ATTACHMENT B-4
UCL OUTPUT - SOUTH PARCEL SOIL
AROCLOR 1254 0-15 FT BGS

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	6/17/2015 8:33:53 AM
From File	South Aroclor 1254 0-15ft UCL Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor 1254

General Statistics

Total Number of Observations	409	Number of Distinct Observations	15
		Number of Missing Observations	5
Number of Detects	6	Number of Non-Detects	403
Number of Distinct Detects	6	Number of Distinct Non-Detects	9
Minimum Detect	0.079	Minimum Non-Detect	0.02
Maximum Detect	0.45	Maximum Non-Detect	0.5
Variance Detects	0.0161	Percent Non-Detects	98.53%
Mean Detects	0.22	SD Detects	0.127
Median Detects	0.205	CV Detects	0.577
Skewness Detects	1.303	Kurtosis Detects	2.508
Mean of Logged Detects	-1.651	SD of Logged Detects	0.58

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.901	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.27	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.362	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

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

Mean	0.023	Standard Error of Mean	0.00153
SD	0.028	95% KM (BCA) UCL	0.0256
95% KM (t) UCL	0.0255	95% KM (Percentile Bootstrap) UCL	0.0255
95% KM (z) UCL	0.0255	95% KM Bootstrap t UCL	0.0254
90% KM Chebyshev UCL	0.0276	95% KM Chebyshev UCL	0.0297
97.5% KM Chebyshev UCL	0.0325	99% KM Chebyshev UCL	0.0382

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.227	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.7	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.199	**Kolmogrov-Smirnoff GOF**
5% K-S Critical Value	0.334	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	3.837	k star (bias corrected MLE)	2.03
Theta hat (MLE)	0.0573	Theta star (bias corrected MLE)	0.108
nu hat (MLE)	46.04	nu star (bias corrected)	24.36
MLE Mean (bias corrected)	0.22	MLE Sd (bias corrected)	0.154

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.674	nu hat (KM)	551.2
Approximate Chi Square Value (551.17, α)	497.7	Adjusted Chi Square Value (551.17, β)	497.5
95% Gamma Approximate KM-UCL (use when n>=50)	0.0255	95% Gamma Adjusted KM-UCL (use when n<50)	0.0255

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 detected data is small such as < 0.1
For such situations, GROS method tends to yield inflated values of UCLs and BTVs
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.0132
Maximum	0.45	Median	0.01
SD	0.029	CV	2.19
k hat (MLE)	2.327	k star (bias corrected MLE)	2.312
Theta hat (MLE)	0.00569	Theta star (bias corrected MLE)	0.00572

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nu hat (MLE)	1904	nu star (bias corrected)	1891
MLE Mean (bias corrected)	0.0132	MLE Sd (bias corrected)	0.0087
		Adjusted Level of Significance (β)	0.0494
Approximate Chi Square Value (N/A, α)	1791	Adjusted Chi Square Value (N/A, β)	1791
95% Gamma Approximate UCL (use when n>=50)	0.014	95% Gamma Adjusted UCL (use when n<50)	0.014

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.978	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.183	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.362	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.00939	Mean in Log Scale	-6.207
SD in Original Scale	0.0315	SD in Log Scale	1.749
95% t UCL (assumes normality of ROS data)	0.012	95% Percentile Bootstrap UCL	0.0122
95% BCA Bootstrap UCL	0.0128	95% Bootstrap t UCL	0.0135
95% H-UCL (Log ROS)	0.0118		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	-3.878	95% H-UCL (KM -Log)	0.0221
KM SD (logged)	0.283	95% Critical H Value (KM-Log)	1.7
KM Standard Error of Mean (logged)	0.0155		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.0322	Mean in Log Scale	-3.63
SD in Original Scale	0.0365	SD in Log Scale	0.498
95% t UCL (Assumes normality)	0.0351	95% H-Stat UCL	0.0314

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.0255	95% KM (Percentile Bootstrap) UCL	0.0255

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.