

## UCL Statistics for Data Sets with Non-Detects

User Selected  
Date/Time of C ProUCL 5.16/19/17 5:11:42 PM  
From File ProUCLinput\_53-001(a)\_0-1.xls  
Full Precision OFF  
Confidence Cc 95%  
Number of Boc 2000

### Aroclor-1260

#### General Statistics

Total Number of Observations	25	Number of Distinct Observations	18
Number of Detects	9	Number of Non-Detects	16
Number of Distinct Detects	9	Number of Distinct Non-Detects	9
Minimum Detect	0.0054	Minimum Non-Detect	0.00358
Maximum Detect	0.256	Maximum Non-Detect	0.04
Variance Detects	0.0057	Percent Non-Detects	64%
Mean Detects	0.101	SD Detects	0.0755
Median Detects	0.0899	CV Detects	0.745
Skewness Detects	0.866	Kurtosis Detects	1.308
Mean of Logged Detects	-2.706	SD of Logged Detects	1.194

#### Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.941	<b>Shapiro Wilk GOF Test</b>
5% Shapiro Wilk Critical Value	0.829	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.149	<b>Lilliefors GOF Test</b>
5% Lilliefors Critical Value	0.274	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

KM Mean	0.042	KM Standard Error of Mean	0.0134
KM SD	0.0619	95% KM (BCA) UCL	0.067
95% KM (t) UCL	0.0649	95% KM (Percentile Bootstrap) UCL	0.0666
95% KM (z) UCL	0.064	95% KM Bootstrap t UCL	0.0712
90% KM Chebyshev UCL	0.0822	95% KM Chebyshev UCL	0.1
97.5% KM Chebyshev UCL	0.126	99% KM Chebyshev UCL	0.175

#### Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.359	<b>Anderson-Darling GOF Test</b>
5% A-D Critical Value	0.737	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.207	<b>Kolmogorov-Smirnov GOF</b>
5% K-S Critical Value	0.285	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)	1.342	k star (bias corrected ML)	0.968
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Theta hat (MLE)	0.0755	Theta star (bias corrected)	0.105
nu hat (MLE)	24.15	nu star (bias corrected)	17.43
Mean (detects)	0.101		

### 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	0.0054	Mean	0.0433
Maximum	0.256	Median	0.01
SD	0.0623	CV	1.437
k hat (MLE)	0.79	k star (bias corrected ML	0.722
Theta hat (MLE)	0.0549	Theta star (bias corrected	0.06
nu hat (MLE)	39.5	nu star (bias corrected)	36.09
Adjusted Level of Signific	0.0395		
Approximate Chi Square	23.34	Adjusted Chi Square Val	22.64
95% Gamma Approxima	0.067	95% Gamma Adjusted U	0.0691

### Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.042	SD (KM)	0.0619
Variance (KM)	0.00383	SE of Mean (KM)	0.0134
k hat (KM)	0.461	k star (KM)	0.432
nu hat (KM)	23.06	nu star (KM)	21.62
theta hat (KM)	0.0911	theta star (KM)	0.0972
80% gamma percentile (	0.0684	90% gamma percentile (	0.117
95% gamma percentile (	0.17	99% gamma percentile (	0.302

### Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square	12.06	Adjusted Chi Square Val	11.57
95% Gamma Approxir	0.0754	95% Gamma Adjusted	0.0785

### Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statist	0.863	<b>Shapiro Wilk GOF Test</b>
5% Shapiro Wilk Critical	0.829	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.269	<b>Lilliefors GOF Test</b>
5% Lilliefors Critical Valu	0.274	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	0.0414	Mean in Log Scale	-4.23
SD in Original Scale	0.0634	SD in Log Scale	1.468
95% t UCL (assumes r	0.0631	95% Percentile Bootstr	0.064
95% BCA Bootstrap UCL	0.0689	95% Bootstrap t UCL	0.0729
95% H-UCL (Log ROS	0.11		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-4.174	KM Geo Mean	0.0154
KM SD (logged)	1.402	95% Critical H Value (t)	3.049
KM Standard Error of Mean	0.406	95% H-UCL (KM -Log)	0.0985
KM SD (logged)	1.402	95% Critical H Value (t)	3.049
KM Standard Error of Mean	0.406		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	0.0478	Mean in Log Scale	-3.614
SD in Original Scale	0.0599	SD in Log Scale	1.084
95% t UCL (Assumes r	0.0683	95% H-Stat UCL	0.0862

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	0.0649
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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.