REVISED
ADDENDUM TO THE
CORRECTIVE MEASURES STUDY

TEXTILEATHER CORPORATION
3729 TWINING STREET
TOLEDO, OHIO

US EPA ID # OHD 980 279 376
U.S. EPA DOCKET # RCRA-05-2010-0001

by

Haley & Aldrich, Inc.
Cleveland, Ohio

for

Textileather Corporation
Toledo, Ohio

File No. 36005-012
December 20, 2013
Revised June 25, 2014

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Attention: Carolyn Bury
EPA Project Manager

Subject: Revised Addendum to the Corrective Measures Study
Textileather Facility, Toledo, Ohio
EPA ID# OHD 980 279 376
U.S. EPA Docket # RCRA-05-2010-0001

Dear Ms. Bury:

On behalf of Textileather Corporation and pursuant to the Administrative Order on Consent (Order) dated 30 September 2009, please find enclosed the revised Addendum to the Corrective Measures Study for the Textileather Facility (the "Facility"). The Corrective Measures Study (CMS) was submitted to the U.S. EPA on 31 December 2012. As presented in the CMS there are three areas (AOI-01, AOI-15, and AOI-28) that may present unacceptable risk for future site use, when the site is ultimately redeveloped. As such, these areas require corrective measures to address.

Textileather has proposed an active remedy for each of the areas where corrective measures were required, which includes removal of impacted media based on the nature and extent of contaminants identified during the Resource Conservation and Recovery Act Facility Investigation. During review of the CMS, the U.S. EPA agreed with the approach for these areas and requested that preliminary remediation goals (PRGs) be established to evaluate whether the excavation remedies meet the corrective measure objectives. Haley & Aldrich proposed risk-based PRGs that were consistent with the methodology established in the RFI and would be protective of human health, given the assumed future use of the Site as commercial/industrial. These proposed PRGs were reviewed and discussed during teleconference calls on August 27 and September 12, 2013 with the U.S. EPA. Based on a follow-up call on March 17, 2014, the U.S. EPA was in general agreement with the methodology to establish the proposed PRGs, utilizing the risk-based approach. However, the U.S. EPA expressed concern regarding the verification of remedy complete for AOI-28, since the proposed PRG was based on a soil gas criteria. With the proposed remedy and impending demolition of the existing structures at the Facility, this criteria may be difficult to verify. Therefore, it was agreed that a PRG based on soil concentrations would be more appropriate for AOI-28. The following revised addendum to the CMS has been prepared to document the methodology used to calculate risk-based preliminary remediation goals (PRGs) that are protective for human health. This revised addendum replaces the document submitted on December 20, 2013 in its entirety.

If you have any questions or require additional information, please contact us.

Sincerely yours,
HALEY & ALDRICH, INC.

Daniel R. Putz
Project Manager

David J. Hagen
Senior Vice President

c: D. Veinot– Canadian General-Tower

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1. INTRODUCTION

The Resource Conservation and Recovery Act (RCRA) Corrective Measures (CMS) (Haley & Aldrich December 2012) was prepared under the direction of Textileather Corporation for the Textileather Facility (the "Facility") located in Toledo, Ohio. The CMS was submitted to the U.S. EPA on 31 December 2012. The United States Environmental Protection Agency (U.S. EPA) ID Number for the Facility is #OHD980279376. The Site is located at 3729 Twining Street, Toledo, Ohio. The CMS describes the evaluation of corrective measures for addressing contaminated environmental media at the Facility identified during the RCRA Facility Investigation (RFI), and the rationale for their selection. The U.S. EPA will select final corrective measures for the Facility after the public comment period has ended and any information submitted during the comment period has been reviewed and considered.

As presented in the CMS there are three areas (AOI-01, AOI-15, and AOI-28) that may present unacceptable risk for future site use, when the site is ultimately redeveloped. As such, these areas require corrective measures to address. Textileather has proposed an active remedy for each of the areas where corrective measures were required, which includes removal of impacted media based on the nature and extent of contaminants identified during the Resource Conservation and Recovery Act Facility Investigation. During review of the CMS, the U.S. EPA agreed with the approach for these areas and requested that preliminary remediation goals (PRGs) be established to evaluate whether the excavation remedies meet the corrective measure objectives. The following addendum to the CMS has been prepared to document the methodology used to calculate risk-based preliminary remediation goals (PRGs) that are protective for human health.

2. PRELIMINARY REMEDIATION GOALS

2.1 Proposed Corrective Measures

The CMS identified three areas (AOI-01, AOI-15, and AOI-28) that may present unacceptable risk for future site use, when the site is ultimately redeveloped. In the CMS, Textileather proposed the most aggressive remedial option, such that the Facility can be brought back to beneficial re-use in the shortest period of time, while minimizing the requirement for long-term maintenance. The CMS concluded that for the issues at the Facility, this turns out to be the most effective, permanent and often most cost-effective alternative:

- AOI-01 – excavation of PCB-impacted subsurface soils and NAPL,
- AOI-15 – excavation of the NAPL around PZ-31, and
- AOI-28 – excavation of VOC-impacted soils.

Based on the evaluation detailed in the CMS, removal of the impacted soils would satisfy the three performance criteria established by the U.S. EPA. In addition, removal would score high in comparison to the balancing criteria. Therefore, the removal option was considered in the CMS to be the best corrective measures alternative for these areas.

2.2 Calculation of Risk-Based PRGs

This addendum provides documentation of the methodology used to calculate risk-based preliminary remediation goals (PRGs) that are protective for human health. PRGs represent chemical concentrations that correspond to set levels of target cancer risk and target hazard index. PRGs may be used to plan remediation (i.e., define the extent of areas that require response actions), and to evaluate the post-remediation confirmatory analytical results, to help determine when remediation has achieved conditions that do not pose unacceptable risks.

PRGs are derived in consideration of the exposure scenarios, media, and chemicals which were associated with risks in excess of USEPA risk management criteria, as defined by the results of the Human Health Risk Assessment (HHRA) provided in the RFI Report (Haley & Aldrich, December 2012). The results of the HHRA indicated that the following media were associated with risks greater than a cancer risk of 1E-04 and/or a hazard index (HI) greater than 1; chemicals that contributed to the risks at these areas are also indicated below, and include polychlorinated biphenyls (PCBs), bis(2-ethylhexyl)phthalate (BEHP), di-n-octylphthalate (DNOP), trichloroethene (TCE), and perchloroethene (PCE).

	Commercial Worker	Construction Worker
AOI-01 Subsurface Soil	**X**$_{(PCBs)}$	**X**$_{(PCBs)}$
AOI-01 NAPL (indoors)	**X**$_{(PCBs)}$	
AOI-15 NAPL (in soil)	**X**$_{(PCBs, BEHP, DNOP)}$	**X**$_{(PCBs, BEHP)}$
AOI-28 Soil Vapor	**X**$_{(TCE, PCE)}$	

PRGs were derived for three groups of chemicals at the Site:

1) Chemicals of Concern (COCs). COCs are chemicals associated with a cancer risk greater than 1E-06 or a hazard index (HI) greater than 1 for Areas of Concern (AOCs) in which cumulative receptor cancer risks exceeded 1E-04 or cumulative receptor hazard index values exceeded 1, based on the results of the HHRA. The COCs are the chemicals listed above.

2) Chemicals of Potential Concern (COPCs). COPCs are the chemicals that were quantitatively evaluated in the HHRA because they were detected in at least one sample at a concentration greater than conservative risk-based screening levels. PRGs were derived for COPCs to provide additional information by which to evaluate post-remedial confirmatory data, where required.

3) Other Site-related Chemicals of Interest. A PRG was also identified for tetrahydrofuran because it is known to be present in Site media. Although it was not detected at concentrations greater than conservative risk-based screening levels (i.e., not retained as a COPC), a PRG for this chemical will allow for evaluation of post-remedial confirmatory data, where required.

PRGs were not derived for NAPL because the remedial objectives for NAPL are to reduce NAPL volume and/or remove NAPL, not to reduce the concentrations of constituents detected within the NAPL.

USEPA describes methods for deriving PRGs in *Risk Assessment Guidance for Superfund (RAGS) Part B* (USEPA, 1991). The methodology provided in RAGS Part B involves the algebraic rearrangement of the exposure intake and risk calculation algorithms used in the HHRA, to derive PRGs for a given set of receptor exposure parameters, toxicity values, and target risks. This methodology is useful for deriving PRGs at the on-set of the RFI process, before the HHRA has been completed. However, since the results of the HHRA establish a relationship between exposure point concentration (EPC), receptor exposure, toxicity, and risk, the results of the HHRA can be used directly to derive PRGs. In this approach, an equality is established between the EPC used in the HHRA and the risk or HI that was calculated for the EPC. The equality is then used to solve for the concentration that corresponds to a specified level of risk or HI; that concentration is the PRG, as shown in the following equation:

$$\frac{EPC}{Risk\ or\ HI} = \frac{PRG}{Target\ Risk\ or\ HI}$$

Table 1 provides documentation of the EPCs and risks that were used to derive PRGs in soil. The information provided in Table 1 was excerpted directly from Tables 37 and 38 of the HHRA. As indicated in Table 1, PRGs were derived for a target cancer risk of 1E-05 and a target HI of 1. Achieving a residual (post-remedial) concentration that does not exceed the lower of the PRG set at a target cancer risk of 1E-05 or a HI of 1 ensures that the cumulative cancer risk among all COCs will not exceed 1E-04.

2.2.1 **AOI-28**

For AOI-28, risks for vapor intrusion were calculated in the HHRA based on measured sub-slab soil gas data. However, it was identified that derivation of PRGs based on soil gas would not be appropriate for evaluation of the post-excavation performance for this area due to complications associated with post-remedial verification sampling of soil gas in the absence of a floor slab (the floor slab at AOI 28 will be removed in order to remediate soil). Therefore, PRGs for vapor intrusion (VI) from soil (soil VI PRGs) were developed using existing soil data, sub-slab soil gas data, and modeling. The PRGs will be used to guide remediation of tetrachloroethene (PCE) and trichloroethene (TCE) in soil at AOI 28, and to then to evaluate post-remedial confirmatory sampling data. The approach used to develop soil VI PRGs is provided below and documented in Table 2.

Table 2 provides the maximum detected soil and sub-slab soil gas concentrations of PCE and TCE at AOI 28. Conceptually, the PCE and TCE concentrations measured in sub-slab soil vapor are a result of partitioning those VOCs from soil to soil gas, and subsequent migration of soil gas through the soil column to void space beneath the concrete floor slab that covers the area of the building designated as AOI 28. Vapor intrusion occurs when sub-slab soil gas migrates into occupied indoor space. In the HHRA, measured soil gas data were used with empirical sub-slab soil gas to indoor air attenuation factors to estimate indoor air concentrations that could arise from the vapor intrusion exposure pathway. Two approaches to deriving soil concentrations that are protective for vapor intrusion were evaluated: the Johnson-Ettinger soil to indoor air model, and direct correlation of bulk soil and soil gas measurements.

Initially, the Johnson-Ettinger soil to indoor air vapor intrusion model was used to calculate a target soil concentration that is protective for vapor intrusion to indoor air. However, it is recognized that the methodology this model uses to estimate partitioning of VOCs from soil to soil gas generally yields overestimates of the resulting soil gas concentrations. To evaluate the significance of this uncertainty at AOI 28, the Johnson-Ettinger model was run using the measured soil concentrations of PCE and TCE. As indicated in Table 2, the estimated soil gas concentrations derived by the model were more than 25 times greater than the sub-slab soil gas concentrations measured at AOI 28. Consequently, the model was not used to derive target soil concentrations.

The measured concentrations of PCE and TCE in soil may be correlated with the measured concentrations of PCE and TCE in sub-slab soil gas. Using this approach, in order to identify a soil concentration that is protective for VI from soil to indoor air under the assumption that a new commercial use building is constructed at AOI 28, it is necessary to identify target (health protective) concentrations of PCE and TCE in indoor air and sub-slab soil gas, and to then establish the soil concentration that is correlated with the target sub-slab soil gas concentration. These steps are described as follows:

- Target Indoor Air Concentrations - Indoor air concentrations of PCE and TCE that correspond to full-time commercial worker exposures (8 hours per day, 250 days per year, 25 years) associated with a hazard index of 1 and an excess lifetime cancer risk of $1x10^{-5}$ are provided in Table 2. The lower of the concentrations based on cancer risk and hazard index are selected as the final indoor air target concentrations (Table 2).

- Target Sub-slab Soil Gas Concentrations - Sub-slab soil gas concentrations that are protective for migration of soil gas to indoor air at the target indoor air concentrations are derived by dividing the final target indoor air concentrations by a sub-slab soil gas to indoor air attenuation factor of 0.01. This attenuation factor was approved for use by USEPA in the RFI human health risk assessment. Target sub-slab soil gas concentrations are provided in Table 2.

- Target Soil Concentration - The target soil concentration may be derived by using the ratio of the measured soil concentration to the measured sub-slab soil gas concentration and then calculating the soil concentration that would correspond to the target sub-slab soil gas concentration. Using this approach, the target soil concentrations of PCE and TCE are 0.68 mg/kg and 0.072 mg/kg, respectively (Table 2).

Based on a review of existing soil sample data from AOI-28, the 0.0 to 2.0-ft soil sample from soil boring SB-28-08 exhibited elevated PCE and TCE soil concentrations in a duplicate analysis that is slightly above the target soil concentrations. Therefore, to be conservative, the proposed excavation remedy for AOI-28 will be extended approximately six feet to the east and one foot north to address these potentially elevated soil concentrations. A revised Figure 5 from the CMS (Haley & Aldrich December 2012), is included in the Figure section of this addendum. The resulting proposed excavation is approximately 630 ft^2 by 4-ft deep, yielding approximately 93 cubic yards. This equates to approximately 150 ton at 1.6 ton per cubic yard. Utilizing the costing from the CMS of $138 per ton excavation and disposal, the estimated cost for excavation of impacted soil in AOI-28 is $20,700. The difference in size of excavation (approximately 20 cubic yards, resulting in approximately 33 tons) does not impact the selection criteria as presented in the CMS (Haley & Aldrich December 2012), consequently removal of the impacted soil remains the preferred remedy.

2.3 Post-Remedy Evaluation

As identified in the CMS, the proposed remedies for the three areas that may present unacceptable risk for future site use, should site conditions change are:

- AOI-01 – excavation of PCB-impacted subsurface soils and NAPL,
- AOI-15 – excavation of the NAPL around PZ-31, and

- AOI-28 – excavation of VOC-impacted soils.

The PRG for excavation of NAPL in AOI-01 and AOI-15 is excavation of all visible signs of NAPL. Based on the RFI activities, the proposed excavations in AOI-01 and AOI-15 presented in the CMS should remove free- and residual- NAPL in these areas. Therefore, no post-remedy sampling is required.

The PRG for the PCB-impacted subsurface soils in AOI-01 is 6.5/8.5 mg/kg for commercial/construction workers. The proposed excavation in AOI-01 presented in the CMS should remove most, if not all, of the PCB-impacted soils. If soil staining or residual NAPL remains at the proposed extend of excavation, soil samples will be obtained from the sidewalls and bottom of the excavation at a rate of 1 per 50 lineal feet on the sidewalls and 1 per 1,000 sqft on the bottom of the excavation. The results will be compared to the PRGs established above.

In AOI-28, the HHRA indicated that the potentially complete future pathway would be for commercial workers exposed to elevated soil gas concentrations, when the site is ultimately redeveloped. Using a direct correlation between measured soil and sub-slab soil gas concentrations, as described above, the target soil concentrations of PCE and TCE are 0.68 mg/kg and 0.072 mg/kg, are proposed as the soil VI PRGs for AOI-28. Four samples from the sidewall and two samples from the bottom of the excavation will be collected to confirm that the potential source of VOCs in soil that may pose a future soil gas issue have been removed.

Results of the post-remedy evaluation will be documented in the construction completion report for the corrective measures.

REFERENCES

1. Haley & Aldrich, 2009. Current Conditions Report for Textileather Corporation, December.

2. Haley & Aldrich, 2009. RCRA Facility Investigation Work Plan for Textileather Corporation, December.

3. Haley & Aldrich, 2010. Eastern Property Boundary Investigation Work Plan for Textileather Corporation, March.

4. Haley & Aldrich, 2010. Field Event #1 Data Results – RCRA Facility Investigation for Textileather Corporation, May.

5. Haley & Aldrich, 2010. Facility Investigation Work Plan Addendum #1 for Field Event #2 for Textileather Corporation, June.

6. Haley & Aldrich, 2010. Eastern Property Boundary Investigation Summary and Evaluation Report for Textileather Corporation, October.

7. Haley & Aldrich, 2010. Field Event #2 Data Results – RCRA Facility Investigation for Textileather Corporation, November.

8. Haley & Aldrich, 2011. Site Management Plan for Textileather Corporation, January.

9. Haley & Aldrich, 2011. Site Specific Health And Safety Plan for Textileather Corporation, January

10. Haley & Aldrich, 2011. CA725 Current Human Exposures Under Control Report – RCRA Facility Investigation for Textileather Corporation, January.

11. Haley & Aldrich, 2011. Field Event #2A and #2B Data Results – RCRA Facility Investigation for Textileather Corporation, July.

12. Haley & Aldrich, 2011. CA750 Migration of Contaminated Groundwater Under Control Report – RCRA Facility Investigation for Textileather Corporation, July.

13. Haley & Aldrich, 2011. Field Event #3 Data Results – RCRA Facility Investigation for Textileather Corporation, September.

14. Haley & Aldrich, 2011. Revised CA725 Current Human Exposures Under Control Report – RCRA Facility Investigation for Textileather Corporation, September.

15. Haley & Aldrich, 2011. RCRA Facility Investigation Report for Textileather Corporation, September.

16. Haley & Aldrich, 2012. Revised RCRA Facility Investigation Report for Textileather Corporation, December.

17. Haley & Aldrich, 2012. RCRA Corrective Measure Study for Textileather Corporation, December.

18. USEPA, 2000. Fact Sheet #2, Expectations For Final Remedies At RCRA Corrective Action Facilities, March.

19. USEPA, 2000. Fact Sheet #3, Final Remedy Selection For Results-Based RCRA Corrective Action, March.

20. 2012. "Regional Screening Levels for Chemical Contaminants at Superfund Sites"; EPA Office of Superfund. November.

21. USEPA, 2011. "Integrated Risk Information System (IRIS)"; on-line data-base search www.epa.gov/iris.

TABLES

TABLE 1
PRELIMINARY REMEDIGATION GOALS FOR SOIL
TEXTILEATHER CORPORATION
TEXTILEATHER FACILTIY
TOLEDO, OHIO

			Basis for Calculating Preliminary Remediation Goals (4)							Preliminary Remediation Goals (5)			
	CASRN	Units	EPC		Construction Worker		Commercial Worker			Construction Worker		Commercial Worker	
Constituent			Value	basis	ELCR	HI	ELCR	HI		ELCR = 1E-5	HI = 1	ELCR = 1E-5	HI = 1
Chemicals of Concern (1)													
Aroclor-1242 (PCB-1242)	53469-21-9	mg/kg	424	AOI 1 - subs	6E-05	6E+01	5E-04	3E+01		76	6.5	8.5	12
Aroclor-1248 (PCB-1248)	12672-29-6	mg/kg	4.7	AOI 22 - ss	6E-07	7E-01	6E-06	4E-01		76	6.5	8.5	12
Chemicals of Potential Concern (2)													
Benzo(a)anthracene	56-55-3	mg/kg	6.1	AOI 3 - ss	1.3E-07	0.0E+00	1.2E-06	0.0E+00		468		53	
Benzo(a)pyrene	50-32-8	mg/kg	5.9	AOI 3 - ss	1.1E-06	0.0E+00	1.0E-05	0.0E+00		52		5.8	
Benzo(b)fluoranthene	205-99-2	mg/kg	6.2	AOI 3 - ss	1.4E-07	0.0E+00	1.2E-06	0.0E+00		453		51	
bis(2-Ethylhexyl)phthalate	117-81-7	mg/kg	73	AOI 2 - subs	6.1E-08	3.0E-03	5.2E-07	5.2E-03		11,911	23,823	1,406	14,056
Di-n-octyl phthalate	117-84-0	mg/kg	425	AOI 2 - subs	0.0E+00	1.5E-02	0.0E+00	5.0E-02			28,587		8,434
Pentachlorophenol	87-86-5	mg/kg	30	AOI 17 - ss	9.8E-07	3.4E-02	9.8E-06	1.4E-02		307	876	31	2,179
Benzene	71-43-2	mg/kg	0.64	AOI 2 - subs	8.4E-09	2.6E-03	4.1E-08	4.9E-04		764	252	159	1,303
Ethylbenzene	100-41-4	mg/kg	426	AOI 2 - subs	0.0E+00	5.9E-03	0.0E+00	7.4E-03			71,928		57,277
Toluene	108-88-3	mg/kg	3025	AOI 2 - subs	0.0E+00	4.6E-02	0.0E+00	4.0E-02			65,869		76,387
Trichloroethene	79-01-6	mg/kg	5.3	AOI 28 - ss	3.3E-08	3.5E-02	1.7E-07	4.0E-02		1,624	152	311	131
Xylene (total)	1330-20-7	mg/kg	2777	AOI 2 - subs	0.0E+00	3.5E-02	0.0E+00	2.3E-01			79,398		11,974
Antimony	7440-36-0	mg/kg	3.4	AOI 2 - ss	0.0E+00	2.7E-02	0.0E+00	7.2E-03			124		467
Arsenic	7440-38-2	mg/kg	2.5	AOI 2 - ss	1.9E-07	3.0E-02	1.4E-06	8.7E-03		133	85	18	291
Chromium Total	7440-47-3	mg/kg	42	AOI 2 - ss	1.0E-08	6.9E-03	2.2E-07	1.2E-02			6,119		3,479
Lead	7439-92-1	mg/kg	178	AOI 2 - ss	0.0E+00	0.0E+00	0.0E+00	0.0E+00			800		800
Other Site-Related Constituents of Interest (3)													
Tetrahydrofuran	109-99-9	mg/kg	5500	Site-wide	Not calculated (not a COPC)						95,300		95,300

Notes and Abbreviations:
(1) - Chemicals which posed a cancer risk greater than 1E-06 or a hazard index greater than 1 at AOCs for which cumulative risks were greater than 1E-04 or a hazard index of 1.
(2) - Chemicals that were carried through the risk assessment, but which were not identified as chemicals of concern.
(3) - Chemicals known to be significant Site-related constituents, but that were not retained as chemicals of potential concern because they were not detected in Site soil at concentrations greater than screening levels.
(4) - Source of exposure point concentration and risk used to calculate preliminary remediation goal as defined in note (5).
(5) - Preliminary remediation goals calculated as follows: PRG = target risk or HI / (EPC x ELCR or HI calculated for EPC)

EPC = Exposure Point Concentration.
mg/kg = milligrams per kilogram.
ELCR = excess lifetime cancer risk
HI = hazard index

TABLE 2
DERIVATION OF PRELIMINARY REMEDIATION GOALS FOR THE SOIL TO INDOOR AIR EXPOSURE PATHWAY - AOI 28
TEXTILEATHER CORPORATION
TEXTILEATHER FACILTIY
TOLEDO, OHIO

Chemical of Potential Concern [1]	CASRN	Measured at AOI 28		Sub-slab Soil Gas	Target Concentrations				
		Sub-slab Soil Gas Maximum (ug/m3)	Soil Maximum (mg/kg)	Calculated Using Model @ Soil Maximum [2] (ug/m3)	Indoor Air (HI = 1) (ug/m3)	Indoor Air (risk = 1E-05) (ug/m3)	Final Indoor Air (ug/m3)	Sub-slab Soil Gas [4] (ug/m3)	Soil PRG [5] (mg/kg)
Volatile Organic Compounds									
Tetrachloroethene	127-18-4	310,000	12.1	8,050,000	175	470	175	17520	0.68
Trichloroethene	79-01-6	64,000	5.28	2,160,000	8.8	30	8.8	876	0.072

Notes and Abbreviations:
(1) Chemicals of potential concern (COPCs) identified in Table 9 of human health risk assessment.
(2) Calculated using the Johnson-Ettinger soil to indoor air model (Attachment 1).
(3) Based on full time indoor air commercial exposures (8 hours/day, 250 days/yr, 25 years). Values are baesd on the industrial use indoor air RSL values from the EPA RSL Table (November 2013).
(4) Calculated using a subslab soil gas to indoor air attenuation factor equal to 0.01 (Indoor Air Target / 0.01)
(5) Calculated by establishing the soil concentration that would be protective for the target soil gas concentration, as follows: Soil Maximum x (Target Sub-slab Soil Gas / Sub-slab Soil Gas Maximum)

FIGURES

SB-28-02	0 - 2 (ft) 2/17/2010	8 - 10 (ft) 2/17/2010
Inorganic Compounds (mg/kg)		
Antimony	< 0.5	< 0.5
Arsenic	3.25 [A]	2.71 [A]
Cadmium	0.35	0.32
Lead	16.1	7.97
PCBs (mg/kg)		
Aroclor-1242 (PCB-1242)	< 0.33	< 0.33
Aroclor-1248 (PCB-1248)	< 0.33	< 0.33
Semi-Volatile Organic Compounds (mg/kg)		
Benzo(a)anthracene	< 0.33	< 0.33
Benzo(a)pyrene	< 0.33	< 0.33
Benzo(b)fluoranthene	< 0.33	< 0.33
bis(2-Ethylhexyl)phthalate	< 0.33	< 0.33
Pentachlorophenol	< 0.33	< 0.33
Volatile Organic Compounds (mg/kg)		
Benzene	< 0.005	< 0.005
Bromodichloromethane	< 0.005	< 0.005
Chloroform (Trichloromethane)	< 0.005	< 0.005
Ethylbenzene	< 0.005	< 0.005
Tetrachloroethene	0.002 J	< 0.005
Tetrahydrofuran	< 0.005 UJ	< 0.005 UJ
Toluene	0.0006 J	< 0.005
Trichloroethene	< 0.005	< 0.005
Vinyl chloride	< 0.005	< 0.005

SB-28-04	0 - 2 (ft) 6/30/2010	6 - 8 (ft) 6/30/2010	8 - 10 (ft) 6/30/2010
Volatile Organic Compounds (mg/kg)			
Benzene	< 0.005	< 0.005/< 0.005	< 0.006
Bromodichloromethane	< 0.005	< 0.005/< 0.005	< 0.006
Chloroform (Trichloromethane)	< 0.005	< 0.005/< 0.005	< 0.006
Ethylbenzene	< 0.005	< 0.005/< 0.005	< 0.006
Tetrachloroethene	0.005	0.005/0.005	< 0.006
Tetrahydrofuran	< 0.005 UJ	< 0.005 UJ/< 0.005 UJ	< 0.006 UJ
Toluene	< 0.005	< 0.005/< 0.005	< 0.006
Trichloroethene	0.0009 J	0.001 J/0.001 J	< 0.006
Vinyl chloride	< 0.005	< 0.005/< 0.005	< 0.006

SB-28-10	0 - 2 (ft) 7/26/2011	8 - 10 (ft) 7/26/2011
Volatile Organic Compounds (mg/kg)		
Benzene	< 0.006/< 0.006	< 0.005
Bromodichloromethane	< 0.006/< 0.006	< 0.005
Chloroform (Trichloromethane)	< 0.006/< 0.006	< 0.005
Ethylbenzene	< 0.006/< 0.006	< 0.005
Tetrachloroethene	0.431/0.393	0.0173
Tetrahydrofuran	< 0.016/< 0.015	< 0.01
Toluene	0.00057 J/0.00044 J	< 0.005
Trichloroethene	0.0225/0.0228	0.0023 J
Vinyl chloride	< 0.006/< 0.006	< 0.005

SB-28-09	0 - 2 (ft) 7/26/2011	8 - 10 (ft) 7/26/2011
Volatile Organic Compounds (mg/kg)		
Benzene	< 0.006	< 0.007
Bromodichloromethane	< 0.006	< 0.007
Chloroform (Trichloromethane)	< 0.006	< 0.007
Ethylbenzene	< 0.006	< 0.007
Tetrachloroethene	0.0189	0.00164 J
Tetrahydrofuran	< 0.015	< 0.016
Toluene	0.00052 J	0.00059 J
Trichloroethene	< 0.006	< 0.007
Vinyl chloride	< 0.006	< 0.007

SB-28-05	0 - 2 (ft) 6/30/2010	6 - 8 (ft) 6/30/2010	8 - 10 (ft) 6/30/2010
Volatile Organic Compounds (mg/kg)			
Benzene	< 0.06	< 0.005	< 0.005
Bromodichloromethane	< 0.06	< 0.005	< 0.005
Chloroform (Trichloromethane)	< 0.06	< 0.005	< 0.005
Ethylbenzene	< 0.06	< 0.005	< 0.005
Tetrachloroethene	5.28	0.12	0.003 J
Tetrahydrofuran	< 0.06 UJ	< 0.005 UJ	< 0.005 UJ
Toluene	< 0.06	< 0.005	< 0.005
Trichloroethene	1.54	0.178	0.014
Vinyl chloride	< 0.1	< 0.005	< 0.005

SB-28-08	0 - 2 (ft) 7/26/2011	8 - 10 (ft) 7/26/2011
Volatile Organic Compounds (mg/kg)		
Benzene	< 0.006/< 0.006	< 0.006
Bromodichloromethane	< 0.006/< 0.006	< 0.006
Chloroform (Trichloromethane)	< 0.006/< 0.006	< 0.006
Ethylbenzene	< 0.006/< 0.006	< 0.006
Tetrachloroethene	0.197 J/0.524 J	< 0.006
Tetrahydrofuran	< 0.015/< 0.015	< 0.016
Toluene	0.00065 J/0.00053 J	0.00056 J
Trichloroethene	0.0336 J/0.114 J	< 0.006
Vinyl chloride	< 0.006/< 0.006	< 0.006

MW-1022	0 - 2 (ft) 7/26/2011	8 - 10 (ft) 7/26/2011
Volatile Organic Compounds (mg/kg)		
Benzene	< 0.005	< 0.005
Bromodichloromethane	< 0.005	< 0.005
Chloroform (Trichloromethane)	< 0.005	< 0.005
Ethylbenzene	< 0.005	< 0.005
Tetrachloroethene	0.0305	< 0.005
Tetrahydrofuran	< 0.01	< 0.01
Toluene	< 0.005	< 0.005
Trichloroethene	0.00796	< 0.005
Vinyl chloride	< 0.005	< 0.005

SB-28-03	0 - 2 (ft) 2/17/2010	8 - 10 (ft) 2/17/2010
Inorganic Compounds (mg/kg)		
Antimony	< 0.5	< 0.5
Arsenic	3.92 [A]	1.69 [A]
Cadmium	0.39	0.22
Lead	14.1	6.51
PCBs (mg/kg)		
Aroclor-1242 (PCB-1242)	< 0.33	< 0.33
Aroclor-1248 (PCB-1248)	< 0.33	< 0.33
Semi-Volatile Organic Compounds (mg/kg)		
Benzo(a)anthracene	< 0.33	< 0.33
Benzo(a)pyrene	< 0.33	< 0.33
Benzo(b)fluoranthene	< 0.33	< 0.33
bis(2-Ethylhexyl)phthalate	< 0.33	< 0.33
Pentachlorophenol	< 0.33	< 0.33
Volatile Organic Compounds (mg/kg)		
Benzene	0.0004 J	< 0.005
Bromodichloromethane	< 0.005	< 0.005
Chloroform (Trichloromethane)	0.002 J	< 0.005
Ethylbenzene	< 0.005	< 0.005
Tetrachloroethene	12.1	0.006
Tetrahydrofuran	< 0.005	< 0.005 UJ
Toluene	0.002 J	0.001 J
Trichloroethene	5.28	0.208
Vinyl chloride	< 0.005	< 0.005

SB-28-07	0 - 2 (ft) 7/26/2011	8 - 10 (ft) 7/26/2011
Volatile Organic Compounds (mg/kg)		
Benzene	< 0.005	< 0.005
Bromodichloromethane	< 0.005	< 0.005
Chloroform (Trichloromethane)	< 0.005	< 0.005
Ethylbenzene	< 0.005	< 0.005
Tetrachloroethene	0.00524	< 0.005
Tetrahydrofuran	0.0093 J	< 0.01
Toluene	0.00194 J	< 0.005
Trichloroethene	0.00882	< 0.005
Vinyl chloride	< 0.005	< 0.005

SB-28-01	0 - 2 (ft) 2/17/2010	8 - 10 (ft) 2/17/2010
Inorganic Compounds (mg/kg)		
Antimony	< 0.5	< 0.5
Arsenic	1.34	1.17
Cadmium	0.31	0.27
Lead	15.5	8.22
PCBs (mg/kg)		
Aroclor-1242 (PCB-1242)	< 0.33	< 0.33
Aroclor-1248 (PCB-1248)	< 0.33	< 0.33
Semi-Volatile Organic Compounds (mg/kg)		
Benzo(a)anthracene	< 0.33	< 0.33
Benzo(a)pyrene	< 0.33	< 0.33
Benzo(b)fluoranthene	< 0.33	< 0.33
bis(2-Ethylhexyl)phthalate	< 0.33	< 0.33
Pentachlorophenol	< 0.33	< 0.33
Volatile Organic Compounds (mg/kg)		
Benzene	< 0.005	< 0.005
Bromodichloromethane	< 0.005	< 0.005
Chloroform (Trichloromethane)	< 0.005	< 0.005
Ethylbenzene	0.002 J	< 0.005
Tetrachloroethene	< 0.005	< 0.005
Tetrahydrofuran	< 0.005 UJ	< 0.005 UJ
Toluene	0.032	0.0008 J
Trichloroethene	< 0.005	< 0.005
Vinyl chloride	< 0.005	< 0.005

SB-28-06	0 - 2 (ft) 7/26/2011	8 - 10 (ft) 7/26/2011
Volatile Organic Compounds (mg/kg)		
Benzene	< 0.005	< 0.005
Bromodichloromethane	< 0.005	< 0.005
Chloroform (Trichloromethane)	< 0.005	< 0.005
Ethylbenzene	< 0.005	< 0.005
Tetrachloroethene	0.0008 J	< 0.005
Tetrahydrofuran	< 0.01	< 0.01
Toluene	0.00037 J	< 0.005
Trichloroethene	< 0.005	< 0.005
Vinyl chloride	< 0.005	< 0.005

LEGEND:

- APPROXIMATE PROPERTY LINE
- RAILROAD
- DRAINAGE SWALE
- FENCE
- VEGETATION
- MONITORING WELL/PIEZOMETER
- SOIL BORING
- SOIL GAS LOCATION
- PRODUCTION WELL
- APPROXIMATE VOC IMPACT AREA

NOTES:

1. BASEPLAN PROVIDED BY AERIAL SURVEY CONDUCTED ON 6 NOVEMBER 2009 BY AEROCON PHOTOGRAMMETRIC SERVICES AND SURVEY BY JC ANDRUS & ASSOCIATES, INC.
2. CONCENTRATIONS SHOWN IN DATABOXES ARE IN MG/KG.
3. <: RESULT IS BELOW INDICATED REPORTING LIMIT
   J: ESTIMATED RESULT
   R: REJECTED
4. ANALYTES SHOWN ARE THOSE THAT EXCEED IN ONE OR MORE SITEWIDE GROUNDWATER, SOIL, AND/OR SOIL VAPOR SAMPLES.
5. SEE SUMMARY TABLES FOR COMPLETE LIST OF ANALYTES.
6. RESULTS GREATER THAN SOIL SCREENING CRITERIA SHOWN IN RED, SPECIFIC SCREENING CRITERIA ARE INDICATED WITHIN [ ]:
   A: INDUSTRIAL DIRECT CONTACT (RSL, NOVEMBER 2012)
7. RESULTS GREATER THAN SOIL SCREENING CRITERIA ABOVE AND LESS THAN BACKGROUND ARE IN CYAN.

N W E S

0 30 60

SCALE IN FEET

HALEY & ALDRICH

TEXTILEATHER FACILITY
3729 TWINING STREET
TOLEDO, OHIO

SOIL ANALYTICAL RESULTS AOI-28

SCALE: AS SHOWN
JUNE 2014

FIGURE 5

G:\36005 TEXTILEATHER\012 - CORRECTIVE MEASURES STUDY\CMS\ADDENDUM REVISED 2014\2014-06-17 REVISED 36005-DATABOX-SO-D1.DWG

APPENDIX A

Johnson-Ettinger Model Output for AOI-28

DATA ENTRY SHEET

SL-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED SOIL CONCENTRATION (enter "X" in "YES" box)

YES

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL SOIL CONCENTRATION (enter "X" in "YES" box and initial soil conc. below)

YES: X

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial soil conc., C_R (µg/kg)	Chemical
127184	1.21E+04	Tetrachloroethylene

MORE

ENTER Average soil temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to top of contamination, L_t (cm)	ENTER Depth below grade to bottom of contamination, (enter value of 0 if value is unknown) L_b (cm)	ENTER Totals must add up to value of L_t (cell G28) 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)
11	15	15	152.4	15	0	0	SIC		

MORE

ENTER Stratum A SCS soil type	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 A soil organic carbon fraction, f_{oc}^A (unitless)	ENTER Stratum B SCS soil type	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 B soil organic carbon fraction, f_{oc}^B (unitless)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)	ENTER Stratum C soil organic carbon fraction, f_{oc}^C (unitless)
Lookup Soil Parameters					Lookup Soil Parameters					Lookup Soil Parameters				
SIC	1.38	0.481	0.216	0.002		1.5	0.43		0.002		1.5	0.43		0.002

MORE

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-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 calculate Q_{soil} (L/m)
15	40	1000	1000	304.8	0.1	0.25	

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	25	25	250	1.0E-06	1

Used to calculate risk-based soil concentration.

END

CHEMICAL PROPERTIES SHEET

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)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)	Physical state at soil temperature, (S,L,G)
7.20E-02	8.20E-06	1.84E-02	25	8,288	394.40	620.20	1.55E+02	2.00E+02	2.6E-07	4.0E-02	L

END

INTERMEDIATE CALCULATIONS SHEET

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)	Initial soil concentration used, C_R ($\mu g/kg$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
7.88E+08	1	0.265	ERROR	ERROR	0.284	1.48E-09	0.844	1.25E-09	4,000	1.21E+04	2.12E+04

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)	Convection path length, L_p (cm)
1.00E+06	4.00E-04	15	9,543	8.30E-03	3.56E-01	1.76E-04	3.74E-03	0.00E+00	0.00E+00	3.74E-03	1	15

Soil-water partition coefficient, K_d (cm^3/g)	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., $C_{building}$ ($\mu g/m^3$)	Finite source β term (unitless)	Finite source ψ term $(sec)^{-1}$	Time for source depletion, τ_D (sec)	Exposure duration > time for source depletion (YES/NO)
3.10E-01	8.05E+06	0.10	1.26E+00	3.74E-03	4.00E+02	3.01E+05	NA	NA	2.97E+03	1.80E-03	2.32E+08	YES

Finite source indoor attenuation coefficient, $<\alpha>$ (unitless)	Mass limit bldg. conc., $C_{building}$ ($\mu g/m^3$)	Finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Final finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
NA	1.37E+02	NA	1.37E+02	2.6E-07	4.0E-02

END

DATA ENTRY SHEET

SL-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED SOIL CONCENTRATION (enter "X" in "YES" box)

YES

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL SOIL CONCENTRATION (enter "X" in "YES" box and initial soil conc. below)

YES: X

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial soil conc., C_R (µg/kg)	Chemical
79016	5.28E+03	Trichloroethylene

MORE

ENTER Average soil temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to top of contamination, L_t (cm)	ENTER Depth below grade to bottom of contamination, (enter value of 0 if value is unknown) L_b (cm)	ENTER Totals must add up to value of L_t (cell G28) 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)
11	15	15	152.4	15	0	0	SIC		

MORE

ENTER Stratum A SCS soil type	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 A soil organic carbon fraction, f_{oc}^A (unitless)	ENTER Stratum B SCS soil type	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 B soil organic carbon fraction, f_{oc}^B (unitless)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)	ENTER Stratum C soil organic carbon fraction, f_{oc}^C (unitless)
Lookup Soil Parameters					Lookup Soil Parameters					Lookup Soil Parameters				
SIC	1.38	0.481	0.216	0.002		1.5	0.43		0.002		1.5	0.43		0.002

MORE

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-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 calculate Q_{soil} (L/m)
15	40	1000	1000	304.8	0.1	0.25	

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	25	25	250	1.0E-06	1

Used to calculate risk-based soil concentration.

END

CHEMICAL PROPERTIES SHEET

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)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)	Physical state at soil temperature, (S,L,G)
7.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	1.66E+02	1.47E+03	4.1E-06	2.0E-03	L

END

INTERMEDIATE CALCULATIONS SHEET

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)	Initial soil concentration used, C_R ($\mu g/kg$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
7.88E+08	1	0.265	ERROR	ERROR	0.284	1.48E-09	0.844	1.25E-09	4,000	5.28E+03	2.12E+04

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)	Convection path length, L_p (cm)
1.00E+06	4.00E-04	15	8,544	5.05E-03	2.17E-01	1.76E-04	4.10E-03	0.00E+00	0.00E+00	4.10E-03	1	15

Soil-water partition coefficient, K_d (cm^3/g)	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., $C_{building}$ ($\mu g/m^3$)	Finite source β term (unitless)	Finite source ψ term $(sec)^{-1}$	Time for source depletion, τ_D (sec)	Exposure duration > time for source depletion (YES/NO)
3.32E-01	2.16E+06	0.10	1.26E+00	4.10E-03	4.00E+02	9.83E+04	NA	NA	3.26E+03	1.21E-03	3.77E+08	YES

Finite source indoor attenuation coefficient, $<\alpha>$ (unitless)	Mass limit bldg. conc., $C_{building}$ ($\mu g/m^3$)	Finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Final finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
NA	6.00E+01	NA	6.00E+01	4.1E-06	2.0E-03

END