ENTERED

DEPARTMENT OF THE AIR FORCE
27TH SPECIAL OPERATIONS MISSION SUPPORT GROUP (AFSOC)
CANNON AIR FORCE BASE NEW MEXICO

FEB 14 2011

Colonel Steven A. Kimball
Commander
110 E Sextant Avenue Suite 1091
Cannon AFB NM 88103

Ms Patricia Stewart
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East Bldg 1
Santa Fe NM 87505-6063

Dear Ms Stewart

Attached are the responses to the comments presented in a letter from Mr. James Bearzi, Chief, Hazardous Waste Bureau, New Mexico Environment Department, dated December 9, 2010 on the Notice of Disapproval Corrective Action Complete Proposals.

If you have any questions regarding this submittal, please contact Mr. Ronald Lancaster, Chief, Asset Management Flight, at (575) 784-1146.

Sincerely

STEVEN A. KIMBALL, Colonel, USAF

Attachment:
Corrective Action Complete Proposals Responses

cc:
New Mexico Environment Department, Mr. David Cobrain w/o Attachment
Environmental Protection Agency, Region VI, Ms. Wendy Jacques w/o Attachment

RESPONSE TO COMMENTS
CORRECTIVE ACTION COMPLETE PROPOSALS
(SWMUs 2, 4, 6, 10, 50, 72, 75, 81, 82, 96, 98, 102, 106, AND 125)
CANNON AIR FORCE BASE, NEW MEXICO
DATED OCTOBER 2010

Comments from James Bearzi, Chief, Hazardous Waste Bureau, New Mexico Environment Department, December 9, 2010

Note: The responses to Comments 4 and 9 were revised based on the January 25, 2011 conference call with NMED.

The New Mexico Environment Department (NMED) has reviewed Cannon Air Force Base's (Permittee's), *Corrective Action Complete Proposals (SWMUs 2, 4, 6, 10, 50, 72, 75, 81, 82, 96, 98, 102, 106 and 125), Cannon Air Force Base, New Mexico* dated October 2010 (Proposals). NMED hereby disapproves the Proposals and provides the following comments.

Several errors relevant to risk screening occur repeatedly in the Proposals. The Permittee is directed to Table 9, Comparison of SWMU 82 Maximum Combined Surface and Subsurface Soil Concentrations (0-75 feet) to NMED SSLs, for an example of the recurring errors.

Comment 1. When no comparison criteria for a contaminant are provided in NMED Soil Screening Levels (SSLs), the Permittee must use comparison values provided in the U.S. Environmental Protection Agency Regional Screening Levels (RSLs). In Table 9, the Permittee used SSL values for naphthalene as a surrogate for 2-methylnaphthalene and inserted "NA" (not applicable) in place of SSL values for benzoic acid and butylbenzylphthalate. Soil screening levels are available for the residential and industrial scenarios in the RSLs for these three chemicals. The permittee must use RSLs when no comparison criteria are listed in the SSLs.

> **Response:** Comment noted. It is not stated anywhere in the NMED Technical Background Document For Development of Soil Screening Levels (Revision 5) (NMED 2009) that RSLs are to be used in place of SSLs, if there is no NMED-specific screening level available.
>
> If RSLs were used in place of the chemicals that have no NMED SSL listed (i.e., shown as NA in the tables), there would be no instances where a maximum detected concentration of a chemical of concern exceeds the respective USEPA RSL. The following bullets summarize the relevant comparisons from Table 9:
>
> - The USEPA residential RSL for benzoic acid is 2.4E+05 while its maximum detected concentration was 3.9E-02
> - The USEPA residential RSL for butylbenzylphthalate is 2.6E+02 while its maximum detected concentration was 4.90E-02
> - The USEPA residential RSL for dibenzofuran is 7.8E+01 while its maximum detected concentration was 6.2E-01
> - The USEPA residential RSL for cobalt is 2.3E+01 while its maximum detected concentration was 1.02+01

The basis of determination and the conclusions for each SWMU would remain unaffected by including RSLs in Tables 1-17. However, in the Permittee's future assessments of risk in New Mexico, the merits of this comment will be considered.

Comment 2. It is important to note that generic SSLs and RSLs were developed for evaluating direct exposure for the residential, industrial and construction worker scenarios. Maximum concentrations of contaminants detected at ten feet below ground surface (bgs) or less for residential and construction workers and at one foot bgs or less for industrial workers should be compared to the SSLs and RSLs and when assessing risk due to direct exposure. Maximum concentrations of four contaminanats in Table 9, benzo(a)anthracene, bis(2-ethylhexyl)phthalate, chrysene and di-n-butylphthalate, occurred at depths greater than ten feet bgs. Use of the higher concentrations results in inflated risk calculations for direct exposure. Inhalation risk, however, should be assessed using the maximum detected concentration at a site and not limited to one foot bgs or ten feet bgs. The Permittee must use values from appropriate depths of soil for comparing detected concentrations to SSLs or RSLs and for calculating cumulative carcinogenic risk and noncarcinogenic hazard. A separate table listing detected concentrations at the appropriate depths may be helpful.

Response: Comment noted. To be conservative, the maximum contaminant concentrations detected from all depths were used for the CAFB screening evaluations. The most conservative NMED residential SSLs were used in all of the tables to screen risks associated with chemical concentrations for each of the SWMUs. Using these conservative values, no significant risks were identified for any of the chemicals detected. Screening with lower subsurface soil concentrations would show less risk, even though there were no significant risks identified using the more conservative approach. However, in the Permittee's future assessments of risk in New Mexico, the merits of this comment will be considered.

Comment 3. The Permittee indicated that pentachlorophenol is not a carcinogen. NMED considers pentachlorophenol to be a carcinogen in all receptor scenarios, as indicated in NMED SSLs. The Permittee must use accurate indicators of carcinogenicity and correct cumulative sums.

Response: Agree. Pentachlorophenol should be listed as a carcinogen and included in the cumulative risk sum. The risk calculated on the basis of the carcinogenic properties of pentachlorophenol is 2.9E-08. However, the basis of determination and the conclusions for SWMU 82 will remain unaffected by this change.

Comment 4. The Permittee failed to calculate hazard quotients for metals that were detected at concentrations exceeding Cannon Air Force Base (CAFB) background values in Table 9. The Permittee must include all metals that exceed background values in cumulative human health carcinogenic risk or noncarcinogenic hazard and, when appropriate, in ecological hazard index analyses.

Response: **Note: This response was revised per the January 25, 2011 conference call with NMED.** Metal concentrations in soil at SWMU 82 and SWMU 98 were further evaluated using mean comparison tests for metals that exceeded background. Data sets

for background comparison at SWMU 82 and SWMU 98 were limited to the 0-10 foot bgs interval. The 95% upper tolerance limits (95% UTL) for background metals representing the 0-10 foot interval were calculated using ProUCL (see **Attachment A**). Maximum site soil concentrations from the 0-10 foot interval were then compared with the 95% UTL for the 0-10 foot bgs interval for background. ProUCL was also used to conduct mean comparison tests (MCT) for those metals that exceeded the 95% UTL. Results for these comparisons are presented in the attached **Tables 1 and 2** as well as **Attachments A and B**. No metals were identified as statistically greater than background based on mean comparison tests at SWMU 82.

Several metals (antimony, cadmium, and thallium) that were detected in the site data sets were not detected in the background data and could not be further evaluated. However, these metals were detected at very low frequencies and were only present in concentrations near the reporting limits. The only metals that were identified as statistically greater than background based on mean comparison tests were barium, calcium, and magnesium at SWMU 98 (see **Attachment B**). Calcium and magnesium are considered essential nutrients and, as such, do not have a risk-based screening level for further evaluation. If barium is included in the cumulative risk/hazard quotient calculations for the SWMU 98 risk screen, the cumulative noncarcinogenic hazard quotient (0.1) is still well below the target of 1. Therefore, even metals that were determined to be present at concentrations statistically greater than background levels do not significantly contribute to the cumulative risks/hazards for SWMUs 82 and 98.

Comment 5. The Permittee used default values in the Johnson and Ettinger (J&E) model for calculating risks and hazards. The soil texture at CAFB is known to be sandy loam. Values for sandy loam vadose zone soil dry bulk density, soil total porosity, and soil water-filled porosity are provided in the J&E lookup tables. The J&E User's guide provides a figure on page 48 for determining the average soil temperature at CAFB. The Permittee entered 0.001 for the vadose zone soil organic carbon fraction. The default value is 0.002. The Permittee should determine the soil organic carbon fraction for the soil at CAFB to determine a site-spcific value. Lastly, the New Mexico target risk for carcinogens is 1.0E-05, not 1.0E-06, as indicated in the Notice of Disapproval dated October 12, 2010. The Permittee's use of default or incorrect values may result in inflated risk values. The Permittee must use correct values and site-specific data when they are available.

Response: Comment noted. The default values used in the J&E model for soil texture, soil properties, and organic carbon fraction were intended to be conservative at this stage of the screening process. The target risk of 1E-06 shown on the [DATENTER] page of the J&E model is the default value used to calculate allowable risk-based soil concentrations and does not affect the incremental risks calculated from actual soil concentrations.

Comment 6. The reference concentration (RfC) for toluene is incorrect. The current datum provided in the Integrated Risk Information System (IRIS) database is 5.0 mg/m^3. The Permittee must revise the J&E spreadsheets and subsequent hazard estimates accordingly.

Response: Agree. The RfC for toluene should have been changed to 5.0 mg/m^3. The subsequent hazard quotient results will be approximately 12 times lower than estimated using the previous RfC of 0.4 mg/m^3. This will not result in significant changes to the conclusions of this document.

Comment 7. In addition to the recurring errors described above, using Table 9 as an example, the Permittee listed incorrect concentrations for total petroleum hydrocarbons (TPH), 2-butanone, methylene chloride, and toluene in Table 13. The values shown in Table 13 are off by a factor of 1,000. For example, the value for TPH shown in Table 13 is 3.38E-01 mg/kg. According to the RCRA Facility Investigation for 21 SWMUs, October 2007, the maximum concentration of TPH at SWMU 98 was 3.38E+02 mg/kg. The Permittee must revise Table 13 using correct concentrations of contaminants.

Response: Agree. There have been unit conversion issues associated with historical data that were identified in the past. These conversion issues appear to be the source of the discrepancy identified by this comment. Therefore, to investigate the concern of this comment, we went back to the chemical data presented for SWMU 98 in the Analytical Database Printout (Appendix C-1) of the Remedial Investigation Report for 18 Solid Waste Management Units (Woodward-Clyde 1992). Based on a comparison with the original 1992 data, only one of the analytes (TPH) referenced in the comment, requires revision. The maximum concentration for TPH will be edited from 3.38E-01 mg/kg to read *3.38E+02* mg/kg. The other chemicals referenced by this comment (2-butanone, methylene chloride, and toluene) are correct as presented in Table 13. Replacement pages for Table 13 with the TPH correction will be submitted. However, this will not result in any significant changes to the conclusions of this document.

Comment 8. 2-methylnaphthalene and dieldrin are included in vapor intrusion scenarios. The inhalation toxicity data for these chemicals have been rescinded. Inclusion of these chemicals has no impact on the conclusions of risk presented in the Proposals. However, to avoid inflated risk analyses, the Permittee should avoid including chemicals with withdrawn inhalation toxicity data in future J&E models.

Response: Comment noted. This will not result in a significant change to the conclusions of this document; therefore, no changes will be made at this time. However, the inhalation pathway will not be evaluated for 2-methylnapthalene or dieldrin in future J&E models.

Comment 9. The Permittee failed to provide overall hazard indices (HI) for ecological receptors in Table 6 and in Table 14, as instructed in the Notice of Disapproval dated October 12, 2010. The Permittee must provide hazard indices for ecological receptors at SWMU 81 (Table 6) and SWMU 102 (Table 14)

Response: **Note: This response was revised per the January 25, 2011 conference call with NMED.** The cumulative EHQ for the VOCs detected in soil at SWMU 81 is 0.5, indicating a very low potential for ecological risk. The cumulative EHQ for organic chemicals detected in soil at SWMU 102 is 0.5, indicating a very low potential for ecological risk. The following metals resulted in an EHQ greater than 1 for SWMU 102:

antimony, barium, cadmium, mercury, thallium, and vanadium. Of these, only the maximum concentrations for cadmium (1.8 mg/kg), mercury (0.03 mg/kg), and thallium (5.2 mg/kg) detected during the 2006 sampling event exceeded the background levels. The background soil concentrations for these three metals were all nondetect with reporting limits of 2.6 mg/kg, 0.038 mg/kg, and 5.3 mg/kg, respectively. The maximum cadmium, mercury, and thallium concentrations detected at SWMU 102 were all below these corresponding reporting limits for background.

The Permittee must revise cumulative risk calculations and incremental risk and hazard quotient values for vapor intrusion in Tables 3, 6, 8, 9,10, 11, 13, 14, and 16.

The Permittee must also submit a revised Proposal to NMED that addresses all of the comments included in this letter no later than February 28, 2011. The submittal must include an electronic copy with all changes presented in redline-strikeout in addition to the paper copies. The Permittee must include all modeling spreadsheets used to calculate the risks and hazards. Where outside the chemical-specific or site-specific data are used in place of default data in the Johnson and Ettinger inputs, the Permittee must provide justification [e.g., sources(s)] for the values.

Please contact Pat Stewart at (505) 476-6059, should you have any questions.

Response: Revision of Tables 3 through 16 is not warranted, except as indicated in responses to Comments 3 and 6. The default values used in the J&E model result in the most conservative estimates of vapor intrusion risks during the initial soil screening evaluations. Many of the default inputs are representative of coarse-grained soil that is often found below and adjacent to foundations. It is recommend that future vapor intrusion evaluations include an approved workplan presenting these input values along with a discussion of the uncertainties associated with this evaluation [see example below]:

Assessment of the vapor intrusion pathway using conservative inputs in the Johnson & Ettinger model allows one to conclude either (1) that no "potential" vapor intrusion condition is likely to exist, or (2) that a "potential" vapor intrusion condition may exist for future scenarios. The Johnson & Ettinger model is sensitive to a number of parameters for which site-specific data may not be available. Site-specific J&E model input values can be incorporated if the screening results indicate that further evaluation is warranted.

However, the factors that influence the movement of vapors from the subsurface soil or groundwater into buildings can be very complex. As a result, the potential for vapor intrusion is highly site specific and will depend on such variables as:

- Type of contaminant;
- Concentration of the contaminant;
- Depth and location of the contamination;
- Nature of the soil;
- The pathway of exposure; and
- Building design

USEPA (2005) has conducted an evaluation of parameter uncertainty in the Johnson & Ettinger model. The EPA (2005) notes that:

"Typical use of this model relies on a suite of estimated data, with few site-specific measurements...An apparent increase in simulated cancer risk caused by the uncertainty introduced from the input parameters was as much as 1285%."

EPA, 2005. Uncertainty and the Johnson-Ettinger Model for Vapor Intrusion Calculations. Office of Research and Development, EPA/600/R-05/110.

TABLES

TABLE 1
COMPARISON OF SWMU 82 MAXIMUM SOIL CONCENTRATIONS (0-10 FT BGS) TO BACKGROUND
CANNON AFB, NEW MEXICO

Chemical	SWMU 82 Maximum (All Depths) (mg/kg)[1]	Backgound UTL (All Depths) (mg/kg)[2]	SWMU 82 Maximum (0-10 ft bgs) (mg/kg)[3]	Background UTL (0-10 ft bgs) (mg/kg)[4]	Exceeds Background (0-10 ft bgs)?	MCT
METALS						
Aluminum	1.05E+04	1.22E+04	8.70E+03	1.02E+04	NO	
Antimony	1.61E+01	1.60E+01	4.21E+00	ND	YES	NA
Arsenic	2.80E+00	4.30E+00	2.80E+00	3.76E+00	NO	
Barium	5.60E+03	8.90E+02	2.48E+02	3.89E+02	NO	
Beryllium	8.21E-01	7.30E-01	8.20E-01	7.27E-01	YES	Site < Background
Cadmium	1.40E+00	1.30E+00	1.40E+00	ND	YES	NA
Calcium	3.58E+05	2.37E+05	8.68E+04	1.87E+05	NO	
Chromium	1.17E+02	1.33E+01	1.00E+01	1.04E+01	NO	
Cobalt	1.02E+01	6.60E+00	4.70E+00	5.32E+00	NO	
Copper	6.17E+01	8.30E+00	1.86E+01	1.14E+01	YES	Site < Background
Iron	1.14E+04	1.31E+04	1.14E+04	9.64E+03	YES	Site < Background
Lead	7.26E+01	8.70E+00	7.26E+01	8.88E+00	YES	Site < Background
Magnesium	2.32E+04	1.93E+04	2.64E+03	3.93E+03	NO	
Manganese	1.74E+02	3.33E+02	1.74E+02	2.18E+02	NO	
Mercury	4.80E-02	1.90E-02	ND	5.60E-02	NO	
Nickel	3.30E+02	1.49E+01	9.70E+00	9.36E+00	YES	Site < Background
Potassium	2.46E+03	2.51E+03	2.46E+03	2.09E+03	YES	Site < Background
Silver	2.60E+00	2.65E+00	1.00E+00	1.10E+00	NO	
Sodium	9.01E+02	1.23E+03	3.25E+02	3.73E+02	NO	
Thallium	1.30E+00	2.65E+00	1.60E-01	ND	YES	NA
Vanadium	2.75E+01	3.28E+01	ND	2.38E+01	NO	
Zinc	8.73E+01	3.06E+01	8.73E+01	2.25E+01	YES	Site < Background

Notes:
bgs = Below ground surface
ft = Feet
MCT = Mean comparison tests
mg/kg = Milligrams per kilogram
NA = Not applicable
ND = Nondetect
RL = Reporting limit
SWMU = Solid Waste Management Unit
UTL = 95% Upper tolerance limit

(1) Maximum detected concentration from all investigations at SWMU 82.
(2) Site-specific background is the 95% upper tolerance limit (UTL) [W-C 1997].
(3) Maximum detected concentration from all investigations (0-10 feet bgs) at SWMU 82.
(4) Site-specific background is the 95% upper tolerance limit (UTL) for the 0-10 feet bgs interval.
Shading indicates the maximum concentration was used for backgroun
Shading indicates the maximum concentration exceeds the designated screening level

TABLE 2
COMPARISON OF SWMU 98 MAXIMUM SOIL CONCENTRATIONS (0-10 FT BGS) TO BACKGROUND
CANNON AFB, NEW MEXICO

Chemical	SWMU 98 Maximum (All Depths) (mg/kg)[1]	Backgound UTL (All Depths) (mg/kg)[2]	SWMU 98 Maximum (0-10 ft bgs) (mg/kg)[3]	Background UTL (0-10 ft bgs) (mg/kg)[4]	Exceeds Background (0-10 ft bgs)?	MCT
METALS						
Aluminum	1.15E+04	1.22E+04	1.15E+04	1.02E+04	YES	Site < Background
Antimony	5.30E+00	1.60E+01	5.30E+00	ND	YES	NA
Arsenic	2.40E+00	4.30E+00	2.00E+00	3.76E+00	NO	
Barium	3.48E+03	8.90E+02	1.83E+03	3.89E+02	YES	Site > Background
Beryllium	7.20E-01	7.30E-01	5.00E-01	7.27E-01	NO	
Cadmium	1.30E+00	1.30E+00	1.30E+00	ND	YES	NA
Calcium	2.46E+05	2.37E+05	2.46E+05	1.87E+05	YES	Site > Background
Chromium	8.40E+00	1.33E+01	7.00E+00	1.04E+01	NO	
Cobalt	4.20E+00	6.60E+00	4.00E+00	5.32E+00	NO	
Copper	1.27E+01	8.30E+00	1.27E+01	1.14E+01	YES	Site < Background
Iron	7.56E+03	1.31E+04	6.86E+03	9.64E+03	NO	
Lead	8.90E+00	8.70E+00	6.00E+00	8.88E+00	NO	
Magnesium	3.53E+04	1.93E+04	5.41E+03	3.93E+03	YES	Site > Background
Manganese	1.33E+02	3.33E+02	1.26E+02	2.18E+02	NO	
Mercury	ND	1.90E-02	ND	5.60E-02	NO	
Nickel	7.50E+00	1.49E+01	7.50E+00	9.36E+00	NO	
Potassium	2.70E+03	2.51E+03	2.70E+03	2.09E+03	YES	Site < Background
Silver	1.00E+00	2.65E+00	1.00E+00	1.10E+00	NO	
Sodium	4.27E+02	1.23E+03	3.71E+02	3.73E+02	NO	
Thallium	2.30E-01	2.65E+00	2.30E-01	ND	YES	NA
Vanadium	2.33E+01	3.28E+01	2.30E+01	2.38E+01	NO	
Zinc	1.95E+01	3.06E+01	1.80E+01	2.25E+01	NO	

Notes:
bgs = Below ground surface
ft = Feet
MCT = Mean comparison tests
mg/kg = Milligrams per kilogram
NA = Not applicable
ND = Nondetect
RL = Reporting limit
SWMU = Solid Waste Management Unit
UTL = 95% Upper tolerance limit

(1) Maximum detected concentration from all investigations at SWMU 98.
(2) Site-specific background is the 95% upper tolerance limit (UTL) [W-C 1997].
(3) Maximum detected concentration from all investigations (0-10 feet bgs) at SWMU 98.
(4) Site-specific background is the 95% upper tolerance limit (UTL) for the 0-10 feet bgs interval.
Shading indicates the maximum concentration was used for backgroun
Shading indicates the maximum concentration exceeds the designated screening level

Al

General Statistics

Total Number of Samples 30

Number of Unique Samples 30

Raw Statistics

Minimum	3370
Maximum	12200
Second Largest	9530
First Quartile	4368
Median	5130
Third Quartile	8003
Mean	6136
SD	2227
Coefficient of Variation	0.363
Skewness	0.872

Log-Transformed Statistics

Minimum	8.123
Maximum	9.409
Second Largest	9.162
First Quartile	8.382
Median	8.543
Third Quartile	8.987
Mean	8.663
SD	0.346

Background Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.902
Shapiro Wilk Critical Value	0.927

Data not Normal at 5% Significance Level

Assuming Normal Distribution

95% UTL with 90% Coverage	10094
95% UPL (t)	9983
90% Percentile (z)	8991
95% Percentile (z)	9800
99% Percentile (z)	11318

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.941
Shapiro Wilk Critical Value	0.927

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

95% UTL with 90% Coverage	10688
95% UPL (t)	10505
90% Percentile (z)	9006
95% Percentile (z)	10211
99% Percentile (z)	12923

Gamma Distribution Test

k star	7.748
Theta Star	792
nu star	464.9

A-D Test Statistic	0.817
5% A-D Critical Value	0.746
K-S Test Statistic	0.183
5% K-S Critical Value	0.16

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

90% Percentile	9076
95% Percentile	10154
99% Percentile	12389

Data Distribution Test

Data appear Lognormal at 5% Significance Level

Nonparametric Statistics

90% Percentile	9256
95% Percentile	10732
99% Percentile	12200

95% UTL with 90% Coverage	9530
95% Percentile Bootstrap UTL with 90% Coverage	9530
95% BCA Bootstrap UTL with 90% Coverage	9530
95% UPL	10732
95% Chebyshev UPL	16005
Upper Threshold Limit Based upon IQR	13455

Note: UPL (or upper percentile for gamma distributed data) represents a preferred estimate of BTV

As

General Statistics

Number of Valid Samples 30
Number of Unique Samples 16

Number of Detected Data 29
Number of Non-Detect Data 1
Percent Non-Detects 3.33%

Raw Statistics

Minimum Detected 1.5
Maximum Detected 3.6
Mean of Detected 2.472
SD of Detected 0.627
Minimum Non-Detect 1.1
Maximum Non-Detect 1.1

Log-transformed Statistics

Minimum Detected 0.405
Maximum Detected 1.281
Mean of Detected 0.874
SD of Detected 0.253
Minimum Non-Detect 0.0953
Maximum Non-Detect 0.0953

Background Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic 0.926
5% Shapiro Wilk Critical Value 0.926
Data appear Normal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method
Mean 2.408
SD 0.709
95% UTL 90% Coverage 3.668
95% UPL (t) 3.633
90% Percentile (z) 3.317
95% Percentile (z) 3.574
99% Percentile (z) 4.057

Maximum Likelihood Estimate(MLE) Method
Mean 2.418
SD 0.674
95% UTL with 90% Coverage 3.615

95% UPL (t) 3.582
90% Percentile (z) 3.281
95% Percentile (z) 3.526
99% Percentile (z) 3.985

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic 0.945
5% Shapiro Wilk Critical Value 0.926
Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

DL/2 Substitution Method
Mean (Log Scale) 0.825
SD (Log Scale) 0.366
95% UTL 90% Coverage 4.374
95% UPL (t) 4.295
90% Percentile (z) 3.648
95% Percentile (z) 4.167
99% Percentile (z) 5.348

Log ROS Method
Mean in Original Scale 2.432
SD in Original Scale 0.654
95% UTL with 90% Coverage 3.819
95% BCA UTL with 90% Coverage 3.3
95% Bootstrap (%) UTL with 90% Coverage 3.5
95% UPL (t) 3.768
90% Percentile (z) 3.335
95% Percentile (z) 3.684
99% Percentile (z) 4.44

Gamma Distribution Test with Detected Values Only

k star (bias corrected) 14.71
Theta Star 0.168
nu star 853.1

A-D Test Statistic 0.575
5% A-D Critical Value 0.745
K-S Test Statistic 0.131
5% K-S Critical Value 0.162
Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics with extrapolated Data
Mean 2.418
Median 2.3
SD 0.684
k star 10.48
Theta star 0.231
Nu star 628.8
95% Percentile of Chisquare (2k) 32.62
90% Percentile 3.411
95% Percentile 3.763
99% Percentile 4.485

Data Distribution Test with Detected Values Only

Data appear Normal at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method
Mean 2.44
SD 0.63
SE of Mean 0.117
95% KM UTL with 90% Coverage 3.56
95% KM Chebyshev UPL 5.232
95% KM UPL (t) 3.528
90% Percentile (z) 3.248
95% Percentile (z) 3.476
99% Percentile (z) 3.906

Note: UPL (or upper percentile for gamma distributed data) represents a preferred estimate of BTV
For an Example: KM-UPL may be used when multiple detection limits are present

Note: DL/2 is not a recommended method.

Ba

General Statistics			
Total Number of Samples	30	Number of Unique Samples	30
Raw Statistics		**Log-Transformed Statistics**	
Minimum	39.2	Minimum	3.669
Maximum	805	Maximum	6.691
Second Largest	670	Second Largest	6.507
First Quartile	56.18	First Quartile	4.027
Median	80.85	Median	4.392
Third Quartile	167.3	Third Quartile	5.119
Mean	144.5	Mean	4.599
SD	174.3	SD	0.776
Coefficient of Variation	1.206		
Skewness	2.977		
Background Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.582	Shapiro Wilk Test Statistic	0.892
Shapiro Wilk Critical Value	0.927	Shapiro Wilk Critical Value	0.927
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% UTL with 90% Coverage	454.2	95% UTL with 90% Coverage	394.9
95% UPL (t)	445.5	95% UPL (t)	380
90% Percentile (z)	367.8	90% Percentile (z)	268.8
95% Percentile (z)	431.1	95% Percentile (z)	356.4
99% Percentile (z)	549.9	99% Percentile (z)	605
Gamma Distribution Test		**Data Distribution Test**	
k star	1.355	**Data do not follow a Discernable Distribution (0.05)**	
Theta Star	106.6		
nu star	81.33		
A-D Test Statistic	1.918	**Nonparametric Statistics**	
5% A-D Critical Value	0.763	90% Percentile	282.9
K-S Test Statistic	0.209	95% Percentile	730.8
5% K-S Critical Value	0.163	99% Percentile	805
Data not Gamma Distributed at 5% Significance Level			
Assuming Gamma Distribution		95% UTL with 90% Coverage	670
90% Percentile	308.6	95% Percentile Bootstrap UTL with 90% Coverage	670
95% Percentile	389.4	95% BCA Bootstrap UTL with 90% Coverage	670
99% Percentile	573.1	95% UPL	730.8
		95% Chebyshev UPL	916.7
		Upper Threshold Limit Based upon IQR	333.9

Note: UPL (or upper percentile for gamma distributed data) represents a preferred estimate of BTV

Be

General Statistics			
Total Number of Samples	30	Number of Unique Samples	20
Raw Statistics		**Log-Transformed Statistics**	
Minimum	0.21	Minimum	-1.561
Maximum	1.1	Maximum	0.0953
Second Largest	0.66	Second Largest	-0.416
First Quartile	0.308	First Quartile	-1.179
Median	0.415	Median	-0.88
Third Quartile	0.51	Third Quartile	-0.674
Mean	0.431	Mean	-0.906
SD	0.174	SD	0.356
Coefficient of Variation	0.404		
Skewness	1.989		
Background Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.84	Shapiro Wilk Test Statistic	0.962
Shapiro Wilk Critical Value	0.927	Shapiro Wilk Critical Value	0.927
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% UTL with 90% Coverage	0.741	95% UTL with 90% Coverage	0.761
95% UPL (t)	0.732	95% UPL (t)	0.747
90% Percentile (z)	0.654	90% Percentile (z)	0.638
95% Percentile (z)	0.718	95% Percentile (z)	0.726
99% Percentile (z)	0.836	99% Percentile (z)	0.925
Gamma Distribution Test		**Data Distribution Test**	
k star	7.109	**Data appear Gamma Distributed at 5% Significance Level**	
Theta Star	0.0607		
nu star	426.6		
A-D Test Statistic	0.471	**Nonparametric Statistics**	
5% A-D Critical Value	0.746	90% Percentile	0.616
K-S Test Statistic	0.142	95% Percentile	0.858
5% K-S Critical Value	0.16	99% Percentile	1.1
Data appear Gamma Distributed at 5% Significance Level			
Assuming Gamma Distribution		95% UTL with 90% Coverage	0.66
90% Percentile	0.647	95% Percentile Bootstrap UTL with 90% Coverage	0.66
95% Percentile	0.727	95% BCA Bootstrap UTL with 90% Coverage	0.66
99% Percentile	0.894	95% UPL	0.858
		95% Chebyshev UPL	1.203
		Upper Threshold Limit Based upon IQR	0.814

Note: UPL (or upper percentile for gamma distributed data) represents a preferred estimate of BTV

Ca

General Statistics			
Total Number of Samples	30	Number of Unique Samples	30
Raw Statistics		**Log-Transformed Statistics**	
Minimum	968	Minimum	6.875
Maximum	253000	Maximum	12.44
Second Largest	171000	Second Largest	12.05
First Quartile	2143	First Quartile	7.668
Median	13270	Median	9.35
Third Quartile	67900	Third Quartile	11.13
Mean	47416	Mean	9.475
SD	64702	SD	1.854
Coefficient of Variation	1.365		
Skewness	1.683		
Background Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.749	Shapiro Wilk Test Statistic	0.88
Shapiro Wilk Critical Value	0.927	Shapiro Wilk Critical Value	0.927
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% UTL with 90% Coverage	162392	95% UTL with 90% Coverage	351532
95% UPL (t)	159170	95% UPL (t)	320535
90% Percentile (z)	130335	90% Percentile (z)	140285
95% Percentile (z)	153841	95% Percentile (z)	275141
99% Percentile (z)	197935	99% Percentile (z)	973462
Gamma Distribution Test		**Data Distribution Test**	
k star	0.466	**Data do not follow a Discernable Distribution (0.05)**	
Theta Star	101781		
nu star	27.95		
A-D Test Statistic	1.381	**Nonparametric Statistics**	
5% A-D Critical Value	0.811	90% Percentile	163900
K-S Test Statistic	0.232	95% Percentile	207900
5% K-S Critical Value	0.169	99% Percentile	253000
Data not Gamma Distributed at 5% Significance Level			
Assuming Gamma Distribution		95% UTL with 90% Coverage	171000
90% Percentile	130142	95% Percentile Bootstrap UTL with 90% Coverage	171000
95% Percentile	186777	95% BCA Bootstrap UTL with 90% Coverage	171000
99% Percentile	327007	95% UPL	207900
		95% Chebyshev UPL	334108
		Upper Threshold Limit Based upon IQR	166536

Note: UPL (or upper percentile for gamma distributed data) represents a preferred estimate of BTV

Cr

General Statistics

Total Number of Samples 30

Number of Unique Samples 21

Raw Statistics

Minimum	2.7
Maximum	11.1
Second Largest	10.5
First Quartile	5.9
Median	6.55
Third Quartile	7.775
Mean	6.89
SD	1.838
Coefficient of Variation	0.267
Skewness	0.287

Log-Transformed Statistics

Minimum	0.993
Maximum	2.407
Second Largest	2.351
First Quartile	1.775
Median	1.879
Third Quartile	2.051
Mean	1.893
SD	0.287

Background Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.97
Shapiro Wilk Critical Value	0.927

Data appear Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.942
Shapiro Wilk Critical Value	0.927

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% UTL with 90% Coverage	10.16
95% UPL (t)	10.06
90% Percentile (z)	9.245
95% Percentile (z)	9.913
99% Percentile (z)	11.17

Assuming Lognormal Distribution

95% UTL with 90% Coverage	11.06
95% UPL (t)	10.9
90% Percentile (z)	9.591
95% Percentile (z)	10.65
99% Percentile (z)	12.95

Gamma Distribution Test

k star	12.26
Theta Star	0.562
nu star	735.8

A-D Test Statistic	0.426
5% A-D Critical Value	0.745
K-S Test Statistic	0.154
5% K-S Critical Value	0.16

Data appear Gamma Distributed at 5% Significance Level

Data Distribution Test

Data appear Normal at 5% Significance Level

Nonparametric Statistics

90% Percentile	9.89
95% Percentile	10.77
99% Percentile	11.1

Assuming Gamma Distribution

90% Percentile	9.501
95% Percentile	10.41
99% Percentile	12.27

95% UTL with 90% Coverage	10.5
95% Percentile Bootstrap UTL with 90% Coverage	10.5
95% BCA Bootstrap UTL with 90% Coverage	10.5
95% UPL	10.77
95% Chebyshev UPL	15.03
Upper Threshold Limit Based upon IQR	10.59

Note: UPL (or upper percentile for gamma distributed data) represents a preferred estimate of BTV

Co

General Statistics

Number of Valid Samples 30
Number of Unique Samples 19

Number of Detected Data 28
Number of Non-Detect Data 2
Percent Non-Detects 6.67%

Raw Statistics

Minimum Detected 1.8
Maximum Detected 5.3
Mean of Detected 3.311
SD of Detected 0.951
Minimum Non-Detect 1.05
Maximum Non-Detect 1.1

Log-transformed Statistics

Minimum Detected 0.588
Maximum Detected 1.668
Mean of Detected 1.155
SD of Detected 0.302
Minimum Non-Detect 0.0488
Maximum Non-Detect 0.0953

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 2
Number treated as Detected with Single DL 28
Single DL Non-Detect Percentage 6.67%

Background Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic 0.961
5% Shapiro Wilk Critical Value 0.924
Data appear Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic 0.948
5% Shapiro Wilk Critical Value 0.924
Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method
Mean 3.126
SD 1.156
95% UTL 90% Coverage 5.181
95% UPL (t) 5.123
90% Percentile (z) 4.608
95% Percentile (z) 5.028
99% Percentile (z) 5.816

Maximum Likelihood Estimate(MLE) Method
Mean 3.134
SD 1.124
95% UTL with 90% Coverage 5.131

95% UPL (t) 5.075
90% Percentile (z) 4.574
95% Percentile (z) 4.983
99% Percentile (z) 5.749

Assuming Lognormal Distribution

DL/2 Substitution Method
Mean (Log Scale) 1.037
SD (Log Scale) 0.536
95% UTL 90% Coverage 7.314
95% UPL (t) 7.122
90% Percentile (z) 5.607
95% Percentile (z) 6.814
99% Percentile (z) 9.821

Log ROS Method
Mean in Original Scale 3.195
SD in Original Scale 1.018
95% UTL with 90% Coverage 5.553
95% BCA UTL with 90% Coverage 4.5
95% Bootstrap (%) UTL with 90% Coverage 4.7
95% UPL (t) 5.459
90% Percentile (z) 4.689
95% Percentile (z) 5.308
99% Percentile (z) 6.697

Gamma Distribution Test with Detected Values Only

k star (bias corrected) 10.77
Theta Star 0.307
nu star 603

A-D Test Statistic 0.35
5% A-D Critical Value 0.745
K-S Test Statistic 0.1
5% K-S Critical Value 0.165
Data appear Gamma Distributed at 5% Significance Level

Data Distribution Test with Detected Values Only

Data appear Normal at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics with extrapolated Data
Mean 3.17
Median 3.15
SD 1.063
k star 7.243
Theta star 0.438
Nu star 434.6
95% Percentile of Chisquare (2k) 24.32
90% Percentile 4.742
95% Percentile 5.322
99% Percentile 6.53

Nonparametric Statistics

Kaplan-Meier (KM) Method
Mean 3.21
SD 0.978
SE of Mean 0.182
95% KM UTL with 90% Coverage 4.948
95% KM Chebyshev UPL 7.543
95% KM UPL (t) 4.899
90% Percentile (z) 4.463
95% Percentile (z) 4.818
99% Percentile (z) 5.485

Note: UPL (or upper percentile for gamma distributed data) represents a preferred estimate of BTV
For an Example: KM-UPL may be used when multiple detection limits are present

Cu

General Statistics			
Total Number of Samples	30	Number of Unique Samples	24
Raw Statistics		**Log-Transformed Statistics**	
Minimum	3.2	Minimum	1.163
Maximum	18.3	Maximum	2.907
Second Largest	15.3	Second Largest	2.728
First Quartile	4.1	First Quartile	1.411
Median	4.95	Median	1.599
Third Quartile	6.7	Third Quartile	1.902
Mean	6.08	Mean	1.704
SD	3.41	SD	0.417
Coefficient of Variation	0.561		
Skewness	2.441		
Background Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.695	Shapiro Wilk Test Statistic	0.868
Shapiro Wilk Critical Value	0.927	Shapiro Wilk Critical Value	0.927
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% UTL with 90% Coverage	12.14	95% UTL with 90% Coverage	11.54
95% UPL (t)	11.97	95% UPL (t)	11.3
90% Percentile (z)	10.45	90% Percentile (z)	9.383
95% Percentile (z)	11.69	95% Percentile (z)	10.92
99% Percentile (z)	14.01	99% Percentile (z)	14.51
Gamma Distribution Test		**Data Distribution Test**	
k star	4.627	Data do not follow a Discernable Distribution (0.05)	
Theta Star	1.314		
nu star	277.6		
A-D Test Statistic	1.895	**Nonparametric Statistics**	
5% A-D Critical Value	0.746	90% Percentile	10.51
K-S Test Statistic	0.228	95% Percentile	16.65
5% K-S Critical Value	0.16	99% Percentile	18.3
Data not Gamma Distributed at 5% Significance Level			
Assuming Gamma Distribution		95% UTL with 90% Coverage	15.3
90% Percentile	9.866	95% Percentile Bootstrap UTL with 90% Coverage	15.3
95% Percentile	11.35	95% BCA Bootstrap UTL with 90% Coverage	15.3
99% Percentile	14.49	95% UPL	16.65
		95% Chebyshev UPL	21.19
		Upper Threshold Limit Based upon IQR	10.6

Note: UPL (or upper percentile for gamma distributed data) represents a preferred estimate of BTV

Fe

General Statistics

Total Number of Samples 30

Number of Unique Samples 29

Raw Statistics

Minimum	2720
Maximum	10100
Second Largest	9700
First Quartile	5518
Median	6255
Third Quartile	7463
Mean	6378
SD	1699
Coefficient of Variation	0.266
Skewness	0.257

Log-Transformed Statistics

Minimum	7.908
Maximum	9.22
Second Largest	9.18
First Quartile	8.616
Median	8.741
Third Quartile	8.918
Mean	8.723
SD	0.288

Background Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.956
Shapiro Wilk Critical Value	0.927

Data appear Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.927
Shapiro Wilk Critical Value	0.927

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% UTL with 90% Coverage	9397
95% UPL (t)	9312
90% Percentile (z)	8555
95% Percentile (z)	9173
99% Percentile (z)	10330

Assuming Lognormal Distribution

95% UTL with 90% Coverage	10245
95% UPL (t)	10099
90% Percentile (z)	8884
95% Percentile (z)	9863
99% Percentile (z)	11999

Gamma Distribution Test

k star	12.23
Theta Star	521.6
nu star	733.7

A-D Test Statistic	0.55
5% A-D Critical Value	0.745
K-S Test Statistic	0.149
5% K-S Critical Value	0.16

Data appear Gamma Distributed at 5% Significance Level

Data Distribution Test

Data appear Normal at 5% Significance Level

Nonparametric Statistics

90% Percentile	9459
95% Percentile	9880
99% Percentile	10100

Assuming Gamma Distribution

90% Percentile	8798
95% Percentile	9644
99% Percentile	11367

95% UTL with 90% Coverage	9700
95% Percentile Bootstrap UTL with 90% Coverage	9700
95% BCA Bootstrap UTL with 90% Coverage	9700
95% UPL	9880
95% Chebyshev UPL	13906
Upper Threshold Limit Based upon IQR	10380

Note: UPL (or upper percentile for gamma distributed data) represents a preferred estimate of BTV

Pb

General Statistics			
Total Number of Samples	30	Number of Unique Samples	21
Raw Statistics		**Log-Transformed Statistics**	
Minimum	3.1	Minimum	1.131
Maximum	10	Maximum	2.303
Second Largest	10	Second Largest	2.303
First Quartile	5.2	First Quartile	1.649
Median	6.15	Median	1.816
Third Quartile	7	Third Quartile	1.946
Mean	6.223	Mean	1.802
SD	1.47	SD	0.235
Coefficient of Variation	0.236		
Skewness	0.853		
Background Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.929	Shapiro Wilk Test Statistic	0.957
Shapiro Wilk Critical Value	0.927	Shapiro Wilk Critical Value	0.927
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% UTL with 90% Coverage	8.836	95% UTL with 90% Coverage	9.2
95% UPL (t)	8.763	95% UPL (t)	9.093
90% Percentile (z)	8.108	90% Percentile (z)	8.19
95% Percentile (z)	8.642	95% Percentile (z)	8.919
99% Percentile (z)	9.644	99% Percentile (z)	10.47
Gamma Distribution Test		**Data Distribution Test**	
k star	17.24	**Data appear Normal at 5% Significance Level**	
Theta Star	0.361		
nu star	1034		
A-D Test Statistic	0.479	**Nonparametric Statistics**	
5% A-D Critical Value	0.744	90% Percentile	8.39
K-S Test Statistic	0.12	95% Percentile	10
5% K-S Critical Value	0.16	99% Percentile	10
Data appear Gamma Distributed at 5% Significance Level			
Assuming Gamma Distribution		95% UTL with 90% Coverage	10
90% Percentile	8.205	95% Percentile Bootstrap UTL with 90% Coverage	10
95% Percentile	8.876	95% BCA Bootstrap UTL with 90% Coverage	10
99% Percentile	10.23	95% UPL	10
		95% Chebyshev UPL	12.74
		Upper Threshold Limit Based upon IQR	9.7

Note: UPL (or upper percentile for gamma distributed data) represents a preferred estimate of BTV

Mg

General Statistics

Total Number of Samples 30

Number of Unique Samples 30

Raw Statistics

Minimum 696
Maximum 4390
Second Largest 3250
First Quartile 909.5
Median 1635
Third Quartile 2845
Mean 1915
SD 1011
Coefficient of Variation 0.528
Skewness 0.504

Log-Transformed Statistics

Minimum 6.545
Maximum 8.387
Second Largest 8.086
First Quartile 6.812
Median 7.399
Third Quartile 7.953
Mean 7.411
SD 0.564

Background Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic 0.907
Shapiro Wilk Critical Value 0.927
Data not Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic 0.912
Shapiro Wilk Critical Value 0.927
Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% UTL with 90% Coverage 3712
95% UPL (t) 3661
90% Percentile (z) 3211
95% Percentile (z) 3578
99% Percentile (z) 4267

Assuming Lognormal Distribution

95% UTL with 90% Coverage 4510
95% UPL (t) 4385
90% Percentile (z) 3409
95% Percentile (z) 4185
99% Percentile (z) 6149

Gamma Distribution Test

k star 3.239
Theta Star 591.2
nu star 194.3

A-D Test Statistic 0.889
5% A-D Critical Value 0.751
K-S Test Statistic 0.135
5% K-S Critical Value 0.161
Data follow Appx. Gamma Distribution at 5% Significance Level

Data Distribution Test

Data Follow Appr. Gamma Distribution at 5% Significance Level

Nonparametric Statistics

90% Percentile 3194
95% Percentile 3763
99% Percentile 4390

Assuming Gamma Distribution

90% Percentile 3341
95% Percentile 3932
99% Percentile 5206

95% UTL with 90% Coverage 3250
95% Percentile Bootstrap UTL with 90% Coverage 3250
95% BCA Bootstrap UTL with 90% Coverage 3250
95% UPL 3763
95% Chebyshev UPL 6396
Upper Threshold Limit Based upon IQR 5748

Note: UPL (or upper percentile for gamma distributed data) represents a preferred estimate of BTV

Mn

General Statistics

Total Number of Samples 30

Number of Unique Samples 28

Raw Statistics

Minimum	32.8
Maximum	275
Second Largest	184
First Quartile	94.5
Median	115
Third Quartile	150.5
Mean	121.7
SD	49.26
Coefficient of Variation	0.405
Skewness	0.904

Log-Transformed Statistics

Minimum	3.49
Maximum	5.617
Second Largest	5.215
First Quartile	4.549
Median	4.745
Third Quartile	5.014
Mean	4.718
SD	0.437

Background Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.944
Shapiro Wilk Critical Value	0.927

Data appear Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.948
Shapiro Wilk Critical Value	0.927

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% UTL with 90% Coverage	209.3
95% UPL (t)	206.8
90% Percentile (z)	184.9
95% Percentile (z)	202.8
99% Percentile (z)	236.3

Assuming Lognormal Distribution

95% UTL with 90% Coverage	243.4
95% UPL (t)	238.2
90% Percentile (z)	196
95% Percentile (z)	229.7
99% Percentile (z)	309.5

Gamma Distribution Test

k star	5.51
Theta Star	22.1
nu star	330.6

A-D Test Statistic	0.366
5% A-D Critical Value	0.746
K-S Test Statistic	0.112
5% K-S Critical Value	0.16

Data appear Gamma Distributed at 5% Significance Level

Data Distribution Test

Data appear Normal at 5% Significance Level

Nonparametric Statistics

90% Percentile	182.8
95% Percentile	225
99% Percentile	275

Assuming Gamma Distribution

90% Percentile	191.1
95% Percentile	217.7
99% Percentile	273.5

95% UTL with 90% Coverage	184
95% Percentile Bootstrap UTL with 90% Coverage	184
95% BCA Bootstrap UTL with 90% Coverage	184
95% UPL	225
95% Chebyshev UPL	340
Upper Threshold Limit Based upon IQR	234.5

Note: UPL (or upper percentile for gamma distributed data) represents a preferred estimate of BTV

Ni

General Statistics

Number of Valid Samples 30
Number of Unique Samples 23

Number of Detected Data 28
Number of Non-Detect Data 2
Percent Non-Detects 6.67%

Raw Statistics

Minimum Detected 3.8
Maximum Detected 11.4
Mean of Detected 6.329
SD of Detected 1.831
Minimum Non-Detect 4.45
Maximum Non-Detect 10.55

Log-transformed Statistics

Minimum Detected 1.335
Maximum Detected 2.434
Mean of Detected 1.806
SD of Detected 0.285
Minimum Non-Detect 1.493
Maximum Non-Detect 2.356

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 29
Number treated as Detected with Single DL 1
Single DL Non-Detect Percentage 96.67%

Background Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic 0.941
5% Shapiro Wilk Critical Value 0.924
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 0.924
Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method
Mean 6.157
SD 1.926
95% UTL 90% Coverage 9.58
95% UPL (t) 9.484
90% Percentile (z) 8.625
95% Percentile (z) 9.325
99% Percentile (z) 10.64

Maximum Likelihood Estimate(MLE) Method N/A

Assuming Lognormal Distribution

DL/2 Substitution Method
Mean (Log Scale) 1.768
SD (Log Scale) 0.331
95% UTL 90% Coverage 10.55
95% UPL (t) 10.38
90% Percentile (z) 8.952
95% Percentile (z) 10.1
99% Percentile (z) 12.65

Log ROS Method
Mean in Original Scale 6.245
SD in Original Scale 1.809
Mean in Log Scale 1.793
SD in Log Scale 0.283
95% UTL 90% Coverage 9.928
95% UPL (t) 9.789
90% Percentile (z) 8.63
95% Percentile (z) 9.563
99% Percentile (z) 11.6

Gamma Distribution Test with Detected Values Only

k star (bias corrected) 11.56
Theta Star 0.548
nu star 647.2

A-D Test Statistic 0.389
5% A-D Critical Value 0.745
K-S Test Statistic 0.111
5% K-S Critical Value 0.165
Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics with extrapolated Data
Mean 6.268
Median 6.5
SD 1.814
k star 11.63
Theta star 0.539
Nu star 697.6
95% Percentile of Chisquare (2k) 35.49
90% Percentile 8.709
95% Percentile 9.566
99% Percentile 11.32

Data Distribution Test with Detected Values Only

Data appear Normal at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method
Mean 6.247
SD 1.805
SE of Mean 0.34
95% KM UTL with 90% Coverage 9.453
95% KM Chebyshev UPL 14.24
95% KM UPL (t) 9.364
90% Percentile (z) 8.559
95% Percentile (z) 9.215
99% Percentile (z) 10.44

Note: UPL (or upper percentile for gamma distributed data) represents a preferred estimate of BTV
For an Example: KM-UPL may be used when multiple detection limits are present

Note: DL/2 is not a recommended method.

K

General Statistics			
Total Number of Samples	30	Number of Unique Samples	23
Raw Statistics		**Log-Transformed Statistics**	
Minimum	754	Minimum	6.625
Maximum	2370	Maximum	7.771
Second Largest	2310	Second Largest	7.745
First Quartile	1060	First Quartile	6.966
Median	1300	Median	7.17
Third Quartile	1578	Third Quartile	7.363
Mean	1365	Mean	7.179
SD	405.7	SD	0.286
Coefficient of Variation	0.297		
Skewness	0.888		
Background Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.929	Shapiro Wilk Test Statistic	0.974
Shapiro Wilk Critical Value	0.927	Shapiro Wilk Critical Value	0.927
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% UTL with 90% Coverage	2086	95% UTL with 90% Coverage	2181
95% UPL (t)	2066	95% UPL (t)	2151
90% Percentile (z)	1885	90% Percentile (z)	1893
95% Percentile (z)	2033	95% Percentile (z)	2100
99% Percentile (z)	2309	99% Percentile (z)	2553
Gamma Distribution Test		**Data Distribution Test**	
k star	11.35	**Data appear Normal at 5% Significance Level**	
Theta Star	120.3		
nu star	681		
A-D Test Statistic	0.374	**Nonparametric Statistics**	
5% A-D Critical Value	0.745	90% Percentile	1927
K-S Test Statistic	0.121	95% Percentile	2337
5% K-S Critical Value	0.16	99% Percentile	2370
Data appear Gamma Distributed at 5% Significance Level			
Assuming Gamma Distribution		95% UTL with 90% Coverage	2310
90% Percentile	1904	95% Percentile Bootstrap UTL with 90% Coverage	2310
95% Percentile	2093	95% BCA Bootstrap UTL with 90% Coverage	2310
99% Percentile	2480	95% UPL	2337
		95% Chebyshev UPL	3163
		Upper Threshold Limit Based upon IQR	2354

Note: UPL (or upper percentile for gamma distributed data) represents a preferred estimate of BTV

Na

General Statistics

Number of Valid Samples	30	Number of Detected Data	10
Number of Unique Samples	9	Number of Non-Detect Data	20
		Percent Non-Detects	66.67%

Raw Statistics

Minimum Detected	84.1
Maximum Detected	503
Mean of Detected	210.4
SD of Detected	143.6
Minimum Non-Detect	264.5
Maximum Non-Detect	1320

Log-transformed Statistics

Minimum Detected	4.432
Maximum Detected	6.221
Mean of Detected	5.146
SD of Detected	0.667
Minimum Non-Detect	5.578
Maximum Non-Detect	7.185

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	30
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	0.859
5% Shapiro Wilk Critical Value	0.842

Data appear Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.897
5% Shapiro Wilk Critical Value	0.842

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method

Mean	224.4
SD	125.1
95% UTL 90% Coverage	446.6
95% UPL (t)	440.4
90% Percentile (z)	384.6
95% Percentile (z)	430.1
99% Percentile (z)	515.3

Maximum Likelihood Estimate(MLE) Method N/A

Assuming Lognormal Distribution

DL/2 Substitution Method

Mean (Log Scale)	5.284
SD (Log Scale)	0.512
95% UTL 90% Coverage	489.4
95% UPL (t)	477.1
90% Percentile (z)	379.8
95% Percentile (z)	457.4
99% Percentile (z)	648.3

Log ROS Method

Mean in Original Scale	163.2
SD in Original Scale	89.18
Mean in Log Scale	5
SD in Log Scale	0.408
95% UTL 90% Coverage	306.3
95% UPL (t)	300.1
90% Percentile (z)	250.2
95% Percentile (z)	290.2
99% Percentile (z)	383.2

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	1.902
Theta Star	110.6
nu star	38.05
A-D Test Statistic	0.477
5% A-D Critical Value	0.733
K-S Test Statistic	0.197
5% K-S Critical Value	0.269

Data appear Gamma Distributed at 5% Significance Level

Data Distribution Test with Detected Values Only

Data appear Normal at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics with extrapolated Data

Mean	221.2
Median	219.5
SD	82.32
k star	6.491
Theta star	34.08
Nu star	389.4
95% Percentile of Chisquare (2k)	22.34
90% Percentile	337.2
95% Percentile	380.6
99% Percentile	471.3

Nonparametric Statistics

Kaplan-Meier (KM) Method

Mean	175.1
SD	114.8
SE of Mean	31.41
95% KM UTL with 90% Coverage	379.1
95% KM Chebyshev UPL	683.7
95% KM UPL (t)	373.4
90% Percentile (z)	322.2
95% Percentile (z)	363.9
99% Percentile (z)	442.1

Note: UPL (or upper percentile for gamma distributed data) represents a preferred estimate of BTV
For an Example: KM-UPL may be used when multiple detection limits are present

Note: DL/2 is not a recommended method.

Vn

General Statistics

Total Number of Samples 30

Number of Unique Samples 28

Raw Statistics

Minimum	9.3
Maximum	26.3
Second Largest	25.8
First Quartile	12.9
Median	16.15
Third Quartile	17.9
Mean	16.37
SD	4.175
Coefficient of Variation	0.255
Skewness	0.838

Log-Transformed Statistics

Minimum	2.23
Maximum	3.27
Second Largest	3.25
First Quartile	2.557
Median	2.782
Third Quartile	2.885
Mean	2.766
SD	0.246

Background Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.924
Shapiro Wilk Critical Value	0.927

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.964
Shapiro Wilk Critical Value	0.927

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% UTL with 90% Coverage	23.79
95% UPL (t)	23.58
90% Percentile (z)	21.72
95% Percentile (z)	23.24
99% Percentile (z)	26.08

Assuming Lognormal Distribution

95% UTL with 90% Coverage	24.6
95% UPL (t)	24.3
90% Percentile (z)	21.78
95% Percentile (z)	23.82
99% Percentile (z)	28.16

Gamma Distribution Test

k star	15.29
Theta Star	1.071
nu star	917.2

A-D Test Statistic	0.545
5% A-D Critical Value	0.745
K-S Test Statistic	0.117
5% K-S Critical Value	0.16

Data appear Gamma Distributed at 5% Significance Level

Data Distribution Test

Data appear Gamma Distributed at 5% Significance Level

Nonparametric Statistics

90% Percentile	23.14
95% Percentile	26.03
99% Percentile	26.3

Assuming Gamma Distribution

90% Percentile	21.91
95% Percentile	23.81
99% Percentile	27.65

95% UTL with 90% Coverage	25.8
95% Percentile Bootstrap UTL with 90% Coverage	25.8
95% BCA Bootstrap UTL with 90% Coverage	25.8
95% UPL	26.03
95% Chebyshev UPL	34.87
Upper Threshold Limit Based upon IQR	25.4

Note: UPL (or upper percentile for gamma distributed data) represents a preferred estimate of BTV

Zn

General Statistics			
Total Number of Samples	30	Number of Unique Samples	27
Raw Statistics		**Log-Transformed Statistics**	
Minimum	8.9	Minimum	2.186
Maximum	29	Maximum	3.367
Second Largest	21.4	Second Largest	3.063
First Quartile	11.93	First Quartile	2.479
Median	14.25	Median	2.657
Third Quartile	18.65	Third Quartile	2.926
Mean	15.13	Mean	2.683
SD	4.223	SD	0.259
Coefficient of Variation	0.279		
Skewness	1.32		
Background Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.904	Shapiro Wilk Test Statistic	0.97
Shapiro Wilk Critical Value	0.927	Shapiro Wilk Critical Value	0.927
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% UTL with 90% Coverage	22.63	95% UTL with 90% Coverage	23.16
95% UPL (t)	22.42	95% UPL (t)	22.86
90% Percentile (z)	20.54	90% Percentile (z)	20.37
95% Percentile (z)	22.07	95% Percentile (z)	22.38
99% Percentile (z)	24.95	99% Percentile (z)	26.69
Gamma Distribution Test		**Data Distribution Test**	
k star	13.53	**Data appear Gamma Distributed at 5% Significance Level**	
Theta Star	1.118		
nu star	811.8		
A-D Test Statistic	0.489	**Nonparametric Statistics**	
5% A-D Critical Value	0.745	90% Percentile	20.48
K-S Test Statistic	0.128	95% Percentile	24.82
5% K-S Critical Value	0.16	99% Percentile	29
Data appear Gamma Distributed at 5% Significance Level			
Assuming Gamma Distribution		95% UTL with 90% Coverage	21.4
90% Percentile	20.58	95% Percentile Bootstrap UTL with 90% Coverage	21.4
95% Percentile	22.46	95% BCA Bootstrap UTL with 90% Coverage	21.4
99% Percentile	26.3	95% UPL	24.82
		95% Chebyshev UPL	33.84
		Upper Threshold Limit Based upon IQR	28.74

Note: UPL (or upper percentile for gamma distributed data) represents a preferred estimate of BTV

Be at SWMU 82

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects

User Selected Options	
From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: Be 82

Background Data: BG Be

Raw Statistics

	Site	Background
Number of Valid Samples	13	30
Number of Non-Detect Data	1	3
Number of Detect Data	12	27
Minimum Non-Detect	0.4	0.44
Maximum Non-Detect	0.4	1.1
Percent Non detects	7.69%	10.00%
Minimum Detected	0.3	0.21
Maximum Detected	0.82	0.66
Mean of Detected Data	0.53	0.406
Median of Detected Data	0.53	0.39
SD of Detected Data	0.128	0.126

Wilcoxon-Mann-Whitney Site vs Background Test

All observations <= 1.1 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	286
WMW Test U-Stat	195
WMW Critical Value (0.050)	304
Approximate P-Value	0.505

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site <= Background

Cu at SWMU 82

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: Cu 82

Background Data: BG Cu

Raw Statistics

	Site	Background
Number of Valid Samples	13	30
Number of Non-Detect Data	11	2
Number of Detect Data	2	28
Minimum Non-Detect	4	4.5
Maximum Non-Detect	4	10.6
Percent Non detects	84.62%	6.67%
Minimum Detected	9.5	3.2
Maximum Detected	18.6	18.3
Mean of Detected Data	14.05	5.975
Median of Detected Data	14.05	4.95
SD of Detected Data	6.435	3.41

Wilcoxon-Mann-Whitney Site vs Background Test

All observations <= 10.6 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	289
WMW Test U-Stat	198
WMW Critical Value (0.050)	304
Approximate P-Value	0.474

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site <= Background

Fe at SWMU 82

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Full Data Sets without NDs

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: Fe 82

Background Data: BG Fe

Raw Statistics

	Site	Background
Number of Valid Samples	13	30
Number of Distinct Samples	13	29
Minimum	3010	2720
Maximum	11400	10100
Mean	6041	6378
Median	5110	6255
SD	2392	1699
SE of Mean	663.4	310.2

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	254
WMW Test U-Stat	163
WMW Critical Value (0.050)	304
Approximate P-Value	0.805

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site <= Background

Pb at SWMU 82

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Full Data Sets without NDs

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: Pb 82

Background Data: BG Pb

Raw Statistics

	Site	Background
Number of Valid Samples	13	30
Number of Distinct Samples	13	21
Minimum	1.9	3.1
Maximum	72.6	10
Mean	10.95	6.223
Median	4.8	6.15
SD	18.86	1.47
SE of Mean	5.231	0.268

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	239
WMW Test U-Stat	148
WMW Critical Value (0.050)	304
Approximate P-Value	0.895

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site <= Background

Ni at SWMU 82

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Full Data Sets without NDs

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: Ni 82

Background Data: BG Ni

Raw Statistics

	Site	Background
Number of Valid Samples	13	30
Number of Distinct Samples	13	25
Minimum	2	3.8
Maximum	9.7	11.4
Mean	6.938	6.407
Median	7	6.5
SD	2.066	1.963
SE of Mean	0.573	0.358

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	331.5
WMW Test U-Stat	240.5
WMW Critical Value (0.050)	304
Approximate P-Value	0.117

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site <= Background

K at SWMU 82

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Full Data Sets without NDs

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: K 82

Background Data: BG K

Raw Statistics

	Site	Background
Number of Valid Samples	13	30
Number of Distinct Samples	12	23
Minimum	876	754
Maximum	2460	2370
Mean	1714	1365
Median	1560	1300
SD	463.6	405.7
SE of Mean	128.6	74.06

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	378.5
WMW Test U-Stat	287.5
WMW Critical Value (0.050)	304
Approximate P-Value	0.00749

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site <= Background

Zn at SWMU 82

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: Zn 82

Background Data: BG Zn

Raw Statistics

	Site	Background
Number of Valid Samples	13	30
Number of Non-Detect Data	9	0
Number of Detect Data	4	30
Minimum Non-Detect	2	N/A
Maximum Non-Detect	2	N/A
Percent Non detects	69.23%	0.00%
Minimum Detected	16.8	8.9
Maximum Detected	87.3	29
Mean of Detected Data	39.03	15.13
Median of Detected Data	26	14.25
SD of Detected Data	32.92	4.223

Wilcoxon-Mann-Whitney Site vs Background Test

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	N/A
WMW Test U-Stat	N/A
WMW Critical Value (0.050)	304
Approximate P-Value	N/A

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site <= Background

Al at SWMU 98

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Full Data Sets without NDs

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: Al 98

Background Data: BG Al

Raw Statistics

	Site	Background
Number of Valid Samples	14	30
Number of Distinct Samples	14	30
Minimum	4670	3370
Maximum	11100	12200
Mean	6839	6136
Median	6730	5130
SD	1869	2227
SE of Mean	499.6	406.6

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	371
WMW Test U-Stat	266
WMW Critical Value (0.050)	327
Approximate P-Value	0.081

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site <= Background

Ba at SWMU 98

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Full Data Sets without NDs

User Selected Options	
From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: Ba 98

Background Data: BG Ba

Raw Statistics

	Site	Background
Number of Valid Samples	13	30
Number of Missing Values	2	0
Number of Distinct Samples	12	30
Minimum	121	39.2
Maximum	1830	805
Mean	568.8	144.5
Median	386	80.85
SD	564.6	174.3
SE of Mean	156.6	31.82

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	425
WMW Test U-Stat	334
WMW Critical Value (0.050)	304
Approximate P-Value	0.0001249

Conclusion with Alpha = 0.05

Reject H0, Conclude Site > Background

Ca at SWMU 98

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Full Data Sets without NDs

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: Ca 98

Background Data: BG Ca

Raw Statistics

	Site	Background
Number of Valid Samples	13	30
Number of Missing Values	2	0
Number of Distinct Samples	12	30
Minimum	57300	968
Maximum	246000	253000
Mean	132485	47416
Median	116000	13270
SD	49491	64702
SE of Mean	13726	11813

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	428.5
WMW Test U-Stat	337.5
WMW Critical Value (0.050)	304
Approximate P-Value	8.664E-05

Conclusion with Alpha = 0.05

Reject H0, Conclude Site > Background

Cu at SWMU 98

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: Cu 98

Background Data: BG Cu

Raw Statistics

	Site	Background
Number of Valid Samples	13	30
Number of Missing Values	2	0
Number of Non-Detect Data	6	2
Number of Detect Data	7	28
Minimum Non-Detect	4.5	4.5
Maximum Non-Detect	7.5	10.6
Percent Non detects	46.15%	6.67%
Minimum Detected	2.2	3.2
Maximum Detected	12.7	18.3
Mean of Detected Data	6.429	5.975
Median of Detected Data	4.7	4.95
SD of Detected Data	4.302	3.41

Wilcoxon-Mann-Whitney Site vs Background Test

All observations <= 10.6 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	301
WMW Test U-Stat	210
WMW Critical Value (0.050)	304
Approximate P-Value	0.351

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site <= Background

Mg at SWMU 98

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Full Data Sets without NDs

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: Mg 98

Background Data: BG Mg

Raw Statistics

	Site	Background
Number of Valid Samples	14	30
Number of Distinct Samples	13	30
Minimum	2980	696
Maximum	35300	4390
Mean	10830	1915
Median	7910	1635
SD	9272	1011
SE of Mean	2478	184.6

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	516
WMW Test U-Stat	411
WMW Critical Value (0.050)	327
Approximate P-Value	0

Conclusion with Alpha = 0.05

Reject H0, Conclude Site > Background

K at SWMU 98

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Full Data Sets without NDs

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: K 98

Background Data: BG K

Raw Statistics

	Site	Background
Number of Valid Samples	13	30
Number of Missing Values	2	0
Number of Distinct Samples	13	23
Minimum	1090	754
Maximum	2700	2370
Mean	1649	1365
Median	1620	1300
SD	427.5	405.7
SE of Mean	118.6	74.06

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	369
WMW Test U-Stat	278
WMW Critical Value (0.050)	304
Approximate P-Value	0.0146

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site <= Background