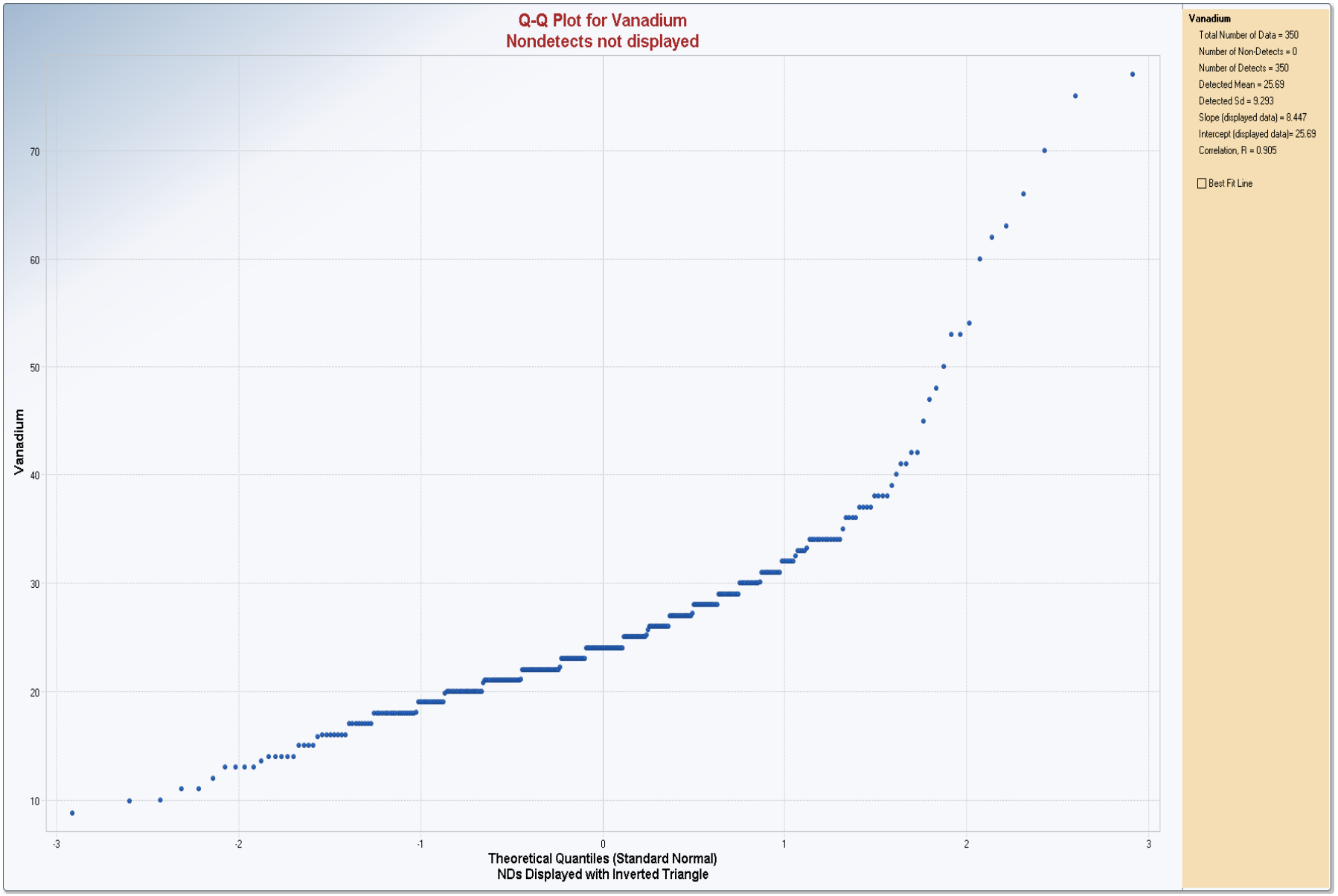
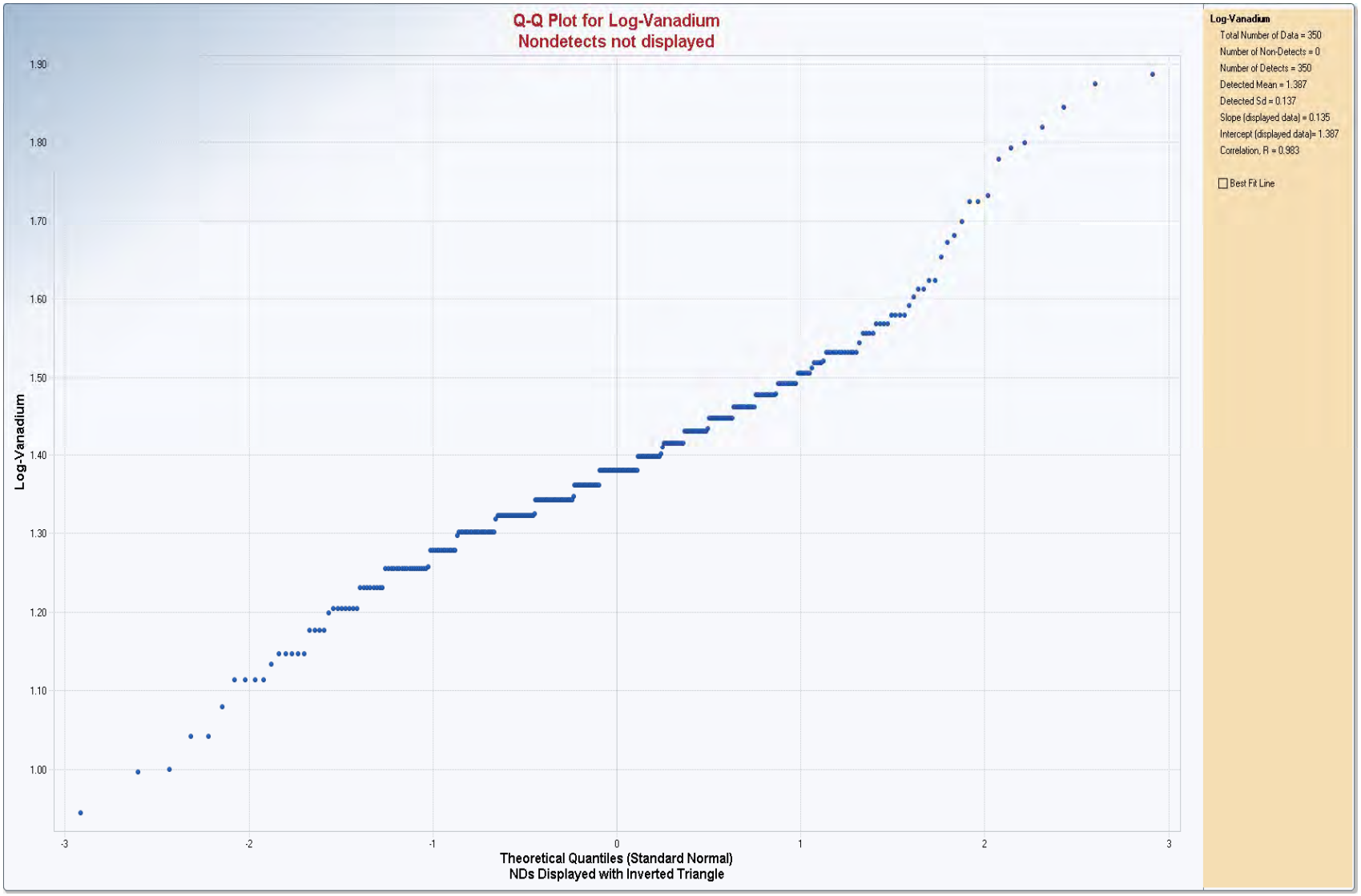
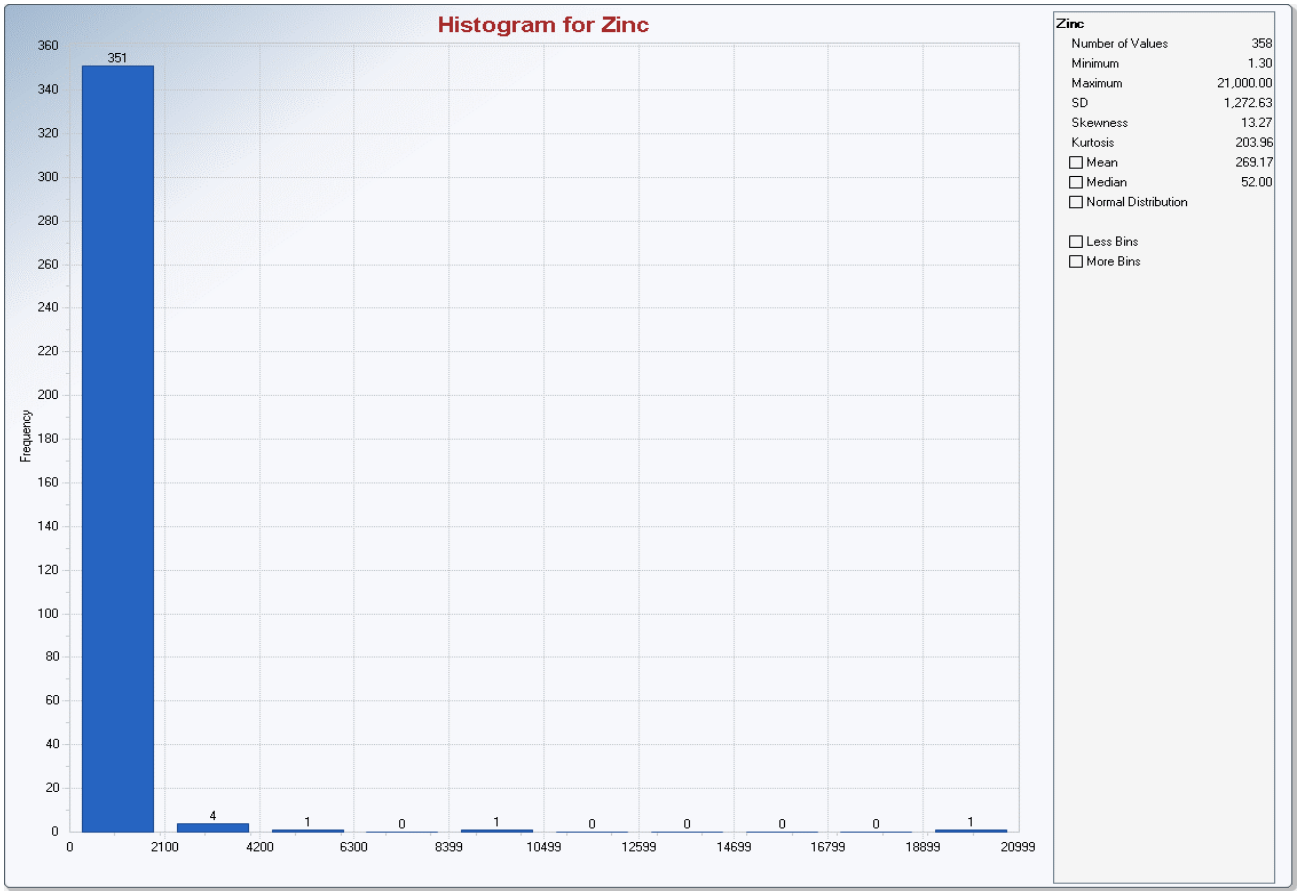
Without Outliers

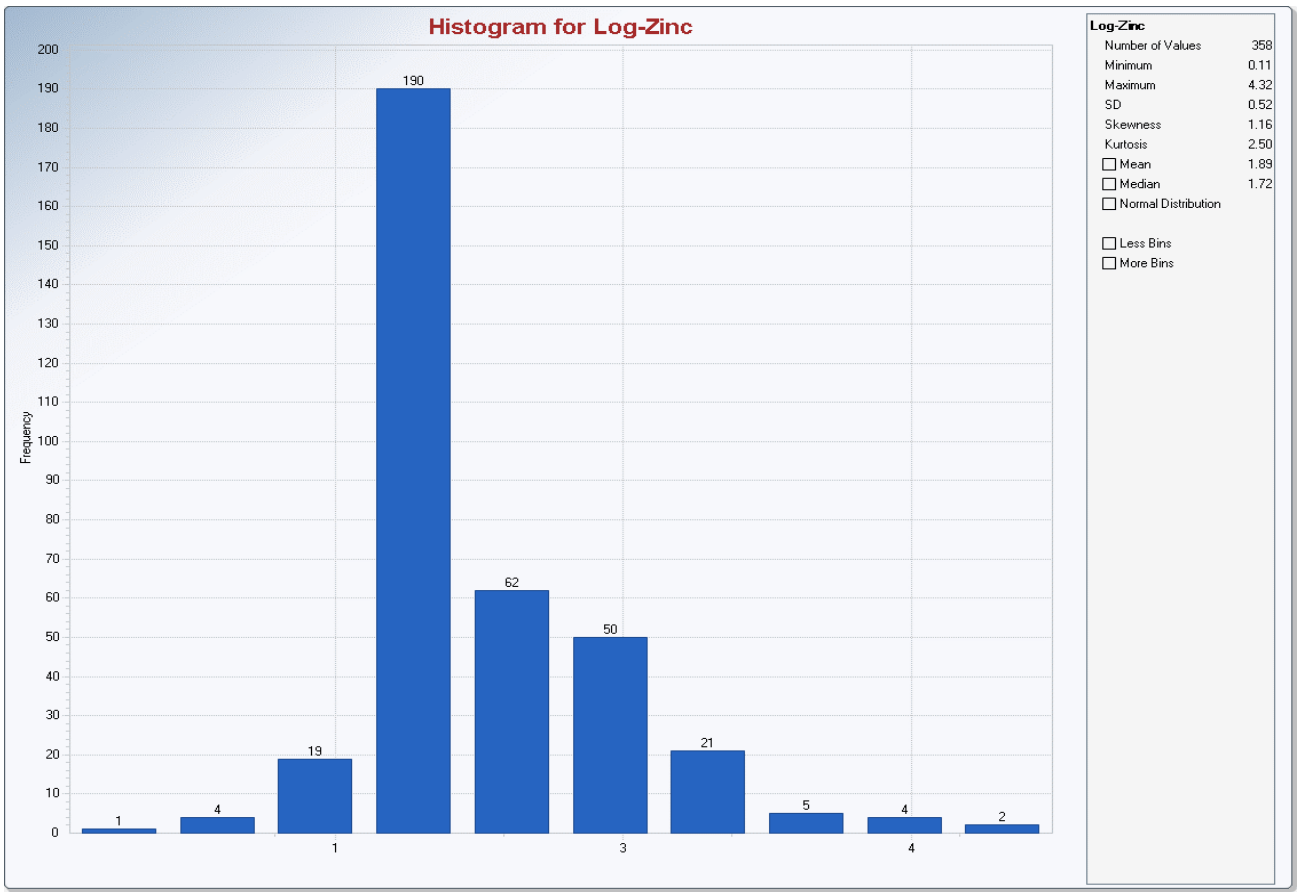


Without Outliers

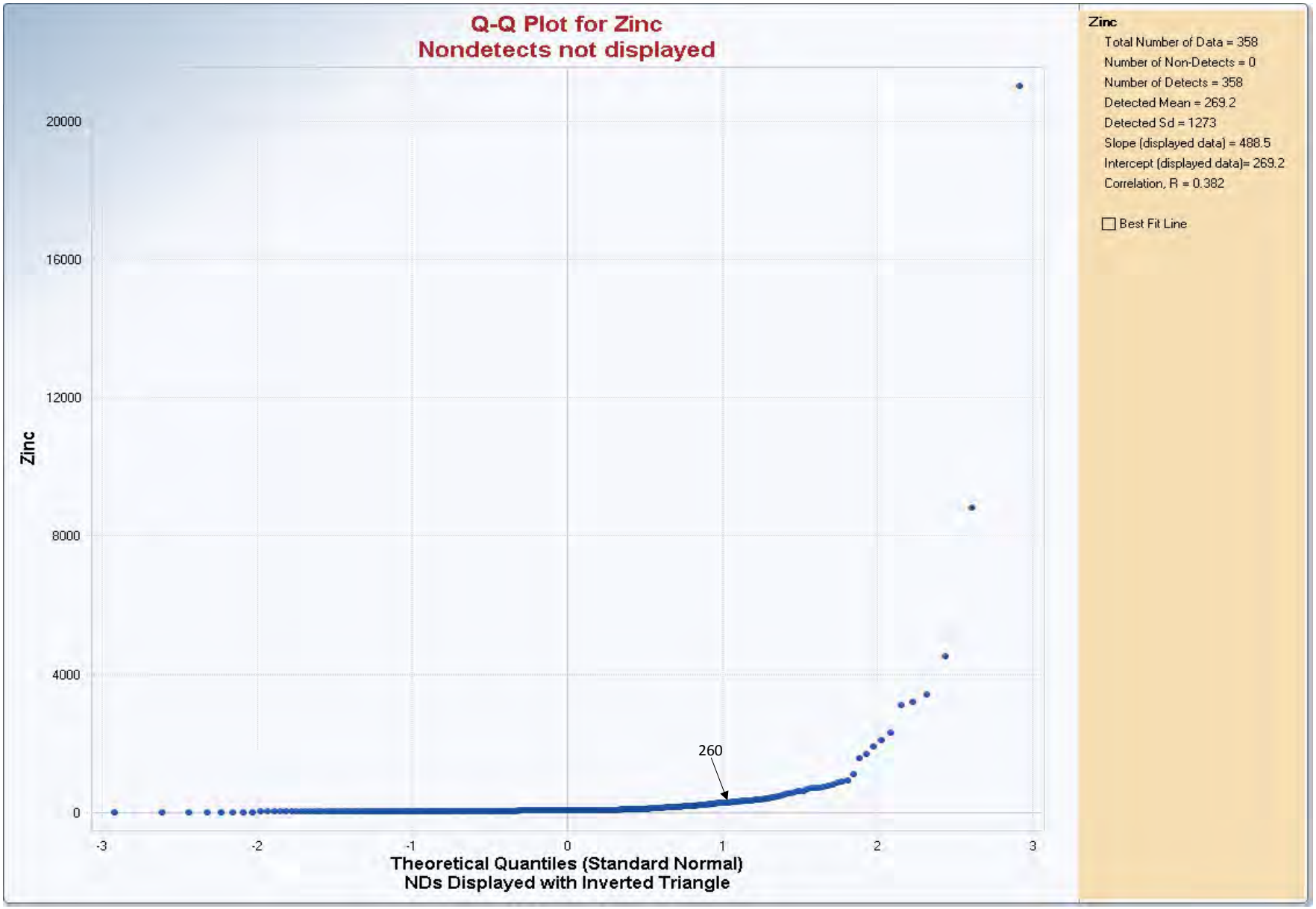


With Outliers

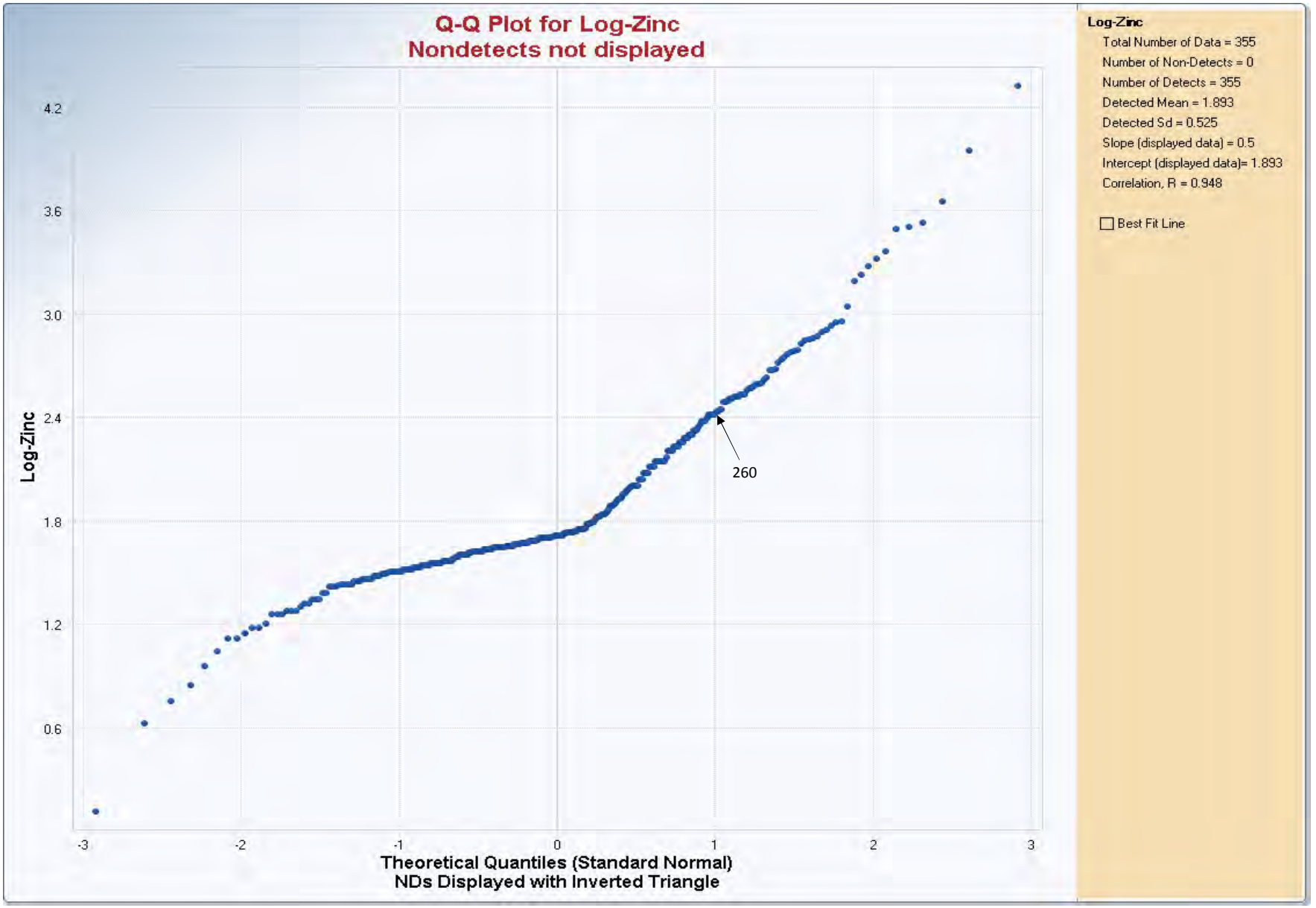




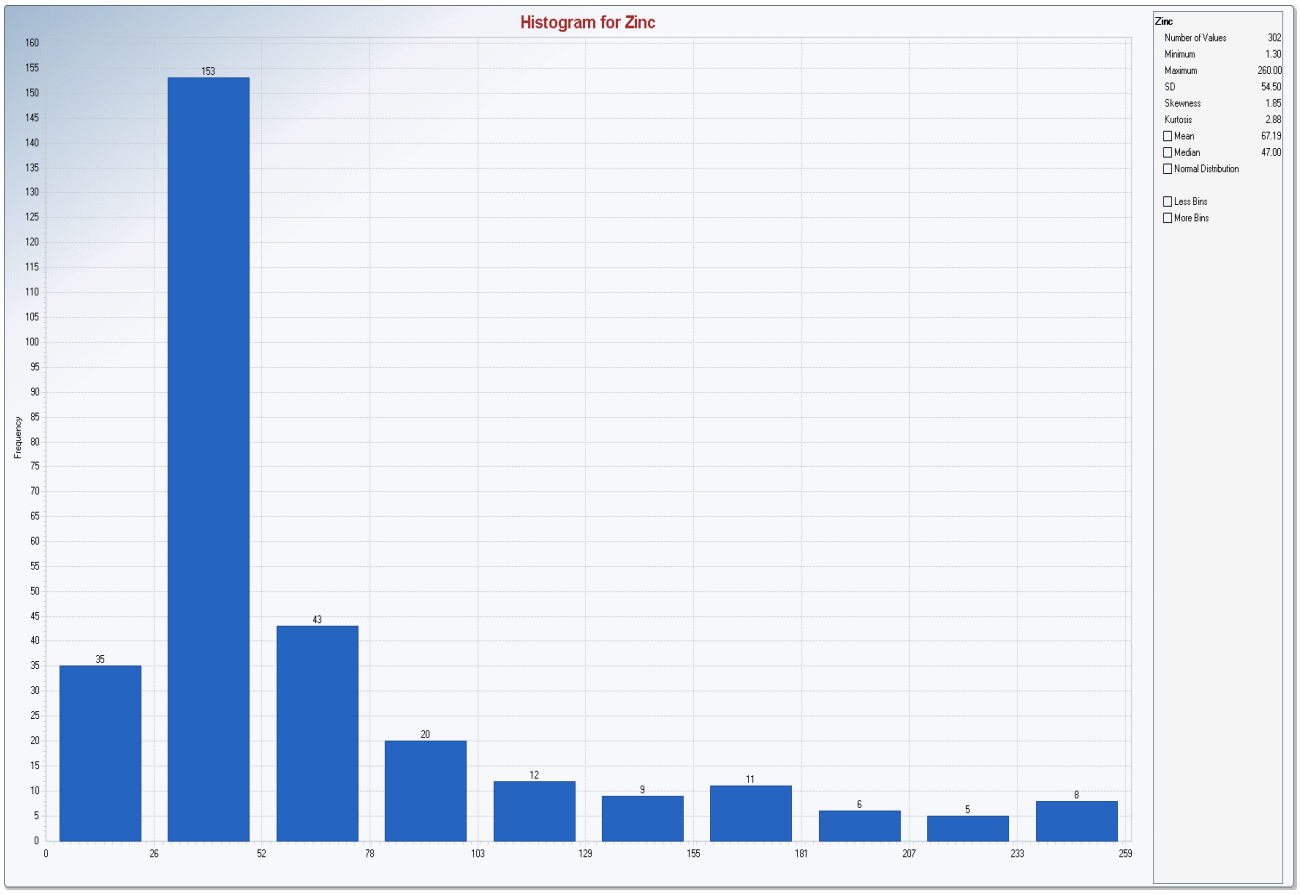
With Outliers

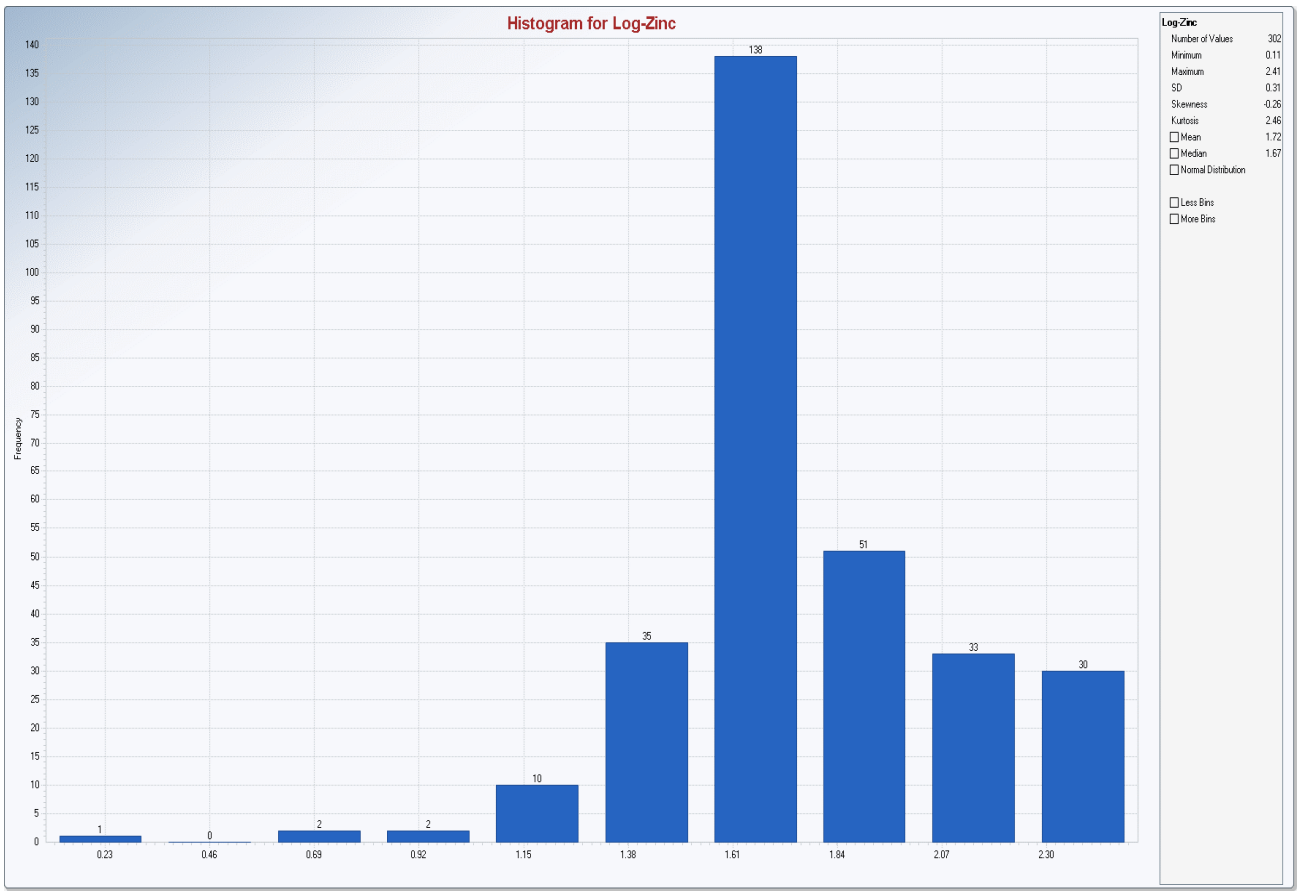


With Outliers

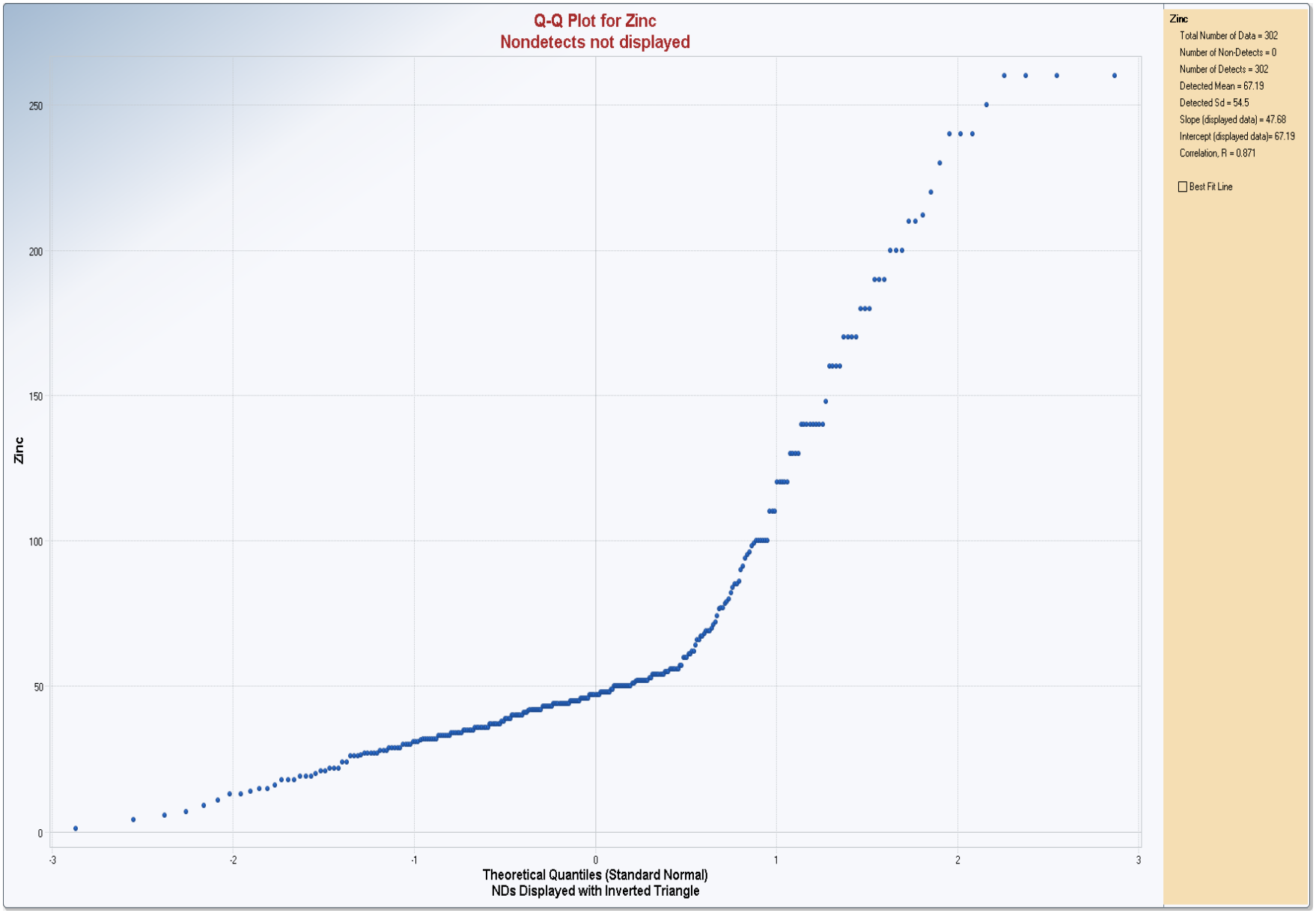


Without Outliers

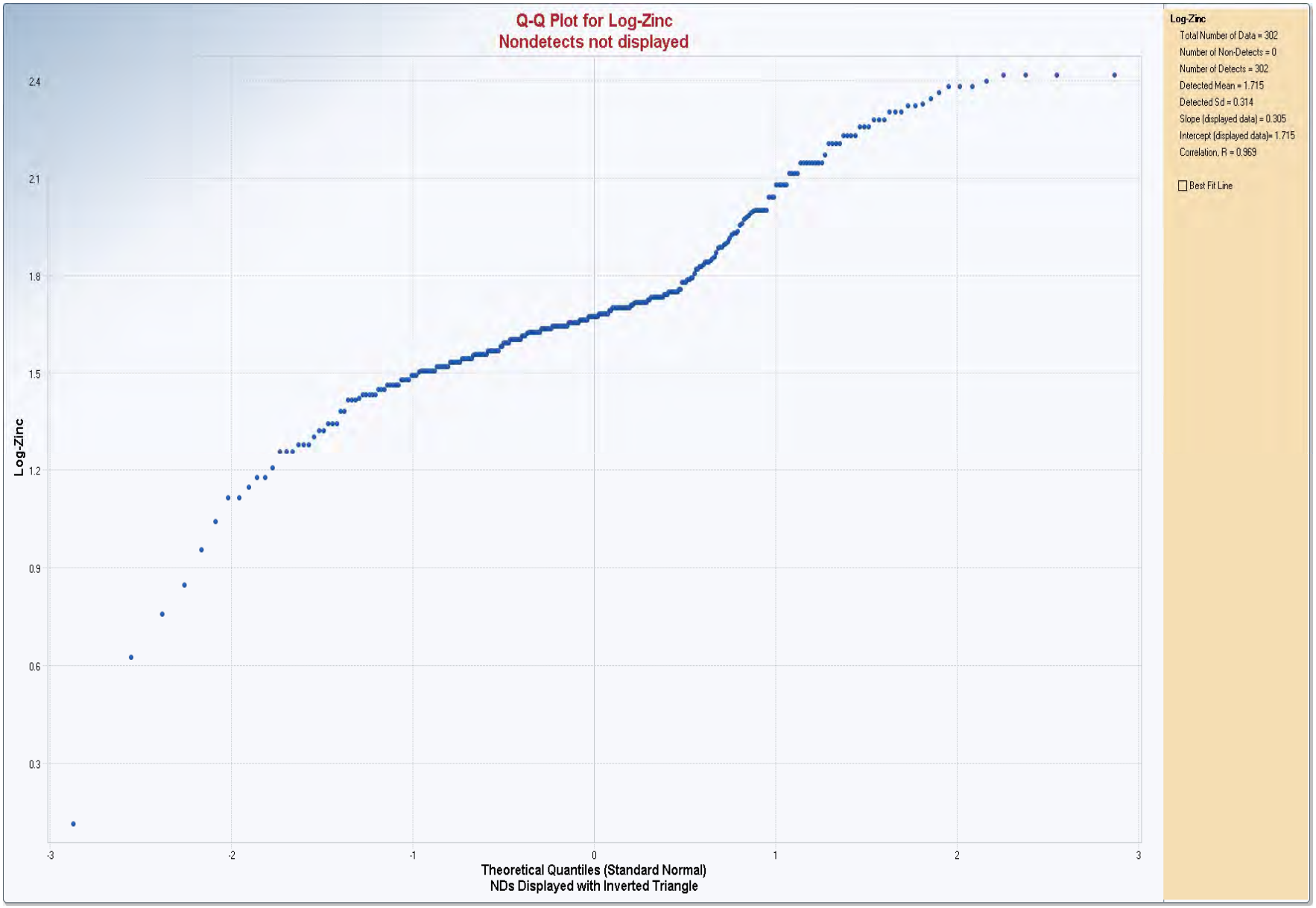




Without Outliers



Without Outliers



1				**Background Statistics for Data Sets with Non-Detects**								
2			**User Selected Options**									
3			Date/Time of Computation	ProUCL 5.112/22/2016 12:07:54 PM								
4			From File	Input_metals_all_depths_outliers_removed.xls								
5			Full Precision	OFF								
6			Confidence Coefficient	95%								
7			Coverage	95%								
8			Different or Future K Observations	1								
9			Number of Bootstrap Operations	2000								
10												
11	**Aluminum**											
12												
13	**General Statistics**											
14						Total Number of Observations	352			Number of Distinct Observations	97		
15										Number of Missing Observations	31	
16						Minimum	1800			First Quartile	6200	
17						Second Largest	16000			Median	7800	
18						Maximum	17000			Third Quartile	9900	
19						Mean	7964			SD	2703	
20						Coefficient of Variation	0.339			Skewness	0.315	
21						Mean of logged Data	8.918			SD of logged Data	0.376	
22												
23						**Critical Values for Background Threshold Values (BTVs)**							
24						Tolerance Factor K (For UTL)	1.786			d2max (for USL)	3.598	
25												
26						**Normal GOF Test**						
27						Shapiro Wilk Test Statistic	0.975			**Normal GOF Test**		
28						5% Shapiro Wilk P Value	0.014			Data Not Normal at 5% Significance Level		
29						Lilliefors Test Statistic	0.0751			**Lilliefors GOF Test**		
30						5% Lilliefors Critical Value	0.0476			Data Not Normal at 5% Significance Level		
31						**Data Not Normal at 5% Significance Level**						
32												
33						**Background Statistics Assuming Normal Distribution**						
34						95% UTL with 95% Coverage	12792			90% Percentile (z)	11428	
35						95% UPL (t)	12428			95% Percentile (z)	12410	
36						95% USL	17689			99% Percentile (z)	14252	
37												
38						**Gamma GOF Test**						
39						A-D Test Statistic	1.839			**Anderson-Darling Gamma GOF Test**		
40						5% A-D Critical Value	0.756			Data Not Gamma Distributed at 5% Significance Level		
41						K-S Test Statistic	0.0662			**Kolmogorov-Smirnov Gamma GOF Test**		
42						5% K-S Critical Value	0.0486			Data Not Gamma Distributed at 5% Significance Level		
43						**Data Not Gamma Distributed at 5% Significance Level**						
44												
45						**Gamma Statistics**						
46						k hat (MLE)	7.938			k star (bias corrected MLE)	7.872	
47						Theta hat (MLE)	1003			Theta star (bias corrected MLE)	1012	
48						nu hat (MLE)	5588			nu star (bias corrected)	5542	
49						MLE Mean (bias corrected)	7964			MLE Sd (bias corrected)	2838	
50												
51						**Background Statistics Assuming Gamma Distribution**						
52						95% Wilson Hilferty (WH) Approx. Gamma UPL	13143			90% Percentile	11749	

53				95% Hawkins Wixley (HW) Approx. Gamma UPL		13294					95% Percentile	13133
54				95% WH Approx. Gamma UTL with 95% Coverage		13682					99% Percentile	16003
55				95% HW Approx. Gamma UTL with 95% Coverage		13869						
56					95% WH USL	22426					95% HW USL	23564
57												
58					**Lognormal GOF Test**							
59					Shapiro Wilk Test Statistic	0.953		**Shapiro Wilk Lognormal GOF Test**				
60					5% Shapiro Wilk P Value	1.035E-11		Data Not Lognormal at 5% Significance Level				
61					Lilliefors Test Statistic	0.0777		**Lilliefors Lognormal GOF Test**				
62					5% Lilliefors Critical Value	0.0476		Data Not Lognormal at 5% Significance Level				
63					**Data Not Lognormal at 5% Significance Level**							
64												
65					**Background Statistics assuming Lognormal Distribution**							
66				95% UTL with 95% Coverage		14613					90% Percentile (z)	12089
67					95% UPL (t)	13892					95% Percentile (z)	13857
68					95% USL	28873					99% Percentile (z)	17903
69												
70					**Nonparametric Distribution Free Background Statistics**							
71					**Data do not follow a Discernible Distribution (0.05)**							
72												
73					**Nonparametric Upper Limits for Background Threshold Values**							
74					Order of Statistic, r	340					95% UTL with 95% Coverage	13000
75				Approx, f used to compute achieved CC		1.377		Approximate Actual Confidence Coefficient achieved by UTL				0.899
76								Approximate Sample Size needed to achieve specified CC				385
77				95% Percentile Bootstrap UTL with 95% Coverage		13450					95% BCA Bootstrap UTL with 95% Coverage	13000
78					95% UPL	13000					90% Percentile	11000
79					90% Chebyshev UPL	16084					95% Percentile	12450
80					95% Chebyshev UPL	19762					99% Percentile	15000
81					95% USL	17000						
82												
83	Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.											
84	Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers											
85	and consists of observations collected from clean unimpacted locations.											
86	The use of USL tends to provide a balance between false positives and false negatives provided the data											
87	represents a background data set and when many onsite observations need to be compared with the BTV.											
88												
89	**Antimony**											
90												
91					**General Statistics**							
92					Total Number of Observations	343					Number of Missing Observations	42
93					Number of Distinct Observations	70						
94					Number of Detects	85					Number of Non-Detects	258
95					Number of Distinct Detects	52					Number of Distinct Non-Detects	24
96					Minimum Detect	0.73					Minimum Non-Detect	0.41
97					Maximum Detect	16.9					Maximum Non-Detect	6.1
98					Variance Detected	12.79					Percent Non-Detects	75.22%
99					Mean Detected	3.748					SD Detected	3.576
100					Mean of Detected Logged Data	0.961					SD of Detected Logged Data	0.833
101												
102					**Critical Values for Background Threshold Values (BTVs)**							
103					Tolerance Factor K (For UTL)	1.788					d2max (for USL)	3.591
104												

105	**Normal GOF Test on Detects Only**											
106					Shapiro Wilk Test Statistic	0.762	**Normal GOF Test on Detected Observations Only**					
107					5% Shapiro Wilk P Value	0	Data Not Normal at 5% Significance Level					
108					Lilliefors Test Statistic	0.209	**Lilliefors GOF Test**					
109					5% Lilliefors Critical Value	0.0962	Data Not Normal at 5% Significance Level					
110	**Data Not Normal at 5% Significance Level**											
111												
112	**Kaplan Meier (KM) Background Statistics Assuming Normal Distribution**											
113					KM Mean	2.288	KM SD	2.171				
114					95% UTL95% Coverage	6.171	95% KM UPL (t)	5.875				
115					90% KM Percentile (z)	5.071	95% KM Percentile (z)	5.86				
116					99% KM Percentile (z)	7.34	95% KM USL	10.09				
117												
118	**DL/2 Substitution Background Statistics Assuming Normal Distribution**											
119					Mean	2.624	SD	1.912				
120					95% UTL95% Coverage	6.043	95% UPL (t)	5.782				
121					90% Percentile (z)	5.075	95% Percentile (z)	5.769				
122					99% Percentile (z)	7.072	95% USL	9.49				
123	**DL/2 is not a recommended method. DL/2 provided for comparisons and historical reasons**											
124												
125	**Gamma GOF Tests on Detected Observations Only**											
126					A-D Test Statistic	1.922	**Anderson-Darling GOF Test**					
127					5% A-D Critical Value	0.77	Data Not Gamma Distributed at 5% Significance Level					
128					K-S Test Statistic	0.111	**Kolmogorov-Smirnov GOF**					
129					5% K-S Critical Value	0.0987	Data Not Gamma Distributed at 5% Significance Level					
130	**Data Not Gamma Distributed at 5% Significance Level**											
131												
132	**Gamma Statistics on Detected Data Only**											
133					k hat (MLE)	1.535	k star (bias corrected MLE)	1.488				
134					Theta hat (MLE)	2.442	Theta star (bias corrected MLE)	2.518				
135					nu hat (MLE)	260.9	nu star (bias corrected)	253				
136					MLE Mean (bias corrected)	3.748						
137					MLE Sd (bias corrected)	3.072	95% Percentile of Chisquare (2kstar)	7.774				
138												
139	**Gamma ROS Statistics using Imputed Non-Detects**											
140	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
141	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)											
142	For such situations, GROS method may yield incorrect values of UCLs and BTVs											
143	This is especially true when the sample size is small.											
144	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates											
145					Minimum	0.01	Mean	2.217				
146					Maximum	16.9	Median	1.597				
147					SD	2.407	CV	1.086				
148					k hat (MLE)	0.637	k star (bias corrected MLE)	0.633				
149					Theta hat (MLE)	3.48	Theta star (bias corrected MLE)	3.5				
150					nu hat (MLE)	437	nu star (bias corrected)	434.5				
151					MLE Mean (bias corrected)	2.217	MLE Sd (bias corrected)	2.785				
152					95% Percentile of Chisquare (2kstar)	4.47	90% Percentile	5.695				
153					95% Percentile	7.823	99% Percentile	12.94				
154	**The following statistics are computed using Gamma ROS Statistics on Imputed Data**											
155	**Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods**											
156						WH	HW				WH	HW

	A	B	C	D	E	F	G	H	I	J	K	L
157	95% Approx. Gamma UTL with 95% Coverage				8.245	9.541	95% Approx. Gamma UPL				7.429	8.437
158	95% Gamma USL				25.19	36.66						
159												
160	**Estimates of Gamma Parameters using KM Estimates**											
161	Mean (KM)					2.288	SD (KM)					2.171
162	Variance (KM)					4.715	SE of Mean (KM)					0.158
163	k hat (KM)					1.111	k star (KM)					1.103
164	nu hat (KM)					761.8	nu star (KM)					756.5
165	theta hat (KM)					2.06	theta star (KM)					2.075
166	80% gamma percentile (KM)					3.652	90% gamma percentile (KM)					5.143
167	95% gamma percentile (KM)					6.623	99% gamma percentile (KM)					10.04
168												
169	**The following statistics are computed using gamma distribution and KM estimates**											
170	**Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods**											
171					WH	HW					WH	HW
172	95% Approx. Gamma UTL with 95% Coverage				5.94	6.033	95% Approx. Gamma UPL				5.515	5.571
173	95% KM Gamma Percentile				5.494	5.548	95% Gamma USL				13.74	15.25
174												
175	**Lognormal GOF Test on Detected Observations Only**											
176	Shapiro Wilk Approximate Test Statistic					0.942	**Shapiro Wilk GOF Test**					
177	5% Shapiro Wilk P Value					0.00136	Data Not Lognormal at 5% Significance Level					
178	Lilliefors Test Statistic					0.0911	**Lilliefors GOF Test**					
179	5% Lilliefors Critical Value					0.0962	Detected Data appear Lognormal at 5% Significance Level					
180	**Detected Data appear Approximate Lognormal at 5% Significance Level**											
181												
182	**Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects**											
183	Mean in Original Scale					2.299	Mean in Log Scale					0.542
184	SD in Original Scale					2.183	SD in Log Scale					0.738
185	95% UTL95% Coverage					6.435	95% BCA UTL95% Coverage					7.2
186	95% Bootstrap (%) UTL95% Coverage					7.38	95% UPL (t)					5.819
187	90% Percentile (z)					4.428	95% Percentile (z)					5.789
188	99% Percentile (z)					9.572	95% USL					24.33
189												
190	**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**											
191	KM Mean of Logged Data					0.526	95% KM UTL (Lognormal)95% Coverage					6.652
192	KM SD of Logged Data					0.766	95% KM UPL (Lognormal)					5.992
193	95% KM Percentile Lognormal (z)					5.961	95% KM USL (Lognormal)					26.44
194												
195	**Background DL/2 Statistics Assuming Lognormal Distribution**											
196	Mean in Original Scale					2.624	Mean in Log Scale					0.822
197	SD in Original Scale					1.912	SD in Log Scale					0.525
198	95% UTL95% Coverage					5.813	95% UPL (t)					5.411
199	90% Percentile (z)					4.456	95% Percentile (z)					5.392
200	99% Percentile (z)					7.71	95% USL					14.97
201	**DL/2 is not a Recommended Method. DL/2 provided for comparisons and historical reasons.**											
202												
203	**Nonparametric Distribution Free Background Statistics**											
204	**Data appear to follow a Discernible Distribution at 5% Significance Level**											
205												
206	**Nonparametric Upper Limits for BTVs(no distinction made between detects and nondetects)**											
207	Order of Statistic, r					332	95% UTL with95% Coverage					7.4
208	Approx, f used to compute achieved CC					1.456	Approximate Actual Confidence Coefficient achieved by UTL					0.926

209	Approximate Sample Size needed to achieve specified CC					361					95% UPL	6.1
210					95% USL	16.9					95% KM Chebyshev UPL	11.77
211												
212	Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.											
213	Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers											
214	and consists of observations collected from clean unimpacted locations.											
215	The use of USL tends to provide a balance between false positives and false negatives provided the data											
216	represents a background data set and when many onsite observations need to be compared with the BTV.											
217												
218	**Arsenic**											
219												
220	**General Statistics**											
221					Total Number of Observations	345					Number of Missing Observations	53
222					Number of Distinct Observations	117						
223					Number of Detects	325					Number of Non-Detects	20
224					Number of Distinct Detects	110					Number of Distinct Non-Detects	10
225					Minimum Detect	0.17					Minimum Non-Detect	0.8
226					Maximum Detect	15					Maximum Non-Detect	4.2
227					Variance Detected	14.85					Percent Non-Detects	5.797%
228					Mean Detected	6.236					SD Detected	3.853
229					Mean of Detected Logged Data	1.557					SD of Detected Logged Data	0.869
230												
231	**Critical Values for Background Threshold Values (BTVs)**											
232					Tolerance Factor K (For UTL)	1.788					d2max (for USL)	3.592
233												
234	**Normal GOF Test on Detects Only**											
235					Shapiro Wilk Test Statistic	0.932	**Normal GOF Test on Detected Observations Only**					
236					5% Shapiro Wilk P Value	0	Data Not Normal at 5% Significance Level					
237					Lilliefors Test Statistic	0.0721	**Lilliefors GOF Test**					
238					5% Lilliefors Critical Value	0.0495	Data Not Normal at 5% Significance Level					
239	**Data Not Normal at 5% Significance Level**											
240												
241	**Kaplan Meier (KM) Background Statistics Assuming Normal Distribution**											
242					KM Mean	5.904					KM SD	3.967
243					95% UTL95% Coverage	13					95% KM UPL (t)	12.46
244					90% KM Percentile (z)	10.99					95% KM Percentile (z)	12.43
245					99% KM Percentile (z)	15.13					95% KM USL	20.16
246												
247	**DL/2 Substitution Background Statistics Assuming Normal Distribution**											
248					Mean	5.906					SD	3.971
249					95% UTL95% Coverage	13					95% UPL (t)	12.46
250					90% Percentile (z)	10.99					95% Percentile (z)	12.44
251					99% Percentile (z)	15.14					95% USL	20.17
252	**DL/2 is not a recommended method. DL/2 provided for comparisons and historical reasons**											
253												
254	**Gamma GOF Tests on Detected Observations Only**											
255					A-D Test Statistic	2.017	**Anderson-Darling GOF Test**					
256					5% A-D Critical Value	0.766	Data Not Gamma Distributed at 5% Significance Level					
257					K-S Test Statistic	0.0737	**Kolmogorov-Smirnov GOF**					
258					5% K-S Critical Value	0.051	Data Not Gamma Distributed at 5% Significance Level					
259	**Data Not Gamma Distributed at 5% Significance Level**											
260												

	A	B	C	D	E	F	G	H	I	J	K	L
261	**Gamma Statistics on Detected Data Only**											
262					k hat (MLE)	1.983			k star (bias corrected MLE)			1.967
263					Theta hat (MLE)	3.144			Theta star (bias corrected MLE)			3.17
264					nu hat (MLE)	1289			nu star (bias corrected)			1279
265					MLE Mean (bias corrected)	6.236						
266					MLE Sd (bias corrected)	4.446			95% Percentile of Chisquare (2kstar)			9.381
267												
268	**Gamma ROS Statistics using Imputed Non-Detects**											
269	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
270	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)											
271	For such situations, GROS method may yield incorrect values of UCLs and BTVs											
272	This is especially true when the sample size is small.											
273	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates											
274					Minimum	0.17			Mean			5.962
275					Maximum	15			Median			5.5
276					SD	3.901			CV			0.654
277					k hat (MLE)	1.841			k star (bias corrected MLE)			1.826
278					Theta hat (MLE)	3.239			Theta star (bias corrected MLE)			3.264
279					nu hat (MLE)	1270			nu star (bias corrected)			1260
280					MLE Mean (bias corrected)	5.962			MLE Sd (bias corrected)			4.411
281					95% Percentile of Chisquare (2kstar)	8.919			90% Percentile			11.85
282					95% Percentile	14.56			99% Percentile			20.6
283	**The following statistics are computed using Gamma ROS Statistics on Imputed Data**											
284	**Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods**											
285					WH	HW				WH	HW	
286				95% Approx. Gamma UTL with 95% Coverage	15.61	16.47			95% Approx. Gamma UPL	14.51	15.19	
287				95% Gamma USL	35.82	42.26						
288												
289	**Estimates of Gamma Parameters using KM Estimates**											
290					Mean (KM)	5.904			SD (KM)			3.967
291					Variance (KM)	15.74			SE of Mean (KM)			0.214
292					k hat (KM)	2.215			k star (KM)			2.197
293					nu hat (KM)	1528			nu star (KM)			1516
294					theta hat (KM)	2.666			theta star (KM)			2.687
295					80% gamma percentile (KM)	8.742			90% gamma percentile (KM)			11.23
296					95% gamma percentile (KM)	13.6			99% gamma percentile (KM)			18.81
297												
298	**The following statistics are computed using gamma distribution and KM estimates**											
299	**Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods**											
300					WH	HW				WH	HW	
301				95% Approx. Gamma UTL with 95% Coverage	16.45	17.68			95% Approx. Gamma UPL	15.22	16.2	
302				95% KM Gamma Percentile	15.16	16.13			95% Gamma USL	39.57	48.52	
303												
304	**Lognormal GOF Test on Detected Observations Only**											
305					Shapiro Wilk Approximate Test Statistic	0.887			**Shapiro Wilk GOF Test**			
306					5% Shapiro Wilk P Value	0			Data Not Lognormal at 5% Significance Level			
307					Lilliefors Test Statistic	0.117			**Lilliefors GOF Test**			
308					5% Lilliefors Critical Value	0.0495			Data Not Lognormal at 5% Significance Level			
309	**Data Not Lognormal at 5% Significance Level**											
310												
311	**Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects**											
312					Mean in Original Scale	5.934			Mean in Log Scale			1.467

313				SD in Original Scale		3.933				SD in Log Scale		0.92
314				95% UTL95% Coverage		22.47				95% BCA UTL95% Coverage		14
315				95% Bootstrap (%) UTL95% Coverage		14				95% UPL (t)		19.83
316				90% Percentile (z)		14.11				95% Percentile (z)		19.7
317				99% Percentile (z)		36.89				95% USL		118.2
318												
319	**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**											
320				KM Mean of Logged Data		1.415				95% KM UTL (Lognormal)95% Coverage		26.05
321				KM SD of Logged Data		1.032				95% KM UPL (Lognormal)		22.64
322				95% KM Percentile Lognormal (z)		22.48				95% KM USL (Lognormal)		167.8
323												
324	**Background DL/2 Statistics Assuming Lognormal Distribution**											
325				Mean in Original Scale		5.906				Mean in Log Scale		1.427
326				SD in Original Scale		3.971				SD in Log Scale		0.998
327				95% UTL95% Coverage		24.81				95% UPL (t)		21.66
328				90% Percentile (z)		14.97				95% Percentile (z)		21.51
329				99% Percentile (z)		42.47				95% USL		150.3
330	**DL/2 is not a Recommended Method. DL/2 provided for comparisons and historical reasons.**											
331												
332	**Nonparametric Distribution Free Background Statistics**											
333	**Data do not follow a Discernible Distribution (0.05)**											
334												
335	**Nonparametric Upper Limits for BTVs(no distinction made between detects and nondetects)**											
336				Order of Statistic, r		334				95% UTL with95% Coverage		14
337				Approx, f used to compute achieved CC		1.465				Approximate Actual Confidence Coefficient achieved by UTL		0.929
338				Approximate Sample Size needed to achieve specified CC		361				95% UPL		14
339				95% USL		15				95% KM Chebyshev UPL		23.22
340												
341	Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.											
342	Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers											
343	and consists of observations collected from clean unimpacted locations.											
344	The use of USL tends to provide a balance between false positives and false negatives provided the data											
345	represents a background data set and when many onsite observations need to be compared with the BTV.											
346												
347	**Barium**											
348												
349	**General Statistics**											
350				Total Number of Observations		355				Number of Distinct Observations		135
351										Number of Missing Observations		43
352				Minimum		6.2				First Quartile		53
353				Second Largest		380				Median		72
354				Maximum		390				Third Quartile		110
355				Mean		100.2				SD		81.8
356				Coefficient of Variation		0.816				Skewness		1.793
357				Mean of logged Data		4.336				SD of logged Data		0.742
358												
359	**Critical Values for Background Threshold Values (BTVs)**											
360				Tolerance Factor K (For UTL)		1.786				d2max (for USL)		3.6
361												
362	**Normal GOF Test**											
363				Shapiro Wilk Test Statistic		0.764	**Normal GOF Test**					
364				5% Shapiro Wilk P Value		0	Data Not Normal at 5% Significance Level					

	A	B	C	D	E	F	G	H	I	J	K	L
365					Lilliefors Test Statistic	0.231	**Lilliefors GOF Test**					
366					5% Lilliefors Critical Value	0.0474	Data Not Normal at 5% Significance Level					
367	**Data Not Normal at 5% Significance Level**											
368												
369	**Background Statistics Assuming Normal Distribution**											
370				95% UTL with	95% Coverage	246.3				90% Percentile (z)		205
371					95% UPL (t)	235.3				95% Percentile (z)		234.8
372					95% USL	394.7				99% Percentile (z)		290.5
373												
374	**Gamma GOF Test**											
375					A-D Test Statistic	8.4	**Anderson-Darling Gamma GOF Test**					
376					5% A-D Critical Value	0.766	Data Not Gamma Distributed at 5% Significance Level					
377					K-S Test Statistic	0.142	**Kolmogorov-Smirnov Gamma GOF Test**					
378					5% K-S Critical Value	0.0489	Data Not Gamma Distributed at 5% Significance Level					
379	**Data Not Gamma Distributed at 5% Significance Level**											
380												
381	**Gamma Statistics**											
382					k hat (MLE)	1.991				k star (bias corrected MLE)		1.977
383					Theta hat (MLE)	50.32				Theta star (bias corrected MLE)		50.7
384					nu hat (MLE)	1414				nu star (bias corrected)		1403
385					MLE Mean (bias corrected)	100.2				MLE Sd (bias corrected)		71.28
386												
387	**Background Statistics Assuming Gamma Distribution**											
388				95% Wilson Hilferty (WH) Approx. Gamma UPL		235.7				90% Percentile		195.4
389				95% Hawkins Wixley (HW) Approx. Gamma UPL		239				95% Percentile		238.6
390				95% WH Approx. Gamma UTL with	95% Coverage	252.9				99% Percentile		334.3
391				95% HW Approx. Gamma UTL with	95% Coverage	257.8						
392					95% WH USL	573.1				95% HW USL		636.6
393												
394	**Lognormal GOF Test**											
395					Shapiro Wilk Test Statistic	0.957	**Shapiro Wilk Lognormal GOF Test**					
396					5% Shapiro Wilk P Value	1.8293E-9	Data Not Lognormal at 5% Significance Level					
397					Lilliefors Test Statistic	0.0912	**Lilliefors Lognormal GOF Test**					
398					5% Lilliefors Critical Value	0.0474	Data Not Lognormal at 5% Significance Level					
399	**Data Not Lognormal at 5% Significance Level**											
400												
401	**Background Statistics assuming Lognormal Distribution**											
402				95% UTL with	95% Coverage	287.5				90% Percentile (z)		197.7
403					95% UPL (t)	260.2				95% Percentile (z)		259
404					95% USL	1106				99% Percentile (z)		429.5
405												
406	**Nonparametric Distribution Free Background Statistics**											
407	**Data do not follow a Discernible Distribution (0.05)**											
408												
409	**Nonparametric Upper Limits for Background Threshold Values**											
410					Order of Statistic, r	343				95% UTL with	95% Coverage	330
411				Approx, f used to compute achieved CC		1.389	Approximate Actual Confidence Coefficient achieved by UTL					0.905
412										Approximate Sample Size needed to achieve specified CC		385
413				95% Percentile Bootstrap UTL with	95% Coverage	330				95% BCA Bootstrap UTL with	95% Coverage	330
414					95% UPL	302.8				90% Percentile		231.8
415					90% Chebyshev UPL	345.9				95% Percentile		300.3
416					95% Chebyshev UPL	457.3				99% Percentile		370

417					95% USL	390						
418												
419	Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.											
420	Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers											
421	and consists of observations collected from clean unimpacted locations.											
422	The use of USL tends to provide a balance between false positives and false negatives provided the data											
423	represents a background data set and when many onsite observations need to be compared with the BTV.											
424												
425	**Beryllium**											
426												
427	**General Statistics**											
428					Total Number of Observations	352			Number of Missing Observations	33		
429					Number of Distinct Observations	79						
430					Number of Detects	346			Number of Non-Detects	6		
431					Number of Distinct Detects	79			Number of Distinct Non-Detects	3		
432					Minimum Detect	0.083			Minimum Non-Detect	0.4		
433					Maximum Detect	0.92			Maximum Non-Detect	0.44		
434					Variance Detected	0.0341			Percent Non-Detects	1.705%		
435					Mean Detected	0.505			SD Detected	0.185		
436					Mean of Detected Logged Data	-0.77			SD of Detected Logged Data	0.45		
437												
438	**Critical Values for Background Threshold Values (BTVs)**											
439					Tolerance Factor K (For UTL)	1.786			d2max (for USL)	3.598		
440												
441	**Normal GOF Test on Detects Only**											
442					Shapiro Wilk Test Statistic	0.963			**Normal GOF Test on Detected Observations Only**			
443					5% Shapiro Wilk P Value	1.6024E-6			Data Not Normal at 5% Significance Level			
444					Lilliefors Test Statistic	0.0569			**Lilliefors GOF Test**			
445					5% Lilliefors Critical Value	0.048			Data Not Normal at 5% Significance Level			
446	**Data Not Normal at 5% Significance Level**											
447												
448	**Kaplan Meier (KM) Background Statistics Assuming Normal Distribution**											
449					KM Mean	0.501			KM SD	0.185		
450					95% UTL95% Coverage	0.832			95% KM UPL (t)	0.807		
451					90% KM Percentile (z)	0.738			95% KM Percentile (z)	0.806		
452					99% KM Percentile (z)	0.932			95% KM USL	1.168		
453												
454	**DL/2 Substitution Background Statistics Assuming Normal Distribution**											
455					Mean	0.5			SD	0.187		
456					95% UTL95% Coverage	0.834			95% UPL (t)	0.808		
457					90% Percentile (z)	0.739			95% Percentile (z)	0.807		
458					99% Percentile (z)	0.935			95% USL	1.172		
459	**DL/2 is not a recommended method. DL/2 provided for comparisons and historical reasons**											
460												
461	**Gamma GOF Tests on Detected Observations Only**											
462					A-D Test Statistic	5.494			**Anderson-Darling GOF Test**			
463					5% A-D Critical Value	0.757			Data Not Gamma Distributed at 5% Significance Level			
464					K-S Test Statistic	0.11			**Kolmogorov-Smirnov GOF**			
465					5% K-S Critical Value	0.049			Data Not Gamma Distributed at 5% Significance Level			
466	**Data Not Gamma Distributed at 5% Significance Level**											
467												
468	**Gamma Statistics on Detected Data Only**											

	A	B	C	D	E	F	G	H	I	J	K	L
469					k hat (MLE)	5.983				k star (bias corrected MLE)		5.933
470					Theta hat (MLE)	0.0843				Theta star (bias corrected MLE)		0.085
471					nu hat (MLE)	4140				nu star (bias corrected)		4106
472					MLE Mean (bias corrected)	0.505						
473					MLE Sd (bias corrected)	0.207				95% Percentile of Chisquare (2kstar)		20.85
474												
475	**Gamma ROS Statistics using Imputed Non-Detects**											
476	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
477	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)											
478	For such situations, GROS method may yield incorrect values of UCLs and BTVs											
479	This is especially true when the sample size is small.											
480	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates											
481					Minimum	0.083				Mean		0.502
482					Maximum	0.92				Median		0.52
483					SD	0.185				CV		0.368
484					k hat (MLE)	5.986				k star (bias corrected MLE)		5.937
485					Theta hat (MLE)	0.0838				Theta star (bias corrected MLE)		0.0845
486					nu hat (MLE)	4214				nu star (bias corrected)		4180
487					MLE Mean (bias corrected)	0.502				MLE Sd (bias corrected)		0.206
488					95% Percentile of Chisquare (2kstar)	20.86				90% Percentile		0.777
489					95% Percentile	0.881				99% Percentile		1.1
490	**The following statistics are computed using Gamma ROS Statistics on Imputed Data**											
491	**Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods**											
492					WH	HW				WH		HW
493				95% Approx. Gamma UTL with 95% Coverage	0.923	0.943			95% Approx. Gamma UPL	0.882		0.898
494				95% Gamma USL	1.6	1.715						
495												
496	**Estimates of Gamma Parameters using KM Estimates**											
497					Mean (KM)	0.501				SD (KM)		0.185
498					Variance (KM)	0.0344				SE of Mean (KM)		0.00991
499					k hat (KM)	7.304				k star (KM)		7.243
500					nu hat (KM)	5142				nu star (KM)		5099
501					theta hat (KM)	0.0686				theta star (KM)		0.0692
502					80% gamma percentile (KM)	0.647				90% gamma percentile (KM)		0.749
503					95% gamma percentile (KM)	0.841				99% gamma percentile (KM)		1.032
504												
505	**The following statistics are computed using gamma distribution and KM estimates**											
506	**Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods**											
507					WH	HW				WH		HW
508				95% Approx. Gamma UTL with 95% Coverage	0.925	0.946			95% Approx. Gamma UPL	0.884		0.901
509				95% KM Gamma Percentile	0.882	0.899			95% Gamma USL	1.61		1.728
510												
511	**Lognormal GOF Test on Detected Observations Only**											
512					Shapiro Wilk Approximate Test Statistic	0.902			**Shapiro Wilk GOF Test**			
513					5% Shapiro Wilk P Value	0			Data Not Lognormal at 5% Significance Level			
514					Lilliefors Test Statistic	0.134			**Lilliefors GOF Test**			
515					5% Lilliefors Critical Value	0.048			Data Not Lognormal at 5% Significance Level			
516	**Data Not Lognormal at 5% Significance Level**											
517												
518	**Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects**											
519					Mean in Original Scale	0.501				Mean in Log Scale		-0.777
520					SD in Original Scale	0.185				SD in Log Scale		0.45

521				95% UTL95% Coverage		1.026				95% BCA UTL95% Coverage		0.78
522				95% Bootstrap (%) UTL95% Coverage		0.82				95% UPL (t)		0.966
523				90% Percentile (z)		0.818				95% Percentile (z)		0.963
524				99% Percentile (z)		1.309				95% USL		2.318
525												
526	**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**											
527				KM Mean of Logged Data		-0.779				95% KM UTL (Lognormal)95% Coverage		1.031
528				KM SD of Logged Data		0.453				95% KM UPL (Lognormal)		0.97
529				95% KM Percentile Lognormal (z)		0.967				95% KM USL (Lognormal)		2.341
530												
531	**Background DL/2 Statistics Assuming Lognormal Distribution**											
532				Mean in Original Scale		0.5				Mean in Log Scale		-0.783
533				SD in Original Scale		0.187				SD in Log Scale		0.457
534				95% UTL95% Coverage		1.034				95% UPL (t)		0.972
535				90% Percentile (z)		0.821				95% Percentile (z)		0.969
536				99% Percentile (z)		1.323				95% USL		2.366
537	**DL/2 is not a Recommended Method. DL/2 provided for comparisons and historical reasons.**											
538												
539	**Nonparametric Distribution Free Background Statistics**											
540	**Data do not follow a Discernible Distribution (0.05)**											
541												
542	**Nonparametric Upper Limits for BTVs(no distinction made between detects and nondetects)**											
543				Order of Statistic, r		340				95% UTL with95% Coverage		0.82
544				Approx, f used to compute achieved CC		1.377				Approximate Actual Confidence Coefficient achieved by UTL		0.899
545				Approximate Sample Size needed to achieve specified CC		385				95% UPL		0.784
546				95% USL		0.92				95% KM Chebyshev UPL		1.31
547												
548	Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.											
549	Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers											
550	and consists of observations collected from clean unimpacted locations.											
551	The use of USL tends to provide a balance between false positives and false negatives provided the data											
552	represents a background data set and when many onsite observations need to be compared with the BTV.											
553												
554	**Cadmium**											
555												
556	**General Statistics**											
557				Total Number of Observations		353				Number of Missing Observations		45
558				Number of Distinct Observations		74						
559				Number of Detects		110				Number of Non-Detects		243
560				Number of Distinct Detects		48				Number of Distinct Non-Detects		30
561				Minimum Detect		0.06				Minimum Non-Detect		0.082
562				Maximum Detect		2.4				Maximum Non-Detect		1.2
563				Variance Detected		0.283				Percent Non-Detects		68.84%
564				Mean Detected		0.476				SD Detected		0.532
565				Mean of Detected Logged Data		-1.231				SD of Detected Logged Data		0.966
566												
567	**Critical Values for Background Threshold Values (BTVs)**											
568				Tolerance Factor K (For UTL)		1.786				d2max (for USL)		3.599
569												
570	**Normal GOF Test on Detects Only**											
571				Shapiro Wilk Test Statistic		0.718				**Normal GOF Test on Detected Observations Only**		
572				5% Shapiro Wilk P Value		0				Data Not Normal at 5% Significance Level		

573					Lilliefors Test Statistic	0.257	**Lilliefors GOF Test**					
574					5% Lilliefors Critical Value	0.0848	Data Not Normal at 5% Significance Level					
575	**Data Not Normal at 5% Significance Level**											
576												
577	**Kaplan Meier (KM) Background Statistics Assuming Normal Distribution**											
578					KM Mean	0.318	KM SD					0.347
579					95% UTL95% Coverage	0.938	95% KM UPL (t)					0.891
580					90% KM Percentile (z)	0.763	95% KM Percentile (z)					0.889
581					99% KM Percentile (z)	1.125	95% KM USL					1.567
582												
583	**DL/2 Substitution Background Statistics Assuming Normal Distribution**											
584					Mean	0.459	SD					0.302
585					95% UTL95% Coverage	0.997	95% UPL (t)					0.957
586					90% Percentile (z)	0.845	95% Percentile (z)					0.955
587					99% Percentile (z)	1.16	95% USL					1.544
588	**DL/2 is not a recommended method. DL/2 provided for comparisons and historical reasons**											
589												
590	**Gamma GOF Tests on Detected Observations Only**											
591					A-D Test Statistic	3.622	**Anderson-Darling GOF Test**					
592					5% A-D Critical Value	0.779	Data Not Gamma Distributed at 5% Significance Level					
593					K-S Test Statistic	0.168	**Kolmogorov-Smirnov GOF**					
594					5% K-S Critical Value	0.0892	Data Not Gamma Distributed at 5% Significance Level					
595	**Data Not Gamma Distributed at 5% Significance Level**											
596												
597	**Gamma Statistics on Detected Data Only**											
598					k hat (MLE)	1.162	k star (bias corrected MLE)					1.136
599					Theta hat (MLE)	0.41	Theta star (bias corrected MLE)					0.419
600					nu hat (MLE)	255.5	nu star (bias corrected)					249.9
601					MLE Mean (bias corrected)	0.476						
602					MLE Sd (bias corrected)	0.446	95% Percentile of Chisquare (2kstar)					6.508
603												
604	**Gamma ROS Statistics using Imputed Non-Detects**											
605	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
606	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)											
607	For such situations, GROS method may yield incorrect values of UCLs and BTVs											
608	This is especially true when the sample size is small.											
609	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates											
610					Minimum	0.01	Mean					0.317
611					Maximum	2.4	Median					0.212
612					SD	0.368	CV					1.16
613					k hat (MLE)	0.837	k star (bias corrected MLE)					0.832
614					Theta hat (MLE)	0.379	Theta star (bias corrected MLE)					0.381
615					nu hat (MLE)	591.1	nu star (bias corrected)					587.4
616					MLE Mean (bias corrected)	0.317	MLE Sd (bias corrected)					0.348
617					95% Percentile of Chisquare (2kstar)	5.323	90% Percentile					0.764
618					95% Percentile	1.015	99% Percentile					1.605
619	**The following statistics are computed using Gamma ROS Statistics on Imputed Data**											
620	**Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods**											
621						WH	HW				WH	HW
622					95% Approx. Gamma UTL with 95% Coverage	1.077	1.161	95% Approx. Gamma UPL			0.978	1.041
623					95% Gamma USL	3.129	4.022					
624												

	A	B	C	D	E	F	G	H	I	J	K	L
625	**Estimates of Gamma Parameters using KM Estimates**											
626					Mean (KM)	0.318				SD (KM)		0.347
627					Variance (KM)	0.12				SE of Mean (KM)		0.0233
628					k hat (KM)	0.839				k star (KM)		0.834
629					nu hat (KM)	592.6				nu star (KM)		588.9
630					theta hat (KM)	0.379				theta star (KM)		0.381
631					80% gamma percentile (KM)	0.518				90% gamma percentile (KM)		0.765
632					95% gamma percentile (KM)	1.016				99% gamma percentile (KM)		1.606
633												
634	**The following statistics are computed using gamma distribution and KM estimates**											
635	**Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods**											
636						WH	HW				WH	HW
637					95% Approx. Gamma UTL with 95% Coverage	0.871	0.878			95% Approx. Gamma UPL	0.806	0.807
638					95% KM Gamma Percentile	0.802	0.804			95% Gamma USL	2.136	2.367
639												
640	**Lognormal GOF Test on Detected Observations Only**											
641					Shapiro Wilk Approximate Test Statistic	0.935				**Shapiro Wilk GOF Test**		
642					5% Shapiro Wilk P Value	2.2090E-5				Data Not Lognormal at 5% Significance Level		
643					Lilliefors Test Statistic	0.0985				**Lilliefors GOF Test**		
644					5% Lilliefors Critical Value	0.0848				Data Not Lognormal at 5% Significance Level		
645	**Data Not Lognormal at 5% Significance Level**											
646												
647	**Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects**											
648					Mean in Original Scale	0.317				Mean in Log Scale		-1.492
649					SD in Original Scale	0.34				SD in Log Scale		0.787
650					95% UTL95% Coverage	0.917				95% BCA UTL95% Coverage		1.2
651					95% Bootstrap (%) UTL95% Coverage	1.24				95% UPL (t)		0.825
652					90% Percentile (z)	0.617				95% Percentile (z)		0.821
653					99% Percentile (z)	1.403				95% USL		3.82
654												
655	**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**											
656					KM Mean of Logged Data	-1.513				95% KM UTL (Lognormal)95% Coverage		0.938
657					KM SD of Logged Data	0.811				95% KM UPL (Lognormal)		0.841
658					95% KM Percentile Lognormal (z)	0.837				95% KM USL (Lognormal)		4.085
659												
660	**Background DL/2 Statistics Assuming Lognormal Distribution**											
661					Mean in Original Scale	0.459				Mean in Log Scale		-0.953
662					SD in Original Scale	0.302				SD in Log Scale		0.631
663					95% UTL95% Coverage	1.189				95% UPL (t)		1.092
664					90% Percentile (z)	0.865				95% Percentile (z)		1.088
665					99% Percentile (z)	1.672				95% USL		3.73
666	**DL/2 is not a Recommended Method. DL/2 provided for comparisons and historical reasons.**											
667												
668	**Nonparametric Distribution Free Background Statistics**											
669	**Data do not follow a Discernible Distribution (0.05)**											
670												
671	**Nonparametric Upper Limits for BTVs(no distinction made between detects and nondetects)**											
672					Order of Statistic, r	341				95% UTL with95% Coverage		1.2
673					Approx, f used to compute achieved CC	1.381				Approximate Actual Confidence Coefficient achieved by UTL		0.901
674					Approximate Sample Size needed to achieve specified CC	385				95% UPL		1.2
675					95% USL	2.4				95% KM Chebyshev UPL		1.833
676												

	A	B	C	D	E	F	G	H	I	J	K	L
677	Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.											
678	Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers											
679	and consists of observations collected from clean unimpacted locations.											
680	The use of USL tends to provide a balance between false positives and false negatives provided the data											
681	represents a background data set and when many onsite observations need to be compared with the BTV.											
682												
683	**Chromium**											
684												
685	**General Statistics**											
686					Total Number of Observations	359				Number of Distinct Observations	67	
687										Number of Missing Observations	39	
688					Minimum	4.8				First Quartile	14	
689					Second Largest	47				Median	16	
690					Maximum	47.7				Third Quartile	19.05	
691					Mean	17.45				SD	6.775	
692					Coefficient of Variation	0.388				Skewness	1.939	
693					Mean of logged Data	2.798				SD of logged Data	0.344	
694												
695	**Critical Values for Background Threshold Values (BTVs)**											
696					Tolerance Factor K (For UTL)	1.785				d2max (for USL)	3.604	
697												
698	**Normal GOF Test**											
699					Shapiro Wilk Test Statistic	0.832				**Normal GOF Test**		
700					5% Shapiro Wilk P Value	0				Data Not Normal at 5% Significance Level		
701					Lilliefors Test Statistic	0.159				**Lilliefors GOF Test**		
702					5% Lilliefors Critical Value	0.0472				Data Not Normal at 5% Significance Level		
703	**Data Not Normal at 5% Significance Level**											
704												
705	**Background Statistics Assuming Normal Distribution**											
706					95% UTL with 95% Coverage	29.54				90% Percentile (z)	26.13	
707					95% UPL (t)	28.64				95% Percentile (z)	28.6	
708					95% USL	41.86				99% Percentile (z)	33.21	
709												
710	**Gamma GOF Test**											
711					A-D Test Statistic	6.371				**Anderson-Darling Gamma GOF Test**		
712					5% A-D Critical Value	0.755				Data Not Gamma Distributed at 5% Significance Level		
713					K-S Test Statistic	0.117				**Kolmogorov-Smirnov Gamma GOF Test**		
714					5% K-S Critical Value	0.0481				Data Not Gamma Distributed at 5% Significance Level		
715	**Data Not Gamma Distributed at 5% Significance Level**											
716												
717	**Gamma Statistics**											
718					k hat (MLE)	8.254				k star (bias corrected MLE)	8.187	
719					Theta hat (MLE)	2.114				Theta star (bias corrected MLE)	2.132	
720					nu hat (MLE)	5926				nu star (bias corrected)	5878	
721					MLE Mean (bias corrected)	17.45				MLE Sd (bias corrected)	6.099	
722												
723	**Background Statistics Assuming Gamma Distribution**											
724					95% Wilson Hilferty (WH) Approx. Gamma UPL	28.5				90% Percentile	25.58	
725					95% Hawkins Wixley (HW) Approx. Gamma UPL	28.57				95% Percentile	28.54	
726					95% WH Approx. Gamma UTL with 95% Coverage	29.64				99% Percentile	34.67	
727					95% HW Approx. Gamma UTL with 95% Coverage	29.75						
728					95% WH USL	48.3				95% HW USL	49.84	

729												
730	**Lognormal GOF Test**											
731					Shapiro Wilk Test Statistic	0.961	**Shapiro Wilk Lognormal GOF Test**					
732					5% Shapiro Wilk P Value	7.1016E-8	Data Not Lognormal at 5% Significance Level					
733					Lilliefors Test Statistic	0.0945	**Lilliefors Lognormal GOF Test**					
734					5% Lilliefors Critical Value	0.0472	Data Not Lognormal at 5% Significance Level					
735	**Data Not Lognormal at 5% Significance Level**											
736												
737	**Background Statistics assuming Lognormal Distribution**											
738				95% UTL with	95% Coverage	30.3	90% Percentile (z)	25.49				
739					95% UPL (t)	28.94	95% Percentile (z)	28.88				
740					95% USL	56.61	99% Percentile (z)	36.5				
741												
742	**Nonparametric Distribution Free Background Statistics**											
743	**Data do not follow a Discernible Distribution (0.05)**											
744												
745	**Nonparametric Upper Limits for Background Threshold Values**											
746					Order of Statistic, r	347	95% UTL with	95% Coverage	34			
747					Approx, f used to compute achieved CC	1.405	Approximate Actual Confidence Coefficient achieved by UTL		0.912			
748							Approximate Sample Size needed to achieve specified CC		385			
749				95% Percentile Bootstrap UTL with	95% Coverage	34.1	95% BCA Bootstrap UTL with	95% Coverage	34.1			
750					95% UPL	32	90% Percentile		25.36			
751					90% Chebyshev UPL	37.8	95% Percentile		30.2			
752					95% Chebyshev UPL	47.02	99% Percentile		45			
753					95% USL	47.7						
754												
755	Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.											
756	Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers											
757	and consists of observations collected from clean unimpacted locations.											
758	The use of USL tends to provide a balance between false positives and false negatives provided the data											
759	represents a background data set and when many onsite observations need to be compared with the BTV.											
760												
761	**Cobalt**											
762												
763	**General Statistics**											
764					Total Number of Observations	347	Number of Missing Observations		36			
765					Number of Distinct Observations	93						
766					Number of Detects	346	Number of Non-Detects		1			
767					Number of Distinct Detects	92	Number of Distinct Non-Detects		1			
768					Minimum Detect	0.6	Minimum Non-Detect		1.7			
769					Maximum Detect	20.4	Maximum Non-Detect		1.7			
770					Variance Detected	11.41	Percent Non-Detects		0.288%			
771					Mean Detected	7.631	SD Detected		3.377			
772					Mean of Detected Logged Data	1.927	SD of Detected Logged Data		0.493			
773												
774	**Critical Values for Background Threshold Values (BTVs)**											
775					Tolerance Factor K (For UTL)	1.787	d2max (for USL)		3.594			
776												
777	**Normal GOF Test on Detects Only**											
778					Shapiro Wilk Test Statistic	0.928	**Normal GOF Test on Detected Observations Only**					
779					5% Shapiro Wilk P Value	0	Data Not Normal at 5% Significance Level					
780					Lilliefors Test Statistic	0.118	**Lilliefors GOF Test**					

781				5% Lilliefors Critical Value		0.048		Data Not Normal at 5% Significance Level				
782	**Data Not Normal at 5% Significance Level**											
783												
784	**Kaplan Meier (KM) Background Statistics Assuming Normal Distribution**											
785				KM Mean		7.612				KM SD		3.386
786				95% UTL95% Coverage		13.66				95% KM UPL (t)		13.2
787				90% KM Percentile (z)		11.95				95% KM Percentile (z)		13.18
788				99% KM Percentile (z)		15.49				95% KM USL		19.78
789												
790	**DL/2 Substitution Background Statistics Assuming Normal Distribution**											
791				Mean		7.612				SD		3.392
792				95% UTL95% Coverage		13.67				95% UPL (t)		13.21
793				90% Percentile (z)		11.96				95% Percentile (z)		13.19
794				99% Percentile (z)		15.5				95% USL		19.8
795	**DL/2 is not a recommended method. DL/2 provided for comparisons and historical reasons**											
796												
797	**Gamma GOF Tests on Detected Observations Only**											
798				A-D Test Statistic		2.76		**Anderson-Darling GOF Test**				
799				5% A-D Critical Value		0.757		Data Not Gamma Distributed at 5% Significance Level				
800				K-S Test Statistic		0.0717		**Kolmogorov-Smirnov GOF**				
801				5% K-S Critical Value		0.0491		Data Not Gamma Distributed at 5% Significance Level				
802	**Data Not Gamma Distributed at 5% Significance Level**											
803												
804	**Gamma Statistics on Detected Data Only**											
805				k hat (MLE)		4.907				k star (bias corrected MLE)		4.867
806				Theta hat (MLE)		1.555				Theta star (bias corrected MLE)		1.568
807				nu hat (MLE)		3396				nu star (bias corrected)		3368
808				MLE Mean (bias corrected)		7.631						
809				MLE Sd (bias corrected)		3.459				95% Percentile of Chisquare (2kstar)		17.94
810												
811	**Gamma ROS Statistics using Imputed Non-Detects**											
812	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
813	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)											
814	For such situations, GROS method may yield incorrect values of UCLs and BTVs											
815	This is especially true when the sample size is small.											
816	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates											
817				Minimum		0.6				Mean		7.615
818				Maximum		20.4				Median		7.2
819				SD		3.386				CV		0.445
820				k hat (MLE)		4.846				k star (bias corrected MLE)		4.806
821				Theta hat (MLE)		1.572				Theta star (bias corrected MLE)		1.585
822				nu hat (MLE)		3363				nu star (bias corrected)		3335
823				MLE Mean (bias corrected)		7.615				MLE Sd (bias corrected)		3.474
824				95% Percentile of Chisquare (2kstar)		17.77				90% Percentile		12.27
825				95% Percentile		14.08				99% Percentile		17.92
826	**The following statistics are computed using Gamma ROS Statistics on Imputed Data**											
827	**Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods**											
828					WH	HW					WH	HW
829				95% Approx. Gamma UTL with 95% Coverage	14.78	15.09				95% Approx. Gamma UPL	14.06	14.32
830				95% Gamma USL	26.73	28.8						
831												
832	**Estimates of Gamma Parameters using KM Estimates**											

833					Mean (KM)	7.612					SD (KM)	3.386
834					Variance (KM)	11.46					SE of Mean (KM)	0.182
835					k hat (KM)	5.055					k star (KM)	5.014
836					nu hat (KM)	3508					nu star (KM)	3479
837					theta hat (KM)	1.506					theta star (KM)	1.518
838					80% gamma percentile (KM)	10.23					90% gamma percentile (KM)	12.16
839					95% gamma percentile (KM)	13.93					99% gamma percentile (KM)	17.65
840												
841	**The following statistics are computed using gamma distribution and KM estimates**											
842	**Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods**											
843						WH	HW				WH	HW
844				95% Approx. Gamma UTL with 95% Coverage		14.81	15.14			95% Approx. Gamma UPL	14.09	14.35
845					95% KM Gamma Percentile	14.05	14.32			95% Gamma USL	26.85	28.97
846												
847	**Lognormal GOF Test on Detected Observations Only**											
848					Shapiro Wilk Approximate Test Statistic	0.931	**Shapiro Wilk GOF Test**					
849					5% Shapiro Wilk P Value	0	Data Not Lognormal at 5% Significance Level					
850					Lilliefors Test Statistic	0.0999	**Lilliefors GOF Test**					
851					5% Lilliefors Critical Value	0.048	Data Not Lognormal at 5% Significance Level					
852	**Data Not Lognormal at 5% Significance Level**											
853												
854	**Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects**											
855					Mean in Original Scale	7.616					Mean in Log Scale	1.924
856					SD in Original Scale	3.385					SD in Log Scale	0.496
857					95% UTL95% Coverage	16.6					95% BCA UTL95% Coverage	15
858					95% Bootstrap (%) UTL95% Coverage	15					95% UPL (t)	15.52
859					90% Percentile (z)	12.92					95% Percentile (z)	15.47
860					99% Percentile (z)	21.69					95% USL	40.66
861												
862	**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**											
863					KM Mean of Logged Data	1.922					95% KM UTL (Lognormal)95% Coverage	16.74
864					KM SD of Logged Data	0.501					95% KM UPL (Lognormal)	15.64
865					95% KM Percentile Lognormal (z)	15.59					95% KM USL (Lognormal)	41.42
866												
867	**Background DL/2 Statistics Assuming Lognormal Distribution**											
868					Mean in Original Scale	7.612					Mean in Log Scale	1.921
869					SD in Original Scale	3.392					SD in Log Scale	0.505
870					95% UTL95% Coverage	16.83					95% UPL (t)	15.71
871					90% Percentile (z)	13.04					95% Percentile (z)	15.66
872					99% Percentile (z)	22.09					95% USL	41.89
873	**DL/2 is not a Recommended Method. DL/2 provided for comparisons and historical reasons.**											
874												
875	**Nonparametric Distribution Free Background Statistics**											
876	**Data do not follow a Discernible Distribution (0.05)**											
877												
878	**Nonparametric Upper Limits for BTVs(no distinction made between detects and nondetects)**											
879					Order of Statistic, r	336					95% UTL with95% Coverage	15
880					Approx, f used to compute achieved CC	1.474					Approximate Actual Confidence Coefficient achieved by UTL	0.932
881					Approximate Sample Size needed to achieve specified CC	361					95% UPL	15
882					95% USL	20.4					95% KM Chebyshev UPL	22.39
883												
884	Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.											

885	Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers											
886	and consists of observations collected from clean unimpacted locations.											
887	The use of USL tends to provide a balance between false positives and false negatives provided the data											
888	represents a background data set and when many onsite observations need to be compared with the BTV.											
889												
890	**Copper**											
891												
892	**General Statistics**											
893						Total Number of Observations	330			Number of Distinct Observations	97		
894										Number of Missing Observations	59		
895						Minimum	2			First Quartile	13		
896						Second Largest	120			Median	16		
897						Maximum	120			Third Quartile	30		
898						Mean	27.31			SD	25.65		
899						Coefficient of Variation	0.939			Skewness	2.036		
900						Mean of logged Data	2.999			SD of logged Data	0.741		
901													
902	**Critical Values for Background Threshold Values (BTVs)**											
903						Tolerance Factor K (For UTL)	1.791			d2max (for USL)	3.58		
904													
905	**Normal GOF Test**											
906						Shapiro Wilk Test Statistic	0.697			**Normal GOF Test**			
907						5% Shapiro Wilk P Value	0			Data Not Normal at 5% Significance Level			
908						Lilliefors Test Statistic	0.257			**Lilliefors GOF Test**			
909						5% Lilliefors Critical Value	0.0492			Data Not Normal at 5% Significance Level			
910	**Data Not Normal at 5% Significance Level**											
911													
912	**Background Statistics Assuming Normal Distribution**											
913						95% UTL with 95% Coverage	73.26			90% Percentile (z)	60.19		
914						95% UPL (t)	69.69			95% Percentile (z)	69.51		
915						95% USL	119.1			99% Percentile (z)	86.99		
916													
917	**Gamma GOF Test**											
918						A-D Test Statistic	17.8			**Anderson-Darling Gamma GOF Test**			
919						5% A-D Critical Value	0.769			Data Not Gamma Distributed at 5% Significance Level			
920						K-S Test Statistic	0.221			**Kolmogorov-Smirnov Gamma GOF Test**			
921						5% K-S Critical Value	0.0508			Data Not Gamma Distributed at 5% Significance Level			
922	**Data Not Gamma Distributed at 5% Significance Level**											
923													
924	**Gamma Statistics**											
925						k hat (MLE)	1.771			k star (bias corrected MLE)	1.757		
926						Theta hat (MLE)	15.42			Theta star (bias corrected MLE)	15.55		
927						nu hat (MLE)	1169			nu star (bias corrected)	1159		
928						MLE Mean (bias corrected)	27.31			MLE Sd (bias corrected)	20.61		
929													
930	**Background Statistics Assuming Gamma Distribution**											
931						95% Wilson Hilferty (WH) Approx. Gamma UPL	66.28			90% Percentile	54.78		
932						95% Hawkins Wixley (HW) Approx. Gamma UPL	66.36			95% Percentile	67.53		
933						95% WH Approx. Gamma UTL with 95% Coverage	71.55			99% Percentile	96.05		
934						95% HW Approx. Gamma UTL with 95% Coverage	72.02						
935						95% WH USL	166			95% HW USL	181.6		
936													

937	**Lognormal GOF Test**											
938					Shapiro Wilk Test Statistic	0.921	**Shapiro Wilk Lognormal GOF Test**					
939					5% Shapiro Wilk P Value	0	Data Not Lognormal at 5% Significance Level					
940					Lilliefors Test Statistic	0.183	**Lilliefors Lognormal GOF Test**					
941					5% Lilliefors Critical Value	0.0492	Data Not Lognormal at 5% Significance Level					
942	**Data Not Lognormal at 5% Significance Level**											
943												
944	**Background Statistics assuming Lognormal Distribution**											
945					95% UTL with 95% Coverage	75.62	90% Percentile (z)	51.85				
946					95% UPL (t)	68.22	95% Percentile (z)	67.86				
947					95% USL	284.4	99% Percentile (z)	112.4				
948												
949	**Nonparametric Distribution Free Background Statistics**											
950	**Data do not follow a Discernible Distribution (0.05)**											
951												
952	**Nonparametric Upper Limits for Background Threshold Values**											
953					Order of Statistic, r	319	95% UTL with 95% Coverage	100				
954					Approx, f used to compute achieved CC	1.399	Approximate Actual Confidence Coefficient achieved by UTL	0.902				
955							Approximate Sample Size needed to achieve specified CC	361				
956					95% Percentile Bootstrap UTL with 95% Coverage	100	95% BCA Bootstrap UTL with 95% Coverage	100				
957					95% UPL	94.45	90% Percentile	60.92				
958					90% Chebyshev UPL	104.4	95% Percentile	94				
959					95% Chebyshev UPL	139.3	99% Percentile	120				
960					95% USL	120						
961												
962	Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.											
963	Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers											
964	and consists of observations collected from clean unimpacted locations.											
965	The use of USL tends to provide a balance between false positives and false negatives provided the data											
966	represents a background data set and when many onsite observations need to be compared with the BTV.											
967												
968	**Iron**											
969												
970	**General Statistics**											
971					Total Number of Observations	342	Number of Distinct Observations	65				
972							Number of Missing Observations	41				
973					Minimum	2980	First Quartile	14775				
974					Second Largest	47000	Median	19000				
975					Maximum	48000	Third Quartile	24000				
976					Mean	19435	SD	7497				
977					Coefficient of Variation	0.386	Skewness	0.944				
978					Mean of logged Data	9.798	SD of logged Data	0.407				
979												
980	**Critical Values for Background Threshold Values (BTVs)**											
981					Tolerance Factor K (For UTL)	1.788	d2max (for USL)	3.59				
982												
983	**Normal GOF Test**											
984					Shapiro Wilk Test Statistic	0.94	**Normal GOF Test**					
985					5% Shapiro Wilk P Value	0	Data Not Normal at 5% Significance Level					
986					Lilliefors Test Statistic	0.0781	**Lilliefors GOF Test**					
987					5% Lilliefors Critical Value	0.0483	Data Not Normal at 5% Significance Level					
988	**Data Not Normal at 5% Significance Level**											

	A	B	C	D	E	F	G	H	I	J	K	L
989												
990	**Background Statistics Assuming Normal Distribution**											
991					95% UTL with 95% Coverage	32843				90% Percentile (z)	29043	
992					95% UPL (t)	31818				95% Percentile (z)	31767	
993					95% USL	46349				99% Percentile (z)	36876	
994												
995	**Gamma GOF Test**											
996					A-D Test Statistic	1.22	**Anderson-Darling Gamma GOF Test**					
997					5% A-D Critical Value	0.756	Data Not Gamma Distributed at 5% Significance Level					
998					K-S Test Statistic	0.0597	**Kolmogorov-Smirnov Gamma GOF Test**					
999					5% K-S Critical Value	0.0493	Data Not Gamma Distributed at 5% Significance Level					
1000	**Data Not Gamma Distributed at 5% Significance Level**											
1001												
1002	**Gamma Statistics**											
1003					k hat (MLE)	6.696				k star (bias corrected MLE)	6.639	
1004					Theta hat (MLE)	2902				Theta star (bias corrected MLE)	2927	
1005					nu hat (MLE)	4580				nu star (bias corrected)	4541	
1006					MLE Mean (bias corrected)	19435				MLE Sd (bias corrected)	7542	
1007												
1008	**Background Statistics Assuming Gamma Distribution**											
1009				95% Wilson Hilferty (WH) Approx. Gamma UPL		33263				90% Percentile	29509	
1010				95% Hawkins Wixley (HW) Approx. Gamma UPL		33639				95% Percentile	33270	
1011				95% WH Approx. Gamma UTL with 95% Coverage		34752				99% Percentile	41120	
1012				95% HW Approx. Gamma UTL with 95% Coverage		35228						
1013					95% WH USL	58722				95% HW USL	61899	
1014												
1015	**Lognormal GOF Test**											
1016					Shapiro Wilk Test Statistic	0.964	**Shapiro Wilk Lognormal GOF Test**					
1017					5% Shapiro Wilk P Value	4.6180E-6	Data Not Lognormal at 5% Significance Level					
1018					Lilliefors Test Statistic	0.0848	**Lilliefors Lognormal GOF Test**					
1019					5% Lilliefors Critical Value	0.0483	Data Not Lognormal at 5% Significance Level					
1020	**Data Not Lognormal at 5% Significance Level**											
1021												
1022	**Background Statistics assuming Lognormal Distribution**											
1023					95% UTL with 95% Coverage	37265				90% Percentile (z)	30322	
1024					95% UPL (t)	35251				95% Percentile (z)	35152	
1025					95% USL	77551				99% Percentile (z)	46382	
1026												
1027	**Nonparametric Distribution Free Background Statistics**											
1028	**Data do not follow a Discernible Distribution (0.05)**											
1029												
1030	**Nonparametric Upper Limits for Background Threshold Values**											
1031					Order of Statistic, r	331				95% UTL with 95% Coverage	37100	
1032					Approx, f used to compute achieved CC	1.452	Approximate Actual Confidence Coefficient achieved by UTL				0.924	
1033							Approximate Sample Size needed to achieve specified CC				361	
1034				95% Percentile Bootstrap UTL with 95% Coverage		36945				95% BCA Bootstrap UTL with 95% Coverage	37045	
1035					95% UPL	32850				90% Percentile	27270	
1036					90% Chebyshev UPL	41959				95% Percentile	31950	
1037					95% Chebyshev UPL	52162				99% Percentile	44000	
1038					95% USL	48000						
1039												
1040	Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.											

1041	Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers											
1042	and consists of observations collected from clean unimpacted locations.											
1043	The use of USL tends to provide a balance between false positives and false negatives provided the data											
1044	represents a background data set and when many onsite observations need to be compared with the BTV.											
1045												
1046	**Lead**											
1047												
1048	**General Statistics**											
1049						Total Number of Observations	357			Number of Missing Observations	41	
1050						Number of Distinct Observations	161					
1051						Number of Detects	331			Number of Non-Detects	26	
1052						Number of Distinct Detects	154			Number of Distinct Non-Detects	10	
1053						Minimum Detect	0.2			Minimum Non-Detect	0	
1054						Maximum Detect	600			Maximum Non-Detect	5	
1055						Variance Detected	18540			Percent Non-Detects	7.283%	
1056						Mean Detected	98.53			SD Detected	136.2	
1057												
1058	**Critical Values for Background Threshold Values (BTVs)**											
1059						Tolerance Factor K (For UTL)	1.785			d2max (for USL)	3.602	
1060												
1061	**Normal GOF Test on Detects Only**											
1062						Shapiro Wilk Test Statistic	0.702			**Normal GOF Test on Detected Observations Only**		
1063						5% Shapiro Wilk P Value	0			Data Not Normal at 5% Significance Level		
1064						Lilliefors Test Statistic	0.247			**Lilliefors GOF Test**		
1065						5% Lilliefors Critical Value	0.0491			Data Not Normal at 5% Significance Level		
1066	**Data Not Normal at 5% Significance Level**											
1067												
1068	**Kaplan Meier (KM) Background Statistics Assuming Normal Distribution**											
1069						KM Mean	91.49			KM SD	133.3	
1070						95% UTL95% Coverage	329.5			95% KM UPL (t)	311.6	
1071						90% KM Percentile (z)	262.3			95% KM Percentile (z)	310.8	
1072						99% KM Percentile (z)	401.6			95% KM USL	571.6	
1073												
1074	**DL/2 Substitution Background Statistics Assuming Normal Distribution**											
1075						Mean	91.51			SD	133.5	
1076						95% UTL95% Coverage	329.8			95% UPL (t)	311.9	
1077						90% Percentile (z)	262.6			95% Percentile (z)	311.1	
1078						99% Percentile (z)	402			95% USL	572.3	
1079	**DL/2 is not a recommended method. DL/2 provided for comparisons and historical reasons**											
1080												
1081	**Gamma GOF Tests on Detected Observations Only**											
1082						A-D Test Statistic	7.891			**Anderson-Darling GOF Test**		
1083						5% A-D Critical Value	0.812			Data Not Gamma Distributed at 5% Significance Level		
1084						K-S Test Statistic	0.138			**Kolmogorov-Smirnov GOF**		
1085						5% K-S Critical Value	0.0525			Data Not Gamma Distributed at 5% Significance Level		
1086	**Data Not Gamma Distributed at 5% Significance Level**											
1087												
1088	**Gamma Statistics on Detected Data Only**											
1089						k hat (MLE)	0.604			k star (bias corrected MLE)	0.6	
1090						Theta hat (MLE)	163.2			Theta star (bias corrected MLE)	164.1	
1091						nu hat (MLE)	399.8			nu star (bias corrected)	397.5	
1092						MLE Mean (bias corrected)	98.53					

1093					MLE Sd (bias corrected)	127.2			95% Percentile of Chisquare (2kstar)			4.32
1094												
1095	**Estimates of Gamma Parameters using KM Estimates**											
1096					Mean (KM)	91.49			SD (KM)			133.3
1097					Variance (KM)	17769			SE of Mean (KM)			7.066
1098					k hat (KM)	0.471			k star (KM)			0.469
1099					nu hat (KM)	336.3			nu star (KM)			334.9
1100					theta hat (KM)	194.2			theta star (KM)			195.1
1101					80% gamma percentile (KM)	149.8			90% gamma percentile (KM)			250.8
1102					95% gamma percentile (KM)	359.5			99% gamma percentile (KM)			628.7
1103												
1104	**The following statistics are computed using gamma distribution and KM estimates**											
1105	**Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods**											
1106						WH	HW				WH	HW
1107					95% Approx. Gamma UTL with 95% Coverage	352.7	380.4		95% Approx. Gamma UPL		314.7	333.6
1108					95% KM Gamma Percentile	312.9	331.4		95% Gamma USL		1205	1631
1109												
1110	**Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects**											
1111	**Data not Log Transformable!**											
1112												
1113	**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**											
1114					KM Mean of Logged Data	N/A			95% KM UTL (Lognormal)95% Coverage			N/A
1115					KM SD of Logged Data	N/A			95% KM UPL (Lognormal)			N/A
1116					95% KM Percentile Lognormal (z)	N/A			95% KM USL (Lognormal)			N/A
1117												
1118	**Nonparametric Distribution Free Background Statistics**											
1119	**Data do not follow a Discernible Distribution (0.05)**											
1120												
1121	**Nonparametric Upper Limits for BTVs(no distinction made between detects and nondetects)**											
1122					Order of Statistic, r	345			95% UTL with95% Coverage			475
1123					Approx, f used to compute achieved CC	1.397			Approximate Actual Confidence Coefficient achieved by UTL			0.908
1124					Approximate Sample Size needed to achieve specified CC	385			95% UPL			402
1125					95% USL	600			95% KM Chebyshev UPL			673.3
1126												
1127	Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.											
1128	Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers											
1129	and consists of observations collected from clean unimpacted locations.											
1130	The use of USL tends to provide a balance between false positives and false negatives provided the data											
1131	represents a background data set and when many onsite observations need to be compared with the BTV.											
1132												
1133	**Magnesium**											
1134												
1135	**General Statistics**											
1136					Total Number of Observations	322			Number of Distinct Observations			85
1137									Number of Missing Observations			61
1138					Minimum	110			First Quartile			952.5
1139					Second Largest	3600			Median			1400
1140					Maximum	3700			Third Quartile			2100
1141					Mean	1542			SD			785.9
1142					Coefficient of Variation	0.51			Skewness			0.566
1143					Mean of logged Data	7.189			SD of logged Data			0.597
1144												

	A	B	C	D	E	F	G	H	I	J	K	L
1145	**Critical Values for Background Threshold Values (BTVs)**											
1146					Tolerance Factor K (For UTL)	1.793				d2max (for USL)		3.573
1147												
1148	**Normal GOF Test**											
1149					Shapiro Wilk Test Statistic	0.941	**Normal GOF Test**					
1150					5% Shapiro Wilk P Value	0	Data Not Normal at 5% Significance Level					
1151					Lilliefors Test Statistic	0.123	**Lilliefors GOF Test**					
1152					5% Lilliefors Critical Value	0.0498	Data Not Normal at 5% Significance Level					
1153	**Data Not Normal at 5% Significance Level**											
1154												
1155	**Background Statistics Assuming Normal Distribution**											
1156				95% UTL with	95% Coverage	2951				90% Percentile (z)		2549
1157					95% UPL (t)	2840				95% Percentile (z)		2834
1158					95% USL	4349				99% Percentile (z)		3370
1159												
1160	**Gamma GOF Test**											
1161					A-D Test Statistic	1.135	**Anderson-Darling Gamma GOF Test**					
1162					5% A-D Critical Value	0.759	Data Not Gamma Distributed at 5% Significance Level					
1163					K-S Test Statistic	0.0687	**Kolmogorov-Smirnov Gamma GOF Test**					
1164					5% K-S Critical Value	0.0509	Data Not Gamma Distributed at 5% Significance Level					
1165	**Data Not Gamma Distributed at 5% Significance Level**											
1166												
1167	**Gamma Statistics**											
1168					k hat (MLE)	3.457				k star (bias corrected MLE)		3.427
1169					Theta hat (MLE)	446				Theta star (bias corrected MLE)		449.9
1170					nu hat (MLE)	2226				nu star (bias corrected)		2207
1171					MLE Mean (bias corrected)	1542				MLE Sd (bias corrected)		832.8
1172												
1173	**Background Statistics Assuming Gamma Distribution**											
1174					95% Wilson Hilferty (WH) Approx. Gamma UPL	3114				90% Percentile		2658
1175					95% Hawkins Wixley (HW) Approx. Gamma UPL	3189				95% Percentile		3116
1176				95% WH Approx. Gamma UTL with	95% Coverage	3304				99% Percentile		4102
1177				95% HW Approx. Gamma UTL with	95% Coverage	3399						
1178					95% WH USL	6405				95% HW USL		7048
1179												
1180	**Lognormal GOF Test**											
1181					Shapiro Wilk Test Statistic	0.938	**Shapiro Wilk Lognormal GOF Test**					
1182					5% Shapiro Wilk P Value	0	Data Not Lognormal at 5% Significance Level					
1183					Lilliefors Test Statistic	0.0623	**Lilliefors Lognormal GOF Test**					
1184					5% Lilliefors Critical Value	0.0498	Data Not Lognormal at 5% Significance Level					
1185	**Data Not Lognormal at 5% Significance Level**											
1186												
1187	**Background Statistics assuming Lognormal Distribution**											
1188				95% UTL with	95% Coverage	3864				90% Percentile (z)		2847
1189					95% UPL (t)	3553				95% Percentile (z)		3537
1190					95% USL	11184				99% Percentile (z)		5313
1191												
1192	**Nonparametric Distribution Free Background Statistics**											
1193	**Data do not follow a Discernible Distribution (0.05)**											
1194												
1195	**Nonparametric Upper Limits for Background Threshold Values**											
1196					Order of Statistic, r	312				95% UTL with	95% Coverage	3100

1197	Approx, f used to compute achieved CC					1.493	Approximate Actual Confidence Coefficient achieved by UTL					0.931
1198							Approximate Sample Size needed to achieve specified CC					336
1199	95% Percentile Bootstrap UTL with 95% Coverage					3095	95% BCA Bootstrap UTL with 95% Coverage					3000
1200	95% UPL					3000	90% Percentile					2700
1201	90% Chebyshev UPL					3903	95% Percentile					3000
1202	95% Chebyshev UPL					4972	99% Percentile					3579
1203	95% USL					3700						
1204												
1205	Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.											
1206	Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers											
1207	and consists of observations collected from clean unimpacted locations.											
1208	The use of USL tends to provide a balance between false positives and false negatives provided the data											
1209	represents a background data set and when many onsite observations need to be compared with the BTV.											
1210												
1211	**Manganese**											
1212												
1213	**General Statistics**											
1214	Total Number of Observations					336	Number of Distinct Observations					91
1215							Number of Missing Observations					47
1216	Minimum					3.9	First Quartile					140
1217	Second Largest					590	Median					210
1218	Maximum					600	Third Quartile					300
1219	Mean					226.8	SD					122.3
1220	Coefficient of Variation					0.539	Skewness					0.679
1221	Mean of logged Data					5.246	SD of logged Data					0.664
1222												
1223	**Critical Values for Background Threshold Values (BTVs)**											
1224	Tolerance Factor K (For UTL)					1.79	d2max (for USL)					3.585
1225												
1226	**Normal GOF Test**											
1227	Shapiro Wilk Test Statistic					0.947	**Normal GOF Test**					
1228	5% Shapiro Wilk P Value					3.297E-14	Data Not Normal at 5% Significance Level					
1229	Lilliefors Test Statistic					0.0789	**Lilliefors GOF Test**					
1230	5% Lilliefors Critical Value					0.0487	Data Not Normal at 5% Significance Level					
1231	**Data Not Normal at 5% Significance Level**											
1232												
1233	**Background Statistics Assuming Normal Distribution**											
1234	95% UTL with 95% Coverage					445.6	90% Percentile (z)					383.5
1235	95% UPL (t)					428.7	95% Percentile (z)					427.9
1236	95% USL					665.1	99% Percentile (z)					511.2
1237												
1238	**Gamma GOF Test**											
1239	A-D Test Statistic					0.77	**Anderson-Darling Gamma GOF Test**					
1240	5% A-D Critical Value					0.76	Data Not Gamma Distributed at 5% Significance Level					
1241	K-S Test Statistic					0.0514	**Kolmogorov-Smirnov Gamma GOF Test**					
1242	5% K-S Critical Value					0.05	Data Not Gamma Distributed at 5% Significance Level					
1243	**Data Not Gamma Distributed at 5% Significance Level**											
1244												
1245	**Gamma Statistics**											
1246	k hat (MLE)					2.975	k star (bias corrected MLE)					2.95
1247	Theta hat (MLE)					76.22	Theta star (bias corrected MLE)					76.86
1248	nu hat (MLE)					1999	nu star (bias corrected)					1983

1249					MLE Mean (bias corrected)	226.8				MLE Sd (bias corrected)		132
1250												
1251					**Background Statistics Assuming Gamma Distribution**							
1252				95% Wilson Hilferty (WH) Approx. Gamma UPL		477.2				90% Percentile		403.7
1253				95% Hawkins Wixley (HW) Approx. Gamma UPL		491.8				95% Percentile		478.2
1254				95% WH Approx. Gamma UTL with 95% Coverage		507.4				99% Percentile		639.6
1255				95% HW Approx. Gamma UTL with 95% Coverage		525.7						
1256					95% WH USL	1024				95% HW USL		1147
1257												
1258					**Lognormal GOF Test**							
1259					Shapiro Wilk Test Statistic	0.936				**Shapiro Wilk Lognormal GOF Test**		
1260					5% Shapiro Wilk P Value	0				Data Not Lognormal at 5% Significance Level		
1261					Lilliefors Test Statistic	0.0929				**Lilliefors Lognormal GOF Test**		
1262					5% Lilliefors Critical Value	0.0487				Data Not Lognormal at 5% Significance Level		
1263					**Data Not Lognormal at 5% Significance Level**							
1264												
1265					**Background Statistics assuming Lognormal Distribution**							
1266					95% UTL with 95% Coverage	623.7				90% Percentile (z)		445
1267					95% UPL (t)	569.1				95% Percentile (z)		566.4
1268					95% USL	2056				99% Percentile (z)		890.9
1269												
1270					**Nonparametric Distribution Free Background Statistics**							
1271					**Data do not follow a Discernible Distribution (0.05)**							
1272												
1273					**Nonparametric Upper Limits for Background Threshold Values**							
1274					Order of Statistic, r	325				95% UTL with 95% Coverage		500
1275					Approx, f used to compute achieved CC	1.425				Approximate Actual Confidence Coefficient achieved by UTL		0.914
1276										Approximate Sample Size needed to achieve specified CC		361
1277				95% Percentile Bootstrap UTL with 95% Coverage		500				95% BCA Bootstrap UTL with 95% Coverage		485
1278					95% UPL	460				90% Percentile		395
1279					90% Chebyshev UPL	594.1				95% Percentile		460
1280					95% Chebyshev UPL	760.5				99% Percentile		576.5
1281					95% USL	600						
1282												
1283					Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.							
1284					Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers							
1285					and consists of observations collected from clean unimpacted locations.							
1286					The use of USL tends to provide a balance between false positives and false negatives provided the data							
1287					represents a background data set and when many onsite observations need to be compared with the BTV.							
1288												
1289	**Mercury**											
1290												
1291					**General Statistics**							
1292					Total Number of Observations	349				Number of Missing Observations		49
1293					Number of Distinct Observations	98						
1294					Number of Detects	304				Number of Non-Detects		45
1295					Number of Distinct Detects	97				Number of Distinct Non-Detects		3
1296					Minimum Detect	0.0078				Minimum Non-Detect		0.039
1297					Maximum Detect	3				Maximum Non-Detect		0.08
1298					Variance Detected	0.382				Percent Non-Detects		12.89%
1299					Mean Detected	0.403				SD Detected		0.618
1300					Mean of Detected Logged Data	-1.891				SD of Detected Logged Data		1.431

1301											
1302	**Critical Values for Background Threshold Values (BTVs)**										
1303				Tolerance Factor K (For UTL)	1.787			d2max (for USL)	3.596		
1304											
1305	**Normal GOF Test on Detects Only**										
1306				Shapiro Wilk Test Statistic	0.639	**Normal GOF Test on Detected Observations Only**					
1307				5% Shapiro Wilk P Value	0	Data Not Normal at 5% Significance Level					
1308				Lilliefors Test Statistic	0.261	**Lilliefors GOF Test**					
1309				5% Lilliefors Critical Value	0.0512	Data Not Normal at 5% Significance Level					
1310	**Data Not Normal at 5% Significance Level**										
1311											
1312	**Kaplan Meier (KM) Background Statistics Assuming Normal Distribution**										
1313				KM Mean	0.356			KM SD	0.589		
1314				95% UTL95% Coverage	1.408			95% KM UPL (t)	1.329		
1315				90% KM Percentile (z)	1.111			95% KM Percentile (z)	1.325		
1316				99% KM Percentile (z)	1.726			95% KM USL	2.474		
1317											
1318	**DL/2 Substitution Background Statistics Assuming Normal Distribution**										
1319				Mean	0.356			SD	0.59		
1320				95% UTL95% Coverage	1.41			95% UPL (t)	1.33		
1321				90% Percentile (z)	1.112			95% Percentile (z)	1.326		
1322				99% Percentile (z)	1.728			95% USL	2.476		
1323	**DL/2 is not a recommended method. DL/2 provided for comparisons and historical reasons**										
1324											
1325	**Gamma GOF Tests on Detected Observations Only**										
1326				A-D Test Statistic	9.477	**Anderson-Darling GOF Test**					
1327				5% A-D Critical Value	0.809	Data Not Gamma Distributed at 5% Significance Level					
1328				K-S Test Statistic	0.136	**Kolmogorov-Smirnov GOF**					
1329				5% K-S Critical Value	0.0544	Data Not Gamma Distributed at 5% Significance Level					
1330	**Data Not Gamma Distributed at 5% Significance Level**										
1331											
1332	**Gamma Statistics on Detected Data Only**										
1333				k hat (MLE)	0.625			k star (bias corrected MLE)	0.621		
1334				Theta hat (MLE)	0.644			Theta star (bias corrected MLE)	0.649		
1335				nu hat (MLE)	380.2			nu star (bias corrected)	377.7		
1336				MLE Mean (bias corrected)	0.403						
1337				MLE Sd (bias corrected)	0.511			95% Percentile of Chisquare (2kstar)	4.415		
1338											
1339	**Gamma ROS Statistics using Imputed Non-Detects**										
1340	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs										
1341	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)										
1342	For such situations, GROS method may yield incorrect values of UCLs and BTVs										
1343	This is especially true when the sample size is small.										
1344	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates										
1345				Minimum	0.0078			Mean	0.353		
1346				Maximum	3			Median	0.09		
1347				SD	0.591			CV	1.676		
1348				k hat (MLE)	0.537			k star (bias corrected MLE)	0.534		
1349				Theta hat (MLE)	0.658			Theta star (bias corrected MLE)	0.661		
1350				nu hat (MLE)	374.5			nu star (bias corrected)	372.6		
1351				MLE Mean (bias corrected)	0.353			MLE Sd (bias corrected)	0.483		
1352				95% Percentile of Chisquare (2kstar)	4.006			90% Percentile	0.942		

	A	B	C	D	E	F	G	H	I	J	K	L
1353				95% Percentile		1.325				99% Percentile		2.26
1354	**The following statistics are computed using Gamma ROS Statistics on Imputed Data**											
1355	**Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods**											
1356					WH	HW					WH	HW
1357	95% Approx. Gamma UTL with 95% Coverage				1.327	1.374	95% Approx. Gamma UPL				1.183	1.206
1358	95% Gamma USL				4.52	5.744						
1359												
1360	**Estimates of Gamma Parameters using KM Estimates**											
1361	Mean (KM)					0.356	SD (KM)					0.589
1362	Variance (KM)					0.347	SE of Mean (KM)					0.0316
1363	k hat (KM)					0.365	k star (KM)					0.364
1364	nu hat (KM)					254.6	nu star (KM)					253.8
1365	theta hat (KM)					0.975	theta star (KM)					0.979
1366	80% gamma percentile (KM)					0.567	90% gamma percentile (KM)					1.021
1367	95% gamma percentile (KM)					1.527	99% gamma percentile (KM)					2.813
1368												
1369	**The following statistics are computed using gamma distribution and KM estimates**											
1370	**Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods**											
1371					WH	HW					WH	HW
1372	95% Approx. Gamma UTL with 95% Coverage				1.298	1.326	95% Approx. Gamma UPL				1.16	1.169
1373	95% KM Gamma Percentile				1.154	1.162	95% Gamma USL				4.291	5.286
1374												
1375	**Lognormal GOF Test on Detected Observations Only**											
1376	Shapiro Wilk Approximate Test Statistic					0.937	**Shapiro Wilk GOF Test**					
1377	5% Shapiro Wilk P Value					0	Data Not Lognormal at 5% Significance Level					
1378	Lilliefors Test Statistic					0.0752	**Lilliefors GOF Test**					
1379	5% Lilliefors Critical Value					0.0512	Data Not Lognormal at 5% Significance Level					
1380	**Data Not Lognormal at 5% Significance Level**											
1381												
1382	**Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects**											
1383	Mean in Original Scale					0.357	Mean in Log Scale					-2.077
1384	SD in Original Scale					0.589	SD in Log Scale					1.444
1385	95% UTL95% Coverage					1.655	95% BCA UTL95% Coverage					2.1
1386	95% Bootstrap (%) UTL95% Coverage					2.16	95% UPL (t)					1.362
1387	90% Percentile (z)					0.798	95% Percentile (z)					1.348
1388	99% Percentile (z)					3.608	95% USL					22.56
1389												
1390	**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**											
1391	KM Mean of Logged Data					-2.085	95% KM UTL (Lognormal)95% Coverage					1.613
1392	KM SD of Logged Data					1.434	95% KM UPL (Lognormal)					1.329
1393	95% KM Percentile Lognormal (z)					1.316	95% KM USL (Lognormal)					21.6
1394												
1395	**Background DL/2 Statistics Assuming Lognormal Distribution**											
1396	Mean in Original Scale					0.356	Mean in Log Scale					-2.068
1397	SD in Original Scale					0.59	SD in Log Scale					1.412
1398	95% UTL95% Coverage					1.578	95% UPL (t)					1.304
1399	90% Percentile (z)					0.773	95% Percentile (z)					1.291
1400	99% Percentile (z)					3.381	95% USL					20.31
1401	**DL/2 is not a Recommended Method. DL/2 provided for comparisons and historical reasons.**											
1402												
1403	**Nonparametric Distribution Free Background Statistics**											
1404	**Data do not follow a Discernible Distribution (0.05)**											

1405												
1406	**Nonparametric Upper Limits for BTVs(no distinction made between detects and nondetects)**											
1407					Order of Statistic, r	338			95% UTL with95% Coverage			2.2
1408					Approx, f used to compute achieved CC	1.482			Approximate Actual Confidence Coefficient achieved by UTL			0.935
1409					Approximate Sample Size needed to achieve specified CC	361			95% UPL			1.7
1410					95% USL	3			95% KM Chebyshev UPL			2.927
1411												
1412	Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.											
1413	Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers											
1414	and consists of observations collected from clean unimpacted locations.											
1415	The use of USL tends to provide a balance between false positives and false negatives provided the data											
1416	represents a background data set and when many onsite observations need to be compared with the BTV.											
1417												
1418	**Nickel**											
1419												
1420	**General Statistics**											
1421					Total Number of Observations	336			Number of Missing Observations			62
1422					Number of Distinct Observations	85						
1423					Number of Detects	335			Number of Non-Detects			1
1424					Number of Distinct Detects	84			Number of Distinct Non-Detects			1
1425					Minimum Detect	0.042			Minimum Non-Detect			0.039
1426					Maximum Detect	27			Maximum Non-Detect			0.039
1427					Variance Detected	20.91			Percent Non-Detects			0.298%
1428					Mean Detected	11.19			SD Detected			4.573
1429					Mean of Detected Logged Data	2.258			SD of Detected Logged Data			0.781
1430												
1431	**Critical Values for Background Threshold Values (BTVs)**											
1432					Tolerance Factor K (For UTL)	1.79			d2max (for USL)			3.585
1433												
1434	**Normal GOF Test on Detects Only**											
1435					Shapiro Wilk Test Statistic	0.963			**Normal GOF Test on Detected Observations Only**			
1436					5% Shapiro Wilk P Value	2.7014E-6			Data Not Normal at 5% Significance Level			
1437					Lilliefors Test Statistic	0.0807			**Lilliefors GOF Test**			
1438					5% Lilliefors Critical Value	0.0488			Data Not Normal at 5% Significance Level			
1439	**Data Not Normal at 5% Significance Level**											
1440												
1441	**Kaplan Meier (KM) Background Statistics Assuming Normal Distribution**											
1442					KM Mean	11.16			KM SD			4.6
1443					95% UTL95% Coverage	19.39			95% KM UPL (t)			18.76
1444					90% KM Percentile (z)	17.05			95% KM Percentile (z)			18.73
1445					99% KM Percentile (z)	21.86			95% KM USL			27.65
1446												
1447	**DL/2 Substitution Background Statistics Assuming Normal Distribution**											
1448					Mean	11.16			SD			4.607
1449					95% UTL95% Coverage	19.4			95% UPL (t)			18.77
1450					90% Percentile (z)	17.06			95% Percentile (z)			18.74
1451					99% Percentile (z)	21.88			95% USL			27.67
1452	**DL/2 is not a recommended method. DL/2 provided for comparisons and historical reasons**											
1453												
1454	**Gamma GOF Tests on Detected Observations Only**											
1455					A-D Test Statistic	14.18			**Anderson-Darling GOF Test**			
1456					5% A-D Critical Value	0.759			Data Not Gamma Distributed at 5% Significance Level			

	A	B	C	D	E	F	G	H	I	J	K	L
1457					K-S Test Statistic	0.157	**Kolmogorov-Smirnov GOF**					
1458					5% K-S Critical Value	0.05	Data Not Gamma Distributed at 5% Significance Level					
1459	**Data Not Gamma Distributed at 5% Significance Level**											
1460												
1461	**Gamma Statistics on Detected Data Only**											
1462					k hat (MLE)	3.328				k star (bias corrected MLE)		3.301
1463					Theta hat (MLE)	3.363				Theta star (bias corrected MLE)		3.391
1464					nu hat (MLE)	2230				nu star (bias corrected)		2211
1465					MLE Mean (bias corrected)	11.19						
1466					MLE Sd (bias corrected)	6.161				95% Percentile of Chisquare (2kstar)		13.48
1467												
1468	**Gamma ROS Statistics using Imputed Non-Detects**											
1469	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
1470	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)											
1471	For such situations, GROS method may yield incorrect values of UCLs and BTVs											
1472	This is especially true when the sample size is small.											
1473	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates											
1474					Minimum	0.042				Mean		11.17
1475					Maximum	27				Median		11
1476					SD	4.585				CV		0.41
1477					k hat (MLE)	3.311				k star (bias corrected MLE)		3.283
1478					Theta hat (MLE)	3.374				Theta star (bias corrected MLE)		3.402
1479					nu hat (MLE)	2225				nu star (bias corrected)		2206
1480					MLE Mean (bias corrected)	11.17				MLE Sd (bias corrected)		6.165
1481					95% Percentile of Chisquare (2kstar)	13.43				90% Percentile		19.44
1482					95% Percentile	22.85				99% Percentile		30.21
1483	**The following statistics are computed using Gamma ROS Statistics on Imputed Data**											
1484	**Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods**											
1485					WH	HW				WH		HW
1486	95% Approx. Gamma UTL with 95% Coverage				23.72	25.43	95% Approx. Gamma UPL			22.41		23.85
1487	95% Gamma USL				45.64	53.8						
1488												
1489	**Estimates of Gamma Parameters using KM Estimates**											
1490					Mean (KM)	11.16				SD (KM)		4.6
1491					Variance (KM)	21.16				SE of Mean (KM)		0.251
1492					k hat (KM)	5.887				k star (KM)		5.837
1493					nu hat (KM)	3956				nu star (KM)		3922
1494					theta hat (KM)	1.896				theta star (KM)		1.912
1495					80% gamma percentile (KM)	14.75				90% gamma percentile (KM)		17.34
1496					95% gamma percentile (KM)	19.68				99% gamma percentile (KM)		24.6
1497												
1498	**The following statistics are computed using gamma distribution and KM estimates**											
1499	**Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods**											
1500					WH	HW				WH		HW
1501	95% Approx. Gamma UTL with 95% Coverage				24.1	26.02	95% Approx. Gamma UPL			22.75		24.37
1502	95% KM Gamma Percentile				22.68	24.29	95% Gamma USL			46.97		56.15
1503												
1504	**Lognormal GOF Test on Detected Observations Only**											
1505					Shapiro Wilk Approximate Test Statistic	0.634	**Shapiro Wilk GOF Test**					
1506					5% Shapiro Wilk P Value	0	Data Not Lognormal at 5% Significance Level					
1507					Lilliefors Test Statistic	0.221	**Lilliefors GOF Test**					
1508					5% Lilliefors Critical Value	0.0488	Data Not Lognormal at 5% Significance Level					

1509	**Data Not Lognormal at 5% Significance Level**											
1510												
1511	**Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects**											
1512					Mean in Original Scale	11.16				Mean in Log Scale	2.252	
1513					SD in Original Scale	4.596				SD in Log Scale	0.787	
1514					95% UTL95% Coverage	38.86				95% BCA UTL95% Coverage	20	
1515					95% Bootstrap (%) UTL95% Coverage	20				95% UPL (t)	34.87	
1516					90% Percentile (z)	26.06				95% Percentile (z)	34.68	
1517					99% Percentile (z)	59.27				95% USL	159.5	
1518												
1519	**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**											
1520					KM Mean of Logged Data	2.241				95% KM UTL (Lognormal)95% Coverage	41.89	
1521					KM SD of Logged Data	0.835				95% KM UPL (Lognormal)	37.34	
1522					95% KM Percentile Lognormal (z)	37.12				95% KM USL (Lognormal)	187.5	
1523												
1524	**Background DL/2 Statistics Assuming Lognormal Distribution**											
1525					Mean in Original Scale	11.16				Mean in Log Scale	2.239	
1526					SD in Original Scale	4.607				SD in Log Scale	0.85	
1527					95% UTL95% Coverage	42.99				95% UPL (t)	38.23	
1528					90% Percentile (z)	27.91				95% Percentile (z)	38.01	
1529					99% Percentile (z)	67.84				95% USL	197.8	
1530	**DL/2 is not a Recommended Method. DL/2 provided for comparisons and historical reasons.**											
1531												
1532	**Nonparametric Distribution Free Background Statistics**											
1533	**Data do not follow a Discernible Distribution (0.05)**											
1534												
1535	**Nonparametric Upper Limits for BTVs(no distinction made between detects and nondetects)**											
1536					Order of Statistic, r	325				95% UTL with95% Coverage	20	
1537					Approx, f used to compute achieved CC	1.425				Approximate Actual Confidence Coefficient achieved by UTL	0.914	
1538					Approximate Sample Size needed to achieve specified CC	361				95% UPL	20	
1539					95% USL	27				95% KM Chebyshev UPL	31.24	
1540												
1541	Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.											
1542	Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers											
1543	and consists of observations collected from clean unimpacted locations.											
1544	The use of USL tends to provide a balance between false positives and false negatives provided the data											
1545	represents a background data set and when many onsite observations need to be compared with the BTV.											
1546												
1547	**Selenium**											
1548												
1549	**General Statistics**											
1550					Total Number of Observations	100				Number of Missing Observations	280	
1551					Number of Distinct Observations	46						
1552					Number of Detects	96				Number of Non-Detects	4	
1553					Number of Distinct Detects	42				Number of Distinct Non-Detects	4	
1554					Minimum Detect	0.27				Minimum Non-Detect	0.7	
1555					Maximum Detect	0.92				Maximum Non-Detect	0.9	
1556					Variance Detected	0.0221				Percent Non-Detects	4%	
1557					Mean Detected	0.458				SD Detected	0.149	
1558					Mean of Detected Logged Data	-0.828				SD of Detected Logged Data	0.304	
1559												
1560	**Critical Values for Background Threshold Values (BTVs)**											

1561					Tolerance Factor K (For UTL)	1.923					d2max (for USL)	3.21
1562												
1563						**Normal GOF Test on Detects Only**							
1564					Shapiro Wilk Test Statistic	0.895			**Normal GOF Test on Detected Observations Only**			
1565					5% Shapiro Wilk P Value	5.1705E-9			Data Not Normal at 5% Significance Level			
1566					Lilliefors Test Statistic	0.117			**Lilliefors GOF Test**			
1567					5% Lilliefors Critical Value	0.0907			Data Not Normal at 5% Significance Level			
1568						**Data Not Normal at 5% Significance Level**						
1569												
1570						**Kaplan Meier (KM) Background Statistics Assuming Normal Distribution**						
1571					KM Mean	0.457			KM SD	0.147		
1572					95% UTL95% Coverage	0.741			95% KM UPL (t)	0.703		
1573					90% KM Percentile (z)	0.646			95% KM Percentile (z)	0.7		
1574					99% KM Percentile (z)	0.8			95% KM USL	0.931		
1575												
1576						**DL/2 Substitution Background Statistics Assuming Normal Distribution**						
1577					Mean	0.456			SD	0.146		
1578					95% UTL95% Coverage	0.737			95% UPL (t)	0.7		
1579					90% Percentile (z)	0.643			95% Percentile (z)	0.696		
1580					99% Percentile (z)	0.796			95% USL	0.925		
1581						**DL/2 is not a recommended method. DL/2 provided for comparisons and historical reasons**						
1582												
1583						**Gamma GOF Tests on Detected Observations Only**						
1584					A-D Test Statistic	1.697			**Anderson-Darling GOF Test**			
1585					5% A-D Critical Value	0.752			Data Not Gamma Distributed at 5% Significance Level			
1586					K-S Test Statistic	0.104			**Kolmogorov-Smirnov GOF**			
1587					5% K-S Critical Value	0.0913			Data Not Gamma Distributed at 5% Significance Level			
1588						**Data Not Gamma Distributed at 5% Significance Level**						
1589												
1590						**Gamma Statistics on Detected Data Only**						
1591					k hat (MLE)	10.66			k star (bias corrected MLE)	10.34		
1592					Theta hat (MLE)	0.043			Theta star (bias corrected MLE)	0.0443		
1593					nu hat (MLE)	2047			nu star (bias corrected)	1985		
1594					MLE Mean (bias corrected)	0.458						
1595					MLE Sd (bias corrected)	0.142			95% Percentile of Chisquare (2kstar)	32.26		
1596												
1597						**Gamma ROS Statistics using Imputed Non-Detects**						
1598						GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs						
1599						GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)						
1600						For such situations, GROS method may yield incorrect values of UCLs and BTVs						
1601						This is especially true when the sample size is small.						
1602						For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates						
1603					Minimum	0.27			Mean	0.457		
1604					Maximum	0.92			Median	0.433		
1605					SD	0.146			CV	0.319		
1606					k hat (MLE)	11.09			k star (bias corrected MLE)	10.76		
1607					Theta hat (MLE)	0.0412			Theta star (bias corrected MLE)	0.0425		
1608					nu hat (MLE)	2218			nu star (bias corrected)	2153		
1609					MLE Mean (bias corrected)	0.457			MLE Sd (bias corrected)	0.139		
1610					95% Percentile of Chisquare (2kstar)	33.33			90% Percentile	0.642		
1611					95% Percentile	0.708			99% Percentile	0.842		
1612						**The following statistics are computed using Gamma ROS Statistics on Imputed Data**						

	A	B	C	D	E	F	G	H	I	J	K	L
1613	**Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods**											
1614					WH	HW					WH	HW
1615	95% Approx. Gamma UTL with 95% Coverage				0.758	0.761	95% Approx. Gamma UPL				0.709	0.711
1616	95% Gamma USL				1.034	1.056						
1617												
1618	**Estimates of Gamma Parameters using KM Estimates**											
1619	Mean (KM)				0.457	SD (KM)					0.147	
1620	Variance (KM)				0.0217	SE of Mean (KM)					0.0151	
1621	k hat (KM)				9.632	k star (KM)					9.349	
1622	nu hat (KM)				1926	nu star (KM)					1870	
1623	theta hat (KM)				0.0475	theta star (KM)					0.0489	
1624	80% gamma percentile (KM)				0.576	90% gamma percentile (KM)					0.657	
1625	95% gamma percentile (KM)				0.728	99% gamma percentile (KM)					0.875	
1626												
1627	**The following statistics are computed using gamma distribution and KM estimates**											
1628	**Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods**											
1629					WH	HW					WH	HW
1630	95% Approx. Gamma UTL with 95% Coverage				0.762	0.766	95% Approx. Gamma UPL				0.713	0.715
1631	95% KM Gamma Percentile				0.708	0.71	95% Gamma USL				1.043	1.065
1632												
1633	**Lognormal GOF Test on Detected Observations Only**											
1634	Shapiro Wilk Approximate Test Statistic				0.936	**Shapiro Wilk GOF Test**						
1635	5% Shapiro Wilk P Value				1.4081E-4	Data Not Lognormal at 5% Significance Level						
1636	Lilliefors Test Statistic				0.0966	**Lilliefors GOF Test**						
1637	5% Lilliefors Critical Value				0.0907	Data Not Lognormal at 5% Significance Level						
1638	**Data Not Lognormal at 5% Significance Level**											
1639												
1640	**Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects**											
1641	Mean in Original Scale				0.457	Mean in Log Scale					-0.829	
1642	SD in Original Scale				0.146	SD in Log Scale					0.298	
1643	95% UTL95% Coverage				0.775	95% BCA UTL95% Coverage					0.78	
1644	95% Bootstrap (%) UTL95% Coverage				0.78	95% UPL (t)					0.718	
1645	90% Percentile (z)				0.64	95% Percentile (z)					0.713	
1646	99% Percentile (z)				0.874	95% USL					1.137	
1647												
1648	**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**											
1649	KM Mean of Logged Data				-0.829	95% KM UTL (Lognormal)95% Coverage					0.78	
1650	KM SD of Logged Data				0.302	95% KM UPL (Lognormal)					0.722	
1651	95% KM Percentile Lognormal (z)				0.717	95% KM USL (Lognormal)					1.15	
1652												
1653	**Background DL/2 Statistics Assuming Lognormal Distribution**											
1654	Mean in Original Scale				0.456	Mean in Log Scale					-0.832	
1655	SD in Original Scale				0.146	SD in Log Scale					0.299	
1656	95% UTL95% Coverage				0.774	95% UPL (t)					0.717	
1657	90% Percentile (z)				0.639	95% Percentile (z)					0.712	
1658	99% Percentile (z)				0.873	95% USL					1.137	
1659	**DL/2 is not a Recommended Method. DL/2 provided for comparisons and historical reasons.**											
1660												
1661	**Nonparametric Distribution Free Background Statistics**											
1662	**Data do not follow a Discernible Distribution (0.05)**											
1663												
1664	**Nonparametric Upper Limits for BTVs(no distinction made between detects and nondetects)**											

1665					Order of Statistic, r	98					95% UTL with95% Coverage	0.87
1666					Approx, f used to compute achieved CC	1.719					Approximate Actual Confidence Coefficient achieved by UTL	0.882
1667					Approximate Sample Size needed to achieve specified CC	124					95% UPL	0.799
1668					95% USL	0.92					95% KM Chebyshev UPL	1.103
1669												
1670					Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.							
1671					Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers							
1672					and consists of observations collected from clean unimpacted locations.							
1673					The use of USL tends to provide a balance between false positives and false negatives provided the data							
1674					represents a background data set and when many onsite observations need to be compared with the BTV.							
1675												
1676	**Silver**											
1677												
1678					**General Statistics**							
1679					Total Number of Observations	341					Number of Missing Observations	57
1680					Number of Distinct Observations	58						
1681					Number of Detects	41					Number of Non-Detects	300
1682					Number of Distinct Detects	27					Number of Distinct Non-Detects	37
1683					Minimum Detect	0.18					Minimum Non-Detect	0.41
1684					Maximum Detect	0.7					Maximum Non-Detect	1.2
1685					Variance Detected	0.02					Percent Non-Detects	87.98%
1686					Mean Detected	0.417					SD Detected	0.141
1687					Mean of Detected Logged Data	-0.936					SD of Detected Logged Data	0.366
1688												
1689					**Critical Values for Background Threshold Values (BTVs)**							
1690					Tolerance Factor K (For UTL)	1.789					d2max (for USL)	3.589
1691												
1692					**Normal GOF Test on Detects Only**							
1693					Shapiro Wilk Test Statistic	0.954					**Shapiro Wilk GOF Test**	
1694					5% Shapiro Wilk Critical Value	0.941					Detected Data appear Normal at 5% Significance Level	
1695					Lilliefors Test Statistic	0.101					**Lilliefors GOF Test**	
1696					5% Lilliefors Critical Value	0.137					Detected Data appear Normal at 5% Significance Level	
1697					**Detected Data appear Normal at 5% Significance Level**							
1698												
1699					**Kaplan Meier (KM) Background Statistics Assuming Normal Distribution**							
1700					KM Mean	0.4					KM SD	0.134
1701					95% UTL95% Coverage	0.64					95% KM UPL (t)	0.622
1702					90% KM Percentile (z)	0.572					95% KM Percentile (z)	0.621
1703					99% KM Percentile (z)	0.713					95% KM USL	0.882
1704												
1705					**DL/2 Substitution Background Statistics Assuming Normal Distribution**							
1706					Mean	0.447					SD	0.0696
1707					95% UTL95% Coverage	0.571					95% UPL (t)	0.562
1708					90% Percentile (z)	0.536					95% Percentile (z)	0.561
1709					99% Percentile (z)	0.609					95% USL	0.697
1710					**DL/2 is not a recommended method. DL/2 provided for comparisons and historical reasons**							
1711												
1712					**Gamma GOF Tests on Detected Observations Only**							
1713					A-D Test Statistic	0.633					**Anderson-Darling GOF Test**	
1714					5% A-D Critical Value	0.749					Detected data appear Gamma Distributed at 5% Significance Level	
1715					K-S Test Statistic	0.143					**Kolmogorov-Smirnov GOF**	
1716					5% K-S Critical Value	0.138					Data Not Gamma Distributed at 5% Significance Level	

	A	B	C	D	E	F	G	H	I	J	K	L
1717	**Detected data follow Appr. Gamma Distribution at 5% Significance Level**											
1718												
1719	**Gamma Statistics on Detected Data Only**											
1720					k hat (MLE)	8.269			k star (bias corrected MLE)			7.68
1721					Theta hat (MLE)	0.0504			Theta star (bias corrected MLE)			0.0543
1722					nu hat (MLE)	678			nu star (bias corrected)			629.7
1723					MLE Mean (bias corrected)	0.417						
1724					MLE Sd (bias corrected)	0.151			95% Percentile of Chisquare (2kstar)			25.46
1725												
1726	**Gamma ROS Statistics using Imputed Non-Detects**											
1727	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
1728	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)											
1729	For such situations, GROS method may yield incorrect values of UCLs and BTVs											
1730	This is especially true when the sample size is small.											
1731	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates											
1732					Minimum	0.18			Mean			0.396
1733					Maximum	0.7			Median			0.385
1734					SD	0.113			CV			0.285
1735					k hat (MLE)	12.27			k star (bias corrected MLE)			12.17
1736					Theta hat (MLE)	0.0323			Theta star (bias corrected MLE)			0.0326
1737					nu hat (MLE)	8370			nu star (bias corrected)			8297
1738					MLE Mean (bias corrected)	0.396			MLE Sd (bias corrected)			0.114
1739					95% Percentile of Chisquare (2kstar)	36.83			90% Percentile			0.547
1740					95% Percentile	0.6			99% Percentile			0.707
1741	**The following statistics are computed using Gamma ROS Statistics on Imputed Data**											
1742	**Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods**											
1743					WH	HW				WH	HW	
1744				95% Approx. Gamma UTL with 95% Coverage	0.621	0.625			95% Approx. Gamma UPL	0.6	0.603	
1745				95% Gamma USL	0.938	0.966						
1746												
1747	**Estimates of Gamma Parameters using KM Estimates**											
1748					Mean (KM)	0.4			SD (KM)			0.134
1749					Variance (KM)	0.018			SE of Mean (KM)			0.02
1750					k hat (KM)	8.898			k star (KM)			8.821
1751					nu hat (KM)	6068			nu star (KM)			6016
1752					theta hat (KM)	0.045			theta star (KM)			0.0454
1753					80% gamma percentile (KM)	0.507			90% gamma percentile (KM)			0.58
1754					95% gamma percentile (KM)	0.645			99% gamma percentile (KM)			0.779
1755												
1756	**The following statistics are computed using gamma distribution and KM estimates**											
1757	**Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods**											
1758					WH	HW				WH	HW	
1759				95% Approx. Gamma UTL with 95% Coverage	0.679	0.686			95% Approx. Gamma UPL	0.652	0.658	
1760				95% KM Gamma Percentile	0.651	0.657			95% Gamma USL	1.097	1.145	
1761												
1762	**Lognormal GOF Test on Detected Observations Only**											
1763					Shapiro Wilk Test Statistic	0.942			**Shapiro Wilk GOF Test**			
1764					5% Shapiro Wilk Critical Value	0.941			Detected Data appear Lognormal at 5% Significance Level			
1765					Lilliefors Test Statistic	0.16			**Lilliefors GOF Test**			
1766					5% Lilliefors Critical Value	0.137			Data Not Lognormal at 5% Significance Level			
1767	**Detected Data appear Approximate Lognormal at 5% Significance Level**											
1768												

1769	**Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects**											
1770					Mean in Original Scale	0.393				Mean in Log Scale	-0.98	
1771					SD in Original Scale	0.119				SD in Log Scale	0.301	
1772					95% UTL95% Coverage	0.643				95% BCA UTL95% Coverage	0.627	
1773					95% Bootstrap (%) UTL95% Coverage	0.639				95% UPL (t)	0.617	
1774					90% Percentile (z)	0.552				95% Percentile (z)	0.616	
1775					99% Percentile (z)	0.757				95% USL	1.107	
1776												
1777	**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**											
1778					KM Mean of Logged Data	-0.976				95% KM UTL (Lognormal)95% Coverage	0.713	
1779					KM SD of Logged Data	0.356				95% KM UPL (Lognormal)	0.679	
1780					95% KM Percentile Lognormal (z)	0.677				95% KM USL (Lognormal)	1.354	
1781												
1782	**Background DL/2 Statistics Assuming Lognormal Distribution**											
1783					Mean in Original Scale	0.447				Mean in Log Scale	-0.82	
1784					SD in Original Scale	0.0696				SD in Log Scale	0.185	
1785					95% UTL95% Coverage	0.612				95% UPL (t)	0.597	
1786					90% Percentile (z)	0.558				95% Percentile (z)	0.596	
1787					99% Percentile (z)	0.676				95% USL	0.854	
1788	**DL/2 is not a Recommended Method. DL/2 provided for comparisons and historical reasons.**											
1789												
1790	**Nonparametric Distribution Free Background Statistics**											
1791	**Data appear to follow a Discernible Distribution at 5% Significance Level**											
1792												
1793	**Nonparametric Upper Limits for BTVs(no distinction made between detects and nondetects)**											
1794					Order of Statistic, r	330				95% UTL with95% Coverage	1	
1795					Approx, f used to compute achieved CC	1.447				Approximate Actual Confidence Coefficient achieved by UTL	0.922	
1796					Approximate Sample Size needed to achieve specified CC	361				95% UPL	1	
1797					95% USL	1.2				95% KM Chebyshev UPL	0.986	
1798												
1799	Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.											
1800	Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers											
1801	and consists of observations collected from clean unimpacted locations.											
1802	The use of USL tends to provide a balance between false positives and false negatives provided the data											
1803	represents a background data set and when many onsite observations need to be compared with the BTV.											
1804												
1805	**Thallium**											
1806												
1807	**General Statistics**											
1808					Total Number of Observations	347				Number of Missing Observations	38	
1809					Number of Distinct Observations	27						
1810					Number of Detects	7				Number of Non-Detects	340	
1811					Number of Distinct Detects	7				Number of Distinct Non-Detects	20	
1812					Minimum Detect	0.36				Minimum Non-Detect	0.8	
1813					Maximum Detect	0.46				Maximum Non-Detect	2.6	
1814					Variance Detected	0.0016				Percent Non-Detects	97.98%	
1815					Mean Detected	0.41				SD Detected	0.04	
1816					Mean of Detected Logged Data	-0.896				SD of Detected Logged Data	0.0978	
1817												
1818	**Critical Values for Background Threshold Values (BTVs)**											
1819					Tolerance Factor K (For UTL)	1.787				d2max (for USL)	3.594	
1820												

	A	B	C	D	E	F	G	H	I	J	K	L
1821	**Normal GOF Test on Detects Only**											
1822				Shapiro Wilk Test Statistic		0.912	**Shapiro Wilk GOF Test**					
1823				5% Shapiro Wilk Critical Value		0.803	Detected Data appear Normal at 5% Significance Level					
1824				Lilliefors Test Statistic		0.202	**Lilliefors GOF Test**					
1825				5% Lilliefors Critical Value		0.304	Detected Data appear Normal at 5% Significance Level					
1826	**Detected Data appear Normal at 5% Significance Level**											
1827												
1828	**Kaplan Meier (KM) Background Statistics Assuming Normal Distribution**											
1829				KM Mean		0.41	KM SD					0.037
1830				95% UTL95% Coverage		0.476	95% KM UPL (t)					0.471
1831				90% KM Percentile (z)		0.457	95% KM Percentile (z)					0.471
1832				99% KM Percentile (z)		0.496	95% KM USL					0.543
1833												
1834	**DL/2 Substitution Background Statistics Assuming Normal Distribution**											
1835				Mean		0.903	SD					0.133
1836				95% UTL95% Coverage		1.141	95% UPL (t)					1.123
1837				90% Percentile (z)		1.074	95% Percentile (z)					1.122
1838				99% Percentile (z)		1.213	95% USL					1.382
1839	**DL/2 is not a recommended method. DL/2 provided for comparisons and historical reasons**											
1840												
1841	**Gamma GOF Tests on Detected Observations Only**											
1842				A-D Test Statistic		0.363	**Anderson-Darling GOF Test**					
1843				5% A-D Critical Value		0.708	Detected data appear Gamma Distributed at 5% Significance Level					
1844				K-S Test Statistic		0.223	**Kolmogorov-Smirnov GOF**					
1845				5% K-S Critical Value		0.311	Detected data appear Gamma Distributed at 5% Significance Level					
1846	**Detected data appear Gamma Distributed at 5% Significance Level**											
1847												
1848	**Gamma Statistics on Detected Data Only**											
1849				k hat (MLE)		122.4	k star (bias corrected MLE)					70.04
1850				Theta hat (MLE)		0.00335	Theta star (bias corrected MLE)					0.00585
1851				nu hat (MLE)		1714	nu star (bias corrected)					980.6
1852				MLE Mean (bias corrected)		0.41						
1853				MLE Sd (bias corrected)		0.049	95% Percentile of Chisquare (2kstar)					168.7
1854												
1855	**Gamma ROS Statistics using Imputed Non-Detects**											
1856	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
1857	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)											
1858	For such situations, GROS method may yield incorrect values of UCLs and BTVs											
1859	This is especially true when the sample size is small.											
1860	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates											
1861				Minimum		0.299	Mean					0.41
1862				Maximum		0.537	Median					0.409
1863				SD		0.0449	CV					0.109
1864				k hat (MLE)		83.56	k star (bias corrected MLE)					82.84
1865				Theta hat (MLE)		0.00491	Theta star (bias corrected MLE)					0.00495
1866				nu hat (MLE)		57993	nu star (bias corrected)					57493
1867				MLE Mean (bias corrected)		0.41	MLE Sd (bias corrected)					0.0451
1868				95% Percentile of Chisquare (2kstar)		196.7	90% Percentile					0.469
1869				95% Percentile		0.487	99% Percentile					0.523
1870	**The following statistics are computed using Gamma ROS Statistics on Imputed Data**											
1871	**Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods**											
1872					WH	HW					WH	HW

	A	B	C	D	E	F	G	H	I	J	K	L
1873	95% Approx. Gamma UTL with 95% Coverage				0.494	0.495	95% Approx. Gamma UPL				0.487	0.488
1874	95% Gamma USL				0.592	0.595						
1875												
1876	**Estimates of Gamma Parameters using KM Estimates**											
1877	Mean (KM)					0.41	SD (KM)					0.037
1878	Variance (KM)					0.00137	SE of Mean (KM)					0.0151
1879	k hat (KM)					122.6	k star (KM)					121.5
1880	nu hat (KM)					85066	nu star (KM)					84332
1881	theta hat (KM)					0.00334	theta star (KM)					0.00337
1882	80% gamma percentile (KM)					0.441	90% gamma percentile (KM)					0.458
1883	95% gamma percentile (KM)					0.473	99% gamma percentile (KM)					0.501
1884												
1885	**The following statistics are computed using gamma distribution and KM estimates**											
1886	**Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods**											
1887					WH	HW					WH	HW
1888	95% Approx. Gamma UTL with 95% Coverage				0.479	0.479	95% Approx. Gamma UPL				0.473	0.473
1889	95% KM Gamma Percentile				0.473	0.473	95% Gamma USL				0.557	0.559
1890												
1891	**Lognormal GOF Test on Detected Observations Only**											
1892	Shapiro Wilk Test Statistic					0.915	**Shapiro Wilk GOF Test**					
1893	5% Shapiro Wilk Critical Value					0.803	Detected Data appear Lognormal at 5% Significance Level					
1894	Lilliefors Test Statistic					0.206	**Lilliefors GOF Test**					
1895	5% Lilliefors Critical Value					0.304	Detected Data appear Lognormal at 5% Significance Level					
1896	**Detected Data appear Lognormal at 5% Significance Level**											
1897												
1898	**Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects**											
1899	Mean in Original Scale					0.411	Mean in Log Scale					-0.896
1900	SD in Original Scale					0.0452	SD in Log Scale					0.11
1901	95% UTL95% Coverage					0.497	95% BCA UTL95% Coverage					0.498
1902	95% Bootstrap (%) UTL95% Coverage					0.499	95% UPL (t)					0.489
1903	90% Percentile (z)					0.47	95% Percentile (z)					0.489
1904	99% Percentile (z)					0.527	95% USL					0.606
1905												
1906	**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**											
1907	KM Mean of Logged Data					-0.896	95% KM UTL (Lognormal)95% Coverage					0.48
1908	KM SD of Logged Data					0.0905	95% KM UPL (Lognormal)					0.474
1909	95% KM Percentile Lognormal (z)					0.474	95% KM USL (Lognormal)					0.565
1910												
1911	**Background DL/2 Statistics Assuming Lognormal Distribution**											
1912	Mean in Original Scale					0.903	Mean in Log Scale					-0.116
1913	SD in Original Scale					0.133	SD in Log Scale					0.184
1914	95% UTL95% Coverage					1.237	95% UPL (t)					1.207
1915	90% Percentile (z)					1.127	95% Percentile (z)					1.205
1916	99% Percentile (z)					1.366	95% USL					1.725
1917	**DL/2 is not a Recommended Method. DL/2 provided for comparisons and historical reasons.**											
1918												
1919	**Nonparametric Distribution Free Background Statistics**											
1920	**Data appear to follow a Discernible Distribution at 5% Significance Level**											
1921												
1922	**Nonparametric Upper Limits for BTVs(no distinction made between detects and nondetects)**											
1923	Order of Statistic, r					336	95% UTL with95% Coverage					2.2
1924	Approx, f used to compute achieved CC					1.474	Approximate Actual Confidence Coefficient achieved by UTL					0.932

1925	Approximate Sample Size needed to achieve specified CC					361					95% UPL	2.1
1926					95% USL	2.6					95% KM Chebyshev UPL	0.572
1927												
1928	Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.											
1929	Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers											
1930	and consists of observations collected from clean unimpacted locations.											
1931	The use of USL tends to provide a balance between false positives and false negatives provided the data											
1932	represents a background data set and when many onsite observations need to be compared with the BTV.											
1933												
1934	**Vanadium**											
1935												
1936	**General Statistics**											
1937					Total Number of Observations	350					Number of Distinct Observations	61
1938											Number of Missing Observations	33
1939					Minimum	8.8					First Quartile	20
1940					Second Largest	75					Median	24
1941					Maximum	77					Third Quartile	29
1942					Mean	25.69					SD	9.293
1943					Coefficient of Variation	0.362					Skewness	2.258
1944					Mean of logged Data	3.194					SD of logged Data	0.315
1945												
1946	**Critical Values for Background Threshold Values (BTVs)**											
1947					Tolerance Factor K (For UTL)	1.787					d2max (for USL)	3.596
1948												
1949	**Normal GOF Test**											
1950					Shapiro Wilk Test Statistic	0.826					**Normal GOF Test**	
1951					5% Shapiro Wilk P Value	0					Data Not Normal at 5% Significance Level	
1952					Lilliefors Test Statistic	0.139					**Lilliefors GOF Test**	
1953					5% Lilliefors Critical Value	0.0478					Data Not Normal at 5% Significance Level	
1954	**Data Not Normal at 5% Significance Level**											
1955												
1956	**Background Statistics Assuming Normal Distribution**											
1957					95% UTL with 95% Coverage	42.3					90% Percentile (z)	37.6
1958					95% UPL (t)	41.04					95% Percentile (z)	40.98
1959					95% USL	59.12					99% Percentile (z)	47.31
1960												
1961	**Gamma GOF Test**											
1962					A-D Test Statistic	4.774					**Anderson-Darling Gamma GOF Test**	
1963					5% A-D Critical Value	0.755					Data Not Gamma Distributed at 5% Significance Level	
1964					K-S Test Statistic	0.0898					**Kolmogorov-Smirnov Gamma GOF Test**	
1965					5% K-S Critical Value	0.0487					Data Not Gamma Distributed at 5% Significance Level	
1966	**Data Not Gamma Distributed at 5% Significance Level**											
1967												
1968	**Gamma Statistics**											
1969					k hat (MLE)	9.698					k star (bias corrected MLE)	9.617
1970					Theta hat (MLE)	2.649					Theta star (bias corrected MLE)	2.672
1971					nu hat (MLE)	6789					nu star (bias corrected)	6732
1972					MLE Mean (bias corrected)	25.69					MLE Sd (bias corrected)	8.286
1973												
1974	**Background Statistics Assuming Gamma Distribution**											
1975					95% Wilson Hilferty (WH) Approx. Gamma UPL	40.61					90% Percentile	36.72
1976					95% Hawkins Wixley (HW) Approx. Gamma UPL	40.67					95% Percentile	40.67

1977			95% WH Approx. Gamma UTL with		95% Coverage	42.14				99% Percentile		48.78
1978			95% HW Approx. Gamma UTL with		95% Coverage	42.25						
1979					95% WH USL	66.49				95% HW USL		68.23
1980												
1981					**Lognormal GOF Test**							
1982					Shapiro Wilk Test Statistic	0.964			**Shapiro Wilk Lognormal GOF Test**			
1983					5% Shapiro Wilk P Value	5.4292E-6			Data Not Lognormal at 5% Significance Level			
1984					Lilliefors Test Statistic	0.0705			**Lilliefors Lognormal GOF Test**			
1985					5% Lilliefors Critical Value	0.0478			Data Not Lognormal at 5% Significance Level			
1986					**Data Not Lognormal at 5% Significance Level**							
1987												
1988					**Background Statistics assuming Lognormal Distribution**							
1989			95% UTL with		95% Coverage	42.81				90% Percentile (z)		36.51
1990					95% UPL (t)	41.02				95% Percentile (z)		40.94
1991					95% USL	75.71				99% Percentile (z)		50.74
1992												
1993					**Nonparametric Distribution Free Background Statistics**							
1994					**Data do not follow a Discernible Distribution (0.05)**							
1995												
1996					**Nonparametric Upper Limits for Background Threshold Values**							
1997					Order of Statistic, r	338				95% UTL with	95% Coverage	47
1998					Approx, f used to compute achieved CC	1.368			Approximate Actual Confidence Coefficient achieved by UTL			0.894
1999									Approximate Sample Size needed to achieve specified CC			385
2000			95% Percentile Bootstrap UTL with		95% Coverage	47.55				95% BCA Bootstrap UTL with	95% Coverage	47.55
2001					95% UPL	41				90% Percentile		34
2002					90% Chebyshev UPL	53.61				95% Percentile		40.55
2003					95% Chebyshev UPL	66.26				99% Percentile		64.53
2004					95% USL	77						
2005												
2006					Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.							
2007					Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers							
2008					and consists of observations collected from clean unimpacted locations.							
2009					The use of USL tends to provide a balance between false positives and false negatives provided the data							
2010					represents a background data set and when many onsite observations need to be compared with the BTV.							
2011												
2012	**Zinc**											
2013												
2014	**General Statistics**											
2015					Total Number of Observations	302				Number of Distinct Observations		99
2016										Number of Missing Observations		87
2017					Minimum	1.3				First Quartile		35.18
2018					Second Largest	260				Median		47
2019					Maximum	260				Third Quartile		73.5
2020					Mean	67.19				SD		54.5
2021					Coefficient of Variation	0.811				Skewness		1.854
2022					Mean of logged Data	3.949				SD of logged Data		0.722
2023												
2024					**Critical Values for Background Threshold Values (BTVs)**							
2025					Tolerance Factor K (For UTL)	1.798				d2max (for USL)		3.554
2026												
2027					**Normal GOF Test**							
2028					Shapiro Wilk Test Statistic	0.747			**Normal GOF Test**			

	A	B	C	D	E	F	G	H	I	J	K	L
2029					5% Shapiro Wilk P Value	0	Data Not Normal at 5% Significance Level					
2030					Lilliefors Test Statistic	0.26	**Lilliefors GOF Test**					
2031					5% Lilliefors Critical Value	0.0514	Data Not Normal at 5% Significance Level					
2032	**Data Not Normal at 5% Significance Level**											
2033												
2034	**Background Statistics Assuming Normal Distribution**											
2035				95% UTL with	95% Coverage	165.2				90% Percentile (z)		137
2036					95% UPL (t)	157.3				95% Percentile (z)		156.8
2037					95% USL	260.9				99% Percentile (z)		194
2038												
2039	**Gamma GOF Test**											
2040					A-D Test Statistic	10.69	**Anderson-Darling Gamma GOF Test**					
2041					5% A-D Critical Value	0.765	Data Not Gamma Distributed at 5% Significance Level					
2042					K-S Test Statistic	0.187	**Kolmogorov-Smirnov Gamma GOF Test**					
2043					5% K-S Critical Value	0.0526	Data Not Gamma Distributed at 5% Significance Level					
2044	**Data Not Gamma Distributed at 5% Significance Level**											
2045												
2046	**Gamma Statistics**											
2047					k hat (MLE)	2.086				k star (bias corrected MLE)		2.068
2048					Theta hat (MLE)	32.2				Theta star (bias corrected MLE)		32.49
2049					nu hat (MLE)	1260				nu star (bias corrected)		1249
2050					MLE Mean (bias corrected)	67.19				MLE Sd (bias corrected)		46.73
2051												
2052	**Background Statistics Assuming Gamma Distribution**											
2053					95% Wilson Hilferty (WH) Approx. Gamma UPL	155.7				90% Percentile		129.7
2054					95% Hawkins Wixley (HW) Approx. Gamma UPL	157.5				95% Percentile		157.7
2055					95% WH Approx. Gamma UTL with 95% Coverage	167.8				99% Percentile		219.8
2056					95% HW Approx. Gamma UTL with 95% Coverage	170.7						
2057					95% WH USL	366.2				95% HW USL		403
2058												
2059	**Lognormal GOF Test**											
2060					Shapiro Wilk Test Statistic	0.943	**Shapiro Wilk Lognormal GOF Test**					
2061					5% Shapiro Wilk P Value	1.377E-14	Data Not Lognormal at 5% Significance Level					
2062					Lilliefors Test Statistic	0.137	**Lilliefors Lognormal GOF Test**					
2063					5% Lilliefors Critical Value	0.0514	Data Not Lognormal at 5% Significance Level					
2064	**Data Not Lognormal at 5% Significance Level**											
2065												
2066	**Background Statistics assuming Lognormal Distribution**											
2067				95% UTL with	95% Coverage	190.2				90% Percentile (z)		131
2068					95% UPL (t)	171.2				95% Percentile (z)		170.3
2069					95% USL	676.2				99% Percentile (z)		278.5
2070												
2071	**Nonparametric Distribution Free Background Statistics**											
2072	**Data do not follow a Discernible Distribution (0.05)**											
2073												
2074	**Nonparametric Upper Limits for Background Threshold Values**											
2075					Order of Statistic, r	292				95% UTL with 95% Coverage		212
2076					Approx, f used to compute achieved CC	1.397				Approximate Actual Confidence Coefficient achieved by UTL		0.892
2077										Approximate Sample Size needed to achieve specified CC		336
2078					95% Percentile Bootstrap UTL with 95% Coverage	212				95% BCA Bootstrap UTL with 95% Coverage		211.9
2079					95% UPL	200				90% Percentile		147.2
2080					90% Chebyshev UPL	231				95% Percentile		199.5

	A	B	C	D	E	F	G	H	I	J	K	L
2081					95% Chebyshev UPL	305.2					99% Percentile	259.9
2082					95% USL	260						
2083												
2084	Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.											
2085	Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers											
2086	and consists of observations collected from clean unimpacted locations.											
2087	The use of USL tends to provide a balance between false positives and false negatives provided the data											
2088	represents a background data set and when many onsite observations need to be compared with the BTV.											
2089												

APPENDIX C

95 Percent UCL Calculation Sheets

sys_loc_code	sys_sample_code	Aluminum	D_Aluminur	Antimony	D_Antimon	Arsenic	D_Arsenic	Barium	D_Barium	Beryllium	D_Beryllium	Cadmium	D_Cadmium	Chromium	D_Chromiur	Cobalt	D_Cobalt	Copper	D_Copper	Iron	D_Iron
AEC_B-1	AEC_B-1_061005_2																				
AEC_B-7	AEC_B-7_061005_6																				
DP-001-SO-100	DP-001-SO-100-01	4380	1	7.8	1	6.5	1	242	1	0.22	1	0.69	1	33.9	1	7.7	1	373	1	27300	1
DP-002-SO-100	DP-002-SO-100-01	3990	1	14.1	1	7.5	1	243	1	0.23	1	0.23	1	29.9	1	7.2	1	329	1	26500	1
DP-003	DP-003-SO-010-01	7200	1	3.3	1	2.3	1	130	1	0.22	1	2	1	34	1	7.7	1	62	1	22000	1
DP-003	DP-003-SO-050-01	5900	1	7.8	1	3.3	1	82	1	0.15	1	0.3	1	15	1	7.2	1	110	1	47000	1
DP-003	DP-003-SO-100-01	13000	1	5	0	1.2	1	39	1	0.35	1	1	0	23	1	5	1	15	1	31000	1
DP-004	DP-004-SO-010-01	3300	1	4.3	0	1.1	1	13	1	0.43	0	0.86	0	9.7	1	1.1	1	12	1	11000	1
DP-004	DP-004-SO-050-01	8500	1	1.6	1	2.5	1	150	1	0.25	1	0.95	0	17	1	5.4	1	27	1	17000	1
DP-005	DP-005-SO-010-01	8300	1	1.1	1	3.6	1	81	1	0.25	1	0.15	1	17	1	6.3	1	100	1	18000	1
DP-005	DP-005-SO-100-01	3500	1	25	1	1.7	1	170	1	0.31	1	1	0	14	1	29	1	120	1	43000	1
DP-006	DP-006-SO-010-01	6100	1	7.1	1	7.2	1	220	1	0.42	1	0.9	0	16	1	6.3	1	50	1	15000	1
DP-006	DP-006-SO-050-01	6600	1	9	1	19	1	210	1	0.5	1	0.96	0	21	1	6.2	1	120	1	20000	1
DP-006	DP-006-SO-100-01	5500	1	2.5	1	2.4	1	42	1	0.15	1	0.88	0	11	1	6.6	1	51	1	13000	1
DP-007	DP-007-SO-010-01	2300	1	4.3	0	4.6	1	25	1	0.26	1	0.85	0	15	1	1.2	1	4.3	1	12000	1
DP-007	DP-007-SO-050-01	7600	1	18	1	22	1	790	1	0.6	1	1.5	1	26	1	8	1	160	1	29000	1
DP-007	DP-007-SO-100-01	6900	1	1.7	1	4.2	1	60	1	0.38	1	0.96	0	16	1	5.1	1	33	1	16000	1
DP-008	DP-008-SO-010-01	5500	1	4.4	0	3.4	1	34	1	0.19	1	0.88	0	29	1	11	1	17	1	16000	1
DP-008	DP-008-SO-050-01	5000	1	6.5	1	9.3	1	250	1	0.55	1	1	0	14	1	6.1	1	100	1	31000	1
DP-008	DP-008-SO-100-01	9200	1	4.6	0	4.1	1	78	1	0.51	1	0.93	0	16	1	7.6	1	16	1	18000	1
DP-009	DP-009-SO-010-01	6000	1	7.4	1	5.7	1	66	1	0.3	1	0.92	0	12	1	4.1	1	22	1	16000	1
DP-009	DP-009-SO-010-02	10000	1	4	1	7.5	1	100	1	0.47	1	0.92	0	16	1	5.8	1	30	1	22000	1
DP-009	DP-009-SO-050-01	4800	1	5.6	1	15	1	330	1	0.56	1	1	0	20	1	5.8	1	160	1	15000	1
DP-009	DP-009-SO-100-01	8600	1	0.86	1	7.2	1	73	1	0.69	1	0.98	0	17	1	12	1	27	1	28000	1
DP-010	DP-010-SO-010-01	6600	1	4.6	0	5.3	1	87	1	0.39	1	0.91	0	15	1	6.3	1	24	1	14000	1
DP-010	DP-010-SO-050-01	6200	1	6	1	12	1	180	1	0.44	1	0.97	0	16	1	6.6	1	220	1	20000	1
DP-010	DP-010-SO-050-02	6700	1	2.6	1	12	1	160	1	0.47	1	0.96	0	14	1	5.8	1	82	1	18000	1
DP-010	DP-010-SO-100-01	10000	1	5	0	6.7	1	76	1	0.7	1	1	0	17	1	10	1	22	1	25000	1
DP-011	DP-011-SO-010-01	11000	1	4.3	0	2.7	1	29	1	0.23	1	0.87	0	13	1	1.8	1	4.8	1	14000	1
DP-011	DP-011-SO-050-01	6200	1	3.9	1	12	1	170	1	0.48	1	1	0	15	1	6.7	1	340	1	20000	1
DP-011	DP-011-SO-100-01	12000	1	4.9	0	4.7	1	53	1	0.51	1	0.98	0	16	1	9.8	1	12	1	23000	1
DP-016	DP-016-SO-010-01	8300	1	4.4	0	4.2	1	120	1	0.23	1	0.24	1	22	1	5.3	1	30	1	24000	1
DP-016	DP-016-SO-050-01	4600	1	13	1	37	1	110	1	0.36	1	1.2	1	35	1	5	1	650	1	44000	1
DP-016	DP-016-SO-100-01	15000	1	4.9	0	1.6	1	50	1	0.52	1	0.98	0	26	1	5.9	1	16	1	36000	1
DP-017	DP-017-SO-010-01	4300	1	0.94	1	5.2	1	89	1	0.27	1	0.25	1	18	1	6.3	1	52	1	16000	1
DP-017	DP-017-SO-050-01	3700	1	2.2	1	7.1	1	260	1	0.42	1	3.3	1	18	1	4.3	1	82	1	15000	1
DP-017	DP-017-SO-100-01	9800	1	5.1	0	1.4	1	67	1	0.65	1	1	0	18	1	15	1	11	1	22000	1
DP-018	DP-018-SO-010-01	5300	1	16	1	1.5	1	120	1	0.36	1	0.31	1	25	1	7.9	1	36	1	33000	1
DP-018	DP-018-SO-050-01	4200	1	4.4	0	7.8	1	38	1	0.2	1	0.89	0	11	1	2.9	1	8.6	1	8500	1
DP-018	DP-018-SO-100-01	7700	1	4.9	0	3.1	1	65	1	0.23	1	0.98	0	15	1	4.9	1	16	1	19000	1
DP-019	DP-019-SO-010-01	5900	1	4.8	1	10	1	250	1	0.47	1	0.32	1	17	1	7	1	54	1	25000	1
DP-019	DP-019-SO-050-01	3700	1	4.5	0	7.2	1	33	1	0.19	1	0.9	0	9.2	1	2.5	1	9.1	1	7700	1
DP-019	DP-019-SO-100-01	13000	1	5	0	1.1	1	43	1	0.55	1	1	0	23	1	8.1	1	15	1	27000	1
DP-020	DP-020-SO-010-01	4300	1	0.84	1	4.7	1	110	1	0.27	1	0.48	1	12	1	5.8	1	82	1	14000	1
DP-020	DP-020-SO-050-01	4800	1	4.7	0	7	1	48	1	0.27	1	0.1	1	15	1	4.7	1	14	1	10000	1
DP-021	DP-021-SO-010-01	6900	1	3.5	1	12	1	330	1	0.58	1	1.3	1	24	1	8	1	94	1	26000	1
DP-021	DP-021-SO-010-02	9800	1	2.9	1	7.2	1	350	1	0.57	1	0.94	1	21	1	6.6	1	100	1	20000	1
DP-021	DP-021-SO-050-01	9700	1	3	1	5.6	1	140	1	0.47	1	0.23	1	19	1	7.7	1	94	1	28000	1
DP-021	DP-021-SO-100-01	10000	1	5	0	0.86	1	54	1	0.52	1	1	0	23	1	7	1	11	1	23000	1
DP-022	DP-022-SO-010-01	6000	1	4.9	1	8.7	1	370	1	0.53	1	1.2	1	20	1	6.4	1	88	1	32000	1
DP-022	DP-022-SO-050-01	4600	1	2.1	1	15	1	370	1	0.62	1	1.6	1	42	1	9.1	1	360	1	68000	1
DP-022	DP-022-SO-100-01	12000	1	5.2	0	13	1	40	1	0.46	1	1	0	20	1	6.2	1	14	1	27000	1
DP-023	DP-023-SO-010-01	5200	1	1.3	1	12	1	90	1	0.4	1	0.28	1	15	1	5.5	1	36	1	18000	1
DP-023	DP-023-SO-050-01	4700	1	4.6	0	6.6	1	35	1	0.22	1	0.13	1	9.8	1	2.5	1	10	1	10000	1
DP-023	DP-023-SO-100-01	7800	1	5	0	2.3	1	49	1	0.56	1	1	0	19	1	9.3	1	9.2	1	18000	1
DP-024	DP-024-SO-010-01	5000	1	4	1	25	1	390	1	0.45	1	0.94	1	18	1	7.2	1	190	1	31000	1
DP-024	DP-024-SO-050-01	6200	1	6.1	1	31	1	320	1	0.49	1	0.52	1	21	1	10	1	120	1	42000	1
DP-024	DP-024-SO-100-01	7500	1	4.8	0	11	1	68	1	0.6	1	0.96	0	16	1	13	1	11	1	18000	1
DP-024	DP-024-SO-100-02	11000	1	4.9	0	11	1	46	1	0.57	1	0.99	0	20	1	8.4	1	10	1	20000	1
DP-025	DP-025-SO-010-01	6600	1	0.73	1	10	1	63	1	0.28	1	0.89	0	21	1	6	1	27	1	15000	1
DP-025	DP-025-SO-050-01	7400	1	22	1	32	1	360	1	0.68	1	1.3	1	23	1	9	1	310	1	40000	1
DP-025	DP-025-SO-100-01	14000	1	4.8	0	14	1	55	1	0.68	1	0.96	0	19	1	14	1	16	1	26000	1

sys_loc_code	sys_sample_code	Aluminum	D_Aluminur	Antimony	D_Antimon	Arsenic	D_Arsenic	Barium	D_Barium	Beryllium	D_Beryllium	Cadmium	D_Cadmiun	Chromium	_Chromiur	Cobalt	D_Cobalt	Copper	D_Copper	Iron	D_Iron
DP-026	DP-026-SO-010-01	7300	1	2.4	1	12	1	110	1	0.48	1	0.06	1	16	1	6.8	1	35	1	18000	1
DP-026	DP-026-SO-050-01	6300	1	20	1	40	1	730	1	0.69	1	0.4	1	37	1	14	1	320	1	52000	1
DP-026	DP-026-SO-100-01	4100	1	3.3	1	9.7	1	220	1	0.37	1	1.2	0	13	1	5.4	1	99	1	44000	1
DP-027	DP-027-SO-010-01	1800	1	4.3	0	0.93	1	16	1	0.09	1	0.86	0	6.2	1	1.1	1	7.6	1	5900	1
DP-027	DP-027-SO-080-01	3600	1	5.8	0	2.9	1	86	1	0.26	1	0.31	1	10	1	3.7	1	56	1	20000	1
DP-028	DP-028-SO-010-01	5400	1	2.4	1	14	1	120	1	0.41	1	0.78	1	13	1	5.1	1	110	1	21000	1
DP-028	DP-028-SO-010-02	6300	1	1.1	1	5.4	1	90	1	0.38	1	0.3	1	16	1	3.3	1	62	1	22000	1
DP-028	DP-028-SO-095-01	3900	1	4.5	1	7.1	1	420	1	0.46	1	0.27	1	14	1	4.1	1	120	1	19000	1
DP-029	DP-029-SO-010-01	7000	1	3.1	1	8.2	1	140	1	0.4	1	2.2	1	38	1	7.4	1	250	1	26000	1
DP-029	DP-029-SO-090-01	5600	1	4.9	0	3	1	110	1	0.32	1	0.28	1	15	1	6.7	1	28	1	15000	1
DP-030	DP-030-SO-010-01	12000	1	4.5	0	2.7	1	68	1	0.44	1	0.91	0	18	1	7.8	1	14	1	23000	1
DP-030	DP-030-SO-100-01	9000	1	5.1	0	1.8	1	70	1	0.79	1	1	0	20	1	13	1	14	1	23000	1
DP-031	DP-031-SO-010-01	7500	1	1.4	1	3.8	1	84	1	0.44	1	0.98	1	23	1	4.6	1	42	1	27000	1
DP-031	DP-031-SO-100-01	12000	1	2	1	5.4	1	56	1	0.62	1	1.2	0	22	1	12	1	18	1	29000	1
DP-032	DP-032-SO-010-01	5600	1	2	1	3.6	1	87	1	0.29	1	1.2	1	21	1	5.6	1	100	1	21000	1
DP-038	DP-038-SO-010-01	7400	1	4.5	0	3	1	45	1	0.38	1	0.9	0	14	1	5.4	1	12	1	16000	1
DP-038	DP-038-SO-050-01	9900	1	4.5	0	3.3	1	29	1	0.35	1	0.9	0	18	1	3.6	1	10	1	19000	1
DP-038	DP-038-SO-100-01	8900	1	4.6	0	5.8	1	20	1	0.38	1	0.91	0	13	1	3.3	1	14	1	19000	1
DP-039	DP-039-SO-010-01	6300	1	1.1	1	4.3	1	84	1	0.34	1	0.2	1	14	1	6	1	29	1	16000	1
DP-039	DP-039-SO-050-01	6600	1	160	1	10	1	230	1	0.56	1	0.31	1	20	1	7.4	1	140	1	20000	1
DP-039	DP-039-SO-050-02	6600	1	190	1	12	1	200	1	0.61	1	0.3	1	17	1	8.6	1	220	1	18000	1
DP-039	DP-039-SO-100-01	8300	1	0.94	1	4.5	1	77	1	0.83	1	0.97	0	19	1	15	1	19	1	18000	1
DP-040	DP-040-SO-010-01	7500	1	4.7	0	4.4	1	82	1	0.36	1	0.18	1	14	1	5.8	1	26	1	16000	1
DP-040	DP-040-SO-050-01	5200	1	1.7	1	17	1	360	1	0.52	1	0.34	1	12	1	6.4	1	160	1	9600	1
DP-040	DP-040-SO-100-01	6100	1	5.4	0	8.3	1	220	1	0.53	1	0.09	1	10	1	6.6	1	31	1	7400	1
DP-040	DP-040-SO-100-02	7100	1	4.3	1	14	1	520	1	0.74	1	0.44	1	22	1	11	1	240	1	19000	1
DP-041	DP-041-SO-010-01	7600	1	4.7	0	5.7	1	110	1	0.49	1	0.94	0	13	1	5.5	1	33	1	16000	1
DP-041	DP-041-SO-050-01	8600	1	0.84	1	17	1	200	1	0.73	1	1	0	14	1	8.1	1	43	1	18000	1
DP-041	DP-041-SO-100-01	9600	1	4.8	0	3.7	1	69	1	0.78	1	0.97	0	15	1	10	1	11	1	17000	1
DP-042	DP-042-SO-010-01	7000	1	4.5	0	6.6	1	120	1	0.42	1	0.9	0	11	1	5.1	1	30	1	13000	1
DP-042	DP-042-SO-010-02	9600	1	4.6	0	2.5	1	240	1	0.77	1	0.91	0	24	1	8.4	1	39	1	23000	1
DP-042	DP-042-SO-050-01	8900	1	5.5	0	11	1	260	1	0.75	1	1.1	0	12	1	8.5	1	78	1	10000	1
DP-042	DP-042-SO-050-02	8300	1	5.2	0	11	1	270	1	0.73	1	0.13	1	16	1	8.5	1	54	1	16000	1
DP-042	DP-042-SO-100-01	9100	1	5	0	5	1	72	1	0.67	1	1	0	15	1	7.4	1	14	1	20000	1
DP-042	DP-042-SO-100-02	5600	1	4.8	0	2.2	1	150	1	0.62	1	0.97	0	9.8	1	5.5	1	21	1	9400	1
DP-043	DP-043-SO-010-01	9300	1	4.6	0	10	1	40	1	0.4	1	0.92	0	26	1	1.8	1	21	1	48000	1
DP-043	DP-043-SO-010-02	5700	1	4.2	0	4.2	0	83	1	0.36	1	0.85	0	14	1	4.9	1	28	1	26000	1
DP-043	DP-043-SO-050-01	7400	1	4.7	0	6.4	1	280	1	0.46	1	0.94	0	12	1	5.6	1	37	1	14000	1
DP-043	DP-043-SO-050-02	6500	1	4.5	0	3.9	1	170	1	0.56	1	0.09	1	14	1	6.2	1	43	1	13000	1
DP-043	DP-043-SO-100-01	8700	1	4.8	0	3.9	1	68	1	0.78	1	0.96	0	16	1	15	1	12	1	17000	1
DP-043	DP-043-SO-100-02	8300	1	5.1	0	1	0	140	1	0.57	1	0.07	1	18	1	7.2	1	100	1	20000	1
DP-044	DP-044-SO-010-01	7100	1	4.4	0	4.8	1	90	1	0.49	1	0.13	1	16	1	13	1	43	1	20000	1
DP-044	DP-044-SO-010-02	7300	1	4.3	0	1.9	1	120	1	0.44	1	0.14	1	15	1	6.5	1	120	1	15000	1
DP-044	DP-044-SO-050-01	6800	1	5.2	0	10	1	280	1	0.78	1	0.24	1	13	1	9.9	1	48	1	12000	1
DP-044	DP-044-SO-050-02	7700	1	5.2	0	8.8	1	320	1	0.77	1	0.08	1	17	1	9	1	77	1	9600	1
DP-044	DP-044-SO-100-01	7900	1	43	1	14	1	250	1	0.7	1	0.2	1	12	1	7.6	1	260	1	8400	1
DP-044	DP-044-SO-100-02	7100	1	5	0	5	1	200	1	0.57	1	0.13	1	14	1	8	1	47	1	12000	1
DP-045	DP-045-SO-010-01	8100	1	4.4	0	5.1	1	66	1	0.38	1	0.15	1	21	1	5.6	1	24	1	26000	1
DP-045	DP-045-SO-010-02	7800	1	7.2	1	9.8	1	110	1	0.58	1	0.49	1	16	1	7.2	1	33	1	16000	1
DP-045	DP-045-SO-050-01	6200	1	1	1	10	1	380	1	0.59	1	0.3	1	13	1	8.4	1	41	1	9000	1
DP-045	DP-045-SO-050-02	7900	1	5	0	5.5	1	210	1	0.83	1	0.1	1	14	1	8	1	56	1	9300	1
DP-045	DP-045-SO-100-01	8300	1	4.6	0	6.3	1	100	1	0.66	1	0.92	0	14	1	9.4	1	28	1	20000	1
DP-045	DP-045-SO-100-02	8900	1	4.9	0	2.1	1	97	1	0.7	1	0.97	0	18	1	16	1	28	1	14000	1
DP-046	DP-046-SO-010-01	7600	1	4.9	0	8.2	1	290	1	0.55	1	0.99	0	12	1	5.5	1	33	1	16000	1
DP-046	DP-046-SO-100-01	8400	1	5	0	5.6	1	79	1	0.84	1	0.99	0	15	1	13	1	15	1	18000	1
DP-047	DP-047-SO-010-01	8100	1	4.3	0	10	1	77	1	0.41	1	0.86	0	13	1	5.2	1	13	1	13000	1
DP-047	DP-047-SO-010-02	12000	1	4.7	0	10	1	89	1	0.48	1	0.93	0	18	1	5.5	1	21	1	16000	1
DP-047	DP-047-SO-050-01	17000	1	4.6	0	14	1	84	1	0.57	1	0.92	0	19	1	11	1	16	1	27000	1
DP-047	DP-047-SO-100-01	11000	1	4.4	0	13	1	53	1	0.64	1	0.88	0	18	1	7.4	1	63	1	24000	1
DP-053	DP-053-SO-010-01	7900	1	4.2	0	22	1	45	1	0.21	1	0.09	1	21	1	8.4	1	43	1	20000	1
DP-053	DP-053-SO-050-01	3100	1	4.1	0	7.4	1	19	1	0.27	1	0.81	0	7.5	1	2.5	1	5	1	16000	1
DP-053	DP-053-SO-100-01	10000	1	4.3	0	8.7	1	84	1	0.68	1	0.86	0	24	1	10	1	28	1	21000	1

sys_loc_code	sys_sample_code	Aluminum	D_Aluminur	Antimony	D_Antimon	Arsenic	D_Arsenic	Barium	D_Barium	Beryllium	D_Berylliun	Cadmium	D_Cadmiun	Chromium	_Chromiur	Cobalt	D_Cobalt	Copper	D_Copper	Iron	D_Iron
DP-054	DP-054-SO-010-01	7400	1	4.4	0	7.4	1	70	1	0.33	1	0.07	1	26	1	5.8	1	16	1	12000	1
DP-054	DP-054-SO-050-01	3400	1	4.3	0	3.7	1	22	1	0.17	1	0.09	1	12	1	4	1	6.2	1	6100	1
DP-054	DP-054-SO-100-01	7600	1	4.6	0	9	1	73	1	0.54	1	0.18	1	13	1	7.2	1	19	1	13000	1
DP-054	DP-054-SO-100-02	6800	1	4.5	0	9.8	1	78	1	0.55	1	0.23	1	15	1	8	1	22	1	14000	1
DP-055	DP-055-SO-010-01	8000	1	4.5	0	11	1	28	1	0.51	1	0.91	0	15	1	2.5	1	10	1	24000	1
DP-055	DP-055-SO-050-01	8800	1	4.3	0	9.8	1	63	1	0.5	1	0.87	0	23	1	5.4	1	12	1	19000	1
DP-055	DP-055-SO-100-01	8100	1	4.6	0	9.1	1	72	1	0.6	1	0.93	0	15	1	15	1	17	1	13000	1
DP-065	DP-065-SO-010-01	9800	1	4.3	0	2.5	1	71	1	0.55	1	0.15	1	16	1	8.5	1	14	1	21000	1
DP-065	DP-065-SO-050-01	5300	1	4.6	0	0.35	1	87	1	0.59	1	0.1	1	9.3	1	6.8	1	8.1	1	20000	1
DP-065	DP-065-SO-100-01	9800	1	4.7	0	0.96	1	88	1	0.82	1	0.94	0	15	1	13	1	7.4	1	15000	1
DP-079	DP-079-SO-010-01																				
DP-079	DP-079-SO-050-01																				
DP-080	DP-080-SO-010-01																				
DP-080	DP-080-SO-010-02																				
DP-080	DP-080-SO-050-01																				
DP-081	DP-081-SO-010-01																				
DP-081	DP-081-SO-050-01																				
DP-082	DP-082-SO-010-01																				
DP-082	DP-082-SO-050-01																				
DP-083	DP-083-SO-010-01																				
DP-083	DP-083-SO-050-01																				
DP-084	DP-084-SO-010-01																				
DP-085	DP-085-SO-010-01																				
DP-085	DP-085-SO-050-01																				
DP-086	DP-086-SO-010-01																				
DP-086	DP-086-SO-010-02																				
DP-086	DP-086-SO-050-01																				
DP-087	DP-087-SO-010-01																				
DP-087	DP-087-SO-050-01																				
DP-088	DP-088-SO-010-01																				
DP-088	DP-088-SO-050-01																				
DP-095	DP-095-SO-010-01	8600	1	4.3	0	4	1	63	1	0.43	1	0.85	0	14	1	6.6	1	15	1	16000	1
DP-095	DP-095-SO-050-01	8400	1	4.4	0	4	1	64	1	0.52	1	0.88	0	13	1	6.1	1	12	1	16000	1
DP-095	DP-095-SO-100-01	9900	1	4.5	0	5.4	1	83	1	0.79	1	0.9	0	16	1	8.6	1	15	1	46000	1
DP-096	DP-096-SO-010-01	10000	1	4.2	0	7.3	1	63	1	0.53	1	0.84	0	16	1	7.8	1	17	1	21000	1
DP-096	DP-096-SO-010-02	9100	1	4.1	0	5.8	1	65	1	0.55	1	0.82	0	16	1	8.3	1	15	1	17000	1
DP-096	DP-096-SO-050-01	8300	1	4.4	0	3.8	1	59	1	0.63	1	0.88	0	15	1	9.3	1	16	1	16000	1
DP-096	DP-096-SO-100-01	7000	1	4.5	0	9.9	1	80	1	0.49	1	0.9	0	12	1	7	1	18	1	16000	1
DP-097	DP-097-SO-010-01	7600	1	4.3	0	5.5	1	57	1	0.46	1	0.85	0	16	1	6.6	1	16	1	18000	1
DP-097	DP-097-SO-050-01	8800	1	4.5	0	6.4	1	58	1	0.53	1	0.9	0	15	1	7.4	1	18	1	19000	1
DP-097	DP-097-SO-100-01	9200	1	4.8	0	15	1	76	1	0.63	1	0.09	1	34	1	15	1	60	1	40000	1
DP-098	DP-098-SO-010-01	6100	1	4	0	3.9	1	41	1	0.31	1	0.81	0	13	1	4.2	1	12	1	10000	1
DP-098	DP-098-SO-050-01	7000	1	4.4	0	4.1	1	69	1	0.7	1	0.09	1	13	1	11	1	22	1	12000	1
DP-098	DP-098-SO-100-01	9000	1	4.6	0	5.3	1	80	1	0.58	1	0.93	0	16	1	9.2	1	15	1	18000	1
DP-099	DP-099-SO-010-01	11000	1	4.5	0	6.7	1	64	1	0.43	1	0.89	0	14	1	6.8	1	16	1	19000	1
DP-099	DP-099-SO-050-01	6300	1	4.4	0	5	1	95	1	0.52	1	0.88	0	12	1	7.4	1	16	1	14000	1
DP-099	DP-099-SO-100-01	8800	1	4.4	0	4.8	1	85	1	0.49	1	0.88	0	15	1	7.3	1	11	1	19000	1
DP-118	DP-118-SO-010-01	5200	1	4.2	0	2.8	1	32	1	0.22	1	0.84	0	17	1	3.8	1	10	1	11000	1
DP-118	DP-118-SO-010-02	6100	1	4.5	0	2.2	1	130	1	0.24	1	0.9	0	16	1	3.4	1	11	1	9400	1
DP-118	DP-118-SO-050-01	7400	1	4.5	0	3.7	1	51	1	0.67	1	0.9	0	14	1	6.7	1	14	1	21000	1
DP-118	DP-118-SO-100-01	8200	1	4.6	0	4.5	1	62	1	0.59	1	0.92	0	13	1	8.8	1	12	1	22000	1
DP-119	DP-119-SO-010-01	7000	1	4.1	0	6.3	1	44	1	0.23	1	0.81	0	24	1	6.5	1	14	1	12000	1
DP-119	DP-119-SO-050-01	6900	1	4.5	0	3.8	1	150	1	0.59	1	0.91	0	12	1	7.1	1	320	1	13000	1
DP-119	DP-119-SO-100-01	3700	1	2.8	1	6.1	1	32	1	0.32	1	0.88	0	8.4	1	5.8	1	16	1	19000	1
DP-120	DP-120-SO-010-01	4000	1	4.1	0	2	1	9.9	1	0.14	1	0.82	0	10	1	1	1	4	1	9200	1
DP-120	DP-120-SO-050-01	7500	1	4.6	0	5.5	1	150	1	0.6	1	0.76	1	13	1	6.7	1	16	1	24000	1
DP-120	DP-120-SO-100-01	7900	1	4.8	0	8	1	78	1	0.57	1	0.96	0	15	1	7.3	1	13	1	24000	1
DP-121	DP-121-SO-010-01	2200	1	4.1	0	1.7	1	6.2	1	0.13	1	0.82	0	6.1	1	0.6	1	2.9	1	9000	1
DP-121	DP-121-SO-050-01	6800	1	4.4	0	2.9	1	77	1	0.53	1	0.89	0	11	1	6.3	1	12	1	16000	1
DP-121	DP-121-SO-100-01	6700	1	4.5	0	3	1	58	1	0.49	1	0.9	0	11	1	6.5	1	12	1	14000	1
DP-122	DP-122-SO-010-01	2600	1	4.2	0	0.84	1	8.3	1	0.32	1	0.84	0	19	1	1.5	1	4.2	1	16000	1
DP-122	DP-122-SO-050-01	7700	1	4.6	0	2.4	1	130	1	0.57	1	0.92	0	16	1	8.1	1	17	1	19000	1

sys_loc_code	sys_sample_code	Aluminum	D_Aluminur	Antimony	D_Antimon	Arsenic	D_Arsenic	Barium	D_Barium	Beryllium	D_Beryllium	Cadmium	D_Cadmiun	Chromium	D_Chromiur	Cobalt	D_Cobalt	Copper	D_Copper	Iron	D_Iron
DP-122	DP-122-SO-100-01	7500	1	4.5	0	1.1	1	67	1	0.54	1	0.91	0	17	1	7.8	1	14	1	18000	1
DP-123	DP-123-SO-010-01	3800	1	4.3	0	2	1	12	1	0.57	1	0.86	0	29	1	2.3	1	6.3	1	24000	1
DP-123	DP-123-SO-050-01	6300	1	4.4	0	12	1	160	1	0.61	1	0.68	1	80	1	11	1	52	1	17000	1
DP-123	DP-123-SO-100-01	7700	1	4.6	0	1.3	1	71	1	0.6	1	0.93	0	16	1	7.2	1	16	1	17000	1
DP-124	DP-124-SO-010-01	4900	1	4.3	0	1.6	1	28	1	0.16	1	0.86	0	22	1	4.5	1	18	1	12000	1
DP-124	DP-124-SO-050-01	5600	1	4.5	0	1.6	1	140	1	0.39	1	0.9	0	12	1	5.2	1	13	1	11000	1
DP-124	DP-124-SO-100-01	8100	1	4.7	0	0.94	0	61	1	0.62	1	0.94	0	16	1	8.4	1	15	1	17000	1
DP-125	DP-125-SO-010-01	4200	1	4.2	0	0.17	1	47	1	0.14	1	0.84	0	15	1	2.7	1	10	1	8100	1
DP-125	DP-125-SO-050-01	7000	1	4.8	0	0.29	1	120	1	0.6	1	0.96	0	14	1	8.2	1	16	1	16000	1
DP-125	DP-125-SO-100-01	10000	1	4.7	0	0.94	0	95	1	0.83	1	0.94	0	18	1	8.6	1	16	1	21000	1
DP-125	DP-125-SO-100-02	6200	1	4.7	0	0.93	0	70	1	0.58	1	0.93	0	13	1	7.6	1	12	1	17000	1
DP-126	DP-126-SO-010-01	5100	1	4.5	0	1.2	1	40	1	0.15	1	0.9	0	27	1	5.2	1	11	1	8300	1
DP-126	DP-126-SO-050-01	6200	1	4.2	0	7.4	1	56	1	0.47	1	0.85	0	13	1	5.8	1	8.8	1	18000	1
DP-126	DP-126-SO-100-01	6400	1	4.5	0	0.91	0	74	1	0.51	1	0.91	0	15	1	9.2	1	15	1	15000	1
DP-127	DP-127-SO-010-01	7600	1	4.3	0	2.8	1	34	1	0.19	1	0.86	0	26	1	6.8	1	35	1	16000	1
DP-127	DP-127-SO-050-01	9000	1	4.4	0	0.88	0	70	1	0.39	1	0.88	0	43	1	7.1	1	21	1	14000	1
DP-127	DP-127-SO-100-01	10000	1	4.7	0	0.67	1	29	1	0.23	1	0.95	0	14	1	3.2	1	12	1	24000	1
DP-128	DP-128-SO-010-01	5700	1	4.2	0	9.7	1	34	1	0.25	1	0.09	1	26	1	5.7	1	24	1	16000	1
DP-128	DP-128-SO-050-01	7200	1	4.4	0	0.94	1	43	1	0.3	1	0.87	0	10	1	5.2	1	12	1	19000	1
DP-128	DP-128-SO-100-01	5800	1	4.6	0	0.93	0	54	1	0.52	1	0.93	0	14	1	6.9	1	14	1	14000	1
DP-129	DP-129-SO-010-01	9700	1	4.4	0	1.3	1	40	1	0.29	1	0.88	0	17	1	3.2	1	6	1	14000	1
DP-129	DP-129-SO-050-01	6200	1	4.6	0	5.9	1	91	1	0.56	1	0.91	0	14	1	8.2	1	17	1	15000	1
DP-129	DP-129-SO-100-01	8500	1	4.6	0	0.92	0	70	1	0.64	1	0.92	0	18	1	9.5	1	16	1	19000	1
DP-130	DP-130-SO-010-01	6000	1	4.4	0	1.4	1	51	1	0.43	1	0.88	0	23	1	7.7	1	17	1	20000	1
DP-130	DP-130-SO-050-01	3700	1	4.3	0	0.94	1	16	1	0.16	1	0.87	0	13	1	1.4	1	6.2	1	12000	1
DP-130	DP-130-SO-100-01	7900	1	4.8	0	0.95	0	72	1	0.66	1	0.95	0	16	1	7.7	1	16	1	19000	1
DP-131	DP-131-SO-010-01	5000	1	4	0	0.8	0	9.2	1	0.4	0	0.8	0	11	1	6.6	1	53	1	10000	1
DP-131	DP-131-SO-050-01	4100	1	4.5	0	4.3	1	20	1	0.22	1	0.9	0	26	1	6.4	1	19	1	13000	1
DP-131	DP-131-SO-100-01	7600	1	4.5	0	0.89	0	66	1	0.6	1	0.89	0	16	1	8.1	1	14	1	19000	1
DP-132	DP-132-SO-010-01	5400	1	4.2	0	1.8	1	44	1	0.26	1	0.14	1	12	1	4.1	1	19	1	12000	1
DP-132	DP-132-SO-050-01	4300	1	4.3	0	0.39	1	28	1	0.29	1	0.86	0	10	1	3.2	1	7.5	1	11000	1
DP-132	DP-132-SO-100-01	9600	1	4.7	0	0.79	1	59	1	0.54	1	0.94	0	19	1	7.3	1	12	1	20000	1
DP-133	DP-133-SO-010-01	7400	1	4.4	0	15	1	29	1	0.44	0	0.89	0	16	1	7.5	1	49	1	19000	1
DP-133	DP-133-SO-050-01	12000	1	4.7	0	12	1	52	1	0.74	1	0.94	0	19	1	8.4	1	15	1	25000	1
DP-133	DP-133-SO-100-01	10000	1	4.6	0	11	1	56	1	0.66	1	0.93	0	14	1	15	1	14	1	22000	1
DP-133	DP-133-SO-100-02	10000	1	4.6	0	10	1	56	1	0.63	1	0.92	0	15	1	11	1	14	1	21000	1
DP-134	DP-134-SO-010-01	7900	1	4.3	0	9.5	1	57	1	0.32	1	0.1	1	47	1	8.6	1	20	1	15000	1
DP-134	DP-134-SO-050-01	7200	1	4.4	0	5.7	1	54	1	0.34	1	0.09	1	26	1	5.3	1	15	1	10000	1
DP-134	DP-134-SO-100-01	13000	1	4.7	0	15	1	66	1	0.67	1	0.95	0	20	1	10	1	15	1	29000	1
DP-135	DP-135-SO-010-01	6900	1	4.5	0	11	1	53	1	0.36	1	0.12	1	46	1	8.3	1	12	1	21000	1
DP-135	DP-135-SO-050-01	8600	1	4.4	0	5.3	1	75	1	0.45	1	0.07	1	30	1	4.4	1	11	1	9400	1
DP-137	DP-137-SO-010-01	5300	1	4.4	0	5.8	1	13	1	0.44	0	0.87	0	12	1	4.2	1	26	1	10000	1
DP-137	DP-137-SO-050-01	9400	1	0.86	1	7.1	1	150	1	0.55	1	0.91	0	19	1	7.6	1	30	1	19000	1
DP-137	DP-137-SO-100-01	13000	1	4.7	0	5.6	1	350	1	0.68	1	0.95	0	19	1	6.5	1	14	1	23000	1
DP-138	DP-138-SO-010-01	7100	1	1.4	1	3.8	1	42	1	0.36	1	0.84	0	14	1	7.2	1	15	1	17000	1
DP-138	DP-138-SO-050-01	6800	1	4.7	0	8.9	1	63	1	0.68	1	0.08	1	14	1	9.1	1	14	1	16000	1
DP-138	DP-138-SO-100-01	3400	1	2.7	1	7	1	45	1	0.24	1	0.08	1	11	1	4.6	1	11	1	9400	1
DP-139	DP-139-SO-010-01	3800	1	4.4	0	2.9	1	7.4	1	0.44	0	0.87	0	7.2	1	1.7	0	2	1	6000	1
DP-139	DP-139-SO-050-01	6700	1	1.2	1	10	1	62	1	0.54	1	0.38	1	14	1	7.6	1	23	1	18000	1
DP-139	DP-139-SO-100-01	6700	1	2.1	1	11	1	91	1	0.49	1	0.3	1	15	1	8.1	1	47	1	18000	1
DP-139	DP-139-SO-100-02	8200	1	4	1	14	1	92	1	0.6	1	0.34	1	19	1	7.3	1	54	1	24000	1
DP-140	DP-140-SO-010-01	3800	1	4.3	0	5.7	1	10	1	0.43	0	0.86	0	10	1	3	1	5.5	1	11000	1
DP-140	DP-140-SO-050-01	7000	1	1	1	47	1	150	1	1.2	1	0.23	1	14	1	8.5	1	48	1	20000	1
DP-140	DP-140-SO-100-01	3600	1	10	1	33	1	310	1	0.53	1	7.6	1	16	1	4.7	1	75	1	33000	1
DP-141	DP-141-SO-010-01	7200	1	4.3	0	8.6	1	100	1	0.59	1	0.28	1	15	1	7.9	1	28	1	15000	1
DP-141	DP-141-SO-050-01	9300	1	4.5	0	10	1	90	1	0.7	1	0.16	1	15	1	6.4	1	14	1	18000	1
DP-141	DP-141-SO-100-01	3400	1	0.79	1	6.4	1	120	1	0.27	1	0.24	1	7.9	1	3.6	1	18	1	8500	1
DP-151	DP-151-SO-010-01	6200	1	4.8	0	5.9	1	38	1	0.38	1	0.96	0	11	1	5.7	1	10	1	14000	1
DP-151	DP-151-SO-050-01	7700	1	4.9	0	6.2	1	67	1	0.59	1	0.98	0	16	1	13	1	12	1	19000	1
DP-151	DP-151-SO-100-01	7900	1	1.1	1	15	1	340	1	0.66	1	0.91	0	26	1	7.8	1	89	1	28000	1
DP-152	DP-152-SO-010-01	16000	1	4.6	0	9.2	1	60	1	0.59	1	0.93	0	22	1	11	1	14	1	28000	1
DP-152	DP-152-SO-050-01	15000	1	4.6	0	9.2	1	65	1	0.59	1	0.92	0	19	1	9.7	1	16	1	27000	1

sys_loc_code	sys_sample_code	Aluminum	D_Aluminur	Antimony	D_Antimon	Arsenic	D_Arsenic	Barium	D_Barium	Beryllium	D_Beryllium	Cadmium	D_Cadmiun	Chromium	D_Chromiur	Cobalt	D_Cobalt	Copper	D_Copper	Iron	D_Iron
DP-152	DP-152-SO-100-01	9500	1	4.4	0	5.9	1	30	1	0.52	1	4.4	0	18	1	8	1	20	1	38000	1
DP-153	DP-153-SO-010-01	6800	1	4.7	0	5.5	1	27	1	0.52	1	0.94	0	12	1	7.6	1	12	1	16000	1
DP-153	DP-153-SO-050-01	3800	1	12	1	8.9	1	250	1	0.17	1	1.6	1	53	1	8.1	1	290	1	43000	1
DP-153	DP-153-SO-100-01	11000	1	6.1	0	14	1	380	1	0.76	1	1.2	0	34	1	10	1	95	1	27000	1
DP-154	DP-154-SO-010-01	5900	1	20	1	22	1	330	1	0.23	1	6.2	1	400	1	24	1	1000	1	330000	1
DP-154	DP-154-SO-050-01	3400	1	18	1	35	1	200	1	0.13	1	62	1	190	1	18	1	14000	1	250000	1
DP-154	DP-154-SO-100-01	4900	1	0.91	1	3.7	1	74	1	0.24	1	0.56	1	12	1	7.4	1	32	1	12000	1
DP-155	DP-155-SO-010-01	5800	1	7.9	1	15	1	190	1	0.1	1	5.7	1	240	1	14	1	910	1	220000	1
DP-155	DP-155-SO-050-01	7200	1	44	1	11	1	330	1	0.25	1	14	1	160	1	13	1	440	1	64000	1
DP-155	DP-155-SO-100-01	14000	1	4.6	0	7.2	1	67	1	0.49	1	0.92	0	19	1	9.1	1	13	1	24000	1
DP-156	DP-156-SO-010-01	7600	1	3.2	1	7.1	1	100	1	0.35	1	0.21	1	13	1	6.2	1	37	1	11000	1
DP-156	DP-156-SO-050-01	12000	1	5.2	0	5.3	1	77	1	0.46	1	0.16	1	16	1	8.7	1	13	1	19000	1
DP-156	DP-156-SO-050-02	6400	1	4.9	0	4.7	1	77	1	0.38	1	0.98	0	12	1	6.8	1	11	1	17000	1
DP-156	DP-156-SO-100-01	9200	1	1.3	1	9.9	1	150	1	0.63	1	0.26	1	12	1	8.7	1	91	1	8200	1
DP-156	DP-156-SO-100-02	2800	1	5.2	0	5.2	1	110	1	0.23	1	1	0	4.8	1	4.1	1	18	1	3000	1
DP-157	DP-157-SO-010-01	14000	1	4.5	0	7	1	45	1	0.49	1	0.9	0	15	1	9.3	1	16	1	22000	1
DP-157	DP-157-SO-050-01	9100	1	4.7	0	4.2	1	35	1	0.26	1	0.93	0	11	1	5.1	1	57	1	12000	1
DP-157	DP-157-SO-100-01	7800	1	4.7	0	5.9	1	63	1	0.34	1	0.94	0	13	1	6.1	1	11	1	21000	1
DP-158	DP-158-SO-010-01	7600	1	54	1	29	1	730	1	0.47	1	93	1	350	1	130	1	1900	1	210000	1
DP-158	DP-158-SO-050-01	7100	1	6.1	1	26	1	300	1	0.27	1	8.4	1	120	1	15	1	2700	1	130000	1
DP-158	DP-158-SO-100-01	9000	1	4.6	0	9	1	52	1	0.4	1	0.92	0	20	1	8.1	1	420	1	24000	1
DP-160	DP-160-SO-010-01	10000	1	4.8	0	2.3	1	56	1	0.75	1	0.96	0	52	1	16	1	28	1	23000	1
DP-160	DP-160-SO-050-01	9600	1	5	0	2.4	1	48	1	0.72	1	1	0	44	1	17	1	29	1	22000	1
DP-160	DP-160-SO-100-01	7800	1	1.2	1	6.6	1	97	1	0.42	1	0.21	1	13	1	7.5	1	15	1	16000	1
DP-161	DP-161-SO-010-01	10000	1	5	0	3.5	1	62	1	0.84	1	1	0	45	1	19	1	38	1	26000	1
DP-161	DP-161-SO-050-01	8300	1	5	0	2.4	1	45	1	0.64	1	1	0	37	1	18	1	27	1	21000	1
DP-161	DP-161-SO-100-01	7500	1	1.2	1	9.8	1	110	1	0.37	1	0.28	1	16	1	9.1	1	30	1	25000	1
DP-162	DP-162-SO-010-01	7800	1	4.9	0	3.5	1	68	1	0.56	1	0.44	1	24	1	9	1	40	1	13000	1
DP-162	DP-162-SO-050-01	10000	1	1.3	1	4.8	1	73	1	0.53	1	0.94	0	20	1	8.7	1	12	1	14000	1
DP-162	DP-162-SO-100-01	6800	1	0.78	1	4.4	1	53	1	0.34	1	0.95	0	12	1	5.8	1	11	1	14000	1
DP-163	DP-163-SO-010-01	4400	1	2.5	1	9.3	1	92	1	0.27	1	0.83	1	13	1	7.6	1	46	1	15000	1
DP-163	DP-163-SO-010-02	2500	1	0.78	1	6	1	59	1	0.18	1	0.32	1	7	1	3.5	1	30	1	8300	1
DP-163	DP-163-SO-050-01	4700	1	11	1	16	1	150	1	0.28	1	1.5	1	14	1	11	1	120	1	19000	1
DP-163	DP-163-SO-050-02	6300	1	4.7	0	6.8	1	69	1	0.33	1	0.94	0	13	1	6.7	1	20	1	15000	1
DP-163	DP-163-SO-100-01	5900	1	1.7	1	22	1	140	1	0.43	1	3.1	1	16	1	8.4	1	74	1	13000	1
GSS-603-800-3	GSS-603-800-3-1	4470	1	0.62	0	9.6	1	150	1	0.48	1	0.39	1	7.9	1	4.1	1	50	1	2980	1
GSS-603-800-3	GSS-603-800-3-2	3420	1	2.4	1	17.6	1	126	1	0.24	1	0.54	1	13.9	1	5.4	1	67.4	1	19800	1
GTW-605-7-1	GTW-605-7-1-1,2,3																				
GTW-605-7-2	GTW-605-7-2-1,2,3,4																				
GTW-605-7-2	GTW-605-7-2-5					8.2	1	77.2	1			0.26	1	15.1	1						
GTW-605-802-10	GTW-605-802-10-1	8420	1	16.9	1	7.6	1	159	1	0.083	1	4.8	1	47.7	1	11.2	1	662	1	37100	1
GTW-605-802-2	GTW-605-802-2-1	7360	1	0.45	0	7.1	1	68.3	1	0.87	1	0.09	0	9.1	1	20.4	1	7	1	16000	1
GTW-605-802-6	GTW-605-802-6-1	3030	1	1.1	1	12.7	1	106	1	0.42	1	0.18	1	6	1	3.3	1	55.3	1	7130	1
GTW-605-802-7	GTW-605-802-7-1	4400	1	2.4	1	3.9	1	53.2	1	0.91	1	0.25	1	9.8	1	3.9	1	53.1	1	14700	1
GTW-605-802-9	GTW-605-802-9-1	4860	1	3.2	1	14.8	1	246	1	0.37	1	2.1	1	19.4	1	5.8	1	104	1	24100	1
GTW-607-13-1	GTW607-13-1-3			0.49	0	7.1	1			0.78	1	0.39	1	18.2	1			18.9	1		
GTW-607-13-2	GTW607-13-2-2			0.54	0	4.8	1			0.5	1	0.11	0	10.3	1			37.9	1		
GTW-661-24-1	GTW661-24-1-4																				
WSP_SB-1	WSP_SB-1_011711_7-9					12.7	1	1100	1			1.3	1	10.9	1						
WSP_SB-2	WSP_SB-2_011711_7-9					12.9	1	299	1			0.67	0	16.9	1						
WSP_SB-3	WSP_SB-3_011711_8-10					6.3	1	73.5	1			0.59	0	32	1						
WSP_SB-4	WSP_SB-4_011711_7-9					6.7	1	109	1			0.71	1	19.1	1						

Lead	D_Lead	Magnesium	_Magnesiu	Manganese	_Manganes	Mercury	D_Mercury	Nickel	D_Nickel	Selenium	D_Seleniun	Silver	D_Silver	Vanadium	D_Vanadiun	Zinc	D_Zinc	ated biphe	inated biphenyls (PCBs)
10.9	1																		
140	1																		
1450	1	2300	1	323	1	0.6	1	119	1	0.7	0	0.45	1	18.1	1	470	1		
1690	1	1740	1	320	1	1.6	1	13	1	0.95	0	0.44	1	19	1	418	1		
320	1	4800	1	350	1	0.61	1	44	1	1.8	0	0.23	1	23	1	340	1	0.178	1
360	1	3000	1	350	1	1.1	1	10	1	0.51	1	0.38	1	19	1	390	1	0.0428	0
13	1	1500	1	130	1	0.1	1	9.2	1	2	0	1	0	41	1	33	1		
38	1	340	1	34	1	0.03	1	2.1	1	1.7	0	0.86	0	14	1	18	1	0.037	0
280	1	2000	1	180	1	3.5	1	8.6	1	1.9	0	0.3	1	21	1	130	1	0.0685	1
160	1	3300	1	220	1	0.44	1	22	1	1.8	0	0.9	0	25	1	140	1	0.00722	1
150	1	3500	1	310	1	1.7	1	16	1	0.34	1	1	0	13	1	200	1	0.145	1
480	1	1200	1	380	1	0.79	1	8.7	1	0.45	1	0.5	1	21	1	260	1		
860	1	1500	1	240	1	2.7	1	11	1	1.2	1	1.7	1	24	1	480	1		
50	1	3000	1	130	1	0.19	1	15	1	0.32	1	0.88	0	25	1	74	1		
0.86	1	370	1	34	1	0.02	1	1.5	1	0.31	1	0.85	0	14	1	15	1		
2500	1	1300	1	350	1	4	1	16	1	1.9	1	1.8	1	24	1	2300	1		
110	1	770	1	89	1	0.8	1	8.3	1	0.61	1	0.96	0	20	1	210	1		
49	1	14000	1	210	1	0.068	1	140	1	1.8	0	0.88	0	18	1	55	1		
1300	1	1400	1	350	1	2.5	1	15	1	0.98	1	3.2	1	17	1	610	1		
53	1	1300	1	370	1	0.56	1	10	1	0.31	1	0.93	0	24	1	45	1		
180	1	1000	1	140	1	0.32	1	6.2	1	0.53	1	0.92	0	22	1	77	1	0.0389	0
270	1	1300	1	220	1	0.65	1	12	1	0.49	1	0.92	0	26	1	170	1		
700	1	810	1	220	1	2.5	1	13	1	1.4	1	2.7	1	20	1	390	1	0.0432	0
120	1	1100	1	500	1	0.79	1	10	1	0.59	1	0.98	0	30	1	340	1		
110	1	2100	1	170	1	0.29	1	14	1	0.41	1	0.91	0	21	1	82	1		
720	1	1000	1	240	1	2.1	1	13	1	0.64	1	3.5	1	21	1	330	1		
440	1	1100	1	200	1	2.7	1	9.8	1	0.72	1	1.1	1	20	1	260	1		
140	1	880	1	190	1	0.51	1	9	1	0.64	1	1	0	34	1	140	1		
1.8	1	480	1	38	1	0.04	1	4.1	1	1.7	0	0.87	0	20	1	11	1	0.0368	0
660	1	1000	1	250	1	1.2	1	16	1	0.64	1	0.42	1	20	1	620	1	0.0418	0
21	1	1400	1	360	1	0.11	1	11	1	0.37	1	0.98	0	25	1	54	1		
260	1	1800	1	160	1	0.48	1	25	1	0.62	1	0.88	0	31	1	170	1		
1800	1	1100	1	380	1	4.1	1	15	1	2.6	1	2.6	1	16	1	910	1		
13	1	1600	1	210	1	0.13	1	9.8	1	0.46	1	0.98	0	47	1	35	1		
420	1	2000	1	300	1	0.83	1	8.2	1	0.52	1	0.28	1	20	1	200	1		
450	1	620	1	190	1	7.1	1	12	1	0.57	1	0.34	1	18	1	720	1		
35	1	1000	1	400	1	0.08	1	8.4	1	0.46	1	1	0	32	1	31	1		
200	1	3100	1	360	1	0.32	1	10	1	1.8	0	0.22	1	30	1	180	1		
18	1	1000	1	57	1	0.02	1	5.1	1	1.8	0	0.89	0	18	1	40	1		
93	1	1200	1	280	1	0.33	1	5.4	1	0.5	1	0.98	0	28	1	36	1		
3200	1	2000	1	530	1	1	1	13	1	0.73	1	0.47	1	23	1	430	1		
19	1	890	1	64	1	0.067	1	3.9	1	1.8	0	0.9	0	17	1	16	1		
14	1	1400	1	180	1	0.11	1	9.8	1	2	0	1	0	42	1	35	1		
280	1	1000	1	340	1	0.65	1	9.4	1	0.51	1	0.34	1	17	1	240	1		
54	1	1800	1	120	1	0.58	1	7.9	1	0.32	1	0.94	0	18	1	70	1		
770	1	1100	1	1000	1	2	1	17	1	0.98	1	0.61	1	25	1	580	1		
850	1	2100	1	420	1	1.1	1	12	1	0.95	1	0.76	1	25	1	470	1		
380	1	1200	1	370	1	1.1	1	12	1	0.33	1	0.42	1	28	1	260	1		
16	1	1100	1	470	1	0.17	1	8.5	1	2	0	1	0	37	1	30	1		
990	1	1800	1	300	1	0.98	1	20	1	0.94	1	0.56	1	27	1	540	1		
1000	1	1000	1	360	1	2.2	1	22	1	3.4	1	0.54	1	20	1	850	1		
8.4	1	1100	1	400	1	0.04	1	9.1	1	2.1	0	1	0	39	1	32	1		
190	1	1500	1	170	1	0.83	1	12	1	1.8	0	0.88	0	20	1	140	1		
38	1	790	1	66	1	0.43	1	4.1	1	1.8	0	0.92	0	17	1	79	1		
23	1	840	1	260	1	0.05	1	7.1	1	0.32	1	1	0	30	1	26	1		
1300	1	2000	1	290	1	14	1	20	1	1.8	0	0.61	1	21	1	780	1		
860	1	1300	1	380	1	1.9	1	13	1	1.8	0	2.4	1	24	1	810	1		
42	1	810	1	200	1	0.06	1	7.3	1	1.9	0	0.96	0	26	1	37	1		
16	1	1100	1	310	1	0.04	1	9.1	1	2	0	0.99	0	34	1	37	1		
120	1	5700	1	170	1	0.37	1	54	1	1.8	0	0.89	0	22	1	120	1		
1500	1	1400	1	380	1	2.8	1	27	1	1.3	1	1.2	0	31	1	890	1		
17	1	2000	1	170	1	0.07	1	15	1	1.9	0	0.96	0	36	1	45	1		

Lead	D_Lead	Magnesium	_Magnesiu	Manganese	_Manganes	Mercury	D_Mercury	Nickel	D_Nickel	Selenium	D_Selenium	Silver	D_Silver	Vanadium	D_Vanadium	Zinc	D_Zinc	ated biphe	inated biphenyls (PCBs)
270	1	2000	1	200	1	0.56	1	13	1	1.7	0	0.86	0	25	1	160	1	0.00581	1
7900	1	1800	1	570	1	12	1	20	1	2	0	3.3	1	29	1	1100	1	0.0427	0
460	1	630	1	270	1	1	1	8.9	1	5.2	1	0.3	1	18	1	670	1		
27	1	240	1	39	1	0.13	1	2	1	1.7	0	0.86	0	8.8	1	18	1		
56	1	1400	1	370	1	0.36	1	7.7	1	1.6	1	1.2	0	15	1	270	1		
360	1	960	1	170	1	0.16	1	7.8	1	0.42	1	0.45	1	19	1	320	1	0.0377	0
170	1	690	1	130	1	1.2	1	6.3	1	1.7	0	0.87	0	25	1	190	1		
320	1	1100	1	120	1	5.7	1	12	1	0.87	1	0.49	1	18	1	250	1	0.429	1
570	1	3000	1	240	1	1.3	1	30	1	1.8	0	0.47	1	28	1	400	1	0.0182	1
150	1	1400	1	420	1	0.74	1	9.2	1	0.4	1	0.28	1	18	1	170	1	0.274	1
34	1	1300	1	280	1	0.05	1	9.6	1	1.8	0	0.91	0	30	1	54	1		
55	1	960	1	1100	1	0.29	1	8.6	1	0.34	1	1	0	31	1	40	1		
220	1	2500	1	150	1	0.31	1	20	1	1.8	0	0.91	0	29	1	220	1		
36	1	1800	1	170	1	0.12	1	11	1	2.5	0	1.2	0	34	1	56	1		
230	1	2800	1	190	1	0.11	1	24	1	1.7	0	0.26	1	24	1	230	1	0.0389	1
21	1	1500	1	150	1	0.04	1	11	1	1.8	0	0.9	0	24	1	37	1	0.0369	0
5.5	1	1100	1	69	1	0.08	0	8.6	1	1.8	0	0.9	0	21	1	29	1	0.0367	0
9.4	1	1100	1	56	1	0.08	0	6.3	1	1.8	0	0.91	0	36	1	24	1	0.0386	0
110	1	3300	1	320	1	0.25	1	7.7	1	1.7	0	0.86	0	24	1	80	1	0.037	0
2400	1	1200	1	320	1	2.9	1	12	1	0.38	1	0.62	1	24	1	240	1	0.0396	0
2400	1	1100	1	300	1	1.2	1	14	1	0.3	1	0.44	1	22	1	380	1		
59	1	870	1	340	1	0.32	1	8.6	1	0.69	1	0.97	0	29	1	50	1	0.0399	0
120	1	2600	1	240	1	0.28	1	8.1	1	1.9	0	0.93	0	22	1	77	1		
700	1	630	1	210	1	0.91	1	18	1	0.48	1	0.46	1	21	1	310	1		
64	1	620	1	110	1	0.13	1	14	1	2.2	0	1.1	0	22	1	120	1		
500	1	970	1	280	1	3.3	1	20	1	0.6	1	0.48	1	37	1	320	1		
150	1	1000	1	260	1	0.26	1	8.8	1	1.9	0	0.94	0	24	1	96	1		
310	1	920	1	290	1	1.2	1	12	1	0.41	1	0.25	1	33	1	140	1		
35	1	910	1	190	1	0.18	1	7.3	1	0.5	1	0.97	0	26	1	32	1		
140	1	1200	1	190	1	0.57	1	8.9	1	0.41	1	0.9	0	21	1	100	1		
140	1	1600	1	310	1	0.18	1	14	1	1.8	0	0.91	0	37	1	100	1	0.0375	0
380	1	720	1	180	1	0.19	1	15	1	0.5	1	1.1	0	31	1	200	1		
400	1	810	1	240	1	0.08	1	17	1	2.1	0	1	0	33	1	310	1	0.0435	0
35	1	920	1	250	1	0.21	1	7.6	1	1.2	1	1	0	27	1	43	1		
230	1	700	1	150	1	0.18	1	9.8	1	1.9	0	0.97	0	17	1	85	1	0.0427	0
23	1	650	1	67	1	0.29	1	2.7	1	0.78	1	0.92	0	53	1	37	1		
120	1	950	1	210	1	0.3	1	9	1	1.7	0	0.85	0	34	1	91	1		
300	1	1400	1	220	1	0.48	1	9.4	1	0.48	1	0.94	0	23	1	130	1		
260	1	2400	1	180	1	0.3	1	13	1	1.8	0	0.9	0	26	1	110	1		
48	1	910	1	890	1	0.19	1	8.9	1	0.31	1	0.96	0	25	1	42	1		
320	1	1100	1	690	1	1.6	1	10	1	2	0	1	0	27	1	170	1		
150	1	1000	1	340	1	0.32	1	10	1	1.8	0	0.88	0	28	1	85	1		
160	1	1500	1	210	1	0.09	1	11	1	1.7	0	0.86	0	24	1	95	1		
300	1	580	1	190	1	0.17	1	17	1	2.1	0	1	0	32	1	160	1		
490	1	660	1	180	1	0.19	1	18	1	2.1	0	1	0	36	1	120	1		
5100	1	690	1	150	1	0.08	1	15	1	2.3	0	1.3	1	40	1	90	1		
240	1	920	1	200	1	0.16	1	13	1	0.4	1	1	0	30	1	110	1		
68	1	1000	1	230	1	0.22	1	7.9	1	1.8	0	0.88	0	34	1	53	1		
160	1	1600	1	290	1	0.21	1	15	1	8.6	0	0.86	0	28	1	98	1	0.0357	0
400	1	640	1	190	1	0.38	1	17	1	2.1	0	1	0	29	1	360	1		
250	1	600	1	220	1	0.05	1	17	1	2	0	0.99	0	25	1	130	1	0.0429	0
60	1	760	1	540	1	0.31	1	7.4	1	1.3	1	0.92	0	27	1	94	1		
100	1	920	1	140	1	0.2	1	10	1	0.92	1	0.97	0	30	1	57	1	0.0412	0
380	1	1200	1	220	1	0.2	1	9.6	1	0.75	1	0.99	0	27	1	100	1	0.0394	0
55	1	800	1	340	1	0.26	1	7.2	1	0.73	1	0.99	0	29	1	52	1	0.04	0
59	1	900	1	240	1	0.12	1	7	1	1.7	0	0.86	0	23	1	66	1		
77	1	1000	1	240	1	0.49	1	8.2	1	1.9	0	0.93	0	29	1	84	1		
2.4	1	2000	1	520	1	0.06	1	15	1	1.8	0	0.92	0	33	1	60	1		
64	1	720	1	390	1	1.3	1	9.2	1	1.8	0	0.88	0	31	1	86	1		
6.6	1	8900	1	290	1	0.06	1	18	1	1.7	0	0.85	0	66	1	69	1		
4.1	0	590	1	100	1	0.07	0	5	1	1.6	0	0.81	0	11	1	15	1		
4.3	0	6900	1	310	1	0.07	0	26	1	1.7	0	0.86	0	28	1	61	1		

Lead	D_Lead	Magnesium	_Magnesiu	Manganese	_Manganes	Mercury	D_Mercury	Nickel	D_Nickel	Selenium	D_Selenium	Silver	D_Silver	Vanadium	D_Vanadium	Zinc	D_Zinc	ated biphe	inated biphenyls (PCBs)
14	1	8900	1	320	1	0.04	1	30	1	1.8	0	0.89	0	34	1	44	1		
10	1	1100	1	92	1	0.03	1	6.8	1	1.7	0	0.86	0	11	1	26	1		
140	1	980	1	210	1	0.6	1	11	1	1.8	0	0.92	0	20	1	120	1		
110	1	920	1	210	1	0.63	1	11	1	1.8	0	0.9	0	21	1	140	1		
4.5	0	610	1	80	1	0.02	1	4.8	1	1.8	0	0.91	0	29	1	22	1		
82	1	850	1	130	1	0.06	1	6.6	1	1.7	0	0.87	0	32	1	44	1		
53	1	1000	1	310	1	0.87	1	10	1	1.9	0	0.93	0	21	1	61	1		
46	1	1000	1	400	1	0.19	1	11	1	1.7	0	0.86	0	22	1	44	1		
8.1	1	510	1	500	1	0.08	0	10	1	1.8	0	0.93	0	13	1	27	1		
22	1	1100	1	1800	1	0.82	1	9.8	1	1.9	0	0.33	1	22	1	29	1		
																		0.0369	0
																		0.0365	0
																		0.0358	0
																		0.0357	0
																		0.0367	0
																		0.039	0
																		0.0355	0
																		0.019	1
																		0.0363	0
																		0.0359	0
																		0.0373	1
																		0.0213	1
																		0.0352	0
																		0.0347	0
																		1.68	1
																		2.46	1
																		0.0373	0
																		0.0271	1
																		0.0112	1
																		0.034	0
																		0.578	1
36	1	1300	1	150	1	0.15	1	9.5	1	1.7	0	0.85	0	23	1	47	1		
30	1	980	1	110	1	0.18	1	7.8	1	1.8	0	0.88	0	22	1	34	1		
4.5	0	2300	1	590	1	0.05	1	13	1	1.8	0	0.9	0	20	1	48	1		
30	1	1500	1	240	1	0.13	1	12	1	1.7	0	0.84	0	26	1	54	1		
22	1	1500	1	220	1	0.08	1	11	1	1.6	0	0.82	0	24	1	48	1		
2.4	1	1800	1	130	1	0.06	1	14	1	1.8	0	0.88	0	22	1	47	1		
130	1	2200	1	290	1	0.1	1	9.2	1	1.8	0	0.9	0	20	1	40	1		
24	1	1400	1	160	1	0.065	1	13	1	1.7	0	0.85	0	22	1	71	1		
26	1	1800	1	220	1	0.13	1	12	1	1.8	0	0.9	0	23	1	64	1		
4.2	1	2400	1	830	1	0.08	0	30	1	1.9	0	0.96	0	28	1	140	1		
22	1	1100	1	100	1	0.04	1	7.8	1	1.6	0	0.81	0	19	1	38	1		
70	1	1100	1	140	1	0.16	1	14	1	1.8	0	0.88	0	20	1	67	1		
16	1	2000	1	120	1	0.06	1	14	1	1.8	0	0.93	0	22	1	54	1		
24	1	1600	1	290	1	0.82	1	10	1	1.8	0	0.89	0	27	1	47	1		
300	1	1000	1	110	1	0.1	1	11	1	1.8	0	0.88	0	19	1	69	1		
4.4	0	1900	1	110	1	0.02	1	13	1	1.8	0	0.88	0	18	1	43	1		
11	1	5000	1	110	1	0.02	1	26	1	0.45	1	0.84	0	23	1	20	1		
14	1	11000	1	150	1	0.03	1	14	1	0.49	1	0.9	0	22	1	56	1		
13	1	1700	1	140	1	0.07	0	11	1	0.44	1	0.9	0	19	1	38	1		
0.75	1	2100	1	220	1	0.03	1	13	1	0.36	1	0.92	0	18	1	40	1		
8.3	1	7800	1	140	1	0.03	1	71	1	0.61	1	0.81	0	22	1	22	1		
180	1	1200	1	160	1	0.43	1	9.8	1	0.29	1	0.91	0	20	1	100	1		
270	1	920	1	260	1	0.07	1	9.7	1	1.8	0	0.18	1	10	1	27	1		
1.7	1	520	1	27	1	0.02	1	2.9	1	1.6	0	0.82	0	15	1	5.7	1		
530	1	1600	1	150	1	1.7	1	10	1	0.42	1	0.92	0	18	1	260	1		
1.6	1	1700	1	160	1	0.03	1	11	1	1.9	0	0.96	0	20	1	36	1		
4.1	0	110	1	22	1	0.02	1	1.5	1	1.6	0	0.82	0	12	1	4.2	1		
230	1	1400	1	220	1	0.23	1	8.6	1	0.56	1	0.89	0	17	1	50	1		
14	1	1700	1	110	1	0.03	1	11	1	1.8	0	0.9	0	16	1	43	1		
4.8	1	130	1	32	1	0.02	1	3.8	1	1.7	0	0.84	0	13	1	9	1		
60	1	2700	1	200	1	0.09	1	12	1	1.8	0	0.92	0	24	1	180	1		

Lead	D_Lead	Magnesium	_Magnesiu	Manganese	_Manganes	Mercury	D_Mercury	Nickel	D_Nickel	Selenium	D_Selenium	Silver	D_Silver	Vanadium	D_Vanadium	Zinc	D_Zinc	ated biphe	inated biphenyls (PCBs)
19	1	2000	1	120	1	0.1	1	13	1	1.8	0	0.91	0	20	1	43	1		
6.6	1	170	1	43	1	0.07	0	5.4	1	1.7	0	0.86	0	19	1	14	1		
140	1	12000	1	170	1	0.29	1	90	1	2.2	1	0.88	0	20	1	270	1		
16	1	2100	1	100	1	0.09	1	14	1	1.9	0	0.93	0	21	1	44	1		
13	1	17000	1	140	1	0.02	1	30	1	1.7	0	0.86	0	34	1	22	1		
520	1	3700	1	190	1	0.73	1	7.4	1	0.3	1	0.9	0	18	1	99	1		
15	1	2200	1	130	1	0.09	1	14	1	0.29	1	0.94	0	21	1	46	1		
13	1	2900	1	73	1	0.02	1	17	1	1.7	0	0.84	0	23	1	13	1		
490	1	1800	1	160	1	0.45	1	12	1	1.9	0	0.96	0	21	1	140	1		
22	1	2900	1	120	1	0.06	1	16	1	1.9	0	0.94	0	24	1	60	1		
32	1	1500	1	250	1	0.02	1	9.7	1	1.9	0	0.93	0	19	1	66	1		
16	1	9000	1	150	1	0.03	1	46	1	1.8	0	0.9	0	23	1	24	1		
28	1	970	1	96	1	0.55	1	6.3	1	0.44	1	0.85	0	21	1	57	1		
31	1	1600	1	110	1	0.12	1	14	1	0.45	1	0.91	0	18	1	44	1		
15	1	7100	1	180	1	0.04	1	33	1	1.7	0	0.86	0	38	1	29	1		
22	1	7800	1	280	1	0.07	1	32	1	1.8	0	0.88	0	32	1	32	1		
13	1	450	1	81	1	0.03	1	5	1	1.9	0	0.95	0	30	1	21	1		
40	1	4600	1	150	1	0.09	1	31	1	0.3	1	0.85	0	34	1	41	1		
21	1	600	1	140	1	0.02	1	6.7	1	0.33	1	0.87	0	24	1	34	1		
22	1	1600	1	110	1	0.22	1	9.2	1	1.9	0	0.93	0	21	1	36	1		
12	1	1300	1	84	1	0.04	1	10	1	0.31	1	0.88	0	24	1	19	1		
64	1	1100	1	260	1	0.22	1	9.6	1	1.8	0	0.91	0	24	1	48	1		
14	1	2600	1	160	1	0.04	1	16	1	1.8	0	0.92	0	23	1	52	1		
73	1	4300	1	200	1	0.17	1	43	1	1.8	0	0.88	0	23	1	62	1		
23	1	510	1	26	1	0.08	1	4.4	1	0.38	1	0.87	0	21	1	13	1		
39	1	1900	1	200	1	0.28	1	12	1	0.38	1	0.95	0	22	1	46	1		
3.7	1	3400	1	93	1	0.07	0	11	1	1.6	0	0.8	0	48	1	18	1		
34	1	6800	1	130	1	0.05	1	55	1	1.8	0	0.9	0	25	1	28	1		
12	1	2200	1	180	1	0.03	1	13	1	0.35	1	0.89	0	20	1	43	1		
77	1	2800	1	140	1	0.12	1	8.5	1	1.7	0	0.85	0	20	1	52	1		
19	1	580	1	64	1	0.04	1	4.7	1	1.7	0	0.86	0	15	1	27	1		
26	1	1300	1	140	1	0.06	1	9.6	1	0.45	1	0.94	0	33	1	33	1		
10	1	4500	1	170	1	0.08	1	15	1	1.8	0	0.89	0	70	1	46	1		
4.7	0	2600	1	250	1	0.02	1	14	1	1.9	0	0.94	0	28	1	49	1		
4.6	0	2200	1	460	1	0.03	1	13	1	1.8	0	0.93	0	24	1	46	1		
4.6	0	2200	1	290	1	0.03	1	13	1	1.8	0	0.92	0	24	1	45	1		
23	1	11000	1	230	1	0.09	1	86	1	1.7	0	0.86	0	35	1	37	1		
21	1	5800	1	200	1	0.09	1	30	1	1.7	0	0.87	0	23	1	30	1		
4.7	0	2000	1	260	1	0.16	1	12	1	1.9	0	0.95	0	32	1	44	1		
15	1	12000	1	210	1	0.06	1	78	1	1.8	0	0.9	0	26	1	34	1		
24	1	7000	1	500	1	0.05	1	19	1	1.8	0	0.88	0	38	1	31	1		
6.2	1	20000	1	150	1	0.04	1	11	1	0.41	1	0.87	0	38	1	26	1		
200	1	1600	1	370	1	1.6	1	12	1	0.38	1	0.91	0	22	1	120	1		
18	1	1600	1	260	1	0.03	1	10	1	0.38	1	0.95	0	29	1	560	1		
40	1	1200	1	200	1	0.51	1	9.1	1	1.7	0	0.84	0	24	1	39	1		
9.2	1	1400	1	140	1	0.12	1	12	1	1.9	0	0.94	0	21	1	42	1		
55	1	1000	1	180	1	0.52	1	6.5	1	1.8	0	0.91	0	16	1	50	1		
1.9	1	120	1	3.9	1	1.1	1	0.56	1	1.7	0	0.87	0	16	1	1.3	1		
140	1	1500	1	180	1	0.47	1	12	1	1.8	0	0.89	0	22	1	72	1		
230	1	1400	1	220	1	1.1	1	14	1	1.8	0	0.91	0	21	1	160	1		
400	1	3600	1	240	1	2.1	1	21	1	1.8	0	0.92	0	30	1	180	1		
1.9	1	450	1	47	1	0.02	1	2.2	1	1.7	0	0.86	0	22	1	7	1		
240	1	940	1	280	1	13	1	14	1	2.5	1	0.9	0	27	1	110	1		
1100	1	580	1	220	1	0.46	1	9.5	1	0.49	1	1	0	16	1	1900	1		
84	1	1300	1	130	1	1.5	1	11	1	1.7	0	0.85	0	24	1	100	1		
38	1	1400	1	190	1	1.6	1	10	1	1.8	0	0.89	0	25	1	69	1		
360	1	510	1	160	1	1.2	1	6.8	1	1.9	0	0.94	0	13	1	130	1		
24	1	830	1	170	1	0.06	1	6.8	1	1.9	0	0.96	0	19	1	33	1	0.0398	0
30	1	830	1	270	1	0.43	1	7.4	1	2	0	0.98	0	27	1	36	1	0.0389	0
750	1	900	1	360	1	8.4	1	12	1	0.29	1	0.46	1	26	1	330	1	0.0378	0
35	1	1800	1	460	1	0.09	1	12	1	1.9	0	0.93	0	34	1	54	1	0.0382	0
790	1	1800	1	360	1	0.08	1	12	1	1.8	0	0.92	0	31	1	52	1	0.037	0

Lead	D_Lead	Magnesium	_Magnesiu	Manganese	_Manganes	Mercury	D_Mercury	Nickel	D_Nickel	Selenium	D_Selenium	Silver	D_Silver	Vanadium	D_Vanadium	Zinc	D_Zinc	ated biphe	inated biphenyls (PCBs)
7.1	1	950	1	160	1	0.14	1	8.9	1	1.8	0	0.88	0	53	1	36	1	0.0375	0
4.1	1	1100	1	230	1	0.04	1	8.2	1	1.9	0	0.94	0	20	1	31	1	0.0385	0
670	1	1700	1	440	1	3.3	1	32	1	0.32	1	1.6	1	26	1	2100	1	1.6	1
1200	1	1600	1	200	1	1	1	16	1	0.94	1	0.31	1	37	1	330	1	0.0528	0
1100	1	5200	1	2500	1	2.6	1	390	1	0.32	1	3.9	1	77	1	3200	1	2	1
3200	1	1900	1	820	1	2.6	1	150	1	0.27	1	0.7	1	20	1	3100	1	5.07	1
180	1	1400	1	180	1	6.3	1	11	1	0.63	1	1	0	14	1	280	1	0.2	1
1400	1	6600	1	2800	1	7.3	1	98	1	1.9	1	0.19	1	100	1	3400	1	0.872	1
2200	1	6700	1	430	1	15	1	53	1	0.78	1	1.3	1	28	1	4500	1	31.8	1
17	1	1700	1	290	1	0.065	1	12	1	1.8	0	0.92	0	29	1	47	1	0.038	0
380	1	950	1	100	1	0.45	1	9	1	0.36	1	0.22	1	20	1	160	1	5.55	1
67	1	1100	1	440	1	0.22	1	9.3	1	0.31	1	1	0	28	1	60	1	0.00641	1
73	1	690	1	370	1	0.23	1	5.8	1	2	0	0.98	0	26	1	50	1	0.0397	0
160	1	480	1	110	1	0.11	1	20	1	2.6	0	1.7	1	29	1	240	1	0.0537	0
27	1	240	1	56	1	0.04	1	8.8	1	2.1	0	1	0	15	1	56	1	0.0428	0
15	1	1600	1	280	1	0.1	1	13	1	0.44	1	0.9	0	24	1	49	1	3.87	1
60	1	590	1	110	1	0.33	1	6.2	1	1.9	0	0.93	0	18	1	44	1	0.0392	0
23	1	1100	1	250	1	0.65	1	8.7	1	1.9	0	0.94	0	19	1	45	1	0.0135	1
5500	1	2500	1	1300	1	23	1	1100	1	6.2	1	2.4	1	41	1	21000	1	0.0819	1
1900	1	3200	1	790	1	2.9	1	93	1	1.8	0	1.8	1	54	1	8800	1	5.77	1
600	1	450	1	280	1	0.37	1	6.3	1	1.8	0	0.92	0	34	1	100	1	0.26	1
9.8	1	3600	1	330	1	0.03	1	20	1	0.34	1	0.96	0	62	1	50	1	0.00473	1
11	1	2900	1	360	1	0.03	1	17	1	0.34	1	1	0	63	1	48	1	2.64	1
260	1	1100	1	270	1	0.16	1	10	1	0.52	1	0.97	0	18	1	700	1	0.407	1
41	1	3200	1	470	1	0.05	1	20	1	0.65	1	1	0	75	1	62	1	0.03	1
12	1	2300	1	420	1	0.03	1	15	1	2	0	1	0	60	1	39	1	0.006	1
140	1	2900	1	420	1	2.4	1	11	1	0.68	1	1.1	0	22	1	190	1	1.41	1
51	1	4300	1	240	1	0.27	1	13	1	1.9	0	0.97	0	27	1	190	1	0.221	1
21	1	2200	1	280	1	0.09	1	21	1	0.5	1	0.94	0	22	1	30	1	0.141	1
93	1	1200	1	170	1	0.08	1	7.9	1	0.66	1	0.95	0	17	1	44	1	0.0577	1
360	1	1000	1	260	1	0.8	1	7.7	1	1.8	0	0.26	1	18	1	370	1	0.0118	1
300	1	850	1	140	1	1.4	1	4.9	1	1.9	0	0.48	1	9.9	1	210	1	0.0381	0
830	1	1000	1	360	1	3	1	9	1	0.45	1	0.52	1	19	1	740	1	0.0375	0
180	1	860	1	320	1	0.41	1	7.9	1	1.9	0	0.94	0	23	1	140	1	0.039	0
230	1	640	1	240	1	1.1	1	25	1	4.2	1	0.61	1	25	1	600	1	0.274	1
79.1	1	345	1	66	1	0.071	1	9.2	1	1.2	0	0.62	0	23	1	148	1	0.214	0
500	1	1160	1	165	1	0.42	1	12.6	1	0.97	0	0.53	1	15.8	1	518	1	0.195	0
																		0.203	0
121	1					0.089	1			0.99	0	0.49	0					0.216	0
1740	1	4460	1	348	1	0.4	1	279	1	0.8	0	1.6	1	890	1	1560	1	4.38	1
14.8	1	672	1	2310	1	0.049	1	6.9	1	0.9	0	0.45	0	22.2	1	19	1	0.223	0
302	1	335	1	73.1	1	0.12	1	8.3	1	1.1	0	0.55	0	13.6	1	76.5	1	0.0399	0
62.1	1	392	1	57.6	1	0.021	1	9.6	1	1.2	0	0.73	1	19.8	1	41.7	1	0.379	0
475	1	1500	1	297	1	0.19	1	15.3	1	1.1	0	0.87	1	21.1	1	371	1	4.29	1
9.4	1					0.03	1	11	1	0.99	0	0.49	0			31.7	1		
170	1					4	1	6.9	1	1.1	0	0.54	0			78.5	1		
																		0.0394	0
273	1					0.36	1	0.36	1	2.2	0	0.55	0					0.036	0
4360	1					0.19	1	0.19	1	2.7	0	0.67	0					0.038	0
81.9	1					0.51	1	0.51	1	2.4	0	0.59	0					0.035	0
217	1					0.52	1	0.52	1	2.5	0	0.63	0					0.3272	1

Naphthalene	d_Naphthalene	Tetrachloroethene	d_Tetrachloroethene	Xylenes	d_Xylenes	Benzo(a)anthracene	d_Benzo(a)anthracene	Benzo(a)pyrene	d_Benzo(a)pyrene	Benzo(b)fluoranthene	d_Benzo(b)fluoranthene
20	0	3.6	1	5.1	1	96	1	76	1	98	1
19.1	0	1.5	0	4.43	0	45	1	44	1	64	1
14	1	0.6	0	3.3	1	42	1	31	1	36	1
10	1	0.141	0	2.07	0	32	1	26	1	32	1
8.9	1	0.12	0	0.91	1	24	1	20	1	25	1
8.3	1	0.07	1	0.657	1	22	1	20	0	20	1
6.6	1	0.061	0	0.12	0	20	0	19.1	0	20	0
6.37	0	0.059	0	0.12	0	19.1	0	17	1	19.1	0
4.9	1	0.0157	0	0.12	0	19	1	16	1	18	1
4.5	1	0.0096	0	0.098	1	18	1	16	1	18	1
4.28	0	0.0074	0	0.09	1	16	1	13	1	16	1
4.18	0	0.0066	0	0.0313	0	16	1	13	1	16	1
4	1	0.0061	0	0.0193	0	14	1	13	1	15	1
3.91	0	0.0059	0	0.0148	0	14	1	12	1	15	1
3.8	1	0.0049	0	0.013	1	14	1	12	1	14	1
3.8	0	0.0043	0	0.0123	0	12	1	11	1	14	1
3.7	0	0.0043	0	0.0117	0	11	1	9.4	1	12	1
3.2	1	0.0043	0	0.0097	0	10	1	8.67	1	10	1
2.9	1	0.003	0	0.0092	0	9.4	1	8.5	1	9.4	1
2.3	0	0.0028	0	0.0086	0	8.62	1	8.4	1	7.66	1
2.22	0	0.0026	1	0.0086	0	8.1	1	7.7	1	7.2	1
2.2	1	0.0016	0	0.0085	0	6.9	1	6.37	0	6.9	1
1.9	0	0.0016	0	0.0085	0	6.37	0	5.5	1	6.4	1
1.9	1	0.0014	1	0.0085	0	6.1	1	5	1	6.4	1
1.9	0	0.0013	0	0.0085	0	6	1	4.9	1	6.37	0
1.8	0	0.0013	0	0.0082	0	5.9	1	4.8	1	6	1
1.8	0	0.0012	0	0.0066	1	5.5	1	4.6	1	5.6	1
1.5	0	0.0012	0	0.0062	0	5.4	1	4.28	0	5.3	1
1.4	1	0.0012	0	0.0056	1	4.9	1	4.2	1	5.3	1
1.3	1	0.0012	0	0.0056	0	4.8	1	4.2	1	5.3	1
1.1	0	0.0012	1	0.0053	1	4.7	1	4.2	1	4.9	1
1.1	0	0.0012	0	0.005	1	4.6	1	4.2	1	4.28	0
1.03	0	0.0012	0	0.0033	0	4.4	1	4.2	1	4.2	1
1	0	0.0012	0	0.0031	0	4.4	1	4.1	1	4.1	1
1	1	0.0012	0	0.003	0	4.3	1	3.91	0	3.91	0
0.97	0	0.0012	0	0.0027	0	4.28	0	3.8	1	3.8	1
0.92	0	0.0012	0	0.0027	0	3.91	0	3.3	1	3.7	1
0.92	1	0.0012	0	0.0026	0	3.9	1	3.2	1	3.6	1
0.85	1	0.0012	0	0.0026	0	3.8	1	3.1	1	3.6	1
0.81	1	0.0012	0	0.0025	0	3.4	1	3	1	3.6	1
0.75	0	0.0012	0	0.0025	0	3.1	1	2.9	1	3.4	1
0.75	0	0.0012	0	0.0025	0	3.1	1	2.8	1	3.3	1
0.74	1	0.0012	0	0.0025	0	3	1	2.8	1	3.3	1
0.73	0	0.0012	0	0.0025	0	3	1	2.7	1	3.2	1
0.73	1	0.0011	0	0.0025	0	2.9	1	2.6	1	3	1
0.71	0	0.0011	0	0.0025	0	2.8	1	2.6	1	3	1
0.7	1	0.0011	0	0.0025	0	2.8	1	2.5	1	3	1
0.65	0	0.0011	0	0.0025	0	2.8	1	2.5	1	2.9	1
0.59	1	0.0011	0	0.0025	0	2.6	1	2.4	1	2.8	1
0.59	1	0.0011	0	0.0025	0	2.6	1	2.3	1	2.8	1
0.51	1	0.0011	0	0.0025	0	2.6	1	2.3	1	2.8	1
0.51	1	0.0011	0	0.0025	0	2.3	1	2.2	1	2.5	1
0.5	0	0.0011	0	0.0024	0	2.3	1	2.2	1	2.5	1
0.5	1	0.001	0	0.0024	0	2.3	1	2.1	1	2.5	1
0.49	1	0.001	0	0.0024	0	2.3	1	2.1	1	2.5	1
0.48	1	0.001	0	0.0024	0	2.2	1	2	1	2.5	1
0.46	1	0.00094	1	0.0024	0	2.1	1	2	1	2.4	1

Naphthalene	d_Naphthalene	Tetrachloroethene	d_Tetrachloroethene	Xylenes	d_Xylenes	Benzo(a)anthracene	d_Benzo(a)anthracene	Benzo(a)pyrene	d_Benzo(a)pyrene	Benzo(b)fluoranthene	d_Benzo(b)fluoranthene
0.45	1	0.00086	1	0.0024	0	2	1	1.9	1	2.4	1
0.43	1	0.00074	1	0.0024	0	2	1	1.9	1	2.4	1
0.43	0	0.00042	1	0.0024	0	2	1	1.8	0	2.2	1
0.42	0	0.00031	1	0.0024	0	1.9	1	1.7	1	2	1
0.42	1			0.0024	0	1.67	1	1.6	1	2	1
0.406	0			0.0024	0	1.6	1	1.5	1	1.9	1
0.398	0			0.0024	0	1.6	1	1.5	1	1.9	1
0.39	0			0.0024	0	1.5	1	1.5	1	1.8	1
0.39	0			0.0024	0	1.5	1	1.5	0	1.8	1
0.39	0			0.0024	0	1.5	1	1.5	0	1.8	1
0.39	1			0.0024	0	1.5	1	1.5	1	1.8	1
0.38	0			0.0024	0	1.5	1	1.5	1	1.8	1
0.38	0			0.0024	0	1.4	1	1.46	1	1.7	1
0.37	0			0.0024	0	1.4	1	1.4	1	1.7	1
0.37	0			0.0024	0	1.4	1	1.4	1	1.7	1
0.37	0			0.0024	0	1.4	1	1.4	1	1.7	1
0.37	0			0.0024	0	1.4	1	1.4	1	1.6	1
0.37	0			0.0023	1	1.4	1	1.4	1	1.6	1
0.37	0			0.0023	0	1.4	1	1.4	0	1.56	1
0.36	0			0.0023	0	1.4	1	1.4	1	1.5	1
0.36	0			0.0023	0	1.4	0	1.4	1	1.5	1
0.36	0			0.0023	0	1.3	1	1.3	1	1.48	1
0.36	0			0.0023	0	1.3	1	1.3	1	1.4	1
0.35	0			0.0023	0	1.3	1	1.3	1	1.4	1
0.34	1			0.0023	0	1.3	1	1.3	1	1.4	0
0.33	1			0.0023	0	1.2	1	1.24	1	1.3	1
0.31	1			0.0023	0	1.2	1	1.2	1	1.3	1
0.3	1			0.0023	0	1.2	1	1.2	1	1.3	1
0.27	0			0.0023	0	1.12	1	1.2	1	1.3	1
0.26	0			0.0023	0	1.1	1	1.2	1	1.3	1
0.26	0			0.0023	0	1.1	1	1.1	1	1.2	1
0.25	1			0.0023	0	1.1	0	1.1	1	1.2	1
0.24	1			0.0023	0	1.1	0	1.1	1	1.2	1
0.24	0			0.0023	0	1.1	0	1.1	1	1.2	1
0.23	0			0.0023	0	1.1	1	1	1	1.2	1
0.23	0			0.0023	0	1	1	1	1	1.2	1
0.23	0			0.0023	0	1	1	0.99	1	1.1	1
0.23	0			0.0023	0	1	1	0.98	1	1.1	1
0.22	0			0.0023	0	0.97	1	0.94	1	1.1	0
0.22	0			0.0023	0	0.94	1	0.9	0	1.1	0
0.22	0			0.0023	0	0.931	1	0.86	0	1	1
0.22	0			0.0022	0	0.92	1	0.858	1	1	1
0.22	0			0.0022	0	0.92	1	0.84	0	0.99	1
0.22	0			0.0022	0	0.9	1	0.82	1	0.98	1
0.22	0			0.0022	0	0.88	1	0.82	1	0.97	1
0.22	0			0.0022	0	0.88	1	0.8	1	0.95	1
0.21	0			0.0022	0	0.85	1	0.8	1	0.95	1
0.21	0			0.0022	0	0.85	1	0.79	0	0.94	1
0.21	0			0.0022	0	0.84	1	0.78	1	0.92	1
0.21	1			0.0022	0	0.83	1	0.78	1	0.89	1
0.21	0			0.0022	0	0.8	1	0.779	1	0.86	1
0.21	0			0.0022	0	0.78	1	0.77	0	0.82	1
0.21	0			0.0022	0	0.76	1	0.76	1	0.79	1
0.21	0			0.0022	0	0.76	1	0.73	1	0.76	1
0.21	0			0.0021	0	0.75	1	0.73	1	0.76	1
0.21	0			0.0021	0	0.74	1	0.71	1	0.75	1
0.21	0			0.0021	0	0.72	1	0.71	1	0.74	1

Naphthalene	d_Naphthalene	Tetrachloroethene	d_Tetrachloroethene	Xylenes	d_Xylenes	Benzo(a)anthracene	d_Benzo(a)anthracene	Benzo(a)pyrene	d_Benzo(a)pyrene	Benzo(b)fluoranthene	d_Benzo(b)fluoranthene
0.21	0			0.0021	0	0.72	1	0.7	1	0.73	1
0.21	0			0.0021	1	0.68	1	0.68	1	0.72	1
0.21	0			0.0021	0	0.68	1	0.67	1	0.72	1
0.21	1			0.0021	0	0.67	0	0.66	1	0.71	1
0.21	0			0.002	0	0.66	1	0.64	1	0.67	0
0.21	0			0.002	0	0.64	0	0.61	1	0.66	1
0.21	0			0.002	0	0.63	1	0.6	1	0.66	1
0.21	0			0.0014	1	0.63	0	0.6	0	0.66	1
0.21	1			0.0012	1	0.63	1	0.59	1	0.65	1
0.21	0			0.00073	1	0.601	1	0.58	1	0.65	1
0.2	0			0.00042	1	0.59	1	0.57	0	0.65	1
0.2	1			0.00022	1	0.59	0	0.56	1	0.646	1
0.2	0					0.58	1	0.56	1	0.64	0
0.2	0					0.58	0	0.55	1	0.63	0
0.2	0					0.56	1	0.55	1	0.62	1
0.2	0					0.56	1	0.53	1	0.59	1
0.2	0					0.55	1	0.53	1	0.59	0
0.2	0					0.54	1	0.52	0	0.58	0
0.2	0					0.54	1	0.5	1	0.55	1
0.2	0					0.5	1	0.5	1	0.54	1
0.2	0					0.49	1	0.495	1	0.52	1
0.2	0					0.48	1	0.47	1	0.52	1
0.2	0					0.47	1	0.47	1	0.5	1
0.2	0					0.44	1	0.47	1	0.5	1
0.2	0					0.44	1	0.46	1	0.48	1
0.2	0					0.44	1	0.44	1	0.48	1
0.2	0					0.43	1	0.44	1	0.459	1
0.2	0					0.43	1	0.41	1	0.45	1
0.2	0					0.43	0	0.4	1	0.45	1
0.2	0					0.42	1	0.398	0	0.44	1
0.2	0					0.4	1	0.39	1	0.43	0
0.2	0					0.4	1	0.39	1	0.41	1
0.2	0					0.4	1	0.39	1	0.4	1
0.2	0					0.398	0	0.38	1	0.4	1
0.2	0					0.38	1	0.38	1	0.398	0
0.2	0					0.38	1	0.38	1	0.39	1
0.2	0					0.37	1	0.37	1	0.39	1
0.2	0					0.37	1	0.36	1	0.38	1
0.2	0					0.36	1	0.36	1	0.38	1
0.2	0					0.36	1	0.35	1	0.38	1
0.2	0					0.36	1	0.34	1	0.37	1
0.2	0					0.35	1	0.32	1	0.36	1
0.2	0					0.33	1	0.31	1	0.36	1
0.2	0					0.33	1	0.3	1	0.35	1
0.2	0					0.33	1	0.29	0	0.346	1
0.2	0					0.33	1	0.28	1	0.34	1
0.2	0					0.32	1	0.28	1	0.33	1
0.2	0					0.32	1	0.28	1	0.33	1
0.2	0					0.31	1	0.28	0	0.32	1
0.2	0					0.3	1	0.28	1	0.32	1
0.2	0					0.3	1	0.28	1	0.31	1
0.2	0					0.296	1	0.28	1	0.31	1
0.2	0					0.29	1	0.27	1	0.3	1
0.2	0					0.29	1	0.26	1	0.3	1
0.2	0					0.28	1	0.26	1	0.3	1
0.2	0					0.27	1	0.26	1	0.3	1
0.2	0					0.26	1	0.257	1	0.3	1

Naphthalene	d_Naphthalene	Tetrachloroethene	d_Tetrachloroethene	Xylenes	d_Xylenes	Benzo(a)anthracene	d_Benzo(a)anthracene	Benzo(a)pyrene	d_Benzo(a)pyrene	Benzo(b)fluoranthene	d_Benzo(b)fluoranthene
0.2	1					0.26	1	0.25	1	0.3	1
0.2	0					0.26	1	0.25	1	0.29	1
0.2	0					0.24	1	0.24	1	0.28	1
0.2	0					0.24	1	0.24	1	0.27	1
0.2	0					0.24	1	0.24	1	0.27	1
0.2	0					0.24	1	0.23	1	0.27	1
0.2	0					0.24	1	0.23	1	0.26	1
0.2	0					0.23	1	0.22	1	0.26	1
0.2	0					0.23	1	0.22	1	0.26	1
0.2	0					0.23	1	0.21	1	0.25	1
0.2	0					0.22	1	0.21	0	0.24	1
0.2	0					0.22	0	0.21	1	0.23	1
0.2	0					0.22	1	0.21	1	0.23	1
0.2	0					0.21	1	0.21	1	0.22	1
0.2	0					0.21	1	0.21	1	0.22	1
0.2	0					0.21	0	0.21	0	0.22	1
0.2	0					0.2	1	0.2	1	0.22	0
0.2	0					0.2	1	0.19	0	0.21	1
0.2	0					0.2	1	0.19	1	0.21	1
0.2	0					0.2	1	0.19	0	0.21	1
0.2	0					0.19	1	0.19	1	0.2	1
0.2	0					0.18	1	0.19	1	0.2	1
0.2	0					0.18	1	0.18	1	0.2	1
0.2	0					0.17	1	0.18	0	0.2	1
0.2	0					0.17	1	0.18	0	0.2	1
0.2	0					0.16	1	0.18	1	0.18	1
0.192	1					0.16	0	0.18	1	0.18	1
0.19	0					0.16	1	0.18	1	0.18	1
0.19	0					0.16	1	0.18	1	0.18	1
0.19	0					0.16	1	0.18	1	0.17	1
0.19	0					0.16	1	0.18	1	0.17	1
0.19	0					0.16	1	0.17	0	0.17	1
0.19	0					0.15	1	0.17	0	0.16	0
0.19	0					0.15	1	0.17	0	0.16	1
0.19	0					0.15	1	0.17	1	0.16	1
0.19	0					0.14	0	0.17	0	0.15	1
0.19	0					0.14	0	0.17	0	0.15	1
0.19	0					0.14	1	0.17	0	0.15	1
0.19	0					0.14	1	0.17	1	0.14	1
0.19	0					0.14	1	0.17	0	0.14	0
0.19	0					0.13	0	0.16	0	0.14	0
0.19	0					0.13	0	0.16	0	0.14	0
0.19	0					0.13	0	0.16	0	0.14	1
0.19	0					0.13	0	0.16	0	0.14	1
0.19	0					0.13	0	0.16	0	0.13	0
0.19	0					0.13	1	0.16	0	0.13	0
0.19	0					0.13	1	0.16	0	0.13	0
0.19	0					0.12	0	0.16	0	0.13	0
0.19	0					0.12	0	0.16	0	0.13	0
0.19	0					0.12	0	0.16	0	0.12	1
0.19	0					0.12	0	0.16	0	0.12	0
0.19	0					0.12	0	0.16	1	0.12	0
0.19	0					0.12	0	0.16	0	0.12	0
0.19	0					0.12	0	0.16	0	0.12	0
0.19	0					0.12	0	0.16	0	0.12	0
0.19	0					0.12	0	0.16	0	0.12	0
0.19	0					0.12	0	0.16	0	0.12	0

Naphthalene	d_Naphthalene	Tetrachloroethene	d_Tetrachloroethene	Xylenes	d_Xylenes	Benzo(a)anthracene	d_Benzo(a)anthracene	Benzo(a)pyrene	d_Benzo(a)pyrene	Benzo(b)fluoranthene	d_Benzo(b)fluoranthene
0.19	0					0.12	0	0.16	0	0.12	0
0.19	0					0.12	0	0.16	0	0.12	1
0.19	0					0.12	0	0.16	0	0.12	0
0.19	0					0.12	0	0.16	0	0.12	0
0.19	0					0.12	0	0.16	0	0.12	0
0.19	0					0.12	0	0.16	0	0.12	0
0.19	0					0.12	0	0.16	0	0.12	0
0.19	0					0.12	0	0.16	0	0.12	0
0.19	0					0.12	0	0.16	0	0.12	0
0.19	0					0.12	0	0.16	0	0.12	0
0.19	0					0.12	0	0.16	1	0.12	0
0.19	0					0.12	0	0.16	0	0.12	0
0.19	0					0.12	0	0.16	0	0.12	0
0.19	0					0.12	0	0.16	0	0.12	0
0.19	0					0.12	0	0.16	0	0.12	0
0.19	0					0.12	0	0.16	0	0.12	0
0.19	0					0.12	0	0.16	0	0.12	0
0.19	0					0.12	0	0.16	0	0.12	0
0.19	0					0.12	0	0.16	0	0.12	0
0.19	0					0.12	0	0.16	0	0.12	0
0.19	0					0.12	0	0.16	0	0.12	1
0.19	0					0.12	0	0.16	0	0.12	0
0.19	1					0.12	0	0.16	0	0.12	0
0.19	0					0.12	0	0.16	0	0.12	0
0.19	0					0.12	0	0.16	0	0.12	0
0.19	0					0.12	0	0.16	0	0.12	0
0.19	0					0.12	0	0.16	0	0.12	0
0.19	0					0.12	0	0.16	0	0.12	0
0.19	0					0.12	0	0.16	0	0.12	0
0.19	0					0.12	0	0.16	1	0.12	0
0.19	0					0.12	0	0.16	0	0.12	0
0.19	0					0.12	0	0.16	0	0.12	0
0.19	0					0.12	0	0.16	0	0.12	0
0.19	0					0.12	0	0.16	0	0.12	0
0.19	0					0.12	0	0.16	0	0.12	0
0.19	0					0.12	0	0.16	0	0.12	0
0.19	0					0.12	0	0.16	0	0.12	0
0.19	0					0.12	0	0.16	0	0.12	0
0.19	0					0.12	0	0.16	0	0.12	0
0.19	0					0.12	1	0.16	0	0.12	0
0.19	0					0.12	1	0.16	0	0.12	0
0.19	0					0.12	0	0.16	0	0.12	0
0.19	0					0.12	1	0.16	0	0.12	0
0.19	0					0.12	0	0.16	0	0.12	0
0.19	0					0.12	0	0.15	0	0.12	0
0.18	0					0.12	0	0.15	1	0.12	0
0.18	0					0.12	0	0.15	0	0.12	0
0.18	0					0.12	0	0.15	0	0.12	0
0.18	0					0.12	0	0.15	0	0.12	0
0.18	0					0.12	0	0.15	0	0.12	0
0.18	0					0.12	0	0.15	0	0.12	0
0.18	0					0.12	0	0.15	0	0.12	0
0.18	0					0.12	0	0.15	0	0.12	0
0.18	0					0.12	1	0.15	0	0.12	0
0.18	0					0.12	0	0.15	0	0.12	0
0.18	0					0.12	0	0.15	0	0.12	0
0.18	0					0.12	0	0.15	0	0.12	1

Naphthalene	d_Naphthalene	Tetrachloroethene	d_Tetrachloroethene	Xylenes	d_Xylenes	Benzo(a)anthracene	d_Benzo(a)anthracene	Benzo(a)pyrene	d_Benzo(a)pyrene	Benzo(b)fluoranthene	d_Benzo(b)fluoranthene
0.18	0					0.12	0	0.15	0	0.12	0
0.18	0					0.12	0	0.15	0	0.12	0
0.18	0					0.11	1	0.15	0	0.12	0
0.18	0					0.11	0	0.15	0	0.12	0
0.18	0					0.11	0	0.15	0	0.12	1
0.18	0					0.11	0	0.15	0	0.12	0
0.18	0					0.11	0	0.15	0	0.11	0
0.18	0					0.11	0	0.15	0	0.11	0
0.18	0					0.11	1	0.15	0	0.11	0
0.18	0					0.11	0	0.15	1	0.11	0
0.18	0					0.11	0	0.15	0	0.11	0
0.18	0					0.11	0	0.15	0	0.11	1
0.18	0					0.11	0	0.15	0	0.11	1
0.18	0					0.11	0	0.15	0	0.11	0
0.18	0					0.11	0	0.15	0	0.11	0
0.18	0					0.11	0	0.15	0	0.11	0
0.18	0					0.11	0	0.15	0	0.11	0
0.18	0					0.11	0	0.15	0	0.11	0
0.18	0					0.11	0	0.15	0	0.11	1
0.18	0					0.11	0	0.15	0	0.11	0
0.18	0					0.11	0	0.15	0	0.11	0
0.18	0					0.11	0	0.15	0	0.11	0
0.18	0					0.11	0	0.15	0	0.11	0
0.18	0					0.11	0	0.15	0	0.11	0
0.18	0					0.11	0	0.14	0	0.11	0
0.18	0					0.11	0	0.14	0	0.11	0
0.18	0					0.11	0	0.14	0	0.11	0
0.18	0					0.11	0	0.14	1	0.11	0
0.18	0					0.11	0	0.14	0	0.11	0
0.18	0					0.11	1	0.14	0	0.11	0
0.18	0					0.11	0	0.14	0	0.11	0
0.18	0					0.11	0	0.14	1	0.11	0
0.18	0					0.11	0	0.14	0	0.11	1
0.18	0					0.11	0	0.14	1	0.11	0
0.18	0					0.11	0	0.14	0	0.11	0
0.18	0					0.1	1	0.14	0	0.11	0
0.18	0					0.1	1	0.14	1	0.11	1
0.18	0					0.1	0	0.13	1	0.11	0
0.18	0					0.1	1	0.13	1	0.11	0
0.18	0					0.1	1	0.12	1	0.11	0
0.18	0					0.1	1	0.12	1	0.1	1
0.17	0					0.1	1	0.11	1	0.1	1
0.17	0					0.098	1	0.11	1	0.1	0
0.17	0					0.097	1	0.11	1	0.1	1
0.17	1					0.096	1	0.11	1	0.097	1
0.16	1					0.094	1	0.1	1	0.092	1
0.15	1					0.093	1	0.1	1	0.089	1
0.15	1					0.09	1	0.1	1	0.089	1
0.15	1					0.089	1	0.1	1	0.088	1
0.13	1					0.088	1	0.096	1	0.088	1
0.13	1					0.088	1	0.094	1	0.087	1
0.13	1					0.083	1	0.094	1	0.086	1
0.13	1					0.083	1	0.092	1	0.086	1
0.13	1					0.075	1	0.091	1	0.085	1
0.12	1					0.074	1	0.089	1	0.084	1
0.12	1					0.074	1	0.088	1	0.083	1
0.12	1					0.073	1	0.086	1	0.082	1
0.12	1					0.072	1	0.082	1	0.081	1

Naphthalene	d_Naphthalene	Tetrachloroethene	d_Tetrachloroethene	Xylenes	d_Xylenes	Benzo(a)anthracene	d_Benzo(a)anthracene	Benzo(a)pyrene	d_Benzo(a)pyrene	Benzo(b)fluoranthene	d_Benzo(b)fluoranthene
0.118	1					0.069	1	0.082	1	0.079	1
0.11	1					0.068	1	0.08	1	0.079	1
0.11	1					0.068	1	0.08	1	0.078	1
0.1	1					0.066	1	0.078	1	0.078	1
0.099	1					0.064	1	0.076	1	0.076	1
0.098	1					0.064	1	0.073	1	0.075	1
0.096	1					0.063	1	0.073	1	0.075	1
0.088	1					0.062	1	0.071	1	0.074	1
0.084	1					0.059	1	0.066	1	0.072	1
0.084	1					0.059	1	0.065	1	0.072	1
0.081	1					0.058	1	0.065	1	0.068	1
0.08	1					0.057	1	0.064	1	0.066	1
0.078	1					0.055	1	0.064	1	0.066	1
0.077	1					0.055	1	0.062	1	0.062	1
0.076	1					0.055	1	0.061	1	0.058	1
0.073	1					0.052	1	0.06	1	0.057	1
0.067	1					0.05	1	0.06	1	0.054	1
0.066	1					0.049	1	0.058	1	0.054	1
0.066	1					0.048	1	0.057	1	0.052	1
0.063	1					0.047	1	0.057	1	0.051	1
0.062	1					0.046	1	0.054	1	0.047	1
0.052	1					0.044	1	0.054	1	0.045	1
0.049	1					0.043	1	0.052	1	0.043	1
0.0421	1					0.041	1	0.051	1	0.04	1
0.04	1					0.036	1	0.047	1	0.04	1
0.0363	1					0.03	1	0.046	1	0.039	1
0.032	1										
0.0294	1										
0.027	1										
0.0157	0										
0.0096	0										
0.0074	0										
0.0061	0										
0.0049	0										
0.0046	0										
0.0043	0										
0.0043	0										
0.0043	0										
0.0043	0										
0.0043	0										
0.0042	0										
0.0041	0										
0.0017	1										

Chrysene	d_Chrysene	dibenz(a,h)anthracene	d_dibenz(a,h)anthracene	Indeno(1,2,3-cd)pyrene	d_Indeno(1,2,3-cd)pyrene
100	1	20	0	46	1
44	1	19.1	0	31	1
36	1	12	1	20	0
30	1	7.4	1	19.1	0
23	1	6.37	0	16	1
22	1	4.8	1	15	1
20	0	4.28	0	12	1
19.1	0	4.18	0	12	1
19	1	3.91	0	10	1
18	1	3.8	1	9.3	1
17	1	3.2	1	8.9	1
15	1	2.7	1	8.4	1
14	1	2.3	1	7.9	1
14	1	2.2	0	7.8	1
13	1	2.2	1	7.5	1
13	1	2.2	1	6.8	1
10	1	1.9	1	6.37	0
9.86	1	1.9	1	6	1
9.8	1	1.9	1	5.6	1
9	1	1.7	1	5.3	1
7.8	1	1.6	1	4.8	1
6.37	0	1.6	1	4.61	1
5.9	1	1.6	1	4.28	0
5.7	1	1.4	0	3.91	0
5.6	1	1.3	1	3.8	1
5.5	1	1.1	1	3.2	1
5.3	1	1.1	1	3.1	1
5	1	1.1	1	2.9	1
5	1	1.1	0	2.9	1
4.9	1	1.1	0	2.8	1
4.4	1	1.1	0	2.8	1
4.3	1	0.92	1	2.7	1
4.28	0	0.91	1	2.7	1
4.2	1	0.9	0	2.5	1
4.2	1	0.86	1	2.3	1
4.1	1	0.84	1	2.2	1
3.91	0	0.8	1	2.1	1
3.9	1	0.72	1	2.1	1
3.3	1	0.7	1	2.1	1
3.3	1	0.68	1	2	1
3.1	1	0.67	0	1.9	1
3	1	0.65	1	1.8	1
2.9	1	0.64	0	1.8	0
2.8	1	0.64	1	1.7	1
2.8	1	0.63	0	1.7	1
2.7	1	0.62	1	1.7	1
2.6	1	0.6	1	1.7	1
2.6	1	0.59	0	1.7	1
2.6	1	0.58	0	1.6	1
2.5	1	0.58	1	1.6	1
2.5	1	0.52	1	1.5	1
2.4	1	0.51	1	1.5	1
2.3	1	0.48	1	1.5	1
2.2	1	0.47	1	1.5	0
2.2	1	0.46	1	1.5	0
2.1	1	0.45	0	1.4	1
2.1	1	0.44	1	1.4	0

Chrysene	d_Chrysene	dibenz(a,h)anthracene	d_dibenz(a,h)anthracene	Indeno(1,2,3-cd)pyrene	d_Indeno(1,2,3-cd)pyrene
2.1	1	0.44	0	1.4	1
1.9	1	0.43	0	1.3	1
1.8	1	0.43	1	1.3	1
1.8	1	0.42	1	1.3	1
1.8	1	0.41	1	1.2	1
1.7	1	0.406	0	1.1	1
1.7	1	0.4	1	1.1	1
1.6	1	0.398	0	1.1	1
1.54	1	0.39	1	1	1
1.5	1	0.39	0	1	1
1.5	1	0.388	0	1	1
1.5	1	0.37	1	1	1
1.5	1	0.37	1	0.98	1
1.4	1	0.36	1	0.97	1
1.4	1	0.36	1	0.97	1
1.4	1	0.36	1	0.96	1
1.4	1	0.36	1	0.96	1
1.4	1	0.34	1	0.92	1
1.4	0	0.33	1	0.91	1
1.3	1	0.33	1	0.9	0
1.3	1	0.329	1	0.89	1
1.3	1	0.32	1	0.86	1
1.3	1	0.32	1	0.86	0
1.2	1	0.31	1	0.86	1
1.2	1	0.3	1	0.84	0
1.2	1	0.3	1	0.82	1
1.2	1	0.29	1	0.82	1
1.2	1	0.29	1	0.8	1
1.15	1	0.27	1	0.79	1
1.14	1	0.27	1	0.79	0
1.1	1	0.26	0	0.77	0
1.1	1	0.26	1	0.76	1
1.1	1	0.26	1	0.76	1
1.1	1	0.25	0	0.718	1
1.1	0	0.24	1	0.714	1
1.1	0	0.24	1	0.7	1
1.1	1	0.24	1	0.7	1
1	1	0.23	1	0.68	1
0.989	1	0.23	0	0.68	1
0.96	1	0.23	0	0.63	1
0.94	1	0.23	1	0.6	1
0.92	1	0.22	1	0.6	0
0.91	1	0.22	0	0.6	1
0.9	1	0.22	0	0.58	1
0.85	1	0.22	0	0.57	1
0.82	1	0.22	0	0.57	0
0.82	1	0.22	1	0.56	1
0.8	1	0.21	1	0.55	1
0.8	1	0.21	0	0.52	1
0.78	1	0.21	0	0.52	0
0.77	1	0.2	1	0.52	1
0.76	1	0.2	1	0.5	1
0.76	1	0.19	1	0.5	1
0.74	1	0.19	1	0.49	1
0.73	1	0.18	1	0.48	1
0.73	1	0.18	1	0.48	1
0.72	1	0.18	1	0.479	1

Chrysene	d_Chrysene	dibenz(a,h)anthracene	d_dibenz(a,h)anthracene	Indeno(1,2,3-cd)pyrene	d_Indeno(1,2,3-cd)pyrene
0.71	1	0.18	1	0.47	1
0.7	1	0.17	1	0.46	1
0.67	1	0.17	1	0.46	1
0.66	1	0.16	1	0.45	1
0.65	1	0.16	0	0.44	1
0.64	0	0.16	1	0.439	1
0.63	0	0.16	0	0.43	1
0.62	1	0.16	0	0.43	1
0.6	1	0.15	0	0.42	1
0.59	0	0.14	1	0.41	1
0.58	0	0.14	1	0.4	1
0.57	1	0.14	0	0.4	1
0.56	1	0.14	0	0.398	0
0.56	1	0.14	0	0.38	1
0.56	1	0.14	0	0.38	1
0.54	1	0.14	0	0.37	1
0.54	1	0.14	0	0.35	1
0.53	1	0.14	1	0.35	1
0.518	1	0.14	1	0.34	1
0.51	1	0.14	1	0.34	1
0.48	1	0.13	0	0.33	1
0.47	1	0.13	0	0.33	1
0.43	1	0.13	0	0.33	1
0.43	1	0.13	0	0.32	1
0.43	1	0.13	1	0.32	1
0.42	1	0.13	0	0.315	1
0.42	1	0.13	0	0.3	1
0.4	1	0.13	0	0.3	0
0.4	1	0.13	0	0.3	1
0.398	0	0.13	0	0.29	1
0.39	1	0.13	1	0.29	1
0.39	1	0.13	0	0.29	0
0.39	1	0.121	1	0.28	0
0.38	1	0.12	1	0.28	0
0.38	1	0.12	0	0.27	1
0.38	1	0.12	0	0.27	1
0.38	1	0.12	0	0.26	1
0.38	1	0.12	0	0.24	1
0.38	1	0.12	0	0.24	1
0.37	1	0.12	0	0.23	1
0.36	1	0.12	0	0.22	1
0.34	1	0.12	0	0.21	1
0.34	1	0.12	0	0.21	0
0.34	1	0.12	0	0.21	1
0.33	1	0.12	0	0.21	1
0.33	1	0.12	0	0.21	1
0.32	1	0.12	0	0.21	0
0.32	1	0.12	0	0.2	1
0.32	1	0.12	0	0.2	1
0.313	1	0.12	0	0.2	1
0.31	1	0.12	1	0.2	1
0.31	1	0.12	0	0.19	0
0.31	1	0.12	0	0.19	0
0.3	1	0.12	0	0.19	1
0.3	1	0.12	0	0.18	0
0.3	1	0.12	0	0.18	0
0.29	1	0.12	0	0.18	1

Chrysene	d_Chrysene	dibenz(a,h)anthracene	d_dibenz(a,h)anthracene	Indeno(1,2,3-cd)pyrene	d_Indeno(1,2,3-cd)pyrene
0.28	1	0.12	0	0.18	1
0.28	1	0.12	0	0.18	1
0.27	1	0.12	0	0.17	1
0.26	1	0.12	0	0.17	1
0.26	1	0.12	0	0.17	0
0.25	1	0.12	0	0.17	0
0.25	1	0.12	0	0.17	0
0.24	1	0.12	0	0.17	0
0.24	1	0.12	0	0.17	0
0.24	1	0.12	0	0.17	0
0.23	1	0.12	0	0.17	1
0.23	1	0.12	0	0.17	1
0.22	1	0.12	0	0.17	0
0.22	1	0.12	0	0.17	1
0.22	0	0.12	0	0.16	0
0.22	1	0.12	0	0.16	0
0.21	1	0.12	0	0.16	1
0.21	1	0.12	0	0.16	0
0.2	1	0.12	0	0.16	0
0.2	1	0.12	0	0.16	0
0.19	1	0.12	0	0.16	0
0.19	1	0.12	0	0.16	0
0.18	1	0.12	0	0.16	0
0.18	1	0.12	0	0.16	0
0.18	1	0.12	0	0.16	0
0.18	1	0.12	0	0.16	0
0.18	1	0.12	0	0.16	0
0.17	1	0.12	0	0.16	0
0.17	1	0.12	0	0.16	0
0.16	0	0.12	0	0.16	0
0.16	1	0.12	0	0.16	1
0.16	1	0.12	0	0.16	0
0.16	1	0.12	0	0.16	0
0.16	1	0.12	0	0.16	0
0.15	1	0.12	0	0.16	0
0.14	0	0.12	0	0.16	0
0.14	0	0.12	0	0.16	0
0.14	1	0.12	0	0.16	0
0.14	1	0.12	0	0.16	0
0.14	1	0.12	0	0.16	0
0.14	1	0.12	0	0.16	0
0.14	1	0.12	0	0.16	0
0.14	1	0.12	1	0.16	0
0.13	0	0.12	0	0.16	0
0.13	0	0.12	0	0.16	0
0.13	0	0.12	0	0.16	0
0.13	0	0.12	0	0.16	0
0.13	0	0.12	0	0.16	0
0.13	1	0.12	0	0.16	0
0.13	1	0.12	0	0.16	0
0.12	0	0.12	0	0.16	0
0.12	0	0.12	0	0.16	0
0.12	0	0.12	0	0.16	0
0.12	0	0.12	0	0.16	0
0.12	0	0.12	0	0.16	0
0.12	0	0.12	0	0.16	0
0.12	0	0.12	0	0.16	0

Chrysene	d_Chrysene	dibenz(a,h)anthracene	d_dibenz(a,h)anthracene	Indeno(1,2,3-cd)pyrene	d_Indeno(1,2,3-cd)pyrene
0.12	0	0.12	0	0.16	0
0.12	0	0.12	1	0.16	0
0.12	0	0.12	0	0.16	0
0.12	0	0.12	0	0.16	0
0.12	0	0.12	0	0.16	0
0.12	0	0.12	0	0.16	0
0.12	0	0.12	0	0.16	0
0.12	0	0.12	0	0.16	0
0.12	0	0.12	0	0.16	0
0.12	0	0.12	0	0.16	0
0.12	0	0.12	0	0.16	0
0.12	0	0.12	0	0.16	0
0.12	0	0.12	0	0.16	0
0.12	0	0.12	0	0.16	0
0.12	0	0.12	0	0.16	0
0.12	0	0.12	1	0.16	0
0.12	0	0.12	0	0.16	0
0.12	0	0.12	0	0.16	0
0.12	0	0.12	0	0.16	0
0.12	0	0.12	0	0.16	0
0.12	0	0.12	0	0.16	0
0.12	0	0.11	1	0.15	1
0.12	0	0.11	0	0.15	0
0.12	0	0.11	0	0.15	0
0.12	0	0.11	0	0.15	0
0.12	0	0.11	0	0.15	1
0.12	0	0.11	0	0.15	1
0.12	0	0.11	0	0.15	0
0.12	0	0.11	0	0.15	0
0.12	0	0.11	1	0.15	0
0.12	0	0.11	0	0.15	0
0.12	0	0.11	0	0.15	0
0.12	0	0.11	1	0.15	0
0.12	0	0.11	0	0.15	0
0.12	0	0.11	0	0.15	0
0.12	0	0.11	0	0.15	0
0.12	0	0.11	0	0.15	0
0.12	0	0.11	0	0.15	0
0.12	0	0.11	0	0.15	0
0.12	0	0.11	0	0.15	0
0.12	0	0.11	0	0.15	1
0.12	0	0.11	0	0.15	0
0.12	1	0.11	0	0.15	0
0.12	0	0.11	0	0.15	0
0.12	1	0.11	0	0.15	0
0.12	0	0.11	0	0.15	0
0.12	0	0.11	0	0.15	0
0.12	0	0.11	0	0.15	0
0.12	0	0.11	0	0.15	0
0.12	0	0.11	0	0.15	0
0.12	0	0.11	0	0.15	0
0.12	0	0.11	0	0.15	0
0.12	0	0.11	0	0.15	0
0.12	0	0.11	0	0.15	0
0.12	0	0.11	0	0.15	0
0.12	0	0.11	0	0.15	0
0.12	1	0.11	0	0.15	0

Chrysene	d_Chrysene	dibenz(a,h)anthracene	d_dibenz(a,h)anthracene	Indeno(1,2,3-cd)pyrene	d_Indeno(1,2,3-cd)pyrene
0.12	0	0.11	0	0.15	0
0.12	0	0.11	0	0.15	0
0.12	0	0.11	0	0.15	0
0.12	0	0.11	0	0.15	0
0.11	0	0.11	0	0.15	0
0.11	0	0.11	0	0.15	1
0.11	0	0.11	0	0.15	0
0.11	0	0.11	0	0.15	0
0.11	1	0.11	0	0.15	0
0.11	0	0.11	0	0.143	1
0.11	0	0.11	0	0.14	0
0.11	0	0.11	0	0.14	0
0.11	0	0.11	0	0.14	0
0.11	0	0.11	0	0.14	0
0.11	0	0.11	0	0.14	0
0.11	0	0.11	0	0.14	0
0.11	0	0.11	0	0.14	0
0.11	0	0.11	1	0.14	0
0.11	0	0.11	0	0.14	0
0.11	0	0.11	0	0.14	1
0.11	0	0.11	0	0.14	1
0.11	0	0.11	0	0.14	0
0.11	0	0.11	0	0.14	0
0.11	0	0.11	0	0.13	1
0.11	0	0.11	0	0.13	1
0.11	0	0.11	1	0.13	1
0.11	0	0.11	0	0.13	1
0.11	0	0.11	0	0.13	1
0.11	0	0.11	0	0.13	1
0.11	0	0.11	0	0.12	1
0.11	0	0.1	0	0.12	1
0.11	0	0.1	0	0.12	1
0.11	1	0.1	1	0.12	1
0.11	0	0.1	1	0.11	1
0.11	0	0.1	0	0.11	1
0.1	1	0.099	1	0.11	1
0.1	1	0.093	1	0.11	1
0.1	0	0.093	1	0.1	1
0.1	1	0.091	1	0.1	1
0.1	1	0.088	1	0.1	1
0.099	1	0.088	1	0.099	1
0.099	1	0.086	1	0.099	1
0.097	1	0.083	1	0.099	1
0.096	1	0.082	1	0.097	1
0.096	1	0.082	1	0.096	1
0.092	1	0.08	1	0.092	1
0.09	1	0.079	1	0.09	1
0.087	1	0.078	1	0.088	1
0.087	1	0.074	1	0.088	1
0.086	1	0.073	1	0.088	1
0.086	1	0.072	1	0.086	1
0.086	1	0.071	1	0.082	1
0.08	1	0.07	1	0.082	1
0.08	1	0.07	1	0.082	1
0.078	1	0.068	1	0.082	1
0.077	1	0.066	1	0.08	1
0.076	1	0.066	1	0.074	1

Chrysene	d_Chrysene	dibenz(a,h)anthracene	d_dibenz(a,h)anthracene	Indeno(1,2,3-cd)pyrene	d_Indeno(1,2,3-cd)pyrene
0.075	1	0.06	1	0.074	1
0.073	1	0.059	1	0.065	1
0.069	1	0.058	1	0.064	1
0.069	1	0.056	1	0.061	1
0.069	1	0.054	1	0.059	1
0.069	1	0.052	1	0.058	1
0.064	1	0.052	1	0.058	1
0.063	1	0.051	1	0.057	1
0.061	1	0.05	1	0.056	1
0.057	1	0.05	1	0.054	1
0.055	1	0.048	1	0.054	1
0.053	1	0.046	1	0.053	1
0.053	1	0.046	1	0.053	1
0.051	1	0.045	1	0.051	1
0.05	1	0.045	1	0.05	1
0.049	1	0.044	1	0.048	1
0.049	1	0.042	1	0.048	1
0.049	1	0.042	1	0.048	1
0.048	1	0.041	1	0.047	1
0.047	1	0.04	1	0.047	1
0.047	1	0.04	1	0.045	1
0.045	1	0.037	1	0.044	1
0.045	1	0.037	1	0.044	1
0.042	1	0.037	0	0.043	1
0.042	1	0.035	1	0.042	1
0.021	1	0.035	0	0.042	1

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.111/30/2016 5:37:12 PM
From File	With_ Ancillary_metals_input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Antimony

General Statistics

Total Number of Observations	269	Number of Distinct Observations	75
		Number of Missing Observations	26
Number of Detects	90	Number of Non-Detects	179
Number of Distinct Detects	60	Number of Distinct Non-Detects	21
Minimum Detect	0.73	Minimum Non-Detect	0.45
Maximum Detect	190	Maximum Non-Detect	6.1
Variance Detects	717.1	Percent Non-Detects	66.54%
Mean Detects	10.2	SD Detects	26.78
Median Detects	2.95	CV Detects	2.625
Skewness Detects	5.569	Kurtosis Detects	33.25
Mean of Logged Detects	1.297	SD of Logged Detects	1.222

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.359	**Normal GOF Test on Detected Observations Only**
5% Shapiro Wilk P Value	0	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.362	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.0936	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

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

KM Mean	4.633	KM Standard Error of Mean	0.982
KM SD	15.92	95% KM (BCA) UCL	6.353
95% KM (t) UCL	6.253	95% KM (Percentile Bootstrap) UCL	6.376
95% KM (z) UCL	6.248	95% KM Bootstrap t UCL	8.497
90% KM Chebyshev UCL	7.578	95% KM Chebyshev UCL	8.912
97.5% KM Chebyshev UCL	10.76	99% KM Chebyshev UCL	14.4

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	6.446	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.808	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.192	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.0989	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.602	k star (bias corrected MLE)	0.59
Theta hat (MLE)	16.94	Theta star (bias corrected MLE)	17.31
nu hat (MLE)	108.4	nu star (bias corrected)	106.1
Mean (detects)	10.2		

53	**Gamma ROS Statistics using Imputed Non-Detects**											
54	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
55	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)											
56	For such situations, GROS method may yield incorrect values of UCLs and BTVs											
57	This is especially true when the sample size is small.											
58	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates											
59						Minimum	0.01				Mean	4.353
60						Maximum	190				Median	0.579
61						SD	16.17				CV	3.714
62						k hat (MLE)	0.234				k star (bias corrected MLE)	0.233
63						Theta hat (MLE)	18.64				Theta star (bias corrected MLE)	18.65
64						nu hat (MLE)	125.6				nu star (bias corrected)	125.6
65						Adjusted Level of Significance (β)	0.0491					
66						Approximate Chi Square Value (125.56, α)	100.7				Adjusted Chi Square Value (125.56, β)	100.6
67						95% Gamma Approximate UCL (use when n>=50)	5.429				95% Gamma Adjusted UCL (use when n<50)	5.436
68												
69	**Estimates of Gamma Parameters using KM Estimates**											
70						Mean (KM)	4.633				SD (KM)	15.92
71						Variance (KM)	253.6				SE of Mean (KM)	0.982
72						k hat (KM)	0.0846				k star (KM)	0.0862
73						nu hat (KM)	45.54				nu star (KM)	46.36
74						theta hat (KM)	54.74				theta star (KM)	53.76
75						80% gamma percentile (KM)	2.532				90% gamma percentile (KM)	11.48
76						95% gamma percentile (KM)	27				99% gamma percentile (KM)	79.19
77												
78	**Gamma Kaplan-Meier (KM) Statistics**											
79						Approximate Chi Square Value (46.36, α)	31.74				Adjusted Chi Square Value (46.36, β)	31.67
80						95% Gamma Approximate KM-UCL (use when n>=50)	6.768				95% Gamma Adjusted KM-UCL (use when n<50)	6.782
81												
82	**Lognormal GOF Test on Detected Observations Only**											
83						Shapiro Wilk Approximate Test Statistic	0.917				**Shapiro Wilk GOF Test**	
84						5% Shapiro Wilk P Value	3.8428E-6				Detected Data Not Lognormal at 5% Significance Level	
85						Lilliefors Test Statistic	0.1				**Lilliefors GOF Test**	
86						5% Lilliefors Critical Value	0.0936				Detected Data Not Lognormal at 5% Significance Level	
87	**Detected Data Not Lognormal at 5% Significance Level**											
88												
89	**Lognormal ROS Statistics Using Imputed Non-Detects**											
90						Mean in Original Scale	4.777				Mean in Log Scale	0.708
91						SD in Original Scale	15.95				SD in Log Scale	1.067
92						95% t UCL (assumes normality of ROS data)	6.383				95% Percentile Bootstrap UCL	6.544
93						95% BCA Bootstrap UCL	7.24				95% Bootstrap t UCL	8.887
94						95% H-UCL (Log ROS)	4.134					
95												
96	**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**											
97						KM Mean (logged)	0.714				KM Geo Mean	2.042
98						KM SD (logged)	0.965				95% Critical H Value (KM-Log)	2.103
99						KM Standard Error of Mean (logged)	0.0835				95% H-UCL (KM -Log)	3.682
100						KM SD (logged)	0.965				95% Critical H Value (KM-Log)	2.103
101						KM Standard Error of Mean (logged)	0.0835					
102												
103	**DL/2 Statistics**											
104	**DL/2 Normal**										**DL/2 Log-Transformed**	

105				Mean in Original Scale	4.915					Mean in Log Scale	0.955	
106				SD in Original Scale	15.88					SD in Log Scale	0.792	
107				95% t UCL (Assumes normality)	6.514					95% H-Stat UCL	3.913	
108	**DL/2 is not a recommended method, provided for comparisons and historical reasons**											
109												
110	**Nonparametric Distribution Free UCL Statistics**											
111	**Data do not follow a Discernible Distribution at 5% Significance Level**											
112												
113	**Suggested UCL to Use**											
114				95% KM (Chebyshev) UCL	8.912							
115												
116	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
117	Recommendations are based upon data size, data distribution, and skewness.											
118	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
119	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
120												
121	**Arsenic**											
122												
123	**General Statistics**											
124				Total Number of Observations	274					Number of Distinct Observations	121	
125										Number of Missing Observations	26	
126				Number of Detects	262					Number of Non-Detects	12	
127				Number of Distinct Detects	114					Number of Distinct Non-Detects	10	
128				Minimum Detect	0.17					Minimum Non-Detect	0.8	
129				Maximum Detect	47					Maximum Non-Detect	4.2	
130				Variance Detects	46.97					Percent Non-Detects	4.38%	
131				Mean Detects	7.889					SD Detects	6.853	
132				Median Detects	6.3					CV Detects	0.869	
133				Skewness Detects	2.467					Kurtosis Detects	8.354	
134				Mean of Logged Detects	1.733					SD of Logged Detects	0.883	
135												
136	**Normal GOF Test on Detects Only**											
137				Shapiro Wilk Test Statistic	0.78					**Normal GOF Test on Detected Observations Only**		
138				5% Shapiro Wilk P Value	0					Detected Data Not Normal at 5% Significance Level		
139				Lilliefors Test Statistic	0.161					**Lilliefors GOF Test**		
140				5% Lilliefors Critical Value	0.0552					Detected Data Not Normal at 5% Significance Level		
141	**Detected Data Not Normal at 5% Significance Level**											
142												
143	**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**											
144				KM Mean	7.574					KM Standard Error of Mean	0.415	
145				KM SD	6.851					95% KM (BCA) UCL	8.271	
146				95% KM (t) UCL	8.258					95% KM (Percentile Bootstrap) UCL	8.269	
147				95% KM (z) UCL	8.256					95% KM Bootstrap t UCL	8.338	
148				90% KM Chebyshev UCL	8.818					95% KM Chebyshev UCL	9.381	
149				97.5% KM Chebyshev UCL	10.16					99% KM Chebyshev UCL	11.7	
150												
151	**Gamma GOF Tests on Detected Observations Only**											
152				A-D Test Statistic	1.006					**Anderson-Darling GOF Test**		
153				5% A-D Critical Value	0.77					Detected Data Not Gamma Distributed at 5% Significance Level		
154				K-S Test Statistic	0.0654					**Kolmogorov-Smirnov GOF**		
155				5% K-S Critical Value	0.0574					Detected Data Not Gamma Distributed at 5% Significance Level		
156	**Detected Data Not Gamma Distributed at 5% Significance Level**											

Gamma Statistics on Detected Data Only		
k hat (MLE)	1.649	k star (bias corrected MLE) 1.633
Theta hat (MLE)	4.783	Theta star (bias corrected MLE) 4.831
nu hat (MLE)	864.3	nu star (bias corrected) 855.8
Mean (detects)	7.889	
Gamma ROS Statistics using Imputed Non-Detects		
GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs		
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)		
For such situations, GROS method may yield incorrect values of UCLs and BTVs		
This is especially true when the sample size is small.		
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates		
Minimum	0.01	Mean 7.55
Maximum	47	Median 5.9
SD	6.887	CV 0.912
k hat (MLE)	1.048	k star (bias corrected MLE) 1.038
Theta hat (MLE)	7.207	Theta star (bias corrected MLE) 7.27
nu hat (MLE)	574	nu star (bias corrected) 569.1
Adjusted Level of Significance (β)	0.0491	
Approximate Chi Square Value (569.08, α)	514.8	Adjusted Chi Square Value (569.08, β) 514.5
95% Gamma Approximate UCL (use when n>=50)	8.347	95% Gamma Adjusted UCL (use when n<50) 8.351
Estimates of Gamma Parameters using KM Estimates		
Mean (KM)	7.574	SD (KM) 6.851
Variance (KM)	46.93	SE of Mean (KM) 0.415
k hat (KM)	1.222	k star (KM) 1.211
nu hat (KM)	669.7	nu star (KM) 663.7
theta hat (KM)	6.197	theta star (KM) 6.253
80% gamma percentile (KM)	11.98	90% gamma percentile (KM) 16.63
95% gamma percentile (KM)	21.22	99% gamma percentile (KM) 31.72
Gamma Kaplan-Meier (KM) Statistics		
Approximate Chi Square Value (663.73, α)	605	Adjusted Chi Square Value (663.73, β) 604.7
95% Gamma Approximate KM-UCL (use when n>=50)	8.309	95% Gamma Adjusted KM-UCL (use when n<50) 8.313
Lognormal GOF Test on Detected Observations Only		
Shapiro Wilk Approximate Test Statistic	0.962	**Shapiro Wilk GOF Test**
5% Shapiro Wilk P Value	5.7714E-5	Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.0813	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.0552	Detected Data Not Lognormal at 5% Significance Level
Detected Data Not Lognormal at 5% Significance Level		
Lognormal ROS Statistics Using Imputed Non-Detects		
Mean in Original Scale	7.59	Mean in Log Scale 1.658
SD in Original Scale	6.846	SD in Log Scale 0.933
95% t UCL (assumes normality of ROS data)	8.273	95% Percentile Bootstrap UCL 8.284
95% BCA Bootstrap UCL	8.337	95% Bootstrap t UCL 8.35
95% H-UCL (Log ROS)	9.125	
Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution		
KM Mean (logged)	1.629	KM Geo Mean 5.096

209				KM SD (logged)	1				95% Critical H Value (KM-Log)			2.133
210				KM Standard Error of Mean (logged)	0.0615				95% H-UCL (KM -Log)			9.564
211				KM SD (logged)	1				95% Critical H Value (KM-Log)			2.133
212				KM Standard Error of Mean (logged)	0.0615							
213												
214	**DL/2 Statistics**											
215	**DL/2 Normal**							**DL/2 Log-Transformed**				
216				Mean in Original Scale	7.57				Mean in Log Scale			1.628
217				SD in Original Scale	6.866				SD in Log Scale			0.997
218				95% t UCL (Assumes normality)	8.255				95% H-Stat UCL			9.519
219	**DL/2 is not a recommended method, provided for comparisons and historical reasons**											
220												
221	**Nonparametric Distribution Free UCL Statistics**											
222	**Data do not follow a Discernible Distribution at 5% Significance Level**											
223												
224	**Suggested UCL to Use**											
225				95% KM (Chebyshev) UCL	9.381							
226												
227	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
228	Recommendations are based upon data size, data distribution, and skewness.											
229	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
230	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
231												
232												
233	**Barium**											
234												
235	**General Statistics**											
236				Total Number of Observations	272				Number of Distinct Observations			125
237									Number of Missing Observations			28
238				Minimum	6.2				Mean			121.4
239				Maximum	1100				Median			77
240				SD	129				Std. Error of Mean			7.823
241				Coefficient of Variation	1.063				Skewness			3.422
242												
243	**Normal GOF Test**											
244				Shapiro Wilk Test Statistic	0.679			**Shapiro Wilk GOF Test**				
245				5% Shapiro Wilk P Value	0			Data Not Normal at 5% Significance Level				
246				Lilliefors Test Statistic	0.234			**Lilliefors GOF Test**				
247				5% Lilliefors Critical Value	0.0541			Data Not Normal at 5% Significance Level				
248	**Data Not Normal at 5% Significance Level**											
249												
250	**Assuming Normal Distribution**											
251	**95% Normal UCL**							**95% UCLs (Adjusted for Skewness)**				
252				95% Student's-t UCL	134.3				95% Adjusted-CLT UCL (Chen-1995)			136
253									95% Modified-t UCL (Johnson-1978)			134.6
254												
255	**Gamma GOF Test**											
256				A-D Test Statistic	6.658			**Anderson-Darling Gamma GOF Test**				
257				5% A-D Critical Value	0.772			Data Not Gamma Distributed at 5% Significance Level				
258				K-S Test Statistic	0.151			**Kolmogorov-Smirnov Gamma GOF Test**				
259				5% K-S Critical Value	0.0564			Data Not Gamma Distributed at 5% Significance Level				
260	**Data Not Gamma Distributed at 5% Significance Level**											

261												
262	**Gamma Statistics**											
263					k hat (MLE)	1.507		k star (bias corrected MLE)				1.493
264					Theta hat (MLE)	80.53		Theta star (bias corrected MLE)				81.3
265					nu hat (MLE)	820		nu star (bias corrected)				812.3
266					MLE Mean (bias corrected)	121.4		MLE Sd (bias corrected)				99.34
267								Approximate Chi Square Value (0.05)				747.1
268					Adjusted Level of Significance	0.0491		Adjusted Chi Square Value				746.8
269												
270	**Assuming Gamma Distribution**											
271				95% Approximate Gamma UCL (use when n>=50))		132		95% Adjusted Gamma UCL (use when n<50)				132
272												
273	**Lognormal GOF Test**											
274					Shapiro Wilk Test Statistic	0.97		**Shapiro Wilk Lognormal GOF Test**				
275					5% Shapiro Wilk P Value	0.00474		Data Not Lognormal at 5% Significance Level				
276					Lilliefors Test Statistic	0.0902		**Lilliefors Lognormal GOF Test**				
277					5% Lilliefors Critical Value	0.0541		Data Not Lognormal at 5% Significance Level				
278	**Data Not Lognormal at 5% Significance Level**											
279												
280	**Lognormal Statistics**											
281					Minimum of Logged Data	1.825		Mean of logged Data				4.432
282					Maximum of Logged Data	7.003		SD of logged Data				0.848
283												
284	**Assuming Lognormal Distribution**											
285					95% H-UCL	133.7		90% Chebyshev (MVUE) UCL				141.8
286					95% Chebyshev (MVUE) UCL	151.6		97.5% Chebyshev (MVUE) UCL				165.1
287					99% Chebyshev (MVUE) UCL	191.7						
288												
289	**Nonparametric Distribution Free UCL Statistics**											
290	**Data do not follow a Discernible Distribution (0.05)**											
291												
292	**Nonparametric Distribution Free UCLs**											
293					95% CLT UCL	134.3		95% Jackknife UCL				134.3
294					95% Standard Bootstrap UCL	134.2		95% Bootstrap-t UCL				136.1
295					95% Hall's Bootstrap UCL	136.4		95% Percentile Bootstrap UCL				134.8
296					95% BCA Bootstrap UCL	136.2						
297					90% Chebyshev(Mean, Sd) UCL	144.9		95% Chebyshev(Mean, Sd) UCL				155.5
298					97.5% Chebyshev(Mean, Sd) UCL	170.2		99% Chebyshev(Mean, Sd) UCL				199.2
299												
300	**Suggested UCL to Use**											
301					95% Chebyshev (Mean, Sd) UCL	155.5						
302												
303	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
304	Recommendations are based upon data size, data distribution, and skewness.											
305	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
306	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
307												
308	**Beryllium**											
309												
310	**General Statistics**											
311					Total Number of Observations	269		Number of Distinct Observations				75
312								Number of Missing Observations				26

313					Number of Detects	263					Number of Non-Detects	6
314					Number of Distinct Detects	75					Number of Distinct Non-Detects	3
315					Minimum Detect	0.083					Minimum Non-Detect	0.4
316					Maximum Detect	1.2					Maximum Non-Detect	0.44
317					Variance Detects	0.035					Percent Non-Detects	2.23%
318					Mean Detects	0.473					SD Detects	0.187
319					Median Detects	0.49					CV Detects	0.396
320					Skewness Detects	0.177					Kurtosis Detects	-0.0661
321					Mean of Logged Detects	-0.843					SD of Logged Detects	0.467
322												
323					**Normal GOF Test on Detects Only**							
324					Shapiro Wilk Test Statistic	0.977				**Normal GOF Test on Detected Observations Only**		
325					5% Shapiro Wilk P Value	0.082				Detected Data appear Normal at 5% Significance Level		
326					Lilliefors Test Statistic	0.0587				**Lilliefors GOF Test**		
327					5% Lilliefors Critical Value	0.055				Detected Data Not Normal at 5% Significance Level		
328					**Detected Data appear Approximate Normal at 5% Significance Level**							
329												
330					**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**							
331					KM Mean	0.469				KM Standard Error of Mean		0.0115
332					KM SD	0.187				95% KM (BCA) UCL		0.486
333					95% KM (t) UCL	0.488				95% KM (Percentile Bootstrap) UCL		0.487
334					95% KM (z) UCL	0.488				95% KM Bootstrap t UCL		0.487
335					90% KM Chebyshev UCL	0.503				95% KM Chebyshev UCL		0.519
336					97.5% KM Chebyshev UCL	0.54				99% KM Chebyshev UCL		0.583
337												
338					**Gamma GOF Tests on Detected Observations Only**							
339					A-D Test Statistic	2.935				**Anderson-Darling GOF Test**		
340					5% A-D Critical Value	0.756				Detected Data Not Gamma Distributed at 5% Significance Level		
341					K-S Test Statistic	0.0989				**Kolmogorov-Smirnov GOF**		
342					5% K-S Critical Value	0.0565				Detected Data Not Gamma Distributed at 5% Significance Level		
343					**Detected Data Not Gamma Distributed at 5% Significance Level**							
344												
345					**Gamma Statistics on Detected Data Only**							
346					k hat (MLE)	5.436				k star (bias corrected MLE)		5.377
347					Theta hat (MLE)	0.087				Theta star (bias corrected MLE)		0.088
348					nu hat (MLE)	2860				nu star (bias corrected)		2828
349					Mean (detects)	0.473						
350												
351					**Gamma ROS Statistics using Imputed Non-Detects**							
352					GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs							
353					GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)							
354					For such situations, GROS method may yield incorrect values of UCLs and BTVs							
355					This is especially true when the sample size is small.							
356					For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates							
357					Minimum	0.083				Mean		0.469
358					Maximum	1.2				Median		0.48
359					SD	0.187				CV		0.398
360					k hat (MLE)	5.45				k star (bias corrected MLE)		5.391
361					Theta hat (MLE)	0.0861				Theta star (bias corrected MLE)		0.0871
362					nu hat (MLE)	2932				nu star (bias corrected)		2901
363					Adjusted Level of Significance (β)	0.0491						
364					Approximate Chi Square Value (N/A, α)	2776				Adjusted Chi Square Value (N/A, β)		2776

365	95% Gamma Approximate UCL (use when n>=50)					0.49	95% Gamma Adjusted UCL (use when n<50)					0.49
366												
367	**Estimates of Gamma Parameters using KM Estimates**											
368	Mean (KM)					0.469	SD (KM)					0.187
369	Variance (KM)					0.035	SE of Mean (KM)					0.0115
370	k hat (KM)					6.27	k star (KM)					6.203
371	nu hat (KM)					3373	nu star (KM)					3337
372	theta hat (KM)					0.0748	theta star (KM)					0.0756
373	80% gamma percentile (KM)					0.615	90% gamma percentile (KM)					0.72
374	95% gamma percentile (KM)					0.815	99% gamma percentile (KM)					1.013
375												
376	**Gamma Kaplan-Meier (KM) Statistics**											
377	Approximate Chi Square Value (N/A, α)					3204	Adjusted Chi Square Value (N/A, β)					3203
378	95% Gamma Approximate KM-UCL (use when n>=50)					0.488	95% Gamma Adjusted KM-UCL (use when n<50)					0.488
379												
380	**Lognormal GOF Test on Detected Observations Only**											
381	Shapiro Wilk Approximate Test Statistic					0.93	**Shapiro Wilk GOF Test**					
382	5% Shapiro Wilk P Value					0	Detected Data Not Lognormal at 5% Significance Level					
383	Lilliefors Test Statistic					0.123	**Lilliefors GOF Test**					
384	5% Lilliefors Critical Value					0.055	Detected Data Not Lognormal at 5% Significance Level					
385	**Detected Data Not Lognormal at 5% Significance Level**											
386												
387	**Lognormal ROS Statistics Using Imputed Non-Detects**											
388	Mean in Original Scale					0.469	Mean in Log Scale					-0.853
389	SD in Original Scale					0.187	SD in Log Scale					0.466
390	95% t UCL (assumes normality of ROS data)					0.488	95% Percentile Bootstrap UCL					0.488
391	95% BCA Bootstrap UCL					0.488	95% Bootstrap t UCL					0.488
392	95% H-UCL (Log ROS)					0.5						
393												
394	**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**											
395	KM Mean (logged)					-0.854	KM Geo Mean					0.426
396	KM SD (logged)					0.47	95% Critical H Value (KM-Log)					1.782
397	KM Standard Error of Mean (logged)					0.0289	95% H-UCL (KM -Log)					0.5
398	KM SD (logged)					0.47	95% Critical H Value (KM-Log)					1.782
399	KM Standard Error of Mean (logged)					0.0289						
400												
401	**DL/2 Statistics**											
402	**DL/2 Normal**						**DL/2 Log-Transformed**					
403	Mean in Original Scale					0.467	Mean in Log Scale					-0.859
404	SD in Original Scale					0.189	SD in Log Scale					0.474
405	95% t UCL (Assumes normality)					0.486	95% H-Stat UCL					0.499
406	**DL/2 is not a recommended method, provided for comparisons and historical reasons**											
407												
408	**Nonparametric Distribution Free UCL Statistics**											
409	**Detected Data appear Approximate Normal Distributed at 5% Significance Level**											
410												
411	**Suggested UCL to Use**											
412	95% KM (t) UCL					0.488						
413												
414	When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test											
415	When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL											
416												

	A	B	C	D	E	F	G	H	I	J	K	L
417	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
418	Recommendations are based upon data size, data distribution, and skewness.											
419	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
420	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
421												
422	**Cadmium**											
423												
424	**General Statistics**											
425						Total Number of Observations	274				Number of Distinct Observations	80	
426											Number of Missing Observations	26	
427						Number of Detects	109				Number of Non-Detects	165	
428						Number of Distinct Detects	57				Number of Distinct Non-Detects	27	
429						Minimum Detect	0.06				Minimum Non-Detect	0.09	
430						Maximum Detect	93				Maximum Non-Detect	4.4	
431						Variance Detects	114.7				Percent Non-Detects	60.22%	
432						Mean Detects	2.32				SD Detects	10.71	
433						Median Detects	0.3				CV Detects	4.616	
434						Skewness Detects	7.367				Kurtosis Detects	56.67	
435						Mean of Logged Detects	-0.92				SD of Logged Detects	1.396	
436													
437	**Normal GOF Test on Detects Only**											
438						Shapiro Wilk Test Statistic	0.219			**Normal GOF Test on Detected Observations Only**			
439						5% Shapiro Wilk P Value	0			Detected Data Not Normal at 5% Significance Level			
440						Lilliefors Test Statistic	0.416			**Lilliefors GOF Test**			
441						5% Lilliefors Critical Value	0.0852			Detected Data Not Normal at 5% Significance Level			
442	**Detected Data Not Normal at 5% Significance Level**											
443													
444	**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**											
445						KM Mean	1.079				KM Standard Error of Mean	0.413	
446						KM SD	6.801				95% KM (BCA) UCL	1.897	
447						95% KM (t) UCL	1.761				95% KM (Percentile Bootstrap) UCL	1.817	
448						95% KM (z) UCL	1.759				95% KM Bootstrap t UCL	4.826	
449						90% KM Chebyshev UCL	2.318				95% KM Chebyshev UCL	2.879	
450						97.5% KM Chebyshev UCL	3.658				99% KM Chebyshev UCL	5.188	
451													
452	**Gamma GOF Tests on Detected Observations Only**											
453						A-D Test Statistic	14.66			**Anderson-Darling GOF Test**			
454						5% A-D Critical Value	0.849			Detected Data Not Gamma Distributed at 5% Significance Level			
455						K-S Test Statistic	0.262			**Kolmogorov-Smirnov GOF**			
456						5% K-S Critical Value	0.0936			Detected Data Not Gamma Distributed at 5% Significance Level			
457	**Detected Data Not Gamma Distributed at 5% Significance Level**											
458													
459	**Gamma Statistics on Detected Data Only**											
460						k hat (MLE)	0.377				k star (bias corrected MLE)	0.373	
461						Theta hat (MLE)	6.155				Theta star (bias corrected MLE)	6.225	
462						nu hat (MLE)	82.19				nu star (bias corrected)	81.26	
463						Mean (detects)	2.32						
464													
465	**Gamma ROS Statistics using Imputed Non-Detects**											
466	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
467	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)											
468	For such situations, GROS method may yield incorrect values of UCLs and BTVs											

469	This is especially true when the sample size is small.											
470	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates											
471					Minimum	0.01			Mean	1.131		
472					Maximum	93			Median	0.07		
473					SD	6.837			CV	6.047		
474					k hat (MLE)	0.261			k star (bias corrected MLE)	0.26		
475					Theta hat (MLE)	4.336			Theta star (bias corrected MLE)	4.343		
476					nu hat (MLE)	142.9			nu star (bias corrected)	142.7		
477					Adjusted Level of Significance (β)	0.0491						
478					Approximate Chi Square Value (142.66, α)	116.1			Adjusted Chi Square Value (142.66, β)	115.9		
479					95% Gamma Approximate UCL (use when n>=50)	1.39			95% Gamma Adjusted UCL (use when n<50)	1.391		
480												
481	**Estimates of Gamma Parameters using KM Estimates**											
482					Mean (KM)	1.079			SD (KM)	6.801		
483					Variance (KM)	46.25			SE of Mean (KM)	0.413		
484					k hat (KM)	0.0252			k star (KM)	0.0273		
485					nu hat (KM)	13.8			nu star (KM)	14.98		
486					theta hat (KM)	42.86			theta star (KM)	39.48		
487					80% gamma percentile (KM)	0.00646			90% gamma percentile (KM)	0.486		
488					95% gamma percentile (KM)	3.804			99% gamma percentile (KM)	28.52		
489												
490	**Gamma Kaplan-Meier (KM) Statistics**											
491					Approximate Chi Square Value (14.98, α)	7.248			Adjusted Chi Square Value (14.98, β)	7.22		
492					95% Gamma Approximate KM-UCL (use when n>=50)	2.23			95% Gamma Adjusted KM-UCL (use when n<50)	2.239		
493												
494	**Lognormal GOF Test on Detected Observations Only**											
495					Shapiro Wilk Approximate Test Statistic	0.887			**Shapiro Wilk GOF Test**			
496					5% Shapiro Wilk P Value	1.197E-11			Detected Data Not Lognormal at 5% Significance Level			
497					Lilliefors Test Statistic	0.151			**Lilliefors GOF Test**			
498					5% Lilliefors Critical Value	0.0852			Detected Data Not Lognormal at 5% Significance Level			
499	**Detected Data Not Lognormal at 5% Significance Level**											
500												
501	**Lognormal ROS Statistics Using Imputed Non-Detects**											
502					Mean in Original Scale	1.107			Mean in Log Scale	-1.26		
503					SD in Original Scale	6.811			SD in Log Scale	1.113		
504					95% t UCL (assumes normality of ROS data)	1.786			95% Percentile Bootstrap UCL	1.868		
505					95% BCA Bootstrap UCL	2.193			95% Bootstrap t UCL	4.74		
506					95% H-UCL (Log ROS)	0.613						
507												
508	**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**											
509					KM Mean (logged)	-1.318			KM Geo Mean	0.268		
510					KM SD (logged)	1.074			95% Critical H Value (KM-Log)	2.195		
511					KM Standard Error of Mean (logged)	0.0844			95% H-UCL (KM -Log)	0.55		
512					KM SD (logged)	1.074			95% Critical H Value (KM-Log)	2.195		
513					KM Standard Error of Mean (logged)	0.0844						
514												
515	**DL/2 Statistics**											
516	**DL/2 Normal**								**DL/2 Log-Transformed**			
517					Mean in Original Scale	1.204			Mean in Log Scale	-0.845		
518					SD in Original Scale	6.798			SD in Log Scale	0.908		
519					95% t UCL (Assumes normality)	1.882			95% H-Stat UCL	0.726		
520	**DL/2 is not a recommended method, provided for comparisons and historical reasons**											

	A	B	C	D	E	F	G	H	I	J	K	L
521												
522	**Nonparametric Distribution Free UCL Statistics**											
523	**Data do not follow a Discernible Distribution at 5% Significance Level**											
524												
525	**Suggested UCL to Use**											
526	95% KM (Chebyshev) UCL					2.879						
527												
528	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
529	Recommendations are based upon data size, data distribution, and skewness.											
530	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
531	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
532												
533	**Cobalt**											
534												
535	**General Statistics**											
536	Total Number of Observations					267		Number of Distinct Observations				93
537								Number of Missing Observations				26
538	Number of Detects					266		Number of Non-Detects				1
539	Number of Distinct Detects					92		Number of Distinct Non-Detects				1
540	Minimum Detect					0.6		Minimum Non-Detect				1.7
541	Maximum Detect					130		Maximum Non-Detect				1.7
542	Variance Detects					70.01		Percent Non-Detects				0.375%
543	Mean Detects					8.019		SD Detects				8.367
544	Median Detects					7.2		CV Detects				1.043
545	Skewness Detects					11.89		Kurtosis Detects				171.6
546	Mean of Logged Detects					1.914		SD of Logged Detects				0.554
547												
548	**Normal GOF Test on Detects Only**											
549	Shapiro Wilk Test Statistic					0.381		**Normal GOF Test on Detected Observations Only**				
550	5% Shapiro Wilk P Value					0		Detected Data Not Normal at 5% Significance Level				
551	Lilliefors Test Statistic					0.264		**Lilliefors GOF Test**				
552	5% Lilliefors Critical Value					0.0547		Detected Data Not Normal at 5% Significance Level				
553	**Detected Data Not Normal at 5% Significance Level**											
554												
555	**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**											
556	KM Mean					7.993		KM Standard Error of Mean				0.512
557	KM SD					8.347		95% KM (BCA) UCL				8.936
558	95% KM (t) UCL					8.838		95% KM (Percentile Bootstrap) UCL				8.937
559	95% KM (z) UCL					8.835		95% KM Bootstrap t UCL				9.712
560	90% KM Chebyshev UCL					9.528		95% KM Chebyshev UCL				10.22
561	97.5% KM Chebyshev UCL					11.19		99% KM Chebyshev UCL				13.09
562												
563	**Gamma GOF Tests on Detected Observations Only**											
564	A-D Test Statistic					3.759E+28		**Anderson-Darling GOF Test**				
565	5% A-D Critical Value					0.759		Detected Data Not Gamma Distributed at 5% Significance Level				
566	K-S Test Statistic					0.14		**Kolmogorov-Smirnov GOF**				
567	5% K-S Critical Value					0.0564		Detected Data Not Gamma Distributed at 5% Significance Level				
568	**Detected Data Not Gamma Distributed at 5% Significance Level**											
569												
570	**Gamma Statistics on Detected Data Only**											
571	k hat (MLE)					3.137		k star (bias corrected MLE)				3.105
572	Theta hat (MLE)					2.556		Theta star (bias corrected MLE)				2.583

573					nu hat (MLE)	1669				nu star (bias corrected)		1652
574					Mean (detects)	8.019						
575												
576	**Gamma ROS Statistics using Imputed Non-Detects**											
577	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
578	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)											
579	For such situations, GROS method may yield incorrect values of UCLs and BTVs											
580	This is especially true when the sample size is small.											
581	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates											
582					Minimum	0.14				Mean		7.989
583					Maximum	130				Median		7.2
584					SD	8.366				CV		1.047
585					k hat (MLE)	2.956				k star (bias corrected MLE)		2.925
586					Theta hat (MLE)	2.703				Theta star (bias corrected MLE)		2.731
587					nu hat (MLE)	1578				nu star (bias corrected)		1562
588					Adjusted Level of Significance (β)	0.0491						
589					Approximate Chi Square Value (N/A, α)	1471				Adjusted Chi Square Value (N/A, β)		1471
590					95% Gamma Approximate UCL (use when n>=50)	8.482				95% Gamma Adjusted UCL (use when n<50)		8.485
591												
592	**Estimates of Gamma Parameters using KM Estimates**											
593					Mean (KM)	7.993				SD (KM)		8.347
594					Variance (KM)	69.67				SE of Mean (KM)		0.512
595					k hat (KM)	0.917				k star (KM)		0.909
596					nu hat (KM)	489.7				nu star (KM)		485.5
597					theta hat (KM)	8.716				theta star (KM)		8.791
598					80% gamma percentile (KM)	12.96				90% gamma percentile (KM)		18.84
599					95% gamma percentile (KM)	24.77				99% gamma percentile (KM)		38.63
600												
601	**Gamma Kaplan-Meier (KM) Statistics**											
602					Approximate Chi Square Value (485.54, α)	435.4				Adjusted Chi Square Value (485.54, β)		435.2
603					95% Gamma Approximate KM-UCL (use when n>=50)	8.913				95% Gamma Adjusted KM-UCL (use when n<50)		8.918
604												
605	**Lognormal GOF Test on Detected Observations Only**											
606					Shapiro Wilk Approximate Test Statistic	0.933				**Shapiro Wilk GOF Test**		
607					5% Shapiro Wilk P Value	0				Detected Data Not Lognormal at 5% Significance Level		
608					Lilliefors Test Statistic	0.119				**Lilliefors GOF Test**		
609					5% Lilliefors Critical Value	0.0547				Detected Data Not Lognormal at 5% Significance Level		
610	**Detected Data Not Lognormal at 5% Significance Level**											
611												
612	**Lognormal ROS Statistics Using Imputed Non-Detects**											
613					Mean in Original Scale	7.997				Mean in Log Scale		1.91
614					SD in Original Scale	8.359				SD in Log Scale		0.558
615					95% t UCL (assumes normality of ROS data)	8.841				95% Percentile Bootstrap UCL		8.959
616					95% BCA Bootstrap UCL	9.416				95% Bootstrap t UCL		9.707
617					95% H-UCL (Log ROS)	8.395						
618												
619	**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**											
620					KM Mean (logged)	1.907				KM Geo Mean		6.734
621					KM SD (logged)	0.563				95% Critical H Value (KM-Log)		1.83
622					KM Standard Error of Mean (logged)	0.0346				95% H-UCL (KM -Log)		8.408
623					KM SD (logged)	0.563				95% Critical H Value (KM-Log)		1.83
624					KM Standard Error of Mean (logged)	0.0346						

625												
626	**DL/2 Statistics**											
627	**DL/2 Normal**						**DL/2 Log-Transformed**					
628				Mean in Original Scale	7.992				Mean in Log Scale	1.906		
629				SD in Original Scale	8.363				SD in Log Scale	0.567		
630				95% t UCL (Assumes normality)	8.837				95% H-Stat UCL	8.424		
631	**DL/2 is not a recommended method, provided for comparisons and historical reasons**											
632												
633	**Nonparametric Distribution Free UCL Statistics**											
634	**Data do not follow a Discernible Distribution at 5% Significance Level**											
635												
636	**Suggested UCL to Use**											
637				95% KM (Chebyshev) UCL	10.22							
638												
639	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
640	Recommendations are based upon data size, data distribution, and skewness.											
641	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
642	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
643												
644												
645	**Copper**											
646												
647	**General Statistics**											
648				Total Number of Observations	269				Number of Distinct Observations	109		
649									Number of Missing Observations	26		
650				Minimum	2				Mean	129.5		
651				Maximum	14000				Median	21		
652				SD	879.2				Std. Error of Mean	53.61		
653				Coefficient of Variation	6.788				Skewness	14.89		
654												
655	**Normal GOF Test**											
656				Shapiro Wilk Test Statistic	0.132		**Shapiro Wilk GOF Test**					
657				5% Shapiro Wilk P Value	0		Data Not Normal at 5% Significance Level					
658				Lilliefors Test Statistic	0.442		**Lilliefors GOF Test**					
659				5% Lilliefors Critical Value	0.0544		Data Not Normal at 5% Significance Level					
660	**Data Not Normal at 5% Significance Level**											
661												
662	**Assuming Normal Distribution**											
663	**95% Normal UCL**						**95% UCLs (Adjusted for Skewness)**					
664				95% Student's-t UCL	218				95% Adjusted-CLT UCL (Chen-1995)	269.7		
665									95% Modified-t UCL (Johnson-1978)	226.1		
666												
667	**Gamma GOF Test**											
668				A-D Test Statistic	3.717E+28		**Anderson-Darling Gamma GOF Test**					
669				5% A-D Critical Value	0.836		Data Not Gamma Distributed at 5% Significance Level					
670				K-S Test Statistic	0.26		**Kolmogorov-Smirnov Gamma GOF Test**					
671				5% K-S Critical Value	0.0594		Data Not Gamma Distributed at 5% Significance Level					
672	**Data Not Gamma Distributed at 5% Significance Level**											
673												
674	**Gamma Statistics**											
675				k hat (MLE)	0.441				k star (bias corrected MLE)	0.438		
676				Theta hat (MLE)	293.8				Theta star (bias corrected MLE)	295.4		

677					nu hat (MLE)	237.2				nu star (bias corrected)		235.9
678					MLE Mean (bias corrected)	129.5				MLE Sd (bias corrected)		195.6
679										Approximate Chi Square Value (0.05)		201.3
680					Adjusted Level of Significance	0.0491				Adjusted Chi Square Value		201.1
681												
682					**Assuming Gamma Distribution**							
683				95% Approximate Gamma UCL (use when n>=50))		151.8				95% Adjusted Gamma UCL (use when n<50)		151.9
684												
685					**Lognormal GOF Test**							
686					Shapiro Wilk Test Statistic	0.907				**Shapiro Wilk Lognormal GOF Test**		
687					5% Shapiro Wilk P Value	0				Data Not Lognormal at 5% Significance Level		
688					Lilliefors Test Statistic	0.132				**Lilliefors Lognormal GOF Test**		
689					5% Lilliefors Critical Value	0.0544				Data Not Lognormal at 5% Significance Level		
690					**Data Not Lognormal at 5% Significance Level**							
691												
692					**Lognormal Statistics**							
693					Minimum of Logged Data	0.693				Mean of logged Data		3.394
694					Maximum of Logged Data	9.547				SD of logged Data		1.21
695												
696					**Assuming Lognormal Distribution**							
697					95% H-UCL	73.51				90% Chebyshev (MVUE) UCL		79.42
698					95% Chebyshev (MVUE) UCL	87.46				97.5% Chebyshev (MVUE) UCL		98.62
699					99% Chebyshev (MVUE) UCL	120.5						
700												
701					**Nonparametric Distribution Free UCL Statistics**							
702					**Data do not follow a Discernible Distribution (0.05)**							
703												
704					**Nonparametric Distribution Free UCLs**							
705					95% CLT UCL	217.7				95% Jackknife UCL		218
706					95% Standard Bootstrap UCL	219.7				95% Bootstrap-t UCL		529.6
707					95% Hall's Bootstrap UCL	530.9				95% Percentile Bootstrap UCL		232.7
708					95% BCA Bootstrap UCL	291						
709					90% Chebyshev(Mean, Sd) UCL	290.3				95% Chebyshev(Mean, Sd) UCL		363.2
710					97.5% Chebyshev(Mean, Sd) UCL	464.3				99% Chebyshev(Mean, Sd) UCL		662.9
711												
712					**Suggested UCL to Use**							
713					95% Chebyshev (Mean, Sd) UCL	363.2						
714												
715					Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.							
716					Recommendations are based upon data size, data distribution, and skewness.							
717					These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).							
718					However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.							
719												
720												
721	**Iron**											
722												
723					**General Statistics**							
724					Total Number of Observations	267				Number of Distinct Observations		64
725										Number of Missing Observations		26
726					Minimum	2980				Mean		23211
727					Maximum	330000				Median		18000
728					SD	31033				Std. Error of Mean		1899

729				Coefficient of Variation		1.337					Skewness	7.097
730												
731						**Normal GOF Test**						
732					Shapiro Wilk Test Statistic	0.351					**Shapiro Wilk GOF Test**	
733					5% Shapiro Wilk P Value	0					Data Not Normal at 5% Significance Level	
734					Lilliefors Test Statistic	0.326					**Lilliefors GOF Test**	
735					5% Lilliefors Critical Value	0.0546					Data Not Normal at 5% Significance Level	
736						**Data Not Normal at 5% Significance Level**						
737												
738						**Assuming Normal Distribution**						
739					**95% Normal UCL**						**95% UCLs (Adjusted for Skewness)**	
740					95% Student's-t UCL	26346					95% Adjusted-CLT UCL (Chen-1995)	27216
741											95% Modified-t UCL (Johnson-1978)	26483
742												
743						**Gamma GOF Test**						
744					A-D Test Statistic	17.72					**Anderson-Darling Gamma GOF Test**	
745					5% A-D Critical Value	0.764					Data Not Gamma Distributed at 5% Significance Level	
746					K-S Test Statistic	0.196					**Kolmogorov-Smirnov Gamma GOF Test**	
747					5% K-S Critical Value	0.0565					Data Not Gamma Distributed at 5% Significance Level	
748						**Data Not Gamma Distributed at 5% Significance Level**						
749												
750						**Gamma Statistics**						
751					k hat (MLE)	2.294					k star (bias corrected MLE)	2.271
752					Theta hat (MLE)	10117					Theta star (bias corrected MLE)	10221
753					nu hat (MLE)	1225					nu star (bias corrected)	1213
754					MLE Mean (bias corrected)	23211					MLE Sd (bias corrected)	15402
755											Approximate Chi Square Value (0.05)	1133
756					Adjusted Level of Significance	0.0491					Adjusted Chi Square Value	1132
757												
758						**Assuming Gamma Distribution**						
759					95% Approximate Gamma UCL (use when n>=50))	24847					95% Adjusted Gamma UCL (use when n<50)	24856
760												
761						**Lognormal GOF Test**						
762					Shapiro Wilk Test Statistic	0.89					**Shapiro Wilk Lognormal GOF Test**	
763					5% Shapiro Wilk P Value	0					Data Not Lognormal at 5% Significance Level	
764					Lilliefors Test Statistic	0.119					**Lilliefors Lognormal GOF Test**	
765					5% Lilliefors Critical Value	0.0546					Data Not Lognormal at 5% Significance Level	
766						**Data Not Lognormal at 5% Significance Level**						
767												
768						**Lognormal Statistics**						
769					Minimum of Logged Data	8					Mean of logged Data	9.819
770					Maximum of Logged Data	12.71					SD of logged Data	0.558
771												
772						**Assuming Lognormal Distribution**						
773					95% H-UCL	22866					90% Chebyshev (MVUE) UCL	23825
774					95% Chebyshev (MVUE) UCL	24894					97.5% Chebyshev (MVUE) UCL	26378
775					99% Chebyshev (MVUE) UCL	29293						
776												
777						**Nonparametric Distribution Free UCL Statistics**						
778						**Data do not follow a Discernible Distribution (0.05)**						
779												
780						**Nonparametric Distribution Free UCLs**						

781					95% CLT UCL	26335					95% Jackknife UCL	26346
782					95% Standard Bootstrap UCL	26389					95% Bootstrap-t UCL	28252
783					95% Hall's Bootstrap UCL	27356					95% Percentile Bootstrap UCL	26487
784					95% BCA Bootstrap UCL	27364						
785					90% Chebyshev(Mean, Sd) UCL	28908					95% Chebyshev(Mean, Sd) UCL	31489
786					97.5% Chebyshev(Mean, Sd) UCL	35071					99% Chebyshev(Mean, Sd) UCL	42108
787												
788					**Suggested UCL to Use**							
789					95% Chebyshev (Mean, Sd) UCL	31489						
790												
791	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
792	Recommendations are based upon data size, data distribution, and skewness.											
793	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
794	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
795												
796	**Lead**											
797												
798					**General Statistics**							
799					Total Number of Observations	276					Number of Distinct Observations	149
800											Number of Missing Observations	24
801					Number of Detects	266					Number of Non-Detects	10
802					Number of Distinct Detects	144					Number of Distinct Non-Detects	6
803					Minimum Detect	0.75					Minimum Non-Detect	4.1
804					Maximum Detect	7900					Maximum Non-Detect	4.7
805					Variance Detects	716678					Percent Non-Detects	3.623%
806					Mean Detects	358.8					SD Detects	846.6
807					Median Detects	75					CV Detects	2.359
808					Skewness Detects	5.195					Kurtosis Detects	33.93
809					Mean of Logged Detects	4.415					SD of Logged Detects	1.792
810												
811					**Normal GOF Test on Detects Only**							
812					Shapiro Wilk Test Statistic	0.452					**Normal GOF Test on Detected Observations Only**	
813					5% Shapiro Wilk P Value	0					Detected Data Not Normal at 5% Significance Level	
814					Lilliefors Test Statistic	0.336					**Lilliefors GOF Test**	
815					5% Lilliefors Critical Value	0.0547					Detected Data Not Normal at 5% Significance Level	
816					**Detected Data Not Normal at 5% Significance Level**							
817												
818					**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**							
819					KM Mean	345.9					KM Standard Error of Mean	50.19
820					KM SD	832.2					95% KM (BCA) UCL	437.7
821					95% KM (t) UCL	428.7					95% KM (Percentile Bootstrap) UCL	428.3
822					95% KM (z) UCL	428.4					95% KM Bootstrap t UCL	453.7
823					90% KM Chebyshev UCL	496.4					95% KM Chebyshev UCL	564.6
824					97.5% KM Chebyshev UCL	659.3					99% KM Chebyshev UCL	845.2
825												
826					**Gamma GOF Tests on Detected Observations Only**							
827					A-D Test Statistic	8.319					**Anderson-Darling GOF Test**	
828					5% A-D Critical Value	0.836					Detected Data Not Gamma Distributed at 5% Significance Level	
829					K-S Test Statistic	0.122					**Kolmogorov-Smirnov GOF**	
830					5% K-S Critical Value	0.0597					Detected Data Not Gamma Distributed at 5% Significance Level	
831					**Detected Data Not Gamma Distributed at 5% Significance Level**							
832												

	A	B	C	D	E	F	G	H	I	J	K	L
833	**Gamma Statistics on Detected Data Only**											
834					k hat (MLE)	0.441			k star (bias corrected MLE)			0.439
835					Theta hat (MLE)	813			Theta star (bias corrected MLE)			817.6
836					nu hat (MLE)	234.8			nu star (bias corrected)			233.5
837					Mean (detects)	358.8						
838												
839	**Gamma ROS Statistics using Imputed Non-Detects**											
840	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
841	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)											
842	For such situations, GROS method may yield incorrect values of UCLs and BTVs											
843	This is especially true when the sample size is small.											
844	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates											
845					Minimum	0.01			Mean			345.8
846					Maximum	7900			Median			65.5
847					SD	833.7			CV			2.411
848					k hat (MLE)	0.378			k star (bias corrected MLE)			0.376
849					Theta hat (MLE)	915.2			Theta star (bias corrected MLE)			919.3
850					nu hat (MLE)	208.6			nu star (bias corrected)			207.6
851					Adjusted Level of Significance (β)	0.0491						
852					Approximate Chi Square Value (207.64, α)	175.3			Adjusted Chi Square Value (207.64, β)			175.1
853					95% Gamma Approximate UCL (use when n>=50)	409.6			95% Gamma Adjusted UCL (use when n<50)			410
854												
855	**Estimates of Gamma Parameters using KM Estimates**											
856					Mean (KM)	345.9			SD (KM)			832.2
857					Variance (KM)	692557			SE of Mean (KM)			50.19
858					k hat (KM)	0.173			k star (KM)			0.173
859					nu hat (KM)	95.35			nu star (KM)			95.65
860					theta hat (KM)	2002			theta star (KM)			1996
861					80% gamma percentile (KM)	418.8			90% gamma percentile (KM)			1041
862					95% gamma percentile (KM)	1846			99% gamma percentile (KM)			4119
863												
864	**Gamma Kaplan-Meier (KM) Statistics**											
865					Approximate Chi Square Value (95.65, α)	74.09			Adjusted Chi Square Value (95.65, β)			73.99
866					95% Gamma Approximate KM-UCL (use when n>=50)	446.5			95% Gamma Adjusted KM-UCL (use when n<50)			447.1
867												
868	**Lognormal GOF Test on Detected Observations Only**											
869					Shapiro Wilk Approximate Test Statistic	0.977			**Shapiro Wilk GOF Test**			
870					5% Shapiro Wilk P Value	0.0798			Detected Data appear Lognormal at 5% Significance Level			
871					Lilliefors Test Statistic	0.0595			**Lilliefors GOF Test**			
872					5% Lilliefors Critical Value	0.0547			Detected Data Not Lognormal at 5% Significance Level			
873	**Detected Data appear Approximate Lognormal at 5% Significance Level**											
874												
875	**Lognormal ROS Statistics Using Imputed Non-Detects**											
876					Mean in Original Scale	345.9			Mean in Log Scale			4.286
877					SD in Original Scale	833.7			SD in Log Scale			1.881
878					95% t UCL (assumes normality of ROS data)	428.7			95% Percentile Bootstrap UCL			438.9
879					95% BCA Bootstrap UCL	443.9			95% Bootstrap t UCL			448.7
880					95% H-UCL (Log ROS)	599.4						
881												
882	**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**											
883					KM Mean (logged)	4.279			KM Geo Mean			72.14
884					KM SD (logged)	1.894			95% Critical H Value (KM-Log)			3.009

885			KM Standard Error of Mean (logged)			0.114				95% H-UCL (KM -Log)		611.7
886			KM SD (logged)			1.894				95% Critical H Value (KM-Log)		3.009
887			KM Standard Error of Mean (logged)			0.114						
888												
889						**DL/2 Statistics**						
890			**DL/2 Normal**						**DL/2 Log-Transformed**			
891			Mean in Original Scale			345.9			Mean in Log Scale			4.284
892			SD in Original Scale			833.7			SD in Log Scale			1.885
893			95% t UCL (Assumes normality)			428.7			95% H-Stat UCL			602.7
894						**DL/2 is not a recommended method, provided for comparisons and historical reasons**						
895												
896						**Nonparametric Distribution Free UCL Statistics**						
897						**Detected Data appear Approximate Lognormal Distributed at 5% Significance Level**						
898												
899						**Suggested UCL to Use**						
900			KM H-UCL			611.7						
901												
902						Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.						
903						Recommendations are based upon data size, data distribution, and skewness.						
904						These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).						
905						However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.						
906												
907												
908	**Manganese**											
909												
910						**General Statistics**						
911			Total Number of Observations			267			Number of Distinct Observations			84
912									Number of Missing Observations			26
913			Minimum			3.9			Mean			277.8
914			Maximum			2800			Median			210
915			SD			310.1			Std. Error of Mean			18.98
916			Coefficient of Variation			1.116			Skewness			5.251
917												
918						**Normal GOF Test**						
919			Shapiro Wilk Test Statistic			0.531			**Shapiro Wilk GOF Test**			
920			5% Shapiro Wilk P Value			0			Data Not Normal at 5% Significance Level			
921			Lilliefors Test Statistic			0.24			**Lilliefors GOF Test**			
922			5% Lilliefors Critical Value			0.0546			Data Not Normal at 5% Significance Level			
923						**Data Not Normal at 5% Significance Level**						
924												
925						**Assuming Normal Distribution**						
926			**95% Normal UCL**						**95% UCLs (Adjusted for Skewness)**			
927			95% Student's-t UCL			309.1			95% Adjusted-CLT UCL (Chen-1995)			315.5
928									95% Modified-t UCL (Johnson-1978)			310.1
929												
930						**Gamma GOF Test**						
931			A-D Test Statistic			5.687			**Anderson-Darling Gamma GOF Test**			
932			5% A-D Critical Value			0.768			Data Not Gamma Distributed at 5% Significance Level			
933			K-S Test Statistic			0.114			**Kolmogorov-Smirnov Gamma GOF Test**			
934			5% K-S Critical Value			0.0567			Data Not Gamma Distributed at 5% Significance Level			
935						**Data Not Gamma Distributed at 5% Significance Level**						
936												

	A	B	C	D	E	F	G	H	I	J	K	L
937	**Gamma Statistics**											
938					k hat (MLE)	1.833			k star (bias corrected MLE)			1.815
939					Theta hat (MLE)	151.6			Theta star (bias corrected MLE)			153.1
940					nu hat (MLE)	978.7			nu star (bias corrected)			969.1
941					MLE Mean (bias corrected)	277.8			MLE Sd (bias corrected)			206.2
942									Approximate Chi Square Value (0.05)			897.8
943					Adjusted Level of Significance	0.0491			Adjusted Chi Square Value			897.5
944												
945	**Assuming Gamma Distribution**											
946				95% Approximate Gamma UCL (use when n>=50))		299.8			95% Adjusted Gamma UCL (use when n<50)			300
947												
948	**Lognormal GOF Test**											
949					Shapiro Wilk Test Statistic	0.958			**Shapiro Wilk Lognormal GOF Test**			
950					5% Shapiro Wilk P Value	2.2516E-6			Data Not Lognormal at 5% Significance Level			
951					Lilliefors Test Statistic	0.0916			**Lilliefors Lognormal GOF Test**			
952					5% Lilliefors Critical Value	0.0546			Data Not Lognormal at 5% Significance Level			
953	**Data Not Lognormal at 5% Significance Level**											
954												
955	**Lognormal Statistics**											
956					Minimum of Logged Data	1.361			Mean of logged Data			5.33
957					Maximum of Logged Data	7.937			SD of logged Data			0.762
958												
959	**Assuming Lognormal Distribution**											
960					95% H-UCL	302.3			90% Chebyshev (MVUE) UCL			319.1
961					95% Chebyshev (MVUE) UCL	338.8			97.5% Chebyshev (MVUE) UCL			366.2
962					99% Chebyshev (MVUE) UCL	420						
963												
964	**Nonparametric Distribution Free UCL Statistics**											
965	**Data do not follow a Discernible Distribution (0.05)**											
966												
967	**Nonparametric Distribution Free UCLs**											
968					95% CLT UCL	309			95% Jackknife UCL			309.1
969					95% Standard Bootstrap UCL	308.4			95% Bootstrap-t UCL			320
970					95% Hall's Bootstrap UCL	319.9			95% Percentile Bootstrap UCL			311.1
971					95% BCA Bootstrap UCL	317.8						
972					90% Chebyshev(Mean, Sd) UCL	334.7			95% Chebyshev(Mean, Sd) UCL			360.5
973					97.5% Chebyshev(Mean, Sd) UCL	396.3			99% Chebyshev(Mean, Sd) UCL			466.7
974												
975	**Suggested UCL to Use**											
976					95% Chebyshev (Mean, Sd) UCL	360.5						
977												
978	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
979	Recommendations are based upon data size, data distribution, and skewness.											
980	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
981	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
982												
983	**Mercury**											
984												
985	**General Statistics**											
986					Total Number of Observations	274			Number of Distinct Observations			103
987									Number of Missing Observations			26
988					Number of Detects	265			Number of Non-Detects			9

989					Number of Distinct Detects	103					Number of Distinct Non-Detects	2
990					Minimum Detect	0.02					Minimum Non-Detect	0.07
991					Maximum Detect	23					Maximum Non-Detect	0.08
992					Variance Detects	5.745					Percent Non-Detects	3.285%
993					Mean Detects	0.95					SD Detects	2.397
994					Median Detects	0.21					CV Detects	2.522
995					Skewness Detects	5.564					Kurtosis Detects	37.86
996					Mean of Logged Detects	-1.415					SD of Logged Detects	1.597
997												
998					**Normal GOF Test on Detects Only**							
999					Shapiro Wilk Test Statistic	0.416	**Normal GOF Test on Detected Observations Only**					
1000					5% Shapiro Wilk P Value	0	Detected Data Not Normal at 5% Significance Level					
1001					Lilliefors Test Statistic	0.349	**Lilliefors GOF Test**					
1002					5% Lilliefors Critical Value	0.0548	Detected Data Not Normal at 5% Significance Level					
1003					**Detected Data Not Normal at 5% Significance Level**							
1004												
1005					**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**							
1006					KM Mean	0.92	KM Standard Error of Mean	0.143				
1007					KM SD	2.358	95% KM (BCA) UCL	1.197				
1008					95% KM (t) UCL	1.156	95% KM (Percentile Bootstrap) UCL	1.182				
1009					95% KM (z) UCL	1.155	95% KM Bootstrap t UCL	1.243				
1010					90% KM Chebyshev UCL	1.349	95% KM Chebyshev UCL	1.543				
1011					97.5% KM Chebyshev UCL	1.812	99% KM Chebyshev UCL	2.341				
1012												
1013					**Gamma GOF Tests on Detected Observations Only**							
1014					A-D Test Statistic	11.75	**Anderson-Darling GOF Test**					
1015					5% A-D Critical Value	0.829	Detected Data Not Gamma Distributed at 5% Significance Level					
1016					K-S Test Statistic	0.146	**Kolmogorov-Smirnov GOF**					
1017					5% K-S Critical Value	0.0596	Detected Data Not Gamma Distributed at 5% Significance Level					
1018					**Detected Data Not Gamma Distributed at 5% Significance Level**							
1019												
1020					**Gamma Statistics on Detected Data Only**							
1021					k hat (MLE)	0.47	k star (bias corrected MLE)	0.467				
1022					Theta hat (MLE)	2.021	Theta star (bias corrected MLE)	2.033				
1023					nu hat (MLE)	249.2	nu star (bias corrected)	247.7				
1024					Mean (detects)	0.95						
1025												
1026					**Gamma ROS Statistics using Imputed Non-Detects**							
1027					GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs							
1028					GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)							
1029					For such situations, GROS method may yield incorrect values of UCLs and BTVs							
1030					This is especially true when the sample size is small.							
1031					For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates							
1032					Minimum	0.01	Mean	0.919				
1033					Maximum	23	Median	0.19				
1034					SD	2.363	CV	2.57				
1035					k hat (MLE)	0.45	k star (bias corrected MLE)	0.447				
1036					Theta hat (MLE)	2.044	Theta star (bias corrected MLE)	2.056				
1037					nu hat (MLE)	246.5	nu star (bias corrected)	245.1				
1038					Adjusted Level of Significance (β)	0.0491						
1039					Approximate Chi Square Value (245.11, α)	209.9	Adjusted Chi Square Value (245.11, β)	209.7				
1040					95% Gamma Approximate UCL (use when n>=50)	1.074	95% Gamma Adjusted UCL (use when n<50)	1.075				

1041												
1042	**Estimates of Gamma Parameters using KM Estimates**											
1043					Mean (KM)	0.92			SD (KM)	2.358		
1044					Variance (KM)	5.562			SE of Mean (KM)	0.143		
1045					k hat (KM)	0.152			k star (KM)	0.153		
1046					nu hat (KM)	83.46			nu star (KM)	83.88		
1047					theta hat (KM)	6.043			theta star (KM)	6.013		
1048					80% gamma percentile (KM)	1.018			90% gamma percentile (KM)	2.737		
1049					95% gamma percentile (KM)	5.045			99% gamma percentile (KM)	11.72		
1050												
1051	**Gamma Kaplan-Meier (KM) Statistics**											
1052					Approximate Chi Square Value (83.88, α)	63.77			Adjusted Chi Square Value (83.88, β)	63.68		
1053					95% Gamma Approximate KM-UCL (use when n>=50)	1.211			95% Gamma Adjusted KM-UCL (use when n<50)	1.212		
1054												
1055	**Lognormal GOF Test on Detected Observations Only**											
1056					Shapiro Wilk Approximate Test Statistic	0.951			**Shapiro Wilk GOF Test**			
1057					5% Shapiro Wilk P Value	4.6109E-9			Detected Data Not Lognormal at 5% Significance Level			
1058					Lilliefors Test Statistic	0.0687			**Lilliefors GOF Test**			
1059					5% Lilliefors Critical Value	0.0548			Detected Data Not Lognormal at 5% Significance Level			
1060	**Detected Data Not Lognormal at 5% Significance Level**											
1061												
1062	**Lognormal ROS Statistics Using Imputed Non-Detects**											
1063					Mean in Original Scale	0.92			Mean in Log Scale	-1.477		
1064					SD in Original Scale	2.363			SD in Log Scale	1.61		
1065					95% t UCL (assumes normality of ROS data)	1.156			95% Percentile Bootstrap UCL	1.179		
1066					95% BCA Bootstrap UCL	1.197			95% Bootstrap t UCL	1.208		
1067					95% H-UCL (Log ROS)	1.085						
1068												
1069	**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**											
1070					KM Mean (logged)	-1.477			KM Geo Mean	0.228		
1071					KM SD (logged)	1.606			95% Critical H Value (KM-Log)	2.7		
1072					KM Standard Error of Mean (logged)	0.0973			95% H-UCL (KM -Log)	1.077		
1073					KM SD (logged)	1.606			95% Critical H Value (KM-Log)	2.7		
1074					KM Standard Error of Mean (logged)	0.0973						
1075												
1076	**DL/2 Statistics**											
1077	**DL/2 Normal**								**DL/2 Log-Transformed**			
1078					Mean in Original Scale	0.92			Mean in Log Scale	-1.477		
1079					SD in Original Scale	2.363			SD in Log Scale	1.606		
1080					95% t UCL (Assumes normality)	1.156			95% H-Stat UCL	1.079		
1081	**DL/2 is not a recommended method, provided for comparisons and historical reasons**											
1082												
1083	**Nonparametric Distribution Free UCL Statistics**											
1084	**Data do not follow a Discernible Distribution at 5% Significance Level**											
1085												
1086	**Suggested UCL to Use**											
1087					95% KM (Chebyshev) UCL	1.543						
1088												
1089	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
1090	Recommendations are based upon data size, data distribution, and skewness.											
1091	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
1092	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											

	A	B	C	D	E	F	G	H	I	J	K	L
1093												
1094												
1095	**Nickel**											
1096												
1097	**General Statistics**											
1098	Total Number of Observations					273	Number of Distinct Observations					97
1099							Number of Missing Observations					27
1100	Minimum					0.19	Mean					21.87
1101	Maximum					1100	Median					11
1102	SD					73.49	Std. Error of Mean					4.448
1103	Coefficient of Variation					3.36	Skewness					12.37
1104												
1105	**Normal GOF Test**											
1106	Shapiro Wilk Test Statistic					0.206	**Shapiro Wilk GOF Test**					
1107	5% Shapiro Wilk P Value					0	Data Not Normal at 5% Significance Level					
1108	Lilliefors Test Statistic					0.384	**Lilliefors GOF Test**					
1109	5% Lilliefors Critical Value					0.054	Data Not Normal at 5% Significance Level					
1110	**Data Not Normal at 5% Significance Level**											
1111												
1112	**Assuming Normal Distribution**											
1113	**95% Normal UCL**						**95% UCLs (Adjusted for Skewness)**					
1114	95% Student's-t UCL					29.22	95% Adjusted-CLT UCL (Chen-1995)					32.75
1115							95% Modified-t UCL (Johnson-1978)					29.77
1116												
1117	**Gamma GOF Test**											
1118	A-D Test Statistic					3.663E+28	**Anderson-Darling Gamma GOF Test**					
1119	5% A-D Critical Value					0.788	Data Not Gamma Distributed at 5% Significance Level					
1120	K-S Test Statistic					0.271	**Kolmogorov-Smirnov Gamma GOF Test**					
1121	5% K-S Critical Value					0.057	Data Not Gamma Distributed at 5% Significance Level					
1122	**Data Not Gamma Distributed at 5% Significance Level**											
1123												
1124	**Gamma Statistics**											
1125	k hat (MLE)					0.92	k star (bias corrected MLE)					0.913
1126	Theta hat (MLE)					23.77	Theta star (bias corrected MLE)					23.97
1127	nu hat (MLE)					502.5	nu star (bias corrected)					498.3
1128	MLE Mean (bias corrected)					21.87	MLE Sd (bias corrected)					22.9
1129							Approximate Chi Square Value (0.05)					447.5
1130	Adjusted Level of Significance					0.0491	Adjusted Chi Square Value					447.3
1131												
1132	**Assuming Gamma Distribution**											
1133	95% Approximate Gamma UCL (use when n>=50))					24.36	95% Adjusted Gamma UCL (use when n<50)					24.37
1134												
1135	**Lognormal GOF Test**											
1136	Shapiro Wilk Test Statistic					0.866	**Shapiro Wilk Lognormal GOF Test**					
1137	5% Shapiro Wilk P Value					0	Data Not Lognormal at 5% Significance Level					
1138	Lilliefors Test Statistic					0.157	**Lilliefors Lognormal GOF Test**					
1139	5% Lilliefors Critical Value					0.054	Data Not Lognormal at 5% Significance Level					
1140	**Data Not Lognormal at 5% Significance Level**											
1141												
1142	**Lognormal Statistics**											
1143	Minimum of Logged Data					-1.661	Mean of logged Data					2.452
1144	Maximum of Logged Data					7.003	SD of logged Data					0.9

1145												
1146	**Assuming Lognormal Distribution**											
1147					95% H-UCL	19.47			90% Chebyshev (MVUE) UCL	20.72		
1148					95% Chebyshev (MVUE) UCL	22.23			97.5% Chebyshev (MVUE) UCL	24.33		
1149					99% Chebyshev (MVUE) UCL	28.47						
1150												
1151	**Nonparametric Distribution Free UCL Statistics**											
1152	**Data do not follow a Discernible Distribution (0.05)**											
1153												
1154	**Nonparametric Distribution Free UCLs**											
1155					95% CLT UCL	29.19			95% Jackknife UCL	29.22		
1156					95% Standard Bootstrap UCL	29.32			95% Bootstrap-t UCL	42.6		
1157					95% Hall's Bootstrap UCL	55.83			95% Percentile Bootstrap UCL	29.72		
1158					95% BCA Bootstrap UCL	35.16						
1159					90% Chebyshev(Mean, Sd) UCL	35.22			95% Chebyshev(Mean, Sd) UCL	41.26		
1160					97.5% Chebyshev(Mean, Sd) UCL	49.65			99% Chebyshev(Mean, Sd) UCL	66.13		
1161												
1162	**Suggested UCL to Use**											
1163					95% Chebyshev (Mean, Sd) UCL	41.26						
1164												
1165	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
1166	Recommendations are based upon data size, data distribution, and skewness.											
1167	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
1168	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
1169												
1170												
1171	**Vanadium**											
1172												
1173	**General Statistics**											
1174					Total Number of Observations	267			Number of Distinct Observations	54		
1175									Number of Missing Observations	26		
1176					Minimum	8.8			Mean	29.13		
1177					Maximum	890			Median	24		
1178					SD	54.03			Std. Error of Mean	3.306		
1179					Coefficient of Variation	1.855			Skewness	15.34		
1180												
1181	**Normal GOF Test**											
1182					Shapiro Wilk Test Statistic	0.17			**Shapiro Wilk GOF Test**			
1183					5% Shapiro Wilk P Value	0			Data Not Normal at 5% Significance Level			
1184					Lilliefors Test Statistic	0.364			**Lilliefors GOF Test**			
1185					5% Lilliefors Critical Value	0.0546			Data Not Normal at 5% Significance Level			
1186	**Data Not Normal at 5% Significance Level**											
1187												
1188	**Assuming Normal Distribution**											
1189	**95% Normal UCL**								**95% UCLs (Adjusted for Skewness)**			
1190					95% Student's-t UCL	34.59			95% Adjusted-CLT UCL (Chen-1995)	37.89		
1191									95% Modified-t UCL (Johnson-1978)	35.11		
1192												
1193	**Gamma GOF Test**											
1194					A-D Test Statistic	3.745E+28			**Anderson-Darling Gamma GOF Test**			
1195					5% A-D Critical Value	0.76			Data Not Gamma Distributed at 5% Significance Level			
1196					K-S Test Statistic	0.208			**Kolmogorov-Smirnov Gamma GOF Test**			

1197				5% K-S Critical Value	0.0563	Data Not Gamma Distributed at 5% Significance Level						
1198	**Data Not Gamma Distributed at 5% Significance Level**											
1199												
1200	**Gamma Statistics**											
1201				k hat (MLE)	3.083	k star (bias corrected MLE)						3.051
1202				Theta hat (MLE)	9.448	Theta star (bias corrected MLE)						9.548
1203				nu hat (MLE)	1646	nu star (bias corrected)						1629
1204				MLE Mean (bias corrected)	29.13	MLE Sd (bias corrected)						16.68
1205						Approximate Chi Square Value (0.05)						1537
1206				Adjusted Level of Significance	0.0491	Adjusted Chi Square Value						1536
1207												
1208	**Assuming Gamma Distribution**											
1209			95% Approximate Gamma UCL (use when n>=50))		30.89	95% Adjusted Gamma UCL (use when n<50)						30.9
1210												
1211	**Lognormal GOF Test**											
1212				Shapiro Wilk Test Statistic	0.86	**Shapiro Wilk Lognormal GOF Test**						
1213				5% Shapiro Wilk P Value	0	Data Not Lognormal at 5% Significance Level						
1214				Lilliefors Test Statistic	0.109	**Lilliefors Lognormal GOF Test**						
1215				5% Lilliefors Critical Value	0.0546	Data Not Lognormal at 5% Significance Level						
1216	**Data Not Lognormal at 5% Significance Level**											
1217												
1218	**Lognormal Statistics**											
1219				Minimum of Logged Data	2.175	Mean of logged Data						3.201
1220				Maximum of Logged Data	6.791	SD of logged Data						0.412
1221												
1222	**Assuming Lognormal Distribution**											
1223				95% H-UCL	27.94	90% Chebyshev (MVUE) UCL						28.83
1224				95% Chebyshev (MVUE) UCL	29.78	97.5% Chebyshev (MVUE) UCL						31.1
1225				99% Chebyshev (MVUE) UCL	33.7							
1226												
1227	**Nonparametric Distribution Free UCL Statistics**											
1228	**Data do not follow a Discernible Distribution (0.05)**											
1229												
1230	**Nonparametric Distribution Free UCLs**											
1231				95% CLT UCL	34.57	95% Jackknife UCL						34.59
1232				95% Standard Bootstrap UCL	34.45	95% Bootstrap-t UCL						50.8
1233				95% Hall's Bootstrap UCL	55.82	95% Percentile Bootstrap UCL						35.61
1234				95% BCA Bootstrap UCL	39.66							
1235				90% Chebyshev(Mean, Sd) UCL	39.05	95% Chebyshev(Mean, Sd) UCL						43.54
1236				97.5% Chebyshev(Mean, Sd) UCL	49.78	99% Chebyshev(Mean, Sd) UCL						62.03
1237												
1238	**Suggested UCL to Use**											
1239				95% Student's-t UCL	34.59	or 95% Modified-t UCL						35.11
1240												
1241	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
1242	Recommendations are based upon data size, data distribution, and skewness.											
1243	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
1244	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
1245												
1246												
1247	**Zinc**											
1248												

	A	B	C	D	E	F	G	H	I	J	K	L
1249	**General Statistics**											
1250	Total Number of Observations					269	Number of Distinct Observations					136
1251							Number of Missing Observations					26
1252	Minimum					1.3	Mean					332
1253	Maximum					21000	Median					66
1254	SD					1459	Std. Error of Mean					88.97
1255	Coefficient of Variation					4.395	Skewness					11.61
1256												
1257	**Normal GOF Test**											
1258	Shapiro Wilk Test Statistic					0.214	**Shapiro Wilk GOF Test**					
1259	5% Shapiro Wilk P Value					0	Data Not Normal at 5% Significance Level					
1260	Lilliefors Test Statistic					0.41	**Lilliefors GOF Test**					
1261	5% Lilliefors Critical Value					0.0544	Data Not Normal at 5% Significance Level					
1262	**Data Not Normal at 5% Significance Level**											
1263												
1264	**Assuming Normal Distribution**											
1265	**95% Normal UCL**						**95% UCLs (Adjusted for Skewness)**					
1266	95% Student's-t UCL					478.8	95% Adjusted-CLT UCL (Chen-1995)					545.6
1267							95% Modified-t UCL (Johnson-1978)					489.3
1268												
1269	**Gamma GOF Test**											
1270	A-D Test Statistic					24.7	**Anderson-Darling Gamma GOF Test**					
1271	5% A-D Critical Value					0.823	Data Not Gamma Distributed at 5% Significance Level					
1272	K-S Test Statistic					0.212	**Kolmogorov-Smirnov Gamma GOF Test**					
1273	5% K-S Critical Value					0.0589	Data Not Gamma Distributed at 5% Significance Level					
1274	**Data Not Gamma Distributed at 5% Significance Level**											
1275												
1276	**Gamma Statistics**											
1277	k hat (MLE)					0.492	k star (bias corrected MLE)					0.489
1278	Theta hat (MLE)					675.1	Theta star (bias corrected MLE)					679.3
1279	nu hat (MLE)					264.5	nu star (bias corrected)					262.9
1280	MLE Mean (bias corrected)					332	MLE Sd (bias corrected)					474.9
1281							Approximate Chi Square Value (0.05)					226.4
1282	Adjusted Level of Significance					0.0491	Adjusted Chi Square Value					226.2
1283												
1284	**Assuming Gamma Distribution**											
1285	95% Approximate Gamma UCL (use when n>=50))					385.6	95% Adjusted Gamma UCL (use when n<50)					385.9
1286												
1287	**Lognormal GOF Test**											
1288	Shapiro Wilk Test Statistic					0.951	**Shapiro Wilk Lognormal GOF Test**					
1289	5% Shapiro Wilk P Value					3.6727E-9	Data Not Lognormal at 5% Significance Level					
1290	Lilliefors Test Statistic					0.11	**Lilliefors Lognormal GOF Test**					
1291	5% Lilliefors Critical Value					0.0544	Data Not Lognormal at 5% Significance Level					
1292	**Data Not Lognormal at 5% Significance Level**											
1293												
1294	**Lognormal Statistics**											
1295	Minimum of Logged Data					0.262	Mean of logged Data					4.51
1296	Maximum of Logged Data					9.952	SD of logged Data					1.3
1297												
1298	**Assuming Lognormal Distribution**											
1299	95% H-UCL					256.1	90% Chebyshev (MVUE) UCL					277.6
1300	95% Chebyshev (MVUE) UCL					307.9	97.5% Chebyshev (MVUE) UCL					350.1

	A	B	C	D	E	F	G	H	I	J	K	L
1301					99% Chebyshev (MVUE) UCL	432.9						
1302												
1303					**Nonparametric Distribution Free UCL Statistics**							
1304					**Data do not follow a Discernible Distribution (0.05)**							
1305												
1306					**Nonparametric Distribution Free UCLs**							
1307					95% CLT UCL	478.3			95% Jackknife UCL	478.8		
1308					95% Standard Bootstrap UCL	477.9			95% Bootstrap-t UCL	710.1		
1309					95% Hall's Bootstrap UCL	1050			95% Percentile Bootstrap UCL	495.9		
1310					95% BCA Bootstrap UCL	561.4						
1311					90% Chebyshev(Mean, Sd) UCL	598.9			95% Chebyshev(Mean, Sd) UCL	719.8		
1312					97.5% Chebyshev(Mean, Sd) UCL	887.6			99% Chebyshev(Mean, Sd) UCL	1217		
1313												
1314					**Suggested UCL to Use**							
1315					95% Chebyshev (Mean, Sd) UCL	719.8						
1316												
1317					Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.							
1318					Recommendations are based upon data size, data distribution, and skewness.							
1319					These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).							
1320					However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.							
1321												

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.111/30/2016 6:13:08 PM
From File	With_ Ancillary_metals_input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Polychlorinated biphenyls (PCBs)

General Statistics

Total Number of Observations	106	Number of Distinct Observations	89
		Number of Missing Observations	194
Number of Detects	44	Number of Non-Detects	62
Number of Distinct Detects	43	Number of Distinct Non-Detects	48
Minimum Detect	0.00473	Minimum Non-Detect	0.034
Maximum Detect	31.8	Maximum Non-Detect	0.379
Variance Detects	24.28	Percent Non-Detects	58.49%
Mean Detects	1.757	SD Detects	4.928
Median Detects	0.211	CV Detects	2.805
Skewness Detects	5.535	Kurtosis Detects	33.76
Mean of Logged Detects	-1.632	SD of Logged Detects	2.365

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.376	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.944	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.361	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.132	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

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

KM Mean	0.738	KM Standard Error of Mean	0.32
KM SD	3.254	95% KM (BCA) UCL	1.333
95% KM (t) UCL	1.269	95% KM (Percentile Bootstrap) UCL	1.316
95% KM (z) UCL	1.264	95% KM Bootstrap t UCL	2.178
90% KM Chebyshev UCL	1.698	95% KM Chebyshev UCL	2.132
97.5% KM Chebyshev UCL	2.735	99% KM Chebyshev UCL	3.919

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.607	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.858	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.168	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.145	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.312	k star (bias corrected MLE)	0.306
Theta hat (MLE)	5.63	Theta star (bias corrected MLE)	5.743
nu hat (MLE)	27.46	nu star (bias corrected)	26.92
Mean (detects)	1.757		

53	**Gamma ROS Statistics using Imputed Non-Detects**											
54	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
55	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)											
56	For such situations, GROS method may yield incorrect values of UCLs and BTVs											
57	This is especially true when the sample size is small.											
58	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates											
59					Minimum	0.00473			Mean	0.735		
60					Maximum	31.8			Median	0.01		
61					SD	3.27			CV	4.449		
62					k hat (MLE)	0.234			k star (bias corrected MLE)	0.234		
63					Theta hat (MLE)	3.137			Theta star (bias corrected MLE)	3.142		
64					nu hat (MLE)	49.67			nu star (bias corrected)	49.6		
65					Adjusted Level of Significance (β)	0.0477						
66					Approximate Chi Square Value (49.60, α)	34.43			Adjusted Chi Square Value (49.60, β)	34.26		
67					95% Gamma Approximate UCL (use when n>=50)	1.059			95% Gamma Adjusted UCL (use when n<50)	1.064		
68												
69	**Estimates of Gamma Parameters using KM Estimates**											
70					Mean (KM)	0.738			SD (KM)	3.254		
71					Variance (KM)	10.59			SE of Mean (KM)	0.32		
72					k hat (KM)	0.0515			k star (KM)	0.0563		
73					nu hat (KM)	10.92			nu star (KM)	11.94		
74					theta hat (KM)	14.34			theta star (KM)	13.11		
75					80% gamma percentile (KM)	0.148			90% gamma percentile (KM)	1.301		
76					95% gamma percentile (KM)	4.076			99% gamma percentile (KM)	15.3		
77												
78	**Gamma Kaplan-Meier (KM) Statistics**											
79					Approximate Chi Square Value (11.94, α)	5.19			Adjusted Chi Square Value (11.94, β)	5.129		
80					95% Gamma Approximate KM-UCL (use when n>=50)	1.699			95% Gamma Adjusted KM-UCL (use when n<50)	1.72		
81												
82	**Lognormal GOF Test on Detected Observations Only**											
83					Shapiro Wilk Test Statistic	0.948			**Shapiro Wilk GOF Test**			
84					5% Shapiro Wilk Critical Value	0.944			Detected Data appear Lognormal at 5% Significance Level			
85					Lilliefors Test Statistic	0.0938			**Lilliefors GOF Test**			
86					5% Lilliefors Critical Value	0.132			Detected Data appear Lognormal at 5% Significance Level			
87	**Detected Data appear Lognormal at 5% Significance Level**											
88												
89	**Lognormal ROS Statistics Using Imputed Non-Detects**											
90					Mean in Original Scale	0.739			Mean in Log Scale	-3.144		
91					SD in Original Scale	3.269			SD in Log Scale	2.028		
92					95% t UCL (assumes normality of ROS data)	1.266			95% Percentile Bootstrap UCL	1.319		
93					95% BCA Bootstrap UCL	1.77			95% Bootstrap t UCL	2.168		
94					95% H-UCL (Log ROS)	0.653						
95												
96	**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**											
97					KM Mean (logged)	-3.245			KM Geo Mean	0.039		
98					KM SD (logged)	2.091			95% Critical H Value (KM-Log)	3.418		
99					KM Standard Error of Mean (logged)	0.232			95% H-UCL (KM -Log)	0.696		
100					KM SD (logged)	2.091			95% Critical H Value (KM-Log)	3.418		
101					KM Standard Error of Mean (logged)	0.232						
102												
103	**DL/2 Statistics**											
104	**DL/2 Normal**								**DL/2 Log-Transformed**			

	A	B	C	D	E	F	G	H	I	J	K	L
105					Mean in Original Scale	0.746				Mean in Log Scale		-2.883
106					SD in Original Scale	3.268				SD in Log Scale		1.893
107					95% t UCL (Assumes normality)	1.273				95% H-Stat UCL		0.603
108	**DL/2 is not a recommended method, provided for comparisons and historical reasons**											
109												
110	**Nonparametric Distribution Free UCL Statistics**											
111	**Detected Data appear Lognormal Distributed at 5% Significance Level**											
112												
113	**Suggested UCL to Use**											
114					KM H-UCL	0.696						
115												
116	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
117	Recommendations are based upon data size, data distribution, and skewness.											
118	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
119	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
120												

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.111/14/2016 3:59:57 PM
From File	With_Ancillary_organics_input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Naphthalene

General Statistics

Total Number of Observations	385	Number of Distinct Observations	111
Number of Detects	91	Number of Non-Detects	294
Number of Distinct Detects	74	Number of Distinct Non-Detects	51
Minimum Detect	0.0017	Minimum Non-Detect	0.0041
Maximum Detect	14	Maximum Non-Detect	20
Variance Detects	5.549	Percent Non-Detects	76.36%
Mean Detects	1.062	SD Detects	2.356
Median Detects	0.192	CV Detects	2.218
Skewness Detects	3.495	Kurtosis Detects	13.27
Mean of Logged Detects	-1.324	SD of Logged Detects	1.585

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.49	**Normal GOF Test on Detected Observations Only**
5% Shapiro Wilk P Value	0	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.349	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.0931	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

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

KM Mean	0.308	KM Standard Error of Mean	0.063
KM SD	1.219	95% KM (BCA) UCL	0.434
95% KM (t) UCL	0.412	95% KM (Percentile Bootstrap) UCL	0.417
95% KM (z) UCL	0.411	95% KM Bootstrap t UCL	0.456
90% KM Chebyshev UCL	0.497	95% KM Chebyshev UCL	0.582
97.5% KM Chebyshev UCL	0.701	99% KM Chebyshev UCL	0.934

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	6.762	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.827	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.211	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.0996	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.464	k star (bias corrected MLE)	0.456
Theta hat (MLE)	2.287	Theta star (bias corrected MLE)	2.327
nu hat (MLE)	84.51	nu star (bias corrected)	83.06
Mean (detects)	1.062		

Gamma ROS Statistics using Imputed Non-Detects

	A	B	C	D	E	F	G	H	I	J	K	L
53	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
54	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)											
55	For such situations, GROS method may yield incorrect values of UCLs and BTVs											
56	This is especially true when the sample size is small.											
57	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates											
58					Minimum	0.0017				Mean	0.288	
59					Maximum	14				Median	0.01	
60					SD	1.225				CV	4.254	
61					k hat (MLE)	0.298				k star (bias corrected MLE)	0.297	
62					Theta hat (MLE)	0.966				Theta star (bias corrected MLE)	0.968	
63					nu hat (MLE)	229.5				nu star (bias corrected)	229.1	
64					Adjusted Level of Significance (β)	0.0494						
65					Approximate Chi Square Value (229.07, α)	195				Adjusted Chi Square Value (229.07, β)	194.9	
66					95% Gamma Approximate UCL (use when n>=50)	0.338				95% Gamma Adjusted UCL (use when n<50)	0.338	
67												
68	**Estimates of Gamma Parameters using KM Estimates**											
69					Mean (KM)	0.308				SD (KM)	1.219	
70					Variance (KM)	1.487				SE of Mean (KM)	0.063	
71					k hat (KM)	0.0637				k star (KM)	0.0649	
72					nu hat (KM)	49.05				nu star (KM)	50	
73					theta hat (KM)	4.831				theta star (KM)	4.739	
74					80% gamma percentile (KM)	0.0918				90% gamma percentile (KM)	0.624	
75					95% gamma percentile (KM)	1.751				99% gamma percentile (KM)	5.998	
76												
77	**Gamma Kaplan-Meier (KM) Statistics**											
78					Approximate Chi Square Value (50.00, α)	34.77				Adjusted Chi Square Value (50.00, β)	34.72	
79					95% Gamma Approximate KM-UCL (use when n>=50)	0.443				95% Gamma Adjusted KM-UCL (use when n<50)	0.443	
80												
81	**Lognormal GOF Test on Detected Observations Only**											
82					Shapiro Wilk Approximate Test Statistic	0.949				**Shapiro Wilk GOF Test**		
83					5% Shapiro Wilk P Value	0.00398				Detected Data Not Lognormal at 5% Significance Level		
84					Lilliefors Test Statistic	0.12				**Lilliefors GOF Test**		
85					5% Lilliefors Critical Value	0.0931				Detected Data Not Lognormal at 5% Significance Level		
86	**Detected Data Not Lognormal at 5% Significance Level**											
87												
88	**Lognormal ROS Statistics Using Imputed Non-Detects**											
89					Mean in Original Scale	0.308				Mean in Log Scale	-2.738	
90					SD in Original Scale	1.217				SD in Log Scale	1.515	
91					95% t UCL (assumes normality of ROS data)	0.41				95% Percentile Bootstrap UCL	0.421	
92					95% BCA Bootstrap UCL	0.436				95% Bootstrap t UCL	0.46	
93					95% H-UCL (Log ROS)	0.249						
94												
95	**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**											
96					KM Mean (logged)	-3.005				KM Geo Mean	0.0496	
97					KM SD (logged)	1.992				95% Critical H Value (KM-Log)	3.108	
98					KM Standard Error of Mean (logged)	0.208				95% H-UCL (KM -Log)	0.494	
99					KM SD (logged)	1.992				95% Critical H Value (KM-Log)	3.108	
100					KM Standard Error of Mean (logged)	0.208						
101												
102	**DL/2 Statistics**											
103	**DL/2 Normal**									**DL/2 Log-Transformed**		
104					Mean in Original Scale	0.436				Mean in Log Scale	-2.02	

105				SD in Original Scale	1.409					SD in Log Scale	1.272	
106				95% t UCL (Assumes normality)	0.554					95% H-Stat UCL	0.348	
107	**DL/2 is not a recommended method, provided for comparisons and historical reasons**											
108												
109	**Nonparametric Distribution Free UCL Statistics**											
110	**Data do not follow a Discernible Distribution at 5% Significance Level**											
111												
112	**Suggested UCL to Use**											
113				95% KM (Chebyshev) UCL	0.582							
114												
115	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
116	Recommendations are based upon data size, data distribution, and skewness.											
117	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
118	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
119												
120	**Tetrachloroethene**											
121												
122	**General Statistics**											
123				Total Number of Observations	61					Number of Distinct Observations	30	
124				Number of Detects	10					Number of Non-Detects	51	
125				Number of Distinct Detects	10					Number of Distinct Non-Detects	21	
126				Minimum Detect	3.1000E-4					Minimum Non-Detect	0.001	
127				Maximum Detect	3.6					Maximum Non-Detect	1.5	
128				Variance Detects	1.29					Percent Non-Detects	83.61%	
129				Mean Detects	0.368					SD Detects	1.136	
130				Median Detects	0.00107					CV Detects	3.088	
131				Skewness Detects	3.16					Kurtosis Detects	9.99	
132				Mean of Logged Detects	-5.772					SD of Logged Detects	2.896	
133												
134	**Normal GOF Test on Detects Only**											
135				Shapiro Wilk Test Statistic	0.376					**Shapiro Wilk GOF Test**		
136				5% Shapiro Wilk Critical Value	0.842					Detected Data Not Normal at 5% Significance Level		
137				Lilliefors Test Statistic	0.503					**Lilliefors GOF Test**		
138				5% Lilliefors Critical Value	0.262					Detected Data Not Normal at 5% Significance Level		
139	**Detected Data Not Normal at 5% Significance Level**											
140												
141	**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**											
142				KM Mean	0.061					KM Standard Error of Mean	0.0617	
143				KM SD	0.457					95% KM (BCA) UCL	0.179	
144				95% KM (t) UCL	0.164					95% KM (Percentile Bootstrap) UCL	0.179	
145				95% KM (z) UCL	0.162					95% KM Bootstrap t UCL	37.68	
146				90% KM Chebyshev UCL	0.246					95% KM Chebyshev UCL	0.33	
147				97.5% KM Chebyshev UCL	0.446					99% KM Chebyshev UCL	0.675	
148												
149	**Gamma GOF Tests on Detected Observations Only**											
150				A-D Test Statistic	2.154					**Anderson-Darling GOF Test**		
151				5% A-D Critical Value	0.892					Detected Data Not Gamma Distributed at 5% Significance Level		
152				K-S Test Statistic	0.436					**Kolmogorov-Smirnov GOF**		
153				5% K-S Critical Value	0.298					Detected Data Not Gamma Distributed at 5% Significance Level		
154	**Detected Data Not Gamma Distributed at 5% Significance Level**											
155												
156	**Gamma Statistics on Detected Data Only**											

157					k hat (MLE)	0.16					k star (bias corrected MLE)	0.178
158					Theta hat (MLE)	2.305					Theta star (bias corrected MLE)	2.062
159					nu hat (MLE)	3.192					nu star (bias corrected)	3.568
160					Mean (detects)	0.368						
161												
162	**Gamma ROS Statistics using Imputed Non-Detects**											
163	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
164	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)											
165	For such situations, GROS method may yield incorrect values of UCLs and BTVs											
166	This is especially true when the sample size is small.											
167	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates											
168					Minimum	3.1000E-4					Mean	0.0687
169					Maximum	3.6					Median	0.01
170					SD	0.46					CV	6.696
171					k hat (MLE)	0.322					k star (bias corrected MLE)	0.317
172					Theta hat (MLE)	0.213					Theta star (bias corrected MLE)	0.217
173					nu hat (MLE)	39.27					nu star (bias corrected)	38.67
174					Adjusted Level of Significance (β)	0.0461						
175					Approximate Chi Square Value (38.67, α)	25.43					Adjusted Chi Square Value (38.67, β)	25.17
176					95% Gamma Approximate UCL (use when n>=50)	0.104					95% Gamma Adjusted UCL (use when n<50)	0.106
177												
178	**Estimates of Gamma Parameters using KM Estimates**											
179					Mean (KM)	0.061					SD (KM)	0.457
180					Variance (KM)	0.209					SE of Mean (KM)	0.0617
181					k hat (KM)	0.0178					k star (KM)	0.0278
182					nu hat (KM)	2.171					nu star (KM)	3.397
183					theta hat (KM)	3.426					theta star (KM)	2.189
184					80% gamma percentile (KM)	4.1623E-4					90% gamma percentile (KM)	0.029
185					95% gamma percentile (KM)	0.219					99% gamma percentile (KM)	1.604
186												
187	**Gamma Kaplan-Meier (KM) Statistics**											
188					Approximate Chi Square Value (3.40, α)	0.499					Adjusted Chi Square Value (3.40, β)	0.475
189					95% Gamma Approximate KM-UCL (use when n>=50)	0.415					95% Gamma Adjusted KM-UCL (use when n<50)	0.436
190												
191	**Lognormal GOF Test on Detected Observations Only**											
192					Shapiro Wilk Test Statistic	0.724	**Shapiro Wilk GOF Test**					
193					5% Shapiro Wilk Critical Value	0.842	Detected Data Not Lognormal at 5% Significance Level					
194					Lilliefors Test Statistic	0.325	**Lilliefors GOF Test**					
195					5% Lilliefors Critical Value	0.262	Detected Data Not Lognormal at 5% Significance Level					
196	**Detected Data Not Lognormal at 5% Significance Level**											
197												
198	**Lognormal ROS Statistics Using Imputed Non-Detects**											
199					Mean in Original Scale	0.061					Mean in Log Scale	-7.27
200					SD in Original Scale	0.461					SD in Log Scale	1.639
201					95% t UCL (assumes normality of ROS data)	0.16					95% Percentile Bootstrap UCL	0.179
202					95% BCA Bootstrap UCL	0.296					95% Bootstrap t UCL	33.49
203					95% H-UCL (Log ROS)	0.00472						
204												
205	**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**											
206					KM Mean (logged)	-7.118					KM Geo Mean	8.1011E-4
207					KM SD (logged)	1.34					95% Critical H Value (KM-Log)	2.342
208					KM Standard Error of Mean (logged)	0.253					95% H-UCL (KM -Log)	0.00298

209					KM SD (logged)	1.34				95% Critical H Value (KM-Log)		2.342
210					KM Standard Error of Mean (logged)	0.253						
211												
212	**DL/2 Statistics**											
213	**DL/2 Normal**						**DL/2 Log-Transformed**					
214					Mean in Original Scale	0.0816				Mean in Log Scale		-6.356
215					SD in Original Scale	0.469				SD in Log Scale		1.953
216					95% t UCL (Assumes normality)	0.182				95% H-Stat UCL		0.0254
217	**DL/2 is not a recommended method, provided for comparisons and historical reasons**											
218												
219	**Nonparametric Distribution Free UCL Statistics**											
220	**Data do not follow a Discernible Distribution at 5% Significance Level**											
221												
222	**Suggested UCL to Use**											
223					97.5% KM (Chebyshev) UCL	0.446						
224												
225	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
226	Recommendations are based upon data size, data distribution, and skewness.											
227	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
228	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
229												
230	**Xylenes**											
231												
232	**General Statistics**											
233					Total Number of Observations	126				Number of Distinct Observations		41
234					Number of Detects	18				Number of Non-Detects		108
235					Number of Distinct Detects	18				Number of Distinct Non-Detects		26
236					Minimum Detect	2.2000E-4				Minimum Non-Detect		0.002
237					Maximum Detect	5.1				Maximum Non-Detect		4.43
238					Variance Detects	1.906				Percent Non-Detects		85.71%
239					Mean Detects	0.567				SD Detects		1.381
240					Median Detects	0.00545				CV Detects		2.436
241					Skewness Detects	2.799				Kurtosis Detects		7.454
242					Mean of Logged Detects	-4.248				SD of Logged Detects		3.106
243												
244	**Normal GOF Test on Detects Only**											
245					Shapiro Wilk Test Statistic	0.483	**Shapiro Wilk GOF Test**					
246					5% Shapiro Wilk Critical Value	0.897	Detected Data Not Normal at 5% Significance Level					
247					Lilliefors Test Statistic	0.411	**Lilliefors GOF Test**					
248					5% Lilliefors Critical Value	0.202	Detected Data Not Normal at 5% Significance Level					
249	**Detected Data Not Normal at 5% Significance Level**											
250												
251	**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**											
252					KM Mean	0.0822				KM Standard Error of Mean		0.05
253					KM SD	0.545				95% KM (BCA) UCL		0.189
254					95% KM (t) UCL	0.165				95% KM (Percentile Bootstrap) UCL		0.177
255					95% KM (z) UCL	0.165				95% KM Bootstrap t UCL		0.534
256					90% KM Chebyshev UCL	0.232				95% KM Chebyshev UCL		0.3
257					97.5% KM Chebyshev UCL	0.395				99% KM Chebyshev UCL		0.58
258												
259	**Gamma GOF Tests on Detected Observations Only**											
260					A-D Test Statistic	1.686	**Anderson-Darling GOF Test**					

261				5% A-D Critical Value	0.889	Detected Data Not Gamma Distributed at 5% Significance Level						
262				K-S Test Statistic	0.296	**Kolmogorov-Smirnov GOF**						
263				5% K-S Critical Value	0.226	Detected Data Not Gamma Distributed at 5% Significance Level						
264	**Detected Data Not Gamma Distributed at 5% Significance Level**											
265												
266	**Gamma Statistics on Detected Data Only**											
267				k hat (MLE)	0.2	k star (bias corrected MLE)					0.204	
268				Theta hat (MLE)	2.833	Theta star (bias corrected MLE)					2.782	
269				nu hat (MLE)	7.199	nu star (bias corrected)					7.333	
270				Mean (detects)	0.567							
271												
272	**Gamma ROS Statistics using Imputed Non-Detects**											
273	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
274	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)											
275	For such situations, GROS method may yield incorrect values of UCLs and BTVs											
276	This is especially true when the sample size is small.											
277	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates											
278				Minimum	2.2000E-4	Mean					0.0895	
279				Maximum	5.1	Median					0.01	
280				SD	0.545	CV					6.093	
281				k hat (MLE)	0.319	k star (bias corrected MLE)					0.317	
282				Theta hat (MLE)	0.281	Theta star (bias corrected MLE)					0.283	
283				nu hat (MLE)	80.36	nu star (bias corrected)					79.78	
284				Adjusted Level of Significance (β)	0.0481							
285				Approximate Chi Square Value (79.78, α)	60.2	Adjusted Chi Square Value (79.78, β)					60.01	
286				95% Gamma Approximate UCL (use when n>=50)	0.119	95% Gamma Adjusted UCL (use when n<50)					0.119	
287												
288	**Estimates of Gamma Parameters using KM Estimates**											
289				Mean (KM)	0.0822	SD (KM)					0.545	
290				Variance (KM)	0.297	SE of Mean (KM)					0.05	
291				k hat (KM)	0.0228	k star (KM)					0.0275	
292				nu hat (KM)	5.734	nu star (KM)					6.931	
293				theta hat (KM)	3.614	theta star (KM)					2.99	
294				80% gamma percentile (KM)	5.1404E-4	90% gamma percentile (KM)					0.0377	
295				95% gamma percentile (KM)	0.292	99% gamma percentile (KM)					2.17	
296												
297	**Gamma Kaplan-Meier (KM) Statistics**											
298				Approximate Chi Square Value (6.93, α)	2.133	Adjusted Chi Square Value (6.93, β)					2.102	
299				95% Gamma Approximate KM-UCL (use when n>=50)	0.267	95% Gamma Adjusted KM-UCL (use when n<50)					0.271	
300												
301	**Lognormal GOF Test on Detected Observations Only**											
302				Shapiro Wilk Test Statistic	0.909	**Shapiro Wilk GOF Test**						
303				5% Shapiro Wilk Critical Value	0.897	Detected Data appear Lognormal at 5% Significance Level						
304				Lilliefors Test Statistic	0.209	**Lilliefors GOF Test**						
305				5% Lilliefors Critical Value	0.202	Detected Data Not Lognormal at 5% Significance Level						
306	**Detected Data appear Approximate Lognormal at 5% Significance Level**											
307												
308	**Lognormal ROS Statistics Using Imputed Non-Detects**											
309				Mean in Original Scale	0.0822	Mean in Log Scale					-7.214	
310				SD in Original Scale	0.546	SD in Log Scale					2.301	
311				95% t UCL (assumes normality of ROS data)	0.163	95% Percentile Bootstrap UCL					0.172	
312				95% BCA Bootstrap UCL	0.222	95% Bootstrap t UCL					0.541	

313				95% H-UCL (Log ROS)		0.0219						
314												
315	**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**											
316				KM Mean (logged)		-6.807				KM Geo Mean		0.00111
317				KM SD (logged)		1.705				95% Critical H Value (KM-Log)		2.914
318				KM Standard Error of Mean (logged)		0.307				95% H-UCL (KM -Log)		0.00738
319				KM SD (logged)		1.705				95% Critical H Value (KM-Log)		2.914
320				KM Standard Error of Mean (logged)		0.307						
321												
322	**DL/2 Statistics**											
323	**DL/2 Normal**						**DL/2 Log-Transformed**					
324				Mean in Original Scale		0.11				Mean in Log Scale		-5.996
325				SD in Original Scale		0.584				SD in Log Scale		1.771
326				95% t UCL (Assumes normality)		0.196				95% H-Stat UCL		0.0192
327	**DL/2 is not a recommended method, provided for comparisons and historical reasons**											
328												
329	**Nonparametric Distribution Free UCL Statistics**											
330	**Detected Data appear Approximate Lognormal Distributed at 5% Significance Level**											
331												
332	**Suggested UCL to Use**											
333				KM H-UCL		0.00738						
334												
335	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
336	Recommendations are based upon data size, data distribution, and skewness.											
337	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
338	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
339												
340	**Benzo(a)anthracene**											
341												
342	**General Statistics**											
343				Total Number of Observations		368				Number of Distinct Observations		152
344				Number of Detects		247				Number of Non-Detects		121
345				Number of Distinct Detects		144				Number of Distinct Non-Detects		22
346				Minimum Detect		0.03				Minimum Non-Detect		0.1
347				Maximum Detect		96				Maximum Non-Detect		20
348				Variance Detects		66.53				Percent Non-Detects		32.88%
349				Mean Detects		2.638				SD Detects		8.157
350				Median Detects		0.44				CV Detects		3.092
351				Skewness Detects		7.634				Kurtosis Detects		75.03
352				Mean of Logged Detects		-0.593				SD of Logged Detects		1.657
353												
354	**Normal GOF Test on Detects Only**											
355				Shapiro Wilk Test Statistic		0.347	**Normal GOF Test on Detected Observations Only**					
356				5% Shapiro Wilk P Value		0	Detected Data Not Normal at 5% Significance Level					
357				Lilliefors Test Statistic		0.375	**Lilliefors GOF Test**					
358				5% Lilliefors Critical Value		0.0568	Detected Data Not Normal at 5% Significance Level					
359	**Detected Data Not Normal at 5% Significance Level**											
360												
361	**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**											
362				KM Mean		1.807				KM Standard Error of Mean		0.354
363				KM SD		6.778				95% KM (BCA) UCL		2.384
364				95% KM (t) UCL		2.391				95% KM (Percentile Bootstrap) UCL		2.438

365				95% KM (z) UCL	2.389					95% KM Bootstrap t UCL	2.765	
366				90% KM Chebyshev UCL	2.869					95% KM Chebyshev UCL	3.351	
367				97.5% KM Chebyshev UCL	4.019					99% KM Chebyshev UCL	5.331	
368												
369				**Gamma GOF Tests on Detected Observations Only**								
370				A-D Test Statistic	14.32	**Anderson-Darling GOF Test**						
371				5% A-D Critical Value	0.841	Detected Data Not Gamma Distributed at 5% Significance Level						
372				K-S Test Statistic	0.183	**Kolmogorov-Smirnov GOF**						
373				5% K-S Critical Value	0.0623	Detected Data Not Gamma Distributed at 5% Significance Level						
374				**Detected Data Not Gamma Distributed at 5% Significance Level**								
375												
376				**Gamma Statistics on Detected Data Only**								
377				k hat (MLE)	0.418	k star (bias corrected MLE)	0.416					
378				Theta hat (MLE)	6.311	Theta star (bias corrected MLE)	6.347					
379				nu hat (MLE)	206.5	nu star (bias corrected)	205.3					
380				Mean (detects)	2.638							
381												
382				**Gamma ROS Statistics using Imputed Non-Detects**								
383				GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs								
384				GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)								
385				For such situations, GROS method may yield incorrect values of UCLs and BTVs								
386				This is especially true when the sample size is small.								
387				For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates								
388				Minimum	0.01	Mean	1.774					
389				Maximum	96	Median	0.155					
390				SD	6.792	CV	3.828					
391				k hat (MLE)	0.281	k star (bias corrected MLE)	0.28					
392				Theta hat (MLE)	6.324	Theta star (bias corrected MLE)	6.335					
393				nu hat (MLE)	206.5	nu star (bias corrected)	206.1					
394				Adjusted Level of Significance (β)	0.0493							
395				Approximate Chi Square Value (206.10, α)	173.9	Adjusted Chi Square Value (206.10, β)	173.8					
396				95% Gamma Approximate UCL (use when n>=50)	2.103	95% Gamma Adjusted UCL (use when n<50)	2.104					
397												
398				**Estimates of Gamma Parameters using KM Estimates**								
399				Mean (KM)	1.807	SD (KM)	6.778					
400				Variance (KM)	45.94	SE of Mean (KM)	0.354					
401				k hat (KM)	0.0711	k star (KM)	0.0723					
402				nu hat (KM)	52.3	nu star (KM)	53.21					
403				theta hat (KM)	25.43	theta star (KM)	24.99					
404				80% gamma percentile (KM)	0.696	90% gamma percentile (KM)	3.996					
405				95% gamma percentile (KM)	10.43	99% gamma percentile (KM)	33.55					
406												
407				**Gamma Kaplan-Meier (KM) Statistics**								
408				Approximate Chi Square Value (53.21, α)	37.45	Adjusted Chi Square Value (53.21, β)	37.4					
409				95% Gamma Approximate KM-UCL (use when n>=50)	2.567	95% Gamma Adjusted KM-UCL (use when n<50)	2.571					
410												
411				**Lognormal GOF Test on Detected Observations Only**								
412				Shapiro Wilk Approximate Test Statistic	0.954	**Shapiro Wilk GOF Test**						
413				5% Shapiro Wilk P Value	3.1061E-7	Detected Data Not Lognormal at 5% Significance Level						
414				Lilliefors Test Statistic	0.057	**Lilliefors GOF Test**						
415				5% Lilliefors Critical Value	0.0568	Detected Data Not Lognormal at 5% Significance Level						
416				**Detected Data Not Lognormal at 5% Significance Level**								

417												
418	**Lognormal ROS Statistics Using Imputed Non-Detects**											
419					Mean in Original Scale	1.801				Mean in Log Scale	-1.302	
420					SD in Original Scale	6.785				SD in Log Scale	1.782	
421				95% t UCL (assumes normality of ROS data)		2.384				95% Percentile Bootstrap UCL	2.482	
422					95% BCA Bootstrap UCL	2.686				95% Bootstrap t UCL	2.766	
423					95% H-UCL (Log ROS)	1.738						
424												
425	**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**											
426					KM Mean (logged)	-1.248				KM Geo Mean	0.287	
427					KM SD (logged)	1.677				95% Critical H Value (KM-Log)	2.763	
428					KM Standard Error of Mean (logged)	0.0898				95% H-UCL (KM -Log)	1.493	
429					KM SD (logged)	1.677				95% Critical H Value (KM-Log)	2.763	
430					KM Standard Error of Mean (logged)	0.0898						
431												
432	**DL/2 Statistics**											
433	**DL/2 Normal**									**DL/2 Log-Transformed**		
434					Mean in Original Scale	1.872				Mean in Log Scale	-1.213	
435					SD in Original Scale	6.808				SD in Log Scale	1.717	
436					95% t UCL (Assumes normality)	2.458				95% H-Stat UCL	1.669	
437	**DL/2 is not a recommended method, provided for comparisons and historical reasons**											
438												
439	**Nonparametric Distribution Free UCL Statistics**											
440	**Data do not follow a Discernible Distribution at 5% Significance Level**											
441												
442	**Suggested UCL to Use**											
443					95% KM (Chebyshev) UCL	3.351						
444												
445	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
446	Recommendations are based upon data size, data distribution, and skewness.											
447	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
448	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
449												
450	**Benzo(a)pyrene**											
451												
452	**General Statistics**											
453					Total Number of Observations	368				Number of Distinct Observations	147	
454					Number of Detects	234				Number of Non-Detects	134	
455					Number of Distinct Detects	133				Number of Distinct Non-Detects	26	
456					Minimum Detect	0.046				Minimum Non-Detect	0.14	
457					Maximum Detect	76				Maximum Non-Detect	20	
458					Variance Detects	47.05				Percent Non-Detects	36.41%	
459					Mean Detects	2.39				SD Detects	6.859	
460					Median Detects	0.498				CV Detects	2.87	
461					Skewness Detects	7.069				Kurtosis Detects	63.86	
462					Mean of Logged Detects	-0.555				SD of Logged Detects	1.581	
463												
464	**Normal GOF Test on Detects Only**											
465					Shapiro Wilk Test Statistic	0.368				**Normal GOF Test on Detected Observations Only**		
466					5% Shapiro Wilk P Value	0				Detected Data Not Normal at 5% Significance Level		
467					Lilliefors Test Statistic	0.366				**Lilliefors GOF Test**		
468					5% Lilliefors Critical Value	0.0583				Detected Data Not Normal at 5% Significance Level		

469	**Detected Data Not Normal at 5% Significance Level**											
470												
471	**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**											
472					KM Mean	1.564			KM Standard Error of Mean	0.291		
473					KM SD	5.57			95% KM (BCA) UCL	2.114		
474					95% KM (t) UCL	2.044			95% KM (Percentile Bootstrap) UCL	2.074		
475					95% KM (z) UCL	2.043			95% KM Bootstrap t UCL	2.3		
476					90% KM Chebyshev UCL	2.438			95% KM Chebyshev UCL	2.833		
477					97.5% KM Chebyshev UCL	3.383			99% KM Chebyshev UCL	4.461		
478												
479	**Gamma GOF Tests on Detected Observations Only**											
480					A-D Test Statistic	12.8			**Anderson-Darling GOF Test**			
481					5% A-D Critical Value	0.833			Detected Data Not Gamma Distributed at 5% Significance Level			
482					K-S Test Statistic	0.174			**Kolmogorov-Smirnov GOF**			
483					5% K-S Critical Value	0.0636			Detected Data Not Gamma Distributed at 5% Significance Level			
484	**Detected Data Not Gamma Distributed at 5% Significance Level**											
485												
486	**Gamma Statistics on Detected Data Only**											
487					k hat (MLE)	0.452			k star (bias corrected MLE)	0.45		
488					Theta hat (MLE)	5.282			Theta star (bias corrected MLE)	5.316		
489					nu hat (MLE)	211.8			nu star (bias corrected)	210.4		
490					Mean (detects)	2.39						
491												
492	**Gamma ROS Statistics using Imputed Non-Detects**											
493	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
494	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)											
495	For such situations, GROS method may yield incorrect values of UCLs and BTVs											
496	This is especially true when the sample size is small.											
497	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates											
498					Minimum	0.01			Mean	1.523		
499					Maximum	76			Median	0.14		
500					SD	5.584			CV	3.666		
501					k hat (MLE)	0.284			k star (bias corrected MLE)	0.283		
502					Theta hat (MLE)	5.365			Theta star (bias corrected MLE)	5.374		
503					nu hat (MLE)	209			nu star (bias corrected)	208.6		
504					Adjusted Level of Significance (β)	0.0493						
505					Approximate Chi Square Value (208.61, α)	176.2			Adjusted Chi Square Value (208.61, β)	176.1		
506					95% Gamma Approximate UCL (use when n>=50)	1.804			95% Gamma Adjusted UCL (use when n<50)	1.805		
507												
508	**Estimates of Gamma Parameters using KM Estimates**											
509					Mean (KM)	1.564			SD (KM)	5.57		
510					Variance (KM)	31.02			SE of Mean (KM)	0.291		
511					k hat (KM)	0.0789			k star (KM)	0.08		
512					nu hat (KM)	58.05			nu star (KM)	58.91		
513					theta hat (KM)	19.83			theta star (KM)	19.54		
514					80% gamma percentile (KM)	0.745			90% gamma percentile (KM)	3.71		
515					95% gamma percentile (KM)	9.096			99% gamma percentile (KM)	27.7		
516												
517	**Gamma Kaplan-Meier (KM) Statistics**											
518					Approximate Chi Square Value (58.91, α)	42.26			Adjusted Chi Square Value (58.91, β)	42.21		
519					95% Gamma Approximate KM-UCL (use when n>=50)	2.18			95% Gamma Adjusted KM-UCL (use when n<50)	2.183		
520												

521	**Lognormal GOF Test on Detected Observations Only**											
522					Shapiro Wilk Approximate Test Statistic	0.95	**Shapiro Wilk GOF Test**					
523					5% Shapiro Wilk P Value	4.1460E-8	Detected Data Not Lognormal at 5% Significance Level					
524					Lilliefors Test Statistic	0.0769	**Lilliefors GOF Test**					
525					5% Lilliefors Critical Value	0.0583	Detected Data Not Lognormal at 5% Significance Level					
526	**Detected Data Not Lognormal at 5% Significance Level**											
527												
528	**Lognormal ROS Statistics Using Imputed Non-Detects**											
529					Mean in Original Scale	1.559	Mean in Log Scale	-1.275				
530					SD in Original Scale	5.575	SD in Log Scale	1.672				
531					95% t UCL (assumes normality of ROS data)	2.038	95% Percentile Bootstrap UCL	2.066				
532					95% BCA Bootstrap UCL	2.196	95% Bootstrap t UCL	2.299				
533					95% H-UCL (Log ROS)	1.437						
534												
535	**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**											
536					KM Mean (logged)	-1.231	KM Geo Mean	0.292				
537					KM SD (logged)	1.576	95% Critical H Value (KM-Log)	2.658				
538					KM Standard Error of Mean (logged)	0.0849	95% H-UCL (KM -Log)	1.259				
539					KM SD (logged)	1.576	95% Critical H Value (KM-Log)	2.658				
540					KM Standard Error of Mean (logged)	0.0849						
541												
542	**DL/2 Statistics**											
543	**DL/2 Normal**						**DL/2 Log-Transformed**					
544					Mean in Original Scale	1.635	Mean in Log Scale	-1.161				
545					SD in Original Scale	5.605	SD in Log Scale	1.59				
546					95% t UCL (Assumes normality)	2.116	95% H-Stat UCL	1.383				
547	**DL/2 is not a recommended method, provided for comparisons and historical reasons**											
548												
549	**Nonparametric Distribution Free UCL Statistics**											
550	**Data do not follow a Discernible Distribution at 5% Significance Level**											
551												
552	**Suggested UCL to Use**											
553					95% KM (Chebyshev) UCL	2.833						
554												
555	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
556	Recommendations are based upon data size, data distribution, and skewness.											
557	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
558	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
559												
560	**Benzo(b)fluoranthene**											
561												
562	**General Statistics**											
563					Total Number of Observations	368	Number of Distinct Observations	149				
564					Number of Detects	248	Number of Non-Detects	120				
565					Number of Distinct Detects	138	Number of Distinct Non-Detects	21				
566					Minimum Detect	0.039	Minimum Non-Detect	0.1				
567					Maximum Detect	98	Maximum Non-Detect	20				
568					Variance Detects	73.99	Percent Non-Detects	32.61%				
569					Mean Detects	2.756	SD Detects	8.602				
570					Median Detects	0.5	CV Detects	3.121				
571					Skewness Detects	7.627	Kurtosis Detects	71.9				
572					Mean of Logged Detects	-0.511	SD of Logged Detects	1.638				

	A	B	C	D	E	F	G	H	I	J	K	L
573												
574	**Normal GOF Test on Detects Only**											
575					Shapiro Wilk Test Statistic	0.336	**Normal GOF Test on Detected Observations Only**					
576					5% Shapiro Wilk P Value	0	Detected Data Not Normal at 5% Significance Level					
577					Lilliefors Test Statistic	0.376	**Lilliefors GOF Test**					
578					5% Lilliefors Critical Value	0.0567	Detected Data Not Normal at 5% Significance Level					
579	**Detected Data Not Normal at 5% Significance Level**											
580												
581	**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**											
582					KM Mean	1.895	KM Standard Error of Mean	0.374				
583					KM SD	7.159	95% KM (BCA) UCL	2.536				
584					95% KM (t) UCL	2.512	95% KM (Percentile Bootstrap) UCL	2.588				
585					95% KM (z) UCL	2.51	95% KM Bootstrap t UCL	2.913				
586					90% KM Chebyshev UCL	3.017	95% KM Chebyshev UCL	3.526				
587					97.5% KM Chebyshev UCL	4.231	99% KM Chebyshev UCL	5.617				
588												
589	**Gamma GOF Tests on Detected Observations Only**											
590					A-D Test Statistic	13.71	**Anderson-Darling GOF Test**					
591					5% A-D Critical Value	0.839	Detected Data Not Gamma Distributed at 5% Significance Level					
592					K-S Test Statistic	0.158	**Kolmogorov-Smirnov GOF**					
593					5% K-S Critical Value	0.0621	Detected Data Not Gamma Distributed at 5% Significance Level					
594	**Detected Data Not Gamma Distributed at 5% Significance Level**											
595												
596	**Gamma Statistics on Detected Data Only**											
597					k hat (MLE)	0.427	k star (bias corrected MLE)	0.425				
598					Theta hat (MLE)	6.455	Theta star (bias corrected MLE)	6.493				
599					nu hat (MLE)	211.8	nu star (bias corrected)	210.6				
600					Mean (detects)	2.756						
601												
602	**Gamma ROS Statistics using Imputed Non-Detects**											
603	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
604	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)											
605	For such situations, GROS method may yield incorrect values of UCLs and BTVs											
606	This is especially true when the sample size is small.											
607	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates											
608					Minimum	0.01	Mean	1.861				
609					Maximum	98	Median	0.175				
610					SD	7.174	CV	3.855				
611					k hat (MLE)	0.282	k star (bias corrected MLE)	0.282				
612					Theta hat (MLE)	6.592	Theta star (bias corrected MLE)	6.603				
613					nu hat (MLE)	207.8	nu star (bias corrected)	207.4				
614					Adjusted Level of Significance (β)	0.0493						
615					Approximate Chi Square Value (207.41, α)	175.1	Adjusted Chi Square Value (207.41, β)	175				
616					95% Gamma Approximate UCL (use when n>=50)	2.204	95% Gamma Adjusted UCL (use when n<50)	2.206				
617												
618	**Estimates of Gamma Parameters using KM Estimates**											
619					Mean (KM)	1.895	SD (KM)	7.159				
620					Variance (KM)	51.25	SE of Mean (KM)	0.374				
621					k hat (KM)	0.07	k star (KM)	0.0713				
622					nu hat (KM)	51.55	nu star (KM)	52.47				
623					theta hat (KM)	27.05	theta star (KM)	26.58				
624					80% gamma percentile (KM)	0.708	90% gamma percentile (KM)	4.146				

625					95% gamma percentile (KM)	10.92					99% gamma percentile (KM)	35.41
626												
627					**Gamma Kaplan-Meier (KM) Statistics**							
628					Approximate Chi Square Value (52.47, α)	36.83					Adjusted Chi Square Value (52.47, β)	36.78
629					95% Gamma Approximate KM-UCL (use when n>=50)	2.699					95% Gamma Adjusted KM-UCL (use when n<50)	2.703
630												
631					**Lognormal GOF Test on Detected Observations Only**							
632					Shapiro Wilk Approximate Test Statistic	0.953					**Shapiro Wilk GOF Test**	
633					5% Shapiro Wilk P Value	1.9783E-7					Detected Data Not Lognormal at 5% Significance Level	
634					Lilliefors Test Statistic	0.0655					**Lilliefors GOF Test**	
635					5% Lilliefors Critical Value	0.0567					Detected Data Not Lognormal at 5% Significance Level	
636					**Detected Data Not Lognormal at 5% Significance Level**							
637												
638					**Lognormal ROS Statistics Using Imputed Non-Detects**							
639					Mean in Original Scale	1.888					Mean in Log Scale	-1.235
640					SD in Original Scale	7.167					SD in Log Scale	1.787
641					95% t UCL (assumes normality of ROS data)	2.504					95% Percentile Bootstrap UCL	2.546
642					95% BCA Bootstrap UCL	2.785					95% Bootstrap t UCL	2.964
643					95% H-UCL (Log ROS)	1.876						
644												
645					**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**							
646					KM Mean (logged)	-1.172					KM Geo Mean	0.31
647					KM SD (logged)	1.673					95% Critical H Value (KM-Log)	2.758
648					KM Standard Error of Mean (logged)	0.0893					95% H-UCL (KM -Log)	1.595
649					KM SD (logged)	1.673					95% Critical H Value (KM-Log)	2.758
650					KM Standard Error of Mean (logged)	0.0893						
651												
652					**DL/2 Statistics**							
653					**DL/2 Normal**						**DL/2 Log-Transformed**	
654					Mean in Original Scale	1.958					Mean in Log Scale	-1.159
655					SD in Original Scale	7.188					SD in Log Scale	1.728
656					95% t UCL (Assumes normality)	2.576					95% H-Stat UCL	1.8
657					**DL/2 is not a recommended method, provided for comparisons and historical reasons**							
658												
659					**Nonparametric Distribution Free UCL Statistics**							
660					**Data do not follow a Discernible Distribution at 5% Significance Level**							
661												
662					**Suggested UCL to Use**							
663					95% KM (Chebyshev) UCL	3.526						
664												
665					Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.							
666					Recommendations are based upon data size, data distribution, and skewness.							
667					These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).							
668					However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.							
669												
670	**Chrysene**											
671												
672					**General Statistics**							
673					Total Number of Observations	368					Number of Distinct Observations	155
674					Number of Detects	251					Number of Non-Detects	117
675					Number of Distinct Detects	145					Number of Distinct Non-Detects	19
676					Minimum Detect	0.021					Minimum Non-Detect	0.1

677				Maximum Detect	100					Maximum Non-Detect	20	
678				Variance Detects	65.74					Percent Non-Detects	31.79%	
679				Mean Detects	2.556					SD Detects	8.108	
680				Median Detects	0.43					CV Detects	3.172	
681				Skewness Detects	8.234					Kurtosis Detects	87.51	
682				Mean of Logged Detects	-0.593					SD of Logged Detects	1.628	
683												
684				**Normal GOF Test on Detects Only**								
685				Shapiro Wilk Test Statistic	0.335		**Normal GOF Test on Detected Observations Only**					
686				5% Shapiro Wilk P Value	0		Detected Data Not Normal at 5% Significance Level					
687				Lilliefors Test Statistic	0.377		**Lilliefors GOF Test**					
688				5% Lilliefors Critical Value	0.0563		Detected Data Not Normal at 5% Significance Level					
689				**Detected Data Not Normal at 5% Significance Level**								
690												
691				**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**								
692				KM Mean	1.778					KM Standard Error of Mean	0.354	
693				KM SD	6.783					95% KM (BCA) UCL	2.456	
694				95% KM (t) UCL	2.363					95% KM (Percentile Bootstrap) UCL	2.41	
695				95% KM (z) UCL	2.361					95% KM Bootstrap t UCL	2.754	
696				90% KM Chebyshev UCL	2.842					95% KM Chebyshev UCL	3.323	
697				97.5% KM Chebyshev UCL	3.992					99% KM Chebyshev UCL	5.305	
698												
699				**Gamma GOF Tests on Detected Observations Only**								
700				A-D Test Statistic	14.75		**Anderson-Darling GOF Test**					
701				5% A-D Critical Value	0.839		Detected Data Not Gamma Distributed at 5% Significance Level					
702				K-S Test Statistic	0.175		**Kolmogorov-Smirnov GOF**					
703				5% K-S Critical Value	0.0617		Detected Data Not Gamma Distributed at 5% Significance Level					
704				**Detected Data Not Gamma Distributed at 5% Significance Level**								
705												
706				**Gamma Statistics on Detected Data Only**								
707				k hat (MLE)	0.426					k star (bias corrected MLE)	0.423	
708				Theta hat (MLE)	6.008					Theta star (bias corrected MLE)	6.042	
709				nu hat (MLE)	213.6					nu star (bias corrected)	212.4	
710				Mean (detects)	2.556							
711												
712				**Gamma ROS Statistics using Imputed Non-Detects**								
713				GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs								
714				GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)								
715				For such situations, GROS method may yield incorrect values of UCLs and BTVs								
716				This is especially true when the sample size is small.								
717				For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates								
718				Minimum	0.01					Mean	1.747	
719				Maximum	100					Median	0.175	
720				SD	6.797					CV	3.891	
721				k hat (MLE)	0.286					k star (bias corrected MLE)	0.286	
722				Theta hat (MLE)	6.099					Theta star (bias corrected MLE)	6.11	
723				nu hat (MLE)	210.8					nu star (bias corrected)	210.4	
724				Adjusted Level of Significance (β)	0.0493							
725				Approximate Chi Square Value (210.39, α)	177.8					Adjusted Chi Square Value (210.39, β)	177.7	
726				95% Gamma Approximate UCL (use when n>=50)	2.067					95% Gamma Adjusted UCL (use when n<50)	2.068	
727												
728				**Estimates of Gamma Parameters using KM Estimates**								

729					Mean (KM)	1.778					SD (KM)	6.783
730					Variance (KM)	46.01					SE of Mean (KM)	0.354
731					k hat (KM)	0.0687					k star (KM)	0.07
732					nu hat (KM)	50.58					nu star (KM)	51.5
733					theta hat (KM)	25.88					theta star (KM)	25.41
734					80% gamma percentile (KM)	0.636					90% gamma percentile (KM)	3.835
735					95% gamma percentile (KM)	10.23					99% gamma percentile (KM)	33.51
736												
737					**Gamma Kaplan-Meier (KM) Statistics**							
738					Approximate Chi Square Value (51.50, α)	36.02					Adjusted Chi Square Value (51.50, β)	35.96
739					95% Gamma Approximate KM-UCL (use when n>=50)	2.543					95% Gamma Adjusted KM-UCL (use when n<50)	2.546
740												
741					**Lognormal GOF Test on Detected Observations Only**							
742					Shapiro Wilk Approximate Test Statistic	0.96					**Shapiro Wilk GOF Test**	
743					5% Shapiro Wilk P Value	1.5568E-5					Detected Data Not Lognormal at 5% Significance Level	
744					Lilliefors Test Statistic	0.0673					**Lilliefors GOF Test**	
745					5% Lilliefors Critical Value	0.0563					Detected Data Not Lognormal at 5% Significance Level	
746					**Detected Data Not Lognormal at 5% Significance Level**							
747												
748					**Lognormal ROS Statistics Using Imputed Non-Detects**							
749					Mean in Original Scale	1.772					Mean in Log Scale	-1.286
750					SD in Original Scale	6.79					SD in Log Scale	1.77
751					95% t UCL (assumes normality of ROS data)	2.355					95% Percentile Bootstrap UCL	2.405
752					95% BCA Bootstrap UCL	2.617					95% Bootstrap t UCL	2.745
753					95% H-UCL (Log ROS)	1.722						
754												
755					**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**							
756					KM Mean (logged)	-1.231					KM Geo Mean	0.292
757					KM SD (logged)	1.666					95% Critical H Value (KM-Log)	2.751
758					KM Standard Error of Mean (logged)	0.0894					95% H-UCL (KM -Log)	1.487
759					KM SD (logged)	1.666					95% Critical H Value (KM-Log)	2.751
760					KM Standard Error of Mean (logged)	0.0894						
761												
762					**DL/2 Statistics**							
763					**DL/2 Normal**						**DL/2 Log-Transformed**	
764					Mean in Original Scale	1.842					Mean in Log Scale	-1.204
765					SD in Original Scale	6.814					SD in Log Scale	1.707
766					95% t UCL (Assumes normality)	2.428					95% H-Stat UCL	1.651
767					**DL/2 is not a recommended method, provided for comparisons and historical reasons**							
768												
769					**Nonparametric Distribution Free UCL Statistics**							
770					**Data do not follow a Discernible Distribution at 5% Significance Level**							
771												
772					**Suggested UCL to Use**							
773					95% KM (Chebyshev) UCL	3.323						
774												
775					Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.							
776					Recommendations are based upon data size, data distribution, and skewness.							
777					These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).							
778					However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.							
779												
780	**dibenz(a,h)anthracene**											

781												
782	**General Statistics**											
783					Total Number of Observations	368			Number of Distinct Observations	114		
784					Number of Detects	151			Number of Non-Detects	217		
785					Number of Distinct Detects	97			Number of Distinct Non-Detects	36		
786					Minimum Detect	0.035			Minimum Non-Detect	0.035		
787					Maximum Detect	12			Maximum Non-Detect	20		
788					Variance Detects	1.715			Percent Non-Detects	58.97%		
789					Mean Detects	0.582			SD Detects	1.309		
790					Median Detects	0.19			CV Detects	2.251		
791					Skewness Detects	5.89			Kurtosis Detects	43.42		
792					Mean of Logged Detects	-1.49			SD of Logged Detects	1.248		
793												
794	**Normal GOF Test on Detects Only**											
795					Shapiro Wilk Test Statistic	0.433			**Normal GOF Test on Detected Observations Only**			
796					5% Shapiro Wilk P Value	0			Detected Data Not Normal at 5% Significance Level			
797					Lilliefors Test Statistic	0.338			**Lilliefors GOF Test**			
798					5% Lilliefors Critical Value	0.0725			Detected Data Not Normal at 5% Significance Level			
799	**Detected Data Not Normal at 5% Significance Level**											
800												
801	**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**											
802					KM Mean	0.282			KM Standard Error of Mean	0.0461		
803					KM SD	0.877			95% KM (BCA) UCL	0.363		
804					95% KM (t) UCL	0.358			95% KM (Percentile Bootstrap) UCL	0.362		
805					95% KM (z) UCL	0.358			95% KM Bootstrap t UCL	0.4		
806					90% KM Chebyshev UCL	0.421			95% KM Chebyshev UCL	0.483		
807					97.5% KM Chebyshev UCL	0.57			99% KM Chebyshev UCL	0.741		
808												
809	**Gamma GOF Tests on Detected Observations Only**											
810					A-D Test Statistic	7.866			**Anderson-Darling GOF Test**			
811					5% A-D Critical Value	0.806			Detected Data Not Gamma Distributed at 5% Significance Level			
812					K-S Test Statistic	0.172			**Kolmogorov-Smirnov GOF**			
813					5% K-S Critical Value	0.0799			Detected Data Not Gamma Distributed at 5% Significance Level			
814	**Detected Data Not Gamma Distributed at 5% Significance Level**											
815												
816	**Gamma Statistics on Detected Data Only**											
817					k hat (MLE)	0.645			k star (bias corrected MLE)	0.636		
818					Theta hat (MLE)	0.902			Theta star (bias corrected MLE)	0.914		
819					nu hat (MLE)	194.7			nu star (bias corrected)	192.2		
820					Mean (detects)	0.582						
821												
822	**Gamma ROS Statistics using Imputed Non-Detects**											
823	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
824	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)											
825	For such situations, GROS method may yield incorrect values of UCLs and BTVs											
826	This is especially true when the sample size is small.											
827	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates											
828					Minimum	0.01			Mean	0.246		
829					Maximum	12			Median	0.01		
830					SD	0.883			CV	3.588		
831					k hat (MLE)	0.356			k star (bias corrected MLE)	0.355		
832					Theta hat (MLE)	0.691			Theta star (bias corrected MLE)	0.693		

833					nu hat (MLE)	262.2				nu star (bias corrected)		261.4
834					Adjusted Level of Significance (β)	0.0493						
835					Approximate Chi Square Value (261.36, α)	224.9				Adjusted Chi Square Value (261.36, β)		224.8
836					95% Gamma Approximate UCL (use when n>=50)	0.286				95% Gamma Adjusted UCL (use when n<50)		0.286
837												
838					**Estimates of Gamma Parameters using KM Estimates**							
839					Mean (KM)	0.282				SD (KM)		0.877
840					Variance (KM)	0.77				SE of Mean (KM)		0.0461
841					k hat (KM)	0.104				k star (KM)		0.104
842					nu hat (KM)	76.18				nu star (KM)		76.89
843					theta hat (KM)	2.727				theta star (KM)		2.701
844					80% gamma percentile (KM)	0.208				90% gamma percentile (KM)		0.764
845					95% gamma percentile (KM)	1.633				99% gamma percentile (KM)		4.386
846												
847					**Gamma Kaplan-Meier (KM) Statistics**							
848					Approximate Chi Square Value (76.89, α)	57.69				Adjusted Chi Square Value (76.89, β)		57.63
849					95% Gamma Approximate KM-UCL (use when n>=50)	0.376				95% Gamma Adjusted KM-UCL (use when n<50)		0.377
850												
851					**Lognormal GOF Test on Detected Observations Only**							
852					Shapiro Wilk Approximate Test Statistic	0.94				**Shapiro Wilk GOF Test**		
853					5% Shapiro Wilk P Value	1.0167E-6				Detected Data Not Lognormal at 5% Significance Level		
854					Lilliefors Test Statistic	0.0858				**Lilliefors GOF Test**		
855					5% Lilliefors Critical Value	0.0725				Detected Data Not Lognormal at 5% Significance Level		
856					**Detected Data Not Lognormal at 5% Significance Level**							
857												
858					**Lognormal ROS Statistics Using Imputed Non-Detects**							
859					Mean in Original Scale	0.282				Mean in Log Scale		-2.312
860					SD in Original Scale	0.875				SD in Log Scale		1.227
861					95% t UCL (assumes normality of ROS data)	0.357				95% Percentile Bootstrap UCL		0.369
862					95% BCA Bootstrap UCL	0.388				95% Bootstrap t UCL		0.398
863					95% H-UCL (Log ROS)	0.244						
864												
865					**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**							
866					KM Mean (logged)	-2.237				KM Geo Mean		0.107
867					KM SD (logged)	1.065				95% Critical H Value (KM-Log)		2.181
868					KM Standard Error of Mean (logged)	0.0634				95% H-UCL (KM -Log)		0.213
869					KM SD (logged)	1.065				95% Critical H Value (KM-Log)		2.181
870					KM Standard Error of Mean (logged)	0.0634						
871												
872					**DL/2 Statistics**							
873					**DL/2 Normal**					**DL/2 Log-Transformed**		
874					Mean in Original Scale	0.368				Mean in Log Scale		-2.117
875					SD in Original Scale	1.14				SD in Log Scale		1.156
876					95% t UCL (Assumes normality)	0.466				95% H-Stat UCL		0.269
877					**DL/2 is not a recommended method, provided for comparisons and historical reasons**							
878												
879					**Nonparametric Distribution Free UCL Statistics**							
880					**Data do not follow a Discernible Distribution at 5% Significance Level**							
881												
882					**Suggested UCL to Use**							
883					95% KM (Chebyshev) UCL	0.483						
884												

885	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
886	Recommendations are based upon data size, data distribution, and skewness.											
887	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
888	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
889												
890	**Indeno(1,2,3-cd)pyrene**											
891												
892	**General Statistics**											
893						Total Number of Observations	368			Number of Distinct Observations	138	
894						Number of Detects	220			Number of Non-Detects	148	
895						Number of Distinct Detects	128			Number of Distinct Non-Detects	27	
896						Minimum Detect	0.042			Minimum Non-Detect	0.14	
897						Maximum Detect	46			Maximum Non-Detect	20	
898						Variance Detects	19.09			Percent Non-Detects	40.22%	
899						Mean Detects	1.594			SD Detects	4.369	
900						Median Detects	0.38			CV Detects	2.741	
901						Skewness Detects	6.804			Kurtosis Detects	58.2	
902						Mean of Logged Detects	-0.856			SD of Logged Detects	1.513	
903												
904	**Normal GOF Test on Detects Only**											
905						Shapiro Wilk Test Statistic	0.379		**Normal GOF Test on Detected Observations Only**			
906						5% Shapiro Wilk P Value	0		Detected Data Not Normal at 5% Significance Level			
907						Lilliefors Test Statistic	0.361		**Lilliefors GOF Test**			
908						5% Lilliefors Critical Value	0.0602		Detected Data Not Normal at 5% Significance Level			
909	**Detected Data Not Normal at 5% Significance Level**											
910												
911	**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**											
912						KM Mean	0.998			KM Standard Error of Mean	0.181	
913						KM SD	3.453			95% KM (BCA) UCL	1.341	
914						95% KM (t) UCL	1.295			95% KM (Percentile Bootstrap) UCL	1.308	
915						95% KM (z) UCL	1.295			95% KM Bootstrap t UCL	1.443	
916						90% KM Chebyshev UCL	1.539			95% KM Chebyshev UCL	1.785	
917						97.5% KM Chebyshev UCL	2.125			99% KM Chebyshev UCL	2.795	
918												
919	**Gamma GOF Tests on Detected Observations Only**											
920						A-D Test Statistic	11.78		**Anderson-Darling GOF Test**			
921						5% A-D Critical Value	0.825		Detected Data Not Gamma Distributed at 5% Significance Level			
922						K-S Test Statistic	0.169		**Kolmogorov-Smirnov GOF**			
923						5% K-S Critical Value	0.065		Detected Data Not Gamma Distributed at 5% Significance Level			
924	**Detected Data Not Gamma Distributed at 5% Significance Level**											
925												
926	**Gamma Statistics on Detected Data Only**											
927						k hat (MLE)	0.483			k star (bias corrected MLE)	0.48	
928						Theta hat (MLE)	3.299			Theta star (bias corrected MLE)	3.324	
929						nu hat (MLE)	212.6			nu star (bias corrected)	211	
930						Mean (detects)	1.594					
931												
932	**Gamma ROS Statistics using Imputed Non-Detects**											
933	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
934	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)											
935	For such situations, GROS method may yield incorrect values of UCLs and BTVs											
936	This is especially true when the sample size is small.											

937	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates											
938					Minimum	0.01				Mean		0.957
939					Maximum	46				Median		0.089
940					SD	3.464				CV		3.62
941					k hat (MLE)	0.298				k star (bias corrected MLE)		0.297
942					Theta hat (MLE)	3.215				Theta star (bias corrected MLE)		3.221
943					nu hat (MLE)	219.1				nu star (bias corrected)		218.6
944					Adjusted Level of Significance (β)	0.0493						
945					Approximate Chi Square Value (218.63, α)	185.4				Adjusted Chi Square Value (218.63, β)		185.3
946					95% Gamma Approximate UCL (use when n>=50)	1.128				95% Gamma Adjusted UCL (use when n<50)		1.129
947												
948	**Estimates of Gamma Parameters using KM Estimates**											
949					Mean (KM)	0.998				SD (KM)		3.453
950					Variance (KM)	11.92				SE of Mean (KM)		0.181
951					k hat (KM)	0.0835				k star (KM)		0.0846
952					nu hat (KM)	61.45				nu star (KM)		62.28
953					theta hat (KM)	11.95				theta star (KM)		11.79
954					80% gamma percentile (KM)	0.528				90% gamma percentile (KM)		2.446
955					95% gamma percentile (KM)	5.811				99% gamma percentile (KM)		17.2
956												
957	**Gamma Kaplan-Meier (KM) Statistics**											
958					Approximate Chi Square Value (62.28, α)	45.13				Adjusted Chi Square Value (62.28, β)		45.07
959					95% Gamma Approximate KM-UCL (use when n>=50)	1.377				95% Gamma Adjusted KM-UCL (use when n<50)		1.379
960												
961	**Lognormal GOF Test on Detected Observations Only**											
962					Shapiro Wilk Approximate Test Statistic	0.947				**Shapiro Wilk GOF Test**		
963					5% Shapiro Wilk P Value	2.7867E-8				Detected Data Not Lognormal at 5% Significance Level		
964					Lilliefors Test Statistic	0.0748				**Lilliefors GOF Test**		
965					5% Lilliefors Critical Value	0.0602				Detected Data Not Lognormal at 5% Significance Level		
966	**Detected Data Not Lognormal at 5% Significance Level**											
967												
968	**Lognormal ROS Statistics Using Imputed Non-Detects**											
969					Mean in Original Scale	0.997				Mean in Log Scale		-1.517
970					SD in Original Scale	3.453				SD in Log Scale		1.522
971					95% t UCL (assumes normality of ROS data)	1.294				95% Percentile Bootstrap UCL		1.317
972					95% BCA Bootstrap UCL	1.416				95% Bootstrap t UCL		1.454
973					95% H-UCL (Log ROS)	0.86						
974												
975	**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**											
976					KM Mean (logged)	-1.502				KM Geo Mean		0.223
977					KM SD (logged)	1.449				95% Critical H Value (KM-Log)		2.532
978					KM Standard Error of Mean (logged)	0.0796				95% H-UCL (KM -Log)		0.772
979					KM SD (logged)	1.449				95% Critical H Value (KM-Log)		2.532
980					KM Standard Error of Mean (logged)	0.0796						
981												
982	**DL/2 Statistics**											
983	**DL/2 Normal**									**DL/2 Log-Transformed**		
984					Mean in Original Scale	1.071				Mean in Log Scale		-1.414
985					SD in Original Scale	3.514				SD in Log Scale		1.461
986					95% t UCL (Assumes normality)	1.373				95% H-Stat UCL		0.858
987	**DL/2 is not a recommended method, provided for comparisons and historical reasons**											
988												

	A	B	C	D	E	F	G	H	I	J	K	L
989	**Nonparametric Distribution Free UCL Statistics**											
990	**Data do not follow a Discernible Distribution at 5% Significance Level**											
991												
992	**Suggested UCL to Use**											
993					95% KM (Chebyshev) UCL	1.785						
994												
995	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
996	Recommendations are based upon data size, data distribution, and skewness.											
997	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
998	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
999												

APPENDIX D

PEF Calculations

APPENDIX D - Landscaper

Particulate Emission Factor Wind Driven

PEF Equation

Philadelphia, PA (8) City (Climatic Zone) – Selection based on most likely climatic conditions for the site	11.32 U_t (equivalent threshold value)
13 A_s (acres)	0.5 V (fraction of vegetative cover) unitless
4.2 U_m (mean annual wind speed) m/s	
10.2871 A (PEF Dispersion Constant)	**0.082666566** F(x) (function dependant on U_m/U_t) unitless
18.7124 B (PEF Dispersion Constant)	**1664353695.** PEF (particulate emission factor) m^3/kg
212.2704 C (PEF Dispersion Constant)	**35.13614582** Q/C_{wind} (inverse of the ratio of the geometric mean air concentration to the emission flux at the center of a square source) g/m^2-s per kg/m^3

APPENDIX D – Spectator

Particulate Emission Factor Wind Driven	
PEF Equation	
Philadelphia, PA (8) City (Climatic Zone) – Selection based on most likely climatic conditions for the site 13 A_s (acres) 4.2 U_m (mean annual wind speed) m/s	11.32 U_t (equivalent threshold value) 0.8 V (fraction of vegetative cover) unitless
10.2871 A (PEF Dispersion Constant) **18.7124** B (PEF Dispersion Constant) **212.2704** C (PEF Dispersion Constant)	**0.082666566** F(x) (function dependant on U_m/U_t) unitless **4160884238.** PEF (particulate emission factor) m^3/kg **35.13614582** Q/C_{wind} (inverse of the ratio of the geometric mean air concentration to the emission flux at the center of a square source) g/m^2-s per kg/m^3

APPENDIX E

VDEQ Trench Model Output

For Mass-Transfer Coefficients			For Emission Flux and Concentration in Trench			Trench dimensions		
Kg,H2O	0.833	cm/s	CF1	1.00E-03	L/cm3	Length	**8**	ft
MWH2O	18		CF2	1.00E+04	cm2/m2		2.44	m
Kl,O2	0.002	cm/s	CF3	3600	s/hr	Width	**3**	ft
MWO2	32		F	**0.5**			0.91	m
T	**77**	F	ACH	2	hr-1	Depth	**8**	ft
T	298	K					2.44	m
R	8.20E-05	atm-m3/mol-K				Width/Depth	0.38	

Table 3.8 Exposure-point concentration: (inhalation) for construction/utility worker in a trench: Groundwater less than 15 feet deep revised 10/5/07	CAS No.	Molecular Weight MWi g/mol	Henry's Law Constant Hi atm-m3/mol	Gas-Phase Mass Transfer Coefficient KiG cm/s	Liquid-Phase Mass Transfer Coefficient KiL cm/s	Overall Mass Transfer Coefficient Ki cm/s	Concentration of Contaminant in Groundwater Cgw ug/L	Volatilization Factor VF L/m3	Concentration of Contaminant in Trench Ctrench ug/m3
TAL Inorganics									
Acetone	67-64-1	58.08	3.88E-05	5.63E-01	1.48E-03	5.58E-04	6.25E+02	2.06E+00	1.29E+03
Benzene	71-43-2	78.11	5.55E-03	5.09E-01	1.28E-03	1.27E-03	3.44E+01	4.67E+00	1.61E+02
Carbon disulfide	75-15-0	76.14	3.03E-02	5.14E-01	1.30E-03	1.29E-03	7.60E-01	4.78E+00	3.63E+00
Chloroform	67-66-3	119.38	3.67E-03	4.42E-01	1.04E-03	1.02E-03	8.90E-01	3.76E+00	3.35E+00
Chloromethane	74-87-3	50.49	8.82E-03	5.90E-01	1.59E-03	1.58E-03	4.40E+00	5.83E+00	2.57E+01
Cyclohexane	110-82-7	84.16	1.95E-01	4.97E-01	1.23E-03	1.23E-03	5.20E+01	4.55E+00	2.37E+02
1,2-Dichloroethane	107-06-2	98.96	9.79E-04	4.71E-01	1.14E-03	1.07E-03	7.40E+00	3.96E+00	2.93E+01
1,2-Dichloroethene (total	540-59-0	96.94	4.51E-03	4.74E-01	1.15E-03	1.13E-03	5.50E+00	4.19E+00	2.30E+01
cis-1,2-Dichloroethene	156-59-2	96.94	4.08E-03	4.74E-01	1.15E-03	1.13E-03	7.02E+01	4.18E+00	2.93E+02
trans-1,2-Dichloroethene	156-60-5	96.94	9.38E-03	4.74E-01	1.15E-03	1.14E-03	1.00E+00	4.21E+00	4.21E+00
1,4-dioxane	123-91-1	88.11	4.80E-06	4.89E-01	1.21E-03	8.90E-05	2.20E+02	3.29E-01	7.23E+01
Ethylbenzene	100-41-4	106.17	7.88E-03	4.60E-01	1.10E-03	1.09E-03	1.22E+01	4.02E+00	4.91E+01
Isopropylbenzene	98-82-8	120.19	1.16E+00	4.41E-01	1.03E-03	1.03E-03	5.10E+01	3.81E+00	1.94E+02
Methyl tert-butyl ethe	1634-04-4	88.15	5.87E-04	4.89E-01	1.21E-03	1.09E-03	5.40E+01	4.03E+00	2.18E+02
Methylcyclohexane	108-87-2	98.19	4.30E-01	4.72E-01	1.14E-03	1.14E-03	2.70E+01	4.21E+00	1.14E+02
Methylene chloride	75-09-2	84.93	2.19E-03	4.95E-01	1.23E-03	1.19E-03	4.24E+01	4.41E+00	1.87E+02
1,1,2,2-Tetrachloroethane	79-34-5	167.85	3.45E-04	3.94E-01	8.73E-04	7.55E-04	5.00E-03	2.79E+00	1.39E-02
Tetrachloroethene	127-18-4	165.83	1.84E-02	3.96E-01	8.79E-04	8.76E-04	2.50E+00	3.23E+00	8.08E+00
Toluene	108-88-3	92.14	6.64E-03	4.82E-01	1.18E-03	1.17E-03	2.00E+00	4.31E+00	8.62E+00
Trichloroethene	79-01-6	131.39	1.03E-02	4.28E-01	9.87E-04	9.82E-04	4.39E+01	3.62E+00	1.59E+02
Vinyl Chloride	75-01-4	62.50	2.70E-02	5.49E-01	1.43E-03	1.43E-03	3.80E+01	5.27E+00	2.00E+02
Total Xylenes	1330-20-7	106.16	5.18E-03	4.60E-01	1.10E-03	1.09E-03	3.60E+00	4.01E+00	1.44E+01
Naphthalene	91-20-3	128.17	4.83E-04	4.32E-01	9.99E-04	8.95E-04	6.74E+01	3.30E+00	2.23E+02

APPENDIX F

VISL Calculator Output

COMMERCIAL WORKER USING ALL SOIL GAS SAMPLES

EPA-OLEM VAPOR INTRUSION ASSESSMENT
Sub-slab or Exterior Soil Gas Concentration to Indoor Air Concentration (SGC-IAC) Calculator Version 3.5.1 (May 2016 RSLs)

Parameter	Symbol	Value	Instructions
Exposure Scenario	Scenario	Commercial	Select residential or commercial scenario from pull down list
Target Risk for Carcinogens	TCR_SG	1.00E-05	Enter target risk for carcinogens (for comparison to the calculated VI carcinogenic risk in column F)
Target Hazard Quotient for Non-Carcinogens	THQ_SG	1	Enter target hazard quotient for non-carcinogens (for comparison to the calculated VI hazard in column G)

CAS	Chemical Name	Site Sub-slab or Exterior Soil Gas Concentration Csg (ug/m^3)	Calculated Indoor Air Concentration Cia (ug/m^3)	VI Carcinogenic Risk CR	VI Hazard HQ	Inhalation Unit Risk IUR ($(ug/m^3)^{-1}$)	IUR Source*	Reference Concentration RfC (mg/m^3)	RFC Source*	Mutagenic Indicator i
67-64-1	Acetone	3.2E+02	1.90E+00	No IUR	1.4E-05			3.10E+01	A	
71-43-2	Benzene	4.7E+02	2.84E+00	1.8E-06	2.2E-02	7.80E-06	I	3.00E-02	I	
75-27-4	Bromodichloromethane	2.1E+01	1.28E-01	3.9E-07	No RfC	3.70E-05	CA			
106-99-0	Butadiene, 1,3-	2.4E+02	1.42E+00	3.5E-06	1.6E-01	3.00E-05	I	2.00E-03	I	
75-15-0	Carbon Disulfide	1.3E+02	7.68E-01	No IUR	2.5E-04			7.00E-01	I	
67-66-3	Chloroform	1.3E+02	7.86E-01	1.5E-06	1.8E-03	2.30E-05	I	9.80E-02	A	
74-87-3	Chloromethane	9.9E-01	5.92E-03	No IUR	1.5E-05			9.00E-02	I	
110-82-7	Cyclohexane	1.1E+03	6.42E+00	No IUR	2.4E-04			6.00E+00	I	
75-71-8	Dichlorodifluoromethane	4.9E+01	2.93E-01	No IUR	6.7E-04			1.00E-01	X	
75-35-4	Dichloroethylene, 1,1-	4.0E+02	2.37E+00	No IUR	2.7E-03			2.00E-01	I	
141-78-6	Ethyl Acetate	1.7E+01	9.96E-02	No IUR	3.2E-04			7.00E-02	P	
100-41-4	Ethylbenzene	3.0E+02	1.81E+00	3.7E-07	4.1E-04	2.50E-06	CA	1.00E+00	I	
110-54-3	Hexane, N-	2.4E+03	1.43E+01	No IUR	4.7E-03			7.00E-01	I	
591-78-6	Hexanone, 2-	8.5E+00	5.09E-02	No IUR	3.9E-04			3.00E-02	I	
67-63-0	Isopropanol	8.3E+00	5.00E-02	No IUR	5.7E-05			2.00E-01	P	
78-93-3	Methyl Ethyl Ketone (2-Butanone)	5.8E+01	3.47E-01	No IUR	1.6E-05			5.00E+00	I	
108-10-1	Methyl Isobutyl Ketone (4-methyl-2-pentanone)	2.5E+02	1.52E+00	No IUR	1.2E-04			3.00E+00	I	
1634-04-4	Methyl tert-Butyl Ether (MTBE)	4.3E+02	2.60E+00	5.5E-08	2.0E-04	2.60E-07	CA	3.00E+00	I	
75-09-2	Methylene Chloride	4.6E+02	2.75E+00	2.2E-09	1.0E-03	1.00E-08	I	6.00E-01	I	Mut
91-20-3	Naphthalene	6.7E+00	4.00E-02	1.1E-07	3.0E-03	3.40E-05	CA	3.00E-03	I	
115-07-1	Propylene	9.1E+03	5.45E+01	No IUR	4.2E-03			3.00E+00	CA	
100-42-5	Styrene	1.2E+01	7.08E-02	No IUR	1.6E-05			1.00E+00	I	
127-18-4	Tetrachloroethylene	1.0E+04	6.18E+01	1.3E-06	3.5E-01	2.60E-07	I	4.00E-02	I	
108-88-3	Toluene	9.0E+02	5.42E+00	No IUR	2.5E-04			5.00E+00	I	
76-13-1	Trichloro-1,2,2-trifluoroethane, 1,1,2-	1.3E+02	7.98E-01	No IUR	6.1E-06			3.00E+01	H	
79-01-6	Trichloroethylene	6.1E+03	3.64E+01	**1.2E-05**	**4.2E+00**	see note	I	2.00E-03	I	TCE
95-63-6	Trimethylbenzene, 1,2,4-	2.9E+02	1.75E+00	No IUR	5.7E-02			7.00E-03	P	
75-01-4	Vinyl Chloride	9.1E+02	5.46E+00	2.0E-06	1.2E-02	4.40E-06	I	1.00E-01	I	VC
108-38-3	Xylene, m-	5.3E+02	3.16E+00	No IUR	7.2E-03			1.00E-01	S	
95-47-6	Xylene, o-	2.1E+02	1.25E+00	No IUR	2.9E-03			1.00E-01	S	

Notes: **Total:** **2E-05** **5E+00**

(1) **Inhalation Pathway Exposure Parameters (RME):**

Exposure Scenario	Units	Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
Averaging time for carcinogens	(yrs)	ATc_R_SG	70	ATc_C_SG	70	ATc_SG	70
Averaging time for non-carcinogens	(yrs)	ATnc_R_SG	26	ATnc_C_SG	25	ATnc_SG	25
Exposure duration	(yrs)	ED_R_SG	26	ED_C_SG	25	ED_SG	25
Exposure frequency	(days/yr)	EF_R_SG	350	EF_C_SG	250	EF_SG	250
Exposure time	(hr/day)	ET_R_SG	24	ET_C_SG	8	ET_SG	8

(2) **Generic Attenuation Factors:**

Source Medium of Vapors	Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
Groundwater (-)	AFgw_R_SG	0.001	AFgw_C_SG	0.001	AFgw_SG	0.001
Sub-Slab and Exterior Soil Gas (-)	AFss_R_SG	0.006	AFss_C_SG	0.006	AFss_SG	0.006

(3) **Formulas**
Cia, target = MIN(Cia,c; Cia,nc)
Cia,c (ug/m3) = TCR x ATc x (365 days/yr) x (24 hrs/day) / (ED x EF x ET x IUR)
Cia,nc (ug/m3) = THQ x ATnc x (365 days/yr) x (24 hrs/day) x RfC x (1000 ug/mg) / (ED x EF x ET)

(4) **Special Case Chemicals**

	Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
Trichloroethylene						
	mIURTCE_R_SG	1.00E-06	mIURTCE_C_SG	0.00E+00	mIURTCE_SG	0.00E+00
	IURTCE_R_SG	3.10E-06	IURTCE_C_SG	4.10E-06	IURTCE_SG	4.10E-06

Mutagenic Chemicals — The exposure durations and age-dependent adjustment factors for mutagenic-mode-of-action are listed in the table below:

Note: This section applies to trichloroethylene and other mutagenic chemicals, but not to vinyl chloride.

Age Cohort	Exposure Duration	Age-dependent adjustment factor
0 - 2 years	2	10
2 - 6 years	4	3
6 - 16 years	10	3
16 - 26 years	10	1

Mutagenic-mode-of-action (MMOA) adjustment factor 25 — This factor is used in the equations for mutagenic chemicals.

Vinyl Chloride — See the Navigation Guide equation for Cia,c for vinyl chloride.

Notation:
I = IRIS: EPA Integrated Risk Information System (IRIS). Available online at: http://www.epa.gov/iris/subst/index.html
P = PPRTV. EPA Provisional Peer Reviewed Toxicity Values (PPRTVs). Available online at: http://hhpprtv.ornl.gov/pprtv.shtml
A = Agency for Toxic Substances and Disease Registry (ATSDR) Minimum Risk Levels (MRLs). Available online at: http://www.atsdr.cdc.gov/mrls/index.html
CA = California Environmental Protection Agency/Office of Environmental Health Hazard Assessment assessments. Available online at: http://www.oehha.ca.gov/risk/ChemicalDB/index.asp
H = HEAST. EPA Superfund Health Effects Assessment Summary Tables (HEAST) database. Available online at: http://epa-heast.ornl.gov/heast.shtml
S = See RSL User Guide, Section 5
X = PPRTV Appendix
Mut = Chemical acts according to the mutagenic-mode-of-action, special exposure parameters apply (see footnote (4) above).
VC = Special exposure equation for vinyl chloride applies (see Navigation Guide for equation).
TCE = Special mutagenic and non-mutagenic IURs for trichloroethylene apply (see footnote (4) above).
Yellow highlighting indicates site-specific parameters that may be edited by the user.
Blue highlighting indicates exposure factors that are based on Risk Assessment Guidance for Superfund (RAGS) or EPA vapor intrusion guidance, which generally should not be changed.
Pink highlighting indicates VI carcinogenic risk greater than the target risk for carcinogens (TCR) or VI Hazard greater than or equal to the target hazard quotient for non-carcinogens (THQ).

COMMERCIAL WORKER OMITTING SOIL GAS SAMPLE SG-13

EPA-OLEM VAPOR INTRUSION ASSESSMENT
Sub-slab or Exterior Soil Gas Concentration to Indoor Air Concentration (SGC-IAC) Calculator Version 3.5.1 (May 2016 RSLs)

Parameter	Symbol	Value	Instructions
Exposure Scenario	Scenario	Commercial	Select residential or commercial scenario from pull down list
Target Risk for Carcinogens	TCR_SG	1.00E-05	Enter target risk for carcinogens (for comparison to the calculated VI carcinogenic risk in column F)
Target Hazard Quotient for Non-Carcinogens	THQ_SG	1	Enter target hazard quotient for non-carcinogens (for comparison to the calculated VI hazard in column G)

CAS	Chemical Name	Site Sub-slab or Exterior Soil Gas Concentration Csg (ug/m^3)	Calculated Indoor Air Concentration Cia (ug/m^3)	VI Carcinogenic Risk CR	VI Hazard HQ	Inhalation Unit Risk IUR ($(ug/m^3)^{-1}$)	IUR Source*	Reference Concentration RfC (mg/m^3)	RFC Source*	Mutagenic Indicator i
67-64-1	Acetone	3.2E+02	1.90E+00	No IUR	1.4E-05			3.10E+01	A	
71-43-2	Benzene	3.7E+02	2.23E+00	1.4E-06	1.7E-02	7.80E-06	I	3.00E-02	I	
75-27-4	Bromodichloromethane	2.1E+01	1.28E-01	3.9E-07	No RfC	3.70E-05	CA			
106-99-0	Butadiene, 1,3-	2.4E+02	1.42E+00	3.5E-06	1.6E-01	3.00E-05	I	2.00E-03	I	
75-15-0	Carbon Disulfide	1.3E+02	7.68E-01	No IUR	2.5E-04			7.00E-01	I	
67-66-3	Chloroform	1.3E+02	7.86E-01	1.5E-06	1.8E-03	2.30E-05	I	9.80E-02	A	
74-87-3	Chloromethane	9.9E-01	5.92E-03	No IUR	1.5E-05			9.00E-02	I	
110-82-7	Cyclohexane	2.5E+02	1.49E+00	No IUR	5.7E-05			6.00E+00	I	
75-71-8	Dichlorodifluoromethane	4.9E+01	2.93E-01	No IUR	6.7E-04			1.00E-01	X	
141-78-6	Ethyl Acetate	1.7E+01	9.96E-02	No IUR	3.2E-04			7.00E-02	P	
100-41-4	Ethylbenzene	3.0E+02	1.81E+00	3.7E-07	4.1E-04	2.50E-06	CA	1.00E+00	I	
110-54-3	Hexane, N-	2.4E+03	1.43E+01	No IUR	4.7E-03			7.00E-01	I	
591-78-6	Hexanone, 2-	8.5E+00	5.09E-02	No IUR	3.9E-04			3.00E-02	I	
67-63-0	Isopropanol	8.3E+00	5.00E-02	No IUR	5.7E-05			2.00E-01	P	
78-93-3	Methyl Ethyl Ketone (2-Butanone)	5.8E+01	3.47E-01	No IUR	1.6E-05			5.00E+00	I	
108-10-1	Methyl Isobutyl Ketone (4-methyl-2-pentanone)	2.5E+02	1.52E+00	No IUR	1.2E-04			3.00E+00	I	
1634-04-4	Methyl tert-Butyl Ether (MTBE)	4.3E+02	2.60E+00	5.5E-08	2.0E-04	2.60E-07	CA	3.00E+00	I	
75-09-2	Methylene Chloride	1.8E+02	1.07E+00	8.8E-10	4.1E-04	1.00E-08	I	6.00E-01	I	Mut
91-20-3	Naphthalene	6.7E+00	4.00E-02	1.1E-07	3.0E-03	3.40E-05	CA	3.00E-03	I	
115-07-1	Propylene	9.1E+03	5.45E+01	No IUR	4.2E-03			3.00E+00	CA	
100-42-5	Styrene	1.2E+01	7.08E-02	No IUR	1.6E-05			1.00E+00	I	
127-18-4	Tetrachloroethylene	6.6E+02	3.95E+00	8.4E-08	2.3E-02	2.60E-07	I	4.00E-02	I	
108-88-3	Toluene	9.0E+02	5.42E+00	No IUR	2.5E-04			5.00E+00	I	
76-13-1	Trichloro-1,2,2-trifluoroethane, 1,1,2-	1.3E+02	7.98E-01	No IUR	6.1E-06			3.00E+01	H	
79-01-6	Trichloroethylene	7.4E+00	4.45E-02	1.5E-08	5.1E-03	see note	I	2.00E-03	I	TCE
95-63-6	Trimethylbenzene, 1,2,4-	2.9E+02	1.75E+00	No IUR	5.7E-02			7.00E-03	P	
75-01-4	Vinyl Chloride	9.1E+02	5.46E+00	2.0E-06	1.2E-02	4.40E-06	I	1.00E-01	I	VC
95-47-6	Xylene, o-	2.1E+02	1.25E+00	No IUR	2.9E-03			1.00E-01	S	
106-42-3	Xylene, P-	5.3E+02	3.16E+00	No IUR	7.2E-03			1.00E-01	S	

Notes: **Total:** **9E-06** **3E-01**

(1) **Inhalation Pathway Exposure Parameters (RME):**

Exposure Scenario	Units	Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
Averaging time for carcinogens	(yrs)	ATc_R_SG	70	ATc_C_SG	70	ATc_SG	70
Averaging time for non-carcinogens	(yrs)	ATnc_R_SG	26	ATnc_C_SG	25	ATnc_SG	25
Exposure duration	(yrs)	ED_R_SG	26	ED_C_SG	25	ED_SG	25
Exposure frequency	(days/yr)	EF_R_SG	350	EF_C_SG	250	EF_SG	250
Exposure time	(hr/day)	ET_R_SG	24	ET_C_SG	8	ET_SG	8

(2) **Generic Attenuation Factors:**

Source Medium of Vapors	Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
Groundwater (-)	AFgw_R_SG	0.001	AFgw_C_SG	0.001	AFgw_SG	0.001
Sub-Slab and Exterior Soil Gas (-)	AFss_R_SG	0.006	AFss_C_SG	0.006	AFss_SG	0.006

(3) **Formulas**
Cia, target = MIN(Cia,c; Cia,nc)
Cia,c (ug/m3) = TCR x ATc x (365 days/yr) x (24 hrs/day) / (ED x EF x ET x IUR)
Cia,nc (ug/m3) = THQ x ATnc x (365 days/yr) x (24 hrs/day) x RfC x (1000 ug/mg) / (ED x EF x ET)

(4) **Special Case Chemicals**

Trichloroethylene

	Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
	mIURTCE_R_SG	1.00E-06	mIURTCE_C_SG	0.00E+00	mIURTCE_SG	0.00E+00
	IURTCE_R_SG	3.10E-06	IURTCE_C_SG	4.10E-06	IURTCE_SG	4.10E-06

Mutagenic Chemicals — The exposure durations and age-dependent adjustment factors for mutagenic-mode-of-action are listed in the table below:

Note: This section applies to trichloroethylene and other mutagenic chemicals, but not to vinyl chloride.

Age Cohort	Exposure Duration	Age-dependent adjustment factor
0 - 2 years	2	10
2 - 6 years	4	3
6 - 16 years	10	3
16 - 26 years	10	1
Mutagenic-mode-of-action (MMOA) adjustment factor		25

This factor is used in the equations for mutagenic chemicals.

Vinyl Chloride — See the Navigation Guide equation for Cia,c for vinyl chloride.

Notation:
I = IRIS: EPA Integrated Risk Information System (IRIS). Available online at: http://www.epa.gov/iris/subst/index.html
P = PPRTV. EPA Provisional Peer Reviewed Toxicity Values (PPRTVs). Available online at: http://hhpprtv.ornl.gov/pprtv.shtml
A = Agency for Toxic Substances and Disease Registry (ATSDR) Minimum Risk Levels (MRLs). Available online at: http://www.atsdr.cdc.gov/mrls/index.html
CA = California Environmental Protection Agency/Office of Environmental Health Hazard Assessment assessments. Available online at: http://www.oehha.ca.gov/risk/ChemicalDB/index.asp
H = HEAST. EPA Superfund Health Effects Assessment Summary Tables (HEAST) database. Available online at: http://epa-heast.ornl.gov/heast.shtml
S = See RSL User Guide, Section 5
X = PPRTV Appendix
Mut = Chemical acts according to the mutagenic-mode-of-action, special exposure parameters apply (see footnote (4) above).
VC = Special exposure equation for vinyl chloride applies (see Navigation Guide for equation).
TCE = Special mutagenic and non-mutagenic IURs for trichloroethylene apply (see footnote (4) above).
Yellow highlighting indicates site-specific parameters that may be edited by the user.
Blue highlighting indicates exposure factors that are based on Risk Assessment Guidance for Superfund (RAGS) or EPA vapor intrusion guidance, which generally should not be changed.
Pink highlighting indicates VI carcinogenic risk greater than the target risk for carcinogens (TCR) or VI Hazard greater than or equal to the target hazard quotient for non-carcinogens (THQ).

SPECTATOR USING ALL SOIL GAS SAMPLES

EPA-OLEM VAPOR INTRUSION ASSESSMENT
Sub-slab or Exterior Soil Gas Concentration to Indoor Air Concentration (SGC-IAC) Calculator Version 3.5.1 (May 2016 RSLs)

Parameter	Symbol	Value	Instructions
Exposure Scenario	Scenario	Commercial	Select residential or commercial scenario from pull down list
Target Risk for Carcinogens	TCR_SG	1.00E-05	Enter target risk for carcinogens (for comparison to the calculated VI carcinogenic risk in column F)
Target Hazard Quotient for Non-Carcinogens	THQ_SG	1	Enter target hazard quotient for non-carcinogens (for comparison to the calculated VI hazard in column G)

CAS	Chemical Name	Site Sub-slab or Exterior Soil Gas Concentration Csg (ug/m^3)	Calculated Indoor Air Concentration Cia (ug/m^3)	VI Carcinogenic Risk CR	VI Hazard HQ	Inhalation Unit Risk IUR ($(ug/m^3)^{-1}$)	IUR Source*	Reference Concentration RfC (mg/m^3)	RFC Source*	Mutagenic Indicator i
67-64-1	Acetone	3.2E+02	1.90E+00	No IUR	7.0E-07			3.10E+01	A	
71-43-2	Benzene	4.7E+02	2.84E+00	9.4E-08	1.1E-03	7.80E-06	I	3.00E-02	I	
75-27-4	Bromodichloromethane	2.1E+01	1.28E-01	2.0E-08	No RfC	3.70E-05	CA			
106-99-0	Butadiene, 1,3-	2.4E+02	1.42E+00	1.8E-07	8.1E-03	3.00E-05	I	2.00E-03	I	
75-15-0	Carbon Disulfide	1.3E+02	7.68E-01	No IUR	1.3E-05			7.00E-01	I	
67-66-3	Chloroform	1.3E+02	7.86E-01	7.7E-08	9.2E-05	2.30E-05	I	9.80E-02	A	
74-87-3	Chloromethane	9.9E-01	5.92E-03	No IUR	7.5E-07			9.00E-02	I	
110-82-7	Cyclohexane	1.1E+03	6.42E+00	No IUR	1.2E-05			6.00E+00	I	
75-71-8	Dichlorodifluoromethane	4.9E+01	2.93E-01	No IUR	3.3E-05			1.00E-01	X	
75-35-4	Dichloroethylene, 1,1-	4.0E+02	2.37E+00	No IUR	1.4E-04			2.00E-01	I	
141-78-6	Ethyl Acetate	1.7E+01	9.96E-02	No IUR	1.6E-05			7.00E-02	P	
100-41-4	Ethylbenzene	3.0E+02	1.81E+00	1.9E-08	2.1E-05	2.50E-06	CA	1.00E+00	I	
110-54-3	Hexane, N-	2.4E+03	1.43E+01	No IUR	2.3E-04			7.00E-01	I	
591-78-6	Hexanone, 2-	8.5E+00	5.09E-02	No IUR	1.9E-05			3.00E-02	I	
67-63-0	Isopropanol	8.3E+00	5.00E-02	No IUR	2.9E-06			2.00E-01	P	
78-93-3	Methyl Ethyl Ketone (2-Butanone)	5.8E+01	3.47E-01	No IUR	7.9E-07			5.00E+00	I	
108-10-1	Methyl Isobutyl Ketone (4-methyl-2-pentanone)	2.5E+02	1.52E+00	No IUR	5.8E-06			3.00E+00	I	
1634-04-4	Methyl tert-Butyl Ether (MTBE)	4.3E+02	2.60E+00	2.9E-09	9.9E-06	2.60E-07	CA	3.00E+00	I	
75-09-2	Methylene Chloride	4.6E+02	2.75E+00	1.2E-10	5.2E-05	1.00E-08	I	6.00E-01	I	Mut
91-20-3	Naphthalene	6.7E+00	4.00E-02	5.8E-09	1.5E-04	3.40E-05	CA	3.00E-03	I	
115-07-1	Propylene	9.1E+03	5.45E+01	No IUR	2.1E-04			3.00E+00	CA	
100-42-5	Styrene	1.2E+01	7.08E-02	No IUR	8.1E-07			1.00E+00	I	
127-18-4	Tetrachloroethylene	1.0E+04	6.18E+01	6.8E-08	1.8E-02	2.60E-07	I	4.00E-02	I	
108-88-3	Toluene	9.0E+02	5.42E+00	No IUR	1.2E-05			5.00E+00	I	
76-13-1	Trichloro-1,2,2-trifluoroethane, 1,1,2-	1.3E+02	7.98E-01	No IUR	3.0E-07			3.00E+01	H	
79-01-6	Trichloroethylene	6.1E+03	3.64E+01	6.3E-07	2.1E-01	see note	I	2.00E-03	I	TCE
95-63-6	Trimethylbenzene, 1,2,4-	2.9E+02	1.75E+00	No IUR	2.9E-03			7.00E-03	P	
75-01-4	Vinyl Chloride	9.1E+02	5.46E+00	1.0E-07	6.2E-04	4.40E-06	I	1.00E-01	I	VC
108-38-3	Xylene, m-	5.3E+02	3.16E+00	No IUR	3.6E-04			1.00E-01	S	
95-47-6	Xylene, o-	2.1E+02	1.25E+00	No IUR	1.4E-04			1.00E-01	S	

Notes: **Total:** **1E-06** **2E-01**

(1) **Inhalation Pathway Exposure Parameters (RME):**

Exposure Scenario	Units	Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
Averaging time for carcinogens	(yrs)	ATc_R_SG	70	ATc_C_SG	70	ATc_SG	70
Averaging time for non-carcinogens	(yrs)	ATnc_R_SG	26	ATnc_C_SG	26	ATnc_SG	26
Exposure duration	(yrs)	ED_R_SG	26	ED_C_SG	26	ED_SG	26
Exposure frequency	(days/yr)	EF_R_SG	25	EF_C_SG	25	EF_SG	25
Exposure time	(hr/day)	ET_R_SG	4	ET_C_SG	4	ET_SG	4

(2) **Generic Attenuation Factors:**

Source Medium of Vapors	Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
Groundwater (-)	AFgw_R_SG	0.001	AFgw_C_SG	0.001	AFgw_SG	0.001
Sub-Slab and Exterior Soil Gas (-)	AFss_R_SG	0.006	AFss_C_SG	0.006	AFss_SG	0.006

(3) **Formulas**

Cia, target = MIN(Cia,c; Cia,nc)
Cia,c (ug/m3) = TCR x ATc x (365 days/yr) x (24 hrs/day) / (ED x EF x ET x IUR)
Cia,nc (ug/m3) = THQ x ATnc x (365 days/yr) x (24 hrs/day) x RfC x (1000 ug/mg) / (ED x EF x ET)

(4) **Special Case Chemicals**

Trichloroethylene	Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
	mIURTCE_R_SG	1.00E-06	mIURTCE_C_SG	0.00E+00	mIURTCE_SG	0.00E+00
	IURTCE_R_SG	3.10E-06	IURTCE_C_SG	4.10E-06	IURTCE_SG	4.10E-06

Mutagenic Chemicals — The exposure durations and age-dependent adjustment factors for mutagenic-mode-of-action are listed in the table below:

Note: This section applies to trichloroethylene and other mutagenic chemicals, but not to vinyl chloride.

Age Cohort	Exposure Duration	Age-dependent adjustment factor
0 - 2 years	2	10
2 - 6 years	4	3
6 - 16 years	10	3
16 - 26 years	10	1

Mutagenic-mode-of-action (MMOA) adjustment factor 26 This factor is used in the equations for mutagenic chemicals.

Vinyl Chloride — See the Navigation Guide equation for Cia,c for vinyl chloride.

Notation:

I = IRIS: EPA Integrated Risk Information System (IRIS). Available online at: http://www.epa.gov/iris/subst/index.html
P = PPRTV. EPA Provisional Peer Reviewed Toxicity Values (PPRTVs). Available online at: http://hhpprtv.ornl.gov/pprtv.shtml
A = Agency for Toxic Substances and Disease Registry (ATSDR) Minimum Risk Levels (MRLs). Available online at: http://www.atsdr.cdc.gov/mrls/index.html
CA = California Environmental Protection Agency/Office of Environmental Health Hazard Assessment assessments. Available online at: http://www.oehha.ca.gov/risk/ChemicalDB/index.asp
H = HEAST. EPA Superfund Health Effects Assessment Summary Tables (HEAST) database. Available online at: http://epa-heast.ornl.gov/heast.shtml
S = See RSL User Guide, Section 5
X = PPRTV Appendix
Mut = Chemical acts according to the mutagenic-mode-of-action, special exposure parameters apply (see footnote (4) above).
VC = Special exposure equation for vinyl chloride applies (see Navigation Guide for equation).
TCE = Special mutagenic and non-mutagenic IURs for trichloroethylene apply (see footnote (4) above).
Yellow highlighting indicates site-specific parameters that may be edited by the user.
Blue highlighting indicates exposure factors that are based on Risk Assessment Guidance for Superfund (RAGS) or EPA vapor intrusion guidance, which generally should not be changed.
Pink highlighting indicates VI carcinogenic risk greater than the target risk for carcinogens (TCR) or VI Hazard greater than or equal to the target hazard quotient for non-carcinogens (THQ).

APPENDIX G

J&E Model Calculations

HALEY ALDRICH

SG-ADV
Version 3.1; 02/04

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical	
76131	1.00E+00			1,1,2-Trichloro-1,2,2-trifluoroethane	
75354	1.00E+00			1,1-Dichloroethylene	
95636	1.00E+00			1,2,4-Trimethylbenzene	
108678	1.00E+00			1,3,5-Trimethylbenzene	
106990	1.00E+00			1,3-Butadiene	
110543	1.00E+00			Hexane	surrogate for 2,2,4-Trimethylpentane
78933	1.00E+00			Methylethylketone (2-butanone)	
78933	1.00E+00			Methylethylketone (2-butanone)	surrogate for 2-Hexanone
95476	1.00E+00			o-Xylene	surrogate for 4-Ethyltoluene
108101	1.00E+00			Methylisobutylketone (4-methyl-2-pentanone)	
67641	1.00E+00			Acetone	
71432	1.00E+00			Benzene	
75274	1.00E+00			Bromodichloromethane	
75150	1.00E+00			Carbon disulfide	
67663	1.00E+00			Chloroform	
74873	1.00E+00			Methyl chloride (chloromethane)	
156592	1.00E+00			cis-1,2-Dichloroethylene	
108872	1.00E+00			Methylcyclohexane	surrogate for cyclohexane
75718	1.00E+00			Dichlorodifluoromethane	
78831	1.00E+00			Isobutanol	surrogate for ethanol
141786	1.00E+00			Ethylacetate	
100414	1.00E+00			Ethylbenzene	
110543	1.00E+00			Hexane	surrogate for Heptane
110543	1.00E+00			Hexane	
78831	1.00E+00			Isobutanol	surrogate for isopropyl alcohol
1634044	1.00E+00			MTBE	
75092	1.00E+00			Methylene chloride	
106423	1.00E+00			p-Xylene	surrogate for m,p-Xylene
91203	1.00E+00			Naphthalene	
95476	1.00E+00			o-Xylene	
110543	1.00E+00			Hexane	surrogate for Propene
100425	1.00E+00			Styrene	
127184	1.00E+00			Tetrachloroethylene	
108883	1.00E+00			Toluene	
156605	1.00E+00			trans-1,2-Dichloroethylene	
79016	1.00E+00			Trichloroethylene	
75694	1.00E+00			Trichlorofluoromethane	
75014	1.00E+00			Vinyl chloride (chloroethene)	

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (^oC)	ENTER Totals must add up to value of Ls (cell F24) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
366	427	14	427	0	0	LS		

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	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)
LS	1.62	0.39	0.076								

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	366	0.1	0.83	5

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
70	25	25	250

END

CHEMICAL PROPERTIES SHEET

	Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Molecular weight, MW (g/mol)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
1,1,2-Trichloro-1,2,2-trifluoroethane	7.80E-02	8.20E-06	4.80E-01	25	6,463	320.70	487.30	187.38	0.0E+00	3.0E+01
1,1-Dichloroethylene	9.00E-02	1.04E-05	2.60E-02	25	6,247	304.75	576.05	96.94	0.0E+00	2.0E-01
1,2,4-Trimethylbenzene	6.06E-02	7.92E-06	6.14E-03	25	9,369	442.30	649.17	120.20	0.0E+00	6.0E-03
1,3,5-Trimethylbenzene	6.02E-02	8.67E-06	5.87E-03	25	9,321	437.89	637.25	120.20	0.0E+00	6.0E-03
1,3-Butadiene	2.49E-01	1.08E-05	7.34E-02	25	5,370	268.60	425.00	54.09	3.0E-02	2.0E-03
Hexane	2.00E-01	7.77E-06	1.66E+00	25	6,895	341.70	508.00	86.18	0.0E+00	2.0E-01
Methylethylketone (2-butanone)	8.08E-02	9.80E-06	5.58E-05	25	7,481	352.50	536.78	72.11	0.0E+00	5.0E+00
Methylethylketone (2-butanone)	8.08E-02	9.80E-06	5.58E-05	25	7,481	352.50	536.78	72.11	0.0E+00	5.0E+00
o-Xylene	8.70E-02	1.00E-05	5.18E-03	25	8,661	417.60	630.30	106.17	0.0E+00	1.0E-01
Methylisobutylketone (4-methyl-2-pentanone)	7.50E-02	7.80E-06	1.38E-04	25	8,243	389.50	571.00	100.16	0.0E+00	3.0E+00
Acetone	1.24E-01	1.14E-05	3.87E-05	25	6,955	329.20	508.10	58.08	0.0E+00	3.5E-01
Benzene	8.80E-02	9.80E-06	5.54E-03	25	7,342	353.24	562.16	78.11	7.8E-06	3.0E-02
Bromodichloromethane	2.98E-02	1.06E-05	1.60E-03	25	7,800	363.15	585.85	163.83	1.8E-05	7.0E-02
Carbon disulfide	1.04E-01	1.00E-05	3.02E-02	25	6,391	319.00	552.00	76.13	0.0E+00	7.0E-01
Chloroform	1.04E-01	1.00E-05	3.66E-03	25	6,988	334.32	536.40	119.38	2.3E-05	0.0E+00
Methyl chloride (chloromethane)	1.26E-01	6.50E-06	8.80E-03	25	5,115	249.00	416.25	50.49	1.0E-06	9.0E-02
cis-1,2-Dichloroethylene	7.36E-02	1.13E-05	4.07E-03	25	7,192	333.65	544.00	96.94	0.0E+00	3.5E-02
Methylcyclohexane	7.35E-02	8.52E-06	1.03E-01	25	7,474	373.90	572.20	98.21	0.0E+00	3.0E+00
Dichlorodifluoromethane	6.65E-02	9.92E-06	3.42E-01	25	9,421	243.20	384.95	120.92	0.0E+00	2.0E-01
Isobutanol	8.60E-02	9.30E-06	1.18E-05	25	10,936	381.04	547.78	74.12	0.0E+00	1.1E+00
Ethylacetate	7.32E-02	9.70E-06	1.38E-04	25	7,634	350.26	523.30	88.12	0.0E+00	3.2E+00
Ethylbenzene	7.50E-02	7.80E-06	7.86E-03	25	8,501	409.34	617.20	106.17	0.0E+00	1.0E+00
Hexane	2.00E-01	7.77E-06	1.66E+00	25	6,895	341.70	508.00	86.18	0.0E+00	2.0E-01
Hexane	2.00E-01	7.77E-06	1.66E+00	25	6,895	341.70	508.00	86.18	0.0E+00	2.0E-01
Isobutanol	8.60E-02	9.30E-06	1.18E-05	25	10,936	381.04	547.78	74.12	0.0E+00	1.1E+00
MTBE	1.02E-01	1.05E-05	6.23E-04	25	6,678	328.30	497.10	88.15	0.0E+00	3.0E+00
Methylene chloride	1.01E-01	1.17E-05	2.18E-03	25	6,706	313.00	510.00	84.93	4.7E-07	3.0E+00
p-Xylene	7.69E-02	8.44E-06	7.64E-03	25	8,525	411.52	616.20	106.17	0.0E+00	1.0E-01
Naphthalene	5.90E-02	7.50E-06	4.82E-04	25	10,373	491.14	748.40	128.18	0.0E+00	3.0E-03
o-Xylene	8.70E-02	1.00E-05	5.18E-03	25	8,661	417.60	630.30	106.17	0.0E+00	1.0E-01
Hexane	2.00E-01	7.77E-06	1.66E+00	25	6,895	341.70	508.00	86.18	0.0E+00	2.0E-01
Styrene	7.10E-02	8.00E-06	2.74E-03	25	8,737	418.31	636.00	104.15	0.0E+00	1.0E+00
Tetrachloroethylene	7.20E-02	8.20E-06	1.84E-02	25	8,288	394.40	620.20	165.83	5.9E-06	6.0E-01
Toluene	8.70E-02	8.60E-06	6.62E-03	25	7,930	383.78	591.79	92.14	0.0E+00	4.0E-01
trans-1,2-Dichloroethylene	7.07E-02	1.19E-05	9.36E-03	25	6,717	320.85	516.50	96.94	0.0E+00	7.0E-02
Trichloroethylene	7.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	131.39	1.1E-04	4.0E-02
Trichlorofluoromethane	8.70E-02	9.70E-06	9.68E-02	25	5,999	296.70	471.00	137.36	0.0E+00	7.0E-01
Vinyl chloride (chloroethene)	1.06E-01	1.23E-05	2.69E-02	25	5,250	259.25	432.00	62.50	8.8E-06	1.0E-01

INTERMEDIATE CALCULATIONS SHEET

	Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
1,1,2-Trichloro-1,2,2-trifluoroethane	7.88E+08	60.72	0.314	ERROR	ERROR	0.079	1.63E-08	0.957	1.56E-08	4,000	1.00E+00	8.43E+04
1,1-Dichloroethylene	7.88E+08	60.72	0.314	ERROR	ERROR	0.079	1.63E-08	0.957	1.56E-08	4,000	1.00E+00	8.43E+04
1,2,4-Trimethylbenzene	7.88E+08	60.72	0.314	ERROR	ERROR	0.079	1.63E-08	0.957	1.56E-08	4,000	1.00E+00	8.43E+04
1,3,5-Trimethylbenzene	7.88E+08	60.72	0.314	ERROR	ERROR	0.079	1.63E-08	0.957	1.56E-08	4,000	1.00E+00	8.43E+04
1,3-Butadiene	7.88E+08	60.72	0.314	ERROR	ERROR	0.079	1.63E-08	0.957	1.56E-08	4,000	1.00E+00	8.43E+04
Hexane	7.88E+08	60.72	0.314	ERROR	ERROR	0.079	1.63E-08	0.957	1.56E-08	4,000	1.00E+00	8.43E+04
Methylethylketone (2-butanone)	7.88E+08	60.72	0.314	ERROR	ERROR	0.079	1.63E-08	0.957	1.56E-08	4,000	1.00E+00	8.43E+04
Methylethylketone (2-butanone)	7.88E+08	60.72	0.314	ERROR	ERROR	0.079	1.63E-08	0.957	1.56E-08	4,000	1.00E+00	8.43E+04
o-Xylene	7.88E+08	60.72	0.314	ERROR	ERROR	0.079	1.63E-08	0.957	1.56E-08	4,000	1.00E+00	8.43E+04
Methylisobutylketone (4-methyl-2-pentanc	7.88E+08	60.72	0.314	ERROR	ERROR	0.079	1.63E-08	0.957	1.56E-08	4,000	1.00E+00	8.43E+04
Acetone	7.88E+08	60.72	0.314	ERROR	ERROR	0.079	1.63E-08	0.957	1.56E-08	4,000	1.00E+00	8.43E+04
Benzene	7.88E+08	60.72	0.314	ERROR	ERROR	0.079	1.63E-08	0.957	1.56E-08	4,000	1.00E+00	8.43E+04
Bromodichloromethane	7.88E+08	60.72	0.314	ERROR	ERROR	0.079	1.63E-08	0.957	1.56E-08	4,000	1.00E+00	8.43E+04
Carbon disulfide	7.88E+08	60.72	0.314	ERROR	ERROR	0.079	1.63E-08	0.957	1.56E-08	4,000	1.00E+00	8.43E+04
Chloroform	7.88E+08	60.72	0.314	ERROR	ERROR	0.079	1.63E-08	0.957	1.56E-08	4,000	1.00E+00	8.43E+04
Methyl chloride (chloromethane)	7.88E+08	60.72	0.314	ERROR	ERROR	0.079	1.63E-08	0.957	1.56E-08	4,000	1.00E+00	8.43E+04
cis-1,2-Dichloroethylene	7.88E+08	60.72	0.314	ERROR	ERROR	0.079	1.63E-08	0.957	1.56E-08	4,000	1.00E+00	8.43E+04
Methylcyclohexane	7.88E+08	60.72	0.314	ERROR	ERROR	0.079	1.63E-08	0.957	1.56E-08	4,000	1.00E+00	8.43E+04
Dichlorodifluoromethane	7.88E+08	60.72	0.314	ERROR	ERROR	0.079	1.63E-08	0.957	1.56E-08	4,000	1.00E+00	8.43E+04
Isobutanol	7.88E+08	60.72	0.314	ERROR	ERROR	0.079	1.63E-08	0.957	1.56E-08	4,000	1.00E+00	8.43E+04
Ethylacetate	7.88E+08	60.72	0.314	ERROR	ERROR	0.079	1.63E-08	0.957	1.56E-08	4,000	1.00E+00	8.43E+04
Ethylbenzene	7.88E+08	60.72	0.314	ERROR	ERROR	0.079	1.63E-08	0.957	1.56E-08	4,000	1.00E+00	8.43E+04
Hexane	7.88E+08	60.72	0.314	ERROR	ERROR	0.079	1.63E-08	0.957	1.56E-08	4,000	1.00E+00	8.43E+04
Hexane	7.88E+08	60.72	0.314	ERROR	ERROR	0.079	1.63E-08	0.957	1.56E-08	4,000	1.00E+00	8.43E+04
Isobutanol	7.88E+08	60.72	0.314	ERROR	ERROR	0.079	1.63E-08	0.957	1.56E-08	4,000	1.00E+00	8.43E+04
MTBE	7.88E+08	60.72	0.314	ERROR	ERROR	0.079	1.63E-08	0.957	1.56E-08	4,000	1.00E+00	8.43E+04
Methylene chloride	7.88E+08	60.72	0.314	ERROR	ERROR	0.079	1.63E-08	0.957	1.56E-08	4,000	1.00E+00	8.43E+04
p-Xylene	7.88E+08	60.72	0.314	ERROR	ERROR	0.079	1.63E-08	0.957	1.56E-08	4,000	1.00E+00	8.43E+04
Naphthalene	7.88E+08	60.72	0.314	ERROR	ERROR	0.079	1.63E-08	0.957	1.56E-08	4,000	1.00E+00	8.43E+04
o-Xylene	7.88E+08	60.72	0.314	ERROR	ERROR	0.079	1.63E-08	0.957	1.56E-08	4,000	1.00E+00	8.43E+04
Hexane	7.88E+08	60.72	0.314	ERROR	ERROR	0.079	1.63E-08	0.957	1.56E-08	4,000	1.00E+00	8.43E+04
Styrene	7.88E+08	60.72	0.314	ERROR	ERROR	0.079	1.63E-08	0.957	1.56E-08	4,000	1.00E+00	8.43E+04
Tetrachloroethylene	7.88E+08	60.72	0.314	ERROR	ERROR	0.079	1.63E-08	0.957	1.56E-08	4,000	1.00E+00	8.43E+04
Toluene	7.88E+08	60.72	0.314	ERROR	ERROR	0.079	1.63E-08	0.957	1.56E-08	4,000	1.00E+00	8.43E+04
trans-1,2-Dichloroethylene	7.88E+08	60.72	0.314	ERROR	ERROR	0.079	1.63E-08	0.957	1.56E-08	4,000	1.00E+00	8.43E+04
Trichloroethylene	7.88E+08	60.72	0.314	ERROR	ERROR	0.079	1.63E-08	0.957	1.56E-08	4,000	1.00E+00	8.43E+04
Trichlorofluoromethane	7.88E+08	60.72	0.314	ERROR	ERROR	0.079	1.63E-08	0.957	1.56E-08	4,000	1.00E+00	8.43E+04
Vinyl chloride (chloroethene)	7.88E+08	60.72	0.314	ERROR	ERROR	0.079	1.63E-08	0.957	1.56E-08	4,000	1.00E+00	8.43E+04

	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
1,1,2-Trichloro-1,2,2-trifluoroethane	2.46E+06	1.62E-04	366	6,918	3.07E-01	1.30E+01	1.77E-04	1.08E-02	0.00E+00	0.00E+00	1.08E-02	60.72
1,1-Dichloroethylene	2.46E+06	1.62E-04	366	6,366	1.73E-02	7.32E-01	1.77E-04	1.25E-02	0.00E+00	0.00E+00	1.25E-02	60.72
1,2,4-Trimethylbenzene	2.46E+06	1.62E-04	366	11,642	2.89E-03	1.23E-01	1.77E-04	8.42E-03	0.00E+00	0.00E+00	8.42E-03	60.72
1,3,5-Trimethylbenzene	2.46E+06	1.62E-04	366	11,626	2.77E-03	1.17E-01	1.77E-04	8.36E-03	0.00E+00	0.00E+00	8.36E-03	60.72
1,3-Butadiene	2.46E+06	1.62E-04	366	5,137	5.27E-02	2.24E+00	1.77E-04	3.46E-02	0.00E+00	0.00E+00	3.46E-02	60.72
Hexane	2.46E+06	1.62E-04	366	7,684	1.01E+00	4.29E+01	1.77E-04	2.78E-02	0.00E+00	0.00E+00	2.78E-02	60.72
Methylethylketone (2-butanone)	2.46E+06	1.62E-04	366	8,370	3.25E-05	1.38E-03	1.77E-04	1.12E-02	0.00E+00	0.00E+00	1.12E-02	60.72
Methylethylketone (2-butanone)	2.46E+06	1.62E-04	366	8,370	3.25E-05	1.38E-03	1.77E-04	1.12E-02	0.00E+00	0.00E+00	1.12E-02	60.72
o-Xylene	2.46E+06	1.62E-04	366	10,359	2.65E-03	1.12E-01	1.77E-04	1.21E-02	0.00E+00	0.00E+00	1.21E-02	60.72
Methylisobutylketone (4-methyl-2-pentanc	2.46E+06	1.62E-04	366	9,808	7.30E-05	3.10E-03	1.77E-04	1.04E-02	0.00E+00	0.00E+00	1.04E-02	60.72
Acetone	2.46E+06	1.62E-04	366	7,510	2.38E-05	1.01E-03	1.77E-04	1.72E-02	0.00E+00	0.00E+00	1.72E-02	60.72
Benzene	2.46E+06	1.62E-04	366	8,081	3.28E-03	1.39E-01	1.77E-04	1.22E-02	0.00E+00	0.00E+00	1.22E-02	60.72
Bromodichloromethane	2.46E+06	1.62E-04	366	8,626	9.14E-04	3.88E-02	1.77E-04	4.14E-03	0.00E+00	0.00E+00	4.14E-03	60.72
Carbon disulfide	2.46E+06	1.62E-04	366	6,651	1.97E-02	8.34E-01	1.77E-04	1.44E-02	0.00E+00	0.00E+00	1.44E-02	60.72
Chloroform	2.46E+06	1.62E-04	366	7,513	2.25E-03	9.56E-02	1.77E-04	1.44E-02	0.00E+00	0.00E+00	1.44E-02	60.72
Methyl chloride (chloromethane)	2.46E+06	1.62E-04	366	4,700	6.49E-03	2.76E-01	1.77E-04	1.75E-02	0.00E+00	0.00E+00	1.75E-02	60.72
cis-1,2-Dichloroethylene	2.46E+06	1.62E-04	366	7,694	2.47E-03	1.05E-01	1.77E-04	1.02E-02	0.00E+00	0.00E+00	1.02E-02	60.72
Methylcyclohexane	2.46E+06	1.62E-04	366	8,540	5.92E-02	2.51E+00	1.77E-04	1.02E-02	0.00E+00	0.00E+00	1.02E-02	60.72
Dichlorodifluoromethane	2.46E+06	1.62E-04	366	8,269	2.00E-01	8.51E+00	1.77E-04	9.24E-03	0.00E+00	0.00E+00	9.24E-03	60.72
Isobutanol	2.46E+06	1.62E-04	366	13,068	5.06E-06	2.15E-04	1.77E-04	1.20E-02	0.00E+00	0.00E+00	1.20E-02	60.72
Ethylacetate	2.46E+06	1.62E-04	366	8,589	7.90E-05	3.35E-03	1.77E-04	1.02E-02	0.00E+00	0.00E+00	1.02E-02	60.72
Ethylbenzene	2.46E+06	1.62E-04	366	10,110	4.09E-03	1.74E-01	1.77E-04	1.04E-02	0.00E+00	0.00E+00	1.04E-02	60.72
Hexane	2.46E+06	1.62E-04	366	7,684	1.01E+00	4.29E+01	1.77E-04	2.78E-02	0.00E+00	0.00E+00	2.78E-02	60.72
Hexane	2.46E+06	1.62E-04	366	7,684	1.01E+00	4.29E+01	1.77E-04	2.78E-02	0.00E+00	0.00E+00	2.78E-02	60.72
Isobutanol	2.46E+06	1.62E-04	366	13,068	5.06E-06	2.15E-04	1.77E-04	1.20E-02	0.00E+00	0.00E+00	1.20E-02	60.72
MTBE	2.46E+06	1.62E-04	366	7,243	3.90E-04	1.66E-02	1.77E-04	1.42E-02	0.00E+00	0.00E+00	1.42E-02	60.72
Methylene chloride	2.46E+06	1.62E-04	366	6,992	1.39E-03	5.90E-02	1.77E-04	1.40E-02	0.00E+00	0.00E+00	1.40E-02	60.72
p-Xylene	2.46E+06	1.62E-04	366	10,202	3.95E-03	1.68E-01	1.77E-04	1.07E-02	0.00E+00	0.00E+00	1.07E-02	60.72
Naphthalene	2.46E+06	1.62E-04	366	12,871	2.10E-04	8.90E-03	1.77E-04	8.20E-03	0.00E+00	0.00E+00	8.20E-03	60.72
o-Xylene	2.46E+06	1.62E-04	366	10,359	2.65E-03	1.12E-01	1.77E-04	1.21E-02	0.00E+00	0.00E+00	1.21E-02	60.72
Hexane	2.46E+06	1.62E-04	366	7,684	1.01E+00	4.29E+01	1.77E-04	2.78E-02	0.00E+00	0.00E+00	2.78E-02	60.72
Styrene	2.46E+06	1.62E-04	366	10,406	1.40E-03	5.94E-02	1.77E-04	9.86E-03	0.00E+00	0.00E+00	9.86E-03	60.72
Tetrachloroethylene	2.46E+06	1.62E-04	366	9,513	9.92E-03	4.21E-01	1.77E-04	1.00E-02	0.00E+00	0.00E+00	1.00E-02	60.72
Toluene	2.46E+06	1.62E-04	366	9,111	3.67E-03	1.56E-01	1.77E-04	1.21E-02	0.00E+00	0.00E+00	1.21E-02	60.72
trans-1,2-Dichloroethylene	2.46E+06	1.62E-04	366	7,094	5.91E-03	2.51E-01	1.77E-04	9.82E-03	0.00E+00	0.00E+00	9.82E-03	60.72
Trichloroethylene	2.46E+06	1.62E-04	366	8,507	5.93E-03	2.52E-01	1.77E-04	1.10E-02	0.00E+00	0.00E+00	1.10E-02	60.72
Trichlorofluoromethane	2.46E+06	1.62E-04	366	6,112	6.52E-02	2.77E+00	1.77E-04	1.21E-02	0.00E+00	0.00E+00	1.21E-02	60.72
Vinyl chloride (chloroethene)	2.46E+06	1.62E-04	366	4,955	1.95E-02	8.30E-01	1.77E-04	1.47E-02	0.00E+00	0.00E+00	1.47E-02	60.72

	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)
1,1,2-Trichloro-1,2,2-trifluoroethane	366	1.00E+00	0.10	8.33E+01	1.08E-02	4.00E+02	3.33E+83	8.31E-04	8.31E-04	NA	3.0E+01
1,1-Dichloroethylene	366	1.00E+00	0.10	8.33E+01	1.25E-02	4.00E+02	2.43E+72	8.49E-04	8.49E-04	NA	2.0E-01
1,2,4-Trimethylbenzene	366	1.00E+00	0.10	8.33E+01	8.42E-03	4.00E+02	3.18E+107	7.95E-04	7.95E-04	NA	6.0E-03
1,3,5-Trimethylbenzene	366	1.00E+00	0.10	8.33E+01	8.36E-03	4.00E+02	1.65E+108	7.94E-04	7.94E-04	NA	6.0E-03
1,3-Butadiene	366	1.00E+00	0.10	8.33E+01	3.46E-02	4.00E+02	1.46E+26	9.33E-04	9.33E-04	3.0E-02	2.0E-03
Hexane	366	1.00E+00	0.10	8.33E+01	2.78E-02	4.00E+02	3.75E+32	9.20E-04	9.20E-04	NA	2.0E-01
Methylethylketone (2-butanone)	366	1.00E+00	0.10	8.33E+01	1.12E-02	4.00E+02	3.67E+80	8.36E-04	8.36E-04	NA	5.0E+00
Methylethylketone (2-butanone)	366	1.00E+00	0.10	8.33E+01	1.12E-02	4.00E+02	3.67E+80	8.36E-04	8.36E-04	NA	5.0E+00
o-Xylene	366	1.00E+00	0.10	8.33E+01	1.21E-02	4.00E+02	7.61E+74	8.45E-04	8.45E-04	NA	1.0E-01
Methylisobutylketone (4-methyl-2-pentanc	366	1.00E+00	0.10	8.33E+01	1.04E-02	4.00E+02	6.87E+86	8.26E-04	8.26E-04	NA	3.0E+00
Acetone	366	1.00E+00	0.10	8.33E+01	1.72E-02	4.00E+02	3.13E+52	8.83E-04	8.83E-04	NA	3.5E-01
Benzene	366	1.00E+00	0.10	8.33E+01	1.22E-02	4.00E+02	1.07E+74	8.46E-04	8.46E-04	7.8E-06	3.0E-02
Bromodichloromethane	366	1.00E+00	0.10	8.33E+01	4.14E-03	4.00E+02	3.96E+218	6.61E-04	6.61E-04	1.8E-05	7.0E-02
Carbon disulfide	366	1.00E+00	0.10	8.33E+01	1.44E-02	4.00E+02	4.38E+62	8.65E-04	8.65E-04	NA	7.0E-01
Chloroform	366	1.00E+00	0.10	8.33E+01	1.44E-02	4.00E+02	4.38E+62	8.65E-04	8.65E-04	2.3E-05	NA
Methyl chloride (chloromethane)	366	1.00E+00	0.10	8.33E+01	1.75E-02	4.00E+02	5.06E+51	8.85E-04	8.85E-04	1.0E-06	9.0E-02
cis-1,2-Dichloroethylene	366	1.00E+00	0.10	8.33E+01	1.02E-02	4.00E+02	3.27E+88	8.23E-04	8.23E-04	NA	3.5E-02
Methylcyclohexane	366	1.00E+00	0.10	8.33E+01	1.02E-02	4.00E+02	4.32E+88	8.23E-04	8.23E-04	NA	3.0E+00
Dichlorodifluoromethane	366	1.00E+00	0.10	8.33E+01	9.24E-03	4.00E+02	9.24E+97	8.09E-04	8.09E-04	NA	2.0E-01
Isobutanol	366	1.00E+00	0.10	8.33E+01	1.20E-02	4.00E+02	2.60E+75	8.44E-04	8.44E-04	NA	1.1E+00
Ethylacetate	366	1.00E+00	0.10	8.33E+01	1.02E-02	4.00E+02	9.29E+88	8.22E-04	8.22E-04	NA	3.2E+00
Ethylbenzene	366	1.00E+00	0.10	8.33E+01	1.04E-02	4.00E+02	7.29E+86	8.26E-04	8.26E-04	NA	1.0E+00
Hexane	366	1.00E+00	0.10	8.33E+01	2.78E-02	4.00E+02	3.75E+32	9.20E-04	9.20E-04	NA	2.0E-01
Hexane	366	1.00E+00	0.10	8.33E+01	2.78E-02	4.00E+02	3.75E+32	9.20E-04	9.20E-04	NA	2.0E-01
Isobutanol	366	1.00E+00	0.10	8.33E+01	1.20E-02	4.00E+02	2.60E+75	8.44E-04	8.44E-04	NA	1.1E+00
MTBE	366	1.00E+00	0.10	8.33E+01	1.42E-02	4.00E+02	4.14E+63	8.64E-04	8.64E-04	NA	3.0E+00
Methylene chloride	366	1.00E+00	0.10	8.33E+01	1.40E-02	4.00E+02	3.17E+64	8.62E-04	8.62E-04	4.7E-07	3.0E+00
p-Xylene	366	1.00E+00	0.10	8.33E+01	1.07E-02	4.00E+02	5.21E+84	8.29E-04	8.29E-04	NA	1.0E-01
Naphthalene	366	1.00E+00	0.10	8.33E+01	8.20E-03	4.00E+02	2.54E+110	7.90E-04	7.90E-04	NA	3.0E-03
o-Xylene	366	1.00E+00	0.10	8.33E+01	1.21E-02	4.00E+02	7.61E+74	8.45E-04	8.45E-04	NA	1.0E-01
Hexane	366	1.00E+00	0.10	8.33E+01	2.78E-02	4.00E+02	3.75E+32	9.20E-04	9.20E-04	NA	2.0E-01
Styrene	366	1.00E+00	0.10	8.33E+01	9.86E-03	4.00E+02	5.69E+91	8.18E-04	8.18E-04	NA	1.0E+00
Tetrachloroethylene	366	1.00E+00	0.10	8.33E+01	1.00E-02	4.00E+02	3.04E+90	8.20E-04	8.20E-04	5.9E-06	6.0E-01
Toluene	366	1.00E+00	0.10	8.33E+01	1.21E-02	4.00E+02	7.61E+74	8.45E-04	8.45E-04	NA	4.0E-01
trans-1,2-Dichloroethylene	366	1.00E+00	0.10	8.33E+01	9.82E-03	4.00E+02	1.40E+92	8.18E-04	8.18E-04	NA	7.0E-02
Trichloroethylene	366	1.00E+00	0.10	8.33E+01	1.10E-02	4.00E+02	2.91E+82	8.33E-04	8.33E-04	1.1E-04	4.0E-02
Trichlorofluoromethane	366	1.00E+00	0.10	8.33E+01	1.21E-02	4.00E+02	7.62E+74	8.45E-04	8.45E-04	NA	7.0E-01
Vinyl chloride (chloroethene)	366	1.00E+00	0.10	8.33E+01	1.47E-02	4.00E+02	2.88E+61	8.68E-04	8.68E-04	8.8E-06	1.0E-01

APPENDIX H

HHRA Calculations

Appendix H, Table H-1
Intake and Risk Equations - Single Age
Soil -
CONSTRUCTION - CONSTRUCTION WORKER (ADULT)

Human Health Risk Assessment
D.C. United Soccer Stadium
Washington, D.C.

Exposure Routes Evaluated		ELCR (Total)
Incidental Ingestion	Yes	2E-06
Dermal Contact	Yes	8E-07
Particulate Inhalation	Yes	5E-07
Ambient Vapor Inhalation	Yes	8E-09
		3E-06

NC - not carcinogenic by this exposure route
NTV - no toxicity value available
NV - not volatile
DAD - dermally absorbed dose
EC - exposure concentration
ABS - absorption factor
CSF - cancer slope factor
UR - cancer unit risk
ELCR - excess lifetime cancer risk
EPC - exposure point concentration
COPC - chemical of potential concern

			Intake Calculations				Absorption Factors		Cancer Toxicity Values							
COPC	**CASRN**	**EPC (mg/kg)**	**$Intake_{ingestion}$ (mg/kg/day)**	**DAD_{dermal} (mg/kg/day)**	**$EC_{particulate}$ (ug/m^3)**	**EC_{vapor} (ug/m^3)**	**ABS_{ing} (unitless)**	**ABS_{d} (unitless)**	**CSF_{oral} $(mg/kg/day)^{-1}$**	**CSF_{dermal} $(mg/kg/day)^{-1}$**	**IUR $(ug/m^3)^{-1}$**	**$ELCR_{ingestion}$**	**$ELCR_{dermal}$**	**$ELCR_{particulate}$**	**$ELCR_{vapor}$**	**$ELCR_{total}$**
Trichloroethylene	79-01-6	3.1E-03	1.3E-10		1.0E-08	1.2E-05	1		4.6E-02	4.6E-02	4.1E-06	5.8E-12		4.1E-14	4.9E-11	5.5E-11
Vinyl Chloride	75-01-4	6.4E-03	2.6E-10		2.1E-08	5.8E-05	1		7.2E-01	7.2E-01	4.4E-06	1.9E-10		9.2E-14	2.5E-10	4.4E-10
1,1,1,2-Tetrachloroethane	630-20-6	6.8E-03	2.7E-10		2.2E-08	1.0E-05	1		2.6E-02	2.6E-02	7.4E-06	7.1E-12		1.6E-13	7.6E-11	8.3E-11
1,1,2,2-Tetrachloroethane	79-34-5															
1,2,4-Trichlorobenzene	120-82-1	3.9E-03	1.6E-10	5.0E-11	NC	NC	1	0.1	2.9E-02	2.9E-02		4.6E-12	1.5E-12			6.0E-12
1,2,4-Trimethylbenzene	95-63-6	2.0E+00	NC	NC	NC	NC	NC	NC								
1,2-Dichlorobenzene	95-50-1	6.0E-04	NC	NC	NC	NC	NC	NC								
1,3,5-Trimethylbenzene	108-67-8	8.5E-01	NC	NC	NC	NC	NC	NC								
1,4-Dichlorobenzene	106-46-7	6.1E-04	2.5E-11	7.9E-12	2.0E-09	4.8E-07	1	0.1	5.4E-03	5.4E-03	1.1E-05	1.3E-13	4.3E-14	2.2E-14	5.3E-12	5.5E-12
Methyl Ethyl Ketone (2-Butanone)	78-93-3	1.6E-01	NC	NC	NC	NC	NC	NC								
2-Hexanone	591-78-6	1.5E-03	NC	NC	NC	NC	NC	NC								
Butylbenzene, sec-	135-98-8															
Methyl Isobutyl Ketone (4-methyl-2-pentanone)	108-10-1	4.2E-02	NC	NC	NC	NC	NC	NC								
Acetone	67-64-1	5.3E-01	NC	NC	NC	NC	NC	NC								
Benzene	71-43-2	6.8E-03	2.7E-10		2.2E-08	1.6E-05	1		5.5E-02	5.5E-02	7.8E-06	1.5E-11		1.7E-13	1.3E-10	1.4E-10
Bromomethane	74-83-9	2.6E-02	NC	NC	NC	NC	1									
Carbon Disulfide	75-15-0															
Chloroform	67-66-3															
Chloromethane (Methyl Chloride)	74-87-3	8.5E-04	3.4E-11		2.8E-09	6.6E-06	1		1.3E-02	1.3E-02	1.8E-06	4.5E-13		5.0E-15	1.2E-11	1.2E-11
cis-1,2-Dichloroethylene	156-59-2	2.7E-02	NC	NC	NC	NC	NC	NC								
Cyclohexane	110-82-7															
Cymene (p-Isopropyltoluene) (surrogate = Cumene)	99-87-6	2.7E-01	NC	NC	NC	NC	NC	NC								
Ethylbenzene	100-41-4	1.0E+00	NC	NC	3.3E-06	1.5E-03	NC	NC			2.5E-06			8.2E-12	3.6E-09	3.6E-09
Isopropylbenzene	98-82-8	7.1E-01	NC	NC	NC	NC	NC	NC								
Isopropyltoluene (surrogate = Cymene)	25155-15-1															
Methyl cyclohexane	108-87-2	2.2E+00	NC	NC	NC	NC	NC	NC								
Methyl tert-Butyl Ether (MTBE)	1634-04-4	1.3E-02	5.2E-10		4.2E-08	2.6E-05	1		1.8E-03	1.8E-03	2.6E-07	9.4E-13		1.1E-14	6.7E-12	7.7E-12
Methylene Chloride	75-09-2	1.5E-02	6.0E-10		4.8E-08	6.2E-05	1		2.0E-03	2.0E-03	1.0E-08	1.2E-12		4.8E-16	6.2E-13	1.8E-12
Butylbenzene, n-	104-51-8	1.7E-01	NC	NC	NC	NC	NC	NC								
Propylbenzene	103-65-1															
Styrene	100-42-5	3.1E-02	NC	NC	NC	NC	NC	NC								
Butylbenzene, tert-	98-06-6															
Tetrachloroethylene	127-18-4	4.5E-01	1.8E-08		1.5E-06	1.6E-03	1		2.1E-03	2.1E-03	2.6E-07	3.8E-11		3.8E-13	4.2E-10	4.5E-10
Toluene	108-88-3	1.4E-01	NC	NC	NC	NC	NC	NC								
trans-1,2-Dichloroethylene	156-60-5	7.9E-04	NC	NC	NC	NC	NC	NC								
Trichlorofluoromethane (CFC-11)	75-69-4	5.1E-02	NC	NC	NC	NC	NC	NC								
Trifluorotrichloroethane (Freon 113)	76-13-1	1.2E-03	NC	NC	NC	NC	NC	NC								
Xylenes	1330-20-7	7.4E-03	NC	NC	NC	NC	NC	NC								
2-Methylnaphthalene	91-57-6	3.1E+01	NC	NC	NC	NC	NC	NC								
Acenaphthene	83-32-9	2.4E+01	NC	NC	NC	NC	NC	NC								
Acenaphthylene	208-96-8	1.7E+01	NC	NC	NC	NV	NC	NC							NV	

Appendix H, Table H-1
Intake and Risk Equations - Single Age
Soil -
CONSTRUCTION - CONSTRUCTION WORKER (ADULT)

Human Health Risk Assessment
D.C. United Soccer Stadium
Washington, D.C.

Exposure Routes Evaluated		ELCR (Total)
Incidental Ingestion	Yes	2E-06
Dermal Contact	Yes	8E-07
Particulate Inhalation	Yes	5E-07
Ambient Vapor Inhalation	Yes	8E-09
		3E-06

NC - not carcinogenic by this exposure route
NTV - no toxicity value available
NV - not volatile
DAD - dermally absorbed dose
EC - exposure concentration
ABS - absorption factor
CSF - cancer slope factor
UR - cancer unit risk
ELCR - excess lifetime cancer risk
EPC - exposure point concentration
COPC - chemical of potential concern

			Intake Calculations				Absorption Factors		Cancer Toxicity Values							
COPC	**CASRN**	**EPC (mg/kg)**	**$Intake_{ingestion}$ (mg/kg/day)**	**DAD_{dermal} (mg/kg/day)**	**$EC_{particulate}$ (ug/m^3)**	**EC_{vapor} (ug/m^3)**	**ABS_{ing} (unitless)**	**ABS_d (unitless)**	**CSF_{oral} $(mg/kg/day)^{-1}$**	**CSF_{dermal} $(mg/kg/day)^{-1}$**	**IUR $(ug/m^3)^{-1}$**	**$ELCR_{ingestion}$**	**$ELCR_{dermal}$**	**$ELCR_{particulate}$**	**$ELCR_{vapor}$**	**$ELCR_{total}$**
Anthracene	120-12-7	5.2E+01	NC	NC	NC	NC	1	0.13								
Benz[a]anthracene	56-55-3	3.4E+00	1.4E-07	5.6E-08	1.1E-05	NV	1	0.13	7.3E-01	7.3E-01	1.1E-04	9.9E-08	4.1E-08	1.2E-09	NV	1.4E-07
Benzo[a]pyrene	50-32-8	2.8E+00	1.1E-07	4.8E-08	9.2E-06	NV	1	0.13	7.3E+00	7.3E+00	1.1E-03	8.3E-07	3.5E-07	1.0E-08	NV	1.2E-06
Benzo[b]fluoranthene	205-99-2	3.5E+00	1.4E-07	5.9E-08	1.2E-05	NV	1	0.13	7.3E-01	7.3E-01	1.1E-04	1.0E-07	4.3E-08	1.3E-09	NV	1.5E-07
Benzo(g,h,i)perylene	191-24-2	4.1E+01	NC	NC	NC	NV	NC	NC							NV	
Benzo[k]fluoranthene	207-08-9	2.3E+01	9.3E-07	3.9E-07	7.5E-05	NV	1	0.13	7.3E-02	7.3E-02	1.1E-04	6.8E-08	2.8E-08	8.3E-09	NV	1.0E-07
Chrysene	218-01-9	3.3E+00	1.3E-07	5.6E-08	1.1E-05	NV	1	0.13	7.3E-03	3.4E+00	1.1E-05	9.8E-10	1.9E-07	1.2E-10	NV	1.9E-07
Dibenz[a,h]anthracene	53-70-3	4.8E-01	1.9E-08	8.1E-09	1.6E-06	NV	1	0.13	7.3E+00	7.3E+00	1.2E-03	1.4E-07	5.9E-08	1.9E-09	NV	2.0E-07
Fluoranthene	206-44-0	1.8E+02	NC	NC	NC	NV	NC	NC							NV	
Fluorene	86-73-7	2.3E+01	NC	NC	NC	NC	NC	NC								
Indeno[1,2,3-cd]pyrene	193-39-5	1.8E+00	7.2E-08	3.0E-08	5.8E-06	NV	1	0.13	7.3E-01	7.3E-01	1.1E-04	5.3E-08	2.2E-08	6.4E-10	NV	7.5E-08
Naphthalene	91-20-3	5.8E-01	NC	NC	1.9E-06	1.0E-04	NC	NC			3.4E-05			6.5E-11	3.5E-09	3.6E-09
Phenanthrene	85-01-8	1.7E+02	NC	NC	NC	NV	NC	NC							NV	
Pyrene	129-00-0	1.7E+02	NC	NC	NC	NC	NC	NC								
Polychlorinated Biphenyls	1336-36-3	7.0E-01	2.8E-08	1.3E-08	2.3E-06	NV	1	0.14	2.0E+00	2.0E+00	5.7E-04	5.6E-08	2.5E-08	1.3E-09	NV	8.3E-08
Aluminum	7429-90-5															
Antimony	7440-36-0	8.9E+00	NC	NC	NC	NV	NC	NC							NV	
Arsenic	7440-38-2	9.4E+00	2.3E-07	3.6E-08	3.1E-05	NV	0.6	0.03	1.5E+00	1.5E+00	4.3E-03	3.4E-07	5.5E-08	1.3E-07	NV	5.3E-07
Barium	7440-39-3	1.6E+02	NC	NC	NC	NV	NC	NC							NV	
Beryllium	7440-41-7	4.8E-01	NC	NC	1.6E-06	NV	NC	NC			2.4E-03			3.8E-09	NV	3.8E-09
Cadmium	7440-43-9	2.9E+00	NC	NC	9.5E-06	NV	NC	NC			1.8E-03			1.7E-08	NV	1.7E-08
Calcium	7440-70-2	7.5E+04	NC	NC	NC	NV	NC	NC							NV	
Chromium, Total	7440-47-3	4.0E+02	NC	NC	NC	NV	NC	NC							NV	
Cobalt	7440-48-4	1.0E+01	NC	NC	3.3E-05	NV	NC	NC			9.0E-03			3.0E-07	NV	3.0E-07
Copper	7440-50-8	3.6E+02	NC	NC	NC	NV	NC	NC							NV	
Iron	7439-89-6	3.1E+04	NC	NC	NC	NV	NC	NC							NV	
Lead	7439-92-1	6.1E+02	NC	NC	NC	NV	1								NV	
Magnesium	7439-95-4	2.0E+04	NC	NC	NC	NV	NC	NC							NV	
Manganese	7439-96-5	3.6E+02	NC	NC	NC	NV	NC	NC							NV	
Mercury	7439-97-6	1.5E+00	NC	NC	NC	NV	NC	NC							NV	
Nickel	7440-02-0	4.1E+01	NC	NC	1.3E-04	NV	NC	NC			2.4E-04			3.2E-08	NV	3.2E-08
Potassium	7440-09-7	5.1E+03	NC	NC	NC	NV	NC	NC							NV	
Selenium	7782-49-2	6.2E+00	NC	NC	NC	NV	NC	NC							NV	
Silver	7440-22-4	3.9E+00	NC	NC	NC	NV	NC	NC							NV	
Sodium	7440-23-5	1.4E+04	NC	NC	NC	NV	NC	NC							NV	
Thallium	7440-28-0	1.2E+00	NC	NC	NC	NV	NC	NC							NV	
Vanadium	7440-62-2	3.5E+01	NC	NC	NC	NV	NC	NC							NV	
Zinc	7440-66-6	7.2E+02	NC	NC	NC	NV	NC	NC							NV	

Appendix H, Table H-2
Non-Cancer Risk Calculations
Soil -
CONSTRUCTION - CONSTRUCTION WORKER (ADULT)

Human Health Risk Assessment
D.C. United Soccer Stadium
Washington, D.C.

Exposure Routes Evaluated		HI (Total)
Incidental Ingestion	Yes	6E-01
Dermal Contact	Yes	8E-02
Particulate Inhalation	Yes	2E+00
Ambient Vapor Inhalation	Yes	3E-02
		3

NV - not volatile
NTV - no toxicity value available
EC - exposure concentration
DAD - dermally absorbed dose
RfD - reference dose
ABS - absorption factor
HI - hazard index
RfC - reference concentration
EPC - exposure point concentration (if blank, then COPC was not detected)
COPC - chemical of potential concern

COPC	CASRN	EPC	Intake Calculations				Absorption Factors		Non-Cancer Toxicity Values			HQ				
			$Intake_{ingestion}$	DAD_{dermal}	$EC_{particulate}$	EC_{vapor}	ABS_{ing}	ABS_{d}	RfD_{oral}	RfD_{dermal}	RfC	$HQ_{ingestion}$	HQ_{dermal}	$HQ_{particulate}$	HQ_{vapor}	HQ_{total}
		(mg/kg)	(mg/kg/day)	(mg/kg/day)	(mg/m^3)	(mg/m^3)	(unitless)	(unitless)	(mg/kg/day)	(mg/kg/day)	(mg/m^3)					
Trichloroethylene	79-01-6	3.1E-03	8.8E-09		7.1E-10	8.4E-07	1		5.0E-04	5.0E-04	2.0E-03	1.8E-05		3.5E-07	4.2E-04	4.4E-04
Vinyl Chloride	75-01-4	6.4E-03	1.8E-08		1.5E-09	4.1E-06	1		3.0E-03	3.0E-03	1.0E-01	6.0E-06		1.5E-08	4.1E-05	4.7E-05
1,1,1,2-Tetrachloroethane	630-20-6	6.8E-03	1.9E-08		1.6E-09	7.1E-07	1		3.0E-02	3.0E-02		6.4E-07		NTV	NTV	6.4E-07
1,1,2,2-Tetrachloroethane	79-34-5															
1,2,4-Trichlorobenzene	120-82-1	3.9E-03	1.1E-08	3.5E-09	8.9E-10	7.5E-08	1	0.1	1.0E-02	1.0E-02	2.0E-03	1.1E-06	3.5E-07	4.5E-07	3.7E-05	3.9E-05
1,2,4-Trimethylbenzene	95-63-6	2.0E+00	5.6E-06		4.5E-07	1.4E-04	1				7.0E-03	NTV	NTV	6.5E-05	2.1E-02	2.1E-02
1,2-Dichlorobenzene	95-50-1	6.0E-04	1.7E-09	5.4E-10	1.4E-10	3.0E-08	1	0.1	9.0E-02	9.0E-02	2.0E-01	1.9E-08	6.0E-09	6.8E-10	1.5E-07	1.7E-07
1,3,5-Trimethylbenzene	108-67-8	8.5E-01	2.4E-06		1.9E-07	7.4E-05	1					NTV	NTV	NTV	NTV	
1,4-Dichlorobenzene	106-46-7	6.1E-04	1.7E-09	5.5E-10	1.4E-10	3.4E-08	1	0.1	7.0E-02	7.0E-02	8.0E-01	2.5E-08	7.9E-09	1.7E-10	4.2E-08	7.5E-08
Methyl Ethyl Ketone (2-Butanon	78-93-3	1.6E-01	4.5E-07		3.7E-08	9.8E-06	1		6.0E-01	6.0E-01	5.0E+00	7.5E-07		7.3E-09	2.0E-06	2.7E-06
2-Hexanone	591-78-6	1.5E-03	4.2E-09		3.4E-10	7.6E-08	1		5.0E-03	5.0E-03	3.0E-02	8.5E-07		1.1E-08	2.5E-06	3.4E-06
Butylbenzene, sec-	135-98-8															
Methyl Isobutyl Ketone (4-meth	108-10-1	4.2E-02	1.2E-07		9.6E-09	2.7E-06	1		8.0E-02	8.0E-02	3.0E+00	1.5E-06		3.2E-09	9.0E-07	2.4E-06
Acetone	67-64-1	5.3E-01	1.5E-06		1.2E-07	3.0E-05	1		9.0E-01	9.0E-01	3.1E+01	1.7E-06		3.9E-09	9.7E-07	2.6E-06
Benzene	71-43-2	6.8E-03	1.9E-08		1.6E-09	1.1E-06	1		4.0E-03	4.0E-03	3.0E-02	4.8E-06		5.2E-08	3.8E-05	4.2E-05
Bromomethane	74-83-9	2.6E-02	7.3E-08		5.9E-09	1.2E-05	1		1.4E-03	1.4E-03	5.0E-03	5.2E-05		1.2E-06	2.4E-03	2.5E-03
Carbon Disulfide	75-15-0															
Chloroform	67-66-3															
Chloromethane (Methyl Chloride	74-87-3	8.5E-04	2.4E-09		1.9E-10	4.6E-07	1				9.0E-02	NTV	NTV	2.2E-09	5.2E-06	5.2E-06
cis-1,2-Dichloroethylene	156-59-2	2.7E-02	7.6E-08		6.2E-09	6.7E-06	1		2.0E-03	2.0E-03		3.8E-05		NTV	NTV	3.8E-05
Cyclohexane	110-82-7															
Cymene (p-Isopropyltoluene) (s	99-87-6	2.7E-01	7.6E-07		6.2E-08	1.8E-05	1		1.0E-01	1.0E-01	4.0E-01	7.6E-06		1.5E-07	4.5E-05	5.3E-05
Ethylbenzene	100-41-4	1.0E+00	2.8E-06		2.3E-07	1.0E-04	1		1.0E-01	1.0E-01	1.0E+00	2.8E-05		2.3E-07	1.0E-04	1.3E-04
Isopropylbenzene	98-82-8	7.1E-01	2.0E-06		1.6E-07	6.6E-05	1		1.0E-01	1.0E-01	4.0E-01	2.0E-05		4.1E-07	1.6E-04	1.8E-04
Isopropyltoluene (surrogate = C	25155-15-1															
Methyl cyclohexane	108-87-2	2.2E+00	6.2E-06		5.0E-07	1.2E-03	1				3.0E+00	NTV	NTV	1.7E-07	4.0E-04	4.0E-04
Methyl tert-Butyl Ether (MTBE)	1634-04-4	1.3E-02	3.7E-08		3.0E-09	1.8E-06	1				3.0E+00	NTV	NTV	9.9E-10	6.1E-07	6.1E-07
Methylene Chloride	75-09-2	1.5E-02	4.2E-08		3.4E-09	4.3E-06	1		6.0E-03	6.0E-03	6.0E-01	7.0E-06		5.6E-09	7.2E-06	1.4E-05
Butylbenzene, n-	104-51-8	1.7E-01	4.8E-07		3.9E-08	1.2E-05	1		5.0E-02	5.0E-02		9.5E-06		NTV	NTV	9.5E-06
Propylbenzene	103-65-1															
Styrene	100-42-5	3.1E-02	8.8E-08		7.1E-09	1.9E-06	1		2.0E-01	2.0E-01	1.0E+00	4.4E-07		7.1E-09	1.9E-06	2.4E-06
Butylbenzene, tert-	98-06-6															
Tetrachloroethylene	127-18-4	4.5E-01	1.3E-06		1.0E-07	1.1E-04	1		6.0E-03	6.0E-03	4.0E-02	2.1E-04		2.5E-06	2.8E-03	3.0E-03
Toluene	108-88-3	1.4E-01	4.0E-07		3.2E-08	1.9E-05	1		8.0E-02	8.0E-02	5.0E+00	4.9E-06		6.4E-09	3.8E-06	8.7E-06
trans-1,2-Dichloroethylene	156-60-5	7.9E-04	2.2E-09		1.8E-10	1.9E-07	1		2.0E-02	2.0E-02		1.1E-07		NTV	NTV	1.1E-07
Trichlorofluoromethane (CFC-1	75-69-4	5.1E-02	1.4E-07		1.2E-08	2.9E-05	1		3.0E-01	3.0E-01	7.0E-01	4.8E-07		1.7E-08	4.1E-05	4.1E-05
Trifluorotrichloroethane (Freon 1	76-13-1	1.2E-03	3.4E-09	1.1E-08	2.7E-10	7.7E-07	1	1	3.0E+01	3.0E+01	3.0E+01	1.1E-10	3.6E-10	9.1E-12	2.6E-08	2.6E-08
Xylenes	1330-20-7	7.4E-03	2.1E-08		1.7E-09	7.3E-07	1		2.0E-01	2.0E-01	1.0E-01	1.0E-07		1.7E-08	7.3E-06	7.4E-06
2-Methylnaphthalene	91-57-6	3.1E+01	8.8E-05	3.7E-05	7.1E-06	3.1E-04	1	0.13	4.0E-03	4.0E-03		2.2E-02	9.1E-03	NTV	NTV	3.1E-02
Acenaphthene	83-32-9	2.4E+01	6.8E-05	2.8E-05	5.5E-06	9.7E-05	1	0.13	6.0E-02	6.0E-02		1.1E-03	4.7E-04	NTV	NTV	1.6E-03

Appendix H, Table H-2
Non-Cancer Risk Calculations
Soil -
CONSTRUCTION - CONSTRUCTION WORKER (ADULT)

Human Health Risk Assessment
D.C. United Soccer Stadium
Washington, D.C.

Exposure Routes Evaluated		HI (Total)
Incidental Ingestion	Yes	6E-01
Dermal Contact	Yes	8E-02
Particulate Inhalation	Yes	2E+00
Ambient Vapor Inhalation	Yes	3E-02
		3

NV - not volatile
NTV - no toxicity value available
EC - exposure concentration
DAD - dermally absorbed dose
RfD - reference dose
ABS - absorption factor
HI - hazard index
RfC - reference concentration
EPC - exposure point concentration (if blank, then COPC was not detected)
COPC - chemical of potential concern

			Intake Calculations				Absorption Factors		Non-Cancer Toxicity Values							
COPC	**CASRN**	**EPC (mg/kg)**	**$Intake_{ingestion}$ (mg/kg/day)**	**DAD_{dermal} (mg/kg/day)**	**$EC_{particulate}$ (mg/m^3)**	**EC_{vapor} (mg/m^3)**	**ABS_{ing} (unitless)**	**ABS_{d} (unitless)**	**RfD_{oral} (mg/kg/day)**	**RfD_{dermal} (mg/kg/day)**	**RfC (mg/m^3)**	**$HQ_{ingestion}$**	**HQ_{dermal}**	**$HQ_{particulate}$**	**HQ_{vapor}**	**HQ_{total}**
Acenaphthylene	208-96-8	1.7E+01	4.8E-05	2.0E-05	3.9E-06	NV	1	0.13	6.0E-02	6.0E-02		8.0E-04	3.3E-04	NTV	NV	1.1E-03
Anthracene	120-12-7	5.2E+01	1.5E-04	6.1E-05	1.2E-05	5.7E-05	1	0.13	3.0E-01	3.0E-01		4.9E-04	2.0E-04	NTV	NTV	6.9E-04
Benz[a]anthracene	56-55-3	3.4E+00	9.5E-06	3.9E-06	7.6E-07	NV	1	0.13				NTV	NTV	NTV	NV	
Benzo[a]pyrene	50-32-8	2.8E+00	8.0E-06	3.3E-06	6.5E-07	NV	1	0.13				NTV	NTV	NTV	NV	
Benzo[b]fluoranthene	205-99-2	3.5E+00	1.0E-05	4.2E-06	8.1E-07	NV	1	0.13				NTV	NTV	NTV	NV	
Benzo(g,h,i)perylene	191-24-2	4.1E+01	1.2E-04	4.8E-05	9.4E-06	NV	1	0.13	3.0E-02	3.0E-02		3.9E-03	1.6E-03	NTV	NV	5.5E-03
Benzo[k]fluoranthene	207-08-9	2.3E+01	6.5E-05	2.7E-05	5.3E-06	NV	1	0.13				NTV	NTV	NTV	NV	
Chrysene	218-01-9	3.3E+00	9.4E-06		7.6E-07	NV	1					NTV	NTV	NTV	NV	
Dibenz[a,h]anthracene	53-70-3	4.8E-01	1.4E-06	5.7E-07	1.1E-07	NV	1	0.13				NTV	NTV	NTV	NV	
Fluoranthene	206-44-0	1.8E+02	5.1E-04	2.1E-04	4.1E-05	NV	1	0.13	4.0E-02	4.0E-02		1.3E-02	5.3E-03	NTV	NV	1.8E-02
Fluorene	86-73-7	2.3E+01	6.5E-05	2.7E-05	5.3E-06	4.7E-05	1	0.13	4.0E-02	4.0E-02		1.6E-03	6.8E-04	NTV	NTV	2.3E-03
Indeno[1,2,3-cd]pyrene	193-39-5	1.8E+00	5.1E-06	2.1E-06	4.1E-07	NV	1	0.13				NTV	NTV	NTV	NV	
Naphthalene	91-20-3	5.8E-01	1.6E-06	6.9E-07	1.3E-07	7.2E-06	1	0.13	2.0E-02	2.0E-02	3.0E-03	8.2E-05	3.4E-05	4.4E-05	2.4E-03	2.6E-03
Phenanthrene	85-01-8	1.7E+02	4.8E-04	2.0E-04	3.9E-05	NV	1	0.13	3.0E-02	3.0E-02		1.6E-02	6.7E-03	NTV	NV	2.3E-02
Pyrene	129-00-0	1.7E+02	4.8E-04	2.0E-04	3.9E-05	4.0E-05	1	0.13	3.0E-02	3.0E-02		1.6E-02	6.7E-03	NTV	NTV	2.3E-02
Polychlorinated Biphenyls	1336-36-3	7.0E-01	2.0E-06	8.8E-07	1.6E-07	NV	1	0.14	2.0E-05	2.0E-05		9.8E-02	4.4E-02	NTV	NV	1.4E-01
Aluminum	7429-90-5															
Antimony	7440-36-0	8.9E+00	2.5E-05		2.0E-06	NV	1		4.0E-04	6.0E-05		6.3E-02		NTV	NV	6.3E-02
Arsenic	7440-38-2	9.4E+00	1.6E-05	2.6E-06	2.1E-06	NV	0.6	0.03	3.0E-04	3.0E-04	1.5E-05	5.3E-02	8.5E-03	1.4E-01	NV	2.0E-01
Barium	7440-39-3	1.6E+02	4.4E-04		3.6E-05	NV	1		2.0E-01	1.4E-02	5.0E-04	2.2E-03		7.1E-02	NV	7.3E-02
Beryllium	7440-41-7	4.8E-01	1.4E-06		1.1E-07	NV	1		2.0E-03	1.4E-05	2.0E-05	6.8E-04		5.5E-03	NV	6.2E-03
Cadmium	7440-43-9	2.9E+00	8.2E-06	2.6E-08	6.6E-07	NV	1	0.001	1.0E-03	2.5E-05	2.0E-05	8.2E-03	1.1E-03	3.3E-02	NV	4.2E-02
Calcium	7440-70-2	7.5E+04	2.1E-01		1.7E-02	NV	1					NTV	NTV	NTV	NV	
Chromium, Total	7440-47-3	4.0E+02	1.1E-03		9.1E-05	NV	1		1.5E+00	2.0E-02		7.5E-04		NTV	NV	7.5E-04
Cobalt	7440-48-4	1.0E+01	2.9E-05		2.3E-06	NV	1		3.0E-04	3.0E-04	6.0E-06	9.6E-02		3.9E-01	NV	4.8E-01
Copper	7440-50-8	3.6E+02	1.0E-03		8.3E-05	NV	1		4.0E-02	4.0E-02		2.6E-02		NTV	NV	2.6E-02
Iron	7439-89-6	3.1E+04	8.8E-02		7.1E-03	NV	1		7.0E-01	7.0E-01		1.3E-01		NTV	NV	1.3E-01
Lead	7439-92-1	6.1E+02	1.7E-03		1.4E-04	NV	1					NTV	NTV	NTV	NV	
Magnesium	7439-95-4	2.0E+04	5.7E-02		4.6E-03	NV	1					NTV	NTV	NTV	NV	
Manganese	7439-96-5	3.6E+02	1.0E-03		8.2E-05	NV	1		1.4E-01	5.6E-03	5.0E-05	7.3E-03		1.6E+00	NV	1.7E+00
Mercury	7439-97-6	1.5E+00	4.2E-06		3.4E-07	NV	1		3.0E-04	2.1E-05	3.0E-04	1.4E-02		1.1E-03	NV	1.5E-02
Nickel	7440-02-0	4.1E+01	1.2E-04		9.4E-06	NV	1		2.0E-02	8.0E-04	9.0E-05	5.8E-03		1.0E-01	NV	1.1E-01
Potassium	7440-09-7	5.1E+03	1.4E-02		1.2E-03	NV	1					NTV	NTV	NTV	NV	
Selenium	7782-49-2	6.2E+00	1.8E-05		1.4E-06	NV	1		5.0E-03	5.0E-03	2.0E-02	3.5E-03		7.1E-05	NV	3.6E-03
Silver	7440-22-4	3.9E+00	1.1E-05		8.9E-07	NV	1		5.0E-03	2.0E-04		2.2E-03		NTV	NV	2.2E-03
Sodium	7440-23-5	1.4E+04	4.0E-02		3.2E-03	NV	1					NTV	NTV	NTV	NV	
Thallium	7440-28-0	1.2E+00	3.4E-06		2.7E-07	NV	1					NTV	NTV	NTV	NV	
Vanadium	7440-62-2	3.5E+01	9.9E-05		8.0E-06	NV	1		5.0E-03	1.3E-04	1.0E-04	2.0E-02		8.0E-02	NV	1.0E-01
Zinc	7440-66-6	7.2E+02	2.0E-03		1.6E-04	NV	1		3.0E-01	3.0E-01		6.8E-03		NTV	NV	6.8E-03

Appendix H, Table H-3
Intake and Risk Equations - Single Age

Human Health Risk Assessment
D.C. United Soccer Stadium
Washington, D.C.

Cancer Risk from Ingestion

$$ELCR = Intake_{ing} * CSF$$

$$Intake_{ing\ (age\ group\ x)} = \frac{[EPC]_{soil} * IR * ABS_{ing} * FI * EF * ED * C1}{BW_x * AT_{lifetime}}$$

Cancer Risk from Dermal Absorption

$$ELCR = DAD * CSF$$

$$DAD_{derm(age\ group\ x)} = \frac{DA_{Event} * SA * EV * EF * ED}{BW_x * AT_{lifetime}}$$

$$DA_{Event} = [EPC]_{soil} * ABS_d * AF * C1$$

Cancer Risk from Inhalation

$$ELCR_{inh} = EC_{can} * IUR$$

$$EC_{can\ (age\ group\ x)} = \frac{[EPC]_{PART} * ET_{Part} * EF * ED \text{ --- OR--- } [EPC]_{VAPOR} * ET_{Vap} * EF * ED}{24 * AT_{lifetime}}$$

Noncancer Risk from Ingestion

$$HQ = \frac{Intake_{ing}}{RfD}$$

$$Intake_{ing} = \frac{[EPC]_{soil} * IR * ABS_{ing} * FI * EF * ED * C1}{BW * AT}$$

Noncancer Risk from Dermal Absorption

$$HQ = \frac{DAD}{RfD}$$

$$DAD_{derm} = \frac{DA_{Event} * SA * EV * EF * ED}{BW * AT}$$

$$DA_{Event} = [EPC]_{soil} * ABS_d * AF * C1$$

Noncancer Risk from Inhalation

$$HQ = \frac{EC_{nc}}{RfC}$$

$$EC_{nc} = \frac{[EPC]_{PART} * ET_{Part} * EF * ED * C2 \text{ --- OR--- } [EPC]_{VAPOR} * ET_{Vap} * EF * ED * C2}{24 * AT}$$

Parameter	Value - Cancer	Value - Non-Cancer	Units
CSF	Chemical specific	--	$(mg/kg\text{-}day)^{-1}$
IUR	Chemical specific	--	$(ug/m^3)^{-1}$
Intake	Age/chemical specific	--	mg/kg-day
EC_{can}	Age/chemical specific	--	(ug/m^3)
ELCR	Age/chemical specific	--	unitless
RfD	--	Chemical specific	mg/kg-day
RfC	--	Chemical specific	(mg/m^3)
DAD	Age/chemical specific	Age/chemical specific	mg/kg-day
DA_{Event}	Age/chemical specific	Age/chemical specific	mg/cm^2-event
EC_{nc}	--	Age/chemical specific	mg/m^3
HQ	--	Age/chemical specific	unitless
$[EPC]_{soil}$	Chemical specific	Chemical specific	mg/kg
$[EPC]_{PART}$	Appendix H, TABLE H-4	Appendix H, TABLE H-4	ug/m^3
$[EPC]_{VAPOR}$	Appendix H, TABLE	Appendix H, TABLE	ug/m^3
ABS_{ing}	Chemical specific	Chemical specific	unitless
ABS_d	Chemical specific	Chemical specific	unitless
BW	80	80	kg
EF	250	250	day/year
ED	1	1	year
AT	--	365	day
ATlifetime	25550	--	day
IR	330	330	mg/day
FI	1	1	unitless
C1	0.000001	0.000001	kg/mg
SA	3527	3527	cm2
AF	0.3	0.3	mg/cm2
EV	1	1	event/day
ETPart	8	8	hours/day
C2	0.001	0.001	mg/ug
ETVap	8	8	hours/day

Appendix H, Table H-4
Exposure Factors

Human Health Risk Assessment
D.C. United Soccer Stadium
Washington, D.C.

PLACE "X" IN THE APPROPRIATE YELLOW SHADED CELLS FOR THE APPROPRIATE RECEPTOR AND BASIS F

SCENARIO USED TO CALCULATE RISKS			**X**	**CONSTRUCTION**
BASIS FOR CANCER CALCULATIONS			**X**	
BASIS FOR NON-CANCER CALCULATIONS			**X**	
RECEPTOR			**CONSTRUCTION WORKER (ADULT)**	
Standard Parameters				
Body Weight	BW	kg	80	USEPA, 2014
Exposure Frequency	EF	day/year	250	USEPA, 2002
Exposure Duration	ED	year	1	USEPA, 2002
Non–carcinogenic Averaging Time	AT	day	365	Exposure duration expressed in days
Carcinogenic Averaging Time	$AT_{lifetime}$	day	25550	70 year lifetime
Incidental Ingestion of Soil				
Soil Ingestion Rate	IR	mg/day	330	USEPA, 2002
Fraction Ingested	FI	unitless	1.0	USEPA, 2002
Age-Adjusted Soil Ingestion Rate	IFSadj	mg-yr/kg-day	NA	
Dermal Exposure with Soil				
Exposed Skin Surface Area	SA	cm^2	3527	USEPA, 2014
Soil Adherence Factor	AF	mg/cm^2	0.30	USEPA, 2002
Fraction Dermal	EV	event/day	1.0	USEPA, 2002
Age-Adjusted Dermal Contact Factor	DFSadj	mg-yr/kg-day	NA	
Particulate Inhalation				
Exposure Time	ET_{Part}	hours/day	8	Assumption
Vapor Inhalation				
Exposure Time	ET_{Vap}	hours/day	8	Assumption

Appendix H, Table H-5
Particulate to Outdoor Air EPC Calculations
Soil -
CONSTRUCTION - CONSTRUCTION WORKER (ADULT)

Human Health Risk Assessment
D.C. United Soccer Stadium
Washington, D.C.

EQUATIONS:

$$EPC_{[PARTICULATE]} = EPC_{[SOIL]} \times PARTICULATE_{[AIR]} \times 1E\text{-}06\ [kg/mg]$$

where:

$$PARTICULATE_{[AIR]} = (1/PEF * 1E+09\ ug/kg) \text{ or Measured/Modelled}$$

and:

$$PEF\ (m^3/kg) = Q/C \times [(3600\ s/hr) / ((0.036 \times (1\text{-}V) \times (U_m/U_t)^3 \times F(x))]$$

PARAMETER/DEFINITION	UNITS	DEFAULT	Source
$PARTICULATE_{[Air]}$ / Particulate concentration in air	ug/m^3	1000	Calculated or measured
Measured or modeled $PARTICULATE_{[AIR]}$	ug/m^3		Measured value
PEF / Particulate emission factor	m^3/kg	1.00E+06	Guidance value
Q/C / inverse of the mean concentration at the center of a 0.5-acre-square source	g/m^2-s per kg/m^3	35.14	Calculated / USEPA, 2014 [a]
V / Fraction of vegetative cover	unitless	0	Site-specific, estimated
U_m / mean annual windspeed	m/s	2.82	Site-specific / USEPA, 2014
U_t / equivalent threshold value of wind speed at 7 m	m/s	11.32	USEPA, 2014
F(x) / function dependant on U_m/U_t derived using Cowherd et al. (1985)	unitless	2.25E-04	Calculated / USEPA, 2014

USEPA, 2014. Regional Screening Levels.
[a] Climactic zone: Phoenix Arizona
[a] Area of Source: Specific to size of Exposure Area

CASRN	COPC	EPC Soil (mg/kg)	EPC Particulate (ug/m^3)
79-01-6	Trichloroethylene	0.0031	3.1E-06
75-01-4	Vinyl Chloride	0.0064	6.4E-06
630-20-6	1,1,1,2-Tetrachloroethane	0.0068	6.8E-06
	1,1,2,2-Tetrachloroethane		
120-82-1	1,2,4-Trichlorobenzene	0.0039	3.9E-06
95-63-6	1,2,4-Trimethylbenzene	1.98	2.0E-03
95-50-1	1,2-Dichlorobenzene	0.0006	6.0E-07
108-67-8	1,3,5-Trimethylbenzene	0.847	8.5E-04
106-46-7	1,4-Dichlorobenzene	0.00061	6.1E-07
78-93-3	Methyl Ethyl Ketone (2-Butanone)	0.16	1.6E-04
591-78-6	2-Hexanone	0.0015	1.5E-06
	Butylbenzene, sec-		
108-10-1	Methyl Isobutyl Ketone (4-methyl-2-pentanone)	0.042	4.2E-05
67-64-1	Acetone	0.53	5.3E-04
71-43-2	Benzene	0.0068	6.8E-06
74-83-9	Bromomethane	0.026	2.6E-05
	Carbon Disulfide		
	Chloroform		
74-87-3	Chloromethane (Methyl Chloride)	0.00085	8.5E-07
156-59-2	cis-1,2-Dichloroethylene	0.027	2.7E-05
	Cyclohexane		
99-87-6	Cymene (p-Isopropyltoluene) (surrogate = Cumene	0.27	2.7E-04
100-41-4	Ethylbenzene	1	1.0E-03
98-82-8	Isopropylbenzene	0.71	7.1E-04
	Isopropyltoluene (surrogate = Cymene)		
108-87-2	Methyl cyclohexane	2.2	2.2E-03
1634-04-4	Methyl tert-Butyl Ether (MTBE)	0.013	1.3E-05
75-09-2	Methylene Chloride	0.0148	1.5E-05
104-51-8	Butylbenzene, n-	0.169	1.7E-04
	Propylbenzene		
100-42-5	Styrene	0.031	3.1E-05
	Butylbenzene, tert-		
127-18-4	Tetrachloroethylene	0.446	4.5E-04
108-88-3	Toluene	0.14	1.4E-04
156-60-5	trans-1,2-Dichloroethylene	0.00079	7.9E-07
75-69-4	Trichlorofluoromethane (CFC-11)	0.051	5.1E-05
76-13-1	Trifluorotrichloroethane (Freon 113)	0.0012	1.2E-06
1330-20-7	Xylenes	0.00738	7.4E-06
91-57-6	2-Methylnaphthalene	31	3.1E-02
83-32-9	Acenaphthene	24	2.4E-02
208-96-8	Acenaphthylene	17	1.7E-02
120-12-7	Anthracene	52	5.2E-02
56-55-3	Benz[a]anthracene	3.35	3.4E-03
50-32-8	Benzo[a]pyrene	2.83	2.8E-03
205-99-2	Benzo[b]fluoranthene	3.53	3.5E-03
191-24-2	Benzo(g,h,i)perylene	41	4.1E-02
207-08-9	Benzo[k]fluoranthene	23	2.3E-02
218-01-9	Chrysene	3.32	3.3E-03
53-70-3	Dibenz[a,h]anthracene	0.483	4.8E-04
206-44-0	Fluoranthene	180	1.8E-01
86-73-7	Fluorene	23	2.3E-02
193-39-5	Indeno[1,2,3-cd]pyrene	1.79	1.8E-03
91-20-3	Naphthalene	0.582	5.8E-04
85-01-8	Phenanthrene	170	1.7E-01
129-00-0	Pyrene	170	1.7E-01
1336-36-3	Polychlorinated Biphenyls	0.696	7.0E-04
	Aluminum		
7440-36-0	Antimony	8.9	8.9E-03
7440-38-2	Arsenic	9.4	9.4E-03
7440-39-3	Barium	156	1.6E-01
7440-41-7	Beryllium	0.48	4.8E-04
7440-43-9	Cadmium	2.9	2.9E-03
7440-70-2	Calcium	75000	7.5E+01
7440-47-3	Chromium, Total	400	4.0E-01
7440-48-4	Cobalt	10.2	1.0E-02
7440-50-8	Copper	363	3.6E-01
7439-89-6	Iron	31000	3.1E+01
7439-92-1	Lead	612	6.1E-01
7439-95-4	Magnesium	20000	2.0E+01
7439-96-5	Manganese	360	3.6E-01
7439-97-6	Mercury	1.5	1.5E-03
7440-02-0	Nickel	41	4.1E-02
7440-09-7	Potassium	5100	5.1E+00
7782-49-2	Selenium	6.2	6.2E-03
7440-22-4	Silver	3.9	3.9E-03
7440-23-5	Sodium	14000	1.4E+01
7440-28-0	Thallium	1.2	1.2E-03
7440-62-2	Vanadium	35	3.5E-02
7440-66-6	Zinc	720	7.2E-01

Appendix H, Table H-6
Vapor to Outdoor Air EPC Calculations
Soil -
CONSTRUCTION - CONSTRUCTION WORKER (ADULT)

Human Health Risk Assessment
D.C. United Soccer Stadium
Washington, D.C.

EQUATIONS:

$$EPC_{[VAPOR]} = EPC_{[SOIL]} \times 1/VF \times 1000\ ug/mg$$

where:

$$VF\ (m^3/kg) = Q/C \times (3.14 \times D_A \times T)^{1/2} \times 10^{-4}(m^2/cm^2) / (2 \times P_b \times D_A)$$

and:

$$DA = [(O_a^{10/3} D_i H' + O_w^{10/3} D_w)/n^2] / P_b K_d + O_w + O_a H'$$

PARAMETER/DEFINITION	UNITS	DEFAULT	Source
VF / volatilization factor	m^3/kg	Calculated	
D_A / apparent diffusivity	cm^2/s	Calculated	
Q/C / inverse of the mean concentration at the center of a 0.5-acre-square source	g/m^2-s per kg/m^3	35.14	USEPA, 2014 [a]
T / exposure interval	s	3.15E+07	CONSTRUCTION
Π_b / dry soil bulk density	g/cm^3	1.62	USEPA, 2014
O_a / air-filled soil porosity	L_{air}/L_{soil}	0.314	USEPA, 2014
n / total soil porosity	L_{pore}/L_{soil}	0.39	USEPA, 2014
O_w / water-filled soil porosity	L_{water}/L_{soil}	0.076	USEPA, 2014
Ψ_s / soil particle density	g/cm^3	2.65	USEPA, 1996
D_i / diffusivity in air	cm^2/s	chemical-specific	
H' / Henry's Law constant	dimensionless	chemical-specific	
D_w / diffusivity in water	cm^2/s	chemical-specific	
K_d / soil-water partition coefficient (Koc x foc) organics	cm^3/g	chemical-specific	
K_{oc} / soil organic carbon partition coefficient	cm^3/g	chemical-specific	
f_{oc} / fraction organic carbon in soil	g/g	0.006	Default

USEPA, 2014. Regional Screening Levels.

[a] Climactic zone: Phoenix Arizona [a] Area of Source: Specific to size of Exposure Area

CASRN	COPC	Volatile (Y/N)	D_i (cm^2/s)	H' (unitless)	D_w (cm^2/s)	K_d (cm^3/g)	K_{oc} (cm^3/g)	D_A (cm^2/s)	VF (m^3/kg)	EPC Soil (mg/kg)	EPC Vapor (ug/m^3)
79-01-6	Trichloroethylene	Y	6.87E-02	4.03E-01	1.02E-05	3.64E-01	6.07E+01	4.8E-03	840	0.0031	3.7E-03
75-01-4	Vinyl Chloride	Y	1.07E-01	1.14E+00	1.20E-05	1.30E-01	2.17E+01	2.6E-02	361	0.0064	1.8E-02
630-20-6	1,1,1,2-Tetrachloroethane	Y	4.82E-02	1.02E-01	9.10E-06	5.16E-01	8.60E+01	7.2E-04	2172	0.0068	3.1E-03
	1,1,2,2-Tetrachloroethane										
120-82-1	1,2,4-Trichlorobenzene	Y	3.96E-02	5.81E-02	8.40E-06	8.14E+00	1.36E+03	2.4E-05	11918	0.0039	3.3E-04
95-63-6	1,2,4-Trimethylbenzene	Y	6.07E-02	2.52E-01	7.92E-06	3.69E+00	6.14E+02	3.5E-04	3140	1.98	6.3E-01
95-50-1	1,2-Dichlorobenzene	Y	5.62E-02	7.85E-02	8.92E-06	2.30E+00	3.83E+02	1.6E-04	4618	0.0006	1.3E-04
108-67-8	1,3,5-Trimethylbenzene	Y	6.02E-02	3.59E-01	7.84E-06	3.61E+00	6.02E+02	4.9E-04	2623	0.847	3.2E-01
106-46-7	1,4-Dichlorobenzene	Y	5.50E-02	9.85E-02	8.68E-06	2.25E+00	3.75E+02	2.0E-04	4127	0.00061	1.5E-04
78-93-3	Methyl Ethyl Ketone (2-Butanone)	Y	9.14E-02	2.33E-03	1.02E-05	2.71E-02	4.51E+00	2.4E-04	3733	0.16	4.3E-02
591-78-6	2-Hexanone	Y	7.04E-02	3.81E-03	8.44E-06	8.99E-02	1.50E+01	1.7E-04	4521	0.0015	3.3E-04
	Butylbenzene, sec-										
108-10-1	Methyl Isobutyl Ketone (4-methyl-2-pentanone)	Y	6.98E-02	5.64E-03	8.35E-06	7.56E-02	1.26E+01	2.7E-04	3537	0.042	1.2E-02
67-64-1	Acetone	Y	1.06E-01	1.43E-03	1.15E-05	1.42E-02	2.36E+00	2.1E-04	4016	0.53	1.3E-01
71-43-2	Benzene	Y	8.95E-02	2.27E-01	1.03E-05	8.75E-01	1.46E+02	1.8E-03	1376	0.0068	4.9E-03
74-83-9	Bromomethane	Y	1.00E-01	3.00E-01	1.35E-05	7.93E-02	1.32E+01	1.4E-02	494	0.026	5.3E-02
	Carbon Disulfide										
	Chloroform										
74-87-3	Chloromethane (Methyl Chloride)	Y	1.24E-01	3.61E-01	1.36E-05	7.92E-02	1.32E+01	1.9E-02	418	0.00085	2.0E-03
156-59-2	cis-1,2-Dichloroethylene	Y	8.84E-02	1.67E-01	1.13E-05	2.38E-01	3.96E+01	4.0E-03	925	0.027	2.9E-02
	Cyclohexane										
99-87-6	Cymene (p-Isopropyltoluene) (surrogate = Cum	Y	5.27E-02	4.50E-01	7.32E-06	6.72E+00	1.12E+03	3.0E-04	3394	0.27	8.0E-02
100-41-4	Ethylbenzene	Y	6.85E-02	3.22E-01	8.46E-06	2.68E+00	4.46E+02	6.8E-04	2244	1	4.5E-01
98-82-8	Isopropylbenzene	Y	6.03E-02	4.70E-01	7.86E-06	4.19E+00	6.98E+02	5.6E-04	2466	0.71	2.9E-01
	Isopropyltoluene (surrogate = Cymene)										
108-87-2	Methyl cyclohexane	Y	8.00E-02	6.13E+00	9.11E-06	8.76E-01	1.46E+02	2.0E-02	414	2.2	5.3E+00
1634-04-4	Methyl tert-Butyl Ether (MTBE)	Y	7.53E-02	2.40E-02	8.59E-06	6.94E-02	1.16E+01	1.3E-03	1633	0.013	8.0E-03
75-09-2	Methylene Chloride	Y	9.99E-02	1.33E-01	1.25E-05	1.30E-01	2.17E+01	5.6E-03	781	0.0148	1.9E-02
104-51-8	Butylbenzene, n-	Y	5.28E-02	6.50E-01	7.33E-06	8.89E+00	1.48E+03	3.2E-04	3245	0.169	5.2E-02
	Propylbenzene										
100-42-5	Styrene	Y	7.11E-02	1.12E-01	8.78E-06	2.68E+00	4.46E+02	2.5E-04	3699	0.031	8.4E-03
	Butylbenzene, tert-										
127-18-4	Tetrachloroethylene	Y	5.05E-02	7.24E-01	9.46E-06	5.70E-01	9.49E+01	4.1E-03	909	0.446	4.9E-01
108-88-3	Toluene	Y	7.78E-02	2.71E-01	9.20E-06	1.40E+00	2.34E+02	1.2E-03	1684	0.14	8.3E-02
156-60-5	trans-1,2-Dichloroethylene	Y	8.76E-02	1.67E-01	1.12E-05	2.38E-01	3.96E+01	3.9E-03	930	0.00079	8.5E-04
75-69-4	Trichlorofluoromethane (CFC-11)	Y	6.54E-02	3.97E+00	1.00E-05	2.63E-01	4.39E+01	2.1E-02	407	0.051	1.3E-01
76-13-1	Trifluorotrichloroethane (Freon 113)	Y	7.80E-02	2.20E+01	8.20E-06	1.20E+00	2.00E+02	2.7E-02	358	0.0012	3.4E-03
1330-20-7	Xylenes	Y	8.47E-02	2.12E-01	9.90E-06	2.30E+00	3.83E+02	6.4E-04	2302	0.00738	3.2E-03
91-57-6	2-Methylnaphthalene	Y	5.24E-02	2.12E-02	7.78E-06	1.49E+01	2.48E+03	6.4E-06	23139	31	1.3E+00
83-32-9	Acenaphthene	Y	5.06E-02	7.52E-03	8.33E-06	3.02E+01	5.03E+03	1.1E-06	56227	24	4.3E-01
208-96-8	Acenaphthylene	N	5.06E-02	7.52E-03	8.33E-06	3.02E+01	5.03E+03				NV
120-12-7	Anthracene	Y	3.90E-02	2.27E-03	7.85E-06	9.82E+01	1.64E+04	7.7E-08	210105	52	2.5E-01
56-55-3	Benz[a]anthracene	N	5.09E-02	4.91E-04	5.94E-06	1.06E+03	1.77E+05				NV
50-32-8	Benzo[a]pyrene	N	4.76E-02	1.87E-05	5.56E-06	3.52E+03	5.87E+05				NV
205-99-2	Benzo[b]fluoranthene	N	4.76E-02	2.69E-05	5.56E-06	3.60E+03	5.99E+05				NV
191-24-2	Benzo(g,h,i)perylene	N	5.28E-02	9.65E-08	6.17E-06	1.35E+00	2.25E+02				NV
207-08-9	Benzo[k]fluoranthene	N	4.76E-02	2.39E-05	5.56E-06	3.52E+03	5.87E+05				NV
218-01-9	Chrysene	N	2.61E-02	2.14E-04	6.75E-06	1.08E+03	1.81E+05				NV
53-70-3	Dibenz[a,h]anthracene	N	4.46E-02	5.76E-06	5.21E-06	1.15E+04	1.91E+06				NV
206-44-0	Fluoranthene	N	2.76E-02	3.62E-04	7.18E-06	3.33E+02	5.55E+04				NV
86-73-7	Fluorene	Y	4.40E-02	3.93E-03	7.89E-06	5.50E+01	9.16E+03	2.7E-07	112561	23	2.0E-01
193-39-5	Indeno[1,2,3-cd]pyrene	N	4.48E-02	6.56E-05	5.23E-06	2.08E+04	3.47E+06				NV
91-20-3	Naphthalene	Y	6.05E-02	1.80E-02	8.38E-06	9.26E+00	1.54E+03	1.0E-05	18468	0.582	3.2E-02
85-01-8	Phenanthrene	N	2.08E-02	5.81E-12	5.19E-06	5.56E+01	9.27E+03				NV
129-00-0	Pyrene	Y	2.78E-02	4.87E-04	7.25E-06	3.26E+02	5.43E+04	3.6E-09	978141	170	1.7E-01
1336-36-3	Polychlorinated Biphenyls	N	4.32E-02	7.77E-03	5.04E-06	4.69E+02	7.81E+04				NV

Appendix H, Table H-6
Vapor to Outdoor Air EPC Calculations
Soil -
CONSTRUCTION - CONSTRUCTION WORKER (ADULT)

Human Health Risk Assessment
D.C. United Soccer Stadium
Washington, D.C.

EQUATIONS:

$$EPC_{[VAPOR]} = EPC_{[SOIL]} \times 1/VF \times 1000\ ug/mg$$

where:

$$VF\ (m^3/kg) = Q/C \times (3.14 \times D_A \times T)^{1/2} \times 10^{-4}(m^2/cm^2) / (2 \times P_b \times D_A)$$

and:

$$DA = [(O_a^{10/3} D_i H' + O_w^{10/3} D_w)/n^2] / P_b K_d + O_w + O_a H'$$

PARAMETER/DEFINITION	UNITS	DEFAULT	Source
VF / volatilization factor	m^3/kg	Calculated	
D_A / apparent diffusivity	cm^2/s	Calculated	
Q/C / inverse of the mean concentration at the center of a 0.5-acre-square source	g/m^2-s per kg/m^3	35.14	USEPA, 2014 [a]
T / exposure interval	s	3.15E+07	CONSTRUCTION
Π_b / dry soil bulk density	g/cm^3	1.62	USEPA, 2014
O_a / air-filled soil porosity	L_{air}/L_{soil}	0.314	USEPA, 2014
n / total soil porosity	L_{pore}/L_{soil}	0.39	USEPA, 2014
O_w / water-filled soil porosity	L_{water}/L_{soil}	0.076	USEPA, 2014
Ψ_s / soil particle density	g/cm^3	2.65	USEPA, 1996
D_i / diffusivity in air	cm^2/s	chemical-specific	
H' / Henry's Law constant	dimensionless	chemical-specific	
D_w / diffusivity in water	cm^2/s	chemical-specific	
K_d / soil-water partition coefficient (Koc x foc) organics	cm^3/g	chemical-specific	
K_{oc} / soil organic carbon partition coefficient	cm^3/g	chemical-specific	
f_{oc} / fraction organic carbon in soil	g/g	0.006	Default

USEPA, 2014. Regional Screening Levels.
[a] Climactic zone: Phoenix Arizona [a] Area of Source: Specific to size of Exposure Area

CASRN	COPC	Volatile (Y/N)	D_i (cm^2/s)	H' (unitless)	D_w (cm^2/s)	K_d (cm^3/g)	K_{oc} (cm^3/g)	D_A (cm^2/s)	VF (m^3/kg)	EPC Soil (mg/kg)	EPC Vapor (ug/m^3)
	Aluminum										
7440-36-0	Antimony	N									NV
7440-38-2	Arsenic	N									NV
7440-39-3	Barium	N									NV
7440-41-7	Beryllium	N									NV
7440-43-9	Cadmium	N									NV
7440-70-2	Calcium	N									NV
7440-47-3	Chromium, Total	N									NV
7440-48-4	Cobalt	N									NV
7440-50-8	Copper	N									NV
7439-89-6	Iron	N									NV
7439-92-1	Lead	N									NV
7439-95-4	Magnesium	N									NV
7439-96-5	Manganese	N									NV
7439-97-6	Mercury	N	3.07E-02	4.67E-01	6.30E-06						NV
7440-02-0	Nickel	N									NV
7440-09-7	Potassium	N									NV
7782-49-2	Selenium	N									NV
7440-22-4	Silver	N									NV
7440-23-5	Sodium	N									NV
7440-28-0	Thallium	N									NV
7440-62-2	Vanadium	N									NV
7440-66-6	Zinc	N									NV

Appendix H, Table H-7
Cancer Risk Calculations - Single Age
Groundwater -
CONSTRUCTION - CONSTRUCTION WORKER (ADULT)

Human Health Risk Assessment
D.C. United Soccer Stadium
Washington, D.C.

Exposure Routes Evaluated		ELCR (Total)
Incidental Ingestion	No	
Dermal Contact	No	
Ambient Vapor Inhalation	Yes	6E-07
		6E-07

NC - not carcinogenic by this exposure route
NTV - no toxicity value available
NV - not volatile
DAD - dermally absorbed dose
EC - exposure concentration
ABS - absorption factor
CSF - cancer slope factor
UR - cancer unit risk
ELCR - excess lifetime cancer risk
EPC - exposure point concentration

COPC	CASRN	EPC	Intake Calculations				Tapwater Dermal Parameters						Cancer Toxicity Values			ELCR			
			$Intake_{ingestion}$	DA_{event}	DAD_{dermal}	EC_{vapor}	B	τ	t*	Kp	FA	In EPD?	CSF_{oral}	CSF_{dermal}	IUR	$ELCR_{ingestion}$	$ELCR_{dermal}$	$ELCR_{vapor}$	$ELCR_{total}$
		(mg/L)	(mg/kg/day)	(mg/kg/day)	(mg/kg/day)	(ug/m^3)	(unitless)	(hr/event)	(hr)	(cm/hr)	(unitless)	(Y/N)	$(mg/kg/day)^{-1}$	$(mg/kg/day)^{-1}$	$(ug/m^3)^{-1}$				
Acetone	67-64-1	6.3E-01	NE	NE	NC	NC	1.5E-03	2.2E-01	5.3E-01	5.1E-04	1	Y	NTV	NTV	NTV	NE	NTV		
Benzene	71-43-2	3.4E-02	NE	NE	NC	7.9E-03	5.1E-02	2.9E-01	6.9E-01	1.5E-02	1	Y	5.5E-02	5.5E-02	7.8E-06	NE		6.1E-08	6.13E-08
Carbon Disulfide	75-15-0	7.6E-04	NE	NE	NC	NC	3.8E-02	2.8E-01	6.7E-01	1.1E-02	1	Y	NTV	NTV	NTV	NE	NTV		
Chloroform	67-66-3	8.9E-04	NE	NE	NC	1.6E-04	2.9E-02	4.9E-01	1.2E+00	6.8E-03	1	Y	NTV	NTV	2.3E-05	NE	NTV	3.8E-09	3.77E-09
Chloromethane (Methyl Chl	74-87-3	4.4E-03	NE	NE	NC	1.3E-03				3.3E-03	1		1.3E-02	1.3E-02	1.8E-06	NE		2.3E-09	2.26E-09
Cyclohexane	110-82-7	5.2E-02	NE	NE	NC	NC				1.0E-01	1		NTV	NTV	NTV	NE	NTV		
1,2-Dichloroethane	107-06-2	7.4E-03	NE	NE	NC	1.4E-03	1.6E-02	3.8E-01	9.0E-01	4.2E-03	1	Y	9.1E-02	9.1E-02	2.6E-05	NE		3.7E-08	3.73E-08
cis-1,2-Dichloroethylene	156-59-2	7.0E-02	NE	NE	NC	NC	4.2E-02	3.7E-01	8.8E-01	1.1E-02	1	Y	NTV	NTV	NTV	NE	NTV		
trans-1,2-Dichloroethylene	156-60-5	1.0E-03	NE	NE	NC	NC	4.2E-02	3.7E-01	8.8E-01	1.1E-02	1	Y	NTV	NTV	NTV	NE	NTV		
1,4-Dioxane	123-91-1	2.2E-01	NE	NE	NC	NV	1.2E-03	3.3E-01	7.9E-01	3.3E-04	1	Y	1.0E-01	1.0E-01	5.0E-06	NE		NV	
Ethylbenzene	100-41-4	1.2E-02	NE	NE	NC	2.4E-03	2.0E-01	4.1E-01	9.9E-01	4.9E-02	1	Y	NTV	NTV	2.5E-06	NE	NTV	6.0E-09	6.00E-09
Isopropylbenzene	98-82-8	5.1E-02	NE	NE	NC	NC	3.8E-01	5.0E-01	1.2E+00	9.0E-02	1	Y	NTV	NTV	NTV	NE	NTV		
Methyl tert-Butyl Ether (MTI	1634-04-4	5.4E-02	NE	NE	NC	1.1E-02	7.6E-03	3.3E-01	7.9E-01	2.1E-03	1	Y	1.8E-03	1.8E-03	2.6E-07	NE		2.8E-09	2.77E-09
Methyl cyclohexane	108-87-2	2.7E-02	NE	NE	NC	NC				1.0E-01	1		NTV	NTV	NTV	NE	NTV		
Methylene Chloride	75-09-2	4.2E-02	NE	NE	NC	9.1E-03	1.3E-02	3.1E-01	7.5E-01	3.5E-03	1	Y	2.0E-03	2.0E-03	1.0E-08	NE		9.1E-11	9.15E-11
1,1,2,2-Tetrachloroethane	79-34-5	5.0E-06	NE	NE	NC	NC	3.5E-02	9.2E-01	2.2E+00	6.9E-03	1	Y	2.0E-01	2.0E-01	NTV	NE			
Tetrachloroethylene	127-18-4	2.5E-03	NE	NE	NC	4.0E-04	1.7E-01	8.9E-01	2.1E+00	3.3E-02	1	Y	2.1E-03	2.1E-03	2.6E-07	NE		1.0E-10	1.03E-10
Toluene	108-88-3	2.0E-03	NE	NE	NC	NC	1.1E-01	3.5E-01	8.3E-01	3.1E-02	1	Y	NTV	NTV	NTV	NE	NTV		
Trichloroethylene	79-01-6	4.4E-02	NE	NE	NC	7.8E-03	5.1E-02	5.7E-01	1.4E+00	1.2E-02	1	Y	4.6E-02	4.6E-02	4.1E-06	NE		3.2E-08	3.19E-08
Vinyl Chloride	75-01-4	3.8E-02	NE	NE	NC	9.8E-03	2.5E-02	2.4E-01	5.7E-01	8.4E-03	1	Y	7.2E-01	7.2E-01	4.4E-06	NE		4.3E-08	4.31E-08
Xylenes	1330-20-7	3.6E-03	NE	NE	NC	NC	2.0E-01	4.1E-01	9.9E-01	5.0E-02	1	Y	NTV	NTV	NTV	NE	NTV		
Naphthalene	91-20-3	6.7E-02	NE	NE	NC	1.1E-02	2.0E-01	5.5E-01	1.3E+00	4.7E-02	1	Y	NTV	NTV	3.4E-05	NE	NTV	3.7E-07	3.70E-07

Appendix H, Table H-8
Non-Cancer Risk Calculations
Groundwater -
CONSTRUCTION - CONSTRUCTION WORKER (ADULT)

Human Health Risk Assessment
D.C. United Soccer Stadium
Washington, D.C.

Exposure Routes Evaluated		HI (Total)
Incidental Ingestion	No	
Dermal Contact	No	
Ambient Vapor Inhalation	Yes	5.7E-01

NV - not volatile
NTV - no toxicity value available
EC - exposure concentration
DAD - dermally absorbed dose
RfD - reference dose
ABS - absorption factor
HI - hazard index
RfC - reference concentration
EPC - exposure point concentration
COPC - chemical of potential concern

COPC	CASRN	EPC	Intake Calculations				Tapwater Dermal Parameters						Non-Cancer Toxicity Values						
			$Intake_{ingestion}$	DA_{event}	DAD_{dermal}	EC_{vapor}	B	τ	t*	Kp	FA	In EPD?	RfD_{oral}	RfD_{dermal}	RfC	$HQ_{ingestion}$	HQ_{dermal}	HQ_{vapor}	HQ_{total}
		(mg/L)	(mg/kg/day)	(mg/kg/day)	(mg/kg/day)	(mg/m^3)	(unitless)	(hr/event)	(hr)	(cm/hr)	(unitless)	(Y/N)	(mg/kg/day)	(mg/kg/day)	(mg/m^3)				
Acetone	67-64-1	6.25E-01	NE	NE		4.4E-03	1.5E-03	2.2E-01	5.3E-01	5.1E-04	1	Y	9.0E-01	9.0E-01	3.1E+01	NE		1.4E-04	1.4E-04
Benzene	71-43-2	3.44E-02	NE	NE		5.5E-04	5.1E-02	2.9E-01	6.9E-01	1.5E-02	1	Y	4.0E-03	4.0E-03	3.0E-02	NE		1.8E-02	1.8E-02
Carbon Disulfide	75-15-0	7.60E-04	NE	NE		1.2E-05	3.8E-02	2.8E-01	6.7E-01	1.1E-02	1	Y	1.0E-01	1.0E-01	7.0E-01	NE		1.8E-05	1.8E-05
Chloroform	67-66-3	8.90E-04	NE	NE		1.1E-05	2.9E-02	4.9E-01	1.2E+00	6.8E-03	1	Y	1.0E-02	1.0E-02	9.8E-02	NE		1.2E-04	1.2E-04
Chloromethane (Methyl Chlo	74-87-3	4.40E-03	NE	NE		8.8E-05	#N/A	#N/A	#N/A	#N/A	1	#N/A			9.0E-02	NE	NTV	9.8E-04	9.8E-04
Cyclohexane	110-82-7	5.20E-02	NE	NE		8.1E-04	#N/A	#N/A	#N/A	#N/A	1	#N/A			6.0E+00	NE	NTV	1.4E-04	1.4E-04
1,2-Dichloroethane	107-06-2	7.40E-03	NE	NE		1.0E-04	1.6E-02	3.8E-01	9.0E-01	4.2E-03	1	Y			7.0E-03	NE	NTV	1.4E-02	1.4E-02
cis-1,2-Dichloroethylene	156-59-2	7.02E-02	NE	NE		1.0E-03	4.2E-02	3.7E-01	8.8E-01	1.1E-02	1	Y	2.0E-03	2.0E-03		NE		NTV	
trans-1,2-Dichloroethylene	156-60-5	1.00E-03	NE	NE		1.4E-05	4.2E-02	3.7E-01	8.8E-01	1.1E-02	1	Y	2.0E-02	2.0E-02		NE		NTV	
1,4-Dioxane	123-91-1	2.20E-01	NE	NE		NV	1.2E-03	3.3E-01	7.9E-01	3.3E-04	1	Y	3.0E-02	3.0E-02	3.0E-02	NE		NV	
Ethylbenzene	100-41-4	1.22E-02	NE	NE		1.7E-04	2.0E-01	4.1E-01	9.9E-01	4.9E-02	1	Y	1.0E-01	1.0E-01	1.0E+00	NE		1.7E-04	1.7E-04
Isopropylbenzene	98-82-8	5.10E-02	NE	NE		6.7E-04	3.8E-01	5.0E-01	1.2E+00	9.0E-02	1	Y	1.0E-01	1.0E-01	4.0E-01	NE		1.7E-03	1.7E-03
Methyl tert-Butyl Ether (MTBI	1634-04-4	5.40E-02	NE	NE		7.5E-04	7.6E-03	3.3E-01	7.9E-01	2.1E-03	1	Y			3.0E+00	NE	NTV	2.5E-04	2.5E-04
Methyl cyclohexane	108-87-2	2.70E-02	NE	NE		3.9E-04	#N/A	#N/A	#N/A	#N/A	1	#N/A			3.0E+00	NE	NTV	1.3E-04	1.3E-04
Methylene Chloride	75-09-2	4.24E-02	NE	NE		6.4E-04	1.3E-02	3.1E-01	7.5E-01	3.5E-03	1	Y	6.0E-03	6.0E-03	6.0E-01	NE		1.1E-03	1.1E-03
1,1,2,2-Tetrachloroethane	79-34-5	5.00E-06	NE	NE		4.8E-08	3.5E-02	9.2E-01	2.2E+00	6.9E-03	1	Y	2.0E-02	2.0E-02		NE		NTV	
Tetrachloroethylene	127-18-4	2.50E-03	NE	NE		2.8E-05	1.7E-01	8.9E-01	2.1E+00	3.3E-02	1	Y	6.0E-03	6.0E-03	4.0E-02	NE		6.9E-04	6.9E-04
Toluene	108-88-3	2.00E-03	NE	NE		3.0E-05	1.1E-01	3.5E-01	8.3E-01	3.1E-02	1	Y	8.0E-02	8.0E-02	5.0E+00	NE		5.9E-06	5.9E-06
Trichloroethylene	79-01-6	4.39E-02	NE	NE		5.4E-04	5.1E-02	5.7E-01	1.4E+00	1.2E-02	1	Y	5.0E-04	5.0E-04	2.0E-03	NE		2.7E-01	2.7E-01
Vinyl Chloride	75-01-4	3.80E-02	NE	NE		6.9E-04	2.5E-02	2.4E-01	5.7E-01	8.4E-03	1	Y	3.0E-03	3.0E-03	1.0E-01	NE		6.9E-03	6.9E-03
Xylenes	1330-20-7	3.60E-03	NE	NE		4.9E-05	2.0E-01	4.1E-01	9.9E-01	5.0E-02	1	Y	2.0E-01	2.0E-01	1.0E-01	NE		4.9E-04	4.9E-04
Naphthalene	91-20-3	6.74E-02	NE	NE		7.6E-04	2.0E-01	5.5E-01	1.3E+00	4.7E-02	1	Y	2.0E-02	2.0E-02	3.0E-03	NE		2.5E-01	2.5E-01

Appendix H, Table H-9
Intake and Risk Equations - Single Age

Human Health Risk Assessment
D.C. United Soccer Stadium
Washington, D.C.

Cancer Risk from Ingestion

$$ELCR = Intake_{ing} * CSF$$

$$Intake_{ing\ (age\ group\ x)} = \frac{[EPC]_{water} * IR * FI * EF * ED * C1}{BW * AT_{lifetime}}$$

Cancer Risk from Dermal Absorption

$$ELCR = DAD * CSF$$

$$DAD_{derm\ (age\ group\ x)} = \frac{DA_{Event} * SA * EV * EF * ED}{AT_{lifetime}}$$

$$DA_{Event} = [EPC]_{water} * PCevent$$

Organic Compounds:

$$PCevent_{Tevent<t*} = 2 * FA * \frac{Kp}{C2} * \sqrt{\frac{6 * \tau * Tevent}{\pi}}$$

$$PCevent_{Tevent>=t*} = FA * \frac{Kp}{C2} * \left[\left(\frac{Tevent}{1+B}\right) + 2 * \tau * \left(\frac{1+3B+3B^2}{(1+B)^2}\right)\right]$$

Inorganics Compounds:

$$PCevent = \frac{Kp * Tevent}{C2}$$

Cancer Risk from Inhalation

$$ELCR_{inh} = EC_{can} * IUR$$

$$EC_{can\ (age\ group\ x)} = \frac{[EPC]_{vapor} * ET_{Vap} * EF * ED * C1}{24 * AT_{lifetime}}$$

Noncancer Risk from Ingestion

$$HQ = \frac{Intake_{ing}}{RfD}$$

$$Intake_{ing} = \frac{[EPC]_{water} * IR * FI * EF * ED * C1}{BW * AT}$$

Noncancer Risk from Dermal Absorption

$$HQ = \frac{DAD}{RfD}$$

$$DAD_{derm} = \frac{DA_{Event} * SA * EV * EF * ED}{BW * AT}$$

$$DA_{Event} = [EPC]_{water} * PCevent$$

Organic Compounds:

$$PCevent_{Tevent<t*} = 2 * FA * \frac{Kp}{C2} * \sqrt{\frac{6 * \tau * Tevent}{\pi}}$$

$$PCevent_{Tevent>=t*} = FA * \frac{Kp}{C2} * \left[\left(\frac{Tevent}{1+B}\right) + 2 * \tau * \left(\frac{1+3B+3B^2}{(1+B)^2}\right)\right]$$

Inorganics Compounds:

$$PCevent = \frac{Kp * Tevent}{C2}$$

Noncancer Risk from Inhalation

$$HQ = \frac{EC_{nc}}{RfC}$$

$$EC_{nc} = \frac{[EPC]_{VAPOR} * ET_{Vap} * EF * ED * C1}{24 * AT}$$

Parameter	Value - Cancer	Value - Non-Cancer	Units
CSF	Chemical specific	--	$(mg/kg\text{-}day)^{-1}$
IUR	Chemical specific	--	$(ug/m^3)^{-1}$
Intake	Age/chemical specific	--	mg/kg-day
EC_{can}	Age/chemical specific	--	(ug/m^3)
ELCR	Age/chemical specific	--	unitless
RfD	--	Chemical specific	mg/kg-day
RfC	--	Chemical specific	(mg/m^3)
DAD	Age/chemical specific	Age/chemical specific	mg/kg-day
DA_{Event}	Age/chemical specific	Age/chemical specific	mg/cm^2-event
EC_{nc}	--	Age/chemical specific	mg/m^3
HQ	--	Age/chemical specific	unitless
$[EPC]_{water}$	Chemical specific	Chemical specific	mg/L
PCevent	Chemical specific	Chemical specific	L/cm^2-event
$[EPC]_{vapor}$	Appendix H, TABLE H-11	Appendix H, TABLE H-11	ug/m^3
BW	80	80	kg
EF	30	30	day/year
ED	1	1	year
AT	--	365	day
ATlifetime	25550	--	day
IR			L/day
FI	1	1	unitless
SA	3527	3527	cm2
Tevent	2.00	2	hr/event
EV	1	1	event/day
C1	0.001	0.001	mg/ug
ETVap	1	1	hr/day
C2	1000	1000	cm^3/L

Appendix H, Table H-10
Exposure Factors

D.C. United Soccer Stadium
Washington, D.C.

PLACE "X" IN THE APPROPRIATE YELLOW SHADED CELLS FOR THE APPROPRIATE RECEPTOR AND BASIS FC

SCENARIO USED TO CALCULATE RISKS				**X**	**CONSTRUCTION**
BASIS FOR CANCER CALCULATIONS				**X**	
BASIS FOR NON-CANCER CALCULATIONS				**X**	
RECEPTOR				**CONSTRUCTION WORKER (ADULT)**	
Standard Parameters					
	Body Weight	BW	kg	80	EPA, 2014
	Exposure Frequency	EF	day/year	30	Site-specific [2]
	Exposure Duration	ED	year	1	Balance of 26-yr exposure
	Non–carcinogenic Averaging Time	AT	day	365	Exposure duration expressed in days
	Carcinogenic Averaging Time	$AT_{lifetime}$	day	25550	70 year lifetime
Ingestion of Water					
	Water Ingestion Rate	IR	L/day	0.000	EPA, 2011 [4]
	Fraction Ingested	FI	unitless	1.0	Site-specific [5]
	Age-Adjusted Water Ingestion Rate	IFWadj	L/kg	NA	
Dermal Exposure with Water					
	Exposed Skin Surface Area	SA	cm^2	3527	EPA, 2011 [6]
	Exposure Time	Tevent	hr/event	2	Site-specific [5]
	Events per Day	EV	event/day	1.0	Site-specific [5]
	Age-Adjusted Dermal Contact Factor	DFWadj	events-cm^2/kg	NA	
Vapor Inhalation					
	Exposure Time	ET_{Vap}	hours/day	1	Site-specific [5]

Appendix H, Table H-11
Vapor to Outdoor Air EPC Calculations
Groundwater -
CONSTRUCTION - CONSTRUCTION WORKER (ADULT)

Human Health Risk Assessment
D.C. United Soccer Stadium
Washington, D.C.

EQUATIONS:

$\mathbf{EPC_{[VAPOR]} = EPC_{[WATER]} \times K \times 1000\ ug/mg}$

or

$\mathbf{EPC_{[VAPOR]} = EPC_{[WATER]} \times VF \times 1000\ ug/mg}$

where:

VF (L/m^3) is calculated using modeling equations as documented in Table

PARAMETER/DEFINITION	UNITS	DEFAULT	Basis of EPC Vapor	Source
K / Andelman Volatilization Factor	L/m^3	0.5		EPA, 1991
VF / volatilization factor	L/m^3	Calculated	X	

EPA, 1991 'Standard

CASRN	COPC	Volatile (Y/N)	K (constant) (L/m^3)	VF (chemical-specific) (L/m^3)	EPC Water (mg/L)	EPC Vapor (ug/m^3)
67-64-1	Acetone	Y		2.06E+00	0.625	1.29E+03
71-43-2	Benzene	Y		4.67E+00	0.0344	1.61E+02
75-15-0	Carbon Disulfide	Y		4.78E+00	0.00076	3.63E+00
67-66-3	Chloroform	Y		3.76E+00	0.00089	3.35E+00
74-87-3	Chloromethane (Methyl Chloride)	Y		5.83E+00	0.0044	2.57E+01
110-82-7	Cyclohexane	Y		4.55E+00	0.052	2.37E+02
107-06-2	1,2-Dichloroethane	Y		3.96E+00	0.0074	2.93E+01
156-59-2	cis-1,2-Dichloroethylene	Y		4.18E+00	0.0702	2.93E+02
156-60-5	trans-1,2-Dichloroethylene	Y		4.21E+00	0.001	4.21E+00
123-91-1	1,4-Dioxane	N		3.29E-01		NV
100-41-4	Ethylbenzene	Y		4.02E+00	0.0122	4.91E+01
98-82-8	Isopropylbenzene	Y		3.81E+00	0.051	1.94E+02
1634-04-4	Methyl tert-Butyl Ether (MTBE)	Y		4.03E+00	0.054	2.18E+02
108-87-2	Methyl cyclohexane	Y		4.21E+00	0.027	1.14E+02
75-09-2	Methylene Chloride	Y		4.41E+00	0.0424	1.87E+02
79-34-5	1,1,2,2-Tetrachloroethane	Y		2.79E+00	0.000005	1.39E-02
127-18-4	Tetrachloroethylene	Y		3.23E+00	0.0025	8.08E+00
108-88-3	Toluene	Y		4.31E+00	0.002	8.62E+00
79-01-6	Trichloroethylene	Y		3.62E+00	0.0439	1.59E+02
75-01-4	Vinyl Chloride	Y		5.27E+00	0.038	2.00E+02
1330-20-7	Xylenes	Y		4.01E+00	0.0036	1.44E+01
91-20-3	Naphthalene	Y		3.30E+00	0.0674	2.23E+02

Appendix H, Table H-12
Cancer Risk Calculations
Soil - During Site Redevelopment -
RESIDENT (4 AGES) - CHILD (AGE 0-<2)

Human Health Risk Assessment
D.C. United Soccer Stadium
Washington, D.C.

Exposure Routes Evaluated		ELCR (Total)
Incidental Ingestion	No	
Dermal Contact	No	
Particulate Inhalation	Yes	2E-06
Ambient Vapor Inhalation	Yes	6E-08
		2E-06

NC - not carcinogenic by this exposure route
NTV - no toxicity value available
NV - not volatile
DAD - dermally absorbed dose
EC - exposure concentration
ABS - absorption factor
CSF - cancer slope factor
UR - cancer unit risk
ELCR - excess lifetime cancer risk
EPC - exposure point concentration
COPC - chemical of potential concern

COPC	CASRN	EPC (mg/kg)	Intake Calculations				Absorption Factors		Mutagenic MOA?	Cancer Toxicity Values			ELCR				
			$Intake_{ingestion}$ (mg/kg/day)	DAD_{dermal} (mg/kg/day)	$EC_{particulate}$ (ug/m^3)	EC_{vapor} (ug/m^3)	ABS_{ing} (unitless)	ABS_d (unitless)		CSF_{oral} $(mg/kg/day)^{-1}$	CSF_{dermal} $(mg/kg/day)^{-1}$	IUR $(ug/m^3)^{-1}$	$ELCR_{ingestion}$	$ELCR_{dermal}$	$ELCR_{particulate}$	$ELCR_{vapor}$	$ELCR_{total}$
Trichloroethylene	79-01-6	3.1E-03	NE	NE	3.2E-08	3.8E-05	1		Y	4.6E-02	4.6E-02	4.1E-06	NE	NE	1.3E-13	1.6E-10	1.6E-10
Vinyl Chloride	75-01-4	6.4E-03	NE	NE	3.2E-06	2.4E-04	1		Y	7.2E-01	7.2E-01	4.4E-06	NE	NE	2.8E-08	2.9E-08	5.7E-08
1,1,1,2-Tetrachloroethane	630-20-6	6.8E-03	NE	NE	9.3E-08	4.3E-05	1		N	2.6E-02	2.6E-02	7.4E-06	NE	NE	6.9E-13	3.2E-10	3.2E-10
1,1,2,2-Tetrachloroethane	79-34-5																
1,2,4-Trichlorobenzene	120-82-1	3.9E-03	NE	NE	NC	NC	1	0.1	N	2.9E-02	2.9E-02		NE	NE			
1,2,4-Trimethylbenzene	95-63-6	2.0E+00	NE	NE	NC	NC	NC	NC	N				NE	NE			
1,2-Dichlorobenzene	95-50-1	6.0E-04	NE	NE	NC	NC	NC	NC	N				NE	NE			
1,3,5-Trimethylbenzene	108-67-8	8.5E-01	NE	NE	NC	NC	NC	NC	N				NE	NE			
1,4-Dichlorobenzene	106-46-7	6.1E-04	NE	NE	8.4E-09	2.0E-06	1	0.1	N	5.4E-03	5.4E-03	1.1E-05	NE	NE	9.2E-14	2.2E-11	2.2E-11
Methyl Ethyl Ketone (2-Butanone)	78-93-3	1.6E-01	NE	NE	NC	NC	NC	NC	N				NE	NE			
2-Hexanone	591-78-6	1.5E-03	NE	NE	NC	NC	NC	NC	N				NE	NE			
Butylbenzene, sec-	135-98-8																
Methyl Isobutyl Ketone (4-methyl-2-pentanone)	108-10-1	4.2E-02	NE	NE	NC	NC	NC	NC	N				NE	NE			
Acetone	67-64-1	5.3E-01	NE	NE	NC	NC	NC	NC	N				NE	NE			
Benzene	71-43-2	6.8E-03	NE	NE	9.3E-08	6.8E-05	1		N	5.5E-02	5.5E-02	7.8E-06	NE	NE	7.3E-13	5.3E-10	5.3E-10
Bromomethane	74-83-9	2.6E-02	NE	NE	NC	NC	1		N				NE	NE			
Carbon Disulfide	75-15-0																
Chloroform	67-66-3																
Chloromethane (Methyl Chloride)	74-87-3	8.5E-04	NE	NE	1.2E-08	2.8E-05	1		N	1.3E-02	1.3E-02	1.8E-06	NE	NE	2.1E-14	5.0E-11	5.0E-11
cis-1,2-Dichloroethylene	156-59-2	2.7E-02	NE	NE	NC	NC	NC	NC	N				NE	NE			
Cyclohexane	110-82-7																
Cymene (p-Isopropyltoluene) (surrogate = Cumene)	99-87-6	2.7E-01	NE	NE	NC	NC	NC	NC	N				NE	NE			
Ethylbenzene	100-41-4	1.0E+00	NE	NE	1.4E-05	6.1E-03	NC	NC	N			2.5E-06	NE	NE	3.4E-11	1.5E-08	1.5E-08
Isopropylbenzene	98-82-8	7.1E-01	NE	NE	NC	NC	NC	NC	N				NE	NE			
Isopropyltoluene (surrogate = Cymene)	25155-15-1																
Methyl cyclohexane	108-87-2	2.2E+00	NE	NE	NC	NC	NC	NC	N				NE	NE			
Methyl tert-Butyl Ether (MTBE)	1634-04-4	1.3E-02	NE	NE	1.8E-07	1.1E-04	1		N	1.8E-03	1.8E-03	2.6E-07	NE	NE	4.6E-14	2.8E-11	2.8E-11
Methylene Chloride	75-09-2	1.5E-02	NE	NE			1		Y	2.0E-03	2.0E-03	1.0E-08	NE	NE			
Butylbenzene, n-	104-51-8	1.7E-01	NE	NE	NC	NC	NC	NC	N				NE	NE			
Propylbenzene	103-65-1																
Styrene	100-42-5	3.1E-02	NE	NE	NC	NC	NC	NC	N				NE	NE			
Butylbenzene, tert-	98-06-6																
Tetrachloroethylene	127-18-4	4.5E-01	NE	NE	6.1E-06	6.7E-03	1		N	2.1E-03	2.1E-03	2.6E-07	NE	NE	1.6E-12	1.7E-09	1.7E-09
Toluene	108-88-3	1.4E-01	NE	NE	NC	NC	NC	NC	N				NE	NE			
trans-1,2-Dichloroethylene	156-60-5	7.9E-04	NE	NE	NC	NC	NC	NC	N				NE	NE			
Trichlorofluoromethane (CFC-11)	75-69-4	5.1E-02	NE	NE	NC	NC	NC	NC	N				NE	NE			
Trifluorotrichloroethane (Freon 113)	76-13-1	1.2E-03	NE	NE	NC	NC	NC	NC	N				NE	NE			
Xylenes	1330-20-7	7.4E-03	NE	NE	NC	NC	NC	NC	N				NE	NE			
2-Methylnaphthalene	91-57-6	3.1E+01	NE	NE	NC	NC	NC	NC	N				NE	NE			
Acenaphthene	83-32-9	2.4E+01	NE	NE	NC	NC	NC	NC	N				NE	NE			

Appendix H, Table H-12
Cancer Risk Calculations
Soil - During Site Redevelopment -
RESIDENT (4 AGES) - CHILD (AGE 0-<2)

Human Health Risk Assessment
D.C. United Soccer Stadium
Washington, D.C.

Exposure Routes Evaluated		ELCR (Total)
Incidental Ingestion	No	
Dermal Contact	No	
Particulate Inhalation	Yes	2E-06
Ambient Vapor Inhalation	Yes	6E-08
		2E-06

NC - not carcinogenic by this exposure route
NTV - no toxicity value available
NV - not volatile
DAD - dermally absorbed dose
EC - exposure concentration
ABS - absorption factor
CSF - cancer slope factor
UR - cancer unit risk
ELCR - excess lifetime cancer risk
EPC - exposure point concentration
COPC - chemical of potential concern

COPC	CASRN	EPC (mg/kg)	Intake Calculations				Absorption Factors		Mutagenic	Cancer Toxicity Values			ELCR				
			$Intake_{ingestion}$ (mg/kg/day)	DAD_{dermal} (mg/kg/day)	$EC_{particulate}$ (ug/m^3)	EC_{vapor} (ug/m^3)	ABS_{ing} (unitless)	ABS_{d} (unitless)	MOA?	CSF_{oral} $(mg/kg/day)^{-1}$	CSF_{dermal} $(mg/kg/day)^{-1}$	IUR $(ug/m^3)^{-1}$	$ELCR_{ingestion}$	$ELCR_{dermal}$	$ELCR_{particulate}$	$ELCR_{vapor}$	$ELCR_{total}$
Acenaphthylene	208-96-8	1.7E+01	NE	NE	NC	NV	NC	NC	N				NE	NE		NV	
Anthracene	120-12-7	5.2E+01	NE	NE	NC	NC	1	0.13	N				NE	NE			
Benz[a]anthracene	56-55-3	3.4E+00	NE	NE		NV	1	0.13	Y	7.3E-01	7.3E-01	1.1E-04	NE	NE		NV	
Benzo[a]pyrene	50-32-8	2.8E+00	NE	NE		NV	1	0.13	Y	7.3E+00	7.3E+00	1.1E-03	NE	NE		NV	
Benzo[b]fluoranthene	205-99-2	3.5E+00	NE	NE		NV	1	0.13	Y	7.3E-01	7.3E-01	1.1E-04	NE	NE		NV	
Benzo(g,h,i)perylene	191-24-2	4.1E+01	NE	NE	NC	NV	NC	NC	N				NE	NE		NV	
Benzo[k]fluoranthene	207-08-9	2.3E+01	NE	NE		NV	1	0.13	Y	7.3E-02	7.3E-02	1.1E-04	NE	NE		NV	
Chrysene	218-01-9	3.3E+00	NE	NE		NV	1	0.13	Y	7.3E-03	3.4E+00	1.1E-05	NE	NE		NV	
Dibenz[a,h]anthracene	53-70-3	4.8E-01	NE	NE		NV	1	0.13	Y	7.3E+00	7.3E+00	1.2E-03	NE	NE		NV	
Fluoranthene	206-44-0	1.8E+02	NE	NE	NC	NV	NC	NC	N				NE	NE		NV	
Fluorene	86-73-7	2.3E+01	NE	NE	NC	NC	NC	NC	N				NE	NE			
Indeno[1,2,3-cd]pyrene	193-39-5	1.8E+00	NE	NE		NV	1	0.13	Y	7.3E-01	7.3E-01	1.1E-04	NE	NE		NV	
Naphthalene	91-20-3	5.8E-01	NE	NE	8.0E-06	4.3E-04	NC	NC	N			3.4E-05	NE	NE	2.7E-10	1.5E-08	1.5E-08
Phenanthrene	85-01-8	1.7E+02	NE	NE	NC	NV	NC	NC	N				NE	NE		NV	
Pyrene	129-00-0	1.7E+02	NE	NE	NC	NC	NC	NC	N				NE	NE			
Polychlorinated Biphenyls	1336-36-3	7.0E-01	NE	NE	9.5E-06	NV	1	0.14	N	2.0E+00	2.0E+00	5.7E-04	NE	NE	5.4E-09	NV	5.4E-09
Aluminum	7429-90-5																
Antimony	7440-36-0	8.9E+00	NE	NE	NC	NV	NC	NC	N				NE	NE		NV	
Arsenic	7440-38-2	9.4E+00	NE	NE	1.3E-04	NV	0.6	0.03	N	1.5E+00	1.5E+00	4.3E-03	NE	NE	5.5E-07	NV	5.5E-07
Barium	7440-39-3	1.6E+02	NE	NE	NC	NV	NC	NC	N				NE	NE		NV	
Beryllium	7440-41-7	4.8E-01	NE	NE	6.6E-06	NV	NC	NC	N			2.4E-03	NE	NE	1.6E-08	NV	1.6E-08
Cadmium	7440-43-9	2.9E+00	NE	NE	4.0E-05	NV	NC	NC	N			1.8E-03	NE	NE	7.2E-08	NV	7.2E-08
Calcium	7440-70-2	7.5E+04	NE	NE	NC	NV	NC	NC	N				NE	NE		NV	
Chromium, Total	7440-47-3	4.0E+02	NE	NE	NC	NV	NC	NC	N				NE	NE		NV	
Cobalt	7440-48-4	1.0E+01	NE	NE	1.4E-04	NV	NC	NC	N			9.0E-03	NE	NE	1.3E-06	NV	1.3E-06
Copper	7440-50-8	3.6E+02	NE	NE	NC	NV	NC	NC	N				NE	NE		NV	
Iron	7439-89-6	3.1E+04	NE	NE	NC	NV	NC	NC	N				NE	NE		NV	
Lead	7439-92-1	6.1E+02	NE	NE	NC	NV	1		N				NE	NE		NV	
Magnesium	7439-95-4	2.0E+04	NE	NE	NC	NV	NC	NC	N				NE	NE		NV	
Manganese	7439-96-5	3.6E+02	NE	NE	NC	NV	NC	NC	N				NE	NE		NV	
Mercury	7439-97-6	1.5E+00	NE	NE	NC	NV	NC	NC	N				NE	NE		NV	
Nickel	7440-02-0	4.1E+01	NE	NE	5.6E-04	NV	NC	NC	N			2.4E-04	NE	NE	1.3E-07	NV	1.3E-07
Potassium	7440-09-7	5.1E+03	NE	NE	NC	NV	NC	NC	N				NE	NE		NV	
Selenium	7782-49-2	6.2E+00	NE	NE	NC	NV	NC	NC	N				NE	NE		NV	
Silver	7440-22-4	3.9E+00	NE	NE	NC	NV	NC	NC	N				NE	NE		NV	
Sodium	7440-23-5	1.4E+04	NE	NE	NC	NV	NC	NC	N				NE	NE		NV	
Thallium	7440-28-0	1.2E+00	NE	NE	NC	NV	NC	NC	N				NE	NE		NV	
Vanadium	7440-62-2	3.5E+01	NE	NE	NC	NV	NC	NC	N				NE	NE		NV	
Zinc	7440-66-6	7.2E+02	NE	NE	NC	NV	NC	NC	N				NE	NE		NV	

Appendix H, Table H-13
Non-Cancer Risk Calculations
Soil - During Site Redevelopment -
RESIDENT (4 AGES) - CHILD (AGE 0-<2)

Human Health Risk Assessment
D.C. United Soccer Stadium
Washington, D.C.

Exposure Routes Evaluated		HI (Total)
Incidental Ingestion	No	
Dermal Contact	No	
Particulate Inhalation	Yes	1E+01
Ambient Vapor Inhalation	Yes	1E-01
		10

NV - not volatile
NTV - no toxicity value available
EC - exposure concentration
DAD - dermally absorbed dose
RfD - reference dose
ABS - absorption factor
HI - hazard index
RfC - reference concentration
EPC - exposure point concentration
COPC - chemical of potential concern

COPC	CASRN	EPC (mg/kg)	Intake Calculations				Absorption Factors		Non-Cancer Toxicity Values			HQ				
			$Intake_{ingestion}$ (mg/kg/day)	DAD_{dermal} (mg/kg/day)	$EC_{particulate}$ (mg/m^3)	EC_{vapor} (mg/m^3)	ABS_{ing} (unitless)	ABS_{d} (unitless)	RfD_{oral} (mg/kg/day)	RfD_{dermal} (mg/kg/day)	RfC (mg/m^3)	$HQ_{ingestion}$	HQ_{dermal}	$HQ_{particulate}$	HQ_{vapor}	HQ_{total}
Trichloroethylene	79-01-6	3.1E-03	NE	NE	3.0E-09	3.5E-06	1		5.0E-04	5.0E-04	2.0E-03	NE	NE	1.5E-06	1.8E-03	1.8E-03
Vinyl Chloride	75-01-4	6.4E-03	NE	NE	6.1E-09	1.7E-05	1		3.0E-03	3.0E-03	1.0E-01	NE	NE	6.1E-08	1.7E-04	1.7E-04
1,1,1,2-Tetrachloroethane	630-20-6	6.8E-03	NE	NE	6.5E-09	3.0E-06	1		3.0E-02	3.0E-02		NE	NE	NTV	NTV	
1,1,2,2-Tetrachloroethane	79-34-5															
1,2,4-Trichlorobenzene	120-82-1	3.9E-03	NE	NE	3.7E-09	3.1E-07	1	0.1	1.0E-02	1.0E-02	2.0E-03	NE	NE	1.9E-06	1.6E-04	1.6E-04
1,2,4-Trimethylbenzene	95-63-6	2.0E+00	NE	NE	1.9E-06	6.0E-04	1				7.0E-03	NE	NE	2.7E-04	8.6E-02	8.7E-02
1,2-Dichlorobenzene	95-50-1	6.0E-04	NE	NE	5.8E-10	1.2E-07	1	0.1	9.0E-02	9.0E-02	2.0E-01	NE	NE	2.9E-09	6.2E-07	6.3E-07
1,3,5-Trimethylbenzene	108-67-8	8.5E-01	NE	NE	8.1E-07	3.1E-04	1					NE	NE	NTV	NTV	
1,4-Dichlorobenzene	106-46-7	6.1E-04	NE	NE	5.8E-10	1.4E-07	1	0.1	7.0E-02	7.0E-02	8.0E-01	NE	NE	7.3E-10	1.8E-07	1.8E-07
Methyl Ethyl Ketone (2-Butanone)	78-93-3	1.6E-01	NE	NE	1.5E-07	4.1E-05	1		6.0E-01	6.0E-01	5.0E+00	NE	NE	3.1E-08	8.2E-06	8.2E-06
2-Hexanone	591-78-6	1.5E-03	NE	NE	1.4E-09	3.2E-07	1		5.0E-03	5.0E-03	3.0E-02	NE	NE	4.8E-08	1.1E-05	1.1E-05
Butylbenzene, sec-	135-98-8															
Methyl Isobutyl Ketone (4-methyl-2-pentanone)	108-10-1	4.2E-02	NE	NE	4.0E-08	1.1E-05	1		8.0E-02	8.0E-02	3.0E+00	NE	NE	1.3E-08	3.8E-06	3.8E-06
Acetone	67-64-1	5.3E-01	NE	NE	5.1E-07	1.3E-04	1		9.0E-01	9.0E-01	3.1E+01	NE	NE	1.6E-08	4.1E-06	4.1E-06
Benzene	71-43-2	6.8E-03	NE	NE	6.5E-09	4.7E-06	1		4.0E-03	4.0E-03	3.0E-02	NE	NE	2.2E-07	1.6E-04	1.6E-04
Bromomethane	74-83-9	2.6E-02	NE	NE	2.5E-08	5.1E-05	1		1.4E-03	1.4E-03	5.0E-03	NE	NE	5.0E-06	1.0E-02	1.0E-02
Carbon Disulfide	75-15-0															
Chloroform	67-66-3															
Chloromethane (Methyl Chloride)	74-87-3	8.5E-04	NE	NE	8.2E-10	2.0E-06	1				9.0E-02	NE	NE	9.1E-09	2.2E-05	2.2E-05
cis-1,2-Dichloroethylene	156-59-2	2.7E-02	NE	NE	2.6E-08	2.8E-05	1		2.0E-03	2.0E-03		NE	NE	NTV	NTV	
Cyclohexane	110-82-7															
Cymene (p-Isopropyltoluene) (surrogate = Cumene	99-87-6	2.7E-01	NE	NE	2.6E-07	7.6E-05	1		1.0E-01	1.0E-01	4.0E-01	NE	NE	6.5E-07	1.9E-04	1.9E-04
Ethylbenzene	100-41-4	1.0E+00	NE	NE	9.6E-07	4.3E-04	1		1.0E-01	1.0E-01	1.0E+00	NE	NE	9.6E-07	4.3E-04	4.3E-04
Isopropylbenzene	98-82-8	7.1E-01	NE	NE	6.8E-07	2.8E-04	1		1.0E-01	1.0E-01	4.0E-01	NE	NE	1.7E-06	6.9E-04	6.9E-04
Isopropyltoluene (surrogate = Cymene)	25155-15-1															
Methyl cyclohexane	108-87-2	2.2E+00	NE	NE	2.1E-06	5.1E-03	1				3.0E+00	NE	NE	7.0E-07	1.7E-03	1.7E-03
Methyl tert-Butyl Ether (MTBE)	1634-04-4	1.3E-02	NE	NE	1.2E-08	7.6E-06	1				3.0E+00	NE	NE	4.2E-09	2.5E-06	2.5E-06
Methylene Chloride	75-09-2	1.5E-02	NE	NE	1.4E-08	1.8E-05	1		6.0E-03	6.0E-03	6.0E-01	NE	NE	2.4E-08	3.0E-05	3.0E-05
Butylbenzene, n-	104-51-8	1.7E-01	NE	NE	1.6E-07	5.0E-05	1		5.0E-02	5.0E-02		NE	NE	NTV	NTV	
Propylbenzene	103-65-1															
Styrene	100-42-5	3.1E-02	NE	NE	3.0E-08	8.0E-06	1		2.0E-01	2.0E-01	1.0E+00	NE	NE	3.0E-08	8.0E-06	8.1E-06
Butylbenzene, tert-	98-06-6															
Tetrachloroethylene	127-18-4	4.5E-01	NE	NE	4.3E-07	4.7E-04	1		6.0E-03	6.0E-03	4.0E-02	NE	NE	1.1E-05	1.2E-02	1.2E-02
Toluene	108-88-3	1.4E-01	NE	NE	1.3E-07	8.0E-05	1		8.0E-02	8.0E-02	5.0E+00	NE	NE	2.7E-08	1.6E-05	1.6E-05
trans-1,2-Dichloroethylene	156-60-5	7.9E-04	NE	NE	7.6E-10	8.1E-07	1		2.0E-02	2.0E-02		NE	NE	NTV	NTV	
Trichlorofluoromethane (CFC-11)	75-69-4	5.1E-02	NE	NE	4.9E-08	1.2E-04	1		3.0E-01	3.0E-01	7.0E-01	NE	NE	7.0E-08	1.7E-04	1.7E-04
Trifluorotrichloroethane (Freon 113)	76-13-1	1.2E-03	NE	NE	1.2E-09	3.2E-06	1	1	3.0E+01	3.0E+01	3.0E+01	NE	NE	3.8E-11	1.1E-07	1.1E-07
Xylenes	1330-20-7	7.4E-03	NE	NE	7.1E-09	3.1E-06	1		2.0E-01	2.0E-01	1.0E-01	NE	NE	7.1E-08	3.1E-05	3.1E-05
2-Methylnaphthalene	91-57-6	3.1E+01	NE	NE	3.0E-05	1.3E-03	1	0.13	4.0E-03	4.0E-03		NE	NE	NTV	NTV	
Acenaphthene	83-32-9	2.4E+01	NE	NE	2.3E-05	4.1E-04	1	0.13	6.0E-02	6.0E-02		NE	NE	NTV	NTV	

Appendix H, Table H-13
Non-Cancer Risk Calculations
Soil - During Site Redevelopment -
RESIDENT (4 AGES) - CHILD (AGE 0-<2)

Human Health Risk Assessment
D.C. United Soccer Stadium
Washington, D.C.

Exposure Routes Evaluated		HI (Total)
Incidental Ingestion	No	
Dermal Contact	No	
Particulate Inhalation	Yes	1E+01
Ambient Vapor Inhalation	Yes	1E-01
		10

NV - not volatile
NTV - no toxicity value available
EC - exposure concentration
DAD - dermally absorbed dose
RfD - reference dose
ABS - absorption factor
HI - hazard index
RfC - reference concentration
EPC - exposure point concentration
COPC - chemical of potential concern

COPC	CASRN	EPC (mg/kg)	Intake Calculations				Absorption Factors		Non-Cancer Toxicity Values			HQ				
			$Intake_{ingestion}$ (mg/kg/day)	DAD_{dermal} (mg/kg/day)	$EC_{particulate}$ (mg/m^3)	EC_{vapor} (mg/m^3)	ABS_{ing} (unitless)	ABS_{d} (unitless)	RfD_{oral} (mg/kg/day)	RfD_{dermal} (mg/kg/day)	RfC (mg/m^3)	$HQ_{ingestion}$	HQ_{dermal}	$HQ_{particulate}$	HQ_{vapor}	HQ_{total}
Acenaphthylene	208-96-8	1.7E+01	NE	NE	1.6E-05	NV	1	0.13	6.0E-02	6.0E-02		NE	NE	NTV	NV	
Anthracene	120-12-7	5.2E+01	NE	NE	5.0E-05	2.4E-04	1	0.13	3.0E-01	3.0E-01		NE	NE	NTV	NTV	
Benz[a]anthracene	56-55-3	3.4E+00	NE	NE	3.2E-06	NV	1	0.13				NE	NE	NTV	NV	
Benzo[a]pyrene	50-32-8	2.8E+00	NE	NE	2.7E-06	NV	1	0.13				NE	NE	NTV	NV	
Benzo[b]fluoranthene	205-99-2	3.5E+00	NE	NE	3.4E-06	NV	1	0.13				NE	NE	NTV	NV	
Benzo(g,h,i)perylene	191-24-2	4.1E+01	NE	NE	3.9E-05	NV	1	0.13	3.0E-02	3.0E-02		NE	NE	NTV	NV	
Benzo[k]fluoranthene	207-08-9	2.3E+01	NE	NE	2.2E-05	NV	1	0.13				NE	NE	NTV	NV	
Chrysene	218-01-9	3.3E+00	NE	NE	3.2E-06	NV	1					NE	NE	NTV	NV	
Dibenz[a,h]anthracene	53-70-3	4.8E-01	NE	NE	4.6E-07	NV	1	0.13				NE	NE	NTV	NV	
Fluoranthene	206-44-0	1.8E+02	NE	NE	1.7E-04	NV	1	0.13	4.0E-02	4.0E-02		NE	NE	NTV	NV	
Fluorene	86-73-7	2.3E+01	NE	NE	2.2E-05	2.0E-04	1	0.13	4.0E-02	4.0E-02		NE	NE	NTV	NTV	
Indeno[1,2,3-cd]pyrene	193-39-5	1.8E+00	NE	NE	1.7E-06	NV	1	0.13				NE	NE	NTV	NV	
Naphthalene	91-20-3	5.8E-01	NE	NE	5.6E-07	3.0E-05	1	0.13	2.0E-02	2.0E-02	3.0E-03	NE	NE	1.9E-04	1.0E-02	1.0E-02
Phenanthrene	85-01-8	1.7E+02	NE	NE	1.6E-04	NV	1	0.13	3.0E-02	3.0E-02		NE	NE	NTV	NV	
Pyrene	129-00-0	1.7E+02	NE	NE	1.6E-04	1.7E-04	1	0.13	3.0E-02	3.0E-02		NE	NE	NTV	NTV	
Polychlorinated Biphenyls	1336-36-3	7.0E-01	NE	NE	6.7E-07	NV	1	0.14	2.0E-05	2.0E-05		NE	NE	NTV	NV	
Aluminum	7429-90-5															
Antimony	7440-36-0	8.9E+00	NE	NE	8.5E-06	NV	1		4.0E-04	6.0E-05		NE	NE	NTV	NV	
Arsenic	7440-38-2	9.4E+00	NE	NE	9.0E-06	NV	0.6	0.03	3.0E-04	3.0E-04	1.5E-05	NE	NE	6.0E-01	NV	6.0E-01
Barium	7440-39-3	1.6E+02	NE	NE	1.5E-04	NV	1		2.0E-01	1.4E-02	5.0E-04	NE	NE	3.0E-01	NV	3.0E-01
Beryllium	7440-41-7	4.8E-01	NE	NE	4.6E-07	NV	1		2.0E-03	1.4E-05	2.0E-05	NE	NE	2.3E-02	NV	2.3E-02
Cadmium	7440-43-9	2.9E+00	NE	NE	2.8E-06	NV	1	0.001	1.0E-03	2.5E-05	2.0E-05	NE	NE	1.4E-01	NV	1.4E-01
Calcium	7440-70-2	7.5E+04	NE	NE	7.2E-02	NV	1					NE	NE	NTV	NV	
Chromium, Total	7440-47-3	4.0E+02	NE	NE	3.8E-04	NV	1		1.5E+00	2.0E-02		NE	NE	NTV	NV	
Cobalt	7440-48-4	1.0E+01	NE	NE	9.8E-06	NV	1		3.0E-04	3.0E-04	6.0E-06	NE	NE	1.6E+00	NV	1.6E+00
Copper	7440-50-8	3.6E+02	NE	NE	3.5E-04	NV	1		4.0E-02	4.0E-02		NE	NE	NTV	NV	
Iron	7439-89-6	3.1E+04	NE	NE	3.0E-02	NV	1		7.0E-01	7.0E-01		NE	NE	NTV	NV	
Lead	7439-92-1	6.1E+02	NE	NE	5.9E-04	NV	1					NE	NE	NTV	NV	
Magnesium	7439-95-4	2.0E+04	NE	NE	1.9E-02	NV	1					NE	NE	NTV	NV	
Manganese	7439-96-5	3.6E+02	NE	NE	3.5E-04	NV	1		1.4E-01	5.6E-03	5.0E-05	NE	NE	6.9E+00	NV	6.9E+00
Mercury	7439-97-6	1.5E+00	NE	NE	1.4E-06	NV	1		3.0E-04	2.1E-05	3.0E-04	NE	NE	4.8E-03	NV	4.8E-03
Nickel	7440-02-0	4.1E+01	NE	NE	3.9E-05	NV	1		2.0E-02	8.0E-04	9.0E-05	NE	NE	4.4E-01	NV	4.4E-01
Potassium	7440-09-7	5.1E+03	NE	NE	4.9E-03	NV	1					NE	NE	NTV	NV	
Selenium	7782-49-2	6.2E+00	NE	NE	5.9E-06	NV	1		5.0E-03	5.0E-03	2.0E-02	NE	NE	3.0E-04	NV	3.0E-04
Silver	7440-22-4	3.9E+00	NE	NE	3.7E-06	NV	1		5.0E-03	2.0E-04		NE	NE	NTV	NV	
Sodium	7440-23-5	1.4E+04	NE	NE	1.3E-02	NV	1					NE	NE	NTV	NV	
Thallium	7440-28-0	1.2E+00	NE	NE	1.2E-06	NV	1					NE	NE	NTV	NV	
Vanadium	7440-62-2	3.5E+01	NE	NE	3.4E-05	NV	1		5.0E-03	1.3E-04	1.0E-04	NE	NE	3.4E-01	NV	3.4E-01
Zinc	7440-66-6	7.2E+02	NE	NE	6.9E-04	NV	1		3.0E-01	3.0E-01		NE	NE	NTV	NV	

Appendix H, Table H-14
Intake and Risk Equations

Human Health Risk Assessment
D.C. United Soccer Stadium
Washington, D.C.

Cancer Risk from Ingestion

$$ELCR = Intake_{ing} * CSF$$

$$Intake_{ing\ (age\ group\ x)} = \frac{[EPC]_{soil} * [IFSadj - OR - IFSM] * ABS_{ING} * FI * EF * C1}{AT_{lifetime}}$$

Cancer Risk from Dermal Absorption

$$ELCR = DAD * CSF$$

$$DAD_{derm(age\ group\ x)} = \frac{DA_{Event} * SA * EV * EF}{AT_{lifetime}}$$

$$DA_{Event} = [EPC]_{soil} * [DFSadj - OR - DFSM] * C1$$

Cancer Risk from Inhalation

$$ELCR_{inh} = EC_{can} * IUR$$

$$EC_{can\ (age\ group\ x)} = \frac{[EPC]_{PART} * ET_{Part} * EF * ED\ ---\ OR ---\ [EPC]_{VAPOR} * ET_{Vap} * EF * ED}{24 * AT_{lifetime}}$$

For mutagens, INHM is used in place of $ET_X * EF * ED$

Noncancer Risk from Ingestion

$$HQ = \frac{Intake_{ing}}{RfD}$$

$$Intake_{ing} = \frac{[EPC]_{soil} * IR * ABS_{ing} * FI * EF * ED * C1}{BW * AT}$$

Noncancer Risk from Dermal Absorption

$$HQ = \frac{DAD}{RfD}$$

$$DAD_{derm} = \frac{DA_{Event} * SA * EV * EF * ED}{BW * AT}$$

$$DA_{Event} = [EPC]_{soil} * ABS_d * AF * C1$$

Noncancer Risk from Inhalation

$$HQ = \frac{EC_{nc}}{RfC}$$

$$EC_{nc} = \frac{[EPC]_{PART} * ET_{Part} * EF * ED * C2\ ---\ OR ---\ [EPC]_{VAPOR} * ET_{Vap} * EF * ED * C2}{24 * AT}$$

Parameter	Value - Cancer	Value - Non-Cancer	Units
CSF	Chemical specific	--	$(mg/kg\text{-}day)^{-1}$
IUR	Chemical specific	--	$(ug/m^3)^{-1}$
Intake	Age/chemical specific	--	mg/kg-day
EC_{can}	Age/chemical specific	--	(ug/m^3)
ELCR	Age/chemical specific	--	unitless
RfD	--	Chemical specific	mg/kg-day
RfC	--	Chemical specific	(mg/m^3)
DAD	Age/chemical specific	Age/chemical specific	mg/kg-day
DA_{Event}	Age/chemical specific	Age/chemical specific	mg/cm^2-event
EC_{nc}	--	Age/chemical specific	mg/m^3
HQ	--	Age/chemical specific	unitless
$[EPC]_{soil}$	Chemical specific	Chemical specific	mg/kg
$[EPC]_{PART}$	Appendix H, TABLE H-16	Appendix H, TABLE H-16	ug/m^3
$[EPC]_{VAPOR}$	Appendix H, TABLE H-17	Appendix H, TABLE H-17	ug/m^3
ABS_{ing}	Chemical specific	Chemical specific	unitless
ABS_d	Chemical specific	Chemical specific	unitless
BW	15	15	kg
EF	350	350	day/year
ED	1	1	year
AT	--	365	day
ATlifetime	25550	--	day
IFSadj	NA	--	mg-yr/kg-day
IFSM		--	mg-yr/kg-day
IR	200	200	mg/day
FI	1	1	unitless
C1	0.000001	0.000001	kg/mg
SA	2690	2690	cm2
AF	2690	0.2	mg/cm2
EV	1	1	event/day
DFSadj	NA	--	mg-yr/kg-day
DFSM		--	mg-yr/kg-day
ETPart	24	24	hours/day
C2	0.001	0.001	mg/ug
ETVap	24	24	ug/mg
INHM		--	unitless

Appendix H, Table H-15
Exposure Factors

Human Health Risk Assessment
D.C. United Soccer Stadium
Washington, D.C.

PLACE "X" IN THE APPROPRIATE YELLOW SHADED CELLS FOR THE APPROPRIATE RECEPTOR AND BASIS

SCENARIO USED TO CALCULATE RISKS			**X**	**RESIDENT (4 AGES)**
BASIS FOR CANCER CALCULATIONS			**X**	
BASIS FOR NON-CANCER CALCULATIONS			**X**	
RECEPTOR			**CHILD (AGE 0-<2)**	
Standard Parameters				
Body Weight	BW	kg	15	EPA, 2014
Exposure Frequency	EF	day/year	350	EPA, 2014
Exposure Duration	ED	year	1	Ages 11 - <16
Non–carcinogenic Averaging Time	AT	day	365	Exposure duration expressed in days
Carcinogenic Averaging Time	$AT_{lifetime}$	day	25550	70 year lifetime
Age-Dependtant Adjustment Factor	ADAF	unitless	10	USEPA, 2008
Incidental Ingestion of Soil				
Soil Ingestion Rate	IR	mg/day	200	EPA, 2014
Fraction Ingested	FI	unitless	1.0	Site-specific [6]
Age-Adjusted Soil Ingestion Factor	IFSadj	mg-yr/kg-day	NA	
Age-Adjusted Soil Ingestion Factor-Mutagenic	IFSM	mg-yr/kg-day		
Dermal Exposure with Soil				
Exposed Skin Surface Area	SA	cm^2	2690	EPA, 2014
Soil Adherence Factor	AF	mg/cm^2	0.2	EPA, 2014
Fraction Dermal	EV	event/day	1.0	EPA, 2014
Age-Adjusted Dermal Contact Factor	DFSadj	mg-yr/kg-day	NA	
Age-Adjusted Dermal Contact Factor-Mutagenic	DFSM	mg-yr/kg-day		
Particulate Inhalation				
Exposure Time	ET_{Part}	hours/day	24	Asumption
Vapor Inhalation				
Exposure Time	ET_{Vap}	hours/day	24	Assumption
Age-Adjusted Inhalation Factor-Mutagenic	INHM	unitless		

Appendix H, Table H-16
Particulate to Outdoor Air EPC Calculations
Soil - During Site Redevelopment -
RESIDENT (4 AGES) - CHILD (AGE 0-<2)

Human Health Risk Assessment
D.C. United Soccer Stadium
Washington, D.C.

EQUATIONS:

$$EPC_{[PARTICULATE]} = EPC_{[SOIL]} \times PARTICULATE_{[AIR]} \times 1E\text{-}06\ [kg/mg]$$

where:

$$PARTICULATE_{[AIR]} = (1/PEF * 1E+09\ ug/kg) \text{ or Measured/Modelled}$$

and:

$$PEF\ (m^3/kg) = Q/C \times [(3600\ s/hr) / ((0.036 \times (1-V) \times (U_m/U_t)^3 \times F(x))]$$

PARAMETER/DEFINITION	UNITS	DEFAULT	Source
$PARTICULATE_{[Air]}$ / Particulate concentration in air	ug/m^3	1000	Calculated or measured
Measured or modeled $PARTICULATE_{[AIR]}$	ug/m^3		Measured value
PEF / Particulate emission factor	m^3/kg	1.00E+06	
Q/C / inverse of the mean concentration at the center of a 0.5-acre-square source	g/m^2-s per kg/m^3	35.14	USEPA, 2014 [a]
V / Fraction of vegetative cover	unitless	0	USEPA, 2014
U_m / mean annual windspeed	m/s	2.82	USEPA, 2014
U_t / equivalent threshold value of wind speed at 7 m	m/s	11.32	USEPA, 2014
F(x) / function dependant on U_m/U_t derived using Cowherd et al. (1985)	unitless	2.25E-04	USEPA, 2014

USEPA, 2014. Regional Screening Levels.

[a] Climactic zone: Phoenix Arizona

[a] Area of Source:

CASRN	COPC	EPC Soil (mg/kg)	EPC Particulate (ug/m^3)
79-01-6	Trichloroethylene	0.0031	3.1E-06
75-01-4	Vinyl Chloride	0.0064	6.4E-06
630-20-6	1,1,1,2-Tetrachloroethane	0.0068	6.8E-06
79-34-5	1,1,2,2-Tetrachloroethane		
120-82-1	1,2,4-Trichlorobenzene	0.0039	3.9E-06
95-63-6	1,2,4-Trimethylbenzene	1.98	2.0E-03
95-50-1	1,2-Dichlorobenzene	0.0006	6.0E-07
108-67-8	1,3,5-Trimethylbenzene	0.847	8.5E-04
106-46-7	1,4-Dichlorobenzene	0.00061	6.1E-07
78-93-3	Methyl Ethyl Ketone (2-Butanone)	0.16	1.6E-04
591-78-6	2-Hexanone	0.0015	1.5E-06
135-98-8	Butylbenzene, sec-		
108-10-1	Methyl Isobutyl Ketone (4-methyl-2-pentanone)	0.042	4.2E-05
67-64-1	Acetone	0.53	5.3E-04
71-43-2	Benzene	0.0068	6.8E-06
74-83-9	Bromomethane	0.026	2.6E-05
75-15-0	Carbon Disulfide		
67-66-3	Chloroform		
74-87-3	Chloromethane (Methyl Chloride)	0.00085	8.5E-07
156-59-2	cis-1,2-Dichloroethylene	0.027	2.7E-05
110-82-7	Cyclohexane		
99-87-6	Cymene (p-Isopropyltoluene) (surrogate = Cumene)	0.27	2.7E-04
100-41-4	Ethylbenzene	1	1.0E-03
98-82-8	Isopropylbenzene	0.71	7.1E-04
25155-15-1	Isopropyltoluene (surrogate = Cymene)		
108-87-2	Methyl cyclohexane	2.2	2.2E-03
1634-04-4	Methyl tert-Butyl Ether (MTBE)	0.013	1.3E-05
75-09-2	Methylene Chloride	0.0148	1.5E-05
104-51-8	Butylbenzene, n-	0.169	1.7E-04
103-65-1	Propylbenzene		
100-42-5	Styrene	0.031	3.1E-05
98-06-6	Butylbenzene, tert-		
127-18-4	Tetrachloroethylene	0.446	4.5E-04
108-88-3	Toluene	0.14	1.4E-04
156-60-5	trans-1,2-Dichloroethylene	0.00079	7.9E-07
75-69-4	Trichlorofluoromethane (CFC-11)	0.051	5.1E-05
76-13-1	Trifluorotrichloroethane (Freon 113)	0.0012	1.2E-06
1330-20-7	Xylenes	0.00738	7.4E-06
91-57-6	2-Methylnaphthalene	31	3.1E-02
83-32-9	Acenaphthene	24	2.4E-02
208-96-8	Acenaphthylene	17	1.7E-02
120-12-7	Anthracene	52	5.2E-02
56-55-3	Benz[a]anthracene	3.35	3.4E-03
50-32-8	Benzo[a]pyrene	2.83	2.8E-03
205-99-2	Benzo[b]fluoranthene	3.53	3.5E-03
191-24-2	Benzo(g,h,i)perylene	41	4.1E-02
207-08-9	Benzo[k]fluoranthene	23	2.3E-02
218-01-9	Chrysene	3.32	3.3E-03
53-70-3	Dibenz[a,h]anthracene	0.483	4.8E-04
206-44-0	Fluoranthene	180	1.8E-01
86-73-7	Fluorene	23	2.3E-02
193-39-5	Indeno[1,2,3-cd]pyrene	1.79	1.8E-03
91-20-3	Naphthalene	0.582	5.8E-04
85-01-8	Phenanthrene	170	1.7E-01
129-00-0	Pyrene	170	1.7E-01
1336-36-3	Polychlorinated Biphenyls	0.696	7.0E-04
7429-90-5	Aluminum		
7440-36-0	Antimony	8.9	8.9E-03
7440-38-2	Arsenic	9.4	9.4E-03
7440-39-3	Barium	156	1.6E-01
7440-41-7	Beryllium	0.48	4.8E-04
7440-43-9	Cadmium	2.9	2.9E-03
7440-70-2	Calcium	75000	7.5E+01
7440-47-3	Chromium, Total	400	4.0E-01
7440-48-4	Cobalt	10.2	1.0E-02
7440-50-8	Copper	363	3.6E-01
7439-89-6	Iron	31000	3.1E+01
7439-92-1	Lead	612	6.1E-01
7439-95-4	Magnesium	20000	2.0E+01
7439-96-5	Manganese	360	3.6E-01
7439-97-6	Mercury	1.5	1.5E-03
7440-02-0	Nickel	41	4.1E-02
7440-09-7	Potassium	5100	5.1E+00
7782-49-2	Selenium	6.2	6.2E-03
7440-22-4	Silver	3.9	3.9E-03
7440-23-5	Sodium	14000	1.4E+01
7440-28-0	Thallium	1.2	1.2E-03
7440-62-2	Vanadium	35	3.5E-02
7440-66-6	Zinc	720	7.2E-01

Appendix H, Table H-17
Vapor to Outdoor Air EPC Calculations
Soil - During Site Redevelopment -
RESIDENT (4 AGES) - CHILD (AGE 0-<2)

Human Health Risk Assessment
D.C. United Soccer Stadium
Washington, D.C.

EQUATIONS:

$$EPC_{[VAPOR]} = EPC_{[SOIL]} \times 1/VF \times 1000\ ug/mg$$

where:

$$VF\ (m^3/kg) = Q/C \times (3.14 \times D_A \times T)^{1/2} \times 10^{-4}(m^2/cm^2) / (2 \times P_b \times D_A)$$

and:

$$DA = [(O_a^{10/3} D_i H' + O_w^{10/3} D_w)/n^2] / P_b K_d + O_w + O_a H'$$

PARAMETER/DEFINITION	UNITS	DEFAULT	Source
VF / volatilization factor	m^3/kg	Calculated	
D_A / apparent diffusivity	cm^2/s	Calculated	
Q/C / inverse of the mean concentration at the center of a 0.5-acre-square source	g/m^2-s per kg/m^3	35.14	USEPA, 2014 [a]
T / exposure interval	s	3.2E+07	RESIDENT (4 AGES)
Π_b / dry soil bulk density	g/cm^3	1.62	USEPA, 2014
O_a / air-filled soil porosity	L_{air}/L_{soil}	0.314	USEPA, 2014
n / total soil porosity	L_{pore}/L_{soil}	0.39	USEPA, 2014
O_w / water-filled soil porosity	L_{water}/L_{soil}	0.076	USEPA, 2014
Ψ_s / soil particle density	g/cm^3	2.65	USEPA, 1996
D_i / diffusivity in air	cm^2/s	chemical-specific	
H' / Henry's Law constant	dimensionless	chemical-specific	
D_w / diffusivity in water	cm^2/s	chemical-specific	
K_d / soil-water partition coefficient (Koc x foc) organics	cm^3/g	chemical-specific	
K_{oc} / soil organic carbon partition coefficient	cm^3/g	chemical-specific	
f_{oc} / fraction organic carbon in soil	g/g	0.006	Default

USEPA, 2014. Regional Screening Levels.

[a] Climactic zone: Phoenix Arizona [a] Area of Source: Specific to size of Exposure Area

CASRN	COPC	Volatile (Y/N)	D_i (cm^2/s)	H' (unitless)	D_w (cm^2/s)	K_d (cm^3/g)	K_{oc} (cm^3/g)	D_A (cm^2/s)	VF (m^3/kg)	EPC Soil (mg/kg)	EPC Vapor (ug/m^3)
79-01-6	Trichloroethylene	Y	6.87E-02	4.03E-01	1.02E-05	3.64E-01	6.07E+01	4.8E-03	840	0.0031	3.7E-03
75-01-4	Vinyl Chloride	Y	1.07E-01	1.14E+00	1.20E-05	1.30E-01	2.17E+01	2.6E-02	361	0.0064	1.8E-02
630-20-6	1,1,1,2-Tetrachloroethane	Y	4.82E-02	1.02E-01	9.10E-06	5.16E-01	8.60E+01	7.2E-04	2172	0.0068	3.1E-03
120-82-1	1,2,4-Trichlorobenzene	Y	3.96E-02	5.81E-02	8.40E-06	8.14E+00	1.36E+03	2.4E-05	11918	0.0039	3.3E-04
95-63-6	1,2,4-Trimethylbenzene	Y	6.07E-02	2.52E-01	7.92E-06	3.69E+00	6.14E+02	3.5E-04	3140	1.98	6.3E-01
95-50-1	1,2-Dichlorobenzene	Y	5.62E-02	7.85E-02	8.92E-06	2.30E+00	3.83E+02	1.6E-04	4618	0.0006	1.3E-04
108-67-8	1,3,5-Trimethylbenzene	Y	6.02E-02	3.59E-01	7.84E-06	3.61E+00	6.02E+02	4.9E-04	2623	0.847	3.2E-01
106-46-7	1,4-Dichlorobenzene	Y	5.50E-02	9.85E-02	8.68E-06	2.25E+00	3.75E+02	2.0E-04	4127	0.00061	1.5E-04
78-93-3	Methyl Ethyl Ketone (2-Butanone)	Y	9.14E-02	2.33E-03	1.02E-05	2.71E-02	4.51E+00	2.4E-04	3733	0.16	4.3E-02
591-78-6	2-Hexanone	Y	7.04E-02	3.81E-03	8.44E-06	8.99E-02	1.50E+01	1.7E-04	4521	0.0015	3.3E-04
108-10-1	Methyl Isobutyl Ketone (4-methyl-2-pentanone)	Y	6.98E-02	5.64E-03	8.35E-06	7.56E-02	1.26E+01	2.7E-04	3537	0.042	1.2E-02
67-64-1	Acetone	Y	1.06E-01	1.43E-03	1.15E-05	1.42E-02	2.36E+00	2.1E-04	4016	0.53	1.3E-01
71-43-2	Benzene	Y	8.95E-02	2.27E-01	1.03E-05	8.75E-01	1.46E+02	1.8E-03	1376	0.0068	4.9E-03
74-83-9	Bromomethane	Y	1.00E-01	3.00E-01	1.35E-05	7.93E-02	1.32E+01	1.4E-02	494	0.026	5.3E-02
74-87-3	Chloromethane (Methyl Chloride)	Y	1.24E-01	3.61E-01	1.36E-05	7.92E-02	1.32E+01	1.9E-02	418	0.00085	2.0E-03
156-59-2	cis-1,2-Dichloroethylene	Y	8.84E-02	1.67E-01	1.13E-05	2.38E-01	3.96E+01	4.0E-03	925	0.027	2.9E-02
99-87-6	Cymene (p-Isopropyltoluene) (surrogate = Cum	Y	5.27E-02	4.50E-01	7.32E-06	6.72E+00	1.12E+03	3.0E-04	3394	0.27	8.0E-02
100-41-4	Ethylbenzene	Y	6.85E-02	3.22E-01	8.46E-06	2.68E+00	4.46E+02	6.8E-04	2244	1	4.5E-01
98-82-8	Isopropylbenzene	Y	6.03E-02	4.70E-01	7.86E-06	4.19E+00	6.98E+02	5.6E-04	2466	0.71	2.9E-01
108-87-2	Methyl cyclohexane	Y	8.00E-02	6.13E+00	9.11E-06	8.76E-01	1.46E+02	2.0E-02	414	2.2	5.3E+00
1634-04-4	Methyl tert-Butyl Ether (MTBE)	Y	7.53E-02	2.40E-02	8.59E-06	6.94E-02	1.16E+01	1.3E-03	1633	0.013	8.0E-03
75-09-2	Methylene Chloride	Y	9.99E-02	1.33E-01	1.25E-05	1.30E-01	2.17E+01	5.6E-03	781	0.0148	1.9E-02
104-51-8	Butylbenzene, n-	Y	5.28E-02	6.50E-01	7.33E-06	8.89E+00	1.48E+03	3.2E-04	3245	0.169	5.2E-02
100-42-5	Styrene	Y	7.11E-02	1.12E-01	8.78E-06	2.68E+00	4.46E+02	2.5E-04	3699	0.031	8.4E-03
127-18-4	Tetrachloroethylene	Y	5.05E-02	7.24E-01	9.46E-06	5.70E-01	9.49E+01	4.1E-03	909	0.446	4.9E-01
108-88-3	Toluene	Y	7.78E-02	2.71E-01	9.20E-06	1.40E+00	2.34E+02	1.2E-03	1684	0.14	8.3E-02
156-60-5	trans-1,2-Dichloroethylene	Y	8.76E-02	1.67E-01	1.12E-05	2.38E-01	3.96E+01	3.9E-03	930	0.00079	8.5E-04
75-69-4	Trichlorofluoromethane (CFC-11)	Y	6.54E-02	3.97E+00	1.00E-05	2.63E-01	4.39E+01	2.1E-02	407	0.051	1.3E-01
76-13-1	Trifluorotrichloroethane (Freon 113)	Y	7.80E-02	2.20E+01	8.20E-06	1.20E+00	2.00E+02	2.7E-02	358	0.0012	3.4E-03
1330-20-7	Xylenes	Y	8.47E-02	2.12E-01	9.90E-06	2.30E+00	3.83E+02	6.4E-04	2302	0.00738	3.2E-03
91-57-6	2-Methylnaphthalene	Y	5.24E-02	2.12E-02	7.78E-06	1.49E+01	2.48E+03	6.4E-06	23139	31	1.3E+00
83-32-9	Acenaphthene	Y	5.06E-02	7.52E-03	8.33E-06	3.02E+01	5.03E+03	1.1E-06	56227	24	4.3E-01
208-96-8	Acenaphthylene	N	5.06E-02	7.52E-03	8.33E-06	3.02E+01	5.03E+03				NV
120-12-7	Anthracene	Y	3.90E-02	2.27E-03	7.85E-06	9.82E+01	1.64E+04	7.7E-08	210105	52	2.5E-01
56-55-3	Benz[a]anthracene	N	5.09E-02	4.91E-04	5.94E-06	1.06E+03	1.77E+05				NV
50-32-8	Benzo[a]pyrene	N	4.76E-02	1.87E-05	5.56E-06	3.52E+03	5.87E+05				NV
205-99-2	Benzo[b]fluoranthene	N	4.76E-02	2.69E-05	5.56E-06	3.60E+03	5.99E+05				NV
191-24-2	Benzo(g,h,i)perylene	N	5.28E-02	9.65E-08	6.17E-06	1.35E+00	2.25E+02				NV
207-08-9	Benzo[k]fluoranthene	N	4.76E-02	2.39E-05	5.56E-06	3.52E+03	5.87E+05				NV
218-01-9	Chrysene	N	2.61E-02	2.14E-04	6.75E-06	1.08E+03	1.81E+05				NV
53-70-3	Dibenz[a,h]anthracene	N	4.46E-02	5.76E-06	5.21E-06	1.15E+04	1.91E+06				NV
206-44-0	Fluoranthene	N	2.76E-02	3.62E-04	7.18E-06	3.33E+02	5.55E+04				NV
86-73-7	Fluorene	Y	4.40E-02	3.93E-03	7.89E-06	5.50E+01	9.16E+03	2.7E-07	112561	23	2.0E-01
193-39-5	Indeno[1,2,3-cd]pyrene	N	4.48E-02	6.56E-05	5.23E-06	2.08E+04	3.47E+06				NV
91-20-3	Naphthalene	Y	6.05E-02	1.80E-02	8.38E-06	9.26E+00	1.54E+03	1.0E-05	18468	0.582	3.2E-02
85-01-8	Phenanthrene	N	2.08E-02	5.81E-12	5.19E-06	5.56E+01	9.27E+03				NV
129-00-0	Pyrene	Y	2.78E-02	4.87E-04	7.25E-06	3.26E+02	5.43E+04	3.6E-09	978141	170	1.7E-01
1336-36-3	Polychlorinated Biphenyls	N	4.32E-02	7.77E-03	5.04E-06	4.69E+02	7.81E+04				NV

Appendix H, Table H-17
Vapor to Outdoor Air EPC Calculations
Soil - During Site Redevelopment -
RESIDENT (4 AGES) - CHILD (AGE 0-<2)

Human Health Risk Assessment
D.C. United Soccer Stadium
Washington, D.C.

EQUATIONS:

$$EPC_{[VAPOR]} = EPC_{[SOIL]} \times 1/VF \times 1000\ ug/mg$$

where:

$$VF\ (m^3/kg) = Q/C \times (3.14 \times D_A \times T)^{1/2} \times 10^{-4}(m^2/cm^2) / (2 \times P_b \times D_A)$$

and:

$$DA = [(O_a^{10/3} D_i H' + O_w^{10/3} D_w)/n^2] / P_b K_d + O_w + O_a H'$$

PARAMETER/DEFINITION	UNITS	DEFAULT	Source
VF / volatilization factor	m^3/kg	Calculated	
D_A / apparent diffusivity	cm^2/s	Calculated	
Q/C / inverse of the mean concentration at the center of a 0.5-acre-square source	g/m^2-s per kg/m^3	35.14	USEPA, 2014 [a]
T / exposure interval	s	3.2E+07	RESIDENT (4 AGES)
Π_b / dry soil bulk density	g/cm^3	1.62	USEPA, 2014
O_a / air-filled soil porosity	L_{air}/L_{soil}	0.314	USEPA, 2014
n / total soil porosity	L_{pore}/L_{soil}	0.39	USEPA, 2014
O_w / water-filled soil porosity	L_{water}/L_{soil}	0.076	USEPA, 2014
Ψ_s / soil particle density	g/cm^3	2.65	USEPA, 1996
D_i / diffusivity in air	cm^2/s	chemical-specific	
H' / Henry's Law constant	dimensionless	chemical-specific	
D_w / diffusivity in water	cm^2/s	chemical-specific	
K_d / soil-water partition coefficient (Koc x foc) organics	cm^3/g	chemical-specific	
K_{oc} / soil organic carbon partition coefficient	cm^3/g	chemical-specific	
f_{oc} / fraction organic carbon in soil	g/g	0.006	Default

USEPA, 2014. Regional Screening Levels.
[a] Climactic zone: Phoenix Arizona [a] Area of Source: Specific to size of Exposure Area

CASRN	COPC	Volatile (Y/N)	D_i (cm^2/s)	H' (unitless)	D_w (cm^2/s)	K_d (cm^3/g)	K_{oc} (cm^3/g)	D_A (cm^2/s)	VF (m^3/kg)	EPC Soil (mg/kg)	EPC Vapor (ug/m^3)
7440-36-0	Antimony	N									NV
7440-38-2	Arsenic	N									NV
7440-39-3	Barium	N									NV
7440-41-7	Beryllium	N									NV
7440-43-9	Cadmium	N									NV
7440-70-2	Calcium	N									NV
7440-47-3	Chromium, Total	N									NV
7440-48-4	Cobalt	N									NV
7440-50-8	Copper	N									NV
7439-89-6	Iron	N									NV
7439-92-1	Lead	N									NV
7439-95-4	Magnesium	N									NV
7439-96-5	Manganese	N									NV
7439-97-6	Mercury	N	3.07E-02	4.67E-01	6.30E-06						NV
7440-02-0	Nickel	N									NV
7440-09-7	Potassium	N									NV
7782-49-2	Selenium	N									NV
7440-22-4	Silver	N									NV
7440-23-5	Sodium	N									NV
7440-28-0	Thallium	N									NV
7440-62-2	Vanadium	N									NV
7440-66-6	Zinc	N									NV

Appendix H, Table H-18
Cancer Risk Calculations
Soil - After Site Redevelopment -
RESIDENT (4 AGES) - TOTAL RESIDENT (AGES birth - 26)

Human Health Risk Assessment
D.C. United Soccer Stadium
Washington, D.C.

Exposure Routes Evaluated		ELCR (Total)
Incidental Ingestion	No	
Dermal Contact	No	
Particulate Inhalation	Yes	9E-11
Ambient Vapor Inhalation	Yes	1E-06
		1E-06

NC - not carcinogenic by this exposure route
NTV - no toxicity value available
NV - not volatile
DAD - dermally absorbed dose
EC - exposure concentration
ABS - absorption factor
CSF - cancer slope factor
UR - cancer unit risk
ELCR - excess lifetime cancer risk
EPC - exposure point concentration
COPC - chemical of potential concern

COPC	CASRN	EPC (mg/kg)	Intake Calculations				Absorption Factors		Mutagenic	Cancer Toxicity Values			ELCR				
			$Intake_{ingestion}$ (mg/kg/day)	DAD_{dermal} (mg/kg/day)	$EC_{particulate}$ (ug/m^3)	EC_{vapor} (ug/m^3)	ABS_{ing} (unitless)	ABS_d (unitless)	MOA?	CSF_{oral} $(mg/kg/day)^{-1}$	CSF_{dermal} $(mg/kg/day)^{-1}$	IUR $(ug/m^3)^{-1}$	$ELCR_{ingestion}$	$ELCR_{dermal}$	$ELCR_{particulate}$	$ELCR_{vapor}$	$ELCR_{total}$
2-Methylnaphthalene	91-57-6	3.1E+01	NE	NE	NC	NC	NC	NC	N				NE	NE			
Acenaphthene	83-32-9	1.1E+00	NE	NE	NC	NC	NC	NC	N				NE	NE			
Acenaphthylene	208-96-8	6.9E-01	NE	NE	NC	NV	NC	NC	N				NE	NE		NV	
Acetone	67-64-1	1.2E-01	NE	NE	NC	NC	NC	NC	N				NE	NE			
Anthracene	120-12-7	3.1E-01	NE	NE	NC	NC	1	0.13	N				NE	NE			
Benz[a]anthracene	56-55-3	3.3E-01	NE	NE	6.7E-08	NV	1	0.13	Y	7.3E-01	7.3E-01	1.1E-04	NE	NE	7.4E-12	NV	7.4E-12
Benzo[a]pyrene	50-32-8	1.8E-01	NE	NE	3.7E-08	NV	1	0.13	Y	7.3E+00	7.3E+00	1.1E-03	NE	NE	4.0E-11	NV	4.0E-11
Benzo[b]fluoranthene	205-99-2	2.8E-01	NE	NE	5.7E-08	NV	1	0.13	Y	7.3E-01	7.3E-01	1.1E-04	NE	NE	6.3E-12	NV	6.3E-12
Benzo(g,h,i)perylene	191-24-2	7.4E-02	NE	NE	NC	NV	NC	NC	N				NE	NE		NV	
Benzo[k]fluoranthene	207-08-9	1.1E-01	NE	NE	2.2E-08	NV	1	0.13	Y	7.3E-02	7.3E-02	1.1E-04	NE	NE	2.5E-12	NV	2.5E-12
Bromomethane	74-83-9	2.4E-02	NE	NE	NC	NC	1		N				NE	NE			
Chrysene	218-01-9	3.2E-01	NE	NE	6.5E-08	NV	1	0.13	Y	7.3E-03	3.4E+00	1.1E-05	NE	NE	7.2E-13	NV	7.2E-13
Ethylbenzene	100-41-4	1.0E+00	NE	NE	8.2E-08	3.1E-02	NC	NC	N			2.5E-06	NE	NE	2.1E-13	7.6E-08	7.6E-08
Fluoranthene	206-44-0	7.8E-01	NE	NE	NC	NV	NC	NC	N				NE	NE		NV	
Fluorene	86-73-7	4.0E+00	NE	NE	NC	NC	NC	NC	N				NE	NE			
Indeno[1,2,3-cd]pyrene	193-39-5	8.8E-02	NE	NE	1.8E-08	NV	1	0.13	Y	7.3E-01	7.3E-01	1.1E-04	NE	NE	2.0E-12	NV	2.0E-12
Isopropylbenzene	98-82-8	7.1E-01	NE	NE	NC	NC	NC	NC	N				NE	NE			
Methyl cyclohexane	108-87-2	2.2E+00	NE	NE	NC	NC	NC	NC	N				NE	NE			
Naphthalene	91-20-3	1.0E+01	NE	NE	8.2E-07	3.7E-02	NC	NC	N			3.4E-05	NE	NE	2.8E-11	1.3E-06	1.3E-06
Phenanthrene	85-01-8	7.0E+00	NE	NE	NC	NV	NC	NC	N				NE	NE		NV	
Pyrene	129-00-0	6.1E-01	NE	NE	NC	NC	NC	NC	N				NE	NE			
Tetrachloroethylene	127-18-4	3.6E+00	NE	NE	3.0E-07	2.7E-01	1		N	2.1E-03	2.1E-03	2.6E-07	NE	NE	7.7E-14	7.1E-08	7.1E-08
Toluene	108-88-3	1.4E-01	NE	NE	NC	NC	NC	NC	N				NE	NE			
Xylenes	1330-20-7	5.1E+00	NE	NE	NC	NC	NC	NC	N				NE	NE			

Appendix H, Table H-19
Non-Cancer Risk Calculations
Soil - After Site Redevelopment -
RESIDENT (4 AGES) - CHILD (AGE 0-<2)

Human Health Risk Assessment
D.C. United Soccer Stadium
Washington, D.C.

Exposure Routes Evaluated		HI (Total)
Incidental Ingestion	No	
Dermal Contact	No	
Particulate Inhalation	Yes	8E-07
Ambient Vapor Inhalation	Yes	6E-02
		0.06

NV - not volatile
NTV - no toxicity value available
EC - exposure concentration
DAD - dermally absorbed dose
RfD - reference dose
ABS - absorption factor
HI - hazard index
RfC - reference concentration
EPC - exposure point concentration
COPC - chemical of potential concern

COPC	CASRN	EPC (mg/kg)	Intake Calculations: $Intake_{ingestion}$ (mg/kg/day)	DAD_{dermal} (mg/kg/day)	$EC_{particulate}$ (mg/m^3)	EC_{vapor} (mg/m^3)	Absorption Factors: ABS_{ing} (unitless)	ABS_d (unitless)	Non-Cancer Toxicity Values: RfD_{oral} (mg/kg/day)	RfD_{dermal} (mg/kg/day)	RfC (mg/m^3)	$HQ_{ingestion}$	HQ_{dermal}	$HQ_{particulate}$	HQ_{vapor}	HQ_{total}
2-Methylnaphthalene	91-57-6	3.1E+01	NE	NE	7.1E-09	2.6E-04	1	0.13	4.0E-03	4.0E-03		NE	NE	NTV	NTV	
Acenaphthene	83-32-9	1.1E+00	NE	NE	2.5E-10	3.8E-06	1	0.13	6.0E-02	6.0E-02		NE	NE	NTV	NTV	
Acenaphthylene	208-96-8	6.9E-01	NE	NE	1.6E-10	NV	1	0.13	6.0E-02	6.0E-02		NE	NE	NTV	NV	
Acetone	67-64-1	1.2E-01	NE	NE	2.8E-11	5.7E-06	1		9.0E-01	9.0E-01	3.1E+01	NE	NE	8.9E-13	1.8E-07	1.8E-07
Anthracene	120-12-7	3.1E-01	NE	NE	7.1E-11	2.8E-07	1	0.13	3.0E-01	3.0E-01		NE	NE	NTV	NTV	
Benz[a]anthracene	56-55-3	3.3E-01	NE	NE	7.6E-11	NV	1	0.13				NE	NE	NTV	NV	
Benzo[a]pyrene	50-32-8	1.8E-01	NE	NE	4.1E-11	NV	1	0.13				NE	NE	NTV	NV	
Benzo[b]fluoranthene	205-99-2	2.8E-01	NE	NE	6.5E-11	NV	1	0.13				NE	NE	NTV	NV	
Benzo(g,h,i)perylene	191-24-2	7.4E-02	NE	NE	1.7E-11	NV	1	0.13	3.0E-02	3.0E-02		NE	NE	NTV	NV	
Benzo[k]fluoranthene	207-08-9	1.1E-01	NE	NE	2.5E-11	NV	1	0.13				NE	NE	NTV	NV	
Bromomethane	74-83-9	2.4E-02	NE	NE	5.5E-12	9.3E-06	1		1.4E-03	1.4E-03	5.0E-03	NE	NE	1.1E-09	1.9E-03	1.9E-03
Chrysene	218-01-9	3.2E-01	NE	NE	7.4E-11	NV	1					NE	NE	NTV	NV	
Ethylbenzene	100-41-4	1.0E+00	NE	NE	2.3E-10	8.5E-05	1		1.0E-01	1.0E-01	1.0E+00	NE	NE	2.3E-10	8.5E-05	8.5E-05
Fluoranthene	206-44-0	7.8E-01	NE	NE	1.8E-10	NV	1	0.13	4.0E-02	4.0E-02		NE	NE	NTV	NV	
Fluorene	86-73-7	4.0E+00	NE	NE	9.2E-10	6.8E-06	1	0.13	4.0E-02	4.0E-02		NE	NE	NTV	NTV	
Indeno[1,2,3-cd]pyrene	193-39-5	8.8E-02	NE	NE	2.0E-11	NV	1	0.13				NE	NE	NTV	NV	
Isopropylbenzene	98-82-8	7.1E-01	NE	NE	1.6E-10	5.5E-05	1		1.0E-01	1.0E-01	4.0E-01	NE	NE	4.1E-10	1.4E-04	1.4E-04
Methyl cyclohexane	108-87-2	2.2E+00	NE	NE	5.1E-10	1.0E-03	1				3.0E+00	NE	NE	1.7E-10	3.4E-04	3.4E-04
Naphthalene	91-20-3	1.0E+01	NE	NE	2.3E-09	1.0E-04	1	0.13	2.0E-02	2.0E-02	3.0E-03	NE	NE	7.7E-07	3.5E-02	3.5E-02
Phenanthrene	85-01-8	7.0E+00	NE	NE	1.6E-09	NV	1	0.13	3.0E-02	3.0E-02		NE	NE	NTV	NV	
Pyrene	129-00-0	6.1E-01	NE	NE	1.4E-10	1.2E-07	1	0.13	3.0E-02	3.0E-02		NE	NE	NTV	NTV	
Tetrachloroethylene	127-18-4	3.6E+00	NE	NE	8.3E-10	7.6E-04	1		6.0E-03	6.0E-03	4.0E-02	NE	NE	2.1E-08	1.9E-02	1.9E-02
Toluene	108-88-3	1.4E-01	NE	NE	3.2E-11	1.6E-05	1		8.0E-02	8.0E-02	5.0E+00	NE	NE	6.5E-12	3.2E-06	3.2E-06
Xylenes	1330-20-7	5.1E+00	NE	NE	1.2E-09	4.2E-04	1		2.0E-01	2.0E-01	1.0E-01	NE	NE	1.2E-08	4.2E-03	4.2E-03

Appendix H, Table H-20
Intake and Risk Equations

Human Health Risk Assessment
D.C. United Soccer Stadium
Washington, D.C.

Cancer Risk from Ingestion

$$ELCR = Intake_{ing} * CSF$$

$$Intake_{ing\ (age\ group\ x)} = \frac{[EPC]_{soil} * [IFSadj - OR - IFSM] * ABS_{ING} * FI * EF * C1}{AT_{lifetime}}$$

Cancer Risk from Dermal Absorption

$$ELCR = DAD * CSF$$

$$DAD_{derm(age\ group\ x)} = \frac{DA_{Event} * SA * EV * EF}{AT_{lifetime}}$$

$$DA_{Event} = [EPC]_{soil} * [DFSadj - OR - DFSM] * C1$$

Cancer Risk from Inhalation

$$ELCR_{inh} = EC_{can} * IUR$$

$$EC_{can\ (age\ group\ x)} = \frac{[EPC]_{PART} * ET_{Part} * EF * ED\ ---\ OR---\ [EPC]_{VAPOR} * ET_{Vap} * EF * ED}{24 * AT_{lifetime}}$$

For mutagens, INHM is used in place of $ET_X * EF * ED$

Noncancer Risk from Ingestion

$$HQ = \frac{Intake_{ing}}{RfD}$$

$$Intake_{ing} = \frac{[EPC]_{soil} * IR * ABS_{ing} * FI * EF * ED * C1}{BW * AT}$$

Noncancer Risk from Dermal Absorption

$$HQ = \frac{DAD}{RfD}$$

$$DAD_{derm} = \frac{DA_{Event} * SA * EV * EF * ED}{BW * AT}$$

$$DA_{Event} = [EPC]_{soil} * ABS_d * AF * C1$$

Noncancer Risk from Inhalation

$$HQ = \frac{EC_{nc}}{RfC}$$

$$EC_{nc} = \frac{[EPC]_{PART} * ET_{Part} * EF * ED * C2\ ---\ OR---\ [EPC]_{VAPOR} * ET_{Vap} * EF * ED * C2}{24 * AT}$$

Parameter	Value - Cancer	Value - Non-Cancer	Units
CSF	Chemical specific	--	$(mg/kg\text{-}day)^{-1}$
IUR	Chemical specific	--	$(ug/m^3)^{-1}$
Intake	Age/chemical specific	--	mg/kg-day
EC_{can}	Age/chemical specific	--	(ug/m^3)
ELCR	Age/chemical specific	--	unitless
RfD	--	Chemical specific	mg/kg-day
RfC	--	Chemical specific	(mg/m^3)
DAD	Age/chemical specific	Age/chemical specific	mg/kg-day
DA_{Event}	Age/chemical specific	Age/chemical specific	mg/cm^2-event
EC_{nc}	--	Age/chemical specific	mg/m^3
HQ	--	Age/chemical specific	unitless
$[EPC]_{soil}$	Chemical specific	Chemical specific	mg/kg
$[EPC]_{PART}$	Appendix H, TABLE H-22	Appendix H, TABLE H-22	ug/m^3
$[EPC]_{VAPOR}$	Appendix H, TABLE H-23	Appendix H, TABLE H-23	ug/m^3
ABS_{ing}	Chemical specific	Chemical specific	unitless
ABS_d	Chemical specific	Chemical specific	unitless
BW	NA	15	kg
EF	350	350	day/year
ED	25	1	year
AT	--	365	day
ATlifetime	25550	--	day
IFSadj	92	--	mg-yr/kg-day
IFSM	343	--	mg-yr/kg-day
IR	NA	200	mg/day
FI	1	1	unitless
C1	0.000001	0.000001	kg/mg
SA	NA	2373	cm2
AF	NA	0.2	mg/cm2
EV	1	1	event/day
DFSadj	264	--	mg-yr/kg-day
DFSM	907	--	mg-yr/kg-day
ETPart	24	24	hours/day
C2	0.001	0.001	mg/ug
ETVap	24	24	ug/mg
INHM	520800	--	unitless

Appendix H, Table H-21
Exposure Factors

Human Health Risk Assessment
D.C. United Soccer Stadium
Washington, D.C.

PLACE "X" IN THE APPROPRIATE YELLOW SHADED CELLS FOR THE APPROPRIATE RECEPTOR AND BASIS FOR CALCULATIONS

SCENARIO USED TO CALCULATE RISKS			X	RESIDENT (4 AGES)										
BASIS FOR CANCER CALCULATIONS													X	
BASIS FOR NON-CANCER CALCULATIONS			X											
RECEPTOR			**CHILD (AGE 0-<2)**		**CHILD (2 - <6)**		**OLDER CHILD(AGE 6 - <16)**		**ADULT**		**TOTAL RESIDENT (AGES birth 26)**	
Standard Parameters												
Body Weight	BW	kg	15	EPA, 2014	15	EPA, 2014	80	EPA, 2014	80	EPA, 2014	NA	
Exposure Frequency	EF	day/year	350	EPA, 2014	350	EPA, 2014	350	EPA, 2014	350	EPA, 2014	350	EPA, 2014
Exposure Duration	ED	year	1	Ages 11 - <16	4	Ages 11 - <16	10	Balance of 26-yr exposure [2]	10	Balance of 26-yr exposure [2]	25	EPA, 2014
Non–carcinogenic Averaging Time	AT	day	365	Exposure duration expressed in days	1460	Exposure duration expressed in days	3650	Exposure duration expressed in days	3650	Exposure duration expressed in days	9125	Exposure duration expressed in days
Carcinogenic Averaging Time	$AT_{lifetime}$	day	25550	70 year lifetime	25550	70 year lifetime	25550	70 year lifetime	25550	70 year lifetime	25550	70 year lifetime
Age-Dependtant Adjustment Factor	ADAF	unitless	10	USEPA, 2008	3	USEPA, 2008	3	USEPA, 2008	1	USEPA, 2008		
Incidental Ingestion of Soil												
Soil Ingestion Rate	IR	mg/day	200	EPA, 2014	200	EPA, 2014	100	EPA, 2014	100	EPA, 2014	NA	
Fraction Ingested	FI	unitless	1.0	Site-specific [6]	1.0	Site-specific [6]	1.0	Site-specific [6]	1.0	Site-specific [6]	1	Site-specific [6]
Age-Adjusted Soil Ingestion Factor	IFSadj	mg-yr/kg-day	NA		NA		NA		NA		92	
Age-Adjusted Soil Ingestion Factor-Mutagenic	IFSM	mg-yr/kg-day									343	
Dermal Exposure with Soil												
Exposed Skin Surface Area	SA	cm^2	2373	EPA, 2014	2373	EPA, 2014	6032	EPA, 2014	6032	EPA, 2014	NA	
Soil Adherence Factor	AF	mg/cm^2	0.2	EPA, 2014	0.2	EPA, 2014	0.07	EPA, 2014	0.07	EPA, 2014	NA	
Fraction Dermal	EV	event/day	1.0	EPA, 2014	1.0	EPA, 2014	1.0	EPA, 2014	1.0	EPA, 2014	1	EPA, 2014
Age-Adjusted Dermal Contact Factor	DFSadj	mg-yr/kg-day	NA		NA		NA		NA		264	
Age-Adjusted Dermal Contact Factor-Mutagenic	DFSM	mg-yr/kg-day									907	
Particulate Inhalation												
Exposure Time	ET_{Part}	hours/day	24	Asumption	24	Asumption	24	Assumption	24	Assumption	24	Assumption
Vapor Inhalation												
Exposure Time	ET_{Vap}	hours/day	24	Assumption	24	Assumption	24	Assumption	24	Assumption	24	Assumption
Age-Adjusted Inhalation Factor-Mutagenic	INHM	unitless									520800	

Appendix H, Table H-22
Particulate to Outdoor Air EPC Calculations
Soil - After Site Redevelopment -
RESIDENT (4 AGES) - TOTAL RESIDENT (AGES birth - 26)

Human Health Risk Assessment
D.C. United Soccer Stadium
Washington, D.C.

EQUATIONS:

$$EPC_{[PARTICULATE]} = EPC_{[SOIL]} \times PARTICULATE_{[AIR]} \times 1E\text{-}06 \text{ [kg/mg]}$$

where:

$$PARTICULATE_{[AIR]} = (1/PEF * 1E+09 \text{ ug/kg}) \text{ or Measured/Modelled}$$

and:

$$PEF (m^3/kg) = Q/C \times [(3600 \text{ s/hr}) / ((0.036 \times (1-V) \times (U_m/U_t)^3 \times F(x))]$$

PARAMETER/DEFINITION	UNITS	DEFAULT	Source
$PARTICULATE_{[Air]}$ / Particulate concentration in air	ug/m^3	0.24	Calculated or measured
Measured or modeled $PARTICULATE_{[AIR]}$	ug/m^3		Measured value
PEF / Particulate emission factor	m^3/kg		
PEF / Particulate emission factor	m^3/kg	4.16E+09	Calculated here
Q/C / inverse of the mean concentration at the center of a 13-acre-square source	g/m^2-s per kg/m^3	35.14	USEPA, 2014 [a]
V / Fraction of vegetative cover	unitless	0.8	USEPA, 2014
U_m / mean annual windspeed	m/s	4.2	USEPA, 2014
U_t / equivalent threshold value of wind speed at 7 m	m/s	11.32	USEPA, 2014
F(x) / function dependant on U_m/U_t derived using Cowherd et al. (1985)	unitless	8.27E-02	USEPA, 2014

USEPA, 2014. Regional Screening Levels.
[a] Climactic zone: Phoenix Arizona [a] Area of Source:

CASRN	COPC	EPC Soil (mg/kg)	EPC Particulate (ug/m^3)
91-57-6	2-Methylnaphthalene	31	7.5E-06
83-32-9	Acenaphthene	1.1	2.6E-07
208-96-8	Acenaphthylene	0.69	1.7E-07
67-64-1	Acetone	0.12	2.9E-08
120-12-7	Anthracene	0.31	7.5E-08
56-55-3	Benz[a]anthracene	0.33	7.9E-08
50-32-8	Benzo[a]pyrene	0.18	4.3E-08
205-99-2	Benzo[b]fluoranthene	0.28	6.7E-08
191-24-2	Benzo(g,h,i)perylene	0.074	1.8E-08
207-08-9	Benzo[k]fluoranthene	0.11	2.6E-08
74-83-9	Bromomethane	0.024	5.8E-09
218-01-9	Chrysene	0.32	7.7E-08
100-41-4	Ethylbenzene	1	2.4E-07
206-44-0	Fluoranthene	0.78	1.9E-07
86-73-7	Fluorene	4	9.6E-07
193-39-5	Indeno[1,2,3-cd]pyrene	0.088	2.1E-08
98-82-8	Isopropylbenzene	0.71	1.7E-07
108-87-2	Methyl cyclohexane	2.2	5.3E-07
91-20-3	Naphthalene	10	2.4E-06
85-01-8	Phenanthrene	7	1.7E-06
129-00-0	Pyrene	0.61	1.5E-07
127-18-4	Tetrachloroethylene	3.6	8.7E-07
108-88-3	Toluene	0.14	3.4E-08
1330-20-7	Xylenes	5.1	1.2E-06

Appendix H, Table H-23
Vapor to Outdoor Air EPC Calculations
Soil - After Site Redevelopment -
RESIDENT (4 AGES) - TOTAL RESIDENT (AGES birth - 26)

Human Health Risk Assessment
D.C. United Soccer Stadium
Washington, D.C.

EQUATIONS:

$$EPC_{[VAPOR]} = EPC_{[SOIL]} \times 1/VF \times 1000\ ug/mg$$

where:

$$VF\ (m^3/kg) = Q/C \times (3.14 \times D_A \times T)^{1/2} \times 10^{-4}(m^2/cm^2) / (2 \times P_b \times D_A)$$

and:

$$DA = [(O_a^{10/3} D_i H' + O_w^{10/3} D_w)/n^2] / P_b K_d + O_w + O_a H'$$

PARAMETER/DEFINITION	UNITS	DEFAULT	Source
VF / volatilization factor	m^3/kg	Calculated	
D_A / apparent diffusivity	cm^2/s	Calculated	
Q/C / inverse of the mean concentration at the center of a 0.5-acre-square source	g/m^2-s per kg/m^3	35.14	USEPA, 2014 [a]
T / exposure interval	s	7.9E+08	RESIDENT (4 AGES)
Π_b / dry soil bulk density	g/cm^3	1.62	USEPA, 2014
O_a / air-filled soil porosity	L_{air}/L_{soil}	0.314	USEPA, 2014
n / total soil porosity	L_{pore}/L_{soil}	0.39	USEPA, 2014
O_w / water-filled soil porosity	L_{water}/L_{soil}	0.076	USEPA, 2014
Ψ_s / soil particle density	g/cm^3	2.65	USEPA, 1996
D_i / diffusivity in air	cm^2/s	chemical-specific	
H' / Henry's Law constant	dimensionless	chemical-specific	
D_w / diffusivity in water	cm^2/s	chemical-specific	
K_d / soil-water partition coefficient (Koc x foc) organics	cm^3/g	chemical-specific	
K_{oc} / soil organic carbon partition coefficient	cm^3/g	chemical-specific	
f_{oc} / fraction organic carbon in soil	g/g	0.006	Default

USEPA, 2014. Regional Screening Levels.

[a] Climactic zone: Phoenix Arizona [a] Area of Source: Specific to size of Exposure Area

CASRN	COPC	Volatile (Y/N)	D_i (cm^2/s)	H' (unitless)	D_w (cm^2/s)	K_d (cm^3/g)	K_{oc} (cm^3/g)	D_A (cm^2/s)	VF (m^3/kg)	EPC Soil (mg/kg)	EPC Vapor (ug/m^3)
91-57-6	2-Methylnaphthalene	Y	5.24E-02	2.12E-02	7.78E-06	1.49E+01	2.48E+03	6.4E-06	115696	31	2.7E-01
83-32-9	Acenaphthene	Y	5.06E-02	7.52E-03	8.33E-06	3.02E+01	5.03E+03	1.1E-06	281135	1.1	3.9E-03
208-96-8	Acenaphthylene	N	5.06E-02	7.52E-03	8.33E-06	3.02E+01	5.03E+03				NV
67-64-1	Acetone	Y	1.06E-01	1.43E-03	1.15E-05	1.42E-02	2.36E+00	2.1E-04	20079	0.12	6.0E-03
120-12-7	Anthracene	Y	3.90E-02	2.27E-03	7.85E-06	9.82E+01	1.64E+04	7.7E-08	1050523	0.31	3.0E-04
56-55-3	Benz[a]anthracene	N	5.09E-02	4.91E-04	5.94E-06	1.06E+03	1.77E+05				NV
50-32-8	Benzo[a]pyrene	N	4.76E-02	1.87E-05	5.56E-06	3.52E+03	5.87E+05				NV
205-99-2	Benzo[b]fluoranthene	N	4.76E-02	2.69E-05	5.56E-06	3.60E+03	5.99E+05				NV
191-24-2	Benzo(g,h,i)perylene	N	5.28E-02	9.65E-08	6.17E-06	1.35E+00	2.25E+02				NV
207-08-9	Benzo[k]fluoranthene	N	4.76E-02	2.39E-05	5.56E-06	3.52E+03	5.87E+05				NV
74-83-9	Bromomethane	Y	1.00E-01	3.00E-01	1.35E-05	7.93E-02	1.32E+01	1.4E-02	2468	0.024	9.7E-03
218-01-9	Chrysene	N	2.61E-02	2.14E-04	6.75E-06	1.08E+03	1.81E+05				NV
100-41-4	Ethylbenzene	Y	6.85E-02	3.22E-01	8.46E-06	2.68E+00	4.46E+02	6.8E-04	11218	1	8.9E-02
206-44-0	Fluoranthene	N	2.76E-02	3.62E-04	7.18E-06	3.33E+02	5.55E+04				NV
86-73-7	Fluorene	Y	4.40E-02	3.93E-03	7.89E-06	5.50E+01	9.16E+03	2.7E-07	562806	4	7.1E-03
193-39-5	Indeno[1,2,3-cd]pyrene	N	4.48E-02	6.56E-05	5.23E-06	2.08E+04	3.47E+06				NV
98-82-8	Isopropylbenzene	Y	6.03E-02	4.70E-01	7.86E-06	4.19E+00	6.98E+02	5.6E-04	12328	0.71	5.8E-02
108-87-2	Methyl cyclohexane	Y	8.00E-02	6.13E+00	9.11E-06	8.76E-01	1.46E+02	2.0E-02	2071	2.2	1.1E+00
91-20-3	Naphthalene	Y	6.05E-02	1.80E-02	8.38E-06	9.26E+00	1.54E+03	1.0E-05	92339	10	1.1E-01
85-01-8	Phenanthrene	N	2.08E-02	5.81E-12	5.19E-06	5.56E+01	9.27E+03				NV
129-00-0	Pyrene	Y	2.78E-02	4.87E-04	7.25E-06	3.26E+02	5.43E+04	3.6E-09	4890707	0.61	1.2E-04
127-18-4	Tetrachloroethylene	Y	5.05E-02	7.24E-01	9.46E-06	5.70E-01	9.49E+01	4.1E-03	4544	3.6	7.9E-01
108-88-3	Toluene	Y	7.78E-02	2.71E-01	9.20E-06	1.40E+00	2.34E+02	1.2E-03	8420	0.14	1.7E-02
1330-20-7	Xylenes	Y	8.47E-02	2.12E-01	9.90E-06	2.30E+00	3.83E+02	6.4E-04	11508	5.1	4.4E-01

Appendix H, Table H-24
Intake and Risk Equations - Single Age
Soil -
LANDSCAPER - LANDSCAPER (ADULT)

Human Health Risk Assessment
D.C. United Soccer Stadium
Washington, D.C.

Exposure Routes Evaluated		ELCR (Total)
Incidental Ingestion	Yes	4E-06
Dermal Contact	Yes	2E-06
Particulate Inhalation	Yes	2E-09
Ambient Vapor Inhalation	Yes	6E-08
		6E-06

NC - not carcinogenic by this exposure route
NTV - no toxicity value available
NV - not volatile
DAD - dermally absorbed dose
EC - exposure concentration
ABS - absorption factor
CSF - cancer slope factor
UR - cancer unit risk
ELCR - excess lifetime cancer risk
EPC - exposure point concentration
COPC - chemical of potential concern

			Intake Calculations				Absorption Factors		Cancer Toxicity Values							
COPC	**CASRN**	**EPC (mg/kg)**	**$Intake_{ingestion}$ (mg/kg/day)**	**DAD_{dermal} (mg/kg/day)**	**$EC_{particulate}$ (ug/m^3)**	**EC_{vapor} (ug/m^3)**	**ABS_{ing} (unitless)**	**ABS_{d} (unitless)**	**CSF_{oral} $(mg/kg/day)^{-1}$**	**CSF_{dermal} $(mg/kg/day)^{-1}$**	**IUR $(ug/m^3)^{-1}$**	**$ELCR_{ingestion}$**	**$ELCR_{dermal}$**	**$ELCR_{particulate}$**	**$ELCR_{vapor}$**	**$ELCR_{total}$**
Trichloroethylene	79-01-6	3.1E-03	2.7E-10		4.4E-11	9.4E-05	1		4.6E-02	4.6E-02	4.1E-06	1.3E-11		1.8E-16	3.8E-10	4.0E-10
Vinyl Chloride	75-01-4	6.4E-03	5.6E-10		9.0E-11	4.5E-04	1		7.2E-01	7.2E-01	4.4E-06	4.1E-10		4.0E-16	2.0E-09	2.4E-09
1,1,1,2-Tetrachloroethane	630-20-6	6.8E-03	6.0E-10		9.6E-11	7.9E-05	1		2.6E-02	2.6E-02	7.4E-06	1.6E-11		7.1E-16	5.9E-10	6.0E-10
1,1,2,2-Tetrachloroethane	79-34-5															
1,2,4-Trichlorobenzene	120-82-1	3.9E-03	3.4E-10	1.5E-10	NC	NC	1	0.1	2.9E-02	2.9E-02		1.0E-11	4.2E-12			1.4E-11
1,2,4-Trimethylbenzene	95-63-6	2.0E+00	NC	NC	NC	NC	NC	NC								
1,2-Dichlorobenzene	95-50-1	6.0E-04	NC	NC	NC	NC	NC	NC								
1,3,5-Trimethylbenzene	108-67-8	8.5E-01	NC	NC	NC	NC	NC	NC								
1,4-Dichlorobenzene	106-46-7	6.1E-04	5.4E-11	2.3E-11	8.6E-12	3.8E-06	1	0.1	5.4E-03	5.4E-03	1.1E-05	2.9E-13	1.2E-13	9.5E-17	4.1E-11	4.2E-11
Methyl Ethyl Ketone (2-Butanone)	78-93-3	1.6E-01	NC	NC	NC	NC	NC	NC								
2-Hexanone	591-78-6	1.5E-03	NC	NC	NC	NC	NC	NC								
Butylbenzene, sec-	135-98-8															
Methyl Isobutyl Ketone (4-methyl-2-pentanone)	108-10-1	4.2E-02	NC	NC	NC	NC	NC	NC								
Acetone	67-64-1	5.3E-01	NC	NC	NC	NC	NC	NC								
Benzene	71-43-2	6.8E-03	6.0E-10		9.6E-11	1.3E-04	1		5.5E-02	5.5E-02	7.8E-06	3.3E-11		7.5E-16	9.8E-10	1.0E-09
Bromomethane	74-83-9	2.6E-02	NC	NC	NC	NC	1									
Carbon Disulfide	75-15-0															
Chloroform	67-66-3															
Chloromethane (Methyl Chloride)	74-87-3	8.5E-04	7.5E-11		1.2E-11	5.2E-05	1		1.3E-02	1.3E-02	1.8E-06	9.7E-13		2.2E-17	9.3E-11	9.4E-11
cis-1,2-Dichloroethylene	156-59-2	2.7E-02	NC	NC	NC	NC	NC	NC								
Cyclohexane	110-82-7															
Cymene (p-Isopropyltoluene) (surrogate = Cumene)	99-87-6	2.7E-01	NC	NC	NC	NC	NC	NC								
Ethylbenzene	100-41-4	1.0E+00	NC	NC	1.4E-08	1.1E-02	NC	NC			2.5E-06			3.5E-14	2.8E-08	2.8E-08
Isopropylbenzene	98-82-8	7.1E-01	NC	NC	NC	NC	NC	NC								
Isopropyltoluene (surrogate = Cymene)	25155-15-1															
Methyl cyclohexane	108-87-2	2.2E+00	NC	NC	NC	NC	NC	NC								
Methyl tert-Butyl Ether (MTBE)	1634-04-4	1.3E-02	1.1E-09		1.8E-10	2.0E-04	1		1.8E-03	1.8E-03	2.6E-07	2.1E-12		4.8E-17	5.3E-11	5.5E-11
Methylene Chloride	75-09-2	1.5E-02	1.3E-09		2.1E-10	4.8E-04	1		2.0E-03	2.0E-03	1.0E-08	2.6E-12		2.1E-18	4.8E-12	7.4E-12
Butylbenzene, n-	104-51-8	1.7E-01	NC	NC	NC	NC	NC	NC								
Propylbenzene	103-65-1															
Styrene	100-42-5	3.1E-02	NC	NC	NC	NC	NC	NC								
Butylbenzene, tert-	98-06-6															
Tetrachloroethylene	127-18-4	4.5E-01	3.9E-08		6.3E-09	1.2E-02	1		2.1E-03	2.1E-03	2.6E-07	8.2E-11		1.6E-15	3.2E-09	3.3E-09
Toluene	108-88-3	1.4E-01	NC	NC	NC	NC	NC	NC								
trans-1,2-Dichloroethylene	156-60-5	7.9E-04	NC	NC	NC	NC	NC	NC								
Trichlorofluoromethane (CFC-11)	75-69-4	5.1E-02	NC	NC	NC	NC	NC	NC								
Trifluorotrichloroethane (Freon 113)	76-13-1	1.2E-03	NC	NC	NC	NC	NC	NC								
Xylenes	1330-20-7	7.4E-03	NC	NC	NC	NC	NC	NC								
2-Methylnaphthalene	91-57-6	3.1E+01	NC	NC	NC	NC	NC	NC								
Acenaphthene	83-32-9	2.4E+01	NC	NC	NC	NC	NC	NC								

Appendix H, Table H-24
Intake and Risk Equations - Single Age
Soil -
LANDSCAPER - LANDSCAPER (ADULT)

Human Health Risk Assessment
D.C. United Soccer Stadium
Washington, D.C.

Exposure Routes Evaluated		ELCR (Total)
Incidental Ingestion	Yes	4E-06
Dermal Contact	Yes	2E-06
Particulate Inhalation	Yes	2E-09
Ambient Vapor Inhalation	Yes	6E-08
		6E-06

NC - not carcinogenic by this exposure route
NTV - no toxicity value available
NV - not volatile
DAD - dermally absorbed dose
EC - exposure concentration
ABS - absorption factor
CSF - cancer slope factor
UR - cancer unit risk
ELCR - excess lifetime cancer risk
EPC - exposure point concentration
COPC - chemical of potential concern

			Intake Calculations				Absorption Factors		Cancer Toxicity Values							
COPC	CASRN	EPC (mg/kg)	$Intake_{ingestion}$ (mg/kg/day)	DAD_{dermal} (mg/kg/day)	$EC_{particulate}$ (ug/m^3)	EC_{vapor} (ug/m^3)	ABS_{ing} (unitless)	ABS_{d} (unitless)	CSF_{oral} $(mg/kg/day)^{-1}$	CSF_{dermal} $(mg/kg/day)^{-1}$	IUR $(ug/m^3)^{-1}$	$ELCR_{ingestion}$	$ELCR_{dermal}$	$ELCR_{particulate}$	$ELCR_{vapor}$	$ELCR_{total}$
Acenaphthylene	208-96-8	1.7E+01	NC	NC	NC	NV	NC	NC							NV	
Anthracene	120-12-7	5.2E+01	NC	NC	NC	NC	1	0.13								
Benz[a]anthracene	56-55-3	3.4E+00	3.0E-07	1.6E-07	4.7E-08	NV	1	0.13	7.3E-01	7.3E-01	1.1E-04	2.2E-07	1.2E-07	5.2E-12	NV	3.3E-07
Benzo[a]pyrene	50-32-8	2.8E+00	2.5E-07	1.4E-07	4.0E-08	NV	1	0.13	7.3E+00	7.3E+00	1.1E-03	1.8E-06	1.0E-06	4.4E-11	NV	2.8E-06
Benzo[b]fluoranthene	205-99-2	3.5E+00	3.1E-07	1.7E-07	5.0E-08	NV	1	0.13	7.3E-01	7.3E-01	1.1E-04	2.3E-07	1.2E-07	5.5E-12	NV	3.5E-07
Benzo(g,h,i)perylene	191-24-2	4.1E+01	NC	NC	NC	NV	NC	NC							NV	
Benzo[k]fluoranthene	207-08-9	2.3E+01	2.0E-06	1.1E-06	3.2E-07	NV	1	0.13	7.3E-02	7.3E-02	1.1E-04	1.5E-07	8.1E-08	3.6E-11	NV	2.3E-07
Chrysene	218-01-9	3.3E+00	2.9E-07	1.6E-07	4.7E-08	NV	1	0.13	7.3E-03	3.4E+00	1.1E-05	2.1E-09	5.5E-07	5.2E-13	NV	5.5E-07
Dibenz[a,h]anthracene	53-70-3	4.8E-01	4.3E-08	2.3E-08	6.8E-09	NV	1	0.13	7.3E+00	7.3E+00	1.2E-03	3.1E-07	1.7E-07	8.2E-12	NV	4.8E-07
Fluoranthene	206-44-0	1.8E+02	NC	NC	NC	NV	NC	NC							NV	
Fluorene	86-73-7	2.3E+01	NC	NC	NC	NC	NC	NC								
Indeno[1,2,3-cd]pyrene	193-39-5	1.8E+00	1.6E-07	8.7E-08	2.5E-08	NV	1	0.13	7.3E-01	7.3E-01	1.1E-04	1.2E-07	6.3E-08	2.8E-12	NV	1.8E-07
Naphthalene	91-20-3	5.8E-01	NC	NC	8.2E-09	8.0E-04	NC	NC			3.4E-05			2.8E-13	2.7E-08	2.7E-08
Phenanthrene	85-01-8	1.7E+02	NC	NC	NC	NV	NC	NC							NV	
Pyrene	129-00-0	1.7E+02	NC	NC	NC	NC	NC	NC								
Polychlorinated Biphenyls	1336-36-3	7.0E-01	6.1E-08	3.6E-08	9.8E-09	NV	1	0.14	2.0E+00	2.0E+00	5.7E-04	1.2E-07	7.3E-08	5.6E-12	NV	2.0E-07
Aluminum	7429-90-5															
Antimony	7440-36-0	8.9E+00	NC	NC	NC	NV	NC	NC							NV	
Arsenic	7440-38-2	9.4E+00	5.0E-07	1.1E-07	1.3E-07	NV	0.6	0.03	1.5E+00	1.5E+00	4.3E-03	7.5E-07	1.6E-07	5.7E-10	NV	9.0E-07
Barium	7440-39-3	1.6E+02	NC	NC	NC	NV	NC	NC							NV	
Beryllium	7440-41-7	4.8E-01	NC	NC	6.8E-09	NV	NC	NC			2.4E-03			1.6E-11	NV	1.6E-11
Cadmium	7440-43-9	2.9E+00	NC	NC	4.1E-08	NV	NC	NC			1.8E-03			7.4E-11	NV	7.4E-11
Calcium	7440-70-2	7.5E+04	NC	NC	NC	NV	NC	NC							NV	
Chromium, Total	7440-47-3	4.0E+02	NC	NC	NC	NV	NC	NC							NV	
Cobalt	7440-48-4	1.0E+01	NC	NC	1.4E-07	NV	NC	NC			9.0E-03			1.3E-09	NV	1.3E-09
Copper	7440-50-8	3.6E+02	NC	NC	NC	NV	NC	NC							NV	
Iron	7439-89-6	3.1E+04	NC	NC	NC	NV	NC	NC							NV	
Lead	7439-92-1	6.1E+02	NC	NC	NC	NV	1								NV	
Magnesium	7439-95-4	2.0E+04	NC	NC	NC	NV	NC	NC							NV	
Manganese	7439-96-5	3.6E+02	NC	NC	NC	NV	NC	NC							NV	
Mercury	7439-97-6	1.5E+00	NC	NC	NC	NV	NC	NC							NV	
Nickel	7440-02-0	4.1E+01	NC	NC	5.8E-07	NV	NC	NC			2.4E-04			1.4E-10	NV	1.4E-10
Potassium	7440-09-7	5.1E+03	NC	NC	NC	NV	NC	NC							NV	
Selenium	7782-49-2	6.2E+00	NC	NC	NC	NV	NC	NC							NV	
Silver	7440-22-4	3.9E+00	NC	NC	NC	NV	NC	NC							NV	
Sodium	7440-23-5	1.4E+04	NC	NC	NC	NV	NC	NC							NV	
Thallium	7440-28-0	1.2E+00	NC	NC	NC	NV	NC	NC							NV	
Vanadium	7440-62-2	3.5E+01	NC	NC	NC	NV	NC	NC							NV	
Zinc	7440-66-6	7.2E+02	NC	NC	NC	NV	NC	NC							NV	

Appendix H, Table H-25
Non-Cancer Risk Calculations
Soil -
LANDSCAPER - LANDSCAPER (ADULT)

Human Health Risk Assessment
D.C. United Soccer Stadium
Washington, D.C.

Exposure Routes Evaluated		HI (Total)
Incidental Ingestion	Yes	5E-02
Dermal Contact	Yes	1E-02
Particulate Inhalation	Yes	4E-04
Ambient Vapor Inhalation	Yes	9E-03
		0.07

NV - not volatile
NTV - no toxicity value available
EC - exposure concentration
DAD - dermally absorbed dose
RfD - reference dose
ABS - absorption factor
HI - hazard index
RfC - reference concentration
EPC - exposure point concentration (if blank, then COPC was not detected)
COPC - chemical of potential concern

COPC	CASRN	EPC	Intake Calculations				Absorption Factors		Non-Cancer Toxicity Values			$HQ_{ingestion}$	HQ_{dermal}	$HQ_{particulate}$	HQ_{vapor}	HQ_{total}
			$Intake_{ingestion}$	DAD_{dermal}	$EC_{particulate}$	EC_{vapor}	ABS_{ing}	ABS_{d}	RfD_{oral}	RfD_{dermal}	RfC					
		(mg/kg)	(mg/kg/day)	(mg/kg/day)	(mg/m^3)	(mg/m^3)	(unitless)	(unitless)	(mg/kg/day)	(mg/kg/day)	(mg/m^3)					
Trichloroethylene	79-01-6	3.1E-03	7.6E-10		1.2E-13	2.6E-07	1		5.0E-04	5.0E-04	2.0E-03	1.5E-06		6.1E-11	1.3E-04	1.3E-04
Vinyl Chloride	75-01-4	6.4E-03	1.6E-09		2.5E-13	1.3E-06	1		3.0E-03	3.0E-03	1.0E-01	5.3E-07		2.5E-12	1.3E-05	1.3E-05
1,1,1,2-Tetrachloroethane	630-20-6	6.8E-03	1.7E-09		2.7E-13	2.2E-07	1		3.0E-02	3.0E-02		5.6E-08		NTV	NTV	5.6E-08
1,1,2,2-Tetrachloroethane	79-34-5															
1,2,4-Trichlorobenzene	120-82-1	3.9E-03	9.6E-10	4.1E-10	1.5E-13	2.3E-08	1	0.1	1.0E-02	1.0E-02	2.0E-03	9.6E-08	4.1E-08	7.7E-11	1.2E-05	1.2E-05
1,2,4-Trimethylbenzene	95-63-6	2.0E+00	4.9E-07		7.8E-11	4.5E-05	1				7.0E-03	NTV	NTV	1.1E-08	6.4E-03	6.4E-03
1,2-Dichlorobenzene	95-50-1	6.0E-04	1.5E-10	6.3E-11	2.4E-14	9.2E-09	1	0.1	9.0E-02	9.0E-02	2.0E-01	1.6E-09	7.0E-10	1.2E-13	4.6E-08	4.9E-08
1,3,5-Trimethylbenzene	108-67-8	8.5E-01	2.1E-07		3.3E-11	2.3E-05	1					NTV	NTV	NTV	NTV	
1,4-Dichlorobenzene	106-46-7	6.1E-04	1.5E-10	6.4E-11	2.4E-14	1.1E-08	1	0.1	7.0E-02	7.0E-02	8.0E-01	2.1E-09	9.1E-10	3.0E-14	1.3E-08	1.6E-08
Methyl Ethyl Ketone (2-Butanon	78-93-3	1.6E-01	3.9E-08		6.3E-12	3.0E-06	1		6.0E-01	6.0E-01	5.0E+00	6.6E-08		1.3E-12	6.1E-07	6.8E-07
2-Hexanone	591-78-6	1.5E-03	3.7E-10		5.9E-14	2.4E-08	1		5.0E-03	5.0E-03	3.0E-02	7.4E-08		2.0E-12	7.9E-07	8.6E-07
Butylbenzene, sec-	135-98-8															
Methyl Isobutyl Ketone (4-meth	108-10-1	4.2E-02	1.0E-08		1.7E-12	8.4E-07	1		8.0E-02	8.0E-02	3.0E+00	1.3E-07		5.5E-13	2.8E-07	4.1E-07
Acetone	67-64-1	5.3E-01	1.3E-07		2.1E-11	9.4E-06	1		9.0E-01	9.0E-01	3.1E+01	1.5E-07		6.8E-13	3.0E-07	4.5E-07
Benzene	71-43-2	6.8E-03	1.7E-09		2.7E-13	3.5E-07	1		4.0E-03	4.0E-03	3.0E-02	4.2E-07		9.0E-12	1.2E-05	1.2E-05
Bromomethane	74-83-9	2.6E-02	6.4E-09		1.0E-12	3.7E-06	1		1.4E-03	1.4E-03	5.0E-03	4.6E-06		2.1E-10	7.5E-04	7.5E-04
Carbon Disulfide	75-15-0															
Chloroform	67-66-3															
Chloromethane (Methyl Chloride	74-87-3	8.5E-04	2.1E-10		3.4E-14	1.4E-07	1				9.0E-02	NTV	NTV	3.7E-13	1.6E-06	1.6E-06
cis-1,2-Dichloroethylene	156-59-2	2.7E-02	6.7E-09		1.1E-12	2.1E-06	1		2.0E-03	2.0E-03		3.3E-06		NTV	NTV	3.3E-06
Cyclohexane	110-82-7															
Cymene (p-Isopropyltoluene) (s	99-87-6	2.7E-01	6.7E-08		1.1E-11	5.7E-06	1		1.0E-01	1.0E-01	4.0E-01	6.7E-07		2.7E-11	1.4E-05	1.5E-05
Ethylbenzene	100-41-4	1.0E+00	2.5E-07		4.0E-11	3.2E-05	1		1.0E-01	1.0E-01	1.0E+00	2.5E-06		4.0E-11	3.2E-05	3.4E-05
Isopropylbenzene	98-82-8	7.1E-01	1.8E-07		2.8E-11	2.0E-05	1		1.0E-01	1.0E-01	4.0E-01	1.8E-06		7.0E-11	5.1E-05	5.3E-05
Isopropyltoluene (surrogate = C	25155-15-1															
Methyl cyclohexane	108-87-2	2.2E+00	5.4E-07		8.7E-11	3.8E-04	1				3.0E+00	NTV	NTV	2.9E-11	1.3E-04	1.3E-04
Methyl tert-Butyl Ether (MTBE)	1634-04-4	1.3E-02	3.2E-09		5.1E-13	5.7E-07	1				3.0E+00	NTV	NTV	1.7E-13	1.9E-07	1.9E-07
Methylene Chloride	75-09-2	1.5E-02	3.6E-09		5.8E-13	1.3E-06	1		6.0E-03	6.0E-03	6.0E-01	6.1E-07		9.7E-13	2.2E-06	2.9E-06
Butylbenzene, n-	104-51-8	1.7E-01	4.2E-08		6.7E-12	3.7E-06	1		5.0E-02	5.0E-02		8.3E-07		NTV	NTV	8.3E-07
Propylbenzene	103-65-1															
Styrene	100-42-5	3.1E-02	7.6E-09		1.2E-12	6.0E-07	1		2.0E-01	2.0E-01	1.0E+00	3.8E-08		1.2E-12	6.0E-07	6.3E-07
Butylbenzene, tert-	98-06-6															
Tetrachloroethylene	127-18-4	4.5E-01	1.1E-07		1.8E-11	3.5E-05	1		6.0E-03	6.0E-03	4.0E-02	1.8E-05		4.4E-10	8.7E-04	8.9E-04
Toluene	108-88-3	1.4E-01	3.5E-08		5.5E-12	5.9E-06	1		8.0E-02	8.0E-02	5.0E+00	4.3E-07		1.1E-12	1.2E-06	1.6E-06
trans-1,2-Dichloroethylene	156-60-5	7.9E-04	1.9E-10		3.1E-14	6.0E-08	1		2.0E-02	2.0E-02		9.7E-09		NTV	NTV	9.7E-09
Trichlorofluoromethane (CFC-1	75-69-4	5.1E-02	1.3E-08		2.0E-12	8.9E-06	1		3.0E-01	3.0E-01	7.0E-01	4.2E-08		2.9E-12	1.3E-05	1.3E-05
Trifluorotrichloroethane (Freon 1	76-13-1	1.2E-03	3.0E-10	1.3E-09	4.7E-14	2.4E-07	1	1	3.0E+01	3.0E+01	3.0E+01	9.9E-12	4.2E-11	1.6E-15	7.9E-09	8.0E-09
Xylenes	1330-20-7	7.4E-03	1.8E-09		2.9E-13	2.3E-07	1		2.0E-01	2.0E-01	1.0E-01	9.1E-09		2.9E-12	2.3E-06	2.3E-06
2-Methylnaphthalene	91-57-6	3.1E+01	7.6E-06	4.2E-06	1.2E-09	9.5E-05	1	0.13	4.0E-03	4.0E-03		1.9E-03	1.1E-03	NTV	NTV	3.0E-03
Acenaphthene	83-32-9	2.4E+01	5.9E-06	3.3E-06	9.5E-10	3.0E-05	1	0.13	6.0E-02	6.0E-02		9.9E-05	5.4E-05	NTV	NTV	1.5E-04

Appendix H, Table H-25
Non-Cancer Risk Calculations
Soil -
LANDSCAPER - LANDSCAPER (ADULT)

Human Health Risk Assessment
D.C. United Soccer Stadium
Washington, D.C.

Exposure Routes Evaluated		HI (Total)
Incidental Ingestion	Yes	5E-02
Dermal Contact	Yes	1E-02
Particulate Inhalation	Yes	4E-04
Ambient Vapor Inhalation	Yes	9E-03
		0.07

NV - not volatile
NTV - no toxicity value available
EC - exposure concentration
DAD - dermally absorbed dose
RfD - reference dose
ABS - absorption factor
HI - hazard index
RfC - reference concentration
EPC - exposure point concentration (if blank, then COPC was not detected)
COPC - chemical of potential concern

			Intake Calculations				Absorption Factors		Non-Cancer Toxicity Values							
COPC	**CASRN**	**EPC (mg/kg)**	**$Intake_{ingestion}$ (mg/kg/day)**	**DAD_{dermal} (mg/kg/day)**	**$EC_{particulate}$ (mg/m^3)**	**EC_{vapor} (mg/m^3)**	**ABS_{ing} (unitless)**	**ABS_{d} (unitless)**	**RfD_{oral} (mg/kg/day)**	**RfD_{dermal} (mg/kg/day)**	**RfC (mg/m^3)**	**$HQ_{ingestion}$**	**HQ_{dermal}**	**$HQ_{particulate}$**	**HQ_{vapor}**	**HQ_{total}**
Acenaphthylene	208-96-8	1.7E+01	4.2E-06	2.3E-06	6.7E-10	NV	1	0.13	6.0E-02	6.0E-02		7.0E-05	3.8E-05	NTV	NV	1.1E-04
Anthracene	120-12-7	5.2E+01	1.3E-05	7.1E-06	2.1E-09	1.8E-05	1	0.13	3.0E-01	3.0E-01		4.3E-05	2.4E-05	NTV	NTV	6.6E-05
Benz[a]anthracene	56-55-3	3.4E+00	8.3E-07	4.5E-07	1.3E-10	NV	1	0.13				NTV	NTV	NTV	NV	
Benzo[a]pyrene	50-32-8	2.8E+00	7.0E-07	3.8E-07	1.1E-10	NV	1	0.13				NTV	NTV	NTV	NV	
Benzo[b]fluoranthene	205-99-2	3.5E+00	8.7E-07	4.8E-07	1.4E-10	NV	1	0.13				NTV	NTV	NTV	NV	
Benzo(g,h,i)perylene	191-24-2	4.1E+01	1.0E-05	5.6E-06	1.6E-09	NV	1	0.13	3.0E-02	3.0E-02		3.4E-04	1.9E-04	NTV	NV	5.2E-04
Benzo[k]fluoranthene	207-08-9	2.3E+01	5.7E-06	3.1E-06	9.1E-10	NV	1	0.13				NTV	NTV	NTV	NV	
Chrysene	218-01-9	3.3E+00	8.2E-07		1.3E-10	NV	1					NTV	NTV	NTV	NV	
Dibenz[a,h]anthracene	53-70-3	4.8E-01	1.2E-07	6.6E-08	1.9E-11	NV	1	0.13				NTV	NTV	NTV	NV	
Fluoranthene	206-44-0	1.8E+02	4.4E-05	2.4E-05	7.1E-09	NV	1	0.13	4.0E-02	4.0E-02		1.1E-03	6.1E-04	NTV	NV	1.7E-03
Fluorene	86-73-7	2.3E+01	5.7E-06	3.1E-06	9.1E-10	1.5E-05	1	0.13	4.0E-02	4.0E-02		1.4E-04	7.8E-05	NTV	NTV	2.2E-04
Indeno[1,2,3-cd]pyrene	193-39-5	1.8E+00	4.4E-07	2.4E-07	7.1E-11	NV	1	0.13				NTV	NTV	NTV	NV	
Naphthalene	91-20-3	5.8E-01	1.4E-07	7.9E-08	2.3E-11	2.2E-06	1	0.13	2.0E-02	2.0E-02	3.0E-03	7.2E-06	3.9E-06	7.7E-09	7.5E-04	7.6E-04
Phenanthrene	85-01-8	1.7E+02	4.2E-05	2.3E-05	6.7E-09	NV	1	0.13	3.0E-02	3.0E-02		1.4E-03	7.7E-04	NTV	NV	2.2E-03
Pyrene	129-00-0	1.7E+02	4.2E-05	2.3E-05	6.7E-09	1.2E-05	1	0.13	3.0E-02	3.0E-02		1.4E-03	7.7E-04	NTV	NTV	2.2E-03
Polychlorinated Biphenyls	1336-36-3	7.0E-01	1.7E-07	1.0E-07	2.8E-11	NV	1	0.14	2.0E-05	2.0E-05		8.6E-03	5.1E-03	NTV	NV	1.4E-02
Aluminum	7429-90-5															
Antimony	7440-36-0	8.9E+00	2.2E-06		3.5E-10	NV	1		4.0E-04	6.0E-05		5.5E-03		NTV	NV	5.5E-03
Arsenic	7440-38-2	9.4E+00	1.4E-06	2.9E-07	3.7E-10	NV	0.6	0.03	3.0E-04	3.0E-04	1.5E-05	4.6E-03	9.8E-04	2.5E-05	NV	5.6E-03
Barium	7440-39-3	1.6E+02	3.8E-05		6.2E-09	NV	1		2.0E-01	1.4E-02	5.0E-04	1.9E-04		1.2E-05	NV	2.0E-04
Beryllium	7440-41-7	4.8E-01	1.2E-07		1.9E-11	NV	1		2.0E-03	1.4E-05	2.0E-05	5.9E-05		9.5E-07	NV	6.0E-05
Cadmium	7440-43-9	2.9E+00	7.2E-07	3.0E-09	1.1E-10	NV	1	0.001	1.0E-03	2.5E-05	2.0E-05	7.2E-04	1.2E-04	5.7E-06	NV	8.4E-04
Calcium	7440-70-2	7.5E+04	1.8E-02		3.0E-06	NV	1					NTV	NTV	NTV	NV	
Chromium, Total	7440-47-3	4.0E+02	9.9E-05		1.6E-08	NV	1		1.5E+00	2.0E-02		6.6E-05		NTV	NV	6.6E-05
Cobalt	7440-48-4	1.0E+01	2.5E-06		4.0E-10	NV	1		3.0E-04	3.0E-04	6.0E-06	8.4E-03		6.7E-05	NV	8.5E-03
Copper	7440-50-8	3.6E+02	9.0E-05		1.4E-08	NV	1		4.0E-02	4.0E-02		2.2E-03		NTV	NV	2.2E-03
Iron	7439-89-6	3.1E+04	7.6E-03		1.2E-06	NV	1		7.0E-01	7.0E-01		1.1E-02		NTV	NV	1.1E-02
Lead	7439-92-1	6.1E+02	1.5E-04		2.4E-08	NV	1					NTV	NTV	NTV	NV	
Magnesium	7439-95-4	2.0E+04	4.9E-03		7.9E-07	NV	1					NTV	NTV	NTV	NV	
Manganese	7439-96-5	3.6E+02	8.9E-05		1.4E-08	NV	1		1.4E-01	5.6E-03	5.0E-05	6.3E-04		2.8E-04	NV	9.2E-04
Mercury	7439-97-6	1.5E+00	3.7E-07		5.9E-11	NV	1		3.0E-04	2.1E-05	3.0E-04	1.2E-03		2.0E-07	NV	1.2E-03
Nickel	7440-02-0	4.1E+01	1.0E-05		1.6E-09	NV	1		2.0E-02	8.0E-04	9.0E-05	5.1E-04		1.8E-05	NV	5.2E-04
Potassium	7440-09-7	5.1E+03	1.3E-03		2.0E-07	NV	1					NTV	NTV	NTV	NV	
Selenium	7782-49-2	6.2E+00	1.5E-06		2.5E-10	NV	1		5.0E-03	5.0E-03	2.0E-02	3.1E-04		1.2E-08	NV	3.1E-04
Silver	7440-22-4	3.9E+00	9.6E-07		1.5E-10	NV	1		5.0E-03	2.0E-04		1.9E-04		NTV	NV	1.9E-04
Sodium	7440-23-5	1.4E+04	3.5E-03		5.5E-07	NV	1					NTV	NTV	NTV	NV	
Thallium	7440-28-0	1.2E+00	3.0E-07		4.7E-11	NV	1					NTV	NTV	NTV	NV	
Vanadium	7440-62-2	3.5E+01	8.6E-06		1.4E-09	NV	1		5.0E-03	1.3E-04	1.0E-04	1.7E-03		1.4E-05	NV	1.7E-03
Zinc	7440-66-6	7.2E+02	1.8E-04		2.8E-08	NV	1		3.0E-01	3.0E-01		5.9E-04		NTV	NV	5.9E-04

Appendix H, Table H-26
Intake and Risk Equations - Single Age

Human Health Risk Assessment
D.C. United Soccer Stadium
Washington, D.C.

Cancer Risk from Ingestion

$$ELCR = Intake_{ing} * CSF$$

$$Intake_{ing\ (age\ group\ x)} = \frac{[EPC]_{soil} * IR * ABS_{ing} * FI * EF * ED * C1}{BW_x * AT_{lifetime}}$$

Cancer Risk from Dermal Absorption

$$ELCR = DAD * CSF$$

$$DAD_{derm(age\ group\ x)} = \frac{DA_{Event} * SA * EV * EF * ED}{BW_x * AT_{lifetime}}$$

$$DA_{Event} = [EPC]_{soil} * ABS_d * AF * C1$$

Cancer Risk from Inhalation

$$ELCR_{inh} = EC_{can} * IUR$$

$$EC_{can\ (age\ group\ x)} = \frac{[EPC]_{PART} * ET_{Part} * EF * ED \text{ --- OR--- } [EPC]_{VAPOR} * ET_{Vap} * EF * ED}{24 * AT_{lifetime}}$$

Noncancer Risk from Ingestion

$$HQ = \frac{Intake_{ing}}{RfD}$$

$$Intake_{ing} = \frac{[EPC]_{soil} * IR * ABS_{ing} * FI * EF * ED * C1}{BW * AT}$$

Noncancer Risk from Dermal Absorption

$$HQ = \frac{DAD}{RfD}$$

$$DAD_{derm} = \frac{DA_{Event} * SA * EV * EF * ED}{BW * AT}$$

$$DA_{Event} = [EPC]_{soil} * ABS_d * AF * C1$$

Noncancer Risk from Inhalation

$$HQ = \frac{EC_{nc}}{RfC}$$

$$EC_{nc} = \frac{[EPC]_{PART} * ET_{Part} * EF * ED * C2 \text{ --- OR--- } [EPC]_{VAPOR} * ET_{Vap} * EF * ED * C2}{24 * AT}$$

Parameter	Value - Cancer	Value - Non-Cancer	Units
CSF	Chemical specific	--	$(mg/kg\text{-}day)^{-1}$
IUR	Chemical specific	--	$(ug/m^3)^{-1}$
Intake	Age/chemical specific	--	mg/kg-day
EC_{can}	Age/chemical specific	--	(ug/m^3)
ELCR	Age/chemical specific	--	unitless
RfD	--	Chemical specific	mg/kg-day
RfC	--	Chemical specific	(mg/m^3)
DAD	Age/chemical specific	Age/chemical specific	mg/kg-day
DA_{Event}	Age/chemical specific	Age/chemical specific	mg/cm^2-event
EC_{nc}	--	Age/chemical specific	mg/m^3
HQ	--	Age/chemical specific	unitless
$[EPC]_{soil}$	Chemical specific	Chemical specific	mg/kg
$[EPC]_{PART}$	Appendix H, TABLE H-27	Appendix H, TABLE H-27	ug/m^3
$[EPC]_{VAPOR}$	Appendix H, TABLE	Appendix H, TABLE	ug/m^3
ABS_{ing}	Chemical specific	Chemical specific	unitless
ABS_d	Chemical specific	Chemical specific	unitless
BW	80	80	kg
EF	72	72	day/year
ED	25	25	year
AT	--	9125	day
ATlifetime	25550	--	day
IR	100	100	mg/day
FI	1	1	unitless
C1	0.000001	0.000001	kg/mg
SA	3527	3527	cm2
AF	0.12	0.12	mg/cm2
EV	1	1	event/day
ETPart	8	8	hours/day
C2	0.001	0.001	mg/ug
ETVap	8	8	hours/day

Appendix H, Table H-27
Exposure Factors

Human Health Risk Assessment
D.C. United Soccer Stadium
Washington, D.C.

PLACE "X" IN THE APPROPRIATE YELLOW SHADED CELLS FOR THE APPROPRIATE RECEPTOR AND BASIS F

SCENARIO USED TO CALCULATE RISKS	**X**	**LANDSCAPER**
BASIS FOR CANCER CALCULATIONS	**X**	
BASIS FOR NON-CANCER CALCULATIONS	**X**	

RECEPTOR			**LANDSCAPER (ADULT)**	
Standard Parameters				
Body Weight	BW	kg	80	USEPA, 2014
Exposure Frequency	EF	day/year	72	SITE SPECIFIC
Exposure Duration	ED	year	25	USEPA, 2002
Non–carcinogenic Averaging Time	AT	day	9125	Exposure duration expressed in days
Carcinogenic Averaging Time	$AT_{lifetime}$	day	25550	70 year lifetime
Incidental Ingestion of Soil				
Soil Ingestion Rate	IR	mg/day	100	USEPA, 2014
Fraction Ingested	FI	unitless	1.0	USEPA, 2002
Age-Adjusted Soil Ingestion Rate	IFSadj	mg-yr/kg-day	NA	
Dermal Exposure with Soil				
Exposed Skin Surface Area	SA	cm^2	3527	USEPA, 2014
Soil Adherence Factor	AF	mg/cm^2	0.12	USEPA, 2014
Fraction Dermal	EV	event/day	1.0	USEPA, 2002
Age-Adjusted Dermal Contact Factor	DFSadj	mg-yr/kg-day	NA	
Particulate Inhalation				
Exposure Time	ET_{Part}	hours/day	8	Assumption
Vapor Inhalation				
Exposure Time	ET_{Vap}	hours/day	8	Assumption

Appendix H, Table H-28
Particulate to Outdoor Air EPC Calculations
Soil -
LANDSCAPER - LANDSCAPER (ADULT)

Human Health Risk Assessment
D.C. United Soccer Stadium
Washington, D.C.

EQUATIONS:

$$EPC_{[PARTICULATE]} = EPC_{[SOIL]} \times PARTICULATE_{[AIR]} \times 1E\text{-}06\ [kg/mg]$$

where:

$$PARTICULATE_{[AIR]} = (1/PEF * 1E+09\ ug/kg) \text{ or Measured/Modelled}$$

and:

$$PEF\ (m^3/kg) = Q/C \times [(3600\ s/hr) / ((0.036 \times (1-V) \times (U_m/U_t)^3 \times F(x))]$$

PARAMETER/DEFINITION	UNITS	DEFAULT	Source
$PARTICULATE_{[Air]}$ / Particulate concentration in air	ug/m^3	0.60	Calculated or measured
Measured or modeled $PARTICULATE_{[AIR]}$	ug/m^3		Measured value
PEF / Particulate emission factor	m^3/kg		Guidance value
PEF / Particulate emission factor	m^3/kg	1.66E+09	Calculated here
Q/C / inverse of the mean concentration at the center of a 13-acre-square source	g/m^2-s per kg/m^3	35.14	Calculated / USEPA, 2014 [a]
V / Fraction of vegetative cover	unitless	0.5	Site-specific, estimated
U_m / mean annual windspeed	m/s	4.2	Site-specific / Washington National Airport
U_t / equivalent threshold value of wind speed at 7 m	m/s	11.32	USEPA, 2014
F(x) / function dependant on U_m/U_t derived using Cowherd et al. (1985)	unitless	8.27E-02	Calculated / USEPA, 2014

USEPA, 2014. Regional Screening Levels.
[a] Climactic zone: Phoenix Arizona [a] Area of Source: Specific to size of Exposure Area

CASRN	COPC	EPC Soil (mg/kg)	EPC Particulate (ug/m^3)
79-01-6	Trichloroethylene	0.0031	1.9E-09
75-01-4	Vinyl Chloride	0.0064	3.8E-09
630-20-6	1,1,1,2-Tetrachloroethane	0.0068	4.1E-09
	1,1,2,2-Tetrachloroethane		
120-82-1	1,2,4-Trichlorobenzene	0.0039	2.3E-09
95-63-6	1,2,4-Trimethylbenzene	1.98	1.2E-06
95-50-1	1,2-Dichlorobenzene	0.0006	3.6E-10
108-67-8	1,3,5-Trimethylbenzene	0.847	5.1E-07
106-46-7	1,4-Dichlorobenzene	0.00061	3.7E-10
78-93-3	Methyl Ethyl Ketone (2-Butanone)	0.16	9.6E-08
591-78-6	2-Hexanone	0.0015	9.0E-10
	Butylbenzene, sec-		
108-10-1	Methyl Isobutyl Ketone (4-methyl-2-pentanone)	0.042	2.5E-08
67-64-1	Acetone	0.53	3.2E-07
71-43-2	Benzene	0.0068	4.1E-09
74-83-9	Bromomethane	0.026	1.6E-08
	Carbon Disulfide		
	Chloroform		
74-87-3	Chloromethane (Methyl Chloride)	0.00085	5.1E-10
156-59-2	cis-1,2-Dichloroethylene	0.027	1.6E-08
	Cyclohexane		
99-87-6	Cymene (p-Isopropyltoluene) (surrogate = Cumene	0.27	1.6E-07
100-41-4	Ethylbenzene	1	6.0E-07
98-82-8	Isopropylbenzene	0.71	4.3E-07
	Isopropyltoluene (surrogate = Cymene)		
108-87-2	Methyl cyclohexane	2.2	1.3E-06
1634-04-4	Methyl tert-Butyl Ether (MTBE)	0.013	7.8E-09
75-09-2	Methylene Chloride	0.0148	8.9E-09
104-51-8	Butylbenzene, n-	0.169	1.0E-07
	Propylbenzene		
100-42-5	Styrene	0.031	1.9E-08
	Butylbenzene, tert-		
127-18-4	Tetrachloroethylene	0.446	2.7E-07
108-88-3	Toluene	0.14	8.4E-08
156-60-5	trans-1,2-Dichloroethylene	0.00079	4.7E-10
75-69-4	Trichlorofluoromethane (CFC-11)	0.051	3.1E-08
76-13-1	Trifluorotrichloroethane (Freon 113)	0.0012	7.2E-10
1330-20-7	Xylenes	0.00738	4.4E-09
91-57-6	2-Methylnaphthalene	31	1.9E-05
83-32-9	Acenaphthene	24	1.4E-05
208-96-8	Acenaphthylene	17	1.0E-05
120-12-7	Anthracene	52	3.1E-05
56-55-3	Benz[a]anthracene	3.35	2.0E-06
50-32-8	Benzo[a]pyrene	2.83	1.7E-06
205-99-2	Benzo[b]fluoranthene	3.53	2.1E-06
191-24-2	Benzo(g,h,i)perylene	41	2.5E-05
207-08-9	Benzo[k]fluoranthene	23	1.4E-05
218-01-9	Chrysene	3.32	2.0E-06
53-70-3	Dibenz[a,h]anthracene	0.483	2.9E-07
206-44-0	Fluoranthene	180	1.1E-04
86-73-7	Fluorene	23	1.4E-05
193-39-5	Indeno[1,2,3-cd]pyrene	1.79	1.1E-06
91-20-3	Naphthalene	0.582	3.5E-07
85-01-8	Phenanthrene	170	1.0E-04
129-00-0	Pyrene	170	1.0E-04
1336-36-3	Polychlorinated Biphenyls	0.696	4.2E-07
	Aluminum		
7440-36-0	Antimony	8.9	5.3E-06
7440-38-2	Arsenic	9.4	5.7E-06
7440-39-3	Barium	156	9.4E-05
7440-41-7	Beryllium	0.48	2.9E-07
7440-43-9	Cadmium	2.9	1.7E-06
7440-70-2	Calcium	75000	4.5E-02
7440-47-3	Chromium, Total	400	2.4E-04
7440-48-4	Cobalt	10.2	6.1E-06
7440-50-8	Copper	363	2.2E-04
7439-89-6	Iron	31000	1.9E-02
7439-92-1	Lead	612	3.7E-04
7439-95-4	Magnesium	20000	1.2E-02
7439-96-5	Manganese	360	2.2E-04
7439-97-6	Mercury	1.5	9.0E-07
7440-02-0	Nickel	41	2.5E-05
7440-09-7	Potassium	5100	3.1E-03
7782-49-2	Selenium	6.2	3.7E-06
7440-22-4	Silver	3.9	2.3E-06
7440-23-5	Sodium	14000	8.4E-03
7440-28-0	Thallium	1.2	7.2E-07
7440-62-2	Vanadium	35	2.1E-05
7440-66-6	Zinc	720	4.3E-04

Appendix H, Table H-29
Vapor to Outdoor Air EPC Calculations
Soil -
LANDSCAPER - LANDSCAPER (ADULT)

Human Health Risk Assessment
D.C. United Soccer Stadium
Washington, D.C.

EQUATIONS:

$EPC_{[VAPOR]} = EPC_{[SOIL]} \times 1/VF \times 1000\ ug/mg$

where:

$VF\ (m^3/kg) = Q/C \times (3.14 \times D_A \times T)^{1/2} \times 10^{-4}(m^2/cm^2) / (2 \times P_b \times D_A)$

and:

$DA = [(O_a^{10/3} D_i H' + O_w^{10/3} D_w)/n^2] / P_b K_d + O_w + O_a H'$

PARAMETER/DEFINITION	UNITS	DEFAULT	Source
VF / volatilization factor	m^3/kg	Calculated	
D_A / apparent diffusivity	cm^2/s	Calculated	
Q/C / inverse of the mean concentration at the center of a 0.5-acre-square source	g/m^2-s per kg/m^3	35.136	USEPA, 2014 [a]
T / exposure interval	s	7.88E+08	LANDSCAPER
Π_b / dry soil bulk density	g/cm^3	1.62	USEPA, 2014
O_a / air-filled soil porosity	L_{air}/L_{soil}	0.314	USEPA, 2014
n / total soil porosity	L_{pore}/L_{soil}	0.39	USEPA, 2014
O_w / water-filled soil porosity	L_{water}/L_{soil}	0.076	USEPA, 2014
Ψ_s / soil particle density	g/cm^3	2.65	USEPA, 1996
D_i / diffusivity in air	cm^2/s	chemical-specific	
H' / Henry's Law constant	dimensionless	chemical-specific	
D_w / diffusivity in water	cm^2/s	chemical-specific	
K_d / soil-water partition coefficient (Koc x foc) organics	cm^3/g	chemical-specific	
K_{oc} / soil organic carbon partition coefficient	cm^3/g	chemical-specific	
f_{oc} / fraction organic carbon in soil	g/g	0.006	Default

USEPA, 2014. Regional Screening Levels.

[a] Climactic zone: Phoenix Arizona [a] Area of Source: Specific to size of Exposure Area

CASRN	COPC	Volatile (Y/N)	D_i (cm^2/s)	H' (unitless)	D_w (cm^2/s)	K_d (cm^3/g)	K_{oc} (cm^3/g)	D_A (cm^2/s)	VF (m^3/kg)	EPC Soil (mg/kg)	EPC Vapor (ug/m^3)
79-01-6	Trichloroethylene	Y	6.87E-02	4.03E-01	1.02E-05	3.64E-01	6.07E+01	4.8E-03	777	0.0031	4.0E-03
75-01-4	Vinyl Chloride	Y	1.07E-01	1.14E+00	1.20E-05	1.30E-01	2.17E+01	2.6E-02	334	0.0064	1.9E-02
630-20-6	1,1,1,2-Tetrachloroethane	Y	4.82E-02	1.02E-01	9.10E-06	5.16E-01	8.60E+01	7.2E-04	2009	0.0068	3.4E-03
	1,1,2,2-Tetrachloroethane										
120-82-1	1,2,4-Trichlorobenzene	Y	3.96E-02	5.81E-02	8.40E-06	8.14E+00	1.36E+03	2.4E-05	11023	0.0039	3.5E-04
95-63-6	1,2,4-Trimethylbenzene	Y	6.07E-02	2.52E-01	7.92E-06	3.69E+00	6.14E+02	3.5E-04	2905	1.98	6.8E-01
95-50-1	1,2-Dichlorobenzene	Y	5.62E-02	7.85E-02	8.92E-06	2.30E+00	3.83E+02	1.6E-04	4271	0.0006	1.4E-04
108-67-8	1,3,5-Trimethylbenzene	Y	6.02E-02	3.59E-01	7.84E-06	3.61E+00	6.02E+02	4.9E-04	2426	0.847	3.5E-01
106-46-7	1,4-Dichlorobenzene	Y	5.50E-02	9.85E-02	8.68E-06	2.25E+00	3.75E+02	2.0E-04	3817	0.00061	1.6E-04
78-93-3	Methyl Ethyl Ketone (2-Butanone)	Y	9.14E-02	2.33E-03	1.02E-05	2.71E-02	4.51E+00	2.4E-04	3453	0.16	4.6E-02
591-78-6	2-Hexanone	Y	7.04E-02	3.81E-03	8.44E-06	8.99E-02	1.50E+01	1.7E-04	4181	0.0015	3.6E-04
	Butylbenzene, sec-										
108-10-1	Methyl Isobutyl Ketone (4-methyl-2-pentanone)	Y	6.98E-02	5.64E-03	8.35E-06	7.56E-02	1.26E+01	2.7E-04	3271	0.042	1.3E-02
67-64-1	Acetone	Y	1.06E-01	1.43E-03	1.15E-05	1.42E-02	2.36E+00	2.1E-04	3714	0.53	1.4E-01
71-43-2	Benzene	Y	8.95E-02	2.27E-01	1.03E-05	8.75E-01	1.46E+02	1.8E-03	1273	0.0068	5.3E-03
74-83-9	Bromomethane	Y	1.00E-01	3.00E-01	1.35E-05	7.93E-02	1.32E+01	1.4E-02	457	0.026	5.7E-02
	Carbon Disulfide										
	Chloroform										
74-87-3	Chloromethane (Methyl Chloride)	Y	1.24E-01	3.61E-01	1.36E-05	7.92E-02	1.32E+01	1.9E-02	386	0.00085	2.2E-03
156-59-2	cis-1,2-Dichloroethylene	Y	8.84E-02	1.67E-01	1.13E-05	2.38E-01	3.96E+01	4.0E-03	856	0.027	3.2E-02
	Cyclohexane										
99-87-6	Cymene (p-Isopropyltoluene) (surrogate = Cum	Y	5.27E-02	4.50E-01	7.32E-06	6.72E+00	1.12E+03	3.0E-04	3139	0.27	8.6E-02
100-41-4	Ethylbenzene	Y	6.85E-02	3.22E-01	8.46E-06	2.68E+00	4.46E+02	6.8E-04	2075	1	4.8E-01
98-82-8	Isopropylbenzene	Y	6.03E-02	4.70E-01	7.86E-06	4.19E+00	6.98E+02	5.6E-04	2280	0.71	3.1E-01
	Isopropyltoluene (surrogate = Cymene)										
108-87-2	Methyl cyclohexane	Y	8.00E-02	6.13E+00	9.11E-06	8.76E-01	1.46E+02	2.0E-02	383	2.2	5.7E+00
1634-04-4	Methyl tert-Butyl Ether (MTBE)	Y	7.53E-02	2.40E-02	8.59E-06	6.94E-02	1.16E+01	1.3E-03	1511	0.013	8.6E-03
75-09-2	Methylene Chloride	Y	9.99E-02	1.33E-01	1.25E-05	1.30E-01	2.17E+01	5.6E-03	722	0.0148	2.0E-02
104-51-8	Butylbenzene, n-	Y	5.28E-02	6.50E-01	7.33E-06	8.89E+00	1.48E+03	3.2E-04	3001	0.169	5.6E-02
	Propylbenzene										
100-42-5	Styrene	Y	7.11E-02	1.12E-01	8.78E-06	2.68E+00	4.46E+02	2.5E-04	3421	0.031	9.1E-03
	Butylbenzene, tert-										
127-18-4	Tetrachloroethylene	Y	5.05E-02	7.24E-01	9.46E-06	5.70E-01	9.49E+01	4.1E-03	841	0.446	5.3E-01
108-88-3	Toluene	Y	7.78E-02	2.71E-01	9.20E-06	1.40E+00	2.34E+02	1.2E-03	1557	0.14	9.0E-02
156-60-5	trans-1,2-Dichloroethylene	Y	8.76E-02	1.67E-01	1.12E-05	2.38E-01	3.96E+01	3.9E-03	860	0.00079	9.2E-04
75-69-4	Trichlorofluoromethane (CFC-11)	Y	6.54E-02	3.97E+00	1.00E-05	2.63E-01	4.39E+01	2.1E-02	377	0.051	1.4E-01
76-13-1	Trifluorotrichloroethane (Freon 113)	Y	7.80E-02	2.20E+01	8.20E-06	1.20E+00	2.00E+02	2.7E-02	331	0.0012	3.6E-03
1330-20-7	Xylenes	Y	8.47E-02	2.12E-01	9.90E-06	2.30E+00	3.83E+02	6.4E-04	2129	0.00738	3.5E-03
91-57-6	2-Methylnaphthalene	Y	5.24E-02	2.12E-02	7.78E-06	1.49E+01	2.48E+03	6.4E-06	21401	31	1.4E+00
83-32-9	Acenaphthene	Y	5.06E-02	7.52E-03	8.33E-06	3.02E+01	5.03E+03	1.1E-06	52004	24	4.6E-01
208-96-8	Acenaphthylene	N	5.06E-02	7.52E-03	8.33E-06	3.02E+01	5.03E+03				NV
120-12-7	Anthracene	Y	3.90E-02	2.27E-03	7.85E-06	9.82E+01	1.64E+04	7.7E-08	194325	52	2.7E-01
56-55-3	Benz[a]anthracene	N	5.09E-02	4.91E-04	5.94E-06	1.06E+03	1.77E+05				NV
50-32-8	Benzo[a]pyrene	N	4.76E-02	1.87E-05	5.56E-06	3.52E+03	5.87E+05				NV
205-99-2	Benzo[b]fluoranthene	N	4.76E-02	2.69E-05	5.56E-06	3.60E+03	5.99E+05				NV
191-24-2	Benzo(g,h,i)perylene	N	5.28E-02	9.65E-08	6.17E-06	1.35E+00	2.25E+02				NV
207-08-9	Benzo[k]fluoranthene	N	4.76E-02	2.39E-05	5.56E-06	3.52E+03	5.87E+05				NV
218-01-9	Chrysene	N	2.61E-02	2.14E-04	6.75E-06	1.08E+03	1.81E+05				NV
53-70-3	Dibenz[a,h]anthracene	N	4.46E-02	5.76E-06	5.21E-06	1.15E+04	1.91E+06				NV
206-44-0	Fluoranthene	N	2.76E-02	3.62E-04	7.18E-06	3.33E+02	5.55E+04				NV
86-73-7	Fluorene	Y	4.40E-02	3.93E-03	7.89E-06	5.50E+01	9.16E+03	2.7E-07	104107	23	2.2E-01
193-39-5	Indeno[1,2,3-cd]pyrene	N	4.48E-02	6.56E-05	5.23E-06	2.08E+04	3.47E+06				NV
91-20-3	Naphthalene	Y	6.05E-02	1.80E-02	8.38E-06	9.26E+00	1.54E+03	1.0E-05	17081	0.582	3.4E-02
85-01-8	Phenanthrene	N	2.08E-02	5.81E-12	5.19E-06	5.56E+01	9.27E+03				NV
129-00-0	Pyrene	Y	2.78E-02	4.87E-04	7.25E-06	3.26E+02	5.43E+04	3.6E-09	904678	170	1.9E-01
1336-36-3	Polychlorinated Biphenyls	N	4.32E-02	7.77E-03	5.04E-06	4.69E+02	7.81E+04				NV

Appendix H, Table H-29
Vapor to Outdoor Air EPC Calculations
Soil -
LANDSCAPER - LANDSCAPER (ADULT)

Human Health Risk Assessment
D.C. United Soccer Stadium
Washington, D.C.

EQUATIONS:

$EPC_{[VAPOR]} = EPC_{[SOIL]} \times 1/VF \times 1000\ ug/mg$

where:

$VF\ (m^3/kg) = Q/C \times (3.14 \times D_A \times T)^{1/2} \times 10^{-4}(m^2/cm^2) / (2 \times P_b \times D_A)$

and:

$DA = [(O_a^{10/3} D_i H' + O_w^{10/3} D_w)/n^2] / P_b K_d + O_w + O_a H'$

PARAMETER/DEFINITION	UNITS	DEFAULT	Source
VF / volatilization factor	m^3/kg	Calculated	
D_A / apparent diffusivity	cm^2/s	Calculated	
Q/C / inverse of the mean concentration at the center of a 0.5-acre-square source	g/m^2-s per kg/m^3	35.136	USEPA, 2014 [a]
T / exposure interval	s	7.88E+08	LANDSCAPER
Π_b / dry soil bulk density	g/cm^3	1.62	USEPA, 2014
O_a / air-filled soil porosity	L_{air}/L_{soil}	0.314	USEPA, 2014
n / total soil porosity	L_{pore}/L_{soil}	0.39	USEPA, 2014
O_w / water-filled soil porosity	L_{water}/L_{soil}	0.076	USEPA, 2014
Ψ_s / soil particle density	g/cm^3	2.65	USEPA, 1996
D_i / diffusivity in air	cm^2/s	chemical-specific	
H' / Henry's Law constant	dimensionless	chemical-specific	
D_w / diffusivity in water	cm^2/s	chemical-specific	
K_d / soil-water partition coefficient (Koc x foc) organics	cm^3/g	chemical-specific	
K_{oc} / soil organic carbon partition coefficient	cm^3/g	chemical-specific	
f_{oc} / fraction organic carbon in soil	g/g	0.006	Default

USEPA, 2014. Regional Screening Levels.
[a] Climactic zone: Phoenix Arizona [a] Area of Source: Specific to size of Exposure Area

CASRN	COPC	Volatile (Y/N)	D_i (cm^2/s)	H' (unitless)	D_w (cm^2/s)	K_d (cm^3/g)	K_{oc} (cm^3/g)	D_A (cm^2/s)	VF (m^3/kg)	EPC Soil (mg/kg)	EPC Vapor (ug/m^3)
	Aluminum										
7440-36-0	Antimony	N									NV
7440-38-2	Arsenic	N									NV
7440-39-3	Barium	N									NV
7440-41-7	Beryllium	N									NV
7440-43-9	Cadmium	N									NV
7440-70-2	Calcium	N									NV
7440-47-3	Chromium, Total	N									NV
7440-48-4	Cobalt	N									NV
7440-50-8	Copper	N									NV
7439-89-6	Iron	N									NV
7439-92-1	Lead	N									NV
7439-95-4	Magnesium	N									NV
7439-96-5	Manganese	N									NV
7439-97-6	Mercury	N	3.07E-02	4.67E-01	6.30E-06						NV
7440-02-0	Nickel	N									NV
7440-09-7	Potassium	N									NV
7782-49-2	Selenium	N									NV
7440-22-4	Silver	N									NV
7440-23-5	Sodium	N									NV
7440-28-0	Thallium	N									NV
7440-62-2	Vanadium	N									NV
7440-66-6	Zinc	N									NV

Appendix H,Table H-30
Cancer Risk Calculations - Single Age
Indoor Air -
COMMERCIAL/INDUSTRIAL - COMMERCIAL WORKER (ADULT)

Human Health Risk Assessment
D.C. United Soccer Stadium
Washington, D.C.

Exposure Routes Evaluated		ELCR (Total)
Vapor Inhalation -	Yes	3E-06

COPC - chemical of potential concern
EPC - exposure point concentration
EC - exposure concentration

NC - not carcinogenic by this exposure route
NTV - no toxicity value available
NV - not volatile

IUR - cancer inhalation unit risk
ELCR - excess lifetime cancer risk

COPC	CASRN	EPC (ug/m^3)	Intake Calculations ECVapor (ug/m^3)	Cancer Toxicity Value IUR $(ug/m^3)^{-1}$	ELCR
Trichloroethylene	79-01-6	5.1E+00	4.1E-01	4.1E-06	1.7E-06
Vinyl Chloride	75-01-4	7.9E-01	6.4E-02	4.4E-06	2.8E-07
1,1-Dichloroethene	75-35-4	3.4E-01	NC		
1,2,4-Trimethylbenzene	95-63-6	2.3E-01	NC		
1,3,5-Trimethylbenzene	108-67-8	1.4E-01	NC		
1,3-Butadiene	106-99-0	2.2E-01	1.8E-02	3.0E-05	5.4E-07
2,2,4-Trimethylpentane (surrogate = hexane)	540-84-1	8.0E+00	NC		
Methyl Ethyl Ketone (2-Butanone)	78-93-3	4.8E-02	NC		
2-Hexanone	591-78-6	7.1E-03	NC		
Xylenes	1330-20-7	7.8E-02	NC		
Methyl Isobutyl Ketone (4-methyl-2-pentanone)	108-10-1	2.1E-01	NC		
Acetone	67-64-1	2.8E-01	NC		
Benzene	71-43-2	4.0E-01	3.3E-02	7.8E-06	2.5E-07
Bromodichloromethane	75-27-4	1.4E-02	1.2E-03	3.7E-05	4.3E-08
Carbon Disulfide	75-15-0	1.1E-01	NC		
Chloroform	67-66-3	1.1E-01	9.2E-03	2.3E-05	2.1E-07
Chloromethane (Methyl Chloride)	74-87-3	8.7E-04	7.1E-05	1.8E-06	1.3E-10
cis-1,2-Dichloroethylene	156-59-2	3.1E+01	NC		
Cyclohexane	110-82-7	8.8E-01	NC		
Dichlorodifluoromethane (CFC-12)	75-71-8	3.9E-02	NC		
Ethanol (surrogate = Isobutanol)	64-17-5	2.5E-02	NC		
Ethyl acetate	141-78-6	1.4E-02	NC		
Ethylbenzene	100-41-4	2.5E-01	2.0E-02	2.5E-06	5.1E-08
Hexane, n-	110-54-3	2.2E+00	NC		

Appendix H,Table H-30
Cancer Risk Calculations - Single Age
Indoor Air -
COMMERCIAL/INDUSTRIAL - COMMERCIAL WORKER (ADULT)

Human Health Risk Assessment
D.C. United Soccer Stadium
Washington, D.C.

Exposure Routes Evaluated		ELCR (Total)
Vapor Inhalation -	Yes	3E-06

COPC - chemical of potential concern
EPC - exposure point concentration
EC - exposure concentration
NC - not carcinogenic by this exposure route
NTV - no toxicity value available
NV - not volatile
IUR - cancer inhalation unit risk
ELCR - excess lifetime cancer risk

COPC	CASRN	EPC (ug/m^3)	Intake Calculations ECVapor (ug/m^3)	Cancer Toxicity Value IUR $(ug/m^3)^{-1}$	ELCR
Isopropyl Alcohol	67-63-0	7.0E-03	NC		
Xylenes	1330-20-7	4.4E-01	NC		
Methyl tert-Butyl Ether (MTBE)	1634-04-4	3.7E-01	3.0E-02	2.6E-07	7.9E-09
Methylene Chloride	75-09-2	4.0E-01	3.2E-02	1.0E-08	3.2E-10
Naphthalene	91-20-3	5.3E-03	4.3E-04	3.4E-05	1.5E-08
N-Heptane (surrogate = hexane)	142-82-5	8.0E-01	NC		
Xylenes	1330-20-7	1.8E-01	NC		
Propylene (Propene)	115-07-1	8.4E+00	NC		
Styrene	100-42-5	9.7E-03	NC		
Tetrachloroethylene	127-18-4	8.4E+00	6.9E-01	2.6E-07	1.8E-07
Toluene	108-88-3	7.6E-01	NC		
trans-1,2-Dichloroethylene	156-60-5	8.1E-01	NC		
Trichlorofluoromethane (CFC-11)	75-69-4	2.2E-01	NC		
Trifluorotrichloroethane (Freon 113)	76-13-1	1.1E-01	NC		

Appendix H,Table H-31
Non-Cancer Risk Calculations
Indoor Air -
COMMERCIAL/INDUSTRIAL - COMMERCIAL WORKER (ADULT)

Human Health Risk Assessment
D.C. United Soccer Stadium
Washington, D.C.

Exposure Routes Evaluated		HI (Total)
Vapor Inhalation -	Yes	7E-01

COPC - chemical of potential concern
EPC - exposure point concentration
EC - exposure concentration
NTV - no toxicity value available
NV - not volatile
RfC - reference concentration
HI - hazard index
HQ - hazard quotient

COPC	CASRN	EPC (ug/m^3)	Intake Calculation ECVapor (mg/m^3)	Non-Cancer Toxicity Value RfC (mg/m^3)	HQ
Trichloroethylene	79-01-6	5.1E+00	1.2E-03	2.0E-03	5.8E-01
Vinyl Chloride	75-01-4	7.9E-01	1.8E-04	1.0E-01	1.8E-03
1,1-Dichloroethene	75-35-4	3.4E-01	7.7E-05	2.0E-01	3.8E-04
1,2,4-Trimethylbenzene	95-63-6	2.3E-01	5.3E-05	7.0E-03	7.6E-03
1,3,5-Trimethylbenzene	108-67-8	1.4E-01	3.2E-05		NTV
1,3-Butadiene	106-99-0	2.2E-01	5.0E-05	2.0E-03	2.5E-02
2,2,4-Trimethylpentane (surrogate = hexane)	540-84-1	8.0E+00	1.8E-03	7.0E-01	2.6E-03
Methyl Ethyl Ketone (2-Butanone)	78-93-3	4.8E-02	1.1E-05	5.0E+00	2.2E-06
2-Hexanone	591-78-6	7.1E-03	1.6E-06	3.0E-02	5.4E-05
Xylenes	1330-20-7	7.8E-02	1.8E-05	1.0E-01	1.8E-04
Methyl Isobutyl Ketone (4-methyl-2-pentanone)	108-10-1	2.1E-01	4.8E-05	3.0E+00	1.6E-05
Acetone	67-64-1	2.8E-01	6.4E-05	3.1E+01	2.1E-06
Benzene	71-43-2	4.0E-01	9.1E-05	3.0E-02	3.0E-03
Bromodichloromethane	75-27-4	1.4E-02	3.2E-06		NTV
Carbon Disulfide	75-15-0	1.1E-01	2.5E-05	7.0E-01	3.6E-05
Chloroform	67-66-3	1.1E-01	2.6E-05	9.8E-02	2.6E-04
Chloromethane (Methyl Chloride)	74-87-3	8.7E-04	2.0E-07	9.0E-02	2.2E-06
cis-1,2-Dichloroethylene	156-59-2	3.1E+01	7.0E-03		NTV
Cyclohexane	110-82-7	8.8E-01	2.0E-04	6.0E+00	3.4E-05
Dichlorodifluoromethane (CFC-12)	75-71-8	3.9E-02	9.0E-06	1.0E-01	9.0E-05
Ethanol (surrogate = Isobutanol)	64-17-5	2.5E-02	5.6E-06	-	NTV
Ethyl acetate	141-78-6	1.4E-02	3.1E-06	7.0E-02	4.5E-05
Ethylbenzene	100-41-4	2.5E-01	5.7E-05	1.0E+00	5.7E-05
Hexane, n-	110-54-3	2.2E+00	5.0E-04	7.0E-01	7.1E-04

Appendix H,Table H-31
Non-Cancer Risk Calculations
Indoor Air -
COMMERCIAL/INDUSTRIAL - COMMERCIAL WORKER (ADULT)

Human Health Risk Assessment
D.C. United Soccer Stadium
Washington, D.C.

Exposure Routes Evaluated		HI (Total)
Vapor Inhalation -	Yes	7E-01

COPC - chemical of potential concern
EPC - exposure point concentration
EC - exposure concentration
NTV - no toxicity value available
NV - not volatile
RfC - reference concentration
HI - hazard index
HQ - hazard quotient

COPC	CASRN	EPC (ug/m^3)	Intake Calculation ECVapor (mg/m^3)	Non-Cancer Toxicity Value RfC (mg/m^3)	HQ
Isopropyl Alcohol	67-63-0	7.0E-03	1.6E-06	2.0E-01	8.0E-06
Xylenes	1330-20-7	4.4E-01	1.0E-04	1.0E-01	1.0E-03
Methyl tert-Butyl Ether (MTBE)	1634-04-4	3.7E-01	8.5E-05	3.0E+00	2.8E-05
Methylene Chloride	75-09-2	4.0E-01	9.0E-05	6.0E-01	1.5E-04
Naphthalene	91-20-3	5.3E-03	1.2E-06	3.0E-03	4.0E-04
N-Heptane (surrogate = hexane)	142-82-5	8.0E-01	1.8E-04	7.0E-01	2.6E-04
Xylenes	1330-20-7	1.8E-01	4.0E-05	1.0E-01	4.0E-04
Propylene (Propene)	115-07-1	8.4E+00	1.9E-03	3.0E+00	6.4E-04
Styrene	100-42-5	9.7E-03	2.2E-06	1.0E+00	2.2E-06
Tetrachloroethylene	127-18-4	8.4E+00	1.9E-03	4.0E-02	4.8E-02
Toluene	108-88-3	7.6E-01	1.7E-04	5.0E+00	3.5E-05
trans-1,2-Dichloroethylene	156-60-5	8.1E-01	1.8E-04		NTV
Trichlorofluoromethane (CFC-11)	75-69-4	2.2E-01	5.0E-05	7.0E-01	7.2E-05
Trifluorotrichloroethane (Freon 113)	76-13-1	1.1E-01	2.5E-05	3.0E+01	8.4E-07

Appendix H,Table H-32
Intake and Risk Equations - Single Age

Human Health Risk Assessment
D.C. United Soccer Stadium
Washington, D.C.

Cancer Risk from Inhalation

$$ELCR_{inh} = EC_{can} * IUR$$

$$EC_{can\ (age\ group\ x)} = \frac{[EPC] * ET * EF * ED}{24 * AT_{lifetime}}$$

Noncancer Risk from Inhalation

$$HQ = \frac{EC_{nc}}{RfC}$$

$$EC_{nc} = \frac{[EPC] * ET * EF * ED * C}{24 * AT}$$

Parameter	Value - Cancer	Value - Non-Cancer	Units
IUR	Chemical specific	--	$(ug/m^3)^{-1}$
EC_{can}	Age/chemical specific	--	(ug/m^3)
ELCR	Age/chemical specific	--	unitless
RfC	--	Chemical specific	(mg/m^3)
EC_{nc}	--	Age/chemical specific	mg/m^3
HQ	--	Age/chemical specific	unitless
[EPC]	-----NOT USED-----	-----NOT USED-----	ug/m^3
EF	250	250	day/year
ED	25	25	year
AT	--	9125	day
ATlifetime	25550	--	day
C	0.001	0.001	mg/ug
ET	8	8	hours/day

Appendix H,Table H-33
Exposure Factors

Human Health Risk Assessment
D.C. United Soccer Stadium
Washington, D.C.

PLACE "X" IN THE APPROPRIATE YELLOW SHADED CELLS FOR THE APPROPRIATE RECEPTOR AND BASIS FOR C

SCENARIO USED TO CALCULATE RISKS			**x**	**COMMERCIAL/INDUSTRIAL**
BASIS FOR CANCER CALCULATIONS			**x**	
BASIS FOR NON-CANCER CALCULATIONS			**x**	
RECEPTOR			**COMMERCIAL WORKER (ADULT)**	
Standard Parameters				
Exposure Frequency	EF	day/year	250	USEPA, 2014
Exposure Duration	ED	year	25	USEPA, 2014
Non–carcinogenic Averaging Time	AT	day	9125	Exposure duration expressed in days
Carcinogenic Averaging Time	$AT_{lifetime}$	day	25550	70 year lifetime
Vapor Inhalation				
Exposure Time	ET	hours/day	8	USEPA, 2014

Appendix H,Table H-34
Cancer Risk Calculations - Composite Receptor/Age-Adjusted
Indoor Air -
SPECTATOR - 4 AGE GROUPS - CHILD, ADOLESCENT, and ADULT

Human Health Risk Assessment
D.C. United Soccer Stadium
Washington, D.C.

Exposure Routes Evaluated		ELCR (Total)
Vapor Inhalation -	Yes	**4E-06**

COPC - chemical of potential concern
EPC - exposure point concentration
EC - exposure concentration
NC - not carcinogenic by this exposure route
NTV - no toxicity value available
NV - not volatile
IUR - cancer inhalation unit risk
ELCR - excess lifetime cancer risk

COPC	CASRN	EPC (ug/m^3)	Intake Calculations ECVapor (ug/m^3)	Mutagenic MOA?	Cancer Toxicity Value IUR $(ug/m^3)^{-1}$	ELCR
Trichloroethylene	79-01-6	5.1E+00	3.1E-02	Y	4.1E-06	1.3E-07
Vinyl Chloride	75-01-4	7.9E-01	3.3E-03	Y	4.4E-06	3.5E-06
1,1-Dichloroethene	75-35-4	3.4E-01	NC	N		
1,2,4-Trimethylbenzene	95-63-6	2.3E-01	NC	N		
1,3,5-Trimethylbenzene	108-67-8	1.4E-01	NC	N		
1,3-Butadiene	106-99-0	2.2E-01	9.4E-04	N	3.0E-05	2.8E-08
2,2,4-Trimethylpentane (surrogate = hexane)	540-84-1	8.0E+00	NC	N		
Methyl Ethyl Ketone (2-Butanone)	78-93-3	4.8E-02	NC	N		
2-Hexanone	591-78-6	7.1E-03	NC	N		
Xylenes	1330-20-7	7.8E-02	NC	N		
Methyl Isobutyl Ketone (4-methyl-2-pentanone)	108-10-1	2.1E-01	NC	N		
Acetone	67-64-1	2.8E-01	NC	N		
Benzene	71-43-2	4.0E-01	1.7E-03	N	7.8E-06	1.3E-08
Bromodichloromethane	75-27-4	1.4E-02	6.0E-05	N	3.7E-05	2.2E-09
Carbon Disulfide	75-15-0	1.1E-01	NC	N		
Chloroform	67-66-3	1.1E-01	4.8E-04	N	2.3E-05	1.1E-08
Chloromethane (Methyl Chloride)	74-87-3	8.7E-04	3.7E-06	N	1.8E-06	6.7E-12
cis-1,2-Dichloroethylene	156-59-2	3.1E+01	NC	N		
Cyclohexane	110-82-7	8.8E-01	NC	N		
Dichlorodifluoromethane (CFC-12)	75-71-8	3.9E-02	NC	N		
Ethanol (surrogate = Isobutanol)	64-17-5	2.5E-02	NC	N		
Ethyl acetate	141-78-6	1.4E-02	NC	N		
Ethylbenzene	100-41-4	2.5E-01	1.1E-03	N	2.5E-06	2.6E-09
Hexane, n-	110-54-3	2.2E+00	NC	N		

Appendix H,Table H-34
Cancer Risk Calculations - Composite Receptor/Age-Adjusted
Indoor Air -
SPECTATOR - 4 AGE GROUPS - CHILD, ADOLESCENT, and ADULT

Human Health Risk Assessment
D.C. United Soccer Stadium
Washington, D.C.

Exposure Routes Evaluated		ELCR (Total)
Vapor Inhalation -	Yes	**4E-06**

COPC - chemical of potential concern
EPC - exposure point concentration
EC - exposure concentration
NC - not carcinogenic by this exposure route
NTV - no toxicity value available
NV - not volatile
IUR - cancer inhalation unit risk
ELCR - excess lifetime cancer risk

COPC	CASRN	EPC (ug/m^3)	Intake Calculations ECVapor (ug/m^3)	Mutagenic MOA?	Cancer Toxicity Value IUR $(ug/m^3)^{-1}$	ELCR
Isopropyl Alcohol	67-63-0	7.0E-03	NC	N		
Xylenes	1330-20-7	4.4E-01	NC	N		
Methyl tert-Butyl Ether (MTBE)	1634-04-4	3.7E-01	1.6E-03	N	2.6E-07	4.1E-10
Methylene Chloride	75-09-2	4.0E-01	4.6E-03	Y	1.0E-08	4.6E-11
Naphthalene	91-20-3	5.3E-03	2.2E-05	N	3.4E-05	7.6E-10
N-Heptane (surrogate = hexane)	142-82-5	8.0E-01	NC	N		
Xylenes	1330-20-7	1.8E-01	NC	N		
Propylene (Propene)	115-07-1	8.4E+00	NC	N		
Styrene	100-42-5	9.7E-03	NC	N		
Tetrachloroethylene	127-18-4	8.4E+00	3.6E-02	N	2.6E-07	9.3E-09
Toluene	108-88-3	7.6E-01	NC	N		
trans-1,2-Dichloroethylene	156-60-5	8.1E-01	NC	N		
Trichlorofluoromethane (CFC-11)	75-69-4	2.2E-01	NC	N		
Trifluorotrichloroethane (Freon 113)	76-13-1	1.1E-01	NC	N		

Appendix H,Table H-35
Non-Cancer Risk Calculations
Indoor Air -
SPECTATOR - 4 AGE GROUPS - CHILD (AGE 0 - <2)

Human Health Risk Assessment
D.C. United Soccer Stadium
Washington, D.C.

Exposure Routes Evaluated		HI (Total)
Vapor Inhalation -	Yes	3E-02

COPC - chemical of potential concern
EPC - exposure point concentration
EC - exposure concentration
NTV - no toxicity value available
NV - not volatile
RfC - reference concentration
HI - hazard index
HQ - hazard quotient

COPC	CASRN	EPC (ug/m^3)	Intake Calculation ECVapor (mg/m^3)	Non-Cancer Toxicity Value RfC (mg/m^3)	HQ
Trichloroethylene	79-01-6	5.1E+00	5.8E-05	2.0E-03	2.9E-02
Vinyl Chloride	75-01-4	7.9E-01	9.0E-06	1.0E-01	9.0E-05
1,1-Dichloroethene	75-35-4	3.4E-01	3.8E-06	2.0E-01	1.9E-05
1,2,4-Trimethylbenzene	95-63-6	2.3E-01	2.6E-06	7.0E-03	3.8E-04
1,3,5-Trimethylbenzene	108-67-8	1.4E-01	1.6E-06		NTV
1,3-Butadiene	106-99-0	2.2E-01	2.5E-06	2.0E-03	1.3E-03
2,2,4-Trimethylpentane (surrogate = hexane)	540-84-1	8.0E+00	9.2E-05	7.0E-01	1.3E-04
Methyl Ethyl Ketone (2-Butanone)	78-93-3	4.8E-02	5.5E-07	5.0E+00	1.1E-07
2-Hexanone	591-78-6	7.1E-03	8.1E-08	3.0E-02	2.7E-06
Xylenes	1330-20-7	7.8E-02	8.9E-07	1.0E-01	8.9E-06
Methyl Isobutyl Ketone (4-methyl-2-pentanone)	108-10-1	2.1E-01	2.4E-06	3.0E+00	7.9E-07
Acetone	67-64-1	2.8E-01	3.2E-06	3.1E+01	1.0E-07
Benzene	71-43-2	4.0E-01	4.6E-06	3.0E-02	1.5E-04
Bromodichloromethane	75-27-4	1.4E-02	1.6E-07		NTV
Carbon Disulfide	75-15-0	1.1E-01	1.3E-06	7.0E-01	1.8E-06
Chloroform	67-66-3	1.1E-01	1.3E-06	9.8E-02	1.3E-05
Chloromethane (Methyl Chloride)	74-87-3	8.7E-04	1.0E-08	9.0E-02	1.1E-07
cis-1,2-Dichloroethylene	156-59-2	3.1E+01	3.5E-04		NTV
Cyclohexane	110-82-7	8.8E-01	1.0E-05	6.0E+00	1.7E-06
Dichlorodifluoromethane (CFC-12)	75-71-8	3.9E-02	4.5E-07	1.0E-01	4.5E-06
Ethanol (surrogate = Isobutanol)	64-17-5	2.5E-02	2.8E-07	-	NTV
Ethyl acetate	141-78-6	1.4E-02	1.6E-07	7.0E-02	2.2E-06
Ethylbenzene	100-41-4	2.5E-01	2.8E-06	1.0E+00	2.8E-06
Hexane, n-	110-54-3	2.2E+00	2.5E-05	7.0E-01	3.6E-05

Appendix H,Table H-35
Non-Cancer Risk Calculations
Indoor Air -
SPECTATOR - 4 AGE GROUPS - CHILD (AGE 0 - <2)

Human Health Risk Assessment
D.C. United Soccer Stadium
Washington, D.C.

Exposure Routes Evaluated		HI (Total)
Vapor Inhalation -	Yes	3E-02

COPC - chemical of potential concern
EPC - exposure point concentration
EC - exposure concentration
NTV - no toxicity value available
NV - not volatile
RfC - reference concentration
HI - hazard index
HQ - hazard quotient

COPC	CASRN	EPC (ug/m^3)	Intake Calculation ECVapor (mg/m^3)	Non-Cancer Toxicity Value RfC (mg/m^3)	HQ
Isopropyl Alcohol	67-63-0	7.0E-03	8.0E-08	2.0E-01	4.0E-07
Xylenes	1330-20-7	4.4E-01	5.0E-06	1.0E-01	5.0E-05
Methyl tert-Butyl Ether (MTBE)	1634-04-4	3.7E-01	4.3E-06	3.0E+00	1.4E-06
Methylene Chloride	75-09-2	4.0E-01	4.5E-06	6.0E-01	7.5E-06
Naphthalene	91-20-3	5.3E-03	6.0E-08	3.0E-03	2.0E-05
N-Heptane (surrogate = hexane)	142-82-5	8.0E-01	9.1E-06	7.0E-01	1.3E-05
Xylenes	1330-20-7	1.8E-01	2.0E-06	1.0E-01	2.0E-05
Propylene (Propene)	115-07-1	8.4E+00	9.6E-05	3.0E+00	3.2E-05
Styrene	100-42-5	9.7E-03	1.1E-07	1.0E+00	1.1E-07
Tetrachloroethylene	127-18-4	8.4E+00	9.6E-05	4.0E-02	2.4E-03
Toluene	108-88-3	7.6E-01	8.7E-06	5.0E+00	1.7E-06
trans-1,2-Dichloroethylene	156-60-5	8.1E-01	9.2E-06		NTV
Trichlorofluoromethane (CFC-11)	75-69-4	2.2E-01	2.5E-06	7.0E-01	3.6E-06
Trifluorotrichloroethane (Freon 113)	76-13-1	1.1E-01	1.3E-06	3.0E+01	4.2E-08

Appendix H,Table H-36
Intake and Risk Equations - Composite Receptor/Age-Adjusted

Human Health Risk Assessment
D.C. United Soccer Stadium
Washington, D.C.

Cancer Risk from Inhalation

$$ELCR_{inh} = EC_{can} * IUR$$

$$EC_{can\ (age\ group\ x)} = \frac{[EPC]_{PART} * ET_{Part} * EF * ED \text{ --- OR --- } [EPC]_{VAPOR} * ET_{Vap} * EF * ED}{24 * AT_{lifetime}}$$

For mutagens, INHM is used in place of $ET_X * EF * ED$

Noncancer Risk from Inhalation

$$HQ = \frac{EC_{nc}}{RfC}$$

$$EC_{nc} = \frac{[EPC] * ET * EF * ED * C}{24 * AT}$$

Parameter	Value - Cancer	Value - Non-Cancer	Units
IUR	Chemical specific	--	$(ug/m^3)^{-1}$
EC_{can}	Age/chemical specific	--	(ug/m^3)
ELCR	Age/chemical specific	--	unitless
RfC	--	Chemical specific	(mg/m^3)
EC_{nc}	--	Age/chemical specific	mg/m^3
HQ	--	Age/chemical specific	unitless
[EPC]	-----NOT USED-----	-----NOT USED-----	ug/m^3
EF	25	25	day/year
ED	26	2	year
AT	--	730	day
ATlifetime	25550	--	day
C	0.001	0.001	mg/ug
ET	4	4	ug/mg
INHM	7.20E+03		unitless

Appendix H,Table H-37
Exposure Factors

Human Health Risk Assessment
D.C. United Soccer Stadium
Washington, D.C.

PLACE "X" IN THE APPROPRIATE YELLOW SHADED CELLS FOR THE APPROPRIATE RECEPTOR AND BASIS FOR CALCULATIONS

SCENARIO USED TO CALCULATE RISKS			x	SPECTATOR - 4 AGE GROUPS										
BASIS FOR CANCER CALCULATIONS													x	
BASIS FOR NON-CANCER CALCULATIONS			x											
RECEPTOR			CHILD (AGE 0 - <2)		CHILD (AGE 2 - <6)		OLDER CHILD (AGE 6 - <16)		ADULT		CHILD, ADOLESCENT, and ADULT	
Standard Parameters												
Exposure Frequency	EF	day/year	25	Site-specific [3]	25	Site-specific [3]	25	Site-specific [3]	25	Site-specific [3]	25.0	Site-specific [3]
Exposure Duration	ED	year	2	Ages 6 - <11	4	Ages 11 - <16	10	Ages 11 - <16	10	Balance of 26-yr exposure	26	EPA, 2014
Non–carcinogenic Averaging Time	AT	day	730	Exposure duration expressed in days	1460	Exposure duration expressed in days	3650	Exposure duration expressed in days	3650	Exposure duration expressed in days	9490	Exposure duration expressed in days
Carcinogenic Averaging Time	$AT_{lifetime}$	day	25550	70 year lifetime	25550	70 year lifetime	25550	70 year lifetime	25550	70 year lifetime	25550	70 year lifetime
Age-Dependtant Adjustment Factor	ADAF	unitless	10	USEPA, 2008	3	USEPA, 2008	3	USEPA, 2008	1	USEPA, 2008		
Exposure Time	ET	hours/day	4	Site-specific	4	Site-specific	4	Site-specific	4	Site-specific	4.0	Site-specific
Age-Adjusted Inhalation Factor-Mutagenic	INHM	unitless									7200	

Appendix H, Table H-38
Cancer Risk Calculations
Soil -
SPECTATOR (4 AGES) - TOTAL SPECTATOR (AGES birth - 26)

Human Health Risk Assessment
D.C. United Soccer Stadium
Washington, D.C.

Exposure Routes Evaluated		ELCR (Total)
Incidental Ingestion	Yes	9E-07
Dermal Contact	Yes	5E-07
Particulate Inhalation	Yes	1E-12
Ambient Vapor Inhalation	Yes	2E-08
		1E-06

NC - not carcinogenic by this exposure route
NTV - no toxicity value available
NV - not volatile
DAD - dermally absorbed dose
EC - exposure concentration
ABS - absorption factor
CSF - cancer slope factor
UR - cancer unit risk
ELCR - excess lifetime cancer risk
EPC - exposure point concentration
COPC - chemical of potential concern

COPC	CASRN	EPC (mg/kg)	Intake Calculations				Absorption Factors		Mutagenic	Cancer Toxicity Values			ELCR				
			$Intake_{ingestion}$ (mg/kg/day)	DAD_{dermal} (mg/kg/day)	$EC_{particulate}$ (ug/m^3)	EC_{vapor} (ug/m^3)	ABS_{ing} (unitless)	ABS_d (unitless)	MOA?	CSF_{oral} $(mg/kg/day)^{-1}$	CSF_{dermal} $(mg/kg/day)^{-1}$	IUR $(ug/m^3)^{-1}$	$ELCR_{ingestion}$	$ELCR_{dermal}$	$ELCR_{particulate}$	$ELCR_{vapor}$	$ELCR_{total}$
2-Methylnaphthalene	91-57-6	3.1E+01	NC	NC	NC	NC	NC	NC	N								
Acenaphthene	83-32-9	1.1E+00	NC	NC	NC	NC	NC	NC	N								
Acenaphthylene	208-96-8	6.9E-01	NC	NC	NC	NV	NC	NC	N							NV	
Acetone	67-64-1	1.2E-01	NC	NC	NC	NC	NC	NC	N								
Anthracene	120-12-7	3.1E-01	NC	NC	NC	NC	1	0.13	N								
Benz[a]anthracene	56-55-3	3.3E-01	1.5E-07	5.1E-08	9.3E-10	NV	1	0.13	Y	7.3E-01	7.3E-01	1.1E-04	1.1E-07	3.7E-08	1.0E-13	NV	1.5E-07
Benzo[a]pyrene	50-32-8	1.8E-01	8.4E-08	2.8E-08	5.1E-10	NV	1	0.13	Y	7.3E+00	7.3E+00	1.1E-03	6.1E-07	2.0E-07	5.6E-13	NV	8.2E-07
Benzo[b]fluoranthene	205-99-2	2.8E-01	1.3E-07	4.4E-08	7.9E-10	NV	1	0.13	Y	7.3E-01	7.3E-01	1.1E-04	9.5E-08	3.2E-08	8.7E-14	NV	1.3E-07
Benzo(g,h,i)perylene	191-24-2	7.4E-02	NC	NC	NC	NV	NC	NC	N							NV	
Benzo[k]fluoranthene	207-08-9	1.1E-01	5.1E-08	1.7E-08	3.1E-10	NV	1	0.13	Y	7.3E-02	7.3E-02	1.1E-04	3.7E-09	1.2E-09	3.4E-14	NV	5.0E-09
Bromomethane	74-83-9	2.4E-02	NC	NC	NC	NC	1		N								
Chrysene	218-01-9	3.2E-01	1.5E-07	5.0E-08	9.0E-10	NV	1	0.13	Y	7.3E-03	3.4E+00	1.1E-05	1.1E-09	1.7E-07	9.9E-15	NV	1.7E-07
Ethylbenzene	100-41-4	1.0E+00	NC	NC	1.0E-09	3.7E-04	NC	NC	N			2.5E-06			2.5E-15	9.3E-10	9.3E-10
Fluoranthene	206-44-0	7.8E-01	NC	NC	NC	NV	NC	NC	N							NV	
Fluorene	86-73-7	4.0E+00	NC	NC	NC	NC	NC	NC	N								
Indeno[1,2,3-cd]pyrene	193-39-5	8.8E-02	4.1E-08	1.4E-08	2.5E-10	NV	1	0.13	Y	7.3E-01	7.3E-01	1.1E-04	3.0E-08	1.0E-08	2.7E-14	NV	4.0E-08
Isopropylbenzene	98-82-8	7.1E-01	NC	NC	NC	NC	NC	NC	N								
Methyl cyclohexane	108-87-2	2.2E+00	NC	NC	NC	NC	NC	NC	N								
Naphthalene	91-20-3	1.0E+01	NC	NC	1.0E-08	4.5E-04	NC	NC	N			3.4E-05			3.5E-13	1.5E-08	1.5E-08
Phenanthrene	85-01-8	7.0E+00	NC	NC	NC	NV	NC	NC	N							NV	
Pyrene	129-00-0	6.1E-01	NC	NC	NC	NC	NC	NC	N								
Tetrachloroethylene	127-18-4	3.6E+00	3.7E-07		3.7E-09	3.3E-03	1		N	2.1E-03	2.1E-03	2.6E-07	7.8E-10		9.5E-16	8.6E-10	1.6E-09
Toluene	108-88-3	1.4E-01	NC	NC	NC	NC	NC	NC	N								
Xylenes	1330-20-7	5.1E+00	NC	NC	NC	NC	NC	NC	N								

Appendix H, Table H-39
Non-Cancer Risk Calculations
Soil -
SPECTATOR (4 AGES) - CHILD (AGE 0-<2)

Human Health Risk Assessment
D.C. United Soccer Stadium
Washington, D.C.

Exposure Routes Evaluated		HI (Total)
Incidental Ingestion	Yes	9E-03
Dermal Contact	Yes	2E-03
Particulate Inhalation	Yes	1E-08
Ambient Vapor Inhalation	Yes	7E-04
		0.01

NV - not volatile
NTV - no toxicity value available
EC - exposure concentration
DAD - dermally absorbed dose
RfD - reference dose
ABS - absorption factor
HI - hazard index
RfC - reference concentration
EPC - exposure point concentration
COPC - chemical of potential concern

COPC	CASRN	EPC (mg/kg)	Intake Calculations				Absorption Factors		Non-Cancer Toxicity Values			HQ				
			$Intake_{ingestion}$ (mg/kg/day)	DAD_{dermal} (mg/kg/day)	$EC_{particulate}$ (mg/m^3)	EC_{vapor} (mg/m^3)	ABS_{ing} (unitless)	ABS_d (unitless)	RfD_{oral} (mg/kg/day)	RfD_{dermal} (mg/kg/day)	RfC (mg/m^3)	$HQ_{ingestion}$	HQ_{dermal}	$HQ_{particulate}$	HQ_{vapor}	HQ_{total}
2-Methylnaphthalene	91-57-6	3.1E+01	2.8E-05	8.7E-06	8.5E-11	3.0E-06	1	0.13	4.0E-03	4.0E-03		7.1E-03	2.2E-03	NTV	NTV	9.3E-03
Acenaphthene	83-32-9	1.1E+00	1.0E-06	3.1E-07	3.0E-12	4.4E-08	1	0.13	6.0E-02	6.0E-02		1.7E-05	5.2E-06	NTV	NTV	2.2E-05
Acenaphthylene	208-96-8	6.9E-01	6.3E-07	1.9E-07	1.9E-12	NV	1	0.13	6.0E-02	6.0E-02		1.1E-05	3.2E-06	NTV	NV	1.4E-05
Acetone	67-64-1	1.2E-01	1.1E-07		3.3E-13	6.7E-08	1		9.0E-01	9.0E-01	3.1E+01	1.2E-07		1.1E-14	2.2E-09	1.2E-07
Anthracene	120-12-7	3.1E-01	2.8E-07	8.7E-08	8.5E-13	3.3E-09	1	0.13	3.0E-01	3.0E-01		9.4E-07	2.9E-07	NTV	NTV	1.2E-06
Benz[a]anthracene	56-55-3	3.3E-01	3.0E-07	9.3E-08	9.1E-13	NV	1	0.13				NTV	NTV	NTV	NV	
Benzo[a]pyrene	50-32-8	1.8E-01	1.6E-07	5.1E-08	4.9E-13	NV	1	0.13				NTV	NTV	NTV	NV	
Benzo[b]fluoranthene	205-99-2	2.8E-01	2.6E-07	7.9E-08	7.7E-13	NV	1	0.13				NTV	NTV	NTV	NV	
Benzo(g,h,i)perylene	191-24-2	7.4E-02	6.8E-08	2.1E-08	2.0E-13	NV	1	0.13	3.0E-02	3.0E-02		2.3E-06	6.9E-07	NTV	NV	2.9E-06
Benzo[k]fluoranthene	207-08-9	1.1E-01	1.0E-07	3.1E-08	3.0E-13	NV	1	0.13				NTV	NTV	NTV	NV	
Bromomethane	74-83-9	2.4E-02	2.2E-08		6.6E-14	1.1E-07	1		1.4E-03	1.4E-03	5.0E-03	1.6E-05		1.3E-11	2.2E-05	3.7E-05
Chrysene	218-01-9	3.2E-01	2.9E-07		8.8E-13	NV	1					NTV	NTV	NTV	NV	
Ethylbenzene	100-41-4	1.0E+00	9.1E-07		2.7E-12	1.0E-06	1		1.0E-01	1.0E-01	1.0E+00	9.1E-06		2.7E-12	1.0E-06	1.0E-05
Fluoranthene	206-44-0	7.8E-01	7.1E-07	2.2E-07	2.1E-12	NV	1	0.13	4.0E-02	4.0E-02		1.8E-05	5.5E-06	NTV	NV	2.3E-05
Fluorene	86-73-7	4.0E+00	3.7E-06	1.1E-06	1.1E-11	8.0E-08	1	0.13	4.0E-02	4.0E-02		9.1E-05	2.8E-05	NTV	NTV	1.2E-04
Indeno[1,2,3-cd]pyrene	193-39-5	8.8E-02	8.0E-08	2.5E-08	2.4E-13	NV	1	0.13				NTV	NTV	NTV	NV	
Isopropylbenzene	98-82-8	7.1E-01	6.5E-07		1.9E-12	6.4E-07	1		1.0E-01	1.0E-01	4.0E-01	6.5E-06		4.9E-12	1.6E-06	8.1E-06
Methyl cyclohexane	108-87-2	2.2E+00	2.0E-06		6.0E-12	1.2E-05	1				3.0E+00	NTV	NTV	2.0E-12	4.0E-06	4.0E-06
Naphthalene	91-20-3	1.0E+01	9.1E-06	2.8E-06	2.7E-11	1.2E-06	1	0.13	2.0E-02	2.0E-02	3.0E-03	4.6E-04	1.4E-04	9.1E-09	4.0E-04	1.0E-03
Phenanthrene	85-01-8	7.0E+00	6.4E-06	2.0E-06	1.9E-11	NV	1	0.13	3.0E-02	3.0E-02		2.1E-04	6.6E-05	NTV	NV	2.8E-04
Pyrene	129-00-0	6.1E-01	5.6E-07	1.7E-07	1.7E-12	1.4E-09	1	0.13	3.0E-02	3.0E-02		1.9E-05	5.7E-06	NTV	NTV	2.4E-05
Tetrachloroethylene	127-18-4	3.6E+00	3.3E-06		9.9E-12	8.9E-06	1		6.0E-03	6.0E-03	4.0E-02	5.5E-04		2.5E-10	2.2E-04	7.7E-04
Toluene	108-88-3	1.4E-01	1.3E-07		3.8E-13	1.9E-07	1		8.0E-02	8.0E-02	5.0E+00	1.6E-06		7.7E-14	3.7E-08	1.6E-06
Xylenes	1330-20-7	5.1E+00	4.7E-06		1.4E-11	5.0E-06	1		2.0E-01	2.0E-01	1.0E-01	2.3E-05		1.4E-10	5.0E-05	7.3E-05

Appendix H, Table H-40
Intake and Risk Equations - Non-Mutagenic

Human Health Risk Assessment
D.C. United Soccer Stadium
Washington, D.C.

Cancer Risk from Ingestion

$$ELCR = Intake_{ing} * CSF$$

$$Intake_{ing\ (age\ group\ x)} = \frac{[EPC]_{soil} * [IFSadj - OR - IFSM] * ABS_{ING} * FI * EF * C1}{AT_{lifetime}}$$

Cancer Risk from Dermal Absorption

$$ELCR = DAD * CSF$$

$$DAD_{derm(age\ group\ x)} = \frac{DA_{Event} * SA * EV * EF}{AT_{lifetime}}$$

$$DA_{Event} = [EPC]_{soil} * [DFSadj - OR - DFSM] * C1$$

Cancer Risk from Inhalation

$$ELCR_{inh} = EC_{can} * IUR$$

$$EC_{can\ (age\ group\ x)} = \frac{[EPC]_{PART} * ET_{Part} * EF * ED\ ---\ OR---\ [EPC]_{VAPOR} * ET_{Vap} * EF * ED}{24 * AT_{lifetime}}$$

For mutagens, INHM is used in place of $ET_X * EF * ED$

Noncancer Risk from Ingestion

$$HQ = \frac{Intake_{ing}}{RfD}$$

$$Intake_{ing} = \frac{[EPC]_{soil} * IR * ABS_{ing} * FI * EF * ED * C1}{BW * AT}$$

Noncancer Risk from Dermal Absorption

$$HQ = \frac{DAD}{RfD}$$

$$DAD_{derm} = \frac{DA_{Event} * SA * EV * EF * ED}{BW * AT}$$

$$DA_{Event} = [EPC]_{soil} * ABS_d * AF * C1$$

Noncancer Risk from Inhalation

$$HQ = \frac{EC_{nc}}{RfC}$$

$$EC_{nc} = \frac{[EPC]_{PART} * ET_{Part} * EF * ED * C2\ ---\ OR---\ [EPC]_{VAPOR} * ET_{Vap} * EF * ED * C2}{24 * AT}$$

Parameter	Value - Cancer	Value - Non-Cancer	Units
CSF	Chemical specific	--	$(mg/kg\text{-}day)^{-1}$
IUR	Chemical specific	--	$(ug/m^3)^{-1}$
Intake	Age/chemical specific	--	mg/kg-day
EC_{can}	Age/chemical specific	--	(ug/m^3)
ELCR	Age/chemical specific	--	unitless
RfD	--	Chemical specific	mg/kg-day
RfC	--	Chemical specific	(mg/m^3)
DAD	Age/chemical specific	Age/chemical specific	mg/kg-day
DA_{Event}	Age/chemical specific	Age/chemical specific	mg/cm^2-event
EC_{nc}	--	Age/chemical specific	mg/m^3
HQ	--	Age/chemical specific	unitless
$[EPC]_{soil}$	Chemical specific	Chemical specific	mg/kg
$[EPC]_{PART}$	Appendix H, TABLE H-42	Appendix H, TABLE H-42	ug/m^3
$[EPC]_{VAPOR}$	Appendix H, TABLE H-43	Appendix H, TABLE H-43	ug/m^3
ABS_{ing}	Chemical specific	Chemical specific	unitless
ABS_d	Chemical specific	Chemical specific	unitless
BW	NA	15	kg
EF	25	25	day/year
ED	26	2	year
AT	--	730	day
ATlifetime	25550	--	day
IFSadj	105	--	mg-yr/kg-day
IFSM	477	--	mg-yr/kg-day
IR	NA	200	mg/day
FI	1	1	unitless
C1	0.000001	0.000001	kg/mg
SA	NA	2373	cm2
AF	NA	0.2	mg/cm2
EV	1	1	event/day
DFSadj	295	--	mg-yr/kg-day
DFSM	1224	--	mg-yr/kg-day
ETPart	4	4	hours/day
C2	0.001	0.001	mg/ug
ETVap	4	4	ug/mg
INHM	7200	--	unitless

Appendix H, Table H-41
Exposure Factors

Human Health Risk Assessment
D.C. United Soccer Stadium
Washington, D.C.

PLACE "X" IN THE APPROPRIATE YELLOW SHADED CELLS FOR THE APPROPRIATE RECEPTOR AND BASIS FOR CALCULATIONS

SCENARIO USED TO CALCULATE RISKS			X	SPECTATOR (4 AGES)										
BASIS FOR CANCER CALCULATIONS													X	
BASIS FOR NON-CANCER CALCULATIONS			X											
RECEPTOR			**CHILD (AGE 0-<2)**		**CHILD (2 - <6)**		**OLDER CHILD(AGE 6 - <16)**		**ADULT**		**TOTAL SPECTATOR (AGES birth - 26)**	
Standard Parameters												
Body Weight	BW	kg	15	EPA, 2014	15	EPA, 2014	80	EPA, 2014	80	EPA, 2014	NA	
Exposure Frequency	EF	day/year	25	EPA, 2014	25	EPA, 2014	25	EPA, 2014	25	EPA, 2014	25	EPA, 2014
Exposure Duration	ED	year	2	Ages 11 - <16	4	Ages 11 - <16	10	Balance of 26-yr exposure [2]	10	Balance of 26-yr exposure [2]	26	EPA, 2014
Non–carcinogenic Averaging Time	AT	day	730	Exposure duration expressed in days	1460	Exposure duration expressed in days	3650	Exposure duration expressed in days	3650	Exposure duration expressed in days	9490	Exposure duration expressed in days
Carcinogenic Averaging Time	$AT_{lifetime}$	day	25550	70 year lifetime	25550	70 year lifetime	25550	70 year lifetime	25550	70 year lifetime	25550	70 year lifetime
Age-Dependtant Adjustment Factor	ADAF	unitless	10	USEPA, 2008	3	USEPA, 2008	3	USEPA, 2008	1	USEPA, 2008		
Incidental Ingestion of Soil												
Soil Ingestion Rate	IR	mg/day	200	EPA, 2014	200	EPA, 2014	100	EPA, 2014	100	EPA, 2014	NA	
Fraction Ingested	FI	unitless	1.0	Site-specific [6]	1.0	Site-specific [6]	1.0	Site-specific [6]	1.0	Site-specific [6]	1	Site-specific [6]
Age-Adjusted Soil Ingestion Factor	IFSadj	mg-yr/kg-day	NA		NA		NA		NA		105	
Age-Adjusted Soil Ingestion Factor-Mutagenic	IFSM	mg-yr/kg-day									477	
Dermal Exposure with Soil												
Exposed Skin Surface Area	SA	cm^2	2373	EPA, 2014	2373	EPA, 2014	6032	EPA, 2014	6032	EPA, 2014	NA	
Soil Adherence Factor	AF	mg/cm^2	0.2	EPA, 2014	0.2	EPA, 2014	0.07	EPA, 2014	0.07	EPA, 2014	NA	
Fraction Dermal	EV	event/day	1.0	EPA, 2014	1.0	EPA, 2014	1.0	EPA, 2014	1.0	EPA, 2014	1	EPA, 2014
Age-Adjusted Dermal Contact Factor	DFSadj	mg-yr/kg-day	NA		NA		NA		NA		295	
Age-Adjusted Dermal Contact Factor-Mutagenic	DFSM	mg-yr/kg-day									1224	
Particulate Inhalation												
Exposure Time	ET_{Part}	hours/day	4	Asumption	4	Asumption	4	Assumption	4	Assumption	4	Assumption
Vapor Inhalation												
Exposure Time	ET_{Vap}	hours/day	4	Assumption	4	Assumption	4	Assumption	4	Assumption	4	Assumption
Age-Adjusted Inhalation Factor-Mutagenic	INHM	unitless									7200	

Appendix H, Table H-42
Particulate to Outdoor Air EPC Calculations
Soil -
SPECTATOR (4 AGES) - TOTAL SPECTATOR (AGES birth - 26)

Human Health Risk Assessment
D.C. United Soccer Stadium
Washington, D.C.

EQUATIONS:

$$EPC_{[PARTICULATE]} = EPC_{[SOIL]} \times PARTICULATE_{[AIR]} \times 1E\text{-}06 \text{ [kg/mg]}$$

where:

$$PARTICULATE_{[AIR]} = (1/PEF * 1E+09 \text{ ug/kg}) \text{ or Measured/Modelled}$$

and:

$$PEF (m^3/kg) = Q/C \times [(3600 \text{ s/hr}) / ((0.036 \times (1-V) \times (U_m/U_t)^3 \times F(x))]$$

PARAMETER/DEFINITION	UNITS	DEFAULT	Source
$PARTICULATE_{[Air]}$ / Particulate concentration in air	ug/m^3	0.24	Calculated or measured
Measured or modeled $PARTICULATE_{[AIR]}$	ug/m^3		Measured value
PEF / Particulate emission factor	m^3/kg		
PEF / Particulate emission factor	m^3/kg	4.16E+09	Calculated here
Q/C / inverse of the mean concentration at the center of a 13-acre-square source	g/m^2-s per kg/m^3	35.14	USEPA, 2014 [a]
V / Fraction of vegetative cover	unitless	0.8	USEPA, 2014
U_m / mean annual windspeed	m/s	4.2	USEPA, 2014
U_t / equivalent threshold value of wind speed at 7 m	m/s	11.32	USEPA, 2014
F(x) / function dependant on U_m/U_t derived using Cowherd et al. (1985)	unitless	8.27E-02	USEPA, 2014

USEPA, 2014. Regional Screening Levels.
[a] Climactic zone: Phoenix Arizona [a] Area of Source:

CASRN	COPC	EPC Soil (mg/kg)	EPC Particulate (ug/m^3)
91-57-6	2-Methylnaphthalene	31	7.5E-06
83-32-9	Acenaphthene	1.1	2.6E-07
208-96-8	Acenaphthylene	0.69	1.7E-07
67-64-1	Acetone	0.12	2.9E-08
120-12-7	Anthracene	0.31	7.5E-08
56-55-3	Benz[a]anthracene	0.33	7.9E-08
50-32-8	Benzo[a]pyrene	0.18	4.3E-08
205-99-2	Benzo[b]fluoranthene	0.28	6.7E-08
191-24-2	Benzo(g,h,i)perylene	0.074	1.8E-08
207-08-9	Benzo[k]fluoranthene	0.11	2.6E-08
74-83-9	Bromomethane	0.024	5.8E-09
218-01-9	Chrysene	0.32	7.7E-08
100-41-4	Ethylbenzene	1	2.4E-07
206-44-0	Fluoranthene	0.78	1.9E-07
86-73-7	Fluorene	4	9.6E-07
193-39-5	Indeno[1,2,3-cd]pyrene	0.088	2.1E-08
98-82-8	Isopropylbenzene	0.71	1.7E-07
108-87-2	Methyl cyclohexane	2.2	5.3E-07
91-20-3	Naphthalene	10	2.4E-06
85-01-8	Phenanthrene	7	1.7E-06
129-00-0	Pyrene	0.61	1.5E-07
127-18-4	Tetrachloroethylene	3.6	8.7E-07
108-88-3	Toluene	0.14	3.4E-08
1330-20-7	Xylenes	5.1	1.2E-06

Appendix H, Table H-43
Vapor to Outdoor Air EPC Calculations
Soil -
SPECTATOR (4 AGES) - TOTAL SPECTATOR (AGES birth - 26)

Human Health Risk Assessment
D.C. United Soccer Stadium
Washington, D.C.

EQUATIONS:

$EPC_{[VAPOR]} = EPC_{[SOIL]} \times 1/VF \times 1000\ ug/mg$

where:

$VF\ (m^3/kg) = Q/C \times (3.14 \times D_A \times T)^{1/2} \times 10^{-4} (m^2/cm^2) / (2 \times P_b \times D_A)$

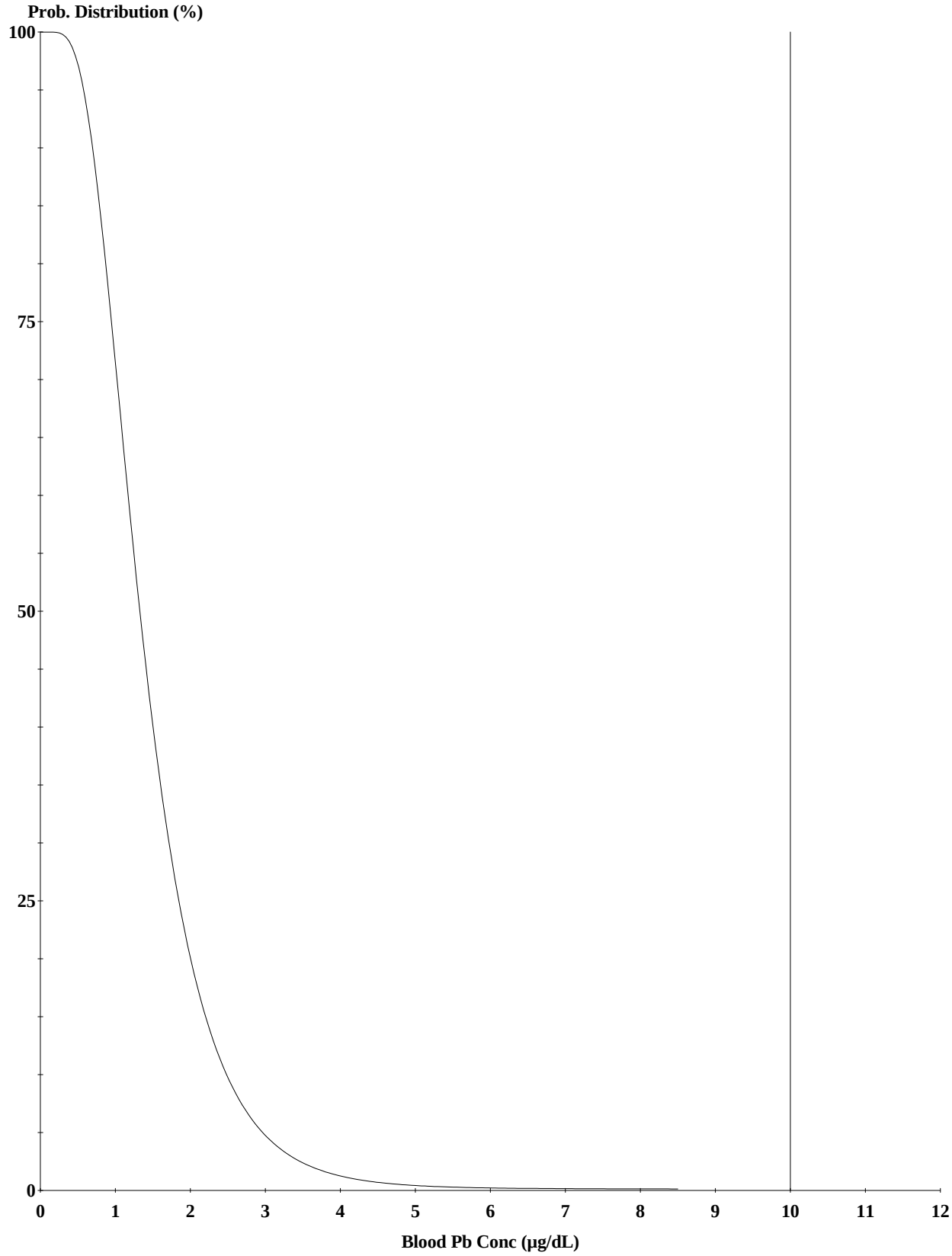
and:

$DA = [(O_a^{10/3} D_i H' + O_w^{10/3} D_w)/n^2] / P_b K_d + O_w + O_a H'$

PARAMETER/DEFINITION	UNITS	DEFAULT	Source
VF / volatilization factor	m^3/kg	Calculated	
D_A / apparent diffusivity	cm^2/s	Calculated	
Q/C / inverse of the mean concentration at the center of a 0.5-acre-square source	g/m^2-s per kg/m^3	35.14	USEPA, 2014 [a]
T / exposure interval	s	8.2E+08	SPECTATOR (4 AGES)
ΓI_b / dry soil bulk density	g/cm^3	1.62	USEPA, 2014
O_a / air-filled soil porosity	L_{air}/L_{soil}	0.314	USEPA, 2014
n / total soil porosity	L_{pore}/L_{soil}	0.39	USEPA, 2014
O_w / water-filled soil porosity	L_{water}/L_{soil}	0.076	USEPA, 2014
Ψ_s / soil particle density	g/cm^3	2.65	USEPA, 1996
D_i / diffusivity in air	cm^2/s	chemical-specific	
H' / Henry's Law constant	dimensionless	chemical-specific	
D_w / diffusivity in water	cm^2/s	chemical-specific	
K_d / soil-water partition coefficient (Koc x foc) organics	cm^3/g	chemical-specific	
K_{oc} / soil organic carbon partition coefficient	cm^3/g	chemical-specific	
f_{oc} / fraction organic carbon in soil	g/g	0.006	Default

USEPA, 2014. Regional Screening Levels.
[a] Climactic zone: Phoenix Arizona [a] Area of Source: Specific to size of Exposure Area

CASRN	COPC	Volatile (Y/N)	D_i (cm^2/s)	H' (unitless)	D_w (cm^2/s)	K_d (cm^3/g)	K_{oc} (cm^3/g)	D_A (cm^2/s)	VF (m^3/kg)	EPC Soil (mg/kg)	EPC Vapor (ug/m^3)
91-57-6	2-Methylnaphthalene	Y	5.24E-02	2.12E-02	7.78E-06	1.49E+01	2.48E+03	6.4E-06	117987	31	2.6E-01
83-32-9	Acenaphthene	Y	5.06E-02	7.52E-03	8.33E-06	3.02E+01	5.03E+03	1.1E-06	286702	1.1	3.8E-03
208-96-8	Acenaphthylene	N	5.06E-02	7.52E-03	8.33E-06	3.02E+01	5.03E+03				NV
67-64-1	Acetone	Y	1.06E-01	1.43E-03	1.15E-05	1.42E-02	2.36E+00	2.1E-04	20477	0.12	5.9E-03
120-12-7	Anthracene	Y	3.90E-02	2.27E-03	7.85E-06	9.82E+01	1.64E+04	7.7E-08	1071327	0.31	2.9E-04
56-55-3	Benz[a]anthracene	N	5.09E-02	4.91E-04	5.94E-06	1.06E+03	1.77E+05				NV
50-32-8	Benzo[a]pyrene	N	4.76E-02	1.87E-05	5.56E-06	3.52E+03	5.87E+05				NV
205-99-2	Benzo[b]fluoranthene	N	4.76E-02	2.69E-05	5.56E-06	3.60E+03	5.99E+05				NV
191-24-2	Benzo(g,h,i)perylene	N	5.28E-02	9.65E-08	6.17E-06	1.35E+00	2.25E+02				NV
207-08-9	Benzo[k]fluoranthene	N	4.76E-02	2.39E-05	5.56E-06	3.52E+03	5.87E+05				NV
74-83-9	Bromomethane	Y	1.00E-01	3.00E-01	1.35E-05	7.93E-02	1.32E+01	1.4E-02	2517	0.024	9.5E-03
218-01-9	Chrysene	N	2.61E-02	2.14E-04	6.75E-06	1.08E+03	1.81E+05				NV
100-41-4	Ethylbenzene	Y	6.85E-02	3.22E-01	8.46E-06	2.68E+00	4.46E+02	6.8E-04	11440	1	8.7E-02
206-44-0	Fluoranthene	N	2.76E-02	3.62E-04	7.18E-06	3.33E+02	5.55E+04				NV
86-73-7	Fluorene	Y	4.40E-02	3.93E-03	7.89E-06	5.50E+01	9.16E+03	2.7E-07	573952	4	7.0E-03
193-39-5	Indeno[1,2,3-cd]pyrene	N	4.48E-02	6.56E-05	5.23E-06	2.08E+04	3.47E+06				NV
98-82-8	Isopropylbenzene	Y	6.03E-02	4.70E-01	7.86E-06	4.19E+00	6.98E+02	5.6E-04	12572	0.71	5.6E-02
108-87-2	Methyl cyclohexane	Y	8.00E-02	6.13E+00	9.11E-06	8.76E-01	1.46E+02	2.0E-02	2112	2.2	1.0E+00
91-20-3	Naphthalene	Y	6.05E-02	1.80E-02	8.38E-06	9.26E+00	1.54E+03	1.0E-05	94167	10	1.1E-01
85-01-8	Phenanthrene	N	2.08E-02	5.81E-12	5.19E-06	5.56E+01	9.27E+03				NV
129-00-0	Pyrene	Y	2.78E-02	4.87E-04	7.25E-06	3.26E+02	5.43E+04	3.6E-09	4987562	0.61	1.2E-04
127-18-4	Tetrachloroethylene	Y	5.05E-02	7.24E-01	9.46E-06	5.70E-01	9.49E+01	4.1E-03	4634	3.6	7.8E-01
108-88-3	Toluene	Y	7.78E-02	2.71E-01	9.20E-06	1.40E+00	2.34E+02	1.2E-03	8587	0.14	1.6E-02
1330-20-7	Xylenes	Y	8.47E-02	2.12E-01	9.90E-06	2.30E+00	3.83E+02	6.4E-04	11736	5.1	4.3E-01



Cutoff = 10.000 µg/dl
Geo Mean = 1.390
GSD = 1.600
% Above = 0.001

Age Range = 0 to 84 months

Run Mode = Research

LEAD MODEL FOR WINDOWS Version 1.1

==========

Model Version: 1.1 Build11
User Name:
Date:
Site Name:
Operable Unit:
Run Mode: Research

==========

******** Air ********

Indoor Air Pb Concentration: 30.000 percent of outdoor.
Other Air Parameters:

Age	Time Outdoors (hours)	Ventilation Rate (m^3/day)	Lung Absorption (%)	Outdoor Air Pb Conc (µg Pb/m^3)
.5-1	1.000	2.000	32.000	0.100
1-2	2.000	3.000	32.000	0.100
2-3	3.000	5.000	32.000	0.100
3-4	4.000	5.000	32.000	0.100
4-5	4.000	5.000	32.000	0.100
5-6	4.000	7.000	32.000	0.100
6-7	4.000	7.000	32.000	0.100

******** Diet ********

Age	Diet Intake(µg/day)
.5-1	2.260
1-2	1.960
2-3	2.130
3-4	2.040
4-5	1.950
5-6	2.050
6-7	2.220

******** Drinking Water ********

Water Consumption:

Age	Water (L/day)
.5-1	0.200
1-2	0.500
2-3	0.520
3-4	0.530
4-5	0.550
5-6	0.580
6-7	0.590

Drinking Water Concentration: 4.000 µg Pb/L

******** Soil & Dust ********

Multiple Source Analysis Used
Average multiple source concentration: 49.900 µg/g

Mass fraction of outdoor soil to indoor dust conversion factor: 0.700
Outdoor airborne lead to indoor household dust lead concentration: 100.000
Use alternate indoor dust Pb sources? No

Age	Soil (µg Pb/g)	House Dust (µg Pb/g)
.5-1	57.000	49.900
1-2	57.000	49.900
2-3	57.000	49.900
3-4	57.000	49.900
4-5	57.000	49.900
5-6	57.000	49.900
6-7	57.000	49.900

****** Alternate Intake ******

Age	Alternate (µg Pb/day)
.5-1	0.000
1-2	0.000
2-3	0.000
3-4	0.000
4-5	0.000
5-6	0.000
6-7	0.000

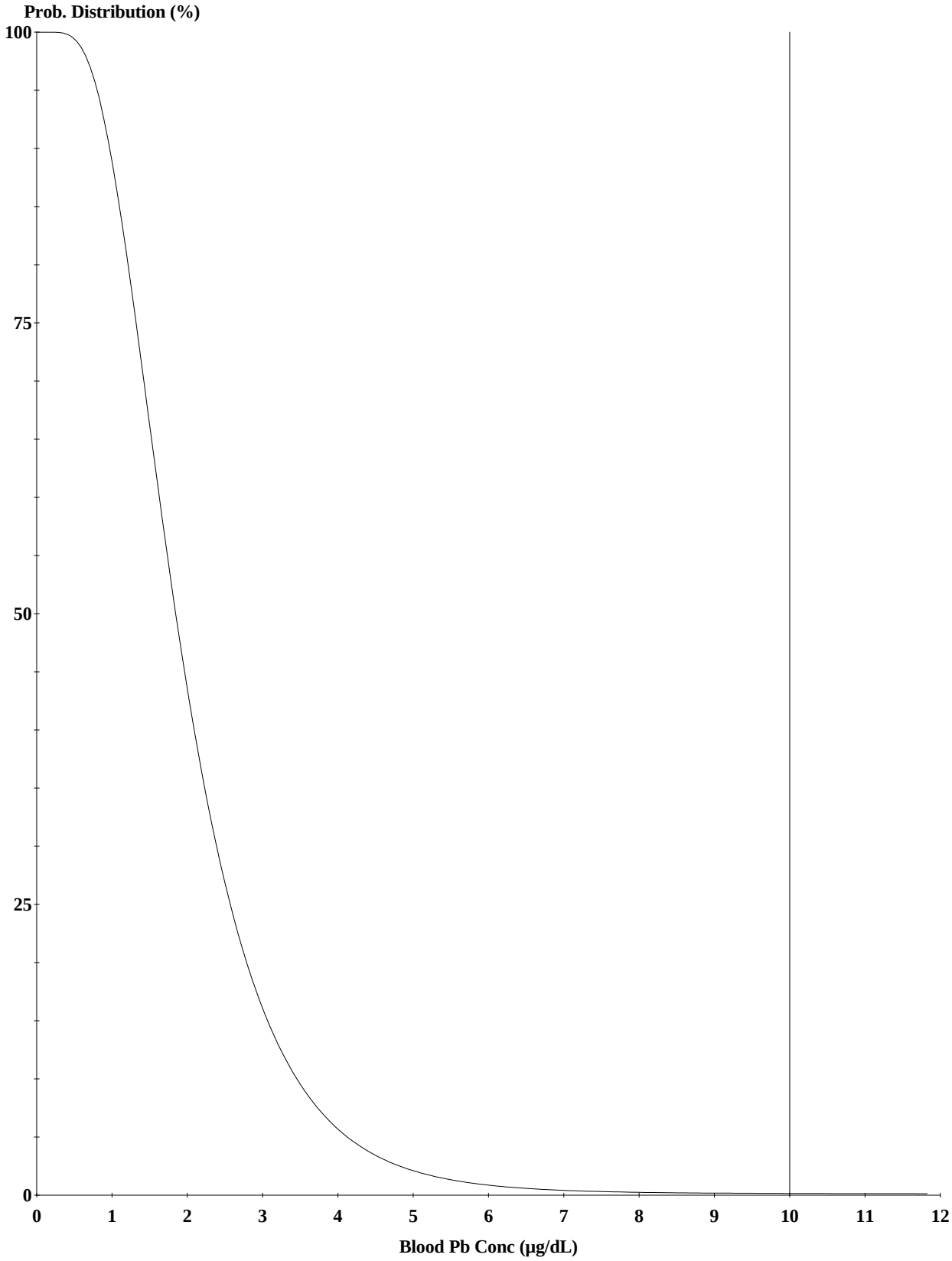
****** Maternal Contribution: Infant Model ******

Maternal Blood Concentration: 1.000 µg Pb/dL

****
CALCULATED BLOOD LEAD AND LEAD UPTAKES:
****

Year	Air (µg/day)	Diet (µg/day)	Alternate (µg/day)	Water (µg/day)
.5-1	0.021	1.095	0.000	0.388
1-2	0.034	0.947	0.000	0.966
2-3	0.062	1.033	0.000	1.009
3-4	0.067	0.994	0.000	1.033
4-5	0.067	0.956	0.000	1.079
5-6	0.093	1.008	0.000	1.140
6-7	0.093	1.093	0.000	1.161

Year	Soil+Dust (µg/day)	Total (µg/day)	Blood (µg/dL)
.5-1	1.312	2.815	1.5
1-2	2.077	4.024	1.7
2-3	2.086	4.189	1.6
3-4	2.095	4.188	1.5
4-5	1.562	3.663	1.3
5-6	1.409	3.650	1.1
6-7	1.333	3.680	1.1



Cutoff = 10.000 µg/dl
Geo Mean = 1.935
GSD = 1.600
% Above = 0.024

Age Range = 0 to 84 months

Run Mode = Research

LEAD MODEL FOR WINDOWS Version 1.1

==========

Model Version: 1.1 Build11
User Name:
Date:
Site Name:
Operable Unit:
Run Mode: Research

==========

******** Air ********

Indoor Air Pb Concentration: 30.000 percent of outdoor.
Other Air Parameters:

Age	Time Outdoors (hours)	Ventilation Rate (m^3/day)	Lung Absorption (%)	Outdoor Air Pb Conc (µg Pb/m^3)
.5-1	1.000	2.000	32.000	0.100
1-2	2.000	3.000	32.000	0.100
2-3	3.000	5.000	32.000	0.100
3-4	4.000	5.000	32.000	0.100
4-5	4.000	5.000	32.000	0.100
5-6	4.000	7.000	32.000	0.100
6-7	4.000	7.000	32.000	0.100

******** Diet ********

Age	Diet Intake(µg/day)
.5-1	2.260
1-2	1.960
2-3	2.130
3-4	2.040
4-5	1.950
5-6	2.050
6-7	2.220

******** Drinking Water ********

Water Consumption:

Age	Water (L/day)
.5-1	0.200
1-2	0.500
2-3	0.520
3-4	0.530
4-5	0.550
5-6	0.580
6-7	0.590

Drinking Water Concentration: 4.000 µg Pb/L

******** Soil & Dust ********

Multiple Source Analysis Used
Average multiple source concentration: 89.800 µg/g

Mass fraction of outdoor soil to indoor dust conversion factor: 0.700
Outdoor airborne lead to indoor household dust lead concentration: 100.000
Use alternate indoor dust Pb sources? No

Age	Soil (µg Pb/g)	House Dust (µg Pb/g)
.5-1	114.000	89.800
1-2	114.000	89.800
2-3	114.000	89.800
3-4	114.000	89.800
4-5	114.000	89.800
5-6	114.000	89.800
6-7	114.000	89.800

****** Alternate Intake ******

Age	Alternate (µg Pb/day)
.5-1	0.000
1-2	0.000
2-3	0.000
3-4	0.000
4-5	0.000
5-6	0.000
6-7	0.000

****** Maternal Contribution: Infant Model ******

Maternal Blood Concentration: 1.000 µg Pb/dL

****
CALCULATED BLOOD LEAD AND LEAD UPTAKES:
****

Year	Air (µg/day)	Diet (µg/day)	Alternate (µg/day)	Water (µg/day)
.5-1	0.021	1.081	0.000	0.383
1-2	0.034	0.932	0.000	0.951
2-3	0.062	1.019	0.000	0.995
3-4	0.067	0.982	0.000	1.021
4-5	0.067	0.949	0.000	1.071
5-6	0.093	1.002	0.000	1.133
6-7	0.093	1.087	0.000	1.155

Year	Soil+Dust (µg/day)	Total (µg/day)	Blood (µg/dL)
.5-1	2.456	3.940	2.2
1-2	3.878	5.795	2.4
2-3	3.903	5.979	2.2
3-4	3.928	5.998	2.1
4-5	2.940	5.026	1.8
5-6	2.656	4.885	1.5
6-7	2.514	4.850	1.4

APPENDIX I

Health-based Remediation Goal Calculations

HALEY ALDRICH

Appendix I, Table I-1
Intake and Risk Equations - Single Age
Soil -
CONSTRUCTION - CONSTRUCTION WORKER (ADULT)

Human Health Risk Assessment
D.C. United Soccer Stadium
Washington, D.C.

Exposure Routes Evaluated		ELCR (Total)
Incidental Ingestion	Yes	1E-06
Dermal Contact	Yes	8E-07
Particulate Inhalation	Yes	6E-08
Ambient Vapor Inhalation	Yes	8E-09
		2E-06

NC - not carcinogenic by this exposure route
NTV - no toxicity value available
NV - not volatile
DAD - dermally absorbed dose
EC - exposure concentration
ABS - absorption factor
CSF - cancer slope factor
UR - cancer unit risk
ELCR - excess lifetime cancer risk
EPC - exposure point concentration
COPC - chemical of potential concern

			Intake Calculations				Absorption Factors		Cancer Toxicity Values							
COPC	**CASRN**	**EPC (mg/kg)**	**$Intake_{ingestion}$ (mg/kg/day)**	**DAD_{dermal} (mg/kg/day)**	**$EC_{particulate}$ (ug/m^3)**	**EC_{vapor} (ug/m^3)**	**ABS_{ing} (unitless)**	**ABS_{d} (unitless)**	**CSF_{oral} $(mg/kg/day)^{-1}$**	**CSF_{dermal} $(mg/kg/day)^{-1}$**	**IUR $(ug/m^3)^{-1}$**	**$ELCR_{ingestion}$**	**$ELCR_{dermal}$**	**$ELCR_{particulate}$**	**$ELCR_{vapor}$**	**$ELCR_{total}$**
Trichloroethylene	79-01-6	3.1E-03	1.3E-10		1.0E-08	1.2E-05	1		4.6E-02	4.6E-02	4.1E-06	5.8E-12		4.1E-14	4.9E-11	5.5E-11
Vinyl Chloride	75-01-4	6.4E-03	2.6E-10		2.1E-08	5.8E-05	1		7.2E-01	7.2E-01	4.4E-06	1.9E-10		9.2E-14	2.5E-10	4.4E-10
1,1,1,2-Tetrachloroethane	630-20-6	6.8E-03	2.7E-10		2.2E-08	1.0E-05	1		2.6E-02	2.6E-02	7.4E-06	7.1E-12		1.6E-13	7.6E-11	8.3E-11
1,1,2,2-Tetrachloroethane	79-34-5															
1,2,4-Trichlorobenzene	120-82-1	3.9E-03	1.6E-10	5.0E-11	NC	NC	1	0.1	2.9E-02	2.9E-02		4.6E-12	1.5E-12			6.0E-12
1,2,4-Trimethylbenzene	95-63-6	2.0E+00	NC	NC	NC	NC	NC	NC								
1,2-Dichlorobenzene	95-50-1	6.0E-04	NC	NC	NC	NC	NC	NC								
1,3,5-Trimethylbenzene	108-67-8	8.5E-01	NC	NC	NC	NC	NC	NC								
1,4-Dichlorobenzene	106-46-7	6.1E-04	2.5E-11	7.9E-12	2.0E-09	4.8E-07	1	0.1	5.4E-03	5.4E-03	1.1E-05	1.3E-13	4.3E-14	2.2E-14	5.3E-12	5.5E-12
Methyl Ethyl Ketone (2-Butanone)	78-93-3	1.6E-01	NC	NC	NC	NC	NC	NC								
2-Hexanone	591-78-6	1.5E-03	NC	NC	NC	NC	NC	NC								
Butylbenzene, sec-	135-98-8															
Methyl Isobutyl Ketone (4-methyl-2-pentanone)	108-10-1	4.2E-02	NC	NC	NC	NC	NC	NC								
Acetone	67-64-1	5.3E-01	NC	NC	NC	NC	NC	NC								
Benzene	71-43-2	6.8E-03	2.7E-10		2.2E-08	1.6E-05	1		5.5E-02	5.5E-02	7.8E-06	1.5E-11		1.7E-13	1.3E-10	1.4E-10
Bromomethane	74-83-9	2.6E-02	NC	NC	NC	NC	1									
Carbon Disulfide	75-15-0															
Chloroform	67-66-3															
Chloromethane (Methyl Chloride)	74-87-3	8.5E-04	3.4E-11		2.8E-09	6.6E-06	1		1.3E-02	1.3E-02	1.8E-06	4.5E-13		5.0E-15	1.2E-11	1.2E-11
cis-1,2-Dichloroethylene	156-59-2	2.7E-02	NC	NC	NC	NC	NC	NC								
Cyclohexane	110-82-7															
Cymene (p-Isopropyltoluene) (surrogate = Cumene)	99-87-6	2.7E-01	NC	NC	NC	NC	NC	NC								
Ethylbenzene	100-41-4	1.0E+00	NC	NC	3.3E-06	1.5E-03	NC	NC			2.5E-06			8.2E-12	3.6E-09	3.6E-09
Isopropylbenzene	98-82-8	7.1E-01	NC	NC	NC	NC	NC	NC								
Isopropyltoluene (surrogate = Cymene)	25155-15-1															
Methyl cyclohexane	108-87-2	2.2E+00	NC	NC	NC	NC	NC	NC								
Methyl tert-Butyl Ether (MTBE)	1634-04-4	1.3E-02	5.2E-10		4.2E-08	2.6E-05	1		1.8E-03	1.8E-03	2.6E-07	9.4E-13		1.1E-14	6.7E-12	7.7E-12
Methylene Chloride	75-09-2	1.5E-02	6.0E-10		4.8E-08	6.2E-05	1		2.0E-03	2.0E-03	1.0E-08	1.2E-12		4.8E-16	6.2E-13	1.8E-12
Butylbenzene, n-	104-51-8	1.7E-01	NC	NC	NC	NC	NC	NC								
Propylbenzene	103-65-1															
Styrene	100-42-5	3.1E-02	NC	NC	NC	NC	NC	NC								
Butylbenzene, tert-	98-06-6															
Tetrachloroethylene	127-18-4	4.5E-01	1.8E-08		1.5E-06	1.6E-03	1		2.1E-03	2.1E-03	2.6E-07	3.8E-11		3.8E-13	4.2E-10	4.5E-10
Toluene	108-88-3	1.4E-01	NC	NC	NC	NC	NC	NC								
trans-1,2-Dichloroethylene	156-60-5	7.9E-04	NC	NC	NC	NC	NC	NC								
Trichlorofluoromethane (CFC-11)	75-69-4	5.1E-02	NC	NC	NC	NC	NC	NC								
Trifluorotrichloroethane (Freon 113)	76-13-1	1.2E-03	NC	NC	NC	NC	NC	NC								
Xylenes	1330-20-7	7.4E-03	NC	NC	NC	NC	NC	NC								
2-Methylnaphthalene	91-57-6	3.1E+01	NC	NC	NC	NC	NC	NC								
Acenaphthene	83-32-9	2.4E+01	NC	NC	NC	NC	NC	NC								
Acenaphthylene	208-96-8	1.7E+01	NC	NC	NC	NV	NC	NC							NV	

Appendix I, Table I-1
Intake and Risk Equations - Single Age
Soil -
CONSTRUCTION - CONSTRUCTION WORKER (ADULT)

Human Health Risk Assessment
D.C. United Soccer Stadium
Washington, D.C.

Exposure Routes Evaluated		ELCR (Total)
Incidental Ingestion	Yes	1E-06
Dermal Contact	Yes	8E-07
Particulate Inhalation	Yes	6E-08
Ambient Vapor Inhalation	Yes	8E-09
		2E-06

NC - not carcinogenic by this exposure route
NTV - no toxicity value available
NV - not volatile
DAD - dermally absorbed dose
EC - exposure concentration
ABS - absorption factor
CSF - cancer slope factor
UR - cancer unit risk
ELCR - excess lifetime cancer risk
EPC - exposure point concentration
COPC - chemical of potential concern

			Intake Calculations				Absorption Factors		Cancer Toxicity Values							
COPC	**CASRN**	**EPC (mg/kg)**	**$Intake_{ingestion}$ (mg/kg/day)**	**DAD_{dermal} (mg/kg/day)**	**$EC_{particulate}$ (ug/m^3)**	**EC_{vapor} (ug/m^3)**	**ABS_{ing} (unitless)**	**ABS_d (unitless)**	**CSF_{oral} $(mg/kg/day)^{-1}$**	**CSF_{dermal} $(mg/kg/day)^{-1}$**	**IUR $(ug/m^3)^{-1}$**	**$ELCR_{ingestion}$**	**$ELCR_{dermal}$**	**$ELCR_{particulate}$**	**$ELCR_{vapor}$**	**$ELCR_{total}$**
Anthracene	120-12-7	5.2E+01	NC	NC	NC	NC	1	0.13								
Benz[a]anthracene	56-55-3	3.4E+00	1.4E-07	5.6E-08	1.1E-05	NV	1	0.13	7.3E-01	7.3E-01	1.1E-04	9.9E-08	4.1E-08	1.2E-09	NV	1.4E-07
Benzo[a]pyrene	50-32-8	2.8E+00	1.1E-07	4.8E-08	9.2E-06	NV	1	0.13	7.3E+00	7.3E+00	1.1E-03	8.3E-07	3.5E-07	1.0E-08	NV	1.2E-06
Benzo[b]fluoranthene	205-99-2	3.5E+00	1.4E-07	5.9E-08	1.2E-05	NV	1	0.13	7.3E-01	7.3E-01	1.1E-04	1.0E-07	4.3E-08	1.3E-09	NV	1.5E-07
Benzo(g,h,i)perylene	191-24-2	4.1E+01	NC	NC	NC	NV	NC	NC							NV	
Benzo[k]fluoranthene	207-08-9	2.3E+01	9.3E-07	3.9E-07	7.5E-05	NV	1	0.13	7.3E-02	7.3E-02	1.1E-04	6.8E-08	2.8E-08	8.3E-09	NV	1.0E-07
Chrysene	218-01-9	3.3E+00	1.3E-07	5.6E-08	1.1E-05	NV	1	0.13	7.3E-03	3.4E+00	1.1E-05	9.8E-10	1.9E-07	1.2E-10	NV	1.9E-07
Dibenz[a,h]anthracene	53-70-3	4.8E-01	1.9E-08	8.1E-09	1.6E-06	NV	1	0.13	7.3E+00	7.3E+00	1.2E-03	1.4E-07	5.9E-08	1.9E-09	NV	2.0E-07
Fluoranthene	206-44-0	1.8E+02	NC	NC	NC	NV	NC	NC							NV	
Fluorene	86-73-7	2.3E+01	NC	NC	NC	NC	NC	NC								
Indeno[1,2,3-cd]pyrene	193-39-5	1.8E+00	7.2E-08	3.0E-08	5.8E-06	NV	1	0.13	7.3E-01	7.3E-01	1.1E-04	5.3E-08	2.2E-08	6.4E-10	NV	7.5E-08
Naphthalene	91-20-3	5.8E-01	NC	NC	1.9E-06	1.0E-04	NC	NC			3.4E-05			6.5E-11	3.5E-09	3.6E-09
Phenanthrene	85-01-8	1.7E+02	NC	NC	NC	NV	NC	NC							NV	
Pyrene	129-00-0	1.7E+02	NC	NC	NC	NC	NC	NC								
Polychlorinated Biphenyls	1336-36-3	7.0E-01	2.8E-08	1.3E-08	2.3E-06	NV	1	0.14	2.0E+00	2.0E+00	5.7E-04	5.6E-08	2.5E-08	1.3E-09	NV	8.3E-08
Aluminum	7429-90-5															
Antimony	7440-36-0	8.9E+00	NC	NC	NC	NV	NC	NC							NV	
Arsenic	7440-38-2															
Barium	7440-39-3	1.6E+02	NC	NC	NC	NV	NC	NC							NV	
Beryllium	7440-41-7	4.8E-01	NC	NC	1.6E-06	NV	NC	NC			2.4E-03			3.8E-09	NV	3.8E-09
Cadmium	7440-43-9															
Calcium	7440-70-2	7.5E+04	NC	NC	NC	NV	NC	NC							NV	
Chromium, Total	7440-47-3	4.0E+02	NC	NC	NC	NV	NC	NC							NV	
Cobalt	7440-48-4															
Copper	7440-50-8	3.6E+02	NC	NC	NC	NV	NC	NC							NV	
Iron	7439-89-6	3.1E+04	NC	NC	NC	NV	NC	NC							NV	
Lead	7439-92-1	6.1E+02	NC	NC	NC	NV	1								NV	
Magnesium	7439-95-4	2.0E+04	NC	NC	NC	NV	NC	NC							NV	
Manganese	7439-96-5															
Mercury	7439-97-6	1.5E+00	NC	NC	NC	NV	NC	NC							NV	
Nickel	7440-02-0	4.1E+01	NC	NC	1.3E-04	NV	NC	NC			2.4E-04			3.2E-08	NV	3.2E-08
Potassium	7440-09-7	5.1E+03	NC	NC	NC	NV	NC	NC							NV	
Selenium	7782-49-2	6.2E+00	NC	NC	NC	NV	NC	NC							NV	
Silver	7440-22-4	3.9E+00	NC	NC	NC	NV	NC	NC							NV	
Sodium	7440-23-5	1.4E+04	NC	NC	NC	NV	NC	NC							NV	
Thallium	7440-28-0	1.2E+00	NC	NC	NC	NV	NC	NC							NV	
Vanadium	7440-62-2	3.5E+01	NC	NC	NC	NV	NC	NC							NV	
Zinc	7440-66-6	7.2E+02	NC	NC	NC	NV	NC	NC							NV	

Appendix I, Table I-2
Non-Cancer Risk Calculations
Soil -
CONSTRUCTION - CONSTRUCTION WORKER (ADULT)

Human Health Risk Assessment
D.C. United Soccer Stadium
Washington, D.C.

Exposure Routes Evaluated		HI (Total)
Incidental Ingestion	Yes	4E-01
Dermal Contact	Yes	8E-02
Particulate Inhalation	Yes	3E-01
Ambient Vapor Inhalation	Yes	3E-02
		0.81

NV - not volatile
NTV - no toxicity value available
EC - exposure concentration
DAD - dermally absorbed dose
RfD - reference dose
ABS - absorption factor
HI - hazard index
RfC - reference concentration
EPC - exposure point concentration (if blank, then COPC was not detected)
COPC - chemical of potential concern

			Intake Calculations				Absorption Factors		Non-Cancer Toxicity Values							
COPC	**CASRN**	**EPC (mg/kg)**	**$Intake_{ingestion}$ (mg/kg/day)**	**DAD_{dermal} (mg/kg/day)**	**$EC_{particulate}$ (mg/m^3)**	**EC_{vapor} (mg/m^3)**	**ABS_{ing} (unitless)**	**ABS_{d} (unitless)**	**RfD_{oral} (mg/kg/day)**	**RfD_{dermal} (mg/kg/day)**	**RfC (mg/m^3)**	**$HQ_{ingestion}$**	**HQ_{dermal}**	**$HQ_{particulate}$**	**HQ_{vapor}**	**HQ_{total}**
Trichloroethylene	79-01-6	3.1E-03	8.8E-09		7.1E-10	8.4E-07	1		5.0E-04	5.0E-04	2.0E-03	1.8E-05		3.5E-07	4.2E-04	4.4E-04
Vinyl Chloride	75-01-4	6.4E-03	1.8E-08		1.5E-09	4.1E-06	1		3.0E-03	3.0E-03	1.0E-01	6.0E-06		1.5E-08	4.1E-05	4.7E-05
1,1,1,2-Tetrachloroethane	630-20-6	6.8E-03	1.9E-08		1.6E-09	7.1E-07	1		3.0E-02	3.0E-02		6.4E-07		NTV	NTV	6.4E-07
1,1,2,2-Tetrachloroethane	79-34-5															
1,2,4-Trichlorobenzene	120-82-1	3.9E-03	1.1E-08	3.5E-09	8.9E-10	7.5E-08	1	0.1	1.0E-02	1.0E-02	2.0E-03	1.1E-06	3.5E-07	4.5E-07	3.7E-05	3.9E-05
1,2,4-Trimethylbenzene	95-63-6	2.0E+00	5.6E-06		4.5E-07	1.4E-04	1				7.0E-03	NTV	NTV	6.5E-05	2.1E-02	2.1E-02
1,2-Dichlorobenzene	95-50-1	6.0E-04	1.7E-09	5.4E-10	1.4E-10	3.0E-08	1	0.1	9.0E-02	9.0E-02	2.0E-01	1.9E-08	6.0E-09	6.8E-10	1.5E-07	1.7E-07
1,3,5-Trimethylbenzene	108-67-8	8.5E-01	2.4E-06		1.9E-07	7.4E-05	1					NTV	NTV	NTV	NTV	
1,4-Dichlorobenzene	106-46-7	6.1E-04	1.7E-09	5.5E-10	1.4E-10	3.4E-08	1	0.1	7.0E-02	7.0E-02	8.0E-01	2.5E-08	7.9E-09	1.7E-10	4.2E-08	7.5E-08
Methyl Ethyl Ketone (2-Butanon	78-93-3	1.6E-01	4.5E-07		3.7E-08	9.8E-06	1		6.0E-01	6.0E-01	5.0E+00	7.5E-07		7.3E-09	2.0E-06	2.7E-06
2-Hexanone	591-78-6	1.5E-03	4.2E-09		3.4E-10	7.6E-08	1		5.0E-03	5.0E-03	3.0E-02	8.5E-07		1.1E-08	2.5E-06	3.4E-06
Butylbenzene, sec-	135-98-8															
Methyl Isobutyl Ketone (4-meth	108-10-1	4.2E-02	1.2E-07		9.6E-09	2.7E-06	1		8.0E-02	8.0E-02	3.0E+00	1.5E-06		3.2E-09	9.0E-07	2.4E-06
Acetone	67-64-1	5.3E-01	1.5E-06		1.2E-07	3.0E-05	1		9.0E-01	9.0E-01	3.1E+01	1.7E-06		3.9E-09	9.7E-07	2.6E-06
Benzene	71-43-2	6.8E-03	1.9E-08		1.6E-09	1.1E-06	1		4.0E-03	4.0E-03	3.0E-02	4.8E-06		5.2E-08	3.8E-05	4.2E-05
Bromomethane	74-83-9	2.6E-02	7.3E-08		5.9E-09	1.2E-05	1		1.4E-03	1.4E-03	5.0E-03	5.2E-05		1.2E-06	2.4E-03	2.5E-03
Carbon Disulfide	75-15-0															
Chloroform	67-66-3															
Chloromethane (Methyl Chloride	74-87-3	8.5E-04	2.4E-09		1.9E-10	4.6E-07	1				9.0E-02	NTV	NTV	2.2E-09	5.2E-06	5.2E-06
cis-1,2-Dichloroethylene	156-59-2	2.7E-02	7.6E-08		6.2E-09	6.7E-06	1		2.0E-03	2.0E-03		3.8E-05		NTV	NTV	3.8E-05
Cyclohexane	110-82-7															
Cymene (p-Isopropyltoluene) (s	99-87-6	2.7E-01	7.6E-07		6.2E-08	1.8E-05	1		1.0E-01	1.0E-01	4.0E-01	7.6E-06		1.5E-07	4.5E-05	5.3E-05
Ethylbenzene	100-41-4	1.0E+00	2.8E-06		2.3E-07	1.0E-04	1		1.0E-01	1.0E-01	1.0E+00	2.8E-05		2.3E-07	1.0E-04	1.3E-04
Isopropylbenzene	98-82-8	7.1E-01	2.0E-06		1.6E-07	6.6E-05	1		1.0E-01	1.0E-01	4.0E-01	2.0E-05		4.1E-07	1.6E-04	1.8E-04
Isopropyltoluene (surrogate = C	25155-15-1															
Methyl cyclohexane	108-87-2	2.2E+00	6.2E-06		5.0E-07	1.2E-03	1				3.0E+00	NTV	NTV	1.7E-07	4.0E-04	4.0E-04
Methyl tert-Butyl Ether (MTBE)	1634-04-4	1.3E-02	3.7E-08		3.0E-09	1.8E-06	1				3.0E+00	NTV	NTV	9.9E-10	6.1E-07	6.1E-07
Methylene Chloride	75-09-2	1.5E-02	4.2E-08		3.4E-09	4.3E-06	1		6.0E-03	6.0E-03	6.0E-01	7.0E-06		5.6E-09	7.2E-06	1.4E-05
Butylbenzene, n-	104-51-8	1.7E-01	4.8E-07		3.9E-08	1.2E-05	1		5.0E-02	5.0E-02		9.5E-06		NTV	NTV	9.5E-06
Propylbenzene	103-65-1															
Styrene	100-42-5	3.1E-02	8.8E-08		7.1E-09	1.9E-06	1		2.0E-01	2.0E-01	1.0E+00	4.4E-07		7.1E-09	1.9E-06	2.4E-06
Butylbenzene, tert-	98-06-6															
Tetrachloroethylene	127-18-4	4.5E-01	1.3E-06		1.0E-07	1.1E-04	1		6.0E-03	6.0E-03	4.0E-02	2.1E-04		2.5E-06	2.8E-03	3.0E-03
Toluene	108-88-3	1.4E-01	4.0E-07		3.2E-08	1.9E-05	1		8.0E-02	8.0E-02	5.0E+00	4.9E-06		6.4E-09	3.8E-06	8.7E-06
trans-1,2-Dichloroethylene	156-60-5	7.9E-04	2.2E-09		1.8E-10	1.9E-07	1		2.0E-02	2.0E-02		1.1E-07		NTV	NTV	1.1E-07
Trichlorofluoromethane (CFC-1	75-69-4	5.1E-02	1.4E-07		1.2E-08	2.9E-05	1		3.0E-01	3.0E-01	7.0E-01	4.8E-07		1.7E-08	4.1E-05	4.1E-05
Trifluorotrichloroethane (Freon 1	76-13-1	1.2E-03	3.4E-09	1.1E-08	2.7E-10	7.7E-07	1	1	3.0E+01	3.0E+01	3.0E+01	1.1E-10	3.6E-10	9.1E-12	2.6E-08	2.6E-08
Xylenes	1330-20-7	7.4E-03	2.1E-08		1.7E-09	7.3E-07	1		2.0E-01	2.0E-01	1.0E-01	1.0E-07		1.7E-08	7.3E-06	7.4E-06
2-Methylnaphthalene	91-57-6	3.1E+01	8.8E-05	3.7E-05	7.1E-06	3.1E-04	1	0.13	4.0E-03	4.0E-03		2.2E-02	9.1E-03	NTV	NTV	3.1E-02
Acenaphthene	83-32-9	2.4E+01	6.8E-05	2.8E-05	5.5E-06	9.7E-05	1	0.13	6.0E-02	6.0E-02		1.1E-03	4.7E-04	NTV	NTV	1.6E-03

Appendix I, Table I-2
Non-Cancer Risk Calculations
Soil -
CONSTRUCTION - CONSTRUCTION WORKER (ADULT)

Human Health Risk Assessment
D.C. United Soccer Stadium
Washington, D.C.

Exposure Routes Evaluated		HI (Total)
Incidental Ingestion	Yes	4E-01
Dermal Contact	Yes	8E-02
Particulate Inhalation	Yes	3E-01
Ambient Vapor Inhalation	Yes	3E-02
		0.81

NV - not volatile
NTV - no toxicity value available
EC - exposure concentration
DAD - dermally absorbed dose
RfD - reference dose
ABS - absorption factor
HI - hazard index
RfC - reference concentration
EPC - exposure point concentration (if blank, then COPC was not detected)
COPC - chemical of potential concern

			Intake Calculations				Absorption Factors		Non-Cancer Toxicity Values							
COPC	**CASRN**	**EPC (mg/kg)**	**$Intake_{ingestion}$ (mg/kg/day)**	**DAD_{dermal} (mg/kg/day)**	**$EC_{particulate}$ (mg/m^3)**	**EC_{vapor} (mg/m^3)**	**ABS_{ing} (unitless)**	**ABS_{d} (unitless)**	**RfD_{oral} (mg/kg/day)**	**RfD_{dermal} (mg/kg/day)**	**RfC (mg/m^3)**	**$HQ_{ingestion}$**	**HQ_{dermal}**	**$HQ_{particulate}$**	**HQ_{vapor}**	**HQ_{total}**
Acenaphthylene	208-96-8	1.7E+01	4.8E-05	2.0E-05	3.9E-06	NV	1	0.13	6.0E-02	6.0E-02		8.0E-04	3.3E-04	NTV	NV	1.1E-03
Anthracene	120-12-7	5.2E+01	1.5E-04	6.1E-05	1.2E-05	5.7E-05	1	0.13	3.0E-01	3.0E-01		4.9E-04	2.0E-04	NTV	NTV	6.9E-04
Benz[a]anthracene	56-55-3	3.4E+00	9.5E-06	3.9E-06	7.6E-07	NV	1	0.13				NTV	NTV	NTV	NV	
Benzo[a]pyrene	50-32-8	2.8E+00	8.0E-06	3.3E-06	6.5E-07	NV	1	0.13				NTV	NTV	NTV	NV	
Benzo[b]fluoranthene	205-99-2	3.5E+00	1.0E-05	4.2E-06	8.1E-07	NV	1	0.13				NTV	NTV	NTV	NV	
Benzo(g,h,i)perylene	191-24-2	4.1E+01	1.2E-04	4.8E-05	9.4E-06	NV	1	0.13	3.0E-02	3.0E-02		3.9E-03	1.6E-03	NTV	NV	5.5E-03
Benzo[k]fluoranthene	207-08-9	2.3E+01	6.5E-05	2.7E-05	5.3E-06	NV	1	0.13				NTV	NTV	NTV	NV	
Chrysene	218-01-9	3.3E+00	9.4E-06		7.6E-07	NV	1					NTV	NTV	NTV	NV	
Dibenz[a,h]anthracene	53-70-3	4.8E-01	1.4E-06	5.7E-07	1.1E-07	NV	1	0.13				NTV	NTV	NTV	NV	
Fluoranthene	206-44-0	1.8E+02	5.1E-04	2.1E-04	4.1E-05	NV	1	0.13	4.0E-02	4.0E-02		1.3E-02	5.3E-03	NTV	NV	1.8E-02
Fluorene	86-73-7	2.3E+01	6.5E-05	2.7E-05	5.3E-06	4.7E-05	1	0.13	4.0E-02	4.0E-02		1.6E-03	6.8E-04	NTV	NTV	2.3E-03
Indeno[1,2,3-cd]pyrene	193-39-5	1.8E+00	5.1E-06	2.1E-06	4.1E-07	NV	1	0.13				NTV	NTV	NTV	NV	
Naphthalene	91-20-3	5.8E-01	1.6E-06	6.9E-07	1.3E-07	7.2E-06	1	0.13	2.0E-02	2.0E-02	3.0E-03	8.2E-05	3.4E-05	4.4E-05	2.4E-03	2.6E-03
Phenanthrene	85-01-8	1.7E+02	4.8E-04	2.0E-04	3.9E-05	NV	1	0.13	3.0E-02	3.0E-02		1.6E-02	6.7E-03	NTV	NV	2.3E-02
Pyrene	129-00-0	1.7E+02	4.8E-04	2.0E-04	3.9E-05	4.0E-05	1	0.13	3.0E-02	3.0E-02		1.6E-02	6.7E-03	NTV	NTV	2.3E-02
Polychlorinated Biphenyls	1336-36-3	7.0E-01	2.0E-06	8.8E-07	1.6E-07	NV	1	0.14	2.0E-05	2.0E-05		9.8E-02	4.4E-02	NTV	NV	1.4E-01
Aluminum	7429-90-5															
Antimony	7440-36-0	8.9E+00	2.5E-05		2.0E-06	NV	1		4.0E-04	6.0E-05		6.3E-02		NTV	NV	6.3E-02
Arsenic	7440-38-2															
Barium	7440-39-3	1.6E+02	4.4E-04		3.6E-05	NV	1		2.0E-01	1.4E-02	5.0E-04	2.2E-03		7.1E-02	NV	7.3E-02
Beryllium	7440-41-7	4.8E-01	1.4E-06		1.1E-07	NV	1		2.0E-03	1.4E-05	2.0E-05	6.8E-04		5.5E-03	NV	6.2E-03
Cadmium	7440-43-9															
Calcium	7440-70-2	7.5E+04	2.1E-01		1.7E-02	NV	1					NTV	NTV	NTV	NV	
Chromium, Total	7440-47-3	4.0E+02	1.1E-03		9.1E-05	NV	1		1.5E+00	2.0E-02		7.5E-04		NTV	NV	7.5E-04
Cobalt	7440-48-4															
Copper	7440-50-8	3.6E+02	1.0E-03		8.3E-05	NV	1		4.0E-02	4.0E-02		2.6E-02		NTV	NV	2.6E-02
Iron	7439-89-6	3.1E+04	8.8E-02		7.1E-03	NV	1		7.0E-01	7.0E-01		1.3E-01		NTV	NV	1.3E-01
Lead	7439-92-1	6.1E+02	1.7E-03		1.4E-04	NV	1					NTV	NTV	NTV	NV	
Magnesium	7439-95-4	2.0E+04	5.7E-02		4.6E-03	NV	1					NTV	NTV	NTV	NV	
Manganese	7439-96-5															
Mercury	7439-97-6	1.5E+00	4.2E-06		3.4E-07	NV	1		3.0E-04	2.1E-05	3.0E-04	1.4E-02		1.1E-03	NV	1.5E-02
Nickel	7440-02-0	4.1E+01	1.2E-04		9.4E-06	NV	1		2.0E-02	8.0E-04	9.0E-05	5.8E-03		1.0E-01	NV	1.1E-01
Potassium	7440-09-7	5.1E+03	1.4E-02		1.2E-03	NV	1					NTV	NTV	NTV	NV	
Selenium	7782-49-2	6.2E+00	1.8E-05		1.4E-06	NV	1		5.0E-03	5.0E-03	2.0E-02	3.5E-03		7.1E-05	NV	3.6E-03
Silver	7440-22-4	3.9E+00	1.1E-05		8.9E-07	NV	1		5.0E-03	2.0E-04		2.2E-03		NTV	NV	2.2E-03
Sodium	7440-23-5	1.4E+04	4.0E-02		3.2E-03	NV	1					NTV	NTV	NTV	NV	
Thallium	7440-28-0	1.2E+00	3.4E-06		2.7E-07	NV	1					NTV	NTV	NTV	NV	
Vanadium	7440-62-2	3.5E+01	9.9E-05		8.0E-06	NV	1		5.0E-03	1.3E-04	1.0E-04	2.0E-02		8.0E-02	NV	1.0E-01
Zinc	7440-66-6	7.2E+02	2.0E-03		1.6E-04	NV	1		3.0E-01	3.0E-01		6.8E-03		NTV	NV	6.8E-03

Appendix I, Table I-3
Intake and Risk Equations - Single Age

Human Health Risk Assessment
D.C. United Soccer Stadium
Washington, D.C.

Cancer Risk from Ingestion

$$ELCR = Intake_{ing} * CSF$$

$$Intake_{ing\ (age\ group\ x)} = \frac{[EPC]_{soil} * IR * ABS_{ing} * FI * EF * ED * C1}{BW_x * AT_{lifetime}}$$

Cancer Risk from Dermal Absorption

$$ELCR = DAD * CSF$$

$$DAD_{derm(age\ group\ x)} = \frac{DA_{Event} * SA * EV * EF * ED}{BW_x * AT_{lifetime}}$$

$$DA_{Event} = [EPC]_{soil} * ABS_d * AF * C1$$

Cancer Risk from Inhalation

$$ELCR_{inh} = EC_{can} * IUR$$

$$EC_{can\ (age\ group\ x)} = \frac{[EPC]_{PART} * ET_{Part} * EF * ED \text{ --- OR--- } [EPC]_{VAPOR} * ET_{Vap} * EF * ED}{24 * AT_{lifetime}}$$

Noncancer Risk from Ingestion

$$HQ = \frac{Intake_{ing}}{RfD}$$

$$Intake_{ing} = \frac{[EPC]_{soil} * IR * ABS_{ing} * FI * EF * ED * C1}{BW * AT}$$

Noncancer Risk from Dermal Absorption

$$HQ = \frac{DAD}{RfD}$$

$$DAD_{derm} = \frac{DA_{Event} * SA * EV * EF * ED}{BW * AT}$$

$$DA_{Event} = [EPC]_{soil} * ABS_d * AF * C1$$

Noncancer Risk from Inhalation

$$HQ = \frac{EC_{nc}}{RfC}$$

$$EC_{nc} = \frac{[EPC]_{PART} * ET_{Part} * EF * ED * C2 \text{ --- OR--- } [EPC]_{VAPOR} * ET_{Vap} * EF * ED * C2}{24 * AT}$$

Parameter	Value - Cancer	Value - Non-Cancer	Units
CSF	Chemical specific	--	$(mg/kg\text{-}day)^{-1}$
IUR	Chemical specific	--	$(ug/m^3)^{-1}$
Intake	Age/chemical specific	--	mg/kg-day
EC_{can}	Age/chemical specific	--	(ug/m^3)
ELCR	Age/chemical specific	--	unitless
RfD	--	Chemical specific	mg/kg-day
RfC	--	Chemical specific	(mg/m^3)
DAD	Age/chemical specific	Age/chemical specific	mg/kg-day
DA_{Event}	Age/chemical specific	Age/chemical specific	mg/cm^2-event
EC_{nc}	--	Age/chemical specific	mg/m^3
HQ	--	Age/chemical specific	unitless
$[EPC]_{soil}$	Chemical specific	Chemical specific	mg/kg
$[EPC]_{PART}$	Appendix I, TABLE I-4	Appendix I, TABLE I-4	ug/m^3
$[EPC]_{VAPOR}$	Appendix I, TABLE	Appendix I, TABLE	ug/m^3
ABS_{ing}	Chemical specific	Chemical specific	unitless
ABS_d	Chemical specific	Chemical specific	unitless
BW	80	80	kg
EF	250	250	day/year
ED	1	1	year
AT	--	365	day
ATlifetime	25550	--	day
IR	330	330	mg/day
FI	1	1	unitless
C1	0.000001	0.000001	kg/mg
SA	3527	3527	cm2
AF	0.3	0.3	mg/cm2
EV	1	1	event/day
ETPart	8	8	hours/day
C2	0.001	0.001	mg/ug
ETVap	8	8	hours/day

Appendix I, Table I-4
Exposure Factors

Human Health Risk Assessment
D.C. United Soccer Stadium
Washington, D.C.

PLACE "X" IN THE APPROPRIATE YELLOW SHADED CELLS FOR THE APPROPRIATE RECEPTOR AND BASIS F

SCENARIO USED TO CALCULATE RISKS			**X**	**CONSTRUCTION**
BASIS FOR CANCER CALCULATIONS			**X**	
BASIS FOR NON-CANCER CALCULATIONS			**X**	
RECEPTOR			**CONSTRUCTION WORKER (ADULT)**	
Standard Parameters				
Body Weight	BW	kg	80	USEPA, 2014
Exposure Frequency	EF	day/year	250	USEPA, 2002
Exposure Duration	ED	year	1	USEPA, 2002
Non–carcinogenic Averaging Time	AT	day	365	Exposure duration expressed in days
Carcinogenic Averaging Time	$AT_{lifetime}$	day	25550	70 year lifetime
Incidental Ingestion of Soil				
Soil Ingestion Rate	IR	mg/day	330	USEPA, 2002
Fraction Ingested	FI	unitless	1.0	USEPA, 2002
Age-Adjusted Soil Ingestion Rate	IFSadj	mg-yr/kg-day	NA	
Dermal Exposure with Soil				
Exposed Skin Surface Area	SA	cm^2	3527	USEPA, 2014
Soil Adherence Factor	AF	mg/cm^2	0.30	USEPA, 2002
Fraction Dermal	EV	event/day	1.0	USEPA, 2002
Age-Adjusted Dermal Contact Factor	DFSadj	mg-yr/kg-day	NA	
Particulate Inhalation				
Exposure Time	ET_{Part}	hours/day	8	Assumption
Vapor Inhalation				
Exposure Time	ET_{Vap}	hours/day	8	Assumption

Appendix I, Table I-5
Particulate to Outdoor Air EPC Calculations
Soil -
CONSTRUCTION - CONSTRUCTION WORKER (ADULT)

Human Health Risk Assessment
D.C. United Soccer Stadium
Washington, D.C.

EQUATIONS:

$$EPC_{[PARTICULATE]} = EPC_{[SOIL]} \times PARTICULATE_{[AIR]} \times 1E\text{-}06\ [kg/mg]$$

where:

$$PARTICULATE_{[AIR]} = (1/PEF * 1E+09\ ug/kg) \text{ or Measured/Modelled}$$

and:

$$PEF\ (m^3/kg) = Q/C \times [(3600\ s/hr) / ((0.036 \times (1-V) \times (U_m/U_t)^3 \times F(x))]$$

PARAMETER/DEFINITION	UNITS	DEFAULT	Source
$PARTICULATE_{[Air]}$ / Particulate concentration in air	ug/m^3	1000	Calculated or measured
Measured or modeled $PARTICULATE_{[AIR]}$	ug/m^3		Measured value
PEF / Particulate emission factor	m^3/kg	1.00E+06	Guidance value
Q/C / inverse of the mean concentration at the center of a 0.5-acre-square source	g/m^2-s per kg/m^3	35.14	Calculated / USEPA, 2014 [a]
V / Fraction of vegetative cover	unitless	0	Site-specific, estimated
U_m / mean annual windspeed	m/s	2.82	Site-specific / USEPA, 2014
U_t / equivalent threshold value of wind speed at 7 m	m/s	11.32	USEPA, 2014
F(x) / function dependant on U_m/U_t derived using Cowherd et al. (1985)	unitless	2.25E-04	Calculated / USEPA, 2014

USEPA, 2014. Regional Screening Levels.
[a] Climactic zone: Phoenix Arizona [a] Area of Source: Specific to size of Exposure Area

CASRN	COPC	EPC Soil (mg/kg)	EPC Particulate (ug/m^3)
79-01-6	Trichloroethylene	0.0031	3.1E-06
75-01-4	Vinyl Chloride	0.0064	6.4E-06
630-20-6	1,1,1,2-Tetrachloroethane	0.0068	6.8E-06
	1,1,2,2-Tetrachloroethane		
120-82-1	1,2,4-Trichlorobenzene	0.0039	3.9E-06
95-63-6	1,2,4-Trimethylbenzene	1.98	2.0E-03
95-50-1	1,2-Dichlorobenzene	0.0006	6.0E-07
108-67-8	1,3,5-Trimethylbenzene	0.847	8.5E-04
106-46-7	1,4-Dichlorobenzene	0.00061	6.1E-07
78-93-3	Methyl Ethyl Ketone (2-Butanone)	0.16	1.6E-04
591-78-6	2-Hexanone	0.0015	1.5E-06
	Butylbenzene, sec-		
108-10-1	Methyl Isobutyl Ketone (4-methyl-2-pentanone)	0.042	4.2E-05
67-64-1	Acetone	0.53	5.3E-04
71-43-2	Benzene	0.0068	6.8E-06
74-83-9	Bromomethane	0.026	2.6E-05
	Carbon Disulfide		
	Chloroform		
74-87-3	Chloromethane (Methyl Chloride)	0.00085	8.5E-07
156-59-2	cis-1,2-Dichloroethylene	0.027	2.7E-05
	Cyclohexane		
99-87-6	Cymene (p-Isopropyltoluene) (surrogate = Cumene	0.27	2.7E-04
100-41-4	Ethylbenzene	1	1.0E-03
98-82-8	Isopropylbenzene	0.71	7.1E-04
	Isopropyltoluene (surrogate = Cymene)		
108-87-2	Methyl cyclohexane	2.2	2.2E-03
1634-04-4	Methyl tert-Butyl Ether (MTBE)	0.013	1.3E-05
75-09-2	Methylene Chloride	0.0148	1.5E-05
104-51-8	Butylbenzene, n-	0.169	1.7E-04
	Propylbenzene		
100-42-5	Styrene	0.031	3.1E-05
	Butylbenzene, tert-		
127-18-4	Tetrachloroethylene	0.446	4.5E-04
108-88-3	Toluene	0.14	1.4E-04
156-60-5	trans-1,2-Dichloroethylene	0.00079	7.9E-07
75-69-4	Trichlorofluoromethane (CFC-11)	0.051	5.1E-05
76-13-1	Trifluorotrichloroethane (Freon 113)	0.0012	1.2E-06
1330-20-7	Xylenes	0.00738	7.4E-06
91-57-6	2-Methylnaphthalene	31	3.1E-02
83-32-9	Acenaphthene	24	2.4E-02
208-96-8	Acenaphthylene	17	1.7E-02
120-12-7	Anthracene	52	5.2E-02
56-55-3	Benz[a]anthracene	3.35	3.4E-03
50-32-8	Benzo[a]pyrene	2.83	2.8E-03
205-99-2	Benzo[b]fluoranthene	3.53	3.5E-03
191-24-2	Benzo(g,h,i)perylene	41	4.1E-02
207-08-9	Benzo[k]fluoranthene	23	2.3E-02
218-01-9	Chrysene	3.32	3.3E-03
53-70-3	Dibenz[a,h]anthracene	0.483	4.8E-04
206-44-0	Fluoranthene	180	1.8E-01
86-73-7	Fluorene	23	2.3E-02
193-39-5	Indeno[1,2,3-cd]pyrene	1.79	1.8E-03
91-20-3	Naphthalene	0.582	5.8E-04
85-01-8	Phenanthrene	170	1.7E-01
129-00-0	Pyrene	170	1.7E-01
1336-36-3	Polychlorinated Biphenyls	0.696	7.0E-04
	Aluminum		
7440-36-0	Antimony	8.9	8.9E-03
	Arsenic		
7440-39-3	Barium	156	1.6E-01
7440-41-7	Beryllium	0.48	4.8E-04
	Cadmium		
7440-70-2	Calcium	75000	7.5E+01
7440-47-3	Chromium, Total	400	4.0E-01
	Cobalt		
7440-50-8	Copper	363	3.6E-01
7439-89-6	Iron	31000	3.1E+01
7439-92-1	Lead	612	6.1E-01
7439-95-4	Magnesium	20000	2.0E+01
	Manganese		
7439-97-6	Mercury	1.5	1.5E-03
7440-02-0	Nickel	41	4.1E-02
7440-09-7	Potassium	5100	5.1E+00
7782-49-2	Selenium	6.2	6.2E-03
7440-22-4	Silver	3.9	3.9E-03
7440-23-5	Sodium	14000	1.4E+01
7440-28-0	Thallium	1.2	1.2E-03
7440-62-2	Vanadium	35	3.5E-02
7440-66-6	Zinc	720	7.2E-01

Appendix I, Table I-6
Vapor to Outdoor Air EPC Calculations
Soil -
CONSTRUCTION - CONSTRUCTION WORKER (ADULT)

Human Health Risk Assessment
D.C. United Soccer Stadium
Washington, D.C.

EQUATIONS:

$$EPC_{[VAPOR]} = EPC_{[SOIL]} \times 1/VF \times 1000\ ug/mg$$

where:

$$VF\ (m^3/kg) = Q/C \times (3.14 \times D_A \times T)^{1/2} \times 10^{-4}(m^2/cm^2) / (2 \times P_b \times D_A)$$

and:

$$DA = [(O_a^{10/3} D_i H' + O_w^{10/3} D_w)/n^2] / P_b K_d + O_w + O_a H'$$

PARAMETER/DEFINITION	UNITS	DEFAULT	Source
VF / volatilization factor	m^3/kg	Calculated	
D_A / apparent diffusivity	cm^2/s	Calculated	
Q/C / inverse of the mean concentration at the center of a 0.5-acre-square source	g/m^2-s per kg/m^3	35.14	USEPA, 2014 [a]
T / exposure interval	s	3.15E+07	CONSTRUCTION
Π_b / dry soil bulk density	g/cm^3	1.62	USEPA, 2014
O_a / air-filled soil porosity	L_{air}/L_{soil}	0.314	USEPA, 2014
n / total soil porosity	L_{pore}/L_{soil}	0.39	USEPA, 2014
O_w / water-filled soil porosity	L_{water}/L_{soil}	0.076	USEPA, 2014
Ψ_s / soil particle density	g/cm^3	2.65	USEPA, 1996
D_i / diffusivity in air	cm^2/s	chemical-specific	
H' / Henry's Law constant	dimensionless	chemical-specific	
D_w / diffusivity in water	cm^2/s	chemical-specific	
K_d / soil-water partition coefficient (Koc x foc) organics	cm^3/g	chemical-specific	
K_{oc} / soil organic carbon partition coefficient	cm^3/g	chemical-specific	
f_{oc} / fraction organic carbon in soil	g/g	0.006	Default

USEPA, 2014. Regional Screening Levels.

[a] Climactic zone: Phoenix Arizona [a] Area of Source: Specific to size of Exposure Area

CASRN	COPC	Volatile (Y/N)	D_i (cm^2/s)	H' (unitless)	D_w (cm^2/s)	K_d (cm^3/g)	K_{oc} (cm^3/g)	D_A (cm^2/s)	VF (m^3/kg)	EPC Soil (mg/kg)	EPC Vapor (ug/m^3)
79-01-6	Trichloroethylene	Y	6.87E-02	4.03E-01	1.02E-05	3.64E-01	6.07E+01	4.8E-03	840	0.0031	3.7E-03
75-01-4	Vinyl Chloride	Y	1.07E-01	1.14E+00	1.20E-05	1.30E-01	2.17E+01	2.6E-02	361	0.0064	1.8E-02
630-20-6	1,1,1,2-Tetrachloroethane	Y	4.82E-02	1.02E-01	9.10E-06	5.16E-01	8.60E+01	7.2E-04	2172	0.0068	3.1E-03
	1,1,2,2-Tetrachloroethane										
120-82-1	1,2,4-Trichlorobenzene	Y	3.96E-02	5.81E-02	8.40E-06	8.14E+00	1.36E+03	2.4E-05	11918	0.0039	3.3E-04
95-63-6	1,2,4-Trimethylbenzene	Y	6.07E-02	2.52E-01	7.92E-06	3.69E+00	6.14E+02	3.5E-04	3140	1.98	6.3E-01
95-50-1	1,2-Dichlorobenzene	Y	5.62E-02	7.85E-02	8.92E-06	2.30E+00	3.83E+02	1.6E-04	4618	0.0006	1.3E-04
108-67-8	1,3,5-Trimethylbenzene	Y	6.02E-02	3.59E-01	7.84E-06	3.61E+00	6.02E+02	4.9E-04	2623	0.847	3.2E-01
106-46-7	1,4-Dichlorobenzene	Y	5.50E-02	9.85E-02	8.68E-06	2.25E+00	3.75E+02	2.0E-04	4127	0.00061	1.5E-04
78-93-3	Methyl Ethyl Ketone (2-Butanone)	Y	9.14E-02	2.33E-03	1.02E-05	2.71E-02	4.51E+00	2.4E-04	3733	0.16	4.3E-02
591-78-6	2-Hexanone	Y	7.04E-02	3.81E-03	8.44E-06	8.99E-02	1.50E+01	1.7E-04	4521	0.0015	3.3E-04
	Butylbenzene, sec-										
108-10-1	Methyl Isobutyl Ketone (4-methyl-2-pentanone)	Y	6.98E-02	5.64E-03	8.35E-06	7.56E-02	1.26E+01	2.7E-04	3537	0.042	1.2E-02
67-64-1	Acetone	Y	1.06E-01	1.43E-03	1.15E-05	1.42E-02	2.36E+00	2.1E-04	4016	0.53	1.3E-01
71-43-2	Benzene	Y	8.95E-02	2.27E-01	1.03E-05	8.75E-01	1.46E+02	1.8E-03	1376	0.0068	4.9E-03
74-83-9	Bromomethane	Y	1.00E-01	3.00E-01	1.35E-05	7.93E-02	1.32E+01	1.4E-02	494	0.026	5.3E-02
	Carbon Disulfide										
	Chloroform										
74-87-3	Chloromethane (Methyl Chloride)	Y	1.24E-01	3.61E-01	1.36E-05	7.92E-02	1.32E+01	1.9E-02	418	0.00085	2.0E-03
156-59-2	cis-1,2-Dichloroethylene	Y	8.84E-02	1.67E-01	1.13E-05	2.38E-01	3.96E+01	4.0E-03	925	0.027	2.9E-02
	Cyclohexane										
99-87-6	Cymene (p-Isopropyltoluene) (surrogate = Cum	Y	5.27E-02	4.50E-01	7.32E-06	6.72E+00	1.12E+03	3.0E-04	3394	0.27	8.0E-02
100-41-4	Ethylbenzene	Y	6.85E-02	3.22E-01	8.46E-06	2.68E+00	4.46E+02	6.8E-04	2244	1	4.5E-01
98-82-8	Isopropylbenzene	Y	6.03E-02	4.70E-01	7.86E-06	4.19E+00	6.98E+02	5.6E-04	2466	0.71	2.9E-01
	Isopropyltoluene (surrogate = Cymene)										
108-87-2	Methyl cyclohexane	Y	8.00E-02	6.13E+00	9.11E-06	8.76E-01	1.46E+02	2.0E-02	414	2.2	5.3E+00
1634-04-4	Methyl tert-Butyl Ether (MTBE)	Y	7.53E-02	2.40E-02	8.59E-06	6.94E-02	1.16E+01	1.3E-03	1633	0.013	8.0E-03
75-09-2	Methylene Chloride	Y	9.99E-02	1.33E-01	1.25E-05	1.30E-01	2.17E+01	5.6E-03	781	0.0148	1.9E-02
104-51-8	Butylbenzene, n-	Y	5.28E-02	6.50E-01	7.33E-06	8.89E+00	1.48E+03	3.2E-04	3245	0.169	5.2E-02
	Propylbenzene										
100-42-5	Styrene	Y	7.11E-02	1.12E-01	8.78E-06	2.68E+00	4.46E+02	2.5E-04	3699	0.031	8.4E-03
	Butylbenzene, tert-										
127-18-4	Tetrachloroethylene	Y	5.05E-02	7.24E-01	9.46E-06	5.70E-01	9.49E+01	4.1E-03	909	0.446	4.9E-01
108-88-3	Toluene	Y	7.78E-02	2.71E-01	9.20E-06	1.40E+00	2.34E+02	1.2E-03	1684	0.14	8.3E-02
156-60-5	trans-1,2-Dichloroethylene	Y	8.76E-02	1.67E-01	1.12E-05	2.38E-01	3.96E+01	3.9E-03	930	0.00079	8.5E-04
75-69-4	Trichlorofluoromethane (CFC-11)	Y	6.54E-02	3.97E+00	1.00E-05	2.63E-01	4.39E+01	2.1E-02	407	0.051	1.3E-01
76-13-1	Trifluorotrichloroethane (Freon 113)	Y	7.80E-02	2.20E+01	8.20E-06	1.20E+00	2.00E+02	2.7E-02	358	0.0012	3.4E-03
1330-20-7	Xylenes	Y	8.47E-02	2.12E-01	9.90E-06	2.30E+00	3.83E+02	6.4E-04	2302	0.00738	3.2E-03
91-57-6	2-Methylnaphthalene	Y	5.24E-02	2.12E-02	7.78E-06	1.49E+01	2.48E+03	6.4E-06	23139	31	1.3E+00
83-32-9	Acenaphthene	Y	5.06E-02	7.52E-03	8.33E-06	3.02E+01	5.03E+03	1.1E-06	56227	24	4.3E-01
208-96-8	Acenaphthylene	N	5.06E-02	7.52E-03	8.33E-06	3.02E+01	5.03E+03				NV
120-12-7	Anthracene	Y	3.90E-02	2.27E-03	7.85E-06	9.82E+01	1.64E+04	7.7E-08	210105	52	2.5E-01
56-55-3	Benz[a]anthracene	N	5.09E-02	4.91E-04	5.94E-06	1.06E+03	1.77E+05				NV
50-32-8	Benzo[a]pyrene	N	4.76E-02	1.87E-05	5.56E-06	3.52E+03	5.87E+05				NV
205-99-2	Benzo[b]fluoranthene	N	4.76E-02	2.69E-05	5.56E-06	3.60E+03	5.99E+05				NV
191-24-2	Benzo(g,h,i)perylene	N	5.28E-02	9.65E-08	6.17E-06	1.35E+00	2.25E+02				NV
207-08-9	Benzo[k]fluoranthene	N	4.76E-02	2.39E-05	5.56E-06	3.52E+03	5.87E+05				NV
218-01-9	Chrysene	N	2.61E-02	2.14E-04	6.75E-06	1.08E+03	1.81E+05				NV
53-70-3	Dibenz[a,h]anthracene	N	4.46E-02	5.76E-06	5.21E-06	1.15E+04	1.91E+06				NV
206-44-0	Fluoranthene	N	2.76E-02	3.62E-04	7.18E-06	3.33E+02	5.55E+04				NV
86-73-7	Fluorene	Y	4.40E-02	3.93E-03	7.89E-06	5.50E+01	9.16E+03	2.7E-07	112561	23	2.0E-01
193-39-5	Indeno[1,2,3-cd]pyrene	N	4.48E-02	6.56E-05	5.23E-06	2.08E+04	3.47E+06				NV
91-20-3	Naphthalene	Y	6.05E-02	1.80E-02	8.38E-06	9.26E+00	1.54E+03	1.0E-05	18468	0.582	3.2E-02
85-01-8	Phenanthrene	N	2.08E-02	5.81E-12	5.19E-06	5.56E+01	9.27E+03				NV
129-00-0	Pyrene	Y	2.78E-02	4.87E-04	7.25E-06	3.26E+02	5.43E+04	3.6E-09	978141	170	1.7E-01
1336-36-3	Polychlorinated Biphenyls	N	4.32E-02	7.77E-03	5.04E-06	4.69E+02	7.81E+04				NV

Appendix I, Table I-6
Vapor to Outdoor Air EPC Calculations
Soil -
CONSTRUCTION - CONSTRUCTION WORKER (ADULT)

Human Health Risk Assessment
D.C. United Soccer Stadium
Washington, D.C.

EQUATIONS:

$$EPC_{[VAPOR]} = EPC_{[SOIL]} \times 1/VF \times 1000\ ug/mg$$

where:

$$VF\ (m^3/kg) = Q/C \times (3.14 \times D_A \times T)^{1/2} \times 10^{-4}(m^2/cm^2) / (2 \times P_b \times D_A)$$

and:

$$DA = [(O_a^{10/3} D_i H' + O_w^{10/3} D_w)/n^2] / P_b K_d + O_w + O_a H'$$

PARAMETER/DEFINITION	UNITS	DEFAULT	Source
VF / volatilization factor	m^3/kg	Calculated	
D_A / apparent diffusivity	cm^2/s	Calculated	
Q/C / inverse of the mean concentration at the center of a 0.5-acre-square source	g/m^2-s per kg/m^3	35.14	USEPA, 2014 [a]
T / exposure interval	s	3.15E+07	CONSTRUCTION
Π_b / dry soil bulk density	g/cm^3	1.62	USEPA, 2014
O_a / air-filled soil porosity	L_{air}/L_{soil}	0.314	USEPA, 2014
n / total soil porosity	L_{pore}/L_{soil}	0.39	USEPA, 2014
O_w / water-filled soil porosity	L_{water}/L_{soil}	0.076	USEPA, 2014
Ψ_s / soil particle density	g/cm^3	2.65	USEPA, 1996
D_i / diffusivity in air	cm^2/s	chemical-specific	
H' / Henry's Law constant	dimensionless	chemical-specific	
D_w / diffusivity in water	cm^2/s	chemical-specific	
K_d / soil-water partition coefficient (Koc x foc) organics	cm^3/g	chemical-specific	
K_{oc} / soil organic carbon partition coefficient	cm^3/g	chemical-specific	
f_{oc} / fraction organic carbon in soil	g/g	0.006	Default

USEPA, 2014. Regional Screening Levels.
[a] Climactic zone: Phoenix Arizona [a] Area of Source: Specific to size of Exposure Area

CASRN	COPC	Volatile (Y/N)	D_i (cm^2/s)	H' (unitless)	D_w (cm^2/s)	K_d (cm^3/g)	K_{oc} (cm^3/g)	D_A (cm^2/s)	VF (m^3/kg)	EPC Soil (mg/kg)	EPC Vapor (ug/m^3)
	Aluminum										
7440-36-0	Antimony	N									NV
	Arsenic										
7440-39-3	Barium	N									NV
7440-41-7	Beryllium	N									NV
	Cadmium										
7440-70-2	Calcium	N									NV
7440-47-3	Chromium, Total	N									NV
	Cobalt										
7440-50-8	Copper	N									NV
7439-89-6	Iron	N									NV
7439-92-1	Lead	N									NV
7439-95-4	Magnesium	N									NV
	Manganese										
7439-97-6	Mercury	N	3.07E-02	4.67E-01	6.30E-06						NV
7440-02-0	Nickel	N									NV
7440-09-7	Potassium	N									NV
7782-49-2	Selenium	N									NV
7440-22-4	Silver	N									NV
7440-23-5	Sodium	N									NV
7440-28-0	Thallium	N									NV
7440-62-2	Vanadium	N									NV
7440-66-6	Zinc	N									NV

Appendix I, Table I-7
Cancer Risk Calculations
Soil -
RESIDENT (4 AGES) - CHILD (AGE 0-<2)

Human Health Risk Assessment
D.C. United Soccer Stadium
Washington, D.C.

Exposure Routes Evaluated		ELCR (Total)
Incidental Ingestion	No	
Dermal Contact	No	
Particulate Inhalation	Yes	2E-07
Ambient Vapor Inhalation	Yes	6E-08
		2E-07

NC - not carcinogenic by this exposure route
NTV - no toxicity value available
NV - not volatile
DAD - dermally absorbed dose
EC - exposure concentration
ABS - absorption factor
CSF - cancer slope factor
UR - cancer unit risk
ELCR - excess lifetime cancer risk
EPC - exposure point concentration
COPC - chemical of potential concern

COPC	CASRN	EPC (mg/kg)	Intake Calculations				Absorption Factors		Mutagenic MOA?	Cancer Toxicity Values			ELCR				
			$Intake_{ingestion}$ (mg/kg/day)	DAD_{dermal} (mg/kg/day)	$EC_{particulate}$ (ug/m^3)	EC_{vapor} (ug/m^3)	ABS_{ing} (unitless)	ABS_d (unitless)		CSF_{oral} $(mg/kg/day)^{-1}$	CSF_{dermal} $(mg/kg/day)^{-1}$	IUR $(ug/m^3)^{-1}$	$ELCR_{ingestion}$	$ELCR_{dermal}$	$ELCR_{particulate}$	$ELCR_{vapor}$	$ELCR_{total}$
Trichloroethylene	79-01-6	3.1E-03	NE	NE	3.2E-08	3.8E-05	1		Y	4.6E-02	4.6E-02	4.1E-06	NE	NE	1.3E-13	1.6E-10	1.6E-10
Vinyl Chloride	75-01-4	6.4E-03	NE	NE	3.2E-06	2.4E-04	1		Y	7.2E-01	7.2E-01	4.4E-06	NE	NE	2.8E-08	2.9E-08	5.7E-08
1,1,1,2-Tetrachloroethane	630-20-6	6.8E-03	NE	NE	9.3E-08	4.3E-05	1		N	2.6E-02	2.6E-02	7.4E-06	NE	NE	6.9E-13	3.2E-10	3.2E-10
1,1,2,2-Tetrachloroethane	79-34-5																
1,2,4-Trichlorobenzene	120-82-1	3.9E-03	NE	NE	NC	NC	1	0.1	N	2.9E-02	2.9E-02		NE	NE			
1,2,4-Trimethylbenzene	95-63-6	2.0E+00	NE	NE	NC	NC	NC	NC	N				NE	NE			
1,2-Dichlorobenzene	95-50-1	6.0E-04	NE	NE	NC	NC	NC	NC	N				NE	NE			
1,3,5-Trimethylbenzene	108-67-8	8.5E-01	NE	NE	NC	NC	NC	NC	N				NE	NE			
1,4-Dichlorobenzene	106-46-7	6.1E-04	NE	NE	8.4E-09	2.0E-06	1	0.1	N	5.4E-03	5.4E-03	1.1E-05	NE	NE	9.2E-14	2.2E-11	2.2E-11
Methyl Ethyl Ketone (2-Butanone)	78-93-3	1.6E-01	NE	NE	NC	NC	NC	NC	N				NE	NE			
2-Hexanone	591-78-6	1.5E-03	NE	NE	NC	NC	NC	NC	N				NE	NE			
Butylbenzene, sec-	135-98-8																
Methyl Isobutyl Ketone (4-methyl-2-pentanone)	108-10-1	4.2E-02	NE	NE	NC	NC	NC	NC	N				NE	NE			
Acetone	67-64-1	5.3E-01	NE	NE	NC	NC	NC	NC	N				NE	NE			
Benzene	71-43-2	6.8E-03	NE	NE	9.3E-08	6.8E-05	1		N	5.5E-02	5.5E-02	7.8E-06	NE	NE	7.3E-13	5.3E-10	5.3E-10
Bromomethane	74-83-9	2.6E-02	NE	NE	NC	NC	1		N				NE	NE			
Carbon Disulfide	75-15-0																
Chloroform	67-66-3																
Chloromethane (Methyl Chloride)	74-87-3	8.5E-04	NE	NE	1.2E-08	2.8E-05	1		N	1.3E-02	1.3E-02	1.8E-06	NE	NE	2.1E-14	5.0E-11	5.0E-11
cis-1,2-Dichloroethylene	156-59-2	2.7E-02	NE	NE	NC	NC	NC	NC	N				NE	NE			
Cyclohexane	110-82-7																
Cymene (p-Isopropyltoluene) (surrogate = Cumene)	99-87-6	2.7E-01	NE	NE	NC	NC	NC	NC	N				NE	NE			
Ethylbenzene	100-41-4	1.0E+00	NE	NE	1.4E-05	6.1E-03	NC	NC	N			2.5E-06	NE	NE	3.4E-11	1.5E-08	1.5E-08
Isopropylbenzene	98-82-8	7.1E-01	NE	NE	NC	NC	NC	NC	N				NE	NE			
Isopropyltoluene (surrogate = Cymene)	25155-15-1																
Methyl cyclohexane	108-87-2	2.2E+00	NE	NE	NC	NC	NC	NC	N				NE	NE			
Methyl tert-Butyl Ether (MTBE)	1634-04-4	1.3E-02	NE	NE	1.8E-07	1.1E-04	1		N	1.8E-03	1.8E-03	2.6E-07	NE	NE	4.6E-14	2.8E-11	2.8E-11
Methylene Chloride	75-09-2	1.5E-02	NE	NE			1		Y	2.0E-03	2.0E-03	1.0E-08	NE	NE			
Butylbenzene, n-	104-51-8	1.7E-01	NE	NE	NC	NC	NC	NC	N				NE	NE			
Propylbenzene	103-65-1																
Styrene	100-42-5	3.1E-02	NE	NE	NC	NC	NC	NC	N				NE	NE			
Butylbenzene, tert-	98-06-6																
Tetrachloroethylene	127-18-4	4.5E-01	NE	NE	6.1E-06	6.7E-03	1		N	2.1E-03	2.1E-03	2.6E-07	NE	NE	1.6E-12	1.7E-09	1.7E-09
Toluene	108-88-3	1.4E-01	NE	NE	NC	NC	NC	NC	N				NE	NE			
trans-1,2-Dichloroethylene	156-60-5	7.9E-04	NE	NE	NC	NC	NC	NC	N				NE	NE			
Trichlorofluoromethane (CFC-11)	75-69-4	5.1E-02	NE	NE	NC	NC	NC	NC	N				NE	NE			
Trifluorotrichloroethane (Freon 113)	76-13-1	1.2E-03	NE	NE	NC	NC	NC	NC	N				NE	NE			
Xylenes	1330-20-7	7.4E-03	NE	NE	NC	NC	NC	NC	N				NE	NE			
2-Methylnaphthalene	91-57-6	3.1E+01	NE	NE	NC	NC	NC	NC	N				NE	NE			
Acenaphthene	83-32-9	2.4E+01	NE	NE	NC	NC	NC	NC	N				NE	NE			

Appendix I, Table I-7
Cancer Risk Calculations
Soil -
RESIDENT (4 AGES) - CHILD (AGE 0-<2)

Human Health Risk Assessment
D.C. United Soccer Stadium
Washington, D.C.

Exposure Routes Evaluated		ELCR (Total)
Incidental Ingestion	No	
Dermal Contact	No	
Particulate Inhalation	Yes	2E-07
Ambient Vapor Inhalation	Yes	6E-08
		2E-07

NC - not carcinogenic by this exposure route
NTV - no toxicity value available
NV - not volatile
DAD - dermally absorbed dose
EC - exposure concentration
ABS - absorption factor
CSF - cancer slope factor
UR - cancer unit risk
ELCR - excess lifetime cancer risk
EPC - exposure point concentration
COPC - chemical of potential concern

COPC	CASRN	EPC (mg/kg)	Intake Calculations				Absorption Factors		Mutagenic	Cancer Toxicity Values			ELCR				
			$Intake_{ingestion}$ (mg/kg/day)	DAD_{dermal} (mg/kg/day)	$EC_{particulate}$ (ug/m^3)	EC_{vapor} (ug/m^3)	ABS_{ing} (unitless)	ABS_{d} (unitless)	MOA?	CSF_{oral} $(mg/kg/day)^{-1}$	CSF_{dermal} $(mg/kg/day)^{-1}$	IUR $(ug/m^3)^{-1}$	$ELCR_{ingestion}$	$ELCR_{dermal}$	$ELCR_{particulate}$	$ELCR_{vapor}$	$ELCR_{total}$
Acenaphthylene	208-96-8	1.7E+01	NE	NE	NC	NV	NC	NC	N				NE	NE		NV	
Anthracene	120-12-7	5.2E+01	NE	NE	NC	NC	1	0.13	N				NE	NE			
Benz[a]anthracene	56-55-3	3.4E+00	NE	NE		NV	1	0.13	Y	7.3E-01	7.3E-01	1.1E-04	NE	NE		NV	
Benzo[a]pyrene	50-32-8	2.8E+00	NE	NE		NV	1	0.13	Y	7.3E+00	7.3E+00	1.1E-03	NE	NE		NV	
Benzo[b]fluoranthene	205-99-2	3.5E+00	NE	NE		NV	1	0.13	Y	7.3E-01	7.3E-01	1.1E-04	NE	NE		NV	
Benzo(g,h,i)perylene	191-24-2	4.1E+01	NE	NE	NC	NV	NC	NC	N				NE	NE		NV	
Benzo[k]fluoranthene	207-08-9	2.3E+01	NE	NE		NV	1	0.13	Y	7.3E-02	7.3E-02	1.1E-04	NE	NE		NV	
Chrysene	218-01-9	3.3E+00	NE	NE		NV	1	0.13	Y	7.3E-03	3.4E+00	1.1E-05	NE	NE		NV	
Dibenz[a,h]anthracene	53-70-3	4.8E-01	NE	NE		NV	1	0.13	Y	7.3E+00	7.3E+00	1.2E-03	NE	NE		NV	
Fluoranthene	206-44-0	1.8E+02	NE	NE	NC	NV	NC	NC	N				NE	NE		NV	
Fluorene	86-73-7	2.3E+01	NE	NE	NC	NC	NC	NC	N				NE	NE			
Indeno[1,2,3-cd]pyrene	193-39-5	1.8E+00	NE	NE		NV	1	0.13	Y	7.3E-01	7.3E-01	1.1E-04	NE	NE		NV	
Naphthalene	91-20-3	5.8E-01	NE	NE	8.0E-06	4.3E-04	NC	NC	N			3.4E-05	NE	NE	2.7E-10	1.5E-08	1.5E-08
Phenanthrene	85-01-8	1.7E+02	NE	NE	NC	NV	NC	NC	N				NE	NE		NV	
Pyrene	129-00-0	1.7E+02	NE	NE	NC	NC	NC	NC	N				NE	NE			
Polychlorinated Biphenyls	1336-36-3	7.0E-01	NE	NE	9.5E-06	NV	1	0.14	N	2.0E+00	2.0E+00	5.7E-04	NE	NE	5.4E-09	NV	5.4E-09
Aluminum	7429-90-5																
Antimony	7440-36-0	8.9E+00	NE	NE	NC	NV	NC	NC	N				NE	NE		NV	
Arsenic	7440-38-2																
Barium	7440-39-3	1.6E+02	NE	NE	NC	NV	NC	NC	N				NE	NE		NV	
Beryllium	7440-41-7	4.8E-01	NE	NE	6.6E-06	NV	NC	NC	N			2.4E-03	NE	NE	1.6E-08	NV	1.6E-08
Cadmium	7440-43-9																
Calcium	7440-70-2	7.5E+04	NE	NE	NC	NV	NC	NC	N				NE	NE		NV	
Chromium, Total	7440-47-3	4.0E+02	NE	NE	NC	NV	NC	NC	N				NE	NE		NV	
Cobalt	7440-48-4																
Copper	7440-50-8	3.6E+02	NE	NE	NC	NV	NC	NC	N				NE	NE		NV	
Iron	7439-89-6	3.1E+04	NE	NE	NC	NV	NC	NC	N				NE	NE		NV	
Lead	7439-92-1	6.1E+02	NE	NE	NC	NV	1		N				NE	NE		NV	
Magnesium	7439-95-4	2.0E+04	NE	NE	NC	NV	NC	NC	N				NE	NE		NV	
Manganese	7439-96-5																
Mercury	7439-97-6	1.5E+00	NE	NE	NC	NV	NC	NC	N				NE	NE		NV	
Nickel	7440-02-0	4.1E+01	NE	NE	5.6E-04	NV	NC	NC	N			2.4E-04	NE	NE	1.3E-07	NV	1.3E-07
Potassium	7440-09-7	5.1E+03	NE	NE	NC	NV	NC	NC	N				NE	NE		NV	
Selenium	7782-49-2	6.2E+00	NE	NE	NC	NV	NC	NC	N				NE	NE		NV	
Silver	7440-22-4	3.9E+00	NE	NE	NC	NV	NC	NC	N				NE	NE		NV	
Sodium	7440-23-5	1.4E+04	NE	NE	NC	NV	NC	NC	N				NE	NE		NV	
Thallium	7440-28-0	1.2E+00	NE	NE	NC	NV	NC	NC	N				NE	NE		NV	
Vanadium	7440-62-2	3.5E+01	NE	NE	NC	NV	NC	NC	N				NE	NE		NV	
Zinc	7440-66-6	7.2E+02	NE	NE	NC	NV	NC	NC	N				NE	NE		NV	

Appendix I, Table I-8
Non-Cancer Risk Calculations
Soil -
RESIDENT (4 AGES) - CHILD (AGE 0-<2)

Human Health Risk Assessment
D.C. United Soccer Stadium
Washington, D.C.

Exposure Routes Evaluated		HI (Total)
Incidental Ingestion	No	
Dermal Contact	No	
Particulate Inhalation	Yes	1E+00
Ambient Vapor Inhalation	Yes	1E-01
		1

NV - not volatile
NTV - no toxicity value available
EC - exposure concentration
DAD - dermally absorbed dose
RfD - reference dose
ABS - absorption factor
HI - hazard index
RfC - reference concentration
EPC - exposure point concentration
COPC - chemical of potential concern

COPC	CASRN	EPC (mg/kg)	Intake$_{ingestion}$ (mg/kg/day)	DAD$_{dermal}$ (mg/kg/day)	EC$_{particulate}$ (mg/m^3)	EC$_{vapor}$ (mg/m^3)	ABS$_{ing}$ (unitless)	ABS$_{d}$ (unitless)	RfD$_{oral}$ (mg/kg/day)	RfD$_{dermal}$ (mg/kg/day)	RfC (mg/m^3)	HQ$_{ingestion}$	HQ$_{dermal}$	HQ$_{particulate}$	HQ$_{vapor}$	HQ$_{total}$
			Intake Calculations				Absorption Factors		Non-Cancer Toxicity Values							
Trichloroethylene	79-01-6	3.1E-03	NE	NE	3.0E-09	3.5E-06	1		5.0E-04	5.0E-04	2.0E-03	NE	NE	1.5E-06	1.8E-03	1.8E-03
Vinyl Chloride	75-01-4	6.4E-03	NE	NE	6.1E-09	1.7E-05	1		3.0E-03	3.0E-03	1.0E-01	NE	NE	6.1E-08	1.7E-04	1.7E-04
1,1,1,2-Tetrachloroethane	630-20-6	6.8E-03	NE	NE	6.5E-09	3.0E-06	1		3.0E-02	3.0E-02		NE	NE	NTV	NTV	
1,1,2,2-Tetrachloroethane	79-34-5															
1,2,4-Trichlorobenzene	120-82-1	3.9E-03	NE	NE	3.7E-09	3.1E-07	1	0.1	1.0E-02	1.0E-02	2.0E-03	NE	NE	1.9E-06	1.6E-04	1.6E-04
1,2,4-Trimethylbenzene	95-63-6	2.0E+00	NE	NE	1.9E-06	6.0E-04	1				7.0E-03	NE	NE	2.7E-04	8.6E-02	8.7E-02
1,2-Dichlorobenzene	95-50-1	6.0E-04	NE	NE	5.8E-10	1.2E-07	1	0.1	9.0E-02	9.0E-02	2.0E-01	NE	NE	2.9E-09	6.2E-07	6.3E-07
1,3,5-Trimethylbenzene	108-67-8	8.5E-01	NE	NE	8.1E-07	3.1E-04	1					NE	NE	NTV	NTV	
1,4-Dichlorobenzene	106-46-7	6.1E-04	NE	NE	5.8E-10	1.4E-07	1	0.1	7.0E-02	7.0E-02	8.0E-01	NE	NE	7.3E-10	1.8E-07	1.8E-07
Methyl Ethyl Ketone (2-Butanone)	78-93-3	1.6E-01	NE	NE	1.5E-07	4.1E-05	1		6.0E-01	6.0E-01	5.0E+00	NE	NE	3.1E-08	8.2E-06	8.2E-06
2-Hexanone	591-78-6	1.5E-03	NE	NE	1.4E-09	3.2E-07	1		5.0E-03	5.0E-03	3.0E-02	NE	NE	4.8E-08	1.1E-05	1.1E-05
Butylbenzene, sec-	135-98-8															
Methyl Isobutyl Ketone (4-methyl-2-pentanone)	108-10-1	4.2E-02	NE	NE	4.0E-08	1.1E-05	1		8.0E-02	8.0E-02	3.0E+00	NE	NE	1.3E-08	3.8E-06	3.8E-06
Acetone	67-64-1	5.3E-01	NE	NE	5.1E-07	1.3E-04	1		9.0E-01	9.0E-01	3.1E+01	NE	NE	1.6E-08	4.1E-06	4.1E-06
Benzene	71-43-2	6.8E-03	NE	NE	6.5E-09	4.7E-06	1		4.0E-03	4.0E-03	3.0E-02	NE	NE	2.2E-07	1.6E-04	1.6E-04
Bromomethane	74-83-9	2.6E-02	NE	NE	2.5E-08	5.1E-05	1		1.4E-03	1.4E-03	5.0E-03	NE	NE	5.0E-06	1.0E-02	1.0E-02
Carbon Disulfide	75-15-0															
Chloroform	67-66-3															
Chloromethane (Methyl Chloride)	74-87-3	8.5E-04	NE	NE	8.2E-10	2.0E-06	1				9.0E-02	NE	NE	9.1E-09	2.2E-05	2.2E-05
cis-1,2-Dichloroethylene	156-59-2	2.7E-02	NE	NE	2.6E-08	2.8E-05	1		2.0E-03	2.0E-03		NE	NE	NTV	NTV	
Cyclohexane	110-82-7															
Cymene (p-Isopropyltoluene) (surrogate = Cumene	99-87-6	2.7E-01	NE	NE	2.6E-07	7.6E-05	1		1.0E-01	1.0E-01	4.0E-01	NE	NE	6.5E-07	1.9E-04	1.9E-04
Ethylbenzene	100-41-4	1.0E+00	NE	NE	9.6E-07	4.3E-04	1		1.0E-01	1.0E-01	1.0E+00	NE	NE	9.6E-07	4.3E-04	4.3E-04
Isopropylbenzene	98-82-8	7.1E-01	NE	NE	6.8E-07	2.8E-04	1		1.0E-01	1.0E-01	4.0E-01	NE	NE	1.7E-06	6.9E-04	6.9E-04
Isopropyltoluene (surrogate = Cymene)	25155-15-1															
Methyl cyclohexane	108-87-2	2.2E+00	NE	NE	2.1E-06	5.1E-03	1				3.0E+00	NE	NE	7.0E-07	1.7E-03	1.7E-03
Methyl tert-Butyl Ether (MTBE)	1634-04-4	1.3E-02	NE	NE	1.2E-08	7.6E-06	1				3.0E+00	NE	NE	4.2E-09	2.5E-06	2.5E-06
Methylene Chloride	75-09-2	1.5E-02	NE	NE	1.4E-08	1.8E-05	1		6.0E-03	6.0E-03	6.0E-01	NE	NE	2.4E-08	3.0E-05	3.0E-05
Butylbenzene, n-	104-51-8	1.7E-01	NE	NE	1.6E-07	5.0E-05	1		5.0E-02	5.0E-02		NE	NE	NTV	NTV	
Propylbenzene	103-65-1															
Styrene	100-42-5	3.1E-02	NE	NE	3.0E-08	8.0E-06	1		2.0E-01	2.0E-01	1.0E+00	NE	NE	3.0E-08	8.0E-06	8.1E-06
Butylbenzene, tert-	98-06-6															
Tetrachloroethylene	127-18-4	4.5E-01	NE	NE	4.3E-07	4.7E-04	1		6.0E-03	6.0E-03	4.0E-02	NE	NE	1.1E-05	1.2E-02	1.2E-02
Toluene	108-88-3	1.4E-01	NE	NE	1.3E-07	8.0E-05	1		8.0E-02	8.0E-02	5.0E+00	NE	NE	2.7E-08	1.6E-05	1.6E-05
trans-1,2-Dichloroethylene	156-60-5	7.9E-04	NE	NE	7.6E-10	8.1E-07	1		2.0E-02	2.0E-02		NE	NE	NTV	NTV	
Trichlorofluoromethane (CFC-11)	75-69-4	5.1E-02	NE	NE	4.9E-08	1.2E-04	1		3.0E-01	3.0E-01	7.0E-01	NE	NE	7.0E-08	1.7E-04	1.7E-04
Trifluorotrichloroethane (Freon 113)	76-13-1	1.2E-03	NE	NE	1.2E-09	3.2E-06	1	1	3.0E+01	3.0E+01	3.0E+01	NE	NE	3.8E-11	1.1E-07	1.1E-07
Xylenes	1330-20-7	7.4E-03	NE	NE	7.1E-09	3.1E-06	1		2.0E-01	2.0E-01	1.0E-01	NE	NE	7.1E-08	3.1E-05	3.1E-05
2-Methylnaphthalene	91-57-6	3.1E+01	NE	NE	3.0E-05	1.3E-03	1	0.13	4.0E-03	4.0E-03		NE	NE	NTV	NTV	
Acenaphthene	83-32-9	2.4E+01	NE	NE	2.3E-05	4.1E-04	1	0.13	6.0E-02	6.0E-02		NE	NE	NTV	NTV	

Appendix I, Table I-8
Non-Cancer Risk Calculations
Soil -
RESIDENT (4 AGES) - CHILD (AGE 0-<2)

Human Health Risk Assessment
D.C. United Soccer Stadium
Washington, D.C.

Exposure Routes Evaluated		HI (Total)
Incidental Ingestion	No	
Dermal Contact	No	
Particulate Inhalation	Yes	1E+00
Ambient Vapor Inhalation	Yes	1E-01
		1

NV - not volatile
NTV - no toxicity value available
EC - exposure concentration
DAD - dermally absorbed dose
RfD - reference dose
ABS - absorption factor
HI - hazard index
RfC - reference concentration
EPC - exposure point concentration
COPC - chemical of potential concern

COPC	CASRN	EPC (mg/kg)	Intake Calculations				Absorption Factors		Non-Cancer Toxicity Values			HQ				
			$Intake_{ingestion}$ (mg/kg/day)	DAD_{dermal} (mg/kg/day)	$EC_{particulate}$ (mg/m^3)	EC_{vapor} (mg/m^3)	ABS_{ing} (unitless)	ABS_{d} (unitless)	RfD_{oral} (mg/kg/day)	RfD_{dermal} (mg/kg/day)	RfC (mg/m^3)	$HQ_{ingestion}$	HQ_{dermal}	$HQ_{particulate}$	HQ_{vapor}	HQ_{total}
Acenaphthylene	208-96-8	1.7E+01	NE	NE	1.6E-05	NV	1	0.13	6.0E-02	6.0E-02		NE	NE	NTV	NV	
Anthracene	120-12-7	5.2E+01	NE	NE	5.0E-05	2.4E-04	1	0.13	3.0E-01	3.0E-01		NE	NE	NTV	NTV	
Benz[a]anthracene	56-55-3	3.4E+00	NE	NE	3.2E-06	NV	1	0.13				NE	NE	NTV	NV	
Benzo[a]pyrene	50-32-8	2.8E+00	NE	NE	2.7E-06	NV	1	0.13				NE	NE	NTV	NV	
Benzo[b]fluoranthene	205-99-2	3.5E+00	NE	NE	3.4E-06	NV	1	0.13				NE	NE	NTV	NV	
Benzo(g,h,i)perylene	191-24-2	4.1E+01	NE	NE	3.9E-05	NV	1	0.13	3.0E-02	3.0E-02		NE	NE	NTV	NV	
Benzo[k]fluoranthene	207-08-9	2.3E+01	NE	NE	2.2E-05	NV	1	0.13				NE	NE	NTV	NV	
Chrysene	218-01-9	3.3E+00	NE	NE	3.2E-06	NV	1					NE	NE	NTV	NV	
Dibenz[a,h]anthracene	53-70-3	4.8E-01	NE	NE	4.6E-07	NV	1	0.13				NE	NE	NTV	NV	
Fluoranthene	206-44-0	1.8E+02	NE	NE	1.7E-04	NV	1	0.13	4.0E-02	4.0E-02		NE	NE	NTV	NV	
Fluorene	86-73-7	2.3E+01	NE	NE	2.2E-05	2.0E-04	1	0.13	4.0E-02	4.0E-02		NE	NE	NTV	NTV	
Indeno[1,2,3-cd]pyrene	193-39-5	1.8E+00	NE	NE	1.7E-06	NV	1	0.13				NE	NE	NTV	NV	
Naphthalene	91-20-3	5.8E-01	NE	NE	5.6E-07	3.0E-05	1	0.13	2.0E-02	2.0E-02	3.0E-03	NE	NE	1.9E-04	1.0E-02	1.0E-02
Phenanthrene	85-01-8	1.7E+02	NE	NE	1.6E-04	NV	1	0.13	3.0E-02	3.0E-02		NE	NE	NTV	NV	
Pyrene	129-00-0	1.7E+02	NE	NE	1.6E-04	1.7E-04	1	0.13	3.0E-02	3.0E-02		NE	NE	NTV	NTV	
Polychlorinated Biphenyls	1336-36-3	7.0E-01	NE	NE	6.7E-07	NV	1	0.14	2.0E-05	2.0E-05		NE	NE	NTV	NV	
Aluminum	7429-90-5															
Antimony	7440-36-0	8.9E+00	NE	NE	8.5E-06	NV	1		4.0E-04	6.0E-05		NE	NE	NTV	NV	
Arsenic	7440-38-2															
Barium	7440-39-3	1.6E+02	NE	NE	1.5E-04	NV	1		2.0E-01	1.4E-02	5.0E-04	NE	NE	3.0E-01	NV	3.0E-01
Beryllium	7440-41-7	4.8E-01	NE	NE	4.6E-07	NV	1		2.0E-03	1.4E-05	2.0E-05	NE	NE	2.3E-02	NV	2.3E-02
Cadmium	7440-43-9															
Calcium	7440-70-2	7.5E+04	NE	NE	7.2E-02	NV	1					NE	NE	NTV	NV	
Chromium, Total	7440-47-3	4.0E+02	NE	NE	3.8E-04	NV	1		1.5E+00	2.0E-02		NE	NE	NTV	NV	
Cobalt	7440-48-4															
Copper	7440-50-8	3.6E+02	NE	NE	3.5E-04	NV	1		4.0E-02	4.0E-02		NE	NE	NTV	NV	
Iron	7439-89-6	3.1E+04	NE	NE	3.0E-02	NV	1		7.0E-01	7.0E-01		NE	NE	NTV	NV	
Lead	7439-92-1	6.1E+02	NE	NE	5.9E-04	NV	1					NE	NE	NTV	NV	
Magnesium	7439-95-4	2.0E+04	NE	NE	1.9E-02	NV	1					NE	NE	NTV	NV	
Manganese	7439-96-5															
Mercury	7439-97-6	1.5E+00	NE	NE	1.4E-06	NV	1		3.0E-04	2.1E-05	3.0E-04	NE	NE	4.8E-03	NV	4.8E-03
Nickel	7440-02-0	4.1E+01	NE	NE	3.9E-05	NV	1		2.0E-02	8.0E-04	9.0E-05	NE	NE	4.4E-01	NV	4.4E-01
Potassium	7440-09-7	5.1E+03	NE	NE	4.9E-03	NV	1					NE	NE	NTV	NV	
Selenium	7782-49-2	6.2E+00	NE	NE	5.9E-06	NV	1		5.0E-03	5.0E-03	2.0E-02	NE	NE	3.0E-04	NV	3.0E-04
Silver	7440-22-4	3.9E+00	NE	NE	3.7E-06	NV	1		5.0E-03	2.0E-04		NE	NE	NTV	NV	
Sodium	7440-23-5	1.4E+04	NE	NE	1.3E-02	NV	1					NE	NE	NTV	NV	
Thallium	7440-28-0	1.2E+00	NE	NE	1.2E-06	NV	1					NE	NE	NTV	NV	
Vanadium	7440-62-2	3.5E+01	NE	NE	3.4E-05	NV	1		5.0E-03	1.3E-04	1.0E-04	NE	NE	3.4E-01	NV	3.4E-01
Zinc	7440-66-6	7.2E+02	NE	NE	6.9E-04	NV	1		3.0E-01	3.0E-01		NE	NE	NTV	NV	

Appendix I, Table I-9
Intake and Risk Equations

Human Health Risk Assessment
D.C. United Soccer Stadium
Washington, D.C.

Cancer Risk from Ingestion

$$ELCR = Intake_{ing} * CSF$$

$$Intake_{ing\ (age\ group\ x)} = \frac{[EPC]_{soil} * [IFSadj - OR - IFSM] * ABS_{ING} * FI * EF * C1}{AT_{lifetime}}$$

Cancer Risk from Dermal Absorption

$$ELCR = DAD * CSF$$

$$DAD_{derm(age\ group\ x)} = \frac{DA_{Event} * SA * EV * EF}{AT_{lifetime}}$$

$$DA_{Event} = [EPC]_{soil} * [DFSadj - OR - DFSM] * C1$$

Cancer Risk from Inhalation

$$ELCR_{inh} = EC_{can} * IUR$$

$$EC_{can\ (age\ group\ x)} = \frac{[EPC]_{PART} * ET_{Part} * EF * ED\ ---\ OR ---\ [EPC]_{VAPOR} * ET_{Vap} * EF * ED}{24 * AT_{lifetime}}$$

For mutagens, INHM is used in place of $ET_X * EF * ED$

Noncancer Risk from Ingestion

$$HQ = \frac{Intake_{ing}}{RfD}$$

$$Intake_{ing} = \frac{[EPC]_{soil} * IR * ABS_{ing} * FI * EF * ED * C1}{BW * AT}$$

Noncancer Risk from Dermal Absorption

$$HQ = \frac{DAD}{RfD}$$

$$DAD_{derm} = \frac{DA_{Event} * SA * EV * EF * ED}{BW * AT}$$

$$DA_{Event} = [EPC]_{soil} * ABS_d * AF * C1$$

Noncancer Risk from Inhalation

$$HQ = \frac{EC_{nc}}{RfC}$$

$$EC_{nc} = \frac{[EPC]_{PART} * ET_{Part} * EF * ED * C2\ ---\ OR ---\ [EPC]_{VAPOR} * ET_{Vap} * EF * ED * C2}{24 * AT}$$

Parameter	Value - Cancer	Value - Non-Cancer	Units
CSF	Chemical specific	--	$(mg/kg\text{-}day)^{-1}$
IUR	Chemical specific	--	$(ug/m^3)^{-1}$
Intake	Age/chemical specific	--	mg/kg-day
EC_{can}	Age/chemical specific	--	(ug/m^3)
ELCR	Age/chemical specific	--	unitless
RfD	--	Chemical specific	mg/kg-day
RfC	--	Chemical specific	(mg/m^3)
DAD	Age/chemical specific	Age/chemical specific	mg/kg-day
DA_{Event}	Age/chemical specific	Age/chemical specific	mg/cm^2-event
EC_{nc}	--	Age/chemical specific	mg/m^3
HQ	--	Age/chemical specific	unitless
$[EPC]_{soil}$	Chemical specific	Chemical specific	mg/kg
$[EPC]_{PART}$	Appendix I, TABLE I-11	Appendix I, TABLE I-11	ug/m^3
$[EPC]_{VAPOR}$	Appendix I, TABLE I-12	Appendix I, TABLE I-12	ug/m^3
ABS_{ing}	Chemical specific	Chemical specific	unitless
ABS_d	Chemical specific	Chemical specific	unitless
BW	15	15	kg
EF	350	350	day/year
ED	1	1	year
AT	--	365	day
ATlifetime	25550	--	day
IFSadj	NA	--	mg-yr/kg-day
IFSM		--	mg-yr/kg-day
IR	200	200	mg/day
FI	1	1	unitless
C1	0.000001	0.000001	kg/mg
SA	2690	2690	cm2
AF	2690	0.2	mg/cm2
EV	1	1	event/day
DFSadj	NA	--	mg-yr/kg-day
DFSM		--	mg-yr/kg-day
ETPart	24	24	hours/day
C2	0.001	0.001	mg/ug
ETVap	24	24	ug/mg
INHM		--	unitless

Appendix I, Table I-10
Exposure Factors

Human Health Risk Assessment
D.C. United Soccer Stadium
Washington, D.C.

PLACE "X" IN THE APPROPRIATE YELLOW SHADED CELLS FOR THE APPROPRIATE RECEPTOR AND BASIS

SCENARIO USED TO CALCULATE RISKS			**X**	**RESIDENT (4 AGES)**
BASIS FOR CANCER CALCULATIONS			**X**	
BASIS FOR NON-CANCER CALCULATIONS			**X**	
RECEPTOR			**CHILD (AGE 0-<2)**	
Standard Parameters				
Body Weight	BW	kg	15	EPA, 2014
Exposure Frequency	EF	day/year	350	EPA, 2014
Exposure Duration	ED	year	1	Ages 11 - <16
Non–carcinogenic Averaging Time	AT	day	365	Exposure duration expressed in days
Carcinogenic Averaging Time	$AT_{lifetime}$	day	25550	70 year lifetime
Age-Dependtant Adjustment Factor	ADAF	unitless	10	USEPA, 2008
Incidental Ingestion of Soil				
Soil Ingestion Rate	IR	mg/day	200	EPA, 2014
Fraction Ingested	FI	unitless	1.0	Site-specific [6]
Age-Adjusted Soil Ingestion Factor	IFSadj	mg-yr/kg-day	NA	
Age-Adjusted Soil Ingestion Factor-Mutagenic	IFSM	mg-yr/kg-day		
Dermal Exposure with Soil				
Exposed Skin Surface Area	SA	cm^2	2690	EPA, 2014
Soil Adherence Factor	AF	mg/cm^2	0.2	EPA, 2014
Fraction Dermal	EV	event/day	1.0	EPA, 2014
Age-Adjusted Dermal Contact Factor	DFSadj	mg-yr/kg-day	NA	
Age-Adjusted Dermal Contact Factor-Mutagenic	DFSM	mg-yr/kg-day		
Particulate Inhalation				
Exposure Time	ET_{Part}	hours/day	24	Asumption
Vapor Inhalation				
Exposure Time	ET_{Vap}	hours/day	24	Assumption
Age-Adjusted Inhalation Factor-Mutagenic	INHM	unitless		

EPA-OLEM VAPOR INTRUSION ASSESSMENT
Sub-slab or Exterior Soil Gas Concentration to Indoor Air Concentration (SGC-IAC) Calculator Version 3.5.1 (May 2016 RSLs)

Parameter	Symbol	Value	Instructions
Exposure Scenario	Scenario	Commercial	Select residential or commercial scenario from pull down list
Target Risk for Carcinogens	TCR_SG	1.00E-05	Enter target risk for carcinogens (for comparison to the calculated VI carcinogenic risk in column F)
Target Hazard Quotient for Non-Carcinogens	THQ_SG	1	Enter target hazard quotient for non-carcinogens (for comparison to the calculated VI hazard in column G)

CAS	Chemical Name	Site Sub-slab or Exterior Soil Gas Concentration Csg (ug/m^3)	Calculated Indoor Air Concentration Cia (ug/m^3)	VI Carcinogenic Risk CR	VI Hazard HQ	Inhalation Unit Risk IUR ($(ug/m^3)^{-1}$)	IUR Source*	Reference Concentration RfC (mg/m^3)	RFC Source*	Mutagenic Indicator i
67-64-1	Acetone	3.2E+02	1.90E+00	No IUR	1.4E-05			3.10E+01	A	
71-43-2	Benzene	4.7E+02	2.84E+00	1.8E-06	2.2E-02	7.80E-06	I	3.00E-02	I	
75-27-4	Bromodichloromethane	2.1E+01	1.28E-01	3.9E-07	No RfC	3.70E-05	CA			
106-99-0	Butadiene, 1,3-	2.4E+02	1.42E+00	3.5E-06	1.6E-01	3.00E-05	I	2.00E-03	I	
75-15-0	Carbon Disulfide	1.3E+02	7.68E-01	No IUR	2.5E-04			7.00E-01	I	
67-66-3	Chloroform	1.3E+02	7.86E-01	1.5E-06	1.8E-03	2.30E-05	I	9.80E-02	A	
74-87-3	Chloromethane	9.9E-01	5.92E-03	No IUR	1.5E-05			9.00E-02	I	
110-82-7	Cyclohexane	1.1E+03	6.42E+00	No IUR	2.4E-04			6.00E+00	I	
75-71-8	Dichlorodifluoromethane	4.9E+01	2.93E-01	No IUR	6.7E-04			1.00E-01	X	
75-35-4	Dichloroethylene, 1,1-	4.0E+02	2.37E+00	No IUR	2.7E-03			2.00E-01	I	
141-78-6	Ethyl Acetate	1.7E+01	9.96E-02	No IUR	3.2E-04			7.00E-02	P	
100-41-4	Ethylbenzene	3.0E+02	1.81E+00	3.7E-07	4.1E-04	2.50E-06	CA	1.00E+00	I	
110-54-3	Hexane, N-	2.4E+03	1.43E+01	No IUR	4.7E-03			7.00E-01	I	
591-78-6	Hexanone, 2-	8.5E+00	5.09E-02	No IUR	3.9E-04			3.00E-02	I	
67-63-0	Isopropanol	8.3E+00	5.00E-02	No IUR	5.7E-05			2.00E-01	P	
78-93-3	Methyl Ethyl Ketone (2-Butanone)	5.8E+01	3.47E-01	No IUR	1.6E-05			5.00E+00	I	
108-10-1	Methyl Isobutyl Ketone (4-methyl-2-pentanone)	2.5E+02	1.52E+00	No IUR	1.2E-04			3.00E+00	I	
1634-04-4	Methyl tert-Butyl Ether (MTBE)	4.3E+02	2.60E+00	5.5E-08	2.0E-04	2.60E-07	CA	3.00E+00	I	
75-09-2	Methylene Chloride	4.6E+02	2.75E+00	2.2E-09	1.0E-03	1.00E-08	I	6.00E-01	I	Mut
91-20-3	Naphthalene	6.7E+00	4.00E-02	1.1E-07	3.0E-03	3.40E-05	CA	3.00E-03	I	
115-07-1	Propylene	9.1E+03	5.45E+01	No IUR	4.2E-03			3.00E+00	CA	
100-42-5	Styrene	1.2E+01	7.08E-02	No IUR	1.6E-05			1.00E+00	I	
127-18-4	Tetrachloroethylene	1.0E+04	6.18E+01	1.3E-06	3.5E-01	2.60E-07	I	4.00E-02	I	
108-88-3	Toluene	9.0E+02	5.42E+00	No IUR	2.5E-04			5.00E+00	I	
76-13-1	Trichloro-1,2,2-trifluoroethane, 1,1,2-	1.3E+02	7.98E-01	No IUR	6.1E-06			3.00E+01	H	
79-01-6	Trichloroethylene	1.2E+03	7.28E+00	2.4E-06	8.3E-01	see note	I	2.00E-03	I	TCE
95-63-6	Trimethylbenzene, 1,2,4-	2.9E+02	1.75E+00	No IUR	5.7E-02			7.00E-03	P	
75-01-4	Vinyl Chloride	9.1E+02	5.46E+00	2.0E-06	1.2E-02	4.40E-06	I	1.00E-01	I	VC
108-38-3	Xylene, m-	5.3E+02	3.16E+00	No IUR	7.2E-03			1.00E-01	S	
95-47-6	Xylene, o-	2.1E+02	1.25E+00	No IUR	2.9E-03			1.00E-01	S	

Notes: **Total:** **1E-05** **1E+00**

(1) **Inhalation Pathway Exposure Parameters (RME):**

Exposure Scenario	Units	Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
Averaging time for carcinogens	(yrs)	ATc_R_SG	70	ATc_C_SG	70	ATc_SG	70
Averaging time for non-carcinogens	(yrs)	ATnc_R_SG	26	ATnc_C_SG	25	ATnc_SG	25
Exposure duration	(yrs)	ED_R_SG	26	ED_C_SG	25	ED_SG	25
Exposure frequency	(days/yr)	EF_R_SG	350	EF_C_SG	250	EF_SG	250
Exposure time	(hr/day)	ET_R_SG	24	ET_C_SG	8	ET_SG	8

(2) **Generic Attenuation Factors:**

Source Medium of Vapors	Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
Groundwater (-)	AFgw_R_SG	0.001	AFgw_C_SG	0.001	AFgw_SG	0.001
Sub-Slab and Exterior Soil Gas (-)	AFss_R_SG	0.006	AFss_C_SG	0.006	AFss_SG	0.006

(3) **Formulas**
Cia, target = MIN(Cia,c; Cia,nc)
Cia,c (ug/m3) = TCR x ATc x (365 days/yr) x (24 hrs/day) / (ED x EF x ET x IUR)
Cia,nc (ug/m3) = THQ x ATnc x (365 days/yr) x (24 hrs/day) x RfC x (1000 ug/mg) / (ED x EF x ET)

(4) **Special Case Chemicals**

	Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
Trichloroethylene	mIURTCE_R_SG	1.00E-06	mIURTCE_C_SG	0.00E+00	mIURTCE_SG	0.00E+00
	IURTCE_R_SG	3.10E-06	IURTCE_C_SG	4.10E-06	IURTCE_SG	4.10E-06

Mutagenic Chemicals — The exposure durations and age-dependent adjustment factors for mutagenic-mode-of-action are listed in the table below:

Note: This section applies to trichloroethylene and other mutagenic chemicals, but not to vinyl chloride.

Age Cohort	Exposure Duration	Age-dependent adjustment factor
0 - 2 years	2	10
2 - 6 years	4	3
6 - 16 years	10	3
16 - 26 years	10	1

Mutagenic-mode-of-action (MMOA) adjustment factor 25 This factor is used in the equations for mutagenic chemicals.

Vinyl Chloride — See the Navigation Guide equation for Cia,c for vinyl chloride.

Notation:
I = IRIS: EPA Integrated Risk Information System (IRIS). Available online at: http://www.epa.gov/iris/subst/index.html
P = PPRTV. EPA Provisional Peer Reviewed Toxicity Values (PPRTVs). Available online at: http://hhpprtv.ornl.gov/pprtv.shtml
A = Agency for Toxic Substances and Disease Registry (ATSDR) Minimum Risk Levels (MRLs). Available online at: http://www.atsdr.cdc.gov/mrls/index.html
CA = California Environmental Protection Agency/Office of Environmental Health Hazard Assessment assessments. Available online at: http://www.oehha.ca.gov/risk/ChemicalDB/index.asp
H = HEAST. EPA Superfund Health Effects Assessment Summary Tables (HEAST) database. Available online at: http://epa-heast.ornl.gov/heast.shtml
S = See RSL User Guide, Section 5
X = PPRTV Appendix
Mut = Chemical acts according to the mutagenic-mode-of-action, special exposure parameters apply (see footnote (4) above).
VC = Special exposure equation for vinyl chloride applies (see Navigation Guide for equation).
TCE = Special mutagenic and non-mutagenic IURs for trichloroethylene apply (see footnote (4) above).
Yellow highlighting indicates site-specific parameters that may be edited by the user.
Blue highlighting indicates exposure factors that are based on Risk Assessment Guidance for Superfund (RAGS) or EPA vapor intrusion guidance, which generally should not be changed.
Pink highlighting indicates VI carcinogenic risk greater than the target risk for carcinogens (TCR) or VI Hazard greater than or equal to the target hazard quotient for non-carcinogens (THQ).

APPENDIX J

Water Protection Level Calculations

HALEY ALDRICH

WATER PROTECTION LEVEL CALCULATIONS - ORGANICS

$$C_t = C_w \left((K_{oc}\, f_{oc}) + \frac{\theta_w + \theta_a H'}{\rho_b} \right)$$

Ct = soil concentration (ug/kg)

Surface water Criteria (µg/L)

DAF_{mix} = dilution-attenuation factor (mixing zone)

DAF_{unsat} = dilution-attenuation factor (unsaturated zone)

DAF_{sat} = dilution-attenuation factor (saturated zone)

Cw = aqueous concentration (ug/L)

Koc = soil organic carbon/water partition coefficient (L/kg)

foc = fraction organic carbon (kg/kg)

Kd = soil-water partition coefficient (L/kg) (Koc x foc)=

0w = water-filled soil porosity)

0a = air filled soil porosity

Pb = dry soil bulk density (kg/L)

H' = dimensionless Henry's Law

Total porosity

Chemical/Parameter Source	***selected WPL (mg/kg)****	***selected WPL (ug/kg)****	***calculated WPL (ug/kg)***	DCWQ, 2013	EPA, 1996	DCRBCA, 2011	DCRBCA, 2011	Water quality objective (ug/L)	EPA, 2016	DCRBCA, 2011	Calculated	Site-specific	Site-specific	Site-specific	EPA, 2016	Site-Specific
Volatile Organic Compounds																
Benzene	1.4E+02	1.4E+05	1.4E+05	5.1E+01	20	1	91	9.3E+04	1.46E+02	0.01	1.46E+00	0.076	0.314	1.62	2.27E-01	0.39
Bromomethane (Methyl Bromide)	6.5E+02	6.5E+05	6.5E+05	1.5E+03	20	1	91	2.7E+06	1.32E+01	0.01	1.32E-01	0.076	0.314	1.62	3.00E-01	0.39
Chloroform (Trichloromethane)	3.4E+02	3.4E+05	3.4E+05	4.7E+02	20	1	91	8.6E+05	3.18E+01	0.01	3.18E-01	0.076	0.314	1.62	1.50E-01	0.39
1,2-Dicholorobenzene	1.4E+03	1.4E+06	1.4E+06	2.0E+02	20	1	91	3.6E+05	3.83E+02	0.01	3.83E+00	0.076	0.314	1.62	7.85E-02	0.39
1,4-Dichlorobenzene	1.3E+03	1.3E+06	1.3E+06	1.9E+02	20	1	91	3.5E+05	3.75E+02	0.01	3.75E+00	0.076	0.314	1.62	9.85E-02	0.39
trans-1,2-Dichloroethylene	9.4E+03	9.4E+06	9.4E+06	1.0E+04	20	1	91	1.8E+07	3.96E+01	0.01	3.96E-01	0.076	0.314	1.62	3.83E-01	0.39
Ethylbenzene	3.3E+02	3.3E+05	3.3E+05	4.0E+01	20	1	91	7.3E+04	4.46E+02	0.01	4.46E+00	0.076	0.314	1.62	3.22E-01	0.39
Methylene chloride	3.1E+02	3.1E+05	3.1E+05	5.9E+02	20	1	91	1.1E+06	2.17E+01	0.01	2.17E-01	0.076	0.314	1.62	1.33E-01	0.39
1,1,2,2-Tetrachloroethane	7.3E+00	7.3E+03	7.3E+03	4.0E+00	20	1	91	7.3E+03	9.49E+01	0.01	9.49E-01	0.076	0.314	1.62	1.50E-02	0.39
Tetrachloroethylene	6.8E+00	6.8E+03	6.8E+03	3.3E+00	20	1	91	6.0E+03	9.49E+01	0.01	9.49E-01	0.076	0.314	1.62	7.24E-01	0.39
Toluene	2.7E+03	2.7E+06	2.7E+06	6.0E+02	20	1	91	1.1E+06	2.34E+02	0.01	2.34E+00	0.076	0.314	1.62	2.71E-01	0.39
Trichloroethylene	4.0E+01	4.0E+04	4.0E+04	3.0E+01	20	1	91	5.5E+04	6.07E+01	0.01	6.07E-01	0.076	0.314	1.62	4.03E-01	0.39
1,2,4-Trichlorobenzene	1.7E+03	1.7E+06	1.7E+06	7.0E+01	20	1	91	1.3E+05	1.36E+03	0.01	1.36E+01	0.076	0.314	1.62	5.81E-02	0.39
Vinyl Chloride	2.1E+00	2.1E+03	2.1E+03	2.4E+00	20	1	91	4.4E+03	2.17E+01	0.01	2.17E-01	0.076	0.314	1.62	1.14E+00	0.39

Chemical/Parameter Source	***selected WPL (mg/kg)****	***selected WPL (ug/kg)****	***calculated WPL (ug/kg)***	DCWQ, 2013	EPA, 1996	DCRBCA, 2011		Water quality objective (ug/L)	EPA, 2016	DCRBCA, 2011	Calculated	Site-specific	Site-specific	Site-specific	EPA, 2016	Site-Specific
Semi-volatile Organic Compounds																
Acenaphthene	4.6E+03	4.6E+06	4.6E+06	5.0E+01	20	1	91	9.1E+04	5.03E+03	0.01	5.03E+01	0.076	0.314	1.62	7.52E-03	0.39
Anthracene	1.0E+06	1.0E+09	1.2E+10	4.0E+04	20	1	91	7.3E+07	1.64E+04	0.01	1.64E+02	0.076	0.314	1.62	2.27E-03	0.39
Benzo(a)anthracene	5.8E+01	5.8E+04	5.8E+04	1.8E-02	20	1	91	3.3E+01	1.77E+05	0.01	1.77E+03	0.076	0.314	1.62	4.91E-04	0.39
Benzo(a)pyrene	1.9E+02	1.9E+05	1.9E+05	1.8E-02	20	1	91	3.3E+01	5.87E+05	0.01	5.87E+03	0.076	0.314	1.62	1.87E-05	0.39
Benzo(b)fluoranthene	2.0E+02	2.0E+05	2.0E+05	1.8E-02	20	1	91	3.3E+01	5.99E+05	0.01	5.99E+03	0.076	0.314	1.62	2.69E-05	0.39
Benzo(k)fluoranthene	1.9E+02	1.9E+05	1.9E+05	1.8E-02	20	1	91	3.3E+01	5.87E+05	0.01	5.87E+03	0.076	0.314	1.62	2.39E-05	0.39
Chrysene	5.9E+01	5.9E+04	5.9E+04	1.8E-02	20	1	91	3.3E+01	1.81E+05	0.01	1.81E+03	0.076	0.314	1.62	2.14E-04	0.39
Dibenz(a,h)anthracene	6.3E+02	6.3E+05	6.3E+05	1.8E-02	20	1	91	3.3E+01	1.91E+06	0.01	1.91E+04	0.076	0.314	1.62	5.76E-06	0.39
Fluoranthene	1.4E+05	1.4E+08	1.4E+08	1.4E+02	20	1	91	2.5E+05	5.55E+04	0.01	5.55E+02	0.076	0.314	1.62	3.62E-04	0.39
Fluorene	1.0E+06	1.0E+09	5.3E+09	5.3E+03	20	1	91	9.6E+06	5.55E+04	0.01	5.55E+02	0.076	0.314	1.62	3.93E-03	0.39
Indeno(1,2,3-cd)pyrene	6.4E+02	6.4E+05	6.4E+05	1.8E-02	20	1	91	3.3E+01	1.95E+06	0.01	1.95E+04	0.076	0.314	1.62	1.42E-05	0.39
Naphthalene	1.7E+04	1.7E+07	1.7E+07	6.0E+02	20	1	91	1.1E+06	1.54E+03	0.01	1.54E+01	0.076	0.314	1.62	1.80E-02	0.39
Pyrene	1.0E+06	1.0E+09	4.0E+09	4.0E+03	20	1	91	7.3E+06	5.43E+04	0.01	5.43E+02	0.076	0.314	1.62	4.87E-04	0.39
PCBs**	1.0E+00	1.0E+03	1.0E+03	na	na	na	na	na	na	na	na	na	na	na	na	na

*Defaulted to 1.0+06 mg/kg when the calculated WPL was greater than 1.0+06 mg/kg

D.C. Water Quality Standards, 2013, 60 DCR 15231

District Department of the Environment Toxic Substances Division Underground Storage Tanks Branch, 2011, District of Columbia Risk-Based Corrective Action Technical Guidance. June.

EPA, 2016. Regional Screening Levels (Formerly PRGs), Pacific Southwest, Region 9. May.

EPA, 1996. Soil Screening Guidance: User's Guide. July.

EPA, 2002. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites.

** EPA Toxic Substances Control Act (TSCA) Performance-based option 40 CFR §761.61(b)

$$C_t = C_w \left(K_d + \frac{\theta_w + \theta_a H'}{\rho_b} \right)$$

Chemical/Parameter Source	Ct = soil concentration (mg/kg)	Site-specific Soil Background Threshold (mg/kg)	Surface water Criteria (µg/L)	DAF_{mix} = dilution-attenuation factor (mixing zone)	DAF_{unsat} = dilution-attenuation factor (unsaturated zone)	DAF_{sat} = dilution-attenuation factor (saturated zone)	Cw = aqueous concentration (mg/L)	Kd = soil-water partition coefficient (L/kg) @ pH = 6.8 when specified (L/kg)	0w = water-filled soil porosity	0a = air filled soil porosity	Pb = dry soil bulk density (kg/L)	H' = dimensionless Henry's Law	Total porosity
	selected WPL (mg/kg)*	***calculated WPL (mg/kg)***	Site-specific	DCWQ, 2013	EPA, 1996	DCRBCA, 2011	DCRBCA, 2011	Water quality objective	EPA, 1996; ORNL, 2014	Site-specific	Site-specific	Site-specific	EPA, 2016	Site-Specific
Metals														
Antimony	5.2E+04	5.2E+04	2.4E+01	6.4E+02	20	1	91	1.2E+03	45	0.076	0.314	1.62	0	0.39
Arsenic	1.5E+01	7.4E+00	1.5E+01	1.4E-01	20	1	91	2.5E-01	29	0.076	0.314	1.62	0	0.39
Cadmium	1.1E+02	1.1E+02	2.4E+00	8.4E-01	20	1	91	1.5E+00	75	0.076	0.314	1.62	0	0.39
Iron	4.8E+04	4.6E+04	4.8E+04	1.0E+03	20	1	91	1.8E+03	25	0.076	0.314	1.62	0	0.39
Manganese	6.0E+02	1.2E+04	6.0E+02	1.0E+02	20	1	91	1.8E+02	65	0.076	0.314	1.62	0	0.39
Mercury	1.4E+01	1.4E+01	3.0E+00	1.5E-01	20	1	91	2.7E-01	52	0.076	0.314	1.62	0	0.39
Nickel	5.4E+05	5.4E+05	2.7E+01	4.6E+03	20	1	91	8.4E+03	65	0.076	0.314	1.62	0	0.39
Selenium	4.6E+01	4.6E+01	9.2E-01	5.0E+00	20	1	91	9.1E+00	5	0.076	0.314	1.62	0	0.39
Silver	9.9E+05	9.9E+05	8.8E-01	6.5E+04	20	1	91	1.2E+05	8.3	0.076	0.314	1.62	0	0.39
Thallium	6.1E+01	6.1E+01	5.4E-01	4.7E-01	20	1	91	8.6E-01	71	0.076	0.314	1.62	0	0.39
Zinc	1.0E+06	2.9E+06	2.6E+02	2.6E+04	20	1	91	4.7E+04	62	0.076	0.314	1.62	0	0.39

*Defaulted to 1.0+06 mg/kg when the calculated WPL was greater than 1.0+06 mg/kg, and the Site-specific background threshold when the calculated WPL was less than that the Site-specific background threshold.

D.C. Water Quality Standards, 2013, 60 DCR 15231

District Department of the Environment Toxic Substances Division Underground Storage Tanks Branch, 2011, District of Columbia Risk-Based Corrective Action Technical Guidance. June.

EPA, 2002. Soil Screening Guidance: User's Guide. July.

ORNL, 2014. RAIS: The Risk Assessment Information System website