



SUSANA MARTINEZ  
Governor  
JOHN A. SANCHEZ  
Lieutenant Governor

General

NEW MEXICO  
ENVIRONMENT DEPARTMENT

2905 Rodeo Park Drive East, Building 1  
Santa Fe, New Mexico 87505-6303  
Phone (505) 476-6000 Fax (505) 476-6030  
www.env.nm.gov



RYAN FLYNN  
Cabinet Secretary  
BUTCH TONGATE  
Deputy Secretary

**CERTIFIED MAIL – RETURN RECEIPT REQUESTED**

October 16, 2015

Doug Hintze, Manager  
U.S. Department of Energy  
EM-Los Alamos Field Office, DOE  
3747 West Jemez Rd, MS A316  
Los Alamos, NM 87544

Michael Brandt, Associate Director  
Environment, Safety, Health  
Los Alamos National Laboratory  
P.O. Box 1663, MS K491  
Los Alamos, NM 87545

**RE: ESTABLISHMENT OF GROUNDWATER BACKGROUND FOR THE  
REGIONAL AQUIFER, LOS ALAMOS NATIONAL LABORATORY  
EPA ID#NM0890010515  
HWB-LANL-GW-MISC**

Dear Messrs. Hintze and Mr. Brandt:

The March 1, 2005, Compliance Order on Consent (the Order), Section IV.A.3.d (most recent revision on October 29, 2012) set forth a requirement by the United States Department of Energy (DOE) and Los Alamos National Laboratory (LANL or the Laboratory) to conduct and prepare a groundwater investigation report for naturally occurring metals and general chemistry (e.g., nitrate). In February 2007, DOE and the Los Alamos National Security, L.L.C's (collectively, the Permittees) submitted a report to the New Mexico Environment Department (NMED) entitled *Groundwater Background Investigation Report, Revision 2*. On March 23, 2007, NMED approved the report with direction. In response to NMED's approval with direction, the Permittees submitted a third revision in May 2007. On February 5, 2010, NMED directed the Permittees to update the groundwater background for the facility. In response to NMED's direction to update the groundwater background, the Permittees submitted "*Groundwater Background Investigation Report, Revision 4*", dated August 2010. On July 25, 2011, NMED approved, with modifications, the Permittee's Revision 4 report. In November 2011, the Permittees submitted a final revision entitled *Groundwater Background Investigation Report, Update to Revision 4* (EP2011-0354, LA-UR-11-6228). The



groundwater background data set incorporated into Revision 4 (Report) included results from background springs and wells sampled between January 2000 and March 2010. Since 2010, additional monitoring wells have been installed in the regional aquifer that produce representative samples and water-quality data that are considered to be of background quality, with "background" being defined as groundwater not impacted by modern-day pollutants from industrial or municipal waste-water discharges. Such groundwater, as represented by the regional drinking-water aquifer beneath the Pajarito Plateau, would not contain a modern-age (e.g., post-1943) component of recharge and would exhibit residence time in excess of 1000 years.

The background data set presented in the Report, and all prior revisions, was acquired by using methodologies designed for groundwater monitoring purposes, in accordance with the Order, and not for determining accurate and precise background concentrations. As a result, a significant amount of non-detect data were incorporated in the Report. For example, the 23 Target Analyte List (TAL) total-dissolved metals published in the Report comprised 4307 observations with 44% of the observations having a detectable result and 56% being non-detectable by analytical methods used during laboratory analyses of groundwater samples. This high percentage of non-detectable data within a background data set for the regional aquifer is undesirable, especially when evaluating whether or not anthropogenic impacts to groundwater have occurred or for early-warning monitoring at and near (i.e., sentinel wells) municipal water-supply wells. For proper contaminant-detection monitoring, it is critical to have detection and reporting limits that yield as high as possible percentage of detectable results.

It should be understood that the contract laboratory method-detection limits and quantitation limits reported by the Permittees in the Report were not intended for background determination or low-level contaminant-detection monitoring, including important analytes such as chromium. Furthermore, the background sampling stations selected by the Permittees were not optimal because they included water-supply (production wells) that are completed at much greater depths and with longer screened intervals than most regional aquifer monitoring wells. Of the 29 regional aquifer background sampling stations selected by the Permittees and presented in the Report, eight were water-supply wells. A reliable and technically defensible groundwater background data set must incorporate high quality analytical methods with low detection limits and sampling stations that best represent the protected aquifer. In addition, since non-contaminated monitoring wells are susceptible to future contamination from migrating contaminant plumes, it is essential to perform low-level detection monitoring at monitoring and supply wells located near both vapor-and aqueous-phase plumes.

In 2011, NMED initiated a project to determine low-level background concentrations for the 23 TAL metals (excluding mercury) and 19 other trace metals such as molybdenum, strontium, and uranium to improve the background data set for metals (total dissolved) in the regional aquifer. The overall intent of the project is to increase the protection of groundwater resources beneath and downgradient of the Permittee's facility. High resolution-inductively coupled plasma mass spectrometry (HR-ICPMS or HRMS) was

the method used to quantify concentrations of these metals at low levels of detection and quantitation. Analytical services for the HRMS analyses were provided by ALS Environmental – Vancouver, Canada (ALS). During 2011 and 2012, NMED collected 102 samples for low-level HRMS analyses at 34 well screens located on the Pajarito Plateau and eight springs discharging in White Rock Canyon. Of these 42 sampling stations, six springs and 11 wells or well screens were identical to several of the locations sampled as part of the Permittee's Report. The selected background stations vary spatially from the western portion of the Laboratory near the recharge zones in the Sierra de Los Valles to the discharge zones located near the eastern edge of the Pajarito Plateau (e.g., R-16r) and regional aquifer springs located on or near the western bank of the Rio Grande in White Rock Canyon. Stations were selected based on having average chloride concentrations less than 3 mg/L and no measurable tritium activities ( $<2$  pCi/L). The sampling stations represent each of the five major Pliocene and Miocene age regional-aquifer lithologies, including the Puye Formation, Tschicoma Formation, Totavi Lentil, basaltic rocks of the Cerros del Rio volcanic field, and Chamita Formation.

Along with the HRMS filtered-metals data set, NMED compiled filtered/dissolved anions, total dissolved solids, and hardness data, and field-parameter measurements collected by LANL at the stations selected for background determination. Analytical results specific to this background data set were collected by the Permittees as part of the Interim Facility Groundwater Monitoring Program (e.g., IFGMP, 2012, LA-UR-12-21331/EP2012-0092), and are reported in the Intellus database (<http://www.intellusndata.com/>). This background data set spans the monitoring period 2008 through 2012.

Table 1 lists sampling stations selected for regional aquifer groundwater background determination. The table also includes the sampling dates and the hydrostratigraphic or lithologic unit(s) for each well-screen interval and spring discharge point. Figure 1 shows the locations of all groundwater background sampling stations.

All groundwater samples were collected at wellheads and spring discharge points or as close to the spring discharge points as possible. All groundwater samples were field filtered using either a 0.45 micrometer Geotech "dispos-a-filter"<sup>TM</sup> from Geotech Environmental Equipment, Inc. or a 0.45 micrometer syringe-top disk filter provided by ALS. Prior to sample collection, four liters of groundwater were passed through each Geotech filter to purge any leachable, low-level metals. Approximately 100 milliliters of groundwater were purged through the disk filters prior to sample collection to remove any leachable constituents. ALS provided all blank water used and analyzed as part of this investigation.

ALS is certified through the Canadian Association for Laboratory Accreditation for providing accurate and technically defensible inorganic and organic analyses for air, soil, oil, waste solid, tissue, and water samples. This accreditation is valid to May 3, 2015. Various quality assurance/control water samples were collected as part of this investigation, including:

1. Eight blind duplicate samples;
2. Four blind equipment-blank samples using 0.45-micrometer disk filters with one-time use disposable syringes;
3. Four blind equipment blanks using 0.45-micrometer Geotech filters and disposable one-time use silicone tubing, and
4. Three blind blanks.

Results of blind duplicates of groundwater samples collected as part of this project are or will be available in the LANL-NMED Intellus database. Additional duplicate results for samples collected at other wells and springs that were not part of this project can also be found in Intellus.

Trace metals with typical dissolved concentrations of less than 10 µg/L in groundwater samples were analyzed by HR-ICPMS, modified from United States Environmental Protection Agency's (US EPA) method 200.8 (Revision 5.5). Inorganic solutes analyzed by the EPA 200.8M method include silver, aluminum, arsenic, boron, barium, beryllium, bismuth, cadmium, cobalt, chromium, cesium, copper, gallium, lithium, manganese, molybdenum, nickel, lead, rubidium, rhenium, antimony, selenium, tin, strontium, tellurium, thorium, titanium, thallium, uranium, vanadium, tungsten, yttrium, zinc, and zirconium. All groundwater samples were filtered through a 0.45 micrometer filter and acidified in the field with ultrapure nitric acid to a pH of 2 or less. Instrument detection and reporting limits for the HR-ICPMS results for various dissolved trace metals (or elements) are below 1 µg/L in the non-digested aqueous samples with turbidity values less than 1 NTU, and are available in Intellus. As an example, detection limits for total-dissolved chromium, lead, selenium, and zinc are 0.05 µg/L, 0.005 µg/L, 0.04 µg/L, and 0.1 µg/L, respectively.

Trace metals with typical dissolved concentrations greater than 10 µg/L in groundwater samples were analyzed by inductively coupled plasma optical emission spectroscopy (ICPOES), based on US EPA Method 6010B. Inorganic solutes analyzed by the EPA 6010B method include calcium, iron, magnesium, sodium, phosphorus, potassium, and silicon. Groundwater samples analyzed by the 6010B method were passed through a 0.45-micrometer filter (Geotech or disk) and acidified with ultrapure nitric acid to a pH of 2 or less. Instrument detection limits for the various dissolved trace elements analyzed by ICPOES are greater than 10 µg/L in the non-digested aqueous samples with turbidity values less than 1 NTU.

Compilation and statistical analyses for the low-level metals, major anions, total dissolved solids, hardness, and field parameters are similar to that prescribed in the Permittee's Report. For the low-level metals, outliers were not identified; therefore, all metal results derived using the low-level methods (HR-ICPMS and ICPOES) were incorporated in the statistical analyses as discussed below. For major anions, total dissolved solids, and hardness data, only analytical results provided by General Engineering Laboratory (see IFGMP, 2012) were used in the

statistical analyses. Duplicate results and results with qualifiers such as hold-time exceedances were removed from the data set. Table 2 highlights all outliers specific to major anions, total dissolved solids, and hardness, which were not incorporated into the statistical analyses due to concerns regarding sample representativeness or data quality. For the field parameters, dissolved oxygen, pH, specific conductance, and temperature, outliers listed in Table 2 were identified using the United States Environmental Protection Agency's (US EPA) statistical-analysis software package ProUCL, Version 4.1 (Pro UCL). At a 5% significance level, up to 10 outliers were selected for each analyzed field parameter. Outlier analysis was not performed on oxidation-reduction potential (ORP) data. The ORP measurements are reported in millivolts (mV) and have not been converted to Eh values, which are dependent on ORP electrode filling solution and water temperature.

The ProUCL software package and the ProUCL 2009 technical guidance document were used to determine the upper tolerance limits (UTL) as well as other statistical parameters (e.g., mean and median) for each constituent. A total of 51 chemical constituents and seven field parameters (e.g., pH) shown in Table 3 were included in the rigorous statistical analyses. Results of the statistical analyses include: 1) percentiles 25, 50, 75, and 90 and means for constituents with 100% detections, 2) Kaplan-Meier means for constituents with both detected and non-detected data, and 3) calculated UTLs for each constituent with at least 25% detections. The detection limit, or average of detection limits, if applicable, was substituted for the UTL for constituents with less than 25% detections (see Table 3). The UTL for each constituent was based on a 95% confidence level with 95% coverage.

The methodology and order for selecting the appropriate UTL includes:

- a. If data have a normal distribution and the constituent was detected at 100% for each sample collected, then the normal UTL based on a 95% confidence level with 95% coverage was selected;
- b. If data have a normal distribution and the constituent was not detected at 100%, then the maximum likelihood estimate of the UTL based on a 95% confidence level with 95% coverage was selected;
- c. If the data are gamma distributed and the constituent was detected at 100%, then the Wilson-Hilferty Approximate Gamma UTL was selected;
- d. If the data are gamma distributed, but the constituent was not detected at 100%, then the Wilson-Hilferty Approximate Gamma UTL based on extrapolated data using the gamma regression-on-order statistics (ROS) substitution method was selected;
- e. If data have a lognormal distribution and the constituent was detected at 100%, then the lognormal UTL based on a 95% confidence level with 95% coverage was selected;

- f. If the data have a lognormal distribution but the constituent was not detected at 100%, then the lognormal ROS substitution UTL based on a 95% confidence level with 95% coverage was selected;
- g. If the data have no discernible distribution and the constituent was detected at 100%, then the nonparametric UTL based on a 95% confidence level with 95% coverage was selected; and
- h. If the data have no discernible distribution and the constituent was not detected at 100%, then the nonparametric UTL Kaplan-Meier (95% confidence level with 95% coverage) was selected.

In comparison to the Permittee's most current Revision 4 background data set for these particular constituents, many of the updated UTLs presented in Table 3 are lower than the Revision 4 UTLs. For example, the updated UTLs for dissolved chromium, barium, chloride, and manganese are approximately one-half the concentration values in the Permittee's Revision 4 Report. In some cases, the UTLs calculated by NMED and LANL are very similar (boron, calcium, fluoride, magnesium, dissolved silicon dioxide, sodium, sulfate, uranium, and vanadium). On the other hand, the updated UTLs for dissolved antimony, nitrate-nitrite as nitrogen and phosphate as phosphorus, and field turbidity were slightly higher than the Revision 4 UTLs. Differences in UTL values calculated by NMED and LANL are most likely related to the lower detection limits and associated higher percentage of detectable results for many of the trace metals reported by the NMED, as well as the quality and number of new or more recent background sampling locations for the regional aquifer. Solute concentrations that are above method detection limits and below reporting limits (J values) were considered by NMED in calculating UTL values for different metals. Statistical data for silicon dioxide (SiO<sub>2</sub>) as noted in Table 3 were calculated from elemental silicon (Si) concentration results provided by ALS. The conversion from Si to SiO<sub>2</sub>:

$\text{SiO}_2 (\text{conc}) = 2.14 \times \text{Si} (\text{conc})$ , where

$$2.14 = \frac{m_w \text{SiO}_2}{a_w} \text{ (or } 60/28\text{), and}$$

$m_w$  = molecular weight and  $a_w$  = atomic weight

Attachment A provides output files for the ProUCL statistical analyses for each background constituent.

Radionuclides, total (non-filtered) metals and anions, and total organic carbon were not evaluated as part of this updated data set of UTLs. For these constituents, the Permittees must continue to apply the current UTLs as published in "*Groundwater Background Investigation Report, Update to Revision 4*", dated November 2011.

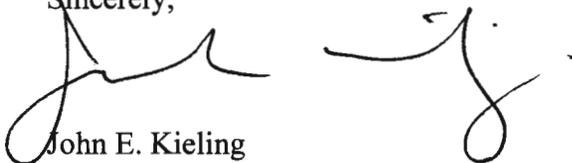
Messrs. Hintze and Brandt  
October 16, 2015  
Page 7

It is acknowledged that US EPA Region 6 participated in the funding associated with HR-ICPMS and ICPOES analyses of groundwater samples collected as part of this investigation.

The UTLs presented in Table 3 for regional aquifer solutes and field parameters must be applied by the Permittees as screening values for all future groundwater sampling (detection monitoring) of the regional aquifer, as required in the March 1, 2005, Compliance Order on Consent, with revisions on June 18, 2008 and October 29, 2012. These regional aquifer background screening values or UTLs must be used to determine the presence or absence of anthropogenic contamination, the distribution, nature and extent of contamination, the reliability and representativeness of groundwater samples collected at monitoring wells and springs, and to assess natural attenuation and progress of active remediation.

Should you have any questions, please contact Michael Dale of my staff at (505) 476-3078.

Sincerely,



John E. Kieling  
Chief  
Hazardous Waste Bureau

- cc: D. Cobrain, NMED HWB  
N. Dhawan, NMED HWB  
B. Wear, NMED HWB  
M. Dale, NMED HWB  
M. Hunter, NMED GWQB  
S. Yanicak, NMED DOE OB, MS M894  
P. Longmire, NMED DOE OB, MS M894  
L. King, EPA 6PD-N  
R. Martinez, San Ildefonso Pueblo  
D. Chavarria, Santa Clara Pueblo  
C. Rodriguez, DOE-EM-LA, MS A316  
J. Buckley, ENV-CP, MS K490  
A. Dorries, ADESH-ENV, MS K490

File: Reading and LANL 2015, Groundwater Background

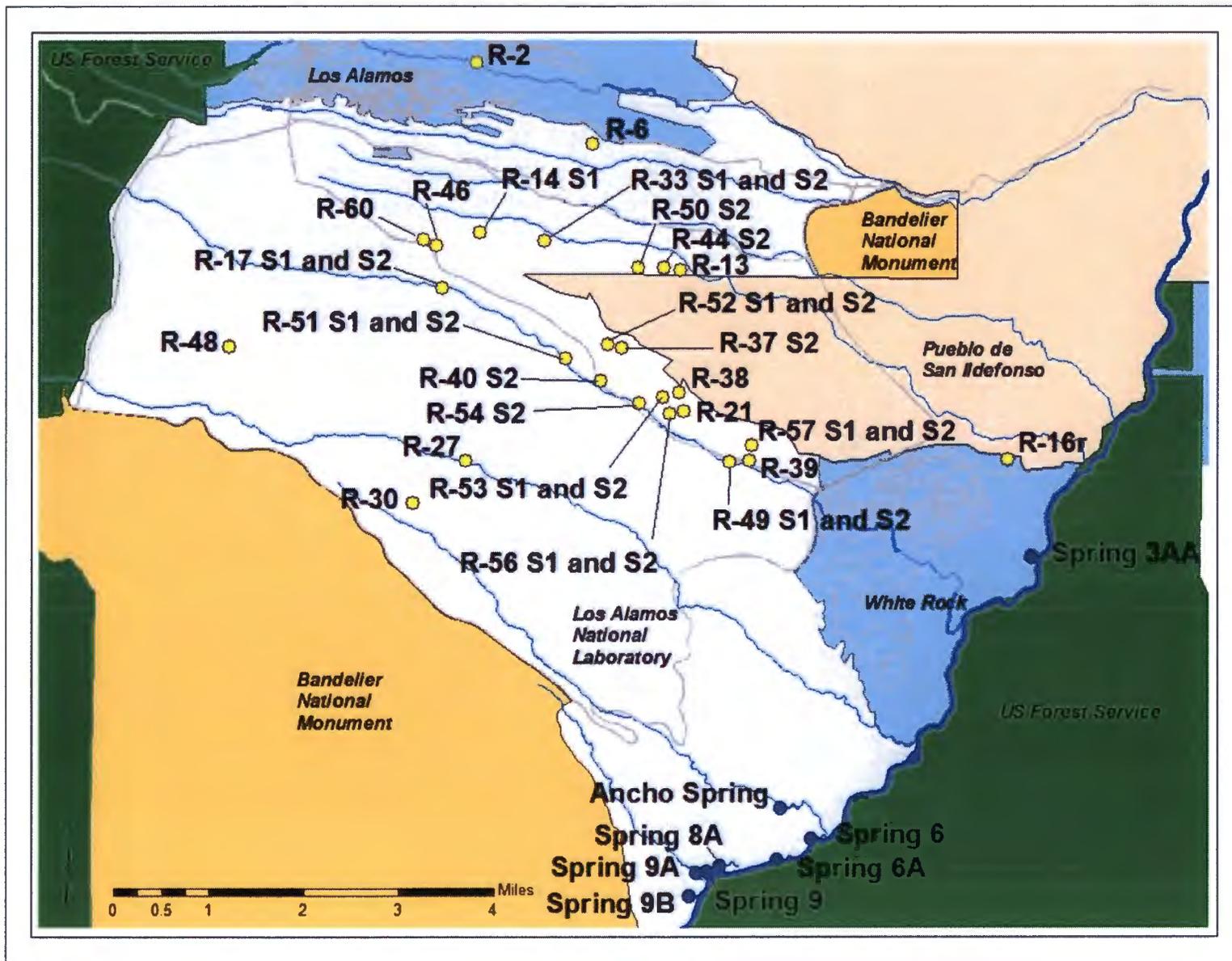


Figure 1. Map Showing Sampling Locations for the Regional Aquifer Groundwater Background Data Set, Los Alamos, New Mexico.

**Table 1. Groundwater Background Sampling Locations, Lithology, and Collection Dates.**

Location	Lithologic Unit(s)	Collection Dates
R-2	Chamita Formation (Miocene Jemez fanglomerate) - Tcar	LANL Data: 1/11/08 to 4/17/12 NMED Data: 4/17/12
R-6	Chamita Formation (Miocene Jemez fanglomerate) - Tcar	LANL Data: 8/27/08 to 8/27/12 NMED Data: 8/27/12
R-13	Puye Formation and Miocene pumiceous deposits - Tpf and Tjfp	LANL Data: 2/14/08 to 10/31/12 NMED Data: 6/5/12 & 10/31/12
R-14 S1	Puye Formation and Miocene pumiceous deposits - Tpf and Tjfp	LANL Data: 8/20/08 to 11/5/12 NMED Data: 11/8/11 to 11/5/12
R-16r	Totavi Lentil - Tpt	LANL Data: 2/6/08 to 8/9/12 NMED Data: 8/9/12
R-17 S1	Puye Formation - Tpf	LANL Data: 3/13/08 to 5/2/12 NMED Data: 5/2/12
R-17 S2	Puye Formation - Tpf	LANL Data: 3/13/08 to 5/02/12 NMED Data: 5/2/12
R-21	Puye Formation and Cerros de Rio volcanic field - Tpf and Tb4	LANL Data: 2/11/08 to 10/15/12 NMED Data: 11/3/11 to 10/15/12
R-27	Puye Formation - Tpf	LANL Data: 10/10/08 to 2/3/12 NMED Data: 2/3/12
R-30	Puye Formation - Tpf	LANL Data: 5/19/10 to 2/1/12 NMED Data: 2/1/12
R-33 S1	Miocene pumiceous deposits - Tjfp	LANL Data: 8/14/08 to 8/21/12 NMED Data: 8/21/12
R-33 S2	Miocene pumiceous deposits - Tjfp	LANL Data: 8/14/08 to 8/21/12 NMED Data: 8/21/12
R-37 S2	Puye Formation - Tpf	LANL Data: 6/22/09 to 10/22/12 NMED Data: 10/31/11 to 10/22/12
R-38	Puye Formation composed of Tb4 sediments - Tpf w/ Tb4 sediments	LANL Data: 2/6/09 to 10/9/12 NMED Data: 10/25/11 to 10/9/12
R-39 S1	Dacitic lavas and dacite-rich sediments - Tb4	LANL Data: 2/19/09 to 10/11/12 NMED Data: 10/27/11 to 10/11/12
R-40 S2	Puye Formation - Tpf	LANL Data: 1/15/09 to 10/12/12 NMED Data: 10/20/11 to 10/12/12
R-44 S2	Puye Formation - Tpf	LANL Data: 2/22/09 to 11/12/12 NMED Data: 11/17/11 to 11/12/12
R-46	Puye Formation - Tpf	LANL Data: 3/11/09 to 11/16/12 NMED Data: 11/8/11 to 11/16/12
R-48	Tschicoma Formation - Tt	LANL Data: 11/23/09 to 1/18/12 NMED Data: 1/18/12
R-49 S1	Dacitic lavas - Tb4	LANL Data: 6/23/09 to 10/15/12 NMED Data: 10/26/11 to 10/15/12
R-49 S2	Totavi Lentil - Tpt	LANL Data: 6/18/09 to 10/25/12 NMED Data: 10/27/11 to 10/25/12
R-50 S2	Miocene pumiceous deposits - Tjfp	LANL Data: 3/11/10 to 11/9/12 NMED Data: 11/28/11 to 11/9/12
R-51 S1	Puye Formation - Tpf	LANL Data: 3/8/10 to 10/10/12 NMED Data: 10/21/11 to 10/10/12
R-51 S2	Puye Formation - Tpf	LANL Data: 6/18/10 to 10/10/12 NMED Data: 10/21/11 to 10/10/12
R-52 S1	Puye Formation - Tpf	LANL Data: 5/2/10 to 10/16/12 NMED Data: 11/1/11 to 10/16/12
R-52 S2	Puye Formation - Tpf	LANL Data: 4/23/10 to 10/16/12 NMED Data: 11/1/11 to 10/16/12
R-53 S1	Puye Formation - Tpf	LANL Data: 4/19/10 to 10/11/12 NMED Data: 4/24/12 to 10/11/12
R-53 S2	Puye Formation - Tpf	LANL Data: 4/14/10 to 10/11/12 NMED Data: 10/25/11 to 10/11/12

**Table 1. (Continued)**

<b>Location</b>	<b>Lithologic Unit(s)</b>	<b>Collection Dates</b>
R-54 S2	Puye Formation - Tpf	LANL Data: 2/21/10 to 10/24/12 NMED Data: 10/31/11 to 10/24/12
R-56 S1	Puye Formation - Tpf	LANL Data: 8/19/10 to 10/18/12 NMED Data: 11/2/11 to 10/18/12
R-56 S2	Puye Formation - Tpf	LANL Data: 8/13/10 to 10/18/12 NMED Data: 11/2/11 to 10/18/12
R-57 S1	Dacitic lavas - Tb4	LANL Data: 7/14/10 to 10/10/12 NMED Data: 10/21/11 to 10/10/12
R-57 S2	Totavi Lentil - Tpt	LANL Data: 6/25/10 to 10/10/12 NMED Data: 10/21/11 to 10/10/12
R-60	Puye Formation - Tpf	LANL Data: 12/16/10 to 11/1/12 NMED Data: 11/22/11 to 11/1/12
Ancho Spring	Totavi Lentil - Tpt	LANL Data: 4/28/08 NMED Data: 1/10/12 to 12/13/12
Spring 3AA	Chamita Formation (Miocene Jemez fanglomerate) covered by landslide - Tcar	LANL Data: 9/29/08 to 9/24/12 NMED Data: 10/3/11 to 9/24/12
Spring 6	Cerros del Rio volcanics - Tb4	LANL Data: 9/30/08 to 9/25/12 NMED Data: 10/6/11 to 9/25/12
Spring 6A	Cerros del Rio volcanics covered by landslide - Tb4	LANL Data: 9/30/08 to 9/25/12 NMED Data: 10/13/11 to 1/10/12
Spring 8A	Cerros del Rio volcanics covered by landslide - Tb4	LANL Data: 9/30/08 to 9/25/12 NMED Data: 10/13/11
Spring 9	Cerros del Rio volcanics covered by landslide - Tb4	LANL Data: 9/30/08 to 9/25/12 NMED Data: 10/6/11 to 9/25/12
Spring 9A	Cerros del Rio volcanics covered by landslide - Tb4	LANL Data: 10/1/08 to 9/26/12 NMED Data: 10/13/11 to 9/26/12
Spring 9B	Cerros del Rio volcanics - Tb4	LANL Data: 4/23/08 to 9/29/12 NMED Data: 10/6/11 to 1/10/12

**Table 2. Groundwater Background Outliers for Anions, Hardness, Total Dissolved Solids, and Field Parameters.**

Location	Collection Date	Outlier(s)	Comment
R-2	1/14/2009	Specific Conductance	Anomalously low value of 23.2 $\mu\text{S}/\text{cm}$ . Rosner's outlier test using ProUCL identified the value as an outlier at a 5% significance level.
R-13	5/14/2008	Specific Conductance	Anomalously high value of 356 $\mu\text{S}/\text{cm}$ . Rosner's outlier test using ProUCL identified the value as an outlier at a 5% significance level.
R-14 S1	2/27/2008	Entire Data Set	Data suspect due to sample collection as part of well reconfiguration.
R-14 S1	7/30/2008	Entire Data Set	Data suspect due to sample collection too soon after well reconfiguration. Intellus showing "10 day tot" statement in the Field Sample Comment column.
R-16r	5/19/2008	Total Phosphate as Phosphorus	Data suspect due to anomalously high value of 15.1 mg/L.
R-16r	8/9/2012	Total Dissolved Solids	Analytical Hold Time exceeded.
R-21	2/11/2008	Specific Conductance	Anomalously low value of 20.5 $\mu\text{S}/\text{cm}$ . Rosner's outlier test using ProUCL identified the value as an outlier at a 5% significance level.
R-21	12/4/2009	Br, Cl, F, and $\text{SO}_4$	Analytical Hold Time exceeded.
R-27	4/11/2008	Entire Data Set	Data suspect due to Intellus showing "Has a sulfuric odor" statement in the Field Sample Comment column.
R-33 S1	8/14/2008	Specific Conductance	Anomalously low value of 17.2 $\mu\text{S}/\text{cm}$ . Rosner's outlier test using ProUCL identified the value as an outlier at a 5% significance level.
R-33 S2	8/14/2008	Specific Conductance	Anomalously low value of 16.43 $\mu\text{S}/\text{cm}$ . Rosner's outlier test using ProUCL identified the value as an outlier at a 5% significance level.
R-37 S2	6/22/2009	Dissolved Oxygen	Anomalously low value of 1.01 mg/L. Rosner's outlier test using ProUCL identified the value as an outlier at a 5% significance level.
R-37 S2	11/18/2009	Entire Data Set	Data suspect due to Intellus showing "1st full suite (characterization) sample after installation of new Baski sampling system. 6 CV purge. Clone of CAMO-10-5484" statement in the Field Sample Comment column.
R-37 S2	12/18/2009	Specific Conductance	Anomalously high value of 215 $\mu\text{S}/\text{cm}$ . Rosner's outlier test using ProUCL identified the value as an outlier at a 5% significance level.

**Table 2. (Continued)**

Location	Collection Date	Outlier(s)	Comment
R-38	12/4/2008	Entire Data Set	Data suspect due to anomalously high concentrations.
R-38	1/23/2009	Entire Data Set	Data suspect due to anomalously high concentrations and Intellus showing "10 day tot" statement in the Field Sample Comment column..
R-38	8/21/2009	Specific Conductance	Anomalously high value of 244 $\mu$ S/cm. Rosner's outlier test using ProUCL identified the value as an outlier at a 5% significance level.
R-38	7/26/2011	Hardness	Data suspect due to Intellus showing two values for the same sample with one result anomalously high and the other low.
R-39	12/9/2009	Br, Cl, F, and SO <sub>4</sub>	Analytical Hold Time exceeded.
R-40 S2	2/23/2010	Temperature	Anomalously low value of 15.48°C. Rosner's outlier test using ProUCL identified the value as an outlier at a 5% significance level.
R-41 S2	9/1/2009	Specific Conductance	Anomalously high value of 344 $\mu$ S/cm. Rosner's outlier test using ProUCL identified the value as an outlier at a 5% significance level.
R-46	2/10/2009	Entire Data Set	Data suspect due to anomalously high concentrations and Intellus showing " <i>R-46 Decon water filtered</i> " statement in the Field Sample Comment column..
R-46	2/25/2009	Entire Data Set	Data suspect due to anomalously high concentrations and Intellus showing "Drill pit fluids R-46 10 day tot" statement in the Field Sample Comment column..
R-46	3/17/2009	Dissolved Oxygen	Anomalously high value of 13.45 mg/L. Rosner's outlier test using ProUCL identified the value as an outlier at a 5% significance level.
R-46	3/17/2009	Temperature	Anomalously low value of 7.6°C. Rosner's outlier test using ProUCL identified the value as an outlier at a 5% significance level.
R-46	5/13/2009	Entire Data Set	Data appear to be duplicated data for original sample but not noted as duplicate in Intellus.
R-46	8/3/2011	Alkalinity-CO <sub>3</sub> +HCO <sub>3</sub>	Data suspect due to an anomalously high value of 530 mg/L.
R-46	11/16/2012	Dissolved Oxygen	Anomalously low value of 0.5 mg/L. Rosner's outlier test using ProUCL identified the value as an outlier at a 5% significance level.

**Table 2. (Continued)**

Location	Collection Date	Outlier(s)	Comment
R-49 S1	6/23/2009	Dissolved Oxygen	Anomalously low value of 0.52 mg/L. Rosner's outlier test using ProUCL identified the value as an outlier at a 5% significance level.
R-49 S1	12/7/2009	Br, Cl, F, and SO <sub>4</sub>	Analytical Hold Time exceeded.
R-49 S2	12/9/2009	Br, Cl, F, and SO <sub>4</sub>	Analytical Hold Time exceeded.
R-49 S2	10/7/2010	Hardness	Data suspect due to anomalously low value of 1.24 mg/L.
R-50 S2	3/11/2010	Temperature	Anomalously low value of 13.78°C. Rosner's outlier test using ProUCL identified the value as an outlier at a 5% significance level.
R-50 S2	8/16/2012	Nitrate-Nitrite as Nitrogen	Analytical Hold Time exceeded.
R-51 S1	6/18/2010	Dissolved Oxygen	Anomalously high value of 11.19 mg/L. Rosner's outlier test using ProUCL identified the value as an outlier at a 5% significance level.
R-51 S2	2/22/2010	Entire Data Set	Data suspect due to Intellus showing " <i>Samples filtered @ TA-59 stormwater lab</i> " statement in the Field Sample Comment column.
R-51 S2	10/19/2010	Entire Data Set	Data suspect due to an anomalously high value of 120 mg/L.
R-52 S1	5/2/2010	Total Dissolved Solids	Analytical Hold Time exceeded.
Ancho Spring	9/30/2008	Entire Data Set	Sample collected down stream of spring source and mixing with an iron-rich microbial mat. Very high Fe and Mn concentrations compared to concentrations from samples collected at the spring source.
Ancho Spring	9/29/2009	Entire Data Set	Sample collected down stream of spring source and mixing with an iron-rich microbial mat. Very high Fe and Mn concentrations compared to concentrations from samples collected at the spring source.
Ancho Spring	9/28/2010	Entire Data Set	Sample collected down stream of spring source and mixing with an iron-rich microbial mat. Very high Fe and Mn concentrations compared to concentrations from samples collected at the spring source.
Ancho Spring	10/7/2011	Entire Data Set	Sample collected down stream of spring source and mixing with an iron-rich microbial mat. Very high Fe and Mn concentrations compared to concentrations from samples collected at the spring source.
Ancho Spring	9/25/2012	Entire Data Set	Sample collected down stream of spring source and mixing with an iron-rich microbial mat. Very high Fe and Mn concentrations compared to concentrations from samples collected at the spring source.

**Table 2. (Continued)**

<b>Location</b>	<b>Collection Date</b>	<b>Outlier(s)</b>	<b>Comment</b>
Spring 6A	9/29/2009	Specific Conductance	Anomalously high value of 360 $\mu\text{S}/\text{cm}$ . Rosner's outlier test using ProUCL identified the value as an outlier at a 5% significance level.
Spring 9	9/30/2008	pH	Anomalously low value of 6.04 S.U. Rosner's outlier test using ProUCL identified the value as an outlier at a 5% significance level.
Spring 9	9/29/2009	Specific Conductance	Anomalously high value of 301 $\mu\text{S}/\text{cm}$ . Rosner's outlier test using ProUCL identified the value as an outlier at a 5% significance level.
Spring 9	9/9/2010	pH	Anomalously low value of 6 S.U. Rosner's outlier test using ProUCL identified the value as an outlier at a 5% significance level.

**Table 3. Results of Statistical Analyses for Groundwater Background**

Analyte	Unit	Filtration	Total Number of Observations/ Number of Valid Data	Number of Detected Data	Minimum/ Minimum Detected	Maximum/ Maximum Detected	Number of Non-Detected Data	Minimum Non-Detect	Maximum Non-Detect	First Quartile/25th Percentile	Median /50th Percentile	Third Quartile/75th Percentile	95th Percentile	Mean /Average	KM Mean	NMED UTL 2013	LANL UTL- Nov. 2011
Alkalinity-CO3+HCO3	mg/L	F	409	409	49.6	86.9	0			57	60.1	63.8	76.6	61.4		78.40	106
Aluminum	µg/L	F	102	101	0.5	25.1	1	1	1						3.4	11.94	47.19
Ammonia as Nitrogen	mg/L	F	411	160	0.02	0.45	251	0.02	0.05						0.04	0.09	0.031
Antimony	µg/L	F	102	102	0.035	4.47	0			0.056	0.067	0.10	0.51	0.2		2.72	0.61
Arsenic	µg/L	F	102	102	0.53	2.34	0			0.68	0.80	0.99	1.34	0.89		2.31	3.9
Barium	µg/L	F	102	102	4.11	62.3	0			17.45	23.35	27.9	31.99	22.41		38.31	73.23
Beryllium	µg/L	F	102	19	0.002	0.004	83	0.002	0.002						0.002	0.002	not reported
Bismuth	µg/L	F	102	2	0.001	0.002	100	0.001	0.001						0.001	0.001	not determined
Boron	µg/L	F	102	102	9.8	28	0			12.2	13.45	14.95	22.5	14.19		26.80	38.33
Bromide	mg/L	F	407	23	0.067	0.104	384	0.067	0.2						0.072	0.188	0.0749
Cadmium	µg/L	F	102	2	0.006	0.013	100	0.005	0.005						0.006	0.005	not reported
Calcium	mg/L	F	102	102	8.66	20.4	0			10.93	11.8	12.6	14.68	12.09		18.2	21.1
Cesium	µg/L	F	102	91	0.005	0.312	11	0.005	0.005						0.050	0.22	not determined
Chloride	mg/L	F	407	407	1.42	4.73	0			1.83	2.09	2.31	2.75	2.11		2.98	7.27
Chromium	µg/L	F	102	102	1.24	5.52	0			2.33	2.87	3.72	5.23	3.12		5.53	10.44
Cobalt	µg/L	F	102	93	0.006	0.671	9	0.005	0.005						0.049	0.217	2.318
Copper	µg/L	F	102	60	0.05	6.03	42	0.05	0.05						0.24	1.47	4.688
DO-field	mg/L	NF	399	399	1.70	9.54	0			5.18	6.0	6.7	7.98	5.93		8.10	7.516
Fluoride	mg/L	F	407	407	0.12	0.69	0			0.22	0.27	0.34	0.47	0.29		0.48	0.497
Gallium	µg/L	F	102	0			102	0.05	0.05							0.05	not determined
Hardness	mg/L	F	396	396	19.9	70.1	0			39.5	43.2	47.1	52.3	43.5		53.3	71.6
Iron	µg/L	F	102	19	10	55	83	10	10						11.3	10.0	63.03
Lead	µg/L	F	102	61	0.005	0.125	41	0.005	0.005						0.014	0.06	0.306
Lithium	µg/L	F	102	102	18.9	30.1	0			22.83	24.2	25.85	27.89	24.23		28.59	not reported
Magnesium	mg/L	F	102	102	0.28	4.19	0			2.95	3.22	3.53	4.05	3.20		4.10	4.48
Manganese	µg/L	F	102	101	0.0104	42.2	1	0.005	0.005						1.821	11.77	21.21
Molybdenum	µg/L	F	102	102	0.74	2.27	0			1.03	1.16	1.46	1.87	1.26		2.02	3.394
Nickel	µg/L	F	102	89	0.05	2.68	13	0.05	0.05						0.51	2.28	2.5
Nitrate-Nitrite as Nitrogen	mg/L	F	412	411	0.025	0.98	1	0.25	0.25						0.44	0.78	0.589
ORP-field	mV	NF	367	367	-69.3	504	0			78.15	132	205	391	152		404	366.1
Perchlorate	µg/L	F	389	389	0.12	0.47	0			0.28	0.32	0.36	0.41	0.32		0.43	0.51
pH-field	SU	NF	403	406	6.57	8.97	0			7.66	7.89	8.07	8.29	7.84		8.35	8.45
Phosphorus	µg/L	F	102	1	2	24.1	101	50	50							50	not determined
Potassium	mg/L	F	102	102	1.11	2.95	0			1.47	1.64	1.79	2.40	1.69		2.84	3.23
Rhenium	µg/L	F	102	0			102	0.005	0.005							0.005	not determined
Rubidium	µg/L	F	102	102	1.47	6.44	0			2.34	2.62	3.1	5.03	2.88		5.69	not determined
Selenium	µg/L	F	102	102	0.113	0.783	0			0.303	0.369	0.448	0.607	0.391		0.659	1.842
Silicon Dioxide*	mg/L	F	102	102	42.6	86	0			68.9	72.9	75.8	79.8	71.2		85.0	86.3
Silver	µg/L	F	102	2	0.005	0.011	100	0.005	0.005						0.005	0.005	not reported
Sodium	mg/L	F	102	102	9.55	16.9	0			10.43	10.9	11.5	14.1	11.22		16.8	18.2
Specific Conductance-field	µS/cm	NF	395	395	98	200	0			124	132	144	174	136		178	211
Strontium	µg/L	F	102	102	37.6	165	0			44.28	47.5	51.7	59.69	51.85		139	190

**Table 3. (Continued)**

Analyte	Unit	Filtration	Total Number of Observations/ Number of Valid Data	Number of Detected Data	Minimum/ Minimum Detected	Maximum/ Maximum Detected	Number of Non-Detected Data	Minimum Non-Detect	Maximum Non-Detect	First Quartile/25th Percentile	Median /50th Percentile	Third Quartile/75th Percentile	95th Percentile	Mean /Average	KM Mean	NMED UTL 2013	LANL UTL- Nov. 2011
Sulfate	mg/L	F	407	407	1.37	7.89	0			2.05	2.69	3.4	5.07	2.95		5.84	7.89
Tellurium	µg/L	F	102	0			102	0.01	0.01							0.01	not determined
Temperature-field	degrees C	NF	400	400	15.9	24.78	0			20.34	21.35	22.07	23.4	21.17		23.69	28.8
Thallium	µg/L	F	102	72	0.001	0.015	30	0.001	0.001						0.004	0.017	0.768
Thorium	µg/L	F	102	7	0.005	0.018	95	0.005	0.005						0.006	0.011	not determined
Tin	µg/L	F	102	7	0.01	0.032	95	0.01	0.01						0.01	0.01	8.224
Titanium	µg/L	F	102	35	0.05	0.38	67	0.05	0.05						0.08	0.20	not reported
TDS	mg/L	F	409	409	81.4	268	0			127	135	143	157	135.6		159	186
Total Phosphate as Phosphorus	mg/L	F	410	366	0.01	0.37	44	0.02	0.05						0.06	0.14	0.0999
Tungsten	µg/L	F	102	102	0.29	22.4	0			0.40	0.50	0.82	1.56	1.08		6.98	not determined
Turbidity-field	NTU	NF	403	403	0	262	0			0.46	0.86	1.92	7.49	2.74		9.54	8.9
Uranium	µg/L	F	102	102	0.12	1.37	0			0.30	0.36	0.50	0.77	0.43		1.27	1.544
Vanadium	µg/L	F	102	102	3.97	14.8	0			4.99	5.86	7.56	11.72	6.55		14.30	15.31
Yttrium	µg/L	F	102	71	0.005	0.035	31	0.005	0.005						0.013	0.059	not determined
Zinc	µg/L	F	102	89	0.11	14	13	0.1	0.4						2.44	11.14	19.5
Zirconium	µg/L	F	102	25	0.01	0.04	77	0.01	0.01						0.01	0.01	not determined

\* Silicon Dioxide data were calculated using ALS's silicon results. The formula used to convert Si to SiO<sub>2</sub> is SiO<sub>2</sub> = Si(conc.) x 2.14

NF - Non-filtered, applied to all field parameters.

**Attachment A**

ProUCL Version 4.1 Output Results

General Statistics

Total Number of Observations: 409  
 Tolerance Factor: 1.775  
 Number of Distinct Observations: 177

Raw Statistics

Minimum: 49.5  
 Maximum: 88.9  
 Second Largest: 85.8  
 First Quartile: 57  
 Median: 60.1  
 Third Quartile: 63.8  
 Mean: 61.36  
 Geometric Mean: 61.04  
 SD: 6.44  
 Coefficient of Variation: 0.105  
 Skewness: 1.302

Log-Transformed Statistics

Minimum: 3.904  
 Maximum: 4.465  
 Second Largest: 4.452  
 First Quartile: 4.043  
 Median: 4.096  
 Third Quartile: 4.156  
 Mean: 4.112  
 SD: 0.0997

Background Statistics

Normal Distribution Test

Lilliefors Test Statistic: 0.11  
 Lilliefors Critical Value: 0.0438

Data not Normal at 5% Significance Level

Assuming Normal Distribution

95% UTL with 95% Coverage: 72.79  
 95% UPL (t): 71.98  
 90% Percentile (z): 69.61  
 95% Percentile (z): 71.95  
 99% Percentile (z): 76.34

Gamma Distribution Test

k star: 97.08  
 Theta Star: 0.632  
 MLE of Mean: 61.36  
 MLE of Standard Deviation: 6.227  
 nu star: 79415

A-D Test Statistic: 7.679  
 5% A-D Critical Value: 0.751  
 K-S Test Statistic: 0.0958  
 5% K-S Critical Value: 0.0446

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

90% Percentile: 69.46  
 95% Percentile: 71.94  
 99% Percentile: 76.76

95% WH Approx. Gamma UPL: 71.95  
 95% HW Approx. Gamma UPL: 71.95  
 95% WH Approx. Gamma UTL with 95% Coverage: 72.82  
 95% HW Approx. Gamma UTL with 95% Coverage: 72.83

Lognormal Distribution Test

Lilliefors Test Statistic: 0.0883  
 Lilliefors Critical Value: 0.0438

Data not Lognormal at 5% Significance Level

Assuming Lognormal Distribution

95% UTL with 95% Coverage: 72.86  
 95% UPL (t): 71.98  
 90% Percentile (z): 69.36  
 95% Percentile (z): 71.92  
 99% Percentile (z): 76.98

Data Distribution Test

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

90% Percentile: 69.32  
 95% Percentile: 76.84  
 99% Percentile: 81.29

95% UTL with 95% Coverage: 78.4  
 95% Percentile Bootstrap UTL with 95% Coverage: 78.32  
 95% BCA Bootstrap UTL with 95% Coverage: 78.4  
 95% UPL: 77  
 95% Chebyshev UPL: 89.46  
 Upper Threshold Limit Based upon IQR: 74

Aluminum

General Statistics

Number of Valid Data 102	Number of Detected Data 101
Number of District Detected Data 89	Number of Non-Detected Data 1
Tolerance Factor 1.92	Percent Non-Detects 0.98%

Raw Statistics

Minimum Detected 0.5  
 Maximum Detected 25.1  
 Mean of Detected 3.457  
 SD of Detected 4.466  
 Minimum Non-Detect 1  
 Maximum Non-Detect 1

Log-transformed Statistics

Minimum Detected -0.693  
 Maximum Detected 3.223  
 Mean of Detected 0.814  
 SD of Detected 0.826  
 Minimum Non-Detect 0  
 Maximum Non-Detect 0

Background Statistics

Normal Distribution Test with Detected Values Only

Likelihood Test Statistic 0.28  
 5% Likelihood Critical Value 0.0882

Data not Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only

Likelihood Test Statistic 0.122  
 5% Likelihood Critical Value 0.0882

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method  
 Mean 3.428  
 SD 4.454  
 95% UTL 95% Coverage 11.98  
 95% UPL (t) 10.86  
 90% Percentile (z) 9.136  
 95% Percentile (z) 10.75  
 99% Percentile (z) 13.79

Maximum Likelihood Estimate (MLE) Method

Mean 2.978  
 SD 4.921  
 95% UTL with 95% Coverage 12.43  
 95% UPL (t) 11.19  
 90% Percentile (z) 9.285  
 95% Percentile (z) 11.07  
 99% Percentile (z) 14.43

Assuming Lognormal Distribution

DL/2 Substitution Method  
 Mean (Log Scale) 0.799  
 SD (Log Scale) 0.835  
 95% UTL 95% Coverage 11.05  
 95% UPL (t) 8.953  
 90% Percentile (z) 6.483  
 95% Percentile (z) 8.78  
 99% Percentile (z) 15.51

Log ROS Method

Mean in Original Scale 3.429  
 SD in Original Scale 4.453  
 95% UTL with 95% Coverage 10.98  
 95% BCA UTL with 95% Coverage 20.98  
 95% Bootstrap (%) UTL with 95% Coverage 21.03  
 95% UPL (t) 8.909  
 90% Percentile (z) 6.463  
 95% Percentile (z) 8.738  
 99% Percentile (z) 15.38

Gamma Distribution Test with Detected Values Only

k star (bias corrected) 1.262  
 Theta Star 2.896  
 nu star 259

A-D Test Statistic 5.666  
 5% A-D Critical Value 0.775  
 K-S Test Statistic 0.193  
 5% K-S Critical Value 0.0612

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics with Extrapolated Data  
 Mean 3.423  
 Median 1.915  
 SD 4.457  
 k star 1.004  
 Theta star 3.409  
 Nu star 204.8  
 95% Percentile of Chi-square (2k) 6.007  
 90% Percentile 7.874  
 95% Percentile 10.24  
 99% Percentile 15.73

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method  
 Mean 3.431  
 SD 4.43  
 SE of Mean 0.441  
 95% KM UTL with 95% Coverage 11.94  
 95% KM Chebyshev UPL 22.84  
 95% KM UPL (t) 10.82  
 90% Percentile (z) 9.108  
 95% Percentile (z) 10.72  
 99% Percentile (z) 13.74

Gamma ROS Limits with Extrapolated Data

95% Wilson Hillier (WH) Approx. Gamma UPL 9.376  
 95% Hawkins Wixley (HW) Approx. Gamma UPL 9.597  
 95% WH Approx. Gamma UTL with 95% Coverage 10.98  
 95% HW Approx. Gamma UTL with 95% Coverage 11.42

Note: DL/2 is not a recommended method.

Ammonia as Nitrogen

General Statistics

Number of Valid Data 411	Number of Deleted Data 160
Number of Distinct Deleted Data 108	Number of Non-Detect Data 251
Tolerance Factor 1.775	Percent Non-Detects 61.07%

Raw Statistics

Minimum Detected 0.016  
 Maximum Detected 0.45  
 Mean of Detected 0.0531  
 SD of Detected 0.0581  
 Minimum Non-Detect 0.017  
 Maximum Non-Detect 0.05

Log-transformed Statistics

Minimum Detected -4.135  
 Maximum Detected -0.799  
 Mean of Detected -3.194  
 SD of Detected 0.635  
 Minimum Non-Detect -4.075  
 Maximum Non-Detect -2.998

•

Data with Multiple Detection Limits

Note: Data have multiple DLs - Use of KM Method is recommended  
 For all methods (except KM, DL2, and ROS Methods),  
 Observations < Largest ND are treated as NDs

Single Detection Limit Scenario

Number treated as Non-Detect with Single DL 358  
 Number treated as Detected with Single DL 53  
 Single DL Non-Detect Percentage 87.10%

Background Statistics

Normal Distribution Test with Detected Values Only  
 Lilliefors Test Statistic 0.261  
 5% Lilliefors Critical Value 0.07

Data not Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only  
 Lilliefors Test Statistic 0.07  
 5% Lilliefors Critical Value 0.07

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method  
 Mean 0.0353  
 SD 0.039  
 95% UTL 85% Coverage 0.105  
 95% UPL (t) 0.0997  
 90% Percentile (z) 0.0853  
 95% Percentile (z) 0.0895  
 99% Percentile (z) 0.126

Maximum Likelihood Estimate (MLE) Method

Mean -0.1  
 SD 0.129  
 95% UTL with 85% Coverage 0.128  
 95% UPL (t) 0.112  
 90% Percentile (z) 0.0646  
 95% Percentile (z) 0.111  
 99% Percentile (z) 0.199

Assuming Lognormal Distribution

DL/2 Substitution Method  
 Mean (Log Scale) -3.538  
 SD (Log Scale) 0.524  
 95% UTL 95% Coverage 0.0737  
 95% UPL (t) 0.089  
 90% Percentile (z) 0.0569  
 95% Percentile (z) 0.0688  
 99% Percentile (z) 0.0963

Log ROS Method

Mean in Original Scale 0.0376  
 SD in Original Scale 0.0396  
 95% UTL with 95% Coverage 0.0907  
 95% BCA UTL with 95% Coverage 0.0889  
 95% Bootstrap (%) UTL with 95% Coverage 0.0889  
 95% UPL (t) 0.0839  
 90% Percentile (z) 0.0666  
 95% Percentile (z) 0.0836  
 99% Percentile (z) 0.128

Gamma Distribution Test with Detected Values Only  
 k star (bias corrected) 2.045  
 Theta Star 0.026  
 nu star 654.4

A-D Test Statistic 5.743  
 5% A-D Critical Value 0.765  
 K-S Test Statistic 0.126  
 5% K-S Critical Value 0.0749

Data not Gamma Distributed at 5% Significance Level

Data Distribution Test with Detected Values Only  
 Data appear Lognormal at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method  
 Mean 0.0376  
 SD 0.039  
 SE of Mean 0.00203  
 95% KM UTL with 85% Coverage 0.107  
 95% KM Chebyshev UPL 0.208  
 95% KM UPL (t) 0.102  
 90% Percentile (z) 0.0876  
 95% Percentile (z) 0.102  
 99% Percentile (z) 0.128

Assuming Gamma Distribution

Gamma ROS Statistics with Extrapolated Data  
 Mean 0.0405  
 Median 0.0358  
 SD 0.0429  
 k star 0.382  
 Theta star 0.103  
 Nu star 322.3  
 95% Percentile of Chi-square (2k) 3.281  
 90% Percentile 0.115  
 95% Percentile 0.17  
 99% Percentile 0.307

Gamma ROS Limits with Extrapolated Data

95% Wilson Hillerty (WH) Approx. Gamma UPL 0.146  
 95% Hawkins Whiteley (HW) Approx. Gamma UPL 0.187  
 95% WH Approx. Gamma UTL with 95% Coverage 0.161  
 95% HW Approx. Gamma UTL with 95% Coverage 0.212

Note: DL/2 is not a recommended method.

Antimony

General Statistics

Total Number of Observations 102  
Tolerance Factor 1.92

Number of Distinct Observations 101

Raw Statistics

Minimum 0.0348  
Maximum 4.47  
Second Largest 2.89  
First Quartile 0.0557  
Median 0.0674  
Third Quartile 0.105  
Mean 0.203  
Geometric Mean 0.0911  
SD 0.58  
Coefficient of Variation 2.857  
Skewness 5.863

Log-Transformed Statistics

Minimum -3.358  
Maximum 1.497  
Second Largest 1.061  
First Quartile -2.889  
Median -2.698  
Third Quartile -2.254  
Mean -2.395  
SD 0.885

Background Statistics

Normal Distribution Test

Lilliefors Test Statistic 0.366  
Lilliefors Critical Value 0.0877

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Lilliefors Test Statistic 0.211  
Lilliefors Critical Value 0.0877

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% UTL with 95% Coverage 1.316  
95% UPL (t) 1.17  
90% Percentile (z) 0.948  
95% Percentile (z) 1.158  
99% Percentile (z) 1.551

Assuming Lognormal Distribution

95% UTL with 95% Coverage 0.498  
95% UPL (t) 0.399  
90% Percentile (z) 0.283  
95% Percentile (z) 0.391  
99% Percentile (z) 0.715

Gamma Distribution Test

k star 0.733  
Theta Star 0.277  
MLE of Mean 0.203  
MLE of Standard Deviation 0.237  
nu star 149.5

Data Distribution Test

Data do not follow a Discernable Distribution (0.05)

A-D Test Statistic 16.64

5% A-D Critical Value 0.795

K-S Test Statistic 0.309

5% K-S Critical Value 0.0924

Data not Gamma Distributed at 5% Significance Level

Nonparametric Statistics

90% Percentile 0.281

95% Percentile 0.506

99% Percentile 2.888

Assuming Gamma Distribution

90% Percentile 0.504  
95% Percentile 0.679  
99% Percentile 1.097

95% UTL with 95% Coverage 2.72

95% Percentile Bootstrap UTL with 95% Coverage 2.618

95% BCA Bootstrap UTL with 95% Coverage 2.614

95% UPL 0.593

95% Chebyshev UPL 2.742

Upper Threshold Limit Based upon KOR 0.179

95% WH Approx. Gamma UPL 0.561

95% HW Approx. Gamma UPL 0.51

95% WH Approx. Gamma UTL with 95% Coverage 0.676

95% HW Approx. Gamma UTL with 95% Coverage 0.62

Arsenic

General Statistics

Total Number of Observations 102  
Tolerance Factor 1.82

Number of Distinct Observations 91

Raw Statistics

Minimum 0.532  
Maximum 2.34  
Second Largest 2.34  
First Quartile 0.879  
Median 0.796  
Third Quartile 0.99  
Mean 0.888  
Geometric Mean 0.84  
SD 0.353  
Coefficient of Variation 0.397  
Skewness 2.58

Log-Transformed Statistics

Minimum -0.631  
Maximum 0.85  
Second Largest 0.85  
First Quartile -0.387  
Median -0.229  
Third Quartile -0.0106  
Mean -0.174  
SD 0.312

Background Statistics

Normal Distribution Test

Lilliefors Test Statistic 0.168  
Lilliefors Critical Value 0.0877

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Lilliefors Test Statistic 0.102  
Lilliefors Critical Value 0.0877

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% UTL with 95% Coverage 1.565  
95% UPL (t) 1.476  
90% Percentile (z) 1.34  
95% Percentile (z) 1.468  
99% Percentile (z) 1.709

Assuming Lognormal Distribution

95% UTL with 95% Coverage 1.528  
95% UPL (t) 1.413  
90% Percentile (z) 1.252  
95% Percentile (z) 1.403  
99% Percentile (z) 1.735

Gamma Distribution Test

k star 8.923  
Theta Star 0.0895  
MLE of Mean 0.888  
MLE of Standard Deviation 0.297  
nu star 1820

Data Distribution Test

Data do not follow a Discernable Distribution (0.06)

A-D Test Statistic 3.354  
5% A-D Critical Value 0.753  
K-S Test Statistic 0.121  
5% K-S Critical Value 0.0889

Data not Gamma Distributed at 5% Significance Level

Nonparametric Statistics

90% Percentile 1.225  
95% Percentile 1.338  
99% Percentile 2.34

Assuming Gamma Distribution

90% Percentile 1.284  
95% Percentile 1.426  
99% Percentile 1.721  
95% WH Approx. Gamma UPL 1.426  
95% HW Approx. Gamma UPL 1.422  
95% WH Approx. Gamma UTL with 95% Coverage 1.53  
95% HW Approx. Gamma UTL with 95% Coverage 1.529

95% UTL with 95% Coverage 2.31  
95% Percentile Bootstrap UTL with 95% Coverage 2.301  
95% BCA Bootstrap UTL with 95% Coverage 2.301  
95% UPL 1.646  
95% Chebyshev UPL 2.433  
Upper Threshold Limit Based upon IQR 1.455

Banum

General Statistics

Total Number of Observations 102  
Tolerance Factor 1.92

Number of Distinct Observations 88

Raw Statistics

Minimum 4.11  
Maximum 62.3  
Second Largest 37.3  
First Quartile 17.45  
Median 23.35  
Third Quartile 27.9  
Mean 22.41  
Geometric Mean 20.68  
SD 8.281  
Coefficient of Variation 0.37  
Skewness 0.752

Log-Transformed Statistics

Minimum 1.413  
Maximum 4.132  
Second Largest 3.619  
First Quartile 2.859  
Median 3.151  
Third Quartile 3.329  
Mean 3.029  
SD 0.435

Background Statistics

Normal Distribution Test

Liliefors Test Statistic 0.0844  
Liliefors Critical Value 0.0877

Data appear Normal at 5% Significance Level

Lognormal Distribution Test

Liliefors Test Statistic 0.165  
Liliefors Critical Value 0.0877

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% UTL with 95% Coverage 38.31  
95% UPL (t) 38.22  
90% Percentile (z) 33.02  
95% Percentile (z) 38.03  
99% Percentile (z) 41.67

Assuming Lognormal Distribution

95% UTL with 95% Coverage 47.71  
95% UPL (t) 42.75  
90% Percentile (z) 36.13  
95% Percentile (z) 42.32  
99% Percentile (z) 56.83

Gamma Distribution Test

k star 6.227  
Theta Star 3.598  
MLE of Mean 22.41  
MLE of Standard Deviation 8.979  
nu star 1270

Data Distribution Test

Data appear Normal at 5% Significance Level

A-D Test Statistic 2.162  
5% A-D Critical Value 0.754  
K-S Test Statistic 0.14  
5% K-S Critical Value 0.089

Data not Gamma Distributed at 5% Significance Level

Nonparametric Statistics

90% Percentile 30.64  
95% Percentile 31.99  
99% Percentile 37.3

Assuming Gamma Distribution

90% Percentile 34.41  
95% Percentile 38.52  
99% Percentile 48.37  
95% WH Approx. Gamma UPL 38.03  
95% HW Approx. Gamma UPL 38.73  
95% WH Approx. Gamma UTL with 95% Coverage 42.35  
95% HW Approx. Gamma UTL with 95% Coverage 43.35

95% UTL with 95% Coverage 37.2  
95% Percentile Bootstrap UTL with 95% Coverage 37.01  
95% BCA Bootstrap UTL with 95% Coverage 37.01  
95% UPL 32.51  
95% Chebyshev UPL 58.88  
Upper Threshold Limit Based upon IQR 43.58

Beryllium

General Statistics

Number of Valid Data 102  
Number of Distinct Detected Data 13  
Tolerance Factor 1.92

Number of Detected Data 19  
Number of Non-Detect Data 83  
Percent Non-Detects 81.37%

Raw Statistics

Minimum Detected 0.0021  
Maximum Detected 0.0042  
Mean of Detected 0.00311  
SD of Detected 0.00062581  
Minimum Non-Detect 0.002  
Maximum Non-Detect 0.002

Log-transformed Statistics

Minimum Detected -6.168  
Maximum Detected -5.473  
Mean of Detected -5.794  
SD of Detected 0.208  
Minimum Non-Detect -6.215  
Maximum Non-Detect -6.215

Background Statistics

Normal Distribution Test with Detected Values Only  
Shapiro Wilk Test Statistic 0.967  
5% Shapiro Wilk Critical Value 0.901  
**Data appear Normal at 5% Significance Level**

Lognormal Distribution Test with Detected Values Only  
Shapiro Wilk Test Statistic 0.962  
5% Shapiro Wilk Critical Value 0.901  
**Data appear Lognormal at 5% Significance Level**

Assuming Normal Distribution

DL/2 Substitution Method  
Mean 0.00139  
SD 0.00086502  
95% UTL 95% Coverage 0.00305  
95% UPL (t) 0.00284  
90% Percentile (z) 0.0025  
95% Percentile (z) 0.00281  
99% Percentile (z) 0.0034

Assuming Lognormal Distribution

DL/2 Substitution Method  
Mean (Log Scale) -6.7  
SD (Log Scale) 0.444  
95% UTL 95% Coverage 0.00289  
95% UPL (t) 0.00258  
90% Percentile (z) 0.00217  
95% Percentile (z) 0.00255  
99% Percentile (z) 0.00346

Maximum Likelihood Estimate(MLE) Method

Mean 0.00040287  
SD 0.00183  
95% UTL with 95% Coverage 0.00392  
95% UPL (t) 0.00346  
90% Percentile (z) 0.00275  
95% Percentile (z) 0.00342  
99% Percentile (z) 0.00467

Log ROS Method

Mean in Original Scale 0.00172  
SD in Original Scale 0.00083161  
95% UTL with 95% Coverage 0.0038  
95% BCA UTL with 95% Coverage 0.00389  
95% Bootstrap (%) UTL with 95% Coverage 0.00389  
95% UPL (t) 0.00338  
90% Percentile (z) 0.00281  
95% Percentile (z) 0.00334  
99% Percentile (z) 0.0046

Gamma Distribution Test with Detected Values Only

k star (bias corrected) 21.43  
Theta Star 0.00014492  
nu star 814.3

Data Distribution Test with Detected Values Only

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

A-D Test Statistic 0.225  
5% A-D Critical Value 0.74  
K-S Test Statistic 0.123  
5% K-S Critical Value 0.188

Nonparametric Statistics

Kaplan-Meier (KM) Method  
Mean 0.00229  
SD 0.00047147  
SE of Mean 4.7962E-05  
95% KM UTL with 95% Coverage 0.00319  
95% KM Chebyshev UPL 0.00435  
95% KM UPL (t) 0.00307  
90% Percentile (z) 0.00289  
95% Percentile (z) 0.00306  
99% Percentile (z) 0.00338

**Data appear Gamma Distributed at 5% Significance Level**

Assuming Gamma Distribution

Gamma ROS Statistics with Extrapolated Data  
Mean 0.00071463  
Median 0.000001  
SD 0.00124  
k star 0.181  
Theta star 0.00395  
Nu star 36.9  
95% Percentile of Chi-square (2k) 1.912  
90% Percentile 0.00216  
95% Percentile 0.00378  
99% Percentile 0.00831

Gamma ROS Limits with Extrapolated Data

95% Wilson Hillerty (WH) Approx. Gamma UPL 0.00278  
95% Hawtens Widley (HW) Approx. Gamma UPL 0.00287  
95% WH Approx. Gamma UTL with 95% Coverage 0.0037  
95% HW Approx. Gamma UTL with 95% Coverage 0.0041

**Note: DL/2 is not a recommended method.**

Bemuth

General Statistics

Number of Valid Data 102 Number of Detected Data 2
Number of Distinct Detected Data 2 Number of Non-Detected Data 100

Warning: Data set has only 2 Detected Values.
This is not enough to compute meaningful and reliable test statistics and estimates.
No statistics will be produced!

Tolerance Factor 1.92 Percent Non-Detects 98.01%

Raw Statistics

Minimum Detected 0.0012
Maximum Detected 0.0021
Mean of Detected 0.00165
SD of Detected 0.0006364
Minimum Non-Detect 0.001
Maximum Non-Detect 0.001

Log-transformed Statistics

Minimum Detected -6.725
Maximum Detected -6.166
Mean of Detected -6.446
SD of Detected 0.2396
Minimum Non-Detect -6.908
Maximum Non-Detect -6.908

Warning: Data set has only 2 Distinct Detected Values.

This may not be adequate enough to compute meaningful and reliable test statistics and estimates.
The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

Unless Data Quality Objectives (DQOs) have been met, it is suggested to collect additional observations.

The number of detected data may not be adequate enough to perform GQP tests, bootstrap, and ROS methods.
These methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.

However, results obtained using 4 to 9 distinct values may not be reliable.

It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

Background Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic N/A
5% Shapiro Wilk Critical Value N/A

Data not Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic N/A
5% Shapiro Wilk Critical Value N/A

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

DL2 Substitution Method
Mean 0.00052255
SD 0.00017229
95% UTL 95% Coverage 0.00085342
95% UPL (t) 0.00080997
90% Percentile (z) 0.00074335
95% Percentile (z) 0.00080594
99% Percentile (z) 0.00092336

Assuming Lognormal Distribution

DL2 Substitution Method
Mean (Log Scale) -7.578
SD (Log Scale) 0.166
95% UTL 95% Coverage 0.0007031
95% UPL (t) 0.00067432
90% Percentile (z) 0.00063247
95% Percentile (z) 0.00067172
99% Percentile (z) 0.00075202

Maximum Likelihood Estimate(MLE) Method N/A

Log ROS Method

Mean in Original Scale N/A
SD in Original Scale N/A
Mean in Log Scale N/A
SD in Log Scale N/A
95% UTL 95% Coverage N/A
95% UPL (t) N/A
90% Percentile (z) N/A
95% Percentile (z) N/A
99% Percentile (z) N/A

Gamma Distribution Test with Detected Values Only

k star (bias corrected) N/A
Theta Star N/A
nu star N/A

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

A-D Test Statistic N/A
5% A-D Critical Value N/A
K-S Test Statistic N/A
5% K-S Critical Value N/A

Data not Gamma Distributed at 5% Significance Level

Nonparametric Statistics

Kaplan Meier (KM) Method
Mean 0.00121
SD 8.8675E-05
SE of Mean 1.2417E-05
95% KM UTL with 95% Coverage 0.00138
95% KM Chebyshev UPL 0.0016
95% KM UPL (t) 0.00136
90% Percentile (z) 0.00132
95% Percentile (z) 0.00135
99% Percentile (z) 0.00142

Assuming Gamma Distribution

Gamma ROS Statistics with Extrapolated Data
Mean N/A
Median N/A
SD N/A
k star N/A
Theta star N/A
nu star N/A
85% Percentile of Chi-square (2k) N/A
90% Percentile N/A
95% Percentile N/A
99% Percentile N/A

Gamma ROS Limits with Extrapolated Data

95% Wilson Hillery (WH) Approx. Gamma UPL N/A
95% Hawkins Wadley (HW) Approx. Gamma UPL N/A
95% WH Approx. Gamma UTL with 95% Coverage N/A
95% HW Approx. Gamma UTL with 95% Coverage N/A

Note: DL2 is not a recommended method.

Boron

General Statistics

Total Number of Observations 102  
Tolerance Factor 1.92

Number of Distinct Observations 55

Raw Statistics

Minimum 9.8  
Maximum 28  
Second Largest 27.2  
First Quartile 12.2  
Median 13.45  
Third Quartile 14.95  
Mean 14.19  
Geometric Mean 13.9  
SD 3.288  
Coefficient of Variation 0.232  
Skewness 2.479

Log-Transformed Statistics

Minimum 2.282  
Maximum 3.332  
Second Largest 3.303  
First Quartile 2.501  
Median 2.589  
Third Quartile 2.705  
Mean 2.632  
SD 0.193

Background Statistics

Normal Distribution Test

Lilliefors Test Statistic 0.195  
Lilliefors Critical Value 0.0877

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Lilliefors Test Statistic 0.152  
Lilliefors Critical Value 0.0877

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% UTL with 95% Coverage 20.51  
95% UPL (t) 19.88  
90% Percentile (z) 18.41  
95% Percentile (z) 19.6  
99% Percentile (z) 21.84

Assuming Lognormal Distribution

95% UTL with 95% Coverage 20.15  
95% UPL (t) 19.19  
90% Percentile (z) 17.81  
95% Percentile (z) 19.11  
99% Percentile (z) 21.8

Gamma Distribution Test

k star 23.59  
Theta Star 0.602  
MLE of Mean 14.19  
MLE of Standard Deviation 2.922  
nu star 4812

Data Distribution Test  
Data do not follow a Dicomvable Distribution (0.05)

A-D Test Statistic 5.071  
5% A-D Critical Value 0.75  
K-S Test Statistic 0.188  
5% K-S Critical Value 0.0887

Nonparametric Statistics

90% Percentile 16.96  
95% Percentile 22.5  
99% Percentile 27.2

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

90% Percentile 18.04  
95% Percentile 19.31  
99% Percentile 21.86  
95% WH Approx. Gamma UPL 19.33  
95% HW Approx. Gamma UPL 18.29  
95% WH Approx. Gamma UTL with 95% Coverage 20.24  
95% HW Approx. Gamma UTL with 95% Coverage 20.21

95% UTL with 95% Coverage 26.8  
95% Percentile Bootstrap UTL with 95% Coverage 26.85  
95% BCA Bootstrap UTL with 95% Coverage 28.65  
95% UPL 22.87  
95% Chebyshov UPL 28.59  
Upper Threshold Limit Based upon IQR 19.08

Bromide

General Statistics

Number of Valid Data 407  
Number of Distinct Detected Data 23  
Tolerance Factor 1.776

Number of Detected Data 23  
Number of Non-Detect Data 384  
Percent Non-Detects 94.35%

Raw Statistics

Minimum Detected 0.0668  
Maximum Detected 0.104  
Mean of Detected 0.0791  
SD of Detected 0.0121  
Minimum Non-Detect 0.067  
Maximum Non-Detect 0.2

Log-transformed Statistics

Minimum Detected -2.706  
Maximum Detected -2.263  
Mean of Detected -2.548  
SD of Detected 0.146  
Minimum Non-Detect -2.703  
Maximum Non-Detect -1.609

Data with Multiple Detection Limits

Note: Data have multiple DLs - Use of KM Method is recommended  
For all methods (except KM, DL2, and ROS Methods),  
Observations < Largest ND are treated as NDs

Single Detection Limit Scenario

Number treated as Non-Detect with Single DL 407  
Number treated as Detected with Single DL 0  
Single DL Non-Detect Percentage 100.00%

Background Statistics

Normal Distribution Test with Detected Values Only  
Shapiro Wilk Test Statistic 0.865  
5% Shapiro Wilk Critical Value 0.914

Data not Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only  
Shapiro Wilk Test Statistic 0.881  
5% Shapiro Wilk Critical Value 0.914

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method  
Mean 0.0931  
SD 0.0191  
95% UTL 95% Coverage 0.127  
95% UPL (t) 0.125  
90% Percentile (z) 0.118  
95% Percentile (z) 0.125  
99% Percentile (z) 0.138

Maximum Likelihood Estimate(MLE) Method N/A

Assuming Lognormal Distribution

DL/2 Substitution Method  
Mean (Log Scale) -2.411  
SD (Log Scale) 0.31  
95% UTL 95% Coverage 0.156  
95% UPL (t) 0.15  
90% Percentile (z) 0.134  
95% Percentile (z) 0.149  
99% Percentile (z) 0.185

Log ROS Method

Mean in Original Scale 0.0646  
SD in Original Scale 0.0154  
Mean in Log Scale -2.767  
SD in Log Scale 0.235  
95% UTL 95% Coverage 0.0955  
95% UPL (t) 0.0927  
90% Percentile (z) 0.085  
95% Percentile (z) 0.0926  
99% Percentile (z) 0.109

Gamma Distribution Test with Detected Values Only  
k star (bias corrected) 41.41  
Theta Star 0.00191  
nu star 1805

A-D Test Statistic 1.031  
5% A-D Critical Value 0.741  
K-S Test Statistic 0.178  
5% K-S Critical Value 0.181

Data follow Appx. Gamma Distribution at 5% Significance Level

Data Distribution Test with Detected Values Only  
Data follow Appx. Gamma Distribution at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method  
Mean 0.0717  
SD 0.00958  
SE of Mean 0.00128  
95% KM UTL with 95% Coverage 0.0886  
95% KM Chebyshev UPL 0.113  
95% KM UPL (t) 0.0874  
90% Percentile (z) 0.0839  
95% Percentile (z) 0.0874  
99% Percentile (z) 0.0939

Assuming Gamma Distribution

Gamma ROS Statistics with Extrapolated Data  
Mean 0.0563  
Median 0.0633  
SD 0.0262  
k star 0.781  
Theta star 0.0721  
Nu star 635.6  
95% Percentile of Chiquare (2k) 5.11  
90% Percentile 0.138  
95% Percentile 0.184  
99% Percentile 0.294

Gamma ROS Limits with Extrapolated Data

95% Wilson Hillerty (WH) Approx. Gamma UPL 0.158  
95% Hawkins Wblay (HW) Approx. Gamma UPL 0.196  
95% WH Approx. Gamma UTL with 95% Coverage 0.17  
95% HW Approx. Gamma UTL with 95% Coverage 0.216

Note: DL/2 is not a recommended method.

Cadmium

General Statistics

Number of Valid Data 102  
Number of Detected Data 2  
Number of Distinct Detected Data 2  
Number of Non-Detected Data 100

**Warning: Data set has only 2 Detected Values.**  
This is not enough to compute meaningful and reliable test statistics and estimates.  
No statistics will be produced!

Tolerance Factor 1.92  
Percent Non-Detects 98.04%

Raw Statistics

Minimum Detected 0.0058  
Maximum Detected 0.0126  
Mean of Detected 0.0092  
SD of Detected 0.00481  
Minimum Non-Detect 0.005  
Maximum Non-Detect 0.005

Log-transformed Statistics

Minimum Detected -5.15  
Maximum Detected -4.374  
Mean of Detected -4.782  
SD of Detected 0.549  
Minimum Non-Detect -5.298  
Maximum Non-Detect -5.298

**Warning: Data set has only 2 Distinct Detected Values.**  
This may not be adequate enough to compute meaningful and reliable test statistics and estimates.  
The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

Unless Data Quality Objectives (DQOs) have been met, it is suggested to collect additional observations.

The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.  
Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.

However, results obtained using 4 to 9 distinct values may not be reliable.

It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

Background Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic N/A  
5% Shapiro Wilk Critical Value N/A

**Data not Normal at 5% Significance Level**

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic N/A  
5% Shapiro Wilk Critical Value N/A

**Data not Lognormal at 5% Significance Level**

Assuming Normal Distribution

DL/2 Substitution Method  
Mean 0.00263  
SD 0.00105  
95% UTL 95% Coverage 0.00465  
95% UPL (l) 0.00438  
90% Percentile (z) 0.00398  
95% Percentile (z) 0.00436  
99% Percentile (z) 0.00507

Assuming Lognormal Distribution

DL/2 Substitution Method  
Mean (Log Scale) -5.987  
SD (Log Scale) 0.18  
95% UTL 95% Coverage 0.00362  
95% UPL (l) 0.00348  
90% Percentile (z) 0.00322  
95% Percentile (z) 0.00344  
99% Percentile (z) 0.00389

Maximum Likelihood Estimate(MLE) Method N/A

Log ROS Method

Mean in Original Scale N/A  
SD in Original Scale N/A  
Mean in Log Scale N/A  
SD in Log Scale N/A  
95% UTL 95% Coverage N/A  
95% UPL (l) N/A  
90% Percentile (z) N/A  
95% Percentile (z) N/A  
99% Percentile (z) N/A

Gamma Distribution Test with Detected Values Only

k star (bias corrected) N/A  
Theta Star N/A  
no star N/A

A-D Test Statistic N/A  
5% A-D Critical Value N/A  
K-S Test Statistic N/A  
5% K-S Critical Value N/A

**Data not Gamma Distributed at 5% Significance Level**

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (D.06)

Nonparametric Statistics

Kaplan-Meier (KM) Method  
Mean 0.00587  
SD 0.00066999  
SE of Mean 9.3818E-05  
95% KM UTL with 95% Coverage 0.00715  
95% KM Chebyshev UPL 0.0088  
95% KM UPL (l) 0.00598  
90% Percentile (z) 0.00673  
95% Percentile (z) 0.00697  
99% Percentile (z) 0.00743

Assuming Gamma Distribution

Gamma ROS Statistics with Extrapolated Data  
Mean N/A  
Median N/A  
SD N/A  
k star N/A  
Theta star N/A  
No star N/A  
95% Percentile of Chi-square (2k) N/A  
90% Percentile N/A  
95% Percentile N/A  
99% Percentile N/A

Gamma ROS Limits with Extrapolated Data

95% Wilson Hillerty (WH) Approx. Gamma UPL N/A  
95% Hawkins Wibley (HW) Approx. Gamma UPL N/A  
95% WH Approx. Gamma UTL with 95% Coverage N/A  
95% HW Approx. Gamma UTL with 95% Coverage N/A

Note: DL/2 is not a recommended method.

Calcium (mg/L)

General Statistics

Total Number of Observations 102  
Tolerance Factor 1.92

Number of Distinct Observations 46

Raw Statistics

Minimum 8.66  
Maximum 20.4  
Second Largest 18.7  
First Quartile 10.93  
Median 11.8  
Third Quartile 12.6  
Mean 12.09  
Geometric Mean 11.96  
SD 1.875  
Coefficient of Variation 0.155  
Skewness 1.397

Log-Transformed Statistics

Minimum 2.159  
Maximum 3.016  
Second Largest 2.929  
First Quartile 2.391  
Median 2.468  
Third Quartile 2.534  
Mean 2.482  
SD 0.14

Background Statistics

Normal Distribution Test

Lilliefors Test Statistic 0.147  
Lilliefors Critical Value 0.0877

Data not Normal at 5% Significance Level

Assuming Normal Distribution

95% UTL with 95% Coverage 15.69  
95% UPL (t) 15.22  
90% Percentile (z) 14.49  
95% Percentile (z) 15.17  
99% Percentile (z) 16.45

Gamma Distribution Test

k star 47.02  
Theta Star 0.257  
MLE of Mean 12.09  
MLE of Standard Deviation 1.763  
nu star 9592

A-D Test Statistic 2.597  
5% A-D Critical Value 0.75  
K-S Test Statistic 0.122  
5% K-S Critical Value 0.0887

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

90% Percentile 14.4  
95% Percentile 15.13  
99% Percentile 16.56  
  
95% WH Approx. Gamma UPL 15.14  
95% HW Approx. Gamma UPL 15.13  
95% WH Approx. Gamma UTL with 95% Coverage 15.66  
95% HW Approx. Gamma UTL with 95% Coverage 15.66

Lognormal Distribution Test

Lilliefors Test Statistic 0.111  
Lilliefors Critical Value 0.0877

Data not Lognormal at 5% Significance Level

Assuming Lognormal Distribution

95% UTL with 95% Coverage 15.86  
95% UPL (t) 15.12  
90% Percentile (z) 14.32  
95% Percentile (z) 15.07  
99% Percentile (z) 16.58

Data Distribution Test

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

90% Percentile 13.59  
95% Percentile 14.68  
99% Percentile 18.7  
  
95% UTL with 95% Coverage 18.2  
95% Percentile Bootstrap UTL with 95% Coverage 18.18  
95% BCA Bootstrap UTL with 95% Coverage 18.01  
95% UPL 17  
95% Chebyshev UPL 20.3  
Upper Threshold Limit Based upon IQR 15.11

Cesium

General Statistics

Number of Valid Data 102  
Number of Distinct Detected Data 73  
Tolerance Factor 1.92

Number of Detected Data 91  
Number of Non-Detected Data 11  
Percent Non-Detects 10.78%

Raw Statistics

Minimum Detected 0.005  
Maximum Detected 0.312  
Mean of Detected 0.0555  
SD of Detected 0.093  
Minimum Non-Detect 0.005  
Maximum Non-Detect 0.005

Log-transformed Statistics

Minimum Detected -5.298  
Maximum Detected -1.165  
Mean of Detected -3.923  
SD of Detected 1.294  
Minimum Non-Detect -5.298  
Maximum Non-Detect -5.298

Background Statistics

Normal Distribution Test with Detected Values Only  
Lilliefors Test Statistic 0.389  
5% Lilliefors Critical Value 0.0929

Data not Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only  
Lilliefors Test Statistic 0.217  
5% Lilliefors Critical Value 0.0929

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

DU/2 Substitution Method  
Mean 0.0498  
SD 0.0893  
95% UTL 95% Coverage 0.221  
95% UPL (t) 0.199  
90% Percentile (z) 0.164  
95% Percentile (z) 0.197  
99% Percentile (z) 0.258

Assuming Lognormal Distribution

DU/2 Substitution Method  
Mean (Log Scale) -4.146  
SD (Log Scale) 1.381  
95% UTL 95% Coverage 0.225  
95% UPL (t) 0.158  
90% Percentile (z) 0.0929  
95% Percentile (z) 0.153  
99% Percentile (z) 0.393

Maximum Likelihood Estimate(MLE) Method

Mean 0.0432  
SD 0.0958  
95% UTL with 95% Coverage 0.227

Log ROS Method

Mean in Original Scale 0.0497  
SD in Original Scale 0.0894  
95% UTL with 95% Coverage 0.266  
95% BCA UTL with 95% Coverage 0.282  
95% Bootstrap (%) UTL with 95% Coverage 0.268  
95% UPL (t) 0.182  
90% Percentile (z) 0.101  
95% Percentile (z) 0.175  
99% Percentile (z) 0.491

Gamma Distribution Test with Detected Values Only

k star (bias corrected) 0.587  
Theta Star 0.0946  
nu star 106.8

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

A-D Test Statistic 11.11

5% A-D Critical Value 0.809

K-S Test Statistic 0.315

5% K-S Critical Value 0.0684

Data not Gamma Distributed at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method

Mean 0.0501

SD 0.0687

SE of Mean 0.00884

95% KM UTL with 95% Coverage 0.22

95% KM Chebyshev UPL 0.439

95% KM UPL (t) 0.198

90% Percentile (z) 0.164

95% Percentile (z) 0.196

99% Percentile (z) 0.257

Assuming Gamma Distribution

Gamma ROS Statistics with Extrapolated Data

Mean 0.0495

Median 0.0105

SD 0.0895

k star 0.337

Theta star 0.147

Nu star 68.73

95% Percentile of Chi-square (2k) 2.988

90% Percentile 0.144

95% Percentile 0.218

99% Percentile 0.409

Gamma ROS Limits with Extrapolated Data

95% Wilson Hillerty (WH) Approx. Gamma UPL 0.177

95% Hawkins Wadley (HW) Approx. Gamma UPL 0.193

95% WH Approx. Gamma UTL with 95% Coverage 0.223

95% HW Approx. Gamma UTL with 95% Coverage 0.252

Note: DU/2 is not a recommended method.

Chloride

General Statistics

Total Number of Observations 407  
Tolerance Factor 1.776

Number of Distinct Observations 129

Raw Statistics

Minimum 1.42  
Maximum 4.73  
Second Largest 3.84  
First Quartile 1.835  
Median 2.09  
Third Quartile 2.315  
Mean 2.111  
Geometric Mean 2.079  
SD 0.39  
Coefficient of Variation 0.185  
Skewness 1.61

Log-Transformed Statistics

Minimum 0.351  
Maximum 1.554  
Second Largest 1.345  
First Quartile 0.607  
Median 0.737  
Third Quartile 0.839  
Mean 0.732  
SD 0.171

Background Statistics

Normal Distribution Test

Lilliefors Test Statistic 0.0766  
Lilliefors Critical Value 0.0439

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Lilliefors Test Statistic 0.0599  
Lilliefors Critical Value 0.0439

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% UTL with 95% Coverage 2.803  
95% UPL (t) 2.755  
90% Percentile (z) 2.611  
95% Percentile (z) 2.752  
99% Percentile (z) 3.018

Assuming Lognormal Distribution

95% UTL with 95% Coverage 2.819  
95% UPL (t) 2.75  
90% Percentile (z) 2.59  
95% Percentile (z) 2.757  
99% Percentile (z) 3.099

Gamma Distribution Test

k star 32.89  
Theta Star 0.0646  
MLE of Mean 2.111  
MLE of Standard Deviation 0.369  
nu star 26611

Data Distribution Test

Data do not follow a Discernable Distribution (0.05)

A-D Test Statistic 2.458  
5% A-D Critical Value 0.752  
K-S Test Statistic 0.0645  
5% K-S Critical Value 0.0447

Data not Gamma Distributed at 5% Significance Level

Nonparametric Statistics

90% Percentile 2.514  
95% Percentile 2.75  
99% Percentile 3.273

Assuming Gamma Distribution

90% Percentile 2.596  
95% Percentile 2.753  
99% Percentile 3.064  
95% WH Approx. Gamma UPL 2.753  
95% HW Approx. Gamma UPL 2.754  
95% WH Approx. Gamma UTL with 95% Coverage 2.809  
95% HW Approx. Gamma UTL with 95% Coverage 2.811

95% UTL with 95% Coverage 2.98

95% Percentile Bootstrap UTL with 95% Coverage 2.956  
95% BCA Bootstrap UTL with 95% Coverage 2.89  
95% UPL 2.756  
95% Chebyshev UPL 3.812  
Upper Threshold Limit Based upon IQR 3.035

Chromium

General Statistics

Total Number of Observations 102  
Tolerance Factor 1.92

Number of Distinct Observations 69

Raw Statistics

Minimum 1.24  
Maximum 5.52  
Second Largest 5.5  
First Quartile 2.333  
Median 2.885  
Third Quartile 3.718  
Mean 3.116  
Geometric Mean 2.957  
SD 1.025  
Coefficient of Variation 0.329  
Skewness 0.669

Log-Transformed Statistics

Minimum 0.215  
Maximum 1.708  
Second Largest 1.705  
First Quartile 0.847  
Median 1.053  
Third Quartile 1.313  
Mean 1.084  
SD 0.326

Background Statistics

Normal Distribution Test

Lilliefors Test Statistic 0.121  
Lilliefors Critical Value 0.0877

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Lilliefors Test Statistic 0.0719  
Lilliefors Critical Value 0.0877

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% UTL with 95% Coverage 5.084  
95% UPL (t) 4.825  
90% Percentile (z) 4.429  
95% Percentile (z) 4.802  
99% Percentile (z) 5.5

Assuming Lognormal Distribution

95% UTL with 95% Coverage 5.526  
95% UPL (t) 5.091  
90% Percentile (z) 4.488  
95% Percentile (z) 5.052  
99% Percentile (z) 6.307

Gamma Distribution Test

k star 9.442  
Theta Star 0.33  
MLE of Mean 3.116  
MLE of Standard Deviation 1.014  
nu star 1926

Data Distribution Test

Data appear Lognormal at 5% Significance Level

A-D Test Statistic 0.774

5% A-D Critical Value 0.752

K-S Test Statistic 0.0908

5% K-S Critical Value 0.0889

Data not Gamma Distributed at 5% Significance Level

Nonparametric Statistics

90% Percentile 4.726

95% Percentile 5.229

99% Percentile 5.489

Assuming Gamma Distribution

90% Percentile 4.466

95% Percentile 4.95

99% Percentile 5.945

95% WH Approx. Gamma UPL 4.962

95% HW Approx. Gamma UPL 4.989

95% WH Approx. Gamma UTL with 95% Coverage 5.315

95% HW Approx. Gamma UTL with 95% Coverage 5.36

95% UTL with 95% Coverage 5.37

95% Percentile Bootstrap UTL with 95% Coverage 5.369

95% BCA Bootstrap UTL with 95% Coverage 5.369

95% UPL 5.291

95% Chebyshev UPL 7.805

Upper Threshold Limit Based upon IQR 5.795

Cobalt

General Statistics

Number of Valid Data 102  
Number of Detected Data 87  
Tolerance Factor 1.92

Number of Detected Data 93  
Number of Non-Detect Data 9  
Percent Non-Detects 8.82%

Raw Statistics

Minimum Detected 0.006  
Maximum Detected 0.671  
Mean of Detected 0.0536  
SD of Detected 0.0889  
Minimum Non-Detect 0.005  
Maximum Non-Detect 0.005

Log-transformed Statistics

Minimum Detected -5.116  
Maximum Detected -0.399  
Mean of Detected -3.469  
SD of Detected 0.954  
Minimum Non-Detect -5.298  
Maximum Non-Detect -5.298

Background Statistics

Normal Distribution Test with Detected Values Only

Lilliefors Test Statistic 0.296  
5% Lilliefors Critical Value 0.0819

Data not Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only

Lilliefors Test Statistic 0.0686  
5% Lilliefors Critical Value 0.0619

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

DL2 Substitution Method

Mean 0.0491  
SD 0.0861  
95% UTL 95% Coverage 0.214  
95% UPL (t) 0.193  
90% Percentile (z) 0.159  
95% Percentile (z) 0.191  
99% Percentile (z) 0.249

Assuming Lognormal Distribution

DL2 Substitution Method

Mean (Log Scale) -3.691  
SD (Log Scale) 1.16  
95% UTL 95% Coverage 0.231  
95% UPL (t) 0.173  
90% Percentile (z) 0.11  
95% Percentile (z) 0.168  
99% Percentile (z) 0.37

Maximum Likelihood Estimate(MLE) Method

Mean 0.044  
SD 0.081  
95% UTL with 95% Coverage 0.219

Log ROS Method

Mean on Original Scale 0.0492  
SD on Original Scale 0.0861  
95% UTL with 95% Coverage 0.217  
95% BCA UTL with 95% Coverage 0.198  
95% Bootstrap (%) UTL with 95% Coverage 0.198  
95% UPL (t) 0.164  
90% Percentile (z) 0.106  
95% Percentile (z) 0.159  
99% Percentile (z) 0.34

95% UPL (t) 0.196

90% Percentile (z) 0.161

95% Percentile (z) 0.194

99% Percentile (z) 0.256

Gamma Distribution Test with Detected Values Only

k star (bias corrected) 1.029  
Theta Star 0.0522  
nu star 191.3

Data Distribution Test with Detected Values Only

Data appear Lognormal at 5% Significance Level

A-D Test Statistic 2.893

5% A-D Critical Value 0.782

K-S Test Statistic 0.122

5% K-S Critical Value 0.0654

Data not Gamma Distributed at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method

Mean 0.0494  
SD 0.0855  
SE of Mean 0.00851  
95% KM UTL with 95% Coverage 0.214  
95% KM Chebyshev UPL 0.424  
95% KM UPL (t) 0.192  
90% Percentile (z) 0.159  
95% Percentile (z) 0.19  
99% Percentile (z) 0.248

Assuming Gamma Distribution

Gamma ROS Statistics with Extrapolated Data

Mean 0.0489  
Median 0.0251  
SD 0.0862  
k star 0.463  
Theta star 0.106  
Nu star 94.42  
95% Percentile of Chi-square (2k) 3.855

Gamma ROS Limits with Extrapolated Data

95% Wilson Hillarty (WH) Approx. Gamma UPL 0.164  
95% Hewlons Wilsley (HW) Approx. Gamma UPL 0.188  
95% WH Approx. Gamma UTL with 95% Coverage 0.2  
95% HW Approx. Gamma UTL with 95% Coverage 0.238

90% Percentile 0.134

95% Percentile 0.193

99% Percentile 0.339

Note: DL2 is not a recommended method.

Copper

General Statistics

Number of Valid Data 102  
Number of Distinct Detected Data 56  
Tolerance Factor 1.82

Number of Detected Data 60  
Number of Non-Detect Data 42  
Percent Non-Detects 41.18%

Raw Statistics

Minimum Detected 0.053  
Maximum Detected 6.03  
Mean of Detected 0.375  
SD of Detected 0.813  
Minimum Non-Detect 0.05  
Maximum Non-Detect 0.05

Log-transformed Statistics

Minimum Detected -2.837  
Maximum Detected 1.797  
Mean of Detected -1.888  
SD of Detected 1.004  
Minimum Non-Detect -2.998  
Maximum Non-Detect -2.998

Background Statistics

Normal Distribution Test with Detected Values Only  
Lilliefors Test Statistic 0.346  
5% Lilliefors Critical Value 0.114

Data not Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only  
Lilliefors Test Statistic 0.146  
5% Lilliefors Critical Value 0.114

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method  
Mean 0.231  
SD 0.645  
95% UTL 95% Coverage 1.489  
95% UPL (t) 1.307  
90% Percentile (z) 1.057  
95% Percentile (z) 1.291  
99% Percentile (z) 1.731

Maximum Likelihood Estimate(MLE) Method

Mean -0.0708  
SD 0.891  
95% UTL with 95% Coverage 1.641  
95% UPL (t) 1.416  
90% Percentile (z) 1.072  
95% Percentile (z) 1.395  
99% Percentile (z) 2.003

Assuming Lognormal Distribution

DL/2 Substitution Method  
Mean (Log Scale) -2.512  
SD (Log Scale) 1.252  
95% UTL 95% Coverage 0.899  
95% UPL (t) 0.655  
90% Percentile (z) 0.404  
95% Percentile (z) 0.636  
99% Percentile (z) 1.494

Log ROS Method

Mean in Original Scale 0.228  
SD in Original Scale 0.646  
95% UTL with 95% Coverage 1.328  
95% BCA UTL with 95% Coverage 1.311  
95% Bootstrap (%) UTL with 95% Coverage 1.311  
95% UPL (t) 0.892  
90% Percentile (z) 0.485  
95% Percentile (z) 0.86  
99% Percentile (z) 2.511

Gamma Distribution Test with Detected Values Only  
k star (bias corrected) 0.805  
Theta Star 0.465  
nu star 96.65

A-D Test Statistic 4.43  
5% A-D Critical Value 0.788  
K-S Test Statistic 0.239  
5% K-S Critical Value 0.119

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics with Extrapolated Data  
Mean 0.22  
Median 0.0685  
SD 0.648  
k star 0.151  
Theta star 1.459  
Nu star 30.81  
95% Percentile of Chi-square (2k) 1.06  
90% Percentile 0.654  
95% Percentile 1.211  
99% Percentile 2.825

Data Distribution Test with Detected Values Only  
Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method  
Mean 0.242  
SD 0.638  
SE of Mean 0.0837  
95% KM UTL with 95% Coverage 1.488  
95% KM Chebyshev UPL 3.038  
95% KM UPL (t) 1.307  
90% Percentile (z) 1.06  
95% Percentile (z) 1.292  
99% Percentile (z) 1.727

Gamma ROS Limits with Extrapolated Data

95% Wilson Hillerty (WH) Approx. Gamma UPL 0.856  
95% Hawkins Wisley (HW) Approx. Gamma UPL 1.014  
95% WH Approx. Gamma UTL with 95% Coverage 1.110  
95% HW Approx. Gamma UTL with 95% Coverage 1.426

Note: DL/2 is not a recommended method.

Dissolved Oxygen

General Statistics

Total Number of Observations 399  
Tolerance Factor 1.777

Number of Distinct Observations 252

Raw Statistics

Minimum 1.7  
Maximum 9.54  
Second Largest 9.37  
First Quartile 5.18  
Median 6  
Third Quartile 6.7  
Mean 5.934  
Geometric Mean 5.796  
SD 1.219  
Coefficient of Variation 0.205  
Skewness -0.131

Log-Transformed Statistics

Minimum 0.531  
Maximum 2.255  
Second Largest 2.238  
First Quartile 1.845  
Median 1.792  
Third Quartile 1.902  
Mean 1.757  
SD 0.225

Background Statistics

Normal Distribution Test

Lilliefors Test Statistic 0.0424  
Lilliefors Critical Value 0.0444

Data appear Normal at 5% Significance Level

Lognormal Distribution Test

Lilliefors Test Statistic 0.0731  
Lilliefors Critical Value 0.0444

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% UTL with 95% Coverage 8.1  
95% UPL (t) 7.946  
90% Percentile (z) 7.436  
95% Percentile (z) 7.938  
99% Percentile (z) 8.769

Assuming Lognormal Distribution

95% UTL with 95% Coverage 8.645  
95% UPL (t) 8.403  
90% Percentile (z) 7.733  
95% Percentile (z) 8.391  
99% Percentile (z) 9.782

Gamma Distribution Test

k star 21.36  
Theta Star 0.278  
MLE of Mean 5.934  
MLE of Standard Deviation 1.284  
nu star 17045

Data Distribution Test

Data appear Normal at 5% Significance Level

A-D Test Statistic 3.189  
5% A-D Critical Value 0.752  
K-S Test Statistic 0.0628  
5% K-S Critical Value 0.0451

Nonparametric Statistics

90% Percentile 7.254  
95% Percentile 7.982  
99% Percentile 9.103

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

90% Percentile 7.627  
95% Percentile 8.191  
99% Percentile 9.321  
95% WH Approx. Gamma UPL 8.194  
95% HW Approx. Gamma UPL 8.238  
95% WH Approx. Gamma UTL with 95% Coverage 8.396  
95% HW Approx. Gamma UTL with 95% Coverage 8.45

95% UTL with 95% Coverage 8.07  
95% Percentile Bootstrap UTL with 95% Coverage 8.12  
95% BCA Bootstrap UTL with 95% Coverage 8.075  
95% UPL 8  
95% Chebyshev UPL 11.25  
Upper Threshold Limit Based upon IQR 8.98

Florida

General Statistics

Total Number of Observations 407  
Tolerance Factor 1.778

Number of Distinct Observations 238

Raw Statistics

Minimum 0.121  
Maximum 0.888  
Second Largest 0.648  
First Quartile 0.221  
Median 0.27  
Third Quartile 0.336  
Mean 0.287  
Geometric Mean 0.273  
SD 0.0945  
Coefficient of Variation 0.329  
Skewness 1.033

Log-Transformed Statistics

Minimum -2.112  
Maximum -0.374  
Second Largest -0.437  
First Quartile -1.51  
Median -1.309  
Third Quartile -1.092  
Mean -1.298  
SD 0.315

Background Statistics

Normal Distribution Test

Lilliefors Test Statistic 0.0901  
Lilliefors Critical Value 0.0439

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Lilliefors Test Statistic 0.0263  
Lilliefors Critical Value 0.0439

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% UTL with 95% Coverage 0.455  
95% UPL (t) 0.443  
90% Percentile (z) 0.408  
95% Percentile (z) 0.443  
99% Percentile (z) 0.507

Assuming Lognormal Distribution

95% UTL with 95% Coverage 0.478  
95% UPL (t) 0.459  
90% Percentile (z) 0.409  
95% Percentile (z) 0.459  
99% Percentile (z) 0.568

Gamma Distribution Test

k star 10.04  
Theta Star 0.0286  
MLE of Mean 0.287  
MLE of Standard Deviation 0.0907  
nu star 8173

Data Distribution Test

Data appear Lognormal at 5% Significance Level

A-D Test Statistic 1.248  
5% A-D Critical Value 0.754  
K-S Test Statistic 0.0476  
5% K-S Critical Value 0.0449

Nonparametric Statistics

90% Percentile 0.414  
95% Percentile 0.472  
99% Percentile 0.574

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

90% Percentile 0.408  
95% Percentile 0.451  
99% Percentile 0.539  
95% WH Approx. Gamma UPL 0.451  
95% HW Approx. Gamma UPL 0.453  
95% WH Approx. Gamma UTL with 95% Coverage 0.466  
95% HW Approx. Gamma UTL with 95% Coverage 0.468

95% UTL with 95% Coverage 0.497  
95% Percentile Bootstrap UTL with 95% Coverage 0.497  
95% BCA Bootstrap UTL with 95% Coverage 0.496  
95% UPL 0.48  
95% Chebyshev UPL 0.7  
Upper Threshold Limit Based upon IQR 0.507

Gallium

General Statistics

Number of Valid Data: 102

Number of Detected Data: 0

Number of Distinct Detected Data: 0

Number of Non-Detect Data: 102

Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!  
Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!  
The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Gallium was not processed!

Hardness

General Statistics

Total Number of Observations 398  
Tolerance Factor 1.778

Number of Distinct Observations 171

Raw Statistics

Minimum 19.9  
Maximum 70.1  
Second Largest 63  
First Quartile 39.5  
Median 43.2  
Third Quartile 47.13  
Mean 43.54  
Geometric Mean 43.2  
SD 5.478  
Coefficient of Variation 0.126  
Skewness 0.302

Log-Transformed Statistics

Minimum 2.981  
Maximum 4.25  
Second Largest 4.143  
First Quartile 3.676  
Median 3.766  
Third Quartile 3.853  
Mean 3.766  
SD 0.128

Background Statistics

Normal Distribution Test

Lilliefors Test Statistic 0.0401  
Lilliefors Critical Value 0.0445

Data appear Normal at 5% Significance Level

Lognormal Distribution Test

Lilliefors Test Statistic 0.039  
Lilliefors Critical Value 0.0445

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% UTL with 95% Coverage 53.28  
95% UPL (t) 52.59  
90% Percentile (z) 50.56  
95% Percentile (z) 52.55  
99% Percentile (z) 56.29

Assuming Lognormal Distribution

95% UTL with 95% Coverage 54.19  
95% UPL (t) 53.32  
90% Percentile (z) 50.86  
95% Percentile (z) 53.27  
99% Percentile (z) 58.11

Gamma Distribution Test

k star 62.3  
Theta Star 0.699  
MLE of Mean 43.54  
MLE of Standard Deviation 5.516  
nu star 49344

Data Distribution Test

Data appear Normal at 5% Significance Level

A-D Test Statistic 0.571

5% A-D Critical Value 0.752

K-S Test Statistic 0.0329

5% K-S Critical Value 0.0453

Data appear Gamma Distributed at 5% Significance Level

Nonparametric Statistics

90% Percentile 50.95

95% Percentile 52.33

99% Percentile 55.81

Assuming Gamma Distribution

90% Percentile 50.74

95% Percentile 53

99% Percentile 57.39

95% WH Approx. Gamma UPL 53

95% HW Approx. Gamma UPL 53.07

95% WH Approx. Gamma UTL with 95% Coverage 53.8

95% HW Approx. Gamma UTL with 95% Coverage 53.89

95% UTL with 95% Coverage 53.1

95% Percentile Bootstrap UTL with 95% Coverage 53.03

95% BCA Bootstrap UTL with 95% Coverage 53.03

95% UPL 52.4

95% Chebyshev UPL 67.45

Upper Threshold Limit Based upon IQR 58.56

Iron

General Statistics

Number of Valid Data: 102  
Number of Detectable Data: 11  
Tolerance Factor: 1.92

Number of Detected Data: 19  
Number of Non-Detect Data: 83  
Percent Non-Detects: 81.37%

Raw Statistics

Minimum Detected: 10  
Maximum Detected: 55  
Mean of Detected: 17.14  
SD of Detected: 10.56  
Minimum Non-Detect: 10  
Maximum Non-Detect: 10

Log-transformed Statistics

Minimum Detected: 2.303  
Maximum Detected: 4.007  
Mean of Detected: 2.734  
SD of Detected: 0.421  
Minimum Non-Detect: 2.303  
Maximum Non-Detect: 2.303

Background Statistics

Normal Distribution Test with Detected Values Only

Shapiro-Wilk Test Statistic: 0.604  
5% Shapiro-Wilk Critical Value: 0.901

Data not Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only

Shapiro-Wilk Test Statistic: 0.767  
5% Shapiro-Wilk Critical Value: 0.901

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

DL 2 Substitution Method

Mean: 7.261  
SD: 8.514  
95% UTL 95% Coverage: 19.77  
95% UPL (t): 18.13  
90% Percentile (z): 15.61  
95% Percentile (z): 17.98  
99% Percentile (z): 22.41

Maximum Likelihood Estimate (MLE) Method

Mean: -5.16  
SD: 16.27  
95% UTL with 95% Coverage: 26.09  
95% UPL (t): 21.99  
90% Percentile (z): 15.7  
95% Percentile (z): 21.61  
99% Percentile (z): 32.7

Assuming Lognormal Distribution

DL 2 Substitution Method

Mean (Log Scale): 1.819  
SD (Log Scale): 0.475  
95% UTL 95% Coverage: 15.34  
95% UPL (t): 13.61  
90% Percentile (z): 11.33  
95% Percentile (z): 13.46  
99% Percentile (z): 18.6

Log ROS Method

Mean in Original Scale: 6.036  
SD in Original Scale: 7.238  
95% UTL with 95% Coverage: 24.27  
95% BCA UTL with 95% Coverage: 18  
95% Bootstrap (%) UTL with 95% Coverage: 25.8  
95% UPL (t): 19.02  
90% Percentile (z): 13.1  
95% Percentile (z): 18.5  
99% Percentile (z): 35.91

Gamma Distribution Test with Detected Values Only

k star (bias corrected): 4.113  
Theta Star: 4.167  
nu star: 156.3

A-D Test Statistic: 1.985

5% A-D Critical Value: 0.743  
K-S Test Statistic: 0.312  
5% K-S Critical Value: 0.199

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics with Extrapolated Data

Mean: 3.222  
Median: 0.000001  
SD: 8.044  
k star: 0.0769  
Theta star: 41.88  
Nu star: 15.7  
95% Percentile of Chi-square (Z): 0.893  
90% Percentile: 7.448  
95% Percentile: 18.7  
99% Percentile: 58.12

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method

Mean: 11.33  
SD: 5.236  
SE of Mean: 0.533  
95% KM UTL with 95% Coverage: 21.38  
95% KM Chebyshev UPL: 34.26  
95% KM UPL (t): 20.06  
90% Percentile (z): 18.04  
95% Percentile (z): 19.94  
99% Percentile (z): 23.51

Gamma ROS Limits with Extrapolated Data

95% Wilson-Hilferty (WH) Approx. Gamma UPL: 10.07  
95% Hawkins-Friday (HW) Approx. Gamma UPL: 8.639  
95% WH Approx. Gamma UTL with 95% Coverage: 14.01  
95% HW Approx. Gamma UTL with 95% Coverage: 13.32

Note: DL/2 is not a recommended method.

Lead

General Statistics

Number of Valid Data 102  
Number of Distinct Detected Data 55  
Tolerance Factor 1.92

Number of Detected Data 61  
Number of Non-Detected Data 41  
Percent Non-Detects 40.20%

Raw Statistics

Minimum Detected 0.0053  
Maximum Detected 0.125  
Mean of Detected 0.0198  
SD of Detected 0.0221  
Minimum Non-Detect 0.005  
Maximum Non-Detect 0.005

Log-transformed Statistics

Minimum Detected -5.24  
Maximum Detected -2.079  
Mean of Detected -4.244  
SD of Detected 0.726  
Minimum Non-Detect -5.298  
Maximum Non-Detect -5.298

Background Statistics

Normal Distribution Test with Detected Values Only

Lilliefors Test Statistic 0.293  
5% Lilliefors Critical Value 0.113

**Data not Normal at 5% Significance Level**

Lognormal Distribution Test with Detected Values Only

Lilliefors Test Statistic 0.113  
5% Lilliefors Critical Value 0.113

**Data appear Lognormal at 5% Significance Level**

Assuming Normal Distribution

DL/2 Substitution Method  
Mean 0.0129  
SD 0.019  
95% UTL 95% Coverage 0.0494  
95% UPL (t) 0.0446  
90% Percentile (z) 0.0373  
95% Percentile (z) 0.0442  
99% Percentile (z) 0.0572

Assuming Lognormal Distribution

DL/2 Substitution Method  
Mean (Log Scale) -4.947  
SD (Log Scale) 1.027  
95% UTL 95% Coverage 0.051  
95% UPL (t) 0.0394  
90% Percentile (z) 0.0265  
95% Percentile (z) 0.0385  
99% Percentile (z) 0.0774

Maximum Likelihood Estimate(MLE) Method

Mean 0.00551  
SD 0.0263  
95% UTL with 95% Coverage 0.056

Log ROS Method

Mean in Original Scale 0.0129  
SD in Original Scale 0.019  
95% UTL with 95% Coverage 0.0598  
95% BCA UTL with 95% Coverage 0.076  
95% Bootstrap (%) UTL with 95% Coverage 0.0765  
95% UPL (t) 0.045  
90% Percentile (z) 0.0291  
95% Percentile (z) 0.0439  
99% Percentile (z) 0.0945

Gamma Distribution Test with Detected Values Only

k star (bias corrected) 1.618  
Theta Star 0.0123  
nu star 197.5

Data Distribution Test with Detected Values Only

**Data appear Lognormal at 5% Significance Level**

A-D Test Statistic 3.063  
5% A-D Critical Value 0.767  
K-S Test Statistic 0.183  
5% K-S Critical Value 0.116

**Data not Gamma Distributed at 5% Significance Level**

Nonparametric Statistics

Kaplan-Meier (KM) Method  
Mean 0.014  
SD 0.0184  
SE of Mean 0.00183  
95% KM UTL with 95% Coverage 0.0493  
95% KM Chebyshev UPL 0.0945  
95% KM UPL (t) 0.0446  
90% Percentile (z) 0.0375  
95% Percentile (z) 0.0442  
99% Percentile (z) 0.0567

Assuming Gamma Distribution

Gamma ROS Statistics with Extrapolated Data  
Mean 0.0119  
Median 0.0072  
SD 0.0196  
k star 0.202  
Theta star 0.0588  
Nu star 41.14  
95% Percentile of Chi-square (2k) 2.074  
90% Percentile 0.0359  
95% Percentile 0.061  
99% Percentile 0.13

Gamma ROS Limits with Extrapolated Data

95% Wilson Hillerty (WH) Approx. Gamma UPL 0.051  
95% Hawkins Wiseley (HW) Approx. Gamma UPL 0.0634  
95% WH Approx. Gamma UTL with 95% Coverage 0.0657  
95% HW Approx. Gamma UTL with 95% Coverage 0.0875

**Note: DL/2 is not a recommended method.**

Lithium

General Statistics

Total Number of Observations 102  
Tolerance Factor 1.92

Number of Distinct Observations 59

Raw Statistics

Minimum 18.9  
Maximum 30.1  
Second Largest 29.1  
First Quartile 22.83  
Median 24.2  
Third Quartile 25.85  
Mean 24.23  
Geometric Mean 24.12  
SD 2.27  
Coefficient of Variation 0.0837  
Skewness 0.0672

Log-Transformed Statistics

Minimum 2.939  
Maximum 3.405  
Second Largest 3.371  
First Quartile 3.128  
Median 3.186  
Third Quartile 3.252  
Mean 3.183  
SD 0.0943

Background Statistics

Normal Distribution Test

Lilliefors Test Statistic: 0.0406  
Lilliefors Critical Value 0.0877

Data appear Normal at 5% Significance Level

Lognormal Distribution Test

Lilliefors Test Statistic: 0.0426  
Lilliefors Critical Value 0.0877

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% UTL with 95% Coverage 28.59  
95% UPL (t) 28.02  
90% Percentile (z) 27.14  
95% Percentile (z) 27.96  
99% Percentile (z) 29.51

Assuming Lognormal Distribution

95% UTL with 95% Coverage 28.91  
95% UPL (t) 28.23  
90% Percentile (z) 27.22  
95% Percentile (z) 28.17  
99% Percentile (z) 30.04

Gamma Distribution Test

k star 111  
Theta Star 0.218  
MLE of Mean 24.23  
MLE of Standard Deviation 2.3  
nu star 22642

Data Distribution Test

Data appear Normal at 5% Significance Level

A-D Test Statistic: 0.159  
5% A-D Critical Value 0.75  
K-S Test Statistic: 0.0369  
5% K-S Critical Value 0.0887

Data appear Gamma Distributed at 5% Significance Level

Nonparametric Statistics

90% Percentile 27.27  
95% Percentile 27.89  
99% Percentile 29.09

Assuming Gamma Distribution

90% Percentile 27.22  
95% Percentile 28.13  
99% Percentile 29.9  
95% WH Approx. Gamma UPL 28.15  
95% HW Approx. Gamma UPL 28.17  
95% WH Approx. Gamma UTL with 95% Coverage 28.79  
95% HW Approx. Gamma UTL with 95% Coverage 28.82

95% UTL with 95% Coverage 28.5  
95% Percentile Bootstrap UTL with 95% Coverage 28.49  
95% BCA Bootstrap UTL with 95% Coverage 28.49  
95% UPL 27.9  
95% Chebyshev UPL 34.17  
Upper Threshold Limit Based upon IQR 30.39

Magnesium (mg/L)

General Statistics

Total Number of Observations: 102  
Tolerance Factor: 1.92

Number of Distinct Observations: 71

Raw Statistics

Minimum: 0.28  
Maximum: 4.19  
Second Largest: 4.18  
First Quartile: 2.955  
Median: 3.22  
Third Quartile: 3.528  
Mean: 3.199  
Geometric Mean: 3.022  
SD: 0.691  
Coefficient of Variation: 0.216  
Skewness: -2.397

Log-Transformed Statistics

Minimum: -1.273  
Maximum: 1.433  
Second Largest: 1.43  
First Quartile: 1.083  
Median: 1.169  
Third Quartile: 1.261  
Mean: 1.106  
SD: 0.414

Background Statistics

Normal Distribution Test

Lilliefors Test Statistic: 0.194  
Lilliefors Critical Value: 0.0877

Data not Normal at 9% Significance Level

Lognormal Distribution Test

Lilliefors Test Statistic: 0.354  
Lilliefors Critical Value: 0.0877

Data not Lognormal at 9% Significance Level

Assuming Normal Distribution

95% UTL with 95% Coverage: 4.525  
95% UPL (t): 4.351  
90% Percentile (z): 4.084  
95% Percentile (z): 4.335  
99% Percentile (z): 4.805

Assuming Lognormal Distribution

95% UTL with 95% Coverage: 7.088  
95% UPL (t): 6.337  
90% Percentile (z): 5.338  
95% Percentile (z): 6.272  
99% Percentile (z): 8.488

Gamma Distribution Test

k star: 8.715  
Theta Star: 0.367  
MLE of Mean: 3.199  
MLE of Standard Deviation: 1.084  
nu star: 1778

Data Distribution Test  
Data do not follow a Discernable Distribution (9.05)

A-D Test Statistic: 13.29  
5% A-D Critical Value: 0.753  
K-S Test Statistic: 0.308  
5% K-S Critical Value: 0.0889

Nonparametric Statistics

90% Percentile: 3.978  
95% Percentile: 4.05  
99% Percentile: 4.179

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

90% Percentile: 4.642  
95% Percentile: 5.164  
99% Percentile: 6.242  
95% WH Approx. Gamma UPL: 5.138  
95% HW Approx. Gamma UPL: 5.343  
95% WH Approx. Gamma UTL with 95% Coverage: 5.507  
95% HW Approx. Gamma UTL with 95% Coverage: 5.77

95% UTL with 95% Coverage: 4.1  
95% Percentile Bootstrap UTL with 95% Coverage: 4.1  
95% BCA Bootstrap UTL with 95% Coverage: 4.09  
95% UPL: 4.076  
95% Chebyshev UPL: 6.224  
Upper Threshold Limit Based upon IQR: 4.386

Manganese

General Statistics

Number of Valid Data 102  
 Number of Distinct Detected Data 99  
 Tolerance Factor 1.92

Number of Detected Data 101  
 Number of Non-Detect Data 1  
 Percent Non-Detects 0.98%

Raw Statistics

Minimum Detected 0.0104  
 Maximum Detected 42.2  
 Mean of Detected 1.839  
 SD of Detected 5.227  
 Minimum Non-Detect 0.005  
 Maximum Non-Detect 0.005

Log-transformed Statistics

Minimum Detected -4.566  
 Maximum Detected 3.742  
 Mean of Detected -0.83  
 SD of Detected 1.614  
 Minimum Non-Detect -5.298  
 Maximum Non-Detect -5.298

Background Statistics

Normal Distribution Test with Detected Values Only  
 Lilliefors Test Statistic 0.363  
 5% Lilliefors Critical Value 0.0882  
**Data not Normal at 5% Significance Level**

Lognormal Distribution Test with Detected Values Only  
 Lilliefors Test Statistic 0.0972  
 5% Lilliefors Critical Value 0.0882  
**Data not Lognormal at 5% Significance Level**

Assuming Normal Distribution

DL2 Substitution Method

Mean 1.821  
 SD 5.204  
 95% UTL 95% Coverage 11.82  
 95% UPL (t) 10.5  
 90% Percentile (z) 8.491  
 95% Percentile (z) 10.38  
 99% Percentile (z) 13.93

Maximum Likelihood Estimate(MLE) Method

Mean 1.788  
 SD 5.211  
 95% UTL with 95% Coverage 11.79  
 95% UPL (t) 10.18  
 90% Percentile (z) 8.464  
 95% Percentile (z) 10.36  
 99% Percentile (z) 13.91

Assuming Lognormal Distribution

DL2 Substitution Method

Mean (Log Scale) -0.381  
 SD (Log Scale) 1.685  
 95% UTL 95% Coverage 10.54  
 95% UPL (t) 6.89  
 90% Percentile (z) 3.592  
 95% Percentile (z) 6.625  
 99% Percentile (z) 20.89

Log ROS Method

Mean in Original Scale 1.821  
 SD in Original Scale 5.204  
 95% UTL with 95% Coverage 10.2  
 95% BCA UTL with 95% Coverage 17.43  
 95% Bootstrap (%) UTL with 95% Coverage 17.43  
 95% UPL (t) 6.706  
 90% Percentile (z) 3.523  
 95% Percentile (z) 6.45  
 99% Percentile (z) 20.05

Gamma Distribution Test with Detected Values Only  
 k star (bias corrected) 0.442  
 Theta Star 4.181  
 nu star 89.29

**Data Distribution Test with Detected Values Only**  
**Data do not follow a Discernable Distribution (0.05)**

A-D Test Statistic 5.779  
 5% A-D Critical Value 0.831  
 K-S Test Statistic 0.2  
 5% K-S Critical Value 0.095

Nonparametric Statistics

Kaplan-Meier (KM) Method

Mean 1.821  
 SD 5.179  
 SE of Mean 0.515  
 95% KM UTL with 95% Coverage 11.77  
 95% KM Chebyshev UPL 24.51  
 95% KM UPL (t) 10.46  
 90% Percentile (z) 8.458  
 95% Percentile (z) 10.34  
 99% Percentile (z) 13.87

**Data not Gamma Distributed at 5% Significance Level**

Assuming Gamma Distribution

Gamma ROS Statistics with Extrapolated Data

Mean 1.821  
 Median 0.353  
 SD 5.204  
 k star 0.414  
 Theta star 4.403  
 Nu star 84.37  
 95% Percentile of Chi-square (2k) 3.397  
 90% Percentile 5.113  
 95% Percentile 7.479  
 99% Percentile 13.41

Gamma ROS Limits with Extrapolated Data

95% Wilson Hillerty (WH) Approx. Gamma UPL 5.877  
 95% Hawkins Widely (HW) Approx. Gamma UPL 5.741  
 95% WH Approx. Gamma UTL with 95% Coverage 7.362  
 95% HW Approx. Gamma UTL with 95% Coverage 7.104

Note: DL2 is not a recommended method.

Molybdenum

General Statistics

Total Number of Observations: 102  
Tolerance Factor: 1.92

Number of Distinct Observations: 70

Raw Statistics

Minimum: 0.743  
Maximum: 2.27  
Second Largest: 2.25  
First Quartile: 1.033  
Median: 1.165  
Third Quartile: 1.46  
Mean: 1.26  
Geometric Mean: 1.225  
SD: 0.318  
Coefficient of Variation: 0.252  
Skewness: 1.076

Log-Transformed Statistics

Minimum: -0.297  
Maximum: 0.82  
Second Largest: 0.811  
First Quartile: 0.032  
Median: 0.153  
Third Quartile: 0.378  
Mean: 0.203  
SD: 0.238

Background Statistics

Normal Distribution Test

Lilliefors Test Statistic: 0.183  
Lilliefors Critical Value: 0.0877

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Lilliefors Test Statistic: 0.142  
Lilliefors Critical Value: 0.0877

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% UTL with 95% Coverage: 1.871  
95% UPL (t): 1.791  
90% Percentile (z): 1.658  
95% Percentile (z): 1.753  
99% Percentile (z): 2

Assuming Lognormal Distribution

95% UTL with 95% Coverage: 1.825  
95% UPL (t): 1.814  
90% Percentile (z): 1.656  
95% Percentile (z): 1.804  
99% Percentile (z): 2.119

Gamma Distribution Test

k star: 17.13  
Theta Star: 0.0736  
MLE of Mean: 1.26  
MLE of Standard Deviation: 0.304  
nu star: 3494

Data Distribution Test

Data do not follow a Discernible Distribution (0.05)

A-D Test Statistic: 2.262

5% A-D Critical Value: 0.75

K-S Test Statistic: 0.157

5% K-S Critical Value: 0.0888

Data not Gamma Distributed at 5% Significance Level

Nonparametric Statistics

90% Percentile: 1.728

95% Percentile: 1.866

99% Percentile: 2.248

Assuming Gamma Distribution

90% Percentile: 1.663  
95% Percentile: 1.799  
99% Percentile: 2.074

95% WH Approx. Gamma UPL: 1.802

95% HW Approx. Gamma UPL: 1.805

95% WH Approx. Gamma UTL with 95% Coverage: 1.9

95% HW Approx. Gamma UTL with 95% Coverage: 1.906

95% UTL with 95% Coverage: 2.02

95% Percentile Bootstrap UTL with 95% Coverage: 2.018

95% BCA Bootstrap UTL with 95% Coverage: 2.018

95% UPL: 1.879

95% Chebyshev UPL: 2.853

Upper Threshold Limit Based upon IQR: 2.101

Neckel

General Statistics

Number of Valid Data 102	Number of Detected Data 89
Number of Distinct Detected Data 81	Number of Non-Detected Data 13
Tolerance Factor 1.92	Percent Non-Detects 12.75%

Raw Statistics

Minimum Detected 0.052  
Maximum Detected 2.68  
Mean of Detected 0.577  
SD of Detected 0.595  
Minimum Non-Detect 0.05  
Maximum Non-Detect 0.05

Log-transformed Statistics

Minimum Detected -2.957  
Maximum Detected 0.936  
Mean of Detected -1.026  
SD of Detected 1.011  
Minimum Non-Detect -2.996  
Maximum Non-Detect -2.996

Background Statistics

Normal Distribution Test with Detected Values Only

Liliefors Test Statistic 0.189  
5% Liliefors Critical Value 0.0939

Data not Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only

Liliefors Test Statistic 0.0491  
5% Liliefors Critical Value 0.0939

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

DL 2 Substitution Method

Mean 0.507  
SD 0.586  
95% UTL 95% Coverage 1.631  
95% UPL (t) 1.484  
90% Percentile (z) 1.257  
95% Percentile (z) 1.47  
99% Percentile (z) 1.869

Maximum Likelihood Estimate (MLE) Method

Mean 0.461  
SD 0.642  
95% UTL with 95% Coverage 1.693

95% UPL (t) 1.531  
90% Percentile (z) 1.283  
95% Percentile (z) 1.516  
99% Percentile (z) 1.953

Gamma Distribution Test with Detected Values Only

k star (bias corrected) 1.156  
Theta Star 0.499  
nu star 205.8

A-D Test Statistic 0.94  
5% A-D Critical Value 0.778  
K-S Test Statistic 0.0953  
5% K-S Critical Value 0.0972

Data follow Appx. Gamma Distribution at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics with Extrapolated Data

Mean 0.504  
Median 0.297  
SD 0.588  
k star 0.339  
Theta star 1.486  
Nu star 69.15  
95% Percentile of Chi-square (2k) 2.96

90% Percentile 1.462  
95% Percentile 2.214  
99% Percentile 4.141

Assuming Lognormal Distribution

DL 2 Substitution Method

Mean (Log Scale) -1.365  
SD (Log Scale) 1.299  
95% UTL 95% Coverage 3.095  
95% UPL (t) 2.23  
90% Percentile (z) 1.35  
95% Percentile (z) 2.164  
99% Percentile (z) 5.244

Log ROS Method

Mean in Original Scale 0.509  
SD in Original Scale 0.584  
95% UTL with 95% Coverage 2.84  
95% BCA UTL with 95% Coverage 2.39  
95% Bootstrap (%) UTL with 95% Coverage 2.486  
95% UPL (t) 2.062  
90% Percentile (z) 1.293  
95% Percentile (z) 2.023  
99% Percentile (z) 4.68

Data Distribution Test with Detected Values Only

Data follow Appx. Gamma Distribution at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method

Mean 0.51  
SD 0.58  
SE of Mean 0.0577  
95% KM UTL with 95% Coverage 1.624  
95% KM Chebyshev UPL 3.05  
95% KM UPL (t) 1.478  
90% Percentile (z) 1.254  
95% Percentile (z) 1.484  
99% Percentile (z) 1.859

Gamma ROS Limits with Extrapolated Data

95% Wilson Hillery (WH) Approx. Gamma UPL 1.858  
95% Hawkins Wistley (HW) Approx. Gamma UPL 2.309  
95% WH Approx. Gamma UTL with 95% Coverage 2.278  
95% HW Approx. Gamma UTL with 95% Coverage 2.973

Note: DL2 is not a recommended method.

Nitrate-Nitrite as Nitrogen

General Statistics

Number of Valid Data 412	Number of Detected Data 411
Number of Distinct Detected Data 259	Number of Non-Detect Data 1
Tolerance Factor 1.775	Percent Non-Detects 0.24%

Raw Statistics

Minimum Detected 0.0254  
 Maximum Detected 0.98  
 Mean of Detected 0.438  
 SD of Detected 0.194  
 Minimum Non-Detect 0.25  
 Maximum Non-Detect 0.25

Log-transformed Statistics

Minimum Detected -3.673  
 Maximum Detected -0.0202  
 Mean of Detected -0.965  
 SD of Detected 0.617  
 Minimum Non-Detect -1.366  
 Maximum Non-Detect -1.366

Background Statistics

Normal Distribution Test with Detected Values Only  
 Lilliefors Test Statistic 0.0786  
 5% Lilliefors Critical Value 0.0437  
**Data not Normal at 5% Significance Level**

Lognormal Distribution Test with Detected Values Only  
 Lilliefors Test Statistic 0.145  
 5% Lilliefors Critical Value 0.0437  
**Data not Lognormal at 5% Significance Level**

Assuming Normal Distribution

DL/2 Substitution Method  
 Mean 0.438  
 SD 0.194  
 95% UTL 95% Coverage 0.782  
 95% UPL (t) 0.758  
 90% Percentile (z) 0.587  
 95% Percentile (z) 0.757  
 99% Percentile (z) 0.89

Assuming Lognormal Distribution

DL/2 Substitution Method  
 Mean (Log Scale) -0.967  
 SD (Log Scale) 0.618  
 95% UTL 95% Coverage 1.139  
 95% UPL (t) 1.055  
 90% Percentile (z) 0.84  
 95% Percentile (z) 1.051  
 99% Percentile (z) 1.602

Maximum Likelihood Estimate(MLE) Method

Mean 0.44  
 SD 0.191  
 95% UTL with 95% Coverage 0.78  
 95% UPL (t) 0.758  
 90% Percentile (z) 0.685  
 95% Percentile (z) 0.755  
 99% Percentile (z) 0.885

Log ROS Method

Mean in Original Scale 0.438  
 SD in Original Scale 0.194  
 95% UTL with 95% Coverage 1.138  
 95% BCA UTL with 95% Coverage 0.786  
 95% Bootstrap (%) UTL with 95% Coverage 0.788  
 95% UPL (t) 1.054  
 90% Percentile (z) 0.839  
 95% Percentile (z) 1.05  
 99% Percentile (z) 1.6

Gamma Distribution Test with Detected Values Only

k star (bias corrected) 3.692  
 Theta Star 0.119  
 nu star 3035  
 A-D Test Statistic 6.592  
 5% A-D Critical Value 0.759  
 K-S Test Statistic 0.101  
 5% K-S Critical Value 0.0449  
**Data not Gamma Distributed at 5% Significance Level**

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method  
 Mean 0.438  
 SD 0.194  
 SE of Mean 0.00957  
 95% KM UTL with 95% Coverage 0.782  
 95% KM Chebyshev UPL 1.264  
 95% KM UPL (t) 0.758  
 90% Percentile (z) 0.686  
 95% Percentile (z) 0.757  
 99% Percentile (z) 0.889

Assuming Gamma Distribution

Gamma ROS Statistics with Extrapolated Data  
 Mean 0.438  
 Median 0.405  
 SD 0.194  
 k star 3.662  
 Theta star 0.12  
 Nu star 3018  
 95% Percentile of Chi-square (2k) 14.54  
 90% Percentile 0.745  
 95% Percentile 0.868  
 99% Percentile 1.136

Gamma ROS Limits with Extrapolated Data

95% Wilson Hillierly (WH) Approx. Gamma UPL 0.866  
 95% Hawkins Wadley (HW) Approx. Gamma UPL 0.899  
 95% WH Approx. Gamma UTL with 95% Coverage 0.913  
 95% HW Approx. Gamma UTL with 95% Coverage 0.95

Note: DL/2 is not a recommended method.

Oxidation-Reduction Potential

General Statistics

Total Number of Observations 367  
Tolerance Factor 1.783

Number of Distinct Observations 345

Raw Statistics

Minimum -69.3  
Maximum 503.7  
Second Largest 455.8  
First Quartile 78.15  
Median 131.9  
Third Quartile 204.8  
Mean 151.8  
Geometric Mean N/A  
SD 108  
Coefficient of Variation 0.712  
Skewness 0.876

Log-Transformed Statistics

Log Statistics Not Available  
Log Statistics Not Available

Background Statistics

Normal Distribution Test

Lilliefors Test Statistic 0.0972  
Lilliefors Critical Value 0.0462

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Not Available

Assuming Normal Distribution

95% UTL 95% Coverage 344.1  
95% UPL (t) 329.9  
90% Percentile (z) 290  
95% Percentile (z) 329.2  
99% Percentile (z) 402.8

Assuming Lognormal Distribution

Cannot Derive Log-Transformed Statistics

Gamma Distribution Test

Gamma Statistics Not Available

Data Distribution Test

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

90% Percentile 300.6  
95% Percentile 391.4  
99% Percentile 442.2  
99% Percentile 442.2

Approximate 95% Confidence with 95% Coverage UTL 403.6  
95% Percentile Bootstrap UTL with 95% Coverage 403.2  
95% BCA Bootstrap UTL with 95% Coverage 403.6  
95% UPL 393.4  
85% Chebyshev UPL 622.8  
Upper Threshold Limit Based upon IQR 394.7

Perchlorate (ug/L)

General Statistics

Total Number of Observations 389  
Tolerance Factor 1.779

Number of Distinct Observations 179

Raw Statistics

Minimum 0.123  
Maximum 0.468  
Second Largest 0.465  
First Quartile 0.277  
Median 0.32  
Third Quartile 0.363  
Mean 0.322  
Geometric Mean 0.317  
SD 0.055  
Coefficient of Variation 0.171  
Skewness 0.129

Log-Transformed Statistics

Minimum -2.098  
Maximum -0.759  
Second Largest -0.786  
First Quartile -1.284  
Median -1.139  
Third Quartile -1.013  
Mean -1.148  
SD 0.175

Background Statistics

Normal Distribution Test

Lilliefors Test Statistic 0.0557  
Lilliefors Critical Value 0.0449

**Data not Normal at 5% Significance Level**

Lognormal Distribution Test

Lilliefors Test Statistic 0.0417  
Lilliefors Critical Value 0.0449

**Data appear Lognormal at 5% Significance Level**

Assuming Normal Distribution

95% UTL with 95% Coverage 0.42  
95% UPL (t) 0.413  
90% Percentile (z) 0.393  
95% Percentile (z) 0.413  
99% Percentile (z) 0.45

Assuming Lognormal Distribution

95% UTL with 95% Coverage 0.434  
95% UPL (t) 0.424  
90% Percentile (z) 0.397  
95% Percentile (z) 0.424  
99% Percentile (z) 0.477

Gamma Distribution Test

k star 33.26  
Theta Star 0.00969  
MLE of Mean 0.322  
MLE of Standard Deviation 0.0559  
nu star 25877

Data Distribution Test

**Data Follow Appr. Gamma Distribution at 5% Significance Level**

A-D Test Statistic 0.939  
5% A-D Critical Value 0.752  
K-S Test Statistic 0.0427  
5% K-S Critical Value 0.0458

Nonparametric Statistics

90% Percentile 0.4  
95% Percentile 0.413  
99% Percentile 0.442

**Data follow Appr. Gamma Distribution at 5% Significance Level**

Assuming Gamma Distribution

90% Percentile 0.396  
95% Percentile 0.419  
99% Percentile 0.466  
95% WH Approx. Gamma UPL 0.419  
95% HW Approx. Gamma UPL 0.42  
95% WH Approx. Gamma UTL with 95% Coverage 0.428  
95% HW Approx. Gamma UTL with 95% Coverage 0.429

95% UTL with 95% Coverage 0.419  
95% Percentile Bootstrap UTL with 95% Coverage 0.419  
95% BCA Bootstrap UTL with 95% Coverage 0.419  
95% UPL 0.413  
95% Chebyshev UPL 0.562  
Upper Threshold Limit Based upon IQR 0.392

pH

General Statistics

Total Number of Observations: 403  
Tolerance Factor: 1.777

Number of Distinct Observations: 134

Raw Statistics

Minimum: 6.57  
Maximum: 8.97  
Second Largest: 8.86  
First Quartile: 7.56  
Median: 7.89  
Third Quartile: 8.07  
Mean: 7.837  
Geometric Mean: 7.829  
SD: 0.348  
Coefficient of Variation: 0.0445  
Skewness: -0.663

Log-Transformed Statistics

Minimum: 1.883  
Maximum: 2.194  
Second Largest: 2.182  
First Quartile: 2.036  
Median: 2.066  
Third Quartile: 2.088  
Mean: 2.058  
SD: 0.0453

Background Statistics

Normal Distribution Test

Lilliefors Test Statistic: 0.091  
Lilliefors Critical Value: 0.0441

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Lilliefors Test Statistic: 0.1  
Lilliefors Critical Value: 0.0441

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% UTL with 95% Coverage: 8.457  
95% UPL (t): 8.413  
90% Percentile (z): 8.284  
95% Percentile (z): 8.411  
99% Percentile (z): 8.849

Assuming Lognormal Distribution

95% UTL with 95% Coverage: 8.486  
95% UPL (t): 8.437  
90% Percentile (z): 8.297  
95% Percentile (z): 8.435  
99% Percentile (z): 8.7

Gamma Distribution Test

k star: 490.5  
Theta Star: 0.016  
MLE of Mean: 7.837  
MLE of Standard Deviation: 0.354  
nu star: 395319

Data do not follow a Discernable Distribution (0.05)

A-D Test Statistic: 5.627  
5% A-D Critical Value: 0.751  
K-S Test Statistic: 0.0972  
5% K-S Critical Value: 0.0449

Data not Gamma Distributed at 5% Significance Level

Nonparametric Statistics

90% Percentile: 8.22  
95% Percentile: 8.29  
99% Percentile: 8.45

Assuming Gamma Distribution

90% Percentile: 8.294  
95% Percentile: 8.428  
99% Percentile: 8.884  
95% WH Approx. Gamma UPL: 8.429  
95% HW Approx. Gamma UPL: 8.431  
95% WH Approx. Gamma UTL with 95% Coverage: 8.475  
95% HW Approx. Gamma UTL with 95% Coverage: 8.478

95% UTL with 95% Coverage: 8.35  
95% Percentile Bootstrap UTL with 95% Coverage: 8.35  
95% BCA Bootstrap UTL with 95% Coverage: 8.328  
95% UPL: 8.298  
95% Chebyshev UPL: 9.36  
Upper Threshold Limit Based upon IQR: 8.685

Phosphorus

General Statistics

Number of Valid Data 102  
Number of Distinct Detected Data 1

Number of Detected Data 1  
Number of Non-Detect Data 101

**Warning: Only one distinct data value was detected! PreUCL (or any other software) should not be used on such a data set!  
It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, STV).**

**The data set for variable Phosphorus was not processed!**

•

•

Potassium (mg/L)

General Statistics

Total Number of Observations 102  
Tolerance Factor 1.92

Number of Distinct Observations 63

Raw Statistics

Minimum 1.11  
Maximum 2.95  
Second Largest 2.87  
First Quartile 1.473  
Median 1.645  
Third Quartile 1.793  
Mean 1.688  
Geometric Mean 1.66  
SD 0.328  
Coefficient of Variation 0.194  
Skewness 1.67

Log-Transformed Statistics

Minimum 0.104  
Maximum 1.082  
Second Largest 1.054  
First Quartile 0.387  
Median 0.498  
Third Quartile 0.584  
Mean 0.507  
SD 0.177

Background Statistics

Normal Distribution Test

Lilliefors Test Statistic 0.146  
Lilliefors Critical Value 0.0877

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Lilliefors Test Statistic 0.104  
Lilliefors Critical Value 0.0877

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% UTL with 95% Coverage 2.318  
95% UPL (t) 2.235  
90% Percentile (z) 2.108  
95% Percentile (z) 2.227  
99% Percentile (z) 2.451

Assuming Lognormal Distribution

95% UTL with 95% Coverage 2.332  
95% UPL (t) 2.23  
90% Percentile (z) 2.083  
95% Percentile (z) 2.221  
99% Percentile (z) 2.505

Gamma Distribution Test

k star 29.82  
Theta Star 0.0566  
MLE of Mean 1.688  
MLE of Standard Deviation 0.309  
nu star 6083

A-D Test Statistic 1.856  
5% A-D Critical Value 0.75  
K-S Test Statistic 0.117  
5% K-S Critical Value 0.0887

Data not Gamma Distributed at 5% Significance Level

Data Distribution Test

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

90% Percentile 2.026  
95% Percentile 2.398  
99% Percentile 2.87

Assuming Gamma Distribution

90% Percentile 2.094  
95% Percentile 2.226  
99% Percentile 2.489

95% WH Approx. Gamma UPL 2.229  
95% HW Approx. Gamma UPL 2.229

95% WH Approx. Gamma UTL with 95% Coverage 2.323  
95% HW Approx. Gamma UTL with 95% Coverage 2.324

95% UTL with 95% Coverage 2.84

95% Percentile Bootstrap UTL with 95% Coverage 2.82  
95% BCA Bootstrap UTL with 95% Coverage 2.82

95% UPL 2.436  
95% Chebyshev UPL 3.125

Upper Threshold Limit Based upon IQR 2.273

Rhenium

General Statistics

Number of Valid Data 102  
Number of Distinct Detected Data 0

Number of Detected Data 0  
Number of Non-Detected Data 102

**Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!  
Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit.  
The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTY).**

**The data set for variable Rhenium was not processed!**

Rubidium

General Statistics

Total Number of Observations 102  
Tolerance Factor 1.92

Number of Distinct Observations 80

Raw Statistics

Minimum 1.47  
Maximum 6.44  
Second Largest 5.9  
First Quartile 2.343  
Median 2.62  
Third Quartile 3.103  
Mean 2.876  
Geometric Mean 2.752  
SD 0.951  
Coefficient of Variation 0.331  
Skewness 1.748

Log-Transformed Statistics

Minimum 0.385  
Maximum 1.863  
Second Largest 1.775  
First Quartile 0.851  
Median 0.963  
Third Quartile 1.132  
Mean 1.012  
SD 0.286

Background Statistics

Normal Distribution Test

Lilliefors Test Statistic 0.185  
Lilliefors Critical Value 0.0877

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Lilliefors Test Statistic 0.118  
Lilliefors Critical Value 0.0877

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% UTL with 95% Coverage 4.702  
95% UPL (t) 4.462  
90% Percentile (z) 4.094  
95% Percentile (z) 4.44  
99% Percentile (z) 5.088

Assuming Lognormal Distribution

95% UTL with 95% Coverage 4.783  
95% UPL (t) 4.432  
90% Percentile (z) 3.868  
95% Percentile (z) 4.402  
99% Percentile (z) 5.349

Gamma Distribution Test

k star 11.19  
Theta Star 0.257  
MLE of Mean 2.876  
MLE of Standard Deviation 0.859  
nu star 228.4

Data not Gamma Distributed at 5% Significance Level

Data Distribution Test

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

90% Percentile 4.041  
95% Percentile 5.035  
99% Percentile 5.898

Assuming Gamma Distribution

90% Percentile 4.017  
95% Percentile 4.42  
99% Percentile 5.242

95% UTL with 95% Coverage 5.69  
95% Percentile Bootstrap UTL with 95% Coverage 5.885  
95% BCA Bootstrap UTL with 95% Coverage 5.885  
95% UPL 5.049  
95% Chebyshev UPL 7.041  
Upper Threshold Limit Based upon IQR 4.243

95% WH Approx. Gamma UPL 4.425  
95% HW Approx. Gamma UPL 4.425

95% WH Approx. Gamma UTL with 95% Coverage 4.717  
95% HW Approx. Gamma UTL with 95% Coverage 4.725

Selenium

General Statistics

Total Number of Observations 102  
Tolerance Factor 1.82  
Number of Distinct Observations 91

Raw Statistics

Minimum 0.113  
Maximum 0.783  
Second Largest 0.708  
First Quartile 0.303  
Median 0.369  
Third Quartile 0.448  
Mean 0.391  
Geometric Mean 0.372  
SD 0.125  
Coefficient of Variation 0.319  
Skewness 0.745

Log-Transformed Statistics

Minimum -2.18  
Maximum -0.245  
Second Largest -0.345  
First Quartile -1.196  
Median -0.997  
Third Quartile -0.804  
Mean -0.988  
SD 0.319

Background Statistics

Normal Distribution Test

Lilliefors Test Statistic 0.0646  
Lilliefors Critical Value 0.0877

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Lilliefors Test Statistic 0.0512  
Lilliefors Critical Value 0.0877

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% UTL with 95% Coverage 0.631  
95% UPL (t) 0.509  
90% Percentile (z) 0.551  
95% Percentile (z) 0.596  
99% Percentile (z) 0.681

Assuming Lognormal Distribution

95% UTL with 95% Coverage 0.688  
95% UPL (t) 0.634  
90% Percentile (z) 0.581  
95% Percentile (z) 0.63  
99% Percentile (z) 0.783

Gamma Distribution Test

k star 9.959  
Theta Star 0.0393  
MLE of Mean 0.391  
MLE of Standard Deviation 0.124  
nu star 2032

Data appear Gamma Distributed at 5% Significance Level

Data Distribution Test

Data appear Gamma Distributed at 5% Significance Level

A-D Test Statistic 0.672  
5% A-D Critical Value 0.752  
K-S Test Statistic 0.065  
5% K-S Critical Value 0.0889

Data appear Gamma Distributed at 5% Significance Level

Nonparametric Statistics

90% Percentile 0.578  
95% Percentile 0.607  
99% Percentile 0.708

Assuming Gamma Distribution

90% Percentile 0.556  
95% Percentile 0.615  
99% Percentile 0.736

95% UTL with 95% Coverage 0.679  
95% Percentile Bootstrap UTL with 95% Coverage 0.676  
95% BCA Bootstrap UTL with 95% Coverage 0.676  
95% UPL 0.622  
95% Chebyshev UPL 0.937  
Upper Threshold Limit Based upon IQR 0.665

95% WH Approx. Gamma UPL 0.616  
95% HW Approx. Gamma UPL 0.62

95% WH Approx. Gamma UTL with 95% Coverage 0.659  
95% HW Approx. Gamma UTL with 95% Coverage 0.665

Silicon Dioxide (mg/L)

General Statistics

Total Number of Observations 102  
Tolerance Factor 1.92

Number of Distinct Observations 50

Raw Statistics

Minimum 42.6  
Maximum 86  
Second Largest 86  
First Quartile 68.9  
Median 72.9  
Third Quartile 75.8  
Mean 71.16  
Geometric Mean 70.56  
SD 8.309  
Coefficient of Variation 0.118  
Skewness -2.008

Log-Transformed Statistics

Minimum 3.752  
Maximum 4.454  
Second Largest 4.454  
First Quartile 4.233  
Median 4.289  
Third Quartile 4.328  
Mean 4.256  
SD 0.138

Background Statistics

Normal Distribution Test

Lilliefors Test Statistic 0.202  
Lilliefors Critical Value 0.0877

Data not Normal at 5% Significance Level

Assuming Normal Distribution

95% UTL with 95% Coverage 87.29  
95% UPL (t) 85.17  
90% Percentile (z) 81.92  
95% Percentile (z) 84.98  
99% Percentile (z) 90.7

Gamma Distribution Test

k star 57.29  
Theta Star 1.242  
MLE of Mean 71.16  
MLE of Standard Deviation 9.402  
nu star 11687

A-D Test Statistic 8.603  
5% A-D Critical Value 0.75  
K-S Test Statistic 0.231  
5% K-S Critical Value 0.0887

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

90% Percentile 83.44  
95% Percentile 87.3  
99% Percentile 94.84  
95% WH Approx. Gamma UPL 87.38  
85% HW Approx. Gamma UPL 87.73  
95% WH Approx. Gamma UTL with 95% Coverage 90.1  
95% HW Approx. Gamma UTL with 95% Coverage 90.54

Lognormal Distribution Test

Lilliefors Test Statistic 0.216  
Lilliefors Critical Value 0.0877

Data not Lognormal at 5% Significance Level

Assuming Lognormal Distribution

95% UTL with 95% Coverage 92.05  
95% UPL (t) 88.89  
90% Percentile (z) 84.26  
95% Percentile (z) 88.6  
99% Percentile (z) 97.37

Data Distribution Test

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

90% Percentile 77.9  
95% Percentile 79.8  
99% Percentile 85.99

95% UTL with 95% Coverage 85

95% Percentile Bootstrap UTL with 95% Coverage 84.77

95% BCA Bootstrap UTL with 95% Coverage 80.5

95% UPL 80.23

95% Chebyshev UPL 108

Upper Threshold Limit Based upon IQR 86.15

General Statistics

Number of Valid Data 102	Number of Detected Data 2
Number of Distinct Detected Data 2	Number of Non-Detect Data 100

**Warning: Data set has only 2 Detected Values.**  
**This is not enough to compute meaningful and reliable test statistics and estimates.**  
**No statistics will be produced!**

Tolerance Factor 1.92	Percent Non-Detects 98.04%
-----------------------	----------------------------

Raw Statistics

Minimum Detected	0.0053
Maximum Detected	0.0109
Mean of Detected	0.0081
SD of Detected	0.00396
Minimum Non-Detect	0.005
Maximum Non-Detect	0.005

Log-transformed Statistics

Minimum Detected	-5.24
Maximum Detected	-4.519
Mean of Detected	-4.88
SD of Detected	0.51
Minimum Non-Detect	-5.298
Maximum Non-Detect	-5.298

**Warning: Data set has only 2 Distinct Detected Values.**

**This may not be adequate enough to compute meaningful and reliable test statistics and estimates.**  
**The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, STV).**

**Unless Data Quality Objectives (DQOs) have been met, it is suggested to collect additional observations.**

**The number of detected data may not be adequate enough to perform GCF tests, bootstrap, and ROS methods.**  
**These methods will return a 'NA' value on your output display!**

**It is necessary to have 4 or more Distinct Values for bootstrap methods.**

**However, results obtained using 4 to 9 distinct values may not be reliable.**

**It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.**

Background Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	N/A
5% Shapiro Wilk Critical Value	N/A

**Data not Normal at 5% Significance Level**

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	N/A
5% Shapiro Wilk Critical Value	N/A

**Data set Lognormal at 5% Significance Level**

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	0.00261
SD	0.00087411
95% UTL	95% Coverage 0.00429
95% UPL (t)	0.00407
90% Percentile (z)	0.00373
95% Percentile (z)	0.00405
99% Percentile (z)	0.00464

Maximum Likelihood Estimate(MLE) Method N/A

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean (Log Scale)	-5.97
SD (Log Scale)	0.163
95% UTL	95% Coverage 0.00349
95% UPL (t)	0.00335
90% Percentile (z)	0.00315
95% Percentile (z)	0.00334
99% Percentile (z)	0.00373

Log ROS Method

Mean in Original Scale	N/A
SD in Original Scale	N/A
Mean in Log Scale	N/A
SD in Log Scale	N/A
95% UTL	95% Coverage N/A
95% UPL (t)	N/A
90% Percentile (z)	N/A
95% Percentile (z)	N/A
99% Percentile (z)	N/A

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	N/A
Theta Star	N/A
no star	N/A

A-D Test Statistic	N/A
5% A-D Critical Value	N/A
K-S Test Statistic	N/A
5% K-S Critical Value	N/A

**Data not Gamma Distributed at 5% Significance Level**

Data Distribution Test with Detected Values Only

Data do not follow a Discernible Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.00535
SD	0.00055176
SE of Mean	7.7262E-05
95% KM UTL with	95% Coverage 0.00641
95% KM Chebyshev UPL	0.00777
95% KM UPL (t)	0.00628
90% Percentile (z)	0.00606
95% Percentile (z)	0.00626
99% Percentile (z)	0.00664

Assuming Gamma Distribution

Gamma ROS Statistics with Extrapolated Data

Mean	N/A
Median	N/A
SD	N/A
k star	N/A
Theta star	N/A
Nu star	N/A
95% Percentile of Chi-square (2k)	N/A
90% Percentile	N/A
95% Percentile	N/A
99% Percentile	N/A

Gamma ROS Limits with Extrapolated Data

95% Wilson Hillerty (WH) Approx. Gamma UPL	N/A
95% Hawkins Wileley (HW) Approx. Gamma UPL	N/A
95% WH Approx. Gamma UTL with	95% Coverage N/A
95% HW Approx. Gamma UTL with	95% Coverage N/A

Sodium (mg/L)

General Statistics

Total Number of Observations 102  
Tolerance Factor 1.92

Number of Distinct Observations 37

Raw Statistics

Minimum 9.55  
Maximum 16.9  
Second Largest 16.9  
First Quartile 10.43  
Median 10.9  
Third Quartile 11.5  
Mean 11.22  
Geometric Mean 11.04  
SD 1.445  
Coefficient of Variation 0.129  
Skewness 2.514

Log-Transformed Statistics

Minimum 2.257  
Maximum 2.827  
Second Largest 2.827  
First Quartile 2.344  
Median 2.389  
Third Quartile 2.442  
Mean 2.41  
SD 0.114

Background Statistics

Normal Distribution Test

Lilliefors Test Statistic 0.22  
Lilliefors Critical Value 0.0877

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Lilliefors Test Statistic 0.198  
Lilliefors Critical Value 0.0877

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% UTL with 95% Coverage 13.99  
95% UPL (t) 13.63  
90% Percentile (z) 13.07  
95% Percentile (z) 13.59  
99% Percentile (z) 14.58

Assuming Lognormal Distribution

95% UTL with 95% Coverage 13.86  
95% UPL (t) 13.47  
90% Percentile (z) 12.89  
95% Percentile (z) 13.43  
99% Percentile (z) 14.52

Gamma Distribution Test

k star 69.92  
Theta Star 0.16  
MLE of Mean 11.22  
MLE of Standard Deviation 1.341  
nu star 14264

A-D Test Statistic 6.885  
5% A-D Critical Value 0.75  
K-S Test Statistic 0.206  
5% K-S Critical Value 0.0887

Data not Gamma Distributed at 5% Significance Level

Data Distribution Test

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

90% Percentile 12.6  
95% Percentile 14.1  
99% Percentile 16.9

Assuming Gamma Distribution

90% Percentile 12.97  
95% Percentile 13.51  
99% Percentile 14.57

95% WH Approx. Gamma UPL 13.52  
95% HW Approx. Gamma UPL 13.51

95% WH Approx. Gamma UTL with 95% Coverage 13.9  
95% HW Approx. Gamma UTL with 95% Coverage 13.89

95% UTL with 95% Coverage 16.8

95% Percentile Bootstrap UTL with 95% Coverage 16.79

95% BCA Bootstrap UTL with 95% Coverage 16.5

85% UPL 14.53

95% Chebyshev UPL 17.55

Upper Threshold Limit Based upon IQR 13.11

Specific Conductance

General Statistics

Total Number of Observations 395  
Tolerance Factor 1.778

Number of Distinct Observations 104

Raw Statistics

Minimum 98  
Maximum 200  
Second Largest 199  
First Quartile 124  
Median 132  
Third Quartile 144  
Mean 135.8  
Geometric Mean 134.7  
SD 18  
Coefficient of Variation 0.133  
Skewness 0.92

Log-Transformed Statistics

Minimum 4.585  
Maximum 5.298  
Second Largest 5.293  
First Quartile 4.82  
Median 4.883  
Third Quartile 4.97  
Mean 4.903  
SD 0.128

Background Statistics

Normal Distribution Test

Lilliefors Test Statistic 0.0983  
Lilliefors Critical Value 0.0446

Data not Normal at 5% Significance Level

Assuming Normal Distribution

95% UTL with 95% Coverage 167.8  
95% UPL (t) 165.5  
90% Percentile (z) 158.9  
95% Percentile (z) 165.4  
99% Percentile (z) 177.7

Gamma Distribution Test

k star 59.81  
Theta Star 2.271  
MLE of Mean 135.8  
MLE of Standard Deviation 17.56  
nu star 47252

A-D Test Statistic 4.781  
5% A-D Critical Value 0.752  
K-S Test Statistic 0.0832  
5% K-S Critical Value 0.0454

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

90% Percentile 158.7  
95% Percentile 165.9  
99% Percentile 180  
95% WH Approx. Gamma UPL 166  
95% HW Approx. Gamma UPL 166  
95% WH Approx. Gamma UTL with 95% Coverage 168.5  
95% HW Approx. Gamma UTL with 95% Coverage 168.6

Lognormal Distribution Test

Lilliefors Test Statistic 0.0768  
Lilliefors Critical Value 0.0446

Data not Lognormal at 5% Significance Level

Assuming Lognormal Distribution

95% UTL with 95% Coverage 169  
95% UPL (t) 166.3  
90% Percentile (z) 158.7  
95% Percentile (z) 166.2  
99% Percentile (z) 181.3

Data Distribution Test

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

90% Percentile 163.2  
95% Percentile 174  
99% Percentile 186.2  
95% UTL with 95% Coverage 178  
95% Percentile Bootstrap UTL with 95% Coverage 176.6  
95% BCA Bootstrap UTL with 95% Coverage 174.6  
95% UPL 174  
95% Chebyshev UPL 214.4  
Upper Threshold Limit Based upon IQR 174

Strontium

General Statistics

Total Number of Observations: 102  
Tolerance Factor: 1.92

Number of Distinct Observations: 81

Raw Statistics

Minimum: 37.6  
Maximum: 165  
Second Largest: 162  
First Quartile: 44.28  
Median: 47.5  
Third Quartile: 51.7  
Mean: 51.85  
Geometric Mean: 49.72  
SD: 20.86  
Coefficient of Variation: 0.402  
Skewness: 4.46

Log-Transformed Statistics

Minimum: 3.627  
Maximum: 5.106  
Second Largest: 5.088  
First Quartile: 3.79  
Median: 3.861  
Third Quartile: 3.945  
Mean: 3.906  
SD: 0.25

Background Statistics

Normal Distribution Test

Lilliefors Test Statistic: 0.331  
Lilliefors Critical Value: 0.0877

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Lilliefors Test Statistic: 0.243  
Lilliefors Critical Value: 0.0877

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% UTL with 95% Coverage: 91.91  
95% UPL (t): 86.65  
90% Percentile (z): 78.58  
95% Percentile (z): 86.16  
99% Percentile (z): 100.4

Assuming Lognormal Distribution

95% UTL with 95% Coverage: 80.29  
95% UPL (t): 75.39  
90% Percentile (z): 68.46  
95% Percentile (z): 74.95  
99% Percentile (z): 88.85

Gamma Distribution Test

k star: 11.76  
Theta Star: 4.41  
MLE of Mean: 51.85  
MLE of Standard Deviation: 15.12  
nu star: 2398

A-D Test Statistic: 13.16  
5% A-D Critical Value: 0.752  
K-S Test Statistic: 0.278  
5% K-S Critical Value: 0.0889

Data not Gamma Distributed at 5% Significance Level

Data Distribution Test

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

90% Percentile: 56.26  
95% Percentile: 59.69  
99% Percentile: 161.8

Assuming Gamma Distribution

90% Percentile: 71.92  
95% Percentile: 78.96  
99% Percentile: 93.33

95% WH Approx. Gamma UPL: 78.68  
95% HW Approx. Gamma UPL: 77.81

95% WH Approx. Gamma UTL with 95% Coverage: 83.74  
95% HW Approx. Gamma UTL with 95% Coverage: 82.83

95% UTL with 95% Coverage: 139

95% Percentile Bootstrap UTL with 95% Coverage: 128.9

95% BCA Bootstrap UTL with 95% Coverage: 136

95% UPL: 62.42

95% Chebyshev UPL: 143.2

Upper Threshold Limit Based upon IQR: 62.84

Sulfate

General Statistics

Total Number of Observations 407  
Tolerance Factor 1.776

Number of Distinct Observations 226

Raw Statistics

Minimum 1.37  
Maximum 7.89  
Second Largest 7.86  
First Quartile 2.05  
Median 2.69  
Third Quartile 3.405  
Mean 2.946  
Geometric Mean 2.76  
SD 1.173  
Coefficient of Variation 0.398  
Skewness 1.642

Log-Transformed Statistics

Minimum 0.315  
Maximum 2.068  
Second Largest 2.062  
First Quartile 0.718  
Median 0.99  
Third Quartile 1.225  
Mean 1.015  
SD 0.349

Background Statistics

Normal Distribution Test

Lilliefors Test Statistic 0.133  
Lilliefors Critical Value 0.0439

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Lilliefors Test Statistic 0.0732  
Lilliefors Critical Value 0.0439

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% UTL with 95% Coverage 5.03  
95% UPL (t) 4.883  
90% Percentile (z) 4.45  
95% Percentile (z) 4.878  
99% Percentile (z) 5.675

Assuming Lognormal Distribution

95% UTL with 95% Coverage 5.129  
95% UPL (t) 4.909  
90% Percentile (z) 4.316  
95% Percentile (z) 4.9  
99% Percentile (z) 6.214

Gamma Distribution Test

k star 7.771  
Theta Star 0.379  
MLE of Mean 2.946  
MLE of Standard Deviation 1.057  
nu star 6326

Data do not follow a Discernable Distribution (0.05)

A-D Test Statistic 6.782  
5% A-D Critical Value 0.755  
K-S Test Statistic 0.0808  
5% K-S Critical Value 0.0449

Data not Gamma Distributed at 5% Significance Level

Nonparametric Statistics

90% Percentile 4.488  
95% Percentile 5.072  
99% Percentile 7.169

Assuming Gamma Distribution

90% Percentile 4.356  
95% Percentile 4.872  
99% Percentile 5.943  
95% WH Approx. Gamma UPL 4.867  
95% HW Approx. Gamma UPL 4.873  
95% WH Approx. Gamma UTL with 95% Coverage 5.053  
95% HW Approx. Gamma UTL with 95% Coverage 5.067

95% UTL with 95% Coverage 5.84  
95% Percentile Bootstrap UTL with 95% Coverage 5.807  
95% BCA Bootstrap UTL with 95% Coverage 5.842  
95% UPL 5.09  
95% Chebyshev UPL 6.068  
Upper Threshold Limit Based upon IQR 5.438

Tellurium

General Statistics

Number of Valid Data 102  
Number of Detect Detected Data 0

Number of Detected Data 0  
Number of Non-Detect Data 102

Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!  
Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!  
The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Tellurium was not processed!

Temperature

General Statistics

Total Number of Observations 400  
Tolerance Factor 1.777  
Number of Distinct Observations 260

Raw Statistics

Minimum 15.8  
Maximum 24.78  
Second Largest 24.64  
First Quartile 20.34  
Median 21.35  
Third Quartile 22.07  
Mean 21.17  
Geometric Mean 21.12  
SD 1.464  
Coefficient of Variation 0.0692  
Skewness -0.483

Log-Transformed Statistics

Minimum 2.766  
Maximum 3.21  
Second Largest 3.204  
First Quartile 3.013  
Median 3.061  
Third Quartile 3.094  
Mean 3.05  
SD 0.0708

Background Statistics

Normal Distribution Test

Lilliefors Test Statistic 0.0652  
Lilliefors Critical Value 0.0443

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Lilliefors Test Statistic 0.0795  
Lilliefors Critical Value 0.0443

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% UTL with 95% Coverage 23.77  
95% UPL (t) 23.59  
90% Percentile (z) 23.05  
95% Percentile (z) 23.58  
99% Percentile (z) 24.58

Assuming Lognormal Distribution

95% UTL with 95% Coverage 23.95  
95% UPL (t) 23.74  
90% Percentile (z) 23.13  
95% Percentile (z) 23.73  
99% Percentile (z) 24.9

Gamma Distribution Test

k star 201.9  
Theta Star 0.105  
MLE of Mean 21.17  
MLE of Standard Deviation 1.49  
nu star 161519

Data Distribution Test

Data do not follow a Discernable Distribution (0.09)

A-D Test Statistic 3.152  
5% A-D Critical Value 0.751  
K-S Test Statistic 0.0748  
5% K-S Critical Value 0.0451

Nonparametric Statistics

90% Percentile 22.91  
95% Percentile 23.4  
99% Percentile 24.3

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

90% Percentile 23.1  
95% Percentile 23.68  
99% Percentile 24.79

95% UTL with 95% Coverage 23.69  
95% Percentile Bootstrap UTL with 95% Coverage 23.89  
95% BCA Bootstrap UTL with 95% Coverage 23.89  
95% UPL 23.41  
85% Chebyshev UPL 27.58  
Upper Threshold Limit Based upon IQR 24.67

95% WH Approx. Gamma UPL 23.89  
95% HW Approx. Gamma UPL 23.7

95% WH Approx. Gamma UTL with 95% Coverage 23.89  
95% HW Approx. Gamma UTL with 95% Coverage 23.9

Thallium

General Statistics

Number of Valid Data 102  
Number of Distinct Detected Data 46  
Tolerance Factor 1.92

Number of Detected Data 72  
Number of Non-Detect Data 30  
Percent Non-Detects 29.41%

Raw Statistics

Minimum Detected 0.001  
Maximum Detected 0.0155  
Mean of Detected 0.00456  
SD of Detected 0.00339  
Minimum Non-Detect 0.001  
Maximum Non-Detect 0.001

Log-transformed Statistics

Minimum Detected -6.908  
Maximum Detected -4.167  
Mean of Detected -5.634  
SD of Detected 0.703  
Minimum Non-Detect -6.908  
Maximum Non-Detect -6.908

Background Statistics

Normal Distribution Test with Detected Values Only

Likelihood Test Statistic 0.147  
5% Likelihood Critical Value 0.104

Data not Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only

Likelihood Test Statistic 0.0747  
5% Likelihood Critical Value 0.104

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

DL2 Substitution Method

Mean 0.00336  
SD 0.00339  
95% UTL 95% Coverage 0.00988  
95% UPL (t) 0.00902  
90% Percentile (z) 0.00771  
95% Percentile (z) 0.00894  
99% Percentile (z) 0.0113

Maximum Likelihood Estimate (MLE) Method

Mean 0.00267  
SD 0.00424  
95% UTL with 95% Coverage 0.0108  
95% UPL (t) 0.00975  
90% Percentile (z) 0.00811  
95% Percentile (z) 0.00965  
99% Percentile (z) 0.0125

Assuming Lognormal Distribution

DL2 Substitution Method

Mean (Log Scale) -6.212  
SD (Log Scale) 1.076  
95% UTL 95% Coverage 0.0158  
95% UPL (t) 0.0121  
90% Percentile (z) 0.00797  
95% Percentile (z) 0.0118  
99% Percentile (z) 0.0245

Log ROS Method

Mean in Original Scale 0.00344  
SD in Original Scale 0.00333  
95% UTL with 95% Coverage 0.0148  
95% BCA UTL with 95% Coverage 0.0137  
95% Bootstrap (%) UTL with 95% Coverage 0.0137  
95% UPL (t) 0.0115  
90% Percentile (z) 0.00785  
95% Percentile (z) 0.0113  
99% Percentile (z) 0.0222

Gamma Distribution Test with Detected Values Only

k star (bias corrected) 2.134  
Theta Star 0.00213  
nu star 307.3

A-D Test Statistic 0.781  
5% A-D Critical Value 0.762  
K-S Test Statistic 0.0869  
5% K-S Critical Value 0.104

Data follow Appr. Gamma Distribution at 5% Significance Level

Data Distribution Test with Detected Values Only

Data follow Appr. Gamma Distribution at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method

Mean 0.00351  
SD 0.00326  
SE of Mean 0.00032467  
95% KM UTL with 95% Coverage 0.00976  
95% KM Chebyshev UPL 0.0178  
95% KM UPL (t) 0.00894  
90% Percentile (z) 0.00768  
95% Percentile (z) 0.00887  
99% Percentile (z) 0.0111

Assuming Gamma Distribution

Gamma ROS Statistics with Extrapolated Data

Mean 0.00322  
Median 0.00215  
SD 0.00352  
k star 0.298  
Theta star 0.0108  
Nu star 60.89  
95% Percentile of Chi-square (2k) 2.729  
90% Percentile 0.00649  
95% Percentile 0.0148  
99% Percentile 0.0284

Gamma ROS Limits with Extrapolated Data

95% Wilson Hillierly (WH) Approx. Gamma UPL 0.0134  
95% Hawkins Wadley (HW) Approx. Gamma UPL 0.017  
95% WH Approx. Gamma UTL with 95% Coverage 0.0169  
85% HW Approx. Gamma UTL with 95% Coverage 0.0226

Note: DL2 is not a recommended method.

Thorium

General Statistics

Number of Valid Data 102	Number of Detected Data 7
Number of Distinct Detected Data 7	Number of Non-Detect Data 95
Tolerance Factor 1.92	Percent Non-Detects 93.14%

Raw Statistics

Minimum Detected 0.0055  
Maximum Detected 0.0182  
Mean of Detected 0.0108  
SD of Detected 0.00471  
Minimum Non-Detect 0.005  
Maximum Non-Detect 0.005

Log-transformed Statistics

Minimum Detected -5.203  
Maximum Detected -4.008  
Mean of Detected -4.608  
SD of Detected 0.441  
Minimum Non-Detect -5.298  
Maximum Non-Detect -5.298

**Warning: There are only 7 Detected Values in this data**  
**Note: It should be noted that even though bootstrap may be performed on this data set the resulting calculations may not be reliable enough to draw conclusions**

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

Background Statistics

Normal Distribution Test with Detected Values Only  
Shapiro Wilk Test Statistic 0.933  
5% Shapiro Wilk Critical Value 0.803  
Data appear Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only  
Shapiro Wilk Test Statistic 0.955  
5% Shapiro Wilk Critical Value 0.803  
Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method  
Mean 0.00307  
SD 0.00241  
95% UTL 95% Coverage 0.0077  
95% UPL (t) 0.00709  
90% Percentile (z) 0.00616  
95% Percentile (z) 0.00703  
99% Percentile (z) 0.00867

Assuming Lognormal Distribution

DL/2 Substitution Method  
Mean (Log Scale) -5.897  
SD (Log Scale) 0.388  
95% UTL 95% Coverage 0.00557  
95% UPL (t) 0.00508  
90% Percentile (z) 0.0044  
95% Percentile (z) 0.00503  
99% Percentile (z) 0.00646

Maximum Likelihood Estimate(MLE) Method

Mean -0.014  
SD 0.0128  
95% UTL with 95% Coverage 0.0106  
95% UPL (t) 0.00738  
90% Percentile (z) 0.00243  
95% Percentile (z) 0.00708  
99% Percentile (z) 0.0158

Log ROS Method

Mean in Original Scale 0.00167  
SD in Original Scale 0.00295  
95% UTL with 95% Coverage 0.00882  
95% BCA UTL with 95% Coverage 0.0119  
95% Bootstrap (%) UTL with 95% Coverage 0.0119  
95% UPL (t) 0.00685  
90% Percentile (z) 0.00395  
95% Percentile (z) 0.00663  
99% Percentile (z) 0.0175

Gamma Distribution Test with Detected Values Only

k star (bias corrected) 3.851  
Theta Star 0.00297  
nu star 51.12

Data Distribution Test with Detected Values Only

Data appear Normal at 5% Significance Level

A-D Test Statistic 0.253  
5% A-D Critical Value 0.71  
K-S Test Statistic 0.212  
5% K-S Critical Value 0.313

Nonparametric Statistics

Kaplan-Meier (KM) Method  
Mean 0.00587  
SD 0.00177  
SE of Mean 0.00018896  
95% KM UTL with 95% Coverage 0.00926  
95% KM Chebyshev UPL 0.0136  
95% KM UPL (t) 0.00681  
90% Percentile (z) 0.00613  
95% Percentile (z) 0.00677  
99% Percentile (z) 0.00998

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics with Extrapolated Data  
Mean 0.00074407  
Median 0.000001  
SD 0.00298  
k star 0.134  
Theta star 0.00557  
Nu star 27.28  
95% Percentile of Chi-square (z) 1.502  
90% Percentile 0.00216  
95% Percentile 0.00418  
99% Percentile 0.0102

Gamma ROS Limits with Extrapolated Data

95% Wilson Hillerty (WH) Approx. Gamma UPL 0.00114  
95% Hawkins Wiseley (HW) Approx. Gamma UPL 0.00090238  
95% WH Approx. Gamma UTL with 95% Coverage 0.00202  
95% HW Approx. Gamma UTL with 95% Coverage 0.00135

Note: DL/2 is not a recommended method.

## General Statistics

Number of Valid Data 102	Number of Detected Data 7
Number of Distinct Detected Data 7	Number of Non-Detect Data 95
Tolerance Factor 1.92	Percent Non-Detects 93.14%

## Raw Statistics

Minimum Detected 0.014
Maximum Detected 0.032
Mean of Detected 0.0241
SD of Detected 0.00626
Minimum Non-Detect 0.01
Maximum Non-Detect 0.01

## Log-transformed Statistics

Minimum Detected -4.269
Maximum Detected -3.442
Mean of Detected -3.756
SD of Detected 0.285
Minimum Non-Detect -4.605
Maximum Non-Detect -4.605

**Warning: There are only 7 Detected Values in this data**

**Note: It should be noted that even though bootstrap may be performed on this data set the resulting calculations may not be reliable enough to draw conclusions**

**It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.**

## Background Statistics

<b>Normal Distribution Test with Detected Values Only</b>	<b>Lognormal Distribution Test with Detected Values Only</b>
Shapiro Wilk Test Statistic 0.973	Shapiro Wilk Test Statistic 0.936
5% Shapiro Wilk Critical Value 0.803	5% Shapiro Wilk Critical Value 0.803
<b>Data appear Normal at 5% Significance Level</b>	<b>Data appear Lognormal at 5% Significance Level</b>

## Assuming Normal Distribution

## DL 2 Substitution Method

Mean 0.00631
SD 0.0051
95% UTL 95% Coverage 0.0181
95% UPL (t) 0.0148
90% Percentile (z) 0.0128
95% Percentile (z) 0.0147
99% Percentile (z) 0.0182

## Maximum Likelihood Estimate(MLE) Method

Mean -0.0327
SD 0.0289
95% UTL with 95% Coverage 0.0229
95% UPL (t) 0.0156
90% Percentile (z) 0.00432
95% Percentile (z) 0.0149
99% Percentile (z) 0.0346

## Gamma Distribution Test with Detected Values Only

k star (bias corrected) 8.957
Theta Star 0.0027
nu star 125.4

A-D Test Statistic 0.235
5% A-D Critical Value 0.707
K-S Test Statistic 0.173
5% K-S Critical Value 0.312

**Data appear Gamma Distributed at 5% Significance Level**

## Assuming Gamma Distribution

## Gamma ROS Statistics with Extrapolated Data

Mean 0.00183
Median 0.000001
SD 0.00637
k star 0.124
Theta star 0.0148
Nu star 25.21
95% Percentile of Chequare (2k) 1.405
90% Percentile 0.00523
95% Percentile 0.0104
99% Percentile 0.0261

## Assuming Lognormal Distribution

## DL 2 Substitution Method

Mean (Log Scale) -5.192
SD (Log Scale) 0.398
95% UTL 95% Coverage 0.0119
95% UPL (t) 0.0108
90% Percentile (z) 0.00926
95% Percentile (z) 0.0107
99% Percentile (z) 0.014

## Log ROS Method

Mean in Original Scale 0.00646
SD in Original Scale 0.00611
95% UTL with 95% Coverage 0.0232
95% BCA UTL with 95% Coverage 0.0268
95% Bootstrap (%) UTL with 95% Coverage 0.0269
95% UPL (t) 0.0187
90% Percentile (z) 0.0135
95% Percentile (z) 0.0183
99% Percentile (z) 0.0327

## Data Distribution Test with Detected Values Only

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

## Nonparametric Statistics

## Kaplan-Meier (KM) Method

Mean 0.0147
SD 0.00298
SE of Mean 0.00031867
95% KM UTL with 95% Coverage 0.0204
95% KM Chebyshev UPL 0.0277
95% KM UPL (t) 0.0197
90% Percentile (z) 0.0185
95% Percentile (z) 0.0196
99% Percentile (z) 0.0216

## Gamma ROS Limits with Extrapolated Data

95% Wilson Hillerty (WH) Approx. Gamma UPL 0.00402
95% Hawkins-Wiley (HW) Approx. Gamma UPL 0.00271
95% WH Approx. Gamma UTL with 95% Coverage 0.00563
95% HW Approx. Gamma UTL with 95% Coverage 0.0041

**Note: DL2 is not a recommended method.**

Titanium

General Statistics

Number of Valid Data 102  
Number of Detected Data 30  
Tolerance Factor 1.82

Number of Detected Data 35  
Number of Non-Detect Data 67  
Percent Non-Detects 85.89%

Raw Statistics

Minimum Detected 0.053  
Maximum Detected 0.385  
Mean of Detected 0.131  
SD of Detected 0.0925  
Minimum Non-Detect 0.05  
Maximum Non-Detect 0.05

Log-transformed Statistics

Minimum Detected -2.937  
Maximum Detected -0.955  
Mean of Detected -2.235  
SD of Detected 0.62  
Minimum Non-Detect -2.996  
Maximum Non-Detect -2.996

Background Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic 0.796  
5% Shapiro Wilk Critical Value 0.934

Data not Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic 0.895  
5% Shapiro Wilk Critical Value 0.934

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method  
Mean 0.0613  
SD 0.0737  
95% UTL 95% Coverage 0.203  
95% UPL (t) 0.184  
90% Percentile (z) 0.156  
95% Percentile (z) 0.183  
99% Percentile (z) 0.233

Assuming Lognormal Distribution

DL/2 Substitution Method  
Mean (Log Scale) -3.19  
SD (Log Scale) 0.781  
95% UTL 95% Coverage 0.185  
95% UPL (t) 0.152  
90% Percentile (z) 0.112  
95% Percentile (z) 0.149  
99% Percentile (z) 0.253

Maximum Likelihood Estimate (MLE) Method

Mean -0.0139  
SD 0.141  
95% UTL with 95% Coverage 0.258

Log ROS Method

Mean in Original Scale 0.0573  
SD in Original Scale 0.0764  
95% UTL with 95% Coverage 0.285  
95% BCA UTL with 95% Coverage 0.336  
95% Bootstrap (%) UTL with 95% Coverage 0.336  
95% UPL (t) 0.217  
90% Percentile (z) 0.136  
95% Percentile (z) 0.211  
99% Percentile (z) 0.482

Gamma Distribution Test with Detected Values Only

k star (bias corrected) 2.426  
Theta Star 0.0539  
nu star 170

A-D Test Statistic 1.411  
5% A-D Critical Value 0.756  
K-S Test Statistic 0.159  
5% K-S Critical Value 0.15

Data not Gamma Distributed at 5% Significance Level

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method  
Mean 0.0787  
SD 0.065  
SE of Mean 0.00653  
95% KM UTL with 95% Coverage 0.204  
95% KM Chebyshev UPL 0.384  
95% KM UPL (t) 0.188  
90% Percentile (z) 0.163  
95% Percentile (z) 0.187  
99% Percentile (z) 0.231

Assuming Gamma Distribution

Gamma ROS Statistics with Extrapolated Data

Mean 0.0449  
Median 0.000001  
SD 0.0823  
k star 0.121  
Theta star 0.371  
Nu star 24.69  
95% Percentile of Chi-square (2k) 1.38  
90% Percentile 0.127  
95% Percentile 0.256  
99% Percentile 0.647

Gamma ROS Limits with Extrapolated Data

95% Wilson Hillerty (WH) Approx. Gamma UPL 0.18  
95% Hawkins Wiley (HW) Approx. Gamma UPL 0.195  
95% WH Approx. Gamma UTL with 95% Coverage 0.243  
95% HW Approx. Gamma UTL with 95% Coverage 0.286

Note: DL/2 is not a recommended method.

Total Dissolved Solids

General Statistics

Total Number of Observations 409  
Tolerance Factor 1.775

Number of Distinct Observations 67

Raw Statistics

Minimum 81.4  
Maximum 268  
Second Largest 222  
First Quartile 127  
Median 135  
Third Quartile 143  
Mean 135.6  
Geometric Mean 134.8  
SD 14.85  
Coefficient of Variation 0.11  
Skewness 1.982

Log-Transformed Statistics

Minimum 4.389  
Maximum 5.591  
Second Largest 5.403  
First Quartile 4.844  
Median 4.905  
Third Quartile 4.963  
Mean 4.904  
SD 0.105

Background Statistics

Normal Distribution Test

Lilliefors Test Statistic 0.0852  
Lilliefors Critical Value 0.0438

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Lilliefors Test Statistic 0.0707  
Lilliefors Critical Value 0.0438

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% UTL with 95% Coverage 162  
95% UPL (t) 160.1  
90% Percentile (z) 154.8  
95% Percentile (z) 160  
99% Percentile (z) 170.1

Assuming Lognormal Distribution

95% UTL with 95% Coverage 162.5  
95% UPL (t) 160.4  
90% Percentile (z) 154.3  
95% Percentile (z) 160.3  
99% Percentile (z) 172.2

Gamma Distribution Test

k star 88.81  
Theta Star 1.527  
MLE of Mean 135.6  
MLE of Standard Deviation 14.39  
nu star 72649

A-D Test Statistic 3.164  
5% A-D Critical Value 0.752  
K-S Test Statistic 0.0722  
5% K-S Critical Value 0.0446

Data not Gamma Distributed at 5% Significance Level

Data Distribution Test

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

90% Percentile 151  
95% Percentile 157  
99% Percentile 166.8

Assuming Gamma Distribution

90% Percentile 154.3  
95% Percentile 160.1  
99% Percentile 171.3

95% WH Approx. Gamma UPL 160.1  
95% HW Approx. Gamma UPL 160.2

95% WH Approx. Gamma UTL with 95% Coverage 162.1  
95% HW Approx. Gamma UTL with 95% Coverage 162.2

95% UTL with 95% Coverage 159

95% Percentile Bootstrap UTL with 95% Coverage 159  
95% BCA Bootstrap UTL with 95% Coverage 157.6

95% UPL 157.5  
95% Chebyshev UPL 200.4

Upper Threshold Limit Based upon IQR 167

Total Phosphate as Phosphorus

General Statistics

Number of Valid Data 410	Number of Detected Data 368
Number of Distinct Detected Data 205	Number of Non-Detected Data 44
Tolerance Factor 1.775	Percent Non-Detects 10.73%
Number of Missing Values 1	

Raw Statistics

Minimum Detected 0.015  
 Maximum Detected 0.37  
 Mean of Detected 0.0668  
 SD of Detected 0.0463  
 Minimum Non-Detect 0.017  
 Maximum Non-Detect 0.05

Log-transformed Statistics

Minimum Detected -4.2  
 Maximum Detected -0.984  
 Mean of Detected -2.869  
 SD of Detected 0.537  
 Minimum Non-Detect -4.075  
 Maximum Non-Detect -2.996

Data with Multiple Detection Limits

**Note: Data have multiple DLs - Use of KM Method is recommended  
 For all methods (except KM, DL2, and ROS Methods),  
 Observations < Largest ND are treated as NDs**

Single Detection Limit Scenario

Number treated as Non-Detect with Single DL 187  
 Number treated as Detected with Single DL 223  
 Single DL Non-Detect Percentage 45.81%

Background Statistics

Normal Distribution Test with Detected Values Only

Lilliefors Test Statistic 0.2  
 5% Lilliefors Critical Value 0.0463

**Data not Normal at 5% Significance Level**

Lognormal Distribution Test with Detected Values Only

Lilliefors Test Statistic 0.0747  
 5% Lilliefors Critical Value 0.0463

**Data not Lognormal at 5% Significance Level**

Assuming Normal Distribution

DL/2 Substitution Method  
 Mean 0.0618  
 SD 0.0458  
 95% UTL 95% Coverage 0.143  
 95% UPL (I) 0.138  
 90% Percentile (z) 0.121  
 95% Percentile (z) 0.137  
 99% Percentile (z) 0.168

Assuming Lognormal Distribution

DL/2 Substitution Method  
 Mean (Log Scale) -2.975  
 SD (Log Scale) 0.607  
 95% UTL 95% Coverage 0.15  
 95% UPL (I) 0.139  
 90% Percentile (z) 0.111  
 95% Percentile (z) 0.139  
 99% Percentile (z) 0.21

Maximum Likelihood Estimate(MLE) Method

Mean 0.0466  
 SD 0.0624  
 95% UTL with 95% Coverage 0.157  
 95% UPL (I) 0.15  
 90% Percentile (z) 0.127  
 95% Percentile (z) 0.149  
 99% Percentile (z) 0.192

Log ROS Method

Mean in Original Scale 0.0627  
 SD in Original Scale 0.0452  
 95% UTL with 95% Coverage 0.144  
 95% BCA UTL with 95% Coverage 0.171  
 95% Bootstrap (%) UTL with 95% Coverage 0.175  
 95% UPL (I) 0.134  
 90% Percentile (z) 0.109  
 95% Percentile (z) 0.134  
 99% Percentile (z) 0.167

Gamma Distribution Test with Detected Values Only

k star (bias corrected) 3.264  
 Theta Star 0.0204  
 nu star 2389

A-D Test Statistic 6.215  
 5% A-D Critical Value 0.76  
 K-S Test Statistic 0.115  
 5% K-S Critical Value 0.0478

**Data not Gamma Distributed at 5% Significance Level**

Data Distribution Test with Detected Values Only

**Data do not follow a Dose-Response Distribution (0.05)**

Nonparametric Statistics

Kaplan-Meier (KM) Method  
 Mean 0.0628  
 SD 0.0451  
 SE of Mean 0.00224  
 95% KM UTL with 95% Coverage 0.143  
 95% KM Chebyshev UPL 0.26  
 95% KM UPL (I) 0.137  
 90% Percentile (z) 0.121  
 95% Percentile (z) 0.137  
 99% Percentile (z) 0.168

Assuming Gamma Distribution

Gamma ROS Statistics with Extrapolated Data  
 Mean 0.0624  
 Median 0.0543  
 SD 0.0459  
 k star 1.216  
 Theta star 0.0513  
 nu star 997.2  
 95% Percentile of Chi-square (2k) 6.805  
 90% Percentile 0.137  
 95% Percentile 0.175  
 99% Percentile 0.261

Gamma ROS Limits with Extrapolated Data

95% Wilson Hillierly (WH) Approx. Gamma UPL 0.154  
 95% Hawkins Wblley (HW) Approx. Gamma UPL 0.174  
 95% WH Approx. Gamma UTL with 95% Coverage 0.165  
 95% HW Approx. Gamma UTL with 95% Coverage 0.189

**Note: DL/2 is not a recommended method.**

Tungsten

General Statistics

Total Number of Observations 102  
Tolerance Factor 1.92

Number of Distinct Observations 98

Raw Statistics

Minimum 0.291  
Maximum 22.4  
Second Largest 18.1  
First Quartile 0.396  
Median 0.504  
Third Quartile 0.82  
Mean 1.082  
Geometric Mean 0.616  
SD 2.835  
Coefficient of Variation 2.62  
Skewness 6.558

Log-Transformed Statistics

Minimum -1.234  
Maximum 3.109  
Second Largest 2.896  
First Quartile -0.928  
Median -0.686  
Third Quartile -0.199  
Mean -0.484  
SD 0.726

Background Statistics

Normal Distribution Test

Lilliefors Test Statistic 0.39  
Lilliefors Critical Value 0.0877

Data not Normal at 5% Significance Level

Assuming Normal Distribution

95% UTL with 95% Coverage 6.528  
95% UPL (t) 5.813  
90% Percentile (z) 4.716  
95% Percentile (z) 5.748  
99% Percentile (z) 7.879

Gamma Distribution Test

k star 0.999  
Theta Star 1.084  
MLE of Mean 1.082  
MLE of Standard Deviation 1.083  
nu star 203.7

A-D Test Statistic 14.45  
5% A-D Critical Value 0.782  
K-S Test Statistic 0.247  
5% K-S Critical Value 0.1018

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

90% Percentile 2.493  
95% Percentile 3.244  
99% Percentile 4.988  
95% WH Approx. Gamma UPL 2.794  
95% HW Approx. Gamma UPL 2.561  
95% WH Approx. Gamma UTL with 95% Coverage 3.294  
95% HW Approx. Gamma UTL with 95% Coverage 3.033

Lognormal Distribution Test

Lilliefors Test Statistic 0.157  
Lilliefors Critical Value 0.0877

Data not Lognormal at 5% Significance Level

Assuming Lognormal Distribution

95% UTL with 95% Coverage 2.485  
95% UPL (t) 2.069  
90% Percentile (z) 1.563  
95% Percentile (z) 2.034  
99% Percentile (z) 3.337

Data Distribution Test

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

90% Percentile 1.177  
95% Percentile 1.56  
99% Percentile 17.99

95% UTL with 95% Coverage 6.98

95% Percentile Bootstrap UTL with 95% Coverage 6.742

95% BCA Bootstrap UTL with 95% Coverage 2.23

95% UPL 1.908

95% Chebyshev UPL 13.5

Upper Threshold Limit Based upon IOR 1.456

Turbidity

General Statistics

Total Number of Observations 403  
Tolerance Factor 1.777

Number of Distinct Observations 215

Raw Statistics

Minimum 0  
Maximum 262  
Second Largest 42.2  
First Quartile 0.46  
Median 0.66  
Third Quartile 1.92  
Mean 2.738  
Geometric Mean 0  
SD 13.61  
Coefficient of Variation 4.973  
Skewness 17.42

Log-Transformed Statistics

Log Statistics Not Available  
Log Statistics Not Available

Background Statistics

Normal Distribution Test  
Lilliefors Test Statistic 0.42  
Lilliefors Critical Value 0.0441

Lognormal Distribution Test  
Not Available

Data not Normal at 5% Significance Level

Assuming Normal Distribution

95% UTL 95% Coverage 26.92  
95% UPL (t) 25.21  
90% Percentile (z) 20.18  
95% Percentile (z) 25.13  
99% Percentile (z) 34.41

Assuming Lognormal Distribution

Cannot Derive Log-Transformed Statistics

Gamma Distribution Test

Gamma Statistics Not Available

Data Distribution Test

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

90% Percentile 4.51  
95% Percentile 7.487  
99% Percentile 27.62  
99% Percentile 27.62

Approximate 95% Confidence with 95% Coverage UTL 9.54  
95% Percentile Bootstrap UTL with 95% Coverage 9.482  
95% BCA Bootstrap UTL with 95% Coverage 9.54  
95% UPL 7.5  
95% Chebyshev UPL 82.15  
Upper Threshold Limit Based upon IOR 4.11

Uranium

General Statistics

Total Number of Observations 102  
Tolerance Factor 1.92

Number of Distinct Observations 94

Raw Statistics

Minimum 0.121  
Maximum 1.37  
Second Largest 1.28  
First Quartile 0.305  
Median 0.357  
Third Quartile 0.486  
Mean 0.435  
Geometric Mean 0.301  
SD 0.23  
Coefficient of Variation 0.529  
Skewness 2.078

Log-Transformed Statistics

Minimum -2.112  
Maximum 0.315  
Second Largest 0.247  
First Quartile -1.187  
Median -1.031  
Third Quartile -0.701  
Mean -0.938  
SD 0.445

Background Statistics

Normal Distribution Test

Lilliefors Test Statistic 0.181  
Lilliefors Critical Value 0.0877

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Lilliefors Test Statistic 0.0889  
Lilliefors Critical Value 0.0877

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% UTL with 95% Coverage 0.877  
95% UPL (t) 0.819  
90% Percentile (z) 0.73  
95% Percentile (z) 0.814  
99% Percentile (z) 0.97

Assuming Lognormal Distribution

95% UTL with 95% Coverage 0.919  
95% UPL (t) 0.821  
90% Percentile (z) 0.692  
95% Percentile (z) 0.813  
99% Percentile (z) 1.1

Gamma Distribution Test

k star 4.737  
Theta Star 0.0918  
MLE of Mean 0.435  
MLE of Standard Deviation 0.2  
nu star 966.3

A-D Test Statistic 2.124  
5% A-D Critical Value 0.755  
K-S Test Statistic 0.117  
5% K-S Critical Value 0.0891

Data not Gamma Distributed at 5% Significance Level

Data Distribution Test

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

90% Percentile 0.687  
95% Percentile 0.767  
99% Percentile 1.28

Assuming Gamma Distribution

90% Percentile 0.703  
95% Percentile 0.807  
99% Percentile 1.029  
95% WH Approx. Gamma UPL 0.807  
95% HW Approx. Gamma UPL 0.809  
95% WH Approx. Gamma UTL with 95% Coverage 0.885  
95% HW Approx. Gamma UTL with 95% Coverage 0.88

95% UTL with 95% Coverage 1.27  
95% Percentile Bootstrap UTL with 95% Coverage 1.265  
95% BCA Bootstrap UTL with 95% Coverage 1.252  
95% UPL 0.884  
95% Chebyshev UPL 1.443  
Upper Threshold Limit Based upon IQR 0.783

Vanadium

General Statistics

Total Number of Observations 102  
Tolerance Factor 1.92

Number of Distinct Observations 93

Raw Statistics

Minimum 3.97  
Maximum 14.8  
Second Largest 14.4  
First Quartile 4.993  
Median 5.865  
Third Quartile 7.56  
Mean 8.554  
Geometric Mean 6.249  
SD 2.266  
Coefficient of Variation 0.346  
Skewness 1.795

Log-Transformed Statistics

Minimum 1.379  
Maximum 2.895  
Second Largest 2.667  
First Quartile 1.608  
Median 1.769  
Third Quartile 2.023  
Mean 1.832  
SD 0.297

Background Statistics

Normal Distribution Test

Likelihood Test Statistic 0.139  
Likelihood Critical Value 0.0877

**Data not Normal at 5% Significance Level**

Lognormal Distribution Test

Likelihood Test Statistic 0.115  
Likelihood Critical Value 0.0877

**Data not Lognormal at 5% Significance Level**

Assuming Normal Distribution

95% UTL with 95% Coverage 10.9  
95% UPL (t) 10.33  
90% Percentile (z) 9.457  
95% Percentile (z) 10.28  
99% Percentile (z) 11.82

Assuming Lognormal Distribution

95% UTL with 95% Coverage 11.05  
95% UPL (t) 10.25  
90% Percentile (z) 9.142  
95% Percentile (z) 10.18  
99% Percentile (z) 12.47

Gamma Distribution Test

k star 10.34  
Theta Star 0.634  
MLE of Mean 6.554  
MLE of Standard Deviation 2.039  
nu star 2109

Data Distribution Test  
**Data do not follow a Discernable Distribution (p.05)**

A-D Test Statistic 2.647  
5% A-D Critical Value 0.752  
K-S Test Statistic 0.123  
5% K-S Critical Value 0.0889

Nonparametric Statistics

90% Percentile 8.902  
95% Percentile 11.72  
99% Percentile 14.4

**Data not Gamma Distributed at 5% Significance Level**

Assuming Gamma Distribution

90% Percentile 9.264  
95% Percentile 10.23  
99% Percentile 12.2  
95% WH Approx. Gamma UPL 10.24  
95% HW Approx. Gamma UPL 10.21  
95% WH Approx. Gamma UTL with 95% Coverage 10.94  
95% HW Approx. Gamma UTL with 95% Coverage 10.96

95% UTL with 95% Coverage 14.3  
95% Percentile Bootstrap UTL with 95% Coverage 14.26  
95% BCA Bootstrap UTL with 95% Coverage 14.26  
95% UPL 11.8  
95% Chebyshev UPL 16.48  
Upper Threshold Limit Based upon IQR 11.41

Yarum

General Statistics

Number of Valid Data 132  
Number of Distinct Detected Data 62  
Tolerance Factor 1.92

Number of Detected Data 71  
Number of Non-Detect Data 31  
Percent Non-Detects 30.38%

Raw Statistics

Minimum Detected 0.0054  
Maximum Detected 0.0353  
Mean of Detected 0.0157  
SD of Detected 0.00753  
Minimum Non-Detect 0.005  
Maximum Non-Detect 0.005

Log-transformed Statistics

Minimum Detected -5.221  
Maximum Detected -3.344  
Mean of Detected -4.271  
SD of Detected 0.493  
Minimum Non-Detect -5.298  
Maximum Non-Detect -5.298

Background Statistics

Normal Distribution Test with Detected Values Only

Lilliefors Test Statistic 0.12  
5% Lilliefors Critical Value 0.105

Data not Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only

Lilliefors Test Statistic 0.006  
5% Lilliefors Critical Value 0.105

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

DL2 Substitution Method

Mean 0.0117  
SD 0.00875  
95% UTL 95% Coverage 0.0285  
95% UPL (t) 0.0263  
90% Percentile (z) 0.0229  
95% Percentile (z) 0.0261  
99% Percentile (z) 0.032

Maximum Likelihood Estimate(MLE) Method

Mean 0.0104  
SD 0.0106  
95% UTL with 95% Coverage 0.0308

95% UPL (t) 0.0281  
90% Percentile (z) 0.024  
95% Percentile (z) 0.0276  
99% Percentile (z) 0.0351

Assuming Lognormal Distribution

DL2 Substitution Method

Mean (Log Scale) -4.794  
SD (Log Scale) 0.895  
95% UTL 95% Coverage 0.0462  
95% UPL (t) 0.0369  
90% Percentile (z) 0.0261  
95% Percentile (z) 0.0361  
99% Percentile (z) 0.0664

Log ROS Method

Mean in Original Scale 0.0123  
SD in Original Scale 0.00813  
95% UTL with 95% Coverage 0.0376  
95% BCA UTL with 95% Coverage 0.0334  
95% Bootstrap (%) UTL with 95% Coverage 0.0334  
95% UPL (t) 0.0315  
90% Percentile (z) 0.024  
95% Percentile (z) 0.031  
99% Percentile (z) 0.0498

Gamma Distribution Test with Detected Values Only

k star (bias corrected) 4.276  
Theta Star 0.00367  
nu star 607.3

A-D Test Statistic 0.859  
5% A-D Critical Value 0.755  
K-S Test Statistic 0.0944  
5% K-S Critical Value 0.106

Data follow Appx. Gamma Distribution at 5% Significance Level

Data Distribution Test with Detected Values Only

Data follow Appx. Gamma Distribution at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method

Mean 0.0126  
SD 0.00783  
SE of Mean 0.00078114  
95% KM UTL with 95% Coverage 0.0276  
95% KM Chebyshev UPL 0.0469  
95% KM UPL (t) 0.0256  
90% Percentile (z) 0.0226  
95% Percentile (z) 0.0254  
99% Percentile (z) 0.0308

Assuming Gamma Distribution

Gamma ROS Statistics with Extrapolated Data

Mean 0.0109  
Median 0.0096  
SD 0.00958  
k star 0.274  
Theta star 0.04  
Nu star 55.8  
95% Percentile of Chi-square (2k) 2.577

90% Percentile 0.0326  
95% Percentile 0.0515  
99% Percentile 0.101

Gamma ROS Limits with Extrapolated Data

95% Wilson Hillery (WH) Approx. Gamma UPL 0.0469  
95% Hawkins Witley (HW) Approx. Gamma UPL 0.0619  
95% WH Approx. Gamma UTL with 95% Coverage 0.0587  
95% HW Approx. Gamma UTL with 95% Coverage 0.0825

Note: DL2 is not a recommended method.

Zinc

General Statistics

Number of Valid Data 102  
Number of Distinct Detected Data 80  
Tolerance Factor 1.82

Number of Detected Data 89  
Number of Non-Detect Data 13  
Percent Non-Detects 12.75%

Raw Statistics

Minimum Detected 0.11  
Maximum Detected 14  
Mean of Detected 2.779  
SD of Detected 2.708  
Minimum Non-Detect 0.1  
Maximum Non-Detect 0.4

Log-transformed Statistics

Minimum Detected -2.207  
Maximum Detected 2.639  
Mean of Detected 0.52  
SD of Detected 1.113  
Minimum Non-Detect -2.303  
Maximum Non-Detect -0.916

Data with Multiple Detection Limits

Note: Data have multiple DLs - Use of KM Method is recommended  
For all methods (except KM, DL/2, and ROS Methods),  
Observations < Largest ND are treated as NDs

Single Detection Limit Scenario

Number treated as Non-Detect with Single DL 22  
Number treated as Detected with Single DL 80  
Single DL Non-Detect Percentage 21.57%

Background Statistics

Normal Distribution Test with Detected Values Only

Liliefors Test Statistic 0.204  
5% Liliefors Critical Value 0.0939

Data not Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only

Liliefors Test Statistic 0.0858  
5% Liliefors Critical Value 0.0639

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method  
Mean 2.435  
SD 2.685  
95% UTL 95% Coverage 7.591  
95% UPL (t) 6.914  
90% Percentile (z) 5.876  
95% Percentile (z) 6.851  
99% Percentile (z) 8.681

Assuming Lognormal Distribution

DL/2 Substitution Method  
Mean (Log Scale) 0.107  
SD (Log Scale) 1.514  
95% UTL 95% Coverage 20.39  
95% UPL (t) 13.92  
90% Percentile (z) 7.75  
95% Percentile (z) 13.43  
99% Percentile (z) 37.7

Maximum Likelihood Estimate(MLE) Method

Mean 2.063  
SD 3.15  
95% UTL with 95% Coverage 8.111

Log ROS Method

Mean in Original Scale 2.446  
SD in Original Scale 2.676  
95% UTL with 95% Coverage 15.8  
95% BCA UTL with 95% Coverage 9.02  
95% Bootstrap (%) UTL with 95% Coverage 9.761  
95% UPL (t) 11.31  
90% Percentile (z) 8.77  
95% Percentile (z) 10.86  
99% Percentile (z) 27.06

Gamma Distribution Test with Detected Values Only

k star (bias corrected) 1.103  
Theta Star 2.519  
nu star 196.3

Data Distribution Test with Detected Values Only

Data appear Gamma Distributed at 5% Significance Level

A-D Test Statistic 0.291

5% A-D Critical Value 0.78  
K-S Test Statistic 0.0843  
5% K-S Critical Value 0.0973

Data appear Gamma Distributed at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method

Mean 2.44  
SD 2.668  
SE of Mean 0.266  
95% KM UTL with 95% Coverage 7.562  
95% KM Chebyshev UPL 14.12  
95% KM UPL (t) 6.89  
90% Percentile (z) 5.658  
95% Percentile (z) 6.827  
99% Percentile (z) 8.645

Assuming Gamma Distribution

Gamma ROS Statistics with Extrapolated Data

Mean 2.425  
Median 1.695  
SD 2.694  
k star 0.31  
Theta star 7.828  
Nu star 63.19  
95% Percentile of Chebyshev (Zk) 2.805

Gamma ROS Limits with Extrapolated Data

95% Wilson Hillisity (WH) Approx. Gamma UPL 9.071  
95% Hawkins Wisley (HW) Approx. Gamma UPL 11.42  
95% WH Approx. Gamma UTL with 95% Coverage 11.14  
95% HW Approx. Gamma UTL with 95% Coverage 14.76

90% Percentile 7.123  
95% Percentile 10.98  
99% Percentile 20.98

Note: DL/2 is not a recommended method.

Zirconium

General Statistics

Number of Valid Data 102  
Number of Detected Data 14  
Tolerance Factor 1.92

Number of Detected Data 25  
Number of Non-Detect Data 77  
Percent Non-Detects 75.49%

Raw Statistics

Minimum Detected 0.01  
Maximum Detected 0.042  
Mean of Detected 0.0177  
SD of Detected 0.00826  
Minimum Non-Detect 0.01  
Maximum Non-Detect 0.014

Log-transformed Statistics

Minimum Detected -4.605  
Maximum Detected -3.17  
Mean of Detected -4.118  
SD of Detected 0.401  
Minimum Non-Detect -4.605  
Maximum Non-Detect -4.269

Data with Multiple Detection Limits

Note: Data have multiple DLs - Use of KM Method is recommended  
For all methods (except KM, DL/2, and ROS Methods).  
Observations < Largest MD are treated as MDs

Single Detection Limit Scenario

Number treated as Non-Detect with Single DL 85  
Number treated as Detected with Single DL 16  
Single DL Non-Detect Percentage 84.31%

Background Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic 0.818  
5% Shapiro Wilk Critical Value 0.918

Data not Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic 0.92  
5% Shapiro Wilk Critical Value 0.918

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method

Mean 0.00814  
SD 0.00681  
95% UTL 95% Coverage 0.0212  
95% UPL (t) 0.0195  
90% Percentile (z) 0.0169  
95% Percentile (z) 0.0193  
99% Percentile (z) 0.024

Assuming Lognormal Distribution

DL/2 Substitution Method

Mean (Log Scale) -5.006  
SD (Log Scale) 0.546  
95% UTL 95% Coverage 0.0191  
95% UPL (t) 0.0167  
90% Percentile (z) 0.0135  
95% Percentile (z) 0.0164  
99% Percentile (z) 0.0239

Maximum Likelihood Estimate(MLE) Method

Mean -0.00164  
SD 0.0153  
95% UTL with 95% Coverage 0.0278

Log ROS Method

Mean in Original Scale 0.00762  
SD in Original Scale 0.00733  
95% UTL with 95% Coverage 0.0279  
95% BCA UTL with 95% Coverage 0.026  
95% Bootstrap (%) UTL with 95% Coverage 0.027  
95% UPL (t) 0.0224  
90% Percentile (z) 0.016  
95% Percentile (z) 0.022  
99% Percentile (z) 0.0397

Gamma Distribution Test with Detected Values Only

k star (bias corrected) 5.377  
Theta Star 0.0033  
nu star 268.9

Data Distribution Test with Detected Values Only

Data appear Lognormal at 5% Significance Level

A-D Test Statistic 0.857  
5% A-D Critical Value 0.747  
K-S Test Statistic 0.203  
5% K-S Critical Value 0.175

Data not Gamma Distributed at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method

Mean 0.0119  
SD 0.00521  
SE of Mean 0.00052605  
95% KM UTL with 95% Coverage 0.0219  
95% KM Chebychev UPL 0.0347  
95% KM UPL (t) 0.0206  
90% Percentile (z) 0.0186  
95% Percentile (z) 0.0205  
99% Percentile (z) 0.024

Assuming Gamma Distribution

Gamma ROS Statistics with Extrapolated Data

Mean 0.00443  
Median 0.000001  
SD 0.00863  
k star 0.139  
Theta star 0.0319  
nu star 28.27  
95% Percentile of Chi-square (2k) 1.548  
90% Percentile 0.013  
95% Percentile 0.0247  
99% Percentile 0.0584

Gamma ROS Limits with Extrapolated Data

95% Wilson Hillery (WH) Approx. Gamma UPL 0.0164  
95% Hawkins Wixley (HW) Approx. Gamma UPL 0.0163  
95% WH Approx. Gamma UTL with 95% Coverage 0.0222  
95% HW Approx. Gamma UTL with 95% Coverage 0.0239

Note: DL/2 is not a recommended method.