIRONMENTAL RISK SOLUTIONS

324 Ivy Drive
Gibsonia, PA 15044
412-445-0247

July 28, 2020

Mr. Joseph E. Hager III
West Virginia State Purchasing Division
2019 Washington Street East
P.O. Box 50130
Charleston, WV 25305

REGARDING: SOLICITATION NO. CRFQ 0313 DEP2100000002
OPEN-END CONTRACT FOR ENVIRONMENTAL RISK ASSESSMENT

Dear Mr. Hager:

Environmental Risk Solutions, LLC (ERS) is pleased to provide this quotation for the open-end Contract for Environmental Risk Assessment for the West Virginia Department of Environmental Protection (WVDEP).

Although ERS is a relatively new firm, its personnel have many years of experience conducting human health and ecological risk assessments for clients in the State of West Virginia, as well as experience under multiple other state and federal programs. Our risk assessors were previously employed by RBR Consulting, Inc., which terminated operations in November 2019.

The attached bid package includes the completed Request for Quotation (RFQ) No. CRFQ 0313 DEP2100000002, including:

- Pricing Page
- Purchasing Affidavit (notarized)
- Certificate of Insurance
- Vendor Registration and Disclosure Statement and Small, Women- and Minority-Owned Business Certification Application
- Risk Assessor Resumes
- Example Risk Assessments

I would like to note that two example risk assessments are provided; one recently completed by ERS and approved without comment by the Pennsylvania Department of Environmental Protection (PADEP). The second example report was completed by RBR Consulting, Inc.; however, it represents a work product completed by the same risk assessors and illustrates our experience with human health and ecological risk assessment under West Virginia's Voluntary Remediation Program.

ERS | ENVIRONMENTAL RISK SOLUTIONS

We appreciate the opportunity to provide our consulting services to the Department. Please do not hesitate to contact me at 412-445-0247 with any questions.

Best Regards,

Christina Traynor

Christina Traynor
Owner / Principal Scientist

Attachments

Purchasing Divison
2019 Washington Street East
Post Office Box 50130
Charleston, WV 25305-0130

State of West Virginia
Request for Quotation
10 — Consulting

Proc Folder: 713506

Doc Description: Open-end contract for Environmental Risk Assessment

Proc Type: Central Master Agreement

Date Issued	Solicitation Closes	Solicitation No	Version
2020-07-14	2020-07-29 13:30:00	CRFQ 0313 DEP2100000002	1

BID RECEIVING LOCATION

BID CLERK
DEPARTMENT OF ADMINISTRATION
PURCHASING DIVISION
2019 WASHINGTON ST E
CHARLESTON WV 25305
US

VENDOR

Vendor Name, Address and Telephone Number:

Christina Traynor
Environmental Risk Solutions LLC
324 Ivy Drive
Gibsonia, PA. 15044
412-445-0247

FOR INFORMATION CONTACT THE BUYER

Joseph E Hager III
(304) 558-2306
joseph.e.hageriii@wv.gov

Signature X Christina Traynor FEIN # **84-3624090** DATE **July 28, 2020**

All offers subject to all terms and conditions contained in this solicitation

FORM ID : WV-PRC-CRFQ-001

ADDITIONAL INFORMATION:

Request for Quotation

The West Virginia Purchasing Division is soliciting bids on behalf of the West Virginia Department of Environmental Protection to establish an open-end contract for an Environmental Risk Assessor to determine ecological and human health risks that may be associated with projects managed by WVDEP.

INVOICE TO	SHIP TO
ENVIRONMENTAL PROTECTION OFFICE OF ENVIRONMENTAL REMEDIATION 601 57TH ST SE CHARLESTON WV25304 US	ENVIRONMENTAL PROTECTION 601 57TH ST CHARLESTON WV 25304 US

Line	Comm Ln Desc	Qty	Unit Issue	Unit Price	Total Price
1	Risk or hazard assessment	700.00000	HOUR	**$95.00**	**$66,500.00**

Comm Code	Manufacturer	Specification	Model #
77101501			

Extended Description :

Environmental Risk Assessor Open end contract for service, bid sheet represents an estimated number of hours for bidding purposes to establish a contracted set price per hour.

INSTRUCTIONS TO VENDORS SUBMITTING BIDS

1. REVIEW DOCUMENTS THOROUGHLY: The attached documents contain a solicitation for bids. Please read these instructions and all documents attached in their entirety. These instructions provide critical information about requirements that if overlooked could lead to disqualification of a Vendor's bid. All bids must be submitted in accordance with the provisions contained in these instructions and the Solicitation. Failure to do so may result in disqualification of Vendor's bid.

2. MANDATORY TERMS: The Solicitation may contain mandatory provisions identified by the use of the words "must," "will," and "shall." Failure to comply with a mandatory term in the Solicitation will result in bid disqualification.

3. PREBID MEETING: The item identified below shall apply to this Solicitation.

☑ A pre-bid meeting will not be held prior to bid opening

☐ A **MANDATORY PRE-BID** meeting will be held at the following place and time:

All Vendors submitting a bid must attend the mandatory pre-bid meeting. Failure to attend the mandatory pre-bid meeting shall result in disqualification of the Vendor's bid. No one individual is permitted to represent more than one vendor at the pre-bid meeting. Any individual that does attempt to represent two or more vendors will be required to select one vendor to which the individual's attendance will be attributed. The vendors not selected will be deemed to have not attended the pre-bid meeting unless another individual attended on their behalf.

An attendance sheet provided at the pre-bid meeting shall serve as the official document verifying attendance. Any person attending the pre-bid meeting on behalf of a Vendor must list on the attendance sheet his or her name and the name of the Vendor he or she is representing.

Additionally, the person attending the pre-bid meeting should include the Vendor's E-Mail address, phone number, and Fax number on the attendance sheet. It is the Vendor's responsibility to locate the attendance sheet and provide the required information. Failure to complete the attendance sheet as required may result in disqualification of Vendor's bid.

All Vendors should arrive prior to the starting time for the pre-bid. Vendors who arrive after the starting time but prior to the end of the pre-bid will be permitted to sign in but are charged with knowing all matters discussed at the pre-bid.

Questions submitted at least five business days prior to a scheduled pre-bid will be discussed at the pre-bid meeting if possible. Any discussions or answers to questions at the pre-bid meeting are preliminary in nature and are non-binding. Official and binding answers to questions will be published in a written addendum to the Solicitation prior to bid opening.

4. VENDOR QUESTION DEADLINE: Vendors may submit questions relating to this Solicitation to the Purchasing Division. Questions must be submitted in writing. All questions must be submitted on or before the date listed below and to the address listed below in order to be considered. A written response will be published in a Solicitation addendum if a response is possible and appropriate. Non-written discussions, conversations, or questions and answers regarding this Solicitation are preliminary in nature and are nonbinding.

Submitted e-mails should have solicitation number in the subject line.

Question Submission Deadline: 07/22/2020 @ 9:00 AM EST

Submit Questions to: Joseph Hager
2019 Washington Street, East
Charleston, WV 25305
Fax: (304) 558-4115 (Vendors should not use this fax number for bid submission)
Email: Joseph.E.HagerIII@wv.gov

5. VERBAL COMMUNICATION: Any verbal communication between the Vendor and any State personnel is not binding, including verbal communication at the mandatory pre-bid conference. Only information issued in writing and added to the Solicitation by an official written addendum by the Purchasing Division is binding.

6. BID SUBMISSION: All bids must be submitted electronically through wvOASIS or signed and delivered by the Vendor to the Purchasing Division at the address listed below on or before the date and time of the bid opening. Any bid received by the Purchasing Division staff is considered to be in the possession of the Purchasing Division and will not be returned for any reason. The Purchasing Division will not accept bids, modification of bids, or addendum acknowledgment forms via e-mail. Acceptable delivery methods include electronic submission via wvOASIS, hand delivery, delivery by courier, or facsimile.

The bid delivery address is:
Department of Administration, Purchasing Division
2019 Washington Street East
Charleston, WV 25305-0130

A bid that is not submitted electronically through wvOASIS should contain the information listed below on the face of the envelope or the bid may be rejected by the Purchasing Division.:

SEALED BID:
BUYER: Joseph Hager
SOLICITATION NO.:
BID OPENING DATE:
BID OPENING TIME: 1:30 PM EST
FAX NUMBER: 304-558-3970

The Purchasing Division may prohibit the submission of bids electronically through wvOASIS at its sole discretion. Such a prohibition will be contained and communicated in the wvOASIS system resulting in the Vendor's inability to submit bids through wvOASIS. Submission of a response to an Expression or Interest or Request for Proposal is not permitted in wvOASIS.

For Request For Proposal ("RFP") Responses Only: In the event that Vendor is responding to a request for proposal, the Vendor shall submit one original technical and one original cost proposal plus ________________convenience copies of each to the Purchasing Division at the address shown above. Additionally, the Vendor should identify the bid type as either a technical or cost proposal on the face of each bid envelope submitted in response to a request for proposal as follows:

BID TYPE: (This only applies to CRFP)
☐ Technical
☐ Cost

7. BID OPENING: Bids submitted in response to this Solicitation will be opened at the location identified below on the date and time listed below. Delivery of a bid after the bid opening date and time will result in bid disqualification. For purposes of this Solicitation, a bid is considered delivered when confirmation of delivery is provided by wvOASIS (in the case of electronic submission) or when the bid is time stamped by the official Purchasing Division time clock (in the case of hand delivery).

Bid Opening Date and Time: 07/29/2020 @ 1:30 PM EST

Bid Opening Location: Department of Administration, Purchasing Division
2019 Washington Street East
Charleston, WV 25305-0130

8. ADDENDUM ACKNOWLEDGEMENT: Changes or revisions to this Solicitation will be made by an official written addendum issued by the Purchasing Division. Vendor should acknowledge receipt of all addenda issued with this Solicitation by completing an Addendum Acknowledgment Form, a copy of which is included herewith. Failure to acknowledge addenda may result in bid disqualification. The addendum acknowledgement should be submitted with the bid to expedite document processing.

9. BID FORMATTING: Vendor should type or electronically enter the information onto its bid to prevent errors in the evaluation. Failure to type or electronically enter the information may result in bid disqualification.

10. ALTERNATE MODEL OR BRAND: Unless the box below is checked, any model, brand, or specification listed in this Solicitation establishes the acceptable level of quality only and is not intended to reflect a preference for, or in any way favor, a particular brand or vendor. Vendors may bid alternates to a listed model or brand provided that the alternate is at least equal to the model or brand and complies with the required specifications. The equality of any alternate being bid shall be determined by the State at its sole discretion. Any Vendor bidding an alternate model or brand should clearly identify the alternate items in its bid and should include manufacturer's specifications, industry literature, and/or any other relevant documentation demonstrating the equality of the alternate items. Failure to provide information for alternate items may be grounds for rejection of a Vendor's bid.

☐ This Solicitation is based upon a standardized commodity established under W. Va. Code § 5A-3-61. Vendors are expected to bid the standardized commodity identified. Failure to bid the standardized commodity will result in your firm's bid being rejected.

11. EXCEPTIONS AND CLARIFICATIONS: The Solicitation contains the specifications that shall form the basis of a contractual agreement. Vendor shall clearly mark any exceptions, clarifications, or other proposed modifications in its bid. Exceptions to, clarifications of, or modifications of a requirement or term and condition of the Solicitation may result in bid disqualification.

12. COMMUNICATION LIMITATIONS: In accordance with West Virginia Code of State Rules §148-1-6.6, communication with the State of West Virginia or any of its employees regarding this Solicitation during the solicitation, bid, evaluation or award periods, except through the Purchasing Division, is strictly prohibited without prior Purchasing Division approval. Purchasing Division approval for such communication is implied for all agency delegated and exempt purchases.

13. REGISTRATION: Prior to Contract award, the apparent successful Vendor must be properly registered with the West Virginia Purchasing Division and must have paid the $125 fee, if applicable.

14. UNIT PRICE: Unit prices shall prevail in cases of a discrepancy in the Vendor's bid.

15. PREFERENCE: Vendor Preference may be requested in purchases of motor vehicles or construction and maintenance equipment and machinery used in highway and other infrastructure projects. Any request for preference must be submitted in writing with the bid, must specifically identify the preference requested with reference to the applicable subsection of West Virginia Code § 5A-3-37, and must include with the bid any information necessary to evaluate and confirm the applicability of the requested preference. A request form to help facilitate the request can be found at: http://www.state.wv.us/admin/purchase/vrc/Venpref.pdf.

15A. RECIPROCAL PREFERENCE: The State of West Virginia applies a reciprocal preference to all solicitations for commodities and printing in accordance with W. Va. Code § 5A-3-37(b). In effect, non-resident vendors receiving a preference in their home states, will see that same preference granted to West Virginia resident vendors bidding against them in West Virginia. Any request for reciprocal preference must include with the bid any information necessary to evaluate and confirm the applicability of the preference. A request form to help facilitate the request can be found at: http://www.state.wv.us/admin/purchase/vrc/Venpref.pdf.

16. SMALL, WOMEN-OWNED, OR MINORITY-OWNED BUSINESSES: For any solicitations publicly advertised for bid, in accordance with West Virginia Code §5A-3-37(a)(7) and W. Va. CSR § 148-22-9, any non-resident vendor certified as a small, women-owned, or minority-owned business under W. Va. CSR § 148-22-9 shall be provided the same preference made available to any resident vendor. Any non-resident small, women-owned, or minority-owned business must identify itself as such in writing, must submit that writing to the Purchasing Division with its bid, and must be properly certified under W. Va. CSR § 148-22-9 prior to contract award to receive the preferences made available to resident vendors. Preference for a non-resident small, women-owned, or minority owned business shall be applied in accordance with W. Va. CSR § 148-22-9.

17. WAIVER OF MINOR IRREGULARITIES: The Director reserves the right to waive minor irregularities in bids or specifications in accordance with West Virginia Code of State Rules § 148-1-4.6.

18. ELECTRONIC FILE ACCESS RESTRICTIONS: Vendor must ensure that its submission in wvOASIS can be accessed and viewed by the Purchasing Division staff immediately upon bid opening. The Purchasing Division will consider any file that cannot be immediately accessed and viewed at the time of the bid opening (such as, encrypted files, password protected files, or incompatible files) to be blank or incomplete as context requires, and are therefore unacceptable. A vendor will not be permitted to unencrypt files, remove password protections, or resubmit documents after bid opening to make a file viewable if those documents are required with the bid. A Vendor may be required to provide document passwords or remove access restrictions to allow the Purchasing Division to print or electronically save documents provided that those documents are viewable by the Purchasing Division prior to obtaining the password or removing the access restriction.

19. NON-RESPONSIBLE: The Purchasing Division Director reserves the right to reject the bid of any vendor as Non-Responsible in accordance with W. Va. Code of State Rules § 148-1-5.3, when the Director determines that the vendor submitting the bid does not have the capability to fully perform, or lacks the integrity and reliability to assure good-faith performance."

20. ACCEPTANCE/REJECTION: The State may accept or reject any bid in whole, or in part in accordance with W. Va. Code of State Rules § 148-1-4.5. and § 148-1-6.4.b."

21. YOUR SUBMISSION IS A PUBLIC DOCUMENT: Vendor's entire response to the Solicitation and the resulting Contract are public documents. As public documents, they will be disclosed to the public following the bid/proposal opening or award of the contract, as required by the competitive bidding laws of West Virginia Code §§ 5A-3-1 et seq., 5-22-1 et seq., and 5G-1-1 et seq. and the Freedom of Information Act West Virginia Code §§ 29B-1-1 et seq.

DO NOT SUBMIT MATERIAL YOU CONSIDER TO BE CONFIDENTIAL, A TRADE SECRET, OR OTHERWISE NOT SUBJECT TO PUBLIC DISCLOSURE.

Submission of any bid, proposal, or other document to the Purchasing Division constitutes your explicit consent to the subsequent public disclosure of the bid, proposal, or document. The Purchasing Division will disclose any document labeled "confidential," "proprietary," "trade secret," "private," or labeled with any other claim against public disclosure of the documents, to include any "trade secrets" as defined by West Virginia Code § 47-22-1 et seq. All submissions are subject to public disclosure without notice.

22. INTERESTED PARTY DISCLOSURE: West Virginia Code § 6D-1-2 requires that the vendor submit to the Purchasing Division a disclosure of interested parties to the contract for all contracts with an actual or estimated value of at least $1 Million. That disclosure must occur on the form prescribed and approved by the WV Ethics Commission prior to contract award. A copy of that form is included with this solicitation or can be obtained from the WV Ethics Commission. This requirement does not apply to publicly traded companies listed on a national or international stock exchange. A more detailed definition of interested parties can be obtained from the form referenced above.

23. WITH THE BID REQUIREMENTS: In instances where these specifications require documentation or other information with the bid, and a vendor fails to provide it with the bid, the Director of the Purchasing Division reserves the right to request those items after bid opening and prior to contract award pursuant to the authority to waive minor irregularities in bids or specifications under W. Va. CSR § 148-1-4.6. This authority does not apply to instances where state law mandates receipt with the bid.

GENERAL TERMS AND CONDITIONS:

1. CONTRACTUAL AGREEMENT: Issuance of a Award Document signed by the Purchasing Division Director, or his designee, and approved as to form by the Attorney General's office constitutes acceptance of this Contract made by and between the State of West Virginia and the Vendor. Vendor's signature on its bid signifies Vendor's agreement to be bound by and accept the terms and conditions contained in this Contract.

2. DEFINITIONS: As used in this Solicitation/Contract, the following terms shall have the meanings attributed to them below. Additional definitions may be found in the specifications included with this Solicitation/Contract.

2.1. "Agency" or **"Agencies"** means the agency, board, commission, or other entity of the State of West Virginia that is identified on the first page of the Solicitation or any other public entity seeking to procure goods or services under this Contract.

2.2. "Bid" or **"Proposal"** means the vendors submitted response to this solicitation.

2.3. "Contract" means the binding agreement that is entered into between the State and the Vendor to provide the goods or services requested in the Solicitation.

2.4. "Director" means the Director of the West Virginia Department of Administration, Purchasing Division.

2.5. "Purchasing Division" means the West Virginia Department of Administration, Purchasing Division.

2.6. "Award Document" means the document signed by the Agency and the Purchasing Division, and approved as to form by the Attorney General, that identifies the Vendor as the contract holder.

2.7. "Solicitation" means the official notice of an opportunity to supply the State with goods or services that is published by the Purchasing Division.

2.8. "State" means the State of West Virginia and/or any of its agencies, commissions, boards, etc. as context requires.

2.9. "Vendor" or **"Vendors"** means any entity submitting a bid in response to the Solicitation, the entity that has been selected as the lowest responsible bidder, or the entity that has been awarded the Contract as context requires.

3. CONTRACT TERM; RENEWAL; EXTENSION: The term of this Contract shall be determined in accordance with the category that has been identified as applicable to this Contract below:

☑ **Term Contract**

Initial Contract Term: Initial Contract Term: This Contract becomes effective on Award and extends for a period of one (1) year(s).

Renewal Term: This Contract may be renewed upon the mutual written consent of the Agency, and the Vendor, with approval of the Purchasing Division and the Attorney General's office (Attorney General approval is as to form only). Any request for renewal should be delivered to the Agency and then submitted to the Purchasing Division thirty (30) days prior to the expiration date of the initial contract term or appropriate renewal term. A Contract renewal shall be in accordance with the terms and conditions of the original contract. Unless otherwise specified below, renewal of this Contract is limited to three (3) successive one (1) year periods or multiple renewal periods of less than one year, provided that the multiple renewal periods do not exceed the total number of months available in all renewal years combined. Automatic renewal of this Contract is prohibited. Renewals must be approved by the Vendor, Agency, Purchasing Division and Attorney General's office (Attorney General approval is as to form only)

> ☐ **Alternate Renewal Term** – This contract may be renewed for __________________ successive __________ year periods or shorter periods provided that they do not exceed the total number of months contained in all available renewals. Automatic renewal of this Contract is prohibited. Renewals must be approved by the Vendor, Agency, Purchasing Division and Attorney General's office (Attorney General approval is as to form only)

Delivery Order Limitations: In the event that this contract permits delivery orders, a delivery order may only be issued during the time this Contract is in effect. Any delivery order issued within one year of the expiration of this Contract shall be effective for one year from the date the delivery order is issued. No delivery order may be extended beyond one year after this Contract has expired.

☐ **Fixed Period Contract:** This Contract becomes effective upon Vendor's receipt of the notice to proceed and must be completed within ________________________days.

☐ **Fixed Period Contract with Renewals:** This Contract becomes effective upon Vendor's receipt of the notice to proceed and part of the Contract more fully described in the attached specifications must be completed within _________________ days. Upon completion of the work covered by the preceding sentence, the vendor agrees that maintenance, monitoring, or warranty services will be provided for ________________ year(s) thereafter.

☐ **One Time Purchase:** The term of this Contract shall run from the issuance of the Award Document until all of the goods contracted for have been delivered, but in no event will this Contract extend for more than one fiscal year.

☐ **Other:** See attached.

4. NOTICE TO PROCEED: Vendor shall begin performance of this Contract immediately upon receiving notice to proceed unless otherwise instructed by the Agency. Unless otherwise specified, the fully executed Award Document will be considered notice to proceed.

5. QUANTITIES: The quantities required under this Contract shall be determined in accordance with the category that has been identified as applicable to this Contract below.

☑ **Open End Contract:** Quantities listed in this Solicitation are approximations only, based on estimates supplied by the Agency. It is understood and agreed that the Contract shall cover the quantities actually ordered for delivery during the term of the Contract, whether more or less than the quantities shown.

☐ **Service:** The scope of the service to be provided will be more clearly defined in the specifications included herewith.

☐ **Combined Service and Goods:** The scope of the service and deliverable goods to be provided will be more clearly defined in the specifications included herewith.

☐ **One Time Purchase:** This Contract is for the purchase of a set quantity of goods that are identified in the specifications included herewith. Once those items have been delivered, no additional goods may be procured under this Contract without an appropriate change order approved by the Vendor, Agency, Purchasing Division, and Attorney General's office.

6. EMERGENCY PURCHASES: The Purchasing Division Director may authorize the Agency to purchase goods or services in the open market that Vendor would otherwise provide under this Contract if those goods or services are for immediate or expedited delivery in an emergency. Emergencies shall include, but are not limited to, delays in transportation or an unanticipated increase in the volume of work. An emergency purchase in the open market, approved by the Purchasing Division Director, shall not constitute of breach of this Contract and shall not entitle the Vendor to any form of compensation or damages. This provision does not excuse the State from fulfilling its obligations under a One Time Purchase contract.

7. REQUIRED DOCUMENTS: All of the items checked below must be provided to the Purchasing Division by the Vendor as specified below.

☐ **BID BOND (Construction Only):** Pursuant to the requirements contained in W. Va. Code § 5-22-1(c), All Vendors submitting a bid on a construction project shall furnish a valid bid bond in the amount of five percent (5%) of the total amount of the bid protecting the State of West Virginia. The bid bond must be submitted with the bid.

☐ **PERFORMANCE BOND:** The apparent successful Vendor shall provide a performance bond in the amount of 100% of the contract. The performance bond must be received by the Purchasing Division prior to Contract award.

☐ **LABOR/MATERIAL PAYMENT BOND:** The apparent successful Vendor shall provide a labor/material payment bond in the amount of 100% of the Contract value. The labor/material payment bond must be delivered to the Purchasing Division prior to Contract award.

In lieu of the Bid Bond, Performance Bond, and Labor/Material Payment Bond, the Vendor may provide certified checks, cashier's checks, or irrevocable letters of credit. Any certified check, cashier's check, or irrevocable letter of credit provided in lieu of a bond must be of the same amount and delivered on the same schedule as the bond it replaces. A letter of credit submitted in lieu of a performance and labor/material payment bond will only be allowed for projects under $100,000. Personal or business checks are not acceptable. Notwithstanding the foregoing, West Virginia Code § 5-22-1 (d) mandates that a vendor provide a performance and labor/material payment bond for construction projects. Accordingly, substitutions for the performance and labor/material payment bonds for construction projects is not permitted.

☐ **MAINTENANCE BOND:** The apparent successful Vendor shall provide a two (2) year maintenance bond covering the roofing system. The maintenance bond must be issued and delivered to the Purchasing Division prior to Contract award.

☐ **LICENSE(S) / CERTIFICATIONS / PERMITS:** In addition to anything required under the Section of the General Terms and Conditions entitled Licensing, the apparent successful Vendor shall furnish proof of the following licenses, certifications, and/or permits upon request and in a form acceptable to the State. The request may be prior to or after contract award at the State's sole discretion.

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The apparent successful Vendor shall also furnish proof of any additional licenses or certifications contained in the specifications regardless of whether or not that requirement is listed above.

8. INSURANCE: The apparent successful Vendor shall furnish proof of the insurance identified by a checkmark below and must include the State as an additional insured on each policy prior to Contract award. The insurance coverages identified below must be maintained throughout the life of this contract. Thirty (30) days prior to the expiration of the insurance policies, Vendor shall provide the Agency with proof that the insurance mandated herein has been continued. Vendor must also provide Agency with immediate notice of any changes in its insurance policies, including but not limited to, policy cancelation, policy reduction, or change in insurers. The apparent successful Vendor shall also furnish proof of any additional insurance requirements contained in the specifications prior to Contract award regardless of whether or not that insurance requirement is listed in this section.

Vendor must maintain:

☑ **Commercial General Liability Insurance** in at least an amount of: $1,000,000.00 per occurrence.

☐ **Automobile Liability Insurance** in at least an amount of: ________________ per occurrence.

☐ **Professional/Malpractice/Errors and Omission Insurance** in at least an amount of: ________________ per occurrence. Notwithstanding the forgoing, Vendor's are not required to list the State as an additional insured for this type of policy.

☐ **Commercial Crime and Third Party Fidelity Insurance** in an amount of: ________________ per occurrence.

☐ **Cyber Liability Insurance** in an amount of: ________________ per occurrence.

☐ **Builders Risk Insurance** in an amount equal to 100% of the amount of the Contract.

☐ **Pollution Insurance** in an amount of: ________________ per occurrence.

☐ **Aircraft Liability** in an amount of: ________________ per occurrence.

☐

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☐

Notwithstanding anything contained in this section to the contrary, the Director of the Purchasing Division reserves the right to waive the requirement that the State be named as an additional insured on one or more of the Vendor's insurance policies if the Director finds that doing so is in the State's best interest.

9. WORKERS' COMPENSATION INSURANCE: The apparent successful Vendor shall comply with laws relating to workers compensation, shall maintain workers' compensation insurance when required, and shall furnish proof of workers' compensation insurance upon request.

10. [Reserved]

11. LIQUIDATED DAMAGES: This clause shall in no way be considered exclusive and shall not limit the State or Agency's right to pursue any other available remedy. Vendor shall pay liquidated damages in the amount specified below or as described in the specifications:

☐ ______________________________ for ____

☐ Liquidated Damages Contained in the Specifications

12. ACCEPTANCE: Vendor's signature on its bid, or on the certification and signature page, constitutes an offer to the State that cannot be unilaterally withdrawn, signifies that the product or service proposed by vendor meets the mandatory requirements contained in the Solicitation for that product or service, unless otherwise indicated, and signifies acceptance of the terms and conditions contained in the Solicitation unless otherwise indicated.

13. PRICING: The pricing set forth herein is firm for the life of the Contract, unless specified elsewhere within this Solicitation/Contract by the State. A Vendor's inclusion of price adjustment provisions in its bid, without an express authorization from the State in the Solicitation to do so, may result in bid disqualification. Notwithstanding the foregoing, Vendor must extend any publicly advertised sale price to the State and invoice at the lower of the contract price or the publicly advertised sale price.

14. PAYMENT IN ARREARS: Payment in advance is prohibited under this Contract. Payment may only be made after the delivery and acceptance of goods or services. The Vendor shall submit invoices, in arrears.

15. PAYMENT METHODS: Vendor must accept payment by electronic funds transfer and P-Card. (The State of West Virginia's Purchasing Card program, administered under contract by a banking institution, processes payment for goods and services through state designated credit cards.)

16. TAXES: The Vendor shall pay any applicable sales, use, personal property or any other taxes arising out of this Contract and the transactions contemplated thereby. The State of West Virginia is exempt from federal and state taxes and will not pay or reimburse such taxes.

17. ADDITIONAL FEES: Vendor is not permitted to charge additional fees or assess additional charges that were not either expressly provided for in the solicitation published by the State of West Virginia or included in the unit price or lump sum bid amount that Vendor is required by the solicitation to provide. Including such fees or charges as notes to the solicitation may result in rejection of vendor's bid. Requesting such fees or charges be paid after the contract has been awarded may result in cancellation of the contract.

18. FUNDING: This Contract shall continue for the term stated herein, contingent upon funds being appropriated by the Legislature or otherwise being made available. In the event funds are not appropriated or otherwise made available, this Contract becomes void and of no effect beginning on July 1 of the fiscal year for which funding has not been appropriated or otherwise made available.

19. CANCELLATION: The Purchasing Division Director reserves the right to cancel this Contract immediately upon written notice to the vendor if the materials or workmanship supplied do not conform to the specifications contained in the Contract. The Purchasing Division Director may also cancel any purchase or Contract upon 30 days written notice to the Vendor in accordance with West Virginia Code of State Rules § 148-1-5.2.b.

20. TIME: Time is of the essence with regard to all matters of time and performance in this Contract.

21. APPLICABLE LAW: This Contract is governed by and interpreted under West Virginia law without giving effect to its choice of law principles. Any information provided in specification manuals, or any other source, verbal or written, which contradicts or violates the West Virginia Constitution, West Virginia Code or West Virginia Code of State Rules is void and of no effect.

22. COMPLIANCE WITH LAWS: Vendor shall comply with all applicable federal, state, and local laws, regulations and ordinances. By submitting a bid, Vendor acknowledges that it has reviewed, understands, and will comply with all applicable laws, regulations, and ordinances.

> **SUBCONTRACTOR COMPLIANCE:** Vendor shall notify all subcontractors providing commodities or services related to this Contract that as subcontractors, they too are required to comply with all applicable laws, regulations, and ordinances. Notification under this provision must occur prior to the performance of any work under the contract by the subcontractor.

23. ARBITRATION: Any references made to arbitration contained in this Contract, Vendor's bid, or in any American Institute of Architects documents pertaining to this Contract are hereby deleted, void, and of no effect.

24. MODIFICATIONS: This writing is the parties' final expression of intent. Notwithstanding anything contained in this Contract to the contrary no modification of this Contract shall be binding without mutual written consent of the Agency, and the Vendor, with approval of the Purchasing Division and the Attorney General's office (Attorney General approval is as to form only). Any change to existing contracts that adds work or changes contract cost, and were not included in the original contract, must be approved by the Purchasing Division and the Attorney General's Office (as to form) prior to the implementation of the change or commencement of work affected by the change.

25. WAIVER: The failure of either party to insist upon a strict performance of any of the terms or provision of this Contract, or to exercise any option, right, or remedy herein contained, shall not be construed as a waiver or a relinquishment for the future of such term, provision, option, right, or remedy, but the same shall continue in full force and effect. Any waiver must be expressly stated in writing and signed by the waiving party.

26. SUBSEQUENT FORMS: The terms and conditions contained in this Contract shall supersede any and all subsequent terms and conditions which may appear on any form documents submitted by Vendor to the Agency or Purchasing Division such as price lists, order forms, invoices, sales agreements, or maintenance agreements, and includes internet websites or other electronic documents. Acceptance or use of Vendor's forms does not constitute acceptance of the terms and conditions contained thereon.

27. ASSIGNMENT: Neither this Contract nor any monies due, or to become due hereunder, may be assigned by the Vendor without the express written consent of the Agency, the Purchasing Division, the Attorney General's office (as to form only), and any other government agency or office that may be required to approve such assignments.

28. WARRANTY: The Vendor expressly warrants that the goods and/or services covered by this Contract will: (a) conform to the specifications, drawings, samples, or other description furnished or specified by the Agency; (b) be merchantable and fit for the purpose intended; and (c) be free from defect in material and workmanship.

29. STATE EMPLOYEES: State employees are not permitted to utilize this Contract for personal use and the Vendor is prohibited from permitting or facilitating the same.

30. PRIVACY, SECURITY, AND CONFIDENTIALITY: The Vendor agrees that it will not disclose to anyone, directly or indirectly, any such personally identifiable information or other confidential information gained from the Agency, unless the individual who is the subject of the information consents to the disclosure in writing or the disclosure is made pursuant to the Agency's policies, procedures, and rules. Vendor further agrees to comply with the Confidentiality Policies and Information Security Accountability Requirements, set forth in http://www.state.wv.us/admin/purchase/privacy/default.html.

31. YOUR SUBMISSION IS A PUBLIC DOCUMENT: Vendor's entire response to the Solicitation and the resulting Contract are public documents. As public documents, they will be disclosed to the public following the bid/proposal opening or award of the contract, as required by the competitive bidding laws of West Virginia Code §§ 5A-3-1 et seq., 5-22-1 et seq., and 5G-1-1 et seq. and the Freedom of Information Act West Virginia Code §§ 29B-1-1 et seq.

DO NOT SUBMIT MATERIAL YOU CONSIDER TO BE CONFIDENTIAL, A TRADE SECRET, OR OTHERWISE NOT SUBJECT TO PUBLIC DISCLOSURE.

Submission of any bid, proposal, or other document to the Purchasing Division constitutes your explicit consent to the subsequent public disclosure of the bid, proposal, or document. The Purchasing Division will disclose any document labeled "confidential," "proprietary," "trade secret," "private," or labeled with any other claim against public disclosure of the documents, to include any "trade secrets" as defined by West Virginia Code § 47-22-1 et seq. All submissions are subject to public disclosure without notice.

32. LICENSING: In accordance with West Virginia Code of State Rules § 148-1-6.1.e, Vendor must be licensed and in good standing in accordance with any and all state and local laws and requirements by any state or local agency of West Virginia, including, but not limited to, the West Virginia Secretary of State's Office, the West Virginia Tax Department, West Virginia Insurance Commission, or any other state agency or political subdivision. Obligations related to political subdivisions may include, but are not limited to, business licensing, business and occupation taxes, inspection compliance, permitting, etc. Upon request, the Vendor must provide all necessary releases to obtain information to enable the Purchasing Division Director or the Agency to verify that the Vendor is licensed and in good standing with the above entities.

SUBCONTRACTOR COMPLIANCE: Vendor shall notify all subcontractors providing commodities or services related to this Contract that as subcontractors, they too are required to be licensed, in good standing, and up-to-date on all state and local obligations as described in this section. Obligations related to political subdivisions may include, but are not limited to, business licensing, business and occupation taxes, inspection compliance, permitting, etc. Notification under this provision must occur prior to the performance of any work under the contract by the subcontractor.

33. ANTITRUST: In submitting a bid to, signing a contract with, or accepting a Award Document from any agency of the State of West Virginia, the Vendor agrees to convey, sell, assign, or transfer to the State of West Virginia all rights, title, and interest in and to all causes of action it may now or hereafter acquire under the antitrust laws of the United States and the State of West Virginia for price fixing and/or unreasonable restraints of trade relating to the particular commodities or services purchased or acquired by the State of West Virginia. Such assignment shall be made and become effective at the time the purchasing agency tenders the initial payment to Vendor.

34. VENDOR CERTIFICATIONS: By signing its bid or entering into this Contract, Vendor certifies (1) that its bid or offer was made without prior understanding, agreement, or connection with any corporation, firm, limited liability company, partnership, person or entity submitting a bid or offer for the same material, supplies, equipment or services; (2) that its bid or offer is in all respects fair and without collusion or fraud; (3) that this Contract is accepted or entered into without any prior understanding, agreement, or connection to any other entity that could be considered a violation of law; and (4) that it has reviewed this Solicitation in its entirety; understands the requirements, terms and conditions, and other information contained herein.

Vendor's signature on its bid or offer also affirms that neither it nor its representatives have any interest, nor shall acquire any interest, direct or indirect, which would compromise the performance of its services hereunder. Any such interests shall be promptly presented in detail to the Agency. The individual signing this bid or offer on behalf of Vendor certifies that he or she is authorized by the Vendor to execute this bid or offer or any documents related thereto on Vendor's behalf; that he or she is authorized to bind the Vendor in a contractual relationship; and that, to the best of his or her knowledge, the Vendor has properly registered with any State agency that may require registration.

35. VENDOR RELATIONSHIP: The relationship of the Vendor to the State shall be that of an independent contractor and no principal-agent relationship or employer-employee relationship is contemplated or created by this Contract. The Vendor as an independent contractor is solely liable for the acts and omissions of its employees and agents. Vendor shall be responsible for selecting, supervising, and compensating any and all individuals employed pursuant to the terms of this Solicitation and resulting contract. Neither the Vendor, nor any employees or subcontractors of the Vendor, shall be deemed to be employees of the State for any purpose whatsoever. Vendor shall be exclusively responsible for payment of employees and contractors for all wages and salaries, taxes, withholding payments, penalties, fees, fringe benefits, professional liability insurance premiums, contributions to insurance and pension, or other deferred compensation plans, including but not limited to, Workers' Compensation and Social Security obligations, licensing fees, etc. and the filing of all necessary documents, forms, and returns pertinent to all of the foregoing.

Vendor shall hold harmless the State, and shall provide the State and Agency with a defense against any and all claims including, but not limited to, the foregoing payments, withholdings, contributions, taxes, Social Security taxes, and employer income tax returns.

36. INDEMNIFICATION: The Vendor agrees to indemnify, defend, and hold harmless the State and the Agency, their officers, and employees from and against: (1) Any claims or losses for services rendered by any subcontractor, person, or firm performing or supplying services, materials, or supplies in connection with the performance of the Contract; (2) Any claims or losses resulting to any person or entity injured or damaged by the Vendor, its officers, employees, or subcontractors by the publication, translation, reproduction, delivery, performance, use, or disposition of any data used under the Contract in a manner not authorized by the Contract, or by Federal or State statutes or regulations; and (3) Any failure of the Vendor, its officers, employees, or subcontractors to observe State and Federal laws including, but not limited to, labor and wage and hour laws.

37. PURCHASING AFFIDAVIT: In accordance with West Virginia Code §§ 5A-3-10a and 5-22-1(i), the State is prohibited from awarding a contract to any bidder that owes a debt to the State or a political subdivision of the State, Vendors are required to sign, notarize, and submit the Purchasing Affidavit to the Purchasing Division affirming under oath that it is not in default on any monetary obligation owed to the state or a political subdivision of the state.

38. ADDITIONAL AGENCY AND LOCAL GOVERNMENT USE: This Contract may be utilized by other agencies, spending units, and political subdivisions of the State of West Virginia; county, municipal, and other local government bodies; and school districts ("Other Government Entities"), provided that both the Other Government Entity and the Vendor agree. Any extension of this Contract to the aforementioned Other Government Entities must be on the same prices, terms, and conditions as those offered and agreed to in this Contract, provided that such extension is in compliance with the applicable laws, rules, and ordinances of the Other Government Entity. A refusal to extend this Contract to the Other Government Entities shall not impact or influence the award of this Contract in any manner.

39. CONFLICT OF INTEREST: Vendor, its officers or members or employees, shall not presently have or acquire an interest, direct or indirect, which would conflict with or compromise the performance of its obligations hereunder. Vendor shall periodically inquire of its officers, members and employees to ensure that a conflict of interest does not arise. Any conflict of interest discovered shall be promptly presented in detail to the Agency.

40. REPORTS: Vendor shall provide the Agency and/or the Purchasing Division with the following reports identified by a checked box below:

☑ Such reports as the Agency and/or the Purchasing Division may request. Requested reports may include, but are not limited to, quantities purchased, agencies utilizing the contract, total contract expenditures by agency, etc.

☑ Quarterly reports detailing the total quantity of purchases in units and dollars, along with a listing of purchases by agency. Quarterly reports should be delivered to the Purchasing Division via email at purchasing.requisitions@wv.gov.

41. BACKGROUND CHECK: In accordance with W. Va. Code § 15-2D-3, the Director of the Division of Protective Services shall require any service provider whose employees are regularly employed on the grounds or in the buildings of the Capitol complex or who have access to sensitive or critical information to submit to a fingerprint-based state and federal background inquiry through the state repository. The service provider is responsible for any costs associated with the fingerprint-based state and federal background inquiry.

After the contract for such services has been approved, but before any such employees are permitted to be on the grounds or in the buildings of the Capitol complex or have access to sensitive or critical information, the service provider shall submit a list of all persons who will be physically present and working at the Capitol complex to the Director of the Division of Protective Services for purposes of verifying compliance with this provision. The State reserves the right to prohibit a service provider's employees from accessing sensitive or critical information or to be present at the Capitol complex based upon results addressed from a criminal background check.

Service providers should contact the West Virginia Division of Protective Services by phone at (304) 558-9911 for more information.

42. PREFERENCE FOR USE OF DOMESTIC STEEL PRODUCTS: Except when authorized by the Director of the Purchasing Division pursuant to W. Va. Code § 5A-3-56, no contractor may use or supply steel products for a State Contract Project other than those steel products made in the United States. A contractor who uses steel products in violation of this section may be subject to civil penalties pursuant to W. Va. Code § 5A-3-56. As used in this section:

a. "State Contract Project" means any erection or construction of, or any addition to, alteration of or other improvement to any building or structure, including, but not limited to, roads or highways, or the installation of any heating or cooling or ventilating plants or other equipment, or the supply of and materials for such projects, pursuant to a contract with the State of West Virginia for which bids were solicited on or after June 6, 2001.

b. "Steel Products" means products rolled, formed, shaped, drawn, extruded, forged, cast, fabricated or otherwise similarly processed, or processed by a combination of two or more or such operations, from steel made by the open heath, basic oxygen, electric furnace, Bessemer or other steel making process. The Purchasing Division Director may, in writing, authorize the use of foreign steel products if:

c. The cost for each contract item used does not exceed one tenth of one percent (.1%) of the total contract cost or two thousand five hundred dollars ($2,500.00), whichever is greater. For the purposes of this section, the cost is the value of the steel product as delivered to the project; or

d. The Director of the Purchasing Division determines that specified steel materials are not produced in the United States in sufficient quantity or otherwise are not reasonably available to meet contract requirements.

43. PREFERENCE FOR USE OF DOMESTIC ALUMINUM, GLASS, AND STEEL: In Accordance with W. Va. Code § 5-19-1 et seq., and W. Va. CSR § 148-10-1 et seq., for every contract or subcontract, subject to the limitations contained herein, for the construction, reconstruction, alteration, repair, improvement or maintenance of public works or for the purchase of any item of machinery or equipment to be used at sites of public works, only domestic aluminum, glass or steel products shall be supplied unless the spending officer determines, in writing, after the receipt of offers or bids, (1) that the cost of domestic aluminum, glass or steel products is unreasonable or inconsistent with the public interest of the State of West Virginia, (2) that domestic aluminum, glass or steel products are not produced in sufficient quantities to meet the contract requirements, or (3) the available domestic aluminum, glass, or steel do not meet the contract specifications. This provision only applies to public works contracts awarded in an amount more than fifty thousand dollars ($50,000) or public works contracts that require more than ten thousand pounds of steel products.

The cost of domestic aluminum, glass, or steel products may be unreasonable if the cost is more than twenty percent (20%) of the bid or offered price for foreign made aluminum, glass, or steel products. If the domestic aluminum, glass or steel products to be supplied or produced in a "substantial labor surplus area", as defined by the United States Department of Labor, the cost of domestic aluminum, glass, or steel products may be unreasonable if the cost is more than thirty percent (30%) of the bid or offered price for foreign made aluminum, glass, or steel products. This preference shall be applied to an item of machinery or equipment, as indicated above, when the item is a single unit of equipment or machinery manufactured primarily of aluminum, glass or steel, is part of a public works contract and has the sole purpose or of being a permanent part of a single public works project. This provision does not apply to equipment or machinery purchased by a spending unit for use by that spending unit and not as part of a single public works project.

All bids and offers including domestic aluminum, glass or steel products that exceed bid or offer prices including foreign aluminum, glass or steel products after application of the preferences provided in this provision may be reduced to a price equal to or lower than the lowest bid or offer price for foreign aluminum, glass or steel products plus the applicable preference. If the reduced bid or offer prices are made in writing and supersede the prior bid or offer prices, all bids or offers, including the reduced bid or offer prices, will be reevaluated in accordance with this rule.

44. INTERESTED PARTY SUPPLEMENTAL DISCLOSURE: W. Va. Code § 6D-1-2 requires that for contracts with an actual or estimated value of at least $1 million, the vendor must submit to the Agency a supplemental disclosure of interested parties reflecting any new or differing interested parties to the contract, which were not included in the original pre-award interested party disclosure, within 30 days following the completion or termination of the contract. A copy of that form is included with this solicitation or can be obtained from the WV Ethics Commission. This requirement does not apply to publicly traded companies listed on a national or international stock exchange. A more detailed definition of interested parties can be obtained from the form referenced above.

45. PROHIBITION AGAINST USED OR REFURBISHED: Unless expressly permitted in the solicitation published by the State, Vendor must provide new, unused commodities, and is prohibited from supplying used or refurbished commodities, in fulfilling its responsibilities under this Contract.

DESIGNATED CONTACT: Vendor appoints the individual identified in this Section as the Contract Administrator and the initial point of contact for matters relating to this Contract.

Christina Traynor

(Name, Title) Christina Traynor, Owner/Principal Scientist

(Printed Name and Title) 324 Ivy Drive, Gibsonia PA. 15044

(Address) 412-445-0247

(Phone Number) / (Fax Number) ctraynor@ers-consulting.com

(email address)

CERTIFICATION AND SIGNATURE: By signing below, or submitting documentation through wvOASIS, I certify that I have reviewed this Solicitation in its entirety; that I understand the requirements, terms and conditions, and other information contained herein; that this bid, offer or proposal constitutes an offer to the State that cannot be unilaterally withdrawn; that the product or service proposed meets the mandatory requirements contained in the Solicitation for that product or service, unless otherwise stated herein; that the Vendor accepts the terms and conditions contained in the Solicitation, unless otherwise stated herein; that I am submitting this bid, offer or proposal for review and consideration; that I am authorized by the vendor to execute and submit this bid, offer, or proposal, or any documents related thereto on vendor's behalf; that I am authorized to bind the vendor in a contractual relationship; and that to the best of my knowledge, the vendor has properly registered with any State agency that may require registration.

Environmental Risk Solutions, LLC

(Company)

Christina Traynor Owner/Principal Scientist

(Authorized Signature) (Representative Name, Title)

Christina Traynor, Owner/Principal Scientist

(Printed Name and Title of Authorized Representative)

July 28, 2020

(Date)

412-445-0247

(Phone Number) (Fax Number)

ADDENDUM ACKNOWLEDGEMENT FORM
SOLICITATION NO.:

Instructions: Please acknowledge receipt of all addenda issued with this solicitation by completing this addendum acknowledgment form. Check the box next to each addendum received and sign below. Failure to acknowledge addenda may result in bid disqualification.

Acknowledgment: I hereby acknowledge receipt of the following addenda and have made the necessary revisions to my proposal, plans and/or specification, etc.

Addendum Numbers Received:
(Check the box next to each addendum received) **** None Received ****

☐ Addendum No. 1	☐ Addendum No. 6
☐ Addendum No. 2	☐ Addendum No. 7
☐ Addendum No. 3	☐ Addendum No. 8
☐ Addendum No. 4	☐ Addendum No. 9
☐ Addendum No. 5	☐ Addendum No. 10

I understand that failure to confirm the receipt of addenda may be cause for rejection of this bid. I further understand that any verbal representation made or assumed to be made during any oral discussion held between Vendor's representatives and any state personnel is not binding. Only the information issued in writing and added to the specifications by an official addendum is binding.

Environmental Risk Solutions, LLC

Company

Christina Traynor

Authorized Signature

July 28, 2020

Date

NOTE: This addendum acknowledgement should be submitted with the bid to expedite document processing.

SPECIFICATIONS

1. **PURPOSE AND SCOPE:** The West Virginia Purchasing Division is soliciting bids on behalf of the West Virginia Department of Environmental Protection to establish an open-end contract for an Environmental Risk Assessor to determine ecological and human health risks that may be associated with projects managed by WVDEP.

   Previous Solicitation: was CRFQ DEP1700000002 that opened on: 09/14/2016. Vendors may view previous solicitation responses on the West Virginia Purchasing Bid Opening: http://www.state.wv.us/admin/purchase/Bids/FY2017/BO20160914.html. Vendors are encouraged to review documentation thoroughly before bidding as Bid requirements, Specifications, And Terms and Conditions may have changed since last solicited in 2016.

2. **DEFINITIONS:** The terms listed below shall have the meanings assigned to them below. Additional definitions can be found in section 2 of the General Terms and Conditions.

   2.1 "Agency" means West Virginia Department of Environmental Protection (WVDEP).

   2.2 "Contract Item" or **"Contract Items"** means the list of items identified in **Section 3.1** below and on the Pricing Pages.

   2.3 "Pricing Pages" means the schedule of prices, estimated order quantity, and totals contained in wvOASIS or attached hereto as Exhibit A, and used to evaluate the Solicitation responses.

   2.4 "Solicitation" means the official notice of an opportunity to supply the State with goods or services that is published by the Purchasing Division.

   2.5 "TCAU" means the Tanks Corrective Action Unit.

   2.6 "WVDEP" means the West Virginia Department of Environmental Protection.

   2.7 "VRP" means the Voluntary Remediation Program.

   2.8 "OER" means the Office of Environmental Remediation.

   2.9 "LRS" means Licensed Remediation Specialist.

2.10 "Environmental Risk Assessor" means a person who evaluates the exposure of human and ecological receptors to contaminants in environmental media (i.e. soil, groundwater, air, sediments, and surface water) and determines the likelihood that such exposure would result in an adverse impact to the health of the receptor. Risk assessments are dependent upon mathematical constructs of interactions between living organisms and contaminants in their environment. Risk assessors must possess knowledge of toxicology, statistics, biology, and chemistry, as well as the ability to apply computer models simulating contaminant behavior in environmental media and/or contamination uptake and distribution within a biological system.

3. GENERAL REQUIREMENTS:

3.1 Contract Items and Mandatory Requirements: Vendor shall provide Agency with the Contract Items listed below on an open-end and continuing basis. Contract Items must meet or exceed the mandatory requirements as shown below. Contracts will be awarded to all Vendors who submit a bid and meet or exceed the mandatory requirements.

3.1.1 Background, Qualifications, Record Retention, Confidentiality, Testimony:

3.1.1.1 Background: There are several sections within the WVDEP that use Risk Assessments within their Programs. The majority of the Risk Assessment work is related to the WVDEP Division of Land Restoration, Office of Environmental Remediation (OER), which oversees the Voluntary Remediation Program (VRP), UECA-LUST Program, Brownfields Assistance Program, and CERCLA Programs. The WVDEP TCAU section also occasionally uses Risk Assessments.

Within these programs, human health and ecological risks are assessed by use of one or more levels of evaluation in order to determine suitability of these sites for reuse and the need for applying controls to mitigate remaining site risks. Guidance for WVDEP Risk Assessments can be found in OER's Voluntary Remediation Program Guidance Manual located on OER's website: https://dep.wv.gov/dlr/oer/brownfieldsection/technicalguidanceandtemplates/Pages/default.aspx .

The primary responsibility for providing an accurate assessment of site risks resides with the Licensed Remediation Specialist (LRS), who is retained by the property owner or interested party to oversee the site evaluation.

In addition, an Agency risk assessor/toxicologist is often consulted during the early stages of a site investigation to assist in developing a preliminary conceptual site model supported by an appropriate sampling and analysis plan.

Currently, risk assessments are most often evaluated by the Agency's risk assessor/toxicologist, but the Agency may experience a temporary need for additional capacity in order to meet required review deadlines for risk assessment and related documents.

3.1.1.2 **Qualifications:** Vendor or Vendor's staff if requirements are inherently limited to individuals rather than corporate entities, shall have the following minimum qualifications:

3.1.1.2.1 A doctoral degree in a relevant field of study from an accredited university and a minimum of three (3) years of relevant professional experience; ***OR***

3.1.1.2.2 A Master of Science degree in a relevant field of study from an accredited university and a minimum of five (5) years of relevant professional experience.

3.1.1.2.3 Relevant professional experience must consist of work related directly to risk assessment, risk characterization, and risk management activities.

3.1.1.2.4 At the discretion of the Vendor, an employee of the Vendor with knowledge in the applicable disciplines of toxicology, statistics, biology, and chemistry may conduct the review. The final report, however, must be prepared by, or under the direction of, an Environmental Risk Assessor.

3.1.1.2.5 Compliance with experience requirements will be determined prior to contract award by the State through references provided by the Vendor with its bid or upon request, through knowledge or documentation of the Vendor's past projects, or some other method that the State determines to be acceptable. Vendors should submit a current resume' which includes information regarding the number of years of qualification, experience and training, and relevant professional education for each individual that will be assigned to this project. Vendor must provide any documentation requested by the State to assist in confirmation of compliance with this provision. References, documentation, or other information to confirm compliance with this experience requirement are preferred with the bid submission; but may be requested prior to award.

3.1.1.2.6 An example risk assessment report or a risk assessment review prepared by the Vendor demonstrating evidence of relevant professional experience must also be provided prior to award. Submission of the sample document(s) may be in electronic format. Redaction of confidential information regarding site/client names on the sample documents is acceptable.

The WVDEP reserves the right to request and approve the credentials of any person assigned to perform work under this contract.

3.1.1.3 Record Retention: The Vendor shall maintain such records a minimum of five (5) years and make available all records to Agency personnel at the Vendor's location during normal business hours, 8:00AM to 5:00PM, upon written request by the Agency within ten (10) calendar days after receipt of the request.

3.1.1.4 Confidentiality: The Vendor shall have access to private and confidential data maintained by the Agency to the extent required for the Vendor to carry out the duties and responsibilities defined in this contract.
Documents will be sent to the Vendor through a secured server. Failure to maintain confidentiality will result in cancellation of the contract.

The Vendor agrees to maintain confidentiality and security of the data made available and shall indemnify and hold harmless the State and Agency against any and all claims brought by any party attributed to actions of breach of confidentiality by the Vendor, subcontractors, or individuals permitted access by the Vendor.

3.1.1.5 Testimony: Should the Agency request additional assistance from the contractor for testimony in any state or federal court or before any board or other administrative body associated with a document prepared under this agreement, such assistance shall be considered to be within the scope of work for this contract and thus billed at the same hourly rate as the rest of the items in this contract. An estimated number of times this might occur is twice a year. Meetings/testimony would likely take place in Charleston, WV; however, other locations are possible.

4. CONTRACT AWARD:

4.1 Contract Award: The Contract is intended to provide the Agency with a purchase price on all Contract Items. The Contract will be awarded to the two (2) lowest bid Vendors that provide the Contract Services meeting the required specifications for the lowest overall TOTAL BID AMOUNT as shown on the Exhibit A Pricing Page. Vendors must provide resumes for verification of qualifications with their bid. Selection will be based on the lowest qualified bids. However, if the Vendor has a conflict of interest on the job, the next Vendor will be selected to avoid the conflict of interest.

4.2 Pricing Pages: Vendor should complete the Pricing Pages by bidding on the price per hour (x) multiplied by the Estimated Quantity of Hours needed (=) equals the extended cost. Vendor should complete the Pricing Pages in their entirety as failure to do so may result in Vendor's bids being disqualified.

The Pricing Pages contain a list of the Contract Items and estimated purchase volume. The estimated purchase volume of each item represents the approximate volume of anticipated purchases only. No future use of the Contract of any individual item is guaranteed or implied.

Vendor should electronically enter the information into the Pricing Pages through wvOASIS, if available, or as an electronic document. In most cases, the Vendor can request an electronic copy of the Pricing Pages for bid purposes by sending an email request to the following address: Guy.L.Nisbet@wv.gov

5. ORDERING AND PAYMENT

5.1 Ordering: Vendor shall accept orders through wvOASIS, regular mail, facsimile, e-mail, or any other written form of communication. Vendor may, but is not required to, accept on-line orders through a secure internet ordering portal/website. If Vendor has the ability to accept on-line orders, it should include in its response a brief description of how Agencies may utilize the on-line ordering system. Vendor shall ensure that its on-line ordering system is properly secured prior to processing Agency orders on-line.

5.1.1 Work Directives: Work will be ordered by issuance of a Work Directive. The Work Directive will contain the location of the project site, the specific problem, the work to be performed, and the time frame during which the work must be completed.

5.1.1.1 Provided there is no conflict of interest in review of a specific project, the Work Directive shall be awarded in the following manner:

5.1.1.1.1 The Work Directive award will go to the first lowest successful Vendor.

5.1.1.1.2 If the Vendor accepts the Work Directive, a work plan and cost proposal will be required from the Vendor as specified in the Work Directive. The Vendor will have five (5) working days to accept or refuse the project. The work plan/cost proposal will consist of a brief description of the work to be performed, the number of hours, and the total dollar amount it will cost to perform each task included in the Work Directive. This can be provided in a simple email. Vendors will not be reimbursed for providing the work plan/cost estimate.

5.1.1.1.3 If the Vendor refuses the Work Directive, it will be offered to the second lowest successful Vendor and so on.

5.1.1.1.4 The Vendor's submitted work plan and cost estimate, containing the quantity estimates, shall be in accordance with the unit prices provided in the response to this RFQ. If the work plan and cost estimate are approved, the WVDEP will issue a Notice to Proceed which will specify the cost of the project and the starting and ending dates. Deliverables will be submitted electronically.

5.1.1.1.5 The Vendor shall not begin work until a signed Notice to Proceed has been issued by the WVDEP.

5.2 Payment: Vendor shall accept payment in accordance with the payment procedures of the State of West Virginia.

5.2.1 Invoice: A flat rate per hour will be the total charge to the state and will cover the full cost of all work hours including labor, travel, and materials. The Vendor will be contacted to provide Risk Assessor services on an "as needed" basis only. The Vendor will invoice WVDEP on a monthly basis. All invoices must be accompanied by a sworn statement detailing actual hours worked.

6. DELIVERY AND RETURN:

6.1 Delivery Time: Vendor shall deliver standard orders as stated in the Work Directive. The Notice to Proceed will specify the starting and ending dates for each Work Directive. Deliverables shall be submitted electronically, unless a specific request is made.

6.2 Late Delivery: The Agency placing the order under this Contract must be notified in writing if orders will be delayed for any reason. Any delay in delivery that could cause harm to an Agency will be grounds for cancellation of the delayed order, and/or obtaining the items ordered from a third party.

Any Agency seeking to obtain items from a third party under this provision must first obtain approval of the Purchasing Division.

6.3 Delivery Payment/Risk of Loss: Standard order delivery shall be F.O.B. destination to the Agency's location. Vendor shall include the cost of standard order delivery charges in its bid pricing/discount and is not permitted to charge the Agency separately for such delivery. The Agency will pay delivery charges on all emergency orders provided that Vendor invoices those delivery costs as a separate charge with the original freight bill attached to the invoice.

6.4 Return of Unacceptable Items: If the Agency deems the Contract Items to be unacceptable, the Contract Items shall be returned to Vendor at Vendor's expense and with no restocking charge. Vendor shall either make arrangements for the return within five (5) days of being notified that items are unacceptable or permit the Agency to arrange for the return and reimburse Agency for delivery expenses. If the original packaging cannot be utilized for the return, Vendor will supply the Agency with appropriate return packaging upon request. All returns of unacceptable items shall be F.O.B. the Agency's location. The returned product shall either be replaced, or the Agency shall receive a full credit or refund for the purchase price, at the Agency's discretion.

6.5 **Return Due to Agency Error**: Items ordered in error by the Agency will be returned for credit within 30 days of receipt, F.O.B. Vendor's location. Vendor shall not charge a restocking fee if returned products are in a resalable condition. Items shall be deemed to be in a resalable condition if they are unused and in the original packaging. Any restocking fee for items not in a resalable condition shall be the lower of the Vendor's customary restocking fee or 5% of the total invoiced value of the returned items.

7 VENDOR DEFAULT:

7.1 The following shall be considered a vendor default under this Contract.

7.1.1 Failure to provide Contract Items in accordance with the requirements contained herein.

7.1.2 Failure to comply with other specifications and requirements contained herein.

7.1.3 Failure to comply with any laws, rules, and ordinances applicable to the Contract Services provided under this Contract.

7.1.4 Failure to remedy deficient performance upon request.

7.2 The following remedies shall be available to Agency upon default.

7.2.1 Immediate cancellation of the Contract.

7.2.2 Immediate cancellation of one or more release orders issued under this Contract.

7.2.3 Any other remedies available in law or equity.

8 MISCELLANEOUS:

8.1 No Substitutions: Vendor shall supply only Contract Items submitted in response to the Solicitation unless a contract modification is approved in accordance with the provisions contained in this Contract.

8.2 Vendor Supply: Vendor must carry sufficient inventory of the Contract Items being offered to fulfill its obligations under this Contract. By signing its bid, Vendor certifies that it can supply the Contract Items contained in its bid response.

8.3 Reports: Vendor shall provide quarterly reports and annual summaries to the Agency showing the Agency's items purchased, quantities of items purchased, and total dollar value of the items purchased. Vendor shall also provide reports, upon request, showing the items purchased during the term of this Contract, the quantity purchased for each of those items, and the total value of purchases for each of those items. Failure to supply such reports may be grounds for cancellation of this Contract.

8.4 Contract Manager: During its performance of this Contract, Vendor must designate and maintain a primary contract manager responsible for overseeing Vendor's responsibilities under this Contract. The Contract manager must be available during normal business hours to address any customer service or other issues related to this Contract. Vendor should list its Contract manager and his or her contact information below.

Contract Manager: Christina Traynor
Telephone Number: 412-445-0247
Fax Number: ______________
Email Address: ctraynor@ers-consulting.com

Environmental Risk Assessor
Exhibit A
Pricing Page

ITEM NO.	ESTIMATED QUANTITY	DESCRIPTION	UNIT PRICE PER HOUR	AMOUNT
1	700	Environmental Risk Assessor	**$95.00**	**$66,500.00**
		TOTAL BID AMOUNT		**$66,500.00**

Quantities listed on the bid schedule are for bid evaluation purposes only are are not a guarantee of quantities to be ordered over the life of the contract. Actual quantities may be more or less than those stated on this schedule.

STATE OF WEST VIRGINIA
Purchasing Division

PURCHASING AFFIDAVIT

CONSTRUCTION CONTRACTS: Under W. Va. Code § 5-22-1(i), the contracting public entity shall not award a construction contract to any bidder that is known to be in default on any monetary obligation owed to the state or a political subdivision of the state, including, but not limited to, obligations related to payroll taxes, property taxes, sales and use taxes, fire service fees, or other fines or fees.

ALL CONTRACTS: Under W. Va. Code §5A-3-10a, no contract or renewal of any contract may be awarded by the state or any of its political subdivisions to any vendor or prospective vendor when the vendor or prospective vendor or a related party to the vendor or prospective vendor is a debtor and: (1) the debt owed is an amount greater than one thousand dollars in the aggregate; or (2) the debtor is in employer default.

EXCEPTION: The prohibition listed above does not apply where a vendor has contested any tax administered pursuant to chapter eleven of the W. Va. Code, workers' compensation premium, permit fee or environmental fee or assessment and the matter has not become final or where the vendor has entered into a payment plan or agreement and the vendor is not in default of any of the provisions of such plan or agreement.

DEFINITIONS:

"Debt" means any assessment, premium, penalty, fine, tax or other amount of money owed to the state or any of its political subdivisions because of a judgment, fine, permit violation, license assessment, defaulted workers' compensation premium, penalty or other assessment presently delinquent or due and required to be paid to the state or any of its political subdivisions, including any interest or additional penalties accrued thereon.

"Employer default" means having an outstanding balance or liability to the old fund or to the uninsured employers' fund or being in policy default, as defined in W. Va. Code § 23-2c-2, failure to maintain mandatory workers' compensation coverage, or failure to fully meet its obligations as a workers' compensation self-insured employer. An employer is not in employer default if it has entered into a repayment agreement with the Insurance Commissioner and remains in compliance with the obligations under the repayment agreement.

"Related party" means a party, whether an individual, corporation, partnership, association, limited liability company or any other form or business association or other entity whatsoever, related to any vendor by blood, marriage, ownership or contract through which the party has a relationship of ownership or other interest with the vendor so that the party will actually or by effect receive or control a portion of the benefit, profit or other consideration from performance of a vendor contract with the party receiving an amount that meets or exceed five percent of the total contract amount.

AFFIRMATION: By signing this form, the vendor's authorized signer affirms and acknowledges under penalty of law for false swearing (*W. Va. Code* §61-5-3) that: (1) for construction contracts, the vendor is not in default on any monetary obligation owed to the state or a political subdivision of the state, and (2) for all other contracts, that neither vendor nor any related party owe a debt as defined above and that neither vendor nor any related party are in employer default as defined above, unless the debt or employer default is permitted under the exception above.

WITNESS THE FOLLOWING SIGNATURE:

Vendor's Name: Environmental Risk Solutions, LLC

Authorized Signature: Christina Traynor Date: July 28, 2020

State of Pennsylvania

County of Allegheny, to-wit:

Taken, subscribed, and sworn to before me this 28 day of July, 2020.

My Commission expires 15 June, 2024.

AFFIX SEAL HERE **NOTARY PUBLIC** Jane Mercuri

Commonwealth of Pennsylvania - Notary Seal
Jane Mercuri, Notary Public
Allegheny County
My commission expires June 15, 2024
Commission number 1372847
Member, Pennsylvania Association of Notaries

ENVIRONMENTAL RISK SOLUTIONS

CERTIFICATE OF INSURANCE

CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY): 7/28/2020

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must have ADDITIONAL INSURED provisions or be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER
Hall & Company
19660 10th Ave NE
Poulsbo WA 98370

CONTACT NAME: John Dewing
PHONE (A/C, No, Ext): 360-626-2011
FAX (A/C, No): 360-626-2011
E-MAIL ADDRESS: jdewing@hallandcompany.com

INSURER(S) AFFORDING COVERAGE	NAIC #
INSURER A : Underwriters at Lloyd's, London/Rivington	
INSURER B :	
INSURER C :	
INSURER D :	
INSURER E :	
INSURER F :	

INSURED ENVIRIS-02
Environmental Risk Solutions LLC
324 Ivy Drive
Gibsonia PA 15044

COVERAGES **CERTIFICATE NUMBER:** 1545536995 **REVISION NUMBER:**

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSD	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
A	X COMMERCIAL GENERAL LIABILITY	Y	Y	ENC0003904-1	12/4/2019	12/4/2020	EACH OCCURRENCE	$ 1,000,000
	X CLAIMS-MADE ☐ OCCUR						DAMAGE TO RENTED PREMISES (Ea occurrence)	$ 1,000,000
							MED EXP (Any one person)	$ $25,000
							PERSONAL & ADV INJURY	$ 1,000,000
	GEN'L AGGREGATE LIMIT APPLIES PER:						GENERAL AGGREGATE	$ 2,000,000
	X POLICY ☐ PRO-JECT ☐ LOC						PRODUCTS - COMP/OP AGG	$ 2,000,000
	OTHER:							$
A	AUTOMOBILE LIABILITY			ENC0003904-1	12/4/2019	12/4/2020	COMBINED SINGLE LIMIT (Ea accident)	$ 1,000,000
	☐ ANY AUTO						BODILY INJURY (Per person)	$
	☐ OWNED AUTOS ONLY ☐ SCHEDULED AUTOS						BODILY INJURY (Per accident)	$
	X HIRED AUTOS ONLY X NON-OWNED AUTOS ONLY						PROPERTY DAMAGE (Per accident)	$
								$
	UMBRELLA LIAB ☐ OCCUR						EACH OCCURRENCE	$
	EXCESS LIAB ☐ CLAIMS-MADE						AGGREGATE	$
	DED ☐ RETENTION $							$
	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY Y / N						PER STATUTE ☐ OTH-ER	
	ANYPROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBEREXCLUDED? ☐	N / A					E.L. EACH ACCIDENT	$
	(Mandatory in NH)						E.L. DISEASE - EA EMPLOYEE	$
	If yes, describe under DESCRIPTION OF OPERATIONS below						E.L. DISEASE - POLICY LIMIT	$
A	Professional Liab;Claims Made Contractors Pollution Liability			ENC0003904-1	12/4/2019	12/4/2020	$1,000,000 Per Claim $1,000,000 Per Claim	$2,000,000 Aggr $2,000,000 Aggr

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (ACORD 101, Additional Remarks Schedule, may be attached if more space is required)

CERTIFICATE HOLDER

Environmental Risk Solutions LLC
324 Ivy Drive
Gibsonia PA 15044
USA

CANCELLATION

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.

AUTHORIZED REPRESENTATIVE

Trudy Polito

VENDOR REGISTRATION AND DISCLOSURE STATEMENT
AND
SMALL, WOMEN- AND MINORITY-OWNED BUSINESS CERTIFICATION APPLICATION

☑ New ☐ Update

STATE OF WEST VIRGINIA - PURCHASING DIVISION

VENDOR REGISTRATION AND DISCLOSURE STATEMENT AND SMALL, WOMEN-, AND MINORITY-OWNED BUSINESS CERTIFICATION APPLICATION

Before a vendor is eligible to sell goods and/or services to the State of West Virginia, the ***West Virginia Code*** §5A-3-12 requires all vendors to have on file with the West Virginia Purchasing Division a completed Vendor Registration and Disclosure Statement. Vendors supplying sole source goods or services to West Virginia state agencies, **or** competitive purchases of $2,500 or less annually in aggregate across all state agencies are required to complete the Vendor Registration and Disclosure Statement (WV-1A form). If the amount for competitive purchases exceed $2,500 in aggregate across all state agencies in any one year, a **$125.00** annual fee is required. Payment of the annual fee includes email notifications on bid opportunities based on the commodities and services selected upon registering in the Vendor Self-Service (VSS) portal at ***wvOASIS.gov***. Please complete **Part I** of this form in its **ENTIRETY** and return to the state agency listed below for their completion of **Part II**. The agency will forward this form to the West Virginia Purchasing Division for processing. Incomplete forms will not be processed and will be returned to the vendor. **Please return all correspondence to:**

STATE AGENCY:

ADDRESS:

CITY, STATE, ZIP:

Whenever a change occurs in the information submitted, such change shall be reported immediately in the same manner as required in the original disclosure statement **(*West Virginia Code* §5A-3-12)**. Vendors doing business with the State of West Virginia are expected to abide by the **Vendor Code of Conduct** available online at ***www.state.wv.us/admin/purchase/vrc/vendorconduct.pdf***.

Privacy Notice: The Purchasing Division is required to collect certain information as stated in ***West Virginia Code*** §5A-3-12, other applicable sections of the ***West Virginia Code***, the Vendor Registration and Disclosure Statement forms, and other documents to facilitate the state bidding and contract administration processes. This information is stored in a secure environment, but unless specifically protected under state law, any information provided may be inspected by or disclosed to the public.

Vendors are also required to be licensed and in good standing in accordance with any and all state and local laws and requirements by any state or local agency of West Virginia, including, but not limited to, the West Virginia Secretary of State's Office, the West Virginia Tax Department, West Virginia Insurance Commission, or other state agencies or political subdivisions. Failure to do so may result in delay of or disqualification from a contract award, pursuant to ***West Virginia Code of State Rules*** §148-1-6.1.7. If you have any questions concerning this ***Vendor Registration and Disclosure Statement***, please contact the Purchasing Division at (304) 558-2311.

Questions concerning this Vendor Registration and Disclosure Statement may be directed to the Purchasing Division at (304) 558-2311. Should you need additional information relating to vendor registration, please visit ***www.state.wv.us/admin/purchase/VendorReg.html***.

VENDOR REGISTRATION AND DISCLOSURE STATEMENT AND SMALL, WOMEN-, AND MINORITY-OWNED BUSINESS CERTIFICATION APPLICATION

PLEASE TYPE OR CLEARLY PRINT ALL INFORMATION

To Be Completed by the Vendor and Returned to the Purchasing Division

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1. Legal Name of Company/Individual Environmental Risk Solutions LLC

Bidding Address 324 Ivy Drive, Gibsonia PA 15044

Ordering Address 324 Ivy Drive, Gibsonia PA 15044

(Please provide a physical address, not a post office box.)

Payment Address 324 Ivy Drive, Gibsonia PA 15044

City, State, Zip Gibsonia PA 15044

Telephone Number 412-445-0247 Fax Number ______

Principle Contact Person Christina Traynor E-mail ctraynor@ers-consulting.com

Contact's Telephone Number 412-445-0247 Contact's Fax Number ______

DBA, if any ______

Bidding Address ______

Ordering Address ______

Payment Address ______

City, State, Zip ______

Telephone Number ______ Fax Number ______

Principle Contact Person ______ E-mail ______

Contact's Telephone Number ______ Contact's Fax Number ______

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2. Vendor Tax Classification:

- ☐ Individual
- ☑ Sole Proprietor
- ☐ Partnership
- ☐ Corporation
- ☐ Board Member
- ☐ Trust
- ☐ Estate
- ☐ Government
- ☐ Medical Corporation
- ☐ Attorney Corporation
- ☐ Non-Profit Organization
- ☐ Payroll
- ☐ Employee

VENDOR REGISTRATION AND DISCLOSURE STATEMENT AND SMALL, WOMEN-, AND MINORITY-OWNED BUSINESS CERTIFICATION APPLICATION

PLEASE TYPE OR CLEARLY PRINT ALL INFORMATION

To Be Completed by the Vendor and Returned to the Purchasing Division

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3. Taxpayer Identification Number (TIN): If you have an Identification Number, enter it below. All partnerships, corporations, or companies with employees must have an EIN.

8	4	3	6	2	4	0	9	0	EIN

If you do not have a EIN, please enter Social Security number (SSN), Individual Taxpayer Identification Number (ITIN) or Adoptive Identification Number (ATIN) and check the correct below.

									- (SSN ☐, ITIN ☐, ATIN ☐)

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4. (A) ***Small, Women-Owned, Minority-Owned Businesses***

West Virginia Code §5A-3-59 establishes a procurement certification program in West Virginia for small, women-, and minority-owned businesses. Requirements related to the certification program are provided in the ***West Virginia Code of State Rules*** §148-2-1 et seq. Note that this certification provides nonresident vendors preference that is equivalent to competing resident (West Virginia) vendors that have applied for resident vendor preference, in accordance with ***West Virginia Code*** §5A-3-37. This certification may assist resident small, women-, and minority-owned businesses when soliciting business in other states. If you are renewing your two-year SWAM business certification status, please indicate the appropriate designation below.

Certification of Status *(Check all those which apply)*

☐ **Minority-owned Business** [1] means a business concern that is at least fifty-one percent owned by one or more minority individuals or in the case of a corporation, partnership, or limited liability company or other entity, at least fifty-one percent of the equity ownership interest in the corporation, partnership, or limited liability company or other entity is owned by one or more minority individuals and both the management and daily business operations are controlled by one or more minority individuals.

- A "minority individual" means an individual who is a citizen of the United States or a noncitizen who is in full compliance with United States immigration law and who satisfies one or more of the following definitions:
  - **African American** means a person having origins in any of the original peoples of Africa and who is regarded as such by the community of which this person claims to be a part.
  - **Asian American** means a person having origins in any of the original peoples of the Far East, Southeast Asia, the Indian subcontinent or the Pacific Islands, including, but not limited to, Japan, China, Vietnam, Samoa, Laos, Cambodia, Taiwan, Northern Mariana, the Philippines, a U.S. territory of the Pacific, India, Pakistan, Bangladesh, or Sri Lanka and who is regarded as such by the community of which this person claims to be a part.
  - **Hispanic American** means a person having origins in any of the Spanish-speaking peoples of Mexico, South or Central America, or the Caribbean Islands or other Spanish or Portuguese cultures and who is regarded as such by the community of which this person claims to be a part.
  - **Native American** means a person having origins in any of the original peoples of North America and who is regarded as such by the community of which this person claims to be a part or who is recognized by a tribal organization.

VENDOR REGISTRATION AND DISCLOSURE STATEMENT AND SMALL, WOMEN-, AND MINORITY-OWNED BUSINESS CERTIFICATION APPLICATION

PLEASE TYPE OR CLEARLY PRINT ALL INFORMATION

To Be Completed by the Vendor and Returned to the Purchasing Division

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☑ **Small Business** [2] means a business, independently owned or operated by one or more persons who are citizens of the United States or noncitizens who are in full compliance with United States immigration law, which, together with affiliates, has two hundred fifty or fewer employees, or average annual gross receipts of $10 million or less averaged over the previous three years.

☑ **Women-owned Business** [3] means a business concern that is at least fifty-one percent owned by one or more women who are citizens of the United States or noncitizens who are in full compliance with United States immigration law, or in the case of a corporation, partnership or limited liability company or other entity, at least fifty-one percent of the equity ownership interest is owned by one or more women who are citizens of the United States or noncitizens who are in full compliance with United States immigration law, and both the management and daily business operations are controlled by one or more women who are citizens of the United States or noncitizens who are in full compliance with United States immigration law.

(B) Other Federal Designations

Additionally, by providing the following information, I represent that this enterprise is a small business as defined by the ***Code of Federal Regulations,*** Title 13, Part 121, as appended - which contains detailed industry definitions and related procedures - and/or the characteristics of the enterprise's control, operation and/or ownership are accurately reflected in the information provided. *Check all that apply.*

☐ Disabled Small Business Ownership [4]

☐ Veteran Small Business Ownership [5]

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5. Commodity Codes: You may register for commodity codes for the products and services that you offer, which will provide you with bid opportunity alerts and notifications should you become a paid registered vendor. To perform this function, visit the Vendor Self-Service (VSS) portal at ***wvOASIS.gov***.

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6. List the name, title, city and state of residence for all owners/officers. If the vendor is an **individual**, list his or her name and city and state of residence, and, if he or she has associates or partners sharing in his or her business, list their names and city and state of residence. If the vendor is a **firm**, list the name and city and state of residence of each member, partner or associate of the firm. If the vendor is a **corporation** created under the laws of this state or authorized to do business in this state, list the names and city and state of residence of the president, vice president, secretary, treasurer and general manager, if any, of the corporation; and the names and city and state of residence of each stockholder of the corporation owning or holding at least ten percent of the capital stock thereof. Attach an additional sheet if space is needed.

Name	Position	City and State of Residence
Christina Traynor	Owner / Principal Scientist	Gibsonia, Pennsylvania

If the vendor has only one owner/officer, list the name, position, and city and state of residence above and please initial here: CLT

VENDOR REGISTRATION AND DISCLOSURE STATEMENT AND SMALL, WOMEN-, AND MINORITY-OWNED BUSINESS CERTIFICATION APPLICATION

PLEASE TYPE OR CLEARLY PRINT ALL INFORMATION

To Be Completed by the Vendor and Returned to the Purchasing Division

7. List the bank name, city, state, and telephone number of one or more financial institutions to serve as reference for the vendor. Dollar Bank, Wexford, PA 15090 724-933-6900

8. What is the latest Dun & Bradstreet number and rating on the vendor?
D&B DUNS Number: 117419272

9. Is the vendor acting as an agent for some other individual, firm or corporation? If yes, attach statement of the principal authorizing such representation. ☑ **No** ☐ **Yes**

By signing below and submitting this form, the vendor certifies and acknowledges that: 1) it has obtained all licenses, certifications, and authorizations necessary to lawfully conduct business in the state of West Virginia; and 2) that the assertions made by completing this form and delivering it to the Purchasing Division are accurate and true in accordance with the applicable law and rules. As authorized agent of the vendor named herein, I do solemnly swear that the above information is true and complete, in accordance with ***West Virginia Code*** §5A-3-12(e).

In the event that the vendor is applying for certification as a small, women-, or minority-owned business, the vendor's signature below further certifies that: 1) the state in which the vendor has its headquarters or principal place of business does not deny a like certification to a West Virginia based small, women-owned, or minority-owned business; 2) the state in which the vendor has its headquarters or principal place of business does not provide a preference to small, women-owned, or minority-owned firms that is unavailable to West Virginia based businesses; and, 3) that it has read and understands this form, along with the law and rules governing certification as a small, women-owned, or minority-owned business.

Christina Traynor
Authorized Agent of Vendor (Print Name)

Christina Traynor
Authorized Agent (Signature)

Owner / Principal Scientist
Title

July 28, 2020
Date

PURCHASING DIVISION USE ONLY

Vendor ID: ______________________

Check No. : ______________________

Memo No. : ______________________

Date: ______________________

Entered by: ______________________

VENDOR REGISTRATION AND DISCLOSURE STATEMENT AND SMALL, WOMEN-, AND MINORITY-OWNED BUSINESS CERTIFICATION APPLICATION

PLEASE TYPE OR CLEARLY PRINT ALL INFORMATION

To Be Completed by the Vendor and Returned to the Purchasing Division

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Part II: FOR STATE USE ONLY - To Be Completed by State Agency and Returned to Purchasing Division

1. Please provide a concise description of the goods and/or services the vendor is providing with your specific transaction.

____

____

____

2. Cite the corresponding exemption code from Section 9 of the Purchasing Division Procedures Handbook, if applicable.

____

____

____

3. Are the goods and/or services considered sole source? ☐ **No** ☐ **Yes**

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4. Will the goods and/or services provided by this vendor exceed $2,500 in aggregate across all state agencies? If not, and an award under this dollar threshold is pending, please also contact the *wv*OASIS Finance Team at financeteam@wvoasis.gov for a processing code to use on your *wv*OASIS award document.

☐ **No** ☐ **Yes**

____

State Agency Procurement Officer Signature *Date*

____

Telephone No. *FAX No.*

Return to: **WV Purchasing Division**
Vendor Registration
2019 Washington Street, East
Charleston, WV 25305-0130

RISK ASSESSOR RESUMES

324 Ivy Drive
Gibsonia, PA 15044

Christina Traynor

Principal Risk Assessment Scientist

Summary

I have over 25 years of experience conducting human health and ecological risk assessments. As the principal scientist and owner of Environmental Risk Solutions LLC, I specialize in the technical detail of each of the risk assessment components and their proper integration. I lead the project team in developing and implementing the technical approach for the most complex risk assessments, including multi-pathway and multi-property residential settings, commercial redevelopments, active industrial facilities, and ecological assessments of terrestrial and aquatic habitats. Over the course of my career, I have developed extensive experience managing and conducting risk assessments under both RCRA and CERCLA federal programs and under the jurisdiction of multiple state regulatory programs. My proficiency with the assessment of PCBs, chlorinated solvents, inorganics, PAHs, and the unique approaches for the assessment of dioxins, lead, and uranium, brings value to our clients.

Core Competencies

- Human health and ecological risk assessment project management
- Statistical analyses, including background comparisons
- Fate and transport evaluations (vapor intrusion, trench modeling, groundwater migration)
- Development of toxicity criteria and reference values for human and ecological receptors
- Interpretation of ecological data (e.g., invertebrate metrics and toxicity test results)
- Balancing cost-effective remedial strategies with responsible risk management
- Excellent technical writing and communication skills

Relevant Experience

Nov 2019 – Present	Owner – Environmental Risk Solutions LLC, Gibsonia, PA
Jan 1999 – Oct 2019	Principal Scientist - RBR Consulting, Inc., Beaver Falls, PA
Aug 1998 – Jan 2005	Risk Assessment Scientist - The RETEC Group, Pittsburgh, PA
Jun 1993 – Jul 1998	Environmental Scientist - ICF Kaiser, Pittsburgh, PA

Certifications and Professional Society Memberships

Woman Owned Small Business (WOSB) – Certification Pending
Society for Risk Analysis (SRA)

Education

Westminster College, Bachelor of Science - Double Major in Biology and Environmental Science, 1993

Representative Project Experience

Active and Former Gasoline Station Sites in Pennsylvania. Managed the project team in their preparation of multiple human health and ecological risk assessment reports for retail gasoline station sites in Pennsylvania. Some of these projects have been managed under the Underground Storage Tank Indemnification Fund (USTIF). Constituents of interest typically consist of BTEX, naphthalene, cumene and methyl-tert-butyl-ether. Both onsite and offsite exposure pathways were considered, as the projects often required evaluation of groundwater migration to adjacent properties and potential vapor intrusion. Many of the projects also required an ecological evaluation, including the review and interpretation of information provided by the Pennsylvania Natural Diversity Inventory (PNDI) and the National Wetlands Inventory (NWI). In most cases, the reports successfully demonstrated attainment under the Site-Specific Standard and supported a conclusion of No Further Action for the site.

Active and Former Gasoline Station Sites in West Virginia. Completed several human health and ecological risk assessment reports for gasoline station sites in West Virginia under the Voluntary Remediation Program (VRP). Sites were located in areas of commercial and residential use, and onsite and offsite exposure pathways were included. Contaminants of concern include the standard gasoline constituents (BTEX, naphthalene, MTBE), and often PAHs and lead. Evaluation of lead was conducted using both the USEPA's Adult Blood Lead model and the Integrated Exposure/Uptake Biokinetic (IEUBK) model for children. Reports prepared under the VRP also required completion of the Ecological 'Checklist to Determine Applicable Remediation Standards' and either a screening-level assessment, or in some cases, a baseline ecological risk assessment.

Former Manufactured Gas Plant Sites in Pennsylvania. Conducted baseline risk assessments and developed site-specific cleanup standards for several former manufactured gas plant (MGP) sites in Pennsylvania. The assessments were prepared under Pennsylvania's Land Recycling and Environmental Remediation Standards Act (Act 2). Constituents of interest at these MGP sites include benzene, toluene, ethylbenzene, and xylenes (BTEX); polynuclear aromatic hydrocarbons (PAHs); and cyanide. Assessments included evaluation of a wide range of nonresidential receptors and exposure pathways. Fate and transport analyses were conducted for site-specific evaluations of vapor intrusion (using the Johnson and Ettinger model) and groundwater to surface water migration (using Pennsylvania's PENTOXSD model). The risk assessments have facilitated several site closures using combinations of the Statewide Health Standard and the Site-Specific Standard.

Explosives Manufacturing Site in Missouri. Performed a complex human health and ecological risk assessment for a nearly 600-acre former explosives manufacturing facility in Missouri under the jurisdiction of USEPA Region VII and the Missouri Department of Natural Resources. The site was divided into twelve individual soil exposure areas, as well as multiple aquatic exposure areas. The human health assessment evaluated potential exposures to constituents in soil, groundwater, indoor air, sediment and surface water from the various areas. The receptors consisted of industrial and recreational receptors, including anglers that might consume recreationally-caught fish. The primary constituents of interest consisted of explosives, arsenic and lead, but additional constituents included total petroleum hydrocarbons (TPH), PAHs, PCBs, VOCs, and perchlorate. The ecological assessment included collection of plant and earthworm tissue samples to develop site-specific soil uptake factors. Multiple terrestrial and aquatic receptors were selected for detailed ecological hazard quotient calculations, which included the uptake modeling and species-specific dose calculations. The conclusions for both the human health and ecological risk assessment were that the great majority of exposure areas did not present potential for unacceptable risk. A residual risk analysis was completed for the areas where benchmarks were exceeded, and focused the remediation to a small number of soil locations.

Gun Club Site in Pennsylvania. Completed a human health and ecological risk assessment for a gun club property located near the Delaware River. Significant concentrations of lead were detected in soils from the site, as would be expected from lead shot used in the recreational shooting activities. Lead was also detected at concentrations above ecological benchmarks in riverbank samples. The results of the human health evaluation indicated that a small area of soil warranted mitigation. Upon excavation of these soils, the residual risk assessment demonstrated acceptable blood lead concentrations for recreational or occupational exposures. A macroinvertebrate survey and analysis was completed in the river, and the results indicated that invertebrate communities in the vicinity of the gun club were not adversely affected by the presence of lead in riverbank samples.

Superfund Site in New Jersey. Completed a comprehensive series of risk assessment reports for a 350-acre chemical manufacturing plant in New Jersey under the jurisdiction of USEPA and the New Jersey Department of Environmental Protection (NJDEP). Risk assessment deliverables included the preparation of a Memorandum of Exposure Scenarios (MES), Pathway Analysis Report (PAR), and Baseline Human Health Risk Assessment (BHHRA), all of which were produced using the “RAGS Part D” spreadsheet format. The human health assessment evaluated potential exposures to constituents in soil, groundwater, indoor air, sediment and surface water from multiple areas of interest. The receptors consisted of industrial and recreational receptors, including hunters and anglers, and hypothetical future residential receptors. Both a Screening Level Ecological Risk Assessment (SLERA) and Baseline Ecological Risk Assessment (BERA) were also completed for the site. Benthic macroinvertebrate sampling and sediment toxicity testing were completed in the creek and other aquatic habitats located on and adjacent to the site. The ecological work also included the derivation of a literature-based Tier II Equilibrium Partitioning Sediment Benchmark (ESB) for cumene, one of the primary site-related constituents of interest. The risk assessments supported focused remedial actions at the site, minimizing the areas of soil and sediment that required excavation.

Uranium Risk Analysis for a Site in Maine. Prepared a health risk analysis for uranium in groundwater with the potential to be used as drinking water. The site utilized groundwater as a source of potable water in cabins and common areas at a camp. Uranium had been detected in the groundwater at concentrations exceeding the Maximum Contaminant Level (MCL). The evaluation considered the percentages of daily water consumption obtained from filtered and unfiltered groundwater, site-specific exposure scenarios for employees and camp visitors, and the unique toxicity considerations for uranium. The evaluation concluded that there was negligible potential for unacceptable risk based on potential exposure to groundwater at the camp.

Former Industrial Landfill in Virginia. Performed a human health and ecological risk assessment for a former industrial landfill located in Covington, Virginia under the Voluntary Remediation Program (VRP). The site was evaluated as discrete exposure units based on historical activities and proposed future land uses, including a soccer field and campground. Human receptors consisted of workers and recreational visitors, and constituents of interest were limited to inorganics and benzo(a)pyrene. The report included an evaluation of the potential for constituents in onsite media to affect offsite media (e.g., sediment and surface water of the Jackson River). The ecological evaluation consisted of a screening-level assessment of the river adjacent to the site. The conclusion of both the human health and ecological assessments was that there was negligible potential for adverse effects due to site exposures.

Regulatory Guidance Review for West Virginia Department of Environmental Protection. Served on a Technical Subcommittee to review and recommend revisions and updates to the risk assessment sections of the Voluntary Remediation Program Guidance Manual.

Hazardous Waste Management Facility in Ohio. Completed a human health risk assessment for a facility in Ohio which specializes in the reclamation of chlorinated and fluorinated solvents for the electronics and metal finishing industry. Trichloroethylene (TCE) was a primary constituent of interest, and indoor air samples indicated that TCE was detected above Ohio EPA's remedial standard. The assessment included evaluation of current workers of the existing building, and hypothetical workers for future building scenarios. Site-specific vapor intrusion modeling was conducted for each discrete building scenario using either soil gas or groundwater data to represent the source. The assessment was carefully conducted to demonstrate that the elevated concentrations of TCE detected in indoor air of the existing building reflected management of the same chemical in the facility, rather than vapor intrusion from a subsurface source.

Wood Treating Sites in Ohio. Performed property-specific human health and ecological risk assessments for two former wood treating facilities in Ohio. The assessments were prepared under the Voluntary Action Program (VAP). Constituents of interest at these sites include PAHs, arsenic, and dioxins. In addition to evaluating baseline conditions, residual risks were calculated for selected remedial alternatives to minimize the amount of soil removal necessary.

Waste Disposal Facility in West Virginia. Performed a human health assessment and ecological screening evaluation for a former industrial waste disposal facility in northern West Virginia under the Voluntary Remediation and Redevelopment Program. The assessment evaluated baseline current conditions at the site, as well as a potential future use scenarios in which the site was redeveloped for industrial or residential use. The risk assessment delineated those areas where remediation or engineering controls would be required. An ecological screening assessment indicated that no species or habitats of concern were present at the site.

Superfund Site in Wisconsin. Conducted a human health risk assessment for a large Superfund site in Wisconsin. Polychlorinated biphenyls (PCBs) are the main constituents of interest, and ingestion of fish contaminated with PCBs drives human health concern. Prepared a detailed evaluation of the health effects of PCBs, focusing on effects due to fish ingestion.

Former Manufactured Gas Plant Sites in Illinois. Prepared remedial objectives reports for a number of former MGP sites in Illinois. The reports were prepared under the Tiered Approach to Corrective Action Objectives (TACO). Based on the results of the tiered evaluation, various remedial objectives were identified for each site. These may be a combination of one or more of the following: Tier 1 (i.e., default) values, site-specific background values, site-specific risk-based values, pathway exclusion (e.g., engineered barriers and/or institutional controls), and remediation. For several sites, potential effects from exposure to lead was modeled using the USEPA's Adult Blood Lead model and the Integrated Exposure/Uptake Biokinetic (IEUBK) model for children.

Metal Fastenings Manufacturing Facility in Connecticut. Prepared human health and ecological risk assessments for a metal fastenings manufacturing facility in Connecticut. The site is currently undergoing voluntary corrective action under the Resource Conservation and Recovery Act (RCRA). The assessments were prepared in accordance with guidance from USEPA Region I as well as the State of Connecticut. Metals were the primary constituents of interest for soils, sediment and surface water associated with the site. The human health assessment evaluated a variety of current and future exposure scenarios, and concluded that no further action was warranted for the site. The ecological assessment included a detailed evaluation of exposure and uptake throughout the food chain. Although some potential for adverse effects was identified under a conservative, worst-case evaluation, many effects were similar to those identified for background areas, and an evaluation of more realistic exposure assumptions indicated that no further action was necessary.

Retail Gasoline Stations in Indiana. Conducted human health risk assessments for several retail gasoline stations in Indiana. The reports were prepared in accordance with the Risk Integrated System of Closure (RISC). Potential exposure to total petroleum hydrocarbon (TPH) components in soil and groundwater was evaluated using methodologies developed by the TPH Criteria Working Group. Vapor intrusion from the subsurface to indoor air of the gasoline stations was assessed using the Johnson and Ettinger model.

Former MGP Sites in Georgia. Performed human health risk assessment tasks for several former MGP sites in Georgia under the Hazardous Site Response Act (HSRA). These tasks included calculation of default and site-specific risk reduction standards for soil and groundwater under both residential and nonresidential land use scenarios. In addition, conducted a focused risk assessment for one site on which four historical buildings were to be preserved. The risk assessment demonstrated that with appropriate institutional controls, residual risk in the vicinity of the preserved buildings was within acceptable limits.

Manufacturing Facility in Virginia. Performed a human health and ecological risk assessment for a manufacturing facility in Staunton, Virginia under the Voluntary Remediation Program (VRP). The significant exposure pathways were determined to be direct contact and inhalation with chlorinated solvents in groundwater and soil. The report included a fate and transport analysis for vapor intrusion of chlorinated compounds from groundwater and soil into indoor air. Groundwater migration pathways were also evaluated. Site-specific remediation standards were calculated for selected compounds in both groundwater and soil.

Andersen Air Force Base, Guam. Completed ecological assessments for multiple sites on Andersen Air Force Base on the island of Guam. Tasks involved development and implementation of protocols for detailed habitat surveys of both terrestrial and aquatic habitats. These protocols required consideration and development of risk assessment methodologies for endangered species in proposed critical habitat such as the Mariana Crow, the Mariana Fruit Bat, the Guam Rail, and a native tree species. The studies also investigated the competing impact of predator brown tree snakes on the decline in flightless bird populations.

Canadian Forces Base Gagetown, New Brunswick, Canada. Conducted a human health risk assessment to evaluate the potential exposure to herbicide residues at Canadian Forces Base (CFB) Gagetown. Specifically, the assessment evaluated exposure to residuals of polychlorinated dibenzo-p-dioxins and furans (PCDD and PCDF) associated with the spraying of Agent Orange and related herbicides. Potential receptors include military personnel, workers, and visitors to the base, as well as hunters and anglers, which could be exposed to the PCDD/PCDF residues in soil, surface water and sediment, fish, game, and/or berries. The base was divided into 11 Subject Areas (SAs) for purposes of the risk assessment. The results indicated that several of the SAs did not present the potential for adverse health effects and that access restrictions were not warranted.

Former Coke Ovens Site in Sydney, Nova Scotia, Canada. Conducted human health risk assessments for a large residential area in the vicinity of a former steel mill in Nova Scotia. In addition, conducted ecological risk assessment for Muggah Creek and its associated estuary (commonly referred to as the Sydney Tar Ponds). Contaminants associated with the former coke ovens include PCBs, PAHs, dioxins and furans, arsenic, and lead. The human health assessment included management of an extensive chemical database and development of an exposure model that could be integrated with the data on a receptor-specific basis. The ecological assessment included quantitative evaluation of potential adverse effects to aquatic receptors (macroinvertebrates and fish) and dose calculations for a variety of higher order valued ecosystem components (meadow vole, red fox, herring gull, red tailed hawk and black duck).

324 Ivy Drive
Gibsonia, PA 15044

Susan Leece
Senior Scientist

Summary

For the last 14 years, I have been a key member of the risk assessment team. I coordinate projects and perform human health and ecological risk assessments under both RCRA and CERCLA federal programs and under multiple state regulatory programs, with a focus on Pennsylvania and West Virginia voluntary programs. As a result, I have extensive knowledge of the regulations under these programs. Our human health risk assessment projects have addressed residential settings, commercial redevelopments, recreational properties, and active industrial facilities. I have also been involved in all phases of screening level and baseline ecological assessments, ranging from simple qualitative assessments to complex quantitative food chain modeling and risk characterization.

Relevant Experience

Nov 2019 – Present Senior Scientist – Environmental Risk Solutions LLC, Gibsonia, PA
Mar 2005 – Oct 2019 Senior Scientist - RBR Consulting, Inc., Beaver Falls, PA

Other Experience

Feb 1985 – Sept 1989 Associate Veterinarian – Buckley & Combe Animal Hospital, St Catharines, ON Canada
May 1982 – Dec 1984 Associate Veterinarian – Eastside Animal Hospital, Stoney Creek, ON Canada

Education

Ontario Veterinary College, University of Guelph, Guelph, Ontario. Doctor of Veterinary Medicine, 1982
University of Guelph, Guelph, Ontario. Bachelor of Science, 1979

Project Responsibilities

- Data Management - Assimilating complex analytical databases from a variety of formats (Excel, EQuIS, PDF)
- Statistical Analyses - Calculation of summary statistics, upper confidence limits, and background comparisons utilizing ProUCL Statistical Software
- Fate & Transport Modeling – Vapor intrusion (utilizing Johnson and Ettinger Model), trench vapor modeling, and groundwater to surface water migration
- Risk Assessment Calculations – Compilation of risk assessment spreadsheets which combine dose estimates with toxicity values to estimate potential carcinogenic risks and non-carcinogenic effects
- Evaluation of Lead - Both the USEPA’s Adult Blood Lead model and the Integrated Exposure/Uptake Biokinetic (IEUBK) model for children
- Text Composition – Technical writing of the main text and supporting texts for appendices
- Report Assembly – Compilation of all tables, appendices and report texts in report-ready format and PDF creation for final submittal

324 Ivy Drive
Gibsonia, PA 15044

Jacquelin Sheaffer

Project Scientist

Summary

I have over 10 years of experience conducting human health and ecological risk assessments. As part of the project team, I have been involved in all technical aspects of risk assessments, and conducted evaluations for residential, recreational, commercial, and industrial properties. Our team has completed assessments under federal programs, as well as under multiple state programs, including those of Pennsylvania, West Virginia, Ohio and Virginia. I also specialize in qualitative and quantitative ecological assessments of both terrestrial and aquatic habitats. I have participated in macroinvertebrate sampling and habitat analysis and have used these data to calculate index of biotic integrity scores to assess the health of the aquatic invertebrate community.

Relevant Experience

Nov 2019 – Present	Project Scientist – Environmental Risk Solutions LLC, Gibsonia, PA
Dec 2009 – Oct 2019	Project Scientist - RBR Consulting, Inc., Beaver Falls, PA
May 2007 – Aug 2007	Chemist/Lab Technician – Pace Analytical, Export, PA

Education

Chatham University, Master of Science – Biology, December 2008
Louisiana Tech University, Bachelor of Science – Major: Biology, Minors: Chemistry, English, May 2005

Project Responsibilities

- Ecological Receptor Surveys – Compiling information on threatened and endangered species, the presence of wetlands and other sensitive habitats, and habitat surveys
- Biological Data Evaluation – Managing invertebrate data and developing metrics to assess biotic integrity
- Analytical Data Management – Compiling analytical data into a standard format for use with our specially-developed programs that compare data to screening benchmarks
- Statistical Analyses - Calculation of summary statistics, upper confidence limits, and background comparisons utilizing ProUCL Statistical Software; also experienced using ChemStat to perform Mann-Kendall trend analyses
- Fate & Transport Modeling – Vapor intrusion (utilizing Johnson and Ettinger Model), trench vapor modeling, and groundwater migration (using BIOSCREEN Natural Attenuation Model)
- Risk Assessment Calculations – Compilation of risk assessment spreadsheets which combine dose estimates with toxicity values to estimate potential carcinogenic risks and non-carcinogenic effects
- QA/QC – Validation of all components of assessments (analytical databases, tables, appendices) for accuracy, completeness and appropriate presentation
- Report Assembly – Compilation of all tables, appendices and report texts in report-ready format and PDF creation for final submittal

EXAMPLE RISK ASSESSMENT REPORT 1:

SITE IN PENNSYLVANIA

HUMAN HEALTH AND ECOLOGICAL RISK ASSESSMENT

FOR THE

FORMER DOLLAR GENERAL PROPERTY
ALBION, PENNSYLVANIA

PADEP FACILITY # 840931

Prepared For:

Insite Group, Inc.
611 S. Irvine Avenue
Sharon, Pennsylvania

Prepared By:

Environmental Risk Solutions LLC
Gibsonia, Pennsylvania

May 2020

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EXECUTIVE SUMMARY

This human health and ecological risk assessment report was prepared by Environmental Risk Solutions LLC (ERS), on behalf of Insite Group, Inc., for the Former Dollar General Property, located in Albion, Pennsylvania (site). This assessment was conducted in a manner consistent with standard and customary approaches specified by the Pennsylvania Department of Environmental Protection (PADEP) under the Land Recycling and Environmental Remediation Standards Act (Act 2), as well as standard and customary United States Environmental Protection Agency (USEPA) approaches as needed. This risk assessment presents an analysis of the site under current and expected future non-residential land use conditions.

The property was historically used as a gasoline service station, and later as an automotive parts store, prior to being redeveloped as a Dollar General store. Dollar General relocated to a larger property in approximately 2012, and the site has remained unoccupied since that time. The building is planned for future occupancy, and the site will remain a commercial property. An environmental covenant will be placed on the site to restrict future residential use and to restrict the use of groundwater as a potable water source.

Constituents in samples of soil, groundwater and sub-slab soil gas were included and considered in the assessment. Constituents of interest (COI) were identified for each medium based on a comparison of the analytical data to USEPA Regional Screening Levels (RSLs) and PADEP vapor intrusion screening values. Analyzed constituents with detected concentrations or detection limits greater than their respective comparison values were identified as COI. Specifically, the following COI were identified for each medium/pathway:

- For onsite soil, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, benzene, ethylbenzene, naphthalene and xylenes (total) were detected above the industrial RSLs and are identified as COI for direct contact pathways. In addition, 1,2-dibromoethane and 1,2-dichloroethane were retained as COI because of elevated detection limits. No COI were identified for direct contact with offsite soil based on a comparison to residential RSLs.

- For groundwater, the following constituents were identified as COI for direct contact based on detected concentrations: 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, benzene, ethylbenzene, isopropylbenzene, naphthalene and xylenes (total). In addition, 1,2-dibromoethane, 1,2-dichloroethane and methyl tert-butyl ether were retained as COI because of elevated detection limits.

- For the vapor intrusion to indoor air pathway, no constituents were identified as COI in sub-slab soil gas.

The receptors considered for quantitative assessment in the risk assessment include outdoor workers, indoor workers and construction/utility workers. The future outdoor worker was evaluated for potential direct contact with soil through incidental ingestion, dermal contact and inhalation of particulates and volatiles in ambient air. The current/future construction/utility worker was evaluated for potential direct contact with soil (incidental ingestion, dermal contact and inhalation of particulates and volatiles), as well as direct contact with shallow groundwater (incidental ingestion and dermal contact), and inhalation of constituents volatilizing from groundwater in an excavated trench. Indoor workers were also considered as potential receptors for the site, however, no COI were identified for vapor intrusion from soil gas to indoor air. The vapor intrusion pathway was therefore considered to be insignificant, and evaluation of an indoor worker was not warranted.

In addition to the onsite worker receptors, visitors and trespassers may be present at the site. However, the magnitude of exposure for visitors or trespassers would be significantly less than for workers, and exposure is considered to be negligible. Therefore, only the worker receptors were retained for quantitative risk evaluation.

Groundwater at the site is not used for any potable purposes, and the onsite building is connected to the public water supply. In addition, an environmental covenant will be placed on the site which restricts the future use of groundwater as a potable water source. Therefore, ingestion of groundwater as drinking water is an incomplete pathway for onsite receptors.

Representative concentrations for COI in each exposure medium were calculated based on analytical data, or estimated based on fate and transport models. The intake assumptions utilized for all receptors were based on a combination of PADEP default values, USEPA default values, and site-specific information. For estimators of the toxicity of COI, values from PADEP and USEPA were employed.

The analyses indicate that the total noncancer hazard indices (HIs) were less than 1 for the future outdoor worker and the current/future construction/utility worker, indicating that the likelihood of adverse noncancer effects is negligible for these receptors. In addition, the potential cumulative cancer risks for these receptors are below PADEP's target risk of 1×10^{-4}, indicating that the likelihood of unacceptable potential cancer risk is also negligible. Specifically, for the future outdoor worker exposed to COI in onsite soil, the total HI is 0.17 and the potential cancer risk is 1.1×10^{-5}. For the current/future construction/utility worker exposed to COI in onsite soil and shallow groundwater, the total HI is 0.34 and the potential cancer risk is 2.7×10^{-6}.

The results of the ecological risk assessment indicate that there are no state-listed threatened or endangered species or species of concern, no exceptional value wetlands, and no habitats of concern at or in the vicinity of the site. There are no viable terrestrial habitats and therefore no complete exposure pathways associated with soil at the site. In addition, there are no complete exposure pathways for ecological receptors to directly contact groundwater. There are no surface water habitats on or adjacent to the site that would provide aquatic habitat for ecological receptors. Data from downgradient monitoring wells indicates that site-related constituents in groundwater will not migrate offsite. Based on the ecological evaluation, there is negligible potential for adverse effects on ecological receptors as a result of exposure to environmental media associated with the site.

This risk assessment concludes that the potential for adverse health effects is within acceptable potential risk benchmarks for all receptors, considering a prohibition on residential land use of the property and restriction on the use of groundwater as drinking water. Based on these results, no further evaluation of human health risk is warranted for the site. The ecological risk assessment concludes that no further evaluation of ecological receptors is warranted.

1.0 INTRODUCTION

This human health and ecological risk assessment report was prepared by Environmental Risk Solutions LLC (ERS), on behalf of Insite Group, Inc. (Insite), for the Former Dollar General Property located in Albion, Pennsylvania (site). The risk assessment consists of a quantitative analysis of the potential for adverse effects on human health and ecological receptors that may be exposed to constituents present in environmental media associated with the site.

1.1 PURPOSE OF THE RISK ASSESSMENT

Risk assessment is defined as the scientific evaluation of potential health effects posed by a particular substance or mixture of substances. The purpose of this risk assessment is to provide quantitative analyses, in a conservative manner, of the likelihood that adverse health effects may be associated with potential exposures to constituents in environmental media associated with the site. In providing health-related information on potential human contact with site-associated constituents, as well as information on potential ecological effects, this risk assessment is designed to provide a sound basis for risk management decisions.

This risk assessment presents an analysis of the site under current and expected future non-residential land use conditions. The risk assessment provides an understanding of the nature of constituent presence, the possible pathways of human and ecological exposure, and the degree to which such exposure may pose a potential for adverse effects.

1.2 REGULATORY FRAMEWORK AND APPROACH

This risk assessment has been prepared pursuant to the requirements of Pennsylvania's Land Recycling and Environmental Remediation Standards Act (Act 2). This risk assessment addresses the site-specific risk assessment requirements under Act 2, the final rules presented in 25 PA Code, Chapter 250 (PADEP, 2019a), and the Act 2 Technical Guidance Manual (TGM) (PADEP, 2019b). In cases where additional detail on risk assessment protocols was required, procedures and approaches developed by the United States Environmental Protection Agency (USEPA) were used (USEPA, 1989, 1991, 1992a, 2002, 2004, 2005, 2009, 2014a, 2014b, 2019a).

As noted above, this risk assessment follows Pennsylvania Department of Environmental Protection (PADEP) guidance. In addition, as set forth in Act 2, standard and customary practice within federal guidelines for the performance of risk assessments is applied. The scientific basis and validity of values used in this assessment are considered and discussed in the context of primary research literature in order to provide a frame of reference for the conclusions. The actual levels of human exposure and the potential health risks associated with exposure to constituents at the site are likely to be significantly lower than the quantitative estimates described in this assessment, due to the conventional practice of using multiple conservative assumptions in preparing risk assessments.

This risk assessment follows 25 PA Code Section 250.602(c), and the guidelines originally published in the USEPA's Risk Assessment Guidance for Superfund, Part A (USEPA, 1989), which suggest that risk assessments should contain the following four major steps:

- **Identification of Constituents of Interest (COI)**. An evaluation of site investigation data and identification of COI with regard to potential health effects;

- **Exposure Assessment**. Identification of the human receptors likely to be exposed to site-originated COI and the likely extent of their exposure under defined exposure scenarios;

- **Toxicity Assessment**. A description of the relationship between the magnitude of exposure (dose) and the probability of occurrence of adverse health effects (response) associated with the COI; and,

- **Risk Characterization**. Description of the nature and magnitude of potential human health risks, comparison to state and federal benchmarks regarding health risks, and a discussion of uncertainties in the analysis.

1.3 RISK ASSESSMENT ORGANIZATION

This report is organized in a manner consistent with the above-mentioned sections of a risk assessment. Following this introduction, the remaining sections of the report are as follows:

- Section 2 presents the procedures for identifying COI for the site.

- Section 3 identifies likely human receptors for the site and presents the exposure factors that are used to estimate the extent of exposure for each receptor.

- Section 4 describes the standard procedures for deriving toxicity values and presents the agency recommended toxicity values for the COI.

- Section 5 quantifies and summarizes the potential risks associated with exposure to the COI.

- Section 6 describes the uncertainties associated with the calculated exposures and potential health risks.
- Section 7 presents the ecological assessment
- Section 8 presents the conclusions of the risk assessment.
- Section 9 presents the references cited in the report.

2.0 SITE BACKGROUND AND IDENTIFICATION OF CONSTITUENTS OF INTEREST

The purpose of this section is to identify the subgroup of detected constituents that will be evaluated quantitatively in the risk assessment. This allows the elimination of constituents that will clearly not pose a contribution to overall site risk. This section presents the analytical data that were used in the risk assessment to identify constituents present at or released from the site. Then, by applying appropriate comparison values, COI are identified for detailed quantitative evaluation. COI for human health risk assessment are defined as those constituents present at a site that will comprise the significant portion of the calculated noncancer hazard and theoretical excess lifetime cancer risk values.

2.1 SITE DESCRIPTION AND HISTORY

The Former Dollar General Property is located at 202 East State Street, Albion Borough, Erie County, Pennsylvania. The approximately 0.4591-acre property consists of a single parcel located on the northeast corner of the intersection of East State Street (State Route 18) and Orchard Street. The property is rectangular in shape (100 feet by 200 feet) and is elongated from north to south. The surrounding area includes a mixture of commercial, residential, and industrial properties. The site is bordered to the north by a vacant lot; to the east by the LECOM Health, Northwestern Area Health Center; to the south by residences (located on the opposite side of East State Street); and to the west by Mattera Funeral Home.

The site includes a vacant, single-story, 8,280-square foot, slab-on-grade structure which was formerly used as a Dollar General store. The building is connected to natural gas, the public water supply, and the public sanitary sewer system. An L-shaped, asphalt parking lot is present on the south and west sides of the building and a truck dock is located at the northwestern corner of the building. The building faces southward toward East State Street. The property slopes gently downward toward the northwest.

The building is planned for future occupancy, and the site will remain a commercial property. An environmental covenant will be placed on the site to restrict future residential use and to restrict the use of groundwater as a potable water source.

2.1.1 <u>Site History</u>

The site was developed as a gasoline service station in the late 1930s or early 1940s. The gasoline service station reportedly closed in 1977. The property then operated as an automotive parts store (J&A Auto Supply) until the building was destroyed by a tornado in 1985. The former gasoline underground storage tanks (USTs) were reportedly removed; however, the number and size of the tanks is unknown (Insite, 2020).

The southern portion of the current building was constructed in 1986 and operated as a hardware store and later a Dollar General store. An addition to the north end of the building was constructed in the late 1990s or early 2000s. Dollar General relocated to a larger property in approximately 2012, and the site has remained unoccupied since that time. Albion Borough purchased the property in 2013.

2.1.2 Investigation Summary

As reported in the Remedial Investigation Report and Cleanup Plan (Insite, 2020), Phase II subsurface investigation activities were conducted by R.A.R. Engineering Group Inc. in March and April 2019. Six soil borings (TB#1 through TB#6) were completed at the site on March 19, 2019 and four soil samples were submitted for laboratory analysis of leaded and unleaded gasoline parameters. Groundwater samples were also collected from two of the soil borings (TB#3 and TB#4). Six additional soil borings (TB#7 through TB#12) were completed at the site on April 23, 2019. A total of 12 soil samples (two from each boring) were submitted for laboratory analysis of leaded and unleaded gasoline parameters (except for lead). No groundwater samples were collected during this drilling event.

In March 2020, additional subsurface investigation activities were completed by Insite to delineate the extent of contamination at the site. Between March 2 and 9, 2020, seven soil borings (B-1 through B-7) were completed, and ten monitoring wells (MW-1 through MW-10) were installed. The wells included three unconsolidated aquifer and three bedrock aquifer monitoring wells on the subject property, two unconsolidated aquifer and one bedrock aquifer monitoring well on the opposite side of Orchard Street to the west of the subject property, and one unconsolidated aquifer monitoring well on the opposite side of East State Street to the south. A total of 17 soil samples were submitted for laboratory analysis of leaded and unleaded gasoline parameters. Groundwater samples were collected from each well that recovered sufficiently, plus one blind duplicate from MW-3. Groundwater in MW-1 and MW-2 did not recover sufficiently for sampling; therefore, these wells were not sampled (Insite, 2020).

Because the extent of impact to groundwater in the unconsolidated aquifer was not defined to the north, one additional monitoring well (MW-11) was installed on April 3, 2020 at the northwestern corner of the site. A groundwater sample was collected from this well on April 7, 2020. On April 21 and 23, 2020, Insite conducted an additional groundwater sampling event for all 11 monitoring wells.

On February 24, 2020, Insite installed two sub-slab soil vapor points (VP-1 and VP-2) in the concrete floor of the existing commercial building on the property. These locations were sampled on March 6, 2020 and again on April 24, 2020.

2.2 SAMPLES INCLUDED IN THE RISK ASSESSMENT

The following subsections describe the samples included in the quantitative risk assessment. This assessment incorporates soil and groundwater samples which were collected onsite, in and around the location of the former USTs and pump island areas, and sub-slab soil gas samples collected from beneath the onsite building. Soil and groundwater samples collected adjacent to the site (along Orchard Street and East State Street) are also included in the assessment.

2.2.1 Soil Samples Included in the Risk Assessment

The onsite soil database consists of 4 surface soil samples and 26 subsurface soil samples. Surface soil samples represent the 0 to 2 foot interval, while subsurface soil samples were collected at depths ranging from 2 to 12 feet below ground surface (bgs). Soil samples were collected onsite during site investigation activities conducted in March and April 2019, and most recently in March 2020. As part of the most recent investigation, three subsurface soil samples were collected during the installation of offsite monitoring wells MW-4 and MW-6 and during the completion of soil boring B-1. Soil boring locations are depicted on Figure 1.

Table 2-1 lists the soil samples included in this risk assessment. The soil samples were analyzed for benzene, toluene, ethylbenzene, and xylenes (total) (collectively known as BTEX), 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, 1,2-dibromoethane, 1,2-dichloroethane, isopropylbenzene (cumene), methyl tert-butyl ether (MTBE), and naphthalene via USEPA Method 8260B. Select samples were also analyzed for lead. Appendix A, Table A-1 presents the complete analytical data for soil samples included in the risk assessment.

2.2.2 Groundwater Samples Included in the Risk Assessment

This risk assessment incorporates onsite groundwater data for the two sampling rounds conducted in March and April 2020. Groundwater samples were collected from onsite wells MW-1 through MW-3, MW-7 through MW-9 and MW-11. In addition, grab groundwater samples collected at the time of installation of test borings TB#3 and TB#4 are included in the assessment. The assessment also incorporates data from offsite wells MW-4 through MW-6 and MW-10, located along Orchard Street and East State Street. The monitoring well locations are depicted in Figure 1.

The data set used for evaluation of groundwater consists of a total of 20 groundwater samples (plus two duplicate samples) collected from the 11 monitoring wells; as well as the two grab groundwater samples from TB#3 and TB#4. As previously noted, wells MW-1 and MW-2 were not sampled in the first round of sampling (conducted in March 2020) because they did not recover quickly enough after purging. Monitoring well MW-11 was sampled initially on April 7, 2020 and then again on April 23, 2020.

The groundwater samples were analyzed for 1,2-dibromoethane via USEPA Method 8011; and 1,2-dichloroethane, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, BTEX, isopropylbenzene, methyl tert-butyl ether, and naphthalene via USEPA Method 8260B. All groundwater samples were also analyzed for lead using USEPA Method 6010B. The sample identification numbers and sampling dates are presented in Table 2-2. Appendix A, Table A-2 presents the complete analytical data for the groundwater samples included in the risk assessment.

2.2.3 <u>Soil Gas Samples Included in the Risk Assessment</u>

Sub-slab soil gas samples were collected from two onsite vapor point locations (VP-1 and VP-2) on March 6, 2020 and April 21, 2020. A duplicate sample was collected from VP-2 during both sampling rounds. The sub-slab soil gas samples were collected from beneath the onsite store building, as depicted in Figure 1. Table 2-3 lists the identification numbers and sampling dates for the sub-slab soil gas samples included in the risk assessment.

Consistent with the soil and groundwater samples, the sub-slab soil gas samples were analyzed for 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, 1,2-dibromoethane, 1,2-dichloroethane, BTEX (including o- and m&p-xylenes), isopropylbenzene, methyl tert-butyl ether and naphthalene. The soil gas samples were analyzed using USEPA Method TO-15. Appendix A, Table A-3 presents the complete analytical data for the sub-slab soil gas samples included in the risk assessment.

2.3 DATA USABILITY

USEPA (1992b) provides guidance for data usability in risk assessments. Data usability is the process of assuring or determining that the quality of the data generated meets the intended use. Analytical data were evaluated with respect to data usability prior to inclusion in this risk assessment. The following data quality issues are addressed in this section: (1) detection limits, (2) qualified data, and (3) quality control samples.

Selecting the analytical method for optimal detection limits is critical to the data usability in risk assessments. The analytical methods used in this assessment were described in the previous subsections. In some cases, even with the best analytical methods, detection limits may exceed risk-based screening values. If detection limits are consistently greater than these risk-based values, this affects the confidence of the results of the risk assessment. There is a possibility that constituents are present at levels between the risk-based concentration and the detection limit. Therefore, as part of this risk assessment, the detection limits for constituents are compared to the appropriate risk-based concentrations (refer to Section 2.4).

Qualified data must be appropriately used in risk assessments. All validated, qualified data were considered usable for this assessment with the exception of unusable or rejected ("R" qualified) samples. No results from the site data set were reported to be rejected. Several soil, groundwater and sub-slab soil gas results were qualified by the laboratory using the following notes (refer to the data tables in Appendix A):

- 1c – (Soil) A matrix spike duplicate was not performed due to insufficient sample volume. (Groundwater) The sample pH is 7.
- E- The analyte concentration exceeded the calibration range. The reported result is estimated.
- IS - The internal standard response is below criteria. Results may be biased high.
- H1 – The analysis was conducted outside the EPA method holding time.
- H2 – The sample extraction or preparation was conducted outside EPA method holding time.
- D6 - The precision between the sample and sample duplicate exceeded laboratory control limits.
- J - The target analyte concentration is below the quantitation limit (RL), but above the Method Detection Limit (MDL) or Estimated Detection Limit (EDL) for SPME-related analyses. The reported value is estimated.
- M1 – Matrix spike recovery exceeded quality control (QC) limits. Batch was accepted based on laboratory control sample (LCS) recovery.

The implications of including qualified results in the risk assessment are discussed in the Uncertainty Analysis (Section 6).

Quality control samples (such as method blanks, trip blanks, and matrix spike samples) are generally not used in the risk assessment, with the exception of field duplicate samples. Duplicate groundwater and sub-slab soil gas samples were collected from the site. If a duplicate was collected for a particular sample, a single concentration was used to represent the sample pair as follows: (1) if both results are detected, the mean of the two values is used to represent that sample; (2) if both results are non-detect, the higher detection limit is used to conservatively represent that sample; and (3) if one result is detected and the other is non-detect, the detected value is used to conservatively represent that sample.

2.4 IDENTIFICATION OF CONSTITUENTS OF INTEREST

An important step in the risk assessment is to identify COI for the site. As noted above, volatile organic compounds (VOCs) and lead have been analyzed in soil, groundwater and sub-slab soil gas associated with the site, however, some of these constituents may be eliminated from further consideration in the quantitative risk assessment because they pose a negligible concern by customary risk assessment standards. Constituents that cannot be eliminated by this process are identified as COI and are carried through to the site-specific, quantitative portion of the risk assessment.

It is important to recognize that the selection of a constituent as a COI does not necessarily indicate that it poses a significant health risk. The selection of a constituent only indicates that there is a need to evaluate it quantitatively in the risk assessment to determine if that constituent may be associated with potential health risks.

2.4.1 Constituents in Soil – Direct Contact

In order to evaluate a current/future non-residential scenario for the onsite area, the COI identification process for constituents in soil consists of a comparison of the concentrations of each constituent with the USEPA industrial soil Regional Screening Levels (RSLs) (USEPA, 2019a). To evaluate unrestricted use for the offsite area, the residential soil RSLs are used for comparison. The use of USEPA RSLs to identify COI in a site-specific risk assessment is consistent with PADEP guidance.

The RSLs used in this assessment are generic values that are based on default exposure parameters and factors that represent reasonable maximum exposure conditions for chronic exposures. These values are based on the methods originally outlined in USEPA's Risk Assessment Guidance for Superfund, Part B Manual (USEPA, 1991) and Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites (USEPA, 2002). Specifically, the comparison values utilized are risk-based values corresponding to a 10^{-6} risk level for carcinogens. The direct contact RSLs for non-carcinogenic constituents reflect a hazard quotient (HQ) of 0.1. The calculation of soil RSLs takes into account incidental ingestion of soil, inhalation of volatiles and particulates emitted from soil, and dermal exposures. Those constituents whose maximum detected concentrations and maximum detection limits are below the applicable comparison values are eliminated as COI.

The results of the COI identification process for direct contact with onsite and offsite soil are presented in Tables 2-4 and 2-5, respectively. For each constituent, these tables present the detection frequency, the minimum and maximum detected concentrations, the sample with the maximum detect, the minimum and maximum detection limits and the applicable soil RSL. The maximum detected concentration and the maximum detection limit of each constituent in soil were compared to the applicable RSL. Constituents that exceeded the RSL were identified as COI for direct contact with soil.

All soil samples collected onsite were included in the direct contact screening evaluation for the site. As indicated in Table 2-4, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, benzene, ethylbenzene, naphthalene and xylenes (total) were detected at maximum concentrations exceeding their respective industrial soil RSLs and are identified as COI for direct contact with onsite soil under a non-residential scenario. This table also indicates that the laboratory detection limits for 1,2-dibromoethane and 1,2-dichloroethane exceed the applicable industrial direct contact screening values. These two constituents are conservatively retained as COI for the direct contact pathway for the onsite area.

The data from offsite soil samples were compared to residential direct contact screening values to evaluate an unrestricted use scenario. As indicated in Table 2-5, only 1,2,4-trimethylbenzene and lead were detected in these samples, and neither constituent was detected at a concentration exceeding the applicable residential soil RSL. Therefore, no COI are identified for direct contact with offsite soil. This table also indicates that the laboratory detection limits for all constituents were below the residential soil RSLs. Therefore, no data usability issues are associated with the detection limits for constituents analyzed in offsite soil.

2.4.2 Constituents in Groundwater – Direct Contact

For constituents in groundwater, the COI identification process is similar to that for soil. The maximum detected concentration of each constituent is compared with the RSL for tapwater (USEPA, 2019a). As with soil RSLs, the tapwater RSLs used in this assessment are generic values that are based on default exposure parameters and factors that represent reasonable maximum exposure conditions for chronic exposures. Specifically, the comparison values utilized are risk-based values, which correspond to a 10^{-6} risk level for carcinogens. The direct contact RSLs for non-carcinogenic constituents reflect a HQ of 0.1. The calculation of tapwater RSLs takes into account ingestion of groundwater as drinking water, dermal contact while bathing/showering, and inhalation of volatiles from groundwater. Those constituents whose maximum detected concentrations and maximum detection limits are below the RSLs are eliminated as COI.

It should be noted that use of the tapwater RSLs in this comparison is considered to be conservative, because the RSLs represent concentrations that are developed for drinking water. Groundwater at the site is not currently used for any potable purposes (the onsite building is connected to the public water supply), and the use of groundwater for drinking water will be restricted in the future by an environmental covenant.

The results of the COI identification process for direct contact with groundwater are presented in Table 2-6. All data from onsite and offsite wells are included in the screening. For each constituent, this table presents the detection frequency, the minimum and maximum detected concentrations, the sample with the maximum detect, the minimum and maximum detection limits and the tap water RSL. The maximum detected concentrations and maximum detection limits for constituents in groundwater are compared to the RSLs, and constituents that exceeded these values are identified as COI for direct contact.

As indicated in Table 2-6, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, benzene, ethylbenzene, isopropylbenzene, naphthalene and xylenes (total) were detected at maximum concentrations exceeding the applicable tap water RSLs and are identified as COI for direct contact with groundwater. It should be noted that all of the detections exceeding the RSLs were reported in wells TB-3, TB-4 and MW-3 (refer to Appendix A-2). The remaining onsite monitoring wells and all offsite monitoring wells have been non-detect for all constituents and sampling events included in this evaluation.

Table 2-6 also indicates (by a value in bold font) that 1,2-dibromoethane, 1,2-dichloroethane, benzene, methyl tert-butyl ether and naphthalene have reported laboratory detection limits which exceed their respective tapwater RSLs. Benzene and naphthalene have already been identified as direct contact COI for groundwater based on their detected concentrations, and will be evaluated further in the quantitative risk assessment. The remaining three constituents (1,2-dibromoethane, 1,2-dichloroethane and methyl tert-butyl ether) are conservatively retained as COI for direct contact with groundwater.

2.4.3 Constituents in Sub-Slab Soil Gas – Vapor Intrusion

PADEP (2019b) provides vapor intrusion screening values which, for a site-specific risk assessment, must be adjusted by a factor of 0.1 to reflect a target HQ of 0.1 and a target cancer risk of 1×10^{-6}. The nonresidential sub-slab soil gas screening values are presented in Table 4 of the Vapor Intrusion TGM (PADEP, 2019b) and have been included in the screening for soil gas.

The results of the COI identification process for sub-slab soil gas for the vapor intrusion pathway under a non-residential scenario are presented in Table 2-7. For each constituent, this table presents the frequency of detection, the minimum and maximum detected concentrations, the sample number of the maximum detected concentration, the minimum and maximum detection limits, and the applicable PADEP vapor screening value (adjusted). The maximum detected concentrations and maximum detection limits for constituents in sub-slab soil gas were compared to the screening values, and constituents that exceed these values are identified as COI.

As indicated in Table 2-7, no constituents were detected at concentrations which exceeded the applicable vapor intrusion screening value, and therefore no COI are identified for potential vapor intrusion from soil gas to indoor air. Table 2-7 also indicates that the laboratory detection limits for all constituents were found to be below the PADEP vapor intrusion screening values. Therefore, no data usability issues are associated with the detection limits for constituents analyzed in sub-slab soil gas.

2.4.4 Summary of Constituents of Interest

Based on the process described above, several constituents have been identified as COI for the site.

- For onsite soil, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, benzene, ethylbenzene, naphthalene and xylenes (total) were detected above the industrial RSLs and are identified as COI for direct contact pathways. In addition, 1,2-dibromoethane and 1,2-dichloroethane were retained as COI because of elevated detection limits. No COI were identified for direct contact with offsite soil based on a comparison to residential RSLs.

- For groundwater, the following constituents were identified as COI for direct contact based on detected concentrations: 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, benzene, ethylbenzene, isopropylbenzene, naphthalene and xylenes (total). In addition, 1,2-dibromoethane, 1,2-dichloroethane and methyl tert-butyl ether were retained as COI because of elevated detection limits.

- For the vapor intrusion to indoor air pathway, no constituents were identified as COI in sub-slab soil gas. No further evaluation of the vapor intrusion pathway is warranted.

The lists of COI for all media and the associated potential exposure pathways are presented in Table 2-8. In the following subsections, exposure pathways will be evaluated for completeness, and COI for all complete pathways will be evaluated in the quantitative risk assessment.

3.0 EXPOSURE ASSESSMENT

Exposure assessment is the process of measuring or estimating the intensity, frequency, and duration of human exposure to a constituent in the environment. This section of the risk assessment discusses the mechanisms by which people might come in contact with COI and the approximate magnitude, frequency, and duration of contact between potential human receptors and COI. The quantitative assessment of exposure, based on COI concentrations and the degree of absorption of each COI, provides the basis for estimating constituent uptake (dose) and associated health risks. The exposure assessment follows the recommendations for conducting an assessment according to Act 2 guidance (PADEP, 2019a), USEPA risk assessment guidance (1989), and the Guidelines for Exposure Assessment (USEPA, 1992a).

3.1 PATHWAYS OF HUMAN EXPOSURE

An exposure pathway describes the course that a constituent takes from its environmental source to a human receptor. Each exposure pathway includes the following elements: (1) a source or constituent release from a source, (2) an exposure medium, (3) a point of potential contact for the receptor with the exposure medium, and (4) an exposure route at the contact point (e.g., ingestion, dermal contact or inhalation). An exposure pathway is considered complete when all of these elements are present.

Once constituents are released into an environmental medium, they may migrate from one medium to another. Complete exposure pathways are those that involve receptor contact with an environmental medium that contains elevated levels of site-associated constituents. The complete exposure pathways for the site and adjacent offsite area are identified below. Only complete exposure pathways are evaluated quantitatively in the risk assessment.

3.1.1 Potential Exposure Media and Routes of Exposure

Soils - Direct Contact: Several constituents have been identified as COI for direct contact with onsite soil based on the approach undertaken in Section 2.4. For receptors with the potential to directly contact site soils, incidental ingestion of constituents in soil and dermal contact with constituents in soil are the standard exposure routes that are assessed.

Soil-to-Air Volatile Emissions: Volatile constituents present in soil can be released to ambient air through volatilization. All constituents identified as COI for direct contact with soil are considered to be volatile by PADEP and USEPA (2019a). Therefore, inhalation of volatile constituents in ambient air is a complete exposure pathway for the site. In addition, volatile constituents in soil may be transported via soil gas to indoor air through vapor intrusion. Receptors could be exposed to vapors in indoor air via inhalation. In this assessment, vapor intrusion to indoor air is evaluated using sub-slab soil gas data (see below).

Soil-to-Air Particulate Emissions: COI that have adhered to soil particulates could be transported to ambient air by wind erosion or construction activities. Inhalation of particulate emissions in outdoor air is considered to be a potentially complete exposure route for the site.

Soil – Migration to Groundwater: Constituents in soil have the potential to migrate to groundwater. Because groundwater has been directly sampled at the site, the soil to groundwater migration pathway is evaluated as part of the groundwater direct contact pathway (see below).

Groundwater – Direct Contact: Several VOCs were identified as COI for direct contact with groundwater. The site is connected to the public water supply and onsite groundwater use will be restricted in the future, therefore there are no complete pathways for onsite receptors to contact groundwater via potable use. However, direct contact with shallow groundwater is possible by construction workers involved in subsurface excavations that extend to the water table. Water level data collected from wells in the unconsolidated aquifer indicate that the depth to water ranges from 3 to 6 feet below ground surface (bgs), which is shallow enough for potential incidental contact during excavation activities. For construction/utility workers potentially exposed to constituents in groundwater, incidental ingestion and dermal contact are the standard exposure routes that are assessed.

Groundwater - Volatile Emissions: Volatile COI in groundwater may be transported to ambient air during construction/excavation activities that reach the water table. A construction worker may be exposed to volatile constituents in ambient air of an excavated trench via inhalation. In addition, volatile constituents in groundwater may be transported via soil gas to indoor air through vapor intrusion. For this site, vapor intrusion is evaluated through the use of sub-slab soil gas data.

Groundwater – Offsite Migration: Groundwater elevation data for the site indicate that flow direction is toward the west or northwest. Reported concentrations of all analytes in offsite wells MW-4, MW-5 and MW-10 (to the west), onsite well MW-11 (to the north), and offsite well MW-6 to the south, were all non-detect for both sampling rounds. Given that the onsite service station closed in 1977, and the USTs were removed in 1985, the groundwater plume is expected to have reached steady-state conditions. It is therefore considered highly unlikely that the offsite wells would show any impact from the site in the future. Based on this information, offsite migration of constituents in groundwater is considered to be an insignificant pathway for the site.

Soil Gas – Vapor Intrusion: Volatile COI in subsurface media may intrude into the indoor air of current or future buildings, and indoor receptors could be exposed to vapors via inhalation. In this assessment, vapor intrusion to indoor air is evaluated using sub-slab soil gas data. No constituents were identified as COI in sub-slab soil gas; therefore, this pathway is considered to be insignificant, and no further evaluation of the vapor intrusion pathway is warranted.

3.1.2 Potential Receptors

The potential human receptors at a site must be identified in order to evaluate potential exposure pathways. Potential receptors are identified based on current/future non-residential use of the site. This risk assessment addresses potential exposure to constituents in soil, groundwater and sub-slab soil gas. The following receptors are considered for inclusion in the risk assessment:

- Future Outdoor Workers
- Future Indoor Workers
- Current/Future Construction/Utility Workers
- Visitors or Trespassers
- Offsite Receptors

Outdoor and indoor workers are potential receptors for the site under current and expected future conditions. There are no apparent impacts to surface soil at the site, and the site is paved. As a result, exposure to the identified COI is unlikely for the outdoor worker, because this receptor is not expected to engage in subsurface activities. However, to be conservative, an evaluation of the outdoor worker is included in this assessment, using data for both surface and subsurface soil. The complete pathways are incidental ingestion of soil, dermal contact with soil, and inhalation of particulate and volatile emissions in ambient air. As previously noted, the site is connected to public water and an environmental covenant will prohibit the use of groundwater as drinking water in the future; therefore, ingestion of groundwater as a drinking water source is an incomplete pathway for onsite workers. No COI were identified for vapor intrusion from onsite soil gas to indoor air, therefore an evaluation of an indoor worker is not warranted.

A current or future construction/utility worker may be involved in a short-term project (e.g., utility line repair and maintenance) at the site. This receptor could potentially be directly exposed to constituents in soil or shallow groundwater during excavation activities. In this assessment, the construction/utility worker is evaluated for direct exposure to soil via incidental ingestion, dermal contact, and inhalation of particulate and volatile emissions in ambient air. This receptor is also evaluated for direct exposure to shallow groundwater via incidental ingestion, dermal contact, and inhalation of volatiles in an excavated trench.

In addition to the onsite worker receptors, visitors and trespassers may be present at the site. However, the magnitude of exposure of visitors or trespassers would be significantly less than workers, and exposure is considered to be negligible. Therefore, only the worker receptors are retained for quantitative risk evaluation.

Offsite receptors were also considered as potential receptors. However, there were no COI identified in offsite soil, and as discussed in Section 3.1.1, reported concentrations of all analytes in offsite wells were non-detect for both sampling rounds. The potential for constituents in onsite groundwater to migrate offsite at unacceptable concentrations is considered to be negligible. Therefore, potential exposure to constituents in offsite soil or groundwater is considered to be insignificant, and no further evaluation of offsite receptors is warranted.

3.1.3 Complete Exposure Pathways

Complete exposure pathways require exposure media with elevated levels of site-associated constituents and receptors with the opportunity to contact these media. The previous sections described the potential exposure pathways for the site under current and expected future land use conditions, as well as the likely human receptors. Figure 2 presents the conceptual site model, which identifies the receptors and associated potential exposure pathways, and whether each pathway is complete. Exposures resulting from all potentially complete pathways are quantitatively evaluated in this assessment.

3.2 QUANTIFICATION OF EXPOSURE POINT CONCENTRATIONS

Potential exposure to constituents in the environment is directly proportional to their concentrations in environmental media and characteristics of exposure (e.g., frequency and duration). The concentrations that a receptor may contact in an environmental medium generally are referred to as exposure point concentrations (EPCs). The analytical results for samples from a given medium were combined to derive a single EPC for each COI that conservatively represents the level of that COI to which potential receptors may be exposed. For COI in soil and groundwater, EPCs were statistically calculated from sampling data. EPCs for particulate and volatile emissions from soil to ambient air were estimated using PADEP methodologies. EPCs for volatile emissions from groundwater to ambient air were estimated using the Virginia Department of Environmental Quality (VDEQ, 2020) equations for groundwater present at depths less than or equal to 15 feet.

3.2.1 Exposure Point Concentrations Based on Measured Data

EPCs generally are estimated using measured concentrations in environmental media, or estimated based on fate and transport models. Depending on the distribution of the data, the proportion of the samples reported as non-detect, and the total number of samples, there are several statistical parameters that may be used to estimate EPCs. USEPA supplemental risk assessment guidance (USEPA, 1992c) stipulates that EPC estimates should be based on the upper confidence limit (UCL) of the arithmetic mean to estimate a Reasonable Maximum Exposure (RME) scenario. RME conditions are defined by USEPA as the "highest exposure that is reasonably expected to occur at the site." The UCL is used to evaluate all COI, with some exceptions as noted below.

In this assessment, the USEPA (2016) software package, ProUCL Version 5.1.00, is used to calculate statistics. This program allows for statistical calculations on data sets with or without non-detect results. For data sets without non-detect results, statistics are simply calculated on the full data set. For data sets with non-detect results, regression on order statistics (ROS) are used to extrapolate non-detect observations based on the distribution of the data set.

The first step in the data evaluation process is to determine the best fit distribution of the data (USEPA, 2016). Untransformed data are tested first to determine if the distribution is normal at $\alpha = 0.05$. If they are normally distributed, the appropriate statistics for normal data are used. If the data are not normal, the data are log-transformed and retested for lognormality at $\alpha = 0.05$. USEPA (2016) also provides methods to test for Goodness of Fit to the Gamma distribution, and indicates that the Gamma distribution is prioritized over the lognormal distribution. A distribution which is neither normal, Gamma, nor lognormal is defined as a non-parametric distribution. The ProUCL output files provide detailed information on statistics generated for each distribution type, and also identify the recommended UCL ("Suggested UCL to Use"). In cases where ProUCL presents more than one "Suggested UCL to Use", the UCL that is calculated using the statistical test best suited to the identified distribution is selected.

3.2.1.1 Exposure Point Concentrations for Constituents in Soil

The UCLs for COI in soil evaluated for the direct contact pathway were calculated using ProUCL Version 5.1.00, and the statistical output is provided in Appendix B-1. All available soil data for the onsite area were combined to calculate the UCLs used to evaluate the outdoor worker and the construction/utility worker (samples from offsite locations MW-4, MW-6 and B-1 were excluded from the representative data set). The final EPC is identified as the lower of the UCL or the maximum detected concentration. For constituents which were non-detect but retained as COI because of elevated detection limits, the EPC was conservatively based on the value of the maximum detection limit. The UCLs and final EPCs for COI in soil are presented in Table 3-1.

3.2.1.2 Exposure Point Concentrations for Constituents in Groundwater

To evaluate groundwater exposure pathways, EPCs should represent the center of the constituent plume. USEPA supplemental guidance (USEPA, 2014a) recommends that monitoring wells within the core/center of the plume be used to calculate the groundwater EPC for each constituent. The use of data from representative wells in the core of the plume is consistent with USEPA guidance for this calculation.

Accordingly, the dataset for each COI incorporates data from the well(s) with the highest detected concentrations.

For purposes of this risk assessment, the center of the plume is defined by those locations from which samples contain the highest concentrations of the COI. The dataset used for the EPC determination in this assessment consists of all samples collected from locations TB#3, TB#4 and MW-3. The final EPC for each COI is identified as the maximum detected concentration (or the value of the maximum detection limit for constituents which were non-detect but retained as COI because of elevated detection limits). The final EPCs for COI in groundwater are presented in Table 3-2.

3.2.2 Exposure Point Concentrations for Particulates in Ambient Air

The concentrations of COI associated with particulate emissions from soil were estimated using a transfer factor (TF). The TF relates the concentration of a constituent in soil to the estimated concentration in respirable airborne particulates. The TF used in this assessment is the default value from Section 250.307(d) of the regulations (PADEP, 2019a), 1 x 10^{10} m^3/kg. The TF was applied to soil concentrations for each COI to estimate particulate concentrations that might be inhaled by a potential receptor.

While the default TF presented by PADEP does not specifically address a construction scenario (i.e., it accounts for wind-generated dusts), it is considered appropriate for both the outdoor worker and the construction worker scenarios in this assessment. The overall contribution of the particulate inhalation pathway to the total worker intake is generally negligible relative to the soil ingestion pathway, which also accounts for airborne dust particles. There are multiple uncertainties associated with the calculation of a particulate emission factor based on effects from earth-moving equipment, which occur for only a portion of the entire duration of the construction project. Therefore, the default TF provided by PADEP is considered to be suitably conservative to evaluate particulate emissions for the onsite construction/utility worker in this risk assessment.

Soil concentrations are converted to air concentrations by dividing the soil concentration (C_S) by the TF to obtain an air concentration (C_A) in units of mg/m^3. The soil source concentrations, the TF, and the resulting concentrations of particulates in ambient air used to evaluate the outdoor worker and the construction/utility worker are presented in Table 3-3.

3.2.3 Exposure Point Concentrations for Volatiles in Ambient Air (Soil Source)

The concentrations of COI associated with volatilization from soil to outdoor air were estimated using a volatilization factor (VF). The VF relates the concentration of a constituent in soil to the estimated concentration in ambient air. USEPA (2019a) provides default volatilization factors for exposure to constituents in soil. Soil concentrations (C_S) in units of mg/kg are converted to air concentrations (C_A) in units of mg/m^3 by dividing the C_S by the VF to obtain the C_A. The soil source concentrations used to evaluate the outdoor worker and the construction/utility worker, the VFs and the resulting concentrations of volatiles in ambient air are presented in Table 3-4.

3.2.4 Exposure Point Concentrations for Volatiles in Ambient Air (Groundwater Source)

There are no well-established models available for estimating migration of volatiles from groundwater into a utility trench. One approach is based on a combination of vadose zone modeling (to estimate the volatilization from groundwater into the excavation) and a box model (to estimate dispersion of the volatiles within the trench and the above-ground atmosphere); this approach has been adopted by the VDEQ. The volatilization factors for groundwater to ambient air in a trench (VF_{trench}) were estimated for each volatile COI in groundwater using the VDEQ (2020) equations for groundwater present at depths less than or equal to 15 feet.

Appendix C presents the details of the calculations for VF_{trench}. The groundwater EPCs are multiplied by the constituent-specific VF_{trench} values to derive ambient air concentrations. The groundwater EPCs, constituent-specific VF_{trench} values, and resulting concentrations of volatile COI in ambient air are presented in Table 3-5.

3.3 ESTIMATION OF CONSTITUENT EXPOSURE AND INTAKE

The USEPA's "Guidelines for Exposure Assessment" (USEPA, 1992a) define constituent exposure as "the condition of a constituent contacting the outer boundary of a human." The constituents are contained in an environmental medium such as water, soil, or air. Generally, two steps are required for a constituent to enter a body; contact with the outer boundary of the body (exposure), then crossing this outside boundary to inside the body (intake). For most exposure routes, intake is evaluated in terms of how much of the carrier medium containing the constituents crosses the outer boundary (e.g., amount of soil ingested, volume of air inhaled).

Two types of doses, applied and internal, are defined for evaluating constituent exposure (USEPA, 1992a). The applied dose is the amount of a constituent present at an absorption barrier (e.g., lung) and available for absorption. This is analogous to the administered dose in a dose-response experiment. The internal dose is the amount of constituent actually absorbed across the barrier and available for internal biological interactions. It is the portion of the internal dose that actually reaches cells, sites, or membranes where adverse effects occur. Doses are generally presented as dose rates (dose per unit time) on a per-unit-body-weight basis (units of mg/kg-day).

Noncarcinogenic health effects are evaluated by calculating the average dose of a constituent over the course of the exposure period. This dose is termed the Average Daily Dose (ADD). Potential carcinogenic health effects are evaluated in terms of an individual's theoretical increased risk of developing cancer over a lifetime. Although the duration of exposure to a constituent release generally does not last for an entire lifetime, constituent intake for carcinogens is estimated as the average dose over the average human lifetime (70 years). This lifetime dose applies specifically to the evaluation of carcinogenic effects and is termed the Lifetime Average Daily Dose (LADD). In a risk assessment, the calculated ADD or LADD are estimated quantitatively using assumptions about the duration, frequency, and magnitude of exposure experienced by each potential receptor, and assumptions about the constituent properties that influence absorption.

Table 3-6 presents the general form of the equation used to evaluate intake of constituents. The specific equations and factors for each of the exposure pathways are discussed in Sections 3.4 and 3.5 and presented in the accompanying tables.

3.4 ESTIMATION OF CONSTITUENT ABSORPTION

3.4.1 Gastrointestinal Bioavailability

As noted above, the amount of a constituent that actually penetrates the exchange boundaries of the organism is termed the internal dose (sometimes called absorbed dose). The toxicity studies that provide the basis for derived constituent health effects values [i.e., reference doses (RfDs) and cancer slope factors (CSFs)] generally report health effects as a function of applied doses rather than internal doses. These values are therefore most correctly compared to calculations of potential applied doses. However, toxicity studies often administer constituents to the laboratory study animals in food, in water, or in a matrix that readily allows absorption. The fraction of a constituent that is absorbed from soil is generally less than the fraction absorbed from food or drinking water. USEPA guidance indicates that RfDs are usually based on or have been adjusted to reflect drinking water exposure (USEPA, 1989). Constituents contained in other environmental media, such as soil, are likely to be absorbed to a lesser degree than occurs in a toxicity study or is inherent in a water-based RfD. For these reasons, a bioavailability factor is often incorporated into the dose calculations for ingestion of COI in soil to take into account the reduced ability of the constituent to be extracted from the environmental matrix, or to be absorbed through the exchange boundary, and any other losses between intake and contact with the exchange boundary (USEPA, 1992a).

The extent of gastrointestinal bioavailability depends on the properties of the constituent and the properties of the matrix with which it is ingested. This risk assessment includes the evaluation of soil and groundwater ingestion pathways. For these exposure routes, an absorption factor of 100 percent was used for all COI.

3.4.2 Dermal Absorption of Constituents from Soil

The administered dose in a dermal exposure pathway is the amount of constituent in the volume of soil contacting the skin. Only a small fraction of this amount of the constituent will actually penetrate the skin and enter the body of a receptor. Dermal exposure calculations are, therefore, always calculated as an absorbed dose and require the inclusion of a dermal absorption fraction (DAF).

The DAF values recommended by USEPA (2019a) are based on dermal guidance from USEPA (2004) and are presented in Table 3-7. For naphthalene in soil, the default dermal absorption fraction of 13% (0.13) is incorporated into the dose equations. Although PADEP does not provide guidance for the dermal exposure pathway, USEPA (2004) guidance indicates that exposure to volatile constituents is accounted for through the inhalation pathway. Therefore, the DAF for 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, 1,2-dibromoethane, 1,2-dichloroethane, benzene, ethylbenzene and xylenes (total) is set to zero (i.e., these constituents are not evaluated for the dermal contact with soil pathway).

3.4.3 Dermal Absorption of Constituents from Groundwater

Pathways that involve dermal contact with water require the calculation of the dermal absorbed dose per event (DA_{event}). This factor reflects the movement of the constituent from the water, across the skin, to the stratum corneum and into the bloodstream.

USEPA guidance (2004) presents equations for calculating DA_{event} for both organic and inorganic constituents. For organic constituents, the DA_{event} values are calculated based on the exposure time for the site-specific scenario as it relates to a constant, t* (time to reach steady state). In this assessment, exposure time for dermal contact with water by a construction/utility worker is assumed to be two hours per event. The equations and input factors used to calculate DA_{event} for all COI in groundwater are presented in Table 3-8. Constituent-specific factors were obtained from USEPA (2019a) and USEPA (2004).

3.5 EXPOSURE ASSUMPTIONS

The quantitative estimation of constituent intake involves incorporation of numerical assumptions for a variety of exposure parameters. Where guidance was available, exposure assumptions used in these intake calculations were based on PADEP (2019a) or USEPA (2002, 2014b, 2019a, 2019b) recommended values. Some exposure values are not addressed in the available guidance, and in these cases, values were derived based on site characteristics or best professional judgment. Exposure assumptions utilized in this risk assessment are described below.

3.5.1 All Pathways

The following factors are consistent across all of the exposure pathways considered in this assessment.

3.5.1.1 Exposure Frequency and Duration

Outdoor Workers: Default exposure factors for an industrial worker are provided by PADEP (2019a). The exposure frequency for the worker is 5 days per week for 50 weeks a year, or 250 days per year. However, for workers potentially exposed via direct contact soil pathways, PADEP recommends multiplying the 250 days/year frequency by a factor of 5/7 to reflect the number of days that soil is frozen. Therefore, an exposure frequency of 180 days/year is incorporated into the evaluation for the outdoor worker. PADEP (2019a) guidance recommends an exposure duration of 25 years for industrial workers.

Construction/Utility Worker: This receptor is not specifically addressed by current PADEP guidance. USEPA (2002) guidance recommends that exposure frequency and duration should be determined on a site-specific basis. On the basis of professional judgment, considering the size of the site and potential for projects requiring excavation, exposure frequency for the construction worker is assumed to be 60 days per year. This frequency is based on an assumed project duration of 12 weeks (5 days per week). Because this is considered a one-time project, the exposure duration for this receptor is one year.

3.5.1.2 Body Weight

The default value for average body weight of an adult is 80 kg based on PADEP (2019a) and USEPA (2014b, 2019a). This value was used for the body weight for the outdoor worker and the construction/utility worker.

3.5.1.3 Averaging Time

As described above, the doses for noncarcinogenic health effects are averaged over the specific period of exposure for a given receptor. Noncarcinogenic averaging times are, therefore, calculated by multiplying the exposure duration for the receptor by 365 days/year. Carcinogenic health effects are calculated over a lifetime exposure, so the PADEP (2019a) value for average lifetime, 70 years, was used for exposure duration. The resulting carcinogenic averaging time was 25,550 days.

3.5.2 Incidental Ingestion of Soil

The factors incorporated into the intake calculations for soil ingestion are discussed in this section. Exposure factors for the outdoor worker and the construction/utility worker are presented in Table 3-9. The equations used to calculate intake (represented as ADD and LADD) for this pathway are also presented in this table.

Soil Ingestion Rate: For workers involved in short-duration construction or utility projects (i.e., the construction/utility worker), a soil ingestion rate of 330 mg/day was used (USEPA, 2019a). The PADEP (2019a) recommended value of 50 mg/day was used to describe soil ingestion for a worker not involved in construction or intrusive activities (i.e. the outdoor worker).

Gastrointestinal Bioavailability Factor: As described in Section 3.4.1, a relative gastrointestinal bioavailability factor was included in calculations of the soil ingestion pathway. A conservative value of 100% was used in this assessment for all constituents.

3.5.3 Dermal Contact with Soil

The factors incorporated into the intake calculations for the dermal contact with soil are discussed in this section. PADEP (2019a) does not address this pathway; therefore, guidance from USEPA sources has been incorporated as noted below. Exposure factors for the outdoor worker and the construction/utility worker are presented in Table 3-10. The equations used to calculate intake (represented as ADD and LADD) for the dermal contact with soil pathway are also presented in this table.

Skin Surface Area: Potentially exposed workers are assumed to wear appropriate clothing during outdoor activities that may involve soil contact, such as long sleeve shirts and long pants. Skin surface area available for dermal contact with soil is assumed to be the hands, forearms, and head. The exposed skin surface area corresponding to these body parts is approximately 3,527 cm^2, based on guidance from USEPA (2014b).

Soil Adherence Factor: The soil adherence factor describes the amount of soil that is assumed to be in contact with the exposed skin surface area. USEPA guidance (2019a) provides a value of 0.3 mg/cm^2 for a construction worker. A value of 0.12 mg/cm^2 is recommended by USEPA (2014b, 2019a) for an outdoor industrial worker.

Dermal Absorption Fraction: As described in Section 3.4.2, a DAF is included in calculations of exposure to constituents in soil through dermal contact. As discussed previously and presented in Table 3-7, for naphthalene in soil, the default dermal absorption fraction of 13% (0.13) is incorporated into the dose equations. For other volatile constituents, USEPA (2004) guidance indicates that exposure is accounted for through the inhalation pathway. Therefore, the DAF for the remaining COI is set to zero (i.e., these constituents are not evaluated for the dermal contact with soil pathway).

3.5.4 Particulate and Volatile Inhalation

In accordance with USEPA's "Supplemental Guidance for Inhalation Risk Assessment" (USEPA, 2009), an intake factor is not calculated for the inhalation pathway. The guidance recommends that when estimating risk via inhalation, the concentration of the constituent in air should be used as the exposure metric (e.g., mg/m^3), rather than inhalation intake of the constituent in air based on inhalation rate and body weight (e.g., mg/kg-day). Thus, instead of a dose calculation, an exposure concentration is calculated for each receptor.

The following factors are incorporated into calculations of inhalation exposure for particulate and volatile emissions in ambient air. Exposure factors for the outdoor worker and the construction/utility worker are presented in Table 3-11. The general calculation for the exposure concentration is also presented in this table.

Exposure Time: The outdoor worker and the construction/utility worker are assumed to be present and subject to inhalation exposure from soil for 8 hours per day (PADEP, 2019a; USEPA, 2014b). For the construction worker exposed to constituents in groundwater in a utility trench, the exposure time was estimated to be two hours per day.

Averaging Time: The averaging times are the same as those discussed previously in Section 3.5.1.3. However, in the calculation of exposure concentration, the averaging time is expressed in units of hours (USEPA, 2009).

3.5.5 Incidental Ingestion of Groundwater

The following factor is incorporated into calculations of the groundwater ingestion pathway. Exposure factors for the construction/utility worker are presented in Table 3-12. The equations used to calculate intake (represented as ADD and LADD) for this pathway are also presented in this table.

Water Ingestion Rate: An incidental water ingestion scenario for a worker is not specifically addressed by PADEP or USEPA guidance; however, as a conservative estimate, an ingestion rate of 0.092 L/day (assuming one 2-hour event per day) was used in this assessment for the groundwater ingestion scenario. This rate was selected to reflect a value of one-half the water ingestion rate of 92 ml/hour, which represents the upper-percentile ingestion rate for an adult while swimming (USEPA, 2019b).

3.5.6 Dermal Contact with Groundwater

The following factors are incorporated into calculations of the dermal contact with water pathway. Exposure factors for the construction/utility worker are presented in Table 3-13. The equations used to calculate intake (represented as ADD and LADD) for this pathway are also presented in this table.

Dermal Absorbed Dose per Event: As described in Section 3.4.3, constituent-specific values for DA_{event} are included in calculations describing dermal exposure to water. These values, calculated according to

USEPA (2004) guidance, were presented in Table 3-8 and reflect the constituent-specific groundwater concentration and an exposure time of two hours per event.

Event Frequency: This factor reflects the number of events per day during which dermal contact with water might occur. For this assessment, one event per day was assumed for the construction/utility worker.

Skin Surface Area: Construction workers are assumed to be exposed to water on the same body parts that soil exposure may occur. As noted above, the exposed skin surface area for a worker is approximately 3,527 cm^2, based on guidance from USEPA (2014b).

3.6 SUMMARY

Calculations of estimated doses for complete exposure pathways identified in this section are presented in Appendix D. These dose estimates were combined in the risk characterization (Section 5) with toxicity values presented in the Toxicity Assessment (Section 4) to estimate potential carcinogenic risks and noncarcinogenic effects.

4.0 TOXICITY ASSESSMENT

The toxicity assessment, also known as the dose-response assessment, provides a description of the relationship between a dose of a constituent and the anticipated incidence of an adverse health effect. The majority of existing knowledge about the dose-response relationship is based on data collected from laboratory studies of animals (usually rodents), studies of human occupational exposures, and theories about how humans respond to environmental doses of constituents.

The USEPA has developed dose-response assessment techniques to set "acceptable" levels of human exposure to constituents in the environment. These USEPA-derived risk values address both subchronic and chronic noncarcinogenic health effects and potential carcinogenic health risks.

4.1 EVALUATION OF NONCARCINOGENIC RESPONSES

The sections that follow discuss the mechanisms of noncarcinogenic response, the derivation of acceptable dose levels, the manner in which these levels are used in this risk assessment, and some of the limitations of these values. The limitations are addressed in greater detail in the uncertainty analysis section of this report (Section 6).

4.1.1 Background

It is widely accepted that noncarcinogenic biological effects of constituents occur only after a threshold dose is achieved (Klaassen, 2001). Typically, physiological mechanisms exist that will minimize the adverse effect, through pharmacokinetic means such as absorption, distribution, excretion, or metabolism (Klaassen, 2001). Therefore, a range of exposures and resulting doses exist that can be tolerated by a receptor with essentially no chance of developing adverse effects. The threshold dose for a compound is usually estimated from the no observed adverse effect level (NOAEL) or the lowest observed adverse effect level (LOAEL), as determined from laboratory animal studies or human data. The NOAEL is the highest dose at which no adverse effects occur, while the LOAEL is the lowest dose at which adverse effects are discernable.

4.1.2 Noncarcinogenic Toxicity Values

USEPA uses the NOAEL or LOAEL estimates of threshold dose to establish RfDs and reference concentrations (RfCs) for human exposure. An RfD (or RfC) is an estimate of a daily exposure level (dose) that is unlikely to present an appreciable risk of deleterious effects during a lifetime. USEPA has derived both chronic and subchronic RfDs. For this assessment, in order to reflect the appropriate duration of exposure, subchronic RfDs/RfCs (when available) have been used to evaluate the construction/utility worker.

RfDs (used to evaluate the oral exposure route) are expressed in units of dose (mg/kg-day), while RfCs (used to evaluate the inhalation exposure route) are expressed as concentrations (mg/m^3). Both types of toxicity values incorporate uncertainty factors to account for limitations in the quality or quantity of available data. An oral RfD is converted to an absorbed dose (dermal RfD) by multiplying the RfD by the fractional absorption efficiency factor. As indicated Exhibit 4-1 of USEPA (2004) and also presented in the Chemical-Specific Parameters Supporting Table (USEPA, 2019a), fractional absorption efficiency factors of 100% are recommended for all COI at the site.

4.1.3 Estimating the Likelihood of Adverse Noncarcinogenic Response

The likelihood of occurrence of adverse noncarcinogenic effects depends on the relationship between the RfD (or RfC) and the estimated average constituent dose (or exposure concentration) received by the receptor. Doses less than the RfD (and exposure concentrations less than the RfC) are not likely to be associated with any adverse health effects and are, generally, not of regulatory concern. Doses that exceed the RfD (and exposure concentrations that exceed the RfC) are considered to present the potential for adverse effects.

Noncarcinogenic responses are evaluated numerically using parameters known as the HQ and hazard index (HI). The HQ is obtained by dividing the ADD by the RfD as presented below.

$$ADD \div RfD = HQ$$

The ADD is the estimated daily dose of a constituent averaged over the specific duration of exposure, which may not necessarily be an entire lifetime. The equations for calculating the ADD were presented in Tables 3-9 and 3-10 and Tables 3-12 and 3-13.

Similarly, for the inhalation exposure route, the HQ is calculated by dividing the exposure concentration by the RfC. The equation for calculating the EC for inhalation pathways was presented in Table 3-11. The exposure concentration is calculated by applying the receptor-specific exposure time, frequency, and duration to the air concentration. Thus, HQ is calculated as follows:

$$[\,(CA \times ET \times EF \times ED)\,/\,AT\,] \div RfC = HQ$$

Each calculation with a specific combination of COI, receptor, and exposure pathway, will have a distinct ADD and calculated HQ. HQs associated with all COI for a particular pathway are summed to yield the HI, as indicated:

$$HQ_i + HQ_{ii} + HQ_{iii} + \ldots = HI$$

If a receptor is subject to exposure through more than one pathway, the HIs for all pathways are summed. A calculated HI of 1 or less indicates that an adverse effect would not be anticipated. HIs are most appropriately derived for constituents that act on the same target system or have similar critical effects. Therefore, if the total HI across all COI exceeds 1, it is appropriate to segregate the COI by toxic effect and mechanism of action and to derive separate HIs for each group (USEPA, 1989).

4.2 EVALUATION OF POTENTIAL CARCINOGENIC RESPONSES

The subsections below discuss the assumed mechanisms of carcinogenic response, the derivation of carcinogenic toxicity values, the manner in which these values are used in this risk assessment, and some of the limitations of these values. The limitations are addressed in greater detail in the uncertainty section of this report (Section 6).

4.2.1 Background

USEPA typically has required that potentially carcinogenic constituents be treated as if minimum threshold doses do not exist (USEPA, 2005). The regulatory dose-response curve used for carcinogens only allows for zero risk at zero dose. Thus, for all environmental doses, some level of risk is assumed to be present using this highly conservative model.

To estimate the theoretical response at environmental doses, various mathematical dose-response models are used. USEPA uses the linearized multistage model for low dose extrapolation. This model assumes that the effect of the carcinogenic agent on tumor formation seen at high doses in animal data is basically the same at low doses (i.e., the slope of the dose-response curve can be extrapolated downward to the origin in a linear manner). USEPA's Guidelines for Carcinogen Risk Assessment (USEPA, 2005) recommend that the linearized multistage model be employed in the absence of adequate information to the contrary.

4.2.2 Potential Carcinogenic Toxicity Values

USEPA evaluates available scientific information, using a weight-of-evidence approach to determine whether a constituent poses a carcinogenic hazard in humans. USEPA groups constituents according to their potential for carcinogenic effects based on clinical evidence (USEPA, 1989):

- Group A - Human Carcinogen
- Group B - Probable Human Carcinogen
- Group C - Possible Human Carcinogen
- Group D - Insufficient Data to Classify as a Human Carcinogen
- Group E - Not a Human Carcinogen

In addition, constituents may have been assessed for carcinogenicity using USEPA's (2005) Guidelines for Carcinogen Risk Assessment. Under the updated guidance, standard descriptors are used as part of the hazard narrative to express the conclusion regarding the weight-of-evidence for carcinogenic hazard potential. There are five recommended standard hazard descriptors: "Carcinogenic to Humans," "Likely to Be Carcinogenic to Humans," "Suggestive Evidence of Carcinogenic Potential," "Inadequate Information to Assess Carcinogenic Potential," and "Not Likely to Be Carcinogenic to Humans."

Cancer slope factors (CSFs) and inhalation unit risks (IURs) are the toxicity values used in quantitatively assessing potential carcinogenic effects from exposure. CSFs are defined as the plausible upper bound, approximating a 95% confidence limit, of the increased cancer risk from a lifetime exposure to a given level of a carcinogen. This estimate, usually expressed in units of proportion (of a population) affected per mg/kg-day, is generally reserved for use in the low dose region of the dose-response relationship, that is, for exposure corresponding to risks less than 1 in 100 (USEPA, 2005).

The CSF (used to evaluate the oral route of exposure) is expressed in units of reciprocal dose (mg/kg-day$)^{-1}$, while the IUR (used to evaluate the inhalation exposure route) is expressed as a reciprocal concentration $(mg/m^3)^{-1}$. CSFs for the dermal route of exposure are developed through route-to-route extrapolation, as described by USEPA (2004). An oral CSF is converted to an absorbed dose by dividing the CSF by the fractional absorption value. The absorption efficiency factors recommended by USEPA (2004; 2019a) were identified in Section 4.1.2 above.

4.2.3 <u>Estimating the Theoretical Excess Lifetime Cancer Risk</u>

For carcinogenic constituents, a risk assessment evaluates the degree to which a receptor may have an increased likelihood of developing cancer over a lifetime due to exposure to site-associated constituents. At environmental dosage levels, the CSF is assumed to be constant and potential carcinogenic risk to be directly related to intake. In order to estimate the theoretical excess lifetime cancer risk, the LADD of a constituent is multiplied by the CSF as shown.

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

The equations for calculating the LADD were presented in Tables 3-9 and 3-10 and Tables 3-12 and 3-13.

Similarly, for the inhalation exposure route, the potential cancer risk is calculated by multiplying the exposure concentration by the IUR. The equation for calculating the EC for inhalation of volatiles was presented in Table 3-11. Thus, the potential cancer risk is calculated as follows:

$$[(C_A \times ET \times EF \times ED) / AT] \times IUR = \text{Risk}$$

For each pathway, these calculations are carried out for each applicable constituent, and the risks are summed to obtain the total risk due to that pathway. The total theoretical excess lifetime cancer risk for a particular receptor is then calculated as the sum of the risks from all exposure pathways for that receptor.

4.3 TOXICITY VALUES FOR CONSTITUENTS OF INTEREST

The chronic noncarcinogenic toxicity values for each COI (used to evaluate the outdoor worker) are presented in Table 4-1. The subchronic noncarcinogenic toxicity values for each COI (used to evaluate the construction utility worker) are presented in Table 4-2. The carcinogenic values are presented in Table 4-3.

Table 4-1 presents the chronic noncarcinogenic oral RfDs and inhalation RfCs and the target system or critical effect for each noncarcinogenic COI. Fractional absorption efficiency factors and dermal toxicity values [estimated from the oral values in accordance with USEPA (2004)] are also presented in Table 4-1.

Table 4-2 presents the subchronic noncarcinogenic oral RfDs and inhalation RfCs and the target system or critical effect for each noncarcinogenic COI. In the absence of a subchronic toxicity value for a COI, the toxicity value is based on the chronic value. Fractional absorption efficiency factors and dermal toxicity values [estimated from the oral values in accordance with USEPA (2004)] are also presented in Table 4-2.

Table 4-3 includes the oral CSFs and inhalation IURs and the USEPA weight-of-evidence classification for each COI. Fractional absorption efficiency factors and dermal toxicity values [estimated from the oral values in accordance with USEPA (2004)] are also presented in Table 4-3.

Toxicity values were obtained from the PADEP (2020) on-line toxicity database and from the following primary sources:

- Integrated Risk Information System (IRIS) on-line database provided by USEPA (2020a);
- Provisional Peer-Reviewed Toxicity Values Database and Appendix (PPRTV; USEPA, 2020b);
- California EPA’s OEHHA chemical database (CalEPA, 2020);
- The USEPA’s Health Effects Assessment Summary Tables (HEAST; USEPA, 2020c); and
- The Agency for Toxic Substances and Disease Registry (ATSDR, 2020).

5.0 RISK CHARACTERIZATION

Risk characterization is the final step of the human health risk assessment process. It includes a description of the nature and magnitude of the potential for occurrence of adverse health effects under reasonable maximal exposure conditions. In this step, the toxicity assessment and site-specific exposure assessment are integrated into quantitative and qualitative estimates of potential health risks. Potential noncarcinogenic and carcinogenic health risks are calculated and summarized individually for each receptor exposed to COI at the site. Estimated risks are combined across COI and exposure pathways as appropriate. The following subsections describe the approaches and results for the evaluation of noncarcinogenic and potential carcinogenic effects.

5.1 NONCARCINOGENIC EFFECTS

Potential noncarcinogenic effects associated with exposure to COI from the site were estimated as described in Section 4.1.3. The total HIs are then calculated for each receptor by combining pathway-specific HIs. A HI value equal to or less than 1 indicates that an adverse effect would not be anticipated (PADEP, 2019a; USEPA, 1989). Conversely, a target-system specific HI greater than 1 indicates that additional evaluation of the case is warranted.

A summary of the noncancer HIs and potential cancer risks for all receptors and exposure pathways is presented in Table 5-1. As indicated in this table, the total noncancer HIs are less than 1 for the future outdoor worker and the current/future construction/utility worker, indicating that the likelihood of adverse noncancer effects would be negligible. The detailed calculations and constituent-specific results, including target-system specific HIs, for each receptor are presented in Appendix D. Constituent-specific results for each receptor are summarized in Tables 5-2 and 5-3.

For the future outdoor worker exposed to COI in soil, the total HI is 0.17 (Table 5-2). For the current/future construction/utility worker exposed to COI in soil and shallow groundwater, the total HI is 0.34 (Table 5-3).

5.2 POTENTIAL CARCINOGENIC EFFECTS

Theoretical excess lifetime cancer risks associated with exposure to COI from the site were calculated as described in Section 4.2.3. Summed theoretical excess risks are calculated for each receptor by combining pathway-specific risks. The results may be compared with target benchmarks for acceptable risk. Various demarcations of acceptable risk have been established by regulatory agencies. PADEP (2019a) presents a target potential cancer risk of 1×10^{-4} and USEPA (1991) considers potential cancer risks in the range of 1×10^{-6} to 1×10^{-4} to be acceptable.

Table 5-1 presents the theoretical excess lifetime cancer risks for each receptor exposed to COI in soil and/or shallow groundwater. As shown in this table, the potential cumulative cancer risks are below the PADEP target risk of 1 x 10^{-4} for the future outdoor worker and the current/future construction/utility worker, indicating that the likelihood of unacceptable potential cancer risk is negligible for these receptors. Constituent-specific results for each receptor are presented in Tables 5-2 and 5-3.

For the outdoor worker exposed to COI in soil, the potential cancer risk is 1.1 x 10^{-5} (Table 5-2). For the construction/utility worker exposed to COI in soil and shallow groundwater, the potential cancer risk is 2.7 x 10^{-6} (Table 5-3).

6.0 UNCERTAINTY ANALYSIS

Uncertainties are inherent in a quantitative risk assessment. The inclusion of site-specific factors, which this assessment has incorporated, decreases uncertainty. An analysis of the areas of uncertainty in a risk assessment is a standard component of the risk assessment process. The uncertainty analysis provides a context for better understanding the assessment conclusions by identifying the uncertainties that have most significantly affected the assessment results.

USEPA (1992a) guidance stresses the importance of providing a complete analysis of uncertainties so that risk management decisions take these uncertainties into account when evaluating risk assessment conclusions. The major sources of uncertainty in the human health risk assessment are identified qualitatively below.

6.1 UNCERTAINTIES IN HAZARD IDENTIFICATION

Uncertainties in the hazard identification step of the risk assessment are primarily associated with the available analytical data and the selection process for identification of COI.

- **Focused vs. Random Sampling.** The environmental sampling conducted at the site was not random. Many of the onsite soil boring and groundwater locations were placed to characterize the potential release area near the former dispenser islands and USTs. Because several of the samples used in this assessment were collected in areas of the site where affected media were considered most likely to be present, the data sets are biased toward high concentrations, which can lead to an overestimation of the actual risks.

- **Identification of COI**. Multiple uncertainties exist in the process of identifying COI. These include uncertainties associated with procedures utilized in constituent analyses, the number of samples selected for use in the risk assessment, and the selection of relevant comparison values. The approaches used to identify COI at this site were very conservative. For example, RSLs based on drinking water were used to identify COI for groundwater, which is not currently used as a source of potable water for the site (and a covenant will be placed to prohibit such use in the future).

- **Use of Qualified Data.** Qualified results were included in this risk assessment, which leads to some level of uncertainty with the actual concentrations present in environmental samples. For example, "J" qualified data reflect results that have been estimated by the laboratory at a concentrations below the reporting limit. Several sub-slab soil gas results were "J" qualified. A small number of soil sample results were assigned the qualifiers "H1" and "H2" because the extraction or preparation and the analysis were conducted outside the USEPA recommended holding time. The result for ethylbenzene in soil sample B-3(2.5-5) was "E" qualified (representative of an estimated concentration) because the analyte concentration exceeded the calibration range. Finally, the result for lead in soil sample B-4(0.5-2) was assigned a "D6" qualifier because the precision between the sample and the sample duplicate exceeded laboratory control limits. An example pertaining to the groundwater data is the result for 1,2-dibromoethane from sample MW-3 collected on March 16, 2020, which was qualified "M1" because the matrix spike recovery exceeded quality control limits. In this case the associated batch was accepted based on laboratory control sample (LCS) recovery. None of the qualifiers reported by the laboratory indicate that the associated sample results are unusable (otherwise they would be qualified as rejected) and affect only a small proportion of overall results. The various qualifiers merely indicate some uncertainty in the reported concentration of the chemical, but do not represent an issue with the overall usability of the data.

- **Samples with Elevated Detection Limits.** The direct contact screening for COI (presented in Section 2.4) identified detection limits for three non-detect constituents (1,2-dibromoethane, 1,2-dichloroethane and methyl tert-butyl ether) in soil and/or groundwater that exceed risk-based comparison values. In these instances, there is a possibility that constituents could be present at levels between the risk-based concentration and the detection limit. An evaluation of the soil data indicates that of all the samples analyzed, the elevated detection limits for 1,2-dibromoethane and 1,2-dichloroethane were reported in only one sample [B3(5-7.5)] and are the result of elevated concentrations of benzene and naphthalene in that sample. Similarly in groundwater, the elevated detection limits reported for 1,2-dibromoethane, 1,2-dichloroethane and methyl tert-butyl ether were present in only two samples (TB#3 and TB#4) and were the result of high concentrations of the other constituents, necessitating a sample dilution. It should be noted that these samples were grab groundwater samples collected at the time of installation of the two soil borings which are located in the area of the former dispensers. These observations suggest that it is unlikely for these constituents to be present at concentrations above the RSLs. However, to be conservative, they were retained as COI and included in the quantitative assessment.

6.2 UNCERTAINTIES IN EXPOSURE ASSESSMENT

The PADEP and USEPA approaches to exposure assessments generally require standard default exposure scenarios rather than site-specific evaluations of exposure. Under this approach, if a constituent is identified as a COI for a particular area and medium, it is assumed that exposure to that substance will occur at levels consistent with the default scenario. The default scenarios used in the human health risk assessment evaluate current and future potential exposure pathways under RME conditions. The RME scenario is defined as the highest exposure that is reasonably expected to occur at a site (USEPA, 1989).

- **Evaluation of the Outdoor Worker.** As noted previously, there are no apparent impacts to surface soil at the site. As a result, exposure to the identified COI is unlikely for the outdoor worker, who is not expected to engage in subsurface activities. However, to be conservative, an evaluation of the outdoor worker is included in this assessment using data for both surface and subsurface soil. This approach over estimates the risk for an outdoor worker.

- **Modeled Concentrations in Trench Air.** As presented in Section 3.2.4, there are no well-established models available for estimating migration of volatiles from groundwater into an excavated trench. This assessment includes the use of the VDEQ (2020) model, which incorporates a number of conservative assumptions. In addition, due to the shallow depth to water at the site, excavations of any significant depth would likely require significant de-watering (as well as health and safety protocols that would minimize exposure). The approach used in this model assumes a trench depth of 6 feet (an approximate depth for utility activities). The conservatism incorporated into the model overestimates the risk for the construction worker.

- **Use of Default Exposure Factors.** The use of default exposure factors, rather than site-specific exposure factors, leads to a degree of uncertainty in the predicted risks. The scientific literature contains examples of studies that indicate that actual environmental exposure factors are lower than the default values recommended by PADEP (2019a) and USEPA (2002; 2014b). As an example, the factors incorporated for incidental ingestion of soil for a worker receptor are typically much higher than are realized in practice. For construction/utility workers, this risk assessment used default values of 330 mg/day, as the amount of soil ingested each day. In actuality, these values are probably much less. The use of default values typically results in an overestimate of the potential risks. However, the default exposure factors represent an RME scenario, as recommended for a baseline risk assessment.

6.3 UNCERTAINTIES IN TOXICITY ASSESSMENT

- **Toxicity Assessment for Noncarcinogens**. Approaches typically utilized for designating reference doses are highly conservative. The USEPA (2020a) applies uncertainty factors (ranging from 3 to 10) to the NOAEL for a constituent in a toxicity study to account for factors such as animal-to-human extrapolation, interindividual variation in the human population, limitations in data quality or incomplete studies. Some of this uncertainty may be reduced if the absorption, distribution, metabolic fate, and excretion parameters of a constituent are known. Because the fate and mechanism of action of a constituent may differ in animals and humans, effects observed in animals may not be observed in humans, and vice versa. Interspecies dose conversion may also be limited by differences in lifespan, body size, breathing rates, or the route of administration utilized in a study.

- **Upper Bound CSFs/IURs**. The USEPA CSFs and IURs are considered to be plausible upper bounds of risk at a 95 percent confidence level. Thus there is a 95 percent probability that the true risks do not exceed these levels, and the risks are likely to be much lower. The Carcinogen Assessment Group (USEPA, 2005) states that the use of the linearized multistage model and upper bound risk estimates is appropriate, but that the lower limit of risk may be as low as zero. When biological factors are considered, the best estimate of the risk at very low levels is often zero.

6.4 UNCERTAINTIES IN RISK CHARACTERIZATION

The typical approach to risk assessment, and that used for the site, involves conservatively multiplying a combination of average and upper bound exposure assumptions together to evaluate exposure, which is likely to overestimate actual risks. USEPA risk assessment guidance (1989) specifies that numerous factors in the exposure equation (such as ingestion rates, exposure frequency and duration) should each be represented by upperbound values. This approach is likely to overestimate actual risks.

7.0 ECOLOGICAL ASSESSMENT

This section presents a site-specific ecological risk assessment (ERA) for the site. The assessment follows PADEP guidance as well as approaches outlined in USEPA's (1997) Ecological Risk Assessment Guidance for Superfund, as recommended by PADEP.

The regulations for Act 2 [25 PA Code Section 250.402(d)(1)] indicate that if the site-specific standard is being used to protect ecological receptors, an ERA shall be performed to determine if an impact has occurred or will occur if the release of a regulated substance goes unabated. Additional guidance regarding the site-specific ERA is provided in Section III.I of the TGM (PADEP, 2019b). The TGM outlines an "Initial Screen" process for a site-specific ERA which consists of two steps. Step 1 of the initial screen consists of an evaluation of fundamental components of the ERA, including a preliminary fate and transport analysis and exposure pathway analysis. Step 2 of the initial screen consists of the preliminary exposure estimate and risk characterization. The results of the initial screen are used to determine whether sufficient information is available to determine that no significant ecological risk exists, or whether further evaluation is warranted. The following subsections provide the information associated with the Initial Screen process for the site-specific ERA of the site.

7.1 SITE BACKGROUND AND ENVIRONMENTAL SETTING

As summarized in Section 2.1, the Former Dollar General Property is located on the northeast corner of the intersection of East State Street (State Route 18) and Orchard Street in Albion, Pennsylvania. The surrounding area includes a mixture of commercial, residential, and industrial properties. The site is bordered to the north by a vacant lot; to the east by the LECOM Health, Northwestern Area Health Center; to the south by residences (located on the opposite side of East State Street); and to the west by Mattera Funeral Home. An L-shaped, asphalt parking lot is present on the south and west sides of the building and a truck dock is located at the northwestern corner of the building. Due to the highly developed nature of the site and adjacent properties, there is no viable terrestrial ecological habitat associated with the site. In addition, there are no surface water bodies on or in close proximity to the site.

7.2 POTENTIAL ECOLOGICAL RECEPTORS

This section presents a description of the evaluation of ecological receptors for the site. PADEP guidance indicates that direct impacts from regulated substances to the following receptors should be assessed and addressed:

- Individuals of threatened or endangered species as designated by the U.S. Fish and Wildlife Service under the Endangered Species Act (16 U.S.C.A Sections 1531-1544);
- Exceptional value wetlands as defined in 25 PA Code Section 105.17;
- Habitats of concern; and
- Species of concern.

Information on the potential for these ecological receptors to be present in the vicinity of the site is presented below.

7.2.1 Threatened or Endangered Species and Species of Concern

"Species of concern", as defined by 25 PA Code Section 250.1, are species that have been designated as of special concern, rare, endangered, or threatened by the Pennsylvania Game Commission, the Pennsylvania Fish and Boat Commission, or the Department of Conservation and Natural Resources, if the species has not also been designated threatened or endangered by the U.S. Fish and Wildlife Service.

To determine the potential for threatened or endangered species or species of concern to be present in the vicinity of the site, a search was completed using the Pennsylvania Natural Diversity Inventory (PNDI) environmental review. An inquiry via the PNDI website generates on-line search results concerning the potential impacts of a project to special concern species and resources. Four government agencies have jurisdiction over the protection of these resources:

- U.S. Fish and Wildlife Service - listed, proposed & candidate species under the federal Endangered Species Act;
- Pennsylvania Game Commission - PA state-listed birds and mammals;
- Pennsylvania Fish and Boat Commission - PA state-listed fish, reptiles, amphibians and aquatic organisms; and
- PA Department of Conservation and Natural Resources - PA state-listed plants, natural communities, terrestrial invertebrates and geological features.

The PNDI Project Environmental Review receipt dated April 21, 2020, is included as Appendix E. Search results from the four Pennsylvania agencies indicated that there are no known impacts to species of concern in the vicinity of the site, and that no further review was required.

7.2.2 Exceptional Value Wetlands

As defined in 25 PA Code Section 105.17, exceptional value wetlands are wetlands that meet one or more of the following criteria:

1. serve as habitat for fauna or flora listed as threatened or endangered under the federal Endangered Species Act or under Pennsylvania's Wild Resource Conservation Act;

2. are hydrologically connected to or located within 0.5-mile of wetlands that are habitat of threatened or endangered species;

3. are located in or along the floodplain of a wild trout stream or waters listed as of exceptional value under 25 PA Code Chapter 93 or located in the corridor of a watercourse or body of water that has been designated as a wild or scenic river under the federal Wild and Scenic Rivers Act or the Pennsylvania Scenic Rivers Act;

4. are located along an existing drinking water supply that maintains the quality or quantity of that drinking water supply; or

5. are located in areas designated by the PA DCNR as natural or wild areas within state forest or park lands, are located in areas designated as federal wilderness areas under the federal Wilderness Act or Eastern Wilderness Act, or are located in areas designated as national natural landmarks under the federal Historic Sites Act.

As noted in Section 7.1, there are no surface water bodies on or in close proximity to the site. To further assess the presence of aquatic habitats on and adjacent to the site, a review of the National Wetlands Inventory (NWI) database was completed (NWI, 2020).

The NWI map of the site is included as Figure 3. Approximately 0.25 miles southwest of the site, there is a wetland area associated with an unnamed tributary of the East Branch of Conneaut Creek. The wetland is classified as "PFO4A" which indicates that the habitat consists of palustrine, forested (needle-leaved evergreen) vegetation. The palustrine system includes all non-tidal wetlands dominated by trees, shrubs, emergents, mosses or lichens. This area is not considered to meet any of the five criteria listed above for an exceptional value wetland (NWI, 2020). Furthermore, as discussed in Section 3.1.1, the potential for constituents in site groundwater to migrate offsite at unacceptable concentrations is considered to be negligible; therefore, there is no potential for impacts to this wetland area from the site.

7.2.3 Habitats of Concern and Other Terrestrial or Aquatic Habitats

As defined by Act 2, Section 250.1, habitats of concern are (1) typical wetlands with identifiable function and value, (2) breeding areas for species of concern, (3) migratory stopover areas for species of concern, (4) wintering areas for species of concern, (5) habitat for state endangered plant and animal species, (6) federal, state, and local parks and wilderness areas, or areas designated as wild, scenic, or recreational, or (7) areas otherwise designated as critical or of concern by the Pennsylvania Game Commission, the Pennsylvania Fish and Boat Commission, or the PA DCNR.

As summarized in Section 2.1, the site is located in a developed area. Due to the developed nature of the site and adjacent properties, there is no viable terrestrial ecological habitat associated with the site. Since there is insufficient terrestrial habitat at the site to warrant further evaluation, exposure by terrestrial receptors via soil pathways is considered to be insignificant for this site.

As discussed above, no exceptional value wetlands were identified on or in close proximity to the site. Concentrations of all analytes in downgradient wells have been non-detect for both rounds of sampling. Therefore, offsite migration of constituents in groundwater is considered to be an insignificant pathway. There are no other aquatic ecological habitats onsite or in the immediate vicinity which could be impacted by site activities.

7.2.4 Species of Special Concern and Other Terrestrial or Aquatic Species

As discussed in Section 7.2.1, information from the Pennsylvania Game Commission, Fish and Boat Commission, Department of Conservation and Natural Resources and the U.S. Fish & Wildlife Service indicates that there is no potential for impacts to threatened or endangered species or other species of concern. Furthermore, due to the absence of significant ecological habitat on and in the vicinity of the site, no other terrestrial or aquatic species are considered to warrant further evaluation.

7.3 CONCEPTUAL SITE EXPOSURE MODEL

As part of Step 1 of the Initial Screen process of the ERA, a conceptual site exposure model (CSEM) was developed. The CSEM identifies potentially complete fate and transport and exposure pathways for ecological receptors.

The main source of constituents for site soil and groundwater are releases assumed to be associated with the former gasoline USTs and dispensers. Soil pathways for potential ecological receptors are considered to be incomplete or *de minimis* because there are no viable terrestrial habitats, nor any identified terrestrial species or habitats of concern. There are no surface water bodies on or adjacent to the site and no potentially complete exposure pathways for ecological receptors to directly contact groundwater.

Additionally, groundwater data from the downgradient wells indicate that all constituents are non-detect; therefore, constituents in site groundwater are not expected to not migrate offsite at unacceptable concentrations. In summary, all potential ecological exposure pathways are considered to be incomplete or insignificant, and no further evaluation is warranted.

7.4 ECOLOGICAL RISK ASSESSMENT SUMMARY AND CONCLUSIONS

The results of the ecological risk assessment indicate that there are no state-listed threatened or endangered species or species of concern, no exceptional value wetlands, and no habitats of concern at or in the vicinity of the site. There are no viable terrestrial habitats and therefore no complete exposure pathways associated with soil at the site. In addition, there are no complete exposure pathways for ecological receptors to directly contact groundwater. There are no surface water habitats on or adjacent to the site that would provide aquatic habitat for ecological receptors. Data from the downgradient monitoring wells indicate that site-related constituents in groundwater will not migrate offsite. Based on the ecological evaluation, there is negligible potential for adverse effects on ecological receptors as a result of exposure to environmental media associated with the site.

8.0 CONCLUSIONS

This risk assessment was conducted in a manner consistent with standard and customary PADEP approaches under Act 2 and those of USEPA. This risk assessment presented an analysis of the site under current/future non-residential land use conditions.

Constituents in samples of soil, groundwater and sub-slab soil gas were included and considered in the assessment. COI were identified for each medium based on a comparison of the analytical data to USEPA RSLs and PADEP vapor intrusion screening values. Analyzed constituents with detected concentrations or detection limits greater than their respective comparison values were identified as COI. Specifically, the following COI were identified for each medium/pathway:

- For onsite soil, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, benzene, ethylbenzene, naphthalene and xylenes (total) were detected above the industrial RSLs and are identified as COI for direct contact pathways. In addition, 1,2-dibromoethane and 1,2-dichloroethane were retained as COI because of elevated detection limits. No COI were identified for direct contact with offsite soil based on a comparison to residential RSLs.

- For groundwater, the following constituents were identified as COI for direct contact based on detected concentrations: 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, benzene, ethylbenzene, isopropylbenzene, naphthalene and xylenes (total). In addition, 1,2-dibromoethane, 1,2-dichloroethane and methyl tert-butyl ether were retained as COI because of elevated detection limits.

- For the vapor intrusion to indoor air pathway, no constituents were identified as COI in sub-slab soil gas.

The receptors considered for quantitative assessment in the risk assessment include outdoor workers, indoor workers and construction/utility workers. The future outdoor worker was evaluated for potential direct contact with soil through incidental ingestion, dermal contact and inhalation of particulates and volatiles in ambient air. The current/future construction/utility worker was evaluated for potential direct contact with soil (incidental ingestion, dermal contact and inhalation of particulates and volatiles), as well as direct contact with shallow groundwater (incidental ingestion and dermal contact), and inhalation of constituents volatilizing from groundwater in an excavated trench. Indoor workers were also considered as potential receptors for the site, however, no COI were identified for vapor intrusion from soil gas to indoor air. The vapor intrusion pathway was therefore considered to be insignificant, and evaluation of an indoor worker was not warranted.

In addition to the onsite worker receptors, visitors and trespassers may be present at the site. However, the magnitude of exposure for visitors or trespassers would be significantly less than for workers, and exposure is considered to be negligible. Therefore, only the worker receptors were retained for quantitative risk evaluation.

Groundwater at the site is not used for any potable purposes, and the onsite building is connected to the public water supply. In addition, an environmental covenant will be placed on the site which restricts the future use of groundwater as a potable water source. Therefore, ingestion of groundwater as drinking water is an incomplete pathway for onsite receptors.

The analyses indicate that the total noncancer HIs were less than 1 for the future outdoor worker and the current/future construction/utility worker, indicating that the likelihood of adverse noncancer effects is negligible for these receptors. In addition, the potential cumulative cancer risks for these receptors are below PADEP's target risk of 1×10^{-4}, indicating that the likelihood of unacceptable potential cancer risk is also negligible. Specifically, for the future outdoor worker exposed to COI in onsite soil, the total HI is 0.17 and the potential cancer risk is 1.1×10^{-5}. For the current/future construction/utility worker exposed to COI in onsite soil and shallow groundwater, the total HI is 0.34 and the potential cancer risk is 2.7×10^{-6}.

The results of the ecological risk assessment indicate that there are no state-listed threatened or endangered species or species of concern, no exceptional value wetlands, and no habitats of concern at or in the vicinity of the site. There are no viable terrestrial habitats and therefore no complete exposure pathways associated with soil at the site. In addition, there are no complete exposure pathways for ecological receptors to directly contact groundwater. There are no surface water habitats on or adjacent to the site that would provide aquatic habitat for ecological receptors. Data from downgradient monitoring wells indicates that site-related constituents in groundwater will not migrate offsite. Based on the ecological evaluation, there is negligible potential for adverse effects on ecological receptors as a result of exposure to environmental media associated with the site.

This risk assessment concludes that the potential for adverse health effects is within acceptable potential risk benchmarks for all receptors, considering a prohibition on residential land use of the property and restriction on the use of groundwater as drinking water. Based on these results, no further evaluation of human health risk is warranted for the site. The ecological risk assessment concludes that no further evaluation of ecological receptors is warranted.

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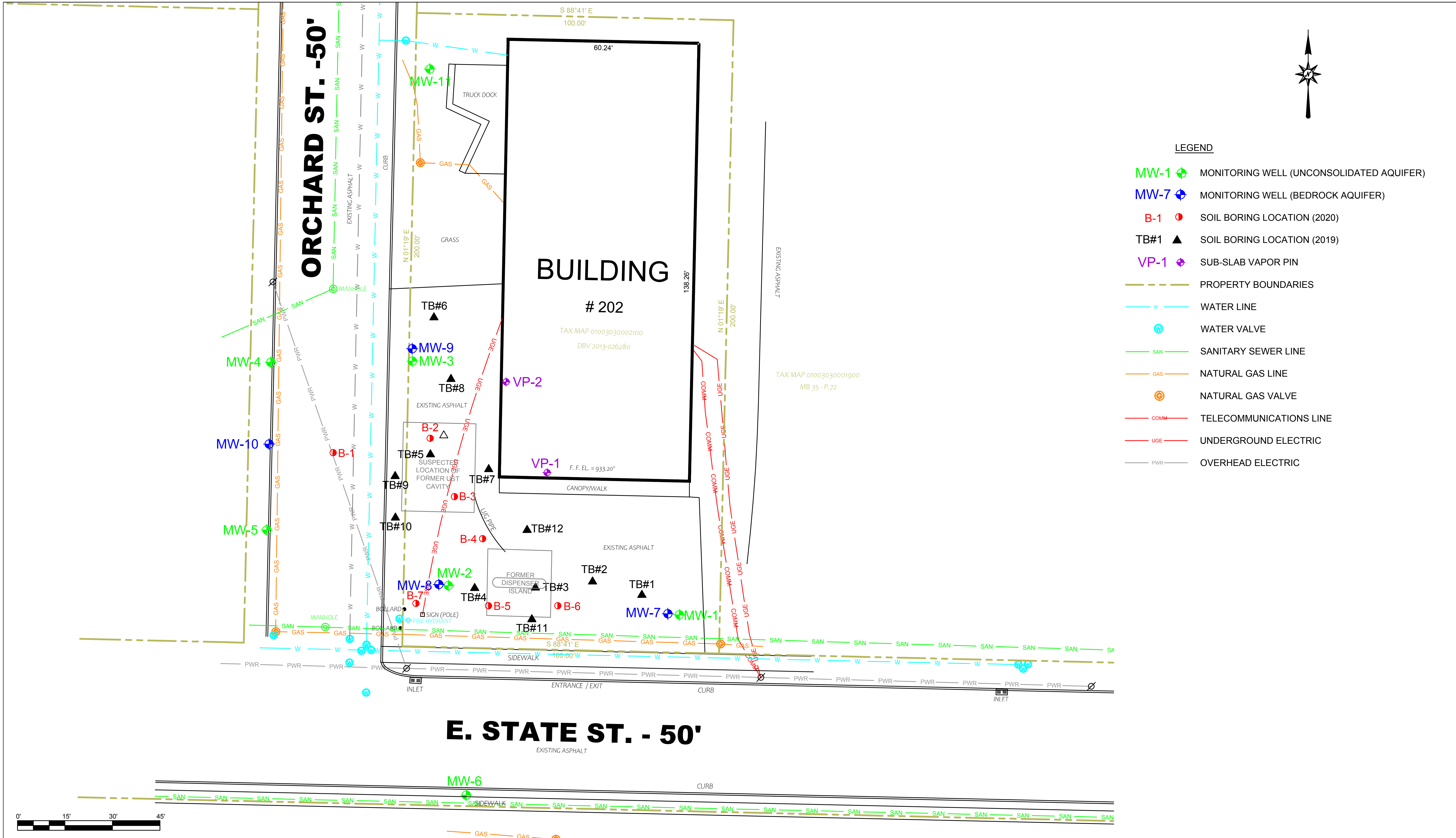
FIGURES



INSITE GROUP INC.
611 SOUTH IRVINE AVENUE
SHARON, PENNSYLVANIA 16146

DRAWN	REVISED	REVIEWED
JLS	JLS	
DATE	DATE	DATE
04/06/2020	05/13/2020	

NOTES
1. ALL UTILITY LOCATIONS ARE APPROXIMATE.
2. BASE MAP SURVEYED BY ROBERT R. DEGLAU, PLS OF ALLSTATE MAPPING, INC. HORIZONTAL DATUM BASED ON GPS (NAD83). VERTICAL DATUM BASED ON GPS (NAVD88).

FIGURE 1: SITE MAP

FORMER DOLLAR GENERAL PROPERTY
202 EAST STATE STREET, ALBION, PA 16401
ALBION BOROUGH, ERIE COUNTY

HUMAN HEALTH AND ECOLOGICAL RISK ASSESSMENT REPORT

FIGURE 2
HUMAN HEALTH CONCEPTUAL SITE EXPOSURE MODEL
Former Dollar General Property - Albion, Pennsylvania

SOURCE	TRANSPORT MECHANISM	EXPOSURE MEDIUM	POTENTIAL EXPOSURE ROUTES	POTENTIAL HUMAN RECEPTORS: OUTDOOR WORKER	INDOOR WORKER	CONSTRUCTION/ UTILITY WORKER	TRESPASSERS OR VISITORS	OFFSITE RECEPTORS
UNDERGROUND STORAGE TANKS & DISPENSERS	**SPILLS, LEAKS**	ONSITE SOIL	INCIDENTAL INGESTION	X		X	0	
			DERMAL CONTACT	X		X	0	
			INHALATION OF VOLATILE EMISSIONS (OUTDOOR AIR)	X		X	0	
			INHALATION OF PARTICULATES (OUTDOOR AIR)	X		X	0	
	LEACHING (From Soil)	ONSITE GROUNDWATER (1)	INCIDENTAL INGESTION			X		
			DERMAL CONTACT			X		
			INHALATION OF VOLATILE EMISSIONS (OUTDOOR AIR)			X		
	VOLATILIZATION TO SOIL GAS AND VAPOR INTRUSION (From Soil or Groundwater)	INDOOR AIR	INHALATION OF VOLATILE EMISSIONS (INDOOR AIR)		0		0	
	DOWNGRADIENT TRANSPORT (in Groundwater)	OFFSITE GROUNDWATER (2)	INGESTION					0
			DERMAL CONTACT					0
			INHALATION OF VOLATILE EMISSIONS					0

Notes:

X - Indicates a potentially complete exposure pathway that is evaluated in the quantitative risk assessment.

0 - Indicates a potentially complete exposure pathway that is not quantitatively evaluated in the risk assessment (e.g., no COI were identified; exposure is negligible).

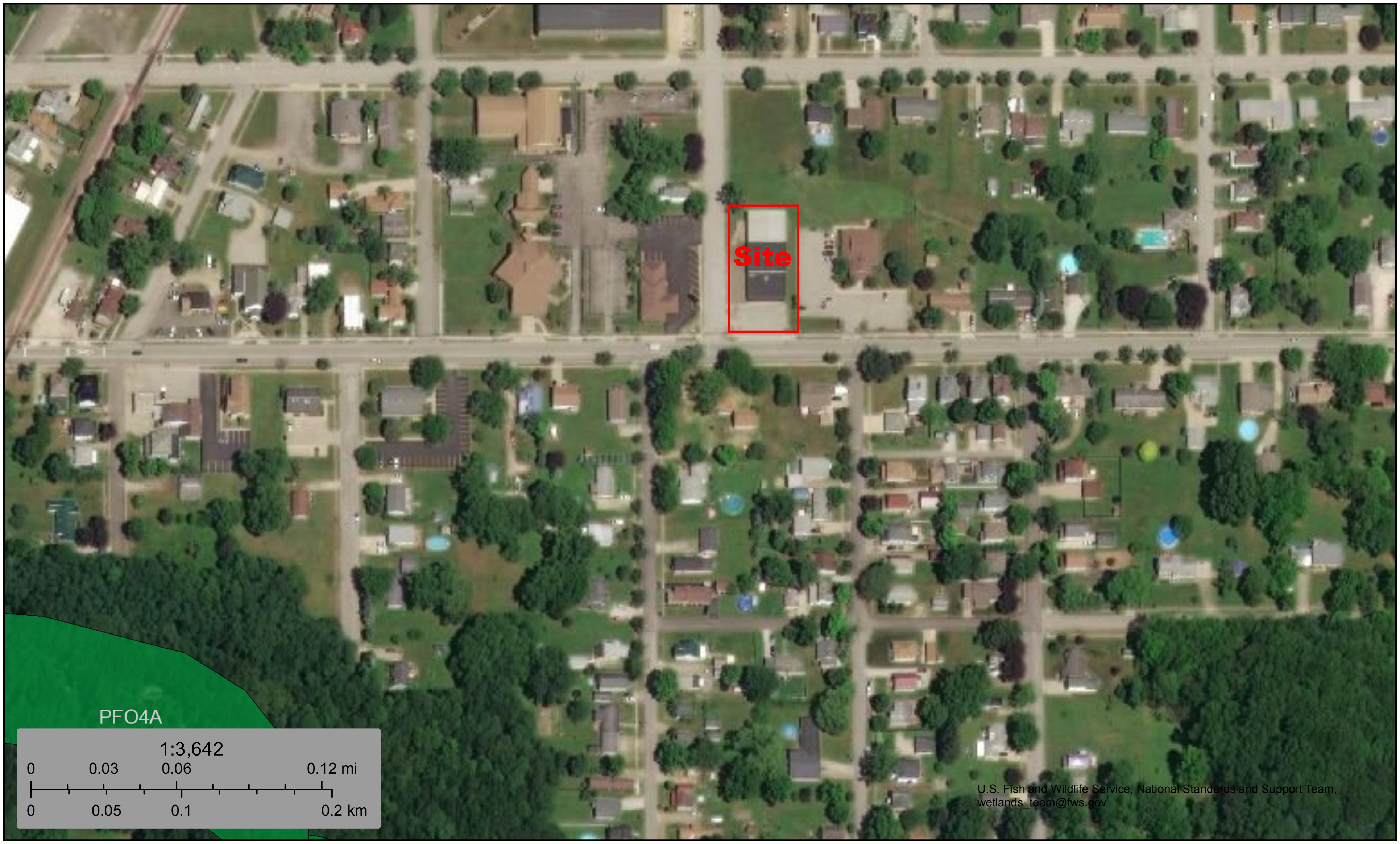
(1) An environmental covenant will be implemented at the site that will prohibit the use of groundwater for any (potable or non-potable) purposes.

(2) Data from offsite monitoring wells MW-4 through MW-6 and MW-10 were all non-detect. The potential for constituents in onsite groundwater to migrate offsite at unacceptable concentrations is considered to be negligible.

U.S. Fish and Wildlife Service
National Wetlands Inventory

Figure 3 National Wetlands Inventory Map

Former Dollar General Property - Albion, Pennsylvania



April 20, 2020

Wetlands

- Estuarine and Marine Deepwater
- Estuarine and Marine Wetland
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Lake
- Other
- Riverine

This map is for general reference only. The US Fish and Wildlife Service is not responsible for the accuracy or currentness of the base data shown on this map. All wetlands related data should be used in accordance with the layer metadata found on the Wetlands Mapper web site.

National Wetlands Inventory (NWI)
This page was produced by the NWI mapper

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TABLES

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TABLE 2-1
SOIL SAMPLES INCLUDED IN THE RISK ASSESSMENT
Former Dollar General Property - Albion, Pennsylvania

Location	Medium	Sample Identification Numbers and Dates			
Onsite	Surface Soil (0 to 2 feet)	B-2 (0.5-2)	3/5/2020	B-4 (0.5-2)	3/4/2020
		B-3 (0.5-2)	3/4/2020	B-5 (0.5-2)	3/4/2020
	Subsurface Soil (>2 feet)	TB#3 (2.5-5)	3/19/2019	TB#11 (5-7.5)	4/23/2019
		TB#4(5-7.5)	3/19/2019	TB#12 (2.5-5)	4/23/2019
		TB#5 (2.5-5)	3/19/2019	TB#12 (5-7.5)	4/23/2019
		TB#6 (2.5-5)	3/19/2019	MW-1 (5-7.5)	3/4/2020
		TB#7 (5-7.5)	4/23/2019	MW-3 (5-7.5)	3/4/2020
		TB#7 (10-12)	4/23/2019	B-2 (5-7.5)	3/5/2020
		TB#8 (2.5-5)	4/23/2019	B-3 (2.5-5)	3/4/2020
		TB#8 (7.5-10)	4/23/2019	B-3 (5-7.5)	3/4/2020
		TB#9 (2.5-5)	4/23/2019	B-4 (2.5-5)	3/4/2020
		TB#9 (5-7.5)	4/23/2019	B-4 (5-7.5)	3/4/2020
		TB#10 (2.5-5)	4/23/2019	B-5 (7.5-10)	3/4/2020
		TB#10 (5-7)	4/23/2019	B-6 (5-7.5)	3/5/2020
		TB#11 (2.5-5)	4/23/2019	B-7 (7.5-10)	3/4/2020
Offsite	Subsurface (>2 feet)	MW-4 (5-7.5)	3/4/2020	B-1 (5-7.5)	3/3/2020
		MW-6 (5-7.5)	3/4/2020		

TABLE 2-2
GROUNDWATER SAMPLES INCLUDED IN THE RISK ASSESSMENT
Former Dollar General Property - Albion, Pennsylvania

Location	Sample Identification Numbers and Dates			
Onsite	TB#3	3/19/2019	MW-7 (3/16/2020)	3/16/2020
	TB#4	3/19/2019	MW-7 (4/21/2020)	4/21/2020
	MW-1 (4/23/2020)	4/23/2020	MW-8 (3/16/2020)	3/16/2020
	MW-2 (4/23/2020)	4/23/2020	MW-8 (4/21/2020)	4/21/2020
	MW-3 (3/16/2020) *	3/16/2020	MW-9 (3/16/2020)	3/16/2020
	MW-3 (3/16/2020) DUP *	3/16/2020	MW-9 (4/21/2020)	4/21/2020
	MW-3 (4/21/2020) *	4/21/2020	MW-11 (4/7/2020)	4/7/2020
	MW-3 (4/21/2020) DUP *	4/21/2020	MW-11 (4/23/2020)	4/23/2020
Offsite	MW-4 (3/16/2020)	3/16/2020	MW-6 (3/16/2020)	3/16/2020
	MW-4 (4/21/2020)	4/21/2020	MW-6 (4/21/2020)	4/21/2020
	MW-5 (3/16/2020)	3/16/2020	MW-10 (3/16/2020)	3/16/2020
	MW-5 (4/23/2020)	4/23/2020	MW-10 (4/21/2020)	4/21/2020

Notes:
* Indicates samples of a duplicate pair.

TABLE 2-3
SUB-SLAB SOIL GAS SAMPLES INCLUDED IN THE RISK ASSESSMENT
Former Dollar General Property - Albion, Pennsylvania

Location	Sample Identification Numbers and Dates	
Onsite	VP-1 (3/6/2020)	3/6/2020
	VP-1 (4/21/2020)	4/21/2020
	VP-2 (3/6/2020)*	3/6/2020
	VP-2 (3/6/2020) DUP *	3/6/2020
	VP-2 (4/21/2020) *	4/21/2020
	VP-2 (4/21/2020) DUP *	4/21/2020

Notes:
* Indicates samples of a duplicate pair.

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TABLE 2-4
IDENTIFICATION OF CONSTITUENTS OF INTEREST IN ONSITE SOIL - INDUSTRIAL DIRECT CONTACT
Former Dollar General Property - Albion, Pennsylvania

Constituent	Frequency of Detection	Minimum Detected Soil Concentration (mg/kg)	Maximum Detected Soil Concentration (mg/kg)	Sample with Maximum Detect	Minimum Detection Limit (mg/kg)	Maximum Detection Limit (mg/kg)	USEPA Industrial Soil RSL [1] (mg/kg)	Constituent of Interest	Comment
Volatile Organics									
1,2,4-Trimethylbenzene	15 / 30	0.0062	483	TB#5 (2.5-5)	0.004	2.08	180	**YES**	Maximum detect exceeds screening value.
1,2-Dibromoethane	0 / 30	ND	ND	ND	0.002	**2.08**	0.16	**YES**	Detection limit(s) exceed screening value.
1,2-Dichloroethane	0 / 30	ND	ND	ND	0.004	**2.08**	2	**YES**	Detection limit(s) exceed screening value.
1,3,5-Trimethylbenzene	13 / 30	0.0052	247	TB#5 (2.5-5)	0.004	2.08	150	**YES**	Maximum detect exceeds screening value.
Benzene	14 / 30	0.0053	8.07	TB#5 (2.5-5)	0.004	0.1	5.1	**YES**	Maximum detect exceeds screening value.
Ethylbenzene	12 / 30	0.0331	94.6	TB#5 (2.5-5)	0.004	0.2	25	**YES**	Maximum detect exceeds screening value.
Isopropylbenzene	12 / 30	0.0071	13.6	TB#5 (2.5-5)	0.004	0.2	990	No	Maximum detect below screening value.
Methyl tert-butyl ether	0 / 30	ND	ND	ND	0.004	2.08	210	No	Constituent not detected.
Naphthalene	18 / 30	0.0044	46.9	TB#5 (2.5-5)	0.004	0.2	17	**YES**	Maximum detect exceeds screening value.
Toluene	5 / 30	0.005	1.26	TB#5 (2.5-5)	0.004	2.08	4700	No	Maximum detect below screening value.
Xylenes, Total	11 / 30	0.0189	579	TB#5 (2.5-5)	0.0043	6.23	250	**YES**	Maximum detect exceeds screening value.
Inorganics									
Lead	18 / 18	8.9	55.5	TB#6 (2.5-5)	- -	- -	800	No	Maximum detect below screening value.

Notes:
Values in bold indicate detection limit exceeds screening value.
"- -" Constituent detected in every sample; detection limit not presented.
ND - Not Detected
[1] Screening levels are the USEPA Industrial Soil Regional Screening Levels (RSLs; USEPA, 2019a). Non-cancer based screening levels reflect a hazard quotient of 0.1

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TABLE 2-5
IDENTIFICATION OF CONSTITUENTS OF INTEREST IN OFFSITE SOIL - RESIDENTIAL DIRECT CONTACT
Former Dollar General Property - Albion, Pennsylvania

Constituent	Frequency of Detection	Minimum Detected Soil Concentration (mg/kg)	Maximum Detected Soil Concentration (mg/kg)	Sample with Maximum Detect	Minimum Detection Limit (mg/kg)	Maximum Detection Limit (mg/kg)	USEPA Residential Soil RSL [1] (mg/kg)	Constituent of Interest	Comment
Volatile Organics									
1,2,4-Trimethylbenzene	1 / 3	0.0047	0.0047	MW-4 (5-7.5)	0.0043	0.0044	30	No	Maximum detect below screening value.
1,2-Dibromoethane	0 / 3	ND	ND	ND	0.0043	0.0044	0.036	No	Constituent not detected.
1,2-Dichloroethane	0 / 3	ND	ND	ND	0.0043	0.0044	0.46	No	Constituent not detected.
1,3,5-Trimethylbenzene	0 / 3	ND	ND	ND	0.0043	0.0044	27	No	Constituent not detected.
Benzene	0 / 3	ND	ND	ND	0.0043	0.0044	1.2	No	Constituent not detected.
Ethylbenzene	0 / 3	ND	ND	ND	0.0043	0.0044	5.8	No	Constituent not detected.
Isopropylbenzene	0 / 3	ND	ND	ND	0.0043	0.0044	190	No	Constituent not detected.
Methyl tert-butyl ether	0 / 3	ND	ND	ND	0.0043	0.0044	47	No	Constituent not detected.
Naphthalene	0 / 3	ND	ND	ND	0.0043	0.0044	3.8	No	Constituent not detected.
Toluene	0 / 3	ND	ND	ND	0.0043	0.0044	490	No	Constituent not detected.
Xylenes, Total	0 / 3	ND	ND	ND	0.0129	0.0132	58	No	Constituent not detected.
Inorganics									
Lead	3 / 3	12.7	26.5	B-1 (5-7.5)	- -	- -	400	No	Maximum detect below screening value.

Notes:

"- -" Constituent detected in every sample; detection limit not presented.

ND - Not Detected

[1] Screening levels are the USEPA Residential Soil Regional Screening Levels (RSLs; USEPA, 2019a). Non-cancer based screening levels reflect a hazard quotient of 0.1

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TABLE 2-6
IDENTIFICATION OF CONSTITUENTS OF INTEREST IN GROUNDWATER - DIRECT CONTACT PATHWAY
Former Dollar General Property - Albion, Pennsylvania

Constituent	Frequency of Detection	Minimum Detected Groundwater Concentration (ug/L)	Maximum Detected Groundwater Concentration (ug/L)	Sample with Maximum Detect	Minimum Detection Limit (ug/L)	Maximum Detection Limit (ug/L)	USEPA Tapwater RSL [1] (ug/L)	Constituent of Interest	Comment
Volatile Organics									
1,2,4-Trimethylbenzene	3 / 22	1.9	1440	TB#4	1	1	5.6	**YES**	Maximum detect exceeds screening value.
1,2-Dibromoethane	0 / 22	ND	ND	ND	**0.04**	**50**	0.0075	**YES**	Detection limit(s) exceed screening value.
1,2-Dichloroethane	0 / 22	ND	ND	ND	**1**	**50**	0.17	**YES**	Detection limit(s) exceed screening value.
1,3,5-Trimethylbenzene	2 / 22	648	653	TB#3	1	1	6	**YES**	Maximum detect exceeds screening value.
Benzene	3 / 22	23.6	564	TB#3	**1**	**25**	0.46	**YES**	Maximum detect exceeds screening value.
Ethylbenzene	4 / 22	13.65	1970	TB#3	1	1	1.5	**YES**	Maximum detect exceeds screening value.
Isopropylbenzene	4 / 22	80.55	90.4	MW-3 (4/21/2020)	1	1	45	**YES**	Maximum detect exceeds screening value.
Methyl tert-butyl ether	0 / 22	ND	ND	ND	1	**50**	14	**YES**	Detection limit(s) exceed screening value.
Naphthalene	4 / 22	64.7	472	TB#3	**2**	**2**	0.17	**YES**	Maximum detect exceeds screening value.
Toluene	3 / 22	1.9	87	TB#4	1	50	110	No	Maximum detect below screening value.
Xylenes (total)	2 / 22	2320	2550	TB#4	3	3	19	**YES**	Maximum detect exceeds screening value.
Inorganics									
Lead	0 / 22	ND	ND	ND	5	10	15	No	Constituent not detected.

Notes:
Values in bold indicate detection limit exceeds screening value.
[1] Screening levels are the USEPA Tapwater Regional Screening Levels (RSLs; USEPA, 2019a). Non-cancer based screening levels reflect a hazard quotient of 0.1.

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TABLE 2-7
IDENTIFICATION OF CONSTITUENTS OF INTEREST IN SUB-SLAB SOIL GAS - VAPOR INTRUSION PATHWAY
Former Dollar General Property - Albion, Pennsylvania

Constituent	Frequency of Detection	Minimum Detected Soil Vapor Concentration (ug/m^3)	Maximum Detected Soil Vapor Concentration (ug/m^3)	Sample with Maximum Detect	Minimum Detection Limit (ug/m^3)	Maximum Detection Limit (ug/m^3)	PADEP Non-Residential Vapor Intrusion Screening Values [1] (ug/m^3)	Constituent of Interest	Comment
Volatile Organics									
1,2,4-Trimethylbenzene	4 / 4	0.398	12.1	VP-1 (3/6/2020)	- -	- -	390	No	Maximum detect below screening value.
1,2-Dibromoethane	0 / 4	ND	ND	ND	1.54	1.54	2.6	No	Constituent not detected.
1,2-Dichloroethane	0 / 4	ND	ND	ND	0.809	0.809	61	No	Constituent not detected.
1,3,5-Trimethylbenzene	4 / 4	0.359	3.31	VP-1 (3/6/2020)	- -	- -	390	No	Maximum detect below screening value.
Benzene	1 / 4	0.22	0.22	VP-1 (4/21/2020)	0.639	0.639	200	No	Maximum detect below screening value.
Ethylbenzene	2 / 4	0.456	33.1	VP-1 (3/6/2020)	0.869	0.869	630	No	Maximum detect below screening value.
Isopropylbenzene	1 / 4	0.379	0.379	VP-1 (3/6/2020)	0.983	0.983	22000	No	Maximum detect below screening value.
m&p Xylenes [2]	2 / 4	1.334	115	VP-1 (3/6/2020)	1.74	1.74	5600	No	Maximum detect below screening value.
Methyl tert-butyl ether	0 / 4	ND	ND	ND	0.721	0.721	6100	No	Constituent not detected.
Naphthalene	2 / 4	0.645	40.1	VP-1 (3/6/2020)	1.05	1.05	46	No	Maximum detect below screening value.
o-Xylene [2]	2 / 4	0.895	7.86	VP-1 (3/6/2020)	0.869	0.869	5600	No	Maximum detect below screening value.
Toluene	4 / 4	0.2825	15.4	VP-1 (3/6/2020)	- -	- -	280000	No	Maximum detect below screening value.
Xylenes, Total	2 / 4	2.98	123	VP-1 (3/6/2020)	0.869	0.869	5600	No	Maximum detect below screening value.

Notes:
ND - Not Detected
"- -" Constituent detected in every sample; detection limit not presented.
[1] PADEP vapor intrusion screening values are 1/10 the Sub-slab Soil Gas NonResidential Vapor Intrusion Screening Levels from Table 4 of the PADEP (2019b) Vapor Intrusion guidance found at http://www.elibrary.dep.state.pa.us/dsweb/Get/Document-115613/261-0300-101.pdf
[2] Screening values for o- and m&p-xylenes are based on the value for xylenes (total).

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TABLE 2-8
SUMMARY OF CONSTITUENTS OF INTEREST FOR THE RISK ASSESSMENT
Former Dollar General Property - Albion, Pennsylvania

Medium	Location	Pathway	Scenario	Constituents of Interest	
Soil	Onsite	Direct Contact	Non-Residential	1,2,4-Trimethylbenzene	Benzene
				1,2-Dibromoethane *	Ethylbenzene
				1,2-Dichloroethane *	Naphthalene
				1,3,5-Trimethylbanzene	Xylenes (Total)
	Offsite	Direct Contact	Residential	*None*	
Groundwater	Onsite	Direct Contact	Residential	1,2,4-Trimethylbenzene	Ethylbenzene
				1,2-Dibromoethane *	Isopropylbenzene
				1,2-Dichloroethane *	Methyl tert-butyl ether *
				1,3,5-Trimethylbanzene	Naphthalene
				Benzene	Xylenes (Total)
Soil Gas	Onsite	Vapor Intrusion	Non-Residential	*None*	

Note:
* This constituent was retained as a COI because the maximum detection limit exceeded the screening value.

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TABLE 3-1
EXPOSURE POINT CONCENTRATIONS FOR CONSTITUENTS OF INTEREST IN SOIL - DIRECT CONTACT PATHWAY
Former Dollar General Property - Albion, Pennsylvania

Constituent of Interest	Number of Samples	Percent Non-detect	Maximum Detection [1] (mg/kg)	Arithmetic Mean [2] (mg/kg)	Distribution	Upper Confidence Limit [3] (mg/kg)	Exposure Point Concentration [4] (mg/kg)
Volatile Organics							
1,2,4-Trimethylbenzene	30	50.0%	483	18.2	Gamma	124	124
1,2-Dibromoethane *	30	100.0%	2.08	NA	NA	NA	2.08
1,2-Dichloroethane *	30	100.0%	2.08	NA	NA	NA	2.08
1,3,5-Trimethylbenzene	30	56.7%	247	9.46	Gamma	62.6	62.6
Benzene	30	53.3%	8.07	0.51	Lognormal	2.36	2.36
Ethylbenzene	30	60.0%	94.6	5.09	Gamma	21.0	21.0
Naphthalene	30	40.0%	46.9	2.93	Gamma	10.3	10.3
Xylenes (Total)	30	63.3%	579	21.7	Lognormal	220	220

Notes:
NA - Not applicable.
* Constituent was retained as a COI because the detection limit(s) exceed the screening value.
[1] For constituents that were 100% non-detect but had detection limits above screening values, the maximum detection is represented by the value of the maximum detection limit. See text Section 3.2.1.1.
[2] The arithmetic mean is calculated using all detected concentrations and non-detects are included at one-half the detection limit.
[3] Details of all statistical calculations are provided in Appendix B-1.
[4] The Exposure Point Concentration (EPC) is the lower of the maximum detected concentration or the Upper Confidence Limit (UCL). For non-detects the EPC is the value of the maximum detection limit.

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TABLE 3-2
EXPOSURE POINT CONCENTRATIONS FOR CONSTITUENTS OF INTEREST IN GROUNDWATER [1] - DIRECT CONTACT PATHWAY
Former Dollar General Property - Albion, Pennsylvania

Constituent of Interest	Number of Samples	Percent Non-detect	Maximum Detection [2] (ug/L)	Arithmetic Mean [3] (ug/L)	Exposure Point Concentration [4] (ug/L)
Volatile Organics					
1,2,4-Trimethylbenzene	4	25.0%	1440	471	1440
!,2-Dibromoethane *	4	100.0%	50	NA	50
1,2-Dichloroethane *	4	100.0%	50	NA	50
1,3,5-Trimethylbenzene	4	50.0%	653	326	653
Benzene	4	25.0%	564	158	564
Ethylbenzene	4	0.0%	1970	955	1970
Isopropylbenzene	4	0.0%	90.4	85.2	90.4
Methyl tert-butyl ether *	4	100.0%	50.0	NA	50.0
Naphthalene	4	0.0%	472	242	472
Xylenes (total)	4	50.0%	2550	1218	2550

Notes:
[*] Constituent was retained as a COI because the detection limit(s) exceed the screening value.
[1] The groundwater data set used to determine EPCs for all COI consists of samples from onsite wells TB#3, TB#4 and MW-3.
[2] For constituents that were 100% non-detect but had detection limits above screening values, the maximum detection is represented by the value of the maximum detection limit. See text Section 3.2.1.2.
[3] The arithmetic mean is calculated using all detected concentrations and non-detects are included at one half the detection limit.
[4] The Exposure Point Concentration (EPC) is the maximum detected concentration or the maximum detection limit for nondetect constituents.

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TABLE 3-3
EXPOSURE POINT CONCENTRATIONS FOR
INHALATION OF PARTICULATE EMISSIONS IN AMBIENT AIR (SOIL SOURCE)
Former Dollar General Property - Albion, Pennsylvania

Constituent of Interest	Soil Source Concentration [1] (mg/kg)	Transfer Factor (TF) [2] (m^3/kg)	Particulate EPC Ambient Air [3] (mg/m^3)
Volatile Organics			
1,2,4-Trimethylbenzene	124	1.00E+10	1.24E-08
1,2-Dibromoethane	2.08	1.00E+10	2.08E-10
1,2-Dichloroethane	2.08	1.00E+10	2.08E-10
1,3,5-Trimethylbenzene	62.6	1.00E+10	6.26E-09
Benzene	2.36	1.00E+10	2.36E-10
Ethylbenzene	21.0	1.00E+10	2.10E-09
Naphthalene	10.3	1.00E+10	1.03E-09
Xylenes (Total)	220	1.00E+10	2.20E-08

Notes:

[1] The soil source concentrations are the EPCs from Table 3-1.

[2] Transfer factor for particulate emissions is the default value from PADEP (2019a) Section 250.307(d).

[3] Ambient air concentration is calculated as the soil source concentration divided by the TF.

TABLE 3-4
EXPOSURE POINT CONCENTRATIONS FOR INHALATION OF VOLATILE EMISSIONS IN AMBIENT AIR (SOIL SOURCE)
Former Dollar General Property - Albion, Pennsylvania

Constituents of Interest	Soil Source Concentration [1] (mg/kg)	Volatilization Factor (VF) [2] (m^3/kg)	Volatile EPC Ambient Air [3] (mg/m^3)
Volatile Organics			
1,2,4-Trimethylbenzene	124	7.91E+03	1.56E-02
1,2-Dibromoethane	2.08	8.64E+03	2.41E-04
1,2-Dichloroethane	2.08	4.57E+03	4.55E-04
1,3,5-Trimethylbenzene	62.63	6.61E+03	9.48E-03
Benzene	2.36	3.54E+03	6.67E-04
Ethylbenzene	21.0	5.67E+03	3.70E-03
Naphthalene	10.3	4.63E+04	2.22E-04
Xylenes (Total)	220	5.74E+03	3.83E-02

Notes:

[1] The soil source concentrations are the EPCs from Table 3-1.

[2] Constituent-specific volatilization factors are the default values from USEPA (2019a).

[3] Ambient air concentration is calculated as the soil source concentration divided by the VF.

TABLE 3-5
EXPOSURE POINT CONCENTRATIONS FOR CONSTITUENTS OF INTEREST IN AMBIENT AIR (GROUNDWATER SOURCE)
Former Dollar General Property - Albion, Pennsylvania

Constituent of Interest	Groundwater Source Concentration [1] (ug/L)	VF_{trench} [2] (L/m^3)	Volatile EPC in Trench Air [3] (mg/m^3) [3]
Volatile Organics			
1,2,4-Trimethylbenzene	1440.0	5.39E-02	7.76E-02
!,2-Dibromoethane	50	4.07E-02	2.03E-03
1,2-Dichloroethane	50.0	5.66E-02	2.83E-03
1,3,5-Trimethylbenzene	653	5.40E-02	3.53E-02
Benzene	564	6.67E-02	3.76E-02
Ethylbenzene	1970	5.74E-02	1.13E-01
Isopropylbenzene	90.4	5.44E-02	4.92E-03
Methyl tert-butyl ether	50.0	5.78E-02	2.89E-03
Naphthalene	472	4.73E-02	2.23E-02
Xylenes (total)	2550	5.74E-02	1.46E-01

Notes:

[1] The groundwater source concentrations are the EPCs from Table 3-2.

[2] Details of the VF_{trench} calculations provided in Appendix C.

[3] Ambient air concentration in units of mg/m^3 is calculated as the groundwater source concentration multiplied by the VF, and incorporating a units conversion factor of 0.001.

TABLE 3-6
GENERAL FORMULA FOR CALCULATION OF CONSTITUENT INTAKES
Former Dollar General Property - Albion, Pennsylvania

Symbol	Factor	Units	Comments
C	Constituent Concentration	mg/kg, mg/L, mg/m^3	Concentration of constituent in environmental medium
CR	Contact Rate	mg/day, L/day, m^3/day	Receptor's rate of contact with environmental medium
EF	Exposure Frequency	days/year	Days per year that the receptor may be exposed
ED	Exposure Duration	years	Number of years during which receptor may be exposed
BW	Body Weight	kilograms	Intake is normalized for receptor's body weight
AT	Averaging Time	days	Period over which exposure is averaged

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

TABLE 3-7
DERMAL ABSORPTION FRACTIONS FOR CONSTITUENTS OF INTEREST IN SOIL
Former Dollar General Property - Albion, Pennsylvania

Constituent of Interest	Dermal Absorption Fraction (unitless)	Source
Volatile Organics		
1,2,4-Trimethylbenzene	NA	USEPA (2004) Section 3.2.2.4
1,2-Dibromoethane	NA	USEPA (2004) Section 3.2.2.4
1,2-Dichloroethane	NA	USEPA (2004) Section 3.2.2.4
1,3,5-Trimethylbenzene	NA	USEPA (2004) Section 3.2.2.4
Benzene	NA	USEPA (2004) Section 3.2.2.4
Ethylbenzene	NA	USEPA (2004) Section 3.2.2.4
Naphthalene	0.13	USEPA (2019a)
Xylenes (Total)	NA	USEPA (2004) Section 3.2.2.4

Notes:

NA - Not Applicable; exposure of volatiles is accounted for through the inhalation pathway. See text Section 3.4.2.

TABLE 3-8
CALCULATION OF DERMAL ABSORBED DOSE PER EVENT FOR CONSTITUENTS OF INTEREST IN GROUNDWATER
Former Dollar General Property - Albion, Pennsylvania

For organics, if t_{event} is $\leq$ t* :

$$DA_{event} = 2FA \times K_P \times Cw\sqrt{\frac{6\tau_{event} \times t_{event}}{\pi}}$$

For organics, if t_{event} is > t* :

$$DA_{event} = 2FA \times K_P \times Cw\left[\frac{t_{event}}{1+B} + 2\tau_{event}\left(\frac{1+3B+3B^2}{(1+B)^2}\right)\right]$$

Parameter	Definition	units	Value
DA_{event}	Absorbed dose per event	mg/cm^2-event	Calculated
FA	Fraction absorbed water	unitless	Constituent specific*
K_P	Dermal permeability coefficient in water	cm/hr	Constituent specific*
C_w	Chemical Concentration in water	mg/cm^3	EPC from Table 3-2 converted for units (e.g., divided by 1E+6)
τ_{event}	Lag time per event	hr/event	Constituent specific*
t_{event}	Event duration	hr/event	Receptor-specific
t*	time to reach steady state	hr	Constituent specific*
B	Ratio of the permeability coefficient of a compound through the stratum corneum relative to its permeability coefficient across the viable epidermis	unitless	Constituent specific*

Constituent	FA	K_P	Cw	τ_{event}	t_{event}	t*	B	DA_{event}
Volatile Organics								
1,2,4-Trimethylbenzene	1.0	8.57E-02	1.44E-03	0.50	2	1.19	0.36	3.45E-04
!,2-Dibromoethane	1.0	2.78E-03	5.00E-05	1.19	2	2.84	0.015	5.92E-07
1,2-Dichloroethane	1.0	4.20E-03	5.00E-05	0.38	2	0.9	0.016	5.74E-07
1,3,5-Trimethylbenzene	1.0	6.21E-02	6.53E-04	0.50	2	1.19	0.26	1.15E-04
Benzene	1.0	1.49E-02	5.64E-04	0.29	2	0.69	0.051	2.11E-05
Ethylbenzene	1.0	4.93E-02	1.97E-03	0.41	2	0.99	0.195	2.58E-04
Isopropylbenzene	1.0	8.97E-02	9.04E-05	0.50	2	1.19	0.378	2.26E-05
Methyl tert-butyl ether	1.0	2.11E-03	5.00E-05	0.33	2	0.79	0.008	2.79E-07
Naphthalene	1.0	4.66E-02	4.72E-04	0.55	2	1.32	0.203	6.55E-05
Xylenes (total)	1.0	5.00E-02	2.55E-03	0.41	2	0.99	0.198	3.39E-04

Notes:
* Constituent-specific factors are from USEPA (2019a) and USEPA (2004). In the absence of a constituent-specific value for FA, the default of 1 was used.

TABLE 3-9
FACTORS USED IN DOSE CALCULATIONS: INCIDENTAL INGESTION OF SOIL
Former Dollar General Property - Albion, Pennsylvania

Symbol	Exposure Factor	Future Outdoor Worker	Current/Future Construction/Utility Worker
CS	Constituent Concentration in Soil (mg/kg)	Constituent-Specific; see Table 3-1.	
IR	Soil Ingestion Rate	50 mg/day	330 mg/day
ABS	Gastrointestinal Absorption Factor	100% for all constituents	
CF	Conversion Factor	1×10^{-6} kg/mg	1×10^{-6} kg/mg
EF	Exposure Frequency	180 days/year	60 days/year
ED	Exposure Duration	25 years	1 year
BW	Body Weight	80 kg	80 kg
AT	Averaging Time	9,125 days (NC) 25,550 days (C)	365 days (NC) 25,550 days (C)

Average Daily Dose (ADD) = CS x IR x ABS x CF x EF x ED x 1/BW x 1/AT(NC)

Lifetime Average Daily Dose (LADD) = CS x IR x ABS x CF x EF x ED x 1/BW x 1/AT(C)

(NC) - Non-carcinogenic Averaging Time
(C) - Carcinogenic Averaging Time

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TABLE 3-10
FACTORS USED IN DOSE CALCULATIONS: DERMAL CONTACT WITH SOIL
Former Dollar General Property - Albion, Pennsylvania

Symbol	Exposure Factor	Future Outdoor Worker	Current/Future Construction/Utility Worker
CS	Constituent Concentration in Soil (mg/kg)	Constituent-Specific; see Table 3-1.	
CF	Conversion Factor	1×10^{-6} kg/mg	1×10^{-6} kg/mg
SA	Skin Surface Area	3,527 cm^2	3,527 cm^2
AF	Soil Adherence Factor	0.12 mg/cm^2	0.3 mg/cm^2
DAF	Dermal Absorption Fraction (unitless)	Constituent-Specific; see Table 3-7.	
EF	Exposure Frequency	180 days/year	60 days/year
ED	Exposure Duration	25 years	1 year
BW	Body Weight	80 kg	80 kg
AT	Averaging Time	9,125 days (NC) 25,550 days (C)	365 days (NC) 25,550 days (C)

Average Daily Dose (ADD) = CS x CF x SA x AF x DAF x EF x ED x 1/BW x 1/AT(NC)

Lifetime Average Daily Dose (LADD) = CS x CF x SA x AF x DAF x EF x ED x 1/BW x 1/AT(C)

(NC) - Non-carcinogenic Averaging Time
(C) - Carcinogenic Averaging Time

TABLE 3-11
FACTORS USED TO CALCULATE THE EXPOSURE CONCENTRATION:
INHALATION OF PARTICULATE OR VOLATILE EMISSIONS
Former Dollar General Property - Albion, Pennsylvania

Symbol	Exposure Factor	Future Outdoor Worker	Current/Future Construction/Utility Worker
CA	Constituent Concentration in Air (mg/m^3)	Constituent and Source-Specific; see Tables 3-3 through 3-5.	
ET	Exposure Time	8 hr/day	8 hr/day (soil) 2 hr/day (groundwater)
EF	Exposure Frequency	180 days/year	60 days/year
ED	Exposure Duration	25 years	1 year
AT	Averaging Time	219,000 hours (NC) 613,200 hours (C)	8,760 hours (NC) 613,200 hours (C)

Exposure Concentration (for Noncarcinogens) = CA x ET x EF x ED x 1/AT(NC)

Exposure Concentration (for Carcinogens) = CA x ET x EF x ED x 1/AT(C)

(NC) - Non-carcinogenic Averaging Time
(C) - Carcinogenic Averaging Time

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TABLE 3-12
FACTORS USED IN DOSE CALCULATIONS: INCIDENTAL INGESTION OF GROUNDWATER
Former Dollar General Property - Albion, Pennsylvania

Symbol	Exposure Factor	Current/Future Construction/Utility Worker
CW	Constituent Concentration in Water (mg/L)	Constituent-specific; see Table 3-2.
IR_W	Water Ingestion Rate	0.092 L/day
EF	Exposure Frequency	60 days/year
ED	Exposure Duration	1 year
BW	Body Weight	80 kg
AT	Averaging Time	365 days (NC) 25,550 days (C)

$$\text{Average Daily Dose (ADD)} = CW \times IR_W \times EF \times ED \times 1/BW \times 1/AT(NC)$$

$$\text{Lifetime Average Daily Dose (LADD)} = CW \times IR_W \times EF \times ED \times 1/BW \times 1/AT(C)$$

(NC) - Non-carcinogenic Averaging Time
(C) - Carcinogenic Averaging Time

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TABLE 3-13
FACTORS USED IN DOSE CALCULATIONS: DERMAL CONTACT WITH GROUNDWATER
Former Dollar General Property - Albion, Pennsylvania

Symbol	Exposure Factor	Current/Future Construction/Utility Worker
DA_{event}	Absorbed Dose per Event (mg/cm^2-event)	Constituent-specific; see Table 3-8.
EV	Event Frequency	1 event/day
EF	Exposure Frequency	60 days/year
ED	Exposure Duration	1 year
SA	Skin Surface Area	3,527 cm^2
BW	Body Weight	80 kg
AT	Averaging Time	365 days (NC) 25,550 days (C)

Average Daily Dose (ADD) = DA_{event} x EV x EF x ED x SA x 1/BW x 1/AT(NC)

Lifetime Average Daily Dose (LADD) = DA_{event} x EV x EF x ED x SA x 1/BW x 1/AT(C)

(NC) - Non-carcinogenic Averaging Time
(C) - Carcinogenic Averaging Time

TABLE 4-1
CHRONIC NONCARCINOGENIC TOXICITY VALUES FOR CONSTITUENTS OF INTEREST
Former Dollar General Property - Albion, Pennsylvania

Constituents of Interest	Target System / Critical Effect Oral/Dermal Pathways	Chronic Oral Reference Dose (mg/kg-day)		Absorption Efficiency Factor	Chronic Dermal Reference Dose [1] (mg/kg-day)	Target System / Critical Effect for Inhalation Pathway	Chronic Inhalation Reference Conc. (mg/m^3)	
Volatile Organics								
1,2,4-Trimethylbenzene	nervous	1.00E-02	I	1	1.00E-02	nervous	6.00E-02	I
1,2-Dibromoethane	endocrine, hepatic, reproductive	9.00E-03	I	1	9.00E-03	respiratory	9.00E-03	I
1,2-Dichloroethane	urinary	6.00E-03	X	1	6.00E-03	nervous	7.00E-03	P
1,3,5-Trimethylbenzene	nervous	1.00E-02	I	1	1.00E-02	nervous	6.00E-02	I
Benzene	immune	4.0E-03	I	1	4.0E-03	immune	3.0E-02	I
Ethylbenzene	hepatic, urinary	1.0E-01	I	1	1.0E-01	developmental	1.0E+00	I
Isopropylbenzene	urinary	1.0E-01	I	1	1.0E-01	endocrine, urinary	4.0E-01	I
Methyl tert-butyl ether	hepatic	NA		1	NA	hepatic, urinary, ocular	3.00E+00	I
Naphthalene	whole body (weight)	2.0E-02	I	1	2.0E-02	nervous, respiratory	3.0E-03	I
Xylenes (Total)	whole body (weight)	2.0E-01	I	1	2.0E-01	nervous	1.0E-01	I

Notes:

[1] Dermal RfDs are calculated by multiplying the oral RfDs by the fractional absorption value, in accordance with USEPA (2004).

(I) - Integrated Risk Information System (IRIS; USEPA, 2020a)

(P) - Provisional Peer-Reviewed Toxicity Values Database (PPRTV; USEPA, 2020b)

(X) - Provisional Peer-Reviewed Toxicity Value Appendix (PPRTV; USEPA, 2020b)

NA - USEPA-derived toxicity values are not available for this particular exposure route or endpoint.

TABLE 4-2
SUBCHRONIC NONCARCINOGENIC TOXICITY VALUES FOR CONSTITUENTS OF INTEREST
Former Dollar General Property - Albion, Pennsylvania

Constituents of Interest	Target System / Critical Effect Oral/Dermal Pathways	Subchronic Oral Reference Dose (mg/kg-day)		Absorption Efficiency Factor	Subchronic Dermal Reference Dose [1] (mg/kg-day)	Target System / Critical Effect for Inhalation Pathway	Subchronic Inhalation Reference Conc. (mg/m^3)	
Volatile Organics								
1,2,4-Trimethylbenzene	nervous	4.00E-02	I	1	4.00E-02	nervous	2.00E-01	I
1,2-Dibromoethane	endocrine, hepatic, reproductive	9.00E-03	ch	1	9.00E-03	reproductive	2.00E-03	H
1,2-Dichloroethane	urinary	2.00E-02	P	1	2.00E-02	nervous	7.00E-02	P
1,3,5-Trimethylbenzene	nervous	4.00E-02	I	1	4.00E-02	nervous	2.00E-01	I
Benzene	immune	1.00E-02	P	1	1.0E-02	immune	8.00E-02	P
Ethylbenzene	hepatic	5.00E-02	P	1	5.0E-02	otic	9.00E+00	P
Isopropylbenzene	urinary	4.00E-01	H	1	4.0E-01	nervous, respiratory	9.00E-02	H
Methyl tert-butyl ether	hepatic	3.00E-01	A	1	3.00E-01	nervous	2.52E+00	A
Naphthalene	nervous	6.00E-01	A	1	6.0E-01	nervous, respiratory	3.00E-03	ch
Xylenes (Total)	whole body (weight)	4.00E-01	P	1	4.0E-01	whole body (weight)	4.00E-01	P

Notes:
[1] Dermal RfDs are calculated by multiplying the oral RfDs by the fractional absorption value, in accordance with USEPA (2004).
(I) - Integrated Risk Information System (IRIS; USEPA, 2020a)
(A) - ATSDR Chronic Minimal Risk Levels, as presented by ATSDR (2020).
(P) - Provisional Peer-Reviewed Toxicity Values Database (PPRTV; USEPA, 2020b)
(H) - Health Effects Assessment Summary Tables (HEAST; USEPA, 2020c).
(ch) - Subchronic value is based on the chronic value.
NA - USEPA-derived toxicity values are not available for this particular exposure route or endpoint.

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TABLE 4-3
CARCINOGENIC TOXICITY VALUES FOR CONSTITUENTS OF INTEREST
Former Dollar General Property - Albion, Pennsylvania

Constituents of Interest	Weight of Evidence Classification	Oral Cancer Slope Factor $(mg/kg\text{-}day)^{-1}$		Absorption Efficiency Factor	Dermal Cancer Slope Factor [1] $(mg/kg\text{-}day)^{-1}$	Inhalation Unit Risk Factor $(ug/m^3)^{-1}$	
Volatile Organics							
1,2,4-Trimethylbenzene	Inadequate information to assess carcinogenic potential	NA		1	NA	NA	
1,2-Dibromothane	Likely to be carcinogenic to humans	2.00E+00	I	1	2.00E+00	6.00E-04	I
1,2-Dichloroethane	B2	9.10E-02	I	1	9.10E-02	2.60E-05	I
1,3,5-Trimethylbenzene	Inadequate information to assess carcinogenic potential	NA		1	NA	NA	
Benzene	Known/likely human carcinogen	5.50E-02	I	1	5.5E-02	7.80E-06	I
Ethylbenzene	D	1.10E-02	C	1	1.1E-02	2.50E-06	C
Isopropylbenzene	carcinogenic potential cannot be determined	NA		1	NA	NA	
Methyl tert-butyl ether	Not Classified	1.80E-03	C	1	1.80E-03	2.60E-07	C
Naphthalene	carcinogenic potential cannot be determined	1.20E-01	C	1	1.2E-01	3.40E-05	C
Xylenes (Total)	Inadequate information to assess carcinogenic potential	NA		1	NA	NA	

Notes:
[1] Dermal CSFs are calculated by dividing the oral CSFs by the fractional absorption value, in accordance with USEPA (2004).
(I) - Integrated Risk Information System (IRIS; USEPA, 2020a)
(C) - California EPA's OEHHA chemical database (CalEPA, 2020) and presented by PADEP (2020).
NA - USEPA-derived toxicity values are not available for this particular exposure route or endpoint.

TABLE 5-1

SUMMARY OF THEORETICAL EXCESS LIFETIME CANCER RISKS AND NONCANCER HAZARD INDICES FOR ALL RECEPTORS
Former Dollar General Property - Albion, Pennsylvania

Receptor	Exposure Pathways	Total Hazard Index	Theoretical Excess Lifetime Cancer Risk
Future Outdoor Worker	Incidental Ingestion of Soil		
	Dermal Contact with Soil		
	Inhalation of Particulate and Volatile Emissions From Soil		
	Total for all pathways	0.17	1.1E-05
Current/Future Construction/Utility Worker	Incidental Ingestion of Soil		
	Dermal Contact with Soil		
	Inhalation of Particulate and Volatile Emissions From Soil		
	Incidental Ingestion of Groundwater		
	Dermal Contact with Groundwater		
	Inhalation of Volatile Emissions in Trench Air		
	Total for all pathways	0.34	2.7E-06

Appendix D presents a detailed breakdown of the risk calculations by pathway and constituent.

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TABLE 5-2

THEORETICAL EXCESS LIFETIME CANCER RISK AND NONCANCER HAZARD INDEX FOR THE FUTURE OUTDOOR WORKER

Former Dollar General Property - Albion, Pennsylvania

Constituent	Total Hazard Index	Potential Cancer Risk
Volatile Organics		
1,2,4-Trimethylbenzene	0.047	NA
1,2-Dibromoethane *	0.0045	8.9E-06
1,2-Dichloroethane *	0.011	7.2E-07
1,3,5-Trimethylbenzene	0.028	NA
Benzene	0.0038	3.2E-07
Ethylbenzene	0.00067	5.7E-07
Naphthalene	0.012	7.3E-07
Xylenes (Total)	0.063	NA
Pathway Summary	0.17	1.1E-05

Notes:
NA = Toxicity values are not available for this endpoint
* Non-detect constituent that was retained as a COI because the detection limit(s) exceed the screening values.

TABLE 5-3
THEORETICAL EXCESS LIFETIME CANCER RISK AND NONCANCER HAZARD INDEX FOR THE CURRENT/FUTURE CONSTRUCTION/UTILITY WORKER

Former Dollar General Property - Albion, Pennsylvania

Constituent	Total Hazard Index	Potential Cancer Risk
Volatile Organics		
1,2,4-Trimethylbenzene	0.081	NA
1,2-Dibromoethane *	0.022	7.85E-07
1,2-Dichloroethane *	0.0017	4.32E-08
1,3,5-Trimethylbenzene	0.03	NA
Benzene	0.033	2.67E-07
Ethylbenzene	0.045	4.17E-07
Isopropylbenzene	0.0012	NA
Methyl tert-butyl ether *	0.000054	4.42E-10
Naphthalene	0.11	1.14E-06
Xylenes (total)	0.018	NA
Pathway Summary	0.34	2.7E-06

Notes:
NA = Toxicity values are not available for this endpoint
* Non-detect constituent that was retained as a COI because the detection limit(s) exceed the screening values.

APPENDIX A

ANALYTICAL DATA USED IN THE RISK ASSESSMENT

TABLE A-1 **Soil Analytical Data**
Former Dollar General - Albion, Pennsylvania

Constituent	Sample Identification / CAS No.	TB#3 (2.5-5)	TB#4(5-7.5)	TB#5 (2.5-5)	TB#6 (2.5-5)	TB#7 (5-7.5)	TB#7 (10-12)	TB#8 (2.5-5)
	Sample Depth	2.5 - 5	5 - 7.5	2.5 - 5	2.5 - 5	5 - 7.5	10 - 12	2.5 - 5
	Sample Date	3/19/2019	3/19/2019	3/19/2019	3/19/2019	4/23/2019	4/23/2019	4/23/2019
	Sample Type	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation
	Surface/Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface
	Sample Location	Onsite	Onsite	Onsite	Onsite	Onsite	Onsite	Onsite
Volatile Organics (mg/kg)								
1,2,4-Trimethylbenzene	95636	36.1	8.26	483	< 0.2	< 0.2	< 0.2	4.95
1,2-Dibromoethane	106934	< 0.2	< 0.2	< 0.2	< 0.2	< 0.002	< 0.002	< 0.002
1,2-Dichloroethane	107062	< 0.2	< 0.2	< 0.2	< 0.2	< 0.1	< 0.1	< 0.1
1,3,5-Trimethylbenzene	108678	20.8	5.58	247	< 0.2	< 0.2	< 0.2	2.24
Benzene	71432	0.266	< 0.1	8.07	0.371	< 0.1	< 0.1	0.336
Ethylbenzene	100414	12.3	3.66	94.6	2.45	< 0.2	< 0.2	1.35
Isopropylbenzene	98828	1.32	0.599	13.6	1.09	< 0.2	< 0.2	0.222
Methyl tert-butyl ether	1634044	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Naphthalene	91203	4.55	1.38	46.9	3.25	< 0.2	< 0.2	1.8
Toluene	108883	< 0.2	< 0.2	1.26	< 0.2	< 0.2	< 0.2	< 0.2
Xylenes, Total	1330207	50.1	3.08	579	< 0.2	< 0.2	< 0.2	7.18
Inorganics (mg/kg)								
Lead	7439921	14.7	18.1	12.6	55.5	NA	NA	NA

Notes:
NA - Not Analyzed
1c - A matrix spike duplicate was not performed due to insufficient sample volume
E- Analyte concentration exceeded the calibration range. The reported result is estimated.
H1 - Analysis conducted outside the EPA method holding time.
H2 - Extraction or preparation conducted outside EPA method holding time.
D6 - The precision between the sample and sample duplicate exceeded laboratory control limits.

TABLE A-1 **Soil Analytical Data**
Former Dollar General - Albion, Pennsylvania

	Sample Identification	TB#8 (7.5-10)	TB#9 (2.5-5)	TB#9 (5-7.5)	TB#10 (2.5-5)	TB#10 (5-7)	TB#11 (2.5-5)	TB#11 (5-7.5)
	Sample Depth	7.5 - 10	2.5 - 5	5 - 7.5	2.5 - 5	5 - 7	2.5 - 5	5 - 7.5
	Sample Date	4/23/2019	4/23/2019	4/23/2019	4/23/2019	4/23/2019	4/23/2019	4/23/2019
	Sample Type	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation
	Surface/Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface
	Sample Location	Onsite	Onsite	Onsite	Onsite	Onsite	Onsite	Onsite
Constituent	**CAS No.**							
Volatile Organics (mg/kg)								
1,2,4-Trimethylbenzene	95636	2.56	7.19	0.527	< 0.2	< 0.2	< 0.2	< 0.2
1,2-Dibromoethane	106934	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002
1,2-Dichloroethane	107062	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
1,3,5-Trimethylbenzene	108678	1.4	3.92	0.336	< 0.2	< 0.2	< 0.2	0.272
Benzene	71432	0.377	0.402	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Ethylbenzene	100414	0.979	1.59	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Isopropylbenzene	98828	< 0.2	0.234	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Methyl tert-butyl ether	1634044	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Naphthalene	91203	0.687	1.76	1.15	< 0.2	0.317	< 0.2	< 0.2
Toluene	108883	< 0.2	0.383	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Xylenes, Total	1330207	2.83	3.75	0.335	< 0.2	< 0.2	< 0.2	< 0.2
Inorganics (mg/kg)								
Lead	7439921	NA	NA	NA	NA	NA	NA	NA

Notes:
NA - Not Analyzed
1c - A matrix spike duplicate was not performed due to insufficient sample volume
E- Analyte concentration exceeded the calibration range. The reported result is estimated.
H1 - Analysis conducted outside the EPA method holding time.
H2 - Extraction or preparation conducted outside EPA method holding time.
D6 - The precision between the sample and sample duplicate exceeded laboratory control limits.

TABLE A-1 **Soil Analytical Data**
Former Dollar General - Albion, Pennsylvania

Sample Identification		TB#12 (2.5-5)	TB#12 (5-7.5)	MW-1 (5-7.5)	MW-3 (5-7.5)	MW-4 (5-7.5)	MW-6 (5-7.5)	B-1 (5-7.5)
Sample Depth		**2.5 - 5**	**5 - 7.5**	**5 - 7.5**	**5 - 7.5**	**5 - 7.5**	**5 - 7.5**	**5 - 7.5**
Sample Date		**4/23/2019**	**4/23/2019**	**3/4/2020**	**3/4/2020**	**3/4/2020**	**3/4/2020**	**3/3/2020**
Sample Type		**Investigation**	**Investigation**	**Investigation**	**Investigation**	**Investigation**	**Investigation**	**Investigation**
Surface/Subsurface		**Subsurface**	**Subsurface**	**Subsurface**	**Subsurface**	**Subsurface**	**Subsurface**	**Subsurface**
Sample Location		**Onsite**	**Onsite**	**Onsite**	**Onsite**	**Offsite**	**Offsite**	**Offsite**
Constituent	**CAS No.**							
Volatile Organics (mg/kg)								
1,2,4-Trimethylbenzene	95636	< 0.2	< 0.2	0.0062 1c,H1,H2	< 0.0045 1c	0.0047 1c,H1,H2	< 0.0043 1c	< 0.0044 1c
1,2-Dibromoethane	106934	< 0.002	< 0.002	< 0.0041 1c,H1,H2	< 0.0045 1c	< 0.0043 1c,H1,H2	< 0.0043 1c	< 0.0044 1c
1,2-Dichloroethane	107062	< 0.1	< 0.1	< 0.0041 1c,H1,H2	< 0.0045 1c	< 0.0043 1c,H1,H2	< 0.0043 1c	< 0.0044 1c
1,3,5-Trimethylbenzene	108678	< 0.2	< 0.2	< 0.0041 1c,H1,H2	< 0.0045 1c	< 0.0043 1c,H1,H2	< 0.0043 1c	< 0.0044 1c
Benzene	71432	< 0.1	< 0.1	< 0.0041 1c,H1,H2	0.0068 1c	< 0.0043 1c,H1,H2	< 0.0043 1c	< 0.0044 1c
Ethylbenzene	100414	< 0.2	< 0.2	< 0.0041 1c,H1,H2	< 0.0045 1c	< 0.0043 1c,H1,H2	< 0.0043 1c	< 0.0044 1c
Isopropylbenzene	98828	< 0.2	< 0.2	< 0.0041 1c,H1,H2	0.039 1c	< 0.0043 1c,H1,H2	< 0.0043 1c	< 0.0044 1c
Methyl tert-butyl ether	1634044	< 0.2	< 0.2	< 0.0041 1c,H1,H2	< 0.0045 1c	< 0.0043 1c,H1,H2	< 0.0043 1c	< 0.0044 1c
Naphthalene	91203	< 0.2	< 0.2	< 0.0041 1c,H1,H2	0.0098 1c	< 0.0043 1c,H1,H2	< 0.0043 1c	< 0.0044 1c
Toluene	108883	< 0.2	< 0.2	< 0.0041 1c,H1,H2	< 0.0045 1c	< 0.0043 1c,H1,H2	< 0.0043 1c	< 0.0044 1c
Xylenes, Total	1330207	< 0.2	< 0.2	< 0.0123 1c,H1,H2	< 0.0135 1c	< 0.0129 1c,H1,H2	< 0.0129 1c	< 0.0132 1c
Inorganics (mg/kg)								
Lead	7439921	NA	NA	13.5	12.4	15	12.7	26.5

Notes:
NA - Not Analyzed
1c - A matrix spike duplicate was not performed due to insufficient sample volume
E- Analyte concentration exceeded the calibration range. The reported result is estimated.
H1 - Analysis conducted outside the EPA method holding time.
H2 - Extraction or preparation conducted outside EPA method holding time.
D6 - The precision between the sample and sample duplicate exceeded laboratory control limits.

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TABLE A-1 **Soil Analytical Data**
Former Dollar General - Albion, Pennsylvania

	Sample Identification	B-2 (0.5-2)		B-2 (5-7.5)		B-3 (0.5-2)		B-3 (2.5-5)		B-3 (5-7.5)		B-4 (0.5-2)		B-4 (2.5-5)	
	Sample Depth	0.5 - 2		5 - 7.5		0.5 - 2		2.5 - 5		5 - 7.5		0.5 - 2		2.5 - 5	
	Sample Date	3/5/2020		3/5/2020		3/4/2020		3/4/2020		3/4/2020		3/4/2020		3/4/2020	
	Sample Type	Investigation		Investigation		Investigation		Investigation		Investigation		Investigation		Investigation	
	Surface/Subsurface	Surface		Subsurface		Surface		Subsurface		Subsurface		Surface		Subsurface	
	Sample Location	Onsite		Onsite		Onsite		Onsite		Onsite		Onsite		Onsite	
Constituent	**CAS No.**														
Volatile Organics (mg/kg)															
1,2,4-Trimethylbenzene	95636	< 0.0043	1c	0.598	1c	0.008	1c	0.0152	1c	< 2.08	1c,H1,H2	0.0322	1c	< 0.0041	1c
1,2-Dibromoethane	106934	< 0.0043	1c	< 0.207	1c	< 0.0042	1c	< 0.0043	1c	< 2.08	1c,H1,H2	< 0.0056	1c	< 0.0041	1c
1,2-Dichloroethane	107062	< 0.0043	1c	< 0.207	1c	< 0.0042	1c	< 0.0043	1c	< 2.08	1c,H1,H2	< 0.0056	1c	< 0.0041	1c
1,3,5-Trimethylbenzene	108678	< 0.0043	1c	0.214	1c	0.0052	1c	0.0179	1c	< 2.08	1c,H1,H2	0.0343	1c	< 0.0041	1c
Benzene	71432	0.0053	1c	0.714	1c	0.135	1c	0.261	1c	3.94	1c,H1,H2	< 0.0056	1c	< 0.0041	1c
Ethylbenzene	100414	< 0.0043	1c	1.02	1c	0.165	1c	0.502	E	33.2	1c,H1,H2	< 0.0056	1c	< 0.0041	1c
Isopropylbenzene	98828	< 0.0043	1c	0.461	1c	0.0212	1c	0.0776	1c	6.91	1c,H1,H2	< 0.0056	1c	< 0.0041	1c
Methyl tert-butyl ether	1634044	< 0.0043	1c	< 0.207	1c	< 0.0042	1c	< 0.0043	1c	< 2.08	1c,H1,H2	< 0.0056	1c	< 0.0041	1c
Naphthalene	91203	< 0.0043	1c	3.09	1c	0.0451	1c	0.0581	1c	22.2	1c,H1,H2	0.0311	1c	< 0.0041	1c
Toluene	108883	0.005	1c	< 0.207	1c	0.0226	1c	0.0265	1c	< 2.08	1c,H1,H2	< 0.0056	1c	< 0.0041	1c
Xylenes, Total	1330207	< 0.013	1c	1.17	1c	0.05	1c	0.0675	1c	< 6.23	1c,H1,H2	< 0.0168	1c	< 0.0122	1c
Inorganics (mg/kg)															
Lead	7439921	16.6		25		19.6		30.8		19.4		9	D6	8.9	

Notes:
NA - Not Analyzed
1c - A matrix spike duplicate was not performed due to insufficient sample volume
E- Analyte concentration exceeded the calibration range. The reported result is estimated.
H1 - Analysis conducted outside the EPA method holding time.
H2 - Extraction or preparation conducted outside EPA method holding time.
D6 - The precision between the sample and sample duplicate exceeded laboratory control limits.

TABLE A-1 **Soil Analytical Data**

Former Dollar General - Albion, Pennsylvania

	Sample Identification		**B-4 (5-7.5)**			**B-5 (0.5-2)**			**B-5 (7.5-10)**			**B-6 (5-7.5)**			**B-7 (7.5-10)**	
	Sample Depth		**5 - 7.5**			**0.5 - 2**			**7.5 - 10**			**5 - 7.5**			**7.5 - 10**	
	Sample Date		**3/4/2020**			**3/4/2020**			**3/4/2020**			**3/5/2020**			**3/4/2020**	
	Sample Type		**Investigation**			**Investigation**			**Investigation**			**Investigation**			**Investigation**	
	Surface/Subsurface		**Subsurface**			**Surface**			**Subsurface**			**Subsurface**			**Subsurface**	
	Sample Location		**Onsite**			**Onsite**			**Onsite**			**Onsite**			**Onsite**	
Constituent	**CAS No.**															
Volatile Organics (mg/kg)																
1,2,4-Trimethylbenzene	95636	<	0.004	1c	<	0.0043	1c		0.0383	1c,H1,H2		0.011	1c		0.008	1c,H1,H2
1,2-Dibromoethane	106934	<	0.004	1c	<	0.0043	1c	<	0.004	1c,H1,H2	<	0.0041	1c	<	0.0043	1c,H1,H2
1,2-Dichloroethane	107062	<	0.004	1c	<	0.0043	1c	<	0.004	1c,H1,H2	<	0.0041	1c	<	0.0043	1c,H1,H2
1,3,5-Trimethylbenzene	108678	<	0.004	1c	<	0.0043	1c		0.0275	1c,H1,H2	<	0.0041	1c	<	0.0043	1c,H1,H2
Benzene	71432	<	0.004	1c	<	0.0043	1c		0.0091	1c,H1,H2		0.0059	1c	<	0.0043	1c,H1,H2
Ethylbenzene	100414	<	0.004	1c	<	0.0043	1c		0.0331	1c,H1,H2	<	0.0041	1c	<	0.0043	1c,H1,H2
Isopropylbenzene	98828	<	0.004	1c	<	0.0043	1c		0.0071	1c,H1,H2	<	0.0041	1c	<	0.0043	1c,H1,H2
Methyl tert-butyl ether	1634044	<	0.004	1c	<	0.0043	1c	<	0.004	1c,H1,H2	<	0.0041	1c	<	0.0043	1c,H1,H2
Naphthalene	91203	<	0.004	1c	<	0.0043	1c		0.009	1c,H1,H2		0.0057	1c		0.0044	1c,H1,H2
Toluene	108883	<	0.004	1c	<	0.0043	1c	<	0.004	1c,H1,H2	<	0.0041	1c	<	0.0043	1c,H1,H2
Xylenes, Total	1330207	<	0.012	1c	<	0.0043	1c		0.0189	1c,H1,H2	<	0.0124	1c	<	0.0128	1c,H1,H2
Inorganics (mg/kg)																
Lead	7439921		15.2			10.7			12.9			9.2			10.2	

Notes:

NA - Not Analyzed

1c - A matrix spike duplicate was not performed due to insufficient sample volume

E- Analyte concentration exceeded the calibration range. The reported result is estimated.

H1 - Analysis conducted outside the EPA method holding time.

H2 - Extraction or preparation conducted outside EPA method holding time.

D6 - The precision between the sample and sample duplicate exceeded laboratory control limits.

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TABLE A-2 **Groundwater Analytical Data**
Former Dollar General - Albion, Pennsylvania

Constituent	Sample Identification / Sample Date / Sample Type / Sample Location / CAS No.	TB#3	TB#4	MW-1 (3/16/2020)	MW-1 (4/23/2020)	MW-2 (3/16/2020)	MW-2 (4/23/2020)	MW-3 (3/16/2020)
	Sample Date	3/19/2019	3/19/2019	3/16/2020	4/23/2020	3/16/2020	4/23/2020	3/16/2020
	Sample Type	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation
	Sample Location	Onsite	Onsite	Onsite	Onsite	Onsite	Onsite	Onsite
	CAS No.							
Volatile Organics (ug/L)								
1,2,4-Trimethylbenzene	95636	443	1440	NS	< 1.0	NS	< 1.0	< 1.0
1,2-Dibromoethane	106934	< 50	< 50	NS	< 0.041	NS	< 0.041	< 0.041 1c,M1
1,2-Dichloroethane	107062	< 50	< 50	NS	< 1.0	NS	< 1.0	< 1.0
1,3,5-Trimethylbenzene	108678	653	648	NS	< 1.0	NS	< 1.0	< 1.0
Benzene	71432	564	< 25	NS	< 1.0	NS	< 1.0	23.3
Ethylbenzene	100414	1970	1820	NS	< 1.0	NS	< 1.0	14.1
Isopropylbenzene	98828	85	85	NS	< 1.0	NS	< 1.0	80.4
Methyl tert-butyl ether	1634044	< 50	< 50	NS	< 1.0	NS	< 1.0	< 1.0
Naphthalene	91203	472	341	NS	< 2.0	NS	< 2.0	62.9
Toluene	108883	< 50	87	NS	< 1.0	NS	< 1.0	2.7
Xylenes (total)	1330207	2320	2550	NS	< 3.0	NS	< 3.0	< 3.0
Inorganics (ug/L)								
Lead	7439921	< 10.0	< 10	NS	< 5.0	NS	< 5.0	< 5.0

Notes:
All detection limits are based on Reporting Limit (RL) values.
NS - Not Sampled - Well did not recover quickly enough after purging.
1c - The sample pH is 7.
M1 - Matrix spike recovery exceeded QC limits. Batch accepted based on laboratory control sample (LCS) recovery.

TABLE A-2 **Groundwater Analytical Data**
Former Dollar General - Albion, Pennsylvania

Constituent	Sample Identification / Sample Date / Sample Type / Sample Location / CAS No.	MW-3 (3/16/2020) DUP 3/16/2020 Duplicate Onsite			MW-3 (4/21/2020) 4/21/2020 Investigation Onsite		MW-3 (4/21/2020) DUP 4/21/2020 Duplicate Onsite		MW-4 (3/16/2020) 3/16/2020 Investigation Offsite			MW-4 (4/21/2020) 4/21/2020 Investigation Offsite		MW-5 (3/16/2020) 3/16/2020 Investigation Offsite			MW-5 (4/23/2020) 4/23/2020 Investigation Offsite	
Volatile Organics (ug/L)																		
1,2,4-Trimethylbenzene	95636		1.9		<	1.0	<	1.0	<	1.0		<	1.0	<	1.0		<	1.0
1,2-Dibromoethane	106934	<	0.041	1c	<	0.040	<	0.041	<	0.040	1c	<	0.042	<	0.040	1c	<	0.041
1,2-Dichloroethane	107062	<	1.0		<	1.0	<	1.0	<	1.0		<	1.0	<	1.0		<	1.0
1,3,5-Trimethylbenzene	108678	<	1.0		<	1.0	<	1.0	<	1.0		<	1.0	<	1.0		<	1.0
Benzene	71432		23.9			30.5		29.9	<	1.0		<	1.0	<	1.0		<	1.0
Ethylbenzene	100414		13.2			17.7		17.5	<	1.0		<	1.0	<	1.0		<	1.0
Isopropylbenzene	98828		80.7			92.0		88.8	<	1.0		<	1.0	<	1.0		<	1.0
Methyl tert-butyl ether	1634044	<	1.0		<	1.0	<	1.0	<	1.0		<	1.0	<	1.0		<	1.0
Naphthalene	91203		66.5			91.8		89.5	<	2.0		<	2.0	<	2.0		<	2.0
Toluene	108883		2.6			1.9		1.9	<	1.0		<	1.0	<	1.0		<	1.0
Xylenes (total)	1330207	<	3.0		<	3.0	<	3.0	<	3.0		<	3.0	<	3.0		<	3.0
Inorganics (ug/L)																		
Lead	7439921	<	5.0		<	5.0	<	5.0	<	5.0		<	5.0	<	5.0		<	5.0

Notes:
All detection limits are based on Reporting Limit (RL) values.
NS - Not Sampled - Well did not recover quickly enough after purging.
1c - The sample pH is 7.
M1 - Matrix spike recovery exceeded QC limits. Batch accepted based on laboratory control sample (LCS) recovery.

TABLE A-2 **Groundwater Analytical Data**
Former Dollar General - Albion, Pennsylvania

Sample Identification		MW-6 (3/16/2020)	MW-6 (4/21/2020)	MW-7 (3/16/2020)	MW-7 (4/21/2020)	MW-8 (3/16/2020)	MW-8 (4/21/2020)	MW-9 (3/16/2020)
Sample Date		3/16/2020	4/21/2020	3/16/2020	4/21/2020	3/16/2020	4/21/2020	3/16/2020
Sample Type		Investigation	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation
Sample Location		Offsite	Offsite	Onsite	Onsite	Onsite	Onsite	Onsite
Constituent	**CAS No.**							
Volatile Organics (ug/L)								
1,2,4-Trimethylbenzene	95636	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dibromoethane	106934	< 0.040 1c	< 0.041	< 0.041 1c	< 0.041	< 0.040 1c	< 0.041	< 0.040 1c
1,2-Dichloroethane	107062	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3,5-Trimethylbenzene	108678	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Benzene	71432	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	100414	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Isopropylbenzene	98828	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Methyl tert-butyl ether	1634044	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Naphthalene	91203	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Toluene	108883	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Xylenes (total)	1330207	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0
Inorganics (ug/L)								
Lead	7439921	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0

Notes:
All detection limits are based on Reporting Limit (RL) values.
NS - Not Sampled - Well did not recover quickly enough after purging.
1c - The sample pH is 7.
M1 - Matrix spike recovery exceeded QC limits. Batch accepted based on laboratory control sample (LCS) recovery.

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TABLE A-2

Groundwater Analytical Data
Former Dollar General - Albion, Pennsylvania

Constituent	Sample Identification	MW-9 (4/21/2020)	MW-10 (3/16/2020)	MW-10 (4/21/2020)	MW-11 (4/7/2020)	MW-11 (4/23/2020)
	Sample Date	4/21/2020	3/16/2020	4/21/2020	4/7/2020	4/23/2020
	Sample Type	Investigation	Investigation	Investigation	Investigation	Investigation
	Sample Location	Onsite	Offsite	Offsite	Onsite	Onsite
	CAS No.					
Volatile Organics (ug/L)						
1,2,4-Trimethylbenzene	95636	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dibromoethane	106934	< 0.041	< 0.041 1c	< 0.041	< 0.041	< 0.041
1,2-Dichloroethane	107062	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3,5-Trimethylbenzene	108678	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Benzene	71432	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	100414	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Isopropylbenzene	98828	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Methyl tert-butyl ether	1634044	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Naphthalene	91203	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Toluene	108883	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Xylenes (total)	1330207	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0
Inorganics (ug/L)						
Lead	7439921	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0

Notes:
All detection limits are based on Reporting Limit (RL) values.
NS - Not Sampled - Well did not recover quickly enough after purging.
1c - The sample pH is 7.
M1 - Matrix spike recovery exceeded QC limits. Batch accepted based on laboratory control sample (LCS) recovery.

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TABLE A-3

Sub-Slab Soil Gas Analytical Data
Former Dollar General - Albion, Pennsylvania

Constituent	Sample Identification Sample Date Sample Type Sample Location CAS No.	VP-1 (3/6/2020) 3/6/2020 Investigation Onsite	VP-1 (4/21/2020) 4/21/2020 Investigation Onsite	VP-2 (3/6/2020) 3/6/2020 Investigation Onsite	VP-2 (3/6/2020) DUP 3/6/2020 Duplicate Onsite	VP-2 (4/21/2020) 4/21/2020 Investigation Onsite	VP-2 (4/21/2020) DUP 4/21/2020 Duplicate Onsite
Volatile Organics (ug/m^3)							
1,2,4-Trimethylbenzene	95636	12.1	0.398 J	0.334 J	1.38	< 0.983	1.64
1,2-Dibromoethane	106934	< 1.54	< 1.54	< 1.54	< 1.54	< 1.54	< 1.54
1,2-Dichloroethane	107062	< 0.809	< 0.809	< 0.809	< 0.809	< 0.809	< 0.809
1,3,5-Trimethylbenzene	108678	3.31	0.477 J	< 0.983	0.359 J	< 0.983	0.477 J
Benzene	71432	< 0.639	0.22 J	< 0.639	< 0.639	< 0.639	< 0.639
Ethylbenzene	100414	33.1	< 0.869	< 0.869	0.456 J	< 0.869	< 0.869
Isopropylbenzene	98828	0.379 J	< 0.983	< 0.983	< 0.983	< 0.983	< 0.983
m&p Xylenes	--	115	< 1.74	0.578 J	2.09	< 1.74	< 1.74
Methyl tert-butyl ether	1634044	< 0.721	< 0.721	< 0.721	< 0.721	< 0.721	< 0.721
Naphthalene	91203	40.1	< 1.05	0.645 J	< 1.05	< 1.05	< 1.05
o-Xylene	95476	7.86	< 0.869	< 0.869	0.895	< 0.869	< 0.869
Toluene	108883	15.4	0.603 J	0.384 J	1.07	0.328 J	0.237 J
Xylenes, Total	1330207	123	< 0.869	< 0.869 J	2.98	< 0.869	< 0.869

Notes:
All detection limits based on Reporting Limit (RL) values.
J - Estimated value.

APPENDIX B

STATISTICAL CALCULATIONS

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TABLE B-1
STATISTICS FOR SOIL
Former Dollar General Property - Albion, Pennsylvania

1,2,4-Trimethylbenzene
All units in mg/kg.

General Statistics

Total Number of Observations	30	Number of Distinct Observations	20
Number of Detects	15	Number of Non-Detects	15
Number of Distinct Detects	14	Number of Distinct Non-Detects	6
Minimum Detect	0.0062	Minimum Non-Detect	0.004
Maximum Detect	483	Maximum Non-Detect	2.08
Variance Detects	15362	Percent Non-Detects	50%
Mean Detects	36.22	SD Detects	123.9
Median Detects	0.527	CV Detects	3.422
Skewness Detects	3.837	Kurtosis Detects	14.79
Mean of Logged Detects	-0.993	SD of Logged Detects	3.601

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.327	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.881	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.456	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.22	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	18.12	KM Standard Error of Mean	16.36
KM SD	86.58	95% KM (BCA) UCL	50.31
95% KM (t) UCL	45.92	95% KM (Percentile Bootstrap) UCL	49.89
95% KM (z) UCL	45.03	95% KM Bootstrap t UCL	787.9
90% KM Chebyshev UCL	67.2	95% KM Chebyshev UCL	89.44
97.5% KM Chebyshev UCL	120.3	99% KM Chebyshev UCL	180.9

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.348	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.914	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.243	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.248	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)	0.165	k star (bias corrected MLE)	0.177
Theta hat (MLE)	219.1	Theta star (bias corrected MLE)	205
nu hat (MLE)	4.96	nu star (bias corrected)	5.301
Mean (detects)	36.22		

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	0.0062	Mean	18.12
Maximum	483	Median	0.01
SD	88.06	CV	4.861
k hat (MLE)	0.137	k star (bias corrected MLE)	0.145
Theta hat (MLE)	132.5	Theta star (bias corrected MLE)	124.7
nu hat (MLE)	8.204	nu star (bias corrected)	8.717
Adjusted Level of Significance (β)	0.041		
Approximate Chi Square Value (8.72, α)	3.157	Adjusted Chi Square Value (8.72, β)	2.966
95% Gamma Approximate UCL (use when n>=50)	50.02	95% Gamma Adjusted UCL (use when n<50)	53.23

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	18.12	SD (KM)	86.58
Variance (KM)	7497	SE of Mean (KM)	16.36
k hat (KM)	0.0438	k star (KM)	0.0616
nu hat (KM)	2.627	nu star (KM)	3.697
theta hat (KM)	413.8	theta star (KM)	294
80% gamma percentile (KM)	4.709	90% gamma percentile (KM)	34.98
95% gamma percentile (KM)	102.1	99% gamma percentile (KM)	361.3

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.70, α)	0.606	Adjusted Chi Square Value (3.70, β)	0.542
95% Gamma Approximate KM-UCL (use when n>=50)	110.5	95% Gamma Adjusted KM-UCL (use when n<50)	123.7

95% Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50)

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.905	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.881	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.202	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.22	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	18.12	Mean in Log Scale	-4.249
SD in Original Scale	88.06	SD in Log Scale	4.617
95% t UCL (assumes normality of ROS data)	45.43	95% Percentile Bootstrap UCL	50.06
95% BCA Bootstrap UCL	67.74	95% Bootstrap t UCL	768.7
95% H-UCL (Log ROS)	783902		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-3.009	KM Geo Mean	0.0494
KM SD (logged)	3.229	95% Critical H Value (KM-Log)	5.97
KM Standard Error of Mean (logged)	0.622	95% H-UCL (KM -Log)	325.3
KM SD (logged)	3.229	95% Critical H Value (KM-Log)	5.97
KM Standard Error of Mean (logged)	0.622		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	18.18	Mean in Log Scale	-2.212
SD in Original Scale	88.05	SD in Log Scale	3.145
95% t UCL (Assumes normality)	45.49	95% H-Stat UCL	461

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

Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50 but k<=1)	123.7

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.

TABLE B-1
STATISTICS FOR SOIL
Former Dollar General Property - Albion, Pennsylvania

1,3,5-Trimethylbenzene
All units in mg/kg.

General Statistics

Total Number of Observations	30	Number of Distinct Observations	19
Number of Detects	13	Number of Non-Detects	17
Number of Distinct Detects	13	Number of Distinct Non-Detects	6
Minimum Detect	0.0052	Minimum Non-Detect	0.004
Maximum Detect	247	Maximum Non-Detect	2.08
Variance Detects	4615	Percent Non-Detects	56.67%
Mean Detects	21.68	SD Detects	67.94
Median Detects	0.336	CV Detects	3.134
Skewness Detects	3.563	Kurtosis Detects	12.77
Mean of Logged Detects	-0.57	SD of Logged Detects	3.087

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.362	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.866	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.44	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.234	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

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

KM Mean	9.402	KM Standard Error of Mean	8.416
KM SD	44.29	95% KM (BCA) UCL	25.83
95% KM (t) UCL	23.7	95% KM (Percentile Bootstrap) UCL	25.57
95% KM (z) UCL	23.25	95% KM Bootstrap t UCL	371
90% KM Chebyshev UCL	34.65	95% KM Chebyshev UCL	46.09
97.5% KM Chebyshev UCL	61.96	99% KM Chebyshev UCL	93.14

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.055	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.873	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.251	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.262	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)	0.202	k star (bias corrected MLE)	0.206
Theta hat (MLE)	107.6	Theta star (bias corrected MLE)	105.1
nu hat (MLE)	5.241	nu star (bias corrected)	5.365
Mean (detects)	21.68		

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	0.0052	Mean	9.401
Maximum	247	Median	0.01
SD	45.05	CV	4.792
k hat (MLE)	0.151	k star (bias corrected MLE)	0.158
Theta hat (MLE)	62.39	Theta star (bias corrected MLE)	59.56
nu hat (MLE)	9.041	nu star (bias corrected)	9.47
Adjusted Level of Significance (β)	0.041		
Approximate Chi Square Value (9.47, α)	3.613	Adjusted Chi Square Value (9.47, β)	3.407
95% Gamma Approximate UCL (use when n>=50)	24.64	95% Gamma Adjusted UCL (use when n<50)	26.13

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	9.402	SD (KM)	44.29
Variance (KM)	1961	SE of Mean (KM)	8.416
k hat (KM)	0.0451	k star (KM)	0.0628
nu hat (KM)	2.704	nu star (KM)	3.767
theta hat (KM)	208.6	theta star (KM)	149.8
80% gamma percentile (KM)	2.57	90% gamma percentile (KM)	18.48
95% gamma percentile (KM)	53.18	99% gamma percentile (KM)	186

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.77, α)	0.632	Adjusted Chi Square Value (3.77, β)	0.566
95% Gamma Approximate KM-UCL (use when n>=50)	56.05	95% Gamma Adjusted KM-UCL (use when n<50)	62.63

95% Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50)

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.974	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.866	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.126	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.234	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	9.397	Mean in Log Scale	-4.839
SD in Original Scale	45.05	SD in Log Scale	4.668
95% t UCL (assumes normality of ROS data)	23.37	95% Percentile Bootstrap UCL	25.58
95% BCA Bootstrap UCL	34.43	95% Bootstrap t UCL	374.4
95% H-UCL (Log ROS)	642412		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-3.207	KM Geo Mean	0.0405
KM SD (logged)	3.076	95% Critical H Value (KM-Log)	5.709
KM Standard Error of Mean (logged)	0.597	95% H-UCL (KM -Log)	119.6
KM SD (logged)	3.076	95% Critical H Value (KM-Log)	5.709
KM Standard Error of Mean (logged)	0.597		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	9.457	Mean in Log Scale	-2.503
SD in Original Scale	45.03	SD in Log Scale	3.09
95% t UCL (Assumes normality)	23.43	95% H-Stat UCL	259.9

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

Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50 but k<=1)	62.63

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.

TABLE B-1
STATISTICS FOR SOIL
Former Dollar General Property - Albion, Pennsylvania

Benzene
All units in mg/kg.

General Statistics			
Total Number of Observations	30	Number of Distinct Observations	19
Number of Detects	14	Number of Non-Detects	16
Number of Distinct Detects	14	Number of Distinct Non-Detects	5
Minimum Detect	0.0053	Minimum Non-Detect	0.004
Maximum Detect	8.07	Maximum Non-Detect	0.1
Variance Detects	5.078	Percent Non-Detects	53.33%
Mean Detects	1.064	SD Detects	2.253
Median Detects	0.301	CV Detects	2.117
Skewness Detects	2.821	Kurtosis Detects	7.952
Mean of Logged Detects	-1.827	SD of Logged Detects	2.352
Normal GOF Test on Detects Only			
Shapiro Wilk Test Statistic	0.514	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.874	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.419	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.226	Detected Data Not Normal at 5% Significance Level	
Detected Data Not Normal at 5% Significance Level			
Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs			
KM Mean	0.499	KM Standard Error of Mean	0.298
KM SD	1.575	95% KM (BCA) UCL	1.019
95% KM (t) UCL	1.006	95% KM (Percentile Bootstrap) UCL	1.006
95% KM (z) UCL	0.99	95% KM Bootstrap t UCL	4.295
90% KM Chebyshev UCL	1.394	95% KM Chebyshev UCL	1.8
97.5% KM Chebyshev UCL	2.362	99% KM Chebyshev UCL	3.468
Gamma GOF Tests on Detected Observations Only			
A-D Test Statistic	0.838	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.821	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.254	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.246	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)	0.355	k star (bias corrected MLE)	0.327
Theta hat (MLE)	2.997	Theta star (bias corrected MLE)	3.258
nu hat (MLE)	9.942	nu star (bias corrected)	9.145
Mean (detects)	1.064		
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	0.0053	Mean	0.502
Maximum	8.07	Median	0.01
SD	1.601	CV	3.189
k hat (MLE)	0.268	k star (bias corrected MLE)	0.264
Theta hat (MLE)	1.872	Theta star (bias corrected MLE)	1.905
nu hat (MLE)	16.09	nu star (bias corrected)	15.81
Adjusted Level of Significance (β)	0.041		
Approximate Chi Square Value (15.81, α)	7.829	Adjusted Chi Square Value (15.81, β)	7.505
95% Gamma Approximate UCL (use when n>=50)	1.014	95% Gamma Adjusted UCL (use when n<50)	1.057
Estimates of Gamma Parameters using KM Estimates			
Mean (KM)	0.499	SD (KM)	1.575
Variance (KM)	2.48	SE of Mean (KM)	0.298
k hat (KM)	0.1	k star (KM)	0.113
nu hat (KM)	6.028	nu star (KM)	6.759
theta hat (KM)	4.968	theta star (KM)	4.431
80% gamma percentile (KM)	0.406	90% gamma percentile (KM)	1.388
95% gamma percentile (KM)	2.869	99% gamma percentile (KM)	7.465
Gamma Kaplan-Meier (KM) Statistics			
Approximate Chi Square Value (6.76, α)	2.039	Adjusted Chi Square Value (6.76, β)	1.893
95% Gamma Approximate KM-UCL (use when n>=50)	1.654	95% Gamma Adjusted KM-UCL (use when n<50)	1.782
Lognormal GOF Test on Detected Observations Only			
Shapiro Wilk Test Statistic	0.888	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.874	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.224	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.226	Detected Data appear Lognormal at 5% Significance Level	
Detected Data appear Lognormal at 5% Significance Level			
Lognormal ROS Statistics Using Imputed Non-Detects			
Mean in Original Scale	0.498	Mean in Log Scale	-4.693
SD in Original Scale	1.602	SD in Log Scale	3.436
95% t UCL (assumes normality of ROS data)	0.995	95% Percentile Bootstrap UCL	1.013
95% BCA Bootstrap UCL	1.271	95% Bootstrap t UCL	4.496
95% H-UCL (Log ROS)	189.9		
Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution			
KM Mean (logged)	-3.727	KM Geo Mean	0.0241
KM SD (logged)	2.364	95% Critical H Value (KM-Log)	4.522
KM Standard Error of Mean (logged)	0.45	95% H-UCL (KM -Log)	2.861
KM SD (logged)	2.364	95% Critical H Value (KM-Log)	4.522
KM Standard Error of Mean (logged)	0.45		
DL/2 Statistics			
DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.514	Mean in Log Scale	-3.076
SD in Original Scale	1.597	SD in Log Scale	2.272
95% t UCL (Assumes normality)	1.009	95% H-Stat UCL	3.858
DL/2 is not a recommended method, provided for comparisons and historical reasons			
Nonparametric Distribution Free UCL Statistics			
Detected Data appear Lognormal Distributed at 5% Significance Level			
Suggested UCL to Use			
97.5% KM (Chebyshev) UCL	2.362		

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).
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TABLE B-1
STATISTICS FOR SOIL
Former Dollar General Property - Albion, Pennsylvania

Ethylbenzene
All units in mg/kg.

General Statistics

Total Number of Observations	30	Number of Distinct Observations	18
Number of Detects	12	Number of Non-Detects	18
Number of Distinct Detects	12	Number of Distinct Non-Detects	6
Minimum Detect	0.0331	Minimum Non-Detect	0.004
Maximum Detect	94.6	Maximum Non-Detect	0.2
Variance Detects	755.2	Percent Non-Detects	60%
Mean Detects	12.65	SD Detects	27.48
Median Detects	1.47	CV Detects	2.172
Skewness Detects	2.867	Kurtosis Detects	8.518
Mean of Logged Detects	0.635	SD of Logged Detects	2.186

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.526	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.859	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.378	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.243	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	5.069	KM Standard Error of Mean	3.386
KM SD	17.76	95% KM (BCA) UCL	10.89
95% KM (t) UCL	10.82	95% KM (Percentile Bootstrap) UCL	10.94
95% KM (z) UCL	10.64	95% KM Bootstrap t UCL	38.97
90% KM Chebyshev UCL	15.23	95% KM Chebyshev UCL	19.83
97.5% KM Chebyshev UCL	26.21	99% KM Chebyshev UCL	38.76

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.755	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.814	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.261	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.264	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)	0.353	k star (bias corrected MLE)	0.32
Theta hat (MLE)	35.86	Theta star (bias corrected MLE)	39.52
nu hat (MLE)	8.469	nu star (bias corrected)	7.685
Mean (detects)	12.65		

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	5.068
Maximum	94.6	Median	0.01
SD	18.06	CV	3.564
k hat (MLE)	0.181	k star (bias corrected MLE)	0.185
Theta hat (MLE)	28.02	Theta star (bias corrected MLE)	27.39
nu hat (MLE)	10.85	nu star (bias corrected)	11.1
Adjusted Level of Significance (β)	0.041		
Approximate Chi Square Value (11.10, α)	4.641	Adjusted Chi Square Value (11.10, β)	4.402
95% Gamma Approximate UCL (use when n>=50)	12.12	95% Gamma Adjusted UCL (use when n<50)	12.78

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	5.069	SD (KM)	17.76
Variance (KM)	315.3	SE of Mean (KM)	3.386
k hat (KM)	0.0815	k star (KM)	0.0956
nu hat (KM)	4.891	nu star (KM)	5.735
theta hat (KM)	62.19	theta star (KM)	53.04
80% gamma percentile (KM)	3.288	90% gamma percentile (KM)	13.23
95% gamma percentile (KM)	29.49	99% gamma percentile (KM)	82.36

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (5.73, α)	1.506	Adjusted Chi Square Value (5.73, β)	1.386
95% Gamma Approximate KM-UCL (use when n>=50)	19.3	95% Gamma Adjusted KM-UCL (use when n<50)	20.98

95% Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50)

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.977	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.859	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.132	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.243	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	5.07	Mean in Log Scale	-3.188
SD in Original Scale	18.06	SD in Log Scale	3.756
95% t UCL (assumes normality of ROS data)	10.67	95% Percentile Bootstrap UCL	11.15
95% BCA Bootstrap UCL	15.28	95% Bootstrap t UCL	38.26
95% H-UCL (Log ROS)	5746		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.9	KM Geo Mean	0.055
KM SD (logged)	3.246	95% Critical H Value (KM-Log)	5.999
KM Standard Error of Mean (logged)	0.641	95% H-UCL (KM -Log)	397.6
KM SD (logged)	3.246	95% Critical H Value (KM-Log)	5.999
KM Standard Error of Mean (logged)	0.641		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	5.092	Mean in Log Scale	-2.276
SD in Original Scale	18.05	SD in Log Scale	3.152
95% t UCL (Assumes normality)	10.69	95% H-Stat UCL	449.8

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

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50 but k<=1)	20.98

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

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TABLE B-1
STATISTICS FOR SOIL
Former Dollar General Property - Albion, Pennsylvania

Naphthalene
All units in mg/kg.

General Statistics

Total Number of Observations	30	Number of Distinct Observations	22
Number of Detects	18	Number of Non-Detects	12
Number of Distinct Detects	18	Number of Distinct Non-Detects	4
Minimum Detect	0.0044	Minimum Non-Detect	0.004
Maximum Detect	46.9	Maximum Non-Detect	0.2
Variance Detects	136.5	Percent Non-Detects	40%
Mean Detects	4.847	SD Detects	11.68
Median Detects	0.919	CV Detects	2.41
Skewness Detects	3.257	Kurtosis Detects	10.89
Mean of Logged Detects	-1.027	SD of Logged Detects	2.891

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.465	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.897	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.399	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.202	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	2.912	KM Standard Error of Mean	1.711
KM SD	9.108	95% KM (BCA) UCL	5.93
95% KM (t) UCL	5.82	95% KM (Percentile Bootstrap) UCL	5.992
95% KM (z) UCL	5.727	95% KM Bootstrap t UCL	22.63
90% KM Chebyshev UCL	8.046	95% KM Chebyshev UCL	10.37
97.5% KM Chebyshev UCL	13.6	99% KM Chebyshev UCL	19.94

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.674	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.857	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.162	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.222	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)	0.269	k star (bias corrected MLE)	0.262
Theta hat (MLE)	17.99	Theta star (bias corrected MLE)	18.53
nu hat (MLE)	9.697	nu star (bias corrected)	9.414
Mean (detects)	4.847		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0044	Mean	2.912
Maximum	46.9	Median	0.01
SD	9.264	CV	3.181
k hat (MLE)	0.207	k star (bias corrected MLE)	0.209
Theta hat (MLE)	14.04	Theta star (bias corrected MLE)	13.94
nu hat (MLE)	12.45	nu star (bias corrected)	12.54
Adjusted Level of Significance (β)	0.041		
Approximate Chi Square Value (12.54, α)	5.582	Adjusted Chi Square Value (12.54, β)	5.315
95% Gamma Approximate UCL (use when n>=50)	6.54	95% Gamma Adjusted UCL (use when n<50)	6.868

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	2.912	SD (KM)	9.108
Variance (KM)	82.96	SE of Mean (KM)	1.711
k hat (KM)	0.102	k star (KM)	0.114
nu hat (KM)	6.135	nu star (KM)	6.854
theta hat (KM)	28.49	theta star (KM)	25.49
80% gamma percentile (KM)	2.412	90% gamma percentile (KM)	8.134
95% gamma percentile (KM)	16.72	99% gamma percentile (KM)	43.24

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (6.85, α)	2.091	Adjusted Chi Square Value (6.85, β)	1.943
95% Gamma Approximate KM-UCL (use when n>=50)	9.547	95% Gamma Adjusted KM-UCL (use when n<50)	10.28

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.935	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.897	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.157	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.202	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	2.912	Mean in Log Scale	-3.273
SD in Original Scale	9.264	SD in Log Scale	3.811
95% t UCL (assumes normality of ROS data)	5.786	95% Percentile Bootstrap UCL	6.01
95% BCA Bootstrap UCL	7.677	95% Bootstrap t UCL	22.58
95% H-UCL (Log ROS)	7486		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.644	KM Geo Mean	0.0711
KM SD (logged)	2.99	95% Critical H Value (KM-Log)	5.565
KM Standard Error of Mean (logged)	0.573	95% H-UCL (KM -Log)	136.8
KM SD (logged)	2.99	95% Critical H Value (KM-Log)	5.565
KM Standard Error of Mean (logged)	0.573		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	2.932	Mean in Log Scale	-2.183
SD in Original Scale	9.258	SD in Log Scale	2.912
95% t UCL (Assumes normality)	5.804	95% H-Stat UCL	148

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

Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50 but k<=1)	10.28

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.

TABLE B-1
STATISTICS FOR SOIL
Former Dollar General Property - Albion, Pennsylvania

Xylenes, Total
All units in mg/kg.

General Statistics			
Total Number of Observations	30	Number of Distinct Observations	22
Number of Detects	11	Number of Non-Detects	19
Number of Distinct Detects	11	Number of Distinct Non-Detects	11
Minimum Detect	0.0189	Minimum Non-Detect	0.0043
Maximum Detect	579	Maximum Non-Detect	6.23
Variance Detects	29971	Percent Non-Detects	63.33%
Mean Detects	58.87	SD Detects	173.1
Median Detects	2.83	CV Detects	2.941
Skewness Detects	3.275	Kurtosis Detects	10.79
Mean of Logged Detects	0.467	SD of Logged Detects	3.075
Normal GOF Test on Detects Only			
Shapiro Wilk Test Statistic	0.393	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.85	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.436	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.251	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	21.61	KM Standard Error of Mean	19.89
KM SD	103.9	95% KM (BCA) UCL	59.96
95% KM (t) UCL	55.41	95% KM (Percentile Bootstrap) UCL	59.96
95% KM (z) UCL	54.33	95% KM Bootstrap t UCL	1453
90% KM Chebyshev UCL	81.29	95% KM Chebyshev UCL	108.3
97.5% KM Chebyshev UCL	145.8	99% KM Chebyshev UCL	219.6
Gamma GOF Tests on Detected Observations Only			
A-D Test Statistic	1.005	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.86	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.306	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.281	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)	0.203	k star (bias corrected MLE)	0.209
Theta hat (MLE)	289.4	Theta star (bias corrected MLE)	282.3
nu hat (MLE)	4.475	nu star (bias corrected)	4.588
Mean (detects)	58.87		
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	21.59
Maximum	579	Median	0.01
SD	105.7	CV	4.894
k hat (MLE)	0.134	k star (bias corrected MLE)	0.143
Theta hat (MLE)	160.9	Theta star (bias corrected MLE)	151
nu hat (MLE)	8.053	nu star (bias corrected)	8.581
Adjusted Level of Significance (β)	0.041		
Approximate Chi Square Value (8.58, α)	3.076	Adjusted Chi Square Value (8.58, β)	2.889
95% Gamma Approximate UCL (use when n>=50)	60.23	95% Gamma Adjusted UCL (use when n<50)	64.15
Estimates of Gamma Parameters using KM Estimates			
Mean (KM)	21.61	SD (KM)	103.9
Variance (KM)	10794	SE of Mean (KM)	19.89
k hat (KM)	0.0432	k star (KM)	0.0611
nu hat (KM)	2.595	nu star (KM)	3.669
theta hat (KM)	499.6	theta star (KM)	353.4
80% gamma percentile (KM)	5.498	90% gamma percentile (KM)	41.41
95% gamma percentile (KM)	121.6	99% gamma percentile (KM)	432.4
Gamma Kaplan-Meier (KM) Statistics			
Approximate Chi Square Value (3.67, α)	0.595	Adjusted Chi Square Value (3.67, β)	0.532
95% Gamma Approximate KM-UCL (use when n>=50)	133.1	95% Gamma Adjusted KM-UCL (use when n<50)	149
95% Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50)			
Lognormal GOF Test on Detected Observations Only			
Shapiro Wilk Test Statistic	0.963	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.85	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.131	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.251	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	21.59	Mean in Log Scale	-4.619
SD in Original Scale	105.7	SD in Log Scale	4.71
95% t UCL (assumes normality of ROS data)	54.37	95% Percentile Bootstrap UCL	59.59
95% BCA Bootstrap UCL	81.14	95% Bootstrap t UCL	1544
95% H-UCL (Log ROS)	1112713		
Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution			
KM Mean (logged)	-3.059	KM Geo Mean	0.0469
KM SD (logged)	3.307	95% Critical H Value (KM-Log)	6.103
KM Standard Error of Mean (logged)	0.655	95% H-UCL (KM -Log)	472.5
KM SD (logged)	3.307	95% Critical H Value (KM-Log)	6.103
KM Standard Error of Mean (logged)	0.655		
DL/2 Statistics			
DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	21.72	Mean in Log Scale	-2.028
SD in Original Scale	105.6	SD in Log Scale	3.011
95% t UCL (Assumes normality)	54.5	95% H-Stat UCL	280.5
DL/2 is not a recommended method, provided for comparisons and historical reasons			
Nonparametric Distribution Free UCL Statistics			
Detected Data appear Lognormal Distributed at 5% Significance Level			
Suggested UCL to Use			
99% KM (Chebyshev) UCL	219.6		

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

APPENDIX C

CALCULATION OF TRANSPORT FACTORS FOR GROUNDWATER TO AMBIENT AIR

APPENDIX C

Calculation of Volatilization Factors for Groundwater to Ambient Air in a Trench

There are no well-established models available for estimating migration of volatiles from groundwater into an excavated trench. One approach is based on a combination of vadose zone modeling (to estimate the volatilization from groundwater into the excavation) and a box model (to estimate dispersion of the volatiles within the trench and the above-ground atmosphere); this approach has been adopted by the Virginia Department of Environmental Quality (VDEQ). The volatilization factors for groundwater to ambient air in a trench (VF_{trench}) were estimated for volatile constituents of interest (COI) in groundwater for the Former Dollar General property in Albion, Pennsylvania, using the VDEQ (2020) equations for groundwater present at depths less than or equal to 15 feet (e.g., groundwater that is considered shallow enough to become directly exposed to ambient air). Water level data collected from the site during the most recent sampling event conducted on April 21, 2020, indicates that the depth to water ranges from 2.66 feet below ground surface (bgs) in MW-3 to 7.84 feet bgs in MW-7. This groundwater could potentially be contacted by a worker engaging in subsurface excavation activities. Therefore, the VDEQ equation for groundwater present at depths less than or equal to 15 feet was used.

The volatilization factor algorithm is presented as Equation 3-4 of the VDEQ guidance:

$$VF_{trench} = \frac{K \times A \times F \times 10^{-3}\, L/cm^3 \times 10^4\, cm^2/m^2 \times 3{,}600 s/hr}{ACH \times V}$$

where:

K	=	Overall mass transfer coefficient (cm/s)
A	=	Area of the trench (m^2)
F	=	Fraction of the floor through which volatilization occurs (unitless)
ACH	=	Air exchanges per hour (hr^{-1})
V	=	Volume of trench (m^3)

For purposes of the risk assessment, it is assumed that an average depth for excavation activities would be 6 feet (1.83 m). The trench length is assumed to be 10 feet (3.05 m) and the trench width is assumed to be 10 feet (3.05 m), for a total area (A) of 9.3 m^2. The input factors are presented in Table C-1.

The number of air exchanges per hour (ACH) is dependent on the ratio of the trench width to trench depth. Consistent with the approach presented by VDEQ (2020), if the width-to-depth ratio is less than or equal to 1, a circulation cell will be created within the trench that limits the degree of gas exchange with the atmosphere, and an ACH of 2/hour is recommended. When the width-to-depth ratio is greater than 1, air exchange between the trench and above-ground atmosphere is not restricted, and an ACH of 360/hour is recommended. For this assessment, the width-to-depth ratio of the trench (3.05 m/1.83 m) is 1.66; therefore the ACH is set to 360/hour (see Table C-1).

The fraction of the floor through which constituents can volatilize (F) is conservatively set to 1 (100%). The final factor of the VF_{trench} algorithm is the overall mass transfer coefficient (K), which is a constituent-specific value that is calculated using the following equation:

$$K = \frac{1}{\left\{ \frac{1}{K_L} + \frac{R \times T}{H \times K_G} \right\}}$$

where:

K_L	=	Liquid-phase mass transfer coefficient (cm/s)
R	=	Ideal gas constant (atm-m^3/mol-K)
T	=	Average system absolute temperature (K)
H	=	Henry's Law Constant (atm-m^3/mol)
K_G	=	Gas-phase mass transfer coefficient (cm/s)

K_L and K_G are constituent specific factors calculated using the following equations:

$$K_L = (MW_{O2} / MWi)^{0.5} \times (T / 298) \times K_L, O_2$$

$$K_G = (MW_{H2O} / MWi)^{0.335} \times (T / 298)^{1.005} \times K_G, H_2O$$

where:

MW_{O2}	=	Molecular weight of oxygen = 32 g/mol
MW_{H2O}	=	Molecular weight of water = 18 g/mol
MW_i	=	Molecular weight of constituent i (g/mol)
K_L,O_2	=	Liquid-phase mass transfer coefficient of oxygen at 25°C = 0.002 cm/s
K_G,H_2O	=	Gas-phase mass transfer coefficient of water vapor at 25°C = 0.833 cm/s

The constituent-specific factors for MW and H, which are used in the equations above, are presented in Table C-2 and were obtained from USEPA (2019). An average system absolute temperature (T) of 287.15^o K was converted from 14°C, the average system temperature for the northwestern region of Pennsylvania (PADEP, 2019). Resulting calculated values for K_L, K_G and K are also presented in Table C-2. The final calculated VF_{trench} values for COI in groundwater are presented in Table C-2.

References

Pennsylvania Department of Environmental Protection (PADEP; 2019) Land Recycling Program Technical Guidance Manual. January 19, 2019.

United States Environmental Protection Agency (USEPA; 2019) Regional Screening Levels for Chemical Contaminants at Superfund Sites. November 2019 Update.

Virginia Department of Environmental Quality (VDEQ; 2020) Virginia Unified Risk Assessment Model (VURAM) Version 3.0 User's Guide for Risk Assessors.

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TABLE C-1
SITE-SPECIFIC AND SYSTEM PARAMETERS USED TO CALCULATE VF_{trench}
Former Dollar General Property - Albion, Pennsylvania

Symbol	Parameter and Units	Value	Source
T	Average System Absolute Temperature (K)	287	Converted from 14°C, the average value for northwestern Pennsylvania
L_{trench}	Trench Length (m)	3.05	Site-specific assumption.
W_{trench}	Trench Width (m)	3.05	Site-specific assumption.
D_{trench}	Trench Depth (m)	1.83	Site-specific assumption (average excavation depth).
A	Area of Trench (m^2)	9.3	Calculated as L_{trench} x W_{trench}
V	Volume of Trench (m^3)	17.01	Calculated as L_{trench} x W_{trench} x D_{trench}
F	Fraction of Floor through which Constituent can Enter	1	Conservative model default value
ACH	Air Exchanges per Hour (hr^{-1})	360	Model default value; dependent on ratio of W_{trench} : D_{trench}

TABLE C-2
CONSTITUENT-SPECIFIC FACTORS AND CALCULATED VALUES FOR VF_{trench}
Former Dollar General Property - Albion, Pennsylvania

Constituent of Interest	Molecular Weight MW (g/mol)	Henry's Law Constant H (atm-m^3/mol)	Gas Phase Mass Transfer Coefficient K_G (cm/sec)	Liquid Phase Mass Transfer Coefficient K_L (cm/sec)	Overall Mass Transfer Coefficient K (cm/sec)	Water to Trench Air Volatilization Factor VF_{trench} (L/m^3)
Volatile Organics						
1,2,4-Trimethylbenzene	120	6.16E-03	4.25E-01	9.94E-04	9.86E-04	5.39E-02
1,2-Dibromoethane	188	7.43E-04	3.66E-01	7.95E-04	7.44E-04	4.07E-02
1,2-Dichloroethane	99	9.79E-04	4.53E-01	1.10E-03	1.04E-03	5.66E-02
1,3,5-Trimethylbenzene	120	7.71E-03	4.25E-01	9.94E-04	9.87E-04	5.40E-02
Benzene	78	5.55E-03	4.91E-01	1.23E-03	1.22E-03	6.67E-02
Ethylbenzene	106	7.88E-03	4.43E-01	1.06E-03	1.05E-03	5.74E-02
Isopropylbenzene	120	1.16E+00	4.25E-01	9.94E-04	9.94E-04	5.44E-02
Methyl tert-butyl ether	88	5.87E-04	4.72E-01	1.16E-03	1.06E-03	5.78E-02
Naphthalene	128	4.83E-04	4.16E-01	9.63E-04	8.65E-04	4.73E-02
Xylenes (total)	106	6.63E-03	4.43E-01	1.06E-03	1.05E-03	5.74E-02

Notes:
Constituent-specific values for MW and H were obtained from the PADEP Chemical Properties Database and/or the USEPA RSL Table (November 2019).

APPENDIX D

RISK CALCULATION SPREADSHEETS

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APPENDIX D
Table 1-A: Intake Factors for the Future Outdoor Worker:
Former Dollar General Property - Albion, Pennsylvania

Soil Ingestion				
	CF	Conversion Factor	1.00E-06	kg/mg
	IRs	Ingestion Rate - Soil	50	mg/day
	EF	Exposure Frequency	180	days/yr
	ED	Exposure Duration	25	years
	BW	Body Weight	80	kg
	ATc	Averaging Time (Cancer)	25550	days
	ATn	Averaging Time (Non-cancer)	9125	days
Dermal Contact with Soil				
	CF	Conversion Factor	1.00E-06	kg/mg
	AF	Soil to Skin Adherence Factor	0.12	mg/cm^2
	SA	Skin Surface Area Available	3527	cm^2
	EF	Exposure Frequency	180	days/yr
	ED	Exposure Duration	25	years
	BW	Body Weight	80	kg
	ATc	Averaging Time (Cancer)	25550	days
	ATn	Averaging Time (Non-cancer)	9125	days
Inhalation of Particulates or Volatiles from Soil				
	EF	Exposure Frequency	180	days/yr
	ED	Exposure Duration	25	years
	ET	Exposure Time	8	hours/day
	ATc	Averaging Time (Cancer)	613200	hours
	ATn	Averaging Time (Non-cancer)	219000	hours

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APPENDIX D
Table 1-B: Constituent-Specific Factors - Former Dollar General Property - Albion, Pennsylvania

Constituent	EPC Soil (mg/kg)	EPC Air Particulate (mg/m^3)	VF (m^3/kg)	EPC Air VOC (Soil) (mg/m^3)	Oral AF (unitless)	Dermal AF (unitless)	Frac Abs (unitless)	RfDo - C (mg/kg-day)	RfC - C (mg/m^3)	RfDd - C (mg/kg-day)	CSFo (mg/kg-day)$^{-1}$	IUR (mg/m^3)$^{-1}$	CSFd (mg/kg-day)$^{-1}$
Volatile Organics													
1,2,4-Trimethylbenzene	124	1.24E-08	7.91E+03	1.56E-02	1		1	1.00E-02	6.00E-02	1.00E-02	NA	NA	NA
1,2-Dibromoethane *	2.08	2.08E-10	8.64E+03	2.41E-04	1		1	9.00E-03	9.00E-03	9.00E-03	2.00E+00	6.00E-01	2.00E+00
1,2-Dichloroethane *	2.08	2.08E-10	4.57E+03	4.55E-04	1		1	6.00E-03	7.00E-03	6.00E-03	9.10E-02	2.60E-02	9.10E-02
1,3,5-Trimethylbenzene	62.6	6.26E-09	6.61E+03	9.48E-03	1		1	1.00E-02	6.00E-02	1.00E-02	NA	NA	NA
Benzene	2.36	2.36E-10	3.54E+03	6.67E-04	1		1	4.00E-03	3.00E-02	4.00E-03	5.50E-02	7.80E-03	5.50E-02
Ethylbenzene	21.0	2.10E-09	5.67E+03	3.70E-03	1		1	1.00E-01	1.00E+00	1.00E-01	1.10E-02	2.50E-03	1.10E-02
Naphthalene	10.3	1.03E-09	4.63E+04	2.22E-04	1	0.13	1	2.00E-02	3.00E-03	2.00E-02	1.20E-01	3.40E-02	1.20E-01
Xylenes (Total)	220	2.20E-08	5.74E+03	3.83E-02	1		1	2.00E-01	1.00E-01	2.00E-01	NA	NA	NA

Notes:
* Non-detect constituent that was retained as a COI because the detection limit(s) exceed the screening value.

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APPENDIX D
Table 1-C: Hazard Indices and Theoretical Excess Lifetime Cancer Risks
Incidental Ingestion of Soil - Future Outdoor Worker

Constituent	Soil EPC (mg/kg)	Oral AF (unitless)	Intake (ADD) (mg/kg-d)	RfDo (mg/kg-d)	Hazard Quotient	Intake (LADD) (mg/kg-d)	CSFo $(mg/kg-d)^{-1}$	Potential Cancer Risk
Volatile Organics								
1,2,4-Trimethylbenzene	124	1	3.81E-05	1.00E-02	3.81E-03	1.36E-05	NA	NA
1,2-Dibromoethane *	2.08	1	6.41E-07	9.00E-03	7.12E-05	2.29E-07	2.00E+00	4.58E-07
1,2-Dichloroethane *	2.1	1	6.41E-07	6.00E-03	1.07E-04	2.29E-07	9.10E-02	2.08E-08
1,3,5-Trimethylbenzene	62.63	1	1.93E-05	1.00E-02	1.93E-03	6.89E-06	NA	NA
Benzene	2.36	1	7.28E-07	4.00E-03	1.82E-04	2.60E-07	5.50E-02	1.43E-08
Ethylbenzene	21.0	1	6.47E-06	1.00E-01	6.47E-05	2.31E-06	1.10E-02	2.54E-08
Naphthalene	10.3	1	3.17E-06	2.00E-02	1.58E-04	1.13E-06	1.20E-01	1.36E-07
Xylenes (Total)	220	1	6.77E-05	2.00E-01	3.38E-04	2.42E-05	NA	NA

Total Hazard Index	0.0067

Potential Cancer Risk	6.54E-07

Notes:
NA = Toxicity values are not available for this endpoint or exposure pathway.
* Non-detect constituent that was retained as a COI because the detection limit(s) exceed the screening value.

APPENDIX D
Table 1-D: Hazard Indices and Theoretical Excess Lifetime Cancer Risks
Dermal Contact with Soil - Future Outdoor Worker

Constituent	Soil EPC (mg/kg)	Dermal AF (unitless)	Intake (ADD) (mg/kg-d)	RfDd (mg/kg-d)	Hazard Quotient	Intake (LADD) (mg/kg-d)	CSFd $(mg/kg\text{-}d)^{-1}$	Potential Cancer Risk
Volatile Organics								
1,2,4-Trimethylbenzene	124	0	0.00E+00	1.00E-02	--	0.00E+00	NA	NA
1,2-Dibromoethane *	2.08	0	0.00E+00	9.00E-03	--	0.00E+00	2.00E+00	--
1,2-Dichloroethane *	2.1	0	0.00E+00	6.00E-03	--	0.00E+00	9.10E-02	--
1,3,5-Trimethylbenzene	62.63	0	0.00E+00	1.00E-02	--	0.00E+00	NA	NA
Benzene	2.36	0	0.00E+00	4.00E-03	--	0.00E+00	5.50E-02	--
Ethylbenzene	21.0	0	0.00E+00	1.00E-01	--	0.00E+00	1.10E-02	--
Naphthalene	10.3	0.13	3.49E-06	2.00E-02	1.74E-04	1.25E-06	1.20E-01	1.49E-07
Xylenes (Total)	220	0	0.00E+00	2.00E-01	--	0.00E+00	NA	NA

Total Hazard Index	0.00017

Potential Cancer Risk	1.49E-07

Notes:
-- = Constituent is not a COI for this medium or exposure pathway.
NA = Toxicity values are not available for this endpoint or exposure pathway.
* Non-detect constituent that was retained as a COI because the detection limit(s) exceed the screening value.

APPENDIX D
Table 1-E: Hazard Indices and Theoretical Excess Lifetime Cancer Risks
Inhalation of Particulates - Future Outdoor Worker

Constituent	EPC Air Part (mg/m^3)	EC (mg/m^3)	RfC (mg/m^3)	Hazard Quotient	EC (mg/m^3)	IUR $(mg/m^3)^{-1}$	Potential Cancer Risk
Volatile Organics							
1,2,4-Trimethylbenzene	1.24E-08	2.03E-09	6.00E-02	3.39E-08	7.26E-10	NA	NA
1,2-Dibromoethane *	2.08E-10	3.42E-11	9.00E-03	3.80E-09	1.22E-11	6.00E-01	7.33E-12
1,2-Dichloroethane *	2.08E-10	3.42E-11	7.00E-03	4.88E-09	1.22E-11	2.60E-02	3.17E-13
1,3,5-Trimethylbenzene	6.26E-09	1.03E-09	6.00E-02	1.72E-08	3.68E-10	NA	NA
Benzene	2.36E-10	3.88E-11	3.00E-02	1.29E-09	1.39E-11	7.80E-03	1.08E-13
Ethylbenzene	2.10E-09	3.45E-10	1.00E+00	3.45E-10	1.23E-10	2.50E-03	3.08E-13
Naphthalene	1.03E-09	1.69E-10	3.00E-03	5.63E-08	6.04E-11	3.40E-02	2.05E-12
Xylenes (Total)	2.20E-08	3.61E-09	1.00E-01	3.61E-08	1.29E-09	NA	NA

Total Hazard Index	1.54E-07

Potential Cancer Risk	1.01E-11

Notes:
NA = Toxicity values are not available for this endpoint or exposure pathway.
* Non-detect constituent that was retained as a COI because the detection limit(s) exceed the screening value.

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APPENDIX D
Table 1-F: Hazard Indices and Theoretical Excess Lifetime Cancer Risks
Inhalation of Volatiles from Soil - Future Outdoor Worker

Constituent	EPC Air VOC (Soil) (mg/m^3)	EC (mg/m^3)	RfC (mg/m^3)	Hazard Quotient	EC (mg/m^3)	IUR $(mg/m^3)^{-1}$	Potential Cancer Risk
Volatile Organics							
1,2,4-Trimethylbenzene	1.56E-02	2.57E-03	6.00E-02	4.28E-02	9.18E-04	NA	NA
1,2-Dibromoethane *	2.41E-04	3.96E-05	9.00E-03	4.40E-03	1.41E-05	6.00E-01	8.48E-06
1,2-Dichloroethane *	4.55E-04	7.48E-05	7.00E-03	1.07E-02	2.67E-05	2.60E-02	6.95E-07
1,3,5-Trimethylbenzene	9.48E-03	1.56E-03	6.00E-02	2.60E-02	5.56E-04	NA	NA
Benzene	6.67E-04	1.10E-04	3.00E-02	3.66E-03	3.92E-05	7.80E-03	3.06E-07
Ethylbenzene	3.70E-03	6.08E-04	1.00E+00	6.08E-04	2.17E-04	2.50E-03	5.43E-07
Naphthalene	2.22E-04	3.65E-05	3.00E-03	1.22E-02	1.30E-05	3.40E-02	4.43E-07
Xylenes (Total)	3.83E-02	6.29E-03	1.00E-01	6.29E-02	2.25E-03	NA	NA

Total Hazard Index	0.16

Potential Cancer Risk	1.05E-05

Notes:
NA = Toxicity values are not available for this endpoint or exposure pathway.
* Non-detect constituent that was retained as a COI because the detection limit(s) exceed the screening value.

APPENDIX D

Table 1-G: Summary of Hazard Indices for the Future Outdoor Worker

Former Dollar General Property - Albion, Pennsylvania

Constituent	Incidental Ingestion of Soil	Dermal Contact with Soil	Inhalation of Particulates	Inhalation of Volatiles from Soil	Total Hazard Index
Volatile Organics					
1,2,4-Trimethylbenzene	3.81E-03	--	3.39E-08	4.28E-02	0.047
1,2-Dibromoethane *	7.12E-05	--	3.80E-09	4.40E-03	0.0045
1,2-Dichloroethane *	1.07E-04	--	4.88E-09	1.07E-02	0.011
1,3,5-Trimethylbenzene	1.93E-03	--	1.72E-08	2.60E-02	0.028
Benzene	1.82E-04	--	1.29E-09	3.66E-03	0.0038
Ethylbenzene	6.47E-05	--	3.45E-10	6.08E-04	0.00067
Naphthalene	1.58E-04	1.74E-04	5.63E-08	1.22E-02	0.012
Xylenes (Total)	3.38E-04	--	3.61E-08	6.29E-02	0.063
Pathway Summary	0.0067	0.00017	1.54E-07	0.16	0.17

Total Developmental/Reproductive HI =	0.0051
Total Endocrine System HI =	0.0045
Total Hepatic System HI =	0.0051
Total Immune System HI =	0.0038
Total Nervous System HI =	0.16
Total Respiratory System HI =	0.017
Total Urinary System HI =	0.011
Total Whole Body HI =	0.076

Notes:

-- = Constituent is not a COI for this medium or exposure pathway.

* Non-detect constituent that was retained as a COI because the detection limit(s) exceed the screening value.

APPENDIX D
Table 1-H: Summary of Theoretical Excess Lifetime Cancer Risks for the Future Outdoor Worker
Former Dollar General Property - Albion, Pennsylvania

Constituent	Incidental Ingestion of Soil	Dermal Contact with Soil	Inhalation of Particulates	Inhalation of Volatiles from Soil	Theoretical Excess Lifetime Cancer Risk
Volatile Organics					
1,2,4-Trimethylbenzene	NA	NA	NA	NA	NA
1,2-Dibromoethane *	4.58E-07	--	7.33E-12	8.48E-06	8.94E-06
1,2-Dichloroethane *	2.08E-08	--	3.17E-13	6.95E-07	7.16E-07
1,3,5-Trimethylbenzene	NA	NA	NA	NA	NA
Benzene	1.43E-08	--	1.08E-13	3.06E-07	3.20E-07
Ethylbenzene	2.54E-08	--	3.08E-13	5.43E-07	5.68E-07
Naphthalene	1.36E-07	1.49E-07	2.05E-12	4.43E-07	7.28E-07
Xylenes (Total)	NA	NA	NA	NA	NA
Pathway Summary	6.54E-07	1.49E-07	1.01E-11	1.05E-05	1.13E-05

Notes:
-- = Constituent is not a COI for this medium or exposure pathway.
NA = Toxicity values are not available for this endpoint or exposure pathway.
* Non-detect constituent that was retained as a COI because the detection limit(s) exceed the screening value.

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Table 2-A: Intake Factors for the Current/Future Construction/Utility Worker : Former Dollar General Property - Albion, Pennsylvania

Soil Ingestion				
	CF	Conversion Factor	1.00E-06	kg/mg
	IRs	Ingestion Rate - Soil	330	mg/day
	EF	Exposure Frequency	60	days/yr
	ED	Exposure Duration	1	year
	BW	Body Weight	80	kg
	ATc	Averaging Time (Cancer)	25550	days
	ATn	Averaging Time (Non-cancer)	365	days
Dermal Contact with Soil				
	CF	Conversion Factor	1.00E-06	kg/mg
	AF	Soil to Skin Adherence Factor	0.3	mg/cm^2
	SA	Skin Surface Area Available	3,527	cm^2
	EF	Exposure Frequency	60	days/yr
	ED	Exposure Duration	1	year
	BW	Body Weight	80	kg
	ATc	Averaging Time (Cancer)	25550	days
	ATn	Averaging Time (Non-cancer)	365	days
Inhalation of Particulates or Volatiles from Soil				
	EF	Exposure Frequency	60	days/yr
	ED	Exposure Duration	1	year
	ET	Exposure Time	8	hours/day
	ATc	Averaging Time (Cancer)	613200	hours
	ATn	Averaging Time (Non-cancer)	8760	hours

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Table 2-A: Intake Factors for the Current/Future Construction/Utility Worker :
Former Dollar General Property - Albion, Pennsylvania

Incidental Ingestion of Water				
	IRw	Ingestion Rate - Water	0.092	L/day
	EF	Exposure Frequency	60	days/yr
	ED	Exposure Duration	1	year
	CF	Conversion Factor	0.001	mg/µg
	BW	Body Weight	80	kg
	ATc	Averaging Time (Cancer)	25550	days
	ATn	Averaging Time (Non-cancer)	365	days
Dermal Contact with Water				
	EV	Event Frequency	1	event/day
	SA	Skin Surface Area Available	3,527	cm^2
	EF	Exposure Frequency	60	days/yr
	ED	Exposure Duration	1	year
	BW	Body Weight	80	kg
	ATc	Averaging Time (Cancer)	25550	days
	ATn	Averaging Time (Non-cancer)	365	days
Inhalation of Volatiles from Water				
	EF	Exposure Frequency	60	days/yr
	ED	Exposure Duration	1	year
	ET	Exposure Time	2	hours/day
	ATc	Averaging Time (Cancer)	613200	hours
	ATn	Averaging Time (Non-cancer)	8760	hours

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Table 2-B: Constituent-Specific Factors - Former Dollar General Property - Albion, Pennsylvania

Constituent	EPC Soil (mg/kg)	EPC Air Particulate (mg/m^3)	VF (m^3/kg)	EPC Air VOC (Soil) (mg/m^3)	EPC Water (µg/L)	EPC Air VOC (Water) (mg/m^3)	Oral AF (unitless)	Dermal AF (unitless)	DA_{event} (mg/cm^2-day)	Frac Abs (unitless)	RfDo - SC (mg/kg-day)	RfC - SC (mg/m^3)	RfDd - SC (mg/kg-day)	CSFo $(mg/kg\text{-}day)^{-1}$	IUR $(mg/m^3)^{-1}$	CSFd $(mg/kg\text{-}day)^{-1}$
Volatile Organics																
1,2,4-Trimethylbenzene	124	1.24E-08	7.91E+03	1.56E-02	1440	7.76E-02	1		3.45E-04	1	4.00E-02	2.00E-01	4.00E-02	NA	NA	NA
1,2-Dibromoethane *	2.08	2.08E-10	8.64E+03	2.41E-04	50	2.03E-03	1		5.92E-07	1	9.00E-03	2.00E-03	9.00E-03	2.00E+00	6.00E-01	2.00E+00
1,2-Dichloroethane *	2.08	2.08E-10	4.57E+03	4.55E-04	50	2.83E-03	1		5.74E-07	1	2.00E-02	7.00E-02	2.00E-02	9.10E-02	2.60E-02	9.10E-02
1,3,5-Trimethylbenzene	62.6	6.26E-09	6.61E+03	9.48E-03	653	3.53E-02	1		1.15E-04	1	4.00E-02	2.00E-01	4.00E-02	NA	NA	NA
Benzene	2.36	2.36E-10	3.54E+03	6.67E-04	564	3.76E-02	1		2.11E-05	1	1.00E-02	8.00E-02	1.00E-02	5.50E-02	7.80E-03	5.50E-02
Ethylbenzene	21.0	2.10E-09	5.67E+03	3.70E-03	1970	1.13E-01	1		2.58E-04	1	5.00E-02	9.00E+00	5.00E-02	1.10E-02	2.50E-03	1.10E-02
Isopropylbenzene					90.4	4.92E-03	1		2.26E-05	1	4.00E-01	9.00E-02	4.00E-01	NA	NA	NA
Methyl tert-butyl ether *					50.0	2.89E-03	1		2.79E-07	1	3.00E-01	2.52E+00	3.00E-01	1.80E-03	2.60E-04	1.80E-03
Naphthalene	10.3	1.03E-09	4.63E+04	2.22E-04	472	2.23E-02	1	0.13	6.55E-05	1	6.00E-01	3.00E-03	6.00E-01	1.20E-01	3.40E-02	1.20E-01
Xylenes (total)	220	2.20E-08	5.74E+03	3.83E-02	2550	1.46E-01	1		3.39E-04	1	4.00E-01	4.00E-01	4.00E-01	NA	NA	NA

APPENDIX D
Table 2-C: Hazard Indices and Theoretical Excess Lifetime Cancer Risks
Incidental Ingestion of Soil - Current/Future Construction/Utility Worker

Constituent	Soil EPC (mg/kg)	Oral AF (unitless)	Intake (ADD) (mg/kg-d)	RfDo (mg/kg-d)	Hazard Quotient	Intake (LADD) (mg/kg-d)	CSFo $(mg/kg\text{-}d)^{-1}$	Potential Cancer Risk
Volatile Organics								
1,2,4-Trimethylbenzene	124	1	8.39E-05	4.00E-02	2.10E-03	1.20E-06	NA	NA
1,2-Dibromoethane *	2.08	1	1.41E-06	9.00E-03	1.57E-04	2.01E-08	2.00E+00	4.03E-08
1,2-Dichloroethane *	2.08	1	1.41E-06	2.00E-02	7.05E-05	2.01E-08	9.10E-02	1.83E-09
1,3,5-Trimethylbenzene	62.63	1	4.25E-05	4.00E-02	1.06E-03	6.07E-07	NA	NA
Benzene	2.36	1	1.60E-06	1.00E-02	1.60E-04	2.29E-08	5.50E-02	1.26E-09
Ethylbenzene	21.0	1	1.42E-05	5.00E-02	2.85E-04	2.03E-07	1.10E-02	2.24E-09
Isopropylbenzene	0	1	0.00E+00	4.00E-01	--	0.00E+00	NA	--
Methyl tert-butyl ether *	0	1	0.00E+00	3.00E-01	--	0.00E+00	1.80E-03	--
Naphthalene	10.3	1	6.97E-06	6.00E-01	1.16E-05	9.96E-08	1.20E-01	1.19E-08
Xylenes (total)	220	1	1.49E-04	4.00E-01	3.72E-04	2.13E-06	NA	NA

Total Hazard Index	0.0042
Potential Cancer Risk	5.76E-08

Notes:
-- = Constituent is not a COI for this medium or exposure pathway.
NA = Toxicity values are not available for this endpoint or exposure pathway.
* Non-detect constituent that was retained as a COI because the detection limit(s) exceed the screening value.

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APPENDIX D
Table 2-D: Hazard Indices and Theoretical Excess Lifetime Cancer Risks
Dermal Contact with Soil - Current/Future Construction/Utility Worker

Constituent	Soil EPC (mg/kg)	Dermal AF (unitless)	Intake (ADD) (mg/kg-d)	RfDd (mg/kg-d)	Hazard Quotient	Intake (LADD) (mg/kg-d)	CSFd $(mg/kg\text{-}d)^{-1}$	Potential Cancer Risk
Volatile Organics								
1,2,4-Trimethylbenzene	124	0	0.00E+00	4.00E-02	--	0.00E+00	NA	NA
1,2-Dibromoethane *	2.08	0	0.00E+00	9.00E-03	--	0.00E+00	2.00E+00	--
1,2-Dichloroethane *	2.1	0	0.00E+00	2.00E-02	--	0.00E+00	9.10E-02	--
1,3,5-Trimethylbenzene	62.63	0	0.00E+00	4.00E-02	--	0.00E+00	NA	NA
Benzene	2.36	0	0.00E+00	1.00E-02	--	0.00E+00	5.50E-02	--
Ethylbenzene	21.0	0	0.00E+00	5.00E-02	--	0.00E+00	1.10E-02	--
Isopropylbenzene	0	0	0.00E+00	4.00E-01	--	0.00E+00	NA	--
Methyl tert-butyl ether *	0	0	0.00E+00	3.00E-01	--	0.00E+00	1.80E-03	--
Naphthalene	10.3	0.13	2.91E-06	6.00E-01	4.84E-06	4.15E-08	1.20E-01	4.98E-09
Xylenes (total)	220	0	0.00E+00	4.00E-01	--	0.00E+00	NA	NA

Total Hazard Index	0.0000048

Potential Cancer Risk	4.98E-09

Notes:
-- = Constituent is not a COI for this medium or exposure pathway.
NA = Toxicity values are not available for this endpoint or exposure pathway.
* Non-detect constituent that was retained as a COI because the detection limit(s) exceed the screening value.

APPENDIX D
Table 2-E: Hazard Indices and Theoretical Excess Lifetime Cancer Risks
Inhalation of Particulates - Current/Future Construction/Utility Worker

Constituent	EPC Air Part (mg/m^3)	EC (mg/m^3)	RfC (mg/m^3)	Hazard Quotient	EC (mg/m^3)	IUR $(mg/m^3)^{-1}$	Potential Cancer Risk
Volatile Organics							
1,2,4-Trimethylbenzene	1.24E-08	6.78E-10	2.00E-01	3.39E-09	9.68E-12	NA	NA
1,2-Dibromoethane *	2.08E-10	1.14E-11	2.00E-03	5.70E-09	1.63E-13	6.00E-01	9.77E-14
1,2-Dichloroethane *	2.08E-10	1.14E-11	7.00E-02	1.63E-10	1.63E-13	2.60E-02	4.23E-15
1,3,5-Trimethylbenzene	6.26E-09	3.43E-10	2.00E-01	1.72E-09	4.90E-12	NA	NA
Benzene	2.36E-10	1.29E-11	8.00E-02	1.62E-10	1.85E-13	7.80E-03	1.44E-15
Ethylbenzene	2.10E-09	1.15E-10	9.00E+00	1.28E-11	1.64E-12	2.50E-03	4.11E-15
Isopropylbenzene	0.00E+00	0.00E+00	9.00E-02	--	0.00E+00	NA	--
Methyl tert-butyl ether *	0.00E+00	0.00E+00	2.52E+00	--	0.00E+00	2.60E-04	--
Naphthalene	1.03E-09	5.63E-11	3.00E-03	1.88E-08	8.05E-13	3.40E-02	2.74E-14
Xylenes (total)	2.20E-08	1.20E-09	4.00E-01	3.01E-09	1.72E-11	NA	NA

Total Hazard Index	3.29E-08
Potential Cancer Risk	1.35E-13

Notes:
-- = Constituent is not a COI for this medium or exposure pathway.
NA = Toxicity values are not available for this endpoint or exposure pathway.
* Non-detect constituent that was retained as a COI because the detection limit(s) exceed the screening value.

APPENDIX D
Table 2-F: Hazard Indices and Theoretical Excess Lifetime Cancer Risks
Inhalation of Volatiles - Current/Future Construction/Utility Worker

Constituent	EPC Air Part (mg/m^3)	EC (mg/m^3)	RfC (mg/m^3)	Hazard Quotient	EC (mg/m^3)	IUR $(mg/m^3)^{-1}$	Potential Cancer Risk
Volatile Organics							
1,2,4-Trimethylbenzene	1.56E-02	8.57E-04	2.00E-01	4.28E-03	1.22E-05	NA	NA
1,2-Dibromoethane *	2.41E-04	1.32E-05	2.00E-03	6.60E-03	1.88E-07	6.00E-01	1.13E-07
1,2-Dichloroethane *	4.55E-04	2.49E-05	7.00E-02	3.56E-04	3.56E-07	2.60E-02	9.26E-09
1,3,5-Trimethylbenzene	9.48E-03	5.19E-04	2.00E-01	2.60E-03	7.42E-06	NA	NA
Benzene	6.67E-04	3.66E-05	8.00E-02	4.57E-04	5.22E-07	7.80E-03	4.07E-09
Ethylbenzene	3.70E-03	2.03E-04	9.00E+00	2.25E-05	2.90E-06	2.50E-03	7.24E-09
Isopropylbenzene	0.00E+00	0.00E+00	9.00E-02	--	0.00E+00	NA	--
Methyl tert-butyl ether *	0.00E+00	0.00E+00	2.52E+00	--	0.00E+00	2.60E-04	--
Naphthalene	2.22E-04	1.22E-05	3.00E-03	4.06E-03	1.74E-07	3.40E-02	5.91E-09
Xylenes (total)	3.83E-02	2.10E-03	4.00E-01	5.24E-03	2.99E-05	NA	NA

Total Hazard Index	0.024

Potential Cancer Risk	1.40E-07

Notes:
-- = Constituent is not a COI for this medium or exposure pathway.
NA = Toxicity values are not available for this endpoint or exposure pathway.
* Non-detect constituent that was retained as a COI because the detection limit(s) exceed the screening value.

APPENDIX D
Table 2-G: Hazard Indices and Theoretical Excess Lifetime Cancer Risks
Incidental Ingestion of Groundwater - Current/Future Construction/Utility Worker

Constituent	Water EPC (µg/L)	Intake (ADD) (mg/kg-d)	RfDo (mg/kg-d)	Hazard Quotient	Intake (LADD) (mg/kg-d)	CSFo $(mg/kg\text{-}d)^{-1}$	Potential Cancer Risk
Volatile Organics							
1,2,4-Trimethylbenzene	1440	2.72E-04	4.00E-02	6.81E-03	3.89E-06	NA	NA
1,2-Dibromoethane *	50.0	9.45E-06	9.00E-03	1.05E-03	1.35E-07	2.00E+00	2.70E-07
1,2-Dichloroethane *	50	9.45E-06	2.00E-02	4.73E-04	1.35E-07	9.10E-02	1.23E-08
1,3,5-Trimethylbenzene	653	1.23E-04	4.00E-02	3.09E-03	1.76E-06	NA	NA
Benzene	564	1.07E-04	1.00E-02	1.07E-02	1.52E-06	5.50E-02	8.38E-08
Ethylbenzene	1970	3.72E-04	5.00E-02	7.45E-03	5.32E-06	1.10E-02	5.85E-08
Isopropylbenzene	90.4	1.71E-05	4.00E-01	4.27E-05	2.44E-07	NA	NA
Methyl tert-butyl ether *	50.0	9.45E-06	3.00E-01	3.15E-05	1.35E-07	1.80E-03	2.43E-10
Naphthalene	472	8.92E-05	6.00E-01	1.49E-04	1.27E-06	1.20E-01	1.53E-07
Xylenes (total)	2550	4.82E-04	4.00E-01	1.21E-03	6.89E-06	NA	NA

Total Hazard Index	0.031

Potential Cancer Risk	5.78E-07

Notes:
NA = Toxicity values are not available for this endpoint or exposure pathway.
* Non-detect constituent that was retained as a COI because the detection limit(s) exceed the screening value.

APPENDIX D
Table 2-H: Hazard Indices and Theoretical Excess Lifetime Cancer Risks
Dermal Contact with Groundwater - Current/Future Construction/Utility Worker

Constituent	DA_{event} (mg/cm^2-day)	Intake (ADD) (mg/kg-d)	RfDd (mg/kg-d)	Hazard Quotient	Intake (LADD) (mg/kg-d)	CSFd $(mg/kg\text{-}d)^{-1}$	Potential Risk
Volatile Organics							
1,2,4-Trimethylbenzene	3.45E-04	2.50E-03	4.00E-02	6.24E-02	3.57E-05	NA	NA
1,2-Dibromoethane *	5.92E-07	4.29E-06	9.00E-03	4.76E-04	6.12E-08	2.00E+00	1.22E-07
1,2-Dichloroethane *	5.74E-07	4.16E-06	2.00E-02	2.08E-04	5.94E-08	9.10E-02	5.41E-09
1,3,5-Trimethylbenzene	1.15E-04	8.30E-04	4.00E-02	2.07E-02	1.19E-05	NA	NA
Benzene	2.11E-05	1.53E-04	1.00E-02	1.53E-02	2.18E-06	5.50E-02	1.20E-07
Ethylbenzene	2.58E-04	1.87E-03	5.00E-02	3.74E-02	2.67E-05	1.10E-02	2.94E-07
Isopropylbenzene	2.26E-05	1.64E-04	4.00E-01	4.10E-04	2.34E-06	NA	NA
Methyl tert-butyl ether *	2.79E-07	2.02E-06	3.00E-01	6.74E-06	2.89E-08	1.80E-03	5.20E-11
Naphthalene	6.55E-05	4.75E-04	6.00E-01	7.91E-04	6.78E-06	1.20E-01	8.14E-07
Xylenes (total)	3.39E-04	2.45E-03	4.00E-01	6.13E-03	3.51E-05	NA	NA

Total Hazard Index	0.14
Potential Cancer Risk	1.36E-06

Notes:
NA = Toxicity values are not available for this endpoint or exposure pathway.
* Non-detect constituent that was retained as a COI because the detection limit(s) exceed the screening value.

APPENDIX D
Table 2-I: Hazard Indices and Theoretical Excess Lifetime Cancer Risks
Inhalation of Volatiles from Groundwater - Current/Future Construction/Utility Worker

Constituent	EPC Air VOC (Water) (mg/m^3)	EC (mg/m^3)	RfC (mg/m^3)	Hazard Quotient	EC (mg/m^3)	IUR $(mg/m^3)^{-1}$	Potential Cancer Risk
Volatile Organics							
1,2,4-Trimethylbenzene	7.76E-02	1.06E-03	2.00E-01	5.32E-03	1.52E-05	NA	NA
1,2-Dibromoethane *	2.03E-03	2.79E-05	2.00E-03	1.39E-02	3.98E-07	6.00E-01	2.39E-07
1,2-Dichloroethane *	2.83E-03	3.88E-05	7.00E-02	5.54E-04	5.54E-07	2.60E-02	1.44E-08
1,3,5-Trimethylbenzene	3.53E-02	4.83E-04	2.00E-01	2.41E-03	6.90E-06	NA	NA
Benzene	3.76E-02	5.16E-04	8.00E-02	6.45E-03	7.37E-06	7.80E-03	5.75E-08
Ethylbenzene	1.13E-01	1.55E-03	9.00E+00	1.72E-04	2.21E-05	2.50E-03	5.54E-08
Isopropylbenzene	4.92E-03	6.73E-05	9.00E-02	7.48E-04	9.62E-07	NA	NA
Methyl tert-butyl ether *	2.89E-03	3.96E-05	2.52E+00	1.57E-05	5.66E-07	2.60E-04	1.47E-10
Naphthalene	2.23E-02	3.06E-04	3.00E-03	1.02E-01	4.37E-06	3.40E-02	1.49E-07
Xylenes (total)	1.46E-01	2.01E-03	4.00E-01	5.01E-03	2.87E-05	NA	NA

Total Hazard Index	0.14

Potential Cancer Risk	5.15E-07

Notes:
NA = Toxicity values are not available for this endpoint or exposure pathway.
* Non-detect constituent that was retained as a COI because the detection limit(s) exceed the screening value.

APPENDIX D
Table 2-J: Summary of Hazard Indices for the Current/Future Construction/Utility Worker
Former Dollar General Property - Albion, Pennsylvania

Constituent	Incidental Ingestion of Soil	Dermal Contact with Soil	Inhalation of Particulates	Inhalation of Volatiles	Incidental Ingestion of Water	Dermal Contact with Water	Inhalation of Volatiles from Water	Total Hazard Index
Volatile Organics								
1,2,4-Trimethylbenzene	2.10E-03	--	3.39E-09	4.28E-03	6.81E-03	6.24E-02	5.32E-03	0.081
1,2-Dibromoethane *	1.57E-04	--	5.70E-09	6.60E-03	1.05E-03	4.76E-04	1.39E-02	0.022
1,2-Dichloroethane *	7.05E-05	--	1.63E-10	3.56E-04	4.73E-04	2.08E-04	5.54E-04	0.0017
1,3,5-Trimethylbenzene	1.06E-03	--	1.72E-09	2.60E-03	3.09E-03	2.07E-02	2.41E-03	0.03
Benzene	1.60E-04	--	1.62E-10	4.57E-04	1.07E-02	1.53E-02	6.45E-03	0.033
Ethylbenzene	2.85E-04	--	1.28E-11	2.25E-05	7.45E-03	3.74E-02	1.72E-04	0.045
Isopropylbenzene	--	--	--	--	4.27E-05	4.10E-04	7.48E-04	0.0012
Methyl tert-butyl ether *	--	--	--	--	3.15E-05	6.74E-06	1.57E-05	0.000054
Naphthalene	1.16E-05	4.84E-06	1.88E-08	4.06E-03	1.49E-04	7.91E-04	1.02E-01	0.11
Xylenes (total)	3.72E-04	--	3.01E-09	5.24E-03	1.21E-03	6.13E-03	5.01E-03	0.018
Pathway Summary	0.0042	0.0000048	3.29E-08	0.024	0.031	0.14	0.14	0.34

Total Developmental/Reproductive HI =	0.022
Total Endocrine System HI =	0.022
Total Hepatic System HI =	0.068
Total Immune System HI =	0.033
Total Nervous System HI =	0.22
Total Otic HI =	0.045
Total Respiratory System HI =	0.11
Total Urinary System HI =	0.0029
Total Whole Body System HI =	0.018

Notes:
-- = Constituent is not a COI for this medium or exposure pathway.
* Non-detect constituent that was retained as a COI because the detection limit(s) in soil and/or groundwater exceed the screening value.

ERS

APPENDIX D
Table 2-K: Summary of Theoretical Excess Lifetime Cancer Risks for the Current/Future Construction/Utility Worker
Former Dollar General Property - Albion, Pennsylvania

Constituent	Incidental Ingestion of Soil	Dermal Contact with Soil	Inhalation of Particulates	Inhalation of Volatiles	Incidental Ingestion of Water	Dermal Contact with Water	Inhalation of Volatiles from Water	Theoretical Excess Lifetime Cancer Risk
Volatile Organics								
1,2,4-Trimethylbenzene	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dibromoethane *	4.03E-08	--	9.77E-14	1.13E-07	2.70E-07	1.22E-07	2.39E-07	7.85E-07
1,2-Dichloroethane *	1.83E-09	--	4.23E-15	9.26E-09	1.23E-08	5.41E-09	1.44E-08	4.32E-08
1,3,5-Trimethylbenzene	NA	NA	NA	NA	NA	NA	NA	NA
Benzene	1.26E-09	--	1.44E-15	4.07E-09	8.38E-08	1.20E-07	5.75E-08	2.67E-07
Ethylbenzene	2.24E-09	--	4.11E-15	7.24E-09	5.85E-08	2.94E-07	5.54E-08	4.17E-07
Isopropylbenzene	--	--	--	--	NA	NA	NA	NA
Methyl tert-butyl ether *	--	--	--	--	2.43E-10	5.20E-11	1.47E-10	4.42E-10
Naphthalene	1.19E-08	4.98E-09	2.74E-14	5.91E-09	1.53E-07	8.14E-07	1.49E-07	1.14E-06
Xylenes (total)	NA	NA	NA	NA	NA	NA	NA	NA
Pathway Summary	5.76E-08	4.98E-09	1.35E-13	1.40E-07	5.78E-07	1.36E-06	5.15E-07	2.65E-06

Notes:
-- = Constituent is not a COI for this medium or exposure pathway.
NA = Toxicity values are not available for this endpoint or exposure pathway.
* Non-detect constituent that was retained as a COI because the detection limit(s) in soil and/or groundwater exceed the screening value.

APPENDIX E

RESULTS OF PENNSYLVANIA NATURAL DIVERSITY INVENTORY PROJECT ENVIRONMENTAL REVIEW

1. PROJECT INFORMATION

Project Name: **Former Dollar General Site - Albion, PA**
Date of Review: **4/21/2020 09:31:29 AM**
Project Category: **Hazardous Waste Clean-up, Site Remediation, and Reclamation, Other**
Project Area: **0.72 acres**
County(s): **Erie**
Township/Municipality(s): **ALBION**
ZIP Code: **16401**
Quadrangle Name(s): **ALBION**
Watersheds HUC 8: **Chautauqua-Conneaut**
Watersheds HUC 12: **Temple Creek-East Branch Conneaut Creek**
Decimal Degrees: **41.891286, -80.358761**
Degrees Minutes Seconds: **41° 53' 28.6278" N, 80° 21' 31.5387" W**

2. SEARCH RESULTS

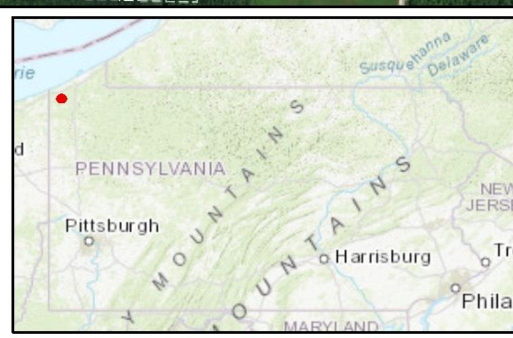
Agency	Results	Response
PA Game Commission	No Known Impact	No Further Review Required
PA Department of Conservation and Natural Resources	No Known Impact	No Further Review Required
PA Fish and Boat Commission	No Known Impact	No Further Review Required
U.S. Fish and Wildlife Service	No Known Impact	No Further Review Required

As summarized above, Pennsylvania Natural Diversity Inventory (PNDI) records indicate no known impacts to threatened and endangered species and/or special concern species and resources within the project area. Therefore, based on the information you provided, no further coordination is required with the jurisdictional agencies. This response does not reflect potential agency concerns regarding impacts to other ecological resources, such as wetlands.

Former Dollar General Site - Albion, PA

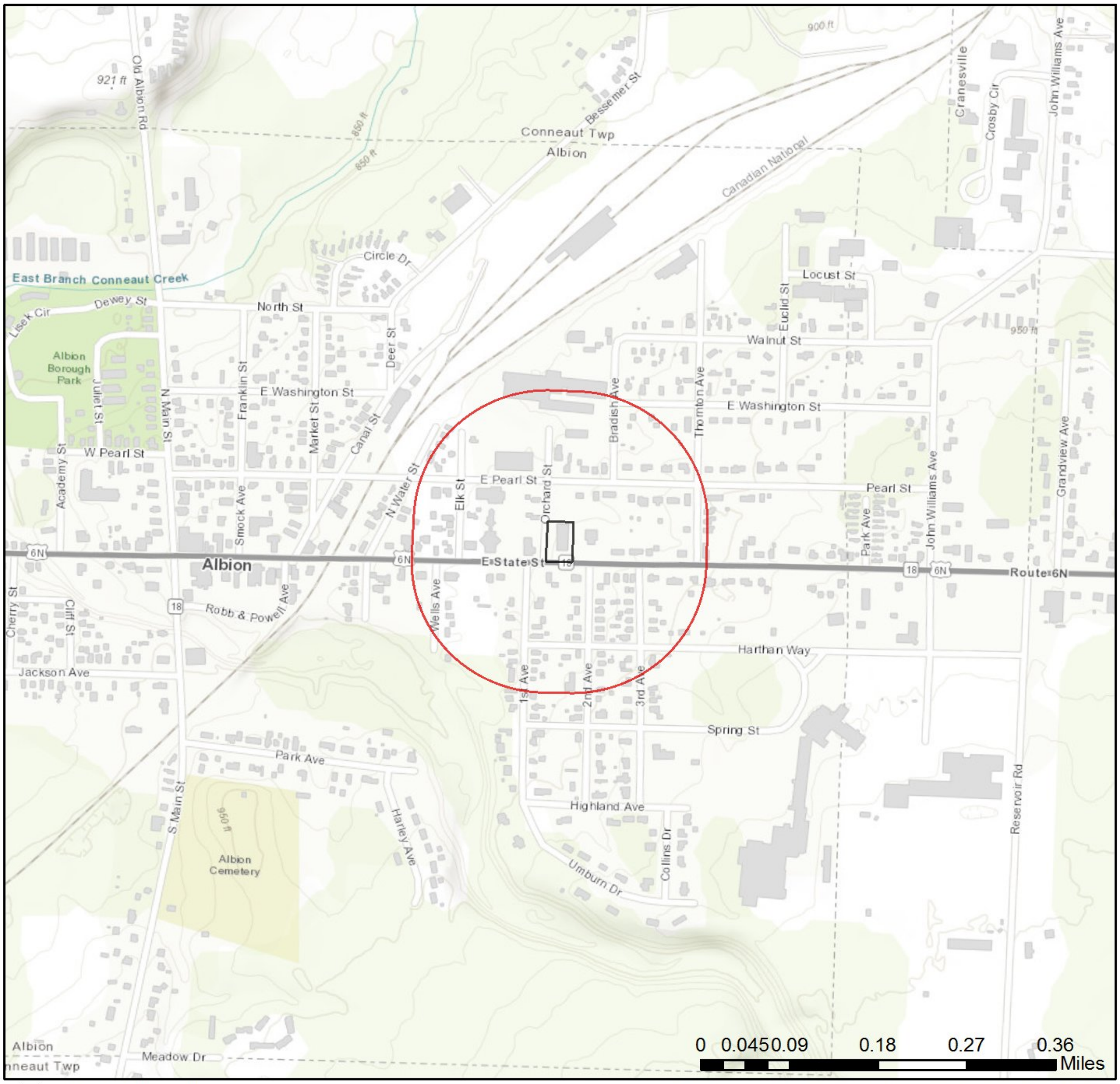
Project Boundary

Buffered Project Boundary



Service Layer Credits: Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community
Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community

Former Dollar General Site - Albion, PA



Project Boundary

Buffered Project Boundary

Service Layer Credits: Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS,

3. AGENCY COMMENTS

Regardless of whether a DEP permit is necessary for this proposed project, any potential impacts to threatened and endangered species and/or special concern species and resources must be resolved with the appropriate jurisdictional agency. In some cases, a permit or authorization from the jurisdictional agency may be needed if adverse impacts to these species and habitats cannot be avoided.

These agency determinations and responses are **valid for two years** (from the date of the review), and are based on the project information that was provided, including the exact project location; the project type, description, and features; and any responses to questions that were generated during this search. If any of the following change: 1) project location, 2) project size or configuration, 3) project type, or 4) responses to the questions that were asked during the online review, the results of this review are not valid, and the review must be searched again via the PNDI Environmental Review Tool and resubmitted to the jurisdictional agencies. The PNDI tool is a primary screening tool, and a desktop review may reveal more or fewer impacts than what is listed on this PNDI receipt. The jursidictional agencies **strongly advise against** conducting surveys for the species listed on the receipt prior to consultation with the agencies.

PA Game Commission
RESPONSE:

No Impact is anticipated to threatened and endangered species and/or special concern species and resources.

PA Department of Conservation and Natural Resources
RESPONSE:

No Impact is anticipated to threatened and endangered species and/or special concern species and resources.

PA Fish and Boat Commission
RESPONSE:

No Impact is anticipated to threatened and endangered species and/or special concern species and resources.

U.S. Fish and Wildlife Service
RESPONSE:

No impacts to **federally** listed or proposed species are anticipated. Therefore, no further consultation/coordination under the Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq. is required. Because no take of federally listed species is anticipated, none is authorized. This response does not reflect potential Fish and Wildlife Service concerns under the Fish and Wildlife Coordination Act or other authorities.

4. DEP INFORMATION

The Pa Department of Environmental Protection (DEP) requires that a signed copy of this receipt, along with any required documentation from jurisdictional agencies concerning resolution of potential impacts, be submitted with applications for permits requiring PNDI review. Two review options are available to permit applicants for handling PNDI coordination in conjunction with DEP's permit review process involving either T&E Species or species of special concern. Under sequential review, the permit applicant performs a PNDI screening and completes all coordination with the appropriate jurisdictional agencies prior to submitting the permit application. The applicant will include with its application, both a PNDI receipt and/or a clearance letter from the jurisdictional agency if the PNDI Receipt shows a Potential Impact to a species or the applicant chooses to obtain letters directly from the jurisdictional agencies. Under concurrent review, DEP, where feasible, will allow technical review of the permit to occur concurrently with the T&E species consultation with the jurisdictional agency. The applicant must still supply a copy of the PNDI Receipt with its permit application. The PNDI Receipt should also be submitted to the appropriate agency according to directions on the PNDI Receipt. The applicant and the jurisdictional agency will work together to resolve the potential impact(s). See the DEP PNDI policy at https://conservationexplorer.dcnr.pa.gov/content/resources.

5. ADDITIONAL INFORMATION

The PNDI environmental review website is a preliminary screening tool. There are often delays in updating species status classifications. Because the proposed status represents the best available information regarding the conservation status of the species, state jurisdictional agency staff give the proposed statuses at least the same consideration as the current legal status. If surveys or further information reveal that a threatened and endangered and/or special concern species and resources exist in your project area, contact the appropriate jurisdictional agency/agencies immediately to identify and resolve any impacts.

For a list of species known to occur in the county where your project is located, please see the species lists by county found on the PA Natural Heritage Program (PNHP) home page (www.naturalheritage.state.pa.us). Also note that the PNDI Environmental Review Tool only contains information about species occurrences that have actually been reported to the PNHP.

6. AGENCY CONTACT INFORMATION

PA Department of Conservation and Natural Resources
Bureau of Forestry, Ecological Services Section
400 Market Street, PO Box 8552
Harrisburg, PA 17105-8552
Email: RA-HeritageReview@pa.gov

PA Fish and Boat Commission
Division of Environmental Services
595 E. Rolling Ridge Dr., Bellefonte, PA 16823
Email: RA-FBPACENOTIFY@pa.gov

U.S. Fish and Wildlife Service
Pennsylvania Field Office
Endangered Species Section
110 Radnor Rd; Suite 101
State College, PA 16801
Email: IR1_ESPenn@fws.gov
NO Faxes Please

PA Game Commission
Bureau of Wildlife Habitat Management
Division of Environmental Planning and Habitat Protection
2001 Elmerton Avenue, Harrisburg, PA 17110-9797
Email: RA-PGC_PNDI@pa.gov
NO Faxes Please

7. PROJECT CONTACT INFORMATION

Name:____
Company/Business Name:________________________________
Address:____
City, State, Zip:_______________________________________
Phone:(_____)_______________________Fax:(______)__________________
Email:____

8. CERTIFICATION

I certify that ALL of the project information contained in this receipt (including project location, project size/configuration, project type, answers to questions) is true, accurate and complete. In addition, if the project type, location, size or configuration changes, or if the answers to any questions that were asked during this online review change, I agree to re-do the online environmental review.

____ ________________________

applicant/project proponent signature date

EXAMPLE RISK ASSESSMENT REPORT 2:

SITE IN WEST VIRGINIA

Risk-Based Remedies
RBR Consulting, Inc.

HEALTH RISK ASSESSMENT

FOR THE

ALKER TIRE (FORMER D&L TIRE) SITE
BUCKHANNON, WEST VIRGINIA
LUST # 01-009, WVID # 4905527

Prepared For:

Thrasher Engineering
Bridgeport, West Virginia

Prepared By:

Risk-Based Remedies
RBR Consulting, Inc.
650 Shady Drive
Beaver Falls, Pennsylvania

October 2018

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EXECUTIVE SUMMARY

This health risk assessment report has been prepared by RBR Consulting, Inc. (RBR) for the Alker Tire (former D&L Tire) site located in Buckhannon, Upshur County, West Virginia (site). The approaches used in this risk assessment are based on guidance provided by the West Virginia Department of Environmental Protection (WVDEP) and supplemented with United States Environmental Protection Agency (USEPA) methodologies, as necessary.

The site is a former gasoline service station and retail tire store located at 21 East Main Street at the corner of East Main Street and Spring Street in Buckhannon, West Virginia. The site had been formerly used for retail gasoline sales, vehicle maintenance, and as a tire store. The USTs and fuel dispenser islands have been removed from the site. The site is currently utilized by the city of Buckhannon for permit parking.

Constituents associated with soil, groundwater, and soil vapor were evaluated and included in the assessment. Contaminants of concern (COC) were identified for each medium based on a comparison of the analytical data to risk-based comparison values from WVDEP and USEPA. Data validation was conducted for the data collected in 2018 and rejected data from soil samples SG-1 (12-13) and SG-3 (13-13) were excluded from the risk assessment. For direct contact with soil, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, benzene, naphthalene and xylenes (total) were identified as COC. For direct contact with groundwater, benzene, ethylbenzene, naphthalene, toluene, xylenes (total) and lead were identified as COC. 1,2,4-Trimethylbenzene, 1,3,5-trimethylbenzene, ethylbenzene, isopropylbenzene, n-heptane, n-hexane, toluene and xylenes (total) were identified as COC for vapor intrusion from soil vapor to indoor air for the onsite scenario, based on detected concentrations. In addition, benzene and naphthalene were retained as COC for the vapor intrusion pathway for the onsite scenario because their laboratory detection limits exceeded the applicable screening values. For the offsite scenario, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, benzene, ethylbenzene, n-heptane, n-hexane, toluene and xylenes (total) were identified as COC for vapor intrusion from soil vapor to indoor air, based on detected concentrations. In addition, naphthalene and isopropylbenzene were retained as COC for the vapor intrusion pathway for the offsite scenario because their laboratory detection limits exceeded the applicable screening values.

Land use for the site and adjacent offsite area is and will remain commercial/industrial, and use restrictions will be implemented for the onsite area that will prohibit future residential use, as well as the use of groundwater as drinking water. Therefore, the receptors considered for quantitative evaluation include current/future outdoor workers, construction/excavation workers, and onsite and offsite indoor workers. Outdoor workers were evaluated for direct contact with surface soil via incidental ingestion, dermal contact, and inhalation of volatiles and particulates in ambient air. Construction/excavation workers were evaluated for direct contact with surface and subsurface soil via incidental ingestion, dermal contact and inhalation of volatiles and particulates in ambient air, as well as direct contact with groundwater via incidental ingestion, dermal contact and inhalation of volatiles in trench air. Indoor workers were evaluated for inhalation of volatile constituents that could potentially migrate from the subsurface to indoor air of current or future onsite or offsite buildings.

Representative concentrations of COC in each exposure medium were calculated based on analytical data, or estimated based on fate and transport models. The intake assumptions utilized for each receptor were based on WVDEP and/or USEPA default values. To estimate the toxic potency of the COC, USEPA values from the Integrated Risk Information System and other sources including WVDEP guidance, were employed. Exposure to lead was addressed using the USEPA Technical Review Workgroup Adult Lead Model.

The results of the analyses indicate that the potential noncancer hazard indices (HIs) are below the WVDEP target benchmark of 1 and the potential cumulative cancer risks are below the WVDEP non-residential benchmark of 1 x 10^{-5} for the outdoor worker, the construction/excavation worker, and the indoor worker (both onsite and offsite), indicating that the potential for excess cancer risk or non-cancer hazard is negligible for these receptors. The results of the analysis for potential exposure to lead in groundwater indicate that calculated blood lead concentrations for the construction/excavation worker are below the blood lead reference value of 10 ug/dL, and also below the proposed lower value of 5 ug/dL.

For the outdoor worker potentially exposed to COC in surface soil, the total HI is 0.000019 and the potential cancer risk is 8.1 x 10^{-10}. For the construction/excavation worker potentially exposed to COC in surface and subsurface soil and groundwater, the total HI is 0.16, the potential cancer risk is 2.6 x 10^{-7} and the predicted fetal blood lead concentration is 1.45 ug/dL. For the onsite indoor worker potentially exposed to COC in indoor air (vapor intrusion from soil vapor), the total HI is 0.40 and the potential cancer risk is 5.6 x 10^{-6}. For the offsite indoor worker potentially exposed to COC in indoor air (vapor intrusion from soil vapor), the total HI is 0.26 and the potential cancer risk is 4.4 x 10^{-6}.

The risk assessment indicates that the calculated non-cancer hazards and potential cancer risks are within acceptable benchmarks for the outdoor worker, the construction/excavation worker, and the indoor worker. It can be concluded that adverse effects are negligible for the site under current and future non-residential scenarios, considering restrictions on residential land use and the use of groundwater as drinking water. Adverse effects are also negligible for indoor workers in the adjacent offsite area.

1.0 INTRODUCTION

This health risk assessment report has been prepared by RBR Consulting, Inc. (RBR) for the Alker Tire (former D&L Tire) site located in Buckhannon, Upshur County, West Virginia (site). The risk assessment consists of a quantitative analysis of the potential for adverse effects to human health or the environment that may be associated with constituents present at the site.

1.1 PURPOSE OF THE RISK ASSESSMENT

Risk assessment is defined as the scientific evaluation of potential adverse effects posed by a particular substance or mixture of substances. The purpose of this risk assessment is to provide quantitative analyses, in a conservative and health-protective manner, of the likelihood that adverse effects may be associated with potential exposures to contaminants in environmental media at the site. In providing health-related information on potential human contact with site-associated constituents, this risk assessment is designed to provide a sound basis for risk management decisions.

This risk assessment presents an analysis of the site and adjacent area under current and future non-residential conditions. The risk assessment provides an understanding of the nature of constituent presence, the possible pathways of human exposure, and the degree to which such exposure may pose a potential for adverse effects.

1.2 REGULATORY FRAMEWORK AND APPROACH

This risk assessment was prepared according to the standards, terms, and conditions set forth under the West Virginia Voluntary Remediation and Redevelopment Rule (VRRR), Title 60 Code of State Regulations, Series 3, as established in the Voluntary Remediation and Redevelopment Act (VRRA) W.Va. Code Section 22-22-1. The site is identified as LUST # 901-009 and WVID # 4905527.

This risk assessment follows applicable guidance as presented in the VRRA Guidance Manual (WVDEP, 2001) as well as United States Environmental Protection Agency (USEPA) risk assessment guidance (USEPA, 1989, 1991, 1992a, 2002a, 2002b, 2004a, 2004b, 2005, 2009, 2016a, 2017a, 2017b, 2018a). To the extent possible, the most recent improvements and refinements in the practice of risk assessment have been incorporated into this report. The scientific basis and validity of values used in this assessment are considered and discussed in the context of primary research literature in order to provide a frame of reference for the conclusions. The actual levels of human exposure and the potential risks associated with exposure to constituents at the site are likely to be significantly lower than the quantitative estimates described in this assessment, due to the conventional practice of using conservative assumptions in preparing risk assessments.

This risk assessment follows the guidelines published in the USEPA's (1989) Risk Assessment Guidance for Superfund (RAGS) Part A, as well as the WVDEP's (2001) Guidance Manual, which suggest that risk assessments should contain the following four major steps:

- **Identification of Contaminants of Concern (COC)**. An evaluation of site investigation data and identification of COC with regard to potential health effects;
- **Exposure Assessment.** Identification of the human receptors likely to be exposed to site-originated COC and the likely extent of their exposure under defined exposure scenarios;
- **Toxicity Assessment.** A description of the relationship between the magnitude of exposure (dose) and the probability of occurrence of adverse health effects (response) associated with the COC; and
- **Risk Characterization.** A description of the nature and magnitude of potential human health risks, comparison to state and federal benchmarks regarding health risks at hazardous waste sites, and a discussion of uncertainties in the analysis.

1.3 RISK ASSESSMENT ORGANIZATION

This chapter provided an introduction to the risk assessment for the site. The remaining chapters of this report are organized in the following manner:

- Section 2 presents the site background and the procedures for identifying COC for the site.
- Section 3 identifies likely human receptors for the site and presents the exposure factors that are used to estimate the extent of exposure for each receptor.
- Section 4 describes the standard procedures for deriving toxicity values, presents the agency recommended toxicity values for the COC, and describes the approach and model for the evaluation of lead exposure.
- Section 5 quantifies and summarizes the potential risks associated with exposure to the COC.
- Section 6 describes the uncertainties associated with the calculated exposures and potential health risks.

- Section 7 presents the conclusions of the human health risk assessment.

- Section 8 presents the references cited in the report.

2.0 SITE BACKGROUND AND IDENTIFICATION OF CONTAMINANTS OF CONCERN

This section provides a summary of the site background and identifies the subgroup of constituents detected in environmental media at the site (contaminants of potential concern, or COPC) that will be evaluated quantitatively in the human health risk assessment. The basis for this identification process is presented in greater detail below, but basically, it allows the elimination in the initial step of the risk assessment of contaminants that will clearly pose a negligible contribution to overall site risk.

This section presents the analytical data that were used in the risk assessment to identify COPC present at or released from the site. Then, by applying comparison values (as outlined in Section 2.6 of WVDEP's (2001) Guidance Manual and most recently updated in June 2017), COC are identified for detailed quantitative evaluation. COC for human health risk assessment are defined as those constituents present at a site that will comprise the significant portion of the calculated noncancer hazard and theoretical excess lifetime cancer risk values.

2.1 SITE BACKGROUND AND CHARACTERIZATION SUMMARY

The site is a former gasoline service station and retail tire store located at 21 East Main Street at the corner of East Main Street and Spring Street in Buckhannon, West Virginia. The site is located in the downtown business district of Buckhannon, and is serviced by public utilities. The site had been formerly used for retail gasoline sales, vehicle maintenance and as a tire store. The underground storage tanks (USTs) and fuel dispenser islands have been removed from the site. The site is currently utilized by the city of Buckhannon for permit parking (EC, 2017).

The immediately adjoining land-use is as follows:

- The site is bounded to the north by Main Street. A series of office buildings are located across Main Street to the north.
- A City of Buckhannon municipal parking lot adjoins the property to the west.
- The site is bounded by an alley to the south; across the alley is the Post Office for the City of Buckhannon.
- The site is bounded by Spring Street to the east followed by a series of office buildings across Spring Street.

The site consists of a one-story brick structure surrounded by paved and gravel parking areas. The structure contains five service bays and an office area. A hydraulic lift is located in Bay 1 and floor drains are located in four of the five service bays. A small concrete pad is located outside the south wall of the structure which may have been used for the storage of drums containing waste automotive fluids (Triad, 2006a, 2006b).

During June and July 1999, Ryan Environmental performed environmental investigations at the site on behalf of George Kalafat of K&K Loans, and the results were documented in the Site Assessment Report dated July 1999. Initial site characterization activities were conducted by Triad Engineering, Inc. (Triad) in February 2006 to determine the nature and extent of residual petroleum hydrocarbon contamination present in surface and subsurface soil and groundwater at the site. Eleven borings (SB-1 through SB-11) were installed and three temporary piezometers (MW-2, MW-7 and RW-3) were installed to collect groundwater grab samples and to gauge the elevation of the groundwater potentiometric surface at the site.

Based on the results of the initial site characterization activities, WVDEP requested that Triad further evaluate the vertical and lateral extent of residual petroleum hydrocarbons in environmental media. On August 7, 2006, Subsurface Inc. installed five additional soil borings and five subsurface soil samples were collected during installation. Four new temporary monitoring wells were installed offsite in borings SB-12, SB-13, SB-15 and SB-16 (designated MW-12, MW-13, MW-15, and MW-16). Temporary groundwater monitoring well MW-1 was removed and a recovery well (RECW-1) was installed at that location. MW-12 was located offsite in the municipal parking lot approximately 40-feet to the northwest of the former UST pit. MW-13 was located in Spring Street approximately 100-feet to the north and hydraulically downgradient of the former UST pit and Dispenser Island #1. MW-15 was located along Main Street approximately 65-feet to the north of the former UST pit and Dispenser Island #1. MW-16 was located in the public sidewalk, approximately 20-feet to the north and hydraulically downgradient of the former UST pit and Dispenser Island #1.

In February 2017, EnviroCheck of Virginia, Inc. (EC) was retained by the WVDEP to conduct a one-time groundwater monitoring and sampling event at the site. On February 27 and 28, 2017, groundwater samples were collected from monitoring wells MW-2, MW-7, MW-12, MW-13, MW-15, MW-16 and recovery wells RW-1 and RW-3. The groundwater monitoring report (EC, 2017) for the site is dated March 17, 2017. Soil, groundwater and soil gas sampling was conducted most recently in April 2018 by Thrasher Engineering.

As summarized in the environmental boring logs, site soils ranged from sandy silt to silty sand from the ground surface down to approximately 16 feet below ground surface (bgs). Groundwater in the area is not used as a source for domestic supply (the site is serviced by public utilities), and the future use of groundwater as drinking water will be prohibited by covenant. For the February 2017 monitoring event, groundwater was gauged at depths ranging from 6.1 feet bgs for MW-7, to 11.86 feet bgs for RW-1.

Groundwater at the site flows to the north towards the Buckhannon River. A potentiometric surface map is provided as Figure 3 of the Expanded Site Characterization Report (Triad, 2006b).

2.2 SAMPLES INCLUDED IN THE RISK ASSESSMENT

This risk assessment incorporates data for soil samples collected in February, April, and August 2006, and most recently in April 2018. Groundwater analytical data used in the risk assessment consist of a total of 14 samples collected in February 2017 and April 2018 from three onsite monitoring wells, two onsite recovery wells, and four offsite monitoring wells. It should be noted that groundwater monitoring was conducted periodically at the site beginning in 2006, however, the analytical data utilized in this assessment (2017 and 2018) are most representative of current site conditions. The assessment also incorporates five soil vapor samples (SG-1 through SG-5) (plus one duplicate soil gas sample) collected on April 6, 2018. A detailed discussion of the samples and analytical data from each medium are provided below.

2.2.1 Soil Samples

The complete list of soil samples included in the risk assessment is presented in Table 2-1. The available analytical data consist of a total of 37 soil samples (plus 1 duplicate sample) collected in February, April, and August 2006 and most recently in April 2018. Figure 1 depicts the locations for samples collected in 2006; Figure 3 depicts the locations for soil sampling conducted in 2018.

Surface soils are classified as soil from depths of 0 to 2 feet bgs. Samples from depths greater than two feet are considered to be subsurface soils; for this site, subsurface soil samples were collected from depths ranging from 2 to 16 feet bgs. A total of 16 surface soil samples and 16 subsurface soil samples (plus one duplicate sample) were collected from the onsite area. Five additional subsurface soil samples were collected from the adjacent offsite areas.

Soil samples collected in 2006 were analyzed for volatile organic compounds (VOCs), polycyclic aromatic hydrocarbons (PAHs), total petroleum hydrocarbons (TPHs), glycols and metals. The 2018 samples were analyzed for VOCs, semi-volatile organic compounds (SVOCs) and metals.

The soil samples submitted to the laboratory were analyzed using the following analytical methods. VOCs were analyzed using USEPA Method SW8260B and, in addition, samples collected in August 2006 were analyzed for benzene, toluene, ethylbenzene, and xylenes (collectively known as BTEX) and methyl tert-butyl ether using USEPA Method 8021B. PAHs were analyzed using USEPA Method 8270D. Glycols were analyzed using USEPA Method 8015. Metals (with the exception of mercury) were analyzed using USEPA Method 6010B and mercury was analyzed using USEPA Method 7471A. TPHs were analyzed using USEPA Method SW8015B.

The complete analytical data for constituents in soil are provided in Appendix A, Table A-1. Soil boring logs are provided in Appendix 2 of the Site Characterization Report (Triad, 2006a).

2.2.2 Groundwater Samples

The complete list of groundwater samples included in the risk assessment is presented in Table 2-2. Figures 2 and 3 depict the locations of the monitoring and recovery wells. The available groundwater data consist of 14 groundwater samples collected in February 2017 and April 2018 from three onsite monitoring wells, two onsite recovery wells, and four offsite monitoring wells.

The 2017 round of groundwater sampling includes samples analyzed for BTEX, methyl tert-butyl ether, tert-butyl alcohol, and PAHs. The samples collected in 2018 were analyzed for the full suite of VOCs, selected metals and glycols.

Groundwater samples were analyzed for VOCs using USEPA Method 8260B, PAHs were analyzed using USEPA Method 8270D. TPHs using USEPA Method 8015B and glycols using USEPA Method 8015. The complete analytical data for constituents in groundwater are provided in Appendix A, Table A-2.

2.2.3 Soil Vapor Samples

Five soil vapor samples (plus one duplicate sample) were collected on April 6, 2018. The complete list of soil vapor samples included in the risk assessment is presented in Table 2-3. Vapor point sampling locations are depicted on Figure 3. Sample SG-1 was collected onsite, samples SG-2 and SG-3 were collected near the sidewalk immediately north of the site, and samples SG-4 and SG-5 were collected across East Main Street to the north of the site.

Soil vapor samples were analyzed for VOCs using USEPA Method TO-15. The complete analytical data for constituents in soil vapor are provided in Appendix A, Table A-3.

2.3 DATA USABILITY

USEPA (1992b) provides guidance for data usability in risk assessments. Data usability is the process of assuring or determining that the quality of the data generated meets the intended use. The analytical data collected from the site were evaluated with respect to data usability prior to inclusion in this risk assessment. The following data quality issues are addressed in this section: (1) detection limits, (2) qualified data, and (3) quality control samples.

Selecting the analytical method for optimal detection limits is critical to the data usability in risk assessments. If detection limits are consistently greater than risk-based comparison values, this affects the confidence of the results of the risk assessment. There is a possibility that constituents are present at levels between the risk-based concentration and the detection limit. Therefore, as part of this risk assessment, the detection limits for constituents are compared to the risk-based concentrations (see Section 2.4).

Qualified data must be appropriately used in risk assessments. All validated, qualified data were considered usable for this assessment with the exception of unusable or rejected ("R" qualified) samples. The soil and groundwater data collected in 2018 were validated by Environmental Data Validation Inc. and the results are outlined in a report dated October 2, 2018. Based on the data validation, results for the following constituents in soil samples SG-1 (12-13) and SG-3 (13-13) (plus its duplicate sample) were "R" qualified due to severe quality control issues: benzyl alcohol, bis(2-chloroethyl)ether, 2-chlorophenol, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, hexachloroethane, 2-methylphenol, n-nitroso-di-n-propylamine, phenol, bis(2-chloroethoxy)methane, 4-chloro-3-methylphenol, 4-chloroaniline, 2,4-dichlorophenol, 2,4-dimethylphenol, hexachlorobutadiene, isophorone, nitrobenzene, and 2-nitrophenol. These data were excluded from the quantitative assessment. No groundwater data were "R" qualified. The soil vapor data were validated by EDV/EOPHC Inc. and the results were presented in a report dated October 11, 2018. No soil vapor data were "R" qualified. The laboratory data validation reports are included in Appendix A.

In addition to the "R" qualified samples as noted above, the following qualifiers were included in the analytical results for soil, groundwater and/or soil vapor (refer to Appendix A):

- J (Soil and Groundwater Data) – The analyte concentration is reported, and is less than the practical quantitation limit (PQL) and greater than or equal to the method detection limit (MDL). The result reported is an estimate.

- J (Soil Vapor Data) - The analyte concentration exceeded the calibration range. The reported result is estimated.

- 1c - A matrix spike/matrix spike duplicate was not performed for this batch due to insufficient sample volume.

- CH - The continuing calibration for this compound is outside of Pace Analytical acceptance limits. The results may be biased high.

Quality control samples (such as method blanks, trip blanks, and matrix spike samples) are generally not used in the risk assessment, with the exception of field duplicate samples. If a duplicate was collected for a particular sample, a single concentration was used to represent the sample pair as follows: (1) if both results are detected, the mean of the two values is used to represent that sample; (2) if both results are non-detect, the higher detection limit is used to conservatively represent that sample; and (3) if one result is detected and the other is non-detect, the detected value is used to conservatively represent that sample.

2.4 IDENTIFICATION OF CONTAMINANTS OF CONCERN

An important step in the risk assessment is to identify the COC at the site. Although several constituents have been detected in soil, groundwater and soil vapor associated with the site, these constituents may not pose a concern by customary risk assessment standards and may be eliminated from further consideration in this preliminary step. The constituents that cannot be eliminated by screening are identified as COC and are carried through to the site-specific, quantitative risk assessment.

It is important to recognize that the selection of a constituent as a COC does not necessarily indicate that it poses a significant health risk. The selection of a COC only indicates that there is a need to evaluate it quantitatively in the risk assessment to determine if that COC may be associated with potential health risks.

2.4.1 Contaminants of Concern in Soil

For soil, the process to identify COC consists of a comparison of the maximum concentration of each detected COPC with applicable health-based screening values. WVDEP (2017) provides *de minimis* screening values that may be used for comparison purposes. There are three sets of *de minimis* screening values available for soil: Residential Soil (direct contact), Industrial Soil (direct contact) and Migration to Groundwater (leach-based). For this assessment, the Industrial Soil *de minimis* values were selected as the applicable comparison values for soil. The *de minimis* screening values are derived from conservative generic risk estimates and, therefore, provide a useful mechanism to identify COPC that need not be considered further in a site-specific risk assessment.

Not all constituents analyzed in soil from the site are listed in the WVDEP (2017) *de minimis* tables. An industrial soil d*e minimis* value is not available for total chromium. For this assessment, a comparison value for total chromium has been calculated based on the assumption that hexavalent and trivalent chromium are present at a ratio of 1:6 (Cr IV to Cr III), consistent with the ratio presented by USEPA (2017a). The industrial soil *de minimis* values are 1,000,000 mg/kg for trivalent chromium and 130 mg/kg for hexavalent chromium. Therefore, the *de minimis* value for total chromium is calculated to be: (1,000,000 x 6) + (130 x 1) / 7 or 857,161 mg/kg. Although not regulatory values, for screening purposes, *de minimis* values for TPH were obtained from the Draft Supplemental Guidance on TPH (WVDEP, 2003).

It should be noted that soil samples from 2018 were analyzed for xylenes (total), in addition to the isomers o-xylene and m&p-xylene. Samples collected originally in 2006 were analyzed for the two isomers only. In order to derive a complete data set for comparison (and to avoid double counting), the value for total xylenes, if not measured directly, was calculated as follows: (1) if results for both isomers were detected, the sum of the two values was used to represent the xylenes (total) concentration for that sample; (2) if both results were non-detect, the higher detection limit was conservatively used to represent the xylenes (total) result; and (3) if one result was detected and the other was non-detect, the detected value was used to conservatively represent the xylenes (total) concentration for that sample.

The maximum detected concentrations of COPC in soil are compared to the *de minimis* screening values. Constituents that are detected at concentrations above the applicable *de minimis* values are retained as COC. The results of the screening process for direct contact with soil are presented in Table 2-4. For each COPC, this table presents the frequency of detection, the minimum and maximum detected concentrations, the sample with the maximum detected concentration, the minimum and maximum detection limits, and the industrial soil *de minimis* screening value. The data set utilized for direct contact screening consists of all available soil samples (e.g., surface and subsurface samples collected onsite and from the adjacent offsite locations).

As indicated in Table 2-4, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, benzene, naphthalene and xylenes (total) were detected above the applicable *de minimis* values and are identified as COC for direct contact with soil. Although TPH-GRO was detected above the applicable screening value, it is not retained for further quantitative evaluation. Rather, its potential presence is evaluated through the individually analyzed BTEX and PAH constituents.

Table 2-4 also indicates (by a value in bold font) that several VOCs have laboratory detection limits which exceeded the direct contact screening values. However, these constituents were not detected in any of the soil or groundwater samples, and their potential presence is considered unlikely. Therefore, the detection limits for constituents analyzed in soil are not considered to be an issue with respect to data usability for the direct contact pathway.

2.4.2 Contaminants of Concern for Direct Contact with Groundwater

For groundwater, the process to identify COC consists of a comparison of the maximum concentration of each detected COPC with health-based screening values. *De minimis* screening values for groundwater are available from WVDEP (2017). A groundwater d*e minimis* value is not available for total chromium. For this constituent, a groundwater value of 100 ug/L has been promulgated by West Virginia (WV 46 CFR 12). Therefore, the screening value for total chromium is based on the value of 100 ug/L.

It should be noted that groundwater samples collected in 2018 were analyzed for xylenes (total), in addition to the isomers o-xylene and m&p-xylene. Groundwater samples collected in 2017 were analyzed for the isomers only. In order to derive a complete data set for comparison, the values for xylenes (total) for the 2017 data were calculated using the same approach described in Section 2.4.1.

The maximum detected concentrations of COPC in groundwater are compared to the *de minimis* screening values. Constituents that are detected at concentrations above the applicable *de minimis* values are retained as COC. The results of the screening process for groundwater are presented in Table 2-5. For each COPC, this table presents the frequency of detection, the minimum and maximum detected concentrations, the sample with the maximum detected concentration, the minimum and maximum detection limits, and the groundwater *de minimis* screening value. Groundwater samples collected in 2017 and 2018 from both onsite and offsite locations were used for the direct contact screening.

As indicated in Table 2-5, the following constituents were detected above *de minimis* values and are identified as COC for direct contact with groundwater: benzene, ethylbenzene, naphthalene, toluene, xylenes (total) and lead.

Table 2-5 also indicates (by a value in bold font) that several VOCs and SVOCs have laboratory detection limits which exceeded the direct contact screening values. Of these, benzene and naphthalene were already identified as COC and will be further evaluated in the quantitative assessment. The remaining VOCs which exhibited elevated detection limits were not detected in any of the soil or groundwater samples, and are excluded from further evaluation on the basis that there is no evidence that they are present. The SVOCs which exhibited elevated detection limits consist of six PAHs (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenz(a,h)anthracene and indeno(1,2,3-cd)pyrene). None of these constituents were detected in groundwater, and although detected in soil, they were eliminated as COC for direct contact with soil because the detections were below *de minimis values*. Furthermore, the groundwater detection limits are consistent with practical quantitation limits for SVOCs (i.e., they are not unusually high). Therefore, the detection limits for constituents analyzed in groundwater are not considered to be an issue with respect to data usability for the direct contact pathway and no additional COC are retained for quantitative evaluation.

2.4.3 Contaminants for Vapor Intrusion to Indoor Air

In some cases, screening requirements in addition to those recommended by WVDEP are necessary to evaluate the potential for unacceptable risk as a result of vapor intrusion of constituents from the subsurface into indoor structures. The vapor intrusion pathway is evaluated for a current or future non-residential scenario. In order to evaluate the vapor intrusion pathway, screening levels were calculated using the USEPA (2018a) Vapor Intrusion Screening Level (VISL) Calculator.

The VISL calculator is a spreadsheet tool that (1) lists chemicals considered to be volatile and known to pose a potential cancer risk or noncancer hazard through the inhalation pathway; (2) provides generally recommended screening-level concentrations for groundwater, soil vapor (exterior to buildings and sub-slab), and indoor air for default target risk levels and exposure scenarios; and (3) allows calculation of site-specific screening levels based on user-defined target risk levels and exposure scenarios. The screening levels for soil gas are calculated from the target indoor air concentrations using empirically-based conservative “generic” attenuation factors that reflect generally reasonable worst-case conditions as described in the Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air (USEPA, 2015) which replaces USEPA’s (2002a) draft vapor intrusion guidance. The default, generic VISLs are based on default exposure parameters and factors that represent RME conditions for long-term/chronic exposures. For this evaluation, commercial VISLs for soil gas were calculated using a target HQ of 0.1, a target risk of 1×10^{-6}, and a system temperature for West Virginia of 12.5 ^{o} C.

It should be noted that all soil vapor samples were analyzed for the isomers o-xylene and m&p-xylene. In order to derive a complete data set for comparison consistent with other media, the value for xylenes (total) was calculated using the approach described in Section 2.4.1.

To identify COC, samples SG-1, SG-2 and SG-3 were included in the screening for an onsite scenario. Samples SG-4 and SG-5 were used to identify COC for potential vapor intrusion offsite. The results of the screening process for vapor intrusion to indoor air for the onsite and offsite areas are presented in Tables 2-6 and 2-7, respectively. For each constituent, these tables present the detection frequency, the minimum and maximum detected concentrations, the sample with the maximum detect, the minimum and maximum detection limits, and the VISL. The maximum detected concentration of each constituent in soil vapor is compared to the screening value.

As indicated in Table 2-6, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, ethylbenzene, isopropylbenzene, n-heptane, n-hexane, toluene and xylenes (total) were detected in soil vapor at concentrations exceeding the applicable VISLs and are identified as COC for vapor intrusion to indoor air for the onsite scenario. Table 2-6 also indicated that several constituents have detection limits that exceed the applicable VISLs (as indicated by a value in bold font). The majority of these constituents, (with the exception of benzene, naphthalene, methylene chloride and tetrachloroethene) were not detected in any of the soil or groundwater samples, and are therefore excluded from further evaluation on the basis that there is no evidence that they are present. Methylene chloride and tetrachloroethene are also excluded because they were either non-detect or detected only once in soil and groundwater. Benzene and naphthalene were not detected in onsite soil gas, however, both these constituents were identified as COC for soil and groundwater; therefore, these two constituents are conservatively retained as COC for the vapor intrusion pathway for the onsite scenario.

As indicated in Table 2-7, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, benzene, ethylbenzene, n-heptane, n-hexane, toluene and xylenes (total) were detected in soil vapor at concentrations exceeding the applicable VISLs and are identified as COC for vapor intrusion to indoor air for the offsite scenario. Table 2-7 also indicated that several constituents have detection limits that exceed the applicable VISLs (as indicated by a value in bold font). The majority of these constituents (with the exception of naphthalene, isopropylbenzene, methylene chloride and tetrachloroethene), were not detected in any of the soil or groundwater samples, and are therefore excluded from further evaluation on the basis that they are unlikely to be present. Methylene chloride and tetrachloroethene are also excluded because they were either non-detect or detected only once in soil and groundwater. Naphthalene was identified as a COC in soil and groundwater; therefore, this constituent is conservatively retained as a COC for the vapor intrusion pathway for the offsite scenario. In addition, isopropylbenzene is retained as a COC for the offsite vapor intrusion scenario because it was identified as a COC in onsite soil gas.

2.4.4 Summary of Contaminants of Concern

Table 2-8 summarizes the COC for each medium that will be retained for further evaluation in the quantitative human health risk assessment. As presented in this table, the following COC have been identified:

- For direct contact with soil, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, benzene, naphthalene and xylenes (total) were identified as COC.

- For direct contact with groundwater, benzene, ethylbenzene, naphthalene, toluene, xylenes (total) and lead were identified as COC.

- 1,2,4-Trimethylbenzene, 1,3,5-trimethylbenzene, ethylbenzene, isopropylbenzene, n-heptane, n-hexane, toluene and xylenes (total) were identified as COC for vapor intrusion from soil vapor to indoor air for the onsite scenario, based on detected concentrations. In addition, benzene and naphthalene were retained as COC for the vapor intrusion pathway because their laboratory detection limits exceeded the applicable screening values. For the offsite scenario 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, benzene, ethylbenzene, n-heptane, n-hexane, toluene and xylenes (total) were identified as COC for vapor intrusion from soil vapor to indoor air, based on detected concentrations. In addition, naphthalene and isopropylbenzene were retained as COC for the vapor intrusion pathway for the offsite scenario because their laboratory detection limits exceeded the applicable screening values.

In the following sections, potential exposure pathways are evaluated for completeness, and COC for complete pathways are retained for further evaluation in the quantitative human health risk assessment.

3.0 EXPOSURE ASSESSMENT

Exposure assessment is the process of measuring or estimating the intensity, frequency, and duration of human exposure to a constituent in the environment. This section of the risk assessment discusses the mechanisms by which humans might come in contact with COC and the approximate magnitude, frequency, and duration of contact between potential human receptors and such constituents. The quantitative assessment of exposure, based on constituent concentrations and the degree of absorption of each constituent, provides the basis for estimating constituent uptake (dose) and associated health risks. The exposure assessment follows the recommendations for conducting an assessment according to USEPA risk assessment guidance (1989), the Guidelines for Exposure Assessment (USEPA, 1992a), and Section 3.4.1.1 of the WVDEP (2001) Guidance Manual.

3.1 PATHWAYS OF HUMAN EXPOSURE

An exposure pathway describes the course that a constituent takes from its environmental source to a human receptor. As defined in USEPA (1992a) and WVDEP (2001), an exposure pathway includes the following elements: (1) a source or constituent release from a source, (2) an exposure medium, (3) a point of potential contact for the receptor with the exposure medium, and (4) an exposure route at the contact point (e.g., ingestion, dermal contact, or inhalation). An exposure pathway is considered complete when all of these elements are present.

Once constituents are released into an environmental medium, they may migrate from one medium to another. Complete exposure pathways are those that involve receptor contact with an environmental medium that contains site-associated COC. The complete exposure pathways for the site are identified below. Only complete exposure pathways are evaluated quantitatively in the risk assessment.

3.1.1 Potential Exposure Media and Routes of Exposure

Soil - Direct Contact: 1,2,4-Trimethylbenzene, 1,3,5-trimethylbenzene, benzene, naphthalene and xylenes (total) have been identified as COC for direct contact with soil based on the approach undertaken in Section 2.4. For receptors with the potential to directly contact site soils, incidental ingestion of constituents in soil and dermal contact with constituents in soil are the standard exposure routes that are assessed.

Soil-to-Air Volatile Emissions: Volatile constituents present in soil can be released to ambient air through volatilization. All the COC identified for direct contact with soil are considered to be volatile by USEPA (2017a). Therefore, inhalation of volatile constituents in ambient air is a complete exposure pathway for the site. In addition, volatile constituents in soil may be transported via soil gas to indoor air through vapor intrusion. Receptors could be exposed to vapors in indoor air via inhalation. In this assessment, vapor intrusion to indoor air is evaluated using soil vapor data.

Soil - Inhalation of Particulates: Constituent-containing soil particulates could be transported to ambient air by wind erosion or construction activities. Inhalation of particulate emissions in ambient air is considered to be a potentially complete exposure route for the site.

Soil - Migration to Groundwater: Constituents in soil have the potential to migrate to groundwater. Because groundwater has been directly sampled at the site, the potential for constituents in soil to migrate to groundwater is evaluated as part of the groundwater direct contact pathway (see below).

Groundwater – Direct Contact: COC for direct contact with groundwater have been identified based on the approach undertaken in Section 2.4. Groundwater is not used as a source for domestic supply (the site and surrounding area are serviced by public utilities), and future groundwater use restrictions will dictate that groundwater at the site shall not be used as drinking water. However, direct contact with shallow groundwater is possible if a construction worker involved in subsurface activities excavates to the water table. In this case, incidental ingestion and dermal contact would be potentially complete exposure pathways.

Groundwater – Volatile Emissions: Volatile COC in groundwater may be transported to ambient air during construction/excavation activities that reach the water table. A construction worker at the site and adjacent area may be exposed to constituents originating from groundwater via inhalation of vapors in an excavation trench. In addition, volatile COC in groundwater may intrude into the indoor air of onsite buildings, and indoor receptors could be exposed to vapors via inhalation. In this assessment, vapor intrusion to indoor air is evaluated using soil vapor data.

Soil Vapor – Vapor Intrusion: Volatile COC in subsurface media may intrude into the indoor air of current or future onsite or offsite buildings, and indoor receptors could be exposed to vapors via inhalation. In this assessment, vapor intrusion to indoor air is evaluated using soil vapor data to represent the source.

3.1.2 Potential Receptors and Complete Exposure Pathways

The potential human receptors at a site must be characterized in order to evaluate potential exposure pathways. Land use for the site and adjacent area is and will remain commercial/industrial, and use restrictions will be implemented for the site that will prohibit future residential use as well as the use of groundwater as drinking water. Therefore, potential receptors are identified based on the continued non-residential use of the site. The following potential receptors were considered for current or future non-residential land use conditions for the site and adjacent area:

- Outdoor Worker
- Construction/Excavation Worker
- Indoor Worker – Onsite and Offsite
- Visitors or Trespassers

The outdoor and indoor workers are typical full-time employees who would be present at the site on a daily basis. The outdoor worker is considered for direct contact exposure to surface soil (incidental ingestion, dermal contact and inhalation of particulate and volatile emissions in ambient air). The onsite and offsite indoor workers are potentially exposed to constituents volatilized from soil vapor to indoor air (of a current or future building) via the inhalation pathway.

Because groundwater is not used as a potable water source onsite and the use of groundwater as drinking water will be prohibited in the future, direct contact with groundwater is an incomplete exposure pathway for site workers. It should be noted that BTEX constituents were detected in groundwater in MW-15, which is situated close to the building across the street from the site. These buildings are also serviced by public utilities, and therefore groundwater is not used as a source of drinking water. Soil gas samples were collected to the west and east of that well location and the vapor intrusion pathway is evaluated separately for the offsite area.

A construction worker may be involved in a short-term construction or excavation project at the site or in the adjacent area. This receptor could potentially be directly exposed to constituents in surface and subsurface soil as well as shallow groundwater. Groundwater at the site and vicinity is present at a minimum depth of six feet bgs; therefore, a construction worker could potentially contact shallow groundwater during excavation activities. In this assessment, the construction/excavation worker is considered for direct exposure to soil via incidental ingestion, dermal contact, and inhalation of particulate and volatile emissions in ambient air. This receptor is also evaluated for direct exposure to groundwater via incidental ingestion, dermal contact, and inhalation of volatile constituents in trench air.

In addition to the onsite worker receptors, visitors and trespassers may be present at the site. However, the magnitude of exposure of visitors or trespassers would be significantly less than workers, and exposure is considered to be negligible. Therefore, only the worker receptors are retained for quantitative risk evaluation.

Figure 4 presents the conceptual site model, which identifies the human receptors and potential exposure pathways, and whether each pathway is complete. Exposures resulting from all complete pathways are quantitatively evaluated in this assessment.

3.2 QUANTIFICATION AND EXPOSURE POINT CONCENTRATIONS

Potential exposure to constituents in the environment is directly proportional to the concentrations of constituents in environmental media and characteristics of exposure (e.g., frequency and duration). The concentrations at exposure points generally are referred to as exposure point concentrations (EPCs). The analytical results for samples from a given medium were combined to derive a single EPC for each constituent that conservatively represents the level of that constituent to which potential receptors may be exposed.

For constituents in soil, groundwater and soil vapor (used as source concentrations for vapor intrusion to indoor air), EPCs were statistically calculated from sampling data. EPCs for volatile emissions from groundwater to ambient air were estimated using the Virginia Department of Environmental Quality (VDEQ, 2018) equations for groundwater present at depths less than or equal to 15 feet. EPCs for volatile emissions from soil vapor to indoor air were estimated using methodologies outlined in the User's Guide for Evaluating Subsurface Vapor Intrusion into Buildings (USEPA, 2004a).

3.2.1 Exposure Point Concentrations Based on Measured Data

EPCs generally are estimated using measured concentrations in environmental media, or estimated based on fate and transport models. Depending on the distribution of the data, the proportion of the samples reported as non-detect, and the total number of samples, there are several statistical parameters that may be used to estimate EPCs. USEPA supplemental risk assessment guidance (USEPA, 1992c) stipulates that EPC estimates should be based on the 95% upper confidence limit (95% UCL) of the arithmetic mean to estimate a Reasonable Maximum Exposure (RME) scenario. RME conditions are defined by USEPA as the "highest exposure that is reasonably expected to occur at the site." The 95% UCL is used to evaluate all COC, with some exceptions, as noted below.

In this assessment, the USEPA (2016a) software package, ProUCL Version 5.1.00, is used to calculate statistics. This program allows for statistical calculations on data sets with or without non-detect results. For data sets without non-detect results, statistics are simply calculated on the full data set. For data sets with both detected and non-detect results, regression on order statistics (ROS) are used to extrapolate non-detect observations based on the distribution of the data set.

The first step in the data evaluation process is to determine the best fit distribution of the data (USEPA, 2016a). Untransformed data are tested first to determine if the distribution is normal at $\alpha = 0.05$. If they are normally distributed, the statistics for normal data are used. If the data are not normal, the data are log-transformed and retested for lognormality at $\alpha = 0.05$. USEPA (2016a) also provides methods to test for Goodness of Fit to the Gamma distribution, and indicates that the Gamma distribution is prioritized over the lognormal distribution. A distribution which is neither normal, Gamma, nor lognormal is defined as a non-parametric distribution. The ProUCL output files provide detailed information on statistics generated for each distribution type, and also identify the recommended UCL ("Suggested UCL to Use"). In cases where ProUCL presents more than one "Suggested UCL to Use", the UCL that is calculated using the statistical test best suited to the identified distribution is selected.

3.2.1.1 Exposure Point Concentrations for Constituents in Soil

EPCs for COC in surface soil used to evaluate incidental exposure by the outdoor worker and surface and subsurface soil used to evaluate incidental exposure by the construction/excavation worker, are presented in Table 3-1. The final EPCs are identified as the lower of the UCL or the maximum detected concentration (duplicate samples were appropriately averaged as discussed in Section 2.3). Details of all statistical calculations are provided in Appendices B-1 and B-2, which contain the output sheets from ProUCL.

It should be noted that the five subsurface soil samples collected in August 2006 were analyzed for VOCs as per USEPA Method SW8260B and in addition, for BTEX and MTBE as per USEPA Method SW8021B. Benzene and xylenes were identified as COC for the data sets analyzed by both methods. The EPCs for benzene and xylenes (total) which are used in the quantitative analysis incorporates the data sets analyzed as per USEPA Method SW8260B. The larger data set provides a better representation of soil EPCs across the site. Although the EPCs calculated for the smaller data set (5 samples) are higher, these values are skewed by the presence of one sample with a high concentration, while the remaining results are non-detect or very low. It should also be noted that the maximum detected concentrations from both data sets are comparable.

3.2.1.2 Exposure Point Concentrations for Constituents in Groundwater

EPCs for COC in groundwater used to evaluate incidental exposure by the construction/excavation worker are presented in Table 3-2. The data set used for this evaluation incorporates data from monitoring wells RW-1 and MW-15 through MW-17. This approach was used because, consistent with USEPA (2014) guidance on calculating EPCs for groundwater, a constituent plume is defined by those wells from which samples contain concentrations of the COC exceeding screening values. The center of the plume is defined by those wells from which samples contain the highest concentrations of the COC. The plume area for this site is in the vicinity of the former dispenser islands and extending downgradient. Separate plumes may be defined for each COC. For constituents with no discernable plume (e.g., detections from a small number of wells and/or samples), the EPC is based on the maximum detected concentration. The approach used to identify representative wells for each COC is provided below.

- For BTEX, UCLs were calculated using the data from the four “center-of-plume wells” RW-1 and MW-15 through MW-17 using ProUCL Version 5.1.00. The statistical output is provided in Appendix B-3. The final EPCs are defined as the lower of the maximum detected concentration or the UCL.

- For naphthalene, detected concentrations were reported in one sample from each of wells RW-1, MW-15 and MW-16. Due to the small number of samples, the EPC for naphthalene is represented by the maximum detected concentration.

- For lead, detected concentrations were reported in one sample from each of wells RW-1, MW-16 and MW-17. As discussed in Section 4.4, lead is evaluated with a different type of exposure model, and the EPC required for this model is the arithmetic mean. Therefore, the EPC for lead is represented by the average of the detected results from the 3 representative wells.

3.2.1.3 Exposure Point Concentrations for Constituents in Soil Vapor

EPCs for COC in soil vapor which are used as source concentrations for vapor intrusion to indoor air for the onsite and offsite scenarios are presented in Tables 3-3 and 3-4, respectively. Due to the limited number of soil vapor samples, for each COC the final EPC is based on the maximum detected concentration.

It should be noted that although benzene and naphthalene were not detected in onsite soil gas, both of these constituents were conservatively retained as COC for the onsite scenario because their detection limits exceeded the applicable screening values, and because they were COC for soil and groundwater. For benzene and naphthalene, the EPCs are represented by a value of one-half the maximum detection limit for each constituent.

Similarly, naphthalene and isopropylbenzene were conservatively retained as COC for the offsite scenario because their detection limits exceeded the applicable screening values, and because they were COC for other media. Naphthalene was not detected in offsite soil gas, therefore the EPC for this constituent is represented by a value of one-half the maximum detection limit. Isopropylbenzene was detected in one of the two samples of offsite soil gas; for this constituent the EPC is represented by the detected concentration.

3.2.2 Exposure Point Concentrations for Particulates in Ambient Air (Soil Source)

Air concentrations of constituents resulting from fugitive dust emissions were estimated using a particulate emission factor (PEF). The PEF relates the concentration of a constituent in soil to the estimated concentration in respirable airborne particulates. The PEF used in this assessment is the default value of 1.316×10^9 m^3/kg presented in Appendix D of the WVDEP (2001) Guidance Manual and the Exposure

Assumptions Spreadsheet (WVDEP 2012). This PEF is also the default value recommended by USEPA (2002b): Supplemental Guidance for Calculating Soil Screening Levels for Superfund Sites.

The PEF is applied to the soil concentration of each COC to estimate particulate concentrations that might be inhaled by a potential receptor. The soil concentrations are converted to air concentrations by dividing the soil concentration (CS) by the PEF to obtain an air concentration (CA) in units of mg/m^3. The surface soil source concentrations (used to evaluate the outdoor worker) and the surface plus subsurface soil source concentrations (used to evaluate the construction/excavation worker), the PEF and the resulting concentrations of COC in ambient air are presented in Table 3-5.

3.2.3 Exposure Point Concentrations for Volatiles in Ambient Air (Soil Source)

The concentrations of COC associated with volatilization from soil to outdoor air were estimated using a volatilization factor (VF). The VF relates the concentration of a constituent in soil to the estimated concentration in ambient air. The VFs were obtained from USEPA (2017a).

Soil concentrations (CS) in units of mg/kg are converted to air concentrations (CA) in units of mg/m^3 by dividing the (CS) by the VF to obtain the CA. The surface soil source concentrations (used to evaluate the outdoor worker) and the surface plus subsurface soil source concentrations (used to evaluate the construction worker), the VFs and the resulting concentrations of COC in ambient air are presented in Table 3-6.

3.2.4 Exposure Point Concentrations for Volatiles in Ambient Air (Groundwater Source)

There are no well-established models available for estimating migration of volatiles from groundwater into an excavated trench. One approach is based on a combination of vadose zone modeling (to estimate the volatilization from groundwater into the excavation) and a box model (to estimate dispersion of the volatiles within the trench and the above-ground atmosphere); this approach has been adopted by the VDEQ. The volatilization factors for groundwater to ambient air in a trench (VF_{trench}) were estimated for each volatile COC in groundwater using the VDEQ (2018) equations for groundwater present at depths less than or equal to 15 feet.

Appendix C presents the details of the calculations for VF_{trench}. The groundwater EPCs are multiplied by the constituent-specific VF_{trench} values to derive ambient air concentrations. The groundwater EPCs, constituent-specific VF_{trench} values, and resulting concentrations of volatile COC in ambient air are presented in Table 3-7.

3.2.5 Exposure Point Concentrations for Volatiles in Indoor Air

The concentrations of COC in indoor air associated with vapor intrusion from soil vapor were estimated using methodologies outlined in the User's Guide for Evaluating Subsurface Vapor Intrusion into Buildings (USEPA, 2004a). A transport factor (TF_{ind}) is required that will relate the constituent concentration in soil vapor to the concentration in indoor air. The TF_{ind} is dependent on the diffusion coefficient and other properties that will affect the transfer of constituents into air, such as distance from the source to the breathing zone, soil properties, and building properties. For indoor air, TF_{ind} is determined using calculations based on the Johnson and Ettinger (1991) vapor intrusion model. Details of the transport factor calculations are provided in Appendix D.

For this assessment, TFs have been calculated based on a combination of site-specific values (such as depth that soil vapor sampling was conducted) and conservative default values (such as the building properties). Constituent-specific values used in the model are based on values from the USEPA (2017a) Chemical-Specific Parameters Supporting Table.

Soil vapor concentrations are converted to indoor air concentrations by applying the TF_{ind} as follows:

$$C_{IA} = C_{SG} \times TF_{ind}$$

The TF_{ind} for each COC, along with the resulting concentrations of volatile COC in indoor air for the onsite and offsite scenarios are presented in Tables 3-8 and 3-9, respectively.

3.3 ESTIMATION OF CONTAMINANT EXPOSURE AND INTAKE

The USEPA's Guidelines for Exposure Assessment (USEPA, 1992a) define constituent exposure as "the condition of a constituent contacting the outer boundary of a human." The constituents are contained in an environmental medium such as water, soil, or air. Generally, two steps are required for a constituent to enter a body; contact with the outer boundary of the body (exposure), then crossing this outside boundary to inside the body (intake). For most exposure routes, intake is evaluated in terms of how much of the carrier medium containing the constituents crosses the outer boundary (e.g., amount of soil ingested, volume of air inhaled).

Two types of doses, applied and internal, are defined for evaluating constituent exposure (USEPA, 1992a). The applied dose is the amount of a constituent present at an absorption barrier (e.g., lung) and available for absorption. The applied dose is analogous to the administered dose in a dose-response experiment. The internal dose is the amount of constituent actually absorbed across the barrier and available for internal biological interactions. It is the portion of the internal dose that actually reaches cells, sites, or membranes where adverse effects occur. Doses are generally presented as dose rates (dose per unit time) on a per-unit-body-weight basis (units of mg/kg-day).

Noncarcinogenic health effects are evaluated by calculating the average dose of a constituent over the course of the exposure period. This dose is termed the Average Daily Dose (ADD). Potential carcinogenic health effects are evaluated in terms of an individual's theoretical increased risk of developing cancer over a lifetime. Although the duration of exposure to a constituent release generally does not last for an entire lifetime, constituent intake for carcinogens is estimated as the average dose over the average human lifetime (70 years). This lifetime dose applies specifically to the evaluation of carcinogenic effects and is termed the Lifetime Average Daily Dose (LADD). In a risk assessment, the calculated ADD or LADD are estimated quantitatively using assumptions about the duration, frequency, and magnitude of exposure experienced by each potential receptor, and assumptions about the constituent properties that influence absorption. Table 3-10 presents the general form of the equation used to evaluate intake of constituents.

3.4 ESTIMATION OF CONSTITUENT ABSORPTION

3.4.1 Gastrointestinal Bioavailability

As noted previously, the amount of a constituent that actually penetrates the exchange boundaries of the organism is termed the internal dose (sometimes called absorbed dose). The toxicity studies that provide the basis for derived constituent health effects values [i.e., reference doses (RfDs) and cancer slope factors (CSFs)] generally report health effects as a function of applied doses rather than internal doses. These values are therefore most correctly compared to calculations of potential applied doses. However, toxicity studies often administer constituents to the laboratory study animals in food, in water, or in a matrix that readily allows absorption. The fraction of a constituent that is absorbed from soil is generally less than the fraction absorbed from food or drinking water. USEPA guidance indicates that RfDs are usually based on or have been adjusted to reflect drinking water exposure (USEPA, 1989). Constituents contained in other environmental media, such as soil, are likely to be absorbed to a lesser degree than occurs in a toxicity study or is inherent in a water-based RfD. For these reasons, a bioavailability factor is often incorporated into the dose calculations for ingestion of constituents in soil to take into account the reduced ability of the constituent to be extracted from the environmental matrix, or to be absorbed through the exchange boundary, and any other losses between intake and contact with the exchange boundary (USEPA, 1992a).

The extent of gastrointestinal bioavailability depends on the properties of the constituent and the properties of the matrix with which it is ingested. This risk assessment includes the evaluation of incidental soil and groundwater ingestion. For these pathways, an absorption factor of 100 percent was used for all COC with the exception of lead. Exposure to lead is discussed separately in Section 4.4.

3.4.2 Dermal Absorption of Constituents from Soil

The administered dose in a dermal exposure pathway is the amount of constituent in the volume of soil contacting the skin. Only a small fraction of this amount will actually penetrate the skin and enter the body of a receptor. Dermal exposure calculations are, therefore, always calculated as an absorbed dose, and require the inclusion of a dermal absorption fraction (DAF). WVDEP (2014) provides dermal absorption fractions for selected constituents in the Chemical Specific Data Spreadsheet. The DAF recommended for naphthalene is 13% (0.13), as presented in Table 3-11. For the remaining volatile COC [1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, benzene and xylenes (total)] USEPA (2004b) guidance indicates that exposure to volatile constituents is accounted for through the inhalation pathway. Therefore, as indicated in Table 3-11, the DAF for 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, benzene and xylenes (total) is set to zero (i.e., these constituents are not evaluated for the dermal contact with soil pathway).

3.4.3 Dermal Absorption of Constituents from Groundwater

Pathways that involve dermal contact with water require the inclusion of a dermal permeability coefficient (K_P) in the equation. This factor reflects the movement of the constituent from the water, across the skin, to the stratum corneum and into the bloodstream. Because permeability coefficients are based on equilibrium partitioning, they are likely to overestimate the amount of constituent absorbed during short exposure periods such as those in the exposure scenarios for this site.

The K_P values for COC in groundwater were obtained from the Chemical-Specific Parameters Supporting Table (USEPA 2017a) and are presented in Table 3-12. For organic constituents, the K_P values are calculated based on the molecular weight and octanol-water partitioning coefficients. Lead absorption is discussed separately in Section 4.4.

3.5 EXPOSURE ASSUMPTIONS

The quantitative estimation of constituent intake involves the incorporation of numerical assumptions for a variety of exposure parameters. Where guidance was available, exposure assumptions used in these intake calculations are based on WVDEP (2012) or USEPA (2009, 2017a) recommended values. However, default exposure factors are not specifically provided by USEPA or WVDEP for all receptors and pathways (e.g., construction worker). Therefore, some exposure values were derived based on site characteristics or best professional judgment. All exposure assumptions utilized in this risk assessment are described below.

3.5.1 All Pathways

The following factors are consistent across all of the exposure pathways considered in this assessment.

3.5.1.1 Exposure Frequency and Duration

Each receptor evaluated in this assessment is assumed to have a particular frequency and duration of exposure.

Outdoor and Indoor Workers. Default exposure factors for industrial workers are provided by WVDEP (2012). Exposure frequency for the worker is 5 days per week for 50 weeks a year, or 250 days per year. The exposure duration for industrial workers is 25 years.

Construction/Excavation Worker. Default exposure factors for a construction or excavation worker are not specifically provided by WVDEP guidance. USEPA (2002b) guidance recommends that exposure frequency and duration be determined on a site-specific basis. On the basis of professional judgment, exposure frequency for the construction worker is 30 days per year. This assumption is based on a short-term project lasting six weeks (five days per week). Because this is considered a one-time project, the exposure duration for this receptor is one year.

3.5.1.2 Body Weight

The default value for average body weight of an adult is 70 kg based on WVDEP (2012). This value was used for the body weight of the outdoor worker and the construction/excavation worker.

3.5.1.3 Averaging Time

As described above, the doses for noncarcinogenic health effects are averaged over the specific period of exposure for a given receptor. Noncarcinogenic averaging times are, therefore, calculated by multiplying the exposure duration for the receptor by 365 days/year. Carcinogenic health effects are calculated over a lifetime exposure, so the value recommended by WVDEP (2012) and USEPA (2017a) for an average lifetime, 70 years, was used for the exposure duration. The resulting carcinogenic averaging time is 25,550 days.

3.5.2 Incidental Ingestion of Soil

The following factors are incorporated into calculations of the soil ingestion pathway. Exposure factors for the outdoor worker and the construction/excavation worker are presented in Table 3-13. The equations used to calculate intake (represented as ADD and LADD), for the incidental ingestion of soil pathway are also presented in this table.

Soil Ingestion Rate. For workers involved in short-duration construction or excavation projects, the soil ingestion rate of 330 mg/day was used (USEPA 2017a). The WVDEP (2012) recommended value of 50 mg/day was used to describe soil ingestion for a worker not involved in construction or intrusive activities (i.e., the outdoor worker).

Gastrointestinal Bioavailability Factor. As described in Section 3.4.1, a gastrointestinal bioavailability factor of 100% was used in this assessment for all COC in soil.

3.5.3 Dermal Contact with Soil

The following factors are incorporated into calculations of the dermal contact with soil pathway. Exposure factors for the outdoor worker and the construction/excavation worker are presented in Table 3-14. The equations used to calculate intake (represented as ADD and LADD) for the dermal contact with soil pathway are also presented in this table.

Skin Surface Area. Potentially exposed workers are assumed to wear appropriate clothing during outdoor activities that may involve soil contact, such as long sleeve shirts and long pants. Skin surface area available for dermal contact with soil is assumed to be the hands, forearms, and head. The exposed skin surface area for outdoor and construction worker receptors corresponding to these body parts is approximately 3,300 cm^2, based on guidance from WVDEP (2012).

Soil Adherence Factor. The WVDEP (2012) default soil adherence factor for an outdoor worker of 0.2 mg/cm^2 was used in the assessment. A value of 0.3 mg/cm^2 is recommended for a construction worker (USEPA 2017a).

Dermal Absorption Fraction. As described in Section 3.4.2, a DAF is included in calculations of exposure to constituents in soil through dermal contact. These values are based on guidance from WVDEP (2014) and USEPA (2004b) and were presented in Table 3-11.

3.5.4 Volatile and Particulate Inhalation

In accordance with USEPA's "Supplemental Guidance for Inhalation Risk Assessment" (USEPA, 2009), an intake factor is not calculated for the inhalation pathway. USEPA recommends that when estimating risk via inhalation, the concentration of the constituent in air should be used as the exposure metric (e.g., mg/m^3), rather than inhalation intake of the constituent in air based on inhalation rate and body weight (e.g., mg/kg-day). Thus, instead of a dose calculation, an exposure concentration (EC) is calculated for each receptor.

The following factors are incorporated into calculations of inhalation exposure to volatile or particulate emissions in ambient and indoor air. Exposure factors for the outdoor worker, the construction/excavation worker, and the indoor worker are presented in Table 3-15. The equation used to calculate the EC is also presented in this table.

Exposure Time. Inhalation exposures are calculated over the specific daily amount of time during which the receptor is exposed to airborne concentrations of constituents. All workers are assumed to be present and subject to inhalation exposure from soil for 8 hours per day (WVDEP 2012; USEPA 2017a). For the construction worker exposed to constituents in groundwater in an excavation, the exposure time was estimated to be two hours per day (see below).

Averaging Time. The averaging times all receptors are the same as those discussed previously in Section 3.5.1.3. However, in the calculation of exposure concentration, the averaging time is expressed in units of hours (USEPA, 2009).

3.5.5 Incidental Ingestion of Groundwater

The following factor is incorporated into calculations of the groundwater ingestion pathway. Exposure factors for the construction/excavation worker are presented in Table 3-16. The equations used to calculate intake (represented as ADD and LADD), for the incidental ingestion of groundwater pathway are also provided in this table.

Water Ingestion Rate. An incidental water ingestion scenario for a worker is not specifically addressed by USEPA guidance; however, USEPA (2017a) guidance provides a value of 50 mL/hour for incidental ingestion of water for recreational receptors (e.g., a swimming scenario). As a conservative estimate based on professional judgment of the amount of water that would accidentally be ingested by a construction worker, this value (50 mL/event) was used for the construction/excavation worker.

3.5.6 Dermal Contact with Groundwater

The following factors are incorporated into calculations of the dermal contact with groundwater pathway. Exposure factors for the construction/excavation worker are presented in Table 3-17. The equations used to calculate intake (represented as ADD and LADD), for the dermal contact with groundwater pathway are also provided in this table.

Skin Surface Area. The construction worker was assumed to be exposed to groundwater in an excavation on the same body parts that soil exposure might occur (hands, forearms and head). Therefore, a total surface area of 3,300 cm^2 was incorporated in the dose equations for dermal contact with groundwater, based on the value provided by WVDEP (2012) for soil contact.

Exposure Time. Exposure to groundwater that is encountered during excavation activities is likely to be intermittent and infrequent. For the purposes of this assessment, the construction worker is conservatively assumed to be in contact with water for two hours per day.

Dermal Permeability Coefficient. As described in Section 3.4.3, constituent-specific K_P values are included in calculations describing dermal exposure to water. These values were provided by USEPA (2017a) and were previously presented in Table 3-12.

3.6 SUMMARY

Calculations of the ADD, LADD, and EC for complete exposure pathways identified in this section are presented in Appendix E. These dose estimates are combined in the risk characterization (Section 5) with toxicity values presented in the Toxicity Assessment (Section 4) to estimate potential carcinogenic risks and noncarcinogenic effects.

4.0 TOXICITY ASSESSMENT

The toxicity assessment, also known as the dose-response assessment, provides a description of the relationship between a dose of a constituent and the anticipated incidence of an adverse health effect. The majority of existing knowledge about the dose-response relationship is based on data collected from laboratory studies of animals (usually rodents), studies of human occupational exposures, and theories about how humans respond to environmental doses of constituents.

The USEPA has developed dose-response assessment techniques to set "acceptable" levels of human exposure to constituents in the environment. These USEPA-derived risk values address both chronic and subchronic noncarcinogenic health effects and potential carcinogenic health risks. WVDEP relies on the USEPA-derived toxicity values to describe the dose-response relationship (WVDEP, 2001).

4.1 EVALUATION OF NONCARCINOGENIC RESPONSES

The sections that follow discuss the mechanisms of noncarcinogenic response, the derivation of acceptable dose levels, the manner in which these levels are used in this risk assessment, and some of the limitations of these values. The limitations are addressed in greater detail in the uncertainty analysis section of this report (Section 6).

4.1.1 Background

It is widely accepted that noncarcinogenic biological effects of substances occur only after a threshold dose is achieved (Klaassen, 2001). Typically, physiological mechanisms exist that will minimize the adverse effect, through pharmacokinetic means such as absorption, distribution, excretion, or metabolism (Klaassen, 2001). Therefore, a range of exposures and resulting doses exist that can be tolerated by a receptor with essentially no chance of developing adverse effects. The threshold dose for a compound is usually estimated from the no observed adverse effect level (NOAEL) or the lowest observed adverse effect level (LOAEL), as determined from animal studies or human data. The NOAEL is the highest dose at which no adverse effects occur, while the LOAEL is the lowest dose at which adverse effects are discernable.

4.1.2 Noncarcinogenic Toxicity Values

USEPA uses the NOAEL or LOAEL estimates of threshold dose to establish reference doses (RfDs) and reference concentrations (RfCs) for human exposure. An RfD or RfC is an estimate of a daily exposure level (dose) that is unlikely to present an appreciable risk of deleterious effects during a lifetime. USEPA has derived RfDs and RfCs for both chronic (long-term) and subchronic (short-term) exposure periods. For this assessment, chronic RfDs/RfCs have been conservatively used to evaluate all receptors.

RfDs (used to evaluate the oral exposure route) are expressed in units of dose (mg/kg-day), while RfCs (used to evaluate the inhalation exposure route) are expressed as concentrations (mg/m^3). Both types of toxicity values incorporate uncertainty factors to account for limitations in the quality or quantity of available data. RfDs for the dermal route of exposure are developed through route-to-route extrapolation, as described by USEPA (2004b). An oral RfD is converted to an absorbed dose by multiplying the RfD by the fractional absorption value. As indicated in Exhibit 4-1 of USEPA (2004b), and also presented in WVDEP (2014) and the Chemical-Specific Parameters Supporting Table (USEPA, 2017a), a fractional absorption value of 1 (100%) is recommended for all of the COC with the exception of lead. Lead absorption is discussed separately in Section 4.4.

4.1.3 Estimating the Likelihood of Adverse Noncarcinogenic Response

The likelihood of occurrence of adverse noncarcinogenic effects depends on the relationship between the RfD (or RfC) and the estimated average constituent dose (or exposure concentration) received by the receptor. Doses less than the RfD (and exposure concentrations less than the RfC) are not likely to be associated with any adverse health effects and are, generally, not of regulatory concern. Doses that exceed the RfD (and exposure concentrations that exceed the RfC) are considered to present the potential for adverse effects.

Noncarcinogenic responses are evaluated numerically using parameters known as the hazard quotient (HQ) and hazard index (HI). For oral and dermal exposure routes, the HQ is obtained by dividing the ADD by the RfD as presented below.

$$ADD \div RfD = HQ$$

The ADD is the estimated daily dose of a constituent averaged over the specific duration of exposure, which may not necessarily be an entire lifetime. The equations for calculating the ADD were presented in Tables 3-13 and 3-14 and Tables 3-16 and 3-17.

Similarly, for the inhalation exposure route, the HQ is calculated by dividing the EC by the RfC. The equation for calculating the EC for inhalation pathways was presented in Table 3-15. Thus, HQ is calculated as follows:

$$EC \div RfC = HQ$$

Each calculation with a specific combination of constituent, receptor, and exposure pathway, will have a distinct calculated HQ. HQs associated with all constituents for a particular pathway are summed to yield the HI, as indicated:

$$HQi + HQii + HQiii + ... = HI$$

If a receptor is subject to exposure through more than one pathway, the HIs for all pathways are summed. A calculated HI of 1 or less indicates that an adverse effect would not be anticipated. HIs are derived for constituents that act on the same target organ/system or have similar critical effect. Therefore, if the total HI across all COC exceeds 1, it is appropriate to segregate the COC by effect and mechanism of action and to derive separate HIs for each group (USEPA, 1989).

4.2 EVALUATION OF POTENTIAL CARCINOGENIC RESPONSES

The subsections below discuss the assumed mechanisms of carcinogenic response, the derivation of carcinogenic toxicity values, the manner in which these values are used in this risk assessment, and some of the limitations of these values. The limitations are addressed in greater detail in the Uncertainty Analysis of this report (Section 6).

4.2.1 Background

USEPA typically has required that potentially carcinogenic constituents be treated as if minimum threshold doses do not exist (USEPA, 2005). The regulatory dose-response curve used for carcinogens only allows for zero risk at zero dose. Thus, for all environmental doses, some level of risk is assumed to be present using this highly conservative model.

To estimate the theoretical response at environmental doses, various mathematical dose-response models are used. USEPA uses the linearized multistage model for low dose extrapolation. This model assumes that the effect of the carcinogenic agent on tumor formation seen at high doses in animal data is basically the same at low doses (i.e., the slope of the dose-response curve can be extrapolated downward to the origin in a linear manner). USEPA's Guidelines for Carcinogen Risk Assessment (USEPA, 2005) recommends that the linearized multistage model be employed in the absence of adequate information to the contrary.

4.2.2 Potential Carcinogenic Toxicity Values

USEPA evaluates all available scientific information, using a weight-of-evidence approach to determine whether a constituent poses a carcinogenic hazard in humans. USEPA groups constituents according to their potential for carcinogenic effects based on clinical evidence (USEPA, 1989):

- Group A - Human Carcinogen
- Group B - Probable Human Carcinogen
- Group C - Possible Human Carcinogen

- Group D - Insufficient Data to Classify as a Human Carcinogen
- Group E - Not a Human Carcinogen

In addition, constituents may have been assessed for carcinogenicity using USEPA's (2005) Guidelines for Carcinogen Risk Assessment. Under the updated guidance, standard descriptors are used as part of the hazard narrative to express the conclusion regarding the weight-of-evidence for carcinogenic hazard potential. There are five recommended standard hazard descriptors: "Carcinogenic to Humans," "Likely to Be Carcinogenic to Humans," "Suggestive Evidence of Carcinogenic Potential," "Inadequate Information to Assess Carcinogenic Potential," and "Not Likely to Be Carcinogenic to Humans."

CSFs and inhalation unit risks (IURs) are the toxicity values used in quantitatively assessing potential carcinogenic effects from exposure. CSFs are defined as the plausible upper bound estimate, approximating a 95% confidence limit, of the increased cancer risk from a lifetime exposure to a given level of a carcinogen. This estimate, usually expressed in units of proportion (of a population) affected per mg/kg-day, is generally reserved for use in the low dose region of the dose-response relationship, that is, for exposure corresponding to risks less than 1 in 100 (USEPA, 2005).

The CSF (used to evaluate the oral exposure route) is expressed in units of reciprocal dose, or $(mg/kg\text{-}day)^{-1}$, while the IUR (used to evaluate the inhalation exposure route) is expressed as a reciprocal concentration $(mg/m^3)^{-1}$. An oral CSF is converted to an absorbed dose by dividing the CSF by the fractional absorption value. The fractional absorption values recommended by USEPA (2004b; 2017a) were identified in Section 4.1.2 above and are 100% for all COC with the exception of lead. Lead absorption is discussed separately in Section 4.4.

4.2.3 Estimating the Theoretical Excess Lifetime Cancer Risk

For potentially carcinogenic constituents, a risk assessment evaluates the degree to which a receptor may have an increased likelihood of developing cancer over a lifetime due to exposure to site-associated constituents. At environmental dosage levels, the CSF is assumed to be constant and potential carcinogenic risk to be directly related to intake. In order to estimate the theoretical excess lifetime cancer risk, the LADD of a constituent was multiplied by the CSF as shown below.

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

The equations for calculating the LADD were presented in Tables 3-13 and 3-14 and Tables 3-16 and 3-17.

Similarly, for the inhalation exposure route, the potential cancer risk was calculated by multiplying the EC by the IUR. The equation for calculating the EC for inhalation of volatiles was presented in Table 3-15. Thus, the potential cancer risk was calculated as follows:

$$EC \times IUR = Risk$$

For each pathway, these calculations were carried out for each applicable constituent, and the risks were summed to obtain the total risk due to that pathway. The total theoretical excess lifetime cancer risk for a particular receptor was then calculated as the sum of the risks from all exposure pathways for that receptor.

4.3 TOXICITY VALUES FOR CONTAMINANTS OF CONCERN

Toxicity values for all COC (with the exception of lead) are presented in Table 4-1. These include the chronic noncarcinogenic oral RfDs and inhalation RfCs, and the oral CSFs and inhalation IURs for potential carcinogens. Fractional absorption factors and dermal toxicity values [estimated from the oral values in accordance with USEPA (2004b)] are also presented in this table, as well as the target system/critical effects for noncarcinogenic COC. Consistent with guidance provided by WVDEP (2017), toxicity values were obtained from the following sources:

- Integrated Risk Information System (IRIS) on-line database provided by USEPA (2018b);
- California EPA toxicity values, as presented in USEPA (2017a); and
- USEPA's Provisional Peer-Reviewed Toxicity Values (PPRTV; USEPA, 2018c) Database and Appendix.

4.4 EVALUATION OF LEAD

Lead was identified as a COC in groundwater. A construction/excavation worker could potentially be exposed to the lead in groundwater while performing excavation activities. The USEPA has not derived toxicity values for lead (USEPA, 2018b). For the construction worker, the methodology proposed by the Technical Review Workgroup (TRW; USEPA, 2003) was selected to assess exposure to lead. The following subsections present the approach used in application of the TRW Adult Lead Model. This model is very similar to the model recommended by WVDEP (2001). This section presents the approach used in application of the TRW Adult Lead Model for the construction worker potentially exposed to lead in groundwater from the site and adjacent area.

The TRW Adult Lead Model was designed to be protective of the fetus of pregnant women, but can be extended to address adult males or women who are not pregnant. The model uses a simplified representation of lead biokinetics to predict quasi-steady state blood lead concentrations among adults who have relatively steady patterns of site exposures. The model incorporates a simplified slope factor approach. The model assumes a baseline lead level using average blood lead levels for adults. Media-specific intake and absorption parameters are assessed for the adult population, and a biokinetic slope factor that relates uptake of lead into the body to blood lead levels is estimated. The model was developed to evaluate exposure via ingestion of soil. However, the basic equation can be extrapolated to evaluate exposure from other media, including water.

4.4.1 Modeling Approach and Equation

The TRW Adult Lead Model predicts a central tendency blood lead concentration ($PbB_{adult,central}$) by summing the typical blood lead concentration ($PbB_{adult,0}$) that would occur in the absence of any recreational or occupational exposure with the increment in blood lead that is expected as a result of site-specific exposure. The latter is estimated by multiplying the absorbed dose of lead from site-specific exposures by a biokinetic slope factor (BKSF). The basic equation has been modified for exposure to water:

$$PbB_{adult\,,\,central} = PbB_{adult,0} + (Pb_W \times BKSF \times IRw \times AFw \times EFw) / AT$$

where:

$PbB_{adult,central}$	=	Central estimate of the blood lead concentration (µg/dL) in an adult (i.e., woman of child-bearing age) that has site exposure to lead via occupational or recreational activities.
$PbB_{adult,0}$	=	Typical (i.e., baseline) blood lead concentration (µg/dL) in an adult not exposed to lead via occupational or recreational activities.
Pb_W	=	Arithmetic mean concentration (ug/L) of lead in water at the location where exposure occurs.
BKSF	=	Biokinetic slope factor relating (quasi-steady state) increase in typical adult blood lead concentration to average daily lead uptake (µg/dL increase in blood lead per µg/day lead absorbed).
IRw	=	Mean daily intake rate of water from areas of lead presence (L/day).
AFw	=	Absolute absorption fraction (bioavailability) of lead in groundwater (dimensionless).
EFw	=	Exposure frequency for contact with water (days/year).
AT	=	Averaging time; the total period during which soil contact may occur; 365 days per year for continuing long term exposures.

The USEPA has not yet issued formal guidance on the blood lead level that is considered applicable for the health of adults and older children. In 2012, Centers for Disease Control and Prevention (CDC) adopted the Advisory Committee on Childhood Lead Poisoning Prevention (ACCLPP)'s recommendations to eliminate the term "level of concern" and use a blood lead reference value that is based on the 97.5th percentile of the National Health and Nutrition Examination Survey (NHANES) PbB distributions in children from 1 to 5 years of age. Using the 2007-2010 NHANES, both the USEPA and CDC recommend that there should be no more than a 5% likelihood that a young child should have a PbB value greater than 10 ug/dL (USEPA, 2016b, 2016c). However, recent scientific evidence has demonstrated adverse health effects at blood lead concentrations below 10 µg/dL down to 5 µg/dL, and possibly below (USEPA, 2017b).

The USEPA (2003, 2017b) recommends that in the industrial setting the pregnant woman industrial worker is the most sensitive receptor and that this receptor should be the subject of the risk assessment. The greater sensitivity is associated with exposure of the fetus to maternal blood lead, rather than the dose to the pregnant woman, herself. Since the exposed populations of workers could include pregnant women, this risk assessment accommodates that recommendation and incorporates the pregnant woman receptor for the construction worker scenario. The health criterion selected for use in this risk assessment is that there should be no calculated event that indicates that the fetus of a pregnant woman in the industrial setting would have a blood lead concentration above 10 ug/dL. To additionally address more recent CDC recommendations, the calculated fetal blood lead levels are also compared to a value of 5 µg/dL (USEPA, 2017b).

The concentration of lead in the blood of an unborn fetus (PbB_{fetal}) can be derived from the blood lead concentration in the mother by applying a transfer factor ($R_{fetal/maternal}$) that relates the two blood concentrations:

$$PbB_{fetal} = PbB_{adult} \times R_{fetal/maternal}$$

USEPA (2003, 2017b) specifies a value of 0.9 for the ratio of the blood lead level in the fetus to the blood lead level in the mother.

4.4.2 Equation Input Parameters

Presented below is a summary of available information on each parameter in this equation, along with the value selected for use in this risk assessment.

Baseline Blood Lead Level ($PbB_{adult,0}$): Of the various types of people who might be exposed to lead in a non-residential setting, the scientific community suggests that the receptor of greatest interest is, as noted above, a woman of child-bearing age. USEPA (2017b) provides a recommended mean PbB value of 0.6

ug/dL to represent women of child-bearing age (17 to 45 years). This value was derived from the updated National Health and Nutrition Examination Survey (NHANES) conducted between 2009 and 2014 (USEPA, 2017b).

Concentration of Lead in Groundwater (Pbw): The groundwater lead concentration for the model is the arithmetic mean concentration. For lead in groundwater from the site, the mean concentration (presented previously in Table 3-2) is 37.5 ug/L.

Biokinetic Slope Factor (BKSF): The biokinetic slope factor proposed by the TRW (USEPA, 2003, 2017b) and WVDEP (2001) is 0.4 µg/dL per µg/day absorbed. This value is derived from a study of adult humans exposed to lead in tap water (Pocock et al., 1983). The calculation was based on the relationship between the concentration of lead in "first-draw" water and the resulting incremental change in blood lead concentration. The "first-draw" parameter represents lead in the drinking water as a result of leaching of lead from pipes or pipe solder into the water as it resides in the pipe prior to flushing.

Ingestion Rate (IRw): The parameter IRw is the site-specific daily intake rate of groundwater. The incidental ingestion rate selected for the dose calculations in this assessment was 0.05 L/day for the construction worker. This value was based on professional judgment.

Absorption Fraction (AFs): Multiple studies have been published on the absorption of lead. The USEPA (2003) provides an absorption factor of 20% for soluble lead in water.

Exposure Frequency (EFw): Exposure frequency for the construction worker is 30 days per year. This is the same exposure frequency identified in Section 3.5.1. It should be noted that the construction worker exposure frequency of 30 days/year is less than the TRW recommended minimum exposure frequency of 90 days/year. Infrequent exposures may produce oscillations in blood lead concentrations associated with the absorption and subsequent clearance of lead from the blood between each exposure event (USEPA, 2003). Therefore, a degree of uncertainty is associated with the use of this model for the construction/excavation workers.

Averaging Time (AT): The averaging time recommended by USEPA (2003) for continuing long-term exposures is 365 days per year.

4.4.3 Calculating the Upperbound Estimate

An upperbound estimate of the concentration of lead in blood can be estimated using the approach adopted by the TRW (USEPA; 2003, 2017b). In this approach, the geometric mean of the blood lead concentration is estimated, and the 95th percentile of the blood lead concentration ($PbB_{adult,0.95}$) is calculated with the following equation:

$$PbB_{adult,\ 0.95} = PbB_{adult,\ central} \times GSDi^{1.645}$$

The GSDi is the estimated value of the geometric standard deviation of the blood lead concentrations of the study population (i.e., women of child-bearing age), and the exponent, 1.645, is the value of the standard normal derivative used to calculate the 95th percentile from a lognormal distribution of blood lead concentrations. The GSDi value of 1.8 was used; this value is based on the updated NHANES study, and is recommended by USEPA (2017b).

As indicated in Section 4.4.1, the concentration of lead in the blood of an unborn fetus can be derived from the blood lead concentration in the mother by applying a transfer factor that relates the two blood concentrations. This equation is applicable for the upperbound concentration as well as the central concentration. Both adult and fetal blood lead concentrations are presented and discussed as part of the risk characterization (Section 5.3).

5.0 RISK CHARACTERIZATION

Risk characterization is the final step of the human health risk assessment process. It includes a description of the nature and magnitude of the potential for occurrence of adverse health effects under reasonable maximal exposure conditions. In this step, the toxicity assessment and site-specific exposure assessment are integrated into quantitative and qualitative estimates of potential health risks. Potential noncarcinogenic and carcinogenic health risks are calculated and summarized individually for each receptor exposed to COC at the site. Estimated risks are combined across contaminants and exposure pathways. The following subsections describe the approaches and results for the evaluation of noncarcinogenic and potential carcinogenic effects.

5.1 NONCARCINOGENIC EFFECTS

Potential noncarcinogenic effects associated with exposure to COC were estimated as described in Section 4.1.3. The total HIs are then calculated for each receptor by combining pathway-specific HIs. An HI value equal to or less than 1 indicates that an adverse effect would not be anticipated. Conversely, an HI greater than 1 indicates that there is potential for noncarcinogenic health effects to occur as a result of exposure to COC in environmental media at the site (WVDEP, 2001; USEPA, 1989)

Table 5-1 presents the total HIs for each receptor exposed to COC in soil, groundwater and indoor air (vapor intrusion from soil vapor) associated with the site and adjacent area. As indicated in this table, the potential noncancer HIs are below the target benchmark of 1 established by WVDEP for outdoor workers, construction/excavation workers and indoor workers (both onsite and offsite), indicating that the likelihood of adverse noncancer effects is negligible for these receptors. The detailed calculations and constituent-specific results for each receptor are presented in Appendices E-1 through E-4, and summarized in Tables 5-2 through 5-5.

For the outdoor worker potentially exposed to COC in surface soil, the total HI is 0.000019 (Table 5-2). For the construction/excavation worker potentially exposed to COC in surface and subsurface soil and groundwater, the total HI is 0.16 (Table 5-3). For the onsite indoor worker potentially exposed to COC in indoor air (vapor intrusion from soil vapor), the total HI is 0.40 (Table 5-4). For the offsite indoor worker potentially exposed to COC in indoor air (vapor intrusion from soil vapor), the total HI is 0.26 (Table 5-5).

5.2 POTENTIAL CARCINOGENIC EFFECTS

Theoretical excess lifetime cancer risks associated with exposure to COC were calculated as described in Section 4.2.3. Summed theoretical excess risks are calculated for each receptor by combining pathway-specific risks. The results may be compared with target benchmarks for acceptable risk. WVDEP (2001) presents a target cancer risk of 1 x 10^{-5} for non-residential scenarios. USEPA (1991) considers potential cancer risks in the range of 1 x 10^{-6} to 1 x 10^{-4} to be acceptable.

Table 5-1 presents the theoretical excess lifetime cancer risks for each receptor exposed to COC in soil, groundwater and indoor air (vapor intrusion from soil vapor) associated with the site. As shown in this table, the potential cancer risks are below the WVDEP benchmark for acceptable risks for the outdoor worker, the construction/excavation worker and the indoor worker (both onsite and offsite), indicating that the likelihood of potential carcinogenic effects would be negligible for these receptors. The detailed calculations and constituent-specific results for each receptor are presented in Appendices E-1 through E-4, and summarized in Tables 5-2 through 5-5.

For the outdoor worker potentially exposed to COC in surface soil, the potential cancer risk is 8.1 x 10^{-10} (Table 5-2). For the construction/excavation worker potentially exposed to COC in surface and subsurface soil and groundwater, the potential cancer risk is 2.6 x 10^{-7} (Table 5-3). For the onsite indoor worker potentially exposed to COC in indoor air (vapor intrusion from soil vapor), the potential cancer risk is 5.6 x 10^{-6} (Table 5-4). For the offsite indoor worker potentially exposed to COC in indoor air (vapor intrusion from soil vapor), the potential cancer risk is 4.4 x 10^{-6} (Table 5-5).

5.3 RESULTS OF LEAD ANALYSIS

Table 5-6 presents the equations (explained in Section 4.4) and the resulting predicted blood lead concentrations associated with exposure to lead in groundwater for the construction/excavation worker. It may be noted that the initial baseline blood lead concentration is set at 0.6 ug/dL. This is assumed to be the contribution to blood lead from sources other than site media. This table also presents the 95th percentile blood lead concentration for the unborn fetus of the adult receptor.

As indicated in Table 5-6, for the construction/excavation worker potentially exposed to lead in groundwater, the 95th percentile adult blood lead concentration is 1.61 ug/dL and the 95th percentile fetal blood lead concentration is 1.45 ug/dL. These results indicate that the potential exposure to lead in groundwater for the construction worker results in a predicted fetal blood lead concentration below the reference value of 10 ug/dL. As noted previously in Section 4.4.1, recent scientific evidence has demonstrated adverse health effects at blood lead concentrations below 10 µg/dL down to 5 µg/dL, and possibly below. The predicted adult and fetal blood lead concentrations for the construction/excavation worker potentially exposed to lead in groundwater are also below 5 ug/dL.

6.0 UNCERTAINTY ANALYSIS

Uncertainties are inherent in a quantitative risk assessment. The inclusion of site-specific factors, which this assessment has incorporated, decreases uncertainty. An analysis of the areas of uncertainty in a risk assessment is a standard component of the risk assessment process. The uncertainty analysis provides a context for better understanding the assessment conclusions by identifying the uncertainties that have most significantly affected the assessment results.

USEPA (1992a) guidance stresses the importance of providing a complete analysis of uncertainties so that risk management decisions take these uncertainties into account when evaluating risk assessment conclusions. The major sources of uncertainty in this risk assessment are identified qualitatively below.

6.1 UNCERTAINTIES IN HAZARD IDENTIFICATION

Uncertainties in the hazard identification step of the risk assessment are primarily associated with the available analytical data and the selection process for identification COC.

- **Focused vs. Random Sampling.** The environmental sampling conducted during the site investigation activities was not random. Locations associated with known areas of contamination were targeted for sampling (e.g., in the location of former USTs and dispenser islands). Because the samples used in this assessment were collected in areas of the site where contamination was considered most likely to exist, the data sets are biased toward high concentrations, which leads to an overestimation of the actual risks.

- **Identification of COC.** Multiple uncertainties exist in the process of identifying COC. These include uncertainties associated with procedures utilized in chemical analyses, the number of samples selected for use in the risk assessment, and the selection of relevant screening values. For example, screening values applicable to drinking water were used to identify COC for groundwater, which is not used for potable purposes. This screening approach was completed to be as conservative as possible for the site.

- **Use of Qualified Data**. “J” qualified data reflect results that have been estimated by the laboratory. These qualifiers do not necessarily indicate a problem that adversely affects the usability of the data. This qualifier indicates uncertainty in the reported concentration of the chemical (i.e., with respect to its detection limit), but not its assigned identity. As shown in Appendix A, detected concentrations of TPHs in soil and VOCs in groundwater were “J” qualified. Data validation of the 2018 data indicated that data validated with the "J" qualifier were usable but were to be used cautiously as they are estimated data with some quality control issues. The inclusion of these detections at their reported concentrations results in some uncertainty, but is considered unlikely to affect the results of the risk assessment.

- **Samples with Elevated Detection Limits.** The screening for COC in soil, groundwater, and soil vapor (presented in Section 2.4) identified several VOCs and SVOCs which had laboratory detection limits exceeding the screening values. The majority of these constituents were not detected at all in soil or groundwater, and therefore were not considered to be present. However, a small number of constituents with elevated detection limits were identified as a COC in other media. These consist of benzene and naphthalene in onsite soil vapor, and naphthalene and isopropylbenzene in offsite soil vapor. These constituents were retained as COC even though they were not detected. Inclusion of these constituents in the quantitative risk assessment is considered to be a conservative approach; however, some level of uncertainty remains because the true concentration of the specific constituent in the sample is unknown. The statistical software used in this risk assessment assigns randomly generated concentrations within the distribution curve of the data set.

6.2 UNCERTAINTIES IN EXPOSURE ASSESSMENT

The WVDEP and USEPA approaches to exposure assessments generally require standard default exposure scenarios rather than site-specific evaluations of exposure. Under this approach, if a constituent is identified as a COC for a particular medium, it is assumed that exposure to that substance will occur at levels consistent with the default scenario. The default scenarios used in the human health risk assessment evaluate current and future potential exposure pathways under RME conditions. The RME scenario is defined as the highest exposure that is reasonably expected to occur at a site (USEPA, 1989).

- **Data Used in the Calculation of Groundwater EPCs.** Five subsurface soil samples collected in August 2006 were analyzed for VOCs as per USEPA Method SW8260B and in addition, for BTEX and MTBE as per USEPA Method SW8021B. Benzene and xylenes were identified as COC for the data sets analyzed by both methods. The EPCs for benzene and xylenes (total) which are used in the quantitative analysis incorporated the data sets analyzed as per USEPA Method SW8260B in order to provide a larger data set which provided a better representation of soil EPCs across the site. Although the EPCs calculated for the smaller data set (5 samples) are higher, these values are skewed by the presence of one sample with a high concentration while the remaining results are non-detect or very low. As such, the smaller data set was not considered to best represent soil concentrations across the site.

- **Vapor Intrusion Modeling.** Because constituent-specific concentrations in indoor air were not measured, conservative fate and transport modeling was conducted to estimate these concentrations. Such models generally provide an overestimation of the actual air concentrations, especially since they assume a constant source concentration (as opposed to a continually degrading source). Another conservative assumption included in the vapor intrusion modeling is the low air exchange rate within the building (commercial buildings, especially with new construction, are typically highly ventilated).

- **Modeled Concentrations in Trench Air.** As presented in Section 3.2.4, there are no well-established models available for estimating migration of volatiles from groundwater into an excavated trench. This assessment includes the use of the VDEQ (2018) model which incorporates a number of conservative assumptions. The conservatism incorporated into the model overestimates the risk for the construction/excavation worker.

- **Dermal Absorption of Constituents from Water.** As noted in Section 3.4.3, pathways that involve dermal contact with water require the inclusion of a dermal permeability coefficient (K_p). K_p values reflect the movement of the constituent from the water, across the skin, to the stratum corneum and into the bloodstream. The K_p values are based on equilibrium partitioning equations, rather than empirical data. Therefore, the actual absorbed doses may be higher or lower than those presented in this risk assessment.

- **Use of Default Exposure Factors.** The use of default exposure factors, rather than site-specific exposure factors, leads to a degree of uncertainty in the predicted risks. The scientific literature contains many examples of carefully designed and conducted studies that indicate that actual environmental exposure factors are significantly lower than the default values recommended by WVDEP (2012) or USEPA (2017a). The default exposure factors represent an RME scenario, as recommended for a baseline risk assessment.

6.3 UNCERTAINTIES IN TOXICITY ASSESSMENT

- **Toxicity Assessment for Noncarcinogens.** Approaches typically utilized for designating RfDs are highly conservative. The USEPA (2018b) applies uncertainty factors (ranging from 3 to 10) to the NOAEL for a constituent in a toxicity study to account for factors such as animal-to-human extrapolation, inter-individual variation in the human population, limitations in data quality or incomplete studies. Some of this uncertainty may be reduced if the absorption, distribution, metabolic fate, and excretion parameters of a constituent are known. Because the fate and mechanism of action of a constituent may differ in animals and humans, effects observed in animals may not be observed in humans, and vice versa. Interspecies dose conversion may also be limited by differences in lifespan, body size, breathing rates, or the route of administration utilized in a study.

- **Upper Bound CSFs and IURs.** The USEPA CSFs and IURs are considered to be plausible upper bounds of risk at a 95 percent confidence level. Thus there is a 95 percent probability that the true risks are not greater than these levels, and the risks are likely to be much lower. The Carcinogen Assessment Group (USEPA, 2005) states that the use of the linearized multistage model and upper bound risk estimates is appropriate, but that the lower limit of risk may be as low as zero. When biological factors are considered, the best estimate of the risk at very low levels is often zero.

6.4 UNCERTAINTIES IN RISK CHARACTERIZATION

The typical approach to risk assessment, and that used for the site, involves conservatively multiplying a combination of average and upper bound exposure assumptions together to evaluate exposure, which is likely to overestimate actual risks. USEPA risk assessment guidance (1989) specifies that numerous factors in the exposure equation should each be represented by the 95% UCL on the mean for that variable. These factors include the EPC, the contact rate with the environmental medium, and the exposure frequency and duration.

7.0 CONCLUSIONS

This human health risk assessment addressed the potential for adverse effects related to exposure to constituents associated with soil, groundwater and soil vapor associated with the site. The assessment focused on current and future non-residential use of the property and adjacent offsite area.

COC were identified for each medium based on a comparison of the analytical data to risk-based comparison values from WVDEP and USEPA. Data validation was conducted for the data collected in 2018 and rejected data from soil samples SG-1 (12-13) and SG-3 (13-13) were excluded from the risk assessment. For direct contact with soil, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, benzene, naphthalene and xylenes (total) were identified as COC. For direct contact with groundwater, benzene, ethylbenzene, naphthalene, toluene, xylenes (total) and lead were identified as COC. 1,2,4-Trimethylbenzene, 1,3,5-trimethylbenzene, ethylbenzene, isopropylbenzene, n-heptane, n-hexane, toluene and xylenes (total) were identified as COC for vapor intrusion from soil vapor to indoor air for the onsite scenario, based on detected concentrations. In addition, benzene and naphthalene were retained as COC for the vapor intrusion pathway for the onsite scenario because their laboratory detection limits exceeded the applicable screening values. For the offsite scenario, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, benzene, ethylbenzene, n-heptane, n-hexane, toluene and xylenes (total) were identified as COC for vapor intrusion from soil vapor to indoor air, based on detected concentrations. In addition, naphthalene and isopropylbenzene were retained as COC for the vapor intrusion pathway for the offsite scenario because their laboratory detection limits exceeded the applicable screening values.

Land use for the site and adjacent offsite area is and will remain commercial/industrial, and use restrictions will be implemented for the onsite area that will prohibit future residential use, as well as the use of groundwater as drinking water. Therefore, the receptors considered for quantitative evaluation include current/future outdoor workers, construction/excavation workers, and onsite and offsite indoor workers. Outdoor workers were evaluated for direct contact with surface soil via incidental ingestion, dermal contact, and inhalation of volatiles and particulates in ambient air. Construction/excavation workers were evaluated for direct contact with surface and subsurface soil via incidental ingestion, dermal contact and inhalation of volatiles and particulates in ambient air, as well as direct contact with groundwater via incidental ingestion, dermal contact and inhalation of volatiles in trench air. Indoor workers were evaluated for inhalation of volatile constituents that could potentially migrate from the subsurface to indoor air of current or future onsite or offsite buildings.

The results of the analyses indicate that the potential noncancer HIs are below the WVDEP target benchmark of 1 and the potential cumulative cancer risks are below the WVDEP non-residential benchmark of 1×10^{-5} for the outdoor worker, the construction/excavation worker, and the indoor worker (both onsite and offsite), indicating that the potential for excess cancer risk or non-cancer hazard is negligible for these receptors. The results of the analysis for potential exposure to lead in groundwater indicate that calculated blood lead concentrations for the construction/excavation worker are below the blood lead reference value of 10 ug/dL, and also below the proposed lower value of 5 ug/dL.

For the outdoor worker potentially exposed to COC in surface soil, the total HI is 0.000019 and the potential cancer risk is 8.1×10^{-10}. For the construction/excavation worker potentially exposed to COC in surface and subsurface soil and groundwater, the total HI is 0.16, the potential cancer risk is 2.6×10^{-7} and the predicted fetal blood lead concentration is 1.45 ug/dL. For the onsite indoor worker potentially exposed to COC in indoor air (vapor intrusion from soil vapor), the total HI is 0.40 and the potential cancer risk is 5.6×10^{-6}. For the offsite indoor worker potentially exposed to COC in indoor air (vapor intrusion from soil vapor), the total HI is 0.26 and the potential cancer risk is 4.4×10^{-6}.

The risk assessment indicates that the calculated non-cancer hazards and potential cancer risks are within acceptable benchmarks for the outdoor worker, the construction/excavation worker, and the indoor worker. It can be concluded that adverse effects are negligible for the site under current and future non-residential scenarios, considering restrictions on residential land use and the use of groundwater as drinking water. Adverse effects are also negligible for indoor workers in the adjacent offsite area.

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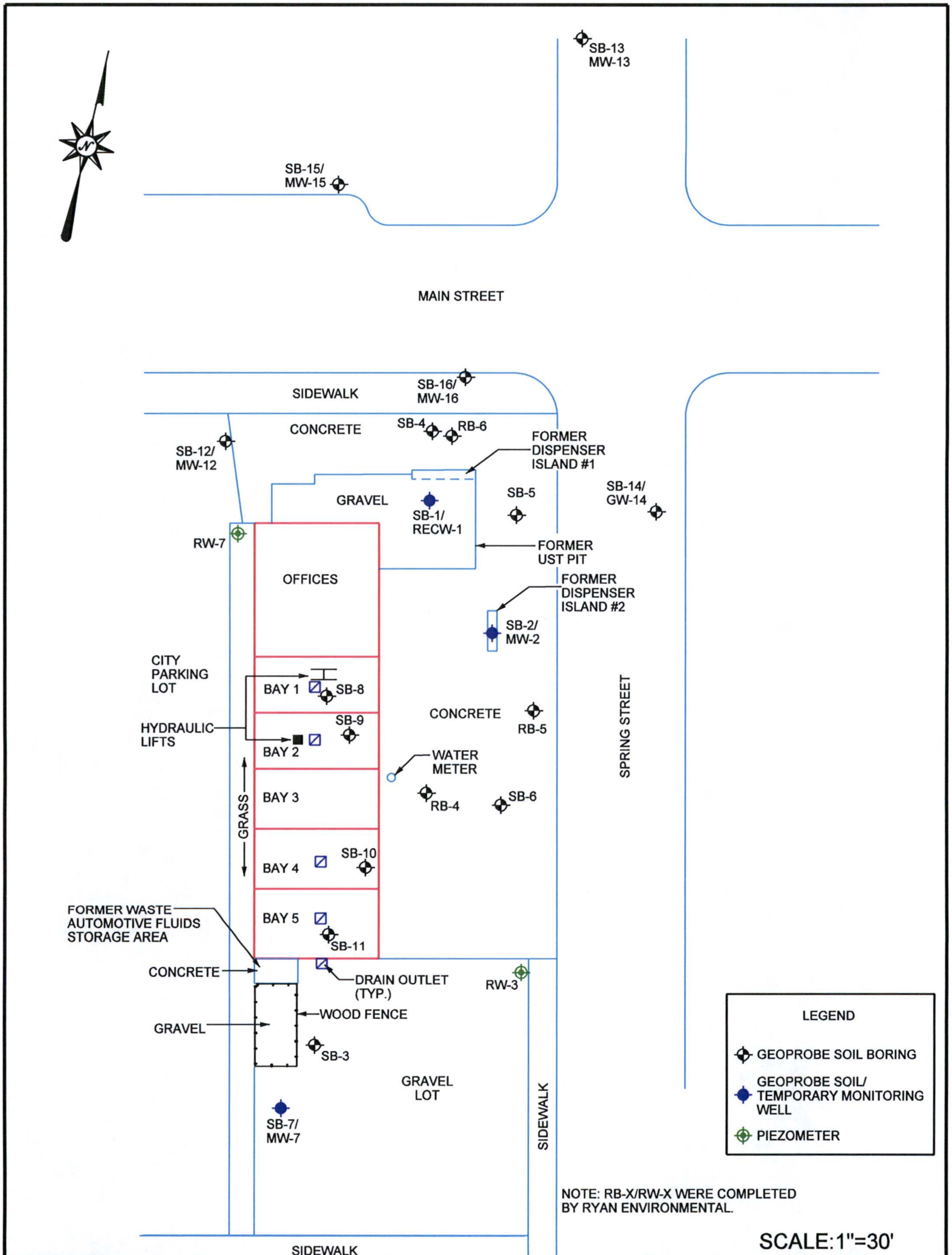
FIGURES



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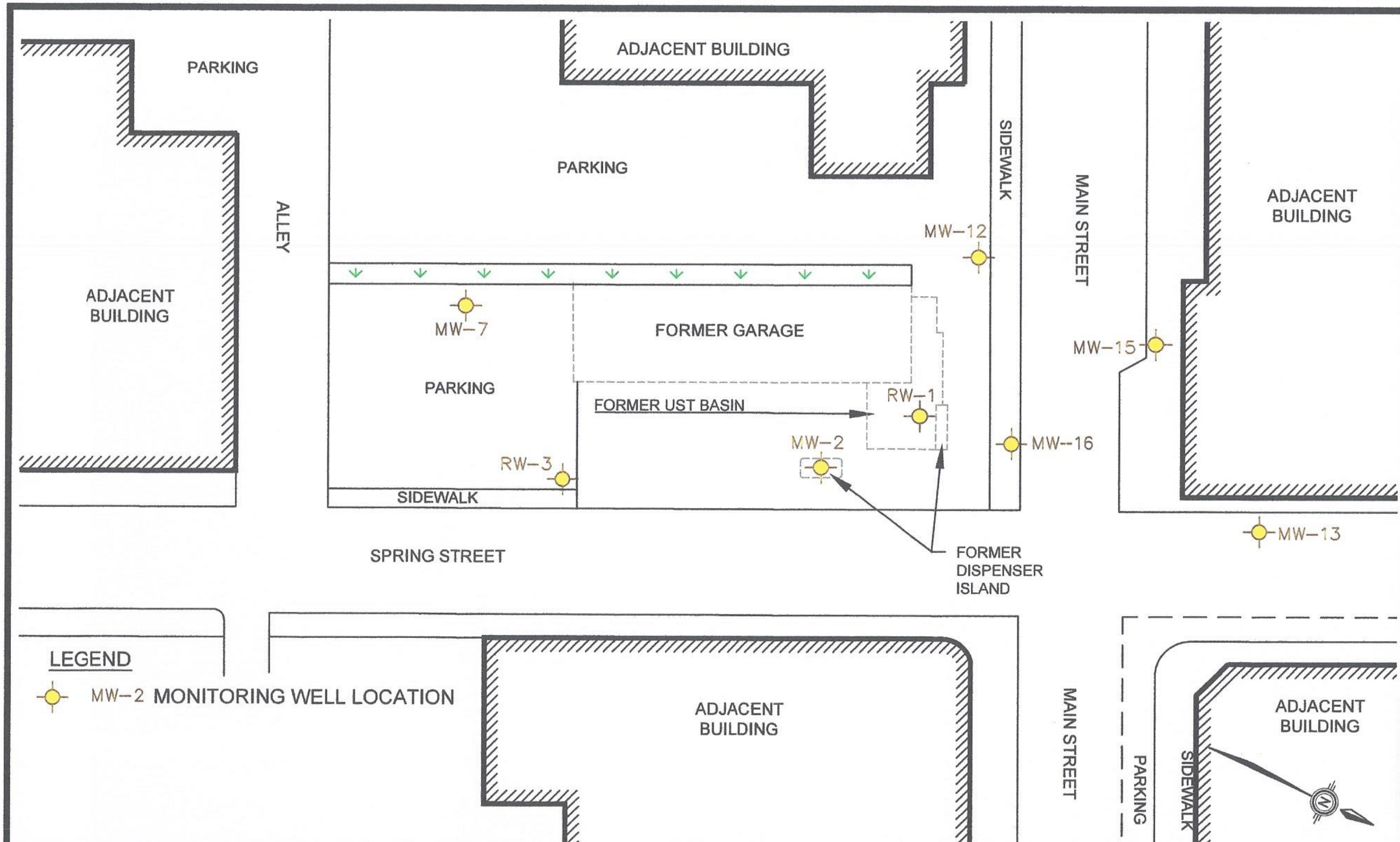
TRIAD

SITE SKETCH AND SAMPLING LOCATIONS
ALKER TIRE ESA
BUCKHANNON, UPSHUR COUNTY, WEST VIRGINIA

FIGURE NO. 1



MAP 2
SITE MAP
MONITORING WELL LOCATIONS

FORMER ALKIRE TIRE
CORNER OF MAIN & SPRING STREETS
BUCKHANNON, UPSHUR COUNTY
WEST VIRGINIA

DATE:	MARCH 2017
SCALE:	1"=40'
DRAWN:	TGR
CHECKED:	JLR
PROJ. #:	EC–109

e²C EnviroCheck

40' 0 40'

1" = 40'

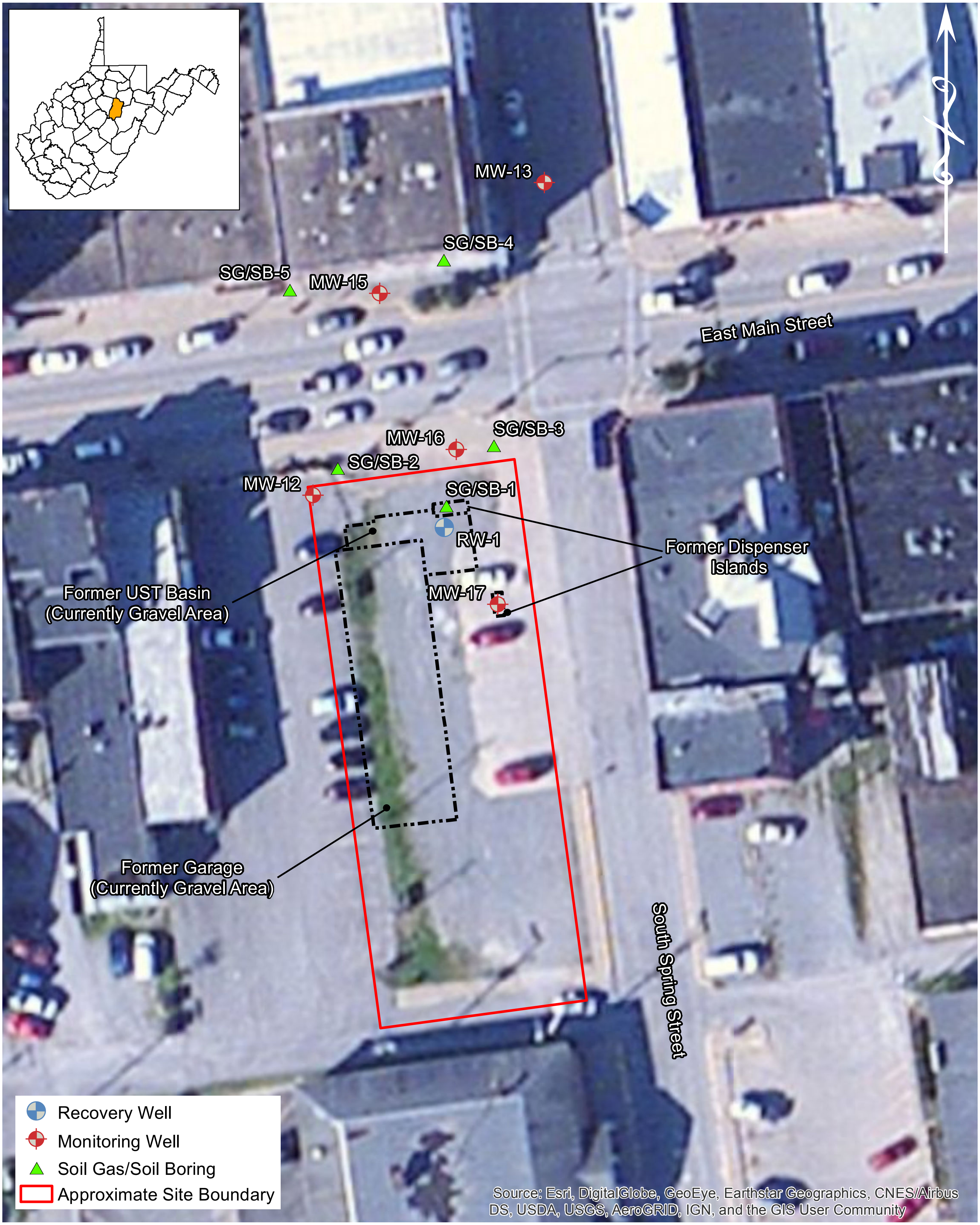


Figure 3: Site Map

Former Alker Tire

Upshur County - West Virginia

THRASHER

1 inch = 45 feet

5/1/2018

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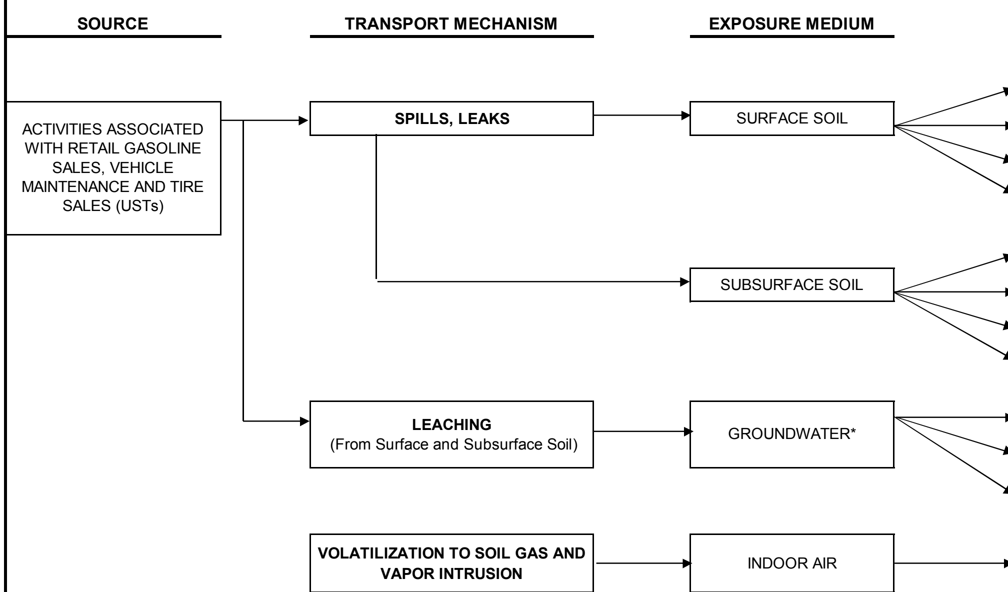
By: bparks

FIGURE 4
HUMAN HEALTH CONCEPTUAL SITE EXPOSURE MODEL
Alker Tire - Buckhannon, Upshur County, West Virginia



POTENTIAL EXPOSURE ROUTES	OUTDOOR WORKER	INDOOR WORKER	CONSTRUCTION/EXCAVATION WORKER	TRESPASSER OR VISITOR
INCIDENTAL INGESTION	X		X	0
DERMAL CONTACT	X		X	0
INHALATION OF VOLATILE EMISSIONS (OUTDOOR AIR)	X		X	0
INHALATION OF PARTICULATES (OUTDOOR AIR)	X		X	0
INCIDENTAL INGESTION			X	
DERMAL CONTACT			X	
INHALATION OF VOLATILE EMISSIONS (OUTDOOR AIR)			X	
INHALATION OF PARTICULATES (OUTDOOR AIR)			X	
INCIDENTAL INGESTION			X	
DERMAL CONTACT			X	
INHALATION OF VOLATILE EMISSIONS (OUTDOOR AIR)			X	
INHALATION OF VOLATILE EMISSIONS (INDOOR AIR)		X		0

(POTENTIAL HUMAN RECEPTORS: OUTDOOR WORKER, INDOOR WORKER, CONSTRUCTION/EXCAVATION WORKER, TRESPASSER OR VISITOR)

Notes:
X - Indicates a potentially complete exposure pathway.
0 - Indicates pathway is potentially complete but considered to be insignificant (e.g., No COC were identified or receptor is exposed at an insignificant level).
* Use of groundwater as drinking water will be restricted by covenant in the future.

TABLES

TABLE 2-1
SOIL SAMPLES INCLUDED IN THE RISK ASSESSMENT
Alker Tire - Buckhannon, Upshur County, West Virginia

Location	Sample Medium/Depth	Sample Numbers and Dates			
Onsite	Surface Soil (0 to 2 feet)	SB-1A (0-2)	2/15/2006	SB-9A (0-2)	2/16/2006
		SB-2A (0-2)	2/15/2006	SB-10A (0-2)	2/16/2006
		SB-3A (0-2)	2/15/2006	SB-11A (0-2)	2/16/2006
		SB-4A (0-2)	2/15/2006	SG-1 (0-2)	4/5/2018
		SB-5A (0-2)	2/15/2006	SG-2 (0-2)	4/5/2018
		SB-6A (0-2)	2/15/2006	SG-3 (0-2)	4/5/2018
		SB-7A (0-2)	2/15/2006	SG-4 (0-2)	4/5/2018
		SB-8A (0-2)	2/16/2006	SG-5 (0-2)	4/5/2018
	Subsurface Soil (2 to 16 feet)	SB-1B (10-12)	2/15/2006	SB-10B (10-12)	2/16/2006
		SB-2B (10-12)	2/15/2006	SB-11B (10-12)	2/16/2006
		SB-3B (6-8)	2/15/2006	SG-1 (12-13)	4/5/2018
		SB-4B (10-12)	2/15/2006	SG-2 (12-13)	4/5/2018
		SB-5B (10-12)	2/15/2006	SG-3 (12-13)*	4/5/2018
		SB-6B (10-12)	2/15/2006	SG-3 (12-13) DUP*	4/5/2018
		SB-7B (6-8)	2/15/2006	SG-4 (12)	4/5/2018
		SB-8B (6-8)	2/16/2006	SG-5 (12-13)	4/5/2018
		SB-9B (10-12)	2/16/2006		
Offsite	Subsurface Soil (2 to 16 feet)	SB-12 (12-14)	8/7/2006	SB-15 (10-12)	8/7/2006
		SB-13 (14-16)	8/7/2006	SB-16 (12-14)	8/7/2006
		SB-14 (12-14)	8/7/2006		

Notes:
* Indicates samples of a duplicate pair.

TABLE 2-2
GROUNDWATER SAMPLES INCLUDED IN THE RISK ASSESSMENT
Alker Tire - Buckhannon, Upshur County, West Virginia

Medium	Location	Sample Numbers and Dates	
Groundwater	Onsite	MW2 (2/27/2017)	2/27/2017
		MW7 (2/27/2017)	2/27/2017
		MW17 (4/6/2018)	4/6/2018
		RMW1 (2/27/2017)	2/27/2017
		RW-1 (4/6/2018)	4/6/2018
		RW3 (12/27/2017)	2/27/2017
	Offsite	MW12 (2/27/2017)	2/27/2017
		MW12 (4/6/2018)	4/6/2018
		MW13 (2/27/2017)	2/27/2017
		MW13 (4/6/2018)	4/6/2018
		MW15 (2/27/2017)	2/27/2017
		MW15 (4/6/2018)	4/6/2018
		MW16 (2/27/2017)	2/27/2017
		MW16 (4/6/2018)	4/6/2018

TABLE 2-3
SOIL GAS SAMPLES INCLUDED IN THE RISK ASSESSMENT
Alker Tire - Buckhannon, Upshur County, West Virginia

Medium	Location	Sample Numbers and Dates	
Soil Gas	Onsite	SG-1	4/6/2018
		SG-2	4/6/2018
		SG-3	4/6/2018
	Offsite	SG-4	4/6/2018
		SG-5	4/6/2018
		SG-5 DUP*	4/6/2018

Notes:
* Indicates samples of a duplicate pair.

TABLE 2-4
IDENTIFICATION OF CONTAMINANTS OF CONCERN IN SOIL - DIRECT CONTACT
Alker Tire - Buckhannon, Upshur County, West Virginia

Contaminant	Frequency of Detection	Minimum Detected Soil Concentration (mg/kg)	Maximum Detected Soil Concentration (mg/kg)	Sample with Maximum Detect	Minimum Detection Limit (mg/kg)	Maximum Detection Limit (mg/kg)	De Minimis Industrial Soil Value [1] (mg/kg)	Contaminant of Concern	Comment
Volatile Organics Method SW8260B									
1,1,1,2-Tetrachloroethane	0 / 27	ND	ND	ND	0.004	10	97	No	Constituent not detected.
1,1,1-Trichloroethane	0 / 37	ND	ND	ND	0.0036	10	640	No	Constituent not detected.
1,1,2,2-Tetrachloroethane	0 / 37	ND	ND	ND	0.0036	10	31	No	Constituent not detected.
1,1,2-Trichloroethane	0 / 37	ND	ND	ND	0.0036	**10**	6.8	No	Constituent not detected.
1,1-Dichloroethane	0 / 37	ND	ND	ND	0.0036	10	170	No	Constituent not detected.
1,1-Dichloroethene	0 / 37	ND	ND	ND	0.0036	10	1100	No	Constituent not detected.
1,1-Dichloropropene	0 / 27	ND	ND	ND	0.004	10	NA	No	Constituent not detected.
1,2,3-Trichlorobenzene	0 / 27	ND	ND	ND	0.004	10	NA	No	Constituent not detected.
1,2,3-Trichloropropane	0 / 27	ND	ND	ND	0.004	**10**	2.2	No	Constituent not detected.
1,2,4-Trichlorobenzene	0 / 27	ND	ND	ND	0.004	10	280	No	Constituent not detected.
1,2,4-Trimethylbenzene	8 / 27	0.0043	804	SB-1B (10-12)	0.004	0.5	220	**YES**	Maximum detect exceeds screening value.
1,2-Dibromo-3-chloropropane	0 / 27	ND	ND	ND	0.004	**10**	0.7	No	Constituent not detected.
1,2-Dibromoethane	0 / 27	ND	ND	ND	0.004	**10**	1.8	No	Constituent not detected.
1,2-Dichlorobenzene	0 / 37	ND	ND	ND	0.0036	10	380	No	Constituent not detected.
1,2-Dichloroethane	0 / 37	ND	ND	ND	0.0036	10	23	No	Constituent not detected.
1,2-Dichloroethene (Total)	0 / 10	ND	ND	ND	0.0072	4.99	NA	No	Constituent not detected.
1,2-Dichloropropane	0 / 37	ND	ND	ND	0.0036	10	49	No	Constituent not detected.
1,3,5-Trimethylbenzene	5 / 27	0.0303	216	SB-1B (10-12)	0.004	0.5	180	**YES**	Maximum detect exceeds screening value.
1,3-Dichlorobenzene	0 / 37	ND	ND	ND	0.0036	10	NA	No	Constituent not detected.
1,3-Dichloropropane	0 / 27	ND	ND	ND	0.004	10	NA	No	Constituent not detected.
1,4-Dichlorobenzene	0 / 37	ND	ND	ND	0.0036	10	120	No	Constituent not detected.
2,2-Dichloropropane	0 / 27	ND	ND	ND	0.004	10	NA	No	Constituent not detected.
2-Butanone (MEK)	0 / 37	ND	ND	ND	0.0072	100	28000	No	Constituent not detected.
2-Chlorotoluene	0 / 27	ND	ND	ND	0.004	10	910	No	Constituent not detected.
2-Hexanone	0 / 37	ND	ND	ND	0.0072	100	3400	No	Constituent not detected.
4-Chlorotoluene	0 / 27	ND	ND	ND	0.004	10	NA	No	Constituent not detected.
4-Isopropyltoluene	1 / 27	19	19	SB-16 (12-14)	0.004	10	270	No	Maximum detect below screening value.
4-Methyl-2-pentanone	1 / 37	28.7	28.7	SG-1 (12-13)	0.0072	100	3400	No	Maximum detect below screening value.
Acetone	12 / 37	0.0097	0.173	SB-8B (6-8)	0.0102	200	110000	No	Maximum detect below screening value.
Acrolein	0 / 27	ND	ND	ND	0.04	**100**	0.65	No	Constituent not detected.
Acrylonitrile	0 / 27	ND	ND	ND	0.04	**100**	13	No	Constituent not detected.
Benzene	8 / 37	0.0052	57.6	SB-16 (12-14)	0.0036	10	57	**YES**	Maximum detect exceeds screening value.
Bromobenzene	0 / 27	ND	ND	ND	0.004	10	NA	No	Constituent not detected.
Bromochloromethane	0 / 27	ND	ND	ND	0.004	10	NA	No	Constituent not detected.
Bromodichloromethane	0 / 37	ND	ND	ND	0.0036	10	14	No	Constituent not detected.
Bromoform	0 / 37	ND	ND	ND	0.0036	10	910	No	Constituent not detected.

TABLE 2-4
IDENTIFICATION OF CONTAMINANTS OF CONCERN IN SOIL - DIRECT CONTACT
Alker Tire - Buckhannon, Upshur County, West Virginia

Contaminant	Frequency of Detection	Minimum Detected Soil Concentration (mg/kg)	Maximum Detected Soil Concentration (mg/kg)	Sample with Maximum Detect	Minimum Detection Limit (mg/kg)	Maximum Detection Limit (mg/kg)	De Minimis Industrial Soil Value [1] (mg/kg)	Contaminant of Concern	Comment
Volatile Organics (Continued)									
Bromomethane	0 / 37	ND	ND	ND	0.0036	10	33	No	Constituent not detected.
Carbon disulfide	0 / 37	ND	ND	ND	0.0036	100	740	No	Constituent not detected.
Carbon tetrachloride	0 / 37	ND	ND	ND	0.0036	10	32	No	Constituent not detected.
Chlorobenzene	0 / 37	ND	ND	ND	0.0036	10	760	No	Constituent not detected.
Chloroethane	0 / 37	ND	ND	ND	0.0036	10	2100	No	Constituent not detected.
Chloroform	0 / 37	ND	ND	ND	0.0036	10	15	No	Constituent not detected.
Chloromethane	0 / 37	ND	ND	ND	0.0036	10	500	No	Constituent not detected.
cis-1,2-Dichloroethene	0 / 37	ND	ND	ND	0.0036	10	81	No	Constituent not detected.
cis-1,3-Dichloropropene	0 / 37	ND	ND	ND	0.0036	10	99	No	Constituent not detected.
Dibromochloromethane	0 / 37	ND	ND	ND	0.0036	10	780	No	Constituent not detected.
Dibromomethane	0 / 27	ND	ND	ND	0.004	10	110	No	Constituent not detected.
Dichlorodifluoromethane	0 / 27	ND	ND	ND	0.004	10	400	No	Constituent not detected.
Ethylbenzene	12 / 37	0.004	234	SB-1B (10-12)	0.0036	0.5	280	No	Maximum detect below screening value.
Hexachlorobutadiene	0 / 27	ND	ND	ND	0.004	10	17	No	Constituent not detected.
Iodomethane	0 / 27	ND	ND	ND	0.04	100	NA	No	Constituent not detected.
Isopropylbenzene	5 / 27	0.0136	109	SB-16 (12-14)	0.004	0.5	270	No	Maximum detect below screening value.
Methyl tert-butyl ether	0 / 37	ND	ND	ND	0.0036	50	2300	No	Constituent not detected.
Methylene Chloride	1 / 37	5.47	5.47	SB-16 (12-14)	0.0036	10	3300	No	Maximum detect below screening value.
Naphthalene	6 / 27	0.0068	283	SB-16 (12-14)	0.004	0.5	180	**YES**	Maximum detect exceeds screening value.
n-Butylbenzene	3 / 27	19.7	89.7	SB-1B (10-12)	0.004	1.2	110	No	Maximum detect below screening value.
n-Propylbenzene	5 / 27	0.0166	134	SB-1B (10-12)	0.004	0.5	260	No	Maximum detect below screening value.
sec-Butylbenzene	0 / 27	ND	ND	ND	0.004	10	NA	No	Constituent not detected.
Styrene	0 / 37	ND	ND	ND	0.0036	10	870	No	Constituent not detected.
tert-Butylbenzene	0 / 27	ND	ND	ND	0.004	10	NA	No	Constituent not detected.
Tetrachloroethene (PCE)	1 / 37	0.0084	0.0084	SB-8A (0-2)	0.0036	10	170	No	Maximum detect below screening value.
Toluene	17 / 37	0.0041	404	SB-16 (12-14)	0.0036	0.5	820	No	Maximum detect below screening value.
trans-1,2-Dichloroethene	0 / 37	ND	ND	ND	0.0036	10	570	No	Constituent not detected.
trans-1,3-Dichloropropene	0 / 37	ND	ND	ND	0.0036	10	NA	No	Constituent not detected.
Trichloroethene(TCE)	0 / 37	ND	ND	ND	0.0036	10	20	No	Constituent not detected.
Trichlorofluoromethane	0 / 27	ND	ND	ND	0.004	10	1200	No	Constituent not detected.
Vinyl acetate	0 / 27	ND	ND	ND	0.04	100	2700	No	Constituent not detected.
Vinyl chloride	0 / 37	ND	ND	ND	0.0036	10	22	No	Constituent not detected.
Xylenes (total)	10 / 37	0.0113	1025	SB-16 (12-14)	0.008	1	260	**YES**	Maximum detect exceeds screening value.

TABLE 2-4
IDENTIFICATION OF CONTAMINANTS OF CONCERN IN SOIL - DIRECT CONTACT
Alker Tire - Buckhannon, Upshur County, West Virginia

Contaminant	Frequency of Detection	Minimum Detected Soil Concentration (mg/kg)	Maximum Detected Soil Concentration (mg/kg)	Sample with Maximum Detect	Minimum Detection Limit (mg/kg)	Maximum Detection Limit (mg/kg)	De Minimis Industrial Soil Value [1] (mg/kg)	Contaminant of Concern	Comment
Volatile Organics Method SW8021B									
Methyl tert-butyl ether	0 / 5	ND	ND	ND	0.0104	0.301	2300	No	Maximum detect below screening value.
Benzene	3 / 5	0.0261	73.8	SB-16 (12-14)	0.0054	0.0064	57	**YES**	Maximum detect exceeds screening value.
Toluene	3 / 5	0.0114	339	SB-16 (12-14)	0.0054	0.0064	820	No	Maximum detect below screening value.
Ethylbenzene	3 / 5	0.0077	128	SB-16 (12-14)	0.0054	0.0064	280	No	Maximum detect below screening value.
Xylenes (Total)	3 / 5	0.013	676	SB-16 (12-14)	0.0109	0.0127	260	**YES**	Maximum detect exceeds screening value.
Semi-Volatile Organics									
1,2,4-Trichlorobenzene	0 / 8	ND	ND	ND	0.344	0.402	280	No	Constituent not detected.
1,2-Dichlorobenzene	0 / 8	ND	ND	ND	0.344	0.402	380	No	Constituent not detected.
1,3-Dichlorobenzene	0 / 8	ND	ND	ND	0.344	0.402	NA	No	Constituent not detected.
1,4-Dichlorobenzene	0 / 8	ND	ND	ND	0.344	0.402	120	No	Constituent not detected.
2,4,5-Trichlorophenol	0 / 10	ND	ND	ND	0.86	1.01	130000	No	Constituent not detected.
2,4,6-Trichlorophenol	0 / 10	ND	ND	ND	0.344	0.402	1300	No	Constituent not detected.
2,4-Dichlorophenol	1 / 9	2.74	2.74	SG-3 (12-13)	0.344	0.402	3800	No	Maximum detect below screening value.
2,4-Dimethylphenol	0 / 8	ND	ND	ND	0.344	0.402	25000	No	Constituent not detected.
2,4-Dinitrophenol	0 / 10	ND	ND	ND	0.345	1.01	2500	No	Constituent not detected.
2,4-Dinitrotoluene	0 / 10	ND	ND	ND	0.344	0.402	110	No	Constituent not detected.
2,6-Dinitrotoluene	0 / 10	ND	ND	ND	0.344	0.402	24	No	Constituent not detected.
2-Chloronaphthalene	0 / 10	ND	ND	ND	0.344	0.402	67000	No	Constituent not detected.
2-Chlorophenol	0 / 8	ND	ND	ND	0.344	0.402	5500	No	Constituent not detected.
2-Methylnaphthalene	2 / 10	26.95	104	SG-1 (12-13)	0.344	0.402	9300	No	Maximum detect below screening value.
2-Methylphenol (o-cresol)	0 / 8	ND	ND	ND	0.344	0.402	63000	No	Constituent not detected.
2-Nitroaniline	0 / 10	ND	ND	ND	0.86	1.01	12000	No	Constituent not detected.
2-Nitrophenol	0 / 8	ND	ND	ND	0.344	0.402	NA	No	Constituent not detected.
3&4-Methylphenol (m,p-Cresol)	0 / 10	ND	ND	ND	0.687	0.804	NA	No	Constituent not detected.
3,3-Dichlorobenzidine	0 / 10	ND	ND	ND	0.344	0.402	79	No	Constituent not detected.
3-Nitroaniline	0 / 10	ND	ND	ND	0.86	1.01	NA	No	Constituent not detected.
4,6-dinitro-2-methyl phenol	0 / 10	ND	ND	ND	0.345	1.01	NA	No	Constituent not detected.
4-Bromophenyl-phenylether	0 / 10	ND	ND	ND	0.344	0.402	NA	No	Constituent not detected.
4-chloro-3-methylphenol	0 / 8	ND	ND	ND	0.344	0.402	130000	No	Constituent not detected.
4-Chloroaniline	0 / 8	ND	ND	ND	0.344	0.402	180	No	Constituent not detected.
4-Chlorophenyl Phenyl Ether	0 / 10	ND	ND	ND	0.344	0.402	NA	No	Constituent not detected.
4-Nitroaniline	0 / 10	ND	ND	ND	0.86	1.01	12000	No	Constituent not detected.
4-Nitrophenol	0 / 10	ND	ND	ND	0.344	0.402	NA	No	Constituent not detected.
Acenaphthene	1 / 10	0.559	0.559	SG-1 (12-13)	0.344	0.402	70000	No	Maximum detect below screening value.
Acenaphthene	2 / 32	0.0652	0.104	SB-1B (10-12)	0.00321	0.402	70000	No	Maximum detect below screening value.
Acenaphthylene	0 / 10	ND	ND	ND	0.344	0.402	80000	No	Constituent not detected.
Acenaphthylene	2 / 32	0.00326	0.0039	SB-1A (0-2)	0.00322	0.402	80000	No	Maximum detect below screening value.

TABLE 2-4
IDENTIFICATION OF CONTAMINANTS OF CONCERN IN SOIL - DIRECT CONTACT
Alker Tire - Buckhannon, Upshur County, West Virginia

Contaminant	Frequency of Detection	Minimum Detected Soil Concentration (mg/kg)	Maximum Detected Soil Concentration (mg/kg)	Sample with Maximum Detect	Minimum Detection Limit (mg/kg)	Maximum Detection Limit (mg/kg)	De Minimis Industrial Soil Value [1] (mg/kg)	Contaminant of Concern	Comment
Semi-Volatile Organics (Continued)									
Anthracene	2 / 32	0.0139	0.0403	SB-1B (10-12)	0.00321	0.402	700000	No	Maximum detect below screening value.
Benzo (g,h,i) perylene	7 / 32	0.00787	0.0918	SB-11A (0-2)	0.00322	0.402	33000	No	Maximum detect below screening value.
Benzo(a)anthracene	8 / 32	0.0103	0.157	SB-11A (0-2)	0.00322	0.402	88	No	Maximum detect below screening value.
Benzo(a)pyrene	7 / 32	0.00598	0.0918	SB-11A (0-2)	0.00322	0.402	4.3	No	Maximum detect below screening value.
Benzo(b)fluoranthene	7 / 32	0.00852	0.0721	SB-11A (0-2)	0.00322	0.402	43	No	Maximum detect below screening value.
Benzo(k)fluoranthene	8 / 32	0.00396	0.0754	SB-11A (0-2)	0.00322	0.402	430	No	Maximum detect below screening value.
Benzyl alcohol	0 / 8	ND	ND	ND	0.344	0.402	130000	No	Constituent not detected.
bis(2-chloroethoxy) methane	0 / 8	ND	ND	ND	0.344	0.402	NA	No	Constituent not detected.
bis(2-chloroethyl) ether	0 / 8	ND	ND	ND	0.344	0.402	13	No	Constituent not detected.
bis(2-chloroisopropyl) ether	0 / 10	ND	ND	ND	0.344	0.402	310	No	Constituent not detected.
bis(2-ethylhexyl) phthalate	0 / 10	ND	ND	ND	0.344	0.402	2500	No	Constituent not detected.
Butyl benzyl phthalate	0 / 10	ND	ND	ND	0.344	0.402	19000	No	Constituent not detected.
Chrysene	8 / 32	0.00331	0.0426	SB-11A (0-2)	0.00322	0.402	4300	No	Maximum detect below screening value.
Dibenz(a,h) anthracene	4 / 32	0.00363	0.00749	SB-7A (0-2)	0.00322	0.402	4.3	No	Maximum detect below screening value.
Dibenzofuran	0 / 10	ND	ND	ND	0.344	0.402	2300	No	Constituent not detected.
Diethyl Phthalate	0 / 10	ND	ND	ND	0.344	0.402	1000000	No	Constituent not detected.
Dimethyl Phthalate	0 / 10	ND	ND	ND	0.344	0.402	NA	No	Constituent not detected.
di-n-Butyl Phthalate	0 / 10	ND	ND	ND	0.344	0.402	130000	No	Constituent not detected.
di-n-Octyl Phthalate	0 / 10	ND	ND	ND	0.344	0.402	NA	No	Constituent not detected.
Fluoranthene	9 / 32	0.00462	0.0787	SB-11A (0-2)	0.00322	0.402	44000	No	Maximum detect below screening value.
Fluorene	4 / 32	0.00422	0.405	SG-1 (12-13)	0.00322	0.402	62000	No	Maximum detect below screening value.
Hexachlorobenzene	0 / 10	ND	ND	ND	0.344	0.402	13	No	Constituent not detected.
Hexachlorobutadiene	0 / 8	ND	ND	ND	0.344	0.402	17	No	Constituent not detected.
Hexachlorocyclopentadiene	0 / 10	ND	ND	ND	0.344	0.402	8	No	Constituent not detected.
Hexachloroethane	0 / 8	ND	ND	ND	0.344	0.402	91	No	Constituent not detected.
Indeno (1,2,3-cd) pyrene	7 / 32	0.00598	0.0689	SB-11A (0-2)	0.00322	0.402	43	No	Maximum detect below screening value.
Isophorone	0 / 8	ND	ND	ND	0.344	0.402	37000	No	Constituent not detected.
Naphthalene	11 / 32	0.00332	87.4	SG-1 (12-13)	0.00322	0.402	180	No	Maximum detect below screening value.
Nitrobenzene	0 / 8	ND	ND	ND	0.344	0.402	240	No	Constituent not detected.

TABLE 2-4
IDENTIFICATION OF CONTAMINANTS OF CONCERN IN SOIL - DIRECT CONTACT
Alker Tire - Buckhannon, Upshur County, West Virginia

Contaminant	Frequency of Detection	Minimum Detected Soil Concentration (mg/kg)	Maximum Detected Soil Concentration (mg/kg)	Sample with Maximum Detect	Minimum Detection Limit (mg/kg)	Maximum Detection Limit (mg/kg)	De Minimis Industrial Soil Value [1] (mg/kg)	Contaminant of Concern	Comment
Semi-Volatile Organics (Continued)									
N-Nitrosodi-n-Propylamine	0 / 8	ND	ND	ND	0.344	0.402	5.1	No	Constituent not detected.
N-Nitrosodiphenylamine	0 / 10	ND	ND	ND	0.344	0.402	7200	No	Constituent not detected.
Pentachlorophenol	0 / 10	ND	ND	ND	0.86	1.01	52	No	Constituent not detected.
Phenanthrene	9 / 32	0.0151	0.794	SG-1 (12-13)	0.00322	0.402	700000	No	Maximum detect below screening value.
Phenol	0 / 8	ND	ND	ND	0.344	0.402	380000	No	Constituent not detected.
Pyrene	9 / 32	0.00396	0.0689	SB-11A (0-2)	0.00322	0.402	66000	No	Maximum detect below screening value.
Glycols, Total									
Diethylene Glycol	0 / 11	ND	ND	ND	200	200	NA	No	Constituent not detected.
Ethylene Glycol	1 / 13	33.8	33.8	SG-1 (12-13)	0.32	200	1000000	No	Maximum detect below screening value.
Propylene Glycol	1 / 2	20.1	20.1	SG-1 (12-13)	0.262	0.262	1000000	No	Maximum detect below screening value.
Triethylene Glycol	0 / 11	ND	ND	ND	200	200	NA	No	Constituent not detected.
Total Petroleum Hydrocarbons [2]									
TPHDRO	7 / 27	8.83	1890	SB-16 (12-14)	3.88	5.13	8300	No	Maximum detect below screening value.
TPHGRO	6 / 27	1.29	11500	SB-16 (12-14)	4.8	6.36	6600	No	Evaluated through individual BTEX & PAH constituents.
TPHORO	3 / 27	11.4	40.7	SB-11A (0-2)	9.69	29.8	9000	No	Maximum detect below screening value.
Inorganics									
Arsenic	15 / 21	0.51	13.5	SB-3A (0-2)	5	5	35	No	Maximum detect below screening value.
Barium	21 / 21	6.3	191	SB-7A (0-2)	- -	- -	400000	No	Maximum detect below screening value.
Cadmium	4 / 21	0.31	7.64	SB-2A (0-2)	0.29	0.5	980	No	Maximum detect below screening value.
Chromium [3]	21 / 21	1.7	66.5	SB-1A (0-2)	- -	- -	857161	No	Maximum detect below screening value.
Lead	21 / 21	2.4	280	SB-3A (0-2)	- -	- -	1000	No	Maximum detect below screening value.
Mercury	5 / 21	0.08	0.885	SB-10A (0-2)	0.05	0.12	3.1	No	Maximum detect below screening value.
Selenium	0 / 21	ND	ND	ND	0.75	5	12000	No	Constituent not detected.
Silver	1 / 21	7.1	7.1	SB-3A (0-2)	0.56	2.5	12000	No	Maximum detect below screening value.

Notes:
ND - Not detected
"--" Detection limit not presented; constituent detected in every sample.
[1] Screening levels are the WVDEP Industrial Soil *de minimis* Values (WVDEP, 2017).
[2] De Minimis Value for TPH are from the Draft Supplemental Guidance on TPH (WVDEP, 2003).
[3] Site-specific screening level for total chromium is based on the assumption that hexavalent and trivalent chromium are present at a ratio of 1:6 (Cr IV to Cr III). See text Section 2.4.1.

TABLE 2-5
IDENTIFICATION OF CONTAMINANTS OF CONCERN IN GROUNDWATER - DIRECT CONTACT
Alker Tire - Buckhannon, Upshur County, West Virginia

Contaminant	Frequency of Detection	Minimum Detected Concentration (ug/L)	Maximum Detected Concentration (ug/L)	Sample with Maximum Detect	Minimum Detection Limit (ug/L)	Maximum Detection Limit (ug/L)	De Minimis Groundwater Value [1] (ug/L)	Contaminant of Concern	Comment
Volatile Organics									
1,1,1-Trichloroethane	0 / 6	ND	ND	ND	1	1	200	No	Constituent not detected.
1,1,2,2-Tetrachloroethane	0 / 6	ND	ND	ND	**1**	**1**	0.076	No	Constituent not detected.
1,1,2-Trichloroethane	0 / 6	ND	ND	ND	1	1	5	No	Constituent not detected.
1,1-Dichloroethane	0 / 6	ND	ND	ND	1	1	2.8	No	Constituent not detected.
1,1-Dichloroethene	0 / 6	ND	ND	ND	1	1	7	No	Constituent not detected.
1,2,4-Trichlorobenzene	0 / 6	ND	ND	ND	1	1	70	No	Constituent not detected.
1,2-Dichlorobenzene	0 / 6	ND	ND	ND	1	1	600	No	Constituent not detected.
1,2-Dichloroethane	0 / 6	ND	ND	ND	1	1	5	No	Constituent not detected.
1,2-Dichloroethene (Total)	0 / 6	ND	ND	ND	2	2	NA	No	Constituent not detected.
1,2-Dichloropropane	0 / 6	ND	ND	ND	1	1	5	No	Constituent not detected.
1,3-Dichlorobenzene	0 / 6	ND	ND	ND	1	1	NA	No	Constituent not detected.
1,4-Dichlorobenzene	0 / 6	ND	ND	ND	1	1	75	No	Constituent not detected.
2-Butanone	0 / 6	ND	ND	ND	10	10	5600	No	Constituent not detected.
2-Hexanone	0 / 6	ND	ND	ND	10	10	1200	No	Constituent not detected.
4-Methyl-2-pentanone	0 / 6	ND	ND	ND	10	10	1200	No	Constituent not detected.
Acetone	1 / 6	177	177	MW17 (4/6/2018)	10	10	14000	No	Maximum detect below screening value.
Benzene	9 / 14	0.53	506	MW15 (2/27/2017)	0.5	**500**	5	**YES**	Maximum detect exceeds screening value.
Bromochloromethane	0 / 6	ND	ND	ND	1	1	NA	No	Constituent not detected.
Bromodichloromethane	0 / 6	ND	ND	ND	**1**	**1**	0.13	No	Constituent not detected.
Bromoform	0 / 6	ND	ND	ND	1	1	3.3	No	Constituent not detected.
Bromomethane	0 / 6	ND	ND	ND	1	1	7.5	No	Constituent not detected.
Carbon Disulfide	1 / 6	1.9	1.9	MW17 (4/6/2018)	1	1	810	No	Maximum detect below screening value.
Carbon Tetrachloride	0 / 6	ND	ND	ND	1	1	5	No	Constituent not detected.
Chlorobenzene	0 / 6	ND	ND	ND	1	1	100	No	Constituent not detected.
Chloroethane	0 / 6	ND	ND	ND	1	1	21000	No	Constituent not detected.
Chloroform	0 / 6	ND	ND	ND	**1**	**1**	0.22	No	Constituent not detected.
Chloromethane	0 / 6	ND	ND	ND	1	1	190	No	Constituent not detected.
cis-1,2-Dichloroethene	0 / 6	ND	ND	ND	1	1	70	No	Constituent not detected.
cis-1,3-Dichloropropene	0 / 6	ND	ND	ND	1	1	NA	No	Constituent not detected.
Dibromochloromethane	0 / 6	ND	ND	ND	**1**	**1**	0.87	No	Constituent not detected.

Risk-Based Remedies
RBR Consulting, Inc.

TABLE 2-5
IDENTIFICATION OF CONTAMINANTS OF CONCERN IN GROUNDWATER - DIRECT CONTACT
Alker Tire - Buckhannon, Upshur County, West Virginia

Contaminant	Frequency of Detection	Minimum Detected Concentration (ug/L)	Maximum Detected Concentration (ug/L)	Sample with Maximum Detect	Minimum Detection Limit (ug/L)	Maximum Detection Limit (ug/L)	De Minimis Groundwater Value [1] (ug/L)	Contaminant of Concern	Comment
Volatile Organics (Continued)									
Ethylbenzene	9 / 14	0.96	1990	RMW1 (2/27/2017)	0.5	1	700	**YES**	Maximum detect exceeds screening value.
Methyl tert-butyl ether (MTBE)	0 / 14	ND	ND	ND	1	**2500**	14	No	Constituent not detected.
Methylene chloride	0 / 6	ND	ND	ND	1	1	5	No	Constituent not detected.
Styrene	0 / 6	ND	ND	ND	1	1	100	No	Constituent not detected.
tert-Butyl alcohol	0 / 8	ND	ND	ND	50	50	NA	No	Constituent not detected.
Tetrachloroethene (PCE)	0 / 6	ND	ND	ND	1	1	5	No	Constituent not detected.
Toluene	9 / 14	1.07	6640	RMW1 (2/27/2017)	0.5	1	1000	**YES**	Maximum detect exceeds screening value.
trans-1,2-Dichloroethene	0 / 6	ND	ND	ND	1	1	100	No	Constituent not detected.
trans-1,3-Dichloropropene	0 / 6	ND	ND	ND	1	1	NA	No	Constituent not detected.
Trichloroethene	0 / 6	ND	ND	ND	1	1	5	No	Constituent not detected.
Vinyl chloride	0 / 6	ND	ND	ND	1	1	2	No	Constituent not detected.
Xylenes (total)	10 / 14	5.67	12600	RMW1 (2/27/2017)	1	3	10000	**YES**	Maximum detect exceeds screening value.
Semi-Volatile Organics									
Acenaphthylene	0 / 8	ND	ND	ND	2	3.3	320	No	Constituent not detected.
Acenaphthene	0 / 8	ND	ND	ND	2	3.3	240	No	Constituent not detected.
Anthracene	0 / 8	ND	ND	ND	2	3.3	1800	No	Constituent not detected.
Benzo(a)anthracene	0 / 8	ND	ND	ND	**2**	**3.3**	0.012	No	Constituent not detected.
Benzo(a)pyrene	0 / 8	ND	ND	ND	**2**	**3.3**	0.2	No	Constituent not detected.
Benzo(b)fluoranthene	0 / 8	ND	ND	ND	**2**	**3.3**	0.034	No	Constituent not detected.
Benzo (ghi) perylene	0 / 8	ND	ND	ND	2	3.3	600	No	Constituent not detected.
Benzo (k) fluoranthene	0 / 8	ND	ND	ND	**3**	**4.9**	0.34	No	Constituent not detected.
Chrysene	0 / 8	ND	ND	ND	2	3.3	3.4	No	Constituent not detected.
Dibenzo (a,h) anthracene	0 / 8	ND	ND	ND	**2**	**3.3**	0.0034	No	Constituent not detected.
Fluoranthene	0 / 8	ND	ND	ND	2	3.3	800	No	Constituent not detected.
Fluorene	0 / 8	ND	ND	ND	2	3.3	150	No	Constituent not detected.
Indeno (1,2,3-cd) pyrene	0 / 8	ND	ND	ND	**2**	**3.3**	0.034	No	Constituent not detected.
Naphthalene	3 / 8	126	310	RMW1 (2/27/2017)	**2**	**3.3**	0.17	**YES**	Maximum detect exceeds screening value.
Phenanthrene	0 / 8	ND	ND	ND	2	3.3	6000	No	Constituent not detected.
Pyrene	0 / 8	ND	ND	ND	2	3.3	79	No	Constituent not detected.

TABLE 2-5
IDENTIFICATION OF CONTAMINANTS OF CONCERN IN GROUNDWATER - DIRECT CONTACT
Alker Tire - Buckhannon, Upshur County, West Virginia

Contaminant	Frequency of Detection	Minimum Detected Concentration (ug/L)	Maximum Detected Concentration (ug/L)	Sample with Maximum Detect	Minimum Detection Limit (ug/L)	Maximum Detection Limit (ug/L)	De Minimis Groundwater Value [1] (ug/L)	Contaminant of Concern	Comment
Glycols, Total									
Diethylene Glycol	0 / 6	ND	ND	ND	9840	9840	NA	No	Constituent not detected.
Monoethylene Glycol	0 / 6	ND	ND	ND	6010	6010	NA	No	Constituent not detected.
Propylene Glycol	0 / 6	ND	ND	ND	8000	8000	400000	No	Constituent not detected.
Triethylene Glycol	0 / 6	ND	ND	ND	12400	12400	NA	No	Constituent not detected.
Inorganics									
Arsenic	0 / 6	ND	ND	ND	5	5	10	No	Constituent not detected.
Barium	6 / 6	39.8	119	MW15 (4/6/2018)	- -	- -	2000	No	Maximum detect below screening value.
Cadmium	0 / 6	ND	ND	ND	3	3	5	No	Constituent not detected.
Chromium [2]	0 / 6	ND	ND	ND	5	5	100	No	Constituent not detected.
Lead	3 / 6	13.3	64.4	RW-1 (4/6/2018)	5	5	15	**YES**	Maximum detect exceeds screening value.
Mercury	0 / 6	ND	ND	ND	0.2	0.2	2	No	Constituent not detected.
Selenium	0 / 6	ND	ND	ND	8	8	50	No	Constituent not detected.
Silver	0 / 6	ND	ND	ND	6	6	94	No	Constituent not detected.

Notes:
ND - Not Detected
NA - Not Available
Bold values indicate that detection limits exceed the screening benchmark.
[1] Screening levels are the WVDEP Groundwater *de minimis* values (WVDEP, 2017).
[2] Screening value for total chromium is from Appendix P of WVDEP (2014) Title 46: Requirements Governing Groundwater Standards (WV 46 CSR 12)

TABLE 2-6
IDENTIFICATION OF CONTAMINANTS OF CONCERN IN ONSITE SOIL GAS - VAPOR INTRUSION TO INDOOR AIR
Alker Tire - Buckhannon, Upshur County, West Virginia

Contaminant	Frequency of Detection	Minimum Detected Concentration (ug/m^3)	Maximum Detected Concentration (ug/m^3)	Sample with Maximum Detect	Minimum Detection Limit (ug/m^3)	Maximum Detection Limit (ug/m^3)	USEPA Soil Gas Vapor Intrusion Screening Level [1] ($\mu g/m^3$)	Contaminant of Concern	Comment
Volatile Organics									
1,1,1-Trichloroethane	0 / 3	ND	ND	ND	8010	8300	73000	No	Constituent not detected.
1,1,2,2-Tetrachloroethane	0 / 3	ND	ND	ND	**5040**	**5220**	7.05	No	Constituent not detected.
1,1,2-Trichloro-1,2,2-trifluoroethane	0 / 3	ND	ND	ND	11300	11700	73000	No	Constituent not detected.
1,1,2-Trichloroethane	0 / 3	ND	ND	ND	**4010**	**4150**	2.92	No	Constituent not detected.
1,1-Dichloroethane	0 / 3	ND	ND	ND	**5940**	**6150**	256	No	Constituent not detected.
1,1-Dichloroethene	0 / 3	ND	ND	ND	**5820**	**6020**	2920	No	Constituent not detected.
1,2,4-Trichlorobenzene	0 / 3	ND	ND	ND	**27200**	**28200**	29.2	No	Constituent not detected.
1,2,4-Trimethylbenzene	3 / 3	12800	62000	SG-1	- -	- -	876	**YES**	Maximum detect exceeds screening value.
1,2-Dibromoethane	0 / 3	ND	ND	ND	11300	11700	0.68	No	Constituent not detected.
1,2-Dichlorobenzene	0 / 3	ND	ND	ND	**8610**	**9120**	2920	No	Constituent not detected.
1,2-Dichloroethane	0 / 3	ND	ND	ND	**2970**	**3070**	15.7	No	Constituent not detected.
1,2-Dichloropropane	0 / 3	ND	ND	ND	**6780**	**7020**	58.4	No	Constituent not detected.
1,3,5-Trimethylbenzene	3 / 3	8070	23800	SG-1	- -	- -	876	**YES**	Maximum detect exceeds screening value.
1,3-Butadiene	0 / 3	ND	ND	ND	**3250**	**3360**	13.6	No	Constituent not detected.
1,3-Dichlorobenzene	0 / 3	ND	ND	ND	8610	9120	NA	No	Constituent not detected.
1,4-Dichlorobenzene	0 / 3	ND	ND	ND	**8810**	**9120**	37.2	No	Constituent not detected.
2-Butanone (MEK)	0 / 3	ND	ND	ND	21700	22400	73000	No	Constituent not detected.
2-Hexanone	0 / 3	ND	ND	ND	**30000**	**31100**	438	No	Constituent not detected.
2-Propanol	0 / 3	ND	ND	ND	18000	18700	NA	No	Constituent not detected.
4-Ethyltoluene [2]	3 / 3	8340	56700	SG-1	- -	- -	73000	No	Maximum detect below screening value.
4-Methyl-2-pentanone	0 / 3	ND	ND	ND	30000	31100	43800	No	Constituent not detected.
Acetone	0 / 3	ND	ND	ND	43600	45100	451000	No	Constituent not detected.
Benzene	0 / 3	ND	ND	ND	**2350**	**2430**	52.4	**YES**	Detection limits exceed screening value.
Benzyl chloride	0 / 3	ND	ND	ND	**19000**	**19700**	8.34	No	Constituent not detected.
Bromodichloromethane	0 / 3	ND	ND	ND	**9820**	**10200**	11.0	No	Constituent not detected.
Bromoform	0 / 3	ND	ND	ND	**15200**	**15700**	372	No	Constituent not detected.
Bromomethane	0 / 3	ND	ND	ND	**5700**	**5900**	73.0	No	Constituent not detected.
Carbon disulfide	0 / 3	ND	ND	ND	4570	4730	10200	No	Constituent not detected.
Carbon tetrachloride	0 / 3	ND	ND	ND	**4610**	**4780**	68.1	No	Constituent not detected.
Chlorobenzene	0 / 3	ND	ND	ND	**6760**	**7000**	730	No	Constituent not detected.
Chloroethane	0 / 3	ND	ND	ND	3870	4010	146000	No	Constituent not detected.
Chloroform	0 / 3	ND	ND	ND	**3580**	**3710**	17.8	No	Constituent not detected.
Chloromethane	0 / 3	ND	ND	ND	**3030**	**3140**	1310	No	Constituent not detected.
cis-1,2-Dichloroethene	0 / 3	ND	ND	ND	5820	6020	NA	No	Constituent not detected.
cis-1,3-Dichloropropene	0 / 3	ND	ND	ND	6660	6900	NA	No	Constituent not detected.

Risk-Based Remedies
RBR Consulting, Inc.

TABLE 2-6
IDENTIFICATION OF CONTAMINANTS OF CONCERN IN ONSITE SOIL GAS - VAPOR INTRUSION TO INDOOR AIR
Alker Tire - Buckhannon, Upshur County, West Virginia

Contaminant	Frequency of Detection	Minimum Detected Concentration (ug/m^3)	Maximum Detected Concentration (ug/m^3)	Sample with Maximum Detect	Minimum Detection Limit (ug/m^3)	Maximum Detection Limit (ug/m^3)	USEPA Soil Gas Vapor Intrusion Screening Level [1] (μg/m³)	Contaminant of Concern	Comment
Volatile Organics (Continued)									
Cyclohexane	0 / 3	ND	ND	ND	5050	5230	87600	No	Constituent not detected.
Dibromochloromethane	0 / 3	ND	ND	ND	12500	12900	NA	No	Constituent not detected.
Dichlorodifluoromethane	0 / 3	ND	ND	ND	**7290**	**7550**	1460	No	Constituent not detected.
Dichlorotetrafluoroethane	0 / 3	ND	ND	ND	10300	10600	NA	No	Constituent not detected.
Ethanol	0 / 3	ND	ND	ND	6920	7160	NA	No	Constituent not detected.
Ethyl Acetate	0 / 3	ND	ND	ND	**5290**	**5480**	1020	No	Constituent not detected.
Ethylbenzene	3 / 3	38500	123000	SG-1	- -	- -	164	**YES**	Maximum detect exceeds screening value.
Hexachlorobutadiene	0 / 3	ND	ND	ND	**6270**	**16200**	18.6	No	Constituent not detected.
isopropylbenzene	3 / 3	23400	46900	SG-1	- -	- -	5840	**YES**	Maximum detect exceeds screening value.
Methyl tert-butyl ether	0 / 3	ND	ND	ND	**26400**	**27400**	1570	No	Constituent not detected.
Methylene Chloride	0 / 3	ND	ND	ND	**25500**	**26400**	8760	No	Constituent not detected.
Naphthalene	0 / 3	ND	ND	ND	**19200**	**19900**	12.0	**YES**	Detection limits exceed screening value.
n-Heptane	3 / 3	705000	1500000	SG-3	- -	- -	5840	**YES**	Maximum detect exceeds screening value.
n-Hexane	3 / 3	1180000	2920000	SG-3	- -	- -	10200	**YES**	Maximum detect exceeds screening value.
Propylene	0 / 3	ND	ND	ND	2530	2620	43800	No	Constituent not detected.
Styrene	0 / 3	ND	ND	ND	6250	6470	14600	No	Constituent not detected.
Tetrachloroethene	0 / 3	ND	ND	ND	**4970**	**5150**	584	No	Constituent not detected.
Tetrahydrofuran	0 / 3	ND	ND	ND	4330	4480	29200	No	Constituent not detected.
Toluene	3 / 3	11500	370000	SG-3	- -	- -	73000	**YES**	Maximum detect exceeds screening value.
trans-1,2-Dichloroethene	0 / 3	ND	ND	ND	5820	6020	NA	No	Constituent not detected.
trans-1,3-Dichloropropene	0 / 3	ND	ND	ND	6660	6900	NA	No	Constituent not detected.
Trichloroethene	0 / 3	ND	ND	ND	**3940**	**4080**	29.2	No	Constituent not detected.
Trichlorofluoromethane	0 / 3	ND	ND	ND	8230	8520	NA	No	Constituent not detected.
Vinyl acetate	0 / 3	ND	ND	ND	**5170**	**5350**	2920	No	Constituent not detected.
Vinyl chloride	0 / 3	ND	ND	ND	**1880**	**1940**	92.9	No	Constituent not detected.
Xylenes (total)	3 / 3	71700	381700	SG-1	- -	- -	1460	**YES**	Maximum detect exceeds screening value.

Notes:
ND - Not Detected
NA - Screening value not available to screen.
"--" - Constituent detected in every sample; detection limit not presented.
Bold values indicate that detection limits exceed the screening benchmark.
[1] Vapor intrusion screening values were calculated using the USEPA (2018a) VISL Calculator 3.5, using a target hazard quotient of 0.1, a target risk of 1E-6, a commercial scenario, and a system temperature of 12.5° C.
[2] Vapor intrusion screening level for 4-ethyltoluene is based on the screening level for toluene.

TABLE 2-7
IDENTIFICATION OF CONTAMINANTS OF CONCERN IN OFFSITE SOIL GAS - VAPOR INTRUSION TO INDOOR AIR
Alker Tire - Buckhannon, Upshur County, West Virginia

Contaminant	Frequency of Detection	Minimum Detected Concentration (ug/m^3)	Maximum Detected Concentration (ug/m^3)	Sample with Maximum Detect	Minimum Detection Limit (ug/m^3)	Maximum Detection Limit (ug/m^3)	USEPA Soil Gas Vapor Intrusion Screening Level [1] (μg/m^3)	Contaminant of Concern	Comment
Volatile Organics									
1,1,1-Trichloroethane	0 / 2	ND	ND	ND	1040	8300	73000	No	Constituent not detected.
1,1,2,2-Tetrachloroethane	0 / 2	ND	ND	ND	**652**	**5220**	7.05	No	Constituent not detected.
1,1,2-Trichloro-1,2,2-trifluoroethane	0 / 2	ND	ND	ND	1460	11700	73000	No	Constituent not detected.
1,1,2-Trichloroethane	0 / 2	ND	ND	ND	**519**	**4150**	2.92	No	Constituent not detected.
1,1-Dichloroethane	0 / 2	ND	ND	ND	**769**	**6150**	256	No	Constituent not detected.
1,1-Dichloroethene	0 / 2	ND	ND	ND	753	**6020**	2920	No	Constituent not detected.
1,2,4-Trichlorobenzene	0 / 2	ND	ND	ND	**3520**	**28200**	29.2	No	Constituent not detected.
1,2,4-Trimethylbenzene	2 / 2	1710	19300	SG-4	- -	- -	876	**YES**	Maximum detect exceeds screening value.
1,2-Dibromoethane	0 / 2	ND	ND	ND	**1460**	**11700**	0.68	No	Constituent not detected.
1,2-Dichlorobenzene	0 / 2	ND	ND	ND	1140	**9120**	2920	No	Constituent not detected.
1,2-Dichloroethane	0 / 2	ND	ND	ND	**384**	**3070**	15.7	No	Constituent not detected.
1,2-Dichloropropane	0 / 2	ND	ND	ND	**877**	**7020**	58.4	No	Constituent not detected.
1,3,5-Trimethylbenzene	2 / 2	1150	9790	SG-4	- -	- -	876	**YES**	Maximum detect exceeds screening value.
1,3-Butadiene	0 / 2	ND	ND	ND	**420**	**3360**	13.6	No	Constituent not detected.
1,3-Dichlorobenzene	0 / 2	ND	ND	ND	1140	9120	NA	No	Constituent not detected.
1,4-Dichlorobenzene	0 / 2	ND	ND	ND	**1140**	**9120**	37.2	No	Constituent not detected.
2-Butanone (MEK)	0 / 2	ND	ND	ND	2800	22400	73000	No	Screening value not available.
2-Hexanone	0 / 2	ND	ND	ND	**3890**	**31100**	438	No	Constituent not detected.
2-Propanol	0 / 2	ND	ND	ND	2340	18700	NA	No	Constituent not detected.
4-Ethyltoluene [2]	2 / 2	1240	25500	SG-4	- -	- -	73000	No	Maximum detect below screening value.
4-Methyl-2-pentanone	0 / 2	ND	ND	ND	3890	31100	43800	No	Constituent not detected.
Acetone	0 / 2	ND	ND	ND	2250	45100	451000	No	Constituent not detected.
Benzene	1 / 2	751.5	751.5	SG-5	**2430**	**2430**	52.4	**YES**	Maximum detect exceeds screening value.
Benzyl chloride	0 / 2	ND	ND	ND	**981**	**19700**	8.34	No	Constituent not detected.
Bromodichloromethane	0 / 2	ND	ND	ND	**1270**	**10200**	11.0	No	Screening value not available.
Bromoform	0 / 2	ND	ND	ND	**4910**	**15700**	372	No	Screening value not available.
Bromomethane	0 / 2	ND	ND	ND	**737**	**5900**	73.0	No	Constituent not detected.
Carbon disulfide	0 / 2	ND	ND	ND	591	4730	10200	No	Constituent not detected.
Carbon tetrachloride	0 / 2	ND	ND	ND	**597**	**4780**	68.1	No	Screening value not available.
Chlorobenzene	0 / 2	ND	ND	ND	**875**	**7000**	730	No	Screening value not available.
Chloroethane	0 / 2	ND	ND	ND	501	4010	146000	No	Constituent not detected.
Chloroform	0 / 2	ND	ND	ND	**463**	**3710**	17.8	No	Screening value not available.
Chloromethane	0 / 2	ND	ND	ND	392	**3140**	1310	No	Constituent not detected.
cis-1,2-Dichloroethene	0 / 2	ND	ND	ND	753	6020	NA	No	Constituent not detected.
cis-1,3-Dichloropropene	0 2	ND	ND	ND	862	6900	NA	No	Constituent not detected.

TABLE 2-7
IDENTIFICATION OF CONTAMINANTS OF CONCERN IN OFFSITE SOIL GAS - VAPOR INTRUSION TO INDOOR AIR
Alker Tire - Buckhannon, Upshur County, West Virginia

Contaminant	Frequency of Detection	Minimum Detected Concentration (ug/m^3)	Maximum Detected Concentration (ug/m^3)	Sample with Maximum Detect	Minimum Detection Limit (ug/m^3)	Maximum Detection Limit (ug/m^3)	USEPA Soil Gas Vapor Intrusion Screening Level [1] (µg/m^3)	Contaminant of Concern	Comment
Volatile Organics (Continued)									
Cyclohexane	0 2	ND	ND	ND	654	5230	87600	No	Constituent not detected.
Dibromochloromethane	0 / 2	ND	ND	ND	1620	12900	NA	No	Constituent not detected.
Dichlorodifluoromethane	0 / 2	ND	ND	ND	944	**7550**	1460	No	Constituent not detected.
Dichlorotetrafluoroethane	0 / 2	ND	ND	ND	1330	10600	NA	No	Constituent not detected.
Ethanol	0 / 2	ND	ND	ND	895	7160	NA	No	Constituent not detected.
Ethyl Acetate	0 / 2	ND	ND	ND	685	**5480**	1020	No	Constituent not detected.
Ethylbenzene	2 / 2	3745	84300	SG-4	- -	- -	164	**YES**	Maximum detect exceeds screening value.
Hexachlorobutadiene	0 / 2	ND	ND	ND	**2030**	**16200**	18.6	No	Constituent not detected.
isopropylbenzene	1 / 2	1800	1800	SG-5	**18700**	**18700**	5840	**YES**	Detection limits exceed screening value.
Methyl tert-butyl ether	0 / 2	ND	ND	ND	**3420**	**27400**	1570	No	Constituent not detected.
Methylene Chloride	0 / 2	ND	ND	ND	3300	**26400**	8760	No	Constituent not detected.
Naphthalene	0 / 2	ND	ND	ND	**2490**	**19900**	12.0	**YES**	Detection limits exceed screening value.
n-Heptane	1 / 2	22550	22550	SG-5	**6230**	**6230**	5840	**YES**	Maximum detect exceeds screening value.
n-Hexane	2 / 2	22050	3280000	SG-4	- -	- -	10200	**YES**	Maximum detect exceeds screening value.
Propylene	1 / 2	653	653	SG-5	2620	2620	43800	No	Maximum detect below screening value.
Styrene	0 / 2	ND	ND	ND	809	6470	14600	No	Constituent not detected.
Tetrachloroethene	0 / 2	ND	ND	ND	**644**	**5150**	584	No	Constituent not detected.
Tetrahydrofuran	0 / 2	ND	ND	ND	561	4480	29200	No	Constituent not detected.
Toluene	2 / 2	7380	389000	SG-4	- -	- -	73000	**YES**	Maximum detect exceeds screening value.
trans-1,2-Dichloroethene	0 / 2	ND	ND	ND	753	6020	NA	No	Screening value not available.
trans-1,3-Dichloropropene	0 / 2	ND	ND	ND	862	6900	NA	No	Constituent not detected.
Trichloroethene	0 / 2	ND	ND	ND	**510**	**4080**	29.2	No	Constituent not detected.
Trichlorofluoromethane	0 / 2	ND	ND	ND	1070	8520	NA	No	Constituent not detected.
Vinyl acetate	0 / 2	ND	ND	ND	669	**5350**	2920	No	Constituent not detected.
Vinyl chloride	0 / 2	ND	ND	ND	**243**	**1940**	92.9	No	Constituent not detected.
Xylenes (total)	2 / 2	13260	279800	SG-4	- -	- -	1460	**YES**	Maximum detect exceeds screening value.

Notes:
ND - Not Detected
NA - Screening value not available to screen.
"--" - Constituent detected in every sample; detection limit not presented.
Bold values indicate that detection limits exceed the screening benchmark.
[1] Vapor intrusion screening values were calculated using the USEPA (2018a) VISL Calculator 3.5, using a target hazard quotient of 0.1, a target risk of 1E-6, a commercial scenario, and a system temperature of 12.5° C.
[2] Vapor intrusion screening level for 4-ethyltoluene is based on the screening level for toluene.

TABLE 2-8
SUMMARY OF CONTAMINANTS OF CONCERN
Alker Tire - Buckhannon, Upshur County, West Virginia

Medium	Pathway	Contaminants of Concern	
Soil	Direct Contact	1,2,4-Trimethylbenzene	Naphthalene
		1,3,5-Trimethylbenzene	Xylenes (Total)
		Benzene	
Groundwater	Direct Contact	Benzene	Toluene
		Ethylbenzene	Xylenes (Total)
		Naphthalene	Lead
Soil Gas	Vapor Intrusion Onsite	1,2,4-Trimethylbenzene	n-Heptane
		1,3,5-Trimethylbenzene	n-Hexane
		Benzene*	Naphthalene*
		Ethylbenzene	Toluene
		Isopropylbenzene	Xylenes (Total)
	Vapor Intrusion Offsite	1,2,4-Trimethylbenzene	n-Heptane
		1,3,5-Trimethylbenzene	n-Hexane
		Benzene	Naphthalene*
		Ethylbenzene	Toluene
		Isopropylbenzene*	Xylenes (Total)

Note:

* This constituent was retained as a COC because the detection limit exceeded the screening value.

TABLE 3-1
EXPOSURE POINT CONCENTRATIONS FOR CONTAMINANTS OF CONCERN IN SOIL - DIRECT CONTACT
Alker Tire - Buckhannon, Upshur County, West Virginia

Depth	Contaminants of Concern	Number of Samples	Percent Non-detect	Maximum Detection (mg/kg)	Arithmetic Mean [1] (mg/kg)	Distribution	Upper Confidence Limit [2] (mg/kg)	Exposure Point Concentration [3] (mg/kg)
Surface	**Volatile Organics Method SW8260B**							
(0-2 feet bgs)	1,2,4-Trimethylbenzene	11	81.8%	0.011	0.0031	Non-parametric	0.0063	0.0063
	1,3,5-Trimethylbenzene	11	100.0%	ND	NA	NA	NA	ND
	Benzene	16	87.5%	0.0059	0.0024	Non-parametric	0.0043	0.0043
	Naphthalene	11	100.0%	ND	NA	NA	NA	ND
	Xylenes (Total)	16	87.5%	0.0304	0.0077	Non-parametric	0.015	0.015
Surface and Subsurface	**Volatile Organics Method SW8260B**							
(0-16 feet bgs)	1,2,4-Trimethylbenzene	27	70.4%	804	83.1	Gamma	264	264
	1,3,5-Trimethylbenzene	27	81.5%	216	20.3	Normal	40.4	40.4
	Benzene	37	78.4%	57.6	1.95	Lognormal	17.9	17.9
	Naphthalene	27	77.8%	283	21.2	Normal	43.4	43.4
	Xylenes (Total)	37	73.0%	1025	99.4	Gamma	254	254
	Volatile Organics Method SW8021B							
	Benzene	5	40.0%	73.8	14.8	Normal	49.2	49.2
	Xylenes (Total)	5	40.0%	676	135	Normal	451	451

Notes:
NA - Not Applicable.
ND - Not Detected; this constituent was not detected in the surface soil data set.
[1] The arithmetic mean is calculated using all detected concentrations and non-detects are included at one half the detection limit.
[2] Details of all statistical calculations are provided in Appendices B-1 and B-2.
[3] The Exposure Point Concentration (EPC) is the lower of the maximum detected concentration or the Upper Confidence Limit (UCL).

TABLE 3-2
EXPOSURE POINT CONCENTRATIONS FOR CONTAMINANTS OF CONCERN IN GROUNDWATER * - DIRECT CONTACT
Alker Tire - Buckhannon, Upshur County, West Virginia

Contaminants of Concern	Representative wells	Number of Samples	Percent Non-detect	Maximum Detection (µg/L)	Arithmetic Mean [1] (µg/L)	Distribution	Upper Confidence Limit [1] (µg/L)	Exposure Point Concentration [2] (µg/L)
Volatile Organics								
Benzene	RW-1, MW-15, MW-16, MW-17	7	14%	506	174	Normal	294	294
Ethylbenzene	RW-1, MW-15, MW-16, MW-17	7	0%	1990	1185	Normal	1533	1533
Naphthalene	RW-1, MW-15, MW-16	3	0%	310	211	NA	NA	310
Toluene	RW-1, MW-15, MW-16, MW-17	7	0%	6640	2414.0	Normal	4274	4274
Xylenes (Total)	RW-1, MW-15, MW-16, MW-17	7	0%	12600	5280	Normal	8850	8850
Lead*	RW-1, MW-16, MW-17	3	0%	64.4	37.5	NA	NA	37.5

Notes:
[1] The arithmetic mean is calculated using all detected concentrations and non-detects are included at one half the detection limit.
[2] Details of all statistical calculations are provided in Appendix B-3.
[3] The Exposure Point Concentration (EPC) is the lower of the maximum detected concentration or the Upper Confidence Limit (UCL).
* The EPC for lead is the arithmeticac mean concentration.
NA - Statistics not calculated due to an insufficient number of detected concentrations in the dataset for this constituent.

TABLE 3-3
INTRUSION
Alker Tire - Buckhannon, Upshur County, West Virginia

Contaminants of Concern	Number of Samples	Percent Non-detect	Maximum Detection (ug/m^3)	Arithmetic Mean [1] (ug/m^3)	Exposure Point Concentration [2] (ug/m^3)
Volatile Organics					
1,2,4-Trimethylbenzene	3	0.0%	62000	36200	62000
1,3,5-Trimethylbenzene	3	0.0%	23800	16200	23800
Benzene*	3	100.0%	1215	1200	1215
Ethylbenzene	3	0.0%	123000	81800	123000
Isopropylbenzene	3	0.0%	46900	36300	46900
Naphthalene*	3	100.0%	9950	9780	9950
n-Heptane	3	0.0%	1500000	1000000	1500000
n-Hexane	3	0.0%	2920000	1840000	2920000
Toluene	3	0.0%	370000	141000	370000
Xylenes (Total)	3	0.0%	381700	245000	381700

Notes:
[2] The arithmetic mean is calculated using all detected concentrations and non-detects are included at one half the detection limit.
[3] The EPC is based on the maximum detected concentration due to the small number of samples.
* Constituent was non-detect but retained as a COC based on elevated detection limits. Maximum detections are represented by a value of one-half the maximum detection limit. See text Section 3.2.1.3.

TABLE 3-4
EXPOSURE POINT CONCENTRATIONS FOR CONTAMINANTS OF CONCERN IN OFFSITE SOIL GAS - VAPOR INTRUSION
Alker Tire - Buckhannon, Upshur County, West Virginia

Contaminants of Concern	Number of Samples	Percent Non-detect	Maximum Detection (ug/m^3)	Arithmetic Mean [1] (ug/m^3)	Exposure Point Concentration [2] (ug/m^3)
Volatile Organics					
1,2,4-Trimethylbenzene	2	0.0%	19300	10500	19300
1,3,5-Trimethylbenzene	2	0.0%	9790	5470	9790
Benzene	2	50.0%	751.5	983	752
Ethylbenzene	2	0.0%	84300	44000	84300
Isopropylbenzene*	2	50.0%	1800	5580	1800
Naphthalene*	2	100.0%	9950	5600	9950
n-Heptane	2	50.0%	22550	12800	22550
n-Hexane	2	0.0%	3280000	1650000	3280000
Toluene	2	0.0%	389000	198000	389000
Xylenes (Total)	2	0.0%	279800	147000	279800

Notes:
[1] The arithmetic mean is calculated using all detected concentrations and non-detects are included at one half the detection limit.
[2] The EPC is based on the maximum detected concentration due to the small number of samples.
* Isopropylbenzene and naphthalene were retained as COC based on elevated detection limits. Naphthalene was non-detect; the maximum detection is represented by a value of one-half the maximum detection limit. See text Section 3.2.1.3.

TABLE 3-5
EXPOSURE POINT CONCENTRATIONS FOR INHALATION OF PARTICULATE EMISSIONS IN AMBIENT AIR
Alker Tire - Buckhannon, Upshur County, West Virginia

Medium	Contaminant of Concern	Soil Source Concentration [1] (mg/kg)	Particulate Emission Factor (PEF) [2] (m^3/kg)	Particulate EPC Ambient Air [3] (mg/m^3)
Surface Soil	**Volatile Organics**			
	1,2,4-Trimethylbenzene	6.26E-03	1.32E+09	4.76E-12
	1,3,5-Trimethylbenzene	ND	1.32E+09	NA
	Benzene	4.25E-03	1.32E+09	3.23E-12
	Naphthalene	ND	1.32E+09	NA
	Xylenes (Total)	1.48E-02	1.32E+09	1.12E-11
Surface and Subsurface	**Volatile Organics**			
Soil	1,2,4-Trimethylbenzene	2.64E+02	1.32E+09	2.00E-07
	1,3,5-Trimethylbenzene	4.04E+01	1.32E+09	3.07E-08
	Benzene	1.79E+01	1.32E+09	1.36E-08
	Naphthalene	4.34E+01	1.32E+09	3.30E-08
	Xylenes (Total)	2.54E+02	1.32E+09	1.93E-07

Notes:
NA - Not Applicable.
ND - Not Detected.
[1] The soil source concentration is the soil EPC as presented in Table 3-1.
[2] Particulate Emission Factor (PEF) is the default value from WVDEP (2012b).
[3] Ambient air concentration is calculated as the soil source concentration divided by the PEF.

TABLE 3-6
EXPOSURE POINT CONCENTRATIONS FOR VOLATILE CONTAMINANTS IN AMBIENT AIR (SOIL SOURCE)
Alker Tire - Buckhannon, Upshur County, West Virginia

Medium	Contaminant of Concern	Soil Source Concentration [1] (mg/kg)	Volatilization Factor (VF) [2] (m^3/kg)	Volatile EPC Ambient Air [3] (mg/m^3)
Surface Soil	**Volatile Organics**			
	1,2,4-Trimethylbenzene	6.26E-03	7.91E+03	7.91E-07
	1,3,5-Trimethylbenzene	ND	6.61E+03	NA
	Benzene	4.25E-03	3.54E+03	1.20E-06
	Naphthalene	ND	4.63E+04	NA
	Xylenes (Total)	1.48E-02	5.74E+03	2.58E-06
Surface and Subsurface	**Volatile Organics**			
Soil	1,2,4-Trimethylbenzene	2.64E+02	7.91E+03	3.33E-02
	1,3,5-Trimethylbenzene	4.04E+01	6.61E+03	6.11E-03
	Benzene	1.79E+01	3.54E+03	5.06E-03
	Naphthalene	4.34E+01	4.63E+04	9.37E-04
	Xylenes (Total)	2.54E+02	5.74E+03	4.42E-02

Notes:
NA - Not Applicable.
ND - Not Detected.
[1] The soil source concentration is the soil EPC as presented in Table 3-1.
[2] Volatilization factor is obtained from USEPA (2017).
[3] Ambient air concentration is calculated as the source concentration divided by the TF.

TABLE 3-7
EXPOSURE POINT CONCENTRATIONS FOR VOLATILE CONTAMINANTS OF CONCERN IN AMBIENT AIR (GROUNDWATER SOURCE)
Alker Tire - Buckhannon, Upshur County, West Virginia

Contaminant of Concern	Exposure Point Concentration in Groundwater [1] (ug/L)	VFtrench [2] (L/m^3)	Exposure Point Concentration in Air [3] (mg/m^3)
Volatile Organics			
Benzene	294	6.65E-02	1.95E-02
Ethylbenzene	1533	5.72E-02	8.77E-02
Naphthalene	310	4.67E-02	1.45E-02
Toluene	4274	6.13E-02	2.62E-01
Xylenes (Total)	37	5.71E-02	2.14E-03

Notes:

[1] The groundwater source concentration is the groundwater EPC as presented in Table 3-2.

[2] Details of the VF_{trench} calculation are provided in Appendix C.

[3] Ambient air concentration is calculated as the groundwater source concentration multiplied by the VF.

TABLE 3-8
EXPOSURE POINT CONCENTRATIONS FOR CONTAMINANTS OF CONCERN IN INDOOR AIR - ONSITE SCENARIO
Alker Tire - Buckhannon, Upshur County, West Virginia

Contaminants of Concern	Soil Gas EPC [1] (mg/m^3)	TF_{ind} for Soil Gas to Indoor Air [2] (cm^3/cm^3)	Volatile EPC in Indoor Air [3] (mg/m^3)
Volatile Organics			
1,2,4-Trimethylbenzene	62.0	1.02E-04	6.32E-03
1,3,5-Trimethylbenzene	23.8	1.02E-04	2.42E-03
Benzene	1.22	1.14E-04	1.39E-04
Ethylbenzene	123	1.06E-04	1.30E-02
Isopropylbenzene	46.9	1.02E-04	4.77E-03
Naphthalene	9.95	1.02E-04	1.01E-03
n-Heptane	1500	1.04E-04	1.56E-01
n-Hexane	2920	1.08E-04	3.16E-01
Toluene	370	1.10E-04	4.07E-02
Xylenes (Total)	382	1.06E-04	4.05E-02

Notes:
[1] The soil vapor source concentration is the EPC for soil vapor as presented in Table 3-3.
[2] Details of Transport Factor (TF_{ind}) calculations are provided in Appendix D.
[3] Indoor air concentration is calculated as the soil gas concentration multiplied by the TF_{ind}.

TABLE 3-9
EXPOSURE POINT CONCENTRATIONS FOR CONTAMINANTS OF CONCERN IN INDOOR AIR - OFFSITE SCENARIO
Alker Tire - Buckhannon, Upshur County, West Virginia

Contaminants of Concern	Soil Gas EPC [1] (mg/m^3)	TF_{ind} for Soil Gas to Indoor Air [2] (cm^3/cm^3)	Volatile EPC in Indoor Air [3] (mg/m^3)
Volatile Organics			
1,2,4-Trimethylbenzene	19.3	9.52E-05	1.84E-03
1,3,5-Trimethylbenzene	9.79	9.49E-05	9.29E-04
Benzene	0.75	1.08E-04	8.15E-05
Ethylbenzene	84.3	9.95E-05	8.39E-03
Isopropylbenzene	1.80	9.50E-05	1.71E-04
Naphthalene	9.95	9.51E-05	9.46E-04
n-Heptane	22.6	9.76E-05	2.20E-03
n-Hexane	3280	1.02E-04	3.34E-01
Toluene	389	1.04E-04	4.04E-02
Xylenes (Total)	280	9.95E-05	2.78E-02

Notes:

[1] The soil vapor source concentration is the EPC for soil vapor as presented in Table 3-4.

[2] Details of Transport Factor (TF_{ind}) calculations are provided in Appendix D.

[3] Indoor air concentration is calculated as the soil gas concentration multiplied by the TF_{ind}.

TABLE 3-10
GENERAL FORMULA FOR CALCULATION OF CONTAMINANT INTAKES
Alker Tire - Buckhannon, Upshur County, West Virginia

Symbol	Factor	Units	Comments
C	Constituent Concentration	mg/kg, mg/L, mg/m^3	Concentration of constituent in environmental medium
CR	Contact Rate	mg/day, L/day, m^3/day	Receptor's rate of contact with environmental medium
EF	Exposure Frequency	days/year	Days per year that the receptor may be exposed
ED	Exposure Duration	years	Number of years during which receptor may be exposed
BW	Body Weight	kilograms	Intake is normalized for receptor's body weight
AT	Averaging Time	days	Period over which exposure is averaged

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

TABLE 3-11
DERMAL ABSORPTION FRACTIONS FOR CONTAMINANTS OF CONCERN IN SOIL
Alker Tire - Buckhannon, Upshur County, West Virginia

Contaminant of Concern	Dermal Absorption Fraction (unitless)	Source
VOCs		
1,2,4-Trimethylbenzene	NA	WVDEP (2014); USEPA (2004b) Section 3.2.2.4
1,3,5-Trimethylbenzene	NA	WVDEP (2014); USEPA (2004b) Section 3.2.2.4
Benzene	NA	WVDEP (2014); USEPA (2004b) Section 3.2.2.4
Naphthalene	0.13	WVDEP (2014); USEPA (2017)
Xylenes (total)	NA	WVDEP (2014); USEPA (2004b) Section 3.2.2.4

Notes:
NA - Not Available

TABLE 3-12

DERMAL PERMEABILITY COEFFICIENTS FOR CONTAMINANTS OF CONCERN IN GROUNDWATER
Alker Tire - Buckhannon, Upshur County, West Virginia

Contaminants of Concern	Dermal Permeability Coefficient (K_P) (cm/hr)	Source
Volatile Organics		
Benzene	1.49E-02	Chemical-Specific Parameters Supporting Table (USEPA, 2017)
Ethylbenzene	4.93E-02	Chemical-Specific Parameters Supporting Table (USEPA, 2017)
Naphthalene	4.66E-02	Chemical-Specific Parameters Supporting Table (USEPA, 2017)
Toluene	3.11E-02	Chemical-Specific Parameters Supporting Table (USEPA, 2017)
Xylenes (Total)	5.00E-02	Chemical-Specific Parameters Supporting Table (USEPA, 2017)

TABLE 3-13
FACTORS USED IN DOSE CALCULATIONS: INCIDENTAL INGESTION OF SOIL
Alker Tire - Buckhannon, Upshur County, West Virginia

Symbol	Exposure Factor	Outdoor Worker	Construction/Excavation Worker
CS	Constituent Concentration in Soil (mg/kg)	Constituent-Specific; see Table 3-1.	
IR	Soil Ingestion Rate	50 mg/day	330 mg/day
ABS	Gastrointestinal Absorption Factor	100% for all constituents.	
CF	Conversion Factor	1 x 10^{-6} kg/mg	1 x 10^{-6} kg/mg
EF	Exposure Frequency	250 days/year	30 days/year
ED	Exposure Duration	25 years	1 year
BW	Body Weight	70 kg	70 kg
AT	Averaging Time	9,125 days (NC) 25,550 days (C)	365 days (NC) 25,550 days (C)

Average Daily Dose (ADD) = CS x IR x ABS x CF x EF x ED x 1/BW x 1/AT(NC)

Lifetime Average Daily Dose (LADD) = CS x IR x ABS x CF x EF x ED x 1/BW x 1/AT(C)

(NC) - Non-carcinogenic Averaging Time
(C) - Carcinogenic Averaging Time

TABLE 3-14
FACTORS USED IN DOSE CALCULATIONS: DERMAL CONTACT WITH SOIL
Alker Tire - Buckhannon, Upshur County, West Virginia

Symbol	Exposure Factor	Outdoor Worker	Construction/Excavation Worker
CS	Constituent Concentration in Soil (mg/kg)	Constituent-Specific; see Table 3-1.	
CF	Conversion Factor	1×10^{-6} kg/mg	1×10^{-6} kg/mg
SA	Skin Surface Area	3,300 cm^2/day	3,300 cm^2/day
AF	Soil Adherence Factor	0.2 mg/cm^2	0.3 mg/cm^2
DAF	Dermal Absorption Fraction (unitless)	Constituent-Specific; see Table 3-11	
EF	Exposure Frequency	250 days/year	30 days/year
ED	Exposure Duration	25 years	1 year
BW	Body Weight	70 kg	70 kg
AT	Averaging Time	9,125 days (NC) 25,550 days (C)	365 days (NC) 25,550 days (C)

Average Daily Dose (ADD) = CS x CF x SA x AF x DAF x EF x ED x 1/BW x 1/AT(NC)

Lifetime Average Daily Dose (LADD) = CS x CF x SA x AF x DAF x EF x ED x 1/BW x 1/AT(C)

(NC) - Non-carcinogenic Averaging Time
(C) - Carcinogenic Averaging Time

TABLE 3-15
FACTORS USED TO CALCULATE THE EXPOSURE CONCENTRATION: INHALATION OF PARTICULATE AND VOLATILE EMISSIONS
Alker Tire - Buckhannon, Upshur County, West Virginia

Symbol	Exposure Factor	Outdoor Worker	Construction/Excavation Worker	Indoor Worker
CA	Constituent Concentration in Air (mg/m^3)	Constituent and Source-Specific; See Tables 3-5 to 3-9.		
ET	Exposure Time	8 hr/day	8 hr/day (soil) 2 hr/day (groundwater)	8 hr/day
EF	Exposure Frequency	250 days/year	30 days/year	250 days/year
ED	Exposure Duration	25 years	1 year	25 years
AT	Averaging Time	219,000 hours (NC) 613,200 hours (C)	8,760 hours (NC) 613,200 hours (C)	219,000 hours (NC) 613,200 hours (C)

Exposure Concentration (for Noncarcinogens) = CA x ET x EF x ED x 1/AT(NC)

Exposure Concentration (for Carcinogens) = CA x ET x EF x ED x 1/AT(C)

(NC) - Non-carcinogenic Averaging Time
(C) - Carcinogenic Averaging Time

TABLE 3-16
FACTORS USED IN DOSE CALCULATIONS: INCIDENTAL INGESTION OF GROUNDWATER
Alker Tire - Buckhannon, Upshur County, West Virginia

Symbol	Exposure Factor	Construction/Excavation Worker
CW	Constituent Concentration in Water (mg/L)	Constituent-specific; see Table 3-2.
IR_W	Water Ingestion Rate	0.05 L/day
EF	Exposure Frequency	30 days/year
ED	Exposure Duration	1 year
BW	Body Weight	70 kg
AT	Averaging Time	365 days (NC) 25,550 days (C)

Average Daily Dose (ADD) = $CW \times IR_W \times EF \times ED \times 1/BW \times 1/AT(NC)$

Lifetime Average Daily Dose (LADD) = $CW \times IR_W \times EF \times ED \times 1/BW \times 1/AT(C)$

(NC) - Non-carcinogenic Averaging Time
(C) - Carcinogenic Averaging Time

TABLE 3-17
FACTORS USED IN DOSE CALCULATIONS: DERMAL CONTACT WITH GROUNDWATER
Alker Tire - Buckhannon, Upshur County, West Virginia

Symbol	Exposure Factor	Construction/Excavation Worker
CW	Constituent Concentration in Water (mg/L)	Constituent-specific; see Table 3-2.
CF	Conversion Factor	1 x 10^{-3} L/cm^3
SA	Skin Surface Area	3,300 cm^2
K_P	Dermal Permeability Coefficient (cm/hr)	Constituent-specific; see Table 3-12.
ET	Exposure Time	2 hrs/day
EF	Exposure Frequency	30 days/year
ED	Exposure Duration	1 year
BW	Body Weight	70 kg
AT	Averaging Time	365 days (NC) 25,550 days (C)

Average Daily Dose (ADD) = CW x CF x SA x Kp x ET x EF x ED x 1/BW x 1/AT(NC)

Lifetime Average Daily Dose (LADD) = CW x CF x SA x Kp x ET x EF x ED x 1/BW x 1/AT(C)

(NC) - Non-carcinogenic Averaging Time
(C) - Carcinogenic Averaging Time

TABLE 4-1
TOXICITY VALUES FOR CONTAMINANTS OF CONCERN
Alker Tire - Buckhannon, Upshur County, West Virginia

Contaminant of Concern	Target System / Critical Effect	Chronic Oral Reference Dose (mg/kg-day)	Oral Cancer Slope Factor $(mg/kg\text{-}day)^{-1}$	Absorption Efficiency Factor	Chronic Dermal Reference Dose [1] (mg/kg-day)	Dermal Cancer Slope Factor [2] $(mg/kg\text{-}day)^{-1}$	Inhalation Reference Conc. (mg/m^3)	Inhalation Unit Risk Factor $(ug/m^3)^{-1}$
Volatile Organics								
1,2,4-Trimethylbenzene	developmental, hematologic, nervous, respiratory	1.0E-02 I	NA	1	1.0E-02	NA	6.0E-02 I	NA
1,3,5-Trimethylbenzene	developmental, nervous	1.0E-02 I	NA	1	1.0E-02	NA	6.0E-02 I	NA
Benzene	immune	4.0E-03 I	5.5E-02 I	1	4.0E-03	5.5E-02	3.0E-02 I	7.8E-06 I
Ethylbenzene	developmental, hepatic, urinary	1.0E-01 I	1.1E-02 C	1	1.0E-01	1.1E-02	1.0E+00 I	2.5E-06 C
Isopropylbenzene	endocrine, urinary	1.0E-01 I	NA	1	1.0E-01	NA	4.0E-01 I	NA
Naphthalene	whole body (weight), nervous, respiratory	2.0E-02 I	NA	1	2.0E-02	NA	3.0E-03 i	3.4E-05 C
n-Heptane	auditory	3.0E-04 X	NA	1	3.0E-04	NA	4.0E-01 P	NA
n-Hexane	nervous	NA	NA	1	NA	NA	7.0E-01 I	NA
Toluene	nervous, urinary	8.0E-02 I	NA	1	8.0E-02	NA	5.0E+00 I	NA
Xylenes (Total)	nervous	2.0E-01 I	NA	1	2.0E-01	NA	1.0E-01 I	NA

Notes:
[1] Dermal RfDs are calculated by multiplying the oral RfDs by the fractional absorption value, in accordance with USEPA (2004b).
[2] Dermal CSFs are calculated by dividing the oral CSFs by the fractional absorption value, in accordance with USEPA (2004b).
(I) - Integrated Risk Information System (IRIS; USEPA, 2018b)
(P) - Provisional Peer Reviewed Toxicity Values (PPRTV; USEPA, 2018c).
(C) - Value from California EPA, as presented by USEPA (2017).
(X) - Provisional Peer Reviewed Toxicity Values Appendix (PPRTV; USEPA, 2018c).
NA - USEPA-derived toxicity values are not available for this particular exposure route or endpoint.

TABLE 5-1
SUMMARY OF THEORETICAL EXCESS LIFETIME CANCER RISKS, NONCANCER HAZARD INDICES AND FETAL BLOOD LEAD LEVELS FOR ALL RECEPTORS
Alker Tire - Buckhannon, Upshur County, West Virginia

Receptor	Exposure Pathways	Noncancer Hazard Index	Theoretical Excess Lifetime Cancer Risk	Fetal Blood Lead Level
Outdoor Worker	Incidental Ingestion of Surface Soil Dermal Contact with Surface Soil Inhalation of Particulate & Volatile Emissions	0.000019	8.1E-10	- -
Construction/Excavation Worker	Incidental Ingestion of Surface and Subsurface Soil Dermal Contact with Surface and Subsurface Soil Inhalation of Particulate & Volatile Emissions from Soil Incidental Ingestion of Groundwater Dermal Contact with Groundwater Inhalation of Volatile Emissions from Groundwater	0.16	2.6E-07	1.45
Onsite Indoor Worker	Inhalation of Volatiles in Indoor Air	0.40	5.6E-06	- -
Offsite Indoor Worker	Inhalation of Volatiles in Indoor Air	0.26	4.4E-06	- -

Notes:
Appendix E presents a detailed breakdown of the risk calculations by pathway and constituent.
- - = Lead is not a COC for this exposure medium.
NA - No toxicity values are available for this endpoint or exposure pathway.

TABLE 5-2
THEORETICAL EXCESS LIFETIME CANCER RISK AND NONCANCER HAZARD INDEX FOR THE OUTDOOR WORKER
Alker Tire - Buckhannon, Upshur County, West Virginia

Constituent	Noncancer Hazard Index	Theoretical Excess Lifetime Cancer Risk
Volatile Organics		
1,2,4-Trimethylbenzene	0.0000033	NA
1,3,5-Trimethylbenzene*	NA	NA
Benzene	0.00001	8.1E-10
Naphthalene*	NA	NA
Xylenes (Total)	0.0000059	NA
Pathway Summary	**0.000019**	**8.1E-10**

Notes:
NA - Toxicity values are not available for this endpoint or exposure pathway
* 1,3,5-Trimethylbenzene and naphthalene were not detected in the surface soil data set.

TABLE 5-3
THEORETICAL EXCESS LIFETIME CANCER RISK AND NONCANCER HAZARD INDEX FOR THE CONSTRUCTION/EXCAVATION WORKER
Alker Tire - Buckhannon, Upshur County, West Virginia

Constituent	Noncancer Hazard Index	Theoretical Excess Lifetime Cancer Risk
Volatile Organics		
1,2,4-Trimethylbenzene	0.025	NA
1,3,5-Trimethylbenzene	0.0044	NA
Benzene	0.024	7.6E-08
Ethylbenzene	0.0074	1.3E-07
Naphthalene	0.049	6.1E-08
Toluene	0.016	NA
Xylenes (total)	0.033	NA
Pathway Summary	**0.16**	**2.6E-07**

Notes:
NA = Toxicity values are not available for this endpoint or exposure pathway.

TABLE 5-4
THEORETICAL EXCESS LIFETIME CANCER RISK AND NONCANCER HAZARD INDEX FOR THE ONSITE INDOOR WORKER
Alker Tire - Buckhannon, Upshur County, West Virginia

Constituent	Noncancer Hazard Index	Theoretical Excess Lifetime Cancer Risk
Volatile Organics		
1,2,4-Trimethylbenzene	0.024	NA
1,3,5-Trimethylbenzene	0.0092	NA
Benzene	0.0011	8.83E-08
Ethylbenzene	0.003	2.66E-06
Isopropylbenzene	0.0027	NA
Naphthalene	0.077	2.81E-06
n-Heptane	0.089	NA
n-Hexane	0.10	NA
Toluene	0.0019	NA
Xylenes (Total)	0.092	NA
Pathway Summary	**0.40**	**5.6E-06**

Notes:
NA = Toxicity values are not available for this endpoint or exposure pathway.

TABLE 5-5
THEORETICAL EXCESS LIFETIME CANCER RISK AND NONCANCER HAZARD INDEX FOR THE OFFSITE INDOOR WORKER
Alker Tire - Buckhannon, Upshur County, West Virginia

Constituent	Noncancer Hazard Index	Theoretical Excess Lifetime Cancer Risk
Volatile Organics		
1,2,4-Trimethylbenzene	0.007	NA
1,3,5-Trimethylbenzene	0.0035	NA
Benzene	0.00062	5.19E-08
Ethylbenzene	0.0019	1.71E-06
Isopropylbenzene	0.000098	NA
Naphthalene	0.072	2.62E-06
n-Heptane	0.0013	NA
n-Hexane	0.11	NA
Toluene	0.0018	NA
Xylenes (Total)	0.064	NA
Pathway Summary	**0.26**	**4.4E-06**

Notes:
NA = Toxicity values are not available for this endpoint or exposure pathway.

TABLE 5-6
CALCULATED BLOOD LEAD CONCENTRATIONS FOR THE CONSTRUCTION/EXCAVATION WORKER
Alker Tire - Buckhannon, Upshur County, West Virginia

Equations:

$$PbB_{adult,central} = PbB_{adult,0} + (PbW \times BKSF \times IR_W \times AF_W \times EF_W) / AT$$

$$PbB_{adult,0.95} = PbB_{adult,central} \times GSDi^{1.645}$$

$$PbB_{fetal,0.95} = PbB_{adult,0.95} \times R_{fetal/maternal}$$

Symbol	Input Parameter	Value	
$PbB_{adult,0}$	Baseline blood lead concentration	0.60	µg/dL
PbW	Average water lead concentration	37.47	ug/L
BKSF	Biokinetic slope factor	0.4	[µg/dL] / [µg/day]
IR_W	Intake rate of water	0.050	L/day
AF_W	Absolute absorption fraction	0.2	unitless
EF_W	Exposure frequency - water	30	days/year
AT	Averaging time	365	days/year
GSDi	Geometric standard deviation	1.8	unitless
$R_{fetal/maternal}$	Transfer factor	0.9	unitless

	Calculated Results	Value	
$PbB_{adult,central}$	Blood lead level: Adult, central tendency	0.61	µg/dL
$PbB_{adult,0.95}$	Blood lead level: Adult, 95th Percentile	1.61	µg/dL
$PbB_{fetal,0.95}$	Blood lead level: Fetus, 95th Percentile	1.45	µg/dL

APPENDIX A

ANALYTICAL DATA USED IN THE RISK ASSESSMENT AND LABORATORY DATA VALIDATION REPORTS FOR DATA COLLECTED IN 2018

TABLE A-1 **Soil Analytical Data**
Alker Tire - Buckhannon, Upshur County, West Virginia

Constituent	Sample Identification / Sample Depth (feet) / Sample Date / Sample Type / Surface/Subsurface / CAS No.	SB-1A (0-2)	SB-1B (10-12)	SB-2A (0-2)	SB-2B (10-12)	SB-3A (0-2)	SB-3B (6-8)	SB-4A (0-2)
	Sample Depth (feet)	0-2	10-12	0-2	10-12	0-2	6-8	0-2
	Sample Date	2/15/2006	2/15/2006	2/15/2006	2/15/2006	2/15/2006	2/15/2006	2/15/2006
	Sample Type	Investigation Onsite	Investigation Onsite	Investigation Onsite	Investigation Onsite	Investigation Onsite	Investigation Onsite	Investigation Onsite
	Surface/Subsurface	Surface	Subsurface	Surface	Subsurface	Surface	Subsurface	Surface
	CAS No.							
Volatile Organics (mg/kg) Method SW8260B								
1,1,1,2-Tetrachloroethane	630206	< 0.004	< 10	< 0.004	< 10	< 0.004	< 0.04	< 0.004
1,1,1-Trichloroethane	71556	< 0.004	< 10	< 0.004	< 10	< 0.004	< 0.04	< 0.004
1,1,2,2-Tetrachloroethane	79345	< 0.004	< 10	< 0.004	< 10	< 0.004	< 0.04	< 0.004
1,1,2-Trichloroethane	79005	< 0.004	< 10	< 0.004	< 10	< 0.004	< 0.04	< 0.004
1,1-Dichloroethane	75343	< 0.004	< 10	< 0.004	< 10	< 0.004	< 0.04	< 0.004
1,1-Dichloroethene	75354	< 0.004	< 10	< 0.004	< 10	< 0.004	< 0.04	< 0.004
1,1-Dichloropropene	563586	< 0.004	< 10	< 0.004	< 10	< 0.004	< 0.04	< 0.004
1,2,3-Trichlorobenzene	87616	< 0.004	< 10	< 0.004	< 10	< 0.004	< 0.04	< 0.004
1,2,3-Trichloropropane	96184	< 0.004	< 10	< 0.004	< 10	< 0.004	< 0.04	< 0.004
1,2,4-Trichlorobenzene	120821	< 0.004	< 10	< 0.004	< 10	< 0.004	< 0.04	< 0.004
1,2,4-Trimethylbenzene	95636	0.0054	804	< 0.004	748	0.0108	< 0.04	< 0.004
1,2-Dibromo-3-chloropropane	96128	< 0.004	< 10	< 0.004	< 10	< 0.004	< 0.04	< 0.004
1,2-Dibromoethane	106934	< 0.004	< 10	< 0.004	< 10	< 0.004	< 0.04	< 0.004
1,2-Dichlorobenzene	95501	< 0.004	< 10	< 0.004	< 10	< 0.004	< 0.04	< 0.004
1,2-Dichloroethane	107062	< 0.004	< 10	< 0.004	< 10	< 0.004	< 0.04	< 0.004
1,2-Dichloroethene (Total)	540590	NA	NA	NA	NA	NA	NA	NA
1,2-Dichloropropane	78875	< 0.004	< 10	< 0.004	< 10	< 0.004	< 0.04	< 0.004
1,3,5-Trimethylbenzene	108678	< 0.004	216	< 0.004	126	< 0.004	< 0.04	< 0.004
1,3-Dichlorobenzene	541731	< 0.004	< 10	< 0.004	< 10	< 0.004	< 0.04	< 0.004
1,3-Dichloropropane	142289	< 0.004	< 10	< 0.004	< 10	< 0.004	< 0.04	< 0.004
1,4-Dichlorobenzene	106467	< 0.004	< 10	< 0.004	< 10	< 0.004	< 0.04	< 0.004
2,2-Dichloropropane	594207	< 0.004	< 10	< 0.004	< 10	< 0.004	< 0.04	< 0.004
2-Butanone (MEK)	78933	< 0.04	< 100	< 0.04	< 100	< 0.04	< 0.4	< 0.04
2-Chlorotoluene	95498	< 0.004	< 10	< 0.004	< 10	< 0.004	< 0.04	< 0.004
2-Hexanone	591786	< 0.04	< 100	< 0.04	< 100	< 0.04	< 0.4	< 0.04
4-Chlorotoluene	106434	< 0.004	< 10	< 0.004	< 10	< 0.004	< 0.04	< 0.004
4-Isopropyltoluene	99876	< 0.004	< 10	< 0.004	< 10	< 0.004	< 0.04	< 0.004
4-Methyl-2-pentanone	108101	< 0.04	< 100	< 0.04	< 100	< 0.04	< 0.4	< 0.04
Acetone	67641	< 0.08	< 200	< 0.08	< 200	< 0.08	< 0.8	< 0.08
Acrolein	107028	< 0.04	< 100	< 0.04	< 100	< 0.04	< 0.4	< 0.04
Acrylonitrile	107131	< 0.04	< 100	< 0.04	< 100	< 0.04	< 0.4	< 0.04
Benzene	71432	< 0.004	< 10	< 0.004	< 10	< 0.004	< 0.04	< 0.004
Bromobenzene	108861	< 0.004	< 10	< 0.004	< 10	< 0.004	< 0.04	< 0.004
Bromochloromethane	74975	< 0.004	< 10	< 0.004	< 10	< 0.004	< 0.04	< 0.004
Bromodichloromethane	75274	< 0.004	< 10	< 0.004	< 10	< 0.004	< 0.04	< 0.004
Bromoform	75252	< 0.004	< 10	< 0.004	< 10	< 0.004	< 0.04	< 0.004
Bromomethane	74839	< 0.004	< 10	< 0.004	< 10	< 0.004	< 0.04	< 0.004
Carbon disulfide	75150	< 0.04	< 100	< 0.04	< 100	< 0.04	< 0.4	< 0.04
Carbon tetrachloride	56235	< 0.004	< 10	< 0.004	< 10	< 0.004	< 0.04	< 0.004
Chlorobenzene	108907	< 0.004	< 10	< 0.004	< 10	< 0.004	< 0.04	< 0.004

TABLE A-1 **Soil Analytical Data**
Alker Tire - Buckhannon, Upshur County, West Virginia

Constituent	CAS No.	SB-1A (0-2)	SB-1B (10-12)	SB-2A (0-2)	SB-2B (10-12)	SB-3A (0-2)	SB-3B (6-8)	SB-4A (0-2)
	Sample Depth (feet)	0-2	10-12	0-2	10-12	0-2	6-8	0-2
	Sample Date	2/15/2006	2/15/2006	2/15/2006	2/15/2006	2/15/2006	2/15/2006	2/15/2006
	Sample Type	Investigation Onsite	Investigation Onsite	Investigation Onsite	Investigation Onsite	Investigation Onsite	Investigation Onsite	Investigation Onsite
	Surface/Subsurface	Surface	Subsurface	Surface	Subsurface	Surface	Subsurface	Surface
Volatile Organics (ug/L) (Continued)								
Chloroethane	75003	< 0.004	< 10	< 0.004	< 10	< 0.004	< 0.04	< 0.004
Chloroform	67663	< 0.004	< 10	< 0.004	< 10	< 0.004	< 0.04	< 0.004
Chloromethane	74873	< 0.004	< 10	< 0.004	< 10	< 0.004	< 0.04	< 0.004
cis-1,2-Dichloroethene	156592	< 0.004	< 10	< 0.004	< 10	< 0.004	< 0.04	< 0.004
cis-1,3-Dichloropropene	542756	< 0.004	< 10	< 0.004	< 10	< 0.004	< 0.04	< 0.004
Dibromochloromethane	124481	< 0.004	< 10	< 0.004	< 10	< 0.004	< 0.04	< 0.004
Dibromomethane	74953	< 0.004	< 10	< 0.004	< 10	< 0.004	< 0.04	< 0.004
Dichlorodifluoromethane	75718	< 0.004	< 10	< 0.004	< 10	< 0.004	< 0.04	< 0.004
Ethylbenzene	100414	< 0.004	234	< 0.004	97.6	0.0057	< 0.04	< 0.004
Hexachlorobutadiene	87683	< 0.004	< 10	< 0.004	< 10	< 0.004	< 0.04	< 0.004
Iodomethane	74884	< 0.04	< 100	< 0.04	< 100	< 0.04	< 0.4	< 0.04
Isopropylbenzene	98828	< 0.004	107	< 0.004	40.8	< 0.004	< 0.04	< 0.004
Methyl tert-butyl ether	1634044	< 0.04	< 50	< 0.04	< 50	< 0.04	< 0.4	< 0.04
Methylene Chloride	75092	< 0.004	< 10	< 0.004	< 10	< 0.004	< 0.04	< 0.004
Naphthalene	91203	< 0.004	151	< 0.004	106	< 0.004	< 0.04	< 0.004
n-Butylbenzene	104518	< 0.004	89.7	< 0.004	53.3	< 0.004	< 0.04	< 0.004
n-Propylbenzene	103651	< 0.004	134	< 0.004	75.5	< 0.004	< 0.04	< 0.004
sec-Butylbenzene	135988	< 0.004	< 10	< 0.004	< 10	< 0.004	< 0.04	< 0.004
Styrene	100425	< 0.004	< 10	< 0.004	< 10	< 0.004	< 0.04	< 0.004
tert-Butylbenzene	98066	< 0.004	< 10	< 0.004	< 10	< 0.004	< 0.04	< 0.004
Tetrachloroethene (PCE)	127184	< 0.004	< 10	< 0.004	< 10	< 0.004	< 0.04	< 0.004
Toluene	108883	0.0102	209	0.0046	20.5	0.0122	< 0.04	0.0041
trans-1,2-Dichloroethene	156605	< 0.004	< 10	< 0.004	< 10	< 0.004	< 0.04	< 0.004
trans-1,3-Dichloropropene	10061026	< 0.004	< 10	< 0.004	< 10	< 0.004	< 0.04	< 0.004
Trichloroethene(TCE)	79016	< 0.004	< 10	< 0.004	< 10	< 0.004	< 0.04	< 0.004
Trichlorofluoromethane	75694	< 0.004	< 10	< 0.004	< 10	< 0.004	< 0.04	< 0.004
Vinyl acetate	108054	< 0.04	< 100	< 0.04	< 100	< 0.04	< 0.4	< 0.04
Vinyl chloride	75014	< 0.004	< 10	< 0.004	< 10	< 0.004	< 0.04	< 0.004
m,p-Xylene	- -	0.0208	660	< 0.008	441	0.0193	< 0.08	< 0.008
o-Xylene	95476	0.0096	234	< 0.004	145	0.0073	< 0.04	< 0.004
Xylenes (total)	1330207	0.0304	894	< 0.008	586	0.0266	< 0.08	< 0.008
Volatile Organics (mg/Kg) Method SW8021B								
Methyl tert-butyl ether	1634044	NA	NA	NA	NA	NA	NA	NA
Benzene	71432	NA	NA	NA	NA	NA	NA	NA
Toluene	108883	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	100414	NA	NA	NA	NA	NA	NA	NA
m,p-Xylene	- -	NA	NA	NA	NA	NA	NA	NA
o-Xylene	95476	NA	NA	NA	NA	NA	NA	NA
Xylenes (Total)*	1330207	NA	NA	NA	NA	NA	NA	NA

Risk-Based Remedies
RBR Consulting, Inc.

TABLE A-1 **Soil Analytical Data**
Alker Tire - Buckhannon, Upshur County, West Virginia

Sample Identification		SB-1A (0-2)	SB-1B (10-12)	SB-2A (0-2)	SB-2B (10-12)	SB-3A (0-2)	SB-3B (6-8)	SB-4A (0-2)
Sample Depth (feet)		0-2	10-12	0-2	10-12	0-2	6-8	0-2
Sample Date		2/15/2006	2/15/2006	2/15/2006	2/15/2006	2/15/2006	2/15/2006	2/15/2006
Sample Type		Investigation Onsite	Investigation Onsite	Investigation Onsite	Investigation Onsite	Investigation Onsite	Investigation Onsite	Investigation Onsite
Surface/Subsurface		Surface	Subsurface	Surface	Subsurface	Surface	Subsurface	Surface
Constituent	**CAS No.**							
Semi-Volatile Organics (mg/Kg)								
1,2,4-Trichlorobenzene	120821	NA	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	95501	NA	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	541731	NA	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	106467	NA	NA	NA	NA	NA	NA	NA
2,4,5-Trichlorophenol	95954	NA	NA	NA	NA	NA	NA	NA
2,4,6-Trichlorophenol	88062	NA	NA	NA	NA	NA	NA	NA
2,4-Dichlorophenol	120832	NA	NA	NA	NA	NA	NA	NA
2,4-Dimethylphenol	105679	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrophenol	51285	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	121142	NA	NA	NA	NA	NA	NA	NA
2,6-Dinitrotoluene	606202	NA	NA	NA	NA	NA	NA	NA
2-Chloronaphthalene	91587	NA	NA	NA	NA	NA	NA	NA
2-Chlorophenol	95578	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	91576	NA	NA	NA	NA	NA	NA	NA
2-Methylphenol (o-cresol)	95487	NA	NA	NA	NA	NA	NA	NA
2-Nitroaniline	88744	NA	NA	NA	NA	NA	NA	NA
2-Nitrophenol	88755	NA	NA	NA	NA	NA	NA	NA
3&4-Methylphenol (m,p-Cresol)	- -	NA	NA	NA	NA	NA	NA	NA
3,3-Dichlorobenzidine	91941	NA	NA	NA	NA	NA	NA	NA
3-Nitroaniline		NA	NA	NA	NA	NA	NA	NA
4,6-dinitro-2-methyl phenol	534521	NA	NA	NA	NA	NA	NA	NA
4-Bromophenyl-phenylether	101553	NA	NA	NA	NA	NA	NA	NA
4-chloro-3-methylphenol	59507	NA	NA	NA	NA	NA	NA	NA
4-Chloroaniline	106478	NA	NA	NA	NA	NA	NA	NA
4-Chlorophenyl Phenyl Ether	7005723	NA	NA	NA	NA	NA	NA	NA
4-Nitroaniline	100016	NA	NA	NA	NA	NA	NA	NA
4-Nitrophenol	100027	NA	NA	NA	NA	NA	NA	NA
Acenaphthene	83329	NA	NA	NA	NA	NA	NA	NA
Acenaphthene	83329	< 0.00321	0.104	< 0.00329	0.0652	< 0.00329	< 0.0033	< 0.0033
Acenaphthylene	208968	NA	NA	NA	NA	NA	NA	NA
Acenaphthylene	208968	0.0039	< 0.00327	< 0.00329	< 0.00328	< 0.00329	< 0.0033	< 0.0033
Anthracene	120127	< 0.00321	0.0403	< 0.00329	0.0139	< 0.00329	< 0.0033	< 0.0033
Benzo (g,h,i) perylene	191242	0.0198	0.0109	0.0093	< 0.00328	0.0183	< 0.0033	< 0.0033
Benzo(a)anthracene	56553	0.0244	0.0307	0.0133	0.0103	0.0156	< 0.0033	< 0.0033
Benzo(a)pyrene	50328	0.0237	0.0211	0.00598	< 0.00328	0.0229	< 0.0033	< 0.0033
Benzo(b)fluoranthene	205992	0.0305	0.0135	0.0093	< 0.00328	0.0269	< 0.0033	< 0.0033
Benzo(k)fluoranthene	207089	0.0214	0.0158	0.00664	< 0.00328	0.0209	< 0.0033	< 0.0033
Benzyl alcohol	100516	NA	NA	NA	NA	NA	NA	NA
bis(2-chloroethoxy) methane	111911	NA	NA	NA	NA	NA	NA	NA
bis(2-chloroethyl) ether	111444	NA	NA	NA	NA	NA	NA	NA
bis(2-chloroisopropyl) ether	108601	NA	NA	NA	NA	NA	NA	NA
bis(2-ethylhexyl) phthalate	117817	NA	NA	NA	NA	NA	NA	NA
Butyl benzyl phthalate	85687	NA	NA	NA	NA	NA	NA	NA

TABLE A-1 **Soil Analytical Data**
Alker Tire - Buckhannon, Upshur County, West Virginia

	Sample Identification	SB-1A (0-2)	SB-1B (10-12)	SB-2A (0-2)	SB-2B (10-12)	SB-3A (0-2)	SB-3B (6-8)	SB-4A (0-2)
	Sample Depth (feet)	0-2	10-12	0-2	10-12	0-2	6-8	0-2
	Sample Date	2/15/2006	2/15/2006	2/15/2006	2/15/2006	2/15/2006	2/15/2006	2/15/2006
	Sample Type	Investigation Onsite	Investigation Onsite	Investigation Onsite	Investigation Onsite	Investigation Onsite	Investigation Onsite	Investigation Onsite
	Surface/Subsurface	Surface	Subsurface	Surface	Subsurface	Surface	Subsurface	Surface
Constituent	**CAS No.**							
Semi-Volatile Organics (mg/Kg) (Continued)								
Chrysene	218019	0.0292	0.0135	0.00565	0.00331	0.0199	< 0.0033	< 0.0033
Dibenz(a,h) anthracene	53703	0.00649	0.00363	< 0.00329	< 0.00328	0.00598	< 0.0033	< 0.0033
Dibenzofuran	132649	NA	NA	NA	NA	NA	NA	NA
Diethyl Phthalate	84662	NA	NA	NA	NA	NA	NA	NA
Dimethyl Phthalate	131113	NA	NA	NA	NA	NA	NA	NA
di-n-Butyl Phthalate	84742	NA	NA	NA	NA	NA	NA	NA
di-n-Octyl Phthalate	117840	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	206440	0.0497	0.0733	0.00631	0.0129	0.0389	< 0.0033	< 0.0033
Fluorene	86737	0.00422	0.0812	< 0.00329	0.0354	< 0.00329	< 0.0033	< 0.0033
Hexachlorobenzene	118741	NA	NA	NA	NA	NA	NA	NA
Hexachlorobutadiene	87683	NA	NA	NA	NA	NA	NA	NA
Hexachlorocyclopentadiene	77474	NA	NA	NA	NA	NA	NA	NA
Hexachloroethane	67721	NA	NA	NA	NA	NA	NA	NA
Indeno (1,2,3-cd) pyrene	193395	0.0133	0.0066	0.00598	< 0.00328	0.0169	< 0.0033	< 0.0033
Isophorone	78591	NA	NA	NA	NA	NA	NA	NA
Naphthalene	91203	0.0315	5.78	0.0645	9.3	0.0329	< 0.0033	< 0.0033
Nitrobenzene	98953	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodi-n-Propylamine	621647	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine	86306	NA	NA	NA	NA	NA	NA	NA
Pentachlorophenol	87865	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	85018	0.0669	0.137	0.0173	0.0556	0.0379	< 0.0033	< 0.0033
Phenol	108952	NA	NA	NA	NA	NA	NA	NA
Pyrene	129000	0.0386	0.0647	0.00565	0.0222	0.0322	< 0.0033	< 0.0033
Glycols, Total (mg/Kg)								
Diethylene Glycol	111466	< 200	NA	< 200	NA	< 200	NA	< 200
Ethylene Glycol	107211	< 200	NA	< 200	NA	< 200	NA	< 200
Propylene Glycol		NA	NA	NA	NA	NA	NA	NA
Triethylene Glycol	112276	< 200	NA	< 200	NA	< 200	NA	< 200
Total Petroleum Hydrocarbons (mg/Kg)								
TPHDRO	TPHDRO	10.6	82.9	< 3.97	716	14.3	< 3.95	< 3.98
TPHGRO	TPHGRO	< 5	9930	< 5	5200	< 5	< 5	< 4.85
TPHORO	TPHORO	< 9.92	< 23.8	< 9.92	< 24.5	< 10	< 9.88	< 9.96

TABLE A-1

Soil Analytical Data
Alker Tire - Buckhannon, Upshur County, West Virginia

Sample Identification		SB-1A (0-2)		SB-1B (10-12)		SB-2A (0-2)		SB-2B (10-12)		SB-3A (0-2)		SB-3B (6-8)		SB-4A (0-2)
Sample Depth (feet)		0-2		10-12		0-2		10-12		0-2		6-8		0-2
Sample Date		2/15/2006		2/15/2006		2/15/2006		2/15/2006		2/15/2006		2/15/2006		2/15/2006
Sample Type		Investigation Onsite		Investigation Onsite		Investigation Onsite		Investigation Onsite		Investigation Onsite		Investigation Onsite		Investigation Onsite
Surface/Subsurface		Surface		Subsurface		Surface		Subsurface		Surface		Subsurface		Surface
Constituent	**CAS No.**													
Inorganics (mg/Kg)														
Arsenic	7440382		10.6	NA		8.5		NA		13.5		NA	<	5
Barium	7440393		125	NA		101		NA		179		NA		44.9
Cadmium	7440439	<	0.5	NA		7.64		NA		0.546		NA	<	0.5
Chromium	16065831		66.5	NA		36.4		NA		53.1		NA		35.3
Lead	7439921		17.6	NA		270		NA		280		NA		10
Mercury	7439976	<	0.05	NA		0.093		NA		0.458		NA	<	0.05
Selenium	7782492	<	5	NA	<	5		NA	<	5		NA	<	5
Silver	7440224	<	2.5	NA	<	2.5		NA		7.1		NA	<	2.5

Notes:
NA - Not Analyzed.
The laboratory detection limits for data collected in 2006 are based on Practical Quantitation Limits (PQLs);
the detection limits for data collected in 2018 are based on Reporting Limits (RLs).
J - Estimated Result.
1c - A matrix spike/matrix spike duplicate was not performed for this batch due to insufficient sample volume.
CH - The continuing calibration for this compound is outside of Pace Analytical acceptance limits. The results may be biased high.
* If not anlyzed directly, the result for xylenes (total) is calculated from the results for the o- and m&p isomers. See Text Section 2.4.1.

TABLE A-1 **Soil Analytical Data**
Alker Tire - Buckhannon, Upshur County, West Virginia

Constituent	Sample Identification / Sample Depth (feet) / Sample Date / Sample Type / Surface/Subsurface / CAS No.	SB-4B (10-12)	SB-5A (0-2)	SB-5B (10-12)	SB-6A (0-2)	SB-6B (10-12)	SB-7A (0-2)	SB-7B (6-8)
	Sample Depth (feet)	10-12	0-2	10-12	0-2	10-12	0-2	6-8
	Sample Date	2/15/2006	2/15/2006	2/15/2006	2/15/2006	2/15/2006	2/15/2006	2/15/2006
	Sample Type	Investigation Onsite	Investigation Onsite	Investigation Onsite	Investigation Onsite	Investigation Onsite	Investigation Onsite	Investigation Onsite
	Surface/Subsurface	Subsurface	Surface	Subsurface	Surface	Subsurface	Surface	Subsurface
	CAS No.							
Volatile Organics (mg/kg) Method SW8260B								
1,1,1,2-Tetrachloroethane	630206	< 5	< 0.004	< 0.5	< 0.004	< 0.004	< 0.004	< 0.004
1,1,1-Trichloroethane	71556	< 5	< 0.004	< 0.5	< 0.004	< 0.004	< 0.004	< 0.004
1,1,2,2-Tetrachloroethane	79345	< 5	< 0.004	< 0.5	< 0.004	< 0.004	< 0.004	< 0.004
1,1,2-Trichloroethane	79005	< 5	< 0.004	< 0.5	< 0.004	< 0.004	< 0.004	< 0.004
1,1-Dichloroethane	75343	< 5	< 0.004	< 0.5	< 0.004	< 0.004	< 0.004	< 0.004
1,1-Dichloroethene	75354	< 5	< 0.004	< 0.5	< 0.004	< 0.004	< 0.004	< 0.004
1,1-Dichloropropene	563586	< 5	< 0.004	< 0.5	< 0.004	< 0.004	< 0.004	< 0.004
1,2,3-Trichlorobenzene	87616	< 5	< 0.004	< 0.5	< 0.004	< 0.004	< 0.004	< 0.004
1,2,3-Trichloropropane	96184	< 5	< 0.004	< 0.5	< 0.004	< 0.004	< 0.004	< 0.004
1,2,4-Trichlorobenzene	120821	< 5	< 0.004	< 0.5	< 0.004	< 0.004	< 0.004	< 0.004
1,2,4-Trimethylbenzene	95636	120	< 0.004	< 0.5	< 0.004	< 0.004	< 0.004	< 0.004
1,2-Dibromo-3-chloropropane	96128	< 5	< 0.004	< 0.5	< 0.004	< 0.004	< 0.004	< 0.004
1,2-Dibromoethane	106934	< 5	< 0.004	< 0.5	< 0.004	< 0.004	< 0.004	< 0.004
1,2-Dichlorobenzene	95501	< 5	< 0.004	< 0.5	< 0.004	< 0.004	< 0.004	< 0.004
1,2-Dichloroethane	107062	< 5	< 0.004	< 0.5	< 0.004	< 0.004	< 0.004	< 0.004
1,2-Dichloroethene (Total)	540590	NA	NA	NA	NA	NA	NA	NA
1,2-Dichloropropane	78875	< 5	< 0.004	< 0.5	< 0.004	< 0.004	< 0.004	< 0.004
1,3,5-Trimethylbenzene	108678	36.7	< 0.004	< 0.5	< 0.004	< 0.004	< 0.004	< 0.004
1,3-Dichlorobenzene	541731	< 5	< 0.004	< 0.5	< 0.004	< 0.004	< 0.004	< 0.004
1,3-Dichloropropane	142289	< 5	< 0.004	< 0.5	< 0.004	< 0.004	< 0.004	< 0.004
1,4-Dichlorobenzene	106467	< 5	< 0.004	< 0.5	< 0.004	< 0.004	< 0.004	< 0.004
2,2-Dichloropropane	594207	< 5	< 0.004	< 0.5	< 0.004	< 0.004	< 0.004	< 0.004
2-Butanone (MEK)	78933	< 50	< 0.04	< 5	< 0.04	< 0.04	< 0.04	< 0.04
2-Chlorotoluene	95498	< 5	< 0.004	< 0.5	< 0.004	< 0.004	< 0.004	< 0.004
2-Hexanone	591786	< 50	< 0.04	< 5	< 0.04	< 0.04	< 0.04	< 0.04
4-Chlorotoluene	106434	< 5	< 0.004	< 0.5	< 0.004	< 0.004	< 0.004	< 0.004
4-Isopropyltoluene	99876	< 5	< 0.004	< 0.5	< 0.004	< 0.004	< 0.004	< 0.004
4-Methyl-2-pentanone	108101	< 50	< 0.04	< 5	< 0.04	< 0.04	< 0.04	< 0.04
Acetone	67641	< 100	< 0.08	< 10	< 0.08	< 0.08	< 0.08	< 0.08
Acrolein	107028	< 50	< 0.04	< 5	< 0.04	< 0.04	< 0.04	< 0.04
Acrylonitrile	107131	< 50	< 0.04	< 5	< 0.04	< 0.04	< 0.04	< 0.04
Benzene	71432	< 5	< 0.004	< 0.5	< 0.004	< 0.004	< 0.004	< 0.004
Bromobenzene	108861	< 5	< 0.004	< 0.5	< 0.004	< 0.004	< 0.004	< 0.004
Bromochloromethane	74975	< 5	< 0.004	< 0.5	< 0.004	< 0.004	< 0.004	< 0.004
Bromodichloromethane	75274	< 5	< 0.004	< 0.5	< 0.004	< 0.004	< 0.004	< 0.004
Bromoform	75252	< 5	< 0.004	< 0.5	< 0.004	< 0.004	< 0.004	< 0.004
Bromomethane	74839	< 5	< 0.004	< 0.5	< 0.004	< 0.004	< 0.004	< 0.004
Carbon disulfide	75150	< 50	< 0.06	< 5	< 0.04	< 0.04	< 0.04	< 0.04
Carbon tetrachloride	56235	< 5	< 0.004	< 0.5	< 0.004	< 0.004	< 0.004	< 0.004
Chlorobenzene	108907	< 5	< 0.004	< 0.5	< 0.004	< 0.004	< 0.004	< 0.004

TABLE A-1 **Soil Analytical Data**
Alker Tire - Buckhannon, Upshur County, West Virginia

Sample Identification		SB-4B (10-12)	SB-5A (0-2)	SB-5B (10-12)	SB-6A (0-2)	SB-6B (10-12)	SB-7A (0-2)	SB-7B (6-8)
Sample Depth (feet)		10-12	0-2	10-12	0-2	10-12	0-2	6-8
Sample Date		2/15/2006	2/15/2006	2/15/2006	2/15/2006	2/15/2006	2/15/2006	2/15/2006
Sample Type		Investigation Onsite	Investigation Onsite	Investigation Onsite	Investigation Onsite	Investigation Onsite	Investigation Onsite	Investigation Onsite
Surface/Subsurface		Subsurface	Surface	Subsurface	Surface	Subsurface	Surface	Subsurface
Constituent	**CAS No.**							
Volatile Organics (ug/L) (Continued)								
Chloroethane	75003	< 5	< 0.004	< 0.5	< 0.004	< 0.004	< 0.004	< 0.004
Chloroform	67663	< 5	< 0.004	< 0.5	< 0.004	< 0.004	< 0.004	< 0.004
Chloromethane	74873	< 5	< 0.004	< 0.5	< 0.004	< 0.004	< 0.004	< 0.004
cis-1,2-Dichloroethene	156592	< 5	< 0.004	< 0.5	< 0.004	< 0.004	< 0.004	< 0.004
cis-1,3-Dichloropropene	542756	< 5	< 0.004	< 0.5	< 0.004	< 0.004	< 0.004	< 0.004
Dibromochloromethane	124481	< 5	< 0.004	< 0.5	< 0.004	< 0.004	< 0.004	< 0.004
Dibromomethane	74953	< 5	< 0.004	< 0.5	< 0.004	< 0.004	< 0.004	< 0.004
Dichlorodifluoromethane	75718	< 5	< 0.004	< 0.5	< 0.004	< 0.004	< 0.004	< 0.004
Ethylbenzene	100414	27.6	< 0.004	< 0.5	< 0.004	< 0.004	< 0.004	< 0.004
Hexachlorobutadiene	87683	< 5	< 0.004	< 0.5	< 0.004	< 0.004	< 0.004	< 0.004
Iodomethane	74884	< 50	< 0.04	< 5	< 0.04	< 0.04	< 0.04	< 0.04
Isopropylbenzene	98828	22.8	< 0.004	< 0.5	< 0.004	< 0.004	< 0.004	< 0.004
Methyl tert-butyl ether	1634044	< 25	< 0.04	< 5	< 0.04	< 0.04	< 0.04	< 0.04
Methylene Chloride	75092	< 5	< 0.004	< 0.5	< 0.004	< 0.004	< 0.004	< 0.004
Naphthalene	91203	32.8	< 0.004	< 0.5	< 0.004	< 0.004	< 0.004	< 0.004
n-Butylbenzene	104518	19.7	< 0.004	< 0.5	< 0.004	< 0.004	< 0.004	< 0.004
n-Propylbenzene	103651	22.5	< 0.004	< 0.5	< 0.004	< 0.004	< 0.004	< 0.004
sec-Butylbenzene	135988	< 5	< 0.004	< 0.5	< 0.004	< 0.004	< 0.004	< 0.004
Styrene	100425	< 5	< 0.004	< 0.5	< 0.004	< 0.004	< 0.004	< 0.004
tert-Butylbenzene	98066	< 5	< 0.004	< 0.5	< 0.004	< 0.004	< 0.004	< 0.004
Tetrachloroethene (PCE)	127184	< 5	< 0.004	< 0.5	< 0.004	< 0.004	< 0.004	< 0.004
Toluene	108883	31.6	0.0056	< 0.5	0.0041	0.0065	< 0.004	< 0.004
trans-1,2-Dichloroethene	156605	< 5	< 0.004	< 0.5	< 0.004	< 0.004	< 0.004	< 0.004
trans-1,3-Dichloropropene	10061026	< 5	< 0.004	< 0.5	< 0.004	< 0.004	< 0.004	< 0.004
Trichloroethene(TCE)	79016	< 5	< 0.004	< 0.5	< 0.004	< 0.004	< 0.004	< 0.004
Trichlorofluoromethane	75694	< 5	< 0.004	< 0.5	< 0.004	< 0.004	< 0.004	< 0.004
Vinyl acetate	108054	< 50	< 0.04	< 5	< 0.04	< 0.04	< 0.04	< 0.04
Vinyl chloride	75014	< 5	< 0.004	< 0.5	< 0.004	< 0.004	< 0.004	< 0.004
m,p-Xylene	- -	118	< 0.008	< 1	< 0.008	< 0.008	< 0.008	< 0.008
o-Xylene	95476	45.8	< 0.004	< 0.5	< 0.004	< 0.004	< 0.004	< 0.004
Xylenes (total)	1330207	163.8	< 0.008	< 1	< 0.008	< 0.008	< 0.008	< 0.008
Volatile Organics (mg/Kg) Method SW8021B								
Methyl tert-butyl ether	1634044	NA	NA	NA	NA	NA	NA	NA
Benzene	71432	NA	NA	NA	NA	NA	NA	NA
Toluene	108883	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	100414	NA	NA	NA	NA	NA	NA	NA
m,p-Xylene	- -	NA	NA	NA	NA	NA	NA	NA
o-Xylene	95476	NA	NA	NA	NA	NA	NA	NA
Xylenes (Total)*	1330207	NA	NA	NA	NA	NA	NA	NA

Risk-Based Remedies
RBR Consulting, Inc.

TABLE A-1 **Soil Analytical Data**
Alker Tire - Buckhannon, Upshur County, West Virginia

Sample Identification		SB-4B (10-12)	SB-5A (0-2)	SB-5B (10-12)	SB-6A (0-2)	SB-6B (10-12)	SB-7A (0-2)	SB-7B (6-8)
Sample Depth (feet)		10-12	0-2	10-12	0-2	10-12	0-2	6-8
Sample Date		2/15/2006	2/15/2006	2/15/2006	2/15/2006	2/15/2006	2/15/2006	2/15/2006
Sample Type		Investigation Onsite	Investigation Onsite	Investigation Onsite	Investigation Onsite	Investigation Onsite	Investigation Onsite	Investigation Onsite
Surface/Subsurface		Subsurface	Surface	Subsurface	Surface	Subsurface	Surface	Subsurface
Constituent	**CAS No.**							
Semi-Volatile Organics (mg/Kg)								
1,2,4-Trichlorobenzene	120821	NA	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	95501	NA	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	541731	NA	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	106467	NA	NA	NA	NA	NA	NA	NA
2,4,5-Trichlorophenol	95954	NA	NA	NA	NA	NA	NA	NA
2,4,6-Trichlorophenol	88062	NA	NA	NA	NA	NA	NA	NA
2,4-Dichlorophenol	120832	NA	NA	NA	NA	NA	NA	NA
2,4-Dimethylphenol	105679	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrophenol	51285	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	121142	NA	NA	NA	NA	NA	NA	NA
2,6-Dinitrotoluene	606202	NA	NA	NA	NA	NA	NA	NA
2-Chloronaphthalene	91587	NA	NA	NA	NA	NA	NA	NA
2-Chlorophenol	95578	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	91576	NA	NA	NA	NA	NA	NA	NA
2-Methylphenol (o-cresol)	95487	NA	NA	NA	NA	NA	NA	NA
2-Nitroaniline	88744	NA	NA	NA	NA	NA	NA	NA
2-Nitrophenol	88755	NA	NA	NA	NA	NA	NA	NA
3&4-Methylphenol (m,p-Cresol)	- -	NA	NA	NA	NA	NA	NA	NA
3,3-Dichlorobenzidine	91941	NA	NA	NA	NA	NA	NA	NA
3-Nitroaniline		NA	NA	NA	NA	NA	NA	NA
4,6-dinitro-2-methyl phenol	534521	NA	NA	NA	NA	NA	NA	NA
4-Bromophenyl-phenylether	101553	NA	NA	NA	NA	NA	NA	NA
4-chloro-3-methylphenol	59507	NA	NA	NA	NA	NA	NA	NA
4-Chloroaniline	106478	NA	NA	NA	NA	NA	NA	NA
4-Chlorophenyl Phenyl Ether	7005723	NA	NA	NA	NA	NA	NA	NA
4-Nitroaniline	100016	NA	NA	NA	NA	NA	NA	NA
4-Nitrophenol	100027	NA	NA	NA	NA	NA	NA	NA
Acenaphthene	83329	NA	NA	NA	NA	NA	NA	NA
Acenaphthene	83329	< 0.00324	< 0.00327	< 0.00329	< 0.00328	< 0.0033	< 0.00322	< 0.00329
Acenaphthylene	208968	NA	NA	NA	NA	NA	NA	NA
Acenaphthylene	208968	< 0.00324	< 0.00327	< 0.00329	< 0.00328	< 0.0033	0.00326	< 0.00329
Anthracene	120127	< 0.00324	< 0.00327	< 0.00329	< 0.00328	< 0.0033	< 0.00322	< 0.00329
Benzo (g,h,i) perylene	191242	< 0.00324	< 0.00327	< 0.00329	< 0.00328	< 0.0033	0.0225	< 0.00329
Benzo(a)anthracene	56553	< 0.00324	< 0.00327	< 0.00329	< 0.00328	< 0.0033	0.0199	< 0.00329
Benzo(a)pyrene	50328	< 0.00324	< 0.00327	< 0.00329	< 0.00328	< 0.0033	0.028	< 0.00329
Benzo(b)fluoranthene	205992	< 0.00324	< 0.00327	< 0.00329	< 0.00328	< 0.0033	0.0316	< 0.00329
Benzo(k)fluoranthene	207089	< 0.00324	0.00396	< 0.00329	< 0.00328	< 0.0033	0.0267	< 0.00329
Benzyl alcohol	100516	NA	NA	NA	NA	NA	NA	NA
bis(2-chloroethoxy) methane	111911	NA	NA	NA	NA	NA	NA	NA
bis(2-chloroethyl) ether	111444	NA	NA	NA	NA	NA	NA	NA
bis(2-chloroisopropyl) ether	108601	NA	NA	NA	NA	NA	NA	NA
bis(2-ethylhexyl) phthalate	117817	NA	NA	NA	NA	NA	NA	NA
Butyl benzyl phthalate	85687	NA	NA	NA	NA	NA	NA	NA

TABLE A-1 **Soil Analytical Data**
Alker Tire - Buckhannon, Upshur County, West Virginia

	Sample Identification	SB-4B (10-12)	SB-5A (0-2)	SB-5B (10-12)	SB-6A (0-2)	SB-6B (10-12)	SB-7A (0-2)	SB-7B (6-8)
	Sample Depth (feet)	10-12	0-2	10-12	0-2	10-12	0-2	6-8
	Sample Date	2/15/2006	2/15/2006	2/15/2006	2/15/2006	2/15/2006	2/15/2006	2/15/2006
	Sample Type	Investigation Onsite	Investigation Onsite	Investigation Onsite	Investigation Onsite	Investigation Onsite	Investigation Onsite	Investigation Onsite
	Surface/Subsurface	Subsurface	Surface	Subsurface	Surface	Subsurface	Surface	Subsurface
Constituent	**CAS No.**							
Semi-Volatile Organics (mg/Kg) (Continued)								
Chrysene	218019	< 0.00324	< 0.00327	< 0.00329	< 0.00328	< 0.0033	0.0254	< 0.00329
Dibenz(a,h) anthracene	53703	< 0.00324	< 0.00327	< 0.00329	< 0.00328	< 0.0033	0.00749	< 0.00329
Dibenzofuran	132649	NA	NA	NA	NA	NA	NA	NA
Diethyl Phthalate	84662	NA	NA	NA	NA	NA	NA	NA
Dimethyl Phthalate	131113	NA	NA	NA	NA	NA	NA	NA
di-n-Butyl Phthalate	84742	NA	NA	NA	NA	NA	NA	NA
di-n-Octyl Phthalate	117840	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	206440	< 0.00324	0.00462	< 0.00329	< 0.00328	< 0.0033	0.059	< 0.00329
Fluorene	86737	< 0.00324	< 0.00327	< 0.00329	< 0.00328	< 0.0033	< 0.00322	< 0.00329
Hexachlorobenzene	118741	NA	NA	NA	NA	NA	NA	NA
Hexachlorobutadiene	87683	NA	NA	NA	NA	NA	NA	NA
Hexachlorocyclopentadiene	77474	NA	NA	NA	NA	NA	NA	NA
Hexachloroethane	67721	NA	NA	NA	NA	NA	NA	NA
Indeno (1,2,3-cd) pyrene	193395	< 0.00324	< 0.00327	< 0.00329	< 0.00328	< 0.0033	0.0212	< 0.00329
Isophorone	78591	NA	NA	NA	NA	NA	NA	NA
Naphthalene	91203	0.00458	< 0.00327	< 0.00329	< 0.00328	< 0.0033	0.0134	< 0.00329
Nitrobenzene	98953	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodi-n-Propylamine	621647	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine	86306	NA	NA	NA	NA	NA	NA	NA
Pentachlorophenol	87865	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	85018	< 0.00324	< 0.00327	< 0.00329	< 0.00328	< 0.0033	0.0397	< 0.00329
Phenol	108952	NA	NA	NA	NA	NA	NA	NA
Pyrene	129000	< 0.00324	0.00396	< 0.00329	< 0.00328	< 0.0033	0.0531	< 0.00329
Glycols, Total (mg/Kg)								
Diethylene Glycol	111466	NA	< 200	NA	< 200	NA	< 200	NA
Ethylene Glycol	107211	NA	< 200	NA	< 200	NA	< 200	NA
Propylene Glycol		NA	NA	NA	NA	NA	NA	NA
Triethylene Glycol	112276	NA	< 200	NA	< 200	NA	< 200	NA
Total Petroleum Hydrocarbons (mg/Kg)								
TPHDRO	TPHDRO	< 3.97	< 3.95	< 3.94	< 3.94	< 3.91	< 3.98	< 3.89
TPHGRO	TPHGRO	3320	< 5	< 5	< 5	< 4.8	< 5	< 5
TPHORO	TPHORO	< 9.92	< 9.88	< 9.84	< 9.84	< 9.77	< 9.96	< 9.73

TABLE A-1

Soil Analytical Data
Alker Tire - Buckhannon, Upshur County, West Virginia

Sample Identification		SB-4B (10-12)		SB-5A (0-2)		SB-5B (10-12)		SB-6A (0-2)		SB-6B (10-12)		SB-7A (0-2)		SB-7B (6-8)
Sample Depth (feet)		10-12		0-2		10-12		0-2		10-12		0-2		6-8
Sample Date		2/15/2006		2/15/2006		2/15/2006		2/15/2006		2/15/2006		2/15/2006		2/15/2006
Sample Type		Investigation Onsite		Investigation Onsite		Investigation Onsite		Investigation Onsite		Investigation Onsite		Investigation Onsite		Investigation Onsite
Surface/Subsurface		Subsurface		Surface		Subsurface		Surface		Subsurface		Surface		Subsurface
Constituent	CAS No.													
Inorganics (mg/Kg)														
Arsenic	7440382	NA	<	5		NA	<	5		NA		11.6		NA
Barium	7440393	NA		80.2		NA		63.5		NA		191		NA
Cadmium	7440439	NA	<	0.5		NA	<	0.5		NA	<	0.5		NA
Chromium	16065831	NA		26.4		NA		21.1		NA		33.5		NA
Lead	7439921	NA		90.9		NA		31.2		NA		152		NA
Mercury	7439976	NA	<	0.05		NA	<	0.05		NA		0.267		NA
Selenium	7782492	NA	<	5		NA	<	5		NA	<	5		NA
Silver	7440224	NA	<	2.5		NA	<	2.5		NA	<	2.5		NA

Notes:
NA - Not Analyzed.
The laboratory detection limits for data collected in 2006 are based on Practical Quantitation Limits (PQLs);
the detection limits for data collected in 2018 are based on Reporting Limits (RLs).
J - Estimated Result.
1c - A matrix spike/matrix spike duplicate was not performed for this batch due to insufficient sample volume.
CH - The continuing calibration for this compound is outside of Pace Analytical acceptance limits. The results may be biased high.
* If not anlyzed directly, the result for xylenes (total) is calculated from the results for the o- and m&p isomers. See Text Section 2.4.1.

TABLE A-1 **Soil Analytical Data**
Alker Tire - Buckhannon, Upshur County, West Virginia

	Sample Identification	SB-8A (0-2)	SB-8B (6-8)	SB-9A (0-2)	SB-9B (10-12)	SB-10A (0-2)	SB-10B (10-12)	SB-11A (0-2)
	Sample Depth (feet)	0-2	6-8	0-2	10-12	0-2	10-12	0-2
	Sample Date	2/16/2006	2/16/2006	2/16/2006	2/16/2006	2/16/2006	2/16/2006	2/16/2006
	Sample Type	Investigation Onsite	Investigation Onsite	Investigation Onsite	Investigation Onsite	Investigation Onsite	Investigation Onsite	Investigation Onsite
	Surface/Subsurface	Surface	Subsurface	Surface	Subsurface	Surface	Subsurface	Surface
Constituent	**CAS No.**							
Volatile Organics (mg/kg) Method SW8260B								
1,1,1,2-Tetrachloroethane	630206	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004
1,1,1-Trichloroethane	71556	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004
1,1,2,2-Tetrachloroethane	79345	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004
1,1,2-Trichloroethane	79005	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004
1,1-Dichloroethane	75343	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004
1,1-Dichloroethene	75354	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004
1,1-Dichloropropene	563586	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004
1,2,3-Trichlorobenzene	87616	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004
1,2,3-Trichloropropane	96184	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004
1,2,4-Trichlorobenzene	120821	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004
1,2,4-Trimethylbenzene	95636	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004
1,2-Dibromo-3-chloropropane	96128	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004
1,2-Dibromoethane	106934	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004
1,2-Dichlorobenzene	95501	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004
1,2-Dichloroethane	107062	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004
1,2-Dichloroethene (Total)	540590	NA	NA	NA	NA	NA	NA	NA
1,2-Dichloropropane	78875	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004
1,3,5-Trimethylbenzene	108678	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004
1,3-Dichlorobenzene	541731	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004
1,3-Dichloropropane	142289	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004
1,4-Dichlorobenzene	106467	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004
2,2-Dichloropropane	594207	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004
2-Butanone (MEK)	78933	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04
2-Chlorotoluene	95498	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004
2-Hexanone	591786	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04
4-Chlorotoluene	106434	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004
4-Isopropyltoluene	99876	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004
4-Methyl-2-pentanone	108101	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04
Acetone	67641	0.156	0.173	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08
Acrolein	107028	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04
Acrylonitrile	107131	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04
Benzene	71432	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004
Bromobenzene	108861	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004
Bromochloromethane	74975	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004
Bromodichloromethane	75274	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004
Bromoform	75252	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004
Bromomethane	74839	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004
Carbon disulfide	75150	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04
Carbon tetrachloride	56235	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004
Chlorobenzene	108907	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004

TABLE A-1 Soil Analytical Data
Alker Tire - Buckhannon, Upshur County, West Virginia

Sample Identification		SB-8A (0-2)	SB-8B (6-8)	SB-9A (0-2)	SB-9B (10-12)	SB-10A (0-2)	SB-10B (10-12)	SB-11A (0-2)
Sample Depth (feet)		0-2	6-8	0-2	10-12	0-2	10-12	0-2
Sample Date		2/16/2006	2/16/2006	2/16/2006	2/16/2006	2/16/2006	2/16/2006	2/16/2006
Sample Type		Investigation Onsite	Investigation Onsite	Investigation Onsite	Investigation Onsite	Investigation Onsite	Investigation Onsite	Investigation Onsite
Surface/Subsurface		Surface	Subsurface	Surface	Subsurface	Surface	Subsurface	Surface
Constituent	**CAS No.**							
Volatile Organics (ug/L) (Continued)								
Chloroethane	75003	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004
Chloroform	67663	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004
Chloromethane	74873	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004
cis-1,2-Dichloroethene	156592	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004
cis-1,3-Dichloropropene	542756	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004
Dibromochloromethane	124481	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004
Dibromomethane	74953	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004
Dichlorodifluoromethane	75718	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004
Ethylbenzene	100414	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004
Hexachlorobutadiene	87683	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004
Iodomethane	74884	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04
Isopropylbenzene	98828	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004
Methyl tert-butyl ether	1634044	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04
Methylene Chloride	75092	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004
Naphthalene	91203	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004
n-Butylbenzene	104518	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004
n-Propylbenzene	103651	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004
sec-Butylbenzene	135988	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004
Styrene	100425	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004
tert-Butylbenzene	98066	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004
Tetrachloroethene (PCE)	127184	0.0084	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004
Toluene	108883	0.0048	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004
trans-1,2-Dichloroethene	156605	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004
trans-1,3-Dichloropropene	10061026	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004
Trichloroethene(TCE)	79016	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004
Trichlorofluoromethane	75694	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004
Vinyl acetate	108054	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04
Vinyl chloride	75014	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004
m,p-Xylene	- -	< 0.008	< 0.008	< 0.008	< 0.008	< 0.008	< 0.008	< 0.008
o-Xylene	95476	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004
Xylenes (total)	1330207	< 0.008	< 0.008	< 0.008	< 0.008	< 0.008	< 0.008	< 0.008
Volatile Organics (mg/Kg) Method SW8021B								
Methyl tert-butyl ether	1634044	NA	NA	NA	NA	NA	NA	NA
Benzene	71432	NA	NA	NA	NA	NA	NA	NA
Toluene	108883	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	100414	NA	NA	NA	NA	NA	NA	NA
m,p-Xylene	- -	NA	NA	NA	NA	NA	NA	NA
o-Xylene	95476	NA	NA	NA	NA	NA	NA	NA
Xylenes (Total)*	1330207	NA	NA	NA	NA	NA	NA	NA

TABLE A-1

Soil Analytical Data
Alker Tire - Buckhannon, Upshur County, West Virginia

Constituent	CAS No.	SB-8A (0-2)	SB-8B (6-8)	SB-9A (0-2)	SB-9B (10-12)	SB-10A (0-2)	SB-10B (10-12)	SB-11A (0-2)
Sample Depth (feet)		0-2	6-8	0-2	10-12	0-2	10-12	0-2
Sample Date		2/16/2006	2/16/2006	2/16/2006	2/16/2006	2/16/2006	2/16/2006	2/16/2006
Sample Type		Investigation Onsite	Investigation Onsite	Investigation Onsite	Investigation Onsite	Investigation Onsite	Investigation Onsite	Investigation Onsite
Surface/Subsurface		Surface	Subsurface	Surface	Subsurface	Surface	Subsurface	Surface
Semi-Volatile Organics (mg/Kg)								
1,2,4-Trichlorobenzene	120821	NA	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	95501	NA	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	541731	NA	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	106467	NA	NA	NA	NA	NA	NA	NA
2,4,5-Trichlorophenol	95954	NA	NA	NA	NA	NA	NA	NA
2,4,6-Trichlorophenol	88062	NA	NA	NA	NA	NA	NA	NA
2,4-Dichlorophenol	120832	NA	NA	NA	NA	NA	NA	NA
2,4-Dimethylphenol	105679	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrophenol	51285	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	121142	NA	NA	NA	NA	NA	NA	NA
2,6-Dinitrotoluene	606202	NA	NA	NA	NA	NA	NA	NA
2-Chloronaphthalene	91587	NA	NA	NA	NA	NA	NA	NA
2-Chlorophenol	95578	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	91576	NA	NA	NA	NA	NA	NA	NA
2-Methylphenol (o-cresol)	95487	NA	NA	NA	NA	NA	NA	NA
2-Nitroaniline	88744	NA	NA	NA	NA	NA	NA	NA
2-Nitrophenol	88755	NA	NA	NA	NA	NA	NA	NA
3&4-Methylphenol (m,p-Cresol)	- -	NA	NA	NA	NA	NA	NA	NA
3,3-Dichlorobenzidine	91941	NA	NA	NA	NA	NA	NA	NA
3-Nitroaniline		NA	NA	NA	NA	NA	NA	NA
4,6-dinitro-2-methyl phenol	534521	NA	NA	NA	NA	NA	NA	NA
4-Bromophenyl-phenylether	101553	NA	NA	NA	NA	NA	NA	NA
4-chloro-3-methylphenol	59507	NA	NA	NA	NA	NA	NA	NA
4-Chloroaniline	106478	NA	NA	NA	NA	NA	NA	NA
4-Chlorophenyl Phenyl Ether	7005723	NA	NA	NA	NA	NA	NA	NA
4-Nitroaniline	100016	NA	NA	NA	NA	NA	NA	NA
4-Nitrophenol	100027	NA	NA	NA	NA	NA	NA	NA
Acenaphthene	83329	NA	NA	NA	NA	NA	NA	NA
Acenaphthene	83329	< 0.00329	< 0.00328	< 0.00329	< 0.00322	< 0.00325	< 0.00322	< 0.0325
Acenaphthylene	208968	NA	NA	NA	NA	NA	NA	NA
Acenaphthylene	208968	< 0.00329	< 0.00328	< 0.00329	< 0.00322	< 0.00325	< 0.00322	< 0.0325
Anthracene	120127	< 0.00329	< 0.00328	< 0.00329	< 0.00322	< 0.00325	< 0.00322	< 0.0325
Benzo (g,h,i) perylene	191242	< 0.00329	< 0.00328	< 0.00329	< 0.00322	0.00787	< 0.00322	0.0918
Benzo(a)anthracene	56553	< 0.00329	< 0.00328	< 0.00329	< 0.00322	0.0164	< 0.00322	0.157
Benzo(a)pyrene	50328	< 0.00329	< 0.00328	< 0.00329	< 0.00322	0.00787	< 0.00322	0.0918
Benzo(b)fluoranthene	205992	< 0.00329	< 0.00328	< 0.00329	< 0.00322	0.00852	< 0.00322	0.0721
Benzo(k)fluoranthene	207089	< 0.00329	< 0.00328	< 0.00329	< 0.00322	0.00918	< 0.00322	0.0754
Benzyl alcohol	100516	NA	NA	NA	NA	NA	NA	NA
bis(2-chloroethoxy) methane	111911	NA	NA	NA	NA	NA	NA	NA
bis(2-chloroethyl) ether	111444	NA	NA	NA	NA	NA	NA	NA
bis(2-chloroisopropyl) ether	108601	NA	NA	NA	NA	NA	NA	NA
bis(2-ethylhexyl) phthalate	117817	NA	NA	NA	NA	NA	NA	NA
Butyl benzyl phthalate	85687	NA	NA	NA	NA	NA	NA	NA

TABLE A-1 — **Soil Analytical Data**
Alker Tire - Buckhannon, Upshur County, West Virginia

Constituent	CAS No.	SB-8A (0-2)	SB-8B (6-8)	SB-9A (0-2)	SB-9B (10-12)	SB-10A (0-2)	SB-10B (10-12)	SB-11A (0-2)
	Sample Depth (feet)	**0-2**	**6-8**	**0-2**	**10-12**	**0-2**	**10-12**	**0-2**
	Sample Date	**2/16/2006**	**2/16/2006**	**2/16/2006**	**2/16/2006**	**2/16/2006**	**2/16/2006**	**2/16/2006**
	Sample Type	**Investigation Onsite**	**Investigation Onsite**	**Investigation Onsite**	**Investigation Onsite**	**Investigation Onsite**	**Investigation Onsite**	**Investigation Onsite**
	Surface/Subsurface	**Surface**	**Subsurface**	**Surface**	**Subsurface**	**Surface**	**Subsurface**	**Surface**
Semi-Volatile Organics (mg/Kg) (Continued)								
Chrysene	218019	< 0.00329	< 0.00328	< 0.00329	< 0.00322	0.00426	< 0.00322	0.0426
Dibenz(a,h) anthracene	53703	< 0.00329	< 0.00328	< 0.00329	< 0.00322	< 0.00325	< 0.00322	< 0.0325
Dibenzofuran	132649	NA	NA	NA	NA	NA	NA	NA
Diethyl Phthalate	84662	NA	NA	NA	NA	NA	NA	NA
Dimethyl Phthalate	131113	NA	NA	NA	NA	NA	NA	NA
di-n-Butyl Phthalate	84742	NA	NA	NA	NA	NA	NA	NA
di-n-Octyl Phthalate	117840	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	206440	< 0.00329	< 0.00328	< 0.00329	< 0.00322	0.00754	< 0.00322	0.0787
Fluorene	86737	< 0.00329	< 0.00328	< 0.00329	< 0.00322	< 0.00325	< 0.00322	< 0.0325
Hexachlorobenzene	118741	NA	NA	NA	NA	NA	NA	NA
Hexachlorobutadiene	87683	NA	NA	NA	NA	NA	NA	NA
Hexachlorocyclopentadiene	77474	NA	NA	NA	NA	NA	NA	NA
Hexachloroethane	67721	NA	NA	NA	NA	NA	NA	NA
Indeno (1,2,3-cd) pyrene	193395	< 0.00329	< 0.00328	< 0.00329	< 0.00322	0.00721	< 0.00322	0.0689
Isophorone	78591	NA	NA	NA	NA	NA	NA	NA
Naphthalene	91203	0.00332	< 0.00328	< 0.00329	< 0.00322	0.0269	< 0.00322	< 0.0325
Nitrobenzene	98953	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodi-n-Propylamine	621647	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine	86306	NA	NA	NA	NA	NA	NA	NA
Pentachlorophenol	87865	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	85018	< 0.00329	< 0.00328	< 0.00329	< 0.00322	0.0151	< 0.00322	0.0328
Phenol	108952	NA	NA	NA	NA	NA	NA	NA
Pyrene	129000	< 0.00329	< 0.00328	< 0.00329	< 0.00322	0.0059	< 0.00322	0.0689
Glycols, Total (mg/Kg)								
Diethylene Glycol	111466	< 200	NA	< 200	NA	< 200	NA	< 200
Ethylene Glycol	107211	< 200	NA	< 200	NA	< 200	NA	< 200
Propylene Glycol		NA	NA	NA	NA	NA	NA	NA
Triethylene Glycol	112276	< 200	NA	< 200	NA	< 200	NA	< 200
Total Petroleum Hydrocarbons (mg/Kg)								
TPHDRO	TPHDRO	< 3.89	< 4	< 3.98	< 3.91	8.83	< 3.98	21.2
TPHGRO	TPHGRO	< 5	< 5	< 5	< 5	< 5	< 5	< 4.85
TPHORO	TPHORO	11.4	< 10	< 9.96	< 9.77	14.4	< 9.96	40.7

TABLE A-1

Soil Analytical Data
Alker Tire - Buckhannon, Upshur County, West Virginia

Constituent	CAS No.	SB-8A (0-2)	SB-8B (6-8)	SB-9A (0-2)	SB-9B (10-12)	SB-10A (0-2)	SB-10B (10-12)	SB-11A (0-2)
Sample Depth (feet)		0-2	6-8	0-2	10-12	0-2	10-12	0-2
Sample Date		2/16/2006	2/16/2006	2/16/2006	2/16/2006	2/16/2006	2/16/2006	2/16/2006
Sample Type		Investigation Onsite	Investigation Onsite	Investigation Onsite	Investigation Onsite	Investigation Onsite	Investigation Onsite	Investigation Onsite
Surface/Subsurface		Surface	Subsurface	Surface	Subsurface	Surface	Subsurface	Surface
Inorganics (mg/Kg)								
Arsenic	7440382	< 5	NA	< 5	NA	8.19	NA	< 5
Barium	7440393	52.4	NA	46.3	NA	127	NA	62.3
Cadmium	7440439	< 0.5	NA	< 0.5	NA	< 0.5	NA	< 0.5
Chromium	16065831	26.5	NA	56.1	NA	25.3	NA	30.7
Lead	7439921	13.9	NA	10.2	NA	162	NA	76.2
Mercury	7439976	< 0.05	NA	< 0.05	NA	0.885	NA	0.08
Selenium	7782492	< 5	NA	< 5	NA	< 5	NA	< 5
Silver	7440224	< 2.5	NA	< 2.5	NA	< 2.5	NA	< 2.5

Notes:
NA - Not Analyzed.
The laboratory detection limits for data collected in 2006 are based on Practical Quantitation Limits (PQLs);
the detection limits for data collected in 2018 are based on Reporting Limits (RLs).
J - Estimated Result.
1c - A matrix spike/matrix spike duplicate was not performed for this batch due to insufficient sample volume.
CH - The continuing calibration for this compound is outside of Pace Analytical acceptance limits. The results may be biased high.
* If not anlyzed directly, the result for xylenes (total) is calculated from the results for the o- and m&p isomers. See Text Section 2.4.1.

TABLE A-1 **Soil Analytical Data**
Alker Tire - Buckhannon, Upshur County, West Virginia

	Sample Identification	SB-11B (10-12)	SB-12 (12-14)	SB-13 (14-16)	SB-14 (12-14)	SB-15 (10-12)	SB-16 (12-14)	SG-1 (0-2)
	Sample Depth (feet)	10-12	12-14	14-16	12-14	10-12	12-14	0-2
	Sample Date	2/16/2006	8/7/2006	8/7/2006	8/7/2006	8/7/2006	8/7/2006	4/5/2018
	Sample Type	Investigation Onsite	Investigation Offsite	Investigation Offsite	Investigation Offsite	Investigation Offsite	Investigation Offsite	Investigation Onsite
	Surface/Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Surface
Constituent	**CAS No.**							
Volatile Organics (mg/kg) Method SW8260B								
1,1,1,2-Tetrachloroethane	630206	< 0.004	< 0.0052	< 0.0042	< 0.0051	< 0.0054	< 1.2	NA
1,1,1-Trichloroethane	71556	< 0.004	< 0.0052	< 0.0042	< 0.0051	< 0.0054	< 1.2	< 0.0051 1c
1,1,2,2-Tetrachloroethane	79345	< 0.004	< 0.0052	< 0.0042	< 0.0051	< 0.0054	< 1.2	< 0.0051 1c
1,1,2-Trichloroethane	79005	< 0.004	< 0.0052	< 0.0042	< 0.0051	< 0.0054	< 1.2	< 0.0051 1c
1,1-Dichloroethane	75343	< 0.004	< 0.0052	< 0.0042	< 0.0051	< 0.0054	< 1.2	< 0.0051 1c
1,1-Dichloroethene	75354	< 0.004	< 0.0052	< 0.0042	< 0.0051	< 0.0054	< 1.2	< 0.0051 1c
1,1-Dichloropropene	563586	< 0.004	< 0.0052	< 0.0042	< 0.0051	< 0.0054	< 1.2	NA
1,2,3-Trichlorobenzene	87616	< 0.004	< 0.0052	< 0.0042	< 0.0051	< 0.0054	< 1.2	NA
1,2,3-Trichloropropane	96184	< 0.004	< 0.0052	< 0.0042	< 0.0051	< 0.0054	< 1.2	NA
1,2,4-Trichlorobenzene	120821	< 0.004	< 0.0052	< 0.0042	< 0.0051	< 0.0054	< 1.2	NA
1,2,4-Trimethylbenzene	95636	< 0.004	< 0.0052	0.0489	< 0.0051	0.0043 J	572	NA
1,2-Dibromo-3-chloropropane	96128	< 0.004	< 0.0052	< 0.0042	< 0.0051	< 0.0054	< 1.2	NA
1,2-Dibromoethane	106934	< 0.004	< 0.0052	< 0.0042	< 0.0051	< 0.0054	< 1.2	NA
1,2-Dichlorobenzene	95501	< 0.004	< 0.0052	< 0.0042	< 0.0051	< 0.0054	< 1.2	< 0.0051 1c
1,2-Dichloroethane	107062	< 0.004	< 0.0052	< 0.0042	< 0.0051	< 0.0054	< 1.2	< 0.0051 1c
1,2-Dichloroethene (Total)	540590	NA	NA	NA	NA	NA	NA	< 0.0102
1,2-Dichloropropane	78875	< 0.004	< 0.0052	< 0.0042	< 0.0051	< 0.0054	< 1.2	< 0.0051 1c
1,3,5-Trimethylbenzene	108678	< 0.004	< 0.0052	0.0303	< 0.0051	< 0.0054	168	NA
1,3-Dichlorobenzene	541731	< 0.004	< 0.0052	< 0.0042	< 0.0051	< 0.0054	< 1.2	< 0.0051 1c
1,3-Dichloropropane	142289	< 0.004	< 0.0052	< 0.0042	< 0.0051	< 0.0054	< 1.2	NA
1,4-Dichlorobenzene	106467	< 0.004	< 0.0052	< 0.0042	< 0.0051	< 0.0054	< 1.2	< 0.0051 1c
2,2-Dichloropropane	594207	< 0.004	< 0.0052	< 0.0042	< 0.0051	< 0.0054	< 1.2	NA
2-Butanone (MEK)	78933	< 0.04	< 0.0519	< 0.042	< 0.0506	< 0.0542	< 12	< 0.0102 1c
2-Chlorotoluene	95498	< 0.004	< 0.0052	< 0.0042	< 0.0051	< 0.0054	< 1.2	NA
2-Hexanone	591786	< 0.04	< 0.0519	< 0.042	< 0.0506	< 0.0542	< 12	< 0.0102 1c
4-Chlorotoluene	106434	< 0.004	< 0.0052	< 0.0042	< 0.0051	< 0.0054	< 1.2	NA
4-Isopropyltoluene	99876	< 0.004	< 0.0052	< 0.0042	< 0.0051	< 0.0054	19	NA
4-Methyl-2-pentanone	108101	< 0.04	< 0.0519	< 0.042	< 0.0506	< 0.0542	< 12	< 0.0102 1c
Acetone	67641	< 0.08	0.0396 J	< 0.084	0.0268 J	< 0.108	< 24.1	< 0.0102 1c
Acrolein	107028	< 0.04	< 0.0519	< 0.042	< 0.0506	< 0.0542	< 12	NA
Acrylonitrile	107131	< 0.04	< 0.0519	< 0.042	< 0.0506	< 0.0542	< 12	NA
Benzene	71432	< 0.004	< 0.0052	0.141	< 0.0051	0.013	57.6	0.0052 1c
Bromobenzene	108861	< 0.004	< 0.0052	< 0.0042	< 0.0051	< 0.0054	< 1.2	NA
Bromochloromethane	74975	< 0.004	< 0.0052	< 0.0042	< 0.0051	< 0.0054	< 1.2	NA
Bromodichloromethane	75274	< 0.004	< 0.0052	< 0.0042	< 0.0051	< 0.0054	< 1.2	< 0.0051 1c
Bromoform	75252	< 0.004	< 0.0052	< 0.0042	< 0.0051	< 0.0054	< 1.2	< 0.0051 1c
Bromomethane	74839	< 0.004	< 0.0052	< 0.0042	< 0.0051	< 0.0054	< 1.2	< 0.0051 1c
Carbon disulfide	75150	< 0.04	< 0.0519	< 0.042	< 0.0506	< 0.0542	< 12	< 0.0051 1c
Carbon tetrachloride	56235	< 0.004	< 0.0052	< 0.0042	< 0.0051	< 0.0054	< 1.2	< 0.0051 1c
Chlorobenzene	108907	< 0.004	< 0.0052	< 0.0042	< 0.0051	< 0.0054	< 1.2	< 0.0051 1c

Risk-Based Remedies
RBR Consulting, Inc.

TABLE A-1 — **Soil Analytical Data**
Alker Tire - Buckhannon, Upshur County, West Virginia

Sample Identification		SB-11B (10-12)	SB-12 (12-14)	SB-13 (14-16)	SB-14 (12-14)	SB-15 (10-12)	SB-16 (12-14)	SG-1 (0-2)
Sample Depth (feet)		10-12	12-14	14-16	12-14	10-12	12-14	0-2
Sample Date		2/16/2006	8/7/2006	8/7/2006	8/7/2006	8/7/2006	8/7/2006	4/5/2018
Sample Type		Investigation Onsite	Investigation Offsite	Investigation Offsite	Investigation Offsite	Investigation Offsite	Investigation Offsite	Investigation Onsite
Surface/Subsurface		Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Surface
Constituent	**CAS No.**							
Volatile Organics (ug/L) (Continued)								
Chloroethane	75003	< 0.004	< 0.0052	< 0.0042	< 0.0051	< 0.0054	< 1.2	< 0.0051 1c
Chloroform	67663	< 0.004	< 0.0052	< 0.0042	< 0.0051	< 0.0054	< 1.2	< 0.0051 1c
Chloromethane	74873	< 0.004	< 0.0052	< 0.0042	< 0.0051	< 0.0054	< 1.2	< 0.0051 1c
cis-1,2-Dichloroethene	156592	< 0.004	< 0.0052	< 0.0042	< 0.0051	< 0.0054	< 1.2	< 0.0051 1c
cis-1,3-Dichloropropene	542756	< 0.004	< 0.0052	< 0.0042	< 0.0051	< 0.0054	< 1.2	< 0.0051 1c
Dibromochloromethane	124481	< 0.004	< 0.0052	< 0.0042	< 0.0051	< 0.0054	< 1.2	< 0.0051 1c
Dibromomethane	74953	< 0.004	< 0.0052	< 0.0042	< 0.0051	< 0.0054	< 1.2	NA
Dichlorodifluoromethane	75718	< 0.004	< 0.0052	< 0.0042	< 0.0051	< 0.0054	< 1.2	NA
Ethylbenzene	100414	< 0.004	< 0.0052	0.281	< 0.0051	0.004 J	185	< 0.0051 1c
Hexachlorobutadiene	87683	< 0.004	< 0.0052	< 0.0042	< 0.0051	< 0.0054	< 1.2	NA
Iodomethane	74884	< 0.04	< 0.0519	< 0.042	< 0.0506	< 0.0542	< 12	NA
Isopropylbenzene	98828	< 0.004	< 0.0052	0.0136	< 0.0051	< 0.0054	109	NA
Methyl tert-butyl ether	1634044	< 0.04	< 0.0519	< 0.042	< 0.0506	< 0.0542	< 12	< 0.0051 1c
Methylene Chloride	75092	< 0.004	< 0.0052	< 0.0042	< 0.0051	< 0.0054	5.47	< 0.0051 1c
Naphthalene	91203	< 0.004	0.0068	0.0414	< 0.0051	< 0.0054	283	NA
n-Butylbenzene	104518	< 0.004	< 0.0052	< 0.0042	< 0.0051	< 0.0054	< 1.2	NA
n-Propylbenzene	103651	< 0.004	< 0.0052	0.0166	< 0.0051	< 0.0054	100	NA
sec-Butylbenzene	135988	< 0.004	< 0.0052	< 0.0042	< 0.0051	< 0.0054	< 1.2	NA
Styrene	100425	< 0.004	< 0.0052	< 0.0042	< 0.0051	< 0.0054	< 1.2	< 0.0051 1c
tert-Butylbenzene	98066	< 0.004	< 0.0052	< 0.0042	< 0.0051	< 0.0054	< 1.2	NA
Tetrachloroethene (PCE)	127184	< 0.004	< 0.0052	< 0.0042	< 0.0051	< 0.0054	< 1.2	< 0.0051 1c
Toluene	108883	< 0.004	< 0.0052	0.0803	< 0.0051	0.0124	404	< 0.0051 1c
trans-1,2-Dichloroethene	156605	< 0.004	< 0.0052	< 0.0042	< 0.0051	< 0.0054	< 1.2	< 0.0051 1c
trans-1,3-Dichloropropene	10061026	< 0.004	< 0.0052	< 0.0042	< 0.0051	< 0.0054	< 1.2	< 0.0051 1c
Trichloroethene(TCE)	79016	< 0.004	< 0.0052	< 0.0042	< 0.0051	< 0.0054	< 1.2	< 0.0051 1c
Trichlorofluoromethane	75694	< 0.004	< 0.0052	< 0.0042	< 0.0051	< 0.0054	< 1.2	NA
Vinyl acetate	108054	< 0.04	< 0.0519	< 0.042	< 0.0506	< 0.0542	< 12	NA
Vinyl chloride	75014	< 0.004	< 0.0052	< 0.0042	< 0.0051	< 0.0054	< 1.2	< 0.0051 1c
m,p-Xylene	- -	< 0.008	< 0.0104	0.1	< 0.0101	0.0076 J	740	< 0.0102 1c
o-Xylene	95476	< 0.004	< 0.0052	0.0233	< 0.0051	0.0037 J	285	< 0.0051 1c
Xylenes (total)	1330207	< 0.008	< 0.0104	0.1233	< 0.0101	0.0113	1025	< 0.0153
Volatile Organics (mg/Kg) Method SW8021B								
Methyl tert-butyl ether	1634044	NA	< 0.0127	< 0.0104	< 0.0109	< 0.013	< 0.301	NA
Benzene	71432	NA	< 0.0064	0.0789	< 0.0054	0.0261	73.8	NA
Toluene	108883	NA	< 0.0064	0.0114	< 0.0054	0.0203	339	NA
Ethylbenzene	100414	NA	< 0.0064	0.18	< 0.0054	0.0077	128	NA
m,p-Xylene	- -	NA	< 0.0127	0.0109	< 0.0109	0.0086 J	474	NA
o-Xylene	95476	NA	< 0.0064	0.0059	< 0.0054	0.0044 J	202	NA
Xylenes (Total)*	1330207	NA	< 0.0127	0.0168	< 0.0109	0.013	676	NA

TABLE A-1 **Soil Analytical Data**
Alker Tire - Buckhannon, Upshur County, West Virginia

	Sample Identification	SB-11B (10-12)	SB-12 (12-14)	SB-13 (14-16)	SB-14 (12-14)	SB-15 (10-12)	SB-16 (12-14)	SG-1 (0-2)
	Sample Depth (feet)	10-12	12-14	14-16	12-14	10-12	12-14	0-2
	Sample Date	2/16/2006	8/7/2006	8/7/2006	8/7/2006	8/7/2006	8/7/2006	4/5/2018
	Sample Type	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation
		Onsite	Offsite	Offsite	Offsite	Offsite	Offsite	Onsite
	Surface/Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Surface
Constituent	**CAS No.**							
Semi-Volatile Organics (mg/Kg)								
1,2,4-Trichlorobenzene	120821	NA	NA	NA	NA	NA	NA	< 0.345
1,2-Dichlorobenzene	95501	NA	NA	NA	NA	NA	NA	< 0.345
1,3-Dichlorobenzene	541731	NA	NA	NA	NA	NA	NA	< 0.345
1,4-Dichlorobenzene	106467	NA	NA	NA	NA	NA	NA	< 0.345
2,4,5-Trichlorophenol	95954	NA	NA	NA	NA	NA	NA	< 0.863
2,4,6-Trichlorophenol	88062	NA	NA	NA	NA	NA	NA	< 0.345
2,4-Dichlorophenol	120832	NA	NA	NA	NA	NA	NA	< 0.345
2,4-Dimethylphenol	105679	NA	NA	NA	NA	NA	NA	< 0.345
2,4-Dinitrophenol	51285	NA	NA	NA	NA	NA	NA	< 0.345
2,4-Dinitrotoluene	121142	NA	NA	NA	NA	NA	NA	< 0.345
2,6-Dinitrotoluene	606202	NA	NA	NA	NA	NA	NA	< 0.345
2-Chloronaphthalene	91587	NA	NA	NA	NA	NA	NA	< 0.345
2-Chlorophenol	95578	NA	NA	NA	NA	NA	NA	< 0.345
2-Methylnaphthalene	91576	NA	NA	NA	NA	NA	NA	< 0.345
2-Methylphenol (o-cresol)	95487	NA	NA	NA	NA	NA	NA	< 0.345
2-Nitroaniline	88744	NA	NA	NA	NA	NA	NA	< 0.863
2-Nitrophenol	88755	NA	NA	NA	NA	NA	NA	< 0.345
3&4-Methylphenol (m,p-Cresol)	- -	NA	NA	NA	NA	NA	NA	< 0.69
3,3-Dichlorobenzidine	91941	NA	NA	NA	NA	NA	NA	< 0.345
3-Nitroaniline		NA	NA	NA	NA	NA	NA	< 0.863 CH
4,6-dinitro-2-methyl phenol	534521	NA	NA	NA	NA	NA	NA	< 0.345
4-Bromophenyl-phenylether	101553	NA	NA	NA	NA	NA	NA	< 0.345
4-chloro-3-methylphenol	59507	NA	NA	NA	NA	NA	NA	< 0.345
4-Chloroaniline	106478	NA	NA	NA	NA	NA	NA	< 0.345 CH
4-Chlorophenyl Phenyl Ether	7005723	NA	NA	NA	NA	NA	NA	< 0.345
4-Nitroaniline	100016	NA	NA	NA	NA	NA	NA	< 0.863
4-Nitrophenol	100027	NA	NA	NA	NA	NA	NA	< 0.345
Acenaphthene	83329	NA	NA	NA	NA	NA	NA	< 0.345
Acenaphthene	83329	< 0.00327	NA	NA	NA	NA	NA	< 0.345
Acenaphthylene	208968	NA	NA	NA	NA	NA	NA	< 0.345
Acenaphthylene	208968	< 0.00327	NA	NA	NA	NA	NA	< 0.345
Anthracene	120127	< 0.00327	NA	NA	NA	NA	NA	< 0.345
Benzo (g,h,i) perylene	191242	< 0.00327	NA	NA	NA	NA	NA	< 0.345
Benzo(a)anthracene	56553	< 0.00327	NA	NA	NA	NA	NA	< 0.345
Benzo(a)pyrene	50328	< 0.00327	NA	NA	NA	NA	NA	< 0.345
Benzo(b)fluoranthene	205992	< 0.00327	NA	NA	NA	NA	NA	< 0.345
Benzo(k)fluoranthene	207089	< 0.00327	NA	NA	NA	NA	NA	< 0.345
Benzyl alcohol	100516	NA	NA	NA	NA	NA	NA	< 0.345
bis(2-chloroethoxy) methane	111911	NA	NA	NA	NA	NA	NA	< 0.345
bis(2-chloroethyl) ether	111444	NA	NA	NA	NA	NA	NA	< 0.345
bis(2-chloroisopropyl) ether	108601	NA	NA	NA	NA	NA	NA	< 0.345
bis(2-ethylhexyl) phthalate	117817	NA	NA	NA	NA	NA	NA	< 0.345
Butyl benzyl phthalate	85687	NA	NA	NA	NA	NA	NA	< 0.345

TABLE A-1 **Soil Analytical Data**
Alker Tire - Buckhannon, Upshur County, West Virginia

Sample Identification		SB-11B (10-12)	SB-12 (12-14)	SB-13 (14-16)	SB-14 (12-14)	SB-15 (10-12)	SB-16 (12-14)	SG-1 (0-2)
Sample Depth (feet)		10-12	12-14	14-16	12-14	10-12	12-14	0-2
Sample Date		2/16/2006	8/7/2006	8/7/2006	8/7/2006	8/7/2006	8/7/2006	4/5/2018
Sample Type		Investigation Onsite	Investigation Offsite	Investigation Offsite	Investigation Offsite	Investigation Offsite	Investigation Offsite	Investigation Onsite
Surface/Subsurface		Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Surface
Constituent	**CAS No.**							
Semi-Volatile Organics (mg/Kg) (Continued)								
Chrysene	218019	< 0.00327	NA	NA	NA	NA	NA	< 0.345
Dibenz(a,h) anthracene	53703	< 0.00327	NA	NA	NA	NA	NA	< 0.345
Dibenzofuran	132649	NA	NA	NA	NA	NA	NA	< 0.345
Diethyl Phthalate	84662	NA	NA	NA	NA	NA	NA	< 0.345
Dimethyl Phthalate	131113	NA	NA	NA	NA	NA	NA	< 0.345
di-n-Butyl Phthalate	84742	NA	NA	NA	NA	NA	NA	< 0.345
di-n-Octyl Phthalate	117840	NA	NA	NA	NA	NA	NA	< 0.345
Fluoranthene	206440	< 0.00327	NA	NA	NA	NA	NA	< 0.345
Fluorene	86737	< 0.00327	NA	NA	NA	NA	NA	< 0.345
Hexachlorobenzene	118741	NA	NA	NA	NA	NA	NA	< 0.345
Hexachlorobutadiene	87683	NA	NA	NA	NA	NA	NA	< 0.345
Hexachlorocyclopentadiene	77474	NA	NA	NA	NA	NA	NA	< 0.345
Hexachloroethane	67721	NA	NA	NA	NA	NA	NA	< 0.345
Indeno (1,2,3-cd) pyrene	193395	< 0.00327	NA	NA	NA	NA	NA	< 0.345
Isophorone	78591	NA	NA	NA	NA	NA	NA	< 0.345
Naphthalene	91203	< 0.00327	NA	NA	NA	NA	NA	< 0.345
Nitrobenzene	98953	NA	NA	NA	NA	NA	NA	< 0.345
N-Nitrosodi-n-Propylamine	621647	NA	NA	NA	NA	NA	NA	< 0.345
N-Nitrosodiphenylamine	86306	NA	NA	NA	NA	NA	NA	< 0.345
Pentachlorophenol	87865	NA	NA	NA	NA	NA	NA	< 0.863
Phenanthrene	85018	< 0.00327	NA	NA	NA	NA	NA	< 0.345
Phenol	108952	NA	NA	NA	NA	NA	NA	< 0.345
Pyrene	129000	< 0.00327	NA	NA	NA	NA	NA	< 0.345
Glycols, Total (mg/Kg)								
Diethylene Glycol	111466	NA	NA	NA	NA	NA	NA	NA
Ethylene Glycol	107211	NA	NA	NA	NA	NA	NA	< 0.32
Propylene Glycol		NA	NA	NA	NA	NA	NA	< 0.262
Triethylene Glycol	112276	NA	NA	NA	NA	NA	NA	NA
Total Petroleum Hydrocarbons (mg/Kg)								
TPHDRO	TPHDRO	< 3.88	< 5.13	< 4.86	< 5	< 5.04	1890	NA
TPHGRO	TPHGRO	< 5	< 6.36	1.29 J	< 5.44	2.38 J	11500	NA
TPHORO	TPHORO	< 9.69	< 12.8	< 12.2	< 12.5	< 12.6	< 29.8	NA

TABLE A-1

Soil Analytical Data
Alker Tire - Buckhannon, Upshur County, West Virginia

Sample Identification		SB-11B (10-12)	SB-12 (12-14)	SB-13 (14-16)	SB-14 (12-14)	SB-15 (10-12)	SB-16 (12-14)	SG-1 (0-2)
Sample Depth (feet)		10-12	12-14	14-16	12-14	10-12	12-14	0-2
Sample Date		2/16/2006	8/7/2006	8/7/2006	8/7/2006	8/7/2006	8/7/2006	4/5/2018
Sample Type		Investigation Onsite	Investigation Offsite	Investigation Offsite	Investigation Offsite	Investigation Offsite	Investigation Offsite	Investigation Onsite
Surface/Subsurface		Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Surface
Constituent	**CAS No.**							
Inorganics (mg/Kg)								
Arsenic	7440382	NA	NA	NA	NA	NA	NA	5.7
Barium	7440393	NA	NA	NA	NA	NA	NA	50.8
Cadmium	7440439	NA	NA	NA	NA	NA	NA	0.36
Chromium	16065831	NA	NA	NA	NA	NA	NA	10.9
Lead	7439921	NA	NA	NA	NA	NA	NA	10
Mercury	7439976	NA	NA	NA	NA	NA	NA	< 0.1
Selenium	7782492	NA	NA	NA	NA	NA	NA	< 0.75
Silver	7440224	NA	NA	NA	NA	NA	NA	< 0.56

Notes:
NA - Not Analyzed.
The laboratory detection limits for data collected in 2006 are based on Practical Quantitation Limits (PQLs);
the detection limits for data collected in 2018 are based on Reporting Limits (RLs).
J - Estimated Result.
1c - A matrix spike/matrix spike duplicate was not performed for this batch due to insufficient sample volume.
CH - The continuing calibration for this compound is outside of Pace Analytical acceptance limits. The results may be biased high.
* If not anlyzed directly, the result for xylenes (total) is calculated from the results for the o- and m&p isomers. See Text Section 2.4.1.

Risk-Based Remedies
RBR Consulting, Inc.

TABLE A-1 **Soil Analytical Data**
Alker Tire - Buckhannon, Upshur County, West Virginia

Sample Identification			SG-1 (12-13)			SG-2 (0-2)			SG-2 (12-13)			SG-3 (0-2)			SG-3 (12-13)			SG-3 (12-13) DUP			SG-4 (0-2)	
Sample Depth (feet)			12-13			0-2			12-13			0-2			12-13			12-13			0-2	
Sample Date			4/5/2018			4/5/2018			4/5/2018			4/5/2018			4/5/2018			4/5/2018			4/5/2018	
Sample Type			Investigation			Investigation			Investigation			Investigation			Investigation			Duplicate			Investigation	
			Onsite			Onsite			Onsite			Onsite			Onsite			Onsite			Onsite	
Surface/Subsurface			Subsurface			Surface			Subsurface			Surface			Subsurface			Subsurface			Surface	
Constituent	**CAS No.**																					
Volatile Organics (mg/kg) Method SW8260B																						
1,1,1,2-Tetrachloroethane	630206		NA			NA			NA			NA			NA			NA			NA	
1,1,1-Trichloroethane	71556	<	2.49	1c	<	0.0042	1c	<	0.0048	1c	<	0.0038	1c	<	0.0047	1c	<	2.4	1c	<	0.0036	1c
1,1,2,2-Tetrachloroethane	79345	<	2.49	1c	<	0.0042	1c	<	0.0048	1c	<	0.0038	1c	<	0.0047	1c	<	2.4	1c	<	0.0036	1c
1,1,2-Trichloroethane	79005	<	2.49	1c	<	0.0042	1c	<	0.0048	1c	<	0.0038	1c	<	0.0047	1c	<	2.4	1c	<	0.0036	1c
1,1-Dichloroethane	75343	<	2.49	1c	<	0.0042	1c	<	0.0048	1c	<	0.0038	1c	<	0.0047	1c	<	2.4	1c	<	0.0036	1c
1,1-Dichloroethene	75354	<	2.49	1c	<	0.0042	1c	<	0.0048	1c	<	0.0038	1c	<	0.0047	1c	<	2.4	1c	<	0.0036	1c
1,1-Dichloropropene	563586		NA			NA			NA			NA			NA			NA			NA	
1,2,3-Trichlorobenzene	87616		NA			NA			NA			NA			NA			NA			NA	
1,2,3-Trichloropropane	96184		NA			NA			NA			NA			NA			NA			NA	
1,2,4-Trichlorobenzene	120821		NA			NA			NA			NA			NA			NA			NA	
1,2,4-Trimethylbenzene	95636		NA			NA			NA			NA			NA			NA			NA	
1,2-Dibromo-3-chloropropane	96128		NA			NA			NA			NA			NA			NA			NA	
1,2-Dibromoethane	106934		NA			NA			NA			NA			NA			NA			NA	
1,2-Dichlorobenzene	95501	<	2.49	1c	<	0.0042	1c	<	0.0048	1c	<	0.0038	1c	<	0.0047	1c	<	2.4	1c	<	0.0036	1c
1,2-Dichloroethane	107062	<	2.49	1c	<	0.0042	1c	<	0.0048	1c	<	0.0038	1c	<	0.0047	1c	<	2.4	1c	<	0.0036	1c
1,2-Dichloroethene (Total)	540590	<	4.99		<	0.0083		<	0.0095		<	0.0076		<	0.0093		<	4.79		<	0.0072	
1,2-Dichloropropane	78875	<	2.49	1c	<	0.0042	1c	<	0.0048	1c	<	0.0038	1c	<	0.0047	1c	<	2.4	1c	<	0.0036	1c
1,3,5-Trimethylbenzene	108678		NA			NA			NA			NA			NA			NA			NA	
1,3-Dichlorobenzene	541731	<	2.49	1c	<	0.0042	1c	<	0.0048	1c	<	0.0038	1c	<	0.0047	1c	<	2.4	1c	<	0.0036	1c
1,3-Dichloropropane	142289		NA			NA			NA			NA			NA			NA			NA	
1,4-Dichlorobenzene	106467	<	2.49	1c	<	0.0042	1c	<	0.0048	1c	<	0.0038	1c	<	0.0047	1c	<	2.4	1c	<	0.0036	1c
2,2-Dichloropropane	594207		NA			NA			NA			NA			NA			NA			NA	
2-Butanone (MEK)	78933	<	4.99	1c	<	0.0083	1c	<	0.0095	1c	<	0.0076	1c	<	0.0093	1c	<	4.79	1c	<	0.0072	1c
2-Chlorotoluene	95498		NA			NA			NA			NA			NA			NA			NA	
2-Hexanone	591786	<	4.99	1c	<	0.0083	1c	<	0.0095	1c	<	0.0076	1c	<	0.0093	1c	<	4.79	1c	<	0.0072	1c
4-Chlorotoluene	106434		NA			NA			NA			NA			NA			NA			NA	
4-Isopropyltoluene	99876		NA			NA			NA			NA			NA			NA			NA	
4-Methyl-2-pentanone	108101		28.7	1c	<	0.0083	1c	<	0.0095	1c	<	0.0076	1c	<	0.0093	1c	<	4.79	1c	<	0.0072	1c
Acetone	67641	<	4.99	1c		0.0707	1c		0.0097	1c		0.0125	1c		0.0559	1c	<	4.79	1c		0.0177	1c
Acrolein	107028		NA			NA			NA			NA			NA			NA			NA	
Acrylonitrile	107131		NA			NA			NA			NA			NA			NA			NA	
Benzene	71432	<	2.49	1c	<	0.0042	1c	<	0.0048	1c	<	0.0038	1c		0.0469	J,1c	<	2.4	1c	<	0.0036	1c
Bromobenzene	108861		NA			NA			NA			NA			NA			NA			NA	
Bromochloromethane	74975		NA			NA			NA			NA			NA			NA			NA	
Bromodichloromethane	75274	<	2.49	1c	<	0.0042	1c	<	0.0048	1c	<	0.0038	1c	<	0.0047	1c	<	2.4	1c	<	0.0036	1c
Bromoform	75252	<	2.49	1c	<	0.0042	1c	<	0.0048	1c	<	0.0038	1c	<	0.0047	1c	<	2.4	1c	<	0.0036	1c
Bromomethane	74839	<	2.49	1c	<	0.0042	1c	<	0.0048	1c	<	0.0038	1c	<	0.0047	1c	<	2.4	1c	<	0.0036	1c
Carbon disulfide	75150	<	2.49	1c	<	0.0042	1c	<	0.0048	1c	<	0.0038	1c	<	0.0047	1c	<	2.4	1c	<	0.0036	1c
Carbon tetrachloride	56235	<	2.49	1c	<	0.0042	1c	<	0.0048	1c	<	0.0038	1c	<	0.0047	1c	<	2.4	1c	<	0.0036	1c
Chlorobenzene	108907	<	2.49	1c	<	0.0042	1c	<	0.0048	1c	<	0.0038	1c	<	0.0047	1c	<	2.4	1c	<	0.0036	1c

Risk-Based Remedies
RBR Consulting, Inc.

TABLE A-1 **Soil Analytical Data**
Alker Tire - Buckhannon, Upshur County, West Virginia

Sample Identification		SG-1 (12-13)			SG-2 (0-2)			SG-2 (12-13)			SG-3 (0-2)			SG-3 (12-13)			SG-3 (12-13) DUP			SG-4 (0-2)		
Sample Depth (feet)		12-13			0-2			12-13			0-2			12-13			12-13			0-2		
Sample Date		4/5/2018			4/5/2018			4/5/2018			4/5/2018			4/5/2018			4/5/2018			4/5/2018		
Sample Type		Investigation Onsite			Investigation Onsite			Investigation Onsite			Investigation Onsite			Investigation Onsite			Duplicate Onsite			Investigation Onsite		
Surface/Subsurface		Subsurface			Surface			Subsurface			Surface			Subsurface			Subsurface			Surface		
Constituent	**CAS No.**																					
Volatile Organics (ug/L) (Continued)																						
Chloroethane	75003	<	2.49	1c	<	0.0042	1c	<	0.0048	1c	<	0.0038	1c	<	0.0047	1c	<	2.4	1c	<	0.0036	1c
Chloroform	67663	<	2.49	1c	<	0.0042	1c	<	0.0048	1c	<	0.0038	1c	<	0.0047	1c	<	2.4	1c	<	0.0036	1c
Chloromethane	74873	<	2.49	1c	<	0.0042	1c	<	0.0048	1c	<	0.0038	1c	<	0.0047	1c	<	2.4	1c	<	0.0036	1c
cis-1,2-Dichloroethene	156592	<	2.49	1c	<	0.0042	1c	<	0.0048	1c	<	0.0038	1c	<	0.0047	1c	<	2.4	1c	<	0.0036	1c
cis-1,3-Dichloropropene	542756	<	2.49	1c	<	0.0042	1c	<	0.0048	1c	<	0.0038	1c	<	0.0047	1c	<	2.4	1c	<	0.0036	1c
Dibromochloromethane	124481	<	2.49	1c	<	0.0042	1c	<	0.0048	1c	<	0.0038	1c	<	0.0047	1c	<	2.4	1c	<	0.0036	1c
Dibromomethane	74953		NA			NA			NA			NA			NA			NA			NA	
Dichlorodifluoromethane	75718		NA			NA			NA			NA			NA			NA			NA	
Ethylbenzene	100414		191	1c	<	0.0042	1c		0.0663	1c	<	0.0038	1c		0.193	J,1c		38.4	J,1c	<	0.0036	1c
Hexachlorobutadiene	87683		NA			NA			NA			NA			NA			NA			NA	
Iodomethane	74884		NA			NA			NA			NA			NA			NA			NA	
Isopropylbenzene	98828		NA			NA			NA			NA			NA			NA			NA	
Methyl tert-butyl ether	1634044	<	2.49	1c	<	0.0042	1c	<	0.0048	1c	<	0.0038	1c	<	0.0047	1c	<	2.4	1c	<	0.0036	1c
Methylene Chloride	75092	<	2.49	1c	<	0.0042	1c	<	0.0048	1c	<	0.0038	1c	<	0.0047	1c	<	2.4	1c	<	0.0036	1c
Naphthalene	91203		NA			NA			NA			NA			NA			NA			NA	
n-Butylbenzene	104518		NA			NA			NA			NA			NA			NA			NA	
n-Propylbenzene	103651		NA			NA			NA			NA			NA			NA			NA	
sec-Butylbenzene	135988		NA			NA			NA			NA			NA			NA			NA	
Styrene	100425	<	2.49	1c	<	0.0042	1c	<	0.0048	1c	<	0.0038	1c	<	0.0047	1c	<	2.4	1c	<	0.0036	1c
tert-Butylbenzene	98066		NA			NA			NA			NA			NA			NA			NA	
Tetrachloroethene (PCE)	127184	<	2.49	1c	<	0.0042	1c	<	0.0048	1c	<	0.0038	1c	<	0.0047	1c	<	2.4	1c	<	0.0036	1c
Toluene	108883		57.9	1c	<	0.0042	1c	<	0.0048	1c	<	0.0038	1c		0.85	J,1c		64.2	J,1c	<	0.0036	1c
trans-1,2-Dichloroethene	156605	<	2.49	1c	<	0.0042	1c	<	0.0048	1c	<	0.0038	1c	<	0.0047	1c	<	2.4	1c	<	0.0036	1c
trans-1,3-Dichloropropene	10061026	<	2.49	1c	<	0.0042	1c	<	0.0048	1c	<	0.0038	1c	<	0.0047	1c	<	2.4	1c	<	0.0036	1c
Trichloroethene(TCE)	79016	<	2.49	1c	<	0.0042	1c	<	0.0048	1c	<	0.0038	1c	<	0.0047	1c	<	2.4	1c	<	0.0036	1c
Trichlorofluoromethane	75694		NA			NA			NA			NA			NA			NA			NA	
Vinyl acetate	108054		NA			NA			NA			NA			NA			NA			NA	
Vinyl chloride	75014	<	2.49	1c	<	0.0042	1c	<	0.0048	1c	<	0.0038	1c	<	0.0047	1c	<	2.4	1c	<	0.0036	1c
m,p-Xylene	- -		680	1c	<	0.0083	1c	<	0.0095	1c	<	0.0076	1c		0.715	J,1c		154	J,1c	<	0.0072	1c
o-Xylene	95476		220	1c	<	0.0042	1c	<	0.0048	1c	<	0.0038	1c		0.193	J,1c		57.4	J,1c	<	0.0036	1c
Xylenes (total)	1330207		900		<	0.0125		<	0.0143		<	0.0115			0.908	J,1c		211	J,1c	<	0.0107	
Volatile Organics (mg/Kg) Method SW8021B																						
Methyl tert-butyl ether	1634044		NA			NA			NA			NA			NA			NA			NA	
Benzene	71432		NA			NA			NA			NA			NA			NA			NA	
Toluene	108883		NA			NA			NA			NA			NA			NA			NA	
Ethylbenzene	100414		NA			NA			NA			NA			NA			NA			NA	
m,p-Xylene	- -		NA			NA			NA			NA			NA			NA			NA	
o-Xylene	95476		NA			NA			NA			NA			NA			NA			NA	
Xylenes (Total)*	1330207		NA			NA			NA			NA			NA			NA			NA	

TABLE A-1 **Soil Analytical Data**
Alker Tire - Buckhannon, Upshur County, West Virginia

	Sample Identification		**SG-1 (12-13)**			**SG-2 (0-2)**			**SG-2 (12-13)**			**SG-3 (0-2)**			**SG-3 (12-13)**			**SG-3 (12-13) DUP**			**SG-4 (0-2)**	
	Sample Depth (feet)		**12-13**			**0-2**			**12-13**			**0-2**			**12-13**			**12-13**			**0-2**	
	Sample Date		**4/5/2018**			**4/5/2018**			**4/5/2018**			**4/5/2018**			**4/5/2018**			**4/5/2018**			**4/5/2018**	
	Sample Type		**Investigation**			**Investigation**			**Investigation**			**Investigation**			**Investigation**			**Duplicate**			**Investigation**	
			Onsite			**Onsite**			**Onsite**			**Onsite**			**Onsite**			**Onsite**			**Onsite**	
	Surface/Subsurface		**Subsurface**			**Surface**			**Subsurface**			**Surface**			**Subsurface**			**Subsurface**			**Surface**	
Constituent	**CAS No.**																					
Semi-Volatile Organics (mg/Kg)																						
1,2,4-Trichlorobenzene	120821	<	0.372	R	<	0.393		<	0.395		<	0.382		<	0.39	R	<	0.39	R	<	0.344	
1,2-Dichlorobenzene	95501	<	0.372	R	<	0.393		<	0.395		<	0.382		<	0.39	R	<	0.39	R	<	0.344	
1,3-Dichlorobenzene	541731	<	0.372	R	<	0.393		<	0.395		<	0.382		<	0.39	R	<	0.39	R	<	0.344	
1,4-Dichlorobenzene	106467	<	0.372	R	<	0.393		<	0.395		<	0.382		<	0.39	R	<	0.39	R	<	0.344	
2,4,5-Trichlorophenol	95954	<	0.93		<	0.984		<	0.989		<	0.957		<	0.975		<	0.975		<	0.86	
2,4,6-Trichlorophenol	88062	<	0.372		<	0.393		<	0.395		<	0.382		<	0.39		<	0.39		<	0.344	
2,4-Dichlorophenol	120832	<	0.372	R	<	0.393		<	0.395		<	0.382			2.74	J	<	0.39	R	<	0.344	
2,4-Dimethylphenol	105679	<	0.372	R	<	0.393		<	0.395		<	0.382		<	0.39	R	<	0.39	R	<	0.344	
2,4-Dinitrophenol	51285	<	0.93		<	0.984		<	0.989		<	0.957		<	0.975		<	0.975		<	0.86	
2,4-Dinitrotoluene	121142	<	0.372		<	0.393		<	0.395		<	0.382		<	0.39		<	0.39		<	0.344	
2,6-Dinitrotoluene	606202	<	0.372		<	0.393		<	0.395		<	0.382		<	0.39		<	0.39		<	0.344	
2-Chloronaphthalene	91587	<	0.372		<	0.393		<	0.395		<	0.382		<	0.39		<	0.39		<	0.344	
2-Chlorophenol	95578	<	0.372	R	<	0.393		<	0.395		<	0.382		<	0.39	R	<	0.39	R	<	0.344	
2-Methylnaphthalene	91576		104	J	<	0.393		<	0.395		<	0.382			24	J		29.9	J	<	0.344	
2-Methylphenol (o-cresol)	95487	<	0.372	R	<	0.393		<	0.395		<	0.382		<	0.39	R	<	0.39	R	<	0.344	
2-Nitroaniline	88744	<	0.93		<	0.984		<	0.989		<	0.957		<	0.975		<	0.975		<	0.86	
2-Nitrophenol	88755	<	0.372	R	<	0.393		<	0.395		<	0.382		<	0.39	R	<	0.39	R	<	0.344	
3&4-Methylphenol (m,p-Cresol)	- -	<	0.744		<	0.787		<	0.791		<	0.765		<	0.78		<	0.779		<	0.687	
3,3-Dichlorobenzidine	91941	<	0.372		<	0.393		<	0.395		<	0.382		<	0.39		<	0.39		<	0.344	
3-Nitroaniline		<	0.93	CH	<	0.984	CH	<	0.989	CH	<	0.957	CH	<	0.975	CH	<	0.975	CH	<	0.86	CH
4,6-dinitro-2-methyl phenol	534521	<	0.93		<	0.984		<	0.989		<	0.957		<	0.975		<	0.975		<	0.86	
4-Bromophenyl-phenylether	101553	<	0.372		<	0.393		<	0.395		<	0.382		<	0.39		<	0.39		<	0.344	
4-chloro-3-methylphenol	59507	<	0.372	R	<	0.393		<	0.395		<	0.382		<	0.39	R	<	0.39	R	<	0.344	
4-Chloroaniline	106478	<	0.372	R	<	0.393	CH	<	0.395	CH	<	0.382	CH	<	0.39	R	<	0.39	R	<	0.344	CH
4-Chlorophenyl Phenyl Ether	7005723	<	0.372		<	0.393		<	0.395		<	0.382		<	0.39		<	0.39		<	0.344	
4-Nitroaniline	100016	<	0.93		<	0.984		<	0.989		<	0.957		<	0.975		<	0.975		<	0.86	
4-Nitrophenol	100027	<	0.372		<	0.393		<	0.395		<	0.382		<	0.39		<	0.39		<	0.344	
Acenaphthene	83329		0.559		<	0.393		<	0.395		<	0.382		<	0.39		<	0.39		<	0.344	
Acenaphthene	83329	<	0.372		<	0.393		<	0.395		<	0.382		<	0.39		<	0.39		<	0.344	
Acenaphthylene	208968	<	0.372		<	0.393		<	0.395		<	0.382		<	0.39		<	0.39		<	0.344	
Acenaphthylene	208968	<	0.372		<	0.393		<	0.395		<	0.382		<	0.39		<	0.39		<	0.344	
Anthracene	120127	<	0.372		<	0.393		<	0.395		<	0.382		<	0.39		<	0.39		<	0.344	
Benzo (g,h,i) perylene	191242	<	0.372		<	0.393		<	0.395		<	0.382		<	0.39		<	0.39		<	0.344	
Benzo(a)anthracene	56553	<	0.372		<	0.393		<	0.395		<	0.382		<	0.39		<	0.39		<	0.344	
Benzo(a)pyrene	50328	<	0.372		<	0.393		<	0.395		<	0.382		<	0.39		<	0.39		<	0.344	
Benzo(b)fluoranthene	205992	<	0.372		<	0.393		<	0.395		<	0.382		<	0.39		<	0.39		<	0.344	
Benzo(k)fluoranthene	207089	<	0.372		<	0.393		<	0.395		<	0.382		<	0.39		<	0.39		<	0.344	
Benzyl alcohol	100516	<	0.372	R	<	0.393		<	0.395		<	0.382		<	0.39	R	<	0.39	R	<	0.344	
bis(2-chloroethoxy) methane	111911	<	0.372	R	<	0.393		<	0.395		<	0.382		<	0.39	R	<	0.39	R	<	0.344	
bis(2-chloroethyl) ether	111444	<	0.372	R	<	0.393		<	0.395		<	0.382		<	0.39	R	<	0.39	R	<	0.344	
bis(2-chloroisopropyl) ether	108601	<	0.372		<	0.393		<	0.395		<	0.382		<	0.39		<	0.39		<	0.344	
bis(2-ethylhexyl) phthalate	117817	<	0.372		<	0.393		<	0.395		<	0.382		<	0.39		<	0.39		<	0.344	
Butyl benzyl phthalate	85687	<	0.372		<	0.393		<	0.395		<	0.382		<	0.39		<	0.39		<	0.344	

TABLE A-1 **Soil Analytical Data**
Alker Tire - Buckhannon, Upshur County, West Virginia

	Sample Identification	SG-1 (12-13)	SG-2 (0-2)	SG-2 (12-13)	SG-3 (0-2)	SG-3 (12-13)	SG-3 (12-13) DUP	SG-4 (0-2)
	Sample Depth (feet)	12-13	0-2	12-13	0-2	12-13	12-13	0-2
	Sample Date	4/5/2018	4/5/2018	4/5/2018	4/5/2018	4/5/2018	4/5/2018	4/5/2018
	Sample Type	Investigation	Investigation	Investigation	Investigation	Investigation	Duplicate	Investigation
		Onsite	Onsite	Onsite	Onsite	Onsite	Onsite	Onsite
	Surface/Subsurface	Subsurface	Surface	Subsurface	Surface	Subsurface	Subsurface	Surface
Constituent	**CAS No.**							
Semi-Volatile Organics (mg/Kg) (Continued)								
Chrysene	218019	< 0.372	< 0.393	< 0.395	< 0.382	< 0.39	< 0.39	< 0.344
Dibenz(a,h) anthracene	53703	< 0.372	< 0.393	< 0.395	< 0.382	< 0.39	< 0.39	< 0.344
Dibenzofuran	132649	< 0.372	< 0.393	< 0.395	< 0.382	< 0.39	< 0.39	< 0.344
Diethyl Phthalate	84662	< 0.372	< 0.393	< 0.395	< 0.382	< 0.39	< 0.39	< 0.344
Dimethyl Phthalate	131113	< 0.372	< 0.393	< 0.395	< 0.382	< 0.39	< 0.39	< 0.344
di-n-Butyl Phthalate	84742	< 0.372	< 0.393	< 0.395	< 0.382	< 0.39	< 0.39	< 0.344
di-n-Octyl Phthalate	117840	< 0.372	< 0.393	< 0.395	< 0.382	< 0.39	< 0.39	< 0.344
Fluoranthene	206440	< 0.372	< 0.393	< 0.395	< 0.382	< 0.39	< 0.39	< 0.344
Fluorene	86737	0.405	< 0.393	< 0.395	< 0.382	< 0.39	< 0.39	< 0.344
Hexachlorobenzene	118741	< 0.372	< 0.393	< 0.395	< 0.382	< 0.39	< 0.39	< 0.344
Hexachlorobutadiene	87683	< 0.372 R	< 0.393	< 0.395	< 0.382	< 0.39 R	< 0.39 R	< 0.344
Hexachlorocyclopentadiene	77474	< 0.372	< 0.393	< 0.395	< 0.382	< 0.39	< 0.39	< 0.344
Hexachloroethane	67721	< 0.372 R	< 0.393	< 0.395	< 0.382	< 0.39 R	< 0.39 R	< 0.344
Indeno (1,2,3-cd) pyrene	193395	< 0.372	< 0.393	< 0.395	< 0.382	< 0.39	< 0.39	< 0.344
Isophorone	78591	< 0.372 R	< 0.393	< 0.395	< 0.382	< 0.39 R	< 0.39 R	< 0.344
Naphthalene	91203	87.4 J	< 0.393	< 0.395	< 0.382	20.7 J	25.4 J	< 0.344
Nitrobenzene	98953	< 0.372 R	< 0.393	< 0.395	< 0.382	< 0.39 R	< 0.39 R	< 0.344
N-Nitrosodi-n-Propylamine	621647	< 0.372 R	< 0.393	< 0.395	< 0.382	< 0.39 R	< 0.39 R	< 0.344
N-Nitrosodiphenylamine	86306	< 0.372	< 0.393	< 0.395	< 0.382	< 0.39	< 0.39	< 0.344
Pentachlorophenol	87865	< 0.93	< 0.984	< 0.989	< 0.957	< 0.975	< 0.975	< 0.86
Phenanthrene	85018	0.794	< 0.393	< 0.395	< 0.382	< 0.39	< 0.39	< 0.344
Phenol	108952	< 0.372 R	< 0.393	< 0.395	< 0.382	< 0.39 R	< 0.39 R	< 0.344
Pyrene	129000	< 0.372	< 0.393	< 0.395	< 0.382	< 0.39	< 0.39	< 0.344
Glycols, Total (mg/Kg)								
Diethylene Glycol	111466	NA	NA	NA	NA	NA	NA	NA
Ethylene Glycol	107211	33.8	NA	NA	NA	NA	NA	NA
Propylene Glycol		20.1	NA	NA	NA	NA	NA	NA
Triethylene Glycol	112276	NA	NA	NA	NA	NA	NA	NA
Total Petroleum Hydrocarbons (mg/Kg)								
TPHDRO	TPHDRO	NA	NA	NA	NA	NA	NA	NA
TPHGRO	TPHGRO	NA	NA	NA	NA	NA	NA	NA
TPHORO	TPHORO	NA	NA	NA	NA	NA	NA	NA

TABLE A-1 **Soil Analytical Data**
Alker Tire - Buckhannon, Upshur County, West Virginia

Sample Identification		SG-1 (12-13)	SG-2 (0-2)	SG-2 (12-13)	SG-3 (0-2)	SG-3 (12-13)	SG-3 (12-13) DUP	SG-4 (0-2)
Sample Depth (feet)		12-13	0-2	12-13	0-2	12-13	12-13	0-2
Sample Date		4/5/2018	4/5/2018	4/5/2018	4/5/2018	4/5/2018	4/5/2018	4/5/2018
Sample Type		Investigation Onsite	Investigation Onsite	Investigation Onsite	Investigation Onsite	Investigation Onsite	Duplicate Onsite	Investigation Onsite
Surface/Subsurface		Subsurface	Surface	Subsurface	Surface	Subsurface	Subsurface	Surface
Constituent	**CAS No.**							
Inorganics (mg/Kg)								
Arsenic	7440382	0.51	4.4	0.59	1.3	0.91	< 0.55	2.3
Barium	7440393	8.5	73	6.3	47.5	10.2	10.3	19.9
Cadmium	7440439	< 0.3	< 0.33	< 0.34	< 0.33	< 0.33	< 0.33	0.31
Chromium	16065831	1.9	10.7	1.7	10.9	2	1.9	13.5
Lead	7439921	10.2	17.5	2.4	9.1	3.3	3.4	3.5
Mercury	7439976	< 0.11	< 0.11	< 0.11	< 0.11	< 0.12	< 0.12	< 0.096
Selenium	7782492	< 0.81	< 0.88	< 0.9	< 0.88	< 0.88	< 0.88	< 0.75
Silver	7440224	< 0.6	< 0.66	< 0.68	< 0.66	< 0.66	< 0.66	< 0.56

Notes:
NA - Not Analyzed.
The laboratory detection limits for data collected in 2006 are based on Practical Quantitation Limits (PQLs);
the detection limits for data collected in 2018 are based on Reporting Limits (RLs).
J - Estimated Result.
1c - A matrix spike/matrix spike duplicate was not performed for this batch due to insufficient sample volume.
CH - The continuing calibration for this compound is outside of Pace Analytical acceptance limits. The results may be biased high.
* If not anlyzed directly, the result for xylenes (total) is calculated from the results for the o- and m&p isomers. See Text Section 2.4.1.

TABLE A-1 **Soil Analytical Data**
Alker Tire - Buckhannon, Upshur County, West Virginia

Sample Identification		SG-4 (12)			SG-5 (0-2)			SG-5 (12-13)		
Sample Depth (feet)			12			0-2			12-13	
Sample Date			4/5/2018			4/5/2018			4/5/2018	
Sample Type			Investigation Onsite			Investigation Onsite			Investigation Onsite	
Surface/Subsurface			Subsurface			Surface			Subsurface	
Constituent	CAS No.									
Volatile Organics (mg/kg) Method SW8260B										
1,1,1,2-Tetrachloroethane	630206		NA			NA			NA	
1,1,1-Trichloroethane	71556	<	0.0042	1c	<	0.0039	1c	<	0.0055	1c
1,1,2,2-Tetrachloroethane	79345	<	0.0042	1c	<	0.0039	1c	<	0.0055	1c
1,1,2-Trichloroethane	79005	<	0.0042	1c	<	0.0039	1c	<	0.0055	1c
1,1-Dichloroethane	75343	<	0.0042	1c	<	0.0039	1c	<	0.0055	1c
1,1-Dichloroethene	75354	<	0.0042	1c	<	0.0039	1c	<	0.0055	1c
1,1-Dichloropropene	563586		NA			NA			NA	
1,2,3-Trichlorobenzene	87616		NA			NA			NA	
1,2,3-Trichloropropane	96184		NA			NA			NA	
1,2,4-Trichlorobenzene	120821		NA			NA			NA	
1,2,4-Trimethylbenzene	95636		NA			NA			NA	
1,2-Dibromo-3-chloropropane	96128		NA			NA			NA	
1,2-Dibromoethane	106934		NA			NA			NA	
1,2-Dichlorobenzene	95501	<	0.0042	1c	<	0.0039	1c	<	0.0055	1c
1,2-Dichloroethane	107062	<	0.0042	1c	<	0.0039	1c	<	0.0055	1c
1,2-Dichloroethene (Total)	540590	<	0.0084		<	0.0078		<	0.011	
1,2-Dichloropropane	78875	<	0.0042	1c	<	0.0039	1c	<	0.0055	1c
1,3,5-Trimethylbenzene	108678		NA			NA			NA	
1,3-Dichlorobenzene	541731	<	0.0042	1c	<	0.0039	1c	<	0.0055	1c
1,3-Dichloropropane	142289		NA			NA			NA	
1,4-Dichlorobenzene	106467	<	0.0042	1c	<	0.0039	1c	<	0.0055	1c
2,2-Dichloropropane	594207		NA			NA			NA	
2-Butanone (MEK)	78933	<	0.0084	1c	<	0.0078	1c	<	0.011	1c
2-Chlorotoluene	95498		NA			NA			NA	
2-Hexanone	591786	<	0.0084	1c	<	0.0078	1c	<	0.011	1c
4-Chlorotoluene	106434		NA			NA			NA	
4-Isopropyltoluene	99876		NA			NA			NA	
4-Methyl-2-pentanone	108101	<	0.0084	1c	<	0.0078	1c	<	0.011	1c
Acetone	67641		0.0166	1c		0.0194	1c		0.128	1c
Acrolein	107028		NA			NA			NA	
Acrylonitrile	107131		NA			NA			NA	
Benzene	71432		0.0059	1c		0.0059	1c		0.231	1c
Bromobenzene	108861		NA			NA			NA	
Bromochloromethane	74975		NA			NA			NA	
Bromodichloromethane	75274	<	0.0042	1c	<	0.0039	1c	<	0.0055	1c
Bromoform	75252	<	0.0042	1c	<	0.0039	1c	<	0.0055	1c
Bromomethane	74839	<	0.0042	1c	<	0.0039	1c	<	0.0055	1c
Carbon disulfide	75150	<	0.0042	1c	<	0.0039	1c	<	0.0055	1c
Carbon tetrachloride	56235	<	0.0042	1c	<	0.0039	1c	<	0.0055	1c
Chlorobenzene	108907	<	0.0042	1c	<	0.0039	1c	<	0.0055	1c

TABLE A-1 **Soil Analytical Data**
Alker Tire - Buckhannon, Upshur County, West Virginia

Constituent	CAS No.		SG-4 (12)			SG-5 (0-2)			SG-5 (12-13)	
	Sample Identification		**SG-4 (12)**			**SG-5 (0-2)**			**SG-5 (12-13)**	
	Sample Depth (feet)		**12**			**0-2**			**12-13**	
	Sample Date		**4/5/2018**			**4/5/2018**			**4/5/2018**	
	Sample Type		**Investigation Onsite**			**Investigation Onsite**			**Investigation Onsite**	
	Surface/Subsurface		**Subsurface**			**Surface**			**Subsurface**	
Volatile Organics (ug/L) (Continued)										
Chloroethane	75003	<	0.0042	1c	<	0.0039	1c	<	0.0055	1c
Chloroform	67663	<	0.0042	1c	<	0.0039	1c	<	0.0055	1c
Chloromethane	74873	<	0.0042	1c	<	0.0039	1c	<	0.0055	1c
cis-1,2-Dichloroethene	156592	<	0.0042	1c	<	0.0039	1c	<	0.0055	1c
cis-1,3-Dichloropropene	542756	<	0.0042	1c	<	0.0039	1c	<	0.0055	1c
Dibromochloromethane	124481	<	0.0042	1c	<	0.0039	1c	<	0.0055	1c
Dibromomethane	74953		NA			NA			NA	
Dichlorodifluoromethane	75718		NA			NA			NA	
Ethylbenzene	100414		0.0074	1c	<	0.0039	1c		0.288	1c
Hexachlorobutadiene	87683		NA			NA			NA	
Iodomethane	74884		NA			NA			NA	
Isopropylbenzene	98828		NA			NA			NA	
Methyl tert-butyl ether	1634044	<	0.0042	1c	<	0.0039	1c	<	0.0055	1c
Methylene Chloride	75092	<	0.0042	1c	<	0.0039	1c	<	0.0055	1c
Naphthalene	91203		NA			NA			NA	
n-Butylbenzene	104518		NA			NA			NA	
n-Propylbenzene	103651		NA			NA			NA	
sec-Butylbenzene	135988		NA			NA			NA	
Styrene	100425	<	0.0042	1c	<	0.0039	1c	<	0.0055	1c
tert-Butylbenzene	98066		NA			NA			NA	
Tetrachloroethene (PCE)	127184	<	0.0042	1c	<	0.0039	1c	<	0.0055	1c
Toluene	108883	<	0.0042	1c	<	0.0039	1c		0.324	1c
trans-1,2-Dichloroethene	156605	<	0.0042	1c	<	0.0039	1c	<	0.0055	1c
trans-1,3-Dichloropropene	10061026	<	0.0042	1c	<	0.0039	1c	<	0.0055	1c
Trichloroethene(TCE)	79016	<	0.0042	1c	<	0.0039	1c	<	0.0055	1c
Trichlorofluoromethane	75694		NA			NA			NA	
Vinyl acetate	108054		NA			NA			NA	
Vinyl chloride	75014	<	0.0042	1c	<	0.0039	1c	<	0.0055	1c
m,p-Xylene	- -	<	0.0084	1c	<	0.0078	1c	<	0.479	1c
o-Xylene	95476	<	0.0042	1c	<	0.0039	1c	<	0.239	1c
Xylenes (total)	1330207	<	0.0126		<	0.0118		<	0.718	
Volatile Organics (mg/Kg) Method SW8021B										
Methyl tert-butyl ether	1634044		NA			NA			NA	
Benzene	71432		NA			NA			NA	
Toluene	108883		NA			NA			NA	
Ethylbenzene	100414		NA			NA			NA	
m,p-Xylene	- -		NA			NA			NA	
o-Xylene	95476		NA			NA			NA	
Xylenes (Total)*	1330207		NA			NA			NA	

TABLE A-1 **Soil Analytical Data**
Alker Tire - Buckhannon, Upshur County, West Virginia

Sample Identification		SG-4 (12)			SG-5 (0-2)			SG-5 (12-13)		
Sample Depth (feet)		12			0-2			12-13		
Sample Date		4/5/2018			4/5/2018			4/5/2018		
Sample Type		Investigation Onsite			Investigation Onsite			Investigation Onsite		
Surface/Subsurface		Subsurface			Surface			Subsurface		
Constituent	CAS No.									
Semi-Volatile Organics (mg/Kg)										
1,2,4-Trichlorobenzene	120821	<	0.381		<	0.344		<	0.402	
1,2-Dichlorobenzene	95501	<	0.381		<	0.344		<	0.402	
1,3-Dichlorobenzene	541731	<	0.381		<	0.344		<	0.402	
1,4-Dichlorobenzene	106467	<	0.381		<	0.344		<	0.402	
2,4,5-Trichlorophenol	95954	<	0.954		<	0.861		<	1.01	
2,4,6-Trichlorophenol	88062	<	0.381		<	0.344		<	0.402	
2,4-Dichlorophenol	120832	<	0.381		<	0.344		<	0.402	
2,4-Dimethylphenol	105679	<	0.381		<	0.344		<	0.402	
2,4-Dinitrophenol	51285	<	0.954		<	0.861		<	1.01	
2,4-Dinitrotoluene	121142	<	0.381		<	0.344		<	0.402	
2,6-Dinitrotoluene	606202	<	0.381		<	0.344		<	0.402	
2-Chloronaphthalene	91587	<	0.381		<	0.344		<	0.402	
2-Chlorophenol	95578	<	0.381		<	0.344		<	0.402	
2-Methylnaphthalene	91576	<	0.381		<	0.344		<	0.402	
2-Methylphenol (o-cresol)	95487	<	0.381		<	0.344		<	0.402	
2-Nitroaniline	88744	<	0.954		<	0.861		<	1.01	
2-Nitrophenol	88755	<	0.381		<	0.344		<	0.402	
3&4-Methylphenol (m,p-Cresol)	- -	<	0.763		<	0.689		<	0.804	
3,3-Dichlorobenzidine	91941	<	0.381		<	0.344		<	0.402	
3-Nitroaniline		<	0.954	CH	<	0.861	CH	<	1.01	CH
4,6-dinitro-2-methyl phenol	534521	<	0.954		<	0.861		<	1.01	
4-Bromophenyl-phenylether	101553	<	0.381		<	0.344		<	0.402	
4-chloro-3-methylphenol	59507	<	0.381		<	0.344		<	0.402	
4-Chloroaniline	106478	<	0.381	CH	<	0.344	CH	<	0.402	CH
4-Chlorophenyl Phenyl Ether	7005723	<	0.381		<	0.344		<	0.402	
4-Nitroaniline	100016	<	0.954		<	0.861		<	1.01	
4-Nitrophenol	100027	<	0.381		<	0.344		<	0.402	
Acenaphthene	83329	<	0.381		<	0.344		<	0.402	
Acenaphthene	83329	<	0.381		<	0.344		<	0.402	
Acenaphthylene	208968	<	0.381		<	0.344		<	0.402	
Acenaphthylene	208968	<	0.381		<	0.344		<	0.402	
Anthracene	120127	<	0.381		<	0.344		<	0.402	
Benzo (g,h,i) perylene	191242	<	0.381		<	0.344		<	0.402	
Benzo(a)anthracene	56553	<	0.381		<	0.344		<	0.402	
Benzo(a)pyrene	50328	<	0.381		<	0.344		<	0.402	
Benzo(b)fluoranthene	205992	<	0.381		<	0.344		<	0.402	
Benzo(k)fluoranthene	207089	<	0.381		<	0.344		<	0.402	
Benzyl alcohol	100516	<	0.381		<	0.344		<	0.402	
bis(2-chloroethoxy) methane	111911	<	0.381		<	0.344		<	0.402	
bis(2-chloroethyl) ether	111444	<	0.381		<	0.344		<	0.402	
bis(2-chloroisopropyl) ether	108601	<	0.381		<	0.344		<	0.402	
bis(2-ethylhexyl) phthalate	117817	<	0.381		<	0.344		<	0.402	
Butyl benzyl phthalate	85687	<	0.381		<	0.344		<	0.402	

TABLE A-1 **Soil Analytical Data**
Alker Tire - Buckhannon, Upshur County, West Virginia

Sample Identification		SG-4 (12)		SG-5 (0-2)		SG-5 (12-13)	
Sample Depth (feet)		12		0-2		12-13	
Sample Date		4/5/2018		4/5/2018		4/5/2018	
Sample Type		Investigation Onsite		Investigation Onsite		Investigation Onsite	
Surface/Subsurface		Subsurface		Surface		Subsurface	
Constituent	**CAS No.**						
Semi-Volatile Organics (mg/Kg) (Continued)							
Chrysene	218019	<	0.381	<	0.344	<	0.402
Dibenz(a,h) anthracene	53703	<	0.381	<	0.344	<	0.402
Dibenzofuran	132649	<	0.381	<	0.344	<	0.402
Diethyl Phthalate	84662	<	0.381	<	0.344	<	0.402
Dimethyl Phthalate	131113	<	0.381	<	0.344	<	0.402
di-n-Butyl Phthalate	84742	<	0.381	<	0.344	<	0.402
di-n-Octyl Phthalate	117840	<	0.381	<	0.344	<	0.402
Fluoranthene	206440	<	0.381	<	0.344	<	0.402
Fluorene	86737	<	0.381	<	0.344	<	0.402
Hexachlorobenzene	118741	<	0.381	<	0.344	<	0.402
Hexachlorobutadiene	87683	<	0.381	<	0.344	<	0.402
Hexachlorocyclopentadiene	77474	<	0.381	<	0.344	<	0.402
Hexachloroethane	67721	<	0.381	<	0.344	<	0.402
Indeno (1,2,3-cd) pyrene	193395	<	0.381	<	0.344	<	0.402
Isophorone	78591	<	0.381	<	0.344	<	0.402
Naphthalene	91203	<	0.381	<	0.344	<	0.402
Nitrobenzene	98953	<	0.381	<	0.344	<	0.402
N-Nitrosodi-n-Propylamine	621647	<	0.381	<	0.344	<	0.402
N-Nitrosodiphenylamine	86306	<	0.381	<	0.344	<	0.402
Pentachlorophenol	87865	<	0.954	<	0.861	<	1.01
Phenanthrene	85018	<	0.381	<	0.344	<	0.402
Phenol	108952	<	0.381	<	0.344	<	0.402
Pyrene	129000	<	0.381	<	0.344	<	0.402
Glycols, Total (mg/Kg)							
Diethylene Glycol	111466		NA		NA		NA
Ethylene Glycol	107211		NA		NA		NA
Propylene Glycol			NA		NA		NA
Triethylene Glycol	112276		NA		NA		NA
Total Petroleum Hydrocarbons (mg/Kg)							
TPHDRO	TPHDRO		NA		NA		NA
TPHGRO	TPHGRO		NA		NA		NA
TPHORO	TPHORO		NA		NA		NA

TABLE A-1 **Soil Analytical Data**
Alker Tire - Buckhannon, Upshur County, West Virginia

Constituent	Sample Identification / Sample Depth (feet) / Sample Date / Sample Type / Surface/Subsurface / CAS No.		SG-4 (12) / 12 / 4/5/2018 / Investigation Onsite / Subsurface		SG-5 (0-2) / 0-2 / 4/5/2018 / Investigation Onsite / Surface		SG-5 (12-13) / 12-13 / 4/5/2018 / Investigation Onsite / Subsurface
Inorganics (mg/Kg)							
Arsenic	7440382		0.53		3.2		0.74
Barium	7440393		15.1		53.9		8.2
Cadmium	7440439	<	0.31	<	0.29	<	0.32
Chromium	16065831		6.1		14		2.9
Lead	7439921		3.9		10.3		5.4
Mercury	7439976	<	0.11	<	0.1	<	0.12
Selenium	7782492	<	0.82	<	0.78	<	0.85
Silver	7440224	<	0.61	<	0.58	<	0.64

Notes:
NA - Not Analyzed.
The laboratory detection limits for data collected in 2006 are based on Practical Quantitation Limits (PQLs);
the detection limits for data collected in 2018 are based on Reporting Limits (RLs).
J - Estimated Result.
1c - A matrix spike/matrix spike duplicate was not performed for this batch due to insufficient sample volume.
CH - The continuing calibration for this compound is outside of Pace Analytical acceptance limits. The results may be biased high.
* If not anlyzed directly, the result for xylenes (total) is calculated from the results for the o- and m&p isomers. See Text Section 2.4.1.

TABLE A-2 **Groundwater Analytical Data**
Alker Tire - Buckhannon, Upshur County, West Virginia

Constituent	Sample Identification / Sample Date / Sample Type / Location / CAS No.	MW2 (2/27/2017)	MW7 (2/27/2017)	MW12 (2/27/2017)	MW12 (4/6/2018)	MW13 (2/27/2017)	MW13 (4/6/2018)	MW15 (2/27/2017)
	Sample Date	2/27/2017	2/27/2017	2/27/2017	4/6/2018	2/27/2017	4/6/2018	2/27/2017
	Sample Type	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation
	Location	Onsite	Onsite	Offsite	Offsite	Offsite	Offsite	Offsite
Volatile Organics (ug/L)								
1,1,1-Trichloroethane	71556	NA	NA	NA	< 1	NA	< 1	NA
1,1,2,2-Tetrachloroethane	79345	NA	NA	NA	< 1	NA	< 1	NA
1,1,2-Trichloroethane	79005	NA	NA	NA	< 1	NA	< 1	NA
1,1-Dichloroethane	75343	NA	NA	NA	< 1	NA	< 1	NA
1,1-Dichloroethene	75354	NA	NA	NA	< 1	NA	< 1	NA
1,2,4-Trichlorobenzene	120821	NA	NA	NA	< 1	NA	< 1	NA
1,2-Dichlorobenzene	95501	NA	NA	NA	< 1	NA	< 1	NA
1,2-Dichloroethane	107062	NA	NA	NA	< 1	NA	< 1	NA
1,2-Dichloroethene (Total)		NA	NA	NA	< 2	NA	< 2	NA
1,2-Dichloropropane	78875	NA	NA	NA	< 1	NA	< 1	NA
1,3-Dichlorobenzene	541731	NA	NA	NA	< 1	NA	< 1	NA
1,4-Dichlorobenzene	106467	NA	NA	NA	< 1	NA	< 1	NA
2-Butanone	78933	NA	NA	NA	< 10	NA	< 10	NA
2-Hexanone	591786	NA	NA	NA	< 10	NA	< 10	NA
4-Methyl-2-pentanone	108101	NA	NA	NA	< 10	NA	< 10	NA
Acetone	67641	NA	NA	NA	< 10	NA	< 10	NA
Benzene	71432	< 0.5	< 0.5	0.53 J	< 1	0.65 J	1.7	506
Bromochloromethane	74975	NA	NA	NA	< 1	NA	< 1	NA
Bromodichloromethane	75274	NA	NA	NA	< 1	NA	< 1	NA
Bromoform	75252	NA	NA	NA	< 1	NA	< 1	NA
Bromomethane	74839	NA	NA	NA	< 1	NA	< 1	NA
Carbon Disulfide	75150	NA	NA	NA	< 1	NA	< 1	NA
Carbon Tetrachloride	56235	NA	NA	NA	< 1	NA	< 1	NA
Chlorobenzene	108907	NA	NA	NA	< 1	NA	< 1	NA
Chloroethane	75003	NA	NA	NA	< 1	NA	< 1	NA
Chloroform	67663	NA	NA	NA	< 1	NA	< 1	NA
Chloromethane	74873	NA	NA	NA	< 1	NA	< 1	NA
cis-1,2-Dichloroethene	156592	NA	NA	NA	< 1	NA	< 1	NA
cis-1,3-Dichloropropene	10061015	NA	NA	NA	< 1	NA	< 1	NA
Dibromochloromethane	124481	NA	NA	NA	< 1	NA	< 1	NA
Ethylbenzene	100414	9.9	< 0.5	< 0.5	< 1	0.96 J	< 1	847
Methyl tert-butyl ether (MTBE)	1634044	< 2.5	< 2.5	< 2.5	< 1	< 2.5	< 1	< 250
Methylene chloride	75092	NA	NA	NA	< 1	NA	< 1	NA
Styrene	100425	NA	NA	NA	< 1	NA	< 1	NA
tert-Butyl alcohol		< 50	< 50	< 50	NA	< 50	NA	< 50
Tetrachloroethene (PCE)	127184	NA	NA	NA	< 1	NA	< 1	NA
Toluene	108883	1.07	< 0.5	< 0.5	< 1	1.51	< 1	305
trans-1,2-Dichloroethene	156605	NA	NA	NA	< 1	NA	< 1	NA
trans-1,3-Dichloropropene	10061026	NA	NA	NA	< 1	NA	< 1	NA
Trichloroethene	79016	NA	NA	NA	< 1	NA	< 1	NA
Vinyl chloride	75014	NA	NA	NA	< 1	NA	< 1	NA
m&p-Xylene	- -	4.79	< 1	6.51	< 2	3.64	< 2	880
o-Xylene	95476	2.41	< 0.5	1.31	< 1	2.03	< 1	< 50
Xylenes (total)*	1330207	7.20	< 1	7.82	< 3	5.67	< 3	880

TABLE A-2 **Groundwater Analytical Data**
Alker Tire - Buckhannon, Upshur County, West Virginia

Constituent	CAS No.	MW2 (2/27/2017)	MW7 (2/27/2017)	MW12 (2/27/2017)	MW12 (4/6/2018)	MW13 (2/27/2017)	MW13 (4/6/2018)	MW15 (2/27/2017)
Sample Date		2/27/2017	2/27/2017	2/27/2017	4/6/2018	2/27/2017	4/6/2018	2/27/2017
Sample Type		Investigation	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation
Location		Onsite	Onsite	Offsite	Offsite	Offsite	Offsite	Offsite
Semi-Volatile Organics (ug/L)								
Acenaphthylene	208968	< 3.3	< 2.2	< 2	NA	< 2.1	NA	< 2.1
Acenaphthene	83329	< 3.3	< 2.2	< 2	NA	< 2.1	NA	< 2.1
Anthracene	120127	< 3.3	< 2.2	< 2	NA	< 2.1	NA	< 2.1
Benzo (a) anthracene	56553	< 3.3	< 2.2	< 2	NA	< 2.1	NA	< 2.1
Benzo (a) pyrene	50328	< 3.3	< 2.2	< 2	NA	< 2.1	NA	< 2.1
Benzo (b) fluoranthene	205992	< 3.3	< 2.2	< 2	NA	< 2.1	NA	< 2.1
Benzo (ghi) perylene	191242	< 3.3	< 2.2	< 2	NA	< 2.1	NA	< 2.1
Benzo (k) fluoranthene	207089	< 4.9	< 3.3	< 3	NA	< 3.1	NA	< 3.1
Chrysene	218019	< 3.3	< 2.2	< 2	NA	< 2.1	NA	< 2.1
Dibenzo (a,h) anthracene	53703	< 3.3	< 2.2	< 2	NA	< 2.1	NA	< 2.1
Fluoranthene	206440	< 3.3	< 2.2	< 2	NA	< 2.1	NA	< 2.1
Fluorene	86737	< 3.3	< 2.2	< 2	NA	< 2.1	NA	< 2.1
Indeno (1,2,3-cd) pyrene	193395	< 3.3	< 2.2	< 2	NA	< 2.1	NA	< 2.1
Naphthalene	91203	< 3.3	< 2.2	< 2	NA	< 2.1	NA	126
Phenanthrene	85018	< 3.3	< 2.2	< 2	NA	< 2.1	NA	< 2.1
Pyrene	129000	< 3.3	< 2.2	< 2	NA	< 2.1	NA	< 2.1
Glycols, Total (ug/L)								
Diethylene Glycol	111466	NA	NA	NA	< 9840	NA	< 9840	NA
Monoethylene Glycol		NA	NA	NA	< 6010	NA	< 6010	NA
Propylene Glycol	107211	NA	NA	NA	< 8000	NA	< 8000	NA
Triethylene Glycol	112276	NA	NA	NA	< 12400	NA	< 12400	NA
Inorganics (ug/L)								
Arsenic	7440382	NA	NA	NA	< 5	NA	< 5	NA
Barium	7440393	NA	NA	NA	114	NA	66	NA
Cadmium	7440439	NA	NA	NA	< 3	NA	< 3	NA
Chromium	16065831	NA	NA	NA	< 5	NA	< 5	NA
Lead	7439921	NA	NA	NA	< 5	NA	< 5	NA
Mercury	7439976	NA	NA	NA	< 0.2	NA	< 0.2	NA
Selenium	7782492	NA	NA	NA	< 8	NA	< 8	NA
Silver	7440224	NA	NA	NA	< 6	NA	< 6	NA

Notes:
NA - Not Analyzed.
J - Analyte concentration is reported, and is less than the PQL and greater than or equal to the MDL. The result reported is an estimate.
* If not anlyzed directly, the result for xylenes (total) is calculated from the results for the o- and m&p isomers. See Text Section 2.4.2.

TABLE A-2 **Groundwater Analytical Data**
Alker Tire - Buckhannon, Upshur County, West Virginia

Constituent	Sample Identification / Sample Date / Sample Type / Location / CAS No.	MW15 (4/6/2018) 4/6/2018 Investigation Offsite	MW16 (2/27/2017) 2/27/2017 Investigation Offsite	MW16 (4/6/2018) 4/6/2018 Investigation Offsite	MW17 (4/6/2018) 4/6/2018 Investigation Onsite	RMW1 (2/27/2017) 2/27/2017 Investigation Onsite	RW-1 (4/6/2018) 4/6/2018 Investigation Onsite	RW3 (12/27/2017) 2/27/2017 Investigation Onsite
Volatile Organics (ug/L)								
1,1,1-Trichloroethane	71556	< 1	NA	< 1	< 1	NA	< 1	NA
1,1,2,2-Tetrachloroethane	79345	< 1	NA	< 1	< 1	NA	< 1	NA
1,1,2-Trichloroethane	79005	< 1	NA	< 1	< 1	NA	< 1	NA
1,1-Dichloroethane	75343	< 1	NA	< 1	< 1	NA	< 1	NA
1,1-Dichloroethene	75354	< 1	NA	< 1	< 1	NA	< 1	NA
1,2,4-Trichlorobenzene	120821	< 1	NA	< 1	< 1	NA	< 1	NA
1,2-Dichlorobenzene	95501	< 1	NA	< 1	< 1	NA	< 1	NA
1,2-Dichloroethane	107062	< 1	NA	< 1	< 1	NA	< 1	NA
1,2-Dichloroethene (Total)		< 2	NA	< 2	< 2	NA	< 2	NA
1,2-Dichloropropane	78875	< 1	NA	< 1	< 1	NA	< 1	NA
1,3-Dichlorobenzene	541731	< 1	NA	< 1	< 1	NA	< 1	NA
1,4-Dichlorobenzene	106467	< 1	NA	< 1	< 1	NA	< 1	NA
2-Butanone	78933	< 10	NA	< 10	< 10	NA	< 10	NA
2-Hexanone	591786	< 10	NA	< 10	< 10	NA	< 10	NA
4-Methyl-2-pentanone	108101	< 10	NA	< 10	< 10	NA	< 10	NA
Acetone	67641	< 10	NA	< 10	177	NA	< 10	NA
Benzene	71432	283 J	98 J	56.3 J	1.3	< 500	21.3 J	< 0.5
Bromochloromethane	74975	< 1	NA	< 1	< 1	NA	< 1	NA
Bromodichloromethane	75274	< 1	NA	< 1	< 1	NA	< 1	NA
Bromoform	75252	< 1	NA	< 1	< 1	NA	< 1	NA
Bromomethane	74839	< 1	NA	< 1	< 1	NA	< 1	NA
Carbon Disulfide	75150	< 1	NA	< 1	1.9	NA	< 1	NA
Carbon Tetrachloride	56235	< 1	NA	< 1	< 1	NA	< 1	NA
Chlorobenzene	108907	< 1	NA	< 1	< 1	NA	< 1	NA
Chloroethane	75003	< 1	NA	< 1	< 1	NA	< 1	NA
Chloroform	67663	< 1	NA	< 1	< 1	NA	< 1	NA
Chloromethane	74873	< 1	NA	< 1	< 1	NA	< 1	NA
cis-1,2-Dichloroethene	156592	< 1	NA	< 1	< 1	NA	< 1	NA
cis-1,3-Dichloropropene	10061015	< 1	NA	< 1	< 1	NA	< 1	NA
Dibromochloromethane	124481	< 1	NA	< 1	< 1	NA	< 1	NA
Ethylbenzene	100414	919 J	893	1430 J	687	1990	1530 J	< 0.5
Methyl tert-butyl ether (MTBE)	1634044	< 1	< 250	< 1	< 1	< 2500	< 1	< 2.5
Methylene chloride	75092	< 1	NA	< 1	< 1	NA	< 1	NA
Styrene	100425	< 1	NA	< 1	< 1	NA	< 1	NA
tert-Butyl alcohol		NA	< 50	NA	NA	< 50	NA	< 50
Tetrachloroethene (PCE)	127184	< 1	NA	< 1	< 1	NA	< 1	NA
Toluene	108883	250 J	1740	3400 J	42.8	6640	4520 J	< 0.5
trans-1,2-Dichloroethene	156605	< 1	NA	< 1	< 1	NA	< 1	NA
trans-1,3-Dichloropropene	10061026	< 1	NA	< 1	< 1	NA	< 1	NA
Trichloroethene	79016	< 1	NA	< 1	< 1	NA	< 1	NA
Vinyl chloride	75014	< 1	NA	< 1	< 1	NA	< 1	NA
m&p-Xylene	- -	656 J	2020	4070 J	2620	8680	8000 J	< 1
o-Xylene	95476	162 J	749	1420 J	392	3920	3360 J	< 0.5
Xylenes (total)*	1330207	818 J	2769	5480 J	3010	12600	11400 J	< 1

TABLE A-2 — **Groundwater Analytical Data**
Alker Tire - Buckhannon, Upshur County, West Virginia

Constituent	Sample Identification / Sample Date / Sample Type / Location / CAS No.	MW15 (4/6/2018) 4/6/2018 Investigation Offsite	MW16 (2/27/2017) 2/27/2017 Investigation Offsite	MW16 (4/6/2018) 4/6/2018 Investigation Offsite	MW17 (4/6/2018) 4/6/2018 Investigation Onsite	RMW1 (2/27/2017) 2/27/2017 Investigation Onsite	RW-1 (4/6/2018) 4/6/2018 Investigation Onsite	RW3 (12/27/2017) 2/27/2017 Investigation Onsite
Semi-Volatile Organics (ug/L)								
Acenaphthylene	208968	NA	< 2.1	NA	NA	< 2	NA	< 2.1
Acenaphthene	83329	NA	< 2.1	NA	NA	< 2	NA	< 2.1
Anthracene	120127	NA	< 2.1	NA	NA	< 2	NA	< 2.1
Benzo (a) anthracene	56553	NA	< 2.1	NA	NA	< 2	NA	< 2.1
Benzo (a) pyrene	50328	NA	< 2.1	NA	NA	< 2	NA	< 2.1
Benzo (b) fluoranthene	205992	NA	< 2.1	NA	NA	< 2	NA	< 2.1
Benzo (ghi) perylene	191242	NA	< 2.1	NA	NA	< 2	NA	< 2.1
Benzo (k) fluoranthene	207089	NA	< 3.1	NA	NA	< 3.1	NA	< 3.1
Chrysene	218019	NA	< 2.1	NA	NA	< 2	NA	< 2.1
Dibenzo (a,h) anthracene	53703	NA	< 2.1	NA	NA	< 2	NA	< 2.1
Fluoranthene	206440	NA	< 2.1	NA	NA	< 2	NA	< 2.1
Fluorene	86737	NA	< 2.1	NA	NA	< 2	NA	< 2.1
Indeno (1,2,3-cd) pyrene	193395	NA	< 2.1	NA	NA	< 2	NA	< 2.1
Naphthalene	91203	NA	197	NA	NA	310	NA	< 2.1
Phenanthrene	85018	NA	< 2.1	NA	NA	< 2	NA	< 2.1
Pyrene	129000	NA	< 2.1	NA	NA	< 2	NA	< 2.1
Glycols, Total (ug/L)								
Diethylene Glycol	111466	< 9840	NA	< 9840	< 9840	NA	< 9840	NA
Monoethylene Glycol		< 6010	NA	< 6010	< 6010	NA	< 6010	NA
Propylene Glycol	107211	< 8000	NA	< 8000	< 8000	NA	< 8000	NA
Triethylene Glycol	112276	< 12400	NA	< 12400	< 12400	NA	< 12400	NA
Inorganics (ug/L)								
Arsenic	7440382	< 5	NA	< 5	< 5	NA	< 5	NA
Barium	7440393	119	NA	86.2	39.8	NA	106	NA
Cadmium	7440439	< 3	NA	< 3	< 3	NA	< 3	NA
Chromium	16065831	< 5	NA	< 5	< 5	NA	< 5	NA
Lead	7439921	< 5	NA	34.7	13.3	NA	64.4	NA
Mercury	7439976	< 0.2	NA	< 0.2	< 0.2	NA	< 0.2	NA
Selenium	7782492	< 8	NA	< 8	< 8	NA	< 8	NA
Silver	7440224	< 6	NA	< 6	< 6	NA	< 6	NA

Notes:
NA - Not Analyzed.
J - Analyte concentration is reported, and is less than the PQL and greater than or equal to the MDL. The result reported is an estimate.
* If not anlyzed directly, the result for xylenes (total) is calculated from the results for the o- and m&p isomers. See Text Section 2.4.2.

TABLE A-3

Soil Gas Analytical Data
Alker Tire - Buckhannon, Upshur County, West Virginia

	Sample Identification	SG-1	SG-2	SG-3	SG-4	SG-5	SG-5 DUP
	Sample Depth (feet)	11	11	10	12	12	12
	Sample Date	4/6/2018	4/6/2018	4/6/2018	4/6/2018	4/6/2018	4/6/2018
	Sample Type	Investigation	Investigation	Investigation	Investigation	Investigation	Duplicate
	Location	Onsite	Onsite	Onsite	Offsite	Offsite	Offsite
Constituent	**CAS No.**						
Volatile Organics (ug/m^3)							
1,1,1-Trichloroethane	71556	< 8180	< 8010	< 8300	< 8300	< 519	< 1040
1,1,2,2-Tetrachloroethane	79345	< 5150	< 5040	< 5220	< 5220	< 326	< 652
1,1,2-Trichloro-1,2,2-trifluoroethane	76131	< 11500	< 11300	< 11700	< 11700	< 729	< 1460
1,1,2-Trichloroethane	79005	< 4090	< 4010	< 4150	< 4150	< 259	< 519
1,1-Dichloroethane	75343	< 6070	< 5940	< 6150	< 6150	< 385	< 769
1,1-Dichloroethene	75354	< 5940	< 5820	< 6020	< 6020	< 377	< 753
1,2,4-Trichlorobenzene	120821	< 27800	< 27200	< 28200	< 28200	< 1760	< 3520
1,2,4-Trimethylbenzene	95636	62000	33700	12800	19300	2280	1140
1,2-Dibromoethane	106934	< 11500	< 11300	< 11700	< 11700	< 729	< 1460
1,2-Dichlorobenzene	95501	< 9000	< 8610	< 9120	< 9120	< 570	< 1140
1,2-Dichloroethane	107062	< 3030	< 2970	< 3070	< 3070	< 192	< 384
1,2-Dichloropropane	78875	< 6920	< 6780	< 7020	< 7020	< 439	< 877
1,3,5-Trimethylbenzene	108678	23800	16800	8070	9790	1150	< 933
1,3-Butadiene	106990	< 3320	< 3250	< 3360	< 3360	< 210	< 420
1,3-Dichlorobenzene	541731	< 9000	< 8610	< 9120	< 9120	< 570	< 1140
1,4-Dichlorobenzene	106467	< 9000	< 8810	< 9120	< 9120	< 570	< 1140
2-Butanone (MEK)	78933	< 22100	< 21700	< 22400	< 22400	< 1400	< 2800
2-Hexanone	591786	< 30700	< 30000	< 31100	< 31100	< 1940	< 3890
2-Propanol	67630	< 18400	< 18000	< 18700	< 18700	< 1170	< 2340
4-Ethyltoluene	622968	56700	8340	23300	25500	1240	< 933
4-Methyl-2-pentanone	108101	< 30700	< 30000	< 31100	< 31100	< 1940	< 3890
Acetone	67641	< 44500	< 43600	< 45100	< 45100	< 1130	< 2250
Benzene	71432	< 2400	< 2350	< 2430	< 2430	743	760
Benzyl chloride	100447	< 19400	< 19000	< 19700	< 19700	< 491	< 981
Bromodichloromethane	75274	< 10000	< 9820	< 10200	< 10200	< 635	< 1270
Bromoform	75252	< 15500	< 15200	< 15700	< 15700	< 2450	< 4910
Bromomethane	74839	< 5820	< 5700	< 5900	< 5900	< 369	< 737
Carbon disulfide	75150	< 4670	< 4570	< 4730	< 4730	< 296	< 591
Carbon tetrachloride	56235	< 4710	< 4610	< 4780	< 4780	< 299	< 597
Chlorobenzene	108907	< 6900	< 6760	< 7000	< 7000	< 437	< 875
Chloroethane	75003	< 3950	< 3870	< 4010	< 4010	< 250	< 501
Chloroform	67663	< 3660	< 3580	< 3710	< 3710	< 232	< 463
Chloromethane	74873	< 3100	< 3030	< 3140	< 3140	< 196	< 392
cis-1,2-Dichloroethene	156592	< 5940	< 5820	< 6020	< 6020	< 377	< 753
cis-1,3-Dichloropropene	542756	< 6810	< 6660	< 6900	< 6900	< 431	< 862

TABLE A-3

Soil Gas Analytical Data
Alker Tire - Buckhannon, Upshur County, West Virginia

	Sample Identification	**SG-1**	**SG-2**	**SG-3**	**SG-4**	**SG-5**	**SG-5 DUP**
	Sample Depth (feet)	**11**	**11**	**10**	**12**	**12**	**12**
	Sample Date	**4/6/2018**	**4/6/2018**	**4/6/2018**	**4/6/2018**	**4/6/2018**	**4/6/2018**
	Sample Type	**Investigation**	**Investigation**	**Investigation**	**Investigation**	**Investigation**	**Duplicate**
	Location	**Onsite**	**Onsite**	**Onsite**	**Offsite**	**Offsite**	**Offsite**
Constituent	**CAS No.**						
Volatile Organics (ug/m3) (Continued)							
Cyclohexane	110827	< 5160	< 5050	< 5230	< 5230	< 327	< 654
Dibromochloromethane	124481	< 12800	< 12500	< 12900	< 12900	< 808	< 1620
Dichlorodifluoromethane	75718	< 7450	< 7290	< 7550	< 7550	< 472	< 944
Dichlorotetrafluoroethane	76142	< 10500	< 10300	< 10600	< 10600	< 663	< 1330
Ethanol	64175	< 7060	< 6920	< 7160	< 7160	< 448	< 895
Ethyl Acetate	141786	< 5400	< 5290	< 5480	< 5480	< 342	< 685
Ethylbenzene	100414	123000	38500	84000	84300	4550	2940
Hexachlorobutadiene	87683	< 16000	< 6270	< 16200	< 16200	< 1010	< 2030
isopropylbenzene	98828	46900	38500	23400	< 18700	1800	< 2340
Methyl tert-butyl ether	1634044	< 27000	< 26400	< 27400	< 27400	< 1710	< 3420
Methylene Chloride	75092	< 26000	< 25500	< 26400	< 26400	< 1650	< 3300
Naphthalene	91203	< 19600	< 19200	< 19900	< 19900	< 1240	< 2490
n-Heptane	142825	809000	705000	1500000 J	< 6230	25700	19400
n-Hexane	110543	1180000 J	1420000 J	2920000 J	3280000 J	25700	18400
Propylene	115071	< 2580	< 2530	< 2620	< 2620	< 164	653
Styrene	100425	< 6390	< 6250	< 6470	< 6470	< 405	< 809
Tetrachloroethene	127184	< 5080	< 4970	< 5150	< 5150	< 322	< 644
Tetrahydrofuran	109999	< 4420	< 4330	< 4480	< 4480	< 280	< 561
Toluene	108883	40300	11500	370000	389000	8490	6270
trans-1,2-Dichloroethene	156605	< 5940	< 5820	< 6020	< 6020	< 377	< 753
trans-1,3-Dichloropropene	10061026	< 6810	< 6660	< 6900	< 6900	< 431	< 862
Trichloroethene	79016	< 4030	< 3940	< 4080	< 4080	< 255	< 510
Trichlorofluoromethane	75694	< 8410	< 8230	< 8520	< 8520	< 533	< 1070
Vinyl acetate	108054	< 5280	< 5170	< 5350	< 5350	< 335	< 669
Vinyl chloride	75014	< 1920	< 1880	< 1940	< 1940	< 121	< 243
m,p-Xylene	- -	325000	64400	236000	230000	13500	8320
o-Xylene	95476	56700	7300	45100	49800	2950	1750
Xylenes (Total)*	1330207	381700	71700	281100	279800	16450	10070

Notes:
* The result for xylenes (total) is calculated from the results for the o- and m&p isomers. See Text Section 2.4.4.
J - Analyte concentration exceeded the calibration range. The reported result is estimated.

APPENDIX B

STATISTICAL CALCULATIONS

TABLE B-1
STATISTICS FOR SURFACE SOIL
Alker Tire - Buckhannon, Upshur County, West Virginia

1,2,4-Trimethylbenzene
All units in mg/kg.

General Statistics

Total Number of Observations	11	Number of Distinct Observations	3
Number of Detects	2	Number of Non-Detects	9
Number of Distinct Detects	2	Number of Distinct Non-Detects	1
Minimum Detect	0.0054	Minimum Non-Detect	0.004
Maximum Detect	0.0108	Maximum Non-Detect	0.004
Variance Detects	1.4580E-5	Percent Non-Detects	81.82%
Mean Detects	0.0081	SD Detects	0.00382
Median Detects	0.0081	CV Detects	0.471
Skewness Detects	N/A	Kurtosis Detects	N/A
Mean of Logged Detects	-4.875	SD of Logged Detects	0.49

Warning: Data set has only 2 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Normal GOF Test on Detects Only
Not Enough Data to Perform GOF Test

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

KM Mean	0.00475	KM Standard Error of Mean	8.3406E-4
KM SD	0.00196	95% KM (BCA) UCL	N/A
95% KM (t) UCL	0.00626	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	0.00612	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	0.00725	95% KM Chebyshev UCL	0.00838
97.5% KM Chebyshev UCL	0.00995	99% KM Chebyshev UCL	0.013

Gamma GOF Tests on Detected Observations Only
Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	8.653	k star (bias corrected MLE)	N/A
Theta hat (MLE)	9.3604E-4	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	34.61	nu star (bias corrected)	N/A
Mean (detects)	0.0081		

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.00475	SD (KM)	0.00196
Variance (KM)	3.8261E-6	SE of Mean (KM)	8.3406E-4
k hat (KM)	5.886	k star (KM)	4.341
nu hat (KM)	129.5	nu star (KM)	95.5
theta hat (KM)	8.0627E-4	theta star (KM)	0.00109
80% gamma percentile (KM)	0.00648	90% gamma percentile (KM)	0.0078
95% gamma percentile (KM)	0.009	99% gamma percentile (KM)	0.0116

Gamma Kaplan-Meier (KM) Statistics

		Adjusted Level of Significance (β)	0.0278
Approximate Chi Square Value (95.50, α)	73.96	Adjusted Chi Square Value (95.50, β)	70.88
95% Gamma Approximate KM-UCL (use when n>=50)	0.00613	95% Gamma Adjusted KM-UCL (use when n<50)	0.00639

Lognormal GOF Test on Detected Observations Only
Not Enough Data to Perform GOF Test
Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.00201	Mean in Log Scale	-7.321
SD in Original Scale	0.0033	SD in Log Scale	1.627
95% t UCL (assumes normality of ROS data)	0.00381	95% Percentile Bootstrap UCL	0.00376
95% BCA Bootstrap UCL	0.00445	95% Bootstrap t UCL	0.00974
95% H-UCL (Log ROS)	0.0228		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-5.404	KM Geo Mean	0.0045
KM SD (logged)	0.29	95% Critical H Value (KM-Log)	1.939
KM Standard Error of Mean (logged)	0.124	95% H-UCL (KM -Log)	0.00561
KM SD (logged)	0.29	95% Critical H Value (KM-Log)	1.939
KM Standard Error of Mean (logged)	0.124		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.00311	Mean in Log Scale	-5.971
SD in Original Scale	0.00275	SD in Log Scale	0.564
95% t UCL (Assumes normality)	0.00461	95% H-Stat UCL	0.00448

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 (t) UCL	0.00626	KM H-UCL	0.00561
95% KM (BCA) UCL	N/A		

Warning: One or more Recommended UCL(s) not available!

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.

TABLE B-1
STATISTICS FOR SURFACE SOIL
Alker Tire - Buckhannon, Upshur County, West Virginia

1,3,5-Trimethylbenzene
All units in mg/kg.

General Statistics

Total Number of Observations	11	Number of Distinct Observations	1
Number of Detects	0	Number of Non-Detects	11
Number of Distinct Detects	0	Number of Distinct Non-Detects	1

Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!
Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!
The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV)

The data set for variable 1,3,5-Trimethylbenzene was not processed!

TABLE B-1
STATISTICS FOR SURFACE SOIL
Alker Tire - Buckhannon, Upshur County, West Virginia

Benzene
All units in mg/kg.

General Statistics

Total Number of Observations	16	Number of Distinct Observations	6
Number of Detects	2	Number of Non-Detects	14
Number of Distinct Detects	2	Number of Distinct Non-Detects	4
Minimum Detect	0.0052	Minimum Non-Detect	0.0036
Maximum Detect	0.0059	Maximum Non-Detect	0.0042
Variance Detects	2.4500E-7	Percent Non-Detects	87.5%
Mean Detects	0.00555	SD Detects	4.9497E-4
Median Detects	0.00555	CV Detects	0.0892
Skewness Detects	N/A	Kurtosis Detects	N/A
Mean of Logged Detects	-5.196	SD of Logged Detects	0.0893

Warning: Data set has only 2 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Normal GOF Test on Detects Only
Not Enough Data to Perform GOF Test

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

KM Mean	0.00384	KM Standard Error of Mean	2.3217E-4
KM SD	6.5667E-4	95% KM (BCA) UCL	N/A
95% KM (t) UCL	0.00425	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	0.00423	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	0.00454	95% KM Chebyshev UCL	0.00486
97.5% KM Chebyshev UCL	0.00529	99% KM Chebyshev UCL	0.00615

Gamma GOF Tests on Detected Observations Only
Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	251.1	k star (bias corrected MLE)	N/A
Theta hat (MLE)	2.2101E-5	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	1004	nu star (bias corrected)	N/A
Mean (detects)	0.00555		

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.00384	SD (KM)	6.5667E-4
Variance (KM)	4.3121E-7	SE of Mean (KM)	2.3217E-4
k hat (KM)	34.26	k star (KM)	27.88
nu hat (KM)	1096	nu star (KM)	892.2
theta hat (KM)	1.1218E-4	theta star (KM)	1.3787E-4
80% gamma percentile (KM)	0.00444	90% gamma percentile (KM)	0.0048
95% gamma percentile (KM)	0.00511	99% gamma percentile (KM)	0.00574

Gamma Kaplan-Meier (KM) Statistics

		Adjusted Level of Significance (β)	0.0335
Approximate Chi Square Value (892.16, α)	823.8	Adjusted Chi Square Value (892.16, β)	816.4
95% Gamma Approximate KM-UCL (use when n>=50)	0.00416	95% Gamma Adjusted KM-UCL (use when n<50)	0.0042

Lognormal GOF Test on Detected Observations Only
Not Enough Data to Perform GOF Test

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.00333	Mean in Log Scale	-5.751
SD in Original Scale	0.00107	SD in Log Scale	0.304
95% t UCL (assumes normality of ROS data)	0.0038	95% Percentile Bootstrap UCL	0.00377
95% BCA Bootstrap UCL	0.00382	95% Bootstrap t UCL	0.00394
95% H-UCL (Log ROS)	0.00386		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-5.573	KM Geo Mean	0.0038
KM SD (logged)	0.144	95% Critical H Value (KM-Log)	1.766
KM Standard Error of Mean (logged)	0.051	95% H-UCL (KM -Log)	0.0041
KM SD (logged)	0.144	95% Critical H Value (KM-Log)	1.766
KM Standard Error of Mean (logged)	0.051		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.00243	Mean in Log Scale	-6.094
SD in Original Scale	0.00123	SD in Log Scale	0.353
95% t UCL (Assumes normality)	0.00297	95% H-Stat UCL	0.00286

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 (t) UCL	0.00425	KM H-UCL	0.0041
95% KM (BCA) UCL	N/A		

Warning: One or more Recommended UCL(s) not available!

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.

TABLE B-1
STATISTICS FOR SURFACE SOIL
Alker Tire - Buckhannon, Upshur County, West Virginia

Naphthalene
All units in mg/kg.

General Statistics

Total Number of Observations	11	Number of Distinct Observations	1
Number of Detects	0	Number of Non-Detects	11
Number of Distinct Detects	0	Number of Distinct Non-Detects	1

Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!
Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!
The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Naphthalene was not processed!

TABLE B-1
STATISTICS FOR SURFACE SOIL
Alker Tire - Buckhannon, Upshur County, West Virginia

Xylenes (Total)
All units in mg/kg.

General Statistics

Total Number of Observations	16	Number of Distinct Observations	8
Number of Detects	2	Number of Non-Detects	14
Number of Distinct Detects	2	Number of Distinct Non-Detects	6
Minimum Detect	0.0266	Minimum Non-Detect	0.008
Maximum Detect	0.0304	Maximum Non-Detect	0.0153
Variance Detects	7.2200E-6	Percent Non-Detects	87.5%
Mean Detects	0.0285	SD Detects	0.00269
Median Detects	0.0285	CV Detects	0.0943
Skewness Detects	N/A	Kurtosis Detects	N/A
Mean of Logged Detects	-3.56	SD of Logged Detects	0.0944

Warning: Data set has only 2 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Normal GOF Test on Detects Only
Not Enough Data to Perform GOF Test

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

KM Mean	0.0106	KM Standard Error of Mean	0.00241
KM SD	0.00681	95% KM (BCA) UCL	N/A
95% KM (t) UCL	0.0148	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	0.0145	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	0.0178	95% KM Chebyshev UCL	0.0211
97.5% KM Chebyshev UCL	0.0256	99% KM Chebyshev UCL	0.0345

Gamma GOF Tests on Detected Observations Only
Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	224.7	k star (bias corrected MLE)	N/A
Theta hat (MLE)	1.2685E-4	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	898.7	nu star (bias corrected)	N/A
Mean (detects)	0.0285		

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.0106	SD (KM)	0.00681
Variance (KM)	4.6416E-5	SE of Mean (KM)	0.00241
k hat (KM)	2.404	k star (KM)	1.995
nu hat (KM)	76.92	nu star (KM)	63.83
theta hat (KM)	0.00439	theta star (KM)	0.0053
80% gamma percentile (KM)	0.0158	90% gamma percentile (KM)	0.0206
95% gamma percentile (KM)	0.0251	99% gamma percentile (KM)	0.0351

Gamma Kaplan-Meier (KM) Statistics

		Adjusted Level of Significance (β)	0.0335
Approximate Chi Square Value (63.83, α)	46.45	Adjusted Chi Square Value (63.83, β)	44.76
95% Gamma Approximate KM-UCL (use when n>=50)	0.0145	95% Gamma Adjusted KM-UCL (use when n<50)	0.0151

Lognormal GOF Test on Detected Observations Only
Not Enough Data to Perform GOF Test

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0166	Mean in Log Scale	-4.144
SD in Original Scale	0.0055	SD in Log Scale	0.302
95% t UCL (assumes normality of ROS data)	0.019	95% Percentile Bootstrap UCL	0.019
95% BCA Bootstrap UCL	0.0192	95% Bootstrap t UCL	0.0202
95% H-UCL (Log ROS)	0.0192		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-4.67	KM Geo Mean	0.00937
KM SD (logged)	0.42	95% Critical H Value (KM-Log)	1.972
KM Standard Error of Mean (logged)	0.149	95% H-UCL (KM -Log)	0.0127
KM SD (logged)	0.42	95% Critical H Value (KM-Log)	1.972
KM Standard Error of Mean (logged)	0.149		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.00774	Mean in Log Scale	-5.143
SD in Original Scale	0.00821	SD in Log Scale	0.653
95% t UCL (Assumes normality)	0.0113	95% H-Stat UCL	0.0105

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 (t) UCL	0.0148	KM H-UCL	0.0127
95% KM (BCA) UCL	N/A		

Warning: One or more Recommended UCL(s) not available!

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.

TABLE B-2
STATISTICS FOR SURFACE AND SUBSURFACE SOIL
Alker Tire - Buckhannon, Upshur County, West Virginia

1,2,4-Trimethylbenzene
All units in mg/kg.

General Statistics			
Total Number of Observations	27	Number of Distinct Observations	13
Number of Detects	8	Number of Non-Detects	19
Number of Distinct Detects	8	Number of Distinct Non-Detects	5
Minimum Detect	0.0043	Minimum Non-Detect	0.004
Maximum Detect	804	Maximum Non-Detect	0.5
Variance Detects	131146	Percent Non-Detects	70.37%
Mean Detects	280.5	SD Detects	362.1
Median Detects	60.02	CV Detects	1.291
Skewness Detects	0.714	Kurtosis Detects	-1.8
Mean of Logged Detects	0.778	SD of Logged Detects	5.775
Normal GOF Test on Detects Only			
Shapiro Wilk Test Statistic	0.75	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.818	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.296	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.283	Detected Data Not Normal at 5% Significance Level	
Detected Data Not Normal at 5% Significance Level			
Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs			
KM Mean	83.12	KM Standard Error of Mean	46.19
KM SD	224.5	95% KM (BCA) UCL	161.8
95% KM (t) UCL	161.9	95% KM (Percentile Bootstrap) UCL	161.8
95% KM (z) UCL	159.1	95% KM Bootstrap t UCL	208.7
90% KM Chebyshev UCL	221.7	95% KM Chebyshev UCL	284.5
97.5% KM Chebyshev UCL	371.6	99% KM Chebyshev UCL	542.7
Gamma GOF Tests on Detected Observations Only			
A-D Test Statistic	0.927	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.875	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.294	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.328	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)	0.157	k star (bias corrected MLE)	0.182
Theta hat (MLE)	1785	Theta star (bias corrected MLE)	1545
nu hat (MLE)	2.514	nu star (bias corrected)	2.905
Mean (detects)	280.5		
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	0.0043	Mean	83.12
Maximum	804	Median	0.01
SD	228.8	CV	2.752
k hat (MLE)	0.108	k star (bias corrected MLE)	0.121
Theta hat (MLE)	768.2	Theta star (bias corrected MLE)	687.7
nu hat (MLE)	5.843	nu star (bias corrected)	6.527
Adjusted Level of Significance (β)	0.0401		
Approximate Chi Square Value (6.53, α)	1.915	Adjusted Chi Square Value (6.53, β)	1.76
95% Gamma Approximate UCL (use when n>=50)	283.3	95% Gamma Adjusted UCL (use when n<50)	308.3
Estimates of Gamma Parameters using KM Estimates			
Mean (KM)	83.12	SD (KM)	224.5
Variance (KM)	50407	SE of Mean (KM)	46.19
k hat (KM)	0.137	k star (KM)	0.147
nu hat (KM)	7.401	nu star (KM)	7.912
theta hat (KM)	606.5	theta star (KM)	567.3
80% gamma percentile (KM)	88.72	90% gamma percentile (KM)	245.6
95% gamma percentile (KM)	459.5	99% gamma percentile (KM)	1083
Gamma Kaplan-Meier (KM) Statistics			
Approximate Chi Square Value (7.91, α)	2.684	Adjusted Chi Square Value (7.91, β)	2.493
95% Gamma Approximate KM-UCL (use when n>=50)	245	95% Gamma Adjusted KM-UCL (use when n<50)	263.8
Lognormal GOF Test on Detected Observations Only			
Shapiro Wilk Test Statistic	0.772	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.818	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.256	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.283	Detected Data appear Lognormal at 5% Significance Level	
Detected Data appear Approximate Lognormal at 5% Significance Level			
Lognormal ROS Statistics Using Imputed Non-Detects			
Mean in Original Scale	83.11	Mean in Log Scale	-11.98
SD in Original Scale	228.8	SD in Log Scale	10.41
95% t UCL (assumes normality of ROS data)	158.2	95% Percentile Bootstrap UCL	157.3
95% BCA Bootstrap UCL	179	95% Bootstrap t UCL	211.8
95% H-UCL (Log ROS)	N/A		
Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution			
KM Mean (logged)	-3.645	KM Geo Mean	0.0261
KM SD (logged)	4.111	95% Critical H Value (KM-Log)	7.709
KM Standard Error of Mean (logged)	0.846	95% H-UCL (KM -Log)	61156
KM SD (logged)	4.111	95% Critical H Value (KM-Log)	7.709
KM Standard Error of Mean (logged)	0.846		
DL/2 Statistics			
DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	83.12	Mean in Log Scale	-3.86
SD in Original Scale	228.8	SD in Log Scale	4.402
95% t UCL (Assumes normality)	158.2	95% H-Stat UCL	412843
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			
Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50 but k<=1)	263.8		
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.			

TABLE B-2
STATISTICS FOR SURFACE AND SUBSURFACE SOIL
Alker Tire - Buckhannon, Upshur County, West Virginia

1,3,5-Trimethylbenzene
All units in mg/kg.

General Statistics

Total Number of Observations	27	Number of Distinct Observations	11
Number of Detects	5	Number of Non-Detects	22
Number of Distinct Detects	5	Number of Distinct Non-Detects	6
Minimum Detect	0.0303	Minimum Non-Detect	0.004
Maximum Detect	216	Maximum Non-Detect	0.5
Variance Detects	8080	Percent Non-Detects	81.48%
Mean Detects	109.3	SD Detects	89.89
Median Detects	126	CV Detects	0.822
Skewness Detects	-0.155	Kurtosis Detects	-2.027
Mean of Logged Detects	3.088	SD of Logged Detects	3.744

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.95	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.191	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.343	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

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

KM Mean	20.25	KM Standard Error of Mean	11.79
KM SD	54.78	95% KM (BCA) UCL	40.7
95% KM (t) UCL	40.36	95% KM (Percentile Bootstrap) UCL	39.66
95% KM (z) UCL	39.64	95% KM Bootstrap t UCL	37.8
90% KM Chebyshev UCL	55.61	95% KM Chebyshev UCL	71.63
97.5% KM Chebyshev UCL	93.86	99% KM Chebyshev UCL	137.5

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.697	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.724	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.33	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.375	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)	0.408	k star (bias corrected MLE)	0.297
Theta hat (MLE)	267.8	Theta star (bias corrected MLE)	368.6
nu hat (MLE)	4.083	nu star (bias corrected)	2.967
Mean (detects)	109.3		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	20.26
Maximum	216	Median	0.01
SD	55.82	CV	2.756
k hat (MLE)	0.127	k star (bias corrected MLE)	0.138
Theta hat (MLE)	159.3	Theta star (bias corrected MLE)	147.1
nu hat (MLE)	6.865	nu star (bias corrected)	7.436
Adjusted Level of Significance (β)	0.0401		
Approximate Chi Square Value (7.44, α)	2.413	Adjusted Chi Square Value (7.44, β)	2.234
95% Gamma Approximate UCL (use when n>=50)	62.43	95% Gamma Adjusted UCL (use when n<50)	67.44

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	20.25	SD (KM)	54.78
Variance (KM)	3001	SE of Mean (KM)	11.79
k hat (KM)	0.137	k star (KM)	0.146
nu hat (KM)	7.38	nu star (KM)	7.894
theta hat (KM)	148.2	theta star (KM)	138.5
80% gamma percentile (KM)	21.58	90% gamma percentile (KM)	59.83
95% gamma percentile (KM)	112	99% gamma percentile (KM)	264.3

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (7.89, α)	2.674	Adjusted Chi Square Value (7.89, β)	2.483
95% Gamma Approximate KM-UCL (use when n>=50)	59.79	95% Gamma Adjusted KM-UCL (use when n<50)	64.39

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.7	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.355	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.343	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	20.25	Mean in Log Scale	-8.068
SD in Original Scale	55.82	SD in Log Scale	7.181
95% t UCL (assumes normality of ROS data)	38.58	95% Percentile Bootstrap UCL	39.57
95% BCA Bootstrap UCL	43.42	95% Bootstrap t UCL	56.14
95% H-UCL (Log ROS)	6.202E+15		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-3.92	KM Geo Mean	0.0198
KM SD (logged)	3.64	95% Critical H Value (KM-Log)	6.872
KM Standard Error of Mean (logged)	0.784	95% H-UCL (KM -Log)	2024
KM SD (logged)	3.64	95% Critical H Value (KM-Log)	6.872
KM Standard Error of Mean (logged)	0.784		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	20.26	Mean in Log Scale	-4.198
SD in Original Scale	55.82	SD in Log Scale	3.96
95% t UCL (Assumes normality)	38.58	95% H-Stat UCL	12370

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

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	40.36

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.

TABLE B-2
STATISTICS FOR SURFACE AND SUBSURFACE SOIL
Alker Tire - Buckhannon, Upshur County, West Virginia

Benzene USEPA Method SW8260B
All units in mg/kg.

General Statistics			
Total Number of Observations	37	Number of Distinct Observations	18
Number of Detects	8	Number of Non-Detects	29
Number of Distinct Detects	7	Number of Distinct Non-Detects	12
Minimum Detect	0.0052	Minimum Non-Detect	0.0036
Maximum Detect	57.6	Maximum Non-Detect	10
Variance Detects	413.8	Percent Non-Detects	78.38%
Mean Detects	7.256	SD Detects	20.34
Median Detects	0.03	CV Detects	2.803
Skewness Detects	2.828	Kurtosis Detects	8
Mean of Logged Detects	-2.787	SD of Logged Detects	3.136
Normal GOF Test on Detects Only			
Shapiro Wilk Test Statistic	0.422	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.818	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.51	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.283	Detected Data Not Normal at 5% Significance Level	
Detected Data Not Normal at 5% Significance Level			
Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs			
KM Mean	1.574	KM Standard Error of Mean	1.641
KM SD	9.338	95% KM (BCA) UCL	4.684
95% KM (t) UCL	4.344	95% KM (Percentile Bootstrap) UCL	4.683
95% KM (z) UCL	4.273	95% KM Bootstrap t UCL	542.4
90% KM Chebyshev UCL	6.497	95% KM Chebyshev UCL	8.727
97.5% KM Chebyshev UCL	11.82	99% KM Chebyshev UCL	17.9
Gamma GOF Tests on Detected Observations Only			
A-D Test Statistic	1.481	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.872	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.413	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.328	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)	0.16	k star (bias corrected MLE)	0.183
Theta hat (MLE)	45.44	Theta star (bias corrected MLE)	39.62
nu hat (MLE)	2.555	nu star (bias corrected)	2.93
Mean (detects)	7.256		
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	0.0052	Mean	1.577
Maximum	57.6	Median	0.01
SD	9.466	CV	6.004
k hat (MLE)	0.163	k star (bias corrected MLE)	0.168
Theta hat (MLE)	9.69	Theta star (bias corrected MLE)	9.411
nu hat (MLE)	12.04	nu star (bias corrected)	12.4
Adjusted Level of Significance (β)	0.0431		
Approximate Chi Square Value (12.40, α)	5.49	Adjusted Chi Square Value (12.40, β)	5.291
95% Gamma Approximate UCL (use when n>=50)	3.561	95% Gamma Adjusted UCL (use when n<50)	3.695
Estimates of Gamma Parameters using KM Estimates			
Mean (KM)	1.574	SD (KM)	9.338
Variance (KM)	87.2	SE of Mean (KM)	1.641
k hat (KM)	0.0284	k star (KM)	0.0441
nu hat (KM)	2.101	nu star (KM)	3.264
theta hat (KM)	55.41	theta star (KM)	35.67
80% gamma percentile (KM)	0.132	90% gamma percentile (KM)	2.009
95% gamma percentile (KM)	7.945	99% gamma percentile (KM)	35.91
Gamma Kaplan-Meier (KM) Statistics			
Approximate Chi Square Value (3.26, α)	0.455	Adjusted Chi Square Value (3.26, β)	0.416
95% Gamma Approximate KM-UCL (use when n>=50)	11.29	95% Gamma Adjusted KM-UCL (use when n<50)	12.36
95% Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50)			
Lognormal GOF Test on Detected Observations Only			
Shapiro Wilk Test Statistic	0.8	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.818	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.215	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.283	Detected Data appear Lognormal at 5% Significance Level	
Detected Data appear Approximate Lognormal at 5% Significance Level			
Lognormal ROS Statistics Using Imputed Non-Detects			
Mean in Original Scale	1.569	Mean in Log Scale	-10.61
SD in Original Scale	9.467	SD in Log Scale	5.278
95% t UCL (assumes normality of ROS data)	4.197	95% Percentile Bootstrap UCL	4.681
95% BCA Bootstrap UCL	7.789	95% Bootstrap t UCL	641
95% H-UCL (Log ROS)	70289		
Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution			
KM Mean (logged)	-4.953	KM Geo Mean	0.00706
KM SD (logged)	1.824	95% Critical H Value (KM-Log)	3.473
KM Standard Error of Mean (logged)	0.329	95% H-UCL (KM -Log)	0.107
KM SD (logged)	1.824	95% Critical H Value (KM-Log)	3.473
KM Standard Error of Mean (logged)	0.329		
DL/2 Statistics			
DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	1.949	Mean in Log Scale	-4.476
SD in Original Scale	9.48	SD in Log Scale	2.86
95% t UCL (Assumes normality)	4.58	95% H-Stat UCL	7.493
DL/2 is not a recommended method, provided for comparisons and historical reasons			
Nonparametric Distribution Free UCL Statistics			
Detected Data appear Approximate Lognormal Distributed at 5% Significance Level			
Suggested UCL to Use			
99% KM (Chebyshev) UCL	17.9		

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.

TABLE B-2
STATISTICS FOR SURFACE AND SUBSURFACE SOIL
Alker Tire - Buckhannon, Upshur County, West Virginia

Naphthalene
All units in mg/kg.

General Statistics

Total Number of Observations	27	Number of Distinct Observations	11
Number of Detects	6	Number of Non-Detects	21
Number of Distinct Detects	6	Number of Distinct Non-Detects	5
Minimum Detect	0.0068	Minimum Non-Detect	0.004
Maximum Detect	283	Maximum Non-Detect	0.5
Variance Detects	12102	Percent Non-Detects	77.78%
Mean Detects	95.47	SD Detects	110
Median Detects	69.4	CV Detects	1.152
Skewness Detects	1.077	Kurtosis Detects	0.573
Mean of Logged Detects	1.774	SD of Logged Detects	4.629

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.88	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.216	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.325	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

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

KM Mean	21.22	KM Standard Error of Mean	13.02
KM SD	61.78	95% KM (BCA) UCL	43.85
95% KM (t) UCL	43.43	95% KM (Percentile Bootstrap) UCL	42.97
95% KM (z) UCL	42.64	95% KM Bootstrap t UCL	64.24
90% KM Chebyshev UCL	60.29	95% KM Chebyshev UCL	77.99
97.5% KM Chebyshev UCL	102.6	99% KM Chebyshev UCL	150.8

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.561	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.783	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.258	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.36	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)	0.254	k star (bias corrected MLE)	0.238
Theta hat (MLE)	375.4	Theta star (bias corrected MLE)	400.7
nu hat (MLE)	3.052	nu star (bias corrected)	2.859
Mean (detects)	95.47		

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	0.0068	Mean	21.22
Maximum	283	Median	0.01
SD	62.95	CV	2.966
k hat (MLE)	0.126	k star (bias corrected MLE)	0.137
Theta hat (MLE)	168.2	Theta star (bias corrected MLE)	155.1
nu hat (MLE)	6.813	nu star (bias corrected)	7.389
Adjusted Level of Significance (β)	0.0401		
Approximate Chi Square Value (7.39, α)	2.387	Adjusted Chi Square Value (7.39, β)	2.209
95% Gamma Approximate UCL (use when n>=50)	65.71	95% Gamma Adjusted UCL (use when n<50)	71.01

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	21.22	SD (KM)	61.78
Variance (KM)	3816	SE of Mean (KM)	13.02
k hat (KM)	0.118	k star (KM)	0.13
nu hat (KM)	6.371	nu star (KM)	6.997
theta hat (KM)	179.9	theta star (KM)	163.8
80% gamma percentile (KM)	20.2	90% gamma percentile (KM)	61.28
95% gamma percentile (KM)	119.8	99% gamma percentile (KM)	295.1

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (7.00, α)	2.169	Adjusted Chi Square Value (7.00, β)	2.001
95% Gamma Approximate KM-UCL (use when n>=50)	68.46	95% Gamma Adjusted KM-UCL (use when n<50)	74.2

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.798	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.311	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.325	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	21.22	Mean in Log Scale	-11.34
SD in Original Scale	62.96	SD in Log Scale	9.21
95% t UCL (assumes normality of ROS data)	41.88	95% Percentile Bootstrap UCL	43.33
95% BCA Bootstrap UCL	51.24	95% Bootstrap t UCL	74.58
95% H-UCL (Log ROS)	5.968E+26		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-3.894	KM Geo Mean	0.0204
KM SD (logged)	3.627	95% Critical H Value (KM-Log)	6.848
KM Standard Error of Mean (logged)	0.765	95% H-UCL (KM -Log)	1913
KM SD (logged)	3.627	95% Critical H Value (KM-Log)	6.848
KM Standard Error of Mean (logged)	0.765		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	21.23	Mean in Log Scale	-4.155
SD in Original Scale	62.95	SD in Log Scale	3.943
95% t UCL (Assumes normality)	41.89	95% H-Stat UCL	11489

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

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	43.43

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.

TABLE B-2
STATISTICS FOR SURFACE AND SUBSURFACE SOIL
Alker Tire - Buckhannon, Upshur County, West Virginia

Xylenes (Total) USEPA Method SW8260B
All units in mg/kg.

General Statistics

Total Number of Observations	37	Number of Distinct Observations	23
Number of Detects	10	Number of Non-Detects	27
Number of Distinct Detects	10	Number of Distinct Non-Detects	13
Minimum Detect	0.0113	Minimum Non-Detect	0.008
Maximum Detect	1025	Maximum Non-Detect	1
Variance Detects	187866	Percent Non-Detects	72.97%
Mean Detects	367.5	SD Detects	433.4
Median Detects	134.9	CV Detects	1.179
Skewness Detects	0.626	Kurtosis Detects	-1.706
Mean of Logged Detects	2.297	SD of Logged Detects	5.011

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.782	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.842	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.281	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.262	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	99.33	KM Standard Error of Mean	46.61
KM SD	268.9	95% KM (BCA) UCL	179
95% KM (t) UCL	178	95% KM (Percentile Bootstrap) UCL	175.5
95% KM (z) UCL	176	95% KM Bootstrap t UCL	223
90% KM Chebyshev UCL	239.1	95% KM Chebyshev UCL	302.5
97.5% KM Chebyshev UCL	390.4	99% KM Chebyshev UCL	563.1

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.97	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.854	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.245	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.294	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)	0.203	k star (bias corrected MLE)	0.209
Theta hat (MLE)	1807	Theta star (bias corrected MLE)	1758
nu hat (MLE)	4.067	nu star (bias corrected)	4.18
Mean (detects)	367.5		

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	99.33
Maximum	1025	Median	0.01
SD	272.7	CV	2.745
k hat (MLE)	0.109	k star (bias corrected MLE)	0.119
Theta hat (MLE)	907.9	Theta star (bias corrected MLE)	837.9
nu hat (MLE)	8.096	nu star (bias corrected)	8.773
Adjusted Level of Significance (β)	0.0431		
Approximate Chi Square Value (8.77, α)	3.19	Adjusted Chi Square Value (8.77, β)	3.045
95% Gamma Approximate UCL (use when n>=50)	273.1	95% Gamma Adjusted UCL (use when n<50)	286.2

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	99.33	SD (KM)	268.9
Variance (KM)	72331	SE of Mean (KM)	46.61
k hat (KM)	0.136	k star (KM)	0.143
nu hat (KM)	10.09	nu star (KM)	10.61
theta hat (KM)	728.2	theta star (KM)	692.9
80% gamma percentile (KM)	104.1	90% gamma percentile (KM)	292.5
95% gamma percentile (KM)	551.4	99% gamma percentile (KM)	1310

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (10.61, α)	4.326	Adjusted Chi Square Value (10.61, β)	4.152
95% Gamma Approximate KM-UCL (use when n>=50)	243.6	95% Gamma Adjusted KM-UCL (use when n<50)	253.8

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.776	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.842	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.282	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.262	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	99.32	Mean in Log Scale	-9.152
SD in Original Scale	272.7	SD in Log Scale	8.484
95% t UCL (assumes normality of ROS data)	175	95% Percentile Bootstrap UCL	177.8
95% BCA Bootstrap UCL	194.6	95% Bootstrap t UCL	218.6
95% H-UCL (Log ROS)	2.273E+20		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.886	KM Geo Mean	0.0558
KM SD (logged)	4.01	95% Critical H Value (KM-Log)	6.864
KM Standard Error of Mean (logged)	0.695	95% H-UCL (KM -Log)	17005
KM SD (logged)	4.01	95% Critical H Value (KM-Log)	6.864
KM Standard Error of Mean (logged)	0.695		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	99.35	Mean in Log Scale	-2.995
SD in Original Scale	272.6	SD in Log Scale	4.254
95% t UCL (Assumes normality)	175	95% H-Stat UCL	73111

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

Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50 but k<=1)	253.8

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

TABLE B-2
STATISTICS FOR SURFACE AND SUBSURFACE SOIL
Alker Tire - Buckhannon, Upshur County, West Virginia

Benzene USEPA Method SW8021B
All units in mg/kg.

General Statistics

Total Number of Observations	5	Number of Distinct Observations	5
Number of Detects	3	Number of Non-Detects	2
Number of Distinct Detects	3	Number of Distinct Non-Detects	2
Minimum Detect	0.0261	Minimum Non-Detect	0.0054
Maximum Detect	73.8	Maximum Non-Detect	0.0064
Variance Detects	1813	Percent Non-Detects	40%
Mean Detects	24.64	SD Detects	42.58
Median Detects	0.0789	CV Detects	1.728
Skewness Detects	1.732	Kurtosis Detects	N/A
Mean of Logged Detects	-0.628	SD of Logged Detects	4.305

Warning: Data set has only 3 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.
guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.751	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.767	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.385	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.425	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Approximate Normal at 5% Significance Level

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

KM Mean	14.78	KM Standard Error of Mean	16.16
KM SD	29.51	95% KM (BCA) UCL	N/A
95% KM (t) UCL	49.24	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	41.37	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	63.27	95% KM Chebyshev UCL	85.23
97.5% KM Chebyshev UCL	115.7	99% KM Chebyshev UCL	175.6

Gamma GOF Tests on Detected Observations Only
Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	0.193	k star (bias corrected MLE)	N/A
Theta hat (MLE)	127.6	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	1.159	nu star (bias corrected)	N/A
Mean (detects)	24.64		

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	14.79
Maximum	73.8	Median	0.0261
SD	32.99	CV	2.231
k hat (MLE)	0.156	k star (bias corrected MLE)	0.196
Theta hat (MLE)	95.01	Theta star (bias corrected MLE)	75.6
nu hat (MLE)	1.556	nu star (bias corrected)	1.956
Adjusted Level of Significance (β)	0.0086		
Approximate Chi Square Value (1.96, α)	0.145	Adjusted Chi Square Value (1.96, β)	0.0684
95% Gamma Approximate UCL (use when n>=50)	199.2	95% Gamma Adjusted UCL (use when n<50)	N/A

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	14.78	SD (KM)	29.51
Variance (KM)	870.7	SE of Mean (KM)	16.16
k hat (KM)	0.251	k star (KM)	0.234
nu hat (KM)	2.51	nu star (KM)	2.337
theta hat (KM)	58.9	theta star (KM)	63.25
80% gamma percentile (KM)	20.93	90% gamma percentile (KM)	44.55
95% gamma percentile (KM)	72.98	99% gamma percentile (KM)	149.4

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (2.34, α)	0.207	Adjusted Chi Square Value (2.34, β)	0.0843
95% Gamma Approximate KM-UCL (use when n>=50)	167.2	95% Gamma Adjusted KM-UCL (use when n<50)	409.9

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.852	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.338	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.425	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	14.78	Mean in Log Scale	-5.648
SD in Original Scale	32.99	SD in Log Scale	7.518
95% t UCL (assumes normality of ROS data)	46.24	95% Percentile Bootstrap UCL	N/A
95% BCA Bootstrap UCL	N/A	95% Bootstrap t UCL	N/A
95% H-UCL (Log ROS)	4.767E+66		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.465	KM Geo Mean	0.085
KM SD (logged)	3.532	95% Critical H Value (KM-Log)	16.42
KM Standard Error of Mean (logged)	1.935	95% H-UCL (KM -Log)	1.701E+14
KM SD (logged)	3.532	95% Critical H Value (KM-Log)	16.42
KM Standard Error of Mean (logged)	1.935		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	14.78	Mean in Log Scale	-2.709
SD in Original Scale	32.99	SD in Log Scale	4.17
95% t UCL (Assumes normality)	46.24	95% H-Stat UCL	1.345E+20

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

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	49.24

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

TABLE B-2
STATISTICS FOR SURFACE AND SUBSURFACE SOIL
Alker Tire - Buckhannon, Upshur County, West Virginia

Xylenes (Total) USEPA Method SW8021B
All units in mg/kg.

General Statistics

Total Number of Observations	5	Number of Distinct Observations	5
Number of Detects	3	Number of Non-Detects	2
Number of Distinct Detects	3	Number of Distinct Non-Detects	2
Minimum Detect	0.013	Minimum Non-Detect	0.0109
Maximum Detect	676	Maximum Non-Detect	0.0127
Variance Detects	152319	Percent Non-Detects	40%
Mean Detects	225.3	SD Detects	390.3
Median Detects	0.0168	CV Detects	1.732
Skewness Detects	1.732	Kurtosis Detects	N/A
Mean of Logged Detects	-0.638	SD of Logged Detects	6.197

Warning: Data set has only 3 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.
Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use
guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.75	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.767	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.385	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.425	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Approximate Normal at 5% Significance Level

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

KM Mean	135.2	KM Standard Error of Mean	148.1
KM SD	270.4	95% KM (BCA) UCL	N/A
95% KM (t) UCL	450.9	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	378.8	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	579.5	95% KM Chebyshev UCL	780.8
97.5% KM Chebyshev UCL	1060	99% KM Chebyshev UCL	1609

Gamma GOF Tests on Detected Observations Only
Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	0.13	k star (bias corrected MLE)	N/A
Theta hat (MLE)	1739	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	0.778	nu star (bias corrected)	N/A
Mean (detects)	225.3		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	135.2
Maximum	676	Median	0.013
SD	302.3	CV	2.236
k hat (MLE)	0.112	k star (bias corrected MLE)	0.178
Theta hat (MLE)	1205	Theta star (bias corrected MLE)	758.7
nu hat (MLE)	1.122	nu star (bias corrected)	1.782
Adjusted Level of Significance (β)	0.0086		
Approximate Chi Square Value (1.78, α)	0.128	Adjusted Chi Square Value (1.78, β)	0.0628
95% Gamma Approximate UCL (use when n>=50)	1886	95% Gamma Adjusted UCL (use when n<50)	N/A

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	135.2	SD (KM)	270.4
Variance (KM)	73113	SE of Mean (KM)	148.1
k hat (KM)	0.25	k star (KM)	0.233
nu hat (KM)	2.5	nu star (KM)	2.334
theta hat (KM)	540.7	theta star (KM)	579.4
80% gamma percentile (KM)	191.3	90% gamma percentile (KM)	407.5
95% gamma percentile (KM)	667.8	99% gamma percentile (KM)	1368

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (2.33, α)	0.206	Adjusted Chi Square Value (2.33, β)	0.0841
95% Gamma Approximate KM-UCL (use when n>=50)	1533	95% Gamma Adjusted KM-UCL (use when n<50)	3752

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.768	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.378	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.425	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	135.2	Mean in Log Scale	-7.561
SD in Original Scale	302.3	SD in Log Scale	10.44
95% t UCL (assumes normality of ROS data)	423.4	95% Percentile Bootstrap UCL	N/A
95% BCA Bootstrap UCL	N/A	95% Bootstrap t UCL	N/A
95% H-UCL (Log ROS)	N/A		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.19	KM Geo Mean	0.112
KM SD (logged)	4.356	95% Critical H Value (KM-Log)	20.22
KM Standard Error of Mean (logged)	2.386	95% H-UCL (KM -Log)	1.971E+22
KM SD (logged)	4.356	95% Critical H Value (KM-Log)	20.22
KM Standard Error of Mean (logged)	2.386		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	135.2	Mean in Log Scale	-2.437
SD in Original Scale	302.3	SD in Log Scale	5.027
95% t UCL (Assumes normality)	423.4	95% H-Stat UCL	7.615E+29

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

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	450.9

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.

TABLE B-3
STATISTICS FOR GROUNDWATER
Alker Tire - Buckhannon, Upshur County, West Virginia

Benzene
All units in ug/L.

General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
Number of Detects	6	Number of Non-Detects	1
Number of Distinct Detects	6	Number of Distinct Non-Detects	1
Minimum Detect	1.3	Minimum Non-Detect	500
Maximum Detect	506	Maximum Non-Detect	500
Variance Detects	38772	Percent Non-Detects	14.29%
Mean Detects	161	SD Detects	196.9
Median Detects	77.15	CV Detects	1.223
Skewness Detects	1.363	Kurtosis Detects	0.995
Mean of Logged Detects	3.968	SD of Logged Detects	2.138

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.832	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.292	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

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

KM Mean	151.1	KM Standard Error of Mean	73.47
KM SD	172.4	95% KM (BCA) UCL	272.9
95% KM (t) UCL	293.9	95% KM (Percentile Bootstrap) UCL	271.7
95% KM (z) UCL	272	95% KM Bootstrap t UCL	616.9
90% KM Chebyshev UCL	371.5	95% KM Chebyshev UCL	471.4
97.5% KM Chebyshev UCL	609.9	99% KM Chebyshev UCL	882.1

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.161	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.732	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.149	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.347	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)	0.561	k star (bias corrected MLE)	0.391
Theta hat (MLE)	287.1	Theta star (bias corrected MLE)	411.2
nu hat (MLE)	6.728	nu star (bias corrected)	4.697
Mean (detects)	161		

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

Minimum	1.3	Mean	147.6
Maximum	506	Median	67.22
SD	183.2	CV	1.241
k hat (MLE)	0.62	k star (bias corrected MLE)	0.449
Theta hat (MLE)	238.1	Theta star (bias corrected MLE)	328.4
nu hat (MLE)	8.678	nu star (bias corrected)	6.292
Adjusted Level of Significance (β)	0.0158		
Approximate Chi Square Value (6.29, α)	1.791	Adjusted Chi Square Value (6.29, β)	1.16
95% Gamma Approximate UCL (use when n>=50)	518.5	95% Gamma Adjusted UCL (use when n<50)	800.5

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	151.1	SD (KM)	172.4
Variance (KM)	29735	SE of Mean (KM)	73.47
k hat (KM)	0.768	k star (KM)	0.534
nu hat (KM)	10.75	nu star (KM)	7.478
theta hat (KM)	196.8	theta star (KM)	282.9
80% gamma percentile (KM)	248.8	90% gamma percentile (KM)	403.2
95% gamma percentile (KM)	567	99% gamma percentile (KM)	967.3

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (7.48, α)	2.437	Adjusted Chi Square Value (7.48, β)	1.66
95% Gamma Approximate KM-UCL (use when n>=50)	463.8	95% Gamma Adjusted KM-UCL (use when n<50)	680.9

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.93	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.178	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	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	142.4	Mean in Log Scale	3.89
SD in Original Scale	186.4	SD in Log Scale	1.963
95% t UCL (assumes normality of ROS data)	279.2	95% Percentile Bootstrap UCL	255.9
95% BCA Bootstrap UCL	293.3	95% Bootstrap t UCL	718.2
95% H-UCL (Log ROS)	68061		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.904	KM Geo Mean	49.58
KM SD (logged)	1.941	95% Critical H Value (KM-Log)	6.561
KM Standard Error of Mean (logged)	0.863	95% H-UCL (KM -Log)	59151
KM SD (logged)	1.941	95% Critical H Value (KM-Log)	6.561
KM Standard Error of Mean (logged)	0.863		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	173.7	Mean in Log Scale	4.19
SD in Original Scale	182.9	SD in Log Scale	2.038
95% t UCL (Assumes normality)	308	95% H-Stat UCL	159844

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

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	293.9

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.

TABLE B-3
STATISTICS FOR GROUNDWATER
Alker Tire - Buckhannon, Upshur County, West Virginia

Ethylbenzene
All units in ug/L.

General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	0
Minimum	687	Mean	1185
Maximum	1990	Median	919
SD	473.5	Std. Error of Mean	179
Coefficient of Variation	0.4	Skewness	0.815

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.89	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.284	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1533	95% Adjusted-CLT UCL (Chen-1995)	1538
		95% Modified-t UCL (Johnson-1978)	1542

Gamma GOF Test

A-D Test Statistic	0.422	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.709	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.284	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.312	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	7.82	k star (bias corrected MLE)	4.564
Theta hat (MLE)	151.5	Theta star (bias corrected MLE)	259.7
nu hat (MLE)	109.5	nu star (bias corrected)	63.9
MLE Mean (bias corrected)	1185	MLE Sd (bias corrected)	554.8
		Approximate Chi Square Value (0.05)	46.51
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	42.06

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	1628	95% Adjusted Gamma UCL (use when n<50)	1800

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.922	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.259	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	6.532	Mean of logged Data	7.012
Maximum of Logged Data	7.596	SD of logged Data	0.386

Assuming Lognormal Distribution

95% H-UCL	1714	90% Chebyshev (MVUE) UCL	1702
95% Chebyshev (MVUE) UCL	1938	97.5% Chebyshev (MVUE) UCL	2264
99% Chebyshev (MVUE) UCL	2906		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1480	95% Jackknife UCL	1533
95% Standard Bootstrap UCL	1452	95% Bootstrap-t UCL	1687
95% Hall's Bootstrap UCL	1450	95% Percentile Bootstrap UCL	1466
95% BCA Bootstrap UCL	1505		
90% Chebyshev(Mean, Sd) UCL	1722	95% Chebyshev(Mean, Sd) UCL	1965
97.5% Chebyshev(Mean, Sd) UCL	2303	99% Chebyshev(Mean, Sd) UCL	2966

Suggested UCL to Use

95% Student's-t UCL	1533

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.

TABLE B-3
STATISTICS FOR GROUNDWATER
Alker Tire - Buckhannon, Upshur County, West Virginia

Naphthalene
All units in ug/L.

General Statistics

Total Number of Observations	3	Number of Distinct Observations	3
		Number of Missing Observations	0
Minimum	126	Mean	211
Maximum	310	Median	197
SD	92.8	Std. Error of Mean	53.58
Coefficient of Variation	0.44	Skewness	0.663

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.983	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.767	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.227	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.425	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	367.4	95% Adjusted-CLT UCL (Chen-1995)	321.1
		95% Modified-t UCL (Johnson-1978)	370.9

Gamma GOF Test

Not Enough Data to Perform GOF Test

Gamma Statistics

k hat (MLE)	7.681	k star (bias corrected MLE)	N/A
Theta hat (MLE)	27.47	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	46.09	nu star (bias corrected)	N/A
MLE Mean (bias corrected)	N/A	MLE Sd (bias corrected)	N/A
		Approximate Chi Square Value (0.05)	N/A
Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	N/A	95% Adjusted Gamma UCL (use when n<50)	N/A

Lognormal GOF Test

Shapiro Wilk Test Statistic	1	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.767	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.175	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.425	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	4.836	Mean of logged Data	5.285
Maximum of Logged Data	5.737	SD of logged Data	0.45

Assuming Lognormal Distribution

95% H-UCL	1401	90% Chebyshev (MVUE) UCL	371.5
95% Chebyshev (MVUE) UCL	444.1	97.5% Chebyshev (MVUE) UCL	545
99% Chebyshev (MVUE) UCL	743.2		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	299.1	95% Jackknife UCL	367.4
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A
95% BCA Bootstrap UCL	N/A		
90% Chebyshev(Mean, Sd) UCL	371.7	95% Chebyshev(Mean, Sd) UCL	444.5
97.5% Chebyshev(Mean, Sd) UCL	545.6	99% Chebyshev(Mean, Sd) UCL	744.1

Suggested UCL to Use

95% Student's-t UCL	367.4

Recommended UCL exceeds the maximum observation

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

TABLE B-3
STATISTICS FOR GROUNDWATER
Alker Tire - Buckhannon, Upshur County, West Virginia

Toluene
All units in ug/L.

General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	0
Minimum	42.8	Mean	2414
Maximum	6640	Median	1740
SD	2532	Std. Error of Mean	957.1
Coefficient of Variation	1.049	Skewness	0.756

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.886	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.226	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	4274	95% Adjusted-CLT UCL (Chen-1995)	4281
		95% Modified-t UCL (Johnson-1978)	4319

Gamma GOF Test

A-D Test Statistic	0.314	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.743	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.212	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.325	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.638	k star (bias corrected MLE)	0.46
Theta hat (MLE)	3782	Theta star (bias corrected MLE)	5248
nu hat (MLE)	8.937	nu star (bias corrected)	6.44
MLE Mean (bias corrected)	2414	MLE Sd (bias corrected)	3559
		Approximate Chi Square Value (0.05)	1.869
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	1.219

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	8319	95% Adjusted Gamma UCL (use when n<50)	12751

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.91	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.204	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	3.757	Mean of logged Data	6.83
Maximum of Logged Data	8.801	SD of logged Data	1.866

Assuming Lognormal Distribution

95% H-UCL	650591	90% Chebyshev (MVUE) UCL	10015
95% Chebyshev (MVUE) UCL	13031	97.5% Chebyshev (MVUE) UCL	17217
99% Chebyshev (MVUE) UCL	25441		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	3988	95% Jackknife UCL	4274
95% Standard Bootstrap UCL	3832	95% Bootstrap-t UCL	4846
95% Hall's Bootstrap UCL	4220	95% Percentile Bootstrap UCL	4019
95% BCA Bootstrap UCL	4072		
90% Chebyshev(Mean, Sd) UCL	5285	95% Chebyshev(Mean, Sd) UCL	6586
97.5% Chebyshev(Mean, Sd) UCL	8391	99% Chebyshev(Mean, Sd) UCL	11937

Suggested UCL to Use

95% Student's-t UCL	4274

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.

TABLE B-3
STATISTICS FOR GROUNDWATER
Alker Tire - Buckhannon, Upshur County, West Virginia

Xylenes (Total)
All units in ug/L.

General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	0
Minimum	818	Mean	5280
Maximum	12600	Median	3010
SD	4861	Std. Error of Mean	1837
Coefficient of Variation	0.921	Skewness	0.853

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.84	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.251	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	8850	95% Adjusted-CLT UCL (Chen-1995)	8935
		95% Modified-t UCL (Johnson-1978)	8949

Gamma GOF Test

A-D Test Statistic	0.348	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.725	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.183	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.318	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.238	k star (bias corrected MLE)	0.803
Theta hat (MLE)	4263	Theta star (bias corrected MLE)	6576
nu hat (MLE)	17.34	nu star (bias corrected)	11.24
MLE Mean (bias corrected)	5280	MLE Sd (bias corrected)	5892
		Approximate Chi Square Value (0.05)	4.731
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	3.541

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	12544	95% Adjusted Gamma UCL (use when n<50)	16758

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.907	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.173	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	6.707	Mean of logged Data	8.116
Maximum of Logged Data	9.441	SD of logged Data	1.104

Assuming Lognormal Distribution

95% H-UCL	37360	90% Chebyshev (MVUE) UCL	12350
95% Chebyshev (MVUE) UCL	15461	97.5% Chebyshev (MVUE) UCL	19780
99% Chebyshev (MVUE) UCL	28262		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	8302	95% Jackknife UCL	8850
95% Standard Bootstrap UCL	7984	95% Bootstrap-t UCL	13440
95% Hall's Bootstrap UCL	13176	95% Percentile Bootstrap UCL	8187
95% BCA Bootstrap UCL	8728		
90% Chebyshev(Mean, Sd) UCL	10792	95% Chebyshev(Mean, Sd) UCL	13289
97.5% Chebyshev(Mean, Sd) UCL	16755	99% Chebyshev(Mean, Sd) UCL	23562

Suggested UCL to Use

95% Student's-t UCL	8850

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.

TABLE B-3
STATISTICS FOR GROUNDWATER
Alker Tire - Buckhannon, Upshur County, West Virginia

Lead
All units in ug/L.

General Statistics

Total Number of Observations	3	Number of Distinct Observations	3
		Number of Missing Observations	0
Minimum	13.3	Mean	37.47
Maximum	64.4	Median	34.7
SD	25.66	Std. Error of Mean	14.82
Coefficient of Variation	0.685	Skewness	0.48

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.991	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.767	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.21	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.425	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	80.73	95% Adjusted-CLT UCL (Chen-1995)	66.22
		95% Modified-t UCL (Johnson-1978)	81.41

Gamma GOF Test
Not Enough Data to Perform GOF Test

Gamma Statistics

k hat (MLE)	2.784	k star (bias corrected MLE)	N/A
Theta hat (MLE)	13.46	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	16.7	nu star (bias corrected)	N/A
MLE Mean (bias corrected)	N/A	MLE Sd (bias corrected)	N/A
		Approximate Chi Square Value (0.05)	N/A
Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	N/A	95% Adjusted Gamma UCL (use when n<50)	N/A

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.985	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.767	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.223	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.425	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.588	Mean of logged Data	3.433
Maximum of Logged Data	4.165	SD of logged Data	0.795

Assuming Lognormal Distribution

95% H-UCL	14361	90% Chebyshev (MVUE) UCL	86.24
95% Chebyshev (MVUE) UCL	108.2	97.5% Chebyshev (MVUE) UCL	138.6
99% Chebyshev (MVUE) UCL	198.3		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	61.84	95% Jackknife UCL	80.73
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A
95% BCA Bootstrap UCL	N/A		
90% Chebyshev(Mean, Sd) UCL	81.91	95% Chebyshev(Mean, Sd) UCL	102
97.5% Chebyshev(Mean, Sd) UCL	130	99% Chebyshev(Mean, Sd) UCL	184.9

Suggested UCL to Use

95% Student's-t UCL	80.73

Recommended UCL exceeds the maximum observation

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

APPENDIX C

CALCULATION OF VOLATILIZATION FACTORS FOR GROUNDWATER TO AMBIENT AIR

APPENDIX C

Calculation of Volatilization Factors for Groundwater to Ambient Air in a Trench

There are no well-established models available for estimating migration of volatiles from groundwater into an excavated trench. One approach is based on a combination of vadose zone modeling (to estimate the volatilization from groundwater into the excavation) and a box model (to estimate dispersion of the volatiles within the trench and the above-ground atmosphere); this approach has been adopted by the Virginia Department of Environmental Quality (VDEQ). The volatilization factors for groundwater to ambient air in a trench (VF_{trench}) were estimated for volatile contaminants of concern (COC) in groundwater for the Alker Tire site located in Buckhannon, West Virginia (site), using the VDEQ (2018) equations for groundwater present at depths less than or equal to 15 feet (e.g., groundwater that is considered shallow enough to become directly exposed to ambient air). Water level data collected during the March 2017 monitoring event (EC, 2017) indicated that the groundwater depth varied across the site from approximately 6.1 feet below ground surface (bgs) in the vicinity of MW-7, to approximately 11.86 feet bgs in the vicinity of RW-1. Therefore this VDEQ equation for groundwater present at depths less than or equal to 15 feet was used.

The volatilization factor algorithm is presented as Equation 3-4 of the VDEQ guidance:

$$VF_{trench} = \frac{K \times A \times F \times 10^{-3}\, L/cm^3 \times 10^4\, cm^2/m^2 \times 3{,}600 s/hr}{ACH \times V}$$

where:

K	=	Overall mass transfer coefficient (cm/s)
A	=	Area of the trench (m^2)
F	=	Fraction of the floor through which volatilization occurs (unitless)
ACH	=	Air exchanges per hour (hr^{-1})
V	=	Volume of trench (m^3)

For purposes of the risk assessment, it is assumed that an average depth for excavation activities would be 6 feet (1.83 m). The trench length is assumed to be 10 feet (3.05 m) and the trench width is assumed to be 8 feet (2.44 m), for a total area (A) of 7.44 m^2. The input factors are presented in Table C-1.

The number of air exchanges per hour (ACH) is dependent on the ratio of the trench width to trench depth. Consistent with the approach presented by VDEQ (2018) if the width-to-depth ratio is less than or equal to 1, a circulation cell will be created within the trench that limits the degree of gas exchange with the atmosphere, and an ACH of 2/hour is recommended. When the width-to-depth ratio is greater than 1, air exchange between the trench and above-ground atmosphere is not restricted, and an ACH of 360/hour is recommended. For this assessment, the width-to-depth ratio of the trench (2.44 m/1.83 m) is 1.33; therefore the ACH is set to 360/hour (see Table C-1).

The fraction of the floor through which constituents can volatilize (F) is conservatively set to 1. The final factor of the VF_{trench} algorithm is the overall mass transfer coefficient (K), which is a constituent-specific value that is calculated using the following equation:

$$K = \frac{1}{\left\{ \frac{1}{K_L} + \frac{R \times T}{H \times K_G} \right\}}$$

where:

K_L	=	Liquid-phase mass transfer coefficient (cm/s)
R	=	Ideal gas constant (atm-m^3/mol-K)
T	=	Average system absolute temperature (K)
H	=	Henry's Law Constant (atm-m^3/mol)
K_G	=	Gas-phase mass transfer coefficient (cm/s)

K_L and K_G are constituent specific factors calculated using the following equations:

$$K_L = (MW_{O2} / MWi)^{0.5} \times (T / 298) \times K_L, O_2$$

$$K_G = (MW_{H2O} / MWi)^{0.335} \times (T / 298)^{1.005} \times K_G, H_2O$$

where:

MW_{O2}	=	Molecular weight of oxygen = 32 g/mol
MW_{H2O}	=	Molecular weight of water = 18 g/mol
MW_i	=	Molecular weight of constituent i (g/mol)
K_L,O_2	=	Liquid-phase mass transfer coefficient of oxygen at 25°C = 0.002 cm/s
K_G,H_2O	=	Gas-phase mass transfer coefficient of water vapor at 25°C = 0.833 cm/s

The constituent-specific factors for MW and H are presented in Table C-2 and were obtained from USEPA (2017). An average system absolute temperature (T) of 286^o K was converted from 12.5°C, the average system temperature for West Virginia (USEPA, 2004). Resulting calculated values for K_L, K_G and K are also presented in Table C-2. The final calculated VF_{trench} values for COC in groundwater are presented in Table C-2.

References

EnviroCheck of Virginia, Inc. (EC, 2017) Groundwater Monitoring Report - Former Alker Tire, Intersection of Main Street and Spring Street, Buckhannon, West Virginia. Leak #901-109. March 17, 2017.

United States Environmental Protection Agency (USEPA, 2004) User's Guide for Evaluating Subsurface Vapor Intrusion into Buildings. Office of Emergency and Remedial Response, February 22, 2004.

United States Environmental Protection Agency (USEPA; 2017) Regional Screening Levels for Chemical Contaminants at Superfund Sites. November 2017 Update.

Virginia Department of Environmental Quality (VDEQ; 2018) Virginia Unified Risk Assessment Model (VURAM) Version 2.0 User's Guide for Risk Assessors.

TABLE C-1
SITE-SPECIFIC AND SYSTEM PARAMETERS USED TO CALCULATE VF_{trench}
Alker Tire - Buckhannon, Upshur County, West Virginia

Symbol	Parameter and Units	Value	Source
T	Average System Absolute Temperature (K)	286	Converted from 12.5°C, the average value for West Virginia
L_{trench}	Trench Length (m)	3.05	Site-specific assumption.
W_{trench}	Trench Width (m)	2.44	Site-specific assumption.
D_{trench}	Trench Depth (m)	1.83	Site-specific assumption (typical excavation depth).
A	Area of Trench (m^2)	7.44	Calculated as L_{trench} x W_{trench}
V	Volume of Trench (m^3)	13.6	Calculated as L_{trench} x W_{trench} x D_{trench}
F	Fraction of Floor through which Constituent can Enter	1	Conservative model default value
ACH	Air Exchanges per Hour (hr^{-1})	360	Model default value; dependent on ratio of W_{trench} : D_{trench}

TABLE C-2
CONSTITUENT-SPECIFIC FACTORS AND CALCULATED VALUES FOR VF_{trench}
Alker Tire - Buckhannon, Upshur County, West Virginia

Contaminant of Concern	Molecular Weight MW (g/mol)	Henry's Law Constant H (atm-m^3/mol)	Gas Phase Mass Transfer Coefficient K_G (cm/sec)	Liquid Phase Mass Transfer Coefficient K_L (cm/sec)	Overall Mass Transfer Coefficient K (cm/sec)	Water to Trench Air Volatilization Factor VF_{trench} (L/m^3)
Volatile Organics						
Benzene	78	5.55E-03	4.89E-01	1.23E-03	1.22E-03	6.65E-02
Ethylbenzene	106	7.88E-03	4.41E-01	1.05E-03	1.05E-03	5.72E-02
Naphthalene	128	4.40E-04	4.14E-01	9.59E-04	8.54E-04	4.67E-02
Toluene	92	6.64E-03	4.63E-01	1.13E-03	1.12E-03	6.13E-02
Xylenes (Total)	106	6.63E-03	4.41E-01	1.05E-03	1.04E-03	5.71E-02

Notes:
Constituent-specific values for MW and H were obtained from USEPA (2017).

APPENDIX D

CALCULATION OF TRANSPORT FACTORS USED TO ESTIMATE INDOOR AIR CONCENTRATIONS

APPENDIX D

Calculation of Transport Factors Used to Estimate Indoor Air Concentrations

This appendix presents the methodology for calculating transport factors that are used to convert soil gas concentrations to concentrations in indoor air. A number of constituents were identified as contaminants of concern (COC) for potential vapor intrusion from onsite and offsite soil gas associated with the Alker Tire site located in Buckhannon, West Virginia (site). In this appendix, transport factors are calculated to estimate the concentrations of COC in indoor air of a current/future onsite or offsite commercial or industrial building.

Transport Factor for Indoor Air

The concentration of a constituent in indoor air (C_{ia}) is proportional to the concentration of the constituent in the pore space in soil (i.e., soil gas concentration or C_{sg}) beneath the building. The following equation is used to calculate C_{ia} from C_{sg}:

$$C_{ia} = C_{sg} \times TF$$

where:

C_{ia} = concentration of constituent in indoor air (mg/m^3);

C_{sg} = concentration of constituent in soil gas (mg/m^3); and

TF = transport factor from soil gas to indoor air.

The transport factor (TF) is an infinite source attenuation coefficient, and can be calculated based on a model developed by Johnson and Ettinger (1991). The equation for calculating TF is as follows:

$$\frac{(D_{eff} \times A_B)/(Q_B \times L_T) \times \exp[(Q_{soil} \times L_{crack})/(D_{crack} \times A_{crack})]}{\exp[(Q_{soil} \times L_{crack})/(D_{crack} \times A_{crack})] + (D_{eff} \times A_B)/(Q_B \times L_T) + (D_{eff} \times A_B)/(Q_{soil} \times L_T) \times (\exp[(Q_{soil} \times L_{crack})/(D_{crack} \times A_{crack})] - 1)}$$

where:

D_{eff} = effective diffusion coefficient for vadose zone soil (cm^2/sec);

A_B = area of enclosed space below grade (cm^2);

Q_B = building ventilation rate (cm^3/sec);

L_T = distance from contaminant source to building foundation (cm);

Q_{soil} = volumetric flow rate of soil gas into building (cm^3/sec);

L_{crack} = foundation thickness (cm);

D_{crack} = vapor diffusion coefficient through crack (cm^2/sec); and

A_{crack} = area of cracks through which vapors can pass (cm^2).

To solve this equation, the USEPA's "SG-ADV" spreadsheet Version 3.1, most recently updated in February 2004, were implemented. A combination of site-specific factors and default values from the User's Guide for Evaluating Subsurface Vapor Intrusion Into Buildings (USEPA, 2004) were used as input values in the model. Constituent-specific values used in the model are based on values from the USEPA (2017) Chemical-Specific Parameters Supporting Table. These values are defined below and presented in Tables D-1-A through D-10-A for the onsite scenario and D-11-A through D-20-A for the offsite scenario.

- The initial soil gas concentrations (C_G) of the COC are the exposure point concentrations (in units of ug/m^3) that were presented in Table 3-3 for the onsite scenario and Table 3-4 for the offsite area.

- The depth below grade to the bottom of the enclosed space floor (L_F) is set to 15 cm, the default value provided by USEPA (2004) for a slab-on-grade structure.

- The soil gas sampling depth below grade (L_S) is a site-specific value. All sample points (SG-1 through SG-5) were installed at approximately 12 inches above the water level at each location. Based on this information, the sampling depth value for the onsite scenario was estimated to be 10 feet bgs, which is 12 inches above the minimum depth to groundwater of 11 feet bgs for the onsite area (vapor point SG-3). For the offsite area, the sampling depth is 12 feet bgs (approximately 12 inches above the depth to water for sampling points SG-4 and SG.5). Therefore, L_S has been set to 304.8 cm for the onsite scenario and 365.76 cm for the offsite scenario.

- The average soil/groundwater temperature (T_S) is set to 12.5°C, the average value for West Virginia as estimated from Figure 8 of the vapor intrusion user's guide (USEPA, 2004).

- The Site Characterization Report (Triad, 2006) states that based on site boring logs, site soils ranged from sandy silt to silty sand, from the ground surface down to approximately sixteen feet bgs. Based on these observations, "loamy sand" ("LS") was selected to represent the soil type for the unsaturated zone.

- The soil properties (bulk density and porosity values) are set to the model default values for the soil type selected for the site. For "loamy sand", the soil dry bulk density (ρb) is 1.62 g/cm^3. The total porosity (n) is 0.39 (cm^3-air/cm^3) and the water-filled porosity (nw) is 0.076 (cm^3-H_2O/cm^3). The resulting air-filled porosity (na) is 0.314 (cm^3-air/cm^3).

- The floor thickness (L_{crack}) is set to the USEPA (2004) default value of 10 cm.

- The soil-building pressure differential (ΔP) is set to the USEPA (2004) default value of 40 g/cm-s^2.

- The building dimensions are conservatively set to the USEPA (2004) default dimensions, namely 1000 cm length by 1000 cm width by 244 cm height (a single-story, slab-on-grade building approximately 33' x 33' x 8').

- The floor-wall seam crack width (w) is set to the USEPA (2004) default value of 0.1 cm.

- The indoor air exchange rate (ER) for both the onsite and offsite scenarios is set to 1.5/hour. This is the default value presented in Table 19-3 of the Exposure Factors Handbook (USEPA, 2011) for an industrial/commercial building.

Tables D-1-B through D-20-B present the constituent-specific properties for COC that were used in the TF calculations. Tables D-1-C through D-20-C present the intermediate calculations used to determine the indoor air attenuation coefficients (i.e., the transport factors). The shaded boxes in Tables D-1-C through D-20-C present the resulting TF values that are applied to the concentrations of COC in soil gas, and the estimated indoor air concentrations for a current/future onsite or offsite building.

References

Johnson, P.C. and R.A. Ettinger (1991) Heuristic model for predicting the intrusion rate of contaminant vapors into buildings. Environ. Sci. Technology, 25: 1445-1452.

Triad Engineering, Inc. (Triad, 2006) Site Characterization Report – Alker Tire (former D&L Tire) - 21 East Main Street, Buckhannon, Upshur County, West Virginia. LUST 01-009, Project # 07531 March 2006.

United States Environmental Protection Agency (USEPA; 2004) User's Guide for Evaluating Subsurface Vapor Intrusion into Buildings. February 22, 2004.

United States Environmental Protection Agency (USEPA; 2017) Regional Screening Levels for Chemical Contaminants at Superfund Sites. November 2017 Update.

United States Environmental Protection Agency (USEPA; 2011) Exposure Factors Handbook 2011 Edition (Final). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-09/052F, 2011.

TABLE D-1-A
DATA ENTRY SHEET FOR 1,2,4-TRIMETHYLBENZENE - ONSITE SCENARIO
Alker Tire - Buckhannon, Upshur County, West Virginia

SG-ADV
Version 3.1; 02/04

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
95636	6.20E+04			1,2,4-Trimethylbenzene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (°C)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
			Totals must add up to value of Ls (cell F24)					
15	304.8	12.5	304.8			LS		

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)
LS	1.62	0.39	0.076	C	1.43	0.459	0.215	S

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)		ENTER Average vapor flow rate into bldg. OR Leave blank to calcula Q_{soil} (L/m)
10	40	1000	1000	244	0.1	1.5		

TABLE D-1-B
DATA ENTRY SHEET FOR 1,2,4-TRIMETHYLBENZENE - ONSITE SCENARIO
Alker Tire - Buckhannon, Upshur County, West Virginia

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Molecular weight, MW (g/mol)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
6.07E-02	7.92E-06	6.16E-03	25	9,370	442.45	649.00	120.20	0.0E+00	6.0E-02

TABLE D-1-C
DATA ENTRY SHEET FOR 1,2,4-TRIMETHYLBENZENE - ONSITE SCENARIO
Alker Tire - Buckhannon, Upshur County, West Virginia

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
7.88E+08	289.8	0.314	0.244	0.321	0.079	1.63E-08	0.957	1.56E-08	4,000	6.20E+04	1.02E+05

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} ($atm\text{-}m^3/mol$)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
1.06E+06	3.77E-04	15	11,669	2.60E-03	1.11E-01	1.76E-04	8.43E-03	0.00E+00	0.00E+00	8.43E-03	289.8

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	**Infinite source indoor attenuation coefficient, α (unitless)**	**Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)**	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	6.20E+04	0.10	1.56E+01	8.43E-03	4.00E+02	1.29E+20	**1.02E-04**	**6.32E+00**	NA	6.0E-02

END

TABLE D-2-A
DATA ENTRY SHEET FOR 1,3,5-TRIMETHYLBENZENE - ONSITE SCENARIO
Alker Tire - Buckhannon, Upshur County, West Virginia

SG-ADV
Version 3.1; 02/04

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
108678	2.38E+04			1,3,5-Trimethylbenzene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (°C)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
			Totals must add up to value of Ls (cell F24)					
15	304.8	12.5	304.8			LS		

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)
LS	1.62	0.39	0.076	C	1.43	0.459	0.215	S

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)		ENTER Average vapor flow rate into bldg. OR Leave blank to calcula Q_{soil} (L/m)
10	40	1000	1000	244	0.1	1.5		

TABLE D-2-B
DATA ENTRY SHEET FOR 1,3,5-TRIMETHYLBENZENE - ONSITE SCENARIO
Alker Tire - Buckhannon, Upshur County, West Virginia

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Molecular weight, MW (g/mol)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
6.02E-02	7.84E-06	8.77E-03	25	9,320	437.85	637.00	120.20	0.0E+00	6.0E-02

TABLE D-2-C
DATA ENTRY SHEET FOR 1,3,5-TRIMETHYLBENZENE - ONSITE SCENARIO
Alker Tire - Buckhannon, Upshur County, West Virginia

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
7.88E+08	289.8	0.314	0.244	0.321	0.079	1.63E-08	0.957	1.56E-08	4,000	2.38E+04	1.02E+05

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
1.06E+06	3.77E-04	15	11,647	3.71E-03	1.58E-01	1.76E-04	8.36E-03	0.00E+00	0.00E+00	8.36E-03	289.8

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	**Infinite source indoor attenuation coefficient, α (unitless)**	**Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)**	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	2.38E+04	0.10	1.56E+01	8.36E-03	4.00E+02	1.90E+20	**1.02E-04**	**2.42E+00**	NA	6.0E-02

END

TABLE D-3-A
DATA ENTRY SHEET FOR BENZENE - ONSITE SCENARIO
Alker Tire - Buckhannon, Upshur County, West Virginia

SG-ADV
Version 3.1; 02/04

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
71432	1.22E+03			Benzene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (^oC)	ENTER Totals must add up to value of Ls (cell F24) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
15	304.8	12.5	304.8			LS		

MORE ↓

ENTER Stratum A SCS soil type Lookup Soil Parameters	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type Lookup Soil Parameters	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type Lookup Soil Parameters
LS	1.62	0.39	0.076	C	1.43	0.459	0.215	S

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)		ENTER Average vapor flow rate into bldg. OR Leave blank to calcula Q_{soil} (L/m)
10	40	1000	1000	244	0.1	1.5		

TABLE D-3-B
DATA ENTRY SHEET FOR BENZENE - ONSITE SCENARIO
Alker Tire - Buckhannon, Upshur County, West Virginia

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Molecular weight, MW (g/mol)	Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)
8.95E-02	1.03E-05	5.55E-03	25	7,340	353.15	562.00	78.12	7.8E-06	3.0E-02

TABLE D-3-C
DATA ENTRY SHEET FOR BENZENE - ONSITE SCENARIO
Alker Tire - Buckhannon, Upshur County, West Virginia

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
7.88E+08	289.8	0.314	0.244	0.321	0.079	1.63E-08	0.957	1.56E-08	4,000	1.22E+03	1.02E+05

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
1.06E+06	3.77E-04	15	8,094	3.05E-03	1.30E-01	1.76E-04	1.24E-02	0.00E+00	0.00E+00	1.24E-02	289.8

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	**Infinite source indoor attenuation coefficient, α (unitless)**	**Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)**	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	1.22E+03	0.10	1.56E+01	1.24E-02	4.00E+02	4.36E+13	**1.14E-04**	**1.39E-01**	7.8E-06	3.0E-02

END

TABLE D-4-A
DATA ENTRY SHEET FOR ETHYLBENZENE - ONSITE SCENARIO
Alker Tire - Buckhannon, Upshur County, West Virginia

SG-ADV
Version 3.1; 02/04

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
100414	1.23E+05			Ethylbenzene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (^oC)	ENTER Totals must add up to value of Ls (cell F24) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
15	304.8	12.5	304.8			LS		

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)
LS	1.62	0.39	0.076	C	1.43	0.459	0.215	S

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)		ENTER Average vapor flow rate into bldg. OR Leave blank to calcula Q_{soil} (L/m)
10	40	1000	1000	244	0.1	1.5		

TABLE D-4-B
DATA ENTRY SHEET FOR ETHYLBENZENE - ONSITE SCENARIO
Alker Tire - Buckhannon, Upshur County, West Virginia

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Molecular weight, MW (g/mol)	Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)
6.85E-02	8.46E-06	7.88E-03	25	8,500	409.25	617.00	106.17	2.5E-06	1.0E+00

TABLE D-4-C
DATA ENTRY SHEET FOR ETHYLBENZENE - ONSITE SCENARIO
Alker Tire - Buckhannon, Upshur County, West Virginia

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
7.88E+08	289.8	0.314	0.244	0.321	0.079	1.63E-08	0.957	1.56E-08	4,000	1.23E+05	1.02E+05

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} ($atm\text{-}m^3/mol$)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
1.06E+06	3.77E-04	15	10,125	3.73E-03	1.59E-01	1.76E-04	9.51E-03	0.00E+00	0.00E+00	9.51E-03	289.8

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	**Infinite source indoor attenuation coefficient, α (unitless)**	**Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)**	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	1.23E+05	0.10	1.56E+01	9.51E-03	4.00E+02	6.62E+17	**1.06E-04**	**1.30E+01**	2.5E-06	1.0E+00

END

TABLE D-5-A
DATA ENTRY SHEET FOR ISOPROPYLBENZENE - ONSITE SCENARIO
Alker Tire - Buckhannon, Upshur County, West Virginia

SG-ADV
Version 3.1; 02/04

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
98828	4.69E+04			Cumene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (°C)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
			Totals must add up to value of Ls (cell F24)					
15	304.8	12.5	304.8			LS		

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)
LS	1.62	0.39	0.076	C	1.43	0.459	0.215	S

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)		ENTER Average vapor flow rate into bldg. OR Leave blank to calcula Q_{soil} (L/m)
10	40	1000	1000	244	0.1	1.5		

TABLE D-5-B
DATA ENTRY SHEET FOR ISOPROPYLBENZENE - ONSITE SCENARIO
Alker Tire - Buckhannon, Upshur County, West Virginia

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Molecular weight, MW (g/mol)	Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)
6.03E-02	7.86E-06	1.15E-02	25	10,300	425.65	631.00	120.20	0.0E+00	4.0E-01

TABLE D-5-C
DATA ENTRY SHEET FOR ISOPROPYLBENZENE - ONSITE SCENARIO
Alker Tire - Buckhannon, Upshur County, West Virginia

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
7.88E+08	289.8	0.314	0.244	0.321	0.079	1.63E-08	0.957	1.56E-08	4,000	4.69E+04	1.02E+05

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
1.06E+06	3.77E-04	15	12,570	4.54E-03	1.94E-01	1.76E-04	8.37E-03	0.00E+00	0.00E+00	8.37E-03	289.8

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(Pe^f) (unitless)	**Infinite source indoor attenuation coefficient, α (unitless)**	**Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)**	Unit risk factor, URF ($\mu g/m^3$)$^{-1}$	Reference conc., RfC (mg/m^3)
15	4.69E+04	0.10	1.56E+01	8.37E-03	4.00E+02	1.75E+20	**1.02E-04**	**4.77E+00**	NA	4.0E-01

END

TABLE D-6-A
DATA ENTRY SHEET FOR NAPHTHALENE - ONSITE SCENARIO
Alker Tire - Buckhannon, Upshur County, West Virginia

SG-ADV
Version 3.1; 02/04

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
91203	9.95E+03			Naphthalene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (°C)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
			Totals must add up to value of Ls (cell F24)					
15	304.8	12.5	304.8			LS		

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)
LS	1.62	0.39	0.076	C	1.43	0.459	0.215	S

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)		ENTER Average vapor flow rate into bldg. OR Leave blank to calcula Q_{soil} (L/m)
10	40	1000	1000	244	0.1	1.5		

TABLE D-6-B
DATA ENTRY SHEET FOR NAPHTHALENE - ONSITE SCENARIO
Alker Tire - Buckhannon, Upshur County, West Virginia

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Molecular weight, MW (g/mol)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
6.05E-02	8.38E-06	4.40E-04	25	10,400	491.05	748.00	128.18	3.4E-05	3.0E-03

TABLE D-6-C
DATA ENTRY SHEET FOR NAPHTHALENE - ONSITE SCENARIO
Alker Tire - Buckhannon, Upshur County, West Virginia

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
7.88E+08	289.8	0.314	0.244	0.321	0.079	1.63E-08	0.957	1.56E-08	4,000	9.95E+03	1.02E+05

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} ($atm\text{-}m^3/mol$)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
1.06E+06	3.77E-04	15	12,923	1.69E-04	7.23E-03	1.76E-04	8.40E-03	0.00E+00	0.00E+00	8.40E-03	289.8

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	**Infinite source indoor attenuation coefficient, α (unitless)**	**Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)**	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	9.95E+03	0.10	1.56E+01	8.40E-03	4.00E+02	1.49E+20	**1.02E-04**	**1.01E+00**	3.4E-05	3.0E-03

END

TABLE D-7-A
DATA ENTRY SHEET FOR N-HEPTANE - ONSITE SCENARIO
Alker Tire - Buckhannon, Upshur County, West Virginia

SG-ADV
Version 3.1; 02/04

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
142825	1.50E+06			Heptane

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (°C)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
			Totals must add up to value of Ls (cell F24)					
15	304.8	12.5	304.8			LS		

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)
LS	1.62	0.39	0.076	C	1.43	0.459	0.215	S

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)		ENTER Average vapor flow rate into bldg. OR Leave blank to calcula Q_{soil} (L/m)
10	40	1000	1000	244	0.1	1.5		

TABLE D-7-B
DATA ENTRY SHEET FOR N-HEPTANE - ONSITE SCENARIO
Alker Tire - Buckhannon, Upshur County, West Virginia

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Molecular weight, MW (g/mol)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
6.49E-02	7.59E-06	2.00E+00	25	7,590	371.65	540.00	100.21	0.0E+00	4.0E-01

TABLE D-7-C
DATA ENTRY SHEET FOR N-HEPTANE - ONSITE SCENARIO
Alker Tire - Buckhannon, Upshur County, West Virginia

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
7.88E+08	289.8	0.314	0.244	0.321	0.079	1.63E-08	0.957	1.56E-08	4,000	1.50E+06	1.02E+05

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} ($atm\text{-}m^3/mol$)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
1.06E+06	3.77E-04	15	8,927	1.03E+00	4.41E+01	1.76E-04	9.01E-03	0.00E+00	0.00E+00	9.01E-03	289.8

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $exp(Pe^f)$ (unitless)	**Infinite source indoor attenuation coefficient, α (unitless)**	**Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)**	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	1.50E+06	0.10	1.56E+01	9.01E-03	4.00E+02	6.45E+18	**1.04E-04**	**1.56E+02**	NA	4.0E-01

END

TABLE D-8-A
DATA ENTRY SHEET FOR N-HEXANE - ONSITE SCENARIO
Alker Tire - Buckhannon, Upshur County, West Virginia

SG-ADV
Version 3.1; 02/04

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
110543	2.92E+06			Hexane

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (°C)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
			Totals must add up to value of Ls (cell F24)					
15	304.8	12.5	304.8			LS		

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)
LS	1.62	0.39	0.076	C	1.43	0.459	0.215	S

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)		ENTER Average vapor flow rate into bldg. OR Leave blank to calcula Q_{soil} (L/m)
10	40	1000	1000	244	0.1	1.5		

TABLE D-8-B
DATA ENTRY SHEET FOR N-HEXANE - ONSITE SCENARIO
Alker Tire - Buckhannon, Upshur County, West Virginia

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Molecular weight, MW (g/mol)	Unit risk factor, URF ($\mu g/m^3$)$^{-1}$	Reference conc., RfC (mg/m^3)
7.31E-02	8.17E-06	1.80E+00	25	6,900	341.85	508.00	86.18	0.0E+00	7.0E-01

TABLE D-8-C
DATA ENTRY SHEET FOR N-HEXANE - ONSITE SCENARIO
Alker Tire - Buckhannon, Upshur County, West Virginia

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
7.88E+08	289.8	0.314	0.244	0.321	0.079	1.63E-08	0.957	1.56E-08	4,000	2.92E+06	1.02E+05

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} ($atm\text{-}m^3/mol$)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
1.06E+06	3.77E-04	15	7,712	1.02E+00	4.34E+01	1.76E-04	1.02E-02	0.00E+00	0.00E+00	1.02E-02	289.8

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	**Infinite source indoor attenuation coefficient, α (unitless)**	**Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)**	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	2.92E+06	0.10	1.56E+01	1.02E-02	4.00E+02	5.00E+16	**1.08E-04**	**3.16E+02**	NA	7.0E-01

END

TABLE D-9-A
DATA ENTRY SHEET FOR TOLUENE - ONSITE SCENARIO
Alker Tire - Buckhannon, Upshur County, West Virginia

SG-ADV
Version 3.1; 02/04

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
108883	3.70E+05			Toluene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (°C)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
			Totals must add up to value of Ls (cell F24)					
15	304.8	12.5	304.8			LS		

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)
LS	1.62	0.39	0.076	C	1.43	0.459	0.215	S

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)		ENTER Average vapor flow rate into bldg. OR Leave blank to calcula Q_{soil} (L/m)
10	40	1000	1000	244	0.1	1.5		

TABLE D-9-B
DATA ENTRY SHEET FOR TOLUENE - ONSITE SCENARIO
Alker Tire - Buckhannon, Upshur County, West Virginia

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Molecular weight, MW (g/mol)	Unit risk factor, URF ($\mu g/m^3$)$^{-1}$	Reference conc., RfC (mg/m^3)
7.78E-02	9.20E-06	6.64E-03	25	7,930	383.75	592.00	92.14	0.0E+00	5.0E+00

TABLE D-9-C
DATA ENTRY SHEET FOR TOLUENE - ONSITE SCENARIO
Alker Tire - Buckhannon, Upshur County, West Virginia

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
7.88E+08	289.8	0.314	0.244	0.321	0.079	1.63E-08	0.957	1.56E-08	4,000	3.70E+05	1.02E+05

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
1.06E+06	3.77E-04	15	9,125	3.38E-03	1.44E-01	1.76E-04	1.08E-02	0.00E+00	0.00E+00	1.08E-02	289.8

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $exp(Pe^f)$ (unitless)	**Infinite source indoor attenuation coefficient, α (unitless)**	**Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)**	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	3.70E+05	0.10	1.56E+01	1.08E-02	4.00E+02	4.90E+15	**1.10E-04**	**4.07E+01**	NA	5.0E+00

END

TABLE D-10-A
DATA ENTRY SHEET FOR XYLENES (TOTAL) - ONSITE SCENARIO
Alker Tire - Buckhannon, Upshur County, West Virginia

SG-ADV
Version 3.1; 02/04

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
1330207	3.82E+05			Xylenes (Total)

MORE

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (°C)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
			Totals must add up to value of Ls (cell F24)					
15	304.8	12.5	304.8			LS		

MORE

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)
LS	1.62	0.39	0.076	C	1.43	0.459	0.215	S

MORE

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)		ENTER Average vapor flow rate into bldg. OR Leave blank to calcula Q_{soil} (L/m)
10	40	1000	1000	244	0.1	1.5		

TABLE D-10-B
DATA ENTRY SHEET FOR XYLENES (TOTAL) - ONSITE SCENARIO
Alker Tire - Buckhannon, Upshur County, West Virginia

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Molecular weight, MW (g/mol)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
6.85E-02	8.46E-06	6.63E-03	25	8,520	411.65	620.00	106.17	0.0E+00	1.0E-01

Risk-Based Remedies
RBR Consulting, Inc.

TABLE D-10-C
DATA ENTRY SHEET FOR XYLENES (TOTAL) - ONSITE SCENARIO
Alker Tire - Buckhannon, Upshur County, West Virginia

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
7.88E+08	289.8	0.314	0.244	0.321	0.079	1.63E-08	0.957	1.56E-08	4,000	3.82E+05	1.02E+05

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} ($atm\text{-}m^3/mol$)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
1.06E+06	3.77E-04	15	10,175	3.13E-03	1.33E-01	1.76E-04	9.51E-03	0.00E+00	0.00E+00	9.51E-03	289.8

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $exp(Pe^f)$ (unitless)	**Infinite source indoor attenuation coefficient, α (unitless)**	**Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)**	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	3.82E+05	0.10	1.56E+01	9.51E-03	4.00E+02	6.62E+17	**1.06E-04**	**4.05E+01**	NA	1.0E-01

END

Risk-Based Remedies
RBR Consulting, Inc.

TABLE D-11-A
DATA ENTRY SHEET FOR 1,2,4-TRIMETHYLBENZENE - OFFSITE SCENARIO
Alker Tire - Buckhannon, Upshur County, West Virginia

SG-ADV
Version 3.1; 02/04

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
95636	1.93E+04			1,2,4-Trimethylbenzene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (^oC)	ENTER Totals must add up to value of Ls (cell F24) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
15	365.76	12.5	365.76			LS		

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)
LS	1.62	0.39	0.076	C	1.43	0.459	0.215	S

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)		ENTER Average vapor flow rate into bldg. OR Leave blank to calcula Q_{soil} (L/m)
10	40	1000	1000	244	0.1	1.5		

TABLE D-11-B
DATA ENTRY SHEET FOR 1,2,4-TRIMETHYLBENZENE - OFFSITE SCENARIO
Alker Tire - Buckhannon, Upshur County, West Virginia

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Molecular weight, MW (g/mol)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
6.07E-02	7.92E-06	6.16E-03	25	9,370	442.45	649.00	120.20	0.0E+00	6.0E-02

TABLE D-11-C
DATA ENTRY SHEET FOR 1,2,4-TRIMETHYLBENZENE - OFFSITE SCENARIO
Alker Tire - Buckhannon, Upshur County, West Virginia

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
7.88E+08	350.76	0.314	0.244	0.321	0.079	1.63E-08	0.957	1.56E-08	4,000	1.93E+04	1.02E+05

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
1.06E+06	3.77E-04	15	11,669	2.60E-03	1.11E-01	1.76E-04	8.43E-03	0.00E+00	0.00E+00	8.43E-03	350.76

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(Pe^f) (unitless)	**Infinite source indoor attenuation coefficient, α (unitless)**	**Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)**	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	1.93E+04	0.10	1.56E+01	8.43E-03	4.00E+02	1.29E+20	**9.52E-05**	**1.84E+00**	NA	6.0E-02

END

TABLE D-12-A
DATA ENTRY SHEET FOR 1,3,5-TRIMETHYLBENZENE - OFFSITE SCENARIO
Alker Tire - Buckhannon, Upshur County, West Virginia

SG-ADV
Version 3.1; 02/04

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
108678	9.79E+03			1,3,5-Trimethylbenzene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (°C)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
			Totals must add up to value of Ls (cell F24)					
15	365.76	12.5	365.76			LS		

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)
LS	1.62	0.39	0.076	C	1.43	0.459	0.215	S

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)		ENTER Average vapor flow rate into bldg. OR Leave blank to calcula Q_{soil} (L/m)
10	40	1000	1000	244	0.1	1.5		

TABLE D-12-B
DATA ENTRY SHEET FOR 1,3,5-TRIMETHYLBENZENE - OFFSITE SCENARIO
Alker Tire - Buckhannon, Upshur County, West Virginia

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Molecular weight, MW (g/mol)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
6.02E-02	7.84E-06	8.77E-03	25	9,320	437.85	637.00	120.20	0.0E+00	6.0E-02

TABLE D-12-C
DATA ENTRY SHEET FOR 1,3,5-TRIMETHYLBENZENE - OFFSITE SCENARIO
Alker Tire - Buckhannon, Upshur County, West Virginia

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
7.88E+08	350.76	0.314	0.244	0.321	0.079	1.63E-08	0.957	1.56E-08	4,000	9.79E+03	1.02E+05

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
1.06E+06	3.77E-04	15	11,647	3.71E-03	1.58E-01	1.76E-04	8.36E-03	0.00E+00	0.00E+00	8.36E-03	350.76

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $exp(Pe^f)$ (unitless)	**Infinite source indoor attenuation coefficient, α (unitless)**	**Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)**	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	9.79E+03	0.10	1.56E+01	8.36E-03	4.00E+02	1.90E+20	**9.49E-05**	**9.29E-01**	NA	6.0E-02

END

TABLE D-13-A
DATA ENTRY SHEET FOR BENZENE - OFFSITE SCENARIO
Alker Tire - Buckhannon, Upshur County, West Virginia

SG-ADV
Version 3.1; 02/04

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
71432	7.52E+02			Benzene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (°C)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
			Totals must add up to value of Ls (cell F24)					
15	365.76	12.5	365.76			LS		

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)
LS	1.62	0.39	0.076	C	1.43	0.459	0.215	S

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)		ENTER Average vapor flow rate into bldg. OR Leave blank to calcula Q_{soil} (L/m)
10	40	1000	1000	244	0.1	1.5		

TABLE D-13-B
DATA ENTRY SHEET FOR BENZENE - OFFSITE SCENARIO
Alker Tire - Buckhannon, Upshur County, West Virginia

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Molecular weight, MW (g/mol)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
8.95E-02	1.03E-05	5.55E-03	25	7,340	353.15	562.00	78.12	7.8E-06	3.0E-02

TABLE D-13-C
DATA ENTRY SHEET FOR BENZENE - OFFSITE SCENARIO
Alker Tire - Buckhannon, Upshur County, West Virginia

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
7.88E+08	350.76	0.314	0.244	0.321	0.079	1.63E-08	0.957	1.56E-08	4,000	7.52E+02	1.02E+05

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} ($atm\text{-}m^3/mol$)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
1.06E+06	3.77E-04	15	8,094	3.05E-03	1.30E-01	1.76E-04	1.24E-02	0.00E+00	0.00E+00	1.24E-02	350.76

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $exp(Pe^f)$ (unitless)	**Infinite source indoor attenuation coefficient, α (unitless)**	**Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)**	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	7.52E+02	0.10	1.56E+01	1.24E-02	4.00E+02	4.36E+13	**1.08E-04**	**8.15E-02**	7.8E-06	3.0E-02

END

TABLE D-14-A
DATA ENTRY SHEET FOR ETHYLBENZENE - OFFSITE SCENARIO
Alker Tire - Buckhannon, Upshur County, West Virginia

SG-ADV
Version 3.1; 02/04

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
100414	8.43E+04			Ethylbenzene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (°C)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
			Totals must add up to value of Ls (cell F24)					
15	365.76	12.5	365.76			LS		

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)
LS	1.62	0.39	0.076	C	1.43	0.459	0.215	S

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)		ENTER Average vapor flow rate into bldg. OR Leave blank to calcula Q_{soil} (L/m)
10	40	1000	1000	244	0.1	1.5		

TABLE D-14-B
DATA ENTRY SHEET FOR ETHYLBENZENE - OFFSITE SCENARIO
Alker Tire - Buckhannon, Upshur County, West Virginia

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Molecular weight, MW (g/mol)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
6.85E-02	8.46E-06	7.88E-03	25	8,500	409.25	617.00	106.17	2.5E-06	1.0E+00

TABLE D-14-C
DATA ENTRY SHEET FOR ETHYLBENZENE - OFFSITE SCENARIO
Alker Tire - Buckhannon, Upshur County, West Virginia

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
7.88E+08	350.76	0.314	0.244	0.321	0.079	1.63E-08	0.957	1.56E-08	4,000	8.43E+04	1.02E+05

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
1.06E+06	3.77E-04	15	10,125	3.73E-03	1.59E-01	1.76E-04	9.51E-03	0.00E+00	0.00E+00	9.51E-03	350.76

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	**Infinite source indoor attenuation coefficient, α (unitless)**	**Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)**	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	8.43E+04	0.10	1.56E+01	9.51E-03	4.00E+02	6.62E+17	**9.95E-05**	**8.39E+00**	2.5E-06	1.0E+00

END

TABLE D-15-A
DATA ENTRY SHEET FOR ISOPROPYLBENZENE - OFFSITE SCENARIO
Alker Tire - Buckhannon, Upshur County, West Virginia

SG-ADV
Version 3.1; 02/04

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
98828	1.80E+03			Cumene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (°C)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
			Totals must add up to value of Ls (cell F24)					
15	365.76	12.5	365.76			LS		

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)
LS	1.62	0.39	0.076	C	1.43	0.459	0.215	S

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)		ENTER Average vapor flow rate into bldg. OR Leave blank to calcula Q_{soil} (L/m)
10	40	1000	1000	244	0.1	1.5		

TABLE D-15-B
DATA ENTRY SHEET FOR ISOPROPYLBENZENE - OFFSITE SCENARIO
Alker Tire - Buckhannon, Upshur County, West Virginia

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Molecular weight, MW (g/mol)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
6.03E-02	7.86E-06	1.15E-02	25	10,300	425.65	631.00	120.20	0.0E+00	4.0E-01

TABLE D-15-C
DATA ENTRY SHEET FOR ISOPROPYLBENZENE - OFFSITE SCENARIO
Alker Tire - Buckhannon, Upshur County, West Virginia

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
7.88E+08	350.76	0.314	0.244	0.321	0.079	1.63E-08	0.957	1.56E-08	4,000	1.80E+03	1.02E+05

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} ($atm\text{-}m^3/mol$)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
1.06E+06	3.77E-04	15	12,570	4.54E-03	1.94E-01	1.76E-04	8.37E-03	0.00E+00	0.00E+00	8.37E-03	350.76

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	**Infinite source indoor attenuation coefficient, α (unitless)**	**Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)**	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	1.80E+03	0.10	1.56E+01	8.37E-03	4.00E+02	1.75E+20	**9.50E-05**	**1.71E-01**	NA	4.0E-01

END

TABLE D-16-A
DATA ENTRY SHEET FOR NAPHTHALENE - OFFSITE SCENARIO
Alker Tire - Buckhannon, Upshur County, West Virginia

SG-ADV
Version 3.1; 02/04

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
91203	9.95E+03			Naphthalene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (°C)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
15	365.76	12.5	365.76			LS		

Note: Totals of h_A, h_B, h_C must add up to value of Ls (cell F24)

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)
LS	1.62	0.39	0.076	C	1.43	0.459	0.215	S

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)		ENTER Average vapor flow rate into bldg. OR Leave blank to calcula Q_{soil} (L/m)
10	40	1000	1000	244	0.1	1.5		

TABLE D-16-B
DATA ENTRY SHEET FOR NAPHTHALENE - OFFSITE SCENARIO
Alker Tire - Buckhannon, Upshur County, West Virginia

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Molecular weight, MW (g/mol)	Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)
6.05E-02	8.38E-06	4.40E-04	25	10,400	491.05	748.00	128.18	3.4E-05	3.0E-03

TABLE D-16-C
DATA ENTRY SHEET FOR NAPHTHALENE - OFFSITE SCENARIO
Alker Tire - Buckhannon, Upshur County, West Virginia

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
7.88E+08	350.76	0.314	0.244	0.321	0.079	1.63E-08	0.957	1.56E-08	4,000	9.95E+03	1.02E+05

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} ($atm\text{-}m^3/mol$)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
1.06E+06	3.77E-04	15	12,923	1.69E-04	7.23E-03	1.76E-04	8.40E-03	0.00E+00	0.00E+00	8.40E-03	350.76

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	**Infinite source indoor attenuation coefficient, α (unitless)**	**Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)**	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	9.95E+03	0.10	1.56E+01	8.40E-03	4.00E+02	1.49E+20	**9.51E-05**	**9.46E-01**	3.4E-05	3.0E-03

END

TABLE D-17-A
DATA ENTRY SHEET FOR N-HEPTANE - OFFSITE SCENARIO
Alker Tire - Buckhannon, Upshur County, West Virginia

SG-ADV
Version 3.1; 02/04

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
142825	2.26E+04			Heptane

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (°C)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
			Totals must add up to value of Ls (cell F24)					
15	365.76	12.5	365.76			LS		

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)
LS	1.62	0.39	0.076	C	1.43	0.459	0.215	S

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)		ENTER Average vapor flow rate into bldg. OR Leave blank to calcula Q_{soil} (L/m)
10	40	1000	1000	244	0.1	1.5		

TABLE D-17-B
DATA ENTRY SHEET FOR N-HEPTANE - OFFSITE SCENARIO
Alker Tire - Buckhannon, Upshur County, West Virginia

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Molecular weight, MW (g/mol)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
6.49E-02	7.59E-06	2.00E+00	25	7,590	371.65	540.00	100.21	0.0E+00	4.0E-01

TABLE D-17-C
DATA ENTRY SHEET FOR N-HEPTANE - OFFSITE SCENARIO
Alker Tire - Buckhannon, Upshur County, West Virginia

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
7.88E+08	350.76	0.314	0.244	0.321	0.079	1.63E-08	0.957	1.56E-08	4,000	2.26E+04	1.02E+05

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} ($atm\text{-}m^3/mol$)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
1.06E+06	3.77E-04	15	8,927	1.03E+00	4.41E+01	1.76E-04	9.01E-03	0.00E+00	0.00E+00	9.01E-03	350.76

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	**Infinite source indoor attenuation coefficient, α (unitless)**	**Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)**	Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)
15	2.26E+04	0.10	1.56E+01	9.01E-03	4.00E+02	6.45E+18	**9.76E-05**	**2.20E+00**	NA	4.0E-01

END

TABLE D-18-A
DATA ENTRY SHEET FOR N-HEXANE - OFFSITE SCENARIO
Alker Tire - Buckhannon, Upshur County, West Virginia

SG-ADV
Version 3.1; 02/04

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)		ENTER Soil gas conc., C_g (ppmv)	Chemical
		OR		
110543	3.28E+06			Hexane

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (°C)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)		ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
			Totals must add up to value of Ls (cell F24)				OR	
15	365.76	12.5	365.76			LS		

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)
LS	1.62	0.39	0.076	C	1.43	0.459	0.215	S

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)		ENTER Average vapor flow rate into bldg. OR Leave blank to calcula Q_{soil} (L/m)
10	40	1000	1000	244	0.1	1.5		

TABLE D-18-B
DATA ENTRY SHEET FOR N-HEXANE - OFFSITE SCENARIO
Alker Tire - Buckhannon, Upshur County, West Virginia

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Molecular weight, MW (g/mol)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
7.31E-02	8.17E-06	1.80E+00	25	6,900	341.85	508.00	86.18	0.0E+00	7.0E-01

TABLE D-18-C
DATA ENTRY SHEET FOR N-HEXANE - OFFSITE SCENARIO
Alker Tire - Buckhannon, Upshur County, West Virginia

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
7.88E+08	350.76	0.314	0.244	0.321	0.079	1.63E-08	0.957	1.56E-08	4,000	3.28E+06	1.02E+05

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
1.06E+06	3.77E-04	15	7,712	1.02E+00	4.34E+01	1.76E-04	1.02E-02	0.00E+00	0.00E+00	1.02E-02	350.76

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $exp(Pe^f)$ (unitless)	**Infinite source indoor attenuation coefficient, α (unitless)**	**Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)**	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	3.28E+06	0.10	1.56E+01	1.02E-02	4.00E+02	5.00E+16	**1.02E-04**	**3.34E+02**	NA	7.0E-01

END

TABLE D-19-A
DATA ENTRY SHEET FOR TOLUENE - OFFSITE SCENARIO
Alker Tire - Buckhannon, Upshur County, West Virginia

SG-ADV
Version 3.1; 02/04

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
108883	3.89E+05			Toluene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (°C)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
			Totals must add up to value of Ls (cell F24)					
15	365.76	12.5	365.76			LS		

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)
LS	1.62	0.39	0.076	C	1.43	0.459	0.215	S

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)		ENTER Average vapor flow rate into bldg. OR Leave blank to calcula Q_{soil} (L/m)
10	40	1000	1000	244	0.1	1.5		

TABLE D-19-B
DATA ENTRY SHEET FOR TOLUENE - OFFSITE SCENARIO
Alker Tire - Buckhannon, Upshur County, West Virginia

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Molecular weight, MW (g/mol)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
7.78E-02	9.20E-06	6.64E-03	25	7,930	383.75	592.00	92.14	0.0E+00	5.0E+00

TABLE D-19-C
DATA ENTRY SHEET FOR TOLUENE - OFFSITE SCENARIO
Alker Tire - Buckhannon, Upshur County, West Virginia

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
7.88E+08	350.76	0.314	0.244	0.321	0.079	1.63E-08	0.957	1.56E-08	4,000	3.89E+05	1.02E+05

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
1.06E+06	3.77E-04	15	9,125	3.38E-03	1.44E-01	1.76E-04	1.08E-02	0.00E+00	0.00E+00	1.08E-02	350.76

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $exp(Pe^f)$ (unitless)	**Infinite source indoor attenuation coefficient, α (unitless)**	**Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)**	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	3.89E+05	0.10	1.56E+01	1.08E-02	4.00E+02	4.90E+15	**1.04E-04**	**4.04E+01**	NA	5.0E+00

END

TABLE D-20-A
DATA ENTRY SHEET FOR XYLENES (TOTAL) - OFFSITE SCENARIO
Alker Tire - Buckhannon, Upshur County, West Virginia

SG-ADV
Version 3.1; 02/04

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
1330207	2.80E+05			Xylenes (Total)

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (°C)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
			Totals must add up to value of Ls (cell F24)					
15	365.76	12.5	365.76			LS		

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)
LS	1.62	0.39	0.076	C	1.43	0.459	0.215	S

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)		ENTER Average vapor flow rate into bldg. OR Leave blank to calcula Q_{soil} (L/m)
10	40	1000	1000	244	0.1	1.5		

TABLE D-20-B
DATA ENTRY SHEET FOR XYLENES (TOTAL) - OFFSITE SCENARIO
Alker Tire - Buckhannon, Upshur County, West Virginia

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Molecular weight, MW (g/mol)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
6.85E-02	8.46E-06	6.63E-03	25	8,520	411.65	620.00	106.17	0.0E+00	1.0E-01

TABLE D-20-C
DATA ENTRY SHEET FOR XYLENES (TOTAL) - OFFSITE SCENARIO
Alker Tire - Buckhannon, Upshur County, West Virginia

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
7.88E+08	350.76	0.314	0.244	0.321	0.079	1.63E-08	0.957	1.56E-08	4,000	2.80E+05	1.02E+05

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} ($atm\text{-}m^3/mol$)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
1.06E+06	3.77E-04	15	10,175	3.13E-03	1.33E-01	1.76E-04	9.51E-03	0.00E+00	0.00E+00	9.51E-03	350.76

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $exp(Pe^f)$ (unitless)	**Infinite source indoor attenuation coefficient, α (unitless)**	**Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)**	Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)
15	2.80E+05	0.10	1.56E+01	9.51E-03	4.00E+02	6.62E+17	**9.95E-05**	**2.78E+01**	NA	1.0E-01

END

APPENDIX E

RISK CALCULATION SPREADSHEETS

APPENDIX E
Table 1-A: Intake Factors for the Outdoor Worker:
Alker Tire - Buckhannon, Upshur County, West Virginia

Soil Ingestion				
	CF	Conversion Factor	1.00E-06	kg/mg
	IRs	Ingestion Rate - Soil	50	mg/day
	EF	Exposure Frequency	250	days/yr
	ED	Exposure Duration	25	years
	BW	Body Weight	70	kg
	ATc	Averaging Time (Cancer)	25550	days
	ATn	Averaging Time (Non-cancer)	9125	days
Dermal Contact with Soil				
	CF	Conversion Factor	1.00E-06	kg/mg
	AF	Soil to Skin Adherence Factor	0.2	mg/cm^2
	SA	Skin Surface Area Available	3300	cm^2
	EF	Exposure Frequency	250	days/yr
	ED	Exposure Duration	25	years
	BW	Body Weight	70	kg
	ATc	Averaging Time (Cancer)	25550	days
	ATn	Averaging Time (Non-cancer)	9125	days
Inhalation of Particulates or Volatiles from Soil				
	EF	Exposure Frequency	250	days/yr
	ED	Exposure Duration	25	years
	ET	Exposure Time	8	hours/day
	ATc	Averaging Time (Cancer)	613200	hours
	ATn	Averaging Time (Non-cancer)	219000	hours

APPENDIX E
Table 1-B: Constituent-Specific Factors - Alker Tire - Buckhannon, Upshur County, West Virginia

Constituent	EPC Soil (mg/kg)	EPC Air Particulate (mg/m^3)	VF (m^3/kg)	EPC Air VOC (Soil) (mg/m^3)	Oral AF (unitless)	Dermal AF (unitless)	Frac Abs (unitless)	RfDo - C (mg/kg-day)	RfC - C (mg/m^3)	RfDd - C (mg/kg-day)	CSFo $(mg/kg\text{-}day)^{-1}$	IUR $(mg/m^3)^{-1}$	CSFd $(mg/kg\text{-}day)^{-1}$
Volatile Organics													
1,2,4-Trimethylbenzene	0.0063	4.76E-12	7.91E+03	7.91E-07	1		1	1.00E-02	6.00E-02	1.00E-02	NA	NA	NA
1,3,5-Trimethylbenzene		0.00E+00	6.61E+03	0.00E+00	1		1	1.00E-02	6.00E-02	1.00E-02	NA	NA	NA
Benzene	0.0043	3.23E-12	3.54E+03	1.20E-06	1		1	4.00E-03	3.01E-02	4.00E-03	5.50E-02	7.80E-03	5.50E-02
Naphthalene		0.00E+00	4.63E+04	0.00E+00	1	0.13	1	2.00E-02	3.00E-03	2.00E-02	NA	3.40E-02	NA
Xylenes (Total)	0.015	1.12E-11	5.74E+03	2.58E-06	1		1	2.00E-01	1.00E-01	2.00E-01	NA	NA	NA

APPENDIX E
Table 1-C: Hazard Indices and Theoretical Excess Lifetime Cancer Risks
Incidental Ingestion of Soil - Outdoor Worker

Constituent	Soil EPC (mg/kg)	Oral AF (unitless)	Intake (ADD) (mg/kg-d)	RfDo (mg/kg-d)	Hazard Quotient	Intake (LADD) (mg/kg-d)	CSFo $(mg/kg\text{-}d)^{-1}$	Potential Cancer Risk
Volatile Organics								
1,2,4-Trimethylbenzene	0.0063	1	3.06E-09	1.00E-02	3.06E-07	1.09E-09	NA	NA
1,3,5-Trimethylbenzene	0.0	1	0.00E+00	1.00E-02	--	0.00E+00	NA	--
Benzene	0.0043	1	2.08E-09	4.00E-03	5.20E-07	7.43E-10	5.50E-02	4.08E-11
Naphthalene	0.0	1	0.00E+00	2.00E-02	--	0.00E+00	NA	--
Xylenes (Total)	0.015	1	7.24E-09	2.00E-01	3.62E-08	2.59E-09	NA	NA

Total Hazard Index	0.00000086

Potential Cancer Risk	4.08E-11

Notes:
-- = Constituent is not a COC for this medium or exposure pathway.
NA = Toxicity values are not available for this endpoint or exposure pathway.

APPENDIX E
Table 1-D: Hazard Indices and Theoretical Excess Lifetime Cancer Risks
Dermal Contact with Soil - Outdoor Worker

Constituent	Soil EPC (mg/kg)	Dermal AF (unitless)	Intake (ADD) (mg/kg-d)	RfDd (mg/kg-d)	Hazard Quotient	Intake (LADD) (mg/kg-d)	CSFd $(mg/kg\text{-}d)^{-1}$	Potential Cancer Risk
Volatile Organics								
1,2,4-Trimethylbenzene	0.0063	0	0.00E+00	1.00E-02	--	0.00E+00	NA	NA
1,3,5-Trimethylbenzene	0.0	0	0.00E+00	1.00E-02	--	0.00E+00	NA	--
Benzene	0.0043	0	0.00E+00	4.00E-03	--	0.00E+00	5.50E-02	--
Naphthalene	0.0	0.13	0.00E+00	2.00E-02	--	0.00E+00	NA	--
Xylenes (Total)	0.015	0	0.00E+00	2.00E-01	--	0.00E+00	NA	NA

Total Hazard Index	0.00

Potential Cancer Risk	0.00E+00

Notes:
-- = Constituent is not a COC for this medium or exposure pathway.
NA = Toxicity values are not available for this endpoint or exposure pathway.

APPENDIX E
Table 1-E: Hazard Indices and Theoretical Excess Lifetime Cancer Risks
Inhalation of Particulates - Outdoor Worker

Constituent	EPC Air Part (mg/m^3)	EC (mg/m^3)	RfC (mg/m^3)	Hazard Quotient	EC (mg/m^3)	IUR $(mg/m^3)^{-1}$	Potential Cancer Risk
Volatile Organics							
1,2,4-Trimethylbenzene	4.76E-12	1.09E-12	6.00E-02	1.81E-11	3.88E-13	NA	NA
1,3,5-Trimethylbenzene	0.00E+00	0.00E+00	6.00E-02	--	0.00E+00	NA	--
Benzene	3.23E-12	7.37E-13	3.01E-02	2.45E-11	2.63E-13	7.80E-03	2.05E-15
Naphthalene	0.00E+00	0.00E+00	3.00E-03	--	0.00E+00	3.40E-02	--
Xylenes (Total)	1.12E-11	2.57E-12	1.00E-01	2.57E-11	9.17E-13	NA	NA

Total Hazard Index	6.83E-11

Potential Cancer Risk	2.05E-15

Notes:
-- = Constituent is not a COC for this medium or exposure pathway.
NA = Toxicity values are not available for this endpoint or exposure pathway.

APPENDIX E
Table 1-F: Hazard Indices and Theoretical Excess Lifetime Cancer Risks
Inhalation of Volatiles from Soil - Outdoor Worker

Constituent	EPC Air VOC (Soil) (mg/m^3)	EC (mg/m^3)	RfC (mg/m^3)	Hazard Quotient	EC (mg/m^3)	IUR (mg/m^3)$^{-1}$	Potential Cancer Risk
Volatile Organics							
1,2,4-Trimethylbenzene	7.91E-07	1.81E-07	6.00E-02	3.01E-06	6.45E-08	NA	NA
1,3,5-Trimethylbenzene	0.00E+00	0.00E+00	6.00E-02	--	0.00E+00	NA	--
Benzene	1.20E-06	2.74E-07	3.01E-02	9.12E-06	9.80E-08	7.80E-03	7.64E-10
Naphthalene	0.00E+00	0.00E+00	3.00E-03	--	0.00E+00	3.40E-02	--
Xylenes (Total)	2.58E-06	5.89E-07	1.00E-01	5.89E-06	2.10E-07	NA	NA

Total Hazard Index	0.000018

Potential Cancer Risk	7.64E-10

Notes:
-- = Constituent is not a COC for this medium or exposure pathway.
NA = Toxicity values are not available for this endpoint or exposure pathway.

APPENDIX E

Table 1-G: Summary of Hazard Indices for the Outdoor Worker

Alker Tire - Buckhannon, Upshur County, West Virginia

Constituent	Incidental Ingestion of Soil	Dermal Contact with Soil	Inhalation of Particulates	Inhalation of Volatiles from Soil	Total Hazard Index
Volatile Organics					
1,2,4-Trimethylbenzene	3.06E-07	--	1.81E-11	3.01E-06	0.0000033
1,3,5-Trimethylbenzene	--	--	--	--	NA
Benzene	5.20E-07	--	2.45E-11	9.12E-06	0.00001
Naphthalene	--	--	--	--	NA
Xylenes (Total)	3.62E-08	--	2.57E-11	5.89E-06	0.0000059
Pathway Summary	0.00000086	--	0.000000000068	0.000018	0.000019

Total Developmental HI =	0.0000033
Total Hematologic System HI =	0.0000033
Total Immune System HI =	0.00001
Total Nervous System HI =	0.0000092
Total Respiratory System HI =	0.0000033

Notes:
-- = Constituent is not a COC for this medium or exposure pathway.
NA = Toxicity values are not available for this endpoint or exposure pathway.

APPENDIX E
Table 1-H: Summary of Theoretical Excess Lifetime Cancer Risks for the Outdoor Worker
Alker Tire - Buckhannon, Upshur County, West Virginia

Constituent	Incidental Ingestion of Soil	Dermal Contact with Soil	Inhalation of Particulates	Inhalation of Volatiles from Soil	Theoretical Excess Lifetime Cancer Risk
Volatile Organics					
1,2,4-Trimethylbenzene	NA	NA	NA	NA	NA
1,3,5-Trimethylbenzene	--	--	--	--	NA
Benzene	4.08E-11	--	2.05E-15	7.64E-10	8.05E-10
Naphthalene	--	--	--	--	NA
Xylenes (Total)	NA	NA	NA	NA	NA
Pathway Summary	4.08E-11	NA	2.05E-15	7.64E-10	8.05E-10

Notes:
-- = Constituent is not a COC for this medium or exposure pathway.
NA = Toxicity values are not available for this endpoint or exposure pathway.

APPENDIX E
Table 2-A: Intake Factors for the Construction/Excavation Worker : Alker Tire - Buckhannon, Upshur County, West Virginia

Soil Ingestion				
	CF	Conversion Factor	1.00E-06	kg/mg
	IRs	Ingestion Rate - Soil	330	mg/day
	EF	Exposure Frequency	30	days/yr
	ED	Exposure Duration	1	year
	BW	Body Weight	70	kg
	ATc	Averaging Time (Cancer)	25550	days
	ATn	Averaging Time (Non-cancer)	365	days
Dermal Contact with Soil				
	CF	Conversion Factor	1.00E-06	kg/mg
	AF	Soil to Skin Adherence Factor	0.3	mg/cm^2
	SA	Skin Surface Area Available	3300	cm^2
	EF	Exposure Frequency	30	days/yr
	ED	Exposure Duration	1	year
	BW	Body Weight	70	kg
	ATc	Averaging Time (Cancer)	25550	days
	ATn	Averaging Time (Non-cancer)	365	days
Inhalation of Particulates or Volatiles from Soil				
	EF	Exposure Frequency	30	days/yr
	ED	Exposure Duration	1	year
	ET	Exposure Time	8	hours/day
	ATc	Averaging Time (Cancer)	613200	hours
	ATn	Averaging Time (Non-cancer)	8760	hours

APPENDIX E
Table 2-A: Intake Factors for the Construction/Excavation Worker :
Alker Tire - Buckhannon, Upshur County, West Virginia

Ingestion of Water				
	IRw	Ingestion Rate - Water	0.05	L/day
	EF	Exposure Frequency	30	days/yr
	ED	Exposure Duration	1	year
	CF	Conversion Factor	0.001	mg/µg
	BW	Body Weight	70	kg
	ATc	Averaging Time (Cancer)	25550	days
	ATn	Averaging Time (Non-cancer)	365	days
Dermal Contact with Water				
	CF1	Conversion Factor 1	1.00E-03	mg/µg
	ET	Exposure Time	2	hours/day
	CF2	Conversion Factor 2	0.001	L/cm^3
	SA	Skin Surface Area Available	3300	cm^2
	EF	Exposure Frequency	30	days/yr
	ED	Exposure Duration	1	year
	BW	Body Weight	70	kg
	ATc	Averaging Time (Cancer)	25550	days
	ATn	Averaging Time (Non-cancer)	365	days
Inhalation of Volatiles from Water				
	EF	Exposure Frequency	30	days/yr
	ED	Exposure Duration	1	year
	ET	Exposure Time	2	hours/day
	ATc	Averaging Time (Cancer)	613200	hours
	ATn	Averaging Time (Non-cancer)	8760	hours

APPENDIX E
Table 2-B: Constituent-Specific Factors - Alker Tire - Buckhannon, Upshur County, West Virginia

Constituent	EPC Soil (mg/kg)	EPC Air Particulate (mg/m³)	VF (m³/kg)	EPC Air VOC (Soil) (mg/m³)	EPC Water (µg/L)	EPC Air VOC (Water) (mg/m³)	Oral AF (unitless)	Dermal AF (unitless)	K_P (cm/hr)	Frac Abs (unitless)	RfDo - C (mg/kg-day)	RfC - C (mg/m³)	RfDd - C (mg/kg-day)	CSFo (mg/kg-day)$^{-1}$	IUR (mg/m³)$^{-1}$	CSFd (mg/kg-day)$^{-1}$
Volatile Organics																
1,2,4-Trimethylbenzene	264	2.00E-07	7.91E+03	3.33E-02			1			1	1.00E-02	6.00E-02	1.00E-02	NA	NA	NA
1,3,5-Trimethylbenzene	40.4	3.07E-08	6.61E+03	6.11E-03			1			1	1.00E-02	6.00E-02	1.00E-02	NA	NA	NA
Benzene	17.9	1.36E-08	3.54E+03	5.06E-03	294	1.95E-02	1		1.49E-02	1	4.00E-03	3.01E-02	4.00E-03	5.50E-02	7.80E-03	5.50E-02
Ethylbenzene					1533	8.77E-02	1		4.93E-02	1	1.00E-01	1.00E+00	1.00E-01	1.10E-02	2.50E-03	1.10E-02
Naphthalene	43.4	3.30E-08	4.63E+04	9.37E-04	310	1.45E-02	1	0.13	4.66E-02	1	2.00E-02	3.00E-03	2.00E-02	NA	3.40E-02	NA
Toluene					4274	2.62E-01	1		3.11E-02	1	8.00E-02	5.00E+00	8.00E-02	NA	NA	NA
Xylenes (total)	254	1.93E-07	5.74E+03	4.42E-02	8850	2.14E-03	1		5.00E-02	1	2.00E-01	1.00E-01	2.00E-01	NA	NA	NA

APPENDIX E
Table 2-C: Hazard Indices and Theoretical Excess Lifetime Cancer Risks
Incidental Ingestion of Soil - Construction/Excavation Worker

Constituent	Soil EPC (mg/kg)	Oral AF (unitless)	Intake (ADD) (mg/kg-d)	RfDo (mg/kg-d)	Hazard Quotient	Intake (LADD) (mg/kg-d)	CSFo $(mg/kg\text{-}d)^{-1}$	Potential Cancer Risk
Volatile Organics								
1,2,4-Trimethylbenzene	264	1	1.02E-04	1.00E-02	1.02E-02	1.46E-06	NA	NA
1,3,5-Trimethylbenzene	40.4	1	1.56E-05	1.00E-02	1.56E-03	2.23E-07	NA	NA
Benzene	17.9	1	6.94E-06	4.00E-03	1.73E-03	9.91E-08	5.50E-02	5.45E-09
Ethylbenzene	0.00	1	0.00E+00	1.00E-01	--	0.00E+00	1.10E-02	--
Naphthalene	43.4	1	1.68E-05	2.00E-02	8.41E-04	2.40E-07	NA	NA
Toluene	0.00	1	0.00E+00	8.00E-02	--	0.00E+00	NA	--
Xylenes (total)	254	1	9.83E-05	2.00E-01	4.92E-04	1.40E-06	NA	NA

Total Hazard Index	0.015

Potential Cancer Risk	5.45E-09

Notes:
-- = Constituent is not a COC for this medium or exposure pathway.
NA = Toxicity values are not available for this endpoint or exposure pathway.

APPENDIX E
Table 2-D: Hazard Indices and Theoretical Excess Lifetime Cancer Risks
Dermal Contact with Soil - Construction/Excavation Worker

Constituent	Soil EPC (mg/kg)	Dermal AF (unitless)	Intake (ADD) (mg/kg-d)	RfDd (mg/kg-d)	Hazard Quotient	Intake (LADD) (mg/kg-d)	CSFd $(mg/kg\text{-}d)^{-1}$	Potential Cancer Risk
Volatile Organics								
1,2,4-Trimethylbenzene	264	0	0.00E+00	1.00E-02	--	0.00E+00	NA	NA
1,3,5-Trimethylbenzene	40.4	0	0.00E+00	1.00E-02	--	0.00E+00	NA	NA
Benzene	17.9	0	0.00E+00	4.00E-03	--	0.00E+00	5.50E-02	--
Ethylbenzene	0.00	0	0.00E+00	1.00E-01	--	0.00E+00	1.10E-02	--
Naphthalene	43.4	0.13	6.56E-06	2.00E-02	3.28E-04	9.38E-08	NA	NA
Toluene	0.00	0	0.00E+00	8.00E-02	--	0.00E+00	NA	--
Xylenes (total)	254	0	0.00E+00	2.00E-01	--	0.00E+00	NA	NA

Total Hazard Index	0.00033

Potential Cancer Risk	0.00E+00

Notes:
-- = Constituent is not a COC for this medium or exposure pathway.
NA = Toxicity values are not available for this endpoint or exposure pathway.

APPENDIX E
Table 2-E: Hazard Indices and Theoretical Excess Lifetime Cancer Risks
Inhalation of Particulates - Construction/Excavation Worker

Constituent	EPC Air Part (mg/m^3)	Intake (ADD) (mg/kg-d)	RfC (mg/m^3)	Hazard Quotient	Intake (LADD) (mg/kg-d)	IUR $(mg/m^3)^{-1}$	Potential Cancer Risk
Volatile Organics							
1,2,4-Trimethylbenzene	2.00E-07	5.49E-09	6.00E-02	9.15E-08	7.84E-11	NA	NA
1,3,5-Trimethylbenzene	3.07E-08	8.40E-10	6.00E-02	1.40E-08	1.20E-11	NA	NA
Benzene	1.36E-08	3.73E-10	3.01E-02	1.24E-08	5.32E-12	7.80E-03	4.15E-14
Ethylbenzene	0.00E+00	0.00E+00	1.00E+00	--	0.00E+00	2.50E-03	--
Naphthalene	3.30E-08	9.04E-10	3.00E-03	3.01E-07	1.29E-11	3.40E-02	4.39E-13
Toluene	0.00E+00	0.00E+00	5.00E+00	--	0.00E+00	NA	--
Xylenes (total)	1.93E-07	5.28E-09	1.00E-01	5.28E-08	7.55E-11	NA	NA

Total Hazard Index	4.72E-07

Potential Cancer Risk	4.81E-13

Notes:
-- = Constituent is not a COC for this medium or exposure pathway.
NA = Toxicity values are not available for this endpoint or exposure pathway.

APPENDIX E
Table 2-F: Hazard Indices and Theoretical Excess Lifetime Cancer Risks
Inhalation of Volatiles from Soil - Construction/Excavation Worker

Constituent	EPC Air VOC (Soil) (mg/m^3)	Intake (ADD) (mg/kg-d)	RfC (mg/m^3)	Hazard Quotient	Intake (LADD) (mg/kg-d)	IUR (mg/m^3)$^{-1}$	Potential Cancer Risk
Volatile Organics							
1,2,4-Trimethylbenzene	3.33E-02	9.13E-04	6.00E-02	1.52E-02	1.30E-05	NA	NA
1,3,5-Trimethylbenzene	6.11E-03	1.67E-04	6.00E-02	2.79E-03	2.39E-06	NA	NA
Benzene	5.06E-03	1.39E-04	3.01E-02	4.61E-03	1.98E-06	7.80E-03	1.55E-08
Ethylbenzene	0.00E+00	0.00E+00	1.00E+00	--	0.00E+00	2.50E-03	--
Naphthalene	9.37E-04	2.57E-05	3.00E-03	8.56E-03	3.67E-07	3.40E-02	1.25E-08
Toluene	0.00E+00	0.00E+00	5.00E+00	--	0.00E+00	NA	--
Xylenes (total)	4.42E-02	1.21E-03	1.00E-01	1.21E-02	1.73E-05	NA	NA

Total Hazard Index	0.043

Potential Cancer Risk	2.79E-08

Notes:
-- = Constituent is not a COC for this medium or exposure pathway.
NA = Toxicity values are not available for this endpoint or exposure pathway.

APPENDIX E
Table 2-G: Hazard Indices and Theoretical Excess Lifetime Cancer Risks
Incidental Ingestion of Groundwater - Construction/Excavation Worker

Constituent	Water EPC (µg/L)	Intake (ADD) (mg/kg-d)	RfDo (mg/kg-d)	Hazard Quotient	Intake (LADD) (mg/kg-d)	CSFo $(mg/kg\text{-}d)^{-1}$	Potential Cancer Risk
Volatile Organics							
1,2,4-Trimethylbenzene	0.00	0.00E+00	1.00E-02	--	0.00E+00	NA	--
1,3,5-Trimethylbenzene	0.00	0.00E+00	1.00E-02	--	0.00E+00	NA	--
Benzene	294	1.73E-05	4.00E-03	4.31E-03	2.46E-07	5.50E-02	1.36E-08
Ethylbenzene	1533	9.00E-05	1.00E-01	9.00E-04	1.29E-06	1.10E-02	1.41E-08
Naphthalene	310	1.82E-05	2.00E-02	9.10E-04	2.60E-07	NA	NA
Toluene	4274	2.51E-04	8.00E-02	3.14E-03	3.58E-06	NA	NA
Xylenes (total)	8850.0	5.20E-04	2.00E-01	2.60E-03	7.42E-06	NA	NA

Total Hazard Index	0.012

Potential Cancer Risk	2.77E-08

Notes:
-- = Constituent is not a COC for this medium or exposure pathway.
NA = Toxicity values are not available for this endpoint or exposure pathway.

APPENDIX E
Table 2-H: Hazard Indices and Theoretical Excess Lifetime Cancer Risks
Dermal Contact with Groundwater - Construction/Excavation Worker

Constituent	Water EPC (µg/L)	K_P (cm/hr)	Intake (ADD) (mg/kg-d)	RfDd (mg/kg-d)	Hazard Quotient	Intake (LADD) (mg/kg-d)	CSFd $(mg/kg\text{-}d)^{-1}$	Potential Risk
Volatile Organics								
1,2,4-Trimethylbenzene	0.00	0.000	0.00E+00	1.00E-02	--	0.00E+00	NA	--
1,3,5-Trimethylbenzene	0.00	0.000	0.00E+00	1.00E-02	--	0.00E+00	NA	--
Benzene	294	0.015	3.39E-05	4.00E-03	8.48E-03	4.85E-07	5.50E-02	2.67E-08
Ethylbenzene	1533	0.049	5.86E-04	1.00E-01	5.86E-03	8.37E-06	1.10E-02	9.20E-08
Naphthalene	310	0.047	1.12E-04	2.00E-02	5.60E-03	1.60E-06	NA	NA
Toluene	4274	0.031	1.03E-03	8.00E-02	1.29E-02	1.47E-05	NA	NA
Xylenes (total)	8850.0	0.050	3.43E-03	2.00E-01	1.71E-02	4.90E-05	NA	NA

Total Hazard Index	0.05

Potential Cancer Risk	1.19E-07

Notes:
-- = Constituent is not a COC for this medium or exposure pathway.
NA = Toxicity values are not available for this endpoint or exposure pathway.

APPENDIX E
Table 2-I: Hazard Indices and Theoretical Excess Lifetime Cancer Risks
Inhalation of Volatiles from Groundwater - Construction/Excavation Worker

Constituent	EPC Air VOC (Water) (mg/m^3)	Intake (ADD) (mg/kg-d)	RfC (mg/m^3)	Hazard Quotient	Intake (LADD) (mg/kg-d)	IUR $(mg/m^3)^{-1}$	Potential Cancer Risk
Volatile Organics							
1,2,4-Trimethylbenzene	0.00E+00	0.00E+00	6.00E-02	--	0.00E+00	NA	--
1,3,5-Trimethylbenzene	0.00E+00	0.00E+00	6.00E-02	--	0.00E+00	NA	--
Benzene	1.95E-02	1.34E-04	3.01E-02	4.45E-03	1.91E-06	7.80E-03	1.49E-08
Ethylbenzene	8.77E-02	6.01E-04	1.00E+00	6.01E-04	8.58E-06	2.50E-03	2.15E-08
Naphthalene	1.45E-02	9.91E-05	3.00E-03	3.30E-02	1.42E-06	3.40E-02	4.81E-08
Toluene	2.62E-01	1.80E-03	5.00E+00	3.59E-04	2.56E-05	NA	NA
Xylenes (total)	2.14E-03	1.47E-05	1.00E-01	1.47E-04	2.09E-07	NA	NA

Total Hazard Index	0.039

Potential Cancer Risk	8.45E-08

Notes:
-- = Constituent is not a COC for this medium or exposure pathway.
NA = Toxicity values are not available for this endpoint or exposure pathway.

APPENDIX E
Table 2-J: Summary of Hazard Indices for the Construction/Excavation Worker
Alker Tire - Buckhannon, Upshur County, West Virginia

Constituent	Incidental Ingestion of Soil	Dermal Contact with Soil	Inhalation of Particulates	Inhalation of Volatiles from Soil	Incidental Ingestion of Water	Dermal Contact with Water	Inhalation of Volatiles from Water	Total Hazard Index
Volatile Organics								
1,2,4-Trimethylbenzene	1.02E-02	--	9.15E-08	1.52E-02	--	--	--	0.025
1,3,5-Trimethylbenzene	1.56E-03	--	1.40E-08	2.79E-03	--	--	--	0.0044
Benzene	1.73E-03	--	1.24E-08	4.61E-03	4.31E-03	8.48E-03	4.45E-03	0.024
Ethylbenzene	--	--	--	--	9.00E-04	5.86E-03	6.01E-04	0.0074
Naphthalene	8.41E-04	3.28E-04	3.01E-07	8.56E-03	9.10E-04	5.60E-03	3.30E-02	0.049
Toluene	--	--	--	--	3.14E-03	1.29E-02	3.59E-04	0.016
Xylenes (total)	4.92E-04	--	5.28E-08	1.21E-02	2.60E-03	1.71E-02	1.47E-04	0.033
Pathway Summary	0.015	0.00033	4.72E-07	0.043	0.012	0.05	0.039	0.16

Total Developmental HI =	0.037
Total Hematologic System HI =	0.025
Total Hepatic System HI =	0.0074
Total Immune System HI =	0.024
Total Nervous System HI =	0.13
Total Respiratory System HI =	0.075
Total Urinary System HI =	0.024
Total Whole Body (weight) HI =	0.049

Notes:
-- = Constituent is not a COC for this medium or exposure pathway.

APPENDIX E
Table 2-K: Summary of Theoretical Excess Lifetime Cancer Risks for the Construction/Excavation Worker
Alker Tire - Buckhannon, Upshur County, West Virginia

Constituent	Incidental Ingestion of Soil	Dermal Contact with Soil	Inhalation of Particulates	Inhalation of Volatiles from Soil	Incidental Ingestion of Water	Dermal Contact with Water	Inhalation of Volatiles from Water	Theoretical Excess Lifetime Cancer Risk
Volatile Organics								
1,2,4-Trimethylbenzene	NA	NA	NA	NA	--	--	--	NA
1,3,5-Trimethylbenzene	NA	NA	NA	NA	--	--	--	NA
Benzene	5.45E-09	--	4.15E-14	1.55E-08	1.36E-08	2.67E-08	1.49E-08	7.60E-08
Ethylbenzene	--	--	--	--	1.41E-08	9.20E-08	2.15E-08	1.28E-07
Naphthalene	NA	NA	4.39E-13	1.25E-08	NA	NA	4.81E-08	6.06E-08
Toluene	--	--	--	--	NA	NA	NA	NA
Xylenes (total)	NA	NA	NA	NA	NA	NA	NA	NA
Pathway Summary	5.45E-09	NA	4.81E-13	2.79E-08	2.77E-08	1.19E-07	8.45E-08	2.64E-07

Notes:
-- = Constituent is not a COC for this medium or exposure pathway.
NA = Toxicity values are not available for this endpoint or exposure pathway.

APPENDIX E
Table 3-A: Intake Factors for the Onsite Indoor Worker:
Alker Tire - Buckhannon, Upshur County, West Virginia

Inhalation of Volatiles				
	EF	Exposure Frequency	250	days/yr
	ED	Exposure Duration	25	year
	ET	Exposure Time	8	hours/day
	ATc	Averaging Time (Cancer)	613200	hours
	ATn	Averaging Time (Non-cancer)	219000	hours

APPENDIX E
Table 3-B: Hazard Indices and Theoretical Excess Lifetime Cancer Risks
Inhalation of Volatiles - Onsite Indoor Worker
Alker Tire - Buckhannon, Upshur County, West Virginia

Constituent	EPC Air VOC (mg/m^3)	EC (mg/m^3)	RfC (mg/m^3)	Hazard Quotient	EC (mg/m^3)	IUR $(mg/m^3)^{-1}$	Potential Cancer Risk
Volatile Organics							
1,2,4-Trimethylbenzene	6.32E-03	1.44E-03	6.00E-02	2.41E-02	5.15E-04	NA	NA
1,3,5-Trimethylbenzene	2.42E-03	5.52E-04	6.00E-02	9.21E-03	1.97E-04	NA	NA
Benzene	1.39E-04	3.17E-05	3.00E-02	1.06E-03	1.13E-05	7.80E-03	8.83E-08
Ethylbenzene	1.30E-02	2.98E-03	1.00E+00	2.98E-03	1.06E-03	2.50E-03	2.66E-06
Isopropylbenzene	4.77E-03	1.09E-03	4.00E-01	2.72E-03	3.89E-04	NA	NA
Naphthalene	1.01E-03	2.31E-04	3.00E-03	7.71E-02	8.26E-05	3.40E-02	2.81E-06
n-Heptane	1.56E-01	3.57E-02	4.00E-01	8.92E-02	1.27E-02	NA	NA
n-Hexane	3.16E-01	7.21E-02	7.00E-01	1.03E-01	2.57E-02	NA	NA
Toluene	4.07E-02	9.30E-03	5.00E+00	1.86E-03	3.32E-03	NA	NA
Xylenes (Total)	4.05E-02	9.24E-03	1.00E-01	9.24E-02	3.30E-03	NA	NA

Total Hazard Index	**0.40**
Potential Cancer Risk	**5.6E-06**

Total Auditory HI =	0.089
Total Developmental HI =	0.036
Total Endocrine System HI =	0.0027
Total Hematologic System HI =	0.024
Total Hepatic System HI =	0.003
Total Immune System HI =	0.0011
Total Nervous System HI =	0.31
Total Respiratory System HI =	0.1
Total Urinary System HI =	0.0076
Total Whole Body (weight) HI =	0.077

Notes:
NA = Toxicity values are not available for this endpoint or exposure pathway.

APPENDIX E
Table 4-A: Intake Factors for the Offsite Indoor Worker:
Alker Tire - Buckhannon, Upshur County, West Virginia

Inhalation of Volatiles				
	EF	Exposure Frequency	250	days/yr
	ED	Exposure Duration	25	year
	ET	Exposure Time	8	hours/day
	ATc	Averaging Time (Cancer)	613200	hours
	ATn	Averaging Time (Non-cancer)	219000	hours

APPENDIX E
Table 4-B: Hazard Indices and Theoretical Excess Lifetime Cancer Risks
Inhalation of Volatiles - Offsite Indoor Worker
Alker Tire - Buckhannon, Upshur County, West Virginia

Constituent	EPC Air VOC (mg/m^3)	EC (mg/m^3)	RfC (mg/m^3)	Hazard Quotient	EC (mg/m^3)	IUR $(mg/m^3)^{-1}$	Potential Cancer Risk
Volatile Organics							
1,2,4-Trimethylbenzene	1.84E-03	4.20E-04	6.00E-02	6.99E-03	1.50E-04	NA	NA
1,3,5-Trimethylbenzene	9.29E-04	2.12E-04	6.00E-02	3.54E-03	7.58E-05	NA	NA
Benzene	8.15E-05	1.86E-05	3.00E-02	6.20E-04	6.65E-06	7.80E-03	5.19E-08
Ethylbenzene	8.39E-03	1.92E-03	1.00E+00	1.92E-03	6.84E-04	2.50E-03	1.71E-06
Isopropylbenzene	1.71E-04	3.90E-05	4.00E-01	9.76E-05	1.39E-05	NA	NA
Naphthalene	9.46E-04	2.16E-04	3.00E-03	7.20E-02	7.72E-05	3.40E-02	2.62E-06
n-Heptane	2.20E-03	5.03E-04	4.00E-01	1.26E-03	1.80E-04	NA	NA
n-Hexane	3.34E-01	7.62E-02	7.00E-01	1.09E-01	2.72E-02	NA	NA
Toluene	4.04E-02	9.23E-03	5.00E+00	1.85E-03	3.30E-03	NA	NA
Xylenes (Total)	2.78E-02	6.36E-03	1.00E-01	6.36E-02	2.27E-03	NA	NA

Total Hazard Index	**0.26**

Potential Cancer Risk	**4.4E-06**

Total Auditory HI =	0.0013
Total Developmental HI =	0.012
Total Endocrine System HI =	0.000098
Total Hematologic System HI =	0.007
Total Hepatic System HI =	0.0019
Total Immune System HI =	0.00062
Total Nervous System HI =	0.26
Total Respiratory System HI =	0.079
Total Urinary System HI =	0.0039
Total Whole Body (weight) HI =	0.072

Notes:
NA = Toxicity values are not available for this endpoint or exposure pathway.