APPENDIX B-3-1
STATISTICS FOR SURFACE SOIL - EASTERN AREA
Clean Harbors Kansas, LLC- Wichita, Kansas

Vinyl chloride
All units in mg/kg.

General Statistics

Number of Valid Data	61
Number of Distinct Detected Data	7

Number of Detected Data	9
Number of Non-Detect Data	52
Percent Non-Detects	85.25%

Raw Statistics

Minimum Detected	0.0013
Maximum Detected	0.371
Mean of Detected	0.0495
SD of Detected	0.121
Minimum Non-Detect	0.0018
Maximum Non-Detect	0.35

Log-transformed Statistics

Minimum Detected	-6.645
Maximum Detected	-0.992
Mean of Detected	-4.813
SD of Detected	1.853
Minimum Non-Detect	-6.32
Maximum Non-Detect	-1.05

Note: Data have multiple DLs - Use of KM Method is recommended
For all methods (except KM, DL/2, and ROS Methods),
Observations < Largest ND are treated as NDs

Number treated as Non-Detect	60
Number treated as Detected	1
Single DL Non-Detect Percentage	98.36%

Warning: There are only 9 Detected Values in this data
Note: It should be noted that even though bootstrap may be performed on this data set the resulting calculations may not be reliable enough to draw conclusions
It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.455
5% Shapiro Wilk Critical Value	0.829

Data not Normal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	0.0145
SD	0.0543
95% DL/2 (t) UCL	0.0261
Maximum Likelihood Estimate(MLE) Method	N/A

MLE method failed to converge properly

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.888
5% Shapiro Wilk Critical Value	0.829

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	-5.72
SD	1.119
95% H-Stat (DL/2) UCL	0.00855
Log ROS Method	
Mean in Log Scale	-6.399
SD in Log Scale	1.11
Mean in Original Scale	0.00861
SD in Original Scale	0.0474
95% t UCL	0.0187
95% Percentile Bootstrap UCL	0.0206
95% BCA Bootstrap UCL	0.0282
95% H-UCL	0.00427

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	0.32
Theta Star	0.155
nu star	5.758
A-D Test Statistic	1.026
5% A-D Critical Value	0.795
K-S Test Statistic	0.795
5% K-S Critical Value	0.299

Data follow Appr. Gamma Distribution at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	0.000001
Maximum	0.371
Mean	0.00837
Median	0.000001
SD	0.0477
k star	0.116
Theta star	0.0719
Nu star	14.2
AppChi2	6.709
95% Gamma Approximate UCL (Use when n >= 40)	0.0177
95% Adjusted Gamma UCL (Use when n < 40)	0.0181

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only
Data Follow Appr. Gamma Distribution at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.00861
SD	0.047
SE of Mean	0.00638
95% KM (t) UCL	0.0193
95% KM (z) UCL	0.0191
95% KM (jackknife) UCL	0.0188
95% KM (bootstrap t) UCL	0.118
95% KM (BCA) UCL	0.0209
95% KM (Percentile Bootstrap) UCL	0.0207
95% KM (Chebyshev) UCL	0.0364
97.5% KM (Chebyshev) UCL	0.0485
99% KM (Chebyshev) UCL	0.0721

Potential UCLs to Use

95% KM (t) UCL	0.0193

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

APPENDIX B-3-1
STATISTICS FOR SURFACE SOIL - EASTERN AREA
Clean Harbors Kansas, LLC- Wichita, Kansas

Benzo(a)pyrene
All units in mg/kg.

General Statistics

Number of Valid Data	34	Number of Detected Data	2
Number of Distinct Detected Data	2	Number of Non-Detect Data	32
		Percent Non-Detects	94.12%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.0455	Minimum Detected	-3.09
Maximum Detected	0.141	Maximum Detected	-1.959
Mean of Detected	0.0933	Mean of Detected	-2.525
SD of Detected	0.0675	SD of Detected	0.8
Minimum Non-Detect	0.16	Minimum Non-Detect	-1.833
Maximum Non-Detect	0.22	Maximum Non-Detect	-1.514

Note: Data have multiple DLs - Use of KM Method is recommended
For all methods (except KM, DL/2, and ROS Methods),
Observations < Largest ND are treated as NDs

Number treated as Non-Detect	34
Number treated as Detected	0
Single DL Non-Detect Percentage	100.00%

Warning: Data set has only 2 Distinct Detected Values.
This may not be adequate enough to compute meaningful and reliable test statistics and estimates.
The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).
Unless Data Quality Objectives (DQOs) have been met, it is suggested to collect additional observations.
The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.
Those methods will return a 'N/A' value on your output display!
It is necessary to have 4 or more Distinct Values for bootstrap methods.
However, results obtained using 4 to 9 distinct values may not be reliable.
It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	N/A
5% Shapiro Wilk Critical Value	N/A
Data not Normal at 5% Significance Level	
Assuming Normal Distribution	
DL/2 Substitution Method	
Mean	0.0878
SD	0.0139
95% DL/2 (t) UCL	0.0919
Maximum Likelihood Estimate(MLE) Method	N/A
MLE method failed to converge properly	

Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	N/A
5% Shapiro Wilk Critical Value	N/A
Data not Lognormal at 5% Significance Level	
Assuming Lognormal Distribution	
DL/2 Substitution Method	
Mean	-2.444
SD	0.161
95% H-Stat (DL/2) UCL	0.0923
Log ROS Method	
Mean in Log Scale	N/A
SD in Log Scale	N/A
Mean in Original Scale	N/A
SD in Original Scale	N/A
95% t UCL	N/A
95% Percentile Bootstrap UCL	N/A
95% BCA Bootstrap UCL	N/A
95% H-UCL	N/A

Gamma Distribution Test with Detected Values Only	
k star (bias corrected)	N/A
Theta Star	N/A
nu star	N/A
A-D Test Statistic	N/A
5% A-D Critical Value	N/A
K-S Test Statistic	N/A
5% K-S Critical Value	N/A
Data not Gamma Distributed at 5% Significance Level	
Assuming Gamma Distribution	
Gamma ROS Statistics using Extrapolated Data	
Minimum	N/A
Maximum	N/A
Mean	N/A
Median	N/A
SD	N/A
k star	N/A
Theta star	N/A
Nu star	N/A
AppChi2	N/A
95% Gamma Approximate UCL (Use when n >= 40)	N/A
95% Adjusted Gamma UCL (Use when n < 40)	N/A

Data Distribution Test with Detected Values Only	
Data do not follow a Discernable Distribution (0.05)	
Nonparametric Statistics	
Kaplan-Meier (KM) Method	
Mean	0.0933
SD	0.0478
SE of Mean	0.0478
95% KM (t) UCL	0.174
95% KM (z) UCL	0.172
95% KM (jackknife) UCL	0.206
95% KM (bootstrap t) UCL	0.189
95% KM (BCA) UCL	0.141
95% KM (Percentile Bootstrap) UCL	N/A
95% KM (Chebyshev) UCL	0.301
97.5% KM (Chebyshev) UCL	0.391
99% KM (Chebyshev) UCL	0.568
Potential UCLs to Use	
95% KM (t) UCL	0.174
95% KM (% Bootstrap) UCL	N/A

Warning: Recommended UCL exceeds the maximum observation

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

APPENDIX B-3-1
STATISTICS FOR SURFACE SOIL - EASTERN AREA
Clean Harbors Kansas, LLC- Wichita, Kansas

Arsenic
All units in mg/kg.

General Statistics

Number of Valid Data	43
Number of Distinct Detected Data	15

Number of Detected Data	17
Number of Non-Detect Data	26
Percent Non-Detects	60.47%

Raw Statistics

Minimum Detected	1.1
Maximum Detected	43.2
Mean of Detected	6.888
SD of Detected	9.565
Minimum Non-Detect	1.6
Maximum Non-Detect	7.6

Log-transformed Statistics

Minimum Detected	0.0953
Maximum Detected	3.766
Mean of Detected	1.536
SD of Detected	0.817
Minimum Non-Detect	0.47
Maximum Non-Detect	2.028

Note: Data have multiple DLs - Use of KM Method is recommended
For all methods (except KM, DL/2, and ROS Methods),
Observations < Largest ND are treated as NDs

Number treated as Non-Detect	41
Number treated as Detected	2
Single DL Non-Detect Percentage	95.35%

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.457
5% Shapiro Wilk Critical Value	0.892

Data not Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.876
5% Shapiro Wilk Critical Value	0.892

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	3.381
SD	6.578
95% DL/2 (t) UCL	5.069
Maximum Likelihood Estimate(MLE) Method	N/A

MLE method failed to converge properly

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	0.622
SD	0.929
95% H-Stat (DL/2) UCL	3.982
Log ROS Method	
Mean in Log Scale	0.658
SD in Log Scale	0.943
Mean in Original Scale	3.442
SD in Original Scale	6.553
95% t UCL	5.123
95% Percentile Bootstrap UCL	5.368
95% BCA Bootstrap UCL	6.317
95% H-UCL	4.209

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	1.202
Theta Star	5.731
nu star	40.86
A-D Test Statistic	1.429
5% A-D Critical Value	0.757
K-S Test Statistic	0.757
5% K-S Critical Value	0.213

Data not Gamma Distributed at 5% Significance Level

Data Distribution Test with Detected Values Only
Data do not follow a Discernable Distribution (0.05)

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	0.000001
Maximum	43.2
Mean	2.867
Median	0.000001
SD	6.777
k star	0.116
Theta star	24.82
Nu star	9.933
AppChi2	3.9
95% Gamma Approximate UCL (Use when n >= 40)	7.303
95% Adjusted Gamma UCL (Use when n < 40)	7.557

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	3.42
SD	6.483
SE of Mean	1.02
95% KM (t) UCL	5.136
95% KM (z) UCL	5.099
95% KM (jackknife) UCL	5.105
95% KM (bootstrap t) UCL	8.09
95% KM (BCA) UCL	6.047
95% KM (Percentile Bootstrap) UCL	5.511
95% KM (Chebyshev) UCL	7.867
97.5% KM (Chebyshev) UCL	9.792
99% KM (Chebyshev) UCL	13.57

Potential UCLs to Use

95% KM (t) UCL	5.136
95% KM (% Bootstrap) UCL	5.511

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

APPENDIX B-3-1
STATISTICS FOR SURFACE SOIL - EASTERN AREA
Clean Harbors Kansas, LLC- Wichita, Kansas

Lead
All units in mg/kg.

General Statistics

Number of Valid Data	44	Number of Detected Data	23
Number of Distinct Detected Data	22	Number of Non-Detect Data	21
		Percent Non-Detects	47.73%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	2.8	Minimum Detected	1.03
Maximum Detected	1710	Maximum Detected	7.444
Mean of Detected	245	Mean of Detected	3.813
SD of Detected	418.3	SD of Detected	2.116
Minimum Non-Detect	3.2	Minimum Non-Detect	1.163
Maximum Non-Detect	5.1	Maximum Non-Detect	1.629

Note: Data have multiple DLs - Use of KM Method is recommended
For all methods (except KM, DL/2, and ROS Methods),
Observations < Largest ND are treated as NDs

Number treated as Non-Detect	26
Number treated as Detected	18
Single DL Non-Detect Percentage	59.09%

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.641	Shapiro Wilk Test Statistic	0.917
5% Shapiro Wilk Critical Value	0.914	5% Shapiro Wilk Critical Value	0.914
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	129	Mean	2.321
SD	323.4	SD	2.19
95% DL/2 (t) UCL	211	95% H-Stat (DL/2) UCL	419.1
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	2.168
		SD in Log Scale	2.357
		Mean in Original Scale	128.9
		SD in Original Scale	323.5
		95% t UCL	210.9
		95% Percentile Bootstrap UCL	213.8
		95% BCA Bootstrap UCL	246.6
		95% H-UCL	636.4
Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	0.369	**Data appear Lognormal at 5% Significance Level**	
Theta Star	663.7		
nu star	16.98		
A-D Test Statistic	0.98	**Nonparametric Statistics**	
5% A-D Critical Value	0.829	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.829	Mean	129.5
5% K-S Critical Value	0.195	SD	319.6
Data not Gamma Distributed at 5% Significance Level		SE of Mean	49.26
Assuming Gamma Distribution		95% KM (t) UCL	212.3
Gamma ROS Statistics using Extrapolated Data		95% KM (z) UCL	210.5
Minimum	0.000001	95% KM (jackknife) UCL	211.4
Maximum	1710	95% KM (bootstrap t) UCL	287.4
Mean	128.1	95% KM (BCA) UCL	212.6
Median	2.85	95% KM (Percentile Bootstrap) UCL	216.4
SD	323.8	95% KM (Chebyshev) UCL	344.2
k star	0.0965	97.5% KM (Chebyshev) UCL	437.1
Theta star	1327	99% KM (Chebyshev) UCL	619.6
Nu star	8.496	**Potential UCLs to Use**	
AppChi2	3.025	99% KM (Chebyshev) UCL	619.6
95% Gamma Approximate UCL (Use when n >= 40)	359.7		
95% Adjusted Gamma UCL (Use when n < 40)	373.3		

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

APPENDIX B-3-2
STATISTICS FOR SURFACE AND SUBSURFACE SOIL - EASTERN AREA
Clean Harbors Kansas, LLC- Wichita, Kansas

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

General Statistics

Number of Valid Data	152	Number of Detected Data	25
Number of Distinct Detected Data	25	Number of Non-Detect Data	127
		Percent Non-Detects	83.55%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.0017	Minimum Detected	-6.377
Maximum Detected	107	Maximum Detected	4.673
Mean of Detected	10.53	Mean of Detected	-1.383
SD of Detected	26.72	SD of Detected	3.315
Minimum Non-Detect	0.0018	Minimum Non-Detect	-6.32
Maximum Non-Detect	2.69	Maximum Non-Detect	0.99

Note: Data have multiple DLs - Use of KM Method is recommended
For all methods (except KM, DL/2, and ROS Methods),
Observations < Largest ND are treated as NDs

Number treated as Non-Detect	145
Number treated as Detected	7
Single DL Non-Detect Percentage	95.39%

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.455
5% Shapiro Wilk Critical Value	0.918

Data not Normal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	1.743
SD	11.35
95% DL/2 (t) UCL	3.267
Maximum Likelihood Estimate(MLE) Method	N/A

MLE yields a negative mean

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.936
5% Shapiro Wilk Critical Value	0.918

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	-5.23
SD	2.242
95% H-Stat (DL/2) UCL	0.127
Log ROS Method	
Mean in Log Scale	-9.25
SD in Log Scale	4.479
Mean in Original Scale	1.732
SD in Original Scale	11.35
95% t UCL	3.256
95% Percentile Bootstrap UCL	3.387
95% BCA Bootstrap UCL	4.085
95% H-UCL	23.88

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	0.2
Theta Star	52.58
nu star	10.01
A-D Test Statistic	1.608
5% A-D Critical Value	0.897
K-S Test Statistic	0.897
5% K-S Critical Value	0.193

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	0.000001
Maximum	107
Mean	1.732
Median	0.000001
SD	11.35
k star	0.0719
Theta star	24.1
Nu star	21.85
AppChi2	12.22
95% Gamma Approximate UCL (Use when n >= 40)	3.096
95% Adjusted Gamma UCL (Use when n < 40)	3.113

Data Distribution Test with Detected Values Only
Data appear Lognormal at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	1.734
SD	11.31
SE of Mean	0.937
95% KM (t) UCL	3.284
95% KM (z) UCL	3.274
95% KM (jackknife) UCL	3.256
95% KM (bootstrap t) UCL	7.556
95% KM (BCA) UCL	3.427
95% KM (Percentile Bootstrap) UCL	3.416
95% KM (Chebyshev) UCL	5.816
97.5% KM (Chebyshev) UCL	7.583
99% KM (Chebyshev) UCL	11.05

Potential UCLs to Use

97.5% KM (Chebyshev) UCL	7.583

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

APPENDIX B-3-2
STATISTICS FOR SURFACE AND SUBSURFACE SOIL - EASTERN AREA
Clean Harbors Kansas, LLC- Wichita, Kansas

Ethylbenzene
All units in mg/kg.

General Statistics

Number of Valid Data	152	Number of Detected Data	25
Number of Distinct Detected Data	25	Number of Non-Detect Data	127
		Percent Non-Detects	83.55%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.0016	Minimum Detected	-6.438
Maximum Detected	881	Maximum Detected	6.781
Mean of Detected	78.39	Mean of Detected	-1.08
SD of Detected	234.9	SD of Detected	4.364
Minimum Non-Detect	0.0018	Minimum Non-Detect	-6.32
Maximum Non-Detect	0.0086	Maximum Non-Detect	-4.756

Note: Data have multiple DLs - Use of KM Method is recommended
For all methods (except KM, DL/2, and ROS Methods),
Observations < Largest ND are treated as NDs

Number treated as Non-Detect	136
Number treated as Detected	16
Single DL Non-Detect Percentage	89.47%

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.364
5% Shapiro Wilk Critical Value	0.918

Data not Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.888
5% Shapiro Wilk Critical Value	0.918

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	12.9
SD	98.09
95% DL/2 (t) UCL	26.06
Maximum Likelihood Estimate(MLE) Method	N/A

MLE yields a negative mean

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	-5.224
SD	2.552
95% H-Stat (DL/2) UCL	0.32
Log ROS Method	
Mean in Log Scale	-8.111
SD in Log Scale	4.292
Mean in Original Scale	12.89
SD in Original Scale	98.09
95% t UCL	26.06
95% Percentile Bootstrap UCL	29.13
95% BCA Bootstrap UCL	35.33
95% H-UCL	27.19

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	0.152
Theta Star	516.1
nu star	7.595
A-D Test Statistic	1.932
5% A-D Critical Value	0.921
K-S Test Statistic	0.921
5% K-S Critical Value	0.195

Data not Gamma Distributed at 5% Significance Level

Data Distribution Test with Detected Values Only
Data do not follow a Discernable Distribution (0.05)

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	0.000001
Maximum	881
Mean	12.89
Median	0.000001
SD	98.09
k star	0.0634
Theta star	203.3
Nu star	19.28
AppChi2	10.32
95% Gamma Approximate UCL (Use when n >= 40)	24.08
95% Adjusted Gamma UCL (Use when n < 40)	24.23

Note: DL/2 is not a recommended method.

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	12.89
SD	97.77
SE of Mean	8.094
95% KM (t) UCL	26.29
95% KM (z) UCL	26.21
95% KM (jackknife) UCL	26.06
95% KM (bootstrap t) UCL	153.4
95% KM (BCA) UCL	29.47
95% KM (Percentile Bootstrap) UCL	28.97
95% KM (Chebyshev) UCL	48.17
97.5% KM (Chebyshev) UCL	63.44
99% KM (Chebyshev) UCL	93.43

Potential UCLs to Use	
97.5% KM (Chebyshev) UCL	63.44

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

APPENDIX B-3-2
STATISTICS FOR SURFACE AND SUBSURFACE SOIL - EASTERN AREA
Clean Harbors Kansas, LLC- Wichita, Kansas

Naphthalene
All units in mg/kg.

General Statistics

Number of Valid Data	152	Number of Detected Data	15
Number of Distinct Detected Data	15	Number of Non-Detect Data	137
		Percent Non-Detects	90.13%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.0034	Minimum Detected	-5.684
Maximum Detected	4.96	Maximum Detected	1.601
Mean of Detected	0.634	Mean of Detected	-2.667
SD of Detected	1.316	SD of Detected	2.433
Minimum Non-Detect	0.0018	Minimum Non-Detect	-6.32
Maximum Non-Detect	41.8	Maximum Non-Detect	3.733

Note: Data have multiple DLs - Use of KM Method is recommended
For all methods (except KM, DL/2, and ROS Methods),
Observations < Largest ND are treated as NDs

Number treated as Non-Detect	152
Number treated as Detected	0
Single DL Non-Detect Percentage	100.00%

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.552
5% Shapiro Wilk Critical Value	0.881

Data not Normal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	0.222
SD	1.758
95% DL/2 (t) UCL	0.458
Maximum Likelihood Estimate(MLE) Method	N/A

MLE method failed to converge properly

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.911
5% Shapiro Wilk Critical Value	0.881

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	-5.484
SD	1.582
95% H-Stat (DL/2) UCL	0.0208
Log ROS Method	
Mean in Log Scale	-12.11
SD in Log Scale	4.111
Mean in Original Scale	0.0626
SD in Original Scale	0.443
95% t UCL	0.122
95% Percentile Bootstrap UCL	0.13
95% BCA Bootstrap UCL	0.181
95% H-UCL	0.195

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	0.293
Theta Star	2.168
nu star	8.777
A-D Test Statistic	0.882
5% A-D Critical Value	0.833
K-S Test Statistic	0.833
5% K-S Critical Value	0.24

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	0.000001
Maximum	4.96
Mean	0.0626
Median	0.000001
SD	0.443
k star	0.0862
Theta star	0.726
Nu star	26.21
AppChi2	15.54
95% Gamma Approximate UCL (Use when n >= 40)	0.106
95% Adjusted Gamma UCL (Use when n < 40)	0.106

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only
Data appear Lognormal at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.0665
SD	0.444
SE of Mean	0.0376
95% KM (t) UCL	0.129
95% KM (z) UCL	0.128
95% KM (jackknife) UCL	0.127
95% KM (bootstrap t) UCL	0.298
95% KM (BCA) UCL	0.143
95% KM (Percentile Bootstrap) UCL	0.136
95% KM (Chebyshev) UCL	0.23
97.5% KM (Chebyshev) UCL	0.301
99% KM (Chebyshev) UCL	0.44

Potential UCLs to Use

97.5% KM (Chebyshev) UCL	0.301

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

APPENDIX B-3-2
STATISTICS FOR SURFACE AND SUBSURFACE SOIL - EASTERN AREA
Clean Harbors Kansas, LLC- Wichita, Kansas

Tetrachloroethene
All units in mg/kg.

General Statistics

Number of Valid Data	152	Number of Detected Data	102
Number of Distinct Detected Data	97	Number of Non-Detect Data	50
		Percent Non-Detects	32.89%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.00082	Minimum Detected	-7.106
Maximum Detected	277	Maximum Detected	5.624
Mean of Detected	3.016	Mean of Detected	-3.488
SD of Detected	27.43	SD of Detected	2.01
Minimum Non-Detect	0.0029	Minimum Non-Detect	-5.843
Maximum Non-Detect	20.9	Maximum Non-Detect	3.04

Note: Data have multiple DLs - Use of KM Method is recommended
For all methods (except KM, DL/2, and ROS Methods),
Observations < Largest ND are treated as NDs

Number treated as Non-Detect	151
Number treated as Detected	1
Single DL Non-Detect Percentage	99.34%

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Lilliefors Test Statistic	0.48	Lilliefors Test Statistic	0.125
5% Lilliefors Critical Value	0.0877	5% Lilliefors Critical Value	0.0877
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	2.104	Mean	-4.198
SD	22.49	SD	2.157
95% DL/2 (t) UCL	5.123	95% H-Stat (DL/2) UCL	0.284
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	-4.581
		SD in Log Scale	2.318
		Mean in Original Scale	2.025
		SD in Original Scale	22.48
		95% t UCL	5.042
		95% Percentile Bootstrap UCL	5.636
		95% BCA Bootstrap UCL	7.541
		95% H-UCL	0.302

Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**
k star (bias corrected)	0.167	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	18.09	
nu star	34.01	
A-D Test Statistic	22.56	**Nonparametric Statistics**
5% A-D Critical Value	0.95	Kaplan-Meier (KM) Method
K-S Test Statistic	0.95	Mean 2.027
5% K-S Critical Value	0.0999	SD 22.4
Data not Gamma Distributed at 5% Significance Level		SE of Mean 1.826
		95% KM (t) UCL 5.049
Assuming Gamma Distribution		95% KM (z) UCL 5.031
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL 5.045
Minimum	0.000001	95% KM (bootstrap t) UCL 61.77
Maximum	277	95% KM (BCA) UCL 5.652
Mean	2.024	95% KM (Percentile Bootstrap) UCL 5.664
Median	0.00995	95% KM (Chebyshev) UCL 9.987
SD	22.48	97.5% KM (Chebyshev) UCL 13.43
k star	0.108	99% KM (Chebyshev) UCL 20.2
Theta star	18.66	
Nu star	32.97	**Potential UCLs to Use**
AppChi2	20.85	97.5% KM (Chebyshev) UCL 13.43
95% Gamma Approximate UCL (Use when n >= 40)	3.202	
95% Adjusted Gamma UCL (Use when n < 40)	3.216	

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

APPENDIX B-3-2
STATISTICS FOR SURFACE AND SUBSURFACE SOIL - EASTERN AREA
Clean Harbors Kansas, LLC- Wichita, Kansas

Total Xylenes
All units in mg/kg.

General Statistics

Number of Valid Data	152	Number of Detected Data	30
Number of Distinct Detected Data	29	Number of Non-Detect Data	122
		Percent Non-Detects	80.26%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.001	Minimum Detected	-6.908
Maximum Detected	4640	Maximum Detected	8.442
Mean of Detected	323.1	Mean of Detected	-0.464
SD of Detected	1096	SD of Detected	4.611
Minimum Non-Detect	0.0031	Minimum Non-Detect	-5.776
Maximum Non-Detect	0.017	Maximum Non-Detect	-4.075

Note: Data have multiple DLs - Use of KM Method is recommended
For all methods (except KM, DL/2, and ROS Methods),
Observations < Largest ND are treated as NDs

Number treated as Non-Detect	131
Number treated as Detected	21
Single DL Non-Detect Percentage	86.18%

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.324	Shapiro Wilk Test Statistic	0.912
5% Shapiro Wilk Critical Value	0.927	5% Shapiro Wilk Critical Value	0.927
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	63.77	Mean	-4.445
SD	497.4	SD	2.855
95% DL/2 (t) UCL	130.5	95% H-Stat (DL/2) UCL	1.911
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	-8.508
		SD in Log Scale	5.375
		Mean in Original Scale	63.77
		SD in Original Scale	497.4
		95% t UCL	130.5
		95% Percentile Bootstrap UCL	131.7
		95% BCA Bootstrap UCL	159.8
		95% H-UCL	11481

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	0.136	**Data do not follow a Discernable Distribution (0.05)**	
Theta Star	2379		
nu star	8.147		
A-D Test Statistic	2.491	**Nonparametric Statistics**	
5% A-D Critical Value	0.935	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.935	Mean	63.77
5% K-S Critical Value	0.18	SD	495.8
Data not Gamma Distributed at 5% Significance Level		SE of Mean	40.9
		95% KM (t) UCL	131.5
Assuming Gamma Distribution		95% KM (z) UCL	131
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	130.5
Minimum	0.000001	95% KM (bootstrap t) UCL	992.9
Maximum	4640	95% KM (BCA) UCL	132.4
Mean	63.77	95% KM (Percentile Bootstrap) UCL	146.8
Median	0.000001	95% KM (Chebyshev) UCL	242
SD	497.4	97.5% KM (Chebyshev) UCL	319.2
k star	0.0597	99% KM (Chebyshev) UCL	470.7
Theta star	1068		
Nu star	18.15	**Potential UCLs to Use**	
AppChi2	9.498	97.5% KM (Chebyshev) UCL	319.2
95% Gamma Approximate UCL (Use when n >= 40)	121.8		
95% Adjusted Gamma UCL (Use when n < 40)	122.6		

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

APPENDIX B-3-2
STATISTICS FOR SURFACE AND SUBSURFACE SOIL - EASTERN AREA
Clean Harbors Kansas, LLC- Wichita, Kansas

Trichloroethene
All units in mg/kg.

General Statistics

Number of Valid Data	152	Number of Detected Data	53
Number of Distinct Detected Data	49	Number of Non-Detect Data	99
		Percent Non-Detects	65.13%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.00095	Minimum Detected	-6.959
Maximum Detected	28.2	Maximum Detected	3.339
Mean of Detected	0.57	Mean of Detected	-4.777
SD of Detected	3.873	SD of Detected	1.728
Minimum Non-Detect	0.0027	Minimum Non-Detect	-5.915
Maximum Non-Detect	20.9	Maximum Non-Detect	3.04

Note: Data have multiple DLs - Use of KM Method is recommended
For all methods (except KM, DL/2, and ROS Methods),
Observations < Largest ND are treated as NDs

Number treated as Non-Detect	151
Number treated as Detected	1
Single DL Non-Detect Percentage	99.34%

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Lilliefors Test Statistic	0.503	Lilliefors Test Statistic	0.174
5% Lilliefors Critical Value	0.122	5% Lilliefors Critical Value	0.122
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.281	Mean	-5.413
SD	2.436	SD	1.518
95% DL/2 (t) UCL	0.608	95% H-Stat (DL/2) UCL	0.0198
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	-5.946
		SD in Log Scale	1.433
		Mean in Original Scale	0.2
		SD in Original Scale	2.289
		95% t UCL	0.507
		95% Percentile Bootstrap UCL	0.565
		95% BCA Bootstrap UCL	0.941
		95% H-UCL	0.00994

Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**
k star (bias corrected)	0.18	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	3.161	
nu star	19.11	
A-D Test Statistic	13.91	
5% A-D Critical Value	0.923	
K-S Test Statistic	0.923	
5% K-S Critical Value	0.136	
Data not Gamma Distributed at 5% Significance Level		

Assuming Gamma Distribution		**Nonparametric Statistics**	
Gamma ROS Statistics using Extrapolated Data		Kaplan-Meier (KM) Method	
Minimum	0.000001	Mean	0.2
Maximum	28.2	SD	2.281
Mean	0.199	SE of Mean	0.187
Median	0.000001	95% KM (t) UCL	0.51
SD	2.289	95% KM (z) UCL	0.508
k star	0.0934	95% KM (jackknife) UCL	0.508
Theta star	2.127	95% KM (bootstrap t) UCL	42.53
Nu star	28.4	95% KM (BCA) UCL	0.57
AppChi2	17.24	95% KM (Percentile Bootstrap) UCL	0.57
95% Gamma Approximate UCL (Use when n >= 40)	0.327	95% KM (Chebyshev) UCL	1.015
95% Adjusted Gamma UCL (Use when n < 40)	0.329	97.5% KM (Chebyshev) UCL	1.367
		99% KM (Chebyshev) UCL	2.059
		Potential UCLs to Use	
		95% KM (Chebyshev) UCL	1.015

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

APPENDIX B-3-2
STATISTICS FOR SURFACE AND SUBSURFACE SOIL - EASTERN AREA
Clean Harbors Kansas, LLC- Wichita, Kansas

Vinyl chloride
All units in mg/kg.

General Statistics

Number of Valid Data	152	Number of Detected Data	16
Number of Distinct Detected Data	14	Number of Non-Detect Data	136
		Percent Non-Detects	89.47%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.0013	Minimum Detected	-6.645
Maximum Detected	2.16	Maximum Detected	0.77
Mean of Detected	0.17	Mean of Detected	-4.407
SD of Detected	0.538	SD of Detected	2.039
Minimum Non-Detect	0.0018	Minimum Non-Detect	-6.32
Maximum Non-Detect	20.9	Maximum Non-Detect	3.04

Note: Data have multiple DLs - Use of KM Method is recommended
For all methods (except KM, DL/2, and ROS Methods),
Observations < Largest ND are treated as NDs

Number treated as Non-Detect	152
Number treated as Detected	0
Single DL Non-Detect Percentage	100.00%

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.354	Shapiro Wilk Test Statistic	0.874
5% Shapiro Wilk Critical Value	0.887	5% Shapiro Wilk Critical Value	0.887
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.109	Mean	-5.608
SD	0.874	SD	1.425
95% DL/2 (t) UCL	0.227	95% H-Stat (DL/2) UCL	0.0137
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	-6.913
		SD in Log Scale	1.389
		Mean in Original Scale	0.0189
		SD in Original Scale	0.178
		95% t UCL	0.0427
		95% Percentile Bootstrap UCL	0.0473
		95% BCA Bootstrap UCL	0.0783
		95% H-UCL	0.0035

Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**
k star (bias corrected)	0.258	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	0.658	
nu star	8.268	
A-D Test Statistic	2.332	**Nonparametric Statistics**
5% A-D Critical Value	0.851	Kaplan-Meier (KM) Method
K-S Test Statistic	0.851	Mean 0.0196
5% K-S Critical Value	0.234	SD 0.179
Data not Gamma Distributed at 5% Significance Level		SE of Mean 0.0151
		95% KM (t) UCL 0.0446
Assuming Gamma Distribution		95% KM (z) UCL 0.0445
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL 0.0439
Minimum	0.000001	95% KM (bootstrap t) UCL 0.823
Maximum	2.16	95% KM (BCA) UCL 0.0484
Mean	0.0187	95% KM (Percentile Bootstrap) UCL 0.0477
Median	0.000001	95% KM (Chebyshev) UCL 0.0855
SD	0.178	97.5% KM (Chebyshev) UCL 0.114
k star	0.0988	99% KM (Chebyshev) UCL 0.17
Theta star	0.189	
Nu star	30.03	**Potential UCLs to Use**
AppChi2	18.51	97.5% KM (Chebyshev) UCL 0.114
95% Gamma Approximate UCL (Use when n >= 40)	0.0303	
95% Adjusted Gamma UCL (Use when n < 40)	0.0305	

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

APPENDIX B-3-2
STATISTICS FOR SURFACE AND SUBSURFACE SOIL - EASTERN AREA
Clean Harbors Kansas, LLC- Wichita, Kansas

Benzo(a)pyrene
All units in mg/kg.

General Statistics

Number of Valid Data	35	Number of Detected Data	2
Number of Distinct Detected Data	2	Number of Non-Detect Data	33
		Percent Non-Detects	94.29%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.0455	Minimum Detected	-3.09
Maximum Detected	0.141	Maximum Detected	-1.959
Mean of Detected	0.0933	Mean of Detected	-2.525
SD of Detected	0.0675	SD of Detected	0.8
Minimum Non-Detect	0.16	Minimum Non-Detect	-1.833
Maximum Non-Detect	0.22	Maximum Non-Detect	-1.514

Note: Data have multiple DLs - Use of KM Method is recommended
For all methods (except KM, DL/2, and ROS Methods),
Observations < Largest ND are treated as NDs

Number treated as Non-Detect	35
Number treated as Detected	0
Single DL Non-Detect Percentage	100.00%

Warning: Data set has only 2 Distinct Detected Values.
This may not be adequate enough to compute meaningful and reliable test statistics and estimates
The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV)
Unless Data Quality Objectives (DQOs) have been met, it is suggested to collect additional observations.
The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.
Those methods will return a 'N/A' value on your output display!
It is necessary to have 4 or more Distinct Values for bootstrap methods.
However, results obtained using 4 to 9 distinct values may not be reliable.
It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	N/A	Shapiro Wilk Test Statistic	N/A
5% Shapiro Wilk Critical Value	N/A	5% Shapiro Wilk Critical Value	N/A
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.0882	Mean	-2.44
SD	0.0138	SD	0.16
95% DL/2 (t) UCL	0.0921	95% H-Stat (DL/2) UCL	0.0925
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	N/A
		SD in Log Scale	N/A
		Mean in Original Scale	N/A
		SD in Original Scale	N/A
		95% t UCL	N/A
		95% Percentile Bootstrap UCL	N/A
		95% BCA Bootstrap UCL	N/A
		95% H-UCL	N/A

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	N/A	**Data do not follow a Discernable Distribution (0.05)**	
Theta Star	N/A		
nu star	N/A		
A-D Test Statistic	N/A	**Nonparametric Statistics**	
5% A-D Critical Value	N/A	Kaplan-Meier (KM) Method	
K-S Test Statistic	N/A	Mean	0.0933
5% K-S Critical Value	N/A	SD	0.0478
Data not Gamma Distributed at 5% Significance Level		SE of Mean	0.0478
		95% KM (t) UCL	0.174
Assuming Gamma Distribution		95% KM (z) UCL	0.172
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	0.206
Minimum	N/A	95% KM (bootstrap t) UCL	0.189
Maximum	N/A	95% KM (BCA) UCL	N/A
Mean	N/A	95% KM (Percentile Bootstrap) UCL	N/A
Median	N/A	95% KM (Chebyshev) UCL	0.301
SD	N/A	97.5% KM (Chebyshev) UCL	0.391
k star	N/A	99% KM (Chebyshev) UCL	0.568
Theta star	N/A		
Nu star	N/A	**Potential UCLs to Use**	
AppChi2	N/A	95% KM (t) UCL	0.174
95% Gamma Approximate UCL (Use when n >= 40)	N/A	95% KM (% Bootstrap) UCL	N/A
95% Adjusted Gamma UCL (Use when n < 40)	N/A		

Warning: Recommended UCL exceeds the maximum observation

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006)
For additional insight, the user may want to consult a statistician.

APPENDIX B-3-2
STATISTICS FOR SURFACE AND SUBSURFACE SOIL - EASTERN AREA
Clean Harbors Kansas, LLC- Wichita, Kansas

Arsenic
All units in mg/kg.

General Statistics

Number of Valid Data	62	Number of Detected Data	36
Number of Distinct Detected Data	30	Number of Non-Detect Data	26
		Percent Non-Detects	41.94%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.94	Minimum Detected	-0.0619
Maximum Detected	43.2	Maximum Detected	3.766
Mean of Detected	5.601	Mean of Detected	1.403
SD of Detected	6.898	SD of Detected	0.753
Minimum Non-Detect	1.6	Minimum Non-Detect	0.47
Maximum Non-Detect	7.6	Maximum Non-Detect	2.028

Note: Data have multiple DLs - Use of KM Method is recommended
For all methods (except KM, DL/2, and ROS Methods),
Observations < Largest ND are treated as NDs

Number treated as Non-Detect	57
Number treated as Detected	5
Single DL Non-Detect Percentage	91.94%

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.484	Shapiro Wilk Test Statistic	0.94
5% Shapiro Wilk Critical Value	0.935	5% Shapiro Wilk Critical Value	0.935
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	3.709	Mean	0.825
SD	5.699	SD	0.912
95% DL/2 (t) UCL	4.918	95% H-Stat (DL/2) UCL	4.465
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	0.929
		SD in Log Scale	0.831
		Mean in Original Scale	3.833
		SD in Original Scale	5.638
		95% t UCL	5.029
		95% Percentile Bootstrap UCL	5.132
		95% BCA Bootstrap UCL	6.035
		95% H-UCL	4.481
Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	1.587	**Data appear Lognormal at 5% Significance Level**	
Theta Star	3.528		
nu star	114.3		
A-D Test Statistic	1.221	**Nonparametric Statistics**	
5% A-D Critical Value	0.764	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.764	Mean	3.783
5% K-S Critical Value	0.149	SD	5.617
Data not Gamma Distributed at 5% Significance Level		SE of Mean	0.725
		95% KM (t) UCL	4.994
Assuming Gamma Distribution		95% KM (z) UCL	4.975
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	4.987
Minimum	0.000001	95% KM (bootstrap t) UCL	6.255
Maximum	43.2	95% KM (BCA) UCL	5.161
Mean	3.515	95% KM (Percentile Bootstrap) UCL	5.156
Median	2.35	95% KM (Chebyshev) UCL	6.943
SD	5.81	97.5% KM (Chebyshev) UCL	8.311
k star	0.213	99% KM (Chebyshev) UCL	11
Theta star	16.51		
Nu star	26.41	**Potential UCLs to Use**	
AppChi2	15.69	95% KM (t) UCL	4.994
95% Gamma Approximate UCL (Use when n >= 40)	5.915	95% KM (% Bootstrap) UCL	5.156
95% Adjusted Gamma UCL (Use when n < 40)	5.99		

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

APPENDIX B-3-2
STATISTICS FOR SURFACE AND SUBSURFACE SOIL - EASTERN AREA
Clean Harbors Kansas, LLC- Wichita, Kansas

Lead
All units in mg/kg.

General Statistics

Number of Valid Data	69	Number of Detected Data	48
Number of Distinct Detected Data	44	Number of Non-Detect Data	21
		Percent Non-Detects	30.43%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	2.2	Minimum Detected	0.788
Maximum Detected	4970	Maximum Detected	8.511
Mean of Detected	275.7	Mean of Detected	3.324
SD of Detected	791.8	SD of Detected	2.078
Minimum Non-Detect	3.2	Minimum Non-Detect	1.163
Maximum Non-Detect	5.1	Maximum Non-Detect	1.629

Note: Data have multiple DLs - Use of KM Method is recommended
For all methods (except KM, DL/2, and ROS Methods),
Observations < Largest ND are treated as NDs

Number treated as Non-Detect	32
Number treated as Detected	37
Single DL Non-Detect Percentage	46.38%

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.398	Shapiro Wilk Test Statistic	0.881
5% Shapiro Wilk Critical Value	0.947	5% Shapiro Wilk Critical Value	0.947
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	192.4	Mean	2.521
SD	670.4	SD	2.118
95% DL/2 (t) UCL	327	95% H-Stat (DL/2) UCL	253.5
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	2.443
		SD in Log Scale	2.208
		Mean in Original Scale	192.3
		SD in Original Scale	670.4
		95% t UCL	326.9
		95% Percentile Bootstrap UCL	341.7
		95% BCA Bootstrap UCL	411.6
		95% H-UCL	296.7
Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	0.296	**Data do not follow a Discernable Distribution (0.05)**	
Theta Star	932.8		
nu star	28.37		
A-D Test Statistic	4.616	**Nonparametric Statistics**	
5% A-D Critical Value	0.862	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.862	Mean	192.6
5% K-S Critical Value	0.139	SD	665.4
Data not Gamma Distributed at 5% Significance Level		SE of Mean	80.95
Assuming Gamma Distribution		95% KM (t) UCL	327.6
Gamma ROS Statistics using Extrapolated Data		95% KM (z) UCL	325.8
Minimum	0.000001	95% KM (jackknife) UCL	327.2
Maximum	4970	95% KM (bootstrap t) UCL	488.4
Mean	191.8	95% KM (BCA) UCL	358.3
Median	7.5	95% KM (Percentile Bootstrap) UCL	335.9
SD	670.5	95% KM (Chebyshev) UCL	545.5
k star	0.117	97.5% KM (Chebyshev) UCL	698.2
Theta star	1642	99% KM (Chebyshev) UCL	998.1
Nu star	16.11	**Potential UCLs to Use**	
AppChi2	8.042	97.5% KM (Chebyshev) UCL	698.2
95% Gamma Approximate UCL (Use when n >= 40)	384.2		
95% Adjusted Gamma UCL (Use when n < 40)	390.1		

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

APPENDIX B-4
STATISTICS FOR GROUNDWATER - VAPOR INTRUSION - WESTERN AREA
Clean Harbors Kansas, LLC- Wichita, Kansas

1,1-Dichloroethane
All units in ug/L.

General Statistics

Number of Valid Data	34	Number of Detected Data	8
Number of Distinct Detected Data	8	Number of Non-Detect Data	26
		Percent Non-Detects	76.47%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.3	Minimum Detected	-1.204
Maximum Detected	2.5	Maximum Detected	0.916
Mean of Detected	0.848	Mean of Detected	-0.391
SD of Detected	0.717	SD of Detected	0.669
Minimum Non-Detect	1	Minimum Non-Detect	0
Maximum Non-Detect	1	Maximum Non-Detect	0

Warning: There are only 8 Detected Values in this data
Note: It should be noted that even though bootstrap may be performed on this data set
the resulting calculations may not be reliable enough to draw conclusions
It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.73
5% Shapiro Wilk Critical Value	0.818

Data not Normal at 5% Significance Level

Assuming Normal Distribution
DL/2 Substitution Method

Mean	0.582
SD	0.363
95% DL/2 (t) UCL	0.687

Maximum Likelihood Estimate(MLE) Method	N/A

MLE method failed to converge properly

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.931
5% Shapiro Wilk Critical Value	0.818

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution
DL/2 Substitution Method

Mean	-0.622
SD	0.334
95% H-Stat (DL/2) UCL	0.631

Log ROS Method

Mean in Log Scale	-0.619
SD in Log Scale	0.533
Mean in Original Scale	0.625
SD in Original Scale	0.417
95% t UCL	0.747
95% Percentile Bootstrap UCL	0.741
95% BCA Bootstrap UCL	0.784
95% H-UCL	0.744

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	1.566
Theta Star	0.541
nu star	25.06
A-D Test Statistic	0.513
5% A-D Critical Value	0.723
K-S Test Statistic	0.723
5% K-S Critical Value	0.297

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution
Gamma ROS Statistics using Extrapolated Data

Minimum	0.000001
Maximum	2.5
Mean	0.702
Median	0.628
SD	0.518
k star	0.454
Theta star	1.547
Nu star	30.87
AppChi2	19.18
95% Gamma Approximate UCL (Use when n >= 40)	1.131
95% Adjusted Gamma UCL (Use when n < 40)	1.158

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only
Data appear Gamma Distributed at 5% Significance Level

Nonparametric Statistics
Kaplan-Meier (KM) Method

Mean	0.598
SD	0.378
SE of Mean	0.0898
95% KM (t) UCL	0.75
95% KM (z) UCL	0.746
95% KM (jackknife) UCL	0.755
95% KM (bootstrap t) UCL	0.806
95% KM (BCA) UCL	0.764
95% KM (Percentile Bootstrap) UCL	0.75
95% KM (Chebyshev) UCL	0.99
97.5% KM (Chebyshev) UCL	1.159
99% KM (Chebyshev) UCL	1.492

Potential UCLs to Use

95% KM (t) UCL	0.75

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

APPENDIX B-4
STATISTICS FOR GROUNDWATER - VAPOR INTRUSION - WESTERN AREA
Clean Harbors Kansas, LLC- Wichita, Kansas

Ethylbenzene
All units in ug/L.

General Statistics

Number of Valid Data	35	Number of Detected Data	1
Number of Distinct Detected Data	1	Number of Non-Detect Data	34
		Percent Non-Detects	97.14%

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!
It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Ethylbenzene was not processed!

APPENDIX B-4
STATISTICS FOR GROUNDWATER - VAPOR INTRUSION - WESTERN AREA
Clean Harbors Kansas, LLC- Wichita, Kansas

Tetrachloroethene
All units in ug/L.

General Statistics

Number of Valid Data	35	Number of Detected Data	33
Number of Distinct Detected Data	33	Number of Non-Detect Data	2
		Percent Non-Detects	5.71%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.365	Minimum Detected	-1.008
Maximum Detected	230	Maximum Detected	5.438
Mean of Detected	51.93	Mean of Detected	2.769
SD of Detected	62.66	SD of Detected	1.94
Minimum Non-Detect	1	Minimum Non-Detect	0
Maximum Non-Detect	1	Maximum Non-Detect	0

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.799	Shapiro Wilk Test Statistic	0.917
5% Shapiro Wilk Critical Value	0.931	5% Shapiro Wilk Critical Value	0.931
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	48.99	Mean	2.571
SD	61.98	SD	2.051
95% DL/2 (t) UCL	66.7	95% H-Stat (DL/2) UCL	433.4
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	39.96	Mean in Log Scale	2.604
SD	72.14	SD in Log Scale	2.004
95% MLE (t) UCL	60.57	Mean in Original Scale	49.01
95% MLE (Tiku) UCL	60.56	SD in Original Scale	61.96
		95% t UCL	66.72
		95% Percentile Bootstrap UCL	67.45
		95% BCA Bootstrap UCL	68.48
		95% H UCL	384

Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**
k star (bias corrected)	0.504	**Data appear Gamma Distributed at 5% Significance Level**
Theta Star	103	
nu star	33.29	
A-D Test Statistic	0.49	**Nonparametric Statistics**
5% A-D Critical Value	0.808	Kaplan-Meier (KM) Method
K-S Test Statistic	0.808	Mean 49
5% K-S Critical Value	0.162	SD 61.08
Data appear Gamma Distributed at 5% Significance Level		SE of Mean 10.48
		95% KM (t) UCL 66.73
Assuming Gamma Distribution		95% KM (z) UCL 66.25
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL 66.72
Minimum	0.000001	95% KM (bootstrap t) UCL 71.47
Maximum	230	95% KM (BCA) UCL 69.35
Mean	48.96	95% KM (Percentile Bootstrap) UCL 66.21
Median	19.2	95% KM (Chebyshev) UCL 94.7
SD	62	97.5% KM (Chebyshev) UCL 114.5
k star	0.319	99% KM (Chebyshev) UCL 153.3
Theta star	153.4	
Nu star	22.34	**Potential UCLs to Use**
AppChi2	12.6	95% KM (Chebyshev) UCL 94.7
95% Gamma Approximate UCL (Use when n >= 40)	86.85	
95% Adjusted Gamma UCL (Use when n < 40)	89.31	

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006). For additional insight, the user may want to consult a statistician.

APPENDIX B-4
STATISTICS FOR GROUNDWATER - VAPOR INTRUSION - WESTERN AREA
Clean Harbors Kansas, LLC- Wichita, Kansas

Trichloroethene
All units in ug/L.

General Statistics

Number of Valid Data	35	Number of Detected Data	31
Number of Distinct Detected Data	28	Number of Non-Detect Data	4
		Percent Non-Detects	11.43%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.38	Minimum Detected	-0.968
Maximum Detected	93.55	Maximum Detected	4.538
Mean of Detected	14.21	Mean of Detected	1.815
SD of Detected	19.3	SD of Detected	1.471
Minimum Non-Detect	1	Minimum Non-Detect	0
Maximum Non-Detect	1	Maximum Non-Detect	0

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.689	Shapiro Wilk Test Statistic	0.951
5% Shapiro Wilk Critical Value	0.929	5% Shapiro Wilk Critical Value	0.929
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	12.64	Mean	1.528
SD	18.66	SD	1.601
95% DL/2 (t) UCL	17.98	95% H-Stat (DL/2) UCL	40.86
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	8.758	Mean in Log Scale	1.56
SD	22.69	SD in Log Scale	1.566
95% MLE (t) UCL	15.24	Mean in Original Scale	12.67
95% MLE (Tiku) UCL	15.37	SD in Original Scale	18.64
		95% t UCL	18
		95% Percentile Bootstrap UCL	18.16
		95% BCA Bootstrap UCL	19.57
		95% H UCL	38.63

Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	0.67	Data Follow Appr. Gamma Distribution at 5% Significance Level	
Theta Star	21.23		
nu star	41.51		
A-D Test Statistic	0.485	**Nonparametric Statistics**	
5% A-D Critical Value	0.791	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.791	Mean	12.66
5% K-S Critical Value	0.164	SD	18.38
Data follow Appr. Gamma Distribution at 5% Significance Level		SE of Mean	3.159
		95% KM (t) UCL	18
Assuming Gamma Distribution		95% KM (z) UCL	17.85
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	17.99
Minimum	0.000001	95% KM (bootstrap t) UCL	20.66
Maximum	93.55	95% KM (BCA) UCL	17.97
Mean	12.59	95% KM (Percentile Bootstrap) UCL	17.83
Median	6.9	95% KM (Chebyshev) UCL	26.42
SD	18.7	97.5% KM (Chebyshev) UCL	32.38
k star	0.274	99% KM (Chebyshev) UCL	44.09
Theta star	45.97		
Nu star	19.17	**Potential UCLs to Use**	
AppChi2	10.24	95% KM (Chebyshev) UCL	26.42
95% Gamma Approximate UCL (Use when n >= 40)	23.56		
95% Adjusted Gamma UCL (Use when n < 40)	24.3		

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

APPENDIX B-4
STATISTICS FOR GROUNDWATER - VAPOR INTRUSION - WESTERN AREA
Clean Harbors Kansas, LLC- Wichita, Kansas

Vinyl chloride
All units in ug/L.

General Statistics

Number of Valid Data	35	Number of Detected Data	0
Number of Distinct Detected Data	0	Number of Non-Detect Data	35
		Percent Non-Detects	100.00%

Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!
Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!
The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Vinyl chloride was not processed!

APPENDIX B-5
STATISTICS FOR GROUNDWATER - VAPOR INTRUSION - CENTRAL AREA
Clean Harbors Kansas, LLC- Wichita, Kansas

1,1-Dichloroethane
All units in ug/L.

General Statistics

Number of Valid Data	47	Number of Detected Data	15
Number of Distinct Detected Data	14	Number of Non-Detect Data	32
		Percent Non-Detects	68.09%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.49	Minimum Detected	-0.713
Maximum Detected	26.2	Maximum Detected	3.266
Mean of Detected	5.499	Mean of Detected	1.051
SD of Detected	6.929	SD of Detected	1.215
Minimum Non-Detect	1	Minimum Non-Detect	0
Maximum Non-Detect	1	Maximum Non-Detect	0

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.712	Shapiro Wilk Test Statistic	0.949
5% Shapiro Wilk Critical Value	0.881	5% Shapiro Wilk Critical Value	0.881
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	2.096	Mean	-0.136
SD	4.49	SD	1.061
95% DL/2 (t) UCL	3.195	95% H-Stat (DL/2) UCL	2.227
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	-0.0571
		SD in Log Scale	1.268
		Mean in Original Scale	2.294
		SD in Original Scale	4.447
		95% t UCL	3.383
		95% Percentile Bootstrap UCL	3.46
		95% BCA Bootstrap UCL	3.94
		95% H-UCL	3.456

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	0.761	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	7.23		
nu star	22.82		
A-D Test Statistic	0.471	Nonparametric Statistics	
5% A-D Critical Value	0.768	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.768	Mean	2.204
5% K-S Critical Value	0.229	SD	4.405
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	0.666
		95% KM (t) UCL	3.323
Assuming Gamma Distribution		95% KM (z) UCL	3.301
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	3.299
Minimum	0.000001	95% KM (bootstrap t) UCL	4.612
Maximum	26.2	95% KM (BCA) UCL	3.439
Mean	2.527	95% KM (Percentile Bootstrap) UCL	3.379
Median	0.82	95% KM (Chebyshev) UCL	5.11
SD	4.55	97.5% KM (Chebyshev) UCL	6.367
k star	0.142	99% KM (Chebyshev) UCL	8.836
Theta star	17.75		
Nu star	13.39	Potential UCLs to Use	
AppChi2	6.153	95% KM (t) UCL	3.323
95% Gamma Approximate UCL (Use when n >= 40)	5.498		
95% Adjusted Gamma UCL (Use when n < 40)	5.64		

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

APPENDIX B-5
STATISTICS FOR GROUNDWATER - VAPOR INTRUSION - CENTRAL AREA
Clean Harbors Kansas, LLC- Wichita, Kansas

Ethylbenzene
All units in ug/L.

General Statistics

Number of Valid Data	47	Number of Detected Data	2
Number of Distinct Detected Data	2	Number of Non-Detect Data	45
		Percent Non-Detects	95.74%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	1	Minimum Detected	0
Maximum Detected	22.1	Maximum Detected	3.096
Mean of Detected	11.55	Mean of Detected	1.548
SD of Detected	14.92	SD of Detected	2.189
Minimum Non-Detect	1	Minimum Non-Detect	0
Maximum Non-Detect	5	Maximum Non-Detect	1.609

Note: Data have multiple DLs - Use of KM Method is recommended
For all methods (except KM, DL/2, and ROS Methods),
Observations < Largest ND are treated as NDs

Number treated as Non-Detect	46
Number treated as Detected	1
Single DL Non-Detect Percentage	97.87%

Warning: Data set has only 2 Distinct Detected Values.
This may not be adequate enough to compute meaningful and reliable test statistics and estimates.
The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).
Unless Data Quality Objectives (DQOs) have been met, it is suggested to collect additional observations.
The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.
Those methods will return a 'N/A' value on your output display!
It is necessary to have 4 or more Distinct Values for bootstrap methods.
However, results obtained using 4 to 9 distinct values may not be reliable.
It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	N/A	Shapiro Wilk Test Statistic	N/A
5% Shapiro Wilk Critical Value	N/A	5% Shapiro Wilk Critical Value	N/A
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	1.066	Mean	-0.515
SD	3.162	SD	0.643
95% DL/2 (t) UCL	1.84	95% H-Stat (DL/2) UCL	0.887
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	N/A
		SD in Log Scale	N/A
		Mean in Original Scale	N/A
		SD in Original Scale	N/A
		95% t UCL	N/A
		95% Percentile Bootstrap UCL	N/A
		95% BCA Bootstrap UCL	N/A
		95% H-UCL	N/A

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	N/A	**Data do not follow a Discernable Distribution (0.05)**	
Theta Star	N/A		
nu star	N/A		
A-D Test Statistic	N/A	**Nonparametric Statistics**	
5% A-D Critical Value	N/A	Kaplan-Meier (KM) Method	
K-S Test Statistic	N/A	Mean	1.449
5% K-S Critical Value	N/A	SD	3.045
Data not Gamma Distributed at 5% Significance Level		SE of Mean	0.628
		95% KM (t) UCL	2.503
Assuming Gamma Distribution		95% KM (z) UCL	2.482
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	15.18
Minimum	N/A	95% KM (bootstrap t) UCL	1.449
Maximum	N/A	95% KM (BCA) UCL	N/A
Mean	N/A	95% KM (Percentile Bootstrap) UCL	22.1
Median	N/A	95% KM (Chebyshev) UCL	4.187
SD	N/A	97.5% KM (Chebyshev) UCL	5.371
k star	N/A	99% KM (Chebyshev) UCL	7.698
Theta star	N/A		
Nu star	N/A	**Potential UCLs to Use**	
AppChi2	N/A	99% KM (Chebyshev) UCL	7.698
95% Gamma Approximate UCL (Use when n >= 40)	N/A		
95% Adjusted Gamma UCL (Use when n < 40)	N/A		

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

APPENDIX B-5
STATISTICS FOR GROUNDWATER - VAPOR INTRUSION - CENTRAL AREA
Clean Harbors Kansas, LLC- Wichita, Kansas

Tetrachloroethene
All units in ug/L.

General Statistics

Number of Valid Data	47	Number of Detected Data	37
Number of Distinct Detected Data	36	Number of Non-Detect Data	10
		Percent Non-Detects	21.28%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.38	Minimum Detected	-0.968
Maximum Detected	724.5	Maximum Detected	6.585
Mean of Detected	47.9	Mean of Detected	1.982
SD of Detected	136.9	SD of Detected	1.813
Minimum Non-Detect	1	Minimum Non-Detect	0
Maximum Non-Detect	1	Maximum Non-Detect	0

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.384	Shapiro Wilk Test Statistic	0.945
5% Shapiro Wilk Critical Value	0.936	5% Shapiro Wilk Critical Value	0.936
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	37.81	Mean	1.413
SD	122.7	SD	1.949
95% DL/2 (t) UCL	67.85	95% H-Stat (DL/2) UCL	75.41
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	2.15	Mean in Log Scale	1.309
SD	151.1	SD in Log Scale	2.111
95% MLE (t) UCL	39.16	Mean in Original Scale	37.8
95% MLE (Tiku) UCL	40.61	SD in Original Scale	122.7
		95% t UCL	67.83
		95% Percentile Bootstrap UCL	70.51
		95% BCA Bootstrap UCL	85.68
		95% H UCL	110.2
Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	0.345	Data appear Lognormal at 5% Significance Level	
Theta Star	139		
nu star	25.5		
A-D Test Statistic	3.173	**Nonparametric Statistics**	
5% A-D Critical Value	0.845	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.845	Mean	37.85
5% K-S Critical Value	0.156	SD	121.3
Data not Gamma Distributed at 5% Significance Level		SE of Mean	17.94
Assuming Gamma Distribution		95% KM (t) UCL	67.97
Gamma ROS Statistics using Extrapolated Data		95% KM (z) UCL	67.36
Minimum	0.000001	95% KM (jackknife) UCL	67.88
Maximum	724.5	95% KM (bootstrap t) UCL	168.3
Mean	37.71	95% KM (BCA) UCL	72.08
Median	3	95% KM (Percentile Bootstrap) UCL	70.92
SD	122.7	95% KM (Chebyshev) UCL	116.1
k star	0.157	97.5% KM (Chebyshev) UCL	149.9
Theta star	239.5	99% KM (Chebyshev) UCL	216.4
Nu star	14.8	**Potential UCLs to Use**	
AppChi2	7.121	97.5% KM (Chebyshev) UCL	149.9
95% Gamma Approximate UCL (Use when n >= 40)	78.36		
95% Adjusted Gamma UCL (Use when n < 40)	80.26		

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

APPENDIX B-5
STATISTICS FOR GROUNDWATER - VAPOR INTRUSION - CENTRAL AREA
Clean Harbors Kansas, LLC- Wichita, Kansas

Trichloroethene
All units in ug/L.

General Statistics

Number of Valid Data	47	Number of Detected Data	35
Number of Distinct Detected Data	34	Number of Non-Detect Data	12
		Percent Non-Detects	25.53%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.35	Minimum Detected	-1.05
Maximum Detected	219.5	Maximum Detected	5.391
Mean of Detected	20.47	Mean of Detected	1.68
SD of Detected	43.08	SD of Detected	1.684
Minimum Non-Detect	1	Minimum Non-Detect	0
Maximum Non-Detect	1	Maximum Non-Detect	0

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.5
5% Shapiro Wilk Critical Value	0.934

Data not Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.966
5% Shapiro Wilk Critical Value	0.934

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method

Mean	15.37
SD	38.07
95% DL/2 (t) UCL	24.69
Maximum Likelihood Estimate(MLE) Method	N/A

MLE yields a negative mean

Assuming Lognormal Distribution

DL/2 Substitution Method

Mean	1.074
SD	1.786
95% H-Stat (DL/2) UCL	34.36

Log ROS Method

Mean in Log Scale	1.058
SD in Log Scale	1.859
Mean in Original Scale	15.41
SD in Original Scale	38.05
95% t UCL	24.73
95% Percentile Bootstrap UCL	25.54
95% BCA Bootstrap UCL	30.6
95% H-UCL	41.18

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	0.456
Theta Star	44.9
nu star	31.91
A-D Test Statistic	1.324
5% A-D Critical Value	0.817
K-S Test Statistic	0.817
5% K-S Critical Value	0.158

Data follow Appr. Gamma Distribution at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data

Minimum	0.000001
Maximum	219.5
Mean	15.24
Median	2.3
SD	38.12
k star	0.158
Theta star	96.7
Nu star	14.82
AppChi2	7.135
95% Gamma Approximate UCL (Use when n >= 40)	31.66
95% Adjusted Gamma UCL (Use when n < 40)	32.43

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data Follow Appr. Gamma Distribution at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method

Mean	15.4
SD	37.65
SE of Mean	5.572
95% KM (t) UCL	24.75
95% KM (z) UCL	24.56
95% KM (jackknife) UCL	24.72
95% KM (bootstrap t) UCL	38.93
95% KM (BCA) UCL	27.03
95% KM (Percentile Bootstrap) UCL	25.81
95% KM (Chebyshev) UCL	39.69
97.5% KM (Chebyshev) UCL	50.2
99% KM (Chebyshev) UCL	70.84

Potential UCLs to Use

95% KM (Chebyshev) UCL	39.69

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

APPENDIX B-5
STATISTICS FOR GROUNDWATER - VAPOR INTRUSION - CENTRAL AREA
Clean Harbors Kansas, LLC- Wichita, Kansas

Vinyl chloride
All units in ug/L.

General Statistics

Number of Valid Data	47	Number of Detected Data	10
Number of Distinct Detected Data	10	Number of Non-Detect Data	37
		Percent Non-Detects	78.72%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.45	Minimum Detected	-0.799
Maximum Detected	102	Maximum Detected	4.625
Mean of Detected	16.38	Mean of Detected	1.522
SD of Detected	31.29	SD of Detected	1.644
Minimum Non-Detect	1	Minimum Non-Detect	0
Maximum Non-Detect	5	Maximum Non-Detect	1.609

Note: Data have multiple DLs - Use of KM Method is recommended
For all methods (except KM, DL/2, and ROS Methods),
Observations < Largest ND are treated as NDs

Number treated as Non-Detect	44
Number treated as Detected	3
Single DL Non-Detect Percentage	93.62%

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.56
5% Shapiro Wilk Critical Value	0.842

Data not Normal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	3.921
SD	15.31
95% DL/2 (t) UCL	7.67
Maximum Likelihood Estimate(MLE) Method	N/A

MLE yields a negative mean

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.94
5% Shapiro Wilk Critical Value	0.842

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	-0.188
SD	1.179
95% H-Stat (DL/2) UCL	2.58
Log ROS Method	
Mean in Log Scale	-0.502
SD in Log Scale	1.747
Mean in Original Scale	4.026
SD in Original Scale	15.3
95% t UCL	7.772
95% Percentile Bootstrap UCL	8.199
95% BCA Bootstrap UCL	11.56
95% H-UCL	6.426

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	0.416
Theta Star	39.39
nu star	8.317
A-D Test Statistic	0.797
5% A-D Critical Value	0.777
K-S Test Statistic	0.777
5% K-S Critical Value	0.281

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	0.000001
Maximum	102
Mean	4.519
Median	0.000001
SD	15.43
k star	0.0958
Theta star	47.15
Nu star	9.01
AppChi2	3.333
95% Gamma Approximate UCL (Use when n >= 40)	12.22
95% Adjusted Gamma UCL (Use when n < 40)	12.63

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only
Data appear Lognormal at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	4.014
SD	15.13
SE of Mean	2.329
95% KM (t) UCL	7.924
95% KM (z) UCL	7.845
95% KM (jackknife) UCL	7.781
95% KM (bootstrap t) UCL	17.89
95% KM (BCA) UCL	9.299
95% KM (Percentile Bootstrap) UCL	8.3
95% KM (Chebyshev) UCL	14.17
97.5% KM (Chebyshev) UCL	18.56
99% KM (Chebyshev) UCL	27.19

Potential UCLs to Use

95% KM (Chebyshev) UCL	14.17

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

APPENDIX B-6
STATISTICS FOR GROUNDWATER - VAPOR INTRUSION - EASTERN AREA
Clean Harbors Kansas, LLC- Wichita, Kansas

1,1-Dichloroethane
All units in ug/L.

General Statistics

Number of Valid Data	35	Number of Detected Data	14
Number of Distinct Detected Data	14	Number of Non-Detect Data	21
		Percent Non-Detects	60.00%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.73	Minimum Detected	-0.315
Maximum Detected	108	Maximum Detected	4.682
Mean of Detected	12.88	Mean of Detected	1.171
SD of Detected	29.78	SD of Detected	1.414
Minimum Non-Detect	1	Minimum Non-Detect	0
Maximum Non-Detect	1	Maximum Non-Detect	0

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.458	Shapiro Wilk Test Statistic	0.788
5% Shapiro Wilk Critical Value	0.874	5% Shapiro Wilk Critical Value	0.874
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	5.453	Mean	0.0524
SD	19.41	SD	1.274
95% DL/2 (t) UCL	11	95% H-Stat (DL/2) UCL	4.388
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	-0.197
		SD in Log Scale	1.638
		Mean in Original Scale	5.451
		SD in Original Scale	19.42
		95% t UCL	11
		95% Percentile Bootstrap UCL	11.48
		95% BCA Bootstrap UCL	16.58
		95% H-UCL	8.011

Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**
k star (bias corrected)	0.412	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	31.25	
nu star	11.54	
A-D Test Statistic	2.358	**Nonparametric Statistics**
5% A-D Critical Value	0.8	Kaplan-Meier (KM) Method
K-S Test Statistic	0.8	Mean 5.633
5% K-S Critical Value	0.243	SD 19.09
Data not Gamma Distributed at 5% Significance Level		SE of Mean 3.349
		95% KM (t) UCL 11.3
		95% KM (z) UCL 11.14
		95% KM (jackknife) UCL 11.17
		95% KM (bootstrap t) UCL 102.3
		95% KM (BCA) UCL 11.72
		95% KM (Percentile Bootstrap) UCL 11.89
		95% KM (Chebyshev) UCL 20.23
		97.5% KM (Chebyshev) UCL 26.54
		99% KM (Chebyshev) UCL 38.95

Assuming Gamma Distribution	
Gamma ROS Statistics using Extrapolated Data	
Minimum	0.000001
Maximum	108
Mean	5.153
Median	0.000001
SD	19.49
k star	0.0988
Theta star	52.13
Nu star	6.919
AppChi2	2.126
95% Gamma Approximate UCL (Use when n >= 40)	16.77
95% Adjusted Gamma UCL (Use when n < 40)	17.8

Potential UCLs to Use	
95% KM (BCA) UCL	11.72

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006). For additional insight, the user may want to consult a statistician.

APPENDIX B-6
STATISTICS FOR GROUNDWATER - VAPOR INTRUSION - EASTERN AREA
Clean Harbors Kansas, LLC- Wichita, Kansas

Ethylbenzene
All units in ug/L.

General Statistics

Number of Valid Data	35	Number of Detected Data	3
Number of Distinct Detected Data	3	Number of Non-Detect Data	32
		Percent Non-Detects	91.43%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.99	Minimum Detected	-0.0101
Maximum Detected	43.1	Maximum Detected	3.764
Mean of Detected	15.86	Mean of Detected	1.669
SD of Detected	23.62	SD of Detected	1.921
Minimum Non-Detect	1	Minimum Non-Detect	0
Maximum Non-Detect	5	Maximum Non-Detect	1.609

Note: Data have multiple DLs - Use of KM Method is recommended
For all methods (except KM, DL/2, and ROS Methods),
Observations < Largest ND are treated as NDs

Number treated as Non-Detect	34
Number treated as Detected	1
Single DL Non-Detect Percentage	97.14%

Warning: There are only 3 Distinct Detected Values in this data set
The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.
Those methods will return a 'N/A' value on your output display!
It is necessary to have 4 or more Distinct Values for bootstrap methods.
However, results obtained using 4 to 9 distinct values may not be reliable.
It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.795	Shapiro Wilk Test Statistic	0.965
5% Shapiro Wilk Critical Value	0.767	5% Shapiro Wilk Critical Value	0.767
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	1.874	Mean	-0.445
SD	7.199	SD	0.85
95% DL/2 (t) UCL	3.932	95% H-Stat (DL/2) UCL	1.282
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	-0.109
		SD in Log Scale	1.317
		Mean in Original Scale	2.577
		SD in Original Scale	7.192
		95% t UCL	4.632
		95% Percentile Bootstrap UCL	4.839
		95% BCA Bootstrap UCL	6.431
		95% H-UCL	4.082

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	N/A	**Data appear Normal at 5% Significance Level**	
Theta Star	N/A		
nu star	N/A		
A-D Test Statistic	N/A	**Nonparametric Statistics**	
5% A-D Critical Value	N/A	Kaplan-Meier (KM) Method	
K-S Test Statistic	N/A	Mean	2.267
5% K-S Critical Value	N/A	SD	7.016
Data not Gamma Distributed at 5% Significance Level		SE of Mean	1.452
		95% KM (t) UCL	4.723
Assuming Gamma Distribution		95% KM (z) UCL	4.656
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	4.409
Minimum	N/A	95% KM (bootstrap t) UCL	16.75
Maximum	N/A	95% KM (BCA) UCL	43.1
Mean	N/A	95% KM (Percentile Bootstrap) UCL	43.1
Median	N/A	95% KM (Chebyshev) UCL	8.598
SD	N/A	97.5% KM (Chebyshev) UCL	11.34
k star	N/A	99% KM (Chebyshev) UCL	16.72
Theta star	N/A		
Nu star	N/A	**Potential UCLs to Use**	
AppChi2	N/A	95% KM (t) UCL	4.723
95% Gamma Approximate UCL (Use when n >= 40)	N/A	95% KM (Percentile Bootstrap) UCL	43.1
95% Adjusted Gamma UCL (Use when n < 40)	N/A		

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

APPENDIX B-6
STATISTICS FOR GROUNDWATER - VAPOR INTRUSION - EASTERN AREA
Clean Harbors Kansas, LLC- Wichita, Kansas

Tetrachloroethene
All units in ug/L.

General Statistics

Number of Valid Data	35	Number of Detected Data	23
Number of Distinct Detected Data	21	Number of Non-Detect Data	12
		Percent Non-Detects	34.29%

Raw Statistics

Minimum Detected	0.6
Maximum Detected	281
Mean of Detected	25.38
SD of Detected	71.61
Minimum Non-Detect	1
Maximum Non-Detect	1

Log-transformed Statistics

Minimum Detected	-0.511
Maximum Detected	5.638
Mean of Detected	1.372
SD of Detected	1.561
Minimum Non-Detect	0
Maximum Non-Detect	0

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.373
5% Shapiro Wilk Critical Value	0.914

Data not Normal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	16.85
SD	58.83
95% DL/2 (t) UCL	33.66
Maximum Likelihood Estimate(MLE) Method	N/A

MLE yields a negative mean

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.825
5% Shapiro Wilk Critical Value	0.914

Data not Lognormal at 5% Significance Level

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	0.664
SD	1.602
95% H-Stat (DL/2) UCL	17.26
Log ROS Method	
Mean in Log Scale	0.399
SD in Log Scale	1.933
Mean in Original Scale	16.79
SD in Original Scale	58.85
95% t UCL	33.61
95% Percentile Bootstrap UCL	35.09
95% BCA Bootstrap UCL	42.86
95% H-UCL	33.88

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	0.342
Theta Star	74.28
nu star	15.71
A-D Test Statistic	3.801
5% A-D Critical Value	0.836
K-S Test Statistic	0.836
5% K-S Critical Value	0.195

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	0.000001
Maximum	281
Mean	16.68
Median	1.4
SD	58.88
k star	0.128
Theta star	130.1
Nu star	8.972
AppChi2	3.31
95% Gamma Approximate UCL (Use when n >= 40)	45.2
95% Adjusted Gamma UCL (Use when n < 40)	47.53

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	16.91
SD	57.97
SE of Mean	10.02
95% KM (t) UCL	33.85
95% KM (z) UCL	33.39
95% KM (jackknife) UCL	33.72
95% KM (bootstrap t) UCL	276.5
95% KM (BCA) UCL	37.71
95% KM (Percentile Bootstrap) UCL	34.4
95% KM (Chebyshev) UCL	60.58
97.5% KM (Chebyshev) UCL	79.48
99% KM (Chebyshev) UCL	116.6

Potential UCLs to Use

99% KM (Chebyshev) UCL	116.6

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

APPENDIX B-6
STATISTICS FOR GROUNDWATER - VAPOR INTRUSION - EASTERN AREA
Clean Harbors Kansas, LLC- Wichita, Kansas

Trichloroethene
All units in ug/L.

General Statistics

Number of Valid Data	35	Number of Detected Data	32
Number of Distinct Detected Data	31	Number of Non-Detect Data	3
		Percent Non-Detects	8.57%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.49	Minimum Detected	-0.713
Maximum Detected	110	Maximum Detected	4.7
Mean of Detected	19.24	Mean of Detected	1.741
SD of Detected	29.85	SD of Detected	1.656
Minimum Non-Detect	1	Minimum Non-Detect	0
Maximum Non-Detect	1	Maximum Non-Detect	0

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.668	Shapiro Wilk Test Statistic	0.936
5% Shapiro Wilk Critical Value	0.93	5% Shapiro Wilk Critical Value	0.93
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	17.63	Mean	1.532
SD	28.99	SD	1.726
95% DL/2 (t) UCL	25.92	95% H-Stat (DL/2) UCL	57.27
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	11.4	Mean in Log Scale	1.541
SD	35.18	SD in Log Scale	1.72
95% MLE (t) UCL	21.45	Mean in Original Scale	17.64
95% MLE (Tiku) UCL	21.62	SD in Original Scale	28.99
		95% t UCL	25.93
		95% Percentile Bootstrap UCL	26.2
		95% BCA Bootstrap UCL	27.76
		95% H UCL	56.89

Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**
k star (bias corrected)	0.491	**Data appear Lognormal at 5% Significance Level**
Theta Star	39.15	
nu star	31.45	
A-D Test Statistic	1.384	**Nonparametric Statistics**
5% A-D Critical Value	0.809	Kaplan-Meier (KM) Method
K-S Test Statistic	0.809	Mean 17.65
5% K-S Critical Value	0.164	SD 28.57
Data not Gamma Distributed at 5% Significance Level		SE of Mean 4.906
Assuming Gamma Distribution		95% KM (t) UCL 25.94
Gamma ROS Statistics using Extrapolated Data		95% KM (z) UCL 25.72
Minimum	0.000001	95% KM (jackknife) UCL 25.93
Maximum	110	95% KM (bootstrap t) UCL 29.55
Mean	17.59	95% KM (BCA) UCL 27.25
Median	4.1	95% KM (Percentile Bootstrap) UCL 25.99
SD	29.02	95% KM (Chebyshev) UCL 39.03
k star	0.278	97.5% KM (Chebyshev) UCL 48.29
Theta star	63.32	99% KM (Chebyshev) UCL 66.46
Nu star	19.45	**Potential UCLs to Use**
AppChi2	10.44	99% KM (Chebyshev) UCL 66.46
95% Gamma Approximate UCL (Use when n >= 40)	32.75	
95% Adjusted Gamma UCL (Use when n < 40)	33.76	

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006). For additional insight, the user may want to consult a statistician.

APPENDIX B-6
STATISTICS FOR GROUNDWATER - VAPOR INTRUSION - EASTERN AREA
Clean Harbors Kansas, LLC- Wichita, Kansas

Vinyl chloride
All units in ug/L.

General Statistics

Number of Valid Data	35
Number of Distinct Detected Data	12
Number of Detected Data	12
Number of Non-Detect Data	23
Percent Non-Detects	65.71%

Raw Statistics

Minimum Detected	0.55
Maximum Detected	14.2
Mean of Detected	2.981
SD of Detected	3.846
Minimum Non-Detect	1
Maximum Non-Detect	5

Log-transformed Statistics

Minimum Detected	-0.598
Maximum Detected	2.653
Mean of Detected	0.558
SD of Detected	1.028
Minimum Non-Detect	0
Maximum Non-Detect	1.609

Note: Data have multiple DLs - Use of KM Method is recommended
For all methods (except KM, DL/2, and ROS Methods),
Observations < Largest ND are treated as NDs

Number treated as Non-Detect	33
Number treated as Detected	2
Single DL Non-Detect Percentage	94.29%

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.66
5% Shapiro Wilk Critical Value	0.859

Data not Normal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	1.408
SD	2.496
95% DL/2 (t) UCL	2.121
Maximum Likelihood Estimate(MLE) Method	N/A

MLE method failed to converge properly

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.928
5% Shapiro Wilk Critical Value	0.859

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	-0.218
SD	0.859
95% H-Stat (DL/2) UCL	1.63
Log ROS Method	
Mean in Log Scale	-0.187
SD in Log Scale	0.969
Mean in Original Scale	1.471
SD in Original Scale	2.473
95% t UCL	2.178
95% Percentile Bootstrap UCL	2.216
95% BCA Bootstrap UCL	2.682
95% H-UCL	1.982

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	0.859
Theta Star	3.47
nu star	20.62
A-D Test Statistic	0.561
5% A-D Critical Value	0.755
K-S Test Statistic	0.755
5% K-S Critical Value	0.252

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	0.000001
Maximum	14.2
Mean	1.573
Median	0.854
SD	2.555
k star	0.183
Theta star	8.605
Nu star	12.8
AppChi2	5.757
95% Gamma Approximate UCL (Use when n >= 40)	3.497
95% Adjusted Gamma UCL (Use when n < 40)	3.639

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data appear Gamma Distributed at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	1.437
SD	2.433
SE of Mean	0.431
95% KM (t) UCL	2.166
95% KM (z) UCL	2.146
95% KM (jackknife) UCL	2.146
95% KM (bootstrap t) UCL	3.266
95% KM (BCA) UCL	2.303
95% KM (Percentile Bootstrap) UCL	2.221
95% KM (Chebyshev) UCL	3.315
97.5% KM (Chebyshev) UCL	4.128
99% KM (Chebyshev) UCL	5.724

Potential UCLs to Use

95% KM (t) UCL	2.166

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

APPENDIX B-7
STATISTICS FOR SEDIMENT
Clean Harbors Kansas, LLC- Wichita, Kansas

Benzo(a)pyrene
All units mg/kg.

General Statistics

Number of Valid Data	11
Number of Distinct Detected Data	2
Number of Detected Data	2
Number of Non-Detect Data	9
Percent Non-Detects	81.82%

Raw Statistics

Minimum Detected	0.0368
Maximum Detected	0.0611
Mean of Detected	0.0489
SD of Detected	0.0172
Minimum Non-Detect	0.19
Maximum Non-Detect	0.21

Log-transformed Statistics

Minimum Detected	-3.302
Maximum Detected	-2.795
Mean of Detected	-3.049
SD of Detected	0.359
Minimum Non-Detect	-1.661
Maximum Non-Detect	-1.561

Note: Data have multiple DLs - Use of KM Method is recommended
For all methods (except KM, DL/2, and ROS Methods),
Observations < Largest ND are treated as NDs

Number treated as Non-Detect	11
Number treated as Detected	0
Single DL Non-Detect Percentage	100.00%

Warning: Data set has only 2 Distinct Detected Values.
This may not be adequate enough to compute meaningful and reliable test statistics and estimates.
The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).
Unless Data Quality Objectives (DQOs) have been met, it is suggested to collect additional observations.
The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.
Those methods will return a 'N/A' value on your output display!
It is necessary to have 4 or more Distinct Values for bootstrap methods.
However, results obtained using 4 to 9 distinct values may not be reliable.
It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	N/A
5% Shapiro Wilk Critical Value	N/A

Data not Normal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method

Mean	0.0916
SD	0.022
95% DL/2 (t) UCL	0.104

Maximum Likelihood Estimate(MLE) Method	N/A

MLE method failed to converge properly

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	N/A
5% Shapiro Wilk Critical Value	N/A

Data not Lognormal at 5% Significance Level

Assuming Lognormal Distribution

DL/2 Substitution Method

Mean	-2.43
SD	0.328
95% H-Stat (DL/2) UCL	0.114

Log ROS Method

Mean in Log Scale	N/A
SD in Log Scale	N/A
Mean in Original Scale	N/A
SD in Original Scale	N/A
95% t UCL	N/A
95% Percentile Bootstrap UCL	N/A
95% BCA Bootstrap UCL	N/A
95% H-UCL	N/A

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	N/A
Theta Star	N/A
nu star	N/A
A-D Test Statistic	N/A
5% A-D Critical Value	N/A
K-S Test Statistic	N/A
5% K-S Critical Value	N/A

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data

Minimum	N/A
Maximum	N/A
Mean	N/A
Median	N/A
SD	N/A
k star	N/A
Theta star	N/A
Nu star	N/A
AppChi2	N/A
95% Gamma Approximate UCL (Use when n >= 40)	N/A
95% Adjusted Gamma UCL (Use when n < 40)	N/A

Data Distribution Test with Detected Values Only
Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method

Mean	0.0489
SD	0.0121
SE of Mean	0.0121
95% KM (t) UCL	0.071
95% KM (z) UCL	0.0689
95% KM (jackknife) UCL	0.0786
95% KM (bootstrap t) UCL	N/A
95% KM (BCA) UCL	N/A
95% KM (Percentile Bootstrap) UCL	N/A
95% KM (Chebyshev) UCL	0.102
97.5% KM (Chebyshev) UCL	0.125
99% KM (Chebyshev) UCL	0.17

Potential UCLs to Use

95% KM (t) UCL	0.071
95% KM (% Bootstrap) UCL	N/A

Warning: Recommended UCL exceeds the maximum observation

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

APPENDIX B-7
STATISTICS FOR SEDIMENT
Clean Harbors Kansas, LLC- Wichita, Kansas

Arsenic
All units mg/kg.

General Statistics

Number of Valid Observations 11

Number of Distinct Observations 11

Raw Statistics

Minimum	2.3
Maximum	13.4
Mean	6
Geometric Mean	5.319
Median	5.8
SD	3.178
Std. Error of Mean	0.958
Coefficient of Variation	0.53
Skewness	1.24

Log-transformed Statistics

Minimum of Log Data	0.833
Maximum of Log Data	2.595
Mean of log Data	1.671
SD of log Data	0.516

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.911
Shapiro Wilk Critical Value	0.85

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	7.737

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	7.959
95% Modified-t UCL (Johnson-1978)	7.796

Gamma Distribution Test

k star (bias corrected)	3.193
Theta Star	1.879
MLE of Mean	6
MLE of Standard Deviation	3.358
nu star	70.25
Approximate Chi Square Value (.05)	51.95
Adjusted Level of Significance	0.0278
Adjusted Chi Square Value	49.4

Anderson-Darling Test Statistic	0.153
Anderson-Darling 5% Critical Value	0.732
Kolmogorov-Smirnov Test Statistic	0.111
Kolmogorov-Smirnov 5% Critical Value	0.256

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL (Use when n >= 40)	8.113
95% Adjusted Gamma UCL (Use when n < 40)	8.533

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.988
Shapiro Wilk Critical Value	0.85

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

95% H-UCL	8.701
95% Chebyshev (MVUE) UCL	10.16
97.5% Chebyshev (MVUE) UCL	11.96
99% Chebyshev (MVUE) UCL	15.49

Data Distribution

Data appear Normal at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	7.576
95% Jackknife UCL	7.737
95% Standard Bootstrap UCL	7.46
95% Bootstrap-t UCL	8.384
95% Hall's Bootstrap UCL	9.194
95% Percentile Bootstrap UCL	7.573
95% BCA Bootstrap UCL	7.9
95% Chebyshev(Mean, Sd) UCL	10.18
97.5% Chebyshev(Mean, Sd) UCL	11.98
99% Chebyshev(Mean, Sd) UCL	15.53

Potential UCL to Use — Use 95% Student's-t UCL 7.737

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

APPENDIX B-7
STATISTICS FOR SEDIMENT
Clean Harbors Kansas, LLC- Wichita, Kansas

Lead
All units mg/kg.

General Statistics

Number of Valid Observations 11

Number of Distinct Observations 11

Raw Statistics

Minimum	5.3
Maximum	3320
Mean	323.1
Geometric Mean	23.21
Median	12.3
SD	994.5
Std. Error of Mean	299.9
Coefficient of Variation	3.078
Skewness	3.309

Log-transformed Statistics

Minimum of Log Data	1.668
Maximum of Log Data	8.108
Mean of log Data	3.145
SD of log Data	1.844

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.365
Shapiro Wilk Critical Value	0.85

Data not Normal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	866.6

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	1136
95% Modified-t UCL (Johnson-1978)	916.5

Gamma Distribution Test

k star (bias corrected)	0.255
Theta Star	1269
MLE of Mean	323.1
MLE of Standard Deviation	640.3
nu star	5.604
Approximate Chi Square Value (.05)	1.441
Adjusted Level of Significance	0.0278
Adjusted Chi Square Value	1.127
Anderson-Darling Test Statistic	2.505
Anderson-Darling 5% Critical Value	0.833
Kolmogorov-Smirnov Test Statistic	0.451
Kolmogorov-Smirnov 5% Critical Value	0.278

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL (Use when n >= 40)	1257
95% Adjusted Gamma UCL (Use when n < 40)	1607

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.696
Shapiro Wilk Critical Value	0.85

Data not Lognormal at 5% Significance Level

Assuming Lognormal Distribution

95% H-UCL	2084
95% Chebyshev (MVUE) UCL	333.8
97.5% Chebyshev (MVUE) UCL	438
99% Chebyshev (MVUE) UCL	642.6

Data Distribution

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

95% CLT UCL	816.4
95% Jackknife UCL	866.6
95% Standard Bootstrap UCL	786.5
95% Bootstrap-t UCL	68233
95% Hall's Bootstrap UCL	19921
95% Percentile Bootstrap UCL	914.6
95% BCA Bootstrap UCL	1225
95% Chebyshev(Mean, Sd) UCL	1630
97.5% Chebyshev(Mean, Sd) UCL	2196
99% Chebyshev(Mean, Sd) UCL	3307

Potential UCL to Use

Use 99% Chebyshev (Mean, Sd) UCL 3307

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Risk-Based Remedies

RBR Consulting, Inc.

APPENDIX C

CALCULATION OF TRANSPORT FACTORS USED TO ESTIMATE INDOOR AIR CONCENTRATIONS

APPENDIX C

Calculation of Transport Factors Used to Estimate Indoor Air Concentrations

This appendix presents the methodology for calculating transport factors that are used to convert soil gas concentrations to concentrations in indoor air. It should be noted that soil gas samples were collected in the vicinity of Building E in the Central Area of the site. However, none of the constituents detected in these two soil gas samples warranted further evaluation. Alternatively, groundwater data from all three areas of the site (the Western Area, the Central Area, and the Eastern Area) were compared to vapor intrusion screening levels. The COI consist of 1,1-dichloroethane, ethylbenzene, tetrachloroethene, trichloroethene and vinyl chloride. The potential for vapor intrusion from groundwater to indoor air was evaluated for a current or future non-residential land use scenario in the three onsite areas. In this appendix, transport factors are calculated to estimate concentrations of COI in indoor air of current/future onsite buildings.

Transport Factor for Indoor Air

The concentration of a constituent in indoor air (C_{ia}) is proportional to the concentration of the constituent in the pore space in soil (i.e., soil gas concentration or C_{sg}) beneath the building. The following equation is used to calculate C_{ia} from C_{sg}:

$$C_{ia} = C_{sg} \times TF$$

where:

C_{ia} = concentration of constituent in indoor air (mg/m^3);

C_{sg} = concentration of constituent in soil gas (mg/m^3); and

TF = transport factor from soil gas to indoor air.

The transport factor (TF) is an infinite source attenuation coefficient, and can be calculated based on a model developed by Johnson and Ettinger (1991). The equation for calculating TF is as follows:

$$\frac{(D_{eff} \times A_B)/(Q_B \times L_T) \times \exp[(Q_{soil} \times L_{crack})/(D_{crack} \times A_{crack})]}{\exp[(Q_{soil} \times L_{crack})/(D_{crack} \times A_{crack})] + (D_{eff} \times A_B)/(Q_B \times L_T) + (D_{eff} \times A_B)/(Q_{soil} \times L_T) \times (\exp[(Q_{soil} \times L_{crack})/(D_{crack} \times A_{crack})] - 1)}$$

where:

D_{eff} = effective diffusion coefficient for vadose zone soil (cm^2/sec);

A_B = area of enclosed space below grade (cm^2);

Q_B = building ventilation rate (cm^3/sec);
L_T = distance from contaminant source to building foundation (cm);
Q_{soil} = volumetric flow rate of soil gas into building (cm^3/sec);
L_{crack} = foundation thickness (cm);
D_{crack} = vapor diffusion coefficient through crack (cm^2/sec); and
A_{crack} = area of cracks through which vapors can pass (cm^2).

To solve this equation, the USEPA's "GW-ADV" spreadsheet (Version 3.1, most recently updated in February 2004) was implemented. A combination of site-specific factors and default values from the User's Guide for Evaluating Subsurface Vapor Intrusion Into Buildings (USEPA, 2004) were used as input values in the models.

The input values are defined below and presented in Tables C-1-A through C-14-A.

- The groundwater source concentration for each COI (CW) in each area of the site is the EPC (in units of ug/L) for each constituent as presented in Tables 3-7 through 3-9 of the report.

- The average system temperature (T_S) is set to 13.9°C, the average value for Kansas as estimated from Figure 8 of the vapor intrusion user's guide (USEPA, 2004).

- The depth below grade to the bottom of the enclosed space floor (L_F) is set to 15 cm, the default value provided by USEPA (2004). The assumption of a slab-on-grade foundation was selected as opposed to a basement foundation, because it is more conservative (i.e., the overall building volume is less).

- The depth below grade to the water table (L_{WT}) is set to 366 cm (12 feet). This value corresponds to the minimum depth to groundwater (as measured at the soil/groundwater interface during 2013 field investigations).

- Based on site boring logs and the description of shallow subsurface soil from the RCRA Facility Investigation Report (Cameron-Cole, 2005), the unsaturated soils are predominantly "gravelly clay and silt". This soil type is not specifically designated in the USEPA (2004) vapor model; however, its characteristics are similar to those of clay loam (CL). Accordingly, the following soil properties are used in the vapor intrusion modeling [based on USEPA (2004) default values for clay loam]: the total porosity (n) is 0.442 cm^3-H_2O/cm^3-soil and the water-filled porosity (n_w) is 0.168 cm^3-H_2O/cm^3-soil. The resulting air-filled porosity (n_a) is 0.274 cm^3-air/cm^3-soil.

- The floor thickness (L_{crack}) is set to the USEPA (2004) default value of 10 cm.
- The soil-building pressure differential (ΔP) is set to the USEPA (2004) default value of 40 g/cm-s^2.
- The building dimensions are set to the USEPA (2004) default dimensions, namely 1000 cm length by 1000 cm width by 244 cm height (a single-story slab on grade building approximately 33' x 33' x 8'). The default dimensions were used to be conservative for a possible future building scenario.
- The floor-wall seam crack width (w) is set to the USEPA (2004) default value of 0.1 cm.
- An indoor air exchange rate (ER) of 0.83/hour is recommended for commercial and industrial buildings, based on ASTM (2002) guidance.

Tables C-1-B through C-14-B present the constituent-specific properties for COI that were used in the TF calculations. Tables C-1-C through C-14-C present the intermediate calculations used to determine the indoor air attenuation coefficients (i.e., the transport factors). The shaded boxes in Tables C-1-C through C-14-C also present the resulting TF values that are applied to the concentrations of COI in soil gas, and the estimated indoor air concentrations.

References

American Society for Testing and Materials (ASTM; 2002) Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites. ASTM E-1739-95 (Reapproved 2002).

Cameron-Cole, LLC (2005) RCRA Facility Investigation (RFI) Report – Clean Harbors Kansas LLC, Formerly Safety-Kleen (Wichita), Inc. KSD007246846. Originally submitted January 20, 2003, and revised on January 20, 2005.

Johnson, P.C. and R.A. Ettinger (1991) Heuristic model for predicting the intrusion rate of contaminant vapors into buildings. *Environ. Sci. Technology*, 25: 1445-1452.

United States Environmental Protection Agency (USEPA; 2004) User's Guide for Evaluating Subsurface Vapor Intrusion into Buildings. February 22, 2004.

APPENDIX C-1-A
DATA ENTRY SHEET FOR 1,1-DICHLOROETHANE - WESTERN AREA
Clean Harbors Kansas, LLC - Wichita, Kansas

GW-ADV
Version 3.1; 02/04

Reset to Defaults

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

YES [ ]

OR

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

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
75343	7.50E-01	1,1-Dichloroethane

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	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 directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	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 L_{WT} (cell G28)							
13.9	15	366	366			A	CL	CL		

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)
CL	1.48	0.442	0.168	S	1.66	0.375	0.054	S	1.66	0.375	0.054

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	244	0.1	0.83	

APPENDIX C-1-B
CHEMICAL PROPERTIES SHEET FOR 1,1-DICHLOROETHANE - WESTERN AREA
Clean Harbors Kansas, LLC - Wichita, Kansas

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (°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)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
7.42E-02	1.05E-05	5.61E-03	25	6,895	330.55	523.00	3.16E+01	5.06E+03	1.6E-06	0.0E+00

END

APPENDIX C-1-C
INTERMEDIATE CALCULATIONS SHEET FOR 1,1-DICHLOROETHANE - WESTERN AREA
Clean Harbors Kansas, LLC - Wichita, Kansas

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)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
9.46E+08	351	0.274	0.321	0.321	0.245	1.27E-09	0.865	1.10E-09	46.88	0.442	0.067	0.375	4,000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	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. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater 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)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
5.63E+04	1.06E+06	3.77E-04	15	7,407	3.46E-03	1.47E-01	1.77E-04	5.10E-03	0.00E+00	0.00E+00	6.05E-05	4.21E-04	351

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	**Infinite source indoor attenuation coefficient, α (unitless)**	**Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)**	Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)
15	1.10E+02	0.10	1.09E+00	5.10E-03	4.00E+02	2.14E+02	**1.05E-05**	**1.15E-03**	1.6E-06	NA

END

APPENDIX C-2-A
DATA ENTRY SHEET FOR ETHYLBENZENE - WESTERN AREA
Clean Harbors Kansas, LLC - Wichita, Kansas

GW-ADV
Version 3.1; 02/04

Reset to Defaults

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

YES [ ]

OR

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

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
100414	1.60E+00	Ethylbenzene

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Totals must add up to value of L_{WT} (cell G28) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	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)
13.9	15	366	366			A	CL	CL		

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)
CL	1.48	0.442	0.168	S	1.66	0.375	0.054	S	1.66	0.375	0.054

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	244	0.1	0.83	

APPENDIX C-2-B
CHEMICAL PROPERTIES SHEET FOR ETHYLBENZENE - WESTERN AREA
Clean Harbors Kansas, LLC - Wichita, Kansas

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)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
7.50E-02	7.80E-06	7.86E-03	25	8,501	409.34	617.20	3.63E+02	1.69E+02	2.5E-06	1.0E+00

END

APPENDIX C-2-C
INTERMEDIATE CALCULATIONS SHEET FOR ETHYLBENZENE - WESTERN AREA
Clean Harbors Kansas, LLC - Wichita, Kansas

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)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
9.46E+08	351	0.274	0.321	0.321	0.245	1.27E-09	0.865	1.10E-09	46.88	0.442	0.067	0.375	4,000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	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. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater 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)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
5.63E+04	1.06E+06	3.77E-04	15	10,111	4.06E-03	1.72E-01	1.77E-04	5.15E-03	0.00E+00	0.00E+00	5.59E-05	3.91E-04	351

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	**Infinite source indoor attenuation coefficient, α (unitless)**	**Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)**	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	2.76E+02	0.10	1.09E+00	5.15E-03	4.00E+02	2.03E+02	**1.01E-05**	**2.79E-03**	2.5E-06	1.0E+00

END

Risk-Based Remedies
RBR Consulting, Inc.

APPENDIX C-3-A
DATA ENTRY SHEET FOR TETRACHLOROETHENE - WESTERN AREA
Clean Harbors Kansas, LLC - Wichita, Kansas

GW-ADV
Version 3.1; 02/04

Reset to Defaults

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

YES [ ]

OR

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

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
127184	9.47E+01	Tetrachloroethylene

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Totals must add up to value of L_{WT} (cell G28) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	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)
13.9	15	366	366			A	CL	CL		

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)
CL	1.48	0.442	0.168	S	1.66	0.375	0.054	S	1.66	0.375	0.054

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	244	0.1	0.83	

APPENDIX C-3-B
CHEMICAL PROPERTIES SHEET FOR TETRACHLOROETHENE - WESTERN AREA
Clean Harbors Kansas, LLC - Wichita, Kansas

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (°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)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
7.20E-02	8.20E-06	1.84E-02	25	8,288	394.40	620.20	1.55E+02	2.00E+02	2.6E-07	4.0E-02

END

APPENDIX C-3-C
INTERMEDIATE CALCULATIONS SHEET FOR TETRACHLOROETHENE - WESTERN AREA
Clean Harbors Kansas, LLC - Wichita, Kansas

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)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
9.46E+08	351	0.274	0.321	0.321	0.245	1.27E-09	0.865	1.10E-09	46.88	0.442	0.067	0.375	4,000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	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. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater 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)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
5.63E+04	1.06E+06	3.77E-04	15	9,514	9.86E-03	4.19E-01	1.77E-04	4.95E-03	0.00E+00	0.00E+00	4.90E-05	3.45E-04	351

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(Pe^f) (unitless)	**Infinite source indoor attenuation coefficient, α (unitless)**	**Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)**	Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)
15	3.97E+04	0.10	1.09E+00	4.95E-03	4.00E+02	2.53E+02	**9.50E-06**	**3.77E-01**	2.6E-07	4.0E-02

END

APPENDIX C-4-A
DATA ENTRY SHEET FOR TRICHLOROETHENE - WESTERN AREA
Clean Harbors Kansas, LLC - Wichita, Kansas

GW-ADV
Version 3.1; 02/04

Reset to Defaults

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

YES [ ]

OR

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

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
79016	2.64E+01	Trichloroethylene

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Totals must add up to value of L_{WT} (cell G28) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	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)
13.9	15	366	366			A	CL	CL		

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)
CL	1.48	0.442	0.168	S	1.66	0.375	0.054	S	1.66	0.375	0.054

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	244	0.1	0.83	

APPENDIX C-4-B
CHEMICAL PROPERTIES SHEET FOR TRICHLOROETHENE - WESTERN AREA
Clean Harbors Kansas, LLC - Wichita, Kansas

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (°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)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
7.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	1.66E+02	1.47E+03	4.1E-06	2.0E-03

END

APPENDIX C-4-C
INTERMEDIATE CALCULATIONS SHEET FOR TRICHLOROETHENE - WESTERN AREA
Clean Harbors Kansas, LLC - Wichita, Kansas

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)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
9.46E+08	351	0.274	0.321	0.321	0.245	1.27E-09	0.865	1.10E-09	46.88	0.442	0.067	0.375	4,000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	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. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater 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)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
5.63E+04	1.06E+06	3.77E-04	15	8,509	5.90E-03	2.50E-01	1.77E-04	5.43E-03	0.00E+00	0.00E+00	5.67E-05	3.97E-04	351

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	**Infinite source indoor attenuation coefficient, α (unitless)**	**Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)**	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	6.61E+03	0.10	1.09E+00	5.43E-03	4.00E+02	1.55E+02	**1.02E-05**	**6.75E-02**	4.1E-06	2.0E-03

END

APPENDIX C-5-A
DATA ENTRY SHEET FOR 1,1-DICHLOROETHANE - CENTRAL AREA
Clean Harbors Kansas, LLC - Wichita, Kansas

GW-ADV
Version 3.1; 02/04

Reset to Defaults

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

YES [ ]

OR

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

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
75343	3.32E+00	1,1-Dichloroethane

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Totals must add up to value of L_{WT} (cell G28) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	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)
13.9	15	366	366			A	CL	CL		

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)
CL	1.48	0.442	0.168	S	1.66	0.375	0.054	S	1.66	0.375	0.054

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	244	0.1	0.83	

APPENDIX C-5-B
CHEMICAL PROPERTIES SHEET FOR 1,1-DICHLOROETHANE - CENTRAL AREA
Clean Harbors Kansas, LLC - Wichita, Kansas

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (°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)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
7.42E-02	1.05E-05	5.61E-03	25	6,895	330.55	523.00	3.16E+01	5.06E+03	1.6E-06	0.0E+00

END

APPENDIX C-5-C
INTERMEDIATE CALCULATIONS SHEET FOR 1,1-DICHLOROETHANE - CENTRAL AREA
Clean Harbors Kansas, LLC - Wichita, Kansas

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)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
9.46E+08	351	0.274	0.321	0.321	0.245	1.27E-09	0.865	1.10E-09	46.88	0.442	0.067	0.375	4,000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	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. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater 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)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
5.63E+04	1.06E+06	3.77E-04	15	7,407	3.46E-03	1.47E-01	1.77E-04	5.10E-03	0.00E+00	0.00E+00	6.05E-05	4.21E-04	351

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	**Infinite source indoor attenuation coefficient, α (unitless)**	**Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)**	Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)
15	4.88E+02	0.10	1.09E+00	5.10E-03	4.00E+02	2.14E+02	**1.05E-05**	**5.11E-03**	1.6E-06	NA

END

APPENDIX C-6-A
DATA ENTRY SHEET FOR ETHYLBENZENE - CENTRAL AREA
Clean Harbors Kansas, LLC - Wichita, Kansas

GW-ADV
Version 3.1; 02/04

Reset to Defaults

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

YES [ ]

OR

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

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
100414	7.70E+00	Ethylbenzene

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Totals must add up to value of L_{WT} (cell G28) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	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)
13.9	15	366	366			A	CL	CL		

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)
CL	1.48	0.442	0.168	S	1.66	0.375	0.054	S	1.66	0.375	0.054

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	244	0.1	0.83	

APPENDIX C-6-B
CHEMICAL PROPERTIES SHEET FOR ETHYLBENZENE - CENTRAL AREA
Clean Harbors Kansas, LLC - Wichita, Kansas

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (°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)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
7.50E-02	7.80E-06	7.86E-03	25	8,501	409.34	617.20	3.63E+02	1.69E+02	2.5E-06	1.0E+00

END

APPENDIX C-6-C
INTERMEDIATE CALCULATIONS SHEET FOR ETHYLBENZENE - CENTRAL AREA
Clean Harbors Kansas, LLC - Wichita, Kansas

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)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
9.46E+08	351	0.274	0.321	0.321	0.245	1.27E-09	0.865	1.10E-09	46.88	0.442	0.067	0.375	4,000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	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. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater 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)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
5.63E+04	1.06E+06	3.77E-04	15	10,111	4.06E-03	1.72E-01	1.77E-04	5.15E-03	0.00E+00	0.00E+00	5.59E-05	3.91E-04	351

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	**Infinite source indoor attenuation coefficient, α (unitless)**	**Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)**	Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)
15	1.33E+03	0.10	1.09E+00	5.15E-03	4.00E+02	2.03E+02	**1.01E-05**	**1.34E-02**	2.5E-06	1.0E+00

END

Risk-Based Remedies
RBR Consulting, Inc.

APPENDIX C-7-A
DATA ENTRY SHEET FOR TETRACHLOROETHENE - CENTRAL AREA
Clean Harbors Kansas, LLC - Wichita, Kansas

GW-ADV
Version 3.1; 02/04

Reset to Defaults

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

YES [ ]

OR

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

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
127184	1.50E+02	Tetrachloroethylene

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Totals must add up to value of L_{WT} (cell G28) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	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)
13.9	15	366	366			A	CL	CL		

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)
CL	1.48	0.442	0.168	S	1.66	0.375	0.054	S	1.66	0.375	0.054

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	244	0.1	0.83	

APPENDIX C-7-B
CHEMICAL PROPERTIES SHEET FOR TETRACHLOROETHENE - CENTRAL AREA
Clean Harbors Kansas, LLC - Wichita, Kansas

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (°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)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
7.20E-02	8.20E-06	1.84E-02	25	8,288	394.40	620.20	1.55E+02	2.00E+02	2.6E-07	4.0E-02

END

APPENDIX C-7-C
INTERMEDIATE CALCULATIONS SHEET FOR TETRACHLOROETHENE - CENTRAL AREA
Clean Harbors Kansas, LLC - Wichita, Kansas

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)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
9.46E+08	351	0.274	0.321	0.321	0.245	1.27E-09	0.865	1.10E-09	46.88	0.442	0.067	0.375	4,000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	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. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater 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)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
5.63E+04	1.06E+06	3.77E-04	15	9,514	9.86E-03	4.19E-01	1.77E-04	4.95E-03	0.00E+00	0.00E+00	4.90E-05	3.45E-04	351

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	**Infinite source indoor attenuation coefficient, α (unitless)**	**Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)**	Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)
15	6.28E+04	0.10	1.09E+00	4.95E-03	4.00E+02	2.53E+02	**9.50E-06**	**5.96E-01**	2.6E-07	4.0E-02

END

APPENDIX C-8-A
DATA ENTRY SHEET FOR TRICHLOROETHENE - CENTRAL AREA
Clean Harbors Kansas, LLC - Wichita, Kansas

GW-ADV
Version 3.1; 02/04

Reset to Defaults

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

YES [ ]

OR

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

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
79016	3.97E+01	Trichloroethylene

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Totals must add up to value of L_{WT} (cell G28) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	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)
13.9	15	366	366			A	CL	CL		

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)
CL	1.48	0.442	0.168	S	1.66	0.375	0.054	S	1.66	0.375	0.054

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s^2)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	244	0.1	0.83	

APPENDIX C-8-B
CHEMICAL PROPERTIES SHEET FOR TRICHLOROETHENE - CENTRAL AREA
Clean Harbors Kansas, LLC - Wichita, Kansas

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

END

APPENDIX C-8-C
INTERMEDIATE CALCULATIONS SHEET FOR TRICHLOROETHENE - CENTRAL AREA
Clean Harbors Kansas, LLC - Wichita, Kansas

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)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
9.46E+08	351	0.274	0.321	0.321	0.245	1.27E-09	0.865	1.10E-09	46.88	0.442	0.067	0.375	4,000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	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. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater 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)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
5.63E+04	1.06E+06	3.77E-04	15	8,509	5.90E-03	2.50E-01	1.77E-04	5.43E-03	0.00E+00	0.00E+00	5.67E-05	3.97E-04	351

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	**Infinite source indoor attenuation coefficient, α (unitless)**	**Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)**	Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)
15	9.93E+03	0.10	1.09E+00	5.43E-03	4.00E+02	1.55E+02	**1.02E-05**	**1.01E-01**	4.1E-06	2.0E-03

END

APPENDIX C-9-A
DATA ENTRY SHEET FOR VINYL CHLORIDE - CENTRAL AREA
Clean Harbors Kansas, LLC - Wichita, Kansas

GW-ADV
Version 3.1; 02/04

Reset to Defaults

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

YES [ ]

OR

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

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
75014	1.42E+01	Vinyl chloride (chloroethene)

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	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 directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	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 L_{WT} (cell G28)							
13.9	15	366	366			A	CL	CL		

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)
CL	1.48	0.442	0.168	S	1.66	0.375	0.054	S	1.66	0.375	0.054

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	244	0.1	0.83	

APPENDIX C-9-B
CHEMICAL PROPERTIES SHEET FOR VINYL CHLORIDE - CENTRAL AREA
Clean Harbors Kansas, LLC - Wichita, Kansas

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (°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)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
1.06E-01	1.23E-05	2.69E-02	25	5,250	259.25	432.00	1.86E+01	8.80E+03	4.4E-06	1.0E-01

END

APPENDIX C-9-C
INTERMEDIATE CALCULATIONS SHEET FOR VINYL CHLORIDE - CENTRAL AREA
Clean Harbors Kansas, LLC - Wichita, Kansas

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)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
9.46E+08	351	0.274	0.321	0.321	0.245	1.27E-09	0.865	1.10E-09	46.88	0.442	0.067	0.375	4,000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	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. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater 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)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
5.63E+04	1.06E+06	3.77E-04	15	4,956	1.95E-02	8.27E-01	1.77E-04	7.28E-03	0.00E+00	0.00E+00	6.94E-05	4.89E-04	351

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	**Infinite source indoor attenuation coefficient, α (unitless)**	**Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)**	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	1.17E+04	0.10	1.09E+00	7.28E-03	4.00E+02	4.29E+01	**1.13E-05**	**1.33E-01**	4.4E-06	1.0E-01

END

APPENDIX C-10-A
DATA ENTRY SHEET FOR 1,1-DICHLOROETHANE - EASTERN AREA
Clean Harbors Kansas, LLC - Wichita, Kansas

GW-ADV
Version 3.1; 02/04

Reset to Defaults

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

YES [ ]

OR

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

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
75343	1.17E+01	1,1-Dichloroethane

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Totals must add up to value of L_{WT} (cell G28) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	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)
13.9	15	366	366			A	CL	CL		

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)
CL	1.48	0.442	0.168	S	1.66	0.375	0.054	S	1.66	0.375	0.054

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	244	0.1	0.83	

APPENDIX C-10-B
CHEMICAL PROPERTIES SHEET FOR 1,1-DICHLOROETHANE - EASTERN AREA
Clean Harbors Kansas, LLC - Wichita, Kansas

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)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
7.42E-02	1.05E-05	5.61E-03	25	6,895	330.55	523.00	3.16E+01	5.06E+03	1.6E-06	0.0E+00

END

APPENDIX C-10-C
INTERMEDIATE CALCULATIONS SHEET FOR 1,1-DICHLOROETHANE - EASTERN AREA
Clean Harbors Kansas, LLC - Wichita, Kansas

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)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
9.46E+08	351	0.274	0.321	0.321	0.245	1.27E-09	0.865	1.10E-09	46.88	0.442	0.067	0.375	4,000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	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. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater 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)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
5.63E+04	1.06E+06	3.77E-04	15	7,407	3.46E-03	1.47E-01	1.77E-04	5.10E-03	0.00E+00	0.00E+00	6.05E-05	4.21E-04	351

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	**Infinite source indoor attenuation coefficient, α (unitless)**	**Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)**	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	1.72E+03	0.10	1.09E+00	5.10E-03	4.00E+02	2.14E+02	**1.05E-05**	**1.80E-02**	1.6E-06	NA

END

APPENDIX C-11-A
DATA ENTRY SHEET FOR ETHYLBENZENE - EASTERN AREA
Clean Harbors Kansas, LLC - Wichita, Kansas

GW-ADV
Version 3.1; 02/04

Reset to Defaults

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

YES [ ]

OR

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

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
100414	4.72E+00	Ethylbenzene

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Totals must add up to value of L_{WT} (cell G28) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	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)
13.9	15	366	366			A	CL	CL		

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)
CL	1.48	0.442	0.168	S	1.66	0.375	0.054	S	1.66	0.375	0.054

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	244	0.1	0.83	

APPENDIX C-11-B
CHEMICAL PROPERTIES SHEET FOR ETHYLBENZENE - EASTERN AREA
Clean Harbors Kansas, LLC - Wichita, Kansas

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)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
7.50E-02	7.80E-06	7.86E-03	25	8,501	409.34	617.20	3.63E+02	1.69E+02	2.5E-06	1.0E+00

END

APPENDIX C-11-C
INTERMEDIATE CALCULATIONS SHEET FOR ETHYLBENZENE - EASTERN AREA
Clean Harbors Kansas, LLC - Wichita, Kansas

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)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
9.46E+08	351	0.274	0.321	0.321	0.245	1.27E-09	0.865	1.10E-09	46.88	0.442	0.067	0.375	4,000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	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. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater 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)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
5.63E+04	1.06E+06	3.77E-04	15	10,111	4.06E-03	1.72E-01	1.77E-04	5.15E-03	0.00E+00	0.00E+00	5.59E-05	3.91E-04	351

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(Pe^f) (unitless)	**Infinite source indoor attenuation coefficient, α (unitless)**	**Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)**	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	8.15E+02	0.10	1.09E+00	5.15E-03	4.00E+02	2.03E+02	**1.01E-05**	**8.25E-03**	2.5E-06	1.0E+00

END

APPENDIX C-12-A
DATA ENTRY SHEET FOR TETRACHLOROETHENE - EASTERN AREA
Clean Harbors Kansas, LLC - Wichita, Kansas

GW-ADV
Version 3.1; 02/04

Reset to Defaults

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

YES [ ]

OR

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

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
127184	1.17E+02	Tetrachloroethylene

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Totals must add up to value of L_{WT} (cell G28) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	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)
13.9	15	366	366			A	CL	CL		

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)
CL	1.48	0.442	0.168	S	1.66	0.375	0.054	S	1.66	0.375	0.054

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	244	0.1	0.83	

APPENDIX C-12-B
CHEMICAL PROPERTIES SHEET FOR TETRACHLOROETHENE - EASTERN AREA
Clean Harbors Kansas, LLC - Wichita, Kansas

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

END

APPENDIX C-12-C
INTERMEDIATE CALCULATIONS SHEET FOR TETRACHLOROETHENE - EASTERN AREA
Clean Harbors Kansas, LLC - Wichita, Kansas

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)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
9.46E+08	351	0.274	0.321	0.321	0.245	1.27E-09	0.865	1.10E-09	46.88	0.442	0.067	0.375	4,000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	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. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater 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)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
5.63E+04	1.06E+06	3.77E-04	15	9,514	9.86E-03	4.19E-01	1.77E-04	4.95E-03	0.00E+00	0.00E+00	4.90E-05	3.45E-04	351

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	**Infinite source indoor attenuation coefficient, α (unitless)**	**Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)**	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	4.88E+04	0.10	1.09E+00	4.95E-03	4.00E+02	2.53E+02	**9.50E-06**	**4.64E-01**	2.6E-07	4.0E-02

END

Risk-Based Remedies
RBR Consulting, Inc.

APPENDIX C-13-A
DATA ENTRY SHEET FOR TRICHLOROETHENE - EASTERN AREA
Clean Harbors Kansas, LLC - Wichita, Kansas

GW-ADV
Version 3.1; 02/04

Reset to Defaults

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

YES [ ]

OR

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

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
79016	6.65E+01	Trichloroethylene

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	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 directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	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 L_{WT} (cell G28)							
13.9	15	366	366			A	CL	CL		

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)
CL	1.48	0.442	0.168	S	1.66	0.375	0.054	S	1.66	0.375	0.054

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	244	0.1	0.83	

APPENDIX C-13-B
CHEMICAL PROPERTIES SHEET FOR TRICHLOROETHENE - EASTERN AREA
Clean Harbors Kansas, LLC - Wichita, Kansas

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (°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)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)
7.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	1.66E+02	1.47E+03	4.1E-06	2.0E-03

END

APPENDIX C-13-C
INTERMEDIATE CALCULATIONS SHEET FOR TRICHLOROETHENE - EASTERN AREA
Clean Harbors Kansas, LLC - Wichita, Kansas

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)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
9.46E+08	351	0.274	0.321	0.321	0.245	1.27E-09	0.865	1.10E-09	46.88	0.442	0.067	0.375	4,000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	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. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater 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)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
5.63E+04	1.06E+06	3.77E-04	15	8,509	5.90E-03	2.50E-01	1.77E-04	5.43E-03	0.00E+00	0.00E+00	5.67E-05	3.97E-04	351

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(Pe^f) (unitless)	**Infinite source indoor attenuation coefficient, α (unitless)**	**Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)**	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	1.66E+04	0.10	1.09E+00	5.43E-03	4.00E+02	1.55E+02	**1.02E-05**	**1.70E-01**	4.1E-06	2.0E-03

END

APPENDIX C-14-A
DATA ENTRY SHEET FOR VINYL CHLORIDE - EASTERN AREA
Clean Harbors Kansas, LLC - Wichita, Kansas

GW-ADV
Version 3.1; 02/04

Reset to Defaults

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

YES [ ]

OR

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

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
75014	2.17E+00	Vinyl chloride (chloroethene)

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Totals must add up to value of L_{WT} (cell G28) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	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)
13.9	15	366	366			A	CL	CL		

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)
CL	1.48	0.442	0.168	S	1.66	0.375	0.054	S	1.66	0.375	0.054

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	244	0.1	0.83	

APPENDIX C-14-B
CHEMICAL PROPERTIES SHEET FOR VINYL CHLORIDE - EASTERN AREA
Clean Harbors Kansas, LLC - Wichita, Kansas

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)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
1.06E-01	1.23E-05	2.69E-02	25	5,250	259.25	432.00	1.86E+01	8.80E+03	4.4E-06	1.0E-01

END

APPENDIX C-14-C
INTERMEDIATE CALCULATIONS SHEET FOR VINYL CHLORIDE - EASTERN AREA
Clean Harbors Kansas, LLC - Wichita, Kansas

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)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
9.46E+08	351	0.274	0.321	0.321	0.245	1.27E-09	0.865	1.10E-09	46.88	0.442	0.067	0.375	4,000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	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. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater 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)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
5.63E+04	1.06E+06	3.77E-04	15	4,956	1.95E-02	8.27E-01	1.77E-04	7.28E-03	0.00E+00	0.00E+00	6.94E-05	4.89E-04	351

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	**Infinite source indoor attenuation coefficient, α (unitless)**	**Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)**	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	1.79E+03	0.10	1.09E+00	7.28E-03	4.00E+02	4.29E+01	**1.13E-05**	**2.03E-02**	4.4E-06	1.0E-01

END

Risk-Based Remedies

RBR Consulting, Inc.

APPENDIX D

RISK CALCULATION SPREADSHEETS

APPENDIX D
Table 1-A: Intake Factors for the Outdoor Worker: Western Area
Clean Harbors Kansas, LLC - Wichita, Kansas

Soil Ingestion				
	CF	Conversion Factor	1.00E-06	kg/mg
	IRs	Ingestion Rate - Soil	100	mg/day
	EF	Exposure Frequency	225	days/yr
	ED	Exposure Duration	25	year
	BW	Body Weight	70	kg
	ATc	Averaging Time (Cancer)	25550	days
	ATn	Averaging Time (Non-cancer)	9125	days
Dermal Contact with Soil				
	CF	Conversion Factor	1.00E-06	kg/mg
	AF	Soil to Skin Adherence Factor	0.2	mg/cm^2
	SA	Skin Surface Area Available	3300	cm^2
	EF	Exposure Frequency	225	days/yr
	ED	Exposure Duration	25	year
	BW	Body Weight	70	kg
	ATc	Averaging Time (Cancer)	25550	days
	ATn	Averaging Time (Non-cancer)	9125	days
Inhalation of Volatiles or Particulates from Soil				
	EF	Exposure Frequency	225	days/yr
	ED	Exposure Duration	25	year
	ET	Exposure Time	8	hours/day
	ATc	Averaging Time (Cancer)	613200	hours
	ATn	Averaging Time (Non-cancer)	219000	hours

APPENDIX D
Table 1-B: Constituent-Specific Factors - Outdoor Worker: Western Area

Constituent	EPC Soil (mg/kg)	EPC Air Part (mg/m^3)	VF (m^3/kg)	EPC Air VOC (Soil) (mg/m^3)	Oral AF (unitless)	DAF (unitless)	Frac Abs (unitless)	RfDo - C (mg/kg-day)	RfC - C (mg/m^3)	RfDd - C (mg/kg-day)	CSFo $(mg/kg\text{-}day)^{-1}$	IUR $(mg/m^3)^{-1}$	CSFd $(mg/kg\text{-}day)^{-1}$
Volatile Organics													
Tetrachloroethene	41.4	4.41E-08	3843	1.08E-02	1		1	6.00E-03	4.00E-02	6.00E-03	2.10E-03	2.60E-04	2.10E-03
Trichloroethene	11.7	1.24E-08	4852	2.41E-03	1		1	5.00E-04	2.00E-03	5.00E-04	4.60E-02	4.10E-03	4.60E-02
Inorganics													
Arsenic	121	1.287E-07			0.6	0.03	1	3.00E-04	1.50E-05	3.00E-04	1.50E+00	4.30E+00	1.50E+00

APPENDIX D
Table 1-C: Hazard Indices and Theoretical Excess Lifetime Cancer Risks
Incidental Ingestion of Soil - Outdoor Worker: Western Area

Constituent	Soil EPC (mg/kg)	Oral AF (unitless)	Intake (ADD) (mg/kg-d)	RfDo (mg/kg-d)	Hazard Quotient	Intake (LADD) (mg/kg-d)	CSFo $(mg/kg\text{-}d)^{-1}$	Potential Cancer Risk
Volatile Organics								
Tetrachloroethene	41.4	1	3.64E-05	6.00E-03	6.07E-03	1.30E-05	2.10E-03	2.73E-08
Trichloroethene	11.7	1	1.03E-05	5.00E-04	2.06E-02	3.67E-06	4.60E-02	1.69E-07
Inorganics								
Arsenic	121	0.6	6.38E-05	3.00E-04	2.13E-01	2.28E-05	1.50E+00	3.42E-05

Total Hazard Index	0.24

Potential Cancer Risk	3.44E-05

APPENDIX D
Table 1-D: Hazard Indices and Theoretical Excess Lifetime Cancer Risks
Dermal Contact with Soil - Outdoor Worker: Western Area

Constituent	Soil EPC (mg/kg)	Dermal AF (unitless)	Intake (ADD) (mg/kg-d)	RfDd (mg/kg-d)	Hazard Quotient	Intake (LADD) (mg/kg-d)	CSFd $(mg/kg\text{-}d)^{-1}$	Potential Cancer Risk
Volatile Organics								
Tetrachloroethene	41.4	0	0.00E+00	0.006	--	0.00E+00	0.0021	--
Trichloroethene	11.7	0	0.00E+00	0.0005	--	0.00E+00	0.046	--
Inorganics								
Arsenic	121	0.03	2.10E-05	0.0003	7.02E-02	7.52E-06	1.5	1.13E-05

Total Hazard Index	0.07

Potential Cancer Risk	1.13E-05

Notes:
-- = Constituent is not a COI for this area or exposure pathway.

APPENDIX D
Table 1-E: Hazard Indices and Theoretical Excess Lifetime Cancer Risks
Inhalation of Particulates - Outdoor Worker: Western Area

Constituent	EPC Air Part (mg/m^3)	Intake (ADD) (mg/kg-d)	EC (mg/m^3)	Hazard Quotient	EC (mg/m^3)	IUR $(mg/m^3)^{-1}$	Potential Cancer Risk
Volatile Organics							
Tetrachloroethene	4.41E-08	9.07E-09	4.00E-02	2.27E-07	3.24E-09	2.60E-04	8.42E-13
Trichloroethene	1.24E-08	2.56E-09	2.00E-03	1.28E-06	9.13E-10	4.10E-03	3.75E-12
Inorganics							
Arsenic	1.29E-07	2.65E-08	1.50E-05	1.76E-03	9.45E-09	4.30E+00	4.06E-08

Total Hazard Index	0.0018

Potential Cancer Risk	4.06E-08

APPENDIX D
Table 1-F: Hazard Indices and Theoretical Excess Lifetime Cancer Risks
Inhalation of Volatiles from Soil - Outdoor Worker: Western Area

Constituent	EPC Air VOC (mg/m^3)	EC (mg/m^3)	RfC (mg/m^3)	Hazard Quotient	EC (mg/m^3)	IUR $(mg/m^3)^{-1}$	Potential Cancer Risk
Volatile Organics							
Tetrachloroethene	1.08E-02	2.21E-03	4.00E-02	5.53E-02	7.90E-04	2.60E-04	2.05E-07
Trichloroethene	2.41E-03	4.94E-04	2.00E-03	2.47E-01	1.77E-04	4.10E-03	7.24E-07
Inorganics							
Arsenic	0.00E+00	0.00E+00	1.50E-05	--	0.00E+00	4.30E+00	--

Total Hazard Index	0.30

Potential Cancer Risk	9.29E-07

Notes:
-- = Constituent is not a COI for this area or exposure pathway.

APPENDIX D
Table 1-G: Summary of Hazard Indices for the Outdoor Worker
Western Area

Constituent	Incidental Ingestion of Soil	Dermal Contact with Soil	Inhalation of Particulates	Inhalation of Volatiles from Soil	Total Hazard Index
Volatile Organics					
Tetrachloroethene	6.07E-03	--	2.27E-07	5.53E-02	0.061
Trichloroethene	2.06E-02	--	1.28E-06	2.47E-01	0.27
Inorganics					
Arsenic	2.13E-01	7.02E-02	1.76E-03	--	0.28
Pathway Summary	0.24	0.07	0.002	0.30	0.61

Total Cardiovascular HI =	0.55
Total CNS HI =	0.35
Total Developmental HI =	0.28
Total Immune System HI =	0.27
Total Skin HI =	0.28

Notes:
-- = Constituent is not a COI for this area or exposure pathway.

APPENDIX D

Table 1-H: Summary of Theoretical Excess Lifetime Cancer Risks for the Outdoor Worker Western Area

Constituent	Incidental Ingestion of Soil	Dermal Contact with Soil	Inhalation of Particulates	Inhalation of Volatiles from Soil	Theoretical Excess Lifetime Cancer Risk
Volatile Organics					
Tetrachloroethene	2.73E-08	--	8.42E-13	2.05E-07	2.33E-07
Trichloroethene	1.69E-07	--	3.75E-12	7.24E-07	8.93E-07
Inorganics					
Arsenic	3.42E-05	1.13E-05	4.06E-08	--	4.55E-05
Pathway Summary	3.44E-05	1.13E-05	4.06E-08	9.29E-07	4.66E-05

Notes:
-- = Constituent is not a COI for this area or exposure pathway.

APPENDIX D
Table 2-A: Intake Factors for the Construction Worker: Western Area
Clean Harbors Kansas, LLC - Wichita, Kansas

Soil Ingestion				
	CF	Conversion Factor	1.00E-06	kg/mg
	IRs	Ingestion Rate - Soil	330	mg/day
	EF	Exposure Frequency	90	days/yr
	ED	Exposure Duration	1	year
	BW	Body Weight	70	kg
	ATc	Averaging Time (Cancer)	25550	days
	ATn	Averaging Time (Non-cancer)	365	days
Dermal Contact with Soil				
	CF	Conversion Factor	1.00E-06	kg/mg
	AF	Soil to Skin Adherence Factor	0.3	mg/cm^2
	SA	Skin Surface Area Available	3300	cm^2
	EF	Exposure Frequency	90	days/yr
	ED	Exposure Duration	1	year
	BW	Body Weight	70	kg
	ATc	Averaging Time (Cancer)	25550	days
	ATn	Averaging Time (Non-cancer)	365	days
Inhalation of Volatiles or Particulates from Soil				
	EF	Exposure Frequency	90	days/yr
	ED	Exposure Duration	1	year
	ET	Exposure Time	8	hours/day
	ATc	Averaging Time (Cancer)	613200	hours
	ATn	Averaging Time (Non-cancer)	8760	hours

APPENDIX D
Table 2-B: Constituent-Specific Factors - Construction Worker: Western Area

Constituent	EPC Soil (mg/kg)	EPC Air Part (mg/m^3)	EPC Air VOC (Soil) (mg/m^3)	Oral AF (unitless)	DAF (unitless)	Frac Abs (unitless)	RfDo - SC (mg/kg-day)	RfC - SC (mg/m^3)	RfDd - SC (mg/kg-day)	CSFo $(mg/kg\text{-}day)^{-1}$	IUR $(mg/m^3)^{-1}$	CSFd $(mg/kg\text{-}day)^{-1}$
Volatile Organics												
Tetrachloroethene	9.56	1.63E-06	2.31E-02	1		1	6.00E-03	4.00E-02	6.00E-03	2.10E-03	2.60E-04	2.10E-03
Trichloroethene	2.61	4.45E-07	5.01E-03	1		1	5.00E-04	2.00E-03	5.00E-04	4.60E-02	4.10E-03	4.60E-02
Inorganics												
Arsenic	86.7	1.478E-05		0.6	0.03	1	3.00E-04	1.50E-05	3.00E-04	1.50E+00	4.30E+00	1.50E+00

APPENDIX D
Table 2-C: Hazard Indices and Theoretical Excess Lifetime Cancer Risks
Incidental Ingestion of Soil - Construction Worker: Western Area

Constituent	Soil EPC (mg/kg)	Oral AF (unitless)	Intake (ADD) (mg/kg-d)	RfDo (mg/kg-d)	Hazard Quotient	Intake (LADD) (mg/kg-d)	CSFo $(mg/kg\text{-}d)^{-1}$	Potential Cancer Risk
Volatile Organics								
Tetrachloroethene	9.56	1	1.11E-05	6.00E-03	1.85E-03	1.59E-07	2.10E-03	3.33E-10
Trichloroethene	2.61	1	3.04E-06	5.00E-04	6.07E-03	4.34E-08	4.60E-02	2.00E-09
Inorganics								
Arsenic	86.7	0.6	6.05E-05	3.00E-04	2.02E-01	8.64E-07	1.50E+00	1.30E-06

Total Hazard Index	0.21

Potential Cancer Risk	1.30E-06

APPENDIX D
Table 2-D: Hazard Indices and Theoretical Excess Lifetime Cancer Risks
Dermal Contact with Soil - Construction Worker: Western Area

Constituent	Soil EPC (mg/kg)	Dermal AF (unitless)	Intake (ADD) (mg/kg-d)	RfDd (mg/kg-d)	Hazard Quotient	Intake (LADD) (mg/kg-d)	CSFd $(mg/kg\text{-}d)^{-1}$	Potential Cancer Risk
Volatile Organics								
Tetrachloroethene	9.56	0	0.00E+00	0.006	--	0.00E+00	0.0021	--
Trichloroethene	2.61	0	0.00E+00	0.0005	--	0.00E+00	0.046	--
Inorganics								
Arsenic	86.7	0.03	9.07E-06	0.0003	3.02E-02	1.30E-07	1.5	1.94E-07

Total Hazard Index	0.03

Potential Cancer Risk	1.94E-07

Notes:
-- = Constituent is not a COI for this area or exposure pathway.

APPENDIX D
Table 2-E: Hazard Indices and Theoretical Excess Lifetime Cancer Risks
Inhalation of Particulates - Construction Worker: Western Area

Constituent	EPC Air Part (mg/m^3)	EC (mg/m^3)	RfC (mg/m^3)	Hazard Quotient	EC (mg/m^3)	IUR $(mg/m^3)^{-1}$	Potential Cancer Risk
Volatile Organics							
Tetrachloroethene	1.63E-06	1.34E-07	4.00E-02	3.35E-06	1.91E-09	2.60E-04	4.97E-13
Trichloroethene	4.45E-07	3.66E-08	2.00E-03	1.83E-05	5.23E-10	4.10E-03	2.14E-12
Inorganics							
Arsenic	1.48E-05	1.21E-06	1.50E-05	8.10E-02	1.74E-08	4.30E+00	7.46E-08

Total Hazard Index	0.0810

Potential Cancer Risk	7.46E-08

APPENDIX D
Table 2-F: Hazard Indices and Theoretical Excess Lifetime Cancer Risks
Inhalation of Volatiles from Soil - Construction Worker: Western Area

Constituent	EPC Air VOC (mg/m^3)	EC (mg/m^3)	RfC (mg/m^3)	Hazard Quotient	EC (mg/m^3)	IUR $(mg/m^3)^{-1}$	Potential Cancer Risk
Volatile Organics							
Tetrachloroethene	2.31E-02	1.90E-03	4.00E-02	4.75E-02	2.72E-05	2.60E-04	7.06E-09
Trichloroethene	5.01E-03	4.12E-04	2.00E-03	2.06E-01	5.88E-06	4.10E-03	2.41E-08
Inorganics							
Arsenic	0.00E+00	0.00E+00	1.50E-05	--	0.00E+00	4.30E+00	--

Total Hazard Index	0.25

Potential Cancer Risk	3.12E-08

Notes:
-- = Constituent is not a COI for this area or exposure pathway.

APPENDIX D
Table 2-G: Summary of Hazard Indices for the Construction Worker
Western Area

Constituent	Incidental Ingestion of Soil	Dermal Contact with Soil	Inhalation of Particulates	Inhalation of Volatiles from Soil	Total Hazard Index
Volatile Organics					
Tetrachloroethene	1.85E-03	--	3.35E-06	4.75E-02	0.049
Trichloroethene	6.07E-03	--	1.83E-05	2.06E-01	0.212
Inorganics					
Arsenic	2.02E-01	3.02E-02	8.10E-02	--	0.31
Pathway Summary	0.21	0.03	0.0810	0.25	0.57

Total Cardiovascular HI =	0.52
Total CNS HI =	0.36
Total Developmental HI =	0.31
Total Immune System HI =	0.21
Total Skin HI =	0.31

Notes:
-- = Constituent is not a COI for this area or exposure pathway.

APPENDIX D

Table 2-H: Summary of Theoretical Excess Lifetime Cancer Risks for the Construction Worker Western Area

Constituent	Incidental Ingestion of Soil	Dermal Contact with Soil	Inhalation of Particulates	Inhalation of Volatiles from Soil	Theoretical Excess Lifetime Cancer Risk
Volatile Organics					
Tetrachloroethene	3.33E-10	--	4.97E-13	7.06E-09	7.40E-09
Trichloroethene	2.00E-09	--	2.14E-12	2.41E-08	2.61E-08
Inorganics					
Arsenic	1.30E-06	1.94E-07	7.46E-08	--	1.56E-06
Pathway Summary	1.30E-06	1.94E-07	7.46E-08	3.12E-08	1.60E-06

Notes:
-- = Constituent is not a COI for this area or exposure pathway.

APPENDIX D

Table 3-A: Intake Factors for the Indoor Worker - Western Area: Clean Harbors Kansas, LLC - Wichita, Kansas

Inhalation of Volatiles			
EF	Exposure Frequency	250	days/yr
ED	Exposure Duration	25	years
ET	Exposure Time	8	hours/day
ATc	Averaging Time (Cancer)	613200	hours
ATn	Averaging Time (Non-cancer)	219000	hours

APPENDIX D
Table 3-B: Hazard Indices and Theoretical Excess Lifetime Cancer Risks
Inhalation of Volatiles - Indoor Worker - Western Area

Constituent	EPC Air VOC (mg/m^3)	EC (mg/m^3)	RfC - C (mg/m^3)	Hazard Quotient	EC (mg/m^3)	IUR $(mg/m^3)^{-1}$	Potential Cancer Risk
Volatile Organics							
1,1-Dichloroethane	1.15E-06	2.63E-07	NA	NA	9.41E-08	1.60E-03	1.50E-10
Ethylbenzene	2.79E-06	6.38E-07	1.00E+00	6.38E-07	2.28E-07	2.50E-03	5.69E-10
Tetrachloroethene	3.77E-04	8.60E-05	4.00E-02	2.15E-03	3.07E-05	2.60E-04	7.99E-09
Trichloroethene	6.75E-05	1.54E-05	2.00E-03	7.71E-03	5.51E-06	4.10E-03	2.26E-08
Pathway Summary				**0.01**			**3.13E-08**

Total Cardiovascular HI =	0.0077
Total CNS HI =	0.0022
Total Fetal HI =	0.00000064
Total Immune System HI =	0.0077
Total Kidney HI =	0.00000064
Total Liver HI =	0.00000064

Notes:
NA = Toxicity values are not available for this endpoint or exposure pathway.

APPENDIX D
Table 4-A: Intake Factors for the Outdoor Worker: Central Area

Soil Ingestion				
	CF	Conversion Factor	1.00E-06	kg/mg
	IRs	Ingestion Rate - Soil	100	mg/day
	EF	Exposure Frequency	225	days/yr
	ED	Exposure Duration	25	year
	BW	Body Weight	70	kg
	ATc	Averaging Time (Cancer)	25550	days
	ATn	Averaging Time (Non-cancer)	9125	days
Dermal Contact with Soil				
	CF	Conversion Factor	1.00E-06	kg/mg
	AF	Soil to Skin Adherence Factor	0.2	mg/cm^2
	SA	Skin Surface Area Available	3300	cm^2
	EF	Exposure Frequency	225	days/yr
	ED	Exposure Duration	25	year
	BW	Body Weight	70	kg
	ATc	Averaging Time (Cancer)	25550	days
	ATn	Averaging Time (Non-cancer)	9125	days
Inhalation of Volatiles or Particulates from Soil				
	EF	Exposure Frequency	225	days/yr
	ED	Exposure Duration	25	year
	ET	Exposure Time	8	hours/day
	ATc	Averaging Time (Cancer)	613200	hours
	ATn	Averaging Time (Non-cancer)	219000	hours

APPENDIX D
Table 4-B: Constituent-Specific Factors - Outdoor Worker: Central Area

Constituent	EPC Soil (mg/kg)	EPC Air Part (mg/m^3)	VF (m^3/kg)	EPC Air VOC (Soil) (mg/m^3)	Oral AF (unitless)	DAF (unitless)	Frac Abs (unitless)	RfDo - C (mg/kg-day)	RfC - C (mg/m^3)	RfDd - C (mg/kg-day)	CSFo $(mg/kg\text{-}day)^{-1}$	IUR $(mg/m^3)^{-1}$	CSFd $(mg/kg\text{-}day)^{-1}$
Volatile Organics													
1,2,4-Trimethylbenzene	0.0064	6.77E-12	21735	2.92E-07	1		1	NA	7.00E-03	NA	NA	NA	NA
Ethylbenzene	0.0022	2.39E-12	8639	2.59E-07	1		1	1.00E-01	1.00E+00	1.00E-01	1.10E-02	2.50E-03	1.10E-02
Naphthalene	0.004	4.23E-12	99247	4.00E-08	1	0.13	1	2.00E-02	3.00E-03	2.00E-02	NA	3.40E-02	NA
Tetrachloroethene	37.2	3.97E-08	3843	9.68E-03	1		1	6.00E-03	4.00E-02	6.00E-03	2.10E-03	2.60E-04	2.10E-03
Total xylenes	0.12	1.27E-10	8972	1.33E-05	1		1	2.00E-01	1.00E-01	2.00E-01	NA	NA	NA
Trichloroethene	5.76	6.14E-09	4852	1.19E-03	1		1	5.00E-04	2.00E-03	5.00E-04	4.60E-02	4.10E-03	4.60E-02
Vinyl Chloride	0.011	1.14E-11	1149	9.31E-06	1		1	3.00E-03	1.00E-01	3.00E-03	7.20E-01	4.40E-03	7.20E-01
Semi-Volatile Organics													
Benzo(a)pyrene	0.055	5.82E-11			1	0.13	1	NA	NA	NA	7.30E+00	1.10E+00	7.30E+00
Herbicides/Pesticides													
mcpp	30.1	3.21E-08			1	0.10	1	1.00E-03	NA	1.00E-03	NA	NA	NA
Toxaphene	2.15	2.29E-09			1	0.10	1	NA	NA	NA	1.10E+00	3.20E-01	1.10E+00
Inorganics													
Arsenic	13.6	1.447E-08			0.6	0.03	1	3.00E-04	1.50E-05	3.00E-04	1.50E+00	4.30E+00	1.50E+00

APPENDIX D
Table 4-C: Hazard Indices and Theoretical Excess Lifetime Cancer Risks
Incidental Ingestion of Soil - Outdoor Worker: Central Area

Constituent	Soil EPC (mg/kg)	Oral AF (unitless)	Intake (ADD) (mg/kg-d)	RfDo (mg/kg-d)	Hazard Quotient	Intake (LADD) (mg/kg-d)	CSFo $(mg/kg\text{-}d)^{-1}$	Potential Cancer Risk
Volatile Organics								
1,2,4-Trimethylbenzene	0.0064	1	5.59E-09	NA	NA	2.00E-09	NA	NA
Ethylbenzene	0.0022	1	1.97E-09	1.00E-01	1.97E-08	7.05E-10	1.10E-02	7.75E-12
Naphthalene	0.004	1	3.50E-09	2.00E-02	1.75E-07	1.25E-09	NA	NA
Tetrachloroethene	37.2	1	3.28E-05	6.00E-03	5.46E-03	1.17E-05	2.10E-03	2.46E-08
Total xylenes	0.12	1	1.05E-07	2.00E-01	5.24E-07	3.74E-08	NA	NA
Trichloroethene	5.76	1	5.07E-06	5.00E-04	1.01E-02	1.81E-06	4.60E-02	8.33E-08
Vinyl Chloride	0.011	1	9.42E-09	3.00E-03	3.14E-06	3.37E-09	7.20E-01	2.42E-09
Semi-Volatile Organics								
Benzo(a)pyrene	0.055	1	4.81E-08	NA	NA	1.72E-08	7.30E+00	1.25E-07
Herbicides/Pesticides								
mcpp	30.1	1	2.65E-05	1.00E-03	2.65E-02	9.47E-06	NA	NA
Toxaphene	2.15	1	1.89E-06	NA	NA	6.76E-07	1.10E+00	7.44E-07
Inorganics								
Arsenic	13.6	0.6	7.17E-06	3.00E-04	2.39E-02	2.56E-06	1.50E+00	3.84E-06

Total Hazard Index	0.066

Potential Cancer Risk	4.82E-06

Notes:
NA = Toxicity values are not available for this endpoint or exposure pathway.

APPENDIX D
Table 4-D: Hazard Indices and Theoretical Excess Lifetime Cancer Risks
Dermal Contact with Soil - Outdoor Worker: Central Area

Constituent	Soil EPC (mg/kg)	Dermal AF (unitless)	Intake (ADD) (mg/kg-d)	RfDd (mg/kg-d)	Hazard Quotient	Intake (LADD) (mg/kg-d)	CSFd $(mg/kg\text{-}d)^{-1}$	Potential Cancer Risk
Volatile Organics								
1,2,4-Trimethylbenzene	0.0064	0	0.00E+00	NA	NA	0.00E+00	NA	NA
Ethylbenzene	0.0022	0	0.00E+00	1.00E-01	--	0.00E+00	1.10E-02	--
Naphthalene	0.004	0.13	3.00E-09	2.00E-02	1.50E-07	1.07E-09	NA	NA
Tetrachloroethene	37.2	0	0.00E+00	6.00E-03	--	0.00E+00	2.10E-03	--
Total xylenes	0.12	0	0.00E+00	2.00E-01	--	0.00E+00	NA	NA
Trichloroethene	5.76	0	0.00E+00	5.00E-04	--	0.00E+00	4.60E-02	--
Vinyl Chloride	0.011	0	0.00E+00	3.00E-03	--	0.00E+00	7.20E-01	--
Semi-Volatile Organics								
Benzo(a)pyrene	0.055	0.13	4.13E-08	NA	NA	1.47E-08	7.30E+00	1.08E-07
Herbicides/Pesticides								
mcpp	30.1	0.1	1.75E-05	1.00E-03	1.75E-02	6.25E-06	NA	NA
Toxaphene	2.15	0.1	1.25E-06	NA	NA	4.46E-07	1.10E+00	4.91E-07
Inorganics								
Arsenic	13.6	0.03	2.37E-06	3.00E-04	7.89E-03	8.45E-07	1.50E+00	1.27E-06

Total Hazard Index	0.025

Potential Cancer Risk	1.87E-06

Notes:
-- = Constituent is not a COI for this area or exposure pathway.
NA = Toxicity values are not available for this endpoint or exposure pathway.

APPENDIX D
Table 4-E: Hazard Indices and Theoretical Excess Lifetime Cancer Risks
Inhalation of Particulates - Outdoor Worker: Central Area

Constituent	EPC Air Part (mg/m^3)	EC (mg/m^3)	RfC (mg/m^3)	Hazard Quotient	EC (mg/m^3)	IUR $(mg/m^3)^{-1}$	Potential Cancer Risk
Volatile Organics							
1,2,4-Trimethylbenzene	6.77E-12	1.39E-12	7.00E-03	1.99E-10	4.97E-13	NA	NA
Ethylbenzene	2.39E-12	4.91E-13	1.00E+00	4.91E-13	1.75E-13	2.50E-03	4.38E-16
Naphthalene	4.23E-12	8.70E-13	3.00E-03	2.90E-10	3.11E-13	3.40E-02	1.06E-14
Tetrachloroethene	3.97E-08	8.15E-09	4.00E-02	2.04E-07	2.91E-09	2.60E-04	7.57E-13
Total xylenes	1.27E-10	2.61E-11	1.00E-01	2.61E-10	9.31E-12	NA	NA
Trichloroethene	6.14E-09	1.26E-09	2.00E-03	6.31E-07	4.51E-10	4.10E-03	1.85E-12
Vinyl Chloride	1.14E-11	2.35E-12	1.00E-01	2.35E-11	8.38E-13	4.40E-03	3.69E-15
Semi-Volatile Organics							
Benzo(a)pyrene	5.82E-11	1.20E-11	NA	NA	4.27E-12	1.10E+00	4.70E-12
Herbicides/Pesticides							
mcpp	3.21E-08	6.60E-09	NA	NA	2.36E-09	NA	NA
Toxaphene	2.29E-09	4.71E-10	NA	NA	1.68E-10	3.20E-01	5.39E-11
Inorganics							
Arsenic	1.45E-08	2.97E-09	1.50E-05	1.98E-04	1.06E-09	4.30E+00	4.57E-09

Total Hazard Index	0.0002

Potential Cancer Risk	4.63E-09

Notes:
NA = Toxicity values are not available for this endpoint or exposure pathway.

APPENDIX D
Table 4-F: Hazard Indices and Theoretical Excess Lifetime Cancer Risks
Inhalation of Volatiles from Soil - Outdoor Worker: Central Area

Constituent	EPC Air VOC (mg/m^3)	EC (mg/m^3)	RfC (mg/m^3)	Hazard Quotient	EC (mg/m^3)	IUR $(mg/m^3)^{-1}$	Potential Cancer Risk
Volatile Organics							
1,2,4-Trimethylbenzene	2.92E-07	6.00E-08	7.00E-03	8.58E-06	2.14E-08	NA	NA
Ethylbenzene	2.59E-07	5.33E-08	1.00E+00	5.33E-08	1.90E-08	2.50E-03	4.76E-11
Naphthalene	4.00E-08	8.22E-09	3.00E-03	2.74E-06	2.94E-09	3.40E-02	9.98E-11
Tetrachloroethene	9.68E-03	1.99E-03	4.00E-02	4.97E-02	7.10E-04	2.60E-04	1.85E-07
Total xylenes	1.33E-05	2.73E-06	1.00E-01	2.73E-05	9.73E-07	NA	NA
Trichloroethene	1.19E-03	2.44E-04	2.00E-03	1.22E-01	8.71E-05	4.10E-03	3.57E-07
Vinyl Chloride	9.31E-06	1.91E-06	1.00E-01	1.91E-05	6.83E-07	4.40E-03	3.01E-09
Semi-Volatile Organics							
Benzo(a)pyrene	0.00E+00	0.00E+00	NA	--	0.00E+00	1.10E+00	--
Herbicides/Pesticides							
mcpp	0.00E+00	0.00E+00	NA	--	0.00E+00	NA	--
Toxaphene	0.00E+00	0.00E+00	NA	--	0.00E+00	3.20E-01	--
Inorganics							
Arsenic	0.00E+00	0.00E+00	1.50E-05	--	0.00E+00	4.30E+00	--

Total Hazard Index	0.17

Potential Cancer Risk	5.45E-07

Notes:
-- = Constituent is not a COI for this area or exposure pathway.
NA = Toxicity values are not available for this endpoint or exposure pathway.

APPENDIX D
Table 4-G: Summary of Hazard Indices for the Outdoor Worker
Central Area

Constituent	Incidental Ingestion of Soil	Dermal Contact with Soil	Inhalation of Particulates	Inhalation of Volatiles from Soil	Total Hazard Index
Volatile Organics					
1,2,4-Trimethylbenzene	NA	NA	1.99E-10	8.58E-06	0.0000086
Ethylbenzene	1.97E-08	--	4.91E-13	5.33E-08	0.000000073
Naphthalene	1.75E-07	1.50E-07	2.90E-10	2.74E-06	0.0000031
Tetrachloroethene	5.46E-03	--	2.04E-07	4.97E-02	0.055
Total xylenes	5.24E-07	--	2.61E-10	2.73E-05	0.000028
Trichloroethene	1.01E-02	--	6.31E-07	1.22E-01	0.13
Vinyl Chloride	3.14E-06	--	2.35E-11	1.91E-05	0.000022
Semi-Volatile Organics					
Benzo(a)pyrene	NA	NA	NA	--	NA
Herbicides/Pesticides					
mcpp	2.65E-02	1.75E-02	NA	--	0.044
Toxaphene	NA	NA	NA	--	NA
Inorganics					
Arsenic	2.39E-02	7.89E-03	1.98E-04	--	0.032
Pathway Summary	0.066	0.025	0.0002	0.17	0.26

Total Blood HI =	0.0000086
Total Cardiovascular HI =	0.16
Total CNS HI =	0.09
Total Developmental HI =	0.032
Total Fetal HI =	0.000000073
Total Immune System HI =	0.13
Total Kidney HI =	0.044
Total Liver HI =	0.000022
Total Respiratory HI =	0.000012
Total Skin HI =	0.032
Total Whole Body HI =	0.000031

Notes:
-- = Constituent is not a COI for this area or exposure pathway.
NA = Toxicity values are not available for this endpoint or exposure pathway.

APPENDIX D

Table 4-H: Summary of Theoretical Excess Lifetime Cancer Risks for the Outdoor Worker
Central Area

Constituent	Incidental Ingestion of Soil	Dermal Contact with Soil	Inhalation of Particulates	Inhalation of Volatiles from Soil	Theoretical Excess Lifetime Cancer Risk
Volatile Organics					
1,2,4-Trimethylbenzene	NA	NA	NA	NA	NA
Ethylbenzene	7.75E-12	--	4.38E-16	4.76E-11	5.53E-11
Naphthalene	NA	NA	1.06E-14	9.98E-11	9.98E-11
Tetrachloroethene	2.46E-08	--	7.57E-13	1.85E-07	2.09E-07
Total xylenes	NA	NA	NA	NA	NA
Trichloroethene	8.33E-08	--	1.85E-12	3.57E-07	4.40E-07
Vinyl Chloride	2.42E-09	--	3.69E-15	3.01E-09	5.43E-09
Semi-Volatile Organics					
Benzo(a)pyrene	1.25E-07	1.08E-07	4.70E-12	--	2.33E-07
Herbicides/Pesticides					
mcpp	NA	NA	NA	--	NA
Toxaphene	7.44E-07	4.91E-07	5.39E-11	--	1.23E-06
Inorganics					
Arsenic	3.84E-06	1.27E-06	4.57E-09	--	5.11E-06
Pathway Summary	4.82E-06	1.87E-06	4.63E-09	5.45E-07	7.24E-06

Notes:
-- = Constituent is not a COI for this area or exposure pathway.
NA = Toxicity values are not available for this endpoint or exposure pathway.

APPENDIX D
Table 5-A: Intake Factors for the Construction Worker: Central Area
Clean Harbors Kansas, LLC - Wichita, Kansas

Soil Ingestion				
	CF	Conversion Factor	1.00E-06	kg/mg
	IRs	Ingestion Rate - Soil	330	mg/day
	EF	Exposure Frequency	90	days/yr
	ED	Exposure Duration	1	year
	BW	Body Weight	70	kg
	ATc	Averaging Time (Cancer)	25550	days
	ATn	Averaging Time (Non-cancer)	365	days
Dermal Contact with Soil				
	CF	Conversion Factor	1.00E-06	kg/mg
	AF	Soil to Skin Adherence Factor	0.3	mg/cm^2
	SA	Skin Surface Area Available	3300	cm^2
	EF	Exposure Frequency	90	days/yr
	ED	Exposure Duration	1	year
	BW	Body Weight	70	kg
	ATc	Averaging Time (Cancer)	25550	days
	ATn	Averaging Time (Non-cancer)	365	days
Inhalation of Volatiles or Particulates from Soil				
	EF	Exposure Frequency	90	days/yr
	ED	Exposure Duration	1	year
	ET	Exposure Time	8	hours/day
	ATc	Averaging Time (Cancer)	613200	hours
	ATn	Averaging Time (Non-cancer)	8760	hours

APPENDIX D
Table 5-B: Constituent-Specific Factors - Construction Worker: Central Area

Constituent	EPC Soil (mg/kg)	EPC Air Part (mg/m^3)	VF (m^3/kg)	EPC Air VOC (Soil) (mg/m^3)	Oral AF (unitless)	DAF (unitless)	Frac Abs (unitless)	RfDo - SC (mg/kg-day)	RfC - SC (mg/m^3)	RfDd - SC (mg/kg-day)	CSFo $(mg/kg\text{-}day)^{-1}$	IUR $(mg/m^3)^{-1}$	CSFd $(mg/kg\text{-}day)^{-1}$
Volatile Organics													
1,2,4-Trimethylbenzene	53.7	9.16E-06	2337	2.30E-02	1		1	NA	1.00E-01	NA	NA	NA	NA
Ethylbenzene	4.23	7.21E-07	929	4.55E-03	1		1	5.00E-02	9.00E+00	5.00E-02	1.10E-02	2.50E-03	1.10E-02
Naphthalene	7.96	1.36E-06	10669	7.46E-04	1	0.13	1	6.00E-01	3.00E-03	6.00E-01	NA	3.40E-02	NA
Tetrachloroethene	45.4	7.73E-06	413	1.10E-01	1		1	6.00E-03	4.00E-02	6.00E-03	2.10E-03	2.60E-04	2.10E-03
Total xylenes	13.3	2.27E-06	965	1.38E-02	1		1	4.00E-01	4.00E-01	4.00E-01	NA	NA	NA
Trichloroethene	3.72	6.34E-07	522	7.13E-03	1		1	5.00E-04	2.00E-03	5.00E-04	4.60E-02	4.10E-03	4.60E-02
Vinyl Chloride	0.0065	6.96E-12	124	5.29E-05	1		1	3.00E-03	1.00E-01	3.00E-03	7.20E-01	4.40E-03	7.20E-01
Semi-Volatile Organics													
Benzo(a)pyrene	0.054	9.26E-09			1	0.13	1	NA	NA	NA	7.30E+00	1.10E+00	7.30E+00
Herbicides/Pesticides													
mcpp	30.1	5.12E-06			1	0.10	1	1.00E-03	NA	1.00E-03	NA	NA	NA
Toxaphene	2.15	3.66E-07			1	0.10	1	NA	NA	NA	1.10E+00	3.20E-01	1.10E+00
Inorganics													
Arsenic	11.0	1.875E-06			0.6	0.03	1	3.00E-04	1.50E-05	3.00E-04	1.50E+00	4.30E+00	1.50E+00

APPENDIX D
Table 5-C: Hazard Indices and Theoretical Excess Lifetime Cancer Risks
Incidental Ingestion of Soil - Construction Worker: Central Area

Constituent	Soil EPC (mg/kg)	Oral AF (unitless)	Intake (ADD) (mg/kg-d)	RfDo (mg/kg-d)	Hazard Quotient	Intake (LADD) (mg/kg-d)	CSFo $(mg/kg\text{-}d)^{-1}$	Potential Cancer Risk
Volatile Organics								
1,2,4-Trimethylbenzene	53.7	1	6.25E-05	NA	NA	8.92E-07	NA	NA
Ethylbenzene	4.23	1	4.91E-06	5.00E-02	9.83E-05	7.02E-08	1.10E-02	7.72E-10
Naphthalene	7.96	1	9.25E-06	6.00E-01	1.54E-05	1.32E-07	NA	NA
Tetrachloroethene	45.4	1	5.27E-05	6.00E-03	8.79E-03	7.53E-07	2.10E-03	1.58E-09
Total xylenes	13.3	1	1.54E-05	4.00E-01	3.86E-05	2.21E-07	NA	NA
Trichloroethene	3.72	1	4.32E-06	5.00E-04	8.65E-03	6.18E-08	4.60E-02	2.84E-09
Vinyl Chloride	0.0065	1	7.59E-09	3.00E-03	2.53E-06	1.08E-10	7.20E-01	7.81E-11
Semi-Volatile Organics								
Benzo(a)pyrene	0.054	1	6.31E-08	NA	NA	9.02E-10	7.30E+00	6.58E-09
Herbicides/Pesticides								
mcpp	30.1	1	3.49E-05	1.00E-03	3.49E-02	4.99E-07	NA	NA
Toxaphene	2.15	1	2.50E-06	NA	NA	3.57E-08	1.10E+00	3.93E-08
Inorganics								
Arsenic	11.0	0.6	7.67E-06	3.00E-04	2.56E-02	1.10E-07	1.50E+00	1.64E-07

Total Hazard Index	0.078

Potential Cancer Risk	2.16E-07

Notes:
NA = Toxicity values are not available for this endpoint or exposure pathway.

APPENDIX D
Table 5-D: Hazard Indices and Theoretical Excess Lifetime Cancer Risks
Dermal Contact with Soil - Construction Worker: Central Area

Constituent	Soil EPC (mg/kg)	Dermal AF (unitless)	Intake (ADD) (mg/kg-d)	RfDd (mg/kg-d)	Hazard Quotient	Intake (LADD) (mg/kg-d)	CSFd $(mg/kg\text{-}d)^{-1}$	Potential Cancer Risk
Volatile Organics								
1,2,4-Trimethylbenzene	53.7	0	0.00E+00	NA	NA	0.00E+00	NA	NA
Ethylbenzene	4.23	0	0.00E+00	5.00E-02	--	0.00E+00	1.10E-02	--
Naphthalene	7.96	0.13	3.61E-06	6.00E-01	6.01E-06	5.15E-08	NA	NA
Tetrachloroethene	45.4	0	0.00E+00	6.00E-03	--	0.00E+00	2.10E-03	--
Total xylenes	13.3	0	0.00E+00	4.00E-01	--	0.00E+00	NA	NA
Trichloroethene	3.72	0	0.00E+00	5.00E-04	--	0.00E+00	4.60E-02	--
Vinyl Chloride	0.0065	0	0.00E+00	3.00E-03	--	0.00E+00	7.20E-01	--
Semi-Volatile Organics								
Benzo(a)pyrene	0.054	0.13	2.46E-08	NA	NA	3.52E-10	7.30E+00	2.57E-09
Herbicides/Pesticides								
mcpp	30.1	0.1	1.05E-05	1.00E-03	1.05E-02	1.50E-07	NA	NA
Toxaphene	2.15	0.1	7.50E-07	NA	NA	1.07E-08	1.10E+00	1.18E-08
Inorganics								
Arsenic	11.0	0.03	1.15E-06	3.00E-04	3.84E-03	1.64E-08	1.50E+00	2.47E-08

Total Hazard Index	0.014

Potential Cancer Risk	3.90E-08

Notes:
-- = Constituent is not a COI for this area or exposure pathway.
NA = Toxicity values are not available for this endpoint or exposure pathway.

APPENDIX D
Table 5-E: Hazard Indices and Theoretical Excess Lifetime Cancer Risks
Inhalation of Particulates - Construction Worker: Central Area

Constituent	EPC Air Part (mg/m^3)	EC (mg/m^3)	RfC (mg/m^3)	Hazard Quotient	EC (mg/m^3)	IUR $(mg/m^3)^{-1}$	Potential Cancer Risk
Volatile Organics							
1,2,4-Trimethylbenzene	9.16E-06	7.53E-07	1.00E-01	7.53E-06	1.08E-08	NA	NA
Ethylbenzene	7.21E-07	5.92E-08	9.00E+00	6.58E-09	8.46E-10	2.50E-03	2.12E-12
Naphthalene	1.36E-06	1.12E-07	3.00E-03	3.72E-05	1.59E-09	3.40E-02	5.42E-11
Tetrachloroethene	7.73E-06	6.36E-07	4.00E-02	1.59E-05	9.08E-09	2.60E-04	2.36E-12
Total xylenes	2.27E-06	1.86E-07	4.00E-01	4.66E-07	2.66E-09	NA	NA
Trichloroethene	6.34E-07	5.21E-08	2.00E-03	2.61E-05	7.45E-10	4.10E-03	3.05E-12
Vinyl Chloride	6.96E-12	5.72E-13	1.00E-01	5.72E-12	8.18E-15	4.40E-03	3.60E-17
Semi-Volatile Organics							
Benzo(a)pyrene	9.26E-09	7.61E-10	NA	NA	1.09E-11	1.10E+00	1.20E-11
Herbicides/Pesticides							
mcpp	5.12E-06	4.21E-07	NA	NA	6.01E-09	NA	NA
Toxaphene	3.66E-07	3.01E-08	NA	NA	4.30E-10	3.20E-01	1.38E-10
Inorganics							
Arsenic	1.88E-06	1.54E-07	1.50E-05	1.03E-02	2.20E-09	4.30E+00	9.47E-09

Total Hazard Index	0.01

Potential Cancer Risk	9.68E-09

Notes:
NA = Toxicity values are not available for this endpoint or exposure pathway.

APPENDIX D
Table 5-F: Hazard Indices and Theoretical Excess Lifetime Cancer Risks
Inhalation of Volatiles from Soil - Construction Worker: Central Area

Constituent	EPC Air VOC (mg/m^3)	EC (mg/m^3)	RfC (mg/m^3)	Hazard Quotient	EC (mg/m^3)	IUR $(mg/m^3)^{-1}$	Potential Cancer Risk
Volatile Organics							
1,2,4-Trimethylbenzene	2.30E-02	1.89E-03	1.00E-01	1.89E-02	2.70E-05	NA	NA
Ethylbenzene	4.55E-03	3.74E-04	9.00E+00	4.16E-05	5.34E-06	2.50E-03	1.34E-08
Naphthalene	7.46E-04	6.13E-05	3.00E-03	2.04E-02	8.76E-07	3.40E-02	2.98E-08
Tetrachloroethene	1.10E-01	9.03E-03	4.00E-02	2.26E-01	1.29E-04	2.60E-04	3.35E-08
Total xylenes	1.38E-02	1.13E-03	4.00E-01	2.83E-03	1.62E-05	NA	NA
Trichloroethene	7.13E-03	5.86E-04	2.00E-03	2.93E-01	8.37E-06	4.10E-03	3.43E-08
Vinyl Chloride	5.29E-05	4.35E-06	1.00E-01	4.35E-05	6.21E-08	4.40E-03	2.73E-10
Semi-Volatile Organics							
Benzo(a)pyrene	0.00E+00	0.00E+00	NA	--	0.00E+00	1.10E+00	--
Herbicides/Pesticides							
mcpp	0.00E+00	0.00E+00	NA	--	0.00E+00	NA	--
Toxaphene	0.00E+00	0.00E+00	NA	--	0.00E+00	3.20E-01	--
Inorganics							
Arsenic	0.00E+00	0.00E+00	1.50E-05	--	0.00E+00	4.30E+00	--

Total Hazard Index	0.56

Potential Cancer Risk	1.11E-07

Notes:
-- = Constituent is not a COI for this area or exposure pathway.
NA = Toxicity values are not available for this endpoint or exposure pathway.

APPENDIX D
Table 5-G: Summary of Hazard Indices for the Construction Worker
Central Area

Constituent	Incidental Ingestion of Soil	Dermal Contact with Soil	Inhalation of Particulates	Inhalation of Volatiles from Soil	Total Hazard Index
Volatile Organics					
1,2,4-Trimethylbenzene	NA	NA	7.53E-06	1.89E-02	0.019
Ethylbenzene	9.83E-05	--	6.58E-09	4.16E-05	0.00014
Naphthalene	1.54E-05	6.01E-06	3.72E-05	2.04E-02	0.02
Tetrachloroethene	8.79E-03	--	1.59E-05	2.26E-01	0.23
Total xylenes	3.86E-05	--	4.66E-07	2.83E-03	0.0029
Trichloroethene	8.65E-03	--	2.61E-05	2.93E-01	0.30
Vinyl Chloride	2.53E-06	--	5.72E-12	4.35E-05	0.000046
Semi-Volatile Organics					
Benzo(a)pyrene	NA	NA	NA	--	NA
Herbicides/Pesticides					
mcpp	3.49E-02	1.05E-02	NA	--	0.045
Toxaphene	NA	NA	NA	--	NA
Inorganics					
Arsenic	2.56E-02	3.84E-03	1.03E-02	--	0.04
Pathway Summary	0.078	0.014	0.01	0.56	0.66

Total Blood HI =	0.019
Total Cardiovascular HI =	0.34
Total CNS HI =	0.28
Total Developmental HI =	0.04
Total Fetal HI =	0.00014
Total Immune System HI =	0.32
Total Kidney HI =	0.066
Total Liver HI =	0.00019
Total Respiratory HI =	0.039
Total Skin HI =	0.04
Total Whole Body HI =	0.023

Notes:
-- = Constituent is not a COI for this area or exposure pathway.
NA = Toxicity values are not available for this endpoint or exposure pathway.

APPENDIX D

Table 5-H: Summary of Theoretical Excess Lifetime Cancer Risks for the Construction Worker Central Area

Constituent	Incidental Ingestion of Soil	Dermal Contact with Soil	Inhalation of Particulates	Inhalation of Volatiles from Soil	Theoretical Excess Lifetime Cancer Risk
Volatile Organics					
1,2,4-Trimethylbenzene	NA	NA	NA	NA	NA
Ethylbenzene	7.72E-10	--	2.12E-12	1.34E-08	1.41E-08
Naphthalene	NA	NA	5.42E-11	2.98E-08	2.98E-08
Tetrachloroethene	1.58E-09	--	2.36E-12	3.35E-08	3.51E-08
Total xylenes	NA	NA	NA	NA	NA
Trichloroethene	2.84E-09	--	3.05E-12	3.43E-08	3.72E-08
Vinyl Chloride	7.81E-11	--	3.60E-17	2.73E-10	3.51E-10
Semi-Volatile Organics					
Benzo(a)pyrene	6.58E-09	2.57E-09	1.20E-11	--	9.16E-09
Herbicides/Pesticides					
mcpp	NA	NA	NA	--	NA
Toxaphene	3.93E-08	1.18E-08	1.38E-10	--	5.12E-08
Inorganics					
Arsenic	1.64E-07	2.47E-08	9.47E-09	--	1.99E-07
Pathway Summary	2.16E-07	3.90E-08	9.68E-09	1.11E-07	3.75E-07

Notes:
-- = Constituent is not a COI for this area or exposure pathway.
NA = Toxicity values are not available for this endpoint or exposure pathway.

APPENDIX D

Table 6-A: Intake Factors for the Indoor Worker - Central Area : Clean Harbors Kansas, LLC - Wichita, Kansas

Inhalation of Volatiles			
EF	Exposure Frequency	250	days/yr
ED	Exposure Duration	25	years
ET	Exposure Time	8	hours/day
ATc	Averaging Time (Cancer)	613200	hours
ATn	Averaging Time (Non-cancer)	219000	hours

APPENDIX D
Table 6-B: Hazard Indices and Theoretical Excess Lifetime Cancer Risks
Inhalation of Volatiles - Indoor Worker - Central Area

Constituent	EPC Air VOC (mg/m^3)	EC (mg/m^3)	RfC - C (mg/m^3)	Hazard Quotient	EC (mg/m^3)	IUR $(mg/m^3)^{-1}$	Potential Cancer Risk
Volatile Organics							
1,1-Dichloroethane	5.11E-06	1.17E-06	NA	NA	4.17E-07	1.60E-03	6.67E-10
Ethylbenzene	1.34E-05	3.07E-06	1.00E+00	3.07E-06	1.10E-06	2.50E-03	2.74E-09
Tetrachloroethene	5.96E-04	1.36E-04	4.00E-02	3.40E-03	4.86E-05	2.60E-04	1.26E-08
Trichloroethene	1.01E-04	2.32E-05	2.00E-03	1.16E-02	8.27E-06	4.10E-03	3.39E-08
Vinyl chloride	1.33E-04	3.03E-05	1.00E-01	3.03E-04	1.08E-05	4.40E-03	4.77E-08
Pathway Summary				**0.015**			**9.76E-08**

Total Cardiovascular HI =	0.012
Total CNS HI =	0.0034
Total Fetal HI =	0.0000031
Total Immune System HI =	0.012
Total Kidney HI =	0.0000031
Total Liver HI =	0.00031

Notes:
NA = Toxicity values are not available for this endpoint or exposure pathway.

APPENDIX D

Table 7-A: Intake Factors for the Indoor Worker - Central Area - Measured Concentrations: Clean Harbors Kansas, LLC - Wichita, Kansas

Inhalation of Volatiles			
EF	Exposure Frequency	250	days/yr
ED	Exposure Duration	25	years
ET	Exposure Time	8	hours/day
ATc	Averaging Time (Cancer)	613200	hours
ATn	Averaging Time (Non-cancer)	219000	hours

APPENDIX D

Table 7-B: Hazard Indices and Theoretical Excess Lifetime Cancer Risks
Inhalation of Volatiles - Indoor Worker - Central Area - Measured Concentrations

Constituent	EPC Air VOC (mg/m^3)	EC (mg/m^3)	RfC - C (mg/m^3)	Hazard Quotient	EC (mg/m^3)	IUR $(mg/m^3)^{-1}$	Potential Cancer Risk
Volatile Organics							
1,2,4-Trimethylbenzene	1.80E-02	4.11E-03	7.00E-03	5.87E-01	1.47E-03	NA	NA
Pathway Summary				**0.59**			**NA**

Total Blood HI =	0.59
Total Respiratory HI =	0.59

Notes:
NA = Toxicity values are not available for this endpoint or exposure pathway.

APPENDIX D
Table 8-A: Intake Factors for the Outdoor Worker: Eastern Area
Clean Harbors Kansas, LLC - Wichita, Kansas

Soil Ingestion				
	CF	Conversion Factor	1.00E-06	kg/mg
	IRs	Ingestion Rate - Soil	100	mg/day
	EF	Exposure Frequency	225	days/yr
	ED	Exposure Duration	25	year
	BW	Body Weight	70	kg
	ATc	Averaging Time (Cancer)	25550	days
	ATn	Averaging Time (Non-cancer)	9125	days
Dermal Contact with Soil				
	CF	Conversion Factor	1.00E-06	kg/mg
	AF	Soil to Skin Adherence Factor	0.2	mg/cm^2
	SA	Skin Surface Area Available	3300	cm^2
	EF	Exposure Frequency	225	days/yr
	ED	Exposure Duration	25	year
	BW	Body Weight	70	kg
	ATc	Averaging Time (Cancer)	25550	days
	ATn	Averaging Time (Non-cancer)	9125	days
Inhalation of Volatiles or Particulates from Soil				
	EF	Exposure Frequency	225	days/yr
	ED	Exposure Duration	25	year
	ET	Exposure Time	8	hours/day
	ATc	Averaging Time (Cancer)	613200	hours
	ATn	Averaging Time (Non-cancer)	219000	hours

APPENDIX D
Table 8-B: Constituent-Specific Factors - Outdoor Worker: Eastern Area

Constituent	EPC Soil (mg/kg)	EPC Air Part (mg/m^3)	VF (m^3/kg)	EPC Air VOC (Soil) (mg/m^3)	Oral AF (unitless)	DAF (unitless)	Frac Abs (unitless)	RfDo - C (mg/kg-day)	RfC - C (mg/m^3)	RfDd - C (mg/kg-day)	CSFo $(mg/kg\text{-}day)^{-1}$	IUR $(mg/m^3)^{-1}$	CSFd $(mg/kg\text{-}day)^{-1}$
Volatile Organics													
1,2,4-Trimethylbenzene	1.98	2.11E-09	21735	9.10E-05	1		1	NA	7.00E-03	NA	NA	NA	NA
Ethylbenzene	9.68	1.03E-08	8639	1.12E-03	1		1	1.00E-01	1.00E+00	1.00E-01	1.10E-02	2.50E-03	1.10E-02
Naphthalene	0.14	1.51E-10	99247	1.43E-06	1	0.13	1	2.00E-02	3.00E-03	2.00E-02	NA	3.40E-02	NA
Tetrachloroethene	1.077	1.15E-09	3843	2.80E-04	1		1	6.00E-03	4.00E-02	6.00E-03	2.10E-03	2.60E-04	2.10E-03
Total xylenes	36.8	3.93E-08	8972	4.10E-03	1		1	2.00E-01	1.00E-01	2.00E-01	NA	NA	NA
Trichloroethene	0.12	1.32E-10	4852	2.56E-05	1		1	5.00E-04	2.00E-03	5.00E-04	4.60E-02	4.10E-03	4.60E-02
Vinyl Chloride	0.019	2.06E-11	1149	1.68E-05	1		1	3.00E-03	1.00E-01	3.00E-03	7.20E-01	4.40E-03	7.20E-01
Semi-Volatile Organics													
Benzo(a)pyrene	0.14	1.50E-10			1	0.13	1	NA	NA	NA	7.30E+00	1.10E+00	7.30E+00
Inorganics													
Arsenic	5.14	5.478E-09			0.6	0.03	1	3.00E-04	1.50E-05	3.00E-04	1.50E+00	4.30E+00	1.50E+00

APPENDIX D
Table 8-C: Hazard Indices and Theoretical Excess Lifetime Cancer Risks
Incidental Ingestion of Soil - Outdoor Worker: Eastern Area

Constituent	Soil EPC (mg/kg)	Oral AF (unitless)	Intake (ADD) (mg/kg-d)	RfDo (mg/kg-d)	Hazard Quotient	Intake (LADD) (mg/kg-d)	CSFo $(mg/kg\text{-}d)^{-1}$	Potential Cancer Risk
Volatile Organics								
1,2,4-Trimethylbenzene	1.98	1	1.74E-06	NA	NA	6.22E-07	NA	NA
Ethylbenzene	9.68	1	8.53E-06	1.00E-01	8.53E-05	3.05E-06	1.10E-02	3.35E-08
Naphthalene	0.14	1	1.25E-07	2.00E-02	6.25E-06	4.47E-08	NA	NA
Tetrachloroethene	1.077	1	9.48E-07	6.00E-03	1.58E-04	3.39E-07	2.10E-03	7.11E-10
Total xylenes	36.8	1	3.24E-05	2.00E-01	1.62E-04	1.16E-05	NA	NA
Trichloroethene	0.12	1	1.09E-07	5.00E-04	2.18E-04	3.90E-08	4.60E-02	1.79E-09
Vinyl Chloride	0.019	1	1.70E-08	3.00E-03	5.67E-06	6.07E-09	7.20E-01	4.37E-09
Semi-Volatile Organics								
Benzo(a)pyrene	0.14	1	1.24E-07	NA	NA	4.43E-08	7.30E+00	3.24E-07
Inorganics								
Arsenic	5.14	0.6	2.71E-06	3.00E-04	9.05E-03	9.69E-07	1.50E+00	1.45E-06

Total Hazard Index	0.01

Potential Cancer Risk	1.82E-06

Notes:
NA = Toxicity values are not available for this endpoint or exposure pathway.

APPENDIX D
Table 8-D: Hazard Indices and Theoretical Excess Lifetime Cancer Risks
Dermal Contact with Soil - Outdoor Worker: Eastern Area

Constituent	Soil EPC (mg/kg)	Dermal AF (unitless)	Intake (ADD) (mg/kg-d)	RfDd (mg/kg-d)	Hazard Quotient	Intake (LADD) (mg/kg-d)	CSFd $(mg/kg\text{-}d)^{-1}$	Potential Cancer Risk
Volatile Organics								
1,2,4-Trimethylbenzene	1.98	0	0.00E+00	NA	NA	0.00E+00	NA	NA
Ethylbenzene	9.68	0	0.00E+00	1.00E-01	--	0.00E+00	1.10E-02	--
Naphthalene	0.14	0.13	1.07E-07	2.00E-02	5.36E-06	3.83E-08	NA	NA
Tetrachloroethene	1.077	0	0.00E+00	6.00E-03	--	0.00E+00	2.10E-03	--
Total xylenes	36.8	0	0.00E+00	2.00E-01	--	0.00E+00	NA	NA
Trichloroethene	0.12	0	0.00E+00	5.00E-04	--	0.00E+00	4.60E-02	--
Vinyl Chloride	0.019	0	0.00E+00	3.00E-03	--	0.00E+00	7.20E-01	--
Semi-Volatile Organics								
Benzo(a)pyrene	0.14	0.13	1.07E-07	NA	NA	3.80E-08	7.30E+00	2.78E-07
Inorganics								
Arsenic	5.14	0.03	8.96E-07	3.00E-04	2.99E-03	3.20E-07	1.50E+00	4.80E-07

Total Hazard Index	0.003

Potential Cancer Risk	7.58E-07

Notes:
-- = Constituent is not a COI for this area or exposure pathway.
NA = Toxicity values are not available for this endpoint or exposure pathway.

APPENDIX D
Table 8-E: Hazard Indices and Theoretical Excess Lifetime Cancer Risks
Inhalation of Particulates - Outdoor Worker: Eastern Area

Constituent	EPC Air Part (mg/m^3)	EC (mg/m^3)	RfC (mg/m^3)	Hazard Quotient	EC (mg/m^3)	IUR $(mg/m^3)^{-1}$	Potential Cancer Risk
Volatile Organics							
1,2,4-Trimethylbenzene	2.11E-09	4.33E-10	7.00E-03	6.19E-08	1.55E-10	NA	NA
Ethylbenzene	1.03E-08	2.12E-09	1.00E+00	2.12E-09	7.58E-10	2.50E-03	1.89E-12
Naphthalene	1.51E-10	3.11E-11	3.00E-03	1.04E-08	1.11E-11	3.40E-02	3.78E-13
Tetrachloroethene	1.15E-09	2.36E-10	4.00E-02	5.90E-09	8.43E-11	2.60E-04	2.19E-14
Total xylenes	3.93E-08	8.07E-09	1.00E-01	8.07E-08	2.88E-09	NA	NA
Trichloroethene	1.32E-10	2.72E-11	2.00E-03	1.36E-08	9.71E-12	4.10E-03	3.98E-14
Vinyl Chloride	2.06E-11	4.23E-12	1.00E-01	4.23E-11	1.51E-12	4.40E-03	6.65E-15
Semi-Volatile Organics							
Benzo(a)pyrene	1.50E-10	3.09E-11	NA	NA	1.10E-11	1.10E+00	1.21E-11
Inorganics							
Arsenic	5.48E-09	1.13E-09	1.50E-05	7.50E-05	4.02E-10	4.30E+00	1.73E-09

Total Hazard Index	0.000075

Potential Cancer Risk	1.74E-09

Notes:
NA = Toxicity values are not available for this endpoint or exposure pathway.

APPENDIX D
Table 8-F: Hazard Indices and Theoretical Excess Lifetime Cancer Risks
Inhalation of Volatiles from Soil - Outdoor Worker: Eastern Area

Constituent	EPC Air VOC (mg/m^3)	EC (mg/m^3)	RfC (mg/m^3)	Hazard Quotient	EC (mg/m^3)	IUR $(mg/m^3)^{-1}$	Potential Cancer Risk
Volatile Organics							
1,2,4-Trimethylbenzene	9.10E-05	1.87E-05	7.00E-03	2.67E-03	6.68E-06	NA	NA
Ethylbenzene	1.12E-03	2.30E-04	1.00E+00	2.30E-04	8.22E-05	2.50E-03	2.06E-07
Naphthalene	1.43E-06	2.94E-07	3.00E-03	9.80E-05	1.05E-07	3.40E-02	3.57E-09
Tetrachloroethene	2.80E-04	5.76E-05	4.00E-02	1.44E-03	2.06E-05	2.60E-04	5.35E-09
Total xylenes	4.10E-03	8.43E-04	1.00E-01	8.43E-03	3.01E-04	NA	NA
Trichloroethene	2.56E-05	5.25E-06	2.00E-03	2.63E-03	1.88E-06	4.10E-03	7.69E-09
Vinyl Chloride	1.68E-05	3.45E-06	1.00E-01	3.45E-05	1.23E-06	4.40E-03	5.42E-09
Semi-Volatile Organics							
Benzo(a)pyrene	0.00E+00	0.00E+00	NA	--	0.00E+00	1.10E+00	--
Inorganics							
Arsenic	0.00E+00	0.00E+00	1.50E-05	--	0.00E+00	4.30E+00	--

Total Hazard Index	0.016

Potential Cancer Risk	2.28E-07

Notes:
-- = Constituent is not a COI for this area or exposure pathway.
NA = Toxicity values are not available for this endpoint or exposure pathway.

APPENDIX D
Table 8-G: Summary of Hazard Indices for the Outdoor Worker
Eastern Area

Constituent	Incidental Ingestion of Soil	Dermal Contact with Soil	Inhalation of Particulates	Inhalation of Volatiles from Soil	Total Hazard Index
Volatile Organics					
1,2,4-Trimethylbenzene	NA	NA	6.19E-08	2.67E-03	0.0027
Ethylbenzene	8.53E-05	--	2.12E-09	2.30E-04	0.00032
Naphthalene	6.25E-06	5.36E-06	1.04E-08	9.80E-05	0.00011
Tetrachloroethene	1.58E-04	--	5.90E-09	1.44E-03	0.0016
Total xylenes	1.62E-04	--	8.07E-08	8.43E-03	0.0086
Trichloroethene	2.18E-04	--	1.36E-08	2.63E-03	0.0028
Vinyl Chloride	5.67E-06	--	4.23E-11	3.45E-05	0.00004
Semi-Volatile Organics					
Benzo(a)pyrene	NA	NA	NA	--	NA
Inorganics					
Arsenic	9.05E-03	2.99E-03	7.50E-05	--	0.012
Pathway Summary	0.01	0.003	0.000075	0.016	0.028

Total Blood HI =	0.0027
Total Cardiovascular HI =	0.015
Total CNS HI =	0.022
Total Developmental HI =	0.012
Total Fetal HI =	0.00032
Total Immune System HI =	0.0030
Total Kidney HI =	0.00043
Total Liver HI =	0.00036
Total Respiratory HI =	0.0028
Total Skin HI =	0.012
Total Whole Body HI =	0.0087

Notes:
-- = Constituent is not a COI for this area or exposure pathway.
NA = Toxicity values are not available for this endpoint or exposure pathway.

APPENDIX D

Table 8-H: Summary of Theoretical Excess Lifetime Cancer Risks for the Outdoor Worker Eastern Area

Constituent	Incidental Ingestion of Soil	Dermal Contact with Soil	Inhalation of Particulates	Inhalation of Volatiles from Soil	Theoretical Excess Lifetime Cancer Risk
Volatile Organics					
1,2,4-Trimethylbenzene	NA	NA	NA	NA	NA
Ethylbenzene	3.35E-08	--	1.89E-12	2.06E-07	2.39E-07
Naphthalene	NA	NA	3.78E-13	3.57E-09	3.57E-09
Tetrachloroethene	7.11E-10	--	2.19E-14	5.35E-09	6.06E-09
Total xylenes	NA	NA	NA	NA	NA
Trichloroethene	1.79E-09	--	3.98E-14	7.69E-09	9.48E-09
Vinyl Chloride	4.37E-09	--	6.65E-15	5.42E-09	9.79E-09
Semi-Volatile Organics					
Benzo(a)pyrene	3.24E-07	2.78E-07	1.21E-11	--	6.01E-07
Inorganics					
Arsenic	1.45E-06	4.80E-07	1.73E-09	--	1.94E-06
Pathway Summary	1.82E-06	7.58E-07	1.74E-09	2.28E-07	2.80E-06

Notes:
-- = Constituent is not a COI for this area or exposure pathway.
NA = Toxicity values are not available for this endpoint or exposure pathway.

APPENDIX D
Table 9-A: Intake Factors for the Construction Worker: Eastern Area
Clean Harbors Kansas, LLC - Wichita, Kansas

Soil Ingestion				
	CF	Conversion Factor	1.00E-06	kg/mg
	IRs	Ingestion Rate - Soil	330	mg/day
	EF	Exposure Frequency	90	days/yr
	ED	Exposure Duration	1	year
	BW	Body Weight	70	kg
	ATc	Averaging Time (Cancer)	25550	days
	ATn	Averaging Time (Non-cancer)	365	days
Dermal Contact with Soil				
	CF	Conversion Factor	1.00E-06	kg/mg
	AF	Soil to Skin Adherence Factor	0.3	mg/cm^2
	SA	Skin Surface Area Available	3300	cm^2
	EF	Exposure Frequency	90	days/yr
	ED	Exposure Duration	1	year
	BW	Body Weight	70	kg
	ATc	Averaging Time (Cancer)	25550	days
	ATn	Averaging Time (Non-cancer)	365	days
Inhalation of Volatiles or Particulates from Soil				
	EF	Exposure Frequency	90	days/yr
	ED	Exposure Duration	1	year
	ET	Exposure Time	8	hours/day
	ATc	Averaging Time (Cancer)	613200	hours
	ATn	Averaging Time (Non-cancer)	8760	hours

APPENDIX D
Table 9-B: Constituent-Specific Factors - Construction Worker: Eastern Area

Constituent	EPC Soil (mg/kg)	EPC Air Part (mg/m^3)	VF (m^3/kg)	EPC Air VOC (Soil) (mg/m^3)	Oral AF (unitless)	DAF (unitless)	Frac Abs (unitless)	RfDo - SC (mg/kg-day)	RfC - SC (mg/m^3)	RfDd - SC (mg/kg-day)	CSFo $(mg/kg\text{-}day)^{-1}$	IUR $(mg/m^3)^{-1}$	CSFd $(mg/kg\text{-}day)^{-1}$
Volatile Organics													
1,2,4-Trimethylbenzene	7.58	1.29E-06	2337	3.25E-03	1		1	NA	1.00E-01	NA	NA	NA	NA
Ethylbenzene	63.4	1.08E-05	929	6.83E-02	1		1	5.00E-02	9.00E+00	5.00E-02	1.10E-02	2.50E-03	1.10E-02
Naphthalene	0.30	5.13E-08	10669	2.82E-05	1	0.13	1	6.00E-01	3.00E-03	6.00E-01	NA	3.40E-02	NA
Tetrachloroethene	13.4	2.29E-06	413	3.25E-02	1		1	6.00E-03	4.00E-02	6.00E-03	2.10E-03	2.60E-04	2.10E-03
Total xylenes	319	5.44E-05	965	3.31E-01	1		1	4.00E-01	4.00E-01	4.00E-01	NA	NA	NA
Trichloroethene	1.02	1.73E-07	522	1.95E-03	1		1	5.00E-04	2.00E-03	5.00E-04	4.60E-02	4.10E-03	4.60E-02
Vinyl Chloride	0.11	1.94E-08	124	9.23E-04	1		1	3.00E-03	1.00E-01	3.00E-03	7.20E-01	4.40E-03	7.20E-01
Semi-Volatile Organics													
Benzo(a)pyrene	0.14	1.50E-10			1	0.13	1	NA	NA	NA	7.30E+00	1.10E+00	7.30E+00
Inorganics													
Arsenic	4.99	8.51E-07			0.6	0.03	1	3.00E-04	1.50E-05	3.00E-04	1.50E+00	4.30E+00	1.50E+00

APPENDIX D
Table 9-C: Hazard Indices and Theoretical Excess Lifetime Cancer Risks
Incidental Ingestion of Soil - Construction Worker: Eastern Area

Constituent	Soil EPC (mg/kg)	Oral AF (unitless)	Intake (ADD) (mg/kg-d)	RfDo (mg/kg-d)	Hazard Quotient	Intake (LADD) (mg/kg-d)	CSFo $(mg/kg\text{-}d)^{-1}$	Potential Cancer Risk
Volatile Organics								
1,2,4-Trimethylbenzene	7.58	1	8.81E-06	NA	NA	1.26E-07	NA	NA
Ethylbenzene	63.4	1	7.37E-05	5.00E-02	1.47E-03	1.05E-06	1.10E-02	1.16E-08
Naphthalene	0.30	1	3.50E-07	6.00E-01	5.83E-07	5.00E-09	NA	NA
Tetrachloroethene	13.4	1	1.56E-05	6.00E-03	2.60E-03	2.23E-07	2.10E-03	4.68E-10
Total xylenes	319	1	3.71E-04	4.00E-01	9.28E-04	5.30E-06	NA	NA
Trichloroethene	1.02	1	1.18E-06	5.00E-04	2.36E-03	1.69E-08	4.60E-02	7.75E-10
Vinyl Chloride	0.11	1	1.33E-07	3.00E-03	4.42E-05	1.89E-09	7.20E-01	1.36E-09
Semi-Volatile Organics								
Benzo(a)pyrene	0.14	1	1.64E-07	NA	NA	2.34E-09	7.30E+00	1.71E-08
Inorganics								
Arsenic	4.99	0.6	3.48E-06	3.00E-04	1.16E-02	4.98E-08	1.50E+00	7.46E-08

Total Hazard Index	0.019

Potential Cancer Risk	1.06E-07

Notes:
NA = Toxicity values are not available for this endpoint or exposure pathway.

APPENDIX D
Table 9-D: Hazard Indices and Theoretical Excess Lifetime Cancer Risks
Dermal Contact with Soil - Construction Worker: Eastern Area

Constituent	Soil EPC (mg/kg)	Dermal AF (unitless)	Intake (ADD) (mg/kg-d)	RfDd (mg/kg-d)	Hazard Quotient	Intake (LADD) (mg/kg-d)	CSFd $(mg/kg\text{-}d)^{-1}$	Potential Cancer Risk
Volatile Organics								
1,2,4-Trimethylbenzene	7.58	0	0.00E+00	NA	NA	0.00E+00	NA	NA
Ethylbenzene	63.4	0	0.00E+00	5.00E-02	--	0.00E+00	1.10E-02	--
Naphthalene	0.30	0.13	1.36E-07	6.00E-01	2.27E-07	1.95E-09	NA	NA
Tetrachloroethene	13.4	0	0.00E+00	6.00E-03	--	0.00E+00	2.10E-03	--
Total xylenes	319	0	0.00E+00	4.00E-01	--	0.00E+00	NA	NA
Trichloroethene	1.02	0	0.00E+00	5.00E-04	--	0.00E+00	4.60E-02	--
Vinyl Chloride	0.11	0	0.00E+00	3.00E-03	--	0.00E+00	7.20E-01	--
Semi-Volatile Organics								
Benzo(a)pyrene	0.14	0.13	6.39E-08	NA	NA	9.13E-10	7.30E+00	6.67E-09
Inorganics								
Arsenic	4.99	0.03	5.22E-07	3.00E-04	1.74E-03	7.46E-09	1.50E+00	1.12E-08

Total Hazard Index	0.0017

Potential Cancer Risk	1.79E-08

Notes:
-- = Constituent is not a COI for this area or exposure pathway.
NA = Toxicity values are not available for this endpoint or exposure pathway.

APPENDIX D
Table 9-E: Hazard Indices and Theoretical Excess Lifetime Cancer Risks
Inhalation of Particulates - Construction Worker: Eastern Area

Constituent	EPC Air Part (mg/m^3)	EC (mg/m^3)	RfC (mg/m^3)	Hazard Quotient	EC (mg/m^3)	IUR $(mg/m^3)^{-1}$	Potential Cancer Risk
Volatile Organics							
1,2,4-Trimethylbenzene	1.29E-06	1.06E-07	1.00E-01	1.06E-06	1.52E-09	NA	NA
Ethylbenzene	1.08E-05	8.89E-07	9.00E+00	9.88E-08	1.27E-08	2.50E-03	3.17E-11
Naphthalene	5.13E-08	4.22E-09	3.00E-03	1.41E-06	6.02E-11	3.40E-02	2.05E-12
Tetrachloroethene	2.29E-06	1.88E-07	4.00E-02	4.70E-06	2.69E-09	2.60E-04	6.99E-13
Total xylenes	5.44E-05	4.47E-06	4.00E-01	1.12E-05	6.39E-08	NA	NA
Trichloroethene	1.73E-07	1.42E-08	2.00E-03	7.11E-06	2.03E-10	4.10E-03	8.33E-13
Vinyl Chloride	1.94E-08	1.60E-09	1.00E-01	1.60E-08	2.28E-11	4.40E-03	1.00E-13
Semi-Volatile Organics							
Benzo(a)pyrene	1.50E-10	1.24E-11	NA	NA	1.77E-13	1.10E+00	1.94E-13
Inorganics							
Arsenic	8.51E-07	7.00E-08	1.50E-05	4.66E-03	1.00E-09	4.30E+00	4.30E-09

Total Hazard Index	0.0047

Potential Cancer Risk	4.33E-09

Notes:
NA = Toxicity values are not available for this endpoint or exposure pathway.

APPENDIX D
Table 9-F: Hazard Indices and Theoretical Excess Lifetime Cancer Risks
Inhalation of Volatiles from Soil - Construction Worker: Eastern Area

Constituent	EPC Air VOC (mg/m^3)	EC (mg/m^3)	RfC (mg/m^3)	Hazard Quotient	EC (mg/m^3)	IUR $(mg/m^3)^{-1}$	Potential Cancer Risk
Volatile Organics							
1,2,4-Trimethylbenzene	3.25E-03	2.67E-04	1.00E-01	2.67E-03	3.81E-06	NA	NA
Ethylbenzene	6.83E-02	5.61E-03	9.00E+00	6.24E-04	8.02E-05	2.50E-03	2.01E-07
Naphthalene	2.82E-05	2.32E-06	3.00E-03	7.73E-04	3.31E-08	3.40E-02	1.13E-09
Tetrachloroethene	3.25E-02	2.67E-03	4.00E-02	6.68E-02	3.82E-05	2.60E-04	9.92E-09
Total xylenes	3.31E-01	2.72E-02	4.00E-01	6.80E-02	3.89E-04	NA	NA
Trichloroethene	1.95E-03	1.60E-04	2.00E-03	8.00E-02	2.29E-06	4.10E-03	9.37E-09
Vinyl Chloride	9.23E-04	7.59E-05	1.00E-01	7.59E-04	1.08E-06	4.40E-03	4.77E-09
Semi-Volatile Organics							
Benzo(a)pyrene	0.00E+00	0.00E+00	NA	--	0.00E+00	1.10E+00	--
Inorganics							
Arsenic	0.00E+00	0.00E+00	1.50E-05	--	0.00E+00	4.30E+00	--

Total Hazard Index	0.22

Potential Cancer Risk	2.26E-07

Notes:
-- = Constituent is not a COI for this area or exposure pathway.
NA = Toxicity values are not available for this endpoint or exposure pathway.

APPENDIX D
Table 9-G: Summary of Hazard Indices for the Construction Worker
Eastern Area

Constituent	Incidental Ingestion of Soil	Dermal Contact with Soil	Inhalation of Particulates	Inhalation of Volatiles from Soil	Total Hazard Index
Volatile Organics					
1,2,4-Trimethylbenzene	NA	NA	1.06E-06	2.67E-03	0.0027
Ethylbenzene	1.47E-03	--	9.88E-08	6.24E-04	0.0021
Naphthalene	5.83E-07	2.27E-07	1.41E-06	7.73E-04	0.00078
Tetrachloroethene	2.60E-03	--	4.70E-06	6.68E-02	0.069
Total xylenes	9.28E-04	--	1.12E-05	6.80E-02	0.069
Trichloroethene	2.36E-03	--	7.11E-06	8.00E-02	0.082
Vinyl Chloride	4.42E-05	--	1.60E-08	7.59E-04	0.0008
Semi-Volatile Organics					
Benzo(a)pyrene	NA	NA	NA	--	NA
Inorganics					
Arsenic	1.16E-02	1.74E-03	4.66E-03	--	0.018
Pathway Summary	0.019	0.0017	0.0047	0.22	0.25

Total Blood HI =	0.0027
Total Cardiovascular HI =	0.10
Total CNS HI =	0.16
Total Developmental HI =	0.018
Total Fetal HI =	0.0021
Total Immune System HI =	0.083
Total Kidney HI =	0.0029
Total Liver HI =	0.0029
Total Respiratory HI =	0.0034
Total Skin HI =	0.018
Total Whole Body HI =	0.070

Notes:
-- = Constituent is not a COI for this area or exposure pathway.
NA = Toxicity values are not available for this endpoint or exposure pathway.

APPENDIX D

Table 9-H: Summary of Theoretical Excess Lifetime Cancer Risks for the Construction Worker Eastern Area

Constituent	Incidental Ingestion of Soil	Dermal Contact with Soil	Inhalation of Particulates	Inhalation of Volatiles from Soil	Theoretical Excess Lifetime Cancer Risk
Volatile Organics					
1,2,4-Trimethylbenzene	NA	NA	NA	NA	NA
Ethylbenzene	1.16E-08	--	3.17E-11	2.01E-07	2.12E-07
Naphthalene	NA	NA	2.05E-12	1.13E-09	1.13E-09
Tetrachloroethene	4.68E-10	--	6.99E-13	9.92E-09	1.04E-08
Total xylenes	NA	NA	NA	NA	NA
Trichloroethene	7.75E-10	--	8.33E-13	9.37E-09	1.01E-08
Vinyl Chloride	1.36E-09	--	1.00E-13	4.77E-09	6.13E-09
Semi-Volatile Organics					
Benzo(a)pyrene	1.71E-08	6.67E-09	1.94E-13	--	2.38E-08
Inorganics					
Arsenic	7.46E-08	1.12E-08	4.30E-09	--	9.01E-08
Pathway Summary	1.06E-07	1.79E-08	4.33E-09	2.26E-07	3.54E-07

Notes:
-- = Constituent is not a COI for this area or exposure pathway.
NA = Toxicity values are not available for this endpoint or exposure pathway.

APPENDIX D

Table 10-A: Intake Factors for the Indoor Worker - Eastern Area: Clean Harbors Kansas, LLC - Wichita, Kansas

Inhalation of Volatiles			
EF	Exposure Frequency	250	days/yr
ED	Exposure Duration	25	years
ET	Exposure Time	8	hours/day
ATc	Averaging Time (Cancer)	613200	hours
ATn	Averaging Time (Non-cancer)	219000	hours

APPENDIX D
Table 10-B: Hazard Indices and Theoretical Excess Lifetime Cancer Risks
Inhalation of Volatiles - Indoor Worker - Eastern Area

Constituent	EPC Air VOC (mg/m^3)	EC (mg/m^3)	RfC - C (mg/m^3)	Hazard Quotient	EC (mg/m^3)	IUR $(mg/m^3)^{-1}$	Potential Cancer Risk
Volatile Organics							
1,1-Dichloroethane	1.80E-05	4.12E-06	NA	NA	1.47E-06	1.60E-03	2.35E-09
Ethylbenzene	8.25E-06	1.88E-06	1.00E+00	1.88E-06	6.72E-07	2.50E-03	1.68E-09
Tetrachloroethene	4.64E-04	1.06E-04	4.00E-02	2.65E-03	3.78E-05	2.60E-04	9.84E-09
Trichloroethene	1.70E-04	3.88E-05	2.00E-03	1.94E-02	1.38E-05	4.10E-03	5.68E-08
Vinyl chloride	2.03E-05	4.64E-06	1.00E-01	4.64E-05	1.66E-06	4.40E-03	7.28E-09
Pathway Summary				**0.022**			**7.79E-08**

Total Cardiovascular HI =	0.019
Total CNS HI =	0.0026
Total Fetal HI =	0.0000019
Total Immune System HI =	0.019
Total Kidney HI =	0.0000019
Total Liver HI =	0.000048

Notes:
NA = Toxicity values are not available for this endpoint or exposure pathway.

APPENDIX D
Table 11-A: Intake Factors for the Recreational Adult:
Clean Harbors Kansas, LLC - Wichita, Kansas

Sediment Ingestion				
	CF	Conversion Factor	1.00E-06	kg/mg
	IRs	Ingestion Rate - Sediment	100	mg/day
	EF	Exposure Frequency	39	days/yr
	ED	Exposure Duration	30	years
	BW	Body Weight	70	kg
	ATc	Averaging Time (Cancer)	25550	days
	ATn	Averaging Time (Non-cancer)	10950	days
Dermal Contact with Sediment				
	CF	Conversion Factor	1.00E-06	kg/mg
	AF	Sediment to Skin Adherence Factor	0.07	mg/cm^2
	SA	Skin Surface Area Available	5700	cm^2
	EF	Exposure Frequency	39	days/yr
	ED	Exposure Duration	30	years
	BW	Body Weight	70	kg
	ATc	Averaging Time (Cancer)	25550	days
	ATn	Averaging Time (Non-cancer)	10950	days

APPENDIX D
Table 11-B: Constituent-Specific Factors - Recreational Adult:
Clean Harbors Kansas, LLC - Wichita, Kansas

Constituent	EPC Sediment (mg/kg)	Oral AF (unitless)	DAF (unitless)	Frac Abs (unitless)	RfDo - C (mg/kg-day)	RfDd - C (mg/kg-day)	CSFo $(mg/kg\text{-}day)^{-1}$	CSFd $(mg/kg\text{-}day)^{-1}$
Semi-Volatile Organics								
Benzo(a)pyrene	0.061	1	0.13	1	NA	NA	7.30E+00	7.30E+00
Inorganics								
Arsenic	7.74	0.6	0.03	1	3.00E-04	3.00E-04	1.50E+00	1.50E+00

APPENDIX D
Table 11-C: Hazard Indices and Theoretical Excess Lifetime Cancer Risks
Incidental Ingestion of Sediment - Recreational Adult:
Clean Harbors Kansas, LLC - Wichita, Kansas

Constituent	Sediment EPC (mg/kg)	Oral AF (unitless)	Intake (ADD) (mg/kg-d)	RfDo (mg/kg-d)	Hazard Quotient	Intake (LADD) (mg/kg-d)	CSFo $(mg/kg\text{-}d)^{-1}$	Potential Cancer Risk
Semi-Volatile Organics								
Benzo(a)pyrene	0.061	1	9.33E-09	NA	NA	4.00E-09	7.30E+00	2.92E-08
Inorganics								
Arsenic	7.74	0.6	7.09E-07	3.00E-04	2.36E-03	3.04E-07	1.50E+00	4.56E-07

Total Hazard Index	0.0024

Potential Cancer Risk	4.85E-07

Notes:
NA = Toxicity Values are not available for this endpoint or exposure pathway.

APPENDIX D
Table 11-D: Hazard Indices and Theoretical Excess Lifetime Cancer Risks
Dermal Contact with Sediment - Recreational Adult:
Clean Harbors Kansas, LLC - Wichita, Kansas

Constituent	Sediment EPC (mg/kg)	Dermal AF (unitless)	Intake (ADD) (mg/kg-d)	RfDd (mg/kg-d)	Hazard Quotient	Intake (LADD) (mg/kg-d)	CSFd $(mg/kg\text{-}d)^{-1}$	Potential Cancer Risk
Semi-Volatile Organics								
Benzo(a)pyrene	0.061	0.13	4.84E-09	NA	NA	2.07E-09	7.30E+00	1.51E-08
Inorganics								
Arsenic	7.74	0.03	1.41E-07	3.00E-04	4.71E-04	6.06E-08	1.50E+00	9.09E-08

Total Hazard Index	0.00047

Potential Cancer Risk	1.06E-07

Notes:
NA = Toxicity values are not available for this endpoint or exposure pathway.

APPENDIX D

Table 11-E: Summary of Hazard Indices for the Recreational Adult
Clean Harbors Kansas, LLC - Wichita, Kansas

Constituent	Incidental Ingestion of Sediment	Dermal Contact with Sediment	Total Hazard Index
Semi-Volatile Organics			
Benzo(a)pyrene	NA	NA	NA
Inorganics			
Arsenic	2.36E-03	4.71E-04	0.0028
Pathway Summary	0.0024	0.00047	0.0028

Total Cardiovascular HI =	0.0028
Total CNS HI =	0.0028
Total Developmental HI =	0.0028
Total Skin HI =	0.0028

Notes:
NA = Toxicity values are not available for this endpoint or exposure pathway.

APPENDIX D

Table 11-F: Summary of Theoretical Excess Lifetime Cancer Risks for the Recreational Adult

Clean Harbors Kansas, LLC - Wichita, Kansas

Constituent	Incidental Ingestion of Sediment	Dermal Contact with Sediment	Theoretical Excess Lifetime Cancer Risk
Semi-Volatile Organics			
Benzo(a)pyrene	2.92E-08	1.51E-08	4.43E-08
Inorganics			
Arsenic	4.56E-07	9.09E-08	5.46E-07
Pathway Summary	4.85E-07	1.06E-07	5.91E-07

APPENDIX D
Table 12-A: Intake Factors for the Recreational Youth:
Clean Harbors Kansas, LLC - Wichita, Kansas

Sediment Ingestion				
	CF	Conversion Factor	1.00E-06	kg/mg
	IRs	Ingestion Rate - Sediment	100	mg/day
	EF	Exposure Frequency	39	days/yr
	EDnc	Exposure Duration	10	years
	BW	Body Weight	44.3	kg
	ATc	Averaging Time (Cancer)	25550	days
	ATn	Averaging Time (Non-cancer)	3650	days
Dermal Contact with Sediment				
	CF	Conversion Factor	1.00E-06	kg/mg
	AF	Sediment to Skin Adherence Factor	0.2	mg/cm^2
	SA	Skin Surface Area Available	3780	cm^2
	EF	Exposure Frequency	39	days/yr
	EDc	Exposure Duration	10	years
	BW	Body Weight	44.3	kg
	ATc	Averaging Time (Cancer)	25550	days
	ATn	Averaging Time (Non-cancer)	3650	days

APPENDIX D
Table 12-B: Constituent-Specific Factors - Recreational Youth:
Clean Harbors Kansas, LLC - Wichita, Kansas

Constituent	EPC Sediment (mg/kg)	Oral AF (unitless)	DAF (unitless)	Frac Abs (unitless)	RfDo - C (mg/kg-day)	RfDd - C (mg/kg-day)	CSFo $(mg/kg\text{-}day)^{-1}$	CSFd $(mg/kg\text{-}day)^{-1}$
Semi-Volatile Organics								
Benzo(a)pyrene	0.061	1	0.13	1	NA	NA	2.19E+01	2.19E+01
Inorganics								
Arsenic	7.74	0.6	0.03	1	3.00E-04	3.00E-04	1.50E+00	1.50E+00

APPENDIX D
Table 12-C: Hazard Indices and Theoretical Excess Lifetime Cancer Risks
Incidental Ingestion of Sediment - Recreational Youth:
Clean Harbors Kansas, LLC - Wichita, Kansas

Constituent	Sediment EPC (mg/kg)	Oral AF (unitless)	Intake (ADD) (mg/kg-d)	RfDo (mg/kg-d)	Hazard Quotient	Intake (LADD) (mg/kg-d)	CSFo $(mg/kg\text{-}d)^{-1}$	Potential Cancer Risk
Semi-Volatile Organics								
Benzo(a)pyrene	0.061	1	1.47E-08	NA	NA	2.11E-09	2.19E+01	4.61E-08
Inorganics								
Arsenic	7.74	0.6	1.12E-06	3.00E-04	3.73E-03	1.60E-07	1.50E+00	2.40E-07

Total Hazard Index	0.0037

Potential Cancer Risk	2.86E-07

Notes:
NA = Toxicity Values are not available for this endpoint or exposure pathway.

APPENDIX D
Table 12-D: Hazard Indices and Theoretical Excess Lifetime Cancer Risks
Dermal Contact with Sediment - Recreational Youth:
Clean Harbors Kansas, LLC - Wichita, Kansas

Constituent	Sediment EPC (mg/kg)	Dermal AF (unitless)	Intake (ADD) (mg/kg-d)	RfDd (mg/kg-d)	Hazard Quotient	Intake (LADD) (mg/kg-d)	CSFd $(mg/kg\text{-}d)^{-1}$	Potential Cancer Risk
Semi-Volatile Organics								
Benzo(a)pyrene	0.061	0.13	1.45E-08	NA	NA	2.07E-09	2.19E+01	4.53E-08
Inorganics								
Arsenic	7.74	0.03	4.23E-07	3.00E-04	1.41E-03	6.05E-08	1.50E+00	9.07E-08

Total Hazard Index	0.0014

Potential Cancer Risk	1.36E-07

Notes:
NA = Toxicity values are not available for this endpoint or exposure pathway.

APPENDIX D

Table 12-E: Summary of Hazard Indices for the Recreational Youth
Clean Harbors Kansas, LLC - Wichita, Kansas

Constituent	Incidental Ingestion of Sediment	Dermal Contact with Sediment	Total Hazard Index
Semi-Volatile Organics			
Benzo(a)pyrene	NA	NA	NA
Inorganics			
Arsenic	3.73E-03	1.41E-03	0.0051
Pathway Summary	0.0037	0.0014	0.0051

Total Cardiovascular HI =	0.0051
Total CNS HI =	0.0051
Total Developmental HI =	0.0051
Total Skin HI =	0.0051

Notes:
NA = Toxicity values are not available for this endpoint or exposure pathway.

APPENDIX D

Table 12-F: Summary of Theoretical Excess Lifetime Cancer Risks for the Recreational Youth

Clean Harbors Kansas, LLC - Wichita, Kansas

Constituent	Incidental Ingestion of Sediment	Dermal Contact with Sediment	Theoretical Excess Lifetime Cancer Risk
Semi-Volatile Organics			
Benzo(a)pyrene	4.61E-08	4.53E-08	9.14E-08
Inorganics			
Arsenic	2.40E-07	9.07E-08	3.31E-07
Pathway Summary	2.86E-07	1.36E-07	4.22E-07