

**APPENDIX B
APRIL 10, 2012 TECHNICAL MEMORANDUM
RESULTS OF VAN STONE MINE BACKGROUND
SAMPLING AND NATURAL BACKGROUND
METAL CONCENTRATIONS**

TECHNICAL MEMORANDUM

DATE: April 10, 2012

TO: Brendan Dowling, Project Manager, Ecology Eastern Division

FROM: Steven Hughes

RE: **Results of Van Stone Mine Background Sampling and Natural Background Metal Concentrations**
17800-11

CC: **Project File**

This technical memorandum presents the draft natural background metal concentrations in soil and sediment at the Van Stone Mine. The natural background concentrations were developed based on statistical analysis of data generated from laboratory analysis of samples collected from areas near the mine. Background surface water samples were collected, but because of the high number of non-detects in the analytical results, background metal concentrations were not calculated.

INTRODUCTION

The Van Stone Mine (Site) is located in the headwaters of the Onion Creek Watershed (Figure 1), 23 miles northeast of Colville, Washington. Historical mining activities at the mine have resulted in environmental impacts on the Site and nearby areas. In 2011, Ecology asked Hart Crowser to prepare a work plan for conducting a Remedial Investigation/Feasibility Study (RI/FS) of the Site. The work plan was developed to comply with cleanup requirements administered by Ecology under the Model Toxics Control Act (MTCA) [WAC 173-4300-360 through 173-340-390]. The final RI/FS work plan (dated September 11, 2011) was approved by Ecology and the investigation subsequently authorized.

Field work at the Site started with collection of background samples. The following sections discuss the basis for using natural background metals concentrations, sample collection, and data analysis used to develop draft natural background for the Site (Table 1). The information presented in this memorandum will be used in the RI/FS and included in the final RI report.



BASIS FOR NATURAL BACKGROUND

Based on our review of historical site information, the Onion Creek watershed is a mostly rural setting with limited residential development along the creek and its tributaries. The Onion Creek Elementary School is located about 1/3 mile west of the western extent of mine features (Lower Tailings Pile). In addition to the Van Stone Mine, logging appears to be the only large commercial/industrial activity present in the watershed.

As part of work plan preparation, we visited the Site in May 2011 to observe current conditions in the watershed. Observed conditions in the watershed were found to be consistent with historical information reviewed before the site visit. Based on the historical information and observed watershed conditions, we concluded that it was most likely that concentrations of hazardous substances on and in the vicinity of the Site are related to releases from the Site, rather than the result of human activities. Thus, the conditions in the watershed are consistent with using a natural background rather than an area background as defined in MTCA [173-340-200]. Where Method A or B cleanup levels are below background concentrations cleanup levels may be established at background concentrations.

Two concerns evaluated in establishing background were: 1) the presence of outcrops of the dolomite host rock that were not mined or changed by mining activity, which may contain naturally elevated metal concentrations; and 2) the lower tailings pile, which is located in a sub-watershed in Onion Creek in which the dominant soil rock types are glacial drift and igneous rock (Figure 1). These conditions presented a potential need for multiple natural backgrounds at the Site. To evaluate this need, the background samples were divided and pooled and a statistical comparison was made on the two data sets, which is discussed in a later section of this memorandum.

Sampling Locations and Sample Size

During development of the RI/FS work plan, analytical datasets were not identified that were suitable for establishing background, as defined in MTCA [WAC 173-340-200, and 709]. To address this data gap, the work plan identified 15 potential background sample locations in the Onion Creek watershed. Selection of sample locations was based on watershed geology, topography, habitat, aerial photography, rural development, and historical mining operations, including the potential extent of areas impacted by mining. The number of samples collected for each media (soil, sediment, surface water) was based on a minimum of 10 samples required under MTCA for establishing a natural background. The minimum number of samples was increased to 15 to provide sufficient sample coverage in the event that any sample results were unusable.



Soil, Sediment, and Surface Water

The background sampling locations presented in the work plan were approximate and adjusted based on field conditions encountered at the time of sampling (i.e., lack of flow in creek or tributary, or access to a sample location). During the field work, as presented in the work plan, 15 samples of each media were collected; however, one location (BG-12) was inadvertently located on the southeast tributary to Onion Creek, rather than a smaller creek tributary. Location BG-12 is potentially mining impacted and was excluded from the final background sample set. All data analysis and draft background concentrations presented in this memorandum are based on a sample size of 14.

Groundwater

Groundwater at the Site may be environmentally impacted; however, development of background for metals in groundwater was only partially addressed. This approach was based on discussions during work plan development with Ecology. Natural background metals concentrations for groundwater are difficult to establish because data on historical groundwater quality and groundwater flow in the glacial material and igneous rock fractures/faults is lacking. Collecting samples is complicated by the size and topography of the area that needs to be sampled.

As a starting point for discussions with Ecology on evaluating potential mining impacts on groundwater, six candidate domestic wells were identified and groundwater samples were collected and submitted for laboratory analysis. As with other sampling locations, the wells actually sampled were adjusted based on discussions with well owners or their lack of availability at the time of the field work.

SAMPLE COLLECTION AND TESTING

Background samples were collected during field investigation activity at the Site in October 2011. Weather conditions were less than ideal during sampling with persistent periods of precipitation, resulting in increased stream flows during field work. Conditions observed at sampling locations are summarized in Table 2.

The background samples were submitted to Test America in Tacoma, Washington, an Ecology-accredited laboratory, for chemical analysis. A quality control/quality assurance (QA/QC) review of background data received from the laboratory was performed. The data was found to be usable as reported from the laboratory. The full data set has been uploaded to Ecology's Environmental Information Management (EIM) website.



The following sections summarize the background sampling protocols from the Sampling and Analysis Plan (SAP), protocol deviations, and sample location descriptions.

Soil Sample Collection Protocols

Protocols for soil, sediment, and groundwater are presented in the SAP. The following three soil protocols are outlined for clarity.

- Each background soil sample collected was a five-point composite sample. At each sampling location a center sampling point was first located and marked with a pin flag. Then a measuring tape was used to delineate an approximately 20-foot by 20-foot square area with pin flags marking the corners of the square. At the majority of locations, the creek channel was narrow allowing sub-samples to be collected from both sides of the creek. This placed the corner sampling points at 10 or more feet from the creek channel. At some sample locations, rock outcroppings or thick undergrowth was present. When this occurred the sampling grid was established completely on the opposite side of the creek channel.
- To avoid natural variations in the shallow soil column, background samples were collected from a depth of 3 to 6 inches. For consistency, the surface layer (i.e., grass, leaves, or forest duff) was removed before collecting each soil sample.
- In cases where a sample location was near dirt roads, telephone and power line right-of-ways, and home sites, care was taken to locate the sample in an area not affected by land disturbance.

Sampling and Analysis Plan (SAP) Deviations

- During the field work, as presented in the work plan, 15 samples of each media were collected; however, one location (BG-12) was inadvertently located on the southeast tributary to Onion Creek rather than in an upgradient small tributary to the creek. The location sampled is potentially mining impacted and was not included in the final background sample set.
- All sediment samples were collected with a pre-cleaned stainless steel spoon in shallow and low energy pools. Care was taken to slowly sample through the water column in order to capture the <2mm fraction of sediment at each location. This procedure was used instead of the McNeil sampler because of the presence of large gravel and cobbles in the creek bed, and the narrow creek channels at many locations.



Background Sample Location Descriptions

Soil, sediment, and water samples were collected from background locations in the upper portion of the Onion Creek watershed (Figure 1). The 14 sampling locations are summarized as follows:

- BG-1,2,3,4: Collected east of the Lower Tailings Pile on the northeast tributary;
- BG-7: Collected south of the Open Pits and topographically uphill from the open pits;
- BG-6,8,11: Collected east of the open pits and waste rock along a tributary which drains into the southeast tributary;
- BG-10: Collected southwest of the Upper Tailings Pile along a tributary which drains into the southeast tributary;
- BG-9,13,14: Collected on Onion Creek above the confluence with the southeast tributary; and
- BG-5: Collected east of the Onion Creek watershed divide.

BG-12 was collected on the southeast tributary upstream of the confluence with Onion Creek. As mentioned earlier, this sample was not included in the background data set. A brief description of the background locations and observations are summarized in Table 2.

DEVELOPMENT OF NATURAL BACKGROUND FOR SOIL AND SEDIMENT

At the Site, rock outcrops containing economic or sub-economic grade ore deposits located outside of the area mined and not altered by mining activity can be considered part of the natural metal background. The host rock for the lead-zinc deposit at the Van Stone Mine is the dolomite unit of the Metaline limestone. As shown on Figure 1, outcrops of the Metaline Formation are limited to higher topographic areas in the southern portion of the watershed. In his master's thesis, which describes the geology of the Van Stone Mine, Neitzel (1972) concluded that the lead-zinc ore was present in the dolomite unit of the Metaline Formation prior to emplacement of the Spirit pluton. This conclusion implies that high metal concentrations associated with ore deposition would likely be limited to rocks of the Metaline Formation. The higher metal concentrations could potentially create a justification for using multiple backgrounds in different areas of the watershed.

To address this concern, the first part of determining natural background was to assess whether background concentrations should be evaluated separately by the dominant geologic formations which weather and form the soils and sediments in the watershed (Figure 1). This was done by dividing the background sample set into two populations of seven samples each. The two populations were based on whether the background samples were collected from or downgradient of the Metaline limestone and older formations (dolomitic) or background samples were collected from continental drift or downgradient of the igneous rocks of the Spirit pluton (non-dolomitic).



While the small sample sizes make the comparisons less robust than desired, they are still considered informative in evaluation of potential multiple backgrounds in soil and sediment.

The software and statistical methods recommended in EPA's ProUCL statistical software package were used both for hypothesis testing to determine if there were statistically significant differences between the two geological units and to calculate the background concentrations¹.

Comparisons between Geologic Units

Nonparametric hypothesis testing methods were used for making the background comparisons. Nonparametric methods were selected because they:

- Can be used on data sets with normal and non-normal distributions;
- Have a good performance for a wide variety of data distributions; and
- Can handle data sets with non-detected values.

Following EPA's ProUCL recommendations, the nonparametric Wilcoxon-Mann-Whitney (WMW) test was used when the dolomitic or non-dolomitic data sets contained non-detect (ND) values.² However, the WMW test was not used on data sets with multiple detection limits. The Gehan test was used when multiple detection limits were present in either of the data sets. The Gehan test was used only for comparing sediment mercury and thallium concentrations and soil thallium concentrations since these were the only cases with multiple detection limits for non-detected results.

With the exception of zinc sediment background samples, there were no statistically significant differences between samples collected from dolomitic and non-dolomitic areas in the watershed (Table 3). The apparent zinc difference was influenced by a single sample (BG-10) which had an anomalously high sediment concentration (3,800 mg/kg) and was located along the northeast-southwest trend of the Van Stone ore deposit.

ProUCL background comparison results are summarized in Table 1 and output files are provided in Attachment A.

¹ ProUCL version 4.00.005 software and supporting documentation are available online at <http://www.epa.gov/esd/tsc/software.htm>.

² Although ProUCL recommends the Quantile test be run in parallel with the Wilcoxon-Mann-Whitney test, the Quantile test is only used to detect a shift to the right in the right tails of the site and background data sets. Since the Quantile test has several statistical limitations that may apply to Van Stone Site data sets, it was not used in the background comparisons.



Natural Background Calculation

Because the data do not support calculating separate background concentrations for the different geological formations, background concentrations were calculated using the pooled data set of 14 background samples collected across the geologic units present in the watershed. The ProUCL test used was the “Background” using the “With NDs” setting and a confidence level of 0.90. For calculating background, MTCA [WAC 173-340-709(3)] states that:

“For lognormally distributed data sets, background shall be defined as the true upper 90th percentile or four times the true 50th percentile, whichever is lower” and “For normally distributed data sets, background shall be defined as the true upper 80th percentile or four times the true 50th percentile, whichever is lower.”

MTCA also allows *“Other statistical methods to be used if approved by the department”* [of Ecology].³

In cases where data fit more than a single distribution, the following hierarchical order was used to calculate the background concentration: lognormal, normal, gamma, and non-parametric.

A summary of calculated surface soil and sediment background metal concentrations for the pooled datasets are shown in Table 1. It is important to note that the calculated natural background concentrations are representative of the immediate, non-impacted surroundings of the Van Stone Mine and may not be representative of natural background concentrations of the larger surrounding region. ProUCL raw statistics and background concentration output files are provided in Appendix A.

Attachments:

Table 1 - Van Stone Mine Background Metal Concentrations

Table 2 - Descriptions of Background Sample Locations

Table 3 - Summary of Hypothesis Test Results for Comparison of Background Data

Figure 1 - Background Sampling Locations and Regional Geology

³ For example, Ecology accepted the use of the 90th percentile for gamma and nonparametric distributions for the 2011 Washington State Background Soil Concentration Study (Hart Crowser 2011b).



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Attachment A - ProUCL Raw Statistics and Background Concentration Output Files

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Table 1 - Van Stone Mine Background Metal Concentrations

Metal	Surface Soil				Sediment			
	Distribution Type	90th Percentile	Median	Selected Background Concentration	Distribution Type	90th Percentile	Median	Selected Background Concentration
		Results in mg/kg				Results in mg/kg		
Antimony	lognormal	0.857	0.345	0.857	lognormal	0.587	0.16	0.587
Arsenic	lognormal	5.04	3.65	5.04	lognormal	6.662	2.4	6.662
Beryllium	lognormal	0.719	0.47	0.719	lognormal	0.741	0.31	0.741
Cadmium	lognormal	1.596	0.49	1.596	nonparametric	0.427	0.2	0.427
Chromium	lognormal	15.84	9.95	15.84	lognormal	14.33	5.95	14.33
Copper	lognormal	12.67	6.15	12.65	lognormal	14.4	3.05	12.2
Lead	lognormal	44.87	20	44.87	nonparametric	26.77	5.7	22.8
Mercury	lognormal	0.134	0.0675	0.134	nonparametric	0.0931	0.0071	0.0284
Nickel	lognormal	13.05	8.05	13.05	lognormal	10.95	5	10.95
Selenium	lognormal	1.645	0.8	1.645	lognormal	2.029	0.515	2.029
Silver	lognormal	0.122	0.0635	0.122	nonparametric	0.171	0.022	0.088
Thallium	lognormal	0.203	0.165	0.203	lognormal	0.406	0.185	0.406
Zinc	nonparametric	315	51.5	206	nonparametric	120.4	33.5	120.4

Background Concentration = 4 x Median
n = 14 Co-located Background Sample Locations

Table 2 - Descriptions of Background Sample Locations

Sample ID	Collection Date	Channel Description (feet and cubic feet per second)	General Location	Sampling Area Observations	Observations of Current or Historical Activity
BG-1	10/6/2011	~3' wide, ~20 cfs.	Along NE tributary, above lower tailings pile.	Below confluence with small tributary, above road. Grassy, organic, lots of worms in soil sample.	Mowed area. Apparently previously used as pasture.
BG-2	10/4/2011	~2-3' wide, ~10 cfs.	NE tributary, upstream from Lower Tailings Pile.	Creek bottom has been logged previously. Heavy tree cover and undergrowth, in an ~50' wide creek basin. Some marshy areas with skunk cabbage.	Previously logged. Burned wood observed in soil sample.
BG-3	10/6/2011	~1.5' wide, ~ 2-5 cfs.	Upstream of Lower Tailings Pile, NE tributary.	Small stream between logged areas. Stumps, downed trees, newer tree growth. Creek disappears under tree roots and forest duff.	Previously logged. Appears to be within streamside management zone.
BG-4	10/6/2011	~1' wide, ~ 2-3cfs.	NE tributary, upstream from lower tailings pile.	Small stream between logged areas. Small trees, heavy undergrowth, downed logs. Creek disappears under logs, debris and forest duff. Two grouse in area.	Clearcuts nearby. Upstream from logging road.
BG-5	10/5/2011	~3' wide, ~20 cfs.	Above main mine area, on tributary that flows into different watershed.	Small creek flowing within wider flat valley (50' wide). Heavily forested with downed logs, minor undergrowth. Creek disappears below forest litter in some areas.	Between clearcuts, upstream from logging road. Old flagging tape observed near one soil subsample.
BG-6	10/4/2011	~1.5' wide, ~ 2-5 cfs.	Above main mine area, on tributary that flows into SE tributary.	Small creek flowing within wider flat valley (~ 20-30' wide). High tree cover, downed trees, little undergrowth. Aerial photos show heavily logged away from stream area.	Between clearcuts, uphill from logging road.
BG-7	10/4/2011	~1.5' wide, ~20-30 cfs.	Above main mine area, on tributary that flows into SE tributary.	Small creek with steep drainage banks above logging road. Heavy tree cover and undergrowth; Downed logs and mossy banks.	Near logging road.
BG-8	10/3/2011	~1.5' wide, 2-6" deep, ~5 cfs.	Above main mine area, on tributary that flows into SE tributary.	Small creek flowing within wider flat valley (~ 50' wide). Downed trees crossing creek, low shrubs and plants in valley, forested on upper banks. Aerial photos show heavily logged away from stream area.	~2 to 5 pieces of clear plastic from old milk carton found in creekbed
BG-9	10/7/2011	~10' wide, ~ 200 cfs.	Onion Creek, above confluence with SE tributary.	Heavily forested, appears unlogged. Downed trees, undergrowth.	Near forest road, ATV trails
BG-10	10/5/2011	~3' wide, ~1-2 cfs.	Small tributary upstream from upper tailings pile, feeds into SE tributary.	Small creek, appears to be intermittent. Small trees, tree stumps, downed trees, minor undergrowth.	~50 feet from road. Previously logged
BG-11	10/8/2011	~2' wide.	Above main mine area, on tributary which flows into SE tributary.	Small creek in open area, many small trees, medium undergrowth. Game animal trail.	Upstream from old road bed. Clearcuts to both sides of creek area.
BG-12	10/7/2011	~8-10 wide, ~150 to 200 cfs.	SE tributary, downstream from mine, above confluence with Onion Creek. Not true background sample.	Grassy area with small trees and shrubs. Near road.	~150' from Onion Creek Road.
BG-13	10/5/2011	6-8' wide, ~200 cfs.	Onion Creek, above confluence with SE tributary.	Flat creekbed, area cleared for DNR management, large trees, some downed logs. Fish in creek.	Area cleared of undergrowth for DNR management.
BG-14	10/6/2011	~8' wide, ~100 cfs	Onion Creek, above confluence with SE tributary.	Flat creekbed, undercut banks, medium dense forest undergrowth, trees and stumps.	~50 feet from road.
BG-15	10/7/2011	~3' wide, ~50 cfs	Tributary that drains into SE tributary.	Heavy undergrowth, logs, trees and stumps.	Upstream from very old logging road. Two old log (early 1900s?) cabin structures downstream on old road.

Notes:

BG - Background
SD - Sediment Sample
cfs - Cubic Feet per Second
NE - Northeast
SE - Southeast
SR-9425 - State Route 9425

Table 3 - Summary of Hypothesis Test Results for Comparison of Background Data

Metal¹	Test Method²	Sediment Result^{3,4}
Antimony	WMW	Do Not Reject H0, Conclude Site = Background
Arsenic	WMW	Do Not Reject H0, Conclude Site = Background
Beryllium	WMW	Do Not Reject H0, Conclude Site = Background
Cadmium	WMW	Do Not Reject H0, Conclude Site = Background
Chromium	WMW	Do Not Reject H0, Conclude Site = Background
Copper	WMW	Do Not Reject H0, Conclude Site = Background
Lead	WMW	Do Not Reject H0, Conclude Site = Background
Mercury	Gehan	Do Not Reject H0, Conclude Site = Background
Nickel	WMW	Do Not Reject H0, Conclude Site = Background
Selenium	WMW	Do Not Reject H0, Conclude Site = Background
Silver	WMW	Do Not Reject H0, Conclude Site = Background
Thallium	Gehan	Do Not Reject H0, Conclude Site = Background
Zinc	WMW	Reject H0, Conclude Site <> Background
Metal¹	Test Method²	Soil Result^{3,4}
Antimony	WMW	Do Not Reject H0, Conclude Site = Background
Arsenic	WMW	Do Not Reject H0, Conclude Site = Background
Beryllium	WMW	Do Not Reject H0, Conclude Site = Background
Cadmium	WMW	Do Not Reject H0, Conclude Site = Background
Chromium	WMW	Do Not Reject H0, Conclude Site = Background
Copper	WMW	Do Not Reject H0, Conclude Site = Background
Lead	WMW	Do Not Reject H0, Conclude Site = Background
Mercury	WMW	Do Not Reject H0, Conclude Site = Background
Nickel	WMW	Do Not Reject H0, Conclude Site = Background
Selenium	WMW	Do Not Reject H0, Conclude Site = Background
Silver	WMW	Do Not Reject H0, Conclude Site = Background
Thallium	Gehan	Do Not Reject H0, Conclude Site = Background
Zinc	WMW	Do Not Reject H0, Conclude Site = Background

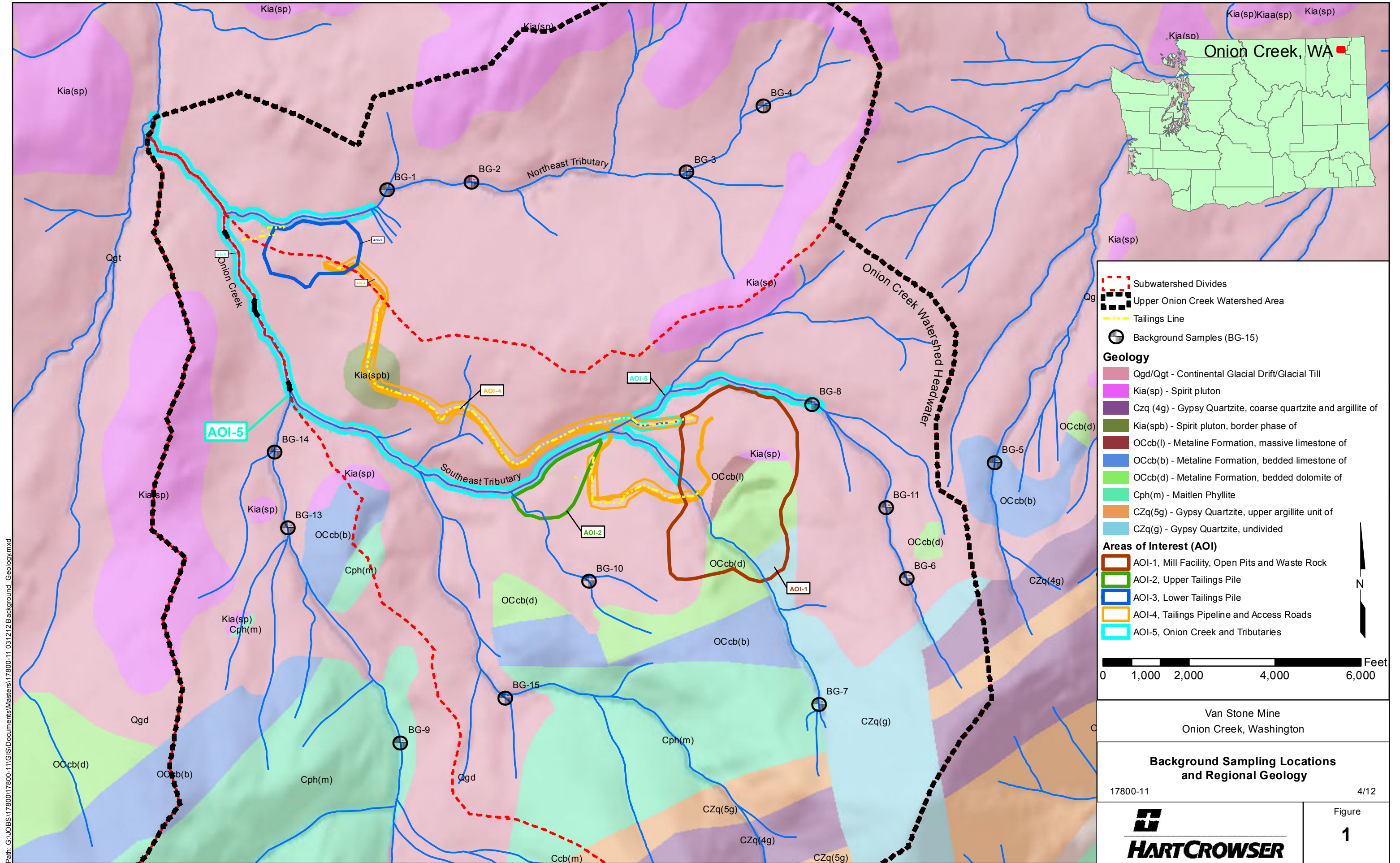
Notes:

1) Background Samples were divided into two pools based on rock type at or upgradient of the sampling locations. Background Samples BG-1,2,3,4,6,8,11 were selected as glacial outwash. Background Samples BG-5,7,9,10,13,14,15 were selected as dolomite/limestone or downgradient of dolomite/limestone outcrops.

2) WMW - Wilcoxon-Mann-Whitney

3) Confidence Coefficient = 95 percent

4) Null Hypothesis (H0): mean/median of glacial till background = mean/median of limestone/dolomite background



Subwatershed Divides
 - Dashed red line

Upper Onion Creek Watershed Area
 - Dashed black line

Tailings Line
 - Dashed yellow line

Background Samples (BG-15)
 - Circle with crosshair

Geology

- Qgd/Qgt - Continental Glacial Drift/Glacial Till
- Kia(sp) - Spirit pluton
- Czq (4g) - Gypsy Quartzite, coarse quartzite and argillite of
- Kia(sp)b - Spirit pluton, border phase of
- OCcb(l) - Metaline Formation, massive limestone of
- OCcb(b) - Metaline Formation, bedded limestone of
- OCcb(d) - Metaline Formation, bedded dolomite of
- Cph(m) - Maitlen Phyllite
- CZq(5g) - Gypsy Quartzite, upper argillite unit of
- CZq(g) - Gypsy Quartzite, undivided

Areas of Interest (AOI)

- AOI-1, Mill Facility, Open Pits and Waste Rock
- AOI-2, Upper Tailings Pile
- AOI-3, Lower Tailings Pile
- AOI-4, Tailings Pipeline and Access Roads
- AOI-5, Onion Creek and Tributaries

0 1,000 2,000 4,000 6,000 Feet

Van Stone Mine
 Onion Creek, Washington

**Background Sampling Locations
 and Regional Geology**

17800-11 4/12

HARTCROWSER

Figure
1

Path: G:\JOBS\17800\17800-11\GIS\Documents\Masters\17800-11_031212 Background_Geology.mxd

**ATTACHMENT A
PROUCL RAW STATISTICS AND BACKGROUND
CONCENTRATION OUTPUT FILES**

Attachment A - Background Metal Distributions

	A	B	C	D	E	F	G	H	I	J	K	L				
1				General Background Statistics for Sediment Data Sets with Non-Detects												
2	User Selected Options															
3	From File			L:\Project Notebook\17800-11 Van Stone Mine\2011-10 Field Event 1\Background Analysis\ProUCL_ajg\Results												
4	Full Precision			OFF												
5	Confidence Coefficient			95%												
6	Coverage			90%												
7	Different or Future K Values			1												
8	Number of Bootstrap Operations			2000												
9																
10																
11	Antimony															
12																
13	General Statistics															
14	Number of Valid Data				14				Number of Detected Data				13			
15	Number of Distinct Detected Data				13				Number of Non-Detect Data				1			
16	Tolerance Factor				2.109				Percent Non-Detects				7.14%			
17																
18	Raw Statistics						Log-transformed Statistics									
19	Minimum Detected			0.051			Minimum Detected			-2.976						
20	Maximum Detected			0.85			Maximum Detected			-0.163						
21	Mean of Detected			0.271			Mean of Detected			-1.666						
22	SD of Detected			0.239			SD of Detected			0.904						
23	Minimum Non-Detect			0.056			Minimum Non-Detect			-2.882						
24	Maximum Non-Detect			0.056			Maximum Non-Detect			-2.882						
25																
26																
27	Background Statistics															
28	Normal Distribution Test with Detected Values Only						Lognormal Distribution Test with Detected Values Only									
29	Shapiro Wilk Test Statistic			0.847			Shapiro Wilk Test Statistic			0.95						
30	5% Shapiro Wilk Critical Value			0.866			5% Shapiro Wilk Critical Value			0.866						
31	Data not Normal at 5% Significance Level						Data appear Lognormal at 5% Significance Level									
32																
33	Assuming Normal Distribution						Assuming Lognormal Distribution									
34	DL/2 Substitution Method						DL/2 Substitution Method									
35	Mean			0.254			Mean (Log Scale)			-1.802						
36	SD			0.238			SD (Log Scale)			1.007						
37	95% UTL 90% Coverage			0.757			95% UTL 90% Coverage			1.379						
38	95% UPL (t)			0.691			95% UPL (t)			1.045						
39	90% Percentile (z)			0.559			90% Percentile (z)			0.599						
40	95% Percentile (z)			0.646			95% Percentile (z)			0.864						
41	99% Percentile (z)			0.809			99% Percentile (z)			1.717						
42																
43	Maximum Likelihood Estimate(MLE) Method						Log ROS Method									
44	Mean			0.234			Mean in Original Scale			0.254						
45	SD			0.256			SD in Original Scale			0.238						
46	95% UTL with 90% Coverage			0.774			95% UTL with 90% Coverage			1.317						

Attachment A - Background Metal Distributions

	A	B	C	D	E	F	G	H	I	J	K	L	
47										95% BCA UTL with 90% Coverage		0.754	
48										95% Bootstrap (%) UTL with 90% Coverage		0.85	
49					95% UPL (t)	0.704				95% UPL (t)		1.005	
50					90% Percentile (z)	0.562				90% Percentile (z)		0.587	
51					95% Percentile (z)	0.655				95% Percentile (z)		0.837	
52					99% Percentile (z)	0.83				99% Percentile (z)		1.628	
53													
54	Gamma Distribution Test with Detected Values Only							Data Distribution Test with Detected Values Only					
55					k star (bias corrected)	1.23		Data appear Gamma Distributed at 5% Significance Level					
56					Theta Star	0.22							
57					nu star	31.97							
58													
59					A-D Test Statistic	0.339		Nonparametric Statistics					
60					5% A-D Critical Value	0.75				Kaplan-Meier (KM) Method			
61					K-S Test Statistic	0.151				Mean		0.255	
62					5% K-S Critical Value	0.241				SD		0.228	
63	Data appear Gamma Distributed at 5% Significance Level										SE of Mean		0.0635
64										95% KM UTL with 90% Coverage		0.737	
65	Assuming Gamma Distribution										95% KM Chebyshev UPL		1.285
66					Gamma ROS Statistics with Extrapolated Data					95% KM UPL (t)		0.674	
67					Mean	0.252				90% Percentile (z)		0.548	
68					Median	0.16				95% Percentile (z)		0.631	
69					SD	0.241				99% Percentile (z)		0.786	
70					k star	0.474							
71					Theta star	0.531		Gamma ROS Limits with Extrapolated Data					
72					Nu star	13.29				95% Wilson Hilferty (WH) Approx. Gamma UPL		0.96	
73					95% Percentile of Chisquare (2k)	3.714				95% Hawkins Wixley (HW) Approx. Gamma UPL		1.189	
74										95% WH Approx. Gamma UTL with 90% Coverage		1.161	
75					90% Percentile	0.688				95% HW Approx. Gamma UTL with 90% Coverage		1.5	
76					95% Percentile	0.985							
77					99% Percentile	1.719							
78													
79	Note: DL/2 is not a recommended method.												
80													
81													
82	Arsenic												
83													
84	General Statistics												
85					Total Number of Observations	14				Number of Distinct Observations		14	
86					Tolerance Factor	2.109							
87													
88	Raw Statistics							Log-Transformed Statistics					
89					Minimum	0.4				Minimum		-0.916	
90					Maximum	10				Maximum		2.303	
91					Second Largest	5.3				Second Largest		1.668	
92					First Quartile	1.113				First Quartile		0.079	

Attachment A - Background Metal Distributions

	A	B	C	D	E	F	G	H	I	J	K	L
93					Median	2.4					Median	0.872
94					Third Quartile	3.675					Third Quartile	1.301
95					Mean	2.886					Mean	0.697
96					Geometric Mean	2.007					SD	0.936
97					SD	2.539						
98					Coefficient of Variation	0.88						
99					Skewness	1.789						
100												
101	Background Statistics											
102	Normal Distribution Test						Lognormal Distribution Test					
103					Shapiro Wilk Test Statistic	0.835					Shapiro Wilk Test Statistic	0.962
104					Shapiro Wilk Critical Value	0.874					Shapiro Wilk Critical Value	0.874
105	Data not Normal at 5% Significance Level						Data appear Lognormal at 5% Significance Level					
106												
107	Assuming Normal Distribution						Assuming Lognormal Distribution					
108					95% UTL with 90% Coverage	8.241					95% UTL with 90% Coverage	14.46
109					95% UPL (t)	7.541					95% UPL (t)	11.17
110					90% Percentile (z)	6.14					90% Percentile (z)	6.662
111					95% Percentile (z)	7.063					95% Percentile (z)	9.361
112					99% Percentile (z)	8.793					99% Percentile (z)	17.72
113												
114	Gamma Distribution Test						Data Distribution Test					
115					k star	1.244	Data appear Gamma Distributed at 5% Significance Level					
116					Theta Star	2.32						
117					MLE of Mean	2.886						
118					MLE of Standard Deviation	2.588						
119					nu star	34.82						
120												
121					A-D Test Statistic	0.201	Nonparametric Statistics					
122					5% A-D Critical Value	0.75					90% Percentile	5
123					K-S Test Statistic	0.112					95% Percentile	6.945
124					5% K-S Critical Value	0.233					99% Percentile	9.389
125	Data appear Gamma Distributed at 5% Significance Level											
126												
127	Assuming Gamma Distribution						95% UTL with 90% Coverage					
128					90% Percentile	6.296	95% Percentile Bootstrap UTL with 90% Coverage				10	
129					95% Percentile	8.011	95% BCA Bootstrap UTL with 90% Coverage				10	
130					99% Percentile	11.93	95% UPL				10	
131							95% Chebyshev UPL				14.34	
132					95% WH Approx. Gamma UPL	8.563	Upper Threshold Limit Based upon IQR				7.519	
133					95% HW Approx. Gamma UPL	8.953						
134					95% WH Approx. Gamma UTL with 90% Coverage	10.01						
135					95% HW Approx. Gamma UTL with 90% Coverage	10.65						
136												
137												
138												

Attachment A - Background Metal Distributions

	A	B	C	D	E	F	G	H	I	J	K	L			
139	Beryllium														
140															
141	General Statistics														
142	Number of Valid Data					14	Number of Detected Data					13			
143	Number of Distinct Detected Data					13	Number of Non-Detect Data					1			
144	Tolerance Factor					2.109	Percent Non-Detects					7.14%			
145															
146	Raw Statistics						Log-transformed Statistics								
147	Minimum Detected					0.16	Minimum Detected					-1.833			
148	Maximum Detected					1.6	Maximum Detected					0.47			
149	Mean of Detected					0.435	Mean of Detected					-1.046			
150	SD of Detected					0.379	SD of Detected					0.62			
151	Minimum Non-Detect					0.34	Minimum Non-Detect					-1.079			
152	Maximum Non-Detect					0.34	Maximum Non-Detect					-1.079			
153															
154															
155	Background Statistics														
156	Normal Distribution Test with Detected Values Only						Lognormal Distribution Test with Detected Values Only								
157	Shapiro Wilk Test Statistic					0.652	Shapiro Wilk Test Statistic					0.901			
158	5% Shapiro Wilk Critical Value					0.866	5% Shapiro Wilk Critical Value					0.866			
159	Data not Normal at 5% Significance Level						Data appear Lognormal at 5% Significance Level								
160															
161	Assuming Normal Distribution						Assuming Lognormal Distribution								
162	DL/2 Substitution Method						DL/2 Substitution Method								
163	Mean					0.416	Mean (Log Scale)					-1.098			
164	SD					0.371	SD (Log Scale)					0.626			
165	95% UTL			90% Coverage			1.198	95% UTL			90% Coverage			1.249	
166	95% UPL (t)					1.096	95% UPL (t)					1.051			
167	90% Percentile (z)					0.891	90% Percentile (z)					0.744			
168	95% Percentile (z)					1.026	95% Percentile (z)					0.934			
169	99% Percentile (z)					1.279	99% Percentile (z)					1.431			
170															
171	Maximum Likelihood Estimate(MLE) Method						Log ROS Method								
172	Mean					0.183	Mean in Original Scale					0.421			
173	SD					0.586	SD in Original Scale					0.368			
174	95% UTL with			90% Coverage			1.419	95% UTL with			90% Coverage			1.222	
175	95% BCA UTL with						95% BCA UTL with						90% Coverage		1.312
176	95% Bootstrap (%) UTL with						95% Bootstrap (%) UTL with						90% Coverage		1.6
177	95% UPL (t)					1.257	95% UPL (t)					1.034			
178	90% Percentile (z)					0.934	90% Percentile (z)					0.741			
179	95% Percentile (z)					1.147	95% Percentile (z)					0.923			
180	99% Percentile (z)					1.546	99% Percentile (z)					1.394			
181															
182	Gamma Distribution Test with Detected Values Only						Data Distribution Test with Detected Values Only								
183	k star (bias corrected)					1.96	Data follow Appr. Gamma Distribution at 5% Significance Level								
184	Theta Star					0.222									

Attachment A - Background Metal Distributions

	A	B	C	D	E	F	G	H	I	J	K	L
185					nu star	50.96						
186												
187					A-D Test Statistic	0.795	Nonparametric Statistics					
188					5% A-D Critical Value	0.741	Kaplan-Meier (KM) Method					
189					K-S Test Statistic	0.204					Mean	0.42
190					5% K-S Critical Value	0.239					SD	0.355
191	Data follow Appx. Gamma Distribution at 5% Significance Level										SE of Mean	0.0987
192										95% KM UTL with 90% Coverage		1.169
193	Assuming Gamma Distribution										95% KM Chebyshev UPL	2.021
194	Gamma ROS Statistics with Extrapolated Data										95% KM UPL (t)	1.071
195					Mean	0.422					90% Percentile (z)	0.875
196					Median	0.267					95% Percentile (z)	1.004
197					SD	0.367					99% Percentile (z)	1.246
198					k star	2.06						
199					Theta star	0.205	Gamma ROS Limits with Extrapolated Data					
200					Nu star	57.69					95% Wilson Hilferty (WH) Approx. Gamma UPL	1.03
201					95% Percentile of Chisquare (2k)	9.683					95% Hawkins Wixley (HW) Approx. Gamma UPL	1.027
202											95% WH Approx. Gamma UTL with 90% Coverage	1.172
203					90% Percentile	0.816					95% HW Approx. Gamma UTL with 90% Coverage	1.178
204					95% Percentile	0.993						
205					99% Percentile	1.384						
206												
207	Note: DL/2 is not a recommended method.											
208												
209												
210	Cadmium											
211												
212	General Statistics											
213					Total Number of Observations	14					Number of Distinct Observations	14
214					Tolerance Factor	2.109						
215												
216	Raw Statistics						Log-Transformed Statistics					
217					Minimum	0.066					Minimum	-2.718
218					Maximum	51					Maximum	3.932
219					Second Largest	0.43					Second Largest	-0.844
220					First Quartile	0.125					First Quartile	-2.082
221					Median	0.2					Median	-1.611
222					Third Quartile	0.378					Third Quartile	-0.976
223					Mean	3.855					Mean	-1.26
224					Geometric Mean	0.284					SD	1.619
225					SD	13.57						
226					Coefficient of Variation	3.52						
227					Skewness	3.741						
228												
229	Background Statistics											
230	Normal Distribution Test						Lognormal Distribution Test					

Attachment A - Background Metal Distributions

	A	B	C	D	E	F	G	H	I	J	K	L
231	Shapiro Wilk Test Statistic					0.305	Shapiro Wilk Test Statistic					0.671
232	Shapiro Wilk Critical Value					0.874	Shapiro Wilk Critical Value					0.874
233	Data not Normal at 5% Significance Level						Data not Lognormal at 5% Significance Level					
234												
235	Assuming Normal Distribution						Assuming Lognormal Distribution					
236	95% UTL with 90% Coverage					32.47	95% UTL with 90% Coverage					8.633
237	95% UPL (t)					28.73	95% UPL (t)					5.522
238	90% Percentile (z)					21.25	90% Percentile (z)					2.26
239	95% Percentile (z)					26.18	95% Percentile (z)					4.071
240	99% Percentile (z)					35.42	99% Percentile (z)					12.28
241												
242	Gamma Distribution Test						Data Distribution Test					
243	k star					0.259	Data do not follow a Discernable Distribution (0.05)					
244	Theta Star					14.88						
245	MLE of Mean					3.855						
246	MLE of Standard Deviation					7.574						
247	nu star					7.252						
248												
249	A-D Test Statistic					3.565	Nonparametric Statistics					
250	5% A-D Critical Value					0.845	90% Percentile					0.427
251	K-S Test Statistic					0.5	95% Percentile					18.13
252	5% K-S Critical Value					0.249	99% Percentile					44.43
253	Data not Gamma Distributed at 5% Significance Level											
254												
255	Assuming Gamma Distribution						95% UTL with 90% Coverage					51
256	90% Percentile					11.54	95% Percentile Bootstrap UTL with 90% Coverage					51
257	95% Percentile					18.46	95% BCA Bootstrap UTL with 90% Coverage					35.83
258	99% Percentile					36.8	95% UPL					51
259							95% Chebyshev UPL					65.08
260	95% WH Approx. Gamma UPL					13.06	Upper Threshold Limit Based upon IQR					0.756
261	95% HW Approx. Gamma UPL					10.76						
262	95% WH Approx. Gamma UTL with 90% Coverage					17.32						
263	95% HW Approx. Gamma UTL with 90% Coverage					14.81						
264												
265												
266												
267	Chromium											
268												
269	General Statistics											
270	Total Number of Observations					14	Number of Distinct Observations					14
271	Tolerance Factor					2.109						
272												
273	Raw Statistics						Log-Transformed Statistics					
274	Minimum					1.8	Minimum					0.588
275	Maximum					33	Maximum					3.497
276	Second Largest					12	Second Largest					2.485

Attachment A - Background Metal Distributions

	A	B	C	D	E	F	G	H	I	J	K	L	
277				First Quartile	4.7						First Quartile	1.547	
278				Median	5.95						Median	1.783	
279				Third Quartile	6.95						Third Quartile	1.938	
280				Mean	7.8						Mean	1.802	
281				Geometric Mean	6.061						SD	0.671	
282				SD	7.668								
283				Coefficient of Variation	0.983								
284				Skewness	3.106								
285													
286	Background Statistics												
287	Normal Distribution Test						Lognormal Distribution Test						
288				Shapiro Wilk Test Statistic	0.594						Shapiro Wilk Test Statistic	0.918	
289				Shapiro Wilk Critical Value	0.874						Shapiro Wilk Critical Value	0.874	
290	Data not Normal at 5% Significance Level						Data appear Lognormal at 5% Significance Level						
291													
292	Assuming Normal Distribution						Assuming Lognormal Distribution						
293				95% UTL with 90% Coverage	23.97						95% UTL with 90% Coverage	24.97	
294				95% UPL (t)	21.86						95% UPL (t)	20.75	
295				90% Percentile (z)	17.63						90% Percentile (z)	14.33	
296				95% Percentile (z)	20.41						95% Percentile (z)	18.29	
297				99% Percentile (z)	25.64						99% Percentile (z)	28.89	
298													
299	Gamma Distribution Test						Data Distribution Test						
300				k star	1.725						Data appear Lognormal at 5% Significance Level		
301				Theta Star	4.523								
302				MLE of Mean	7.8								
303				MLE of Standard Deviation	5.939								
304				nu star	48.29								
305													
306				A-D Test Statistic	0.96						Nonparametric Statistics		
307				5% A-D Critical Value	0.745						90% Percentile	11.07	
308				K-S Test Statistic	0.247						95% Percentile	19.35	
309				5% K-S Critical Value	0.231						99% Percentile	30.27	
310	Data not Gamma Distributed at 5% Significance Level												
311													
312	Assuming Gamma Distribution						95% UTL with 90% Coverage						33
313				90% Percentile	15.71						95% Percentile Bootstrap UTL with 90% Coverage	33	
314				95% Percentile	19.4						95% BCA Bootstrap UTL with 90% Coverage	33	
315				99% Percentile	27.66						95% UPL	33	
316											95% Chebyshev UPL	42.39	
317				95% WH Approx. Gamma UPL	20.14						Upper Threshold Limit Based upon IQR	10.33	
318				95% HW Approx. Gamma UPL	20.14								
319				95% WH Approx. Gamma UTL with 90% Coverage	23.13								
320				95% HW Approx. Gamma UTL with 90% Coverage	23.33								
321													
322													

Attachment A - Background Metal Distributions

	A	B	C	D	E	F	G	H	I	J	K	L		
323														
324	Copper													
325														
326	General Statistics													
327	Number of Valid Data						14	Number of Detected Data						13
328	Number of Distinct Detected Data						13	Number of Non-Detect Data						1
329	Tolerance Factor						2.109	Percent Non-Detects						7.14%
330														
331	Raw Statistics						Log-transformed Statistics							
332	Minimum Detected						1.1	Minimum Detected						0.0953
333	Maximum Detected						21	Maximum Detected						3.045
334	Mean of Detected						6.385	Mean of Detected						1.421
335	SD of Detected						6.608	SD of Detected						0.947
336	Minimum Non-Detect						0.9	Minimum Non-Detect						-0.105
337	Maximum Non-Detect						0.9	Maximum Non-Detect						-0.105
338														
339														
340	Background Statistics													
341	Normal Distribution Test with Detected Values Only						Lognormal Distribution Test with Detected Values Only							
342	Shapiro Wilk Test Statistic						0.758	Shapiro Wilk Test Statistic						0.942
343	5% Shapiro Wilk Critical Value						0.866	5% Shapiro Wilk Critical Value						0.866
344	Data not Normal at 5% Significance Level						Data appear Lognormal at 5% Significance Level							
345														
346	Assuming Normal Distribution						Assuming Lognormal Distribution							
347	DL/2 Substitution Method							DL/2 Substitution Method						
348	Mean						5.961	Mean (Log Scale)						1.263
349	SD						6.544	SD (Log Scale)						1.086
350	95% UTL 90% Coverage						19.76	95% UTL 90% Coverage						34.92
351	95% UPL (t)						17.96	95% UPL (t)						25.88
352	90% Percentile (z)						14.35	90% Percentile (z)						14.22
353	95% Percentile (z)						16.72	95% Percentile (z)						21.09
354	99% Percentile (z)						21.18	99% Percentile (z)						44.21
355														
356	Maximum Likelihood Estimate(MLE) Method							Log ROS Method						
357	Mean						5.716	Mean in Original Scale						5.957
358	SD						6.631	SD in Original Scale						6.547
359	95% UTL with 90% Coverage						19.7	95% UTL with 90% Coverage						35.85
360								95% BCA UTL with 90% Coverage						20.4
361								95% Bootstrap (%) UTL with 90% Coverage						21
362	95% UPL (t)						17.87	95% UPL (t)						26.45
363	90% Percentile (z)						14.21	90% Percentile (z)						14.4
364	95% Percentile (z)						16.62	95% Percentile (z)						21.49
365	99% Percentile (z)						21.14	99% Percentile (z)						45.55
366														
367	Gamma Distribution Test with Detected Values Only						Data Distribution Test with Detected Values Only							
368	k star (bias corrected)						1.049	Data appear Gamma Distributed at 5% Significance Level						

Attachment A - Background Metal Distributions

	A	B	C	D	E	F	G	H	I	J	K	L
369					Theta Star	6.086						
370					nu star	27.28						
371												
372					A-D Test Statistic	0.574	Nonparametric Statistics					
373					5% A-D Critical Value	0.753	Kaplan-Meier (KM) Method					
374					K-S Test Statistic	0.203					Mean	6.007
375					5% K-S Critical Value	0.242					SD	6.267
376	Data appear Gamma Distributed at 5% Significance Level										SE of Mean	1.743
377										95% KM UTL with 90% Coverage		19.22
378	Assuming Gamma Distribution										95% KM Chebyshev UPL	34.28
379	Gamma ROS Statistics with Extrapolated Data										95% KM UPL (t)	17.5
380					Mean	5.929				90% Percentile (z)		14.04
381					Median	3.05				95% Percentile (z)		16.32
382					SD	6.574				99% Percentile (z)		20.59
383					k star	0.399						
384					Theta star	14.87	Gamma ROS Limits with Extrapolated Data					
385					Nu star	11.16				95% Wilson Hilferty (WH) Approx. Gamma UPL		23.19
386					95% Percentile of Chisquare (2k)	3.317				95% Hawkins Wixley (HW) Approx. Gamma UPL		28.58
387										95% WH Approx. Gamma UTL with 90% Coverage		28.24
388					90% Percentile	16.76				95% HW Approx. Gamma UTL with 90% Coverage		36.33
389					95% Percentile	24.66						
390					99% Percentile	44.55						
391												
392	Note: DL/2 is not a recommended method.											
393												
394												
395	Lead											
396												
397	General Statistics											
398					Total Number of Observations	14				Number of Distinct Observations		14
399					Tolerance Factor	2.109						
400												
401	Raw Statistics						Log-Transformed Statistics					
402					Minimum	2.2				Minimum		0.788
403					Maximum	170				Maximum		5.136
404					Second Largest	34				Second Largest		3.526
405					First Quartile	3.925				First Quartile		1.358
406					Median	5.7				Median		1.74
407					Third Quartile	8.9				Third Quartile		2.181
408					Mean	19.23				Mean		1.978
409					Geometric Mean	7.226				SD		1.141
410					SD	44.12						
411					Coefficient of Variation	2.294						
412					Skewness	3.549						
413												
414	Background Statistics											

Attachment A - Background Metal Distributions

	A	B	C	D	E	F	G	H	I	J	K	L
415	Normal Distribution Test						Lognormal Distribution Test					
416	Shapiro Wilk Test Statistic					0.409	Shapiro Wilk Test Statistic					0.809
417	Shapiro Wilk Critical Value					0.874	Shapiro Wilk Critical Value					0.874
418	Data not Normal at 5% Significance Level						Data not Lognormal at 5% Significance Level					
419												
420	Assuming Normal Distribution						Assuming Lognormal Distribution					
421	95% UTL with 90% Coverage					112.3	95% UTL with 90% Coverage					80.24
422	95% UPL (t)					100.1	95% UPL (t)					58.56
423	90% Percentile (z)					75.77	90% Percentile (z)					31.2
424	95% Percentile (z)					91.8	95% Percentile (z)					47.24
425	99% Percentile (z)					121.9	99% Percentile (z)					102.8
426												
427	Gamma Distribution Test						Data Distribution Test					
428	k star					0.54	Data do not follow a Discernable Distribution (0.05)					
429	Theta Star					35.58						
430	MLE of Mean					19.23						
431	MLE of Standard Deviation					26.16						
432	nu star					15.13						
433												
434	A-D Test Statistic					2.122	Nonparametric Statistics					
435	5% A-D Critical Value					0.782	90% Percentile					26.77
436	K-S Test Statistic					0.37	95% Percentile					81.6
437	5% K-S Critical Value					0.24	99% Percentile					152.3
438	Data not Gamma Distributed at 5% Significance Level											
439												
440	Assuming Gamma Distribution						95% UTL with 90% Coverage					170
441	90% Percentile					51.17	95% Percentile Bootstrap UTL with 90% Coverage					170
442	95% Percentile					71.84	95% BCA Bootstrap UTL with 90% Coverage					170
443	99% Percentile					122.3	95% UPL					170
444							95% Chebyshev UPL					218.3
445	95% WH Approx. Gamma UPL					69.75	Upper Threshold Limit Based upon IQR					16.36
446	95% HW Approx. Gamma UPL					66.25						
447	95% WH Approx. Gamma UTL with 90% Coverage					86.35						
448	95% HW Approx. Gamma UTL with 90% Coverage					83.68						
449												
450												
451												
452	Mercury											
453												
454	General Statistics											
455	Number of Valid Data					14	Number of Detected Data					10
456	Number of Distinct Detected Data					10	Number of Non-Detect Data					4
457	Tolerance Factor					2.109	Percent Non-Detects					28.57%
458												
459	Raw Statistics						Log-transformed Statistics					
460	Minimum Detected					0.0049	Minimum Detected					-5.319

Attachment A - Background Metal Distributions

	A	B	C	D	E	F	G	H	I	J	K	L		
461				Maximum Detected		0.15				Maximum Detected		-1.897		
462				Mean of Detected		0.0455				Mean of Detected		-3.915		
463				SD of Detected		0.0529				SD of Detected		1.425		
464				Minimum Non-Detect		0.0045				Minimum Non-Detect		-5.404		
465				Maximum Non-Detect		0.0085				Maximum Non-Detect		-4.768		
466														
467	Data with Multiple Detection Limits						Single Detection Limit Scenario							
468	Note: Data have multiple DLs - Use of KM Method is recommended						Number treated as Non-Detect with Single DL						9	
469	For all methods (except KM, DL/2, and ROS Methods),						Number treated as Detected with Single DL						5	
470	Observations < Largest ND are treated as NDs						Single DL Non-Detect Percentage						64.29%	
471														
472	Background Statistics													
473	Normal Distribution Test with Detected Values Only						Lognormal Distribution Test with Detected Values Only							
474	Shapiro Wilk Test Statistic						0.784	Shapiro Wilk Test Statistic						0.808
475	5% Shapiro Wilk Critical Value						0.842	5% Shapiro Wilk Critical Value						0.842
476	Data not Normal at 5% Significance Level						Data not Lognormal at 5% Significance Level							
477														
478	Assuming Normal Distribution						Assuming Lognormal Distribution							
479	DL/2 Substitution Method							DL/2 Substitution Method						
480	Mean						0.0334	Mean (Log Scale)						-4.448
481	SD						0.0483	SD (Log Scale)						1.479
482	95% UTL 90% Coverage						0.135	95% UTL 90% Coverage						0.265
483	95% UPL (t)						0.122	95% UPL (t)						0.176
484	90% Percentile (z)						0.0953	90% Percentile (z)						0.0779
485	95% Percentile (z)						0.113	95% Percentile (z)						0.133
486	99% Percentile (z)						0.146	99% Percentile (z)						0.365
487														
488	Maximum Likelihood Estimate(MLE) Method							Log ROS Method						
489	Mean						-0.0248	Mean in Original Scale						0.0332
490	SD						0.102	SD in Original Scale						0.0484
491	95% UTL with 90% Coverage						0.189	95% UTL with 90% Coverage						0.335
492								95% BCA UTL with 90% Coverage						0.135
493								95% Bootstrap (%) UTL with 90% Coverage						0.15
494	95% UPL (t)						0.161	95% UPL (t)						0.212
495	90% Percentile (z)						0.105	90% Percentile (z)						0.0857
496	95% Percentile (z)						0.142	95% Percentile (z)						0.156
497	99% Percentile (z)						0.212	99% Percentile (z)						0.479
498														
499	Gamma Distribution Test with Detected Values Only						Data Distribution Test with Detected Values Only							
500	k star (bias corrected)						0.576	Data do not follow a Discernable Distribution (0.05)						
501	Theta Star						0.079							
502	nu star						11.53							
503														
504	A-D Test Statistic						0.955	Nonparametric Statistics						
505	5% A-D Critical Value						0.759	Kaplan-Meier (KM) Method						
506	K-S Test Statistic						0.286	Mean						0.034

Attachment A - Background Metal Distributions

	A	B	C	D	E	F	G	H	I	J	K	L		
507	5% K-S Critical Value					0.276						SD	0.0461	
508	Data not Gamma Distributed at 5% Significance Level											SE of Mean	0.013	
509							95% KM UTL with 90% Coverage					0.131		
510	Assuming Gamma Distribution						95% KM Chebyshev UPL					0.242		
511	Gamma ROS Statistics with Extrapolated Data						95% KM UPL (t)					0.119		
512	Mean						0.0325	90% Percentile (z)					0.0931	
513	Median						0.0059	95% Percentile (z)					0.11	
514	SD						0.0489	99% Percentile (z)					0.141	
515	k star						0.219							
516	Theta star						0.148	Gamma ROS Limits with Extrapolated Data						
517	Nu star						6.145	95% Wilson Hilferty (WH) Approx. Gamma UPL					0.168	
518	95% Percentile of Chisquare (2k)						2.206	95% Hawkins Wixley (HW) Approx. Gamma UPL					0.212	
519							95% WH Approx. Gamma UTL with 90% Coverage					0.218		
520	90% Percentile						0.0982	95% HW Approx. Gamma UTL with 90% Coverage					0.295	
521	95% Percentile						0.163							
522	99% Percentile						0.34							
523														
524	Note: DL/2 is not a recommended method.													
525														
526														
527	Nickel													
528														
529	General Statistics													
530	Total Number of Observations					14	Number of Distinct Observations					13		
531	Tolerance Factor					2.109								
532														
533	Raw Statistics						Log-Transformed Statistics							
534	Minimum					1.1	Minimum					0.0953		
535	Maximum					15	Maximum					2.708		
536	Second Largest					9.2	Second Largest					2.219		
537	First Quartile					3.6	First Quartile					1.28		
538	Median					5	Median					1.609		
539	Third Quartile					7.125	Third Quartile					1.959		
540	Mean					5.714	Mean					1.565		
541	Geometric Mean					4.784	SD					0.646		
542	SD					3.544								
543	Coefficient of Variation					0.62								
544	Skewness					1.42								
545														
546	Background Statistics													
547	Normal Distribution Test						Lognormal Distribution Test							
548	Shapiro Wilk Test Statistic					0.893	Shapiro Wilk Test Statistic					0.974		
549	Shapiro Wilk Critical Value					0.874	Shapiro Wilk Critical Value					0.874		
550	Data appear Normal at 5% Significance Level						Data appear Lognormal at 5% Significance Level							
551														
552	Assuming Normal Distribution						Assuming Lognormal Distribution							

Attachment A - Background Metal Distributions

	A	B	C	D	E	F	G	H	I	J	K	L
553	95% UTL with 90% Coverage					13.19	95% UTL with 90% Coverage					18.69
554	95% UPL (t)					12.21	95% UPL (t)					15.64
555	90% Percentile (z)					10.26	90% Percentile (z)					10.95
556	95% Percentile (z)					11.54	95% Percentile (z)					13.85
557	99% Percentile (z)					13.96	99% Percentile (z)					21.51
558												
559	Gamma Distribution Test						Data Distribution Test					
560	k star					2.382	Data appear Normal at 5% Significance Level					
561	Theta Star					2.399						
562	MLE of Mean					5.714						
563	MLE of Standard Deviation					3.702						
564	nu star					66.7						
565												
566	A-D Test Statistic					0.18	Nonparametric Statistics					
567	5% A-D Critical Value					0.743	90% Percentile					9.11
568	K-S Test Statistic					0.116	95% Percentile					11.23
569	5% K-S Critical Value					0.231	99% Percentile					14.25
570	Data appear Gamma Distributed at 5% Significance Level											
571												
572	Assuming Gamma Distribution						95% UTL with 90% Coverage					15
573	90% Percentile					10.67	95% Percentile Bootstrap UTL with 90% Coverage					15
574	95% Percentile					12.84	95% BCA Bootstrap UTL with 90% Coverage					15
575	99% Percentile					17.59	95% UPL					15
576							95% Chebyshev UPL					21.7
577	95% WH Approx. Gamma UPL					13.42	Upper Threshold Limit Based upon IQR					12.41
578	95% HW Approx. Gamma UPL					13.79						
579	95% WH Approx. Gamma UTL with 90% Coverage					15.16						
580	95% HW Approx. Gamma UTL with 90% Coverage					15.74						
581												
582												
583												
584	Selenium											
585												
586	General Statistics											
587	Number of Valid Data					14	Number of Detected Data					13
588	Number of Distinct Detected Data					13	Number of Non-Detect Data					1
589	Tolerance Factor					2.109	Percent Non-Detects					7.14%
590												
591	Raw Statistics						Log-transformed Statistics					
592	Minimum Detected					0.24	Minimum Detected					-1.427
593	Maximum Detected					3.6	Maximum Detected					1.281
594	Mean of Detected					0.992	Mean of Detected					-0.393
595	SD of Detected					0.992	SD of Detected					0.881
596	Minimum Non-Detect					0.25	Minimum Non-Detect					-1.386
597	Maximum Non-Detect					0.25	Maximum Non-Detect					-1.386
598												

Attachment A - Background Metal Distributions

	A	B	C	D	E	F	G	H	I	J	K	L		
599														
600	Background Statistics													
601	Normal Distribution Test with Detected Values Only						Lognormal Distribution Test with Detected Values Only							
602	Shapiro Wilk Test Statistic						0.753	Shapiro Wilk Test Statistic						0.904
603	5% Shapiro Wilk Critical Value						0.866	5% Shapiro Wilk Critical Value						0.866
604	Data not Normal at 5% Significance Level						Data appear Lognormal at 5% Significance Level							
605														
606	Assuming Normal Distribution						Assuming Lognormal Distribution							
607	DL/2 Substitution Method							DL/2 Substitution Method						
608	Mean						0.93	Mean (Log Scale)						-0.514
609	SD						0.981	SD (Log Scale)						0.959
610	95% UTL 90% Coverage						3	95% UTL 90% Coverage						4.525
611	95% UPL (t)						2.729	95% UPL (t)						3.472
612	90% Percentile (z)						2.188	90% Percentile (z)						2.046
613	95% Percentile (z)						2.545	95% Percentile (z)						2.899
614	99% Percentile (z)						3.213	99% Percentile (z)						5.574
615														
616	Maximum Likelihood Estimate(MLE) Method							Log ROS Method						
617	Mean						0.847	Mean in Original Scale						0.931
618	SD						1.05	SD in Original Scale						0.981
619	95% UTL with 90% Coverage						3.06	95% UTL with 90% Coverage						4.445
620								95% BCA UTL with 90% Coverage						3.6
621								95% Bootstrap (%) UTL with 90% Coverage						3.6
622	95% UPL (t)						2.771	95% UPL (t)						3.422
623	90% Percentile (z)						2.192	90% Percentile (z)						2.029
624	95% Percentile (z)						2.573	95% Percentile (z)						2.863
625	99% Percentile (z)						3.288	99% Percentile (z)						5.461
626														
627	Gamma Distribution Test with Detected Values Only						Data Distribution Test with Detected Values Only							
628	k star (bias corrected)						1.16	Data follow Appr. Gamma Distribution at 5% Significance Level						
629	Theta Star						0.856							
630	nu star						30.15							
631														
632	A-D Test Statistic						0.775	Nonparametric Statistics						
633	5% A-D Critical Value						0.751	Kaplan-Meier (KM) Method						
634	K-S Test Statistic						0.227	Mean						0.939
635	5% K-S Critical Value						0.241	SD						0.939
636	Data follow Appx. Gamma Distribution at 5% Significance Level						SE of Mean						0.261	
637								95% KM UTL with 90% Coverage						2.919
638	Assuming Gamma Distribution						95% KM Chebyshev UPL						5.176	
639	Gamma ROS Statistics with Extrapolated Data							95% KM UPL (t)						2.66
640	Mean						0.921	90% Percentile (z)						2.142
641	Median						0.515	95% Percentile (z)						2.483
642	SD						0.99	99% Percentile (z)						3.123
643	k star						0.441							
644	Theta star						2.092	Gamma ROS Limits with Extrapolated Data						

Attachment A - Background Metal Distributions

	A	B	C	D	E	F	G	H	I	J	K	L
645					Nu star	12.34		95% Wilson Hilferty (WH) Approx. Gamma UPL				3.531
646			95% Percentile of Chisquare (2k)			3.54		95% Hawkins Wixley (HW) Approx. Gamma UPL				4.348
647								95% WH Approx. Gamma UTL with 90% Coverage				4.284
648				90% Percentile	2.557			95% HW Approx. Gamma UTL with 90% Coverage				5.5
649				95% Percentile	3.702							
650				99% Percentile	6.553							
651												
652	Note: DL/2 is not a recommended method.											
653												
654												
655	Silver											
656												
657	General Statistics											
658	Number of Valid Data					14	Number of Detected Data					13
659	Number of Distinct Detected Data					12	Number of Non-Detect Data					1
660	Tolerance Factor					2.109	Percent Non-Detects					7.14%
661												
662	Raw Statistics						Log-transformed Statistics					
663	Minimum Detected					0.014	Minimum Detected					-4.269
664	Maximum Detected					0.28	Maximum Detected					-1.273
665	Mean of Detected					0.0685	Mean of Detected					-3.261
666	SD of Detected					0.0888	SD of Detected					1.03
667	Minimum Non-Detect					0.015	Minimum Non-Detect					-4.2
668	Maximum Non-Detect					0.015	Maximum Non-Detect					-4.2
669												
670												
671	Background Statistics											
672	Normal Distribution Test with Detected Values Only						Lognormal Distribution Test with Detected Values Only					
673	Shapiro Wilk Test Statistic					0.648	Shapiro Wilk Test Statistic					0.827
674	5% Shapiro Wilk Critical Value					0.866	5% Shapiro Wilk Critical Value					0.866
675	Data not Normal at 5% Significance Level						Data not Lognormal at 5% Significance Level					
676												
677	Assuming Normal Distribution						Assuming Lognormal Distribution					
678	DL/2 Substitution Method						DL/2 Substitution Method					
679	Mean					0.0641	Mean (Log Scale)					-3.377
680	SD					0.0868	SD (Log Scale)					1.081
681	95% UTL 90% Coverage					0.247	95% UTL 90% Coverage					0.334
682	95% UPL (t)					0.223	95% UPL (t)					0.248
683	90% Percentile (z)					0.175	90% Percentile (z)					0.136
684	95% Percentile (z)					0.207	95% Percentile (z)					0.202
685	99% Percentile (z)					0.266	99% Percentile (z)					0.422
686												
687	Maximum Likelihood Estimate(MLE) Method						Log ROS Method					
688	Mean					0.056	Mean in Original Scale					0.064
689	SD					0.0927	SD in Original Scale					0.0869
690	95% UTL with 90% Coverage					0.252	95% UTL with 90% Coverage					0.342

Attachment A - Background Metal Distributions

	A	B	C	D	E	F	G	H	I	J	K	L	
691										95% BCA UTL with 90% Coverage		0.268	
692										95% Bootstrap (%) UTL with 90% Coverage		0.28	
693					95% UPL (t)	0.226					95% UPL (t)	0.253	
694					90% Percentile (z)	0.175					90% Percentile (z)	0.138	
695					95% Percentile (z)	0.209					95% Percentile (z)	0.205	
696					99% Percentile (z)	0.272					99% Percentile (z)	0.434	
697													
698					Gamma Distribution Test with Detected Values Only						Data Distribution Test with Detected Values Only		
699					k star (bias corrected)	0.818					Data do not follow a Discernable Distribution (0.05)		
700					Theta Star	0.0837							
701					nu star	21.27							
702													
703					A-D Test Statistic	1.331				Nonparametric Statistics			
704					5% A-D Critical Value	0.758				Kaplan-Meier (KM) Method			
705					K-S Test Statistic	0.299					Mean	0.0646	
706					5% K-S Critical Value	0.243					SD	0.0834	
707					Data not Gamma Distributed at 5% Significance Level						SE of Mean	0.0232	
708										95% KM UTL with 90% Coverage		0.24	
709					Assuming Gamma Distribution						95% KM Chebyshev UPL	0.441	
710					Gamma ROS Statistics with Extrapolated Data						95% KM UPL (t)	0.217	
711					Mean	0.0636					90% Percentile (z)	0.171	
712					Median	0.022					95% Percentile (z)	0.202	
713					SD	0.0872					99% Percentile (z)	0.259	
714					k star	0.444							
715					Theta star	0.143				Gamma ROS Limits with Extrapolated Data			
716					Nu star	12.42					95% Wilson Hilferty (WH) Approx. Gamma UPL	0.255	
717					95% Percentile of Chisquare (2k)	3.555					95% Hawkins Wixley (HW) Approx. Gamma UPL	0.296	
718											95% WH Approx. Gamma UTL with 90% Coverage	0.313	
719					90% Percentile	0.176					95% HW Approx. Gamma UTL with 90% Coverage	0.379	
720					95% Percentile	0.255							
721					99% Percentile	0.45							
722													
723					Note: DL/2 is not a recommended method.								
724													
725													
726					Thallium								
727													
728					General Statistics								
729					Number of Valid Data	14					Number of Detected Data	6	
730					Number of Distinct Detected Data	6					Number of Non-Detect Data	8	
731					Tolerance Factor	2.109					Percent Non-Detects	57.14%	
732													
733					Raw Statistics						Log-transformed Statistics		
734					Minimum Detected	0.15					Minimum Detected	-1.897	
735					Maximum Detected	0.91					Maximum Detected	-0.0943	
736					Mean of Detected	0.37					Mean of Detected	-1.254	

Attachment A - Background Metal Distributions

	A	B	C	D	E	F	G	H	I	J	K	L		
737	SD of Detected					0.312	SD of Detected					0.754		
738	Minimum Non-Detect					0.13	Minimum Non-Detect					-2.04		
739	Maximum Non-Detect					0.41	Maximum Non-Detect					-0.892		
740														
741	Data with Multiple Detection Limits						Single Detection Limit Scenario							
742	Note: Data have multiple DLs - Use of KM Method is recommended						Number treated as Non-Detect with Single DL						12	
743	For all methods (except KM, DL/2, and ROS Methods),						Number treated as Detected with Single DL						2	
744	Observations < Largest ND are treated as NDs						Single DL Non-Detect Percentage						85.71%	
745														
746														
747	Warning: There are only 6 Detected Values in this data													
748	Note: It should be noted that even though bootstrap may be performed on this data set													
749	the resulting calculations may not be reliable enough to draw conclusions													
750														
751	It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.													
752														
753	Background Statistics													
754	Normal Distribution Test with Detected Values Only						Lognormal Distribution Test with Detected Values Only							
755	Shapiro Wilk Test Statistic					0.765	Shapiro Wilk Test Statistic					0.824		
756	5% Shapiro Wilk Critical Value					0.788	5% Shapiro Wilk Critical Value					0.788		
757	Data not Normal at 5% Significance Level						Data appear Lognormal at 5% Significance Level							
758														
759	Assuming Normal Distribution						Assuming Lognormal Distribution							
760	DL/2 Substitution Method						DL/2 Substitution Method							
761	Mean					0.219	Mean (Log Scale)					-1.862		
762	SD					0.239	SD (Log Scale)					0.772		
763	95% UTL 90% Coverage					0.723	95% UTL 90% Coverage					0.792		
764	95% UPL (t)					0.657	95% UPL (t)					0.64		
765	90% Percentile (z)					0.525	90% Percentile (z)					0.418		
766	95% Percentile (z)					0.612	95% Percentile (z)					0.553		
767	99% Percentile (z)					0.775	99% Percentile (z)					0.937		
768														
769	Maximum Likelihood Estimate(MLE) Method						N/A	Log ROS Method						
770								Mean in Original Scale						0.204
771								SD in Original Scale						0.245
772								Mean in Log Scale						-2.019
773								SD in Log Scale						0.873
774								95% UTL 90% Coverage						0.837
775								95% UPL (t)						0.658
776								90% Percentile (z)						0.406
777								95% Percentile (z)						0.558
778								99% Percentile (z)						1.011
779														
780	Gamma Distribution Test with Detected Values Only						Data Distribution Test with Detected Values Only							
781	k star (bias corrected)					1.151	Data follow Appr. Gamma Distribution at 5% Significance Level							
782	Theta Star					0.322								

Attachment A - Background Metal Distributions

	A	B	C	D	E	F	G	H	I	J	K	L
783					nu star	13.81						
784												
785					A-D Test Statistic	0.688	Nonparametric Statistics					
786					5% A-D Critical Value	0.704	Kaplan-Meier (KM) Method					
787					K-S Test Statistic	0.36					Mean	0.247
788					5% K-S Critical Value	0.336					SD	0.215
789	Data follow Appx. Gamma Distribution at 5% Significance Level										SE of Mean	0.063
790										95% KM UTL with 90% Coverage		0.701
791	Assuming Gamma Distribution										95% KM Chebyshev UPL	1.217
792	Gamma ROS Statistics with Extrapolated Data										95% KM UPL (t)	0.641
793					Mean	0.159					90% Percentile (z)	0.523
794					Median	0.000001					95% Percentile (z)	0.601
795					SD	0.271					99% Percentile (z)	0.747
796					k star	0.142						
797					Theta star	1.116	Gamma ROS Limits with Extrapolated Data					
798					Nu star	3.98					95% Wilson Hilferty (WH) Approx. Gamma UPL	0.876
799					95% Percentile of Chisquare (2k)	1.58					95% Hawkins Wixley (HW) Approx. Gamma UPL	1.108
800											95% WH Approx. Gamma UTL with 90% Coverage	1.179
801					90% Percentile	0.466					95% HW Approx. Gamma UTL with 90% Coverage	1.629
802					95% Percentile	0.882						
803					99% Percentile	2.1						
804												
805	Note: DL/2 is not a recommended method.											
806												
807												
808	Zinc											
809												
810	General Statistics											
811					Total Number of Observations	14					Number of Distinct Observations	12
812					Tolerance Factor	2.109						
813												
814	Raw Statistics						Log-Transformed Statistics					
815					Minimum	14					Minimum	2.639
816					Maximum	3800					Maximum	8.243
817					Second Largest	130					Second Largest	4.868
818					First Quartile	24					First Quartile	3.178
819					Median	33.5					Median	3.498
820					Third Quartile	59.25					Third Quartile	4.075
821					Mean	312.9					Mean	3.919
822					Geometric Mean	50.35					SD	1.392
823					SD	1004						
824					Coefficient of Variation	3.209						
825					Skewness	3.735						
826												
827	Background Statistics											
828	Normal Distribution Test						Lognormal Distribution Test					

Attachment A - Background Metal Distributions

	A	B	C	D	E	F	G	H	I	J	K	L
829	Shapiro Wilk Test Statistic					0.322	Shapiro Wilk Test Statistic					0.711
830	Shapiro Wilk Critical Value					0.874	Shapiro Wilk Critical Value					0.874
831	Data not Normal at 5% Significance Level						Data not Lognormal at 5% Significance Level					
832												
833	Assuming Normal Distribution						Assuming Lognormal Distribution					
834	95% UTL with 90% Coverage					2431	95% UTL with 90% Coverage					948.3
835	95% UPL (t)					2154	95% UPL (t)					645.9
836	90% Percentile (z)					1600	90% Percentile (z)					299.7
837	95% Percentile (z)					1965	95% Percentile (z)					497
838	99% Percentile (z)					2649	99% Percentile (z)					1283
839												
840	Gamma Distribution Test						Data Distribution Test					
841	k star					0.335	Data do not follow a Discernable Distribution (0.05)					
842	Theta Star					934.7						
843	MLE of Mean					312.9						
844	MLE of Standard Deviation					540.8						
845	nu star					9.374						
846												
847	A-D Test Statistic					3.122	Nonparametric Statistics					
848	5% A-D Critical Value					0.819	90% Percentile					120.4
849	K-S Test Statistic					0.386	95% Percentile					1415
850	5% K-S Critical Value					0.246	99% Percentile					3323
851	Data not Gamma Distributed at 5% Significance Level											
852												
853	Assuming Gamma Distribution						95% UTL with 90% Coverage					3800
854	90% Percentile					909.6	95% Percentile Bootstrap UTL with 90% Coverage					3800
855	95% Percentile					1381	95% BCA Bootstrap UTL with 90% Coverage					2699
856	99% Percentile					2590	95% UPL					3800
857							95% Chebyshev UPL					4844
858	95% WH Approx. Gamma UPL					1124	Upper Threshold Limit Based upon IQR					112.1
859	95% HW Approx. Gamma UPL					982.9						
860	95% WH Approx. Gamma UTL with 90% Coverage					1451						
861	95% HW Approx. Gamma UTL with 90% Coverage					1305						
862												
863												

A	B	C	D	E	F	G	H	I	J	K	L		
1	General Background Statistics for Soil Data Sets with Non-Detects												
2	User Selected Options												
3	From File	L:\Project Notebook\17800-11 Van Stone Mine\2011-10 Field Event 1\Background Analysis\ProUCL_ajg\Results											
4	Full Precision	OFF											
5	Confidence Coefficient	95%											
6	Coverage	90%											
7	Different or Future K Values	1											
8	Number of Bootstrap Operations	2000											
9													
10													
11	Antimony												
12													
13	General Statistics												
14	Total Number of Observations	14								Number of Distinct Observations	12		
15	Tolerance Factor	2.109											
16													
17	Raw Statistics					Log-Transformed Statistics							
18	Minimum	0.14					Minimum	-1.966					
19	Maximum	1					Maximum	0					
20	Second Largest	1					Second Largest	0					
21	First Quartile	0.238					First Quartile	-1.445					
22	Median	0.345					Median	-1.067					
23	Third Quartile	0.608					Third Quartile	-0.503					
24	Mean	0.457					Mean	-0.966					
25	Geometric Mean	0.381					SD	0.633					
26	SD	0.288											
27	Coefficient of Variation	0.63											
28	Skewness	0.941											
29													
30	Background Statistics												
31	Normal Distribution Test					Lognormal Distribution Test							
32	Shapiro Wilk Test Statistic	0.878					Shapiro Wilk Test Statistic	0.959					
33	Shapiro Wilk Critical Value	0.874					Shapiro Wilk Critical Value	0.874					
34	Data appear Normal at 5% Significance Level					Data appear Lognormal at 5% Significance Level							
35													
36	Assuming Normal Distribution					Assuming Lognormal Distribution							
37	95% UTL with 90% Coverage	1.065					95% UTL with 90% Coverage	1.447					
38	95% UPL (t)	0.985					95% UPL (t)	1.215					
39	90% Percentile (z)	0.826					90% Percentile (z)	0.857					
40	95% Percentile (z)	0.931					95% Percentile (z)	1.079					
41	99% Percentile (z)	1.127					99% Percentile (z)	1.66					
42													
43	Gamma Distribution Test					Data Distribution Test							
44	k star	2.32					Data appear Normal at 5% Significance Level						
45	Theta Star	0.197											
46	MLE of Mean	0.457											
47	MLE of Standard Deviation	0.3											
48	nu star	64.95											
49													
50	A-D Test Statistic	0.303									Nonparametric Statistics		
51	5% A-D Critical Value	0.743								90% Percentile	0.919		

A	B	C	D	E	F	G	H	I	J	K	L
52	K-S Test Statistic			0.144	95% Percentile			1			
53	5% K-S Critical Value			0.231	99% Percentile			1			
54	Data appear Gamma Distributed at 5% Significance Level										
55											
56	Assuming Gamma Distribution				95% UTL with 90% Coverage			1			
57	90% Percentile			0.859	95% Percentile Bootstrap UTL with 90% Coverage			1			
58	95% Percentile			1.035	95% BCA Bootstrap UTL with 90% Coverage			1			
59	99% Percentile			1.423	95% UPL			1			
60					95% Chebyshev UPL			1.757			
61	95% WH Approx. Gamma UPL			1.085	Upper Threshold Limit Based upon IQR			1.163			
62	95% HW Approx. Gamma UPL			1.109							
63	95% WH Approx. Gamma UTL with 90% Coverage			1.228							
64	95% HW Approx. Gamma UTL with 90% Coverage			1.268							
65											
66											
67											
68	Arsenic										
69											
70	General Statistics										
71	Total Number of Observations			14	Number of Distinct Observations			13			
72	Tolerance Factor			2.109							
73											
74	Raw Statistics				Log-Transformed Statistics						
75	Minimum			1.8	Minimum			0.588			
76	Maximum			5.2	Maximum			1.649			
77	Second Largest			4.6	Second Largest			1.526			
78	First Quartile			2.45	First Quartile			0.895			
79	Median			3.65	Median			1.295			
80	Third Quartile			4.3	Third Quartile			1.459			
81	Mean			3.436	Mean			1.184			
82	Geometric Mean			3.266	SD			0.339			
83	SD			1.08							
84	Coefficient of Variation			0.314							
85	Skewness			-0.0744							
86											
87	Background Statistics										
88	Normal Distribution Test				Lognormal Distribution Test						
89	Shapiro Wilk Test Statistic			0.942	Shapiro Wilk Test Statistic			0.926			
90	Shapiro Wilk Critical Value			0.874	Shapiro Wilk Critical Value			0.874			
91	Data appear Normal at 5% Significance Level				Data appear Lognormal at 5% Significance Level						
92											
93	Assuming Normal Distribution				Assuming Lognormal Distribution						
94	95% UTL with 90% Coverage			5.713	95% UTL with 90% Coverage			6.671			
95	95% UPL (t)			5.415	95% UPL (t)			6.076			
96	90% Percentile (z)			4.819	90% Percentile (z)			5.041			
97	95% Percentile (z)			5.212	95% Percentile (z)			5.701			
98	99% Percentile (z)			5.947	99% Percentile (z)			7.181			
99											
100	Gamma Distribution Test				Data Distribution Test						
101	k star			7.949	Data appear Normal at 5% Significance Level						
102	Theta Star			0.432							

A	B	C	D	E	F	G	H	I	J	K	L
103	MLE of Mean			3.436							
104	MLE of Standard Deviation			1.219							
105	nu star			222.6							
106											
107	A-D Test Statistic			0.463	Nonparametric Statistics						
108	5% A-D Critical Value			0.735				90% Percentile	4.54		
109	K-S Test Statistic			0.172				95% Percentile	4.81		
110	5% K-S Critical Value			0.229				99% Percentile	5.122		
111	Data appear Gamma Distributed at 5% Significance Level										
112											
113	Assuming Gamma Distribution					95% UTL with 90% Coverage			5.2		
114	90% Percentile			5.06	95% Percentile Bootstrap UTL with 90% Coverage			5.2			
115	95% Percentile			5.654	95% BCA Bootstrap UTL with 90% Coverage			5.2			
116	99% Percentile			6.884	95% UPL			5.2			
117					95% Chebyshev UPL			8.307			
118	95% WH Approx. Gamma UPL			5.778	Upper Threshold Limit Based upon IQR			7.075			
119	95% HW Approx. Gamma UPL			5.842							
120	95% WH Approx. Gamma UTL with 90% Coverage			6.228							
121	95% HW Approx. Gamma UTL with 90% Coverage			6.322							
122											
123											
124											
125	Beryllium										
126											
127	General Statistics										
128	Total Number of Observations			14	Number of Distinct Observations			12			
129	Tolerance Factor			2.109							
130											
131	Raw Statistics					Log-Transformed Statistics					
132	Minimum			0.27	Minimum			-1.309			
133	Maximum			0.78	Maximum			-0.248			
134	Second Largest			0.73	Second Largest			-0.315			
135	First Quartile			0.35	First Quartile			-1.054			
136	Median			0.47	Median			-0.755			
137	Third Quartile			0.57	Third Quartile			-0.563			
138	Mean			0.486	Mean			-0.776			
139	Geometric Mean			0.46	SD			0.348			
140	SD			0.166							
141	Coefficient of Variation			0.342							
142	Skewness			0.452							
143											
144	Background Statistics										
145	Normal Distribution Test					Lognormal Distribution Test					
146	Shapiro Wilk Test Statistic			0.927	Shapiro Wilk Test Statistic			0.942			
147	Shapiro Wilk Critical Value			0.874	Shapiro Wilk Critical Value			0.874			
148	Data appear Normal at 5% Significance Level					Data appear Lognormal at 5% Significance Level					
149											
150	Assuming Normal Distribution					Assuming Lognormal Distribution					
151	95% UTL with 90% Coverage			0.837	95% UTL with 90% Coverage			0.958			
152	95% UPL (t)			0.791	95% UPL (t)			0.871			
153	90% Percentile (z)			0.7	90% Percentile (z)			0.719			

A	B	C	D	E	F	G	H	I	J	K	L
154			95% Percentile (z)	0.76					95% Percentile (z)	0.815	
155			99% Percentile (z)	0.873					99% Percentile (z)	1.033	
156											
157	Gamma Distribution Test					Data Distribution Test					
158			k star	7.295		Data appear Normal at 5% Significance Level					
159			Theta Star	0.0667							
160			MLE of Mean	0.486							
161			MLE of Standard Deviation	0.18							
162			nu star	204.3							
163											
164			A-D Test Statistic	0.341		Nonparametric Statistics					
165			5% A-D Critical Value	0.735					90% Percentile	0.724	
166			K-S Test Statistic	0.14					95% Percentile	0.748	
167			5% K-S Critical Value	0.229					99% Percentile	0.774	
168	Data appear Gamma Distributed at 5% Significance Level										
169											
170	Assuming Gamma Distribution								95% UTL with 90% Coverage	0.78	
171			90% Percentile	0.727					95% Percentile Bootstrap UTL with 90% Coverage	0.78	
172			95% Percentile	0.815					95% BCA Bootstrap UTL with 90% Coverage	0.78	
173			99% Percentile	1					95% UPL	0.78	
174									95% Chebyshev UPL	1.237	
175			95% WH Approx. Gamma UPL	0.834					Upper Threshold Limit Based upon IQR	0.9	
176			95% HW Approx. Gamma UPL	0.842							
177			95% WH Approx. Gamma UTL with 90% Coverage	0.901							
178			95% HW Approx. Gamma UTL with 90% Coverage	0.913							
179											
180											
181											
182	Cadmium										
183											
184	General Statistics										
185			Total Number of Observations	14					Number of Distinct Observations	13	
186			Tolerance Factor	2.109							
187											
188	Raw Statistics					Log-Transformed Statistics					
189			Minimum	0.2					Minimum	-1.609	
190			Maximum	3.1					Maximum	1.131	
191			Second Largest	1.8					Second Largest	0.588	
192			First Quartile	0.303					First Quartile	-1.203	
193			Median	0.49					Median	-0.724	
194			Third Quartile	0.848					Third Quartile	-0.166	
195			Mean	0.798					Mean	-0.567	
196			Geometric Mean	0.567					SD	0.807	
197			SD	0.803							
198			Coefficient of Variation	1.006							
199			Skewness	2.16							
200											
201	Background Statistics										
202	Normal Distribution Test					Lognormal Distribution Test					
203			Shapiro Wilk Test Statistic	0.727					Shapiro Wilk Test Statistic	0.94	
204			Shapiro Wilk Critical Value	0.874					Shapiro Wilk Critical Value	0.874	

A	B	C	D	E	F	G	H	I	J	K	L
205	Data not Normal at 5% Significance Level					Data appear Lognormal at 5% Significance Level					
206											
207	Assuming Normal Distribution					Assuming Lognormal Distribution					
208	95% UTL with 90% Coverage			2.49		95% UTL with 90% Coverage			3.112		
209	95% UPL (t)			2.269		95% UPL (t)			2.491		
210	90% Percentile (z)			1.826		90% Percentile (z)			1.596		
211	95% Percentile (z)			2.118		95% Percentile (z)			2.14		
212	99% Percentile (z)			2.665		99% Percentile (z)			3.709		
213											
214	Gamma Distribution Test					Data Distribution Test					
215	k star			1.315		Data appear Gamma Distributed at 5% Significance Level					
216	Theta Star			0.607							
217	MLE of Mean			0.798							
218	MLE of Standard Deviation			0.696							
219	nu star			36.83							
220											
221	A-D Test Statistic			0.634		Nonparametric Statistics					
222	5% A-D Critical Value			0.75		90% Percentile			1.65		
223	K-S Test Statistic			0.204		95% Percentile			2.255		
224	5% K-S Critical Value			0.232		99% Percentile			2.931		
225	Data appear Gamma Distributed at 5% Significance Level										
226											
227	Assuming Gamma Distribution					95% UTL with 90% Coverage			3.1		
228	90% Percentile			1.717		95% Percentile Bootstrap UTL with 90% Coverage			3.1		
229	95% Percentile			2.173		95% BCA Bootstrap UTL with 90% Coverage			3.1		
230	99% Percentile			3.211		95% UPL			3.1		
231						95% Chebyshev UPL			4.419		
232	95% WH Approx. Gamma UPL			2.293		Upper Threshold Limit Based upon IQR			1.665		
233	95% HW Approx. Gamma UPL			2.323							
234	95% WH Approx. Gamma UTL with 90% Coverage			2.675							
235	95% HW Approx. Gamma UTL with 90% Coverage			2.745							
236											
237											
238											
239	Chromium										
240											
241	General Statistics										
242	Total Number of Observations			14		Number of Distinct Observations			13		
243	Tolerance Factor			2.109							
244											
245	Raw Statistics					Log-Transformed Statistics					
246	Minimum			4.7		Minimum			1.548		
247	Maximum			16		Maximum			2.773		
248	Second Largest			15		Second Largest			2.708		
249	First Quartile			7.375		First Quartile			1.997		
250	Median			9.95		Median			2.298		
251	Third Quartile			12.75		Third Quartile			2.545		
252	Mean			10.18		Mean			2.251		
253	Geometric Mean			9.498		SD			0.399		
254	SD			3.716							
255	Coefficient of Variation			0.365							

A	B	C	D	E	F	G	H	I	J	K	L	
256	Skewness				0.08							
257												
258	Background Statistics											
259	Normal Distribution Test					Lognormal Distribution Test						
260	Shapiro Wilk Test Statistic				0.952	Shapiro Wilk Test Statistic				0.939		
261	Shapiro Wilk Critical Value				0.874	Shapiro Wilk Critical Value				0.874		
262	Data appear Normal at 5% Significance Level					Data appear Lognormal at 5% Significance Level						
263												
264	Assuming Normal Distribution					Assuming Lognormal Distribution						
265	95% UTL with 90% Coverage				18.02	95% UTL with 90% Coverage				22.03		
266	95% UPL (t)				16.99	95% UPL (t)				19.73		
267	90% Percentile (z)				14.94	90% Percentile (z)				15.84		
268	95% Percentile (z)				16.29	95% Percentile (z)				18.31		
269	99% Percentile (z)				18.82	99% Percentile (z)				24.02		
270												
271	Gamma Distribution Test					Data Distribution Test						
272	k star				5.856	Data appear Normal at 5% Significance Level						
273	Theta Star				1.738							
274	MLE of Mean				10.18							
275	MLE of Standard Deviation				4.206							
276	nu star				164							
277												
278	A-D Test Statistic				0.267	Nonparametric Statistics						
279	5% A-D Critical Value				0.736	90% Percentile				15		
280	K-S Test Statistic				0.129	95% Percentile				15.35		
281	5% K-S Critical Value				0.229	99% Percentile				15.87		
282	Data appear Gamma Distributed at 5% Significance Level											
283												
284	Assuming Gamma Distribution					95% UTL with 90% Coverage				16		
285	90% Percentile				15.8	95% Percentile Bootstrap UTL with 90% Coverage				16		
286	95% Percentile				17.94	95% BCA Bootstrap UTL with 90% Coverage				15.7		
287	99% Percentile				22.41	95% UPL				16		
288						95% Chebyshev UPL				26.94		
289	95% WH Approx. Gamma UPL				18.41	Upper Threshold Limit Based upon IQR						20.81
290	95% HW Approx. Gamma UPL				18.69							
291	95% WH Approx. Gamma UTL with 90% Coverage				20.05							
292	95% HW Approx. Gamma UTL with 90% Coverage				20.46							
293												
294												
295												
296	Copper											
297												
298	General Statistics											
299	Total Number of Observations				14	Number of Distinct Observations				13		
300	Tolerance Factor				2.109							
301												
302	Raw Statistics					Log-Transformed Statistics						
303	Minimum				2.5	Minimum				0.916		
304	Maximum				20	Maximum				2.996		
305	Second Largest				14	Second Largest				2.639		
306	First Quartile				3.7	First Quartile				1.307		

A	B	C	D	E	F	G	H	I	J	K	L
307				Median	6.15					Median	1.816
308				Third Quartile	7.225					Third Quartile	1.977
309				Mean	7					Mean	1.765
310				Geometric Mean	5.843					SD	0.604
311				SD	4.853						
312				Coefficient of Variation	0.693						
313				Skewness	1.779						
314											
315	Background Statistics										
316	Normal Distribution Test					Lognormal Distribution Test					
317				Shapiro Wilk Test Statistic	0.806					Shapiro Wilk Test Statistic	0.952
318				Shapiro Wilk Critical Value	0.874					Shapiro Wilk Critical Value	0.874
319	Data not Normal at 5% Significance Level					Data appear Lognormal at 5% Significance Level					
320											
321	Assuming Normal Distribution					Assuming Lognormal Distribution					
322				95% UTL with 90% Coverage	17.24					95% UTL with 90% Coverage	20.88
323				95% UPL (t)	15.9					95% UPL (t)	17.67
324				90% Percentile (z)	13.22					90% Percentile (z)	12.67
325				95% Percentile (z)	14.98					95% Percentile (z)	15.77
326				99% Percentile (z)	18.29					99% Percentile (z)	23.8
327											
328	Gamma Distribution Test					Data Distribution Test					
329				k star	2.345	Data appear Gamma Distributed at 5% Significance Level					
330				Theta Star	2.985						
331				MLE of Mean	7						
332				MLE of Standard Deviation	4.571						
333				nu star	65.66						
334											
335				A-D Test Statistic	0.447	Nonparametric Statistics					
336				5% A-D Critical Value	0.743					90% Percentile	12.8
337				K-S Test Statistic	0.171					95% Percentile	16.1
338				5% K-S Critical Value	0.231					99% Percentile	19.22
339	Data appear Gamma Distributed at 5% Significance Level										
340											
341	Assuming Gamma Distribution					95% UTL with 90% Coverage					
342				90% Percentile	13.12	95% Percentile Bootstrap UTL with 90% Coverage					20
343				95% Percentile	15.8	95% BCA Bootstrap UTL with 90% Coverage					20
344				99% Percentile	21.7	95% UPL					20
345						95% Chebyshev UPL					28.9
346				95% WH Approx. Gamma UPL	16.49	Upper Threshold Limit Based upon IQR					12.51
347				95% HW Approx. Gamma UPL	16.69						
348				95% WH Approx. Gamma UTL with 90% Coverage	18.65						
349				95% HW Approx. Gamma UTL with 90% Coverage	19.05						
350											
351											
352											
353	Lead										
354											
355	General Statistics										
356				Total Number of Observations	14					Number of Distinct Observations	13
357				Tolerance Factor	2.109						

A	B	C	D	E	F	G	H	I	J	K	L
358											
359	Raw Statistics					Log-Transformed Statistics					
360	Minimum			9.6	Minimum			2.262			
361	Maximum			47	Maximum			3.85			
362	Second Largest			45	Second Largest			3.807			
363	First Quartile			13	First Quartile			2.565			
364	Median			20	Median			2.994			
365	Third Quartile			38.25	Third Quartile			3.644			
366	Mean			24.9	Mean			3.062			
367	Geometric Mean			21.38	SD			0.579			
368	SD			13.96							
369	Coefficient of Variation			0.561							
370	Skewness			0.497							
371											
372	Background Statistics										
373	Normal Distribution Test					Lognormal Distribution Test					
374	Shapiro Wilk Test Statistic			0.86	Shapiro Wilk Test Statistic			0.897			
375	Shapiro Wilk Critical Value			0.874	Shapiro Wilk Critical Value			0.874			
376	Data not Normal at 5% Significance Level					Data appear Lognormal at 5% Significance Level					
377											
378	Assuming Normal Distribution					Assuming Lognormal Distribution					
379	95% UTL with 90% Coverage			54.34	95% UTL with 90% Coverage			72.42			
380	95% UPL (t)			50.49	95% UPL (t)			61.74			
381	90% Percentile (z)			42.79	90% Percentile (z)			44.87			
382	95% Percentile (z)			47.86	95% Percentile (z)			55.37			
383	99% Percentile (z)			57.37	99% Percentile (z)			82.13			
384											
385	Gamma Distribution Test					Data Distribution Test					
386	k star			2.745	Data appear Gamma Distributed at 5% Significance Level						
387	Theta Star			9.07							
388	MLE of Mean			24.9							
389	MLE of Standard Deviation			15.03							
390	nu star			76.87							
391											
392	A-D Test Statistic			0.665	Nonparametric Statistics						
393	5% A-D Critical Value			0.741	90% Percentile			44.1			
394	K-S Test Statistic			0.18	95% Percentile			45.7			
395	5% K-S Critical Value			0.23	99% Percentile			46.74			
396	Data appear Gamma Distributed at 5% Significance Level										
397											
398	Assuming Gamma Distribution					95% UTL with 90% Coverage 47					
399	90% Percentile			45.04	95% Percentile Bootstrap UTL with 90% Coverage			47			
400	95% Percentile			53.62	95% BCA Bootstrap UTL with 90% Coverage			47			
401	99% Percentile			72.3	95% UPL			47			
402					95% Chebyshev UPL			87.88			
403	95% WH Approx. Gamma UPL			56	Upper Threshold Limit Based upon IQR			76.13			
404	95% HW Approx. Gamma UPL			57.14							
405	95% WH Approx. Gamma UTL with 90% Coverage			62.88							
406	95% HW Approx. Gamma UTL with 90% Coverage			64.73							
407											
408											

A	B	C	D	E	F	G	H	I	J	K	L	
409												
410	Mercury											
411												
412	General Statistics											
413	Total Number of Observations				14		Number of Distinct Observations				13	
414	Tolerance Factor				2.109							
415												
416	Raw Statistics					Log-Transformed Statistics						
417	Minimum				0.023		Minimum				-3.772	
418	Maximum				0.15		Maximum				-1.897	
419	Second Largest				0.12		Second Largest				-2.12	
420	First Quartile				0.0393		First Quartile				-3.239	
421	Median				0.0675		Median				-2.702	
422	Third Quartile				0.105		Third Quartile				-2.263	
423	Mean				0.0721		Mean				-2.787	
424	Geometric Mean				0.0616		SD				0.605	
425	SD				0.0395							
426	Coefficient of Variation				0.549							
427	Skewness				0.492							
428												
429	Background Statistics											
430	Normal Distribution Test					Lognormal Distribution Test						
431	Shapiro Wilk Test Statistic				0.941		Shapiro Wilk Test Statistic				0.95	
432	Shapiro Wilk Critical Value				0.874		Shapiro Wilk Critical Value				0.874	
433	Data appear Normal at 5% Significance Level					Data appear Lognormal at 5% Significance Level						
434												
435	Assuming Normal Distribution					Assuming Lognormal Distribution						
436	95% UTL with 90% Coverage				0.155		95% UTL with 90% Coverage				0.221	
437	95% UPL (t)				0.145		95% UPL (t)				0.187	
438	90% Percentile (z)				0.123		90% Percentile (z)				0.134	
439	95% Percentile (z)				0.137		95% Percentile (z)				0.167	
440	99% Percentile (z)				0.164		99% Percentile (z)				0.252	
441												
442	Gamma Distribution Test					Data Distribution Test						
443	k star				2.669		Data appear Normal at 5% Significance Level					
444	Theta Star				0.027							
445	MLE of Mean				0.0721							
446	MLE of Standard Deviation				0.0441							
447	nu star				74.72							
448												
449	A-D Test Statistic				0.253		Nonparametric Statistics					
450	5% A-D Critical Value				0.742		90% Percentile				0.117	
451	K-S Test Statistic				0.129		95% Percentile				0.131	
452	5% K-S Critical Value				0.23		99% Percentile				0.146	
453	Data appear Gamma Distributed at 5% Significance Level											
454												
455	Assuming Gamma Distribution					95% UTL with 90% Coverage						0.15
456	90% Percentile				0.131		95% Percentile Bootstrap UTL with 90% Coverage				0.15	
457	95% Percentile				0.156		95% BCA Bootstrap UTL with 90% Coverage				0.141	
458	99% Percentile				0.212		95% UPL				0.15	
459							95% Chebyshev UPL				0.251	

A	B	C	D	E	F	G	H	I	J	K	L	
460		95% WH Approx. Gamma UPL	0.164	Upper Threshold Limit Based upon IQR							0.202	
461		95% HW Approx. Gamma UPL	0.168									
462		95% WH Approx. Gamma UTL with 90% Coverage	0.184									
463		95% HW Approx. Gamma UTL with 90% Coverage	0.191									
464												
465												
466												
467	Nickel											
468												
469	General Statistics											
470	Total Number of Observations			14	Number of Distinct Observations			13				
471	Tolerance Factor			2.109								
472												
473	Raw Statistics					Log-Transformed Statistics						
474	Minimum			3.7	Minimum			1.308				
475	Maximum			14	Maximum			2.639				
476	Second Largest			13	Second Largest			2.565				
477	First Quartile			6.425	First Quartile			1.857				
478	Median			8.05	Median			2.086				
479	Third Quartile			9.9	Third Quartile			2.292				
480	Mean			8.2	Mean			2.027				
481	Geometric Mean			7.591	SD			0.423				
482	SD			3.165								
483	Coefficient of Variation			0.386								
484	Skewness			0.252								
485												
486	Background Statistics											
487	Normal Distribution Test					Lognormal Distribution Test						
488	Shapiro Wilk Test Statistic			0.955	Shapiro Wilk Test Statistic			0.929				
489	Shapiro Wilk Critical Value			0.874	Shapiro Wilk Critical Value			0.874				
490	Data appear Normal at 5% Significance Level					Data appear Lognormal at 5% Significance Level						
491												
492	Assuming Normal Distribution					Assuming Lognormal Distribution						
493	95% UTL with 90% Coverage			14.88	95% UTL with 90% Coverage			18.52				
494	95% UPL (t)			14	95% UPL (t)			16.48				
495	90% Percentile (z)			12.26	90% Percentile (z)			13.05				
496	95% Percentile (z)			13.41	95% Percentile (z)			15.22				
497	99% Percentile (z)			15.56	99% Percentile (z)			20.31				
498												
499	Gamma Distribution Test					Data Distribution Test						
500	k star			5.262	Data appear Normal at 5% Significance Level							
501	Theta Star			1.558								
502	MLE of Mean			8.2								
503	MLE of Standard Deviation			3.575								
504	nu star			147.3								
505												
506	A-D Test Statistic			0.323	Nonparametric Statistics							
507	5% A-D Critical Value			0.737	90% Percentile			12.4				
508	K-S Test Statistic			0.163	95% Percentile			13.35				
509	5% K-S Critical Value			0.229	99% Percentile			13.87				
510	Data appear Gamma Distributed at 5% Significance Level											

A	B	C	D	E	F	G	H	I	J	K	L
511											
512	Assuming Gamma Distribution					95% UTL with 90% Coverage					14
513	90% Percentile			12.98	95% Percentile Bootstrap UTL with 90% Coverage					14	
514	95% Percentile			14.82	95% BCA Bootstrap UTL with 90% Coverage					14	
515	99% Percentile			18.7	95% UPL					14	
516						95% Chebyshev UPL					22.48
517	95% WH Approx. Gamma UPL			15.25	Upper Threshold Limit Based upon IQR					15.11	
518	95% HW Approx. Gamma UPL			15.5							
519	95% WH Approx. Gamma UTL with 90% Coverage			16.67							
520	95% HW Approx. Gamma UTL with 90% Coverage			17.04							
521											
522											
523											
524	Selenium										
525											
526	General Statistics										
527	Total Number of Observations				14	Number of Distinct Observations				11	
528	Tolerance Factor				2.109						
529											
530	Raw Statistics					Log-Transformed Statistics					
531	Minimum			0.45	Minimum			-0.799			
532	Maximum			2.3	Maximum			0.833			
533	Second Largest			2.3	Second Largest			0.833			
534	First Quartile			0.65	First Quartile			-0.431			
535	Median			0.8	Median			-0.227			
536	Third Quartile			0.96	Third Quartile			-0.0408			
537	Mean			0.994	Mean			-0.133			
538	Geometric Mean			0.875	SD			0.493			
539	SD			0.594							
540	Coefficient of Variation			0.598							
541	Skewness			1.729							
542											
543	Background Statistics										
544	Normal Distribution Test					Lognormal Distribution Test					
545	Shapiro Wilk Test Statistic			0.74	Shapiro Wilk Test Statistic			0.894			
546	Shapiro Wilk Critical Value			0.874	Shapiro Wilk Critical Value			0.874			
547	Data not Normal at 5% Significance Level					Data appear Lognormal at 5% Significance Level					
548											
549	Assuming Normal Distribution					Assuming Lognormal Distribution					
550	95% UTL with 90% Coverage			2.246	95% UTL with 90% Coverage			2.474			
551	95% UPL (t)			2.082	95% UPL (t)			2.159			
552	90% Percentile (z)			1.755	90% Percentile (z)			1.645			
553	95% Percentile (z)			1.97	95% Percentile (z)			1.968			
554	99% Percentile (z)			2.375	99% Percentile (z)			2.753			
555											
556	Gamma Distribution Test					Data Distribution Test					
557	k star			3.267	Data appear Lognormal at 5% Significance Level						
558	Theta Star			0.304							
559	MLE of Mean			0.994							
560	MLE of Standard Deviation			0.55							
561	nu star			91.47							

A	B	C	D	E	F	G	H	I	J	K	L
562											
563			A-D Test Statistic	0.897		Nonparametric Statistics					
564			5% A-D Critical Value	0.74					90% Percentile	2	
565			K-S Test Statistic	0.247					95% Percentile	2.3	
566			5% K-S Critical Value	0.23					99% Percentile	2.3	
567	Data not Gamma Distributed at 5% Significance Level										
568											
569	Assuming Gamma Distribution								95% UTL with 90% Coverage	2.3	
570			90% Percentile	1.731				95% Percentile Bootstrap UTL with 90% Coverage	2.3		
571			95% Percentile	2.035				95% BCA Bootstrap UTL with 90% Coverage	2.3		
572			99% Percentile	2.693					95% UPL	2.3	
573									95% Chebyshev UPL	3.673	
574			95% WH Approx. Gamma UPL	2.105				Upper Threshold Limit Based upon IQR			1.425
575			95% HW Approx. Gamma UPL	2.114							
576			95% WH Approx. Gamma UTL with 90% Coverage	2.345							
577			95% HW Approx. Gamma UTL with 90% Coverage	2.37							
578											
579											
580											
581	Silver										
582											
583	General Statistics										
584			Total Number of Observations	14					Number of Distinct Observations	12	
585			Tolerance Factor	2.109							
586											
587	Raw Statistics					Log-Transformed Statistics					
588			Minimum	0.03					Minimum	-3.507	
589			Maximum	0.15					Maximum	-1.897	
590			Second Largest	0.12					Second Largest	-2.12	
591			First Quartile	0.056					First Quartile	-2.882	
592			Median	0.0635					Median	-2.757	
593			Third Quartile	0.0955					Third Quartile	-2.352	
594			Mean	0.075					Mean	-2.688	
595			Geometric Mean	0.068					SD	0.459	
596			SD	0.0351							
597			Coefficient of Variation	0.467							
598			Skewness	0.897							
599											
600	Background Statistics										
601	Normal Distribution Test					Lognormal Distribution Test					
602			Shapiro Wilk Test Statistic	0.91					Shapiro Wilk Test Statistic	0.971	
603			Shapiro Wilk Critical Value	0.874					Shapiro Wilk Critical Value	0.874	
604	Data appear Normal at 5% Significance Level					Data appear Lognormal at 5% Significance Level					
605											
606	Assuming Normal Distribution					Assuming Lognormal Distribution					
607			95% UTL with 90% Coverage	0.149					95% UTL with 90% Coverage	0.179	
608			95% UPL (t)	0.139					95% UPL (t)	0.158	
609			90% Percentile (z)	0.12					90% Percentile (z)	0.122	
610			95% Percentile (z)	0.133					95% Percentile (z)	0.145	
611			99% Percentile (z)	0.157					99% Percentile (z)	0.198	
612											

A	B	C	D	E	F	G	H	I	J	K	L	
613	Gamma Distribution Test					Data Distribution Test						
614	k star				4.199	Data appear Normal at 5% Significance Level						
615	Theta Star				0.0179							
616	MLE of Mean				0.075							
617	MLE of Standard Deviation				0.0366							
618	nu star				117.6							
619												
620	A-D Test Statistic				0.329	Nonparametric Statistics						
621	5% A-D Critical Value				0.738	90% Percentile				0.12		
622	K-S Test Statistic				0.16	95% Percentile				0.131		
623	5% K-S Critical Value				0.229	99% Percentile				0.146		
624	Data appear Gamma Distributed at 5% Significance Level											
625												
626	Assuming Gamma Distribution					95% UTL with 90% Coverage				0.15		
627	90% Percentile				0.124	95% Percentile Bootstrap UTL with 90% Coverage				0.15		
628	95% Percentile				0.144	95% BCA Bootstrap UTL with 90% Coverage				0.141		
629	99% Percentile				0.185	95% UPL				0.15		
630						95% Chebyshev UPL				0.233		
631	95% WH Approx. Gamma UPL				0.148	Upper Threshold Limit Based upon IQR						0.155
632	95% HW Approx. Gamma UPL				0.15							
633	95% WH Approx. Gamma UTL with 90% Coverage				0.163							
634	95% HW Approx. Gamma UTL with 90% Coverage				0.166							
635												
636												
637												
638	Thallium											
639												
640	General Statistics											
641	Number of Valid Data				14	Number of Detected Data				9		
642	Number of Distinct Detected Data				5	Number of Non-Detect Data				5		
643	Tolerance Factor				2.109	Percent Non-Detects				35.71%		
644												
645	Raw Statistics					Log-transformed Statistics						
646	Minimum Detected				0.15	Minimum Detected				-1.897		
647	Maximum Detected				0.23	Maximum Detected				-1.47		
648	Mean of Detected				0.177	Mean of Detected				-1.744		
649	SD of Detected				0.0274	SD of Detected				0.148		
650	Minimum Non-Detect				0.14	Minimum Non-Detect				-1.966		
651	Maximum Non-Detect				0.26	Maximum Non-Detect				-1.347		
652												
653	Data with Multiple Detection Limits					Single Detection Limit Scenario						
654	Note: Data have multiple DLs - Use of KM Method is recommended					Number treated as Non-Detect with Single DL				14		
655	For all methods (except KM, DL/2, and ROS Methods),					Number treated as Detected with Single DL				0		
656	Observations < Largest ND are treated as NDs					Single DL Non-Detect Percentage				100.00%		
657												
658												
659	Warning: There are only 9 Detected Values in this data											
660	Note: It should be noted that even though bootstrap may be performed on this data set											
661	the resulting calculations may not be reliable enough to draw conclusions											
662												
663	It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.											

A	B	C	D	E	F	G	H	I	J	K	L	
664												
665	Background Statistics											
666	Normal Distribution Test with Detected Values Only					Lognormal Distribution Test with Detected Values Only						
667	Shapiro Wilk Test Statistic				0.868	Shapiro Wilk Test Statistic				0.888		
668	5% Shapiro Wilk Critical Value				0.829	5% Shapiro Wilk Critical Value				0.829		
669	Data appear Normal at 5% Significance Level					Data appear Lognormal at 5% Significance Level						
670												
671	Assuming Normal Distribution					Assuming Lognormal Distribution						
672	DL/2 Substitution Method					DL/2 Substitution Method						
673	Mean				0.146	Mean (Log Scale)				-1.989		
674	SD				0.0501	SD (Log Scale)				0.395		
675	95% UTL		90% Coverage		0.252	95% UTL		90% Coverage		0.315		
676	95% UPL (t)				0.238	95% UPL (t)				0.282		
677	90% Percentile (z)				0.21	90% Percentile (z)				0.227		
678	95% Percentile (z)				0.228	95% Percentile (z)				0.262		
679	99% Percentile (z)				0.263	99% Percentile (z)				0.343		
680												
681	Maximum Likelihood Estimate(MLE) Method					N/A	Log ROS Method					
682							Mean in Original Scale				0.163	
683							SD in Original Scale				0.0303	
684							Mean in Log Scale				-1.828	
685							SD in Log Scale				0.181	
686							95% UTL		90% Coverage		0.235	
687							95% UPL (t)				0.224	
688							90% Percentile (z)				0.203	
689							95% Percentile (z)				0.216	
690							99% Percentile (z)				0.245	
691												
692	Gamma Distribution Test with Detected Values Only					Data Distribution Test with Detected Values Only						
693	k star (bias corrected)				33.35	Data appear Normal at 5% Significance Level						
694	Theta Star				0.0053							
695	nu star				600.3							
696												
697	A-D Test Statistic				0.537	Nonparametric Statistics						
698	5% A-D Critical Value				0.721	Kaplan-Meier (KM) Method						
699	K-S Test Statistic				0.255	Mean				0.17		
700	5% K-S Critical Value				0.279	SD				0.0247		
701	Data appear Gamma Distributed at 5% Significance Level					SE of Mean						0.00744
702						95% KM UTL with 90% Coverage				0.222		
703	Assuming Gamma Distribution					95% KM Chebyshev UPL						0.281
704	Gamma ROS Statistics with Extrapolated Data					95% KM UPL (t)						0.215
705	Mean				0.154	90% Percentile (z)				0.201		
706	Median				0.16	95% Percentile (z)				0.21		
707	SD				0.0455	99% Percentile (z)				0.227		
708	k star				7.833							
709	Theta star				0.0197	Gamma ROS Limits with Extrapolated Data						
710	Nu star				219.3	95% Wilson Hilferty (WH) Approx. Gamma UPL				0.26		
711	95% Percentile of Chisquare (2k)				25.86	95% Hawkins Wixley (HW) Approx. Gamma UPL				0.264		
712						95% WH Approx. Gamma UTL with 90% Coverage				0.28		
713	90% Percentile				0.228	95% HW Approx. Gamma UTL with 90% Coverage				0.286		
714	95% Percentile				0.254							

A	B	C	D	E	F	G	H	I	J	K	L		
715	99% Percentile			0.31									
716													
717	Note: DL/2 is not a recommended method.												
718													
719													
720	Zinc												
721													
722	General Statistics												
723	Total Number of Observations			14	Number of Distinct Observations			14					
724	Tolerance Factor			2.109									
725													
726	Raw Statistics					Log-Transformed Statistics							
727	Minimum			23	Minimum			3.135					
728	Maximum			660	Maximum			6.492					
729	Second Largest			390	Second Largest			5.966					
730	First Quartile			36.25	First Quartile			3.59					
731	Median			51.5	Median			3.942					
732	Third Quartile			84.75	Third Quartile			4.433					
733	Mean			122.2	Mean			4.209					
734	Geometric Mean			67.32	SD			0.989					
735	SD			181.2									
736	Coefficient of Variation			1.483									
737	Skewness			2.552									
738													
739	Background Statistics												
740	Normal Distribution Test					Lognormal Distribution Test							
741	Shapiro Wilk Test Statistic			0.579	Shapiro Wilk Test Statistic			0.862					
742	Shapiro Wilk Critical Value			0.874	Shapiro Wilk Critical Value			0.874					
743	Data not Normal at 5% Significance Level					Data not Lognormal at 5% Significance Level							
744													
745	Assuming Normal Distribution					Assuming Lognormal Distribution							
746	95% UTL with 90% Coverage			504.4	95% UTL with 90% Coverage			542.5					
747	95% UPL (t)			454.4	95% UPL (t)			412.9					
748	90% Percentile (z)			354.5	90% Percentile (z)			239.3					
749	95% Percentile (z)			420.3	95% Percentile (z)			342.7					
750	99% Percentile (z)			543.8	99% Percentile (z)			672.7					
751													
752	Gamma Distribution Test					Data Distribution Test							
753	k star			0.811	Data do not follow a Discernable Distribution (0.05)								
754	Theta Star			150.7									
755	MLE of Mean			122.2									
756	MLE of Standard Deviation			135.7									
757	nu star			22.7									
758													
759	A-D Test Statistic			1.436	Nonparametric Statistics								
760	5% A-D Critical Value			0.761	90% Percentile			315					
761	K-S Test Statistic			0.278	95% Percentile			484.5					
762	5% K-S Critical Value			0.235	99% Percentile			624.9					
763	Data not Gamma Distributed at 5% Significance Level												
764													
765	Assuming Gamma Distribution					95% UTL with 90% Coverage			660				

	A	B	C	D	E	F	G	H	I	J	K	L
766					90% Percentile	296.2		95% Percentile Bootstrap UTL with 90% Coverage				660
767					95% Percentile	394.5		95% BCA Bootstrap UTL with 90% Coverage				660
768					99% Percentile	626.5					95% UPL	660
769											95% Chebyshev UPL	939.9
770					95% WH Approx. Gamma UPL	411.6		Upper Threshold Limit Based upon IQR				157.5
771					95% HW Approx. Gamma UPL	409						
772					95% WH Approx. Gamma UTL with 90% Coverage	494.9						
773					95% HW Approx. Gamma UTL with 90% Coverage	500.2						
774												
775												