

UCL Statistics for Data Sets with Non-Detects

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From File ProUCLinput_20-001(a)_0-10.xls

Full Precision OFF

Confidence Cc 95%

Number of Boc 2000

Barium

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	63.5	Mean	82.15
Maximum	108	Median	84.45
SD	14.15	Std. Error of Mean	5.002
Coefficient of Variation	0.172	Skewness	0.519

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	0.945	Shapiro Wilk GOF Test
5% Shapiro Wilk Critical Value	0.818	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.182	Lilliefors GOF Test
5% Lilliefors Critical Value	0.283	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	91.63	95% Adjusted-CLT UCL (Chen-1995)	91.36
		95% Modified-t UCL (Johnson-1978)	91.78

Gamma GOF Test

A-D Test Statistic	0.279	Anderson-Darling Gamma GOF Test
5% A-D Critical Value	0.715	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.155	Kolmogorov-Smirnov Gamma GOF Test
5% K-S Critical Value	0.294	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	39.28	k star (bias corrected MLE)	24.63
Theta hat (MLE)	2.092	Theta star (bias corrected MLE)	3.335
nu hat (MLE)	628.4	nu star (bias corrected)	394.1
MLE Mean (bias corrected)	82.15	MLE Sd (bias corrected)	16.55
		Approximate Chi Square Value (0.05)	349.1
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	338.3

Assuming Gamma Distribution

95% Approximate Gamma UCL (use wh	92.74	95% Adjusted Gamma UCL (use wh	95.69
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Lognormal GOF Test

Shapiro Wilk Test Statistic	0.958	Shapiro Wilk Lognormal GOF Test
5% Shapiro Wilk Critical Value	0.818	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.161	Lilliefors Lognormal GOF Test
5% Lilliefors Critical Value	0.283	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	4.151	Mean of logged Data	4.396
Maximum of Logged Data	4.682	SD of logged Data	0.171

Assuming Lognormal Distribution

95% H-UCL	93.1	90% Chebyshev (MVUE) UCL	97.03
95% Chebyshev (MVUE) UCL	103.8	97.5% Chebyshev (MVUE) UCL	113.1
99% Chebyshev (MVUE) UCL	131.5		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	90.38	95% Jackknife UCL	91.63
95% Standard Bootstrap UCL	89.77	95% Bootstrap-t UCL	92.32
95% Hall's Bootstrap UCL	92.35	95% Percentile Bootstrap UCL	89.79
95% BCA Bootstrap UCL	90.39		
90% Chebyshev(Mean, Sd) UCL	97.16	95% Chebyshev(Mean, Sd) UCL	104
97.5% Chebyshev(Mean, Sd) UCL	113.4	99% Chebyshev(Mean, Sd) UCL	131.9

Suggested UCL to Use

95% Student's-t UCL	91.63
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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.

Copper**General Statistics**

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	3.82	Mean	5.968
Maximum	7.75	Median	5.81
SD	1.212	Std. Error of Mean	0.429
Coefficient of Variation	0.203	Skewness	-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

Shapiro Wilk Test Statistic	0.944	Shapiro Wilk GOF Test	
5% Shapiro Wilk Critical Value	0.818	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.213	Lilliefors GOF Test	
5% Lilliefors Critical Value	0.283	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	6.779	95% Adjusted-CLT UCL (Chen-1995)	6.638
		95% Modified-t UCL (Johnson-1978)	6.774

Gamma GOF Test

A-D Test Statistic	0.354	Anderson-Darling Gamma GOF Test	
5% A-D Critical Value	0.716	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.227	Kolmogorov-Smirnov Gamma GOF Test	

5% K-S Critical Value 0.294 Detected data appear Gamma Distributed at 5% Significance Level
Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	25.86	k star (bias corrected MLE)	16.24
Theta hat (MLE)	0.231	Theta star (bias corrected MLE)	0.367
nu hat (MLE)	413.7	nu star (bias corrected)	259.9
MLE Mean (bias corrected)	5.968	MLE Sd (bias corrected)	1.481
		Approximate Chi Square Value (0.05)	223.6
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	215

Assuming Gamma Distribution

95% Approximate Gamma UCL (use wh)	6.937	95% Adjusted Gamma UCL (use wh)	7.213
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Lognormal GOF Test

Shapiro Wilk Test Statistic	0.916	Shapiro Wilk Lognormal GOF Test	
5% Shapiro Wilk Critical Value	0.818	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.249	Lilliefors Lognormal GOF Test	
5% Lilliefors Critical Value	0.283	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.34	Mean of logged Data	1.767
Maximum of Logged Data	2.048	SD of logged Data	0.216

Assuming Lognormal Distribution

95% H-UCL	7.029	90% Chebyshev (MVUE) UCL	7.343
95% Chebyshev (MVUE) UCL	7.963	97.5% Chebyshev (MVUE) UCL	8.825
99% Chebyshev (MVUE) UCL	10.52		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	6.672	95% Jackknife UCL	6.779
95% Standard Bootstrap UCL	6.618	95% Bootstrap-t UCL	6.884
95% Hall's Bootstrap UCL	6.911	95% Percentile Bootstrap UCL	6.604
95% BCA Bootstrap UCL	6.631		
90% Chebyshev(Mean, Sd) UCL	7.253	95% Chebyshev(Mean, Sd) UCL	7.836
97.5% Chebyshev(Mean, Sd) UCL	8.644	99% Chebyshev(Mean, Sd) UCL	10.23

Suggested UCL to Use

95% Student's-t UCL	6.779
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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.

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	9.82	Mean	10.73
Maximum	11.8	Median	10.55
SD	0.695	Std. Error of Mean	0.246

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	0.938	Shapiro Wilk GOF Test	
5% Shapiro Wilk Critical Value	0.818	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.181	Lilliefors GOF Test	
5% Lilliefors Critical Value	0.283	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	11.19	95% Adjusted-CLT UCL (Chen-1995)	11.18
		95% Modified-t UCL (Johnson-1978)	11.2

Gamma GOF Test

A-D Test Statistic	0.296	Anderson-Darling Gamma GOF Test	
5% A-D Critical Value	0.715	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.189	Kolmogorov-Smirnov Gamma GOF Test	
5% K-S Critical Value	0.294	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	276.4	k star (bias corrected MLE)	172.8
Theta hat (MLE)	0.0388	Theta star (bias corrected MLE)	0.0621
nu hat (MLE)	4422	nu star (bias corrected)	2765
MLE Mean (bias corrected)	10.73	MLE Sd (bias corrected)	0.816
		Approximate Chi Square Value (0.05)	2644
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	2614

Assuming Gamma Distribution

95% Approximate Gamma UCL (use wh	11.22	95% Adjusted Gamma UCL (use wh	11.35
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Lognormal GOF Test

Shapiro Wilk Test Statistic	0.945	Shapiro Wilk Lognormal GOF Test	
5% Shapiro Wilk Critical Value	0.818	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.176	Lilliefors Lognormal GOF Test	
5% Lilliefors Critical Value	0.283	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.284	Mean of logged Data	2.371
Maximum of Logged Data	2.468	SD of logged Data	0.0641

Assuming Lognormal Distribution

95% H-UCL	N/A	90% Chebyshev (MVUE) UCL	11.46
95% Chebyshev (MVUE) UCL	11.79	97.5% Chebyshev (MVUE) UCL	12.25
99% Chebyshev (MVUE) UCL	13.15		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	11.13	95% Jackknife UCL	11.19
95% Standard Bootstrap UCL	11.1	95% Bootstrap-t UCL	11.32
95% Hall's Bootstrap UCL	11.3	95% Percentile Bootstrap UCL	11.13
95% BCA Bootstrap UCL	11.15		

90% Chebyshev(Mean, Sd) UCL	11.46	95% Chebyshev(Mean, Sd) UCL	11.8
97.5% Chebyshev(Mean, Sd) UCL	12.26	99% Chebyshev(Mean, Sd) UCL	13.17

Suggested UCL to Use

95% Student's-t UCL	11.19
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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.

Nickel

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	3.58	Mean	5.008
Maximum	6.66	Median	5.285
SD	1.157	Std. Error of Mean	0.409
Coefficient of Variation	0.231	Skewness	-0.0743

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	0.907	Shapiro Wilk GOF Test
5% Shapiro Wilk Critical Value	0.818	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.221	Lilliefors GOF Test
5% Lilliefors Critical Value	0.283	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	5.783	95% Adjusted-CLT UCL (Chen-1995)	5.669
		95% Modified-t UCL (Johnson-1978)	5.781

Gamma GOF Test

A-D Test Statistic	0.481	Anderson-Darling Gamma GOF Test
5% A-D Critical Value	0.716	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.237	Kolmogorov-Smirnov Gamma GOF Test
5% K-S Critical Value	0.294	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	20.62	k star (bias corrected MLE)	12.97
Theta hat (MLE)	0.243	Theta star (bias corrected MLE)	0.386
nu hat (MLE)	330	nu star (bias corrected)	207.6
MLE Mean (bias corrected)	5.008	MLE Sd (bias corrected)	1.39
		Approximate Chi Square Value (0.05)	175.2
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	167.7

Assuming Gamma Distribution

95% Approximate Gamma UCL (use wh	5.932	95% Adjusted Gamma UCL (use wh	6.198
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Lognormal GOF Test

Shapiro Wilk Test Statistic	0.889	Shapiro Wilk Lognormal GOF Test
5% Shapiro Wilk Critical Value	0.818	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.221	Lilliefors Lognormal GOF Test

5% Lilliefors Critical Value 0.283 Data appear Lognormal at 5% Significance Level
Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.275	Mean of logged Data	1.586
Maximum of Logged Data	1.896	SD of logged Data	0.239

Assuming Lognormal Distribution

95% H-UCL	6.016	90% Chebyshev (MVUE) UCL	6.283
95% Chebyshev (MVUE) UCL	6.86	97.5% Chebyshev (MVUE) UCL	7.661
99% Chebyshev (MVUE) UCL	9.234		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	5.68	95% Jackknife UCL	5.783
95% Standard Bootstrap UCL	5.644	95% Bootstrap-t UCL	5.734
95% Hall's Bootstrap UCL	5.581	95% Percentile Bootstrap UCL	5.624
95% BCA Bootstrap UCL	5.644		
90% Chebyshev(Mean, Sd) UCL	6.235	95% Chebyshev(Mean, Sd) UCL	6.791
97.5% Chebyshev(Mean, Sd) UCL	7.562	99% Chebyshev(Mean, Sd) UCL	9.078

Suggested UCL to Use

95% Student's-t UCL	5.783
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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.

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 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	7.6500E-4	Minimum Non-Detect	0.0021
Maximum Detect	0.00279	Maximum Non-Detect	0.00211
Variance Detects	5.8312E-7	Percent Non-Detects	25%
Mean Detects	0.00149	SD Detects	7.6362E-4
Median Detects	0.00121	CV Detects	0.512
Skewness Detects	1.18	Kurtosis Detects	0.489
Mean of Logged Detects	-6.607	SD of Logged Detects	0.478

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	0.879	Shapiro Wilk GOF Test	
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.286	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	0.00143	KM Standard Error of Mean	2.6957E-4
KM SD	6.4948E-4	95% KM (BCA) UCL	0.00187
95% KM (t) UCL	0.00194	95% KM (Percentile Bootstrap) UCL	0.00186
95% KM (z) UCL	0.00187	95% KM Bootstrap t UCL	0.00271
90% KM Chebyshev UCL	0.00224	95% KM Chebyshev UCL	0.0026
97.5% KM Chebyshev UCL	0.00311	99% KM Chebyshev UCL	0.00411

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.324	Anderson-Darling GOF Test	
5% A-D Critical Value	0.698	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.256	Kolmogorov-Smirnov GOF	
5% K-S Critical Value	0.333	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)	5.194	k star (bias corrected MLE)	2.708
Theta hat (MLE)	2.8734E-4	Theta star (bias corrected MLE)	5.5110E-4
nu hat (MLE)	62.32	nu star (bias corrected)	32.5
Mean (detects)	0.00149		

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	7.6500E-4	Mean	0.00362
Maximum	0.01	Median	0.00164
SD	0.00399	CV	1.103
k hat (MLE)	1.17	k star (bias corrected MLE)	0.814
Theta hat (MLE)	0.00309	Theta star (bias corrected MLE)	0.00444
nu hat (MLE)	18.72	nu star (bias corrected)	13.03
Adjusted Level of Significance (β)	0.0195		
Approximate Chi Square Value (13.03, α)	5.913	Adjusted Chi Square Value (13.03, β)	4.757
95% Gamma Approximate UCL (use whe	0.00798	95% Gamma Adjusted UCL (use wher	0.00991

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.00143	SD (KM)	6.4948E-4
Variance (KM)	4.2183E-7	SE of Mean (KM)	2.6957E-4
k hat (KM)	4.83	k star (KM)	3.102
nu hat (KM)	77.29	nu star (KM)	49.64
theta hat (KM)	2.9551E-4	theta star (KM)	4.6012E-4
80% gamma percentile (KM)	0.00203	90% gamma percentile (KM)	0.00251
95% gamma percentile (KM)	0.00297	99% gamma percentile (KM)	0.00395

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (49.64, α)	34.46	Adjusted Chi Square Value (49.64, β)	31.29
95% Gamma Approximate KM-UCL (us	0.00206	95% Gamma Adjusted KM-UCL (use	0.00226

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.951	Shapiro Wilk GOF Test	
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.225	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	0.00142	Mean in Log Scale	-6.64
SD in Original Scale	6.6101E-4	SD in Log Scale	0.408
95% t UCL (assumes normality of ROS	0.00186	95% Percentile Bootstrap UCL	0.0018
95% BCA Bootstrap UCL	0.00194	95% Bootstrap t UCL	0.00274

95% H-UCL (Log ROS) 0.002

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-6.643	KM Geo Mean	0.0013
KM SD (logged)	0.415	95% Critical H Value (KM-Log)	2.217
KM Standard Error of Mean (logged)	0.177	95% H-UCL (KM -Log)	0.00201
KM SD (logged)	0.415	95% Critical H Value (KM-Log)	2.217
KM Standard Error of Mean (logged)	0.177		

DL/2 Statistics

DL/2 Normal

Mean in Original Scale	0.00138	DL/2 Log-Transformed	
SD in Original Scale	6.7674E-4	Mean in Log Scale	-6.669
95% t UCL (Assumes normality)	0.00184	SD in Log Scale	0.42
		95% H-Stat UCL	0.00197

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 0.00194

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.

Uranium-235/236

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	0.0572	Mean	0.0817
Maximum	0.112	Median	0.073
SD	0.0234	Std. Error of Mean	0.00829
Coefficient of Variation	0.287	Skewness	0.46

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	0.837	Shapiro Wilk GOF Test	
5% Shapiro Wilk Critical Value	0.818	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.231	Lilliefors GOF Test	
5% Lilliefors Critical Value	0.283	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	0.0974	95% Adjusted-CLT UCL (Chen-1995)	0.0968
		95% Modified-t UCL (Johnson-1978)	0.0976

Gamma GOF Test

A-D Test Statistic	0.59	Anderson-Darling Gamma GOF Test	
5% A-D Critical Value	0.716	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.225	Kolmogorov-Smirnov Gamma GOF Test	
5% K-S Critical Value	0.294	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	14.33	k star (bias corrected MLE)	9.038
Theta hat (MLE)	0.0057	Theta star (bias corrected MLE)	0.00904
nu hat (MLE)	229.2	nu star (bias corrected)	144.6
MLE Mean (bias corrected)	0.0817	MLE Sd (bias corrected)	0.0272
		Approximate Chi Square Value (0.05)	117.8
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	111.7

Assuming Gamma Distribution

95% Approximate Gamma UCL (use wh	0.1	95% Adjusted Gamma UCL (use wh	0.106
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Lognormal GOF Test

Shapiro Wilk Test Statistic	0.86	Shapiro Wilk Lognormal GOF Test	
5% Shapiro Wilk Critical Value	0.818	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.211	Lilliefors Lognormal GOF Test	
5% Lilliefors Critical Value	0.283	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-2.861	Mean of logged Data	-2.54
Maximum of Logged Data	-2.189	SD of logged Data	0.282

Assuming Lognormal Distribution

95% H-UCL	0.102	90% Chebyshev (MVUE) UCL	0.106
95% Chebyshev (MVUE) UCL	0.117	97.5% Chebyshev (MVUE) UCL	0.133
99% Chebyshev (MVUE) UCL	0.163		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.0953	95% Jackknife UCL	0.0974
95% Standard Bootstrap UCL	0.0948	95% Bootstrap-t UCL	0.0988
95% Hall's Bootstrap UCL	0.0917	95% Percentile Bootstrap UCL	0.0946
95% BCA Bootstrap UCL	0.0956		
90% Chebyshev(Mean, Sd) UCL	0.107	95% Chebyshev(Mean, Sd) UCL	0.118
97.5% Chebyshev(Mean, Sd) UCL	0.133	99% Chebyshev(Mean, Sd) UCL	0.164

Suggested UCL to Use

95% Student's-t UCL	0.0974
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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.