

UCL Statistics for Data Sets with Non-Detects

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From File ProUCLinput_20-002(c)_0-1.xls

Full Precision OFF

Confidence Cc 95%

Number of Boc 2000

Antimony

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
Number of Detects	6	Number of Non-Detects	2
Number of Distinct Detects	6	Number of Distinct Non-Detects	2
Minimum Detect	0.62	Minimum Non-Detect	0.891
Maximum Detect	1.12	Maximum Non-Detect	0.97
Variance Detects	0.0325	Percent Non-Detects	25%
Mean Detects	0.826	SD Detects	0.18
Median Detects	0.824	CV Detects	0.218
Skewness Detects	0.66	Kurtosis Detects	0.338
Mean of Logged Detects	-0.21	SD of Logged Detects	0.215

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statist	0.955	Shapiro Wilk GOF Test
5% Shapiro Wilk Critical	0.788	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.165	Lilliefors GOF Test
5% Lilliefors Critical Value	0.325	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	0.807	KM Standard Error of Mean	0.0644
KM SD	0.155	95% KM (BCA) UCL	0.904
95% KM (t) UCL	0.929	95% KM (Percentile Bootstrap) UCL	0.905
95% KM (z) UCL	0.913	95% KM Bootstrap t UCL	0.939
90% KM Chebyshev UCL	1	95% KM Chebyshev UCL	1.087
97.5% KM Chebyshev UCL	1.209	99% KM Chebyshev UCL	1.447

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.209	Anderson-Darling GOF Test
5% A-D Critical Value	0.697	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.173	Kolmogorov-Smirnov GOF
5% K-S Critical Value	0.332	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)	25.98	k star (bias corrected ML)	13.1
Theta hat (MLE)	0.0318	Theta star (bias corrected ML)	0.0631
nu hat (MLE)	311.8	nu star (bias corrected)	157.2
Mean (detects)	0.826		

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 data distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.62	Mean	0.807
Maximum	1.12	Median	0.778
SD	0.157	CV	0.195
k hat (MLE)	32.37	k star (bias corrected ML	20.32
Theta hat (MLE)	0.0249	Theta star (bias correcte	0.0397
nu hat (MLE)	518	nu star (bias corrected)	325.1
Adjusted Level of Signific	0.0195		
Approximate Chi Square	284.3	Adjusted Chi Square Val	274.6
95% Gamma Approxima	0.922	95% Gamma Adjusted U	0.955

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.807	SD (KM)	0.155
Variance (KM)	0.0241	SE of Mean (KM)	0.0644
k hat (KM)	27.02	k star (KM)	16.97
nu hat (KM)	432.3	nu star (KM)	271.5
theta hat (KM)	0.0299	theta star (KM)	0.0475
80% gamma percentile (	0.965	90% gamma percentile (	1.066
95% gamma percentile (	1.153	99% gamma percentile (	1.331

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square	234.3	Adjusted Chi Square Val	225.6
95% Gamma Approxirr	0.935	95% Gamma Adjusted	0.971

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statist	0.971	Shapiro Wilk GOF Test
5% Shapiro Wilk Critical	0.788	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.153	Lilliefors GOF Test
5% Lilliefors Critical Valu	0.325	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	0.805	Mean in Log Scale	-0.232
SD in Original Scale	0.157	SD in Log Scale	0.186
95% t UCL (assumes r	0.911	95% Percentile Bootstr	0.899
95% BCA Bootstrap UCL	0.911	95% Bootstrap t UCL	0.949
95% H-UCL (Log ROS	0.924		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.233	KM Geo Mean	0.792
KM SD (logged)	0.187	95% Critical H Value (t	1.93
KM Standard Error of Me	0.079	95% H-UCL (KM -Log)	0.924
KM SD (logged)	0.187	95% Critical H Value (t	1.93
KM Standard Error of Me	0.079		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	0.736	Mean in Log Scale	-0.349
SD in Original Scale	0.226	SD in Log Scale	0.316
95% t UCL (Assumes r	0.888	95% H-Stat UCL	0.95

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	0.929
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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.

Barium

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	13.2	Mean	61.39
Maximum	88.6	Median	74.3
SD	29.44	Std. Error of Mean	10.41
Coefficient of Variation	0.48	Skewness	-1.186

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.786	Shapiro Wilk GOF Test
5% Shapiro Wilk Critical	0.818	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.278	Lilliefors GOF Test
5% Lilliefors Critical Value	0.283	Data appear Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	81.11	95% Adjusted-CLT UC	73.85
		95% Modified-t UCL (J	80.38

Gamma GOF Test

A-D Test Statistic	1.169	Anderson-Darling Gamma GOF Test
5% A-D Critical Value	0.722	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.346	Kolmogorov-Smirnov Gamma GOF Test
5% K-S Critical Value	0.296	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.83	k star (bias corrected ML)	1.852
Theta hat (MLE)	21.69	Theta star (bias corrected)	33.14
nu hat (MLE)	45.28	nu star (bias corrected)	29.63
MLE Mean (bias corrected)	61.39	MLE Sd (bias corrected)	45.11
		Approximate Chi Square	18.21
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	15.98

Assuming Gamma Distribution

95% Approximate Gamma	99.92	95% Adjusted Gamma	113.8
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Lognormal GOF Test

Shapiro Wilk Test Statistic	0.704	Shapiro Wilk Lognormal GOF Test
5% Shapiro Wilk Critical	0.818	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.36	Lilliefors Lognormal GOF Test
5% Lilliefors Critical Value	0.283	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.58	Mean of logged Data	3.93
Maximum of Logged Data	4.484	SD of logged Data	0.76

Assuming Lognormal Distribution

95% H-UCL	154.6	90% Chebyshev (MVU)	118.5
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95% Chebyshev (MVU	142.7	97.5% Chebyshev (MVL	176.3
99% Chebyshev (MVU	242.2		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs			
95% CLT UCL	78.51	95% Jackknife UCL	81.11
95% Standard Bootstrap	77.05	95% Bootstrap-t UCL	77.36
95% Hall's Bootstrap U	73.61	95% Percentile Bootstr	77.1
95% BCA Bootstrap U	73.69		
90% Chebyshev(Mean	92.62	95% Chebyshev(Mean	106.8
97.5% Chebyshev(Mear	126.4	99% Chebyshev(Mean	165

Suggested UCL to Use
95% Student's-t UCL 81.11

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

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.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positively skewed data sets.

Chromium

General Statistics			
Total Number of Observa	8	Number of Distinct Obse	8
		Number of Missing Obse	0
Minimum	4.79	Mean	38.17
Maximum	60.7	Median	43
SD	21.6	Std. Error of Mean	7.637
Coefficient of Variation	0.566	Skewness	-1.032

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test		
Shapiro Wilk Test Statist	0.814	Shapiro Wilk GOF Test
5% Shapiro Wilk Critical	0.818	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.313	Lilliefors GOF Test
5% Lilliefors Critical Valu	0.283	Data Not Normal at 5% Significance Level
Data Not Normal at 5% Significance Level		

Assuming Normal Distribution			
95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	52.64	95% Adjusted-CLT UC	47.75
		95% Modified-t UCL (J	52.17

Gamma GOF Test			
A-D Test Statistic	1.221	Anderson-Darling Gamma GOF Test	
5% A-D Critical Value	0.727	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.395	Kolmogorov-Smirnov Gamma GOF Test	
5% K-S Critical Value	0.298	Data Not Gamma Distributed at 5% Significance Level	

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.658	k star (bias corrected ML	1.12
Theta hat (MLE)	23.02	Theta star (bias correcte	34.09
nu hat (MLE)	26.53	nu star (bias corrected)	17.91
MLE Mean (bias correcte	38.17	MLE Sd (bias corrected)	36.07
		Approximate Chi Square	9.327
Adjusted Level of Signific	0.0195	Adjusted Chi Square Val	7.811

Assuming Gamma Distribution

95% Approximate Garr	73.3	95% Adjusted Gamma	87.53
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Lognormal GOF Test

Shapiro Wilk Test Statist	0.677	Shapiro Wilk Lognormal GOF Test	
5% Shapiro Wilk Critical	0.818	Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.401	Lilliefors Lognormal GOF Test	
5% Lilliefors Critical Valu	0.283	Data Not Lognormal at 5% Significance Level	

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.567	Mean of logged Data	3.311
Maximum of Logged Dat	4.106	SD of logged Data	1.074

Assuming Lognormal Distribution

95% H-UCL	211.6	90% Chebyshev (MVU	95.82
95% Chebyshev (MVU	119.2	97.5% Chebyshev (MVL	151.6
99% Chebyshev (MVU	215.2		

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	50.73	95% Jackknife UCL	52.64
95% Standard Bootstrap	50.07	95% Bootstrap-t UCL	49.85
95% Hall's Bootstrap U	47.26	95% Percentile Bootstr	49.58
95% BCA Bootstrap U	48.12		
90% Chebyshev(Mean	61.08	95% Chebyshev(Mean	71.46
97.5% Chebyshev(Mear	85.86	99% Chebyshev(Mean	114.2

Suggested UCL to Use

95% Hall's Bootstrap UC	47.26
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In Case Bootstrap t and/or Hall's Bootstrap yields an unreasonably large UCL value, use 97.5% or 99% Chebyshev (Mean, Sd

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.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positively skewed data sets.

Copper

General Statistics

Total Number of Observa	8	Number of Distinct Obse	8
		Number of Missing Obse	0
Minimum	1.45	Mean	8.858
Maximum	13.7	Median	10.85

SD	4.755	Std. Error of Mean	1.681
Coefficient of Variation	0.537	Skewness	-1.086

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statist	0.804	Shapiro Wilk GOF Test
5% Shapiro Wilk Critical	0.818	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.284	Lilliefors GOF Test
5% Lilliefors Critical Valu	0.283	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	12.04	95% Adjusted-CLT UC	10.93
		95% Modified-t UCL (J	11.94

Gamma GOF Test

A-D Test Statistic	1.205	Anderson-Darling Gamma GOF Test
5% A-D Critical Value	0.724	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.339	Kolmogorov-Smirnov Gamma GOF Test
5% K-S Critical Value	0.297	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.01	k star (bias corrected ML	1.339
Theta hat (MLE)	4.408	Theta star (bias correcte	6.614
nu hat (MLE)	32.15	nu star (bias corrected)	21.43
MLE Mean (bias correcte	8.858	MLE Sd (bias corrected)	7.654
		Approximate Chi Square	11.91
Adjusted Level of Signific	0.0195	Adjusted Chi Square Val	10.16

Assuming Gamma Distribution

95% Approximate Garr	15.94	95% Adjusted Gamma	18.67
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Lognormal GOF Test

Shapiro Wilk Test Statist	0.685	Shapiro Wilk Lognormal GOF Test
5% Shapiro Wilk Critical	0.818	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.359	Lilliefors Lognormal GOF Test
5% Lilliefors Critical Valu	0.283	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	0.372	Mean of logged Data	1.912
Maximum of Logged Dat	2.617	SD of logged Data	0.943

Assuming Lognormal Distribution

95% H-UCL	34.06	90% Chebyshev (MVU	19.87
95% Chebyshev (MVU	24.42	97.5% Chebyshev (MVL	30.74
99% Chebyshev (MVU	43.13		

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	11.62	95% Jackknife UCL	12.04
95% Standard Bootstra	11.48	95% Bootstrap-t UCL	11.34
95% Hall's Bootstrap U	10.81	95% Percentile Bootstr	11.29

95% BCA Bootstrap UCL	11.02	95% Chebyshev(Mean	16.19
90% Chebyshev(Mean	13.9	99% Chebyshev(Mean	25.59
97.5% Chebyshev(Mean	19.36		

Suggested UCL to Use

95% Chebyshev (Mean, 16.19

Recommended UCL exceeds the maximum observation

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.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positively skewed data sets.

Lead

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	2.54	Mean	17.21
Maximum	24.6	Median	20.2
SD	7.759	Std. Error of Mean	2.743
Coefficient of Variation	0.451	Skewness	-1.387

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.

For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).

Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.781	Shapiro Wilk GOF Test
5% Shapiro Wilk Critical	0.818	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.366	Lilliefors GOF Test
5% Lilliefors Critical Value	0.283	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	22.41	95% Adjusted-CLT UCL	20.29
		95% Modified-t UCL (J)	22.18

Gamma GOF Test

A-D Test Statistic	1.209	Anderson-Darling Gamma GOF Test
5% A-D Critical Value	0.722	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.41	Kolmogorov-Smirnov Gamma GOF Test
5% K-S Critical Value	0.296	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.863	k star (bias corrected ML)	1.873
Theta hat (MLE)	6.011	Theta star (bias corrected)	9.189
nu hat (MLE)	45.81	nu star (bias corrected)	29.97
MLE Mean (bias corrected)	17.21	MLE Sd (bias corrected)	12.58
		Approximate Chi Square	18.47
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	16.23

Assuming Gamma Distribution

95% Approximate Gar	27.93	95% Adjusted Gamma	31.79
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Lognormal GOF Test

Shapiro Wilk Test Statist	0.683	Shapiro Wilk Lognormal GOF Test
5% Shapiro Wilk Critical	0.818	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.403	Lilliefors Lognormal GOF Test
5% Lilliefors Critical Valu	0.283	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	0.932	Mean of logged Data	2.661
Maximum of Logged Dat	3.203	SD of logged Data	0.787

Assuming Lognormal Distribution

95% H-UCL	46.57	90% Chebyshev (MVU)	34.46
95% Chebyshev (MVU)	41.64	97.5% Chebyshev (MVL)	51.6
99% Chebyshev (MVU)	71.16		

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	21.72	95% Jackknife UCL	22.41
95% Standard Bootstrap	21.5	95% Bootstrap-t UCL	21.13
95% Hall's Bootstrap U	20.51	95% Percentile Bootstrap	21.24
95% BCA Bootstrap U	20.75		
90% Chebyshev(Mean	25.44	95% Chebyshev(Mean	29.17
97.5% Chebyshev(Mear	34.34	99% Chebyshev(Mean	44.51

Suggested UCL to Use

95% Chebyshev (Mean,	29.17
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Recommended UCL exceeds the maximum observation

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.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positively skewed data sets.

Perchlorate

General Statistics

Total Number of Observa	8	Number of Distinct Obse	7
Number of Detects	6	Number of Non-Detects	2
Number of Distinct Detect	6	Number of Distinct Non-I	1
Minimum Detect	6.7500E-4	Minimum Non-Detect	0.00211
Maximum Detect	0.00451	Maximum Non-Detect	0.00211
Variance Detects	2.2507E-6	Percent Non-Detects	25%
Mean Detects	0.00183	SD Detects	0.0015
Median Detects	0.00124	CV Detects	0.82
Skewness Detects	1.433	Kurtosis Detects	1.474
Mean of Logged Detects	-6.557	SD of Logged Detects	0.762

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statist	0.826	Shapiro Wilk GOF Test
5% Shapiro Wilk Critical	0.788	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.264	Lilliefors GOF Test
5% Lilliefors Critical Valu	0.325	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	0.00161	KM Standard Error of Me	4.9179E-4
KM SD	0.00125	95% KM (BCA) UCL	0.00241
95% KM (t) UCL	0.00254	95% KM (Percentile Boo	0.00246
95% KM (z) UCL	0.00242	95% KM Bootstrap t U	0.00394
90% KM Chebyshev UCL	0.00309	95% KM Chebyshev UCL	0.00376
97.5% KM Chebyshev U	0.00468	99% KM Chebyshev UCL	0.00651

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.377	Anderson-Darling GOF Test
5% A-D Critical Value	0.704	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.204	Kolmogorov-Smirnov GOF
5% K-S Critical Value	0.336	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)	2.121	k star (bias corrected ML	1.172
Theta hat (MLE)	8.6288E-4	Theta star (bias correcte	0.00156
nu hat (MLE)	25.46	nu star (bias corrected)	14.06
Mean (detects)	0.00183		

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	6.7500E-4	Mean	0.00387
Maximum	0.01	Median	0.00205
SD	0.00399	CV	1.03
k hat (MLE)	1.107	k star (bias corrected ML	0.775
Theta hat (MLE)	0.0035	Theta star (bias correcte	0.00499
nu hat (MLE)	17.72	nu star (bias corrected)	12.41
Adjusted Level of Signific	0.0195		
Approximate Chi Square	5.496	Adjusted Chi Square Val	4.389
95% Gamma Approxima	0.00874	95% Gamma Adjusted U	0.0109

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.00161	SD (KM)	0.00125
Variance (KM)	1.5741E-6	SE of Mean (KM)	4.9179E-4
k hat (KM)	1.653	k star (KM)	1.116
nu hat (KM)	26.45	nu star (KM)	17.86
theta hat (KM)	9.7584E-4	theta star (KM)	0.00144
80% gamma percentile (	0.00257	90% gamma percentile (	0.00361
95% gamma percentile (	0.00465	99% gamma percentile (	0.00703

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square	9.292	Adjusted Chi Square Val	7.779
95% Gamma Approxirr	0.0031	95% Gamma Adjusted	0.0037

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statist	0.914	Shapiro Wilk GOF Test
5% Shapiro Wilk Critical	0.788	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.168	Lilliefors GOF Test

5% Lilliefors Critical Value 0.325 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	0.00162	Mean in Log Scale	-6.658
SD in Original Scale	0.00133	SD in Log Scale	0.687
95% t UCL (assumes r	0.00251	95% Percentile Bootstr	0.00239
95% BCA Bootstrap UCL	0.00272	95% Bootstrap t UCL	0.00433
95% H-UCL (Log ROS	0.00328		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-6.668	KM Geo Mean	0.00127
KM SD (logged)	0.652	95% Critical H Value (t	2.636
KM Standard Error of Me	0.263	95% H-UCL (KM -Log)	0.00301
KM SD (logged)	0.652	95% Critical H Value (t	2.636
KM Standard Error of Me	0.263		

DL/2 Statistics

DL/2 Normal

DL/2 Log-Transformed

Mean in Original Scale	0.00164	Mean in Log Scale	-6.631
SD in Original Scale	0.00132	SD in Log Scale	0.659
95% t UCL (Assumes r	0.00252	95% H-Stat UCL	0.00317

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	0.00254
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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.

Silver

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
Number of Detects	7	Number of Non-Detects	1
Number of Distinct Detects	7	Number of Distinct Non-Detects	1
Minimum Detect	0.108	Minimum Non-Detect	0.356
Maximum Detect	2.31	Maximum Non-Detect	0.356
Variance Detects	0.539	Percent Non-Detects	12.5%
Mean Detects	1.575	SD Detects	0.734
Median Detects	1.81	CV Detects	0.466
Skewness Detects	-1.584	Kurtosis Detects	2.652
Mean of Logged Detects	0.178	SD of Logged Detects	1.08

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.845	Shapiro Wilk GOF Test
5% Shapiro Wilk Critical Value	0.803	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.303	Lilliefors GOF Test
5% Lilliefors Critical Value	0.304	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	1.392	KM Standard Error of Me	0.305
KM SD	0.8	95% KM (BCA) UCL	1.867
95% KM (t) UCL	1.971	95% KM (Percentile Boo	1.836
95% KM (z) UCL	1.894	95% KM Bootstrap t U	1.856
90% KM Chebyshev UCL	2.308	95% KM Chebyshev UCL	2.724
97.5% KM Chebyshev U	3.3	99% KM Chebyshev UCL	4.431

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.132	Anderson-Darling GOF Test
5% A-D Critical Value	0.715	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.362	Kolmogorov-Smirnov GOF
5% K-S Critical Value	0.315	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)	1.956	k star (bias corrected ML	1.213
Theta hat (MLE)	0.805	Theta star (bias correcte	1.299
nu hat (MLE)	27.38	nu star (bias corrected)	16.98
Mean (detects)	1.575		

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	0.108	Mean	1.468
Maximum	2.31	Median	1.775
SD	0.745	CV	0.508
k hat (MLE)	1.999	k star (bias corrected ML	1.333
Theta hat (MLE)	0.734	Theta star (bias correcte	1.101
nu hat (MLE)	31.98	nu star (bias corrected)	21.32
Adjusted Level of Signific	0.0195		
Approximate Chi Square	11.83	Adjusted Chi Square Val	10.09
95% Gamma Approxima	2.645	95% Gamma Adjusted U	3.101

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	1.392	SD (KM)	0.8
Variance (KM)	0.64	SE of Mean (KM)	0.305
k hat (KM)	3.028	k star (KM)	1.976
nu hat (KM)	48.45	nu star (KM)	31.62
theta hat (KM)	0.46	theta star (KM)	0.704
80% gamma percentile (	2.087	90% gamma percentile (	2.715
95% gamma percentile (	3.314	99% gamma percentile (	4.645

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square	19.77	Adjusted Chi Square Val	17.44
95% Gamma Approxirr	2.226	95% Gamma Adjusted	2.524

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statist	0.622	Shapiro Wilk GOF Test
5% Shapiro Wilk Critical	0.803	Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.35	Lilliefors GOF Test
5% Lilliefors Critical Valu	0.304	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	1.412	Mean in Log Scale	-0.00906
SD in Original Scale	0.822	SD in Log Scale	1.131
95% t UCL (assumes r	1.963	95% Percentile Bootstr	1.832

95% BCA Bootstrap UCL	1.785	95% Bootstrap t UCL	1.858
95% H-UCL (Log ROS)	9.36		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.123	KM Geo Mean	0.884
KM SD (logged)	1.228	95% Critical H Value (t)	4.009
KM Standard Error of Mean	0.469	95% H-UCL (KM -Log)	12.07
KM SD (logged)	1.228	95% Critical H Value (t)	4.009
KM Standard Error of Mean	0.469		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	1.401	Mean in Log Scale	-0.0603
SD in Original Scale	0.84	SD in Log Scale	1.206
95% t UCL (Assumes normality)	1.964	95% H-Stat UCL	11.78

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	1.971
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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.

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