Groundwater BTV ProUCL Input and Output
<p>| Well  | Antimony, Dissolved (µg/L) | D_Antimony, Dissolved (µg/L) | Antimony, Total (µg/L) | D_Antimony, Total (µg/L) | Arsenic, Dissolved (µg/L) | D_Arsenic, Dissolved (µg/L) | Arsenic, Total (µg/L) | D_Arsenic, Total (µg/L) | Mercury, Dissolved (ng/L) | D_Mercury, Dissolved (ng/L) | Mercury, Total (1631 ng/L) | D_Mercury, Total (1631 ng/L) | Log_Antimony, Total (µg/L) | D_Log_Antimony, Total (µg/L) | Log_Arsenic, Total (µg/L) | D_Log_Arsenic, Total (µg/L) | Log_Mercury, Dissolved (ng/L) | D_Log_Mercury, Dissolved (ng/L) | Log_Mercury, Total (1631 ng/L) | D_Log_Mercury, Total (1631 ng/L) |
|-------|---------------------------|-------------------------------|------------------------|--------------------------|--------------------------|---------------------------|------------------------|--------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------|---------------------|---------------------|---------------------|
| MW29  | 1.568499982               | 1                            | 7.550000019            | 1                        | 0.873750019              | 1                          | 10.67500001            | 1                        | 0.989                      | 1                          | 1.790777231              | 1                          | 1.9782740345        | 1                          | 0.65051044            | 1                        | 1.306738074           | 1                        |
| MW31  | 0.027000001               | 1                            | 0.750000001            | 1                        | 0.099999999             | 1                          | 0.59999996         | 1                        | 0.146                      | 1                          | 0.266913894             | 1                          | 0.2453135610        | 1                          | 0.49568054            | 1                        | 2.014159878           | 1                        |
| MW40  | 7.46999993                | 1                            | 146.25                 | 1                        | 0.867499999             | 1                          | 79.67499995         | 1                        | 0.073125                   | 1                          | 0.872156289             | 1                          | 2.1593587587        | 1                          | 0.171548734           | 1                        | 1.901322072           | 1                        |
| MW42  | 250                        | 1                            | 440                    | 1                        | 69.75000001             | 1                          | 88.20000003         | 1                        | 0.26875                     | 1                          | 2.361278236             | 1                          | 2.6345452676        | 1                          | 1.83071895            | 1                        | 2.831274639           | 1                        |
| MW43  | 7.09999999                | 1                            | 194.5                  | 1                        | 2.607500003             | 1                          | 17.62625037         | 1                        | 0.069                      | 1                          | 0.811294543             | 1                          | 2.285859096         | 1                          | 0.46324215           | 1                        | 1.251900502           | 1                        |
| MW50  | 7.30000019                | 1                            | 490                    | 1                        | 14.82000002             | 1                          | 1.13000000          | 1                        | 0.56999996                 | 1                          | 0.855228781             | 1                          | 2.902190908        | 1                          | 1.170261721           | 1                        | 1.305107843           | 1                        |
| MW55  | 0.12                       | 1                            | 2.399999952            | 1                        | 0.349999999             | 0                          | 13.4999962          | 0                        | 0.15000062                 | 0                          | 0.88054664               | 1                          | 0.361278237        | 0                          | 0.455101961           | 0                        | 1.11805374            | 0                        |
| MW57  | 0.15000001                | 1                            | 2.5                    | 1                        | 13.6000004              | 1                          | 1.19000062          | 1                        | 0.15000062                 | 0                          | 0.829008724             | 0                          | 0.97400009         | 1                          | 1.13153821           | 0                        | 2.075456961           | 1                        |
| MW59  | 8.89999962                | 1                            | 78                     | 1                        | 3.71499991              | 0                          | 312                   | 1                        | 0.15000001                 | 0                          | 0.945898888             | 1                          | 1.85204603        | 0                          | 0.56958808            | 0                        | 2.494154954           | 1                        |</p>
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<th>Antimony, Dissolved (µg/L)</th>
<th>D_Antimony, Dissolved (µg/L)</th>
<th>Antimony, Total (µg/L)</th>
<th>D_Antimony, Total (µg/L)</th>
<th>Arsenic, Dissolved (µg/L)</th>
<th>D_Arsenic, Dissolved (µg/L)</th>
<th>Arsenic, Total (µg/L)</th>
<th>D_Arsenic, Total (µg/L)</th>
<th>Mercury, Dissolved (ng/L)</th>
<th>D_Mercury, Dissolved (ng/L)</th>
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<th>D_Mercury, Total (µg/L)</th>
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<th>D_Log_Antimony, Total (µg/L)</th>
<th>Log_Arsenic, Total (µg/L)</th>
<th>D_Log_Arsenic, Total (µg/L)</th>
<th>Log_Mercury, Total (ng/L)</th>
<th>D_Log_Mercury, Total (ng/L)</th>
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Outlier Tests for Selected Variables replacing nondetects with 1/2 the Detection Limit

User Selected Options
Date/Time of Computation ProUCL 5.16/2/2018 4:09:52 PM
From File BTVs for GW from Minerlized Areas near RDM 06022018_a.xls
Full Precision OFF

Dixon's Outlier Test for Antimony, Total
(µg/L)

Total N = 9
Number NDs = 0
Number Detects = 9
Number Data (n) = 9
10% critical value: 0.441
5% critical value: 0.512
1% critical value: 0.635
Note: NDs replaced by DL/2 in Outlier Test

1. Data Value 230 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.962

For 10% significance level, 230 is an outlier.
For 5% significance level, 230 is an outlier.
For 1% significance level, 230 is an outlier.

2. Data Value 0.129999995231628 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.002

For 10% significance level, 0.129999995231628 is not an outlier.
For 5% significance level, 0.129999995231628 is not an outlier.
For 1% significance level, 0.129999995231628 is not an outlier.
Q-Q Plot for Log Antimony, Total
(µg/L)
Reported values used for nondetects

Antimony, Total
(µg/L)
Number of Data = 9
Number of Non-Detects = 0
Number of Detects = 9
Distributed Mean = 29.23
Distributed Std. Dev = 75.30
Skewness (unbiased) = 50.36
Kurtosis (unbiased) = 23.23
Correlation, R = 0.955

Best Fit Line
**Dixon's Outlier Test for Log_Antimony, Total**
(
\(\mu g/L\))

Total \(N = 9\)
Number NDs = 0
Number Detects = 9
Number Data (\(n\)) = 9
10\% critical value: 0.441
5\% critical value: 0.512
1\% critical value: 0.635
Note: NDs replaced by DL/2 in Outlier Test

1. Data Value 2.36172783601759 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.443

**For 10\% significance level, 2.36172783601759 is an outlier.**
For 5\% significance level, 2.36172783601759 is not an outlier.
For 1\% significance level, 2.36172783601759 is not an outlier.

2. Data Value -0.886056663622992 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.034

**For 10\% significance level, -0.886056663622992 is not an outlier.**
For 5\% significance level, -0.886056663622992 is not an outlier.
For 1\% significance level, -0.886056663622992 is not an outlier.
Q-Q Plot for Arsenic, Total
(μg/L)
Reported values used for nondetects

Theoretical Quantiles (Standard Normal)
NDs Displayed with Inverted Triangle

Arsenic, Total (μg/L)
Number of Data = 9
Number of Nondetects = 0
Number of Detects = 9
Detected Mean = 157.2
Detected Sd = 187.1
Slope (displayed data) = 187.4
Intercept (displayed data) = 157.2
Correlation, R = 0.907

Best Fit Line
Outlier Tests for Selected Variables replacing nondetects with 1/2 the Detection Limit

User Selected Options

Date/Time of Computation       ProUCL 5.16/2/2018 4:18:13 PM
From File                     BTVs for GW from Minelized Areas near RDM 06022018_
Full Precision                OFF

**Dixon's Outlier Test for Arsenic, Total**
(µg/L)

Total N = 9
Number NDs = 0
Number Detects = 9
Number Data (n) = 9
10% critical value: 0.441
5% critical value: 0.512
1% critical value: 0.635
Note: NDs replaced by DL/2 in Outlier Test

1. Data Value 490 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.103

**For 10% significance level, 490 is not an outlier.**
**For 5% significance level, 490 is not an outlier.**
**For 1% significance level, 490 is not an outlier.**

2. Data Value 1.75999997369945 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.001

**For 10% significance level, 1.75999997369945 is not an outlier.**
**For 5% significance level, 1.75999997369945 is not an outlier.**
**For 1% significance level, 1.75999997369945 is not an outlier.**
Q-Q Plot for Log Arsenic, Total
(μg/L)
Reported values used for nondetects

Arsenic, Total
Number of Data = 9
Number of Non Detects = 0
Number of Detects = 8
Detectected Mean = 157.2
Detectected Std = 187.1
Slope (displayed data) = 167.4
Intercept (displayed data) = 157.2
Correlation, R = 0.907

Best Fit Line
Dixon's Outlier Test for Log_Arsenic, Total
(µg/L)

Total N = 9
Number NDs = 0
Number Detects = 9
Number Data (n) = 9
10% critical value: 0.441
5% critical value: 0.512
1% critical value: 0.635
Note: NDs replaced by DL/2 in Outlier Test

1. Data Value 2.69019608002851 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.020

For 10% significance level, 2.69019608002851 is not an outlier.
For 5% significance level, 2.69019608002851 is not an outlier.
For 1% significance level, 2.69019608002851 is not an outlier.

2. Data Value 0.245512661324273 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.048

For 10% significance level, 0.245512661324273 is not an outlier.
For 5% significance level, 0.245512661324273 is not an outlier.
For 1% significance level, 0.245512661324273 is not an outlier.
Mercury, Dissolved

Q-Q Plot for Mercury, Dissolved (ng/L)
Reported values used for nondetects

Mercury Dissolved (ng/L)
- Total Number of Data = 9
- Number of Non-Detects = 2
- Number of Detects = 7
- Detectable Mean = 18.28
- Detectable SD = 23.78
- Slope (displayed data) = 17.2
- Intercept (displayed data) = 12.34
- Correlation, R = 0.751

Best Fit Line

Mercury Dissolved (ng/L)
Theoretical Quantiles (Standard Normal)
NDs Displayed with Inverted Triangle
Outlier Tests for Selected Variables replacing nondetects with 1/2 the Detection Limit

User Selected Options
Date/Time of Computation   ProUCL 5.16/2/2018 4:26:31 PM
From File   BTVs for GW from Minerlized Areas near RDM 06022018_
Full Precision   OFF

Dixon's Outlier Test for Mercury, Dissolved (ng/L)

Total N = 9
Number NDs = 2
Number Detects = 7
Number Data (n) = 9
10% critical value: 0.441
5% critical value: 0.512
1% critical value: 0.635
Note: NDs replaced by DL/2 in Outlier Test

1. Data Value 67.7200000882149 is a Potential Outlier (Upper Tail)?
Test Statistic: 0.789
For 10% significance level, 67.7200000882149 is an outlier.
For 5% significance level, 67.7200000882149 is an outlier.
For 1% significance level, 67.7200000882149 is an outlier.

2. Data Value 0.174999997019768 is a Potential Outlier (Lower Tail)?
Test Statistic: 0.034
For 10% significance level, 0.174999997019768 is not an outlier.
For 5% significance level, 0.174999997019768 is not an outlier.
For 1% significance level, 0.174999997019768 is not an outlier.
Dixon's Outlier Test for Log_Mercury, Dissolved (ng/L)

Total N = 9
Number NDs = 2
Number Detects = 7
Number Data (n) = 9
10% critical value: 0.441
5% critical value: 0.512
1% critical value: 0.635
Note: NDs replaced by DL/2 in Outlier Test

1. Data Value 1.83071695000263 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.329

For 10% significance level, 1.83071695000263 is not an outlier.
For 5% significance level, 1.83071695000263 is not an outlier.
For 1% significance level, 1.83071695000263 is not an outlier.

2. Data Value -0.227965981522857 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.037

For 10% significance level, -0.227965981522857 is not an outlier.
For 5% significance level, -0.227965981522857 is not an outlier.
For 1% significance level, -0.227965981522857 is not an outlier.
Mercury, Total (Method 1631)

Q-Q Plot for Mercury, Total (1631) (ng/L)
Reported values used for nondetects

Mercury, Total (1631) (ng/L)
- Total Number of Data = 9
- Number of Non-Detects = 7
- Number of Detects = 0
- Detected Mean = 315.5
- Detected SD = 332.8
- Slope (displayed data) = 0.469
- Intercept (displayed data) = -281.5
- Correlation, R = 0.952

Theoretical Quantiles (Standard Normal)
NDs Displayed with Inverted Triangle

Mercury Total (1631) (ng/L)
Outlier Tests for Selected Variables replacing nondetects with 1/2 the Detection Limit
User Selected Options
Date/Time of Computation       ProUCL 5.16/2/2018 4:33:27 PM
From File                     BTVs for GW from Mineralized Areas near RDM 06022018_
Full Precision                OFF

**Dixon's Outlier Test for Mercury, Total (1631) (ng/L)**

Total N = 9
Number NDs = 1
Number Detects = 8
Number Data (n) = 9
10% critical value: 0.441
5% critical value: 0.512
1% critical value: 0.635
Note: NDs replaced by DL/2 in Outlier Test

1. **Data Value 1130 is a Potential Outlier (Upper Tail)?**
   
   Test Statistic: 0.404
   
   **For 10% significance level, 1130 is not an outlier.**
   **For 5% significance level, 1130 is not an outlier.**
   **For 1% significance level, 1130 is not an outlier.**

2. **Data Value 6.57499980926515 is a Potential Outlier (Lower Tail)?**
   
   Test Statistic: 0.017
   
   **For 10% significance level, 6.57499980926515 is not an outlier.**
   **For 5% significance level, 6.57499980926515 is not an outlier.**
   **For 1% significance level, 6.57499980926515 is not an outlier.**
Dixon's Outlier Test for Log_Mercury, Total (1631) (ng/L)

Total N = 9
Number NDs = 1
Number Detects = 8
Number Data (n) = 9
10% critical value: 0.441
5% critical value: 0.512
1% critical value: 0.635
Note: NDs replaced by DL/2 in Outlier Test

1. Data Value 3.05307844348342 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.122

For 10% significance level, 3.05307844348342 is not an outlier.
For 5% significance level, 3.05307844348342 is not an outlier.
For 1% significance level, 3.05307844348342 is not an outlier.

2. Data Value 0.559462870113642 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.304

For 10% significance level, 0.559462870113642 is not an outlier.
For 5% significance level, 0.559462870113642 is not an outlier.
For 1% significance level, 0.559462870113642 is not an outlier.
ProUCL Output - Complete Dataset

Background Statistics for Data Sets with Non-Detects

User Selected Options
Date/Time of Computation   ProUCL 5.1/2/2018 4:43:36 PM
From File   BTVs for GW from Minerlized Areas near RDM 06022018_a.xls
Full Precision   OFF
Confidence Coefficient   95%
Coverage   95%
Different or Future K Observations   1
Number of Bootstrap Operations   2000

Antimony, Dissolved (µg/L)

General Statistics
Total Number of Observations 2 Number of Distinct Observations 2
Minimum 0.027 First Quartile 0.412
Second Largest 0.027 Median 0.798
Maximum 1.568 Third Quartile 1.183
Mean 0.798 SD 1.09
Coefficient of Variation 1.366 Skewness N/A

Warning: This data set only has 2 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Antimony, Dissolved (µg/L) was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Antimony, Total
(µg/L)

General Statistics
Total Number of Observations 9 Number of Distinct Observations 9
Minimum 0.13 First Quartile 0.505
Second Largest 8.9 Median 7.1
Maximum 230 Third Quartile 7.45
Mean 29.23 SD 75.38
Coefficient of Variation 2.579 Skewness 2.987
Mean of logged Data 1.041 SD of logged Data 2.367

Critical Values for Background Threshold Values (BTVs)
Tolerance Factor K (For UTL) 3.031 d2max (for USL) 2.11

Normal GOF Test
Shapiro Wilk Test Statistic 0.432 Shapiro Wilk GOF Test
5% Shapiro Wilk Critical Value 0.829 Data Not Normal at 5% Significance Level
Lilliefors Test Statistic 0.495 Lilliefors GOF Test
5% Lilliefors Critical Value 0.274 Data Not Normal at 5% Significance Level
Data Not Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution
95% UTL with 95% Coverage 257.7 90% Percentile (z) 125.8
95% UPL (t) 177 95% Percentile (z) 153.2
95% USL 188.2 99% Percentile (z) 204.6
### Gamma GOF Test

- **A-D Test Statistic:** 0.911 Anderson-Darling Gamma GOF Test
- **5% A-D Critical Value:** 0.809 Data Not Gamma Distributed at 5% Significance Level
- **K-S Test Statistic:** 0.354 Kolmogorov-Smirnov Gamma GOF Test
- **5% K-S Critical Value:** 0.302 Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

### Gamma Statistics

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### Background Statistics Assuming Gamma Distribution

- **95% Wilson Hilferty (WH) Approx. Gamma UPL:** 144.5 90% Percentile 87.13
- **95% Hawkins Wixley (HW) Approx. Gamma UPL:** 147.6 95% Percentile 138
- **95% WH Approx. Gamma UTL with 95% Coverage:** 355.4 99% Percentile 271.8
- **95% HW Approx. Gamma UTL with 95% Coverage:** 431.2
- **95% WH USL:** 166.7 95% HW USL 174.6

### Lognormal GOF Test

- **Shapiro Wilk Test Statistic:** 0.916 Shapiro Wilk Lognormal GOF Test
- **5% Shapiro Wilk Critical Value:** 0.829 Data appear Lognormal at 5% Significance Level
- **Lilliefors Test Statistic:** 0.207 Lilliefors Lognormal GOF Test
- **5% Lilliefors Critical Value:** 0.274 Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

### Background Statistics assuming Lognormal Distribution

- **95% UTL with 95% Coverage:** 3698 90% Percentile (z) 58.82
- **95% UPL (t):** 293.1 95% Percentile (z) 139
- **95% USL:** 417.5 99% Percentile (z) 697.5

### Nonparametric Distribution Free Background Statistics

Data appear Lognormal at 5% Significance Level

### Nonparametric Upper Limits for Background Threshold Values

<table>
<thead>
<tr>
<th>Order of Statistic, r</th>
<th>9 95% UTL with 95% Coverage</th>
<th>230</th>
</tr>
</thead>
<tbody>
<tr>
<td>Approx, f used to compute achieved CC</td>
<td>0.474 Approximate Actual Confidence Coefficient achieved by U</td>
<td>0.37</td>
</tr>
<tr>
<td>Approximate Sample Size needed to achieve specified CC</td>
<td>59</td>
<td></td>
</tr>
<tr>
<td>95% Percentile Bootstrap UTL with 95% Coverage</td>
<td>230 95% BCA Bootstrap UTL with 95% Coverage</td>
<td>230</td>
</tr>
<tr>
<td>95% UPL</td>
<td>230 90% Percentile</td>
<td>53.12</td>
</tr>
<tr>
<td>90% Chebyshev UPL</td>
<td>267.6 95% Percentile</td>
<td>141.6</td>
</tr>
<tr>
<td>95% Chebyshev UPL</td>
<td>375.6 99% Percentile</td>
<td>212.3</td>
</tr>
<tr>
<td>95% USL</td>
<td>230</td>
<td></td>
</tr>
</tbody>
</table>

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20. Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers and consists of observations collected from clean unimpacted locations. The use of USL tends to provide a balance between false positives and false negatives provided the data represents a background data set and when many onsite observations need to be compared with the BTV.
### Arsenic, Dissolved (µg/L)

**General Statistics**
- Total Number of Observations: 2
- Number of Missing Observations: 0
- Number of Distinct Observations: 2
- Number of Detects: 1
- Number of Non-Detects: 1
- Number of Distinct Detects: 1
- Number of Distinct Non-Detects: 1
- Minimum Detect: 25.55
- Maximum Detect: 25.55
- Minimum Non-Detect: 0.05
- Maximum Non-Detect: 0.05
- Variance Detected: N/A
- Percent Non-Detects: 50%
- Mean Detected: 25.55
- SD Detected: N/A
- Mean of Detected Logged Data: 3.241
- SD of Detected Logged Data: N/A

**Warning:** This data set only has 2 observations!

**Data set is too small to compute reliable and meaningful statistics and estimates!**

The data set for variable Arsenic, Dissolved (µg/L) was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

### Arsenic, Total (µg/L)

**General Statistics**
- Total Number of Observations: 9
- Number of Distinct Observations: 9
- Minimum: 1.76
- First Quartile: 2.5
- Second Largest: 440
- Median: 78
- Maximum: 490
- Third Quartile: 194.5
- Mean: 157.2
- SD: 187.1
- Coefficient of Variation: 1.19
- Skewness: 1.151
- Mean of logged Data: 3.7
- SD of logged Data: 2.303

**Critical Values for Background Threshold Values (BTVs)**
- Tolerance Factor K (For UTL): 3.031
- d2max (for USL): 2.11

**Normal GOF Test**
- Shapiro Wilk Test Statistic: 0.808
- Shapiro Wilk GOF Test: Data Not Normal at 5% Significance Level
- 5% Shapiro Wilk Critical Value: 0.829
- Lilliefors Test Statistic: 0.22
- Lilliefors GOF Test: Data appear Normal at 5% Significance Level
- 5% Lilliefors Critical Value: 0.274

**Data appear Approximate Normal at 5% Significance Level**

**Background Statistics Assuming Normal Distribution**
- 95% UTL with 95% Coverage: 724.4
- 95% Percentile (z): 397
- 95% UPL (t): 524
- 95% Percentile (z): 465
- 95% USL: 552
- 99% Percentile (z): 592.5

**Gamma GOF Test**
- A-D Test Statistic: 0.448
- Anderson-Darling Gamma GOF Test: Detected data appear Gamma Distributed at 5% Significance Level
- 5% A-D Critical Value: 0.776
- Detected data appear Gamma Distributed at 5% Significance Level
- K-S Test Statistic: 0.221
- Kolmogorov-Smirnov Gamma GOF Test: Detected data appear Gamma Distributed at 5% Significance Level
- 5% K-S Critical Value: 0.295
- Detected data appear Gamma Distributed at 5% Significance Level
Gamma Statistics

\[ k \hat{\text{ (MLE) }} = 0.472 \quad k \star \text{ (bias corrected MLE) } = 0.389 \]
\[ \Theta \hat{\text{ (MLE) }} = 333.1 \quad \Theta \star \text{ (bias corrected MLE) } = 404.5 \]
\[ \nu \hat{\text{ (MLE) }} = 8.496 \quad \nu \star \text{ (bias corrected) } = 6.997 \]
\[ \text{MLE Mean (bias corrected) } = 157.2 \quad \text{MLE Sd (bias corrected) } = 252.2 \]

Background Statistics Assuming Gamma Distribution

- 95% Wilson Hilferty (WH) Approx. Gamma UPL: 828.7, 90% Percentile: 446.3
- 95% Hawkins Wixley (HW) Approx. Gamma UPL: 997.1, 95% Percentile: 659.7
- 95% WH Approx. Gamma UTL with 95% Coverage: 1807, 99% Percentile: 1159
- 95% HW Approx. Gamma UTL with 95% Coverage: 2567
- 95% WH UPL: 936, 95% HW UPL: 1154

Lognormal GOF Test

- Shapiro Wilk Test Statistic: 0.839
- 5% Shapiro Wilk Critical Value: 0.829
- Data appear Lognormal at 5% Significance Level

- Lilliefors Test Statistic: 0.234
- 5% Lilliefors Critical Value: 0.274
- Data appear Lognormal at 5% Significance Level

Background Statistics assuming Lognormal Distribution

- 95% UTL with 95% Coverage: 43433, 90% Percentile (z): 773.3
- 95% UPL (t): 3689, 95% Percentile (z): 1785
- 95% USL: 5204, 99% Percentile (z): 8574

Nonparametric Distribution Free Background Statistics

Data appear Approximate Normal at 5% Significance Level

Nonparametric Upper Limits for Background Threshold Values

- Order of Statistic, r = 9
- Approx. f used to compute achieved CC = 0.474
- 95% Percentile Bootstrap UTL with 95% Coverage = 490, 95% BCA Bootstrap UTL with 95% Coverage = 490
- 95% UPL = 490, 90% Percentile = 450
- 90% Chebyshev UPL = 748.9, 95% Percentile = 470
- 95% Chebyshev UPL = 1017, 99% Percentile = 486
- 95% USL = 490

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20. Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers and consists of observations collected from clean unimpacted locations. The use of USL tends to provide a balance between false positives and false negatives provided the data represents a background data set and when many onsite observations need to be compared with the BTV.
Mercury, Dissolved (ng/L)

General Statistics
Total Number of Observations 9  Number of Missing Observations 0
Number of Distinct Observations 9
Number of Detects 7  Number of Non-Detects 2
Number of Distinct Detects 7  Number of Distinct Non-Detects 2
Minimum Detect 0.667  Minimum Non-Detect 0.35
Maximum Detect 67.72  Maximum Non-Detect 3.715
Variance Detected 565.4  Percent Non-Detects 22.22%
Mean Detected 15.28  SD Detected 23.78
Mean of Detected Logged Data 1.815  SD of Detected Logged Data 1.494

Critical Values for Background Threshold Values (BTVs)
Tolerance Factor K (For UTL) 3.031  d2max (for USL) 2.11

Normal GOF Test on Detects Only
Shapiro Wilk Test Statistic 0.65  Shapiro Wilk GOF Test
5% Shapiro Wilk Critical Value 0.803  Data Not Normal at 5% Significance Level
Lilliefors Test Statistic 0.365  Lilliefors GOF Test
5% Lilliefors Critical Value 0.304  Data Not Normal at 5% Significance Level

Kaplan Meier (KM) Background Statistics Assuming Normal Distribution
KM Mean 12.11  KM SD 20.31
95% UTL 95% Coverage 73.66  95% KM UPL (t) 51.91
90% KM Percentile (z) 38.13  95% KM Percentile (z) 45.51
99% KM Percentile (z) 59.35  95% KM USL 54.95

DL/2 Substitution Background Statistics Assuming Normal Distribution
Mean 12.11  SD 21.54
95% UTL 95% Coverage 77.39  95% UPL (t) 54.32
90% Percentile (z) 39.71  95% Percentile (z) 47.53
99% Percentile (z) 62.21  95% USL 57.54

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

Gamma GOF Tests on Detected Observations Only
A-D Test Statistic 0.4  Anderson-Darling GOF Test
5% A-D Critical Value 0.741  Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic 0.226  Kolmogorov-Smirnov GOF
5% K-S Critical Value 0.324  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) 0.667  k star (bias corrected MLE) 0.476
Theta hat (MLE) 22.9  Theta star (bias corrected MLE) 32.07
nu hat (MLE) 9.34  nu star (bias corrected) 6.671
MLE Mean (bias corrected) 15.28
MLE Sd (bias corrected) 22.14  95% Percentile of Chi-square (2kstar) 3.724
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

<table>
<thead>
<tr>
<th>Minimum</th>
<th>0.01 Mean</th>
<th>11.89</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum</td>
<td>67.72 Median</td>
<td>3.095</td>
</tr>
<tr>
<td>SD</td>
<td>21.67 CV</td>
<td>1.823</td>
</tr>
<tr>
<td>k hat (MLE)</td>
<td>0.326 k star (bias corrected MLE)</td>
<td>0.291</td>
</tr>
<tr>
<td>Theta hat (MLE)</td>
<td>36.47 Theta star (bias corrected MLE)</td>
<td>40.8</td>
</tr>
<tr>
<td>nu hat (MLE)</td>
<td>5.866 nu star (bias corrected)</td>
<td>5.244</td>
</tr>
<tr>
<td>MLE Mean (bias corrected)</td>
<td>11.89 MLE Sd (bias corrected)</td>
<td>22.02</td>
</tr>
<tr>
<td>95% Percentile of Chisquare (2kstar)</td>
<td>2.691 90% Percentile</td>
<td>35.18</td>
</tr>
<tr>
<td>95% Percentile</td>
<td>54.89 99% Percentile</td>
<td>106.3</td>
</tr>
</tbody>
</table>

The following statistics are computed using Gamma ROS Statistics on Imputed Data
Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods

<table>
<thead>
<tr>
<th>WH</th>
<th>HW</th>
<th>WH</th>
<th>HW</th>
</tr>
</thead>
<tbody>
<tr>
<td>95% Approx. Gamma UTL with 95% Coverage</td>
<td>151.5</td>
<td>219.9</td>
<td>95% Approx. Gamma UPL</td>
</tr>
<tr>
<td>95% Gamma USL</td>
<td>74.47</td>
<td>91.99</td>
<td></td>
</tr>
</tbody>
</table>

Estimates of Gamma Parameters using KM Estimates
Mean (KM) 12.11 SD (KM) 20.31
Variance (KM) 412.4 SE of Mean (KM) 7.313
k hat (KM) 0.356 k star (KM) 0.311
nu hat (KM) 6.402 nu star (KM) 5.601
theta hat (KM) 34.05 theta star (KM) 38.92
80% gamma percentile (KM) 18.73 90% gamma percentile (KM) 35.56
95% gamma percentile (KM) 54.75 99% gamma percentile (KM) 104.4

The following statistics are computed using gamma distribution and KM estimates
Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods

<table>
<thead>
<tr>
<th>WH</th>
<th>HW</th>
<th>WH</th>
<th>HW</th>
</tr>
</thead>
<tbody>
<tr>
<td>95% Approx. Gamma UTL with 95% Coverage</td>
<td>110.9</td>
<td>132</td>
<td>95% Approx. Gamma UPL</td>
</tr>
<tr>
<td>95% KM Gamma Percentile</td>
<td>40.15</td>
<td>40.81</td>
<td>95% KM USL (Lognormal)</td>
</tr>
</tbody>
</table>

Lognormal GOF Test on Detected Observations Only
Shapiro Wilk Test Statistic 0.974 Shapiro Wilk GOF Test
5% Shapiro Wilk Critical Value 0.803 Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic 0.155 Lilliefors GOF Test
5% Lilliefors Critical Value 0.304 Detected Data appear Lognormal at 5% Significance Level
Detected Data appear Lognormal at 5% Significance Level

Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects
Mean in Original Scale 12.03 Mean in Log Scale 1.234
SD in Original Scale 21.58 SD in Log Scale 1.788
95% UTL95% Coverage 774.3 95% BCA UTL95% Coverage 67.72
95% Bootstrap (%) UTL95% Coverage 67.72 95% UPL (t) 114.2
90% Percentile (z) 33.94 95% Percentile (z) 64.98
99% Percentile (z) 219.7 95% USL 149.1

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution
KM Mean of Logged Data 1.312 95% KM UTL (Lognormal)95% Coverage 468
KM SD of Logged Data 1.596 95% KM UPL (Lognormal) 84.77
95% KM Percentile Lognormal (z) 51.26 95% KM USL (Lognormal) 107.6
Background DL/2 Statistics Assuming Lognormal Distribution

Mean in Original Scale 12.11 Mean in Log Scale 1.286
SD in Original Scale 21.54 SD in Log Scale 1.767
95% UTL 95% Coverage 766.3 95% UPL (t) 115.5
90% Percentile (z) 34.84 95% Percentile (z) 66.19
99% Percentile (z) 220.7 95% USL 150.4

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

Nonparametric Distribution Free Background Statistics

Data appear to follow a discernible distribution at 5% significance level.

Nonparametric Upper Limits for BTVs (no distinction made between detects and nondetects)

Order of Statistic, r 9 95% UTL with 95% Coverage 67.72
Approx, f used to compute achieved CC 0.474 Approximate Actual Confidence Coefficient achieved by U 0.37
Approximate Sample Size needed to achieve specified CC 59 95% UPL 67.72
95% USL 67.72 95% KM Chebyshev UPL 105.4

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20. Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers and consists of observations collected from clean unimpacted locations.

The use of USL tends to provide a balance between false positives and false negatives provided the data represents a background data set and when many onsite observations need to be compared with the BTV.

Mercury, Total (1631) (ng/L)

General Statistics

Total Number of Observations 9 Number of Missing Observations 0
Number of Distinct Observations 9
Number of Detects 8 Number of Non-Detects 1
Number of Distinct Detects 8 Number of Distinct Non-Detects 1
Minimum Detect 17.83 Minimum Non-Detect 13.15
Maximum Detect 1130 Maximum Non-Detect 13.15
Variance Detected 154309 Percent Non-Detects 11.11%
Mean Detected 315.5 SD Detected 392.8
Mean of Detected Logged Data 5.045 SD of Detected Logged Data 1.331

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL) 3.031 d2max (for USL) 2.11

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic 0.758 Shapiro Wilk GOF Test
5% Shapiro Wilk Critical Value 0.818 Data Not Normal at 5% Significance Level
Lilliefors Test Statistic 0.317 Lilliefors GOF Test
5% Lilliefors Critical Value 0.283 Data Not Normal at 5% Significance Level
Data Not Normal at 5% Significance Level

Kaplan Meier (KM) Background Statistics Assuming Normal Distribution

KM Mean 281.9 KM SD 359.2
95% UTL 95% Coverage 1371 95% KM UPL (t) 986
90% KM Percentile (z) 742.2 95% KM Percentile (z) 872.7
99% KM Percentile (z) 1118 95% KM USL 1040

DL/2 Substitution Background Statistics Assuming Normal Distribution

Mean 281.1 SD 381.6
95% UTL 95% Coverage 1438 95% UPL (t) 1029
90% Percentile (z) 770.2 95% Percentile (z) 908.8
99% Percentile (z) 1169 95% USL 1086

DL/2 is not a recommended method. DL/2 provided for comparisons and historical reasons.
Gamma GOF Tests on Detected Observations Only

<table>
<thead>
<tr>
<th>Test Statistic</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-D Test Statistic</td>
<td>0.441</td>
<td>Anderson-Darling GOF Test</td>
</tr>
<tr>
<td>5% A-D Critical Value</td>
<td>0.742</td>
<td>Detected data appear Gamma Distributed at 5% Significance Level</td>
</tr>
<tr>
<td>K-S Test Statistic</td>
<td>0.272</td>
<td>Kolmogorov-Smirnov GOF</td>
</tr>
<tr>
<td>5% K-S Critical Value</td>
<td>0.303</td>
<td>Detected data appear Gamma Distributed at 5% Significance Level</td>
</tr>
</tbody>
</table>

**Detected data appear Gamma Distributed at 5% Significance Level**

Gamma Statistics on Detected Data Only

- $k$ hat (MLE): 0.833
- $k$ star (bias corrected MLE): 0.604
- Theta hat (MLE): 378.7
- Theta star (bias corrected MLE): 522.3
- nu hat (MLE): 13.33
- nu star (bias corrected): 9.664
- MLE Mean (bias corrected): 315.5
- MLE Sd (bias corrected): 405.9
- 95% Percentile of Chi-square (2$k$star): 4.336

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 $k$star 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: 0.01
Maximum: 1130
SD: 382.2

- k hat (MLE): 0.396
- k star (bias corrected MLE): 0.338
- Theta hat (MLE): 707.7
- Theta star (bias corrected MLE): 829
- nu hat (MLE): 7.132
- nu star (bias corrected): 6.088
- MLE Mean (bias corrected): 280.4
- MLE Sd (bias corrected): 482.2
- 95% Percentile of Chi-square (2$k$star): 2.975
- 95% Percentile: 813.9
- 99% Percentile: 2308

The following statistics are computed using Gamma ROS Statistics on Imputed Data

Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods

<table>
<thead>
<tr>
<th>WH</th>
<th>HW</th>
</tr>
</thead>
<tbody>
<tr>
<td>95% Approx. Gamma UTL with 95% Coverage</td>
<td>3098</td>
</tr>
<tr>
<td>95% Gamma USL</td>
<td>1433</td>
</tr>
<tr>
<td>95% Gamma USL</td>
<td>1616</td>
</tr>
</tbody>
</table>

Estimates of Gamma Parameters using KM Estimates

- Mean (KM): 281.9
- SD (KM): 359.2
- Variance (KM): 129044
- k hat (KM): 0.616
- k star (KM): 0.485
- nu hat (KM): 11.08
- nu star (KM): 8.722
- theta hat (KM): 457.8
- theta star (KM): 581.7
- 80% gamma percentile (KM): 462.2
- 90% gamma percentile (KM): 767.6
- 95% gamma percentile (KM): 1903

The following statistics are computed using gamma distribution and KM estimates

Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods

<table>
<thead>
<tr>
<th>WH</th>
<th>HW</th>
</tr>
</thead>
<tbody>
<tr>
<td>95% Approx. Gamma UTL with 95% Coverage</td>
<td>2304</td>
</tr>
<tr>
<td>95% KM Gamma Percentile</td>
<td>903.6</td>
</tr>
<tr>
<td>95% Gamma UTL</td>
<td>1149</td>
</tr>
<tr>
<td>95% Gamma USL</td>
<td>1279</td>
</tr>
</tbody>
</table>

Lognormal GOF Test on Detected Observations Only

<table>
<thead>
<tr>
<th>Test Statistic</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shapiro Wilk Test Statistic</td>
<td>0.95</td>
<td>Shapiro Wilk GOF Test</td>
</tr>
<tr>
<td>5% Shapiro Wilk Critical Value</td>
<td>0.818</td>
<td>Detected Data appear Lognormal at 5% Significance Level</td>
</tr>
<tr>
<td>Lilliefors Test Statistic</td>
<td>0.204</td>
<td>Lilliefors GOF Test</td>
</tr>
<tr>
<td>5% Lilliefors Critical Value</td>
<td>0.283</td>
<td>Detected Data appear Lognormal at 5% Significance Level</td>
</tr>
</tbody>
</table>

**Detected data appear Lognormal at 5% Significance Level**
Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects

Mean in Original Scale 281.1  Mean in Log Scale 4.683
SD in Original Scale 381.7  SD in Log Scale 1.653
95% UTL 95% Coverage 16189 95% BCA UTL 95% Coverage 1130
95% Bootstrap (%) UTL 95% Coverage 1130 95% UPL (t) 2759
90% Percentile (z) 898.8 95% Percentile (z) 1638
99% Percentile (z) 5052 95% USL 3531

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean of Logged Data 4.771 95% KM UTL (Lognormal) 95% Coverage 8407
KM SD of Logged Data 1.407 95% KM UPL (Lognormal) 1863
95% KM Percentile Lognormal (z) 1195 95% KM USL (Lognormal) 2299

Background DL/2 Statistics Assuming Lognormal Distribution

Mean in Original Scale 281.1  Mean in Log Scale 4.694
SD in Original Scale 381.6  SD in Log Scale 1.632
95% UTL 95% Coverage 15357 95% UPL (t) 2676
90% Percentile (z) 884.4 95% Percentile (z) 1600
99% Percentile (z) 4864 95% USL 3415

DL/2 is not a Recommended Method. DL/2 provided for comparisons and historical reasons.

Nonparametric Distribution Free Background Statistics

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

Nonparametric Upper Limits for BTVs (no distinction made between detects and nondetects)

Order of Statistic, r 9 95% UTL with 95% Coverage 1130
Approx, f used to compute achieved CC 0.474 Approximate Actual Confidence Coefficient achieved by U 0.37
Approximate Sample Size needed to achieve specified CC 59 95% UPL 1130
95% USL 1130 95% KM Chebyshev UPL 1932

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20. Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers and consists of observations collected from clean unimpacted locations.

The use of USL tends to provide a balance between false positives and false negatives provided the data represents a background data set and when many onsite observations need to be compared with the BTV.

Mercury, Total (7470) (µg/L)

General Statistics

Total Number of Observations 9  Number of Missing Observations 0
Number of Distinct Observations 7
Number of Detects 6  Number of Non-Detects 3
Number of Distinct Detects 6  Number of Distinct Non-Detects 1
Minimum Detect 0.069 Minimum Non-Detect 0.15
Maximum Detect 0.57 Maximum Non-Detect 0.15
Variance Detected 0.0376 Percent Non-Detects 33.33%
Mean Detected 0.203 SD Detected 0.194
Mean of Detected Logged Data -1.91 SD of Detected Logged Data 0.824

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL) 3.031 d2max (for USL) 2.11

Normal GOF Test on Detects Only
Shapiro Wilk Test Statistic 0.765 Shapiro Wilk GOF Test
5% Shapiro Wilk Critical Value 0.788 Data Not Normal at 5% Significance Level
Lilliefors Test Statistic 0.293 Lilliefors GOF Test
5% Lilliefors Critical Value 0.325 Detected Data appear Normal at 5% Significance Level
Detected Data appear Approximate Normal at 5% Significance Level

Kaplan Meier (KM) Background Statistics Assuming Normal Distribution

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>KM Mean</td>
<td>0.167</td>
<td>0.154</td>
</tr>
<tr>
<td>95% UTL 95% Coverage</td>
<td>0.634</td>
<td>0.469</td>
</tr>
<tr>
<td>90% KM Percentile (z)</td>
<td>0.364</td>
<td>0.42</td>
</tr>
<tr>
<td>99% KM Percentile (z)</td>
<td>0.525</td>
<td>0.492</td>
</tr>
</tbody>
</table>

DL/2 Substitution Background Statistics Assuming Normal Distribution

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>0.16</td>
</tr>
<tr>
<td>95% UTL 95% Coverage</td>
<td>0.663</td>
</tr>
<tr>
<td>90% Percentile (z)</td>
<td>0.373</td>
</tr>
<tr>
<td>99% Percentile (z)</td>
<td>0.546</td>
</tr>
</tbody>
</table>

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

Gamma GOF Tests on Detected Observations Only

<table>
<thead>
<tr>
<th>Test Type</th>
<th>Statistic</th>
<th>Critical Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-D Test</td>
<td>0.462</td>
<td>0.706</td>
<td>Detected data appear Gamma Distributed at 5% Significance Level</td>
</tr>
<tr>
<td>K-S Test</td>
<td>0.244</td>
<td>0.337</td>
<td>Detected data appear Gamma Distributed at 5% Significance Level</td>
</tr>
</tbody>
</table>

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>k hat (MLE)</td>
<td>1.744</td>
<td>0.983</td>
</tr>
<tr>
<td>Theta hat (MLE)</td>
<td>0.116</td>
<td>0.206</td>
</tr>
<tr>
<td>nu hat (MLE)</td>
<td>20.92</td>
<td>11.79</td>
</tr>
<tr>
<td>MLE Mean (bias corrected)</td>
<td>0.203</td>
<td></td>
</tr>
<tr>
<td>MLE Sd (bias corrected)</td>
<td>0.204</td>
<td>5.925</td>
</tr>
</tbody>
</table>

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     | 0.0225 | 0.166 |
Maximum     | 0.57   | 0.0989|
SD          | 0.167  | 1.002 |

The following statistics are computed using Gamma ROS Statistics on Imputed Data

Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods

<table>
<thead>
<tr>
<th>Method</th>
<th>WH</th>
<th>HW</th>
</tr>
</thead>
<tbody>
<tr>
<td>95% Approx. Gamma UTL with 95% Coverage</td>
<td>0.951</td>
<td>1.054</td>
</tr>
<tr>
<td>95% Gamma USL</td>
<td>0.59</td>
<td>0.617</td>
</tr>
</tbody>
</table>

Estimates of Gamma Parameters using KM Estimates

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean (KM)</td>
<td>0.167</td>
<td>0.154</td>
</tr>
<tr>
<td>Variance (KM)</td>
<td>0.0237</td>
<td>0.0568</td>
</tr>
<tr>
<td>k hat (KM)</td>
<td>1.173</td>
<td>0.856</td>
</tr>
<tr>
<td>nu hat (KM)</td>
<td>21.12</td>
<td>15.41</td>
</tr>
<tr>
<td>theta hat (KM)</td>
<td>0.142</td>
<td>0.195</td>
</tr>
<tr>
<td>80% gamma percentile</td>
<td>0.271</td>
<td>0.399</td>
</tr>
<tr>
<td>95% gamma percentile</td>
<td>0.528</td>
<td>0.831</td>
</tr>
</tbody>
</table>
The following statistics are computed using gamma distribution and KM estimates

<table>
<thead>
<tr>
<th>Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods</th>
<th>WH</th>
<th>HW</th>
<th>WH</th>
<th>HW</th>
</tr>
</thead>
<tbody>
<tr>
<td>95% Approx. Gamma UTL with 95% Coverage</td>
<td>0.762</td>
<td>0.797</td>
<td>95% Approx. Gamma UPL</td>
<td>0.461</td>
</tr>
<tr>
<td>95% KM Gamma Percentile</td>
<td>0.391</td>
<td>0.388</td>
<td>95% Gamma USL</td>
<td>0.498</td>
</tr>
</tbody>
</table>

Lognormal GOF Test on Detected Observations Only

- Shapiro Wilk Test Statistic: 0.9
- 5% Shapiro Wilk Critical Value: 0.788
- Lilliefors Test Statistic: 0.193
- 5% Lilliefors Critical Value: 0.325

Detected Data appear Lognormal at 5% Significance Level

Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects

<table>
<thead>
<tr>
<th>Mean in Original Scale</th>
<th>Mean in Log Scale</th>
<th>95% UTL95% Coverage</th>
<th>95% Bootstrap (%) UTL95% Coverage</th>
<th>95% UPL (t)</th>
<th>90% Percentile (z)</th>
<th>99% Percentile (z)</th>
<th>95% USL</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.169</td>
<td>-2.057</td>
<td>1.151</td>
<td>0.57</td>
<td>0.498</td>
<td>0.324</td>
<td>0.691</td>
<td>0.53</td>
</tr>
</tbody>
</table>

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

| KM Mean of Logged Data | -2.071 95% KM UTL (Lognormal)95% Coverage | 0.975 |
| KM SD of Logged Data   | 0.675 95% KM UPL (Lognormal)              | 0.473 |
| 95% KM Percentile Lognormal (z) | 0.383 95% KM USL (Lognormal)               | 0.524 |

Background DL/2 Statistics Assuming Lognormal Distribution

<table>
<thead>
<tr>
<th>Mean in Original Scale</th>
<th>Mean in Log Scale</th>
<th>95% UTL95% Coverage</th>
<th>95% UPL (t)</th>
<th>90% Percentile (z)</th>
<th>99% Percentile (z)</th>
<th>95% USL</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.16</td>
<td>-2.137</td>
<td>1.095</td>
<td>0.498</td>
<td>0.303</td>
<td>0.652</td>
<td>0.556</td>
</tr>
</tbody>
</table>

DL/2 is not a Recommended Method. DL/2 provided for comparisons and historical reasons.

Nonparametric Distribution Free Background Statistics

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

Nonparametric Upper Limits for BTVs (no distinction made between detects and nondetects)

<table>
<thead>
<tr>
<th>Order of Statistic, r</th>
<th>9 95% UTL with95% Coverage</th>
<th>Approx, f used to compute achieved CC</th>
<th>Approximate Sample Size needed to achieve specified CC</th>
<th>95% USL</th>
<th>0.57 95% KM Chebyshev UPL</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.474</td>
<td>0.474</td>
<td>Approximate Actual Confidence Coefficient achieved by U</td>
<td>0.474 Approximate Actual Confidence Coefficient achieved by U</td>
<td>0.57</td>
<td>0.874</td>
</tr>
</tbody>
</table>

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20. Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers and consists of observations collected from clean unimpacted locations. The use of USL tends to provide a balance between false positives and false negatives provided the data represents a background data set and when many onsite observations need to be compared with the BTV.
ProUCL Output - Trimmed Dataset

Background Statistics for Data Sets with Non-Detects

User Selected Options
Date/Time of Computation    ProUCL 5.16/2/2018 5:30:54 PM
From File    BTVs for GW from Minelrized Areas near RDM 06022018_a.xls
Full Precision    OFF
Confidence Coefficient    95%
Coverage    95%
Different or Future K Observations    1
Number of Bootstrap Operations    2000

Antimony, Total
(µg/L)

General Statistics
Total Number of Observations    8
Number of Distinct Observations    8
Number of Missing Observations    1
Minimum    0.13
First Quartile    0.416
Second Largest    7.45
Median    4.303
Maximum    8.9
Third Quartile    7.338
Mean    4.13
SD    3.864
Coefficient of Variation    0.936
Skewness    0.0343
Mean of logged Data    0.491
SD of logged Data    1.815

Critical Values for Background Threshold Values (BTVs)
Tolerance Factor K (For UTL)    3.187
d2max (for USL)    2.032

Normal GOF Test
Shapiro Wilk Test Statistic    0.795
Shapiro Wilk GOF Test
5% Shapiro Wilk Critical Value    0.818
Data Not Normal at 5% Significance Level
Lilliefors Test Statistic    0.279
Lilliefors GOF Test
5% Lilliefors Critical Value    0.283
Data appear Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution
95% UTL with    95% Coverage    16.44
95% UPL (t)    11.89
95% USL    11.98

Gamma GOF Test
A-D Test Statistic    0.729
Anderson-Darling Gamma GOF Test
5% A-D Critical Value    0.751
Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic    0.311
Kolmogorov-Smirnov Gamma GOF Test
5% K-S Critical Value    0.306
Data Not Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics
k hat (MLE)    0.658
k star (bias corrected MLE)    0.494
Theta hat (MLE)    6.279
Theta star (bias corrected MLE)    8.354
nu hat (MLE)    10.52
nu star (bias corrected)    7.911
MLE Mean (bias corrected)    4.13
MLE Sd (bias corrected)    5.874

Background Statistics Assuming Gamma Distribution
95% Wilson Hilferty (WH) Approx. Gamma UPL    20.48
95% Hawkins Wixley (HW) Approx. Gamma UPL    24.1
95% WH Approx. Gamma UTL with 95% Coverage    44.49
95% HW Approx. Gamma UTL with 95% Coverage    60.94
95% WH USL    20.83
95% HW USL    24.58
Lognormal GOF Test
Shapiro Wilk Test Statistic 0.819  Shapiro Wilk Lognormal GOF Test
5% Shapiro Wilk Critical Value 0.818  Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic 0.291  Lilliefors Lognormal GOF Test
5% Lilliefors Critical Value 0.283  Data Not Lognormal at 5% Significance Level
Data appear Approximate Lognormal at 5% Significance Level

Background Statistics assuming Lognormal Distribution
95% UTL with 95% Coverage 532.3  90% Percentile (z) 16.74
95% UPL (t) 62.77  95% Percentile (z) 32.38
95% USL 65.35  99% Percentile (z) 111.6

Nonparametric Distribution Free Background Statistics
Data appear Approximate Normal at 5% Significance Level

Nonparametric Upper Limits for Background Threshold Values
Order of Statistic, r 8 95% UTL with 95% Coverage 8.9
Approx, f used to compute achieved CC 0.421  Approximate Actual Confidence Coefficient achieved by U 0.337
Approximate Sample Size needed to achieve specified CC 59
95% Percentile Bootstrap UTL with 95% Coverage 8.9 95% BCA Bootstrap UTL with 95% Coverage 8.9
95% UPL 8.9 90% Percentile 7.885
90% Chebyshev UPL 16.43 95% Percentile 8.392
95% Chebyshev UPL 21.99 99% Percentile 8.798
95% USL 8.9

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20. Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers and consists of observations collected from clean unimpacted locations. The use of USL tends to provide a balance between false positives and false negatives provided the data represents a background data set and when many onsite observations need to be compared with the BTV.

**Mercury, Dissolved (ng/L)**

General Statistics
Total Number of Observations 8  Number of Missing Observations 1
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 0.667  Minimum Non-Detect 0.35
Maximum Detect 14.8  Maximum Non-Detect 3.715
Variance Detected 36.83  Percent Non-Detects 25%
Mean Detected 6.541  SD Detected 6.069
Mean of Detected Logged Data 1.414  SD of Detected Logged Data 1.155

Critical Values for Background Threshold Values (BTVs)
Tolerance Factor K (For UTL) 3.187  d2max (for USL) 2.032

Normal GOF Test on Detects Only
Shapiro Wilk Test Statistic 0.821  Shapiro Wilk GOF Test
5% Shapiro Wilk Critical Value 0.788  Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic 0.3  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) Background Statistics Assuming Normal Distribution
KM Mean 5.159  KM SD 5.388
95% UTL95% Coverage 22.33  95% KM UPL (t) 15.99
90% KM Percentile (z) 12.06  95% KM Percentile (z) 14.02
99% KM Percentile (z) 17.69  95% KM USL 16.11
DL/2 Substitution Background Statistics Assuming Normal Distribution

Mean 5.159  SD 5.749
95% UTL 95% Coverage 23.48  95% UPL (t) 16.71
90% Percentile (z) 12.53  95% Percentile (z) 14.62
99% Percentile (z) 18.53  95% USL 16.84

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

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic 0.349  Anderson-Darling GOF Test
5% A-D Critical Value 0.712  Detected data appear Gamma Distributed at 5% Significance Level

K-S Test Statistic 0.219  Kolmogorov-Smirnov GOF
5% K-S Critical Value 0.339  Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

\( k_{\text{hat}} \) (MLE) 1.218  \( k_{\star} \) (bias corrected MLE) 0.72
\( \theta_{\text{hat}} \) (MLE) 5.369  \( \theta_{\star} \) (bias corrected MLE) 9.081
\( \nu_{\text{hat}} \) (MLE) 14.62  \( \nu_{\star} \) (bias corrected) 8.643
MLE Mean (bias corrected) 6.541
MLE Sd (bias corrected) 7.707  95% Percentile of Chi-square (2\( k_{\star} \)) 4.853

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 \( k_{\star} \) 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 0.01  Mean 5.017
Maximum 14.8  Median 2.851
SD 5.858  CV 1.168
\( k_{\text{hat}} \) (MLE) 0.548  \( k_{\star} \) (bias corrected MLE) 0.426
\( \theta_{\text{hat}} \) (MLE) 9.155  \( \theta_{\star} \) (bias corrected MLE) 11.78
\( \nu_{\text{hat}} \) (MLE) 8.769  \( \nu_{\star} \) (bias corrected) 6.814
MLE Mean (bias corrected) 5.017  MLE Sd (bias corrected) 7.689
95% Percentile of Chi-square (2\( k_{\star} \)) 3.463  90% Percentile 14.01
95% Percentile 20.4  99% Percentile 36.35

The following statistics are computed using Gamma ROS Statistics on Imputed Data

Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods

<table>
<thead>
<tr>
<th>WH</th>
<th>HW</th>
</tr>
</thead>
<tbody>
<tr>
<td>95% Approx. Gamma UTL with 95% Coverage</td>
<td>56.51</td>
</tr>
<tr>
<td>95% Gamma USL</td>
<td>25.98</td>
</tr>
</tbody>
</table>

Estimates of Gamma Parameters using KM Estimates

Mean (KM) 5.159  SD (KM) 5.388
Variance (KM) 29.03  SE of Mean (KM) 2.095
\( k_{\text{hat}} \) (KM) 0.917  \( k_{\star} \) (KM) 0.656
\( \nu_{\text{hat}} \) (KM) 14.67  \( \nu_{\star} \) (KM) 10.5
\( \theta_{\text{hat}} \) (KM) 5.627  \( \theta_{\star} \) (KM) 7.861
80% gamma percentile (KM) 8.495  90% gamma percentile (KM) 13.15
95% gamma percentile (KM) 17.97  99% gamma percentile (KM) 29.56

The following statistics are computed using gamma distribution and KM estimates

Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods

<table>
<thead>
<tr>
<th>WH</th>
<th>HW</th>
</tr>
</thead>
<tbody>
<tr>
<td>95% Approx. Gamma UTL with 95% Coverage</td>
<td>41.41</td>
</tr>
<tr>
<td>95% KM Gamma Percentile</td>
<td>15.85</td>
</tr>
</tbody>
</table>
Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic 0.928  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 0.325  Detected Data appear Lognormal at 5% Significance Level
Detected Data appear Lognormal at 5% Significance Level

Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects
Mean in Original Scale 5.097  Mean in Log Scale 0.938
SD in Original Scale 5.789  SD in Log Scale 1.367
95% UTL 95% Coverage 199.3  95% BCA UTL 95% Coverage 14.8
95% Bootstrap (%) UTL 95% Coverage 14.8  95% UPL (t) 39.86
90% Percentile (z) 14.73  95% Percentile (z) 24.21
99% Percentile (z) 61.46  95% USL 41.08

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution
KM Mean of Logged Data 0.949  95% KM UTL (Lognormal) 95% Coverage 160.6
KM SD of Logged Data 1.296  95% KM UPL (Lognormal) 34.93
95% KM Percentile Lognormal (z) 21.78  95% KM USL (Lognormal) 35.94

Background DL/2 Statistics Assuming Lognormal Distribution
Mean in Original Scale 5.159  Mean in Log Scale 0.92
SD in Original Scale 5.749  SD in Log Scale 1.479
95% UTL 95% Coverage 280.1  95% UPL (t) 49.07
90% Percentile (z) 16.72  95% Percentile (z) 28.61
99% Percentile (z) 78.41  95% USL 50.71

DL/2 is not a Recommended Method. DL/2 provided for comparisons and historical reasons.

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

Nonparametric Upper Limits for BTVs(no distinction made between detects and nondetects)
Order of Statistic, r 8  95% UTL with 95% Coverage 14.8
Approx, f used to compute achieved CC 0.421  Approximate Actual Confidence Coefficient achieved by U 0.337
Approximate Sample Size needed to achieve specified CC 59  95% UPL 14.8
95% USL 14.8  95% KM Chebyshev UPL 30.07

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20. Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers and consists of observations collected from clean unimpacted locations. The use of USL tends to provide a balance between false positives and false negatives provided the data represents a background data set and when many onsite observations need to be compared with the BTV.