KEY ENGINEERING GROUP LTD.
ENVIRONMENTAL • CIVIL/GEOTECH • COMPLIANCE

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20030813_37

August 11, 2003

Mr. Binyoti F. Amungwafor
Wisconsin Department of Natural Resources
2300 North Dr. Martin Luther King, Jr. Drive
Post Office Box 12436
Milwaukee, Wisconsin 53212-0436

Reference: *Soil Vapor Investigation Results*
Decorah Shopping Center Annex
1011-1025 South Main Street
West Bend, Wisconsin
WDNR FID #: 267161400
WDNR BRRTS #: 02-67-151266

KEY ENGINEERING GROUP, LTD.
File No. 0702007

Dear Mr. Amungwafor:

The purpose of this letter is to provide the Wisconsin Department of Natural Resources (WDNR) with the results of soil vapor investigation activities at the above referenced site. This letter was prepared by Key Engineering Group, Ltd. (KEY) on behalf of Continental VI Fund Limited Partnership (Continental).

PROJECT BACKGROUND

The soil vapor investigation objectives are documented in the following correspondence:

- *Soil Vapor Screening Work Plan*, KEY, March 4, 2003.
- Electronic mail correspondence, Wisconsin Department of Health and Family Services – Bureau of Environmental Health, March 19, 2003.
- Electronic mail correspondence, KEY, April 4, 2003.
- *Soil Vapor Screening Work Plan* letter, WDNR, April 8, 2003.

SOIL VAPOR INVESTIGATION RESULTS

Soil vapor samples were collected from three soil probes (GP-23, GP-24 and GP-25) triangulated around the residence determined to be at the greatest risk from indoor intrusion of soil vapors (in the vicinity of the highest groundwater concentrations of tetrachloroethene (PCE) and trichloroethene (TCE)) on June 10, 2003. The soil probes were advanced to depths ranging from 7 to 9 feet below ground surface . Temporary vapor sampling wells were constructed and set at a final depth of approximately 1 foot above the groundwater level. The soil probe and vapor sampling well locations are depicted on Figure 1. The soil probe installations are documented on soil boring logs included as Attachment 1.

Composite soil vapor samples were collected from each temporary vapor well over a 6-hour time period utilizing a Summa canister. Collected soil vapor samples were submitted to Severn Trent Laboratories, Inc. (STL) for laboratory analysis of volatile organic compounds utilizing United States Environmental Protection Agency Method TO-15. The STL laboratory analytical report is included as Attachment 2.

The soil vapor sample analytical results indicated that PCE was detected at vapor well GP-24 and GP-25 at concentrations of 1.1 parts per billion volume (ppbv) and 1.2 ppbv, respectively. The vapor sample analytical results also indicated that TCE was detected at vapor well GP-24 and GP-25 at concentrations of 0.73 ppbv and 0.80 ppbv, respectively. No other compounds were detected at concentrations above laboratory detection limits. The soil vapor sample analytical results are summarized in Table 1.

SOIL VAPOR MODELING RESULTS

The soil vapor sample analytical results for vapor wells GP-23 through GP-25 were evaluated utilizing the *Johnson and Ettinger (1991) Model for Subsurface Vapor Intrusion into Buildings* (JE Model). The JE Model indicated that the Incremental Risk Screening Factors for PCE and TCE in vapor wells GP-23 through GP-25 ranged from approximately 2 to 4 orders of magnitude below the established acceptable risk screening factor of 1×10^{-6}. The JE Model results are summarized in Table 1 and the JE Model calculation documentation is included as Attachment 3.

SOIL VAPOR INVESTIGATION CONCLUSIONS

Based on the soil vapor sample analytical results and the results of the JE Model Incremental Risk Screening Factor calculations, the pathway for vapor intrusion into residential buildings due to the existing PCE and TCE groundwater contaminant plume can be eliminated as a risk factor.

Please contact KEY if you have any questions.

Sincerely,

KEY ENGINEERING GROUP, LTD.

Kristopher T. King
Project Scientist

Andrew B. Graham, PE, PG, CHMM
Senior Engineer

KTK/vjc

Attachments:

	Table 1	Summary of Soil Vapor Sample Analytical Results
	Figure 1	Site Vicinity Layout with Soil Vapor Sampling Locations
	Attachment 1	Soil Boring Logs
	Attachment 2	Laboratory Analytical Report
	Attachment 3	Johnson and Ettinger Model Calculations

cc: Ms. Mary Mokwa, Continental VI Fund Limited Partnership
Mr. Donald P. Gallo, Reinhart, Boerner & Van Deuren, S.C.
Mr. Robert Thiboldeaux, State of Wisconsin Department of Health and Family Services

TABLE 1

SUMMARY OF SOIL VAPOR SAMPLE ANALYTICAL RESULTS

DECORAH SHOPPING CENTER ANNEX

1011-1025 South Main Street

West Bend, Wisconsin

PARAMETERS	SAMPLE IDENTIFICATION			EPA Soil Gas Screening Level* (1×10^{-6} Risk Factor)				
	GP-23	GP-24	GP-25	Attenuation Factor				
Date Collected	6/10/2003	6/10/2003	6/10/2003	2×10^{-3}	1×10^{-3}	7×10^{-4}	4×10^{-4}	2×10^{-4}
Depth (feet bgs)	9	7	7					
Approximate Groundwater Depth (feet bgs)#	10	8	8					
Detected Soil Vapors (ppbv)								
Tetrachloroethene	<0.50	1.1	1.2	60	120	170	300	600
Trichloroethene	<0.50	0.73	0.80	2.1	4.1	5.9	10	21
Incremental Risk Screening Factor - PCE**	5.0×10^{-10}	2.2×10^{-9}	2.4×10^{-9}	NA	NA	NA	NA	NA
Incremental Risk Screening Factor - TCE**	1.5×10^{-8}	4.4×10^{-8}	4.9×10^{-8}	NA	NA	NA	NA	NA

Notes:

* - From the U.S. Environmental Protection Agency's *Draft Guidance For Evaluating the Vapor Intrusion to Indoor Pathway From Groundwater and Soils* Table 3c-SG: Soil Gas Screening Levels for Scenario-Specific Vapor Attenuation Factors (α)

** - Calculated utilizing the Johnson and Ettinger (1991) Model for Subsurface Vapor Intrusion into Buildings

- groundwater level measured from the nearest site groundwater quality monitoring well

bgs - below ground surface

NA - not applicable

PCE - tetrachloroethene

ppbv - parts per billion volume

TCE - trichloroethene

HAWTHORN DRIVE

SOUTH MAIN STREET

LINCOLN DRIVE WEST

TERRACE DRIVE

SUNSET DRIVE

MW-20

MW-18

MW-17

MW-21

MW-19

P-4

MW-16

SP-03

MW-7

GP-22

GP-21

SP-02

GP-20

MW-13

GP-25

MW-14

GP-19

GP-24

GP-18

GP-23

SP-01

GP-17

MW-15

GP-16

MW-10

MW-11

P-1

MW-7

P-3

MW-4

MW-8

MW-9

SUBJECT SITE

MW-3

MW-5

P-2

MW-12

MW-6

DRY CLEANER

MW-1

MW-2

LEGEND

- MONITORING WELL LOCATION
- SOIL PROBE/TEMPORARY WELL LOCATION
- SOIL VAPOR SAMPLE LOCATION
- ABANDONED MONITORING WELL LOCATION
- APPROXIMATE FORMER TEMPORARY WELL LOCATION (FORMER McDONALDS PROPERTY)
- MONITORING WELL LOCATION (MATANAER SITE)

SCALE IN FEET

0 100'

DESIGNED BY KTK	DATE 07/15/03
DRAWN BY CTM	PROJECT 0702007
APPROVED BY DJG	SHEET NO. 1
CADFILE G:\ACAD\0702007\7020075.dwg XREF LMAN	

FIGURE 1
SITE VICINITY LAYOUT WITH PROPOSED SOIL VAPOR SAMPLING LOCATIONS

DECORAH SHOPPING CENTER ANNEX
1011–1025 SOUTH MAIN STREET
WEST BEND, WISCONSIN

KEY ENGINEERING GROUP LTD.
ENVIRONMENTAL • CIVIL • RAILROAD

ATTACHMENT 1

State of Wisconsin
Department of Natural Resources

SOIL BORING LOG INFORMATION

Form 4400-122 Rev. 7-98

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Redevelopment ☐ Other ☐

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Decorah Shopping Center Annex	-	GP-23

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Dave Paulson Soil Essentials	6/10/2003	6/10/2003	Direct Push

WI Unique Well No.	DNR Well ID No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
			Feet MSL	Feet MSL	2.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane N, E S/C/N
SW 1/2 of NW 1/4 of Section 24, T 11 N, R 19 E
Lat ° ' "
Long ° ' "
Local Grid Location ☐ N ☐ E Feet ☐ S Feet ☐ W

Facility ID	County	County Code	Civil Town/City/ or Village
	Washington	67	West Bend

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	Pocket Penetrometer
1 SS	48 / 40		1	TOPSOIL Brown, fine to medium SAND and GRAVEL (fill)	GP			<1						
			2	Brown, fine to medium SAND with trace silt	SP									
			3					<1						
2 SS	48 / 42		4											
			5					<1						
			6											
			7					<1						
3 SS	12 / 12		8											
			9					<1						
				End of soil boring at 9'										

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm	Tel: (262) 375-4750
	KEY ENGINEERING GROUP, LTD. W66 N215 COMMERCE CT. CEDARBURG, WI 53012	Fax: (262) 375-9680

This form is authorized by Chapters 281, 283, 289, 291, 292, 293, 295, and 299, Wis. Stats. Completion of this form is mandatory. Failure to file this form may result in forfeiture of between $10 and $25,000, or imprisonment for up to one year, depending on the program and conduct involved. Personally identifiable information on this form is not intended to be be used for any other purpose. NOTE: See instructions for more information, including where the completed form should be sent.

State of Wisconsin
Department of Natural Resources

SOIL BORING LOG INFORMATION

Form 4400-122 Rev. 7-98

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Redevelopment ☐ Other ☐

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Decorah Shopping Center Annex	-	GP-24

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Dave Paulson Soil Essentials	6/10/2003	6/10/2003	Direct Push

WI Unique Well No.	DNR Well ID No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
			Feet MSL	Feet MSL	2.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane N, E S/C/N
SW 1/2 of NW 1/4 of Section 24, T 11 N, R 19 E
Lat ° ' "
Long ° ' "
Local Grid Location ☐ N Feet ☐ S ☐ E Feet ☐ W

Facility ID	County	County Code	Civil Town/City/ or Village
	Washington	67	West Bend

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	Pocket Penetrometer
1 SS	48 42		1	TOPSOIL Dark brown, fine to medium SAND with trace gravel	SP			<1						
			2											
			3					<1						
			4											
2 SS	36 32		5					<1						
			6											
			7	End of soil boring at 7'				<1						

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature

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State of Wisconsin
Department of Natural Resources

SOIL BORING LOG INFORMATION

Form 4400-122 Rev. 7-98

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Redevelopment ☐ Other ☐

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Decorah Shopping Center Annex	-	GP-25

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Dave Paulson Soil Essentials	6/10/2003	6/10/2003	Direct Push

WI Unique Well No.	DNR Well ID No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
			Feet MSL	Feet MSL	2.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane N, E S/C/N
SW 1/2 of NW 1/4 of Section 24, T 11 N, R 19 E
Lat ° ' "
Long ° ' "
Local Grid Location ☐ N Feet ☐ S ☐ E Feet ☐ W

Facility ID	County	County Code	Civil Town/City/ or Village
	Washington	67	West Bend

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	Pocket Penetrometer
1 SS	48 48		1	TOPSOIL Brown, fine to medium SAND and GRAVEL (fill)	GP			<1						
			2	Reddish brown, fine to medium SAND with trace gravel				<1						
			3											
2 SS	36 36		4		SP			<1						
			5											
			6											
			7					<1						
				End of soil boring at 7'										

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature

Firm KEY ENGINEERING GROUP, LTD.
W66 N215 COMMERCE CT. CEDARBURG, WI 53012
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ATTACHMENT 2

SEVERN

June 26, 2003

Mr. Chris King
Key Engineering
W66n215 Commerce Court
Cederburg, WI 53012

Re: Laboratory Project No. 23000
Case No. 23000; SDG: 94201

Dear Mr. King:

Enclosed are the analytical results of samples received intact by Severn Trent Laboratories on June 13, 2003. Laboratory numbers have been assigned and designated as follows:

Lab ID	Client Sample ID	Sample Date	Sample Matrix
	Received: 06/13/03 ETR No: 94201		
530979	GP-23	06/10/03	Air
530980	GP-24	06/10/03	Air
530981	GP-25	06/10/03	Air

Method TO15 – Volatile Organics:
Please note that no exceptions to the method prescribed quality control criteria were observed during the analyses of the samples in this delivery group.

Client specified matrix spike/matrix spike duplicate samples were not analyzed or requested with the above samples. However, routine method quality control analyses were performed.

If there are any questions regarding this submittal, please contact Ron Pentkowski at (802) 655-1203.

This report shall not be reproduced, except in full, without the written approval of the laboratory. This report is sequentially numbered starting with page 0001 and ending with page 0024.

Severn Trent Laboratories, Inc.
STL Burlington ◦ 208 South Park Drive, Suite 1, Colchester, VT 05446
Tel 802 655 1203 Fax 802 655 1248 ◦ www.stl-inc.com

I certify that this package is in compliance with the NELAC requirements, both technically and for completeness, for other than the conditions detailed above. The release of the data contained in this hardcopy data package has been authorized by the Laboratory Director or his designee, as verified by the following signature.

Sincerely,

Michael F. Wheeler, Ph.D.
Laboratory Director

Enclosure

TO-14/15
Result Summary

CLIENT SAMPLE NO.

GP-23

Lab Name: STL Burlington

SDG Number: 94201

Case Number:

Sample Matrix: Air

Lab Sample No.: 530979

Date Analyzed: 06/20/2003

Date Received: 06/13/2003

Target Compound	CAS Number	Results in ppbv	Q	RL in ppbv	Results in ug/m3	Q	RL in ug/m3
Vinyl Chloride	75-01-4	0.50	U	0.50	1.3	U	1.3
1,1-Dichloroethene	75-35-4	0.50	U	0.50	2.0	U	2.0
cis-1,2-Dichloroethene	156-59-2	0.50	U	0.50	2.0	U	2.0
1,1,1-Trichloroethane	71-55-6	0.50	U	0.50	2.7	U	2.7
Trichloroethene	79-01-6	0.50	U	0.50	2.7	U	2.7
Tetrachloroethene	127-18-4	0.50	U	0.50	3.4	U	3.4
trans-1,2-Dichloroethene	156-60-5	0.50	U	0.50	2.0	U	2.0

TO-14/15
Result Summary

CLIENT SAMPLE NO.

GP-24

Lab Name: STL Burlington

SDG Number: 94201

Case Number:

Sample Matrix: Air

Lab Sample No.: 530980

Date Analyzed: 06/20/2003

Date Received: 06/13/2003

Target Compound	CAS Number	Results in ppbv	Q	RL in ppbv	Results in ug/m3	Q	RL in ug/m3
Vinyl Chloride	75-01-4	0.50	U	0.50	1.3	U	1.3
1,1-Dichloroethene	75-35-4	0.50	U	0.50	2.0	U	2.0
cis-1,2-Dichloroethene	156-59-2	0.50	U	0.50	2.0	U	2.0
1,1,1-Trichloroethane	71-55-6	0.50	U	0.50	2.7	U	2.7
Trichloroethene	79-01-6	0.73		0.50	3.9		2.7
Tetrachloroethene	127-18-4	1.1		0.50	7.5		3.4
trans-1,2-Dichloroethene	156-60-5	0.50	U	0.50	2.0	U	2.0

TO-14/15
Result Summary

CLIENT SAMPLE NO.

GP-25

Lab Name: STL Burlington

SDG Number: 94201

Case Number:

Sample Matrix: Air

Lab Sample No.: 530981

Date Analyzed: 06/20/2003

Date Received: 06/13/2003

Target Compound	CAS Number	Results in ppbv	Q	RL in ppbv	Results in ug/m3	Q	RL in ug/m3
Vinyl Chloride	75-01-4	0.50	U	0.50	1.3	U	1.3
1,1-Dichloroethene	75-35-4	0.50	U	0.50	2.0	U	2.0
cis-1,2-Dichloroethene	156-59-2	0.50	U	0.50	2.0	U	2.0
1,1,1-Trichloroethane	71-55-6	0.50	U	0.50	2.7	U	2.7
Trichloroethene	79-01-6	0.80		0.50	4.3		2.7
Tetrachloroethene	127-18-4	1.2		0.50	8.1		3.4
trans-1,2-Dichloroethene	156-60-5	0.50	U	0.50	2.0	U	2.0

TO-14/15
Result Summary

CLIENT SAMPLE NO.

ABLKE1

Lab Name: STL Burlington

SDG Number: 94201

Case Number:

Sample Matrix: AIR

Lab Sample No.: ABLKE1

Date Analyzed: 06/19/2003

Date Received: / /

Target Compound	CAS Number	Results in ppbv	Q	RL in ppbv	Results in ug/m3	Q	RL in ug/m3
Vinyl Chloride	75-01-4	0.50	U	0.50	1.3	U	1.3
1,1-Dichloroethene	75-35-4	0.50	U	0.50	2.0	U	2.0
cis-1,2-Dichloroethene	156-59-2	0.50	U	0.50	2.0	U	2.0
1,1,1-Trichloroethane	71-55-6	0.50	U	0.50	2.7	U	2.7
Trichloroethene	79-01-6	0.50	U	0.50	2.7	U	2.7
Tetrachloroethene	127-18-4	0.50	U	0.50	3.4	U	3.4
trans-1,2-Dichloroethene	156-60-5	0.50	U	0.50	2.0	U	2.0

TO-14/15
Result Summary

CLIENT SAMPLE NO.

E1LCS

Lab Name: STL Burlington

SDG Number: 94201

Case Number:

Sample Matrix: AIR

Lab Sample No.: E1LCS

Date Analyzed: 06/19/2003

Date Received: / /

Target Compound	CAS Number	Results in ppbv	Q	RL in ppbv	Results in ug/m3	Q	RL in ug/m3
Vinyl Chloride	75-01-4	8.9		0.50	23		1.3
1,1-Dichloroethene	75-35-4	9.1		0.50	36		2.0
cis-1,2-Dichloroethene	156-59-2	9.1		0.50	36		2.0
1,1,1-Trichloroethane	71-55-6	9.3		0.50	51		2.7
Trichloroethene	79-01-6	9.1		0.50	49		2.7
Tetrachloroethene	127-18-4	9.6		0.50	65		3.4
trans-1,2-Dichloroethene	156-60-5	8.9		0.50	35		2.0

TO-14/15
Result Summary

CLIENT SAMPLE NO.

E1LCSD

Lab Name: STL Burlington

SDG Number: 94201

Case Number:

Sample Matrix: AIR

Lab Sample No.: E1LCSD

Date Analyzed: 06/19/2003

Date Received: / /

Target Compound	CAS Number	Results in ppbv	Q	RL in ppbv	Results in ug/m3	Q	RL in ug/m3
Vinyl Chloride	75-01-4	8.4		0.50	21		1.3
1,1-Dichloroethene	75-35-4	8.8		0.50	35		2.0
cis-1,2-Dichloroethene	156-59-2	8.9		0.50	35		2.0
1,1,1-Trichloroethane	71-55-6	9.4		0.50	51		2.7
Trichloroethene	79-01-6	9.1		0.50	49		2.7
Tetrachloroethene	127-18-4	9.6		0.50	65		3.4
trans-1,2-Dichloroethene	156-60-5	8.6		0.50	34		2.0

SEVERN TRENT STL

The following Qualifiers may be used when reporting any Organic parameters analyzed by Gas Chromatography/mass Spectometry (GCMS). Any additional qualifiers used in the reports will be described in the case narrative. These flags are based on the EPA Contract Laboratory Program statement of work.

GC/MS Qualifiers

A- The reported Tentatively Identified Compound (TIC) is a suspected Aldol-condensation product.

B- The reported analyte was detected in the associated method blank as well as the sample.

D - This flag identifies all compounds identified in an analysis at a secondary dilution factor. This flag alerts data users that any discrepancies between the concentrations reported for the dilutions may be due to dilution of the sample or extract. It additionally indicates that spike recoveries may have been diluted below quantifiable levels.

E- Compound quantitation is above the instrument's calibration range for this analysis.

J - Indicates an estimated value. This flag is used when the result is less than the reporting limit, but > ½ reporting limit.

U- Indicates compound was analyzed for but not detected above the reporting limit.

N- Indicates presumptive evidence of a compound. Used for TICs where the identification is based on a mass spectral library search.

X,Y,Z - Laboratory defined flags. These flags must be fully described, and such description attached to the Sample Data Summary Package and the case Narrative. Begin by using "X" and go on to "Y" as necessary. These flags may also be used to combine several flags, as needed.

FORM 1 KEYENG SAMPLE NO.

VOLATILE ORGANICS ANALYSIS DATA SHEET

GP-23

Lab Name: STL BURLINGTON Contract: 23000

Lab Code: STLVT Case No.: 23000 SAS No.: SDG No.: 94201

Matrix: (soil/water) AIR Lab Sample ID: 530979

Sample wt/vol: 200.0 (g/mL) ML Lab File ID: 530979

Level: (low/med) LOW Date Received: 06/13/03

% Moisture: not dec. _____ Date Analyzed: 06/20/03

GC Column: RTX-624 ID: 0.32 (mm) Dilution Factor: 1.0

Soil Extract Volume:_____(uL) Soil Aliquot Volume: _____(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) PPBV	Q
75-01-4	Vinyl Chloride	0.50	U
75-35-4	1,1-Dichloroethene	0.50	U
156-59-2	cis-1,2-Dichloroethene	0.50	U
71-55-6	1,1,1-Trichloroethane	0.50	U
79-01-6	Trichloroethene	0.50	U
127-18-4	Tetrachloroethene	0.50	U
156-60-5	trans-1,2-Dichloroethene	0.50	U

FORM 1
VOLATILE ORGANICS ANALYSIS DATA SHEET

KEYENG SAMPLE NO.

GP-24

Lab Name: STL BURLINGTON Contract: 23000

Lab Code: STLVT Case No.: 23000 SAS No.: SDG No.: 94201

Matrix: (soil/water) AIR Lab Sample ID: 530980

Sample wt/vol: 200.0 (g/mL) ML Lab File ID: 530980

Level: (low/med) LOW Date Received: 06/13/03

% Moisture: not dec. _____ Date Analyzed: 06/20/03

GC Column: RTX-624 ID: 0.32 (mm) Dilution Factor: 1.0

Soil Extract Volume:_____(uL) Soil Aliquot Volume: _____(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) PPBV	Q
75-01-4	Vinyl Chloride	0.50	U
75-35-4	1,1-Dichloroethene	0.50	U
156-59-2	cis-1,2-Dichloroethene	0.50	U
71-55-6	1,1,1-Trichloroethane	0.50	U
79-01-6	Trichloroethene	0.73	
127-18-4	Tetrachloroethene	1.1	
156-60-5	trans-1,2-Dichloroethene	0.50	U

FORM 1
VOLATILE ORGANICS ANALYSIS DATA SHEET

KEYENG SAMPLE NO.

GP-25

Lab Name: STL BURLINGTON Contract: 23000

Lab Code: STLVT Case No.: 23000 SAS No.: SDG No.: 94201

Matrix: (soil/water) AIR Lab Sample ID: 530981

Sample wt/vol: 200.0 (g/mL) ML Lab File ID: 530981

Level: (low/med) LOW Date Received: 06/13/03

% Moisture: not dec. _____ Date Analyzed: 06/20/03

GC Column: RTX-624 ID: 0.32 (mm) Dilution Factor: 1.0

Soil Extract Volume:_____(uL) Soil Aliquot Volume: _____(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) PPBV	Q
75-01-4	Vinyl Chloride	0.50	U
75-35-4	1,1-Dichloroethene	0.50	U
156-59-2	cis-1,2-Dichloroethene	0.50	U
71-55-6	1,1,1-Trichloroethane	0.50	U
79-01-6	Trichloroethene	0.80	
127-18-4	Tetrachloroethene	1.2	
156-60-5	trans-1,2-Dichloroethene	0.50	U

FORM 1
VOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

ABLKE1

Lab Name: STL BURLINGTON Contract: 23000

Lab Code: STLVT Case No.: 23000 SAS No.: SDG No.: 94201

Matrix: (soil/water) AIR Lab Sample ID: ABLKE1

Sample wt/vol: 200.0 (g/mL) ML Lab File ID: DCB001B

Level: (low/med) LOW Date Received: _____

% Moisture: not dec. _____ Date Analyzed: 06/19/03

GC Column: RTX-624 ID: 0.32 (mm) Dilution Factor: 1.0

Soil Extract Volume:_____(uL) Soil Aliquot Volume: _____(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) PPBV	Q
75-01-4	Vinyl Chloride	0.50	U
75-35-4	1,1-Dichloroethene	0.50	U
156-59-2	cis-1,2-Dichloroethene	0.50	U
71-55-6	1,1,1-Trichloroethane	0.50	U
79-01-6	Trichloroethene	0.50	U
127-18-4	Tetrachloroethene	0.50	U
156-60-5	trans-1,2-Dichloroethene	0.50	U

FORM 1
VOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

E1LCS

Lab Name: STL BURLINGTON Contract: 23000

Lab Code: STLVT Case No.: 23000 SAS No.: SDG No.: 94201

Matrix: (soil/water) AIR Lab Sample ID: E1LCS

Sample wt/vol: 200.0 (g/mL) ML Lab File ID: DC010BQ

Level: (low/med) LOW Date Received: _____

% Moisture: not dec. _____ Date Analyzed: 06/19/03

GC Column: RTX-624 ID: 0.32 (mm) Dilution Factor: 1.0

Soil Extract Volume:_____(uL) Soil Aliquot Volume: _____(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) PPBV	Q
75-01-4	Vinyl Chloride	8.9	
75-35-4	1,1-Dichloroethene	9.1	
156-59-2	cis-1,2-Dichloroethene	9.1	
71-55-6	1,1,1-Trichloroethane	9.3	
79-01-6	Trichloroethene	9.1	
127-18-4	Tetrachloroethene	9.6	
156-60-5	trans-1,2-Dichloroethene	8.9	

FORM 1
VOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

E1LCSD

Lab Name: STL BURLINGTON Contract: 23000

Lab Code: STLVT Case No.: 23000 SAS No.: SDG No.: 94201

Matrix: (soil/water) AIR Lab Sample ID: E1LCSD

Sample wt/vol: 200.0 (g/mL) ML Lab File ID: DC011BQD

Level: (low/med) LOW Date Received: _____

% Moisture: not dec. _____ Date Analyzed: 06/19/03

GC Column: RTX-624 ID: 0.32 (mm) Dilution Factor: 1.0

Soil Extract Volume:_____(uL) Soil Aliquot Volume: _____(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) PPBV	Q
75-01-4	Vinyl Chloride	8.4	
75-35-4	1,1-Dichloroethene	8.8	
156-59-2	cis-1,2-Dichloroethene	8.9	
71-55-6	1,1,1-Trichloroethane	9.4	
79-01-6	Trichloroethene	9.1	
127-18-4	Tetrachloroethene	9.6	
156-60-5	trans-1,2-Dichloroethene	8.6	

FORM 3
AIR VOLATILE LAB CONTROL SAMPLE

Lab Name: STL BURLINGTON Contract: 23000

Lab Code: STLVT Case No.: 23000 SAS No.: SDG No.: 94201

Matrix Spike - Sample No.: E1LCS

COMPOUND	SPIKE ADDED (ppbv)	SAMPLE CONCENTRATION (ug/L)	LCS CONCENTRATION (ppbv)	LCS % REC #	QC. LIMITS REC.
Vinyl Chloride	10		8.9	89	70-130
1,1-Dichloroethene	10		9.1	91	70-130
cis-1,2-Dichloroethene	10		9.1	91	70-130
1,1,1-Trichloroethane	10		9.3	93	70-130
Trichloroethene	10		9.1	91	70-130
Tetrachloroethene	10		9.6	96	70-130
trans-1,2-Dichloroethen	10		8.9	89	70-130

COMPOUND	SPIKE ADDED (ppbv)	LCSD CONCENTRATION (ppbv)	LCSD % REC #	% RPD #	QC LIMITS RPD	QC LIMITS REC.
Vinyl Chloride	10	8.4	84	6	40	70-130
1,1-Dichloroethene	10	8.8	88	3	40	70-130
cis-1,2-Dichloroethene	10	8.9	89	2	40	70-130
1,1,1-Trichloroethane	10	9.4	94	1	40	70-130
Trichloroethene	10	9.1	91	0	40	70-130
Tetrachloroethene	10	9.6	96	0	40	70-130
trans-1,2-Dichloroethen	10	8.6	86	3	40	70-130

Column to be used to flag recovery and RPD values with an asterisk

* Values outside of QC limits

RPD: 0 out of 7 outside limits
Spike Recovery: 0 out of 14 outside limits

COMMENTS: _____

FORM 4
VOLATILE METHOD BLANK SUMMARY

CLIENT SAMPLE NO.

ABLKE1

Lab Name: STL BURLINGTON Contract: 23000

Lab Code: STLVT Case No.: 23000 SAS No.: SDG No.: 94201

Lab File ID: DCB001B Lab Sample ID: ABLKE1

Date Analyzed: 06/19/03 Time Analyzed: 1604

GC Column: RTX-624 ID: 0.32 (mm) Heated Purge: (Y/N) N

Instrument ID: V

THIS METHOD BLANK APPLIES TO THE FOLLOWING SAMPLES, MS and MSD:

	SAMPLE NO.	LAB SAMPLE ID	LAB FILE ID	TIME ANALYZED
01	E1LCS	E1LCS	DC010BQ	1429
02	E1LCSD	E1LCSD	DC011BQD	1514
03	GP-23	530979	530979	0009
04	GP-24	530980	530980	0053
05	GP-25	530981	530981	0137
06				
07				
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30				

COMMENTS:

SEVERN TRENT STL

SEVERN TRENT LABORATORIES, INC.

STL Burlington
208 South Park Drive, Suite 1
Colchester, VT 05446 Tel 802 655 1203

CHAIN OF CUSTODY RECORD

Report to:	Invoice to:
Company:	Company:
Address:	Address:
Contact:	Contact:
Phone:	Phone:
Fax:	Fax:
Contract/ Quote:	

ANALYSIS REQUESTED

Lab Use Only
Due Date:

Temp. of coolers when received (C°):

1	2	3	4	5

Custody Seal N / Y
Intact N / Y

Screened For Radioactivity ☐

Sampler's Name

Sampler's Signature

Proj. No.

Project Name

No/Type of Containers²

Matrix¹	Date	Time	Comp	Grab	Identifying Marks of Sample(s)	VOA	A/G 1 Lt.	250 ml	P/O	Lab/Sample ID (Lab Use Only)

Relinquished by: (Signature)	Date	Time	Received by: (Signature	Date	Time
Relinquished by: (Signature)	Date	Time	Received by: (Signature	Date	Time
Relinquished by: (Signature)	Date	Time	Received by: (Signature	Date	Time

Remarks

Client's delivery of samples constitutes acceptance of Severn Trent Laboratories terms and conditions contained in the Price Schedule.

¹Matrix WW - Wastewater W - Water S - Soil L - Liquid A - Air bag C - Charcoal Tube SL - Sludge O - Oil

²Container VOA - 40 ml vial A/G - Amber / Or Glass 1 Liter 250 ml - Glass wide mouth P/O - Plastic or other _____

STL cannot accept verbal changes.
Please Fax written changes to
(802) 655-1248

STL8234-200 (12/02)

0018

STL-Burlington
Air Canister Certification Checklist

Batch ID: VCXK 4/14/03
Batch Canister: 6206
Analyst: WRJ

_____ Runlog Pages

_____ BFB Report

_____ CCV Report

_____ Blank Report

_____ Clean Can Report

_____ Dirty Can Report

Certified Canisters:

1. 6254
2. 6206
3. 6329
4. 6266 ✓
5. 6301
6. 6327
7. 6249
8. 6212

Comments:

_____

_____

_____

STL Burlington

TARGET COMPOUNDS

Client Name:
Lab Smp Id: 6206
Sample Location:
Sample Date:
Sample Matrix: AIR
Analysis Type: VOA
Data Type: MS DATA
Misc Info: 6206;0414Y3;.4;500MLS

Client SDG: vcxkto15

Sample Point:
Date Received:
Quant Type: ISTD
Level: LOW
Operator: WRD

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/KG) ppbv	Q
75-71-8	Dichlorodifluoromethane	0.20	U
76-14-2	1,2-Dichlorotetrafluoroethan	0.20	U
74-87-3	Chloromethane	0.20	U
75-01-4	Vinyl Chloride	0.20	U
106-99-0	1,3-Butadiene	0.20	U
74-83-9	Bromomethane	0.20	U
75-00-3	Chloroethane	0.20	U
593-60-2	Bromoethene	0.20	U
75-69-4	Trichlorofluoromethane	0.20	U
76-13-1	Freon TF	0.20	U
75-35-4	1,1-Dichloroethene	0.20	U
67-64-1	Acetone	2.0	U
75-15-0	Carbon Disulfide	0.20	U
67-63-0	Isopropyl Alcohol	2.0	U
107-05-1	3-Chloropropene	0.20	U
75-09-2	Methylene Chloride	0.20	U
1634-04-4	Methyl tert-Butyl Ether	0.20	U
156-60-5	trans-1,2-Dichloroethene	0.20	U
110-54-3	n-Hexane	0.20	U
75-34-3	1,1-Dichloroethane	0.20	U
156-59-2	cis-1,2-Dichloroethene	0.20	U
78-93-3	Methyl Ethyl Ketone	0.20	U
67-66-3	Chloroform	0.20	U
109-99-9	Tetrahydrofuran	2.0	U
71-55-6	1,1,1-Trichloroethane	0.20	U
110-82-7	Cyclohexane	0.20	U
56-23-5	Carbon Tetrachloride	0.20	U
540-84-1	2,2,4-Trimethylpentane	0.20	U
71-43-2	Benzene	0.20	U
107-06-2	1,2-Dichloroethane	0.20	U
142-82-5	n-Heptane	0.20	U
79-01-6	Trichloroethene	0.20	U
80-62-6	Methyl Methacrylate	0.20	U
78-87-5	1,2-Dichloropropane	0.20	U
123-91-1	1,4-Dioxane	2.0	U

STL Burlington

TARGET COMPOUNDS

Client Name:
Client SDG: vcxkto15
Lab Smp Id: 6206
Sample Location:
Sample Point:
Sample Date:
Date Received:
Sample Matrix: AIR
Quant Type: ISTD
Analysis Type: VOA
Level: LOW
Data Type: MS DATA
Operator: WRD
Misc Info: 6206;0414Y3;.4;500MLS

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/KG) ppbv	Q
75-27-4	Bromodichloromethane	0.20	U
10061-01-5	cis-1,3-Dichloropropene	0.20	U
108-10-1	Methyl Isobutyl Ketone	0.20	U
108-88-3	Toluene	0.20	U
10061-02-6	trans-1,3-Dichloropropene	0.20	U
79-00-5	1,1,2-Trichloroethane	0.20	U
127-18-4	Tetrachloroethene	0.20	U
591-78-6	Methyl Butyl Ketone	0.20	U
124-48-1	Dibromochloromethane	0.20	U
106-93-4	1,2-Dibromoethane	0.20	U
108-90-7	Chlorobenzene	0.20	U
100-41-4	Ethylbenzene	0.20	U
1330-20-7	Xylene (m,p)	0.20	U
95-47-6	Xylene (o)	0.20	U
100-42-5	Styrene	0.20	U
75-25-2	Bromoform	0.20	U
79-34-5	1,1,2,2-Tetrachloroethane	0.20	U
622-96-8	4-Ethyltoluene	0.20	U
108-67-8	1,3,5-Trimethylbenzene	0.20	U
95-49-8	2-Chlorotoluene	0.20	U
95-63-6	1,2,4-Trimethylbenzene	0.20	U
541-73-1	1,3-Dichlorobenzene	0.20	U
106-46-7	1,4-Dichlorobenzene	0.20	U
95-50-1	1,2-Dichlorobenzene	0.20	U
120-82-1	1,2,4-Trichlorobenzene	0.20	U
87-68-3	Hexachlorobutadiene	0.20	U

STL-Burlington
Air Canister Certification Checklist

Batch ID: VCX1 4/11/03
Batch Canister: 6406
Analyst: WW

_____ Runlog Pages

_____ BFB Report

_____ CCV Report

_____ Blank Report

_____ Clean Can Report

_____ Dirty Can Report

Certified Canisters:

1. 6409
2. 6215 ✓
3. 6247
4. 6435
5. 6221 ✓
6. 6356
7. 6420
8. 6406

Comments:

_____

_____

_____

STL Burlington

TARGET COMPOUNDS

Client Name: Client SDG: vcxito15
Lab Smp Id: 6406
Sample Location: Sample Point:
Sample Date: Date Received:
Sample Matrix: AIR Quant Type: ISTD
Analysis Type: VOA Level: LOW
Data Type: MS DATA Operator: WRD
Misc Info: 6406;0411Y2;.4;500MLS

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/KG) ppbv	Q
75-71-8	Dichlorodifluoromethane	0.20	U
76-14-2	1,2-Dichlorotetrafluoroethan	0.20	U
74-87-3	Chloromethane	0.20	U
75-01-4	Vinyl Chloride	0.20	U
106-99-0	1,3-Butadiene	0.20	U
74-83-9	Bromomethane	0.20	U
75-00-3	Chloroethane	0.20	U
593-60-2	Bromoethene	0.20	U
75-69-4	Trichlorofluoromethane	0.20	U
76-13-1	Freon TF	0.20	U
75-35-4	1,1-Dichloroethene	0.20	U
67-64-1	Acetone	2.0	U
75-15-0	Carbon Disulfide	0.20	U
67-63-0	Isopropyl Alcohol	2.0	U
107-05-1	3-Chloropropene	0.20	U
75-09-2	Methylene Chloride	0.20	U
1634-04-4	Methyl tert-Butyl Ether	0.20	U
156-60-5	trans-1,2-Dichloroethene	0.20	U
110-54-3	n-Hexane	0.20	U
75-34-3	1,1-Dichloroethane	0.20	U
156-59-2	cis-1,2-Dichloroethene	0.20	U
78-93-3	Methyl Ethyl Ketone	0.20	U
67-66-3	Chloroform	0.20	U
109-99-9	Tetrahydrofuran	2.0	U
71-55-6	1,1,1-Trichloroethane	0.20	U
110-82-7	Cyclohexane	0.20	U
56-23-5	Carbon Tetrachloride	0.20	U
540-84-1	2,2,4-Trimethylpentane	0.20	U
71-43-2	Benzene	0.20	U
107-06-2	1,2-Dichloroethane	0.20	U
142-82-5	n-Heptane	0.20	U
79-01-6	Trichloroethene	0.20	U
80-62-6	Methyl Methacrylate	0.20	U
78-87-5	1,2-Dichloropropane	0.20	U
123-91-1	1,4-Dioxane	2.0	U

STL Burlington

TARGET COMPOUNDS

Client Name:
Lab Smp Id: 6406
Sample Location:
Sample Date:
Sample Matrix: AIR
Analysis Type: VOA
Data Type: MS DATA
Misc Info: 6406;0411Y2;.4;500MLS

Client SDG: vcxito15
Sample Point:
Date Received:
Quant Type: ISTD
Level: LOW
Operator: WRD

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/KG) ppbv	Q
75-27-4	Bromodichloromethane	0.20	U
10061-01-5	cis-1,3-Dichloropropene	0.20	U
108-10-1	Methyl Isobutyl Ketone	0.20	U
108-88-3	Toluene	0.20	U
10061-02-6	trans-1,3-Dichloropropene	0.20	U
79-00-5	1,1,2-Trichloroethane	0.20	U
127-18-4	Tetrachloroethene	0.20	U
591-78-6	Methyl Butyl Ketone	0.20	U
124-48-1	Dibromochloromethane	0.20	U
106-93-4	1,2-Dibromoethane	0.20	U
108-90-7	Chlorobenzene	0.20	U
100-41-4	Ethylbenzene	0.20	U
1330-20-7	Xylene (m,p)	0.20	U
95-47-6	Xylene (o)	0.20	U
100-42-5	Styrene	0.20	U
75-25-2	Bromoform	0.20	U
79-34-5	1,1,2,2-Tetrachloroethane	0.20	U
622-96-8	4-Ethyltoluene	0.20	U
108-67-8	1,3,5-Trimethylbenzene	0.20	U
95-49-8	2-Chlorotoluene	0.20	U
95-63-6	1,2,4-Trimethylbenzene	0.20	U
541-73-1	1,3-Dichlorobenzene	0.20	U
106-46-7	1,4-Dichlorobenzene	0.20	U
95-50-1	1,2-Dichlorobenzene	0.20	U
120-82-1	1,2,4-Trichlorobenzene	0.20	U
87-68-3	Hexachlorobutadiene	0.20	U

ATTACHMENT 3

Decorah Shopping Center Annex
PCE Soil Vapor Analysis
GP-23
DATA ENTRY SHEET

SG-SCREEN
Version 2.0; 04/0

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
127184	1.70E+00			Tetrachloroethylene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (°C)	ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vadose zone soil vapor permeability, k_v (cm^2)
200	274.32	10	SL		

MORE ↓

ENTER Vandose zone SCS soil type (Lookup Soil Parameters)	ENTER Vadose zone soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone soil water-filled porosity, θ_w^V (cm^3/cm^3)	ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
SL	1.62	1.449	0.103	

MORE ↓

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)
70	30	30	350

END

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm \cdot m^3/mol$)	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)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)	Molecular weight, MW (g/mol)
7.20E-02	8.20E-06	1.84E-02	25	8,288	394.40	620.20	3.0E-06	0.0E+00	165.83

END

INTERMEDIATE CALCULATIONS SHEET

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^V (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone 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)
74.32	1.346	0.045	5.93E-09	0.977	5.79E-09	4,000	1.70E+00	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} ($atm\cdot m^3/mol$)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm·s)	Vadose zone effective diffusion coefficient, D^{eff}_v (cm^2/s)	Diffusion path length, L_d (cm)
1.80E+06	2.22E-04	200	9,553	7.81E-03	3.36E-01	1.75E-04	9.22E-02	74.32

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., $C_{building}$ ($\mu g/m^3$)
200	1.70E+00	0.10	4.00E+00	9.22E-02	4.00E+02	2.96E+00	2.37E-04	4.03E-04

Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
3.0E-06	NA

END

RESULTS SHEET

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
5.0E-10	NA

MESSAGE SUMMARY BELOW:

END

Decorah Shopping Center Annex
TCE Soil Vapor Analysis
GP-23
DATA ENTRY SHEET

SG-SCREEN
Version 2.0; 04/0

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
79016	1.35E+00			Trichloroethylene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (°C)	ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vadose zone soil vapor permeability, k_v (cm^2)
200	274.32	10	SL		

MORE ↓

ENTER Vandose zone SCS soil type (Lookup Soil Parameters)	ENTER Vadose zone soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone soil water-filled porosity, θ_w^V (cm^3/cm^3)	ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
SL	1.62	1.449	0.103	

MORE ↓

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)
70	30	30	350

END

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm \cdot m^3/mol$)	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)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)	Molecular weight, MW (g/mol)
7.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	1.1E-04	4.0E-02	131.39

END

INTERMEDIATE CALCULATIONS SHEET

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^v (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone 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)
74.32	1.346	0.045	5.93E-09	0.977	5.79E-09	4,000	1.35E+00	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)	Vadose zone effective diffusion coefficient, D^{eff}_v (cm^2/s)	Diffusion path length, L_d (cm)
1.80E+06	2.22E-04	200	8,557	4.78E-03	2.06E-01	1.75E-04	1.01E-01	74.32

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., $C_{building}$ ($\mu g/m^3$)
200	1.35E+00	0.10	4.00E+00	1.01E-01	4.00E+02	2.69E+00	2.50E-04	3.38E-04

Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
1.1E-04	4.0E-02

END

RESULTS SHEET

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
1.5E-08	8.1E-06

MESSAGE SUMMARY BELOW:

MESSAGE: Risk/HQ or risk-based soil concentration is based on a route-to-route extrapolation.

END

Decorah Shopping Center Annex
PCE Soil Vapor Analysis
GP-24
DATA ENTRY SHEET

SG-SCREEN
ersion 2.0; 04/0

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
127184	7.50E+00			Tetrachloroethylene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (°C)	ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vadose zone soil vapor permeability, k_v (cm^2)
200	213.36	10	SL		

MORE ↓

ENTER Vandose zone SCS soil type (Lookup Soil Parameters)	ENTER Vadose zone soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone soil water-filled porosity, θ_w^V (cm^3/cm^3)	ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
SL	1.62	1.449	0.103	

MORE ↓

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)
70	30	30	350

END

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	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)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)	Molecular weight, MW (g/mol)
7.20E-02	8.20E-06	1.84E-02	25	8,288	394.40	620.20	3.0E-06	0.0E+00	165.83

END

INTERMEDIATE CALCULATIONS SHEET

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^V (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone 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)
13.36	1.346	0.045	5.93E-09	0.977	5.79E-09	4,000	7.50E+00	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} ($atm\cdot m^3/mol$)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm·s)	Vadose zone effective diffusion coefficient, D^{eff}_v (cm^2/s)	Diffusion path length, L_d (cm)
1.80E+06	2.22E-04	200	9,553	7.81E-03	3.36E-01	1.75E-04	9.22E-02	13.36

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') (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)
200	7.50E+00	0.10	4.00E+00	9.22E-02	4.00E+02	2.96E+00	2.38E-04	1.78E-03

Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
3.0E-06	NA

END

RESULTS SHEET

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
2.2E-09	NA

MESSAGE SUMMARY BELOW:

END

SG-SCREEN
Version 2.0; 04/0

Reset to Defaults

Decorah Shopping Center Annex
TCE Soil Vapor Analysis
GP-24
DATA ENTRY SHEET

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_R ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
79016	3.90E+00			Trichloroethylene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (°C)	ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vadose zone soil vapor permeability, k_v (cm^2)
200	213.36	10	SL		

MORE ↓

ENTER Vandose zone SCS soil type (Lookup Soil Parameters)	ENTER Vadose zone soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone soil water-filled porosity, θ_w^V (cm^3/cm^3)	ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
SL	1.62	1.449	0.103	

MORE ↓

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)
70	30	30	350

END

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm \cdot m^3/mol$)	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)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)	Molecular weight, MW (g/mol)
7.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	1.1E-04	4.0E-02	131.39

END

INTERMEDIATE CALCULATIONS SHEET

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^v (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone 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)
13.36	1.346	0.045	5.93E-09	0.977	5.79E-09	4,000	3.90E+00	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} ($atm\text{-}m^3/mol$)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_v (cm^2/s)	Diffusion path length, L_d (cm)
1.80E+06	2.22E-04	200	8,557	4.78E-03	2.06E-01	1.75E-04	1.01E-01	13.36

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., $C_{building}$ ($\mu g/m^3$)
200	3.90E+00	0.10	4.00E+00	1.01E-01	4.00E+02	2.69E+00	2.51E-04	9.78E-04

Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
1.1E-04	4.0E-02

END

RESULTS SHEET

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
4.4E-08	2.3E-05

MESSAGE SUMMARY BELOW:

MESSAGE: Risk/HQ or risk-based soil concentration is based on a route-to-route extrapolation.

END

Decorah Shopping Center Annex
PCE Soil Vapor Analysis
GP-25
DATA ENTRY SHEET

SG-SCREEN
Version 2.0; 04/0

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
127184	8.10E+00			Tetrachloroethylene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (°C)	ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vadose zone soil vapor permeability, k_v (cm^2)
200	213.36	10	SL		

MORE ↓

ENTER Vandose zone SCS soil type (Lookup Soil Parameters)	ENTER Vadose zone soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone soil water-filled porosity, θ_w^V (cm^3/cm^3)	ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
SL	1.62	1.449	0.103	

MORE ↓

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)
70	30	30	350

END

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	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)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)	Molecular weight, MW (g/mol)
7.20E-02	8.20E-06	1.84E-02	25	8,288	394.40	620.20	3.0E-06	0.0E+00	165.83

END

INTERMEDIATE CALCULATIONS SHEET

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^V (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone 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)
13.36	1.346	0.045	5.93E-09	0.977	5.79E-09	4,000	8.10E+00	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} ($atm \cdot m^3/mol$)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm·s)	Vadose zone effective diffusion coefficient, D^{eff}_V (cm^2/s)	Diffusion path length, L_d (cm)
1.80E+06	2.22E-04	200	9,553	7.81E-03	3.36E-01	1.75E-04	9.22E-02	13.36

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., $C_{building}$ ($\mu g/m^3$)
200	8.10E+00	0.10	4.00E+00	9.22E-02	4.00E+02	2.96E+00	2.38E-04	1.93E-03

Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
3.0E-06	NA

END

RESULTS SHEET

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
2.4E-09	NA

MESSAGE SUMMARY BELOW:

END

SG-SCREEN
ersion 2.0; 04/0

Reset to Defaults

Decorah Shopping Center Annex
TCE Soil Vapor Analysis
GP-25
DATA ENTRY SHEET

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
79016	4.30E+00			Trichloroethylene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (°C)	ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vadose zone soil vapor permeability, k_v (cm^2)
200	213.36	10	SL		

MORE ↓

ENTER Vandose zone SCS soil type (Lookup Soil Parameters)	ENTER Vadose zone soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone soil water-filled porosity, θ_w^V (cm^3/cm^3)	ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
SL	1.62	1.449	0.103	

MORE ↓

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)
70	30	30	350

END

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	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)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)	Molecular weight, MW (g/mol)
7.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	1.1E-04	4.0E-02	131.39

END

RESULTS SHEET

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
4.9E-08	2.6E-05

MESSAGE SUMMARY BELOW:

MESSAGE: Risk/HQ or risk-based soil concentration is based on a route-to-route extrapolation.

END