Attachment A-3: Upper Confidence Limit Calculations for Chromium
LOU 10 Landfill, excluding cap and 1 foot of Underlying Native Soil

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	90%
Number of Bootstrap Operations	2000

General Statistics

Number of Valid Data	30	Number of Detected Data	28
Number of Distinct Detected Data	23	Number of Non-Detect Data	2
		Percent Non-Detects	6.67%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.041	Minimum Detected	-3.194
Maximum Detected	16	Maximum Detected	2.773
Mean of Detected	3.47	Mean of Detected	-0.0347
SD of Detected	5.319	SD of Detected	1.743
Minimum Non-Detect	0.1	Minimum Non-Detect	-2.303
Maximum Non-Detect	0.1	Maximum Non-Detect	-2.303

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.651	Shapiro Wilk Test Statistic	0.948
5% Shapiro Wilk Critical Value	0.924	5% Shapiro Wilk Critical Value	0.924
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	3.242	Mean	-0.232
SD	5.205	SD	1.842
90% DL/2 (t) UCL	4.489	90% H-Stat (DL/2) UCL	10.92
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	2.611	Mean in Log Scale	-0.231
SD	5.812	SD in Log Scale	1.843
90% MLE (t) UCL	4.002	**Mean in Original Scale**	**3.243**
90% MLE (Tiku) UCL	3.96	SD in Original Scale	5.205
		90% t UCL	4.489
		90% Percentile Bootstrap UCL	4.555
		90% BCA Bootstrap UCL	**4.72**

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	0.468	Data appear Lognormal at 5% Significance Level	
Theta Star	7.421		
nu star	26.19		
A-D Test Statistic	1.341	**Nonparametric Statistics**	
5% A-D Critical Value	0.811	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.811	Mean	3.243
5% K-S Critical Value	0.175	SD	5.117
Data not Gamma Distributed at 5% Significance Level		SE of Mean	0.951
		90% KM (t) UCL	4.491
Assuming Gamma Distribution		90% KM (z) UCL	4.462
Gamma ROS Statistics using Extrapolated Data		90% KM (jackknife) UCL	4.489
Minimum	1E-12	90% KM (bootstrap t) UCL	4.849
Maximum	16	90% KM (BCA) UCL	4.472
Mean	3.239	90% KM (Percentile Bootstrap) UCL	4.483
Median	0.605	90% KM (Chebyshev) UCL	6.097
SD	5.207		
k star	0.234		
Theta star	13.85		
Nu star	14.03		
AppChi2	7.816		
90% Gamma Approximate UCL	5.816		
90% Adjusted Gamma UCL	5.976		

Note: DL/2 is not a recommended method.

Attachment A- 1: Upper Confidence Limit Calculations for Chromium LOU 10 Landfill, including cap and 1 foot of Underlying Native Soil

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	90%
Number of Bootstrap Operations	2000

General Statistics

Number of Valid Data	42	Number of Detected Data	34
Number of Distinct Detected Data	28	Number of Non-Detect Data	8
		Percent Non-Detects	19.05%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.037	Minimum Detected	-3.297
Maximum Detected	16	Maximum Detected	2.773
Mean of Detected	2.917	Mean of Detected	-0.355
SD of Detected	4.964	SD of Detected	1.803
Minimum Non-Detect	0.1	Minimum Non-Detect	-2.303
Maximum Non-Detect	0.1	Maximum Non-Detect	-2.303

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.603	Shapiro Wilk Test Statistic	0.944
5% Shapiro Wilk Critical Value	0.933	5% Shapiro Wilk Critical Value	0.933
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	2.371	Mean	-0.858
SD	4.597	SD	1.928
90% DL/2 (t) UCL	3.295	90% H-Stat (DL/2) UCL	6.038
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	0.707	Mean in Log Scale	-0.838
SD	6.161	SD in Log Scale	1.941
90% MLE (t) UCL	1.945	**Mean in Original Scale**	**2.376**
90% MLE (Tiku) UCL	2.05	SD in Original Scale	4.595
		90% t UCL	3.299
		90% Percentile Bootstrap UCL	3.35
		90% BCA Bootstrap UCL	**3.502**

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	0.432	Data appear Lognormal at 5% Significance Level	
Theta Star	6.749		
nu star	29.39		
A-D Test Statistic	1.688	**Nonparametric Statistics**	
5% A-D Critical Value	0.822	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.822	Mean	2.374
5% K-S Critical Value	0.161	SD	4.54
Data not Gamma Distributed at 5% Significance Level		SE of Mean	0.711
		90% KM (t) UCL	3.301
Assuming Gamma Distribution		90% KM (z) UCL	3.286
Gamma ROS Statistics using Extrapolated Data		90% KM (jackknife) UCL	3.298
Minimum	1E-12	90% KM (bootstrap t) UCL	3.609
Maximum	16	90% KM (BCA) UCL	3.234
Mean	2.366	90% KM (Percentile Bootstrap) UCL	3.288
Median	0.43	90% KM (Chebyshev) UCL	4.508
SD	4.6		
k star	0.141		
Theta star	16.79		
Nu star	11.84		
AppChi2	6.185		
90% Gamma Approximate UCL	4.527		
90% Adjusted Gamma UCL	4.612		

Note: DL/2 is not a recommended method.

Attachment A-2: Upper Confidence Limit Calculations for Chromium
LOU 10 Landfill, excluding cap and including 1-ft of Underlying Native Soil

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	90%
Number of Bootstrap Operations	2000

General Statistics

Number of Valid Data	36	Number of Detected Data	34
Number of Distinct Detected Data	28	Number of Non-Detect Data	2
		Percent Non-Detects	5.56%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.037	Minimum Detected	-3.297
Maximum Detected	16	Maximum Detected	2.773
Mean of Detected	2.917	Mean of Detected	-0.355
SD of Detected	4.964	SD of Detected	1.803
Minimum Non-Detect	0.1	Minimum Non-Detect	-2.303
Maximum Non-Detect	0.1	Maximum Non-Detect	-2.303

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.603	Shapiro Wilk Test Statistic	0.944
5% Shapiro Wilk Critical Value	0.933	5% Shapiro Wilk Critical Value	0.933
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	2.758	Mean	-0.502
SD	4.866	SD	1.855
90% DL/2 (t) UCL	3.817	90% H-Stat (DL/2) UCL	7.659
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	1.736	Mean in Log Scale	-0.489
SD	5.856	SD in Log Scale	1.841
90% MLE (t) UCL	3.011	**Mean in Original Scale**	**2.759**
90% MLE (Tiku) UCL	3.024	SD in Original Scale	4.866
		90% t UCL	3.818
		90% Percentile Bootstrap UCL	3.803
		90% BCA Bootstrap UCL	**3.978**

Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	0.432	Data appear Lognormal at 5% Significance Level	
Theta Star	6.749		
nu star	29.39		
A-D Test Statistic	1.688	**Nonparametric Statistics**	
5% A-D Critical Value	0.822	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.822	Mean	2.759
5% K-S Critical Value	0.161	SD	4.798
Data not Gamma Distributed at 5% Significance Level		SE of Mean	0.812
		90% KM (t) UCL	3.819
Assuming Gamma Distribution		90% KM (z) UCL	3.799
Gamma ROS Statistics using Extrapolated Data		90% KM (jackknife) UCL	3.818
Minimum	1E-12	90% KM (bootstrap t) UCL	4.1
Maximum	16	90% KM (BCA) UCL	3.795
Mean	2.755	90% KM (Percentile Bootstrap) UCL	3.845
Median	0.52	90% KM (Chebyshev) UCL	5.194
SD	4.868		
k star	0.245		
Theta star	11.26		
Nu star	17.62		
AppChi2	10.57		
90% Gamma Approximate UCL	4.594		
90% Adjusted Gamma UCL	4.68		

Note: DL/2 is not a recommended method.