Appendix F

Sediment Risk Calculations and Summary Tables

Appendix F – Sediment Risk Calculations and Summary Tables

ProUCL Outputs

- **Sediment**

Summary Statistics

- **Sediment**

Risk Calculations

- **Sediment**

ProUCL Outputs

Table of Contents for ProUCL Outputs - Sediment
Baseline Human Health Risk Assessment
Asarco LLC Hayden Plant Site, Hayden, Arizona

ProUCL File #	Media	Parameter
1	Sediment	Aluminum
2	Sediment	Antimony
3	Sediment	Arsenic
4	Sediment	Barium
5	Sediment	Beryllium
6	Sediment	Boron
7	Sediment	Cadmium
8	Sediment	Calcium
9	Sediment	Chromium
10	Sediment	Cobalt
11	Sediment	Copper
12	Sediment	Iron
13	Sediment	Lead
14	Sediment	Magnesium
15	Sediment	Manganese
16	Sediment	Mercury
17	Sediment	Molybdenum
18	Sediment	Nickel
19	Sediment	Potassium
20	Sediment	Selenium
21	Sediment	Sodium
22	Sediment	Thallium
23	Sediment	Vanadium
24	Sediment	Zinc

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\lhilsche\Asarco Hayden\mar08\EPCs5\all5.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

File #	Media	Parameter
_1	Sediment	Aluminum

General Statistics

Number of Valid Samples	20	Number of Unique Samples	20

Raw Statistics		**Log-transformed Statistics**	
Minimum	4240	Minimum of Log Data	8.352
Maximum	20400	Maximum of Log Data	9.923
Mean	14004	Mean of log Data	9.461
Median	14100	SD of log Data	0.468
SD	5067		
Coefficient of Variation	0.362		
Skewness	-0.545		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.931	Shapiro Wilk Test Statistic	0.844
Shapiro Wilk Critical Value	0.905	Shapiro Wilk Critical Value	0.905
Data appear Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	15963	95% H-UCL	17710
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	20949
95% Adjusted-CLT UCL	15720	97.5% Chebyshev (MVUE) UCL	23850
95% Modified-t UCL	15940	99% Chebyshev (MVUE) UCL	29546

Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	5.106	Data appear Normal at 5% Significance Level	
Theta Star	2743		
nu star	204.2		
Approximate Chi Square Value (.05)	172.2	**Nonparametric Statistics**	
Adjusted Level of Significance	0.038	95% CLT UCL	15868
Adjusted Chi Square Value	169.8	95% Jackknife UCL	15963
		95% Standard Bootstrap UCL	15800
Anderson-Darling Test Statistic	0.798	95% Bootstrap-t UCL	15840
Anderson-Darling 5% Critical Value	0.745	95% Hall's Bootstrap UCL	15675
Kolmogorov-Smirnov Test Statistic	0.183	95% Percentile Bootstrap UCL	15798
Kolmogorov-Smirnov 5% Critical Value	0.194	95% BCA Bootstrap UCL	15742
Data follow Appr. Gamma Distribution at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	18943
		97.5% Chebyshev(Mean, Sd) UCL	21080
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	25278
95% Approximate Gamma UCL	16613		
95% Adjusted Gamma UCL	16840		

Potential UCL to Use		Use 95% Student's-t UCL	15963

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\lhilsche\Asarco Hayden\mar08\EPCs5\all5.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

File #	Media	Parameter
_2	Sediment	Antimony

General Statistics

Number of Valid Samples	20	Number of Detected Data	19
Number of Unique Samples	19	Number of Non-Detect Data	1
		Percent Non-Detects	5.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.4	Minimum Detected	-0.916
Maximum Detected	1.2	Maximum Detected	0.182
Mean of Detected	0.709	Mean of Detected	-0.41
SD of Detected	0.266	SD of Detected	0.373
Minimum Non-Detect	1.2	Minimum Non-Detect	0.182
Maximum Non-Detect	1.2	Maximum Non-Detect	0.182

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.877	Shapiro Wilk Test Statistic	0.896
5% Shapiro Wilk Critical Value	0.901	5% Shapiro Wilk Critical Value	0.901
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.704	Mean	-0.415
SD	0.26	SD	0.363
95% DL/2 (t) UCL	0.804	95% H-Stat (DL/2) UCL	0.904

Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	-0.412
		SD in Log Scale	0.363
		Mean in Original Scale	0.706
		SD in Original Scale	0.259
		95% Percentile Bootstrap UCL	0.801
		95% BCA Bootstrap UCL	0.809

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	6.544	Data Follow Appr. Gamma Distribution at 5% Significance Level	
Theta Star	0.108		
nu star	248.7		
A-D Test Statistic	0.892	Nonparametric Statistics	
5% A-D Critical Value	0.742	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.742	Mean	0.708
5% K-S Critical Value	0.199	SD	0.258
Data follow Appr. Gamma Distribution at 5% Significance Level		SE of Mean	0.0605
		95% KM (t) UCL	0.812
Assuming Gamma Distribution		95% KM (z) UCL	0.807
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	0.812
Minimum	0.4	95% KM (bootstrap t) UCL	0.823
Maximum	1.2	95% KM (BCA) UCL	0.804
Mean	0.711	95% KM (Percentile Bootstrap) UCL	0.808
Median	0.66	95% KM (Chebyshev) UCL	0.971
SD	0.259	97.5% KM (Chebyshev) UCL	1.086
k star	6.932	99% KM (Chebyshev) UCL	1.31
Theta star	0.103		
Nu star	277.3	Potential UCLs to Use	
AppChi2	239.7	95% KM (BCA) UCL	0.804
95% Gamma Approximate UCL	0.823		
95% Adjusted Gamma UCL	0.832		

Note: DL/2 is not a recommended method.

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\lhilsche\Asarco Hayden\mar08\EPCs5\all5.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

File #	Media	Parameter
_3	Sediment	Arsenic

General Statistics

Number of Valid Samples	20	Number of Unique Samples	16

Raw Statistics		Log-transformed Statistics	
Minimum	1.1	Minimum of Log Data	0.0953
Maximum	5.5	Maximum of Log Data	1.705
Mean	3.68	Mean of log Data	1.212
Median	4.2	SD of log Data	0.48
SD	1.363		
Coefficient of Variation	0.37		
Skewness	-0.551		

Relevant UCL Statistics

Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.919	Shapiro Wilk Test Statistic	0.836
Shapiro Wilk Critical Value	0.905	Shapiro Wilk Critical Value	0.905
Data appear Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	4.207	95% H-UCL	4.692
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	5.56
95% Adjusted-CLT UCL	4.141	97.5% Chebyshev (MVUE) UCL	6.344
95% Modified-t UCL	4.201	99% Chebyshev (MVUE) UCL	7.884

Gamma Distribution Test		Data Distribution	
k star (bias corrected)	4.864	Data appear Normal at 5% Significance Level	
Theta Star	0.757		
nu star	194.6		
Approximate Chi Square Value (.05)	163.3	**Nonparametric Statistics**	
Adjusted Level of Significance	0.038	95% CLT UCL	4.181
Adjusted Chi Square Value	161	95% Jackknife UCL	4.207
		95% Standard Bootstrap UCL	4.165
Anderson-Darling Test Statistic	0.933	95% Bootstrap-t UCL	4.158
Anderson-Darling 5% Critical Value	0.745	95% Hall's Bootstrap UCL	4.128
Kolmogorov-Smirnov Test Statistic	0.228	95% Percentile Bootstrap UCL	4.155
Kolmogorov-Smirnov 5% Critical Value	0.194	95% BCA Bootstrap UCL	4.135
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	5.009
		97.5% Chebyshev(Mean, Sd) UCL	5.584
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	6.713
95% Approximate Gamma UCL	4.385		
95% Adjusted Gamma UCL	4.446		

Potential UCL to Use		Use 95% Student's-t UCL	4.207

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\lhilsche\Asarco Hayden\mar08\EPCs5\all5.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

File #	Media	Parameter
_4	Sediment	Barium

General Statistics

Number of Valid Samples	20	Number of Unique Samples	18

Raw Statistics		**Log-transformed Statistics**	
Minimum	51.8	Minimum of Log Data	3.947
Maximum	180	Maximum of Log Data	5.193
Mean	133.2	Mean of log Data	4.829
Median	143	SD of log Data	0.392
SD	42.57		
Coefficient of Variation	0.32		
Skewness	-0.726		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.881	Shapiro Wilk Test Statistic	0.831
Shapiro Wilk Critical Value	0.905	Shapiro Wilk Critical Value	0.905
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	149.7	95% H-UCL	160.3
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	187
95% Adjusted-CLT UCL	147.2	97.5% Chebyshev (MVUE) UCL	209.7
95% Modified-t UCL	149.4	99% Chebyshev (MVUE) UCL	254.3

Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	6.882	Data do not follow a Discernable Distribution (0.05)	
Theta Star	19.36		
nu star	275.3		
Approximate Chi Square Value (.05)	237.9	**Nonparametric Statistics**	
Adjusted Level of Significance	0.038	95% CLT UCL	148.9
Adjusted Chi Square Value	235.1	95% Jackknife UCL	149.7
		95% Standard Bootstrap UCL	148.4
Anderson-Darling Test Statistic	1.193	95% Bootstrap-t UCL	148.5
Anderson-Darling 5% Critical Value	0.743	95% Hall's Bootstrap UCL	147.2
Kolmogorov-Smirnov Test Statistic	0.252	95% Percentile Bootstrap UCL	147.9
Kolmogorov-Smirnov 5% Critical Value	0.194	95% BCA Bootstrap UCL	147.4
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	174.7
		97.5% Chebyshev(Mean, Sd) UCL	192.7
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	227.9
95% Approximate Gamma UCL	154.2		
95% Adjusted Gamma UCL	156		

Potential UCL to Use		Use 95% Student's-t UCL	149.7
		or 95% Modified-t UCL	149.4

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\lhilsche\Asarco Hayden\mar08\EPCs5\all5.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

File #	Media	Parameter
_5	Sediment	Beryllium

General Statistics

Number of Valid Samples	20	Number of Unique Samples	17

Raw Statistics		Log-transformed Statistics	
Minimum	0.09	Minimum of Log Data	-2.408
Maximum	1	Maximum of Log Data	0
Mean	0.572	Mean of log Data	-0.708
Median	0.575	SD of log Data	0.631
SD	0.269		
Coefficient of Variation	0.47		
Skewness	-0.0579		

Relevant UCL Statistics

Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.969	Shapiro Wilk Test Statistic	0.886
Shapiro Wilk Critical Value	0.905	Shapiro Wilk Critical Value	0.905
Data appear Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	0.676	95% H-UCL	0.819
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	0.98
95% Adjusted-CLT UCL	0.67	97.5% Chebyshev (MVUE) UCL	1.147
95% Modified-t UCL	0.676	99% Chebyshev (MVUE) UCL	1.475

Gamma Distribution Test		Data Distribution	
k star (bias corrected)	3.017	Data appear Normal at 5% Significance Level	
Theta Star	0.19		
nu star	120.7		
Approximate Chi Square Value (.05)	96.33	**Nonparametric Statistics**	
Adjusted Level of Significance	0.038	95% CLT UCL	0.671
Adjusted Chi Square Value	94.61	95% Jackknife UCL	0.676
		95% Standard Bootstrap UCL	0.669
Anderson-Darling Test Statistic	0.421	95% Bootstrap-t UCL	0.677
Anderson-Darling 5% Critical Value	0.747	95% Hall's Bootstrap UCL	0.67
Kolmogorov-Smirnov Test Statistic	0.135	95% Percentile Bootstrap UCL	0.664
Kolmogorov-Smirnov 5% Critical Value	0.195	95% BCA Bootstrap UCL	0.668
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	0.834
		97.5% Chebyshev(Mean, Sd) UCL	0.947
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	1.17
95% Approximate Gamma UCL	0.717		
95% Adjusted Gamma UCL	0.73		

Potential UCL to Use	Use 95% Student's-t UCL	0.676

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\lhilsche\Asarco Hayden\mar08\EPCs5\all5.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

File #	Media	Parameter
_6	Sediment	Boron

General Statistics

Number of Valid Samples	20	Number of Unique Samples	20

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.81	Minimum of Log Data	-0.211
Maximum	10.9	Maximum of Log Data	2.389
Mean	5.871	Mean of log Data	1.582
Median	5.55	SD of log Data	0.71
SD	3.069		
Coefficient of Variation	0.523		
Skewness	0.0252		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.959	Shapiro Wilk Test Statistic	0.888
Shapiro Wilk Critical Value	0.905	Shapiro Wilk Critical Value	0.905
Data appear Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	7.057	95% H-UCL	8.986
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	10.72
95% Adjusted-CLT UCL	7.003	97.5% Chebyshev (MVUE) UCL	12.69
95% Modified-t UCL	7.058	99% Chebyshev (MVUE) UCL	16.57

Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	2.421	Data appear Normal at 5% Significance Level	
Theta Star	2.424		
nu star	96.85		
Approximate Chi Square Value (.05)	75.15	**Nonparametric Statistics**	
Adjusted Level of Significance	0.038	95% CLT UCL	6.999
Adjusted Chi Square Value	73.64	95% Jackknife UCL	7.057
		95% Standard Bootstrap UCL	6.968
Anderson-Darling Test Statistic	0.539	95% Bootstrap-t UCL	7.02
Anderson-Darling 5% Critical Value	0.748	95% Hall's Bootstrap UCL	6.959
Kolmogorov-Smirnov Test Statistic	0.164	95% Percentile Bootstrap UCL	7.01
Kolmogorov-Smirnov 5% Critical Value	0.195	95% BCA Bootstrap UCL	7.011
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	8.862
		97.5% Chebyshev(Mean, Sd) UCL	10.16
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	12.7
95% Approximate Gamma UCL	7.566		
95% Adjusted Gamma UCL	7.721		

Potential UCL to Use		Use 95% Student's-t UCL	7.057

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\lhilsche\Asarco Hayden\mar08\EPCs5\all5.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

File #	Media	Parameter
_7	Sediment	Cadmium

General Statistics

Number of Valid Samples	19	Number of Detected Data	5
Number of Unique Samples	4	Number of Non-Detect Data	14
		Percent Non-Detects	73.68%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.03	Minimum Detected	-3.507
Maximum Detected	0.11	Maximum Detected	-2.207
Mean of Detected	0.056	Mean of Detected	-2.993
SD of Detected	0.0321	SD of Detected	0.504
Minimum Non-Detect	0.46	Minimum Non-Detect	-0.777
Maximum Non-Detect	1.1	Maximum Non-Detect	0.0953

Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	19
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	0
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	100.00%

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.816	Shapiro Wilk Test Statistic	0.91
5% Shapiro Wilk Critical Value	0.762	5% Shapiro Wilk Critical Value	0.762
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.233	Mean	-1.703
SD	0.13	SD	0.85
95% DL/2 (t) UCL	0.285	95% H-Stat (DL/2) UCL	1.156

Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	-2.993
		SD in Log Scale	0.271
		Mean in Original Scale	0.0521
		SD in Original Scale	0.0167
		95% Percentile Bootstrap UCL	0.0589
		95% BCA Bootstrap UCL	0.0609

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only
k star (bias corrected)	2.006	Data appear Normal at 5% Significance Level
Theta Star	0.0279	
nu star	20.06	

A-D Test Statistic	0.432	Nonparametric Statistics	
5% A-D Critical Value	0.681	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.681	Mean	0.056
5% K-S Critical Value	0.358	SD	0.0287
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	0.0144
		95% KM (t) UCL	0.0809
Assuming Gamma Distribution		95% KM (z) UCL	0.0796
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	0.0831
Minimum	0.03	95% KM (bootstrap t) UCL	0.162
Maximum	0.11	95% KM (BCA) UCL	0.085
Mean	0.0577	95% KM (Percentile Bootstrap) UCL	0.085
Median	0.0586	95% KM (Chebyshev) UCL	0.119
SD	0.0171	97.5% KM (Chebyshev) UCL	0.146
k star	11.15	99% KM (Chebyshev) UCL	0.199
Theta star	0.00517		
Nu star	423.6	Potential UCLs to Use	
AppChi2	376.9	95% KM (t) UCL	0.0809
95% Gamma Approximate UCL	0.0648	95% KM (Percentile Bootstrap) UCL	0.085
95% Adjusted Gamma UCL	0.0655		

Note: DL/2 is not a recommended method.

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\lhilsche\Asarco Hayden\mar08\EPCs5\all5.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

File #	Media	Parameter
_8	Sediment	Calcium

General Statistics

Number of Valid Samples	20	Number of Unique Samples	20

Raw Statistics		**Log-transformed Statistics**	
Minimum	7800	Minimum of Log Data	8.962
Maximum	41900	Maximum of Log Data	10.64
Mean	27494	Mean of log Data	10.11
Median	31550	SD of log Data	0.535
SD	10565		
Coefficient of Variation	0.384		
Skewness	-0.823		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.888	Shapiro Wilk Test Statistic	0.778
Shapiro Wilk Critical Value	0.905	Shapiro Wilk Critical Value	0.905
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	31579	95% H-UCL	36570
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	43608
95% Adjusted-CLT UCL	30916	97.5% Chebyshev (MVUE) UCL	50253
95% Modified-t UCL	31507	99% Chebyshev (MVUE) UCL	63306

Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	4.099	Data do not follow a Discernable Distribution (0.05)	
Theta Star	6708		
nu star	164		
Approximate Chi Square Value (.05)	135.4	**Nonparametric Statistics**	
Adjusted Level of Significance	0.038	95% CLT UCL	31380
Adjusted Chi Square Value	133.3	95% Jackknife UCL	31579
		95% Standard Bootstrap UCL	31318
Anderson-Darling Test Statistic	1.575	95% Bootstrap-t UCL	30961
Anderson-Darling 5% Critical Value	0.745	95% Hall's Bootstrap UCL	30761
Kolmogorov-Smirnov Test Statistic	0.245	95% Percentile Bootstrap UCL	31097
Kolmogorov-Smirnov 5% Critical Value	0.195	95% BCA Bootstrap UCL	30930
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	37792
		97.5% Chebyshev(Mean, Sd) UCL	42248
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	51001
95% Approximate Gamma UCL	33305		
95% Adjusted Gamma UCL	33817		

Potential UCL to Use		Use 95% Chebyshev (Mean, Sd) UCL	37792

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\lhilsche\Asarco Hayden\mar08\EPCs5\all5.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

File #	Media	Parameter
_9	Sediment	Chromium

General Statistics

Number of Valid Samples	20	Number of Unique Samples	18

Raw Statistics		**Log-transformed Statistics**	
Minimum	4.3	Minimum of Log Data	1.459
Maximum	21	Maximum of Log Data	3.045
Mean	12.52	Mean of log Data	2.443
Median	12.55	SD of log Data	0.456
SD	4.603		
Coefficient of Variation	0.368		
Skewness	-0.305		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.955	Shapiro Wilk Test Statistic	0.865
Shapiro Wilk Critical Value	0.905	Shapiro Wilk Critical Value	0.905
Data appear Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	14.3	95% H-UCL	15.68
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	18.52
95% Adjusted-CLT UCL	14.14	97.5% Chebyshev (MVUE) UCL	21.04
95% Modified-t UCL	14.29	99% Chebyshev (MVUE) UCL	25.99

Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	5.213	Data appear Normal at 5% Significance Level	
Theta Star	2.402		
nu star	208.5		
Approximate Chi Square Value (.05)	176.1	**Nonparametric Statistics**	
Adjusted Level of Significance	0.038	95% CLT UCL	14.21
Adjusted Chi Square Value	173.8	95% Jackknife UCL	14.3
		95% Standard Bootstrap UCL	14.2
Anderson-Darling Test Statistic	0.827	95% Bootstrap-t UCL	14.31
Anderson-Darling 5% Critical Value	0.744	95% Hall's Bootstrap UCL	14.25
Kolmogorov-Smirnov Test Statistic	0.197	95% Percentile Bootstrap UCL	14.16
Kolmogorov-Smirnov 5% Critical Value	0.194	95% BCA Bootstrap UCL	14.09
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	17.01
		97.5% Chebyshev(Mean, Sd) UCL	18.95
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	22.76
95% Approximate Gamma UCL	14.82		
95% Adjusted Gamma UCL	15.03		

Potential UCL to Use		Use 95% Student's-t UCL	14.3

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\lhilsche\Asarco Hayden\mar08\EPCs5\all5.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

File #	Media	Parameter
_10	Sediment	Cobalt

General Statistics

Number of Valid Samples	20	Number of Unique Samples	19

Raw Statistics		**Log-transformed Statistics**	
Minimum	3.2	Minimum of Log Data	1.163
Maximum	14.8	Maximum of Log Data	2.695
Mean	9.56	Mean of log Data	2.193
Median	9.55	SD of log Data	0.39
SD	3.219		
Coefficient of Variation	0.337		
Skewness	-0.0821		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.975	Shapiro Wilk Test Statistic	0.929
Shapiro Wilk Critical Value	0.905	Shapiro Wilk Critical Value	0.905
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	10.8	95% H-UCL	11.47
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	13.38
95% Adjusted-CLT UCL	10.73	97.5% Chebyshev (MVUE) UCL	15
95% Modified-t UCL	10.8	99% Chebyshev (MVUE) UCL	18.19

Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	6.776	Data appear Normal at 5% Significance Level	
Theta Star	1.411		
nu star	271		
Approximate Chi Square Value (.05)	233.9	**Nonparametric Statistics**	
Adjusted Level of Significance	0.038	95% CLT UCL	10.74
Adjusted Chi Square Value	231.2	95% Jackknife UCL	10.8
		95% Standard Bootstrap UCL	10.7
Anderson-Darling Test Statistic	0.295	95% Bootstrap-t UCL	10.79
Anderson-Darling 5% Critical Value	0.743	95% Hall's Bootstrap UCL	10.75
Kolmogorov-Smirnov Test Statistic	0.119	95% Percentile Bootstrap UCL	10.65
Kolmogorov-Smirnov 5% Critical Value	0.194	95% BCA Bootstrap UCL	10.65
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	12.7
		97.5% Chebyshev(Mean, Sd) UCL	14.05
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	16.72
95% Approximate Gamma UCL	11.08		
95% Adjusted Gamma UCL	11.21		

Potential UCL to Use		Use 95% Student's-t UCL	10.8

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\lhilsche\Asarco Hayden\mar08\EPCs5\all5.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

File #	Media	Parameter
_11	Sediment	Copper

General Statistics

Number of Valid Samples	20	Number of Unique Samples	20

Raw Statistics		**Log-transformed Statistics**	
Minimum	11.6	Minimum of Log Data	2.451
Maximum	392	Maximum of Log Data	5.971
Mean	109.7	Mean of log Data	4.42
Median	100	SD of log Data	0.842
SD	82.45		
Coefficient of Variation	0.751		
Skewness	2.087		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.811	Shapiro Wilk Test Statistic	0.925
Shapiro Wilk Critical Value	0.905	Shapiro Wilk Critical Value	0.905
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	141.6	95% H-UCL	187.6
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	219.3
95% Adjusted-CLT UCL	149.3	97.5% Chebyshev (MVUE) UCL	264.2
95% Modified-t UCL	143.1	99% Chebyshev (MVUE) UCL	352.2

Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	1.689	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	64.96		
nu star	67.57		
Approximate Chi Square Value (.05)	49.65	**Nonparametric Statistics**	
Adjusted Level of Significance	0.038	95% CLT UCL	140.1
Adjusted Chi Square Value	48.44	95% Jackknife UCL	141.6
		95% Standard Bootstrap UCL	139
Anderson-Darling Test Statistic	0.436	95% Bootstrap-t UCL	156.3
Anderson-Darling 5% Critical Value	0.753	95% Hall's Bootstrap UCL	295.8
Kolmogorov-Smirnov Test Statistic	0.13	95% Percentile Bootstrap UCL	142.2
Kolmogorov-Smirnov 5% Critical Value	0.196	95% BCA Bootstrap UCL	148.4
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	190.1
		97.5% Chebyshev(Mean, Sd) UCL	224.9
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	293.2
95% Approximate Gamma UCL	149.4		
95% Adjusted Gamma UCL	153.1		

Potential UCL to Use		Use 95% Approximate Gamma UCL	149.4

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\lhilsche\Asarco Hayden\mar08\EPCs5\all5.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

File #	Media	Parameter
_12	Sediment	Iron

General Statistics

Number of Valid Samples	20	Number of Unique Samples	20

Raw Statistics		**Log-transformed Statistics**	
Minimum	6890	Minimum of Log Data	8.838
Maximum	26300	Maximum of Log Data	10.18
Mean	17415	Mean of log Data	9.713
Median	17850	SD of log Data	0.349
SD	5214		
Coefficient of Variation	0.299		
Skewness	-0.344		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.977	Shapiro Wilk Test Statistic	0.915
Shapiro Wilk Critical Value	0.905	Shapiro Wilk Critical Value	0.905
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	19431	95% H-UCL	20432
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	23601
95% Adjusted-CLT UCL	19237	97.5% Chebyshev (MVUE) UCL	26231
95% Modified-t UCL	19416	99% Chebyshev (MVUE) UCL	31397

Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	8.395	Data appear Normal at 5% Significance Level	
Theta Star	2074		
nu star	335.8		
Approximate Chi Square Value (.05)	294.3	**Nonparametric Statistics**	
Adjusted Level of Significance	0.038	95% CLT UCL	19333
Adjusted Chi Square Value	291.3	95% Jackknife UCL	19431
		95% Standard Bootstrap UCL	19296
Anderson-Darling Test Statistic	0.45	95% Bootstrap-t UCL	19436
Anderson-Darling 5% Critical Value	0.742	95% Hall's Bootstrap UCL	19375
Kolmogorov-Smirnov Test Statistic	0.155	95% Percentile Bootstrap UCL	19225
Kolmogorov-Smirnov 5% Critical Value	0.194	95% BCA Bootstrap UCL	19125
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	22497
		97.5% Chebyshev(Mean, Sd) UCL	24696
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	29015
95% Approximate Gamma UCL	19868		
95% Adjusted Gamma UCL	20077		

Potential UCL to Use		Use 95% Student's-t UCL	19431

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\lhilsche\Asarco Hayden\mar08\EPCs5\all5.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

File #	Media	Parameter
_13	Sediment	Lead

General Statistics

Number of Valid Samples	20	Number of Unique Samples	19

Raw Statistics		**Log-transformed Statistics**	
Minimum	3.4	Minimum of Log Data	1.224
Maximum	21.2	Maximum of Log Data	3.054
Mean	14.15	Mean of log Data	2.543
Median	15.7	SD of log Data	0.527
SD	5.516		
Coefficient of Variation	0.39		
Skewness	-0.675		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.914	Shapiro Wilk Test Statistic	0.83
Shapiro Wilk Critical Value	0.905	Shapiro Wilk Critical Value	0.905
Data appear Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	16.28	95% H-UCL	18.68
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	22.25
95% Adjusted-CLT UCL	15.98	97.5% Chebyshev (MVUE) UCL	25.61
95% Modified-t UCL	16.25	99% Chebyshev (MVUE) UCL	32.19

Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	4.16	Data appear Normal at 5% Significance Level	
Theta Star	3.402		
nu star	166.4		
Approximate Chi Square Value (.05)	137.6	**Nonparametric Statistics**	
Adjusted Level of Significance	0.038	95% CLT UCL	16.18
Adjusted Chi Square Value	135.5	95% Jackknife UCL	16.28
		95% Standard Bootstrap UCL	16.18
Anderson-Darling Test Statistic	1.124	95% Bootstrap-t UCL	16.17
Anderson-Darling 5% Critical Value	0.745	95% Hall's Bootstrap UCL	16.05
Kolmogorov-Smirnov Test Statistic	0.211	95% Percentile Bootstrap UCL	16.01
Kolmogorov-Smirnov 5% Critical Value	0.194	95% BCA Bootstrap UCL	15.96
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	19.53
		97.5% Chebyshev(Mean, Sd) UCL	21.85
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	26.42
95% Approximate Gamma UCL	17.12		
95% Adjusted Gamma UCL	17.38		

Potential UCL to Use		Use 95% Student's-t UCL	16.28

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\lhilsche\Asarco Hayden\mar08\EPCs5\all5.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

File #	Media	Parameter
_14	Sediment	Magnesium

General Statistics

Number of Valid Samples	20	Number of Unique Samples	20

Raw Statistics		**Log-transformed Statistics**	
Minimum	2260	Minimum of Log Data	7.723
Maximum	9910	Maximum of Log Data	9.201
Mean	6850	Mean of log Data	8.76
Median	7245	SD of log Data	0.424
SD	2298		
Coefficient of Variation	0.336		
Skewness	-0.637		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.932	Shapiro Wilk Test Statistic	0.849
Shapiro Wilk Critical Value	0.905	Shapiro Wilk Critical Value	0.905
Data appear Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	7739	95% H-UCL	8414
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	9881
95% Adjusted-CLT UCL	7617	97.5% Chebyshev (MVUE) UCL	11154
95% Modified-t UCL	7726	99% Chebyshev (MVUE) UCL	13655

Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	6.06	Data appear Normal at 5% Significance Level	
Theta Star	1130		
nu star	242.4		
Approximate Chi Square Value (.05)	207.4	**Nonparametric Statistics**	
Adjusted Level of Significance	0.038	95% CLT UCL	7695
Adjusted Chi Square Value	204.8	95% Jackknife UCL	7739
		95% Standard Bootstrap UCL	7678
Anderson-Darling Test Statistic	0.886	95% Bootstrap-t UCL	7646
Anderson-Darling 5% Critical Value	0.744	95% Hall's Bootstrap UCL	7610
Kolmogorov-Smirnov Test Statistic	0.202	95% Percentile Bootstrap UCL	7674
Kolmogorov-Smirnov 5% Critical Value	0.194	95% BCA Bootstrap UCL	7659
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	9090
		97.5% Chebyshev(Mean, Sd) UCL	10059
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	11963
95% Approximate Gamma UCL	8008		
95% Adjusted Gamma UCL	8108		

Potential UCL to Use		Use 95% Student's-t UCL	7739

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\lhilsche\Asarco Hayden\mar08\EPCs5\all5.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

File #	Media	Parameter
_15	Sediment	Manganese

General Statistics

Number of Valid Samples	20	Number of Unique Samples	19

Raw Statistics		**Log-transformed Statistics**	
Minimum	113	Minimum of Log Data	4.727
Maximum	2410	Maximum of Log Data	7.787
Mean	721.1	Mean of log Data	6.318
Median	523	SD of log Data	0.761
SD	559.1		
Coefficient of Variation	0.775		
Skewness	1.667		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.833	Shapiro Wilk Test Statistic	0.972
Shapiro Wilk Critical Value	0.905	Shapiro Wilk Critical Value	0.905
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	937.2	95% H-UCL	1104
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	1310
95% Adjusted-CLT UCL	976.5	97.5% Chebyshev (MVUE) UCL	1561
95% Modified-t UCL	945	99% Chebyshev (MVUE) UCL	2056

Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	1.781	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	404.8		
nu star	71.24		
Approximate Chi Square Value (.05)	52.81	**Nonparametric Statistics**	
Adjusted Level of Significance	0.038	95% CLT UCL	926.7
Adjusted Chi Square Value	51.56	95% Jackknife UCL	937.2
		95% Standard Bootstrap UCL	928
Anderson-Darling Test Statistic	0.425	95% Bootstrap-t UCL	1028
Anderson-Darling 5% Critical Value	0.752	95% Hall's Bootstrap UCL	1058
Kolmogorov-Smirnov Test Statistic	0.179	95% Percentile Bootstrap UCL	919
Kolmogorov-Smirnov 5% Critical Value	0.196	95% BCA Bootstrap UCL	959.5
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	1266
		97.5% Chebyshev(Mean, Sd) UCL	1502
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	1965
95% Approximate Gamma UCL	972.7		
95% Adjusted Gamma UCL	996.4		

Potential UCL to Use		Use 95% Approximate Gamma UCL	972.7

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\lhilsche\Asarco Hayden\mar08\EPCs5\all5.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

File #	Media	Parameter
_16	Sediment	Mercury

General Statistics

Number of Valid Samples	19	Number of Detected Data	10
Number of Unique Samples	9	Number of Non-Detect Data	9
		Percent Non-Detects	47.37%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.03	Minimum Detected	-3.507
Maximum Detected	0.1	Maximum Detected	-2.303
Mean of Detected	0.072	Mean of Detected	-2.717
SD of Detected	0.0272	SD of Detected	0.468
Minimum Non-Detect	0.024	Minimum Non-Detect	-3.73
Maximum Non-Detect	0.066	Maximum Non-Detect	-2.718

Note: Data have multiple DLs - Use of KM Method is recommended	Number treated as Non-Detect	12
For all methods (except KM, DL/2, and ROS Methods),	Number treated as Detected	7
Observations < Largest ND are treated as NDs	Single DL Non-Detect Percentage	63.16%

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.832	Shapiro Wilk Test Statistic	0.786
5% Shapiro Wilk Critical Value	0.842	5% Shapiro Wilk Critical Value	0.842
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.0487	Mean	-3.252
SD	0.0322	SD	0.717
95% DL/2 (t) UCL	0.0615	95% H-Stat (DL/2) UCL	0.0842
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	0.0883	Mean in Log Scale	-3.152
SD	0.00879	SD in Log Scale	0.587
95% MLE (t) UCL	0.0918	Mean in Original Scale	0.0505
95% MLE (Tiku) UCL	0.0941	SD in Original Scale	0.0303
		95% Percentile Bootstrap UCL	0.0621
		95% BCA Bootstrap UCL	0.0623

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	4.259	Data do not follow a Discernable Distribution (0.05)	
Theta Star	0.0169		
nu star	85.18		
A-D Test Statistic	0.997	Nonparametric Statistics	
5% A-D Critical Value	0.729	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.729	Mean	0.0526
5% K-S Critical Value	0.267	SD	0.0278
Data not Gamma Distributed at 5% Significance Level		SE of Mean	0.00674
		95% KM (t) UCL	0.0643
Assuming Gamma Distribution		95% KM (z) UCL	0.0637
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	0.0633
Minimum	0.03	95% KM (bootstrap t) UCL	0.0644
Maximum	0.1	95% KM (BCA) UCL	0.0798
Mean	0.0694	95% KM (Percentile Bootstrap) UCL	0.068
Median	0.074	95% KM (Chebyshev) UCL	0.082
SD	0.0205	97.5% KM (Chebyshev) UCL	0.0947
k star	8.452	99% KM (Chebyshev) UCL	0.12
Theta star	0.00821		
Nu star	321.2	Potential UCLs to Use	
AppChi2	280.7	95% KM (t) UCL	0.0643
95% Gamma Approximate UCL	0.0794	95% KM (% Bootstrap) UCL	0.068
95% Adjusted Gamma UCL	0.0804		

Note: DL/2 is not a recommended method.

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\lhilsche\Asarco Hayden\mar08\EPCs5\all5.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

File #	Media	Parameter
_17	Sediment	Molybdenum

General Statistics

Number of Valid Samples	19	Number of Detected Data	10
Number of Unique Samples	8	Number of Non-Detect Data	9
		Percent Non-Detects	47.37%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.2	Minimum Detected	-1.609
Maximum Detected	2.4	Maximum Detected	0.875
Mean of Detected	1.57	Mean of Detected	0.271
SD of Detected	0.707	SD of Detected	0.769
Minimum Non-Detect	0.09	Minimum Non-Detect	-2.408
Maximum Non-Detect	2.5	Maximum Non-Detect	0.916

Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	19
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	0
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	100.00%

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.908	Shapiro Wilk Test Statistic	0.741
5% Shapiro Wilk Critical Value	0.842	5% Shapiro Wilk Critical Value	0.842
Data appear Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	1.028	Mean	-0.51
SD	0.834	SD	1.238
95% DL/2 (t) UCL	1.36	95% H-Stat (DL/2) UCL	4.147

Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	-0.344
		SD in Log Scale	0.915
		Mean in Original Scale	1.018
		SD in Original Scale	0.799
		95% Percentile Bootstrap UCL	1.325
		95% BCA Bootstrap UCL	1.335

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only
k star (bias corrected)	2.119	Data appear Normal at 5% Significance Level
Theta Star	0.741	
nu star	42.37	
A-D Test Statistic	0.888	**Nonparametric Statistics**
5% A-D Critical Value	0.732	Kaplan-Meier (KM) Method
K-S Test Statistic	0.732	Mean 1.009
5% K-S Critical Value	0.269	SD 0.846
Data not Gamma Distributed at 5% Significance Level		SE of Mean 0.216
		95% KM (t) UCL 1.384
Assuming Gamma Distribution		95% KM (z) UCL 1.365
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL 1.361
Minimum	0.2	95% KM (bootstrap t) UCL 1.362
Maximum	2.591	95% KM (BCA) UCL 1.78
Mean	1.546	95% KM (Percentile Bootstrap) UCL 1.687
Median	1.5	95% KM (Chebyshev) UCL 1.952
SD	0.585	97.5% KM (Chebyshev) UCL 2.361
k star	3.947	99% KM (Chebyshev) UCL 3.163
Theta star	0.392	
Nu star	150	Potential UCLs to Use
AppChi2	122.7	95% KM (t) UCL 1.384
95% Gamma Approximate UCL	1.89	95% KM (Percentile Bootstrap) UCL 1.687
95% Adjusted Gamma UCL	1.924	

Note: DL/2 is not a recommended method.

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\lhilsche\Asarco Hayden\mar08\EPCs5\all5.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

File #	Media	Parameter
_18	Sediment	Nickel

General Statistics

Number of Valid Samples	20	Number of Unique Samples	19

Raw Statistics		**Log-transformed Statistics**	
Minimum	6.1	Minimum of Log Data	1.808
Maximum	21.8	Maximum of Log Data	3.082
Mean	14.89	Mean of log Data	2.646
Median	14.95	SD of log Data	0.36
SD	4.54		
Coefficient of Variation	0.305		
Skewness	-0.459		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.955	Shapiro Wilk Test Statistic	0.893
Shapiro Wilk Critical Value	0.905	Shapiro Wilk Critical Value	0.905
Data appear Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	16.64	95% H-UCL	17.56
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	20.34
95% Adjusted-CLT UCL	16.44	97.5% Chebyshev (MVUE) UCL	22.66
95% Modified-t UCL	16.62	99% Chebyshev (MVUE) UCL	27.21

Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	7.964	Data appear Normal at 5% Significance Level	
Theta Star	1.869		
nu star	318.6		
Approximate Chi Square Value (.05)	278.2	**Nonparametric Statistics**	
Adjusted Level of Significance	0.038	95% CLT UCL	16.55
Adjusted Chi Square Value	275.2	95% Jackknife UCL	16.64
		95% Standard Bootstrap UCL	16.52
Anderson-Darling Test Statistic	0.598	95% Bootstrap-t UCL	16.54
Anderson-Darling 5% Critical Value	0.742	95% Hall's Bootstrap UCL	16.42
Kolmogorov-Smirnov Test Statistic	0.144	95% Percentile Bootstrap UCL	16.47
Kolmogorov-Smirnov 5% Critical Value	0.194	95% BCA Bootstrap UCL	16.42
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	19.31
		97.5% Chebyshev(Mean, Sd) UCL	21.23
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	24.99
95% Approximate Gamma UCL	17.04		
95% Adjusted Gamma UCL	17.23		

Potential UCL to Use		Use 95% Student's-t UCL	16.64

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\lhilsche\Asarco Hayden\mar08\EPCs5\all5.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

File #	Media	Parameter
_19	Sediment	Potassium

General Statistics

Number of Valid Samples	20	Number of Unique Samples	20

Raw Statistics		**Log-transformed Statistics**	
Minimum	585	Minimum of Log Data	6.372
Maximum	3760	Maximum of Log Data	8.232
Mean	2450	Mean of log Data	7.68
Median	2605	SD of log Data	0.571
SD	1017		
Coefficient of Variation	0.415		
Skewness	-0.596		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.918	Shapiro Wilk Test Statistic	0.821
Shapiro Wilk Critical Value	0.905	Shapiro Wilk Critical Value	0.905
Data appear Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	2844	95% H-UCL	3345
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	3998
95% Adjusted-CLT UCL	2792	97.5% Chebyshev (MVUE) UCL	4635
95% Modified-t UCL	2839	99% Chebyshev (MVUE) UCL	5887

Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	3.607	Data appear Normal at 5% Significance Level	
Theta Star	679.4		
nu star	144.3		
Approximate Chi Square Value (.05)	117.5	**Nonparametric Statistics**	
Adjusted Level of Significance	0.038	95% CLT UCL	2824
Adjusted Chi Square Value	115.6	95% Jackknife UCL	2844
		95% Standard Bootstrap UCL	2810
Anderson-Darling Test Statistic	1.118	95% Bootstrap-t UCL	2806
Anderson-Darling 5% Critical Value	0.745	95% Hall's Bootstrap UCL	2787
Kolmogorov-Smirnov Test Statistic	0.203	95% Percentile Bootstrap UCL	2834
Kolmogorov-Smirnov 5% Critical Value	0.195	95% BCA Bootstrap UCL	2814
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	3442
		97.5% Chebyshev(Mean, Sd) UCL	3871
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	4713
95% Approximate Gamma UCL	3008		
95% Adjusted Gamma UCL	3058		

Potential UCL to Use		Use 95% Student's-t UCL	2844

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\lhilsche\Asarco Hayden\mar08\EPCs5\all5.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

File #	Media	Parameter
_20	Sediment	Selenium

General Statistics

Number of Valid Samples	19	Number of Detected Data	10
Number of Unique Samples	10	Number of Non-Detect Data	9
		Percent Non-Detects	47.37%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.51	Minimum Detected	-0.673
Maximum Detected	1.3	Maximum Detected	0.262
Mean of Detected	0.795	Mean of Detected	-0.263
SD of Detected	0.227	SD of Detected	0.272
Minimum Non-Detect	0.59	Minimum Non-Detect	-0.528
Maximum Non-Detect	1.4	Maximum Non-Detect	0.336

Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	19
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	0
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	100.00%

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.92	Shapiro Wilk Test Statistic	0.971
5% Shapiro Wilk Critical Value	0.842	5% Shapiro Wilk Critical Value	0.842
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.614	Mean	-0.575
SD	0.267	SD	0.429
95% DL/2 (t) UCL	0.72	95% H-Stat (DL/2) UCL	0.9

Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	-0.4
		SD in Log Scale	0.254
		Mean in Original Scale	0.693
		SD in Original Scale	0.199
		95% Percentile Bootstrap UCL	0.77
		95% BCA Bootstrap UCL	0.787

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	10.47	Data appear Normal at 5% Significance Level	
Theta Star	0.076		
nu star	209.3		
A-D Test Statistic	0.229	Nonparametric Statistics	
5% A-D Critical Value	0.725	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.725	Mean	0.698
5% K-S Critical Value	0.266	SD	0.202
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	0.0527
		95% KM (t) UCL	0.79
Assuming Gamma Distribution		95% KM (z) UCL	0.785
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	0.786
Minimum	0.51	95% KM (bootstrap t) UCL	0.815
Maximum	1.3	95% KM (BCA) UCL	0.811
Mean	0.797	95% KM (Percentile Bootstrap) UCL	0.793
Median	0.779	95% KM (Chebyshev) UCL	0.928
SD	0.164	97.5% KM (Chebyshev) UCL	1.027
k star	22.47	99% KM (Chebyshev) UCL	1.223
Theta star	0.0354		
Nu star	854	Potential UCLs to Use	
AppChi2	787.2	95% KM (t) UCL	0.79
95% Gamma Approximate UCL	0.864	95% KM (Percentile Bootstrap) UCL	0.793
95% Adjusted Gamma UCL	0.87		

Note: DL/2 is not a recommended method.

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\lhilsche\Asarco Hayden\mar08\EPCs5\all5.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

File #	Media	Parameter
_21	Sediment	Sodium

General Statistics

Number of Valid Samples	19	Number of Detected Data	12
Number of Unique Samples	12	Number of Non-Detect Data	7
		Percent Non-Detects	36.84%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	387	Minimum Detected	5.958
Maximum Detected	2790	Maximum Detected	7.934
Mean of Detected	1132	Mean of Detected	6.918
SD of Detected	613.9	SD of Detected	0.491
Minimum Non-Detect	265	Minimum Non-Detect	5.58
Maximum Non-Detect	633	Maximum Non-Detect	6.45

Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	8
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	11
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	42.11%

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.834	Shapiro Wilk Test Statistic	0.976
5% Shapiro Wilk Critical Value	0.859	5% Shapiro Wilk Critical Value	0.859
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	800	Mean	6.364
SD	656	SD	0.853
95% DL/2 (t) UCL	1061	95% H-Stat (DL/2) UCL	1411
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	713.1	Mean in Log Scale	6.51
SD	772.8	SD in Log Scale	0.674
95% MLE (t) UCL	1021	Mean in Original Scale	838.4
95% MLE (Tiku) UCL	1065	SD in Original Scale	621.6
		95% Percentile Bootstrap UCL	1087
		95% BCA Bootstrap UCL	1138

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	3.483	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	324.9		
nu star	83.6		
A-D Test Statistic	0.284	Nonparametric Statistics	
5% A-D Critical Value	0.734	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.734	Mean	857.3
5% K-S Critical Value	0.246	SD	589.3
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	141.2
		95% KM (t) UCL	1102
Assuming Gamma Distribution		95% KM (z) UCL	1090
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	1080
Minimum	365.4	95% KM (bootstrap t) UCL	1194
Maximum	2790	95% KM (BCA) UCL	1232
Mean	1000	95% KM (Percentile Bootstrap) UCL	1159
Median	843.8	95% KM (Chebyshev) UCL	1473
SD	521.9	97.5% KM (Chebyshev) UCL	1739
k star	4.359	99% KM (Chebyshev) UCL	2262
Theta star	229.5		
Nu star	165.6	Potential UCLs to Use	
AppChi2	136.9	95% KM (Percentile Bootstrap) UCL	1159
95% Gamma Approximate UCL	1211		
95% Adjusted Gamma UCL	1231		

Note: DL/2 is not a recommended method.

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\lhilsche\Asarco Hayden\mar08\EPCs5\all5.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

File #	Media	Parameter
_22	Sediment	Thallium

General Statistics

Number of Valid Samples	20	Number of Detected Data	6
Number of Unique Samples	6	Number of Non-Detect Data	14
		Percent Non-Detects	70.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.57	Minimum Detected	-0.562
Maximum Detected	1.2	Maximum Detected	0.182
Mean of Detected	0.84	Mean of Detected	-0.213
SD of Detected	0.259	SD of Detected	0.305
Minimum Non-Detect	0.8	Minimum Non-Detect	-0.223
Maximum Non-Detect	1.9	Maximum Non-Detect	0.642

Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	20
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	0
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	100.00%

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.902	Shapiro Wilk Test Statistic	0.92
5% Shapiro Wilk Critical Value	0.788	5% Shapiro Wilk Critical Value	0.788
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.656	Mean	-0.475
SD	0.23	SD	0.327
95% DL/2 (t) UCL	0.744	95% H-Stat (DL/2) UCL	0.996

Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	-0.324
		SD in Log Scale	0.183
		Mean in Original Scale	0.736
		SD in Original Scale	0.156
		95% Percentile Bootstrap UCL	0.799
		95% BCA Bootstrap UCL	0.812

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only
k star (bias corrected)	6.594	Data appear Normal at 5% Significance Level
Theta Star	0.127	
nu star	79.13	

		Nonparametric Statistics	
A-D Test Statistic	0.334		
5% A-D Critical Value	0.698	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.698	Mean	0.74
5% K-S Critical Value	0.332	SD	0.186
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	0.065
		95% KM (t) UCL	0.852
Assuming Gamma Distribution		95% KM (z) UCL	0.847
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	0.861
Minimum	0.57	95% KM (bootstrap t) UCL	0.868
Maximum	1.2	95% KM (BCA) UCL	0.88
Mean	0.864	95% KM (Percentile Bootstrap) UCL	0.861
Median	0.864	95% KM (Chebyshev) UCL	1.023
SD	0.149	97.5% KM (Chebyshev) UCL	1.146
k star	29.45	99% KM (Chebyshev) UCL	1.387
Theta star	0.0293		
Nu star	1178	Potential UCLs to Use	
AppChi2	1099	95% KM (t) UCL	0.852
95% Gamma Approximate UCL	0.926	95% KM (Percentile Bootstrap) UCL	0.861
95% Adjusted Gamma UCL	0.931		

Note: DL/2 is not a recommended method.

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\lhilsche\Asarco Hayden\mar08\EPCs5\all5.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

File #	Media	Parameter
_23	Sediment	Vanadium

General Statistics

Number of Valid Samples	20	Number of Unique Samples	19

Raw Statistics		**Log-transformed Statistics**	
Minimum	14.2	Minimum of Log Data	2.653
Maximum	60.7	Maximum of Log Data	4.106
Mean	38.2	Mean of log Data	3.579
Median	39.55	SD of log Data	0.391
SD	12.52		
Coefficient of Variation	0.328		
Skewness	-0.269		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.966	Shapiro Wilk Test Statistic	0.887
Shapiro Wilk Critical Value	0.905	Shapiro Wilk Critical Value	0.905
Data appear Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	43.03	95% H-UCL	45.93
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	53.58
95% Adjusted-CLT UCL	42.62	97.5% Chebyshev (MVUE) UCL	60.09
95% Modified-t UCL	43.01	99% Chebyshev (MVUE) UCL	72.87

Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	6.862	Data appear Normal at 5% Significance Level	
Theta Star	5.566		
nu star	274.5		
Approximate Chi Square Value (.05)	237.1	**Nonparametric Statistics**	
Adjusted Level of Significance	0.038	95% CLT UCL	42.8
Adjusted Chi Square Value	234.4	95% Jackknife UCL	43.03
		95% Standard Bootstrap UCL	42.72
Anderson-Darling Test Statistic	0.537	95% Bootstrap-t UCL	42.75
Anderson-Darling 5% Critical Value	0.743	95% Hall's Bootstrap UCL	42.53
Kolmogorov-Smirnov Test Statistic	0.153	95% Percentile Bootstrap UCL	42.6
Kolmogorov-Smirnov 5% Critical Value	0.194	95% BCA Bootstrap UCL	42.77
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	50.4
		97.5% Chebyshev(Mean, Sd) UCL	55.68
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	66.05
95% Approximate Gamma UCL	44.21		
95% Adjusted Gamma UCL	44.73		

Potential UCL to Use		Use 95% Student's-t UCL	43.03

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\lhilsche\Asarco Hayden\mar08\EPCs5\all5.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

File #	Media	Parameter
_24	Sediment	Zinc

General Statistics

Number of Valid Samples	20	Number of Unique Samples	20

Raw Statistics		**Log-transformed Statistics**	
Minimum	14.5	Minimum of Log Data	2.674
Maximum	74.9	Maximum of Log Data	4.316
Mean	50.75	Mean of log Data	3.835
Median	50.9	SD of log Data	0.485
SD	18.6		
Coefficient of Variation	0.366		
Skewness	-0.692		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.908	Shapiro Wilk Test Statistic	0.817
Shapiro Wilk Critical Value	0.905	Shapiro Wilk Critical Value	0.905
Data appear Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	57.93	95% H-UCL	64.98
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	77.06
95% Adjusted-CLT UCL	56.9	97.5% Chebyshev (MVUE) UCL	88.02
95% Modified-t UCL	57.83	99% Chebyshev (MVUE) UCL	109.5

Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	4.807	Data appear Normal at 5% Significance Level	
Theta Star	10.56		
nu star	192.3		
Approximate Chi Square Value (.05)	161.2	**Nonparametric Statistics**	
Adjusted Level of Significance	0.038	95% CLT UCL	57.58
Adjusted Chi Square Value	159	95% Jackknife UCL	57.93
		95% Standard Bootstrap UCL	57.34
Anderson-Darling Test Statistic	1.213	95% Bootstrap-t UCL	57.23
Anderson-Darling 5% Critical Value	0.745	95% Hall's Bootstrap UCL	57.05
Kolmogorov-Smirnov Test Statistic	0.238	95% Percentile Bootstrap UCL	57.32
Kolmogorov-Smirnov 5% Critical Value	0.194	95% BCA Bootstrap UCL	57.24
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	68.87
		97.5% Chebyshev(Mean, Sd) UCL	76.71
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	92.12
95% Approximate Gamma UCL	60.53		
95% Adjusted Gamma UCL	61.38		

Potential UCL to Use		Use 95% Student's-t UCL	57.93

Summary Statistics

Table of Contents for In Stream Sediment - Appendix F
Baseline Human Health Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Table #	Title
Table F-1	Summary Statistics for Sediment
Table F-2	Risk Calculation Worksheet for In Stream Sediment - Carcinogenic Effects - Recreation Exposure Scenario
Table F-3	Risk Calculation Worksheet for In Stream Sediment - Noncarcinogenic Effects - Recreation Exposure Scenario
Table F-4	Detailed Summary of Recreation Cancer Risks and Noncancer Hazards - Gila River and San Pedro River - In Stream Sediment
Table F-5	Summary of Recreation Cancer Risks and Noncancer Hazards - Gila River and San Pedro River - In Stream Sediment
Table F-6	Gila River and San Pedro River - In Stream Sediment - Summary of Recreation Cancer Risks and Noncancer Hazards (including EPCs and lead screening levels)

Table F-1
Summary Statistics for Sediment
Baseline Human Health Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Parameter	Number of Detects	Number of Analyses	Percent Detects	Units	Minimum Detected Value	Maximum Detected Value	Minimum DL for Non-detects	Maximum DL for Non-detects	Location of Maximum Detected Concentration	Arithmetic Mean Value	Standard Deviation	Exposure Point Concentration	EPC Basis	Exposure Point Concentration (may be Max)	EPC Basis (may be Max)
Aluminum	20	20	100	mg/kg	4,240	20,400	NA	NA	GR-SED-03	14,000	5,070	16,000	95% Student's-t UCL	16,000	95% Student's-t UCL
Antimony	19	20	95	mg/kg	0.4	1.2	1.2	1.2	GR-SED-08	0.704	0.26	0.804	95% KM (BCA) UCL	0.804	95% KM (BCA) UCL
Arsenic	20	20	100	mg/kg	1.1	5.5	NA	NA	GR-SED-11	3.68	1.36	4.21	95% Student's-t UCL	4.21	95% Student's-t UCL
Barium	20	20	100	mg/kg	51.8	180	NA	NA	GR-SED-09	133	42.6	150	95% Student's-t UCL	150	95% Student's-t UCL
Beryllium	20	20	100	mg/kg	0.09	1	NA	NA	GR-SED-09	0.572	0.269	0.676	95% Student's-t UCL	0.676	95% Student's-t UCL
Boron	20	20	100	mg/kg	0.81	10.9	NA	NA	GR-SED-03	5.87	3.07	7.06	95% Student's-t UCL	7.06	95% Student's-t UCL
Cadmium	5	19	26	mg/kg	0.03	0.11	0.46	1.1	GR-SED-11	0.233	0.13	0.0809	95% KM (t) UCL	0.0809	95% KM (t) UCL
Calcium	20	20	100	mg/kg	7,800	41,900	NA	NA	GR-SED-03	27,500	10,600	37,800	95% Chebyshev (Mean, Sd) UCL	37,800	95% Chebyshev (Mean, Sd) UCL
Chromium	20	20	100	mg/kg	4.3	21	NA	NA	GR-SED-08	12.5	4.6	14.3	95% Student's-t UCL	14.3	95% Student's-t UCL
Cobalt	20	20	100	mg/kg	3.2	14.8	NA	NA	GR-SED-03	9.56	3.22	10.8	95% Student's-t UCL	10.8	95% Student's-t UCL
Copper	20	20	100	mg/kg	11.6	392	NA	NA	GR-SED-03	110	82.5	149	95% Approximate Gamma UCL	149	95% Approximate Gamma UCL
Iron	20	20	100	mg/kg	6,890	26,300	NA	NA	GR-SED-08	17,400	5,210	19,400	95% Student's-t UCL	19,400	95% Student's-t UCL
Lead	20	20	100	mg/kg	3.4	21.2	NA	NA	GR-SED-09	14.2	5.52	16.3	95% Student's-t UCL	16.3	95% Student's-t UCL
Magnesium	20	20	100	mg/kg	2,260	9,910	NA	NA	GR-SED-03	6,850	2,300	7,740	95% Student's-t UCL	7,740	95% Student's-t UCL
Manganese	20	20	100	mg/kg	113	2,410	NA	NA	GR-SED-03	721	559	973	95% Approximate Gamma UCL	973	95% Approximate Gamma UCL
Mercury	10	19	53	mg/kg	0.03	0.1	0.024	0.066	GR-SED-08	0.0487	0.0322	0.0643	95% KM (t) UCL	0.0643	95% KM (t) UCL
Molybdenum	10	19	53	mg/kg	0.2	2.4	0.09	2.5	GR-SED-08	1.03	0.834	1.38	95% KM (t) UCL	1.38	95% KM (t) UCL
Nickel	20	20	100	mg/kg	6.1	21.8	NA	NA	GR-SED-03	14.9	4.54	16.6	95% Student's-t UCL	16.6	95% Student's-t UCL
Potassium	20	20	100	mg/kg	585	3,760	NA	NA	GR-SED-11	2,450	1,020	2,840	95% Student's-t UCL	2,840	95% Student's-t UCL
Selenium	10	19	53	mg/kg	0.51	1.3	0.59	1.4	GR-SED-03	0.614	0.267	0.79	95% KM (t) UCL	0.79	95% KM (t) UCL
Sodium	12	19	63	mg/kg	387	2,790	265	633	GR-SED-07	800	656	1,160	95% KM (Percentile Bootstrap) UCL	1,160	95% KM (Percentile Bootstrap) UC
Thallium	6	20	30	mg/kg	0.57	1.2	0.8	1.9	GR-SED-11	0.656	0.23	0.852	95% KM (t) UCL	0.852	95% KM (t) UCL
Vanadium	20	20	100	mg/kg	14.2	60.7	NA	NA	GR-SED-08	38.2	12.5	43	95% Student's-t UCL	43	95% Student's-t UCL
Zinc	20	20	100	mg/kg	14.5	74.9	NA	NA	GR-SED-08	50.7	18.6	57.9	95% Student's-t UCL	57.9	95% Student's-t UCL

Risk Calculations

Table F-2
Risk Calculation Worksheet for In Stream Sediment - Carcinogenic Effects - Recreation Exposure Scenario
Baseline Human Health Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Exposure Scenario Information		
	Exposure Scenario:	Recreation
	Scenario Timeframe:	Chronic
	Exposure Medium:	Sediment
	Exposure Point:	In Stream
	Receptor Population:	Adult/Child Angler
	Receptor Age:	Child

Exposure Scenario/Exposure Area Description

Site Risks
Gila River and San Pedro River - In Stream Sediment

Exposure Parameter	Variable	Adult Value	Child Value	Units
Exposure Frequency	EF	100	100	day/yr
Exposure Duration	ED	24	6	yr
Exposure Time	ET	2	2	hrs/day
Soil Ingestion Rate	IR	100	200	mg/day
Skin Surface Area (Sediment Contact; 1 event per day)	SA_s	5700	3000	cm^2/day [sediment]
Body Weight	BW	70	28	kg
Averaging Time for carcinogens	ATc	70	70	yr
Averaging Time for noncarcinogens	ATnc	24	6	yr
Conversion Factor (yr to day)	CF_1	2.74E-03	2.74E-03	yrs/day
Conversion Factor (mg to kg)	CF_2	1.00E-06	1.00E-06	kg/mg
Bioavailability Factor for Arsenic	BAF_As	0.8	0.8	unitless
Dermal Absorption Arsenic	ABS_As	0.03	0.03	unitless
Dermal Absorption for Other Inorganics	ABS	0.01	0.01	unitless
Adherence Factor	AF	0.07	0.2	mg/cm^2

Risk Calculations

		Exposure Route = Oral			Exposure Route = Dermal			Exposure Route = Inhalation			
Chemical of Potential Concern	**RME Medium EPC Value, Cs [mg/kg]**	**Chronic Daily Intake [mg/kg/day]**	**Cancer Slope Factor, SF $[mg/kg/day]^{-1}$**	**Cancer Risk [-]**	**Chronic Daily Intake [mg/kg/day]**	**Cancer Slope Factor, SF $[mg/kg/day]^{-1}$**	**Cancer Risk [-]**	**Chronic Daily Intake [mg/kg/day]**	**Cancer Slope Factor, SF $[mg/kg/day]^{-1}$**	**Cancer Risk [-]**	**Total Cancer Risk [-]**
Adult Angler											
Arsenic	4.21E+00	4.52E-07	1.50E+00	6.78E-07	6.76E-08	1.50E+00	1.01E-07	NA	1.51E+01		7.79E-07
Copper	1.49E+02	2.00E-05	NA		7.98E-07	NA		NA	NA		
Iron	1.94E+04	2.60E-03	NA		1.04E-04	NA		NA	NA		
Manganese	9.73E+02	1.31E-04	NA		5.21E-06	NA		NA	NA		
Vanadium	4.30E+01	5.77E-06	NA		2.30E-07	NA		NA	NA		
Child Angler											
Arsenic	4.21E+00	5.63E-07	1.50E+00	8.44E-07	6.33E-08	1.50E+00	9.50E-08	NA	1.51E+01		9.39E-07
Copper	1.49E+02	2.49E-05	NA		7.47E-07	NA		NA	NA		
Iron	1.94E+04	3.24E-03	NA		9.73E-05	NA		NA	NA		
Manganese	9.73E+02	1.63E-04	NA		4.88E-06	NA		NA	NA		
Vanadium	4.30E+01	7.19E-06	NA		2.16E-07	NA		NA	NA		
Total Adult Angler				6.8E-07			1.0E-07			0.0E+00	7.8E-07
Total Child Angler				8.4E-07			9.5E-08			0.0E+00	9.4E-07
Total Adult/Child Angler		(88.6% Contribution)		1.5E-06	(11.4% Contribution)		2.0E-07	(0% Contribution)		0.0E+00	1.7E-06

Notes:
NA = no data; this toxicity value is not available in the standard U.S. EPA toxicity value databases. Inhalation of nonvolatile chemicals and particulates was not considered for sediment.
RME = reasonable maximum exposure.
EPC = exposure point concentration.

Table F-3
Risk Calculation Worksheet for In Stream Sediment - Noncarcinogenic Effects - Recreation Exposure Scenario
Baseline Human Health Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Exposure Scenario Information		
	Exposure Scenario:	Recreation
	Scenario Timeframe:	Chronic
	Exposure Medium:	Sediment
	Exposure Point:	In Stream
	Receptor Population:	Adult Angler
	Receptor Age:	Child

Exposure Scenario/Exposure Area Description

Site Risks
Gila River and San Pedro River - In Stream Sediment

Exposure Parameter	Variable	Adult Value	Child Value	Units
Exposure Frequency	EF	100	100	day/yr
Exposure Duration	ED	24	6	yr
Exposure Time	ET	2	2	hrs/day
Soil Ingestion Rate	IR	100	200	mg/day
Skin Surface Area (Sediment Contact; 1 event per day)	SA_s	5700	3000	cm^2/day [sediment]
Body Weight	BW	70	28	kg
Averaging Time for carcinogens	ATc	70	70	yr
Averaging Time for noncarcinogens	ATnc	24	6	yr
Conversion Factor (yr to day)	CF_1	2.74E-03	2.74E-03	yrs/day
Conversion Factor (mg to kg)	CF_2	1.00E-06	1.00E-06	kg/mg
Bioavailability Factor for Arsenic	BAF_As	0.8	0.8	unitless
Dermal Absorption Arsenic	ABS_As	0.03	0.03	unitless
Dermal Absorption for Other Inorganics	ABS	0.01	0.01	unitless
Adherence Factor	AF	0.07	0.2	mg/cm^2

Risk Calculations

		Exposure Route = Oral			Exposure Route = Dermal			Exposure Route = Inhalation			
Chemical of Potential Concern	**RME Medium EPC Value, Cs [mg/kg]**	**Chronic Daily Intake [mg/kg/day]**	**Reference Dose RfD [mg/kg/day]**	**Hazard Quotient [-]**	**Chronic Daily Intake [mg/kg/day]**	**Reference Dose RfD [mg/kg/day]**	**Hazard Quotient [-]**	**Chronic Daily Intake [mg/kg/day]**	**Reference Dose RfD [mg/kg/day]**	**Hazard Quotient [-]**	**Total Hazard Quotient [-]**
Adult Angler											
Arsenic	4.21E+00	1.32E-06	3.00E-04	4.39E-03	1.97E-07	3.00E-04	6.57E-04	NA	NA		5.05E-03
Copper	1.49E+02	5.83E-05	4.00E-02	1.46E-03	2.33E-06	4.00E-02	5.82E-05	NA	NA		1.52E-03
Iron	1.94E+04	7.59E-03	3.00E-01	2.53E-02	3.03E-04	3.00E-01	1.01E-03	NA	NA		2.63E-02
Manganese	9.73E+02	3.81E-04	1.40E-02	2.72E-02	1.52E-05	1.40E-02	1.09E-03	NA	1.40E-05		2.83E-02
Vanadium	4.30E+01	1.68E-05	1.00E-03	1.68E-02	6.72E-07	1.00E-03	6.72E-04	NA	NA		1.75E-02
Child Angler											
Arsenic	4.21E+00	6.57E-06	3.00E-04	2.19E-02	7.39E-07	3.00E-04	2.46E-03	NA	NA		2.44E-02
Copper	1.49E+02	2.91E-04	4.00E-02	7.26E-03	8.72E-06	4.00E-02	2.18E-04	NA	NA		7.48E-03
Iron	1.94E+04	3.78E-02	3.00E-01	1.26E-01	1.13E-03	3.00E-01	3.78E-03	NA	NA		1.30E-01
Manganese	9.73E+02	1.90E-03	1.40E-02	1.36E-01	5.69E-05	1.40E-02	4.07E-03	NA	1.40E-05		1.40E-01
Vanadium	4.30E+01	8.38E-05	1.00E-03	8.38E-02	2.52E-06	1.00E-03	2.52E-03	NA	NA		8.64E-02
Total Adult Angler				7.5E-02			3.5E-03			0.0E+00	0.079
Total Child Angler			(96.6% Contribution)	3.7E-01		(3.4% Contribution)	1.3E-02		(0% Contribution)	0.0E+00	0.4

Notes:
NA = no data; this toxicity value is not available in the standard U.S. EPA toxicity value databases. Inhalation of nonvolatile chemicals and particulates was not considered for sediment.
RME = reasonable maximum exposure.
EPC = exposure point concentration.

Table F-4
Detailed Summary of Recreation Cancer Risks and Noncancer Hazards - Gila River and San Pedro River - In Stream Sediment
Baseline Human Health Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Property	Receptor	COPC	RME Medium EPC Value (mg/kg)	Carcinogenic Risk Oral	Carcinogenic Risk Dermal	Carcinogenic Risk Inhalation	Carcinogenic Risk Total	Noncarcinogenic HI Oral	Noncarcinogenic HI Dermal	Noncarcinogenic HI Inhalation	Noncarcinogenic HI Total
In Stream Sediment	**Adult Angler**	Arsenic	4.21E+00	6.78E-07	1.01E-07		7.79E-07	4.39E-03	6.57E-04		5.05E-03
		Copper	1.49E+02					1.46E-03	5.82E-05		1.52E-03
		Iron	1.94E+04					2.53E-02	1.01E-03		2.63E-02
		Manganese	9.73E+02					2.72E-02	1.09E-03		2.83E-02
		Vanadium	4.30E+01					1.68E-02	6.72E-04		1.75E-02
		Total					7.8E-07				0.079
	Child Angler	Arsenic	4.21E+00	8.44E-07	9.50E-08		9.39E-07	2.19E-02	2.46E-03		2.44E-02
		Copper	1.49E+02					7.26E-03	2.18E-04		7.48E-03
		Iron	1.94E+04					1.26E-01	3.78E-03		1.30E-01
		Manganese	9.73E+02					1.36E-01	4.07E-03		1.40E-01
		Vanadium	4.30E+01					8.38E-02	2.52E-03		8.64E-02
		Total					9.4E-07				0.4
	Adult/Child Angler	Arsenic	4.21E+00	1.52E-06	1.96E-07		1.72E-06				
		Copper	1.49E+02								
		Iron	1.94E+04								
		Manganese	9.73E+02								
		Vanadium	4.30E+01								
		Total					1.7E-06				NA

Notes:
NA = Not applicable

Table F-5
Summary of Recreation Cancer Risks and Noncancer Hazards - Gila River and San Pedro River - In Stream Sediment
Baseline Human Health Risk Assessment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Property	Adult plus Child Cancer Risks	Child Noncancer Hazards
In Stream Sediment	2E-06	0.4

Table F-6
Gila River and San Pedro River - In Stream Sediment - Summary of Recreation Cancer Risks and Noncancer Hazards (including EPCs and lead screening levels)
Baseline Human Health Risk Assesment
ASARCO LLC Hayden Plant Site, Hayden, Arizona

Property	Recreation Adult/Child Cancer Risks	Recreation Child Noncancer Hazards	Lead Exposure Point Conc. (mg/kg)	Does Lead Concentration Exceed Screening Level of 212 mg/kg (excluding homegrown produce)?	Does Lead Concentration Exceed Screening Level of 122 mg/kg (including homegrown produce)?
In Stream Sediment	2E-06	0.4	16	No	No