Voluntary Cleanup Plan Amendment
Missoula Sawmill Facility

Prepared for:

Millsite Revitalization Project, LLC
2800 South Reserve
Missoula, Montana 59802

April 18, 2008

Project No. 10817

Geomatrix

May 27, 2008

Ms. Kate Fry
Montana Department of Environmental Quality
Site Response Section
P.O. Box 200901
Helena, Montana 59802

Re: Voluntary Cleanup Plan Amendment
Missoula Sawmill Facility
Missoula, Montana

Dear Kate,

On behalf of Millsite Revitalization Project, Inc. (MRP), Geomatrix is submitting this amendment to the Voluntary Cleanup Plan (VCP) for the Missoula Sawmill Facility. The VCP was approved by Montana Department of Environmental Quality (DEQ) on July 2, 2007. This amendment is being submitted to identify Trichloroethylene (TCE) as a contaminant of concern in soil vapor at the Tractor Repair Shop Area, and to establish a site-specific soil vapor cleanup level for TCE at the Tractor Repair Shop Area.

COMPLETED SOIL EXCAVATION AND UNFORSEEN DETECTION OF TCE

Remedial excavation at the Tractor Repair Shop (TRS) Area was completed between August and October 2007 to remove subsurface petroleum-contaminated soil and reduce soil petroleum vapor concentrations to risk levels acceptable for residential reuse. The remedial excavation removed soil to depths between 22 and 24 feet below ground surface (bgs). The VCP required removal of soil to 14 feet bgs; however, MRP extended the excavation horizontally and vertically in an effort to remove additional petroleum contaminant mass in the TRS area that potentially contributed to petroleum hydrocarbons in soil vapor. Approximately 6,800 cubic yards of impacted soil were excavated and transported to the Allied Waste Services, Inc. (AWS) landfill in Missoula, Montana for disposal. The excavation has been backfilled and compacted to grade. In addition, a soil vapor extraction (SVE) system consisting of lateral and vertical lines of extraction was installed to further reduce concentrations of volatile hydrocarbons in soil vapor. The layout of the SVE system is shown in Figure 1.

As approved in the VCP, soil vapor probes were installed as compliance monitoring points in the TRS Area. As shown in Figure 2, eight soil vapor probes are located in the TRS Area to evaluate concentrations of contaminants of concern in vapor. Seven vapor probes were originally installed prior to excavation to evaluate soil vapor petroleum

concentrations. Probes destroyed during excavation (VP-7, VP-9, VP-10 and VP-11), were replaced at the location of the previous probe, and one additional probe was added (VP-13) based on observations of the extent of petroleum impacted soil.

Vapor probes were sampled for petroleum compounds to determine if the excavation and operation of the SVE system reduced the risks associated with petroleum vapors to below the VCP-approved acceptable risk levels of $1x10^{-5}$ (excess cancer risk) and a hazard quotient of 1 (non-cancer risks). Vapor samples were collected from the vapor probes in the TRS area on October 23, 2007, and approximately one month later on November 21, 2007 in accordance with sampling procedures provided in the SVE Design Report (Appendix N of the VCP). The samples collected on October 23, 2007 were submitted to Con-Test Analytical Laboratory in East Longmeadow, Massachusetts for analysis of volatile petroleum hydrocarbons by the MDEP air-phase petroleum hydrocarbons (APH) method. Results showed that low levels of TCE were detected in five of the eight vapor sampling probes (Table 1, Figure 2, Attachment A). Based on the detection of TCE during the October sampling event, the November 2007 vapor samples from all probes were analyzed for TCE using the U.S. Environmental Protection Agency (EPA) TO-15 method, which is the method recommended by EPA for analysis of TCE, and considered more reliable then the APH method used in the October sampling event. The November 2007 vapor samples were also analyzed for petroleum constituents by the APH method.

A summary of the soil vapor analytical results is presented in Table 1 and on Figure 2 (Attachment A). Laboratory analytical and data validation reports are provided in Attachment B. As shown on Table 1 and Figure 2 (Attachment A), TCE was detected in vapor probes VP-7R, VP-9R, VP-10R, VP-11R, and VP-13 at concentrations ranging from 0.18 milligrams per cubic meter (mg/m^3) to 0.34 mg/m^3 on October 23, 2007 by the MDEP APH method. TCE concentrations detected in vapor probes sampled on November 21, 2007 by the EPA TO-15 method were considerably lower, ranging from <0.015 mg/m^3 to 0.14 mg/m^3 in these same vapor probes.

The presence of TCE in vapor at the TRS Area was not expected. Previous analytical testing of soil and groundwater samples collected at the TRS area showed that TCE was not detected in soil or groundwater. Analytical results of soil and groundwater samples in the TRS area prior to the current investigation are included in Appendix Q of the VCP.

Because TCE was detected at the TRS area, it is a contaminant of concern for the Facility. The detection of low levels of TCE in vapor and not in soil or groundwater indicates that the source mass of TCE in the TRS area is limited in extent, magnitude, and severity. Observations during soil excavation revealed that there were two dry wells (rock drain structures) that received waste streams during operation of the Tractor Repair Shop at the Facility (see Figure 2). The dry wells were located just north of the former Tractor Repair Shop, and extended to 10-15 feet bgs. Both were removed during the excavation and material was disposed of at the Allied Waste

Landfill. Based on the operational history of the site, it appears that small amounts of TCE may have been used as a degreaser and discharged to the dry wells at the TRS area, resulting in the presence of TCE in vapor samples collected at the site.

SITE-SPECIFIC CLEANUP LEVEL FOR TCE IN SOIL VAPOR

The approved VCP adopted a soil vapor cleanup risk level of $1x10^{-5}$ (carcinogenic risk) and a hazard quotient of 1 (non-cancer risks) in the TRS. Cleanup levels approved in the VCP are presented in Table 2 of this amendment and Table 5-12, (page 93) of the VCP. MRP proposes that the same total cancer risk (soil vapor cleanup risk level of $1x10^{-5}$ (carcinogenic risk) and a hazard quotient of 1 (non-cancer risks)) be used for TCE. At these risk levels, TCE vapor concentrations must be at or below 90 $\mu g/m^3$ in probes 8 feet deep and 150 $\mu g/m^3$ in probes 15 feet deep to be below the acceptable cumulative excess carcinogenic risk level of $1x10^{-5}$ and a hazard quotient of 1. Calculation of the risk levels based on TCE concentrations and applicable site-specific soil vapor cleanup levels are shown in Attachment C and D. The TCE concentrations detected in the October 23, 2007 vapor samples by the MDEP APH method were not included in the calculations because the method is not considered reliable for non-petroleum compounds.

PROPOSED REMEDY FOR TCE IN SOIL VAPOR

To remediate TCE in vapor at the TRS area, MRP is proposing to implement the same SVE system to remove TCE in soil and vapor, as proposed in Alternative 2 of the approved VCP for petroleum vapors. The SVE system would be operated until TCE vapor concentrations in probes are reduced to below the site-specific cleanup levels representative of acceptable risks for two consecutive vapor sampling events. Consistent with the VCP, vapor samples will be collected a minimum of 30 days apart and the last sample at least 30 days after the SVE system is shut down to allow for vapor concentrations in soil to reach equilibrium. All samples will be analyzed for TCE by EPA Method TO-15.

As shown in Table 1 (Attachment A) and risk calculations in Attachment C, soil excavation and operation of the SVE system to date has reduced petroleum vapor concentrations to acceptable risk levels for two consecutive samples and therefore, no additional remediation or sampling of petroleum vapors is proposed in the TRS area. TCE concentrations in vapor probe locations VP-6, VP-8, and VP-12 were also below concentrations representative of acceptable risk levels for TCE for two consecutive samples. Therefore, the objective of additional SVE will be to lower TCE concentrations in vapor probes VP-7R, VP-9R, VP-10R, VP-11R, and VP-13, which were installed to a depth of 8 feet bgs after completion of excavation, to less than an excess cancer risk of $1x10^{-5}$ (TCE vapor concentration of 90 $\mu g/m^3$).

The November 2007 sampling event shows that only one vapor probe had a soil vapor concentration greater than 90 $\mu g/m^3$ (VP-7R at 140 $\mu g/m^3$). SVE will be concentrated in

the vicinity of VP-7R; however, future samples will be collected from all five probes listed above for TCE analysis to demonstrate that acceptable risk levels have been reached for two consecutive samples, as described above. If sampling shows that vapor from a probe has reached acceptable risk levels for two consecutive vapor samples, it will no longer be sampled.

We anticipate that TCE concentrations will be lowered to acceptable risk levels in all probes within several (3-6) months but in any event well within the 5 year period allowed by statute. After reducing TCE concentrations to acceptable risk levels, MRP shall submit a revised Soil Closure Request Report to the DEQ that describes the operation of the SVE, analytical reports of all vapor sampling, data validation reports, and risk calculations demonstrating that risk levels have been lowered to below the acceptable risks indicated in this amendment. This information will also be provided in the Construction Completion Report submitted to DEQ at the end of all remedial action proposed in the VCP.

Sincerely,

Chris Cerquone
Senior Scientist

Attachments: A – Figures and Tables
B – Laboratory Analytical and Data Validation Reports
C – Risk Calculations
D – Johnson & Ettinger Model Runs (November 2007)

cc: Ed Wetherbee and Kevin Mytty, MRP
Scott Reisch & Rebecca Watson, Hogan & Hartson LLP

ATTACHMENT A – TABLES AND FIGURES

TABLE I

SOIL VAPOR ANALYTICAL RESULTS

Tractor Repair Shop Area

Missoula Sawmill Site

Vapor Sampling Locations	Sample Collection Depth (ft bgs)	Date Collected	Volatile Petroleum Hydrocarbons, mg/m^3										Acetone, mg/m^3	2- Propanol, mg/m^3	Trichloroethene, mg/m^3
			Benzene	Toluene	Ethylbenzene	m,p-Xylenes	o-Xylene	Naphthalene	MTBE	C5-C8 aliphatics	C9-C12 Aliphatics	C9-C10 Aromatics			
VP-6	15	11/22/2006	0.013[1]	0.011[1]	0.0041[1]	0.0089[1]	0.0048[1]	< 1.0	< 0.0026[1]	< 20	40	21	NA	<0.0071[1]	NA
	15	10/23/2007	< 0.12	< 0.14	< 0.082	< 0.082	< 0.082	< 0.098	< 0.068	0.17	8.3	< 0.56	0.11	<0.025	<0.01
	15	11/21/2007	< 0.0027	< 0.0032	< 0.0037	< 0.0037	< 0.0037	< 0.0044	< 0.0030 UJ	0.52	3.7	< 0.025	NA	0.0016	0.0009[1]
VP-7	15	11/22/2006	0.031[1]	0.035[1]	0.0085[1]	0.015[1]	0.0061[1]	< 1.0	< 0.0027[1]	21	68	31	NA	0.029[1]	NA
VP-7R	8	10/23/2007	< 0.12	< 0.14	< 0.082	< 0.082	< 0.082	< 0.098	< 0.068	16	17	< 0.56	0.49	<0.025	0.18
	8	11/21/2007	0.0078	0.021	< 0.0037	0.0043	< 0.0037	< 0.0037	< 0.0044 UJ	1.1	3.4	< 0.025	NA	0.00074	0.14[1]
VP-8	15	11/22/2006	0.051[1]	0.047[1]	0.013[1]	0.018[1]	0.0081[1]	< 1.0	< 0.0027[1]	30	23	< 20	NA	0.038[1]	NA
	15	10/23/2007	< 0.12	< 0.14	< 0.082	< 0.082	< 0.082	< 0.098	< 0.068	0.14	4.0	< 0.56	0.084	<0.025	<0.01
	15	11/21/2007	< 0.0027	< 0.0032	< 0.0037	< 0.0037	< 0.0037	< 0.0044	< 0.0030	0.53	3.3	0.025	NA	0.43	0.00043[1]
VP-9	15	11/22/2006	0.0055[1]	0.0049[1]	< 0.0032[1]	0.0041[1]	< 0.0032[1]	< 1.0	< 0.0026[1]	< 20	24	< 20	NA	<0.0072[1]	NA
VP-9R	8	10/23/2007	< 0.12	< 0.14	< 0.082	< 0.082	< 0.082	< 0.098	< 0.068	0.75	10	< 0.56	0.11	<0.025	0.18
	8	11/21/2007	< 0.06	< 0.07	< 0.082	< 0.082	< 0.082	< 0.098	< 0.068 UJ	18	2.4	< 0.56	NA	62	0.022[1]
	8	11/21/2007	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.018[2]
VP-10	15	11/22/2006	< 0.45[1]	1.4[1]	< 0.61[1]	< 0.61[1]	< 0.61[1]	< 1.0	< 0.51[1]	141	599	252	NA	780 J[1]	NA
VP-10R	8	10/23/2007	0.12	0.33	< 0.082	0.12	< 0.082	< 0.098	< 0.068	1.5	11	< 0.56	0.22	0.081	0.34
	8	11/21/2007	< .0027	0.018	0.018	0.04	0.035	< 0.0044	< 0.0030 UJ	0.32	4.2	0.12	NA	0.13	0.028[1]
	8	11/21/2007	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.022[2]
VP-11	15	11/22/2006	0.44[1]	0.43[1]	0.791	4.0[1]	2.6[1]	< 1.0	< 0.027[1]	140	478	230	NA	<0.075	NA
VP-11R	8	10/23/2007	< 0.12	< 0.14	< 0.082	< 0.082	< 0.082	< 0.098	< 0.068	1.5	15	< 0.56	0.20	0.042	0.18
	8	11/21/2007	< 0.06	< 0.07	< 0.082	< 0.082	< 0.082	< 0.098	< 0.068 UJ	3.3	2.5	< 0.56	NA	8.6	0.015[1]
VP-12	15	11/22/2006	0.10[1]	0.13[1]	0.019[1]	0.045[1]	0.02[1]	< 1.0	< 0.0027[1]	25	35	19	NA	0.010[1]	NA
	15	10/23/2007	< 0.12	< 0.14	< 0.082	< 0.082	< 0.082	< 0.098	< 0.068	0.19	7.0	< 0.56	0.052	<0.025	<0.01
	15	11/21/2007	< 0.0027	< 0.0032	< 0.0037	< 0.0037	< 0.0037	< 0.0044	< 0.0030 UJ	0.16	4.5	< 0.025	NA	0.0089	< 0.00024
VP-13	8	10/23/2007	< 0.12	< 0.14	< 0.082	< 0.082	< 0.082	< 0.098	< 0.068	3.5	11.0	< 0.56	0.250	<0.025	0.32
	8	11/21/2007	< 0.0027	0.0046	< 0.0037	0.011	0.005	< 0.0044	< 0.0030 UJ	0.34	3.9	0.032	NA	0.032	0.06[1]
EPA Target Screeing Level[3]		$1x10^{-5}$ target	0.031	---	---	---	---	---	---	Site Specific Cleanup Level (8 feet)					0.09
		$1x10^{-6}$ target	0.31	---	---	---	---	---	---	Site Specific Cleanup Level (15 feet)					0.15

Notes:

All samples were analyzed using the Massachusetts Air-Phase Hydrocarbon (APH) method, except as noted.

Samples collected in 2006 were prior to remedial excavation of contaminated soils.

< Less than; compound not detected above method detection limit.

J Estiamted value.

NA Not analyzed.

MTBE Methyl tert butyl ether.

mg/m3 Milligrams per cubic meter.

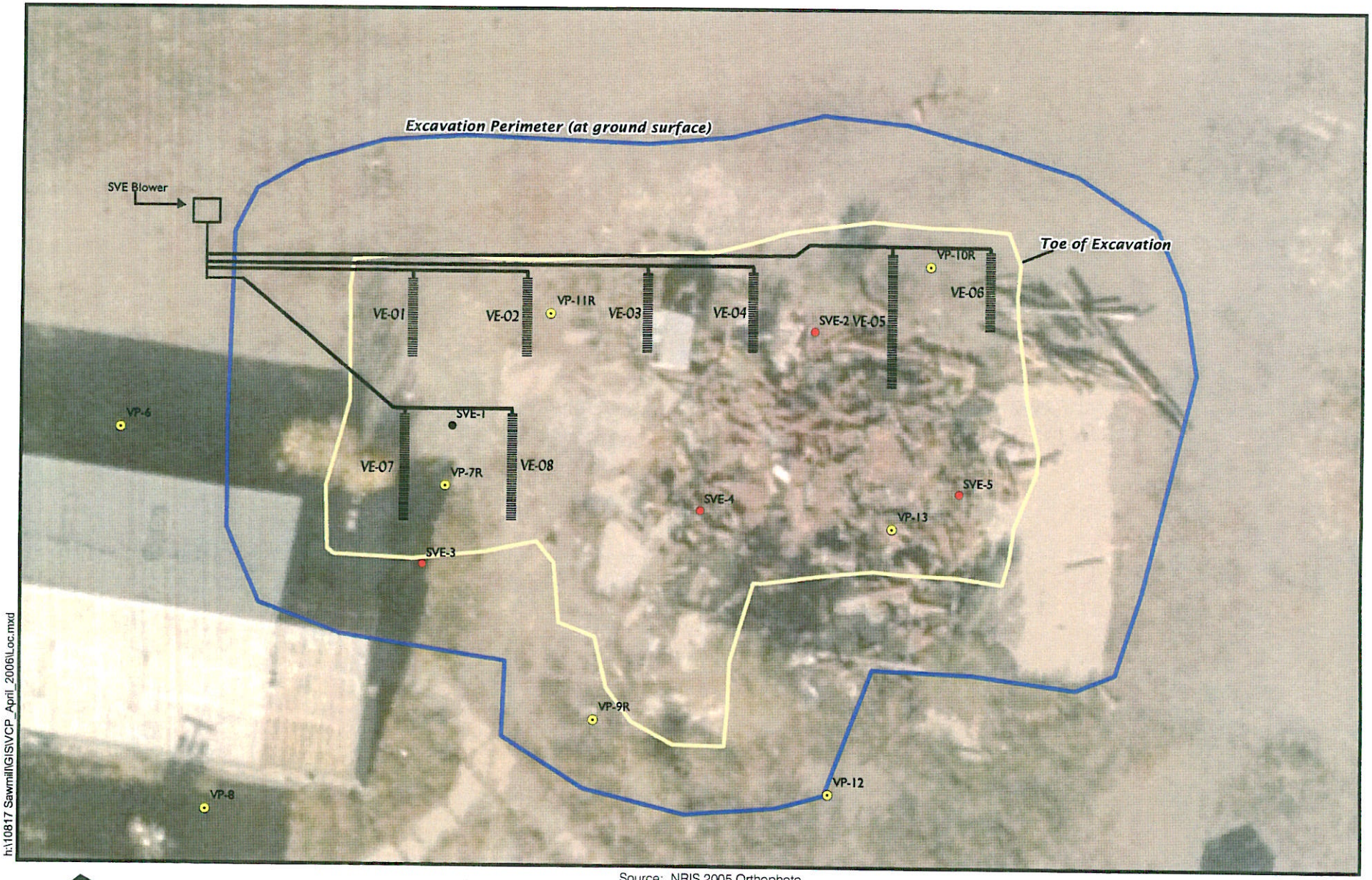
--- Not applicable.

= above the site-specific concentration representative of $1x10^{-5}$ excess cancer risk.

[1] Result obtained using U.S. Environmental Protection Agency (USEPA) Method TO-15.

[2] Split sample analyzed by Air Toxics, Ltd. of Folsom, California by USEPA Method TO-15. Corresponding natural sample analyzed by Con-Test Analytical Laboratory of East Longmeadow, Massachussetts.

[3] U.S. Enivonmental Protection Agency, 2002. *OSWER Draft Guidance For Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance)*. November 2002.



h:\10817 Sawmill\GIS\VCP_April_2006\Loc.mxd

Source: NRIS 2005 Orthophoto

N

0 30
Feet

Geomatrix

SVE Well (shallow)

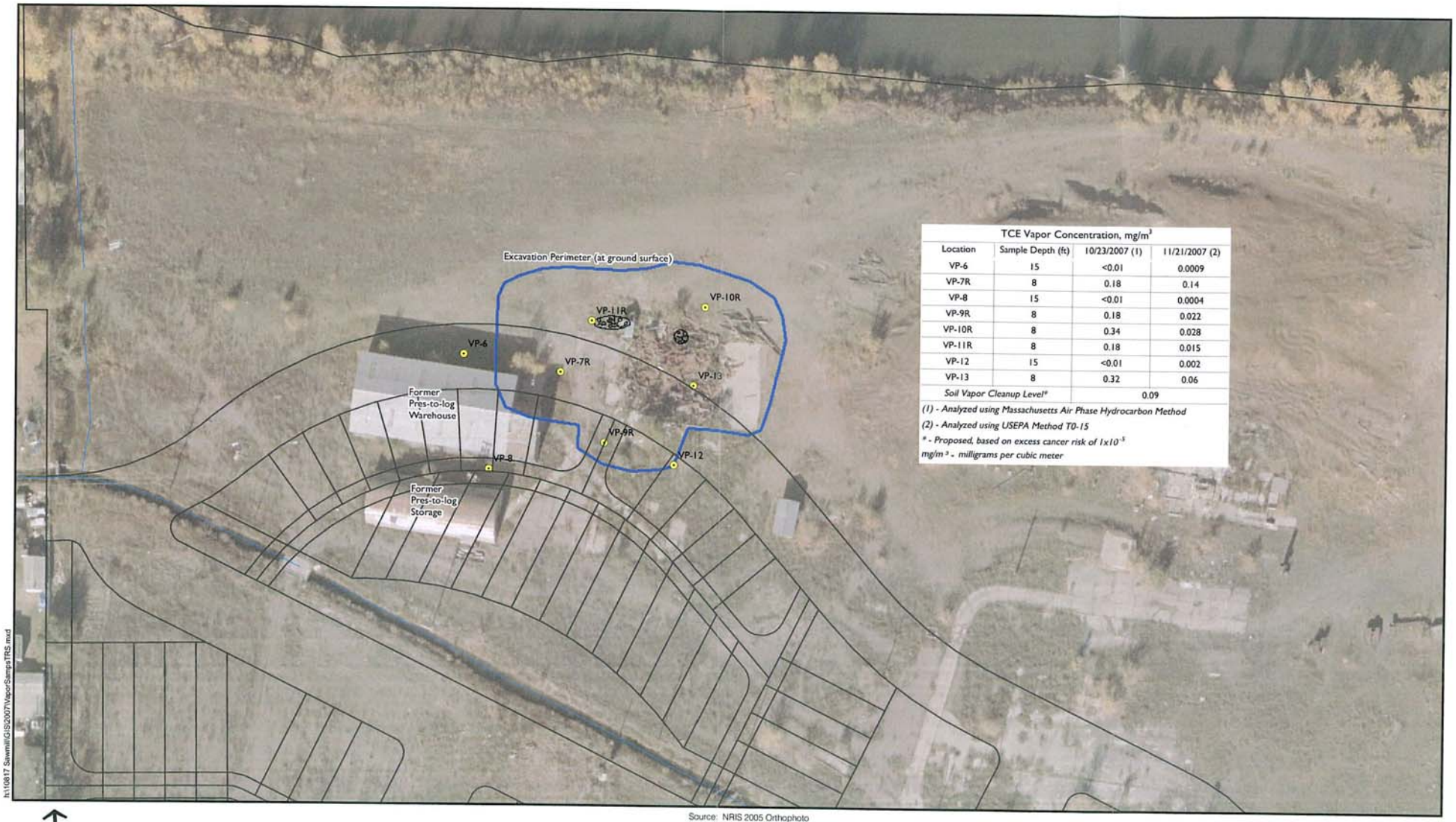
SVE Well (deep)

Vapor Probe Location

SVE Lateral (22' bgs)

Excavation Perimeter

Soil Vapor Extraction System
Tractor Repair Shop Area
Missoula Sawmill Facility
Missoula, Montana
FIGURE 1



TCE Vapor Concentration, mg/m^3			
Location	Sample Depth (ft)	10/23/2007 (1)	11/21/2007 (2)
VP-6	15	<0.01	0.0009
VP-7R	8	0.18	0.14
VP-8	15	<0.01	0.0004
VP-9R	8	0.18	0.022
VP-10R	8	0.34	0.028
VP-11R	8	0.18	0.015
VP-12	15	<0.01	0.002
VP-13	8	0.32	0.06
*Soil Vapor Cleanup Level**	0.09		

(1) - Analyzed using Massachusetts Air Phase Hydrocarbon Method
(2) - Analyzed using USEPA Method T0-15
** - Proposed, based on excess cancer risk of $1x10^{-5}$*
mg/m^3 - milligrams per cubic meter

Source: NRIS 2005 Orthophoto

N

0 70
Feet

Geomatrix

- Vapor Monitoring Point
- Proposed Lot Boundaries
- Excavation Perimeter
- Dry Wells (consisting of drain rock)

Vapor Sampling Locations
Tractor Repair Shop Area
Missoula Sawmill Facility
Missoula, Montana
FIGURE 2

h:\10817 Sawmill\GIS\2007\VaporSamplsTRS.mxd

ATTACHMENT B - LABORATORY ANALYTICAL AND DATA VALIDATION REPORTS

con-test
ANALYTICAL LABORATORY

39 Spruce Street ° East Longmeadow, MA 01028 ° FAX 413/525-6405 ° TEL. 413/525-2332

REPORT DATE 12/5/2007

GEOMATRIX - MT
1001 S. HIGGINS AVENUE, BLDG. B-1
MISSOULA, MT 59801-4144
ATTN: WILHELM WELZENBACH

CONTRACT NUMBER:
PURCHASE ORDER NUMBER: 10817

PROJECT NUMBER: 10817.000.0 TASK L

ANALYTICAL SUMMARY

LIMS BAT #: LIMT-11007
JOB NUMBER: 10817.000.0

The results of analyses performed on the following samples submitted to the CON-TEST Analytical Laboratory are found in this report.

PROJECT LOCATION: MISSOULA SAWMILL

FIELD SAMPLE #	LAB ID	MATRIX	SAMPLE DESCRIPTION	TEST
VP-06	07B42892	AIR	NOT SPECIFIED	aph air
VP-07	07B42893	AIR	NOT SPECIFIED	aph air
VP-08	07B42894	AIR	NOT SPECIFIED	aph air
VP-09	07B42895	AIR	NOT SPECIFIED	aph air
VP-10	07B42896	AIR	NOT SPECIFIED	aph air
VP-11	07B42897	AIR	NOT SPECIFIED	aph air
VP-12	07B42898	AIR	NOT SPECIFIED	aph air
VP-13	07B42899	AIR	NOT SPECIFIED	aph air

Comments :

LIMS BATCH NO. : LIMT-11007

12/5/07 - REVISED REPORT - QC INCLUDED WITH REPORT

11/13/2007 - REVISED REPORT - ISOPROPANOL RESULTS ADDED FOR ALL SAMPLES

IN THE APH METHOD, ANY REPORTED RESULT FOR 1,3-BUTADIENE, MTBE, NAPHTHALENE, OR 2-METHYLNAPHTHALENE IS ESTIMATED. EITHER INITIAL OR CONTINUING CALIBRATION DID NOT MEET METHOD SPECIFIED CRITERIA.

The CON-TEST Environmental Laboratory operates under the following certifications and accreditations. AIHA accreditations only apply to NIOSH methods and Environmental Lead Analyses.

AIHA 100033	AIHA ELLAP (LEAD) 100033	NORTH CAROLINA CERT. # 652
MASSACHUSETTS MA0100	NEW HAMPSHIRE NELAP 2516	NEW JERSEY NELAP NJ MA007 (AIR)
CONNECTICUT PH-0567	VERMONT DOH (LEAD) No. LL015036	FLORIDA DOH E871027 (AIR)
NEW YORK ELAP/NELAP 10899	RHODE ISLAND (LIC. No. 112)	

I certify that the analyses listed above, unless specifically listed as subcontracted, if any, were performed under my direction according to the approved methodologies listed in this document, and that based upon my inquiry of those individuals immediately responsible for obtaining the information, the material contained in this report is, to the best of my knowledge and belief, accurate and complete.

Sondra L. Slesinski 12/05/07 Tod Kopyscinski, Director of Operations — Sondra L. Slesinski, Quality Assurance Officer

SIGNATURE DATE

Edward Denson
Technical Director

* See end of data tabulation for notes and comments pertaining to this sample

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ANALYTICAL LABORATORY
39 Spruce Street ° East Longmeadow, MA 01028 ° FAX 413/525-6405 ° TEL. 413/525-2332

WILHELM WELZENBACH
GEOMATRIX - MT
1001 S. HIGGINS AVENUE, BLDG. B-1
MISSOULA, MT 59801-4144

Purchase Order No.: 10817

12/5/2007

Project Number: 10817.000.0 TASK L
LIMS-BAT #: LIMT-11007
Job Number: 10817.000.0

Project Location: MISSOULA SAWMILL
Date Received: 10/31/2007

Field Sample # : VP-06

Sample ID : 07B42892
Sampled : 10/23/2007
NOT SPECIFIED
Sample Matrix: AIR
Sample Medium : SUMMA

	Units	Results	Date Analyzed	Analyst	RL	SPEC Limit Lo	SPEC Limit Hi	P/ F
SPECIAL TEST			11/01/07	TPH				

SEE RESULTS PAGE FOR MORE INFORMATION.

Field Sample # : VP-07

Sample ID : 07B42893
Sampled : 10/23/2007
NOT SPECIFIED
Sample Matrix: AIR
Sample Medium : SUMMA

	Units	Results	Date Analyzed	Analyst	RL	SPEC Limit Lo	SPEC Limit Hi	P/ F
SPECIAL TEST			11/01/07	TPH				

SEE RESULTS PAGE FOR MORE INFORMATION.

Field Sample # : VP-08

Sample ID : 07B42894
Sampled : 10/23/2007
NOT SPECIFIED
Sample Matrix: AIR
Sample Medium : SUMMA

	Units	Results	Date Analyzed	Analyst	RL	SPEC Limit Lo	SPEC Limit Hi	P/ F
SPECIAL TEST			11/01/07	TPH				

SEE RESULTS PAGE FOR MORE INFORMATION.

Field Sample # : VP-09

Sample ID : 07B42895
Sampled : 10/23/2007
NOT SPECIFIED
Sample Matrix: AIR
Sample Medium : SUMMA

	Units	Results	Date Analyzed	Analyst	RL	SPEC Limit Lo	SPEC Limit Hi	P/ F
SPECIAL TEST			11/01/07	TPH				

SEE RESULTS PAGE FOR MORE INFORMATION.

RL = Reporting Limit

ND = Not Detected at or above the Reporting Limit

NM = Not Measured

* = See end of report for comments and notes applying to this sample

SPEC LIMIT = a client specified recommended or regulatory level for comparison with data to determine PASS (P) or FAIL (F) condition of results.

con-test ANALYTICAL LABORATORY

39 Spruce Street ° East Longmeadow, MA 01028 ° FAX 413/525-6405 ° TEL. 413/525-2332

WILHELM WELZENBACH
GEOMATRIX - MT
1001 S. HIGGINS AVENUE, BLDG. B-1
MISSOULA, MT 59801-4144

Purchase Order No.: 10817

Project Number: 10817.000.0 TASK L
LIMS-BAT #: LIMT-11007
Job Number: 10817.000.0

Project Location: MISSOULA SAWMILL
Date Received: 10/31/2007

Field Sample # : VP-10

Sample ID : 07B42896

Sampled : 10/23/2007
NOT SPECIFIED

Sample Matrix: AIR

Sample Medium : SUMMA

	Units	Results	Date Analyzed	Analyst	RL	SPEC Limit Lo	SPEC Limit Hi	P/ F
SPECIAL TEST			11/01/07	TPH				

SEE RESULTS PAGE FOR MORE INFORMATION.

Field Sample # : VP-11

Sample ID : 07B42897

Sampled : 10/23/2007
NOT SPECIFIED

Sample Matrix: AIR

Sample Medium : SUMMA

	Units	Results	Date Analyzed	Analyst	RL	SPEC Limit Lo	SPEC Limit Hi	P/ F
SPECIAL TEST			11/01/07	TPH				

SEE RESULTS PAGE FOR MORE INFORMATION.

Field Sample # : VP-12

Sample ID : 07B42898

Sampled : 10/23/2007
NOT SPECIFIED

Sample Matrix: AIR

Sample Medium : SUMMA

	Units	Results	Date Analyzed	Analyst	RL	SPEC Limit Lo	SPEC Limit Hi	P/ F
SPECIAL TEST			11/01/07	TPH				

SEE RESULTS PAGE FOR MORE INFORMATION.

Field Sample # : VP-13

Sample ID : 07B42899

Sampled : 10/23/2007
NOT SPECIFIED

Sample Matrix: AIR

Sample Medium : SUMMA

	Units	Results	Date Analyzed	Analyst	RL	SPEC Limit Lo	SPEC Limit Hi	P/ F
SPECIAL TEST			11/01/07	TPH				

SEE RESULTS PAGE FOR MORE INFORMATION.

RL = Reporting Limit

ND = Not Detected at or above the Reporting Limit

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Purchase Order No.: 10817

12/5/2007

Project Number: 10817.000.0 TASK L
LIMS-BAT #: LIMT-11007
Job Number: 10817.000.0

Project Location: MISSOULA SAWMILL
Date Received: 10/31/2007

** END OF REPORT **

RL = Reporting Limit

ND = Not Detected at or above the Reporting Limit

NM = Not Measured

* = See end of report for comments and notes applying to this sample

SPEC LIMIT = a client specified recommended or regulatory level for comparison with data to determine PASS (P) or FAIL (F) condition of results.

con-test®
ANALYTICAL LABORATORY
39 Spruce Street, 2nd Floor
East Longmeadow, MA 01028
413.525.2332
413.525.6405 (fax)

RESULTS FOR METHOD APH

Lab ID Number:07B42892
Client ID Number: VP-6

LIMT Number: 11007
Date Analyzed: 11/1/07
Analyst: TPH

Analyte:	Reporting Limits		Sample Results		Dilution Factor
	ug/m3	PPBv	ug/m3	PPBv	
1,3 Butadiene	42	19	ND	ND	20
Methyl-tert-butylether	68	19	ND	ND	20
Benzene	120	38	ND	ND	20
Toluene	140	38	ND	ND	20
Ethylbenzene	82	19	ND	ND	20
m/p -Xylenes	82	19	ND	ND	20
o-Xylene	82	19	ND	ND	20
Naphthalene	98	19	ND	ND	20
2-Methylnaphthalene	220	38	ND	ND	20
C5 - C8 Aliphatic Hydrocarbons	420		170		20
C9 - C12 Aliphatic Hydrocarbons	680		8300		20
C9 - C10 Aromatic Hydrocarbons	560		ND		20
Unadjusted C5 - C8 Aliphatics	420		170		20
Unadjusted C9 - C12 Aliphatics	680		8300		20

Surrogate (4-Bromofluorobenzene): 86 %

E = Estimated Value.
MADEP - APH (Modified).

Compounds in C5 - C8 Aliphatic range	ug/m3
Acetone	110
IPA	<25

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RESULTS FOR METHOD APH

Lab ID Number:07B42892DUP
Client ID Number: VP-6

LIMT Number: 11007
Date Analyzed: 11/1/07
Analyst: TPH

Analyte:	Reporting Limits		Sample Results		Dilution Factor
	ug/m3	PPBv	ug/m3	PPBv	
1,3 Butadiene	42	19	ND	ND	20
Methyl-tert-butylether	68	19	ND	ND	20
Benzene	120	38	ND	ND	20
Toluene	140	38	ND	ND	20
Ethylbenzene	82	19	ND	ND	20
m/p -Xylenes	82	19	ND	ND	20
o-Xylene	82	19	ND	ND	20
Naphthalene	98	19	ND	ND	20
2-Methylnaphthalene	220	38	ND	ND	20
C5 - C8 Aliphatic Hydrocarbons	420		160		20
C9 - C12 Aliphatic Hydrocarbons	680		8100		20
C9 - C10 Aromatic Hydrocarbons	560		ND		20
Unadjusted C5 - C8 Aliphatics	420		160		20
Unadjusted C9 - C12 Aliphatics	680		8100		20

Surrogate (4-Bromofluorobenzene): 87 %

E = Estimated Value.
MADEP - APH (Modified).

Compounds in C5 - C8 Aliphatic range	ug/m3
Acetone	110
IPA	<25

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RESULTS FOR METHOD APH

Lab ID Number:07B42893
Client ID Number: VP-7

LIMT Number: 11007
Date Analyzed: 11/1/07
Analyst: TPH

Analyte:	Reporting Limits		Sample Results		Dilution Factor
	ug/m3	PPBv	ug/m3	PPBv	
1,3 Butadiene	42	19	ND	ND	20
Methyl-tert-butylether	68	19	ND	ND	20
Benzene	120	38	ND	ND	20
Toluene	140	38	ND	ND	20
Ethylbenzene	82	19	ND	ND	20
m/p -Xylenes	82	19	ND	ND	20
o-Xylene	82	19	ND	ND	20
Naphthalene	98	19	ND	ND	20
2-Methylnaphthalene	220	38	ND	ND	20
C5 - C8 Aliphatic Hydrocarbons	420		1600		20
C9 - C12 Aliphatic Hydrocarbons	680		17000		20
C9 - C10 Aromatic Hydrocarbons	560		ND		20
Unadjusted C5 - C8 Aliphatics	420		1600		20
Unadjusted C9 - C12 Aliphatics	680		17000		20

Surrogate (4-Bromofluorobenzene): 86 %

E = Estimated Value.
MADEP - APH (Modified).

Compounds in C5 - C8 Aliphatic range	ug/m3
Acetone	490
Trichloroethene	180
IPA	<25

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RESULTS FOR METHOD APH

Lab ID Number:07B42894
Client ID Number: VP-8

LIMT Number: 11007
Date Analyzed: 11/1/07
Analyst: TPH

Analyte:	Reporting Limits		Sample Results		Dilution Factor
	ug/m3	PPBv	ug/m3	PPBv	
1,3 Butadiene	42	19	ND	ND	20
Methyl-tert-butylether	68	19	ND	ND	20
Benzene	120	38	ND	ND	20
Toluene	140	38	ND	ND	20
Ethylbenzene	82	19	ND	ND	20
m/p -Xylenes	82	19	ND	ND	20
o-Xylene	82	19	ND	ND	20
Naphthalene	98	19	ND	ND	20
2-Methylnaphthalene	220	38	ND	ND	20
C5 - C8 Aliphatic Hydrocarbons	420		140		20
C9 - C12 Aliphatic Hydrocarbons	680		4000		20
C9 - C10 Aromatic Hydrocarbons	560		ND		20
Unadjusted C5 - C8 Aliphatics	420		140		20
Unadjusted C9 - C12 Aliphatics	680		4000		20

Surrogate (4-Bromofluorobenzene): 84 %

E = Estimated Value.
MADEP - APH (Modified).

Compounds in C5 - C8 Aliphatic range	ug/m3
Acetone	84
IPA	<25

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RESULTS FOR METHOD APH

Lab ID Number:07B42895
Client ID Number: VP-9

LIMT Number: 11007
Date Analyzed: 11/1/07
Analyst: TPH

Analyte:	Reporting Limits		Sample Results		Dilution Factor
	ug/m3	PPBv	ug/m3	PPBv	
1,3 Butadiene	42	19	ND	ND	20
Methyl-tert-butylether	68	19	ND	ND	20
Benzene	120	38	ND	ND	20
Toluene	140	38	ND	ND	20
Ethylbenzene	82	19	ND	ND	20
m/p -Xylenes	82	19	ND	ND	20
o-Xylene	82	19	ND	ND	20
Naphthalene	98	19	ND	ND	20
2-Methylnaphthalene	220	38	ND	ND	20
C5 - C8 Aliphatic Hydrocarbons	420		750		20
C9 - C12 Aliphatic Hydrocarbons	680		10000		20
C9 - C10 Aromatic Hydrocarbons	560		ND		20
Unadjusted C5 - C8 Aliphatics	420		750		20
Unadjusted C9 - C12 Aliphatics	680		10000		20

Surrogate (4-Bromofluorobenzene): 86 %

E = Estimated Value.
MADEP - APH (Modified).

Compounds in C5 - C8 Aliphatic range	ug/m3
Acetone	110
Trichloroethene	180
IPA	<25

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RESULTS FOR METHOD APH

Lab ID Number:07B42896
Client ID Number: VP-10

LIMT Number: 11007
Date Analyzed: 11/1/07
Analyst: TPH

Analyte:	Reporting Limits		Sample Results		Dilution Factor
	ug/m3	PPBv	ug/m3	PPBv	
1,3 Butadiene	42	19	ND	ND	20
Methyl-tert-butylether	68	19	ND	ND	20
Benzene	120	38	120	38	20
Toluene	140	38	330	88	20
Ethylbenzene	82	19	ND	ND	20
m/p -Xylenes	82	19	120	27	20
o-Xylene	82	19	ND	ND	20
Naphthalene	98	19	ND	ND	20
2-Methylnaphthalene	220	38	ND	ND	20
C5 - C8 Aliphatic Hydrocarbons	420		1500		20
C9 - C12 Aliphatic Hydrocarbons	680		11000		20
C9 - C10 Aromatic Hydrocarbons	560		ND		20
Unadjusted C5 - C8 Aliphatics	420		2100		20
Unadjusted C9 - C12 Aliphatics	680		11000		20

Surrogate (4-Bromofluorobenzene): 83 %

E = Estimated Value.
MADEP - APH (Modified).

Compounds in C5 - C8 Aliphatic range	ug/m3
Acetone	220
Trichloroethene	340
IPA	81

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RESULTS FOR METHOD APH

Lab ID Number:07B42897
Client ID Number: VP-11

LIMT Number: 11007
Date Analyzed: 11/1/07
Analyst: TPH

Analyte:	Reporting Limits		Sample Results		Dilution Factor
	ug/m3	PPBv	ug/m3	PPBv	
1,3 Butadiene	42	19	ND	ND	20
Methyl-tert-butylether	68	19	ND	ND	20
Benzene	120	38	ND	ND	20
Toluene	140	38	ND	ND	20
Ethylbenzene	82	19	ND	ND	20
m/p -Xylenes	82	19	ND	ND	20
o-Xylene	82	19	ND	ND	20
Naphthalene	98	19	ND	ND	20
2-Methylnaphthalene	220	38	ND	ND	20
C5 - C8 Aliphatic Hydrocarbons	420		1500		20
C9 - C12 Aliphatic Hydrocarbons	680		15000		20
C9 - C10 Aromatic Hydrocarbons	560		ND		20
Unadjusted C5 - C8 Aliphatics	420		1500		20
Unadjusted C9 - C12 Aliphatics	680		15000		20

Surrogate (4-Bromofluorobenzene): 85 %

E = Estimated Value.
MADEP - APH (Modified).

Compounds in C5 - C8 Aliphatic range	ug/m3
Acetone	200
Trichloroethene	180
IPA	42

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RESULTS FOR METHOD APH

Lab ID Number:07B42898
Client ID Number: VP-12

LIMT Number: 11007
Date Analyzed: 11/1/07
Analyst: TPH

Analyte:	Reporting Limits		Sample Results		Dilution Factor
	ug/m3	PPBv	ug/m3	PPBv	
1,3 Butadiene	42	19	ND	ND	20
Methyl-tert-butylether	68	19	ND	ND	20
Benzene	120	38	ND	ND	20
Toluene	140	38	ND	ND	20
Ethylbenzene	82	19	ND	ND	20
m/p -Xylenes	82	19	ND	ND	20
o-Xylene	82	19	ND	ND	20
Naphthalene	98	19	ND	ND	20
2-Methylnaphthalene	220	38	ND	ND	20
C5 - C8 Aliphatic Hydrocarbons	420		190		20
C9 - C12 Aliphatic Hydrocarbons	680		7000		20
C9 - C10 Aromatic Hydrocarbons	560		ND		20
Unadjusted C5 - C8 Aliphatics	420		190		20
Unadjusted C9 - C12 Aliphatics	680		7000		20

Surrogate (4-Bromofluorobenzene): 85 %

E = Estimated Value.
MADEP - APH (Modified).

Compounds in C5 - C8 Aliphatic range	ug/m3
Acetone	52
IPA	<25

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RESULTS FOR METHOD APH

Lab ID Number:07B42899
Client ID Number: VP-13

LIMT Number: 11007
Date Analyzed: 11/1/07
Analyst: TPH

Analyte:	Reporting Limits		Sample Results		Dilution Factor
	ug/m3	PPBv	ug/m3	PPBv	
1,3 Butadiene	42	19	ND	ND	20
Methyl-tert-butylether	68	19	ND	ND	20
Benzene	120	38	ND	ND	20
Toluene	140	38	190	51	20
Ethylbenzene	82	19	ND	ND	20
m/p -Xylenes	82	19	ND	ND	20
o-Xylene	82	19	ND	ND	20
Naphthalene	98	19	ND	ND	20
2-Methylnaphthalene	220	38	ND	ND	20
C5 - C8 Aliphatic Hydrocarbons	420		3500		20
C9 - C12 Aliphatic Hydrocarbons	680		11000		20
C9 - C10 Aromatic Hydrocarbons	560		ND		20
Unadjusted C5 - C8 Aliphatics	420		3700		20
Unadjusted C9 - C12 Aliphatics	680		11000		20

Surrogate (4-Bromofluorobenzene): 83 %

E = Estimated Value.
MADEP - APH (Modified).

Compounds in C5 - C8 Aliphatic range	ug/m3
Acetone	250
Hexane	170
Trichloroethene	320
IPA	<25

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RESULTS FOR METHOD APH

Lab ID Number: Blank
Client ID Number: -

LIMT Number: 11007
Date Analyzed: 11/1/07
Analyst: TPH

Analyte:	Reporting Limits		Sample Results		Dilution Factor
	ug/m3	PPBv	ug/m3	PPBv	
1,3 Butadiene	2.1	0.94	ND	ND	1.0
Methyl-tert-butylether	3.4	0.94	ND	ND	1.0
Benzene	3.0	0.94	ND	ND	1.0
Toluene	3.5	0.94	ND	ND	1.0
Ethylbenzene	4.1	0.94	ND	ND	1.0
m/p -Xylenes	4.1	0.94	ND	ND	1.0
o-Xylene	4.1	0.94	ND	ND	1.0
Naphthalene	4.9	0.94	ND	ND	1.0
2-Methylnaphthalene	5.5	0.94	ND	ND	1.0
C5 - C8 Aliphatic Hydrocarbons	21		ND		1.0
C9 - C12 Aliphatic Hydrocarbons	34		ND		1.0
C9 - C10 Aromatic Hydrocarbons	28		ND		1.0
Unadjusted C5 - C8 Aliphatics	21		ND		1.0
Unadjusted C9 - C12 Aliphatics	34		ND		1.0

Surrogate (4-Bromofluorobenzene): 85 %

E = Estimated Value.
MADEP - APH (Modified).

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QC RESULTS

Lab ID Number: LCS
Client ID Number: -

LIMT Number: 11007
Date Analyzed: 11/1/07
Analyst: TPH
True Value: 10PPBV

Analyte:	Sample Results PPBv	% RECOVERY
1,3-Butadiene	8.40	84%
MTBE	6.39	64%
Benzene	8.43	84%
Toluene	9.02	90%
Ethylbenzene	7.35	74%
m/p-Xylene	14.79	74%
o-Xylene	7.32	73%

Surrogate Recovery (4-BFB) 88 %

Method: TO-15 (Modified)
Sampled into a Summa Canister.
Analyzed by GC/MS.

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Email: info@contestlabs.com
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AIR SAMPLE CHAIN OF CUSTODY RECORD

39 SPRUCE ST
EAST LONGMEADOW, MA 01028

LBMT-11007

Company Name: Geomatrix
Address: 1001 S. Higgins Ave, Bldg B-1, Missoula, MT 59801
Attention: Wilhelm Welzenbach
Project Location: Missoula Sawmill
Sampled By: Wilhelm Welzenbach
Telephone: (406) 542-0129
Project # 10817.000.0 Task L
Client PO # 10817

Proposal Provided? (For Billing purposes)
☐ yes _____ proposal date

DATA DELIVERY (check one):
☐ FAX ☒ EMAIL ☐ WEBSITE CLIENT
Fax # :
Email: wwelzenbach@geomatrix.com
Format: ☒ EXCEL ☐ PDF ☐ GIS KEY ☐ OTHER___

Please fill out completely, sign, date and retain the yellow copy for your record.
Summa canisters and flow controllers must be returned within 14 days of receipt or rental fees will apply.
Summa canisters will be retained for a minimum of 14 days after sampling date prior to cleaning.

Field ID	Sample Description	Media	Lab # 07B428	Date Sampled Start Date Time	Date Sampled Stop Date Time	ONLY USE WHEN USING PUMPS: Total Minutes Sampled	Flow Rate M^3/Min. or L/Min.	Volume Liters or M^3	Matrix Code*	ANALYSIS REQUESTED: APH (Incl. IPA tracer)				" Hg Initial pressure	" Hg Final pressure	" Hg Lab Receipt pressure	Summa Canister ID	Flow Controller ID
IP-6	6 L Summa	S	92	10/23/07 12:20	12:50				SG	X				-30	-6.0	-7	1756	
IP-7		S	93	10/23/07 13:19	13:49					X				-31	-7.5	-7	1033	
IP-8		S	94	10/23/07 10:30	11:00					X				-29	-5.5	-7	1069	
IP-9		S	95	10/23/07 11:01	11:31					X				-28.5	-5.0	-7	1055	
IP-10		S	96	10/23/07 13:43	14:13					X				-28.5	-4.0	-7	1467	
IP-11		S	97	10/23/07 14:06	14:36					X				-29.0	-4.0	-7	1336	
IP-12		S	98	10/23/07 11:15	11:45					X				-29.5	-6.0	-8	1118	
IP-13		S	99	10/23/07 13:28	13:58					X				-29.0	-5.0	-7	1674	

Laboratory Comments:

CLIENT COMMENTS: Isopropyl alcohol (IPA) used as leak tracer.

Relinquished by: (signature)	Date/Time:
[signature]	10/23/07
Received by: (signature)	Date/Time: 10/31/07 1231
Relinquished by: (signature)	Date/Time:
Received by: (signature)	Date/Time:

Turnaround **
☒ 7-Day
☐ 10-Day
☐ Other ___
RUSH *
☐ *24-Hr ☐ *48-Hr
☐ *72-Hr ☐ *4-Day
*Approval Required

Special Requirements
Regulations:
Data Enhancement/RCP? ☐ Y ☐ N
Enhanced Data Package ☐ Y ☐ N
(Surchage Applies)
Required Detection Limits:
Other:

***Matrix Code:**
SG= SOIL GAS
IA= INDOOR AIR
AMB=AMBIENT
SS = SUB SLAB
D = DUP
BL = BLANK
O = other_____

****Media Codes:**
S=summa can
T=tedlar bag
P=PUF
T=tube
F= filter
C=cassette
O = Other_____

TURNAROUND TIME STARTS AT 9:00 A.M. THE DAY AFTER SAMPLE RECEIPT UNLESS THERE ARE QUESTIONS ON YOUR CHAIN. IF THIS FORM IS NOT FILLED OUT COMPLETELY OR IS CORRECT, TURNAROUND TIME WILL NOT START UNTIL ALL QUESTIONS ARE ANSWERED BY OUR CLIENT.

AIHA, NELAC & WBE/DBE Certified

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SAMPLE RECEIPT CHECKLIST

CLIENT NAME: Geomatrix
RECEIVED BY: Km DATE: 10/31/07

1. Was chain of custody relinquished and signed? YES NO
2. Does Chain agree with samples? YES NO

   If not, explain:

3. All Samples in good condition? YES NO

   If not, explain:

4. Were samples received in compliance with Temperature 0-6 degrees C? YES NO Degrees: NA
5. Are there any dissolved samples for the lab to filter? YES NO

   Who was notified? _____ Date: _____ Time: _____

6. Are there any on hold samples? YES NO STORED WHERE:
7. Are there any short holding time samples and who was notified? _____ Date: _____ Time _____
8. Location where samples are stored: ASR

CONTAINERS SENT IN TO CON-TEST	# of container
1 liter amber	
500 ml amber	
250 ml amber (8oz. Amber)	
1 liter plastic	
500 ml plastic	
250 ml plastic	
40 ml vial—which kind—list below	
Colisure bottle	
Dissolved oxygen bottle	
Flashpoint bottle	

CONTAINERS SENT TO CON-TEST	# of containers
Air Cassettes	
8 oz clear jar	
4 oz clear jar	
2 oz clear jar	
Plastic bag	
Encore	
Brass Sleeves	
Tubes	
Summa cans	10
Other restrictors	10

Laboratory comments:

# of HCL Vial _____ # of Methanol vials _____ # of Sodium Bisulfate vials _____

# of DI water(to be frozen) vials _____ Time and Date when frozen _____

Do all the samples have the correct pH levels? YES NO If no, please explain above

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REPORT DATE 12/5/2007

GEOMATRIX - MT
1001 S. HIGGINS AVENUE, BLDG. B-1
MISSOULA, MT 59801-4144
ATTN: WILHELM WELZENBACH

CONTRACT NUMBER:
PURCHASE ORDER NUMBER: 10817

PROJECT NUMBER: 10817.000.0 TASK L

ANALYTICAL SUMMARY

LIMS BAT #: LIMT-11669
JOB NUMBER: 10817.000.0

The results of analyses performed on the following samples submitted to the CON-TEST Analytical Laboratory are found in this report.

PROJECT LOCATION: MISSOULA SAWMILL

FIELD SAMPLE #	LAB ID	MATRIX	SAMPLE DESCRIPTION	TEST
VP-06	07B45962	AIR	NOT SPECIFIED	air special test
VP-06	07B45970	AIR	NOT SPECIFIED	aph air
VP-07	07B45963	AIR	NOT SPECIFIED	air special test
VP-07	07B45971	AIR	NOT SPECIFIED	aph air
VP-08	07B45964	AIR	NOT SPECIFIED	air special test
VP-08	07B45972	AIR	NOT SPECIFIED	aph air
VP-09	07B45965	AIR	NOT SPECIFIED	air special test
VP-09	07B45973	AIR	NOT SPECIFIED	aph air
VP-10	07B45966	AIR	NOT SPECIFIED	air special test
VP-10	07B45974	AIR	NOT SPECIFIED	aph air
VP-11	07B45967	AIR	NOT SPECIFIED	air special test
VP-11	07B45975	AIR	NOT SPECIFIED	aph air
VP-12	07B45968	AIR	NOT SPECIFIED	air special test
VP-12	07B45976	AIR	NOT SPECIFIED	aph air
VP-13	07B45969	AIR	NOT SPECIFIED	air special test
VP-13	07B45977	AIR	NOT SPECIFIED	aph air

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REPORT DATE 12/5/2007

GEOMATRIX - MT
1001 S. HIGGINS AVENUE, BLDG. B-1
MISSOULA, MT 59801-4144
ATTN: WILHELM WELZENBACH

CONTRACT NUMBER:
PURCHASE ORDER NUMBER: 10817

PROJECT NUMBER: 10817.000.0 TASK L

ANALYTICAL SUMMARY

LIMS BAT #: LIMT-11669
JOB NUMBER: 10817.000.0

The results of analyses performed on the following samples submitted to the CON-TEST Analytical Laboratory are found in this report.

Comments :

LIMS BATCH NO. : LIMT-11669

12/5/07 - REVISED REPORT - QC INCLUDED WITH REPORT

The CON-TEST Environmental Laboratory operates under the following certifications and accreditations. AIHA accreditations only apply to NIOSH methods and Environmental Lead Analyses.

AIHA 100033	AIHA ELLAP (LEAD) 100033	NORTH CAROLINA CERT. # 652
MASSACHUSETTS MA0100	NEW HAMPSHIRE NELAP 2516	NEW JERSEY NELAP NJ MA007 (AIR)
CONNECTICUT PH-0567	VERMONT DOH (LEAD) No. LL015036	FLORIDA DOH E871027 (AIR)
NEW YORK ELAP/NELAP 10899	RHODE ISLAND (LIC. No. 112)	

I certify that the analyses listed above, unless specifically listed as subcontracted, if any, were performed under my direction according to the approved methodologies listed in this document, and that based upon my inquiry of those individuals immediately responsible for obtaining the information, the material contained in this report is, to the best of my knowledge and belief, accurate and complete.

Sondra L Slesinski 12/05/07

SIGNATURE DATE

Tod Kopyscinski
Director of Operations

Sondra L. Slesinski
Quality Assurance Officer

Edward Denson
Technical Director

* See end of data tabulation for notes and comments pertaining to this sample

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WILHELM WELZENBACH
GEOMATRIX - MT
1001 S. HIGGINS AVENUE, BLDG. B-1
MISSOULA, MT 59801-4144

12/5/2007

Purchase Order No.: 10817

Project Number: 10817.000.0 TASK L
LIMS-BAT #: LIMT-11669
Job Number: 10817.000.0

Project Location: MISSOULA SAWMILL
Date Received: 11/26/2007

Field Sample # : VP-06

Sample ID : 07B45962
Sampled : 11/21/2007
NOT SPECIFIED
Sample Matrix: AIR
Sample Medium : SUMMA

	Units	Results	Date Analyzed	Analyst	RL	SPEC Limit Lo	SPEC Limit Hi	P/ F
SPECIAL TEST			11/28/07	TPH				

SEE RESULTS PAGE FOR MORE INFORMATION.

Field Sample # : VP-07

Sample ID : 07B45963
Sampled : 11/21/2007
NOT SPECIFIED
Sample Matrix: AIR
Sample Medium : SUMMA

	Units	Results	Date Analyzed	Analyst	RL	SPEC Limit Lo	SPEC Limit Hi	P/ F
SPECIAL TEST			11/28/07	TPH				

SEE RESULTS PAGE FOR MORE INFORMATION.

Field Sample # : VP-08

Sample ID : 07B45964
Sampled : 11/21/2007
NOT SPECIFIED
Sample Matrix: AIR
Sample Medium : SUMMA

	Units	Results	Date Analyzed	Analyst	RL	SPEC Limit Lo	SPEC Limit Hi	P/ F
SPECIAL TEST			11/28/07	TPH				

SEE RESULTS PAGE FOR MORE INFORMATION.

Field Sample # : VP-09

Sample ID : 07B45965
Sampled : 11/21/2007
NOT SPECIFIED
Sample Matrix: AIR
Sample Medium : SUMMA

	Units	Results	Date Analyzed	Analyst	RL	SPEC Limit Lo	SPEC Limit Hi	P/ F
SPECIAL TEST			11/27/07	TPH				

SEE RESULTS PAGE FOR MORE INFORMATION.

RL = Reporting Limit

ND = Not Detected at or above the Reporting Limit

NM = Not Measured

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MISSOULA, MT 59801-4144

Purchase Order No.: 10817

12/5/2007

Project Number: 10817.000.0 TASK L
LIMS-BAT #: LIMT-11669
Job Number: 10817.000.0

Project Location: MISSOULA SAWMILL
Date Received: 11/26/2007

Field Sample # : VP-10

Sample ID : 07B45966 Sampled : 11/21/2007
NOT SPECIFIED
Sample Matrix: AIR Sample Medium : SUMMA

	Units	Results	Date Analyzed	Analyst	RL	SPEC Limit Lo	Hi	P/ F
SPECIAL TEST			11/28/07	TPH				

SEE RESULTS PAGE FOR MORE INFORMATION.

Field Sample # : VP-11

Sample ID : 07B45967 Sampled : 11/21/2007
NOT SPECIFIED
Sample Matrix: AIR Sample Medium : SUMMA

	Units	Results	Date Analyzed	Analyst	RL	SPEC Limit Lo	Hi	P/ F
SPECIAL TEST			11/27/07	TPH				

SEE RESULTS PAGE FOR MORE INFORMATION.

Field Sample # : VP-12

Sample ID : 07B45968 Sampled : 11/21/2007
NOT SPECIFIED
Sample Matrix: AIR Sample Medium : SUMMA

	Units	Results	Date Analyzed	Analyst	RL	SPEC Limit Lo	Hi	P/ F
SPECIAL TEST			11/29/07	TPH				

SEE RESULTS PAGE FOR MORE INFORMATION.

Field Sample # : VP-13

Sample ID : 07B45969 Sampled : 11/21/2007
NOT SPECIFIED
Sample Matrix: AIR Sample Medium : SUMMA

	Units	Results	Date Analyzed	Analyst	RL	SPEC Limit Lo	Hi	P/ F
SPECIAL TEST			11/29/07	TPH				

SEE RESULTS PAGE FOR MORE INFORMATION.

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ND = Not Detected at or above the Reporting Limit

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Purchase Order No.: 10817

12/5/2007

Project Number: 10817.000.0 TASK L
LIMS-BAT #: LIMT-11669
Job Number: 10817.000.0

Project Location: MISSOULA SAWMILL
Date Received: 11/26/2007

Field Sample # : VP-06

Sample ID : 07B45970

Sampled : 11/21/2007
NOT SPECIFIED

Sample Matrix: AIR

Sample Medium : SUMMA

	Units	Results	Date Analyzed	Analyst	RL	SPEC Limit Lo	SPEC Limit Hi	P/ F
SPECIAL TEST			11/28/07	TPH				

ANALYTE	REPORTING LIMIT (PPBV)	REPORTING LIMIT (UG/M3)	SAMPLE RESULTS (PPBV)	SAMPLE RESULTS (UG/M3)
TRICHLOROETHENE	0.05	0.24	0.17	0.90

Field Sample # : VP-07

Sample ID : 07B45971

Sampled : 11/21/2007
NOT SPECIFIED

Sample Matrix: AIR

Sample Medium : SUMMA

	Units	Results	Date Analyzed	Analyst	RL	SPEC Limit Lo	SPEC Limit Hi	P/ F
SPECIAL TEST			11/28/07	TPH				

ANALYTE	REPORTING LIMIT (PPBV)	REPORTING LIMIT (UG/M3)	SAMPLE RESULTS (PPBV)	SAMPLE RESULTS (UG/M3)
TRICHLOROETHENE	0.05	0.24	26	140

Field Sample # : VP-08

Sample ID : 07B45972

Sampled : 11/21/2007
NOT SPECIFIED

Sample Matrix: AIR

Sample Medium : SUMMA

	Units	Results	Date Analyzed	Analyst	RL	SPEC Limit Lo	SPEC Limit Hi	P/ F
SPECIAL TEST			11/28/07	TPH				

ANALYTE	REPORTING LIMIT (PPBV)	REPORTING LIMIT (UG/M3)	SAMPLE RESULTS (PPBV)	SAMPLE RESULTS (UG/M3)
TRICHLOROETHENE	0.05	0.24	0.08	0.43

RL = Reporting Limit

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Purchase Order No.: 10817

Project Number: 10817.000.0 TASK L
LIMS-BAT #: LIMT-11669
Job Number: 10817.000.0

Project Location: MISSOULA SAWMILL
Date Received: 11/26/2007

Field Sample # : VP-09

Sample ID : 07B45973

Sampled : 11/21/2007
NOT SPECIFIED

Sample Matrix: AIR

Sample Medium : SUMMA

	Units	Results	Date Analyzed	Analyst	RL	SPEC Limit Lo	SPEC Limit Hi	P/ F
SPECIAL TEST			11/27/07	TPH				

ANALYTE	REPORTING LIMIT (PPBV)	REPORTING LIMIT (UG/M3)	SAMPLE RESULTS (PPBV)	SAMPLE RESULTS (UG/M3)
TRICHLOROETHENE	1.0	5.3	4.2	22

Field Sample # : VP-10

Sample ID : 07B45974

Sampled : 11/21/2007
NOT SPECIFIED

Sample Matrix: AIR

Sample Medium : SUMMA

	Units	Results	Date Analyzed	Analyst	RL	SPEC Limit Lo	SPEC Limit Hi	P/ F
SPECIAL TEST			11/28/07	TPH				

ANALYTE	REPORTING LIMIT (PPBV)	REPORTING LIMIT (UG/M3)	SAMPLE RESULTS (PPBV)	SAMPLE RESULTS (UG/M3)
TRICHLOROETHENE	0.05	0.24	5.3	28

Field Sample # : VP-11

Sample ID : 07B45975

Sampled : 11/21/2007
NOT SPECIFIED

Sample Matrix: AIR

Sample Medium : SUMMA

	Units	Results	Date Analyzed	Analyst	RL	SPEC Limit Lo	SPEC Limit Hi	P/ F
SPECIAL TEST			11/27/07	TPH				

ANALYTE	REPORTING LIMIT (PPBV)	REPORTING LIMIT (UG/M3)	SAMPLE RESULTS (PPBV)	SAMPLE RESULTS (UG/M3)
TRICHLOROETHENE	1.0	5.3	2.8	15

RL = Reporting Limit

ND = Not Detected at or above the Reporting Limit

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Purchase Order No.: 10817

12/5/2007

Project Number: 10817.000.0 TASK L
LIMS-BAT #: LIMT-11669
Job Number: 10817.000.0

Project Location: MISSOULA SAWMILL
Date Received: 11/26/2007

Field Sample # : VP-12

Sample ID : 07B45976

Sampled : 11/21/2007
NOT SPECIFIED

Sample Matrix: AIR

Sample Medium : SUMMA

	Units	Results	Date Analyzed	Analyst	RL	SPEC Limit Lo	SPEC Limit Hi	P/ F
SPECIAL TEST			11/29/07	TPH				

ANALYTE	REPORTING LIMIT (PPBV)	REPORTING LIMIT (UG/M3)	SAMPLE RESULTS (PPBV)	SAMPLE RESULTS (UG/M3)
TRICHLOROETHENE	0.05	0.24	N.D.	N.D.

Field Sample # : VP-13

Sample ID : 07B45977

Sampled : 11/21/2007
NOT SPECIFIED

Sample Matrix: AIR

Sample Medium : SUMMA

	Units	Results	Date Analyzed	Analyst	RL	SPEC Limit Lo	SPEC Limit Hi	P/ F
SPECIAL TEST			11/29/07	TPH				

ANALYTE	REPORTING LIMIT (PPBV)	REPORTING LIMIT (UG/M3)	SAMPLE RESULTS (PPBV)	SAMPLE RESULTS (UG/M3)
TRICHLOROETHENE	0.05	0.24	11	60

RL = Reporting Limit

ND = Not Detected at or above the Reporting Limit

NM = Not Measured

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Purchase Order No.: 10817

12/5/2007

Project Location: MISSOULA SAWMILL
Date Received: 11/26/2007

Project Number: 10817.000.0 TASK L
LIMS-BAT #: LIMT-11669
Job Number: 10817.000.0

** END OF REPORT **

RL = Reporting Limit

ND = Not Detected at or above the Reporting Limit

NM = Not Measured

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RESULTS FOR METHOD APH

Lab ID Number:07B45962
Client ID Number: VP-6

LIMT Number: 11669
Date Analyzed: 11/28/07
Analyst: TPH

Analyte:	Reporting Limits		Sample Results		Dilution Factor
	ug/m3	PPBv	ug/m3	PPBv	
1,3 Butadiene	1.9	0.85	ND	ND	0.9
Methyl-tert-butylether	3.0	0.85	ND	ND	0.9
Benzene	2.7	0.85	ND	ND	0.9
Toluene	3.2	0.85	ND	ND	0.9
Ethylbenzene	3.7	0.85	ND	ND	0.9
m/p -Xylenes	3.7	0.85	ND	ND	0.9
o-Xylene	3.7	0.85	ND	ND	0.9
Naphthalene	4.4	0.85	ND	ND	0.9
2-Methylnaphthalene	5.0	0.85	ND	ND	0.9
C5 - C8 Aliphatic Hydrocarbons	19		520		0.9
C9 - C12 Aliphatic Hydrocarbons	31		3700		0.9
C9 - C10 Aromatic Hydrocarbons	25		ND		0.9
Unadjusted C5 - C8 Aliphatics	19		520		0.9
Unadjusted C9 - C12 Aliphatics	31		3700		0.9

Surrogate (4-Bromofluorobenzene): 112 %

E = Estimated Value.
MADEP - APH (Modified).

Compounds in C5 - C8 Aliphatic range	ug/m3
IPA	1.6

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RESULTS FOR METHOD APH

Lab ID Number:07B45963
Client ID Number: VP-7

LIMT Number: 11669
Date Analyzed: 11/28/07
Analyst: TPH

Analyte:	Reporting Limits		Sample Results		Dilution Factor
	ug/m3	PPBv	ug/m3	PPBv	
1,3 Butadiene	1.9	0.85	ND	ND	0.9
Methyl-tert-butylether	3.0	0.85	ND	ND	0.9
Benzene	2.7	0.85	7.8	2.4	0.9
Toluene	3.2	0.85	21	5.6	0.9
Ethylbenzene	3.7	0.85	ND	ND	0.9
m/p -Xylenes	3.7	0.85	4.3	0.99	0.9
o-Xylene	3.7	0.85	ND	ND	0.9
Naphthalene	4.4	0.85	ND	ND	0.9
2-Methylnaphthalene	5.0	0.85	ND	ND	0.9
C5 - C8 Aliphatic Hydrocarbons	19		1100		0.9
C9 - C12 Aliphatic Hydrocarbons	31		3400		0.9
C9 - C10 Aromatic Hydrocarbons	25		ND		0.9
Unadjusted C5 - C8 Aliphatics	19		1100		0.9
Unadjusted C9 - C12 Aliphatics	31		3400		0.9

Surrogate (4-Bromofluorobenzene): 102 %

E = Estimated Value.
MADEP - APH (Modified).

Compounds in C5 - C8 Aliphatic range	ug/m3
IPA	0.74

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RESULTS FOR METHOD APH

Lab ID Number:07B45964
Client ID Number: VP-8

LIMT Number: 11669
Date Analyzed: 11/28/07
Analyst: TPH

Analyte:	Reporting Limits		Sample Results		Dilution Factor
	ug/m3	PPBv	ug/m3	PPBv	
1,3 Butadiene	1.9	0.85	ND	ND	0.9
Methyl-tert-butylether	3.0	0.85	ND	ND	0.9
Benzene	2.7	0.85	ND	ND	0.9
Toluene	3.2	0.85	ND	ND	0.9
Ethylbenzene	3.7	0.85	ND	ND	0.9
m/p -Xylenes	3.7	0.85	ND	ND	0.9
o-Xylene	3.7	0.85	ND	ND	0.9
Naphthalene	4.4	0.85	ND	ND	0.9
2-Methylnaphthalene	5.0	0.85	ND	ND	0.9
C5 - C8 Aliphatic Hydrocarbons	19		530		0.9
C9 - C12 Aliphatic Hydrocarbons	31		3300		0.9
C9 - C10 Aromatic Hydrocarbons	25		25		0.9
Unadjusted C5 - C8 Aliphatics	19		530		0.9
Unadjusted C9 - C12 Aliphatics	31		3300		0.9

Surrogate (4-Bromofluorobenzene): 105 %

E = Estimated Value.
MADEP - APH (Modified).

Compounds in C5 - C8 Aliphatic range	ug/m3
IPA	430

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RESULTS FOR METHOD APH

Lab ID Number:07B45965
Client ID Number: VP-9

LIMT Number: 11669
Date Analyzed: 11/27/07
Analyst: TPH

Analyte:	Reporting Limits		Sample Results		Dilution Factor
	ug/m3	PPBv	ug/m3	PPBv	
1,3 Butadiene	42	19	ND	ND	20
Methyl-tert-butylether	68	19	ND	ND	20
Benzene	60	19	ND	ND	20
Toluene	70	19	ND	ND	20
Ethylbenzene	82	19	ND	ND	20
m/p -Xylenes	82	19	ND	ND	20
o-Xylene	82	19	ND	ND	20
Naphthalene	98	19	ND	ND	20
2-Methylnaphthalene	110	19	ND	ND	20
C5 - C8 Aliphatic Hydrocarbons	420		18000		20
C9 - C12 Aliphatic Hydrocarbons	680		2400		20
C9 - C10 Aromatic Hydrocarbons	560		ND		20
Unadjusted C5 - C8 Aliphatics	420		18000		20
Unadjusted C9 - C12 Aliphatics	680		2400		20

Surrogate (4-Bromofluorobenzene): 103 %

E = Estimated Value.
MADEP - APH (Modified).

Compounds in C5 - C8 Aliphatic range	ug/m3
IPA	62000

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RESULTS FOR METHOD APH

Lab ID Number:07B45966
Client ID Number: VP-10

LIMT Number: 11669
Date Analyzed: 11/28/07
Analyst: TPH

Analyte:	Reporting Limits		Sample Results		Dilution Factor
	ug/m3	PPBv	ug/m3	PPBv	
1,3 Butadiene	1.9	0.85	ND	ND	0.9
Methyl-tert-butylether	3.0	0.85	ND	ND	0.9
Benzene	2.7	0.85	ND	ND	0.9
Toluene	3.2	0.85	18	4.8	0.9
Ethylbenzene	3.7	0.85	18	4.0	0.9
m/p -Xylenes	3.7	0.85	40	9.2	0.9
o-Xylene	3.7	0.85	35	8.1	0.9
Naphthalene	4.4	0.85	ND	ND	0.9
2-Methylnaphthalene	5.0	0.85	ND	ND	0.9
C5 - C8 Aliphatic Hydrocarbons	19		320		0.9
C9 - C12 Aliphatic Hydrocarbons	31		4200		0.9
C9 - C10 Aromatic Hydrocarbons	25		120		0.9
Unadjusted C5 - C8 Aliphatics	19		440		0.9
Unadjusted C9 - C12 Aliphatics	31		4200		0.9

Surrogate (4-Bromofluorobenzene): 109 %

E = Estimated Value.
MADEP - APH (Modified).

Compounds in C5 - C8 Aliphatic range	ug/m3
IPA	130

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RESULTS FOR METHOD APH

Lab ID Number:07B45967
Client ID Number: VP-11

LIMT Number: 11669
Date Analyzed: 11/27/07
Analyst: TPH

Analyte:	Reporting Limits		Sample Results		Dilution Factor
	ug/m3	PPBv	ug/m3	PPBv	
1,3 Butadiene	42	19	ND	ND	20
Methyl-tert-butylether	68	19	ND	ND	20
Benzene	60	19	ND	ND	20
Toluene	70	19	ND	ND	20
Ethylbenzene	82	19	ND	ND	20
m/p -Xylenes	82	19	ND	ND	20
o-Xylene	82	19	ND	ND	20
Naphthalene	98	19	ND	ND	20
2-Methylnaphthalene	110	19	ND	ND	20
C5 - C8 Aliphatic Hydrocarbons	420		3300		20
C9 - C12 Aliphatic Hydrocarbons	680		2500		20
C9 - C10 Aromatic Hydrocarbons	560		ND		20
Unadjusted C5 - C8 Aliphatics	420		3300		20
Unadjusted C9 - C12 Aliphatics	680		2500		20

Surrogate (4-Bromofluorobenzene): 102 %

E = Estimated Value.
MADEP - APH (Modified).

Compounds in C5 - C8 Aliphatic range	ug/m3
IPA	8600

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RESULTS FOR METHOD APH

Lab ID Number:07B45968
Client ID Number: VP-12

LIMT Number: 11669
Date Analyzed: 11/29/07
Analyst: TPH

Analyte:	Reporting Limits		Sample Results		Dilution Factor
	ug/m3	PPBv	ug/m3	PPBv	
1,3 Butadiene	1.9	0.85	ND	ND	0.9
Methyl-tert-butylether	3.0	0.85	ND	ND	0.9
Benzene	2.7	0.85	ND	ND	0.9
Toluene	3.2	0.85	ND	ND	0.9
Ethylbenzene	3.7	0.85	ND	ND	0.9
m/p -Xylenes	3.7	0.85	ND	ND	0.9
o-Xylene	3.7	0.85	ND	ND	0.9
Naphthalene	4.4	0.85	ND	ND	0.9
2-Methylnaphthalene	5.0	0.85	ND	ND	0.9
C5 - C8 Aliphatic Hydrocarbons	19		160		0.9
C9 - C12 Aliphatic Hydrocarbons	31		4500		0.9
C9 - C10 Aromatic Hydrocarbons	25		ND		0.9
Unadjusted C5 - C8 Aliphatics	19		160		0.9
Unadjusted C9 - C12 Aliphatics	31		4500		0.9

Surrogate (4-Bromofluorobenzene): 104 %

E = Estimated Value.
MADEP - APH (Modified).

Compounds in C5 - C8 Aliphatic range	ug/m3
IPA	8.9

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RESULTS FOR METHOD APH

Lab ID Number:07B45969
Client ID Number: VP-13

LIMT Number: 11669
Date Analyzed: 11/29/07
Analyst: TPH

Analyte:	Reporting Limits		Sample Results		Dilution Factor
	ug/m3	PPBv	ug/m3	PPBv	
1,3 Butadiene	1.9	0.85	ND	ND	0.9
Methyl-tert-butylether	3.0	0.85	ND	ND	0.9
Benzene	2.7	0.85	ND	ND	0.9
Toluene	3.2	0.85	4.6	1.2	0.9
Ethylbenzene	3.7	0.85	ND	ND	0.9
m/p -Xylenes	3.7	0.85	11	2.5	0.9
o-Xylene	3.7	0.85	5.0	1.1	0.9
Naphthalene	4.4	0.85	ND	ND	0.9
2-Methylnaphthalene	5.0	0.85	ND	ND	0.9
C5 - C8 Aliphatic Hydrocarbons	19		340		0.9
C9 - C12 Aliphatic Hydrocarbons	31		3900		0.9
C9 - C10 Aromatic Hydrocarbons	25		32		0.9
Unadjusted C5 - C8 Aliphatics	19		360		0.9
Unadjusted C9 - C12 Aliphatics	31		3900		0.9

Surrogate (4-Bromofluorobenzene): 107 %

E = Estimated Value.
MADEP - APH (Modified).

Compounds in C5 - C8 Aliphatic range	ug/m3
IPA	32

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RESULTS FOR TO-14A

Lab ID Number: BLANK 800ML
Client ID Number: -

LIMT Number: 11669
Date Analyzed: 11/28/07
Analyst: TPH

Analyte:	Sample Results PPBv	Sample Results UG/M3	Reporting Limit PPBv	Reporting Limit UG/M3
Trichloroethene	ND	ND	0.03	0.13

MDL = Minimum Detectable Limit
ND = Not Detected
PPBv = Parts Per Billion By Volume

Method: TO-14A (Modified)

Sampled into a Summa Canister. Analyzed by GCMS.

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QC RESULTS

Lab ID Number: LCS
Client ID Number: -

LIMT Number: 11669
Date Analyzed: 11/28/07
Analyst: TPH
True Value: 10PPBV

Analyte:	Sample Results PPBv	% RECOVERY
Trichloroethene	10.7	107%

Surrogate Recovery (4-BFB) 96 %
Method: TO-15 (Modified)
Sampled into a Summa Canister.
Analyzed by GC/MS.

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RESULTS FOR METHOD APH

Lab ID Number: Blank 800ML
Client ID Number: -

LIMT Number: 11669
Date Analyzed: 11/28/07
Analyst: TPH

Analyte:	Reporting Limits		Sample Results		Dilution Factor
	ug/m3	PPBv	ug/m3	PPBv	
1,3 Butadiene	1.1	0.47	ND	ND	0.5
Methyl-tert-butylether	1.7	0.47	ND	ND	0.5
Benzene	1.5	0.47	ND	ND	0.5
Toluene	1.8	0.47	ND	ND	0.5
Ethylbenzene	2.1	0.47	ND	ND	0.5
m/p -Xylenes	2.1	0.47	ND	ND	0.5
o-Xylene	2.1	0.47	ND	ND	0.5
Naphthalene	2.5	0.47	ND	ND	0.5
2-Methylnaphthalene	2.8	0.47	ND	ND	0.5
C5 - C8 Aliphatic Hydrocarbons	11		ND		0.5
C9 - C12 Aliphatic Hydrocarbons	17		ND		0.5
C9 - C10 Aromatic Hydrocarbons	14		ND		0.5
Unadjusted C5 - C8 Aliphatics	11		ND		0.5
Unadjusted C9 - C12 Aliphatics	17		ND		0.5

Surrogate (4-Bromofluorobenzene): 111 %

E = Estimated Value.
MADEP - APH (Modified).

con-test®
ANALYTICAL LABORATORY
39 Spruce Street, 2nd Floor
East Longmeadow, MA 01028
413.525.2332
413.525.6405 (fax)

QC RESULTS

Lab ID Number: LCS
Client ID Number: -

LIMT Number: 11669
Date Analyzed: 11/28/07
Analyst: TPH
True Value: 10PPBV

Analyte:	Sample Results PPBv	% RECOVERY
1,3-Butadiene	11.25	113%
MTBE	12.97	130%
Benzene	11.14	111%
Toluene	10.76	108%
Ethylbenzene	11.29	113%
m/p-Xylene	22.76	114%
o-Xylene	11.50	115%

Surrogate Recovery (4-BFB) 112 %

Method: TO-15 (Modified)
Sampled into a Summa Canister.
Analyzed by GC/MS.

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Phone: 413-525-2332
Fax: 413-525-6405
Email: info@contestlabs.com
www.contestlabs.com

AIR SAMPLE CHAIN OF CUSTODY RECORD

LIMT-11669

39 SPRUCE ST
EAST LONGMEADOW, MA 01028

Company Name: Geomatrix
Address: 1001 S. Higgins Ave, Bldg B-1, Missoula, MT 59801
Attention: Wilhelm Welzenbach
Project Location: Missoula Sawmill
Sampled By: Wilhelm Welzenbach
Proposal Provided? (For Billing purposes) ☐ yes _____ proposal date

Telephone: (406) 542-0129
Project # 10817.000.0 Task L
Client PO # 10817

DATA DELIVERY (check one): ☐FAX ☒EMAIL ☐WEBSITE CLIENT
Fax # :
Email: wwelzenbach@geomatrix.com
Format: ☒ EXCEL ☐ PDF ☐ GIS KEY ☐ OTHER___

Please fill out completely, sign, date and retain the yellow copy for your record.

Summa canisters and flow controllers must be returned within 14 days of receipt or rental fees will apply.

Summa canisters will be retained for a minimum of 14 days after sampling date prior to cleaning.

Field ID	Sample Description	Media	Lab #	Date Sampled Start Date Time	Date Sampled Stop Date Time	ONLY USE WHEN USING PUMPS: Total Minutes Sampled	Flow Rate M³/Min. or L / Min.	Volume Liters or M³	Matrix Code*	ANALYSIS REQUESTED: APH (incl. IPA tracer)	TCE by TO-15			" Hg Initial pressure	Final pressure	Lab Receipt pressure	Summa Canister ID	Flow Controller ID
VP-6	6L Summa	S	07B45962	11/21/07 15:07	15:37				SG	X	X			27.5	4.0		1493	
VP-7			71+63	11/21/07 14:53	15:23					X	X			26.0	2.0		1729	
VP-8			72+64	11/21/07 13:00	13:30					X	X			28.0	3.0		1662	
VP-9			73+65	11/21/07 14:38	15:08					X	X			30.0	2.0		1176	
VP-10			74+66	11/21/07 16:38	17:08					X	X			30.0	8.0		1039	
VP-11			75+67	11/21/07 16:12	16:42					X	X			28.0	2.5		1096	
VP-12			76+68	11/21/07 14:05	14:35					X	X			28.5	4.0		1081	
VP-13			77+69	11/21/07 16:56	17:26					X	X			30.0	6.0		1072	

Laboratory Comments:

CLIENT COMMENTS: Isopropyl alcohol (IPA) used as leak tracer

Relinquished by: (signature) Wilhelm Welzenbach	Date/Time: 11/23/07
Received by: (signature) [signature]	Date/Time: 11/26/07 0900
Relinquished by: (signature)	Date/Time:
Received by: (signature)	Date/Time:

Turnaround **
☐ 7-Day
☐ 10-Day
☐ Other ___
RUSH *
☐ *24-Hr ☐ *48-Hr
☒ *72-Hr ☐ *4-Day
*Approval Required

Special Requirements
Regulations:
Data Enhancement/RCP? ☐ Y ☐ N
Enhanced Data Package ☐ Y ☐ N
(Surchage Applies)
Required Detection Limits:
Other:

***Matrix Code:**
SG= SOIL GAS
IA= INDOOR AIR
AMB=AMBIENT
SS = SUB SLAB
D = DUP
BL = BLANK
O = other_____

****Media Codes:**
S=summa can
T=tedlar bag
P=PUF
T=tube
F= filter
C=cassette
O = Other_____

TURNAROUND TIME STARTS AT 9:00 A.M. THE DAY AFTER SAMPLE RECEIPT UNLESS THERE ARE QUESTIONS ON YOUR CHAIN. IF THIS FORM IS NOT FILLED OUT COMPLETELY OR IS

Español | Customer Support | FedEx Locations Search Go

Package/Envelope | Freight | Expedited | Office/Print Services

Ship | Track | Manage | Business Solutions

Track Shipments/FedEx Kinko's Orders

Detailed Results

Printable Version | Quick Help

Tracking number	859918540383	**Delivered to**	Shipping/Receiving
Signed for by	T.KOPY	**Service type**	Priority Overnight
Ship date	Nov 23, 2007	**Master tracking number**	859918540383
Delivery date	Nov 26, 2007 9:00 AM	**Weight**	13.0 lbs.
		Total Shipment Weight	66.0 lbs.
Status	Delivered		
Signature image available	Yes		

Date/Time		Activity	Location	Details
Nov 26, 2007	9:00 AM	**Delivered**		
	7:29 AM	On FedEx vehicle for delivery	WINDSOR LOCKS, CT	
	6:47 AM	At local FedEx facility	WINDSOR LOCKS, CT	
Nov 24, 2007	6:44 AM	At dest sort facility	EAST GRANBY, CT	
	3:19 AM	Departed FedEx location	MEMPHIS, TN	
	12:47 AM	Arrived at FedEx location	MEMPHIS, TN	
Nov 23, 2007	6:03 PM	Left origin	MISSOULA, MT	
	10:17 AM	Picked up	MISSOULA, MT	

Signature proof | E-mail results | Track more shipments/orders | << Multi-piece summary

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	English		
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Add personal message:

Not available for Wireless or non-English characters.

con-test ANALYTICAL LABORATORY

www.contestlabs.com

39 Spruce Street
East Longmeadow, MA
Phone: 1-413-525-2332
Fax: 1-413-525-6405

SAMPLE RECEIPT CHECKLIST

CLIENT NAME: Geomatrix
RECEIVED BY: KM DATE: 11/26/07

1. Was chain of custody relinquished and signed? YES NO
2. Does Chain agree with samples? YES NO

   If not, explain:

3. All Samples in good condition? YES NO

   If not, explain:

4. Were samples received in compliance with Temperature 0-6 degrees C? YES NO Degrees: N/A
5. Are there any dissolved samples for the lab to filter? YES NO

   Who was notified? _____ Date: _____ Time: _____

6. Are there any on hold samples? YES NO STORED WHERE:
7. Are there any short holding time samples and who was notified? _____ Date: _____ Time _____
8. Location where samples are stored: AIR

CONTAINERS SENT IN TO CON-TEST	# of container
1 liter amber	
500 ml amber	
250 ml amber (8oz. Amber)	
1 liter plastic	
500 ml plastic	
250 ml plastic	
40 ml vial—which kind—list below	
Colisure bottle	
Dissolved oxygen bottle	
Flashpoint bottle	

CONTAINERS SENT TO CON-TEST	# of containers
Air Cassettes	
8 oz clear jar	
4 oz clear jar	
2 oz clear jar	
Plastic bag	
Encore	
Brass Sleeves	
Tubes	
Summa cans	10
Other restrictors	10

Laboratory comments:

# of HCL Vial _____ # of Methanol vials _____ # of Sodium Bisulfate vials _____

# of DI water(to be frozen) vials _____ Time and Date when frozen _____

Do all the samples have the correct pH levels? YES NO If no, please explain above

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Air Toxics Ltd. Introduces the Electronic Report

Thank you for choosing Air Toxics Ltd. To better serve our customers, we are providing your report by e-mail. This document is provided in Portable Document Format which can be viewed with Acrobat Reader by Adobe.

This electronic report includes the following:

- Work order Summary;
- Laboratory Narrative;
- Results; and
- Chain of Custody (copy).

180 BLUE RAVINE ROAD, SUITE B FOLSOM, CA - 95630

(916) 985-1000 .FAX (916) 985-1020
Hours 8:00 A.M to 6:00 P.M. Pacific

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WORK ORDER #: 0711480

Work Order Summary

CLIENT:	Mr. Matt Wright Geomatrix Consultants 1001 South Higgins, Building B1 Missoula, MT 59801	**BILL TO:**	Mr. Matt Wright Geomatrix Consultants 1001 South Higgins, Building B1 Missoula, MT 59801
PHONE:	406-542-0129	**P.O. #**	Task L
FAX:		**PROJECT #**	10817 Missoula Sawmill
DATE RECEIVED:	11/26/2007	**CONTACT:**	Kelly Buettner
DATE COMPLETED:	11/28/2007		

FRACTION #	NAME	TEST	RECEIPT VAC./PRES.
01A	VP-9	Modified TO-15	6.0 "Hg
02A	VP-10	Modified TO-15	9.0 "Hg
03A	Lab Blank	Modified TO-15	NA
04A	CCV	Modified TO-15	NA
05A	LCS	Modified TO-15	NA

CERTIFIED BY: Linda S. Freeman DATE: 11/28/07

Laboratory Director

Certfication numbers: CA NELAP - 02110CA, LA NELAP/LELAP- AI 30763, NJ NELAP - CA004
NY NELAP - 11291, UT NELAP - 9166389892
Name of Accrediting Agency: NELAP/Florida Department of Health, Scope of Application: Clean Air Act,
Accreditation number: E87680, Effective date: 07/01/07, Expiration date: 06/30/08
Air Toxics Ltd. certifies that the test results contained in this report meet all requirements of the NELAC standards

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LABORATORY NARRATIVE
Modified TO-15
Geomatrix Consultants
Workorder# 0711480

Two 6 Liter Summa Canister samples were received on November 26, 2007. The laboratory performed analysis via modified EPA Method TO-15 using GC/MS in the full scan mode. The method involves concentrating up to 0.2 liters of air. The concentrated aliquot is then flash vaporized and swept through a water management system to remove water vapor. Following dehumidification, the sample passes directly into the GC/MS for analysis.

This workorder was independently validated prior to submittal using 'USEPA National Functional Guidelines' as generally applied to the analysis of volatile organic compounds in air. A rules-based, logic driven, independent validation engine was employed to assess completeness, evaluate pass/fail of relevant project quality control requirements and verification of all quantified amounts.

Method modifications taken to run these samples are summarized in the table below. Specific project requirements may over-ride the ATL modifications.

Requirement	*TO-15*	*ATL Modifications*
Daily CCV	+- 30% Difference	</= 30% Difference with two allowed out up to </=40%.; flag and narrate outliers
Sample collection media	Summa canister	ATL recommends use of summa canisters to insure data defensibility, but will report results from Tedlar bags at client request
Method Detection Limit	Follow 40CFR Pt.136 App. B	The MDL met all relevant requirements in Method TO-15 (statistical MDL less than the LOQ). The concentration of the spiked replicate may have exceeded 10X the calculated MDL in some cases

Receiving Notes

There were no receiving discrepancies.

Analytical Notes

There were no analytical discrepancies.

Definition of Data Qualifying Flags

Eight qualifiers may have been used on the data analysis sheets and indicates as follows:

B - Compound present in laboratory blank greater than reporting limit (background subtraction no performed).

J - Estimated value.

E - Exceeds instrument calibration range.

S - Saturated peak.

Q - Exceeds quality control limits.

U - Compound analyzed for but not detected above the reporting limit.

UJ- Non-detected compound associated with low bias in the CCV
N - The identification is based on presumptive evidence.

File extensions may have been used on the data analysis sheets and indicates as follows:
a-File was requantified
b-File was quantified by a second column and detector
r1-File was requantified for the purpose of reissue

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Summary of Detected Compounds
MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

Client Sample ID: VP-9

Lab ID#: 0711480-01A

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (uG/m3)	Amount (uG/m3)
Trichloroethene	2.2	3.4	12	18

Client Sample ID: VP-10

Lab ID#: 0711480-02A

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (uG/m3)	Amount (uG/m3)
Trichloroethene	0.96	4.0	5.1	22

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Client Sample ID: VP-9

Lab ID#: 0711480-01A

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	**1112727**	**Date of Collection:**	**11/21/07**
Dil. Factor:	**4.48**	**Date of Analysis:**	**11/28/07 08:06 AM**

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (uG/m3)	Amount (uG/m3)
Trichloroethene	2.2	3.4	12	18

Container Type: 6 Liter Summa Canister

Surrogates	%Recovery	Method Limits
1,2-Dichloroethane-d4	101	70-130
Toluene-d8	100	70-130
4-Bromofluorobenzene	102	70-130

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Client Sample ID: VP-10

Lab ID#: 0711480-02A

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	**1112726**	**Date of Collection:**	**11/21/07**
Dil. Factor:	**1.91**	**Date of Analysis:**	**11/28/07 07:33 AM**

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (uG/m3)	Amount (uG/m3)
Trichloroethene	0.96	4.0	5.1	22

Container Type: 6 Liter Summa Canister

Surrogates	%Recovery	Method Limits
1,2-Dichloroethane-d4	102	70-130
Toluene-d8	98	70-130
4-Bromofluorobenzene	100	70-130

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Client Sample ID: Lab Blank

Lab ID#: 0711480-03A

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	**1112704**	**Date of Collection: NA**	
Dil. Factor:	**1.00**	**Date of Analysis: 11/27/07 10:38 AM**	

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (uG/m3)	Amount (uG/m3)
Trichloroethene	0.50	Not Detected	2.7	Not Detected

Container Type: NA - Not Applicable

Surrogates	%Recovery	Method Limits
1,2-Dichloroethane-d4	97	70-130
Toluene-d8	96	70-130
4-Bromofluorobenzene	100	70-130

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AN ENVIRONMENTAL ANALYTICAL LABORATORY

Client Sample ID: CCV

Lab ID#: 0711480-04A

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	**1112702**	**Date of Collection: NA**	
Dil. Factor:	**1.00**	**Date of Analysis: 11/27/07 08:58 AM**	

Compound	**%Recovery**
Trichloroethene	104

Container Type: NA - Not Applicable

Surrogates	**%Recovery**	**Method Limits**
1,2-Dichloroethane-d4	99	70-130
Toluene-d8	100	70-130
4-Bromofluorobenzene	104	70-130

AN ENVIRONMENTAL ANALYTICAL LABORATORY

Client Sample ID: LCS

Lab ID#: 0711480-05A

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	**1112703**	**Date of Collection: NA**	
Dil. Factor:	**1.00**	**Date of Analysis: 11/27/07 09:35 AM**	

Compound	**%Recovery**
Trichloroethene	112

Container Type: NA - Not Applicable

Surrogates	**%Recovery**	**Method Limits**
1,2-Dichloroethane-d4	102	70-130
Toluene-d8	102	70-130
4-Bromofluorobenzene	105	70-130

Air Toxics LTD.

CHAIN-OF-CUSTODY RECORD

Sample Transportation Notice
Relinquishing signature on this document indicates that sample is being shipped in compliance with all applicable local, State, Federal, national, and international laws, regulations and ordinances of any kind. Air Toxics Limited assumes no liability with respect to the collection, handling or shipping of these samples. Relinquishing signature also indicates agreement to hold harmless, defend, and indemnify Air Toxics Limited against any claim, demand, or action, of any kind, related to the collection, handling, or shipping of samples. D.O.T. Hotline (800) 467-4922

180 BLUE RAVINE ROAD, SUITE B
FOLSOM, CA 95630-4719
(916) 985-1000 FAX (916) 985-1020

Project Manager: Chris Cerqueone
Collected by: (Print and Sign) Wilhelm Welzenbach
Company: Geomatrix Email: wwelzenbach@geomatrix.com
Address: 1001 S. Higgins City: Missoula State: MT Zip: 59801
Phone: 406-529-0129 Fax: 406-529-0130

Project Info:
P.O. #: Task L
Project #: 10817
Project Name: Missoula Sawmill

Turn Around Time:
☐ Normal
☒ Rush 3 day (specify)

Lab Use Only
Pressurized by: KB
Date: 11/26/07
Pressurization Gas: (N) He

Lab I.D.	Field Sample I.D. (Location)	Can #	Date of Collection	Time of Collection	Analyses Requested	Canister Pressure/Vacuum Initial	Final	Receipt	Final (psi)
01A	VP-9	33771	11/21/07	16:17	TCE by TO-15	28.0	4.5	6.0	5.4
02A	VP-10	34029	11/21/07	17:50	TCE by TO-15	28.5	9.0	9.0	

Relinquished by: (signature)	Date/Time	Received by: (signature)	Date/Time
Wilhelm Welzenbach	11/21/07	Monica Gregson ATL	11/26/07 850
Relinquished by: (signature)	Date/Time	Received by: (signature)	Date/Time
Relinquished by: (signature)	Date/Time	Received by: (signature)	Date/Time

Notes:

Lab Use Only	Shipper Name	Air Bill #	Temp (°C)	Condition	Custody Seals Intact?	Work Order #
	Fed Ex		NA	Good	Yes No None	071148

Form 1252 rev.11

DATA VALIDATION REPORT
TRACTOR REPAIR SHOP VAPOR SAMPLES

1. Introduction

- This validation applies to vapor samples collected from the subsurface in the Tractor Repair Shop area at the Missoula Sawmill Facility on October 23 and November 21, 2007. A total of 18 samples were submitted for analysis. All of the samples were analyzed by the Massachusetts Air-Phase Hydrocarbon (APH) method, and 10 of the samples were also analyzed for trichloroethene by USEPA Method TO-15. Analysis was performed in accordance with the July 2, 2007 Voluntary Cleanup Plan (VCP), with the addition of confirmatory trichloroethene analysis run as split samples to test for precision between laboratories. Isopropyl alcohol (IPA) was used as a leak tracer gas.

- Validation procedures used are generally consistent with:
  ___ EPA CLP National Functional Guidelines for Inorganic Data Review
  _X_ Quality Assurance Project Plan for the Missoula Sawmill Site dated October 2004 and the VCP.
  ___ Other

- Overall level of validation:
  ___ Contract Laboratory Program (CLP)
  _X_ Standard
  ___ Visual

2. Deliverables

- All laboratory document deliverables were present as specified in the CLP-Statement of Work (CLP-SOW), EPA, 1993 and/or the project contract.
  _X_ Yes
  ___ No

- All documentation of field procedures was provided as required.
  _X_ Yes
  ___ No

3. Condition of Samples Upon Receipt

Review the sample receipt checklist from the laboratory and note any problems.

- Temperature of samples – Not Applicable.
- Proper container used – yes
- Container intact – yes.

CONCLUSION *– No problems identified.*

4. Field Quality Control Samples

Blanks: Please note that the highest blank value associated with any particular analyte is the blank value used for the flagging process.

DI, trip, rinsate, or any other field blanks have been carried out at the proper frequency.

__ Yes
___ No
_X_ NA

- **Field duplicates (or split samples)**

  Field split samples have been collected at the proper frequency.

  _X_ Yes
  ___ No

  Field split Relative Percent Difference (RPD) was within the control limit of 30% for the Air Phase Hydrocarbons method and 25% for Method TO-15.

  _X_ Yes, see below.
  ___ No

Split Sample Precision

TCE Conc. (mg/m^3)			
Sample Location	Air Toxics	Con-Test	RPD
VP-9	0.018	0.022	20
VP-10	0.022	0.028	24

5. Laboratory Procedures

- **Laboratory procedures followed**

  ___ CLP-SOW
  _X_ USEPA TO-15
  ___ Methods for Chemical Analysis of Water and Wastes
  ___ XRF Standard Operating Procedures
  _X_ Other: Massachusetts APH

- **Holding times met**
  _X_ Yes
  ___ No

- **Consistency with project requirements**

  Analyses were carried out as requested.
  _X_ Yes
  ___ No

  Project specified methods were used.
  _X_ Yes
  ___ No

6. Detection Limits

- Reporting detection limits met project required detection limits (PRDLs).
  _X_ Yes
  ___ No

7a. Laboratory Blanks

- **Preparation blanks**
  Preparation blanks were prepared and analyzed at the required frequency.
  _X_ Yes
  ___ No

  All analytes in the preparation blank were less than the CRDL (or the PRDL if a project detection limit has been specified).
  _X_ Yes
  ___ No

7b. Leak Tracer Results

- Was leak tracer detected above the quality control limit of 10 µg/L for IPA (equivalent to 10,000 µg/m^3), requiring results to be qualified as potentially biased low?
  _X_ Yes. Sample VP-9R collected on November 21, 2007 had an IPA result of 62 µg/L, requiring the results for that sample to be qualified as biased low.
  ___ No

- Was leak tracer detected above the quality control limit of 100 µg/L for IPA (equivalent to 100,000 µg/m^3), requiring any results to be rejected?
  ___ Yes
  _X_ No

8. Laboratory Matrix Spikes

- Matrix spike samples or surrogate spikes were prepared and analyzed at the required frequency.

  ___ Yes
  ___ No
  _X_ NA

9. Laboratory Duplicates

- Laboratory duplicate samples were analyzed at the proper frequency.

  _X_ Yes. Of the 16 natural samples analyzed, one sample (VP-6 collected October 23, 2007) was analyzed in duplicate.
  ___ No

- The laboratory duplicate relative percent differences (RPDs) were within the required control limits (RPD of 30% or less for the Air Phase Hydrocarbons method).

  _X_ Yes, see below.
  ___ No

Laboratory Duplicate Sample Precision

Analyte Concentration. (mg/m^3)			
Compound	VP-6	VP-6 "DUP"	RPD
C5-C8 aliphatics	170	160	6
C9-C12 aliphatics	8300	8100	2

10. Laboratory Control Standards

- The reference material used was of the correct matrix and concentration.

  _X_ Yes
  ___ No

- Laboratory control standards (LCSs) and/or Calibration Verification (CCV) samples were prepared and analyzed at the proper frequency.

  _X_ Yes. One LCS/CCVsample was analyzed for each set of 8 or less natural samples.
  ___ No

- LCSs/CCV samples were prepared in the same way as the associated natural samples.

  _X_ Yes
  ___ No

- LCS/CCV recoveries were within the required control limits (70-130% for the Air Phase Hydrocarbons and TO-15 methods for the target analytes).

  _X_ Yes, with the exception of low recovery of MTBE for the samples collected on October 23, 2007. All MTBE results for that report were flagged "UJ".
  ___ No

11. Data Quality Objectives

- Project data quality objectives (DQO's) met.

  _X_ Yes, with qualifications listed below.
  ___ No

Accuracy

The overall accuracy objectives were met, as recovery in the LCSs/CCV samples were within limits, and all surrogate compounds were detected within control limits, with the exception of the MTBE in the control sample of the October 23, 2007 Air Phase Hydrocarbons work order. For the tracer compound results, one sample, VP-9 on November 21, 2007, had detections of tracer gas above the lower QC limit, indicating that the results for that sample are potentially biased low. Results associated with the poor MTBE recovery or tracer gas issues identified above were qualified appropriately. No results were rejected.

Precision

The overall precision objectives were met, as 100% of the lab duplicates were within control limits.

Completeness

The overall completeness objectives were met, as 100% of the data were deemed valid, with no results rejected.

DATA VALIDATION REPORT

Prepared by: Wilhelm Welzenbach
Reviewed by: Chris Cerquone

ATTACHMENT C – RISK CALCULATIONS

TABLE C-1
JOHNSON AND ETTINGER MODEL INPUT PARAMETERS
Tractor Repair Shop Area
Missoula Sawmill Site
Missoula, Montana

PARAMETER	UNITS	RESIDENTIAL INPUT	SOURCE
GENERAL PARAMETERS			
Average Soil Temperature	°C / °F	7.2 / 45	U.S. EPA, 2004
Vadose Zone Soil and Building Parameters			
Soil Type	--	Sand	U.S. EPA, 2004; coarsest soil type available
Soil Vapor Permeability	cm^2	9.86×10^{-8}	U.S. EPA, 2004. Calculated for sand.
Dry Density	g/cm^3	1.66	U.S. EPA, 2004 - Soil Properties Lookup Table
Total Porosity	--	0.375	U.S. EPA, 2004 - Soil Properties Lookup Table
Water-Filled Porosity	cm^3/cm^3	0.054	U.S. EPA, 2004 - Soil Properties Lookup Table
Depth Below Grade to Bottom of Enclosed Space Floor	cm / ft	200 / 6.6	U.S. EPA, 2004; default for basement scenario
Enclosed Space Floor Length	cm / ft	1000 / 30	U.S. EPA, 2004; default
Enclosed Space Floor Width	cm / ft	1000 / 30	U.S. EPA, 2004; default
Enclosed Space Height	cm / ft	366 / 12	U.S. EPA, 2004; default for basement scenario
Indoor Air Exchange Rate	1/hr	0.25	U.S. EPA, 2004; default residential value
Average Vapor Flow Rate into Building	cm^3/s	83.3 / 5	U.S. EPA, 2004
Exposure Parameters			
Exposure Duration	years	30	U.S. EPA, 2004 - Default
Exposure Frequency	days/yr	350	U.S. EPA, 2004 - Default
Carcinogens: Averaging Time	years	75	U.S. EPA, 1997
Noncarcinogens: Averaging Time	years	30	U.S. EPA, 2004 - Default
Soil Gas-Specific Modeling			
Soil Gas Concentration	$\mu g/m^3$	1	Unit concentration
Soil Gas Sampling Depth Below Grade	cm / ft	243.8 / 8	Sample-specific sampling depth
		457.2 / 15	Sample-specific sampling depth

Notes:

U.S. EPA, 2004: User's Guide for Evaluating Subsurface Vapor Intrusion into Buildings, prepared by Environmental Quality Management, Inc. and prepared for Industrial Economics Incorporated, EPA Contract Number: 68-W-02-33, Work Assignment No. 004, PN 030224.0002, submitted to U.S. EPA Office of Emergency and Remedial Response, February 22, 2004.

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

TABLE C-2
SOIL VAPOR ANALYTICAL RESULTS (2007) AND SITE-SPECIFIC VAPOR CLEANUP LEVELS
Tractor Repair Shop Area
Missoula Sawmill Site

Concentrations reported in micrograms per cubic meter, $\mu g/m^3$

Vapor Sampling Locations	Sample Collection Depth (ft bgs)	Date Collected[1]	Benzene	Toluene	Ethylbenzene	m,p-Xylenes	o-Xylene	Naphthalene	MTBE	C5-C8 aliphatics	C9-C12 Aliphatics	C9-C10 Aromatics	Acetone	Trichloroethene[2]
VP-6	15	10/23/2007	<120	<140	<82	<82	<82	<98	<68	170	8300	<560	110	<10
	15	11/21/2007	<2.7	<3.2	<3.7	<3.7	<3.7	<4.4	<3	520	3700	<25	na	0.9
VP-7R	8	10/23/2007	<120	<140	<82	<82	<82	<98	<68	16000	17000	<560	490	**180**
	8	11/21/2007	7.8	21	<3.7	4.3	<3.7	<3.7	<4.4	1100	3400	<25	na	**140**
VP-8	15	10/23/2007	<120	<140	<82	<82	<82	<98	<68	140	4000	<560	84	<10
	15	11/21/2007	<2.7	<3.2	<3.7	<3.7	<3.7	<4.4	<3	530	3300	25	na	0.43
VP-9R	8	10/23/2007	<120	<140	<82	<82	<82	<98	<68	750	10000	<560	110	**180**
	8	11/21/2007	<60	<70	<82	<82	<82	<98	<68	18000	2400	<560	na	22
VP-10R	8	10/23/2007	120	330	<82	120	<82	<98	<68	1500	11000	<560	220	**340**
	8	11/21/2007	<2.7	18	18	40	35	<4.4	<3	320	4200	120	na	28
VP-11R	8	10/23/2007	<120	<140	<82	<82	<82	<98	<68	1500	15000	<560	200	**180**
	8	11/21/2007	<60	<70	<82	<82	<82	<98	<68	3300	2500	<560	na	15
VP-12	8	10/23/2007	<120	<140	<82	<82	<82	<98	<68	190	7000	<560	52	<10
	8	11/21/2007	<2.7	<3.2	<3.7	<3.7	<3.7	<4.4	<3	160	4500	<25	na	<0.24
VP-13	8	10/23/2007	<120	<140	<82	<82	<82	<98	<68	3500	11000	<560	250	**320**
	8	11/21/2007	<2.7	4.6	<3.7	11	5	<4.4	<3	340	3900	32	na	60
Site-Specific Soil Vapor Cleanup Levels[3]	8	$1x10^{-6}$ target	120	--	--	--	--	--	--	--	--	--	--	--[4]
		$1x10^{-5}$ target	1200	--	--	--	--	--	--	--	--	--	--	90
	15	$1x10^{-6}$ target	200	--	--	--	--	--	--	--	--	--	--	--[4]
		$1x10^{-5}$ target	2000	--	--	--	--	--	--	--	--	--	--	150

Notes:

1. All samples were analyzed according to the Massachusetts Air-Phase Hydrocarbon (APH) method with the following exception: Trichloroethene samples collected 11/21/07 were analyzed according to U.S. EPA Method TO-15.
2. **Bold** values indicate a detected concentration exceeding the $1x10^{-5}$ target risk site-specific screening level.
3. Presented for carcinogenic chemicals at two sampling depths; calculated as follows:
   Soil Vapor Screening Level ($\mu g/m^3$) = Measured soil vapor concentration ($\mu g/m^3$) x Target Risk Level / Chemical-Specific Cancer Risk (Table C-3)
4. The screening level corresponding to a $1x10^{-5}$ cancer risk is the most appropriate value; benzene is not detected or detected at concentrations below the $1x10^{-6}$ risk level and therefore, contributes insignificantly to potential cancer risk.

Abbreviations:

na = not analyzed
-- = not applicable
ft bgs = feet below ground surface

TABLE C-3
LIFETIME CANCER RISK AND NONCANCER HAZARD INDEX - RESIDENTIAL SCENARIO
VAPOR INTRUSION MODEL RESULTS FOR SOIL GAS
Tractor Repair Shop Area

Missoula Sawmill Site

Missoula, Montana

Compound	Sample Date	Potential VOC Concentration in Indoor Air[1,2] (Cia) (ug/m^3)								Carcinogenic Compounds: Unit Risk Factor[3] (URF) (ug/m^3)$^{-1}$	Inhalation Slope Factor (SF) (mg/kg-d)$^{-1}$	Lifetime Cancer Risk[4]								Noncarcinogenic Compounds: Inhalation Reference Concentration[3] (RfC) (mg/m^3)	Noncancer Hazard Index[5]							
		VP-6	VP-7	VP-8	VP-9	VP-10	VP-11	VP-12	VP-13			VP-6	VP-7	VP-8	VP-9	VP-10	VP-11	VP-12	VP-13		VP-6	VP-7	VP-8	VP-9	VP-10	VP-11	VP-12	VP-13
Benzene	11/21/07	0.0024	0.0224	0.0024	0.0861	0.0039	0.0861	0.0024	0.0039	7.80E-06	2.7E-02	6.7E-09	6.2E-08	6.7E-09	2.4E-07	1.1E-08	2.4E-07	6.7E-09	1.1E-08	0.03	7.7E-05	7.2E-04	7.7E-05	2.8E-03	1.2E-04	2.8E-03	7.7E-05	1.2E-04
Ethylbenzene	11/21/07	0.0026	0.0590	0.0026	0.0983	0.0506	0.0983	0.0026	0.0129	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.0	2.5E-06	5.7E-05	2.5E-06	9.4E-05	4.8E-05	9.4E-05	2.5E-06	1.2E-05
Toluene	11/21/07	0.0033	0.0053	0.0033	0.1175	0.0516	0.1175	0.0033	0.0053	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5.0	6.3E-07	1.0E-06	6.3E-07	2.3E-05	9.9E-06	2.3E-05	6.3E-07	1.0E-06
Total Xylenes	11/21/07	0.0031	0.0121	0.0031	0.1156	0.2114	0.1156	0.0031	0.0451	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.1	3.0E-05	1.2E-04	3.0E-05	1.1E-03	2.0E-03	1.1E-03	3.0E-05	4.3E-04
Naphthalene	11/21/07	0.0032	0.0050	0.0032	0.1325	0.0059	0.1325	0.0032	0.0059	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.003	1.0E-03	1.6E-03	1.0E-03	4.2E-02	1.9E-03	4.2E-02	1.0E-03	1.9E-03
MTBE	11/21/07	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3.0	ND	ND	ND	ND	ND	ND	ND	ND
C5-C8 Aliphatics	11/21/07	0.888	3.12	0.905	51.0	0.907	9.35	0.273	0.964	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.2	4.3E-03	1.5E-02	4.3E-03	2.4E-01	4.3E-03	4.5E-02	1.3E-03	4.6E-03
C9-C12 Aliphatics	11/21/07	5.9	9.5	5.3	6.7	11.7	7.0	7.2	10.8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.2	2.8E-02	4.5E-02	2.5E-02	3.2E-02	5.6E-02	3.3E-02	3.4E-02	5.2E-02
C9-C10 Aromatics	11/21/07	0.0200	0.0348	0.0399	0.778	0.334	0.778	0.0200	0.0890	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.05	3.8E-04	6.7E-04	7.7E-04	1.5E-02	6.4E-03	1.5E-02	3.8E-04	1.7E-03
Acetone	11/21/07	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.35	ND	ND	ND	ND	ND	ND	ND	ND
Trichloroethene	11/21/07	0.0015	0.3961	0.0007	0.0622	0.0792	0.0424	0.0002	0.1697	1.10E-04	4E-01	6.0E-08	**1.6E-05**	2.9E-08	2.5E-06	3.1E-06	1.7E-06	8.0E-09	6.7E-06	0.04	3.7E-05	9.5E-03	1.7E-05	1.5E-03	1.9E-03	1.0E-03	4.9E-06	4.1E-03
TOTAL CANCER RISK OR HAZARD INDEX[6]												7E-08	**2E-05**	4E-08	3E-06	3E-06	2E-06	1E-08	7E-06		3E-02	7E-02	3E-02	3E-01	7E-02	1E-01	4E-02	6E-02

NOTES:

[1]For measured soil gas concentrations; see Table C-2.

[2]Calculated by the U.S. EPA Johnson and Ettinger Subsurface Vapor Intrusion Model (U.S. EPA, 2004a); see Attachment D.

[3]U.S. EPA's Integrated Risk Information System (IRIS), on-line database, 2007; RfCs for the petroleum hydrocarbon mixtures were provided by MDEQ.

[4]Estimated upper-bound lifetime incremental cancer risk for a resident's 30-year exposure for 350 days/year, which is calculated as follows:

Risk = [(Cia) x (EF) x (IRAadj) x (SF)] / [(ATca) x (1000 µg/mg)]

[5]Estimated chronic noncancer hazard index for a resident's 30-year exposure, 350 days/year, which is calculated by the J&E Model as follows:

HI = [(Cia) x (EF) x (ED) x 1mg/1000µg] / [(RfC x ATnc)]

[6]Totals are rounded to one significant figure per standard risk assessment practice; **Bold** values indicate target risk levels of $1x10^{-5}$ for cancer risk or 1 for noncancer health effects are exceeded.

ABBREVIATIONS:

ND = Not detected

REFERENCES:

U.S. EPA, 2004a: U.S. EPA, Office of Emergency and Remedial Response; *User's Guide for Evaluating Subsurface Vapor Intrusion into Buildings, February 22, 2004.*

Exposure Parameters	Symbol	Values	Units
Exposure Frequency	EF	350	days/year
Exposure Duration	ED	30	year
Body Weight	BW	70	kg
Averaging Time-Non-cancer	ATnc	9,125	days
Averaging Time-Cancer	ATca	27,375	days
Age Adjusted Inhalation Rate Factor	IRAadj	8.0	m^3-yr/kg-dy

ATTACHMENT D – JOHNSON AND ETTINGER MODEL RUNS (NOVEMBER 2007)

SG-ADV
Version 3.1; 02/04

Reset to Defaults

Geomatrix Consultants, Inc.
modified by CAK; 10/05
Mult. Chemical; version 3.1.2

ENTER U.S. EPA or Cal-EPA: U.S. EPA

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	1.35E+00			Benzene
100414	1.60E+00			Ethylbenzene
108883	1.85E+00			Toluene
106423	1.85E+00			p-Xylene
91203	2.20E+00			Naphthalene
1634044	0.00E+00			MTBE
1	5.20E+02			C5-C8 Aliphatics
2	3.70E+03			C9-C12 Aliphatics
3	1.25E+01			C9-C10 Aromatics
67641	0.00E+00			Acetone
79016	9.00E-01			Trichloroethylene

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)					
200	457.2	7.2	457.2	0	0	S		

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)	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)
S	1.66	0.375	0.054	SCL	1.63	0.384	0.146	C	1.43	0.459	0.215

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 calculate Q_{soil} (L/m)
10	40	1000	1000	366	0.1	0.25	5

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)
75	30	30	350

END

CHEMICAL PROPERTIES

	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 (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Molecular weight, MW (g/mol)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
Benzene	8.80E-02	9.80E-06	5.54E-03	25	7,342	353.24	562.16	78.11	7.8E-06	3.0E-02
Ethylbenzene	7.50E-02	7.80E-06	7.86E-03	25	8,501	409.34	617.20	106.17	0.0E+00	1.0E+00
Toluene	8.70E-02	8.60E-06	6.62E-03	25	7,930	383.78	591.79	92.14	0.0E+00	5.0E+00
p-Xylene	7.69E-02	8.44E-06	7.64E-03	25	8,525	411.52	616.20	106.17	0.0E+00	1.0E-01
Naphthalene	5.90E-02	7.50E-06	4.82E-04	25	10,373	491.14	748.40	128.18	0.0E+00	3.0E-03
MTBE	1.02E-01	1.05E-05	6.23E-04	25	6,678	328.30	497.10	88.15	0.0E+00	3.0E+00
C5-C8 Aliphatics	8.00E-02	1.00E-05	1.32E+00	25	7,541	341.89	508.00	0.00	0.0E+00	2.0E-01
C9-C12 Aliphatics	7.00E-02	1.00E-05	1.59E+00	25	11,100	423.96	595.00	0.00	0.0E+00	2.0E-01
C9-C10 Aromatics	7.00E-02	1.00E-05	8.07E-03	25	14,370	667.95	936.00	0.00	0.0E+00	5.0E-02
Acetone	1.24E-01	1.14E-05	3.87E-05	25	6,955	329.20	508.10	58.08	0.0E+00	3.5E-01
Trichloroethylene	7.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	131.39	1.1E-04	4.0E-02

	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)
Benzene	9.46E+08	257.2	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	1.35E+00	2.54E+04
Ethylbenzene	9.46E+08	257.2	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	1.60E+00	2.54E+04
Toluene	9.46E+08	257.2	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	1.85E+00	2.54E+04
p-Xylene	9.46E+08	257.2	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	1.85E+00	2.54E+04
Naphthalene	9.46E+08	257.2	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	2.20E+00	2.54E+04
MTBE	9.46E+08	257.2	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	0.00E+00	2.54E+04
C5-C8 Aliphatics	9.46E+08	257.2	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	5.20E+02	2.54E+04
C9-C12 Aliphatics	9.46E+08	257.2	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	3.70E+03	2.54E+04
C9-C10 Aromatics	9.46E+08	257.2	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	1.25E+01	2.54E+04
Acetone	9.46E+08	257.2	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	0.00E+00	2.54E+04
Trichloroethylene	9.46E+08	257.2	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	9.00E-01	2.54E+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)
Benzene	1.80E+06	2.22E-04	200	8,150	2.31E-03	1.00E-01	1.75E-04	1.42E-02	0.00E+00	0.00E+00	1.42E-02	257.2
Ethylbenzene	1.80E+06	2.22E-04	200	10,187	2.64E-03	1.15E-01	1.75E-04	1.21E-02	0.00E+00	0.00E+00	1.21E-02	257.2
Toluene	1.80E+06	2.22E-04	200	9,185	2.48E-03	1.08E-01	1.75E-04	1.41E-02	0.00E+00	0.00E+00	1.41E-02	257.2
p-Xylene	1.80E+06	2.22E-04	200	10,281	2.54E-03	1.10E-01	1.75E-04	1.24E-02	0.00E+00	0.00E+00	1.24E-02	257.2
Naphthalene	1.80E+06	2.22E-04	200	12,941	1.20E-04	5.23E-03	1.75E-04	9.54E-03	0.00E+00	0.00E+00	9.54E-03	257.2
MTBE	1.80E+06	2.22E-04	200	7,330	2.84E-04	1.24E-02	1.75E-04	1.66E-02	0.00E+00	0.00E+00	1.66E-02	257.2
C5-C8 Aliphatics	1.80E+06	2.22E-04	200	8,506	5.31E-01	2.31E+01	1.75E-04	1.29E-02	0.00E+00	0.00E+00	1.29E-02	257.2
C9-C12 Aliphatics	1.80E+06	2.22E-04	200	14,252	3.45E-01	1.50E+01	1.75E-04	1.13E-02	0.00E+00	0.00E+00	1.13E-02	257.2
C9-C10 Aromatics	1.80E+06	2.22E-04	200	20,736	8.75E-04	3.80E-02	1.75E-04	1.13E-02	0.00E+00	0.00E+00	1.13E-02	257.2
Acetone	1.80E+06	2.22E-04	200	7,593	1.72E-05	7.46E-04	1.75E-04	2.01E-02	0.00E+00	0.00E+00	2.01E-02	257.2
Trichloroethylene	1.80E+06	2.22E-04	200	8,591	4.09E-03	1.78E-01	1.75E-04	1.28E-02	0.00E+00	0.00E+00	1.28E-02	257.2

	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)
Benzene	200	1.35E+00	0.10	8.33E+01	1.42E-02	4.00E+02	3.98E+63	1.78E-03	2.41E-03	7.8E-06	3.0E-02
Ethylbenzene	200	1.60E+00	0.10	8.33E+01	1.21E-02	4.00E+02	4.21E+74	1.65E-03	2.65E-03	NA	1.0E+00
Toluene	200	1.85E+00	0.10	8.33E+01	1.41E-02	4.00E+02	2.15E+64	1.78E-03	3.28E-03	NA	5.0E+00
p-Xylene	200	1.85E+00	0.10	8.33E+01	1.24E-02	4.00E+02	6.04E+72	1.67E-03	3.10E-03	NA	1.0E-01
Naphthalene	200	2.20E+00	0.10	8.33E+01	9.54E-03	4.00E+02	7.17E+94	1.46E-03	3.21E-03	NA	3.0E-03
MTBE	200	0.00E+00	0.10	8.33E+01	1.66E-02	4.00E+02	4.52E+54	1.91E-03	0.00E+00	NA	3.0E+00
C5-C8 Aliphatics	200	5.20E+02	0.10	8.33E+01	1.29E-02	4.00E+02	9.13E+69	1.71E-03	8.88E-01	NA	2.0E-01
C9-C12 Aliphatics	200	3.70E+03	0.10	8.33E+01	1.13E-02	4.00E+02	9.02E+79	1.60E-03	5.91E+00	NA	2.0E-01
C9-C10 Aromatics	200	1.25E+01	0.10	8.33E+01	1.13E-02	4.00E+02	9.00E+79	1.60E-03	2.00E-02	NA	5.0E-02
Acetone	200	0.00E+00	0.10	8.33E+01	2.01E-02	4.00E+02	1.32E+45	2.06E-03	0.00E+00	NA	3.5E-01
Trichloroethylene	200	9.00E-01	0.10	8.33E+01	1.28E-02	4.00E+02	7.02E+70	1.70E-03	1.53E-03	1.1E-04	4.0E-02

END

INCREMENTAL RISK CALCULATIONS:

	Incremental risk from vapor intrusion to indoor air, carcinogen[1] (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
Benzene	7.2E-09	7.7E-05
Ethylbenzene	NA	2.5E-06
Toluene	NA	6.3E-07
p-Xylene	NA	3.0E-05
Naphthalene	NA	1.0E-03
MTBE	NA	0.0E+00
C5-C8 Aliphatics	NA	4.3E-03
C9-C12 Aliphatics	NA	2.8E-02
C9-C10 Aromatics	NA	3.8E-04
Acetone	NA	0.0E+00
Trichloroethylene	6.4E-08	3.7E-05

Notes:

[1] Cancer risks differ slightly from Table C-3; risks in Table C-3 were calculated according to MDEQ recommendations for age-adjusted residential exposure.

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

END

SG-ADV
Version 3.1; 02/04

Reset to Defaults

Geomatrix Consultants, Inc.
modified by CAK; 10/05
Mult. Chemical; version 3.1.2

ENTER U.S. EPA or Cal-EPA: U.S. EPA

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	7.80E+00			Benzene
100414	2.10E+01			Ethylbenzene
108883	1.85E+00			Toluene
106423	4.30E+00			p-Xylene
91203	1.85E+00			Naphthalene
1634044	0.00E+00			MTBE
1	1.10E+03			C5-C8 Aliphatics
2	3.40E+03			C9-C12 Aliphatics
3	1.25E+01			C9-C10 Aromatics
67641	0.00E+00			Acetone
79016	1.40E+02			Trichloroethylene

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 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)
200	243.84	7.2	243.84	0	0	S		

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)	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)
S	1.66	0.375	0.054	SCL	1.63	0.384	0.146	C	1.43	0.459	0.215

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 calculate Q_{soil} (L/m)
10	40	1000	1000	366	0.1	0.25	5

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)
75	30	30	350

END

CHEMICAL PROPERTIES

	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)
Benzene	8.80E-02	9.80E-06	5.54E-03	25	7,342	353.24	562.16	78.11	7.8E-06	3.0E-02
Ethylbenzene	7.50E-02	7.80E-06	7.86E-03	25	8,501	409.34	617.20	106.17	0.0E+00	1.0E+00
Toluene	8.70E-02	8.60E-06	6.62E-03	25	7,930	383.78	591.79	92.14	0.0E+00	5.0E+00
p-Xylene	7.69E-02	8.44E-06	7.64E-03	25	8,525	411.52	616.20	106.17	0.0E+00	1.0E-01
Naphthalene	5.90E-02	7.50E-06	4.82E-04	25	10,373	491.14	748.40	128.18	0.0E+00	3.0E-03
MTBE	1.02E-01	1.05E-05	6.23E-04	25	6,678	328.30	497.10	88.15	0.0E+00	3.0E+00
C5-C8 Aliphatics	8.00E-02	1.00E-05	1.32E+00	25	7,541	341.89	508.00	0.00	0.0E+00	2.0E-01
C9-C12 Aliphatics	7.00E-02	1.00E-05	1.59E+00	25	11,100	423.96	595.00	0.00	0.0E+00	2.0E-01
C9-C10 Aromatics	7.00E-02	1.00E-05	8.07E-03	25	14,370	667.95	936.00	0.00	0.0E+00	5.0E-02
Acetone	1.24E-01	1.14E-05	3.87E-05	25	6,955	329.20	508.10	58.08	0.0E+00	3.5E-01
Trichloroethylene	7.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	131.39	1.1E-04	4.0E-02

	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)
Benzene	9.46E+08	43.84	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	7.80E+00	2.54E+04
Ethylbenzene	9.46E+08	43.84	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	2.10E+01	2.54E+04
Toluene	9.46E+08	43.84	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	1.85E+00	2.54E+04
p-Xylene	9.46E+08	43.84	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	4.30E+00	2.54E+04
Naphthalene	9.46E+08	43.84	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	1.85E+00	2.54E+04
MTBE	9.46E+08	43.84	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	0.00E+00	2.54E+04
C5-C8 Aliphatics	9.46E+08	43.84	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	1.10E+03	2.54E+04
C9-C12 Aliphatics	9.46E+08	43.84	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	3.40E+03	2.54E+04
C9-C10 Aromatics	9.46E+08	43.84	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	1.25E+01	2.54E+04
Acetone	9.46E+08	43.84	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	0.00E+00	2.54E+04
Trichloroethylene	9.46E+08	43.84	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	1.40E+02	2.54E+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)
Benzene	1.80E+06	2.22E-04	200	8,150	2.31E-03	1.00E-01	1.75E-04	1.42E-02	0.00E+00	0.00E+00	1.42E-02	43.84
Ethylbenzene	1.80E+06	2.22E-04	200	10,187	2.64E-03	1.15E-01	1.75E-04	1.21E-02	0.00E+00	0.00E+00	1.21E-02	43.84
Toluene	1.80E+06	2.22E-04	200	9,185	2.48E-03	1.08E-01	1.75E-04	1.41E-02	0.00E+00	0.00E+00	1.41E-02	43.84
p-Xylene	1.80E+06	2.22E-04	200	10,281	2.54E-03	1.10E-01	1.75E-04	1.24E-02	0.00E+00	0.00E+00	1.24E-02	43.84
Naphthalene	1.80E+06	2.22E-04	200	12,941	1.20E-04	5.23E-03	1.75E-04	9.54E-03	0.00E+00	0.00E+00	9.54E-03	43.84
MTBE	1.80E+06	2.22E-04	200	7,330	2.84E-04	1.24E-02	1.75E-04	1.66E-02	0.00E+00	0.00E+00	1.66E-02	43.84
C5-C8 Aliphatics	1.80E+06	2.22E-04	200	8,506	5.31E-01	2.31E+01	1.75E-04	1.29E-02	0.00E+00	0.00E+00	1.29E-02	43.84
C9-C12 Aliphatics	1.80E+06	2.22E-04	200	14,252	3.45E-01	1.50E+01	1.75E-04	1.13E-02	0.00E+00	0.00E+00	1.13E-02	43.84
C9-C10 Aromatics	1.80E+06	2.22E-04	200	20,736	8.75E-04	3.80E-02	1.75E-04	1.13E-02	0.00E+00	0.00E+00	1.13E-02	43.84
Acetone	1.80E+06	2.22E-04	200	7,593	1.72E-05	7.46E-04	1.75E-04	2.01E-02	0.00E+00	0.00E+00	2.01E-02	43.84
Trichloroethylene	1.80E+06	2.22E-04	200	8,591	4.09E-03	1.78E-01	1.75E-04	1.28E-02	0.00E+00	0.00E+00	1.28E-02	43.84

	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)
Benzene	200	7.80E+00	0.10	8.33E+01	1.42E-02	4.00E+02	3.98E+63	2.87E-03	2.24E-02	7.8E-06	3.0E-02
Ethylbenzene	200	2.10E+01	0.10	8.33E+01	1.21E-02	4.00E+02	4.21E+74	2.81E-03	5.90E-02	NA	1.0E+00
Toluene	200	1.85E+00	0.10	8.33E+01	1.41E-02	4.00E+02	2.15E+64	2.87E-03	5.30E-03	NA	5.0E+00
p-Xylene	200	4.30E+00	0.10	8.33E+01	1.24E-02	4.00E+02	6.04E+72	2.82E-03	1.21E-02	NA	1.0E-01
Naphthalene	200	1.85E+00	0.10	8.33E+01	9.54E-03	4.00E+02	7.17E+94	2.70E-03	5.00E-03	NA	3.0E-03
MTBE	200	0.00E+00	0.10	8.33E+01	1.66E-02	4.00E+02	4.52E+54	2.92E-03	0.00E+00	NA	3.0E+00
C5-C8 Aliphatics	200	1.10E+03	0.10	8.33E+01	1.29E-02	4.00E+02	9.13E+69	2.83E-03	3.12E+00	NA	2.0E-01
C9-C12 Aliphatics	200	3.40E+03	0.10	8.33E+01	1.13E-02	4.00E+02	9.02E+79	2.78E-03	9.45E+00	NA	2.0E-01
C9-C10 Aromatics	200	1.25E+01	0.10	8.33E+01	1.13E-02	4.00E+02	9.00E+79	2.78E-03	3.48E-02	NA	5.0E-02
Acetone	200	0.00E+00	0.10	8.33E+01	2.01E-02	4.00E+02	1.32E+45	2.98E-03	0.00E+00	NA	3.5E-01
Trichloroethylene	200	1.40E+02	0.10	8.33E+01	1.28E-02	4.00E+02	7.02E+70	2.83E-03	3.96E-01	1.1E-04	4.0E-02

END

INCREMENTAL RISK CALCULATIONS:

	Incremental risk from vapor intrusion to indoor air, carcinogen[1] (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
Benzene	6.7E-08	7.2E-04
Ethylbenzene	NA	5.7E-05
Toluene	NA	1.0E-06
p-Xylene	NA	1.2E-04
Naphthalene	NA	1.6E-03
MTBE	NA	0.0E+00
C5-C8 Aliphatics	NA	1.5E-02
C9-C12 Aliphatics	NA	4.5E-02
C9-C10 Aromatics	NA	6.7E-04
Acetone	NA	0.0E+00
Trichloroethylene	1.7E-05	9.5E-03

Notes:

[1] Cancer risks differ slightly from Table C-3; risks in Table C-3 were calculated according to MDEQ recommendations for age-adjusted residential exposure.

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

END

SG-ADV
Version 3.1; 02/04

Reset to Defaults

Geomatrix Consultants, Inc.
modified by CAK; 10/05
Mult. Chemical; version 3.1.2

ENTER U.S. EPA or Cal-EPA: U.S. EPA

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	1.35E+00			Benzene
100414	1.60E+00			Ethylbenzene
108883	1.85E+00			Toluene
106423	1.85E+00			p-Xylene
91203	2.20E+00			Naphthalene
1634044	0.00E+00			MTBE
1	5.30E+02			C5-C8 Aliphatics
2	3.30E+03			C9-C12 Aliphatics
3	2.50E+01			C9-C10 Aromatics
67641	0.00E+00			Acetone
79016	4.30E-01			Trichloroethylene

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 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)
200	457.2	7.2	457.2	0	0	S		

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)	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)
S	1.66	0.375	0.054	SCL	1.63	0.384	0.146	C	1.43	0.459	0.215

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 calculate Q_{soil} (L/m)
10	40	1000	1000	366	0.1	0.25	5

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)
75	30	30	350

END

CHEMICAL PROPERTIES

	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 (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Molecular weight, MW (g/mol)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
Benzene	8.80E-02	9.80E-06	5.54E-03	25	7,342	353.24	562.16	78.11	7.8E-06	3.0E-02
Ethylbenzene	7.50E-02	7.80E-06	7.86E-03	25	8,501	409.34	617.20	106.17	0.0E+00	1.0E+00
Toluene	8.70E-02	8.60E-06	6.62E-03	25	7,930	383.78	591.79	92.14	0.0E+00	5.0E+00
p-Xylene	7.69E-02	8.44E-06	7.64E-03	25	8,525	411.52	616.20	106.17	0.0E+00	1.0E-01
Naphthalene	5.90E-02	7.50E-06	4.82E-04	25	10,373	491.14	748.40	128.18	0.0E+00	3.0E-03
MTBE	1.02E-01	1.05E-05	6.23E-04	25	6,678	328.30	497.10	88.15	0.0E+00	3.0E+00
C5-C8 Aliphatics	8.00E-02	1.00E-05	1.32E+00	25	7,541	341.89	508.00	0.00	0.0E+00	2.0E-01
C9-C12 Aliphatics	7.00E-02	1.00E-05	1.59E+00	25	11,100	423.96	595.00	0.00	0.0E+00	2.0E-01
C9-C10 Aromatics	7.00E-02	1.00E-05	8.07E-03	25	14,370	667.95	936.00	0.00	0.0E+00	5.0E-02
Acetone	1.24E-01	1.14E-05	3.87E-05	25	6,955	329.20	508.10	58.08	0.0E+00	3.5E-01
Trichloroethylene	7.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	131.39	1.1E-04	4.0E-02

	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)
Benzene	9.46E+08	257.2	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	1.35E+00	2.54E+04
Ethylbenzene	9.46E+08	257.2	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	1.60E+00	2.54E+04
Toluene	9.46E+08	257.2	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	1.85E+00	2.54E+04
p-Xylene	9.46E+08	257.2	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	1.85E+00	2.54E+04
Naphthalene	9.46E+08	257.2	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	2.20E+00	2.54E+04
MTBE	9.46E+08	257.2	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	0.00E+00	2.54E+04
C5-C8 Aliphatics	9.46E+08	257.2	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	5.30E+02	2.54E+04
C9-C12 Aliphatics	9.46E+08	257.2	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	3.30E+03	2.54E+04
C9-C10 Aromatics	9.46E+08	257.2	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	2.50E+01	2.54E+04
Acetone	9.46E+08	257.2	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	0.00E+00	2.54E+04
Trichloroethylene	9.46E+08	257.2	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	4.30E-01	2.54E+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)
Benzene	1.80E+06	2.22E-04	200	8,150	2.31E-03	1.00E-01	1.75E-04	1.42E-02	0.00E+00	0.00E+00	1.42E-02	257.2
Ethylbenzene	1.80E+06	2.22E-04	200	10,187	2.64E-03	1.15E-01	1.75E-04	1.21E-02	0.00E+00	0.00E+00	1.21E-02	257.2
Toluene	1.80E+06	2.22E-04	200	9,185	2.48E-03	1.08E-01	1.75E-04	1.41E-02	0.00E+00	0.00E+00	1.41E-02	257.2
p-Xylene	1.80E+06	2.22E-04	200	10,281	2.54E-03	1.10E-01	1.75E-04	1.24E-02	0.00E+00	0.00E+00	1.24E-02	257.2
Naphthalene	1.80E+06	2.22E-04	200	12,941	1.20E-04	5.23E-03	1.75E-04	9.54E-03	0.00E+00	0.00E+00	9.54E-03	257.2
MTBE	1.80E+06	2.22E-04	200	7,330	2.84E-04	1.24E-02	1.75E-04	1.66E-02	0.00E+00	0.00E+00	1.66E-02	257.2
C5-C8 Aliphatics	1.80E+06	2.22E-04	200	8,506	5.31E-01	2.31E+01	1.75E-04	1.29E-02	0.00E+00	0.00E+00	1.29E-02	257.2
C9-C12 Aliphatics	1.80E+06	2.22E-04	200	14,252	3.45E-01	1.50E+01	1.75E-04	1.13E-02	0.00E+00	0.00E+00	1.13E-02	257.2
C9-C10 Aromatics	1.80E+06	2.22E-04	200	20,736	8.75E-04	3.80E-02	1.75E-04	1.13E-02	0.00E+00	0.00E+00	1.13E-02	257.2
Acetone	1.80E+06	2.22E-04	200	7,593	1.72E-05	7.46E-04	1.75E-04	2.01E-02	0.00E+00	0.00E+00	2.01E-02	257.2
Trichloroethylene	1.80E+06	2.22E-04	200	8,591	4.09E-03	1.78E-01	1.75E-04	1.28E-02	0.00E+00	0.00E+00	1.28E-02	257.2

	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)
Benzene	200	1.35E+00	0.10	8.33E+01	1.42E-02	4.00E+02	3.98E+63	1.78E-03	2.41E-03	7.8E-06	3.0E-02
Ethylbenzene	200	1.60E+00	0.10	8.33E+01	1.21E-02	4.00E+02	4.21E+74	1.65E-03	2.65E-03	NA	1.0E+00
Toluene	200	1.85E+00	0.10	8.33E+01	1.41E-02	4.00E+02	2.15E+64	1.78E-03	3.28E-03	NA	5.0E+00
p-Xylene	200	1.85E+00	0.10	8.33E+01	1.24E-02	4.00E+02	6.04E+72	1.67E-03	3.10E-03	NA	1.0E-01
Naphthalene	200	2.20E+00	0.10	8.33E+01	9.54E-03	4.00E+02	7.17E+94	1.46E-03	3.21E-03	NA	3.0E-03
MTBE	200	0.00E+00	0.10	8.33E+01	1.66E-02	4.00E+02	4.52E+54	1.91E-03	0.00E+00	NA	3.0E+00
C5-C8 Aliphatics	200	5.30E+02	0.10	8.33E+01	1.29E-02	4.00E+02	9.13E+69	1.71E-03	9.05E-01	NA	2.0E-01
C9-C12 Aliphatics	200	3.30E+03	0.10	8.33E+01	1.13E-02	4.00E+02	9.02E+79	1.60E-03	5.27E+00	NA	2.0E-01
C9-C10 Aromatics	200	2.50E+01	0.10	8.33E+01	1.13E-02	4.00E+02	9.00E+79	1.60E-03	3.99E-02	NA	5.0E-02
Acetone	200	0.00E+00	0.10	8.33E+01	2.01E-02	4.00E+02	1.32E+45	2.06E-03	0.00E+00	NA	3.5E-01
Trichloroethylene	200	4.30E-01	0.10	8.33E+01	1.28E-02	4.00E+02	7.02E+70	1.70E-03	7.30E-04	1.1E-04	4.0E-02

END

INCREMENTAL RISK CALCULATIONS:

	Incremental risk from vapor intrusion to indoor air, carcinogen[1] (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
Benzene	7.2E-09	7.7E-05
Ethylbenzene	NA	2.5E-06
Toluene	NA	6.3E-07
p-Xylene	NA	3.0E-05
Naphthalene	NA	1.0E-03
MTBE	NA	0.0E+00
C5-C8 Aliphatics	NA	4.3E-03
C9-C12 Aliphatics	NA	2.5E-02
C9-C10 Aromatics	NA	7.7E-04
Acetone	NA	0.0E+00
Trichloroethylene	3.1E-08	1.7E-05

Notes:

[1] Cancer risks differ slightly from Table C-3; risks in Table C-3 were calculated according to MDEQ recommendations for age-adjusted residential exposure.

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

END

SG-ADV
Version 3.1; 02/04

Reset to Defaults

Geomatrix Consultants, Inc.
modified by CAK; 10/05
Mult. Chemical; version 3.1.2

ENTER
U.S. EPA or
Cal-EPA

U.S. EPA

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	3.00E+01			Benzene
100414	3.50E+01			Ethylbenzene
108883	4.10E+01			Toluene
106423	4.10E+01			p-Xylene
91203	4.90E+01			Naphthalene
1634044	0.00E+00			MTBE
1	1.80E+04			C5-C8 Aliphatics
2	2.40E+03			C9-C12 Aliphatics
3	2.80E+02			C9-C10 Aromatics
67641	0.00E+00			Acetone
79016	2.20E+01			Trichloroethylene

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 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)
200	243.84	7.2	243.84	0	0	S		

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)	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)
S	1.66	0.375	0.054	SCL	1.63	0.384	0.146	C	1.43	0.459	0.215

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 calculate Q_{soil} (L/m)
10	40	1000	1000	366	0.1	0.25	5

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)
75	30	30	350

END

CHEMICAL PROPERTIES

	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 (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Molecular weight, MW (g/mol)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
Benzene	8.80E-02	9.80E-06	5.54E-03	25	7,342	353.24	562.16	78.11	7.8E-06	3.0E-02
Ethylbenzene	7.50E-02	7.80E-06	7.86E-03	25	8,501	409.34	617.20	106.17	0.0E+00	1.0E+00
Toluene	8.70E-02	8.60E-06	6.62E-03	25	7,930	383.78	591.79	92.14	0.0E+00	5.0E+00
p-Xylene	7.69E-02	8.44E-06	7.64E-03	25	8,525	411.52	616.20	106.17	0.0E+00	1.0E-01
Naphthalene	5.90E-02	7.50E-06	4.82E-04	25	10,373	491.14	748.40	128.18	0.0E+00	3.0E-03
MTBE	1.02E-01	1.05E-05	6.23E-04	25	6,678	328.30	497.10	88.15	0.0E+00	3.0E+00
C5-C8 Aliphatics	8.00E-02	1.00E-05	1.32E+00	25	7,541	341.89	508.00	0.00	0.0E+00	2.0E-01
C9-C12 Aliphatics	7.00E-02	1.00E-05	1.59E+00	25	11,100	423.96	595.00	0.00	0.0E+00	2.0E-01
C9-C10 Aromatics	7.00E-02	1.00E-05	8.07E-03	25	14,370	667.95	936.00	0.00	0.0E+00	5.0E-02
Acetone	1.24E-01	1.14E-05	3.87E-05	25	6,955	329.20	508.10	58.08	0.0E+00	3.5E-01
Trichloroethylene	7.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	131.39	1.1E-04	4.0E-02

	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)
Benzene	9.46E+08	43.84	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	3.00E+01	2.54E+04
Ethylbenzene	9.46E+08	43.84	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	3.50E+01	2.54E+04
Toluene	9.46E+08	43.84	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	4.10E+01	2.54E+04
p-Xylene	9.46E+08	43.84	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	4.10E+01	2.54E+04
Naphthalene	9.46E+08	43.84	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	4.90E+01	2.54E+04
MTBE	9.46E+08	43.84	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	0.00E+00	2.54E+04
C5-C8 Aliphatics	9.46E+08	43.84	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	1.80E+04	2.54E+04
C9-C12 Aliphatics	9.46E+08	43.84	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	2.40E+03	2.54E+04
C9-C10 Aromatics	9.46E+08	43.84	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	2.80E+02	2.54E+04
Acetone	9.46E+08	43.84	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	0.00E+00	2.54E+04
Trichloroethylene	9.46E+08	43.84	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	2.20E+01	2.54E+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)
Benzene	1.80E+06	2.22E-04	200	8,150	2.31E-03	1.00E-01	1.75E-04	1.42E-02	0.00E+00	0.00E+00	1.42E-02	43.84
Ethylbenzene	1.80E+06	2.22E-04	200	10,187	2.64E-03	1.15E-01	1.75E-04	1.21E-02	0.00E+00	0.00E+00	1.21E-02	43.84
Toluene	1.80E+06	2.22E-04	200	9,185	2.48E-03	1.08E-01	1.75E-04	1.41E-02	0.00E+00	0.00E+00	1.41E-02	43.84
p-Xylene	1.80E+06	2.22E-04	200	10,281	2.54E-03	1.10E-01	1.75E-04	1.24E-02	0.00E+00	0.00E+00	1.24E-02	43.84
Naphthalene	1.80E+06	2.22E-04	200	12,941	1.20E-04	5.23E-03	1.75E-04	9.54E-03	0.00E+00	0.00E+00	9.54E-03	43.84
MTBE	1.80E+06	2.22E-04	200	7,330	2.84E-04	1.24E-02	1.75E-04	1.66E-02	0.00E+00	0.00E+00	1.66E-02	43.84
C5-C8 Aliphatics	1.80E+06	2.22E-04	200	8,506	5.31E-01	2.31E+01	1.75E-04	1.29E-02	0.00E+00	0.00E+00	1.29E-02	43.84
C9-C12 Aliphatics	1.80E+06	2.22E-04	200	14,252	3.45E-01	1.50E+01	1.75E-04	1.13E-02	0.00E+00	0.00E+00	1.13E-02	43.84
C9-C10 Aromatics	1.80E+06	2.22E-04	200	20,736	8.75E-04	3.80E-02	1.75E-04	1.13E-02	0.00E+00	0.00E+00	1.13E-02	43.84
Acetone	1.80E+06	2.22E-04	200	7,593	1.72E-05	7.46E-04	1.75E-04	2.01E-02	0.00E+00	0.00E+00	2.01E-02	43.84
Trichloroethylene	1.80E+06	2.22E-04	200	8,591	4.09E-03	1.78E-01	1.75E-04	1.28E-02	0.00E+00	0.00E+00	1.28E-02	43.84

	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)
Benzene	200	3.00E+01	0.10	8.33E+01	1.42E-02	4.00E+02	3.98E+63	2.87E-03	8.61E-02	7.8E-06	3.0E-02
Ethylbenzene	200	3.50E+01	0.10	8.33E+01	1.21E-02	4.00E+02	4.21E+74	2.81E-03	9.83E-02	NA	1.0E+00
Toluene	200	4.10E+01	0.10	8.33E+01	1.41E-02	4.00E+02	2.15E+64	2.87E-03	1.17E-01	NA	5.0E+00
p-Xylene	200	4.10E+01	0.10	8.33E+01	1.24E-02	4.00E+02	6.04E+72	2.82E-03	1.16E-01	NA	1.0E-01
Naphthalene	200	4.90E+01	0.10	8.33E+01	9.54E-03	4.00E+02	7.17E+94	2.70E-03	1.32E-01	NA	3.0E-03
MTBE	200	0.00E+00	0.10	8.33E+01	1.66E-02	4.00E+02	4.52E+54	2.92E-03	0.00E+00	NA	3.0E+00
C5-C8 Aliphatics	200	1.80E+04	0.10	8.33E+01	1.29E-02	4.00E+02	9.13E+69	2.83E-03	5.10E+01	NA	2.0E-01
C9-C12 Aliphatics	200	2.40E+03	0.10	8.33E+01	1.13E-02	4.00E+02	9.02E+79	2.78E-03	6.67E+00	NA	2.0E-01
C9-C10 Aromatics	200	2.80E+02	0.10	8.33E+01	1.13E-02	4.00E+02	9.00E+79	2.78E-03	7.78E-01	NA	5.0E-02
Acetone	200	0.00E+00	0.10	8.33E+01	2.01E-02	4.00E+02	1.32E+45	2.98E-03	0.00E+00	NA	3.5E-01
Trichloroethylene	200	2.20E+01	0.10	8.33E+01	1.28E-02	4.00E+02	7.02E+70	2.83E-03	6.22E-02	1.1E-04	4.0E-02

END

INCREMENTAL RISK CALCULATIONS:

	Incremental risk from vapor intrusion to indoor air, carcinogen[1] (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
Benzene	2.6E-07	2.8E-03
Ethylbenzene	NA	9.4E-05
Toluene	NA	2.3E-05
p-Xylene	NA	1.1E-03
Naphthalene	NA	4.2E-02
MTBE	NA	0.0E+00
C5-C8 Aliphatics	NA	2.4E-01
C9-C12 Aliphatics	NA	3.2E-02
C9-C10 Aromatics	NA	1.5E-02
Acetone	NA	0.0E+00
Trichloroethylene	2.6E-06	1.5E-03

Notes:

[1] Cancer risks differ slightly from Table C-3; risks in Table C-3 were calculated according to MDEQ recommendations for age-adjusted residential exposure.

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

END

SG-ADV
Version 3.1; 02/04

Reset to Defaults

Geomatrix Consultants, Inc.
modified by CAK; 10/05
Mult. Chemical; version 3.1.2

ENTER
U.S. EPA or
Cal-EPA

U.S. EPA

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	1.35E+00			Benzene
100414	1.80E+01			Ethylbenzene
108883	1.80E+01			Toluene
106423	7.50E+01			p-Xylene
91203	2.20E+00			Naphthalene
1634044	0.00E+00			MTBE
1	3.20E+02			C5-C8 Aliphatics
2	4.20E+03			C9-C12 Aliphatics
3	1.20E+02			C9-C10 Aromatics
67641	0.00E+00			Acetone
79016	2.80E+01			Trichloroethylene

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)					
200	243.84	7.2	243.84	0	0	S		

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)	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)
S	1.66	0.375	0.054	SCL	1.63	0.384	0.146	C	1.43	0.459	0.215

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 calculate Q_{soil} (L/m)
10	40	1000	1000	366	0.1	0.25	5

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)
75	30	30	350

END

CHEMICAL PROPERTIES

	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 (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Molecular weight, MW (g/mol)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
Benzene	8.80E-02	9.80E-06	5.54E-03	25	7,342	353.24	562.16	78.11	7.8E-06	3.0E-02
Ethylbenzene	7.50E-02	7.80E-06	7.86E-03	25	8,501	409.34	617.20	106.17	0.0E+00	1.0E+00
Toluene	8.70E-02	8.60E-06	6.62E-03	25	7,930	383.78	591.79	92.14	0.0E+00	5.0E+00
p-Xylene	7.69E-02	8.44E-06	7.64E-03	25	8,525	411.52	616.20	106.17	0.0E+00	1.0E-01
Naphthalene	5.90E-02	7.50E-06	4.82E-04	25	10,373	491.14	748.40	128.18	0.0E+00	3.0E-03
MTBE	1.02E-01	1.05E-05	6.23E-04	25	6,678	328.30	497.10	88.15	0.0E+00	3.0E+00
C5-C8 Aliphatics	8.00E-02	1.00E-05	1.32E+00	25	7,541	341.89	508.00	0.00	0.0E+00	2.0E-01
C9-C12 Aliphatics	7.00E-02	1.00E-05	1.59E+00	25	11,100	423.96	595.00	0.00	0.0E+00	2.0E-01
C9-C10 Aromatics	7.00E-02	1.00E-05	8.07E-03	25	14,370	667.95	936.00	0.00	0.0E+00	5.0E-02
Acetone	1.24E-01	1.14E-05	3.87E-05	25	6,955	329.20	508.10	58.08	0.0E+00	3.5E-01
Trichloroethylene	7.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	131.39	1.1E-04	4.0E-02

	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)
Benzene	9.46E+08	43.84	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	1.35E+00	2.54E+04
Ethylbenzene	9.46E+08	43.84	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	1.80E+01	2.54E+04
Toluene	9.46E+08	43.84	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	1.80E+01	2.54E+04
p-Xylene	9.46E+08	43.84	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	7.50E+01	2.54E+04
Naphthalene	9.46E+08	43.84	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	2.20E+00	2.54E+04
MTBE	9.46E+08	43.84	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	0.00E+00	2.54E+04
C5-C8 Aliphatics	9.46E+08	43.84	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	3.20E+02	2.54E+04
C9-C12 Aliphatics	9.46E+08	43.84	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	4.20E+03	2.54E+04
C9-C10 Aromatics	9.46E+08	43.84	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	1.20E+02	2.54E+04
Acetone	9.46E+08	43.84	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	0.00E+00	2.54E+04
Trichloroethylene	9.46E+08	43.84	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	2.80E+01	2.54E+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)
Benzene	1.80E+06	2.22E-04	200	8,150	2.31E-03	1.00E-01	1.75E-04	1.42E-02	0.00E+00	0.00E+00	1.42E-02	43.84
Ethylbenzene	1.80E+06	2.22E-04	200	10,187	2.64E-03	1.15E-01	1.75E-04	1.21E-02	0.00E+00	0.00E+00	1.21E-02	43.84
Toluene	1.80E+06	2.22E-04	200	9,185	2.48E-03	1.08E-01	1.75E-04	1.41E-02	0.00E+00	0.00E+00	1.41E-02	43.84
p-Xylene	1.80E+06	2.22E-04	200	10,281	2.54E-03	1.10E-01	1.75E-04	1.24E-02	0.00E+00	0.00E+00	1.24E-02	43.84
Naphthalene	1.80E+06	2.22E-04	200	12,941	1.20E-04	5.23E-03	1.75E-04	9.54E-03	0.00E+00	0.00E+00	9.54E-03	43.84
MTBE	1.80E+06	2.22E-04	200	7,330	2.84E-04	1.24E-02	1.75E-04	1.66E-02	0.00E+00	0.00E+00	1.66E-02	43.84
C5-C8 Aliphatics	1.80E+06	2.22E-04	200	8,506	5.31E-01	2.31E+01	1.75E-04	1.29E-02	0.00E+00	0.00E+00	1.29E-02	43.84
C9-C12 Aliphatics	1.80E+06	2.22E-04	200	14,252	3.45E-01	1.50E+01	1.75E-04	1.13E-02	0.00E+00	0.00E+00	1.13E-02	43.84
C9-C10 Aromatics	1.80E+06	2.22E-04	200	20,736	8.75E-04	3.80E-02	1.75E-04	1.13E-02	0.00E+00	0.00E+00	1.13E-02	43.84
Acetone	1.80E+06	2.22E-04	200	7,593	1.72E-05	7.46E-04	1.75E-04	2.01E-02	0.00E+00	0.00E+00	2.01E-02	43.84
Trichloroethylene	1.80E+06	2.22E-04	200	8,591	4.09E-03	1.78E-01	1.75E-04	1.28E-02	0.00E+00	0.00E+00	1.28E-02	43.84

	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)
Benzene	200	1.35E+00	0.10	8.33E+01	1.42E-02	4.00E+02	3.98E+63	2.87E-03	3.87E-03	7.8E-06	3.0E-02
Ethylbenzene	200	1.80E+01	0.10	8.33E+01	1.21E-02	4.00E+02	4.21E+74	2.81E-03	5.06E-02	NA	1.0E+00
Toluene	200	1.80E+01	0.10	8.33E+01	1.41E-02	4.00E+02	2.15E+64	2.87E-03	5.16E-02	NA	5.0E+00
p-Xylene	200	7.50E+01	0.10	8.33E+01	1.24E-02	4.00E+02	6.04E+72	2.82E-03	2.11E-01	NA	1.0E-01
Naphthalene	200	2.20E+00	0.10	8.33E+01	9.54E-03	4.00E+02	7.17E+94	2.70E-03	5.95E-03	NA	3.0E-03
MTBE	200	0.00E+00	0.10	8.33E+01	1.66E-02	4.00E+02	4.52E+54	2.92E-03	0.00E+00	NA	3.0E+00
C5-C8 Aliphatics	200	3.20E+02	0.10	8.33E+01	1.29E-02	4.00E+02	9.13E+69	2.83E-03	9.07E-01	NA	2.0E-01
C9-C12 Aliphatics	200	4.20E+03	0.10	8.33E+01	1.13E-02	4.00E+02	9.02E+79	2.78E-03	1.17E+01	NA	2.0E-01
C9-C10 Aromatics	200	1.20E+02	0.10	8.33E+01	1.13E-02	4.00E+02	9.00E+79	2.78E-03	3.34E-01	NA	5.0E-02
Acetone	200	0.00E+00	0.10	8.33E+01	2.01E-02	4.00E+02	1.32E+45	2.98E-03	0.00E+00	NA	3.5E-01
Trichloroethylene	200	2.80E+01	0.10	8.33E+01	1.28E-02	4.00E+02	7.02E+70	2.83E-03	7.92E-02	1.1E-04	4.0E-02

END

INCREMENTAL RISK CALCULATIONS:

	Incremental risk from vapor intrusion to indoor air, carcinogen[1] (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
Benzene	1.2E-08	1.2E-04
Ethylbenzene	NA	4.8E-05
Toluene	NA	9.9E-06
p-Xylene	NA	2.0E-03
Naphthalene	NA	1.9E-03
MTBE	NA	0.0E+00
C5-C8 Aliphatics	NA	4.3E-03
C9-C12 Aliphatics	NA	5.6E-02
C9-C10 Aromatics	NA	6.4E-03
Acetone	NA	0.0E+00
Trichloroethylene	3.3E-06	1.9E-03

Notes:

[1] Cancer risks differ slightly from Table C-3; risks in Table C-3 were calculated according to MDEQ recommendations for age-adjusted residential exposure.

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

END

SG-ADV
Version 3.1; 02/04

Reset to Defaults

Geomatrix Consultants, Inc.
modified by CAK; 10/05
Mult. Chemical; version 3.1.2

ENTER
U.S. EPA or
Cal-EPA

U.S. EPA

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	3.00E+01			Benzene
100414	3.50E+01			Ethylbenzene
108883	4.10E+01			Toluene
106423	4.10E+01			p-Xylene
91203	4.90E+01			Naphthalene
1634044	0.00E+00			MTBE
1	3.30E+03			C5-C8 Aliphatics
2	2.50E+03			C9-C12 Aliphatics
3	2.80E+02			C9-C10 Aromatics
67641	0.00E+00			Acetone
79016	1.50E+01			Trichloroethylene

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 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)
200	243.84	7.2	243.84	0	0	S		

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)	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)
S	1.66	0.375	0.054	SCL	1.63	0.384	0.146	C	1.43	0.459	0.215

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 calculate Q_{soil} (L/m)
10	40	1000	1000	366	0.1	0.25	5

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)
75	30	30	350

END

CHEMICAL PROPERTIES

	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 (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Molecular weight, MW (g/mol)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
Benzene	8.80E-02	9.80E-06	5.54E-03	25	7,342	353.24	562.16	78.11	7.8E-06	3.0E-02
Ethylbenzene	7.50E-02	7.80E-06	7.86E-03	25	8,501	409.34	617.20	106.17	0.0E+00	1.0E+00
Toluene	8.70E-02	8.60E-06	6.62E-03	25	7,930	383.78	591.79	92.14	0.0E+00	5.0E+00
p-Xylene	7.69E-02	8.44E-06	7.64E-03	25	8,525	411.52	616.20	106.17	0.0E+00	1.0E-01
Naphthalene	5.90E-02	7.50E-06	4.82E-04	25	10,373	491.14	748.40	128.18	0.0E+00	3.0E-03
MTBE	1.02E-01	1.05E-05	6.23E-04	25	6,678	328.30	497.10	88.15	0.0E+00	3.0E+00
C5-C8 Aliphatics	8.00E-02	1.00E-05	1.32E+00	25	7,541	341.89	508.00	0.00	0.0E+00	2.0E-01
C9-C12 Aliphatics	7.00E-02	1.00E-05	1.59E+00	25	11,100	423.96	595.00	0.00	0.0E+00	2.0E-01
C9-C10 Aromatics	7.00E-02	1.00E-05	8.07E-03	25	14,370	667.95	936.00	0.00	0.0E+00	5.0E-02
Acetone	1.24E-01	1.14E-05	3.87E-05	25	6,955	329.20	508.10	58.08	0.0E+00	3.5E-01
Trichloroethylene	7.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	131.39	1.1E-04	4.0E-02

	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)
Benzene	9.46E+08	43.84	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	3.00E+01	2.54E+04
Ethylbenzene	9.46E+08	43.84	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	3.50E+01	2.54E+04
Toluene	9.46E+08	43.84	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	4.10E+01	2.54E+04
p-Xylene	9.46E+08	43.84	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	4.10E+01	2.54E+04
Naphthalene	9.46E+08	43.84	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	4.90E+01	2.54E+04
MTBE	9.46E+08	43.84	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	0.00E+00	2.54E+04
C5-C8 Aliphatics	9.46E+08	43.84	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	3.30E+03	2.54E+04
C9-C12 Aliphatics	9.46E+08	43.84	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	2.50E+03	2.54E+04
C9-C10 Aromatics	9.46E+08	43.84	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	2.80E+02	2.54E+04
Acetone	9.46E+08	43.84	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	0.00E+00	2.54E+04
Trichloroethylene	9.46E+08	43.84	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	1.50E+01	2.54E+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)
Benzene	1.80E+06	2.22E-04	200	8,150	2.31E-03	1.00E-01	1.75E-04	1.42E-02	0.00E+00	0.00E+00	1.42E-02	43.84
Ethylbenzene	1.80E+06	2.22E-04	200	10,187	2.64E-03	1.15E-01	1.75E-04	1.21E-02	0.00E+00	0.00E+00	1.21E-02	43.84
Toluene	1.80E+06	2.22E-04	200	9,185	2.48E-03	1.08E-01	1.75E-04	1.41E-02	0.00E+00	0.00E+00	1.41E-02	43.84
p-Xylene	1.80E+06	2.22E-04	200	10,281	2.54E-03	1.10E-01	1.75E-04	1.24E-02	0.00E+00	0.00E+00	1.24E-02	43.84
Naphthalene	1.80E+06	2.22E-04	200	12,941	1.20E-04	5.23E-03	1.75E-04	9.54E-03	0.00E+00	0.00E+00	9.54E-03	43.84
MTBE	1.80E+06	2.22E-04	200	7,330	2.84E-04	1.24E-02	1.75E-04	1.66E-02	0.00E+00	0.00E+00	1.66E-02	43.84
C5-C8 Aliphatics	1.80E+06	2.22E-04	200	8,506	5.31E-01	2.31E+01	1.75E-04	1.29E-02	0.00E+00	0.00E+00	1.29E-02	43.84
C9-C12 Aliphatics	1.80E+06	2.22E-04	200	14,252	3.45E-01	1.50E+01	1.75E-04	1.13E-02	0.00E+00	0.00E+00	1.13E-02	43.84
C9-C10 Aromatics	1.80E+06	2.22E-04	200	20,736	8.75E-04	3.80E-02	1.75E-04	1.13E-02	0.00E+00	0.00E+00	1.13E-02	43.84
Acetone	1.80E+06	2.22E-04	200	7,593	1.72E-05	7.46E-04	1.75E-04	2.01E-02	0.00E+00	0.00E+00	2.01E-02	43.84
Trichloroethylene	1.80E+06	2.22E-04	200	8,591	4.09E-03	1.78E-01	1.75E-04	1.28E-02	0.00E+00	0.00E+00	1.28E-02	43.84

	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)
Benzene	200	3.00E+01	0.10	8.33E+01	1.42E-02	4.00E+02	3.98E+63	2.87E-03	8.61E-02	7.8E-06	3.0E-02
Ethylbenzene	200	3.50E+01	0.10	8.33E+01	1.21E-02	4.00E+02	4.21E+74	2.81E-03	9.83E-02	NA	1.0E+00
Toluene	200	4.10E+01	0.10	8.33E+01	1.41E-02	4.00E+02	2.15E+64	2.87E-03	1.17E-01	NA	5.0E+00
p-Xylene	200	4.10E+01	0.10	8.33E+01	1.24E-02	4.00E+02	6.04E+72	2.82E-03	1.16E-01	NA	1.0E-01
Naphthalene	200	4.90E+01	0.10	8.33E+01	9.54E-03	4.00E+02	7.17E+94	2.70E-03	1.32E-01	NA	3.0E-03
MTBE	200	0.00E+00	0.10	8.33E+01	1.66E-02	4.00E+02	4.52E+54	2.92E-03	0.00E+00	NA	3.0E+00
C5-C8 Aliphatics	200	3.30E+03	0.10	8.33E+01	1.29E-02	4.00E+02	9.13E+69	2.83E-03	9.35E+00	NA	2.0E-01
C9-C12 Aliphatics	200	2.50E+03	0.10	8.33E+01	1.13E-02	4.00E+02	9.02E+79	2.78E-03	6.95E+00	NA	2.0E-01
C9-C10 Aromatics	200	2.80E+02	0.10	8.33E+01	1.13E-02	4.00E+02	9.00E+79	2.78E-03	7.78E-01	NA	5.0E-02
Acetone	200	0.00E+00	0.10	8.33E+01	2.01E-02	4.00E+02	1.32E+45	2.98E-03	0.00E+00	NA	3.5E-01
Trichloroethylene	200	1.50E+01	0.10	8.33E+01	1.28E-02	4.00E+02	7.02E+70	2.83E-03	4.24E-02	1.1E-04	4.0E-02

END

INCREMENTAL RISK CALCULATIONS:

	Incremental risk from vapor intrusion to indoor air, carcinogen[1] (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
Benzene	2.6E-07	2.8E-03
Ethylbenzene	NA	9.4E-05
Toluene	NA	2.3E-05
p-Xylene	NA	1.1E-03
Naphthalene	NA	4.2E-02
MTBE	NA	0.0E+00
C5-C8 Aliphatics	NA	4.5E-02
C9-C12 Aliphatics	NA	3.3E-02
C9-C10 Aromatics	NA	1.5E-02
Acetone	NA	0.0E+00
Trichloroethylene	1.8E-06	1.0E-03

Notes:

[1] Cancer risks differ slightly from Table C-3; risks in Table C-3 were calculated according to MDEQ recommendations for age-adjusted residential exposure.

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

END

SG-ADV
Version 3.1; 02/04

Reset to Defaults

Geomatrix Consultants, Inc.
modified by CAK; 10/05
Mult. Chemical; version 3.1.2

ENTER
U.S. EPA or Cal-EPA

U.S. EPA

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	1.35E+00			Benzene
100414	1.60E+00			Ethylbenzene
108883	1.85E+00			Toluene
106423	1.85E+00			p-Xylene
91203	2.20E+00			Naphthalene
1634044	0.00E+00			MTBE
1	1.60E+02			C5-C8 Aliphatics
2	4.50E+03			C9-C12 Aliphatics
3	1.25E+01			C9-C10 Aromatics
67641	0.00E+00			Acetone
79016	1.20E-01			Trichloroethylene

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)					
200	457.2	7.2	457.2	0	0	S		

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)	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)
S	1.66	0.375	0.054	SCL	1.63	0.384	0.146	C	1.43	0.459	0.215

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 calculate Q_{soil} (L/m)
10	40	1000	1000	366	0.1	0.25	5

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)
75	30	30	350

END

CHEMICAL PROPERTIES

	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 (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Molecular weight, MW (g/mol)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
Benzene	8.80E-02	9.80E-06	5.54E-03	25	7,342	353.24	562.16	78.11	7.8E-06	3.0E-02
Ethylbenzene	7.50E-02	7.80E-06	7.86E-03	25	8,501	409.34	617.20	106.17	0.0E+00	1.0E+00
Toluene	8.70E-02	8.60E-06	6.62E-03	25	7,930	383.78	591.79	92.14	0.0E+00	5.0E+00
p-Xylene	7.69E-02	8.44E-06	7.64E-03	25	8,525	411.52	616.20	106.17	0.0E+00	1.0E-01
Naphthalene	5.90E-02	7.50E-06	4.82E-04	25	10,373	491.14	748.40	128.18	0.0E+00	3.0E-03
MTBE	1.02E-01	1.05E-05	6.23E-04	25	6,678	328.30	497.10	88.15	0.0E+00	3.0E+00
C5-C8 Aliphatics	8.00E-02	1.00E-05	1.32E+00	25	7,541	341.89	508.00	0.00	0.0E+00	2.0E-01
C9-C12 Aliphatics	7.00E-02	1.00E-05	1.59E+00	25	11,100	423.96	595.00	0.00	0.0E+00	2.0E-01
C9-C10 Aromatics	7.00E-02	1.00E-05	8.07E-03	25	14,370	667.95	936.00	0.00	0.0E+00	5.0E-02
Acetone	1.24E-01	1.14E-05	3.87E-05	25	6,955	329.20	508.10	58.08	0.0E+00	3.5E-01
Trichloroethylene	7.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	131.39	1.1E-04	4.0E-02

	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)
Benzene	9.46E+08	257.2	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	1.35E+00	2.54E+04
Ethylbenzene	9.46E+08	257.2	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	1.60E+00	2.54E+04
Toluene	9.46E+08	257.2	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	1.85E+00	2.54E+04
p-Xylene	9.46E+08	257.2	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	1.85E+00	2.54E+04
Naphthalene	9.46E+08	257.2	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	2.20E+00	2.54E+04
MTBE	9.46E+08	257.2	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	0.00E+00	2.54E+04
C5-C8 Aliphatics	9.46E+08	257.2	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	1.60E+02	2.54E+04
C9-C12 Aliphatics	9.46E+08	257.2	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	4.50E+03	2.54E+04
C9-C10 Aromatics	9.46E+08	257.2	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	1.25E+01	2.54E+04
Acetone	9.46E+08	257.2	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	0.00E+00	2.54E+04
Trichloroethylene	9.46E+08	257.2	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	1.20E-01	2.54E+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)
Benzene	1.80E+06	2.22E-04	200	8,150	2.31E-03	1.00E-01	1.75E-04	1.42E-02	0.00E+00	0.00E+00	1.42E-02	257.2
Ethylbenzene	1.80E+06	2.22E-04	200	10,187	2.64E-03	1.15E-01	1.75E-04	1.21E-02	0.00E+00	0.00E+00	1.21E-02	257.2
Toluene	1.80E+06	2.22E-04	200	9,185	2.48E-03	1.08E-01	1.75E-04	1.41E-02	0.00E+00	0.00E+00	1.41E-02	257.2
p-Xylene	1.80E+06	2.22E-04	200	10,281	2.54E-03	1.10E-01	1.75E-04	1.24E-02	0.00E+00	0.00E+00	1.24E-02	257.2
Naphthalene	1.80E+06	2.22E-04	200	12,941	1.20E-04	5.23E-03	1.75E-04	9.54E-03	0.00E+00	0.00E+00	9.54E-03	257.2
MTBE	1.80E+06	2.22E-04	200	7,330	2.84E-04	1.24E-02	1.75E-04	1.66E-02	0.00E+00	0.00E+00	1.66E-02	257.2
C5-C8 Aliphatics	1.80E+06	2.22E-04	200	8,506	5.31E-01	2.31E+01	1.75E-04	1.29E-02	0.00E+00	0.00E+00	1.29E-02	257.2
C9-C12 Aliphatics	1.80E+06	2.22E-04	200	14,252	3.45E-01	1.50E+01	1.75E-04	1.13E-02	0.00E+00	0.00E+00	1.13E-02	257.2
C9-C10 Aromatics	1.80E+06	2.22E-04	200	20,736	8.75E-04	3.80E-02	1.75E-04	1.13E-02	0.00E+00	0.00E+00	1.13E-02	257.2
Acetone	1.80E+06	2.22E-04	200	7,593	1.72E-05	7.46E-04	1.75E-04	2.01E-02	0.00E+00	0.00E+00	2.01E-02	257.2
Trichloroethylene	1.80E+06	2.22E-04	200	8,591	4.09E-03	1.78E-01	1.75E-04	1.28E-02	0.00E+00	0.00E+00	1.28E-02	257.2

	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)
Benzene	200	1.35E+00	0.10	8.33E+01	1.42E-02	4.00E+02	3.98E+63	1.78E-03	2.41E-03	7.8E-06	3.0E-02
Ethylbenzene	200	1.60E+00	0.10	8.33E+01	1.21E-02	4.00E+02	4.21E+74	1.65E-03	2.65E-03	NA	1.0E+00
Toluene	200	1.85E+00	0.10	8.33E+01	1.41E-02	4.00E+02	2.15E+64	1.78E-03	3.28E-03	NA	5.0E+00
p-Xylene	200	1.85E+00	0.10	8.33E+01	1.24E-02	4.00E+02	6.04E+72	1.67E-03	3.10E-03	NA	1.0E-01
Naphthalene	200	2.20E+00	0.10	8.33E+01	9.54E-03	4.00E+02	7.17E+94	1.46E-03	3.21E-03	NA	3.0E-03
MTBE	200	0.00E+00	0.10	8.33E+01	1.66E-02	4.00E+02	4.52E+54	1.91E-03	0.00E+00	NA	3.0E+00
C5-C8 Aliphatics	200	1.60E+02	0.10	8.33E+01	1.29E-02	4.00E+02	9.13E+69	1.71E-03	2.73E-01	NA	2.0E-01
C9-C12 Aliphatics	200	4.50E+03	0.10	8.33E+01	1.13E-02	4.00E+02	9.02E+79	1.60E-03	7.19E+00	NA	2.0E-01
C9-C10 Aromatics	200	1.25E+01	0.10	8.33E+01	1.13E-02	4.00E+02	9.00E+79	1.60E-03	2.00E-02	NA	5.0E-02
Acetone	200	0.00E+00	0.10	8.33E+01	2.01E-02	4.00E+02	1.32E+45	2.06E-03	0.00E+00	NA	3.5E-01
Trichloroethylene	200	1.20E-01	0.10	8.33E+01	1.28E-02	4.00E+02	7.02E+70	1.70E-03	2.04E-04	1.1E-04	4.0E-02

END

INCREMENTAL RISK CALCULATIONS:

	Incremental risk from vapor intrusion to indoor air, carcinogen[1] (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
Benzene	7.2E-09	7.7E-05
Ethylbenzene	NA	2.5E-06
Toluene	NA	6.3E-07
p-Xylene	NA	3.0E-05
Naphthalene	NA	1.0E-03
MTBE	NA	0.0E+00
C5-C8 Aliphatics	NA	1.3E-03
C9-C12 Aliphatics	NA	3.4E-02
C9-C10 Aromatics	NA	3.8E-04
Acetone	NA	0.0E+00
Trichloroethylene	8.6E-09	4.9E-06

Notes:

[1] Cancer risks differ slightly from Table C-3; risks in Table C-3 were calculated according to MDEQ recommendations for age-adjusted residential exposure.

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

END

SG-ADV
Version 3.1; 02/04

Reset to Defaults

Geomatrix Consultants, Inc.
modified by CAK; 10/05
Mult. Chemical; version 3.1.2

ENTER U.S. EPA or Cal-EPA: U.S. EPA

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	1.35E+00			Benzene
100414	4.60E+00			Ethylbenzene
108883	1.85E+00			Toluene
106423	1.60E+01			p-Xylene
91203	2.20E+00			Naphthalene
1634044	0.00E+00			MTBE
1	3.40E+02			C5-C8 Aliphatics
2	3.90E+03			C9-C12 Aliphatics
3	3.20E+01			C9-C10 Aromatics
67641	0.00E+00			Acetone
79016	6.00E+01			Trichloroethylene

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 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)
200	243.84	7.2	243.84	0	0	S		

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)	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)
S	1.66	0.375	0.054	SCL	1.63	0.384	0.146	C	1.43	0.459	0.215

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 calculate Q_{soil} (L/m)
10	40	1000	1000	366	0.1	0.25	5

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)
75	30	30	350

END

CHEMICAL PROPERTIES

	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 (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Molecular weight, MW (g/mol)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
Benzene	8.80E-02	9.80E-06	5.54E-03	25	7,342	353.24	562.16	78.11	7.8E-06	3.0E-02
Ethylbenzene	7.50E-02	7.80E-06	7.86E-03	25	8,501	409.34	617.20	106.17	0.0E+00	1.0E+00
Toluene	8.70E-02	8.60E-06	6.62E-03	25	7,930	383.78	591.79	92.14	0.0E+00	5.0E+00
p-Xylene	7.69E-02	8.44E-06	7.64E-03	25	8,525	411.52	616.20	106.17	0.0E+00	1.0E-01
Naphthalene	5.90E-02	7.50E-06	4.82E-04	25	10,373	491.14	748.40	128.18	0.0E+00	3.0E-03
MTBE	1.02E-01	1.05E-05	6.23E-04	25	6,678	328.30	497.10	88.15	0.0E+00	3.0E+00
C5-C8 Aliphatics	8.00E-02	1.00E-05	1.32E+00	25	7,541	341.89	508.00	0.00	0.0E+00	2.0E-01
C9-C12 Aliphatics	7.00E-02	1.00E-05	1.59E+00	25	11,100	423.96	595.00	0.00	0.0E+00	2.0E-01
C9-C10 Aromatics	7.00E-02	1.00E-05	8.07E-03	25	14,370	667.95	936.00	0.00	0.0E+00	5.0E-02
Acetone	1.24E-01	1.14E-05	3.87E-05	25	6,955	329.20	508.10	58.08	0.0E+00	3.5E-01
Trichloroethylene	7.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	131.39	1.1E-04	4.0E-02

	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)
Benzene	9.46E+08	43.84	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	1.35E+00	2.54E+04
Ethylbenzene	9.46E+08	43.84	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	4.60E+00	2.54E+04
Toluene	9.46E+08	43.84	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	1.85E+00	2.54E+04
p-Xylene	9.46E+08	43.84	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	1.60E+01	2.54E+04
Naphthalene	9.46E+08	43.84	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	2.20E+00	2.54E+04
MTBE	9.46E+08	43.84	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	0.00E+00	2.54E+04
C5-C8 Aliphatics	9.46E+08	43.84	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	3.40E+02	2.54E+04
C9-C12 Aliphatics	9.46E+08	43.84	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	3.90E+03	2.54E+04
C9-C10 Aromatics	9.46E+08	43.84	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	3.20E+01	2.54E+04
Acetone	9.46E+08	43.84	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	0.00E+00	2.54E+04
Trichloroethylene	9.46E+08	43.84	0.321	0.238	0.244	0.003	9.88E-08	0.998	9.86E-08	4,000	6.00E+01	2.54E+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)
Benzene	1.80E+06	2.22E-04	200	8,150	2.31E-03	1.00E-01	1.75E-04	1.42E-02	0.00E+00	0.00E+00	1.42E-02	43.84
Ethylbenzene	1.80E+06	2.22E-04	200	10,187	2.64E-03	1.15E-01	1.75E-04	1.21E-02	0.00E+00	0.00E+00	1.21E-02	43.84
Toluene	1.80E+06	2.22E-04	200	9,185	2.48E-03	1.08E-01	1.75E-04	1.41E-02	0.00E+00	0.00E+00	1.41E-02	43.84
p-Xylene	1.80E+06	2.22E-04	200	10,281	2.54E-03	1.10E-01	1.75E-04	1.24E-02	0.00E+00	0.00E+00	1.24E-02	43.84
Naphthalene	1.80E+06	2.22E-04	200	12,941	1.20E-04	5.23E-03	1.75E-04	9.54E-03	0.00E+00	0.00E+00	9.54E-03	43.84
MTBE	1.80E+06	2.22E-04	200	7,330	2.84E-04	1.24E-02	1.75E-04	1.66E-02	0.00E+00	0.00E+00	1.66E-02	43.84
C5-C8 Aliphatics	1.80E+06	2.22E-04	200	8,506	5.31E-01	2.31E+01	1.75E-04	1.29E-02	0.00E+00	0.00E+00	1.29E-02	43.84
C9-C12 Aliphatics	1.80E+06	2.22E-04	200	14,252	3.45E-01	1.50E+01	1.75E-04	1.13E-02	0.00E+00	0.00E+00	1.13E-02	43.84
C9-C10 Aromatics	1.80E+06	2.22E-04	200	20,736	8.75E-04	3.80E-02	1.75E-04	1.13E-02	0.00E+00	0.00E+00	1.13E-02	43.84
Acetone	1.80E+06	2.22E-04	200	7,593	1.72E-05	7.46E-04	1.75E-04	2.01E-02	0.00E+00	0.00E+00	2.01E-02	43.84
Trichloroethylene	1.80E+06	2.22E-04	200	8,591	4.09E-03	1.78E-01	1.75E-04	1.28E-02	0.00E+00	0.00E+00	1.28E-02	43.84

	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)
Benzene	200	1.35E+00	0.10	8.33E+01	1.42E-02	4.00E+02	3.98E+63	2.87E-03	3.87E-03	7.8E-06	3.0E-02
Ethylbenzene	200	4.60E+00	0.10	8.33E+01	1.21E-02	4.00E+02	4.21E+74	2.81E-03	1.29E-02	NA	1.0E+00
Toluene	200	1.85E+00	0.10	8.33E+01	1.41E-02	4.00E+02	2.15E+64	2.87E-03	5.30E-03	NA	5.0E+00
p-Xylene	200	1.60E+01	0.10	8.33E+01	1.24E-02	4.00E+02	6.04E+72	2.82E-03	4.51E-02	NA	1.0E-01
Naphthalene	200	2.20E+00	0.10	8.33E+01	9.54E-03	4.00E+02	7.17E+94	2.70E-03	5.95E-03	NA	3.0E-03
MTBE	200	0.00E+00	0.10	8.33E+01	1.66E-02	4.00E+02	4.52E+54	2.92E-03	0.00E+00	NA	3.0E+00
C5-C8 Aliphatics	200	3.40E+02	0.10	8.33E+01	1.29E-02	4.00E+02	9.13E+69	2.83E-03	9.64E-01	NA	2.0E-01
C9-C12 Aliphatics	200	3.90E+03	0.10	8.33E+01	1.13E-02	4.00E+02	9.02E+79	2.78E-03	1.08E+01	NA	2.0E-01
C9-C10 Aromatics	200	3.20E+01	0.10	8.33E+01	1.13E-02	4.00E+02	9.00E+79	2.78E-03	8.90E-02	NA	5.0E-02
Acetone	200	0.00E+00	0.10	8.33E+01	2.01E-02	4.00E+02	1.32E+45	2.98E-03	0.00E+00	NA	3.5E-01
Trichloroethylene	200	6.00E+01	0.10	8.33E+01	1.28E-02	4.00E+02	7.02E+70	2.83E-03	1.70E-01	1.1E-04	4.0E-02

END

INCREMENTAL RISK CALCULATIONS:

	Incremental risk from vapor intrusion to indoor air, carcinogen[1] (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
Benzene	1.2E-08	1.2E-04
Ethylbenzene	NA	1.2E-05
Toluene	NA	1.0E-06
p-Xylene	NA	4.3E-04
Naphthalene	NA	1.9E-03
MTBE	NA	0.0E+00
C5-C8 Aliphatics	NA	4.6E-03
C9-C12 Aliphatics	NA	5.2E-02
C9-C10 Aromatics	NA	1.7E-03
Acetone	NA	0.0E+00
Trichloroethylene	7.2E-06	4.1E-03

Notes:

[1] Cancer risks differ slightly from Table C-3; risks in Table C-3 were calculated according to MDEQ recommendations for age-adjusted residential exposure.

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

END