APPENDIX – A

VSP Sample Design Report for Calculating a Two-Sided Confidence Interval for the Population Median Using Simple Random Sampling

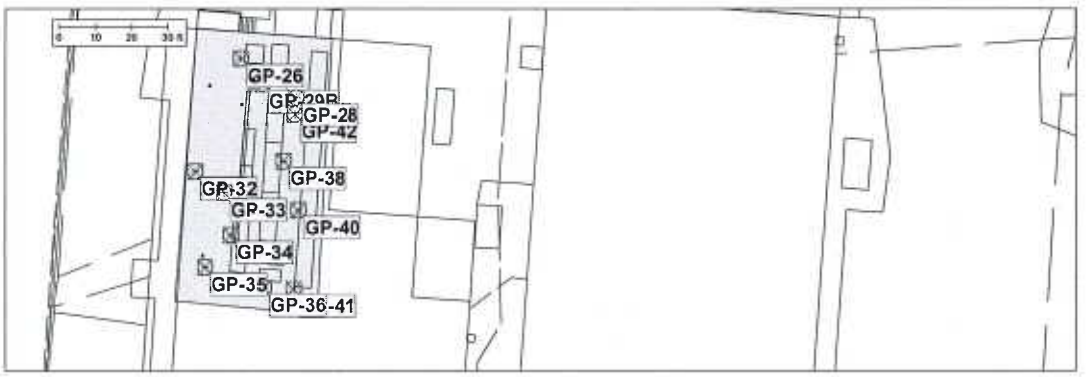
Summary

This report summarizes the sampling design used, associated statistical assumptions, as well as general guidelines for conducting post-sampling data analysis. Sampling plan components presented here include how many sampling locations to choose and where within the sampling area to collect those samples. The type of medium to sample (i.e., soil, groundwater, etc.) and how to analyze the samples (in-situ, fixed laboratory, etc.) are addressed in other sections of the sampling plan.

The following table summarizes the sampling design developed. A figure that shows sampling locations in the field and a table that lists sampling location coordinates are also provided below.

SUMMARY OF SAMPLING DESIGN	
Primary Objective of Design	Construct a Confidence Interval on the True Median
Type of Sampling Design	Non-Parametric
Sample Placement (Location) in the Field	Simple random sampling
Formula for calculating number of sampling locations	Nonparametric Confidence Limits
Calculated total number of samples	15
Number of samples on map [a]	18
Number of selected sample areas [b]	1
Specified sampling area [c]	2826.73 ft^2
Total cost of sampling [d]	$2,890.00

[a] This number may differ from the calculated number because of 1) grid edge effects, 2) adding judgment samples, or 3) selecting or unselecting sample areas.
[b] The number of selected sample areas is the number of colored areas on the map of the site. These sample areas contain the locations where samples are collected.
[c] The sampling area is the total surface area of the selected colored sample areas on the map of the site.
[d] Including measurement analyses and fixed overhead costs. See the Cost of Sampling section for an explanation of the costs presented here.



Area: Area 3					
X Coord	**Y Coord**	**Label**	**Value**	**Type**	**Historical**
4947.9347	5089.9428	GP-41	0.292	Random	
4921.1000	5121.6752	GP-32	1.88	Random	
4939.5678	5145.4075	GP-29B	0.351	Random	

4930.8339	5104.5202	GP-34	2.03	Random	
4948.3017	5137.2526	GP-42	0.303	Random	
4939.8843	5090.2245	GP-36	0.298	Random	
4929.1504	5115.9569	GP-33	2.11	Random	
4948.6182	5141.6892	GP-28	1.75	Random	
4923.7835	5095.8019	GP-35	0.303	Random	
4945.2513	5124.5343	GP-38	0.519	Random	
4933.5174	5152.2667	GP-26	0.298	Random	
4949.2765	5111.1916	GP-40	0.303	Random	
4937.0000	5147.0000	GP-27B	0.566	Unknown	
4934.0000	5140.0000	GP-31	1.67	Unknown	
4925.0000	5145.0000	GP-30	0.311	Unknown	
4937.0000	5111.0000	GP-37	0.481	Unknown	
4957.0000	5134.0000	GP-39	1.97	Unknown	
4923.0000	5099.0000	HA-1	57.5	Unknown	

Primary Sampling Objective
The primary purpose of sampling at this site is to construct a confidence interval on the true population median value. After the samples are collected and analyzed, the resulting sample values can be used to construct a two-sided confidence interval. Once the confidence interval is computed (which will be an upper and a lower threshold), you can have the specified confidence that the true population median is between the upper and lower thresholds.

Selected Sampling Approach
A non-parametric random sampling approach was used to determine the number of samples and to specify sampling locations. A parametric formula was not chosen because the conceptual model and historical information (e.g., historical data from this site or a very similar site) indicate that parametric assumptions are not true. These assumptions will be examined in post-sampling data analysis.

Both parametric and non-parametric equations rely on assumptions about the population. Typically, however, non-parametric equations require fewer assumptions and allow for more uncertainty about the statistical distribution of values at the site. The trade-off is that if the parametric assumptions are valid, the required number of samples is usually less than if a non-parametric equation was used.

Locating the sample points randomly provides data that are separated by many distances, whereas systematic samples are all equidistant apart. Therefore, random sampling provides more information about the spatial structure of the potential contamination than systematic sampling does. As with systematic sampling, random sampling also provides information regarding the mean or median value, but there is the possibility that areas of the site will not be represented with the same frequency as if uniform grid sampling were performed.

Number of Total Samples: Calculation Equation and Inputs
Two sample confidence interval calculation methods are available for when n□20 and n>20 (Conover, 1980, p. 111-117) (Gilbert, 1987,p. 141-142). In VSP, the user specifies a one-sided or two-sided CI, and the percent confidence desired to be within a specified number of percentiles of the median. A binary search is then performed on the CI equations to solve for the minimum sample size to satisfy these parameters. VSP first uses the n□20 method to determine if a solution can be found where n□20, and if not, then uses the n>20 method.

For a one-sided CI, the n□20 method follows a binomial distribution and determines the lowest value of n where the yth quantile of the sample would be equal to or above the true median at least X% of the time (Note that the sample sizes work out to be the same regardless of whether the CI will be a lower or upper tailed, so the same formula can be used for any one-sided CI). X% is the specified confidence for one-sided confidence intervals, and the average of 100% and the specified confidence for two-sided confidence intervals. The yth quantile is determined by taking 50% and subtracting the allowable number of percentiles from the median specified by the user.

For a two-sided CI, the n□20 method is the same as performing a one-sided confidence interval, but replacing the

specified percent confidence with the average of 100% and the specified percent confidence. If no solution is found where n□20, a binary search is conducted using Equation (1) for a one-sided CI and Equation (2) for a two-sided interval to compute the value of r (r is the the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest), rounding r up to the next higher integer. The search is repeated until the smallest n is found where 100*2*r/n is greater than 50% minus the allowable number of percentiles from the median specified by the user.

$$r = 0.5 * n - 0.5 * w_{\alpha} \sqrt{n} \qquad (1)$$

$$r = 0.5 * n - 0.5 * w_{\alpha/2} \sqrt{n} \qquad (2)$$

Where:

n is the sample size

r is the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest

$w_{\square}$ is the specified quantile of a normal distribution, e.g. if □=0.2 then $w_{\square}$ is the 0.2 quantile (20th percentile) of a normal distribution.

The n>20 method described above is an approximation method, so VSP also performs a final check using a binomial distribution in a similar manner to the n□20 method, and may increase the sample size by 1 to ensure the specified confidence levels are met.

Cost of Sampling

The total cost of the completed sampling program depends on several cost inputs, some of which are fixed, and others that are based on the number of samples collected and measured. Based on the numbers of samples determined above, the estimated total cost of sampling and analysis at this site is $2,890.00, which averages out to a per sample cost of $192.67. The following table summarizes the inputs and resulting cost estimates.

COST INFORMATION			
Cost Details	**Per Analysis**	**Per Sample**	**15 Samples**
Field collection costs		$100.00	$1,500.00
Analytical costs	$26.00	$26.00	$390.00
Sum of Field & Analytical costs		**$126.00**	**$1,890.00**
Fixed planning and validation costs			$1,000.00
Total cost			**$2,890.00**

Data Analysis for Cr +6

The following data points were entered by the user for analysis.

Cr +6										
Rank	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
0	0.292	0.298	0.298	0.303	0.303	0.303	0.311	0.351	0.481	0.519
10	0.566	1.67	1.75	1.88	1.97	2.03	2.11	57.5		

SUMMARY STATISTICS for Cr +6	
n	18
Min	0.292
Max	57.5

Range	57.208
Mean	4.0519
Median	0.5
Variance	178.48
StdDev	13.36
Std Error	3.1489
Skewness	4.2206
Interquartile Range	1.5995

Percentiles								
1%	**5%**	**10%**	**25%**	**50%**	**75%**	**90%**	**95%**	**99%**
0.292	0.292	0.2974	0.303	0.5	1.902	7.649	57.5	57.5

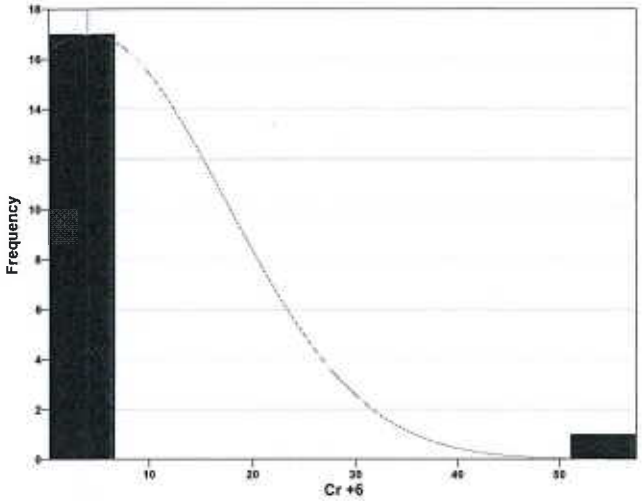
Data Plots

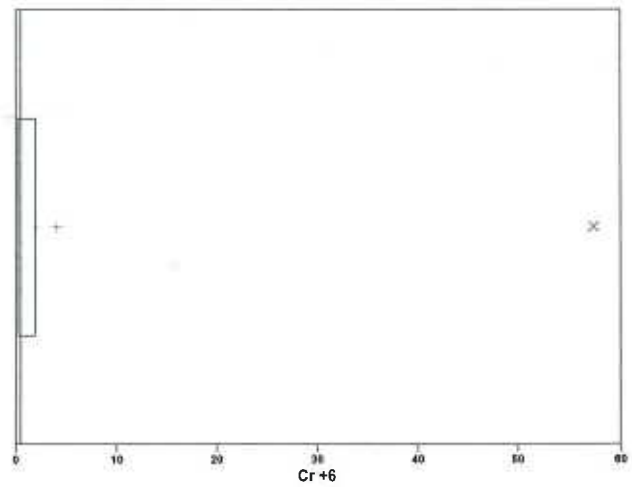
Three graphical displays of the data are shown below: the Histogram, the Box and Whiskers plot, and the Quantile-Quantile (Q-Q) plot.

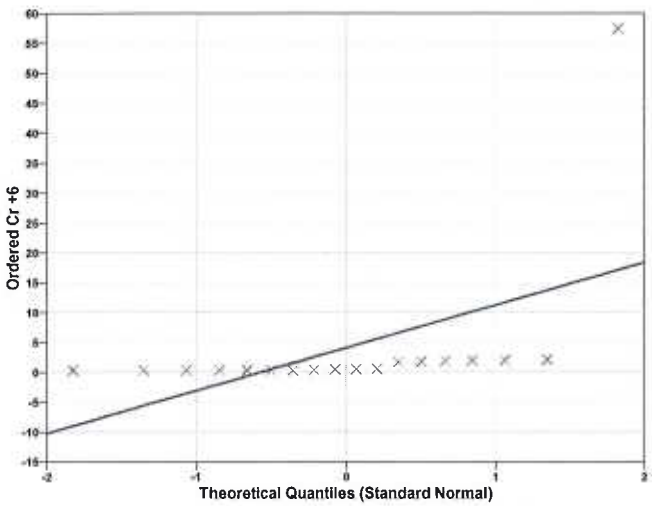
The Histogram is a plot of the fraction of the n observed data that fall within specified data "bins." A histogram is generated by dividing the x axis (range of the observed data values) into "bins" and displaying the number of data in each bin as the height of a bar for the bin. The area of the bar is the fraction of the n data values that lie within the bin. The sum of the fractions for all bins equals one. A histogram is used to assess how the n data are distributed (spread) over their range of values. If the histogram is more or less symmetric and bell shaped, then the data may be normally distributed.

The Box and Whiskers plot is composed of a central box divided by a line, and with two lines extending out from the box, called the "whiskers". The line through the box is drawn at the median of the n data observed. The two ends of the box represent the 25th and 75th percentiles of the n data values, which are also called the lower and upper quartiles, respectively, of the data set. The sample mean (mean of the n data) is shown as a "+" sign. The upper whisker extends to the largest data value that is less than the upper quartile plus 1.5 times the interquartile range (upper quartile minus the lower quartile). The lower whisker extends to the smallest data value that is greater than the lower quartile minus 1.5 times the interquartile range. Extreme data values (greater or smaller than the ends of the whiskers) are plotted individually. A Box and Whiskers plot is used to assess the symmetry of the distribution of the data set. If the distribution is symmetrical, the box is divided into two equal halves by the median, the whiskers will be the same length, and the number of extreme data points will be distributed equally on either end of the plot.

The Q-Q plot graphs the quantiles of a set of n data against the quantiles of a specific distribution. We show here only the Q-Q plot for an assumed normal distribution. The pth quantile of a distribution of data is the data value, x_p, for which a fraction p of the distribution is less than x_p. If the data plotted on the normal distribution Q-Q plot closely follow a straight line, even at the ends of the line, then the data may be assumed to be normally distributed. If the data points deviate substantially from a linear line, then the data are not normally distributed.







For more information on these three plots consult Guidance for Data Quality Assessment, EPA QA/G-9, pgs 2.3-1 through 2.3-12. (http://www.epa.gov/quality/qa-docs.html).

Two-Sided Confidence Interval on the True Median

For calculating the confidence interval, the values are ordered from smallest to largest. The confidence limits are the highest value of the r+1 and/or lowest value of the s-1 order statistics that fit the formulas below, except when the rth ordered value is tied with higher ordered values or the sth ordered value is tied with lower ordered values. If higher numbered ordered values are ties with the rth ordered value, then the closest ordered value that is lower than r will be the confidence limit. If higher-numbered ordered values are ties with the sth ordered value, then the closest ordered value that is higher than s will be the confidence limit.

Upper Two-Sided Confidence Interval

$$\sum_{s}^{1}\left(\frac{n!}{r!(n-s)!}\right)p^{0.5}(1-p)^{n-0.5} \geq 1-\alpha/2$$

Lower Two-Sided Confidence interval

$$\sum_{r}^{1}\left(\frac{n!}{r!(n-r)!}\right)p^{0.5}(1-p)^{n-0.5} \leq \alpha/2$$

Upper 95% Two-Sided Confidence Interval on the Median	1.97

Sample Median	0.5
Lower 95% Two-Sided Confidence Interval on the Median	0.303

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* - The report contents may have been modified or reformatted by end-user of software.

VSP Sample Design Report for Calculating a Two-Sided Confidence Interval for the Population Median Using Simple Random Sampling

Summary

This report summarizes the sampling design used, associated statistical assumptions, as well as general guidelines for conducting post-sampling data analysis. Sampling plan components presented here include how many sampling locations to choose and where within the sampling area to collect those samples. The type of medium to sample (i.e., soil, groundwater, etc.) and how to analyze the samples (in-situ, fixed laboratory, etc.) are addressed in other sections of the sampling plan.

The following table summarizes the sampling design developed. A figure that shows sampling locations in the field and a table that lists sampling location coordinates are also provided below.

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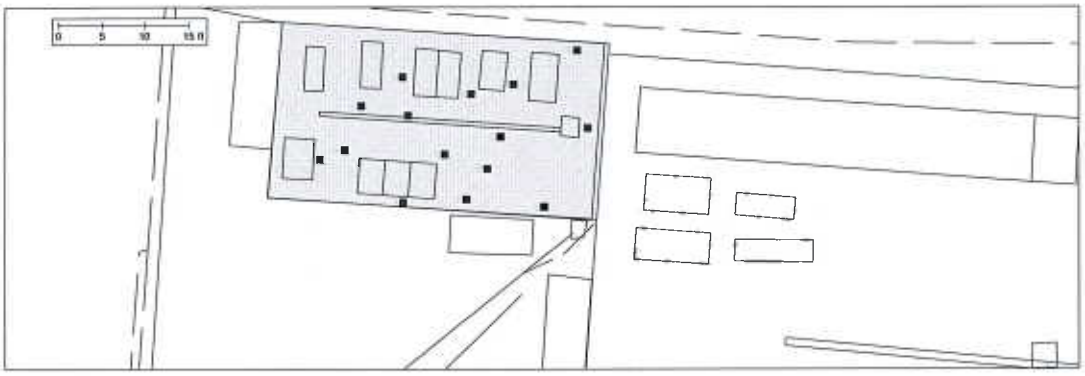
Primary Objective of Design	Construct a Confidence Interval on the True Median
Type of Sampling Design	Non-Parametric
Sample Placement (Location) in the Field	Simple random sampling
Formula for calculating number of sampling locations	Nonparametric Confidence Limits
Calculated total number of samples	15
Number of samples on map [a]	15
Number of selected sample areas [b]	1
Specified sampling area [c]	755.90 ft^2
Total cost of sampling [d]	$310.00

[a] This number may differ from the calculated number because of 1) grid edge effects, 2) adding judgment samples, or 3) selecting or unselecting sample areas.
[b] The number of selected sample areas is the number of colored areas on the map of the site. These sample areas contain the locations where samples are collected.
[c] The sampling area is the total surface area of the selected colored sample areas on the map of the site.
[d] Including measurement analyses and fixed overhead costs. See the Cost of Sampling section for an explanation of the costs presented here.



Area: Area 1					
X Coord	Y Coord	Label	Value	Type	Historical
4928.9658	5229.8854	GP-44	44	Random	
4922.1885	5239.3872	GP-51	71	Random	
4941.7431	5246.8890	GP-49	65	Random	

4911.9669	5234.3860	GP-55	51	Random	
4929.5215	5241.8878	GP-50	51	Random	
4914.8555	5235.4974	GP-54	39	Random	
4934.4101	5242.9992	GP-48	39	Random	
4921.6328	5229.4961	GP-57	65	Random	
4943.0000	5237.9980	GP-46	30	Random	
4926.4661	5234.9967	GP-56	75	Random	
4916.6888	5240.4986	GP-53	39	Random	
4931.3547	5233.3309	GP-45	49	Random	
4921.5774	5243.8327	GP-52	58	Random	
4938.0000	5229.0000	GP-43	30	Unknown	
4932.8900	5237.0000	GP-47	65	Unknown	

Primary Sampling Objective
The primary purpose of sampling at this site is to construct a confidence interval on the true population median value. After the samples are collected and analyzed, the resulting sample values can be used to construct a two-sided confidence interval. Once the confidence interval is computed (which will be an upper and a lower threshold), you can have the specified confidence that the true population median is between the upper and lower thresholds.

Selected Sampling Approach
A non-parametric random sampling approach was used to determine the number of samples and to specify sampling locations. A parametric formula was not chosen because the conceptual model and historical information (e.g., historical data from this site or a very similar site) indicate that parametric assumptions are not true. These assumptions will be examined in post-sampling data analysis.

Both parametric and non-parametric equations rely on assumptions about the population. Typically, however, non-parametric equations require fewer assumptions and allow for more uncertainty about the statistical distribution of values at the site. The trade-off is that if the parametric assumptions are valid, the required number of samples is usually less than if a non-parametric equation was used.

Locating the sample points randomly provides data that are separated by many distances, whereas systematic samples are all equidistant apart. Therefore, random sampling provides more information about the spatial structure of the potential contamination than systematic sampling does. As with systematic sampling, random sampling also provides information regarding the mean or median value, but there is the possibility that areas of the site will not be represented with the same frequency as if uniform grid sampling were performed.

Number of Total Samples: Calculation Equation and Inputs
Two sample confidence interval calculation methods are available for when n□20 and n>20 (Conover, 1980, p. 111-117) (Gilbert, 1987,p. 141-142). In VSP, the user specifies a one-sided or two-sided CI, and the percent confidence desired to be within a specified number of percentiles of the median. A binary search is then performed on the CI equations to solve for the minimum sample size to satisfy these parameters. VSP first uses the n□20 method to determine if a solution can be found where n□20, and if not, then uses the n>20 method.

For a one-sided CI, the n□20 method follows a binomial distribution and determines the lowest value of n where the yth quantile of the sample would be equal to or above the true median at least X% of the time (Note that the sample sizes work out to be the same regardless of whether the CI will be a lower or upper tailed, so the same formula can be used for any one-sided CI). X% is the specified confidence for one-sided confidence intervals, and the average of 100% and the specified confidence for two-sided confidence intervals. The yth quantile is determined by taking 50% and subtracting the allowable number of percentiles from the median specified by the user.

For a two-sided CI, the n□20 method is the same as performing a one-sided confidence interval, but replacing the specified percent confidence with the average of 100% and the specified percent confidence. If no solution is found where n□20, a binary search is conducted using Equation (1) for a one-sided CI and Equation (2) for a two-sided interval to compute the value of r (r is the the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest), rounding r up to the next higher integer. The search is repeated until the smallest n is

found where 100*2*r/n is greater than 50% minus the allowable number of percentiles from the median specified by the user.

$$r = 0.5 * n - 0.5 * w_{\alpha} \sqrt{n} \qquad (1)$$

$$r = 0.5 * n - 0.5 * w_{\alpha/2} \sqrt{n} \qquad (2)$$

Where:

n is the sample size

r is the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest

$w_{\square}$ is the specified quantile of a normal distribution, e.g. if □=0.2 then $w_{\square}$ is the 0.2 quantile (20th percentile) of a normal distribution.

The n>20 method described above is an approximation method, so VSP also performs a final check using a binomial distribution in a similar manner to the n□20 method, and may increase the sample size by 1 to ensure the specified confidence levels are met.

Cost of Sampling
The total cost of the completed sampling program depends on several cost inputs, some of which are fixed, and others that are based on the number of samples collected and measured. Based on the numbers of samples determined above, the estimated total cost of sampling and analysis at this site is $310.00, which averages out to a per sample cost of $20.67. The following table summarizes the inputs and resulting cost estimates.

COST INFORMATION			
Cost Details	**Per Analysis**	**Per Sample**	**15 Samples**
Field collection costs		$10.00	$150.00
Analytical costs	$10.00	$10.00	$150.00
Sum of Field & Analytical costs		**$20.00**	**$300.00**
Fixed planning and validation costs			$10.00
Total cost			**$310.00**

Data Analysis for Zinc
The following data points were entered by the user for analysis.

Zinc										
Rank	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
0	30	30	39	39	39	44	49	51	51	58
10	65	65	65	71	75					

SUMMARY STATISTICS for Zinc	
n	15
Min	30
Max	75
Range	45
Mean	51.4
Median	51

Variance				212.69				
StdDev				14.584				
Std Error				3.7655				
Skewness				0.073547				
Interquartile Range				26				
Percentiles								
1%	**5%**	**10%**	**25%**	**50%**	**75%**	**90%**	**95%**	**99%**
30	30	30	39	51	65	72.6	75	75

Data Plots

Three graphical displays of the data are shown below: the Histogram, the Box and Whiskers plot, and the Quantile-Quantile (Q-Q) plot.

The Histogram is a plot of the fraction of the n observed data that fall within specified data "bins." A histogram is generated by dividing the x axis (range of the observed data values) into "bins" and displaying the number of data in each bin as the height of a bar for the bin. The area of the bar is the fraction of the n data values that lie within the bin. The sum of the fractions for all bins equals one. A histogram is used to assess how the n data are distributed (spread) over their range of values. If the histogram is more or less symmetric and bell shaped, then the data may be normally distributed.

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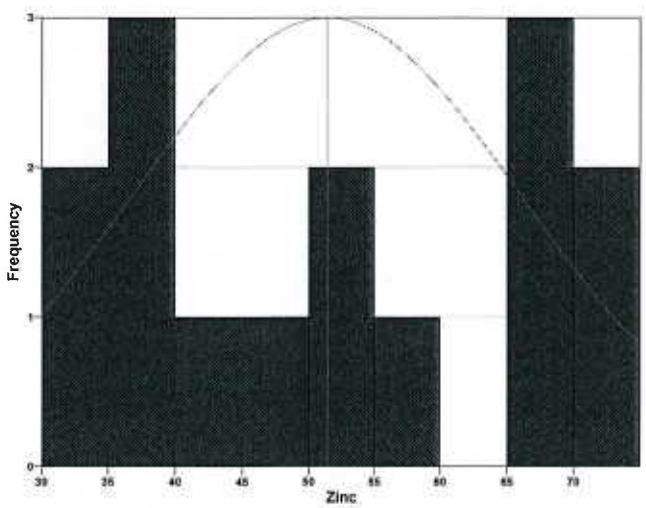

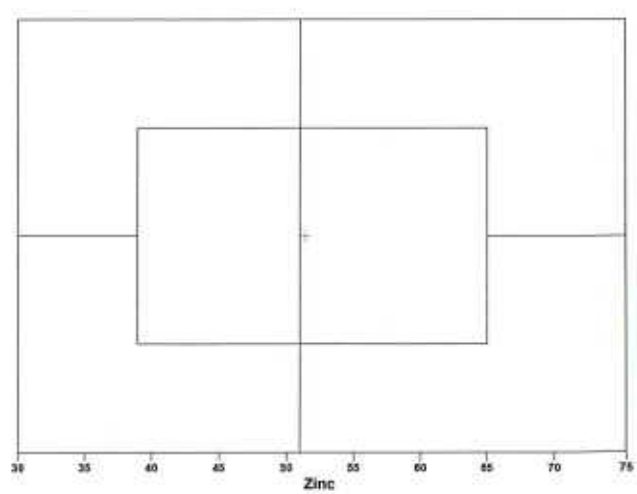

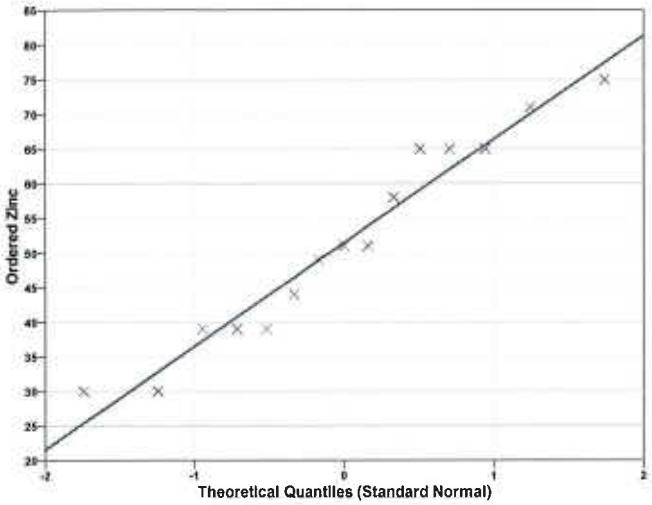

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Two-Sided Confidence Interval on the True Median

For calculating the confidence interval, the values are ordered from smallest to largest. The confidence limits are the highest value of the r+1 and/or lowest value of the s-1 order statistics that fit the formulas below, except when the rth ordered value is tied with higher ordered values or the sth ordered value is tied with lower ordered values. If higher numbered ordered values are ties with the rth ordered value, then the closest ordered value that is lower than r will be the confidence limit. If higher-numbered ordered values are ties with the sth ordered value, then the closest ordered value that is higher than s will be the confidence limit.

Upper Two-Sided Confidence Interval

$$\sum_{s}^{1}\left(\frac{n!}{r!(n-s)!}\right)p^{0.5}(1-p)^{n-0.5} \geq 1-\alpha/2$$

Lower Two-Sided Confidence interval

$$\sum_{r}^{1}\left(\frac{n!}{r!(n-r)!}\right)p^{0.5}(1-p)^{n-0.5} \leq \alpha/2$$

Upper 95% Two-Sided Confidence Interval on the Median	65
Sample Median	51
Lower 95% Two-Sided Confidence Interval on the Median	39

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The following table summarizes the sampling design developed. A figure that shows sampling locations in the field and a table that lists sampling location coordinates are also provided below.

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Primary Objective of Design	Construct a Confidence Interval on the True Median
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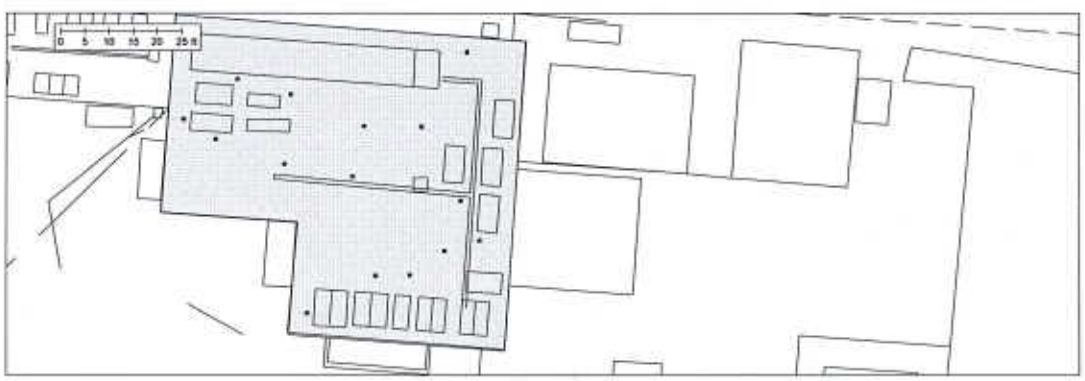
Sample Placement (Location) in the Field	Simple random sampling
Formula for calculating number of sampling locations	Nonparametric Confidence Limits
Calculated total number of samples	15
Number of samples on map [a]	15
Number of selected sample areas [b]	1
Specified sampling area [c]	3910.04 ft^2
Total cost of sampling [d]	$2,860.00

[a] This number may differ from the calculated number because of 1) grid edge effects, 2) adding judgment samples, or 3) selecting or unselecting sample areas.
[b] The number of selected sample areas is the number of colored areas on the map of the site. These sample areas contain the locations where samples are collected.
[c] The sampling area is the total surface area of the selected colored sample areas on the map of the site.
[d] Including measurement analyses and fixed overhead costs. See the Cost of Sampling section for an explanation of the costs presented here.



Area: Area 2					
X Coord	Y Coord	Label	Value	Type	Historical
4981.9002	5213.6371	GP-15	19	Random	
5000.6401	5198.5254	GP-11	3.6	Random	
4953.7905	5221.1929	GP-17	9.7	Random	

4972.5303	5185.9324	GP-24	28	Random	
5008.0100	5200.5999	GP-25	6.4	Random	
4947.1056	5225.2673	GP-21	29	Random	
4986.5852	5193.4882	GP-9	13	Random	
4967.8454	5216.1557	GP-16	39	Random	
5005.3250	5238.8231	GP-20	63	Random	
4995.9551	5223.7115	GP-13	48	Random	
4984.2427	5223.8359	GP-14	22	Random	
5003.9825	5208.7242	GP-12	3.8	Random	
4958.1330	5233.3917	GP-22	36	Random	
4993.6126	5193.6126	GP-10	7.4	Random	
4969.1604	5230.3045	GP-18	3.3	Random	

Primary Sampling Objective
The primary purpose of sampling at this site is to construct a confidence interval on the true population median value. After the samples are collected and analyzed, the resulting sample values can be used to construct a two-sided confidence interval. Once the confidence interval is computed (which will be an upper and a lower threshold), you can have the specified confidence that the true population median is between the upper and lower thresholds.

Selected Sampling Approach
A non-parametric random sampling approach was used to determine the number of samples and to specify sampling locations. A parametric formula was not chosen because the conceptual model and historical information (e.g., historical data from this site or a very similar site) indicate that parametric assumptions are not true. These assumptions will be examined in post-sampling data analysis.

Both parametric and non-parametric equations rely on assumptions about the population. Typically, however, non-parametric equations require fewer assumptions and allow for more uncertainty about the statistical distribution of values at the site. The trade-off is that if the parametric assumptions are valid, the required number of samples is usually less than if a non-parametric equation was used.

Locating the sample points randomly provides data that are separated by many distances, whereas systematic samples are all equidistant apart. Therefore, random sampling provides more information about the spatial structure of the potential contamination than systematic sampling does. As with systematic sampling, random sampling also provides information regarding the mean or median value, but there is the possibility that areas of the site will not be represented with the same frequency as if uniform grid sampling were performed.

Number of Total Samples: Calculation Equation and Inputs
Two sample confidence interval calculation methods are available for when n□20 and n>20 (Conover, 1980, p. 111-117) (Gilbert, 1987,p. 141-142). In VSP, the user specifies a one-sided or two-sided CI, and the percent confidence desired to be within a specified number of percentiles of the median. A binary search is then performed on the CI equations to solve for the minimum sample size to satisfy these parameters. VSP first uses the n□20 method to determine if a solution can be found where n□20, and if not, then uses the n>20 method.

For a one-sided CI, the n□20 method follows a binomial distribution and determines the lowest value of n where the yth quantile of the sample would be equal to or above the true median at least X% of the time (Note that the sample sizes work out to be the same regardless of whether the CI will be a lower or upper tailed, so the same formula can be used for any one-sided CI). X% is the specified confidence for one-sided confidence intervals, and the average of 100% and the specified confidence for two-sided confidence intervals. The yth quantile is determined by taking 50% and subtracting the allowable number of percentiles from the median specified by the user.

For a two-sided CI, the n□20 method is the same as performing a one-sided confidence interval, but replacing the specified percent confidence with the average of 100% and the specified percent confidence. If no solution is found where n□20, a binary search is conducted using Equation (1) for a one-sided CI and Equation (2) for a two-sided interval to compute the value of r (r is the the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest), rounding r up to the next higher integer. The search is repeated until the smallest n is

found where 100*2*r/n is greater than 50% minus the allowable number of percentiles from the median specified by the user.

$$r = 0.5*n - 0.5*w_{\alpha}\sqrt{n} \qquad (1)$$

$$r = 0.5*n - 0.5*w_{\alpha/2}\sqrt{n} \qquad (2)$$

Where:

n is the sample size

r is the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest

$w_{\square}$ is the specified quantile of a normal distribution, e.g. if □=0.2 then $w_{\square}$ is the 0.2 quantile (20th percentile) of a normal distribution.

The n>20 method described above is an approximation method, so VSP also performs a final check using a binomial distribution in a similar manner to the n□20 method, and may increase the sample size by 1 to ensure the specified confidence levels are met.

Cost of Sampling
The total cost of the completed sampling program depends on several cost inputs, some of which are fixed, and others that are based on the number of samples collected and measured. Based on the numbers of samples determined above, the estimated total cost of sampling and analysis at this site is $2,860.00, which averages out to a per sample cost of $190.67. The following table summarizes the inputs and resulting cost estimates.

COST INFORMATION			
Cost Details	**Per Analysis**	**Per Sample**	**15 Samples**
Field collection costs		$100.00	$1,500.00
Analytical costs	$24.00	$24.00	$360.00
Sum of Field & Analytical costs		**$124.00**	**$1,860.00**
Fixed planning and validation costs			$1,000.00
Total cost			**$2,860.00**

Data Analysis for Ni
The following data points were entered by the user for analysis.

Ni										
Rank	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
0	3.3	3.6	3.8	6.4	7.4	9.7	13	19	22	28
10	29	36	39	48	63					

SUMMARY STATISTICS for Ni	
n	15
Min	3.3
Max	63
Range	59.7
Mean	22.08
Median	19

Variance				331.73				
StdDev				18.213				
Std Error				4.7027				
Skewness				0.89042				
Interquartile Range				29.6				
Percentiles								
1%	**5%**	**10%**	**25%**	**50%**	**75%**	**90%**	**95%**	**99%**
3.3	3.3	3.48	6.4	19	36	54	63	63

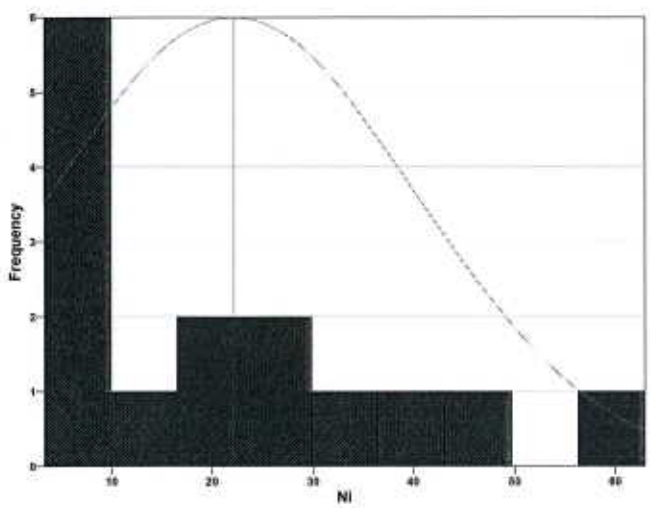
Data Plots

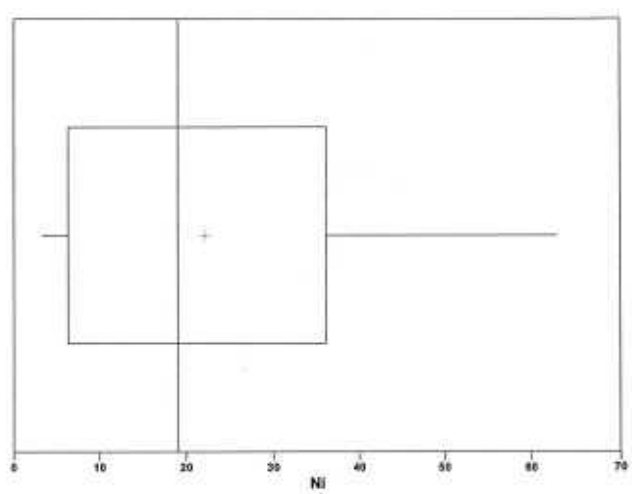
Three graphical displays of the data are shown below: the Histogram, the Box and Whiskers plot, and the Quantile-Quantile (Q-Q) plot.

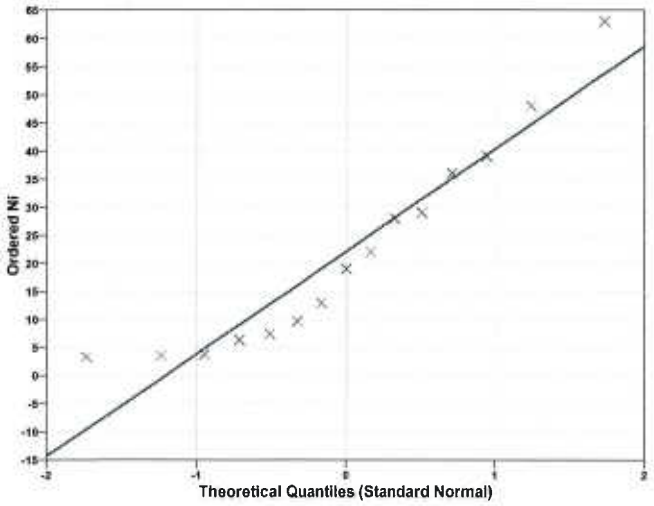
The Histogram is a plot of the fraction of the n observed data that fall within specified data "bins." A histogram is generated by dividing the x axis (range of the observed data values) into "bins" and displaying the number of data in each bin as the height of a bar for the bin. The area of the bar is the fraction of the n data values that lie within the bin. The sum of the fractions for all bins equals one. A histogram is used to assess how the n data are distributed (spread) over their range of values. If the histogram is more or less symmetric and bell shaped, then the data may be normally distributed.

The Box and Whiskers plot is composed of a central box divided by a line, and with two lines extending out from the box, called the "whiskers". The line through the box is drawn at the median of the n data observed. The two ends of the box represent the 25th and 75th percentiles of the n data values, which are also called the lower and upper quartiles, respectively, of the data set. The sample mean (mean of the n data) is shown as a "+" sign. The upper whisker extends to the largest data value that is less than the upper quartile plus 1.5 times the interquartile range (upper quartile minus the lower quartile). The lower whisker extends to the smallest data value that is greater than the lower quartile minus 1.5 times the interquartile range. Extreme data values (greater or smaller than the ends of the whiskers) are plotted individually. A Box and Whiskers plot is used to assess the symmetry of the distribution of the data set. If the distribution is symmetrical, the box is divided into two equal halves by the median, the whiskers will be the same length, and the number of extreme data points will be distributed equally on either end of the plot.

The Q-Q plot graphs the quantiles of a set of n data against the quantiles of a specific distribution. We show here only the Q-Q plot for an assumed normal distribution. The pth quantile of a distribution of data is the data value, x_p, for which a fraction p of the distribution is less than x_p. If the data plotted on the normal distribution Q-Q plot closely follow a straight line, even at the ends of the line, then the data may be assumed to be normally distributed. If the data points deviate substantially from a linear line, then the data are not normally distributed.







For more information on these three plots consult Guidance for Data Quality Assessment, EPA QA/G-9, pgs 2.3-1 through 2.3-12. (http://www.epa.gov/quality/qa-docs.html).

Two-Sided Confidence Interval on the True Median

For calculating the confidence interval, the values are ordered from smallest to largest. The confidence limits are the highest value of the r+1 and/or lowest value of the s-1 order statistics that fit the formulas below, except when the rth ordered value is tied with higher ordered values or the sth ordered value is tied with lower ordered values. If higher numbered ordered values are ties with the rth ordered value, then the closest ordered value that is lower than r will be the confidence limit. If higher-numbered ordered values are ties with the sth ordered value, then the closest ordered value that is higher than s will be the confidence limit.

Upper Two-Sided Confidence Interval

$$\sum_{s}^{1}\left(\frac{n!}{r!(n-s)!}\right)p^{0.5}(1-p)^{n-0.5} \geq 1-\alpha/2$$

Lower Two-Sided Confidence interval

$$\sum_{r}^{1}\left(\frac{n!}{r!(n-r)!}\right)p^{0.5}(1-p)^{n-0.5} \leq \alpha/2$$

Upper 95% Two-Sided Confidence Interval on the Median	39
Sample Median	19
Lower 95% Two-Sided Confidence Interval on the Median	3.8

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* - The report contents may have been modified or reformatted by end-user of software.

APPENDIX – B

CLIENT	JOB #	BORING #	SHEET
United Metal Finishing	**09-11981E**	**MW-1**	**1 OF 1**

PROJECT NAME	ARCHITECT-ENGINEER
United Metal Finishing	

SITE LOCATION
133 Bluebell Road, Greensboro, North Carolina

CALIBRATED PENETROMETER TONS/FT. 1 2 3 4 5+

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %

ROCK QUALITY DESIGNATION & RECOVERY
ROD % — REC. %
20% 40% 60% 80% 100%

STANDARD PENETRATION BLOWS/FT.
10 20 30 40 50+

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION

SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS ELEVATION (FT)
0	1	SS	60	18	Tan Brown Clayey Silt	
5	2	SS	60	18	Orange Tan Clayey Silt	-5
10	3	SS	60	18	Orange Tan Clayey Silt	-10
15	3	SS	60	18	Orange Tan Clayey Silt	-15
20					Boring Terminated at 20'	-20

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN-SITU THE TRANSITION MAY BE GRADUAL

WL - 21 Feet WS OR WD	BORING STARTED – August 20, 2011	
WL(BCR) WL(ACR)	BORING COMPLETED – August 20, 2011	CAVE IN DEPTH @
24 HOUR WL – 12.42'	RIG FOREMAN	DRILLING METHOD - Geoprobe

CLIENT	JOB #	BORING #	SHEET
United Metal Finishing	**09-11981E**	**MW-2**	1 OF 1

PROJECT NAME	ARCHITECT-ENGINEER
United Metal Finishing	

SITE LOCATION
133 Bluebell Road, Greensboro, North Carolina

CALIBRATED PENETROMETER TONS/FT. 1 2 3 4 5+

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %

ROCK QUALITY DESIGNATION & RECOVERY
ROD % — REC. %
20% 40% 60% 80% 100%

STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50+

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION

SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS ELEVATION (FT)
0	1	SS	60	18	Tan Brown Clayey Silt	
5	2	SS	60	18	Orange Tan Clayey Silt	-5
10	3	SS	60	18	Orange Tan Clayey Silt	-10
15	3	SS	60	18	Tan Brown Clayey Silt	-15
20					Boring Terminated at 20'	-20

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN-SITU THE TRANSITION MAY BE GRADUAL

WL - 21 Feet WS OR WD	BORING STARTED – August 20, 2011	
WL(BCR) WL(ACR)	BORING COMPLETED – August 20, 2011	CAVE IN DEPTH @
24 HOUR WL – 12.21'	RIG FOREMAN	DRILLING METHOD - Geoprobe

CLIENT	JOB #	BORING #	SHEET
United Metal Finishing	**09-11981E**	**MW-3**	**1 OF 1**

PROJECT NAME	ARCHITECT-ENGINEER
United Metal Finishing	

SITE LOCATION
133 Bluebell Road, Greensboro, North Carolina

CALIBRATED PENETROMETER TONS/FT. 1 2 3 4 5+

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %

ROCK QUALITY DESIGNATION & RECOVERY
ROD % — REC. %
20% 40% 60% 80% 100%

STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50+

DESCRIPTION OF MATERIAL — ENGLISH UNITS
BOTTOM OF CASING — LOSS OF CIRCULATION
SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS ELEVATION (FT)
0	1	SS	60	18	Orange Brown Clayey Silt	
5	2	SS	60	18	Orange Brown Clayey Silt	-5
10	3	SS	60	18	Tan Brown Clayey Silt	-10
15	3	SS	60	18	Tan Brown Clayey Silt	-15
20					Boring Terminated at 20'	-20

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN-SITU THE TRANSITION MAY BE GRADUAL

WL - 21 Feet WS OR WD	BORING STARTED – August 20, 2011	
WL(BCR) WL(ACR)	BORING COMPLETED – August 20, 2011	CAVE IN DEPTH @
24 HOUR WL – 11.45'	RIG FOREMAN	DRILLING METHOD - Geoprobe

CLIENT	JOB #	BORING #	SHEET
United Metal Finishing	**09-11981E**	**MW-4**	**1 OF 1**

PROJECT NAME	ARCHITECT-ENGINEER
United Metal Finishing	

SITE LOCATION
133 Bluebell Road, Greensboro, North Carolina

CALIBRATED PENETROMETER TONS/FT. 1 2 3 4 5+

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %

ROCK QUALITY DESIGNATION & RECOVERY
ROD % — REC. %
20% 40% 60% 80% 100%

STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50+

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION 100%

SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS ELEVATION (FT)
0	1	SS	60	18	Tan Brown Clayey Silt	
5	2	SS	60	18	Tan Orange Clayey Silt	-5
10	3	SS	60	18	Tan Brown Clayey Silt	-10
15	3	SS	60	18	Tan Brown Clayey Silt	-15
20					Boring Terminated at 20'	-20

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN-SITU THE TRANSITION MAY BE GRADUAL

WL - 21 Feet WS OR WD	BORING STARTED – August 20, 2011	
WL(BCR) WL(ACR)	BORING COMPLETED – August 20, 2011	CAVE IN DEPTH @
24 HOUR WL – 11.78'	RIG FOREMAN	DRILLING METHOD - Geoprobe

CLIENT	JOB #	BORING #	SHEET
United Metal Finishing	**09-11981E**	**MW-5**	**1 OF 1**

PROJECT NAME
United Metal Finishing

ARCHITECT-ENGINEER

SITE LOCATION
133 Bluebell Road, Greensboro, North Carolina

CALIBRATED PENETROMETER TONS/FT. 1 2 3 4 5+

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %

ROCK QUALITY DESIGNATION & RECOVERY
ROD % — REC. %
20% 40% 60% 80% 100%

STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50+

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION

SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS ELEVATION (FT)
0	1	SS	60	18	Tan Brown Clayey Silt	
5	2	SS	60	18	Tan Brown Clayey Silt	-5
10	3	SS	60	18	Tan Brown Clayey Silt	-10
15	3	SS	60	18	Tan Brown Clayey Silt	-15
20					Boring Terminated at 20'	-20

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN-SITU THE TRANSITION MAY BE GRADUAL

WL - 21 Feet WS OR WD	BORING STARTED – August 20, 2011	
WL(BCR) WL(ACR)	BORING COMPLETED – August 20, 2011	CAVE IN DEPTH @
24 HOUR WL – 13.40'	RIG FOREMAN	DRILLING METHOD - Geoprobe

CLIENT	JOB #	BORING #	SHEET
United Metal Finishing	**09-11981E**	**MW-6**	**1 OF 1**

PROJECT NAME	ARCHITECT-ENGINEER
United Metal Finishing	

SITE LOCATION
133 Bluebell Road, Greensboro, North Carolina

CALIBRATED PENETROMETER TONS/FT. 1 2 3 4 5+

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %

ROCK QUALITY DESIGNATION & RECOVERY
ROD % — REC. %
20% 40% 60% 80% 100%

STANDARD PENETRATION BLOWS/FT.
10 20 30 40 50+

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION

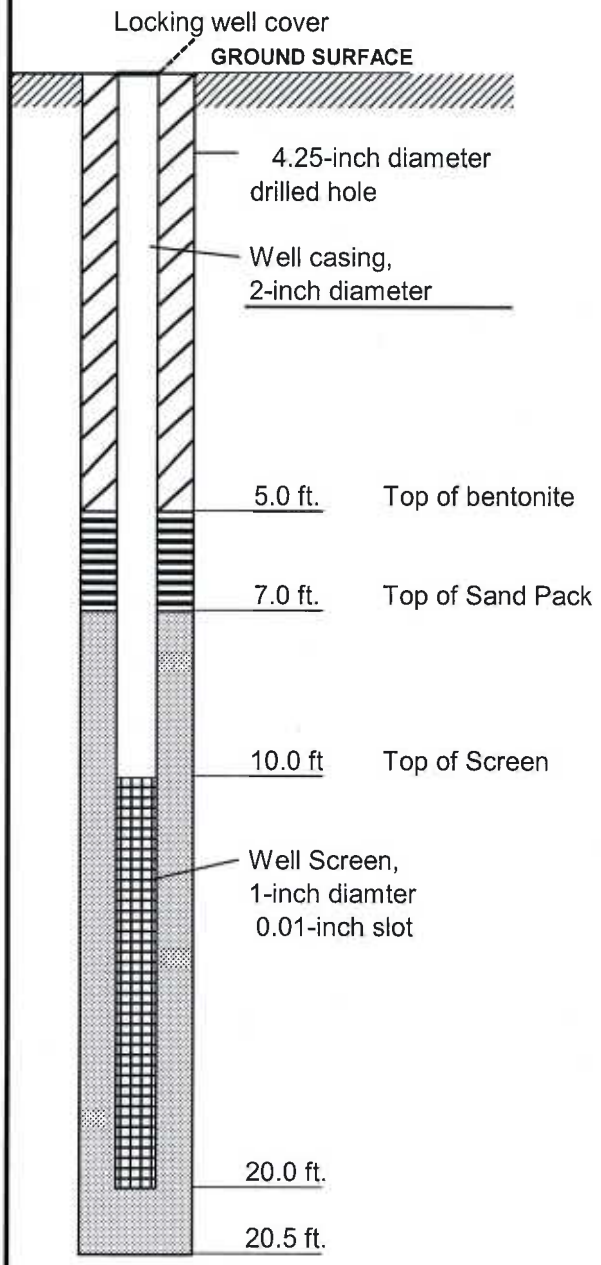
SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS ELEVATION (FT)
0	1	SS	60	18	Tan Brown Clayey Silt	
5	2	SS	60	18	Tan Brown Clayey Silt	-5
10	3	SS	60	18	Tan Brown Clayey Silt	-10
15					Boring Terminated at 15'	-15
						-
						-

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN-SITU THE TRANSITION MAY BE GRADUAL

WL - 21 Feet WS OR WD	BORING STARTED – September 22, 2011	
WL(BCR) WL(ACR)	BORING COMPLETED – September 22, 2011	CAVE IN DEPTH @
24 HOUR WL – 5.74'	RIG FOREMAN	DRILLING METHOD - Geoprobe

TEMPORARY MONITORING WELL CONSTRUCTION DIAGRAM



All Measurments are from the Ground Surface Unless Otherwise Noted.

Project	United Metal Finishing
Well No.	MW-1
Location	133 Bluebell Road
	Greensboro, NC
Drilled By	3D Environmental
Drilling Started	August 20, 2011
Drilling Completed	August 20, 2011
Method of Drilling	Geoprobe w/ Augers
Type of Rig	Geoprobe

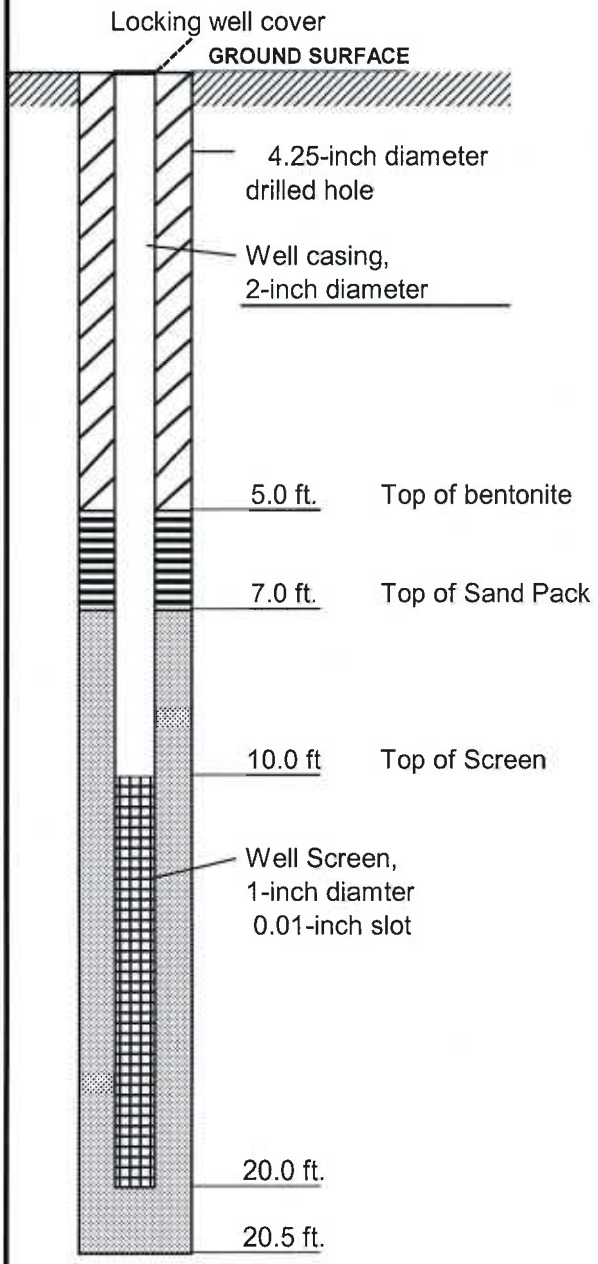
MONITORING WELL DATA

Well No.	MW-1
Hole Diameter	4.25 inches
Hole Depth	20.5 feet
Casing Diameter	2 inch
Casing Length	20 feet
Screen Diameter	2 inch
Screen Slot	0.01 inch
Screen Type	slot
Surface Elevation	756.81
Screen Top El.	756.38
Screen Bottom El.	746.38
Well Status	permanent

REMARKS

Temperature	19.5°C
Specific Conductance	0.617 mS/cm^{c}
Dissolved Oxygen	5.55 mg/L
pH	5.91
ORP	68.7

TEMPORARY MONITORING WELL CONSTRUCTION DIAGRAM



All Measurments are from the Ground Surface Unless Otherwise Noted.

Project	United Metal Finishing
Well No.	MW-2
Location	133 Bluebell Road
	Greensboro, NC
Drilled By	3D Environmental
Drilling Started	August 20, 2011
Drilling Completed	August 20, 2011
Method of Drilling	Geoprobe w/ Augers
Type of Rig	Geoprobe

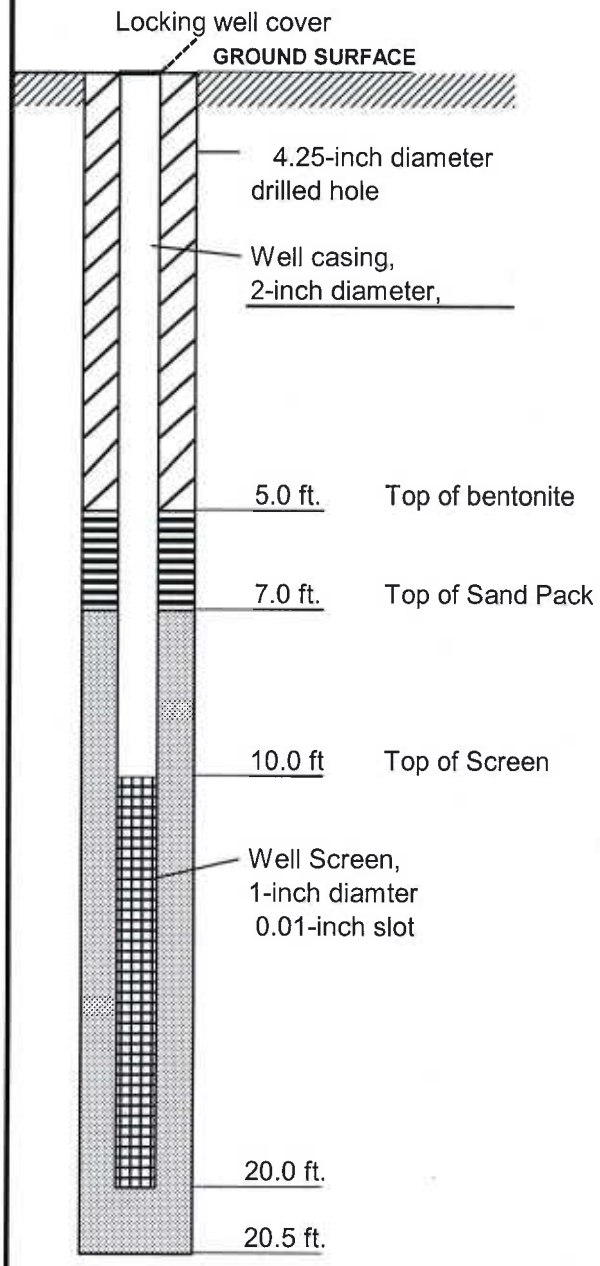
MONITORING WELL DATA

Well No.	MW-2
Hole Diameter	4.25 inches
Hole Depth	20.5 feet
Casing Diameter	2 inch
Casing Length	20 feet
Screen Diameter	2 inch
Screen Slot	0.01 inch
Screen Type	slot
Surface Elevation	756.65
Screen Top El.	756.21
Screen Bottom El.	746.21
Well Status	permanent

REMARKS

Temperature	19.08°C
Specific Conductance	2.892 mS/cm^{c}
Dissolved Oxygen	0.80 mg/L
pH	5.73
ORP	6.5

TEMPORARY MONITORING WELL CONSTRUCTION DIAGRAM



All Measurments are from the Ground Surface Unless Otherwise Noted.

Project	United Metal Finishing
Well No.	MW-3
Location	133 Bluebell Road
	Greensboro, NC
Drilled By	3D Environmental
Drilling Started	August 20, 2011
Drilling Completed	August 20, 2011
Method of Drilling	Geoprobe w/ Augers
Type of Rig	Geoprobe

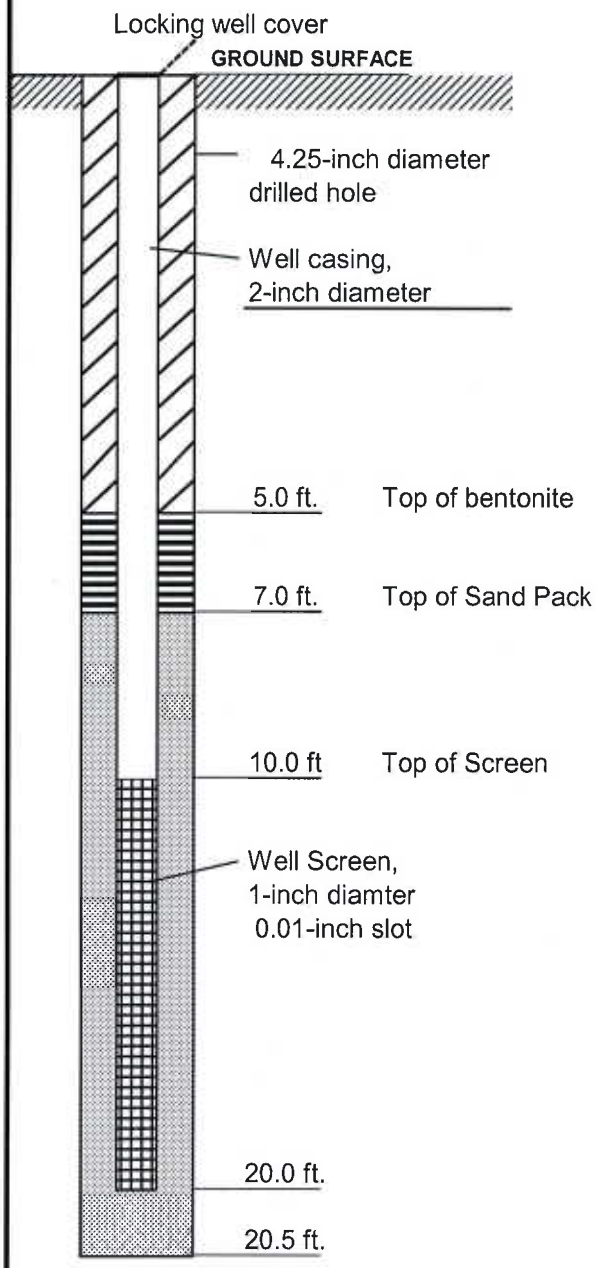
MONITORING WELL DATA

Well No.	MW-3
Hole Diameter	4.25 inches
Hole Depth	20.5 feet
Casing Diameter	2 inch
Casing Length	20 feet
Screen Diameter	2 inch
Screen Slot	0.01 inch
Screen Type	slot
Surface Elevation	755.71
Screen Top El.	755.36
Screen Bottom El.	745.36
Well Status	permanent

REMARKS

Temperature	19.46°C
Specific Conductance	1.020 mS/cm^c
Dissolved Oxygen	6.19 mg/L
pH	5.76
ORP	41.5

TEMPORARY MONITORING WELL CONSTRUCTION DIAGRAM



All Measurments are from the Ground Surface Unless Otherwise Noted.

Project	United Metal Finishing
Well No.	MW-4
Location	133 Bluebell Road
	Greensboro, NC
Drilled By	3D Environmental
Drilling Started	August 20, 2011
Drilling Completed	August 20, 2011
Method of Drilling	Geoprobe w/ Augers
Type of Rig	Geoprobe

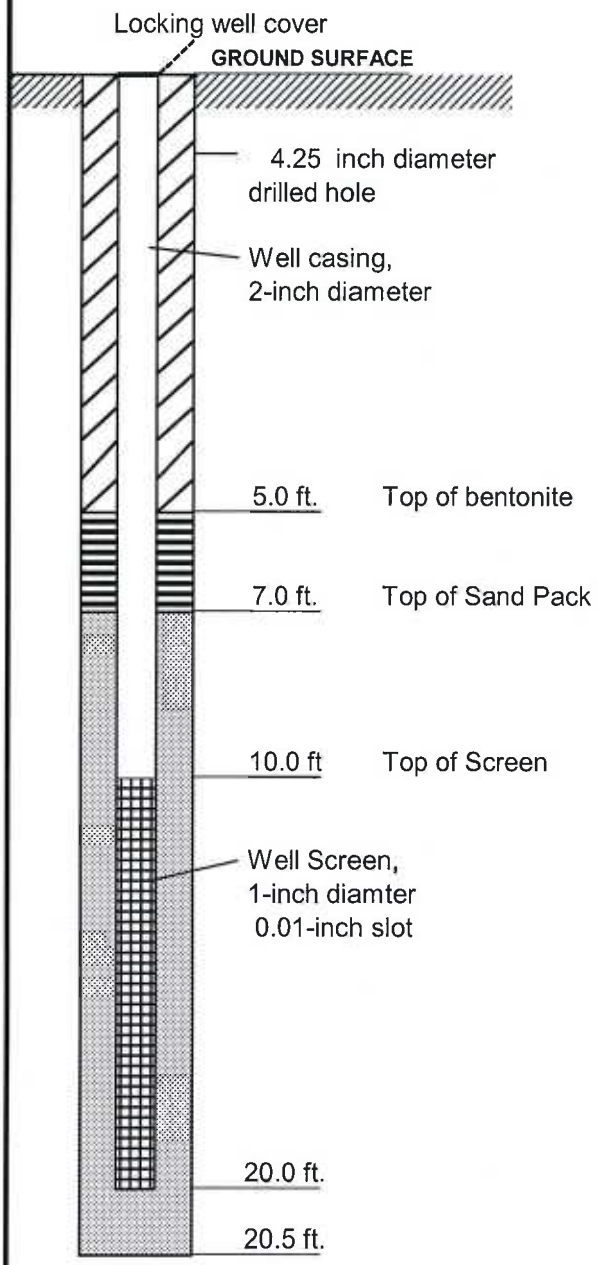
MONITORING WELL DATA

Well No.	MW-4
Hole Diameter	4.25 inches
Hole Depth	20.5 feet
Casing Diameter	2 inch
Casing Length	20 feet
Screen Diameter	2 inch
Screen Slot	0.01 inch
Screen Type	slot
Surface Elevation	755.38
Screen Top El.	754.99
Screen Bottom El.	744.99
Well Status	permanent

REMARKS

Temperature	19.60°C
Specific Conductance	1.262 mS/cm^{c}
Dissolved Oxygen	5.21 mg/L
pH	5.83
ORP	50.6

TEMPORARY MONITORING WELL CONSTRUCTION DIAGRAM



All Measurments are from the Ground Surface Unless Otherwise Noted.

Project	United Metal Finishing
Well No.	MW-5
Location	133 Bluebell Road
	Greensboro, NC
Drilled By	3D Environmental
Drilling Started	August 20, 2011
Drilling Completed	August 20, 2011
Method of Drilling	Geoprobe w/ Augers
Type of Rig	Geoprobe

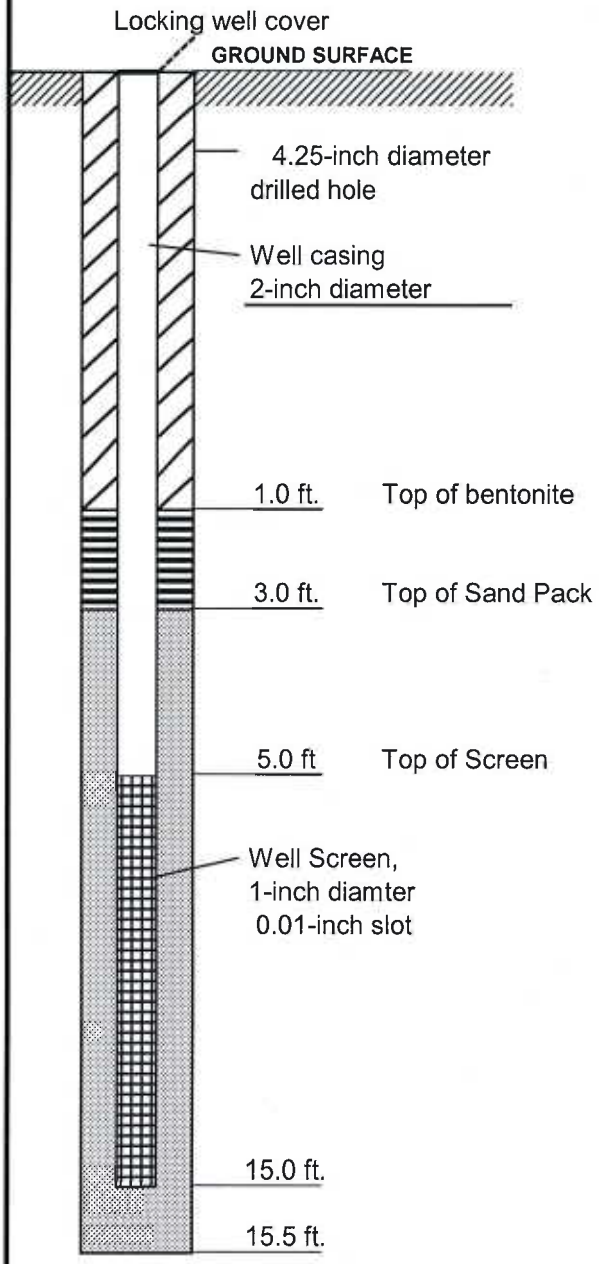
MONITORING WELL DATA

Well No.	MW-5
Hole Diameter	4.25 inches
Hole Depth	20.5 feet
Casing Diameter	2 inch
Casing Length	20 feet
Screen Diameter	2 inch
Screen Slot	0.01 inch
Screen Type	slot
Surface Elevation	758.68
Screen Top El.	758.22
Screen Bottom El.	748.22
Well Status	permanent

REMARKS

Temperature	19.41°C
Specific Conductance	0.931 mS/cm^c
Dissolved Oxygen	5.41 mg/L
pH	5.8
ORP	54.2

TEMPORARY MONITORING WELL CONSTRUCTION DIAGRAM



All Measurments are from the Ground Surface Unless Otherwise Noted.

Project	United Metal Finishing
Well No.	MW-6
Location	133 Bluebell Road
	Greensboro, NC
Drilled By	Probe Technologies, Inc.
Drilling Started	September 22, 2011
Drilling Completed	September 22, 2011
Method of Drilling	Geoprobe w/ Augers
Type of Rig	Geoprobe

MONITORING WELL DATA

Well No.	MW-6
Hole Diameter	4.25 inches
Hole Depth	15.5 feet
Casing Diameter	2 inch
Casing Length	15 feet
Screen Diameter	2 inch
Screen Slot	0.01 inch
Screen Type	slot
Surface Elevation	747.85
Screen Top El.	747.95
Screen Bottom El.	732.85
Well Status	permanent

REMARKS

Temperature	19.77°C
Specific Conductance	1.063 mS/cm^c
Dissolved Oxygen	4.62 mg/L
pH	5.96
ORP	62.3

NON RESIDENTIAL WELL CONSTRUCTION RECORD

North Carolina Department of Environment and Natural Resources- Division of Water Quality

WELL CONTRACTOR CERTIFICATION # 3162-A

1. WELL CONTRACTOR:

Walter Lea Davis
Well Contractor (Individual) Name

3D Environmental Investigations L.L.C
Well Contractor Company Name

2157 Mocksville Highway
Street Address

statesville NC 28625
City or Town State Zip Code

(704) 657-7785
Area code Phone number

2. WELL INFORMATION:

WELL CONSTRUCTION PERMIT#

OTHER ASSOCIATED PERMIT#(if applicable)

SITE WELL ID #(if applicable) MW #1

3. WELL USE (Check One Box) Monitoring ☑ Municipal/Public ☐
Industrial/Commercial ☐ Agricultural ☐ Recovery ☐ Injection ☐
Irrigation ☐ Other ☐ (list use)

DATE DRILLED 7-29-11

4. WELL LOCATION:

133 Bluebell Rd
(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)

CITY: Greensboro COUNTY

TOPOGRAPHIC / LAND SETTING: (check appropriate box)
☐ Slope ☐ Valley ☐ Flat ☐ Ridge ☐ Other

LATITUDE 36 ° ' " DMS OR 3X.XXXXXXXX DD

LONGITUDE 75 ° ' " DMS OR 7X.XXXXXXXX DD

Latitude/longitude source: ☐ GPS ☐ Topographic map
(location of well must be shown on a USGS topo map andattached to this form if not using GPS)

5. FACILITY (Name of the business where the well is located.)

Facility Name: 133 Bluebell Road Facility ID# (if applicable)

Street Address: Greensboro

City or Town: NC State Zip Code

ECS (Toby)
Contact Name

4811 Koger Blvd
Mailing Address

Greensboro NC. 27407
City or Town State Zip Code

(336) 856-7150
Area code Phone number

6. WELL DETAILS:

a. **TOTAL DEPTH:** 20

b. **DOES WELL REPLACE EXISTING WELL?** YES ☐ NO ☑

c. **WATER LEVEL** Below Top of Casing: _____ FT.
(Use "+" if Above Top of Casing)

d. **TOP OF CASING IS** _____ FT. Above Land Surface*
*Top of casing terminated at/or below land surface may require a variance in accordance with 15A NCAC 2C .0118.

e. **YIELD (gpm):** _____ **METHOD OF TEST** _____

f. **DISINFECTION: Type** _____ **Amount** _____

g. **WATER ZONES** (depth):

Top	Bottom	Top	Bottom
Top	Bottom	Top	Bottom
Top	Bottom	Top	Bottom

7. CASING:

Depth		Diameter	Thickness/ Weight	Material
Top 0	Bottom 5 Ft.	2	Sch 40	PVC
Top	Bottom Ft.			
Top	Bottom Ft.			

8. GROUT:

Depth		Material	Method
Top 0	Bottom 2 Ft.	Cement	PUMP
Top	Bottom Ft.		
Top	Bottom Ft.		

9. SCREEN:

Depth		Diameter	Slot Size	Material
Top 5	Bottom 20 Ft.	2 in.	0.10 in.	PVC
Top	Bottom Ft.	in.	in.	
Top	Bottom Ft.	in.	in.	

10. SAND/GRAVEL PACK:

Depth		Size	Material
Top 3	Bottom 20 Ft.	#2	Sand
Top	Bottom Ft.		
Top	Bottom Ft.		

11. DRILLING LOG

Top	Bottom	Formation Description

12. REMARKS:

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

Walter L Davis 7-30-11
SIGNATURE OF CERTIFIED WELL CONTRACTOR DATE

Walter L Davis
PRINTED NAME OF PERSON CONSTRUCTING THE WELL

Submit within 30 days of completion to: Division of Water Quality - Information Processing, 1617 Mail Service Center, Raleigh, NC 27699-161, Phone : (919) 807-6300

Form GW-1b
Rev. 2/09

NON RESIDENTIAL WELL CONSTRUCTION RECORD

North Carolina Department of Environment and Natural Resources- Division of Water Quality

WELL CONTRACTOR CERTIFICATION # 3162-A

1. WELL CONTRACTOR:

Walter Lea Davis
Well Contractor (Individual) Name

3D Environmental Investigations L.L.C
Well Contractor Company Name

2157 Mocksville Highway
Street Address

statesville NC 28625
City or Town State Zip Code

(704) 657-7785
Area code Phone number

2. WELL INFORMATION:

WELL CONSTRUCTION PERMIT#

OTHER ASSOCIATED PERMIT#(if applicable)

SITE WELL ID #(if applicable) MW #2

3. WELL USE (Check One Box) Monitoring ☑ Municipal/Public ☐
Industrial/Commercial ☐ Agricultural ☐ Recovery ☐ Injection ☐
Irrigation ☐ Other ☐ (list use)

DATE DRILLED 7-29-11

4. WELL LOCATION:

133 Bluebell Rd
(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)

CITY: Greensboro COUNTY

TOPOGRAPHIC / LAND SETTING: (check appropriate box)
☐ Slope ☐ Valley ☐ Flat ☐ Ridge ☐ Other

LATITUDE 36 ° ' " DMS OR 3X.XXXXXXXX DD

LONGITUDE 75 ° ' " DMS OR 7X.XXXXXXXX DD

Latitude/longitude source: ☐ GPS ☐ Topographic map
(location of well must be shown on a USGS topo map andattached to this form if not using GPS)

5. FACILITY (Name of the business where the well is located.)

Facility Name: 133 Bluebell Road — Facility ID# (if applicable)

Street Address: Greensboro

City or Town: NC State — Zip Code

Contact Name: ECS (Toby)

Mailing Address: 4811 Koger Blvd

City or Town: Greensboro NC State — 27407 Zip Code

(336) 856-7150
Area code Phone number

6. WELL DETAILS:

a. **TOTAL DEPTH:** 20

b. **DOES WELL REPLACE EXISTING WELL?** YES ☐ NO ☑

c. **WATER LEVEL** Below Top of Casing: _____ FT.
(Use "+" if Above Top of Casing)

d. **TOP OF CASING IS** _____ FT. Above Land Surface*
*Top of casing terminated at/or below land surface may require a variance in accordance with 15A NCAC 2C .0118.

e. **YIELD (gpm):** _____ **METHOD OF TEST** _____

f. **DISINFECTION: Type** _____ **Amount** _____

g. **WATER ZONES** (depth):

Top	Bottom	Top	Bottom
Top	Bottom	Top	Bottom
Top	Bottom	Top	Bottom

7. CASING:

Depth		Diameter	Thickness/ Weight	Material
Top 0	Bottom 5 Ft.	2	Sch 40	PVC
Top	Bottom Ft.			
Top	Bottom Ft.			

8. GROUT:

Depth		Material	Method
Top 0	Bottom 2 Ft.	cement	PUMP
Top	Bottom Ft.		
Top	Bottom Ft.		

9. SCREEN:

Depth		Diameter	Slot Size	Material
Top 5	Bottom 20 Ft.	2 in.	0.10 in.	PVC
Top	Bottom Ft.	in.	in.	
Top	Bottom Ft.	in.	in.	

10. SAND/GRAVEL PACK:

Depth		Size	Material
Top 3	Bottom 20 Ft.	#2	Sand
Top	Bottom Ft.		
Top	Bottom Ft.		

11. DRILLING LOG

Top	Bottom	Formation Description

12. REMARKS:

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

Walter L Davis — 7-30-11
SIGNATURE OF CERTIFIED WELL CONTRACTOR — DATE

WALTER L DAVIS
PRINTED NAME OF PERSON CONSTRUCTING THE WELL

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Form GW-1b
Rev. 2/09

NON RESIDENTIAL WELL CONSTRUCTION RECORD

North Carolina Department of Environment and Natural Resources- Division of Water Quality

WELL CONTRACTOR CERTIFICATION # 3162-A

1. WELL CONTRACTOR:

Walter Lea Davis
Well Contractor (Individual) Name

3D Environmental Investigations L.L.C
Well Contractor Company Name

2157 Mocksville Highway
Street Address

statesville NC 28625
City or Town State Zip Code

(704) 657-7785
Area code Phone number

2. WELL INFORMATION:

WELL CONSTRUCTION PERMIT#

OTHER ASSOCIATED PERMIT#(if applicable)

SITE WELL ID #(if applicable) MW #3

3. WELL USE (Check One Box) Monitoring ☑ Municipal/Public ☐
Industrial/Commercial ☐ Agricultural ☐ Recovery ☐ Injection ☐
Irrigation ☐ Other ☐ (list use)

DATE DRILLED 7-29-11

4. WELL LOCATION:

133 Bluebell Rd
(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)

CITY: Greensboro COUNTY

TOPOGRAPHIC / LAND SETTING: (check appropriate box)
☐ Slope ☐ Valley ☐ Flat ☐ Ridge ☐ Other

LATITUDE 36 ° ' " DMS OR 3x.xxxxxxxx DD

LONGITUDE 75 ° ' " DMS OR 7x.xxxxxxxx DD

Latitude/longitude source: ☐ GPS ☐ Topographic map
(location of well must be shown on a USGS topo map andattached to this form if not using GPS)

5. FACILITY (Name of the business where the well is located.)

Facility Name: 133 Bluebell Road — Facility ID# (if applicable)

Street Address: Greensboro

City or Town: ECS (Toby) — State: NC — Zip Code:

Contact Name: 4811 Koger Blvd

Mailing Address: Greensboro

City or Town: NC. — State — Zip Code: 27407

(336) 856-7150
Area code Phone number

6. WELL DETAILS:

a. **TOTAL DEPTH:** 20

b. **DOES WELL REPLACE EXISTING WELL?** YES ☐ NO ☑

c. **WATER LEVEL** Below Top of Casing: _____ FT.
(Use "+" if Above Top of Casing)

d. **TOP OF CASING IS** _____ FT. Above Land Surface*
*Top of casing terminated at/or below land surface may require a variance in accordance with 15A NCAC 2C .0118.

e. **YIELD (gpm):** _____ **METHOD OF TEST** _____

f. **DISINFECTION: Type** _____ **Amount** _____

g. **WATER ZONES** (depth):

Top	Bottom	Top	Bottom
Top	Bottom	Top	Bottom
Top	Bottom	Top	Bottom

7. CASING:

Depth		Diameter	Thickness/ Weight	Material
Top 0	Bottom 5 Ft.	2	Sch 40	PVC
Top	Bottom Ft.			
Top	Bottom Ft.			

8. GROUT:

Depth		Material	Method
Top 0	Bottom 2 Ft.	Cement	Pump
Top	Bottom Ft.		
Top	Bottom Ft.		

9. SCREEN:

Depth		Diameter	Slot Size	Material
Top 5	Bottom 20 Ft.	2 in.	0.10 in.	PVC
Top	Bottom Ft.	in.	in.	
Top	Bottom Ft.	in.	in.	

10. SAND/GRAVEL PACK:

Depth		Size	Material
Top 3	Bottom 20 Ft.	#2	Sand
Top	Bottom Ft.		
Top	Bottom Ft.		

11. DRILLING LOG

Top	Bottom	Formation Description

12. REMARKS:

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

Walter L Davis — 7-30-11
SIGNATURE OF CERTIFIED WELL CONTRACTOR — DATE

Walter L Davis
PRINTED NAME OF PERSON CONSTRUCTING THE WELL

Submit within 30 days of completion to: Division of Water Quality - Information Processing, 1617 Mail Service Center, Raleigh, NC 27699-161, Phone : (919) 807-6300

Form GW-1b
Rev. 2/09

NON RESIDENTIAL WELL CONSTRUCTION RECORD

North Carolina Department of Environment and Natural Resources- Division of Water Quality

WELL CONTRACTOR CERTIFICATION # 3162-A

1. WELL CONTRACTOR:

Walter Lea Davis
Well Contractor (Individual) Name

3D Environmental Investigations L.L.C
Well Contractor Company Name

2157 Mocksville Highway
Street Address

statesville NC 28625
City or Town State Zip Code

(704) 657-7785
Area code Phone number

2. WELL INFORMATION:

WELL CONSTRUCTION PERMIT#

OTHER ASSOCIATED PERMIT#(if applicable)

SITE WELL ID #(if applicable) MW #4

3. WELL USE (Check One Box) Monitoring ☑ Municipal/Public ☐
Industrial/Commercial ☐ Agricultural ☐ Recovery ☐ Injection ☐
Irrigation ☐ Other ☐ (list use)

DATE DRILLED 7-29-11

4. WELL LOCATION:

133 Bluebell Rd
(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)

CITY: Greensboro COUNTY

TOPOGRAPHIC / LAND SETTING: (check appropriate box)
☐Slope ☐Valley ☐Flat ☐Ridge ☐Other

LATITUDE 36 ° ' " DMS OR 3X.XXXXXXXX DD

LONGITUDE 75 ° ' " DMS OR 7X.XXXXXXXX DD

Latitude/longitude source: ☐GPS ☐Topographic map
(location of well must be shown on a USGS topo map andattached to this form if not using GPS)

5. FACILITY (Name of the business where the well is located.)

Facility Name: 133 Bluebell Road Facility ID# (if applicable)

Street Address: Greensboro

City or Town: NC State Zip Code

ECS (Toby)
Contact Name

4811 Koger Blvd
Mailing Address

Greensboro NC. 27407
City or Town State Zip Code

(336) 856-7150
Area code Phone number

6. WELL DETAILS:

a. **TOTAL DEPTH:** 20

b. **DOES WELL REPLACE EXISTING WELL?** YES ☐ NO ☑

c. **WATER LEVEL** Below Top of Casing: _____ FT.
(Use "+" if Above Top of Casing)

d. **TOP OF CASING IS** _____ FT. Above Land Surface*
*Top of casing terminated at/or below land surface may require a variance in accordance with 15A NCAC 2C .0118.

e. **YIELD (gpm):** _____ **METHOD OF TEST** _____

f. **DISINFECTION: Type** _____ **Amount** _____

g. **WATER ZONES** (depth):

Top	Bottom	Top	Bottom
Top	Bottom	Top	Bottom
Top	Bottom	Top	Bottom

7. CASING:

Depth		Diameter	Thickness/ Weight	Material
Top 0	Bottom 5 Ft.	2	Sch 40	PVC
Top	Bottom Ft.			
Top	Bottom Ft.			

8. GROUT:

Depth		Material	Method
Top 0	Bottom 2 Ft.	Cement	PUMP
Top	Bottom Ft.		
Top	Bottom Ft.		

9. SCREEN:

Depth		Diameter	Slot Size	Material
Top 5	Bottom 20 Ft.	2 in.	0.10 in.	PVC
Top	Bottom Ft.	in.	in.	
Top	Bottom Ft.	in.	in.	

10. SAND/GRAVEL PACK:

Depth		Size	Material
Top 3	Bottom 20 Ft.	#2	Sand
Top	Bottom Ft.		
Top	Bottom Ft.		

11. DRILLING LOG

Top	Bottom	Formation Description

12. REMARKS:

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

Walter L Davis 7-30-11
SIGNATURE OF CERTIFIED WELL CONTRACTOR DATE

Walter L Davis
PRINTED NAME OF PERSON CONSTRUCTING THE WELL

Submit within 30 days of completion to: Division of Water Quality - Information Processing, 1617 Mail Service Center, Raleigh, NC 27699-161, Phone : (919) 807-6300

Form GW-1b
Rev. 2/09

ECS 14

NON RESIDENTIAL WELL CONSTRUCTION RECORD

North Carolina Department of Environment and Natural Resources- Division of Water Quality

WELL CONTRACTOR CERTIFICATION # 3162-A

1. WELL CONTRACTOR:

Walter Lea Davis
Well Contractor (Individual) Name

3D Environmental Investigations L.L.C
Well Contractor Company Name

2157 Mocksville Highway
Street Address

statesville NC 28625
City or Town State Zip Code

(704) 657-7785
Area code Phone number

2. WELL INFORMATION:

WELL CONSTRUCTION PERMIT#

OTHER ASSOCIATED PERMIT#(if applicable)

SITE WELL ID #(if applicable) MW #5

3. WELL USE (Check One Box) Monitoring ☑ Municipal/Public ☐
Industrial/Commercial ☐ Agricultural ☐ Recovery ☐ Injection ☐
Irrigation ☐ Other ☐ (list use)

DATE DRILLED 7-29-11

4. WELL LOCATION:

133 Bluebell Rd
(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)

CITY: Greensboro COUNTY

TOPOGRAPHIC / LAND SETTING: (check appropriate box)
☐ Slope ☐ Valley ☐ Flat ☐ Ridge ☐ Other

LATITUDE 36 ° ' " DMS OR 3X.XXXXXXXX DD

LONGITUDE 75 ° ' " DMS OR 7X.XXXXXXXX DD

Latitude/longitude source: ☐ GPS ☐ Topographic map
(location of well must be shown on a USGS topo map andattached to this form if not using GPS)

5. FACILITY (Name of the business where the well is located.)

Facility Name: 133 Bluebell Road — Facility ID# (if applicable)

Street Address: Greensboro

City or Town: ECS (Toby) — State: NC — Zip Code:

Contact Name: 4811 Koger Blvd

Mailing Address: Greensboro

City or Town: NC. State — Zip Code: 27407

(336) 856-7150
Area code Phone number

6. WELL DETAILS:

a. **TOTAL DEPTH:** 20

b. **DOES WELL REPLACE EXISTING WELL?** YES ☐ NO ☑

c. **WATER LEVEL** Below Top of Casing: _____ FT.
(Use "+" if Above Top of Casing)

d. **TOP OF CASING IS** _____ FT. Above Land Surface*
*Top of casing terminated at/or below land surface may require a variance in accordance with 15A NCAC 2C .0118.

e. **YIELD (gpm):** _____ **METHOD OF TEST** _____

f. **DISINFECTION: Type** _____ **Amount** _____

g. **WATER ZONES** (depth):

Top	Bottom	Top	Bottom

7. CASING:

Depth		Diameter	Thickness/ Weight	Material
Top 0	Bottom 5 Ft.	2	Sch 40	PVC
Top	Bottom Ft.			
Top	Bottom Ft.			

8. GROUT:

Depth		Material	Method
Top 0	Bottom 2 Ft.	Cement	PUMP
Top	Bottom Ft.		
Top	Bottom Ft.		

9. SCREEN:

Depth		Diameter	Slot Size	Material
Top 5	Bottom 20 Ft.	2 in.	0.10 in.	PVC
Top	Bottom Ft.	in.	in.	
Top	Bottom Ft.	in.	in.	

10. SAND/GRAVEL PACK:

Depth		Size	Material
Top 3	Bottom 20 Ft.	#2	Sand
Top	Bottom Ft.		
Top	Bottom Ft.		

11. DRILLING LOG

Top	Bottom	Formation Description

12. REMARKS:

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

Walter L Davis — 7-30-11
SIGNATURE OF CERTIFIED WELL CONTRACTOR — DATE

Walter L Davis
PRINTED NAME OF PERSON CONSTRUCTING THE WELL

Submit within 30 days of completion to: Division of Water Quality - Information Processing, 1617 Mail Service Center, Raleigh, NC 27699-161, Phone : (919) 807-6300

Form GW-1b
Rev. 2/09

APPENDIX – C

MATERIAL MANIFEST

Zebra
Environmental & Industrial Services

Manifest Document No.
Page 1 of 1
Zebra Job No.

EMERGENCY PHONE NO.
(336) 841-5276

POST OFFICE BOX 357
HIGH POINT, NC 27261

TEL (336) 841-5276
FAX (336) 841-5509

GENERATOR INFORMATION

Name: ECS		US EPA ID No.
Street Address: 133 Bluebell Rd Greensboro NC	Mailing Address	Phone No. 336-362-4210
		Contact: Toby

DESCRIPTION OF MATERIALS

	HM	USDOT Proper Shipping Name (Complete All Items for Hazardous Materials)	Hazard Class or Div	UN / NA ID No.	Packing Group	Containers Qty.	Containers Type	Total Quantity	Unit Wt./Vol.
a.		Non Haz Soil	—	—	—	5	DM	5	55gal Drums
b.		Non Haz Water	—	—	—	1	DM	1	55gal Drum
c.									

ADDITIONAL INFORMATION		ERG No.	Zebra Profile Code	Facility Use
a.				
b.				
c.				

GENERATOR'S CERTIFICATION

This is to certify that the above-described materials are properly classified, described, packaged, marked and labeled, and are in proper condition for transportation according to the applicable regulations of the Department of Transportation. I further certify that none of the materials described above are a hazardous waste as defined by EPA 40 CFR Part 261 or any applicable state law, and unless specifically identified above, the materials contain less than 1,000 ppm total halogens and do not contain quantifiable levels (2 ppm) of PCBs as defined by EPA 40 CFR Parts 279 and 761.

Printed / Typed Name	Signature	Mo. / Day / Yr.
		9/15/11

TRANSPORTER INFORMATION

Transporter: Zebra Environmental & Industrial Services Inc

Address: 901 East Springfield Road, High Point, NC 27263

Transporter or EPA ID No.: NCO991302669 Unit No.: BT-1

Phone: (336) 841-5276

I hereby acknowledge receipt of the above-described materials for transport from the generator site listed above.

Signature: James Pettiger Shipment Date: 9/15/11

I hereby acknowledge receipt of the above-described materials were received from the generator site and were transported to the facility listed below.

Signature: James Pettiger Delivery Date: 9/15/11

FACILITY INFORMATION

Facility: Zebra Environmental & Industrial Services, Inc.

Address: 901 East Springfield Road, High Point, NC 27263

Facility or EPA ID No.: NCO991302669

Phone: (336) 841-5276

Contact: David Tedder

I hereby acknowledge receipt of the materials covered by this manifest except for any discrepancy noted below.

Signature: [illegible] Receipt Date: 9/21/2011

Discrepancies / Routing Codes / Handing Methods

a.

b.

c.

ORIGINAL - Facility Retain COPY 2 - Return to Generator COPY 3 - Transporter Retain COPY 4 - Generator Retain

APPENDIX – D

PRISM LABORATORIES, INC. | Full-Service Analytical & Environmental Solutions

NC Certification No. 402
SC Certification No. 99012
NC Drinking Water Cert No. 37735

Case Narrative

06/21/2011

ECS Carolinas - Greensboro
Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Lab Submittal Date: 06/08/2011
Prism Work Order: 1060179

This data package contains the analytical results for the project identified above and includes a Case Narrative, Sample Results and Chain of Custody. Unless otherwise noted, all samples were received in acceptable condition and processed according to the referenced methods.

Data qualifiers are flagged individually on each sample. A key reference for the data qualifiers appears at the end of this case narrative.

Narrative Notes:

Hexavalent Chromium analysis was subcontracted to GCAL. Laboratory report is attached.

Please call if you have any questions relating to this analytical report.

Respectfully,

PRISM LABORATORIES, INC.

VP Laboratory Services

Reviewed By

Data Qualifiers Key Reference:

BRL	Below Reporting Limit
MDL	Method Detection Limit
RPD	Relative Percent Difference
*	Results reported to the reporting limit. All other results are reported to the MDL with values between MDL and reporting limit indicated with a J.

This report should not be reproduced, except in its entirety, without the written consent of Prism Laboratories, Inc.

449 Springbrook Road - P.O. Box 240543 - Charlotte, NC 28224-0543
Phone: 704/529-6364 - Toll Free Number: 1-800/529-6364 - Fax: 704/525-0409

PRISM LABORATORIES, INC. | Full-Service Analytical & Environmental Solutions

Sample Receipt Summary

06/21/2011

Prism Work Order: 1060179

Client Sample ID	Lab Sample ID	Matrix	Date Sampled	Date Received
HA-1 (4)	1060179-01	Solid	06/07/11	06/08/11
HA-2 (2)	1060179-02	Solid	06/07/11	06/08/11
HA-3 (3)	1060179-03	Solid	06/07/11	06/08/11
HA-4 (2)	1060179-04	Solid	06/07/11	06/08/11
BKG (3)	1060179-05	Solid	06/07/11	06/08/11

Samples received in good condition at 3.2 degrees C unless otherwise noted.

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449 Springbrook Road - P.O. Box 240543 - Charlotte, NC 28224-0543
Phone: 704/529-6364 - Toll Free Number: 1-800/529-6364 - Fax: 704/525-0409

PRISM LABORATORIES, INC. | Full-Service Analytical & Environmental Solutions

Laboratory Report

06/21/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: HA-1 (4)
Prism Sample ID: 1060179-01
Prism Work Order: 1060179
Time Collected: 06/07/11 11:30
Time Submitted: 06/08/11 15:25

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**74.0**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**6/10/11 15:30**	**JAB**	**P1F0213**
Trivalent Chromium	**2200**	**mg/kg**	**1.0**		**1**	***Calculation**	**6/21/11 11:46**	**HMBJ**	**P1F0375**
Total Metals									
Chromium	**2300**	**mg/kg dry**	**6.8**	**0.93**	**20**	***6010C**	**6/13/11 14:36**	**DWR**	**P1F0194**

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PRISM LABORATORIES, INC. | Full-Service Analytical & Environmental Solutions

Laboratory Report

06/21/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: HA-2 (2)
Prism Sample ID: 1060179-02
Prism Work Order: 1060179
Time Collected: 06/07/11 12:05
Time Submitted: 06/08/11 15:25

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**77.0**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**6/10/11 15:30**	**JAB**	**P1F0213**
Trivalent Chromium	**67**	**mg/kg**	**1.0**		**1**	***Calculation**	**6/21/11 11:46**	**HMBJ**	**P1F0375**
Total Metals									
Chromium	**68**	**mg/kg dry**	**0.32**	**0.044**	**1**	***6010C**	**6/13/11 12:02**	**DWR**	**P1F0194**

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PRISM LABORATORIES, INC. | Full-Service Analytical & Environmental Solutions

Laboratory Report

06/21/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: HA-3 (3)
Prism Sample ID: 1060179-03
Prism Work Order: 1060179
Time Collected: 06/07/11 13:00
Time Submitted: 06/08/11 15:25

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**88.7**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**6/10/11 15:30**	**JAB**	**P1F0213**
Trivalent Chromium	**13**	**mg/kg**	**1.0**		**1**	***Calculation**	**6/21/11 11:46**	**HMBJ**	**P1F0375**
Total Metals									
Chromium	**13**	**mg/kg dry**	**0.28**	**0.038**	**1**	***6010C**	**6/13/11 12:11**	**DWR**	**P1F0194**

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PRISM LABORATORIES, INC. | Full-Service Analytical & Environmental Solutions

Laboratory Report

06/21/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: HA-4 (2)
Prism Sample ID: 1060179-04
Prism Work Order: 1060179
Time Collected: 06/07/11 13:45
Time Submitted: 06/08/11 15:25

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**79.1**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**6/10/11 15:30**	**JAB**	**P1F0213**
Trivalent Chromium	**1500**	**mg/kg**	**1.0**		**1**	***Calculation**	**6/21/11 11:46**	**HMBJ**	**P1F0375**
Total Metals									
Chromium	**1500**	**mg/kg dry**	**3.1**	**0.43**	**10**	***6010C**	**6/13/11 14:43**	**DWR**	**P1F0194**

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PRISM LABORATORIES, INC. | Full-Service Analytical & Environmental Solutions

Laboratory Report

06/21/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: BKG (3)
Prism Sample ID: 1060179-05
Prism Work Order: 1060179
Time Collected: 06/07/11 14:05
Time Submitted: 06/08/11 15:25

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**92.2**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**6/10/11 15:30**	**JAB**	**P1F0213**
Trivalent Chromium	**6.1**	**mg/kg**	**1.0**		**1**	***Calculation**	**6/21/11 11:46**	**HMBJ**	**P1F0375**
Total Metals									
Chromium	**6.7**	**mg/kg dry**	**0.28**	**0.038**	**1**	***6010C**	**6/13/11 12:38**	**DWR**	**P1F0194**

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ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Prism Work Order: 1060179
Time Submitted: 6/8/11 3:25:00PM

Total Metals - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch P1F0194 - 3050B										
Blank (P1F0194-BLK1)				Prepared: 06/10/11	Analyzed: 06/13/11					
Chromium	BRL	0.25	mg/kg wet							
LCS (P1F0194-BS1)				Prepared: 06/10/11	Analyzed: 06/13/11					
Chromium	24.5	0.25	mg/kg wet	25.1		98	80-120			

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ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Prism Work Order: 1060179
Time Submitted: 6/8/11 3:25:00PM

General Chemistry Parameters - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch P1F0213 - NO PREP										
Blank (P1F0213-BLK1)				Prepared & Analyzed: 06/10/11						
% Solids	100	0.100	% by Weight							

Sample Extraction Data

Prep Method: 3050B

Lab Number	Batch	Initial	Final	Date/Time
1060179-01	P1F0194	2 g	50 mL	06/10/11 8:15
1060179-02	P1F0194	2.02 g	50 mL	06/10/11 8:15
1060179-03	P1F0194	2.03 g	50 mL	06/10/11 8:15
1060179-04	P1F0194	2.03 g	50 mL	06/10/11 8:15
1060179-05	P1F0194	1.97 g	50 mL	06/10/11 8:15

Subcontracted Analyses

The following analyses were subcontracted to Gulf Coast Analytical Labs, Inc.

Lab Number	Analysis
1060179-01	Hexavalent Chromium (Sub)
1060179-02	Hexavalent Chromium (Sub)
1060179-03	Hexavalent Chromium (Sub)
1060179-04	Hexavalent Chromium (Sub)
1060179-05	Hexavalent Chromium (Sub)

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Phone: 704/529-6364 • Fax: 704/525-0409

CHAIN OF CUSTODY RECORD

PAGE ____ OF ____ QUOTE # TO ENSURE PROPER BILLING: _____

Client Company Name: ECS Carolinas
Report To/Contact Name: Toby Benfield
Reporting Address: 4811 Koger Blvd
tBenfield@ECSLimited.com
Phone: _____ Fax (Yes) (No): _____
Email (Yes) (No) Email Address tBenfield@ECSLimited.com
EDD Type: PDF X Excel ____ Other _____
Site Location Name: United Metal
Site Location Physical Address: 133 Blue Bell Rd

Project Name: _____
Short Hold Analysis: (Yes) (No) UST Project: (Yes) (No)
*Please ATTACH any project specific reporting (QC LEVEL I II III IV) provisions and/or QC Requirements
Invoice To: Toby Benfield
Address: 4811 Koger Blvd
Greensboro NC 27407
Purchase Order No./Billing Reference _____
Requested Due Date ☐ 1 Day ☐ 2 Days ☐ 3 Days ☐ 4 Days ☐ 5 Days
"Working Days" ☐ 6-9 Days ☐ Standard 10 days ☐ Rush Work Must Be Pre-Approved
Samples received after 15:00 will be processed next business day.
Turnaround time is based on business days, excluding weekends and holidays.
(SEE REVERSE FOR TERMS & CONDITIONS REGARDING SERVICES RENDERED BY PRISM LABORATORIES, INC. TO CLIENT)

LAB USE ONLY

	YES	NO	N/A
Samples INTACT upon arrival? 3.2	X		
Received ON WET ICE? Temp	X		
PROPER PRESERVATIVES indicated?	X		
Received WITHIN HOLDING TIMES?	X		
CUSTODY SEALS INTACT?			X
VOLATILES rec'd W/OUT HEADSPACE?			X
PROPER CONTAINERS used?	X		

TO BE FILLED IN BY CLIENT/SAMPLING PERSONNEL
Certification: NELAC ____ USACE ____ FL ____ NC ____
SC ____ OTHER ____ N/A ____
Water Chlorinated: YES ____ NO ____
Sample Iced Upon Collection: YES X NO ____

CLIENT SAMPLE DESCRIPTION	DATE COLLECTED	TIME COLLECTED MILITARY HOURS	MATRIX (SOIL, WATER OR SLUDGE)	SAMPLE CONTAINER *TYPE SEE BELOW	NO.	SIZE	PRESERVATIVES	ANALYSES REQUESTED (8x3)	(8x4)					REMARKS	PRISM LAB ID NO.
HA-1 (4)	6-7	1130	S					✓	✓						01
HA-2 (2)	↓	1205	↓					✓	✓						02
HA-3 (3)		1300						✓	✓						03
HA-4 (2)		1345						✓	✓						04
BKG (3)	↓	1405	↓					✓							05

PRESS DOWN FIRMLY - 3 COPIES

Sampler's Signature _____ Sampled By (Print Name) Toby S Benfield Affiliation _____

Upon relinquishing, this Chain of Custody is your authorization for Prism to proceed with the analyses as requested above. Any changes must be submitted in writing to the Prism Project Manager. There will be charges for any changes after analyses have been initialized.

		Date	Military/Hours
Relinquished By: (Signature)	Received By: (Signature) Rich Lane	6/8/11	12:45
Relinquished By: (Signature) Rich Lane	Received By: (Signature)	6/8/11	13:15
Relinquished By: (Signature) 6/8/11 15:25	Received for Prism Laboratories By:	6-8-11	15:25

Method of Shipment: NOTE: ALL SAMPLE COOLERS SHOULD BE TAPED SHUT WITH CUSTODY SEALS FOR TRANSPORTATION TO THE LABORATORY. SAMPLES ARE NOT ACCEPTED AND VERIFIED AGAINST COC UNTIL RECEIVED AT THE LABORATORY.
☐ Fed Ex ☐ UPS ☐ Hand-delivered ☐ Prism Field Service ☐ Other _____

COC Group No. 1060179

Additional Comments: 4 oz JARS

PRISM USE ONLY
Site Arrival Time:
Site Departure Time:
Field Tech Fee:
Mileage:

CODES:	UST:	GROUNDWATER:	DRINKING WATER:	SOLID WASTE:	RCRA:	CERCLA	LANDFILL	OTHER:
NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC	X NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC

CONTAINER TYPE CODES: A = Amber C = Clear G = Glass P = Plastic; TL = Teflon-Lined Cap VOA = Volatile Organics Analysis (Zero Head Space)

SEE REVERSE FOR TERMS & CONDITIONS

ORIGINAL

ACCESS
ANALYTICAL, INC.

ANALYTICAL REPORT

CLIENT
Prism Laboratories, Inc.
PO BOX 240543
Charlotte, NC 28224

ATTENTION
Angie Overcash

PROJECT ID
1060179

LABORATORY REPORT NUMBER
211061324

DATE
06/15/2011

Primary Data Review By

IntegriSign

Curtis Ekker
Data Validation Manager, GCAL

Secondary Data Review By

Ashley B. Amick
Project Manager, Access Analytical, Inc.
aamick@accessanalyticalinc.com

PLEASE NOTE:

- **Unless otherwise noted, all analysis on this report performed at Gulf Coast Analytical Labs (GCAL), 7979 GSRI Avenue, Baton Rouge, LA 70820.**
- **GCAL is SCDHEC certified laboratory # 73006, NCDENR certified lab # 618, GA certified lab # LA-01955, NELAP certified laboratory # 01955**
- Local support services for this project are provided by Access Analytical, Inc.. Access Analytical is a representative of GCAL serving clients in the SC/NC/GA areas. All questions regarding this report should be directed to your local Access Analytical representative at 803.781.4243 or toll free at 888.315.4243.

NELAP CERTIFICATE NUMBER 01955
DOD ELAP CERTIFICATE NUMBER ADE - 1482

ANALYTICAL RESULTS

PERFORMED BY

GULF COAST ANALYTICAL LABORATORIES, INC.
7979 GSRI Avenue
Baton Rouge, LA 70820

Report Date 06/15/2011

GCAL Report 211061324

Deliver To	Prism Laboratories, Inc. PO BOX 240543 Charlotte, NC 28224 706-529-6364
Attn	Angie Overcash

Project 1060179

CASE NARRATIVE

Client: Prism Laboratories, Inc. **Report:** 211061324

Gulf Coast Analytical Laboratories received and analyzed the sample(s) listed on the sample cross-reference page of this report. Receipt of the sample(s) is documented by the attached chain of custody. This applies only to the sample(s) listed in this report. No sample integrity or quality control exceptions were identified unless noted below.

CONVENTIONALS

In the SW-846 7196A analysis, sample 21106132401 (HA-1 (4)) had to be diluted in order to bracket the concentration within the calibration range of the instrument.

MISCELLANEOUS

All samples were received at 16°C which was outside the recommended NELAC range of 4°C ± 2°C as stated in 5.5.8.3.1.

Laboratory Endorsement

Sample analysis was performed in accordance with approved methodologies provided by the Environmental Protection Agency or other recognized agencies. The samples and their corresponding extracts will be maintained for a period of 30 days unless otherwise arranged. Following this retention period the samples will be disposed in accordance with GCAL's Standard Operating Procedures.

Common Abbreviations Utilized in this Report

ND	Indicates the result was Not Detected at the specified RDL
DO	Indicates the result was Diluted Out
MI	Indicates the result was subject to Matrix Interference
TNTC	Indicates the result was Too Numerous To Count
SUBC	Indicates the analysis was Sub-Contracted
FLD	Indicates the analysis was performed in the Field
PQL	Practical Quantitation Limit
MDL	Method Detection Limit
RDL	Reporting Detection Limit
00:00	Reported as a time equivalent to 12:00 AM

Reporting Flags Utilized in this Report

J	Indicates an estimated value
U	Indicates the compound was analyzed for but not detected
B	(ORGANICS) Indicates the analyte was detected in the associated Method Blank
B	(INORGANICS) Indicates the result is between the RDL and MDL

Sample receipt at GCAL is documented through the attached chain of custody. In accordance with NELAC, this report shall be reproduced only in full and with the written permission of GCAL. The results contained within this report relate only to the samples reported. The documented results are presented within this report.

This report pertains only to the samples listed in the Report Sample Summary and should be retained as a permanent record thereof. The results contained within this report are intended for the use of the client. Any unauthorized use of the information contained in this report is prohibited.

I certify that this data package is in compliance with the NELAC standard and terms and conditions of the contract and Statement of Work both technically and for completeness, for other than the conditions in the case narrative. Release of the data contained in this hardcopy data package and in the computer-readable data submitted has been authorized by the Quality Assurance Manager or his/her designee, as verified by the following signature.

Estimated uncertainty of measurement is available upon request. This report is in compliance with the DOD QSM as specified in the contract if applicable.

IntegriSign

Robyn Migues
Technical Director
GCAL REPORT 211061324

IntegriSi

THIS REPORT CONTAINS 19 PAGES.

Report Sample Summary

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21106132401	HA-1 (4)	Solid	06/07/2011 11:30	06/11/2011 09:10
21106132402	HA-2 (2)	Solid	06/07/2011 12:05	06/11/2011 09:10
21106132403	HA-3 (3)	Solid	06/07/2011 13:00	06/11/2011 09:10
21106132404	HA-4 (2)	Solid	06/07/2011 13:45	06/11/2011 09:10
21106132405	BKG (3)	Solid	06/07/2011 14:05	06/11/2011 09:10

Summary of Compounds Detected

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21106132401	HA-1 (4)	Solid	06/07/2011 11:30	06/11/2011 09:10

SW-846 7196A Chromium VI

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	57.5	2.52	1.26	mg/kg

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21106132402	HA-2 (2)	Solid	06/07/2011 12:05	06/11/2011 09:10

SW-846 7196A Chromium VI

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	1.40	1.27	0.636	mg/kg

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21106132404	HA-4 (2)	Solid	06/07/2011 13:45	06/11/2011 09:10

SW-846 7196A Chromium VI

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	43.3	1.31	0.654	mg/kg

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21106132401	HA-1 (4)	Solid	06/07/2011 11:30	06/11/2011 09:10

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
06/14/2011 11:30	458359	SW-846 3060A	2	06/14/2011 16:29	JEM	458470

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	57.5	2.52	1.26	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21106132402	HA-2 (2)	Solid	06/07/2011 12:05	06/11/2011 09:10

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
06/14/2011 11:30	458359	SW-846 3060A	1	06/14/2011 16:26	JEM	458470

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	1.40	1.27	0.636	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21106132403	HA-3 (3)	Solid	06/07/2011 13:00	06/11/2011 09:10

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
06/14/2011 11:30	458359	SW-846 3060A	1	06/14/2011 16:26	JEM	458470

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	0.563U	1.13	0.563	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21106132404	HA-4 (2)	Solid	06/07/2011 13:45	06/11/2011 09:10

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
06/14/2011 11:30	458359	SW-846 3060A	1	06/14/2011 16:27	JEM	458470

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	43.3	1.31	0.654	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
211061324-05	BKG (3)	Solid	06/07/2011 14:05	06/11/2011 09:10

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
06/14/2011 11:30	458359	SW-846 3060A	1	06/14/2011 16:27	JEM	458470

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	0.537U	1.07	0.537	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

General Chemistry Quality Control Summary

Analytical Batch 458470	Client ID	MB458359			LCS458359		
Prep Batch 458359	GCAL ID	956693			956694		
Prep Method SW-846	Sample Type	Method Blank			LCS		
3060A	Prep Date	06/14/2011 11:30			06/14/2011 11:30		
	Analytical Date	06/14/2011 16:22			06/14/2011 16:23		
	Matrix	Solid			Solid		
SW-846 7196A Chromium VI		Units	mg/kg Result	Spike Added	Result	% R	Control Limits % R
18540-29-9	Chromium VI		0.500U	0.500	100	83.9	83.9	75 - 125

Analytical Batch 458470	Client ID	HA-1 (4)			956627MS		
Prep Batch 458359	GCAL ID	21106132401			956695		
Prep Method SW-846	Sample Type	SAMPLE			MS		
3060A	Prep Date	06/14/2011 11:30			06/14/2011 11:30		
	Analytical Date	06/14/2011 16:29			06/14/2011 16:31		
	Matrix	Solid			Solid		
SW-846 7196A Chromium VI		Units	mg/kg Result	Spike Added	Result	% R	Control Limits % R
18540-29-9	Chromium VI		45.6	1.00	100	124	78.6	74.5 -125.4

Analytical Batch 458470	Client ID	HA-2 (2)		956634DUP		
Prep Batch 458359	GCAL ID	21106132402		956696		
Prep Method SW-846	Sample Type	SAMPLE		DUP		
3060A	Prep Date	06/14/2011 11:30		06/14/2011 11:30		
	Analytical Date	06/14/2011 16:26		06/14/2011 16:26		
	Matrix	Solid		Solid		
SW-846 7196A Chromium VI		Units Result	mg/kg RDL	Result	RPD	RPD Limit
18540-29-9	Chromium VI		1.10	0.500	1.10	0	25

ACCESS/4565/211061324/6/17/11

PRISM LABORATORIES, INC. | Full-Service Analytical & Environmental Solutions

SUBCONTRACT ORDER

Prism Laboratories, Inc.

1060179

Certification: NELAC___ USACE___
SC___ Other _____
N/A___

SENDING LABORATORY:

Prism Laboratories, Inc.
P. O. Box 240543
Charlotte, NC 28224-0543
Phone: 800-529-6364
Fax: 704-525-0409
Project Manager: Angela D. Overcash

RECEIVING LABORATORY:

Gulf Coast Analytical Labs, Inc.
7979 GSRI Avenue
Baton Rouge, LA 70820
Phone :(225) 769-4900
Fax: (225) 767-5717

Analysis	Due	Expires	Laboratory ID	Comments	
Sample ID: 1060179-01	**Solid**	**Sampled:06/07/11 11:30**	[redacted]		1
Hexavalent Chromium (Sub)		06/08/11 11:30			
Containers Supplied:					
Sample ID: 1060179-02	**Solid**	**Sampled:06/07/11 12:05**	[redacted]		2
Hexavalent Chromium (Sub)		06/08/11 12:05			
Containers Supplied:					
Sample ID: 1060179-03	**Solid**	**Sampled:06/07/11 13:00**	[redacted]		3
Hexavalent Chromium (Sub)		06/08/11 13:00			
Containers Supplied:					
Sample ID: 1060179-04	**Solid**	**Sampled:06/07/11 13:45**	[redacted]		4
Hexavalent Chromium (Sub)		06/08/11 13:45			
Containers Supplied:					
Sample ID: 1060179-05	**Solid**	**Sampled:06/07/11 14:05**	[redacted]		5
Hexavalent Chromium (Sub)		06/08/11 14:05			

Released By	Date	Received By	Date
[signature]	6/10/11	Fedex	6/10/11
FedEx # 7971 9468 1708	6/11/11 @ 0910	[signature]	6/11/11 @ 0910

7.10 C

GCAL
GULF COAST ANALYTICAL LABORATORIES, INC

SAMPLE RECEIVING CHECKLIST

Workorder: 211061324

Client: 4565 - Access Analytical

Profile: 80251 - Prism Lab

Line Item: 2 - Solid

Received by: Pfeifer, Ben J.

Received Date/Time: 6/11/2011 9:10:00 AM

Samples Received via: FEDEX

Number of Coolers Received: 1

Cooler tracking numbers(s): 7971 9418 1708

Cooler temperature(s): 7.1°C

Were all coolers received at a temperature of 0 - 6° C?	☐ Yes	☑ No	☐ N/A
Were all custody seals intact?	☑ Yes	☐ No	☐ N/A
Were all samples recevied in proper containers?	☑ Yes	☐ No	☐ N/A
Were all samples properly preserved?	☑ Yes	☐ No	☐ N/A
Was preservative added to any container at the lab?	☐ Yes	☑ No	☐ N/A
Were all containers received in good condition?	☑ Yes	☐ No	☐ N/A
Were all VOA vials received with no head space?	☐ Yes	☐ No	☑ N/A
Do all sample labels match the Chain of Custody?	☑ Yes	☐ No	☐ N/A
Was the client notified about any discrepancies?	☐ Yes	☐ No	☑ N/A

Notes/Comments:

Case Narrative

08/26/2011

ECS Carolinas - Greensboro
Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Lab Submittal Date: 08/16/2011
Prism Work Order: 1080439

This data package contains the analytical results for the project identified above and includes a Case Narrative, Sample Results and Chain of Custody. Unless otherwise noted, all samples were received in acceptable condition and processed according to the referenced methods.

Data qualifiers are flagged individually on each sample. A key reference for the data qualifiers appears at the end of this case narrative.

Please call if you have any questions relating to this analytical report.

Respectfully,

PRISM LABORATORIES, INC.

VP Laboratory Services

Steven H. Byntill

Reviewed By

Data Qualifiers Key Reference:

D	RPD value outside of the control limits.
E	Estimated concentration above the calibration range
IH	Internal standard area below the QC limit. Compound reported with possible high bias.
J	Detected but below the Reporting Limit; therefore, result is an estimated concentration (CLP J-Flag).
MC	Sample concentration too high for recovery evaluation.
MI	Matrix spike outside of the control limits. Matrix interference suspected.
BRL	Below Reporting Limit
MDL	Method Detection Limit
RPD	Relative Percent Difference
*	Results reported to the reporting limit. All other results are reported to the MDL with values between MDL and reporting limit indicated with a J.

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Sample Receipt Summary

08/26/2011

Prism Work Order: 1080439

Client Sample ID	Lab Sample ID	Matrix	Date Sampled	Date Received
GP-1	1080439-01	Solid	08/15/11	08/16/11
GP-2	1080439-02	Solid	08/15/11	08/16/11
GP-3	1080439-03	Solid	08/15/11	08/16/11
GP-4	1080439-04	Solid	08/15/11	08/16/11
GP-5	1080439-05	Solid	08/15/11	08/16/11
GP-6	1080439-06	Solid	08/15/11	08/16/11
GP-7	1080439-07	Solid	08/15/11	08/16/11
GP-8	1080439-08	Solid	08/15/11	08/16/11
Duplicate	1080439-09	Solid	08/15/11	08/16/11
GP-9	1080439-10	Solid	08/15/11	08/16/11
GP-10	1080439-11	Solid	08/15/11	08/16/11
GP-11	1080439-12	Solid	08/15/11	08/16/11
GP-12	1080439-13	Solid	08/15/11	08/16/11
GP-13	1080439-14	Solid	08/15/11	08/16/11
GP-14	1080439-15	Solid	08/15/11	08/16/11
GP-15	1080439-16	Solid	08/15/11	08/16/11
GP-16	1080439-17	Solid	08/15/11	08/16/11
GP-17	1080439-18	Solid	08/15/11	08/16/11
GP-18B	1080439-19	Solid	08/15/11	08/16/11
GP-19	1080439-20	Solid	08/15/11	08/16/11
GP-20	1080439-21	Solid	08/15/11	08/16/11
GP-21	1080439-22	Solid	08/15/11	08/16/11
GP-22	1080439-23	Solid	08/15/11	08/16/11
GP-23	1080439-24	Solid	08/15/11	08/16/11
GP-24	1080439-25	Solid	08/15/11	08/16/11
GP-25	1080439-26	Solid	08/15/11	08/16/11
BKG-1	1080439-27	Solid	08/15/11	08/16/11
BKG-2	1080439-28	Solid	08/15/11	08/16/11
BKG-3	1080439-29	Solid	08/15/11	08/16/11
BKG-4	1080439-30	Solid	08/15/11	08/16/11

Samples received in good condition at 6.4 degrees C unless otherwise noted.

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Summary of Detections

08/26/2011

Prism Work Order: 1080439

Prism ID	Client ID	Parameter	Method	Result		Units
1080439-01	GP-1	Beryllium	*6010C	0.45		mg/kg dry
1080439-01	GP-1	Chromium	*6010C	7.2		mg/kg dry
1080439-01	GP-1	Copper	*6010C	29		mg/kg dry
1080439-01	GP-1	Lead	*6010C	2.9		mg/kg dry
1080439-01	GP-1	Nickel	*6010C	9.0		mg/kg dry
1080439-01	GP-1	Zinc	*6010C	56		mg/kg dry
1080439-02	GP-2	Beryllium	*6010C	0.80		mg/kg dry
1080439-02	GP-2	Chromium	*6010C	4.3		mg/kg dry
1080439-02	GP-2	Copper	*6010C	15		mg/kg dry
1080439-02	GP-2	Lead	*6010C	3.8		mg/kg dry
1080439-02	GP-2	Nickel	*6010C	6.1		mg/kg dry
1080439-02	GP-2	Zinc	*6010C	72		mg/kg dry
1080439-03	GP-3	Beryllium	*6010C	0.93		mg/kg dry
1080439-03	GP-3	Chromium	*6010C	2.8		mg/kg dry
1080439-03	GP-3	Copper	*6010C	81		mg/kg dry
1080439-03	GP-3	Lead	*6010C	4.6		mg/kg dry
1080439-03	GP-3	Nickel	*6010C	7.7		mg/kg dry
1080439-03	GP-3	Zinc	*6010C	44		mg/kg dry
1080439-03	GP-3	Acetone	8260B	4.9	J	ug/kg dry
1080439-04	GP-4	Beryllium	*6010C	0.66		mg/kg dry
1080439-04	GP-4	Chromium	*6010C	0.80		mg/kg dry
1080439-04	GP-4	Copper	*6010C	38		mg/kg dry
1080439-04	GP-4	Lead	*6010C	2.1		mg/kg dry
1080439-04	GP-4	Nickel	*6010C	1.3		mg/kg dry
1080439-04	GP-4	Zinc	*6010C	30		mg/kg dry
1080439-05	GP-5	Beryllium	*6010C	0.34		mg/kg dry
1080439-05	GP-5	Chromium	*6010C	7.6		mg/kg dry
1080439-05	GP-5	Copper	*6010C	12		mg/kg dry
1080439-05	GP-5	Lead	*6010C	5.6		mg/kg dry
1080439-05	GP-5	Nickel	*6010C	8.1		mg/kg dry
1080439-05	GP-5	Selenium	*6010C	1.2		mg/kg dry
1080439-05	GP-5	Zinc	*6010C	24		mg/kg dry
1080439-05	GP-5	Acetone	8260B	4.4	J	ug/kg dry
1080439-06	GP-6	Beryllium	*6010C	0.37		mg/kg dry
1080439-06	GP-6	Chromium	*6010C	5.4		mg/kg dry
1080439-06	GP-6	Copper	*6010C	40		mg/kg dry
1080439-06	GP-6	Lead	*6010C	0.66		mg/kg dry
1080439-06	GP-6	Nickel	*6010C	6.5		mg/kg dry
1080439-06	GP-6	Zinc	*6010C	55		mg/kg dry
1080439-06	GP-6	Acetone	8260B	5.0	J	ug/kg dry
1080439-07	GP-7	Chromium	*6010C	8.6		mg/kg dry
1080439-07	GP-7	Copper	*6010C	46		mg/kg dry
1080439-07	GP-7	Lead	*6010C	1.4		mg/kg dry
1080439-07	GP-7	Nickel	*6010C	4.5		mg/kg dry

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Summary of Detections

08/26/2011

Prism Work Order: 1080439

Prism ID	Client ID	Parameter	Method	Result		Units
1080439-07	GP-7	Zinc	*6010C	20		mg/kg dry
1080439-08	GP-8	Beryllium	*6010C	0.92		mg/kg dry
1080439-08	GP-8	Chromium	*6010C	5.6		mg/kg dry
1080439-08	GP-8	Copper	*6010C	38		mg/kg dry
1080439-08	GP-8	Lead	*6010C	2.0		mg/kg dry
1080439-08	GP-8	Nickel	*6010C	6.8		mg/kg dry
1080439-08	GP-8	Thallium	*6010C	0.67		mg/kg dry
1080439-08	GP-8	Zinc	*6010C	89		mg/kg dry
1080439-08	GP-8	Acetone	8260B	8.5	J	ug/kg dry
1080439-09	Duplicate	Beryllium	*6010C	0.62		mg/kg dry
1080439-09	Duplicate	Chromium	*6010C	3.7		mg/kg dry
1080439-09	Duplicate	Copper	*6010C	13		mg/kg dry
1080439-09	Duplicate	Lead	*6010C	2.7		mg/kg dry
1080439-09	Duplicate	Nickel	*6010C	4.8		mg/kg dry
1080439-09	Duplicate	Zinc	*6010C	46		mg/kg dry
1080439-09	Duplicate	Acetone	8260B	3.9	J	ug/kg dry
1080439-10	GP-9	Beryllium	*6010C	0.65		mg/kg dry
1080439-10	GP-9	Chromium	*6010C	7.2		mg/kg dry
1080439-10	GP-9	Copper	*6010C	19		mg/kg dry
1080439-10	GP-9	Lead	*6010C	1.0		mg/kg dry
1080439-10	GP-9	Nickel	*6010C	13		mg/kg dry
1080439-10	GP-9	Selenium	*6010C	0.75		mg/kg dry
1080439-10	GP-9	Zinc	*6010C	36		mg/kg dry
1080439-11	GP-10	Chromium	*6010C	3.3		mg/kg dry
1080439-11	GP-10	Copper	*6010C	15		mg/kg dry
1080439-11	GP-10	Lead	*6010C	0.34		mg/kg dry
1080439-11	GP-10	Nickel	*6010C	7.4		mg/kg dry
1080439-11	GP-10	Zinc	*6010C	35		mg/kg dry
1080439-12	GP-11	Beryllium	*6010C	0.34		mg/kg dry
1080439-12	GP-11	Chromium	*6010C	4.1		mg/kg dry
1080439-12	GP-11	Copper	*6010C	37		mg/kg dry
1080439-12	GP-11	Lead	*6010C	0.94		mg/kg dry
1080439-12	GP-11	Nickel	*6010C	3.6		mg/kg dry
1080439-12	GP-11	Zinc	*6010C	44		mg/kg dry
1080439-13	GP-12	Chromium	*6010C	7.5		mg/kg dry
1080439-13	GP-12	Copper	*6010C	14		mg/kg dry
1080439-13	GP-12	Lead	*6010C	0.62		mg/kg dry
1080439-13	GP-12	Nickel	*6010C	3.8		mg/kg dry
1080439-13	GP-12	Selenium	*6010C	3.2		mg/kg dry
1080439-13	GP-12	Thallium	*6010C	0.72		mg/kg dry
1080439-13	GP-12	Zinc	*6010C	29		mg/kg dry
1080439-14	GP-13	Chromium	*6010C	4.4		mg/kg dry
1080439-14	GP-13	Copper	*6010C	36		mg/kg dry
1080439-14	GP-13	Lead	*6010C	0.41		mg/kg dry
1080439-14	GP-13	Nickel	*6010C	48		mg/kg dry

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Summary of Detections

08/26/2011

Prism Work Order: 1080439

Prism ID	Client ID	Parameter	Method	Result	Units
1080439-14	GP-13	Selenium	*6010C	3.6	mg/kg dry
1080439-14	GP-13	Thallium	*6010C	0.80	mg/kg dry
1080439-14	GP-13	Zinc	*6010C	32	mg/kg dry
1080439-15	GP-14	Arsenic	*6010C	0.87	mg/kg dry
1080439-15	GP-14	Beryllium	*6010C	0.47	mg/kg dry
1080439-15	GP-14	Chromium	*6010C	22	mg/kg dry
1080439-15	GP-14	Copper	*6010C	13	mg/kg dry
1080439-15	GP-14	Lead	*6010C	1.0	mg/kg dry
1080439-15	GP-14	Nickel	*6010C	22	mg/kg dry
1080439-15	GP-14	Selenium	*6010C	8.8	mg/kg dry
1080439-15	GP-14	Thallium	*6010C	2.8	mg/kg dry
1080439-15	GP-14	Zinc	*6010C	36	mg/kg dry
1080439-16	GP-15	Chromium	*6010C	30	mg/kg dry
1080439-16	GP-15	Copper	*6010C	31	mg/kg dry
1080439-16	GP-15	Lead	*6010C	0.28	mg/kg dry
1080439-16	GP-15	Nickel	*6010C	19	mg/kg dry
1080439-16	GP-15	Selenium	*6010C	3.6	mg/kg dry
1080439-16	GP-15	Thallium	*6010C	0.97	mg/kg dry
1080439-16	GP-15	Zinc	*6010C	26	mg/kg dry
1080439-17	GP-16	Arsenic	*6010C	0.91	mg/kg dry
1080439-17	GP-16	Chromium	*6010C	26	mg/kg dry
1080439-17	GP-16	Copper	*6010C	63	mg/kg dry
1080439-17	GP-16	Lead	*6010C	0.58	mg/kg dry
1080439-17	GP-16	Nickel	*6010C	39	mg/kg dry
1080439-17	GP-16	Selenium	*6010C	8.4	mg/kg dry
1080439-17	GP-16	Thallium	*6010C	2.5	mg/kg dry
1080439-17	GP-16	Zinc	*6010C	36	mg/kg dry
1080439-18	GP-17	Chromium	*6010C	13	mg/kg dry
1080439-18	GP-17	Copper	*6010C	23	mg/kg dry
1080439-18	GP-17	Lead	*6010C	0.43	mg/kg dry
1080439-18	GP-17	Nickel	*6010C	9.7	mg/kg dry
1080439-18	GP-17	Selenium	*6010C	3.7	mg/kg dry
1080439-18	GP-17	Zinc	*6010C	23	mg/kg dry
1080439-19	GP-18B	Chromium	*6010C	3.2	mg/kg dry
1080439-19	GP-18B	Copper	*6010C	3.5	mg/kg dry
1080439-19	GP-18B	Lead	*6010C	0.39	mg/kg dry
1080439-19	GP-18B	Nickel	*6010C	3.3	mg/kg dry
1080439-19	GP-18B	Selenium	*6010C	3.3	mg/kg dry
1080439-19	GP-18B	Thallium	*6010C	0.70	mg/kg dry
1080439-19	GP-18B	Zinc	*6010C	27	mg/kg dry
1080439-20	GP-19	Beryllium	*6010C	0.26	mg/kg dry
1080439-20	GP-19	Chromium	*6010C	13	mg/kg dry
1080439-20	GP-19	Copper	*6010C	51	mg/kg dry
1080439-20	GP-19	Lead	*6010C	0.37	mg/kg dry
1080439-20	GP-19	Nickel	*6010C	130	mg/kg dry

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Summary of Detections

08/26/2011

Prism Work Order: 1080439

Prism ID	Client ID	Parameter	Method	Result	Units
1080439-20	GP-19	Zinc	*6010C	30	mg/kg dry
1080439-21	GP-20	Beryllium	*6010C	0.47	mg/kg dry
1080439-21	GP-20	Cadmium	*6010C	1.5	mg/kg dry
1080439-21	GP-20	Chromium	*6010C	23	mg/kg dry
1080439-21	GP-20	Copper	*6010C	57	mg/kg dry
1080439-21	GP-20	Lead	*6010C	4.0	mg/kg dry
1080439-21	GP-20	Nickel	*6010C	63	mg/kg dry
1080439-21	GP-20	Selenium	*6010C	2.4	mg/kg dry
1080439-21	GP-20	Thallium	*6010C	0.81	mg/kg dry
1080439-21	GP-20	Zinc	*6010C	52	mg/kg dry
1080439-22	GP-21	Beryllium	*6010C	0.42	mg/kg dry
1080439-22	GP-21	Chromium	*6010C	43	mg/kg dry
1080439-22	GP-21	Copper	*6010C	26	mg/kg dry
1080439-22	GP-21	Lead	*6010C	1.6	mg/kg dry
1080439-22	GP-21	Nickel	*6010C	29	mg/kg dry
1080439-22	GP-21	Selenium	*6010C	3.6	mg/kg dry
1080439-22	GP-21	Thallium	*6010C	1.0	mg/kg dry
1080439-22	GP-21	Zinc	*6010C	45	mg/kg dry
1080439-23	GP-22	Arsenic	*6010C	0.74	mg/kg dry
1080439-23	GP-22	Beryllium	*6010C	0.41	mg/kg dry
1080439-23	GP-22	Chromium	*6010C	20	mg/kg dry
1080439-23	GP-22	Copper	*6010C	30	mg/kg dry
1080439-23	GP-22	Lead	*6010C	2.4	mg/kg dry
1080439-23	GP-22	Nickel	*6010C	36	mg/kg dry
1080439-23	GP-22	Selenium	*6010C	5.5	mg/kg dry
1080439-23	GP-22	Thallium	*6010C	1.8	mg/kg dry
1080439-23	GP-22	Zinc	*6010C	20	mg/kg dry
1080439-24	GP-23	Beryllium	*6010C	0.49	mg/kg dry
1080439-24	GP-23	Chromium	*6010C	3.5	mg/kg dry
1080439-24	GP-23	Copper	*6010C	25	mg/kg dry
1080439-24	GP-23	Lead	*6010C	0.54	mg/kg dry
1080439-24	GP-23	Nickel	*6010C	6.4	mg/kg dry
1080439-24	GP-23	Selenium	*6010C	2.4	mg/kg dry
1080439-24	GP-23	Thallium	*6010C	1.0	mg/kg dry
1080439-24	GP-23	Zinc	*6010C	41	mg/kg dry
1080439-25	GP-24	Beryllium	*6010C	0.57	mg/kg dry
1080439-25	GP-24	Chromium	*6010C	29	mg/kg dry
1080439-25	GP-24	Copper	*6010C	76	mg/kg dry
1080439-25	GP-24	Lead	*6010C	0.78	mg/kg dry
1080439-25	GP-24	Nickel	*6010C	28	mg/kg dry
1080439-25	GP-24	Selenium	*6010C	3.1	mg/kg dry
1080439-25	GP-24	Thallium	*6010C	0.97	mg/kg dry
1080439-25	GP-24	Zinc	*6010C	32	mg/kg dry
1080439-26	GP-25	Beryllium	*6010C	0.43	mg/kg dry
1080439-26	GP-25	Cadmium	*6010C	5.2	mg/kg dry

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Summary of Detections

08/26/2011

Prism Work Order: 1080439

Prism ID	Client ID	Parameter	Method	Result		Units
1080439-26	GP-25	Chromium	*6010C	25		mg/kg dry
1080439-26	GP-25	Copper	*6010C	41		mg/kg dry
1080439-26	GP-25	Lead	*6010C	0.90		mg/kg dry
1080439-26	GP-25	Nickel	*6010C	6.4		mg/kg dry
1080439-26	GP-25	Selenium	*6010C	2.4		mg/kg dry
1080439-26	GP-25	Zinc	*6010C	200		mg/kg dry
1080439-27	BKG-1	Arsenic	*6010C	0.72		mg/kg dry
1080439-27	BKG-1	Beryllium	*6010C	0.73		mg/kg dry
1080439-27	BKG-1	Chromium	*6010C	2.9		mg/kg dry
1080439-27	BKG-1	Copper	*6010C	2.3		mg/kg dry
1080439-27	BKG-1	Lead	*6010C	2.4		mg/kg dry
1080439-27	BKG-1	Nickel	*6010C	3.8		mg/kg dry
1080439-27	BKG-1	Selenium	*6010C	2.2		mg/kg dry
1080439-27	BKG-1	Thallium	*6010C	1.6		mg/kg dry
1080439-27	BKG-1	Zinc	*6010C	190		mg/kg dry
1080439-27	BKG-1	Acetone	8260B	18		ug/kg dry
1080439-27	BKG-1	Methyl Ethyl Ketone (2-Butanone)	8260B	3.0	J	ug/kg dry
1080439-28	BKG-2	Arsenic	*6010C	1.6		mg/kg dry
1080439-28	BKG-2	Beryllium	*6010C	1.3		mg/kg dry
1080439-28	BKG-2	Chromium	*6010C	50		mg/kg dry
1080439-28	BKG-2	Copper	*6010C	76		mg/kg dry
1080439-28	BKG-2	Lead	*6010C	2.4		mg/kg dry
1080439-28	BKG-2	Nickel	*6010C	19		mg/kg dry
1080439-28	BKG-2	Selenium	*6010C	5.7		mg/kg dry
1080439-28	BKG-2	Thallium	*6010C	1.5		mg/kg dry
1080439-28	BKG-2	Zinc	*6010C	80		mg/kg dry
1080439-28	BKG-2	Acetone	8260B	10	J	ug/kg dry
1080439-28	BKG-2	Methyl Ethyl Ketone (2-Butanone)	8260B	17		ug/kg dry
1080439-29	BKG-3	Beryllium	*6010C	0.49		mg/kg dry
1080439-29	BKG-3	Chromium	*6010C	0.85		mg/kg dry
1080439-29	BKG-3	Copper	*6010C	1.6		mg/kg dry
1080439-29	BKG-3	Lead	*6010C	1.7		mg/kg dry
1080439-29	BKG-3	Nickel	*6010C	1.7		mg/kg dry
1080439-29	BKG-3	Selenium	*6010C	5.2		mg/kg dry
1080439-29	BKG-3	Thallium	*6010C	1.6		mg/kg dry
1080439-29	BKG-3	Zinc	*6010C	26		mg/kg dry
1080439-29	BKG-3	Acetone	8260B	27		ug/kg dry
1080439-30	BKG-4	Arsenic	*6010C	1.0		mg/kg dry
1080439-30	BKG-4	Beryllium	*6010C	1.1		mg/kg dry
1080439-30	BKG-4	Chromium	*6010C	11		mg/kg dry
1080439-30	BKG-4	Copper	*6010C	50		mg/kg dry
1080439-30	BKG-4	Lead	*6010C	2.1		mg/kg dry
1080439-30	BKG-4	Nickel	*6010C	10		mg/kg dry
1080439-30	BKG-4	Selenium	*6010C	4.3		mg/kg dry
1080439-30	BKG-4	Thallium	*6010C	0.85		mg/kg dry

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Summary of Detections

08/26/2011

Prism Work Order: 1080439

Prism ID	Client ID	Parameter	Method	Result	Units
1080439-30	BKG-4	Zinc	*6010C	52	mg/kg dry
1080439-30	BKG-4	Acetone	8260B	36	ug/kg dry

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PRISM LABORATORIES, INC. | Full-Service Analytical & Environmental Solutions

Laboratory Report

08/26/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: GP-1
Prism Sample ID: 1080439-01
Prism Work Order: 1080439
Time Collected: 08/15/11 08:55
Time Submitted: 08/16/11 11:30

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**88.3**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**8/18/11 15:00**	**JAB**	**P1H0405**
Total Metals									
Mercury	BRL	mg/kg dry	0.023	0.0028	1	*7471B	8/23/11 15:03	LTB	P1H0413
Antimony	BRL	mg/kg dry	0.23	0.041	1	*6010C	8/19/11 20:53	DWR	P1H0419
Arsenic	BRL	mg/kg dry	0.57	0.065	1	*6010C	8/19/11 20:53	DWR	P1H0419
Beryllium	**0.45**	**mg/kg dry**	**0.29**	**0.049**	**1**	***6010C**	**8/19/11 20:53**	**DWR**	**P1H0419**
Cadmium	BRL	mg/kg dry	0.29	0.030	1	*6010C	8/19/11 20:53	DWR	P1H0419
Chromium	**7.2**	**mg/kg dry**	**0.29**	**0.039**	**1**	***6010C**	**8/19/11 20:53**	**DWR**	**P1H0419**
Copper	**29**	**mg/kg dry**	**0.57**	**0.25**	**1**	***6010C**	**8/19/11 20:53**	**DWR**	**P1H0419**
Lead	**2.9**	**mg/kg dry**	**0.29**	**0.071**	**1**	***6010C**	**8/19/11 20:53**	**DWR**	**P1H0419**
Nickel	**9.0**	**mg/kg dry**	**1.1**	**0.35**	**1**	***6010C**	**8/19/11 20:53**	**DWR**	**P1H0419**
Selenium	BRL	mg/kg dry	0.57	0.12	1	*6010C	8/19/11 20:53	DWR	P1H0419
Silver	BRL	mg/kg dry	0.29	0.029	1	*6010C	8/19/11 20:53	DWR	P1H0419
Thallium	BRL	mg/kg dry	0.57	0.11	1	*6010C	8/19/11 20:53	DWR	P1H0419
Tin	BRL	mg/kg dry	5.7	0.51	1	*6010C	8/22/11 15:31	DWR	P1H0419
Zinc	**56**	**mg/kg dry**	**2.9**	**0.29**	**1**	***6010C**	**8/19/11 20:53**	**DWR**	**P1H0419**
Volatile Organic Compounds by GC/MS									
1,1,1,2-Tetrachloroethane	BRL	ug/kg dry	3.9	0.23	1	8260B	8/23/11 13:10	VHL	P1H0472
1,1,1-Trichloroethane	BRL	ug/kg dry	3.9	0.13	1	8260B	8/23/11 13:10	VHL	P1H0472
1,1,2,2-Tetrachloroethane	BRL	ug/kg dry	3.9	0.64	1	8260B	8/23/11 13:10	VHL	P1H0472
1,1,2-Trichloroethane	BRL	ug/kg dry	3.9	0.33	1	8260B	8/23/11 13:10	VHL	P1H0472
1,1-Dichloroethane	BRL	ug/kg dry	3.9	0.33	1	8260B	8/23/11 13:10	VHL	P1H0472
1,1-Dichloroethylene	BRL	ug/kg dry	3.9	0.23	1	8260B	8/23/11 13:10	VHL	P1H0472
1,1-Dichloropropylene	BRL	ug/kg dry	3.9	0.41	1	8260B	8/23/11 13:10	VHL	P1H0472
1,2,3-Trichlorobenzene	BRL	ug/kg dry	7.7	0.29	1	8260B	8/23/11 13:10	VHL	P1H0472
1,2,3-Trichloropropane	BRL	ug/kg dry	3.9	0.58	1	8260B	8/23/11 13:10	VHL	P1H0472
1,2,4-Trichlorobenzene	BRL	ug/kg dry	7.7	0.23	1	8260B	8/23/11 13:10	VHL	P1H0472
1,2,4-Trimethylbenzene	BRL	ug/kg dry	7.7	0.76	1	8260B	8/23/11 13:10	VHL	P1H0472
1,2-Dibromo-3-chloropropane	BRL	ug/kg dry	3.9	1.2	1	8260B	8/23/11 13:10	VHL	P1H0472
1,2-Dibromoethane	BRL	ug/kg dry	3.9	0.44	1	8260B	8/23/11 13:10	VHL	P1H0472
1,2-Dichlorobenzene	BRL	ug/kg dry	7.7	0.17	1	8260B	8/23/11 13:10	VHL	P1H0472
1,2-Dichloroethane	BRL	ug/kg dry	3.9	0.62	1	8260B	8/23/11 13:10	VHL	P1H0472
1,2-Dichloropropane	BRL	ug/kg dry	3.9	0.24	1	8260B	8/23/11 13:10	VHL	P1H0472
1,3,5-Trimethylbenzene	BRL	ug/kg dry	7.7	0.18	1	8260B	8/23/11 13:10	VHL	P1H0472
1,3-Dichlorobenzene	BRL	ug/kg dry	7.7	0.053	1	8260B	8/23/11 13:10	VHL	P1H0472
1,3-Dichloropropane	BRL	ug/kg dry	3.9	0.42	1	8260B	8/23/11 13:10	VHL	P1H0472
1,4-Dichlorobenzene	BRL	ug/kg dry	7.7	0.28	1	8260B	8/23/11 13:10	VHL	P1H0472
2,2-Dichloropropane	BRL	ug/kg dry	3.9	0.24	1	8260B	8/23/11 13:10	VHL	P1H0472
2-Chloroethyl Vinyl Ether	BRL	ug/kg dry	7.7	2.2	1	8260B	8/23/11 13:10	VHL	P1H0472
2-Chlorotoluene	BRL	ug/kg dry	7.7	0.24	1	8260B	8/23/11 13:10	VHL	P1H0472
4-Chlorotoluene	BRL	ug/kg dry	7.7	0.18	1	8260B	8/23/11 13:10	VHL	P1H0472

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PRISM LABORATORIES, INC. | Full-Service Analytical & Environmental Solutions

Laboratory Report

08/26/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: GP-1
Prism Sample ID: 1080439-01
Prism Work Order: 1080439
Time Collected: 08/15/11 08:55
Time Submitted: 08/16/11 11:30

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
4-Isopropyltoluene	BRL	ug/kg dry	12	0.24	1	8260B	8/23/11 13:10	VHL	P1H0472
Acetone	BRL	ug/kg dry	15	2.0	1	8260B	8/23/11 13:10	VHL	P1H0472
Acrolein	BRL	ug/kg dry	77	2.3	1	8260B	8/23/11 13:10	VHL	P1H0472
Acrylonitrile	BRL	ug/kg dry	77	1.9	1	8260B	8/23/11 13:10	VHL	P1H0472
Benzene	BRL	ug/kg dry	2.3	0.23	1	8260B	8/23/11 13:10	VHL	P1H0472
Bromobenzene	BRL	ug/kg dry	3.9	0.16	1	8260B	8/23/11 13:10	VHL	P1H0472
Bromochloromethane	BRL	ug/kg dry	3.9	0.56	1	8260B	8/23/11 13:10	VHL	P1H0472
Bromodichloromethane	BRL	ug/kg dry	3.9	0.18	1	8260B	8/23/11 13:10	VHL	P1H0472
Bromoform	BRL	ug/kg dry	3.9	0.68	1	8260B	8/23/11 13:10	VHL	P1H0472
Bromomethane	BRL	ug/kg dry	7.7	1.1	1	8260B	8/23/11 13:10	VHL	P1H0472
Carbon disulfide	BRL	ug/kg dry	7.7	0.32	1	8260B	8/23/11 13:10	VHL	P1H0472
Carbon Tetrachloride	BRL	ug/kg dry	3.9	0.21	1	8260B	8/23/11 13:10	VHL	P1H0472
Chlorobenzene	BRL	ug/kg dry	3.9	0.18	1	8260B	8/23/11 13:10	VHL	P1H0472
Chloroethane	BRL	ug/kg dry	7.7	2.9	1	8260B	8/23/11 13:10	VHL	P1H0472
Chloroform	BRL	ug/kg dry	3.9	0.16	1	8260B	8/23/11 13:10	VHL	P1H0472
Chloromethane	BRL	ug/kg dry	7.7	2.0	1	8260B	8/23/11 13:10	VHL	P1H0472
cis-1,2-Dichloroethylene	BRL	ug/kg dry	3.9	0.31	1	8260B	8/23/11 13:10	VHL	P1H0472
cis-1,3-Dichloropropylene	BRL	ug/kg dry	3.9	0.19	1	8260B	8/23/11 13:10	VHL	P1H0472
Dibromochloromethane	BRL	ug/kg dry	3.9	0.26	1	8260B	8/23/11 13:10	VHL	P1H0472
Dibromomethane	BRL	ug/kg dry	3.9	0.26	1	8260B	8/23/11 13:10	VHL	P1H0472
Dichlorodifluoromethane	BRL	ug/kg dry	7.7	0.41	1	8260B	8/23/11 13:10	VHL	P1H0472
Ethylbenzene	BRL	ug/kg dry	3.9	0.25	1	8260B	8/23/11 13:10	VHL	P1H0472
Hexachlorobutadiene	BRL	ug/kg dry	12	0.50	1	8260B	8/23/11 13:10	VHL	P1H0472
Isopropyl Ether	BRL	ug/kg dry	3.9	0.16	1	8260B	8/23/11 13:10	VHL	P1H0472
Isopropylbenzene (Cumene)	BRL	ug/kg dry	7.7	0.19	1	8260B	8/23/11 13:10	VHL	P1H0472
m,p-Xylenes	BRL	ug/kg dry	7.7	0.50	1	8260B	8/23/11 13:10	VHL	P1H0472
Methyl Butyl Ketone (2-Hexanone)	BRL	ug/kg dry	39	0.79	1	8260B	8/23/11 13:10	VHL	P1H0472
Methyl Ethyl Ketone (2-Butanone)	BRL	ug/kg dry	15	1.4	1	8260B	8/23/11 13:10	VHL	P1H0472
Methyl Isobutyl Ketone	BRL	ug/kg dry	7.7	1.0	1	8260B	8/23/11 13:10	VHL	P1H0472
Methylene Chloride	BRL	ug/kg dry	7.7	0.28	1	8260B	8/23/11 13:10	VHL	P1H0472
Methyl-tert-Butyl Ether	BRL	ug/kg dry	3.9	0.30	1	8260B	8/23/11 13:10	VHL	P1H0472
Naphthalene	BRL	ug/kg dry	3.9	0.28	1	8260B	8/23/11 13:10	VHL	P1H0472
n-Butylbenzene	BRL	ug/kg dry	12	0.17	1	8260B	8/23/11 13:10	VHL	P1H0472
n-Propylbenzene	BRL	ug/kg dry	7.7	0.22	1	8260B	8/23/11 13:10	VHL	P1H0472
o-Xylene	BRL	ug/kg dry	3.9	0.24	1	8260B	8/23/11 13:10	VHL	P1H0472
sec-Butylbenzene	BRL	ug/kg dry	12	0.16	1	8260B	8/23/11 13:10	VHL	P1H0472
Styrene	BRL	ug/kg dry	3.9	0.17	1	8260B	8/23/11 13:10	VHL	P1H0472
tert-Butylbenzene	BRL	ug/kg dry	15	0.20	1	8260B	8/23/11 13:10	VHL	P1H0472
Tetrachloroethylene	BRL	ug/kg dry	7.7	0.27	1	8260B	8/23/11 13:10	VHL	P1H0472
Toluene	BRL	ug/kg dry	3.9	0.23	1	8260B	8/23/11 13:10	VHL	P1H0472
trans-1,2-Dichloroethylene	BRL	ug/kg dry	3.9	0.45	1	8260B	8/23/11 13:10	VHL	P1H0472
trans-1,3-Dichloropropylene	BRL	ug/kg dry	3.9	0.19	1	8260B	8/23/11 13:10	VHL	P1H0472
Trichloroethylene	BRL	ug/kg dry	3.9	0.36	1	8260B	8/23/11 13:10	VHL	P1H0472

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Laboratory Report

08/26/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: GP-1
Prism Sample ID: 1080439-01
Prism Work Order: 1080439
Time Collected: 08/15/11 08:55
Time Submitted: 08/16/11 11:30

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
Trichlorofluoromethane	BRL	ug/kg dry	3.9	0.31	1	8260B	8/23/11 13:10	VHL	P1H0472
Vinyl acetate	BRL	ug/kg dry	7.7	1.1	1	8260B	8/23/11 13:10	VHL	P1H0472
Vinyl chloride	BRL	ug/kg dry	7.7	0.50	1	8260B	8/23/11 13:10	VHL	P1H0472

Surrogate	Recovery	Control Limits
4-Bromofluorobenzene	*96 %*	*70-130*
Dibromofluoromethane	*112 %*	*84-123*
Toluene-d8	*98 %*	*76-129*

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08/26/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: GP-2
Prism Sample ID: 1080439-02
Prism Work Order: 1080439
Time Collected: 08/15/11 09:10
Time Submitted: 08/16/11 11:30

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**77.8**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**8/18/11 15:00**	**JAB**	**P1H0405**
Total Metals									
Mercury	BRL	mg/kg dry	0.028	0.0033	1	*7471B	8/23/11 15:07	LTB	P1H0413
Antimony	BRL	mg/kg dry	0.26	0.047	1	*6010C	8/19/11 21:02	DWR	P1H0419
Arsenic	BRL	mg/kg dry	0.64	0.073	1	*6010C	8/19/11 21:02	DWR	P1H0419
Beryllium	**0.80**	**mg/kg dry**	**0.32**	**0.054**	**1**	***6010C**	**8/19/11 21:02**	**DWR**	**P1H0419**
Cadmium	BRL	mg/kg dry	0.32	0.034	1	*6010C	8/19/11 21:02	DWR	P1H0419
Chromium	**4.3**	**mg/kg dry**	**0.32**	**0.044**	**1**	***6010C**	**8/19/11 21:02**	**DWR**	**P1H0419**
Copper	**15**	**mg/kg dry**	**0.64**	**0.28**	**1**	***6010C**	**8/19/11 21:02**	**DWR**	**P1H0419**
Lead	**3.8**	**mg/kg dry**	**0.32**	**0.079**	**1**	***6010C**	**8/19/11 21:02**	**DWR**	**P1H0419**
Nickel	**6.1**	**mg/kg dry**	**1.3**	**0.39**	**1**	***6010C**	**8/19/11 21:02**	**DWR**	**P1H0419**
Selenium	BRL	mg/kg dry	0.64	0.13	1	*6010C	8/19/11 21:02	DWR	P1H0419
Silver	BRL	mg/kg dry	0.32	0.033	1	*6010C	8/19/11 21:02	DWR	P1H0419
Thallium	BRL	mg/kg dry	0.64	0.12	1	*6010C	8/19/11 21:02	DWR	P1H0419
Tin	BRL	mg/kg dry	6.4	0.57	1	*6010C	8/22/11 15:40	DWR	P1H0419
Zinc	**72**	**mg/kg dry**	**3.2**	**0.33**	**1**	***6010C**	**8/19/11 21:02**	**DWR**	**P1H0419**
Volatile Organic Compounds by GC/MS									
1,1,1,2-Tetrachloroethane	BRL	ug/kg dry	4.5	0.27	1	8260B	8/23/11 13:42	VHL	P1H0472
1,1,1-Trichloroethane	BRL	ug/kg dry	4.5	0.15	1	8260B	8/23/11 13:42	VHL	P1H0472
1,1,2,2-Tetrachloroethane	BRL	ug/kg dry	4.5	0.75	1	8260B	8/23/11 13:42	VHL	P1H0472
1,1,2-Trichloroethane	BRL	ug/kg dry	4.5	0.38	1	8260B	8/23/11 13:42	VHL	P1H0472
1,1-Dichloroethane	BRL	ug/kg dry	4.5	0.38	1	8260B	8/23/11 13:42	VHL	P1H0472
1,1-Dichloroethylene	BRL	ug/kg dry	4.5	0.28	1	8260B	8/23/11 13:42	VHL	P1H0472
1,1-Dichloropropylene	BRL	ug/kg dry	4.5	0.48	1	8260B	8/23/11 13:42	VHL	P1H0472
1,2,3-Trichlorobenzene	BRL	ug/kg dry	9.1	0.34	1	8260B	8/23/11 13:42	VHL	P1H0472
1,2,3-Trichloropropane	BRL	ug/kg dry	4.5	0.69	1	8260B	8/23/11 13:42	VHL	P1H0472
1,2,4-Trichlorobenzene	BRL	ug/kg dry	9.1	0.27	1	8260B	8/23/11 13:42	VHL	P1H0472
1,2,4-Trimethylbenzene	BRL	ug/kg dry	9.1	0.89	1	8260B	8/23/11 13:42	VHL	P1H0472
1,2-Dibromo-3-chloropropane	BRL	ug/kg dry	4.5	1.4	1	8260B	8/23/11 13:42	VHL	P1H0472
1,2-Dibromoethane	BRL	ug/kg dry	4.5	0.52	1	8260B	8/23/11 13:42	VHL	P1H0472
1,2-Dichlorobenzene	BRL	ug/kg dry	9.1	0.21	1	8260B	8/23/11 13:42	VHL	P1H0472
1,2-Dichloroethane	BRL	ug/kg dry	4.5	0.73	1	8260B	8/23/11 13:42	VHL	P1H0472
1,2-Dichloropropane	BRL	ug/kg dry	4.5	0.29	1	8260B	8/23/11 13:42	VHL	P1H0472
1,3,5-Trimethylbenzene	BRL	ug/kg dry	9.1	0.22	1	8260B	8/23/11 13:42	VHL	P1H0472
1,3-Dichlorobenzene	BRL	ug/kg dry	9.1	0.063	1	8260B	8/23/11 13:42	VHL	P1H0472
1,3-Dichloropropane	BRL	ug/kg dry	4.5	0.49	1	8260B	8/23/11 13:42	VHL	P1H0472
1,4-Dichlorobenzene	BRL	ug/kg dry	9.1	0.33	1	8260B	8/23/11 13:42	VHL	P1H0472
2,2-Dichloropropane	BRL	ug/kg dry	4.5	0.29	1	8260B	8/23/11 13:42	VHL	P1H0472
2-Chloroethyl Vinyl Ether	BRL	ug/kg dry	9.1	2.5	1	8260B	8/23/11 13:42	VHL	P1H0472
2-Chlorotoluene	BRL	ug/kg dry	9.1	0.28	1	8260B	8/23/11 13:42	VHL	P1H0472
4-Chlorotoluene	BRL	ug/kg dry	9.1	0.21	1	8260B	8/23/11 13:42	VHL	P1H0472

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PRISM LABORATORIES, INC. | Full-Service Analytical & Environmental Solutions

Laboratory Report

08/26/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: GP-2
Prism Sample ID: 1080439-02
Prism Work Order: 1080439
Time Collected: 08/15/11 09:10
Time Submitted: 08/16/11 11:30

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
4-Isopropyltoluene	BRL	ug/kg dry	14	0.29	1	8260B	8/23/11 13:42	VHL	P1H0472
Acetone	BRL	ug/kg dry	18	2.4	1	8260B	8/23/11 13:42	VHL	P1H0472
Acrolein	BRL	ug/kg dry	91	2.8	1	8260B	8/23/11 13:42	VHL	P1H0472
Acrylonitrile	BRL	ug/kg dry	91	2.3	1	8260B	8/23/11 13:42	VHL	P1H0472
Benzene	BRL	ug/kg dry	2.7	0.28	1	8260B	8/23/11 13:42	VHL	P1H0472
Bromobenzene	BRL	ug/kg dry	4.5	0.19	1	8260B	8/23/11 13:42	VHL	P1H0472
Bromochloromethane	BRL	ug/kg dry	4.5	0.66	1	8260B	8/23/11 13:42	VHL	P1H0472
Bromodichloromethane	BRL	ug/kg dry	4.5	0.21	1	8260B	8/23/11 13:42	VHL	P1H0472
Bromoform	BRL	ug/kg dry	4.5	0.80	1	8260B	8/23/11 13:42	VHL	P1H0472
Bromomethane	BRL	ug/kg dry	9.1	1.3	1	8260B	8/23/11 13:42	VHL	P1H0472
Carbon disulfide	BRL	ug/kg dry	9.1	0.38	1	8260B	8/23/11 13:42	VHL	P1H0472
Carbon Tetrachloride	BRL	ug/kg dry	4.5	0.25	1	8260B	8/23/11 13:42	VHL	P1H0472
Chlorobenzene	BRL	ug/kg dry	4.5	0.21	1	8260B	8/23/11 13:42	VHL	P1H0472
Chloroethane	BRL	ug/kg dry	9.1	3.4	1	8260B	8/23/11 13:42	VHL	P1H0472
Chloroform	BRL	ug/kg dry	4.5	0.19	1	8260B	8/23/11 13:42	VHL	P1H0472
Chloromethane	BRL	ug/kg dry	9.1	2.3	1	8260B	8/23/11 13:42	VHL	P1H0472
cis-1,2-Dichloroethylene	BRL	ug/kg dry	4.5	0.37	1	8260B	8/23/11 13:42	VHL	P1H0472
cis-1,3-Dichloropropylene	BRL	ug/kg dry	4.5	0.23	1	8260B	8/23/11 13:42	VHL	P1H0472
Dibromochloromethane	BRL	ug/kg dry	4.5	0.31	1	8260B	8/23/11 13:42	VHL	P1H0472
Dibromomethane	BRL	ug/kg dry	4.5	0.31	1	8260B	8/23/11 13:42	VHL	P1H0472
Dichlorodifluoromethane	BRL	ug/kg dry	9.1	0.49	1	8260B	8/23/11 13:42	VHL	P1H0472
Ethylbenzene	BRL	ug/kg dry	4.5	0.29	1	8260B	8/23/11 13:42	VHL	P1H0472
Hexachlorobutadiene	BRL	ug/kg dry	14	0.58	1	8260B	8/23/11 13:42	VHL	P1H0472
Isopropyl Ether	BRL	ug/kg dry	4.5	0.19	1	8260B	8/23/11 13:42	VHL	P1H0472
Isopropylbenzene (Cumene)	BRL	ug/kg dry	9.1	0.23	1	8260B	8/23/11 13:42	VHL	P1H0472
m,p-Xylenes	BRL	ug/kg dry	9.1	0.58	1	8260B	8/23/11 13:42	VHL	P1H0472
Methyl Butyl Ketone (2-Hexanone)	BRL	ug/kg dry	45	0.93	1	8260B	8/23/11 13:42	VHL	P1H0472
Methyl Ethyl Ketone (2-Butanone)	BRL	ug/kg dry	18	1.6	1	8260B	8/23/11 13:42	VHL	P1H0472
Methyl Isobutyl Ketone	BRL	ug/kg dry	9.1	1.2	1	8260B	8/23/11 13:42	VHL	P1H0472
Methylene Chloride	BRL	ug/kg dry	9.1	0.33	1	8260B	8/23/11 13:42	VHL	P1H0472
Methyl-tert-Butyl Ether	BRL	ug/kg dry	4.5	0.35	1	8260B	8/23/11 13:42	VHL	P1H0472
Naphthalene	BRL	ug/kg dry	4.5	0.33	1	8260B	8/23/11 13:42	VHL	P1H0472
n-Butylbenzene	BRL	ug/kg dry	14	0.20	1	8260B	8/23/11 13:42	VHL	P1H0472
n-Propylbenzene	BRL	ug/kg dry	9.1	0.26	1	8260B	8/23/11 13:42	VHL	P1H0472
o-Xylene	BRL	ug/kg dry	4.5	0.29	1	8260B	8/23/11 13:42	VHL	P1H0472
sec-Butylbenzene	BRL	ug/kg dry	14	0.18	1	8260B	8/23/11 13:42	VHL	P1H0472
Styrene	BRL	ug/kg dry	4.5	0.20	1	8260B	8/23/11 13:42	VHL	P1H0472
tert-Butylbenzene	BRL	ug/kg dry	18	0.24	1	8260B	8/23/11 13:42	VHL	P1H0472
Tetrachloroethylene	BRL	ug/kg dry	9.1	0.31	1	8260B	8/23/11 13:42	VHL	P1H0472
Toluene	BRL	ug/kg dry	4.5	0.27	1	8260B	8/23/11 13:42	VHL	P1H0472
trans-1,2-Dichloroethylene	BRL	ug/kg dry	4.5	0.53	1	8260B	8/23/11 13:42	VHL	P1H0472
trans-1,3-Dichloropropylene	BRL	ug/kg dry	4.5	0.22	1	8260B	8/23/11 13:42	VHL	P1H0472
Trichloroethylene	BRL	ug/kg dry	4.5	0.42	1	8260B	8/23/11 13:42	VHL	P1H0472

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PRISM LABORATORIES, INC. | Full-Service Analytical & Environmental Solutions

Laboratory Report

08/26/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: GP-2
Prism Sample ID: 1080439-02
Prism Work Order: 1080439
Time Collected: 08/15/11 09:10
Time Submitted: 08/16/11 11:30

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
Trichlorofluoromethane	BRL	ug/kg dry	4.5	0.37	1	8260B	8/23/11 13:42	VHL	P1H0472
Vinyl acetate	BRL	ug/kg dry	9.1	1.3	1	8260B	8/23/11 13:42	VHL	P1H0472
Vinyl chloride	BRL	ug/kg dry	9.1	0.59	1	8260B	8/23/11 13:42	VHL	P1H0472

Surrogate	Recovery	Control Limits
4-Bromofluorobenzene	*95 %*	*70-130*
Dibromofluoromethane	*110 %*	*84-123*
Toluene-d8	*98 %*	*76-129*

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Laboratory Report

08/26/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: GP-3
Prism Sample ID: 1080439-03
Prism Work Order: 1080439
Time Collected: 08/15/11 09:25
Time Submitted: 08/16/11 11:30

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**86.0**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**8/18/11 15:00**	**JAB**	**P1H0405**
Total Metals									
Mercury	BRL	mg/kg dry	0.024	0.0028	1	*7471B	8/22/11 13:29	BGM	P1H0455
Antimony	BRL	mg/kg dry	0.23	0.042	1	*6010C	8/19/11 21:21	DWR	P1H0419
Arsenic	BRL	mg/kg dry	0.58	0.065	1	*6010C	8/19/11 21:21	DWR	P1H0419
Beryllium	**0.93**	**mg/kg dry**	**0.29**	**0.049**	**1**	***6010C**	**8/19/11 21:21**	**DWR**	**P1H0419**
Cadmium	BRL	mg/kg dry	0.29	0.031	1	*6010C	8/19/11 21:21	DWR	P1H0419
Chromium	**2.8**	**mg/kg dry**	**0.29**	**0.040**	**1**	***6010C**	**8/19/11 21:21**	**DWR**	**P1H0419**
Copper	**81**	**mg/kg dry**	**0.58**	**0.25**	**1**	***6010C**	**8/19/11 21:21**	**DWR**	**P1H0419**
Lead	**4.6**	**mg/kg dry**	**0.29**	**0.071**	**1**	***6010C**	**8/19/11 21:21**	**DWR**	**P1H0419**
Nickel	**7.7**	**mg/kg dry**	**1.2**	**0.36**	**1**	***6010C**	**8/19/11 21:21**	**DWR**	**P1H0419**
Selenium	BRL	mg/kg dry	0.58	0.12	1	*6010C	8/19/11 21:21	DWR	P1H0419
Silver	BRL	mg/kg dry	0.29	0.030	1	*6010C	8/19/11 21:21	DWR	P1H0419
Thallium	BRL	mg/kg dry	0.58	0.11	1	*6010C	8/19/11 21:21	DWR	P1H0419
Tin	BRL	mg/kg dry	5.8	0.51	1	*6010C	8/22/11 15:48	DWR	P1H0419
Zinc	**44**	**mg/kg dry**	**2.9**	**0.30**	**1**	***6010C**	**8/19/11 21:21**	**DWR**	**P1H0419**
Volatile Organic Compounds by GC/MS									
1,1,1,2-Tetrachloroethane	BRL	ug/kg dry	3.8	0.23	1	8260B	8/23/11 14:14	VHL	P1H0472
1,1,1-Trichloroethane	BRL	ug/kg dry	3.8	0.12	1	8260B	8/23/11 14:14	VHL	P1H0472
1,1,2,2-Tetrachloroethane	BRL	ug/kg dry	3.8	0.63	1	8260B	8/23/11 14:14	VHL	P1H0472
1,1,2-Trichloroethane	BRL	ug/kg dry	3.8	0.32	1	8260B	8/23/11 14:14	VHL	P1H0472
1,1-Dichloroethane	BRL	ug/kg dry	3.8	0.32	1	8260B	8/23/11 14:14	VHL	P1H0472
1,1-Dichloroethylene	BRL	ug/kg dry	3.8	0.23	1	8260B	8/23/11 14:14	VHL	P1H0472
1,1-Dichloropropylene	BRL	ug/kg dry	3.8	0.40	1	8260B	8/23/11 14:14	VHL	P1H0472
1,2,3-Trichlorobenzene	BRL	ug/kg dry	7.6	0.28	1	8260B	8/23/11 14:14	VHL	P1H0472
1,2,3-Trichloropropane	BRL	ug/kg dry	3.8	0.57	1	8260B	8/23/11 14:14	VHL	P1H0472
1,2,4-Trichlorobenzene	BRL	ug/kg dry	7.6	0.22	1	8260B	8/23/11 14:14	VHL	P1H0472
1,2,4-Trimethylbenzene	BRL	ug/kg dry	7.6	0.74	1	8260B	8/23/11 14:14	VHL	P1H0472
1,2-Dibromo-3-chloropropane	BRL	ug/kg dry	3.8	1.2	1	8260B	8/23/11 14:14	VHL	P1H0472
1,2-Dibromoethane	BRL	ug/kg dry	3.8	0.44	1	8260B	8/23/11 14:14	VHL	P1H0472
1,2-Dichlorobenzene	BRL	ug/kg dry	7.6	0.17	1	8260B	8/23/11 14:14	VHL	P1H0472
1,2-Dichloroethane	BRL	ug/kg dry	3.8	0.61	1	8260B	8/23/11 14:14	VHL	P1H0472
1,2-Dichloropropane	BRL	ug/kg dry	3.8	0.24	1	8260B	8/23/11 14:14	VHL	P1H0472
1,3,5-Trimethylbenzene	BRL	ug/kg dry	7.6	0.18	1	8260B	8/23/11 14:14	VHL	P1H0472
1,3-Dichlorobenzene	BRL	ug/kg dry	7.6	0.052	1	8260B	8/23/11 14:14	VHL	P1H0472
1,3-Dichloropropane	BRL	ug/kg dry	3.8	0.41	1	8260B	8/23/11 14:14	VHL	P1H0472
1,4-Dichlorobenzene	BRL	ug/kg dry	7.6	0.28	1	8260B	8/23/11 14:14	VHL	P1H0472
2,2-Dichloropropane	BRL	ug/kg dry	3.8	0.24	1	8260B	8/23/11 14:14	VHL	P1H0472
2-Chloroethyl Vinyl Ether	BRL	ug/kg dry	7.6	2.1	1	8260B	8/23/11 14:14	VHL	P1H0472
2-Chlorotoluene	BRL	ug/kg dry	7.6	0.23	1	8260B	8/23/11 14:14	VHL	P1H0472
4-Chlorotoluene	BRL	ug/kg dry	7.6	0.18	1	8260B	8/23/11 14:14	VHL	P1H0472

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ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: GP-3
Prism Sample ID: 1080439-03
Prism Work Order: 1080439
Time Collected: 08/15/11 09:25
Time Submitted: 08/16/11 11:30

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
4-Isopropyltoluene	BRL	ug/kg dry	11	0.24	1	8260B	8/23/11 14:14	VHL	P1H0472
Acetone	**4.9 J**	**ug/kg dry**	**15**	**2.0**	**1**	**8260B**	**8/23/11 14:14**	**VHL**	**P1H0472**
Acrolein	BRL	ug/kg dry	76	2.3	1	8260B	8/23/11 14:14	VHL	P1H0472
Acrylonitrile	BRL	ug/kg dry	76	1.9	1	8260B	8/23/11 14:14	VHL	P1H0472
Benzene	BRL	ug/kg dry	2.3	0.23	1	8260B	8/23/11 14:14	VHL	P1H0472
Bromobenzene	BRL	ug/kg dry	3.8	0.16	1	8260B	8/23/11 14:14	VHL	P1H0472
Bromochloromethane	BRL	ug/kg dry	3.8	0.55	1	8260B	8/23/11 14:14	VHL	P1H0472
Bromodichloromethane	BRL	ug/kg dry	3.8	0.17	1	8260B	8/23/11 14:14	VHL	P1H0472
Bromoform	BRL	ug/kg dry	3.8	0.67	1	8260B	8/23/11 14:14	VHL	P1H0472
Bromomethane	BRL	ug/kg dry	7.6	1.1	1	8260B	8/23/11 14:14	VHL	P1H0472
Carbon disulfide	BRL	ug/kg dry	7.6	0.31	1	8260B	8/23/11 14:14	VHL	P1H0472
Carbon Tetrachloride	BRL	ug/kg dry	3.8	0.21	1	8260B	8/23/11 14:14	VHL	P1H0472
Chlorobenzene	BRL	ug/kg dry	3.8	0.18	1	8260B	8/23/11 14:14	VHL	P1H0472
Chloroethane	BRL	ug/kg dry	7.6	2.9	1	8260B	8/23/11 14:14	VHL	P1H0472
Chloroform	BRL	ug/kg dry	3.8	0.16	1	8260B	8/23/11 14:14	VHL	P1H0472
Chloromethane	BRL	ug/kg dry	7.6	1.9	1	8260B	8/23/11 14:14	VHL	P1H0472
cis-1,2-Dichloroethylene	BRL	ug/kg dry	3.8	0.31	1	8260B	8/23/11 14:14	VHL	P1H0472
cis-1,3-Dichloropropylene	BRL	ug/kg dry	3.8	0.19	1	8260B	8/23/11 14:14	VHL	P1H0472
Dibromochloromethane	BRL	ug/kg dry	3.8	0.26	1	8260B	8/23/11 14:14	VHL	P1H0472
Dibromomethane	BRL	ug/kg dry	3.8	0.26	1	8260B	8/23/11 14:14	VHL	P1H0472
Dichlorodifluoromethane	BRL	ug/kg dry	7.6	0.41	1	8260B	8/23/11 14:14	VHL	P1H0472
Ethylbenzene	BRL	ug/kg dry	3.8	0.24	1	8260B	8/23/11 14:14	VHL	P1H0472
Hexachlorobutadiene	BRL	ug/kg dry	11	0.49	1	8260B	8/23/11 14:14	VHL	P1H0472
Isopropyl Ether	BRL	ug/kg dry	3.8	0.16	1	8260B	8/23/11 14:14	VHL	P1H0472
Isopropylbenzene (Cumene)	BRL	ug/kg dry	7.6	0.19	1	8260B	8/23/11 14:14	VHL	P1H0472
m,p-Xylenes	BRL	ug/kg dry	7.6	0.49	1	8260B	8/23/11 14:14	VHL	P1H0472
Methyl Butyl Ketone (2-Hexanone)	BRL	ug/kg dry	38	0.78	1	8260B	8/23/11 14:14	VHL	P1H0472
Methyl Ethyl Ketone (2-Butanone)	BRL	ug/kg dry	15	1.3	1	8260B	8/23/11 14:14	VHL	P1H0472
Methyl Isobutyl Ketone	BRL	ug/kg dry	7.6	1.0	1	8260B	8/23/11 14:14	VHL	P1H0472
Methylene Chloride	BRL	ug/kg dry	7.6	0.28	1	8260B	8/23/11 14:14	VHL	P1H0472
Methyl-tert-Butyl Ether	BRL	ug/kg dry	3.8	0.29	1	8260B	8/23/11 14:14	VHL	P1H0472
Naphthalene	BRL	ug/kg dry	3.8	0.28	1	8260B	8/23/11 14:14	VHL	P1H0472
n-Butylbenzene	BRL	ug/kg dry	11	0.17	1	8260B	8/23/11 14:14	VHL	P1H0472
n-Propylbenzene	BRL	ug/kg dry	7.6	0.22	1	8260B	8/23/11 14:14	VHL	P1H0472
o-Xylene	BRL	ug/kg dry	3.8	0.24	1	8260B	8/23/11 14:14	VHL	P1H0472
sec-Butylbenzene	BRL	ug/kg dry	11	0.15	1	8260B	8/23/11 14:14	VHL	P1H0472
Styrene	BRL	ug/kg dry	3.8	0.17	1	8260B	8/23/11 14:14	VHL	P1H0472
tert-Butylbenzene	BRL	ug/kg dry	15	0.20	1	8260B	8/23/11 14:14	VHL	P1H0472
Tetrachloroethylene	BRL	ug/kg dry	7.6	0.26	1	8260B	8/23/11 14:14	VHL	P1H0472
Toluene	BRL	ug/kg dry	3.8	0.22	1	8260B	8/23/11 14:14	VHL	P1H0472
trans-1,2-Dichloroethylene	BRL	ug/kg dry	3.8	0.44	1	8260B	8/23/11 14:14	VHL	P1H0472
trans-1,3-Dichloropropylene	BRL	ug/kg dry	3.8	0.18	1	8260B	8/23/11 14:14	VHL	P1H0472
Trichloroethylene	BRL	ug/kg dry	3.8	0.35	1	8260B	8/23/11 14:14	VHL	P1H0472

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Laboratory Report

08/26/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: GP-3
Prism Sample ID: 1080439-03
Prism Work Order: 1080439
Time Collected: 08/15/11 09:25
Time Submitted: 08/16/11 11:30

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
Trichlorofluoromethane	BRL	ug/kg dry	3.8	0.31	1	8260B	8/23/11 14:14	VHL	P1H0472
Vinyl acetate	BRL	ug/kg dry	7.6	1.1	1	8260B	8/23/11 14:14	VHL	P1H0472
Vinyl chloride	BRL	ug/kg dry	7.6	0.49	1	8260B	8/23/11 14:14	VHL	P1H0472

Surrogate	Recovery	Control Limits
4-Bromofluorobenzene	*96 %*	*70-130*
Dibromofluoromethane	*111 %*	*84-123*
Toluene-d8	*102 %*	*76-129*

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Laboratory Report

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ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: GP-4
Prism Sample ID: 1080439-04
Prism Work Order: 1080439
Time Collected: 08/15/11 09:35
Time Submitted: 08/16/11 11:30

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**87.4**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**8/18/11 15:00**	**JAB**	**P1H0405**
Total Metals									
Mercury	BRL	mg/kg dry	0.022	0.0026	1	*7471B	8/22/11 13:43	BGM	P1H0455
Antimony	BRL	mg/kg dry	0.23	0.042	1	*6010C	8/19/11 21:30	DWR	P1H0419
Arsenic	BRL	mg/kg dry	0.57	0.065	1	*6010C	8/19/11 21:30	DWR	P1H0419
Beryllium	**0.66**	**mg/kg dry**	**0.29**	**0.049**	**1**	***6010C**	**8/19/11 21:30**	**DWR**	**P1H0419**
Cadmium	BRL	mg/kg dry	0.29	0.030	1	*6010C	8/19/11 21:30	DWR	P1H0419
Chromium	**0.80**	**mg/kg dry**	**0.29**	**0.040**	**1**	***6010C**	**8/19/11 21:30**	**DWR**	**P1H0419**
Copper	**38**	**mg/kg dry**	**0.57**	**0.25**	**1**	***6010C**	**8/19/11 21:30**	**DWR**	**P1H0419**
Lead	**2.1**	**mg/kg dry**	**0.29**	**0.071**	**1**	***6010C**	**8/19/11 21:30**	**DWR**	**P1H0419**
Nickel	**1.3**	**mg/kg dry**	**1.1**	**0.35**	**1**	***6010C**	**8/19/11 21:30**	**DWR**	**P1H0419**
Selenium	BRL	mg/kg dry	0.57	0.12	1	*6010C	8/19/11 21:30	DWR	P1H0419
Silver	BRL	mg/kg dry	0.29	0.029	1	*6010C	8/19/11 21:30	DWR	P1H0419
Thallium	BRL	mg/kg dry	0.57	0.11	1	*6010C	8/19/11 21:30	DWR	P1H0419
Tin	BRL	mg/kg dry	5.7	0.51	1	*6010C	8/22/11 15:56	DWR	P1H0419
Zinc	**30**	**mg/kg dry**	**2.9**	**0.29**	**1**	***6010C**	**8/19/11 21:30**	**DWR**	**P1H0419**
Volatile Organic Compounds by GC/MS									
1,1,1,2-Tetrachloroethane	BRL	ug/kg dry	3.8	0.23	1	8260B	8/23/11 14:46	VHL	P1H0472
1,1,1-Trichloroethane	BRL	ug/kg dry	3.8	0.12	1	8260B	8/23/11 14:46	VHL	P1H0472
1,1,2,2-Tetrachloroethane	BRL	ug/kg dry	3.8	0.63	1	8260B	8/23/11 14:46	VHL	P1H0472
1,1,2-Trichloroethane	BRL	ug/kg dry	3.8	0.32	1	8260B	8/23/11 14:46	VHL	P1H0472
1,1-Dichloroethane	BRL	ug/kg dry	3.8	0.32	1	8260B	8/23/11 14:46	VHL	P1H0472
1,1-Dichloroethylene	BRL	ug/kg dry	3.8	0.23	1	8260B	8/23/11 14:46	VHL	P1H0472
1,1-Dichloropropylene	BRL	ug/kg dry	3.8	0.40	1	8260B	8/23/11 14:46	VHL	P1H0472
1,2,3-Trichlorobenzene	BRL	ug/kg dry	7.6	0.28	1	8260B	8/23/11 14:46	VHL	P1H0472
1,2,3-Trichloropropane	BRL	ug/kg dry	3.8	0.57	1	8260B	8/23/11 14:46	VHL	P1H0472
1,2,4-Trichlorobenzene	BRL	ug/kg dry	7.6	0.22	1	8260B	8/23/11 14:46	VHL	P1H0472
1,2,4-Trimethylbenzene	BRL	ug/kg dry	7.6	0.74	1	8260B	8/23/11 14:46	VHL	P1H0472
1,2-Dibromo-3-chloropropane	BRL	ug/kg dry	3.8	1.2	1	8260B	8/23/11 14:46	VHL	P1H0472
1,2-Dibromoethane	BRL	ug/kg dry	3.8	0.44	1	8260B	8/23/11 14:46	VHL	P1H0472
1,2-Dichlorobenzene	BRL	ug/kg dry	7.6	0.17	1	8260B	8/23/11 14:46	VHL	P1H0472
1,2-Dichloroethane	BRL	ug/kg dry	3.8	0.61	1	8260B	8/23/11 14:46	VHL	P1H0472
1,2-Dichloropropane	BRL	ug/kg dry	3.8	0.24	1	8260B	8/23/11 14:46	VHL	P1H0472
1,3,5-Trimethylbenzene	BRL	ug/kg dry	7.6	0.18	1	8260B	8/23/11 14:46	VHL	P1H0472
1,3-Dichlorobenzene	BRL	ug/kg dry	7.6	0.052	1	8260B	8/23/11 14:46	VHL	P1H0472
1,3-Dichloropropane	BRL	ug/kg dry	3.8	0.41	1	8260B	8/23/11 14:46	VHL	P1H0472
1,4-Dichlorobenzene	BRL	ug/kg dry	7.6	0.28	1	8260B	8/23/11 14:46	VHL	P1H0472
2,2-Dichloropropane	BRL	ug/kg dry	3.8	0.24	1	8260B	8/23/11 14:46	VHL	P1H0472
2-Chloroethyl Vinyl Ether	BRL	ug/kg dry	7.6	2.1	1	8260B	8/23/11 14:46	VHL	P1H0472
2-Chlorotoluene	BRL	ug/kg dry	7.6	0.23	1	8260B	8/23/11 14:46	VHL	P1H0472
4-Chlorotoluene	BRL	ug/kg dry	7.6	0.18	1	8260B	8/23/11 14:46	VHL	P1H0472

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PRISM LABORATORIES, INC. | Full-Service Analytical & Environmental Solutions

Laboratory Report

08/26/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: GP-4
Prism Sample ID: 1080439-04
Prism Work Order: 1080439
Time Collected: 08/15/11 09:35
Time Submitted: 08/16/11 11:30

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
4-Isopropyltoluene	BRL	ug/kg dry	11	0.24	1	8260B	8/23/11 14:46	VHL	P1H0472
Acetone	BRL	ug/kg dry	15	2.0	1	8260B	8/23/11 14:46	VHL	P1H0472
Acrolein	BRL	ug/kg dry	76	2.3	1	8260B	8/23/11 14:46	VHL	P1H0472
Acrylonitrile	BRL	ug/kg dry	76	1.9	1	8260B	8/23/11 14:46	VHL	P1H0472
Benzene	BRL	ug/kg dry	2.3	0.23	1	8260B	8/23/11 14:46	VHL	P1H0472
Bromobenzene	BRL	ug/kg dry	3.8	0.16	1	8260B	8/23/11 14:46	VHL	P1H0472
Bromochloromethane	BRL	ug/kg dry	3.8	0.55	1	8260B	8/23/11 14:46	VHL	P1H0472
Bromodichloromethane	BRL	ug/kg dry	3.8	0.17	1	8260B	8/23/11 14:46	VHL	P1H0472
Bromoform	BRL	ug/kg dry	3.8	0.67	1	8260B	8/23/11 14:46	VHL	P1H0472
Bromomethane	BRL	ug/kg dry	7.6	1.1	1	8260B	8/23/11 14:46	VHL	P1H0472
Carbon disulfide	BRL	ug/kg dry	7.6	0.31	1	8260B	8/23/11 14:46	VHL	P1H0472
Carbon Tetrachloride	BRL	ug/kg dry	3.8	0.21	1	8260B	8/23/11 14:46	VHL	P1H0472
Chlorobenzene	BRL	ug/kg dry	3.8	0.18	1	8260B	8/23/11 14:46	VHL	P1H0472
Chloroethane	BRL	ug/kg dry	7.6	2.9	1	8260B	8/23/11 14:46	VHL	P1H0472
Chloroform	BRL	ug/kg dry	3.8	0.16	1	8260B	8/23/11 14:46	VHL	P1H0472
Chloromethane	BRL	ug/kg dry	7.6	1.9	1	8260B	8/23/11 14:46	VHL	P1H0472
cis-1,2-Dichloroethylene	BRL	ug/kg dry	3.8	0.31	1	8260B	8/23/11 14:46	VHL	P1H0472
cis-1,3-Dichloropropylene	BRL	ug/kg dry	3.8	0.19	1	8260B	8/23/11 14:46	VHL	P1H0472
Dibromochloromethane	BRL	ug/kg dry	3.8	0.26	1	8260B	8/23/11 14:46	VHL	P1H0472
Dibromomethane	BRL	ug/kg dry	3.8	0.26	1	8260B	8/23/11 14:46	VHL	P1H0472
Dichlorodifluoromethane	BRL	ug/kg dry	7.6	0.41	1	8260B	8/23/11 14:46	VHL	P1H0472
Ethylbenzene	BRL	ug/kg dry	3.8	0.24	1	8260B	8/23/11 14:46	VHL	P1H0472
Hexachlorobutadiene	BRL	ug/kg dry	11	0.49	1	8260B	8/23/11 14:46	VHL	P1H0472
Isopropyl Ether	BRL	ug/kg dry	3.8	0.16	1	8260B	8/23/11 14:46	VHL	P1H0472
Isopropylbenzene (Cumene)	BRL	ug/kg dry	7.6	0.19	1	8260B	8/23/11 14:46	VHL	P1H0472
m,p-Xylenes	BRL	ug/kg dry	7.6	0.49	1	8260B	8/23/11 14:46	VHL	P1H0472
Methyl Butyl Ketone (2-Hexanone)	BRL	ug/kg dry	38	0.78	1	8260B	8/23/11 14:46	VHL	P1H0472
Methyl Ethyl Ketone (2-Butanone)	BRL	ug/kg dry	15	1.3	1	8260B	8/23/11 14:46	VHL	P1H0472
Methyl Isobutyl Ketone	BRL	ug/kg dry	7.6	1.0	1	8260B	8/23/11 14:46	VHL	P1H0472
Methylene Chloride	BRL	ug/kg dry	7.6	0.28	1	8260B	8/23/11 14:46	VHL	P1H0472
Methyl-tert-Butyl Ether	BRL	ug/kg dry	3.8	0.29	1	8260B	8/23/11 14:46	VHL	P1H0472
Naphthalene	BRL	ug/kg dry	3.8	0.28	1	8260B	8/23/11 14:46	VHL	P1H0472
n-Butylbenzene	BRL	ug/kg dry	11	0.17	1	8260B	8/23/11 14:46	VHL	P1H0472
n-Propylbenzene	BRL	ug/kg dry	7.6	0.22	1	8260B	8/23/11 14:46	VHL	P1H0472
o-Xylene	BRL	ug/kg dry	3.8	0.24	1	8260B	8/23/11 14:46	VHL	P1H0472
sec-Butylbenzene	BRL	ug/kg dry	11	0.15	1	8260B	8/23/11 14:46	VHL	P1H0472
Styrene	BRL	ug/kg dry	3.8	0.16	1	8260B	8/23/11 14:46	VHL	P1H0472
tert-Butylbenzene	BRL	ug/kg dry	15	0.20	1	8260B	8/23/11 14:46	VHL	P1H0472
Tetrachloroethylene	BRL	ug/kg dry	7.6	0.26	1	8260B	8/23/11 14:46	VHL	P1H0472
Toluene	BRL	ug/kg dry	3.8	0.22	1	8260B	8/23/11 14:46	VHL	P1H0472
trans-1,2-Dichloroethylene	BRL	ug/kg dry	3.8	0.44	1	8260B	8/23/11 14:46	VHL	P1H0472
trans-1,3-Dichloropropylene	BRL	ug/kg dry	3.8	0.18	1	8260B	8/23/11 14:46	VHL	P1H0472
Trichloroethylene	BRL	ug/kg dry	3.8	0.35	1	8260B	8/23/11 14:46	VHL	P1H0472

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PRISM LABORATORIES, INC. | Full-Service Analytical & Environmental Solutions

Laboratory Report

08/26/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: GP-4
Prism Sample ID: 1080439-04
Prism Work Order: 1080439
Time Collected: 08/15/11 09:35
Time Submitted: 08/16/11 11:30

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
Trichlorofluoromethane	BRL	ug/kg dry	3.8	0.31	1	8260B	8/23/11 14:46	VHL	P1H0472
Vinyl acetate	BRL	ug/kg dry	7.6	1.1	1	8260B	8/23/11 14:46	VHL	P1H0472
Vinyl chloride	BRL	ug/kg dry	7.6	0.49	1	8260B	8/23/11 14:46	VHL	P1H0472

Surrogate	Recovery	Control Limits
4-Bromofluorobenzene	*93 %*	*70-130*
Dibromofluoromethane	*109 %*	*84-123*
Toluene-d8	*94 %*	*76-129*

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Laboratory Report

08/26/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: GP-5
Prism Sample ID: 1080439-05
Prism Work Order: 1080439
Time Collected: 08/15/11 09:45
Time Submitted: 08/16/11 11:30

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**88.2**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**8/18/11 15:00**	**JAB**	**P1H0405**
Total Metals									
Mercury	BRL	mg/kg dry	0.024	0.0029	1	*7471B	8/22/11 13:48	BGM	P1H0455
Antimony	BRL	mg/kg dry	0.22	0.040	1	*6010C	8/19/11 21:39	DWR	P1H0419
Arsenic	BRL	mg/kg dry	0.56	0.063	1	*6010C	8/19/11 21:39	DWR	P1H0419
Beryllium	**0.34**	**mg/kg dry**	**0.28**	**0.047**	**1**	***6010C**	**8/19/11 21:39**	**DWR**	**P1H0419**
Cadmium	BRL	mg/kg dry	0.28	0.030	1	*6010C	8/19/11 21:39	DWR	P1H0419
Chromium	**7.6**	**mg/kg dry**	**0.28**	**0.038**	**1**	***6010C**	**8/19/11 21:39**	**DWR**	**P1H0419**
Copper	**12**	**mg/kg dry**	**0.56**	**0.24**	**1**	***6010C**	**8/19/11 21:39**	**DWR**	**P1H0419**
Lead	**5.6**	**mg/kg dry**	**0.28**	**0.069**	**1**	***6010C**	**8/19/11 21:39**	**DWR**	**P1H0419**
Nickel	**8.1**	**mg/kg dry**	**1.1**	**0.34**	**1**	***6010C**	**8/19/11 21:39**	**DWR**	**P1H0419**
Selenium	**1.2**	**mg/kg dry**	**0.56**	**0.11**	**1**	***6010C**	**8/19/11 21:39**	**DWR**	**P1H0419**
Silver	BRL	mg/kg dry	0.28	0.028	1	*6010C	8/19/11 21:39	DWR	P1H0419
Thallium	BRL	mg/kg dry	0.56	0.11	1	*6010C	8/19/11 21:39	DWR	P1H0419
Tin	BRL	mg/kg dry	5.6	0.50	1	*6010C	8/22/11 16:06	DWR	P1H0419
Zinc	**24**	**mg/kg dry**	**2.8**	**0.29**	**1**	***6010C**	**8/19/11 21:39**	**DWR**	**P1H0419**
Volatile Organic Compounds by GC/MS									
1,1,1,2-Tetrachloroethane	BRL	ug/kg dry	3.8	0.23	1	8260B	8/23/11 15:18	VHL	P1H0472
1,1,1-Trichloroethane	BRL	ug/kg dry	3.8	0.13	1	8260B	8/23/11 15:18	VHL	P1H0472
1,1,2,2-Tetrachloroethane	BRL	ug/kg dry	3.8	0.64	1	8260B	8/23/11 15:18	VHL	P1H0472
1,1,2-Trichloroethane	BRL	ug/kg dry	3.8	0.32	1	8260B	8/23/11 15:18	VHL	P1H0472
1,1-Dichloroethane	BRL	ug/kg dry	3.8	0.32	1	8260B	8/23/11 15:18	VHL	P1H0472
1,1-Dichloroethylene	BRL	ug/kg dry	3.8	0.23	1	8260B	8/23/11 15:18	VHL	P1H0472
1,1-Dichloropropylene	BRL	ug/kg dry	3.8	0.41	1	8260B	8/23/11 15:18	VHL	P1H0472
1,2,3-Trichlorobenzene	BRL	ug/kg dry	7.7	0.28	1	8260B	8/23/11 15:18	VHL	P1H0472
1,2,3-Trichloropropane	BRL	ug/kg dry	3.8	0.58	1	8260B	8/23/11 15:18	VHL	P1H0472
1,2,4-Trichlorobenzene	BRL	ug/kg dry	7.7	0.23	1	8260B	8/23/11 15:18	VHL	P1H0472
1,2,4-Trimethylbenzene	BRL	ug/kg dry	7.7	0.76	1	8260B	8/23/11 15:18	VHL	P1H0472
1,2-Dibromo-3-chloropropane	BRL	ug/kg dry	3.8	1.2	1	8260B	8/23/11 15:18	VHL	P1H0472
1,2-Dibromoethane	BRL	ug/kg dry	3.8	0.44	1	8260B	8/23/11 15:18	VHL	P1H0472
1,2-Dichlorobenzene	BRL	ug/kg dry	7.7	0.17	1	8260B	8/23/11 15:18	VHL	P1H0472
1,2-Dichloroethane	BRL	ug/kg dry	3.8	0.62	1	8260B	8/23/11 15:18	VHL	P1H0472
1,2-Dichloropropane	BRL	ug/kg dry	3.8	0.24	1	8260B	8/23/11 15:18	VHL	P1H0472
1,3,5-Trimethylbenzene	BRL	ug/kg dry	7.7	0.18	1	8260B	8/23/11 15:18	VHL	P1H0472
1,3-Dichlorobenzene	BRL	ug/kg dry	7.7	0.053	1	8260B	8/23/11 15:18	VHL	P1H0472
1,3-Dichloropropane	BRL	ug/kg dry	3.8	0.42	1	8260B	8/23/11 15:18	VHL	P1H0472
1,4-Dichlorobenzene	BRL	ug/kg dry	7.7	0.28	1	8260B	8/23/11 15:18	VHL	P1H0472
2,2-Dichloropropane	BRL	ug/kg dry	3.8	0.24	1	8260B	8/23/11 15:18	VHL	P1H0472
2-Chloroethyl Vinyl Ether	BRL	ug/kg dry	7.7	2.2	1	8260B	8/23/11 15:18	VHL	P1H0472
2-Chlorotoluene	BRL	ug/kg dry	7.7	0.24	1	8260B	8/23/11 15:18	VHL	P1H0472

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Laboratory Report

08/26/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: GP-5
Prism Sample ID: 1080439-05
Prism Work Order: 1080439
Time Collected: 08/15/11 09:45
Time Submitted: 08/16/11 11:30

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
4-Chlorotoluene	BRL	ug/kg dry	7.7	0.18	1	8260B	8/23/11 15:18	VHL	P1H0472
4-Isopropyltoluene	BRL	ug/kg dry	12	0.24	1	8260B	8/23/11 15:18	VHL	P1H0472
Acetone	**4.4 J**	**ug/kg dry**	**15**	**2.0**	**1**	**8260B**	**8/23/11 15:18**	**VHL**	**P1H0472**
Acrolein	BRL	ug/kg dry	77	2.3	1	8260B	8/23/11 15:18	VHL	P1H0472
Acrylonitrile	BRL	ug/kg dry	77	1.9	1	8260B	8/23/11 15:18	VHL	P1H0472
Benzene	BRL	ug/kg dry	2.3	0.23	1	8260B	8/23/11 15:18	VHL	P1H0472
Bromobenzene	BRL	ug/kg dry	3.8	0.16	1	8260B	8/23/11 15:18	VHL	P1H0472
Bromochloromethane	BRL	ug/kg dry	3.8	0.56	1	8260B	8/23/11 15:18	VHL	P1H0472
Bromodichloromethane	BRL	ug/kg dry	3.8	0.18	1	8260B	8/23/11 15:18	VHL	P1H0472
Bromoform	BRL	ug/kg dry	3.8	0.68	1	8260B	8/23/11 15:18	VHL	P1H0472
Bromomethane	BRL	ug/kg dry	7.7	1.1	1	8260B	8/23/11 15:18	VHL	P1H0472
Carbon disulfide	BRL	ug/kg dry	7.7	0.32	1	8260B	8/23/11 15:18	VHL	P1H0472
Carbon Tetrachloride	BRL	ug/kg dry	3.8	0.21	1	8260B	8/23/11 15:18	VHL	P1H0472
Chlorobenzene	BRL	ug/kg dry	3.8	0.18	1	8260B	8/23/11 15:18	VHL	P1H0472
Chloroethane	BRL	ug/kg dry	7.7	2.9	1	8260B	8/23/11 15:18	VHL	P1H0472
Chloroform	BRL	ug/kg dry	3.8	0.16	1	8260B	8/23/11 15:18	VHL	P1H0472
Chloromethane	BRL	ug/kg dry	7.7	2.0	1	8260B	8/23/11 15:18	VHL	P1H0472
cis-1,2-Dichloroethylene	BRL	ug/kg dry	3.8	0.31	1	8260B	8/23/11 15:18	VHL	P1H0472
cis-1,3-Dichloropropylene	BRL	ug/kg dry	3.8	0.19	1	8260B	8/23/11 15:18	VHL	P1H0472
Dibromochloromethane	BRL	ug/kg dry	3.8	0.26	1	8260B	8/23/11 15:18	VHL	P1H0472
Dibromomethane	BRL	ug/kg dry	3.8	0.26	1	8260B	8/23/11 15:18	VHL	P1H0472
Dichlorodifluoromethane	BRL	ug/kg dry	7.7	0.41	1	8260B	8/23/11 15:18	VHL	P1H0472
Ethylbenzene	BRL	ug/kg dry	3.8	0.25	1	8260B	8/23/11 15:18	VHL	P1H0472
Hexachlorobutadiene	BRL	ug/kg dry	12	0.50	1	8260B	8/23/11 15:18	VHL	P1H0472
Isopropyl Ether	BRL	ug/kg dry	3.8	0.16	1	8260B	8/23/11 15:18	VHL	P1H0472
Isopropylbenzene (Cumene)	BRL	ug/kg dry	7.7	0.19	1	8260B	8/23/11 15:18	VHL	P1H0472
m,p-Xylenes	BRL	ug/kg dry	7.7	0.49	1	8260B	8/23/11 15:18	VHL	P1H0472
Methyl Butyl Ketone (2-Hexanone)	BRL	ug/kg dry	38	0.79	1	8260B	8/23/11 15:18	VHL	P1H0472
Methyl Ethyl Ketone (2-Butanone)	BRL	ug/kg dry	15	1.4	1	8260B	8/23/11 15:18	VHL	P1H0472
Methyl Isobutyl Ketone	BRL	ug/kg dry	7.7	1.0	1	8260B	8/23/11 15:18	VHL	P1H0472
Methylene Chloride	BRL	ug/kg dry	7.7	0.28	1	8260B	8/23/11 15:18	VHL	P1H0472
Methyl-tert-Butyl Ether	BRL	ug/kg dry	3.8	0.30	1	8260B	8/23/11 15:18	VHL	P1H0472
Naphthalene	BRL	ug/kg dry	3.8	0.28	1	8260B	8/23/11 15:18	VHL	P1H0472
n-Butylbenzene	BRL	ug/kg dry	12	0.17	1	8260B	8/23/11 15:18	VHL	P1H0472
n-Propylbenzene	BRL	ug/kg dry	7.7	0.22	1	8260B	8/23/11 15:18	VHL	P1H0472
o-Xylene	BRL	ug/kg dry	3.8	0.24	1	8260B	8/23/11 15:18	VHL	P1H0472
sec-Butylbenzene	BRL	ug/kg dry	12	0.16	1	8260B	8/23/11 15:18	VHL	P1H0472
Styrene	BRL	ug/kg dry	3.8	0.17	1	8260B	8/23/11 15:18	VHL	P1H0472
tert-Butylbenzene	BRL	ug/kg dry	15	0.20	1	8260B	8/23/11 15:18	VHL	P1H0472
Tetrachloroethylene	BRL	ug/kg dry	7.7	0.27	1	8260B	8/23/11 15:18	VHL	P1H0472
Toluene	BRL	ug/kg dry	3.8	0.23	1	8260B	8/23/11 15:18	VHL	P1H0472
trans-1,2-Dichloroethylene	BRL	ug/kg dry	3.8	0.45	1	8260B	8/23/11 15:18	VHL	P1H0472
trans-1,3-Dichloropropylene	BRL	ug/kg dry	3.8	0.19	1	8260B	8/23/11 15:18	VHL	P1H0472

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Laboratory Report

08/26/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: GP-5
Prism Sample ID: 1080439-05
Prism Work Order: 1080439
Time Collected: 08/15/11 09:45
Time Submitted: 08/16/11 11:30

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
Trichloroethylene	BRL	ug/kg dry	3.8	0.36	1	8260B	8/23/11 15:18	VHL	P1H0472
Trichlorofluoromethane	BRL	ug/kg dry	3.8	0.31	1	8260B	8/23/11 15:18	VHL	P1H0472
Vinyl acetate	BRL	ug/kg dry	7.7	1.1	1	8260B	8/23/11 15:18	VHL	P1H0472
Vinyl chloride	BRL	ug/kg dry	7.7	0.50	1	8260B	8/23/11 15:18	VHL	P1H0472

Surrogate	Recovery	Control Limits
4-Bromofluorobenzene	*94 %*	*70-130*
Dibromofluoromethane	*106 %*	*84-123*
Toluene-d8	*97 %*	*76-129*

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Laboratory Report

08/26/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: GP-6
Prism Sample ID: 1080439-06
Prism Work Order: 1080439
Time Collected: 08/15/11 09:55
Time Submitted: 08/16/11 11:30

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**87.1**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**8/18/11 15:00**	**JAB**	**P1H0405**
Total Metals									
Mercury	BRL	mg/kg dry	0.024	0.0029	1	*7471B	8/22/11 13:52	BGM	P1H0455
Antimony	BRL	mg/kg dry	0.23	0.042	1	*6010C	8/19/11 21:47	DWR	P1H0419
Arsenic	BRL	mg/kg dry	0.57	0.065	1	*6010C	8/19/11 21:47	DWR	P1H0419
Beryllium	**0.37**	**mg/kg dry**	**0.29**	**0.049**	**1**	***6010C**	**8/19/11 21:47**	**DWR**	**P1H0419**
Cadmium	BRL	mg/kg dry	0.29	0.030	1	*6010C	8/19/11 21:47	DWR	P1H0419
Chromium	**5.4**	**mg/kg dry**	**0.29**	**0.039**	**1**	***6010C**	**8/19/11 21:47**	**DWR**	**P1H0419**
Copper	**40**	**mg/kg dry**	**0.57**	**0.25**	**1**	***6010C**	**8/19/11 21:47**	**DWR**	**P1H0419**
Lead	**0.66**	**mg/kg dry**	**0.29**	**0.071**	**1**	***6010C**	**8/19/11 21:47**	**DWR**	**P1H0419**
Nickel	**6.5**	**mg/kg dry**	**1.1**	**0.35**	**1**	***6010C**	**8/19/11 21:47**	**DWR**	**P1H0419**
Selenium	BRL	mg/kg dry	0.57	0.12	1	*6010C	8/19/11 21:47	DWR	P1H0419
Silver	BRL	mg/kg dry	0.29	0.029	1	*6010C	8/19/11 21:47	DWR	P1H0419
Thallium	BRL	mg/kg dry	0.57	0.11	1	*6010C	8/19/11 21:47	DWR	P1H0419
Tin	BRL	mg/kg dry	5.7	0.51	1	*6010C	8/22/11 16:15	DWR	P1H0419
Zinc	**55**	**mg/kg dry**	**2.9**	**0.29**	**1**	***6010C**	**8/19/11 21:47**	**DWR**	**P1H0419**
Volatile Organic Compounds by GC/MS									
1,1,1,2-Tetrachloroethane	BRL	ug/kg dry	3.7	0.23	1	8260B	8/23/11 15:51	VHL	P1H0472
1,1,1-Trichloroethane	BRL	ug/kg dry	3.7	0.12	1	8260B	8/23/11 15:51	VHL	P1H0472
1,1,2,2-Tetrachloroethane	BRL	ug/kg dry	3.7	0.62	1	8260B	8/23/11 15:51	VHL	P1H0472
1,1,2-Trichloroethane	BRL	ug/kg dry	3.7	0.32	1	8260B	8/23/11 15:51	VHL	P1H0472
1,1-Dichloroethane	BRL	ug/kg dry	3.7	0.32	1	8260B	8/23/11 15:51	VHL	P1H0472
1,1-Dichloroethylene	BRL	ug/kg dry	3.7	0.23	1	8260B	8/23/11 15:51	VHL	P1H0472
1,1-Dichloropropylene	BRL	ug/kg dry	3.7	0.39	1	8260B	8/23/11 15:51	VHL	P1H0472
1,2,3-Trichlorobenzene	BRL	ug/kg dry	7.5	0.28	1	8260B	8/23/11 15:51	VHL	P1H0472
1,2,3-Trichloropropane	BRL	ug/kg dry	3.7	0.57	1	8260B	8/23/11 15:51	VHL	P1H0472
1,2,4-Trichlorobenzene	BRL	ug/kg dry	7.5	0.22	1	8260B	8/23/11 15:51	VHL	P1H0472
1,2,4-Trimethylbenzene	BRL	ug/kg dry	7.5	0.74	1	8260B	8/23/11 15:51	VHL	P1H0472
1,2-Dibromo-3-chloropropane	BRL	ug/kg dry	3.7	1.2	1	8260B	8/23/11 15:51	VHL	P1H0472
1,2-Dibromoethane	BRL	ug/kg dry	3.7	0.43	1	8260B	8/23/11 15:51	VHL	P1H0472
1,2-Dichlorobenzene	BRL	ug/kg dry	7.5	0.17	1	8260B	8/23/11 15:51	VHL	P1H0472
1,2-Dichloroethane	BRL	ug/kg dry	3.7	0.60	1	8260B	8/23/11 15:51	VHL	P1H0472
1,2-Dichloropropane	BRL	ug/kg dry	3.7	0.24	1	8260B	8/23/11 15:51	VHL	P1H0472
1,3,5-Trimethylbenzene	BRL	ug/kg dry	7.5	0.18	1	8260B	8/23/11 15:51	VHL	P1H0472
1,3-Dichlorobenzene	BRL	ug/kg dry	7.5	0.052	1	8260B	8/23/11 15:51	VHL	P1H0472
1,3-Dichloropropane	BRL	ug/kg dry	3.7	0.40	1	8260B	8/23/11 15:51	VHL	P1H0472
1,4-Dichlorobenzene	BRL	ug/kg dry	7.5	0.27	1	8260B	8/23/11 15:51	VHL	P1H0472
2,2-Dichloropropane	BRL	ug/kg dry	3.7	0.24	1	8260B	8/23/11 15:51	VHL	P1H0472
2-Chloroethyl Vinyl Ether	BRL	ug/kg dry	7.5	2.1	1	8260B	8/23/11 15:51	VHL	P1H0472
2-Chlorotoluene	BRL	ug/kg dry	7.5	0.23	1	8260B	8/23/11 15:51	VHL	P1H0472
4-Chlorotoluene	BRL	ug/kg dry	7.5	0.18	1	8260B	8/23/11 15:51	VHL	P1H0472

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Laboratory Report

08/26/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: GP-6
Prism Sample ID: 1080439-06
Prism Work Order: 1080439
Time Collected: 08/15/11 09:55
Time Submitted: 08/16/11 11:30

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
4-Isopropyltoluene	BRL	ug/kg dry	11	0.24	1	8260B	8/23/11 15:51	VHL	P1H0472
Acetone	**5.0 J**	**ug/kg dry**	**15**	**2.0**	**1**	**8260B**	**8/23/11 15:51**	**VHL**	**P1H0472**
Acrolein	BRL	ug/kg dry	75	2.3	1	8260B	8/23/11 15:51	VHL	P1H0472
Acrylonitrile	BRL	ug/kg dry	75	1.9	1	8260B	8/23/11 15:51	VHL	P1H0472
Benzene	BRL	ug/kg dry	2.2	0.23	1	8260B	8/23/11 15:51	VHL	P1H0472
Bromobenzene	BRL	ug/kg dry	3.7	0.16	1	8260B	8/23/11 15:51	VHL	P1H0472
Bromochloromethane	BRL	ug/kg dry	3.7	0.54	1	8260B	8/23/11 15:51	VHL	P1H0472
Bromodichloromethane	BRL	ug/kg dry	3.7	0.17	1	8260B	8/23/11 15:51	VHL	P1H0472
Bromoform	BRL	ug/kg dry	3.7	0.66	1	8260B	8/23/11 15:51	VHL	P1H0472
Bromomethane	BRL	ug/kg dry	7.5	1.1	1	8260B	8/23/11 15:51	VHL	P1H0472
Carbon disulfide	BRL	ug/kg dry	7.5	0.31	1	8260B	8/23/11 15:51	VHL	P1H0472
Carbon Tetrachloride	BRL	ug/kg dry	3.7	0.20	1	8260B	8/23/11 15:51	VHL	P1H0472
Chlorobenzene	BRL	ug/kg dry	3.7	0.17	1	8260B	8/23/11 15:51	VHL	P1H0472
Chloroethane	BRL	ug/kg dry	7.5	2.8	1	8260B	8/23/11 15:51	VHL	P1H0472
Chloroform	BRL	ug/kg dry	3.7	0.16	1	8260B	8/23/11 15:51	VHL	P1H0472
Chloromethane	BRL	ug/kg dry	7.5	1.9	1	8260B	8/23/11 15:51	VHL	P1H0472
cis-1,2-Dichloroethylene	BRL	ug/kg dry	3.7	0.30	1	8260B	8/23/11 15:51	VHL	P1H0472
cis-1,3-Dichloropropylene	BRL	ug/kg dry	3.7	0.19	1	8260B	8/23/11 15:51	VHL	P1H0472
Dibromochloromethane	BRL	ug/kg dry	3.7	0.25	1	8260B	8/23/11 15:51	VHL	P1H0472
Dibromomethane	BRL	ug/kg dry	3.7	0.25	1	8260B	8/23/11 15:51	VHL	P1H0472
Dichlorodifluoromethane	BRL	ug/kg dry	7.5	0.40	1	8260B	8/23/11 15:51	VHL	P1H0472
Ethylbenzene	BRL	ug/kg dry	3.7	0.24	1	8260B	8/23/11 15:51	VHL	P1H0472
Hexachlorobutadiene	BRL	ug/kg dry	11	0.48	1	8260B	8/23/11 15:51	VHL	P1H0472
Isopropyl Ether	BRL	ug/kg dry	3.7	0.16	1	8260B	8/23/11 15:51	VHL	P1H0472
Isopropylbenzene (Cumene)	BRL	ug/kg dry	7.5	0.19	1	8260B	8/23/11 15:51	VHL	P1H0472
m,p-Xylenes	BRL	ug/kg dry	7.5	0.48	1	8260B	8/23/11 15:51	VHL	P1H0472
Methyl Butyl Ketone (2-Hexanone)	BRL	ug/kg dry	37	0.77	1	8260B	8/23/11 15:51	VHL	P1H0472
Methyl Ethyl Ketone (2-Butanone)	BRL	ug/kg dry	15	1.3	1	8260B	8/23/11 15:51	VHL	P1H0472
Methyl Isobutyl Ketone	BRL	ug/kg dry	7.5	0.99	1	8260B	8/23/11 15:51	VHL	P1H0472
Methylene Chloride	BRL	ug/kg dry	7.5	0.27	1	8260B	8/23/11 15:51	VHL	P1H0472
Methyl-tert-Butyl Ether	BRL	ug/kg dry	3.7	0.29	1	8260B	8/23/11 15:51	VHL	P1H0472
Naphthalene	BRL	ug/kg dry	3.7	0.27	1	8260B	8/23/11 15:51	VHL	P1H0472
n-Butylbenzene	BRL	ug/kg dry	11	0.17	1	8260B	8/23/11 15:51	VHL	P1H0472
n-Propylbenzene	BRL	ug/kg dry	7.5	0.21	1	8260B	8/23/11 15:51	VHL	P1H0472
o-Xylene	BRL	ug/kg dry	3.7	0.24	1	8260B	8/23/11 15:51	VHL	P1H0472
sec-Butylbenzene	BRL	ug/kg dry	11	0.15	1	8260B	8/23/11 15:51	VHL	P1H0472
Styrene	BRL	ug/kg dry	3.7	0.16	1	8260B	8/23/11 15:51	VHL	P1H0472
tert-Butylbenzene	BRL	ug/kg dry	15	0.19	1	8260B	8/23/11 15:51	VHL	P1H0472
Tetrachloroethylene	BRL	ug/kg dry	7.5	0.26	1	8260B	8/23/11 15:51	VHL	P1H0472
Toluene	BRL	ug/kg dry	3.7	0.22	1	8260B	8/23/11 15:51	VHL	P1H0472
trans-1,2-Dichloroethylene	BRL	ug/kg dry	3.7	0.43	1	8260B	8/23/11 15:51	VHL	P1H0472
trans-1,3-Dichloropropylene	BRL	ug/kg dry	3.7	0.18	1	8260B	8/23/11 15:51	VHL	P1H0472
Trichloroethylene	BRL	ug/kg dry	3.7	0.35	1	8260B	8/23/11 15:51	VHL	P1H0472

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Laboratory Report

08/26/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: GP-6
Prism Sample ID: 1080439-06
Prism Work Order: 1080439
Time Collected: 08/15/11 09:55
Time Submitted: 08/16/11 11:30

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
Trichlorofluoromethane	BRL	ug/kg dry	3.7	0.30	1	8260B	8/23/11 15:51	VHL	P1H0472
Vinyl acetate	BRL	ug/kg dry	7.5	1.1	1	8260B	8/23/11 15:51	VHL	P1H0472
Vinyl chloride	BRL	ug/kg dry	7.5	0.48	1	8260B	8/23/11 15:51	VHL	P1H0472

Surrogate	Recovery	Control Limits
4-Bromofluorobenzene	*94 %*	*70-130*
Dibromofluoromethane	*110 %*	*84-123*
Toluene-d8	*99 %*	*76-129*

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Laboratory Report

08/26/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: GP-7
Prism Sample ID: 1080439-07
Prism Work Order: 1080439
Time Collected: 08/15/11 10:00
Time Submitted: 08/16/11 11:30

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**94.9**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**8/18/11 15:00**	**JAB**	**P1H0405**
Total Metals									
Mercury	BRL	mg/kg dry	0.022	0.0026	1	*7471B	8/22/11 13:57	BGM	P1H0455
Antimony	BRL	mg/kg dry	0.21	0.039	1	*6010C	8/19/11 21:56	DWR	P1H0419
Arsenic	BRL	mg/kg dry	0.53	0.060	1	*6010C	8/19/11 21:56	DWR	P1H0419
Beryllium	BRL	mg/kg dry	0.27	0.045	1	*6010C	8/19/11 21:56	DWR	P1H0419
Cadmium	BRL	mg/kg dry	0.27	0.028	1	*6010C	8/19/11 21:56	DWR	P1H0419
Chromium	**8.6**	**mg/kg dry**	**0.27**	**0.037**	**1**	***6010C**	**8/19/11 21:56**	**DWR**	**P1H0419**
Copper	**46**	**mg/kg dry**	**0.53**	**0.23**	**1**	***6010C**	**8/19/11 21:56**	**DWR**	**P1H0419**
Lead	**1.4**	**mg/kg dry**	**0.27**	**0.066**	**1**	***6010C**	**8/19/11 21:56**	**DWR**	**P1H0419**
Nickel	**4.5**	**mg/kg dry**	**1.1**	**0.33**	**1**	***6010C**	**8/19/11 21:56**	**DWR**	**P1H0419**
Selenium	BRL	mg/kg dry	0.53	0.11	1	*6010C	8/19/11 21:56	DWR	P1H0419
Silver	BRL	mg/kg dry	0.27	0.027	1	*6010C	8/19/11 21:56	DWR	P1H0419
Thallium	BRL	mg/kg dry	0.53	0.10	1	*6010C	8/19/11 21:56	DWR	P1H0419
Tin	BRL	mg/kg dry	5.3	0.47	1	*6010C	8/22/11 16:23	DWR	P1H0419
Zinc	**20**	**mg/kg dry**	**2.7**	**0.27**	**1**	***6010C**	**8/19/11 21:56**	**DWR**	**P1H0419**
Volatile Organic Compounds by GC/MS									
1,1,1,2-Tetrachloroethane	BRL	ug/kg dry	3.3	0.20	1	8260B	8/24/11 13:23	VHL	P1H0533
1,1,1-Trichloroethane	BRL	ug/kg dry	3.3	0.11	1	8260B	8/24/11 13:23	VHL	P1H0533
1,1,2,2-Tetrachloroethane	BRL	ug/kg dry	3.3	0.54	1	8260B	8/24/11 13:23	VHL	P1H0533
1,1,2-Trichloroethane	BRL	ug/kg dry	3.3	0.28	1	8260B	8/24/11 13:23	VHL	P1H0533
1,1-Dichloroethane	BRL	ug/kg dry	3.3	0.28	1	8260B	8/24/11 13:23	VHL	P1H0533
1,1-Dichloroethylene	BRL	ug/kg dry	3.3	0.20	1	8260B	8/24/11 13:23	VHL	P1H0533
1,1-Dichloropropylene	BRL	ug/kg dry	3.3	0.35	1	8260B	8/24/11 13:23	VHL	P1H0533
1,2,3-Trichlorobenzene	BRL	ug/kg dry	6.6	0.24	1	8260B	8/24/11 13:23	VHL	P1H0533
1,2,3-Trichloropropane	BRL	ug/kg dry	3.3	0.50	1	8260B	8/24/11 13:23	VHL	P1H0533
1,2,4-Trichlorobenzene	BRL	ug/kg dry	6.6	0.19	1	8260B	8/24/11 13:23	VHL	P1H0533
1,2,4-Trimethylbenzene	BRL	ug/kg dry	6.6	0.65	1	8260B	8/24/11 13:23	VHL	P1H0533
1,2-Dibromo-3-chloropropane	BRL	ug/kg dry	3.3	1.0	1	8260B	8/24/11 13:23	VHL	P1H0533
1,2-Dibromoethane	BRL	ug/kg dry	3.3	0.38	1	8260B	8/24/11 13:23	VHL	P1H0533
1,2-Dichlorobenzene	BRL	ug/kg dry	6.6	0.15	1	8260B	8/24/11 13:23	VHL	P1H0533
1,2-Dichloroethane	BRL	ug/kg dry	3.3	0.53	1	8260B	8/24/11 13:23	VHL	P1H0533
1,2-Dichloropropane	BRL	ug/kg dry	3.3	0.21	1	8260B	8/24/11 13:23	VHL	P1H0533
1,3,5-Trimethylbenzene	BRL	ug/kg dry	6.6	0.16	1	8260B	8/24/11 13:23	VHL	P1H0533
1,3-Dichlorobenzene	BRL	ug/kg dry	6.6	0.045	1	8260B	8/24/11 13:23	VHL	P1H0533
1,3-Dichloropropane	BRL	ug/kg dry	3.3	0.36	1	8260B	8/24/11 13:23	VHL	P1H0533
1,4-Dichlorobenzene	BRL	ug/kg dry	6.6	0.24	1	8260B	8/24/11 13:23	VHL	P1H0533
2,2-Dichloropropane	BRL	ug/kg dry	3.3	0.21	1	8260B	8/24/11 13:23	VHL	P1H0533
2-Chloroethyl Vinyl Ether	BRL	ug/kg dry	6.6	1.8	1	8260B	8/24/11 13:23	VHL	P1H0533
2-Chlorotoluene	BRL	ug/kg dry	6.6	0.20	1	8260B	8/24/11 13:23	VHL	P1H0533
4-Chlorotoluene	BRL	ug/kg dry	6.6	0.15	1	8260B	8/24/11 13:23	VHL	P1H0533

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PRISM LABORATORIES, INC. | Full-Service Analytical & Environmental Solutions

Laboratory Report

08/26/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: GP-7
Prism Sample ID: 1080439-07
Prism Work Order: 1080439
Time Collected: 08/15/11 10:00
Time Submitted: 08/16/11 11:30

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
4-Isopropyltoluene	BRL	ug/kg dry	9.9	0.21	1	8260B	8/24/11 13:23	VHL	P1H0533
Acetone	BRL	ug/kg dry	13	1.8	1	8260B	8/24/11 13:23	VHL	P1H0533
Acrolein	BRL	ug/kg dry	66	2.0	1	8260B	8/24/11 13:23	VHL	P1H0533
Acrylonitrile	BRL	ug/kg dry	66	1.6	1	8260B	8/24/11 13:23	VHL	P1H0533
Benzene	BRL	ug/kg dry	2.0	0.20	1	8260B	8/24/11 13:23	VHL	P1H0533
Bromobenzene	BRL	ug/kg dry	3.3	0.14	1	8260B	8/24/11 13:23	VHL	P1H0533
Bromochloromethane	BRL	ug/kg dry	3.3	0.48	1	8260B	8/24/11 13:23	VHL	P1H0533
Bromodichloromethane	BRL	ug/kg dry	3.3	0.15	1	8260B	8/24/11 13:23	VHL	P1H0533
Bromoform	BRL	ug/kg dry	3.3	0.58	1	8260B	8/24/11 13:23	VHL	P1H0533
Bromomethane	BRL	ug/kg dry	6.6	0.93	1	8260B	8/24/11 13:23	VHL	P1H0533
Carbon disulfide	BRL	ug/kg dry	6.6	0.27	1	8260B	8/24/11 13:23	VHL	P1H0533
Carbon Tetrachloride	BRL	ug/kg dry	3.3	0.18	1	8260B	8/24/11 13:23	VHL	P1H0533
Chlorobenzene	BRL	ug/kg dry	3.3	0.15	1	8260B	8/24/11 13:23	VHL	P1H0533
Chloroethane	BRL	ug/kg dry	6.6	2.5	1	8260B	8/24/11 13:23	VHL	P1H0533
Chloroform	BRL	ug/kg dry	3.3	0.14	1	8260B	8/24/11 13:23	VHL	P1H0533
Chloromethane	BRL	ug/kg dry	6.6	1.7	1	8260B	8/24/11 13:23	VHL	P1H0533
cis-1,2-Dichloroethylene	BRL	ug/kg dry	3.3	0.27	1	8260B	8/24/11 13:23	VHL	P1H0533
cis-1,3-Dichloropropylene	BRL	ug/kg dry	3.3	0.16	1	8260B	8/24/11 13:23	VHL	P1H0533
Dibromochloromethane	BRL	ug/kg dry	3.3	0.22	1	8260B	8/24/11 13:23	VHL	P1H0533
Dibromomethane	BRL	ug/kg dry	3.3	0.22	1	8260B	8/24/11 13:23	VHL	P1H0533
Dichlorodifluoromethane	BRL	ug/kg dry	6.6	0.35	1	8260B	8/24/11 13:23	VHL	P1H0533
Ethylbenzene	BRL	ug/kg dry	3.3	0.21	1	8260B	8/24/11 13:23	VHL	P1H0533
Hexachlorobutadiene	BRL	ug/kg dry	9.9	0.42	1	8260B	8/24/11 13:23	VHL	P1H0533
Isopropyl Ether	BRL	ug/kg dry	3.3	0.14	1	8260B	8/24/11 13:23	VHL	P1H0533
Isopropylbenzene (Cumene)	BRL	ug/kg dry	6.6	0.16	1	8260B	8/24/11 13:23	VHL	P1H0533
m,p-Xylenes	BRL	ug/kg dry	6.6	0.42	1	8260B	8/24/11 13:23	VHL	P1H0533
Methyl Butyl Ketone (2-Hexanone)	BRL	ug/kg dry	33	0.68	1	8260B	8/24/11 13:23	VHL	P1H0533
Methyl Ethyl Ketone (2-Butanone)	BRL	ug/kg dry	13	1.2	1	8260B	8/24/11 13:23	VHL	P1H0533
Methyl Isobutyl Ketone	BRL	ug/kg dry	6.6	0.87	1	8260B	8/24/11 13:23	VHL	P1H0533
Methylene Chloride	BRL	ug/kg dry	6.6	0.24	1	8260B	8/24/11 13:23	VHL	P1H0533
Methyl-tert-Butyl Ether	BRL	ug/kg dry	3.3	0.25	1	8260B	8/24/11 13:23	VHL	P1H0533
Naphthalene	BRL	ug/kg dry	3.3	0.24	1	8260B	8/24/11 13:23	VHL	P1H0533
n-Butylbenzene	BRL	ug/kg dry	9.9	0.15	1	8260B	8/24/11 13:23	VHL	P1H0533
n-Propylbenzene	BRL	ug/kg dry	6.6	0.19	1	8260B	8/24/11 13:23	VHL	P1H0533
o-Xylene	BRL	ug/kg dry	3.3	0.21	1	8260B	8/24/11 13:23	VHL	P1H0533
sec-Butylbenzene	BRL	ug/kg dry	9.9	0.13	1	8260B	8/24/11 13:23	VHL	P1H0533
Styrene	BRL	ug/kg dry	3.3	0.14	1	8260B	8/24/11 13:23	VHL	P1H0533
tert-Butylbenzene	BRL	ug/kg dry	13	0.17	1	8260B	8/24/11 13:23	VHL	P1H0533
Tetrachloroethylene	BRL	ug/kg dry	6.6	0.23	1	8260B	8/24/11 13:23	VHL	P1H0533
Toluene	BRL	ug/kg dry	3.3	0.20	1	8260B	8/24/11 13:23	VHL	P1H0533
trans-1,2-Dichloroethylene	BRL	ug/kg dry	3.3	0.38	1	8260B	8/24/11 13:23	VHL	P1H0533
trans-1,3-Dichloropropylene	BRL	ug/kg dry	3.3	0.16	1	8260B	8/24/11 13:23	VHL	P1H0533
Trichloroethylene	BRL	ug/kg dry	3.3	0.30	1	8260B	8/24/11 13:23	VHL	P1H0533

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Laboratory Report

08/26/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: GP-7
Prism Sample ID: 1080439-07
Prism Work Order: 1080439
Time Collected: 08/15/11 10:00
Time Submitted: 08/16/11 11:30

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
Trichlorofluoromethane	BRL	ug/kg dry	3.3	0.27	1	8260B	8/24/11 13:23	VHL	P1H0533
Vinyl acetate	BRL	ug/kg dry	6.6	0.94	1	8260B	8/24/11 13:23	VHL	P1H0533
Vinyl chloride	BRL	ug/kg dry	6.6	0.43	1	8260B	8/24/11 13:23	VHL	P1H0533

Surrogate	Recovery	Control Limits
4-Bromofluorobenzene	*89 %*	*70-130*
Dibromofluoromethane	*97 %*	*84-123*
Toluene-d8	*93 %*	*76-129*

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08/26/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: GP-8
Prism Sample ID: 1080439-08
Prism Work Order: 1080439
Time Collected: 08/15/11 10:10
Time Submitted: 08/16/11 11:30

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**88.7**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**8/18/11 15:00**	**JAB**	**P1H0405**
Total Metals									
Mercury	BRL	mg/kg dry	0.022	0.0026	1	*7471B	8/22/11 14:02	BGM	P1H0455
Antimony	BRL	mg/kg dry	0.23	0.041	1	*6010C	8/19/11 22:05	DWR	P1H0419
Arsenic	BRL	mg/kg dry	0.57	0.065	1	*6010C	8/19/11 22:05	DWR	P1H0419
Beryllium	**0.92**	**mg/kg dry**	**0.29**	**0.049**	**1**	***6010C**	**8/19/11 22:05**	**DWR**	**P1H0419**
Cadmium	BRL	mg/kg dry	0.29	0.030	1	*6010C	8/19/11 22:05	DWR	P1H0419
Chromium	**5.6**	**mg/kg dry**	**0.29**	**0.039**	**1**	***6010C**	**8/19/11 22:05**	**DWR**	**P1H0419**
Copper	**38**	**mg/kg dry**	**0.57**	**0.25**	**1**	***6010C**	**8/19/11 22:05**	**DWR**	**P1H0419**
Lead	**2.0**	**mg/kg dry**	**0.29**	**0.071**	**1**	***6010C**	**8/19/11 22:05**	**DWR**	**P1H0419**
Nickel	**6.8**	**mg/kg dry**	**1.1**	**0.35**	**1**	***6010C**	**8/19/11 22:05**	**DWR**	**P1H0419**
Selenium	BRL	mg/kg dry	0.57	0.12	1	*6010C	8/19/11 22:05	DWR	P1H0419
Silver	BRL	mg/kg dry	0.29	0.029	1	*6010C	8/19/11 22:05	DWR	P1H0419
Thallium	**0.67**	**mg/kg dry**	**0.57**	**0.11**	**1**	***6010C**	**8/19/11 22:05**	**DWR**	**P1H0419**
Tin	BRL	mg/kg dry	5.7	0.51	1	*6010C	8/22/11 16:32	DWR	P1H0419
Zinc	**89**	**mg/kg dry**	**2.9**	**0.29**	**1**	***6010C**	**8/19/11 22:05**	**DWR**	**P1H0419**
Volatile Organic Compounds by GC/MS									
1,1,1,2-Tetrachloroethane	BRL	ug/kg dry	3.6	0.21	1	8260B	8/23/11 16:55	VHL	P1H0472
1,1,1-Trichloroethane	BRL	ug/kg dry	3.6	0.12	1	8260B	8/23/11 16:55	VHL	P1H0472
1,1,2,2-Tetrachloroethane	BRL	ug/kg dry	3.6	0.59	1	8260B	8/23/11 16:55	VHL	P1H0472
1,1,2-Trichloroethane	BRL	ug/kg dry	3.6	0.30	1	8260B	8/23/11 16:55	VHL	P1H0472
1,1-Dichloroethane	BRL	ug/kg dry	3.6	0.30	1	8260B	8/23/11 16:55	VHL	P1H0472
1,1-Dichloroethylene	BRL	ug/kg dry	3.6	0.22	1	8260B	8/23/11 16:55	VHL	P1H0472
1,1-Dichloropropylene	BRL	ug/kg dry	3.6	0.37	1	8260B	8/23/11 16:55	VHL	P1H0472
1,2,3-Trichlorobenzene	BRL	ug/kg dry	7.1	0.26	1	8260B	8/23/11 16:55	VHL	P1H0472
1,2,3-Trichloropropane	BRL	ug/kg dry	3.6	0.54	1	8260B	8/23/11 16:55	VHL	P1H0472
1,2,4-Trichlorobenzene	BRL	ug/kg dry	7.1	0.21	1	8260B	8/23/11 16:55	VHL	P1H0472
1,2,4-Trimethylbenzene	BRL	ug/kg dry	7.1	0.70	1	8260B	8/23/11 16:55	VHL	P1H0472
1,2-Dibromo-3-chloropropane	BRL	ug/kg dry	3.6	1.1	1	8260B	8/23/11 16:55	VHL	P1H0472
1,2-Dibromoethane	BRL	ug/kg dry	3.6	0.41	1	8260B	8/23/11 16:55	VHL	P1H0472
1,2-Dichlorobenzene	BRL	ug/kg dry	7.1	0.16	1	8260B	8/23/11 16:55	VHL	P1H0472
1,2-Dichloroethane	BRL	ug/kg dry	3.6	0.57	1	8260B	8/23/11 16:55	VHL	P1H0472
1,2-Dichloropropane	BRL	ug/kg dry	3.6	0.23	1	8260B	8/23/11 16:55	VHL	P1H0472
1,3,5-Trimethylbenzene	BRL	ug/kg dry	7.1	0.17	1	8260B	8/23/11 16:55	VHL	P1H0472
1,3-Dichlorobenzene	BRL	ug/kg dry	7.1	0.049	1	8260B	8/23/11 16:55	VHL	P1H0472
1,3-Dichloropropane	BRL	ug/kg dry	3.6	0.38	1	8260B	8/23/11 16:55	VHL	P1H0472
1,4-Dichlorobenzene	BRL	ug/kg dry	7.1	0.26	1	8260B	8/23/11 16:55	VHL	P1H0472
2,2-Dichloropropane	BRL	ug/kg dry	3.6	0.22	1	8260B	8/23/11 16:55	VHL	P1H0472
2-Chloroethyl Vinyl Ether	BRL	ug/kg dry	7.1	2.0	1	8260B	8/23/11 16:55	VHL	P1H0472
2-Chlorotoluene	BRL	ug/kg dry	7.1	0.22	1	8260B	8/23/11 16:55	VHL	P1H0472

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Project: United Metal

Sample Matrix: Solid

Client Sample ID: GP-8
Prism Sample ID: 1080439-08
Prism Work Order: 1080439
Time Collected: 08/15/11 10:10
Time Submitted: 08/16/11 11:30

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
4-Chlorotoluene	BRL	ug/kg dry	7.1	0.17	1	8260B	8/23/11 16:55	VHL	P1H0472
4-Isopropyltoluene	BRL	ug/kg dry	11	0.23	1	8260B	8/23/11 16:55	VHL	P1H0472
Acetone	**8.5 J**	**ug/kg dry**	**14**	**1.9**	**1**	**8260B**	**8/23/11 16:55**	**VHL**	**P1H0472**
Acrolein	BRL	ug/kg dry	71	2.2	1	8260B	8/23/11 16:55	VHL	P1H0472
Acrylonitrile	BRL	ug/kg dry	71	1.8	1	8260B	8/23/11 16:55	VHL	P1H0472
Benzene	BRL	ug/kg dry	2.1	0.22	1	8260B	8/23/11 16:55	VHL	P1H0472
Bromobenzene	BRL	ug/kg dry	3.6	0.15	1	8260B	8/23/11 16:55	VHL	P1H0472
Bromochloromethane	BRL	ug/kg dry	3.6	0.52	1	8260B	8/23/11 16:55	VHL	P1H0472
Bromodichloromethane	BRL	ug/kg dry	3.6	0.16	1	8260B	8/23/11 16:55	VHL	P1H0472
Bromoform	BRL	ug/kg dry	3.6	0.63	1	8260B	8/23/11 16:55	VHL	P1H0472
Bromomethane	BRL	ug/kg dry	7.1	1.0	1	8260B	8/23/11 16:55	VHL	P1H0472
Carbon disulfide	BRL	ug/kg dry	7.1	0.30	1	8260B	8/23/11 16:55	VHL	P1H0472
Carbon Tetrachloride	BRL	ug/kg dry	3.6	0.19	1	8260B	8/23/11 16:55	VHL	P1H0472
Chlorobenzene	BRL	ug/kg dry	3.6	0.17	1	8260B	8/23/11 16:55	VHL	P1H0472
Chloroethane	BRL	ug/kg dry	7.1	2.7	1	8260B	8/23/11 16:55	VHL	P1H0472
Chloroform	BRL	ug/kg dry	3.6	0.15	1	8260B	8/23/11 16:55	VHL	P1H0472
Chloromethane	BRL	ug/kg dry	7.1	1.8	1	8260B	8/23/11 16:55	VHL	P1H0472
cis-1,2-Dichloroethylene	BRL	ug/kg dry	3.6	0.29	1	8260B	8/23/11 16:55	VHL	P1H0472
cis-1,3-Dichloropropylene	BRL	ug/kg dry	3.6	0.18	1	8260B	8/23/11 16:55	VHL	P1H0472
Dibromochloromethane	BRL	ug/kg dry	3.6	0.24	1	8260B	8/23/11 16:55	VHL	P1H0472
Dibromomethane	BRL	ug/kg dry	3.6	0.24	1	8260B	8/23/11 16:55	VHL	P1H0472
Dichlorodifluoromethane	BRL	ug/kg dry	7.1	0.38	1	8260B	8/23/11 16:55	VHL	P1H0472
Ethylbenzene	BRL	ug/kg dry	3.6	0.23	1	8260B	8/23/11 16:55	VHL	P1H0472
Hexachlorobutadiene	BRL	ug/kg dry	11	0.46	1	8260B	8/23/11 16:55	VHL	P1H0472
Isopropyl Ether	BRL	ug/kg dry	3.6	0.15	1	8260B	8/23/11 16:55	VHL	P1H0472
Isopropylbenzene (Cumene)	BRL	ug/kg dry	7.1	0.18	1	8260B	8/23/11 16:55	VHL	P1H0472
m,p-Xylenes	BRL	ug/kg dry	7.1	0.46	1	8260B	8/23/11 16:55	VHL	P1H0472
Methyl Butyl Ketone (2-Hexanone)	BRL	ug/kg dry	36	0.73	1	8260B	8/23/11 16:55	VHL	P1H0472
Methyl Ethyl Ketone (2-Butanone)	BRL	ug/kg dry	14	1.3	1	8260B	8/23/11 16:55	VHL	P1H0472
Methyl Isobutyl Ketone	BRL	ug/kg dry	7.1	0.94	1	8260B	8/23/11 16:55	VHL	P1H0472
Methylene Chloride	BRL	ug/kg dry	7.1	0.26	1	8260B	8/23/11 16:55	VHL	P1H0472
Methyl-tert-Butyl Ether	BRL	ug/kg dry	3.6	0.27	1	8260B	8/23/11 16:55	VHL	P1H0472
Naphthalene	BRL	ug/kg dry	3.6	0.26	1	8260B	8/23/11 16:55	VHL	P1H0472
n-Butylbenzene	BRL	ug/kg dry	11	0.16	1	8260B	8/23/11 16:55	VHL	P1H0472
n-Propylbenzene	BRL	ug/kg dry	7.1	0.20	1	8260B	8/23/11 16:55	VHL	P1H0472
o-Xylene	BRL	ug/kg dry	3.6	0.23	1	8260B	8/23/11 16:55	VHL	P1H0472
sec-Butylbenzene	BRL	ug/kg dry	11	0.14	1	8260B	8/23/11 16:55	VHL	P1H0472
Styrene	BRL	ug/kg dry	3.6	0.15	1	8260B	8/23/11 16:55	VHL	P1H0472
tert-Butylbenzene	BRL	ug/kg dry	14	0.18	1	8260B	8/23/11 16:55	VHL	P1H0472
Tetrachloroethylene	BRL	ug/kg dry	7.1	0.25	1	8260B	8/23/11 16:55	VHL	P1H0472
Toluene	BRL	ug/kg dry	3.6	0.21	1	8260B	8/23/11 16:55	VHL	P1H0472
trans-1,2-Dichloroethylene	BRL	ug/kg dry	3.6	0.41	1	8260B	8/23/11 16:55	VHL	P1H0472
trans-1,3-Dichloropropylene	BRL	ug/kg dry	3.6	0.17	1	8260B	8/23/11 16:55	VHL	P1H0472

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PRISM LABORATORIES, INC. | Full-Service Analytical & Environmental Solutions

Laboratory Report

08/26/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: GP-8
Prism Sample ID: 1080439-08
Prism Work Order: 1080439
Time Collected: 08/15/11 10:10
Time Submitted: 08/16/11 11:30

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
Trichloroethylene	BRL	ug/kg dry	3.6	0.33	1	8260B	8/23/11 16:55	VHL	P1H0472
Trichlorofluoromethane	BRL	ug/kg dry	3.6	0.29	1	8260B	8/23/11 16:55	VHL	P1H0472
Vinyl acetate	BRL	ug/kg dry	7.1	1.0	1	8260B	8/23/11 16:55	VHL	P1H0472
Vinyl chloride	BRL	ug/kg dry	7.1	0.46	1	8260B	8/23/11 16:55	VHL	P1H0472

Surrogate	Recovery	Control Limits
4-Bromofluorobenzene	*95 %*	*70-130*
Dibromofluoromethane	*111 %*	*84-123*
Toluene-d8	*95 %*	*76-129*

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PRISM LABORATORIES, INC. | Full-Service Analytical & Environmental Solutions

Laboratory Report

08/26/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: Duplicate
Prism Sample ID: 1080439-09
Prism Work Order: 1080439
Time Collected: 08/15/11 10:15
Time Submitted: 08/16/11 11:30

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**81.6**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**8/18/11 15:00**	**JAB**	**P1H0405**
Total Metals									
Mercury	BRL	mg/kg dry	0.025	0.0029	1	*7471B	8/22/11 14:32	BGM	P1H0455
Antimony	BRL	mg/kg dry	0.25	0.045	1	*6010C	8/19/11 22:15	DWR	P1H0419
Arsenic	BRL	mg/kg dry	0.62	0.070	1	*6010C	8/19/11 22:15	DWR	P1H0419
Beryllium	**0.62**	**mg/kg dry**	**0.31**	**0.052**	**1**	***6010C**	**8/19/11 22:15**	**DWR**	**P1H0419**
Cadmium	BRL	mg/kg dry	0.31	0.033	1	*6010C	8/19/11 22:15	DWR	P1H0419
Chromium	**3.7**	**mg/kg dry**	**0.31**	**0.042**	**1**	***6010C**	**8/19/11 22:15**	**DWR**	**P1H0419**
Copper	**13**	**mg/kg dry**	**0.62**	**0.27**	**1**	***6010C**	**8/19/11 22:15**	**DWR**	**P1H0419**
Lead	**2.7**	**mg/kg dry**	**0.31**	**0.076**	**1**	***6010C**	**8/19/11 22:15**	**DWR**	**P1H0419**
Nickel	**4.8**	**mg/kg dry**	**1.2**	**0.38**	**1**	***6010C**	**8/19/11 22:15**	**DWR**	**P1H0419**
Selenium	BRL	mg/kg dry	0.62	0.12	1	*6010C	8/19/11 22:15	DWR	P1H0419
Silver	BRL	mg/kg dry	0.31	0.031	1	*6010C	8/19/11 22:15	DWR	P1H0419
Thallium	BRL	mg/kg dry	0.62	0.12	1	*6010C	8/19/11 22:15	DWR	P1H0419
Tin	BRL	mg/kg dry	6.2	0.55	1	*6010C	8/22/11 16:52	DWR	P1H0419
Zinc	**46**	**mg/kg dry**	**3.1**	**0.32**	**1**	***6010C**	**8/19/11 22:15**	**DWR**	**P1H0419**
Volatile Organic Compounds by GC/MS									
1,1,1,2-Tetrachloroethane	BRL	ug/kg dry	3.7	0.22	1	8260B	8/23/11 17:27	VHL	P1H0472
1,1,1-Trichloroethane	BRL	ug/kg dry	3.7	0.12	1	8260B	8/23/11 17:27	VHL	P1H0472
1,1,2,2-Tetrachloroethane	BRL	ug/kg dry	3.7	0.61	1	8260B	8/23/11 17:27	VHL	P1H0472
1,1,2-Trichloroethane	BRL	ug/kg dry	3.7	0.31	1	8260B	8/23/11 17:27	VHL	P1H0472
1,1-Dichloroethane	BRL	ug/kg dry	3.7	0.31	1	8260B	8/23/11 17:27	VHL	P1H0472
1,1-Dichloroethylene	BRL	ug/kg dry	3.7	0.22	1	8260B	8/23/11 17:27	VHL	P1H0472
1,1-Dichloropropylene	BRL	ug/kg dry	3.7	0.39	1	8260B	8/23/11 17:27	VHL	P1H0472
1,2,3-Trichlorobenzene	BRL	ug/kg dry	7.4	0.27	1	8260B	8/23/11 17:27	VHL	P1H0472
1,2,3-Trichloropropane	BRL	ug/kg dry	3.7	0.56	1	8260B	8/23/11 17:27	VHL	P1H0472
1,2,4-Trichlorobenzene	BRL	ug/kg dry	7.4	0.22	1	8260B	8/23/11 17:27	VHL	P1H0472
1,2,4-Trimethylbenzene	BRL	ug/kg dry	7.4	0.73	1	8260B	8/23/11 17:27	VHL	P1H0472
1,2-Dibromo-3-chloropropane	BRL	ug/kg dry	3.7	1.1	1	8260B	8/23/11 17:27	VHL	P1H0472
1,2-Dibromoethane	BRL	ug/kg dry	3.7	0.43	1	8260B	8/23/11 17:27	VHL	P1H0472
1,2-Dichlorobenzene	BRL	ug/kg dry	7.4	0.17	1	8260B	8/23/11 17:27	VHL	P1H0472
1,2-Dichloroethane	BRL	ug/kg dry	3.7	0.60	1	8260B	8/23/11 17:27	VHL	P1H0472
1,2-Dichloropropane	BRL	ug/kg dry	3.7	0.23	1	8260B	8/23/11 17:27	VHL	P1H0472
1,3,5-Trimethylbenzene	BRL	ug/kg dry	7.4	0.18	1	8260B	8/23/11 17:27	VHL	P1H0472
1,3-Dichlorobenzene	BRL	ug/kg dry	7.4	0.051	1	8260B	8/23/11 17:27	VHL	P1H0472
1,3-Dichloropropane	BRL	ug/kg dry	3.7	0.40	1	8260B	8/23/11 17:27	VHL	P1H0472
1,4-Dichlorobenzene	BRL	ug/kg dry	7.4	0.27	1	8260B	8/23/11 17:27	VHL	P1H0472
2,2-Dichloropropane	BRL	ug/kg dry	3.7	0.23	1	8260B	8/23/11 17:27	VHL	P1H0472
2-Chloroethyl Vinyl Ether	BRL	ug/kg dry	7.4	2.1	1	8260B	8/23/11 17:27	VHL	P1H0472
2-Chlorotoluene	BRL	ug/kg dry	7.4	0.23	1	8260B	8/23/11 17:27	VHL	P1H0472
4-Chlorotoluene	BRL	ug/kg dry	7.4	0.17	1	8260B	8/23/11 17:27	VHL	P1H0472

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Laboratory Report

08/26/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: Duplicate
Prism Sample ID: 1080439-09
Prism Work Order: 1080439
Time Collected: 08/15/11 10:15
Time Submitted: 08/16/11 11:30

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
4-Isopropyltoluene	BRL	ug/kg dry	11	0.23	1	8260B	8/23/11 17:27	VHL	P1H0472
Acetone	**3.9 J**	**ug/kg dry**	**15**	**2.0**	**1**	**8260B**	**8/23/11 17:27**	**VHL**	**P1H0472**
Acrolein	BRL	ug/kg dry	74	2.2	1	8260B	8/23/11 17:27	VHL	P1H0472
Acrylonitrile	BRL	ug/kg dry	74	1.8	1	8260B	8/23/11 17:27	VHL	P1H0472
Benzene	BRL	ug/kg dry	2.2	0.22	1	8260B	8/23/11 17:27	VHL	P1H0472
Bromobenzene	BRL	ug/kg dry	3.7	0.16	1	8260B	8/23/11 17:27	VHL	P1H0472
Bromochloromethane	BRL	ug/kg dry	3.7	0.54	1	8260B	8/23/11 17:27	VHL	P1H0472
Bromodichloromethane	BRL	ug/kg dry	3.7	0.17	1	8260B	8/23/11 17:27	VHL	P1H0472
Bromoform	BRL	ug/kg dry	3.7	0.65	1	8260B	8/23/11 17:27	VHL	P1H0472
Bromomethane	BRL	ug/kg dry	7.4	1.0	1	8260B	8/23/11 17:27	VHL	P1H0472
Carbon disulfide	BRL	ug/kg dry	7.4	0.31	1	8260B	8/23/11 17:27	VHL	P1H0472
Carbon Tetrachloride	BRL	ug/kg dry	3.7	0.20	1	8260B	8/23/11 17:27	VHL	P1H0472
Chlorobenzene	BRL	ug/kg dry	3.7	0.17	1	8260B	8/23/11 17:27	VHL	P1H0472
Chloroethane	BRL	ug/kg dry	7.4	2.8	1	8260B	8/23/11 17:27	VHL	P1H0472
Chloroform	BRL	ug/kg dry	3.7	0.16	1	8260B	8/23/11 17:27	VHL	P1H0472
Chloromethane	BRL	ug/kg dry	7.4	1.9	1	8260B	8/23/11 17:27	VHL	P1H0472
cis-1,2-Dichloroethylene	BRL	ug/kg dry	3.7	0.30	1	8260B	8/23/11 17:27	VHL	P1H0472
cis-1,3-Dichloropropylene	BRL	ug/kg dry	3.7	0.18	1	8260B	8/23/11 17:27	VHL	P1H0472
Dibromochloromethane	BRL	ug/kg dry	3.7	0.25	1	8260B	8/23/11 17:27	VHL	P1H0472
Dibromomethane	BRL	ug/kg dry	3.7	0.25	1	8260B	8/23/11 17:27	VHL	P1H0472
Dichlorodifluoromethane	BRL	ug/kg dry	7.4	0.40	1	8260B	8/23/11 17:27	VHL	P1H0472
Ethylbenzene	BRL	ug/kg dry	3.7	0.24	1	8260B	8/23/11 17:27	VHL	P1H0472
Hexachlorobutadiene	BRL	ug/kg dry	11	0.48	1	8260B	8/23/11 17:27	VHL	P1H0472
Isopropyl Ether	BRL	ug/kg dry	3.7	0.16	1	8260B	8/23/11 17:27	VHL	P1H0472
Isopropylbenzene (Cumene)	BRL	ug/kg dry	7.4	0.19	1	8260B	8/23/11 17:27	VHL	P1H0472
m,p-Xylenes	BRL	ug/kg dry	7.4	0.48	1	8260B	8/23/11 17:27	VHL	P1H0472
Methyl Butyl Ketone (2-Hexanone)	BRL	ug/kg dry	37	0.76	1	8260B	8/23/11 17:27	VHL	P1H0472
Methyl Ethyl Ketone (2-Butanone)	BRL	ug/kg dry	15	1.3	1	8260B	8/23/11 17:27	VHL	P1H0472
Methyl Isobutyl Ketone	BRL	ug/kg dry	7.4	0.98	1	8260B	8/23/11 17:27	VHL	P1H0472
Methylene Chloride	BRL	ug/kg dry	7.4	0.27	1	8260B	8/23/11 17:27	VHL	P1H0472
Methyl-tert-Butyl Ether	BRL	ug/kg dry	3.7	0.28	1	8260B	8/23/11 17:27	VHL	P1H0472
Naphthalene	BRL	ug/kg dry	3.7	0.27	1	8260B	8/23/11 17:27	VHL	P1H0472
n-Butylbenzene	BRL	ug/kg dry	11	0.16	1	8260B	8/23/11 17:27	VHL	P1H0472
n-Propylbenzene	BRL	ug/kg dry	7.4	0.21	1	8260B	8/23/11 17:27	VHL	P1H0472
o-Xylene	BRL	ug/kg dry	3.7	0.23	1	8260B	8/23/11 17:27	VHL	P1H0472
sec-Butylbenzene	BRL	ug/kg dry	11	0.15	1	8260B	8/23/11 17:27	VHL	P1H0472
Styrene	BRL	ug/kg dry	3.7	0.16	1	8260B	8/23/11 17:27	VHL	P1H0472
tert-Butylbenzene	BRL	ug/kg dry	15	0.19	1	8260B	8/23/11 17:27	VHL	P1H0472
Tetrachloroethylene	BRL	ug/kg dry	7.4	0.26	1	8260B	8/23/11 17:27	VHL	P1H0472
Toluene	BRL	ug/kg dry	3.7	0.22	1	8260B	8/23/11 17:27	VHL	P1H0472
trans-1,2-Dichloroethylene	BRL	ug/kg dry	3.7	0.43	1	8260B	8/23/11 17:27	VHL	P1H0472
trans-1,3-Dichloropropylene	BRL	ug/kg dry	3.7	0.18	1	8260B	8/23/11 17:27	VHL	P1H0472
Trichloroethylene	BRL	ug/kg dry	3.7	0.34	1	8260B	8/23/11 17:27	VHL	P1H0472

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PRISM LABORATORIES, INC. | Full-Service Analytical & Environmental Solutions

Laboratory Report

08/26/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: Duplicate
Prism Sample ID: 1080439-09
Prism Work Order: 1080439
Time Collected: 08/15/11 10:15
Time Submitted: 08/16/11 11:30

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
Trichlorofluoromethane	BRL	ug/kg dry	3.7	0.30	1	8260B	8/23/11 17:27	VHL	P1H0472
Vinyl acetate	BRL	ug/kg dry	7.4	1.1	1	8260B	8/23/11 17:27	VHL	P1H0472
Vinyl chloride	BRL	ug/kg dry	7.4	0.48	1	8260B	8/23/11 17:27	VHL	P1H0472

Surrogate	Recovery	Control Limits
4-Bromofluorobenzene	*94 %*	*70-130*
Dibromofluoromethane	*110 %*	*84-123*
Toluene-d8	*96 %*	*76-129*

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08/26/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: GP-9
Prism Sample ID: 1080439-10
Prism Work Order: 1080439
Time Collected: 08/15/11 10:40
Time Submitted: 08/16/11 11:30

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**77.7**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**8/18/11 15:00**	**JAB**	**P1H0405**
Total Metals									
Mercury	BRL	mg/kg dry	0.027	0.0033	1	*7471B	8/22/11 14:37	BGM	P1H0455
Antimony	BRL	mg/kg dry	0.26	0.046	1	*6010C	8/19/11 22:23	DWR	P1H0419
Arsenic	BRL	mg/kg dry	0.64	0.072	1	*6010C	8/19/11 22:23	DWR	P1H0419
Beryllium	**0.65**	**mg/kg dry**	**0.32**	**0.054**	**1**	***6010C**	**8/19/11 22:23**	**DWR**	**P1H0419**
Cadmium	BRL	mg/kg dry	0.32	0.034	1	*6010C	8/19/11 22:23	DWR	P1H0419
Chromium	**7.2**	**mg/kg dry**	**0.32**	**0.044**	**1**	***6010C**	**8/19/11 22:23**	**DWR**	**P1H0419**
Copper	**19**	**mg/kg dry**	**0.64**	**0.28**	**1**	***6010C**	**8/19/11 22:23**	**DWR**	**P1H0419**
Lead	**1.0**	**mg/kg dry**	**0.32**	**0.079**	**1**	***6010C**	**8/19/11 22:23**	**DWR**	**P1H0419**
Nickel	**13**	**mg/kg dry**	**1.3**	**0.39**	**1**	***6010C**	**8/19/11 22:23**	**DWR**	**P1H0419**
Selenium	**0.75**	**mg/kg dry**	**0.64**	**0.13**	**1**	***6010C**	**8/19/11 22:23**	**DWR**	**P1H0419**
Silver	BRL	mg/kg dry	0.32	0.033	1	*6010C	8/19/11 22:23	DWR	P1H0419
Thallium	BRL	mg/kg dry	0.64	0.12	1	*6010C	8/19/11 22:23	DWR	P1H0419
Tin	BRL	mg/kg dry	6.4	0.57	1	*6010C	8/22/11 17:00	DWR	P1H0419
Zinc	**36**	**mg/kg dry**	**3.2**	**0.33**	**1**	***6010C**	**8/19/11 22:23**	**DWR**	**P1H0419**

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Laboratory Report

08/26/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: GP-10
Prism Sample ID: 1080439-11
Prism Work Order: 1080439
Time Collected: 08/15/11 10:50
Time Submitted: 08/16/11 11:30

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**92.1**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**8/18/11 15:00**	**JAB**	**P1H0405**
Total Metals									
Mercury	BRL	mg/kg dry	0.022	0.0026	1	*7471B	8/22/11 14:41	BGM	P1H0455
Antimony	BRL	mg/kg dry	0.21	0.039	1	*6010C	8/19/11 22:32	DWR	P1H0419
Arsenic	BRL	mg/kg dry	0.53	0.060	1	*6010C	8/19/11 22:32	DWR	P1H0419
Beryllium	BRL	mg/kg dry	0.27	0.045	1	*6010C	8/19/11 22:32	DWR	P1H0419
Cadmium	BRL	mg/kg dry	0.27	0.028	1	*6010C	8/19/11 22:32	DWR	P1H0419
Chromium	**3.3**	**mg/kg dry**	**0.27**	**0.037**	**1**	***6010C**	**8/19/11 22:32**	**DWR**	**P1H0419**
Copper	**15**	**mg/kg dry**	**0.53**	**0.23**	**1**	***6010C**	**8/19/11 22:32**	**DWR**	**P1H0419**
Lead	**0.34**	**mg/kg dry**	**0.27**	**0.066**	**1**	***6010C**	**8/19/11 22:32**	**DWR**	**P1H0419**
Nickel	**7.4**	**mg/kg dry**	**1.1**	**0.33**	**1**	***6010C**	**8/19/11 22:32**	**DWR**	**P1H0419**
Selenium	BRL	mg/kg dry	0.53	0.11	1	*6010C	8/19/11 22:32	DWR	P1H0419
Silver	BRL	mg/kg dry	0.27	0.027	1	*6010C	8/19/11 22:32	DWR	P1H0419
Thallium	BRL	mg/kg dry	0.53	0.10	1	*6010C	8/19/11 22:32	DWR	P1H0419
Tin	BRL	mg/kg dry	5.3	0.47	1	*6010C	8/22/11 17:08	DWR	P1H0419
Zinc	**35**	**mg/kg dry**	**2.7**	**0.27**	**1**	***6010C**	**8/19/11 22:32**	**DWR**	**P1H0419**

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PRISM LABORATORIES, INC. | Full-Service Analytical & Environmental Solutions

Laboratory Report

08/26/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: GP-11
Prism Sample ID: 1080439-12
Prism Work Order: 1080439
Time Collected: 08/15/11 11:05
Time Submitted: 08/16/11 11:30

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**87.8**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**8/18/11 15:00**	**JAB**	**P1H0405**
Total Metals									
Mercury	BRL	mg/kg dry	0.022	0.0027	1	*7471B	8/22/11 14:46	BGM	P1H0455
Antimony	BRL	mg/kg dry	0.23	0.042	1	*6010C	8/19/11 22:40	DWR	P1H0419
Arsenic	BRL	mg/kg dry	0.58	0.065	1	*6010C	8/19/11 22:40	DWR	P1H0419
Beryllium	**0.34**	**mg/kg dry**	**0.29**	**0.049**	**1**	***6010C**	**8/19/11 22:40**	**DWR**	**P1H0419**
Cadmium	BRL	mg/kg dry	0.29	0.030	1	*6010C	8/19/11 22:40	DWR	P1H0419
Chromium	**4.1**	**mg/kg dry**	**0.29**	**0.040**	**1**	***6010C**	**8/19/11 22:40**	**DWR**	**P1H0419**
Copper	**37**	**mg/kg dry**	**0.58**	**0.25**	**1**	***6010C**	**8/19/11 22:40**	**DWR**	**P1H0419**
Lead	**0.94**	**mg/kg dry**	**0.29**	**0.071**	**1**	***6010C**	**8/19/11 22:40**	**DWR**	**P1H0419**
Nickel	**3.6**	**mg/kg dry**	**1.2**	**0.35**	**1**	***6010C**	**8/19/11 22:40**	**DWR**	**P1H0419**
Selenium	BRL	mg/kg dry	0.58	0.12	1	*6010C	8/19/11 22:40	DWR	P1H0419
Silver	BRL	mg/kg dry	0.29	0.029	1	*6010C	8/19/11 22:40	DWR	P1H0419
Thallium	BRL	mg/kg dry	0.58	0.11	1	*6010C	8/19/11 22:40	DWR	P1H0419
Tin	BRL	mg/kg dry	5.8	0.51	1	*6010C	8/22/11 17:17	DWR	P1H0419
Zinc	**44**	**mg/kg dry**	**2.9**	**0.29**	**1**	***6010C**	**8/19/11 22:40**	**DWR**	**P1H0419**

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08/26/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: GP-12
Prism Sample ID: 1080439-13
Prism Work Order: 1080439
Time Collected: 08/15/11 11:15
Time Submitted: 08/16/11 11:30

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**93.0**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**8/18/11 15:00**	**JAB**	**P1H0405**
Total Metals									
Mercury	BRL	mg/kg dry	0.020	0.0024	1	*7471B	8/22/11 14:50	BGM	P1H0455
Antimony	BRL	mg/kg dry	0.22	0.039	1	*6010C	8/22/11 17:25	DWR	P1H0419
Arsenic	BRL	mg/kg dry	0.54	0.061	1	*6010C	8/22/11 17:25	DWR	P1H0419
Beryllium	BRL	mg/kg dry	0.27	0.046	1	*6010C	8/19/11 23:00	DWR	P1H0419
Cadmium	BRL	mg/kg dry	0.27	0.029	1	*6010C	8/22/11 17:25	DWR	P1H0419
Chromium	**7.5**	**mg/kg dry**	**0.27**	**0.037**	**1**	***6010C**	**8/22/11 17:25**	**DWR**	**P1H0419**
Copper	**14**	**mg/kg dry**	**0.54**	**0.23**	**1**	***6010C**	**8/19/11 23:00**	**DWR**	**P1H0419**
Lead	**0.62**	**mg/kg dry**	**0.27**	**0.067**	**1**	***6010C**	**8/19/11 23:00**	**DWR**	**P1H0419**
Nickel	**3.8**	**mg/kg dry**	**1.1**	**0.33**	**1**	***6010C**	**8/19/11 23:00**	**DWR**	**P1H0419**
Selenium	**3.2**	**mg/kg dry**	**0.54**	**0.11**	**1**	***6010C**	**8/22/11 17:25**	**DWR**	**P1H0419**
Silver	BRL	mg/kg dry	0.27	0.028	1	*6010C	8/19/11 23:00	DWR	P1H0419
Thallium	**0.72**	**mg/kg dry**	**0.54**	**0.10**	**1**	***6010C**	**8/22/11 17:25**	**DWR**	**P1H0419**
Tin	BRL	mg/kg dry	5.4	0.48	1	*6010C	8/22/11 17:25	DWR	P1H0419
Zinc	**29**	**mg/kg dry**	**2.7**	**0.28**	**1**	***6010C**	**8/19/11 23:00**	**DWR**	**P1H0419**

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08/26/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: GP-13
Prism Sample ID: 1080439-14
Prism Work Order: 1080439
Time Collected: 08/15/11 11:20
Time Submitted: 08/16/11 11:30

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**92.6**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**8/18/11 15:00**	**JAB**	**P1H0405**
Total Metals									
Mercury	BRL	mg/kg dry	0.022	0.0026	1	*7471B	8/22/11 14:55	BGM	P1H0455
Antimony	BRL	mg/kg dry	0.21	0.038	1	*6010C	8/22/11 17:34	DWR	P1H0419
Arsenic	BRL	mg/kg dry	0.53	0.060	1	*6010C	8/22/11 17:34	DWR	P1H0419
Beryllium	BRL	mg/kg dry	0.26	0.045	1	*6010C	8/19/11 23:09	DWR	P1H0419
Cadmium	BRL	mg/kg dry	0.26	0.028	1	*6010C	8/22/11 17:34	DWR	P1H0419
Chromium	**4.4**	**mg/kg dry**	**0.26**	**0.036**	**1**	***6010C**	**8/22/11 17:34**	**DWR**	**P1H0419**
Copper	**36**	**mg/kg dry**	**0.53**	**0.23**	**1**	***6010C**	**8/19/11 23:09**	**DWR**	**P1H0419**
Lead	**0.41**	**mg/kg dry**	**0.26**	**0.065**	**1**	***6010C**	**8/19/11 23:09**	**DWR**	**P1H0419**
Nickel	**48**	**mg/kg dry**	**1.1**	**0.33**	**1**	***6010C**	**8/19/11 23:09**	**DWR**	**P1H0419**
Selenium	**3.6**	**mg/kg dry**	**0.53**	**0.11**	**1**	***6010C**	**8/22/11 17:34**	**DWR**	**P1H0419**
Silver	BRL	mg/kg dry	0.26	0.027	1	*6010C	8/19/11 23:09	DWR	P1H0419
Thallium	**0.80**	**mg/kg dry**	**0.53**	**0.10**	**1**	***6010C**	**8/22/11 17:34**	**DWR**	**P1H0419**
Tin	BRL	mg/kg dry	5.3	0.47	1	*6010C	8/22/11 17:34	DWR	P1H0419
Zinc	**32**	**mg/kg dry**	**2.6**	**0.27**	**1**	***6010C**	**8/19/11 23:09**	**DWR**	**P1H0419**

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08/26/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: GP-14
Prism Sample ID: 1080439-15
Prism Work Order: 1080439
Time Collected: 08/15/11 11:30
Time Submitted: 08/16/11 11:30

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**80.9**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**8/18/11 15:00**	**JAB**	**P1H0405**
Total Metals									
Mercury	BRL	mg/kg dry	0.025	0.0030	1	*7471B	8/22/11 14:59	BGM	P1H0455
Antimony	BRL	mg/kg dry	0.25	0.045	1	*6010C	8/22/11 17:42	DWR	P1H0419
Arsenic	**0.87**	**mg/kg dry**	**0.62**	**0.070**	**1**	***6010C**	**8/22/11 17:42**	**DWR**	**P1H0419**
Beryllium	**0.47**	**mg/kg dry**	**0.31**	**0.053**	**1**	***6010C**	**8/19/11 23:17**	**DWR**	**P1H0419**
Cadmium	BRL	mg/kg dry	0.31	0.033	1	*6010C	8/22/11 17:42	DWR	P1H0419
Chromium	**22**	**mg/kg dry**	**0.31**	**0.043**	**1**	***6010C**	**8/22/11 17:42**	**DWR**	**P1H0419**
Copper	**13**	**mg/kg dry**	**0.62**	**0.27**	**1**	***6010C**	**8/19/11 23:17**	**DWR**	**P1H0419**
Lead	**1.0**	**mg/kg dry**	**0.31**	**0.077**	**1**	***6010C**	**8/19/11 23:17**	**DWR**	**P1H0419**
Nickel	**22**	**mg/kg dry**	**1.2**	**0.38**	**1**	***6010C**	**8/19/11 23:17**	**DWR**	**P1H0419**
Selenium	**8.8**	**mg/kg dry**	**0.62**	**0.13**	**1**	***6010C**	**8/22/11 17:42**	**DWR**	**P1H0419**
Silver	BRL	mg/kg dry	0.31	0.032	1	*6010C	8/19/11 23:17	DWR	P1H0419
Thallium	**2.8**	**mg/kg dry**	**0.62**	**0.12**	**1**	***6010C**	**8/22/11 17:42**	**DWR**	**P1H0419**
Tin	BRL	mg/kg dry	6.2	0.55	1	*6010C	8/22/11 17:42	DWR	P1H0419
Zinc	**36**	**mg/kg dry**	**3.1**	**0.32**	**1**	***6010C**	**8/19/11 23:17**	**DWR**	**P1H0419**

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08/26/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: GP-15
Prism Sample ID: 1080439-16
Prism Work Order: 1080439
Time Collected: 08/15/11 11:40
Time Submitted: 08/16/11 11:30

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**89.6**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**8/18/11 15:00**	**JAB**	**P1H0405**
Total Metals									
Mercury	BRL	mg/kg dry	0.021	0.0025	1	*7471B	8/22/11 15:04	BGM	P1H0455
Antimony	BRL	mg/kg dry	0.22	0.040	1	*6010C	8/22/11 17:51	DWR	P1H0419
Arsenic	BRL	mg/kg dry	0.56	0.063	1	*6010C	8/22/11 17:51	DWR	P1H0419
Beryllium	BRL	mg/kg dry	0.28	0.047	1	*6010C	8/19/11 23:27	DWR	P1H0419
Cadmium	BRL	mg/kg dry	0.28	0.030	1	*6010C	8/22/11 17:51	DWR	P1H0419
Chromium	**30**	**mg/kg dry**	**0.28**	**0.038**	**1**	***6010C**	**8/22/11 17:51**	**DWR**	**P1H0419**
Copper	**31**	**mg/kg dry**	**0.56**	**0.24**	**1**	***6010C**	**8/19/11 23:27**	**DWR**	**P1H0419**
Lead	**0.28**	**mg/kg dry**	**0.28**	**0.069**	**1**	***6010C**	**8/19/11 23:27**	**DWR**	**P1H0419**
Nickel	**19**	**mg/kg dry**	**1.1**	**0.34**	**1**	***6010C**	**8/19/11 23:27**	**DWR**	**P1H0419**
Selenium	**3.6**	**mg/kg dry**	**0.56**	**0.11**	**1**	***6010C**	**8/22/11 17:51**	**DWR**	**P1H0419**
Silver	BRL	mg/kg dry	0.28	0.028	1	*6010C	8/19/11 23:27	DWR	P1H0419
Thallium	**0.97**	**mg/kg dry**	**0.56**	**0.11**	**1**	***6010C**	**8/22/11 17:51**	**DWR**	**P1H0419**
Tin	BRL	mg/kg dry	5.6	0.50	1	*6010C	8/22/11 17:51	DWR	P1H0419
Zinc	**26**	**mg/kg dry**	**2.8**	**0.29**	**1**	***6010C**	**8/19/11 23:27**	**DWR**	**P1H0419**

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08/26/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: GP-16
Prism Sample ID: 1080439-17
Prism Work Order: 1080439
Time Collected: 08/15/11 12:00
Time Submitted: 08/16/11 11:30

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**89.6**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**8/18/11 15:00**	**JAB**	**P1H0405**
Total Metals									
Mercury	BRL	mg/kg dry	0.022	0.0027	1	*7471B	8/22/11 15:09	BGM	P1H0455
Antimony	BRL	mg/kg dry	0.22	0.041	1	*6010C	8/22/11 17:59	DWR	P1H0419
Arsenic	**0.91**	**mg/kg dry**	**0.56**	**0.063**	**1**	***6010C**	**8/22/11 17:59**	**DWR**	**P1H0419**
Beryllium	BRL	mg/kg dry	0.28	0.048	1	*6010C	8/19/11 23:35	DWR	P1H0419
Cadmium	BRL	mg/kg dry	0.28	0.030	1	*6010C	8/22/11 17:59	DWR	P1H0419
Chromium	**26**	**mg/kg dry**	**0.28**	**0.039**	**1**	***6010C**	**8/22/11 17:59**	**DWR**	**P1H0419**
Copper	**63**	**mg/kg dry**	**0.56**	**0.24**	**1**	***6010C**	**8/19/11 23:35**	**DWR**	**P1H0419**
Lead	**0.58**	**mg/kg dry**	**0.28**	**0.069**	**1**	***6010C**	**8/19/11 23:35**	**DWR**	**P1H0419**
Nickel	**39**	**mg/kg dry**	**1.1**	**0.34**	**1**	***6010C**	**8/19/11 23:35**	**DWR**	**P1H0419**
Selenium	**8.4**	**mg/kg dry**	**0.56**	**0.11**	**1**	***6010C**	**8/22/11 17:59**	**DWR**	**P1H0419**
Silver	BRL	mg/kg dry	0.28	0.029	1	*6010C	8/19/11 23:35	DWR	P1H0419
Thallium	**2.5**	**mg/kg dry**	**0.56**	**0.11**	**1**	***6010C**	**8/22/11 17:59**	**DWR**	**P1H0419**
Tin	BRL	mg/kg dry	5.6	0.50	1	*6010C	8/22/11 17:59	DWR	P1H0419
Zinc	**36**	**mg/kg dry**	**2.8**	**0.29**	**1**	***6010C**	**8/19/11 23:35**	**DWR**	**P1H0419**

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08/26/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: GP-17
Prism Sample ID: 1080439-18
Prism Work Order: 1080439
Time Collected: 08/15/11 12:20
Time Submitted: 08/16/11 11:30

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**80.3**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**8/18/11 15:00**	**JAB**	**P1H0405**
Total Metals									
Mercury	BRL	mg/kg dry	0.026	0.0031	1	*7471B	8/22/11 15:26	BGM	P1H0455
Antimony	BRL	mg/kg dry	0.25	0.045	1	*6010C	8/22/11 18:09	DWR	P1H0419
Arsenic	BRL	mg/kg dry	0.62	0.070	1	*6010C	8/22/11 18:09	DWR	P1H0419
Beryllium	BRL	mg/kg dry	0.31	0.052	1	*6010C	8/19/11 23:44	DWR	P1H0419
Cadmium	BRL	mg/kg dry	0.31	0.033	1	*6010C	8/22/11 18:09	DWR	P1H0419
Chromium	**13**	**mg/kg dry**	**0.31**	**0.042**	**1**	***6010C**	**8/22/11 18:09**	**DWR**	**P1H0419**
Copper	**23**	**mg/kg dry**	**0.62**	**0.27**	**1**	***6010C**	**8/19/11 23:44**	**DWR**	**P1H0419**
Lead	**0.43**	**mg/kg dry**	**0.31**	**0.076**	**1**	***6010C**	**8/19/11 23:44**	**DWR**	**P1H0419**
Nickel	**9.7**	**mg/kg dry**	**1.2**	**0.38**	**1**	***6010C**	**8/19/11 23:44**	**DWR**	**P1H0419**
Selenium	**3.7**	**mg/kg dry**	**0.62**	**0.12**	**1**	***6010C**	**8/22/11 18:09**	**DWR**	**P1H0419**
Silver	BRL	mg/kg dry	0.31	0.031	1	*6010C	8/19/11 23:44	DWR	P1H0419
Thallium	BRL	mg/kg dry	0.62	0.12	1	*6010C	8/22/11 18:09	DWR	P1H0419
Tin	BRL	mg/kg dry	6.2	0.55	1	*6010C	8/22/11 18:09	DWR	P1H0419
Zinc	**23**	**mg/kg dry**	**3.1**	**0.32**	**1**	***6010C**	**8/19/11 23:44**	**DWR**	**P1H0419**

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Laboratory Report

08/26/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: GP-18B
Prism Sample ID: 1080439-19
Prism Work Order: 1080439
Time Collected: 08/15/11 12:35
Time Submitted: 08/16/11 11:30

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**78.2**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**8/18/11 15:00**	**JAB**	**P1H0405**
Total Metals									
Mercury	BRL	mg/kg dry	0.026	0.0031	1	*7471B	8/22/11 15:31	BGM	P1H0455
Antimony	BRL	mg/kg dry	0.26	0.047	1	*6010C	8/22/11 18:18	DWR	P1H0419
Arsenic	BRL	mg/kg dry	0.65	0.074	1	*6010C	8/22/11 18:18	DWR	P1H0419
Beryllium	BRL	mg/kg dry	0.33	0.055	1	*6010C	8/19/11 23:53	DWR	P1H0419
Cadmium	BRL	mg/kg dry	0.33	0.035	1	*6010C	8/22/11 18:18	DWR	P1H0419
Chromium	**3.2**	**mg/kg dry**	**0.33**	**0.045**	**1**	***6010C**	**8/22/11 18:18**	**DWR**	**P1H0419**
Copper	**3.5**	**mg/kg dry**	**0.65**	**0.28**	**1**	***6010C**	**8/19/11 23:53**	**DWR**	**P1H0419**
Lead	**0.39**	**mg/kg dry**	**0.33**	**0.081**	**1**	***6010C**	**8/19/11 23:53**	**DWR**	**P1H0419**
Nickel	**3.3**	**mg/kg dry**	**1.3**	**0.40**	**1**	***6010C**	**8/19/11 23:53**	**DWR**	**P1H0419**
Selenium	**3.3**	**mg/kg dry**	**0.65**	**0.13**	**1**	***6010C**	**8/22/11 18:18**	**DWR**	**P1H0419**
Silver	BRL	mg/kg dry	0.33	0.033	1	*6010C	8/19/11 23:53	DWR	P1H0419
Thallium	**0.70**	**mg/kg dry**	**0.65**	**0.13**	**1**	***6010C**	**8/22/11 18:18**	**DWR**	**P1H0419**
Tin	BRL	mg/kg dry	6.5	0.58	1	*6010C	8/22/11 18:18	DWR	P1H0419
Zinc	**27**	**mg/kg dry**	**3.3**	**0.33**	**1**	***6010C**	**8/19/11 23:53**	**DWR**	**P1H0419**

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PRISM LABORATORIES, INC. | Full-Service Analytical & Environmental Solutions

Laboratory Report

08/26/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: GP-19
Prism Sample ID: 1080439-20
Prism Work Order: 1080439
Time Collected: 08/15/11 00:00
Time Submitted: 08/16/11 11:30

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**94.4**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**8/18/11 15:00**	**JAB**	**P1H0405**
Total Metals									
Mercury	BRL	mg/kg dry	0.021	0.0025	1	*7471B	8/22/11 15:35	BGM	P1H0455
Antimony	BRL	mg/kg dry	0.21	0.038	1	*6010C	8/24/11 16:28	DWR	P1H0468
Arsenic	BRL	mg/kg dry	0.53	0.060	1	*6010C	8/24/11 16:28	DWR	P1H0468
Beryllium	**0.26**	**mg/kg dry**	**0.26**	**0.045**	**1**	***6010C**	**8/24/11 16:28**	**DWR**	**P1H0468**
Cadmium	BRL	mg/kg dry	0.26	0.028	1	*6010C	8/24/11 16:28	DWR	P1H0468
Chromium	**13**	**mg/kg dry**	**0.26**	**0.036**	**1**	***6010C**	**8/24/11 16:28**	**DWR**	**P1H0468**
Copper	**51**	**mg/kg dry**	**0.53**	**0.23**	**1**	***6010C**	**8/24/11 16:28**	**DWR**	**P1H0468**
Lead	**0.37**	**mg/kg dry**	**0.26**	**0.065**	**1**	***6010C**	**8/24/11 16:28**	**DWR**	**P1H0468**
Nickel	**130**	**mg/kg dry**	**1.1**	**0.32**	**1**	***6010C**	**8/24/11 16:28**	**DWR**	**P1H0468**
Selenium	BRL	mg/kg dry	0.53	0.11	1	*6010C	8/24/11 16:28	DWR	P1H0468
Silver	BRL	mg/kg dry	0.26	0.027	1	*6010C	8/24/11 16:28	DWR	P1H0468
Thallium	BRL	mg/kg dry	0.53	0.10	1	*6010C	8/24/11 16:28	DWR	P1H0468
Tin	BRL	mg/kg dry	5.3	0.47	1	*6010C	8/24/11 16:28	DWR	P1H0468
Zinc	**30**	**mg/kg dry**	**2.6**	**0.27**	**1**	***6010C**	**8/24/11 16:28**	**DWR**	**P1H0468**

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08/26/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: GP-20
Prism Sample ID: 1080439-21
Prism Work Order: 1080439
Time Collected: 08/15/11 00:00
Time Submitted: 08/16/11 11:30

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**91.6**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**8/18/11 15:00**	**JAB**	**P1H0405**
Total Metals									
Mercury	BRL	mg/kg dry	0.021	0.0025	1	*7471B	8/22/11 15:54	BGM	P1H0455
Antimony	BRL	mg/kg dry	0.22	0.040	1	*6010C	8/22/11 23:44	DWR	P1H0468
Arsenic	BRL	mg/kg dry	0.55	0.062	1	*6010C	8/22/11 23:44	DWR	P1H0468
Beryllium	**0.47**	**mg/kg dry**	**0.27**	**0.047**	**1**	***6010C**	**8/22/11 23:44**	**DWR**	**P1H0468**
Cadmium	**1.5**	**mg/kg dry**	**0.27**	**0.029**	**1**	***6010C**	**8/22/11 23:44**	**DWR**	**P1H0468**
Chromium	**23**	**mg/kg dry**	**0.27**	**0.038**	**1**	***6010C**	**8/22/11 23:44**	**DWR**	**P1H0468**
Copper	**57**	**mg/kg dry**	**0.55**	**0.24**	**1**	***6010C**	**8/22/11 23:44**	**DWR**	**P1H0468**
Lead	**4.0**	**mg/kg dry**	**0.27**	**0.068**	**1**	***6010C**	**8/22/11 23:44**	**DWR**	**P1H0468**
Nickel	**63**	**mg/kg dry**	**1.1**	**0.34**	**1**	***6010C**	**8/22/11 23:44**	**DWR**	**P1H0468**
Selenium	**2.4**	**mg/kg dry**	**0.55**	**0.11**	**1**	***6010C**	**8/22/11 23:44**	**DWR**	**P1H0468**
Silver	BRL	mg/kg dry	0.27	0.028	1	*6010C	8/22/11 23:44	DWR	P1H0468
Thallium	**0.81**	**mg/kg dry**	**0.55**	**0.11**	**1**	***6010C**	**8/22/11 23:44**	**DWR**	**P1H0468**
Tin	BRL	mg/kg dry	5.5	0.49	1	*6010C	8/22/11 23:44	DWR	P1H0468
Zinc	**52**	**mg/kg dry**	**2.7**	**0.28**	**1**	***6010C**	**8/22/11 23:44**	**DWR**	**P1H0468**

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08/26/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: GP-21
Prism Sample ID: 1080439-22
Prism Work Order: 1080439
Time Collected: 08/15/11 00:00
Time Submitted: 08/16/11 11:30

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**76.2**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**8/18/11 15:00**	**JAB**	**P1H0405**
Total Metals									
Mercury	BRL	mg/kg dry	0.026	0.0031	1	*7471B	8/22/11 15:45	BGM	P1H0455
Antimony	BRL	mg/kg dry	0.27	0.048	1	*6010C	8/22/11 23:52	DWR	P1H0468
Arsenic	BRL	mg/kg dry	0.66	0.075	1	*6010C	8/22/11 23:52	DWR	P1H0468
Beryllium	**0.42**	**mg/kg dry**	**0.33**	**0.056**	**1**	***6010C**	**8/22/11 23:52**	**DWR**	**P1H0468**
Cadmium	BRL	mg/kg dry	0.33	0.035	1	*6010C	8/22/11 23:52	DWR	P1H0468
Chromium	**43**	**mg/kg dry**	**0.33**	**0.046**	**1**	***6010C**	**8/22/11 23:52**	**DWR**	**P1H0468**
Copper	**26**	**mg/kg dry**	**0.66**	**0.29**	**1**	***6010C**	**8/22/11 23:52**	**DWR**	**P1H0468**
Lead	**1.6**	**mg/kg dry**	**0.33**	**0.082**	**1**	***6010C**	**8/22/11 23:52**	**DWR**	**P1H0468**
Nickel	**29**	**mg/kg dry**	**1.3**	**0.41**	**1**	***6010C**	**8/22/11 23:52**	**DWR**	**P1H0468**
Selenium	**3.6**	**mg/kg dry**	**0.66**	**0.13**	**1**	***6010C**	**8/22/11 23:52**	**DWR**	**P1H0468**
Silver	BRL	mg/kg dry	0.33	0.034	1	*6010C	8/22/11 23:52	DWR	P1H0468
Thallium	**1.0**	**mg/kg dry**	**0.66**	**0.13**	**1**	***6010C**	**8/22/11 23:52**	**DWR**	**P1H0468**
Tin	BRL	mg/kg dry	6.6	0.59	1	*6010C	8/22/11 23:52	DWR	P1H0468
Zinc	**45**	**mg/kg dry**	**3.3**	**0.34**	**1**	***6010C**	**8/22/11 23:52**	**DWR**	**P1H0468**

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08/26/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: GP-22
Prism Sample ID: 1080439-23
Prism Work Order: 1080439
Time Collected: 08/15/11 00:00
Time Submitted: 08/16/11 11:30

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**79.7**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**8/18/11 15:00**	**JAB**	**P1H0405**
Total Metals									
Mercury	BRL	mg/kg dry	0.026	0.0031	1	*7471B	8/23/11 15:30	LTB	P1H0489
Antimony	BRL	mg/kg dry	0.25	0.045	1	*6010C	8/23/11 0:01	DWR	P1H0468
Arsenic	**0.74**	**mg/kg dry**	**0.62**	**0.070**	**1**	***6010C**	**8/23/11 0:01**	**DWR**	**P1H0468**
Beryllium	**0.41**	**mg/kg dry**	**0.31**	**0.053**	**1**	***6010C**	**8/23/11 0:01**	**DWR**	**P1H0468**
Cadmium	BRL	mg/kg dry	0.31	0.033	1	*6010C	8/23/11 0:01	DWR	P1H0468
Chromium	**20**	**mg/kg dry**	**0.31**	**0.043**	**1**	***6010C**	**8/23/11 0:01**	**DWR**	**P1H0468**
Copper	**30**	**mg/kg dry**	**0.62**	**0.27**	**1**	***6010C**	**8/23/11 0:01**	**DWR**	**P1H0468**
Lead	**2.4**	**mg/kg dry**	**0.31**	**0.077**	**1**	***6010C**	**8/23/11 0:01**	**DWR**	**P1H0468**
Nickel	**36**	**mg/kg dry**	**1.2**	**0.38**	**1**	***6010C**	**8/23/11 0:01**	**DWR**	**P1H0468**
Selenium	**5.5**	**mg/kg dry**	**0.62**	**0.13**	**1**	***6010C**	**8/23/11 0:01**	**DWR**	**P1H0468**
Silver	BRL	mg/kg dry	0.31	0.032	1	*6010C	8/23/11 0:01	DWR	P1H0468
Thallium	**1.8**	**mg/kg dry**	**0.62**	**0.12**	**1**	***6010C**	**8/23/11 0:01**	**DWR**	**P1H0468**
Tin	BRL	mg/kg dry	6.2	0.55	1	*6010C	8/23/11 0:01	DWR	P1H0468
Zinc	**20**	**mg/kg dry**	**3.1**	**0.32**	**1**	***6010C**	**8/23/11 0:01**	**DWR**	**P1H0468**

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08/26/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: GP-23
Prism Sample ID: 1080439-24
Prism Work Order: 1080439
Time Collected: 08/15/11 00:00
Time Submitted: 08/16/11 11:30

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**78.9**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**8/18/11 15:00**	**JAB**	**P1H0405**
Total Metals									
Mercury	BRL	mg/kg dry	0.024	0.0029	1	*7471B	8/23/11 15:53	LTB	P1H0489
Antimony	BRL	mg/kg dry	0.25	0.045	1	*6010C	8/23/11 0:11	DWR	P1H0468
Arsenic	BRL	mg/kg dry	0.62	0.071	1	*6010C	8/23/11 0:11	DWR	P1H0468
Beryllium	**0.49**	**mg/kg dry**	**0.31**	**0.053**	**1**	***6010C**	**8/23/11 0:11**	**DWR**	**P1H0468**
Cadmium	BRL	mg/kg dry	0.31	0.033	1	*6010C	8/23/11 0:11	DWR	P1H0468
Chromium	**3.5**	**mg/kg dry**	**0.31**	**0.043**	**1**	***6010C**	**8/23/11 0:11**	**DWR**	**P1H0468**
Copper	**25**	**mg/kg dry**	**0.62**	**0.27**	**1**	***6010C**	**8/23/11 0:11**	**DWR**	**P1H0468**
Lead	**0.54**	**mg/kg dry**	**0.31**	**0.077**	**1**	***6010C**	**8/23/11 0:11**	**DWR**	**P1H0468**
Nickel	**6.4**	**mg/kg dry**	**1.2**	**0.38**	**1**	***6010C**	**8/23/11 0:11**	**DWR**	**P1H0468**
Selenium	**2.4**	**mg/kg dry**	**0.62**	**0.13**	**1**	***6010C**	**8/23/11 0:11**	**DWR**	**P1H0468**
Silver	BRL	mg/kg dry	0.31	0.032	1	*6010C	8/23/11 0:11	DWR	P1H0468
Thallium	**1.0**	**mg/kg dry**	**0.62**	**0.12**	**1**	***6010C**	**8/23/11 0:11**	**DWR**	**P1H0468**
Tin	BRL	mg/kg dry	6.2	0.55	1	*6010C	8/23/11 0:11	DWR	P1H0468
Zinc	**41**	**mg/kg dry**	**3.1**	**0.32**	**1**	***6010C**	**8/23/11 0:11**	**DWR**	**P1H0468**

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08/26/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: GP-24
Prism Sample ID: 1080439-25
Prism Work Order: 1080439
Time Collected: 08/15/11 00:00
Time Submitted: 08/16/11 11:30

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**85.2**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**8/18/11 15:00**	**JAB**	**P1H0405**
Total Metals									
Mercury	BRL	mg/kg dry	0.025	0.0030	1	*7471B	8/23/11 15:58	LTB	P1H0489
Antimony	BRL	mg/kg dry	0.24	0.043	1	*6010C	8/23/11 0:30	DWR	P1H0468
Arsenic	BRL	mg/kg dry	0.60	0.067	1	*6010C	8/23/11 0:30	DWR	P1H0468
Beryllium	**0.57**	**mg/kg dry**	**0.30**	**0.051**	**1**	***6010C**	**8/23/11 0:30**	**DWR**	**P1H0468**
Cadmium	BRL	mg/kg dry	0.30	0.032	1	*6010C	8/23/11 0:30	DWR	P1H0468
Chromium	**29**	**mg/kg dry**	**0.30**	**0.041**	**1**	***6010C**	**8/23/11 0:30**	**DWR**	**P1H0468**
Copper	**76**	**mg/kg dry**	**0.60**	**0.26**	**1**	***6010C**	**8/23/11 0:30**	**DWR**	**P1H0468**
Lead	**0.78**	**mg/kg dry**	**0.30**	**0.074**	**1**	***6010C**	**8/23/11 0:30**	**DWR**	**P1H0468**
Nickel	**28**	**mg/kg dry**	**1.2**	**0.37**	**1**	***6010C**	**8/23/11 0:30**	**DWR**	**P1H0468**
Selenium	**3.1**	**mg/kg dry**	**0.60**	**0.12**	**1**	***6010C**	**8/23/11 0:30**	**DWR**	**P1H0468**
Silver	BRL	mg/kg dry	0.30	0.030	1	*6010C	8/23/11 0:30	DWR	P1H0468
Thallium	**0.97**	**mg/kg dry**	**0.60**	**0.11**	**1**	***6010C**	**8/23/11 0:30**	**DWR**	**P1H0468**
Tin	BRL	mg/kg dry	6.0	0.53	1	*6010C	8/23/11 0:30	DWR	P1H0468
Zinc	**32**	**mg/kg dry**	**3.0**	**0.31**	**1**	***6010C**	**8/23/11 0:30**	**DWR**	**P1H0468**

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08/26/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: GP-25
Prism Sample ID: 1080439-26
Prism Work Order: 1080439
Time Collected: 08/15/11 00:00
Time Submitted: 08/16/11 11:30

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**92.8**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**8/18/11 15:00**	**JAB**	**P1H0405**
Total Metals									
Mercury	BRL	mg/kg dry	0.021	0.0025	1	*7471B	8/23/11 16:02	LTB	P1H0489
Antimony	BRL	mg/kg dry	0.22	0.039	1	*6010C	8/23/11 0:38	DWR	P1H0468
Arsenic	BRL	mg/kg dry	0.54	0.061	1	*6010C	8/23/11 0:38	DWR	P1H0468
Beryllium	**0.43**	**mg/kg dry**	**0.27**	**0.046**	**1**	***6010C**	**8/23/11 0:38**	**DWR**	**P1H0468**
Cadmium	**5.2**	**mg/kg dry**	**0.27**	**0.029**	**1**	***6010C**	**8/23/11 0:38**	**DWR**	**P1H0468**
Chromium	**25**	**mg/kg dry**	**0.27**	**0.037**	**1**	***6010C**	**8/23/11 0:38**	**DWR**	**P1H0468**
Copper	**41**	**mg/kg dry**	**0.54**	**0.23**	**1**	***6010C**	**8/23/11 0:38**	**DWR**	**P1H0468**
Lead	**0.90**	**mg/kg dry**	**0.27**	**0.066**	**1**	***6010C**	**8/23/11 0:38**	**DWR**	**P1H0468**
Nickel	**6.4**	**mg/kg dry**	**1.1**	**0.33**	**1**	***6010C**	**8/23/11 0:38**	**DWR**	**P1H0468**
Selenium	**2.4**	**mg/kg dry**	**0.54**	**0.11**	**1**	***6010C**	**8/23/11 0:38**	**DWR**	**P1H0468**
Silver	BRL	mg/kg dry	0.27	0.027	1	*6010C	8/23/11 0:38	DWR	P1H0468
Thallium	BRL	mg/kg dry	0.54	0.10	1	*6010C	8/23/11 0:38	DWR	P1H0468
Tin	BRL	mg/kg dry	5.4	0.48	1	*6010C	8/23/11 0:38	DWR	P1H0468
Zinc	**200**	**mg/kg dry**	**13**	**1.4**	**5**	***6010C**	**8/24/11 16:55**	**DWR**	**P1H0468**

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PRISM LABORATORIES, INC. | Full-Service Analytical & Environmental Solutions

Laboratory Report

08/26/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: BKG-1
Prism Sample ID: 1080439-27
Prism Work Order: 1080439
Time Collected: 08/15/11 13:40
Time Submitted: 08/16/11 11:30

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**92.3**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**8/18/11 15:00**	**JAB**	**P1H0405**
Total Metals									
Mercury	BRL	mg/kg dry	0.022	0.0027	1	*7471B	8/24/11 7:35	LTB	P1H0489
Antimony	BRL	mg/kg dry	0.22	0.040	1	*6010C	8/23/11 0:47	DWR	P1H0468
Arsenic	**0.72**	**mg/kg dry**	**0.55**	**0.062**	**1**	***6010C**	**8/23/11 0:47**	**DWR**	**P1H0468**
Beryllium	**0.73**	**mg/kg dry**	**0.27**	**0.047**	**1**	***6010C**	**8/23/11 0:47**	**DWR**	**P1H0468**
Cadmium	BRL	mg/kg dry	0.27	0.029	1	*6010C	8/23/11 0:47	DWR	P1H0468
Chromium	**2.9**	**mg/kg dry**	**0.27**	**0.038**	**1**	***6010C**	**8/23/11 0:47**	**DWR**	**P1H0468**
Copper	**2.3**	**mg/kg dry**	**0.55**	**0.24**	**1**	***6010C**	**8/23/11 0:47**	**DWR**	**P1H0468**
Lead	**2.4**	**mg/kg dry**	**0.27**	**0.068**	**1**	***6010C**	**8/23/11 0:47**	**DWR**	**P1H0468**
Nickel	**3.8**	**mg/kg dry**	**1.1**	**0.34**	**1**	***6010C**	**8/23/11 0:47**	**DWR**	**P1H0468**
Selenium	**2.2**	**mg/kg dry**	**0.55**	**0.11**	**1**	***6010C**	**8/23/11 0:47**	**DWR**	**P1H0468**
Silver	BRL	mg/kg dry	0.27	0.028	1	*6010C	8/23/11 0:47	DWR	P1H0468
Thallium	**1.6**	**mg/kg dry**	**0.55**	**0.11**	**1**	***6010C**	**8/23/11 0:47**	**DWR**	**P1H0468**
Tin	BRL	mg/kg dry	5.5	0.49	1	*6010C	8/23/11 0:47	DWR	P1H0468
Zinc	**190**	**mg/kg dry**	**14**	**1.4**	**5**	***6010C**	**8/24/11 17:03**	**DWR**	**P1H0468**
Volatile Organic Compounds by GC/MS									
1,1,1,2-Tetrachloroethane	BRL	ug/kg dry	3.7	0.22	1	8260B	8/23/11 17:59	VHL	P1H0472
1,1,1-Trichloroethane	BRL	ug/kg dry	3.7	0.12	1	8260B	8/23/11 17:59	VHL	P1H0472
1,1,2,2-Tetrachloroethane	BRL	ug/kg dry	3.7	0.61	1	8260B	8/23/11 17:59	VHL	P1H0472
1,1,2-Trichloroethane	BRL	ug/kg dry	3.7	0.31	1	8260B	8/23/11 17:59	VHL	P1H0472
1,1-Dichloroethane	BRL	ug/kg dry	3.7	0.31	1	8260B	8/23/11 17:59	VHL	P1H0472
1,1-Dichloroethylene	BRL	ug/kg dry	3.7	0.22	1	8260B	8/23/11 17:59	VHL	P1H0472
1,1-Dichloropropylene	BRL	ug/kg dry	3.7	0.39	1	8260B	8/23/11 17:59	VHL	P1H0472
1,2,3-Trichlorobenzene	BRL	ug/kg dry	7.4	0.27	1	8260B	8/23/11 17:59	VHL	P1H0472
1,2,3-Trichloropropane	BRL	ug/kg dry	3.7	0.56	1	8260B	8/23/11 17:59	VHL	P1H0472
1,2,4-Trichlorobenzene	BRL	ug/kg dry	7.4	0.22	1	8260B	8/23/11 17:59	VHL	P1H0472
1,2,4-Trimethylbenzene	BRL	ug/kg dry	7.4	0.72	1	8260B	8/23/11 17:59	VHL	P1H0472
1,2-Dibromo-3-chloropropane	BRL	ug/kg dry	3.7	1.1	1	8260B	8/23/11 17:59	VHL	P1H0472
1,2-Dibromoethane	BRL	ug/kg dry	3.7	0.42	1	8260B	8/23/11 17:59	VHL	P1H0472
1,2-Dichlorobenzene	BRL	ug/kg dry	7.4	0.17	1	8260B	8/23/11 17:59	VHL	P1H0472
1,2-Dichloroethane	BRL	ug/kg dry	3.7	0.59	1	8260B	8/23/11 17:59	VHL	P1H0472
1,2-Dichloropropane	BRL	ug/kg dry	3.7	0.23	1	8260B	8/23/11 17:59	VHL	P1H0472
1,3,5-Trimethylbenzene	BRL	ug/kg dry	7.4	0.18	1	8260B	8/23/11 17:59	VHL	P1H0472
1,3-Dichlorobenzene	BRL	ug/kg dry	7.4	0.051	1	8260B	8/23/11 17:59	VHL	P1H0472
1,3-Dichloropropane	BRL	ug/kg dry	3.7	0.40	1	8260B	8/23/11 17:59	VHL	P1H0472
1,4-Dichlorobenzene	BRL	ug/kg dry	7.4	0.27	1	8260B	8/23/11 17:59	VHL	P1H0472
2,2-Dichloropropane	BRL	ug/kg dry	3.7	0.23	1	8260B	8/23/11 17:59	VHL	P1H0472
2-Chloroethyl Vinyl Ether	BRL	ug/kg dry	7.4	2.1	1	8260B	8/23/11 17:59	VHL	P1H0472
2-Chlorotoluene	BRL	ug/kg dry	7.4	0.23	1	8260B	8/23/11 17:59	VHL	P1H0472

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PRISM LABORATORIES, INC. | Full-Service Analytical & Environmental Solutions

Laboratory Report

08/26/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: BKG-1
Prism Sample ID: 1080439-27
Prism Work Order: 1080439
Time Collected: 08/15/11 13:40
Time Submitted: 08/16/11 11:30

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
4-Chlorotoluene	BRL	ug/kg dry	7.4	0.17	1	8260B	8/23/11 17:59	VHL	P1H0472
4-Isopropyltoluene	BRL	ug/kg dry	11	0.23	1	8260B	8/23/11 17:59	VHL	P1H0472
Acetone	**18**	**ug/kg dry**	**15**	**2.0**	**1**	**8260B**	**8/23/11 17:59**	**VHL**	**P1H0472**
Acrolein	BRL	ug/kg dry	74	2.2	1	8260B	8/23/11 17:59	VHL	P1H0472
Acrylonitrile	BRL	ug/kg dry	74	1.8	1	8260B	8/23/11 17:59	VHL	P1H0472
Benzene	BRL	ug/kg dry	2.2	0.22	1	8260B	8/23/11 17:59	VHL	P1H0472
Bromobenzene	BRL	ug/kg dry	3.7	0.16	1	8260B	8/23/11 17:59	VHL	P1H0472
Bromochloromethane	BRL	ug/kg dry	3.7	0.54	1	8260B	8/23/11 17:59	VHL	P1H0472
Bromodichloromethane	BRL	ug/kg dry	3.7	0.17	1	8260B	8/23/11 17:59	VHL	P1H0472
Bromoform	BRL	ug/kg dry	3.7	0.65	1	8260B	8/23/11 17:59	VHL	P1H0472
Bromomethane	BRL	ug/kg dry	7.4	1.0	1	8260B	8/23/11 17:59	VHL	P1H0472
Carbon disulfide	BRL	ug/kg dry	7.4	0.31	1	8260B	8/23/11 17:59	VHL	P1H0472
Carbon Tetrachloride	BRL	ug/kg dry	3.7	0.20	1	8260B	8/23/11 17:59	VHL	P1H0472
Chlorobenzene	BRL	ug/kg dry	3.7	0.17	1	8260B	8/23/11 17:59	VHL	P1H0472
Chloroethane	BRL	ug/kg dry	7.4	2.8	1	8260B	8/23/11 17:59	VHL	P1H0472
Chloroform	BRL	ug/kg dry	3.7	0.15	1	8260B	8/23/11 17:59	VHL	P1H0472
Chloromethane	BRL	ug/kg dry	7.4	1.9	1	8260B	8/23/11 17:59	VHL	P1H0472
cis-1,2-Dichloroethylene	BRL	ug/kg dry	3.7	0.30	1	8260B	8/23/11 17:59	VHL	P1H0472
cis-1,3-Dichloropropylene	BRL	ug/kg dry	3.7	0.18	1	8260B	8/23/11 17:59	VHL	P1H0472
Dibromochloromethane	BRL	ug/kg dry	3.7	0.25	1	8260B	8/23/11 17:59	VHL	P1H0472
Dibromomethane	BRL	ug/kg dry	3.7	0.25	1	8260B	8/23/11 17:59	VHL	P1H0472
Dichlorodifluoromethane	BRL	ug/kg dry	7.4	0.40	1	8260B	8/23/11 17:59	VHL	P1H0472
Ethylbenzene	BRL	ug/kg dry	3.7	0.24	1	8260B	8/23/11 17:59	VHL	P1H0472
Hexachlorobutadiene	BRL	ug/kg dry	11	0.47	1	8260B	8/23/11 17:59	VHL	P1H0472
Isopropyl Ether	BRL	ug/kg dry	3.7	0.16	1	8260B	8/23/11 17:59	VHL	P1H0472
Isopropylbenzene (Cumene)	BRL	ug/kg dry	7.4	0.18	1	8260B	8/23/11 17:59	VHL	P1H0472
m,p-Xylenes	BRL	ug/kg dry	7.4	0.47	1	8260B	8/23/11 17:59	VHL	P1H0472
Methyl Butyl Ketone (2-Hexanone)	BRL	ug/kg dry	37	0.76	1	8260B	8/23/11 17:59	VHL	P1H0472
Methyl Ethyl Ketone (2-Butanone)	**3.0 J**	**ug/kg dry**	**15**	**1.3**	**1**	**8260B**	**8/23/11 17:59**	**VHL**	**P1H0472**
Methyl Isobutyl Ketone	BRL	ug/kg dry	7.4	0.97	1	8260B	8/23/11 17:59	VHL	P1H0472
Methylene Chloride	BRL	ug/kg dry	7.4	0.27	1	8260B	8/23/11 17:59	VHL	P1H0472
Methyl-tert-Butyl Ether	BRL	ug/kg dry	3.7	0.28	1	8260B	8/23/11 17:59	VHL	P1H0472
Naphthalene	BRL	ug/kg dry	3.7	0.27	1	8260B	8/23/11 17:59	VHL	P1H0472
n-Butylbenzene	BRL	ug/kg dry	11	0.16	1	8260B	8/23/11 17:59	VHL	P1H0472
n-Propylbenzene	BRL	ug/kg dry	7.4	0.21	1	8260B	8/23/11 17:59	VHL	P1H0472
o-Xylene	BRL	ug/kg dry	3.7	0.23	1	8260B	8/23/11 17:59	VHL	P1H0472
sec-Butylbenzene	BRL	ug/kg dry	11	0.15	1	8260B	8/23/11 17:59	VHL	P1H0472
Styrene	BRL	ug/kg dry	3.7	0.16	1	8260B	8/23/11 17:59	VHL	P1H0472
tert-Butylbenzene	BRL	ug/kg dry	15	0.19	1	8260B	8/23/11 17:59	VHL	P1H0472
Tetrachloroethylene	BRL	ug/kg dry	7.4	0.26	1	8260B	8/23/11 17:59	VHL	P1H0472
Toluene	BRL	ug/kg dry	3.7	0.22	1	8260B	8/23/11 17:59	VHL	P1H0472
trans-1,2-Dichloroethylene	BRL	ug/kg dry	3.7	0.43	1	8260B	8/23/11 17:59	VHL	P1H0472
trans-1,3-Dichloropropylene	BRL	ug/kg dry	3.7	0.18	1	8260B	8/23/11 17:59	VHL	P1H0472

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Laboratory Report

08/26/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: BKG-1
Prism Sample ID: 1080439-27
Prism Work Order: 1080439
Time Collected: 08/15/11 13:40
Time Submitted: 08/16/11 11:30

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
Trichloroethylene	BRL	ug/kg dry	3.7	0.34	1	8260B	8/23/11 17:59	VHL	P1H0472
Trichlorofluoromethane	BRL	ug/kg dry	3.7	0.30	1	8260B	8/23/11 17:59	VHL	P1H0472
Vinyl acetate	BRL	ug/kg dry	7.4	1.0	1	8260B	8/23/11 17:59	VHL	P1H0472
Vinyl chloride	BRL	ug/kg dry	7.4	0.48	1	8260B	8/23/11 17:59	VHL	P1H0472

Surrogate	Recovery	Control Limits
4-Bromofluorobenzene	*96 %*	*70-130*
Dibromofluoromethane	*112 %*	*84-123*
Toluene-d8	*88 %*	*76-129*

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Laboratory Report

08/26/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: BKG-2
Prism Sample ID: 1080439-28
Prism Work Order: 1080439
Time Collected: 08/15/11 13:50
Time Submitted: 08/16/11 11:30

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**75.3**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**8/18/11 15:00**	**JAB**	**P1H0405**
Total Metals									
Mercury	BRL	mg/kg dry	0.026	0.0031	1	*7471B	8/24/11 7:40	LTB	P1H0489
Antimony	BRL	mg/kg dry	0.27	0.048	1	*6010C	8/23/11 0:56	DWR	P1H0468
Arsenic	**1.6**	**mg/kg dry**	**0.67**	**0.075**	**1**	***6010C**	**8/23/11 0:56**	**DWR**	**P1H0468**
Beryllium	**1.3**	**mg/kg dry**	**0.33**	**0.057**	**1**	***6010C**	**8/23/11 0:56**	**DWR**	**P1H0468**
Cadmium	BRL	mg/kg dry	0.33	0.035	1	*6010C	8/23/11 0:56	DWR	P1H0468
Chromium	**50**	**mg/kg dry**	**0.33**	**0.046**	**1**	***6010C**	**8/23/11 0:56**	**DWR**	**P1H0468**
Copper	**76**	**mg/kg dry**	**0.67**	**0.29**	**1**	***6010C**	**8/23/11 0:56**	**DWR**	**P1H0468**
Lead	**2.4**	**mg/kg dry**	**0.33**	**0.082**	**1**	***6010C**	**8/23/11 0:56**	**DWR**	**P1H0468**
Nickel	**19**	**mg/kg dry**	**1.3**	**0.41**	**1**	***6010C**	**8/23/11 0:56**	**DWR**	**P1H0468**
Selenium	**5.7**	**mg/kg dry**	**0.67**	**0.13**	**1**	***6010C**	**8/23/11 0:56**	**DWR**	**P1H0468**
Silver	BRL	mg/kg dry	0.33	0.034	1	*6010C	8/23/11 0:56	DWR	P1H0468
Thallium	**1.5**	**mg/kg dry**	**0.67**	**0.13**	**1**	***6010C**	**8/23/11 0:56**	**DWR**	**P1H0468**
Tin	BRL	mg/kg dry	6.7	0.59	1	*6010C	8/23/11 0:56	DWR	P1H0468
Zinc	**80**	**mg/kg dry**	**3.3**	**0.34**	**1**	***6010C**	**8/23/11 0:56**	**DWR**	**P1H0468**
Volatile Organic Compounds by GC/MS									
1,1,1,2-Tetrachloroethane	BRL	ug/kg dry	3.9	0.23	1	8260B	8/24/11 13:55	VHL	P1H0533
1,1,1-Trichloroethane	BRL	ug/kg dry	3.9	0.13	1	8260B	8/24/11 13:55	VHL	P1H0533
1,1,2,2-Tetrachloroethane	BRL	ug/kg dry	3.9	0.64	1	8260B	8/24/11 13:55	VHL	P1H0533
1,1,2-Trichloroethane	BRL	ug/kg dry	3.9	0.33	1	8260B	8/24/11 13:55	VHL	P1H0533
1,1-Dichloroethane	BRL	ug/kg dry	3.9	0.33	1	8260B	8/24/11 13:55	VHL	P1H0533
1,1-Dichloroethylene	BRL	ug/kg dry	3.9	0.24	1	8260B	8/24/11 13:55	VHL	P1H0533
1,1-Dichloropropylene	BRL	ug/kg dry	3.9	0.41	1	8260B	8/24/11 13:55	VHL	P1H0533
1,2,3-Trichlorobenzene	BRL	ug/kg dry	7.8	0.29	1	8260B	8/24/11 13:55	VHL	P1H0533
1,2,3-Trichloropropane	BRL	ug/kg dry	3.9	0.59	1	8260B	8/24/11 13:55	VHL	P1H0533
1,2,4-Trichlorobenzene	BRL	ug/kg dry	7.8	0.23	1	8260B	8/24/11 13:55	VHL	P1H0533
1,2,4-Trimethylbenzene	BRL	ug/kg dry	7.8	0.76	1	8260B	8/24/11 13:55	VHL	P1H0533
1,2-Dibromo-3-chloropropane	BRL	ug/kg dry	3.9	1.2	1	8260B	8/24/11 13:55	VHL	P1H0533
1,2-Dibromoethane	BRL	ug/kg dry	3.9	0.45	1	8260B	8/24/11 13:55	VHL	P1H0533
1,2-Dichlorobenzene	BRL	ug/kg dry	7.8	0.18	1	8260B	8/24/11 13:55	VHL	P1H0533
1,2-Dichloroethane	BRL	ug/kg dry	3.9	0.63	1	8260B	8/24/11 13:55	VHL	P1H0533
1,2-Dichloropropane	BRL	ug/kg dry	3.9	0.25	1	8260B	8/24/11 13:55	VHL	P1H0533
1,3,5-Trimethylbenzene	BRL	ug/kg dry	7.8	0.19	1	8260B	8/24/11 13:55	VHL	P1H0533
1,3-Dichlorobenzene	BRL	ug/kg dry	7.8	0.054	1	8260B	8/24/11 13:55	VHL	P1H0533
1,3-Dichloropropane	BRL	ug/kg dry	3.9	0.42	1	8260B	8/24/11 13:55	VHL	P1H0533
1,4-Dichlorobenzene	BRL	ug/kg dry	7.8	0.28	1	8260B	8/24/11 13:55	VHL	P1H0533
2,2-Dichloropropane	BRL	ug/kg dry	3.9	0.25	1	8260B	8/24/11 13:55	VHL	P1H0533
2-Chloroethyl Vinyl Ether	BRL	ug/kg dry	7.8	2.2	1	8260B	8/24/11 13:55	VHL	P1H0533
2-Chlorotoluene	BRL	ug/kg dry	7.8	0.24	1	8260B	8/24/11 13:55	VHL	P1H0533

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Project: United Metal

Sample Matrix: Solid

Client Sample ID: BKG-2
Prism Sample ID: 1080439-28
Prism Work Order: 1080439
Time Collected: 08/15/11 13:50
Time Submitted: 08/16/11 11:30

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
4-Chlorotoluene	BRL	ug/kg dry	7.8	0.18	1	8260B	8/24/11 13:55	VHL	P1H0533
4-Isopropyltoluene	BRL	ug/kg dry	12	0.25	1	8260B	8/24/11 13:55	VHL	P1H0533
Acetone	**10 J**	**ug/kg dry**	**16**	**2.1**	**1**	**8260B**	**8/24/11 13:55**	**VHL**	**P1H0533**
Acrolein	BRL	ug/kg dry	78	2.4	1	8260B	8/24/11 13:55	VHL	P1H0533
Acrylonitrile	BRL	ug/kg dry	78	1.9	1	8260B	8/24/11 13:55	VHL	P1H0533
Benzene	BRL	ug/kg dry	2.3	0.24	1	8260B	8/24/11 13:55	VHL	P1H0533
Bromobenzene	BRL	ug/kg dry	3.9	0.17	1	8260B	8/24/11 13:55	VHL	P1H0533
Bromochloromethane	BRL	ug/kg dry	3.9	0.57	1	8260B	8/24/11 13:55	VHL	P1H0533
Bromodichloromethane	BRL	ug/kg dry	3.9	0.18	1	8260B	8/24/11 13:55	VHL	P1H0533
Bromoform	BRL	ug/kg dry	3.9	0.69	1	8260B	8/24/11 13:55	VHL	P1H0533
Bromomethane	BRL	ug/kg dry	7.8	1.1	1	8260B	8/24/11 13:55	VHL	P1H0533
Carbon disulfide	BRL	ug/kg dry	7.8	0.32	1	8260B	8/24/11 13:55	VHL	P1H0533
Carbon Tetrachloride	BRL	ug/kg dry	3.9	0.21	1	8260B	8/24/11 13:55	VHL	P1H0533
Chlorobenzene	BRL	ug/kg dry	3.9	0.18	1	8260B	8/24/11 13:55	VHL	P1H0533
Chloroethane	BRL	ug/kg dry	7.8	3.0	1	8260B	8/24/11 13:55	VHL	P1H0533
Chloroform	BRL	ug/kg dry	3.9	0.16	1	8260B	8/24/11 13:55	VHL	P1H0533
Chloromethane	BRL	ug/kg dry	7.8	2.0	1	8260B	8/24/11 13:55	VHL	P1H0533
cis-1,2-Dichloroethylene	BRL	ug/kg dry	3.9	0.31	1	8260B	8/24/11 13:55	VHL	P1H0533
cis-1,3-Dichloropropylene	BRL	ug/kg dry	3.9	0.19	1	8260B	8/24/11 13:55	VHL	P1H0533
Dibromochloromethane	BRL	ug/kg dry	3.9	0.26	1	8260B	8/24/11 13:55	VHL	P1H0533
Dibromomethane	BRL	ug/kg dry	3.9	0.26	1	8260B	8/24/11 13:55	VHL	P1H0533
Dichlorodifluoromethane	BRL	ug/kg dry	7.8	0.42	1	8260B	8/24/11 13:55	VHL	P1H0533
Ethylbenzene	BRL	ug/kg dry	3.9	0.25	1	8260B	8/24/11 13:55	VHL	P1H0533
Hexachlorobutadiene	BRL	ug/kg dry	12	0.50	1	8260B	8/24/11 13:55	VHL	P1H0533
Isopropyl Ether	BRL	ug/kg dry	3.9	0.17	1	8260B	8/24/11 13:55	VHL	P1H0533
Isopropylbenzene (Cumene)	BRL	ug/kg dry	7.8	0.19	1	8260B	8/24/11 13:55	VHL	P1H0533
m,p-Xylenes	BRL	ug/kg dry	7.8	0.50	1	8260B	8/24/11 13:55	VHL	P1H0533
Methyl Butyl Ketone (2-Hexanone)	BRL	ug/kg dry	39	0.80	1	8260B	8/24/11 13:55	VHL	P1H0533
Methyl Ethyl Ketone (2-Butanone)	**17**	**ug/kg dry**	**16**	**1.4**	**1**	**8260B**	**8/24/11 13:55**	**VHL**	**P1H0533**
Methyl Isobutyl Ketone	BRL	ug/kg dry	7.8	1.0	1	8260B	8/24/11 13:55	VHL	P1H0533
Methylene Chloride	BRL	ug/kg dry	7.8	0.28	1	8260B	8/24/11 13:55	VHL	P1H0533
Methyl-tert-Butyl Ether	BRL	ug/kg dry	3.9	0.30	1	8260B	8/24/11 13:55	VHL	P1H0533
Naphthalene	BRL	ug/kg dry	3.9	0.29	1	8260B	8/24/11 13:55	VHL	P1H0533
n-Butylbenzene	BRL	ug/kg dry	12	0.17	1	8260B	8/24/11 13:55	VHL	P1H0533
n-Propylbenzene	BRL	ug/kg dry	7.8	0.22	1	8260B	8/24/11 13:55	VHL	P1H0533
o-Xylene	BRL	ug/kg dry	3.9	0.25	1	8260B	8/24/11 13:55	VHL	P1H0533
sec-Butylbenzene	BRL	ug/kg dry	12	0.16	1	8260B	8/24/11 13:55	VHL	P1H0533
Styrene	BRL	ug/kg dry	3.9	0.17	1	8260B	8/24/11 13:55	VHL	P1H0533
tert-Butylbenzene	BRL	ug/kg dry	16	0.20	1	8260B	8/24/11 13:55	VHL	P1H0533
Tetrachloroethylene	BRL	ug/kg dry	7.8	0.27	1	8260B	8/24/11 13:55	VHL	P1H0533
Toluene	BRL	ug/kg dry	3.9	0.23	1	8260B	8/24/11 13:55	VHL	P1H0533
trans-1,2-Dichloroethylene	BRL	ug/kg dry	3.9	0.45	1	8260B	8/24/11 13:55	VHL	P1H0533
trans-1,3-Dichloropropylene	BRL	ug/kg dry	3.9	0.19	1	8260B	8/24/11 13:55	VHL	P1H0533

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PRISM LABORATORIES, INC. | Full-Service Analytical & Environmental Solutions

Laboratory Report

08/26/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: BKG-2
Prism Sample ID: 1080439-28
Prism Work Order: 1080439
Time Collected: 08/15/11 13:50
Time Submitted: 08/16/11 11:30

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
Trichloroethylene	BRL	ug/kg dry	3.9	0.36	1	8260B	8/24/11 13:55	VHL	P1H0533
Trichlorofluoromethane	BRL	ug/kg dry	3.9	0.32	1	8260B	8/24/11 13:55	VHL	P1H0533
Vinyl acetate	BRL	ug/kg dry	7.8	1.1	1	8260B	8/24/11 13:55	VHL	P1H0533
Vinyl chloride	BRL	ug/kg dry	7.8	0.50	1	8260B	8/24/11 13:55	VHL	P1H0533

Surrogate	Recovery	Control Limits
4-Bromofluorobenzene	*84 %*	*70-130*
Dibromofluoromethane	*103 %*	*84-123*
Toluene-d8	*89 %*	*76-129*

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PRISM LABORATORIES, INC. | Full-Service Analytical & Environmental Solutions

Laboratory Report

08/26/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: BKG-3
Prism Sample ID: 1080439-29
Prism Work Order: 1080439
Time Collected: 08/15/11 13:55
Time Submitted: 08/16/11 11:30

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**83.3**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**8/18/11 15:00**	**JAB**	**P1H0405**
Total Metals									
Mercury	BRL	mg/kg dry	0.024	0.0029	1	*7471B	8/24/11 7:44	LTB	P1H0489
Antimony	BRL	mg/kg dry	0.24	0.044	1	*6010C	8/23/11 1:05	DWR	P1H0468
Arsenic	BRL	mg/kg dry	0.61	0.069	1	*6010C	8/23/11 1:05	DWR	P1H0468
Beryllium	**0.49**	**mg/kg dry**	**0.30**	**0.052**	**1**	***6010C**	**8/23/11 1:05**	**DWR**	**P1H0468**
Cadmium	BRL	mg/kg dry	0.30	0.032	1	*6010C	8/23/11 1:05	DWR	P1H0468
Chromium	**0.85**	**mg/kg dry**	**0.30**	**0.042**	**1**	***6010C**	**8/23/11 1:05**	**DWR**	**P1H0468**
Copper	**1.6**	**mg/kg dry**	**0.61**	**0.26**	**1**	***6010C**	**8/23/11 1:05**	**DWR**	**P1H0468**
Lead	**1.7**	**mg/kg dry**	**0.30**	**0.075**	**1**	***6010C**	**8/23/11 1:05**	**DWR**	**P1H0468**
Nickel	**1.7**	**mg/kg dry**	**1.2**	**0.37**	**1**	***6010C**	**8/23/11 1:05**	**DWR**	**P1H0468**
Selenium	**5.2**	**mg/kg dry**	**0.61**	**0.12**	**1**	***6010C**	**8/23/11 1:05**	**DWR**	**P1H0468**
Silver	BRL	mg/kg dry	0.30	0.031	1	*6010C	8/23/11 1:05	DWR	P1H0468
Thallium	**1.6**	**mg/kg dry**	**0.61**	**0.12**	**1**	***6010C**	**8/23/11 1:05**	**DWR**	**P1H0468**
Tin	BRL	mg/kg dry	6.1	0.54	1	*6010C	8/23/11 1:05	DWR	P1H0468
Zinc	**26**	**mg/kg dry**	**3.0**	**0.31**	**1**	***6010C**	**8/23/11 1:05**	**DWR**	**P1H0468**
Volatile Organic Compounds by GC/MS									
1,1,1,2-Tetrachloroethane	BRL	ug/kg dry	4.8	0.29	1	8260B	8/24/11 14:28	VHL	P1H0533
1,1,1-Trichloroethane	BRL	ug/kg dry	4.8	0.16	1	8260B	8/24/11 14:28	VHL	P1H0533
1,1,2,2-Tetrachloroethane	BRL	ug/kg dry	4.8	0.79	1	8260B	8/24/11 14:28	VHL	P1H0533
1,1,2-Trichloroethane	BRL	ug/kg dry	4.8	0.40	1	8260B	8/24/11 14:28	VHL	P1H0533
1,1-Dichloroethane	BRL	ug/kg dry	4.8	0.40	1	8260B	8/24/11 14:28	VHL	P1H0533
1,1-Dichloroethylene	BRL	ug/kg dry	4.8	0.29	1	8260B	8/24/11 14:28	VHL	P1H0533
1,1-Dichloropropylene	BRL	ug/kg dry	4.8	0.50	1	8260B	8/24/11 14:28	VHL	P1H0533
1,2,3-Trichlorobenzene	BRL	ug/kg dry	9.6	0.35	1	8260B	8/24/11 14:28	VHL	P1H0533
1,2,3-Trichloropropane	BRL	ug/kg dry	4.8	0.72	1	8260B	8/24/11 14:28	VHL	P1H0533
1,2,4-Trichlorobenzene	BRL	ug/kg dry	9.6	0.28	1	8260B	8/24/11 14:28	VHL	P1H0533
1,2,4-Trimethylbenzene	BRL	ug/kg dry	9.6	0.94	1	8260B	8/24/11 14:28	VHL	P1H0533
1,2-Dibromo-3-chloropropane	BRL	ug/kg dry	4.8	1.5	1	8260B	8/24/11 14:28	VHL	P1H0533
1,2-Dibromoethane	BRL	ug/kg dry	4.8	0.55	1	8260B	8/24/11 14:28	VHL	P1H0533
1,2-Dichlorobenzene	BRL	ug/kg dry	9.6	0.22	1	8260B	8/24/11 14:28	VHL	P1H0533
1,2-Dichloroethane	BRL	ug/kg dry	4.8	0.77	1	8260B	8/24/11 14:28	VHL	P1H0533
1,2-Dichloropropane	BRL	ug/kg dry	4.8	0.30	1	8260B	8/24/11 14:28	VHL	P1H0533
1,3,5-Trimethylbenzene	BRL	ug/kg dry	9.6	0.23	1	8260B	8/24/11 14:28	VHL	P1H0533
1,3-Dichlorobenzene	BRL	ug/kg dry	9.6	0.066	1	8260B	8/24/11 14:28	VHL	P1H0533
1,3-Dichloropropane	BRL	ug/kg dry	4.8	0.52	1	8260B	8/24/11 14:28	VHL	P1H0533
1,4-Dichlorobenzene	BRL	ug/kg dry	9.6	0.35	1	8260B	8/24/11 14:28	VHL	P1H0533
2,2-Dichloropropane	BRL	ug/kg dry	4.8	0.30	1	8260B	8/24/11 14:28	VHL	P1H0533
2-Chloroethyl Vinyl Ether	BRL	ug/kg dry	9.6	2.7	1	8260B	8/24/11 14:28	VHL	P1H0533
2-Chlorotoluene	BRL	ug/kg dry	9.6	0.29	1	8260B	8/24/11 14:28	VHL	P1H0533

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Laboratory Report

08/26/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: BKG-3
Prism Sample ID: 1080439-29
Prism Work Order: 1080439
Time Collected: 08/15/11 13:55
Time Submitted: 08/16/11 11:30

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
4-Chlorotoluene	BRL	ug/kg dry	9.6	0.22	1	8260B	8/24/11 14:28	VHL	P1H0533
4-Isopropyltoluene	BRL	ug/kg dry	14	0.30	1	8260B	8/24/11 14:28	VHL	P1H0533
Acetone	**27**	**ug/kg dry**	**19**	**2.5**	**1**	**8260B**	**8/24/11 14:28**	**VHL**	**P1H0533**
Acrolein	BRL	ug/kg dry	96	2.9	1	8260B	8/24/11 14:28	VHL	P1H0533
Acrylonitrile	BRL	ug/kg dry	96	2.4	1	8260B	8/24/11 14:28	VHL	P1H0533
Benzene	BRL	ug/kg dry	2.9	0.29	1	8260B	8/24/11 14:28	VHL	P1H0533
Bromobenzene	BRL	ug/kg dry	4.8	0.20	1	8260B	8/24/11 14:28	VHL	P1H0533
Bromochloromethane	BRL	ug/kg dry	4.8	0.70	1	8260B	8/24/11 14:28	VHL	P1H0533
Bromodichloromethane	BRL	ug/kg dry	4.8	0.22	1	8260B	8/24/11 14:28	VHL	P1H0533
Bromoform	BRL	ug/kg dry	4.8	0.85	1	8260B	8/24/11 14:28	VHL	P1H0533
Bromomethane	BRL	ug/kg dry	9.6	1.3	1	8260B	8/24/11 14:28	VHL	P1H0533
Carbon disulfide	BRL	ug/kg dry	9.6	0.40	1	8260B	8/24/11 14:28	VHL	P1H0533
Carbon Tetrachloride	BRL	ug/kg dry	4.8	0.26	1	8260B	8/24/11 14:28	VHL	P1H0533
Chlorobenzene	BRL	ug/kg dry	4.8	0.22	1	8260B	8/24/11 14:28	VHL	P1H0533
Chloroethane	BRL	ug/kg dry	9.6	3.6	1	8260B	8/24/11 14:28	VHL	P1H0533
Chloroform	BRL	ug/kg dry	4.8	0.20	1	8260B	8/24/11 14:28	VHL	P1H0533
Chloromethane	BRL	ug/kg dry	9.6	2.4	1	8260B	8/24/11 14:28	VHL	P1H0533
cis-1,2-Dichloroethylene	BRL	ug/kg dry	4.8	0.39	1	8260B	8/24/11 14:28	VHL	P1H0533
cis-1,3-Dichloropropylene	BRL	ug/kg dry	4.8	0.24	1	8260B	8/24/11 14:28	VHL	P1H0533
Dibromochloromethane	BRL	ug/kg dry	4.8	0.32	1	8260B	8/24/11 14:28	VHL	P1H0533
Dibromomethane	BRL	ug/kg dry	4.8	0.32	1	8260B	8/24/11 14:28	VHL	P1H0533
Dichlorodifluoromethane	BRL	ug/kg dry	9.6	0.51	1	8260B	8/24/11 14:28	VHL	P1H0533
Ethylbenzene	BRL	ug/kg dry	4.8	0.31	1	8260B	8/24/11 14:28	VHL	P1H0533
Hexachlorobutadiene	BRL	ug/kg dry	14	0.62	1	8260B	8/24/11 14:28	VHL	P1H0533
Isopropyl Ether	BRL	ug/kg dry	4.8	0.20	1	8260B	8/24/11 14:28	VHL	P1H0533
Isopropylbenzene (Cumene)	BRL	ug/kg dry	9.6	0.24	1	8260B	8/24/11 14:28	VHL	P1H0533
m,p-Xylenes	BRL	ug/kg dry	9.6	0.61	1	8260B	8/24/11 14:28	VHL	P1H0533
Methyl Butyl Ketone (2-Hexanone)	BRL	ug/kg dry	48	0.98	1	8260B	8/24/11 14:28	VHL	P1H0533
Methyl Ethyl Ketone (2-Butanone)	BRL	ug/kg dry	19	1.7	1	8260B	8/24/11 14:28	VHL	P1H0533
Methyl Isobutyl Ketone	BRL	ug/kg dry	9.6	1.3	1	8260B	8/24/11 14:28	VHL	P1H0533
Methylene Chloride	BRL	ug/kg dry	9.6	0.35	1	8260B	8/24/11 14:28	VHL	P1H0533
Methyl-tert-Butyl Ether	BRL	ug/kg dry	4.8	0.37	1	8260B	8/24/11 14:28	VHL	P1H0533
Naphthalene	BRL	ug/kg dry	4.8	0.35	1	8260B	8/24/11 14:28	VHL	P1H0533
n-Butylbenzene	BRL	ug/kg dry	14	0.21	1	8260B	8/24/11 14:28	VHL	P1H0533
n-Propylbenzene	BRL	ug/kg dry	9.6	0.27	1	8260B	8/24/11 14:28	VHL	P1H0533
o-Xylene	BRL	ug/kg dry	4.8	0.30	1	8260B	8/24/11 14:28	VHL	P1H0533
sec-Butylbenzene	BRL	ug/kg dry	14	0.19	1	8260B	8/24/11 14:28	VHL	P1H0533
Styrene	BRL	ug/kg dry	4.8	0.21	1	8260B	8/24/11 14:28	VHL	P1H0533
tert-Butylbenzene	BRL	ug/kg dry	19	0.25	1	8260B	8/24/11 14:28	VHL	P1H0533
Tetrachloroethylene	BRL	ug/kg dry	9.6	0.33	1	8260B	8/24/11 14:28	VHL	P1H0533
Toluene	BRL	ug/kg dry	4.8	0.28	1	8260B	8/24/11 14:28	VHL	P1H0533
trans-1,2-Dichloroethylene	BRL	ug/kg dry	4.8	0.55	1	8260B	8/24/11 14:28	VHL	P1H0533
trans-1,3-Dichloropropylene	BRL	ug/kg dry	4.8	0.23	1	8260B	8/24/11 14:28	VHL	P1H0533

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PRISM LABORATORIES, INC. | Full-Service Analytical & Environmental Solutions

Laboratory Report

08/26/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: BKG-3
Prism Sample ID: 1080439-29
Prism Work Order: 1080439
Time Collected: 08/15/11 13:55
Time Submitted: 08/16/11 11:30

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
Trichloroethylene	BRL	ug/kg dry	4.8	0.44	1	8260B	8/24/11 14:28	VHL	P1H0533
Trichlorofluoromethane	BRL	ug/kg dry	4.8	0.39	1	8260B	8/24/11 14:28	VHL	P1H0533
Vinyl acetate	BRL	ug/kg dry	9.6	1.4	1	8260B	8/24/11 14:28	VHL	P1H0533
Vinyl chloride	BRL	ug/kg dry	9.6	0.62	1	8260B	8/24/11 14:28	VHL	P1H0533

Surrogate	Recovery	Control Limits
4-Bromofluorobenzene	*89 %*	*70-130*
Dibromofluoromethane	*101 %*	*84-123*
Toluene-d8	*90 %*	*76-129*

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Laboratory Report

08/26/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: BKG-4
Prism Sample ID: 1080439-30
Prism Work Order: 1080439
Time Collected: 08/15/11 14:10
Time Submitted: 08/16/11 11:30

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**87.7**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**8/18/11 15:00**	**JAB**	**P1H0405**
Total Metals									
Mercury	BRL	mg/kg dry	0.022	0.0027	1	*7471B	8/24/11 7:49	LTB	P1H0489
Antimony	BRL	mg/kg dry	0.22	0.040	1	*6010C	8/23/11 1:14	DWR	P1H0468
Arsenic	**1.0**	**mg/kg dry**	**0.56**	**0.063**	**1**	***6010C**	**8/23/11 1:14**	**DWR**	**P1H0468**
Beryllium	**1.1**	**mg/kg dry**	**0.28**	**0.047**	**1**	***6010C**	**8/23/11 1:14**	**DWR**	**P1H0468**
Cadmium	BRL	mg/kg dry	0.28	0.030	1	*6010C	8/23/11 1:14	DWR	P1H0468
Chromium	**11**	**mg/kg dry**	**0.28**	**0.038**	**1**	***6010C**	**8/23/11 1:14**	**DWR**	**P1H0468**
Copper	**50**	**mg/kg dry**	**0.56**	**0.24**	**1**	***6010C**	**8/23/11 1:14**	**DWR**	**P1H0468**
Lead	**2.1**	**mg/kg dry**	**0.28**	**0.069**	**1**	***6010C**	**8/23/11 1:14**	**DWR**	**P1H0468**
Nickel	**10**	**mg/kg dry**	**1.1**	**0.34**	**1**	***6010C**	**8/23/11 1:14**	**DWR**	**P1H0468**
Selenium	**4.3**	**mg/kg dry**	**0.56**	**0.11**	**1**	***6010C**	**8/23/11 1:14**	**DWR**	**P1H0468**
Silver	BRL	mg/kg dry	0.28	0.029	1	*6010C	8/23/11 1:14	DWR	P1H0468
Thallium	**0.85**	**mg/kg dry**	**0.56**	**0.11**	**1**	***6010C**	**8/23/11 1:14**	**DWR**	**P1H0468**
Tin	BRL	mg/kg dry	5.6	0.50	1	*6010C	8/23/11 1:14	DWR	P1H0468
Zinc	**52**	**mg/kg dry**	**2.8**	**0.29**	**1**	***6010C**	**8/23/11 1:14**	**DWR**	**P1H0468**
Volatile Organic Compounds by GC/MS									
1,1,1,2-Tetrachloroethane	BRL	ug/kg dry	4.4	0.27	1	8260B	8/24/11 15:00	VHL	P1H0533
1,1,1-Trichloroethane	BRL	ug/kg dry	4.4	0.14	1	8260B	8/24/11 15:00	VHL	P1H0533
1,1,2,2-Tetrachloroethane	BRL	ug/kg dry	4.4	0.73	1	8260B	8/24/11 15:00	VHL	P1H0533
1,1,2-Trichloroethane	BRL	ug/kg dry	4.4	0.37	1	8260B	8/24/11 15:00	VHL	P1H0533
1,1-Dichloroethane	BRL	ug/kg dry	4.4	0.37	1	8260B	8/24/11 15:00	VHL	P1H0533
1,1-Dichloroethylene	BRL	ug/kg dry	4.4	0.27	1	8260B	8/24/11 15:00	VHL	P1H0533
1,1-Dichloropropylene	BRL	ug/kg dry	4.4	0.46	1	8260B	8/24/11 15:00	VHL	P1H0533
1,2,3-Trichlorobenzene	BRL	ug/kg dry	8.8	0.33	1	8260B	8/24/11 15:00	VHL	P1H0533
1,2,3-Trichloropropane	BRL	ug/kg dry	4.4	0.66	1	8260B	8/24/11 15:00	VHL	P1H0533
1,2,4-Trichlorobenzene	BRL	ug/kg dry	8.8	0.26	1	8260B	8/24/11 15:00	VHL	P1H0533
1,2,4-Trimethylbenzene	BRL	ug/kg dry	8.8	0.86	1	8260B	8/24/11 15:00	VHL	P1H0533
1,2-Dibromo-3-chloropropane	BRL	ug/kg dry	4.4	1.4	1	8260B	8/24/11 15:00	VHL	P1H0533
1,2-Dibromoethane	BRL	ug/kg dry	4.4	0.51	1	8260B	8/24/11 15:00	VHL	P1H0533
1,2-Dichlorobenzene	BRL	ug/kg dry	8.8	0.20	1	8260B	8/24/11 15:00	VHL	P1H0533
1,2-Dichloroethane	BRL	ug/kg dry	4.4	0.71	1	8260B	8/24/11 15:00	VHL	P1H0533
1,2-Dichloropropane	BRL	ug/kg dry	4.4	0.28	1	8260B	8/24/11 15:00	VHL	P1H0533
1,3,5-Trimethylbenzene	BRL	ug/kg dry	8.8	0.21	1	8260B	8/24/11 15:00	VHL	P1H0533
1,3-Dichlorobenzene	BRL	ug/kg dry	8.8	0.061	1	8260B	8/24/11 15:00	VHL	P1H0533
1,3-Dichloropropane	BRL	ug/kg dry	4.4	0.48	1	8260B	8/24/11 15:00	VHL	P1H0533
1,4-Dichlorobenzene	BRL	ug/kg dry	8.8	0.32	1	8260B	8/24/11 15:00	VHL	P1H0533
2,2-Dichloropropane	BRL	ug/kg dry	4.4	0.28	1	8260B	8/24/11 15:00	VHL	P1H0533
2-Chloroethyl Vinyl Ether	BRL	ug/kg dry	8.8	2.5	1	8260B	8/24/11 15:00	VHL	P1H0533
2-Chlorotoluene	BRL	ug/kg dry	8.8	0.27	1	8260B	8/24/11 15:00	VHL	P1H0533

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Laboratory Report

08/26/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: BKG-4
Prism Sample ID: 1080439-30
Prism Work Order: 1080439
Time Collected: 08/15/11 14:10
Time Submitted: 08/16/11 11:30

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
4-Chlorotoluene	BRL	ug/kg dry	8.8	0.21	1	8260B	8/24/11 15:00	VHL	P1H0533
4-Isopropyltoluene	BRL	ug/kg dry	13	0.28	1	8260B	8/24/11 15:00	VHL	P1H0533
Acetone	**36**	**ug/kg dry**	**18**	**2.3**	**1**	**8260B**	**8/24/11 15:00**	**VHL**	**P1H0533**
Acrolein	BRL	ug/kg dry	88	2.7	1	8260B	8/24/11 15:00	VHL	P1H0533
Acrylonitrile	BRL	ug/kg dry	88	2.2	1	8260B	8/24/11 15:00	VHL	P1H0533
Benzene	BRL	ug/kg dry	2.6	0.27	1	8260B	8/24/11 15:00	VHL	P1H0533
Bromobenzene	BRL	ug/kg dry	4.4	0.19	1	8260B	8/24/11 15:00	VHL	P1H0533
Bromochloromethane	BRL	ug/kg dry	4.4	0.64	1	8260B	8/24/11 15:00	VHL	P1H0533
Bromodichloromethane	BRL	ug/kg dry	4.4	0.20	1	8260B	8/24/11 15:00	VHL	P1H0533
Bromoform	BRL	ug/kg dry	4.4	0.78	1	8260B	8/24/11 15:00	VHL	P1H0533
Bromomethane	BRL	ug/kg dry	8.8	1.2	1	8260B	8/24/11 15:00	VHL	P1H0533
Carbon disulfide	BRL	ug/kg dry	8.8	0.37	1	8260B	8/24/11 15:00	VHL	P1H0533
Carbon Tetrachloride	BRL	ug/kg dry	4.4	0.24	1	8260B	8/24/11 15:00	VHL	P1H0533
Chlorobenzene	BRL	ug/kg dry	4.4	0.20	1	8260B	8/24/11 15:00	VHL	P1H0533
Chloroethane	BRL	ug/kg dry	8.8	3.3	1	8260B	8/24/11 15:00	VHL	P1H0533
Chloroform	BRL	ug/kg dry	4.4	0.18	1	8260B	8/24/11 15:00	VHL	P1H0533
Chloromethane	BRL	ug/kg dry	8.8	2.2	1	8260B	8/24/11 15:00	VHL	P1H0533
cis-1,2-Dichloroethylene	BRL	ug/kg dry	4.4	0.35	1	8260B	8/24/11 15:00	VHL	P1H0533
cis-1,3-Dichloropropylene	BRL	ug/kg dry	4.4	0.22	1	8260B	8/24/11 15:00	VHL	P1H0533
Dibromochloromethane	BRL	ug/kg dry	4.4	0.30	1	8260B	8/24/11 15:00	VHL	P1H0533
Dibromomethane	BRL	ug/kg dry	4.4	0.30	1	8260B	8/24/11 15:00	VHL	P1H0533
Dichlorodifluoromethane	BRL	ug/kg dry	8.8	0.47	1	8260B	8/24/11 15:00	VHL	P1H0533
Ethylbenzene	BRL	ug/kg dry	4.4	0.28	1	8260B	8/24/11 15:00	VHL	P1H0533
Hexachlorobutadiene	BRL	ug/kg dry	13	0.57	1	8260B	8/24/11 15:00	VHL	P1H0533
Isopropyl Ether	BRL	ug/kg dry	4.4	0.19	1	8260B	8/24/11 15:00	VHL	P1H0533
Isopropylbenzene (Cumene)	BRL	ug/kg dry	8.8	0.22	1	8260B	8/24/11 15:00	VHL	P1H0533
m,p-Xylenes	BRL	ug/kg dry	8.8	0.56	1	8260B	8/24/11 15:00	VHL	P1H0533
Methyl Butyl Ketone (2-Hexanone)	BRL	ug/kg dry	44	0.90	1	8260B	8/24/11 15:00	VHL	P1H0533
Methyl Ethyl Ketone (2-Butanone)	BRL	ug/kg dry	18	1.6	1	8260B	8/24/11 15:00	VHL	P1H0533
Methyl Isobutyl Ketone	BRL	ug/kg dry	8.8	1.2	1	8260B	8/24/11 15:00	VHL	P1H0533
Methylene Chloride	BRL	ug/kg dry	8.8	0.32	1	8260B	8/24/11 15:00	VHL	P1H0533
Methyl-tert-Butyl Ether	BRL	ug/kg dry	4.4	0.34	1	8260B	8/24/11 15:00	VHL	P1H0533
Naphthalene	BRL	ug/kg dry	4.4	0.32	1	8260B	8/24/11 15:00	VHL	P1H0533
n-Butylbenzene	BRL	ug/kg dry	13	0.19	1	8260B	8/24/11 15:00	VHL	P1H0533
n-Propylbenzene	BRL	ug/kg dry	8.8	0.25	1	8260B	8/24/11 15:00	VHL	P1H0533
o-Xylene	BRL	ug/kg dry	4.4	0.28	1	8260B	8/24/11 15:00	VHL	P1H0533
sec-Butylbenzene	BRL	ug/kg dry	13	0.18	1	8260B	8/24/11 15:00	VHL	P1H0533
Styrene	BRL	ug/kg dry	4.4	0.19	1	8260B	8/24/11 15:00	VHL	P1H0533
tert-Butylbenzene	BRL	ug/kg dry	18	0.23	1	8260B	8/24/11 15:00	VHL	P1H0533
Tetrachloroethylene	BRL	ug/kg dry	8.8	0.30	1	8260B	8/24/11 15:00	VHL	P1H0533
Toluene	BRL	ug/kg dry	4.4	0.26	1	8260B	8/24/11 15:00	VHL	P1H0533
trans-1,2-Dichloroethylene	BRL	ug/kg dry	4.4	0.51	1	8260B	8/24/11 15:00	VHL	P1H0533
trans-1,3-Dichloropropylene	BRL	ug/kg dry	4.4	0.21	1	8260B	8/24/11 15:00	VHL	P1H0533

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Laboratory Report

08/26/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: BKG-4
Prism Sample ID: 1080439-30
Prism Work Order: 1080439
Time Collected: 08/15/11 14:10
Time Submitted: 08/16/11 11:30

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
Trichloroethylene	BRL	ug/kg dry	4.4	0.41	1	8260B	8/24/11 15:00	VHL	P1H0533
Trichlorofluoromethane	BRL	ug/kg dry	4.4	0.36	1	8260B	8/24/11 15:00	VHL	P1H0533
Vinyl acetate	BRL	ug/kg dry	8.8	1.2	1	8260B	8/24/11 15:00	VHL	P1H0533
Vinyl chloride	BRL	ug/kg dry	8.8	0.57	1	8260B	8/24/11 15:00	VHL	P1H0533

Surrogate	Recovery	Control Limits
4-Bromofluorobenzene	*88 %*	*70-130*
Dibromofluoromethane	*106 %*	*84-123*
Toluene-d8	*87 %*	*76-129*

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ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Prism Work Order: 1080439
Time Submitted: 8/16/2011 11:30:00AM

Volatile Organic Compounds by GC/MS - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch P1H0472 - 5035										
Blank (P1H0472-BLK1)				Prepared & Analyzed: 08/23/11						
1,1,1,2-Tetrachloroethane	BRL	5.0	ug/kg wet							
1,1,1-Trichloroethane	BRL	5.0	ug/kg wet							
1,1,2,2-Tetrachloroethane	BRL	5.0	ug/kg wet							
1,1,2-Trichloroethane	BRL	5.0	ug/kg wet							
1,1-Dichloroethane	BRL	5.0	ug/kg wet							
1,1-Dichloroethylene	BRL	5.0	ug/kg wet							
1,1-Dichloropropylene	BRL	5.0	ug/kg wet							
1,2,3-Trichlorobenzene	BRL	10	ug/kg wet							
1,2,3-Trichloropropane	BRL	5.0	ug/kg wet							
1,2,4-Trichlorobenzene	BRL	10	ug/kg wet							
1,2,4-Trimethylbenzene	BRL	10	ug/kg wet							
1,2-Dibromo-3-chloropropane	BRL	5.0	ug/kg wet							
1,2-Dibromoethane	BRL	5.0	ug/kg wet							
1,2-Dichlorobenzene	BRL	10	ug/kg wet							
1,2-Dichloroethane	BRL	5.0	ug/kg wet							
1,2-Dichloropropane	BRL	5.0	ug/kg wet							
1,3,5-Trimethylbenzene	BRL	10	ug/kg wet							
1,3-Dichlorobenzene	BRL	10	ug/kg wet							
1,3-Dichloropropane	BRL	5.0	ug/kg wet							
1,4-Dichlorobenzene	BRL	10	ug/kg wet							
2,2-Dichloropropane	BRL	5.0	ug/kg wet							
2-Chloroethyl Vinyl Ether	BRL	10	ug/kg wet							
2-Chlorotoluene	BRL	10	ug/kg wet							
4-Chlorotoluene	BRL	10	ug/kg wet							
4-Isopropyltoluene	BRL	15	ug/kg wet							
Acetone	BRL	20	ug/kg wet							
Acrolein	BRL	100	ug/kg wet							
Acrylonitrile	BRL	100	ug/kg wet							
Benzene	BRL	3.0	ug/kg wet							
Bromobenzene	BRL	5.0	ug/kg wet							
Bromochloromethane	BRL	5.0	ug/kg wet							
Bromodichloromethane	BRL	5.0	ug/kg wet							
Bromoform	BRL	5.0	ug/kg wet							
Bromomethane	BRL	10	ug/kg wet							
Carbon disulfide	BRL	10	ug/kg wet							
Carbon Tetrachloride	BRL	5.0	ug/kg wet							
Chlorobenzene	BRL	5.0	ug/kg wet							
Chloroethane	BRL	10	ug/kg wet							
Chloroform	BRL	5.0	ug/kg wet							
Chloromethane	BRL	10	ug/kg wet							
cis-1,2-Dichloroethylene	BRL	5.0	ug/kg wet							
cis-1,3-Dichloropropylene	BRL	5.0	ug/kg wet							
Dibromochloromethane	BRL	5.0	ug/kg wet							
Dibromomethane	BRL	5.0	ug/kg wet							
Dichlorodifluoromethane	BRL	10	ug/kg wet							
Ethylbenzene	BRL	5.0	ug/kg wet							

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Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Prism Work Order: 1080439
Time Submitted: 8/16/2011 11:30:00AM

Volatile Organic Compounds by GC/MS - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch P1H0472 - 5035										
Blank (P1H0472-BLK1)				Prepared & Analyzed: 08/23/11						
Hexachlorobutadiene	BRL	15	ug/kg wet							
Isopropyl Ether	BRL	5.0	ug/kg wet							
Isopropylbenzene (Cumene)	BRL	10	ug/kg wet							
m,p-Xylenes	BRL	10	ug/kg wet							
Methyl Butyl Ketone (2-Hexanone)	BRL	50	ug/kg wet							
Methyl Ethyl Ketone (2-Butanone)	BRL	20	ug/kg wet							
Methyl Isobutyl Ketone	BRL	10	ug/kg wet							
Methylene Chloride	BRL	10	ug/kg wet							
Methyl-tert-Butyl Ether	BRL	5.0	ug/kg wet							
Naphthalene	BRL	5.0	ug/kg wet							
n-Butylbenzene	BRL	15	ug/kg wet							
n-Propylbenzene	BRL	10	ug/kg wet							
o-Xylene	BRL	5.0	ug/kg wet							
sec-Butylbenzene	BRL	15	ug/kg wet							
Styrene	BRL	5.0	ug/kg wet							
tert-Butylbenzene	BRL	20	ug/kg wet							
Tetrachloroethylene	BRL	10	ug/kg wet							
Toluene	BRL	5.0	ug/kg wet							
trans-1,2-Dichloroethylene	BRL	5.0	ug/kg wet							
trans-1,3-Dichloropropylene	BRL	5.0	ug/kg wet							
Trichloroethylene	BRL	5.0	ug/kg wet							
Trichlorofluoromethane	BRL	5.0	ug/kg wet							
Vinyl acetate	BRL	10	ug/kg wet							
Vinyl chloride	BRL	10	ug/kg wet							
Surrogate: 4-Bromofluorobenzene	*47.4*		*ug/kg wet*	*50.0*		*95*	*70-130*			
Surrogate: Dibromofluoromethane	*51.9*		*ug/kg wet*	*50.0*		*104*	*84-123*			
Surrogate: Toluene-d8	*48.6*		*ug/kg wet*	*50.0*		*97*	*76-129*			

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ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Prism Work Order: 1080439
Time Submitted: 8/16/2011 11:30:00AM

Volatile Organic Compounds by GC/MS - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch P1H0472 - 5035										
LCS (P1H0472-BS1)				Prepared & Analyzed: 08/23/11						
1,1-Dichloroethylene	56.0	5.0	ug/kg wet	50.0		112	67-149			
Benzene	51.2	3.0	ug/kg wet	50.0		102	74-127			
Chlorobenzene	49.0	5.0	ug/kg wet	50.0		98	74-118			
Toluene	49.8	5.0	ug/kg wet	50.0		100	71-129			
Trichloroethylene	49.0	5.0	ug/kg wet	50.0		98	75-133			
Surrogate: 4-Bromofluorobenzene	*48.6*		*ug/kg wet*	*50.0*		*97*	*70-130*			
Surrogate: Dibromofluoromethane	*51.6*		*ug/kg wet*	*50.0*		*103*	*84-123*			
Surrogate: Toluene-d8	*48.2*		*ug/kg wet*	*50.0*		*96*	*76-129*			
LCS Dup (P1H0472-BSD1)				Prepared & Analyzed: 08/23/11						
1,1-Dichloroethylene	55.7	5.0	ug/kg wet	50.0		111	67-149	0.6	200	
Benzene	50.3	3.0	ug/kg wet	50.0		101	74-127	2	200	
Chlorobenzene	49.7	5.0	ug/kg wet	50.0		99	74-118	2	200	
Toluene	52.5	5.0	ug/kg wet	50.0		105	71-129	5	200	
Trichloroethylene	50.0	5.0	ug/kg wet	50.0		100	75-133	2	200	
Surrogate: 4-Bromofluorobenzene	*49.2*		*ug/kg wet*	*50.0*		*98*	*70-130*			
Surrogate: Dibromofluoromethane	*53.5*		*ug/kg wet*	*50.0*		*107*	*84-123*			
Surrogate: Toluene-d8	*48.3*		*ug/kg wet*	*50.0*		*97*	*76-129*			
Matrix Spike (P1H0472-MS1)		**Source: 1080439-04**		Prepared & Analyzed: 08/24/11						
1,1-Dichloroethylene	51.8	6.0	ug/kg dry	60.5	BRL	86	54-162			
Benzene	46.8	3.6	ug/kg dry	60.5	BRL	77	60-135			
Chlorobenzene	43.1	6.0	ug/kg dry	60.5	BRL	71	57-125			
Toluene	45.2	6.0	ug/kg dry	60.5	BRL	75	57-135			
Trichloroethylene	43.5	6.0	ug/kg dry	60.5	BRL	72	38-164			
Surrogate: 4-Bromofluorobenzene	*50.8*		*ug/kg dry*	*60.5*		*84*	*70-130*			
Surrogate: Dibromofluoromethane	*62.4*		*ug/kg dry*	*60.5*		*103*	*84-123*			
Surrogate: Toluene-d8	*54.3*		*ug/kg dry*	*60.5*		*90*	*76-129*			

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ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Prism Work Order: 1080439
Time Submitted: 8/16/2011 11:30:00AM

Volatile Organic Compounds by GC/MS - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch P1H0472 - 5035										
Matrix Spike Dup (P1H0472-MSD1)		**Source: 1080439-04**		Prepared & Analyzed: 08/24/11						**D, IH**
1,1-Dichloroethylene	76.0	6.0	ug/kg dry	59.6	BRL	128	54-162	38	22	
Benzene	68.6	3.6	ug/kg dry	59.6	BRL	115	60-135	38	20	
Chlorobenzene	57.9	6.0	ug/kg dry	59.6	BRL	97	57-125	29	14	
Toluene	64.4	6.0	ug/kg dry	59.6	BRL	108	57-135	35	22	
Trichloroethylene	60.1	6.0	ug/kg dry	59.6	BRL	101	38-164	32	18	
Surrogate: 4-Bromofluorobenzene	*53.9*		*ug/kg dry*	*59.6*		*90*	*70-130*			
Surrogate: Dibromofluoromethane	*59.8*		*ug/kg dry*	*59.6*		*100*	*84-123*			
Surrogate: Toluene-d8	*52.0*		*ug/kg dry*	*59.6*		*87*	*76-129*			
Batch P1H0533 - 5035										
Blank (P1H0533-BLK1)				Prepared & Analyzed: 08/24/11						
1,1,1,2-Tetrachloroethane	BRL	5.0	ug/kg wet							
1,1,1-Trichloroethane	BRL	5.0	ug/kg wet							
1,1,2,2-Tetrachloroethane	BRL	5.0	ug/kg wet							
1,1,2-Trichloroethane	BRL	5.0	ug/kg wet							
1,1-Dichloroethane	BRL	5.0	ug/kg wet							
1,1-Dichloroethylene	BRL	5.0	ug/kg wet							
1,1-Dichloropropylene	BRL	5.0	ug/kg wet							
1,2,3-Trichlorobenzene	BRL	10	ug/kg wet							
1,2,3-Trichloropropane	BRL	5.0	ug/kg wet							
1,2,4-Trichlorobenzene	BRL	10	ug/kg wet							
1,2,4-Trimethylbenzene	BRL	10	ug/kg wet							
1,2-Dibromo-3-chloropropane	BRL	5.0	ug/kg wet							
1,2-Dibromoethane	BRL	5.0	ug/kg wet							
1,2-Dichlorobenzene	BRL	10	ug/kg wet							
1,2-Dichloroethane	BRL	5.0	ug/kg wet							
1,2-Dichloropropane	BRL	5.0	ug/kg wet							
1,3,5-Trimethylbenzene	BRL	10	ug/kg wet							
1,3-Dichlorobenzene	BRL	10	ug/kg wet							
1,3-Dichloropropane	BRL	5.0	ug/kg wet							
1,4-Dichlorobenzene	BRL	10	ug/kg wet							
2,2-Dichloropropane	BRL	5.0	ug/kg wet							
2-Chloroethyl Vinyl Ether	BRL	10	ug/kg wet							
2-Chlorotoluene	BRL	10	ug/kg wet							
4-Chlorotoluene	BRL	10	ug/kg wet							
4-Isopropyltoluene	BRL	15	ug/kg wet							
Acetone	BRL	20	ug/kg wet							
Acrolein	BRL	100	ug/kg wet							
Acrylonitrile	BRL	100	ug/kg wet							
Benzene	BRL	3.0	ug/kg wet							
Bromobenzene	BRL	5.0	ug/kg wet							
Bromochloromethane	BRL	5.0	ug/kg wet							
Bromodichloromethane	BRL	5.0	ug/kg wet							
Bromoform	BRL	5.0	ug/kg wet							
Bromomethane	BRL	10	ug/kg wet							
Carbon disulfide	BRL	10	ug/kg wet							

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Project: United Metal

Prism Work Order: 1080439
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Volatile Organic Compounds by GC/MS - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch P1H0533 - 5035										
Blank (P1H0533-BLK1)				Prepared & Analyzed: 08/24/11						
Carbon Tetrachloride	BRL	5.0	ug/kg wet							
Chlorobenzene	BRL	5.0	ug/kg wet							
Chloroethane	BRL	10	ug/kg wet							
Chloroform	BRL	5.0	ug/kg wet							
Chloromethane	BRL	10	ug/kg wet							
cis-1,2-Dichloroethylene	BRL	5.0	ug/kg wet							
cis-1,3-Dichloropropylene	BRL	5.0	ug/kg wet							
Dibromochloromethane	BRL	5.0	ug/kg wet							
Dibromomethane	BRL	5.0	ug/kg wet							
Dichlorodifluoromethane	BRL	10	ug/kg wet							
Ethylbenzene	BRL	5.0	ug/kg wet							
Hexachlorobutadiene	BRL	15	ug/kg wet							
Isopropyl Ether	BRL	5.0	ug/kg wet							
Isopropylbenzene (Cumene)	BRL	10	ug/kg wet							
m,p-Xylenes	BRL	10	ug/kg wet							
Methyl Butyl Ketone (2-Hexanone)	BRL	50	ug/kg wet							
Methyl Ethyl Ketone (2-Butanone)	BRL	20	ug/kg wet							
Methyl Isobutyl Ketone	BRL	10	ug/kg wet							
Methylene Chloride	BRL	10	ug/kg wet							
Methyl-tert-Butyl Ether	BRL	5.0	ug/kg wet							
Naphthalene	BRL	5.0	ug/kg wet							
n-Butylbenzene	BRL	15	ug/kg wet							
n-Propylbenzene	BRL	10	ug/kg wet							
o-Xylene	BRL	5.0	ug/kg wet							
sec-Butylbenzene	BRL	15	ug/kg wet							
Styrene	BRL	5.0	ug/kg wet							
tert-Butylbenzene	BRL	20	ug/kg wet							
Tetrachloroethylene	BRL	10	ug/kg wet							
Toluene	BRL	5.0	ug/kg wet							
trans-1,2-Dichloroethylene	BRL	5.0	ug/kg wet							
trans-1,3-Dichloropropylene	BRL	5.0	ug/kg wet							
Trichloroethylene	BRL	5.0	ug/kg wet							
Trichlorofluoromethane	BRL	5.0	ug/kg wet							
Vinyl acetate	BRL	10	ug/kg wet							
Vinyl chloride	BRL	10	ug/kg wet							
Surrogate: 4-Bromofluorobenzene	*46.6*		*ug/kg wet*	*50.0*		*93*	*70-130*			
Surrogate: Dibromofluoromethane	*48.3*		*ug/kg wet*	*50.0*		*97*	*84-123*			
Surrogate: Toluene-d8	*45.8*		*ug/kg wet*	*50.0*		*92*	*76-129*			

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Project: United Metal

Prism Work Order: 1080439
Time Submitted: 8/16/2011 11:30:00AM

Volatile Organic Compounds by GC/MS - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch P1H0533 - 5035										
LCS (P1H0533-BS1)				Prepared & Analyzed: 08/24/11						
1,1-Dichloroethylene	55.5	5.0	ug/kg wet	50.0		111	67-149			
Benzene	50.1	3.0	ug/kg wet	50.0		100	74-127			
Chlorobenzene	48.4	5.0	ug/kg wet	50.0		97	74-118			
Toluene	50.5	5.0	ug/kg wet	50.0		101	71-129			
Trichloroethylene	48.7	5.0	ug/kg wet	50.0		97	75-133			
Surrogate: 4-Bromofluorobenzene	*46.6*		*ug/kg wet*	*50.0*		*93*	*70-130*			
Surrogate: Dibromofluoromethane	*48.5*		*ug/kg wet*	*50.0*		*97*	*84-123*			
Surrogate: Toluene-d8	*45.5*		*ug/kg wet*	*50.0*		*91*	*76-129*			
LCS Dup (P1H0533-BSD1)				Prepared & Analyzed: 08/24/11						
1,1-Dichloroethylene	54.5	5.0	ug/kg wet	50.0		109	67-149	2	200	
Benzene	49.8	3.0	ug/kg wet	50.0		100	74-127	0.5	200	
Chlorobenzene	46.8	5.0	ug/kg wet	50.0		94	74-118	3	200	
Toluene	47.4	5.0	ug/kg wet	50.0		95	71-129	6	200	
Trichloroethylene	46.9	5.0	ug/kg wet	50.0		94	75-133	4	200	
Surrogate: 4-Bromofluorobenzene	*44.2*		*ug/kg wet*	*50.0*		*88*	*70-130*			
Surrogate: Dibromofluoromethane	*48.5*		*ug/kg wet*	*50.0*		*97*	*84-123*			
Surrogate: Toluene-d8	*44.8*		*ug/kg wet*	*50.0*		*90*	*76-129*			
Matrix Spike (P1H0533-MS1)		**Source: 1080439-28**		Prepared & Analyzed: 08/25/11						
1,1-Dichloroethylene	53.0	7.1	ug/kg dry	71.4	BRL	74	54-162			
Benzene	47.3	4.3	ug/kg dry	71.4	BRL	66	60-135			
Chlorobenzene	47.1	7.1	ug/kg dry	71.4	BRL	66	57-125			
Toluene	48.0	7.1	ug/kg dry	71.4	BRL	67	57-135			
Trichloroethylene	47.3	7.1	ug/kg dry	71.4	BRL	66	38-164			
Surrogate: 4-Bromofluorobenzene	*75.1*		*ug/kg dry*	*71.4*		*105*	*70-130*			
Surrogate: Dibromofluoromethane	*74.2*		*ug/kg dry*	*71.4*		*104*	*84-123*			
Surrogate: Toluene-d8	*71.3*		*ug/kg dry*	*71.4*		*100*	*76-129*			

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Volatile Organic Compounds by GC/MS - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch P1H0533 - 5035										
Matrix Spike Dup (P1H0533-MSD1)		**Source: 1080439-28**		Prepared & Analyzed: 08/25/11						
1,1-Dichloroethylene	47.0	7.0	ug/kg dry	69.9	BRL	67	54-162	12	22	
Benzene	44.5	4.2	ug/kg dry	69.9	BRL	64	60-135	6	20	
Chlorobenzene	47.6	7.0	ug/kg dry	69.9	BRL	68	57-125	1	14	
Toluene	43.6	7.0	ug/kg dry	69.9	BRL	62	57-135	10	22	
Trichloroethylene	42.3	7.0	ug/kg dry	69.9	BRL	61	38-164	11	18	
Surrogate: 4-Bromofluorobenzene	*70.7*		*ug/kg dry*	*69.9*		*101*	*70-130*			
Surrogate: Dibromofluoromethane	*69.4*		*ug/kg dry*	*69.9*		*99*	*84-123*			
Surrogate: Toluene-d8	*71.0*		*ug/kg dry*	*69.9*		*102*	*76-129*			

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ECS Carolinas - Greensboro
Attn: Toby Benfield
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Greensboro, NC 27407

Project: United Metal

Prism Work Order: 1080439
Time Submitted: 8/16/2011 11:30:00AM

Total Metals - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch P1H0413 - 7471B										
Blank (P1H0413-BLK1)				Prepared & Analyzed: 08/23/11						
Mercury	BRL	0.020	mg/kg wet							
LCS (P1H0413-BS1)				Prepared & Analyzed: 08/23/11						
Mercury	0.431	0.020	mg/kg wet	0.417		103	80-120			
Batch P1H0419 - 3050B										
Blank (P1H0419-BLK1)				Prepared & Analyzed: 08/19/11						
Antimony	BRL	0.20	mg/kg wet							
Arsenic	BRL	0.50	mg/kg wet							
Beryllium	BRL	0.25	mg/kg wet							
Cadmium	BRL	0.25	mg/kg wet							
Chromium	BRL	0.25	mg/kg wet							
Copper	BRL	0.50	mg/kg wet							
Lead	BRL	0.25	mg/kg wet							
Nickel	BRL	0.99	mg/kg wet							
Selenium	BRL	0.50	mg/kg wet							
Silver	BRL	0.25	mg/kg wet							
Thallium	BRL	0.50	mg/kg wet							
Tin	BRL	5.0	mg/kg wet							
Zinc	BRL	2.5	mg/kg wet							
LCS (P1H0419-BS1)				Prepared & Analyzed: 08/19/11						
Antimony	22.3	0.20	mg/kg wet	25.3		88	80-120			
Arsenic	22.7	0.51	mg/kg wet	25.3		90	80-120			
Beryllium	23.1	0.25	mg/kg wet	25.3		92	80-120			
Cadmium	22.7	0.25	mg/kg wet	25.3		90	80-120			
Chromium	23.4	0.25	mg/kg wet	25.3		93	80-120			
Copper	24.3	0.51	mg/kg wet	25.3		96	80-120			
Lead	23.2	0.25	mg/kg wet	25.3		92	80-120			
Nickel	23.1	1.0	mg/kg wet	25.3		91	80-120			
Selenium	23.0	0.51	mg/kg wet	25.3		91	80-120			
Silver	23.1	0.25	mg/kg wet	25.3		91	80-120			
Thallium	23.0	0.51	mg/kg wet	25.3		91	80-120			
Tin	25.3	5.1	mg/kg wet	25.3		100	80-120			
Zinc	22.8	2.5	mg/kg wet	25.3		90	80-120			

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Project: United Metal

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Time Submitted: 8/16/2011 11:30:00AM

Total Metals - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch P1H0455 - 7471B										
Blank (P1H0455-BLK1)				Prepared & Analyzed: 08/22/11						
Mercury	BRL	0.020	mg/kg wet							
LCS (P1H0455-BS1)				Prepared & Analyzed: 08/22/11						
Mercury	0.437	0.020	mg/kg wet	0.417		105	80-120			
Matrix Spike (P1H0455-MS1)		Source: 1080439-03		Prepared & Analyzed: 08/22/11						
Mercury	0.560	0.023	mg/kg dry	0.477	BRL	118	80-120			
Matrix Spike Dup (P1H0455-MSD1)		Source: 1080439-03		Prepared & Analyzed: 08/22/11						
Mercury	0.558	0.024	mg/kg dry	0.493	BRL	113	80-120	0.4	20	
Batch P1H0468 - 3050B										
Blank (P1H0468-BLK1)				Prepared & Analyzed: 08/22/11						
Antimony	BRL	0.20	mg/kg wet							
Arsenic	BRL	0.50	mg/kg wet							
Beryllium	BRL	0.25	mg/kg wet							
Cadmium	BRL	0.25	mg/kg wet							
Chromium	BRL	0.25	mg/kg wet							
Copper	BRL	0.50	mg/kg wet							
Lead	BRL	0.25	mg/kg wet							
Nickel	BRL	1.0	mg/kg wet							
Selenium	BRL	0.50	mg/kg wet							
Silver	BRL	0.25	mg/kg wet							
Thallium	BRL	0.50	mg/kg wet							
Tin	BRL	5.0	mg/kg wet							
Zinc	BRL	2.5	mg/kg wet							

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Total Metals - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch P1H0468 - 3050B										
LCS (P1H0468-BS1)				Prepared & Analyzed: 08/22/11						
Antimony	22.7	0.20	mg/kg wet	25.0		91	80-120			
Arsenic	22.7	0.50	mg/kg wet	25.0		91	80-120			
Beryllium	23.3	0.25	mg/kg wet	25.0		93	80-120			
Cadmium	22.2	0.25	mg/kg wet	25.0		89	80-120			
Chromium	23.2	0.25	mg/kg wet	25.0		93	80-120			
Copper	24.9	0.50	mg/kg wet	25.0		99	80-120			
Lead	23.6	0.25	mg/kg wet	25.0		95	80-120			
Nickel	23.1	1.0	mg/kg wet	25.0		92	80-120			
Selenium	23.1	0.50	mg/kg wet	25.0		93	80-120			
Silver	23.4	0.25	mg/kg wet	25.0		93	80-120			
Thallium	22.9	0.50	mg/kg wet	25.0		91	80-120			
Tin	23.3	5.0	mg/kg wet	25.0		93	80-120			
Zinc	23.3	2.5	mg/kg wet	25.0		93	80-120			
Matrix Spike (P1H0468-MS1)		**Source: 1080439-20**		Prepared: 08/22/11	Analyzed: 08/24/11					
Antimony	9.40	0.21	mg/kg dry	26.8	BRL	35	75-125			MI
Arsenic	22.2	0.54	mg/kg dry	26.8	0.0611	83	75-125			
Beryllium	22.1	0.27	mg/kg dry	26.8	0.259	82	75-125			
Cadmium	19.9	0.27	mg/kg dry	26.8	BRL	74	75-125			MI
Chromium	36.7	0.27	mg/kg dry	26.8	13.2	88	75-125			
Copper	80.3	0.54	mg/kg dry	26.8	51.2	109	75-125			
Lead	20.5	0.27	mg/kg dry	26.8	0.371	75	75-125			
Nickel	2.68E10	1.1	mg/kg dry	26.8	131	NR	75-125			E, MC
Selenium	22.6	0.54	mg/kg dry	26.8	0.392	83	75-125			
Silver	23.9	0.27	mg/kg dry	26.8	BRL	90	75-125			
Thallium	19.8	0.54	mg/kg dry	26.8	0.109	74	75-125			MI
Tin	20.6	5.4	mg/kg dry	26.8	BRL	77	75-125			
Zinc	54.4	2.7	mg/kg dry	26.8	29.6	93	75-125			

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Total Metals - Quality Control

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Batch P1H0468 - 3050B										
Matrix Spike Dup (P1H0468-MSD1)		**Source: 1080439-20**		Prepared: 08/22/11	Analyzed: 08/24/11					
Antimony	9.22	0.21	mg/kg dry	26.6	BRL	35	75-125	2	20	MI
Arsenic	22.5	0.53	mg/kg dry	26.6	0.0611	84	75-125	1	20	
Beryllium	22.4	0.27	mg/kg dry	26.6	0.259	83	75-125	1	20	
Cadmium	20.1	0.27	mg/kg dry	26.6	BRL	76	75-125	1	20	
Chromium	38.3	0.27	mg/kg dry	26.6	13.2	94	75-125	4	20	
Copper	86.4	0.53	mg/kg dry	26.6	51.2	132	75-125	7	20	MC
Lead	20.6	0.27	mg/kg dry	26.6	0.371	76	75-125	0.7	20	
Nickel	2.66E10	1.1	mg/kg dry	26.6	131	NR	75-125	0.5	20	E, MC
Selenium	22.9	0.53	mg/kg dry	26.6	0.392	85	75-125	2	20	
Silver	24.3	0.27	mg/kg dry	26.6	BRL	91	75-125	2	20	
Thallium	20.0	0.53	mg/kg dry	26.6	0.109	75	75-125	0.9	20	
Tin	20.6	5.3	mg/kg dry	26.6	BRL	77	75-125	0.003	20	
Zinc	56.3	2.7	mg/kg dry	26.6	29.6	101	75-125	3	20	
Post Spike (P1H0468-PS1)		**Source: 1080439-20**		Prepared: 08/22/11	Analyzed: 08/23/11					
Antimony	0.693		mg/L	1.00	-0.00916	70	80-120			MI
Arsenic	0.717		mg/L	1.00	0.00232	71	80-120			MI
Beryllium	0.759		mg/L	1.00	0.00983	75	80-120			MI
Cadmium	0.647		mg/L	1.00	-0.00370	65	80-120			MI
Chromium	1.15		mg/L	1.00	0.499	65	80-120			MI
Copper	2.69		mg/L	1.00	1.94	75	80-120			MI
Lead	0.694		mg/L	1.00	0.0141	68	80-120			MI
Nickel	1.00E9		mg/L	1.00	4.96	NR	80-120			MC
Selenium	0.827		mg/L	1.00	0.0149	81	80-120			MI
Silver	0.834		mg/L	1.00	-0.00767	84	80-120			
Thallium	0.648		mg/L	1.00	0.00414	64	80-120			MI
Tin	0.681		mg/L	1.00	0.0106	67	80-120			MI
Zinc	1.72		mg/L	1.00	1.12	60	80-120			MI

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Total Metals - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch P1H0489 - 7471B										
Blank (P1H0489-BLK1)				Prepared & Analyzed: 08/23/11						
Mercury	BRL	0.020	mg/kg wet							
LCS (P1H0489-BS1)				Prepared & Analyzed: 08/23/11						
Mercury	0.405	0.020	mg/kg wet	0.417		97	80-120			
Matrix Spike (P1H0489-MS1)		**Source: 1080439-23**		Prepared & Analyzed: 08/23/11						
Mercury	0.510	0.024	mg/kg dry	0.490	BRL	104	80-120			
Matrix Spike Dup (P1H0489-MSD1)		**Source: 1080439-23**		Prepared & Analyzed: 08/23/11						
Mercury	0.536	0.025	mg/kg dry	0.523	BRL	102	80-120	5	20	

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ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Prism Work Order: 1080439
Time Submitted: 8/16/2011 11:30:00AM

General Chemistry Parameters - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch P1H0405 - NO PREP										
Blank (P1H0405-BLK1)				Prepared & Analyzed: 08/18/11						
% Solids	100	0.100	% by Weight							
Duplicate (P1H0405-DUP1)		**Source: 1080439-10**		Prepared & Analyzed: 08/18/11						
% Solids	78.4	0.100	% by Weight		77.7			0.9	20	
Duplicate (P1H0405-DUP2)		**Source: 1080439-20**		Prepared & Analyzed: 08/18/11						
% Solids	94.0	0.100	% by Weight		94.4			0.4	20	
Duplicate (P1H0405-DUP3)		**Source: 1080439-30**		Prepared & Analyzed: 08/18/11						
% Solids	87.9	0.100	% by Weight		87.7			0.2	20	

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Sample Extraction Data

Prep Method: 3050B

Lab Number	Batch	Initial	Final	Date/Time
1080439-01	P1H0419	1.98 g	50 mL	08/19/11 8:00
1080439-01	P1H0419	1.98 g	50 mL	08/19/11 8:00
1080439-02	P1H0419	2 g	50 mL	08/19/11 8:00
1080439-02	P1H0419	2 g	50 mL	08/19/11 8:00
1080439-03	P1H0419	2.01 g	50 mL	08/19/11 8:00
1080439-03	P1H0419	2.01 g	50 mL	08/19/11 8:00
1080439-04	P1H0419	1.99 g	50 mL	08/19/11 8:00
1080439-04	P1H0419	1.99 g	50 mL	08/19/11 8:00
1080439-05	P1H0419	2.03 g	50 mL	08/19/11 8:00
1080439-05	P1H0419	2.03 g	50 mL	08/19/11 8:00
1080439-06	P1H0419	2 g	50 mL	08/19/11 8:00
1080439-06	P1H0419	2 g	50 mL	08/19/11 8:00
1080439-07	P1H0419	1.97 g	50 mL	08/19/11 8:00
1080439-07	P1H0419	1.97 g	50 mL	08/19/11 8:00
1080439-08	P1H0419	1.97 g	50 mL	08/19/11 8:00
1080439-08	P1H0419	1.97 g	50 mL	08/19/11 8:00
1080439-09	P1H0419	1.99 g	50 mL	08/19/11 8:00
1080439-09	P1H0419	1.99 g	50 mL	08/19/11 8:00
1080439-10	P1H0419	2.01 g	50 mL	08/19/11 8:00
1080439-10	P1H0419	2.01 g	50 mL	08/19/11 8:00
1080439-11	P1H0419	2.03 g	50 mL	08/19/11 8:00
1080439-11	P1H0419	2.03 g	50 mL	08/19/11 8:00
1080439-12	P1H0419	1.98 g	50 mL	08/19/11 8:00
1080439-12	P1H0419	1.98 g	50 mL	08/19/11 8:00
1080439-13	P1H0419	1.99 g	50 mL	08/19/11 8:00
1080439-13	P1H0419	1.99 g	50 mL	08/19/11 8:00
1080439-14	P1H0419	2.04 g	50 mL	08/19/11 8:00
1080439-14	P1H0419	2.04 g	50 mL	08/19/11 8:00
1080439-15	P1H0419	1.99 g	50 mL	08/19/11 8:00
1080439-15	P1H0419	1.99 g	50 mL	08/19/11 8:00
1080439-16	P1H0419	2 g	50 mL	08/19/11 8:00
1080439-16	P1H0419	2 g	50 mL	08/19/11 8:00
1080439-17	P1H0419	1.99 g	50 mL	08/19/11 8:00
1080439-17	P1H0419	1.99 g	50 mL	08/19/11 8:00
1080439-18	P1H0419	2.02 g	50 mL	08/19/11 8:00
1080439-18	P1H0419	2.02 g	50 mL	08/19/11 8:00
1080439-19	P1H0419	1.96 g	50 mL	08/19/11 8:00
1080439-19	P1H0419	1.96 g	50 mL	08/19/11 8:00
1080439-20	P1H0468	2.01 g	50 mL	08/22/11 8:00
1080439-21	P1H0468	1.99 g	50 mL	08/22/11 8:00
1080439-22	P1H0468	1.98 g	50 mL	08/22/11 8:00
1080439-23	P1H0468	2.02 g	50 mL	08/22/11 8:00
1080439-24	P1H0468	2.03 g	50 mL	08/22/11 8:00
1080439-25	P1H0468	1.97 g	50 mL	08/22/11 8:00
1080439-26	P1H0468	2 g	50 mL	08/22/11 8:00
1080439-26	P1H0468	2 g	50 mL	08/22/11 8:00
1080439-27	P1H0468	1.97 g	50 mL	08/22/11 8:00
1080439-27	P1H0468	1.97 g	50 mL	08/22/11 8:00
1080439-28	P1H0468	1.99 g	50 mL	08/22/11 8:00
1080439-29	P1H0468	1.97 g	50 mL	08/22/11 8:00
1080439-30	P1H0468	2.04 g	50 mL	08/22/11 8:00

Prep Method: 7471B

Lab Number	Batch	Initial	Final	Date/Time
1080439-01	P1H0413	0.58 g	50 mL	08/23/11 10:05
1080439-02	P1H0413	0.56 g	50 mL	08/23/11 10:05

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Sample Extraction Data

Prep Method: 7471B

Lab Number	Batch	Initial	Final	Date/Time
1080439-03	P1H0455	0.59 g	50 mL	08/22/11 10:10
1080439-04	P1H0455	0.63 g	50 mL	08/22/11 10:10
1080439-05	P1H0455	0.56 g	50 mL	08/22/11 10:10
1080439-06	P1H0455	0.57 g	50 mL	08/22/11 10:10
1080439-07	P1H0455	0.58 g	50 mL	08/22/11 10:10
1080439-08	P1H0455	0.62 g	50 mL	08/22/11 10:10
1080439-09	P1H0455	0.6 g	50 mL	08/22/11 10:10
1080439-10	P1H0455	0.57 g	50 mL	08/22/11 10:10
1080439-11	P1H0455	0.6 g	50 mL	08/22/11 10:10
1080439-12	P1H0455	0.61 g	50 mL	08/22/11 10:10
1080439-13	P1H0455	0.64 g	50 mL	08/22/11 10:10
1080439-14	P1H0455	0.6 g	50 mL	08/22/11 10:10
1080439-15	P1H0455	0.59 g	50 mL	08/22/11 10:10
1080439-16	P1H0455	0.64 g	50 mL	08/22/11 10:10
1080439-17	P1H0455	0.6 g	50 mL	08/22/11 10:10
1080439-18	P1H0455	0.58 g	50 mL	08/22/11 10:10
1080439-19	P1H0455	0.6 g	50 mL	08/22/11 10:10
1080439-20	P1H0455	0.61 g	50 mL	08/22/11 10:10
1080439-21	P1H0455	0.63 g	50 mL	08/22/11 10:10
1080439-22	P1H0455	0.61 g	50 mL	08/22/11 10:10
1080439-23	P1H0489	0.58 g	50 mL	08/23/11 10:05
1080439-24	P1H0489	0.63 g	50 mL	08/23/11 10:05
1080439-25	P1H0489	0.57 g	50 mL	08/23/11 10:05
1080439-26	P1H0489	0.62 g	50 mL	08/23/11 10:05
1080439-27	P1H0489	0.58 g	50 mL	08/23/11 10:05
1080439-28	P1H0489	0.61 g	50 mL	08/23/11 10:05
1080439-29	P1H0489	0.6 g	50 mL	08/23/11 10:05
1080439-30	P1H0489	0.61 g	50 mL	08/23/11 10:05

Prep Method: 5035

Lab Number	Batch	Initial	Final	Date/Time
1080439-01	P1H0472	7.35 g	5 mL	08/23/11 9:15
1080439-02	P1H0472	7.08 g	5 mL	08/23/11 9:15
1080439-03	P1H0472	7.68 g	5 mL	08/23/11 9:15
1080439-04	P1H0472	7.56 g	5 mL	08/23/11 9:15
1080439-05	P1H0472	7.37 g	5 mL	08/23/11 9:15
1080439-06	P1H0472	7.67 g	5 mL	08/23/11 9:15
1080439-07	P1H0533	8 g	5 mL	08/24/11 9:00
1080439-08	P1H0472	7.93 g	5 mL	08/23/11 9:15
1080439-09	P1H0472	8.28 g	5 mL	08/23/11 9:15
1080439-27	P1H0472	7.35 g	5 mL	08/23/11 9:15
1080439-28	P1H0533	8.55 g	5 mL	08/24/11 9:00
1080439-29	P1H0533	6.28 g	5 mL	08/24/11 9:00
1080439-30	P1H0533	6.49 g	5 mL	08/24/11 9:00

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Subcontracted Analyses

The following analyses were subcontracted to Gulf Coast Analytical Labs, Inc.

Lab Number	Analysis
1080439-01	Hexavalent Chromium (Sub)
1080439-02	Hexavalent Chromium (Sub)
1080439-03	Hexavalent Chromium (Sub)
1080439-04	Hexavalent Chromium (Sub)
1080439-05	Hexavalent Chromium (Sub)
1080439-06	Hexavalent Chromium (Sub)
1080439-07	Hexavalent Chromium (Sub)
1080439-08	Hexavalent Chromium (Sub)
1080439-09	Hexavalent Chromium (Sub)
1080439-10	Hexavalent Chromium (Sub)
1080439-11	Hexavalent Chromium (Sub)
1080439-12	Hexavalent Chromium (Sub)
1080439-13	Hexavalent Chromium (Sub)
1080439-14	Hexavalent Chromium (Sub)
1080439-15	Hexavalent Chromium (Sub)
1080439-16	Hexavalent Chromium (Sub)
1080439-17	Hexavalent Chromium (Sub)
1080439-18	Hexavalent Chromium (Sub)
1080439-19	Hexavalent Chromium (Sub)
1080439-20	Hexavalent Chromium (Sub)
1080439-21	Hexavalent Chromium (Sub)
1080439-22	Hexavalent Chromium (Sub)
1080439-23	Hexavalent Chromium (Sub)
1080439-24	Hexavalent Chromium (Sub)
1080439-25	Hexavalent Chromium (Sub)
1080439-26	Hexavalent Chromium (Sub)
1080439-27	Hexavalent Chromium (Sub)
1080439-28	Hexavalent Chromium (Sub)
1080439-29	Hexavalent Chromium (Sub)
1080439-30	Hexavalent Chromium (Sub)

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Mike Dobby - 336-478-1633
Brian 336-209-8069

CHAIN OF CUSTODY RECORD

PAGE 1 OF 3 QUOTE # TO ENSURE PROPER BILLING: _____

Project Name: UMF

Short Hold Analysis: (Yes) (No) UST Project: (Yes) (No)

*Please ATTACH any project specific reporting (QC LEVEL I II III IV) provisions and/or QC Requirements

Invoice To: ECS Limited

Address: 4811 Koger Blvd Ste 750 Greensboro NC

Purchase Order No./Billing Reference _____

Requested Due Date ☐ 1 Day ☐ 2 Days ☐ 3 Days ☐ 4 Days ☐ 5 Days

"Working Days" ☐ 6-9 Days ☒ Standard 10 days ☐ Rush Work Must Be Pre-Approved

Samples received after 15:00 will be processed next business day.

Turnaround time is based on business days, excluding weekends and holidays.

(SEE REVERSE FOR TERMS & CONDITIONS REGARDING SERVICES RENDERED BY PRISM LABORATORIES, INC. TO CLIENT)

Client Company Name: ECS Greensboro

Report To/Contact Name: Coby Bendfeldt

Reporting Address: T Bendfeldt@ECSLimited.com 4811 Koger Blvd 750, NC

Phone: 336 856 7150 Fax (Yes) (No): 856 7160

Email (Yes) (No) Email Address TBendfeldt@ECSLimited.com

EDD Type: PDF ✓ Excel ✓ Other _____

Site Location Name: United Metals Finishing Corp

Site Location Physical Address: 133 Bluebell Rd

LAB USE ONLY

	YES	NO	N/A
Samples INTACT upon arrival?	X		
Received ON WET ICE? Temp 6.4	X		
PROPER PRESERVATIVES indicated?	X		
Received WITHIN HOLDING TIMES?	X		
CUSTODY SEALS INTACT?			X
VOLATILES rec'd W/OUT HEADSPACE?			X
PROPER CONTAINERS used?	X		

TO BE FILLED IN BY CLIENT/SAMPLING PERSONNEL

Certification: NELAC ____ USACE ____ FL ____ NC ____ SC ____ OTHER ____ N/A ____

Water Chlorinated: YES ___ NO ___

Sample Iced Upon Collection: YES ✓ NO ___

CLIENT SAMPLE DESCRIPTION	DATE COLLECTED	TIME COLLECTED MILITARY HOURS	MATRIX (SOIL, WATER OR SLUDGE)	SAMPLE CONTAINER *TYPE SEE BELOW	NO.	SIZE	PRESERVATIVES	8260	Cr+6	Prism Dilution Kit + SD			REMARKS	PRISM LAB ID NO.
GP-1	8-15	855	S	VOA	3		methanol Sodium Bisulfate	✓	✓	✓				Ø1
GP-2		910						✓	✓	✓				Ø2
GP-3		925						✓	✓	✓				Ø3
GP-4		935						✓	✓	✓				Ø4
GP-5		945						✓	✓	✓				Ø5
GP-6		955						✓	✓	✓				Ø6
GP-7		1000						✓	✓	✓				Ø7
GP-8		1010						✓	✓	✓				Ø8
Duplicate		1015						✓	✓	✓				Ø9

Sampler's Signature: Jon Stewart Sampled By (Print Name): Jon Stewart Affiliation: ECS

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Upon relinquishing, this Chain of Custody is your authorization for Prism to proceed with the analyses as requested above. Any changes must be submitted in writing to the Prism Project Manager. There will be charges for any changes after analyses have been initialized.

Relinquished By: (Signature)	Received By: (Signature)	Date	Military Hours
	Jon M. Stewart	8/16/11	1030
Jon M. Stewart	Nick Yore	8/16/11	1030
Nick Yore	Dave Moss	8-16-11	1130

Method of Shipment: NOTE: ALL SAMPLE COOLERS SHOULD BE TAPED SHUT WITH CUSTODY SEALS FOR TRANSPORTATION TO THE LABORATORY. SAMPLES ARE NOT ACCEPTED AND VERIFIED AGAINST COC UNTIL RECEIVED AT THE LABORATORY.

☐ Fed Ex ☐ UPS ☐ Hand-delivered ☒ Prism Field Service ☐ Other _____

COC Group No. 1Ø8Ø439

Additional Comments: Relinquished by Dave Moss 8-16-11 1530 Mike 8/16/11 1530

PRISM USE ONLY

Site Arrival Time:

Site Departure Time:

Field Tech Fee:

Mileage:

NPDES:	UST:	GROUNDWATER:	DRINKING WATER:	SOLID WASTE:	RCRA:	CERCLA	LANDFILL	OTHER:
☐ NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC
☐ _____	☐ _____	☐ _____	☐ _____	☐ _____	☐ _____	☐ _____	☐ _____	☐ _____

*CONTAINER TYPE CODES: A = Amber C = Clear G = Glass P = Plastic; TL = Teflon-Lined Cap VOA = Volatile Organics Analysis (Zero Head Space)

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Phone: 704/529-6364 • Fax: 704/525-0409

CHAIN OF CUSTODY RECORD

PAGE 2 OF 3 QUOTE # TO ENSURE PROPER BILLING:

Client Company Name: ECS
Report To/Contact Name: Robin Bradfield
Reporting Address: 1821 Kew Blvd GSO, NC
Phone: 856-7150 Fax (Yes) (No):
Email (Yes) (No) Email Address
EDD Type: PDF___ Excel___ Other
Site Location Name:
Site Location Physical Address:

Project Name: UMF
Short Hold Analysis: (Yes) (No) UST Project: (Yes) (No)
*Please ATTACH any project specific reporting (QC LEVEL I II III IV) provisions and/or QC Requirements
Invoice To:
Address:

Purchase Order No./Billing Reference
Requested Due Date ☐ 1 Day ☐ 2 Days ☐ 3 Days ☐ 4 Days ☐ 5 Days
"Working Days" ☐ 6-9 Days ☐ Standard 10 days ☐ Rush Work Must Be Pre-Approved
Samples received after 15:00 will be processed next business day.
Turnaround time is based on business days, excluding weekends and holidays.
(SEE REVERSE FOR TERMS & CONDITIONS REGARDING SERVICES RENDERED BY PRISM LABORATORIES, INC. TO CLIENT)

LAB USE ONLY

	YES	NO	N/A
Samples INTACT upon arrival?	X		
Received ON WET ICE? Temp 6.4	X		
PROPER PRESERVATIVES indicated?	X		
Received WITHIN HOLDING TIMES?	X		
CUSTODY SEALS INTACT?			X
VOLATILES rec'd W/OUT HEADSPACE?			X
PROPER CONTAINERS used?	X		

TO BE FILLED IN BY CLIENT/SAMPLING PERSONNEL
Certification: NELAC___ USACE___ FL___ NC ✓ SC___ OTHER___ N/A ✓
Water Chlorinated: YES___ NO ✓
Sample Iced Upon Collection: YES ✓ NO___

CLIENT SAMPLE DESCRIPTION	DATE COLLECTED	TIME COLLECTED MILITARY HOURS	MATRIX (SOIL, WATER OR SLUDGE)	SAMPLE CONTAINER *TYPE SEE BELOW	NO.	SIZE	PRESERVATIVES	ANALYSES REQUESTED: Pesticides +SB	Cr6					REMARKS	PRISM LAB ID NO.
GP-9	8-15	1040	S	[redacted]/C	2		[redacted]	✓	✓						10
GP-10		1050						✓	✓						11
GP-11		1105						✓	✓						12
GP-12		1115						✓	✓						13
GP-13		1120						✓	✓						14
GP-14		1130						✓	✓						15
GP-15		1140						✓	✓						16
GP-16		1200						✓	✓						17
GP-17		1220						✓	✓						18
GP-18B		1235						✓	✓						19

Sampler's Signature [signature] Sampled By (Print Name) John Stewart Affiliation ECS

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Relinquished By: (Signature)	Received By: (Signature)	Date	Military/Hours
[signature]	[signature]	8/16/11	1030
[signature]	[signature]	8-16-11	1130
[signature] 8-16-11 1530	[signature]	8/16/11	1550

Method of Shipment: NOTE: ALL SAMPLE COOLERS SHOULD BE TAPED SHUT WITH CUSTODY SEALS FOR TRANSPORTATION TO THE LABORATORY. SAMPLES ARE NOT ACCEPTED AND VERIFIED AGAINST COC UNTIL RECEIVED AT THE LABORATORY.
☐ Fed Ex ☐ UPS ☐ Hand-delivered ☒ Prism Field Service ☐ Other

COC Group No. 1080439

Additional Comments:

PRISM USE ONLY
Site Arrival Time:
Site Departure Time:
Field Tech Fee:
Mileage:

NPDES:	UST:	GROUNDWATER:	DRINKING WATER:	SOLID WASTE:	RCRA:	CERCLA	LANDFILL	OTHER:
☐ NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC	☒ NC ☐ SC

*CONTAINER TYPE CODES: A = Amber C = Clear G = Glass P = Plastic; TL = Teflon-Lined Cap VOA = Volatile Organics Analysis (Zero Head Space)

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CHAIN OF CUSTODY RECORD

PAGE 3 OF 3 QUOTE # TO ENSURE PROPER BILLING: _____

Project Name: UMF

Short Hold Analysis: (Yes) (No) UST Project: (Yes) (No)

*Please ATTACH any project specific reporting (QC LEVEL I II III IV) provisions and/or QC Requirements

Invoice To: _____

Address: _____

Purchase Order No./Billing Reference _____

Requested Due Date ☐ 1 Day ☐ 2 Days ☐ 3 Days ☐ 4 Days ☐ 5 Days

"Working Days" ☐ 6-9 Days ☐ Standard 10 days ☐ Rush Work Must Be Pre-Approved

Samples received after 15:00 will be processed next business day.
Turnaround time is based on business days, excluding weekends and holidays.
(SEE REVERSE FOR TERMS & CONDITIONS REGARDING SERVICES RENDERED BY PRISM LABORATORIES, INC. TO CLIENT)

Client Company Name: ECS Greensboro

Report To/Contact Name: _____

Reporting Address: _____

Phone: _____ Fax (Yes) (No): _____

Email (Yes) (No) Email Address _____

EDD Type: PDF____ Excel____ Other_____

Site Location Name: _____

Site Location Physical Address: _____

LAB USE ONLY

	YES	NO	N/A
Samples INTACT upon arrival?			
Received ON WET ICE? Temp ____			
PROPER PRESERVATIVES indicated?			
Received WITHIN HOLDING TIMES?			
CUSTODY SEALS INTACT?			
VOLATILES rec'd W/OUT HEADSPACE?			
PROPER CONTAINERS used?			

TO BE FILLED IN BY CLIENT/SAMPLING PERSONNEL

Certification: NELAC____ USACE____ FL____ NC✓____ SC____ OTHER____ N/A____

Water Chlorinated: YES___ NO✓___

Sample Iced Upon Collection: YES✓___ NO___

CLIENT SAMPLE DESCRIPTION	DATE COLLECTED	TIME COLLECTED MILITARY HOURS	MATRIX (SOIL, WATER OR SLUDGE)	SAMPLE CONTAINER *TYPE SEE BELOW	NO.	SIZE	PRESERVATIVES	Pesticides + 52	8260	Cr6			REMARKS	PRISM LAB ID NO.
GP-19	8-15		S	C				✓		✓				20
GP-20								✓		✓				21
GP-21								✓		✓				22
GP-22								✓		✓				23
GP-23								✓		✓				24
GP-24								✓		✓				25
GP-25								✓		✓				26
BKG-1		140		VOA			Schedule Backup Mg 14	✓	✓	✓				27
BKG-2		150						✓	✓	✓				28
BKG-3		155						✓	✓	✓				29
BKG-4		210						✓	✓	✓				30

Sampler's Signature: John Stewart Sampled By (Print Name): John Stewart Affiliation: ECS

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Upon relinquishing, this Chain of Custody is your authorization for Prism to proceed with the analyses as requested above. Any changes must be submitted in writing to the Prism Project Manager. There will be charges for any changes after analyses have been initialized.

Relinquished By: (Signature)	Received By: (Signature)	Date	Military/Hours
John Stewart	Nick Lane	8/16/11	1030
Nick Lane	David Moir	8-16-11	1130
David Moir 8-16-11 1550	Received For Prism Laboratories By:	8/16/11	1550

Method of Shipment: NOTE: ALL SAMPLE COOLERS SHOULD BE TAPED SHUT WITH CUSTODY SEALS FOR TRANSPORTATION TO THE LABORATORY. SAMPLES ARE NOT ACCEPTED AND VERIFIED AGAINST COC UNTIL RECEIVED AT THE LABORATORY.

☐ Fed Ex ☐ UPS ☐ Hand-delivered ☐ Prism Field Service ☐ Other _____

COC Group No. 1080439

Additional Comments:

PRISM USE ONLY

Site Arrival Time:
Site Departure Time:
Field Tech Fee:
Mileage:

NPDES:	UST:	GROUNDWATER:	DRINKING WATER:	SOLID WASTE:	RCRA:	CERCLA	LANDFILL	OTHER:
☐ NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC
☐ _____	☐ _____	☐ _____	☐ _____	☐ _____	☐ _____	☐ _____	☐ _____	☐ _____

*CONTAINER TYPE CODES: A = Amber C = Clear G = Glass P = Plastic; TL = Teflon-Lined Cap VOA = Volatile Organics Analysis (Zero Head Space)

SEE REVERSE FOR TERMS & CONDITIONS

ORIGINAL

ACCESS
ANALYTICAL, INC.

ANALYTICAL REPORT

CLIENT
Prism Laboratories, Inc.
PO BOX 240543
Charlotte, NC 28224

ATTENTION
Angie Overcash

PROJECT ID
1080439

LABORATORY REPORT NUMBER
211081904

DATE
08/24/2011

Primary Data Review By

IntegriSign

Curtis Ekker
Data Validation Manager, GCAL

Secondary Data Review By

Ashley B. Amick
Project Manager, Access Analytical, Inc.
aamick@accessanalyticalinc.com

PLEASE NOTE:

- **Unless otherwise noted, all analysis on this report performed at Gulf Coast Analytical Labs (GCAL), 7979 GSRI Avenue, Baton Rouge, LA 70820.**
- **GCAL is SCDHEC certified laboratory # 73006, NCDENR certified lab # 618, GA certified lab # LA-01955, NELAP certified laboratory # 01955**
- Local support services for this project are provided by Access Analytical, Inc.. Access Analytical is a representative of GCAL serving clients in the SC/NC/GA areas. All questions regarding this report should be directed to your local Access Analytical representative at 803.781.4243 or toll free at 888.315.4243.

NELAP CERTIFICATE NUMBER 01955
DOD ELAP CERTIFICATE NUMBER ADE - 1482

ANALYTICAL RESULTS

PERFORMED BY

GULF COAST ANALYTICAL LABORATORIES, INC.
7979 GSRI Avenue
Baton Rouge, LA 70820

Report Date 08/24/2011

GCAL Report 211081904

Deliver To	Prism Laboratories, Inc. PO BOX 240543 Charlotte, NC 28224 706-529-6364
Attn	Angie Overcash

Project 1080439

CASE NARRATIVE

Client: Prism Laboratories, Inc. **Report:** 211081904

Gulf Coast Analytical Laboratories received and analyzed the sample(s) listed on the sample cross-reference page of this report. Receipt of the sample(s) is documented by the attached chain of custody. This applies only to the sample(s) listed in this report. No sample integrity or quality control exceptions were identified unless noted below.

Laboratory Endorsement

Sample analysis was performed in accordance with approved methodologies provided by the Environmental Protection Agency or other recognized agencies. The samples and their corresponding extracts will be maintained for a period of 30 days unless otherwise arranged. Following this retention period the samples will be disposed in accordance with GCAL's Standard Operating Procedures.

Common Abbreviations Utilized in this Report

ND	Indicates the result was Not Detected at the specified RDL
DO	Indicates the result was Diluted Out
MI	Indicates the result was subject to Matrix Interference
TNTC	Indicates the result was Too Numerous To Count
SUBC	Indicates the analysis was Sub-Contracted
FLD	Indicates the analysis was performed in the Field
PQL	Practical Quantitation Limit
MDL	Method Detection Limit
RDL	Reporting Detection Limit
00:00	Reported as a time equivalent to 12:00 AM

Reporting Flags Utilized in this Report

J	Indicates an estimated value
U	Indicates the compound was analyzed for but not detected
B	(ORGANICS) Indicates the analyte was detected in the associated Method Blank
B	(INORGANICS) Indicates the result is between the RDL and MDL

Sample receipt at GCAL is documented through the attached chain of custody. In accordance with NELAC, this report shall be reproduced only in full and with the written permission of GCAL. The results contained within this report relate only to the samples reported. The documented results are presented within this report.

This report pertains only to the samples listed in the Report Sample Summary and should be retained as a permanent record thereof. The results contained within this report are intended for the use of the client. Any unauthorized use of the information contained in this report is prohibited.

I certify that this data package is in compliance with the NELAC standard and terms and conditions of the contract and Statement of Work both technically and for completeness, for other than the conditions in the case narrative. Release of the data contained in this hardcopy data package and in the computer-readable data submitted has been authorized by the Quality Assurance Manager or his/her designee, as verified by the following signature.

Estimated uncertainty of measurement is available upon request. This report is in compliance with the DOD QSM as specified in the contract if applicable.

IntegriSign

Robyn Migues
Technical Director
GCAL REPORT 211081904

IntegriSign

THIS REPORT CONTAINS ____ PAGES.

Report Sample Summary

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108190401	GP-1	Solid	08/15/2011 08:55	08/19/2011 08:55
21108190402	GP-2	Solid	08/15/2011 09:10	08/19/2011 08:55
21108190403	GP-3	Solid	08/15/2011 09:25	08/19/2011 08:55
21108190404	GP-4	Solid	08/15/2011 09:35	08/19/2011 08:55
21108190405	GP-5	Solid	08/15/2011 09:45	08/19/2011 08:55
21108190406	GP-6	Solid	08/15/2011 09:55	08/19/2011 08:55
21108190407	GP-7	Solid	08/15/2011 10:00	08/19/2011 08:55
21108190408	GP-8	Solid	08/15/2011 10:10	08/19/2011 08:55
21108190409	DUPLICATE	Solid	08/15/2011 10:15	08/19/2011 08:55
21108190410	GP-9	Solid	08/15/2011 10:40	08/19/2011 08:55
21108190411	GP-10	Solid	08/15/2011 10:50	08/19/2011 08:55
21108190412	GP-11	Solid	08/15/2011 11:05	08/19/2011 08:55
21108190413	GP-12	Solid	08/15/2011 11:15	08/19/2011 08:55
21108190414	GP-13	Solid	08/15/2011 11:20	08/19/2011 08:55
21108190415	GP-14	Solid	08/15/2011 11:30	08/19/2011 08:55
21108190416	GP-15	Solid	08/15/2011 11:40	08/19/2011 08:55
21108190417	GP-16	Solid	08/15/2011 12:00	08/19/2011 08:55
21108190418	GP-17	Solid	08/15/2011 12:20	08/19/2011 08:55
21108190419	GP-18B	Solid	08/15/2011 12:35	08/19/2011 08:55
21108190420	GP-19	Solid	08/15/2011 00:00	08/19/2011 08:55
21108190421	GP-20	Solid	08/15/2011 00:00	08/19/2011 08:55
21108190422	GP-21	Solid	08/15/2011 00:00	08/19/2011 08:55
21108190423	GP-22	Solid	08/15/2011 00:00	08/19/2011 08:55
21108190424	GP-23	Solid	08/15/2011 00:00	08/19/2011 08:55
21108190425	GP-24	Solid	08/15/2011 00:00	08/19/2011 08:55
21108190426	GP-25	Solid	08/15/2011 00:00	08/19/2011 08:55
21108190427	BKG-1	Solid	08/15/2011 13:40	08/19/2011 08:55
21108190428	BKG-2	Solid	08/15/2011 13:50	08/19/2011 08:55
21108190429	BKG-3	Solid	08/15/2011 13:55	08/19/2011 08:55
21108190430	BKG-4	Solid	08/15/2011 14:10	08/19/2011 08:55

Summary of Compounds Detected

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108190401	GP-1	Solid	08/15/2011 08:55	08/19/2011 08:55

SW-846 7196A Chromium VI

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	0.663	0.603	0.302	mg/kg

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108190409	DUPLICATE	Solid	08/15/2011 10:15	08/19/2011 08:55

SW-846 7196A Chromium VI

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	1.10	0.549	0.274	mg/kg

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108190410	GP-9	Solid	08/15/2011 10:40	08/19/2011 08:55

SW-846 7196A Chromium VI

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	1.16	0.613	0.307	mg/kg

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108190416	GP-15	Solid	08/15/2011 11:40	08/19/2011 08:55

SW-846 7196A Chromium VI

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	0.442B	0.553	0.276	mg/kg

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108190418	GP-17	Solid	08/15/2011 12:20	08/19/2011 08:55

SW-846 7196A Chromium VI

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	1.25	0.570	0.285	mg/kg

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108190421	GP-20	Solid	08/15/2011 00:00	08/19/2011 08:55

SW-846 7196A Chromium VI

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	1.48	0.617	0.309	mg/kg

Summary of Compounds Detected (con't)

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108190423	GP-22	Solid	08/15/2011 00:00	08/19/2011 08:55

SW-846 7196A Chromium VI

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	0.335B	0.558	0.279	mg/kg

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108190424	GP-23	Solid	08/15/2011 00:00	08/19/2011 08:55

SW-846 7196A Chromium VI

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	0.328B	0.547	0.273	mg/kg

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108190426	GP-25	Solid	08/15/2011 00:00	08/19/2011 08:55

SW-846 7196A Chromium VI

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	17.9	0.531	0.266	mg/kg

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108190427	BKG-1	Solid	08/15/2011 13:40	08/19/2011 08:55

SW-846 7196A Chromium VI

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	0.326B	0.652	0.326	mg/kg

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108190428	BKG-2	Solid	08/15/2011 13:50	08/19/2011 08:55

SW-846 7196A Chromium VI

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	1.60	0.640	0.320	mg/kg

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108190429	BKG-3	Solid	08/15/2011 13:55	08/19/2011 08:55

SW-846 7196A Chromium VI

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	0.364B	0.607	0.303	mg/kg

Summary of Compounds Detected (con't)

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108190430	BKG-4	Solid	08/15/2011 14:10	08/19/2011 08:55

SW-846 7196A Chromium VI

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	0.589	0.589	0.295	mg/kg

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108190401	GP-1	Solid	08/15/2011 08:55	08/19/2011 08:55

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
08/23/2011 09:00	464016	SW-846 3060A	1	08/23/2011 13:43	JEM	464028

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	0.663	0.603	0.302	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
211081904-02	GP-2	Solid	08/15/2011 09:10	08/19/2011 08:55

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
08/23/2011 09:00	464016	SW-846 3060A	1	08/23/2011 13:43	JEM	464028

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	0.322U	0.644	0.322	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
211081904003	GP-3	Solid	08/15/2011 09:25	08/19/2011 08:55

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
08/23/2011 09:00	464016	SW-846 3060A	1	08/23/2011 13:44	JEM	464028

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	0.285U	0.569	0.285	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108190404	GP-4	Solid	08/15/2011 09:35	08/19/2011 08:55

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
08/23/2011 09:00	464016	SW-846 3060A	1	08/23/2011 13:44	JEM	464028

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	0.327U	0.655	0.327	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108190405	GP-5	Solid	08/15/2011 09:45	08/19/2011 08:55

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
08/23/2011 09:00	464016	SW-846 3060A	1	08/23/2011 13:45	JEM	464028

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	0.293U	0.587	0.293	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108190406	GP-6	Solid	08/15/2011 09:55	08/19/2011 08:55

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
08/23/2011 09:00	464016	SW-846 3060A	1	08/23/2011 13:45	JEM	464028

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	0.286U	0.572	0.286	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
211081904O7	GP-7	Solid	08/15/2011 10:00	08/19/2011 08:55

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
08/23/2011 09:00	464016	SW-846 3060A	1	08/23/2011 13:46	JEM	464028

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	0.262U	0.525	0.262	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108190408	GP-8	Solid	08/15/2011 10:10	08/19/2011 08:55

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
08/23/2011 09:00	464016	SW-846 3060A	1	08/23/2011 13:47	JEM	464028

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	0.330U	0.659	0.330	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108190409	DUPLICATE	Solid	08/15/2011 10:15	08/19/2011 08:55

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
08/23/2011 09:00	464016	SW-846 3060A	1	08/23/2011 13:47	JEM	464028

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	1.10	0.549	0.274	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108190410	GP-9	Solid	08/15/2011 10:40	08/19/2011 08:55

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
08/23/2011 09:00	464016	SW-846 3060A	1	08/23/2011 13:47	JEM	464028

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	1.16	0.613	0.307	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108190411	GP-10	Solid	08/15/2011 10:50	08/19/2011 08:55

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
08/23/2011 09:00	464016	SW-846 3060A	1	08/23/2011 13:48	JEM	464028

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	0.268U	0.536	0.268	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108190412	GP-11	Solid	08/15/2011 11:05	08/19/2011 08:55

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
08/23/2011 09:00	464016	SW-846 3060A	1	08/23/2011 13:48	JEM	464028

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	0.316U	0.632	0.316	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
211081904-13	GP-12	Solid	08/15/2011 11:15	08/19/2011 08:55

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
08/23/2011 09:00	464016	SW-846 3060A	1	08/23/2011 13:49	JEM	464028

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	0.278U	0.555	0.278	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108190414	GP-13	Solid	08/15/2011 11:20	08/19/2011 08:55

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
08/23/2011 09:00	464016	SW-846 3060A	1	08/23/2011 13:49	JEM	464028

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	0.271U	0.543	0.271	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108190415	GP-14	Solid	08/15/2011 11:30	08/19/2011 08:55

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
08/23/2011 09:00	464016	SW-846 3060A	1	08/23/2011 13:49	JEM	464028

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	0.299U	0.598	0.299	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108190416	GP-15	Solid	08/15/2011 11:40	08/19/2011 08:55

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
08/23/2011 09:30	464017	SW-846 3060A	1	08/23/2011 16:15	JEM	464042

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	0.442B	0.553	0.276	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108190417	GP-16	Solid	08/15/2011 12:00	08/19/2011 08:55

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
08/23/2011 09:30	464017	SW-846 3060A	1	08/23/2011 16:16	JEM	464042

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	0.331U	0.663	0.331	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108190418	GP-17	Solid	08/15/2011 12:20	08/19/2011 08:55

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
08/23/2011 09:30	464017	SW-846 3060A	1	08/23/2011 16:16	JEM	464042

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	1.25	0.570	0.285	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108190419	GP-18B	Solid	08/15/2011 12:35	08/19/2011 08:55

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
08/23/2011 09:30	464017	SW-846 3060A	1	08/23/2011 16:17	JEM	464042

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	0.315U	0.629	0.315	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108190420	GP-19	Solid	08/15/2011 00:00	08/19/2011 08:55

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
08/23/2011 09:30	464017	SW-846 3060A	1	08/23/2011 16:17	JEM	464042

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	0.315U	0.631	0.315	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108190421	GP-20	Solid	08/15/2011 00:00	08/19/2011 08:55

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
08/23/2011 09:30	464017	SW-846 3060A	1	08/23/2011 16:17	JEM	464042

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	1.48	0.617	0.309	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108190422	GP-21	Solid	08/15/2011 00:00	08/19/2011 08:55

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
08/23/2011 09:30	464017	SW-846 3060A	1	08/23/2011 16:19	JEM	464042

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	0.326U	0.651	0.326	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108190423	GP-22	Solid	08/15/2011 00:00	08/19/2011 08:55

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
08/23/2011 09:30	464017	SW-846 3060A	1	08/23/2011 16:19	JEM	464042

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	0.335B	0.558	0.279	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108190424	GP-23	Solid	08/15/2011 00:00	08/19/2011 08:55

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
08/23/2011 09:30	464017	SW-846 3060A	1	08/23/2011 16:19	JEM	464042

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	0.328B	0.547	0.273	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
211081904 25	GP-24	Solid	08/15/2011 00:00	08/19/2011 08:55

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
08/23/2011 09:30	464017	SW-846 3060A	1	08/23/2011 16:20	JEM	464042

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	0.293U	0.586	0.293	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108190426	GP-25	Solid	08/15/2011 00:00	08/19/2011 08:55

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
08/23/2011 09:30	464017	SW-846 3060A	1	08/23/2011 16:20	JEM	464042

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	17.9	0.531	0.266	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108190427	BKG-1	Solid	08/15/2011 13:40	08/19/2011 08:55

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
08/23/2011 09:30	464017	SW-846 3060A	1	08/23/2011 16:20	JEM	464042

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	0.326B	0.652	0.326	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108190428	BKG-2	Solid	08/15/2011 13:50	08/19/2011 08:55

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
08/23/2011 09:30	464017	SW-846 3060A	1	08/23/2011 16:21	JEM	464042

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	1.60	0.640	0.320	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108190429	BKG-3	Solid	08/15/2011 13:55	08/19/2011 08:55

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
08/23/2011 09:30	464017	SW-846 3060A	1	08/23/2011 16:21	JEM	464042

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	0.364B	0.607	0.303	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108190430	BKG-4	Solid	08/15/2011 14:10	08/19/2011 08:55

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
08/23/2011 09:30	464017	SW-846 3060A	1	08/23/2011 16:21	JEM	464042

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	0.589	0.589	0.295	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

General Chemistry Quality Control Summary

Analytical Batch 464028	**Client ID**	MB464016			LCS464016		
Prep Batch 464016	**GCAL ID**	981825			981826		
Prep Method SW-846	**Sample Type**	Method Blank			LCS		
3060A	**Prep Date**	08/23/2011 09:00			08/23/2011 09:00		
	Analytical Date	08/23/2011 13:42			08/23/2011 13:42		
	Matrix	Solid			Solid		
SW-846 7196A Chromium VI		**Units**	mg/kg	**Spike**	**Result**		**Control**
		Result	**RDL**	**Added**		**% R**	**Limits % R**
18540-29-9 Chromium VI		0.250U	0.250	50.0	43.0	86	75 - 125

Analytical Batch 464028	**Client ID**	GP-1			980782MS		
Prep Batch 464016	**GCAL ID**	21108190401			981827		
Prep Method SW-846	**Sample Type**	SAMPLE			MS		
3060A	**Prep Date**	08/23/2011 09:00			08/23/2011 09:00		
	Analytical Date	08/23/2011 13:43			08/23/2011 13:43		
	Matrix	Solid			Solid		
SW-846 7196A Chromium VI		**Units**	mg/kg	**Spike**	**Result**		**Control**
		Result	**RDL**	**Added**		**% R**	**Limits % R**
18540-29-9 Chromium VI		0.550	0.250	50.0	43.1	85	74.5 -125.4

Analytical Batch 464028	**Client ID**	GP-2		980786DUP		
Prep Batch 464016	**GCAL ID**	21108190402		981828		
Prep Method SW-846	**Sample Type**	SAMPLE		DUP		
3060A	**Prep Date**	08/23/2011 09:00		08/23/2011 09:00		
	Analytical Date	08/23/2011 13:43		08/23/2011 13:44		
	Matrix	Solid		Solid		
SW-846 7196A Chromium VI		**Units**	mg/kg	**Result**		**RPD**
		Result	**RDL**		**RPD**	**Limit**
18540-29-9 Chromium VI		0.000	0.250	0.000	0	25

General Chemistry Quality Control Summary

Analytical Batch 464042	**Client ID**	MB464017			LCS464017		
Prep Batch 464017	**GCAL ID**	981829			981830		
Prep Method SW-846	**Sample Type**	Method Blank			LCS		
3060A	**Prep Date**	08/23/2011 09:30			08/23/2011 09:30		
	Analytical Date	08/23/2011 16:14			08/23/2011 16:15		
	Matrix	Solid			Solid		
SW-846 7196A Chromium VI		**Units**	mg/kg	**Spike**	**Result**		**Control**
		Result	**RDL**	**Added**		**% R**	**Limits % R**
18540-29-9 Chromium VI		0.250U	0.250	50.0	43.6	87.2	75 - 125

Analytical Batch 464042	**Client ID**	GP-15			980802MS		
Prep Batch 464017	**GCAL ID**	21108190416			981831		
Prep Method SW-846	**Sample Type**	SAMPLE			MS		
3060A	**Prep Date**	08/23/2011 09:30			08/23/2011 09:30		
	Analytical Date	08/23/2011 16:15			08/23/2011 16:15		
	Matrix	Solid			Solid		
SW-846 7196A Chromium VI		**Units**	mg/kg	**Spike**	**Result**		**Control**
		Result	**RDL**	**Added**		**% R**	**Limits % R**
18540-29-9 Chromium VI		0.400	0.250	50.0	39.0	77.1	74.5 -125.4

Analytical Batch 464042	**Client ID**	GP-16		980803DUP		
Prep Batch 464017	**GCAL ID**	21108190417		981832		
Prep Method SW-846	**Sample Type**	SAMPLE		DUP		
3060A	**Prep Date**	08/23/2011 09:30		08/23/2011 09:30		
	Analytical Date	08/23/2011 16:16		08/23/2011 16:16		
	Matrix	Solid		Solid		
SW-846 7196A Chromium VI		**Units**	mg/kg	**Result**		**RPD**
		Result	**RDL**		**RPD**	**Limit**
18540-29-9 Chromium VI		0.000	0.250	0.000	0	25

Access / 4565 / 211081904 / 8/25/11
Sub to GCAL 8/18/11

PRISM LABORATORIES, INC. | Full-Service Analytical & Environmental Solutions

SUBCONTRACT ORDER

Prism Laboratories, Inc.

1080439

Certification: NELAC___ USACE___ SC___ Other NC N/A___

SENDING LABORATORY:

Prism Laboratories, Inc.
P. O. Box 240543
Charlotte, NC 28224-0543
Phone: 800-529-6364
Fax: 704-525-0409
Project Manager: Angela D. Overcash

RECEIVING LABORATORY:

Gulf Coast Analytical Labs, Inc.
7979 GSRI Avenue
Baton Rouge, LA 70820
Phone :(225) 769-4900
Fax: (225) 767-5717

Analysis	Due	Expires	Laboratory ID	Comments
Sample ID: 1080439-01	**Solid**	**Sampled:08/15/11 08:55**	GP-1	Need lab report 8/26 if possible Thank You! 1
Hexavalent Chromium (Sub)		08/16/11 08:55		
Containers Supplied:				
Sample ID: 1080439-02	**Solid**	**Sampled:08/15/11 09:10**	GP-2	2
Hexavalent Chromium (Sub)		08/16/11 09:10		
Containers Supplied:				
Sample ID: 1080439-03	**Solid**	**Sampled:08/15/11 09:25**	GP-3	3
Hexavalent Chromium (Sub)		08/16/11 09:25		
Containers Supplied:				
Sample ID: 1080439-04	**Solid**	**Sampled:08/15/11 09:35**	GP-4	4
Hexavalent Chromium (Sub)		08/16/11 09:35		
Containers Supplied:				
Sample ID: 1080439-05	**Solid**	**Sampled:08/15/11 09:45**	GP-5	5
Hexavalent Chromium (Sub)		08/16/11 09:45		

3.3°C

Released By	Date	Received By	Date
[signature]	8/18/11	Fed Ex	8/18/11
Fed Ex 7974 2776 0184	8/19/11 855	[signature] GCAL	8/19/11 855

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Access/456/211081904/ 8/25/11

SUBCONTRACT ORDER

Prism Laboratories, Inc.

1080439

Certification: NELAC___ USACE___
SC___ Other NC
N/A___

Analysis	Due	Expires	Laboratory ID	Comments	
Containers Supplied:					
Sample ID: 1080439-06	**Solid**	**Sampled:08/15/11 09:55**	GP-6		6
Hexavalent Chromium (Sub)		08/16/11 09:55			
Containers Supplied:					
Sample ID: 1080439-07	**Solid**	**Sampled:08/15/11 10:00**	GP-7		7
Hexavalent Chromium (Sub)		08/16/11 10:00			
Containers Supplied:					
Sample ID: 1080439-08	**Solid**	**Sampled:08/15/11 10:10**	GP-8		8
Hexavalent Chromium (Sub)		08/16/11 10:10			
Containers Supplied:					
Sample ID: 1080439-09	**Solid**	**Sampled:08/15/11 10:15**	Duplicate		9
Hexavalent Chromium (Sub)		08/16/11 10:15			
Containers Supplied:					
Sample ID: 1080439-10	**Solid**	**Sampled:08/15/11 10:40**	GP-9		10
Hexavalent Chromium (Sub)		08/16/11 10:40			
Containers Supplied:					
Sample ID: 1080439-11	**Solid**	**Sampled:08/15/11 10:50**	GP-10		11
Hexavalent Chromium (Sub)		08/16/11 10:50			
Containers Supplied:					
Sample ID: 1080439-12	**Solid**	**Sampled:08/15/11 11:05**	GP-11		12
Hexavalent Chromium (Sub)		08/16/11 11:05			
Containers Supplied:					

[signature]	8/18/11	Fed Ex	8/18/11
Released By	Date	Received By	Date
Fed Ex			
Released By	Date	Received By GCAL	Date
Released By	Date	Received By	Date
Released By	Date	Received By	Date

Access / 4565 / 21108190 4 / 8/25/11

SUBCONTRACT ORDER

Prism Laboratories, Inc.

1080439

Certification: NELAC___ USACE___
SC___ Other NC
N/A___

Analysis	Due	Expires	Laboratory ID	Comments
Sample ID: 1080439-13	**Solid**	**Sampled:08/15/11 11:15**	[redacted]	13
Hexavalent Chromium (Sub)		08/16/11 11:15		
Containers Supplied:				
Sample ID: 1080439-14	**Solid**	**Sampled:08/15/11 11:20**	[redacted]	14
Hexavalent Chromium (Sub)		08/16/11 11:20		
Containers Supplied:				
Sample ID: 1080439-15	**Solid**	**Sampled:08/15/11 11:30**	[redacted]	15
Hexavalent Chromium (Sub)		08/16/11 11:30		
Containers Supplied:				
Sample ID: 1080439-16	**Solid**	**Sampled:08/15/11 11:40**	[redacted]	16
Hexavalent Chromium (Sub)		08/16/11 11:40		
Containers Supplied:				
Sample ID: 1080439-17	**Solid**	**Sampled:08/15/11 12:00**	[redacted]	17
Hexavalent Chromium (Sub)		08/16/11 12:00		
Containers Supplied:				
Sample ID: 1080439-18	**Solid**	**Sampled:08/15/11 12:20**	[redacted]	18
Hexavalent Chromium (Sub)		08/16/11 12:20		
Containers Supplied:				
Sample ID: 1080439-19	**Solid**	**Sampled:08/15/11 12:35**	[redacted]	19
Hexavalent Chromium (Sub)		08/16/11 12:35		
Containers Supplied:				

Released By	Date	Received By	Date
[signature]	8/18/11	Fed Ex	8/18/11
Fed Ex			
Released By	Date	Received By GCAL	Date
Released By	Date	Received By	Date
Released By	Date	Received By	Date

Access / 4565 / 211081904 / 8/25/11

SUBCONTRACT ORDER

Prism Laboratories, Inc.

1080439

Certification: NELAC___ USACE___
SC___ Other N/C
N/A___

Analysis	Due	Expires	Laboratory ID	Comments
Sample ID: 1080439-20	Solid	Sampled:08/15/11 00:00	GP-19	20
Hexavalent Chromium (Sub)		08/16/11 00:00		
Containers Supplied:				
Sample ID: 1080439-21	Solid	Sampled:08/15/11 00:00	GP-20	21
Hexavalent Chromium (Sub)		08/16/11 00:00		
Containers Supplied:				
Sample ID: 1080439-22	Solid	Sampled:08/15/11 00:00	GP-21	22
Hexavalent Chromium (Sub)		08/16/11 00:00		
Containers Supplied:				
Sample ID: 1080439-23	Solid	Sampled:08/15/11 00:00	GP-22	23
Hexavalent Chromium (Sub)		08/16/11 00:00		
Containers Supplied:				
Sample ID: 1080439-24	Solid	Sampled:08/15/11 00:00	GP-23	24
Hexavalent Chromium (Sub)		08/16/11 00:00		
Containers Supplied:				
Sample ID: 1080439-25	Solid	Sampled:08/15/11 00:00	GP-24	25
Hexavalent Chromium (Sub)		08/16/11 00:00		
Containers Supplied:				
Sample ID: 1080439-26	Solid	Sampled:08/15/11 00:00	GP-25	26
Hexavalent Chromium (Sub)		08/16/11 00:00		
Containers Supplied:				

Released By	Date	Received By	Date
[signature]	8/18/11	Fed Ex	8/18/11
Fed Ex			
Released By	Date	Received By GCAL	Date
Released By	Date	Received By	Date
Released By	Date	Received By	Date

ACCESS / 4565 / 211081904 / 8/25/11

SUBCONTRACT ORDER

Prism Laboratories, Inc.

1080439

Certification: NELAC___ USACE___
SC___ Other _____
N/A____

Analysis	Due	Expires	Laboratory ID	Comments
Sample ID: 1080439-27	**Solid**	**Sampled:08/15/11 13:40**	[redacted]	27
Hexavalent Chromium (Sub)		08/16/11 13:40		
Containers Supplied:				
Sample ID: 1080439-28	**Solid**	**Sampled:08/15/11 13:50**	[redacted]	28
Hexavalent Chromium (Sub)		08/16/11 13:50		
Containers Supplied:				
Sample ID: 1080439-29	**Solid**	**Sampled:08/15/11 13:55**	[redacted]	29
Hexavalent Chromium (Sub)		08/16/11 13:55		
Containers Supplied:				
Sample ID: 1080439-30	**Solid**	**Sampled:08/15/11 14:10**	[redacted]	30
Hexavalent Chromium (Sub)		08/16/11 14:10		
Containers Supplied:				

Released By	Date	Received By	Date
[signature]	8/18/11	Fed Ex	8/18/11
Fed Ex			
		GCAL	

GCAL
GULF COAST ANALYTICAL LABORATORIES, INC

SAMPLE RECEIVING CHECKLIST

Workorder: 211081904

Client: 4565 - Access Analytical

Profile: 80251 - Prism Lab

Line Item: 2 - Solid

Received by: Carstens, Jennifer K.

Received Date/Time: 8/19/2011 8:55:00 AM

Samples Received via: FEDEX

Number of Coolers Received: 1

Cooler tracking numbers(s): 7974 2776 0184

Cooler temperature(s): 3.3

Were all coolers received at a temperature of 0 - 6° C?	☑ Yes	☐ No	☐ N/A
Were all custody seals intact?	☑ Yes	☐ No	☐ N/A
Were all samples received in proper containers?	☑ Yes	☐ No	☐ N/A
Were all samples properly preserved?	☑ Yes	☐ No	☐ N/A
Was preservative added to any container at the lab?	☐ Yes	☑ No	☐ N/A
Were all containers received in good condition?	☑ Yes	☐ No	☐ N/A
Were all VOA vials received with no head space?	☐ Yes	☐ No	☑ N/A
Do all sample labels match the Chain of Custody?	☑ Yes	☐ No	☐ N/A
Was the client notified about any discrepancies?	☐ Yes	☐ No	☑ N/A

Notes/Comments:

PRISM LABORATORIES, INC. | Full-Service Analytical & Environmental Solutions

NC Certification No. 402
SC Certification No. 99012
NC Drinking Water Cert No. 37735

Case Narrative

08/30/2011

ECS Carolinas - Greensboro
Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Lab Submittal Date: 08/18/2011
Prism Work Order: 1080517

This data package contains the analytical results for the project identified above and includes a Case Narrative, Sample Results and Chain of Custody. Unless otherwise noted, all samples were received in acceptable condition and processed according to the referenced methods.

Data qualifiers are flagged individually on each sample. A key reference for the data qualifiers appears at the end of this case narrative.

Narrative Notes:

Hexavalent Chromium analysis was subcontracted to GCAL. Laboratory report is attached.

Please call if you have any questions relating to this analytical report.

Respectfully,

PRISM LABORATORIES, INC.

VP Laboratory Services

Reviewed By

Data Qualifiers Key Reference:

D	RPD value outside of the control limits.
MC	Sample concentration too high for recovery evaluation.
MI	Matrix spike outside of the control limits. Matrix interference suspected.
BRL	Below Reporting Limit
MDL	Method Detection Limit
RPD	Relative Percent Difference
*	Results reported to the reporting limit. All other results are reported to the MDL with values between MDL and reporting limit indicated with a J.

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449 Springbrook Road - P.O. Box 240543 - Charlotte, NC 28224-0543
Phone: 704/529-6364 - Toll Free Number: 1-800/529-6364 - Fax: 704/525-0409

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Sample Receipt Summary

08/30/2011

Prism Work Order: 1080517

Client Sample ID	Lab Sample ID	Matrix	Date Sampled	Date Received
GP-26	1080517-01	Solid	08/16/11	08/18/11
GP-27B	1080517-02	Solid	08/16/11	08/18/11
GP-28	1080517-03	Solid	08/16/11	08/18/11
GP-29	1080517-04	Solid	08/16/11	08/18/11
GP-30	1080517-05	Solid	08/16/11	08/18/11
GP-31	1080517-06	Solid	08/16/11	08/18/11
GP-32	1080517-07	Solid	08/16/11	08/18/11
GP-33	1080517-08	Solid	08/16/11	08/18/11
GP-34	1080517-09	Solid	08/16/11	08/18/11
GP-35	1080517-10	Solid	08/16/11	08/18/11
GP-36	1080517-11	Solid	08/16/11	08/18/11
GP-37	1080517-12	Solid	08/16/11	08/18/11
GP-38	1080517-13	Solid	08/16/11	08/18/11
GP-39	1080517-14	Solid	08/16/11	08/18/11
GP-40	1080517-15	Solid	08/16/11	08/18/11
GP-41	1080517-16	Solid	08/16/11	08/18/11
GP-42	1080517-17	Solid	08/16/11	08/18/11
GP-53	1080517-18	Solid	08/16/11	08/18/11
GP-54	1080517-19	Solid	08/16/11	08/18/11
DISPOSAL-1	1080517-20	Solid	08/16/11	08/18/11

Samples received in good condition at 4.8 degrees C unless otherwise noted.

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PRISM LABORATORIES, INC. | Full-Service Analytical & Environmental Solutions

Laboratory Report

08/30/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: GP-26
Prism Sample ID: 1080517-01
Prism Work Order: 1080517
Time Collected: 08/16/11 09:05
Time Submitted: 08/18/11 15:15

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**84.2**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**8/19/11 14:00**	**JAB**	**P1H0435**
Total Metals									
Mercury	BRL	mg/kg dry	0.024	0.0029	1	*7471B	8/25/11 9:29	LTB	P1H0523
Antimony	BRL	mg/kg dry	0.24	0.043	1	*6010C	8/23/11 2:07	DWR	P1H0468
Arsenic	**0.67**	**mg/kg dry**	**0.60**	**0.067**	**1**	***6010C**	**8/23/11 2:07**	**DWR**	**P1H0468**
Beryllium	**0.54**	**mg/kg dry**	**0.30**	**0.051**	**1**	***6010C**	**8/23/11 2:07**	**DWR**	**P1H0468**
Cadmium	BRL	mg/kg dry	0.30	0.032	1	*6010C	8/23/11 2:07	DWR	P1H0468
Chromium	**39**	**mg/kg dry**	**0.30**	**0.041**	**1**	***6010C**	**8/23/11 2:07**	**DWR**	**P1H0468**
Copper	**83**	**mg/kg dry**	**0.60**	**0.26**	**1**	***6010C**	**8/23/11 2:07**	**DWR**	**P1H0468**
Lead	**0.58**	**mg/kg dry**	**0.30**	**0.074**	**1**	***6010C**	**8/23/11 2:07**	**DWR**	**P1H0468**
Nickel	**33**	**mg/kg dry**	**1.2**	**0.37**	**1**	***6010C**	**8/23/11 2:07**	**DWR**	**P1H0468**
Selenium	**3.2**	**mg/kg dry**	**0.60**	**0.12**	**1**	***6010C**	**8/23/11 2:07**	**DWR**	**P1H0468**
Silver	BRL	mg/kg dry	0.30	0.030	1	*6010C	8/23/11 2:07	DWR	P1H0468
Thallium	BRL	mg/kg dry	0.60	0.11	1	*6010C	8/23/11 2:07	DWR	P1H0468
Tin	BRL	mg/kg dry	6.0	0.53	1	*6010C	8/23/11 2:07	DWR	P1H0468
Zinc	**26**	**mg/kg dry**	**3.0**	**0.31**	**1**	***6010C**	**8/23/11 2:07**	**DWR**	**P1H0468**

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PRISM LABORATORIES, INC. | Full-Service Analytical & Environmental Solutions

Laboratory Report

08/30/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: GP-27B
Prism Sample ID: 1080517-02
Prism Work Order: 1080517
Time Collected: 08/16/11 09:15
Time Submitted: 08/18/11 15:15

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**81.5**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**8/19/11 14:00**	**JAB**	**P1H0435**
Total Metals									
Mercury	BRL	mg/kg dry	0.025	0.0030	1	*7471B	8/25/11 11:50	LTB	P1H0523
Antimony	BRL	mg/kg dry	0.24	0.044	1	*6010C	8/23/11 2:16	DWR	P1H0468
Arsenic	**0.71**	**mg/kg dry**	**0.60**	**0.068**	**1**	***6010C**	**8/23/11 2:16**	**DWR**	**P1H0468**
Beryllium	**0.50**	**mg/kg dry**	**0.30**	**0.051**	**1**	***6010C**	**8/23/11 2:16**	**DWR**	**P1H0468**
Cadmium	**3.7**	**mg/kg dry**	**0.30**	**0.032**	**1**	***6010C**	**8/23/11 2:16**	**DWR**	**P1H0468**
Chromium	**40**	**mg/kg dry**	**0.30**	**0.041**	**1**	***6010C**	**8/23/11 2:16**	**DWR**	**P1H0468**
Copper	**60**	**mg/kg dry**	**0.60**	**0.26**	**1**	***6010C**	**8/23/11 2:16**	**DWR**	**P1H0468**
Lead	**0.78**	**mg/kg dry**	**0.30**	**0.074**	**1**	***6010C**	**8/23/11 2:16**	**DWR**	**P1H0468**
Nickel	**51**	**mg/kg dry**	**1.2**	**0.37**	**1**	***6010C**	**8/23/11 2:16**	**DWR**	**P1H0468**
Selenium	**3.5**	**mg/kg dry**	**0.60**	**0.12**	**1**	***6010C**	**8/23/11 2:16**	**DWR**	**P1H0468**
Silver	BRL	mg/kg dry	0.30	0.031	1	*6010C	8/23/11 2:16	DWR	P1H0468
Thallium	BRL	mg/kg dry	0.60	0.12	1	*6010C	8/23/11 2:16	DWR	P1H0468
Tin	BRL	mg/kg dry	6.0	0.53	1	*6010C	8/23/11 2:16	DWR	P1H0468
Zinc	**40**	**mg/kg dry**	**3.0**	**0.31**	**1**	***6010C**	**8/23/11 2:16**	**DWR**	**P1H0468**

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Laboratory Report

08/30/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: GP-28
Prism Sample ID: 1080517-03
Prism Work Order: 1080517
Time Collected: 08/16/11 09:20
Time Submitted: 08/18/11 15:15

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**81.2**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**8/19/11 14:00**	**JAB**	**P1H0435**
Total Metals									
Mercury	BRL	mg/kg dry	0.023	0.0028	1	*7471B	8/25/11 11:55	LTB	P1H0523
Antimony	BRL	mg/kg dry	0.25	0.045	1	*6010C	8/23/11 2:26	DWR	P1H0468
Arsenic	**18**	**mg/kg dry**	**0.62**	**0.070**	**1**	***6010C**	**8/23/11 2:26**	**DWR**	**P1H0468**
Beryllium	**0.36**	**mg/kg dry**	**0.31**	**0.052**	**1**	***6010C**	**8/23/11 2:26**	**DWR**	**P1H0468**
Cadmium	**24**	**mg/kg dry**	**0.31**	**0.033**	**1**	***6010C**	**8/23/11 2:26**	**DWR**	**P1H0468**
Chromium	**5200**	**mg/kg dry**	**31**	**4.2**	**100**	***6010C**	**8/24/11 17:49**	**DWR**	**P1H0468**
Copper	**97**	**mg/kg dry**	**0.62**	**0.27**	**1**	***6010C**	**8/23/11 2:26**	**DWR**	**P1H0468**
Lead	**140**	**mg/kg dry**	**0.31**	**0.076**	**1**	***6010C**	**8/23/11 2:26**	**DWR**	**P1H0468**
Nickel	**140**	**mg/kg dry**	**1.2**	**0.38**	**1**	***6010C**	**8/23/11 2:26**	**DWR**	**P1H0468**
Selenium	**8.7**	**mg/kg dry**	**0.62**	**0.12**	**1**	***6010C**	**8/23/11 2:26**	**DWR**	**P1H0468**
Silver	**2.0**	**mg/kg dry**	**0.31**	**0.031**	**1**	***6010C**	**8/23/11 2:26**	**DWR**	**P1H0468**
Thallium	**1.0**	**mg/kg dry**	**0.62**	**0.12**	**1**	***6010C**	**8/23/11 2:26**	**DWR**	**P1H0468**
Tin	BRL	mg/kg dry	6.2	0.55	1	*6010C	8/23/11 2:26	DWR	P1H0468
Zinc	**150**	**mg/kg dry**	**3.1**	**0.32**	**1**	***6010C**	**8/23/11 2:26**	**DWR**	**P1H0468**

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08/30/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: GP-29
Prism Sample ID: 1080517-04
Prism Work Order: 1080517
Time Collected: 08/16/11 09:28
Time Submitted: 08/18/11 15:15

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**71.0**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**8/19/11 14:00**	**JAB**	**P1H0435**
Total Metals									
Mercury	BRL	mg/kg dry	0.028	0.0033	1	*7471B	8/25/11 11:59	LTB	P1H0523
Antimony	BRL	mg/kg dry	0.28	0.051	1	*6010C	8/23/11 2:35	DWR	P1H0468
Arsenic	**1.5**	**mg/kg dry**	**0.71**	**0.080**	**1**	***6010C**	**8/23/11 2:35**	**DWR**	**P1H0468**
Beryllium	**1.1**	**mg/kg dry**	**0.35**	**0.060**	**1**	***6010C**	**8/23/11 2:35**	**DWR**	**P1H0468**
Cadmium	**11**	**mg/kg dry**	**0.35**	**0.038**	**1**	***6010C**	**8/23/11 2:35**	**DWR**	**P1H0468**
Chromium	**87**	**mg/kg dry**	**0.35**	**0.049**	**1**	***6010C**	**8/23/11 2:35**	**DWR**	**P1H0468**
Copper	**65**	**mg/kg dry**	**0.71**	**0.31**	**1**	***6010C**	**8/23/11 2:35**	**DWR**	**P1H0468**
Lead	**1.5**	**mg/kg dry**	**0.35**	**0.087**	**1**	***6010C**	**8/23/11 2:35**	**DWR**	**P1H0468**
Nickel	**84**	**mg/kg dry**	**1.4**	**0.43**	**1**	***6010C**	**8/23/11 2:35**	**DWR**	**P1H0468**
Selenium	**7.1**	**mg/kg dry**	**0.71**	**0.14**	**1**	***6010C**	**8/23/11 2:35**	**DWR**	**P1H0468**
Silver	BRL	mg/kg dry	0.35	0.036	1	*6010C	8/23/11 2:35	DWR	P1H0468
Thallium	**1.1**	**mg/kg dry**	**0.71**	**0.14**	**1**	***6010C**	**8/23/11 2:35**	**DWR**	**P1H0468**
Tin	BRL	mg/kg dry	7.1	0.63	1	*6010C	8/23/11 2:35	DWR	P1H0468
Zinc	**120**	**mg/kg dry**	**3.5**	**0.36**	**1**	***6010C**	**8/23/11 2:35**	**DWR**	**P1H0468**

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08/30/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: GP-30
Prism Sample ID: 1080517-05
Prism Work Order: 1080517
Time Collected: 08/16/11 09:38
Time Submitted: 08/18/11 15:15

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**83.8**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**8/19/11 14:00**	**JAB**	**P1H0435**
Total Metals									
Mercury	BRL	mg/kg dry	0.025	0.0030	1	*7471B	8/25/11 12:04	LTB	P1H0523
Antimony	BRL	mg/kg dry	0.24	0.043	1	*6010C	8/23/11 2:44	DWR	P1H0468
Arsenic	BRL	mg/kg dry	0.60	0.068	1	*6010C	8/23/11 2:44	DWR	P1H0468
Beryllium	**0.55**	**mg/kg dry**	**0.30**	**0.051**	**1**	***6010C**	**8/23/11 2:44**	**DWR**	**P1H0468**
Cadmium	**2.6**	**mg/kg dry**	**0.30**	**0.032**	**1**	***6010C**	**8/23/11 2:44**	**DWR**	**P1H0468**
Chromium	**44**	**mg/kg dry**	**0.30**	**0.041**	**1**	***6010C**	**8/23/11 2:44**	**DWR**	**P1H0468**
Copper	**92**	**mg/kg dry**	**0.60**	**0.26**	**1**	***6010C**	**8/23/11 2:44**	**DWR**	**P1H0468**
Lead	**0.31**	**mg/kg dry**	**0.30**	**0.074**	**1**	***6010C**	**8/23/11 2:44**	**DWR**	**P1H0468**
Nickel	**46**	**mg/kg dry**	**1.2**	**0.37**	**1**	***6010C**	**8/23/11 2:44**	**DWR**	**P1H0468**
Selenium	**4.1**	**mg/kg dry**	**0.60**	**0.12**	**1**	***6010C**	**8/23/11 2:44**	**DWR**	**P1H0468**
Silver	BRL	mg/kg dry	0.30	0.031	1	*6010C	8/23/11 2:44	DWR	P1H0468
Thallium	BRL	mg/kg dry	0.60	0.12	1	*6010C	8/23/11 2:44	DWR	P1H0468
Tin	BRL	mg/kg dry	6.0	0.53	1	*6010C	8/23/11 2:44	DWR	P1H0468
Zinc	**39**	**mg/kg dry**	**3.0**	**0.31**	**1**	***6010C**	**8/23/11 2:44**	**DWR**	**P1H0468**

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ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: GP-31
Prism Sample ID: 1080517-06
Prism Work Order: 1080517
Time Collected: 08/16/11 09:55
Time Submitted: 08/18/11 15:15

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**82.6**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**8/19/11 14:00**	**JAB**	**P1H0435**
Total Metals									
Mercury	BRL	mg/kg dry	0.025	0.0031	1	*7471B	8/25/11 12:08	LTB	P1H0523
Antimony	BRL	mg/kg dry	0.24	0.044	1	*6010C	8/24/11 20:08	DWR	P1H0493
Arsenic	**0.81**	**mg/kg dry**	**0.60**	**0.068**	**1**	***6010C**	**8/24/11 20:08**	**DWR**	**P1H0493**
Beryllium	**0.89**	**mg/kg dry**	**0.30**	**0.051**	**1**	***6010C**	**8/24/11 20:08**	**DWR**	**P1H0493**
Cadmium	BRL	mg/kg dry	0.30	0.032	1	*6010C	8/24/11 20:08	DWR	P1H0493
Chromium	**68**	**mg/kg dry**	**0.30**	**0.041**	**1**	***6010C**	**8/24/11 20:08**	**DWR**	**P1H0493**
Copper	**72**	**mg/kg dry**	**0.60**	**0.26**	**1**	***6010C**	**8/24/11 20:08**	**DWR**	**P1H0493**
Lead	**1.7**	**mg/kg dry**	**0.30**	**0.074**	**1**	***6010C**	**8/24/11 20:08**	**DWR**	**P1H0493**
Nickel	**41**	**mg/kg dry**	**1.2**	**0.37**	**1**	***6010C**	**8/24/11 20:08**	**DWR**	**P1H0493**
Selenium	**0.84**	**mg/kg dry**	**0.60**	**0.12**	**1**	***6010C**	**8/24/11 20:08**	**DWR**	**P1H0493**
Silver	BRL	mg/kg dry	0.30	0.031	1	*6010C	8/24/11 20:08	DWR	P1H0493
Thallium	**1.7**	**mg/kg dry**	**0.60**	**0.12**	**1**	***6010C**	**8/24/11 20:08**	**DWR**	**P1H0493**
Tin	BRL	mg/kg dry	6.0	0.53	1	*6010C	8/24/11 20:08	DWR	P1H0493
Zinc	**100**	**mg/kg dry**	**3.0**	**0.31**	**1**	***6010C**	**8/24/11 20:08**	**DWR**	**P1H0493**

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Laboratory Report

08/30/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: GP-32
Prism Sample ID: 1080517-07
Prism Work Order: 1080517
Time Collected: 08/16/11 10:05
Time Submitted: 08/18/11 15:15

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**88.0**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**8/19/11 14:00**	**JAB**	**P1H0435**
Total Metals									
Mercury	BRL	mg/kg dry	0.024	0.0029	1	*7471B	8/25/11 12:13	LTB	P1H0523
Antimony	BRL	mg/kg dry	0.22	0.041	1	*6010C	8/24/11 20:53	DWR	P1H0493
Arsenic	BRL	mg/kg dry	0.56	0.063	1	*6010C	8/24/11 20:53	DWR	P1H0493
Beryllium	**0.45**	**mg/kg dry**	**0.28**	**0.047**	**1**	***6010C**	**8/24/11 20:53**	**DWR**	**P1H0493**
Cadmium	BRL	mg/kg dry	0.28	0.030	1	*6010C	8/24/11 20:53	DWR	P1H0493
Chromium	**36**	**mg/kg dry**	**0.28**	**0.039**	**1**	***6010C**	**8/24/11 20:53**	**DWR**	**P1H0493**
Copper	**38**	**mg/kg dry**	**0.56**	**0.24**	**1**	***6010C**	**8/24/11 20:53**	**DWR**	**P1H0493**
Lead	**0.75**	**mg/kg dry**	**0.28**	**0.069**	**1**	***6010C**	**8/24/11 20:53**	**DWR**	**P1H0493**
Nickel	**19**	**mg/kg dry**	**1.1**	**0.34**	**1**	***6010C**	**8/24/11 20:53**	**DWR**	**P1H0493**
Selenium	**0.99**	**mg/kg dry**	**0.56**	**0.11**	**1**	***6010C**	**8/24/11 20:53**	**DWR**	**P1H0493**
Silver	BRL	mg/kg dry	0.28	0.029	1	*6010C	8/24/11 20:53	DWR	P1H0493
Thallium	**0.86**	**mg/kg dry**	**0.56**	**0.11**	**1**	***6010C**	**8/24/11 20:53**	**DWR**	**P1H0493**
Tin	BRL	mg/kg dry	5.6	0.50	1	*6010C	8/24/11 20:53	DWR	P1H0493
Zinc	**23**	**mg/kg dry**	**2.8**	**0.29**	**1**	***6010C**	**8/24/11 20:53**	**DWR**	**P1H0493**

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08/30/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: GP-33
Prism Sample ID: 1080517-08
Prism Work Order: 1080517
Time Collected: 08/16/11 10:15
Time Submitted: 08/18/11 15:15

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**84.8**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**8/19/11 14:00**	**JAB**	**P1H0435**
Total Metals									
Mercury	BRL	mg/kg dry	0.024	0.0028	1	*7471B	8/25/11 12:18	LTB	P1H0523
Antimony	BRL	mg/kg dry	0.24	0.043	1	*6010C	8/24/11 21:03	DWR	P1H0493
Arsenic	BRL	mg/kg dry	0.60	0.067	1	*6010C	8/24/11 21:03	DWR	P1H0493
Beryllium	**0.61**	**mg/kg dry**	**0.30**	**0.051**	**1**	***6010C**	**8/24/11 21:03**	**DWR**	**P1H0493**
Cadmium	**4.9**	**mg/kg dry**	**0.30**	**0.032**	**1**	***6010C**	**8/24/11 21:03**	**DWR**	**P1H0493**
Chromium	**46**	**mg/kg dry**	**0.30**	**0.041**	**1**	***6010C**	**8/24/11 21:03**	**DWR**	**P1H0493**
Copper	**86**	**mg/kg dry**	**0.60**	**0.26**	**1**	***6010C**	**8/24/11 21:03**	**DWR**	**P1H0493**
Lead	**1.1**	**mg/kg dry**	**0.30**	**0.073**	**1**	***6010C**	**8/24/11 21:03**	**DWR**	**P1H0493**
Nickel	**29**	**mg/kg dry**	**1.2**	**0.37**	**1**	***6010C**	**8/24/11 21:03**	**DWR**	**P1H0493**
Selenium	**1.4**	**mg/kg dry**	**0.60**	**0.12**	**1**	***6010C**	**8/24/11 21:03**	**DWR**	**P1H0493**
Silver	BRL	mg/kg dry	0.30	0.030	1	*6010C	8/24/11 21:03	DWR	P1H0493
Thallium	BRL	mg/kg dry	0.60	0.11	1	*6010C	8/24/11 21:03	DWR	P1H0493
Tin	BRL	mg/kg dry	6.0	0.53	1	*6010C	8/24/11 21:03	DWR	P1H0493
Zinc	**44**	**mg/kg dry**	**3.0**	**0.30**	**1**	***6010C**	**8/24/11 21:03**	**DWR**	**P1H0493**

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Laboratory Report

08/30/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: GP-34
Prism Sample ID: 1080517-09
Prism Work Order: 1080517
Time Collected: 08/16/11 10:22
Time Submitted: 08/18/11 15:15

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**80.5**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**8/19/11 14:00**	**JAB**	**P1H0435**
Total Metals									
Mercury	BRL	mg/kg dry	0.025	0.0030	1	*7471B	8/25/11 12:22	LTB	P1H0523
Antimony	BRL	mg/kg dry	0.25	0.045	1	*6010C	8/24/11 21:11	DWR	P1H0493
Arsenic	BRL	mg/kg dry	0.62	0.071	1	*6010C	8/24/11 21:11	DWR	P1H0493
Beryllium	**0.40**	**mg/kg dry**	**0.31**	**0.053**	**1**	***6010C**	**8/24/11 21:11**	**DWR**	**P1H0493**
Cadmium	**9.9**	**mg/kg dry**	**0.31**	**0.033**	**1**	***6010C**	**8/24/11 21:11**	**DWR**	**P1H0493**
Chromium	**110**	**mg/kg dry**	**0.31**	**0.043**	**1**	***6010C**	**8/24/11 21:11**	**DWR**	**P1H0493**
Copper	**53**	**mg/kg dry**	**0.62**	**0.27**	**1**	***6010C**	**8/24/11 21:11**	**DWR**	**P1H0493**
Lead	**2.2**	**mg/kg dry**	**0.31**	**0.077**	**1**	***6010C**	**8/24/11 21:11**	**DWR**	**P1H0493**
Nickel	**84**	**mg/kg dry**	**1.2**	**0.38**	**1**	***6010C**	**8/24/11 21:11**	**DWR**	**P1H0493**
Selenium	**1.9**	**mg/kg dry**	**0.62**	**0.13**	**1**	***6010C**	**8/24/11 21:11**	**DWR**	**P1H0493**
Silver	BRL	mg/kg dry	0.31	0.032	1	*6010C	8/24/11 21:11	DWR	P1H0493
Thallium	**0.68**	**mg/kg dry**	**0.62**	**0.12**	**1**	***6010C**	**8/24/11 21:11**	**DWR**	**P1H0493**
Tin	BRL	mg/kg dry	6.2	0.55	1	*6010C	8/24/11 21:11	DWR	P1H0493
Zinc	**93**	**mg/kg dry**	**3.1**	**0.32**	**1**	***6010C**	**8/24/11 21:11**	**DWR**	**P1H0493**

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Laboratory Report

08/30/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: GP-35
Prism Sample ID: 1080517-10
Prism Work Order: 1080517
Time Collected: 08/16/11 10:35
Time Submitted: 08/18/11 15:15

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**82.5**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**8/19/11 14:00**	**JAB**	**P1H0435**
Total Metals									
Mercury	BRL	mg/kg dry	0.024	0.0029	1	*7471B	8/25/11 12:27	LTB	P1H0523
Antimony	BRL	mg/kg dry	0.24	0.044	1	*6010C	8/24/11 21:30	DWR	P1H0493
Arsenic	BRL	mg/kg dry	0.61	0.069	1	*6010C	8/24/11 21:30	DWR	P1H0493
Beryllium	**0.41**	**mg/kg dry**	**0.31**	**0.052**	**1**	***6010C**	**8/24/11 21:30**	**DWR**	**P1H0493**
Cadmium	BRL	mg/kg dry	0.31	0.032	1	*6010C	8/24/11 21:30	DWR	P1H0493
Chromium	**36**	**mg/kg dry**	**0.31**	**0.042**	**1**	***6010C**	**8/24/11 21:30**	**DWR**	**P1H0493**
Copper	**45**	**mg/kg dry**	**0.61**	**0.26**	**1**	***6010C**	**8/24/11 21:30**	**DWR**	**P1H0493**
Lead	**0.96**	**mg/kg dry**	**0.31**	**0.076**	**1**	***6010C**	**8/24/11 21:30**	**DWR**	**P1H0493**
Nickel	**31**	**mg/kg dry**	**1.2**	**0.38**	**1**	***6010C**	**8/24/11 21:30**	**DWR**	**P1H0493**
Selenium	**1.4**	**mg/kg dry**	**0.61**	**0.12**	**1**	***6010C**	**8/24/11 21:30**	**DWR**	**P1H0493**
Silver	BRL	mg/kg dry	0.31	0.031	1	*6010C	8/24/11 21:30	DWR	P1H0493
Thallium	BRL	mg/kg dry	0.61	0.12	1	*6010C	8/24/11 21:30	DWR	P1H0493
Tin	BRL	mg/kg dry	6.1	0.54	1	*6010C	8/24/11 21:30	DWR	P1H0493
Zinc	**40**	**mg/kg dry**	**3.1**	**0.31**	**1**	***6010C**	**8/24/11 21:30**	**DWR**	**P1H0493**

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08/30/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: GP-36
Prism Sample ID: 1080517-11
Prism Work Order: 1080517
Time Collected: 08/16/11 10:42
Time Submitted: 08/18/11 15:15

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**85.8**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**8/19/11 14:00**	**JAB**	**P1H0435**
Total Metals									
Mercury	BRL	mg/kg dry	0.022	0.0027	1	*7471B	8/25/11 12:31	LTB	P1H0523
Antimony	BRL	mg/kg dry	0.24	0.043	1	*6010C	8/24/11 21:39	DWR	P1H0493
Arsenic	BRL	mg/kg dry	0.59	0.067	1	*6010C	8/24/11 21:39	DWR	P1H0493
Beryllium	**0.51**	**mg/kg dry**	**0.30**	**0.050**	**1**	***6010C**	**8/24/11 21:39**	**DWR**	**P1H0493**
Cadmium	BRL	mg/kg dry	0.30	0.032	1	*6010C	8/24/11 21:39	DWR	P1H0493
Chromium	**5.9**	**mg/kg dry**	**0.30**	**0.041**	**1**	***6010C**	**8/24/11 21:39**	**DWR**	**P1H0493**
Copper	**64**	**mg/kg dry**	**0.59**	**0.26**	**1**	***6010C**	**8/24/11 21:39**	**DWR**	**P1H0493**
Lead	**0.78**	**mg/kg dry**	**0.30**	**0.073**	**1**	***6010C**	**8/24/11 21:39**	**DWR**	**P1H0493**
Nickel	**7.8**	**mg/kg dry**	**1.2**	**0.37**	**1**	***6010C**	**8/24/11 21:39**	**DWR**	**P1H0493**
Selenium	**1.5**	**mg/kg dry**	**0.59**	**0.12**	**1**	***6010C**	**8/24/11 21:39**	**DWR**	**P1H0493**
Silver	BRL	mg/kg dry	0.30	0.030	1	*6010C	8/24/11 21:39	DWR	P1H0493
Thallium	BRL	mg/kg dry	0.59	0.11	1	*6010C	8/24/11 21:39	DWR	P1H0493
Tin	BRL	mg/kg dry	5.9	0.53	1	*6010C	8/24/11 21:39	DWR	P1H0493
Zinc	**31**	**mg/kg dry**	**3.0**	**0.30**	**1**	***6010C**	**8/24/11 21:39**	**DWR**	**P1H0493**

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08/30/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: GP-37
Prism Sample ID: 1080517-12
Prism Work Order: 1080517
Time Collected: 08/16/11 10:50
Time Submitted: 08/18/11 15:15

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**82.2**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**8/19/11 14:00**	**JAB**	**P1H0435**
Total Metals									
Mercury	BRL	mg/kg dry	0.026	0.0031	1	*7471B	8/25/11 12:45	LTB	P1H0523
Antimony	BRL	mg/kg dry	0.24	0.044	1	*6010C	8/24/11 21:48	DWR	P1H0493
Arsenic	**0.68**	**mg/kg dry**	**0.61**	**0.069**	**1**	***6010C**	**8/24/11 21:48**	**DWR**	**P1H0493**
Beryllium	**0.60**	**mg/kg dry**	**0.30**	**0.052**	**1**	***6010C**	**8/24/11 21:48**	**DWR**	**P1H0493**
Cadmium	BRL	mg/kg dry	0.30	0.032	1	*6010C	8/24/11 21:48	DWR	P1H0493
Chromium	**13**	**mg/kg dry**	**0.30**	**0.042**	**1**	***6010C**	**8/24/11 21:48**	**DWR**	**P1H0493**
Copper	**50**	**mg/kg dry**	**0.61**	**0.26**	**1**	***6010C**	**8/24/11 21:48**	**DWR**	**P1H0493**
Lead	**1.4**	**mg/kg dry**	**0.30**	**0.075**	**1**	***6010C**	**8/24/11 21:48**	**DWR**	**P1H0493**
Nickel	**6.5**	**mg/kg dry**	**1.2**	**0.37**	**1**	***6010C**	**8/24/11 21:48**	**DWR**	**P1H0493**
Selenium	**1.3**	**mg/kg dry**	**0.61**	**0.12**	**1**	***6010C**	**8/24/11 21:48**	**DWR**	**P1H0493**
Silver	BRL	mg/kg dry	0.30	0.031	1	*6010C	8/24/11 21:48	DWR	P1H0493
Thallium	**0.64**	**mg/kg dry**	**0.61**	**0.12**	**1**	***6010C**	**8/24/11 21:48**	**DWR**	**P1H0493**
Tin	BRL	mg/kg dry	6.1	0.54	1	*6010C	8/24/11 21:48	DWR	P1H0493
Zinc	**70**	**mg/kg dry**	**3.0**	**0.31**	**1**	***6010C**	**8/24/11 21:48**	**DWR**	**P1H0493**

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08/30/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: GP-38
Prism Sample ID: 1080517-13
Prism Work Order: 1080517
Time Collected: 08/16/11 11:00
Time Submitted: 08/18/11 15:15

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**86.1**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**8/19/11 14:00**	**JAB**	**P1H0435**
Total Metals									
Mercury	BRL	mg/kg dry	0.024	0.0028	1	*7471B	8/25/11 12:50	LTB	P1H0523
Antimony	BRL	mg/kg dry	0.23	0.042	1	*6010C	8/24/11 21:57	DWR	P1H0493
Arsenic	BRL	mg/kg dry	0.59	0.066	1	*6010C	8/24/11 21:57	DWR	P1H0493
Beryllium	**0.51**	**mg/kg dry**	**0.29**	**0.050**	**1**	***6010C**	**8/24/11 21:57**	**DWR**	**P1H0493**
Cadmium	BRL	mg/kg dry	0.29	0.031	1	*6010C	8/24/11 21:57	DWR	P1H0493
Chromium	**30**	**mg/kg dry**	**0.29**	**0.040**	**1**	***6010C**	**8/24/11 21:57**	**DWR**	**P1H0493**
Copper	**61**	**mg/kg dry**	**0.59**	**0.25**	**1**	***6010C**	**8/24/11 21:57**	**DWR**	**P1H0493**
Lead	**0.78**	**mg/kg dry**	**0.29**	**0.072**	**1**	***6010C**	**8/24/11 21:57**	**DWR**	**P1H0493**
Nickel	**26**	**mg/kg dry**	**1.2**	**0.36**	**1**	***6010C**	**8/24/11 21:57**	**DWR**	**P1H0493**
Selenium	**0.94**	**mg/kg dry**	**0.59**	**0.12**	**1**	***6010C**	**8/24/11 21:57**	**DWR**	**P1H0493**
Silver	BRL	mg/kg dry	0.29	0.030	1	*6010C	8/24/11 21:57	DWR	P1H0493
Thallium	**0.77**	**mg/kg dry**	**0.59**	**0.11**	**1**	***6010C**	**8/24/11 21:57**	**DWR**	**P1H0493**
Tin	BRL	mg/kg dry	5.9	0.52	1	*6010C	8/24/11 21:57	DWR	P1H0493
Zinc	**34**	**mg/kg dry**	**2.9**	**0.30**	**1**	***6010C**	**8/24/11 21:57**	**DWR**	**P1H0493**

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08/30/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: GP-39
Prism Sample ID: 1080517-14
Prism Work Order: 1080517
Time Collected: 08/16/11 11:20
Time Submitted: 08/18/11 15:15

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**83.4**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**8/19/11 14:00**	**JAB**	**P1H0435**
Total Metals									
Mercury	BRL	mg/kg dry	0.024	0.0028	1	*7471B	8/25/11 12:54	LTB	P1H0523
Antimony	BRL	mg/kg dry	0.24	0.043	1	*6010C	8/24/11 22:05	DWR	P1H0493
Arsenic	BRL	mg/kg dry	0.59	0.067	1	*6010C	8/24/11 22:05	DWR	P1H0493
Beryllium	**0.47**	**mg/kg dry**	**0.30**	**0.050**	**1**	***6010C**	**8/24/11 22:05**	**DWR**	**P1H0493**
Cadmium	**3.2**	**mg/kg dry**	**0.30**	**0.031**	**1**	***6010C**	**8/24/11 22:05**	**DWR**	**P1H0493**
Chromium	**37**	**mg/kg dry**	**0.30**	**0.041**	**1**	***6010C**	**8/24/11 22:05**	**DWR**	**P1H0493**
Copper	**68**	**mg/kg dry**	**0.59**	**0.26**	**1**	***6010C**	**8/24/11 22:05**	**DWR**	**P1H0493**
Lead	**1.2**	**mg/kg dry**	**0.30**	**0.073**	**1**	***6010C**	**8/24/11 22:05**	**DWR**	**P1H0493**
Nickel	**49**	**mg/kg dry**	**1.2**	**0.36**	**1**	***6010C**	**8/24/11 22:05**	**DWR**	**P1H0493**
Selenium	**1.3**	**mg/kg dry**	**0.59**	**0.12**	**1**	***6010C**	**8/24/11 22:05**	**DWR**	**P1H0493**
Silver	BRL	mg/kg dry	0.30	0.030	1	*6010C	8/24/11 22:05	DWR	P1H0493
Thallium	BRL	mg/kg dry	0.59	0.11	1	*6010C	8/24/11 22:05	DWR	P1H0493
Tin	BRL	mg/kg dry	5.9	0.53	1	*6010C	8/24/11 22:05	DWR	P1H0493
Zinc	**40**	**mg/kg dry**	**3.0**	**0.30**	**1**	***6010C**	**8/24/11 22:05**	**DWR**	**P1H0493**

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Laboratory Report

08/30/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: GP-40
Prism Sample ID: 1080517-15
Prism Work Order: 1080517
Time Collected: 08/16/11 11:10
Time Submitted: 08/18/11 15:15

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**86.4**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**8/19/11 14:00**	**JAB**	**P1H0435**
Total Metals									
Mercury	BRL	mg/kg dry	0.024	0.0028	1	*7471B	8/25/11 12:59	LTB	P1H0523
Antimony	BRL	mg/kg dry	0.23	0.041	1	*6010C	8/24/11 22:14	DWR	P1H0493
Arsenic	**0.74**	**mg/kg dry**	**0.57**	**0.065**	**1**	***6010C**	**8/24/11 22:14**	**DWR**	**P1H0493**
Beryllium	**0.50**	**mg/kg dry**	**0.29**	**0.049**	**1**	***6010C**	**8/24/11 22:14**	**DWR**	**P1H0493**
Cadmium	BRL	mg/kg dry	0.29	0.030	1	*6010C	8/24/11 22:14	DWR	P1H0493
Chromium	**3.9**	**mg/kg dry**	**0.29**	**0.039**	**1**	***6010C**	**8/24/11 22:14**	**DWR**	**P1H0493**
Copper	**42**	**mg/kg dry**	**0.57**	**0.25**	**1**	***6010C**	**8/24/11 22:14**	**DWR**	**P1H0493**
Lead	**0.65**	**mg/kg dry**	**0.29**	**0.071**	**1**	***6010C**	**8/24/11 22:14**	**DWR**	**P1H0493**
Nickel	**5.0**	**mg/kg dry**	**1.1**	**0.35**	**1**	***6010C**	**8/24/11 22:14**	**DWR**	**P1H0493**
Selenium	**7.2**	**mg/kg dry**	**0.57**	**0.12**	**1**	***6010C**	**8/24/11 22:14**	**DWR**	**P1H0493**
Silver	BRL	mg/kg dry	0.29	0.029	1	*6010C	8/24/11 22:14	DWR	P1H0493
Thallium	**1.7**	**mg/kg dry**	**0.57**	**0.11**	**1**	***6010C**	**8/24/11 22:14**	**DWR**	**P1H0493**
Tin	BRL	mg/kg dry	5.7	0.51	1	*6010C	8/24/11 22:14	DWR	P1H0493
Zinc	**20**	**mg/kg dry**	**2.9**	**0.29**	**1**	***6010C**	**8/24/11 22:14**	**DWR**	**P1H0493**

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08/30/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: GP-41
Prism Sample ID: 1080517-16
Prism Work Order: 1080517
Time Collected: 08/16/11 11:25
Time Submitted: 08/18/11 15:15

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**87.1**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**8/19/11 14:00**	**JAB**	**P1H0435**
Total Metals									
Mercury	BRL	mg/kg dry	0.023	0.0028	1	*7471B	8/25/11 13:04	LTB	P1H0523
Antimony	BRL	mg/kg dry	0.23	0.041	1	*6010C	8/24/11 22:23	DWR	P1H0493
Arsenic	BRL	mg/kg dry	0.57	0.064	1	*6010C	8/24/11 22:23	DWR	P1H0493
Beryllium	**0.40**	**mg/kg dry**	**0.28**	**0.048**	**1**	***6010C**	**8/24/11 22:23**	**DWR**	**P1H0493**
Cadmium	BRL	mg/kg dry	0.28	0.030	1	*6010C	8/24/11 22:23	DWR	P1H0493
Chromium	**20**	**mg/kg dry**	**0.28**	**0.039**	**1**	***6010C**	**8/24/11 22:23**	**DWR**	**P1H0493**
Copper	**48**	**mg/kg dry**	**0.57**	**0.24**	**1**	***6010C**	**8/24/11 22:23**	**DWR**	**P1H0493**
Lead	**0.67**	**mg/kg dry**	**0.28**	**0.070**	**1**	***6010C**	**8/24/11 22:23**	**DWR**	**P1H0493**
Nickel	**7.6**	**mg/kg dry**	**1.1**	**0.35**	**1**	***6010C**	**8/24/11 22:23**	**DWR**	**P1H0493**
Selenium	**1.1**	**mg/kg dry**	**0.57**	**0.11**	**1**	***6010C**	**8/24/11 22:23**	**DWR**	**P1H0493**
Silver	BRL	mg/kg dry	0.28	0.029	1	*6010C	8/24/11 22:23	DWR	P1H0493
Thallium	BRL	mg/kg dry	0.57	0.11	1	*6010C	8/24/11 22:23	DWR	P1H0493
Tin	BRL	mg/kg dry	5.7	0.50	1	*6010C	8/24/11 22:23	DWR	P1H0493
Zinc	**30**	**mg/kg dry**	**2.8**	**0.29**	**1**	***6010C**	**8/24/11 22:23**	**DWR**	**P1H0493**

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PRISM LABORATORIES, INC. | Full-Service Analytical & Environmental Solutions

Laboratory Report

08/30/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: GP-42
Prism Sample ID: 1080517-17
Prism Work Order: 1080517
Time Collected: 08/16/11 09:45
Time Submitted: 08/18/11 15:15

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**83.3**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**8/19/11 14:00**	**JAB**	**P1H0435**
Total Metals									
Mercury	BRL	mg/kg dry	0.024	0.0029	1	*7471B	8/25/11 13:08	LTB	P1H0523
Antimony	BRL	mg/kg dry	0.24	0.044	1	*6010C	8/24/11 22:32	DWR	P1H0493
Arsenic	BRL	mg/kg dry	0.60	0.068	1	*6010C	8/24/11 22:32	DWR	P1H0493
Beryllium	**0.53**	**mg/kg dry**	**0.30**	**0.051**	**1**	***6010C**	**8/24/11 22:32**	**DWR**	**P1H0493**
Cadmium	BRL	mg/kg dry	0.30	0.032	1	*6010C	8/24/11 22:32	DWR	P1H0493
Chromium	**46**	**mg/kg dry**	**0.30**	**0.042**	**1**	***6010C**	**8/24/11 22:32**	**DWR**	**P1H0493**
Copper	**75**	**mg/kg dry**	**0.60**	**0.26**	**1**	***6010C**	**8/24/11 22:32**	**DWR**	**P1H0493**
Lead	**0.88**	**mg/kg dry**	**0.30**	**0.074**	**1**	***6010C**	**8/24/11 22:32**	**DWR**	**P1H0493**
Nickel	**29**	**mg/kg dry**	**1.2**	**0.37**	**1**	***6010C**	**8/24/11 22:32**	**DWR**	**P1H0493**
Selenium	**1.7**	**mg/kg dry**	**0.60**	**0.12**	**1**	***6010C**	**8/24/11 22:32**	**DWR**	**P1H0493**
Silver	BRL	mg/kg dry	0.30	0.031	1	*6010C	8/24/11 22:32	DWR	P1H0493
Thallium	BRL	mg/kg dry	0.60	0.12	1	*6010C	8/24/11 22:32	DWR	P1H0493
Tin	BRL	mg/kg dry	6.0	0.54	1	*6010C	8/24/11 22:32	DWR	P1H0493
Zinc	**24**	**mg/kg dry**	**3.0**	**0.31**	**1**	***6010C**	**8/24/11 22:32**	**DWR**	**P1H0493**

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PRISM LABORATORIES, INC. | Full-Service Analytical & Environmental Solutions

Laboratory Report

08/30/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: GP-53
Prism Sample ID: 1080517-18
Prism Work Order: 1080517
Time Collected: 08/16/11 15:05
Time Submitted: 08/18/11 15:15

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**76.5**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**8/19/11 14:00**	**JAB**	**P1H0435**
Total Metals									
Mercury	BRL	mg/kg dry	0.029	0.0034	1	*7471B	8/29/11 12:00	LTB	P1H0564
Antimony	BRL	mg/kg dry	0.26	0.047	1	*6010C	8/24/11 22:41	DWR	P1H0493
Arsenic	**1.0**	**mg/kg dry**	**0.65**	**0.073**	**1**	***6010C**	**8/24/11 22:41**	**DWR**	**P1H0493**
Beryllium	**0.79**	**mg/kg dry**	**0.33**	**0.055**	**1**	***6010C**	**8/24/11 22:41**	**DWR**	**P1H0493**
Cadmium	BRL	mg/kg dry	0.33	0.034	1	*6010C	8/24/11 22:41	DWR	P1H0493
Chromium	**14**	**mg/kg dry**	**0.33**	**0.045**	**1**	***6010C**	**8/24/11 22:41**	**DWR**	**P1H0493**
Copper	**52**	**mg/kg dry**	**0.65**	**0.28**	**1**	***6010C**	**8/24/11 22:41**	**DWR**	**P1H0493**
Lead	**2.4**	**mg/kg dry**	**0.33**	**0.080**	**1**	***6010C**	**8/24/11 22:41**	**DWR**	**P1H0493**
Nickel	**17**	**mg/kg dry**	**1.3**	**0.40**	**1**	***6010C**	**8/24/11 22:41**	**DWR**	**P1H0493**
Selenium	**2.6**	**mg/kg dry**	**0.65**	**0.13**	**1**	***6010C**	**8/24/11 22:41**	**DWR**	**P1H0493**
Silver	BRL	mg/kg dry	0.33	0.033	1	*6010C	8/24/11 22:41	DWR	P1H0493
Thallium	BRL	mg/kg dry	0.65	0.13	1	*6010C	8/24/11 22:41	DWR	P1H0493
Tin	BRL	mg/kg dry	6.5	0.58	1	*6010C	8/24/11 22:41	DWR	P1H0493
Zinc	**39**	**mg/kg dry**	**3.3**	**0.33**	**1**	***6010C**	**8/24/11 22:41**	**DWR**	**P1H0493**

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PRISM LABORATORIES, INC. | Full-Service Analytical & Environmental Solutions

Laboratory Report

08/30/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: GP-54
Prism Sample ID: 1080517-19
Prism Work Order: 1080517
Time Collected: 08/16/11 15:25
Time Submitted: 08/18/11 15:15

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**76.4**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**8/19/11 14:00**	**JAB**	**P1H0435**
Total Metals									
Mercury	BRL	mg/kg dry	0.025	0.0030	1	*7471B	8/29/11 12:32	LTB	P1H0564
Antimony	BRL	mg/kg dry	0.26	0.047	1	*6010C	8/24/11 22:50	DWR	P1H0493
Arsenic	**0.79**	**mg/kg dry**	**0.65**	**0.074**	**1**	***6010C**	**8/24/11 22:50**	**DWR**	**P1H0493**
Beryllium	**0.68**	**mg/kg dry**	**0.33**	**0.055**	**1**	***6010C**	**8/24/11 22:50**	**DWR**	**P1H0493**
Cadmium	BRL	mg/kg dry	0.33	0.035	1	*6010C	8/24/11 22:50	DWR	P1H0493
Chromium	**14**	**mg/kg dry**	**0.33**	**0.045**	**1**	***6010C**	**8/24/11 22:50**	**DWR**	**P1H0493**
Copper	**40**	**mg/kg dry**	**0.65**	**0.28**	**1**	***6010C**	**8/24/11 22:50**	**DWR**	**P1H0493**
Lead	**2.1**	**mg/kg dry**	**0.33**	**0.081**	**1**	***6010C**	**8/24/11 22:50**	**DWR**	**P1H0493**
Nickel	**14**	**mg/kg dry**	**1.3**	**0.40**	**1**	***6010C**	**8/24/11 22:50**	**DWR**	**P1H0493**
Selenium	**2.0**	**mg/kg dry**	**0.65**	**0.13**	**1**	***6010C**	**8/24/11 22:50**	**DWR**	**P1H0493**
Silver	BRL	mg/kg dry	0.33	0.033	1	*6010C	8/24/11 22:50	DWR	P1H0493
Thallium	BRL	mg/kg dry	0.65	0.13	1	*6010C	8/24/11 22:50	DWR	P1H0493
Tin	BRL	mg/kg dry	6.5	0.58	1	*6010C	8/24/11 22:50	DWR	P1H0493
Zinc	**39**	**mg/kg dry**	**3.3**	**0.34**	**1**	***6010C**	**8/24/11 22:50**	**DWR**	**P1H0493**

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Laboratory Report

08/30/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: DISPOSAL-1
Prism Sample ID: 1080517-20
Prism Work Order: 1080517
Time Collected: 08/16/11 12:30
Time Submitted: 08/18/11 15:15

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
TCLP Extraction by EPA 1311									
TCLP Extraction	Complete	N/A			1	*1311	8/25/11 9:00	BGM	P1H0557
TCLP Metals									
Mercury	BRL	mg/L	0.010	0.000014	1	*7470A	8/26/11 16:12	LTB	P1H0572
Arsenic	BRL	mg/L	0.050	0.010	1	*6010C	8/26/11 15:40	DWR	P1H0558
Barium	BRL	mg/L	5.0	0.013	1	*6010C	8/26/11 15:40	DWR	P1H0558
Cadmium	BRL	mg/L	0.025	0.00043	1	*6010C	8/26/11 15:40	DWR	P1H0558
Chromium	BRL	mg/L	0.25	0.00085	1	*6010C	8/26/11 15:40	DWR	P1H0558
Lead	**2.7**	**mg/L**	**0.050**	**0.0038**	**1**	***6010C**	**8/26/11 15:40**	**DWR**	**P1H0558**
Selenium	BRL	mg/L	0.10	0.012	1	*6010C	8/26/11 15:40	DWR	P1H0558
Silver	BRL	mg/L	0.25	0.0017	1	*6010C	8/26/11 15:40	DWR	P1H0558

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ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Prism Work Order: 1080517
Time Submitted: 8/18/11 3:15:00PM

Total Metals - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch P1H0468 - 3050B										
Blank (P1H0468-BLK1)				Prepared & Analyzed: 08/22/11						
Antimony	BRL	0.20	mg/kg wet							
Arsenic	BRL	0.50	mg/kg wet							
Beryllium	BRL	0.25	mg/kg wet							
Cadmium	BRL	0.25	mg/kg wet							
Chromium	BRL	0.25	mg/kg wet							
Copper	BRL	0.50	mg/kg wet							
Lead	BRL	0.25	mg/kg wet							
Nickel	BRL	1.0	mg/kg wet							
Selenium	BRL	0.50	mg/kg wet							
Silver	BRL	0.25	mg/kg wet							
Thallium	BRL	0.50	mg/kg wet							
Tin	BRL	5.0	mg/kg wet							
Zinc	BRL	2.5	mg/kg wet							
LCS (P1H0468-BS1)				Prepared & Analyzed: 08/22/11						
Antimony	22.7	0.20	mg/kg wet	25.0		91	80-120			
Arsenic	22.7	0.50	mg/kg wet	25.0		91	80-120			
Beryllium	23.3	0.25	mg/kg wet	25.0		93	80-120			
Cadmium	22.2	0.25	mg/kg wet	25.0		89	80-120			
Chromium	23.2	0.25	mg/kg wet	25.0		93	80-120			
Copper	24.9	0.50	mg/kg wet	25.0		99	80-120			
Lead	23.6	0.25	mg/kg wet	25.0		95	80-120			
Nickel	23.1	1.0	mg/kg wet	25.0		92	80-120			
Selenium	23.1	0.50	mg/kg wet	25.0		93	80-120			
Silver	23.4	0.25	mg/kg wet	25.0		93	80-120			
Thallium	22.9	0.50	mg/kg wet	25.0		91	80-120			
Tin	23.3	5.0	mg/kg wet	25.0		93	80-120			
Zinc	23.3	2.5	mg/kg wet	25.0		93	80-120			

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ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Prism Work Order: 1080517
Time Submitted: 8/18/11 3:15:00PM

Total Metals - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch P1H0493 - 3050B										
Blank (P1H0493-BLK1)				Prepared: 08/23/11 Analyzed: 08/24/11						
Antimony	BRL	0.20	mg/kg wet							
Arsenic	BRL	0.50	mg/kg wet							
Beryllium	BRL	0.25	mg/kg wet							
Cadmium	BRL	0.25	mg/kg wet							
Chromium	BRL	0.25	mg/kg wet							
Copper	BRL	0.50	mg/kg wet							
Lead	BRL	0.25	mg/kg wet							
Nickel	BRL	1.0	mg/kg wet							
Selenium	BRL	0.50	mg/kg wet							
Silver	BRL	0.25	mg/kg wet							
Thallium	BRL	0.50	mg/kg wet							
Tin	BRL	5.0	mg/kg wet							
Zinc	BRL	2.5	mg/kg wet							
LCS (P1H0493-BS1)				Prepared: 08/23/11 Analyzed: 08/24/11						
Antimony	23.3	0.20	mg/kg wet	25.0		93	80-120			
Arsenic	23.4	0.50	mg/kg wet	25.0		94	80-120			
Beryllium	23.7	0.25	mg/kg wet	25.0		95	80-120			
Cadmium	23.1	0.25	mg/kg wet	25.0		92	80-120			
Chromium	24.5	0.25	mg/kg wet	25.0		98	80-120			
Copper	25.4	0.50	mg/kg wet	25.0		102	80-120			
Lead	23.8	0.25	mg/kg wet	25.0		95	80-120			
Nickel	23.7	1.0	mg/kg wet	25.0		95	80-120			
Selenium	23.3	0.50	mg/kg wet	25.0		93	80-120			
Silver	24.0	0.25	mg/kg wet	25.0		96	80-120			
Thallium	23.8	0.50	mg/kg wet	25.0		95	80-120			
Tin	24.6	5.0	mg/kg wet	25.0		98	80-120			
Zinc	23.4	2.5	mg/kg wet	25.0		94	80-120			

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ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Prism Work Order: 1080517
Time Submitted: 8/18/11 3:15:00PM

Total Metals - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch P1H0493 - 3050B										
Matrix Spike (P1H0493-MS1)		**Source: 1080517-06**		Prepared: 08/23/11	Analyzed: 08/24/11					
Antimony	3.55	0.24	mg/kg dry	30.4	BRL	12	75-125			MI
Arsenic	21.3	0.61	mg/kg dry	30.4	0.812	67	75-125			MI
Beryllium	22.2	0.30	mg/kg dry	30.4	0.892	70	75-125			MI
Cadmium	17.9	0.30	mg/kg dry	30.4	BRL	59	75-125			MI
Chromium	96.9	0.30	mg/kg dry	30.4	68.5	93	75-125			MC
Copper	80.0	0.61	mg/kg dry	30.4	71.6	28	75-125			MC
Lead	20.4	0.30	mg/kg dry	30.4	1.73	61	75-125			MI
Nickel	58.2	1.2	mg/kg dry	30.4	40.7	58	75-125			MC
Selenium	22.2	0.61	mg/kg dry	30.4	0.835	70	75-125			MI
Silver	24.8	0.30	mg/kg dry	30.4	BRL	82	75-125			
Thallium	20.6	0.61	mg/kg dry	30.4	1.71	62	75-125			MI
Tin	16.8	6.1	mg/kg dry	30.4	0.733	53	75-125			MI
Zinc	127	3.0	mg/kg dry	30.4	100	87	75-125			
Matrix Spike Dup (P1H0493-MSD1)		**Source: 1080517-06**		Prepared: 08/23/11	Analyzed: 08/24/11					
Antimony	3.57	0.24	mg/kg dry	30.0	BRL	12	75-125	0.5	20	MI
Arsenic	21.9	0.60	mg/kg dry	30.0	0.812	70	75-125	3	20	MI
Beryllium	22.5	0.30	mg/kg dry	30.0	0.892	72	75-125	1	20	MI
Cadmium	18.6	0.30	mg/kg dry	30.0	BRL	62	75-125	4	20	MI
Chromium	73.3	0.30	mg/kg dry	30.0	68.5	16	75-125	28	20	D, MC
Copper	93.1	0.60	mg/kg dry	30.0	71.6	72	75-125	15	20	MC
Lead	20.5	0.30	mg/kg dry	30.0	1.73	63	75-125	0.7	20	MI
Nickel	58.9	1.2	mg/kg dry	30.0	40.7	61	75-125	1	20	MC
Selenium	23.3	0.60	mg/kg dry	30.0	0.835	75	75-125	5	20	
Silver	24.9	0.30	mg/kg dry	30.0	BRL	83	75-125	0.1	20	
Thallium	20.6	0.60	mg/kg dry	30.0	1.71	63	75-125	0.03	20	MI
Tin	17.2	6.0	mg/kg dry	30.0	0.733	55	75-125	2	20	MI
Zinc	116	3.0	mg/kg dry	30.0	100	52	75-125	9	20	MC

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ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Prism Work Order: 1080517
Time Submitted: 8/18/11 3:15:00PM

Total Metals - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch P1H0493 - 3050B										
Post Spike (P1H0493-PS1)		**Source: 1080517-06**		Prepared: 08/23/11		Analyzed: 08/24/11				
Antimony	0.833		mg/L	1.00	-0.0250	86	80-120			
Arsenic	0.835		mg/L	1.00	0.0270	81	80-120			
Beryllium	0.835		mg/L	1.00	0.0296	81	80-120			
Cadmium	0.740		mg/L	1.00	-0.00633	75	80-120			MI
Chromium	2.04		mg/L	1.00	2.27	NR	80-120			MC
Copper	2.24		mg/L	1.00	2.38	NR	80-120			MI
Lead	0.782		mg/L	1.00	0.0576	72	80-120			MI
Nickel	1.40		mg/L	1.00	1.35	5	80-120			MI
Selenium	0.879		mg/L	1.00	0.0277	85	80-120			
Silver	0.897		mg/L	1.00	-0.0132	91	80-120			
Thallium	0.769		mg/L	1.00	0.0569	71	80-120			MI
Tin	0.805		mg/L	1.00	0.0243	78	80-120			MI
Zinc	1.61		mg/L	1.00	3.33	NR	80-120			MC
Batch P1H0523 - 7471B										
Blank (P1H0523-BLK1)				Prepared: 08/24/11		Analyzed: 08/25/11				
Mercury	BRL	0.020	mg/kg wet							
LCS (P1H0523-BS1)				Prepared: 08/24/11		Analyzed: 08/25/11				
Mercury	0.434	0.020	mg/kg wet	0.417		104	80-120			
Batch P1H0564 - 7471B										
Blank (P1H0564-BLK1)				Prepared & Analyzed: 08/29/11						
Mercury	BRL	0.019	mg/kg wet							

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449 Springbrook Road - P.O. Box 240543 - Charlotte, NC 28224-0543
Phone: 704/529-6364 - Toll Free Number: 1-800/529-6364 - Fax: 704/525-0409

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Prism Work Order: 1080517
Time Submitted: 8/18/11 3:15:00PM

Total Metals - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch P1H0564 - 7471B										
LCS (P1H0564-BS1)				Prepared & Analyzed: 08/29/11						
Mercury	0.440	0.020	mg/kg wet	0.417		106	80-120			
Matrix Spike (P1H0564-MS1)		**Source: 1080517-18**		Prepared & Analyzed: 08/29/11						
Mercury	0.666	0.029	mg/kg dry	0.594	0.0147	110	80-120			
Matrix Spike Dup (P1H0564-MSD1)		**Source: 1080517-18**		Prepared & Analyzed: 08/29/11						
Mercury	0.674	0.028	mg/kg dry	0.584	0.0147	113	80-120	1	20	

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ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Prism Work Order: 1080517
Time Submitted: 8/18/11 3:15:00PM

TCLP Metals - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch P1H0558 - 3010A										
Blank (P1H0558-BLK1)				Prepared: 08/25/11 Analyzed: 08/26/11						
Arsenic	BRL	0.050	mg/L							
Barium	BRL	5.0	mg/L							
Cadmium	BRL	0.025	mg/L							
Chromium	BRL	0.25	mg/L							
Lead	BRL	0.050	mg/L							
Selenium	BRL	0.10	mg/L							
Silver	BRL	0.25	mg/L							
LCS (P1H0558-BS1)				Prepared: 08/25/11 Analyzed: 08/26/11						
Arsenic	1.24	0.050	mg/L	1.25		99	80-120			
Barium	1.16	5.0	mg/L	1.25		93	80-120			
Cadmium	1.21	0.025	mg/L	1.25		97	80-120			
Chromium	1.17	0.25	mg/L	1.25		94	80-120			
Lead	1.21	0.050	mg/L	1.25		97	80-120			
Selenium	1.30	0.10	mg/L	1.25		104	80-120			
Silver	1.20	0.25	mg/L	1.25		96	80-120			
Batch P1H0572 - 7470A										
Blank (P1H0572-BLK1)				Prepared: 08/25/11 Analyzed: 08/26/11						
Mercury	BRL	0.010	mg/L							
LCS (P1H0572-BS1)				Prepared: 08/25/11 Analyzed: 08/26/11						
Mercury	0.00968	0.010	mg/L	0.00938		103	80-120			

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ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Prism Work Order: 1080517
Time Submitted: 8/18/11 3:15:00PM

General Chemistry Parameters - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch P1H0435 - NO PREP										
Blank (P1H0435-BLK1)				Prepared & Analyzed: 08/19/11						
% Solids	100	0.100	% by Weight							
Duplicate (P1H0435-DUP2)		**Source: 1080517-09**		Prepared & Analyzed: 08/19/11						
% Solids	86.1	0.100	% by Weight		80.5			7	20	
Duplicate (P1H0435-DUP3)		**Source: 1080517-19**		Prepared & Analyzed: 08/19/11						
% Solids	76.8	0.100	% by Weight		76.4			0.5	20	

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Sample Extraction Data

Prep Method: 1311

Lab Number	Batch	Initial	Final	Date/Time
1080517-20	P1H0557	100 g	2000 mL	08/24/11 15:00

Prep Method: 3010A

Lab Number	Batch	Initial	Final	Date/Time
1080517-20	P1H0558	10 mL	50 mL	08/25/11 11:00

Prep Method: 7470A

Lab Number	Batch	Initial	Final	Date/Time
1080517-20	P1H0572	20 mL	30 mL	08/25/11 14:00

Prep Method: 3050B

Lab Number	Batch	Initial	Final	Date/Time
1080517-01	P1H0468	1.99 g	50 mL	08/22/11 8:00
1080517-02	P1H0468	2.04 g	50 mL	08/22/11 8:00
1080517-03	P1H0468	2 g	50 mL	08/22/11 8:00
1080517-03	P1H0468	2 g	50 mL	08/22/11 8:00
1080517-04	P1H0468	1.99 g	50 mL	08/22/11 8:00
1080517-05	P1H0468	1.99 g	50 mL	08/22/11 8:00
1080517-06	P1H0493	2.01 g	50 mL	08/23/11 8:10
1080517-07	P1H0493	2.03 g	50 mL	08/23/11 8:10
1080517-08	P1H0493	1.98 g	50 mL	08/23/11 8:10
1080517-09	P1H0493	1.99 g	50 mL	08/23/11 8:10
1080517-10	P1H0493	1.98 g	50 mL	08/23/11 8:10
1080517-11	P1H0493	1.96 g	50 mL	08/23/11 8:10
1080517-12	P1H0493	2 g	50 mL	08/23/11 8:10
1080517-13	P1H0493	1.98 g	50 mL	08/23/11 8:10
1080517-14	P1H0493	2.02 g	50 mL	08/23/11 8:10
1080517-15	P1H0493	2.02 g	50 mL	08/23/11 8:10
1080517-16	P1H0493	2.03 g	50 mL	08/23/11 8:10
1080517-17	P1H0493	1.99 g	50 mL	08/23/11 8:10
1080517-18	P1H0493	2.01 g	50 mL	08/23/11 8:10
1080517-19	P1H0493	2 g	50 mL	08/23/11 8:10

Prep Method: 7471B

Lab Number	Batch	Initial	Final	Date/Time
1080517-01	P1H0523	0.6 g	50 mL	08/24/11 10:05
1080517-02	P1H0523	0.59 g	50 mL	08/24/11 10:05
1080517-03	P1H0523	0.63 g	50 mL	08/24/11 10:05
1080517-04	P1H0523	0.61 g	50 mL	08/24/11 10:05
1080517-05	P1H0523	0.57 g	50 mL	08/24/11 10:05
1080517-06	P1H0523	0.57 g	50 mL	08/24/11 10:05
1080517-07	P1H0523	0.57 g	50 mL	08/24/11 10:05
1080517-08	P1H0523	0.6 g	50 mL	08/24/11 10:05
1080517-09	P1H0523	0.59 g	50 mL	08/24/11 10:05
1080517-10	P1H0523	0.61 g	50 mL	08/24/11 10:05
1080517-11	P1H0523	0.63 g	50 mL	08/24/11 10:05
1080517-12	P1H0523	0.57 g	50 mL	08/24/11 10:05
1080517-13	P1H0523	0.59 g	50 mL	08/24/11 10:05
1080517-14	P1H0523	0.61 g	50 mL	08/24/11 10:05
1080517-15	P1H0523	0.59 g	50 mL	08/24/11 10:05
1080517-16	P1H0523	0.6 g	50 mL	08/24/11 10:05
1080517-17	P1H0523	0.6 g	50 mL	08/24/11 10:05
1080517-18	P1H0564	0.55 g	50 mL	08/29/11 8:50

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Sample Extraction Data

Prep Method: 7471B

Lab Number	Batch	Initial	Final	Date/Time
1080517-19	P1H0564	0.62 g	50 mL	08/29/11 8:50

Subcontracted Analyses

The following analyses were subcontracted to Gulf Coast Analytical Labs, Inc.

Lab Number	Analysis
1080517-01	Hexavalent Chromium (Sub)
1080517-02	Hexavalent Chromium (Sub)
1080517-03	Hexavalent Chromium (Sub)
1080517-04	Hexavalent Chromium (Sub)
1080517-05	Hexavalent Chromium (Sub)
1080517-06	Hexavalent Chromium (Sub)
1080517-07	Hexavalent Chromium (Sub)
1080517-08	Hexavalent Chromium (Sub)
1080517-09	Hexavalent Chromium (Sub)
1080517-10	Hexavalent Chromium (Sub)
1080517-11	Hexavalent Chromium (Sub)
1080517-12	Hexavalent Chromium (Sub)
1080517-13	Hexavalent Chromium (Sub)
1080517-14	Hexavalent Chromium (Sub)
1080517-15	Hexavalent Chromium (Sub)
1080517-16	Hexavalent Chromium (Sub)
1080517-17	Hexavalent Chromium (Sub)
1080517-18	Hexavalent Chromium (Sub)
1080517-19	Hexavalent Chromium (Sub)

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PRISM LABORATORIES, INC.
Full-Service Analytical & Environmental Solutions
449 Springbrook Road • P.O. Box 240543 • Charlotte, NC 28224-0543
Phone: 704/529-6364 • Fax: 704/525-0409

CHAIN OF CUSTODY RECORD

PAGE 1 OF 2 QUOTE # TO ENSURE PROPER BILLING:

Client Company Name: ECS
Report To/Contact Name: Tobi Benfield
Reporting Address: 8511 Rear Blvd Greensboro NC
Phone: 856 7150 Fax (Yes) (No): 856 7160
Email (Yes) (No) Email Address: TBenfield@ECSLimited.com
EDD Type: PDF ✓ Excel ✗ Other
Site Location Name: UMF
Site Location Physical Address: 133 Blue Bell Rd Greensboro NC

Project Name: UMF
Short Hold Analysis: (Yes) (No) UST Project: (Yes) (No)
*Please ATTACH any project specific reporting (QC LEVEL I II III IV) provisions and/or QC Requirements
Invoice To: TBenfield@ECSlimited.com
Address:

Purchase Order No./Billing Reference
Requested Due Date ☐ 1 Day ☐ 2 Days ☐ 3 Days ☐ 4 Days ☐ 5 Days
"Working Days" ☐ 6-9 Days ☑ Standard 10 days ☐ Rush Work Must Be Pre-Approved
Samples received after 15:00 will be processed next business day.
Turnaround time is based on business days, excluding weekends and holidays.
(SEE REVERSE FOR TERMS & CONDITIONS REGARDING SERVICES RENDERED BY PRISM LABORATORIES, INC. TO CLIENT)

LAB USE ONLY

	YES	NO	N/A
Samples INTACT upon arrival?	✓		
Received ON WET ICE? Temp 4.8	✓		
PROPER PRESERVATIVES indicated?	✓		
Received WITHIN HOLDING TIMES?	✓		
CUSTODY SEALS INTACT?			✗
VOLATILES rec'd W/OUT HEADSPACE?			✗
PROPER CONTAINERS used?	✓		

TO BE FILLED IN BY CLIENT/SAMPLING PERSONNEL
Certification: NELAC ____ USACE ____ FL ____ NC ✓
SC ____ OTHER ____ N/A ____
Water Chlorinated: YES ___ NO ___
Sample Iced Upon Collection: YES ___ NO ✓

CLIENT SAMPLE DESCRIPTION	DATE COLLECTED	TIME COLLECTED MILITARY HOURS	MATRIX (SOIL, WATER OR SLUDGE)	SAMPLE CONTAINER *TYPE SEE BELOW	NO.	SIZE	PRESERVATIVES	13 priority pollutant metals	C-46					REMARKS	PRISM LAB ID NO.
GP-26	8-16	905	S	C	2	4oz	-	✓	✓						01
GP-27B		915						✓	✓						02
GP-28		920						✓	✓						03
GP-29		928						✓	✓						04
GP-30		938						✓	✓						05
GP-31		955						✓	✓						06
GP-32		1005						✓	✓						07
GP-33		1015						✓	✓						08
GP-34		1022						✓	✓						09
GP-35		1035						✓	✓						10

Sampler's Signature ____ Sampled By (Print Name) ____ Affiliation ____

PRESS DOWN FIRMLY - 3 COPIES

Upon relinquishing, this Chain of Custody is your authorization for Prism to proceed with the analyses as requested above. Any changes must be submitted in writing to the Prism Project Manager. There will be charges for any changes after analyses have been initialized.

		Date	Military/Hours
Relinquished By: (Signature)	Received By: (Signature)	8/18/	1200
Relinquished By: (Signature)	Received By: (Signature)	Date	
Relinquished By: (Signature)	Received For Prism Laboratories By:	Date 8/18/	1515

Method of Shipment: NOTE: ALL SAMPLE COOLERS SHOULD BE TAPED SHUT WITH CUSTODY SEALS FOR TRANSPORTATION TO THE LABORATORY. SAMPLES ARE NOT ACCEPTED AND VERIFIED AGAINST COC UNTIL RECEIVED AT THE LABORATORY.
☐ Fed Ex ☐ UPS ☐ Hand-delivered ☑ Prism Field Service ☐ Other
COC Group No. 1080517

Additional Comments:

PRISM USE ONLY
Site Arrival Time:
Site Departure Time:
Field Tech Fee:
Mileage:

TBC

SEE REVERSE FOR TERMS & CONDITIONS

NPDES:	UST:	GROUNDWATER:	DRINKING WATER:	SOLID WASTE:	RCRA:	CERCLA	LANDFILL	OTHER:
☐ NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC
☐ ____	☐ ____	☐ ____	☐ ____	☐ ____	☐ ____	☐ ____	☐ ____	☐ ____

*CONTAINER TYPE CODES: A = Amber C = Clear G = Glass P = Plastic; TL = Teflon-Lined Cap VOA = Volatile Organics Analysis (Zero Head Space)

ORIGINAL

PRISM LABORATORIES, INC.
Full-Service Analytical & Environmental Solutions
449 Springbrook Road • P.O. Box 240543 • Charlotte, NC 28224-0543
Phone: 704/529-6364 • Fax: 704/525-0409

CHAIN OF CUSTODY RECORD

PAGE 2 OF 2 QUOTE # TO ENSURE PROPER BILLING: _____

Client Company Name: ECS
Report To/Contact Name: _____
Reporting Address: _____
Phone: _____ Fax (Yes) (No): _____
Email (Yes) (No) Email Address _____
EDD Type: PDF____ Excel____ Other _____
Site Location Name: LMF
Site Location Physical Address: 133 Blue Bell Rd

Project Name: LMF
Short Hold Analysis: (Yes) (No) UST Project: (Yes) (No)
*Please ATTACH any project specific reporting (QC LEVEL I II III IV) provisions and/or QC Requirements
Invoice To: _____
Address: _____
Purchase Order No./Billing Reference _____
Requested Due Date ☐ 1 Day ☐ 2 Days ☐ 3 Days ☐ 4 Days ☐ 5 Days
"Working Days" ☐ 6-9 Days ☒ Standard 10 days ☐ Rush Work Must Be Pre-Approved
Samples received after 15:00 will be processed next business day.
Turnaround time is based on business days, excluding weekends and holidays.
(SEE REVERSE FOR TERMS & CONDITIONS REGARDING SERVICES RENDERED BY PRISM LABORATORIES, INC. TO CLIENT)

LAB USE ONLY

	YES	NO	N/A
Samples INTACT upon arrival?	X		
Received ON WET ICE? Temp 4.8	X		
PROPER PRESERVATIVES indicated?	X		
Received WITHIN HOLDING TIMES?	X		
CUSTODY SEALS INTACT?			X
VOLATILES rec'd W/OUT HEADSPACE?			X
PROPER CONTAINERS used?	X		

TO BE FILLED IN BY CLIENT/SAMPLING PERSONNEL
Certification: NELAC____ USACE____ FL____ NC✓____ SC____ OTHER _____ N/A✓
Water Chlorinated: YES___ NO___
Sample Iced Upon Collection: YES___ NO✓___

CLIENT SAMPLE DESCRIPTION	DATE COLLECTED	TIME COLLECTED MILITARY HOURS	MATRIX (SOIL, WATER OR SLUDGE)	SAMPLE CONTAINER *TYPE SEE BELOW	NO.	SIZE	PRESERVATIVES	13 8 PM + 5N	CS +		Tetrals			REMARKS	PRISM LAB ID NO.
GP-36	F-16	1042	S	C	2	4oz		✓	✓						11
GP-37		1050						✓	✓						12
GP-38		1100						✓	✓						13
GP-39		1120						✓	✓						14
GP-40		1110						✓	✓						15
GP-41		1125						✓	✓						16
GP-42		0945						✓	✓						17
GP-53		1305						✓	✓						18
GP-54		1325						✓	✓						19
D-Spoil-1		12:30									✓				20

Sampler's Signature _____ Sampled By (Print Name) _____ Affiliation _____

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Upon relinquishing, this Chain of Custody is your authorization for Prism to proceed with the analyses as requested above. Any changes must be submitted in writing to the Prism Project Manager. There will be charges for any changes after analyses have been initialized.

		Date	Military/Hours
Relinquished By: (Signature)	Received By: (Signature)	8/8/14	1500
Relinquished By: (Signature)	Received By: (Signature)	Date	
Relinquished By: (Signature)	Received For Prism Laboratories By:	8/8/14	1515

Method of Shipment: NOTE: ALL SAMPLE COOLERS SHOULD BE TAPED SHUT WITH CUSTODY SEALS FOR TRANSPORTATION TO THE LABORATORY. SAMPLES ARE NOT ACCEPTED AND VERIFIED AGAINST COC UNTIL RECEIVED AT THE LABORATORY.
☐ Fed Ex ☐ UPS ☐ Hand-delivered ☒ Prism Field Service ☐ Other _____
COC Group No. 1080517

Additional Comments:

PRISM USE ONLY
Site Arrival Time:
Site Departure Time:
Field Tech Fee:
Mileage:

NPDES:	UST:	GROUNDWATER:	DRINKING WATER:	SOLID WASTE:	RCRA:	CERCLA	LANDFILL	OTHER:
☐ NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC
☐ _____	☐ _____	☐ _____	☐ _____	☐ _____	☐ _____	☐ _____	☐ _____	☐ _____

*CONTAINER TYPE CODES: A = Amber C = Clear G = Glass P = Plastic; TL = Teflon-Lined Cap VOA = Volatile Organics Analysis (Zero Head Space)

SEE REVERSE FOR TERMS & CONDITIONS

ORIGINAL

ACCESS
ANALYTICAL, INC.

ANALYTICAL REPORT

CLIENT
Prism Laboratories, Inc.
PO BOX 240543
Charlotte, NC 28224

ATTENTION
Angie Overcash

PROJECT ID
1080517

LABORATORY REPORT NUMBER
211082205

DATE
08/24/2011

Primary Data Review By

IntegriSign

Curtis Ekker
Data Validation Manager, GCAL

Secondary Data Review By

Ashley B. Amick
Project Manager, Access Analytical, Inc.
aamick@accessanalyticalinc.com

PLEASE NOTE:

- **Unless otherwise noted, all analysis on this report performed at Gulf Coast Analytical Labs (GCAL), 7979 GSRI Avenue, Baton Rouge, LA 70820.**
- **GCAL is SCDHEC certified laboratory # 73006, NCDENR certified lab # 618, GA certified lab # LA-01955, NELAP certified laboratory # 01955**
- Local support services for this project are provided by Access Analytical, Inc.. Access Analytical is a representative of GCAL serving clients in the SC/NC/GA areas. All questions regarding this report should be directed to your local Access Analytical representative at 803.781.4243 or toll free at 888.315.4243.

NELAP CERTIFICATE NUMBER 01955
DOD ELAP CERTIFICATE NUMBER ADE - 1482

ANALYTICAL RESULTS

PERFORMED BY

GULF COAST ANALYTICAL LABORATORIES, INC.
7979 GSRI Avenue
Baton Rouge, LA 70820

Report Date 08/24/2011

GCAL Report 211082205

Deliver To	Prism Laboratories, Inc. PO BOX 240543 Charlotte, NC 28224 706-529-6364
Attn	Angie Overcash

Project 1080517

CASE NARRATIVE

Client: Prism Laboratories, Inc. **Report:** 211082205

Gulf Coast Analytical Laboratories received and analyzed the sample(s) listed on the sample cross-reference page of this report. Receipt of the sample(s) is documented by the attached chain of custody. This applies only to the sample(s) listed in this report. No sample integrity or quality control exceptions were identified unless noted below.

CONVENTIONALS

In the Hexavalent Chromium analysis for prep batch 463948, the MS recovery is very low or 0%. The LCS recovery is acceptable. A post-digestion spike was performed with a recovery of 91%. This indicates that the matrix reduced the added Hexavalent Chromium and no measurable native Hexavalent Chromium existed in the original sample.

The Sample/Duplicate RPD for Chromium VI for prep batch 463949 is not applicable because the sample and/or duplicate concentration is less than five times the reporting limit.

Laboratory Endorsement

Sample analysis was performed in accordance with approved methodologies provided by the Environmental Protection Agency or other recognized agencies. The samples and their corresponding extracts will be maintained for a period of 30 days unless otherwise arranged. Following this retention period the samples will be disposed in accordance with GCAL's Standard Operating Procedures.

Common Abbreviations Utilized in this Report

ND	Indicates the result was Not Detected at the specified RDL
DO	Indicates the result was Diluted Out
MI	Indicates the result was subject to Matrix Interference
TNTC	Indicates the result was Too Numerous To Count
SUBC	Indicates the analysis was Sub-Contracted
FLD	Indicates the analysis was performed in the Field
PQL	Practical Quantitation Limit
MDL	Method Detection Limit
RDL	Reporting Detection Limit
00:00	Reported as a time equivalent to 12:00 AM

Reporting Flags Utilized in this Report

J	Indicates an estimated value
U	Indicates the compound was analyzed for but not detected
B	(ORGANICS) Indicates the analyte was detected in the associated Method Blank
B	(INORGANICS) Indicates the result is between the RDL and MDL

Sample receipt at GCAL is documented through the attached chain of custody. In accordance with NELAC, this report shall be reproduced only in full and with the written permission of GCAL. The results contained within this report relate only to the samples reported. The documented results are presented within this report.

This report pertains only to the samples listed in the Report Sample Summary and should be retained as a permanent record thereof. The results contained within this report are intended for the use of the client. Any unauthorized use of the information contained in this report is prohibited.

I certify that this data package is in compliance with the NELAC standard and terms and conditions of the contract and Statement of Work both technically and for completeness, for other than the conditions in the case narrative. Release of the data contained in this hardcopy data package and in the computer-readable data submitted has been authorized by the Quality Assurance Manager or his/her designee, as verified by the following signature.

Estimated uncertainty of measurement is available upon request. This report is in compliance with the DOD QSM as specified in the contract if applicable.

IntegriSign

Robyn Migues
Technical Director
GCAL REPORT 211082205 IntegriSig

THIS REPORT CONTAINS 27 PAGES.

Report Sample Summary

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108220501	GP-26	Solid	08/16/2011 09:05	08/20/2011 08:55
21108220502	GP-27B	Solid	08/16/2011 09:15	08/20/2011 08:55
21108220503	GP-28	Solid	08/16/2011 09:20	08/20/2011 08:55
21108220504	GP-29	Solid	08/16/2011 09:28	08/20/2011 08:55
21108220505	GP-30	Solid	08/16/2011 09:38	08/20/2011 08:55
21108220506	GP-31	Solid	08/16/2011 09:55	08/20/2011 08:55
21108220507	GP-32	Solid	08/16/2011 10:05	08/20/2011 08:55
21108220508	GP-33	Solid	08/16/2011 10:15	08/20/2011 08:55
21108220509	GP-34	Solid	08/16/2011 10:22	08/20/2011 08:55
21108220510	GP-35	Solid	08/16/2011 10:35	08/20/2011 08:55
21108220511	GP-36	Solid	08/16/2011 10:42	08/20/2011 08:55
21108220512	GP-37	Solid	08/16/2011 10:50	08/20/2011 08:55
21108220513	GP-38	Solid	08/16/2011 11:00	08/20/2011 08:55
21108220514	GP-39	Solid	08/16/2011 11:20	08/20/2011 08:55
21108220515	GP-40	Solid	08/16/2011 11:10	08/20/2011 08:55
21108220516	GP-41	Solid	08/16/2011 11:25	08/20/2011 08:55
21108220517	GP-42	Solid	08/16/2011 09:45	08/20/2011 08:55
21108220518	GP-53	Solid	08/16/2011 15:05	08/20/2011 08:55
21108220519	GP-54	Solid	08/16/2011 15:25	08/20/2011 08:55

Summary of Compounds Detected

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108220502	GP-27B	Solid	08/16/2011 09:15	08/20/2011 08:55

SW-846 7196A Chromium VI

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	0.566B	0.628	0.314	mg/kg

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108220503	GP-28	Solid	08/16/2011 09:20	08/20/2011 08:55

SW-846 7196A Chromium VI

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	1.75	0.604	0.302	mg/kg

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108220506	GP-31	Solid	08/16/2011 09:55	08/20/2011 08:55

SW-846 7196A Chromium VI

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	1.67	0.595	0.297	mg/kg

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108220507	GP-32	Solid	08/16/2011 10:05	08/20/2011 08:55

SW-846 7196A Chromium VI

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	1.86	0.581	0.291	mg/kg

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108220508	GP-33	Solid	08/16/2011 10:15	08/20/2011 08:55

SW-846 7196A Chromium VI

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	2.11	0.638	0.319	mg/kg

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108220509	GP-34	Solid	08/16/2011 10:22	08/20/2011 08:55

SW-846 7196A Chromium VI

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	2.03	0.581	0.290	mg/kg

Summary of Compounds Detected (con't)

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108220512	GP-37	Solid	08/16/2011 10:50	08/20/2011 08:55

SW-846 7196A Chromium VI

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	0.481B	0.688	0.344	mg/kg

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108220513	GP-38	Solid	08/16/2011 11:00	08/20/2011 08:55

SW-846 7196A Chromium VI

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	0.519B	0.576	0.288	mg/kg

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108220514	GP-39	Solid	08/16/2011 11:20	08/20/2011 08:55

SW-846 7196A Chromium VI

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	1.97	0.656	0.328	mg/kg

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108220515	GP-40	Solid	08/16/2011 11:10	08/20/2011 08:55

SW-846 7196A Chromium VI

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	0.303B	0.606	0.303	mg/kg

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
211082205D1	GP-26	Solid	08/15/2011 09:05	08/20/2011 08:55

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
08/23/2011 15:30	463948	SW-846 3060A	1	08/24/2011 09:08	JEM	464072

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	0.298U	0.596	0.298	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108220502	GP-27B	Solid	08/16/2011 09:15	08/20/2011 08:55

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
08/23/2011 15:30	463948	SW-846 3060A	1	08/24/2011 09:08	JEM	464072

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	0.566B	0.628	0.314	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
211082205O3	GP-28	Solid	08/16/2011 09:20	08/20/2011 08:55

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
08/23/2011 15:30	463948	SW-846 3060A	1	08/24/2011 09:10	JEM	464072

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	1.75	0.604	0.302	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108220504	GP-29	Solid	08/16/2011 09:28	08/20/2011 08:55

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
08/23/2011 15:30	463948	SW-846 3060A	1	08/24/2011 09:10	JEM	464072

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	0.351U	0.702	0.351	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
211082205 05	GP-30	Solid	08/16/2011 09:38	08/20/2011 08:55

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
08/23/2011 15:30	463948	SW-846 3060A	1	08/24/2011 09:11	JEM	464072

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	0.311U	0.622	0.311	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108220506	GP-31	Solid	08/16/2011 09:55	08/20/2011 08:55

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
08/23/2011 15:30	463948	SW-846 3060A	1	08/24/2011 09:11	JEM	464072

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	1.67	0.595	0.297	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108220507	GP-32	Solid	08/16/2011 10:05	08/20/2011 08:55

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
08/23/2011 15:30	463948	SW-846 3060A	1	08/24/2011 09:12	JEM	464072

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	1.86	0.581	0.291	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108220508	GP-33	Solid	08/16/2011 10:15	08/20/2011 08:55

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
08/23/2011 15:30	463948	SW-846 3060A	1	08/24/2011 09:12	JEM	464072

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	2.11	0.638	0.319	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108220509	GP-34	Solid	08/16/2011 10:22	08/20/2011 08:55

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
08/23/2011 15:30	463948	SW-846 3060A	1	08/24/2011 09:12	JEM	464072

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	2.03	0.581	0.290	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
211082205-10	GP-35	Solid	08/16/2011 10:35	08/20/2011 08:55

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
08/23/2011 15:30	463948	SW-846 3060A	1	08/24/2011 09:13	JEM	464072

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	0.303U	0.606	0.303	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
211082205 11	GP-36	Solid	08/16/2011 10:42	08/20/2011 08:55

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
08/23/2011 15:45	463949	SW-846 3060A	1	08/24/2011 08:30	JEM	464071

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	0.298U	0.597	0.298	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108220512	GP-37	Solid	08/16/2011 10:50	08/20/2011 08:55

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
08/23/2011 15:45	463949	SW-846 3060A	1	08/24/2011 08:31	JEM	464071

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	0.481B	0.688	0.344	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
211082205 13	GP-38	Solid	08/16/2011 11:00	08/20/2011 08:55

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
08/23/2011 15:45	463949	SW-846 3060A	1	08/24/2011 08:32	JEM	464071

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	0.519B	0.576	0.288	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
211082205 14	GP-39	Solid	08/16/2011 11:20	08/20/2011 08:55

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
08/23/2011 15:45	463949	SW-846 3060A	1	08/24/2011 08:33	JEM	464071

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	**Chromium VI**	**1.97**	**0.656**	**0.328**	**mg/kg**

RESULTS REPORTED ON A DRY WEIGHT BASIS

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108220515	GP-40	Solid	08/16/2011 11:10	08/20/2011 08:55

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
08/23/2011 15:45	463949	SW-846 3060A	1	08/24/2011 08:33	JEM	464071

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	0.303B	0.606	0.303	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108220516	GP-41	Solid	08/16/2011 11:25	08/20/2011 08:55

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
08/23/2011 15:45	463949	SW-846 3060A	1	08/24/2011 08:33	JEM	464071

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	0.292U	0.584	0.292	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108220517	GP-42	Solid	08/16/2011 09:45	08/20/2011 08:55

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
08/23/2011 15:45	463949	SW-846 3060A	1	08/24/2011 08:35	JEM	464071

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	0.303U	0.606	0.303	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108220518	GP-53	Solid	08/16/2011 15:05	08/20/2011 08:55

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
08/23/2011 15:45	463949	SW-846 3060A	1	08/24/2011 08:36	JEM	464071

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	0.330U	0.661	0.330	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
211082205 19	GP-54	Solid	08/16/2011 15:25	08/20/2011 08:55

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
08/23/2011 15:45	463949	SW-846 3060A	1	08/24/2011 08:36	JEM	464071

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	0.326U	0.651	0.326	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

General Chemistry Quality Control Summary

Analytical Batch	464071	**Client ID**	MB463949			LCS463949		
Prep Batch	463949	**GCAL ID**	981545			981546		
Prep Method	SW-846	**Sample Type**	Method Blank			LCS		
	3060A	**Prep Date**	08/23/2011 15:45			08/23/2011 15:45		
		Analytical Date	08/24/2011 08:29			08/24/2011 08:30		
		Matrix	Solid			Solid		
SW-846 7196A Chromium VI			**Units**	mg/kg	**Spike**	**Result**		**Control**
			Result	**RDL**	**Added**		**% R**	**Limits % R**
18540-29-9	Chromium VI		0.250U	0.250	50.0	44.0	88	75 - 125

Analytical Batch	464071	**Client ID**	GP-36			981456MS		
Prep Batch	463949	**GCAL ID**	21108220511			981547		
Prep Method	SW-846	**Sample Type**	SAMPLE			MS		
	3060A	**Prep Date**	08/23/2011 15:45			08/23/2011 15:45		
		Analytical Date	08/24/2011 08:30			08/24/2011 08:31		
		Matrix	Solid			Solid		
SW-846 7196A Chromium VI			**Units**	mg/kg	**Spike**	**Result**		**Control**
			Result	**RDL**	**Added**		**% R**	**Limits % R**
18540-29-9	Chromium VI		0.000	0.250	50.0	42.7	85.4	74.5 -125.4

Analytical Batch	464071	**Client ID**	GP-37		981457DUP		
Prep Batch	463949	**GCAL ID**	21108220512		981548		
Prep Method	SW-846	**Sample Type**	SAMPLE		DUP		
	3060A	**Prep Date**	08/23/2011 15:45		08/23/2011 15:45		
		Analytical Date	08/24/2011 08:31		08/24/2011 08:32		
		Matrix	Solid		Solid		
SW-846 7196A Chromium VI			**Units**	mg/kg	**Result**		**RPD**
			Result	**RDL**		**RPD**	**Limit**
18540-29-9	Chromium VI		0.350	0.250	0.250	**33.3***	25

General Chemistry Quality Control Summary

Analytical Batch	464072	**Client ID**	MB463948	LCS463948
Prep Batch	463948	**GCAL ID**	981539	981540
Prep Method	SW-846	**Sample Type**	Method Blank	LCS
	3060A	**Prep Date**	08/23/2011 15:30	08/23/2011 15:30
		Analytical Date	08/24/2011 09:02	08/24/2011 09:03
		Matrix	Solid	Solid

SW-846 7196A Chromium VI		**Units**	mg/kg	**Spike**	**Result**		**Control**
		Result	**RDL**	**Added**		**% R**	**Limits % R**
18540-29-9	Chromium VI	0.250U	0.250	50.0	43.5	86.9	75 - 125

Analytical Batch	464072	**Client ID**	DD-1	981427MS
Prep Batch	463948	**GCAL ID**	21108220201	981541
Prep Method	SW-846	**Sample Type**	SAMPLE	MS
	3060A	**Prep Date**	08/23/2011 15:30	08/23/2011 15:30
		Analytical Date	08/24/2011 09:04	08/24/2011 09:04
		Matrix	Solid	Solid

SW-846 7196A Chromium VI		**Units**	mg/kg	**Spike**	**Result**		**Control**
		Result	**RDL**	**Added**		**% R**	**Limits % R**
18540-29-9	Chromium VI	1.00	0.250	50.0	7.80	**13.6***	74.5 -125.4

Analytical Batch	464072	**Client ID**	DD-2	981434DUP
Prep Batch	463948	**GCAL ID**	21108220202	981542
Prep Method	SW-846	**Sample Type**	SAMPLE	DUP
	3060A	**Prep Date**	08/23/2011 15:30	08/23/2011 15:30
		Analytical Date	08/24/2011 09:06	08/24/2011 09:06
		Matrix	Solid	Solid

SW-846 7196A Chromium VI		**Units**	mg/kg	**Result**		**RPD**
		Result	**RDL**		**RPD**	**Limit**
18540-29-9	Chromium VI	0.000	0.250	0.000	0	25

Prism / 4565 / 21108 2205 / 8/26/11
Sub to GCAL on 8/19/11

PRISM LABORATORIES, INC. | Full-Service Analytical & Environmental Solutions

SUBCONTRACT ORDER

Prism Laboratories, Inc.

1080517

Certification: NELAC___ USACE___
SC___ Other NC
N/A___

SENDING LABORATORY:

Prism Laboratories, Inc.
P. O. Box 240543
Charlotte, NC 28224-0543
Phone: 800-529-6364
Fax: 704-525-0409
Project Manager: Angela D. Overcash

RECEIVING LABORATORY:

Gulf Coast Analytical Labs, Inc.
7979 GSRI Avenue
Baton Rouge, LA 70820
Phone :(225) 769-4900
Fax: (225) 767-5717

Analysis	Due	Expires	Laboratory ID	Comments
Sample ID: 1080517-01	**Solid**	**Sampled:08/16/11 09:05**	GP-26	1
Hexavalent Chromium (Sub)		08/17/11 09:05		
Containers Supplied: 4 oz CLEAR GLASS				
Sample ID: 1080517-02	**Solid**	**Sampled:08/16/11 09:15**	GP-27B	2
Hexavalent Chromium (Sub)		08/17/11 09:15		
Containers Supplied:				
Sample ID: 1080517-03	**Solid**	**Sampled:08/16/11 09:20**	GP-28	3
Hexavalent Chromium (Sub)		08/17/11 09:20		
Containers Supplied:				
Sample ID: 1080517-04	**Solid**	**Sampled:08/16/11 09:28**	GP-29	4
Hexavalent Chromium (Sub)		08/17/11 09:28		
Containers Supplied:				
Sample ID: 1080517-05	**Solid**	**Sampled:08/16/11 09:38**	GP-30	5
Hexavalent Chromium (Sub)		08/17/11 09:38		

Released By	Date	Received By	Date
[signature]	8/19/11	Fed Ex	8/19/11 3.8°C
Fed Ex 8682 1201 5320	8/20/11 855	[signature] GCAL	8/20/11 855

Page 1 of 3

Prism / 4565/ 211082205/ 8/26/11

SUBCONTRACT ORDER

Prism Laboratories, Inc.

1080517

Certification: NELAC___ USACE____
SC___ Other _____
N/A_____

Analysis	Due	Expires	Laboratory ID	Comments
Containers Supplied:				
Sample ID: 1080517-06	**Solid**	**Sampled:08/16/11 09:55**	GP-31	6
Hexavalent Chromium (Sub)		08/17/11 09:55		
Containers Supplied: 4 OZ CLEAR GLASS				
Sample ID: 1080517-07	**Solid**	**Sampled:08/16/11 10:05**	GP-32	7
Hexavalent Chromium (Sub)		08/17/11 10:05		
Containers Supplied:				
Sample ID: 1080517-08	**Solid**	**Sampled:08/16/11 10:15**	GP-33	8
Hexavalent Chromium (Sub)		08/17/11 10:15		
Containers Supplied:				
Sample ID: 1080517-09	**Solid**	**Sampled:08/16/11 10:22**	GP-34	9
Hexavalent Chromium (Sub)		08/17/11 10:22		
Containers Supplied:				
Sample ID: 1080517-10	**Solid**	**Sampled:08/16/11 10:35**	GP-35	10
Hexavalent Chromium (Sub)		08/17/11 10:35		
Containers Supplied:				
Sample ID: 1080517-11	**Solid**	**Sampled:08/16/11 10:42**	GP-36	11
Hexavalent Chromium (Sub)		08/17/11 10:42		
Containers Supplied:				
Sample ID: 1080517-12	**Solid**	**Sampled:08/16/11 10:50**	GP-37	12
Hexavalent Chromium (Sub)		08/17/11 10:50		
Containers Supplied:				

Released By	Date	Received By	Date
[signature]	8/19/11	Fed Ex	8/19/11
Fed Ex	8/20/11 855	[signature] GCAL	8/20/855

Prism/4565/ 2110822 05/ 8/26/11

SUBCONTRACT ORDER

Prism Laboratories, Inc.

1080517

Certification: NELAC___ USACE___
SC___ Other _____
N/A_____

Analysis	Due	Expires	Laboratory ID	Comments
Sample ID: 1080517-13	Solid	Sampled:08/16/11 11:00	GP-38	13
Hexavalent Chromium (Sub)		08/17/11 11:00		
Containers Supplied:				
Sample ID: 1080517-14	Solid	Sampled:08/16/11 11:20	GP-39	14
Hexavalent Chromium (Sub)		08/17/11 11:20		
Containers Supplied:				
Sample ID: 1080517-15	Solid	Sampled:08/16/11 11:10	GP-40	15
Hexavalent Chromium (Sub)		08/17/11 11:10		
Containers Supplied:				
Sample ID: 1080517-16	Solid	Sampled:08/16/11 11:25	GP-41	16
Hexavalent Chromium (Sub)		08/17/11 11:25		
Containers Supplied:				
Sample ID: 1080517-17	Solid	Sampled:08/16/11 09:45	GP-42	17
Hexavalent Chromium (Sub)		08/17/11 09:45		
Containers Supplied:				
Sample ID: 1080517-18	Solid	Sampled:08/16/11 15:05	GP-53	18
Hexavalent Chromium (Sub)		08/17/11 15:05		
Containers Supplied:				
Sample ID: 1080517-19	Solid	Sampled:08/16/11 15:25	GP-54	19
Hexavalent Chromium (Sub)		08/17/11 15:25		
Containers Supplied:				

Released By	Date	Received By	Date
[signature]	8/19/11	Fed Ex	8/19/11
Fed Ex	8/20/11 855	[signature] GCAL	8/20/11 855

GCAL
GULF COAST ANALYTICAL LABORATORIES, INC

SAMPLE RECEIVING CHECKLIST

Workorder: 211082205

Client: 4565 - Access Analytical

Profile: 80251 - Prism Lab

Line Item: 2 - Solid

Received by: Carstens, Jennifer K.

Received Date/Time: 8/20/2011 8:55:00 AM

Samples Received via: FEDEX

Number of Coolers Received: 1

Cooler tracking numbers(s): 8682 1201 5320

Cooler temperature(s): 3.8°C

Were all coolers received at a temperature of 0 - 6° C?	☑ Yes	☐ No	☐ N/A
Were all custody seals intact?	☑ Yes	☐ No	☐ N/A
Were all samples received in proper containers?	☑ Yes	☐ No	☐ N/A
Were all samples properly preserved?	☑ Yes	☐ No	☐ N/A
Was preservative added to any container at the lab?	☐ Yes	☑ No	☐ N/A
Were all containers received in good condition?	☑ Yes	☐ No	☐ N/A
Were all VOA vials received with no head space?	☐ Yes	☐ No	☑ N/A
Do all sample labels match the Chain of Custody?	☑ Yes	☐ No	☐ N/A
Was the client notified about any discrepancies?	☐ Yes	☐ No	☑ N/A

Notes/Comments:

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Full-Service Analytical & Environmental Solutions

NC Certification No. 402
SC Certification No. 99012
NC Drinking Water Cert No. 37735

Case Narrative

09/01/2011

ECS Carolinas - Greensboro
Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: UMF

Lab Submittal Date: 08/22/2011
Prism Work Order: 1080611

This data package contains the analytical results for the project identified above and includes a Case Narrative, Sample Results and Chain of Custody. Unless otherwise noted, all samples were received in acceptable condition and processed according to the referenced methods.

Data qualifiers are flagged individually on each sample. A key reference for the data qualifiers appears at the end of this case narrative.

Narrative Notes:

Hexavalent Chromium analysis was subcontracted to GCAL. Laboratory report is attached.

Please call if you have any questions relating to this analytical report.

Respectfully,

PRISM LABORATORIES, INC.

VP Laboratory Services

Reviewed By

Data Qualifiers Key Reference:

D	RPD value outside of the control limits.
MI	Matrix spike outside of the control limits. Matrix interference suspected.
BRL	Below Reporting Limit
MDL	Method Detection Limit
RPD	Relative Percent Difference
*	Results reported to the reporting limit. All other results are reported to the MDL with values between MDL and reporting limit indicated with a J.

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Sample Receipt Summary

09/01/2011

Prism Work Order: 1080611

Client Sample ID	Lab Sample ID	Matrix	Date Sampled	Date Received
GP-43	1080611-01	Solid	08/19/11	08/22/11
GP-44	1080611-02	Solid	08/19/11	08/22/11
GP-45	1080611-03	Solid	08/19/11	08/22/11
GP-46	1080611-04	Solid	08/19/11	08/22/11
GP-47B	1080611-05	Solid	08/19/11	08/22/11
GP-48	1080611-06	Solid	08/19/11	08/22/11
GP-49	1080611-07	Solid	08/19/11	08/22/11
GP-50	1080611-08	Solid	08/19/11	08/22/11
GP-51	1080611-09	Solid	08/19/11	08/22/11
GP-52	1080611-10	Solid	08/19/11	08/22/11
GP-55	1080611-11	Solid	08/19/11	08/22/11
GP-56	1080611-12	Solid	08/19/11	08/22/11
GP-57	1080611-13	Solid	08/19/11	08/22/11
GP-58	1080611-14	Solid	08/19/11	08/22/11
DUPLICATE	1080611-15	Solid	08/19/11	08/22/11

Samples received in good condition at 6.8 degrees C unless otherwise noted.

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Laboratory Report

09/01/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: UMF

Sample Matrix: Solid

Client Sample ID: GP-43
Prism Sample ID: 1080611-01
Prism Work Order: 1080611
Time Collected: 08/19/11 09:45
Time Submitted: 08/22/11 16:25

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**85.8**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**8/24/11 16:12**	**JAB**	**P1H0543**
Total Metals									
Mercury	BRL	mg/kg dry	0.025	0.0031	1	*7471B	8/29/11 12:41	LTB	P1H0564
Antimony	BRL	mg/kg dry	0.23	0.042	1	*6010C	8/26/11 18:30	DWR	P1H0562
Arsenic	**0.66**	**mg/kg dry**	**0.58**	**0.066**	**1**	***6010C**	**8/26/11 18:30**	**DWR**	**P1H0562**
Beryllium	**0.43**	**mg/kg dry**	**0.29**	**0.049**	**1**	***6010C**	**8/26/11 18:30**	**DWR**	**P1H0562**
Cadmium	BRL	mg/kg dry	0.29	0.031	1	*6010C	8/26/11 18:30	DWR	P1H0562
Chromium	**9.6**	**mg/kg dry**	**0.29**	**0.040**	**1**	***6010C**	**8/26/11 18:30**	**DWR**	**P1H0562**
Copper	**14**	**mg/kg dry**	**0.58**	**0.25**	**1**	***6010C**	**8/26/11 18:30**	**DWR**	**P1H0562**
Lead	**1.1**	**mg/kg dry**	**0.29**	**0.072**	**1**	***6010C**	**8/26/11 18:30**	**DWR**	**P1H0562**
Nickel	**5.7**	**mg/kg dry**	**1.2**	**0.36**	**1**	***6010C**	**8/26/11 18:30**	**DWR**	**P1H0562**
Selenium	**1.7**	**mg/kg dry**	**0.58**	**0.12**	**1**	***6010C**	**8/26/11 18:30**	**DWR**	**P1H0562**
Silver	BRL	mg/kg dry	0.29	0.030	1	*6010C	8/26/11 18:30	DWR	P1H0562
Thallium	BRL	mg/kg dry	0.58	0.11	1	*6010C	8/26/11 18:30	DWR	P1H0562
Tin	BRL	mg/kg dry	5.8	0.51	1	*6010C	8/26/11 18:30	DWR	P1H0562
Zinc	**30**	**mg/kg dry**	**2.9**	**0.30**	**1**	***6010C**	**8/26/11 18:30**	**DWR**	**P1H0562**

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09/01/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: UMF

Sample Matrix: Solid

Client Sample ID: GP-44
Prism Sample ID: 1080611-02
Prism Work Order: 1080611
Time Collected: 08/19/11 09:55
Time Submitted: 08/22/11 16:25

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**79.5**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**8/24/11 15:40**	**JAB**	**P1H0543**
Total Metals									
Mercury	BRL	mg/kg dry	0.026	0.0031	1	*7471B	8/29/11 12:46	LTB	P1H0564
Antimony	BRL	mg/kg dry	0.25	0.046	1	*6010C	8/26/11 18:58	DWR	P1H0562
Arsenic	BRL	mg/kg dry	0.64	0.072	1	*6010C	8/26/11 18:58	DWR	P1H0562
Beryllium	**0.96**	**mg/kg dry**	**0.32**	**0.054**	**1**	***6010C**	**8/26/11 18:58**	**DWR**	**P1H0562**
Cadmium	BRL	mg/kg dry	0.32	0.034	1	*6010C	8/26/11 18:58	DWR	P1H0562
Chromium	**33**	**mg/kg dry**	**0.32**	**0.044**	**1**	***6010C**	**8/26/11 18:58**	**DWR**	**P1H0562**
Copper	**42**	**mg/kg dry**	**0.64**	**0.27**	**1**	***6010C**	**8/26/11 18:58**	**DWR**	**P1H0562**
Lead	**1.5**	**mg/kg dry**	**0.32**	**0.078**	**1**	***6010C**	**8/26/11 18:58**	**DWR**	**P1H0562**
Nickel	**7.5**	**mg/kg dry**	**1.3**	**0.39**	**1**	***6010C**	**8/26/11 18:58**	**DWR**	**P1H0562**
Selenium	**3.0**	**mg/kg dry**	**0.64**	**0.13**	**1**	***6010C**	**8/26/11 18:58**	**DWR**	**P1H0562**
Silver	BRL	mg/kg dry	0.32	0.032	1	*6010C	8/26/11 18:58	DWR	P1H0562
Thallium	BRL	mg/kg dry	0.64	0.12	1	*6010C	8/26/11 18:58	DWR	P1H0562
Tin	BRL	mg/kg dry	6.4	0.56	1	*6010C	8/26/11 18:58	DWR	P1H0562
Zinc	**44**	**mg/kg dry**	**3.2**	**0.33**	**1**	***6010C**	**8/26/11 18:58**	**DWR**	**P1H0562**

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09/01/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: UMF

Sample Matrix: Solid

Client Sample ID: GP-45
Prism Sample ID: 1080611-03
Prism Work Order: 1080611
Time Collected: 08/19/11 08:45
Time Submitted: 08/22/11 16:25

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**77.0**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**8/24/11 16:12**	**JAB**	**P1H0543**
Total Metals									
Mercury	BRL	mg/kg dry	0.028	0.0034	1	*7471B	8/29/11 12:50	LTB	P1H0564
Antimony	BRL	mg/kg dry	0.26	0.047	1	*6010C	8/26/11 19:07	DWR	P1H0562
Arsenic	BRL	mg/kg dry	0.64	0.073	1	*6010C	8/26/11 19:07	DWR	P1H0562
Beryllium	**0.65**	**mg/kg dry**	**0.32**	**0.055**	**1**	***6010C**	**8/26/11 19:07**	**DWR**	**P1H0562**
Cadmium	BRL	mg/kg dry	0.32	0.034	1	*6010C	8/26/11 19:07	DWR	P1H0562
Chromium	**25**	**mg/kg dry**	**0.32**	**0.044**	**1**	***6010C**	**8/26/11 19:07**	**DWR**	**P1H0562**
Copper	**47**	**mg/kg dry**	**0.64**	**0.28**	**1**	***6010C**	**8/26/11 19:07**	**DWR**	**P1H0562**
Lead	**1.4**	**mg/kg dry**	**0.32**	**0.079**	**1**	***6010C**	**8/26/11 19:07**	**DWR**	**P1H0562**
Nickel	**14**	**mg/kg dry**	**1.3**	**0.39**	**1**	***6010C**	**8/26/11 19:07**	**DWR**	**P1H0562**
Selenium	**3.4**	**mg/kg dry**	**0.64**	**0.13**	**1**	***6010C**	**8/26/11 19:07**	**DWR**	**P1H0562**
Silver	BRL	mg/kg dry	0.32	0.033	1	*6010C	8/26/11 19:07	DWR	P1H0562
Thallium	BRL	mg/kg dry	0.64	0.12	1	*6010C	8/26/11 19:07	DWR	P1H0562
Tin	BRL	mg/kg dry	6.4	0.57	1	*6010C	8/26/11 19:07	DWR	P1H0562
Zinc	**49**	**mg/kg dry**	**3.2**	**0.33**	**1**	***6010C**	**8/26/11 19:07**	**DWR**	**P1H0562**

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09/01/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: UMF

Sample Matrix: Solid

Client Sample ID: GP-46
Prism Sample ID: 1080611-04
Prism Work Order: 1080611
Time Collected: 08/19/11 08:55
Time Submitted: 08/22/11 16:25

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**78.5**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**8/24/11 16:12**	**JAB**	**P1H0543**
Total Metals									
Mercury	BRL	mg/kg dry	0.026	0.0031	1	*7471B	8/29/11 13:04	LTB	P1H0564
Antimony	BRL	mg/kg dry	0.25	0.046	1	*6010C	8/26/11 19:15	DWR	P1H0562
Arsenic	BRL	mg/kg dry	0.63	0.071	1	*6010C	8/26/11 19:15	DWR	P1H0562
Beryllium	**0.79**	**mg/kg dry**	**0.32**	**0.053**	**1**	***6010C**	**8/26/11 19:15**	**DWR**	**P1H0562**
Cadmium	BRL	mg/kg dry	0.32	0.033	1	*6010C	8/26/11 19:15	DWR	P1H0562
Chromium	**38**	**mg/kg dry**	**0.32**	**0.043**	**1**	***6010C**	**8/26/11 19:15**	**DWR**	**P1H0562**
Copper	**80**	**mg/kg dry**	**0.63**	**0.27**	**1**	***6010C**	**8/26/11 19:15**	**DWR**	**P1H0562**
Lead	**1.7**	**mg/kg dry**	**0.32**	**0.078**	**1**	***6010C**	**8/26/11 19:15**	**DWR**	**P1H0562**
Nickel	**200**	**mg/kg dry**	**6.3**	**1.9**	**5**	***6010C**	**8/29/11 12:44**	**DWR**	**P1H0562**
Selenium	**4.2**	**mg/kg dry**	**0.63**	**0.13**	**1**	***6010C**	**8/26/11 19:15**	**DWR**	**P1H0562**
Silver	BRL	mg/kg dry	0.32	0.032	1	*6010C	8/26/11 19:15	DWR	P1H0562
Thallium	BRL	mg/kg dry	0.63	0.12	1	*6010C	8/26/11 19:15	DWR	P1H0562
Tin	BRL	mg/kg dry	6.3	0.56	1	*6010C	8/26/11 19:15	DWR	P1H0562
Zinc	**43**	**mg/kg dry**	**3.2**	**0.32**	**1**	***6010C**	**8/26/11 19:15**	**DWR**	**P1H0562**

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09/01/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: UMF

Sample Matrix: Solid

Client Sample ID: GP-47B
Prism Sample ID: 1080611-05
Prism Work Order: 1080611
Time Collected: 08/19/11 09:05
Time Submitted: 08/22/11 16:25

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**87.6**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**8/24/11 16:12**	**JAB**	**P1H0543**
Total Metals									
Mercury	BRL	mg/kg dry	0.023	0.0028	1	*7471B	8/29/11 13:09	LTB	P1H0564
Antimony	BRL	mg/kg dry	0.23	0.042	1	*6010C	8/26/11 19:24	DWR	P1H0562
Arsenic	BRL	mg/kg dry	0.58	0.065	1	*6010C	8/26/11 19:24	DWR	P1H0562
Beryllium	**0.36**	**mg/kg dry**	**0.29**	**0.049**	**1**	***6010C**	**8/26/11 19:24**	**DWR**	**P1H0562**
Cadmium	**1.9**	**mg/kg dry**	**0.29**	**0.031**	**1**	***6010C**	**8/26/11 19:24**	**DWR**	**P1H0562**
Chromium	**6.5**	**mg/kg dry**	**0.29**	**0.040**	**1**	***6010C**	**8/26/11 19:24**	**DWR**	**P1H0562**
Copper	**31**	**mg/kg dry**	**0.58**	**0.25**	**1**	***6010C**	**8/26/11 19:24**	**DWR**	**P1H0562**
Lead	**1.2**	**mg/kg dry**	**0.29**	**0.071**	**1**	***6010C**	**8/26/11 19:24**	**DWR**	**P1H0562**
Nickel	**130**	**mg/kg dry**	**1.2**	**0.35**	**1**	***6010C**	**8/26/11 19:24**	**DWR**	**P1H0562**
Selenium	**2.1**	**mg/kg dry**	**0.58**	**0.12**	**1**	***6010C**	**8/26/11 19:24**	**DWR**	**P1H0562**
Silver	BRL	mg/kg dry	0.29	0.029	1	*6010C	8/26/11 19:24	DWR	P1H0562
Thallium	BRL	mg/kg dry	0.58	0.11	1	*6010C	8/26/11 19:24	DWR	P1H0562
Tin	BRL	mg/kg dry	5.8	0.51	1	*6010C	8/26/11 19:24	DWR	P1H0562
Zinc	**65**	**mg/kg dry**	**2.9**	**0.30**	**1**	***6010C**	**8/26/11 19:24**	**DWR**	**P1H0562**

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Laboratory Report

09/01/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: UMF

Sample Matrix: Solid

Client Sample ID: GP-48
Prism Sample ID: 1080611-06
Prism Work Order: 1080611
Time Collected: 08/19/11 09:20
Time Submitted: 08/22/11 16:25

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**81.0**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**8/24/11 16:12**	**JAB**	**P1H0543**
Total Metals									
Mercury	BRL	mg/kg dry	0.026	0.0031	1	*7471B	8/29/11 13:13	LTB	P1H0564
Antimony	BRL	mg/kg dry	0.24	0.044	1	*6010C	8/26/11 19:33	DWR	P1H0562
Arsenic	BRL	mg/kg dry	0.61	0.069	1	*6010C	8/26/11 19:33	DWR	P1H0562
Beryllium	**0.76**	**mg/kg dry**	**0.31**	**0.052**	**1**	***6010C**	**8/26/11 19:33**	**DWR**	**P1H0562**
Cadmium	BRL	mg/kg dry	0.31	0.032	1	*6010C	8/26/11 19:33	DWR	P1H0562
Chromium	**21**	**mg/kg dry**	**0.31**	**0.042**	**1**	***6010C**	**8/26/11 19:33**	**DWR**	**P1H0562**
Copper	**36**	**mg/kg dry**	**0.61**	**0.26**	**1**	***6010C**	**8/26/11 19:33**	**DWR**	**P1H0562**
Lead	**1.8**	**mg/kg dry**	**0.31**	**0.075**	**1**	***6010C**	**8/26/11 19:33**	**DWR**	**P1H0562**
Nickel	**97**	**mg/kg dry**	**1.2**	**0.38**	**1**	***6010C**	**8/26/11 19:33**	**DWR**	**P1H0562**
Selenium	**5.7**	**mg/kg dry**	**0.61**	**0.12**	**1**	***6010C**	**8/26/11 19:33**	**DWR**	**P1H0562**
Silver	BRL	mg/kg dry	0.31	0.031	1	*6010C	8/26/11 19:33	DWR	P1H0562
Thallium	BRL	mg/kg dry	0.61	0.12	1	*6010C	8/26/11 19:33	DWR	P1H0562
Tin	BRL	mg/kg dry	6.1	0.54	1	*6010C	8/26/11 19:33	DWR	P1H0562
Zinc	**39**	**mg/kg dry**	**3.1**	**0.31**	**1**	***6010C**	**8/26/11 19:33**	**DWR**	**P1H0562**

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Laboratory Report

09/01/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: UMF

Sample Matrix: Solid

Client Sample ID: GP-49
Prism Sample ID: 1080611-07
Prism Work Order: 1080611
Time Collected: 08/19/11 09:30
Time Submitted: 08/22/11 16:25

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**81.6**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**8/24/11 16:12**	**JAB**	**P1H0543**
Total Metals									
Mercury	BRL	mg/kg dry	0.025	0.0030	1	*7471B	8/29/11 13:18	LTB	P1H0564
Antimony	BRL	mg/kg dry	0.24	0.044	1	*6010C	8/26/11 19:43	DWR	P1H0562
Arsenic	BRL	mg/kg dry	0.61	0.069	1	*6010C	8/26/11 19:43	DWR	P1H0562
Beryllium	**0.57**	**mg/kg dry**	**0.30**	**0.052**	**1**	***6010C**	**8/26/11 19:43**	**DWR**	**P1H0562**
Cadmium	**0.95**	**mg/kg dry**	**0.30**	**0.032**	**1**	***6010C**	**8/26/11 19:43**	**DWR**	**P1H0562**
Chromium	**8.0**	**mg/kg dry**	**0.30**	**0.042**	**1**	***6010C**	**8/26/11 19:43**	**DWR**	**P1H0562**
Copper	**21**	**mg/kg dry**	**0.61**	**0.26**	**1**	***6010C**	**8/26/11 19:43**	**DWR**	**P1H0562**
Lead	**1.6**	**mg/kg dry**	**0.30**	**0.075**	**1**	***6010C**	**8/26/11 19:43**	**DWR**	**P1H0562**
Nickel	**300**	**mg/kg dry**	**6.1**	**1.9**	**5**	***6010C**	**8/29/11 12:52**	**DWR**	**P1H0562**
Selenium	**3.7**	**mg/kg dry**	**0.61**	**0.12**	**1**	***6010C**	**8/26/11 19:43**	**DWR**	**P1H0562**
Silver	BRL	mg/kg dry	0.30	0.031	1	*6010C	8/26/11 19:43	DWR	P1H0562
Thallium	BRL	mg/kg dry	0.61	0.12	1	*6010C	8/26/11 19:43	DWR	P1H0562
Tin	BRL	mg/kg dry	6.1	0.54	1	*6010C	8/26/11 19:43	DWR	P1H0562
Zinc	**65**	**mg/kg dry**	**3.0**	**0.31**	**1**	***6010C**	**8/26/11 19:43**	**DWR**	**P1H0562**

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09/01/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: UMF

Sample Matrix: Solid

Client Sample ID: GP-50
Prism Sample ID: 1080611-08
Prism Work Order: 1080611
Time Collected: 08/19/11 08:15
Time Submitted: 08/22/11 16:25

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**79.3**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**8/24/11 16:12**	**JAB**	**P1H0543**
Total Metals									
Mercury	BRL	mg/kg dry	0.025	0.0030	1	*7471B	8/29/11 13:31	LTB	P1H0564
Antimony	BRL	mg/kg dry	0.25	0.045	1	*6010C	8/26/11 20:02	DWR	P1H0562
Arsenic	BRL	mg/kg dry	0.62	0.070	1	*6010C	8/26/11 20:02	DWR	P1H0562
Beryllium	**0.77**	**mg/kg dry**	**0.31**	**0.052**	**1**	***6010C**	**8/26/11 20:02**	**DWR**	**P1H0562**
Cadmium	BRL	mg/kg dry	0.31	0.033	1	*6010C	8/26/11 20:02	DWR	P1H0562
Chromium	**26**	**mg/kg dry**	**0.31**	**0.043**	**1**	***6010C**	**8/26/11 20:02**	**DWR**	**P1H0562**
Copper	**33**	**mg/kg dry**	**0.62**	**0.27**	**1**	***6010C**	**8/26/11 20:02**	**DWR**	**P1H0562**
Lead	**5.3**	**mg/kg dry**	**0.31**	**0.076**	**1**	***6010C**	**8/26/11 20:02**	**DWR**	**P1H0562**
Nickel	**240**	**mg/kg dry**	**6.2**	**1.9**	**5**	***6010C**	**8/29/11 12:59**	**DWR**	**P1H0562**
Selenium	**4.2**	**mg/kg dry**	**0.62**	**0.12**	**1**	***6010C**	**8/26/11 20:02**	**DWR**	**P1H0562**
Silver	BRL	mg/kg dry	0.31	0.032	1	*6010C	8/26/11 20:02	DWR	P1H0562
Thallium	BRL	mg/kg dry	0.62	0.12	1	*6010C	8/26/11 20:02	DWR	P1H0562
Tin	BRL	mg/kg dry	6.2	0.55	1	*6010C	8/26/11 20:02	DWR	P1H0562
Zinc	**51**	**mg/kg dry**	**3.1**	**0.32**	**1**	***6010C**	**8/26/11 20:02**	**DWR**	**P1H0562**

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09/01/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: UMF

Sample Matrix: Solid

Client Sample ID: GP-51
Prism Sample ID: 1080611-09
Prism Work Order: 1080611
Time Collected: 08/19/11 08:25
Time Submitted: 08/22/11 16:25

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**83.8**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**8/24/11 16:12**	**JAB**	**P1H0543**
Total Metals									
Mercury	BRL	mg/kg dry	0.025	0.0030	1	*7471B	8/29/11 13:36	LTB	P1H0564
Antimony	BRL	mg/kg dry	0.24	0.043	1	*6010C	8/26/11 20:10	DWR	P1H0562
Arsenic	BRL	mg/kg dry	0.59	0.067	1	*6010C	8/26/11 20:10	DWR	P1H0562
Beryllium	**0.58**	**mg/kg dry**	**0.30**	**0.050**	**1**	***6010C**	**8/26/11 20:10**	**DWR**	**P1H0562**
Cadmium	**0.62**	**mg/kg dry**	**0.30**	**0.031**	**1**	***6010C**	**8/26/11 20:10**	**DWR**	**P1H0562**
Chromium	**89**	**mg/kg dry**	**0.30**	**0.041**	**1**	***6010C**	**8/26/11 20:10**	**DWR**	**P1H0562**
Copper	**55**	**mg/kg dry**	**0.59**	**0.26**	**1**	***6010C**	**8/26/11 20:10**	**DWR**	**P1H0562**
Lead	**15**	**mg/kg dry**	**0.30**	**0.073**	**1**	***6010C**	**8/26/11 20:10**	**DWR**	**P1H0562**
Nickel	**19**	**mg/kg dry**	**1.2**	**0.36**	**1**	***6010C**	**8/26/11 20:10**	**DWR**	**P1H0562**
Selenium	**3.2**	**mg/kg dry**	**0.59**	**0.12**	**1**	***6010C**	**8/26/11 20:10**	**DWR**	**P1H0562**
Silver	BRL	mg/kg dry	0.30	0.030	1	*6010C	8/26/11 20:10	DWR	P1H0562
Thallium	BRL	mg/kg dry	0.59	0.11	1	*6010C	8/26/11 20:10	DWR	P1H0562
Tin	BRL	mg/kg dry	5.9	0.53	1	*6010C	8/26/11 20:10	DWR	P1H0562
Zinc	**71**	**mg/kg dry**	**3.0**	**0.30**	**1**	***6010C**	**8/26/11 20:10**	**DWR**	**P1H0562**

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ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: UMF

Sample Matrix: Solid

Client Sample ID: GP-52
Prism Sample ID: 1080611-10
Prism Work Order: 1080611
Time Collected: 08/19/11 08:35
Time Submitted: 08/22/11 16:25

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**74.9**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**8/24/11 16:12**	**JAB**	**P1H0543**
Total Metals									
Mercury	BRL	mg/kg dry	0.025	0.0030	1	*7471B	8/29/11 13:41	LTB	P1H0564
Antimony	BRL	mg/kg dry	0.26	0.047	1	*6010C	8/26/11 20:18	DWR	P1H0562
Arsenic	**0.69**	**mg/kg dry**	**0.65**	**0.074**	**1**	***6010C**	**8/26/11 20:18**	**DWR**	**P1H0562**
Beryllium	**0.78**	**mg/kg dry**	**0.33**	**0.055**	**1**	***6010C**	**8/26/11 20:18**	**DWR**	**P1H0562**
Cadmium	BRL	mg/kg dry	0.33	0.035	1	*6010C	8/26/11 20:18	DWR	P1H0562
Chromium	**17**	**mg/kg dry**	**0.33**	**0.045**	**1**	***6010C**	**8/26/11 20:18**	**DWR**	**P1H0562**
Copper	**50**	**mg/kg dry**	**0.65**	**0.28**	**1**	***6010C**	**8/26/11 20:18**	**DWR**	**P1H0562**
Lead	**2.4**	**mg/kg dry**	**0.33**	**0.081**	**1**	***6010C**	**8/26/11 20:18**	**DWR**	**P1H0562**
Nickel	**16**	**mg/kg dry**	**1.3**	**0.40**	**1**	***6010C**	**8/26/11 20:18**	**DWR**	**P1H0562**
Selenium	**4.7**	**mg/kg dry**	**0.65**	**0.13**	**1**	***6010C**	**8/26/11 20:18**	**DWR**	**P1H0562**
Silver	BRL	mg/kg dry	0.33	0.033	1	*6010C	8/26/11 20:18	DWR	P1H0562
Thallium	BRL	mg/kg dry	0.65	0.13	1	*6010C	8/26/11 20:18	DWR	P1H0562
Tin	BRL	mg/kg dry	6.5	0.58	1	*6010C	8/26/11 20:18	DWR	P1H0562
Zinc	**58**	**mg/kg dry**	**3.3**	**0.34**	**1**	***6010C**	**8/26/11 20:18**	**DWR**	**P1H0562**

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ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: UMF

Sample Matrix: Solid

Client Sample ID: GP-55
Prism Sample ID: 1080611-11
Prism Work Order: 1080611
Time Collected: 08/19/11 10:00
Time Submitted: 08/22/11 16:25

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**74.6**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**8/24/11 16:12**	**JAB**	**P1H0543**
Total Metals									
Mercury	BRL	mg/kg dry	0.029	0.0035	1	*7471B	8/29/11 13:45	LTB	P1H0564
Antimony	BRL	mg/kg dry	0.26	0.048	1	*6010C	8/26/11 20:26	DWR	P1H0562
Arsenic	BRL	mg/kg dry	0.66	0.075	1	*6010C	8/26/11 20:26	DWR	P1H0562
Beryllium	**0.79**	**mg/kg dry**	**0.33**	**0.056**	**1**	***6010C**	**8/26/11 20:26**	**DWR**	**P1H0562**
Cadmium	BRL	mg/kg dry	0.33	0.035	1	*6010C	8/26/11 20:26	DWR	P1H0562
Chromium	**19**	**mg/kg dry**	**0.33**	**0.045**	**1**	***6010C**	**8/26/11 20:26**	**DWR**	**P1H0562**
Copper	**16**	**mg/kg dry**	**0.66**	**0.29**	**1**	***6010C**	**8/26/11 20:26**	**DWR**	**P1H0562**
Lead	**3.4**	**mg/kg dry**	**0.33**	**0.081**	**1**	***6010C**	**8/26/11 20:26**	**DWR**	**P1H0562**
Nickel	**13**	**mg/kg dry**	**1.3**	**0.41**	**1**	***6010C**	**8/26/11 20:26**	**DWR**	**P1H0562**
Selenium	**4.6**	**mg/kg dry**	**0.66**	**0.13**	**1**	***6010C**	**8/26/11 20:26**	**DWR**	**P1H0562**
Silver	BRL	mg/kg dry	0.33	0.034	1	*6010C	8/26/11 20:26	DWR	P1H0562
Thallium	BRL	mg/kg dry	0.66	0.13	1	*6010C	8/26/11 20:26	DWR	P1H0562
Tin	BRL	mg/kg dry	6.6	0.59	1	*6010C	8/26/11 20:26	DWR	P1H0562
Zinc	**51**	**mg/kg dry**	**3.3**	**0.34**	**1**	***6010C**	**8/26/11 20:26**	**DWR**	**P1H0562**

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09/01/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: UMF

Sample Matrix: Solid

Client Sample ID: GP-56
Prism Sample ID: 1080611-12
Prism Work Order: 1080611
Time Collected: 08/19/11 10:10
Time Submitted: 08/22/11 16:25

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**79.0**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**8/24/11 16:12**	**JAB**	**P1H0543**
Total Metals									
Mercury	BRL	mg/kg dry	0.026	0.0031	1	*7471B	8/29/11 13:50	LTB	P1H0564
Antimony	BRL	mg/kg dry	0.25	0.046	1	*6010C	8/26/11 20:35	DWR	P1H0562
Arsenic	**0.73**	**mg/kg dry**	**0.63**	**0.072**	**1**	***6010C**	**8/26/11 20:35**	**DWR**	**P1H0562**
Beryllium	**0.73**	**mg/kg dry**	**0.32**	**0.054**	**1**	***6010C**	**8/26/11 20:35**	**DWR**	**P1H0562**
Cadmium	BRL	mg/kg dry	0.32	0.034	1	*6010C	8/26/11 20:35	DWR	P1H0562
Chromium	**58**	**mg/kg dry**	**0.32**	**0.044**	**1**	***6010C**	**8/26/11 20:35**	**DWR**	**P1H0562**
Copper	**23**	**mg/kg dry**	**0.63**	**0.27**	**1**	***6010C**	**8/26/11 20:35**	**DWR**	**P1H0562**
Lead	**1.7**	**mg/kg dry**	**0.32**	**0.078**	**1**	***6010C**	**8/26/11 20:35**	**DWR**	**P1H0562**
Nickel	**15**	**mg/kg dry**	**1.3**	**0.39**	**1**	***6010C**	**8/26/11 20:35**	**DWR**	**P1H0562**
Selenium	**4.5**	**mg/kg dry**	**0.63**	**0.13**	**1**	***6010C**	**8/26/11 20:35**	**DWR**	**P1H0562**
Silver	BRL	mg/kg dry	0.32	0.032	1	*6010C	8/26/11 20:35	DWR	P1H0562
Thallium	BRL	mg/kg dry	0.63	0.12	1	*6010C	8/26/11 20:35	DWR	P1H0562
Tin	BRL	mg/kg dry	6.3	0.56	1	*6010C	8/26/11 20:35	DWR	P1H0562
Zinc	**75**	**mg/kg dry**	**3.2**	**0.32**	**1**	***6010C**	**8/26/11 20:35**	**DWR**	**P1H0562**

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ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: UMF

Sample Matrix: Solid

Client Sample ID: GP-57
Prism Sample ID: 1080611-13
Prism Work Order: 1080611
Time Collected: 08/19/11 10:25
Time Submitted: 08/22/11 16:25

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**80.2**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**8/24/11 16:12**	**JAB**	**P1H0543**
Total Metals									
Mercury	BRL	mg/kg dry	0.024	0.0029	1	*7471B	8/29/11 14:04	LTB	P1H0564
Antimony	BRL	mg/kg dry	0.24	0.044	1	*6010C	8/26/11 20:45	DWR	P1H0562
Arsenic	**0.81**	**mg/kg dry**	**0.61**	**0.069**	**1**	***6010C**	**8/26/11 20:45**	**DWR**	**P1H0562**
Beryllium	**0.68**	**mg/kg dry**	**0.31**	**0.052**	**1**	***6010C**	**8/26/11 20:45**	**DWR**	**P1H0562**
Cadmium	BRL	mg/kg dry	0.31	0.032	1	*6010C	8/26/11 20:45	DWR	P1H0562
Chromium	**93**	**mg/kg dry**	**0.31**	**0.042**	**1**	***6010C**	**8/26/11 20:45**	**DWR**	**P1H0562**
Copper	**35**	**mg/kg dry**	**0.61**	**0.26**	**1**	***6010C**	**8/26/11 20:45**	**DWR**	**P1H0562**
Lead	**1.3**	**mg/kg dry**	**0.31**	**0.075**	**1**	***6010C**	**8/26/11 20:45**	**DWR**	**P1H0562**
Nickel	**9.0**	**mg/kg dry**	**1.2**	**0.38**	**1**	***6010C**	**8/26/11 20:45**	**DWR**	**P1H0562**
Selenium	**3.0**	**mg/kg dry**	**0.61**	**0.12**	**1**	***6010C**	**8/26/11 20:45**	**DWR**	**P1H0562**
Silver	BRL	mg/kg dry	0.31	0.031	1	*6010C	8/26/11 20:45	DWR	P1H0562
Thallium	**0.69**	**mg/kg dry**	**0.61**	**0.12**	**1**	***6010C**	**8/26/11 20:45**	**DWR**	**P1H0562**
Tin	BRL	mg/kg dry	6.1	0.54	1	*6010C	8/26/11 20:45	DWR	P1H0562
Zinc	**65**	**mg/kg dry**	**3.1**	**0.31**	**1**	***6010C**	**8/26/11 20:45**	**DWR**	**P1H0562**

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ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: UMF

Sample Matrix: Solid

Client Sample ID: GP-58
Prism Sample ID: 1080611-14
Prism Work Order: 1080611
Time Collected: 08/19/11 10:50
Time Submitted: 08/22/11 16:25

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**84.1**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**8/24/11 16:12**	**JAB**	**P1H0543**
Total Metals									
Mercury	BRL	mg/kg dry	0.025	0.0031	1	*7471B	8/29/11 14:08	LTB	P1H0564
Antimony	BRL	mg/kg dry	0.24	0.043	1	*6010C	8/26/11 20:53	DWR	P1H0562
Arsenic	BRL	mg/kg dry	0.59	0.067	1	*6010C	8/26/11 20:53	DWR	P1H0562
Beryllium	**0.36**	**mg/kg dry**	**0.30**	**0.050**	**1**	***6010C**	**8/26/11 20:53**	**DWR**	**P1H0562**
Cadmium	BRL	mg/kg dry	0.30	0.031	1	*6010C	8/26/11 20:53	DWR	P1H0562
Chromium	**3.6**	**mg/kg dry**	**0.30**	**0.041**	**1**	***6010C**	**8/26/11 20:53**	**DWR**	**P1H0562**
Copper	**8.3**	**mg/kg dry**	**0.59**	**0.26**	**1**	***6010C**	**8/26/11 20:53**	**DWR**	**P1H0562**
Lead	**0.98**	**mg/kg dry**	**0.30**	**0.073**	**1**	***6010C**	**8/26/11 20:53**	**DWR**	**P1H0562**
Nickel	**2.9**	**mg/kg dry**	**1.2**	**0.36**	**1**	***6010C**	**8/26/11 20:53**	**DWR**	**P1H0562**
Selenium	**1.6**	**mg/kg dry**	**0.59**	**0.12**	**1**	***6010C**	**8/26/11 20:53**	**DWR**	**P1H0562**
Silver	BRL	mg/kg dry	0.30	0.030	1	*6010C	8/26/11 20:53	DWR	P1H0562
Thallium	BRL	mg/kg dry	0.59	0.11	1	*6010C	8/26/11 20:53	DWR	P1H0562
Tin	BRL	mg/kg dry	5.9	0.53	1	*6010C	8/26/11 20:53	DWR	P1H0562
Zinc	**24**	**mg/kg dry**	**3.0**	**0.30**	**1**	***6010C**	**8/26/11 20:53**	**DWR**	**P1H0562**

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Phone: 704/529-6364 - Toll Free Number: 1-800/529-6364 - Fax: 704/525-0409

PRISM LABORATORIES, INC. | Full-Service Analytical & Environmental Solutions

Laboratory Report

09/01/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: UMF

Sample Matrix: Solid

Client Sample ID: DUPLICATE
Prism Sample ID: 1080611-15
Prism Work Order: 1080611
Time Collected: 08/19/11 09:30
Time Submitted: 08/22/11 16:25

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**75.5**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**8/24/11 16:12**	**JAB**	**P1H0543**
Total Metals									
Mercury	BRL	mg/kg dry	0.027	0.0033	1	*7471B	8/29/11 14:13	LTB	P1H0564
Antimony	BRL	mg/kg dry	0.26	0.048	1	*6010C	8/26/11 21:01	DWR	P1H0562
Arsenic	BRL	mg/kg dry	0.66	0.074	1	*6010C	8/26/11 21:01	DWR	P1H0562
Beryllium	**0.63**	**mg/kg dry**	**0.33**	**0.056**	**1**	***6010C**	**8/26/11 21:01**	**DWR**	**P1H0562**
Cadmium	**3.2**	**mg/kg dry**	**0.33**	**0.035**	**1**	***6010C**	**8/26/11 21:01**	**DWR**	**P1H0562**
Chromium	**12**	**mg/kg dry**	**0.33**	**0.045**	**1**	***6010C**	**8/26/11 21:01**	**DWR**	**P1H0562**
Copper	**47**	**mg/kg dry**	**0.66**	**0.28**	**1**	***6010C**	**8/26/11 21:01**	**DWR**	**P1H0562**
Lead	**1.9**	**mg/kg dry**	**0.33**	**0.081**	**1**	***6010C**	**8/26/11 21:01**	**DWR**	**P1H0562**
Nickel	**1100**	**mg/kg dry**	**13**	**4.0**	**10**	***6010C**	**8/29/11 13:07**	**DWR**	**P1H0562**
Selenium	**4.1**	**mg/kg dry**	**0.66**	**0.13**	**1**	***6010C**	**8/26/11 21:01**	**DWR**	**P1H0562**
Silver	BRL	mg/kg dry	0.33	0.034	1	*6010C	8/26/11 21:01	DWR	P1H0562
Thallium	BRL	mg/kg dry	0.66	0.13	1	*6010C	8/26/11 21:01	DWR	P1H0562
Tin	BRL	mg/kg dry	6.6	0.59	1	*6010C	8/26/11 21:01	DWR	P1H0562
Zinc	**130**	**mg/kg dry**	**3.3**	**0.34**	**1**	***6010C**	**8/26/11 21:01**	**DWR**	**P1H0562**

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ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: UMF

Prism Work Order: 1080611
Time Submitted: 8/22/11 4:25:00PM

Total Metals - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch P1H0562 - 3050B										
Blank (P1H0562-BLK1)				Prepared: 08/25/11 Analyzed: 08/26/11						
Antimony	BRL	0.20	mg/kg wet							
Arsenic	BRL	0.50	mg/kg wet							
Beryllium	BRL	0.25	mg/kg wet							
Cadmium	BRL	0.25	mg/kg wet							
Chromium	BRL	0.25	mg/kg wet							
Copper	BRL	0.50	mg/kg wet							
Lead	BRL	0.25	mg/kg wet							
Nickel	BRL	1.0	mg/kg wet							
Selenium	BRL	0.50	mg/kg wet							
Silver	BRL	0.25	mg/kg wet							
Thallium	BRL	0.50	mg/kg wet							
Tin	BRL	5.0	mg/kg wet							
Zinc	BRL	2.5	mg/kg wet							
LCS (P1H0562-BS1)				Prepared: 08/25/11 Analyzed: 08/26/11						
Antimony	24.0	0.20	mg/kg wet	25.00		96	80-120			
Arsenic	24.2	0.50	mg/kg wet	25.00		97	80-120			
Beryllium	24.7	0.25	mg/kg wet	25.00		99	80-120			
Cadmium	24.1	0.25	mg/kg wet	25.00		97	80-120			
Chromium	24.9	0.25	mg/kg wet	25.00		100	80-120			
Copper	25.4	0.50	mg/kg wet	25.00		102	80-120			
Lead	24.9	0.25	mg/kg wet	25.00		100	80-120			
Nickel	24.4	1.0	mg/kg wet	25.00		98	80-120			
Selenium	24.1	0.50	mg/kg wet	25.00		97	80-120			
Silver	24.5	0.25	mg/kg wet	25.00		98	80-120			
Thallium	24.9	0.50	mg/kg wet	25.00		100	80-120			
Tin	25.4	5.0	mg/kg wet	25.00		102	80-120			
Zinc	24.6	2.5	mg/kg wet	25.00		99	80-120			

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Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: UMF

Prism Work Order: 1080611
Time Submitted: 8/22/11 4:25:00PM

Total Metals - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch P1H0562 - 3050B										
Matrix Spike (P1H0562-MS1)		**Source: 1080611-01**		Prepared: 08/25/11	Analyzed: 08/26/11					
Antimony	6.16	0.23	mg/kg dry	29.14	BRL	21	75-125			MI
Arsenic	23.1	0.58	mg/kg dry	29.14	0.665	77	75-125			
Beryllium	26.1	0.29	mg/kg dry	29.14	0.427	88	75-125			
Cadmium	23.7	0.29	mg/kg dry	29.14	BRL	81	75-125			
Chromium	32.7	0.29	mg/kg dry	29.14	9.57	79	75-125			
Copper	44.9	0.58	mg/kg dry	29.14	14.3	105	75-125			
Lead	23.2	0.29	mg/kg dry	29.14	1.14	76	75-125			
Nickel	27.5	1.2	mg/kg dry	29.14	5.73	75	75-125			
Selenium	25.9	0.58	mg/kg dry	29.14	1.69	83	75-125			
Silver	26.4	0.29	mg/kg dry	29.14	BRL	91	75-125			
Thallium	21.9	0.58	mg/kg dry	29.14	BRL	75	75-125			
Tin	20.3	5.8	mg/kg dry	29.14	BRL	70	75-125			MI
Zinc	55.5	2.9	mg/kg dry	29.14	29.8	88	75-125			
Matrix Spike Dup (P1H0562-MSD1)		**Source: 1080611-01**		Prepared: 08/25/11	Analyzed: 08/26/11					
Antimony	5.08	0.23	mg/kg dry	29.14	BRL	17	75-125	19	20	MI
Arsenic	19.3	0.58	mg/kg dry	29.14	0.665	64	75-125	18	20	MI
Beryllium	26.7	0.29	mg/kg dry	29.14	0.427	90	75-125	3	20	
Cadmium	24.2	0.29	mg/kg dry	29.14	BRL	83	75-125	2	20	
Chromium	25.8	0.29	mg/kg dry	29.14	9.57	56	75-125	23	20	D, MI
Copper	43.6	0.58	mg/kg dry	29.14	14.3	100	75-125	3	20	
Lead	19.8	0.29	mg/kg dry	29.14	1.14	64	75-125	16	20	MI
Nickel	22.4	1.2	mg/kg dry	29.14	5.73	57	75-125	20	20	MI
Selenium	23.5	0.58	mg/kg dry	29.14	1.69	75	75-125	9	20	
Silver	26.9	0.29	mg/kg dry	29.14	BRL	92	75-125	2	20	
Thallium	19.1	0.58	mg/kg dry	29.14	BRL	66	75-125	13	20	MI
Tin	17.1	5.8	mg/kg dry	29.14	BRL	59	75-125	18	20	MI
Zinc	54.7	2.9	mg/kg dry	29.14	29.8	86	75-125	1	20	

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ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: UMF

Prism Work Order: 1080611
Time Submitted: 8/22/11 4:25:00PM

Total Metals - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch P1H0562 - 3050B										
Post Spike (P1H0562-PS1)		**Source: 1080611-01**		Prepared: 08/25/11		Analyzed: 08/26/11				
Antimony	0.815		mg/L	1.000	-0.0123	83	80-120			
Arsenic	0.840		mg/L	1.000	0.0229	82	80-120			
Beryllium	0.846		mg/L	1.000	0.0147	83	80-120			
Cadmium	0.759		mg/L	1.000	-0.00605	77	80-120			MI
Chromium	1.13		mg/L	1.000	0.330	80	80-120			
Copper	1.42		mg/L	1.000	0.494	92	80-120			
Lead	0.818		mg/L	1.000	0.0394	78	80-120			MI
Nickel	0.967		mg/L	1.000	0.198	77	80-120			MI
Selenium	0.891		mg/L	1.000	0.0582	83	80-120			
Silver	0.881		mg/L	1.000	-0.00758	89	80-120			
Thallium	0.782		mg/L	1.000	-0.00166	78	80-120			MI
Tin	0.808		mg/L	1.000	0.00809	80	80-120			
Zinc	1.77		mg/L	1.000	1.03	74	80-120			MI
Batch P1H0564 - 7471B										
Blank (P1H0564-BLK1)				Prepared & Analyzed: 08/29/11						
Mercury	BRL	0.019	mg/kg wet							
LCS (P1H0564-BS1)				Prepared & Analyzed: 08/29/11						
Mercury	0.440	0.020	mg/kg wet	0.4167		106	80-120			

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ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: UMF

Prism Work Order: 1080611
Time Submitted: 8/22/11 4:25:00PM

General Chemistry Parameters - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch P1H0543 - NO PREP										
Blank (P1H0543-BLK1)				Prepared & Analyzed: 08/24/11						
% Solids	100	0.100	% by Weight							
Duplicate (P1H0543-DUP1)		**Source: 1080611-06**		Prepared & Analyzed: 08/24/11						
% Solids	81.0	0.100	% by Weight		81.0			0	20	

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Sample Extraction Data

Prep Method: 3050B

Lab Number	Batch	Initial	Final	Date/Time
1080611-01	P1H0562	2.01 g	50 mL	08/25/11 8:05
1080611-02	P1H0562	1.98 g	50 mL	08/25/11 8:05
1080611-03	P1H0562	2.02 g	50 mL	08/25/11 8:05
1080611-04	P1H0562	2.02 g	50 mL	08/25/11 8:05
1080611-04	P1H0562	2.02 g	50 mL	08/25/11 8:05
1080611-05	P1H0562	1.98 g	50 mL	08/25/11 8:05
1080611-06	P1H0562	2.02 g	50 mL	08/25/11 8:05
1080611-07	P1H0562	2.01 g	50 mL	08/25/11 8:05
1080611-07	P1H0562	2.01 g	50 mL	08/25/11 8:05
1080611-08	P1H0562	2.04 g	50 mL	08/25/11 8:05
1080611-08	P1H0562	2.04 g	50 mL	08/25/11 8:05
1080611-09	P1H0562	2.01 g	50 mL	08/25/11 8:05
1080611-10	P1H0562	2.04 g	50 mL	08/25/11 8:05
1080611-11	P1H0562	2.03 g	50 mL	08/25/11 8:05
1080611-12	P1H0562	2 g	50 mL	08/25/11 8:05
1080611-13	P1H0562	2.04 g	50 mL	08/25/11 8:05
1080611-14	P1H0562	2.01 g	50 mL	08/25/11 8:05
1080611-15	P1H0562	2.01 g	50 mL	08/25/11 8:05
1080611-15	P1H0562	2.01 g	50 mL	08/25/11 8:05

Prep Method: 7471B

Lab Number	Batch	Initial	Final	Date/Time
1080611-01	P1H0564	0.55 g	50 mL	08/29/11 8:50
1080611-02	P1H0564	0.58 g	50 mL	08/29/11 8:50
1080611-03	P1H0564	0.55 g	50 mL	08/29/11 8:50
1080611-04	P1H0564	0.59 g	50 mL	08/29/11 8:50
1080611-05	P1H0564	0.59 g	50 mL	08/29/11 8:50
1080611-06	P1H0564	0.57 g	50 mL	08/29/11 8:50
1080611-07	P1H0564	0.59 g	50 mL	08/29/11 8:50
1080611-08	P1H0564	0.61 g	50 mL	08/29/11 8:50
1080611-09	P1H0564	0.58 g	50 mL	08/29/11 8:50
1080611-10	P1H0564	0.65 g	50 mL	08/29/11 8:50
1080611-11	P1H0564	0.55 g	50 mL	08/29/11 8:50
1080611-12	P1H0564	0.59 g	50 mL	08/29/11 8:50
1080611-13	P1H0564	0.62 g	50 mL	08/29/11 8:50
1080611-14	P1H0564	0.56 g	50 mL	08/29/11 8:50
1080611-15	P1H0564	0.58 g	50 mL	08/29/11 8:50

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Subcontracted Analyses

The following analyses were subcontracted to Gulf Coast Analytical Labs, Inc.

Lab Number	Analysis
1080611-01	Hexavalent Chromium (Sub)
1080611-02	Hexavalent Chromium (Sub)
1080611-03	Hexavalent Chromium (Sub)
1080611-04	Hexavalent Chromium (Sub)
1080611-05	Hexavalent Chromium (Sub)
1080611-06	Hexavalent Chromium (Sub)
1080611-07	Hexavalent Chromium (Sub)
1080611-08	Hexavalent Chromium (Sub)
1080611-09	Hexavalent Chromium (Sub)
1080611-10	Hexavalent Chromium (Sub)
1080611-11	Hexavalent Chromium (Sub)
1080611-12	Hexavalent Chromium (Sub)
1080611-13	Hexavalent Chromium (Sub)
1080611-14	Hexavalent Chromium (Sub)
1080611-15	Hexavalent Chromium (Sub)

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CHAIN OF CUSTODY RECORD

PAGE 1 OF 2 QUOTE # TO ENSURE PROPER BILLING: _____

Client Company Name: ECS Carolinas, LLP
Report To/Contact Name: Toby Benfield
Reporting Address: 4811 Roger Blvd Greensboro NC
Phone: 856 7150 Fax (Yes) (No): 856 7160
Email (Yes) (No) Email Address: TBenfield@ECSLimited.com
EDD Type: PDF ✓ Excel ✓ Other _____
Site Location Name: UMF
Site Location Physical Address: 133 Blue bell Rd Greensboro NC

Project Name: UMF
Short Hold Analysis: (Yes) (No) UST Project: (Yes) (No)
*Please ATTACH any project specific reporting (QC LEVEL I II III-IV) provisions and/or QC Requirements
Invoice To: Toby Benfield - Email
Address: _____

Purchase Order No./Billing Reference _____
Requested Due Date ☐ 1 Day ☐ 2 Days ☐ 3 Days ☐ 4 Days ☐ 5 Days
"Working Days" ☐ 6-9 Days ☒ Standard 10 days ☐ Rush Work Must Be Pre-Approved
Samples received after 15:00 will be processed next business day.
Turnaround time is based on business days, excluding weekends and holidays.
(SEE REVERSE FOR TERMS & CONDITIONS REGARDING SERVICES RENDERED BY PRISM LABORATORIES, INC. TO CLIENT)

LAB USE ONLY

	YES	NO	N/A
Samples INTACT upon arrival?	✓		
Received ON WET ICE? Temp 6.8	✓		
PROPER PRESERVATIVES indicated?	✓		
Received WITHIN HOLDING TIMES?	✓		
CUSTODY SEALS INTACT?			✓
VOLATILES rec'd W/OUT HEADSPACE?			✓
PROPER CONTAINERS used?	✓		

TO BE FILLED IN BY CLIENT/SAMPLING PERSONNEL
Certification: NELAC ____ USACE ____ FL ____ NC ____
SC ____ OTHER ____ N/A ____
Water Chlorinated: YES ___ NO ___
Sample Iced Upon Collection: YES ___ NO ___

CLIENT SAMPLE DESCRIPTION	DATE COLLECTED	TIME COLLECTED MILITARY HOURS	MATRIX (SOIL, WATER OR SLUDGE)	SAMPLE CONTAINER *TYPE SEE BELOW	NO.	SIZE	PRESERVATIVES	Benzene/Toluene/Ethylbenzene/Xylenes	Cr+6					REMARKS	PRISM LAB ID NO.
GP-43	8-19	0945	S	C	2	4oz		✓	✓						01
GP-44	↓	0955	↓	↓	2	↓		✓	✓						02
GP-45	↓	845	↓	↓	↓	↓		✓	✓						03
GP-46	↓	855	↓	↓	↓	↓		✓	✓						04
GP-47B	↓	905	↓	↓	↓	↓		✓	✓						05
GP-48	↓	920	↓	↓	↓	↓		✓	✓						06
GP-49	↓	930	↓	↓	↓	↓		✓	✓						07
GP-50	↓	815	↓	↓	↓	↓		✓	✓						08
GP-51	↓	825	↓	↓	↓	↓		✓	✓						09
GP-52	↓	835	↓	↓	↓	↓		✓	✓						10

PRESS DOWN FIRMLY - 3 COPIES

Sampler's Signature _____ Sampled By (Print Name) _____ Affiliation _____

Upon relinquishing, this Chain of Custody is your authorization for Prism to proceed with the analyses as requested above. Any changes must be submitted in writing to the Prism Project Manager. There will be charges for any changes after analyses have been initialized.

Relinquished By: (Signature)	Received By: (Signature)	Date	Military/Hours
	[signature]	8-22-11	1220
Relinquished By: (Signature) [signature] 8-22-11 1625	Received By: (Signature)	Date	
Relinquished By: (Signature)	Received For Prism Laboratories By: [signature]	Date 8/22/11	1625

Method of Shipment: NOTE: ALL SAMPLE COOLERS SHOULD BE TAPED SHUT WITH CUSTODY SEALS FOR TRANSPORTATION TO THE LABORATORY. SAMPLES ARE NOT ACCEPTED AND VERIFIED AGAINST COC UNTIL RECEIVED AT THE LABORATORY.
☐ Fed Ex ☐ UPS ☐ Hand-delivered ☒ Prism Field Service ☐ Other _____

COC Group No. 1080611

Additional Comments:

PRISM USE ONLY
Site Arrival Time:
Site Departure Time:
Field Tech Fee:
Mileage:

TBC

SEE REVERSE FOR TERMS & CONDITIONS

NPDES:	UST:	GROUNDWATER:	DRINKING WATER:	SOLID WASTE:	RCRA:	CERCLA	LANDFILL	OTHER:
☐ NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC

CONTAINER TYPE CODES: A = Amber C = Clear G = Glass P = Plastic; TL = Teflon-Lined Cap VOA = Volatile Organics Analysis (Zero Head Space)

ORIGINAL

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Phone: 704/529-6364 • Fax: 704/525-0409

CHAIN OF CUSTODY RECORD

PAGE 2 OF 2 QUOTE # TO ENSURE PROPER BILLING: _____

Client Company Name: CCS
Report To/Contact Name: Toby Bensfield
Reporting Address: _____

Phone: _____ Fax (Yes) (No): _____
Email (Yes) (No) Email Address _____
EDD Type: PDF X Excel X Other _____
Site Location Name: _____
Site Location Physical Address: UMF 133 Blue bell Road

Project Name: UMF
Short Hold Analysis: (Yes) (No) UST Project: (Yes) (No)
*Please ATTACH any project specific reporting (QC LEVEL I II III IV) provisions and/or QC Requirements
Invoice To: _____
Address: _____

Purchase Order No./Billing Reference _____
Requested Due Date ☐ 1 Day ☐ 2 Days ☐ 3 Days ☐ 4 Days ☐ 5 Days
"Working Days" ☐ 6-9 Days ☐ Standard 10 days ☐ Rush Work Must Be Pre-Approved
Samples received after 15:00 will be processed next business day.
Turnaround time is based on business days, excluding weekends and holidays.
(SEE REVERSE FOR TERMS & CONDITIONS REGARDING SERVICES RENDERED BY PRISM LABORATORIES, INC. TO CLIENT)

LAB USE ONLY

	YES	NO	N/A
Samples INTACT upon arrival?	✓		
Received ON WET ICE? Temp 6.8	✓		
PROPER PRESERVATIVES indicated?	✓		
Received WITHIN HOLDING TIMES?	✓		
CUSTODY SEALS INTACT?			✓
VOLATILES rec'd W/OUT HEADSPACE?			✓
PROPER CONTAINERS used?	✓		

TO BE FILLED IN BY CLIENT/SAMPLING PERSONNEL
Certification: NELAC ____ USACE ____ FL ____ NC ____
SC ____ OTHER ____ N/A ____
Water Chlorinated: YES ___ NO ___
Sample Iced Upon Collection: YES ___ NO ___

CLIENT SAMPLE DESCRIPTION	DATE COLLECTED	TIME COLLECTED MILITARY HOURS	MATRIX (SOIL, WATER OR SLUDGE)	SAMPLE CONTAINER *TYPE SEE BELOW	NO.	SIZE	PRESERVATIVES	Bacteria Allowance + SM	CCT6					REMARKS	PRISM LAB ID NO.
GP-55		1000	S	G	2	4oz		✓	✓						11
GP-56		1010	↓	↓	↓	↓		✓	✓						12
GP-57		1025	↓	↓	↓	↓		✓	✓						13
GP-58		1030	↓	↓	↓	↓		✓	✓						14
Duplicate		0930	↓	↓	↓	↓		✓	✓						15

PRESS DOWN FIRMLY - 3 COPIES

Sampler's Signature _____ Sampled By (Print Name) _____ Affiliation _____

Upon relinquishing, this Chain of Custody is your authorization for Prism to proceed with the analyses as requested above. Any changes must be submitted in writing to the Prism Project Manager. There will be charges for any changes after analyses have been initialized.

Relinquished By: (Signature)	Received By: (Signature)	Date	Military/Hours
	[signature]	8-22-11	1220
Relinquished By: (Signature) [signature] 8-22-11 1625	Received By: (Signature)	Date	
Relinquished By: (Signature)	Received For Prism Laboratories By: [signature]	Date 8/22/11	1625

Method of Shipment: NOTE: ALL SAMPLE COOLERS SHOULD BE TAPED SHUT WITH CUSTODY SEALS FOR TRANSPORTATION TO THE LABORATORY. SAMPLES ARE NOT ACCEPTED AND VERIFIED AGAINST COC UNTIL RECEIVED AT THE LABORATORY.
☐ Fed Ex ☐ UPS ☐ Hand-delivered ☒ Prism Field Service ☐ Other _____
COC Group No. 1080611

Additional Comments:

PRISM USE ONLY
Site Arrival Time:
Site Departure Time:
Field Tech Fee:
Mileage:

NPDES:	UST:	GROUNDWATER:	DRINKING WATER:	SOLID WASTE:	RCRA:	CERCLA	LANDFILL	OTHER:
☐ NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC

CONTAINER TYPE CODES: A = Amber C = Clear G = Glass P = Plastic; TL = Teflon-Lined Cap VOA = Volatile Organics Analysis (Zero Head Space)

SEE REVERSE FOR TERMS & CONDITIONS

ORIGINAL

ACCESS
ANALYTICAL, INC.

ANALYTICAL REPORT

CLIENT
Prism Laboratories, Inc.
PO BOX 240543
Charlotte, NC 28224

ATTENTION
Angie Overcash

PROJECT ID
1080611

LABORATORY REPORT NUMBER
211082707

DATE
08/31/2011

Primary Data Review By

IntegriSign

Curtis Ekker
Data Validation Manager, GCAL

Secondary Data Review By

Ashley B. Amick
Project Manager, Access Analytical, Inc.
aamick@accessanalyticalinc.com

PLEASE NOTE:

- **Unless otherwise noted, all analysis on this report performed at Gulf Coast Analytical Labs (GCAL), 7979 GSRI Avenue, Baton Rouge, LA 70820.**
- **GCAL Is SCDHEC certified laboratory # 73006, NCDENR certified lab # 618, GA certified lab # LA-01955, NELAP certified laboratory # 01955**
- Local support services for this project are provided by Access Analytical, Inc.. Access Analytical is a representative of GCAL serving clients in the SC/NC/GA areas. All questions regarding this report should be directed to your local Access Analytical representative at 803.781.4243 or toll free at 888.315.4243.

NELAP CERTIFICATE NUMBER 01955
DOD ELAP CERTIFICATE NUMBER ADE - 1482

ANALYTICAL RESULTS

PERFORMED BY

GULF COAST ANALYTICAL LABORATORIES, INC.
7979 GSRI Avenue
Baton Rouge, LA 70820

Report Date 08/31/2011

GCAL Report 211082707

Deliver To	Prism Laboratories, Inc. PO BOX 240543 Charlotte, NC 28224 706-529-6364
Attn	Angie Overcash

Project 1080611

CASE NARRATIVE

Client: Prism Laboratories, Inc. **Report:** 211082707

Gulf Coast Analytical Laboratories received and analyzed the sample(s) listed on the sample cross-reference page of this report. Receipt of the sample(s) is documented by the attached chain of custody. This applies only to the sample(s) listed in this report. No sample integrity or quality control exceptions were identified unless noted below.

CONVENTIONALS

In the SW-846 7196A analysis, sample 21108270713 (GP-57) had to be diluted in order to bracket the concentration within the calibration range of the instrument.

Laboratory Endorsement

Sample analysis was performed in accordance with approved methodologies provided by the Environmental Protection Agency or other recognized agencies. The samples and their corresponding extracts will be maintained for a period of 30 days unless otherwise arranged. Following this retention period the samples will be disposed in accordance with GCAL's Standard Operating Procedures.

Common Abbreviations Utilized in this Report

ND	Indicates the result was Not Detected at the specified RDL
DO	Indicates the result was Diluted Out
MI	Indicates the result was subject to Matrix Interference
TNTC	Indicates the result was Too Numerous To Count
SUBC	Indicates the analysis was Sub-Contracted
FLD	Indicates the analysis was performed in the Field
PQL	Practical Quantitation Limit
MDL	Method Detection Limit
RDL	Reporting Detection Limit
00:00	Reported as a time equivalent to 12:00 AM

Reporting Flags Utilized in this Report

J	Indicates an estimated value
U	Indicates the compound was analyzed for but not detected
B	(ORGANICS) Indicates the analyte was detected in the associated Method Blank
B	(INORGANICS) Indicates the result is between the RDL and MDL

Sample receipt at GCAL is documented through the attached chain of custody. In accordance with NELAC, this report shall be reproduced only in full and with the written permission of GCAL. The results contained within this report relate only to the samples reported. The documented results are presented within this report.

This report pertains only to the samples listed in the Report Sample Summary and should be retained as a permanent record thereof. The results contained within this report are intended for the use of the client. Any unauthorized use of the information contained in this report is prohibited.

I certify that this data package is in compliance with the NELAC standard and terms and conditions of the contract and Statement of Work both technically and for completeness, for other than the conditions in the case narrative. Release of the data contained in this hardcopy data package and in the computer-readable data submitted has been authorized by the Quality Assurance Manager or his/her designee, as verified by the following signature.

Estimated uncertainty of measurement is available upon request. This report is in compliance with the DOD QSM as specified in the contract if applicable.

IntegriSign

Robyn Migues
Technical Director
GCAL REPORT 211082707

IntegriSi

THIS REPORT CONTAINS ___gn___ PAGES.

Report Sample Summary

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108270701	GP-43	Solid	08/19/2011 09:45	08/27/2011 09:00
21108270702	GP-44	Solid	08/19/2011 09:55	08/27/2011 09:00
21108270703	GP-45	Solid	08/19/2011 08:45	08/27/2011 09:00
21108270704	GP-46	Solid	08/19/2011 08:55	08/27/2011 09:00
21108270705	GP-47B	Solid	08/19/2011 09:05	08/27/2011 09:00
21108270706	GP-48	Solid	08/19/2011 09:20	08/27/2011 09:00
21108270707	GP-49	Solid	08/19/2011 09:30	08/27/2011 09:00
21108270708	GP-50	Solid	08/19/2011 08:15	08/27/2011 09:00
21108270709	GP-51	Solid	08/19/2011 08:25	08/27/2011 09:00
21108270710	GP-52	Solid	08/19/2011 08:35	08/27/2011 09:00
21108270711	GP-55	Solid	08/19/2011 10:00	08/27/2011 09:00
21108270712	GP-56	Solid	08/19/2011 10:10	08/27/2011 09:00
21108270713	GP-57	Solid	08/19/2011 10:25	08/27/2011 09:00
21108270714	GP-58	Solid	08/19/2011 10:50	08/27/2011 09:00
21108270715	DUPLICATE	Solid	08/19/2011 09:30	08/27/2011 09:00

Summary of Compounds Detected

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108270701	GP-43	Solid	08/19/2011 09:45	08/27/2011 09:00

SW-846 7196A Chromium VI

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	0.491B	0.613	0.307	mg/kg

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108270702	GP-44	Solid	08/19/2011 09:55	08/27/2011 09:00

SW-846 7196A Chromium VI

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	17.1	0.623	0.312	mg/kg

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108270707	GP-49	Solid	08/19/2011 09:30	08/27/2011 09:00

SW-846 7196A Chromium VI

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	3.81	0.669	0.335	mg/kg

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108270708	GP-50	Solid	08/19/2011 08:15	08/27/2011 09:00

SW-846 7196A Chromium VI

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	2.33	0.648	0.324	mg/kg

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108270710	GP-52	Solid	08/19/2011 08:35	08/27/2011 09:00

SW-846 7196A Chromium VI

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	0.534B	0.667	0.334	mg/kg

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108270712	GP-56	Solid	08/19/2011 10:10	08/27/2011 09:00

SW-846 7196A Chromium VI

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	15.0	0.644	0.322	mg/kg

Summary of Compounds Detected (con't)

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108270713	GP-57	Solid	08/19/2011 10:25	08/27/2011 09:00

SW-846 7196A Chromium VI

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	68.8	1.20	0.599	mg/kg

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108270701	GP-43	Solid	08/19/2011 09:45	08/27/2011 09:00

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
08/29/2011 06:15	464316	SW-846 3060A	1	08/29/2011 15:53	JEM	464396

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	0.491B	0.613	0.307	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108270702	GP-44	Solid	08/19/2011 09:55	08/27/2011 09:00

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
08/29/2011 06:15	464316	SW-846 3060A	1	08/29/2011 15:54	JEM	464396

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	17.1	0.623	0.312	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108270703	GP-45	Solid	08/19/2011 08:45	08/27/2011 09:00

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
08/29/2011 06:15	464316	SW-846 3060A	1	08/29/2011 15:55	JEM	464396

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	0.343U	0.685	0.343	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108270704	GP-46	Solid	08/19/2011 08:55	08/27/2011 09:00

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
08/29/2011 06:15	464316	SW-846 3060A	1	08/29/2011 15:55	JEM	464396

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	0.311U	0.622	0.311	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108270705	GP-47B	Solid	08/19/2011 09:05	08/27/2011 09:00

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
08/29/2011 06:15	464316	SW-846 3060A	1	08/29/2011 15:55	JEM	464396

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	0.299U	0.598	0.299	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108270706	GP-48	Solid	08/19/2011 09:20	08/27/2011 09:00

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
08/29/2011 06:15	464316	SW-846 3060A	1	08/29/2011 15:56	JEM	464396

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	0.320U	0.640	0.320	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108270707	GP-49	Solid	08/19/2011 09:30	08/27/2011 09:00

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
08/29/2011 06:15	464316	SW-846 3060A	1	08/29/2011 15:57	JEM	464396

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	3.81	0.669	0.335	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108270708	GP-50	Solid	08/19/2011 08:15	08/27/2011 09:00

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
08/29/2011 06:15	464316	SW-846 3060A	1	08/29/2011 15:57	JEM	464396

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	2.33	0.648	0.324	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108270709	GP-51	Solid	08/19/2011 08:25	08/27/2011 09:00

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
08/29/2011 06:15	464316	SW-846 3060A	1	08/29/2011 15:58	JEM	464396

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	0.331U	0.662	0.331	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108270710	GP-52	Solid	08/19/2011 08:35	08/27/2011 09:00

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
08/29/2011 06:15	464316	SW-846 3060A	1	08/29/2011 15:58	JEM	464396

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	0.534B	0.667	0.334	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108270711	GP-55	Solid	08/19/2011 10:00	08/27/2011 09:00

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
08/29/2011 06:15	464316	SW-846 3060A	1	08/29/2011 15:59	JEM	464396

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	0.337U	0.674	0.337	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108270712	GP-56	Solid	08/19/2011 10:10	08/27/2011 09:00

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
08/29/2011 06:15	464316	SW-846 3060A	1	08/29/2011 15:59	JEM	464396

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	15.0	0.644	0.322	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108270713	GP-57	Solid	08/19/2011 10:25	08/27/2011 09:00

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
08/29/2011 06:15	464316	SW-846 3060A	2	08/29/2011 16:00	JEM	464396

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	68.8	1.20	0.599	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108270714	GP-58	Solid	08/19/2011 10:50	08/27/2011 09:00

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
08/29/2011 06:15	464316	SW-846 3060A	1	08/29/2011 16:00	JEM	464396

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	0.307U	0.613	0.307	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108270715	DUPLICATE	Solid	08/19/2011 09:30	08/27/2011 09:00

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
08/29/2011 06:15	464316	SW-846 3060A	1	08/29/2011 16:00	JEM	464396

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	0.335U	0.670	0.335	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

General Chemistry Quality Control Summary

Analytical Batch 464396	Client ID	MB464316		LCS464316
Prep Batch 464316	GCAL ID	983264		983265
Prep Method SW-846	Sample Type	Method Blank		LCS
3060A	Prep Date	08/29/2011 06:15		08/29/2011 06:15
	Analytical Date	08/29/2011 15:52		08/29/2011 15:53
	Matrix	Solid		Solid

SW-846 7196A Chromium VI	Units	mg/kg	Spike	Result		Control
	Result	RDL	Added		% R	Limits % R
18540-29-9 Chromium VI	0.250U	0.250	50.0	48.6	97.1	75 - 125

Analytical Batch 464396	Client ID	GP-43		983241MS
Prep Batch 464316	GCAL ID	21108270701		983266
Prep Method SW-846	Sample Type	SAMPLE		MS
3060A	Prep Date	08/29/2011 06:15		08/29/2011 06:15
	Analytical Date	08/29/2011 15:53		08/29/2011 15:54
	Matrix	Solid		Solid

SW-846 7196A Chromium VI	Units	mg/kg	Spike	Result		Control
	Result	RDL	Added		% R	Limits % R
18540-29-9 Chromium VI	0.400	0.250	50.0	39.3	77.7	74.5 -125.4

Analytical Batch 464396	Client ID	GP-44		983242DUP
Prep Batch 464316	GCAL ID	21108270702		983267
Prep Method SW-846	Sample Type	SAMPLE		DUP
3060A	Prep Date	08/29/2011 06:15		08/29/2011 06:15
	Analytical Date	08/29/2011 15:54		08/29/2011 15:54
	Matrix	Solid		Solid

SW-846 7196A Chromium VI	Units	mg/kg	Result		RPD
	Result	RDL		RPD	Limit
18540-29-9 Chromium VI	13.7	0.250	13.6	0.73	25

Access/4565/211082707/9/2/11

PRISM LABORATORIES, INC. | Full-Service Analytical & Environmental Solutions

SUBCONTRACT ORDER

Prism Laboratories, Inc.

1080611

Certification: NELAC___ USACE___
SC___ Other _____
N/A____

SENDING LABORATORY:

Prism Laboratories, Inc.
P. O. Box 240543
Charlotte, NC 28224-0543
Phone: 800-529-6364
Fax: 704-525-0409
Project Manager: Angela D. Overcash

RECEIVING LABORATORY:

Gulf Coast Analytical Labs, Inc.
7979 GSRI Avenue
Baton Rouge, LA 70820
Phone :(225) 769-4900
Fax: (225) 767-5717

Need 5-day TAT

Analysis	Due	Expires	Laboratory ID	Comments	
Sample ID: 1080611-01	Solid	Sampled: 08/19/11 09:45	[redacted]	Report Low Level	1
Hexavalent Chromium (Sub)		08/20/11 09:45			
Containers Supplied: 4 oz CLEAR GLASS				All sample	
Sample ID: 1080611-02	Solid	Sampled: 08/19/11 09:55	[redacted]		2
Hexavalent Chromium (Sub)		08/20/11 09:55			
Containers Supplied:					
Sample ID: 1080611-03	Solid	Sampled: 08/19/11 08:45	[redacted]		3
Hexavalent Chromium (Sub)		08/20/11 08:45			
Containers Supplied:					
Sample ID: 1080611-04	Solid	Sampled: 08/19/11 08:55	[redacted]		4
Hexavalent Chromium (Sub)		08/20/11 08:55			
Containers Supplied:					
Sample ID: 1080611-05	Solid	Sampled: 08/19/11 09:05	[redacted]		5
Hexavalent Chromium (Sub)		08/20/11 09:05			

Released By	Date	Received By	Date
[signature]	8/25/11	FED EX	8/25/11
FED EX	8/27/11	[signature] GCAL	8/27/11 0900
7951 2475 1330			

3.2°

Page 1 of 3

SUBCONTRACT ORDER

Prism Laboratories, Inc.

1080611

Certification: NELAC___ USACE___
SC___ Other _____
N/A____

Analysis	Due	Expires	Laboratory ID	Comments	
Containers Supplied:					
Sample ID: 1080611-06	Solid	Sampled: 08/19/11 09:20	[redacted]		6
Hexavalent Chromium (Sub)		08/20/11 09:20			
Containers Supplied: 4 oz CLEAR GLASS					
Sample ID: 1080611-07	Solid	Sampled: 08/19/11 09:30	[redacted]		7
Hexavalent Chromium (Sub)		08/20/11 09:30			
Containers Supplied:					
Sample ID: 1080611-08	Solid	Sampled: 08/19/11 08:15	[redacted]		8
Hexavalent Chromium (Sub)		08/20/11 08:15			
Containers Supplied:					
Sample ID: 1080611-09	Solid	Sampled: 08/19/11 08:25	[redacted]		9
Hexavalent Chromium (Sub)		08/20/11 08:25			
Containers Supplied:					
Sample ID: 1080611-10	Solid	Sampled: 08/19/11 08:35	[redacted]		10
Hexavalent Chromium (Sub)		08/20/11 08:35			
Containers Supplied:					
Sample ID: 1080611-11	Solid	Sampled: 08/19/11 10:00	[redacted]		11
Hexavalent Chromium (Sub)		08/20/11 10:00			
Containers Supplied:					
Sample ID: 1080611-12	Solid	Sampled: 08/19/11 10:10	[redacted]		12
Hexavalent Chromium (Sub)		08/20/11 10:10			
Containers Supplied:					

Released By	Date	Received By	Date
[signature]	8/25/11	FED EX	8/25/11
FED EX	8/27/11	[signature] GCAL	8/27/11 0900

3.2°

Page 2 of 3

SUBCONTRACT ORDER

Prism Laboratories, Inc.

1080611

Certification: NELAC___ USACE___
SC___ Other _____
N/A____

Analysis	Due	Expires	Laboratory ID	Comments
Sample ID: 1080611-13	Solid	Sampled: 08/19/11 10:25	[redacted]	13
Hexavalent Chromium (Sub)		08/20/11 10:25		
Containers Supplied: 4 oz CLEAR GLASS				
Sample ID: 1080611-14	Solid	Sampled: 08/19/11 10:50	[redacted]	14
Hexavalent Chromium (Sub)		08/20/11 10:50		
Containers Supplied:				
Sample ID: 1080611-15	Solid	Sampled: 08/19/11 09:30	[redacted]	15
Hexavalent Chromium (Sub)		08/20/11 09:30		
Containers Supplied:				

Released By	Date	Received By	Date	
[signature]	8/25/11	FED EX	8/25/11	
FED EX	8/27/11	[signature] GCAL	8/27/11 6900	3.2°

GCAL
GULF COAST ANALYTICAL LABORATORIES, INC

SAMPLE RECEIVING CHECKLIST

Workorder: 211082707

Client: 4565 - Access Analytical

Profile: 80251 - Prism Lab

Line Item: 2 - Solid

Received by: Pfeifer, Ben J.

Received Date/Time: 8/27/2011 9:00:00 AM

Samples Received via: FEDEX

Number of Coolers Received: 1

Cooler tracking numbers(s): 7951 2475 1330

Cooler temperature(s): 3.2

Were all coolers received at a temperature of 0 - 6° C?	☑ Yes	☐ No	☐ N/A
Were all custody seals intact?	☑ Yes	☐ No	☐ N/A
Were all samples received in proper containers?	☑ Yes	☐ No	☐ N/A
Were all samples properly preserved?	☑ Yes	☐ No	☐ N/A
Was preservative added to any container at the lab?	☐ Yes	☑ No	☐ N/A
Were all containers received in good condition?	☑ Yes	☐ No	☐ N/A
Were all VOA vials received with no head space?	☐ Yes	☐ No	☑ N/A
Do all sample labels match the Chain of Custody?	☑ Yes	☐ No	☐ N/A
Was the client notified about any discrepancies?	☐ Yes	☐ No	☑ N/A

Notes/Comments:

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NC Certification No. 402
SC Certification No. 99012
NC Drinking Water Cert No. 37735

Case Narrative

08/29/2011

ECS Carolinas - Greensboro
Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Lab Submittal Date: 08/18/2011
Prism Work Order: 1080516

This data package contains the analytical results for the project identified above and includes a Case Narrative, Sample Results and Chain of Custody. Unless otherwise noted, all samples were received in acceptable condition and processed according to the referenced methods.

Data qualifiers are flagged individually on each sample. A key reference for the data qualifiers appears at the end of this case narrative.

Narrative Notes:

Hexavalent Chromium analysis was subcontracted to GCAL. Laboratory report is attached.

Please call if you have any questions relating to this analytical report.

Respectfully,

PRISM LABORATORIES, INC.

VP Laboratory Services

Reviewed By

Data Qualifiers Key Reference:

BRL	Below Reporting Limit
MDL	Method Detection Limit
RPD	Relative Percent Difference
*	Results reported to the reporting limit. All other results are reported to the MDL with values between MDL and reporting limit indicated with a J.

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Sample Receipt Summary

08/29/2011

Prism Work Order: 1080516

Client Sample ID	Lab Sample ID	Matrix	Date Sampled	Date Received
DC-1	1080516-01	Solid	08/18/11	08/18/11
DC-2	1080516-02	Solid	08/18/11	08/18/11
DC-3	1080516-03	Solid	08/18/11	08/18/11
DD-1	1080516-04	Solid	08/18/11	08/18/11
DD-2	1080516-05	Solid	08/18/11	08/18/11
DD-3	1080516-06	Solid	08/18/11	08/18/11

Samples received in good condition at 4.2 degrees C unless otherwise noted.

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Laboratory Report

08/29/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: DC-1
Prism Sample ID: 1080516-01
Prism Work Order: 1080516
Time Collected: 08/18/11 13:05
Time Submitted: 08/18/11 15:15

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
TCLP Extraction by EPA 1311									
TCLP Extraction	Complete	N/A			1	*1311	8/24/11 9:00	BGM	P1H0515
TCLP Metals									
Mercury	BRL	mg/L	0.010	0.000014	1	*7470A	8/26/11 15:34	LTB	P1H0572
Arsenic	BRL	mg/L	0.050	0.010	1	*6010C	8/25/11 5:25	DWR	P1H0526
Barium	BRL	mg/L	5.0	0.013	1	*6010C	8/25/11 5:25	DWR	P1H0526
Cadmium	**0.090**	**mg/L**	**0.025**	**0.00043**	**1**	***6010C**	**8/25/11 5:25**	**DWR**	**P1H0526**
Chromium	BRL	mg/L	0.25	0.00085	1	*6010C	8/25/11 5:25	DWR	P1H0526
Lead	BRL	mg/L	0.050	0.0038	1	*6010C	8/25/11 5:25	DWR	P1H0526
Selenium	BRL	mg/L	0.10	0.012	1	*6010C	8/25/11 5:25	DWR	P1H0526
Silver	BRL	mg/L	0.25	0.0017	1	*6010C	8/25/11 5:25	DWR	P1H0526

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Laboratory Report

08/29/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: DC-2
Prism Sample ID: 1080516-02
Prism Work Order: 1080516
Time Collected: 08/18/11 13:25
Time Submitted: 08/18/11 15:15

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
TCLP Extraction by EPA 1311									
TCLP Extraction	Complete	N/A			1	*1311	8/24/11 9:00	BGM	P1H0515
TCLP Metals									
Mercury	BRL	mg/L	0.010	0.000014	1	*7470A	8/26/11 16:05	LTB	P1H0572
Arsenic	BRL	mg/L	0.050	0.010	1	*6010C	8/25/11 5:48	DWR	P1H0526
Barium	BRL	mg/L	5.0	0.013	1	*6010C	8/25/11 5:48	DWR	P1H0526
Cadmium	**12**	**mg/L**	**0.025**	**0.00043**	**1**	***6010C**	**8/25/11 5:48**	**DWR**	**P1H0526**
Chromium	BRL	mg/L	0.25	0.00085	1	*6010C	8/25/11 5:48	DWR	P1H0526
Lead	BRL	mg/L	0.050	0.0038	1	*6010C	8/25/11 5:48	DWR	P1H0526
Selenium	BRL	mg/L	0.10	0.012	1	*6010C	8/25/11 5:48	DWR	P1H0526
Silver	BRL	mg/L	0.25	0.0017	1	*6010C	8/25/11 5:48	DWR	P1H0526

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Laboratory Report

08/29/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: DC-3
Prism Sample ID: 1080516-03
Prism Work Order: 1080516
Time Collected: 08/18/11 13:50
Time Submitted: 08/18/11 15:15

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
TCLP Extraction by EPA 1311									
TCLP Extraction	Complete	N/A			1	*1311	8/24/11 9:00	BGM	P1H0515
TCLP Metals									
Mercury	BRL	mg/L	0.010	0.000014	1	*7470A	8/26/11 16:08	LTB	P1H0572
Arsenic	BRL	mg/L	0.050	0.010	1	*6010C	8/25/11 5:55	DWR	P1H0526
Barium	BRL	mg/L	5.0	0.013	1	*6010C	8/25/11 5:55	DWR	P1H0526
Cadmium	**0.18**	**mg/L**	**0.025**	**0.00043**	**1**	***6010C**	**8/25/11 5:55**	**DWR**	**P1H0526**
Chromium	BRL	mg/L	0.25	0.00085	1	*6010C	8/25/11 5:55	DWR	P1H0526
Lead	BRL	mg/L	0.050	0.0038	1	*6010C	8/25/11 5:55	DWR	P1H0526
Selenium	BRL	mg/L	0.10	0.012	1	*6010C	8/25/11 5:55	DWR	P1H0526
Silver	BRL	mg/L	0.25	0.0017	1	*6010C	8/25/11 5:55	DWR	P1H0526

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08/29/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: DD-1
Prism Sample ID: 1080516-04
Prism Work Order: 1080516
Time Collected: 08/18/11 14:10
Time Submitted: 08/18/11 15:15

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**74.7**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**8/19/11 14:00**	**JAB**	**P1H0435**
Total Metals									
Mercury	**0.029**	**mg/kg dry**	**0.028**	**0.0033**	**1**	***7471B**	**8/25/11 8:57**	**LTB**	**P1H0523**
Antimony	BRL	mg/kg dry	0.27	0.048	1	*6010C	8/23/11 1:30	DWR	P1H0468
Arsenic	**1.2**	**mg/kg dry**	**0.66**	**0.075**	**1**	***6010C**	**8/23/11 1:30**	**DWR**	**P1H0468**
Beryllium	**0.44**	**mg/kg dry**	**0.33**	**0.056**	**1**	***6010C**	**8/23/11 1:30**	**DWR**	**P1H0468**
Cadmium	**81**	**mg/kg dry**	**0.33**	**0.035**	**1**	***6010C**	**8/23/11 1:30**	**DWR**	**P1H0468**
Chromium	**320**	**mg/kg dry**	**1.7**	**0.23**	**5**	***6010C**	**8/24/11 17:27**	**DWR**	**P1H0468**
Copper	**120**	**mg/kg dry**	**0.66**	**0.29**	**1**	***6010C**	**8/23/11 1:30**	**DWR**	**P1H0468**
Lead	**77**	**mg/kg dry**	**0.33**	**0.082**	**1**	***6010C**	**8/23/11 1:30**	**DWR**	**P1H0468**
Nickel	**310**	**mg/kg dry**	**6.6**	**2.0**	**5**	***6010C**	**8/24/11 17:27**	**DWR**	**P1H0468**
Selenium	**3.1**	**mg/kg dry**	**0.66**	**0.13**	**1**	***6010C**	**8/23/11 1:30**	**DWR**	**P1H0468**
Silver	BRL	mg/kg dry	0.33	0.034	1	*6010C	8/23/11 1:30	DWR	P1H0468
Thallium	BRL	mg/kg dry	0.66	0.13	1	*6010C	8/23/11 1:30	DWR	P1H0468
Tin	**32**	**mg/kg dry**	**6.6**	**0.59**	**1**	***6010C**	**8/23/11 1:30**	**DWR**	**P1H0468**
Zinc	**380**	**mg/kg dry**	**17**	**1.7**	**5**	***6010C**	**8/24/11 17:27**	**DWR**	**P1H0468**

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08/29/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: DD-2
Prism Sample ID: 1080516-05
Prism Work Order: 1080516
Time Collected: 08/18/11 14:30
Time Submitted: 08/18/11 15:15

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**71.7**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**8/19/11 14:00**	**JAB**	**P1H0435**
Total Metals									
Mercury	BRL	mg/kg dry	0.028	0.0033	1	*7471B	8/25/11 9:20	LTB	P1H0523
Antimony	BRL	mg/kg dry	0.28	0.050	1	*6010C	8/23/11 1:39	DWR	P1H0468
Arsenic	**1.4**	**mg/kg dry**	**0.69**	**0.078**	**1**	***6010C**	**8/23/11 1:39**	**DWR**	**P1H0468**
Beryllium	**0.65**	**mg/kg dry**	**0.35**	**0.059**	**1**	***6010C**	**8/23/11 1:39**	**DWR**	**P1H0468**
Cadmium	**43**	**mg/kg dry**	**0.35**	**0.037**	**1**	***6010C**	**8/23/11 1:39**	**DWR**	**P1H0468**
Chromium	**69**	**mg/kg dry**	**0.35**	**0.048**	**1**	***6010C**	**8/23/11 1:39**	**DWR**	**P1H0468**
Copper	**97**	**mg/kg dry**	**0.69**	**0.30**	**1**	***6010C**	**8/23/11 1:39**	**DWR**	**P1H0468**
Lead	**15**	**mg/kg dry**	**0.35**	**0.085**	**1**	***6010C**	**8/23/11 1:39**	**DWR**	**P1H0468**
Nickel	**280**	**mg/kg dry**	**6.9**	**2.1**	**5**	***6010C**	**8/24/11 17:34**	**DWR**	**P1H0468**
Selenium	**3.7**	**mg/kg dry**	**0.69**	**0.14**	**1**	***6010C**	**8/23/11 1:39**	**DWR**	**P1H0468**
Silver	BRL	mg/kg dry	0.35	0.035	1	*6010C	8/23/11 1:39	DWR	P1H0468
Thallium	BRL	mg/kg dry	0.69	0.13	1	*6010C	8/23/11 1:39	DWR	P1H0468
Tin	BRL	mg/kg dry	6.9	0.61	1	*6010C	8/23/11 1:39	DWR	P1H0468
Zinc	**320**	**mg/kg dry**	**17**	**1.8**	**5**	***6010C**	**8/24/11 17:34**	**DWR**	**P1H0468**

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Laboratory Report

08/29/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Solid

Client Sample ID: DD-3
Prism Sample ID: 1080516-06
Prism Work Order: 1080516
Time Collected: 08/18/11 15:00
Time Submitted: 08/18/11 15:15

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
% Solids	**60.0**	**% by Weight**	**0.100**	**0.100**	**1**	***SM2540 G**	**8/19/11 14:00**	**JAB**	**P1H0435**
Total Metals									
Mercury	**0.066**	**mg/kg dry**	**0.036**	**0.0043**	**1**	***7471B**	**8/25/11 9:25**	**LTB**	**P1H0523**
Antimony	BRL	mg/kg dry	0.34	0.061	1	*6010C	8/23/11 1:48	DWR	P1H0468
Arsenic	**7.7**	**mg/kg dry**	**0.84**	**0.095**	**1**	***6010C**	**8/23/11 1:48**	**DWR**	**P1H0468**
Beryllium	**0.70**	**mg/kg dry**	**0.42**	**0.071**	**1**	***6010C**	**8/23/11 1:48**	**DWR**	**P1H0468**
Cadmium	**91**	**mg/kg dry**	**0.42**	**0.044**	**1**	***6010C**	**8/23/11 1:48**	**DWR**	**P1H0468**
Chromium	**3600**	**mg/kg dry**	**21**	**2.9**	**50**	***6010C**	**8/24/11 17:41**	**DWR**	**P1H0468**
Copper	**550**	**mg/kg dry**	**42**	**18**	**50**	***6010C**	**8/24/11 17:41**	**DWR**	**P1H0468**
Lead	**180**	**mg/kg dry**	**0.42**	**0.10**	**1**	***6010C**	**8/23/11 1:48**	**DWR**	**P1H0468**
Nickel	**860**	**mg/kg dry**	**84**	**26**	**50**	***6010C**	**8/24/11 17:41**	**DWR**	**P1H0468**
Selenium	**5.1**	**mg/kg dry**	**0.84**	**0.17**	**1**	***6010C**	**8/23/11 1:48**	**DWR**	**P1H0468**
Silver	**0.98**	**mg/kg dry**	**0.42**	**0.043**	**1**	***6010C**	**8/23/11 1:48**	**DWR**	**P1H0468**
Thallium	BRL	mg/kg dry	0.84	0.16	1	*6010C	8/23/11 1:48	DWR	P1H0468
Tin	**18**	**mg/kg dry**	**8.4**	**0.74**	**1**	***6010C**	**8/23/11 1:48**	**DWR**	**P1H0468**
Zinc	**800**	**mg/kg dry**	**210**	**21**	**50**	***6010C**	**8/24/11 17:41**	**DWR**	**P1H0468**

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ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Prism Work Order: 1080516
Time Submitted: 8/18/11 3:15:00PM

Total Metals - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch P1H0468 - 3050B										
Blank (P1H0468-BLK1)				Prepared & Analyzed: 08/22/11						
Antimony	BRL	0.20	mg/kg wet							
Arsenic	BRL	0.50	mg/kg wet							
Beryllium	BRL	0.25	mg/kg wet							
Cadmium	BRL	0.25	mg/kg wet							
Chromium	BRL	0.25	mg/kg wet							
Copper	BRL	0.50	mg/kg wet							
Lead	BRL	0.25	mg/kg wet							
Nickel	BRL	1.0	mg/kg wet							
Selenium	BRL	0.50	mg/kg wet							
Silver	BRL	0.25	mg/kg wet							
Thallium	BRL	0.50	mg/kg wet							
Tin	BRL	5.0	mg/kg wet							
Zinc	BRL	2.5	mg/kg wet							
LCS (P1H0468-BS1)				Prepared & Analyzed: 08/22/11						
Antimony	22.7	0.20	mg/kg wet	25.0		91	80-120			
Arsenic	22.7	0.50	mg/kg wet	25.0		91	80-120			
Beryllium	23.3	0.25	mg/kg wet	25.0		93	80-120			
Cadmium	22.2	0.25	mg/kg wet	25.0		89	80-120			
Chromium	23.2	0.25	mg/kg wet	25.0		93	80-120			
Copper	24.9	0.50	mg/kg wet	25.0		99	80-120			
Lead	23.6	0.25	mg/kg wet	25.0		95	80-120			
Nickel	23.1	1.0	mg/kg wet	25.0		92	80-120			
Selenium	23.1	0.50	mg/kg wet	25.0		93	80-120			
Silver	23.4	0.25	mg/kg wet	25.0		93	80-120			
Thallium	22.9	0.50	mg/kg wet	25.0		91	80-120			
Tin	23.3	5.0	mg/kg wet	25.0		93	80-120			
Zinc	23.3	2.5	mg/kg wet	25.0		93	80-120			

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Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Prism Work Order: 1080516
Time Submitted: 8/18/11 3:15:00PM

Total Metals - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch P1H0523 - 7471B										
Blank (P1H0523-BLK1)				Prepared: 08/24/11		Analyzed: 08/25/11				
Mercury	BRL	0.020	mg/kg wet							
LCS (P1H0523-BS1)				Prepared: 08/24/11		Analyzed: 08/25/11				
Mercury	0.434	0.020	mg/kg wet	0.417		104	80-120			
Matrix Spike (P1H0523-MS1)		**Source: 1080516-04**		Prepared: 08/24/11		Analyzed: 08/25/11				
Mercury	0.578	0.025	mg/kg dry	0.531	0.0287	103	80-120			
Matrix Spike Dup (P1H0523-MSD1)		**Source: 1080516-04**		Prepared: 08/24/11		Analyzed: 08/25/11				
Mercury	0.599	0.026	mg/kg dry	0.549	0.0287	104	80-120	4	20	

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Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Prism Work Order: 1080516
Time Submitted: 8/18/11 3:15:00PM

TCLP Metals - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch P1H0526 - 3010A										
Blank (P1H0526-BLK1)				Prepared: 08/24/11		Analyzed: 08/25/11				
Arsenic	BRL	0.050	mg/L							
Barium	BRL	5.0	mg/L							
Cadmium	BRL	0.025	mg/L							
Chromium	BRL	0.25	mg/L							
Lead	BRL	0.050	mg/L							
Selenium	BRL	0.10	mg/L							
Silver	BRL	0.25	mg/L							
LCS (P1H0526-BS1)				Prepared: 08/24/11		Analyzed: 08/25/11				
Arsenic	1.14	0.050	mg/L	1.25		91	80-120			
Barium	1.08	5.0	mg/L	1.25		86	80-120			
Cadmium	1.13	0.025	mg/L	1.25		90	80-120			
Chromium	1.10	0.25	mg/L	1.25		88	80-120			
Lead	1.11	0.050	mg/L	1.25		89	80-120			
Selenium	1.17	0.10	mg/L	1.25		93	80-120			
Silver	1.12	0.25	mg/L	1.25		89	80-120			
Matrix Spike (P1H0526-MS1)	**Source: 1080516-01**			Prepared: 08/24/11		Analyzed: 08/25/11				
Arsenic	1.04	0.050	mg/L	1.25	BRL	84	75-125			
Barium	1.71	5.0	mg/L	1.25	0.772	75	75-125			
Cadmium	1.12	0.025	mg/L	1.25	0.0902	83	75-125			
Chromium	1.02	0.25	mg/L	1.25	0.000884	81	75-125			
Lead	1.03	0.050	mg/L	1.25	BRL	83	75-125			
Selenium	1.08	0.10	mg/L	1.25	BRL	87	75-125			
Silver	1.03	0.25	mg/L	1.25	BRL	83	75-125			
Matrix Spike Dup (P1H0526-MSD1)	**Source: 1080516-01**			Prepared: 08/24/11		Analyzed: 08/25/11				
Arsenic	1.15	0.050	mg/L	1.25	BRL	92	75-125	10	20	
Barium	1.86	5.0	mg/L	1.25	0.772	87	75-125	8	20	
Cadmium	1.24	0.025	mg/L	1.25	0.0902	92	75-125	10	20	
Chromium	1.12	0.25	mg/L	1.25	0.000884	89	75-125	10	20	
Lead	1.14	0.050	mg/L	1.25	BRL	91	75-125	9	20	
Selenium	1.20	0.10	mg/L	1.25	BRL	96	75-125	10	20	
Silver	1.14	0.25	mg/L	1.25	BRL	91	75-125	10	20	

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ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Prism Work Order: 1080516
Time Submitted: 8/18/11 3:15:00PM

TCLP Metals - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch P1H0572 - 7470A										
Blank (P1H0572-BLK1)				Prepared: 08/25/11		Analyzed: 08/26/11				
Mercury	BRL	0.010	mg/L							
LCS (P1H0572-BS1)				Prepared: 08/25/11		Analyzed: 08/26/11				
Mercury	0.00968	0.010	mg/L	0.00938		103	80-120			
Matrix Spike (P1H0572-MS1)		**Source: 1080516-01**		Prepared: 08/25/11		Analyzed: 08/26/11				
Mercury	0.00936	0.010	mg/L	0.00938	BRL	100	80-120			
Matrix Spike Dup (P1H0572-MSD1)		**Source: 1080516-01**		Prepared: 08/25/11		Analyzed: 08/26/11				
Mercury	0.00940	0.010	mg/L	0.00938	BRL	100	80-120	0.4	20	

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ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Prism Work Order: 1080516
Time Submitted: 8/18/11 3:15:00PM

General Chemistry Parameters - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch P1H0435 - NO PREP										
Blank (P1H0435-BLK1)				Prepared & Analyzed: 08/19/11						
% Solids	100	0.100	% by Weight							

Sample Extraction Data

Prep Method: 1311

Lab Number	Batch	Initial	Final	Date/Time
1080516-01	P1H0515	100 g	2000 mL	08/23/11 15:30
1080516-02	P1H0515	100 g	2000 mL	08/23/11 15:30
1080516-03	P1H0515	100 g	2000 mL	08/23/11 15:30

Prep Method: 3010A

Lab Number	Batch	Initial	Final	Date/Time
1080516-01	P1H0526	10 mL	50 mL	08/24/11 12:00
1080516-02	P1H0526	10 mL	50 mL	08/24/11 12:00
1080516-03	P1H0526	10 mL	50 mL	08/24/11 12:00

Prep Method: 7470A

Lab Number	Batch	Initial	Final	Date/Time
1080516-01	P1H0572	20 mL	30 mL	08/25/11 14:00
1080516-02	P1H0572	20 mL	30 mL	08/25/11 14:00
1080516-03	P1H0572	20 mL	30 mL	08/25/11 14:00

Prep Method: 3050B

Lab Number	Batch	Initial	Final	Date/Time
1080516-04	P1H0468	2.02 g	50 mL	08/22/11 8:00
1080516-04	P1H0468	2.02 g	50 mL	08/22/11 8:00
1080516-05	P1H0468	2.02 g	50 mL	08/22/11 8:00
1080516-05	P1H0468	2.02 g	50 mL	08/22/11 8:00
1080516-06	P1H0468	1.99 g	50 mL	08/22/11 8:00
1080516-06	P1H0468	1.99 g	50 mL	08/22/11 8:00

Prep Method: 7471B

Lab Number	Batch	Initial	Final	Date/Time
1080516-04	P1H0523	0.58 g	50 mL	08/24/11 10:05
1080516-05	P1H0523	0.6 g	50 mL	08/24/11 10:05
1080516-06	P1H0523	0.56 g	50 mL	08/24/11 10:05

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Subcontracted Analyses

The following analyses were subcontracted to Gulf Coast Analytical Labs, Inc.

Lab Number	Analysis
1080516-04	Hexavalent Chromium (Sub)
1080516-05	Hexavalent Chromium (Sub)
1080516-06	Hexavalent Chromium (Sub)

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Phone: 704/529-6364 • Fax: 704/525-0409

CHAIN OF CUSTODY RECORD

PAGE 1 OF 1 QUOTE # TO ENSURE PROPER BILLING: _____

Project Name: UMF
Short Hold Analysis: (Yes) (No) UST Project: (Yes) (No)
*Please ATTACH any project specific reporting (QC LEVEL I II III IV) provisions and/or QC Requirements
Invoice To: TBenfield@ECSLimited.com
Address:

Client Company Name: ECS
Report To/Contact Name: Toby Benfield
Reporting Address: 4811 Kroger Blvd Greensboro
Phone: 336 856 7150 Fax (Yes) (No): 336 856 7160
Email (Yes) (No) Email Address TBenfield@ECSLimited.com
EDD Type: PDF X Excel X Other
Site Location Name: UMF
Site Location Physical Address: 133 Bluebell Rd Greensboro NC

Purchase Order No./Billing Reference _____
Requested Due Date ☐ 1 Day ☐ 2 Days ☐ 3 Days ☐ 4 Days ☐ 5 Days
"Working Days" ☐ 6-9 Days ☐ Standard 10 days ☐ Rush Work Must Be Pre-Approved
Samples received after 15:00 will be processed next business day.
Turnaround time is based on business days, excluding weekends and holidays.
(SEE REVERSE FOR TERMS & CONDITIONS REGARDING SERVICES RENDERED BY PRISM LABORATORIES, INC. TO CLIENT)

LAB USE ONLY

	YES	NO	N/A
Samples INTACT upon arrival?	X		
Received ON WET ICE? Temp 4.2	X		
PROPER PRESERVATIVES indicated?	X		
Received WITHIN HOLDING TIMES?	X		
CUSTODY SEALS INTACT?			X
VOLATILES rec'd W/OUT HEADSPACE?			X
PROPER CONTAINERS used?	X		

TO BE FILLED IN BY CLIENT/SAMPLING PERSONNEL ✓
Certification: NELAC ____ USACE ____ FL ____ NC ____
SC ____ OTHER ____ N/A ____
Water Chlorinated: YES ___ NO ___
Sample Iced Upon Collection: YES ✓ NO ___

CLIENT SAMPLE DESCRIPTION	DATE COLLECTED	TIME COLLECTED MILITARY HOURS	MATRIX (SOIL, WATER OR SLUDGE)	SAMPLE CONTAINER *TYPE SEE BELOW	NO.	SIZE	PRESERVATIVES	ANALYSES REQUESTED: TCLP metals		Cr+6	13 priority metals			REMARKS	PRISM LAB ID NO.
DC-1	8-17	1305	S	G	2	4oz		✓							01
DC-2	↓	1325	S	↓	↓	↓		✓							02
DC-3		1350	S	↓	↓	↓		✓							03
DD-1		1410	S	C	2	4oz				✓	✓				04
DD-2		1430	S	↓	↓	↓				✓	✓				05
DD-3	↓	1500	S	↓	↓	↓				✓	✓				06

Sampler's Signature _____ Sampled By (Print Name) _____ Affiliation _____

PRESS DOWN FIRMLY - 3 COPIES

Upon relinquishing, this Chain of Custody is your authorization for Prism to proceed with the analyses as requested above. Any changes must be submitted in writing to the Prism Project Manager. There will be charges for any changes after analyses have been initialized.

Relinquished By: (Signature)	Received By: (Signature)	Date	Military/Hours
[signature]	[signature]	8/18/	1200
Relinquished By: (Signature)	Received By: (Signature)	Date	
[signature]			
Relinquished By: (Signature)	Received For Prism Laboratories By:	Date	
[signature]	[signature]	8/18/	1515

Method of Shipment: NOTE: ALL SAMPLE COOLERS SHOULD BE TAPED SHUT WITH CUSTODY SEALS FOR TRANSPORTATION TO THE LABORATORY. SAMPLES ARE NOT ACCEPTED AND VERIFIED AGAINST COC UNTIL RECEIVED AT THE LABORATORY.
☐ Fed Ex ☐ UPS ☐ Hand-delivered X Prism Field Service ☐ Other _____
COC Group No. 1080516

Additional Comments:

PRISM USE ONLY
Site Arrival Time:
Site Departure Time:
Field Tech Fee:
Mileage:

TBC

SEE REVERSE FOR TERMS & CONDITIONS

NPDES:	UST:	GROUNDWATER:	DRINKING WATER:	SOLID WASTE:	RCRA:	CERCLA	LANDFILL	OTHER:
☐ NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC

*CONTAINER TYPE CODES: A = Amber C = Clear G = Glass P = Plastic; TL = Teflon-Lined Cap VOA = Volatile Organics Analysis (Zero Head Space)

ORIGINAL

ACCESS
ANALYTICAL, INC.

ANALYTICAL REPORT

CLIENT
Prism Laboratories, Inc.
PO BOX 240543
Charlotte, NC 28224

ATTENTION
Angie Overcash

PROJECT ID
1080516

LABORATORY REPORT NUMBER
211082202

DATE
08/24/2011

Primary Data Review By

IntegriSign

Curtis Ekker
Data Validation Manager, GCAL

Secondary Data Review By

Ashley B. Amick
Project Manager, Access Analytical, Inc.
aamick@accessanalyticalinc.com

PLEASE NOTE:

- **Unless otherwise noted, all analysis on this report performed at Gulf Coast Analytical Labs (GCAL), 7979 GSRI Avenue, Baton Rouge, LA 70820.**
- **GCAL is SCDHEC certified laboratory # 73006, NCDENR certified lab # 618, GA certified lab # LA-01955, NELAP certified laboratory # 01955**
- Local support services for this project are provided by Access Analytical, Inc.. Access Analytical is a representative of GCAL serving clients in the SC/NC/GA areas. All questions regarding this report should be directed to your local Access Analytical representative at 803.781.4243 or toll free at 888.315.4243.

NELAP CERTIFICATE NUMBER 01955
DOD ELAP CERTIFICATE NUMBER ADE - 1482

ANALYTICAL RESULTS

PERFORMED BY

GULF COAST ANALYTICAL LABORATORIES, INC.
7979 GSRI Avenue
Baton Rouge, LA 70820

Report Date 08/24/2011

GCAL Report 211082202

Deliver To	Prism Laboratories, Inc. PO BOX 240543 Charlotte, NC 28224 706-529-6364
Attn	Angie Overcash

Project 1080516

CASE NARRATIVE

Client: Prism Laboratories, Inc. **Report:** 211082202

Gulf Coast Analytical Laboratories received and analyzed the sample(s) listed on the sample cross-reference page of this report. Receipt of the sample(s) is documented by the attached chain of custody. This applies only to the sample(s) listed in this report. No sample integrity or quality control exceptions were identified unless noted below.

CONVENTIONALS

In the Hexavalent Chromium analysis for prep batch 463948, the MS recovery is very low or 0%. The LCS recovery is acceptable. A post-digestion spike was performed with a recovery of 91%. This indicates that the matrix reduced the added Hexavalent Chromium and no measurable native Hexavalent Chromium existed in the original sample.

Laboratory Endorsement

Sample analysis was performed in accordance with approved methodologies provided by the Environmental Protection Agency or other recognized agencies. The samples and their corresponding extracts will be maintained for a period of 30 days unless otherwise arranged. Following this retention period the samples will be disposed in accordance with GCAL's Standard Operating Procedures.

Common Abbreviations Utilized in this Report

ND	Indicates the result was Not Detected at the specified RDL
DO	Indicates the result was Diluted Out
MI	Indicates the result was subject to Matrix Interference
TNTC	Indicates the result was Too Numerous To Count
SUBC	Indicates the analysis was Sub-Contracted
FLD	Indicates the analysis was performed in the Field
PQL	Practical Quantitation Limit
MDL	Method Detection Limit
RDL	Reporting Detection Limit
00:00	Reported as a time equivalent to 12:00 AM

Reporting Flags Utilized in this Report

J	Indicates an estimated value
U	Indicates the compound was analyzed for but not detected
B	(ORGANICS) Indicates the analyte was detected in the associated Method Blank
B	(INORGANICS) Indicates the result is between the RDL and MDL

Sample receipt at GCAL is documented through the attached chain of custody. In accordance with NELAC, this report shall be reproduced only in full and with the written permission of GCAL. The results contained within this report relate only to the samples reported. The documented results are presented within this report.

This report pertains only to the samples listed in the Report Sample Summary and should be retained as a permanent record thereof. The results contained within this report are intended for the use of the client. Any unauthorized use of the information contained in this report is prohibited.

I certify that this data package is in compliance with the NELAC standard and terms and conditions of the contract and Statement of Work both technically and for completeness, for other than the conditions in the case narrative. Release of the data contained in this hardcopy data package and in the computer-readable data submitted has been authorized by the Quality Assurance Manager or his/her designee, as verified by the following signature.

Estimated uncertainty of measurement is available upon request. This report is in compliance with the DOD QSM as specified in the contract if applicable.

IntegriSign

Robyn Migues
Technical Director
GCAL REPORT 211082202

IntegriSig

THIS REPORT CONTAINS 19 PAGES.

Report Sample Summary

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108220201	DD-1	Solid	08/18/2011 14:10	08/20/2011 08:55
21108220202	DD-2	Solid	08/18/2011 14:30	08/20/2011 08:55
21108220203	DD-3	Solid	08/18/2011 15:00	08/20/2011 08:55

Summary of Compounds Detected

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108220201	DD-1	Solid	08/18/2011 14:10	08/20/2011 08:55

SW-846 7196A Chromium VI

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	1.41	0.704	0.352	mg/kg

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108220203	DD-3	Solid	08/18/2011 15:00	08/20/2011 08:55

SW-846 7196A Chromium VI

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	6.27	0.824	0.412	mg/kg

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21108220201	DD-1	Solid	08/18/2011 14:10	08/20/2011 08:55

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
08/23/2011 15:30	463948	SW-846 3060A	1	08/24/2011 09:04	JEM	464072

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	1.41	0.704	0.352	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
211082202-02	DD-2	Solid	08/18/2011 14:30	08/20/2011 08:55

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
08/23/2011 15:30	463948	SW-846 3060A	1	08/24/2011 09:06	JEM	464072

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	0.345U	0.689	0.345	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
211082202-03	DD-3	Solid	08/18/2011 15:00	08/20/2011 08:55

SW-846 7196A Chromium VI

Prep Date	Prep Batch	Prep Method	Dilution	Analyzed	By	Analytical Batch
08/23/2011 15:30	463948	SW-846 3060A	1	08/24/2011 09:07	JEM	464072

CAS#	Parameter	Result	RDL	MDL	Units
18540-29-9	Chromium VI	6.27	0.824	0.412	mg/kg

RESULTS REPORTED ON A DRY WEIGHT BASIS

General Chemistry Quality Control Summary

Analytical Batch 464072	**Client ID**	MB463948		LCS463948
Prep Batch 463948	**GCAL ID**	981539		981540
Prep Method SW-846	**Sample Type**	Method Blank		LCS
3060A	**Prep Date**	08/23/2011 15:30		08/23/2011 15:30
	Analytical Date	08/24/2011 09:02		08/24/2011 09:03
	Matrix	Solid		Solid

SW-846 7196A Chromium VI	**Units**	mg/kg	**Spike**	**Result**		**Control**
	Result	**RDL**	**Added**		**% R**	**Limits % R**
18540-29-9 Chromium VI	0.250U	0.250	50.0	43.5	86.9	75 - 125

Analytical Batch 464072	**Client ID**	DD-1		981427MS
Prep Batch 463948	**GCAL ID**	21108220201		981541
Prep Method SW-846	**Sample Type**	SAMPLE		MS
3060A	**Prep Date**	08/23/2011 15:30		08/23/2011 15:30
	Analytical Date	08/24/2011 09:04		08/24/2011 09:04
	Matrix	Solid		Solid

SW-846 7196A Chromium VI	**Units**	mg/kg	**Spike**	**Result**		**Control**
	Result	**RDL**	**Added**		**% R**	**Limits % R**
18540-29-9 Chromium VI	1.00	0.250	50.0	7.80	**13.6***	74.5 -125.4

Analytical Batch 464072	**Client ID**	DD-2	981434DUP
Prep Batch 463948	**GCAL ID**	21108220202	981542
Prep Method SW-846	**Sample Type**	SAMPLE	DUP
3060A	**Prep Date**	08/23/2011 15:30	08/23/2011 15:30
	Analytical Date	08/24/2011 09:06	08/24/2011 09:06
	Matrix	Solid	Solid

SW-846 7196A Chromium VI	**Units**	mg/kg	**Result**		**RPD**
	Result	**RDL**		**RPD**	**Limit**
18540-29-9 Chromium VI	0.000	0.250	0.000	0	25

Prism / 4565 / 2110822 02 / 8/26/11
Sub to GCAL on 8/19/11

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SUBCONTRACT ORDER

Prism Laboratories, Inc.

1080516

Certification: NELAC___ USACE___
SC___ Other NC
N/A___

SENDING LABORATORY:

Prism Laboratories, Inc.
P. O. Box 240543
Charlotte, NC 28224-0543
Phone: 800-529-6364
Fax: 704-525-0409
Project Manager: Angela D. Overcash

RECEIVING LABORATORY:

Gulf Coast Analytical Labs, Inc.
7979 GSRI Avenue
Baton Rouge, LA 70820
Phone :(225) 769-4900
Fax: (225) 767-5717

Analysis	Due	Expires	Laboratory ID	Comments
Sample ID: 1080516-04	**Solid**	**Sampled:08/18/11 14:10**	DD-1	1
Hexavalent Chromium (Sub)		08/19/11 14:10		
Containers Supplied: 4 OZ CLEAR GLASS				
Sample ID: 1080516-05	**Solid**	**Sampled:08/18/11 14:30**	DD-2	2
Hexavalent Chromium (Sub)		08/19/11 14:30		
Containers Supplied:				
Sample ID: 1080516-06	**Solid**	**Sampled:08/18/11 15:00**	AD-3	3
Hexavalent Chromium (Sub)		08/19/11 15:00		
Containers Supplied:				

3.8

Released By	Date	Received By	Date
[signature]	8/19/11	Fed Ex	8/19/11
Fed Ex		[signature] GCAL	8/20/11 855
		8682 1201 5320	

Page 1 of 1

GCAL

GULF COAST ANALYTICAL LABORATORIES, INC

SAMPLE RECEIVING CHECKLIST

Workorder: 211082202

Client: 4565 - Access Analytical

Profile: 80251 - Prism Lab

Line Item: 2 - Solid

Received by: Carstens, Jennifer K.

Received Date/Time: 8/20/2011 8:55:00 AM

Samples Received via: FEDEX

Number of Coolers Received: 1

Cooler tracking numbers(s): 8682 1201 5320

Cooler temperature(s): 3.8

Were all coolers received at a temperature of 0 - 6° C?	☑ Yes	☐ No	☐ N/A
Were all custody seals intact?	☑ Yes	☐ No	☐ N/A
Were all samples received in proper containers?	☑ Yes	☐ No	☐ N/A
Were all samples properly preserved?	☑ Yes	☐ No	☐ N/A
Was preservative added to any container at the lab?	☐ Yes	☑ No	☐ N/A
Were all containers received in good condition?	☑ Yes	☐ No	☐ N/A
Were all VOA vials received with no head space?	☐ Yes	☐ No	☑ N/A
Do all sample labels match the Chain of Custody?	☑ Yes	☐ No	☐ N/A
Was the client notified about any discrepancies?	☐ Yes	☐ No	☑ N/A

Notes/Comments:

PRISM LABORATORIES, INC. | Full-Service Analytical & Environmental Solutions

NC Certification No. 402
SC Certification No. 99012
NC Drinking Water Cert No. 37735

Case Narrative

09/01/2011

ECS Carolinas - Greensboro
Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: UMF

Lab Submittal Date: 08/25/2011
Prism Work Order: 1080706

This data package contains the analytical results for the project identified above and includes a Case Narrative, Sample Results and Chain of Custody. Unless otherwise noted, all samples were received in acceptable condition and processed according to the referenced methods.

Data qualifiers are flagged individually on each sample. A key reference for the data qualifiers appears at the end of this case narrative.

Narrative Notes:

Methylene Chloride was detected in the trip blank. This compound was not detected in the samples associated with this Work Order.

Please call if you have any questions relating to this analytical report.

Respectfully,

PRISM LABORATORIES, INC.

VP Laboratory Services

Reviewed By

Data Qualifiers Key Reference:

E	Estimated concentration above the calibration range
J	Detected but below the Reporting Limit; therefore, result is an estimated concentration (CLP J-Flag).
MC	Sample concentration too high for recovery evaluation.
BRL	Below Reporting Limit
MDL	Method Detection Limit
RPD	Relative Percent Difference
*	Results reported to the reporting limit. All other results are reported to the MDL with values between MDL and reporting limit indicated with a J.

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Sample Receipt Summary

09/01/2011

Prism Work Order: 1080706

Client Sample ID	Lab Sample ID	Matrix	Date Sampled	Date Received
MW-1	1080706-01	Water	08/25/11	08/25/11
MW-2	1080706-02	Water	08/25/11	08/25/11
MW-3	1080706-03	Water	08/25/11	08/25/11
MW-4	1080706-04	Water	08/25/11	08/25/11
MW-5	1080706-05	Water	08/25/11	08/25/11
Trip Blank	1080706-06	Water	08/25/11	08/25/11

Samples received in good condition at 2.1 degrees C unless otherwise noted.

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Laboratory Report

09/01/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: UMF

Sample Matrix: Water

Client Sample ID: MW-1
Prism Sample ID: 1080706-01
Prism Work Order: 1080706
Time Collected: 08/25/11 10:15
Time Submitted: 08/25/11 15:40

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
Trivalent Chromium	BRL	mg/L	0.50	0.070	20	Trivalent Chromium	8/25/11 17:00	CDE	[CALC]
Hexavalent Chromium	**12**	**mg/L**	**0.50**	**0.070**	**20**	***SM3500-Cr D**	**8/25/11 17:00**	**CDE**	**P1H0601**
Total Metals									
Mercury	BRL	mg/L	0.00020	0.000014	1	*7470A	8/31/11 13:36	LTB	P1H0666
Antimony	**0.014**	**mg/L**	**0.010**	**0.00060**	**1**	***6010C**	**8/30/11 10:59**	**DWR**	**P1H0631**
Arsenic	BRL	mg/L	0.010	0.0020	1	*6010C	8/30/11 10:59	DWR	P1H0631
Beryllium	BRL	mg/L	0.0020	0.00015	1	*6010C	8/30/11 10:59	DWR	P1H0631
Cadmium	BRL	mg/L	0.0010	0.000086	1	*6010C	8/30/11 10:59	DWR	P1H0631
Chromium	**12**	**mg/L**	**0.025**	**0.00085**	**5**	***6010C**	**8/31/11 10:23**	**LTB**	**P1H0631**
Copper	**0.017**	**mg/L**	**0.010**	**0.00068**	**1**	***6010C**	**8/30/11 10:59**	**DWR**	**P1H0631**
Lead	BRL	mg/L	0.0050	0.00077	1	*6010C	8/30/11 10:59	DWR	P1H0631
Nickel	**0.014**	**mg/L**	**0.010**	**0.00035**	**1**	***6010C**	**8/30/11 10:59**	**DWR**	**P1H0631**
Selenium	BRL	mg/L	0.020	0.0023	1	*6010C	8/30/11 10:59	DWR	P1H0631
Silver	BRL	mg/L	0.0050	0.00034	1	*6010C	8/30/11 10:59	DWR	P1H0631
Thallium	BRL	mg/L	0.010	0.00081	1	*6010C	8/30/11 10:59	DWR	P1H0631
Tin	BRL	mg/L	0.050	0.00043	1	*6010C	8/30/11 10:59	DWR	P1H0631
Zinc	BRL	mg/L	0.030	0.00083	1	*6010C	8/30/11 10:59	DWR	P1H0631
Volatile Organic Compounds by GC/MS									
1,1,1,2-Tetrachloroethane	BRL	ug/L	0.50	0.15	1	8260B	8/30/11 0:50	MGB	P1H0632
1,1,1-Trichloroethane	BRL	ug/L	0.50	0.063	1	8260B	8/30/11 0:50	MGB	P1H0632
1,1,2,2-Tetrachloroethane	BRL	ug/L	0.50	0.071	1	8260B	8/30/11 0:50	MGB	P1H0632
1,1,2-Trichloroethane	BRL	ug/L	0.50	0.17	1	8260B	8/30/11 0:50	MGB	P1H0632
1,1-Dichloroethane	BRL	ug/L	0.50	0.096	1	8260B	8/30/11 0:50	MGB	P1H0632
1,1-Dichloroethylene	BRL	ug/L	0.50	0.078	1	8260B	8/30/11 0:50	MGB	P1H0632
1,1-Dichloropropylene	BRL	ug/L	0.50	0.061	1	8260B	8/30/11 0:50	MGB	P1H0632
1,2,3-Trichlorobenzene	BRL	ug/L	2.0	0.20	1	8260B	8/30/11 0:50	MGB	P1H0632
1,2,3-Trichloropropane	BRL	ug/L	1.0	0.081	1	8260B	8/30/11 0:50	MGB	P1H0632
1,2,4-Trichlorobenzene	BRL	ug/L	1.0	0.10	1	8260B	8/30/11 0:50	MGB	P1H0632
1,2,4-Trimethylbenzene	BRL	ug/L	0.50	0.048	1	8260B	8/30/11 0:50	MGB	P1H0632
1,2-Dibromo-3-chloropropane	BRL	ug/L	2.0	0.59	1	8260B	8/30/11 0:50	MGB	P1H0632
1,2-Dibromoethane	BRL	ug/L	0.50	0.14	1	8260B	8/30/11 0:50	MGB	P1H0632
1,2-Dichlorobenzene	BRL	ug/L	0.50	0.076	1	8260B	8/30/11 0:50	MGB	P1H0632
1,2-Dichloroethane	BRL	ug/L	0.50	0.14	1	8260B	8/30/11 0:50	MGB	P1H0632
1,2-Dichloropropane	BRL	ug/L	0.50	0.13	1	8260B	8/30/11 0:50	MGB	P1H0632
1,3,5-Trimethylbenzene	BRL	ug/L	0.50	0.057	1	8260B	8/30/11 0:50	MGB	P1H0632
1,3-Dichlorobenzene	BRL	ug/L	0.50	0.074	1	8260B	8/30/11 0:50	MGB	P1H0632
1,3-Dichloropropane	BRL	ug/L	0.50	0.11	1	8260B	8/30/11 0:50	MGB	P1H0632
1,4-Dichlorobenzene	BRL	ug/L	0.50	0.068	1	8260B	8/30/11 0:50	MGB	P1H0632
2,2-Dichloropropane	BRL	ug/L	2.0	0.11	1	8260B	8/30/11 0:50	MGB	P1H0632
2-Chloroethyl Vinyl Ether	BRL	ug/L	2.0	0.22	1	8260B	8/30/11 0:50	MGB	P1H0632
2-Chlorotoluene	BRL	ug/L	0.50	0.038	1	8260B	8/30/11 0:50	MGB	P1H0632

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PRISM LABORATORIES, INC. | Full-Service Analytical & Environmental Solutions

Laboratory Report

09/01/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: UMF

Sample Matrix: Water

Client Sample ID: MW-1
Prism Sample ID: 1080706-01
Prism Work Order: 1080706
Time Collected: 08/25/11 10:15
Time Submitted: 08/25/11 15:40

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
4-Chlorotoluene	BRL	ug/L	0.50	0.053	1	8260B	8/30/11 0:50	MGB	P1H0632
4-Isopropyltoluene	BRL	ug/L	0.50	0.065	1	8260B	8/30/11 0:50	MGB	P1H0632
Acetone	BRL	ug/L	5.0	0.62	1	8260B	8/30/11 0:50	MGB	P1H0632
Acrolein	BRL	ug/L	20	1.1	1	8260B	8/30/11 0:50	MGB	P1H0632
Acrylonitrile	BRL	ug/L	20	0.86	1	8260B	8/30/11 0:50	MGB	P1H0632
Benzene	BRL	ug/L	0.50	0.072	1	8260B	8/30/11 0:50	MGB	P1H0632
Bromobenzene	BRL	ug/L	0.50	0.064	1	8260B	8/30/11 0:50	MGB	P1H0632
Bromochloromethane	BRL	ug/L	0.50	0.13	1	8260B	8/30/11 0:50	MGB	P1H0632
Bromodichloromethane	BRL	ug/L	0.50	0.062	1	8260B	8/30/11 0:50	MGB	P1H0632
Bromoform	BRL	ug/L	1.0	0.27	1	8260B	8/30/11 0:50	MGB	P1H0632
Bromomethane	BRL	ug/L	1.0	0.47	1	8260B	8/30/11 0:50	MGB	P1H0632
Carbon disulfide	BRL	ug/L	5.0	1.4	1	8260B	8/30/11 0:50	MGB	P1H0632
Carbon Tetrachloride	BRL	ug/L	0.50	0.12	1	8260B	8/30/11 0:50	MGB	P1H0632
Chlorobenzene	BRL	ug/L	0.50	0.061	1	8260B	8/30/11 0:50	MGB	P1H0632
Chloroethane	BRL	ug/L	0.50	0.13	1	8260B	8/30/11 0:50	MGB	P1H0632
Chloroform	**6.0**	**ug/L**	**0.50**	**0.089**	**1**	**8260B**	**8/30/11 0:50**	**MGB**	**P1H0632**
Chloromethane	BRL	ug/L	0.50	0.11	1	8260B	8/30/11 0:50	MGB	P1H0632
cis-1,2-Dichloroethylene	BRL	ug/L	0.50	0.076	1	8260B	8/30/11 0:50	MGB	P1H0632
cis-1,3-Dichloropropylene	BRL	ug/L	0.50	0.10	1	8260B	8/30/11 0:50	MGB	P1H0632
Dibromochloromethane	BRL	ug/L	0.50	0.30	1	8260B	8/30/11 0:50	MGB	P1H0632
Dibromomethane	BRL	ug/L	0.50	0.13	1	8260B	8/30/11 0:50	MGB	P1H0632
Dichlorodifluoromethane	BRL	ug/L	1.0	0.11	1	8260B	8/30/11 0:50	MGB	P1H0632
Ethylbenzene	BRL	ug/L	0.50	0.067	1	8260B	8/30/11 0:50	MGB	P1H0632
Hexachlorobutadiene	BRL	ug/L	2.0	0.36	1	8260B	8/30/11 0:50	MGB	P1H0632
Isopropyl Ether	BRL	ug/L	0.50	0.043	1	8260B	8/30/11 0:50	MGB	P1H0632
Isopropylbenzene (Cumene)	BRL	ug/L	0.50	0.072	1	8260B	8/30/11 0:50	MGB	P1H0632
m,p-Xylenes	BRL	ug/L	1.0	0.081	1	8260B	8/30/11 0:50	MGB	P1H0632
Methyl Butyl Ketone (2-Hexanone)	BRL	ug/L	5.0	0.19	1	8260B	8/30/11 0:50	MGB	P1H0632
Methyl Ethyl Ketone (2-Butanone)	BRL	ug/L	5.0	0.90	1	8260B	8/30/11 0:50	MGB	P1H0632
Methyl Isobutyl Ketone	BRL	ug/L	5.0	0.12	1	8260B	8/30/11 0:50	MGB	P1H0632
Methylene Chloride	BRL	ug/L	1.0	0.44	1	8260B	8/30/11 0:50	MGB	P1H0632
Methyl-tert-Butyl Ether	**1.1**	**ug/L**	**0.50**	**0.070**	**1**	**8260B**	**8/30/11 0:50**	**MGB**	**P1H0632**
Naphthalene	BRL	ug/L	1.0	0.098	1	8260B	8/30/11 0:50	MGB	P1H0632
n-Butylbenzene	BRL	ug/L	1.0	0.11	1	8260B	8/30/11 0:50	MGB	P1H0632
n-Propylbenzene	BRL	ug/L	0.50	0.060	1	8260B	8/30/11 0:50	MGB	P1H0632
o-Xylene	BRL	ug/L	0.50	0.046	1	8260B	8/30/11 0:50	MGB	P1H0632
sec-Butylbenzene	BRL	ug/L	0.50	0.087	1	8260B	8/30/11 0:50	MGB	P1H0632
Styrene	BRL	ug/L	0.50	0.047	1	8260B	8/30/11 0:50	MGB	P1H0632
tert-Butylbenzene	BRL	ug/L	0.50	0.080	1	8260B	8/30/11 0:50	MGB	P1H0632
Tetrachloroethylene	**22**	**ug/L**	**0.50**	**0.069**	**1**	**8260B**	**8/30/11 0:50**	**MGB**	**P1H0632**
Toluene	BRL	ug/L	0.50	0.042	1	8260B	8/30/11 0:50	MGB	P1H0632
trans-1,2-Dichloroethylene	BRL	ug/L	0.50	0.12	1	8260B	8/30/11 0:50	MGB	P1H0632
trans-1,3-Dichloropropylene	BRL	ug/L	0.50	0.043	1	8260B	8/30/11 0:50	MGB	P1H0632

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PRISM LABORATORIES, INC. | Full-Service Analytical & Environmental Solutions

Laboratory Report

09/01/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: UMF

Sample Matrix: Water

Client Sample ID: MW-1
Prism Sample ID: 1080706-01
Prism Work Order: 1080706
Time Collected: 08/25/11 10:15
Time Submitted: 08/25/11 15:40

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
Trichloroethylene	BRL	ug/L	0.50	0.054	1	8260B	8/30/11 0:50	MGB	P1H0632
Trichlorofluoromethane	BRL	ug/L	0.50	0.088	1	8260B	8/30/11 0:50	MGB	P1H0632
Vinyl acetate	BRL	ug/L	2.0	0.10	1	8260B	8/30/11 0:50	MGB	P1H0632
Vinyl chloride	BRL	ug/L	0.50	0.16	1	8260B	8/30/11 0:50	MGB	P1H0632

Surrogate	Recovery	Control Limits
4-Bromofluorobenzene	*103 %*	*80-124*
Dibromofluoromethane	*104 %*	*75-129*
Toluene-d8	*99 %*	*77-123*

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09/01/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: UMF

Sample Matrix: Water

Client Sample ID: MW-2
Prism Sample ID: 1080706-02
Prism Work Order: 1080706
Time Collected: 08/25/11 11:55
Time Submitted: 08/25/11 15:40

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
Trivalent Chromium	BRL	mg/L	0.50	0.070	20	Trivalent Chromium	8/25/11 17:00	CDE	[CALC]
Hexavalent Chromium	**2.4**	**mg/L**	**0.50**	**0.070**	**20**	***SM3500-Cr D**	**8/25/11 17:00**	**CDE**	**P1H0601**
Total Metals									
Mercury	BRL	mg/L	0.00020	0.000014	1	*7470A	8/31/11 13:40	LTB	P1H0666
Antimony	BRL	mg/L	0.010	0.00060	1	*6010C	8/30/11 11:18	DWR	P1H0631
Arsenic	BRL	mg/L	0.010	0.0020	1	*6010C	8/30/11 11:18	DWR	P1H0631
Beryllium	BRL	mg/L	0.0020	0.00015	1	*6010C	8/30/11 11:18	DWR	P1H0631
Cadmium	BRL	mg/L	0.0010	0.000086	1	*6010C	8/30/11 11:18	DWR	P1H0631
Chromium	**2.0**	**mg/L**	**0.0050**	**0.00017**	**1**	***6010C**	**8/30/11 11:18**	**DWR**	**P1H0631**
Copper	BRL	mg/L	0.010	0.00068	1	*6010C	8/30/11 11:18	DWR	P1H0631
Lead	BRL	mg/L	0.0050	0.00077	1	*6010C	8/30/11 11:18	DWR	P1H0631
Nickel	**0.25**	**mg/L**	**0.010**	**0.00035**	**1**	***6010C**	**8/30/11 11:18**	**DWR**	**P1H0631**
Selenium	BRL	mg/L	0.020	0.0023	1	*6010C	8/30/11 11:18	DWR	P1H0631
Silver	BRL	mg/L	0.0050	0.00034	1	*6010C	8/30/11 11:18	DWR	P1H0631
Thallium	BRL	mg/L	0.010	0.00081	1	*6010C	8/30/11 11:18	DWR	P1H0631
Tin	BRL	mg/L	0.050	0.00043	1	*6010C	8/30/11 11:18	DWR	P1H0631
Zinc	BRL	mg/L	0.030	0.00083	1	*6010C	8/30/11 11:18	DWR	P1H0631
Volatile Organic Compounds by GC/MS									
1,1,1,2-Tetrachloroethane	BRL	ug/L	0.50	0.15	1	8260B	8/30/11 1:16	MGB	P1H0632
1,1,1-Trichloroethane	BRL	ug/L	0.50	0.063	1	8260B	8/30/11 1:16	MGB	P1H0632
1,1,2,2-Tetrachloroethane	BRL	ug/L	0.50	0.071	1	8260B	8/30/11 1:16	MGB	P1H0632
1,1,2-Trichloroethane	BRL	ug/L	0.50	0.17	1	8260B	8/30/11 1:16	MGB	P1H0632
1,1-Dichloroethane	BRL	ug/L	0.50	0.096	1	8260B	8/30/11 1:16	MGB	P1H0632
1,1-Dichloroethylene	BRL	ug/L	0.50	0.078	1	8260B	8/30/11 1:16	MGB	P1H0632
1,1-Dichloropropylene	BRL	ug/L	0.50	0.061	1	8260B	8/30/11 1:16	MGB	P1H0632
1,2,3-Trichlorobenzene	BRL	ug/L	2.0	0.20	1	8260B	8/30/11 1:16	MGB	P1H0632
1,2,3-Trichloropropane	BRL	ug/L	1.0	0.081	1	8260B	8/30/11 1:16	MGB	P1H0632
1,2,4-Trichlorobenzene	BRL	ug/L	1.0	0.10	1	8260B	8/30/11 1:16	MGB	P1H0632
1,2,4-Trimethylbenzene	BRL	ug/L	0.50	0.048	1	8260B	8/30/11 1:16	MGB	P1H0632
1,2-Dibromo-3-chloropropane	BRL	ug/L	2.0	0.59	1	8260B	8/30/11 1:16	MGB	P1H0632
1,2-Dibromoethane	BRL	ug/L	0.50	0.14	1	8260B	8/30/11 1:16	MGB	P1H0632
1,2-Dichlorobenzene	BRL	ug/L	0.50	0.076	1	8260B	8/30/11 1:16	MGB	P1H0632
1,2-Dichloroethane	**0.51**	**ug/L**	**0.50**	**0.14**	**1**	**8260B**	**8/30/11 1:16**	**MGB**	**P1H0632**
1,2-Dichloropropane	BRL	ug/L	0.50	0.13	1	8260B	8/30/11 1:16	MGB	P1H0632
1,3,5-Trimethylbenzene	BRL	ug/L	0.50	0.057	1	8260B	8/30/11 1:16	MGB	P1H0632
1,3-Dichlorobenzene	BRL	ug/L	0.50	0.074	1	8260B	8/30/11 1:16	MGB	P1H0632
1,3-Dichloropropane	BRL	ug/L	0.50	0.11	1	8260B	8/30/11 1:16	MGB	P1H0632
1,4-Dichlorobenzene	BRL	ug/L	0.50	0.068	1	8260B	8/30/11 1:16	MGB	P1H0632
2,2-Dichloropropane	BRL	ug/L	2.0	0.11	1	8260B	8/30/11 1:16	MGB	P1H0632
2-Chloroethyl Vinyl Ether	BRL	ug/L	2.0	0.22	1	8260B	8/30/11 1:16	MGB	P1H0632
2-Chlorotoluene	BRL	ug/L	0.50	0.038	1	8260B	8/30/11 1:16	MGB	P1H0632

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Laboratory Report

09/01/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: UMF

Sample Matrix: Water

Client Sample ID: MW-2
Prism Sample ID: 1080706-02
Prism Work Order: 1080706
Time Collected: 08/25/11 11:55
Time Submitted: 08/25/11 15:40

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
4-Chlorotoluene	BRL	ug/L	0.50	0.053	1	8260B	8/30/11 1:16	MGB	P1H0632
4-Isopropyltoluene	BRL	ug/L	0.50	0.065	1	8260B	8/30/11 1:16	MGB	P1H0632
Acetone	**3.9 J**	**ug/L**	**5.0**	**0.62**	**1**	**8260B**	**8/30/11 1:16**	**MGB**	**P1H0632**
Acrolein	BRL	ug/L	20	1.1	1	8260B	8/30/11 1:16	MGB	P1H0632
Acrylonitrile	BRL	ug/L	20	0.86	1	8260B	8/30/11 1:16	MGB	P1H0632
Benzene	BRL	ug/L	0.50	0.072	1	8260B	8/30/11 1:16	MGB	P1H0632
Bromobenzene	BRL	ug/L	0.50	0.064	1	8260B	8/30/11 1:16	MGB	P1H0632
Bromochloromethane	BRL	ug/L	0.50	0.13	1	8260B	8/30/11 1:16	MGB	P1H0632
Bromodichloromethane	**0.99**	**ug/L**	**0.50**	**0.062**	**1**	**8260B**	**8/30/11 1:16**	**MGB**	**P1H0632**
Bromoform	BRL	ug/L	1.0	0.27	1	8260B	8/30/11 1:16	MGB	P1H0632
Bromomethane	BRL	ug/L	1.0	0.47	1	8260B	8/30/11 1:16	MGB	P1H0632
Carbon disulfide	BRL	ug/L	5.0	1.4	1	8260B	8/30/11 1:16	MGB	P1H0632
Carbon Tetrachloride	BRL	ug/L	0.50	0.12	1	8260B	8/30/11 1:16	MGB	P1H0632
Chlorobenzene	BRL	ug/L	0.50	0.061	1	8260B	8/30/11 1:16	MGB	P1H0632
Chloroethane	BRL	ug/L	0.50	0.13	1	8260B	8/30/11 1:16	MGB	P1H0632
Chloroform	**9.1**	**ug/L**	**0.50**	**0.089**	**1**	**8260B**	**8/30/11 1:16**	**MGB**	**P1H0632**
Chloromethane	BRL	ug/L	0.50	0.11	1	8260B	8/30/11 1:16	MGB	P1H0632
cis-1,2-Dichloroethylene	BRL	ug/L	0.50	0.076	1	8260B	8/30/11 1:16	MGB	P1H0632
cis-1,3-Dichloropropylene	BRL	ug/L	0.50	0.10	1	8260B	8/30/11 1:16	MGB	P1H0632
Dibromochloromethane	BRL	ug/L	0.50	0.30	1	8260B	8/30/11 1:16	MGB	P1H0632
Dibromomethane	BRL	ug/L	0.50	0.13	1	8260B	8/30/11 1:16	MGB	P1H0632
Dichlorodifluoromethane	**0.54 J**	**ug/L**	**1.0**	**0.11**	**1**	**8260B**	**8/30/11 1:16**	**MGB**	**P1H0632**
Ethylbenzene	BRL	ug/L	0.50	0.067	1	8260B	8/30/11 1:16	MGB	P1H0632
Hexachlorobutadiene	BRL	ug/L	2.0	0.36	1	8260B	8/30/11 1:16	MGB	P1H0632
Isopropyl Ether	BRL	ug/L	0.50	0.043	1	8260B	8/30/11 1:16	MGB	P1H0632
Isopropylbenzene (Cumene)	BRL	ug/L	0.50	0.072	1	8260B	8/30/11 1:16	MGB	P1H0632
m,p-Xylenes	BRL	ug/L	1.0	0.081	1	8260B	8/30/11 1:16	MGB	P1H0632
Methyl Butyl Ketone (2-Hexanone)	BRL	ug/L	5.0	0.19	1	8260B	8/30/11 1:16	MGB	P1H0632
Methyl Ethyl Ketone (2-Butanone)	BRL	ug/L	5.0	0.90	1	8260B	8/30/11 1:16	MGB	P1H0632
Methyl Isobutyl Ketone	BRL	ug/L	5.0	0.12	1	8260B	8/30/11 1:16	MGB	P1H0632
Methylene Chloride	BRL	ug/L	1.0	0.44	1	8260B	8/30/11 1:16	MGB	P1H0632
Methyl-tert-Butyl Ether	BRL	ug/L	0.50	0.070	1	8260B	8/30/11 1:16	MGB	P1H0632
Naphthalene	BRL	ug/L	1.0	0.098	1	8260B	8/30/11 1:16	MGB	P1H0632
n-Butylbenzene	BRL	ug/L	1.0	0.11	1	8260B	8/30/11 1:16	MGB	P1H0632
n-Propylbenzene	BRL	ug/L	0.50	0.060	1	8260B	8/30/11 1:16	MGB	P1H0632
o-Xylene	BRL	ug/L	0.50	0.046	1	8260B	8/30/11 1:16	MGB	P1H0632
sec-Butylbenzene	BRL	ug/L	0.50	0.087	1	8260B	8/30/11 1:16	MGB	P1H0632
Styrene	BRL	ug/L	0.50	0.047	1	8260B	8/30/11 1:16	MGB	P1H0632
tert-Butylbenzene	BRL	ug/L	0.50	0.080	1	8260B	8/30/11 1:16	MGB	P1H0632
Tetrachloroethylene	**51**	**ug/L**	**0.50**	**0.069**	**1**	**8260B**	**8/30/11 1:16**	**MGB**	**P1H0632**
Toluene	BRL	ug/L	0.50	0.042	1	8260B	8/30/11 1:16	MGB	P1H0632
trans-1,2-Dichloroethylene	BRL	ug/L	0.50	0.12	1	8260B	8/30/11 1:16	MGB	P1H0632
trans-1,3-Dichloropropylene	BRL	ug/L	0.50	0.043	1	8260B	8/30/11 1:16	MGB	P1H0632

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Laboratory Report

09/01/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: UMF

Sample Matrix: Water

Client Sample ID: MW-2
Prism Sample ID: 1080706-02
Prism Work Order: 1080706
Time Collected: 08/25/11 11:55
Time Submitted: 08/25/11 15:40

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
Trichloroethylene	BRL	ug/L	0.50	0.054	1	8260B	8/30/11 1:16	MGB	P1H0632
Trichlorofluoromethane	BRL	ug/L	0.50	0.088	1	8260B	8/30/11 1:16	MGB	P1H0632
Vinyl acetate	BRL	ug/L	2.0	0.10	1	8260B	8/30/11 1:16	MGB	P1H0632
Vinyl chloride	BRL	ug/L	0.50	0.16	1	8260B	8/30/11 1:16	MGB	P1H0632

Surrogate	Recovery	Control Limits
4-Bromofluorobenzene	*121 %*	*80-124*
Dibromofluoromethane	*129 %*	*75-129*
Toluene-d8	*120 %*	*77-123*

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Laboratory Report

09/01/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: UMF

Sample Matrix: Water

Client Sample ID: MW-3
Prism Sample ID: 1080706-03
Prism Work Order: 1080706
Time Collected: 08/25/11 11:20
Time Submitted: 08/25/11 15:40

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
Trivalent Chromium	BRL	mg/L	2.5	0.35	100	Trivalent Chromium	8/25/11 17:00	CDE	[CALC]
Hexavalent Chromium	**49**	**mg/L**	**2.5**	**0.35**	**100**	***SM3500-Cr D**	**8/25/11 17:00**	**CDE**	**P1H0601**
Total Metals									
Mercury	BRL	mg/L	0.00020	0.000014	1	*7470A	8/31/11 13:44	LTB	P1H0666
Antimony	**0.054**	**mg/L**	**0.010**	**0.00060**	**1**	***6010C**	**8/30/11 11:26**	**DWR**	**P1H0631**
Arsenic	BRL	mg/L	0.010	0.0020	1	*6010C	8/30/11 11:26	DWR	P1H0631
Beryllium	BRL	mg/L	0.0020	0.00015	1	*6010C	8/30/11 11:26	DWR	P1H0631
Cadmium	BRL	mg/L	0.0010	0.000086	1	*6010C	8/30/11 11:26	DWR	P1H0631
Chromium	**47**	**mg/L**	**0.050**	**0.0017**	**10**	***6010C**	**8/31/11 10:30**	**LTB**	**P1H0631**
Copper	BRL	mg/L	0.010	0.00068	1	*6010C	8/30/11 11:26	DWR	P1H0631
Lead	BRL	mg/L	0.0050	0.00077	1	*6010C	8/30/11 11:26	DWR	P1H0631
Nickel	BRL	mg/L	0.010	0.00035	1	*6010C	8/30/11 11:26	DWR	P1H0631
Selenium	BRL	mg/L	0.020	0.0023	1	*6010C	8/30/11 11:26	DWR	P1H0631
Silver	BRL	mg/L	0.0050	0.00034	1	*6010C	8/30/11 11:26	DWR	P1H0631
Thallium	BRL	mg/L	0.010	0.00081	1	*6010C	8/30/11 11:26	DWR	P1H0631
Tin	BRL	mg/L	0.050	0.00043	1	*6010C	8/30/11 11:26	DWR	P1H0631
Zinc	BRL	mg/L	0.030	0.00083	1	*6010C	8/30/11 11:26	DWR	P1H0631
Volatile Organic Compounds by GC/MS									
1,1,1,2-Tetrachloroethane	BRL	ug/L	0.50	0.15	1	8260B	8/30/11 1:43	MGB	P1H0632
1,1,1-Trichloroethane	BRL	ug/L	0.50	0.063	1	8260B	8/30/11 1:43	MGB	P1H0632
1,1,2,2-Tetrachloroethane	BRL	ug/L	0.50	0.071	1	8260B	8/30/11 1:43	MGB	P1H0632
1,1,2-Trichloroethane	BRL	ug/L	0.50	0.17	1	8260B	8/30/11 1:43	MGB	P1H0632
1,1-Dichloroethane	BRL	ug/L	0.50	0.096	1	8260B	8/30/11 1:43	MGB	P1H0632
1,1-Dichloroethylene	BRL	ug/L	0.50	0.078	1	8260B	8/30/11 1:43	MGB	P1H0632
1,1-Dichloropropylene	BRL	ug/L	0.50	0.061	1	8260B	8/30/11 1:43	MGB	P1H0632
1,2,3-Trichlorobenzene	BRL	ug/L	2.0	0.20	1	8260B	8/30/11 1:43	MGB	P1H0632
1,2,3-Trichloropropane	BRL	ug/L	1.0	0.081	1	8260B	8/30/11 1:43	MGB	P1H0632
1,2,4-Trichlorobenzene	BRL	ug/L	1.0	0.10	1	8260B	8/30/11 1:43	MGB	P1H0632
1,2,4-Trimethylbenzene	BRL	ug/L	0.50	0.048	1	8260B	8/30/11 1:43	MGB	P1H0632
1,2-Dibromo-3-chloropropane	BRL	ug/L	2.0	0.59	1	8260B	8/30/11 1:43	MGB	P1H0632
1,2-Dibromoethane	BRL	ug/L	0.50	0.14	1	8260B	8/30/11 1:43	MGB	P1H0632
1,2-Dichlorobenzene	BRL	ug/L	0.50	0.076	1	8260B	8/30/11 1:43	MGB	P1H0632
1,2-Dichloroethane	BRL	ug/L	0.50	0.14	1	8260B	8/30/11 1:43	MGB	P1H0632
1,2-Dichloropropane	BRL	ug/L	0.50	0.13	1	8260B	8/30/11 1:43	MGB	P1H0632
1,3,5-Trimethylbenzene	BRL	ug/L	0.50	0.057	1	8260B	8/30/11 1:43	MGB	P1H0632
1,3-Dichlorobenzene	BRL	ug/L	0.50	0.074	1	8260B	8/30/11 1:43	MGB	P1H0632
1,3-Dichloropropane	BRL	ug/L	0.50	0.11	1	8260B	8/30/11 1:43	MGB	P1H0632
1,4-Dichlorobenzene	BRL	ug/L	0.50	0.068	1	8260B	8/30/11 1:43	MGB	P1H0632
2,2-Dichloropropane	BRL	ug/L	2.0	0.11	1	8260B	8/30/11 1:43	MGB	P1H0632
2-Chloroethyl Vinyl Ether	BRL	ug/L	2.0	0.22	1	8260B	8/30/11 1:43	MGB	P1H0632
2-Chlorotoluene	BRL	ug/L	0.50	0.038	1	8260B	8/30/11 1:43	MGB	P1H0632

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PRISM LABORATORIES, INC. | Full-Service Analytical & Environmental Solutions

Laboratory Report

09/01/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: UMF

Sample Matrix: Water

Client Sample ID: MW-3
Prism Sample ID: 1080706-03
Prism Work Order: 1080706
Time Collected: 08/25/11 11:20
Time Submitted: 08/25/11 15:40

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
4-Chlorotoluene	BRL	ug/L	0.50	0.053	1	8260B	8/30/11 1:43	MGB	P1H0632
4-Isopropyltoluene	BRL	ug/L	0.50	0.065	1	8260B	8/30/11 1:43	MGB	P1H0632
Acetone	BRL	ug/L	5.0	0.62	1	8260B	8/30/11 1:43	MGB	P1H0632
Acrolein	BRL	ug/L	20	1.1	1	8260B	8/30/11 1:43	MGB	P1H0632
Acrylonitrile	BRL	ug/L	20	0.86	1	8260B	8/30/11 1:43	MGB	P1H0632
Benzene	BRL	ug/L	0.50	0.072	1	8260B	8/30/11 1:43	MGB	P1H0632
Bromobenzene	BRL	ug/L	0.50	0.064	1	8260B	8/30/11 1:43	MGB	P1H0632
Bromochloromethane	BRL	ug/L	0.50	0.13	1	8260B	8/30/11 1:43	MGB	P1H0632
Bromodichloromethane	**0.51**	**ug/L**	**0.50**	**0.062**	**1**	**8260B**	**8/30/11 1:43**	**MGB**	**P1H0632**
Bromoform	BRL	ug/L	1.0	0.27	1	8260B	8/30/11 1:43	MGB	P1H0632
Bromomethane	BRL	ug/L	1.0	0.47	1	8260B	8/30/11 1:43	MGB	P1H0632
Carbon disulfide	BRL	ug/L	5.0	1.4	1	8260B	8/30/11 1:43	MGB	P1H0632
Carbon Tetrachloride	BRL	ug/L	0.50	0.12	1	8260B	8/30/11 1:43	MGB	P1H0632
Chlorobenzene	BRL	ug/L	0.50	0.061	1	8260B	8/30/11 1:43	MGB	P1H0632
Chloroethane	BRL	ug/L	0.50	0.13	1	8260B	8/30/11 1:43	MGB	P1H0632
Chloroform	**4.0**	**ug/L**	**0.50**	**0.089**	**1**	**8260B**	**8/30/11 1:43**	**MGB**	**P1H0632**
Chloromethane	BRL	ug/L	0.50	0.11	1	8260B	8/30/11 1:43	MGB	P1H0632
cis-1,2-Dichloroethylene	BRL	ug/L	0.50	0.076	1	8260B	8/30/11 1:43	MGB	P1H0632
cis-1,3-Dichloropropylene	BRL	ug/L	0.50	0.10	1	8260B	8/30/11 1:43	MGB	P1H0632
Dibromochloromethane	BRL	ug/L	0.50	0.30	1	8260B	8/30/11 1:43	MGB	P1H0632
Dibromomethane	BRL	ug/L	0.50	0.13	1	8260B	8/30/11 1:43	MGB	P1H0632
Dichlorodifluoromethane	BRL	ug/L	1.0	0.11	1	8260B	8/30/11 1:43	MGB	P1H0632
Ethylbenzene	BRL	ug/L	0.50	0.067	1	8260B	8/30/11 1:43	MGB	P1H0632
Hexachlorobutadiene	BRL	ug/L	2.0	0.36	1	8260B	8/30/11 1:43	MGB	P1H0632
Isopropyl Ether	BRL	ug/L	0.50	0.043	1	8260B	8/30/11 1:43	MGB	P1H0632
Isopropylbenzene (Cumene)	BRL	ug/L	0.50	0.072	1	8260B	8/30/11 1:43	MGB	P1H0632
m,p-Xylenes	BRL	ug/L	1.0	0.081	1	8260B	8/30/11 1:43	MGB	P1H0632
Methyl Butyl Ketone (2-Hexanone)	BRL	ug/L	5.0	0.19	1	8260B	8/30/11 1:43	MGB	P1H0632
Methyl Ethyl Ketone (2-Butanone)	BRL	ug/L	5.0	0.90	1	8260B	8/30/11 1:43	MGB	P1H0632
Methyl Isobutyl Ketone	BRL	ug/L	5.0	0.12	1	8260B	8/30/11 1:43	MGB	P1H0632
Methylene Chloride	BRL	ug/L	1.0	0.44	1	8260B	8/30/11 1:43	MGB	P1H0632
Methyl-tert-Butyl Ether	**0.58**	**ug/L**	**0.50**	**0.070**	**1**	**8260B**	**8/30/11 1:43**	**MGB**	**P1H0632**
Naphthalene	BRL	ug/L	1.0	0.098	1	8260B	8/30/11 1:43	MGB	P1H0632
n-Butylbenzene	BRL	ug/L	1.0	0.11	1	8260B	8/30/11 1:43	MGB	P1H0632
n-Propylbenzene	BRL	ug/L	0.50	0.060	1	8260B	8/30/11 1:43	MGB	P1H0632
o-Xylene	BRL	ug/L	0.50	0.046	1	8260B	8/30/11 1:43	MGB	P1H0632
sec-Butylbenzene	BRL	ug/L	0.50	0.087	1	8260B	8/30/11 1:43	MGB	P1H0632
Styrene	BRL	ug/L	0.50	0.047	1	8260B	8/30/11 1:43	MGB	P1H0632
tert-Butylbenzene	BRL	ug/L	0.50	0.080	1	8260B	8/30/11 1:43	MGB	P1H0632
Tetrachloroethylene	**2.1**	**ug/L**	**0.50**	**0.069**	**1**	**8260B**	**8/30/11 1:43**	**MGB**	**P1H0632**
Toluene	BRL	ug/L	0.50	0.042	1	8260B	8/30/11 1:43	MGB	P1H0632
trans-1,2-Dichloroethylene	BRL	ug/L	0.50	0.12	1	8260B	8/30/11 1:43	MGB	P1H0632
trans-1,3-Dichloropropylene	BRL	ug/L	0.50	0.043	1	8260B	8/30/11 1:43	MGB	P1H0632

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Laboratory Report

09/01/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: UMF

Sample Matrix: Water

Client Sample ID: MW-3
Prism Sample ID: 1080706-03
Prism Work Order: 1080706
Time Collected: 08/25/11 11:20
Time Submitted: 08/25/11 15:40

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
Trichloroethylene	BRL	ug/L	0.50	0.054	1	8260B	8/30/11 1:43	MGB	P1H0632
Trichlorofluoromethane	BRL	ug/L	0.50	0.088	1	8260B	8/30/11 1:43	MGB	P1H0632
Vinyl acetate	BRL	ug/L	2.0	0.10	1	8260B	8/30/11 1:43	MGB	P1H0632
Vinyl chloride	BRL	ug/L	0.50	0.16	1	8260B	8/30/11 1:43	MGB	P1H0632

Surrogate	Recovery	Control Limits
4-Bromofluorobenzene	*101 %*	*80-124*
Dibromofluoromethane	*105 %*	*75-129*
Toluene-d8	*98 %*	*77-123*

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Laboratory Report

09/01/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: UMF

Sample Matrix: Water

Client Sample ID: MW-4
Prism Sample ID: 1080706-04
Prism Work Order: 1080706
Time Collected: 08/25/11 12:50
Time Submitted: 08/25/11 15:40

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
Trivalent Chromium	BRL	mg/L	0.25	0.035	10	Trivalent Chromium	8/25/11 17:00	CDE	[CALC]
Hexavalent Chromium	**0.97**	**mg/L**	**0.25**	**0.035**	**10**	***SM3500-Cr D**	**8/25/11 17:00**	**CDE**	**P1H0601**
Total Metals									
Mercury	BRL	mg/L	0.00020	0.000014	1	*7470A	8/31/11 13:47	LTB	P1H0666
Antimony	BRL	mg/L	0.010	0.00060	1	*6010C	8/30/11 11:33	DWR	P1H0631
Arsenic	BRL	mg/L	0.010	0.0020	1	*6010C	8/30/11 11:33	DWR	P1H0631
Beryllium	BRL	mg/L	0.0020	0.00015	1	*6010C	8/30/11 11:33	DWR	P1H0631
Cadmium	BRL	mg/L	0.0010	0.000086	1	*6010C	8/30/11 11:33	DWR	P1H0631
Chromium	**0.77**	**mg/L**	**0.0050**	**0.00017**	**1**	***6010C**	**8/30/11 11:33**	**DWR**	**P1H0631**
Copper	**0.015**	**mg/L**	**0.010**	**0.00068**	**1**	***6010C**	**8/30/11 11:33**	**DWR**	**P1H0631**
Lead	BRL	mg/L	0.0050	0.00077	1	*6010C	8/30/11 11:33	DWR	P1H0631
Nickel	**0.016**	**mg/L**	**0.010**	**0.00035**	**1**	***6010C**	**8/30/11 11:33**	**DWR**	**P1H0631**
Selenium	BRL	mg/L	0.020	0.0023	1	*6010C	8/30/11 11:33	DWR	P1H0631
Silver	BRL	mg/L	0.0050	0.00034	1	*6010C	8/30/11 11:33	DWR	P1H0631
Thallium	BRL	mg/L	0.010	0.00081	1	*6010C	8/30/11 11:33	DWR	P1H0631
Tin	BRL	mg/L	0.050	0.00043	1	*6010C	8/30/11 11:33	DWR	P1H0631
Zinc	BRL	mg/L	0.030	0.00083	1	*6010C	8/30/11 11:33	DWR	P1H0631
Volatile Organic Compounds by GC/MS									
1,1,1,2-Tetrachloroethane	BRL	ug/L	0.50	0.15	1	8260B	8/30/11 2:09	MGB	P1H0632
1,1,1-Trichloroethane	**2.4**	**ug/L**	**0.50**	**0.063**	**1**	**8260B**	**8/30/11 2:09**	**MGB**	**P1H0632**
1,1,2,2-Tetrachloroethane	BRL	ug/L	0.50	0.071	1	8260B	8/30/11 2:09	MGB	P1H0632
1,1,2-Trichloroethane	BRL	ug/L	0.50	0.17	1	8260B	8/30/11 2:09	MGB	P1H0632
1,1-Dichloroethane	**2.2**	**ug/L**	**0.50**	**0.096**	**1**	**8260B**	**8/30/11 2:09**	**MGB**	**P1H0632**
1,1-Dichloroethylene	BRL	ug/L	0.50	0.078	1	8260B	8/30/11 2:09	MGB	P1H0632
1,1-Dichloropropylene	BRL	ug/L	0.50	0.061	1	8260B	8/30/11 2:09	MGB	P1H0632
1,2,3-Trichlorobenzene	BRL	ug/L	2.0	0.20	1	8260B	8/30/11 2:09	MGB	P1H0632
1,2,3-Trichloropropane	BRL	ug/L	1.0	0.081	1	8260B	8/30/11 2:09	MGB	P1H0632
1,2,4-Trichlorobenzene	BRL	ug/L	1.0	0.10	1	8260B	8/30/11 2:09	MGB	P1H0632
1,2,4-Trimethylbenzene	BRL	ug/L	0.50	0.048	1	8260B	8/30/11 2:09	MGB	P1H0632
1,2-Dibromo-3-chloropropane	BRL	ug/L	2.0	0.59	1	8260B	8/30/11 2:09	MGB	P1H0632
1,2-Dibromoethane	BRL	ug/L	0.50	0.14	1	8260B	8/30/11 2:09	MGB	P1H0632
1,2-Dichlorobenzene	BRL	ug/L	0.50	0.076	1	8260B	8/30/11 2:09	MGB	P1H0632
1,2-Dichloroethane	BRL	ug/L	0.50	0.14	1	8260B	8/30/11 2:09	MGB	P1H0632
1,2-Dichloropropane	BRL	ug/L	0.50	0.13	1	8260B	8/30/11 2:09	MGB	P1H0632
1,3,5-Trimethylbenzene	BRL	ug/L	0.50	0.057	1	8260B	8/30/11 2:09	MGB	P1H0632
1,3-Dichlorobenzene	BRL	ug/L	0.50	0.074	1	8260B	8/30/11 2:09	MGB	P1H0632
1,3-Dichloropropane	BRL	ug/L	0.50	0.11	1	8260B	8/30/11 2:09	MGB	P1H0632
1,4-Dichlorobenzene	BRL	ug/L	0.50	0.068	1	8260B	8/30/11 2:09	MGB	P1H0632
2,2-Dichloropropane	BRL	ug/L	2.0	0.11	1	8260B	8/30/11 2:09	MGB	P1H0632
2-Chloroethyl Vinyl Ether	BRL	ug/L	2.0	0.22	1	8260B	8/30/11 2:09	MGB	P1H0632
2-Chlorotoluene	BRL	ug/L	0.50	0.038	1	8260B	8/30/11 2:09	MGB	P1H0632

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PRISM LABORATORIES, INC. | Full-Service Analytical & Environmental Solutions

Laboratory Report

09/01/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: UMF

Sample Matrix: Water

Client Sample ID: MW-4
Prism Sample ID: 1080706-04
Prism Work Order: 1080706
Time Collected: 08/25/11 12:50
Time Submitted: 08/25/11 15:40

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
4-Chlorotoluene	BRL	ug/L	0.50	0.053	1	8260B	8/30/11 2:09	MGB	P1H0632
4-Isopropyltoluene	BRL	ug/L	0.50	0.065	1	8260B	8/30/11 2:09	MGB	P1H0632
Acetone	BRL	ug/L	5.0	0.62	1	8260B	8/30/11 2:09	MGB	P1H0632
Acrolein	BRL	ug/L	20	1.1	1	8260B	8/30/11 2:09	MGB	P1H0632
Acrylonitrile	BRL	ug/L	20	0.86	1	8260B	8/30/11 2:09	MGB	P1H0632
Benzene	BRL	ug/L	0.50	0.072	1	8260B	8/30/11 2:09	MGB	P1H0632
Bromobenzene	BRL	ug/L	0.50	0.064	1	8260B	8/30/11 2:09	MGB	P1H0632
Bromochloromethane	BRL	ug/L	0.50	0.13	1	8260B	8/30/11 2:09	MGB	P1H0632
Bromodichloromethane	BRL	ug/L	0.50	0.062	1	8260B	8/30/11 2:09	MGB	P1H0632
Bromoform	BRL	ug/L	1.0	0.27	1	8260B	8/30/11 2:09	MGB	P1H0632
Bromomethane	BRL	ug/L	1.0	0.47	1	8260B	8/30/11 2:09	MGB	P1H0632
Carbon disulfide	BRL	ug/L	5.0	1.4	1	8260B	8/30/11 2:09	MGB	P1H0632
Carbon Tetrachloride	BRL	ug/L	0.50	0.12	1	8260B	8/30/11 2:09	MGB	P1H0632
Chlorobenzene	BRL	ug/L	0.50	0.061	1	8260B	8/30/11 2:09	MGB	P1H0632
Chloroethane	BRL	ug/L	0.50	0.13	1	8260B	8/30/11 2:09	MGB	P1H0632
Chloroform	BRL	ug/L	0.50	0.089	1	8260B	8/30/11 2:09	MGB	P1H0632
Chloromethane	BRL	ug/L	0.50	0.11	1	8260B	8/30/11 2:09	MGB	P1H0632
cis-1,2-Dichloroethylene	BRL	ug/L	0.50	0.076	1	8260B	8/30/11 2:09	MGB	P1H0632
cis-1,3-Dichloropropylene	BRL	ug/L	0.50	0.10	1	8260B	8/30/11 2:09	MGB	P1H0632
Dibromochloromethane	BRL	ug/L	0.50	0.30	1	8260B	8/30/11 2:09	MGB	P1H0632
Dibromomethane	BRL	ug/L	0.50	0.13	1	8260B	8/30/11 2:09	MGB	P1H0632
Dichlorodifluoromethane	BRL	ug/L	1.0	0.11	1	8260B	8/30/11 2:09	MGB	P1H0632
Ethylbenzene	BRL	ug/L	0.50	0.067	1	8260B	8/30/11 2:09	MGB	P1H0632
Hexachlorobutadiene	BRL	ug/L	2.0	0.36	1	8260B	8/30/11 2:09	MGB	P1H0632
Isopropyl Ether	BRL	ug/L	0.50	0.043	1	8260B	8/30/11 2:09	MGB	P1H0632
Isopropylbenzene (Cumene)	BRL	ug/L	0.50	0.072	1	8260B	8/30/11 2:09	MGB	P1H0632
m,p-Xylenes	BRL	ug/L	1.0	0.081	1	8260B	8/30/11 2:09	MGB	P1H0632
Methyl Butyl Ketone (2-Hexanone)	BRL	ug/L	5.0	0.19	1	8260B	8/30/11 2:09	MGB	P1H0632
Methyl Ethyl Ketone (2-Butanone)	BRL	ug/L	5.0	0.90	1	8260B	8/30/11 2:09	MGB	P1H0632
Methyl Isobutyl Ketone	BRL	ug/L	5.0	0.12	1	8260B	8/30/11 2:09	MGB	P1H0632
Methylene Chloride	BRL	ug/L	1.0	0.44	1	8260B	8/30/11 2:09	MGB	P1H0632
Methyl-tert-Butyl Ether	BRL	ug/L	0.50	0.070	1	8260B	8/30/11 2:09	MGB	P1H0632
Naphthalene	BRL	ug/L	1.0	0.098	1	8260B	8/30/11 2:09	MGB	P1H0632
n-Butylbenzene	BRL	ug/L	1.0	0.11	1	8260B	8/30/11 2:09	MGB	P1H0632
n-Propylbenzene	BRL	ug/L	0.50	0.060	1	8260B	8/30/11 2:09	MGB	P1H0632
o-Xylene	BRL	ug/L	0.50	0.046	1	8260B	8/30/11 2:09	MGB	P1H0632
sec-Butylbenzene	BRL	ug/L	0.50	0.087	1	8260B	8/30/11 2:09	MGB	P1H0632
Styrene	BRL	ug/L	0.50	0.047	1	8260B	8/30/11 2:09	MGB	P1H0632
tert-Butylbenzene	BRL	ug/L	0.50	0.080	1	8260B	8/30/11 2:09	MGB	P1H0632
Tetrachloroethylene	**11**	**ug/L**	**0.50**	**0.069**	**1**	**8260B**	**8/30/11 2:09**	**MGB**	**P1H0632**
Toluene	BRL	ug/L	0.50	0.042	1	8260B	8/30/11 2:09	MGB	P1H0632
trans-1,2-Dichloroethylene	BRL	ug/L	0.50	0.12	1	8260B	8/30/11 2:09	MGB	P1H0632
trans-1,3-Dichloropropylene	BRL	ug/L	0.50	0.043	1	8260B	8/30/11 2:09	MGB	P1H0632
Trichloroethylene	BRL	ug/L	0.50	0.054	1	8260B	8/30/11 2:09	MGB	P1H0632

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Laboratory Report

09/01/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: UMF

Sample Matrix: Water

Client Sample ID: MW-4
Prism Sample ID: 1080706-04
Prism Work Order: 1080706
Time Collected: 08/25/11 12:50
Time Submitted: 08/25/11 15:40

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
Trichlorofluoromethane	BRL	ug/L	0.50	0.088	1	8260B	8/30/11 2:09	MGB	P1H0632
Vinyl acetate	BRL	ug/L	2.0	0.10	1	8260B	8/30/11 2:09	MGB	P1H0632
Vinyl chloride	BRL	ug/L	0.50	0.16	1	8260B	8/30/11 2:09	MGB	P1H0632

Surrogate	Recovery	Control Limits
4-Bromofluorobenzene	*102 %*	*80-124*
Dibromofluoromethane	*105 %*	*75-129*
Toluene-d8	*98 %*	*77-123*

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09/01/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: UMF

Sample Matrix: Water

Client Sample ID: MW-5
Prism Sample ID: 1080706-05
Prism Work Order: 1080706
Time Collected: 08/25/11 11:15
Time Submitted: 08/25/11 15:40

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
Trivalent Chromium	BRL	mg/L	0.025	0.0035	1	Trivalent Chromium	8/25/11 17:00	CDE	[CALC]
Hexavalent Chromium	**0.24**	**mg/L**	**0.025**	**0.0035**	**1**	***SM3500-Cr D**	**8/25/11 17:00**	**CDE**	**P1H0601**
Total Metals									
Mercury	BRL	mg/L	0.00020	0.000014	1	*7470A	8/31/11 13:05	LTB	P1H0666
Antimony	BRL	mg/L	0.010	0.00060	1	*6010C	8/30/11 11:41	DWR	P1H0631
Arsenic	BRL	mg/L	0.010	0.0020	1	*6010C	8/30/11 11:41	DWR	P1H0631
Beryllium	BRL	mg/L	0.0020	0.00015	1	*6010C	8/30/11 11:41	DWR	P1H0631
Cadmium	BRL	mg/L	0.0010	0.000086	1	*6010C	8/30/11 11:41	DWR	P1H0631
Chromium	**0.033**	**mg/L**	**0.0050**	**0.00017**	**1**	***6010C**	**8/30/11 11:41**	**DWR**	**P1H0631**
Copper	**0.032**	**mg/L**	**0.010**	**0.00068**	**1**	***6010C**	**8/30/11 11:41**	**DWR**	**P1H0631**
Lead	BRL	mg/L	0.0050	0.00077	1	*6010C	8/30/11 11:41	DWR	P1H0631
Nickel	**0.030**	**mg/L**	**0.010**	**0.00035**	**1**	***6010C**	**8/30/11 11:41**	**DWR**	**P1H0631**
Selenium	BRL	mg/L	0.020	0.0023	1	*6010C	8/30/11 11:41	DWR	P1H0631
Silver	BRL	mg/L	0.0050	0.00034	1	*6010C	8/30/11 11:41	DWR	P1H0631
Thallium	BRL	mg/L	0.010	0.00081	1	*6010C	8/30/11 11:41	DWR	P1H0631
Tin	BRL	mg/L	0.050	0.00043	1	*6010C	8/30/11 11:41	DWR	P1H0631
Zinc	**0.034**	**mg/L**	**0.030**	**0.00083**	**1**	***6010C**	**8/30/11 11:41**	**DWR**	**P1H0631**
Volatile Organic Compounds by GC/MS									
1,1,1,2-Tetrachloroethane	BRL	ug/L	0.50	0.15	1	8260B	8/30/11 2:35	MGB	P1H0632
1,1,1-Trichloroethane	BRL	ug/L	0.50	0.063	1	8260B	8/30/11 2:35	MGB	P1H0632
1,1,2,2-Tetrachloroethane	BRL	ug/L	0.50	0.071	1	8260B	8/30/11 2:35	MGB	P1H0632
1,1,2-Trichloroethane	BRL	ug/L	0.50	0.17	1	8260B	8/30/11 2:35	MGB	P1H0632
1,1-Dichloroethane	BRL	ug/L	0.50	0.096	1	8260B	8/30/11 2:35	MGB	P1H0632
1,1-Dichloroethylene	BRL	ug/L	0.50	0.078	1	8260B	8/30/11 2:35	MGB	P1H0632
1,1-Dichloropropylene	BRL	ug/L	0.50	0.061	1	8260B	8/30/11 2:35	MGB	P1H0632
1,2,3-Trichlorobenzene	BRL	ug/L	2.0	0.20	1	8260B	8/30/11 2:35	MGB	P1H0632
1,2,3-Trichloropropane	BRL	ug/L	1.0	0.081	1	8260B	8/30/11 2:35	MGB	P1H0632
1,2,4-Trichlorobenzene	BRL	ug/L	1.0	0.10	1	8260B	8/30/11 2:35	MGB	P1H0632
1,2,4-Trimethylbenzene	BRL	ug/L	0.50	0.048	1	8260B	8/30/11 2:35	MGB	P1H0632
1,2-Dibromo-3-chloropropane	BRL	ug/L	2.0	0.59	1	8260B	8/30/11 2:35	MGB	P1H0632
1,2-Dibromoethane	BRL	ug/L	0.50	0.14	1	8260B	8/30/11 2:35	MGB	P1H0632
1,2-Dichlorobenzene	BRL	ug/L	0.50	0.076	1	8260B	8/30/11 2:35	MGB	P1H0632
1,2-Dichloroethane	BRL	ug/L	0.50	0.14	1	8260B	8/30/11 2:35	MGB	P1H0632
1,2-Dichloropropane	BRL	ug/L	0.50	0.13	1	8260B	8/30/11 2:35	MGB	P1H0632
1,3,5-Trimethylbenzene	BRL	ug/L	0.50	0.057	1	8260B	8/30/11 2:35	MGB	P1H0632
1,3-Dichlorobenzene	BRL	ug/L	0.50	0.074	1	8260B	8/30/11 2:35	MGB	P1H0632
1,3-Dichloropropane	BRL	ug/L	0.50	0.11	1	8260B	8/30/11 2:35	MGB	P1H0632
1,4-Dichlorobenzene	BRL	ug/L	0.50	0.068	1	8260B	8/30/11 2:35	MGB	P1H0632
2,2-Dichloropropane	BRL	ug/L	2.0	0.11	1	8260B	8/30/11 2:35	MGB	P1H0632
2-Chloroethyl Vinyl Ether	BRL	ug/L	2.0	0.22	1	8260B	8/30/11 2:35	MGB	P1H0632
2-Chlorotoluene	BRL	ug/L	0.50	0.038	1	8260B	8/30/11 2:35	MGB	P1H0632

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Laboratory Report

09/01/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: UMF

Sample Matrix: Water

Client Sample ID: MW-5
Prism Sample ID: 1080706-05
Prism Work Order: 1080706
Time Collected: 08/25/11 11:15
Time Submitted: 08/25/11 15:40

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
4-Chlorotoluene	BRL	ug/L	0.50	0.053	1	8260B	8/30/11 2:35	MGB	P1H0632
4-Isopropyltoluene	BRL	ug/L	0.50	0.065	1	8260B	8/30/11 2:35	MGB	P1H0632
Acetone	BRL	ug/L	5.0	0.62	1	8260B	8/30/11 2:35	MGB	P1H0632
Acrolein	BRL	ug/L	20	1.1	1	8260B	8/30/11 2:35	MGB	P1H0632
Acrylonitrile	BRL	ug/L	20	0.86	1	8260B	8/30/11 2:35	MGB	P1H0632
Benzene	BRL	ug/L	0.50	0.072	1	8260B	8/30/11 2:35	MGB	P1H0632
Bromobenzene	BRL	ug/L	0.50	0.064	1	8260B	8/30/11 2:35	MGB	P1H0632
Bromochloromethane	BRL	ug/L	0.50	0.13	1	8260B	8/30/11 2:35	MGB	P1H0632
Bromodichloromethane	BRL	ug/L	0.50	0.062	1	8260B	8/30/11 2:35	MGB	P1H0632
Bromoform	BRL	ug/L	1.0	0.27	1	8260B	8/30/11 2:35	MGB	P1H0632
Bromomethane	BRL	ug/L	1.0	0.47	1	8260B	8/30/11 2:35	MGB	P1H0632
Carbon disulfide	BRL	ug/L	5.0	1.4	1	8260B	8/30/11 2:35	MGB	P1H0632
Carbon Tetrachloride	BRL	ug/L	0.50	0.12	1	8260B	8/30/11 2:35	MGB	P1H0632
Chlorobenzene	BRL	ug/L	0.50	0.061	1	8260B	8/30/11 2:35	MGB	P1H0632
Chloroethane	BRL	ug/L	0.50	0.13	1	8260B	8/30/11 2:35	MGB	P1H0632
Chloroform	**0.51**	**ug/L**	**0.50**	**0.089**	**1**	**8260B**	**8/30/11 2:35**	**MGB**	**P1H0632**
Chloromethane	BRL	ug/L	0.50	0.11	1	8260B	8/30/11 2:35	MGB	P1H0632
cis-1,2-Dichloroethylene	BRL	ug/L	0.50	0.076	1	8260B	8/30/11 2:35	MGB	P1H0632
cis-1,3-Dichloropropylene	BRL	ug/L	0.50	0.10	1	8260B	8/30/11 2:35	MGB	P1H0632
Dibromochloromethane	BRL	ug/L	0.50	0.30	1	8260B	8/30/11 2:35	MGB	P1H0632
Dibromomethane	BRL	ug/L	0.50	0.13	1	8260B	8/30/11 2:35	MGB	P1H0632
Dichlorodifluoromethane	BRL	ug/L	1.0	0.11	1	8260B	8/30/11 2:35	MGB	P1H0632
Ethylbenzene	BRL	ug/L	0.50	0.067	1	8260B	8/30/11 2:35	MGB	P1H0632
Hexachlorobutadiene	BRL	ug/L	2.0	0.36	1	8260B	8/30/11 2:35	MGB	P1H0632
Isopropyl Ether	BRL	ug/L	0.50	0.043	1	8260B	8/30/11 2:35	MGB	P1H0632
Isopropylbenzene (Cumene)	BRL	ug/L	0.50	0.072	1	8260B	8/30/11 2:35	MGB	P1H0632
m,p-Xylenes	BRL	ug/L	1.0	0.081	1	8260B	8/30/11 2:35	MGB	P1H0632
Methyl Butyl Ketone (2-Hexanone)	BRL	ug/L	5.0	0.19	1	8260B	8/30/11 2:35	MGB	P1H0632
Methyl Ethyl Ketone (2-Butanone)	BRL	ug/L	5.0	0.90	1	8260B	8/30/11 2:35	MGB	P1H0632
Methyl Isobutyl Ketone	BRL	ug/L	5.0	0.12	1	8260B	8/30/11 2:35	MGB	P1H0632
Methylene Chloride	BRL	ug/L	1.0	0.44	1	8260B	8/30/11 2:35	MGB	P1H0632
Methyl-tert-Butyl Ether	BRL	ug/L	0.50	0.070	1	8260B	8/30/11 2:35	MGB	P1H0632
Naphthalene	BRL	ug/L	1.0	0.098	1	8260B	8/30/11 2:35	MGB	P1H0632
n-Butylbenzene	BRL	ug/L	1.0	0.11	1	8260B	8/30/11 2:35	MGB	P1H0632
n-Propylbenzene	BRL	ug/L	0.50	0.060	1	8260B	8/30/11 2:35	MGB	P1H0632
o-Xylene	BRL	ug/L	0.50	0.046	1	8260B	8/30/11 2:35	MGB	P1H0632
sec-Butylbenzene	BRL	ug/L	0.50	0.087	1	8260B	8/30/11 2:35	MGB	P1H0632
Styrene	BRL	ug/L	0.50	0.047	1	8260B	8/30/11 2:35	MGB	P1H0632
tert-Butylbenzene	BRL	ug/L	0.50	0.080	1	8260B	8/30/11 2:35	MGB	P1H0632
Tetrachloroethylene	**40**	**ug/L**	**0.50**	**0.069**	**1**	**8260B**	**8/30/11 2:35**	**MGB**	**P1H0632**
Toluene	BRL	ug/L	0.50	0.042	1	8260B	8/30/11 2:35	MGB	P1H0632
trans-1,2-Dichloroethylene	BRL	ug/L	0.50	0.12	1	8260B	8/30/11 2:35	MGB	P1H0632
trans-1,3-Dichloropropylene	BRL	ug/L	0.50	0.043	1	8260B	8/30/11 2:35	MGB	P1H0632

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Laboratory Report

09/01/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: UMF

Sample Matrix: Water

Client Sample ID: MW-5
Prism Sample ID: 1080706-05
Prism Work Order: 1080706
Time Collected: 08/25/11 11:15
Time Submitted: 08/25/11 15:40

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
Trichloroethylene	BRL	ug/L	0.50	0.054	1	8260B	8/30/11 2:35	MGB	P1H0632
Trichlorofluoromethane	BRL	ug/L	0.50	0.088	1	8260B	8/30/11 2:35	MGB	P1H0632
Vinyl acetate	BRL	ug/L	2.0	0.10	1	8260B	8/30/11 2:35	MGB	P1H0632
Vinyl chloride	BRL	ug/L	0.50	0.16	1	8260B	8/30/11 2:35	MGB	P1H0632

Surrogate	Recovery	Control Limits
4-Bromofluorobenzene	*99 %*	*80-124*
Dibromofluoromethane	*101 %*	*75-129*
Toluene-d8	*98 %*	*77-123*

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Laboratory Report

09/01/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: UMF

Sample Matrix: Water

Client Sample ID: Trip Blank
Prism Sample ID: 1080706-06
Prism Work Order: 1080706
Time Collected: 08/25/11 00:00
Time Submitted: 08/25/11 15:40

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
Volatile Organic Compounds by GC/MS									
1,1,1,2-Tetrachloroethane	BRL	ug/L	0.50	0.15	1	8260B	8/29/11 18:15	MGB	P1H0632
1,1,1-Trichloroethane	BRL	ug/L	0.50	0.063	1	8260B	8/29/11 18:15	MGB	P1H0632
1,1,2,2-Tetrachloroethane	BRL	ug/L	0.50	0.071	1	8260B	8/29/11 18:15	MGB	P1H0632
1,1,2-Trichloroethane	BRL	ug/L	0.50	0.17	1	8260B	8/29/11 18:15	MGB	P1H0632
1,1-Dichloroethane	BRL	ug/L	0.50	0.096	1	8260B	8/29/11 18:15	MGB	P1H0632
1,1-Dichloroethylene	BRL	ug/L	0.50	0.078	1	8260B	8/29/11 18:15	MGB	P1H0632
1,1-Dichloropropylene	BRL	ug/L	0.50	0.061	1	8260B	8/29/11 18:15	MGB	P1H0632
1,2,3-Trichlorobenzene	BRL	ug/L	2.0	0.20	1	8260B	8/29/11 18:15	MGB	P1H0632
1,2,3-Trichloropropane	BRL	ug/L	1.0	0.081	1	8260B	8/29/11 18:15	MGB	P1H0632
1,2,4-Trichlorobenzene	BRL	ug/L	1.0	0.10	1	8260B	8/29/11 18:15	MGB	P1H0632
1,2,4-Trimethylbenzene	BRL	ug/L	0.50	0.048	1	8260B	8/29/11 18:15	MGB	P1H0632
1,2-Dibromo-3-chloropropane	BRL	ug/L	2.0	0.59	1	8260B	8/29/11 18:15	MGB	P1H0632
1,2-Dibromoethane	BRL	ug/L	0.50	0.14	1	8260B	8/29/11 18:15	MGB	P1H0632
1,2-Dichlorobenzene	BRL	ug/L	0.50	0.076	1	8260B	8/29/11 18:15	MGB	P1H0632
1,2-Dichloroethane	BRL	ug/L	0.50	0.14	1	8260B	8/29/11 18:15	MGB	P1H0632
1,2-Dichloropropane	BRL	ug/L	0.50	0.13	1	8260B	8/29/11 18:15	MGB	P1H0632
1,3,5-Trimethylbenzene	BRL	ug/L	0.50	0.057	1	8260B	8/29/11 18:15	MGB	P1H0632
1,3-Dichlorobenzene	BRL	ug/L	0.50	0.074	1	8260B	8/29/11 18:15	MGB	P1H0632
1,3-Dichloropropane	BRL	ug/L	0.50	0.11	1	8260B	8/29/11 18:15	MGB	P1H0632
1,4-Dichlorobenzene	BRL	ug/L	0.50	0.068	1	8260B	8/29/11 18:15	MGB	P1H0632
2,2-Dichloropropane	BRL	ug/L	2.0	0.11	1	8260B	8/29/11 18:15	MGB	P1H0632
2-Chloroethyl Vinyl Ether	BRL	ug/L	2.0	0.22	1	8260B	8/29/11 18:15	MGB	P1H0632
2-Chlorotoluene	BRL	ug/L	0.50	0.038	1	8260B	8/29/11 18:15	MGB	P1H0632
4-Chlorotoluene	BRL	ug/L	0.50	0.053	1	8260B	8/29/11 18:15	MGB	P1H0632
4-Isopropyltoluene	BRL	ug/L	0.50	0.065	1	8260B	8/29/11 18:15	MGB	P1H0632
Acetone	BRL	ug/L	5.0	0.62	1	8260B	8/29/11 18:15	MGB	P1H0632
Acrolein	BRL	ug/L	20	1.1	1	8260B	8/29/11 18:15	MGB	P1H0632
Acrylonitrile	BRL	ug/L	20	0.86	1	8260B	8/29/11 18:15	MGB	P1H0632
Benzene	BRL	ug/L	0.50	0.072	1	8260B	8/29/11 18:15	MGB	P1H0632
Bromobenzene	BRL	ug/L	0.50	0.064	1	8260B	8/29/11 18:15	MGB	P1H0632
Bromochloromethane	BRL	ug/L	0.50	0.13	1	8260B	8/29/11 18:15	MGB	P1H0632
Bromodichloromethane	BRL	ug/L	0.50	0.062	1	8260B	8/29/11 18:15	MGB	P1H0632
Bromoform	BRL	ug/L	1.0	0.27	1	8260B	8/29/11 18:15	MGB	P1H0632
Bromomethane	BRL	ug/L	1.0	0.47	1	8260B	8/29/11 18:15	MGB	P1H0632
Carbon disulfide	BRL	ug/L	5.0	1.4	1	8260B	8/29/11 18:15	MGB	P1H0632
Carbon Tetrachloride	BRL	ug/L	0.50	0.12	1	8260B	8/29/11 18:15	MGB	P1H0632
Chlorobenzene	BRL	ug/L	0.50	0.061	1	8260B	8/29/11 18:15	MGB	P1H0632
Chloroethane	BRL	ug/L	0.50	0.13	1	8260B	8/29/11 18:15	MGB	P1H0632
Chloroform	BRL	ug/L	0.50	0.089	1	8260B	8/29/11 18:15	MGB	P1H0632
Chloromethane	BRL	ug/L	0.50	0.11	1	8260B	8/29/11 18:15	MGB	P1H0632
cis-1,2-Dichloroethylene	BRL	ug/L	0.50	0.076	1	8260B	8/29/11 18:15	MGB	P1H0632
cis-1,3-Dichloropropylene	BRL	ug/L	0.50	0.10	1	8260B	8/29/11 18:15	MGB	P1H0632

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Laboratory Report

09/01/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: UMF

Sample Matrix: Water

Client Sample ID: Trip Blank
Prism Sample ID: 1080706-06
Prism Work Order: 1080706
Time Collected: 08/25/11 00:00
Time Submitted: 08/25/11 15:40

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
Dibromochloromethane	BRL	ug/L	0.50	0.30	1	8260B	8/29/11 18:15	MGB	P1H0632
Dibromomethane	BRL	ug/L	0.50	0.13	1	8260B	8/29/11 18:15	MGB	P1H0632
Dichlorodifluoromethane	BRL	ug/L	1.0	0.11	1	8260B	8/29/11 18:15	MGB	P1H0632
Ethylbenzene	BRL	ug/L	0.50	0.067	1	8260B	8/29/11 18:15	MGB	P1H0632
Hexachlorobutadiene	BRL	ug/L	2.0	0.36	1	8260B	8/29/11 18:15	MGB	P1H0632
Isopropyl Ether	BRL	ug/L	0.50	0.043	1	8260B	8/29/11 18:15	MGB	P1H0632
Isopropylbenzene (Cumene)	BRL	ug/L	0.50	0.072	1	8260B	8/29/11 18:15	MGB	P1H0632
m,p-Xylenes	BRL	ug/L	1.0	0.081	1	8260B	8/29/11 18:15	MGB	P1H0632
Methyl Butyl Ketone (2-Hexanone)	BRL	ug/L	5.0	0.19	1	8260B	8/29/11 18:15	MGB	P1H0632
Methyl Ethyl Ketone (2-Butanone)	BRL	ug/L	5.0	0.90	1	8260B	8/29/11 18:15	MGB	P1H0632
Methyl Isobutyl Ketone	BRL	ug/L	5.0	0.12	1	8260B	8/29/11 18:15	MGB	P1H0632
Methylene Chloride	**1.2**	**ug/L**	**1.0**	**0.44**	**1**	**8260B**	**8/29/11 18:15**	**MGB**	**P1H0632**
Methyl-tert-Butyl Ether	BRL	ug/L	0.50	0.070	1	8260B	8/29/11 18:15	MGB	P1H0632
Naphthalene	BRL	ug/L	1.0	0.098	1	8260B	8/29/11 18:15	MGB	P1H0632
n-Butylbenzene	BRL	ug/L	1.0	0.11	1	8260B	8/29/11 18:15	MGB	P1H0632
n-Propylbenzene	BRL	ug/L	0.50	0.060	1	8260B	8/29/11 18:15	MGB	P1H0632
o-Xylene	BRL	ug/L	0.50	0.046	1	8260B	8/29/11 18:15	MGB	P1H0632
sec-Butylbenzene	BRL	ug/L	0.50	0.087	1	8260B	8/29/11 18:15	MGB	P1H0632
Styrene	BRL	ug/L	0.50	0.047	1	8260B	8/29/11 18:15	MGB	P1H0632
tert-Butylbenzene	BRL	ug/L	0.50	0.080	1	8260B	8/29/11 18:15	MGB	P1H0632
Tetrachloroethylene	BRL	ug/L	0.50	0.069	1	8260B	8/29/11 18:15	MGB	P1H0632
Toluene	BRL	ug/L	0.50	0.042	1	8260B	8/29/11 18:15	MGB	P1H0632
trans-1,2-Dichloroethylene	BRL	ug/L	0.50	0.12	1	8260B	8/29/11 18:15	MGB	P1H0632
trans-1,3-Dichloropropylene	BRL	ug/L	0.50	0.043	1	8260B	8/29/11 18:15	MGB	P1H0632
Trichloroethylene	BRL	ug/L	0.50	0.054	1	8260B	8/29/11 18:15	MGB	P1H0632
Trichlorofluoromethane	BRL	ug/L	0.50	0.088	1	8260B	8/29/11 18:15	MGB	P1H0632
Vinyl acetate	BRL	ug/L	2.0	0.10	1	8260B	8/29/11 18:15	MGB	P1H0632
Vinyl chloride	BRL	ug/L	0.50	0.16	1	8260B	8/29/11 18:15	MGB	P1H0632

Surrogate	Recovery	Control Limits
4-Bromofluorobenzene	*102 %*	*80-124*
Dibromofluoromethane	*102 %*	*75-129*
Toluene-d8	*99 %*	*77-123*

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ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: UMF

Prism Work Order: 1080706
Time Submitted: 8/25/11 3:40:00PM

Volatile Organic Compounds by GC/MS - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch P1H0632 - 5030B										
Blank (P1H0632-BLK1)				Prepared & Analyzed: 08/29/11						
1,1,1,2-Tetrachloroethane	BRL	0.50	ug/L							
1,1,1-Trichloroethane	BRL	0.50	ug/L							
1,1,2,2-Tetrachloroethane	BRL	0.50	ug/L							
1,1,2-Trichloroethane	BRL	0.50	ug/L							
1,1-Dichloroethane	BRL	0.50	ug/L							
1,1-Dichloroethylene	BRL	0.50	ug/L							
1,1-Dichloropropylene	BRL	0.50	ug/L							
1,2,3-Trichlorobenzene	BRL	2.0	ug/L							
1,2,3-Trichloropropane	BRL	1.0	ug/L							
1,2,4-Trichlorobenzene	BRL	1.0	ug/L							
1,2,4-Trimethylbenzene	BRL	0.50	ug/L							
1,2-Dibromo-3-chloropropane	BRL	2.0	ug/L							
1,2-Dibromoethane	BRL	0.50	ug/L							
1,2-Dichlorobenzene	BRL	0.50	ug/L							
1,2-Dichloroethane	BRL	0.50	ug/L							
1,2-Dichloropropane	BRL	0.50	ug/L							
1,3,5-Trimethylbenzene	BRL	0.50	ug/L							
1,3-Dichlorobenzene	BRL	0.50	ug/L							
1,3-Dichloropropane	BRL	0.50	ug/L							
1,4-Dichlorobenzene	BRL	0.50	ug/L							
2,2-Dichloropropane	BRL	2.0	ug/L							
2-Chloroethyl Vinyl Ether	BRL	2.0	ug/L							
2-Chlorotoluene	BRL	0.50	ug/L							
4-Chlorotoluene	BRL	0.50	ug/L							
4-Isopropyltoluene	BRL	0.50	ug/L							
Acetone	0.690	5.0	ug/L							J
Acrolein	BRL	20	ug/L							
Acrylonitrile	BRL	20	ug/L							
Benzene	BRL	0.50	ug/L							
Bromobenzene	BRL	0.50	ug/L							
Bromochloromethane	BRL	0.50	ug/L							
Bromodichloromethane	BRL	0.50	ug/L							
Bromoform	BRL	1.0	ug/L							
Bromomethane	BRL	1.0	ug/L							
Carbon disulfide	BRL	5.0	ug/L							
Carbon Tetrachloride	BRL	0.50	ug/L							
Chlorobenzene	BRL	0.50	ug/L							
Chloroethane	BRL	0.50	ug/L							
Chloroform	BRL	0.50	ug/L							
Chloromethane	BRL	0.50	ug/L							
cis-1,2-Dichloroethylene	BRL	0.50	ug/L							
cis-1,3-Dichloropropylene	BRL	0.50	ug/L							
Dibromochloromethane	BRL	0.50	ug/L							
Dibromomethane	BRL	0.50	ug/L							
Dichlorodifluoromethane	BRL	1.0	ug/L							
Ethylbenzene	BRL	0.50	ug/L							

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4811 Koger Blvd.
Greensboro, NC 27407

Project: UMF

Prism Work Order: 1080706
Time Submitted: 8/25/11 3:40:00PM

Volatile Organic Compounds by GC/MS - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch P1H0632 - 5030B										
Blank (P1H0632-BLK1)				Prepared & Analyzed: 08/29/11						
Hexachlorobutadiene	0.710	2.0	ug/L							J
Isopropyl Ether	BRL	0.50	ug/L							
Isopropylbenzene (Cumene)	BRL	0.50	ug/L							
m,p-Xylenes	BRL	1.0	ug/L							
Methyl Butyl Ketone (2-Hexanone)	BRL	5.0	ug/L							
Methyl Ethyl Ketone (2-Butanone)	BRL	5.0	ug/L							
Methyl Isobutyl Ketone	BRL	5.0	ug/L							
Methylene Chloride	BRL	1.0	ug/L							
Methyl-tert-Butyl Ether	BRL	0.50	ug/L							
Naphthalene	BRL	1.0	ug/L							
n-Butylbenzene	BRL	1.0	ug/L							
n-Propylbenzene	BRL	0.50	ug/L							
o-Xylene	BRL	0.50	ug/L							
sec-Butylbenzene	BRL	0.50	ug/L							
Styrene	BRL	0.50	ug/L							
tert-Butylbenzene	BRL	0.50	ug/L							
Tetrachloroethylene	BRL	0.50	ug/L							
Toluene	BRL	0.50	ug/L							
trans-1,2-Dichloroethylene	BRL	0.50	ug/L							
trans-1,3-Dichloropropylene	BRL	0.50	ug/L							
Trichloroethylene	BRL	0.50	ug/L							
Trichlorofluoromethane	BRL	0.50	ug/L							
Vinyl acetate	BRL	2.0	ug/L							
Vinyl chloride	BRL	0.50	ug/L							
Surrogate: 4-Bromofluorobenzene	*52.2*		*ug/L*	*50.00*		*104*	*80-124*			
Surrogate: Dibromofluoromethane	*51.8*		*ug/L*	*50.00*		*104*	*75-129*			
Surrogate: Toluene-d8	*50.0*		*ug/L*	*50.00*		*100*	*77-123*			

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ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: UMF

Prism Work Order: 1080706
Time Submitted: 8/25/11 3:40:00PM

Volatile Organic Compounds by GC/MS - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch P1H0632 - 5030B										
LCS (P1H0632-BS1)				Prepared & Analyzed: 08/29/11						
1,1-Dichloroethylene	21.2	0.50	ug/L	20.00		106	70-154			
Benzene	22.5	0.50	ug/L	20.00		113	77-128			
Chlorobenzene	23.2	0.50	ug/L	20.00		116	78-119			
Toluene	23.0	0.50	ug/L	20.00		115	76-131			
Trichloroethylene	24.0	0.50	ug/L	20.00		120	77-133			
Surrogate: 4-Bromofluorobenzene	*50.4*		*ug/L*	*50.00*		*101*	*80-124*			
Surrogate: Dibromofluoromethane	*50.1*		*ug/L*	*50.00*		*100*	*75-129*			
Surrogate: Toluene-d8	*49.6*		*ug/L*	*50.00*		*99*	*77-123*			
LCS Dup (P1H0632-BSD1)				Prepared & Analyzed: 08/29/11						
1,1-Dichloroethylene	20.9	0.50	ug/L	20.00		105	70-154	1	200	
Benzene	22.3	0.50	ug/L	20.00		111	77-128	1	200	
Chlorobenzene	22.6	0.50	ug/L	20.00		113	78-119	2	200	
Toluene	22.5	0.50	ug/L	20.00		113	76-131	2	200	
Trichloroethylene	23.7	0.50	ug/L	20.00		119	77-133	1	200	
Surrogate: 4-Bromofluorobenzene	*48.6*		*ug/L*	*50.00*		*97*	*80-124*			
Surrogate: Dibromofluoromethane	*48.6*		*ug/L*	*50.00*		*97*	*75-129*			
Surrogate: Toluene-d8	*48.5*		*ug/L*	*50.00*		*97*	*77-123*			

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ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: UMF

Prism Work Order: 1080706
Time Submitted: 8/25/11 3:40:00PM

Total Metals - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch P1H0631 - 3010A										
Blank (P1H0631-BLK1)				Prepared: 08/29/11 Analyzed: 08/30/11						
Antimony	BRL	0.010	mg/L							
Arsenic	BRL	0.010	mg/L							
Beryllium	BRL	0.0020	mg/L							
Cadmium	BRL	0.0010	mg/L							
Chromium	BRL	0.0050	mg/L							
Copper	BRL	0.010	mg/L							
Lead	BRL	0.0050	mg/L							
Nickel	BRL	0.010	mg/L							
Selenium	BRL	0.020	mg/L							
Silver	BRL	0.0050	mg/L							
Thallium	BRL	0.010	mg/L							
Tin	BRL	0.050	mg/L							
Zinc	BRL	0.030	mg/L							
LCS (P1H0631-BS1)				Prepared: 08/29/11 Analyzed: 08/30/11						
Antimony	0.244	0.010	mg/L	0.2500		98	80-120			
Arsenic	0.250	0.010	mg/L	0.2500		100	80-120			
Beryllium	0.251	0.0020	mg/L	0.2500		101	80-120			
Cadmium	0.252	0.0010	mg/L	0.2500		101	80-120			
Chromium	0.256	0.0050	mg/L	0.2500		102	80-120			
Copper	0.259	0.010	mg/L	0.2500		104	80-120			
Lead	0.256	0.0050	mg/L	0.2500		103	80-120			
Nickel	0.255	0.010	mg/L	0.2500		102	80-120			
Selenium	0.250	0.020	mg/L	0.2500		100	80-120			
Silver	0.258	0.0050	mg/L	0.2500		103	80-120			
Thallium	0.260	0.010	mg/L	0.2500		104	80-120			
Tin	0.288	0.050	mg/L	0.2500		115	80-120			
Zinc	0.249	0.030	mg/L	0.2500		100	80-120			

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ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: UMF

Prism Work Order: 1080706
Time Submitted: 8/25/11 3:40:00PM

Total Metals - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch P1H0631 - 3010A										
Matrix Spike (P1H0631-MS1)		**Source: 1080706-01**		Prepared: 08/29/11	Analyzed: 08/30/11					
Antimony	0.241	0.010	mg/L	0.2500	0.0139	91	75-125			
Arsenic	0.229	0.010	mg/L	0.2500	BRL	92	75-125			
Beryllium	0.242	0.0020	mg/L	0.2500	BRL	97	75-125			
Cadmium	0.234	0.0010	mg/L	0.2500	BRL	94	75-125			
Chromium	11.0	0.0050	mg/L	0.2500	11.7	NR	75-125			E, MC
Copper	0.260	0.010	mg/L	0.2500	0.0174	97	75-125			
Lead	0.234	0.0050	mg/L	0.2500	0.00183	93	75-125			
Nickel	0.242	0.010	mg/L	0.2500	0.0141	91	75-125			
Selenium	0.240	0.020	mg/L	0.2500	0.00539	94	75-125			
Silver	0.241	0.0050	mg/L	0.2500	BRL	96	75-125			
Thallium	0.236	0.010	mg/L	0.2500	BRL	95	75-125			
Tin	0.263	0.050	mg/L	0.2500	0.0179	98	75-125			
Zinc	0.255	0.030	mg/L	0.2500	0.0201	94	75-125			
Matrix Spike Dup (P1H0631-MSD1)		**Source: 1080706-01**		Prepared: 08/29/11	Analyzed: 08/30/11					
Antimony	0.230	0.010	mg/L	0.2500	0.0139	86	75-125	5	20	
Arsenic	0.227	0.010	mg/L	0.2500	BRL	91	75-125	0.9	20	
Beryllium	0.237	0.0020	mg/L	0.2500	BRL	95	75-125	2	20	
Cadmium	0.232	0.0010	mg/L	0.2500	BRL	93	75-125	0.9	20	
Chromium	10.8	0.0050	mg/L	0.2500	11.7	NR	75-125	2	20	E, MC
Copper	0.255	0.010	mg/L	0.2500	0.0174	95	75-125	2	20	
Lead	0.230	0.0050	mg/L	0.2500	0.00183	91	75-125	2	20	
Nickel	0.239	0.010	mg/L	0.2500	0.0141	90	75-125	1	20	
Selenium	0.238	0.020	mg/L	0.2500	0.00539	93	75-125	0.6	20	
Silver	0.237	0.0050	mg/L	0.2500	BRL	95	75-125	1	20	
Thallium	0.232	0.010	mg/L	0.2500	BRL	93	75-125	2	20	
Tin	0.258	0.050	mg/L	0.2500	0.0179	96	75-125	2	20	
Zinc	0.252	0.030	mg/L	0.2500	0.0201	93	75-125	1	20	

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ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: UMF

Prism Work Order: 1080706
Time Submitted: 8/25/11 3:40:00PM

Total Metals - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch P1H0666 - 7470A										
Blank (P1H0666-BLK1)				Prepared: 08/30/11	Analyzed: 08/31/11					
Mercury	BRL	0.00020	mg/L							
LCS (P1H0666-BS1)				Prepared: 08/30/11	Analyzed: 08/31/11					
Mercury	0.00880	0.00020	mg/L	0.009375		94	80-120			
Matrix Spike (P1H0666-MS1)		**Source: 1080706-05**		Prepared: 08/30/11	Analyzed: 08/31/11					
Mercury	0.00873	0.00020	mg/L	0.009375	BRL	93	80-120			
Matrix Spike Dup (P1H0666-MSD1)		**Source: 1080706-05**		Prepared: 08/30/11	Analyzed: 08/31/11					
Mercury	0.00877	0.00020	mg/L	0.009375	BRL	94	80-120	0.4	20	

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ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: UMF

Prism Work Order: 1080706
Time Submitted: 8/25/11 3:40:00PM

General Chemistry Parameters - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch P1H0601 - NO PREP										
Blank (P1H0601-BLK1)				Prepared & Analyzed: 08/25/11						
Hexavalent Chromium	BRL	0.025	mg/L							
LCS (P1H0601-BS1)				Prepared & Analyzed: 08/25/11						
Hexavalent Chromium	0.402	0.025	mg/L	0.4000		100	90-110			
Matrix Spike (P1H0601-MS1)		Source: 1080706-04		Prepared & Analyzed: 08/25/11						
Hexavalent Chromium	5.01	0.25	mg/L	4.000	0.967	101	85-115			
Matrix Spike Dup (P1H0601-MSD1)		Source: 1080706-04		Prepared & Analyzed: 08/25/11						
Hexavalent Chromium	5.04	0.25	mg/L	4.000	0.967	102	85-115	0.5	20	

Sample Extraction Data

Prep Method: 3010A

Lab Number	Batch	Initial	Final	Date/Time
1080706-01	P1H0631	50 mL	50 mL	08/29/11 7:45
1080706-01	P1H0631	50 mL	50 mL	08/29/11 7:45
1080706-02	P1H0631	50 mL	50 mL	08/29/11 7:45
1080706-03	P1H0631	50 mL	50 mL	08/29/11 7:45
1080706-03	P1H0631	50 mL	50 mL	08/29/11 7:45
1080706-04	P1H0631	50 mL	50 mL	08/29/11 7:45
1080706-05	P1H0631	50 mL	50 mL	08/29/11 7:45

Prep Method: 7470A

Lab Number	Batch	Initial	Final	Date/Time
1080706-01	P1H0666	20 mL	30 mL	08/30/11 13:15
1080706-02	P1H0666	20 mL	30 mL	08/30/11 13:15
1080706-03	P1H0666	20 mL	30 mL	08/30/11 13:15
1080706-04	P1H0666	20 mL	30 mL	08/30/11 13:15
1080706-05	P1H0666	20 mL	30 mL	08/30/11 13:15

Prep Method: 5030B

Lab Number	Batch	Initial	Final	Date/Time
1080706-01	P1H0632	10 mL	10 mL	08/29/11 13:58
1080706-02	P1H0632	10 mL	10 mL	08/29/11 13:58
1080706-03	P1H0632	10 mL	10 mL	08/29/11 13:58
1080706-04	P1H0632	10 mL	10 mL	08/29/11 13:58
1080706-05	P1H0632	10 mL	10 mL	08/29/11 13:58
1080706-06	P1H0632	10 mL	10 mL	08/29/11 13:58

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CHAIN OF CUSTODY RECORD

PAGE ____ OF ____ QUOTE # TO ENSURE PROPER BILLING: ____

Client Company Name: ECS Carolinas
Report To/Contact Name: Toby Benfield
Reporting Address: 2811 Lager Blvd Greensboro
Phone: 306 856 7150 Fax (Yes) (No): 856 7160
Email (Yes) (No) Email Address TBenfield@ECSLimited.com
EDD Type: PDF X Excel X Other
Site Location Name: UMF
Site Location Physical Address: 130 Blue Bell Rd Greensboro NC

Project Name: UMF
Short Hold Analysis: (Yes) (No) UST Project: (Yes) (No)
*Please ATTACH any project specific reporting (QC LEVEL I II III IV) provisions and/or QC Requirements
Invoice To: TBenfield@ECSLimited.com
Address:

Purchase Order No./Billing Reference ____
Requested Due Date ☐ 1 Day ☐ 2 Days ☐ 3 Days ☐ 4 Days ☐ 5 Days
"Working Days" ☐ 6-9 Days ☒ Standard 10 days ☐ Rush Work Must Be Pre-Approved
Samples received after 15:00 will be processed next business day.
Turnaround time is based on business days, excluding weekends and holidays.
(SEE REVERSE FOR TERMS & CONDITIONS REGARDING SERVICES RENDERED BY PRISM LABORATORIES, INC. TO CLIENT)

LAB USE ONLY

	YES	NO	N/A
Samples INTACT upon arrival?	✓		
Received ON WET ICE? Temp 2.1	✓		
PROPER PRESERVATIVES indicated?	✓		
Received WITHIN HOLDING TIMES?	✓		
CUSTODY SEALS INTACT?			✓
VOLATILES rec'd W/OUT HEADSPACE?	✓		
PROPER CONTAINERS used?	✓		

TO BE FILLED IN BY CLIENT/SAMPLING PERSONNEL
Certification: NELAC ____ USACE ____ FL ____ NC ____
SC ____ OTHER ____ N/A ____
Water Chlorinated: YES ___ NO ___
Sample Iced Upon Collection: YES ___ NO ___

CLIENT SAMPLE DESCRIPTION	DATE COLLECTED	TIME COLLECTED MILITARY HOURS	MATRIX (SOIL, WATER OR SLUDGE)	SAMPLE CONTAINER *TYPE SEE BELOW	NO.	SIZE	PRESERVATIVES	ANALYSES REQUESTED 8260B	13 prioritized +5X	Cr +6				REMARKS	PRISM LAB ID NO.
MW-1	8:25	10:15	Water				HCL	✓	✓	✓					01
MW-2	↓	1155	↓					✓	✓	✓					02
MW-3	↓	1120	↓					✓	✓	✓					03
MW-4	↓	1250	↓					✓	✓	✓					04
MW-5	↓	1115	↓					✓	✓	✓					05
								✓	✓	✓					

Sampler's Signature [signature] Sampled By (Print Name) Toby Benfield Affiliation ____

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Upon relinquishing, this Chain of Custody is your authorization for Prism to proceed with the analyses as requested above. Any changes must be submitted in writing to the Prism Project Manager. There will be charges for any changes after analyses have been initialized.

Relinquished By: (Signature)	Received By: (Signature)	Date	Military/Hours
[signature]	[signature]	8/25/11	13:45
[signature]	[signature]	8/25/11	14:00
[signature]	Received For Prism Laboratories By: [signature]	8/25/11	15:40

Additional Comments:

PRISM USE ONLY
Site Arrival Time:
Site Departure Time:
Field Tech Fee:
Mileage:

Method of Shipment: NOTE: ALL SAMPLE COOLERS SHOULD BE TAPED SHUT WITH CUSTODY SEALS FOR TRANSPORTATION TO THE LABORATORY. SAMPLES ARE NOT ACCEPTED AND VERIFIED AGAINST COC UNTIL RECEIVED AT THE LABORATORY.
☐ Fed Ex ☐ UPS ☐ Hand-delivered ☐ Prism Field Service ☐ Other ____
COC Group No. 1080706

NPDES:	UST:	GROUNDWATER:	DRINKING WATER:	SOLID WASTE:	RCRA:	CERCLA	LANDFILL	OTHER:
☐ NC ☐ SC	☐ NC ☐ SC	☒ NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC

*CONTAINER TYPE CODES: A = Amber C = Clear G = Glass P = Plastic; TL = Teflon-Lined Cap VOA = Volatile Organics Analysis (Zero Head Space)

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ORIGINAL

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NC Certification No. 402
SC Certification No. 99012
NC Drinking Water Cert No. 37735

Case Narrative

10/06/2011

ECS Carolinas - Greensboro
Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Lab Submittal Date: 09/27/2011
Prism Work Order: 1090641

This data package contains the analytical results for the project identified above and includes a Case Narrative, Sample Results and Chain of Custody. Unless otherwise noted, all samples were received in acceptable condition and processed according to the referenced methods.

Data qualifiers are flagged individually on each sample. A key reference for the data qualifiers appears at the end of this case narrative.

Please call if you have any questions relating to this analytical report.

Respectfully,

PRISM LABORATORIES, INC.

VP Laboratory Services

Reviewed By

Data Qualifiers Key Reference:

E	Estimated concentration above the calibration range
MC	Sample concentration too high for recovery evaluation.
BRL	Below Reporting Limit
MDL	Method Detection Limit
RPD	Relative Percent Difference
*	Results reported to the reporting limit. All other results are reported to the MDL with values between MDL and reporting limit indicated with a J.

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Sample Receipt Summary

10/06/2011

Prism Work Order: 1090641

Client Sample ID	Lab Sample ID	Matrix	Date Sampled	Date Received
MW-6	1090641-01	Water	09/27/11	09/27/11

Samples received in good condition at 5.6 degrees C unless otherwise noted.

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Laboratory Report

10/06/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Water

Client Sample ID: MW-6
Prism Sample ID: 1090641-01
Prism Work Order: 1090641
Time Collected: 09/27/11 11:15
Time Submitted: 09/27/11 14:45

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
General Chemistry Parameters									
Hexavalent Chromium	BRL	ug/L	25	3.5	1	*SM3500-Cr D	9/27/11 17:00	CDE	P1I0527
Total Metals									
Mercury	BRL	ug/L	0.20	0.014	1	*7470A	10/4/11 9:28	LTB	P1J0015
Antimony	BRL	ug/L	10	0.60	1	*6010C	9/29/11 18:13	DWR	P1I0539
Arsenic	BRL	ug/L	10	2.0	1	*6010C	9/29/11 18:13	DWR	P1I0539
Beryllium	BRL	ug/L	2.0	0.15	1	*6010C	9/29/11 18:13	DWR	P1I0539
Cadmium	BRL	mg/L	0.0010	0.000086	1	*6010C	9/29/11 18:13	DWR	P1I0539
Chromium	BRL	ug/L	5.0	0.17	1	*6010C	9/29/11 18:13	DWR	P1I0539
Copper	BRL	ug/L	10	0.68	1	*6010C	9/29/11 18:13	DWR	P1I0539
Lead	**9.2**	**ug/L**	**5.0**	**0.77**	**1**	***6010C**	**9/29/11 18:13**	**DWR**	**P1I0539**
Nickel	**16000**	**ug/L**	**100**	**3.5**	**10**	***6010C**	**9/30/11 13:03**	**LTB**	**P1I0539**
Selenium	BRL	ug/L	20	2.3	1	*6010C	9/29/11 18:13	DWR	P1I0539
Silver	BRL	ug/L	5.0	0.34	1	*6010C	9/29/11 18:13	DWR	P1I0539
Thallium	BRL	ug/L	10	0.81	1	*6010C	9/29/11 18:13	DWR	P1I0539
Tin	BRL	ug/L	50	0.43	1	*6010C	9/29/11 18:13	DWR	P1I0539
Zinc	**120**	**ug/L**	**30**	**0.83**	**1**	***6010C**	**9/29/11 18:13**	**DWR**	**P1I0539**
Volatile Organic Compounds by GC/MS									
1,1,1,2-Tetrachloroethane	BRL	ug/L	1.0	0.15	1	*8260B	9/28/11 15:23	MGB	P1I0498
1,1,1-Trichloroethane	BRL	ug/L	1.0	0.063	1	*8260B	9/28/11 15:23	MGB	P1I0498
1,1,2,2-Tetrachloroethane	BRL	ug/L	1.0	0.071	1	*8260B	9/28/11 15:23	MGB	P1I0498
1,1,2-Trichloroethane	BRL	ug/L	1.0	0.17	1	*8260B	9/28/11 15:23	MGB	P1I0498
1,1-Dichloroethane	BRL	ug/L	1.0	0.096	1	*8260B	9/28/11 15:23	MGB	P1I0498
1,1-Dichloroethylene	BRL	ug/L	1.0	0.078	1	*8260B	9/28/11 15:23	MGB	P1I0498
1,1-Dichloropropylene	BRL	ug/L	1.0	0.061	1	*8260B	9/28/11 15:23	MGB	P1I0498
1,2,3-Trichlorobenzene	BRL	ug/L	2.0	0.20	1	*8260B	9/28/11 15:23	MGB	P1I0498
1,2,3-Trichloropropane	BRL	ug/L	1.0	0.081	1	*8260B	9/28/11 15:23	MGB	P1I0498
1,2,4-Trichlorobenzene	BRL	ug/L	1.0	0.10	1	*8260B	9/28/11 15:23	MGB	P1I0498
1,2,4-Trimethylbenzene	BRL	ug/L	1.0	0.048	1	*8260B	9/28/11 15:23	MGB	P1I0498
1,2-Dibromo-3-chloropropane	BRL	ug/L	2.0	0.59	1	*8260B	9/28/11 15:23	MGB	P1I0498
1,2-Dibromoethane	BRL	ug/L	1.0	0.14	1	*8260B	9/28/11 15:23	MGB	P1I0498
1,2-Dichlorobenzene	BRL	ug/L	1.0	0.076	1	*8260B	9/28/11 15:23	MGB	P1I0498
1,2-Dichloroethane	BRL	ug/L	1.0	0.14	1	*8260B	9/28/11 15:23	MGB	P1I0498
1,2-Dichloropropane	BRL	ug/L	1.0	0.13	1	*8260B	9/28/11 15:23	MGB	P1I0498
1,3,5-Trimethylbenzene	BRL	ug/L	1.0	0.057	1	*8260B	9/28/11 15:23	MGB	P1I0498
1,3-Dichlorobenzene	BRL	ug/L	1.0	0.074	1	*8260B	9/28/11 15:23	MGB	P1I0498
1,3-Dichloropropane	BRL	ug/L	1.0	0.11	1	*8260B	9/28/11 15:23	MGB	P1I0498
1,4-Dichlorobenzene	BRL	ug/L	1.0	0.068	1	*8260B	9/28/11 15:23	MGB	P1I0498
2,2-Dichloropropane	BRL	ug/L	2.0	0.11	1	*8260B	9/28/11 15:23	MGB	P1I0498
2-Chloroethyl Vinyl Ether	BRL	ug/L	2.0	0.22	1	*8260B	9/28/11 15:23	MGB	P1I0498
2-Chlorotoluene	BRL	ug/L	1.0	0.038	1	*8260B	9/28/11 15:23	MGB	P1I0498
4-Chlorotoluene	BRL	ug/L	1.0	0.053	1	*8260B	9/28/11 15:23	MGB	P1I0498

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Laboratory Report

10/06/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Water

Client Sample ID: MW-6
Prism Sample ID: 1090641-01
Prism Work Order: 1090641
Time Collected: 09/27/11 11:15
Time Submitted: 09/27/11 14:45

Parameter	Result	Units	Report Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
4-Isopropyltoluene	BRL	ug/L	1.0	0.065	1	*8260B	9/28/11 15:23	MGB	P1I0498
Acetone	BRL	ug/L	10	0.62	1	*8260B	9/28/11 15:23	MGB	P1I0498
Acrolein	BRL	ug/L	100	1.1	1	*8260B	9/28/11 15:23	MGB	P1I0498
Acrylonitrile	BRL	ug/L	100	0.86	1	*8260B	9/28/11 15:23	MGB	P1I0498
Benzene	BRL	ug/L	1.0	0.072	1	*8260B	9/28/11 15:23	MGB	P1I0498
Bromobenzene	BRL	ug/L	1.0	0.064	1	*8260B	9/28/11 15:23	MGB	P1I0498
Bromochloromethane	BRL	ug/L	1.0	0.13	1	*8260B	9/28/11 15:23	MGB	P1I0498
Bromodichloromethane	BRL	ug/L	1.0	0.062	1	*8260B	9/28/11 15:23	MGB	P1I0498
Bromoform	BRL	ug/L	1.0	0.27	1	*8260B	9/28/11 15:23	MGB	P1I0498
Bromomethane	BRL	ug/L	3.0	0.47	1	*8260B	9/28/11 15:23	MGB	P1I0498
Carbon disulfide	BRL	ug/L	5.0	1.4	1	*8260B	9/28/11 15:23	MGB	P1I0498
Carbon Tetrachloride	BRL	ug/L	2.0	0.12	1	*8260B	9/28/11 15:23	MGB	P1I0498
Chlorobenzene	BRL	ug/L	1.0	0.061	1	*8260B	9/28/11 15:23	MGB	P1I0498
Chloroethane	BRL	ug/L	5.0	0.13	1	*8260B	9/28/11 15:23	MGB	P1I0498
Chloroform	**1.0**	**ug/L**	**1.0**	**0.089**	**1**	***8260B**	**9/28/11 15:23**	**MGB**	**P1I0498**
Chloromethane	BRL	ug/L	2.0	0.11	1	*8260B	9/28/11 15:23	MGB	P1I0498
cis-1,2-Dichloroethylene	BRL	ug/L	1.0	0.076	1	*8260B	9/28/11 15:23	MGB	P1I0498
cis-1,3-Dichloropropylene	BRL	ug/L	1.0	0.10	1	*8260B	9/28/11 15:23	MGB	P1I0498
Dibromochloromethane	BRL	ug/L	1.0	0.30	1	*8260B	9/28/11 15:23	MGB	P1I0498
Dibromomethane	BRL	ug/L	1.0	0.13	1	*8260B	9/28/11 15:23	MGB	P1I0498
Dichlorodifluoromethane	BRL	ug/L	2.0	0.11	1	*8260B	9/28/11 15:23	MGB	P1I0498
Ethylbenzene	BRL	ug/L	1.0	0.067	1	*8260B	9/28/11 15:23	MGB	P1I0498
Hexachlorobutadiene	BRL	ug/L	2.0	0.36	1	*8260B	9/28/11 15:23	MGB	P1I0498
Isopropyl Ether	BRL	ug/L	1.0	0.043	1	*8260B	9/28/11 15:23	MGB	P1I0498
Isopropylbenzene (Cumene)	BRL	ug/L	1.0	0.072	1	*8260B	9/28/11 15:23	MGB	P1I0498
m,p-Xylenes	BRL	ug/L	2.0	0.081	1	*8260B	9/28/11 15:23	MGB	P1I0498
Methyl Butyl Ketone (2-Hexanone)	BRL	ug/L	5.0	0.19	1	*8260B	9/28/11 15:23	MGB	P1I0498
Methyl Ethyl Ketone (2-Butanone)	BRL	ug/L	5.0	0.90	1	*8260B	9/28/11 15:23	MGB	P1I0498
Methyl Isobutyl Ketone	BRL	ug/L	5.0	0.12	1	*8260B	9/28/11 15:23	MGB	P1I0498
Methylene Chloride	BRL	ug/L	2.0	0.44	1	*8260B	9/28/11 15:23	MGB	P1I0498
Methyl-tert-Butyl Ether	BRL	ug/L	1.0	0.070	1	*8260B	9/28/11 15:23	MGB	P1I0498
Naphthalene	BRL	ug/L	1.0	0.098	1	*8260B	9/28/11 15:23	MGB	P1I0498
n-Butylbenzene	BRL	ug/L	1.0	0.11	1	*8260B	9/28/11 15:23	MGB	P1I0498
n-Propylbenzene	BRL	ug/L	1.0	0.060	1	*8260B	9/28/11 15:23	MGB	P1I0498
o-Xylene	BRL	ug/L	1.0	0.046	1	*8260B	9/28/11 15:23	MGB	P1I0498
sec-Butylbenzene	BRL	ug/L	1.0	0.087	1	*8260B	9/28/11 15:23	MGB	P1I0498
Styrene	BRL	ug/L	1.0	0.047	1	*8260B	9/28/11 15:23	MGB	P1I0498
tert-Butylbenzene	BRL	ug/L	1.0	0.080	1	*8260B	9/28/11 15:23	MGB	P1I0498
Tetrachloroethylene	BRL	ug/L	1.0	0.069	1	*8260B	9/28/11 15:23	MGB	P1I0498
Toluene	BRL	ug/L	1.0	0.042	1	*8260B	9/28/11 15:23	MGB	P1I0498
trans-1,2-Dichloroethylene	BRL	ug/L	2.0	0.12	1	*8260B	9/28/11 15:23	MGB	P1I0498
trans-1,3-Dichloropropylene	BRL	ug/L	1.0	0.043	1	*8260B	9/28/11 15:23	MGB	P1I0498
Trichloroethylene	BRL	ug/L	2.0	0.054	1	*8260B	9/28/11 15:23	MGB	P1I0498
Trichlorofluoromethane	BRL	ug/L	2.0	0.088	1	*8260B	9/28/11 15:23	MGB	P1I0498

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Laboratory Report

10/06/2011

ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Sample Matrix: Water

Client Sample ID: MW-6
Prism Sample ID: 1090641-01
Prism Work Order: 1090641
Time Collected: 09/27/11 11:15
Time Submitted: 09/27/11 14:45

Parameter	Result	Units	Raport Limit	MDL	Dilution Factor	Method	Analysis Date/Time	Analyst	Batch ID
Vinyl acetate	BRL	ug/L	20	0.10	1	*8260B	9/28/11 15:23	MGB	P1I0498
Vinyl chloride	BRL	ug/L	2.0	0.16	1	*8260B	9/28/11 15:23	MGB	P1I0498

Surrogate	Recovery	Control Limits
4-Bromofluorobenzene	*112 %*	*80-124*
Dibromofluoromethane	*111 %*	*75-129*
Toluene-d8	*104 %*	*77-123*

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ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Prism Work Order: 1090641
Time Submitted: 9/27/2011 2:45:00PM

Volatile Organic Compounds by GC/MS - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch P1I0498 - 5030B										
Blank (P1I0498-BLK1)				Prepared: 09/27/11 Analyzed: 09/28/11						
1,1,1,2-Tetrachloroethane	BRL	1.0	ug/L							
1,1,1-Trichloroethane	BRL	1.0	ug/L							
1,1,2,2-Tetrachloroethane	BRL	1.0	ug/L							
1,1,2-Trichloroethane	BRL	1.0	ug/L							
1,1-Dichloroethane	BRL	1.0	ug/L							
1,1-Dichloroethylene	BRL	1.0	ug/L							
1,1-Dichloropropylene	BRL	1.0	ug/L							
1,2,3-Trichlorobenzene	BRL	2.0	ug/L							
1,2,3-Trichloropropane	BRL	1.0	ug/L							
1,2,4-Trichlorobenzene	BRL	1.0	ug/L							
1,2,4-Trimethylbenzene	BRL	1.0	ug/L							
1,2-Dibromo-3-chloropropane	BRL	2.0	ug/L							
1,2-Dibromoethane	BRL	1.0	ug/L							
1,2-Dichlorobenzene	BRL	1.0	ug/L							
1,2-Dichloroethane	BRL	1.0	ug/L							
1,2-Dichloropropane	BRL	1.0	ug/L							
1,3,5-Trimethylbenzene	BRL	1.0	ug/L							
1,3-Dichlorobenzene	BRL	1.0	ug/L							
1,3-Dichloropropane	BRL	1.0	ug/L							
1,4-Dichlorobenzene	BRL	1.0	ug/L							
2,2-Dichloropropane	BRL	2.0	ug/L							
2-Chloroethyl Vinyl Ether	BRL	2.0	ug/L							
2-Chlorotoluene	BRL	1.0	ug/L							
4-Chlorotoluene	BRL	1.0	ug/L							
4-Isopropyltoluene	BRL	1.0	ug/L							
Acetone	BRL	10	ug/L							
Acrolein	BRL	100	ug/L							
Acrylonitrile	BRL	100	ug/L							
Benzene	BRL	1.0	ug/L							
Bromobenzene	BRL	1.0	ug/L							
Bromochloromethane	BRL	1.0	ug/L							
Bromodichloromethane	BRL	1.0	ug/L							
Bromoform	BRL	1.0	ug/L							
Bromomethane	BRL	3.0	ug/L							
Carbon disulfide	BRL	5.0	ug/L							
Carbon Tetrachloride	BRL	2.0	ug/L							
Chlorobenzene	BRL	1.0	ug/L							
Chloroethane	BRL	5.0	ug/L							
Chloroform	BRL	1.0	ug/L							
Chloromethane	BRL	2.0	ug/L							
cis-1,2-Dichloroethylene	BRL	1.0	ug/L							
cis-1,3-Dichloropropylene	BRL	1.0	ug/L							
Dibromochloromethane	BRL	1.0	ug/L							
Dibromomethane	BRL	1.0	ug/L							
Dichlorodifluoromethane	BRL	2.0	ug/L							
Ethylbenzene	BRL	1.0	ug/L							

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ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Prism Work Order: 1090641
Time Submitted: 9/27/2011 2:45:00PM

Volatile Organic Compounds by GC/MS - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch P1I0498 - 5030B										
Blank (P1I0498-BLK1)				Prepared: 09/27/11 Analyzed: 09/28/11						
Hexachlorobutadiene	BRL	2.0	ug/L							
Isopropyl Ether	BRL	1.0	ug/L							
Isopropylbenzene (Cumene)	BRL	1.0	ug/L							
m,p-Xylenes	BRL	2.0	ug/L							
Methyl Butyl Ketone (2-Hexanone)	BRL	5.0	ug/L							
Methyl Ethyl Ketone (2-Butanone)	BRL	5.0	ug/L							
Methyl Isobutyl Ketone	BRL	5.0	ug/L							
Methylene Chloride	BRL	2.0	ug/L							
Methyl-tert-Butyl Ether	BRL	1.0	ug/L							
Naphthalene	BRL	1.0	ug/L							
n-Butylbenzene	BRL	1.0	ug/L							
n-Propylbenzene	BRL	1.0	ug/L							
o-Xylene	BRL	1.0	ug/L							
sec-Butylbenzene	BRL	1.0	ug/L							
Styrene	BRL	1.0	ug/L							
tert-Butylbenzene	BRL	1.0	ug/L							
Tetrachloroethylene	BRL	1.0	ug/L							
Toluene	BRL	1.0	ug/L							
trans-1,2-Dichloroethylene	BRL	2.0	ug/L							
trans-1,3-Dichloropropylene	BRL	1.0	ug/L							
Trichloroethylene	BRL	2.0	ug/L							
Trichlorofluoromethane	BRL	2.0	ug/L							
Vinyl acetate	BRL	20	ug/L							
Vinyl chloride	BRL	2.0	ug/L							
Surrogate: 4-Bromofluorobenzene	*52.9*		*ug/L*	*50.00*		*106*	*80-124*			
Surrogate: Dibromofluoromethane	*55.2*		*ug/L*	*50.00*		*110*	*75-129*			
Surrogate: Toluene-d8	*52.4*		*ug/L*	*50.00*		*105*	*77-123*			

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Project: United Metal

Prism Work Order: 1090641
Time Submitted: 9/27/2011 2:45:00PM

Volatile Organic Compounds by GC/MS - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch P1I0498 - 5030B										
LCS (P1I0498-BS1)				Prepared: 09/27/11		Analyzed: 09/28/11				
1,1-Dichloroethylene	20.8	1.0	ug/L	20.00		104	70-154			
Benzene	20.5	1.0	ug/L	20.00		102	77-128			
Chlorobenzene	20.6	1.0	ug/L	20.00		103	78-119			
Toluene	20.5	1.0	ug/L	20.00		102	76-131			
Trichloroethylene	22.2	2.0	ug/L	20.00		111	77-133			
Surrogate: 4-Bromofluorobenzene	*51.3*		*ug/L*	*50.00*		*103*	*80-124*			
Surrogate: Dibromofluoromethane	*51.2*		*ug/L*	*50.00*		*102*	*75-129*			
Surrogate: Toluene-d8	*51.4*		*ug/L*	*50.00*		*103*	*77-123*			
LCS Dup (P1I0498-BSD1)				Prepared: 09/27/11		Analyzed: 09/28/11				
1,1-Dichloroethylene	20.7	1.0	ug/L	20.00		103	70-154	0.6	200	
Benzene	20.0	1.0	ug/L	20.00		100	77-128	2	200	
Chlorobenzene	20.2	1.0	ug/L	20.00		101	78-119	2	200	
Toluene	20.3	1.0	ug/L	20.00		102	76-131	0.7	200	
Trichloroethylene	22.5	2.0	ug/L	20.00		112	77-133	1	200	
Surrogate: 4-Bromofluorobenzene	*52.2*		*ug/L*	*50.00*		*104*	*80-124*			
Surrogate: Dibromofluoromethane	*51.9*		*ug/L*	*50.00*		*104*	*75-129*			
Surrogate: Toluene-d8	*50.9*		*ug/L*	*50.00*		*102*	*77-123*			

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ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Prism Work Order: 1090641
Time Submitted: 9/27/2011 2:45:00PM

Total Metals - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch P1I0539 - 3010A										
Blank (P1I0539-BLK1)				Prepared & Analyzed: 09/29/11						
Antimony	BRL	10	ug/L							
Arsenic	BRL	10	ug/L							
Beryllium	BRL	2.0	ug/L							
Cadmium	BRL	0.0010	mg/L							
Chromium	BRL	5.0	ug/L							
Copper	BRL	10	ug/L							
Lead	BRL	5.0	ug/L							
Nickel	BRL	10	ug/L							
Selenium	BRL	20	ug/L							
Silver	BRL	5.0	ug/L							
Thallium	BRL	10	ug/L							
Tin	BRL	50	ug/L							
Zinc	BRL	30	ug/L							
LCS (P1I0539-BS1)				Prepared & Analyzed: 09/29/11						
Antimony	260	10	ug/L	250.0		104	80-120			
Arsenic	261	10	ug/L	250.0		104	80-120			
Beryllium	256	2.0	ug/L	250.0		103	80-120			
Cadmium	0.254	0.0010	mg/L	0.2500		102	80-120			
Chromium	257	5.0	ug/L	250.0		103	80-120			
Copper	254	10	ug/L	250.0		102	80-120			
Lead	266	5.0	ug/L	250.0		106	80-120			
Nickel	250	10	ug/L	250.0		100	80-120			
Selenium	265	20	ug/L	250.0		106	80-120			
Silver	252	5.0	ug/L	250.0		101	80-120			
Thallium	264	10	ug/L	250.0		106	80-120			
Tin	259	50	ug/L	250.0		103	80-120			
Zinc	254	30	ug/L	250.0		101	80-120			

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Project: United Metal

Prism Work Order: 1090641
Time Submitted: 9/27/2011 2:45:00PM

Total Metals - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch P1I0539 - 3010A										
Matrix Spike (P1I0539-MS1)	**Source: 1090641-01**			Prepared & Analyzed: 09/29/11						
Antimony	225	10	ug/L	250.0	BRL	90	75-125			
Arsenic	239	10	ug/L	250.0	BRL	96	75-125			
Beryllium	224	2.0	ug/L	250.0	BRL	90	75-125			
Cadmium	0.212	0.0010	mg/L	0.2500	0.000905	84	75-125			
Chromium	216	5.0	ug/L	250.0	BRL	87	75-125			
Copper	247	10	ug/L	250.0	5.09	97	75-125			
Lead	231	5.0	ug/L	250.0	9.19	89	75-125			
Nickel	14100	10	ug/L	250.0	15900	NR	75-125			E, MC
Selenium	253	20	ug/L	250.0	12.1	96	75-125			
Silver	233	5.0	ug/L	250.0	BRL	93	75-125			
Thallium	215	10	ug/L	250.0	3.58	85	75-125			
Tin	216	50	ug/L	250.0	BRL	87	75-125			
Zinc	344	30	ug/L	250.0	117	91	75-125			
Matrix Spike Dup (P1I0539-MSD1)	**Source: 1090641-01**			Prepared & Analyzed: 09/29/11						
Antimony	205	10	ug/L	250.0	BRL	82	75-125	9	20	
Arsenic	218	10	ug/L	250.0	BRL	87	75-125	9	20	
Beryllium	205	2.0	ug/L	250.0	BRL	82	75-125	9	20	
Cadmium	0.194	0.0010	mg/L	0.2500	0.000905	77	75-125	9	20	
Chromium	198	5.0	ug/L	250.0	BRL	79	75-125	9	20	
Copper	225	10	ug/L	250.0	5.09	88	75-125	9	20	
Lead	210	5.0	ug/L	250.0	9.19	80	75-125	9	20	
Nickel	12900	10	ug/L	250.0	15900	NR	75-125	9	20	E, MC
Selenium	234	20	ug/L	250.0	12.1	89	75-125	8	20	
Silver	212	5.0	ug/L	250.0	BRL	85	75-125	9	20	
Thallium	200	10	ug/L	250.0	3.58	78	75-125	7	20	
Tin	197	50	ug/L	250.0	BRL	79	75-125	10	20	
Zinc	315	30	ug/L	250.0	117	79	75-125	9	20	

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ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Prism Work Order: 1090641
Time Submitted: 9/27/2011 2:45:00PM

Total Metals - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch P1J0015 - 7470A										
Blank (P1J0015-BLK1)				Prepared: 10/03/11		Analyzed: 10/04/11				
Mercury	BRL	0.20	ug/L							
LCS (P1J0015-BS1)				Prepared: 10/03/11		Analyzed: 10/04/11				
Mercury	9.14	0.20	ug/L	9.375		97	80-120			

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ECS Carolinas - Greensboro
Attn: Toby Benfield
4811 Koger Blvd.
Greensboro, NC 27407

Project: United Metal

Prism Work Order: 1090641
Time Submitted: 9/27/2011 2:45:00PM

General Chemistry Parameters - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch P1I0527 - NO PREP										
Blank (P1I0527-BLK1)				Prepared & Analyzed: 09/27/11						
Hexavalent Chromium	BRL	25	ug/L							
LCS (P1I0527-BS1)				Prepared & Analyzed: 09/27/11						
Hexavalent Chromium	428	25	ug/L	400.0		107	90-110			
Matrix Spike (P1I0527-MS1)		Source: 1090641-01		Prepared & Analyzed: 09/27/11						
Hexavalent Chromium	411	25	ug/L	400.0	12.0	100	85-115			
Matrix Spike Dup (P1I0527-MSD1)		Source: 1090641-01		Prepared & Analyzed: 09/27/11						
Hexavalent Chromium	414	25	ug/L	400.0	12.0	100	85-115	0.7	20	

Sample Extraction Data

Prep Method: 3010A

Lab Number	Batch	Initial	Final	Date/Time
1090641-01	P1I0539	50 mL	50 mL	09/29/11 11:02
1090641-01	P1I0539	50 mL	50 mL	09/29/11 11:02
1090641-01	P1I0539	50 mL	50 mL	09/29/11 8:00

Prep Method: 7470A

Lab Number	Batch	Initial	Final	Date/Time
1090641-01	P1J0015	20 mL	30 mL	10/03/11 12:05

Prep Method: 5030B

Lab Number	Batch	Initial	Final	Date/Time
1090641-01	P1I0498	10 mL	10 mL	09/27/11 15:28

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CHAIN OF CUSTODY RECORD

PAGE 1 OF 1 QUOTE # TO ENSURE PROPER BILLING:

Client Company Name: ECS Carolinas
Report To/Contact Name: Toby Benfield
Reporting Address: 4811 Koch Blvd Greensboro
Phone: 856 7150 Fax (Yes) (No):
Email (Yes) (No) Email Address: tbenfield@ecslimited.com
EDD Type: PDF X Excel X Other
Site Location Name: United Metals
Site Location Physical Address: 133 Bluebell Rd Greensboro NC

Project Name: United Metals
Short Hold Analysis: (Yes) (No) UST Project: (Yes) (No)
*Please ATTACH any project specific reporting (QC LEVEL I II III IV) provisions and/or QC Requirements
Invoice To: ECS Carolinas
Address:

Purchase Order No./Billing Reference
Requested Due Date ☐ 1 Day ☐ 2 Days ☐ 3 Days ☐ 4 Days ☐ 5 Days
"Working Days" ☐ 6-9 Days ☐ Standard 10 days ☐ Rush Work Must Be Pre-Approved
Samples received after 15:00 will be processed next business day.
Turnaround time is based on business days, excluding weekends and holidays.
(SEE REVERSE FOR TERMS & CONDITIONS REGARDING SERVICES RENDERED BY PRISM LABORATORIES, INC. TO CLIENT)

LAB USE ONLY

	YES	NO	N/A
Samples INTACT upon arrival?	✓		
Received ON WET ICE? Temp 5.6	✓		
PROPER PRESERVATIVES indicated?	✓		
Received WITHIN HOLDING TIMES?	✓		
CUSTODY SEALS INTACT?			✓
VOLATILES rec'd W/OUT HEADSPACE?	✓		✗ TDC
PROPER CONTAINERS used?	✓		

TO BE FILLED IN BY CLIENT/SAMPLING PERSONNEL
Certification: NELAC ___ USACE ___ FL ___ NC ___ SC ___ OTHER ___ N/A ___
Water Chlorinated: YES ___ NO ___
Sample Iced Upon Collection: YES ___ NO ___

CLIENT SAMPLE DESCRIPTION	DATE COLLECTED	TIME COLLECTED MILITARY HOURS	MATRIX (SOIL, WATER OR SLUDGE)	SAMPLE CONTAINER *TYPE SEE BELOW	NO.	SIZE	PRESERVATIVES	13 ppm + SW	Cr+6	8260B				REMARKS	PRISM LAB ID NO.
MW-1	9-27	1115	W	P, VOA	2/3		HCL HNO3	✓	✓	✓					01

PRESS DOWN FIRMLY - 3 COPIES

Sampler's Signature: [signature] Sampled By (Print Name): Toby Benfield Affiliation:

Upon relinquishing, this Chain of Custody is your authorization for Prism to proceed with the analyses as requested above. Any changes must be submitted in writing to the Prism Project Manager. There will be charges for any changes after analyses have been initialized.

Relinquished By: (Signature)	Received By: (Signature)	Date	Military/Hours
[signature]	[signature]	9/27/11	12:20
Relinquished By: (Signature) [signature]	Received By: (Signature) [signature]	9/27/11	12:55
Relinquished By: (Signature) [signature]	Received For Prism Laboratories By: [signature]	9/27/11	14:45

Method of Shipment: NOTE: ALL SAMPLE COOLERS SHOULD BE TAPED SHUT WITH CUSTODY SEALS FOR TRANSPORTATION TO THE LABORATORY. SAMPLES ARE NOT ACCEPTED AND VERIFIED AGAINST COC UNTIL RECEIVED AT THE LABORATORY.
☐ Fed Ex ☐ UPS ☐ Hand-delivered ☐ Prism Field Service ☐ Other

COC/Group No. 109641

Additional Comments:

PRISM USE ONLY
Site Arrival Time:
Site Departure Time:
Field Tech Fee:
Mileage:

TDC

SEE REVERSE FOR TERMS & CONDITIONS

NPDES:	UST:	GROUNDWATER:	DRINKING WATER:	SOLID WASTE:	RCRA:	CERCLA	LANDFILL	OTHER:
☐ NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC	☐ NC ☐ SC

CONTAINER TYPE CODES: A = Amber C = Clear G = Glass P = Plastic; TL = Teflon-Lined Cap VOA = Volatile Organics Analysis (Zero Head Space)

ORIGINAL

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39 Spruce Street * East Longmeadow, MA 01028 * FAX 413/525-6405 * TEL. 413/525-2332

February 8, 2012

Randy Cavallier
ECS LTD
4811 Koger Boulevard
Greensboro, NC 27407

Project Location: United Metals
Client Job Number:
Project Number: 09.11981F
Laboratory Work Order Number: 12B0053

Enclosed are results of analyses for samples received by the laboratory on February 1, 2012. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Holly L. Folsom

Holly L. Folsom
Project Manager

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39 Spruce Street * East Longmeadow, MA 01028 * FAX 413/525-6405 * TEL. 413/525-2332

ECS LTD
4811 Koger Boulevard
Greensboro, NC 27407
ATTN: Randy Cavallier

REPORT DATE: 2/8/2012

PURCHASE ORDER NUMBER:

PROJECT NUMBER: 09.11981F

ANALYTICAL SUMMARY

WORK ORDER NUMBER: 12B0053

The results of analyses performed on the following samples submitted to the CON-TEST Analytical Laboratory are found in this report.

PROJECT LOCATION: United Metals

FIELD SAMPLE #	LAB ID:	MATRIX	SAMPLE DESCRIPTION	TEST	SUB LAB
SG-1	12B0053-01	Soil Gas		EPA TO-15	
SG-2	12B0053-02	Soil Gas		EPA TO-15	

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CASE NARRATIVE SUMMARY

All reported results are within defined laboratory quality control objectives unless listed below or otherwise qualified in this report.

EPA TO-15

Qualifications:

Laboratory fortified blank /laboratory control sample recovery outside of control limits. Data validation is not affected since all results are "not detected" for all samples in this batch for this compound and bias is on the high side.

Analyte & Samples(s) Qualified:

Chloroethane

B045751-BS1

Continuing calibration did not meet method specifications and was biased on the high side for this compound. Increased uncertainty is associated with the reported value which is likely to be biased on the high side.

Analyte & Samples(s) Qualified:

Chloroethane

B045751-BS1

The results of analyses reported only relate to samples submitted to the Con-Test Analytical Laboratory for testing.
I certify that the analyses listed above, unless specifically listed as subcontracted, if any. were performed under my direction according to the approved methodologies listed in this document, and that based upon my inquiry of those individuuals immediately responsible for obtaining the information, the material contained in this report is, to the best of my knowledge and belief, accurate and complete.

Daren J. Damboragian
Laboratory Manager

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ANALYTICAL RESULTS

Project Location: United Metals
Date Received: 2/1/2012
Field Sample #: SG-1
Sample ID: 12B0053-01
Sample Matrix: Soil Gas
Sampled: 1/30/2012 15:20

Sample Description/Location:
Sub Description/Location:
Canister ID: 1212
Canister Size: 6 liter
Flow Controller ID: 4066
Sample Type: 30 min

Work Order: 12B0053
Initial Vacuum(in Hg): -28
Final Vacuum(in Hg): -4
Receipt Vacuum(in Hg): -4
Flow Controller Type: Fixed-Orifice
Flow Controller Calibration
RPD Pre and Post-Sampling:

EPA TO-15

	ppbv				ug/m3			Date/Time	
Analyte	Results	RL	MDL	Flag	Results	RL	Dilution	Analyzed	Analyst
Acetone	87	4.0	0.46		210	9.5	2	2/2/12 11:27	WSD
Benzene	48	0.10	0.052		150	0.32	2	2/2/12 11:27	WSD
Benzyl chloride	ND	0.10	0.018		ND	0.52	2	2/2/12 11:27	WSD
Bromodichloromethane	ND	0.10	0.028		ND	0.67	2	2/2/12 11:27	WSD
Bromoform	ND	0.10	0.026		ND	1.0	2	2/2/12 11:27	WSD
Bromomethane	ND	0.10	0.096		ND	0.39	2	2/2/12 11:27	WSD
1,3-Butadiene	ND	0.10	0.058		ND	0.22	2	2/2/12 11:27	WSD
2-Butanone (MEK)	14	4.0	0.076		41	12	2	2/2/12 11:27	WSD
Carbon Disulfide	0.096	1.0	0.028	J	0.30	3.1	2	2/2/12 11:27	WSD
Carbon Tetrachloride	0.070	0.10	0.028	J	0.44	0.63	2	2/2/12 11:27	WSD
Chlorobenzene	ND	0.10	0.084		ND	0.46	2	2/2/12 11:27	WSD
Chloroethane	0.20	0.10	0.056		0.52	0.26	2	2/2/12 11:27	WSD
Chloroform	ND	0.10	0.036		ND	0.49	2	2/2/12 11:27	WSD
Chloromethane	1.2	0.10	0.050		2.5	0.21	2	2/2/12 11:27	WSD
Cyclohexane	32	0.10	0.096		110	0.34	2	2/2/12 11:27	WSD
Dibromochloromethane	ND	0.10	0.024		ND	0.85	2	2/2/12 11:27	WSD
1,2-Dibromoethane (EDB)	ND	0.10	0.028		ND	0.77	2	2/2/12 11:27	WSD
1,2-Dichlorobenzene	ND	0.10	0.052		ND	0.60	2	2/2/12 11:27	WSD
1,3-Dichlorobenzene	ND	0.10	0.028		ND	0.60	2	2/2/12 11:27	WSD
1,4-Dichlorobenzene	ND	0.10	0.026		ND	0.60	2	2/2/12 11:27	WSD
Dichlorodifluoromethane (Freon 12)	2.0	0.10	0.042		9.9	0.49	2	2/2/12 11:27	WSD
1,1-Dichloroethane	0.79	0.10	0.030		3.2	0.40	2	2/2/12 11:27	WSD
1,2-Dichloroethane	0.54	0.10	0.034		2.2	0.40	2	2/2/12 11:27	WSD
1,1-Dichloroethylene	ND	0.10	0.032		ND	0.40	2	2/2/12 11:27	WSD
cis-1,2-Dichloroethylene	ND	0.10	0.028		ND	0.40	2	2/2/12 11:27	WSD
trans-1,2-Dichloroethylene	ND	0.10	0.034		ND	0.40	2	2/2/12 11:27	WSD
1,2-Dichloropropane	ND	0.10	0.040		ND	0.46	2	2/2/12 11:27	WSD
cis-1,3-Dichloropropene	ND	0.10	0.020		ND	0.45	2	2/2/12 11:27	WSD
trans-1,3-Dichloropropene	ND	0.10	0.020		ND	0.45	2	2/2/12 11:27	WSD
1,2-Dichloro-1,1,2,2-tetrafluoroethane (Freon 114)	ND	0.10	0.076		ND	0.70	2	2/2/12 11:27	WSD
1,4-Dioxane	ND	0.10	0.050		ND	0.36	2	2/2/12 11:27	WSD
Ethanol	260	4.0	0.47		480	7.5	2	2/2/12 11:27	WSD
Ethyl Acetate	ND	0.10	0.052		ND	0.36	2	2/2/12 11:27	WSD
Ethylbenzene	20	0.10	0.028		89	0.43	2	2/2/12 11:27	WSD
4-Ethyltoluene	7.4	0.10	0.036		36	0.49	2	2/2/12 11:27	WSD
Heptane	53	0.10	0.034		220	0.41	2	2/2/12 11:27	WSD
Hexachlorobutadiene	ND	0.10	0.036		ND	1.1	2	2/2/12 11:27	WSD
Hexane	170	4.0	0.088		590	14	2	2/2/12 11:27	WSD

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ANALYTICAL RESULTS

Project Location: United Metals
Date Received: 2/1/2012
Field Sample #: SG-1
Sample ID: 12B0053-01
Sample Matrix: Soil Gas
Sampled: 1/30/2012 15:20

Sample Description/Location:
Sub Description/Location:
Canister ID: 1212
Canister Size: 6 liter
Flow Controller ID: 4066
Sample Type: 30 min

Work Order: 12B0053
Initial Vacuum(in Hg): -28
Final Vacuum(in Hg): -4
Receipt Vacuum(in Hg): -4
Flow Controller Type: Fixed-Orifice
Flow Controller Calibration
RPD Pre and Post-Sampling:

EPA TO-15

	ppbv				ug/m3			Date/Time	
Analyte	Results	RL	MDL	Flag	Results	RL	Dilution	Analyzed	Analyst
2-Hexanone (MBK)	ND	0.10	0.030		ND	0.41	2	2/2/12 11:27	WSD
Isopropanol	ND	4.0	0.060		ND	9.8	2	2/2/12 11:27	WSD
Methyl tert-Butyl Ether (MTBE)	ND	0.10	0.028		ND	0.36	2	2/2/12 11:27	WSD
Methylene Chloride	ND	1.0	0.13		ND	3.5	2	2/2/12 11:27	WSD
4-Methyl-2-pentanone (MIBK)	ND	0.10	0.030		ND	0.41	2	2/2/12 11:27	WSD
Naphthalene	0.27	0.10	0.054		1.4	0.52	2	2/2/12 11:27	WSD
Propene	9.5	4.0	0.076		16	6.9	2	2/2/12 11:27	WSD
Styrene	0.42	0.10	0.022		1.8	0.43	2	2/2/12 11:27	WSD
1,1,2,2-Tetrachloroethane	ND	0.10	0.034		ND	0.69	2	2/2/12 11:27	WSD
Tetrachloroethylene	1.2	0.10	0.030		8.2	0.68	2	2/2/12 11:27	WSD
Tetrahydrofuran	19	0.10	0.032		57	0.29	2	2/2/12 11:27	WSD
Toluene	140	1.0	0.28		550	3.8	20	2/2/12 5:42	WSD
1,2,4-Trichlorobenzene	ND	0.20	0.038		ND	1.5	2	2/2/12 11:27	WSD
1,1,1-Trichloroethane	ND	0.10	0.034		ND	0.55	2	2/2/12 11:27	WSD
1,1,2-Trichloroethane	ND	0.10	0.032		ND	0.55	2	2/2/12 11:27	WSD
Trichloroethylene	ND	0.10	0.028		ND	0.54	2	2/2/12 11:27	WSD
Trichlorofluoromethane (Freon 11)	0.23	0.10	0.062		1.3	0.56	2	2/2/12 11:27	WSD
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	0.068	0.10	0.034	J	0.52	0.77	2	2/2/12 11:27	WSD
1,2,4-Trimethylbenzene	22	0.10	0.034		110	0.49	2	2/2/12 11:27	WSD
1,3,5-Trimethylbenzene	8.6	0.10	0.030		42	0.49	2	2/2/12 11:27	WSD
Vinyl Acetate	ND	0.10	0.050		ND	0.35	2	2/2/12 11:27	WSD
Vinyl Chloride	ND	0.10	0.050		ND	0.26	2	2/2/12 11:27	WSD
m&p-Xylene	62	0.20	0.052		270	0.87	2	2/2/12 11:27	WSD
o-Xylene	28	0.10	0.026		120	0.43	2	2/2/12 11:27	WSD

Surrogates	% Recovery	% REC Limits	
4-Bromofluorobenzene (1)	101	70-130	2/2/12 5:42
4-Bromofluorobenzene (1)	109	70-130	2/2/12 11:27

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ANALYTICAL RESULTS

Project Location: United Metals
Date Received: 2/1/2012
Field Sample #: SG-2
Sample ID: 12B0053-02
Sample Matrix: Soil Gas
Sampled: 1/30/2012 16:10

Sample Description/Location:
Sub Description/Location:
Canister ID: 1781
Canister Size: 6 liter
Flow Controller ID: 4075
Sample Type: 30 min

Work Order: 12B0053
Initial Vacuum(in Hg): -29
Final Vacuum(in Hg): -6
Receipt Vacuum(in Hg): -6
Flow Controller Type: Fixed-Orifice
Flow Controller Calibration
RPD Pre and Post-Sampling:

EPA TO-15

Analyte	ppbv Results	ppbv RL	ppbv MDL	Flag	ug/m3 Results	ug/m3 RL	Dilution	Date/Time Analyzed	Analyst
Acetone	13	4.0	0.46		31	9.5	2	2/2/12 12:07	WSD
Benzene	0.71	0.10	0.052		2.3	0.32	2	2/2/12 12:07	WSD
Benzyl chloride	ND	0.10	0.018		ND	0.52	2	2/2/12 12:07	WSD
Bromodichloromethane	0.88	0.10	0.028		5.9	0.67	2	2/2/12 12:07	WSD
Bromoform	ND	0.10	0.026		ND	1.0	2	2/2/12 12:07	WSD
Bromomethane	ND	0.10	0.096		ND	0.39	2	2/2/12 12:07	WSD
1,3-Butadiene	ND	0.10	0.058		ND	0.22	2	2/2/12 12:07	WSD
2-Butanone (MEK)	0.91	4.0	0.076	J	2.7	12	2	2/2/12 12:07	WSD
Carbon Disulfide	ND	1.0	0.028		ND	3.1	2	2/2/12 12:07	WSD
Carbon Tetrachloride	0.052	0.10	0.028	J	0.33	0.63	2	2/2/12 12:07	WSD
Chlorobenzene	ND	0.10	0.084		ND	0.46	2	2/2/12 12:07	WSD
Chloroethane	ND	0.10	0.056		ND	0.26	2	2/2/12 12:07	WSD
Chloroform	42	0.10	0.036		200	0.49	2	2/2/12 12:07	WSD
Chloromethane	0.49	0.10	0.050		1.0	0.21	2	2/2/12 12:07	WSD
Cyclohexane	ND	0.10	0.096		ND	0.34	2	2/2/12 12:07	WSD
Dibromochloromethane	ND	0.10	0.024		ND	0.85	2	2/2/12 12:07	WSD
1,2-Dibromoethane (EDB)	ND	0.10	0.028		ND	0.77	2	2/2/12 12:07	WSD
1,2-Dichlorobenzene	ND	0.10	0.052		ND	0.60	2	2/2/12 12:07	WSD
1,3-Dichlorobenzene	ND	0.10	0.028		ND	0.60	2	2/2/12 12:07	WSD
1,4-Dichlorobenzene	0.046	0.10	0.026	J	0.28	0.60	2	2/2/12 12:07	WSD
Dichlorodifluoromethane (Freon 12)	71	0.10	0.042		350	0.49	2	2/2/12 12:07	WSD
1,1-Dichloroethane	ND	0.10	0.030		ND	0.40	2	2/2/12 12:07	WSD
1,2-Dichloroethane	ND	0.10	0.034		ND	0.40	2	2/2/12 12:07	WSD
1,1-Dichloroethylene	ND	0.10	0.032		ND	0.40	2	2/2/12 12:07	WSD
cis-1,2-Dichloroethylene	ND	0.10	0.028		ND	0.40	2	2/2/12 12:07	WSD
trans-1,2-Dichloroethylene	ND	0.10	0.034		ND	0.40	2	2/2/12 12:07	WSD
1,2-Dichloropropane	ND	0.10	0.040		ND	0.46	2	2/2/12 12:07	WSD
cis-1,3-Dichloropropene	ND	0.10	0.020		ND	0.45	2	2/2/12 12:07	WSD
trans-1,3-Dichloropropene	ND	0.10	0.020		ND	0.45	2	2/2/12 12:07	WSD
1,2-Dichloro-1,1,2,2-tetrafluoroethane (Freon 114)	ND	0.10	0.076		ND	0.70	2	2/2/12 12:07	WSD
1,4-Dioxane	ND	0.10	0.050		ND	0.36	2	2/2/12 12:07	WSD
Ethanol	6.0	4.0	0.47		11	7.5	2	2/2/12 12:07	WSD
Ethyl Acetate	ND	0.10	0.052		ND	0.36	2	2/2/12 12:07	WSD
Ethylbenzene	1.8	0.10	0.028		8.0	0.43	2	2/2/12 12:07	WSD
4-Ethyltoluene	2.2	0.10	0.036		11	0.49	2	2/2/12 12:07	WSD
Heptane	1.2	0.10	0.034		5.0	0.41	2	2/2/12 12:07	WSD
Hexachlorobutadiene	ND	0.10	0.036		ND	1.1	2	2/2/12 12:07	WSD
Hexane	2.4	4.0	0.088	J	8.4	14	2	2/2/12 12:07	WSD

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ANALYTICAL RESULTS

Project Location: United Metals
Date Received: 2/1/2012
Field Sample #: SG-2
Sample ID: 12B0053-02
Sample Matrix: Soil Gas
Sampled: 1/30/2012 16:10

Sample Description/Location:
Sub Description/Location:
Canister ID: 1781
Canister Size: 6 liter
Flow Controller ID: 4075
Sample Type: 30 min

Work Order: 12B0053
Initial Vacuum(in Hg): -29
Final Vacuum(in Hg): -6
Receipt Vacuum(in Hg): -6
Flow Controller Type: Fixed-Orifice
Flow Controller Calibration
RPD Pre and Post-Sampling:

EPA TO-15

Analyte	ppbv Results	ppbv RL	ppbv MDL	Flag	ug/m3 Results	ug/m3 RL	Dilution	Date/Time Analyzed	Analyst
2-Hexanone (MBK)	ND	0.10	0.030		ND	0.41	2	2/2/12 12:07	WSD
Isopropanol	0.54	4.0	0.060	J	1.3	9.8	2	2/2/12 12:07	WSD
Methyl tert-Butyl Ether (MTBE)	ND	0.10	0.028		ND	0.36	2	2/2/12 12:07	WSD
Methylene Chloride	0.37	1.0	0.13	J	1.3	3.5	2	2/2/12 12:07	WSD
4-Methyl-2-pentanone (MIBK)	ND	0.10	0.030		ND	0.41	2	2/2/12 12:07	WSD
Naphthalene	0.30	0.10	0.054		1.6	0.52	2	2/2/12 12:07	WSD
Propene	1.4	4.0	0.076	J	2.4	6.9	2	2/2/12 12:07	WSD
Styrene	0.19	0.10	0.022		0.81	0.43	2	2/2/12 12:07	WSD
1,1,2,2-Tetrachloroethane	ND	0.10	0.034		ND	0.69	2	2/2/12 12:07	WSD
Tetrachloroethylene	200	1.0	0.30		1400	6.8	20	2/2/12 6:19	WSD
Tetrahydrofuran	0.32	0.10	0.032		0.94	0.29	2	2/2/12 12:07	WSD
Toluene	6.0	0.10	0.028		22	0.38	2	2/2/12 12:07	WSD
1,2,4-Trichlorobenzene	ND	0.20	0.038		ND	1.5	2	2/2/12 12:07	WSD
1,1,1-Trichloroethane	ND	0.10	0.034		ND	0.55	2	2/2/12 12:07	WSD
1,1,2-Trichloroethane	ND	0.10	0.032		ND	0.55	2	2/2/12 12:07	WSD
Trichloroethylene	0.11	0.10	0.028		0.58	0.54	2	2/2/12 12:07	WSD
Trichlorofluoromethane (Freon 11)	0.23	0.10	0.062		1.3	0.56	2	2/2/12 12:07	WSD
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	0.076	0.10	0.034	J	0.58	0.77	2	2/2/12 12:07	WSD
1,2,4-Trimethylbenzene	10	0.10	0.034		50	0.49	2	2/2/12 12:07	WSD
1,3,5-Trimethylbenzene	2.7	0.10	0.030		13	0.49	2	2/2/12 12:07	WSD
Vinyl Acetate	ND	0.10	0.050		ND	0.35	2	2/2/12 12:07	WSD
Vinyl Chloride	ND	0.10	0.050		ND	0.26	2	2/2/12 12:07	WSD
m&p-Xylene	8.4	0.20	0.052		37	0.87	2	2/2/12 12:07	WSD
o-Xylene	3.7	0.10	0.026		16	0.43	2	2/2/12 12:07	WSD

Surrogates	% Recovery	% REC Limits	
4-Bromofluorobenzene (1)	102	70-130	2/2/12 6:19
4-Bromofluorobenzene (1)	105	70-130	2/2/12 12:07

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Sample Extraction Data

Prep Method: TO-15 Prep-EPA TO-15

Lab Number [Field ID]	Batch	Pressure Dilution	Pre Dilution	Pre-Dil Initial mL	Pre-Dil Final mL	Default Injection mL	Actual Injection mL	Date
12B0053-01 [SG-1]	B045751	1	1	N/A	1000	400	200	02/01/12
12B0053-01RE1 [SG-1]	B045751	1	1	N/A	1000	400	20	02/01/12
12B0053-02 [SG-2]	B045751	1	1	N/A	1000	400	200	02/01/12
12B0053-02RE1 [SG-2]	B045751	1	1	N/A	1000	400	20	02/01/12

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QUALITY CONTROL

Air Toxics by EPA Compendium Methods - Quality Control

Analyte	ppbv Results	ppbv RL	ug/m3 Results	ug/m3 RL	Spike Level ppbv	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch B045751 - TO-15 Prep											
Blank (B045751-BLK1)					Prepared & Analyzed: 02/01/12						
Acetone	0.38	0.80									J
Benzene	ND	0.020									
Benzyl chloride	ND	0.020									
Bromodichloromethane	ND	0.020									
Bromoform	ND	0.020									
Bromomethane	ND	0.020									
1,3-Butadiene	ND	0.020									
2-Butanone (MEK)	ND	0.80									
Carbon Disulfide	ND	0.20									
Carbon Tetrachloride	ND	0.020									
Chlorobenzene	ND	0.020									
Chloroethane	ND	0.020									
Chloroform	ND	0.020									
Chloromethane	ND	0.020									
Cyclohexane	ND	0.020									
Dibromochloromethane	ND	0.020									
1,2-Dibromoethane (EDB)	ND	0.020									
1,2-Dichlorobenzene	ND	0.020									
1,3-Dichlorobenzene	ND	0.020									
1,4-Dichlorobenzene	ND	0.020									
Dichlorodifluoromethane (Freon 12)	ND	0.020									
1,1-Dichloroethane	ND	0.020									
1,2-Dichloroethane	ND	0.020									
1,1-Dichloroethylene	ND	0.020									
cis-1,2-Dichloroethylene	ND	0.020									
trans-1,2-Dichloroethylene	ND	0.020									
1,2-Dichloropropane	ND	0.020									
cis-1,3-Dichloropropene	ND	0.020									
trans-1,3-Dichloropropene	ND	0.020									
1,2-Dichloro-1,1,2,2-tetrafluoroethane (Freon 114)	ND	0.020									
1,4-Dioxane	ND	0.020									
Ethanol	ND	0.80									
Ethyl Acetate	ND	0.020									
Ethylbenzene	ND	0.020									
4-Ethyltoluene	ND	0.020									
Heptane	ND	0.020									
Hexachlorobutadiene	ND	0.020									
Hexane	ND	0.80									
2-Hexanone (MBK)	ND	0.020									
Isopropanol	ND	0.80									
Methyl tert-Butyl Ether (MTBE)	ND	0.020									
Methylene Chloride	0.16	0.20									J
4-Methyl-2-pentanone (MIBK)	ND	0.020									
Naphthalene	ND	0.020									
Propene	ND	0.80									
Styrene	ND	0.020									

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QUALITY CONTROL

Air Toxics by EPA Compendium Methods - Quality Control

Analyte	ppbv Results	ppbv RL	ug/m3 Results	ug/m3 RL	Spike Level ppbv	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch B045751 - TO-15 Prep											
Blank (B045751-BLK1)					Prepared & Analyzed: 02/01/12						
1,1,2,2-Tetrachloroethane	ND	0.020									
Tetrachloroethylene	ND	0.020									
Tetrahydrofuran	ND	0.020									
Toluene	ND	0.020									
1,2,4-Trichlorobenzene	ND	0.020									
1,1,1-Trichloroethane	ND	0.020									
1,1,2-Trichloroethane	ND	0.020									
Trichloroethylene	ND	0.020									
Trichlorofluoromethane (Freon 11)	ND	0.020									
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	ND	0.020									
1,2,4-Trimethylbenzene	ND	0.020									
1,3,5-Trimethylbenzene	ND	0.020									
Vinyl Acetate	ND	0.020									
Vinyl Chloride	ND	0.020									
m&p-Xylene	ND	0.040									
o-Xylene	ND	0.020									
Surrogate: 4-Bromofluorobenzene (1)	*8.15*				*8.00*		*102*	*70-130*			
LCS (B045751-BS1)					Prepared & Analyzed: 02/01/12						
Acetone	5.07				5.00		101	50-150			
Benzene	3.97				5.00		79.5	70-130			
Benzyl chloride	6.24				5.00		125	70-130			
Bromodichloromethane	4.21				5.00		84.2	70-130			
Bromoform	5.73				5.00		115	70-130			
Bromomethane	5.93				5.00		119	70-130			
1,3-Butadiene	6.22				5.00		124	70-130			
2-Butanone (MEK)	4.56				5.00		91.3	70-130			
Carbon Disulfide	5.11				5.00		102	70-130			
Carbon Tetrachloride	4.92				5.00		98.5	70-130			
Chlorobenzene	4.64				5.00		92.8	70-130			
Chloroethane	6.65				5.00		**133** *	70-130			L-01, V-06
Chloroform	5.06				5.00		101	70-130			
Chloromethane	5.66				5.00		113	70-130			
Cyclohexane	4.34				5.00		86.8	50-150			
Dibromochloromethane	5.18				5.00		104	70-130			
1,2-Dibromoethane (EDB)	4.45				5.00		89.0	70-130			
1,2-Dichlorobenzene	5.15				5.00		103	70-130			
1,3-Dichlorobenzene	5.30				5.00		106	70-130			
1,4-Dichlorobenzene	5.16				5.00		103	70-130			
Dichlorodifluoromethane (Freon 12)	5.68				5.00		114	70-130			
1,1-Dichloroethane	4.77				5.00		95.3	70-130			
1,2-Dichloroethane	4.57				5.00		91.5	70-130			
1,1-Dichloroethylene	4.75				5.00		95.0	70-130			
cis-1,2-Dichloroethylene	4.66				5.00		93.1	70-130			
trans-1,2-Dichloroethylene	4.65				5.00		93.1	70-130			
1,2-Dichloropropane	3.86				5.00		77.1	70-130			

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QUALITY CONTROL

Air Toxics by EPA Compendium Methods - Quality Control

Analyte	ppbv Results	ppbv RL	ug/m3 Results	ug/m3 RL	Spike Level ppbv	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch B045751 - TO-15 Prep											
LCS (B045751-BS1)					Prepared & Analyzed: 02/01/12						
cis-1,3-Dichloropropene	4.42				5.00		88.3	70-130			
trans-1,3-Dichloropropene	3.98				5.00		79.6	70-130			
1,2-Dichloro-1,1,2,2-tetrafluoroethane (Freon 114)	5.89				5.00		118	70-130			
1,4-Dioxane	4.43				5.00		88.6	70-130			
Ethanol	7.08				5.00		142	50-150			
Ethyl Acetate	5.03				5.00		101	50-150			
Ethylbenzene	4.66				5.00		93.1	70-130			
4-Ethyltoluene	5.00				5.00		100	50-150			
Heptane	4.21				5.00		84.3	50-150			
Hexachlorobutadiene	5.07				5.00		101	70-130			
Hexane	4.84				5.00		96.7	70-130			
2-Hexanone (MBK)	3.80				5.00		76.0	50-150			
Isopropanol	3.74				5.00		74.8	50-150			
Methyl tert-Butyl Ether (MTBE)	5.08				5.00		102	70-130			
Methylene Chloride	4.92				5.00		98.3	70-130			
4-Methyl-2-pentanone (MIBK)	3.69				5.00		73.8	70-130			
Naphthalene	4.73				5.00		94.7	50-150			
Propene	5.10				5.00		102	50-150			
Styrene	4.94				5.00		98.8	70-130			
1,1,2,2-Tetrachloroethane	4.54				5.00		90.8	70-130			
Tetrachloroethylene	4.70				5.00		94.0	70-130			
Tetrahydrofuran	5.44				5.00		109	50-150			
Toluene	4.56				5.00		91.3	70-130			
1,2,4-Trichlorobenzene	5.64				5.00		113	70-130			
1,1,1-Trichloroethane	4.18				5.00		83.5	70-130			
1,1,2-Trichloroethane	4.49				5.00		89.8	70-130			
Trichloroethylene	4.19				5.00		83.7	70-130			
Trichlorofluoromethane (Freon 11)	4.58				5.00		91.6	70-130			
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	5.60				5.00		112	70-130			
1,2,4-Trimethylbenzene	5.02				5.00		100	70-130			
1,3,5-Trimethylbenzene	5.04				5.00		101	70-130			
Vinyl Acetate	4.63				5.00		92.5	70-130			
Vinyl Chloride	5.68				5.00		114	70-130			
m&p-Xylene	9.69				10.0		96.9	70-130			
o-Xylene	4.75				5.00		95.0	70-130			
Surrogate: 4-Bromofluorobenzene (1)	*8.46*				*8.00*		*106*	*70-130*			

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FLAG/QUALIFIER SUMMARY

*	QC result is outside of established limits.
†	Wide recovery limits established for difficult compound.
‡	Wide RPD limits established for difficult compound.
#	Data exceeded client recommended or regulatory level
	Percent recoveries and relative percent differences (RPDs) are determined by the software using values in the calculation which have not been rounded.
J	Detected but below the Reporting Limit (lowest calibration standard); therefore, result is an estimated concentration (CLP J-Flag).
L-01	Laboratory fortified blank /laboratory control sample recovery outside of control limits. Data validation is not affected since all results are "not detected" for all samples in this batch for this compound and bias is on the high side.
V-06	Continuing calibration did not meet method specifications and was biased on the high side for this compound. Increased uncertainty is associated with the reported value which is likely to be biased on the high side.

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CERTIFICATIONS

Certified Analyses included in this Report

Analyte	Certifications
EPA TO-15 in Air	
Acetone	AIHA
Benzene	AIHA,FL,NJ,NY
Benzyl chloride	AIHA,FL,NJ,NY
Bromodichloromethane	AIHA,NJ
Bromoform	AIHA,NJ
Bromomethane	AIHA,FL,NJ,NY
1,3-Butadiene	AIHA,NJ
2-Butanone (MEK)	AIHA,FL,NJ,NY
Carbon Disulfide	AIHA,NJ
Carbon Tetrachloride	AIHA,FL,NJ,NY
Chlorobenzene	AIHA,FL,NJ,NY
Chloroethane	AIHA,FL,NJ,NY
Chloroform	AIHA,FL,NJ,NY
Chloromethane	AIHA,FL,NJ,NY
Cyclohexane	AIHA,NJ
Dibromochloromethane	AIHA
1,2-Dibromoethane (EDB)	AIHA,NJ
1,2-Dichlorobenzene	AIHA,FL,NJ,NY
1,3-Dichlorobenzene	AIHA,NJ
1,4-Dichlorobenzene	AIHA,FL,NJ,NY
Dichlorodifluoromethane (Freon 12)	AIHA
1,1-Dichloroethane	AIHA,FL,NJ,NY
1,2-Dichloroethane	AIHA,FL,NJ,NY
1,1-Dichloroethylene	AIHA,FL,NJ,NY
cis-1,2-Dichloroethylene	AIHA,FL,NY
trans-1,2-Dichloroethylene	AIHA,NJ,NY
1,2-Dichloropropane	AIHA,FL,NJ,NY
cis-1,3-Dichloropropene	AIHA,FL,NJ,NY
trans-1,3-Dichloropropene	AIHA
1,2-Dichloro-1,1,2,2-tetrafluoroethane (Freon 114)	AIHA,NJ
1,4-Dioxane	AIHA,NJ
Ethanol	AIHA
Ethyl Acetate	AIHA
Ethylbenzene	AIHA,FL,NJ,NY
4-Ethyltoluene	AIHA,NJ
Heptane	AIHA,NJ,NY
Hexachlorobutadiene	AIHA,NJ,NY
Hexane	AIHA,FL,NJ,NY
2-Hexanone (MBK)	AIHA
Isopropanol	AIHA,NY
Methyl tert-Butyl Ether (MTBE)	AIHA,FL,NJ,NY
Methylene Chloride	AIHA,FL,NJ,NY
4-Methyl-2-pentanone (MIBK)	AIHA,FL,NJ,NY
Propene	AIHA
Styrene	AIHA,FL,NJ,NY
1,1,2,2-Tetrachloroethane	AIHA,FL,NJ,NY
Tetrachloroethylene	AIHA,FL,NJ,NY

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CERTIFICATIONS

Certified Analyses included in this Report

Analyte	Certifications
EPA TO-15 in Air	
Tetrahydrofuran	AIHA
Toluene	AIHA,FL,NJ,NY
1,2,4-Trichlorobenzene	AIHA,NJ,NY
1,1,1-Trichloroethane	AIHA,FL,NJ,NY
1,1,2-Trichloroethane	AIHA,FL,NJ,NY
Trichloroethylene	AIHA,FL,NJ,NY
Trichlorofluoromethane (Freon 11)	AIHA
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	AIHA,NJ,NY
1,2,4-Trimethylbenzene	AIHA,NJ
1,3,5-Trimethylbenzene	AIHA,NJ
Vinyl Acetate	AIHA,FL,NJ,NY
Vinyl Chloride	AIHA,FL,NJ,NY
m&p-Xylene	AIHA,FL,NJ,NY
o-Xylene	AIHA,FL,NJ,NY

The CON-TEST Environmental Laboratory operates under the following certifications and accreditations:

Code	Description	Number	Expires
AIHA	AIHA-LAP, LLC	100033	02/1/2014
MA	Massachusetts DEP	M-MA100	06/30/2012
CT	Connecticut Department of Publilc Health	PH-0567	09/30/2013
NY	New York State Department of Health	10899 NELAP	04/1/2012
NH	New Hampshire Environmental Lab	2516 NELAP	02/5/2012
RI	Rhode Island Department of Health	LAO00112	12/30/2012
NC	North Carolina Div. of Water Quality	652	12/31/2012
NJ	New Jersey DEP	MA007 NELAP	06/30/2012
FL	Florida Department of Health	E871027 NELAP	06/30/2012
VT	Vermont Department of Health Lead Laboratory	LL015036	07/30/2012
WA	State of Washington Department of Ecology	C2065	02/23/2012
ME	State of Maine	2011028	06/9/2013
VA	Commonwealth of Virginia	1381	12/14/2012

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Fax: 413-525-6405
Email: info@contestlabs.com
www.contestlabs.com
39 SPRUCE ST
EAST LONGMEADOW, MA 01028

AIR SAMPLE CHAIN OF CUSTODY RECORD

12B0053

Page 1 of 1

Company Name: ECS Carolinas LLP
Address: 4811 Koger Blvd
Greensboro, NC 27407
Attention: Randy Cavallier
Project Location: United Metals
Sampled By: Randy Cavallier

Telephone: (336) 856-7150
Project # 08.11981F
Client PO #

DATA DELIVERY (check one):
☐ FAX ☐ EMAIL ☒ WEBSITE CLIENT
Fax # :
Email: rcavallier@ecslimited.com
Format: ☐ EXCEL ☒ PDF ☐ GIS KEY ☐ OTHER___

Proposal Provided? (For Billing purposes)
☐ yes _____ proposal date

Please fill out completely, sign, date and retain the yellow copy for your record.

Summa canisters and flow controllers must be returned within 14 days of receipt or rental fees will apply.

Summa canisters will be retained for a minimum of 14 days after sampling date prior to cleaning.

Field ID	Sample Description	Media	Lab #	Date Sampled Start Date Time	Date Sampled Stop Date Time	Total Minutes Sampled	Flow Rate M³/Min. or L / Min.	Volume Liters or M³	Matrix Code*	ANALYSIS REQUESTED: TO-15				" Hg Initial pressure	" Hg Final pressure	" Hg Lab Receipt pressure	Summa Canister ID	Flow Controller ID
SG-1	Subslab Soil Gas	S	01	1/30/12 250	1/30/12 320	-			SG	✓				-28	-4	-4	1212	4066
SG-2	"	S	02	1/30/12 340	1/30/12 410				SG	✓				-29	-6	-6	1781	4075

Laboratory Comments:

CLIENT COMMENTS:

Relinquished by: (signature)	Date/Time: 1/31/12 5:00	
Received by: (signature) Fedex AMBill 8162-7567-4947	Date/Time: "	
Relinquished by: (signature)	Date/Time:	
Received by: (signature) Alan Pankowski	Date/Time: 2/1/12 12:19	

Turnaround **
☒ 7-Day
☐ 10-Day
☐ Other ___
RUSH *
☐ *24-Hr ☐ *48-Hr
☐ *72-Hr ☐ *4-Day
*Approval Required

Special Requirements
Regulations:
Data Enhancement/RCP? ☐ Y ☐ N
Enhanced Data Package ☐ Y ☐ N
(Surchage Applies)
Required Detection Limits:
Other:

***Matrix Code:**
SG= SOIL GAS
IA= INDOOR AIR
AMB=AMBIENT
SS = SUB SLAB
D = DUP
BL = BLANK
O = other_____

****Media Codes:**
S=summa can
TB=tedlar bag
P=PUF
T=tube
F= filter
C=cassette
O = Other_____

** TURNAROUND TIME STARTS AT 9:00 A.M. THE DAY AFTER SAMPLE RECEIPT UNLESS THERE ARE QUESTIONS ON YOUR CHAIN. IF THIS FORM IS NOT FILLED OUT COMPLETELY OR IS INCORRECT, TURNAROUND TIME WILL NOT START UNTIL ALL QUESTIONS ARE ANSWERED BY OUR CLIENT.

AIHA, NELAC & WBE/DBE Certified

Detailed Results

Tracking no.: 876275674947 Select time format: 12H | 24H E-mail notifications

Delivered

Initiated → Picked up → In transit → Delivered

Delivered
Signed for by: C.COLLINS

Shipment Dates

Ship date Jan 31, 2012
Delivery date Feb 1, 2012 12:19 PM

Destination

Signature Proof of Delivery

Shipment Options

Help

Hold at FedEx Location
Hold at FedEx Location service is not available for this shipment.

Shipment Facts

Help

Service type	Priority Overnight	Delivered to	Shipping/Receiving
Weight	14.0 lbs/6.4 kg		

Shipment Travel History

Help

Select time zone: Local Scan Time

All shipment travel activity is displayed in local time for the location

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AIR Only Receipt Checklist

39 Spruce St.
East Longmeadow, MA.
01028
P: 413-525-2332
F: 413-525-6405

CLIENT NAME: ECS Carolinas RECEIVED BY: AP DATE: 2/1/12

1) Was the chain(s) of custody relinquished and signed? Yes No

2) Does the chain agree with the samples? Yes No
If not, explain:

3) Are all the samples in good condition? Yes No
If not, explain:

4) Are there any samples "On Hold"? Yes No Stored where:

5) Are there any RUSH or SHORT HOLDING TIME samples? Yes No

Who was notified _____ Date _____ Time _____

6) Location where samples are stored: AirLab

Permission to subcontract samples? Yes No
(Walk-in clients only) if not already approved
Client Signature: _____

Air Media received at Con-Test

			# of Containers	Types (Size, Duration)
Air Sampling Media	Summa Cans		2	6L
	Tedlar Bags			
	Tubes			
Flow Controllers	Regulators			30min
	Restrictors			
Extras	Tubing			
	Other			

Unused Summas:
1212
1781

Unused Regulators:
4066
4075

1) Was all media (used & unused checked into the WASP?

2) Were all returned summa cans, Restrictors, & Regulators documented as returned in the Air Lab Inbound/Outbound Excel Spreadsheet?

Laboratory Comments:

APPENDIX – E

Chem Bldg Cd

VSP Sample Design Report for Calculating a Two-Sided Confidence Interval for the Population Median Using Simple Random Sampling

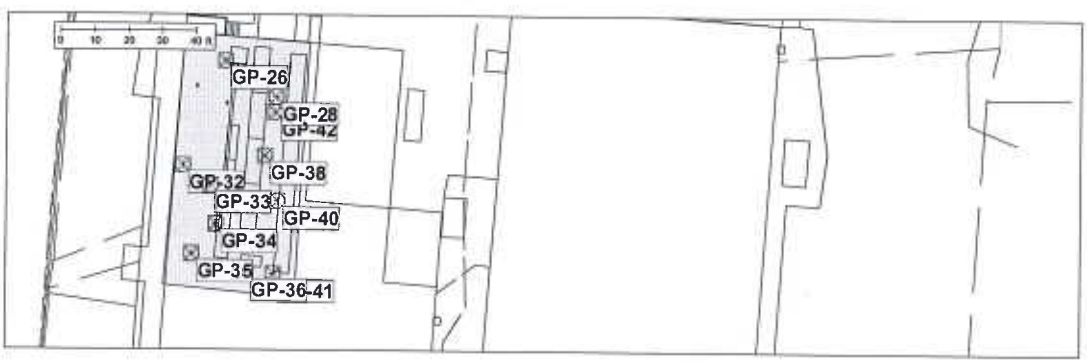
Summary

This report summarizes the sampling design used, associated statistical assumptions, as well as general guidelines for conducting post-sampling data analysis. Sampling plan components presented here include how many sampling locations to choose and where within the sampling area to collect those samples. The type of medium to sample (i.e., soil, groundwater, etc.) and how to analyze the samples (in-situ, fixed laboratory, etc.) are addressed in other sections of the sampling plan.

The following table summarizes the sampling design developed. A figure that shows sampling locations in the field and a table that lists sampling location coordinates are also provided below.

SUMMARY OF SAMPLING DESIGN	
Primary Objective of Design	Construct a Confidence Interval on the True Median
Type of Sampling Design	Non-Parametric
Sample Placement (Location) in the Field	Simple random sampling
Formula for calculating number of sampling locations	Nonparametric Confidence Limits
Calculated total number of samples	15
Number of samples on map [a]	15
Number of selected sample areas [b]	1
Specified sampling area [c]	2826.73 ft^2
Total cost of sampling [d]	$8,050.00

[a] This number may differ from the calculated number because of 1) grid edge effects, 2) adding judgment samples, or 3) selecting or unselecting sample areas.
[b] The number of selected sample areas is the number of colored areas on the map of the site. These sample areas contain the locations where samples are collected.
[c] The sampling area is the total surface area of the selected colored sample areas on the map of the site.
[d] Including measurement analyses and fixed overhead costs. See the Cost of Sampling section for an explanation of the costs presented here.



Area: Area 3					
X Coord	Y Coord	Label	Value	Type	Historical
4947.9347	5089.9428	GP-41	0.015	Random	
4921.1000	5121.6752	GP-32	0.015	Random	
4930.8339	5104.5202	GP-34	9.9	Random	

4948.3017	5137.2526	GP-42	0.016	Random	
4939.8843	5090.2245	GP-36	0.016	Random	
4929.1504	5115.9569	GP-33	4.9	Random	
4948.6182	5141.6892	GP-28	24	Random	
4923.7835	5095.8019	GP-35	0.016	Random	
4945.2513	5124.5343	GP-38	0.016	Random	
4933.5174	5152.2667	GP-26	0.016	Random	
4949.2765	5111.1916	GP-40	0.015	Random	
4934.0000	5140.0000	GP-31	0.016	Unknown	
4925.0000	5145.0000	GP-30	2.6	Unknown	
4937.0000	5111.0000	GP-37	0.016	Unknown	
4957.0000	5134.0000	GP-39	3.2	Unknown	

Primary Sampling Objective
The primary purpose of sampling at this site is to construct a confidence interval on the true population median value. After the samples are collected and analyzed, the resulting sample values can be used to construct a two-sided confidence interval. Once the confidence interval is computed (which will be an upper and a lower threshold), you can have the specified confidence that the true population median is between the upper and lower thresholds.

Selected Sampling Approach
A non-parametric random sampling approach was used to determine the number of samples and to specify sampling locations. A parametric formula was not chosen because the conceptual model and historical information (e.g., historical data from this site or a very similar site) indicate that parametric assumptions are not true. These assumptions will be examined in post-sampling data analysis.

Both parametric and non-parametric equations rely on assumptions about the population. Typically, however, non-parametric equations require fewer assumptions and allow for more uncertainty about the statistical distribution of values at the site. The trade-off is that if the parametric assumptions are valid, the required number of samples is usually less than if a non-parametric equation was used.

Locating the sample points randomly provides data that are separated by many distances, whereas systematic samples are all equidistant apart. Therefore, random sampling provides more information about the spatial structure of the potential contamination than systematic sampling does. As with systematic sampling, random sampling also provides information regarding the mean or median value, but there is the possibility that areas of the site will not be represented with the same frequency as if uniform grid sampling were performed.

Number of Total Samples: Calculation Equation and Inputs
Two sample confidence interval calculation methods are available for when n□20 and n>20 (Conover, 1980, p. 111-117) (Gilbert, 1987,p. 141-142). In VSP, the user specifies a one-sided or two-sided CI, and the percent confidence desired to be within a specified number of percentiles of the median. A binary search is then performed on the CI equations to solve for the minimum sample size to satisfy these parameters. VSP first uses the n□20 method to determine if a solution can be found where n□20, and if not, then uses the n>20 method.

For a one-sided CI, the n□20 method follows a binomial distribution and determines the lowest value of n where the yth quantile of the sample would be equal to or above the true median at least X% of the time (Note that the sample sizes work out to be the same regardless of whether the CI will be a lower or upper tailed, so the same formula can be used for any one-sided CI). X% is the specified confidence for one-sided confidence intervals, and the average of 100% and the specified confidence for two-sided confidence intervals. The yth quantile is determined by taking 50% and subtracting the allowable number of percentiles from the median specified by the user.

For a two-sided CI, the n□20 method is the same as performing a one-sided confidence interval, but replacing the specified percent confidence with the average of 100% and the specified percent confidence. If no solution is found where n□20, a binary search is conducted using Equation (1) for a one-sided CI and Equation (2) for a two-sided interval to compute the value of r (r is the the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest), rounding r up to the next higher integer. The search is repeated until the smallest n is

found where 100*2*r/n is greater than 50% minus the allowable number of percentiles from the median specified by the user.

$$r = 0.5 * n - 0.5 * w_{\alpha} \sqrt{n} \qquad (1)$$

$$r = 0.5 * n - 0.5 * w_{\alpha/2} \sqrt{n} \qquad (2)$$

Where:

n is the sample size

r is the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest

$w_{\square}$ is the specified quantile of a normal distribution, e.g. if $\square$=0.2 then $w_{\square}$ is the 0.2 quantile (20th percentile) of a normal distribution.

The n>20 method described above is an approximation method, so VSP also performs a final check using a binomial distribution in a similar manner to the n$\square$20 method, and may increase the sample size by 1 to ensure the specified confidence levels are met.

Cost of Sampling
The total cost of the completed sampling program depends on several cost inputs, some of which are fixed, and others that are based on the number of samples collected and measured. Based on the numbers of samples determined above, the estimated total cost of sampling and analysis at this site is $8,050.00, which averages out to a per sample cost of $536.67. The following table summarizes the inputs and resulting cost estimates.

COST INFORMATION			
Cost Details	**Per Analysis**	**Per Sample**	**15 Samples**
Field collection costs		$250.00	$3,750.00
Analytical costs	$220.00	$220.00	$3,300.00
Sum of Field & Analytical costs		**$470.00**	**$7,050.00**
Fixed planning and validation costs			$1,000.00
Total cost			**$8,050.00**

Data Analysis for Cd
The following data points were entered by the user for analysis.

Cd										
Rank	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
0	0.015	0.015	0.015	0.016	0.016	0.016	0.016	0.016	0.016	0.016
10	2.6	3.2	4.9	9.9	24					

SUMMARY STATISTICS for Cd	
n	15
Min	0.015
Max	24
Range	23.985
Mean	2.9838
Median	0.016

Variance	41.534
StdDev	6.4447
Std Error	1.664
Skewness	2.8816
Interquartile Range	3.184

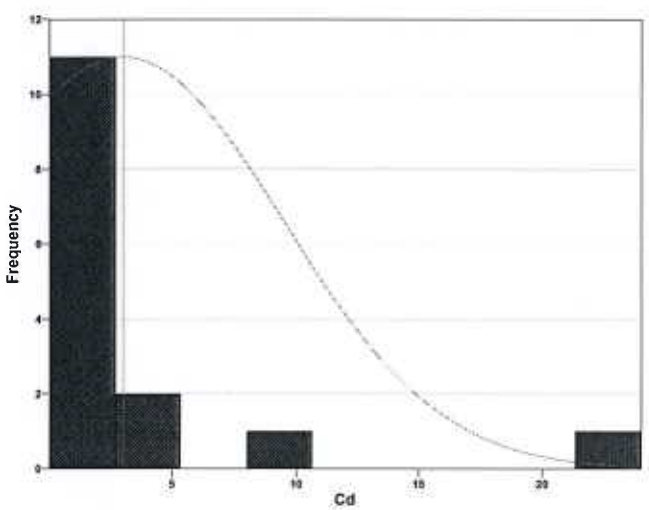
Percentiles								
1%	**5%**	**10%**	**25%**	**50%**	**75%**	**90%**	**95%**	**99%**
0.015	0.015	0.015	0.016	0.016	3.2	15.54	24	24

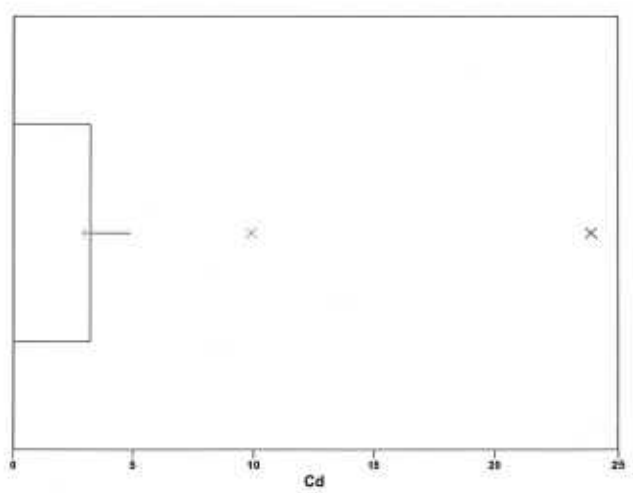
Data Plots
Three graphical displays of the data are shown below: the Histogram, the Box and Whiskers plot, and the Quantile-Quantile (Q-Q) plot.

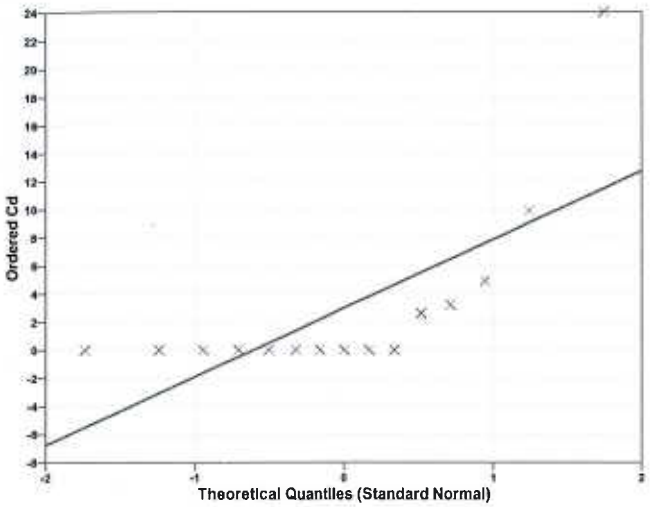
The Histogram is a plot of the fraction of the n observed data that fall within specified data "bins." A histogram is generated by dividing the x axis (range of the observed data values) into "bins" and displaying the number of data in each bin as the height of a bar for the bin. The area of the bar is the fraction of the n data values that lie within the bin. The sum of the fractions for all bins equals one. A histogram is used to assess how the n data are distributed (spread) over their range of values. If the histogram is more or less symmetric and bell shaped, then the data may be normally distributed.

The Box and Whiskers plot is composed of a central box divided by a line, and with two lines extending out from the box, called the "whiskers". The line through the box is drawn at the median of the n data observed. The two ends of the box represent the 25th and 75th percentiles of the n data values, which are also called the lower and upper quartiles, respectively, of the data set. The sample mean (mean of the n data) is shown as a "+" sign. The upper whisker extends to the largest data value that is less than the upper quartile plus 1.5 times the interquartile range (upper quartile minus the lower quartile). The lower whisker extends to the smallest data value that is greater than the lower quartile minus 1.5 times the interquartile range. Extreme data values (greater or smaller than the ends of the whiskers) are plotted individually. A Box and Whiskers plot is used to assess the symmetry of the distribution of the data set. If the distribution is symmetrical, the box is divided into two equal halves by the median, the whiskers will be the same length, and the number of extreme data points will be distributed equally on either end of the plot.

The Q-Q plot graphs the quantiles of a set of n data against the quantiles of a specific distribution. We show here only the Q-Q plot for an assumed normal distribution. The pth quantile of a distribution of data is the data value, x_n, for which a fraction p of the distribution is less than x_n. If the data plotted on the normal distribution Q-Q plot closely follow a straight line, even at the ends of the line, then the data may be assumed to be normally distributed. If the data points deviate substantially from a linear line, then the data are not normally distributed.







For more information on these three plots consult Guidance for Data Quality Assessment, EPA QA/G-9, pgs 2.3-1 through 2.3-12. (http://www.epa.gov/quality/qa-docs.html).

Two-Sided Confidence Interval on the True Median

For calculating the confidence interval, the values are ordered from smallest to largest. The confidence limits are the highest value of the r+1 and/or lowest value of the s-1 order statistics that fit the formulas below, except when the rth ordered value is tied with higher ordered values or the sth ordered value is tied with lower ordered values. If higher numbered ordered values are ties with the rth ordered value, then the closest ordered value that is lower than r will be the confidence limit. If higher-numbered ordered values are ties with the sth ordered value, then the closest ordered value that is higher than s will be the confidence limit.

Upper Two-Sided Confidence Interval

$$\sum_{s}^{1}\left(\frac{n!}{r!(n-s)!}\right)p^{0.5}(1-p)^{n-0.5} \geq 1-\alpha/2$$

Lower Two-Sided Confidence interval

$$\sum_{r}^{1}\left(\frac{n!}{r!(n-r)!}\right)p^{0.5}(1-p)^{n-0.5} \leq \alpha/2$$

Upper 95% Two-Sided Confidence Interval on the Median	4.9
Sample Median	0.016
Lower 95% Two-Sided Confidence Interval on the Median	0.015

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* - The report contents may have been modified or reformatted by end-user of software.

Chem Bldg Cd Borehole

VSP Sample Design Report for Calculating a Two-Sided Confidence Interval for the Population Median Using Simple Random Sampling

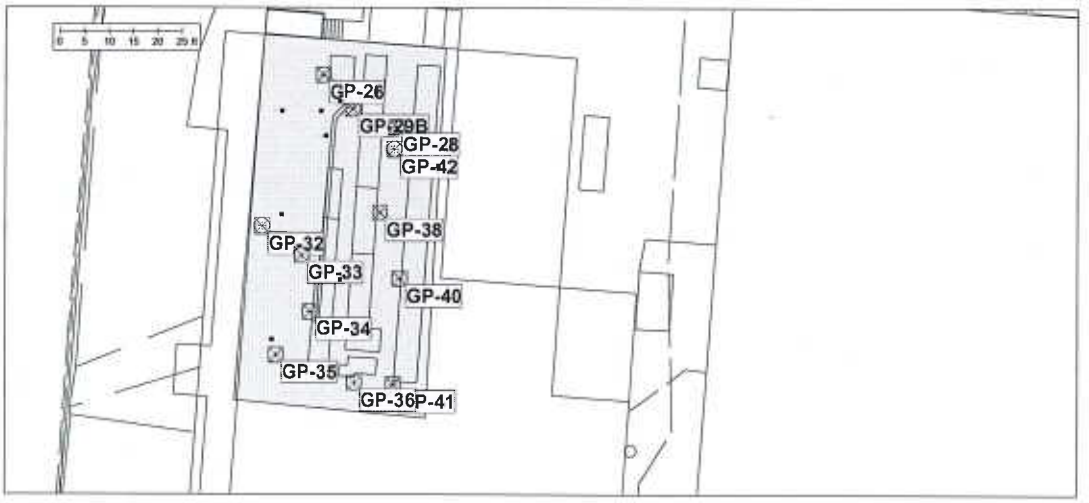
Summary

This report summarizes the sampling design used, associated statistical assumptions, as well as general guidelines for conducting post-sampling data analysis. Sampling plan components presented here include how many sampling locations to choose and where within the sampling area to collect those samples. The type of medium to sample (i.e., soil, groundwater, etc.) and how to analyze the samples (in-situ, fixed laboratory, etc.) are addressed in other sections of the sampling plan.

The following table summarizes the sampling design developed. A figure that shows sampling locations in the field and a table that lists sampling location coordinates are also provided below.

SUMMARY OF SAMPLING DESIGN	
Primary Objective of Design	Construct a Confidence Interval on the True Median
Type of Sampling Design	Non-Parametric
Sample Placement (Location) in the Field	Simple random sampling
Formula for calculating number of sampling locations	Nonparametric Confidence Limits
Calculated total number of samples	15
Number of samples on map [a]	20
Number of selected sample areas [b]	1
Specified sampling area [c]	2826.73 ft^2
Total cost of sampling [d]	$8,050.00

[a] This number may differ from the calculated number because of 1) grid edge effects, 2) adding judgment samples, or 3) selecting or unselecting sample areas.
[b] The number of selected sample areas is the number of colored areas on the map of the site. These sample areas contain the locations where samples are collected.
[c] The sampling area is the total surface area of the selected colored sample areas on the map of the site.
[d] Including measurement analyses and fixed overhead costs. See the Cost of Sampling section for an explanation of the costs presented here.



Area: Area 3					
X Coord	Y Coord	Label	Value	Type	Historical

4947.9347	5089.9428	GP-41	0.015	Random	
4921.1000	5121.6752	GP-32	0.015	Random	
4939.5678	5145.4075	GP-29B	11	Random	
4930.8339	5104.5202	GP-34	9.9	Random	
4948.3017	5137.2526	GP-42	0.016	Random	
4939.8843	5090.2245	GP-36	0.16	Random	
4929.1504	5115.9569	GP-33	4.9	Random	
4948.6182	5141.6892	GP-28	24	Random	
4923.7835	5095.8019	GP-35	0.016	Random	
4945.2513	5124.5343	GP-38	0.015	Random	
4933.5174	5152.2667	GP-26	0.016	Random	
4949.2765	5111.1916	GP-40	0.015	Random	
4937.0000	5147.0000	GP-27B	3.7	Unknown	
4934.0000	5140.0000	GP-31	0.016	Unknown	
4925.0000	5145.0000	GP-30	2.6	Unknown	
4937.0000	5111.0000	GP-37	0.016	Unknown	
4957.0000	5134.0000	GP-39	3.2	Unknown	
4923.0000	5099.0000	HA-1		Unknown	
4925.0000	5124.0000	HA-2		Unknown	
4933.0000	5145.0000	HA-3		Unknown	

Primary Sampling Objective
The primary purpose of sampling at this site is to construct a confidence interval on the true population median value. After the samples are collected and analyzed, the resulting sample values can be used to construct a two-sided confidence interval. Once the confidence interval is computed (which will be an upper and a lower threshold), you can have the specified confidence that the true population median is between the upper and lower thresholds.

Selected Sampling Approach
A non-parametric random sampling approach was used to determine the number of samples and to specify sampling locations. A parametric formula was not chosen because the conceptual model and historical information (e.g., historical data from this site or a very similar site) indicate that parametric assumptions are not true. These assumptions will be examined in post-sampling data analysis.

Both parametric and non-parametric equations rely on assumptions about the population. Typically, however, non-parametric equations require fewer assumptions and allow for more uncertainty about the statistical distribution of values at the site. The trade-off is that if the parametric assumptions are valid, the required number of samples is usually less than if a non-parametric equation was used.

Locating the sample points randomly provides data that are separated by many distances, whereas systematic samples are all equidistant apart. Therefore, random sampling provides more information about the spatial structure of the potential contamination than systematic sampling does. As with systematic sampling, random sampling also provides information regarding the mean or median value, but there is the possibility that areas of the site will not be represented with the same frequency as if uniform grid sampling were performed.

Number of Total Samples: Calculation Equation and Inputs
Two sample confidence interval calculation methods are available for when n□20 and n>20 (Conover, 1980, p. 111-117) (Gilbert, 1987,p. 141-142). In VSP, the user specifies a one-sided or two-sided CI, and the percent confidence desired to be within a specified number of percentiles of the median. A binary search is then performed on the CI equations to solve for the minimum sample size to satisfy these parameters. VSP first uses the n□20 method to determine if a solution can be found where n□20, and if not, then uses the n>20 method.

For a one-sided CI, the n□20 method follows a binomial distribution and determines the lowest value of n where the yth quantile of the sample would be equal to or above the true median at least X% of the time (Note that the sample sizes work out to be the same regardless of whether the CI will be a lower or upper tailed, so the same formula can be used for any one-sided CI). X% is the specified confidence for one-sided confidence intervals, and the average of 100% and the specified confidence for two-sided confidence intervals. The yth quantile is determined by taking 50% and subtracting the allowable number of percentiles from the median specified by the user.

For a two-sided CI, the n□20 method is the same as performing a one-sided confidence interval, but replacing the specified percent confidence with the average of 100% and the specified percent confidence. If no solution is found where n□20, a binary search is conducted using Equation (1) for a one-sided CI and Equation (2) for a two-sided interval to compute the value of r (r is the the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest), rounding r up to the next higher integer. The search is repeated until the smallest n is found where 100*2*r/n is greater than 50% minus the allowable number of percentiles from the median specified by the user.

$$r = 0.5 * n - 0.5 * w_{\alpha} \sqrt{n} \qquad (1)$$

$$r = 0.5 * n - 0.5 * w_{\alpha/2} \sqrt{n} \qquad (2)$$

Where:

n is the sample size

r is the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest

$w_{\square}$ is the specified quantile of a normal distribution, e.g. if □=0.2 then $w_{\square}$ is the 0.2 quantile (20th percentile) of a normal distribution.

The n>20 method described above is an approximation method, so VSP also performs a final check using a binomial distribution in a similar manner to the n□20 method, and may increase the sample size by 1 to ensure the specified confidence levels are met.

Cost of Sampling

The total cost of the completed sampling program depends on several cost inputs, some of which are fixed, and others that are based on the number of samples collected and measured. Based on the numbers of samples determined above, the estimated total cost of sampling and analysis at this site is $8,050.00, which averages out to a per sample cost of $536.67. The following table summarizes the inputs and resulting cost estimates.

COST INFORMATION			
Cost Details	**Per Analysis**	**Per Sample**	**15 Samples**
Field collection costs		$250.00	$3,750.00
Analytical costs	$220.00	$220.00	$3,300.00
Sum of Field & Analytical costs		**$470.00**	**$7,050.00**
Fixed planning and validation costs			$1,000.00
Total cost			**$8,050.00**

Data Analysis for Cd

The following data points were entered by the user for analysis.

Cd										
Rank	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
0	0.015	0.015	0.015	0.015	0.016	0.016	0.016	0.016	0.016	0.16
10	2.6	3.2	3.7	4.9	9.9	11	24			

SUMMARY STATISTICS for Cd	
n	17
Min	0.015
Max	24
Range	23.985
Mean	3.5059
Median	0.016
Variance	40.049
StdDev	6.3284
Std Error	1.5349
Skewness	2.4795
Interquartile Range	4.2845

Percentiles								
1%	5%	10%	25%	50%	75%	90%	95%	99%
0.015	0.015	0.015	0.0155	0.016	4.3	13.6	24	24

Data Plots

Three graphical displays of the data are shown below: the Histogram, the Box and Whiskers plot, and the Quantile-Quantile (Q-Q) plot.

The Histogram is a plot of the fraction of the n observed data that fall within specified data "bins." A histogram is generated by dividing the x axis (range of the observed data values) into "bins" and displaying the number of data in each bin as the height of a bar for the bin. The area of the bar is the fraction of the n data values that lie within the bin. The sum of the fractions for all bins equals one. A histogram is used to assess how the n data are distributed (spread) over their range of values. If the histogram is more or less symmetric and bell shaped, then the data may be normally distributed.

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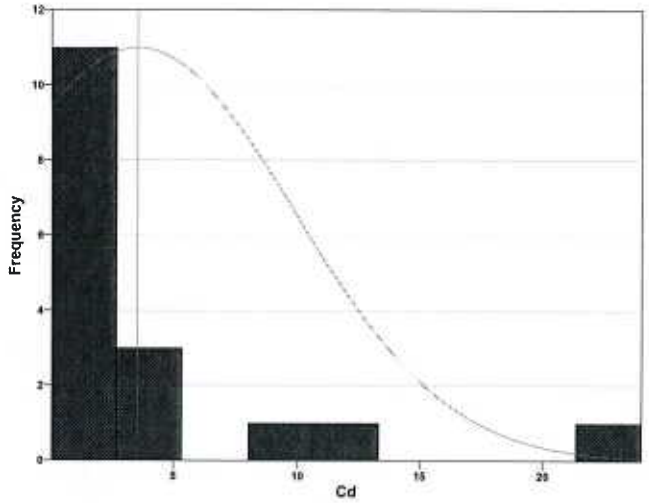
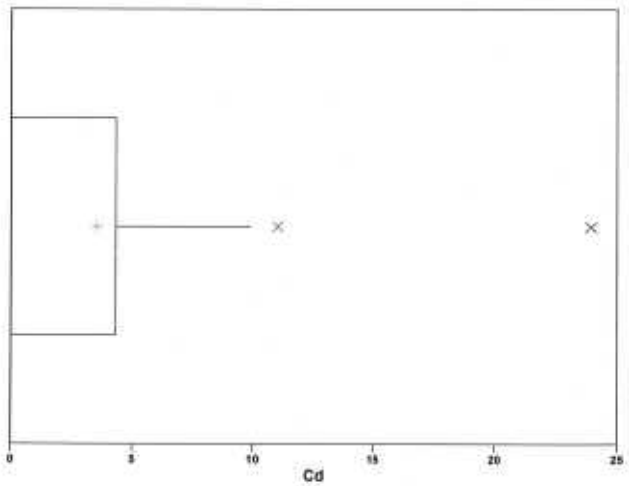
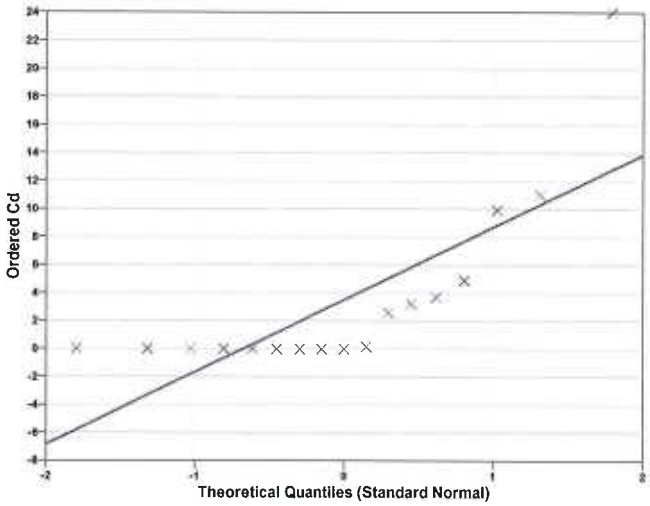
The Q-Q plot graphs the quantiles of a set of n data against the quantiles of a specific distribution. We show here only the Q-Q plot for an assumed normal distribution. The pth quantile of a distribution of data is the data value, x_p, for which a fraction p of the distribution is less than x_p. If the data plotted on the normal distribution Q-Q plot closely follow a straight line, even at the ends of the line, then the data may be assumed to be normally distributed. If the data points deviate substantially from a linear line, then the data are not normally distributed.







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Two-Sided Confidence Interval on the True Median

For calculating the confidence interval, the values are ordered from smallest to largest. The confidence limits are the highest value of the r+1 and/or lowest value of the s-1 order statistics that fit the formulas below, except when the rth ordered value is tied with higher ordered values or the sth ordered value is tied with lower ordered values. If higher numbered ordered values are ties with the rth ordered value, then the closest ordered value that is lower than r will be the confidence limit. If higher-numbered ordered values are ties with the sth ordered value, then the closest ordered value that is higher than s will be the confidence limit.

Upper Two-Sided Confidence Interval

$$\sum_{s}^{1}\left(\frac{n!}{r!(n-s)!}\right)p^{0.5}(1-p)^{n-0.5} \geq 1-\alpha/2$$

Lower Two-Sided Confidence interval

$$\sum_{r}^{1}\left(\frac{n!}{r!(n-r)!}\right)p^{0.5}(1-p)^{n-0.5} \leq \alpha/2$$

Upper 95% Two-Sided Confidence Interval on the Median	4.9

Sample Median	0.016
Lower 95% Two-Sided Confidence Interval on the Median	0.015

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* - The report contents may have been modified or reformatted by end-user of software.

Chrome Bldg Crt 3

VSP Sample Design Report for Calculating a Two-Sided Confidence Interval for the Population Median Using Simple Random Sampling

Summary

This report summarizes the sampling design used, associated statistical assumptions, as well as general guidelines for conducting post-sampling data analysis. Sampling plan components presented here include how many sampling locations to choose and where within the sampling area to collect those samples. The type of medium to sample (i.e., soil, groundwater, etc.) and how to analyze the samples (in-situ, fixed laboratory, etc.) are addressed in other sections of the sampling plan.

The following table summarizes the sampling design developed. A figure that shows sampling locations in the field and a table that lists sampling location coordinates are also provided below.

SUMMARY OF SAMPLING DESIGN	
Primary Objective of Design	Construct a Confidence Interval on the True Median
Type of Sampling Design	Non-Parametric
Sample Placement (Location) in the Field	Simple random sampling
Formula for calculating number of sampling locations	Nonparametric Confidence Limits
Calculated total number of samples	15
Number of samples on map [a]	15
Number of selected sample areas [b]	1
Specified sampling area [c]	2826.73 ft^2
Total cost of sampling [d]	$8,050.00

[a] This number may differ from the calculated number because of 1) grid edge effects, 2) adding judgment samples, or 3) selecting or unselecting sample areas.
[b] The number of selected sample areas is the number of colored areas on the map of the site. These sample areas contain the locations where samples are collected.
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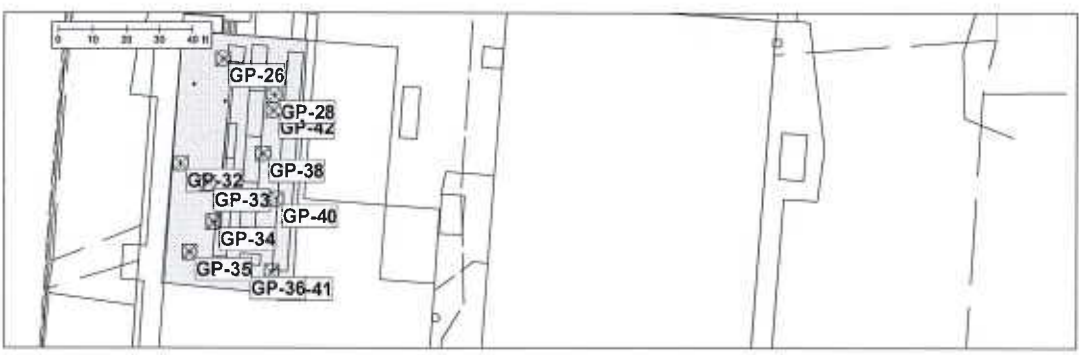

Area: Area 3					
X Coord	Y Coord	Label	Value	Type	Historical
4947.9347	5089.9428	GP-41	20	Random	
4921.1000	5121.6752	GP-32	34.14	Random	
4930.8339	5104.5202	GP-34	108	Random	

4948.3017	5137.2526	GP-42	46	Random	
4939.8843	5090.2245	GP-36	5.9	Random	
4929.1504	5115.9569	GP-33	43.89	Random	
4948.6182	5141.6892	GP-28	5198	Random	
4923.7835	5095.8019	GP-35	36	Random	
4945.2513	5124.5343	GP-38	29.5	Random	
4933.5174	5152.2667	GP-26	39	Random	
4949.2765	5111.1916	GP-40	3.59	Random	
4934.0000	5140.0000	GP-31	66.33	Unknown	
4925.0000	5145.0000	GP-30	44	Unknown	
4937.0000	5111.0000	GP-37	12.52	Unknown	
4957.0000	5134.0000	GP-39	35.03	Unknown	

Primary Sampling Objective
The primary purpose of sampling at this site is to construct a confidence interval on the true population median value. After the samples are collected and analyzed, the resulting sample values can be used to construct a two-sided confidence interval. Once the confidence interval is computed (which will be an upper and a lower threshold), you can have the specified confidence that the true population median is between the upper and lower thresholds.

Selected Sampling Approach
A non-parametric random sampling approach was used to determine the number of samples and to specify sampling locations. A parametric formula was not chosen because the conceptual model and historical information (e.g., historical data from this site or a very similar site) indicate that parametric assumptions are not true. These assumptions will be examined in post-sampling data analysis.

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Locating the sample points randomly provides data that are separated by many distances, whereas systematic samples are all equidistant apart. Therefore, random sampling provides more information about the spatial structure of the potential contamination than systematic sampling does. As with systematic sampling, random sampling also provides information regarding the mean or median value, but there is the possibility that areas of the site will not be represented with the same frequency as if uniform grid sampling were performed.

Number of Total Samples: Calculation Equation and Inputs
Two sample confidence interval calculation methods are available for when n□20 and n>20 (Conover, 1980, p. 111-117) (Gilbert, 1987,p. 141-142). In VSP, the user specifies a one-sided or two-sided CI, and the percent confidence desired to be within a specified number of percentiles of the median. A binary search is then performed on the CI equations to solve for the minimum sample size to satisfy these parameters. VSP first uses the n□20 method to determine if a solution can be found where n□20, and if not, then uses the n>20 method.

For a one-sided CI, the n□20 method follows a binomial distribution and determines the lowest value of n where the yth quantile of the sample would be equal to or above the true median at least X% of the time (Note that the sample sizes work out to be the same regardless of whether the CI will be a lower or upper tailed, so the same formula can be used for any one-sided CI). X% is the specified confidence for one-sided confidence intervals, and the average of 100% and the specified confidence for two-sided confidence intervals. The yth quantile is determined by taking 50% and subtracting the allowable number of percentiles from the median specified by the user.

For a two-sided CI, the n□20 method is the same as performing a one-sided confidence interval, but replacing the specified percent confidence with the average of 100% and the specified percent confidence. If no solution is found where n□20, a binary search is conducted using Equation (1) for a one-sided CI and Equation (2) for a two-sided interval to compute the value of r (r is the the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest), rounding r up to the next higher integer. The search is repeated until the smallest n is

found where 100*2*r/n is greater than 50% minus the allowable number of percentiles from the median specified by the user.

$$r = 0.5 * n - 0.5 * w_{\alpha} \sqrt{n} \qquad (1)$$

$$r = 0.5 * n - 0.5 * w_{\alpha/2} \sqrt{n} \qquad (2)$$

Where:

n is the sample size

r is the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest

$w_{\square}$ is the specified quantile of a normal distribution, e.g. if □=0.2 then $w_{\square}$ is the 0.2 quantile (20th percentile) of a normal distribution.

The n>20 method described above is an approximation method, so VSP also performs a final check using a binomial distribution in a similar manner to the n□20 method, and may increase the sample size by 1 to ensure the specified confidence levels are met.

Cost of Sampling
The total cost of the completed sampling program depends on several cost inputs, some of which are fixed, and others that are based on the number of samples collected and measured. Based on the numbers of samples determined above, the estimated total cost of sampling and analysis at this site is $8,050.00, which averages out to a per sample cost of $536.67. The following table summarizes the inputs and resulting cost estimates.

COST INFORMATION			
Cost Details	**Per Analysis**	**Per Sample**	**15 Samples**
Field collection costs		$250.00	$3,750.00
Analytical costs	$220.00	$220.00	$3,300.00
Sum of Field & Analytical costs		**$470.00**	**$7,050.00**
Fixed planning and validation costs			$1,000.00
Total cost			**$8,050.00**

Data Analysis for 3
The following data points were entered by the user for analysis.

3										
Rank	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
0	3.59	5.9	12.52	20	29.5	34.14	35.03	36	39	43.89
10	44	46	66.33	108	5198					

SUMMARY STATISTICS for 3	
n	15
Min	3.59
Max	5198
Range	5194.4
Mean	381.46
Median	36

Variance	1.7761e+006
StdDev	1332.7
Std Error	344.1
Skewness	3.8705
Interquartile Range	26

Percentiles								
1%	**5%**	**10%**	**25%**	**50%**	**75%**	**90%**	**95%**	**99%**
3.59	3.59	4.976	20	36	46	2144	5198	5198

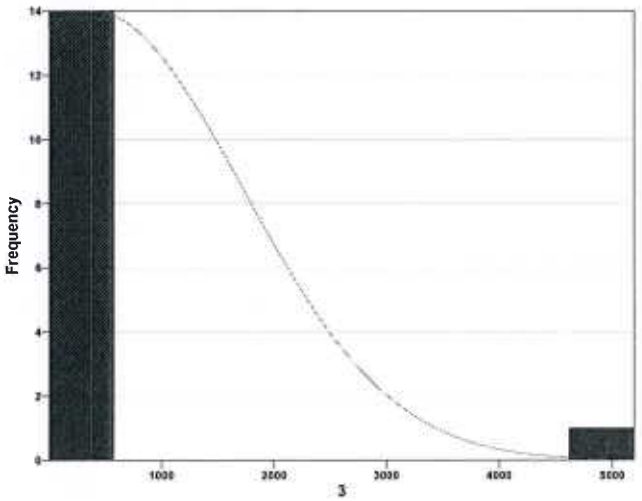
Data Plots

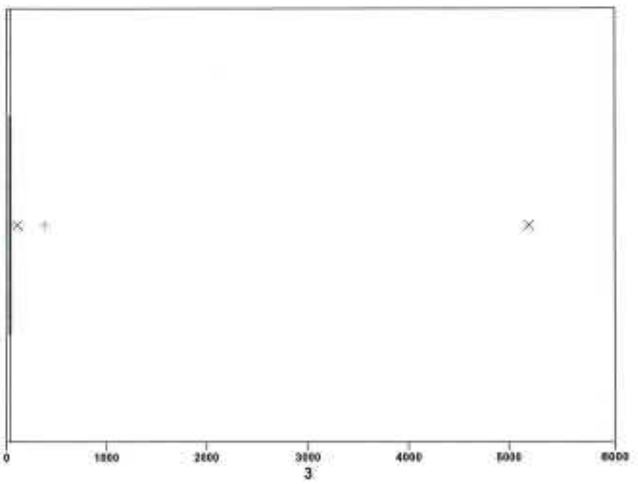
Three graphical displays of the data are shown below: the Histogram, the Box and Whiskers plot, and the Quantile-Quantile (Q-Q) plot.

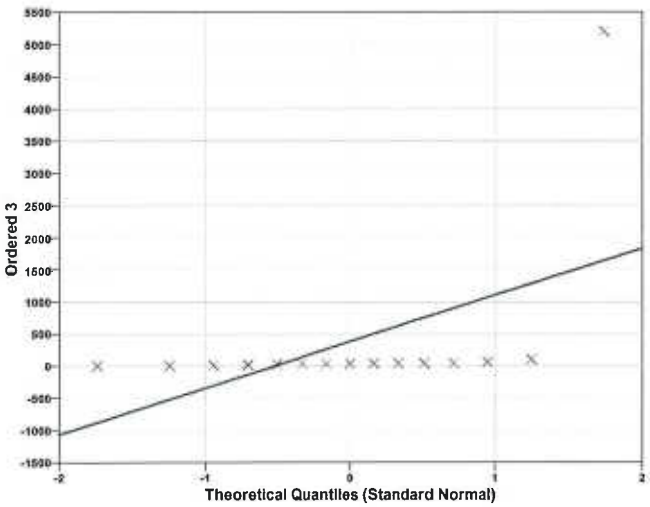
The Histogram is a plot of the fraction of the n observed data that fall within specified data "bins." A histogram is generated by dividing the x axis (range of the observed data values) into "bins" and displaying the number of data in each bin as the height of a bar for the bin. The area of the bar is the fraction of the n data values that lie within the bin. The sum of the fractions for all bins equals one. A histogram is used to assess how the n data are distributed (spread) over their range of values. If the histogram is more or less symmetric and bell shaped, then the data may be normally distributed.

The Box and Whiskers plot is composed of a central box divided by a line, and with two lines extending out from the box, called the "whiskers". The line through the box is drawn at the median of the n data observed. The two ends of the box represent the 25th and 75th percentiles of the n data values, which are also called the lower and upper quartiles, respectively, of the data set. The sample mean (mean of the n data) is shown as a "+" sign. The upper whisker extends to the largest data value that is less than the upper quartile plus 1.5 times the interquartile range (upper quartile minus the lower quartile). The lower whisker extends to the smallest data value that is greater than the lower quartile minus 1.5 times the interquartile range. Extreme data values (greater or smaller than the ends of the whiskers) are plotted individually. A Box and Whiskers plot is used to assess the symmetry of the distribution of the data set. If the distribution is symmetrical, the box is divided into two equal halves by the median, the whiskers will be the same length, and the number of extreme data points will be distributed equally on either end of the plot.

The Q-Q plot graphs the quantiles of a set of n data against the quantiles of a specific distribution. We show here only the Q-Q plot for an assumed normal distribution. The pth quantile of a distribution of data is the data value, x_n, for which a fraction p of the distribution is less than x_n. If the data plotted on the normal distribution Q-Q plot closely follow a straight line, even at the ends of the line, then the data may be assumed to be normally distributed. If the data points deviate substantially from a linear line, then the data are not normally distributed.







For more information on these three plots consult Guidance for Data Quality Assessment, EPA QA/G-9, pgs 2.3-1 through 2.3-12. (http://www.epa.gov/quality/qa-docs.html).

Two-Sided Confidence Interval on the True Median

For calculating the confidence interval, the values are ordered from smallest to largest. The confidence limits are the highest value of the r+1 and/or lowest value of the s-1 order statistics that fit the formulas below, except when the rth ordered value is tied with higher ordered values or the sth ordered value is tied with lower ordered values. If higher numbered ordered values are ties with the rth ordered value, then the closest ordered value that is lower than r will be the confidence limit. If higher-numbered ordered values are ties with the sth ordered value, then the closest ordered value that is higher than s will be the confidence limit.

Upper Two-Sided Confidence Interval

$$\sum_{s}^{1}\left(\frac{n!}{r!(n-s)!}\right)p^{0.5}(1-p)^{n-0.5} \geq 1-\alpha/2$$

Lower Two-Sided Confidence interval

$$\sum_{r}^{1}\left(\frac{n!}{r!(n-r)!}\right)p^{0.5}(1-p)^{n-0.5} \leq \alpha/2$$

Upper 95% Two-Sided Confidence Interval on the Median	66.33
Sample Median	36
Lower 95% Two-Sided Confidence Interval on the Median	12.52

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* - The report contents may have been modified or reformatted by end-user of software.

Chrome Bldg Cr+3 biased

VSP Sample Design Report for Calculating a Two-Sided Confidence Interval for the Population Median Using Simple Random Sampling

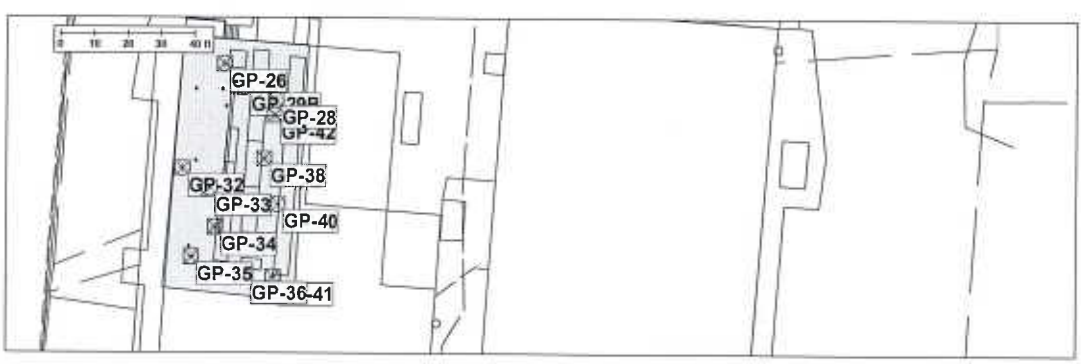
Summary

This report summarizes the sampling design used, associated statistical assumptions, as well as general guidelines for conducting post-sampling data analysis. Sampling plan components presented here include how many sampling locations to choose and where within the sampling area to collect those samples. The type of medium to sample (i.e., soil, groundwater, etc.) and how to analyze the samples (in-situ, fixed laboratory, etc.) are addressed in other sections of the sampling plan.

The following table summarizes the sampling design developed. A figure that shows sampling locations in the field and a table that lists sampling location coordinates are also provided below.

SUMMARY OF SAMPLING DESIGN	
Primary Objective of Design	Construct a Confidence Interval on the True Median
Type of Sampling Design	Non-Parametric
Sample Placement (Location) in the Field	Simple random sampling
Formula for calculating number of sampling locations	Nonparametric Confidence Limits
Calculated total number of samples	15
Number of samples on map [a]	20
Number of selected sample areas [b]	1
Specified sampling area [c]	2826.73 ft^2
Total cost of sampling [d]	$8,050.00

[a] This number may differ from the calculated number because of 1) grid edge effects, 2) adding judgment samples, or 3) selecting or unselecting sample areas.
[b] The number of selected sample areas is the number of colored areas on the map of the site. These sample areas contain the locations where samples are collected.
[c] The sampling area is the total surface area of the selected colored sample areas on the map of the site.
[d] Including measurement analyses and fixed overhead costs. See the Cost of Sampling section for an explanation of the costs presented here.



Area: Area 3					
X Coord	Y Coord	Label	Value	Type	Historical
4947.9347	5089.9428	GP-41	20	Random	
4921.1000	5121.6752	GP-32	34.14	Random	
4939.5678	5145.4075	GP-29B	87	Random	

4930.8339	5104.5202	GP-34	108	Random	
4948.3017	5137.2526	GP-42	46	Random	
4939.8843	5090.2245	GP-36	5.9	Random	
4929.1504	5115.9569	GP-33	43.89	Random	
4948.6182	5141.6892	GP-28	5198	Random	
4923.7835	5095.8019	GP-35	36	Random	
4945.2513	5124.5343	GP-38	29.5	Random	
4933.5174	5152.2667	GP-26	39	Random	
4949.2765	5111.1916	GP-40	3.59	Random	
4937.0000	5147.0000	GP-27B	39.43	Unknown	
4934.0000	5140.0000	GP-31	66.33	Unknown	
4925.0000	5145.0000	GP-30	44	Unknown	
4937.0000	5111.0000	GP-37	12.52	Unknown	
4957.0000	5134.0000	GP-39	35.03	Unknown	
4923.0000	5099.0000	HA-1	2200	Unknown	
4925.0000	5124.0000	HA-2	67	Unknown	
4933.0000	5145.0000	HA-3	13	Unknown	

Primary Sampling Objective
The primary purpose of sampling at this site is to construct a confidence interval on the true population median value. After the samples are collected and analyzed, the resulting sample values can be used to construct a two-sided confidence interval. Once the confidence interval is computed (which will be an upper and a lower threshold), you can have the specified confidence that the true population median is between the upper and lower thresholds.

Selected Sampling Approach
A non-parametric random sampling approach was used to determine the number of samples and to specify sampling locations. A parametric formula was not chosen because the conceptual model and historical information (e.g., historical data from this site or a very similar site) indicate that parametric assumptions are not true. These assumptions will be examined in post-sampling data analysis.

Both parametric and non-parametric equations rely on assumptions about the population. Typically, however, non-parametric equations require fewer assumptions and allow for more uncertainty about the statistical distribution of values at the site. The trade-off is that if the parametric assumptions are valid, the required number of samples is usually less than if a non-parametric equation was used.

Locating the sample points randomly provides data that are separated by many distances, whereas systematic samples are all equidistant apart. Therefore, random sampling provides more information about the spatial structure of the potential contamination than systematic sampling does. As with systematic sampling, random sampling also provides information regarding the mean or median value, but there is the possibility that areas of the site will not be represented with the same frequency as if uniform grid sampling were performed.

Number of Total Samples: Calculation Equation and Inputs
Two sample confidence interval calculation methods are available for when n□20 and n>20 (Conover, 1980, p. 111-117) (Gilbert, 1987,p. 141-142). In VSP, the user specifies a one-sided or two-sided CI, and the percent confidence desired to be within a specified number of percentiles of the median. A binary search is then performed on the CI equations to solve for the minimum sample size to satisfy these parameters. VSP first uses the n□20 method to determine if a solution can be found where n□20, and if not, then uses the n>20 method.

For a one-sided CI, the n□20 method follows a binomial distribution and determines the lowest value of n where the yth quantile of the sample would be equal to or above the true median at least X% of the time (Note that the sample sizes work out to be the same regardless of whether the CI will be a lower or upper tailed, so the same formula can be used for any one-sided CI). X% is the specified confidence for one-sided confidence intervals, and the average of 100% and the specified confidence for two-sided confidence intervals. The yth quantile is determined by taking 50% and subtracting the

allowable number of percentiles from the median specified by the user.

For a two-sided CI, the n□20 method is the same as performing a one-sided confidence interval, but replacing the specified percent confidence with the average of 100% and the specified percent confidence. If no solution is found where n□20, a binary search is conducted using Equation (1) for a one-sided CI and Equation (2) for a two-sided interval to compute the value of r (r is the the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest), rounding r up to the next higher integer. The search is repeated until the smallest n is found where 100*2*r/n is greater than 50% minus the allowable number of percentiles from the median specified by the user.

$$r = 0.5 * n - 0.5 * w_{\alpha} \sqrt{n} \qquad (1)$$

$$r = 0.5 * n - 0.5 * w_{\alpha/2} \sqrt{n} \qquad (2)$$

Where:

n is the sample size

r is the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest

$w_{\square}$ is the specified quantile of a normal distribution, e.g. if □=0.2 then $w_{\square}$ is the 0.2 quantile (20th percentile) of a normal distribution.

The n>20 method described above is an approximation method, so VSP also performs a final check using a binomial distribution in a similar manner to the n□20 method, and may increase the sample size by 1 to ensure the specified confidence levels are met.

Cost of Sampling
The total cost of the completed sampling program depends on several cost inputs, some of which are fixed, and others that are based on the number of samples collected and measured. Based on the numbers of samples determined above, the estimated total cost of sampling and analysis at this site is $8,050.00, which averages out to a per sample cost of $536.67. The following table summarizes the inputs and resulting cost estimates.

COST INFORMATION			
Cost Details	**Per Analysis**	**Per Sample**	**15 Samples**
Field collection costs		$250.00	$3,750.00
Analytical costs	$220.00	$220.00	$3,300.00
Sum of Field & Analytical costs		**$470.00**	**$7,050.00**
Fixed planning and validation costs			$1,000.00
Total cost			**$8,050.00**

Data Analysis for Cr +3
The following data points were entered by the user for analysis.

Cr +3										
Rank	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
0	3.59	5.9	12.52	13	20	29.5	34.14	35.03	36	39
10	39.43	43.89	44	46	66.33	67	87	108	2200	5198

SUMMARY STATISTICS for Cr +3	
n	20

Min	3.59
Max	5198
Range	5194.4
Mean	406.42
Median	39.215
Variance	1.5052e+006
StdDev	1226.9
Std Error	274.33
Skewness	3.6382
Interquartile Range	44.457

Percentiles								
1%	**5%**	**10%**	**25%**	**50%**	**75%**	**90%**	**95%**	**99%**
3.59	3.705	6.562	22.38	39.22	66.83	1991	5048	5198

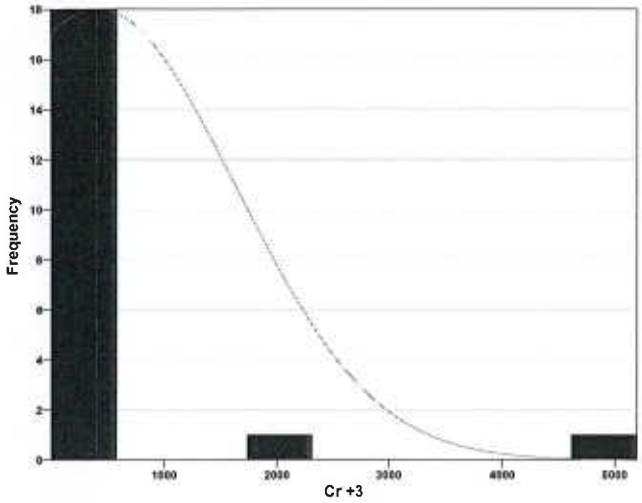
Data Plots

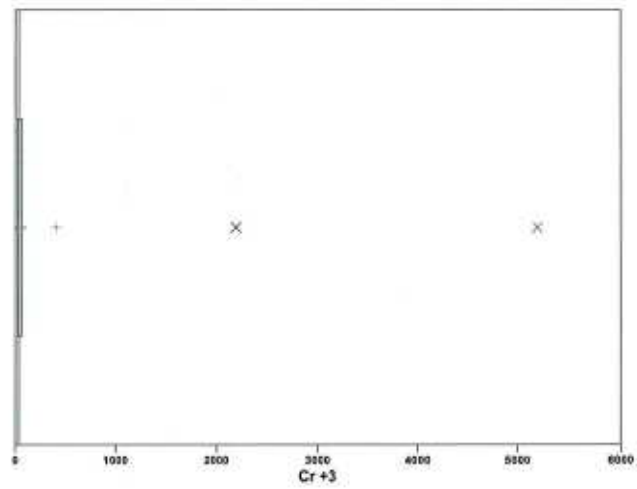
Three graphical displays of the data are shown below: the Histogram, the Box and Whiskers plot, and the Quantile-Quantile (Q-Q) plot.

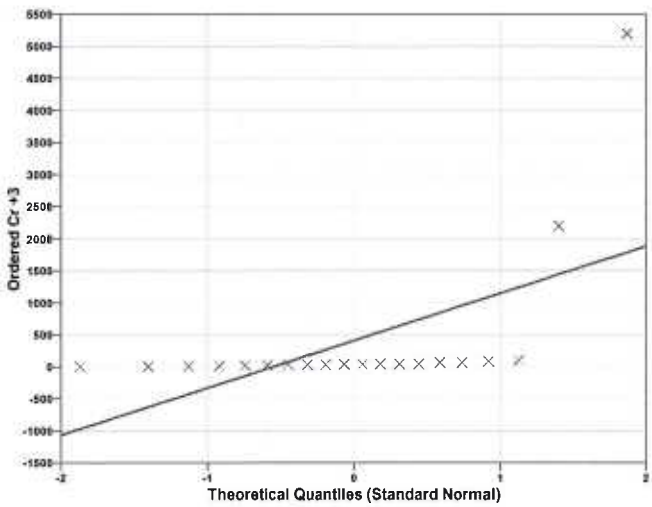
The Histogram is a plot of the fraction of the n observed data that fall within specified data "bins." A histogram is generated by dividing the x axis (range of the observed data values) into "bins" and displaying the number of data in each bin as the height of a bar for the bin. The area of the bar is the fraction of the n data values that lie within the bin. The sum of the fractions for all bins equals one. A histogram is used to assess how the n data are distributed (spread) over their range of values. If the histogram is more or less symmetric and bell shaped, then the data may be normally distributed.

The Box and Whiskers plot is composed of a central box divided by a line, and with two lines extending out from the box, called the "whiskers". The line through the box is drawn at the median of the n data observed. The two ends of the box represent the 25th and 75th percentiles of the n data values, which are also called the lower and upper quartiles, respectively, of the data set. The sample mean (mean of the n data) is shown as a "+" sign. The upper whisker extends to the largest data value that is less than the upper quartile plus 1.5 times the interquartile range (upper quartile minus the lower quartile). The lower whisker extends to the smallest data value that is greater than the lower quartile minus 1.5 times the interquartile range. Extreme data values (greater or smaller than the ends of the whiskers) are plotted individually. A Box and Whiskers plot is used to assess the symmetry of the distribution of the data set. If the distribution is symmetrical, the box is divided into two equal halves by the median, the whiskers will be the same length, and the number of extreme data points will be distributed equally on either end of the plot.

The Q-Q plot graphs the quantiles of a set of n data against the quantiles of a specific distribution. We show here only the Q-Q plot for an assumed normal distribution. The pth quantile of a distribution of data is the data value, x_n, for which a fraction p of the distribution is less than x_n. If the data plotted on the normal distribution Q-Q plot closely follow a straight line, even at the ends of the line, then the data may be assumed to be normally distributed. If the data points deviate substantially from a linear line, then the data are not normally distributed.







For more information on these three plots consult Guidance for Data Quality Assessment, EPA QA/G-9, pgs 2.3-1 through 2.3-12. (http://www.epa.gov/quality/qa-docs.html).

Two-Sided Confidence Interval on the True Median

For calculating the confidence interval, the values are ordered from smallest to largest. The confidence limits are the highest value of the r+1 and/or lowest value of the s-1 order statistics that fit the formulas below, except when the rth ordered value is tied with higher ordered values or the sth ordered value is tied with lower ordered values. If higher numbered ordered values are ties with the rth ordered value, then the closest ordered value that is lower than r will be the confidence limit. If higher-numbered ordered values are ties with the sth ordered value, then the closest ordered value that is higher than s will be the confidence limit.

Upper Two-Sided Confidence Interval

$$\sum_{s}^{1}\left(\frac{n!}{r!(n-s)!}\right)p^{0.5}(1-p)^{n-0.5} \geq 1-\alpha/2$$

Lower Two-Sided Confidence interval

$$\sum_{r}^{1}\left(\frac{n!}{r!(n-r)!}\right)p^{0.5}(1-p)^{n-0.5} \leq \alpha/2$$

Sample Median	39.215
Lower 95% Two-Sided Confidence Interval on the Median	20

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* - The report contents may have been modified or reformatted by end-user of software.

Chrome Bldg Cr+6

VSP Sample Design Report for Calculating a Two-Sided Confidence Interval for the Population Median Using Simple Random Sampling

Summary

This report summarizes the sampling design used, associated statistical assumptions, as well as general guidelines for conducting post-sampling data analysis. Sampling plan components presented here include how many sampling locations to choose and where within the sampling area to collect those samples. The type of medium to sample (i.e., soil, groundwater, etc.) and how to analyze the samples (in-situ, fixed laboratory, etc.) are addressed in other sections of the sampling plan.

The following table summarizes the sampling design developed. A figure that shows sampling locations in the field and a table that lists sampling location coordinates are also provided below.

SUMMARY OF SAMPLING DESIGN	
Primary Objective of Design	Construct a Confidence Interval on the True Median
Type of Sampling Design	Non-Parametric
Sample Placement (Location) in the Field	Simple random sampling
Formula for calculating number of sampling locations	Nonparametric Confidence Limits
Calculated total number of samples	15
Number of samples on map [a]	15
Number of selected sample areas [b]	1
Specified sampling area [c]	2826.73 ft^2
Total cost of sampling [d]	$8,050.00

[a] This number may differ from the calculated number because of 1) grid edge effects, 2) adding judgment samples, or 3) selecting or unselecting sample areas.
[b] The number of selected sample areas is the number of colored areas on the map of the site. These sample areas contain the locations where samples are collected.
[c] The sampling area is the total surface area of the selected colored sample areas on the map of the site.
[d] Including measurement analyses and fixed overhead costs. See the Cost of Sampling section for an explanation of the costs presented here.

Area: Area 3					
X Coord	Y Coord	Label	Value	Type	Historical
4947.9347	5089.9428	GP-41	0.292	Random	
4921.1000	5121.6752	GP-32	1.88	Random	
4930.8339	5104.5202	GP-34	2.03	Random	

4948.3017	5137.2526	GP-42	0.303	Random	
4939.8843	5090.2245	GP-36	0.298	Random	
4929.1504	5115.9569	GP-33	2.11	Random	
4948.6182	5141.6892	GP-28	1.75	Random	
4923.7835	5095.8019	GP-35	0.303	Random	
4945.2513	5124.5343	GP-38	0.519	Random	
4933.5174	5152.2667	GP-26	0.298	Random	
4949.2765	5111.1916	GP-40	0.303	Random	
4934.0000	5140.0000	GP-31	1.67	Unknown	
4925.0000	5145.0000	GP-30	0.311	Unknown	
4937.0000	5111.0000	GP-37	0.481	Unknown	
4957.0000	5134.0000	GP-39	1.97	Unknown	

Primary Sampling Objective
The primary purpose of sampling at this site is to construct a confidence interval on the true population median value. After the samples are collected and analyzed, the resulting sample values can be used to construct a two-sided confidence interval. Once the confidence interval is computed (which will be an upper and a lower threshold), you can have the specified confidence that the true population median is between the upper and lower thresholds.

Selected Sampling Approach
A non-parametric random sampling approach was used to determine the number of samples and to specify sampling locations. A parametric formula was not chosen because the conceptual model and historical information (e.g., historical data from this site or a very similar site) indicate that parametric assumptions are not true. These assumptions will be examined in post-sampling data analysis.

Both parametric and non-parametric equations rely on assumptions about the population. Typically, however, non-parametric equations require fewer assumptions and allow for more uncertainty about the statistical distribution of values at the site. The trade-off is that if the parametric assumptions are valid, the required number of samples is usually less than if a non-parametric equation was used.

Locating the sample points randomly provides data that are separated by many distances, whereas systematic samples are all equidistant apart. Therefore, random sampling provides more information about the spatial structure of the potential contamination than systematic sampling does. As with systematic sampling, random sampling also provides information regarding the mean or median value, but there is the possibility that areas of the site will not be represented with the same frequency as if uniform grid sampling were performed.

Number of Total Samples: Calculation Equation and Inputs
Two sample confidence interval calculation methods are available for when n□20 and n>20 (Conover, 1980, p. 111-117) (Gilbert, 1987,p. 141-142). In VSP, the user specifies a one-sided or two-sided CI, and the percent confidence desired to be within a specified number of percentiles of the median. A binary search is then performed on the CI equations to solve for the minimum sample size to satisfy these parameters. VSP first uses the n□20 method to determine if a solution can be found where n□20, and if not, then uses the n>20 method.

For a one-sided CI, the n□20 method follows a binomial distribution and determines the lowest value of n where the yth quantile of the sample would be equal to or above the true median at least X% of the time (Note that the sample sizes work out to be the same regardless of whether the CI will be a lower or upper tailed, so the same formula can be used for any one-sided CI). X% is the specified confidence for one-sided confidence intervals, and the average of 100% and the specified confidence for two-sided confidence intervals. The yth quantile is determined by taking 50% and subtracting the allowable number of percentiles from the median specified by the user.

For a two-sided CI, the n□20 method is the same as performing a one-sided confidence interval, but replacing the specified percent confidence with the average of 100% and the specified percent confidence. If no solution is found where n□20, a binary search is conducted using Equation (1) for a one-sided CI and Equation (2) for a two-sided interval to compute the value of r (r is the the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest), rounding r up to the next higher integer. The search is repeated until the smallest n is

found where 100*2*r/n is greater than 50% minus the allowable number of percentiles from the median specified by the user.

$$r = 0.5 * n - 0.5 * w_{\alpha} \sqrt{n} \qquad (1)$$

$$r = 0.5 * n - 0.5 * w_{\alpha/2} \sqrt{n} \qquad (2)$$

Where:

n is the sample size

r is the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest

$w_{\square}$ is the specified quantile of a normal distribution, e.g. if $\square$=0.2 then $w_{\square}$ is the 0.2 quantile (20th percentile) of a normal distribution.

The n>20 method described above is an approximation method, so VSP also performs a final check using a binomial distribution in a similar manner to the n$\square$20 method, and may increase the sample size by 1 to ensure the specified confidence levels are met.

Cost of Sampling
The total cost of the completed sampling program depends on several cost inputs, some of which are fixed, and others that are based on the number of samples collected and measured. Based on the numbers of samples determined above, the estimated total cost of sampling and analysis at this site is $8,050.00, which averages out to a per sample cost of $536.67. The following table summarizes the inputs and resulting cost estimates.

COST INFORMATION			
Cost Details	**Per Analysis**	**Per Sample**	**15 Samples**
Field collection costs		$250.00	$3,750.00
Analytical costs	$220.00	$220.00	$3,300.00
Sum of Field & Analytical costs		**$470.00**	**$7,050.00**
Fixed planning and validation costs			$1,000.00
Total cost			**$8,050.00**

Data Analysis for Cr +6
The following data points were entered by the user for analysis.

Cr +6										
Rank	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
0	0.292	0.298	0.298	0.303	0.303	0.303	0.311	0.481	0.519	1.67
10	1.75	1.88	1.97	2.03	2.11					

SUMMARY STATISTICS for Cr +6	
n	15
Min	0.292
Max	2.11
Range	1.818
Mean	0.96787
Median	0.481

Variance	0.63743
StdDev	0.79839
Std Error	0.20614
Skewness	0.48538
Interquartile Range	1.577

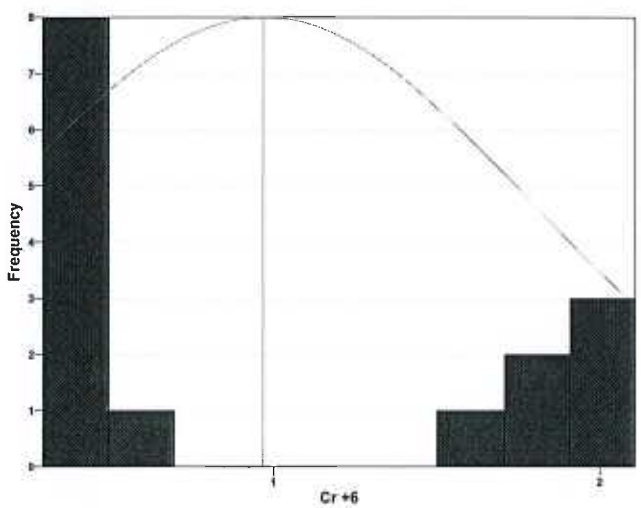
Percentiles								
1%	**5%**	**10%**	**25%**	**50%**	**75%**	**90%**	**95%**	**99%**
0.292	0.292	0.2956	0.303	0.481	1.88	2.062	2.11	2.11

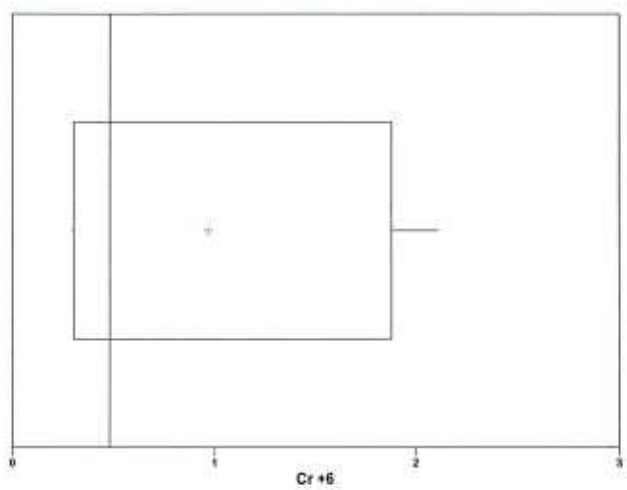
Data Plots
Three graphical displays of the data are shown below: the Histogram, the Box and Whiskers plot, and the Quantile-Quantile (Q-Q) plot.

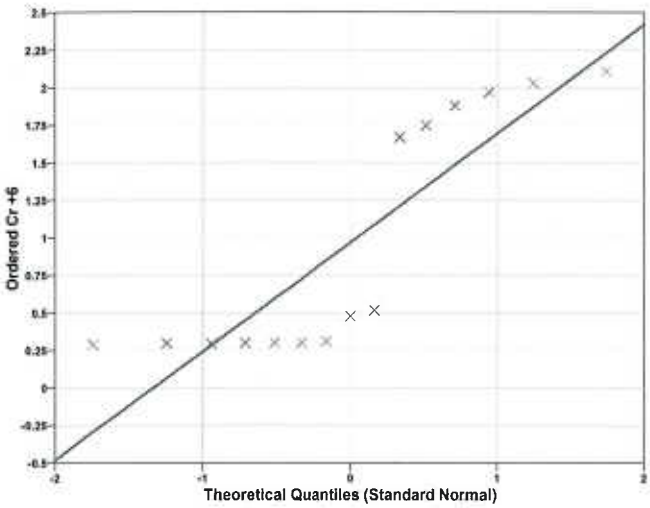
The Histogram is a plot of the fraction of the n observed data that fall within specified data "bins." A histogram is generated by dividing the x axis (range of the observed data values) into "bins" and displaying the number of data in each bin as the height of a bar for the bin. The area of the bar is the fraction of the n data values that lie within the bin. The sum of the fractions for all bins equals one. A histogram is used to assess how the n data are distributed (spread) over their range of values. If the histogram is more or less symmetric and bell shaped, then the data may be normally distributed.

The Box and Whiskers plot is composed of a central box divided by a line, and with two lines extending out from the box, called the "whiskers". The line through the box is drawn at the median of the n data observed. The two ends of the box represent the 25th and 75th percentiles of the n data values, which are also called the lower and upper quartiles, respectively, of the data set. The sample mean (mean of the n data) is shown as a "+" sign. The upper whisker extends to the largest data value that is less than the upper quartile plus 1.5 times the interquartile range (upper quartile minus the lower quartile). The lower whisker extends to the smallest data value that is greater than the lower quartile minus 1.5 times the interquartile range. Extreme data values (greater or smaller than the ends of the whiskers) are plotted individually. A Box and Whiskers plot is used to assess the symmetry of the distribution of the data set. If the distribution is symmetrical, the box is divided into two equal halves by the median, the whiskers will be the same length, and the number of extreme data points will be distributed equally on either end of the plot.

The Q-Q plot graphs the quantiles of a set of n data against the quantiles of a specific distribution. We show here only the Q-Q plot for an assumed normal distribution. The pth quantile of a distribution of data is the data value, x_n, for which a fraction p of the distribution is less than x_n. If the data plotted on the normal distribution Q-Q plot closely follow a straight line, even at the ends of the line, then the data may be assumed to be normally distributed. If the data points deviate substantially from a linear line, then the data are not normally distributed.







For more information on these three plots consult Guidance for Data Quality Assessment, EPA QA/G-9, pgs 2.3-1 through 2.3-12. (http://www.epa.gov/quality/qa-docs.html).

Two-Sided Confidence Interval on the True Median

For calculating the confidence interval, the values are ordered from smallest to largest. The confidence limits are the highest value of the r+1 and/or lowest value of the s-1 order statistics that fit the formulas below, except when the rth ordered value is tied with higher ordered values or the sth ordered value is tied with lower ordered values. If higher numbered ordered values are ties with the rth ordered value, then the closest ordered value that is lower than r will be the confidence limit. If higher-numbered ordered values are ties with the sth ordered value, then the closest ordered value that is higher than s will be the confidence limit.

Upper Two-Sided Confidence Interval

$$\sum_{s}^{1}\left(\frac{n!}{r!(n-s)!}\right)p^{0.5}(1-p)^{n-0.5} \geq 1-\alpha/2$$

Lower Two-Sided Confidence interval

$$\sum_{r}^{1}\left(\frac{n!}{r!(n-r)!}\right)p^{0.5}(1-p)^{n-0.5} \leq \alpha/2$$

Upper 95% Two-Sided Confidence Interval on the Median	1.97
Sample Median	0.481
Lower 95% Two-Sided Confidence Interval on the Median	0.298

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* - The report contents may have been modified or reformatted by end-user of software.

Chrome Bldg Cr+6 biased

VSP Sample Design Report for Calculating a Two-Sided Confidence Interval for the Population Median Using Simple Random Sampling

Summary

This report summarizes the sampling design used, associated statistical assumptions, as well as general guidelines for conducting post-sampling data analysis. Sampling plan components presented here include how many sampling locations to choose and where within the sampling area to collect those samples. The type of medium to sample (i.e., soil, groundwater, etc.) and how to analyze the samples (in-situ, fixed laboratory, etc.) are addressed in other sections of the sampling plan.

The following table summarizes the sampling design developed. A figure that shows sampling locations in the field and a table that lists sampling location coordinates are also provided below.

SUMMARY OF SAMPLING DESIGN	
Primary Objective of Design	Construct a Confidence Interval on the True Median
Type of Sampling Design	Non-Parametric
Sample Placement (Location) in the Field	Simple random sampling
Formula for calculating number of sampling locations	Nonparametric Confidence Limits
Calculated total number of samples	15
Number of samples on map [a]	20
Number of selected sample areas [b]	1
Specified sampling area [c]	2826.73 ft^2
Total cost of sampling [d]	$8,050.00

[a] This number may differ from the calculated number because of 1) grid edge effects, 2) adding judgment samples, or 3) selecting or unselecting sample areas.
[b] The number of selected sample areas is the number of colored areas on the map of the site. These sample areas contain the locations where samples are collected.
[c] The sampling area is the total surface area of the selected colored sample areas on the map of the site.
[d] Including measurement analyses and fixed overhead costs. See the Cost of Sampling section for an explanation of the costs presented here.

Area: Area 3					
X Coord	Y Coord	Label	Value	Type	Historical
4947.9347	5089.9428	GP-41	0.292	Random	
4921.1000	5121.6752	GP-32	1.88	Random	
4939.5678	5145.4075	GP-29B	0.351	Random	

4930.8339	5104.5202	GP-34	2.03	Random	
4948.3017	5137.2526	GP-42	0.303	Random	
4939.8843	5090.2245	GP-36	0.298	Random	
4929.1504	5115.9569	GP-33	2.11	Random	
4948.6182	5141.6892	GP-28	1.75	Random	
4923.7835	5095.8019	GP-35	0.303	Random	
4945.2513	5124.5343	GP-38	0.519	Random	
4933.5174	5152.2667	GP-26	0.298	Random	
4949.2765	5111.1916	GP-40	0.303	Random	
4937.0000	5147.0000	GP-27B	0.566	Unknown	
4934.0000	5140.0000	GP-31	1.67	Unknown	
4925.0000	5145.0000	GP-30	0.311	Unknown	
4937.0000	5111.0000	GP-37	0.481	Unknown	
4957.0000	5134.0000	GP-39	1.97	Unknown	
4923.0000	5099.0000	HA-1	57.5	Unknown	
4925.0000	5124.0000	HA-2	1.4	Unknown	
4933.0000	5145.0000	HA-3	0.563	Unknown	

Primary Sampling Objective
The primary purpose of sampling at this site is to construct a confidence interval on the true population median value. After the samples are collected and analyzed, the resulting sample values can be used to construct a two-sided confidence interval. Once the confidence interval is computed (which will be an upper and a lower threshold), you can have the specified confidence that the true population median is between the upper and lower thresholds.

Selected Sampling Approach
A non-parametric random sampling approach was used to determine the number of samples and to specify sampling locations. A parametric formula was not chosen because the conceptual model and historical information (e.g., historical data from this site or a very similar site) indicate that parametric assumptions are not true. These assumptions will be examined in post-sampling data analysis.

Both parametric and non-parametric equations rely on assumptions about the population. Typically, however, non-parametric equations require fewer assumptions and allow for more uncertainty about the statistical distribution of values at the site. The trade-off is that if the parametric assumptions are valid, the required number of samples is usually less than if a non-parametric equation was used.

Locating the sample points randomly provides data that are separated by many distances, whereas systematic samples are all equidistant apart. Therefore, random sampling provides more information about the spatial structure of the potential contamination than systematic sampling does. As with systematic sampling, random sampling also provides information regarding the mean or median value, but there is the possibility that areas of the site will not be represented with the same frequency as if uniform grid sampling were performed.

Number of Total Samples: Calculation Equation and Inputs
Two sample confidence interval calculation methods are available for when n□20 and n>20 (Conover, 1980, p. 111-117) (Gilbert, 1987,p. 141-142). In VSP, the user specifies a one-sided or two-sided CI, and the percent confidence desired to be within a specified number of percentiles of the median. A binary search is then performed on the CI equations to solve for the minimum sample size to satisfy these parameters. VSP first uses the n□20 method to determine if a solution can be found where n□20, and if not, then uses the n>20 method.

For a one-sided CI, the n□20 method follows a binomial distribution and determines the lowest value of n where the yth quantile of the sample would be equal to or above the true median at least X% of the time (Note that the sample sizes work out to be the same regardless of whether the CI will be a lower or upper tailed, so the same formula can be used for any one-sided CI). X% is the specified confidence for one-sided confidence intervals, and the average of 100% and the specified confidence for two-sided confidence intervals. The yth quantile is determined by taking 50% and subtracting the

allowable number of percentiles from the median specified by the user.

For a two-sided CI, the n□20 method is the same as performing a one-sided confidence interval, but replacing the specified percent confidence with the average of 100% and the specified percent confidence. If no solution is found where n□20, a binary search is conducted using Equation (1) for a one-sided CI and Equation (2) for a two-sided interval to compute the value of r (r is the the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest), rounding r up to the next higher integer. The search is repeated until the smallest n is found where 100*2*r/n is greater than 50% minus the allowable number of percentiles from the median specified by the user.

$$r = 0.5 * n - 0.5 * w_{\alpha} \sqrt{n} \qquad (1)$$

$$r = 0.5 * n - 0.5 * w_{\alpha/2} \sqrt{n} \qquad (2)$$

Where:

n is the sample size

r is the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest

$w_{\square}$ is the specified quantile of a normal distribution, e.g. if □=0.2 then $w_{\square}$ is the 0.2 quantile (20th percentile) of a normal distribution.

The n>20 method described above is an approximation method, so VSP also performs a final check using a binomial distribution in a similar manner to the n□20 method, and may increase the sample size by 1 to ensure the specified confidence levels are met.

Cost of Sampling
The total cost of the completed sampling program depends on several cost inputs, some of which are fixed, and others that are based on the number of samples collected and measured. Based on the numbers of samples determined above, the estimated total cost of sampling and analysis at this site is $8,050.00, which averages out to a per sample cost of $536.67. The following table summarizes the inputs and resulting cost estimates.

COST INFORMATION			
Cost Details	**Per Analysis**	**Per Sample**	**15 Samples**
Field collection costs		$250.00	$3,750.00
Analytical costs	$220.00	$220.00	$3,300.00
Sum of Field & Analytical costs		**$470.00**	**$7,050.00**
Fixed planning and validation costs			$1,000.00
Total cost			**$8,050.00**

Data Analysis for Cr +6
The following data points were entered by the user for analysis.

Cr +6										
Rank	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
0	0.292	0.298	0.298	0.303	0.303	0.303	0.311	0.351	0.481	0.519
10	0.563	0.566	1.4	1.67	1.75	1.88	1.97	2.03	2.11	57.5

SUMMARY STATISTICS for Cr +6	
n	20

Min	0.292
Max	57.5
Range	57.208
Mean	3.7449
Median	0.541
Variance	160.6
StdDev	12.673
Std Error	2.8338
Skewness	4.4484
Interquartile Range	1.5445

Percentiles								
1%	**5%**	**10%**	**25%**	**50%**	**75%**	**90%**	**95%**	**99%**
0.292	0.2923	0.298	0.303	0.541	1.847	2.102	54.73	57.5

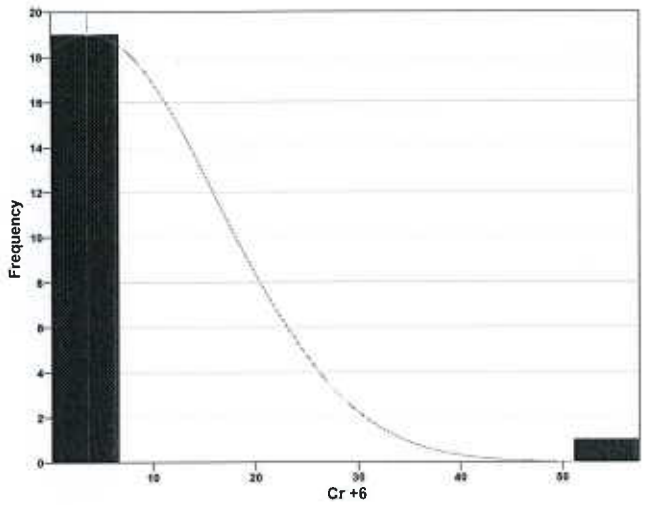
Data Plots

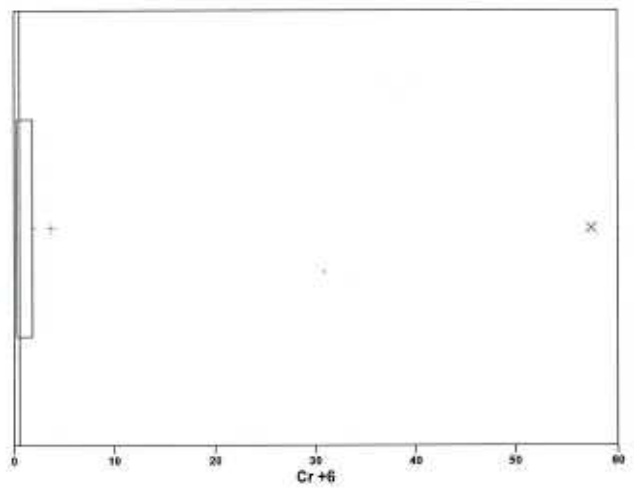
Three graphical displays of the data are shown below: the Histogram, the Box and Whiskers plot, and the Quantile-Quantile (Q-Q) plot.

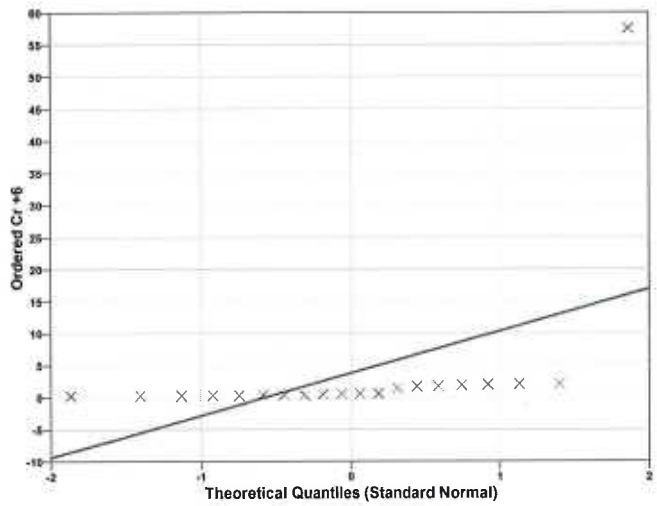
The Histogram is a plot of the fraction of the n observed data that fall within specified data "bins." A histogram is generated by dividing the x axis (range of the observed data values) into "bins" and displaying the number of data in each bin as the height of a bar for the bin. The area of the bar is the fraction of the n data values that lie within the bin. The sum of the fractions for all bins equals one. A histogram is used to assess how the n data are distributed (spread) over their range of values. If the histogram is more or less symmetric and bell shaped, then the data may be normally distributed.

The Box and Whiskers plot is composed of a central box divided by a line, and with two lines extending out from the box, called the "whiskers". The line through the box is drawn at the median of the n data observed. The two ends of the box represent the 25th and 75th percentiles of the n data values, which are also called the lower and upper quartiles, respectively, of the data set. The sample mean (mean of the n data) is shown as a "+" sign. The upper whisker extends to the largest data value that is less than the upper quartile plus 1.5 times the interquartile range (upper quartile minus the lower quartile). The lower whisker extends to the smallest data value that is greater than the lower quartile minus 1.5 times the interquartile range. Extreme data values (greater or smaller than the ends of the whiskers) are plotted individually. A Box and Whiskers plot is used to assess the symmetry of the distribution of the data set. If the distribution is symmetrical, the box is divided into two equal halves by the median, the whiskers will be the same length, and the number of extreme data points will be distributed equally on either end of the plot.

The Q-Q plot graphs the quantiles of a set of n data against the quantiles of a specific distribution. We show here only the Q-Q plot for an assumed normal distribution. The pth quantile of a distribution of data is the data value, x_p, for which a fraction p of the distribution is less than x_p. If the data plotted on the normal distribution Q-Q plot closely follow a straight line, even at the ends of the line, then the data may be assumed to be normally distributed. If the data points deviate substantially from a linear line, then the data are not normally distributed.







For more information on these three plots consult Guidance for Data Quality Assessment, EPA QA/G-9, pgs 2.3-1 through 2.3-12. (http://www.epa.gov/quality/qa-docs.html).

Two-Sided Confidence Interval on the True Median

For calculating the confidence interval, the values are ordered from smallest to largest. The confidence limits are the highest value of the r+1 and/or lowest value of the s-1 order statistics that fit the formulas below, except when the rth ordered value is tied with higher ordered values or the sth ordered value is tied with lower ordered values. If higher numbered ordered values are ties with the rth ordered value, then the closest ordered value that is lower than r will be the confidence limit. If higher-numbered ordered values are ties with the sth ordered value, then the closest ordered value that is higher than s will be the confidence limit.

Upper Two-Sided Confidence Interval

$$\sum_{s}^{1}\left(\frac{n!}{r!(n-s)!}\right)p^{0.5}(1-p)^{n-0.5} \geq 1-\alpha/2$$

Lower Two-Sided Confidence interval

$$\sum_{r}^{1}\left(\frac{n!}{r!(n-r)!}\right)p^{0.5}(1-p)^{n-0.5} \leq \alpha/2$$

Upper 95% Two-Sided Confidence Interval on the Median	1.88

Sample Median	0.541
Lower 95% Two-Sided Confidence Interval on the Median	0.303

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* - The report contents may have been modified or reformatted by end-user of software.

Chrom Poly Cu

VSP Sample Design Report for Calculating a Two-Sided Confidence Interval for the Population Median Using Simple Random Sampling

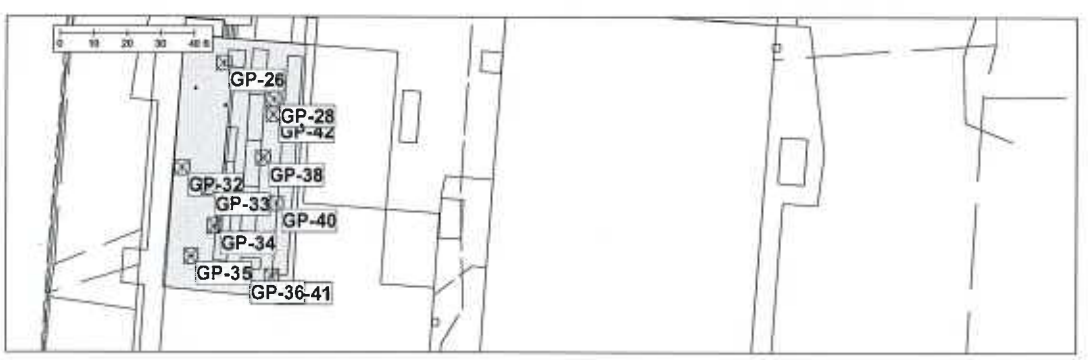
Summary

This report summarizes the sampling design used, associated statistical assumptions, as well as general guidelines for conducting post-sampling data analysis. Sampling plan components presented here include how many sampling locations to choose and where within the sampling area to collect those samples. The type of medium to sample (i.e., soil, groundwater, etc.) and how to analyze the samples (in-situ, fixed laboratory, etc.) are addressed in other sections of the sampling plan.

The following table summarizes the sampling design developed. A figure that shows sampling locations in the field and a table that lists sampling location coordinates are also provided below.

SUMMARY OF SAMPLING DESIGN	
Primary Objective of Design	Construct a Confidence Interval on the True Median
Type of Sampling Design	Non-Parametric
Sample Placement (Location) in the Field	Simple random sampling
Formula for calculating number of sampling locations	Nonparametric Confidence Limits
Calculated total number of samples	15
Number of samples on map [a]	15
Number of selected sample areas [b]	1
Specified sampling area [c]	2826.73 ft^2
Total cost of sampling [d]	$8,050.00

[a] This number may differ from the calculated number because of 1) grid edge effects, 2) adding judgment samples, or 3) selecting or unselecting sample areas.
[b] The number of selected sample areas is the number of colored areas on the map of the site. These sample areas contain the locations where samples are collected.
[c] The sampling area is the total surface area of the selected colored sample areas on the map of the site.
[d] Including measurement analyses and fixed overhead costs. See the Cost of Sampling section for an explanation of the costs presented here.



Area: Area 3					
X Coord	Y Coord	Label	Value	Type	Historical
4947.9347	5089.9428	GP-41	48	Random	
4921.1000	5121.6752	GP-32	38	Random	
4930.8339	5104.5202	GP-34	53	Random	

4948.3017	5137.2526	GP-42	75	Random	
4939.8843	5090.2245	GP-36	64	Random	
4929.1504	5115.9569	GP-33	86	Random	
4948.6182	5141.6892	GP-28	97	Random	
4923.7835	5095.8019	GP-35	45	Random	
4945.2513	5124.5343	GP-38	61	Random	
4933.5174	5152.2667	GP-26	83	Random	
4949.2765	5111.1916	GP-40	42	Random	
4934.0000	5140.0000	GP-31	72	Unknown	
4925.0000	5145.0000	GP-30	92	Unknown	
4937.0000	5111.0000	GP-37	50	Unknown	
4957.0000	5134.0000	GP-39	68	Unknown	

Primary Sampling Objective
The primary purpose of sampling at this site is to construct a confidence interval on the true population median value. After the samples are collected and analyzed, the resulting sample values can be used to construct a two-sided confidence interval. Once the confidence interval is computed (which will be an upper and a lower threshold), you can have the specified confidence that the true population median is between the upper and lower thresholds.

Selected Sampling Approach
A non-parametric random sampling approach was used to determine the number of samples and to specify sampling locations. A parametric formula was not chosen because the conceptual model and historical information (e.g., historical data from this site or a very similar site) indicate that parametric assumptions are not true. These assumptions will be examined in post-sampling data analysis.

Both parametric and non-parametric equations rely on assumptions about the population. Typically, however, non-parametric equations require fewer assumptions and allow for more uncertainty about the statistical distribution of values at the site. The trade-off is that if the parametric assumptions are valid, the required number of samples is usually less than if a non-parametric equation was used.

Locating the sample points randomly provides data that are separated by many distances, whereas systematic samples are all equidistant apart. Therefore, random sampling provides more information about the spatial structure of the potential contamination than systematic sampling does. As with systematic sampling, random sampling also provides information regarding the mean or median value, but there is the possibility that areas of the site will not be represented with the same frequency as if uniform grid sampling were performed.

Number of Total Samples: Calculation Equation and Inputs
Two sample confidence interval calculation methods are available for when n□20 and n>20 (Conover, 1980, p. 111-117) (Gilbert, 1987,p. 141-142). In VSP, the user specifies a one-sided or two-sided CI, and the percent confidence desired to be within a specified number of percentiles of the median. A binary search is then performed on the CI equations to solve for the minimum sample size to satisfy these parameters. VSP first uses the n□20 method to determine if a solution can be found where n□20, and if not, then uses the n>20 method.

For a one-sided CI, the n□20 method follows a binomial distribution and determines the lowest value of n where the yth quantile of the sample would be equal to or above the true median at least X% of the time (Note that the sample sizes work out to be the same regardless of whether the CI will be a lower or upper tailed, so the same formula can be used for any one-sided CI). X% is the specified confidence for one-sided confidence intervals, and the average of 100% and the specified confidence for two-sided confidence intervals. The yth quantile is determined by taking 50% and subtracting the allowable number of percentiles from the median specified by the user.

For a two-sided CI, the n□20 method is the same as performing a one-sided confidence interval, but replacing the specified percent confidence with the average of 100% and the specified percent confidence. If no solution is found where n□20, a binary search is conducted using Equation (1) for a one-sided CI and Equation (2) for a two-sided interval to compute the value of r (r is the the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest), rounding r up to the next higher integer. The search is repeated until the smallest n is

found where 100*2*r/n is greater than 50% minus the allowable number of percentiles from the median specified by the user.

$$r = 0.5 * n - 0.5 * w_{\alpha} \sqrt{n} \qquad (1)$$

$$r = 0.5 * n - 0.5 * w_{\alpha/2} \sqrt{n} \qquad (2)$$

Where:

n is the sample size

r is the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest

$w_{\square}$ is the specified quantile of a normal distribution, e.g. if $\square$=0.2 then $w_{\square}$ is the 0.2 quantile (20th percentile) of a normal distribution.

The n>20 method described above is an approximation method, so VSP also performs a final check using a binomial distribution in a similar manner to the n$\square$20 method, and may increase the sample size by 1 to ensure the specified confidence levels are met.

Cost of Sampling
The total cost of the completed sampling program depends on several cost inputs, some of which are fixed, and others that are based on the number of samples collected and measured. Based on the numbers of samples determined above, the estimated total cost of sampling and analysis at this site is $8,050.00, which averages out to a per sample cost of $536.67. The following table summarizes the inputs and resulting cost estimates.

COST INFORMATION			
Cost Details	**Per Analysis**	**Per Sample**	**15 Samples**
Field collection costs		$250.00	$3,750.00
Analytical costs	$220.00	$220.00	$3,300.00
Sum of Field & Analytical costs		**$470.00**	**$7,050.00**
Fixed planning and validation costs			$1,000.00
Total cost			**$8,050.00**

Data Analysis for Cu
The following data points were entered by the user for analysis.

Cu										
Rank	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
0	38	42	45	48	50	53	61	64	68	72
10	75	83	86	92	97					

SUMMARY STATISTICS for Cu	
n	15
Min	38
Max	97
Range	59
Mean	64.933
Median	64

Variance	357.78
StdDev	18.915
Std Error	4.8839
Skewness	0.24338
Interquartile Range	35

Percentiles								
1%	**5%**	**10%**	**25%**	**50%**	**75%**	**90%**	**95%**	**99%**
38	38	40.4	48	64	83	94	97	97

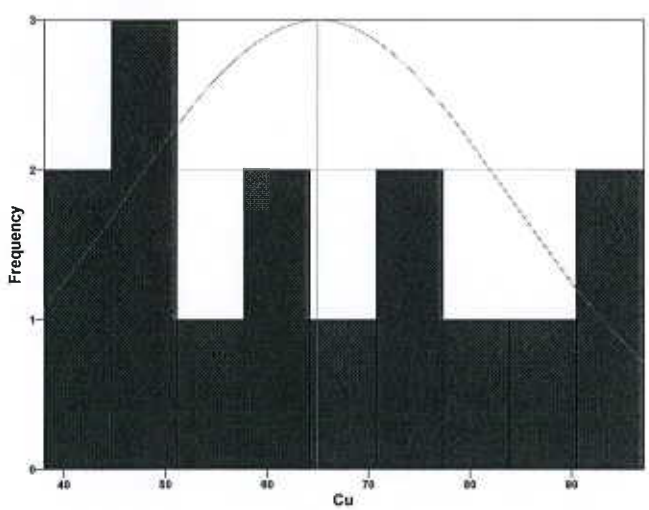
Data Plots

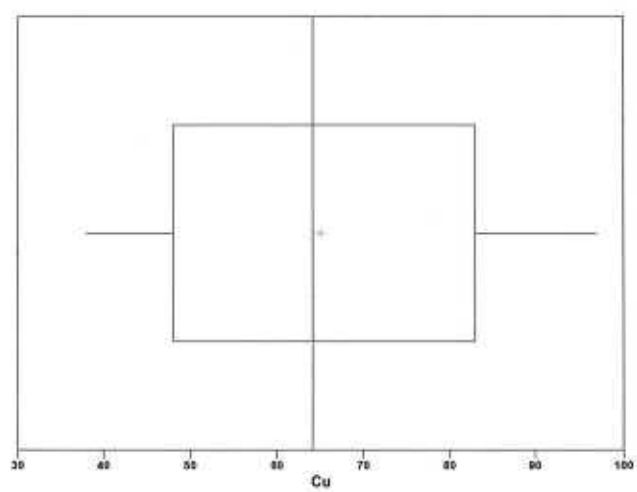
Three graphical displays of the data are shown below: the Histogram, the Box and Whiskers plot, and the Quantile-Quantile (Q-Q) plot.

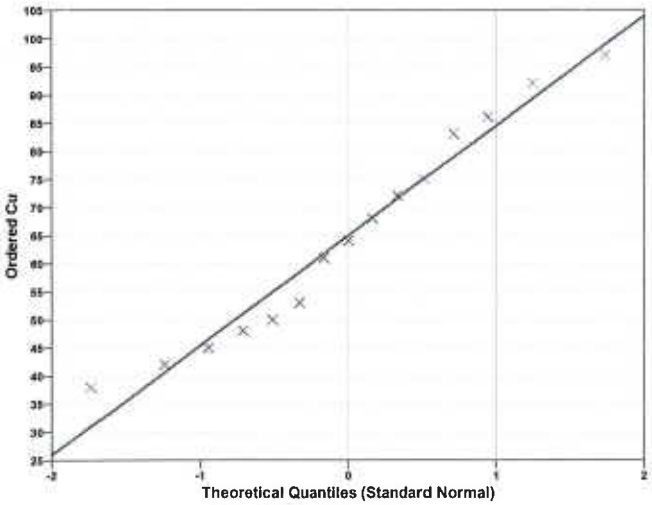
The Histogram is a plot of the fraction of the n observed data that fall within specified data "bins." A histogram is generated by dividing the x axis (range of the observed data values) into "bins" and displaying the number of data in each bin as the height of a bar for the bin. The area of the bar is the fraction of the n data values that lie within the bin. The sum of the fractions for all bins equals one. A histogram is used to assess how the n data are distributed (spread) over their range of values. If the histogram is more or less symmetric and bell shaped, then the data may be normally distributed.

The Box and Whiskers plot is composed of a central box divided by a line, and with two lines extending out from the box, called the "whiskers". The line through the box is drawn at the median of the n data observed. The two ends of the box represent the 25th and 75th percentiles of the n data values, which are also called the lower and upper quartiles, respectively, of the data set. The sample mean (mean of the n data) is shown as a "+" sign. The upper whisker extends to the largest data value that is less than the upper quartile plus 1.5 times the interquartile range (upper quartile minus the lower quartile). The lower whisker extends to the smallest data value that is greater than the lower quartile minus 1.5 times the interquartile range. Extreme data values (greater or smaller than the ends of the whiskers) are plotted individually. A Box and Whiskers plot is used to assess the symmetry of the distribution of the data set. If the distribution is symmetrical, the box is divided into two equal halves by the median, the whiskers will be the same length, and the number of extreme data points will be distributed equally on either end of the plot.

The Q-Q plot graphs the quantiles of a set of n data against the quantiles of a specific distribution. We show here only the Q-Q plot for an assumed normal distribution. The pth quantile of a distribution of data is the data value, x_p, for which a fraction p of the distribution is less than x_p. If the data plotted on the normal distribution Q-Q plot closely follow a straight line, even at the ends of the line, then the data may be assumed to be normally distributed. If the data points deviate substantially from a linear line, then the data are not normally distributed.







For more information on these three plots consult Guidance for Data Quality Assessment, EPA QA/G-9, pgs 2.3-1 through 2.3-12. (http://www.epa.gov/quality/qa-docs.html).

Two-Sided Confidence Interval on the True Median

For calculating the confidence interval, the values are ordered from smallest to largest. The confidence limits are the highest value of the r+1 and/or lowest value of the s-1 order statistics that fit the formulas below, except when the rth ordered value is tied with higher ordered values or the sth ordered value is tied with lower ordered values. If higher numbered ordered values are ties with the rth ordered value, then the closest ordered value that is lower than r will be the confidence limit. If higher-numbered ordered values are ties with the sth ordered value, then the closest ordered value that is higher than s will be the confidence limit.

Upper Two-Sided Confidence Interval

$$\sum_{s}^{1}\left(\frac{n!}{r!(n-s)!}\right)p^{0.5}(1-p)^{n-0.5} \geq 1-\alpha/2$$

Lower Two-Sided Confidence interval

$$\sum_{r}^{1}\left(\frac{n!}{r!(n-r)!}\right)p^{0.5}(1-p)^{n-0.5} \leq \alpha/2$$

Upper 95% Two-Sided Confidence Interval on the Median	86
Sample Median	64
Lower 95% Two-Sided Confidence Interval on the Median	45

This report was automatically produced* by Visual Sample Plan (VSP) software version 6.1b.
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* - The report contents may have been modified or reformatted by end-user of software.

Chrom Bldg - Cu Borings

VSP Sample Design Report for Calculating a Two-Sided Confidence Interval for the Population Median Using Simple Random Sampling

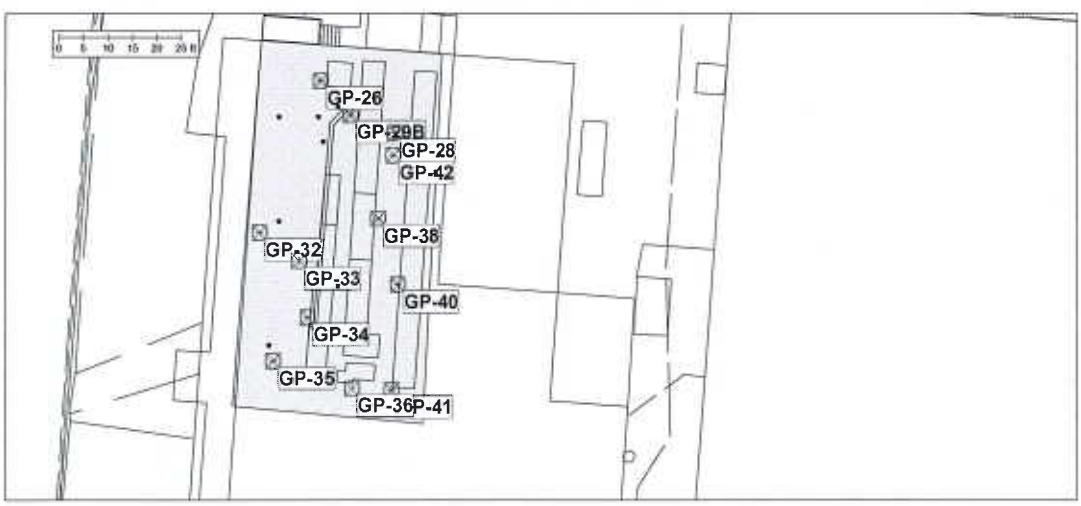
Summary

This report summarizes the sampling design used, associated statistical assumptions, as well as general guidelines for conducting post-sampling data analysis. Sampling plan components presented here include how many sampling locations to choose and where within the sampling area to collect those samples. The type of medium to sample (i.e., soil, groundwater, etc.) and how to analyze the samples (in-situ, fixed laboratory, etc.) are addressed in other sections of the sampling plan.

The following table summarizes the sampling design developed. A figure that shows sampling locations in the field and a table that lists sampling location coordinates are also provided below.

SUMMARY OF SAMPLING DESIGN	
Primary Objective of Design	Construct a Confidence Interval on the True Median
Type of Sampling Design	Non-Parametric
Sample Placement (Location) in the Field	Simple random sampling
Formula for calculating number of sampling locations	Nonparametric Confidence Limits
Calculated total number of samples	15
Number of samples on map [a]	~~20~~ 18
Number of selected sample areas [b]	1
Specified sampling area [c]	2826.73 ft^2
Total cost of sampling [d]	$8,050.00

[a] This number may differ from the calculated number because of 1) grid edge effects, 2) adding judgment samples, or 3) selecting or unselecting sample areas.
[b] The number of selected sample areas is the number of colored areas on the map of the site. These sample areas contain the locations where samples are collected.
[c] The sampling area is the total surface area of the selected colored sample areas on the map of the site.
[d] Including measurement analyses and fixed overhead costs. See the Cost of Sampling section for an explanation of the costs presented here.



Area: Area 3					
X Coord	Y Coord	Label	Value	Type	Historical

4947.9347	5089.9428	GP-41	48	Random	
4921.1000	5121.6752	GP-32	38	Random	
4939.5678	5145.4075	GP-29B	65	Random	
4930.8339	5104.5202	GP-34	53	Random	
4948.3017	5137.2526	GP-42	75	Random	
4939.8843	5090.2245	GP-36	64	Random	
4929.1504	5115.9569	GP-33	86	Random	
4948.6182	5141.6892	GP-28	97	Random	
4923.7835	5095.8019	GP-35	45	Random	
4945.2513	5124.5343	GP-38	61	Random	
4933.5174	5152.2667	GP-26	83	Random	
4949.2765	5111.1916	GP-40	42	Random	
4937.0000	5147.0000	GP-27B	60	Unknown	
4934.0000	5140.0000	GP-31	72	Unknown	
4925.0000	5145.0000	GP-30	92	Unknown	
4937.0000	5111.0000	GP-37	50	Unknown	
4957.0000	5134.0000	GP-39	68	Unknown	
4923.0000	5099.0000	HA-1		Unknown	
4925.0000	5124.0000	HA-2		Unknown	
4933.0000	5145.0000	HA-3		Unknown	

Primary Sampling Objective
The primary purpose of sampling at this site is to construct a confidence interval on the true population median value. After the samples are collected and analyzed, the resulting sample values can be used to construct a two-sided confidence interval. Once the confidence interval is computed (which will be an upper and a lower threshold), you can have the specified confidence that the true population median is between the upper and lower thresholds.

Selected Sampling Approach
A non-parametric random sampling approach was used to determine the number of samples and to specify sampling locations. A parametric formula was not chosen because the conceptual model and historical information (e.g., historical data from this site or a very similar site) indicate that parametric assumptions are not true. These assumptions will be examined in post-sampling data analysis.

Both parametric and non-parametric equations rely on assumptions about the population. Typically, however, non-parametric equations require fewer assumptions and allow for more uncertainty about the statistical distribution of values at the site. The trade-off is that if the parametric assumptions are valid, the required number of samples is usually less than if a non-parametric equation was used.

Locating the sample points randomly provides data that are separated by many distances, whereas systematic samples are all equidistant apart. Therefore, random sampling provides more information about the spatial structure of the potential contamination than systematic sampling does. As with systematic sampling, random sampling also provides information regarding the mean or median value, but there is the possibility that areas of the site will not be represented with the same frequency as if uniform grid sampling were performed.

Number of Total Samples: Calculation Equation and Inputs
Two sample confidence interval calculation methods are available for when n□20 and n>20 (Conover, 1980, p. 111-117) (Gilbert, 1987,p. 141-142). In VSP, the user specifies a one-sided or two-sided CI, and the percent confidence desired to be within a specified number of percentiles of the median. A binary search is then performed on the CI equations to solve for the minimum sample size to satisfy these parameters. VSP first uses the n□20 method to determine if a solution can be found where n□20, and if not, then uses the n>20 method.

For a one-sided CI, the n□20 method follows a binomial distribution and determines the lowest value of n where the yth quantile of the sample would be equal to or above the true median at least X% of the time (Note that the sample sizes work out to be the same regardless of whether the CI will be a lower or upper tailed, so the same formula can be used for any one-sided CI). X% is the specified confidence for one-sided confidence intervals, and the average of 100% and the specified confidence for two-sided confidence intervals. The yth quantile is determined by taking 50% and subtracting the allowable number of percentiles from the median specified by the user.

For a two-sided CI, the n□20 method is the same as performing a one-sided confidence interval, but replacing the specified percent confidence with the average of 100% and the specified percent confidence. If no solution is found where n□20, a binary search is conducted using Equation (1) for a one-sided CI and Equation (2) for a two-sided interval to compute the value of r (r is the the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest), rounding r up to the next higher integer. The search is repeated until the smallest n is found where 100*2*r/n is greater than 50% minus the allowable number of percentiles from the median specified by the user.

$$r = 0.5*n - 0.5*w_{\alpha}\sqrt{n} \qquad (1)$$

$$r = 0.5*n - 0.5*w_{\alpha/2}\sqrt{n} \qquad (2)$$

Where:

n is the sample size

r is the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest

$w_{\square}$ is the specified quantile of a normal distribution, e.g. if □=0.2 then $w_{\square}$ is the 0.2 quantile (20th percentile) of a normal distribution.

The n>20 method described above is an approximation method, so VSP also performs a final check using a binomial distribution in a similar manner to the n□20 method, and may increase the sample size by 1 to ensure the specified confidence levels are met.

Cost of Sampling

The total cost of the completed sampling program depends on several cost inputs, some of which are fixed, and others that are based on the number of samples collected and measured. Based on the numbers of samples determined above, the estimated total cost of sampling and analysis at this site is $8,050.00, which averages out to a per sample cost of $536.67. The following table summarizes the inputs and resulting cost estimates.

COST INFORMATION			
Cost Details	**Per Analysis**	**Per Sample**	**15 Samples**
Field collection costs		$250.00	$3,750.00
Analytical costs	$220.00	$220.00	$3,300.00
Sum of Field & Analytical costs		**$470.00**	**$7,050.00**
Fixed planning and validation costs			$1,000.00
Total cost			**$8,050.00**

Data Analysis for Cu

The following data points were entered by the user for analysis.

Cu										
Rank	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
0	38	42	45	48	50	53	60	61	64	65
10	68	72	75	83	86	92	97			

SUMMARY STATISTICS for Cu	
n	17
Min	38
Max	97
Range	59
Mean	64.647
Median	64
Variance	314.49
StdDev	17.734
Std Error	4.3011
Skewness	0.30718
Interquartile Range	30

Percentiles								
1%	5%	10%	25%	50%	75%	90%	95%	99%
38	38	41.2	49	64	79	93	97	97

Data Plots

Three graphical displays of the data are shown below: the Histogram, the Box and Whiskers plot, and the Quantile-Quantile (Q-Q) plot.

The Histogram is a plot of the fraction of the n observed data that fall within specified data "bins." A histogram is generated by dividing the x axis (range of the observed data values) into "bins" and displaying the number of data in each bin as the height of a bar for the bin. The area of the bar is the fraction of the n data values that lie within the bin. The sum of the fractions for all bins equals one. A histogram is used to assess how the n data are distributed (spread) over their range of values. If the histogram is more or less symmetric and bell shaped, then the data may be normally distributed.

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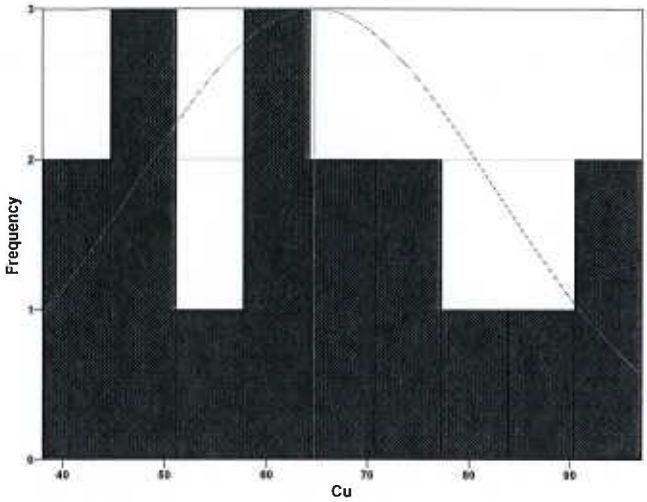
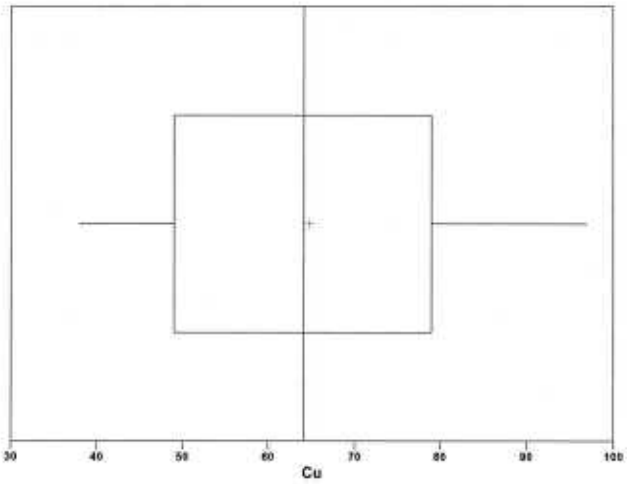
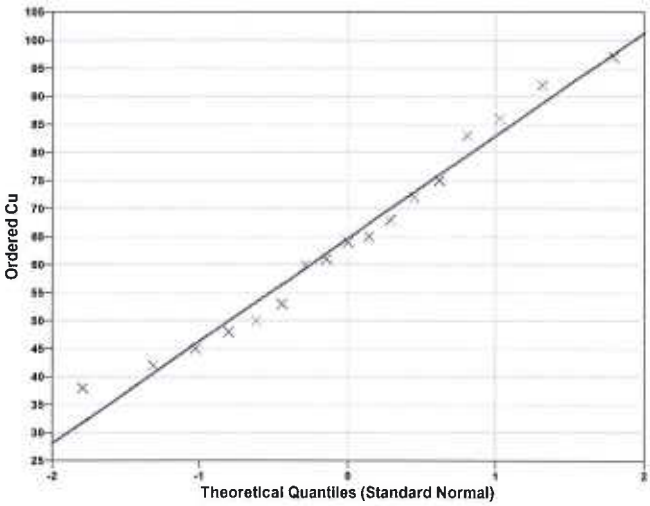
The Q-Q plot graphs the quantiles of a set of n data against the quantiles of a specific distribution. We show here only the Q-Q plot for an assumed normal distribution. The pth quantile of a distribution of data is the data value, x_p, for which a fraction p of the distribution is less than x_p. If the data plotted on the normal distribution Q-Q plot closely follow a straight line, even at the ends of the line, then the data may be assumed to be normally distributed. If the data points deviate substantially from a linear line, then the data are not normally distributed.







For more information on these three plots consult Guidance for Data Quality Assessment, EPA QA/G-9, pgs 2.3-1 through 2.3-12. (http://www.epa.gov/quality/qa-docs.html).

Two-Sided Confidence Interval on the True Median

For calculating the confidence interval, the values are ordered from smallest to largest. The confidence limits are the highest value of the r+1 and/or lowest value of the s-1 order statistics that fit the formulas below, except when the rth ordered value is tied with higher ordered values or the sth ordered value is tied with lower ordered values. If higher numbered ordered values are ties with the rth ordered value, then the closest ordered value that is lower than r will be the confidence limit. If higher-numbered ordered values are ties with the sth ordered value, then the closest ordered value that is higher than s will be the confidence limit.

Upper Two-Sided Confidence Interval

$$\sum_{s}^{1}\left(\frac{n!}{r!(n-s)!}\right)p^{0.5}(1-p)^{n-0.5} \geq 1-\alpha/2$$

Lower Two-Sided Confidence interval

$$\sum_{r}^{1}\left(\frac{n!}{r!(n-r)!}\right)p^{0.5}(1-p)^{n-0.5} \leq \alpha/2$$

Sample Median	64
Lower 95% Two-Sided Confidence Interval on the Median	48

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* - The report contents may have been modified or reformatted by end-user of software.

Chrome Bldg - Pb

VSP Sample Design Report for Calculating a Two-Sided Confidence Interval for the Population Median Using Simple Random Sampling

Summary

This report summarizes the sampling design used, associated statistical assumptions, as well as general guidelines for conducting post-sampling data analysis. Sampling plan components presented here include how many sampling locations to choose and where within the sampling area to collect those samples. The type of medium to sample (i.e., soil, groundwater, etc.) and how to analyze the samples (in-situ, fixed laboratory, etc.) are addressed in other sections of the sampling plan.

The following table summarizes the sampling design developed. A figure that shows sampling locations in the field and a table that lists sampling location coordinates are also provided below.

SUMMARY OF SAMPLING DESIGN	
Primary Objective of Design	Construct a Confidence Interval on the True Median
Type of Sampling Design	Non-Parametric
Sample Placement (Location) in the Field	Simple random sampling
Formula for calculating number of sampling locations	Nonparametric Confidence Limits
Calculated total number of samples	15
Number of samples on map [a]	15
Number of selected sample areas [b]	1
Specified sampling area [c]	2826.73 ft^2
Total cost of sampling [d]	$8,050.00

[a] This number may differ from the calculated number because of 1) grid edge effects, 2) adding judgment samples, or 3) selecting or unselecting sample areas.
[b] The number of selected sample areas is the number of colored areas on the map of the site. These sample areas contain the locations where samples are collected.
[c] The sampling area is the total surface area of the selected colored sample areas on the map of the site.
[d] Including measurement analyses and fixed overhead costs. See the Cost of Sampling section for an explanation of the costs presented here.

Area: Area 3					
X Coord	Y Coord	Label	Value	Type	Historical
4947.9347	5089.9428	GP-41	0.67	Random	
4921.1000	5121.6752	GP-32	0.75	Random	
4930.8339	5104.5202	GP-34	2.2	Random	

4948.3017	5137.2526	GP-42	0.88	Random	
4939.8843	5090.2245	GP-36	0.78	Random	
4929.1504	5115.9569	GP-33	1.1	Random	
4948.6182	5141.6892	GP-28	140	Random	
4923.7835	5095.8019	GP-35	0.96	Random	
4945.2513	5124.5343	GP-38	0.78	Random	
4933.5174	5152.2667	GP-26	0.58	Random	
4949.2765	5111.1916	GP-40	0.65	Random	
4934.0000	5140.0000	GP-31	1.7	Unknown	
4925.0000	5145.0000	GP-30	0.31	Unknown	
4937.0000	5111.0000	GP-37	1.4	Unknown	
4957.0000	5134.0000	GP-39	1.2	Unknown	

Primary Sampling Objective
The primary purpose of sampling at this site is to construct a confidence interval on the true population median value. After the samples are collected and analyzed, the resulting sample values can be used to construct a two-sided confidence interval. Once the confidence interval is computed (which will be an upper and a lower threshold), you can have the specified confidence that the true population median is between the upper and lower thresholds.

Selected Sampling Approach
A non-parametric random sampling approach was used to determine the number of samples and to specify sampling locations. A parametric formula was not chosen because the conceptual model and historical information (e.g., historical data from this site or a very similar site) indicate that parametric assumptions are not true. These assumptions will be examined in post-sampling data analysis.

Both parametric and non-parametric equations rely on assumptions about the population. Typically, however, non-parametric equations require fewer assumptions and allow for more uncertainty about the statistical distribution of values at the site. The trade-off is that if the parametric assumptions are valid, the required number of samples is usually less than if a non-parametric equation was used.

Locating the sample points randomly provides data that are separated by many distances, whereas systematic samples are all equidistant apart. Therefore, random sampling provides more information about the spatial structure of the potential contamination than systematic sampling does. As with systematic sampling, random sampling also provides information regarding the mean or median value, but there is the possibility that areas of the site will not be represented with the same frequency as if uniform grid sampling were performed.

Number of Total Samples: Calculation Equation and Inputs
Two sample confidence interval calculation methods are available for when n□20 and n>20 (Conover, 1980, p. 111-117) (Gilbert, 1987,p. 141-142). In VSP, the user specifies a one-sided or two-sided CI, and the percent confidence desired to be within a specified number of percentiles of the median. A binary search is then performed on the CI equations to solve for the minimum sample size to satisfy these parameters. VSP first uses the n□20 method to determine if a solution can be found where n□20, and if not, then uses the n>20 method.

For a one-sided CI, the n□20 method follows a binomial distribution and determines the lowest value of n where the yth quantile of the sample would be equal to or above the true median at least X% of the time (Note that the sample sizes work out to be the same regardless of whether the CI will be a lower or upper tailed, so the same formula can be used for any one-sided CI). X% is the specified confidence for one-sided confidence intervals, and the average of 100% and the specified confidence for two-sided confidence intervals. The yth quantile is determined by taking 50% and subtracting the allowable number of percentiles from the median specified by the user.

For a two-sided CI, the n□20 method is the same as performing a one-sided confidence interval, but replacing the specified percent confidence with the average of 100% and the specified percent confidence. If no solution is found where n□20, a binary search is conducted using Equation (1) for a one-sided CI and Equation (2) for a two-sided interval to compute the value of r (r is the the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest), rounding r up to the next higher integer. The search is repeated until the smallest n is

found where 100*2*r/n is greater than 50% minus the allowable number of percentiles from the median specified by the user.

$$r = 0.5 * n - 0.5 * w_{\alpha} \sqrt{n} \qquad (1)$$

$$r = 0.5 * n - 0.5 * w_{\alpha/2} \sqrt{n} \qquad (2)$$

Where:

n is the sample size

r is the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest

$w_{\square}$ is the specified quantile of a normal distribution, e.g. if □=0.2 then $w_{\square}$ is the 0.2 quantile (20th percentile) of a normal distribution.

The n>20 method described above is an approximation method, so VSP also performs a final check using a binomial distribution in a similar manner to the n□20 method, and may increase the sample size by 1 to ensure the specified confidence levels are met.

Cost of Sampling
The total cost of the completed sampling program depends on several cost inputs, some of which are fixed, and others that are based on the number of samples collected and measured. Based on the numbers of samples determined above, the estimated total cost of sampling and analysis at this site is $8,050.00, which averages out to a per sample cost of $536.67. The following table summarizes the inputs and resulting cost estimates.

COST INFORMATION			
Cost Details	**Per Analysis**	**Per Sample**	**15 Samples**
Field collection costs		$250.00	$3,750.00
Analytical costs	$220.00	$220.00	$3,300.00
Sum of Field & Analytical costs		**$470.00**	**$7,050.00**
Fixed planning and validation costs			$1,000.00
Total cost			**$8,050.00**

Data Analysis for Pb
The following data points were entered by the user for analysis.

Pb										
Rank	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
0	0.31	0.58	0.65	0.67	0.75	0.78	0.78	0.88	0.96	1.1
10	1.2	1.4	1.7	2.2	140					

SUMMARY STATISTICS for Pb	
n	15
Min	0.31
Max	140
Range	139.69
Mean	10.264
Median	0.88

Variance	1288.3
StdDev	35.894
Std Error	9.2677
Skewness	3.8718
Interquartile Range	0.73

Percentiles								
1%	**5%**	**10%**	**25%**	**50%**	**75%**	**90%**	**95%**	**99%**
0.31	0.31	0.472	0.67	0.88	1.4	57.32	140	140

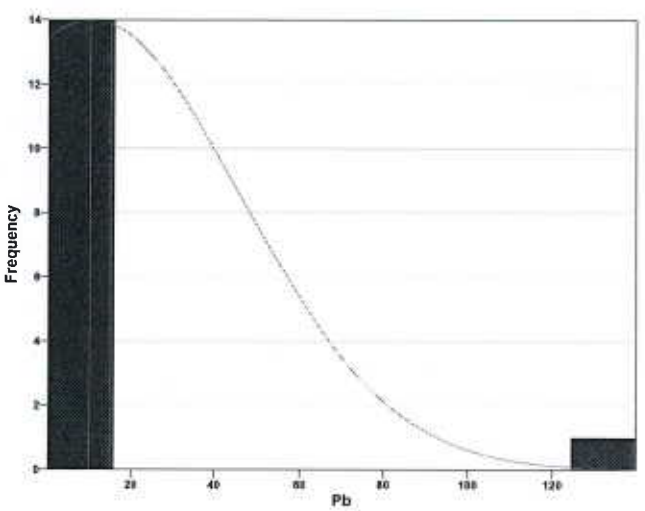
Data Plots

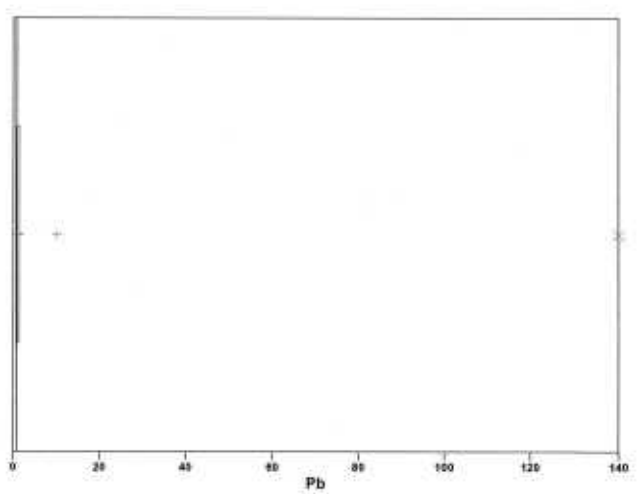
Three graphical displays of the data are shown below: the Histogram, the Box and Whiskers plot, and the Quantile-Quantile (Q-Q) plot.

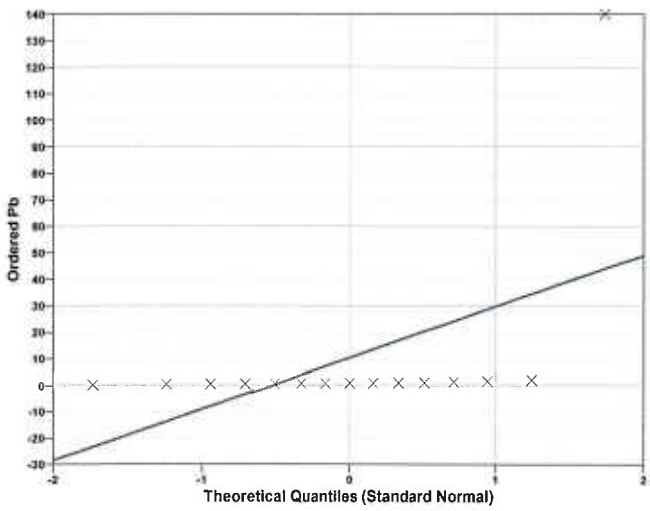
The Histogram is a plot of the fraction of the n observed data that fall within specified data "bins." A histogram is generated by dividing the x axis (range of the observed data values) into "bins" and displaying the number of data in each bin as the height of a bar for the bin. The area of the bar is the fraction of the n data values that lie within the bin. The sum of the fractions for all bins equals one. A histogram is used to assess how the n data are distributed (spread) over their range of values. If the histogram is more or less symmetric and bell shaped, then the data may be normally distributed.

The Box and Whiskers plot is composed of a central box divided by a line, and with two lines extending out from the box, called the "whiskers". The line through the box is drawn at the median of the n data observed. The two ends of the box represent the 25th and 75th percentiles of the n data values, which are also called the lower and upper quartiles, respectively, of the data set. The sample mean (mean of the n data) is shown as a "+" sign. The upper whisker extends to the largest data value that is less than the upper quartile plus 1.5 times the interquartile range (upper quartile minus the lower quartile). The lower whisker extends to the smallest data value that is greater than the lower quartile minus 1.5 times the interquartile range. Extreme data values (greater or smaller than the ends of the whiskers) are plotted individually. A Box and Whiskers plot is used to assess the symmetry of the distribution of the data set. If the distribution is symmetrical, the box is divided into two equal halves by the median, the whiskers will be the same length, and the number of extreme data points will be distributed equally on either end of the plot.

The Q-Q plot graphs the quantiles of a set of n data against the quantiles of a specific distribution. We show here only the Q-Q plot for an assumed normal distribution. The pth quantile of a distribution of data is the data value, x_n, for which a fraction p of the distribution is less than x_n. If the data plotted on the normal distribution Q-Q plot closely follow a straight line, even at the ends of the line, then the data may be assumed to be normally distributed. If the data points deviate substantially from a linear line, then the data are not normally distributed.







For more information on these three plots consult Guidance for Data Quality Assessment, EPA QA/G-9, pgs 2.3-1 through 2.3-12. (http://www.epa.gov/quality/qa-docs.html).

Two-Sided Confidence Interval on the True Median

For calculating the confidence interval, the values are ordered from smallest to largest. The confidence limits are the highest value of the r+1 and/or lowest value of the s-1 order statistics that fit the formulas below, except when the rth ordered value is tied with higher ordered values or the sth ordered value is tied with lower ordered values. If higher numbered ordered values are ties with the rth ordered value, then the closest ordered value that is lower than r will be the confidence limit. If higher-numbered ordered values are ties with the sth ordered value, then the closest ordered value that is higher than s will be the confidence limit.

Upper Two-Sided Confidence Interval

$$\sum_{s}^{1}\left(\frac{n!}{r!(n-s)!}\right)p^{0.5}(1-p)^{n-0.5} \geq 1-\alpha/2$$

Lower Two-Sided Confidence interval

$$\sum_{r}^{1}\left(\frac{n!}{r!(n-r)!}\right)p^{0.5}(1-p)^{n-0.5} \leq \alpha/2$$

Upper 95% Two-Sided Confidence Interval on the Median	1.7
Sample Median	0.88
Lower 95% Two-Sided Confidence Interval on the Median	0.65

This report was automatically produced* by Visual Sample Plan (VSP) software version 6.1b.
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* - The report contents may have been modified or reformatted by end-user of software.

Chrom Boldy Pb biased

VSP Sample Design Report for Calculating a Two-Sided Confidence Interval for the Population Median Using Simple Random Sampling

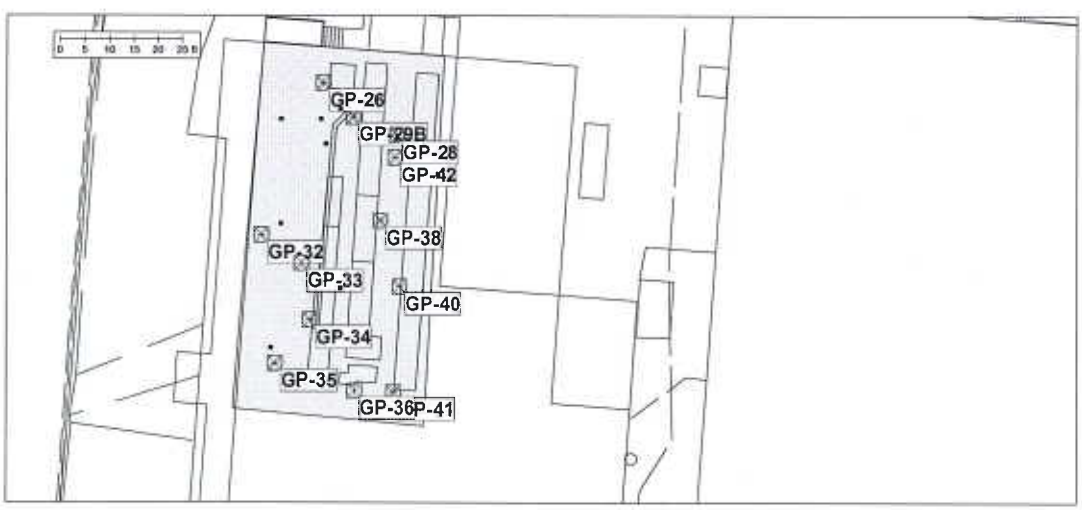
Summary

This report summarizes the sampling design used, associated statistical assumptions, as well as general guidelines for conducting post-sampling data analysis. Sampling plan components presented here include how many sampling locations to choose and where within the sampling area to collect those samples. The type of medium to sample (i.e., soil, groundwater, etc.) and how to analyze the samples (in-situ, fixed laboratory, etc.) are addressed in other sections of the sampling plan.

The following table summarizes the sampling design developed. A figure that shows sampling locations in the field and a table that lists sampling location coordinates are also provided below.

SUMMARY OF SAMPLING DESIGN	
Primary Objective of Design	Construct a Confidence Interval on the True Median
Type of Sampling Design	Non-Parametric
Sample Placement (Location) in the Field	Simple random sampling
Formula for calculating number of sampling locations	Nonparametric Confidence Limits
Calculated total number of samples	15
Number of samples on map [a]	~~20~~ 18
Number of selected sample areas [b]	1
Specified sampling area [c]	2826.73 ft^2
Total cost of sampling [d]	$8,050.00

[a] This number may differ from the calculated number because of 1) grid edge effects, 2) adding judgment samples, or 3) selecting or unselecting sample areas.
[b] The number of selected sample areas is the number of colored areas on the map of the site. These sample areas contain the locations where samples are collected.
[c] The sampling area is the total surface area of the selected colored sample areas on the map of the site.
[d] Including measurement analyses and fixed overhead costs. See the Cost of Sampling section for an explanation of the costs presented here.



Area: Area 3					
X Coord	Y Coord	Label	Value	Type	Historical

4947.9347	5089.9428	GP-41	0.67	Random	
4921.1000	5121.6752	GP-32	0.75	Random	
4939.5678	5145.4075	GP-29B	1.5	Random	
4930.8339	5104.5202	GP-34	2.2	Random	
4948.3017	5137.2526	GP-42	0.88	Random	
4939.8843	5090.2245	GP-36	0.78	Random	
4929.1504	5115.9569	GP-33	1.1	Random	
4948.6182	5141.6892	GP-28	140	Random	
4923.7835	5095.8019	GP-35	0.96	Random	
4945.2513	5124.5343	GP-38	0.78	Random	
4933.5174	5152.2667	GP-26	0.58	Random	
4949.2765	5111.1916	GP-40	0.65	Random	
4937.0000	5147.0000	GP-27B	0.78	Unknown	
4934.0000	5140.0000	GP-31	1.7	Unknown	
4925.0000	5145.0000	GP-30	0.31	Unknown	
4937.0000	5111.0000	GP-37	1.4	Unknown	
4957.0000	5134.0000	GP-39	1.2	Unknown	
4923.0000	5099.0000	HA-1		Unknown	
4925.0000	5124.0000	HA-2		Unknown	
4933.0000	5145.0000	HA-3		Unknown	

Primary Sampling Objective
The primary purpose of sampling at this site is to construct a confidence interval on the true population median value. After the samples are collected and analyzed, the resulting sample values can be used to construct a two-sided confidence interval. Once the confidence interval is computed (which will be an upper and a lower threshold), you can have the specified confidence that the true population median is between the upper and lower thresholds.

Selected Sampling Approach
A non-parametric random sampling approach was used to determine the number of samples and to specify sampling locations. A parametric formula was not chosen because the conceptual model and historical information (e.g., historical data from this site or a very similar site) indicate that parametric assumptions are not true. These assumptions will be examined in post-sampling data analysis.

Both parametric and non-parametric equations rely on assumptions about the population. Typically, however, non-parametric equations require fewer assumptions and allow for more uncertainty about the statistical distribution of values at the site. The trade-off is that if the parametric assumptions are valid, the required number of samples is usually less than if a non-parametric equation was used.

Locating the sample points randomly provides data that are separated by many distances, whereas systematic samples are all equidistant apart. Therefore, random sampling provides more information about the spatial structure of the potential contamination than systematic sampling does. As with systematic sampling, random sampling also provides information regarding the mean or median value, but there is the possibility that areas of the site will not be represented with the same frequency as if uniform grid sampling were performed.

Number of Total Samples: Calculation Equation and Inputs
Two sample confidence interval calculation methods are available for when n□20 and n>20 (Conover, 1980, p. 111-117) (Gilbert, 1987,p. 141-142). In VSP, the user specifies a one-sided or two-sided CI, and the percent confidence desired to be within a specified number of percentiles of the median. A binary search is then performed on the CI equations to solve for the minimum sample size to satisfy these parameters. VSP first uses the n□20 method to determine if a solution can be found where n□20, and if not, then uses the n>20 method.

For a one-sided CI, the n□20 method follows a binomial distribution and determines the lowest value of n where the yth quantile of the sample would be equal to or above the true median at least X% of the time (Note that the sample sizes work out to be the same regardless of whether the CI will be a lower or upper tailed, so the same formula can be used for any one-sided CI). X% is the specified confidence for one-sided confidence intervals, and the average of 100% and the specified confidence for two-sided confidence intervals. The yth quantile is determined by taking 50% and subtracting the allowable number of percentiles from the median specified by the user.

For a two-sided CI, the n□20 method is the same as performing a one-sided confidence interval, but replacing the specified percent confidence with the average of 100% and the specified percent confidence. If no solution is found where n□20, a binary search is conducted using Equation (1) for a one-sided CI and Equation (2) for a two-sided interval to compute the value of r (r is the the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest), rounding r up to the next higher integer. The search is repeated until the smallest n is found where 100*2*r/n is greater than 50% minus the allowable number of percentiles from the median specified by the user.

$$r = 0.5 * n - 0.5 * w_{\alpha} \sqrt{n} \qquad (1)$$

$$r = 0.5 * n - 0.5 * w_{\alpha/2} \sqrt{n} \qquad (2)$$

Where:

n is the sample size

r is the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest

$w_{\square}$ is the specified quantile of a normal distribution, e.g. if □=0.2 then $w_{\square}$ is the 0.2 quantile (20th percentile) of a normal distribution.

The n>20 method described above is an approximation method, so VSP also performs a final check using a binomial distribution in a similar manner to the n□20 method, and may increase the sample size by 1 to ensure the specified confidence levels are met.

Cost of Sampling

The total cost of the completed sampling program depends on several cost inputs, some of which are fixed, and others that are based on the number of samples collected and measured. Based on the numbers of samples determined above, the estimated total cost of sampling and analysis at this site is $8,050.00, which averages out to a per sample cost of $536.67. The following table summarizes the inputs and resulting cost estimates.

COST INFORMATION			
Cost Details	**Per Analysis**	**Per Sample**	**15 Samples**
Field collection costs		$250.00	$3,750.00
Analytical costs	$220.00	$220.00	$3,300.00
Sum of Field & Analytical costs		**$470.00**	**$7,050.00**
Fixed planning and validation costs			$1,000.00
Total cost			**$8,050.00**

Data Analysis for Pb

The following data points were entered by the user for analysis.

Pb										
Rank	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
0	0.31	0.58	0.65	0.67	0.75	0.78	0.78	0.78	0.88	0.96
10	1.1	1.2	1.4	1.5	1.7	2.2	140			

SUMMARY STATISTICS for Pb	
n	17
Min	0.31
Max	140
Range	139.69
Mean	9.1906
Median	0.88
Variance	1136.5
StdDev	33.712
Std Error	8.1764
Skewness	4.1218
Interquartile Range	0.74

Percentiles								
1%	5%	10%	25%	50%	75%	90%	95%	99%
0.31	0.31	0.526	0.71	0.88	1.45	29.76	140	140

Data Plots

Three graphical displays of the data are shown below: the Histogram, the Box and Whiskers plot, and the Quantile-Quantile (Q-Q) plot.

The Histogram is a plot of the fraction of the n observed data that fall within specified data "bins." A histogram is generated by dividing the x axis (range of the observed data values) into "bins" and displaying the number of data in each bin as the height of a bar for the bin. The area of the bar is the fraction of the n data values that lie within the bin. The sum of the fractions for all bins equals one. A histogram is used to assess how the n data are distributed (spread) over their range of values. If the histogram is more or less symmetric and bell shaped, then the data may be normally distributed.

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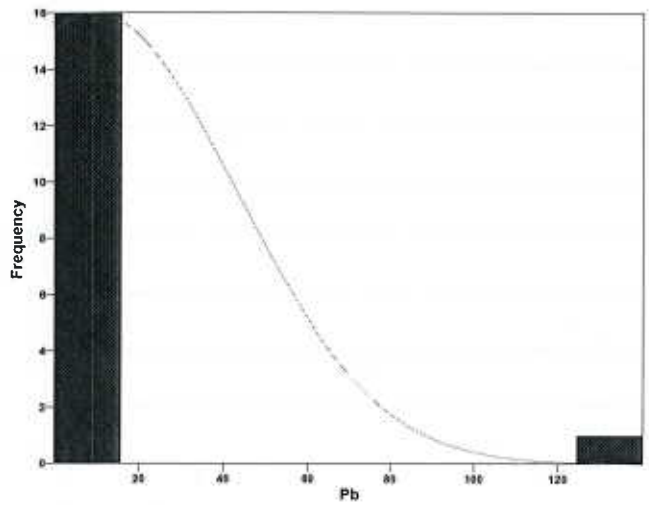
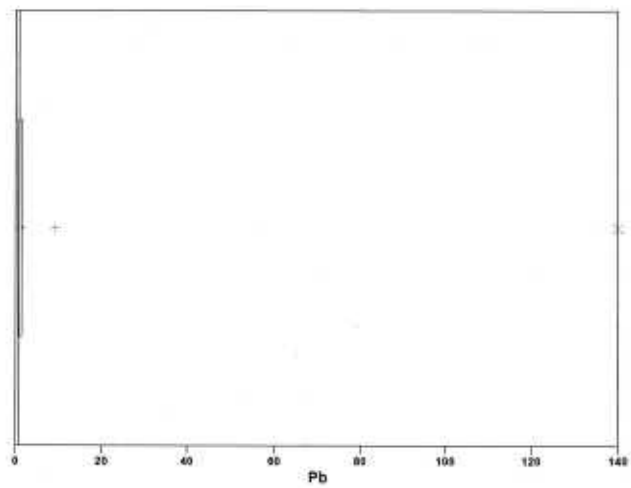
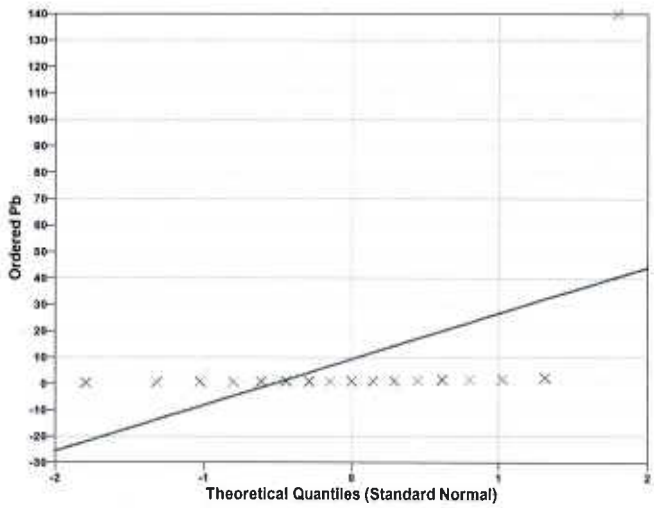
The Q-Q plot graphs the quantiles of a set of n data against the quantiles of a specific distribution. We show here only the Q-Q plot for an assumed normal distribution. The pth quantile of a distribution of data is the data value, x_n, for which a fraction p of the distribution is less than x_n. If the data plotted on the normal distribution Q-Q plot closely follow a straight line, even at the ends of the line, then the data may be assumed to be normally distributed. If the data points deviate substantially from a linear line, then the data are not normally distributed.







For more information on these three plots consult Guidance for Data Quality Assessment, EPA QA/G-9, pgs 2.3-1 through 2.3-12. (http://www.epa.gov/quality/qa-docs.html).

Two-Sided Confidence Interval on the True Median

For calculating the confidence interval, the values are ordered from smallest to largest. The confidence limits are the highest value of the r+1 and/or lowest value of the s-1 order statistics that fit the formulas below, except when the rth ordered value is tied with higher ordered values or the sth ordered value is tied with lower ordered values. If higher numbered ordered values are ties with the rth ordered value, then the closest ordered value that is lower than r will be the confidence limit. If higher-numbered ordered values are ties with the sth ordered value, then the closest ordered value that is higher than s will be the confidence limit.

Upper Two-Sided Confidence Interval

$$\sum_{s}^{1}\left(\frac{n!}{r!(n-s)!}\right)p^{0.5}(1-p)^{n-0.5} \geq 1-\alpha/2$$

Lower Two-Sided Confidence interval

$$\sum_{r}^{1}\left(\frac{n!}{r!(n-r)!}\right)p^{0.5}(1-p)^{n-0.5} \leq \alpha/2$$

Upper 95% Two-Sided Confidence Interval on the Median	1.5

Sample Median	0.88
Lower 95% Two-Sided Confidence Interval on the Median	0.67

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* - The report contents may have been modified or reformatted by end-user of software.

Chrom Boldy Ni

VSP Sample Design Report for Calculating a Two-Sided Confidence Interval for the Population Median Using Simple Random Sampling

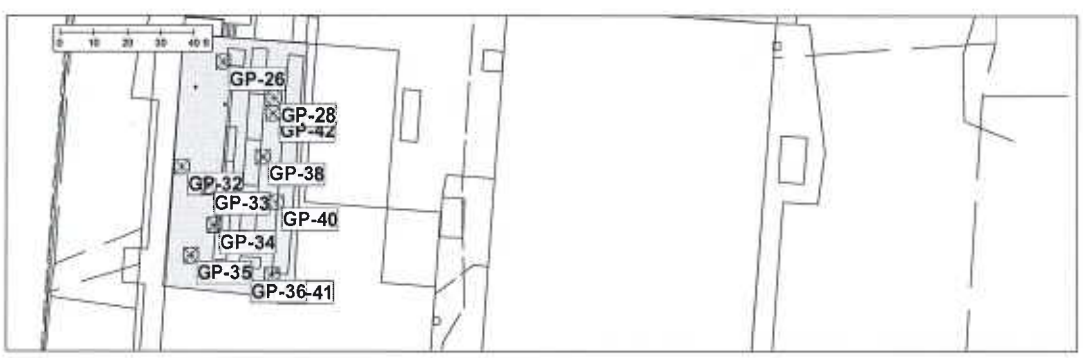
Summary

This report summarizes the sampling design used, associated statistical assumptions, as well as general guidelines for conducting post-sampling data analysis. Sampling plan components presented here include how many sampling locations to choose and where within the sampling area to collect those samples. The type of medium to sample (i.e., soil, groundwater, etc.) and how to analyze the samples (in-situ, fixed laboratory, etc.) are addressed in other sections of the sampling plan.

The following table summarizes the sampling design developed. A figure that shows sampling locations in the field and a table that lists sampling location coordinates are also provided below.

SUMMARY OF SAMPLING DESIGN	
Primary Objective of Design	Construct a Confidence Interval on the True Median
Type of Sampling Design	Non-Parametric
Sample Placement (Location) in the Field	Simple random sampling
Formula for calculating number of sampling locations	Nonparametric Confidence Limits
Calculated total number of samples	15
Number of samples on map [a]	15
Number of selected sample areas [b]	1
Specified sampling area [c]	2826.73 ft^2
Total cost of sampling [d]	$8,050.00

[a] This number may differ from the calculated number because of 1) grid edge effects, 2) adding judgment samples, or 3) selecting or unselecting sample areas.
[b] The number of selected sample areas is the number of colored areas on the map of the site. These sample areas contain the locations where samples are collected.
[c] The sampling area is the total surface area of the selected colored sample areas on the map of the site.
[d] Including measurement analyses and fixed overhead costs. See the Cost of Sampling section for an explanation of the costs presented here.



Area: Area 3					
X Coord	Y Coord	Label	Value	Type	Historical
4947.9347	5089.9428	GP-41	7.6	Random	
4921.1000	5121.6752	GP-32	19	Random	
4930.8339	5104.5202	GP-34	84	Random	

4948.3017	5137.2526	GP-42	29	Random	
4939.8843	5090.2245	GP-36	7.8	Random	
4929.1504	5115.9569	GP-33	29	Random	
4948.6182	5141.6892	GP-28	140	Random	
4923.7835	5095.8019	GP-35	31	Random	
4945.2513	5124.5343	GP-38	26	Random	
4933.5174	5152.2667	GP-26	33	Random	
4949.2765	5111.1916	GP-40	5	Random	
4934.0000	5140.0000	GP-31	41	Unknown	
4925.0000	5145.0000	GP-30	46	Unknown	
4937.0000	5111.0000	GP-37	6.5	Unknown	
4957.0000	5134.0000	GP-39	49	Unknown	

Primary Sampling Objective
The primary purpose of sampling at this site is to construct a confidence interval on the true population median value. After the samples are collected and analyzed, the resulting sample values can be used to construct a two-sided confidence interval. Once the confidence interval is computed (which will be an upper and a lower threshold), you can have the specified confidence that the true population median is between the upper and lower thresholds.

Selected Sampling Approach
A non-parametric random sampling approach was used to determine the number of samples and to specify sampling locations. A parametric formula was not chosen because the conceptual model and historical information (e.g., historical data from this site or a very similar site) indicate that parametric assumptions are not true. These assumptions will be examined in post-sampling data analysis.

Both parametric and non-parametric equations rely on assumptions about the population. Typically, however, non-parametric equations require fewer assumptions and allow for more uncertainty about the statistical distribution of values at the site. The trade-off is that if the parametric assumptions are valid, the required number of samples is usually less than if a non-parametric equation was used.

Locating the sample points randomly provides data that are separated by many distances, whereas systematic samples are all equidistant apart. Therefore, random sampling provides more information about the spatial structure of the potential contamination than systematic sampling does. As with systematic sampling, random sampling also provides information regarding the mean or median value, but there is the possibility that areas of the site will not be represented with the same frequency as if uniform grid sampling were performed.

Number of Total Samples: Calculation Equation and Inputs
Two sample confidence interval calculation methods are available for when n□20 and n>20 (Conover, 1980, p. 111-117) (Gilbert, 1987,p. 141-142). In VSP, the user specifies a one-sided or two-sided CI, and the percent confidence desired to be within a specified number of percentiles of the median. A binary search is then performed on the CI equations to solve for the minimum sample size to satisfy these parameters. VSP first uses the n□20 method to determine if a solution can be found where n□20, and if not, then uses the n>20 method.

For a one-sided CI, the n□20 method follows a binomial distribution and determines the lowest value of n where the yth quantile of the sample would be equal to or above the true median at least X% of the time (Note that the sample sizes work out to be the same regardless of whether the CI will be a lower or upper tailed, so the same formula can be used for any one-sided CI). X% is the specified confidence for one-sided confidence intervals, and the average of 100% and the specified confidence for two-sided confidence intervals. The yth quantile is determined by taking 50% and subtracting the allowable number of percentiles from the median specified by the user.

For a two-sided CI, the n□20 method is the same as performing a one-sided confidence interval, but replacing the specified percent confidence with the average of 100% and the specified percent confidence. If no solution is found where n□20, a binary search is conducted using Equation (1) for a one-sided CI and Equation (2) for a two-sided interval to compute the value of r (r is the the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest), rounding r up to the next higher integer. The search is repeated until the smallest n is

found where 100*2*r/n is greater than 50% minus the allowable number of percentiles from the median specified by the user.

$$r = 0.5 * n - 0.5 * w_{\alpha} \sqrt{n} \qquad (1)$$

$$r = 0.5 * n - 0.5 * w_{\alpha/2} \sqrt{n} \qquad (2)$$

Where:

n is the sample size

r is the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest

$w_{\square}$ is the specified quantile of a normal distribution, e.g. if $\square$=0.2 then $w_{\square}$ is the 0.2 quantile (20th percentile) of a normal distribution.

The n>20 method described above is an approximation method, so VSP also performs a final check using a binomial distribution in a similar manner to the n$\square$20 method, and may increase the sample size by 1 to ensure the specified confidence levels are met.

Cost of Sampling
The total cost of the completed sampling program depends on several cost inputs, some of which are fixed, and others that are based on the number of samples collected and measured. Based on the numbers of samples determined above, the estimated total cost of sampling and analysis at this site is $8,050.00, which averages out to a per sample cost of $536.67. The following table summarizes the inputs and resulting cost estimates.

COST INFORMATION			
Cost Details	**Per Analysis**	**Per Sample**	**15 Samples**
Field collection costs		$250.00	$3,750.00
Analytical costs	$220.00	$220.00	$3,300.00
Sum of Field & Analytical costs		**$470.00**	**$7,050.00**
Fixed planning and validation costs			$1,000.00
Total cost			**$8,050.00**

Data Analysis for Ni
The following data points were entered by the user for analysis.

Ni										
Rank	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
0	5	6.5	7.6	7.8	19	26	29	29	31	33
10	41	46	49	84	140					

SUMMARY STATISTICS for Ni	
n	15
Min	5
Max	140
Range	135
Mean	36.927
Median	29

Variance				1239.7				
StdDev				35.209				
Std Error				9.0909				
Skewness				2.045				
Interquartile Range				38.2				
Percentiles								
1%	**5%**	**10%**	**25%**	**50%**	**75%**	**90%**	**95%**	**99%**
5	5	5.9	7.8	29	46	106.4	140	140

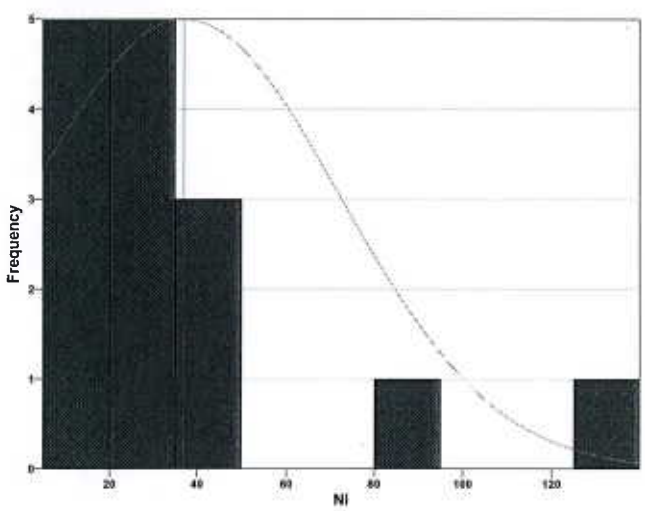
Data Plots

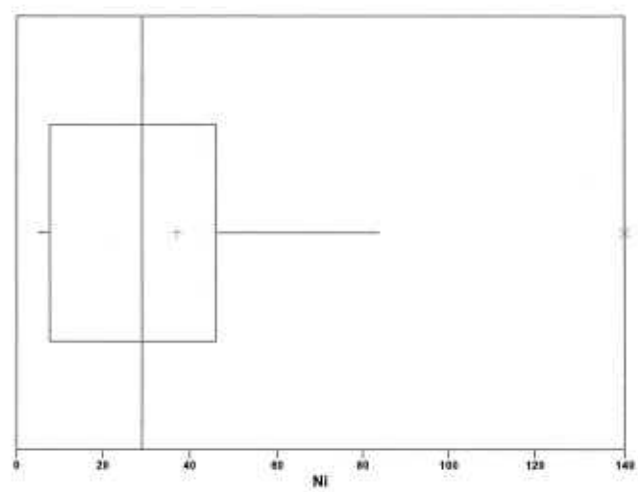
Three graphical displays of the data are shown below: the Histogram, the Box and Whiskers plot, and the Quantile-Quantile (Q-Q) plot.

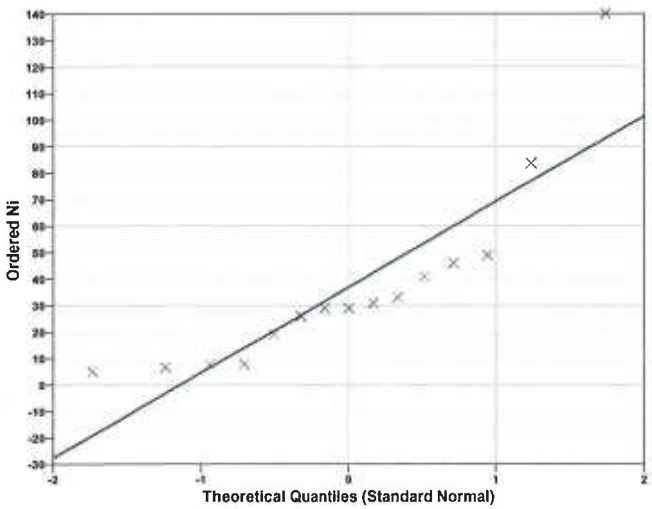
The Histogram is a plot of the fraction of the n observed data that fall within specified data "bins." A histogram is generated by dividing the x axis (range of the observed data values) into "bins" and displaying the number of data in each bin as the height of a bar for the bin. The area of the bar is the fraction of the n data values that lie within the bin. The sum of the fractions for all bins equals one. A histogram is used to assess how the n data are distributed (spread) over their range of values. If the histogram is more or less symmetric and bell shaped, then the data may be normally distributed.

The Box and Whiskers plot is composed of a central box divided by a line, and with two lines extending out from the box, called the "whiskers". The line through the box is drawn at the median of the n data observed. The two ends of the box represent the 25th and 75th percentiles of the n data values, which are also called the lower and upper quartiles, respectively, of the data set. The sample mean (mean of the n data) is shown as a "+" sign. The upper whisker extends to the largest data value that is less than the upper quartile plus 1.5 times the interquartile range (upper quartile minus the lower quartile). The lower whisker extends to the smallest data value that is greater than the lower quartile minus 1.5 times the interquartile range. Extreme data values (greater or smaller than the ends of the whiskers) are plotted individually. A Box and Whiskers plot is used to assess the symmetry of the distribution of the data set. If the distribution is symmetrical, the box is divided into two equal halves by the median, the whiskers will be the same length, and the number of extreme data points will be distributed equally on either end of the plot.

The Q-Q plot graphs the quantiles of a set of n data against the quantiles of a specific distribution. We show here only the Q-Q plot for an assumed normal distribution. The pth quantile of a distribution of data is the data value, x_n, for which a fraction p of the distribution is less than x_n. If the data plotted on the normal distribution Q-Q plot closely follow a straight line, even at the ends of the line, then the data may be assumed to be normally distributed. If the data points deviate substantially from a linear line, then the data are not normally distributed.







For more information on these three plots consult Guidance for Data Quality Assessment, EPA QA/G-9, pgs 2.3-1 through 2.3-12. (http://www.epa.gov/quality/qa-docs.html).

Two-Sided Confidence Interval on the True Median

For calculating the confidence interval, the values are ordered from smallest to largest. The confidence limits are the highest value of the r+1 and/or lowest value of the s-1 order statistics that fit the formulas below, except when the rth ordered value is tied with higher ordered values or the sth ordered value is tied with lower ordered values. If higher numbered ordered values are ties with the rth ordered value, then the closest ordered value that is lower than r will be the confidence limit. If higher-numbered ordered values are ties with the sth ordered value, then the closest ordered value that is higher than s will be the confidence limit.

Upper Two-Sided Confidence Interval

$$\sum_{s}^{1}\left(\frac{n!}{r!(n-s)!}\right)p^{0.5}(1-p)^{n-0.5} \geq 1-\alpha/2$$

Lower Two-Sided Confidence interval

$$\sum_{r}^{1}\left(\frac{n!}{r!(n-r)!}\right)p^{0.5}(1-p)^{n-0.5} \leq \alpha/2$$

Upper 95% Two-Sided Confidence Interval on the Median	49
Sample Median	29
Lower 95% Two-Sided Confidence Interval on the Median	7.6

This report was automatically produced* by Visual Sample Plan (VSP) software version 6.1b.
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* - The report contents may have been modified or reformatted by end-user of software.

Chrome Bldg Ni Biscard

VSP Sample Design Report for Calculating a Two-Sided Confidence Interval for the Population Median Using Simple Random Sampling

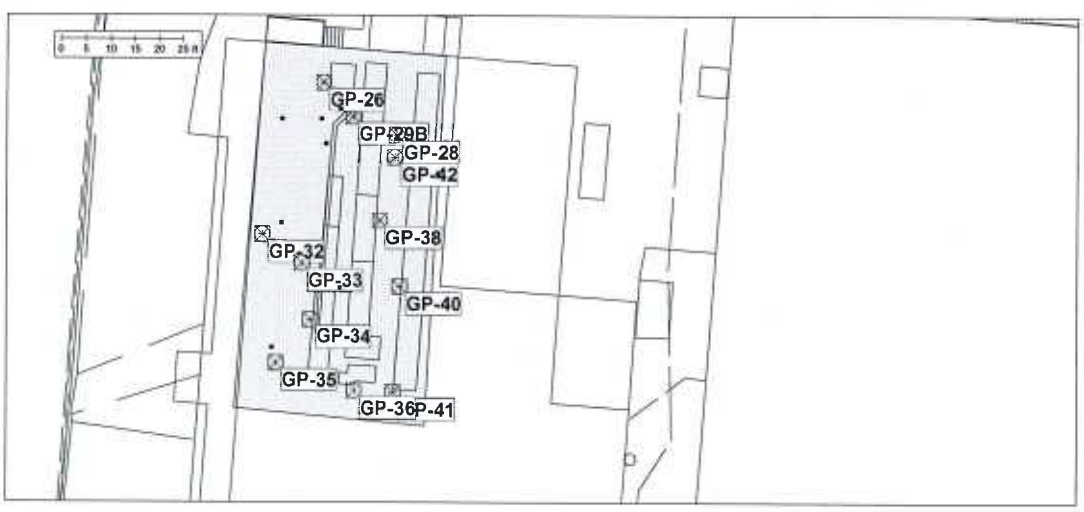
Summary

This report summarizes the sampling design used, associated statistical assumptions, as well as general guidelines for conducting post-sampling data analysis. Sampling plan components presented here include how many sampling locations to choose and where within the sampling area to collect those samples. The type of medium to sample (i.e., soil, groundwater, etc.) and how to analyze the samples (in-situ, fixed laboratory, etc.) are addressed in other sections of the sampling plan.

The following table summarizes the sampling design developed. A figure that shows sampling locations in the field and a table that lists sampling location coordinates are also provided below.

SUMMARY OF SAMPLING DESIGN	
Primary Objective of Design	Construct a Confidence Interval on the True Median
Type of Sampling Design	Non-Parametric
Sample Placement (Location) in the Field	Simple random sampling
Formula for calculating number of sampling locations	Nonparametric Confidence Limits
Calculated total number of samples	15
Number of samples on map [a]	~~20~~ 18
Number of selected sample areas [b]	1
Specified sampling area [c]	2826.73 ft^2
Total cost of sampling [d]	$8,050.00

[a] This number may differ from the calculated number because of 1) grid edge effects, 2) adding judgment samples, or 3) selecting or unselecting sample areas.
[b] The number of selected sample areas is the number of colored areas on the map of the site. These sample areas contain the locations where samples are collected.
[c] The sampling area is the total surface area of the selected colored sample areas on the map of the site.
[d] Including measurement analyses and fixed overhead costs. See the Cost of Sampling section for an explanation of the costs presented here.



Area: Area 3					
X Coord	Y Coord	Label	Value	Type	Historical

4947.9347	5089.9428	GP-41	7.6	Random	
4921.1000	5121.6752	GP-32	19	Random	
4939.5678	5145.4075	GP-29B	84	Random	
4930.8339	5104.5202	GP-34	84	Random	
4948.3017	5137.2526	GP-42	29	Random	
4939.8843	5090.2245	GP-36	7.8	Random	
4929.1504	5115.9569	GP-33	29	Random	
4948.6182	5141.6892	GP-28	140	Random	
4923.7835	5095.8019	GP-35	31	Random	
4945.2513	5124.5343	GP-38	26	Random	
4933.5174	5152.2667	GP-26	33	Random	
4949.2765	5111.1916	GP-40	5	Random	
4937.0000	5147.0000	GP-27B	51	Unknown	
4934.0000	5140.0000	GP-31	41	Unknown	
4925.0000	5145.0000	GP-30	46	Unknown	
4937.0000	5111.0000	GP-37	6.5	Unknown	
4957.0000	5134.0000	GP-39	49	Unknown	
4923.0000	5099.0000	HA-1		Unknown	
4925.0000	5124.0000	HA-2		Unknown	
4933.0000	5145.0000	HA-3		Unknown	

Primary Sampling Objective
The primary purpose of sampling at this site is to construct a confidence interval on the true population median value. After the samples are collected and analyzed, the resulting sample values can be used to construct a two-sided confidence interval. Once the confidence interval is computed (which will be an upper and a lower threshold), you can have the specified confidence that the true population median is between the upper and lower thresholds.

Selected Sampling Approach
A non-parametric random sampling approach was used to determine the number of samples and to specify sampling locations. A parametric formula was not chosen because the conceptual model and historical information (e.g., historical data from this site or a very similar site) indicate that parametric assumptions are not true. These assumptions will be examined in post-sampling data analysis.

Both parametric and non-parametric equations rely on assumptions about the population. Typically, however, non-parametric equations require fewer assumptions and allow for more uncertainty about the statistical distribution of values at the site. The trade-off is that if the parametric assumptions are valid, the required number of samples is usually less than if a non-parametric equation was used.

Locating the sample points randomly provides data that are separated by many distances, whereas systematic samples are all equidistant apart. Therefore, random sampling provides more information about the spatial structure of the potential contamination than systematic sampling does. As with systematic sampling, random sampling also provides information regarding the mean or median value, but there is the possibility that areas of the site will not be represented with the same frequency as if uniform grid sampling were performed.

Number of Total Samples: Calculation Equation and Inputs
Two sample confidence interval calculation methods are available for when n□20 and n>20 (Conover, 1980, p. 111-117) (Gilbert, 1987,p. 141-142). In VSP, the user specifies a one-sided or two-sided CI, and the percent confidence desired to be within a specified number of percentiles of the median. A binary search is then performed on the CI equations to solve for the minimum sample size to satisfy these parameters. VSP first uses the n□20 method to determine if a solution can be found where n□20, and if not, then uses the n>20 method.

For a one-sided CI, the n□20 method follows a binomial distribution and determines the lowest value of n where the yth quantile of the sample would be equal to or above the true median at least X% of the time (Note that the sample sizes work out to be the same regardless of whether the CI will be a lower or upper tailed, so the same formula can be used for any one-sided CI). X% is the specified confidence for one-sided confidence intervals, and the average of 100% and the specified confidence for two-sided confidence intervals. The yth quantile is determined by taking 50% and subtracting the allowable number of percentiles from the median specified by the user.

For a two-sided CI, the n□20 method is the same as performing a one-sided confidence interval, but replacing the specified percent confidence with the average of 100% and the specified percent confidence. If no solution is found where n□20, a binary search is conducted using Equation (1) for a one-sided CI and Equation (2) for a two-sided interval to compute the value of r (r is the the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest), rounding r up to the next higher integer. The search is repeated until the smallest n is found where 100*2*r/n is greater than 50% minus the allowable number of percentiles from the median specified by the user.

$$r = 0.5 * n - 0.5 * w_{\alpha} \sqrt{n} \qquad (1)$$

$$r = 0.5 * n - 0.5 * w_{\alpha/2} \sqrt{n} \qquad (2)$$

Where:

n is the sample size

r is the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest

$w_{\square}$ is the specified quantile of a normal distribution, e.g. if □=0.2 then $w_{\square}$ is the 0.2 quantile (20th percentile) of a normal distribution.

The n>20 method described above is an approximation method, so VSP also performs a final check using a binomial distribution in a similar manner to the n□20 method, and may increase the sample size by 1 to ensure the specified confidence levels are met.

Cost of Sampling

The total cost of the completed sampling program depends on several cost inputs, some of which are fixed, and others that are based on the number of samples collected and measured. Based on the numbers of samples determined above, the estimated total cost of sampling and analysis at this site is $8,050.00, which averages out to a per sample cost of $536.67. The following table summarizes the inputs and resulting cost estimates.

COST INFORMATION			
Cost Details	**Per Analysis**	**Per Sample**	**15 Samples**
Field collection costs		$250.00	$3,750.00
Analytical costs	$220.00	$220.00	$3,300.00
Sum of Field & Analytical costs		**$470.00**	**$7,050.00**
Fixed planning and validation costs			$1,000.00
Total cost			**$8,050.00**

Data Analysis for Ni

The following data points were entered by the user for analysis.

Ni										
Rank	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
0	5	6.5	7.6	7.8	19	26	29	29	31	33
10	41	46	49	51	84	84	140			

SUMMARY STATISTICS for Ni	
n	17
Min	5
Max	140
Range	135
Mean	40.524
Median	31
Variance	1221.8
StdDev	34.955
Std Error	8.4777
Skewness	1.6226
Interquartile Range	36.6

Percentiles								
1%	5%	10%	25%	50%	75%	90%	95%	99%
5	5	6.2	13.4	31	50	95.2	140	140

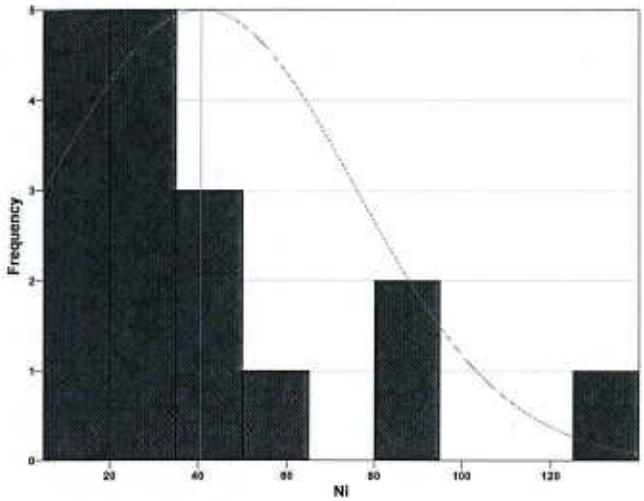
Data Plots

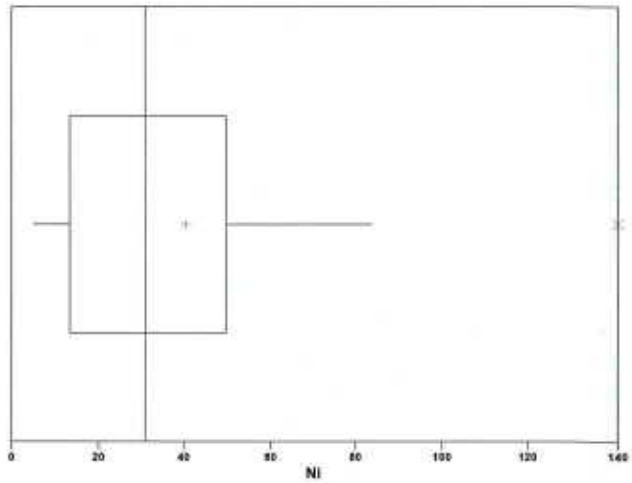
Three graphical displays of the data are shown below: the Histogram, the Box and Whiskers plot, and the Quantile-Quantile (Q-Q) plot.

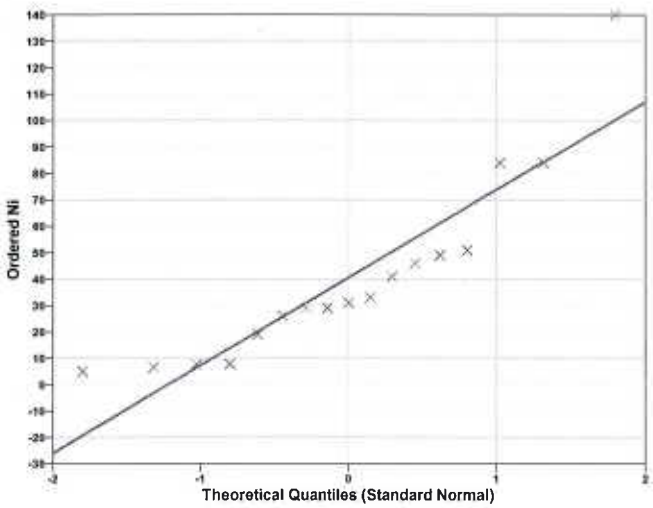
The Histogram is a plot of the fraction of the n observed data that fall within specified data "bins." A histogram is generated by dividing the x axis (range of the observed data values) into "bins" and displaying the number of data in each bin as the height of a bar for the bin. The area of the bar is the fraction of the n data values that lie within the bin. The sum of the fractions for all bins equals one. A histogram is used to assess how the n data are distributed (spread) over their range of values. If the histogram is more or less symmetric and bell shaped, then the data may be normally distributed.

The Box and Whiskers plot is composed of a central box divided by a line, and with two lines extending out from the box, called the "whiskers". The line through the box is drawn at the median of the n data observed. The two ends of the box represent the 25th and 75th percentiles of the n data values, which are also called the lower and upper quartiles, respectively, of the data set. The sample mean (mean of the n data) is shown as a "+" sign. The upper whisker extends to the largest data value that is less than the upper quartile plus 1.5 times the interquartile range (upper quartile minus the lower quartile). The lower whisker extends to the smallest data value that is greater than the lower quartile minus 1.5 times the interquartile range. Extreme data values (greater or smaller than the ends of the whiskers) are plotted individually. A Box and Whiskers plot is used to assess the symmetry of the distribution of the data set. If the distribution is symmetrical, the box is divided into two equal halves by the median, the whiskers will be the same length, and the number of extreme data points will be distributed equally on either end of the plot.

The Q-Q plot graphs the quantiles of a set of n data against the quantiles of a specific distribution. We show here only the Q-Q plot for an assumed normal distribution. The pth quantile of a distribution of data is the data value, x_p, for which a fraction p of the distribution is less than x_p. If the data plotted on the normal distribution Q-Q plot closely follow a straight line, even at the ends of the line, then the data may be assumed to be normally distributed. If the data points deviate substantially from a linear line, then the data are not normally distributed.







For more information on these three plots consult Guidance for Data Quality Assessment, EPA QA/G-9, pgs 2.3-1 through 2.3-12. (http://www.epa.gov/quality/qa-docs.html).

Two-Sided Confidence Interval on the True Median

For calculating the confidence interval, the values are ordered from smallest to largest. The confidence limits are the highest value of the r+1 and/or lowest value of the s-1 order statistics that fit the formulas below, except when the rth ordered value is tied with higher ordered values or the sth ordered value is tied with lower ordered values. If higher numbered ordered values are ties with the rth ordered value, then the closest ordered value that is lower than r will be the confidence limit. If higher-numbered ordered values are ties with the sth ordered value, then the closest ordered value that is higher than s will be the confidence limit.

Upper Two-Sided Confidence Interval

$$\sum_{s}^{1}\left(\frac{n!}{r!(n-s)!}\right)p^{0.5}(1-p)^{n-0.5} \geq 1-\alpha/2$$

Lower Two-Sided Confidence interval

$$\sum_{r}^{1}\left(\frac{n!}{r!(n-r)!}\right)p^{0.5}(1-p)^{n-0.5} \leq \alpha/2$$

Upper 95% Two-Sided Confidence Interval on the Median	51

Sample Median	31
Lower 95% Two-Sided Confidence Interval on the Median	7.8

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* - The report contents may have been modified or reformatted by end-user of software.

Chrom Bldg Su

VSP Sample Design Report for Calculating a Two-Sided Confidence Interval for the Population Median Using Simple Random Sampling

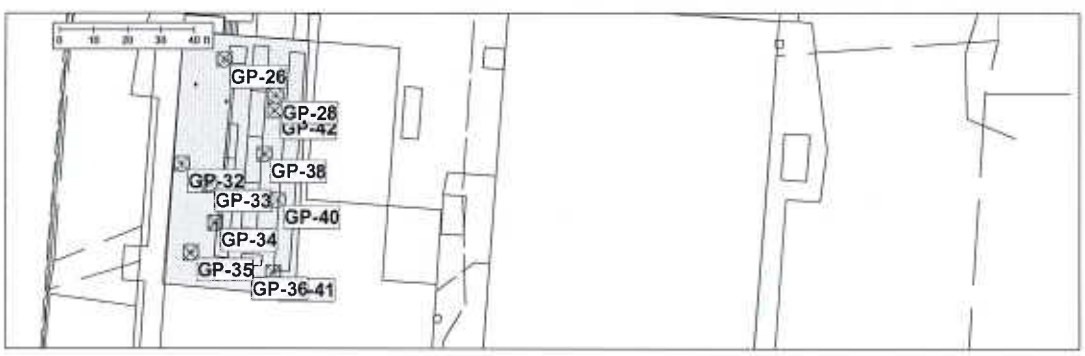
Summary

This report summarizes the sampling design used, associated statistical assumptions, as well as general guidelines for conducting post-sampling data analysis. Sampling plan components presented here include how many sampling locations to choose and where within the sampling area to collect those samples. The type of medium to sample (i.e., soil, groundwater, etc.) and how to analyze the samples (in-situ, fixed laboratory, etc.) are addressed in other sections of the sampling plan.

The following table summarizes the sampling design developed. A figure that shows sampling locations in the field and a table that lists sampling location coordinates are also provided below.

SUMMARY OF SAMPLING DESIGN	
Primary Objective of Design	Construct a Confidence Interval on the True Median
Type of Sampling Design	Non-Parametric
Sample Placement (Location) in the Field	Simple random sampling
Formula for calculating number of sampling locations	Nonparametric Confidence Limits
Calculated total number of samples	15
Number of samples on map [a]	15
Number of selected sample areas [b]	1
Specified sampling area [c]	2826.73 ft^2
Total cost of sampling [d]	$8,050.00

[a] This number may differ from the calculated number because of 1) grid edge effects, 2) adding judgment samples, or 3) selecting or unselecting sample areas.
[b] The number of selected sample areas is the number of colored areas on the map of the site. These sample areas contain the locations where samples are collected.
[c] The sampling area is the total surface area of the selected colored sample areas on the map of the site.
[d] Including measurement analyses and fixed overhead costs. See the Cost of Sampling section for an explanation of the costs presented here.



Area: Area 3					
X Coord	Y Coord	Label	Value	Type	Historical
4947.9347	5089.9428	GP-41	0.25	Random	
4921.1000	5121.6752	GP-32	0.25	Random	
4930.8339	5104.5202	GP-34	0.275	Random	

4948.3017	5137.2526	GP-42	0.27	Random	
4939.8843	5090.2245	GP-36	0.265	Random	
4929.1504	5115.9569	GP-33	0.265	Random	
4948.6182	5141.6892	GP-28	0.275	Random	
4923.7835	5095.8019	GP-35	0.27	Random	
4945.2513	5124.5343	GP-38	0.26	Random	
4933.5174	5152.2667	GP-26	0.265	Random	
4949.2765	5111.1916	GP-40	0.255	Random	
4934.0000	5140.0000	GP-31	0.265	Unknown	
4925.0000	5145.0000	GP-30	0.265	Unknown	
4937.0000	5111.0000	GP-37	0.27	Unknown	
4957.0000	5134.0000	GP-39	0.265	Unknown	

Primary Sampling Objective
The primary purpose of sampling at this site is to construct a confidence interval on the true population median value. After the samples are collected and analyzed, the resulting sample values can be used to construct a two-sided confidence interval. Once the confidence interval is computed (which will be an upper and a lower threshold), you can have the specified confidence that the true population median is between the upper and lower thresholds.

Selected Sampling Approach
A non-parametric random sampling approach was used to determine the number of samples and to specify sampling locations. A parametric formula was not chosen because the conceptual model and historical information (e.g., historical data from this site or a very similar site) indicate that parametric assumptions are not true. These assumptions will be examined in post-sampling data analysis.

Both parametric and non-parametric equations rely on assumptions about the population. Typically, however, non-parametric equations require fewer assumptions and allow for more uncertainty about the statistical distribution of values at the site. The trade-off is that if the parametric assumptions are valid, the required number of samples is usually less than if a non-parametric equation was used.

Locating the sample points randomly provides data that are separated by many distances, whereas systematic samples are all equidistant apart. Therefore, random sampling provides more information about the spatial structure of the potential contamination than systematic sampling does. As with systematic sampling, random sampling also provides information regarding the mean or median value, but there is the possibility that areas of the site will not be represented with the same frequency as if uniform grid sampling were performed.

Number of Total Samples: Calculation Equation and Inputs
Two sample confidence interval calculation methods are available for when n□20 and n>20 (Conover, 1980, p. 111-117) (Gilbert, 1987,p. 141-142). In VSP, the user specifies a one-sided or two-sided CI, and the percent confidence desired to be within a specified number of percentiles of the median. A binary search is then performed on the CI equations to solve for the minimum sample size to satisfy these parameters. VSP first uses the n□20 method to determine if a solution can be found where n□20, and if not, then uses the n>20 method.

For a one-sided CI, the n□20 method follows a binomial distribution and determines the lowest value of n where the yth quantile of the sample would be equal to or above the true median at least X% of the time (Note that the sample sizes work out to be the same regardless of whether the CI will be a lower or upper tailed, so the same formula can be used for any one-sided CI). X% is the specified confidence for one-sided confidence intervals, and the average of 100% and the specified confidence for two-sided confidence intervals. The yth quantile is determined by taking 50% and subtracting the allowable number of percentiles from the median specified by the user.

For a two-sided CI, the n□20 method is the same as performing a one-sided confidence interval, but replacing the specified percent confidence with the average of 100% and the specified percent confidence. If no solution is found where n□20, a binary search is conducted using Equation (1) for a one-sided CI and Equation (2) for a two-sided interval to compute the value of r (r is the the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest), rounding r up to the next higher integer. The search is repeated until the smallest n is

found where 100*2*r/n is greater than 50% minus the allowable number of percentiles from the median specified by the user.

$$r = 0.5 * n - 0.5 * w_{\alpha} \sqrt{n} \qquad (1)$$

$$r = 0.5 * n - 0.5 * w_{\alpha/2} \sqrt{n} \qquad (2)$$

Where:

n is the sample size

r is the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest

$w_{\square}$ is the specified quantile of a normal distribution, e.g. if □=0.2 then $w_{\square}$ is the 0.2 quantile (20th percentile) of a normal distribution.

The n>20 method described above is an approximation method, so VSP also performs a final check using a binomial distribution in a similar manner to the n□20 method, and may increase the sample size by 1 to ensure the specified confidence levels are met.

Cost of Sampling
The total cost of the completed sampling program depends on several cost inputs, some of which are fixed, and others that are based on the number of samples collected and measured. Based on the numbers of samples determined above, the estimated total cost of sampling and analysis at this site is $8,050.00, which averages out to a per sample cost of $536.67. The following table summarizes the inputs and resulting cost estimates.

COST INFORMATION			
Cost Details	**Per Analysis**	**Per Sample**	**15 Samples**
Field collection costs		$250.00	$3,750.00
Analytical costs	$220.00	$220.00	$3,300.00
Sum of Field & Analytical costs		**$470.00**	**$7,050.00**
Fixed planning and validation costs			$1,000.00
Total cost			**$8,050.00**

Data Analysis for Sn
The following data points were entered by the user for analysis.

Sn										
Rank	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
0	0.25	0.25	0.255	0.26	0.265	0.265	0.265	0.265	0.265	0.265
10	0.27	0.27	0.27	0.275	0.275					

SUMMARY STATISTICS for Sn	
n	15
Min	0.25
Max	0.275
Range	0.025
Mean	0.26433
Median	0.265

Variance	6.0238e-005
StdDev	0.0077613
Std Error	0.002004
Skewness	-0.67145
Interquartile Range	0.01

Percentiles								
1%	5%	10%	25%	50%	75%	90%	95%	99%
0.25	0.25	0.25	0.26	0.265	0.27	0.275	0.275	0.275

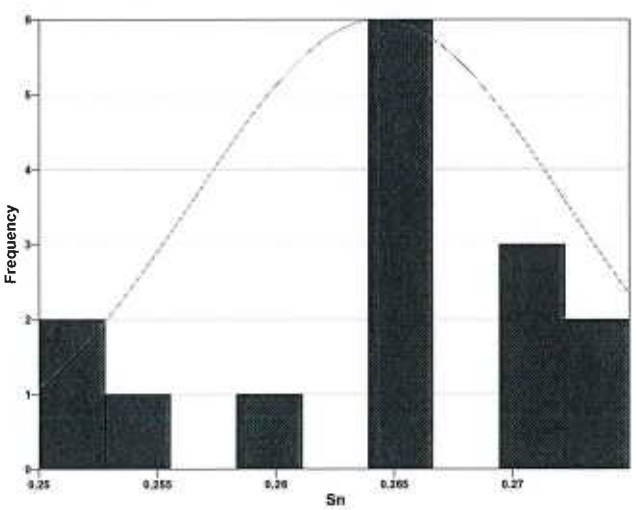
Data Plots

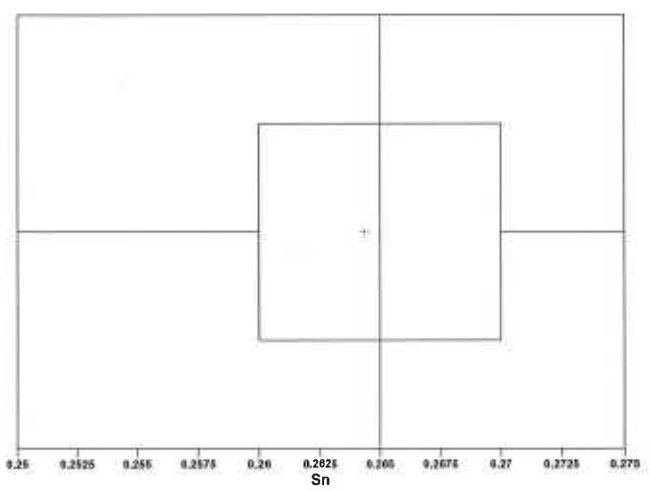
Three graphical displays of the data are shown below: the Histogram, the Box and Whiskers plot, and the Quantile-Quantile (Q-Q) plot.

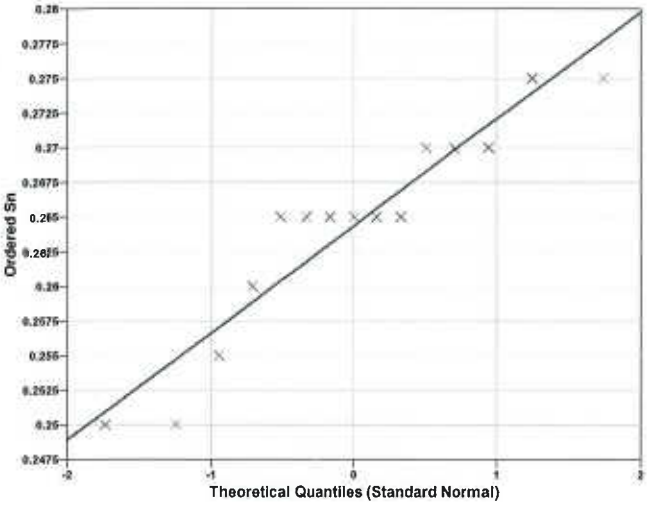
The Histogram is a plot of the fraction of the n observed data that fall within specified data "bins." A histogram is generated by dividing the x axis (range of the observed data values) into "bins" and displaying the number of data in each bin as the height of a bar for the bin. The area of the bar is the fraction of the n data values that lie within the bin. The sum of the fractions for all bins equals one. A histogram is used to assess how the n data are distributed (spread) over their range of values. If the histogram is more or less symmetric and bell shaped, then the data may be normally distributed.

The Box and Whiskers plot is composed of a central box divided by a line, and with two lines extending out from the box, called the "whiskers". The line through the box is drawn at the median of the n data observed. The two ends of the box represent the 25th and 75th percentiles of the n data values, which are also called the lower and upper quartiles, respectively, of the data set. The sample mean (mean of the n data) is shown as a "+" sign. The upper whisker extends to the largest data value that is less than the upper quartile plus 1.5 times the interquartile range (upper quartile minus the lower quartile). The lower whisker extends to the smallest data value that is greater than the lower quartile minus 1.5 times the interquartile range. Extreme data values (greater or smaller than the ends of the whiskers) are plotted individually. A Box and Whiskers plot is used to assess the symmetry of the distribution of the data set. If the distribution is symmetrical, the box is divided into two equal halves by the median, the whiskers will be the same length, and the number of extreme data points will be distributed equally on either end of the plot.

The Q-Q plot graphs the quantiles of a set of n data against the quantiles of a specific distribution. We show here only the Q-Q plot for an assumed normal distribution. The pth quantile of a distribution of data is the data value, x_n, for which a fraction p of the distribution is less than x_n. If the data plotted on the normal distribution Q-Q plot closely follow a straight line, even at the ends of the line, then the data may be assumed to be normally distributed. If the data points deviate substantially from a linear line, then the data are not normally distributed.







For more information on these three plots consult Guidance for Data Quality Assessment, EPA QA/G-9, pgs 2.3-1 through 2.3-12. (http://www.epa.gov/quality/qa-docs.html).

Two-Sided Confidence Interval on the True Median

For calculating the confidence interval, the values are ordered from smallest to largest. The confidence limits are the highest value of the r+1 and/or lowest value of the s-1 order statistics that fit the formulas below, except when the rth ordered value is tied with higher ordered values or the sth ordered value is tied with lower ordered values. If higher numbered ordered values are ties with the rth ordered value, then the closest ordered value that is lower than r will be the confidence limit. If higher-numbered ordered values are ties with the sth ordered value, then the closest ordered value that is higher than s will be the confidence limit.

Upper Two-Sided Confidence Interval

$$\sum_{s}^{1}\left(\frac{n!}{r!\,(n-s)!}\right)p^{0.5}(1-p)^{n-0.5} \geq 1-\alpha/2$$

Lower Two-Sided Confidence interval

$$\sum_{r}^{1}\left(\frac{n!}{r!\,(n-r)!}\right)p^{0.5}(1-p)^{n-0.5} \leq \alpha/2$$

Upper 95% Two-Sided Confidence Interval on the Median	0.27
Sample Median	0.265
Lower 95% Two-Sided Confidence Interval on the Median	0.255

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* - The report contents may have been modified or reformatted by end-user of software.

Chrome Bldg - Sn Bruno

VSP Sample Design Report for Calculating a Two-Sided Confidence Interval for the Population Median Using Simple Random Sampling

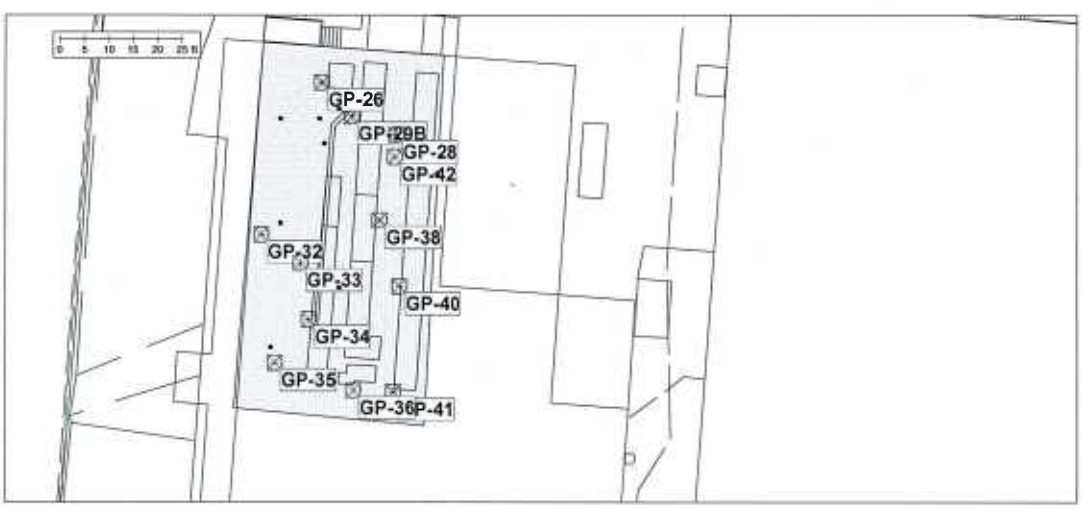
Summary

This report summarizes the sampling design used, associated statistical assumptions, as well as general guidelines for conducting post-sampling data analysis. Sampling plan components presented here include how many sampling locations to choose and where within the sampling area to collect those samples. The type of medium to sample (i.e., soil, groundwater, etc.) and how to analyze the samples (in-situ, fixed laboratory, etc.) are addressed in other sections of the sampling plan.

The following table summarizes the sampling design developed. A figure that shows sampling locations in the field and a table that lists sampling location coordinates are also provided below.

SUMMARY OF SAMPLING DESIGN	
Primary Objective of Design	Construct a Confidence Interval on the True Median
Type of Sampling Design	Non-Parametric
Sample Placement (Location) in the Field	Simple random sampling
Formula for calculating number of sampling locations	Nonparametric Confidence Limits
Calculated total number of samples	15
Number of samples on map [a]	~~20~~ 18
Number of selected sample areas [b]	1
Specified sampling area [c]	2826.73 ft^2
Total cost of sampling [d]	$8,050.00

[a] This number may differ from the calculated number because of 1) grid edge effects, 2) adding judgment samples, or 3) selecting or unselecting sample areas.
[b] The number of selected sample areas is the number of colored areas on the map of the site. These sample areas contain the locations where samples are collected.
[c] The sampling area is the total surface area of the selected colored sample areas on the map of the site.
[d] Including measurement analyses and fixed overhead costs. See the Cost of Sampling section for an explanation of the costs presented here.



Area: Area 3					
X Coord	Y Coord	Label	Value	Type	Historical

4947.9347	5089.9428	GP-41	0.26	Random	
4921.1000	5121.6752	GP-32	0.25	Random	
4939.5678	5145.4075	GP-29B	0.26	Random	
4930.8339	5104.5202	GP-34	0.27	Random	
4948.3017	5137.2526	GP-42	0.27	Random	
4939.8843	5090.2245	GP-36	0.26	Random	
4929.1504	5115.9569	GP-33	0.26	Random	
4948.6182	5141.6892	GP-28	0.27	Random	
4923.7835	5095.8019	GP-35	0.26	Random	
4945.2513	5124.5343	GP-38	0.25	Random	
4933.5174	5152.2667	GP-26	0.26	Random	
4949.2765	5111.1916	GP-40	0.25	Random	
4937.0000	5147.0000	GP-27B	0.26	Unknown	
4934.0000	5140.0000	GP-31	0.26	Unknown	
4925.0000	5145.0000	GP-30	0.26	Unknown	
4937.0000	5111.0000	GP-37	0.27	Unknown	
4957.0000	5134.0000	GP-39	0.26	Unknown	
4923.0000	5099.0000	HA-1	0.26	Unknown	
4925.0000	5124.0000	HA-2		Unknown	
4933.0000	5145.0000	HA-3		Unknown	

Primary Sampling Objective
The primary purpose of sampling at this site is to construct a confidence interval on the true population median value. After the samples are collected and analyzed, the resulting sample values can be used to construct a two-sided confidence interval. Once the confidence interval is computed (which will be an upper and a lower threshold), you can have the specified confidence that the true population median is between the upper and lower thresholds.

Selected Sampling Approach
A non-parametric random sampling approach was used to determine the number of samples and to specify sampling locations. A parametric formula was not chosen because the conceptual model and historical information (e.g., historical data from this site or a very similar site) indicate that parametric assumptions are not true. These assumptions will be examined in post-sampling data analysis.

Both parametric and non-parametric equations rely on assumptions about the population. Typically, however, non-parametric equations require fewer assumptions and allow for more uncertainty about the statistical distribution of values at the site. The trade-off is that if the parametric assumptions are valid, the required number of samples is usually less than if a non-parametric equation was used.

Locating the sample points randomly provides data that are separated by many distances, whereas systematic samples are all equidistant apart. Therefore, random sampling provides more information about the spatial structure of the potential contamination than systematic sampling does. As with systematic sampling, random sampling also provides information regarding the mean or median value, but there is the possibility that areas of the site will not be represented with the same frequency as if uniform grid sampling were performed.

Number of Total Samples: Calculation Equation and Inputs
Two sample confidence interval calculation methods are available for when n□20 and n>20 (Conover, 1980, p. 111-117) (Gilbert, 1987,p. 141-142). In VSP, the user specifies a one-sided or two-sided CI, and the percent confidence desired to be within a specified number of percentiles of the median. A binary search is then performed on the CI equations to solve for the minimum sample size to satisfy these parameters. VSP first uses the n□20 method to determine if a solution can be found where n□20, and if not, then uses the n>20 method.

For a one-sided CI, the n□20 method follows a binomial distribution and determines the lowest value of n where the yth quantile of the sample would be equal to or above the true median at least X% of the time (Note that the sample sizes work out to be the same regardless of whether the CI will be a lower or upper tailed, so the same formula can be used for any one-sided CI). X% is the specified confidence for one-sided confidence intervals, and the average of 100% and the specified confidence for two-sided confidence intervals. The yth quantile is determined by taking 50% and subtracting the allowable number of percentiles from the median specified by the user.

For a two-sided CI, the n□20 method is the same as performing a one-sided confidence interval, but replacing the specified percent confidence with the average of 100% and the specified percent confidence. If no solution is found where n□20, a binary search is conducted using Equation (1) for a one-sided CI and Equation (2) for a two-sided interval to compute the value of r (r is the the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest), rounding r up to the next higher integer. The search is repeated until the smallest n is found where 100*2*r/n is greater than 50% minus the allowable number of percentiles from the median specified by the user.

$$r = 0.5 * n - 0.5 * w_{\alpha} \sqrt{n} \qquad (1)$$

$$r = 0.5 * n - 0.5 * w_{\alpha/2} \sqrt{n} \qquad (2)$$

Where:

n is the sample size

r is the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest

$w_{\square}$ is the specified quantile of a normal distribution, e.g. if □=0.2 then $w_{\square}$ is the 0.2 quantile (20th percentile) of a normal distribution.

The n>20 method described above is an approximation method, so VSP also performs a final check using a binomial distribution in a similar manner to the n□20 method, and may increase the sample size by 1 to ensure the specified confidence levels are met.

Cost of Sampling

The total cost of the completed sampling program depends on several cost inputs, some of which are fixed, and others that are based on the number of samples collected and measured. Based on the numbers of samples determined above, the estimated total cost of sampling and analysis at this site is $8,050.00, which averages out to a per sample cost of $536.67. The following table summarizes the inputs and resulting cost estimates.

COST INFORMATION			
Cost Details	**Per Analysis**	**Per Sample**	**15 Samples**
Field collection costs		$250.00	$3,750.00
Analytical costs	$220.00	$220.00	$3,300.00
Sum of Field & Analytical costs		**$470.00**	**$7,050.00**
Fixed planning and validation costs			$1,000.00
Total cost			**$8,050.00**

Data Analysis for Sn

The following data points were entered by the user for analysis.

Sn										
Rank	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
0	0.25	0.25	0.25	0.26	0.26	0.26	0.26	0.26	0.26	0.26
10	0.26	0.26	0.26	0.26	0.27	0.27	0.27	0.27		

SUMMARY STATISTICS for Sn	
n	18
Min	0.25
Max	0.27
Range	0.02
Mean	0.26056
Median	0.26
Variance	4.085e-005
StdDev	0.0063914
Std Error	0.0015065
Skewness	-0.04068
Interquartile Range	0.0025

Percentiles								
1%	5%	10%	25%	50%	75%	90%	95%	99%
0.25	0.25	0.25	0.26	0.26	0.2625	0.27	0.27	0.27

Data Plots

Three graphical displays of the data are shown below: the Histogram, the Box and Whiskers plot, and the Quantile-Quantile (Q-Q) plot.

The Histogram is a plot of the fraction of the n observed data that fall within specified data "bins." A histogram is generated by dividing the x axis (range of the observed data values) into "bins" and displaying the number of data in each bin as the height of a bar for the bin. The area of the bar is the fraction of the n data values that lie within the bin. The sum of the fractions for all bins equals one. A histogram is used to assess how the n data are distributed (spread) over their range of values. If the histogram is more or less symmetric and bell shaped, then the data may be normally distributed.

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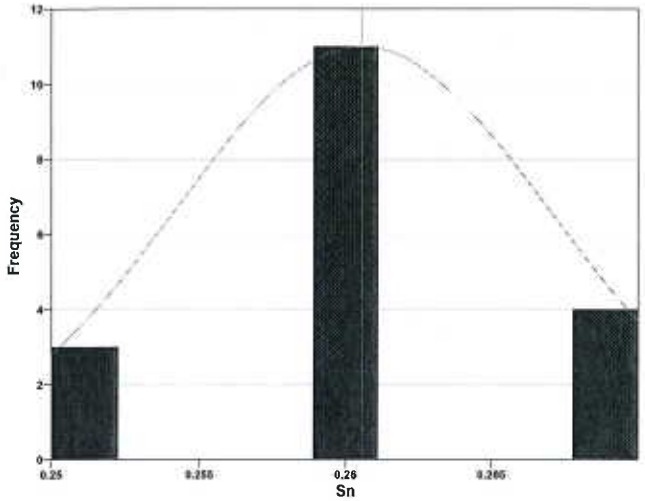
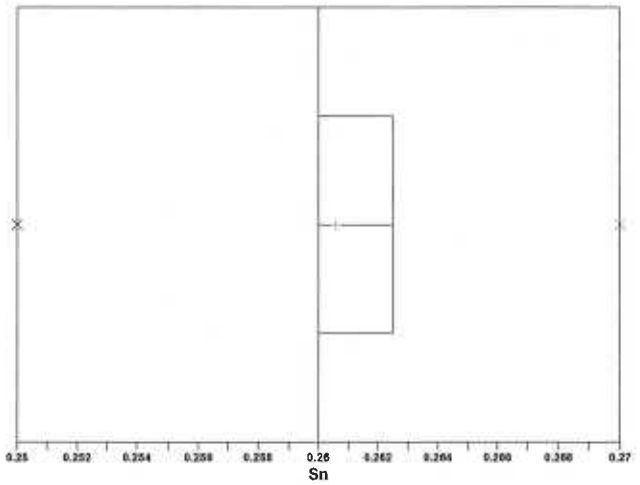
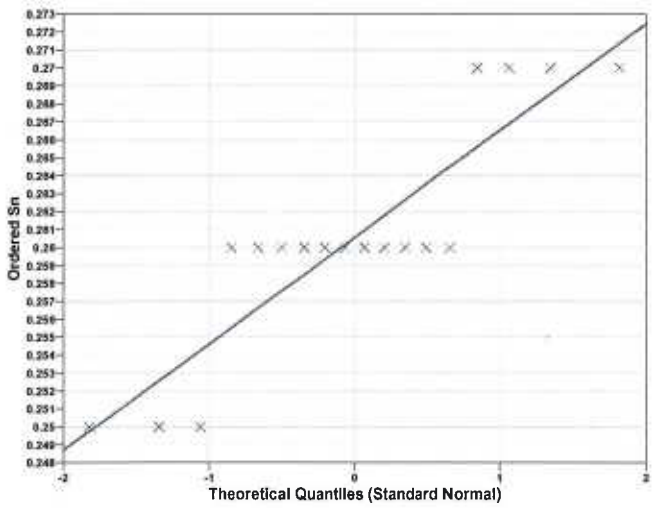
The Q-Q plot graphs the quantiles of a set of n data against the quantiles of a specific distribution. We show here only the Q-Q plot for an assumed normal distribution. The pth quantile of a distribution of data is the data value, x_p, for which a fraction p of the distribution is less than x_p. If the data plotted on the normal distribution Q-Q plot closely follow a straight line, even at the ends of the line, then the data may be assumed to be normally distributed. If the data points deviate substantially from a linear line, then the data are not normally distributed.







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Two-Sided Confidence Interval on the True Median

For calculating the confidence interval, the values are ordered from smallest to largest. The confidence limits are the highest value of the r+1 and/or lowest value of the s-1 order statistics that fit the formulas below, except when the rth ordered value is tied with higher ordered values or the sth ordered value is tied with lower ordered values. If higher numbered ordered values are ties with the rth ordered value, then the closest ordered value that is lower than r will be the confidence limit. If higher-numbered ordered values are ties with the sth ordered value, then the closest ordered value that is higher than s will be the confidence limit.

Upper Two-Sided Confidence Interval

$$\sum_{s}^{1}\left(\frac{n!}{r!\,(n-s)!}\right)p^{0.5}(1-p)^{n-0.5} \geq 1-\alpha/2$$

Lower Two-Sided Confidence interval

$$\sum_{r}^{1}\left(\frac{n!}{r!\,(n-r)!}\right)p^{0.5}(1-p)^{n-0.5} \leq \alpha/2$$

Upper 95% Two-Sided Confidence Interval on the Median	0.27

Sample Median	0.26
Lower 95% Two-Sided Confidence Interval on the Median	0.26

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* - The report contents may have been modified or reformatted by end-user of software.

Chrome Bldg Zn

VSP Sample Design Report for Calculating a Two-Sided Confidence Interval for the Population Median Using Simple Random Sampling

Summary

This report summarizes the sampling design used, associated statistical assumptions, as well as general guidelines for conducting post-sampling data analysis. Sampling plan components presented here include how many sampling locations to choose and where within the sampling area to collect those samples. The type of medium to sample (i.e., soil, groundwater, etc.) and how to analyze the samples (in-situ, fixed laboratory, etc.) are addressed in other sections of the sampling plan.

The following table summarizes the sampling design developed. A figure that shows sampling locations in the field and a table that lists sampling location coordinates are also provided below.

SUMMARY OF SAMPLING DESIGN	
Primary Objective of Design	Construct a Confidence Interval on the True Median
Type of Sampling Design	Non-Parametric
Sample Placement (Location) in the Field	Simple random sampling
Formula for calculating number of sampling locations	Nonparametric Confidence Limits
Calculated total number of samples	15
Number of samples on map [a]	15
Number of selected sample areas [b]	1
Specified sampling area [c]	2826.73 ft^2
Total cost of sampling [d]	$8,050.00

[a] This number may differ from the calculated number because of 1) grid edge effects, 2) adding judgment samples, or 3) selecting or unselecting sample areas.
[b] The number of selected sample areas is the number of colored areas on the map of the site. These sample areas contain the locations where samples are collected.
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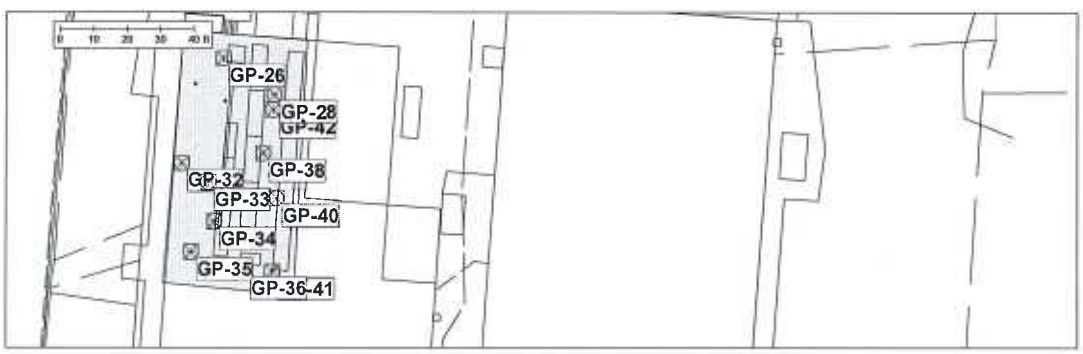


Area: Area 3					
X Coord	Y Coord	Label	Value	Type	Historical
4947.9347	5089.9428	GP-41	30	Random	
4921.1000	5121.6752	GP-32	23	Random	
4930.8339	5104.5202	GP-34	93	Random	

4948.3017	5137.2526	GP-42	24	Random	
4939.8843	5090.2245	GP-36	31	Random	
4929.1504	5115.9569	GP-33	44	Random	
4948.6182	5141.6892	GP-28	150	Random	
4923.7835	5095.8019	GP-35	40	Random	
4945.2513	5124.5343	GP-38	34	Random	
4933.5174	5152.2667	GP-26	26	Random	
4949.2765	5111.1916	GP-40	20	Random	
4934.0000	5140.0000	GP-31	100	Unknown	
4925.0000	5145.0000	GP-30	39	Unknown	
4937.0000	5111.0000	GP-37	70	Unknown	
4957.0000	5134.0000	GP-39	40	Unknown	

Primary Sampling Objective
The primary purpose of sampling at this site is to construct a confidence interval on the true population median value. After the samples are collected and analyzed, the resulting sample values can be used to construct a two-sided confidence interval. Once the confidence interval is computed (which will be an upper and a lower threshold), you can have the specified confidence that the true population median is between the upper and lower thresholds.

Selected Sampling Approach
A non-parametric random sampling approach was used to determine the number of samples and to specify sampling locations. A parametric formula was not chosen because the conceptual model and historical information (e.g., historical data from this site or a very similar site) indicate that parametric assumptions are not true. These assumptions will be examined in post-sampling data analysis.

Both parametric and non-parametric equations rely on assumptions about the population. Typically, however, non-parametric equations require fewer assumptions and allow for more uncertainty about the statistical distribution of values at the site. The trade-off is that if the parametric assumptions are valid, the required number of samples is usually less than if a non-parametric equation was used.

Locating the sample points randomly provides data that are separated by many distances, whereas systematic samples are all equidistant apart. Therefore, random sampling provides more information about the spatial structure of the potential contamination than systematic sampling does. As with systematic sampling, random sampling also provides information regarding the mean or median value, but there is the possibility that areas of the site will not be represented with the same frequency as if uniform grid sampling were performed.

Number of Total Samples: Calculation Equation and Inputs
Two sample confidence interval calculation methods are available for when n□20 and n>20 (Conover, 1980, p. 111-117) (Gilbert, 1987,p. 141-142). In VSP, the user specifies a one-sided or two-sided CI, and the percent confidence desired to be within a specified number of percentiles of the median. A binary search is then performed on the CI equations to solve for the minimum sample size to satisfy these parameters. VSP first uses the n□20 method to determine if a solution can be found where n□20, and if not, then uses the n>20 method.

For a one-sided CI, the n□20 method follows a binomial distribution and determines the lowest value of n where the yth quantile of the sample would be equal to or above the true median at least X% of the time (Note that the sample sizes work out to be the same regardless of whether the CI will be a lower or upper tailed, so the same formula can be used for any one-sided CI). X% is the specified confidence for one-sided confidence intervals, and the average of 100% and the specified confidence for two-sided confidence intervals. The yth quantile is determined by taking 50% and subtracting the allowable number of percentiles from the median specified by the user.

For a two-sided CI, the n□20 method is the same as performing a one-sided confidence interval, but replacing the specified percent confidence with the average of 100% and the specified percent confidence. If no solution is found where n□20, a binary search is conducted using Equation (1) for a one-sided CI and Equation (2) for a two-sided interval to compute the value of r (r is the the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest), rounding r up to the next higher integer. The search is repeated until the smallest n is

found where 100*2*r/n is greater than 50% minus the allowable number of percentiles from the median specified by the user.

$$r = 0.5*n - 0.5*w_{\alpha}\sqrt{n} \qquad (1)$$

$$r = 0.5*n - 0.5*w_{\alpha/2}\sqrt{n} \qquad (2)$$

Where:

n is the sample size

r is the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest

$w_{\square}$ is the specified quantile of a normal distribution, e.g. if □=0.2 then $w_{\square}$ is the 0.2 quantile (20th percentile) of a normal distribution.

The n>20 method described above is an approximation method, so VSP also performs a final check using a binomial distribution in a similar manner to the n□20 method, and may increase the sample size by 1 to ensure the specified confidence levels are met.

Cost of Sampling
The total cost of the completed sampling program depends on several cost inputs, some of which are fixed, and others that are based on the number of samples collected and measured. Based on the numbers of samples determined above, the estimated total cost of sampling and analysis at this site is $8,050.00, which averages out to a per sample cost of $536.67. The following table summarizes the inputs and resulting cost estimates.

COST INFORMATION			
Cost Details	**Per Analysis**	**Per Sample**	**15 Samples**
Field collection costs		$250.00	$3,750.00
Analytical costs	$220.00	$220.00	$3,300.00
Sum of Field & Analytical costs		**$470.00**	**$7,050.00**
Fixed planning and validation costs			$1,000.00
Total cost			**$8,050.00**

Data Analysis for Zn
The following data points were entered by the user for analysis.

Zn										
Rank	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
0	20	23	24	26	30	31	34	39	40	40
10	44	70	93	100	150					

SUMMARY STATISTICS for Zn	
n	15
Min	20
Max	150
Range	130
Mean	50.933
Median	39

Variance				1356.5				
StdDev				36.831				
Std Error				9.5096				
Skewness				1.7465				
Interquartile Range				44				
Percentiles								
1%	**5%**	**10%**	**25%**	**50%**	**75%**	**90%**	**95%**	**99%**
20	20	21.8	26	39	70	120	150	150

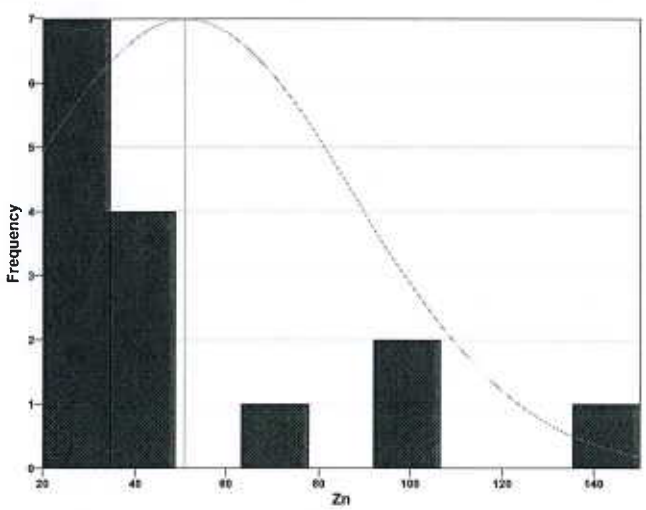
Data Plots

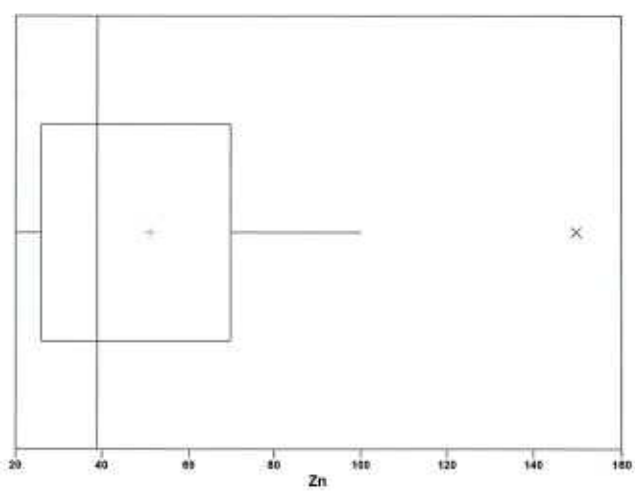
Three graphical displays of the data are shown below: the Histogram, the Box and Whiskers plot, and the Quantile-Quantile (Q-Q) plot.

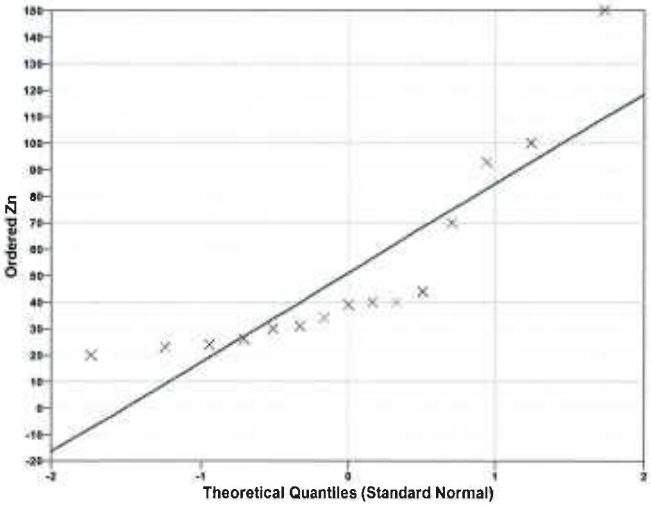
The Histogram is a plot of the fraction of the n observed data that fall within specified data "bins." A histogram is generated by dividing the x axis (range of the observed data values) into "bins" and displaying the number of data in each bin as the height of a bar for the bin. The area of the bar is the fraction of the n data values that lie within the bin. The sum of the fractions for all bins equals one. A histogram is used to assess how the n data are distributed (spread) over their range of values. If the histogram is more or less symmetric and bell shaped, then the data may be normally distributed.

The Box and Whiskers plot is composed of a central box divided by a line, and with two lines extending out from the box, called the "whiskers". The line through the box is drawn at the median of the n data observed. The two ends of the box represent the 25th and 75th percentiles of the n data values, which are also called the lower and upper quartiles, respectively, of the data set. The sample mean (mean of the n data) is shown as a "+" sign. The upper whisker extends to the largest data value that is less than the upper quartile plus 1.5 times the interquartile range (upper quartile minus the lower quartile). The lower whisker extends to the smallest data value that is greater than the lower quartile minus 1.5 times the interquartile range. Extreme data values (greater or smaller than the ends of the whiskers) are plotted individually. A Box and Whiskers plot is used to assess the symmetry of the distribution of the data set. If the distribution is symmetrical, the box is divided into two equal halves by the median, the whiskers will be the same length, and the number of extreme data points will be distributed equally on either end of the plot.

The Q-Q plot graphs the quantiles of a set of n data against the quantiles of a specific distribution. We show here only the Q-Q plot for an assumed normal distribution. The pth quantile of a distribution of data is the data value, x_p, for which a fraction p of the distribution is less than x_p. If the data plotted on the normal distribution Q-Q plot closely follow a straight line, even at the ends of the line, then the data may be assumed to be normally distributed. If the data points deviate substantially from a linear line, then the data are not normally distributed.







For more information on these three plots consult Guidance for Data Quality Assessment, EPA QA/G-9, pgs 2.3-1 through 2.3-12. (http://www.epa.gov/quality/qa-docs.html).

Two-Sided Confidence Interval on the True Median

For calculating the confidence interval, the values are ordered from smallest to largest. The confidence limits are the highest value of the r+1 and/or lowest value of the s-1 order statistics that fit the formulas below, except when the rth ordered value is tied with higher ordered values or the sth ordered value is tied with lower ordered values. If higher numbered ordered values are ties with the rth ordered value, then the closest ordered value that is lower than r will be the confidence limit. If higher-numbered ordered values are ties with the sth ordered value, then the closest ordered value that is higher than s will be the confidence limit.

Upper Two-Sided Confidence Interval

$$\sum_{s}^{1}\left(\frac{n!}{r!(n-s)!}\right)p^{0.5}(1-p)^{n-0.5} \geq 1-\alpha/2$$

Lower Two-Sided Confidence interval

$$\sum_{r}^{1}\left(\frac{n!}{r!(n-r)!}\right)p^{0.5}(1-p)^{n-0.5} \leq \alpha/2$$

Upper 95% Two-Sided Confidence Interval on the Median	93
Sample Median	39
Lower 95% Two-Sided Confidence Interval on the Median	24

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* - The report contents may have been modified or reformatted by end-user of software.

Chrome Bldg Zn biased.

VSP Sample Design Report for Calculating a Two-Sided Confidence Interval for the Population Median Using Simple Random Sampling

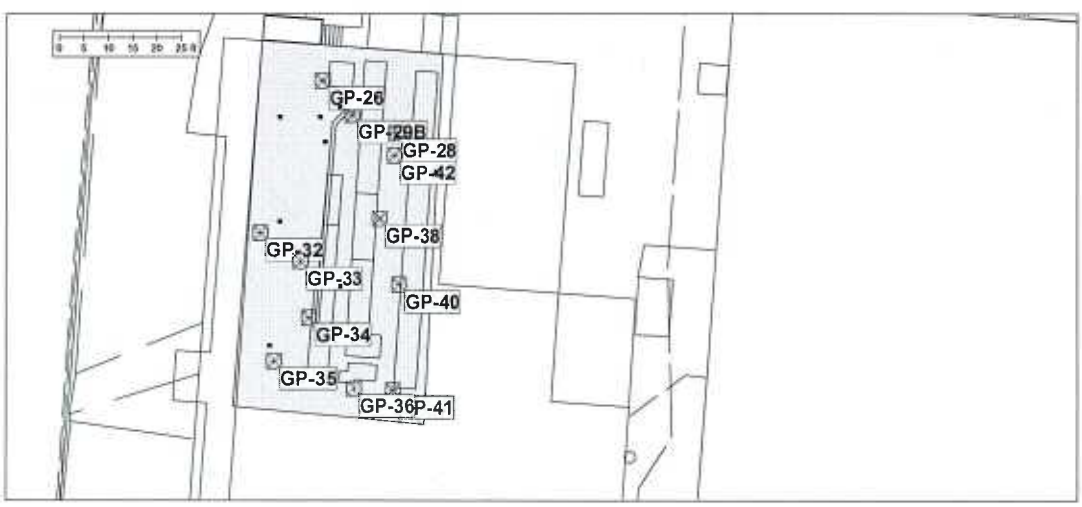
Summary

This report summarizes the sampling design used, associated statistical assumptions, as well as general guidelines for conducting post-sampling data analysis. Sampling plan components presented here include how many sampling locations to choose and where within the sampling area to collect those samples. The type of medium to sample (i.e., soil, groundwater, etc.) and how to analyze the samples (in-situ, fixed laboratory, etc.) are addressed in other sections of the sampling plan.

The following table summarizes the sampling design developed. A figure that shows sampling locations in the field and a table that lists sampling location coordinates are also provided below.

SUMMARY OF SAMPLING DESIGN	
Primary Objective of Design	Construct a Confidence Interval on the True Median
Type of Sampling Design	Non-Parametric
Sample Placement (Location) in the Field	Simple random sampling
Formula for calculating number of sampling locations	Nonparametric Confidence Limits
Calculated total number of samples	15
Number of samples on map [a]	20
Number of selected sample areas [b]	1
Specified sampling area [c]	2826.73 ft^2
Total cost of sampling [d]	$8,050.00

[a] This number may differ from the calculated number because of 1) grid edge effects, 2) adding judgment samples, or 3) selecting or unselecting sample areas.
[b] The number of selected sample areas is the number of colored areas on the map of the site. These sample areas contain the locations where samples are collected.
[c] The sampling area is the total surface area of the selected colored sample areas on the map of the site.
[d] Including measurement analyses and fixed overhead costs. See the Cost of Sampling section for an explanation of the costs presented here.



Area: Area 3					
X Coord	Y Coord	Label	Value	Type	Historical

4947.9347	5089.9428	GP-41	30	Random	
4921.1000	5121.6752	GP-32	23	Random	
4939.5678	5145.4075	GP-29B	120	Random	
4930.8339	5104.5202	GP-34	93	Random	
4948.3017	5137.2526	GP-42	24	Random	
4939.8843	5090.2245	GP-36	31	Random	
4929.1504	5115.9569	GP-33	44	Random	
4948.6182	5141.6892	GP-28	150	Random	
4923.7835	5095.8019	GP-35	40	Random	
4945.2513	5124.5343	GP-38	34	Random	
4933.5174	5152.2667	GP-26	26	Random	
4949.2765	5111.1916	GP-40	20	Random	
4937.0000	5147.0000	GP-27B	40	Unknown	
4934.0000	5140.0000	GP-31	100	Unknown	
4925.0000	5145.0000	GP-30	39	Unknown	
4937.0000	5111.0000	GP-37	70	Unknown	
4957.0000	5134.0000	GP-39	40	Unknown	
4923.0000	5099.0000	HA-1		Unknown	
4925.0000	5124.0000	HA-2		Unknown	
4933.0000	5145.0000	HA-3		Unknown	

Primary Sampling Objective
The primary purpose of sampling at this site is to construct a confidence interval on the true population median value. After the samples are collected and analyzed, the resulting sample values can be used to construct a two-sided confidence interval. Once the confidence interval is computed (which will be an upper and a lower threshold), you can have the specified confidence that the true population median is between the upper and lower thresholds.

Selected Sampling Approach
A non-parametric random sampling approach was used to determine the number of samples and to specify sampling locations. A parametric formula was not chosen because the conceptual model and historical information (e.g., historical data from this site or a very similar site) indicate that parametric assumptions are not true. These assumptions will be examined in post-sampling data analysis.

Both parametric and non-parametric equations rely on assumptions about the population. Typically, however, non-parametric equations require fewer assumptions and allow for more uncertainty about the statistical distribution of values at the site. The trade-off is that if the parametric assumptions are valid, the required number of samples is usually less than if a non-parametric equation was used.

Locating the sample points randomly provides data that are separated by many distances, whereas systematic samples are all equidistant apart. Therefore, random sampling provides more information about the spatial structure of the potential contamination than systematic sampling does. As with systematic sampling, random sampling also provides information regarding the mean or median value, but there is the possibility that areas of the site will not be represented with the same frequency as if uniform grid sampling were performed.

Number of Total Samples: Calculation Equation and Inputs
Two sample confidence interval calculation methods are available for when n□20 and n>20 (Conover, 1980, p. 111-117) (Gilbert, 1987,p. 141-142). In VSP, the user specifies a one-sided or two-sided CI, and the percent confidence desired to be within a specified number of percentiles of the median. A binary search is then performed on the CI equations to solve for the minimum sample size to satisfy these parameters. VSP first uses the n□20 method to determine if a solution can be found where n□20, and if not, then uses the n>20 method.

For a one-sided CI, the n□20 method follows a binomial distribution and determines the lowest value of n where the yth quantile of the sample would be equal to or above the true median at least X% of the time (Note that the sample sizes work out to be the same regardless of whether the CI will be a lower or upper tailed, so the same formula can be used for any one-sided CI). X% is the specified confidence for one-sided confidence intervals, and the average of 100% and the specified confidence for two-sided confidence intervals. The yth quantile is determined by taking 50% and subtracting the allowable number of percentiles from the median specified by the user.

For a two-sided CI, the n□20 method is the same as performing a one-sided confidence interval, but replacing the specified percent confidence with the average of 100% and the specified percent confidence. If no solution is found where n□20, a binary search is conducted using Equation (1) for a one-sided CI and Equation (2) for a two-sided interval to compute the value of r (r is the the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest), rounding r up to the next higher integer. The search is repeated until the smallest n is found where 100*2*r/n is greater than 50% minus the allowable number of percentiles from the median specified by the user.

$$r = 0.5 * n - 0.5 * w_{\alpha} \sqrt{n} \qquad (1)$$

$$r = 0.5 * n - 0.5 * w_{\alpha/2} \sqrt{n} \qquad (2)$$

Where:

n is the sample size

r is the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest

$w_{\square}$ is the specified quantile of a normal distribution, e.g. if □=0.2 then $w_{\square}$ is the 0.2 quantile (20th percentile) of a normal distribution.

The n>20 method described above is an approximation method, so VSP also performs a final check using a binomial distribution in a similar manner to the n□20 method, and may increase the sample size by 1 to ensure the specified confidence levels are met.

Cost of Sampling

The total cost of the completed sampling program depends on several cost inputs, some of which are fixed, and others that are based on the number of samples collected and measured. Based on the numbers of samples determined above, the estimated total cost of sampling and analysis at this site is $8,050.00, which averages out to a per sample cost of $536.67. The following table summarizes the inputs and resulting cost estimates.

COST INFORMATION			
Cost Details	**Per Analysis**	**Per Sample**	**15 Samples**
Field collection costs		$250.00	$3,750.00
Analytical costs	$220.00	$220.00	$3,300.00
Sum of Field & Analytical costs		**$470.00**	**$7,050.00**
Fixed planning and validation costs			$1,000.00
Total cost			**$8,050.00**

Data Analysis for Zn

The following data points were entered by the user for analysis.

Zn										
Rank	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
0	20	23	24	26	30	31	34	39	40	40
10	40	44	70	93	100	120	150			

SUMMARY STATISTICS for Zn	
n	17
Min	20
Max	150
Range	130
Mean	54.353
Median	40
Variance	1480.1
StdDev	38.472
Std Error	9.3309
Skewness	1.4221
Interquartile Range	53.5

Percentiles								
1%	5%	10%	25%	50%	75%	90%	95%	99%
20	20	22.4	28	40	81.5	126	150	150

Data Plots

Three graphical displays of the data are shown below: the Histogram, the Box and Whiskers plot, and the Quantile-Quantile (Q-Q) plot.

The Histogram is a plot of the fraction of the n observed data that fall within specified data "bins." A histogram is generated by dividing the x axis (range of the observed data values) into "bins" and displaying the number of data in each bin as the height of a bar for the bin. The area of the bar is the fraction of the n data values that lie within the bin. The sum of the fractions for all bins equals one. A histogram is used to assess how the n data are distributed (spread) over their range of values. If the histogram is more or less symmetric and bell shaped, then the data may be normally distributed.

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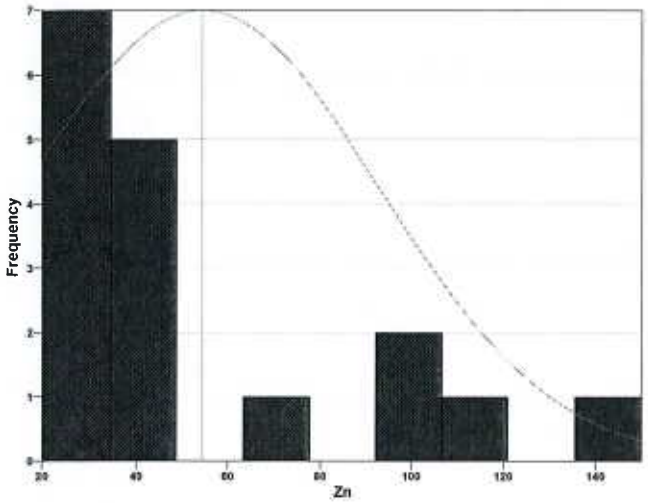
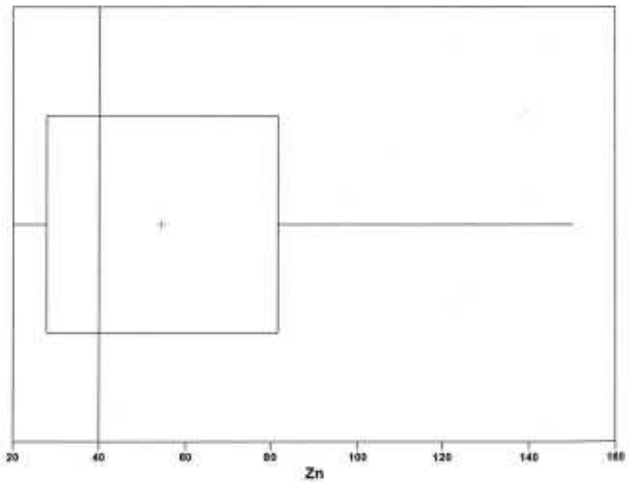
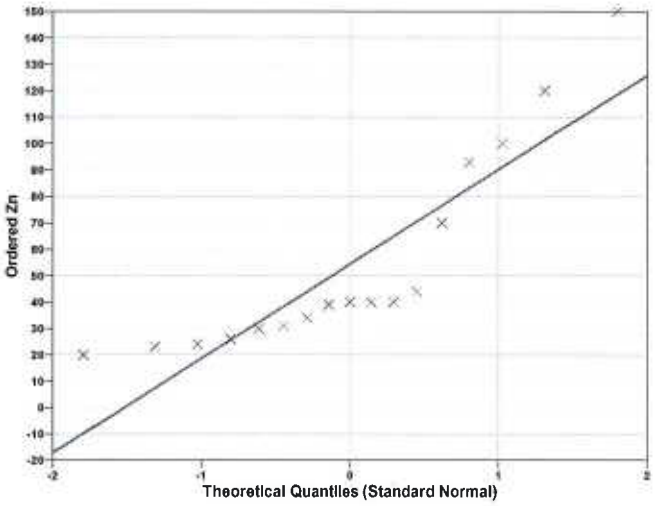
The Q-Q plot graphs the quantiles of a set of n data against the quantiles of a specific distribution. We show here only the Q-Q plot for an assumed normal distribution. The pth quantile of a distribution of data is the data value, x_p, for which a fraction p of the distribution is less than x_p. If the data plotted on the normal distribution Q-Q plot closely follow a straight line, even at the ends of the line, then the data may be assumed to be normally distributed. If the data points deviate substantially from a linear line, then the data are not normally distributed.







For more information on these three plots consult Guidance for Data Quality Assessment, EPA QA/G-9, pgs 2.3-1 through 2.3-12. (http://www.epa.gov/quality/qa-docs.html).

Two-Sided Confidence Interval on the True Median

For calculating the confidence interval, the values are ordered from smallest to largest. The confidence limits are the highest value of the r+1 and/or lowest value of the s-1 order statistics that fit the formulas below, except when the rth ordered value is tied with higher ordered values or the sth ordered value is tied with lower ordered values. If higher numbered ordered values are ties with the rth ordered value, then the closest ordered value that is lower than r will be the confidence limit. If higher-numbered ordered values are ties with the sth ordered value, then the closest ordered value that is higher than s will be the confidence limit.

Upper Two-Sided Confidence Interval

$$\sum_{s}^{1}\left(\frac{n!}{r!(n-s)!}\right)p^{0.5}(1-p)^{n-0.5} \geq 1-\alpha/2$$

Lower Two-Sided Confidence interval

$$\sum_{r}^{1}\left(\frac{n!}{r!(n-r)!}\right)p^{0.5}(1-p)^{n-0.5} \leq \alpha/2$$

Upper 95% Two-Sided Confidence Interval on the Median	93

Sample Median	40
Lower 95% Two-Sided Confidence Interval on the Median	26

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* - The report contents may have been modified or reformatted by end-user of software.

Anodizing Bldg. Cd

VSP Sample Design Report for Calculating a Two-Sided Confidence Interval for the Population Median Using Simple Random Sampling

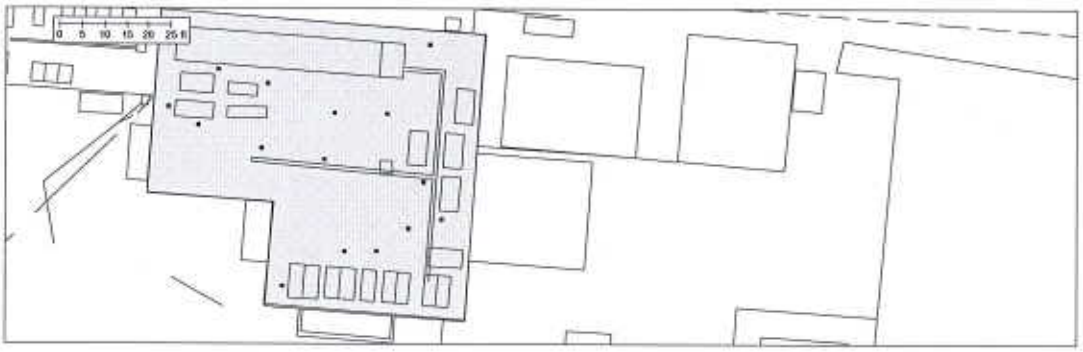
Summary

This report summarizes the sampling design used, associated statistical assumptions, as well as general guidelines for conducting post-sampling data analysis. Sampling plan components presented here include how many sampling locations to choose and where within the sampling area to collect those samples. The type of medium to sample (i.e., soil, groundwater, etc.) and how to analyze the samples (in-situ, fixed laboratory, etc.) are addressed in other sections of the sampling plan.

The following table summarizes the sampling design developed. A figure that shows sampling locations in the field and a table that lists sampling location coordinates are also provided below.

SUMMARY OF SAMPLING DESIGN	
Primary Objective of Design	Construct a Confidence Interval on the True Median
Type of Sampling Design	Non-Parametric
Sample Placement (Location) in the Field	Simple random sampling
Formula for calculating number of sampling locations	Nonparametric Confidence Limits
Calculated total number of samples	15
Number of samples on map [a]	15
Number of selected sample areas [b]	1
Specified sampling area [c]	3910.04 ft^2
Total cost of sampling [d]	$2,860.00

[a] This number may differ from the calculated number because of 1) grid edge effects, 2) adding judgment samples, or 3) selecting or unselecting sample areas.
[b] The number of selected sample areas is the number of colored areas on the map of the site. These sample areas contain the locations where samples are collected.
[c] The sampling area is the total surface area of the selected colored sample areas on the map of the site.
[d] Including measurement analyses and fixed overhead costs. See the Cost of Sampling section for an explanation of the costs presented here.



Area: Area 2					
X Coord	Y Coord	Label	Value	Type	Historical
4981.9002	5213.6371	GP-15	0.015	Random	
5000.6401	5198.5254	GP-11	0.015	Random	
4953.7905	5221.1929	GP-17	0.0165	Random	

4972.5303	5185.9324	GP-24	0.016	Random	
5008.0100	5200.5999	GP-25	5.2	Random	
4947.1056	5225.2673	GP-21	0.0175	Random	
4986.5852	5193.4882	GP-9	0.017	Random	
4967.8454	5216.1557	GP-16	0.015	Random	
5005.3250	5238.8231	GP-20	1.5	Random	
4995.9551	5223.7115	GP-13	0.014	Random	
4984.2427	5223.8359	GP-14	0.155	Random	
5003.9825	5208.7242	GP-12	0.0145	Random	
4958.1330	5233.3917	GP-22	0.0165	Random	
4993.6126	5193.6126	GP-10	0.014	Random	
4969.1604	5230.3045	GP-18	0.0175	Random	

Primary Sampling Objective
The primary purpose of sampling at this site is to construct a confidence interval on the true population median value. After the samples are collected and analyzed, the resulting sample values can be used to construct a two-sided confidence interval. Once the confidence interval is computed (which will be an upper and a lower threshold), you can have the specified confidence that the true population median is between the upper and lower thresholds.

Selected Sampling Approach
A non-parametric random sampling approach was used to determine the number of samples and to specify sampling locations. A parametric formula was not chosen because the conceptual model and historical information (e.g., historical data from this site or a very similar site) indicate that parametric assumptions are not true. These assumptions will be examined in post-sampling data analysis.

Both parametric and non-parametric equations rely on assumptions about the population. Typically, however, non-parametric equations require fewer assumptions and allow for more uncertainty about the statistical distribution of values at the site. The trade-off is that if the parametric assumptions are valid, the required number of samples is usually less than if a non-parametric equation was used.

Locating the sample points randomly provides data that are separated by many distances, whereas systematic samples are all equidistant apart. Therefore, random sampling provides more information about the spatial structure of the potential contamination than systematic sampling does. As with systematic sampling, random sampling also provides information regarding the mean or median value, but there is the possibility that areas of the site will not be represented with the same frequency as if uniform grid sampling were performed.

Number of Total Samples: Calculation Equation and Inputs
Two sample confidence interval calculation methods are available for when n□20 and n>20 (Conover, 1980, p. 111-117) (Gilbert, 1987,p. 141-142). In VSP, the user specifies a one-sided or two-sided CI, and the percent confidence desired to be within a specified number of percentiles of the median. A binary search is then performed on the CI equations to solve for the minimum sample size to satisfy these parameters. VSP first uses the n□20 method to determine if a solution can be found where n□20, and if not, then uses the n>20 method.

For a one-sided CI, the n□20 method follows a binomial distribution and determines the lowest value of n where the yth quantile of the sample would be equal to or above the true median at least X% of the time (Note that the sample sizes work out to be the same regardless of whether the CI will be a lower or upper tailed, so the same formula can be used for any one-sided CI). X% is the specified confidence for one-sided confidence intervals, and the average of 100% and the specified confidence for two-sided confidence intervals. The yth quantile is determined by taking 50% and subtracting the allowable number of percentiles from the median specified by the user.

For a two-sided CI, the n□20 method is the same as performing a one-sided confidence interval, but replacing the specified percent confidence with the average of 100% and the specified percent confidence. If no solution is found where n□20, a binary search is conducted using Equation (1) for a one-sided CI and Equation (2) for a two-sided interval to compute the value of r (r is the the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest), rounding r up to the next higher integer. The search is repeated until the smallest n is

found where 100*2*r/n is greater than 50% minus the allowable number of percentiles from the median specified by the user.

$$r = 0.5 * n - 0.5 * w_{\alpha} \sqrt{n} \qquad (1)$$

$$r = 0.5 * n - 0.5 * w_{\alpha/2} \sqrt{n} \qquad (2)$$

Where:

n is the sample size

r is the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest

$w_{\square}$ is the specified quantile of a normal distribution, e.g. if $\square$=0.2 then $w_{\square}$ is the 0.2 quantile (20th percentile) of a normal distribution.

The n>20 method described above is an approximation method, so VSP also performs a final check using a binomial distribution in a similar manner to the n$\square$20 method, and may increase the sample size by 1 to ensure the specified confidence levels are met.

Cost of Sampling
The total cost of the completed sampling program depends on several cost inputs, some of which are fixed, and others that are based on the number of samples collected and measured. Based on the numbers of samples determined above, the estimated total cost of sampling and analysis at this site is $2,860.00, which averages out to a per sample cost of $190.67. The following table summarizes the inputs and resulting cost estimates.

COST INFORMATION			
Cost Details	**Per Analysis**	**Per Sample**	**15 Samples**
Field collection costs		$100.00	$1,500.00
Analytical costs	$24.00	$24.00	$360.00
Sum of Field & Analytical costs		**$124.00**	**$1,860.00**
Fixed planning and validation costs			$1,000.00
Total cost			**$2,860.00**

Data Analysis for Cd
The following data points were entered by the user for analysis.

Cd										
Rank	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
0	0.014	0.014	0.0145	0.015	0.015	0.015	0.016	0.0165	0.0165	0.017
10	0.0175	0.0175	0.155	1.5	5.2					

SUMMARY STATISTICS for Cd	
n	15
Min	0.014
Max	5.2
Range	5.186
Mean	0.46957
Median	0.0165

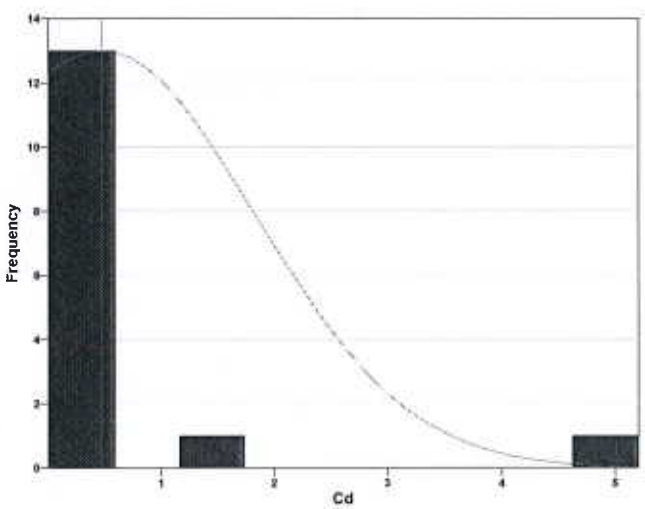
Variance				1.8578				
StdDev				1.363				
Std Error				0.35193				
Skewness				3.4433				
Interquartile Range				0.0025				
Percentiles								
1%	**5%**	**10%**	**25%**	**50%**	**75%**	**90%**	**95%**	**99%**
0.014	0.014	0.014	0.015	0.0165	0.0175	2.98	5.2	5.2

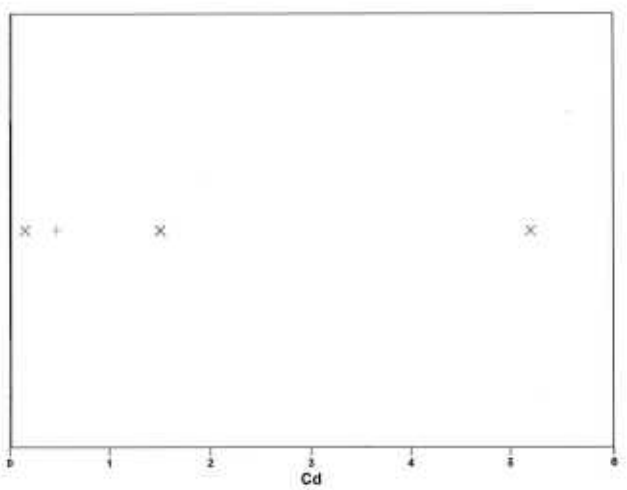
Data Plots
Three graphical displays of the data are shown below: the Histogram, the Box and Whiskers plot, and the Quantile-Quantile (Q-Q) plot.

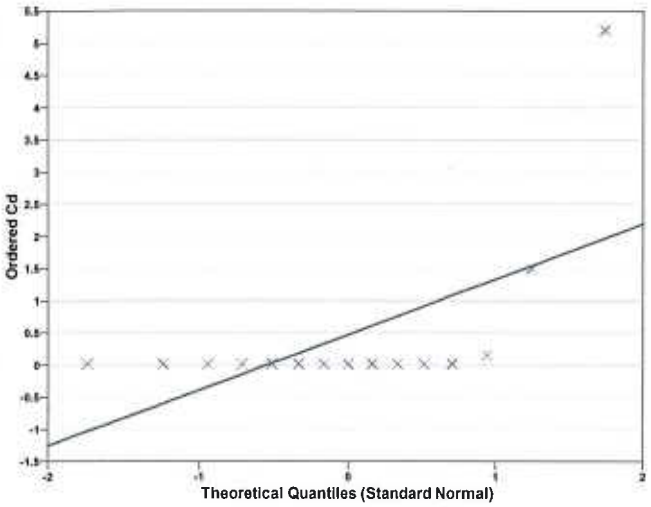
The Histogram is a plot of the fraction of the n observed data that fall within specified data "bins." A histogram is generated by dividing the x axis (range of the observed data values) into "bins" and displaying the number of data in each bin as the height of a bar for the bin. The area of the bar is the fraction of the n data values that lie within the bin. The sum of the fractions for all bins equals one. A histogram is used to assess how the n data are distributed (spread) over their range of values. If the histogram is more or less symmetric and bell shaped, then the data may be normally distributed.

The Box and Whiskers plot is composed of a central box divided by a line, and with two lines extending out from the box, called the "whiskers". The line through the box is drawn at the median of the n data observed. The two ends of the box represent the 25th and 75th percentiles of the n data values, which are also called the lower and upper quartiles, respectively, of the data set. The sample mean (mean of the n data) is shown as a "+" sign. The upper whisker extends to the largest data value that is less than the upper quartile plus 1.5 times the interquartile range (upper quartile minus the lower quartile). The lower whisker extends to the smallest data value that is greater than the lower quartile minus 1.5 times the interquartile range. Extreme data values (greater or smaller than the ends of the whiskers) are plotted individually. A Box and Whiskers plot is used to assess the symmetry of the distribution of the data set. If the distribution is symmetrical, the box is divided into two equal halves by the median, the whiskers will be the same length, and the number of extreme data points will be distributed equally on either end of the plot.

The Q-Q plot graphs the quantiles of a set of n data against the quantiles of a specific distribution. We show here only the Q-Q plot for an assumed normal distribution. The pth quantile of a distribution of data is the data value, x_p, for which a fraction p of the distribution is less than x_p. If the data plotted on the normal distribution Q-Q plot closely follow a straight line, even at the ends of the line, then the data may be assumed to be normally distributed. If the data points deviate substantially from a linear line, then the data are not normally distributed.







For more information on these three plots consult Guidance for Data Quality Assessment, EPA QA/G-9, pgs 2.3-1 through 2.3-12. (http://www.epa.gov/quality/qa-docs.html).

Two-Sided Confidence Interval on the True Median

For calculating the confidence interval, the values are ordered from smallest to largest. The confidence limits are the highest value of the r+1 and/or lowest value of the s-1 order statistics that fit the formulas below, except when the rth ordered value is tied with higher ordered values or the sth ordered value is tied with lower ordered values. If higher numbered ordered values are ties with the rth ordered value, then the closest ordered value that is lower than r will be the confidence limit. If higher-numbered ordered values are ties with the sth ordered value, then the closest ordered value that is higher than s will be the confidence limit.

Upper Two-Sided Confidence Interval

$$\sum_{s}^{1}\left(\frac{n!}{r!(n-s)!}\right)p^{0.5}(1-p)^{n-0.5} \geq 1-\alpha/2$$

Lower Two-Sided Confidence interval

$$\sum_{r}^{1}\left(\frac{n!}{r!(n-r)!}\right)p^{0.5}(1-p)^{n-0.5} \leq \alpha/2$$

Upper 95% Two-Sided Confidence Interval on the Median	0.155
Sample Median	0.0165
Lower 95% Two-Sided Confidence Interval on the Median	0.0145

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* - The report contents may have been modified or reformatted by end-user of software.

Anodizing Bldg. Cd Biased.

VSP Sample Design Report for Calculating a Two-Sided Confidence Interval for the Population Median Using Simple Random Sampling

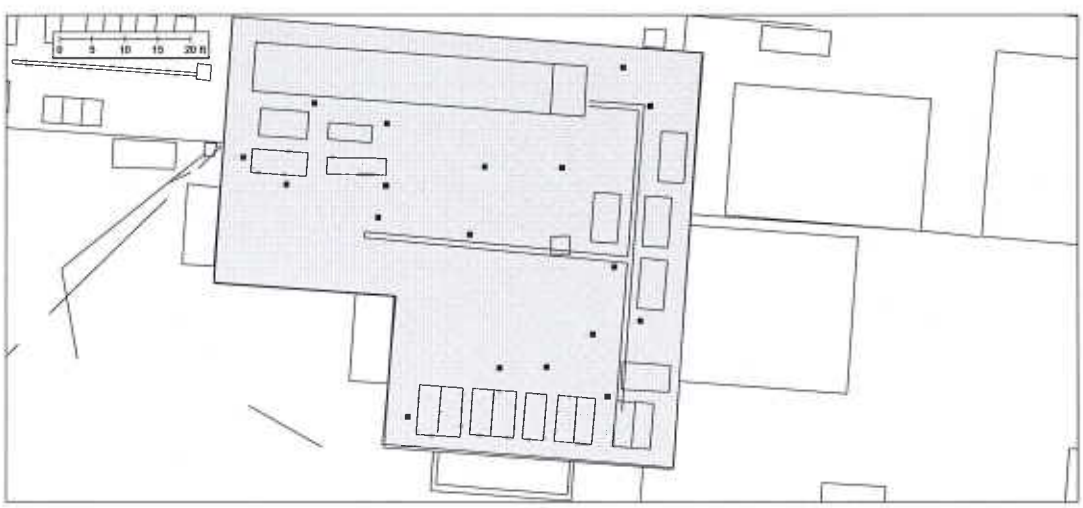
Summary

This report summarizes the sampling design used, associated statistical assumptions, as well as general guidelines for conducting post-sampling data analysis. Sampling plan components presented here include how many sampling locations to choose and where within the sampling area to collect those samples. The type of medium to sample (i.e., soil, groundwater, etc.) and how to analyze the samples (in-situ, fixed laboratory, etc.) are addressed in other sections of the sampling plan.

The following table summarizes the sampling design developed. A figure that shows sampling locations in the field and a table that lists sampling location coordinates are also provided below.

SUMMARY OF SAMPLING DESIGN	
Primary Objective of Design	Construct a Confidence Interval on the True Median
Type of Sampling Design	Non-Parametric
Sample Placement (Location) in the Field	Simple random sampling
Formula for calculating number of sampling locations	Nonparametric Confidence Limits
Calculated total number of samples	15
Number of samples on map [a]	18
Number of selected sample areas [b]	1
Specified sampling area [c]	3910.04 ft^2
Total cost of sampling [d]	$2,860.00

[a] This number may differ from the calculated number because of 1) grid edge effects, 2) adding judgment samples, or 3) selecting or unselecting sample areas.
[b] The number of selected sample areas is the number of colored areas on the map of the site. These sample areas contain the locations where samples are collected.
[c] The sampling area is the total surface area of the selected colored sample areas on the map of the site.
[d] Including measurement analyses and fixed overhead costs. See the Cost of Sampling section for an explanation of the costs presented here.



Area: Area 2					
X Coord	**Y Coord**	**Label**	**Value**	**Type**	**Historical**

4981.9002	5213.6371	GP-15	0.015	Random	
5000.6401	5198.5254	GP-11	0.015	Random	
4953.7905	5221.1929	GP-17	0.0165	Random	
4972.5303	5185.9324	GP-24	0.016	Random	
5008.0100	5200.5999	GP-25	5.2	Random	
4947.1056	5225.2673	GP-21	0.0175	Random	
4986.5852	5193.4882	GP-9	0.017	Random	
4967.8454	5216.1557	GP-16	0.015	Random	
5005.3250	5238.8231	GP-20	1.5	Random	
4995.9551	5223.7115	GP-13	0.014	Random	
4984.2427	5223.8359	GP-14	0.0155	Random	
5003.9825	5208.7242	GP-12	0.0145	Random	
4958.1330	5233.3917	GP-22	0.0165	Random	
4993.6126	5193.6126	GP-10	0.014	Random	
4969.1604	5230.3045	GP-18	0.0175	Random	
5003.0000	5189.0000	GP-23	0.0165	Unknown	
5009.5000	5233.0000	GP-19	0.014	Unknown	
4969.0000	5221.0000	HA-4		Unknown	

Primary Sampling Objective
The primary purpose of sampling at this site is to construct a confidence interval on the true population median value. After the samples are collected and analyzed, the resulting sample values can be used to construct a two-sided confidence interval. Once the confidence interval is computed (which will be an upper and a lower threshold), you can have the specified confidence that the true population median is between the upper and lower thresholds.

Selected Sampling Approach
A non-parametric random sampling approach was used to determine the number of samples and to specify sampling locations. A parametric formula was not chosen because the conceptual model and historical information (e.g., historical data from this site or a very similar site) indicate that parametric assumptions are not true. These assumptions will be examined in post-sampling data analysis.

Both parametric and non-parametric equations rely on assumptions about the population. Typically, however, non-parametric equations require fewer assumptions and allow for more uncertainty about the statistical distribution of values at the site. The trade-off is that if the parametric assumptions are valid, the required number of samples is usually less than if a non-parametric equation was used.

Locating the sample points randomly provides data that are separated by many distances, whereas systematic samples are all equidistant apart. Therefore, random sampling provides more information about the spatial structure of the potential contamination than systematic sampling does. As with systematic sampling, random sampling also provides information regarding the mean or median value, but there is the possibility that areas of the site will not be represented with the same frequency as if uniform grid sampling were performed.

Number of Total Samples: Calculation Equation and Inputs
Two sample confidence interval calculation methods are available for when n□20 and n>20 (Conover, 1980, p. 111-117) (Gilbert, 1987,p. 141-142). In VSP, the user specifies a one-sided or two-sided CI, and the percent confidence desired to be within a specified number of percentiles of the median. A binary search is then performed on the CI equations to solve for the minimum sample size to satisfy these parameters. VSP first uses the n□20 method to determine if a solution can be found where n□20, and if not, then uses the n>20 method.

For a one-sided CI, the n□20 method follows a binomial distribution and determines the lowest value of n where the yth quantile of the sample would be equal to or above the true median at least X% of the time (Note that the sample sizes work out to be the same regardless of whether the CI will be a lower or upper tailed, so the same formula can be used for

any one-sided CI). X% is the specified confidence for one-sided confidence intervals, and the average of 100% and the specified confidence for two-sided confidence intervals. The yth quantile is determined by taking 50% and subtracting the allowable number of percentiles from the median specified by the user.

For a two-sided CI, the n□20 method is the same as performing a one-sided confidence interval, but replacing the specified percent confidence with the average of 100% and the specified percent confidence. If no solution is found where n□20, a binary search is conducted using Equation (1) for a one-sided CI and Equation (2) for a two-sided interval to compute the value of r (r is the the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest), rounding r up to the next higher integer. The search is repeated until the smallest n is found where 100*2*r/n is greater than 50% minus the allowable number of percentiles from the median specified by the user.

$$r = 0.5 * n - 0.5 * w_{\alpha} \sqrt{n} \qquad (1)$$

$$r = 0.5 * n - 0.5 * w_{\alpha/2} \sqrt{n} \qquad (2)$$

Where:

n is the sample size

r is the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest

$w_{\square}$ is the specified quantile of a normal distribution, e.g. if □=0.2 then $w_{\square}$ is the 0.2 quantile (20th percentile) of a normal distribution.

The n>20 method described above is an approximation method, so VSP also performs a final check using a binomial distribution in a similar manner to the n□20 method, and may increase the sample size by 1 to ensure the specified confidence levels are met.

Cost of Sampling
The total cost of the completed sampling program depends on several cost inputs, some of which are fixed, and others that are based on the number of samples collected and measured. Based on the numbers of samples determined above, the estimated total cost of sampling and analysis at this site is $2,860.00, which averages out to a per sample cost of $190.67. The following table summarizes the inputs and resulting cost estimates.

COST INFORMATION			
Cost Details	**Per Analysis**	**Per Sample**	**15 Samples**
Field collection costs		$100.00	$1,500.00
Analytical costs	$24.00	$24.00	$360.00
Sum of Field & Analytical costs		**$124.00**	**$1,860.00**
Fixed planning and validation costs			$1,000.00
Total cost			**$2,860.00**

Data Analysis for Cd
The following data points were entered by the user for analysis.

Cd										
Rank	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
0	0.014	0.014	0.014	0.0145	0.015	0.015	0.015	0.0155	0.016	0.0165
10	0.0165	0.0165	0.017	0.0175	0.0175	1.5	5.2			

SUMMARY STATISTICS for Cd

n	17
Min	0.014
Max	5.2
Range	5.186
Mean	0.40791
Median	0.016
Variance	1.6541
StdDev	1.2861
Std Error	0.31193
Skewness	3.6775
Interquartile Range	0.0025

Percentiles								
1%	**5%**	**10%**	**25%**	**50%**	**75%**	**90%**	**95%**	**99%**
0.014	0.014	0.014	0.01475	0.016	0.01725	2.24	5.2	5.2

Data Plots

Three graphical displays of the data are shown below: the Histogram, the Box and Whiskers plot, and the Quantile-Quantile (Q-Q) plot.

The Histogram is a plot of the fraction of the n observed data that fall within specified data "bins." A histogram is generated by dividing the x axis (range of the observed data values) into "bins" and displaying the number of data in each bin as the height of a bar for the bin. The area of the bar is the fraction of the n data values that lie within the bin. The sum of the fractions for all bins equals one. A histogram is used to assess how the n data are distributed (spread) over their range of values. If the histogram is more or less symmetric and bell shaped, then the data may be normally distributed.

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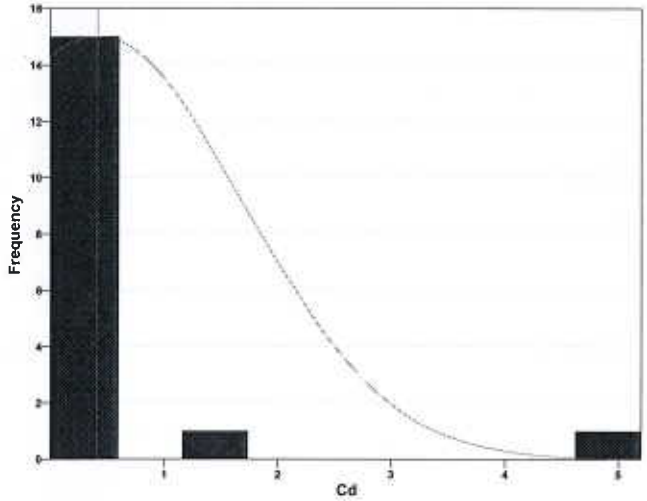

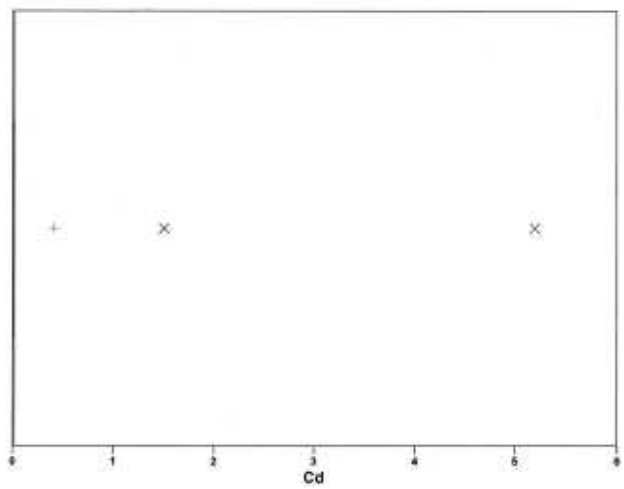

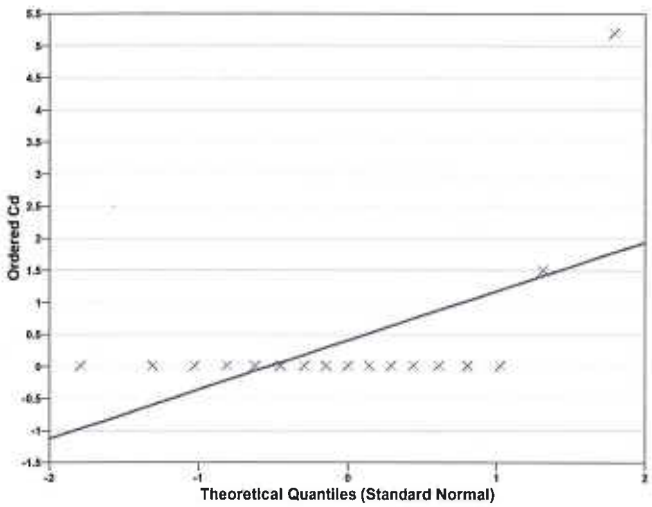

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Two-Sided Confidence Interval on the True Median

For calculating the confidence interval, the values are ordered from smallest to largest. The confidence limits are the highest value of the r+1 and/or lowest value of the s-1 order statistics that fit the formulas below, except when the rth ordered value is tied with higher ordered values or the sth ordered value is tied with lower ordered values. If higher numbered ordered values are ties with the rth ordered value, then the closest ordered value that is lower than r will be the confidence limit. If higher-numbered ordered values are ties with the sth ordered value, then the closest ordered value that is higher than s will be the confidence limit.

Upper Two-Sided Confidence Interval

$$\sum_{s}^{1}\left(\frac{n!}{r!(n-s)!}\right)p^{0.5}(1-p)^{n-0.5} \geq 1-\alpha/2$$

Lower Two-Sided Confidence interval

$$\sum_{r}^{1}\left(\frac{n!}{r!(n-r)!}\right)p^{0.5}(1-p)^{n-0.5} \leq \alpha/2$$

Upper 95% Two-Sided Confidence Interval on the Median	0.0175

Sample Median	0.016
Lower 95% Two-Sided Confidence Interval on the Median	0.0145

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* - The report contents may have been modified or reformatted by end-user of software.

Anodizing Bldg Cr+3

VSP Sample Design Report for Calculating a Two-Sided Confidence Interval for the Population Median Using Simple Random Sampling

Summary

This report summarizes the sampling design used, associated statistical assumptions, as well as general guidelines for conducting post-sampling data analysis. Sampling plan components presented here include how many sampling locations to choose and where within the sampling area to collect those samples. The type of medium to sample (i.e., soil, groundwater, etc.) and how to analyze the samples (in-situ, fixed laboratory, etc.) are addressed in other sections of the sampling plan.

The following table summarizes the sampling design developed. A figure that shows sampling locations in the field and a table that lists sampling location coordinates are also provided below.

SUMMARY OF SAMPLING DESIGN	
Primary Objective of Design	Construct a Confidence Interval on the True Median
Type of Sampling Design	Non-Parametric
Sample Placement (Location) in the Field	Simple random sampling
Formula for calculating number of sampling locations	Nonparametric Confidence Limits
Calculated total number of samples	15
Number of samples on map [a]	15
Number of selected sample areas [b]	1
Specified sampling area [c]	3910.04 ft^2
Total cost of sampling [d]	$2,860.00

[a] This number may differ from the calculated number because of 1) grid edge effects, 2) adding judgment samples, or 3) selecting or unselecting sample areas.
[b] The number of selected sample areas is the number of colored areas on the map of the site. These sample areas contain the locations where samples are collected.
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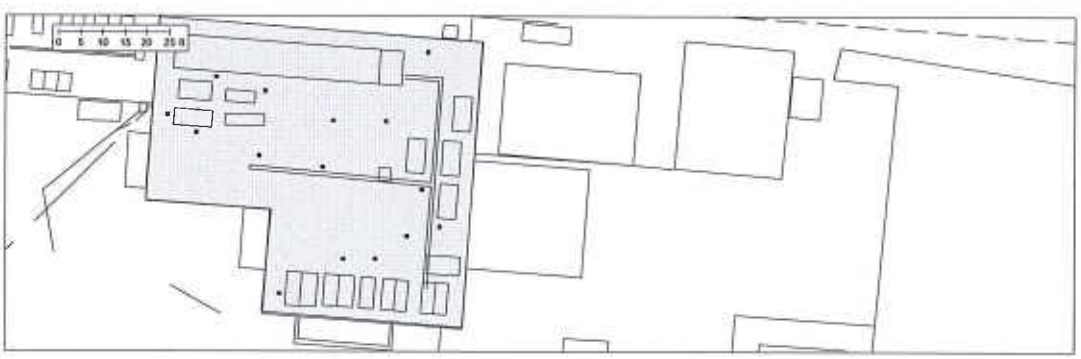

Area: Area 2					
X Coord	Y Coord	Label	Value	Type	Historical
4981.9002	5213.6371	GP-15	19	Random	
5000.6401	5198.5254	GP-11	3.6	Random	
4953.7905	5221.1929	GP-17	9.7	Random	

4972.5303	5185.9324	GP-24	28	Random	
5008.0100	5200.5999	GP-25	6.4	Random	
4947.1056	5225.2673	GP-21	29	Random	
4986.5852	5193.4882	GP-9	13	Random	
4967.8454	5216.1557	GP-16	39	Random	
5005.3250	5238.8231	GP-20	63	Random	
4995.9551	5223.7115	GP-13	48	Random	
4984.2427	5223.8359	GP-14	22	Random	
5003.9825	5208.7242	GP-12	3.8	Random	
4958.1330	5233.3917	GP-22	36	Random	
4993.6126	5193.6126	GP-10	7.4	Random	
4969.1604	5230.3045	GP-18	3.3	Random	

Primary Sampling Objective
The primary purpose of sampling at this site is to construct a confidence interval on the true population median value. After the samples are collected and analyzed, the resulting sample values can be used to construct a two-sided confidence interval. Once the confidence interval is computed (which will be an upper and a lower threshold), you can have the specified confidence that the true population median is between the upper and lower thresholds.

Selected Sampling Approach
A non-parametric random sampling approach was used to determine the number of samples and to specify sampling locations. A parametric formula was not chosen because the conceptual model and historical information (e.g., historical data from this site or a very similar site) indicate that parametric assumptions are not true. These assumptions will be examined in post-sampling data analysis.

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Locating the sample points randomly provides data that are separated by many distances, whereas systematic samples are all equidistant apart. Therefore, random sampling provides more information about the spatial structure of the potential contamination than systematic sampling does. As with systematic sampling, random sampling also provides information regarding the mean or median value, but there is the possibility that areas of the site will not be represented with the same frequency as if uniform grid sampling were performed.

Number of Total Samples: Calculation Equation and Inputs
Two sample confidence interval calculation methods are available for when n□20 and n>20 (Conover, 1980, p. 111-117) (Gilbert, 1987,p. 141-142). In VSP, the user specifies a one-sided or two-sided CI, and the percent confidence desired to be within a specified number of percentiles of the median. A binary search is then performed on the CI equations to solve for the minimum sample size to satisfy these parameters. VSP first uses the n□20 method to determine if a solution can be found where n□20, and if not, then uses the n>20 method.

For a one-sided CI, the n□20 method follows a binomial distribution and determines the lowest value of n where the yth quantile of the sample would be equal to or above the true median at least X% of the time (Note that the sample sizes work out to be the same regardless of whether the CI will be a lower or upper tailed, so the same formula can be used for any one-sided CI). X% is the specified confidence for one-sided confidence intervals, and the average of 100% and the specified confidence for two-sided confidence intervals. The yth quantile is determined by taking 50% and subtracting the allowable number of percentiles from the median specified by the user.

For a two-sided CI, the n□20 method is the same as performing a one-sided confidence interval, but replacing the specified percent confidence with the average of 100% and the specified percent confidence. If no solution is found where n□20, a binary search is conducted using Equation (1) for a one-sided CI and Equation (2) for a two-sided interval to compute the value of r (r is the the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest), rounding r up to the next higher integer. The search is repeated until the smallest n is

found where 100*2*r/n is greater than 50% minus the allowable number of percentiles from the median specified by the user.

$$r = 0.5 * n - 0.5 * w_{\alpha} \sqrt{n} \qquad (1)$$

$$r = 0.5 * n - 0.5 * w_{\alpha/2} \sqrt{n} \qquad (2)$$

Where:

n is the sample size

r is the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest

$w_{\square}$ is the specified quantile of a normal distribution, e.g. if $\square$=0.2 then $w_{\square}$ is the 0.2 quantile (20th percentile) of a normal distribution.

The n>20 method described above is an approximation method, so VSP also performs a final check using a binomial distribution in a similar manner to the n$\square$20 method, and may increase the sample size by 1 to ensure the specified confidence levels are met.

Cost of Sampling
The total cost of the completed sampling program depends on several cost inputs, some of which are fixed, and others that are based on the number of samples collected and measured. Based on the numbers of samples determined above, the estimated total cost of sampling and analysis at this site is $2,860.00, which averages out to a per sample cost of $190.67. The following table summarizes the inputs and resulting cost estimates.

COST INFORMATION			
Cost Details	**Per Analysis**	**Per Sample**	**15 Samples**
Field collection costs		$100.00	$1,500.00
Analytical costs	$24.00	$24.00	$360.00
Sum of Field & Analytical costs		**$124.00**	**$1,860.00**
Fixed planning and validation costs			$1,000.00
Total cost			**$2,860.00**

Data Analysis for Ni
The following data points were entered by the user for analysis.

Ni										
Rank	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
0	3.3	3.6	3.8	6.4	7.4	9.7	13	19	22	28
10	29	36	39	48	63					

SUMMARY STATISTICS for Ni	
n	15
Min	3.3
Max	63
Range	59.7
Mean	22.08
Median	19

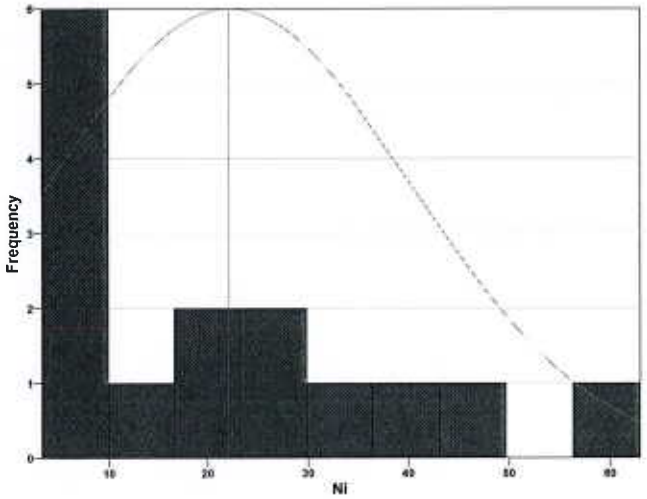
Variance				331.73				
StdDev				18.213				
Std Error				4.7027				
Skewness				0.89042				
Interquartile Range				29.6				
Percentiles								
1%	**5%**	**10%**	**25%**	**50%**	**75%**	**90%**	**95%**	**99%**
3.3	3.3	3.48	6.4	19	36	54	63	63

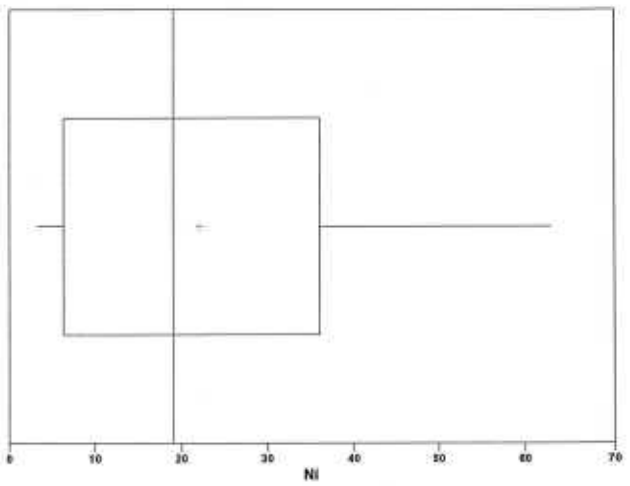
Data Plots
Three graphical displays of the data are shown below: the Histogram, the Box and Whiskers plot, and the Quantile-Quantile (Q-Q) plot.

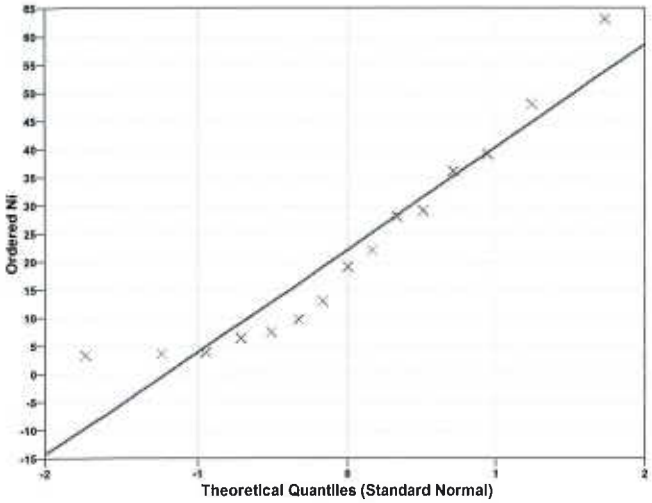
The Histogram is a plot of the fraction of the n observed data that fall within specified data "bins." A histogram is generated by dividing the x axis (range of the observed data values) into "bins" and displaying the number of data in each bin as the height of a bar for the bin. The area of the bar is the fraction of the n data values that lie within the bin. The sum of the fractions for all bins equals one. A histogram is used to assess how the n data are distributed (spread) over their range of values. If the histogram is more or less symmetric and bell shaped, then the data may be normally distributed.

The Box and Whiskers plot is composed of a central box divided by a line, and with two lines extending out from the box, called the "whiskers". The line through the box is drawn at the median of the n data observed. The two ends of the box represent the 25th and 75th percentiles of the n data values, which are also called the lower and upper quartiles, respectively, of the data set. The sample mean (mean of the n data) is shown as a "+" sign. The upper whisker extends to the largest data value that is less than the upper quartile plus 1.5 times the interquartile range (upper quartile minus the lower quartile). The lower whisker extends to the smallest data value that is greater than the lower quartile minus 1.5 times the interquartile range. Extreme data values (greater or smaller than the ends of the whiskers) are plotted individually. A Box and Whiskers plot is used to assess the symmetry of the distribution of the data set. If the distribution is symmetrical, the box is divided into two equal halves by the median, the whiskers will be the same length, and the number of extreme data points will be distributed equally on either end of the plot.

The Q-Q plot graphs the quantiles of a set of n data against the quantiles of a specific distribution. We show here only the Q-Q plot for an assumed normal distribution. The pth quantile of a distribution of data is the data value, x_n, for which a fraction p of the distribution is less than x_n. If the data plotted on the normal distribution Q-Q plot closely follow a straight line, even at the ends of the line, then the data may be assumed to be normally distributed. If the data points deviate substantially from a linear line, then the data are not normally distributed.







For more information on these three plots consult Guidance for Data Quality Assessment, EPA QA/G-9, pgs 2.3-1 through 2.3-12. (http://www.epa.gov/quality/qa-docs.html).

Two-Sided Confidence Interval on the True Median

For calculating the confidence interval, the values are ordered from smallest to largest. The confidence limits are the highest value of the r+1 and/or lowest value of the s-1 order statistics that fit the formulas below, except when the rth ordered value is tied with higher ordered values or the sth ordered value is tied with lower ordered values. If higher numbered ordered values are ties with the rth ordered value, then the closest ordered value that is lower than r will be the confidence limit. If higher-numbered ordered values are ties with the sth ordered value, then the closest ordered value that is higher than s will be the confidence limit.

Upper Two-Sided Confidence Interval

$$\sum_{s}^{1}\left(\frac{n!}{r!(n-s)!}\right)p^{0.5}(1-p)^{n-0.5} \geq 1-\alpha/2$$

Lower Two-Sided Confidence interval

$$\sum_{r}^{1}\left(\frac{n!}{r!(n-r)!}\right)p^{0.5}(1-p)^{n-0.5} \leq \alpha/2$$

Upper 95% Two-Sided Confidence Interval on the Median	39
Sample Median	19
Lower 95% Two-Sided Confidence Interval on the Median	3.8

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* - The report contents may have been modified or reformatted by end-user of software.

~~Chrome~~ Anodizing Bldg Cr^{+3} Biased

VSP Sample Design Report for Calculating a Two-Sided Confidence Interval for the Population Median Using Simple Random Sampling

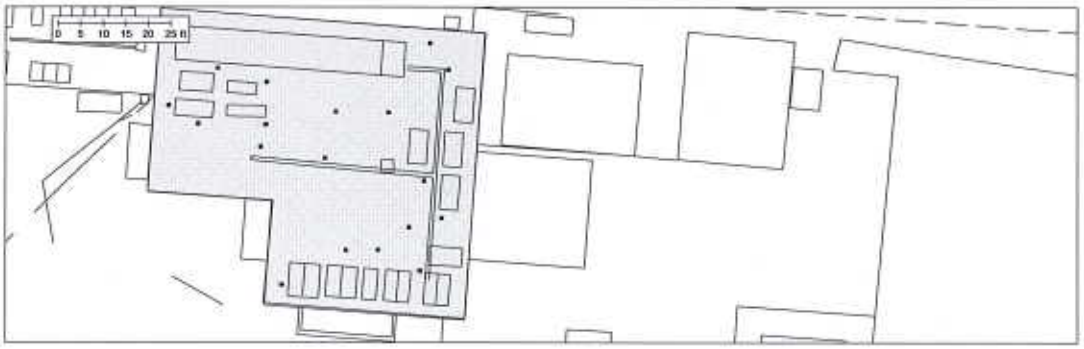
Summary

This report summarizes the sampling design used, associated statistical assumptions, as well as general guidelines for conducting post-sampling data analysis. Sampling plan components presented here include how many sampling locations to choose and where within the sampling area to collect those samples. The type of medium to sample (i.e., soil, groundwater, etc.) and how to analyze the samples (in-situ, fixed laboratory, etc.) are addressed in other sections of the sampling plan.

The following table summarizes the sampling design developed. A figure that shows sampling locations in the field and a table that lists sampling location coordinates are also provided below.

SUMMARY OF SAMPLING DESIGN	
Primary Objective of Design	Construct a Confidence Interval on the True Median
Type of Sampling Design	Non-Parametric
Sample Placement (Location) in the Field	Simple random sampling
Formula for calculating number of sampling locations	Nonparametric Confidence Limits
Calculated total number of samples	15
Number of samples on map [a]	18
Number of selected sample areas [b]	1
Specified sampling area [c]	3910.04 ft^2
Total cost of sampling [d]	$2,860.00

[a] This number may differ from the calculated number because of 1) grid edge effects, 2) adding judgment samples, or 3) selecting or unselecting sample areas.
[b] The number of selected sample areas is the number of colored areas on the map of the site. These sample areas contain the locations where samples are collected.
[c] The sampling area is the total surface area of the selected colored sample areas on the map of the site.
[d] Including measurement analyses and fixed overhead costs. See the Cost of Sampling section for an explanation of the costs presented here.



Area: Area 2					
X Coord	Y Coord	Label	Value	Type	Historical
4981.9002	5213.6371	GP-15	29.6	Random	
5000.6401	5198.5254	GP-11	4.1	Random	
4953.7905	5221.1929	GP-17	11.75	Random	

4972.5303	5185.9324	GP-24	29	Random	
5008.0100	5200.5999	GP-25	7.1	Random	
4947.1056	5225.2673	GP-21	43	Random	
4986.5852	5193.4882	GP-9	6.04	Random	
4967.8454	5216.1557	GP-16	26	Random	
5005.3250	5238.8231	GP-20	21.52	Random	
4995.9551	5223.7115	GP-13	4.4	Random	
4984.2427	5223.8359	GP-14	22	Random	
5003.9825	5208.7242	GP-12	7.5	Random	
4958.1330	5233.3917	GP-22	19.67	Random	
4993.6126	5193.6126	GP-10	3.3	Random	
4969.1604	5230.3045	GP-18	3.2	Random	
5003.0000	5189.0000	GP-23	3.17	Unknown	
5009.5000	5233.0000	GP-19	13	Unknown	
4969.0000	5221.0000	HA-4	1500	Unknown	

Primary Sampling Objective
The primary purpose of sampling at this site is to construct a confidence interval on the true population median value. After the samples are collected and analyzed, the resulting sample values can be used to construct a two-sided confidence interval. Once the confidence interval is computed (which will be an upper and a lower threshold), you can have the specified confidence that the true population median is between the upper and lower thresholds.

Selected Sampling Approach
A non-parametric random sampling approach was used to determine the number of samples and to specify sampling locations. A parametric formula was not chosen because the conceptual model and historical information (e.g., historical data from this site or a very similar site) indicate that parametric assumptions are not true. These assumptions will be examined in post-sampling data analysis.

Both parametric and non-parametric equations rely on assumptions about the population. Typically, however, non-parametric equations require fewer assumptions and allow for more uncertainty about the statistical distribution of values at the site. The trade-off is that if the parametric assumptions are valid, the required number of samples is usually less than if a non-parametric equation was used.

Locating the sample points randomly provides data that are separated by many distances, whereas systematic samples are all equidistant apart. Therefore, random sampling provides more information about the spatial structure of the potential contamination than systematic sampling does. As with systematic sampling, random sampling also provides information regarding the mean or median value, but there is the possibility that areas of the site will not be represented with the same frequency as if uniform grid sampling were performed.

Number of Total Samples: Calculation Equation and Inputs
Two sample confidence interval calculation methods are available for when n□20 and n>20 (Conover, 1980, p. 111-117) (Gilbert, 1987,p. 141-142). In VSP, the user specifies a one-sided or two-sided CI, and the percent confidence desired to be within a specified number of percentiles of the median. A binary search is then performed on the CI equations to solve for the minimum sample size to satisfy these parameters. VSP first uses the n□20 method to determine if a solution can be found where n□20, and if not, then uses the n>20 method.

For a one-sided CI, the n□20 method follows a binomial distribution and determines the lowest value of n where the yth quantile of the sample would be equal to or above the true median at least X% of the time (Note that the sample sizes work out to be the same regardless of whether the CI will be a lower or upper tailed, so the same formula can be used for any one-sided CI). X% is the specified confidence for one-sided confidence intervals, and the average of 100% and the specified confidence for two-sided confidence intervals. The yth quantile is determined by taking 50% and subtracting the allowable number of percentiles from the median specified by the user.

For a two-sided CI, the n□20 method is the same as performing a one-sided confidence interval, but replacing the

specified percent confidence with the average of 100% and the specified percent confidence. If no solution is found where n□20, a binary search is conducted using Equation (1) for a one-sided CI and Equation (2) for a two-sided interval to compute the value of r (r is the the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest), rounding r up to the next higher integer. The search is repeated until the smallest n is found where 100*2*r/n is greater than 50% minus the allowable number of percentiles from the median specified by the user.

$$r = 0.5 * n - 0.5 * w_{\alpha} \sqrt{n} \qquad (1)$$

$$r = 0.5 * n - 0.5 * w_{\alpha/2} \sqrt{n} \qquad (2)$$

Where:

n is the sample size

r is the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest

$w_{\square}$ is the specified quantile of a normal distribution, e.g. if □=0.2 then $w_{\square}$ is the 0.2 quantile (20th percentile) of a normal distribution.

The n>20 method described above is an approximation method, so VSP also performs a final check using a binomial distribution in a similar manner to the n□20 method, and may increase the sample size by 1 to ensure the specified confidence levels are met.

Cost of Sampling

The total cost of the completed sampling program depends on several cost inputs, some of which are fixed, and others that are based on the number of samples collected and measured. Based on the numbers of samples determined above, the estimated total cost of sampling and analysis at this site is $2,860.00, which averages out to a per sample cost of $190.67. The following table summarizes the inputs and resulting cost estimates.

COST INFORMATION			
Cost Details	**Per Analysis**	**Per Sample**	**15 Samples**
Field collection costs		$100.00	$1,500.00
Analytical costs	$24.00	$24.00	$360.00
Sum of Field & Analytical costs		**$124.00**	**$1,860.00**
Fixed planning and validation costs			$1,000.00
Total cost			**$2,860.00**

Data Analysis for Cr+3

The following data points were entered by the user for analysis.

Cr+3										
Rank	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
0	3.17	3.2	3.3	4.1	4.4	6.04	7.1	7.5	11.75	13
10	19.67	21.52	22	26	29	29.6	43	1500		

SUMMARY STATISTICS for Cr+3	
n	18
Min	3.17
Max	1500

Range	1496.8
Mean	97.464
Median	12.375
Variance	1.2265e+005
StdDev	350.22
Std Error	82.547
Skewness	4.2348
Interquartile Range	22.425

Percentiles								
1%	**5%**	**10%**	**25%**	**50%**	**75%**	**90%**	**95%**	**99%**
3.17	3.17	3.197	4.325	12.38	26.75	188.7	1500	1500

Data Plots

Three graphical displays of the data are shown below: the Histogram, the Box and Whiskers plot, and the Quantile-Quantile (Q-Q) plot.

The Histogram is a plot of the fraction of the n observed data that fall within specified data "bins." A histogram is generated by dividing the x axis (range of the observed data values) into "bins" and displaying the number of data in each bin as the height of a bar for the bin. The area of the bar is the fraction of the n data values that lie within the bin. The sum of the fractions for all bins equals one. A histogram is used to assess how the n data are distributed (spread) over their range of values. If the histogram is more or less symmetric and bell shaped, then the data may be normally distributed.

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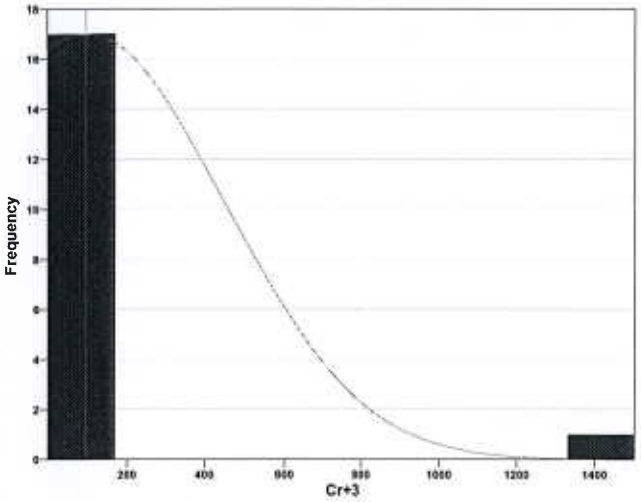
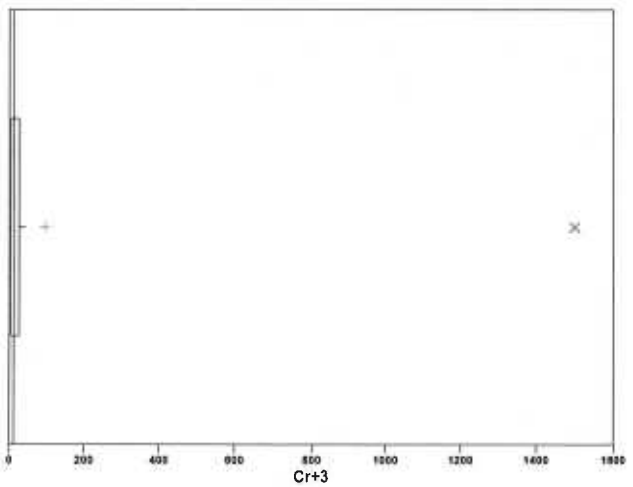
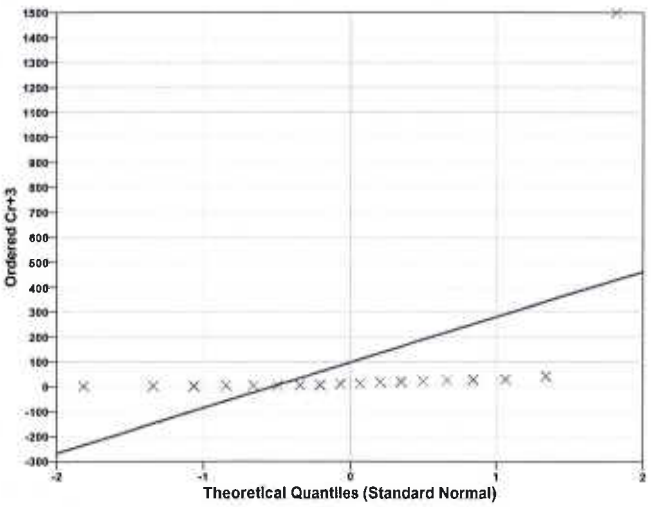
The Q-Q plot graphs the quantiles of a set of n data against the quantiles of a specific distribution. We show here only the Q-Q plot for an assumed normal distribution. The pth quantile of a distribution of data is the data value, x_p, for which a fraction p of the distribution is less than x_p. If the data plotted on the normal distribution Q-Q plot closely follow a straight line, even at the ends of the line, then the data may be assumed to be normally distributed. If the data points deviate substantially from a linear line, then the data are not normally distributed.







For more information on these three plots consult Guidance for Data Quality Assessment, EPA QA/G-9, pgs 2.3-1 through 2.3-12. (http://www.epa.gov/quality/qa-docs.html).

Two-Sided Confidence Interval on the True Median

For calculating the confidence interval, the values are ordered from smallest to largest. The confidence limits are the highest value of the r+1 and/or lowest value of the s-1 order statistics that fit the formulas below, except when the rth ordered value is tied with higher ordered values or the sth ordered value is tied with lower ordered values. If higher numbered ordered values are ties with the rth ordered value, then the closest ordered value that is lower than r will be the confidence limit. If higher-numbered ordered values are ties with the sth ordered value, then the closest ordered value that is higher than s will be the confidence limit.

Upper Two-Sided Confidence Interval

$$\sum_{s}^{1}\left(\frac{n!}{r!(n-s)!}\right)p^{0.5}(1-p)^{n-0.5} \geq 1-\alpha/2$$

Lower Two-Sided Confidence interval

$$\sum_{r}^{1}\left(\frac{n!}{r!(n-r)!}\right)p^{0.5}(1-p)^{n-0.5} \leq \alpha/2$$

Upper 95% Two-Sided Confidence Interval on the Median	29

Sample Median	12.375
Lower 95% Two-Sided Confidence Interval on the Median	4.1

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* - The report contents may have been modified or reformatted by end-user of software.

Anodizing Bldg Cr+6

VSP Sample Design Report for Calculating a Two-Sided Confidence Interval for the Population Median Using Simple Random Sampling

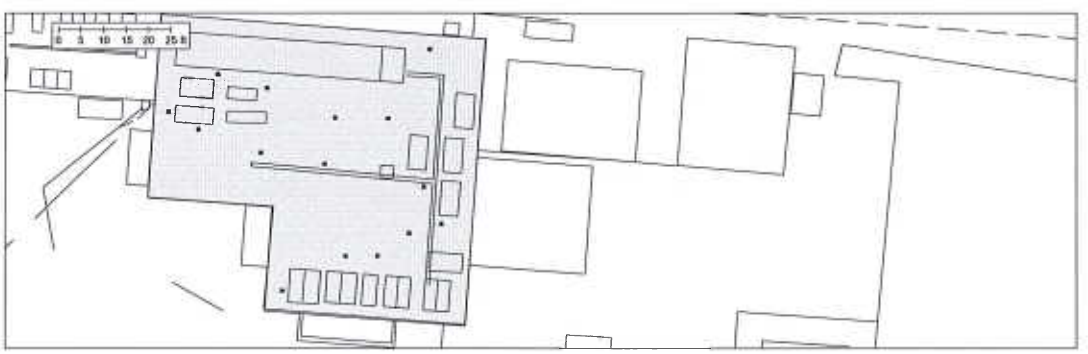
Summary

This report summarizes the sampling design used, associated statistical assumptions, as well as general guidelines for conducting post-sampling data analysis. Sampling plan components presented here include how many sampling locations to choose and where within the sampling area to collect those samples. The type of medium to sample (i.e., soil, groundwater, etc.) and how to analyze the samples (in-situ, fixed laboratory, etc.) are addressed in other sections of the sampling plan.

The following table summarizes the sampling design developed. A figure that shows sampling locations in the field and a table that lists sampling location coordinates are also provided below.

SUMMARY OF SAMPLING DESIGN	
Primary Objective of Design	Construct a Confidence Interval on the True Median
Type of Sampling Design	Non-Parametric
Sample Placement (Location) in the Field	Simple random sampling
Formula for calculating number of sampling locations	Nonparametric Confidence Limits
Calculated total number of samples	15
Number of samples on map [a]	15
Number of selected sample areas [b]	1
Specified sampling area [c]	3910.04 ft^2
Total cost of sampling [d]	$2,860.00

[a] This number may differ from the calculated number because of 1) grid edge effects, 2) adding judgment samples, or 3) selecting or unselecting sample areas.
[b] The number of selected sample areas is the number of colored areas on the map of the site. These sample areas contain the locations where samples are collected.
[c] The sampling area is the total surface area of the selected colored sample areas on the map of the site.
[d] Including measurement analyses and fixed overhead costs. See the Cost of Sampling section for an explanation of the costs presented here.



Area: Area 2					
X Coord	Y Coord	Label	Value	Type	Historical
4981.9002	5213.6371	GP-15	0.221	Random	
5000.6401	5198.5254	GP-11	0.158	Random	
4953.7905	5221.1929	GP-17	1.25	Random	

4972.5303	5185.9324	GP-24	0.146	Random	
5008.0100	5200.5999	GP-25	17.9	Random	
4947.1056	5225.2673	GP-21	0.163	Random	
4986.5852	5193.4882	GP-9	1.16	Random	
4967.8454	5216.1557	GP-16	0.165	Random	
5005.3250	5238.8231	GP-20	1.48	Random	
4995.9551	5223.7115	GP-13	0.135	Random	
4984.2427	5223.8359	GP-14	0.149	Random	
5003.9825	5208.7242	GP-12	0.133	Random	
4958.1330	5233.3917	GP-22	0.335	Random	
4993.6126	5193.6126	GP-10	0.134	Random	
4969.1604	5230.3045	GP-18	0.157	Random	

Primary Sampling Objective
The primary purpose of sampling at this site is to construct a confidence interval on the true population median value. After the samples are collected and analyzed, the resulting sample values can be used to construct a two-sided confidence interval. Once the confidence interval is computed (which will be an upper and a lower threshold), you can have the specified confidence that the true population median is between the upper and lower thresholds.

Selected Sampling Approach
A non-parametric random sampling approach was used to determine the number of samples and to specify sampling locations. A parametric formula was not chosen because the conceptual model and historical information (e.g., historical data from this site or a very similar site) indicate that parametric assumptions are not true. These assumptions will be examined in post-sampling data analysis.

Both parametric and non-parametric equations rely on assumptions about the population. Typically, however, non-parametric equations require fewer assumptions and allow for more uncertainty about the statistical distribution of values at the site. The trade-off is that if the parametric assumptions are valid, the required number of samples is usually less than if a non-parametric equation was used.

Locating the sample points randomly provides data that are separated by many distances, whereas systematic samples are all equidistant apart. Therefore, random sampling provides more information about the spatial structure of the potential contamination than systematic sampling does. As with systematic sampling, random sampling also provides information regarding the mean or median value, but there is the possibility that areas of the site will not be represented with the same frequency as if uniform grid sampling were performed.

Number of Total Samples: Calculation Equation and Inputs
Two sample confidence interval calculation methods are available for when n□20 and n>20 (Conover, 1980, p. 111-117) (Gilbert, 1987,p. 141-142). In VSP, the user specifies a one-sided or two-sided CI, and the percent confidence desired to be within a specified number of percentiles of the median. A binary search is then performed on the CI equations to solve for the minimum sample size to satisfy these parameters. VSP first uses the n□20 method to determine if a solution can be found where n□20, and if not, then uses the n>20 method.

For a one-sided CI, the n□20 method follows a binomial distribution and determines the lowest value of n where the yth quantile of the sample would be equal to or above the true median at least X% of the time (Note that the sample sizes work out to be the same regardless of whether the CI will be a lower or upper tailed, so the same formula can be used for any one-sided CI). X% is the specified confidence for one-sided confidence intervals, and the average of 100% and the specified confidence for two-sided confidence intervals. The yth quantile is determined by taking 50% and subtracting the allowable number of percentiles from the median specified by the user.

For a two-sided CI, the n□20 method is the same as performing a one-sided confidence interval, but replacing the specified percent confidence with the average of 100% and the specified percent confidence. If no solution is found where n□20, a binary search is conducted using Equation (1) for a one-sided CI and Equation (2) for a two-sided interval to compute the value of r (r is the the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest), rounding r up to the next higher integer. The search is repeated until the smallest n is

found where 100*2*r/n is greater than 50% minus the allowable number of percentiles from the median specified by the user.

$$r = 0.5 * n - 0.5 * w_{\alpha} \sqrt{n} \qquad (1)$$

$$r = 0.5 * n - 0.5 * w_{\alpha/2} \sqrt{n} \qquad (2)$$

Where:

n is the sample size

r is the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest

$w_{\square}$ is the specified quantile of a normal distribution, e.g. if □=0.2 then $w_{\square}$ is the 0.2 quantile (20th percentile) of a normal distribution.

The n>20 method described above is an approximation method, so VSP also performs a final check using a binomial distribution in a similar manner to the n□20 method, and may increase the sample size by 1 to ensure the specified confidence levels are met.

Cost of Sampling
The total cost of the completed sampling program depends on several cost inputs, some of which are fixed, and others that are based on the number of samples collected and measured. Based on the numbers of samples determined above, the estimated total cost of sampling and analysis at this site is $2,860.00, which averages out to a per sample cost of $190.67. The following table summarizes the inputs and resulting cost estimates.

COST INFORMATION			
Cost Details	**Per Analysis**	**Per Sample**	**15 Samples**
Field collection costs		$100.00	$1,500.00
Analytical costs	$24.00	$24.00	$360.00
Sum of Field & Analytical costs		**$124.00**	**$1,860.00**
Fixed planning and validation costs			$1,000.00
Total cost			**$2,860.00**

Data Analysis for Cr+6
The following data points were entered by the user for analysis.

Cr+6										
Rank	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
0	0.133	0.134	0.135	0.146	0.149	0.157	0.158	0.163	0.165	0.221
10	0.335	1.16	1.25	1.48	17.9					

SUMMARY STATISTICS for Cr+6	
n	15
Min	0.133
Max	17.9
Range	17.767
Mean	1.5791
Median	0.163

Variance	20.605
StdDev	4.5393
Std Error	1.172
Skewness	3.8037
Interquartile Range	1.014

Percentiles								
1%	**5%**	**10%**	**25%**	**50%**	**75%**	**90%**	**95%**	**99%**
0.133	0.133	0.1336	0.146	0.163	1.16	8.048	17.9	17.9

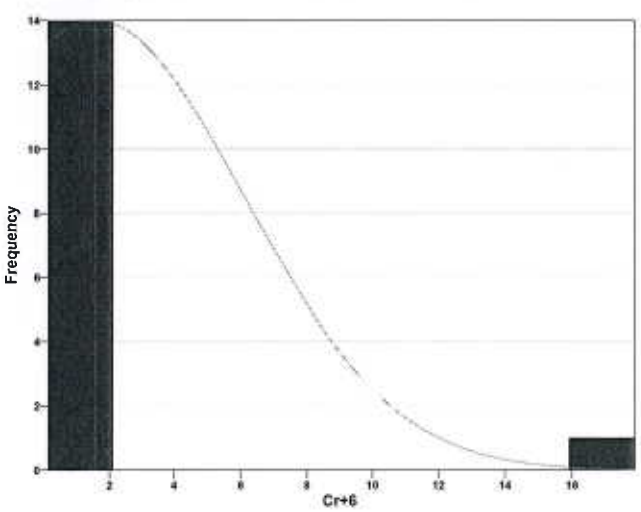
Data Plots

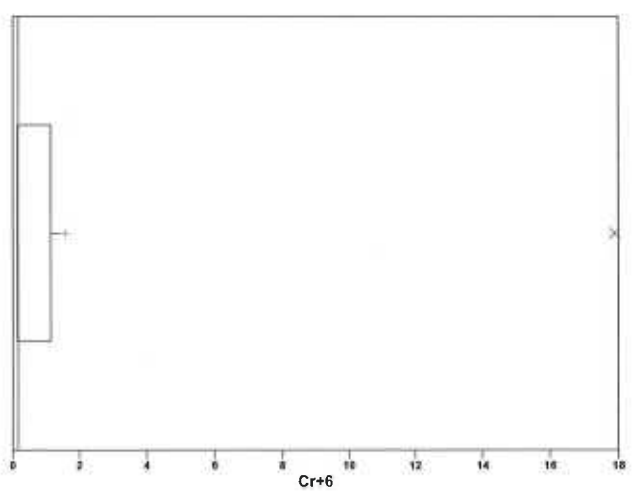
Three graphical displays of the data are shown below: the Histogram, the Box and Whiskers plot, and the Quantile-Quantile (Q-Q) plot.

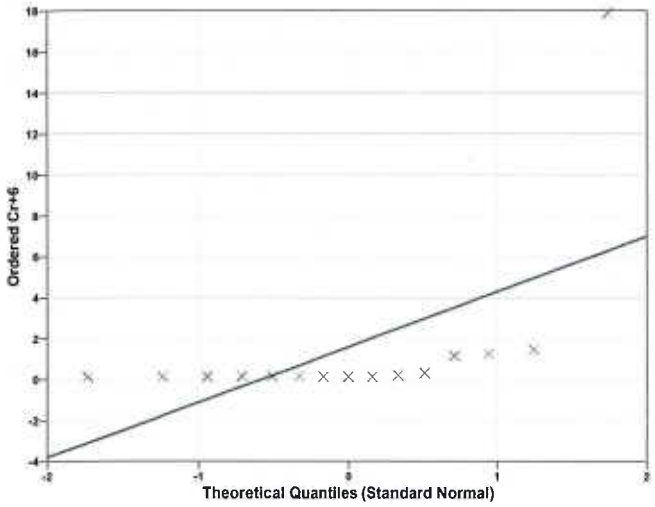
The Histogram is a plot of the fraction of the n observed data that fall within specified data "bins." A histogram is generated by dividing the x axis (range of the observed data values) into "bins" and displaying the number of data in each bin as the height of a bar for the bin. The area of the bar is the fraction of the n data values that lie within the bin. The sum of the fractions for all bins equals one. A histogram is used to assess how the n data are distributed (spread) over their range of values. If the histogram is more or less symmetric and bell shaped, then the data may be normally distributed.

The Box and Whiskers plot is composed of a central box divided by a line, and with two lines extending out from the box, called the "whiskers". The line through the box is drawn at the median of the n data observed. The two ends of the box represent the 25th and 75th percentiles of the n data values, which are also called the lower and upper quartiles, respectively, of the data set. The sample mean (mean of the n data) is shown as a "+" sign. The upper whisker extends to the largest data value that is less than the upper quartile plus 1.5 times the interquartile range (upper quartile minus the lower quartile). The lower whisker extends to the smallest data value that is greater than the lower quartile minus 1.5 times the interquartile range. Extreme data values (greater or smaller than the ends of the whiskers) are plotted individually. A Box and Whiskers plot is used to assess the symmetry of the distribution of the data set. If the distribution is symmetrical, the box is divided into two equal halves by the median, the whiskers will be the same length, and the number of extreme data points will be distributed equally on either end of the plot.

The Q-Q plot graphs the quantiles of a set of n data against the quantiles of a specific distribution. We show here only the Q-Q plot for an assumed normal distribution. The pth quantile of a distribution of data is the data value, x_n, for which a fraction p of the distribution is less than x_n. If the data plotted on the normal distribution Q-Q plot closely follow a straight line, even at the ends of the line, then the data may be assumed to be normally distributed. If the data points deviate substantially from a linear line, then the data are not normally distributed.







For more information on these three plots consult Guidance for Data Quality Assessment, EPA QA/G-9, pgs 2.3-1 through 2.3-12. (http://www.epa.gov/quality/qa-docs.html).

Two-Sided Confidence Interval on the True Median

For calculating the confidence interval, the values are ordered from smallest to largest. The confidence limits are the highest value of the r+1 and/or lowest value of the s-1 order statistics that fit the formulas below, except when the rth ordered value is tied with higher ordered values or the sth ordered value is tied with lower ordered values. If higher numbered ordered values are ties with the rth ordered value, then the closest ordered value that is lower than r will be the confidence limit. If higher-numbered ordered values are ties with the sth ordered value, then the closest ordered value that is higher than s will be the confidence limit.

Upper Two-Sided Confidence Interval

$$\sum_{s}^{1}\left(\frac{n!}{r!(n-s)!}\right)p^{0.5}(1-p)^{n-0.5} \geq 1-\alpha/2$$

Lower Two-Sided Confidence interval

$$\sum_{r}^{1}\left(\frac{n!}{r!(n-r)!}\right)p^{0.5}(1-p)^{n-0.5} \leq \alpha/2$$

Upper 95% Two-Sided Confidence Interval on the Median	1.25
Sample Median	0.163
Lower 95% Two-Sided Confidence Interval on the Median	0.135

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* - The report contents may have been modified or reformatted by end-user of software.

Anodizing Bldg Cr + Cl Biased.

VSP Sample Design Report for Calculating a Two-Sided Confidence Interval for the Population Median Using Simple Random Sampling

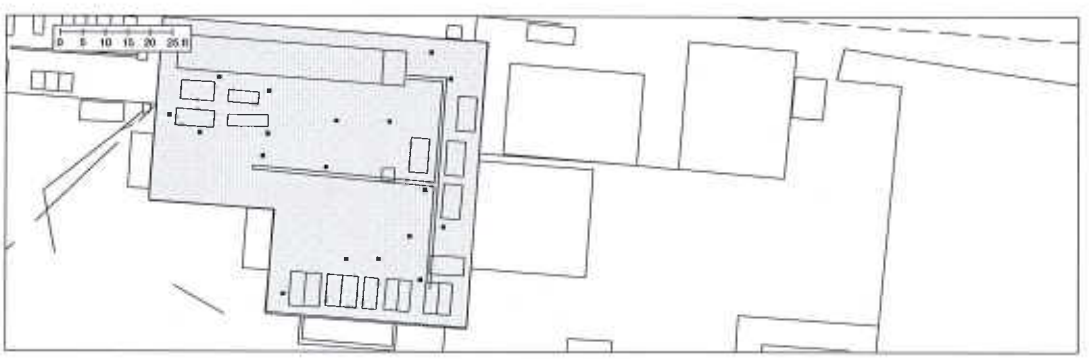
Summary

This report summarizes the sampling design used, associated statistical assumptions, as well as general guidelines for conducting post-sampling data analysis. Sampling plan components presented here include how many sampling locations to choose and where within the sampling area to collect those samples. The type of medium to sample (i.e., soil, groundwater, etc.) and how to analyze the samples (in-situ, fixed laboratory, etc.) are addressed in other sections of the sampling plan.

The following table summarizes the sampling design developed. A figure that shows sampling locations in the field and a table that lists sampling location coordinates are also provided below.

SUMMARY OF SAMPLING DESIGN	
Primary Objective of Design	Construct a Confidence Interval on the True Median
Type of Sampling Design	Non-Parametric
Sample Placement (Location) in the Field	Simple random sampling
Formula for calculating number of sampling locations	Nonparametric Confidence Limits
Calculated total number of samples	15
Number of samples on map [a]	18
Number of selected sample areas [b]	1
Specified sampling area [c]	3910.04 ft^2
Total cost of sampling [d]	$2,860.00

[a] This number may differ from the calculated number because of 1) grid edge effects, 2) adding judgment samples, or 3) selecting or unselecting sample areas.
[b] The number of selected sample areas is the number of colored areas on the map of the site. These sample areas contain the locations where samples are collected.
[c] The sampling area is the total surface area of the selected colored sample areas on the map of the site.
[d] Including measurement analyses and fixed overhead costs. See the Cost of Sampling section for an explanation of the costs presented here.



Area: Area 2					
X Coord	Y Coord	Label	Value	Type	Historical
4981.9002	5213.6371	GP-15	0.442	Random	
5000.6401	5198.5254	GP-11	0.158	Random	
4953.7905	5221.1929	GP-17	1.25	Random	

4972.5303	5185.9324	GP-24	0.146	Random	
5008.0100	5200.5999	GP-25	17.9	Random	
4947.1056	5225.2673	GP-21	0.163	Random	
4986.5852	5193.4882	GP-9	1.16	Random	
4967.8454	5216.1557	GP-16	0.165	Random	
5005.3250	5238.8231	GP-20	1.48	Random	
4995.9551	5223.7115	GP-13	0.135	Random	
4984.2427	5223.8359	GP-14	0.495	Random	
5003.9825	5208.7242	GP-12	0.139	Random	
4958.1330	5233.3917	GP-22	0.335	Random	
4993.6126	5193.6126	GP-10	0.184	Random	
4969.1604	5230.3045	GP-18	0.157	Random	
5003.0000	5189.0000	GP-23	0.164	Unknown	
5009.5000	5233.0000	GP-19	0.157	Unknown	
4969.0000	5221.0000	HA-4	43.3	Unknown	

Primary Sampling Objective
The primary purpose of sampling at this site is to construct a confidence interval on the true population median value. After the samples are collected and analyzed, the resulting sample values can be used to construct a two-sided confidence interval. Once the confidence interval is computed (which will be an upper and a lower threshold), you can have the specified confidence that the true population median is between the upper and lower thresholds.

Selected Sampling Approach
A non-parametric random sampling approach was used to determine the number of samples and to specify sampling locations. A parametric formula was not chosen because the conceptual model and historical information (e.g., historical data from this site or a very similar site) indicate that parametric assumptions are not true. These assumptions will be examined in post-sampling data analysis.

Both parametric and non-parametric equations rely on assumptions about the population. Typically, however, non-parametric equations require fewer assumptions and allow for more uncertainty about the statistical distribution of values at the site. The trade-off is that if the parametric assumptions are valid, the required number of samples is usually less than if a non-parametric equation was used.

Locating the sample points randomly provides data that are separated by many distances, whereas systematic samples are all equidistant apart. Therefore, random sampling provides more information about the spatial structure of the potential contamination than systematic sampling does. As with systematic sampling, random sampling also provides information regarding the mean or median value, but there is the possibility that areas of the site will not be represented with the same frequency as if uniform grid sampling were performed.

Number of Total Samples: Calculation Equation and Inputs
Two sample confidence interval calculation methods are available for when n□20 and n>20 (Conover, 1980, p. 111-117) (Gilbert, 1987,p. 141-142). In VSP, the user specifies a one-sided or two-sided CI, and the percent confidence desired to be within a specified number of percentiles of the median. A binary search is then performed on the CI equations to solve for the minimum sample size to satisfy these parameters. VSP first uses the n□20 method to determine if a solution can be found where n□20, and if not, then uses the n>20 method.

For a one-sided CI, the n□20 method follows a binomial distribution and determines the lowest value of n where the yth quantile of the sample would be equal to or above the true median at least X% of the time (Note that the sample sizes work out to be the same regardless of whether the CI will be a lower or upper tailed, so the same formula can be used for any one-sided CI). X% is the specified confidence for one-sided confidence intervals, and the average of 100% and the specified confidence for two-sided confidence intervals. The yth quantile is determined by taking 50% and subtracting the allowable number of percentiles from the median specified by the user.

For a two-sided CI, the n□20 method is the same as performing a one-sided confidence interval, but replacing the

specified percent confidence with the average of 100% and the specified percent confidence. If no solution is found where n□20, a binary search is conducted using Equation (1) for a one-sided CI and Equation (2) for a two-sided interval to compute the value of r (r is the the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest), rounding r up to the next higher integer. The search is repeated until the smallest n is found where 100*2*r/n is greater than 50% minus the allowable number of percentiles from the median specified by the user.

$$r = 0.5 * n - 0.5 * w_{\alpha} \sqrt{n} \qquad (1)$$

$$r = 0.5 * n - 0.5 * w_{\alpha/2} \sqrt{n} \qquad (2)$$

Where:

n is the sample size

r is the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest

$w_{\square}$ is the specified quantile of a normal distribution, e.g. if □=0.2 then $w_{\square}$ is the 0.2 quantile (20th percentile) of a normal distribution.

The n>20 method described above is an approximation method, so VSP also performs a final check using a binomial distribution in a similar manner to the n□20 method, and may increase the sample size by 1 to ensure the specified confidence levels are met.

Cost of Sampling

The total cost of the completed sampling program depends on several cost inputs, some of which are fixed, and others that are based on the number of samples collected and measured. Based on the numbers of samples determined above, the estimated total cost of sampling and analysis at this site is $2,860.00, which averages out to a per sample cost of $190.67. The following table summarizes the inputs and resulting cost estimates.

COST INFORMATION			
Cost Details	**Per Analysis**	**Per Sample**	**15 Samples**
Field collection costs		$100.00	$1,500.00
Analytical costs	$24.00	$24.00	$360.00
Sum of Field & Analytical costs		**$124.00**	**$1,860.00**
Fixed planning and validation costs			$1,000.00
Total cost			**$2,860.00**

Data Analysis for Cr+6

The following data points were entered by the user for analysis.

Cr+6										
Rank	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
0	0.135	0.139	0.146	0.157	0.157	0.158	0.163	0.164	0.165	0.184
10	0.335	0.442	0.495	1.16	1.25	1.48	17.9	43.3		

SUMMARY STATISTICS for Cr+6	
n	18
Min	0.135
Max	43.3

Range	43.165
Mean	3.7739
Median	0.1745
Variance	114.4
StdDev	10.696
Std Error	2.521
Skewness	3.4579
Interquartile Range	1.0255

Percentiles								
1%	**5%**	**10%**	**25%**	**50%**	**75%**	**90%**	**95%**	**99%**
0.135	0.135	0.1386	0.157	0.1745	1.182	20.44	43.3	43.3

Data Plots

Three graphical displays of the data are shown below: the Histogram, the Box and Whiskers plot, and the Quantile-Quantile (Q-Q) plot.

The Histogram is a plot of the fraction of the n observed data that fall within specified data "bins." A histogram is generated by dividing the x axis (range of the observed data values) into "bins" and displaying the number of data in each bin as the height of a bar for the bin. The area of the bar is the fraction of the n data values that lie within the bin. The sum of the fractions for all bins equals one. A histogram is used to assess how the n data are distributed (spread) over their range of values. If the histogram is more or less symmetric and bell shaped, then the data may be normally distributed.

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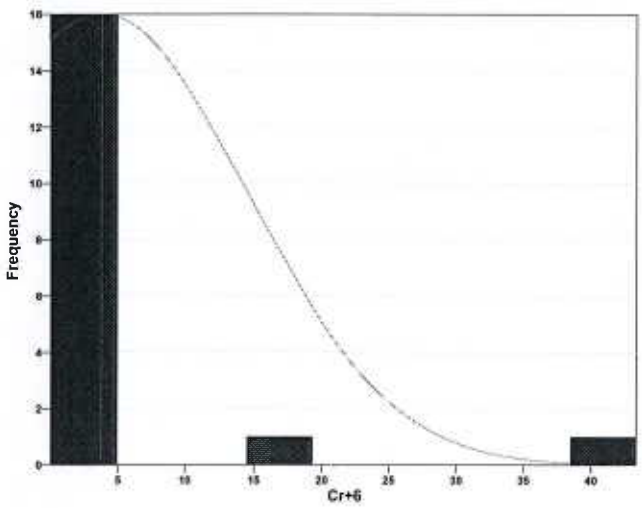
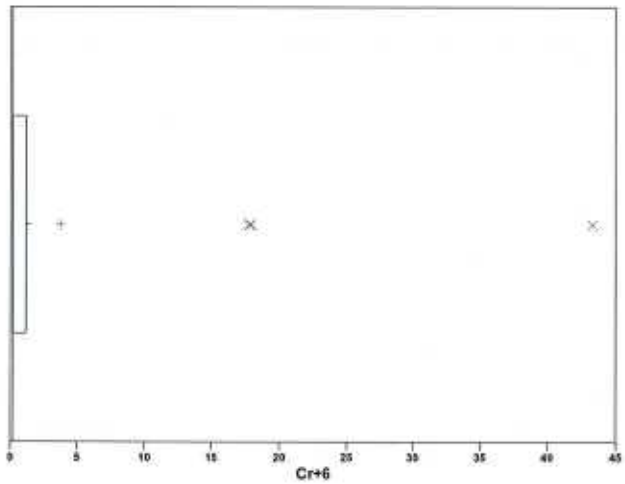
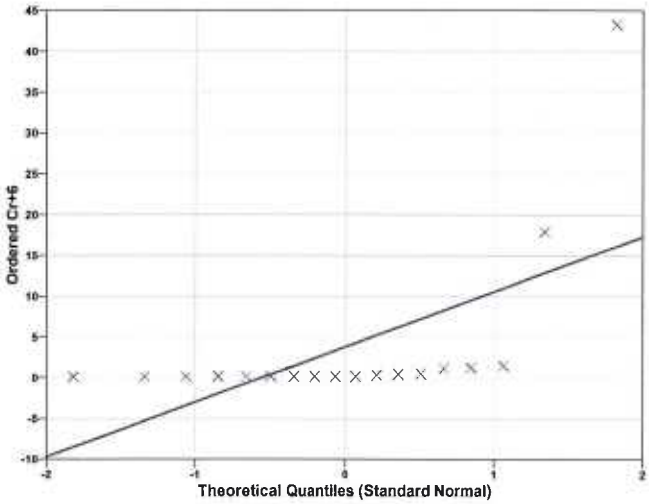
The Q-Q plot graphs the quantiles of a set of n data against the quantiles of a specific distribution. We show here only the Q-Q plot for an assumed normal distribution. The pth quantile of a distribution of data is the data value, x_n, for which a fraction p of the distribution is less than x_n. If the data plotted on the normal distribution Q-Q plot closely follow a straight line, even at the ends of the line, then the data may be assumed to be normally distributed. If the data points deviate substantially from a linear line, then the data are not normally distributed.







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Two-Sided Confidence Interval on the True Median

For calculating the confidence interval, the values are ordered from smallest to largest. The confidence limits are the highest value of the r+1 and/or lowest value of the s-1 order statistics that fit the formulas below, except when the rth ordered value is tied with higher ordered values or the sth ordered value is tied with lower ordered values. If higher numbered ordered values are ties with the rth ordered value, then the closest ordered value that is lower than r will be the confidence limit. If higher-numbered ordered values are ties with the sth ordered value, then the closest ordered value that is higher than s will be the confidence limit.

Upper Two-Sided Confidence Interval

$$\sum_{s}^{1}\left(\frac{n!}{r!(n-s)!}\right)p^{0.5}(1-p)^{n-0.5} \geq 1-\alpha/2$$

Lower Two-Sided Confidence interval

$$\sum_{r}^{1}\left(\frac{n!}{r!(n-r)!}\right)p^{0.5}(1-p)^{n-0.5} \leq \alpha/2$$

Upper 95% Two-Sided Confidence Interval on the Median	1.25

Sample Median	0.1745
Lower 95% Two-Sided Confidence Interval on the Median	0.157

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Anodizing Bldg Cu.

VSP Sample Design Report for Calculating a Two-Sided Confidence Interval for the Population Median Using Simple Random Sampling

Summary

This report summarizes the sampling design used, associated statistical assumptions, as well as general guidelines for conducting post-sampling data analysis. Sampling plan components presented here include how many sampling locations to choose and where within the sampling area to collect those samples. The type of medium to sample (i.e., soil, groundwater, etc.) and how to analyze the samples (in-situ, fixed laboratory, etc.) are addressed in other sections of the sampling plan.

The following table summarizes the sampling design developed. A figure that shows sampling locations in the field and a table that lists sampling location coordinates are also provided below.

SUMMARY OF SAMPLING DESIGN	
Primary Objective of Design	Construct a Confidence Interval on the True Median
Type of Sampling Design	Non-Parametric
Sample Placement (Location) in the Field	Simple random sampling
Formula for calculating number of sampling locations	Nonparametric Confidence Limits
Calculated total number of samples	15
Number of samples on map [a]	15
Number of selected sample areas [b]	1
Specified sampling area [c]	3910.04 ft^2
Total cost of sampling [d]	$2,860.00

[a] This number may differ from the calculated number because of 1) grid edge effects, 2) adding judgment samples, or 3) selecting or unselecting sample areas.
[b] The number of selected sample areas is the number of colored areas on the map of the site. These sample areas contain the locations where samples are collected.
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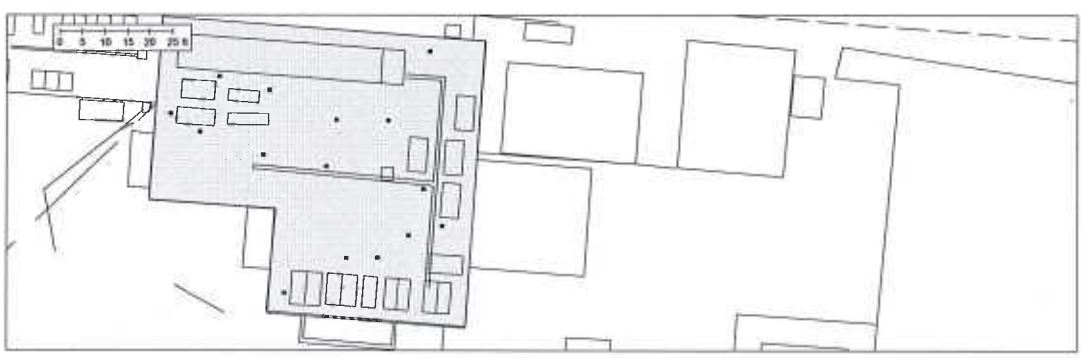
[d] Including measurement analyses and fixed overhead costs. See the Cost of Sampling section for an explanation of the costs presented here.



Area: Area 2					
X Coord	Y Coord	Label	Value	Type	Historical
4981.9002	5213.6371	GP-15	31	Random	
5000.6401	5198.5254	GP-11	37	Random	
4953.7905	5221.1929	GP-17	23	Random	

4972.5303	5185.9324	GP-24	76	Random	
5008.0100	5200.5999	GP-25	41	Random	
4947.1056	5225.2673	GP-21	26	Random	
4986.5852	5193.4882	GP-9	19	Random	
4967.8454	5216.1557	GP-16	63	Random	
5005.3250	5238.8231	GP-20	57	Random	
4995.9551	5223.7115	GP-13	36	Random	
4984.2427	5223.8359	GP-14	13	Random	
5003.9825	5208.7242	GP-12	14	Random	
4958.1330	5233.3917	GP-22	30	Random	
4993.6126	5193.6126	GP-10	15	Random	
4969.1604	5230.3045	GP-18	3.5	Random	

Primary Sampling Objective
The primary purpose of sampling at this site is to construct a confidence interval on the true population median value. After the samples are collected and analyzed, the resulting sample values can be used to construct a two-sided confidence interval. Once the confidence interval is computed (which will be an upper and a lower threshold), you can have the specified confidence that the true population median is between the upper and lower thresholds.

Selected Sampling Approach
A non-parametric random sampling approach was used to determine the number of samples and to specify sampling locations. A parametric formula was not chosen because the conceptual model and historical information (e.g., historical data from this site or a very similar site) indicate that parametric assumptions are not true. These assumptions will be examined in post-sampling data analysis.

Both parametric and non-parametric equations rely on assumptions about the population. Typically, however, non-parametric equations require fewer assumptions and allow for more uncertainty about the statistical distribution of values at the site. The trade-off is that if the parametric assumptions are valid, the required number of samples is usually less than if a non-parametric equation was used.

Locating the sample points randomly provides data that are separated by many distances, whereas systematic samples are all equidistant apart. Therefore, random sampling provides more information about the spatial structure of the potential contamination than systematic sampling does. As with systematic sampling, random sampling also provides information regarding the mean or median value, but there is the possibility that areas of the site will not be represented with the same frequency as if uniform grid sampling were performed.

Number of Total Samples: Calculation Equation and Inputs
Two sample confidence interval calculation methods are available for when n□20 and n>20 (Conover, 1980, p. 111-117) (Gilbert, 1987,p. 141-142). In VSP, the user specifies a one-sided or two-sided CI, and the percent confidence desired to be within a specified number of percentiles of the median. A binary search is then performed on the CI equations to solve for the minimum sample size to satisfy these parameters. VSP first uses the n□20 method to determine if a solution can be found where n□20, and if not, then uses the n>20 method.

For a one-sided CI, the n□20 method follows a binomial distribution and determines the lowest value of n where the yth quantile of the sample would be equal to or above the true median at least X% of the time (Note that the sample sizes work out to be the same regardless of whether the CI will be a lower or upper tailed, so the same formula can be used for any one-sided CI). X% is the specified confidence for one-sided confidence intervals, and the average of 100% and the specified confidence for two-sided confidence intervals. The yth quantile is determined by taking 50% and subtracting the allowable number of percentiles from the median specified by the user.

For a two-sided CI, the n□20 method is the same as performing a one-sided confidence interval, but replacing the specified percent confidence with the average of 100% and the specified percent confidence. If no solution is found where n□20, a binary search is conducted using Equation (1) for a one-sided CI and Equation (2) for a two-sided interval to compute the value of r (r is the the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest), rounding r up to the next higher integer. The search is repeated until the smallest n is

found where 100*2*r/n is greater than 50% minus the allowable number of percentiles from the median specified by the user.

$$r = 0.5*n - 0.5*w_{\alpha}\sqrt{n} \qquad (1)$$

$$r = 0.5*n - 0.5*w_{\alpha/2}\sqrt{n} \qquad (2)$$

Where:

n is the sample size

r is the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest

$w_{\square}$ is the specified quantile of a normal distribution, e.g. if □=0.2 then $w_{\square}$ is the 0.2 quantile (20th percentile) of a normal distribution.

The n>20 method described above is an approximation method, so VSP also performs a final check using a binomial distribution in a similar manner to the n□20 method, and may increase the sample size by 1 to ensure the specified confidence levels are met.

Cost of Sampling
The total cost of the completed sampling program depends on several cost inputs, some of which are fixed, and others that are based on the number of samples collected and measured. Based on the numbers of samples determined above, the estimated total cost of sampling and analysis at this site is $2,860.00, which averages out to a per sample cost of $190.67. The following table summarizes the inputs and resulting cost estimates.

COST INFORMATION			
Cost Details	**Per Analysis**	**Per Sample**	**15 Samples**
Field collection costs		$100.00	$1,500.00
Analytical costs	$24.00	$24.00	$360.00
Sum of Field & Analytical costs		**$124.00**	**$1,860.00**
Fixed planning and validation costs			$1,000.00
Total cost			**$2,860.00**

Data Analysis for Cu
The following data points were entered by the user for analysis.

Cu										
Rank	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
0	3.5	13	14	15	19	23	26	30	31	36
10	37	41	57	63	76					

SUMMARY STATISTICS for Cu	
n	15
Min	3.5
Max	76
Range	72.5
Mean	32.3
Median	30

Variance				408.56				
StdDev				20.213				
Std Error				5.219				
Skewness				0.823				
Interquartile Range				26				
Percentiles								
1%	**5%**	**10%**	**25%**	**50%**	**75%**	**90%**	**95%**	**99%**
3.5	3.5	9.2	15	30	41	68.2	76	76

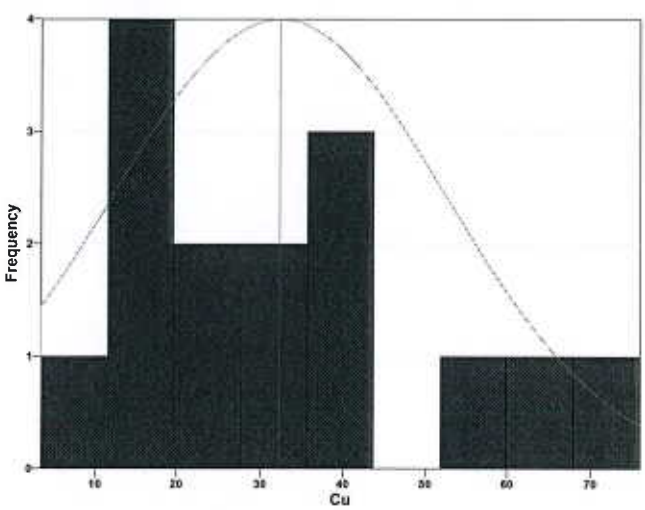
Data Plots

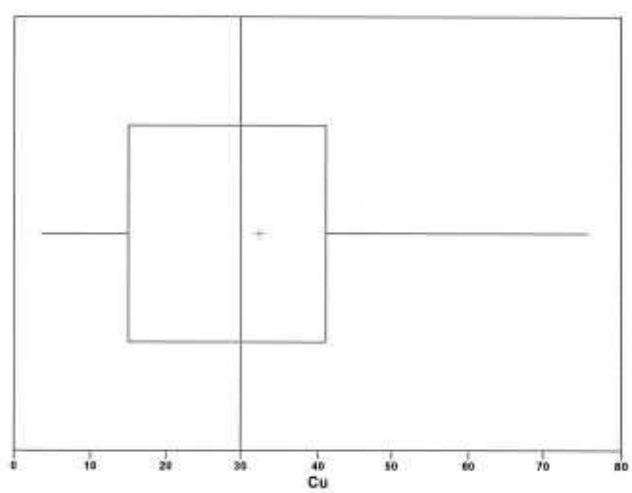
Three graphical displays of the data are shown below: the Histogram, the Box and Whiskers plot, and the Quantile-Quantile (Q-Q) plot.

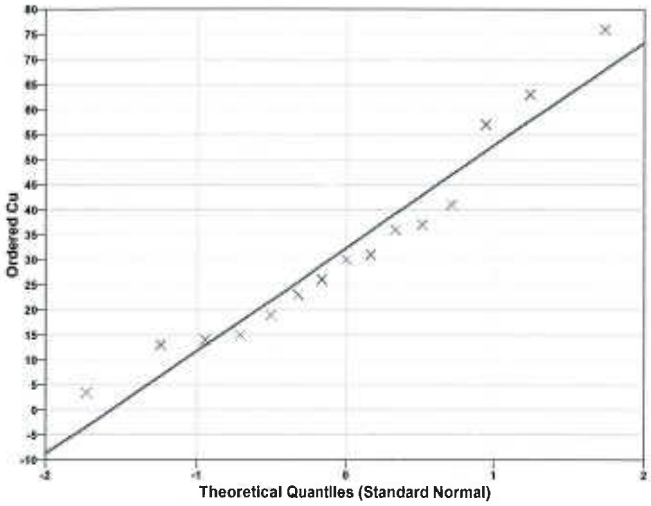
The Histogram is a plot of the fraction of the n observed data that fall within specified data "bins." A histogram is generated by dividing the x axis (range of the observed data values) into "bins" and displaying the number of data in each bin as the height of a bar for the bin. The area of the bar is the fraction of the n data values that lie within the bin. The sum of the fractions for all bins equals one. A histogram is used to assess how the n data are distributed (spread) over their range of values. If the histogram is more or less symmetric and bell shaped, then the data may be normally distributed.

The Box and Whiskers plot is composed of a central box divided by a line, and with two lines extending out from the box, called the "whiskers". The line through the box is drawn at the median of the n data observed. The two ends of the box represent the 25th and 75th percentiles of the n data values, which are also called the lower and upper quartiles, respectively, of the data set. The sample mean (mean of the n data) is shown as a "+" sign. The upper whisker extends to the largest data value that is less than the upper quartile plus 1.5 times the interquartile range (upper quartile minus the lower quartile). The lower whisker extends to the smallest data value that is greater than the lower quartile minus 1.5 times the interquartile range. Extreme data values (greater or smaller than the ends of the whiskers) are plotted individually. A Box and Whiskers plot is used to assess the symmetry of the distribution of the data set. If the distribution is symmetrical, the box is divided into two equal halves by the median, the whiskers will be the same length, and the number of extreme data points will be distributed equally on either end of the plot.

The Q-Q plot graphs the quantiles of a set of n data against the quantiles of a specific distribution. We show here only the Q-Q plot for an assumed normal distribution. The pth quantile of a distribution of data is the data value, x_n, for which a fraction p of the distribution is less than x_n. If the data plotted on the normal distribution Q-Q plot closely follow a straight line, even at the ends of the line, then the data may be assumed to be normally distributed. If the data points deviate substantially from a linear line, then the data are not normally distributed.







For more information on these three plots consult Guidance for Data Quality Assessment, EPA QA/G-9, pgs 2.3-1 through 2.3-12. (http://www.epa.gov/quality/qa-docs.html).

Two-Sided Confidence Interval on the True Median

For calculating the confidence interval, the values are ordered from smallest to largest. The confidence limits are the highest value of the r+1 and/or lowest value of the s-1 order statistics that fit the formulas below, except when the rth ordered value is tied with higher ordered values or the sth ordered value is tied with lower ordered values. If higher numbered ordered values are ties with the rth ordered value, then the closest ordered value that is lower than r will be the confidence limit. If higher-numbered ordered values are ties with the sth ordered value, then the closest ordered value that is higher than s will be the confidence limit.

Upper Two-Sided Confidence Interval

$$\sum_{s}^{1}\left(\frac{n!}{r!(n-s)!}\right)p^{0.5}(1-p)^{n-0.5} \geq 1-\alpha/2$$

Lower Two-Sided Confidence interval

$$\sum_{r}^{1}\left(\frac{n!}{r!(n-r)!}\right)p^{0.5}(1-p)^{n-0.5} \leq \alpha/2$$

Upper 95% Two-Sided Confidence Interval on the Median	57
Sample Median	30
Lower 95% Two-Sided Confidence Interval on the Median	14

This report was automatically produced* by Visual Sample Plan (VSP) software version 6.1b.

Software and documentation available at http://vsp.pnl.gov

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* - The report contents may have been modified or reformatted by end-user of software.

Anodizing Bldg. Cu Biased

VSP Sample Design Report for Calculating a Two-Sided Confidence Interval for the Population Median Using Simple Random Sampling

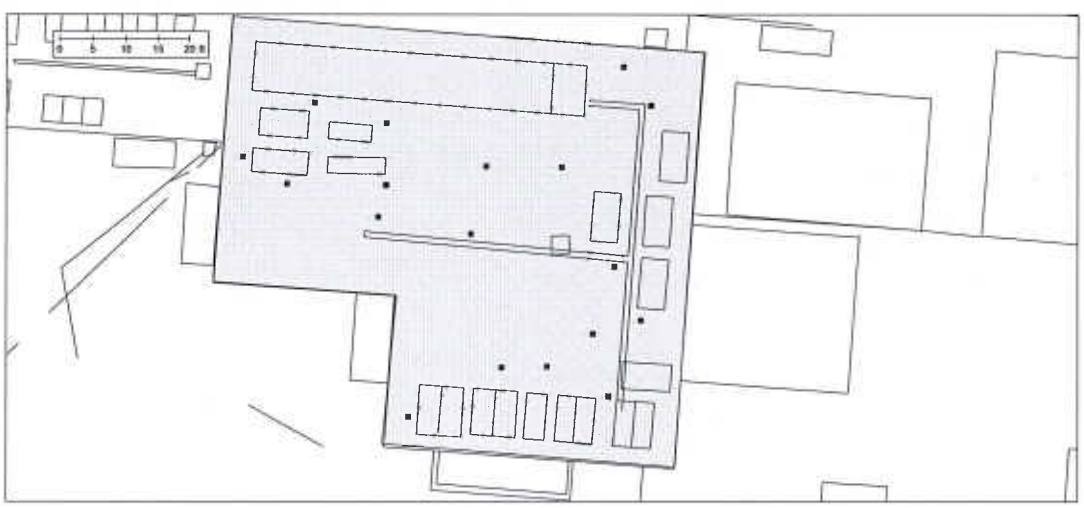
Summary

This report summarizes the sampling design used, associated statistical assumptions, as well as general guidelines for conducting post-sampling data analysis. Sampling plan components presented here include how many sampling locations to choose and where within the sampling area to collect those samples. The type of medium to sample (i.e., soil, groundwater, etc.) and how to analyze the samples (in-situ, fixed laboratory, etc.) are addressed in other sections of the sampling plan.

The following table summarizes the sampling design developed. A figure that shows sampling locations in the field and a table that lists sampling location coordinates are also provided below.

SUMMARY OF SAMPLING DESIGN	
Primary Objective of Design	Construct a Confidence Interval on the True Median
Type of Sampling Design	Non-Parametric
Sample Placement (Location) in the Field	Simple random sampling
Formula for calculating number of sampling locations	Nonparametric Confidence Limits
Calculated total number of samples	15
Number of samples on map [a]	18
Number of selected sample areas [b]	1
Specified sampling area [c]	3910.04 ft^2
Total cost of sampling [d]	$2,860.00

[a] This number may differ from the calculated number because of 1) grid edge effects, 2) adding judgment samples, or 3) selecting or unselecting sample areas.
[b] The number of selected sample areas is the number of colored areas on the map of the site. These sample areas contain the locations where samples are collected.
[c] The sampling area is the total surface area of the selected colored sample areas on the map of the site.
[d] Including measurement analyses and fixed overhead costs. See the Cost of Sampling section for an explanation of the costs presented here.



Area: Area 2					
X Coord	Y Coord	Label	Value	Type	Historical

4981.9002	5213.6371	GP-15	31	Random	
5000.6401	5198.5254	GP-11	37	Random	
4953.7905	5221.1929	GP-17	23	Random	
4972.5303	5185.9324	GP-24	76	Random	
5008.0100	5200.5999	GP-25	41	Random	
4947.1056	5225.2673	GP-21	26	Random	
4986.5852	5193.4882	GP-9	19	Random	
4967.8454	5216.1557	GP-16	63	Random	
5005.3250	5238.8231	GP-20	57	Random	
4995.9551	5223.7115	GP-13	36	Random	
4984.2427	5223.8359	GP-14	13	Random	
5003.9825	5208.7242	GP-12	14	Random	
4958.1330	5233.3917	GP-22	30	Random	
4993.6126	5193.6126	GP-10	15	Random	
4969.1604	5230.3045	GP-18	3.5	Random	
5003.0000	5189.0000	GP-23	25	Unknown	
5009.5000	5233.0000	GP-19	51	Unknown	
4969.0000	5221.0000	HA-4		Unknown	

Primary Sampling Objective
The primary purpose of sampling at this site is to construct a confidence interval on the true population median value. After the samples are collected and analyzed, the resulting sample values can be used to construct a two-sided confidence interval. Once the confidence interval is computed (which will be an upper and a lower threshold), you can have the specified confidence that the true population median is between the upper and lower thresholds.

Selected Sampling Approach
A non-parametric random sampling approach was used to determine the number of samples and to specify sampling locations. A parametric formula was not chosen because the conceptual model and historical information (e.g., historical data from this site or a very similar site) indicate that parametric assumptions are not true. These assumptions will be examined in post-sampling data analysis.

Both parametric and non-parametric equations rely on assumptions about the population. Typically, however, non-parametric equations require fewer assumptions and allow for more uncertainty about the statistical distribution of values at the site. The trade-off is that if the parametric assumptions are valid, the required number of samples is usually less than if a non-parametric equation was used.

Locating the sample points randomly provides data that are separated by many distances, whereas systematic samples are all equidistant apart. Therefore, random sampling provides more information about the spatial structure of the potential contamination than systematic sampling does. As with systematic sampling, random sampling also provides information regarding the mean or median value, but there is the possibility that areas of the site will not be represented with the same frequency as if uniform grid sampling were performed.

Number of Total Samples: Calculation Equation and Inputs
Two sample confidence interval calculation methods are available for when n□20 and n>20 (Conover, 1980, p. 111-117) (Gilbert, 1987,p. 141-142). In VSP, the user specifies a one-sided or two-sided CI, and the percent confidence desired to be within a specified number of percentiles of the median. A binary search is then performed on the CI equations to solve for the minimum sample size to satisfy these parameters. VSP first uses the n□20 method to determine if a solution can be found where n□20, and if not, then uses the n>20 method.

For a one-sided CI, the n□20 method follows a binomial distribution and determines the lowest value of n where the yth quantile of the sample would be equal to or above the true median at least X% of the time (Note that the sample sizes work out to be the same regardless of whether the CI will be a lower or upper tailed, so the same formula can be used for

any one-sided CI). X% is the specified confidence for one-sided confidence intervals, and the average of 100% and the specified confidence for two-sided confidence intervals. The yth quantile is determined by taking 50% and subtracting the allowable number of percentiles from the median specified by the user.

For a two-sided CI, the n□20 method is the same as performing a one-sided confidence interval, but replacing the specified percent confidence with the average of 100% and the specified percent confidence. If no solution is found where n□20, a binary search is conducted using Equation (1) for a one-sided CI and Equation (2) for a two-sided interval to compute the value of r (r is the the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest), rounding r up to the next higher integer. The search is repeated until the smallest n is found where 100*2*r/n is greater than 50% minus the allowable number of percentiles from the median specified by the user.

$$r = 0.5 * n - 0.5 * w_{\alpha} \sqrt{n} \qquad (1)$$

$$r = 0.5 * n - 0.5 * w_{\alpha/2} \sqrt{n} \qquad (2)$$

Where:

n is the sample size

r is the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest

$w_{\square}$ is the specified quantile of a normal distribution, e.g. if □=0.2 then $w_{\square}$ is the 0.2 quantile (20th percentile) of a normal distribution.

The n>20 method described above is an approximation method, so VSP also performs a final check using a binomial distribution in a similar manner to the n□20 method, and may increase the sample size by 1 to ensure the specified confidence levels are met.

Cost of Sampling
The total cost of the completed sampling program depends on several cost inputs, some of which are fixed, and others that are based on the number of samples collected and measured. Based on the numbers of samples determined above, the estimated total cost of sampling and analysis at this site is $2,860.00, which averages out to a per sample cost of $190.67. The following table summarizes the inputs and resulting cost estimates.

COST INFORMATION			
Cost Details	**Per Analysis**	**Per Sample**	**15 Samples**
Field collection costs		$100.00	$1,500.00
Analytical costs	$24.00	$24.00	$360.00
Sum of Field & Analytical costs		**$124.00**	**$1,860.00**
Fixed planning and validation costs			$1,000.00
Total cost			**$2,860.00**

Data Analysis for Cu
The following data points were entered by the user for analysis.

Cu										
Rank	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
0	3.5	13	14	15	19	23	25	26	30	31
10	36	37	41	51	57	63	76			

SUMMARY STATISTICS for Cu

n	17
Min	3.5
Max	76
Range	72.5
Mean	32.971
Median	30
Variance	382.2
StdDev	19.55
Std Error	4.7416
Skewness	0.72338
Interquartile Range	29

Percentiles								
1%	**5%**	**10%**	**25%**	**50%**	**75%**	**90%**	**95%**	**99%**
3.5	3.5	11.1	17	30	46	65.6	76	76

Data Plots

Three graphical displays of the data are shown below: the Histogram, the Box and Whiskers plot, and the Quantile-Quantile (Q-Q) plot.

The Histogram is a plot of the fraction of the n observed data that fall within specified data "bins." A histogram is generated by dividing the x axis (range of the observed data values) into "bins" and displaying the number of data in each bin as the height of a bar for the bin. The area of the bar is the fraction of the n data values that lie within the bin. The sum of the fractions for all bins equals one. A histogram is used to assess how the n data are distributed (spread) over their range of values. If the histogram is more or less symmetric and bell shaped, then the data may be normally distributed.

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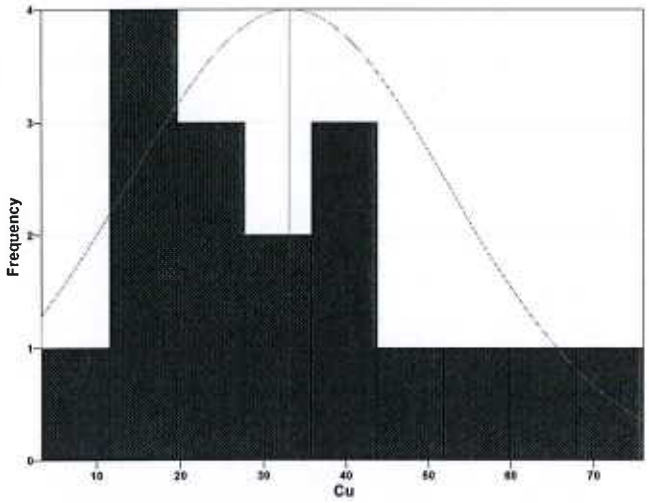

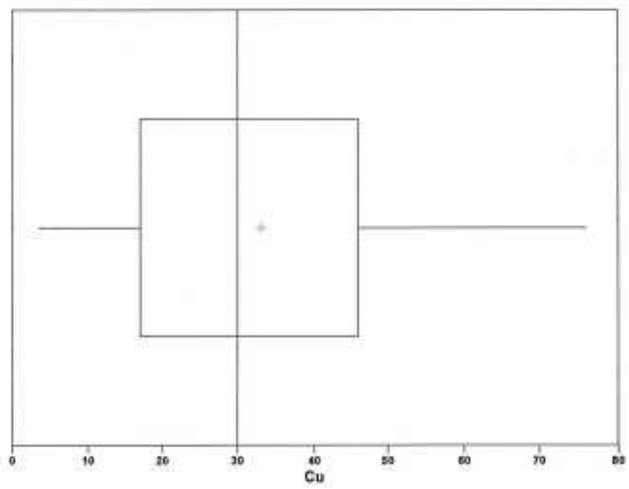

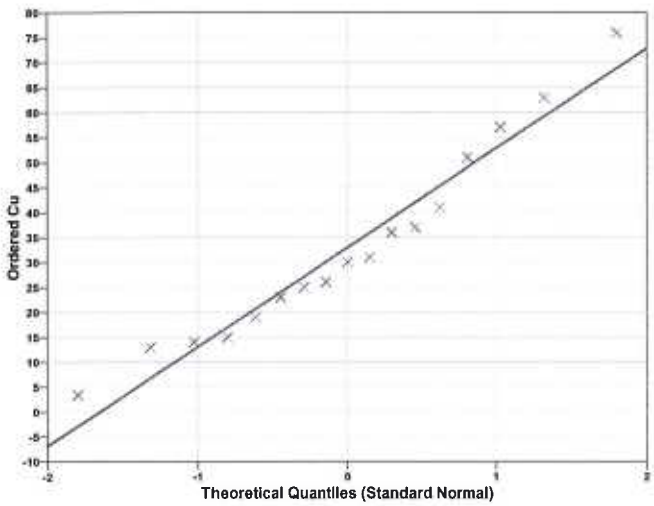

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Two-Sided Confidence Interval on the True Median

For calculating the confidence interval, the values are ordered from smallest to largest. The confidence limits are the highest value of the r+1 and/or lowest value of the s-1 order statistics that fit the formulas below, except when the rth ordered value is tied with higher ordered values or the sth ordered value is tied with lower ordered values. If higher numbered ordered values are ties with the rth ordered value, then the closest ordered value that is lower than r will be the confidence limit. If higher-numbered ordered values are ties with the sth ordered value, then the closest ordered value that is higher than s will be the confidence limit.

Upper Two-Sided Confidence Interval

$$\sum_{s}^{1}\left(\frac{n!}{r!\,(n-s)!}\right)p^{0.5}(1-p)^{n-0.5} \geq 1-\alpha/2$$

Lower Two-Sided Confidence interval

$$\sum_{r}^{1}\left(\frac{n!}{r!\,(n-r)!}\right)p^{0.5}(1-p)^{n-0.5} \leq \alpha/2$$

Upper 95% Two-Sided Confidence Interval on the Median	51

Sample Median	30
Lower 95% Two-Sided Confidence Interval on the Median	15

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* - The report contents may have been modified or reformatted by end-user of software.

Anodizing Bldg Pb

VSP Sample Design Report for Calculating a Two-Sided Confidence Interval for the Population Median Using Simple Random Sampling

Summary

This report summarizes the sampling design used, associated statistical assumptions, as well as general guidelines for conducting post-sampling data analysis. Sampling plan components presented here include how many sampling locations to choose and where within the sampling area to collect those samples. The type of medium to sample (i.e., soil, groundwater, etc.) and how to analyze the samples (in-situ, fixed laboratory, etc.) are addressed in other sections of the sampling plan.

The following table summarizes the sampling design developed. A figure that shows sampling locations in the field and a table that lists sampling location coordinates are also provided below.

SUMMARY OF SAMPLING DESIGN	
Primary Objective of Design	Construct a Confidence Interval on the True Median
Type of Sampling Design	Non-Parametric
Sample Placement (Location) in the Field	Simple random sampling
Formula for calculating number of sampling locations	Nonparametric Confidence Limits
Calculated total number of samples	15
Number of samples on map [a]	15
Number of selected sample areas [b]	1
Specified sampling area [c]	3910.04 ft^2
Total cost of sampling [d]	$2,860.00

[a] This number may differ from the calculated number because of 1) grid edge effects, 2) adding judgment samples, or 3) selecting or unselecting sample areas.
[b] The number of selected sample areas is the number of colored areas on the map of the site. These sample areas contain the locations where samples are collected.
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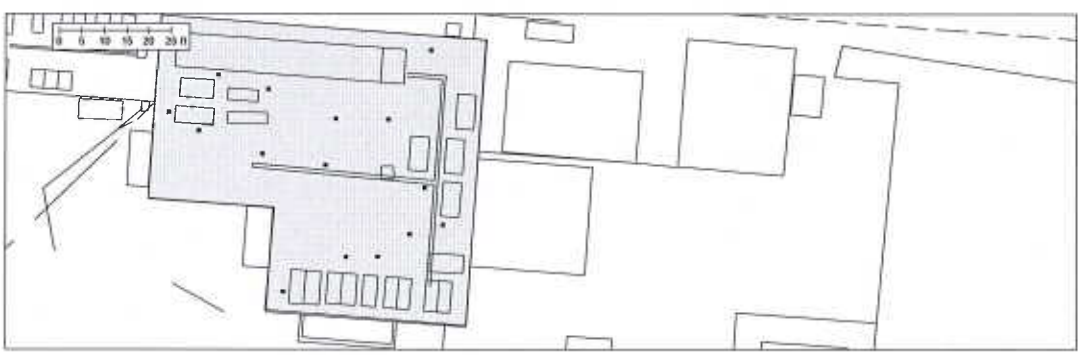

Area: Area 2					
X Coord	Y Coord	Label	Value	Type	Historical
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5000.6401	5198.5254	GP-11	3.6	Random	
4953.7905	5221.1929	GP-17	0.43	Random	

4972.5303	5185.9324	GP-24	0.78	Random	
5008.0100	5200.5999	GP-25	0.9	Random	
4947.1056	5225.2673	GP-21	1.6	Random	
4986.5852	5193.4882	GP-9	1	Random	
4967.8454	5216.1557	GP-16	0.58	Random	
5005.3250	5238.8231	GP-20	4	Random	
4995.9551	5223.7115	GP-13	0.41	Random	
4984.2427	5223.8359	GP-14	1	Random	
5003.9825	5208.7242	GP-12	0.62	Random	
4958.1330	5233.3917	GP-22	2.4	Random	
4993.6126	5193.6126	GP-10	0.34	Random	
4969.1604	5230.3045	GP-18	0.37	Random	

Primary Sampling Objective
The primary purpose of sampling at this site is to construct a confidence interval on the true population median value. After the samples are collected and analyzed, the resulting sample values can be used to construct a two-sided confidence interval. Once the confidence interval is computed (which will be an upper and a lower threshold), you can have the specified confidence that the true population median is between the upper and lower thresholds.

Selected Sampling Approach
A non-parametric random sampling approach was used to determine the number of samples and to specify sampling locations. A parametric formula was not chosen because the conceptual model and historical information (e.g., historical data from this site or a very similar site) indicate that parametric assumptions are not true. These assumptions will be examined in post-sampling data analysis.

Both parametric and non-parametric equations rely on assumptions about the population. Typically, however, non-parametric equations require fewer assumptions and allow for more uncertainty about the statistical distribution of values at the site. The trade-off is that if the parametric assumptions are valid, the required number of samples is usually less than if a non-parametric equation was used.

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Number of Total Samples: Calculation Equation and Inputs
Two sample confidence interval calculation methods are available for when n□20 and n>20 (Conover, 1980, p. 111-117) (Gilbert, 1987,p. 141-142). In VSP, the user specifies a one-sided or two-sided CI, and the percent confidence desired to be within a specified number of percentiles of the median. A binary search is then performed on the CI equations to solve for the minimum sample size to satisfy these parameters. VSP first uses the n□20 method to determine if a solution can be found where n□20, and if not, then uses the n>20 method.

For a one-sided CI, the n□20 method follows a binomial distribution and determines the lowest value of n where the yth quantile of the sample would be equal to or above the true median at least X% of the time (Note that the sample sizes work out to be the same regardless of whether the CI will be a lower or upper tailed, so the same formula can be used for any one-sided CI). X% is the specified confidence for one-sided confidence intervals, and the average of 100% and the specified confidence for two-sided confidence intervals. The yth quantile is determined by taking 50% and subtracting the allowable number of percentiles from the median specified by the user.

For a two-sided CI, the n□20 method is the same as performing a one-sided confidence interval, but replacing the specified percent confidence with the average of 100% and the specified percent confidence. If no solution is found where n□20, a binary search is conducted using Equation (1) for a one-sided CI and Equation (2) for a two-sided interval to compute the value of r (r is the the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest), rounding r up to the next higher integer. The search is repeated until the smallest n is

found where 100*2*r/n is greater than 50% minus the allowable number of percentiles from the median specified by the user.

$$r = 0.5 * n - 0.5 * w_{\alpha} \sqrt{n} \qquad (1)$$

$$r = 0.5 * n - 0.5 * w_{\alpha/2} \sqrt{n} \qquad (2)$$

Where:

n is the sample size

r is the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest

$w_{\square}$ is the specified quantile of a normal distribution, e.g. if $\square$=0.2 then $w_{\square}$ is the 0.2 quantile (20th percentile) of a normal distribution.

The n>20 method described above is an approximation method, so VSP also performs a final check using a binomial distribution in a similar manner to the n$\square$20 method, and may increase the sample size by 1 to ensure the specified confidence levels are met.

Cost of Sampling
The total cost of the completed sampling program depends on several cost inputs, some of which are fixed, and others that are based on the number of samples collected and measured. Based on the numbers of samples determined above, the estimated total cost of sampling and analysis at this site is $2,860.00, which averages out to a per sample cost of $190.67. The following table summarizes the inputs and resulting cost estimates.

COST INFORMATION			
Cost Details	**Per Analysis**	**Per Sample**	**15 Samples**
Field collection costs		$100.00	$1,500.00
Analytical costs	$24.00	$24.00	$360.00
Sum of Field & Analytical costs		**$124.00**	**$1,860.00**
Fixed planning and validation costs			$1,000.00
Total cost			**$2,860.00**

Data Analysis for Pb
The following data points were entered by the user for analysis.

Pb										
Rank	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
0	0.28	0.34	0.37	0.41	0.43	0.58	0.62	0.78	0.9	1
10	1	1.6	2.4	3.6	4					

SUMMARY STATISTICS for Pb	
n	15
Min	0.28
Max	4
Range	3.72
Mean	1.2207
Median	0.78

Variance	1.4109
StdDev	1.1878
Std Error	0.30669
Skewness	1.6158
Interquartile Range	1.19

Percentiles								
1%	**5%**	**10%**	**25%**	**50%**	**75%**	**90%**	**95%**	**99%**
0.28	0.28	0.316	0.41	0.78	1.6	3.76	4	4

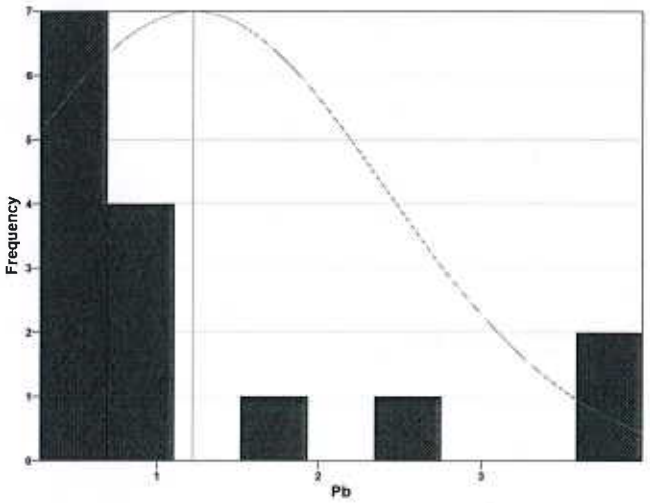
Data Plots

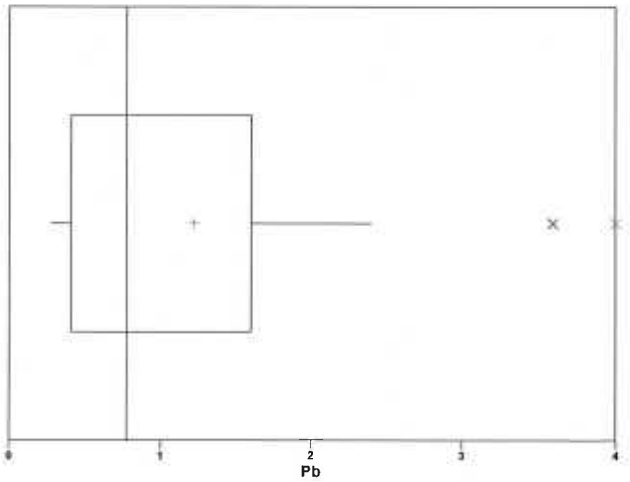
Three graphical displays of the data are shown below: the Histogram, the Box and Whiskers plot, and the Quantile-Quantile (Q-Q) plot.

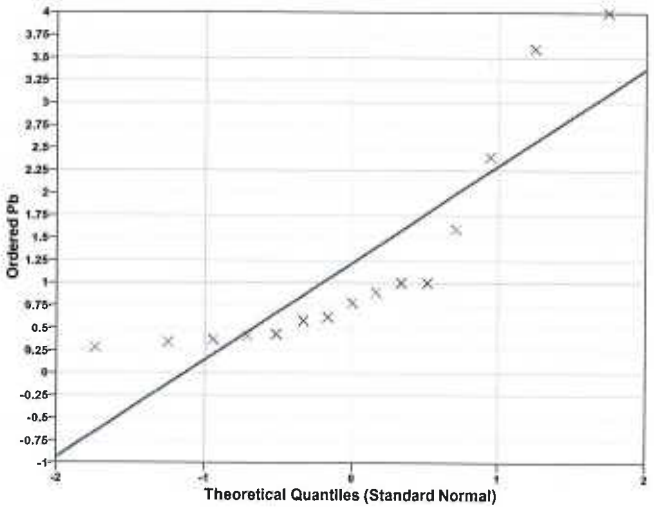
The Histogram is a plot of the fraction of the n observed data that fall within specified data "bins." A histogram is generated by dividing the x axis (range of the observed data values) into "bins" and displaying the number of data in each bin as the height of a bar for the bin. The area of the bar is the fraction of the n data values that lie within the bin. The sum of the fractions for all bins equals one. A histogram is used to assess how the n data are distributed (spread) over their range of values. If the histogram is more or less symmetric and bell shaped, then the data may be normally distributed.

The Box and Whiskers plot is composed of a central box divided by a line, and with two lines extending out from the box, called the "whiskers". The line through the box is drawn at the median of the n data observed. The two ends of the box represent the 25th and 75th percentiles of the n data values, which are also called the lower and upper quartiles, respectively, of the data set. The sample mean (mean of the n data) is shown as a "+" sign. The upper whisker extends to the largest data value that is less than the upper quartile plus 1.5 times the interquartile range (upper quartile minus the lower quartile). The lower whisker extends to the smallest data value that is greater than the lower quartile minus 1.5 times the interquartile range. Extreme data values (greater or smaller than the ends of the whiskers) are plotted individually. A Box and Whiskers plot is used to assess the symmetry of the distribution of the data set. If the distribution is symmetrical, the box is divided into two equal halves by the median, the whiskers will be the same length, and the number of extreme data points will be distributed equally on either end of the plot.

The Q-Q plot graphs the quantiles of a set of n data against the quantiles of a specific distribution. We show here only the Q-Q plot for an assumed normal distribution. The pth quantile of a distribution of data is the data value, x_n, for which a fraction p of the distribution is less than x_n. If the data plotted on the normal distribution Q-Q plot closely follow a straight line, even at the ends of the line, then the data may be assumed to be normally distributed. If the data points deviate substantially from a linear line, then the data are not normally distributed.







For more information on these three plots consult Guidance for Data Quality Assessment, EPA QA/G-9, pgs 2.3-1 through 2.3-12. (http://www.epa.gov/quality/qa-docs.html).

Two-Sided Confidence Interval on the True Median

For calculating the confidence interval, the values are ordered from smallest to largest. The confidence limits are the highest value of the r+1 and/or lowest value of the s-1 order statistics that fit the formulas below, except when the rth ordered value is tied with higher ordered values or the sth ordered value is tied with lower ordered values. If higher numbered ordered values are ties with the rth ordered value, then the closest ordered value that is lower than r will be the confidence limit. If higher-numbered ordered values are ties with the sth ordered value, then the closest ordered value that is higher than s will be the confidence limit.

Upper Two-Sided Confidence Interval

$$\sum_{s}^{1}\left(\frac{n!}{r!(n-s)!}\right)p^{0.5}(1-p)^{n-0.5} \geq 1-\alpha/2$$

Lower Two-Sided Confidence interval

$$\sum_{r}^{1}\left(\frac{n!}{r!(n-r)!}\right)p^{0.5}(1-p)^{n-0.5} \leq \alpha/2$$

Upper 95% Two-Sided Confidence Interval on the Median	2.4
Sample Median	0.78
Lower 95% Two-Sided Confidence Interval on the Median	0.37

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* - The report contents may have been modified or reformatted by end-user of software.

Anodizing Bldg. Pb based

VSP Sample Design Report for Calculating a Two-Sided Confidence Interval for the Population Median Using Simple Random Sampling

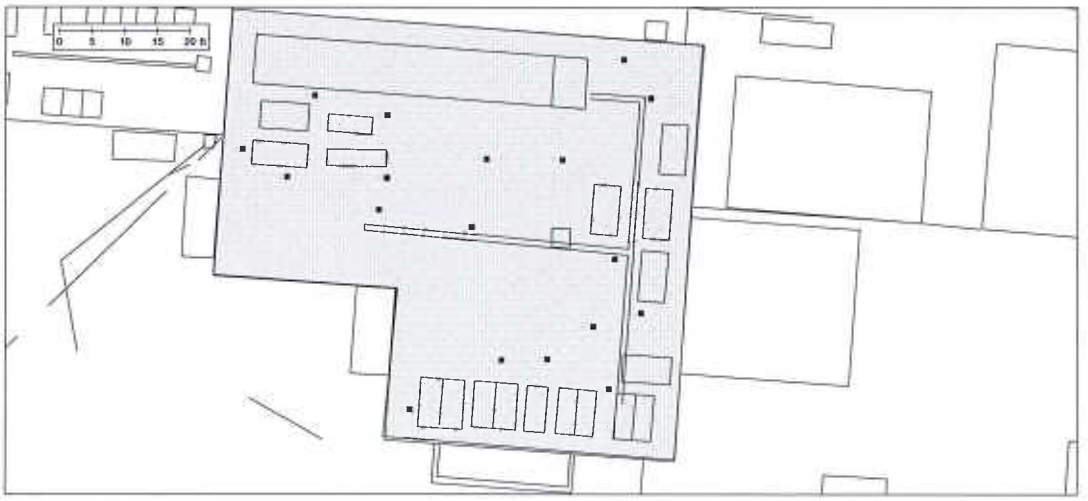
Summary

This report summarizes the sampling design used, associated statistical assumptions, as well as general guidelines for conducting post-sampling data analysis. Sampling plan components presented here include how many sampling locations to choose and where within the sampling area to collect those samples. The type of medium to sample (i.e., soil, groundwater, etc.) and how to analyze the samples (in-situ, fixed laboratory, etc.) are addressed in other sections of the sampling plan.

The following table summarizes the sampling design developed. A figure that shows sampling locations in the field and a table that lists sampling location coordinates are also provided below.

SUMMARY OF SAMPLING DESIGN	
Primary Objective of Design	Construct a Confidence Interval on the True Median
Type of Sampling Design	Non-Parametric
Sample Placement (Location) in the Field	Simple random sampling
Formula for calculating number of sampling locations	Nonparametric Confidence Limits
Calculated total number of samples	15
Number of samples on map [a]	18
Number of selected sample areas [b]	1
Specified sampling area [c]	3910.04 ft^2
Total cost of sampling [d]	$2,860.00

[a] This number may differ from the calculated number because of 1) grid edge effects, 2) adding judgment samples, or 3) selecting or unselecting sample areas.
[b] The number of selected sample areas is the number of colored areas on the map of the site. These sample areas contain the locations where samples are collected.
[c] The sampling area is the total surface area of the selected colored sample areas on the map of the site.
[d] Including measurement analyses and fixed overhead costs. See the Cost of Sampling section for an explanation of the costs presented here.



Area: Area 2					
X Coord	Y Coord	Label	Value	Type	Historical

4981.9002	5213.6371	GP-15	0.28	Random	
5000.6401	5198.5254	GP-11	0.94	Random	
4953.7905	5221.1929	GP-17	0.43	Random	
4972.5303	5185.9324	GP-24	0.78	Random	
5008.0100	5200.5999	GP-25	0.9	Random	
4947.1056	5225.2673	GP-21	1.6	Random	
4986.5852	5193.4882	GP-9	1	Random	
4967.8454	5216.1557	GP-16	0.58	Random	
5005.3250	5238.8231	GP-20	4	Random	
4995.9551	5223.7115	GP-13	0.41	Random	
4984.2427	5223.8359	GP-14	1	Random	
5003.9825	5208.7242	GP-12	0.62	Random	
4958.1330	5233.3917	GP-22	2.4	Random	
4993.6126	5193.6126	GP-10	0.34	Random	
4969.1604	5230.3045	GP-18	0.39	Random	
5003.0000	5189.0000	GP-23	0.54	Unknown	
5009.5000	5233.0000	GP-19	0.37	Unknown	
4969.0000	5221.0000	HA-4		Unknown	

Primary Sampling Objective
The primary purpose of sampling at this site is to construct a confidence interval on the true population median value. After the samples are collected and analyzed, the resulting sample values can be used to construct a two-sided confidence interval. Once the confidence interval is computed (which will be an upper and a lower threshold), you can have the specified confidence that the true population median is between the upper and lower thresholds.

Selected Sampling Approach
A non-parametric random sampling approach was used to determine the number of samples and to specify sampling locations. A parametric formula was not chosen because the conceptual model and historical information (e.g., historical data from this site or a very similar site) indicate that parametric assumptions are not true. These assumptions will be examined in post-sampling data analysis.

Both parametric and non-parametric equations rely on assumptions about the population. Typically, however, non-parametric equations require fewer assumptions and allow for more uncertainty about the statistical distribution of values at the site. The trade-off is that if the parametric assumptions are valid, the required number of samples is usually less than if a non-parametric equation was used.

Locating the sample points randomly provides data that are separated by many distances, whereas systematic samples are all equidistant apart. Therefore, random sampling provides more information about the spatial structure of the potential contamination than systematic sampling does. As with systematic sampling, random sampling also provides information regarding the mean or median value, but there is the possibility that areas of the site will not be represented with the same frequency as if uniform grid sampling were performed.

Number of Total Samples: Calculation Equation and Inputs
Two sample confidence interval calculation methods are available for when n□20 and n>20 (Conover, 1980, p. 111-117) (Gilbert, 1987,p. 141-142). In VSP, the user specifies a one-sided or two-sided CI, and the percent confidence desired to be within a specified number of percentiles of the median. A binary search is then performed on the CI equations to solve for the minimum sample size to satisfy these parameters. VSP first uses the n□20 method to determine if a solution can be found where n□20, and if not, then uses the n>20 method.

For a one-sided CI, the n□20 method follows a binomial distribution and determines the lowest value of n where the yth quantile of the sample would be equal to or above the true median at least X% of the time (Note that the sample sizes work out to be the same regardless of whether the CI will be a lower or upper tailed, so the same formula can be used for

any one-sided CI). X% is the specified confidence for one-sided confidence intervals, and the average of 100% and the specified confidence for two-sided confidence intervals. The yth quantile is determined by taking 50% and subtracting the allowable number of percentiles from the median specified by the user.

For a two-sided CI, the n□20 method is the same as performing a one-sided confidence interval, but replacing the specified percent confidence with the average of 100% and the specified percent confidence. If no solution is found where n□20, a binary search is conducted using Equation (1) for a one-sided CI and Equation (2) for a two-sided interval to compute the value of r (r is the the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest), rounding r up to the next higher integer. The search is repeated until the smallest n is found where 100*2*r/n is greater than 50% minus the allowable number of percentiles from the median specified by the user.

$$r = 0.5 * n - 0.5 * w_{\alpha} \sqrt{n} \qquad (1)$$

$$r = 0.5 * n - 0.5 * w_{\alpha/2} \sqrt{n} \qquad (2)$$

Where:

n is the sample size

r is the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest

$w_{\square}$ is the specified quantile of a normal distribution, e.g. if □=0.2 then $w_{\square}$ is the 0.2 quantile (20th percentile) of a normal distribution.

The n>20 method described above is an approximation method, so VSP also performs a final check using a binomial distribution in a similar manner to the n□20 method, and may increase the sample size by 1 to ensure the specified confidence levels are met.

Cost of Sampling
The total cost of the completed sampling program depends on several cost inputs, some of which are fixed, and others that are based on the number of samples collected and measured. Based on the numbers of samples determined above, the estimated total cost of sampling and analysis at this site is $2,860.00, which averages out to a per sample cost of $190.67. The following table summarizes the inputs and resulting cost estimates.

COST INFORMATION			
Cost Details	**Per Analysis**	**Per Sample**	**15 Samples**
Field collection costs		$100.00	$1,500.00
Analytical costs	$24.00	$24.00	$360.00
Sum of Field & Analytical costs		**$124.00**	**$1,860.00**
Fixed planning and validation costs			$1,000.00
Total cost			**$2,860.00**

Data Analysis for Pb
The following data points were entered by the user for analysis.

Pb										
Rank	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
0	0.28	0.34	0.37	0.39	0.41	0.43	0.54	0.58	0.62	0.78
10	0.9	0.94	1	1	1.6	2.4	4			

SUMMARY STATISTICS for Pb

n	17
Min	0.28
Max	4
Range	3.72
Mean	0.97529
Median	0.62
Variance	0.89375
StdDev	0.94538
Std Error	0.22929
Skewness	2.4524
Interquartile Range	0.6

Percentiles								
1%	**5%**	**10%**	**25%**	**50%**	**75%**	**90%**	**95%**	**99%**
0.28	0.28	0.328	0.4	0.62	1	2.72	4	4

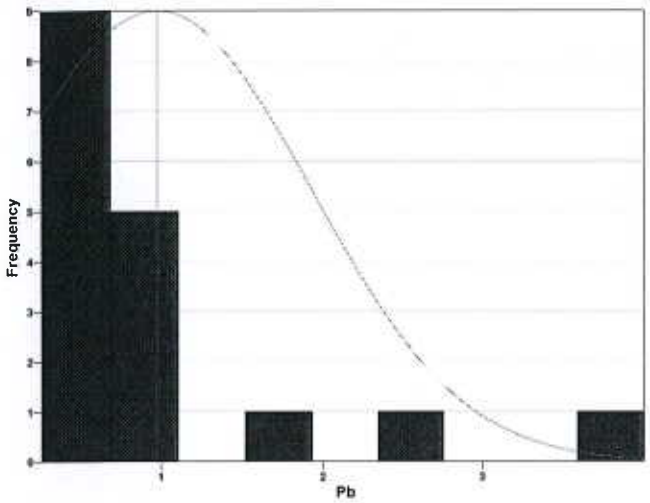
Data Plots

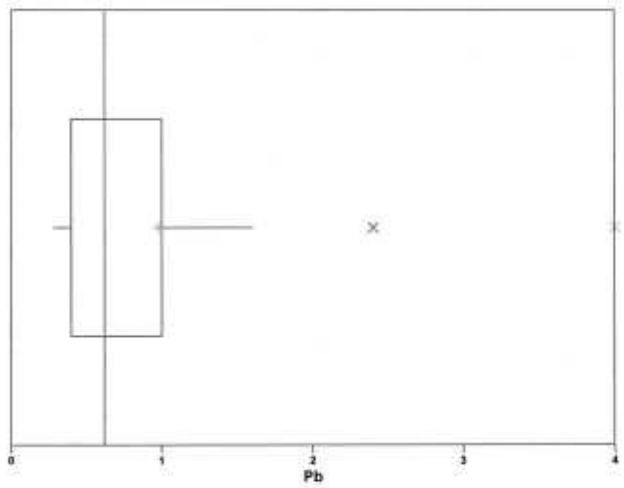
Three graphical displays of the data are shown below: the Histogram, the Box and Whiskers plot, and the Quantile-Quantile (Q-Q) plot.

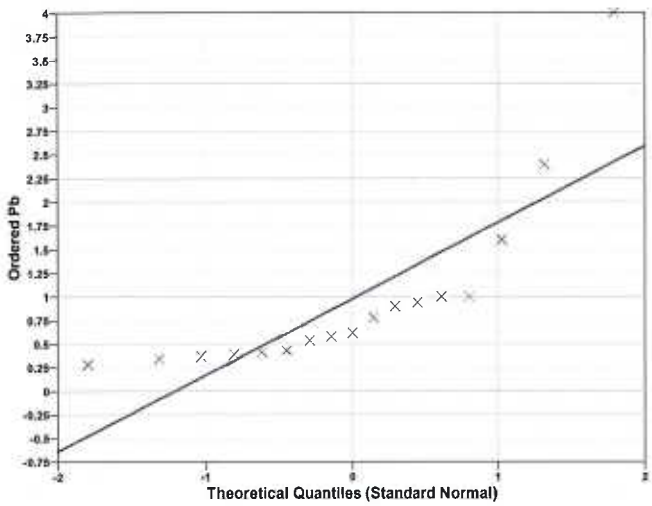
The Histogram is a plot of the fraction of the n observed data that fall within specified data "bins." A histogram is generated by dividing the x axis (range of the observed data values) into "bins" and displaying the number of data in each bin as the height of a bar for the bin. The area of the bar is the fraction of the n data values that lie within the bin. The sum of the fractions for all bins equals one. A histogram is used to assess how the n data are distributed (spread) over their range of values. If the histogram is more or less symmetric and bell shaped, then the data may be normally distributed.

The Box and Whiskers plot is composed of a central box divided by a line, and with two lines extending out from the box, called the "whiskers". The line through the box is drawn at the median of the n data observed. The two ends of the box represent the 25th and 75th percentiles of the n data values, which are also called the lower and upper quartiles, respectively, of the data set. The sample mean (mean of the n data) is shown as a "+" sign. The upper whisker extends to the largest data value that is less than the upper quartile plus 1.5 times the interquartile range (upper quartile minus the lower quartile). The lower whisker extends to the smallest data value that is greater than the lower quartile minus 1.5 times the interquartile range. Extreme data values (greater or smaller than the ends of the whiskers) are plotted individually. A Box and Whiskers plot is used to assess the symmetry of the distribution of the data set. If the distribution is symmetrical, the box is divided into two equal halves by the median, the whiskers will be the same length, and the number of extreme data points will be distributed equally on either end of the plot.

The Q-Q plot graphs the quantiles of a set of n data against the quantiles of a specific distribution. We show here only the Q-Q plot for an assumed normal distribution. The pth quantile of a distribution of data is the data value, x_p, for which a fraction p of the distribution is less than x_p. If the data plotted on the normal distribution Q-Q plot closely follow a straight line, even at the ends of the line, then the data may be assumed to be normally distributed. If the data points deviate substantially from a linear line, then the data are not normally distributed.







For more information on these three plots consult Guidance for Data Quality Assessment, EPA QA/G-9, pgs 2.3-1 through 2.3-12. (http://www.epa.gov/quality/qa-docs.html).

Two-Sided Confidence Interval on the True Median

For calculating the confidence interval, the values are ordered from smallest to largest. The confidence limits are the highest value of the r+1 and/or lowest value of the s-1 order statistics that fit the formulas below, except when the rth ordered value is tied with higher ordered values or the sth ordered value is tied with lower ordered values. If higher numbered ordered values are ties with the rth ordered value, then the closest ordered value that is lower than r will be the confidence limit. If higher-numbered ordered values are ties with the sth ordered value, then the closest ordered value that is higher than s will be the confidence limit.

Upper Two-Sided Confidence Interval

$$\sum_{s}^{1}\left(\frac{n!}{r!(n-s)!}\right)p^{0.5}(1-p)^{n-0.5} \geq 1-\alpha/2$$

Lower Two-Sided Confidence interval

$$\sum_{r}^{1}\left(\frac{n!}{r!(n-r)!}\right)p^{0.5}(1-p)^{n-0.5} \leq \alpha/2$$

Upper 95% Two-Sided Confidence Interval on the Median	1

Sample Median	0.62
Lower 95% Two-Sided Confidence Interval on the Median	0.39

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* - The report contents may have been modified or reformatted by end-user of software.

Anodizing Bldg Ni

VSP Sample Design Report for Calculating a Two-Sided Confidence Interval for the Population Median Using Simple Random Sampling

Summary

This report summarizes the sampling design used, associated statistical assumptions, as well as general guidelines for conducting post-sampling data analysis. Sampling plan components presented here include how many sampling locations to choose and where within the sampling area to collect those samples. The type of medium to sample (i.e., soil, groundwater, etc.) and how to analyze the samples (in-situ, fixed laboratory, etc.) are addressed in other sections of the sampling plan.

The following table summarizes the sampling design developed. A figure that shows sampling locations in the field and a table that lists sampling location coordinates are also provided below.

SUMMARY OF SAMPLING DESIGN	
Primary Objective of Design	Construct a Confidence Interval on the True Median
Type of Sampling Design	Non-Parametric
Sample Placement (Location) in the Field	Simple random sampling
Formula for calculating number of sampling locations	Nonparametric Confidence Limits
Calculated total number of samples	15
Number of samples on map [a]	15
Number of selected sample areas [b]	1
Specified sampling area [c]	3910.04 ft^2
Total cost of sampling [d]	$2,860.00

[a] This number may differ from the calculated number because of 1) grid edge effects, 2) adding judgment samples, or 3) selecting or unselecting sample areas.
[b] The number of selected sample areas is the number of colored areas on the map of the site. These sample areas contain the locations where samples are collected.
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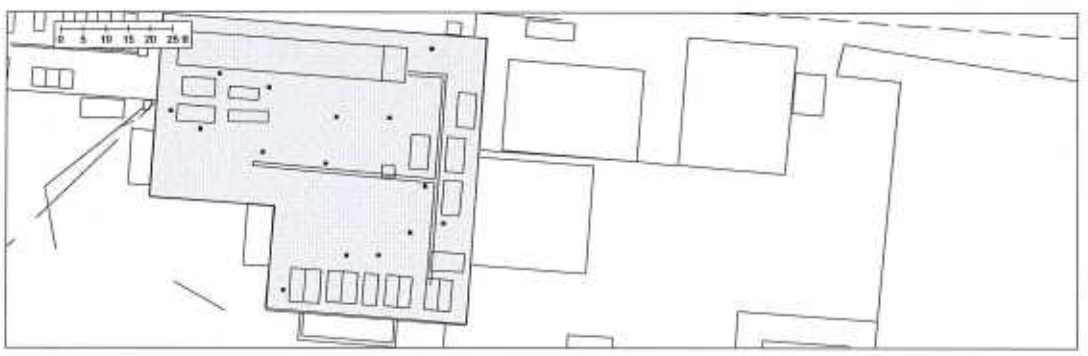
[d] Including measurement analyses and fixed overhead costs. See the Cost of Sampling section for an explanation of the costs presented here.



Area: Area 2					
X Coord	**Y Coord**	**Label**	**Value**	**Type**	**Historical**
4981.9002	5213.6371	GP-15	19	Random	
5000.6401	5198.5254	GP-11	3.6	Random	
4953.7905	5221.1929	GP-17	9.7	Random	

4972.5303	5185.9324	GP-24	28	Random	
5008.0100	5200.5999	GP-25	6.4	Random	
4947.1056	5225.2673	GP-21	29	Random	
4986.5852	5193.4882	GP-9	13	Random	
4967.8454	5216.1557	GP-16	39	Random	
5005.3250	5238.8231	GP-20	63	Random	
4995.9551	5223.7115	GP-13	48	Random	
4984.2427	5223.8359	GP-14	22	Random	
5003.9825	5208.7242	GP-12	3.8	Random	
4958.1330	5233.3917	GP-22	36	Random	
4993.6126	5193.6126	GP-10	7.4	Random	
4969.1604	5230.3045	GP-18	3.3	Random	

Primary Sampling Objective
The primary purpose of sampling at this site is to construct a confidence interval on the true population median value. After the samples are collected and analyzed, the resulting sample values can be used to construct a two-sided confidence interval. Once the confidence interval is computed (which will be an upper and a lower threshold), you can have the specified confidence that the true population median is between the upper and lower thresholds.

Selected Sampling Approach
A non-parametric random sampling approach was used to determine the number of samples and to specify sampling locations. A parametric formula was not chosen because the conceptual model and historical information (e.g., historical data from this site or a very similar site) indicate that parametric assumptions are not true. These assumptions will be examined in post-sampling data analysis.

Both parametric and non-parametric equations rely on assumptions about the population. Typically, however, non-parametric equations require fewer assumptions and allow for more uncertainty about the statistical distribution of values at the site. The trade-off is that if the parametric assumptions are valid, the required number of samples is usually less than if a non-parametric equation was used.

Locating the sample points randomly provides data that are separated by many distances, whereas systematic samples are all equidistant apart. Therefore, random sampling provides more information about the spatial structure of the potential contamination than systematic sampling does. As with systematic sampling, random sampling also provides information regarding the mean or median value, but there is the possibility that areas of the site will not be represented with the same frequency as if uniform grid sampling were performed.

Number of Total Samples: Calculation Equation and Inputs
Two sample confidence interval calculation methods are available for when n□20 and n>20 (Conover, 1980, p. 111-117) (Gilbert, 1987,p. 141-142). In VSP, the user specifies a one-sided or two-sided CI, and the percent confidence desired to be within a specified number of percentiles of the median. A binary search is then performed on the CI equations to solve for the minimum sample size to satisfy these parameters. VSP first uses the n□20 method to determine if a solution can be found where n□20, and if not, then uses the n>20 method.

For a one-sided CI, the n□20 method follows a binomial distribution and determines the lowest value of n where the yth quantile of the sample would be equal to or above the true median at least X% of the time (Note that the sample sizes work out to be the same regardless of whether the CI will be a lower or upper tailed, so the same formula can be used for any one-sided CI). X% is the specified confidence for one-sided confidence intervals, and the average of 100% and the specified confidence for two-sided confidence intervals. The yth quantile is determined by taking 50% and subtracting the allowable number of percentiles from the median specified by the user.

For a two-sided CI, the n□20 method is the same as performing a one-sided confidence interval, but replacing the specified percent confidence with the average of 100% and the specified percent confidence. If no solution is found where n□20, a binary search is conducted using Equation (1) for a one-sided CI and Equation (2) for a two-sided interval to compute the value of r (r is the the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest), rounding r up to the next higher integer. The search is repeated until the smallest n is

found where 100*2*r/n is greater than 50% minus the allowable number of percentiles from the median specified by the user.

$$r = 0.5 * n - 0.5 * w_{\alpha} \sqrt{n} \qquad (1)$$

$$r = 0.5 * n - 0.5 * w_{\alpha/2} \sqrt{n} \qquad (2)$$

Where:

n is the sample size

r is the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest

$w_{\square}$ is the specified quantile of a normal distribution, e.g. if $\square$=0.2 then $w_{\square}$ is the 0.2 quantile (20th percentile) of a normal distribution.

The n>20 method described above is an approximation method, so VSP also performs a final check using a binomial distribution in a similar manner to the n$\square$20 method, and may increase the sample size by 1 to ensure the specified confidence levels are met.

Cost of Sampling

The total cost of the completed sampling program depends on several cost inputs, some of which are fixed, and others that are based on the number of samples collected and measured. Based on the numbers of samples determined above, the estimated total cost of sampling and analysis at this site is $2,860.00, which averages out to a per sample cost of $190.67. The following table summarizes the inputs and resulting cost estimates.

COST INFORMATION			
Cost Details	**Per Analysis**	**Per Sample**	**15 Samples**
Field collection costs		$100.00	$1,500.00
Analytical costs	$24.00	$24.00	$360.00
Sum of Field & Analytical costs		**$124.00**	**$1,860.00**
Fixed planning and validation costs			$1,000.00
Total cost			**$2,860.00**

Data Analysis for Ni

The following data points were entered by the user for analysis.

Ni										
Rank	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
0	3.3	3.6	3.8	6.4	7.4	9.7	13	19	22	28
10	29	36	39	48	63					

SUMMARY STATISTICS for Ni	
n	15
Min	3.3
Max	63
Range	59.7
Mean	22.08
Median	19

Variance				331.73				
StdDev				18.213				
Std Error				4.7027				
Skewness				0.89042				
Interquartile Range				29.6				
Percentiles								
1%	**5%**	**10%**	**25%**	**50%**	**75%**	**90%**	**95%**	**99%**
3.3	3.3	3.48	6.4	19	36	54	63	63

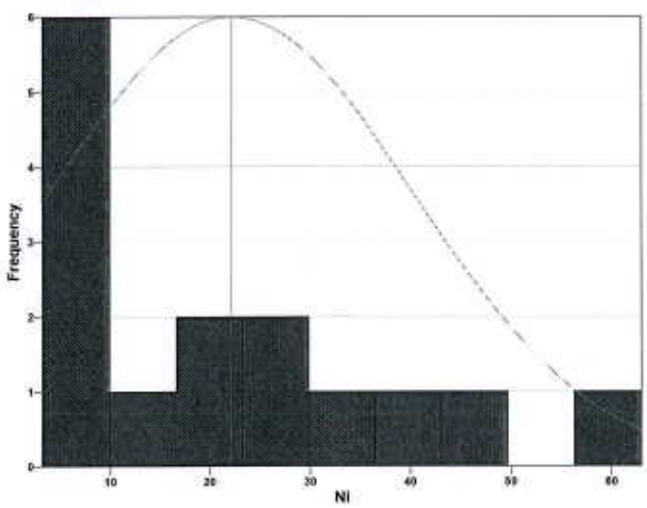
Data Plots

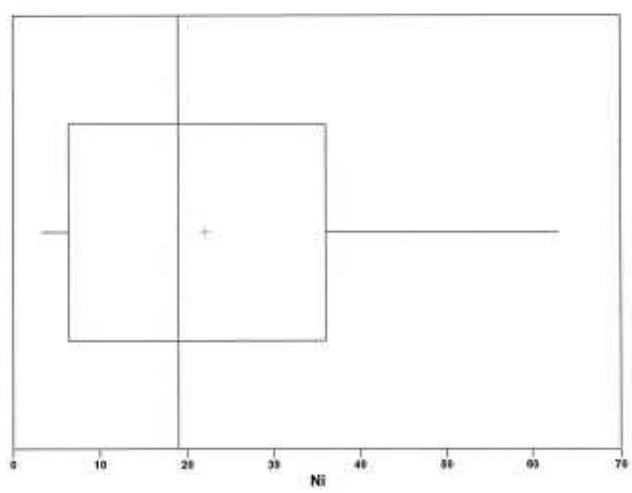
Three graphical displays of the data are shown below: the Histogram, the Box and Whiskers plot, and the Quantile-Quantile (Q-Q) plot.

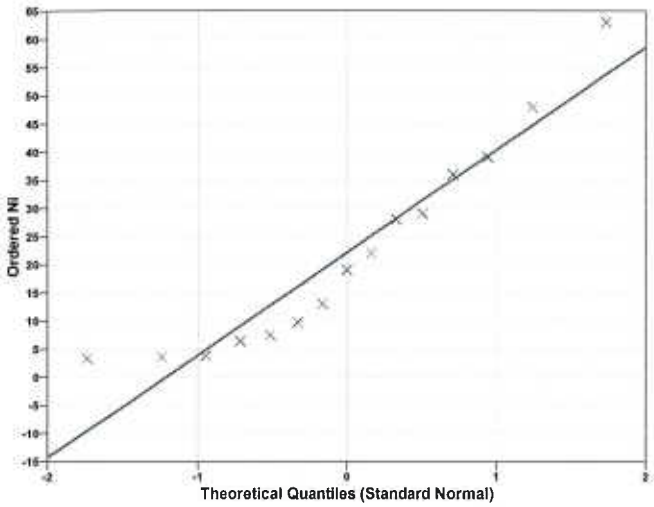
The Histogram is a plot of the fraction of the n observed data that fall within specified data "bins." A histogram is generated by dividing the x axis (range of the observed data values) into "bins" and displaying the number of data in each bin as the height of a bar for the bin. The area of the bar is the fraction of the n data values that lie within the bin. The sum of the fractions for all bins equals one. A histogram is used to assess how the n data are distributed (spread) over their range of values. If the histogram is more or less symmetric and bell shaped, then the data may be normally distributed.

The Box and Whiskers plot is composed of a central box divided by a line, and with two lines extending out from the box, called the "whiskers". The line through the box is drawn at the median of the n data observed. The two ends of the box represent the 25th and 75th percentiles of the n data values, which are also called the lower and upper quartiles, respectively, of the data set. The sample mean (mean of the n data) is shown as a "+" sign. The upper whisker extends to the largest data value that is less than the upper quartile plus 1.5 times the interquartile range (upper quartile minus the lower quartile). The lower whisker extends to the smallest data value that is greater than the lower quartile minus 1.5 times the interquartile range. Extreme data values (greater or smaller than the ends of the whiskers) are plotted individually. A Box and Whiskers plot is used to assess the symmetry of the distribution of the data set. If the distribution is symmetrical, the box is divided into two equal halves by the median, the whiskers will be the same length, and the number of extreme data points will be distributed equally on either end of the plot.

The Q-Q plot graphs the quantiles of a set of n data against the quantiles of a specific distribution. We show here only the Q-Q plot for an assumed normal distribution. The pth quantile of a distribution of data is the data value, x_n, for which a fraction p of the distribution is less than x_n. If the data plotted on the normal distribution Q-Q plot closely follow a straight line, even at the ends of the line, then the data may be assumed to be normally distributed. If the data points deviate substantially from a linear line, then the data are not normally distributed.







For more information on these three plots consult Guidance for Data Quality Assessment, EPA QA/G-9, pgs 2.3-1 through 2.3-12. (http://www.epa.gov/quality/qa-docs.html).

Two-Sided Confidence Interval on the True Median

For calculating the confidence interval, the values are ordered from smallest to largest. The confidence limits are the highest value of the r+1 and/or lowest value of the s-1 order statistics that fit the formulas below, except when the rth ordered value is tied with higher ordered values or the sth ordered value is tied with lower ordered values. If higher numbered ordered values are ties with the rth ordered value, then the closest ordered value that is lower than r will be the confidence limit. If higher-numbered ordered values are ties with the sth ordered value, then the closest ordered value that is higher than s will be the confidence limit.

Upper Two-Sided Confidence Interval

$$\sum_{s}^{1}\left(\frac{n!}{r!(n-s)!}\right)p^{0.5}(1-p)^{n-0.5} \geq 1-\alpha/2$$

Lower Two-Sided Confidence interval

$$\sum_{r}^{1}\left(\frac{n!}{r!(n-r)!}\right)p^{0.5}(1-p)^{n-0.5} \leq \alpha/2$$

Upper 95% Two-Sided Confidence Interval on the Median	39
Sample Median	19
Lower 95% Two-Sided Confidence Interval on the Median	3.8

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* - The report contents may have been modified or reformatted by end-user of software.

Anodizing Bldg Ni Based

VSP Sample Design Report for Calculating a Two-Sided Confidence Interval for the Population Median Using Simple Random Sampling

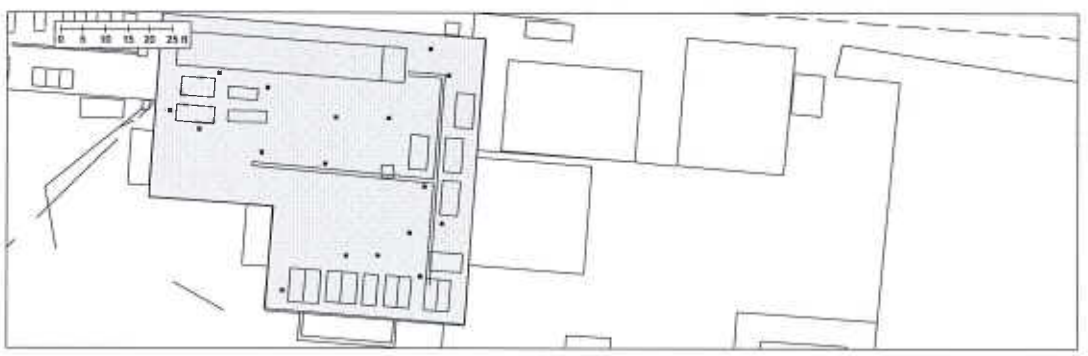
Summary

This report summarizes the sampling design used, associated statistical assumptions, as well as general guidelines for conducting post-sampling data analysis. Sampling plan components presented here include how many sampling locations to choose and where within the sampling area to collect those samples. The type of medium to sample (i.e., soil, groundwater, etc.) and how to analyze the samples (in-situ, fixed laboratory, etc.) are addressed in other sections of the sampling plan.

The following table summarizes the sampling design developed. A figure that shows sampling locations in the field and a table that lists sampling location coordinates are also provided below.

SUMMARY OF SAMPLING DESIGN	
Primary Objective of Design	Construct a Confidence Interval on the True Median
Type of Sampling Design	Non-Parametric
Sample Placement (Location) in the Field	Simple random sampling
Formula for calculating number of sampling locations	Nonparametric Confidence Limits
Calculated total number of samples	15
Number of samples on map [a]	17
Number of selected sample areas [b]	1
Specified sampling area [c]	3910.04 ft^2
Total cost of sampling [d]	$2,860.00

[a] This number may differ from the calculated number because of 1) grid edge effects, 2) adding judgment samples, or 3) selecting or unselecting sample areas.
[b] The number of selected sample areas is the number of colored areas on the map of the site. These sample areas contain the locations where samples are collected.
[c] The sampling area is the total surface area of the selected colored sample areas on the map of the site.
[d] Including measurement analyses and fixed overhead costs. See the Cost of Sampling section for an explanation of the costs presented here.



Area: Area 2					
X Coord	Y Coord	Label	Value	Type	Historical
4981.9002	5213.6371	GP-15	19	Random	
5000.6401	5198.5254	GP-11	3.6	Random	
4953.7905	5221.1929	GP-17	9.7	Random	

4972.5303	5185.9324	GP-24	28	Random	
5008.0100	5200.5999	GP-25	6.4	Random	
4947.1056	5225.2673	GP-21	29	Random	
4986.5852	5193.4882	GP-9	13	Random	
4967.8454	5216.1557	GP-16	39	Random	
5005.3250	5238.8231	GP-20	63	Random	
4995.9551	5223.7115	GP-13	48	Random	
4984.2427	5223.8359	GP-14	22	Random	
5003.9825	5208.7242	GP-12	3.8	Random	
4958.1330	5233.3917	GP-22	36	Random	
4993.6126	5193.6126	GP-10	7.4	Random	
4969.1604	5230.3045	GP-18	3.3	Random	
5003.0000	5189.0000	GP-23	6.4	Unknown	
5009.5000	5233.0000	GP-19	130	Unknown	

Primary Sampling Objective
The primary purpose of sampling at this site is to construct a confidence interval on the true population median value. After the samples are collected and analyzed, the resulting sample values can be used to construct a two-sided confidence interval. Once the confidence interval is computed (which will be an upper and a lower threshold), you can have the specified confidence that the true population median is between the upper and lower thresholds.

Selected Sampling Approach
A non-parametric random sampling approach was used to determine the number of samples and to specify sampling locations. A parametric formula was not chosen because the conceptual model and historical information (e.g., historical data from this site or a very similar site) indicate that parametric assumptions are not true. These assumptions will be examined in post-sampling data analysis.

Both parametric and non-parametric equations rely on assumptions about the population. Typically, however, non-parametric equations require fewer assumptions and allow for more uncertainty about the statistical distribution of values at the site. The trade-off is that if the parametric assumptions are valid, the required number of samples is usually less than if a non-parametric equation was used.

Locating the sample points randomly provides data that are separated by many distances, whereas systematic samples are all equidistant apart. Therefore, random sampling provides more information about the spatial structure of the potential contamination than systematic sampling does. As with systematic sampling, random sampling also provides information regarding the mean or median value, but there is the possibility that areas of the site will not be represented with the same frequency as if uniform grid sampling were performed.

Number of Total Samples: Calculation Equation and Inputs
Two sample confidence interval calculation methods are available for when n□20 and n>20 (Conover, 1980, p. 111-117) (Gilbert, 1987,p. 141-142). In VSP, the user specifies a one-sided or two-sided CI, and the percent confidence desired to be within a specified number of percentiles of the median. A binary search is then performed on the CI equations to solve for the minimum sample size to satisfy these parameters. VSP first uses the n□20 method to determine if a solution can be found where n□20, and if not, then uses the n>20 method.

For a one-sided CI, the n□20 method follows a binomial distribution and determines the lowest value of n where the yth quantile of the sample would be equal to or above the true median at least X% of the time (Note that the sample sizes work out to be the same regardless of whether the CI will be a lower or upper tailed, so the same formula can be used for any one-sided CI). X% is the specified confidence for one-sided confidence intervals, and the average of 100% and the specified confidence for two-sided confidence intervals. The yth quantile is determined by taking 50% and subtracting the allowable number of percentiles from the median specified by the user.

For a two-sided CI, the n□20 method is the same as performing a one-sided confidence interval, but replacing the specified percent confidence with the average of 100% and the specified percent confidence. If no solution is found where

n□20, a binary search is conducted using Equation (1) for a one-sided CI and Equation (2) for a two-sided interval to compute the value of r (r is the the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest), rounding r up to the next higher integer. The search is repeated until the smallest n is found where 100*2*r/n is greater than 50% minus the allowable number of percentiles from the median specified by the user.

$$r = 0.5 * n - 0.5 * w_{\alpha} \sqrt{n} \qquad (1)$$

$$r = 0.5 * n - 0.5 * w_{\alpha/2} \sqrt{n} \qquad (2)$$

Where:

n is the sample size

r is the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest

$w_{\square}$ is the specified quantile of a normal distribution, e.g. if □=0.2 then $w_{\square}$ is the 0.2 quantile (20th percentile) of a normal distribution.

The n>20 method described above is an approximation method, so VSP also performs a final check using a binomial distribution in a similar manner to the n□20 method, and may increase the sample size by 1 to ensure the specified confidence levels are met.

Cost of Sampling

The total cost of the completed sampling program depends on several cost inputs, some of which are fixed, and others that are based on the number of samples collected and measured. Based on the numbers of samples determined above, the estimated total cost of sampling and analysis at this site is $2,860.00, which averages out to a per sample cost of $190.67. The following table summarizes the inputs and resulting cost estimates.

COST INFORMATION			
Cost Details	**Per Analysis**	**Per Sample**	**15 Samples**
Field collection costs		$100.00	$1,500.00
Analytical costs	$24.00	$24.00	$360.00
Sum of Field & Analytical costs		**$124.00**	**$1,860.00**
Fixed planning and validation costs			$1,000.00
Total cost			**$2,860.00**

Data Analysis for Ni

The following data points were entered by the user for analysis.

Ni										
Rank	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
0	3.3	3.6	3.8	6.4	6.4	7.4	9.7	13	19	22
10	28	29	36	39	48	63	130			

SUMMARY STATISTICS for Ni	
n	17
Min	3.3
Max	130
Range	126.7

Mean	27.506
Median	19
Variance	1002.3
StdDev	31.659
Std Error	7.6783
Skewness	2.3542
Interquartile Range	31.1

Percentiles								
1%	**5%**	**10%**	**25%**	**50%**	**75%**	**90%**	**95%**	**99%**
3.3	3.3	3.54	6.4	19	37.5	76.4	130	130

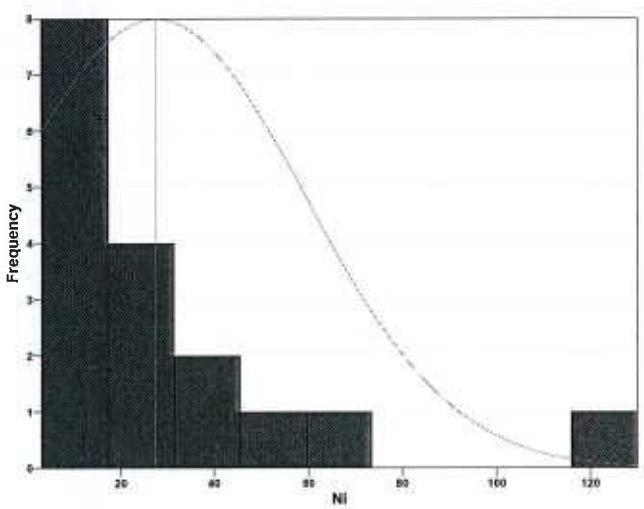
Data Plots

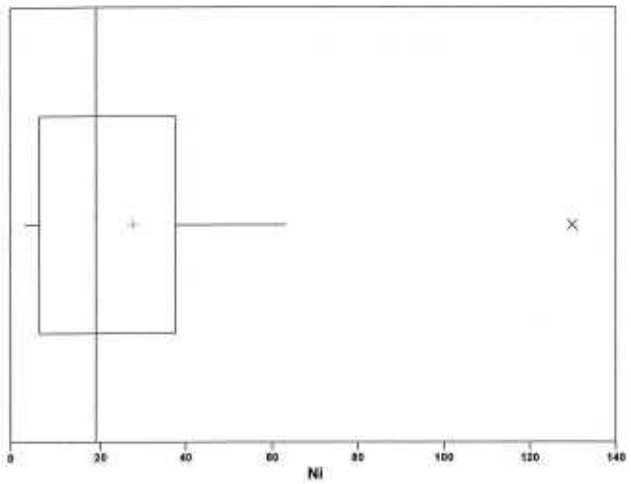
Three graphical displays of the data are shown below: the Histogram, the Box and Whiskers plot, and the Quantile-Quantile (Q-Q) plot.

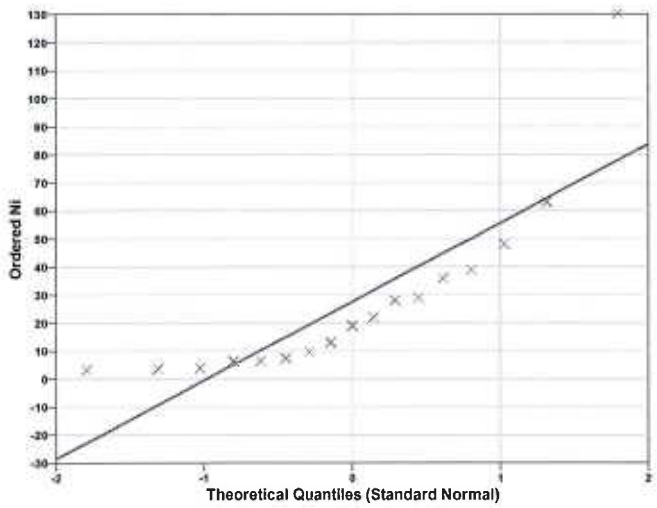
The Histogram is a plot of the fraction of the n observed data that fall within specified data "bins." A histogram is generated by dividing the x axis (range of the observed data values) into "bins" and displaying the number of data in each bin as the height of a bar for the bin. The area of the bar is the fraction of the n data values that lie within the bin. The sum of the fractions for all bins equals one. A histogram is used to assess how the n data are distributed (spread) over their range of values. If the histogram is more or less symmetric and bell shaped, then the data may be normally distributed.

The Box and Whiskers plot is composed of a central box divided by a line, and with two lines extending out from the box, called the "whiskers". The line through the box is drawn at the median of the n data observed. The two ends of the box represent the 25th and 75th percentiles of the n data values, which are also called the lower and upper quartiles, respectively, of the data set. The sample mean (mean of the n data) is shown as a "+" sign. The upper whisker extends to the largest data value that is less than the upper quartile plus 1.5 times the interquartile range (upper quartile minus the lower quartile). The lower whisker extends to the smallest data value that is greater than the lower quartile minus 1.5 times the interquartile range. Extreme data values (greater or smaller than the ends of the whiskers) are plotted individually. A Box and Whiskers plot is used to assess the symmetry of the distribution of the data set. If the distribution is symmetrical, the box is divided into two equal halves by the median, the whiskers will be the same length, and the number of extreme data points will be distributed equally on either end of the plot.

The Q-Q plot graphs the quantiles of a set of n data against the quantiles of a specific distribution. We show here only the Q-Q plot for an assumed normal distribution. The pth quantile of a distribution of data is the data value, x_n, for which a fraction p of the distribution is less than x_n. If the data plotted on the normal distribution Q-Q plot closely follow a straight line, even at the ends of the line, then the data may be assumed to be normally distributed. If the data points deviate substantially from a linear line, then the data are not normally distributed.







For more information on these three plots consult Guidance for Data Quality Assessment, EPA QA/G-9, pgs 2.3-1 through 2.3-12. (http://www.epa.gov/quality/qa-docs.html).

Two-Sided Confidence Interval on the True Median

For calculating the confidence interval, the values are ordered from smallest to largest. The confidence limits are the highest value of the r+1 and/or lowest value of the s-1 order statistics that fit the formulas below, except when the rth ordered value is tied with higher ordered values or the sth ordered value is tied with lower ordered values. If higher numbered ordered values are ties with the rth ordered value, then the closest ordered value that is lower than r will be the confidence limit. If higher-numbered ordered values are ties with the sth ordered value, then the closest ordered value that is higher than s will be the confidence limit.

Upper Two-Sided Confidence Interval

$$\sum_{s}^{1}\left(\frac{n!}{r!(n-s)!}\right)p^{0.5}(1-p)^{n-0.5} \geq 1-\alpha/2$$

Lower Two-Sided Confidence interval

$$\sum_{r}^{1}\left(\frac{n!}{r!(n-r)!}\right)p^{0.5}(1-p)^{n-0.5} \leq \alpha/2$$

Sample Median	19
Lower 95% Two-Sided Confidence Interval on the Median	6.4

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* - The report contents may have been modified or reformatted by end-user of software.

Anodizing Bldg Sn

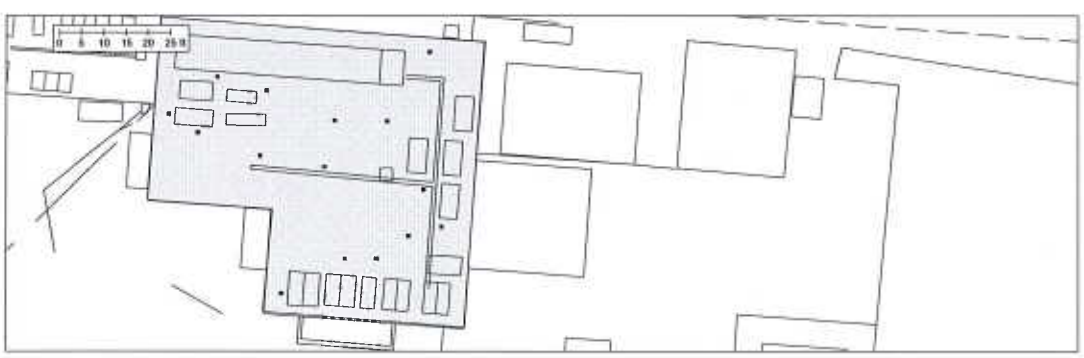
VSP Sample Design Report for Calculating a Two-Sided Confidence Interval for the Population Median Using Simple Random Sampling

Summary
This report summarizes the sampling design used, associated statistical assumptions, as well as general guidelines for conducting post-sampling data analysis. Sampling plan components presented here include how many sampling locations to choose and where within the sampling area to collect those samples. The type of medium to sample (i.e., soil, groundwater, etc.) and how to analyze the samples (in-situ, fixed laboratory, etc.) are addressed in other sections of the sampling plan.

The following table summarizes the sampling design developed. A figure that shows sampling locations in the field and a table that lists sampling location coordinates are also provided below.

SUMMARY OF SAMPLING DESIGN	
Primary Objective of Design	Construct a Confidence Interval on the True Median
Type of Sampling Design	Non-Parametric
Sample Placement (Location) in the Field	Simple random sampling
Formula for calculating number of sampling locations	Nonparametric Confidence Limits
Calculated total number of samples	15
Number of samples on map [a]	15
Number of selected sample areas [b]	1
Specified sampling area [c]	3910.04 ft^2
Total cost of sampling [d]	$2,860.00

[a] This number may differ from the calculated number because of 1) grid edge effects, 2) adding judgment samples, or 3) selecting or unselecting sample areas.
[b] The number of selected sample areas is the number of colored areas on the map of the site. These sample areas contain the locations where samples are collected.
[c] The sampling area is the total surface area of the selected colored sample areas on the map of the site.
[d] Including measurement analyses and fixed overhead costs. See the Cost of Sampling section for an explanation of the costs presented here.



Area: Area 2					
X Coord	Y Coord	Label	Value	Type	Historical
4981.9002	5213.6371	GP-15	0.25	Random	
5000.6401	5198.5254	GP-11	0.255	Random	
4953.7905	5221.1929	GP-17	0.275	Random	

4972.5303	5185.9324	GP-24	0.265	Random	
5008.0100	5200.5999	GP-25	0.24	Random	
4947.1056	5225.2673	GP-21	0.295	Random	
4986.5852	5193.4882	GP-9	0.285	Random	
4967.8454	5216.1557	GP-16	0.25	Random	
5005.3250	5238.8231	GP-20	0.245	Random	
4995.9551	5223.7115	GP-13	0.235	Random	
4984.2427	5223.8359	GP-14	0.275	Random	
5003.9825	5208.7242	GP-12	0.24	Random	
4958.1330	5233.3917	GP-22	0.275	Random	
4993.6126	5193.6126	GP-10	0.235	Random	
4969.1604	5230.3045	GP-18	0.29	Random	

Primary Sampling Objective
The primary purpose of sampling at this site is to construct a confidence interval on the true population median value. After the samples are collected and analyzed, the resulting sample values can be used to construct a two-sided confidence interval. Once the confidence interval is computed (which will be an upper and a lower threshold), you can have the specified confidence that the true population median is between the upper and lower thresholds.

Selected Sampling Approach
A non-parametric random sampling approach was used to determine the number of samples and to specify sampling locations. A parametric formula was not chosen because the conceptual model and historical information (e.g., historical data from this site or a very similar site) indicate that parametric assumptions are not true. These assumptions will be examined in post-sampling data analysis.

Both parametric and non-parametric equations rely on assumptions about the population. Typically, however, non-parametric equations require fewer assumptions and allow for more uncertainty about the statistical distribution of values at the site. The trade-off is that if the parametric assumptions are valid, the required number of samples is usually less than if a non-parametric equation was used.

Locating the sample points randomly provides data that are separated by many distances, whereas systematic samples are all equidistant apart. Therefore, random sampling provides more information about the spatial structure of the potential contamination than systematic sampling does. As with systematic sampling, random sampling also provides information regarding the mean or median value, but there is the possibility that areas of the site will not be represented with the same frequency as if uniform grid sampling were performed.

Number of Total Samples: Calculation Equation and Inputs
Two sample confidence interval calculation methods are available for when n□20 and n>20 (Conover, 1980, p. 111-117) (Gilbert, 1987,p. 141-142). In VSP, the user specifies a one-sided or two-sided CI, and the percent confidence desired to be within a specified number of percentiles of the median. A binary search is then performed on the CI equations to solve for the minimum sample size to satisfy these parameters. VSP first uses the n□20 method to determine if a solution can be found where n□20, and if not, then uses the n>20 method.

For a one-sided CI, the n□20 method follows a binomial distribution and determines the lowest value of n where the yth quantile of the sample would be equal to or above the true median at least X% of the time (Note that the sample sizes work out to be the same regardless of whether the CI will be a lower or upper tailed, so the same formula can be used for any one-sided CI). X% is the specified confidence for one-sided confidence intervals, and the average of 100% and the specified confidence for two-sided confidence intervals. The yth quantile is determined by taking 50% and subtracting the allowable number of percentiles from the median specified by the user.

For a two-sided CI, the n□20 method is the same as performing a one-sided confidence interval, but replacing the specified percent confidence with the average of 100% and the specified percent confidence. If no solution is found where n□20, a binary search is conducted using Equation (1) for a one-sided CI and Equation (2) for a two-sided interval to compute the value of r (r is the the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest), rounding r up to the next higher integer. The search is repeated until the smallest n is

found where 100*2*r/n is greater than 50% minus the allowable number of percentiles from the median specified by the user.

$$r = 0.5 * n - 0.5 * w_{\alpha} \sqrt{n} \qquad (1)$$

$$r = 0.5 * n - 0.5 * w_{\alpha/2} \sqrt{n} \qquad (2)$$

Where:

n is the sample size

r is the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest

$w_{\square}$ is the specified quantile of a normal distribution, e.g. if □=0.2 then $w_{\square}$ is the 0.2 quantile (20th percentile) of a normal distribution.

The n>20 method described above is an approximation method, so VSP also performs a final check using a binomial distribution in a similar manner to the n□20 method, and may increase the sample size by 1 to ensure the specified confidence levels are met.

Cost of Sampling
The total cost of the completed sampling program depends on several cost inputs, some of which are fixed, and others that are based on the number of samples collected and measured. Based on the numbers of samples determined above, the estimated total cost of sampling and analysis at this site is $2,860.00, which averages out to a per sample cost of $190.67. The following table summarizes the inputs and resulting cost estimates.

COST INFORMATION			
Cost Details	**Per Analysis**	**Per Sample**	**15 Samples**
Field collection costs		$100.00	$1,500.00
Analytical costs	$24.00	$24.00	$360.00
Sum of Field & Analytical costs		**$124.00**	**$1,860.00**
Fixed planning and validation costs			$1,000.00
Total cost			**$2,860.00**

Data Analysis for Sn
The following data points were entered by the user for analysis.

Sn										
Rank	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
0	0.235	0.235	0.24	0.24	0.245	0.25	0.25	0.255	0.265	0.275
10	0.275	0.275	0.285	0.29	0.295					

SUMMARY STATISTICS for Sn	
n	15
Min	0.235
Max	0.295
Range	0.06
Mean	0.26067
Median	0.255

Variance				0.00042452				
StdDev				0.020604				
Std Error				0.0053199				
Skewness				0.29312				
Interquartile Range				0.035				
Percentiles								
1%	**5%**	**10%**	**25%**	**50%**	**75%**	**90%**	**95%**	**99%**
0.235	0.235	0.235	0.24	0.255	0.275	0.292	0.295	0.295

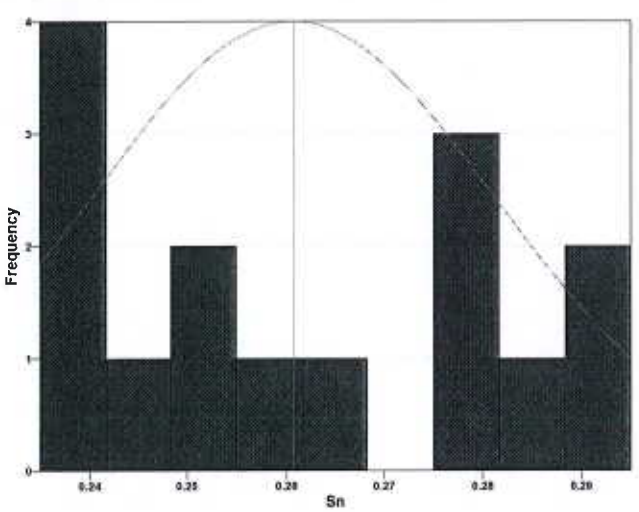
Data Plots

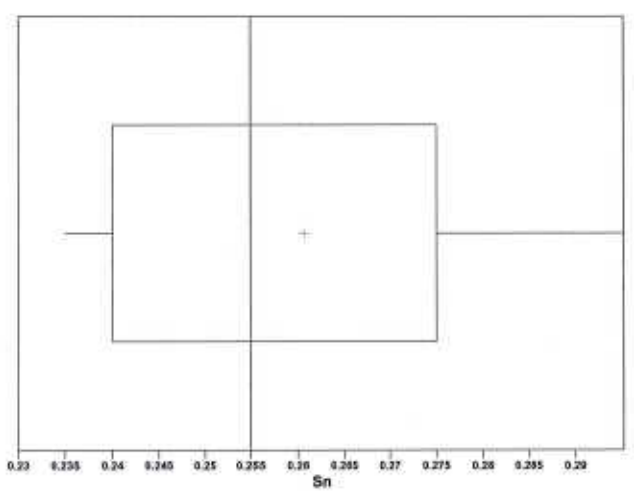
Three graphical displays of the data are shown below: the Histogram, the Box and Whiskers plot, and the Quantile-Quantile (Q-Q) plot.

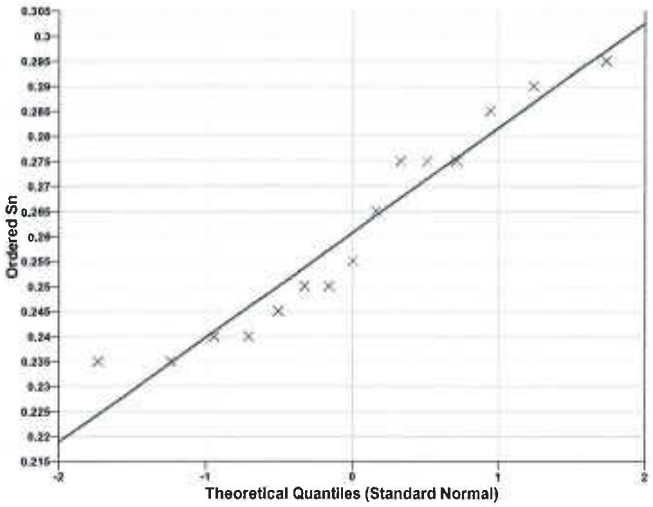
The Histogram is a plot of the fraction of the n observed data that fall within specified data "bins." A histogram is generated by dividing the x axis (range of the observed data values) into "bins" and displaying the number of data in each bin as the height of a bar for the bin. The area of the bar is the fraction of the n data values that lie within the bin. The sum of the fractions for all bins equals one. A histogram is used to assess how the n data are distributed (spread) over their range of values. If the histogram is more or less symmetric and bell shaped, then the data may be normally distributed.

The Box and Whiskers plot is composed of a central box divided by a line, and with two lines extending out from the box, called the "whiskers". The line through the box is drawn at the median of the n data observed. The two ends of the box represent the 25th and 75th percentiles of the n data values, which are also called the lower and upper quartiles, respectively, of the data set. The sample mean (mean of the n data) is shown as a "+" sign. The upper whisker extends to the largest data value that is less than the upper quartile plus 1.5 times the interquartile range (upper quartile minus the lower quartile). The lower whisker extends to the smallest data value that is greater than the lower quartile minus 1.5 times the interquartile range. Extreme data values (greater or smaller than the ends of the whiskers) are plotted individually. A Box and Whiskers plot is used to assess the symmetry of the distribution of the data set. If the distribution is symmetrical, the box is divided into two equal halves by the median, the whiskers will be the same length, and the number of extreme data points will be distributed equally on either end of the plot.

The Q-Q plot graphs the quantiles of a set of n data against the quantiles of a specific distribution. We show here only the Q-Q plot for an assumed normal distribution. The pth quantile of a distribution of data is the data value, x_n, for which a fraction p of the distribution is less than x_n. If the data plotted on the normal distribution Q-Q plot closely follow a straight line, even at the ends of the line, then the data may be assumed to be normally distributed. If the data points deviate substantially from a linear line, then the data are not normally distributed.







For more information on these three plots consult Guidance for Data Quality Assessment, EPA QA/G-9, pgs 2.3-1 through 2.3-12. (http://www.epa.gov/quality/qa-docs.html).

Two-Sided Confidence Interval on the True Median

For calculating the confidence interval, the values are ordered from smallest to largest. The confidence limits are the highest value of the r+1 and/or lowest value of the s-1 order statistics that fit the formulas below, except when the rth ordered value is tied with higher ordered values or the sth ordered value is tied with lower ordered values. If higher numbered ordered values are ties with the rth ordered value, then the closest ordered value that is lower than r will be the confidence limit. If higher-numbered ordered values are ties with the sth ordered value, then the closest ordered value that is higher than s will be the confidence limit.

Upper Two-Sided Confidence Interval

$$\sum_{s}^{1}\left(\frac{n!}{r!(n-s)!}\right)p^{0.5}(1-p)^{n-0.5} \geq 1-\alpha/2$$

Lower Two-Sided Confidence interval

$$\sum_{r}^{1}\left(\frac{n!}{r!(n-r)!}\right)p^{0.5}(1-p)^{n-0.5} \leq \alpha/2$$

Upper 95% Two-Sided Confidence Interval on the Median	0.285
Sample Median	0.255
Lower 95% Two-Sided Confidence Interval on the Median	0.24

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* - The report contents may have been modified or reformatted by end-user of software.

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VSP Sample Design Report for Calculating a Two-Sided Confidence Interval for the Population Median Using Simple Random Sampling

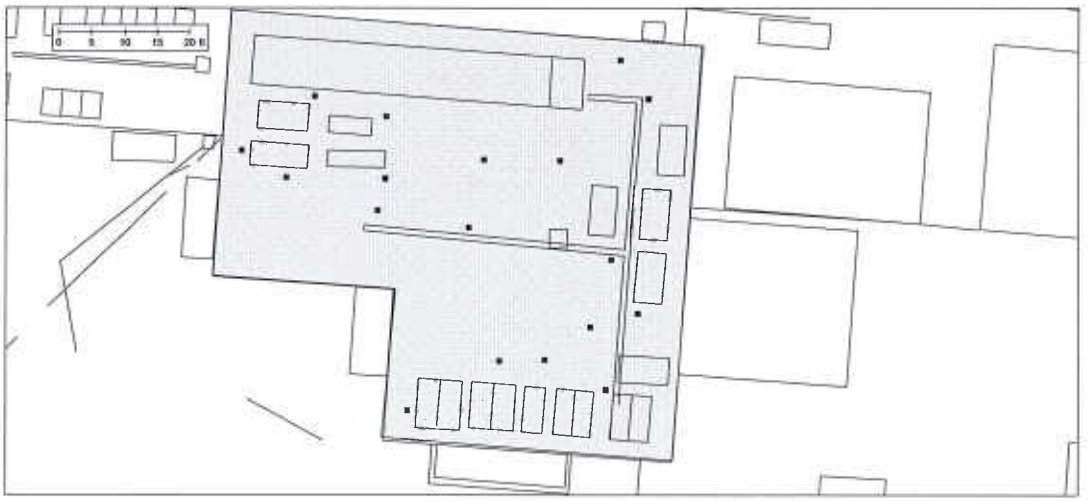
Summary

This report summarizes the sampling design used, associated statistical assumptions, as well as general guidelines for conducting post-sampling data analysis. Sampling plan components presented here include how many sampling locations to choose and where within the sampling area to collect those samples. The type of medium to sample (i.e., soil, groundwater, etc.) and how to analyze the samples (in-situ, fixed laboratory, etc.) are addressed in other sections of the sampling plan.

The following table summarizes the sampling design developed. A figure that shows sampling locations in the field and a table that lists sampling location coordinates are also provided below.

SUMMARY OF SAMPLING DESIGN	
Primary Objective of Design	Construct a Confidence Interval on the True Median
Type of Sampling Design	Non-Parametric
Sample Placement (Location) in the Field	Simple random sampling
Formula for calculating number of sampling locations	Nonparametric Confidence Limits
Calculated total number of samples	15
Number of samples on map [a]	18
Number of selected sample areas [b]	1
Specified sampling area [c]	3910.04 ft^2
Total cost of sampling [d]	$2,860.00

[a] This number may differ from the calculated number because of 1) grid edge effects, 2) adding judgment samples, or 3) selecting or unselecting sample areas.
[b] The number of selected sample areas is the number of colored areas on the map of the site. These sample areas contain the locations where samples are collected.
[c] The sampling area is the total surface area of the selected colored sample areas on the map of the site.
[d] Including measurement analyses and fixed overhead costs. See the Cost of Sampling section for an explanation of the costs presented here.



Area: Area 2					
X Coord	Y Coord	Label	Value	Type	Historical

4981.9002	5213.6371	GP-15	0.25	Random	
5000.6401	5198.5254	GP-11	0.255	Random	
4953.7905	5221.1929	GP-17	0.275	Random	
4972.5303	5185.9324	GP-24	0.265	Random	
5008.0100	5200.5999	GP-25	0.24	Random	
4947.1056	5225.2673	GP-21	0.295	Random	
4986.5852	5193.4882	GP-9	0.285	Random	
4967.8454	5216.1557	GP-16	0.25	Random	
5005.3250	5238.8231	GP-20	0.245	Random	
4995.9551	5223.7115	GP-13	0.235	Random	
4984.2427	5223.8359	GP-14	0.275	Random	
5003.9825	5208.7242	GP-12	0.24	Random	
4958.1330	5233.3917	GP-22	0.275	Random	
4993.6126	5193.6126	GP-10	0.235	Random	
4969.1604	5230.3045	GP-18	0.29	Random	
5003.0000	5189.0000	GP-23	0.275	Unknown	
5009.5000	5233.0000	GP-19	0.235	Unknown	
4969.0000	5221.0000	HA-4		Unknown	

Primary Sampling Objective
The primary purpose of sampling at this site is to construct a confidence interval on the true population median value. After the samples are collected and analyzed, the resulting sample values can be used to construct a two-sided confidence interval. Once the confidence interval is computed (which will be an upper and a lower threshold), you can have the specified confidence that the true population median is between the upper and lower thresholds.

Selected Sampling Approach
A non-parametric random sampling approach was used to determine the number of samples and to specify sampling locations. A parametric formula was not chosen because the conceptual model and historical information (e.g., historical data from this site or a very similar site) indicate that parametric assumptions are not true. These assumptions will be examined in post-sampling data analysis.

Both parametric and non-parametric equations rely on assumptions about the population. Typically, however, non-parametric equations require fewer assumptions and allow for more uncertainty about the statistical distribution of values at the site. The trade-off is that if the parametric assumptions are valid, the required number of samples is usually less than if a non-parametric equation was used.

Locating the sample points randomly provides data that are separated by many distances, whereas systematic samples are all equidistant apart. Therefore, random sampling provides more information about the spatial structure of the potential contamination than systematic sampling does. As with systematic sampling, random sampling also provides information regarding the mean or median value, but there is the possibility that areas of the site will not be represented with the same frequency as if uniform grid sampling were performed.

Number of Total Samples: Calculation Equation and Inputs
Two sample confidence interval calculation methods are available for when n□20 and n>20 (Conover, 1980, p. 111-117) (Gilbert, 1987,p. 141-142). In VSP, the user specifies a one-sided or two-sided CI, and the percent confidence desired to be within a specified number of percentiles of the median. A binary search is then performed on the CI equations to solve for the minimum sample size to satisfy these parameters. VSP first uses the n□20 method to determine if a solution can be found where n□20, and if not, then uses the n>20 method.

For a one-sided CI, the n□20 method follows a binomial distribution and determines the lowest value of n where the yth quantile of the sample would be equal to or above the true median at least X% of the time (Note that the sample sizes work out to be the same regardless of whether the CI will be a lower or upper tailed, so the same formula can be used for

any one-sided CI). X% is the specified confidence for one-sided confidence intervals, and the average of 100% and the specified confidence for two-sided confidence intervals. The yth quantile is determined by taking 50% and subtracting the allowable number of percentiles from the median specified by the user.

For a two-sided CI, the n□20 method is the same as performing a one-sided confidence interval, but replacing the specified percent confidence with the average of 100% and the specified percent confidence. If no solution is found where n□20, a binary search is conducted using Equation (1) for a one-sided CI and Equation (2) for a two-sided interval to compute the value of r (r is the the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest), rounding r up to the next higher integer. The search is repeated until the smallest n is found where 100*2*r/n is greater than 50% minus the allowable number of percentiles from the median specified by the user.

$$r = 0.5 * n - 0.5 * w_{\alpha} \sqrt{n} \qquad (1)$$

$$r = 0.5 * n - 0.5 * w_{\alpha/2} \sqrt{n} \qquad (2)$$

Where:

n is the sample size

r is the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest

$w_{\square}$ is the specified quantile of a normal distribution, e.g. if □=0.2 then $w_{\square}$ is the 0.2 quantile (20th percentile) of a normal distribution.

The n>20 method described above is an approximation method, so VSP also performs a final check using a binomial distribution in a similar manner to the n□20 method, and may increase the sample size by 1 to ensure the specified confidence levels are met.

Cost of Sampling
The total cost of the completed sampling program depends on several cost inputs, some of which are fixed, and others that are based on the number of samples collected and measured. Based on the numbers of samples determined above, the estimated total cost of sampling and analysis at this site is $2,860.00, which averages out to a per sample cost of $190.67. The following table summarizes the inputs and resulting cost estimates.

COST INFORMATION			
Cost Details	**Per Analysis**	**Per Sample**	**15 Samples**
Field collection costs		$100.00	$1,500.00
Analytical costs	$24.00	$24.00	$360.00
Sum of Field & Analytical costs		**$124.00**	**$1,860.00**
Fixed planning and validation costs			$1,000.00
Total cost			**$2,860.00**

Data Analysis for Sn
The following data points were entered by the user for analysis.

Sn										
Rank	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
0	0.235	0.235	0.235	0.24	0.24	0.245	0.25	0.25	0.255	0.265
10	0.275	0.275	0.275	0.275	0.285	0.29	0.295			

SUMMARY STATISTICS for Sn

n	17
Min	0.235
Max	0.295
Range	0.06
Mean	0.26
Median	0.255
Variance	0.000425
StdDev	0.020616
Std Error	0.005
Skewness	0.2486
Interquartile Range	0.035

Percentiles								
1%	**5%**	**10%**	**25%**	**50%**	**75%**	**90%**	**95%**	**99%**
0.235	0.235	0.235	0.24	0.255	0.275	0.291	0.295	0.295

Data Plots

Three graphical displays of the data are shown below: the Histogram, the Box and Whiskers plot, and the Quantile-Quantile (Q-Q) plot.

The Histogram is a plot of the fraction of the n observed data that fall within specified data "bins." A histogram is generated by dividing the x axis (range of the observed data values) into "bins" and displaying the number of data in each bin as the height of a bar for the bin. The area of the bar is the fraction of the n data values that lie within the bin. The sum of the fractions for all bins equals one. A histogram is used to assess how the n data are distributed (spread) over their range of values. If the histogram is more or less symmetric and bell shaped, then the data may be normally distributed.

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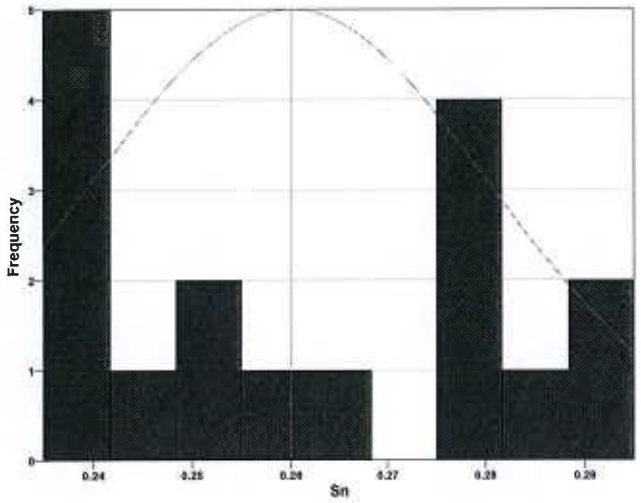

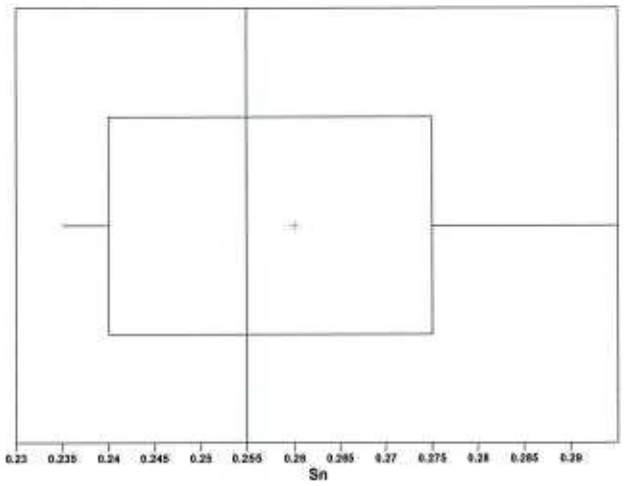

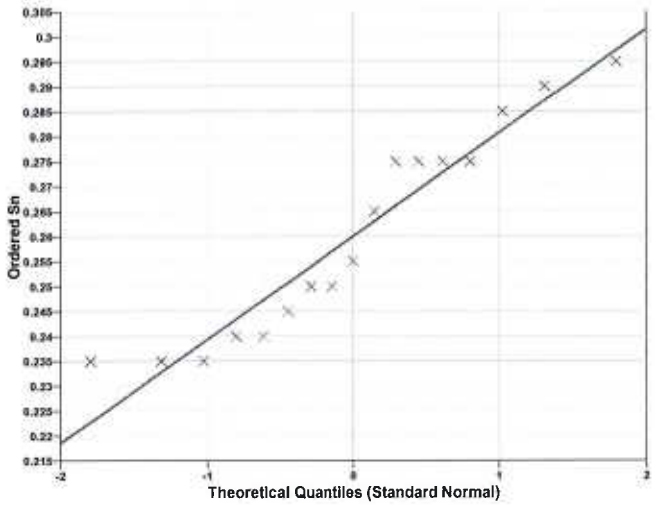

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Two-Sided Confidence Interval on the True Median

For calculating the confidence interval, the values are ordered from smallest to largest. The confidence limits are the highest value of the r+1 and/or lowest value of the s-1 order statistics that fit the formulas below, except when the rth ordered value is tied with higher ordered values or the sth ordered value is tied with lower ordered values. If higher numbered ordered values are ties with the rth ordered value, then the closest ordered value that is lower than r will be the confidence limit. If higher-numbered ordered values are ties with the sth ordered value, then the closest ordered value that is higher than s will be the confidence limit.

Upper Two-Sided Confidence Interval

$$\sum_{s}^{1}\left(\frac{n!}{r!(n-s)!}\right)p^{0.5}(1-p)^{n-0.5} \geq 1-\alpha/2$$

Lower Two-Sided Confidence interval

$$\sum_{r}^{1}\left(\frac{n!}{r!(n-r)!}\right)p^{0.5}(1-p)^{n-0.5} \leq \alpha/2$$

Upper 95% Two-Sided Confidence Interval on the Median	0.275

Sample Median	0.255
Lower 95% Two-Sided Confidence Interval on the Median	0.24

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VSP Sample Design Report for Calculating a Two-Sided Confidence Interval for the Population Median Using Simple Random Sampling

Summary

This report summarizes the sampling design used, associated statistical assumptions, as well as general guidelines for conducting post-sampling data analysis. Sampling plan components presented here include how many sampling locations to choose and where within the sampling area to collect those samples. The type of medium to sample (i.e., soil, groundwater, etc.) and how to analyze the samples (in-situ, fixed laboratory, etc.) are addressed in other sections of the sampling plan.

The following table summarizes the sampling design developed. A figure that shows sampling locations in the field and a table that lists sampling location coordinates are also provided below.

SUMMARY OF SAMPLING DESIGN	
Primary Objective of Design	Construct a Confidence Interval on the True Median
Type of Sampling Design	Non-Parametric
Sample Placement (Location) in the Field	Simple random sampling
Formula for calculating number of sampling locations	Nonparametric Confidence Limits
Calculated total number of samples	15
Number of samples on map [a]	15
Number of selected sample areas [b]	1
Specified sampling area [c]	3910.04 ft^2
Total cost of sampling [d]	$2,860.00

[a] This number may differ from the calculated number because of 1) grid edge effects, 2) adding judgment samples, or 3) selecting or unselecting sample areas.
[b] The number of selected sample areas is the number of colored areas on the map of the site. These sample areas contain the locations where samples are collected.
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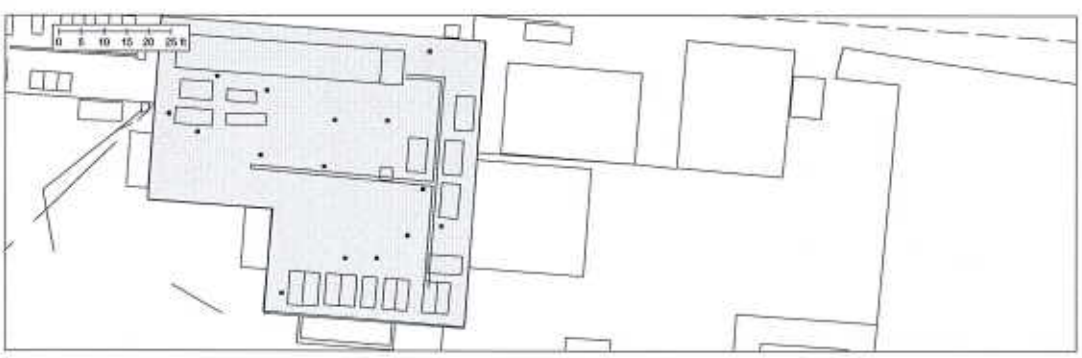

Area: Area 2					
X Coord	Y Coord	Label	Value	Type	Historical
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5000.6401	5198.5254	GP-11	44	Random	
4953.7905	5221.1929	GP-17	23	Random	

4972.5303	5185.9324	GP-24	32	Random	
5008.0100	5200.5999	GP-25	200	Random	
4947.1056	5225.2673	GP-21	45	Random	
4986.5852	5193.4882	GP-9	36	Random	
4967.8454	5216.1557	GP-16	36	Random	
5005.3250	5238.8231	GP-20	52	Random	
4995.9551	5223.7115	GP-13	32	Random	
4984.2427	5223.8359	GP-14	36	Random	
5003.9825	5208.7242	GP-12	29	Random	
4958.1330	5233.3917	GP-22	20	Random	
4993.6126	5193.6126	GP-10	35	Random	
4969.1604	5230.3045	GP-18	27	Random	

Primary Sampling Objective
The primary purpose of sampling at this site is to construct a confidence interval on the true population median value. After the samples are collected and analyzed, the resulting sample values can be used to construct a two-sided confidence interval. Once the confidence interval is computed (which will be an upper and a lower threshold), you can have the specified confidence that the true population median is between the upper and lower thresholds.

Selected Sampling Approach
A non-parametric random sampling approach was used to determine the number of samples and to specify sampling locations. A parametric formula was not chosen because the conceptual model and historical information (e.g., historical data from this site or a very similar site) indicate that parametric assumptions are not true. These assumptions will be examined in post-sampling data analysis.

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Number of Total Samples: Calculation Equation and Inputs
Two sample confidence interval calculation methods are available for when n□20 and n>20 (Conover, 1980, p. 111-117) (Gilbert, 1987,p. 141-142). In VSP, the user specifies a one-sided or two-sided CI, and the percent confidence desired to be within a specified number of percentiles of the median. A binary search is then performed on the CI equations to solve for the minimum sample size to satisfy these parameters. VSP first uses the n□20 method to determine if a solution can be found where n□20, and if not, then uses the n>20 method.

For a one-sided CI, the n□20 method follows a binomial distribution and determines the lowest value of n where the yth quantile of the sample would be equal to or above the true median at least X% of the time (Note that the sample sizes work out to be the same regardless of whether the CI will be a lower or upper tailed, so the same formula can be used for any one-sided CI). X% is the specified confidence for one-sided confidence intervals, and the average of 100% and the specified confidence for two-sided confidence intervals. The yth quantile is determined by taking 50% and subtracting the allowable number of percentiles from the median specified by the user.

For a two-sided CI, the n□20 method is the same as performing a one-sided confidence interval, but replacing the specified percent confidence with the average of 100% and the specified percent confidence. If no solution is found where n□20, a binary search is conducted using Equation (1) for a one-sided CI and Equation (2) for a two-sided interval to compute the value of r (r is the the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest), rounding r up to the next higher integer. The search is repeated until the smallest n is

found where 100*2*r/n is greater than 50% minus the allowable number of percentiles from the median specified by the user.

$$r = 0.5 * n - 0.5 * w_{\alpha} \sqrt{n} \qquad (1)$$

$$r = 0.5 * n - 0.5 * w_{\alpha/2} \sqrt{n} \qquad (2)$$

Where:

n is the sample size

r is the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest

$w_{\square}$ is the specified quantile of a normal distribution, e.g. if $\square$=0.2 then $w_{\square}$ is the 0.2 quantile (20th percentile) of a normal distribution.

The n>20 method described above is an approximation method, so VSP also performs a final check using a binomial distribution in a similar manner to the n$\square$20 method, and may increase the sample size by 1 to ensure the specified confidence levels are met.

Cost of Sampling
The total cost of the completed sampling program depends on several cost inputs, some of which are fixed, and others that are based on the number of samples collected and measured. Based on the numbers of samples determined above, the estimated total cost of sampling and analysis at this site is $2,860.00, which averages out to a per sample cost of $190.67. The following table summarizes the inputs and resulting cost estimates.

COST INFORMATION			
Cost Details	**Per Analysis**	**Per Sample**	**15 Samples**
Field collection costs		$100.00	$1,500.00
Analytical costs	$24.00	$24.00	$360.00
Sum of Field & Analytical costs		**$124.00**	**$1,860.00**
Fixed planning and validation costs			$1,000.00
Total cost			**$2,860.00**

Data Analysis for Zn
The following data points were entered by the user for analysis.

Zn										
Rank	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
0	20	23	26	27	29	32	32	35	36	36
10	36	44	45	52	200					

SUMMARY STATISTICS for Zn	
n	15
Min	20
Max	200
Range	180
Mean	44.867
Median	35

Variance	1914.7
StdDev	43.757
Std Error	11.298
Skewness	3.6243
Interquartile Range	17

Percentiles								
1%	**5%**	**10%**	**25%**	**50%**	**75%**	**90%**	**95%**	**99%**
20	20	21.8	27	35	44	111.2	200	200

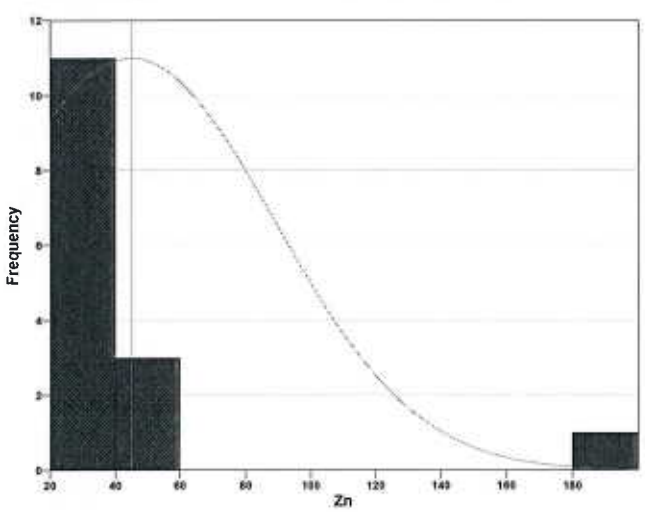
Data Plots

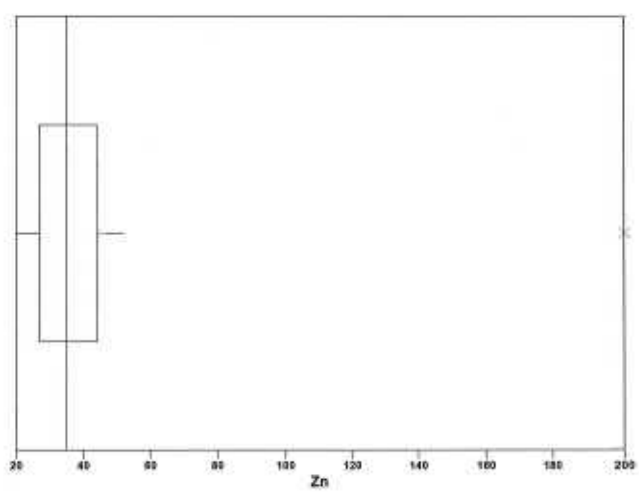
Three graphical displays of the data are shown below: the Histogram, the Box and Whiskers plot, and the Quantile-Quantile (Q-Q) plot.

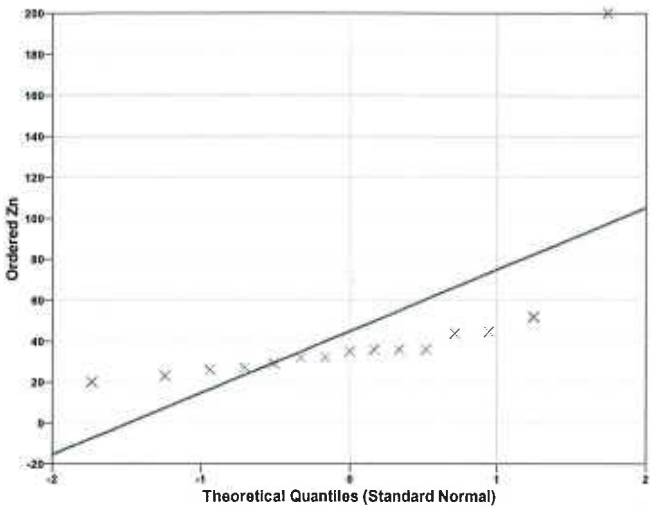
The Histogram is a plot of the fraction of the n observed data that fall within specified data "bins." A histogram is generated by dividing the x axis (range of the observed data values) into "bins" and displaying the number of data in each bin as the height of a bar for the bin. The area of the bar is the fraction of the n data values that lie within the bin. The sum of the fractions for all bins equals one. A histogram is used to assess how the n data are distributed (spread) over their range of values. If the histogram is more or less symmetric and bell shaped, then the data may be normally distributed.

The Box and Whiskers plot is composed of a central box divided by a line, and with two lines extending out from the box, called the "whiskers". The line through the box is drawn at the median of the n data observed. The two ends of the box represent the 25th and 75th percentiles of the n data values, which are also called the lower and upper quartiles, respectively, of the data set. The sample mean (mean of the n data) is shown as a "+" sign. The upper whisker extends to the largest data value that is less than the upper quartile plus 1.5 times the interquartile range (upper quartile minus the lower quartile). The lower whisker extends to the smallest data value that is greater than the lower quartile minus 1.5 times the interquartile range. Extreme data values (greater or smaller than the ends of the whiskers) are plotted individually. A Box and Whiskers plot is used to assess the symmetry of the distribution of the data set. If the distribution is symmetrical, the box is divided into two equal halves by the median, the whiskers will be the same length, and the number of extreme data points will be distributed equally on either end of the plot.

The Q-Q plot graphs the quantiles of a set of n data against the quantiles of a specific distribution. We show here only the Q-Q plot for an assumed normal distribution. The pth quantile of a distribution of data is the data value, x_n, for which a fraction p of the distribution is less than x_n. If the data plotted on the normal distribution Q-Q plot closely follow a straight line, even at the ends of the line, then the data may be assumed to be normally distributed. If the data points deviate substantially from a linear line, then the data are not normally distributed.







For more information on these three plots consult Guidance for Data Quality Assessment, EPA QA/G-9, pgs 2.3-1 through 2.3-12. (http://www.epa.gov/quality/qa-docs.html).

Two-Sided Confidence Interval on the True Median

For calculating the confidence interval, the values are ordered from smallest to largest. The confidence limits are the highest value of the r+1 and/or lowest value of the s-1 order statistics that fit the formulas below, except when the rth ordered value is tied with higher ordered values or the sth ordered value is tied with lower ordered values. If higher numbered ordered values are ties with the rth ordered value, then the closest ordered value that is lower than r will be the confidence limit. If higher-numbered ordered values are ties with the sth ordered value, then the closest ordered value that is higher than s will be the confidence limit.

Upper Two-Sided Confidence Interval

$$\sum_{s}^{1}\left(\frac{n!}{r!(n-s)!}\right)p^{0.5}(1-p)^{n-0.5} \geq 1-\alpha/2$$

Lower Two-Sided Confidence interval

$$\sum_{r}^{1}\left(\frac{n!}{r!(n-r)!}\right)p^{0.5}(1-p)^{n-0.5} \leq \alpha/2$$

Upper 95% Two-Sided Confidence Interval on the Median	45
Sample Median	35
Lower 95% Two-Sided Confidence Interval on the Median	26

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* - The report contents may have been modified or reformatted by end-user of software.

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VSP Sample Design Report for Calculating a Two-Sided Confidence Interval for the Population Median Using Simple Random Sampling

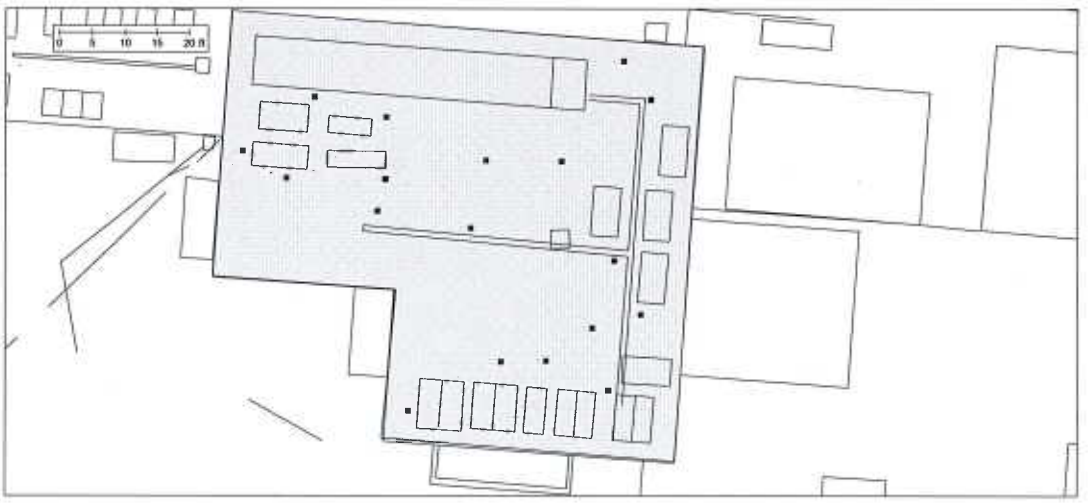
Summary

This report summarizes the sampling design used, associated statistical assumptions, as well as general guidelines for conducting post-sampling data analysis. Sampling plan components presented here include how many sampling locations to choose and where within the sampling area to collect those samples. The type of medium to sample (i.e., soil, groundwater, etc.) and how to analyze the samples (in-situ, fixed laboratory, etc.) are addressed in other sections of the sampling plan.

The following table summarizes the sampling design developed. A figure that shows sampling locations in the field and a table that lists sampling location coordinates are also provided below.

SUMMARY OF SAMPLING DESIGN	
Primary Objective of Design	Construct a Confidence Interval on the True Median
Type of Sampling Design	Non-Parametric
Sample Placement (Location) in the Field	Simple random sampling
Formula for calculating number of sampling locations	Nonparametric Confidence Limits
Calculated total number of samples	15
Number of samples on map [a]	18
Number of selected sample areas [b]	1
Specified sampling area [c]	3910.04 ft^2
Total cost of sampling [d]	$2,860.00

[a] This number may differ from the calculated number because of 1) grid edge effects, 2) adding judgment samples, or 3) selecting or unselecting sample areas.
[b] The number of selected sample areas is the number of colored areas on the map of the site. These sample areas contain the locations where samples are collected.
[c] The sampling area is the total surface area of the selected colored sample areas on the map of the site.
[d] Including measurement analyses and fixed overhead costs. See the Cost of Sampling section for an explanation of the costs presented here.



Area: Area 2					
X Coord	Y Coord	Label	Value	Type	Historical

4981.9002	5213.6371	GP-15	26	Random	
5000.6401	5198.5254	GP-11	44	Random	
4953.7905	5221.1929	GP-17	23	Random	
4972.5303	5185.9324	GP-24	32	Random	
5008.0100	5200.5999	GP-25	200	Random	
4947.1056	5225.2673	GP-21	45	Random	
4986.5852	5193.4882	GP-9	36	Random	
4967.8454	5216.1557	GP-16	36	Random	
5005.3250	5238.8231	GP-20	52	Random	
4995.9551	5223.7115	GP-13	32	Random	
4984.2427	5223.8359	GP-14	36	Random	
5003.9825	5208.7242	GP-12	29	Random	
4958.1330	5233.3917	GP-22	20	Random	
4993.6126	5193.6126	GP-10	35	Random	
4969.1604	5230.3045	GP-18	27	Random	
5003.0000	5189.0000	GP-23	41	Unknown	
5009.5000	5233.0000	GP-19	30	Unknown	
4969.0000	5221.0000	HA-4		Unknown	

Primary Sampling Objective
The primary purpose of sampling at this site is to construct a confidence interval on the true population median value. After the samples are collected and analyzed, the resulting sample values can be used to construct a two-sided confidence interval. Once the confidence interval is computed (which will be an upper and a lower threshold), you can have the specified confidence that the true population median is between the upper and lower thresholds.

Selected Sampling Approach
A non-parametric random sampling approach was used to determine the number of samples and to specify sampling locations. A parametric formula was not chosen because the conceptual model and historical information (e.g., historical data from this site or a very similar site) indicate that parametric assumptions are not true. These assumptions will be examined in post-sampling data analysis.

Both parametric and non-parametric equations rely on assumptions about the population. Typically, however, non-parametric equations require fewer assumptions and allow for more uncertainty about the statistical distribution of values at the site. The trade-off is that if the parametric assumptions are valid, the required number of samples is usually less than if a non-parametric equation was used.

Locating the sample points randomly provides data that are separated by many distances, whereas systematic samples are all equidistant apart. Therefore, random sampling provides more information about the spatial structure of the potential contamination than systematic sampling does. As with systematic sampling, random sampling also provides information regarding the mean or median value, but there is the possibility that areas of the site will not be represented with the same frequency as if uniform grid sampling were performed.

Number of Total Samples: Calculation Equation and Inputs
Two sample confidence interval calculation methods are available for when n□20 and n>20 (Conover, 1980, p. 111-117) (Gilbert, 1987,p. 141-142). In VSP, the user specifies a one-sided or two-sided CI, and the percent confidence desired to be within a specified number of percentiles of the median. A binary search is then performed on the CI equations to solve for the minimum sample size to satisfy these parameters. VSP first uses the n□20 method to determine if a solution can be found where n□20, and if not, then uses the n>20 method.

For a one-sided CI, the n□20 method follows a binomial distribution and determines the lowest value of n where the yth quantile of the sample would be equal to or above the true median at least X% of the time (Note that the sample sizes work out to be the same regardless of whether the CI will be a lower or upper tailed, so the same formula can be used for

any one-sided CI). X% is the specified confidence for one-sided confidence intervals, and the average of 100% and the specified confidence for two-sided confidence intervals. The yth quantile is determined by taking 50% and subtracting the allowable number of percentiles from the median specified by the user.

For a two-sided CI, the n□20 method is the same as performing a one-sided confidence interval, but replacing the specified percent confidence with the average of 100% and the specified percent confidence. If no solution is found where n□20, a binary search is conducted using Equation (1) for a one-sided CI and Equation (2) for a two-sided interval to compute the value of r (r is the the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest), rounding r up to the next higher integer. The search is repeated until the smallest n is found where 100*2*r/n is greater than 50% minus the allowable number of percentiles from the median specified by the user.

$$r = 0.5 * n - 0.5 * w_{\alpha} \sqrt{n} \qquad (1)$$

$$r = 0.5 * n - 0.5 * w_{\alpha/2} \sqrt{n} \qquad (2)$$

Where:

n is the sample size

r is the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest

$w_{\square}$ is the specified quantile of a normal distribution, e.g. if □=0.2 then $w_{\square}$ is the 0.2 quantile (20th percentile) of a normal distribution.

The n>20 method described above is an approximation method, so VSP also performs a final check using a binomial distribution in a similar manner to the n□20 method, and may increase the sample size by 1 to ensure the specified confidence levels are met.

Cost of Sampling

The total cost of the completed sampling program depends on several cost inputs, some of which are fixed, and others that are based on the number of samples collected and measured. Based on the numbers of samples determined above, the estimated total cost of sampling and analysis at this site is $2,860.00, which averages out to a per sample cost of $190.67. The following table summarizes the inputs and resulting cost estimates.

COST INFORMATION			
Cost Details	**Per Analysis**	**Per Sample**	**15 Samples**
Field collection costs		$100.00	$1,500.00
Analytical costs	$24.00	$24.00	$360.00
Sum of Field & Analytical costs		**$124.00**	**$1,860.00**
Fixed planning and validation costs			$1,000.00
Total cost			**$2,860.00**

Data Analysis for Zn

The following data points were entered by the user for analysis.

Zn										
Rank	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
0	20	23	26	27	29	30	32	32	35	36
10	36	36	41	44	45	52	200			

SUMMARY STATISTICS for Zn

n	17
Min	20
Max	200
Range	180
Mean	43.765
Median	35
Variance	1688.8
StdDev	41.095
Std Error	9.9671
Skewness	3.848
Interquartile Range	14.5

Percentiles								
1%	**5%**	**10%**	**25%**	**50%**	**75%**	**90%**	**95%**	**99%**
20	20	22.4	28	35	42.5	81.6	200	200

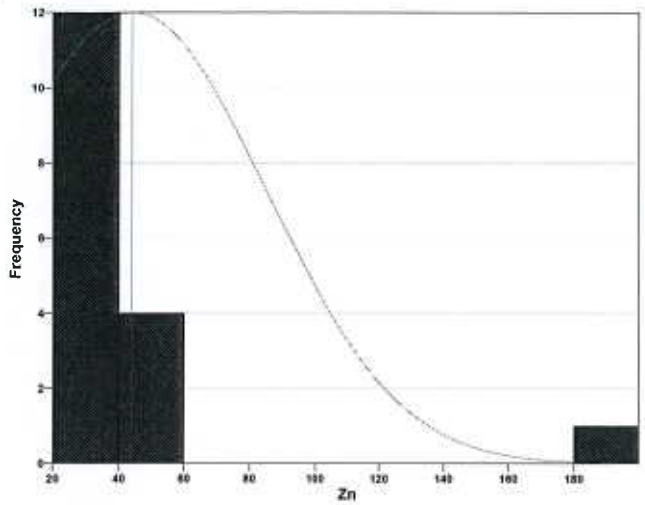
Data Plots

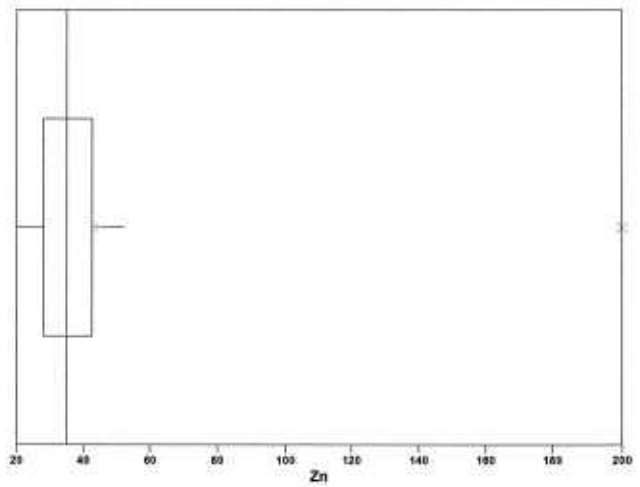
Three graphical displays of the data are shown below: the Histogram, the Box and Whiskers plot, and the Quantile-Quantile (Q-Q) plot.

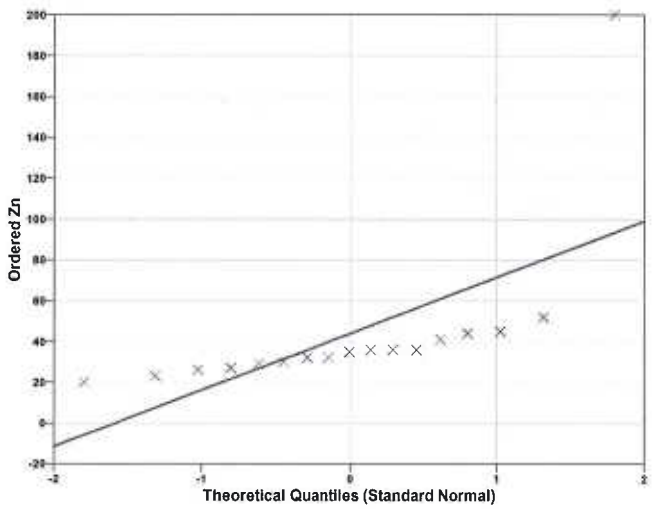
The Histogram is a plot of the fraction of the n observed data that fall within specified data "bins." A histogram is generated by dividing the x axis (range of the observed data values) into "bins" and displaying the number of data in each bin as the height of a bar for the bin. The area of the bar is the fraction of the n data values that lie within the bin. The sum of the fractions for all bins equals one. A histogram is used to assess how the n data are distributed (spread) over their range of values. If the histogram is more or less symmetric and bell shaped, then the data may be normally distributed.

The Box and Whiskers plot is composed of a central box divided by a line, and with two lines extending out from the box, called the "whiskers". The line through the box is drawn at the median of the n data observed. The two ends of the box represent the 25th and 75th percentiles of the n data values, which are also called the lower and upper quartiles, respectively, of the data set. The sample mean (mean of the n data) is shown as a "+" sign. The upper whisker extends to the largest data value that is less than the upper quartile plus 1.5 times the interquartile range (upper quartile minus the lower quartile). The lower whisker extends to the smallest data value that is greater than the lower quartile minus 1.5 times the interquartile range. Extreme data values (greater or smaller than the ends of the whiskers) are plotted individually. A Box and Whiskers plot is used to assess the symmetry of the distribution of the data set. If the distribution is symmetrical, the box is divided into two equal halves by the median, the whiskers will be the same length, and the number of extreme data points will be distributed equally on either end of the plot.

The Q-Q plot graphs the quantiles of a set of n data against the quantiles of a specific distribution. We show here only the Q-Q plot for an assumed normal distribution. The pth quantile of a distribution of data is the data value, x_p, for which a fraction p of the distribution is less than x_p. If the data plotted on the normal distribution Q-Q plot closely follow a straight line, even at the ends of the line, then the data may be assumed to be normally distributed. If the data points deviate substantially from a linear line, then the data are not normally distributed.







For more information on these three plots consult Guidance for Data Quality Assessment, EPA QA/G-9, pgs 2.3-1 through 2.3-12. (http://www.epa.gov/quality/qa-docs.html).

Two-Sided Confidence Interval on the True Median

For calculating the confidence interval, the values are ordered from smallest to largest. The confidence limits are the highest value of the r+1 and/or lowest value of the s-1 order statistics that fit the formulas below, except when the rth ordered value is tied with higher ordered values or the sth ordered value is tied with lower ordered values. If higher numbered ordered values are ties with the rth ordered value, then the closest ordered value that is lower than r will be the confidence limit. If higher-numbered ordered values are ties with the sth ordered value, then the closest ordered value that is higher than s will be the confidence limit.

Upper Two-Sided Confidence Interval

$$\sum_{s}^{1}\left(\frac{n!}{r!(n-s)!}\right)p^{0.5}(1-p)^{n-0.5} \geq 1-\alpha/2$$

Lower Two-Sided Confidence interval

$$\sum_{r}^{1}\left(\frac{n!}{r!(n-r)!}\right)p^{0.5}(1-p)^{n-0.5} \leq \alpha/2$$

Sample Median	35
Lower 95% Two-Sided Confidence Interval on the Median	27

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* - The report contents may have been modified or reformatted by end-user of software.

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.nple Design Report for Calculating a Two-Sided Confidence Interval for the Population Median Using .ie Random Sampling

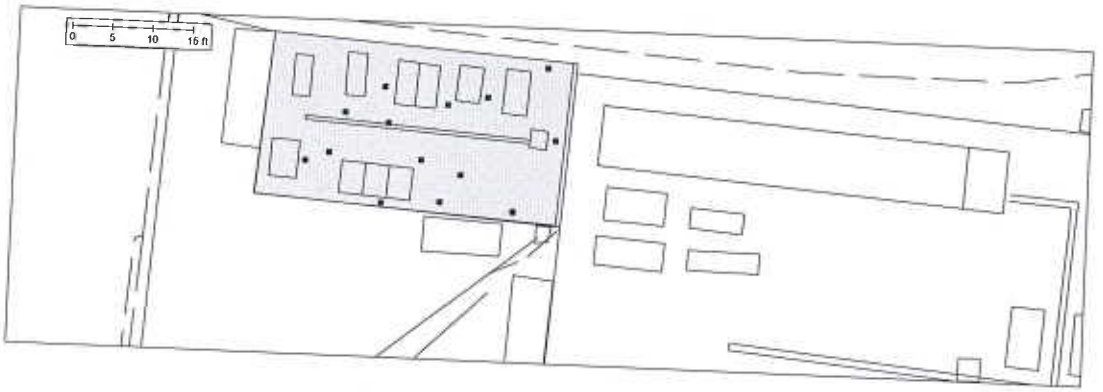
Summary

This report summarizes the sampling design used, associated statistical assumptions, as well as general guidelines for conducting post-sampling data analysis. Sampling plan components presented here include how many sampling locations to choose and where within the sampling area to collect those samples. The type of medium to sample (i.e., soil, groundwater, etc.) and how to analyze the samples (in-situ, fixed laboratory, etc.) are addressed in other sections of the sampling plan.

The following table summarizes the sampling design developed. A figure that shows sampling locations in the field and a table that lists sampling location coordinates are also provided below.

SUMMARY OF SAMPLING DESIGN	
Primary Objective of Design	Construct a Confidence Interval on the True Median
Type of Sampling Design	Non-Parametric
Sample Placement (Location) in the Field	Simple random sampling
Formula for calculating number of sampling locations	Nonparametric Confidence Limits
Calculated total number of samples	15
Number of samples on map [a]	14
Number of selected sample areas [b]	1
Specified sampling area [c]	755.90 ft^2
Total cost of sampling [d]	$6,700.00

[a] This number may differ from the calculated number because of 1) grid edge effects, 2) adding judgment samples, or 3) selecting or unselecting sample areas.
[b] The number of selected sample areas is the number of colored areas on the map of the site. These sample areas contain the locations where samples are collected.
[c] The sampling area is the total surface area of the selected colored sample areas on the map of the site.
[d] Including measurement analyses and fixed overhead costs. See the Cost of Sampling section for an explanation of the costs presented here.



Area: Area 1					
X Coord	Y Coord	Label	Value	Type	Historical
4928.9658	5229.8854	GP-44	0.017	Random	
4922.1885	5239.3872	GP-51	0.62	Random	
4941.7431	5246.8890	GP-49	0.95	Random	

4911.9669	5234.3860	GP-55	0.0175	Random	
4929.5215	5241.8878	GP-50	0.0165	Random	
4914.8555	5235.4974	GP-54	0.0175	Random	
4934.4101	5242.9992	GP-48	0.016	Random	
4921.6328	5229.4961	GP-57	0.016	Random	
4943.0000	5237.9980	GP-46	0.0165	Random	
4926.4661	5234.9967	GP-56	0.017	Random	
4916.6888	5240.4986	GP-53	0.017	Random	
4931.3547	5233.3309	GP-45	0.017	Random	
4921.5774	5243.8327	GP-52	0.0175	Random	
4938.0000	5229.0000	GP-43	0.0155	Unknown	

Primary Sampling Objective
The primary purpose of sampling at this site is to construct a confidence interval on the true population median value. After the samples are collected and analyzed, the resulting sample values can be used to construct a two-sided confidence interval. Once the confidence interval is computed (which will be an upper and a lower threshold), you can have the specified confidence that the true population median is between the upper and lower thresholds.

Selected Sampling Approach
A non-parametric random sampling approach was used to determine the number of samples and to specify sampling locations. A parametric formula was not chosen because the conceptual model and historical information (e.g., historical data from this site or a very similar site) indicate that parametric assumptions are not true. These assumptions will be examined in post-sampling data analysis.

Both parametric and non-parametric equations rely on assumptions about the population. Typically, however, non-parametric equations require fewer assumptions and allow for more uncertainty about the statistical distribution of values at the site. The trade-off is that if the parametric assumptions are valid, the required number of samples is usually less than if a non-parametric equation was used.

Locating the sample points randomly provides data that are separated by many distances, whereas systematic samples are all equidistant apart. Therefore, random sampling provides more information about the spatial structure of the potential contamination than systematic sampling does. As with systematic sampling, random sampling also provides information regarding the mean or median value, but there is the possibility that areas of the site will not be represented with the same frequency as if uniform grid sampling were performed.

Number of Total Samples: Calculation Equation and Inputs
Two sample confidence interval calculation methods are available for when n□20 and n>20 (Conover, 1980, p. 111-117) (Gilbert, 1987,p. 141-142). In VSP, the user specifies a one-sided or two-sided CI, and the percent confidence desired to be within a specified number of percentiles of the median. A binary search is then performed on the CI equations to solve for the minimum sample size to satisfy these parameters. VSP first uses the n□20 method to determine if a solution can be found where n□20, and if not, then uses the n>20 method.

For a one-sided CI, the n□20 method follows a binomial distribution and determines the lowest value of n where the yth quantile of the sample would be equal to or above the true median at least X% of the time (Note that the sample sizes work out to be the same regardless of whether the CI will be a lower or upper tailed, so the same formula can be used for any one-sided CI). X% is the specified confidence for one-sided confidence intervals, and the average of 100% and the specified confidence for two-sided confidence intervals. The yth quantile is determined by taking 50% and subtracting the allowable number of percentiles from the median specified by the user.

For a two-sided CI, the n□20 method is the same as performing a one-sided confidence interval, but replacing the specified percent confidence with the average of 100% and the specified percent confidence. If no solution is found where n□20, a binary search is conducted using Equation (1) for a one-sided CI and Equation (2) for a two-sided interval to compute the value of r (r is the the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest), rounding r up to the next higher integer. The search is repeated until the smallest n is found where 100*2*r/n is greater than 50% minus the allowable number of percentiles from the median specified by the user.

$$r = 0.5*n - 0.5*w_{\alpha}\sqrt{n} \qquad (1)$$

$$r = 0.5*n - 0.5*w_{\alpha/2}\sqrt{n} \qquad (2)$$

Where:

n is the sample size

r is the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest

$w_{\square}$ is the specified quantile of a normal distribution, e.g. if □=0.2 then $w_{\square}$ is the 0.2 quantile (20th percentile) of a normal distribution.

The n>20 method described above is an approximation method, so VSP also performs a final check using a binomial distribution in a similar manner to the n□20 method, and may increase the sample size by 1 to ensure the specified confidence levels are met.

Cost of Sampling
The total cost of the completed sampling program depends on several cost inputs, some of which are fixed, and others that are based on the number of samples collected and measured. Based on the numbers of samples determined above, the estimated total cost of sampling and analysis at this site is $6,700.00, which averages out to a per sample cost of $446.67. The following table summarizes the inputs and resulting cost estimates.

COST INFORMATION			
Cost Details	**Per Analysis**	**Per Sample**	**15 Samples**
Field collection costs		$250.00	$3,750.00
Analytical costs	$130.00	$130.00	$1,950.00
Sum of Field & Analytical costs		**$380.00**	**$5,700.00**
Fixed planning and validation costs			$1,000.00
Total cost			**$6,700.00**

Data Analysis for Cd
The following data points were entered by the user for analysis.

Cd										
Rank	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
0	0.0155	0.016	0.016	0.0165	0.0165	0.017	0.017	0.017	0.017	0.0175
10	0.0175	0.0175	0.62	0.95						

SUMMARY STATISTICS for Cd	
n	14
Min	0.0155
Max	0.95
Range	0.9345
Mean	0.1265
Median	0.017
Variance	0.082018
StdDev	0.28639

Std Error					0.076541			
Skewness					2.5322			
Interquartile Range					0.001125			
Percentiles								
1%	5%	10%	25%	50%	75%	90%	95%	99%
0.0155	0.0155	0.01575	0.01638	0.017	0.0175	0.785	0.95	0.95

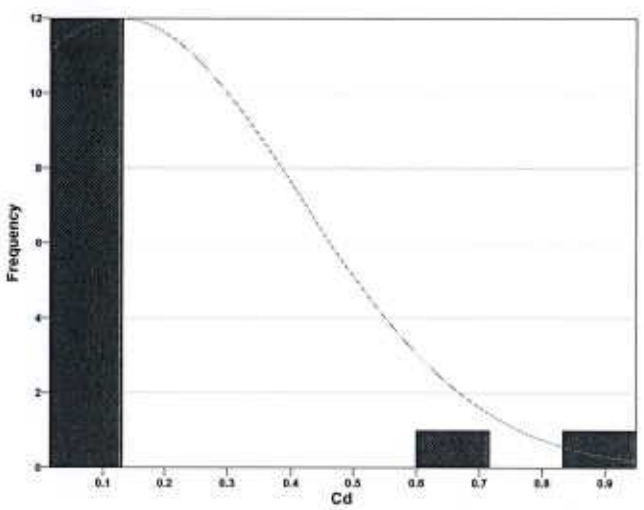
Data Plots

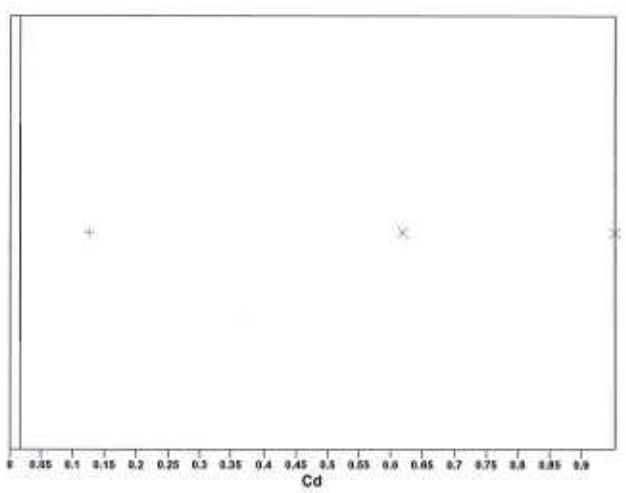
Three graphical displays of the data are shown below: the Histogram, the Box and Whiskers plot, and the Quantile-Quantile (Q-Q) plot.

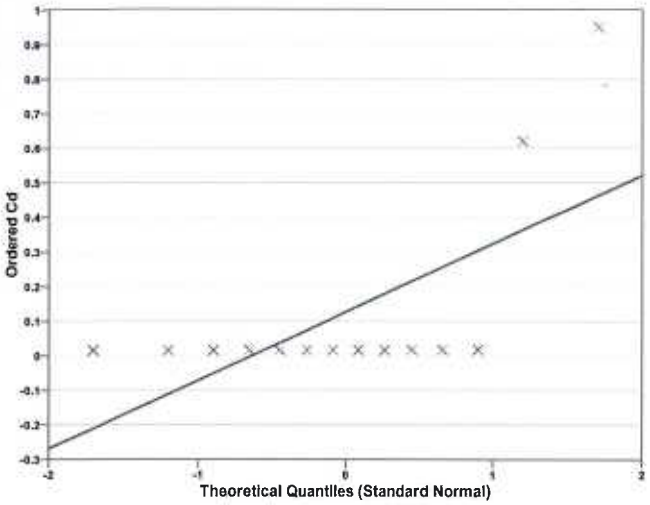
The Histogram is a plot of the fraction of the n observed data that fall within specified data "bins." A histogram is generated by dividing the x axis (range of the observed data values) into "bins" and displaying the number of data in each bin as the height of a bar for the bin. The area of the bar is the fraction of the n data values that lie within the bin. The sum of the fractions for all bins equals one. A histogram is used to assess how the n data are distributed (spread) over their range of values. If the histogram is more or less symmetric and bell shaped, then the data may be normally distributed.

The Box and Whiskers plot is composed of a central box divided by a line, and with two lines extending out from the box, called the "whiskers". The line through the box is drawn at the median of the n data observed. The two ends of the box represent the 25th and 75th percentiles of the n data values, which are also called the lower and upper quartiles, respectively, of the data set. The sample mean (mean of the n data) is shown as a "+" sign. The upper whisker extends to the largest data value that is less than the upper quartile plus 1.5 times the interquartile range (upper quartile minus the lower quartile). The lower whisker extends to the smallest data value that is greater than the lower quartile minus 1.5 times the interquartile range. Extreme data values (greater or smaller than the ends of the whiskers) are plotted individually. A Box and Whiskers plot is used to assess the symmetry of the distribution of the data set. If the distribution is symmetrical, the box is divided into two equal halves by the median, the whiskers will be the same length, and the number of extreme data points will be distributed equally on either end of the plot.

The Q-Q plot graphs the quantiles of a set of n data against the quantiles of a specific distribution. We show here only the Q-Q plot for an assumed normal distribution. The pth quantile of a distribution of data is the data value, x_n, for which a fraction p of the distribution is less than x_n. If the data plotted on the normal distribution Q-Q plot closely follow a straight line, even at the ends of the line, then the data may be assumed to be normally distributed. If the data points deviate substantially from a linear line, then the data are not normally distributed.







For more information on these three plots consult Guidance for Data Quality Assessment, EPA QA/G-9, pgs 2.3-1 through 2.3-12. (http://www.epa.gov/quality/qa-docs.html).

Two-Sided Confidence Interval on the True Median

For calculating the confidence interval, the values are ordered from smallest to largest. The confidence limits are the highest value of the r+1 and/or lowest value of the s-1 order statistics that fit the formulas below, except when the rth ordered value is tied with higher ordered values or the sth ordered value is tied with lower ordered values. If higher numbered ordered values are ties with the rth ordered value, then the closest ordered value that is lower than r will be the confidence limit. If higher-numbered ordered values are ties with the sth ordered value, then the closest ordered value that is higher than s will be the confidence limit.

Upper Two-Sided Confidence Interval

$$\sum_{s}^{1}\left(\frac{n!}{r!(n-s)!}\right)p^{0.5}(1-p)^{n-0.5} \geq 1-\alpha/2$$

Lower Two-Sided Confidence interval

$$\sum_{r}^{1}\left(\frac{n!}{r!(n-r)!}\right)p^{0.5}(1-p)^{n-0.5} \leq \alpha/2$$

Upper 95% Two-Sided Confidence Interval on the Median	0.62
Sample Median	0.017
Lower 95% Two-Sided Confidence Interval on the Median	0.016

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* - The report contents may have been modified or reformatted by end-user of software.

Electrolysis Bldg Cd Board

VSP Sample Design Report for Calculating a Two-Sided Confidence Interval for the Population Median Using Simple Random Sampling

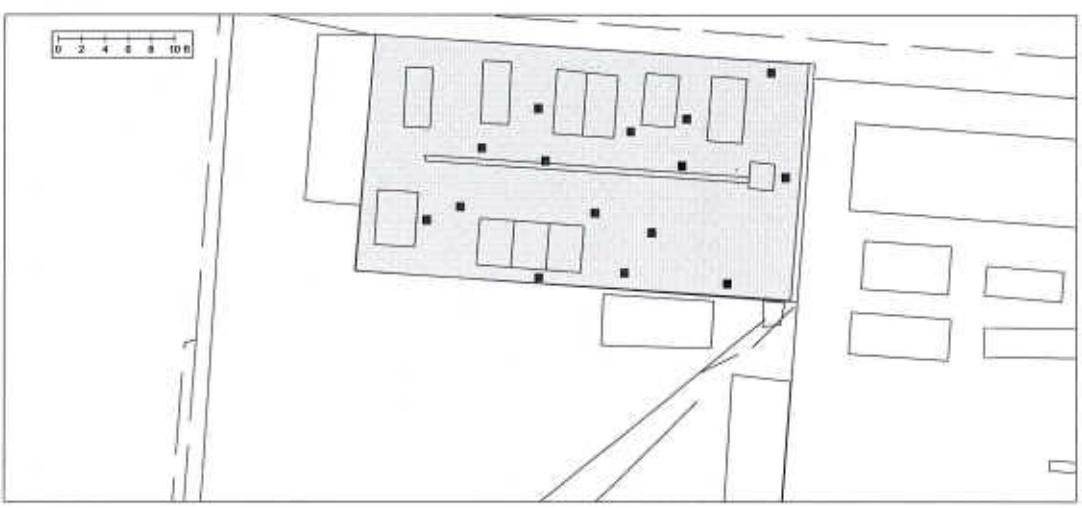
Summary

This report summarizes the sampling design used, associated statistical assumptions, as well as general guidelines for conducting post-sampling data analysis. Sampling plan components presented here include how many sampling locations to choose and where within the sampling area to collect those samples. The type of medium to sample (i.e., soil, groundwater, etc.) and how to analyze the samples (in-situ, fixed laboratory, etc.) are addressed in other sections of the sampling plan.

The following table summarizes the sampling design developed. A figure that shows sampling locations in the field and a table that lists sampling location coordinates are also provided below.

SUMMARY OF SAMPLING DESIGN	
Primary Objective of Design	Construct a Confidence Interval on the True Median
Type of Sampling Design	Non-Parametric
Sample Placement (Location) in the Field	Simple random sampling
Formula for calculating number of sampling locations	Nonparametric Confidence Limits
Calculated total number of samples	15
Number of samples on map [a]	15
Number of selected sample areas [b]	1
Specified sampling area [c]	755.90 ft^2
Total cost of sampling [d]	$6,700.00

[a] This number may differ from the calculated number because of 1) grid edge effects, 2) adding judgment samples, or 3) selecting or unselecting sample areas.
[b] The number of selected sample areas is the number of colored areas on the map of the site. These sample areas contain the locations where samples are collected.
[c] The sampling area is the total surface area of the selected colored sample areas on the map of the site.
[d] Including measurement analyses and fixed overhead costs. See the Cost of Sampling section for an explanation of the costs presented here.



Area: Area 1					
X Coord	Y Coord	Label	Value	Type	Historical

4928.9658	5229.8854	GP-44	0.017	Random	
4922.1885	5239.3872	GP-51	0.62	Random	
4941.7431	5246.8890	GP-49	0.95	Random	
4911.9669	5234.3860	GP-55	0.0175	Random	
4929.5215	5241.8878	GP-50	0.0365	Random	
4914.8555	5235.4974	GP-54	0.0175	Random	
4934.4101	5242.9992	GP-48	0.016	Random	
4921.6328	5229.4961	GP-57	0.016	Random	
4943.0000	5237.9980	GP-46	0.0365	Random	
4926.4661	5234.9967	GP-56	0.017	Random	
4916.6888	5240.4986	GP-53	0.0017	Random	
4931.3547	5233.3309	GP-45	0.017	Random	
4921.5774	5243.8327	GP-52	0.0175	Random	
4938.0000	5229.0000	GP-43	0.0155	Unknown	
4934.0000	5239.0000	GP-47	1.9	Unknown	

Primary Sampling Objective
The primary purpose of sampling at this site is to construct a confidence interval on the true population median value. After the samples are collected and analyzed, the resulting sample values can be used to construct a two-sided confidence interval. Once the confidence interval is computed (which will be an upper and a lower threshold), you can have the specified confidence that the true population median is between the upper and lower thresholds.

Selected Sampling Approach
A non-parametric random sampling approach was used to determine the number of samples and to specify sampling locations. A parametric formula was not chosen because the conceptual model and historical information (e.g., historical data from this site or a very similar site) indicate that parametric assumptions are not true. These assumptions will be examined in post-sampling data analysis.

Both parametric and non-parametric equations rely on assumptions about the population. Typically, however, non-parametric equations require fewer assumptions and allow for more uncertainty about the statistical distribution of values at the site. The trade-off is that if the parametric assumptions are valid, the required number of samples is usually less than if a non-parametric equation was used.

Locating the sample points randomly provides data that are separated by many distances, whereas systematic samples are all equidistant apart. Therefore, random sampling provides more information about the spatial structure of the potential contamination than systematic sampling does. As with systematic sampling, random sampling also provides information regarding the mean or median value, but there is the possibility that areas of the site will not be represented with the same frequency as if uniform grid sampling were performed.

Number of Total Samples: Calculation Equation and Inputs
Two sample confidence interval calculation methods are available for when n□20 and n>20 (Conover, 1980, p. 111-117) (Gilbert, 1987,p. 141-142). In VSP, the user specifies a one-sided or two-sided CI, and the percent confidence desired to be within a specified number of percentiles of the median. A binary search is then performed on the CI equations to solve for the minimum sample size to satisfy these parameters. VSP first uses the n□20 method to determine if a solution can be found where n□20, and if not, then uses the n>20 method.

For a one-sided CI, the n□20 method follows a binomial distribution and determines the lowest value of n where the yth quantile of the sample would be equal to or above the true median at least X% of the time (Note that the sample sizes work out to be the same regardless of whether the CI will be a lower or upper tailed, so the same formula can be used for any one-sided CI). X% is the specified confidence for one-sided confidence intervals, and the average of 100% and the specified confidence for two-sided confidence intervals. The yth quantile is determined by taking 50% and subtracting the allowable number of percentiles from the median specified by the user.

For a two-sided CI, the n□20 method is the same as performing a one-sided confidence interval, but replacing the

specified percent confidence with the average of 100% and the specified percent confidence. If no solution is found where n□20, a binary search is conducted using Equation (1) for a one-sided CI and Equation (2) for a two-sided interval to compute the value of r (r is the the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest), rounding r up to the next higher integer. The search is repeated until the smallest n is found where 100*2*r/n is greater than 50% minus the allowable number of percentiles from the median specified by the user.

$$r = 0.5*n - 0.5*w_{\alpha}\sqrt{n} \qquad (1)$$

$$r = 0.5*n - 0.5*w_{\alpha/2}\sqrt{n} \qquad (2)$$

Where:

n is the sample size

r is the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest

$w_{\square}$ is the specified quantile of a normal distribution, e.g. if □=0.2 then $w_{\square}$ is the 0.2 quantile (20th percentile) of a normal distribution.

The n>20 method described above is an approximation method, so VSP also performs a final check using a binomial distribution in a similar manner to the n□20 method, and may increase the sample size by 1 to ensure the specified confidence levels are met.

Cost of Sampling

The total cost of the completed sampling program depends on several cost inputs, some of which are fixed, and others that are based on the number of samples collected and measured. Based on the numbers of samples determined above, the estimated total cost of sampling and analysis at this site is $6,700.00, which averages out to a per sample cost of $446.67. The following table summarizes the inputs and resulting cost estimates.

COST INFORMATION			
Cost Details	**Per Analysis**	**Per Sample**	**15 Samples**
Field collection costs		$250.00	$3,750.00
Analytical costs	$130.00	$130.00	$1,950.00
Sum of Field & Analytical costs		**$380.00**	**$5,700.00**
Fixed planning and validation costs			$1,000.00
Total cost			**$6,700.00**

Data Analysis for Cd

The following data points were entered by the user for analysis.

Cd										
Rank	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
0	0.0017	0.0155	0.016	0.016	0.017	0.017	0.017	0.0175	0.0175	0.0175
10	0.0365	0.0365	0.62	0.95	1.9					

SUMMARY STATISTICS for Cd	
n	15
Min	0.0017
Max	1.9

Range				1.8983				
Mean				0.24638				
Median				0.0175				
Variance				0.28511				
StdDev				0.53396				
Std Error				0.13787				
Skewness				2.5879				
Interquartile Range				0.0205				
Percentiles								
1%	**5%**	**10%**	**25%**	**50%**	**75%**	**90%**	**95%**	**99%**
0.0017	0.0017	0.00998	0.016	0.0175	0.0365	1.33	1.9	1.9

Data Plots
Three graphical displays of the data are shown below: the Histogram, the Box and Whiskers plot, and the Quantile-Quantile (Q-Q) plot.

The Histogram is a plot of the fraction of the n observed data that fall within specified data "bins." A histogram is generated by dividing the x axis (range of the observed data values) into "bins" and displaying the number of data in each bin as the height of a bar for the bin. The area of the bar is the fraction of the n data values that lie within the bin. The sum of the fractions for all bins equals one. A histogram is used to assess how the n data are distributed (spread) over their range of values. If the histogram is more or less symmetric and bell shaped, then the data may be normally distributed.

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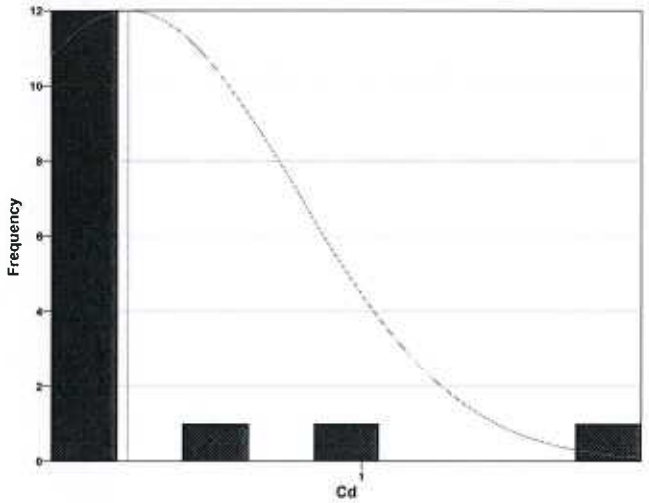

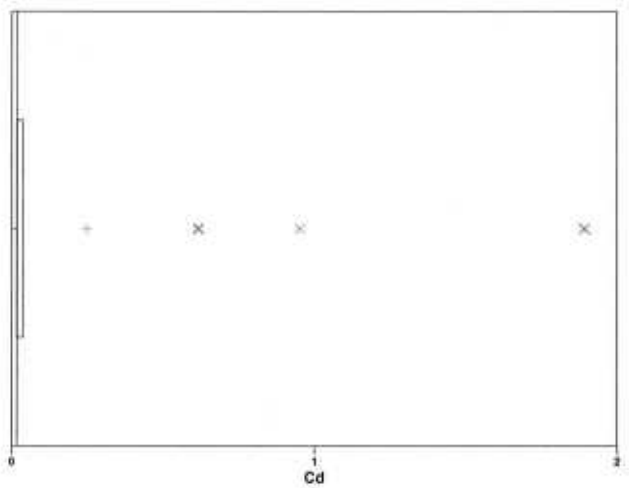

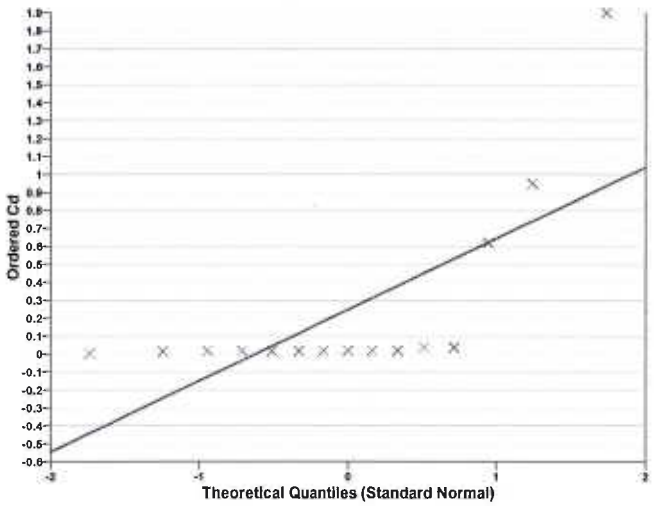

For more information on these three plots consult Guidance for Data Quality Assessment, EPA QA/G-9, pgs 2.3-1 through 2.3-12. (http://www.epa.gov/quality/qa-docs.html).

Two-Sided Confidence Interval on the True Median

For calculating the confidence interval, the values are ordered from smallest to largest. The confidence limits are the highest value of the r+1 and/or lowest value of the s-1 order statistics that fit the formulas below, except when the rth ordered value is tied with higher ordered values or the sth ordered value is tied with lower ordered values. If higher numbered ordered values are ties with the rth ordered value, then the closest ordered value that is lower than r will be the confidence limit. If higher-numbered ordered values are ties with the sth ordered value, then the closest ordered value that is higher than s will be the confidence limit.

Upper Two-Sided Confidence Interval

$$\sum_{s}^{1}\left(\frac{n!}{r!(n-s)!}\right)p^{0.5}(1-p)^{n-0.5} \geq 1-\alpha/2$$

Lower Two-Sided Confidence interval

$$\sum_{r}^{1}\left(\frac{n!}{r!(n-r)!}\right)p^{0.5}(1-p)^{n-0.5} \leq \alpha/2$$

Upper 95% Two-Sided Confidence Interval on the Median	0.62

Sample Median	0.0175
Lower 95% Two-Sided Confidence Interval on the Median	0.016

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Elect. Bldg Cr +3

VSP Sample Design Report for Calculating a Two-Sided Confidence Interval for the Population Median Using Simple Random Sampling

Summary

This report summarizes the sampling design used, associated statistical assumptions, as well as general guidelines for conducting post-sampling data analysis. Sampling plan components presented here include how many sampling locations to choose and where within the sampling area to collect those samples. The type of medium to sample (i.e., soil, groundwater, etc.) and how to analyze the samples (in-situ, fixed laboratory, etc.) are addressed in other sections of the sampling plan.

The following table summarizes the sampling design developed. A figure that shows sampling locations in the field and a table that lists sampling location coordinates are also provided below.

SUMMARY OF SAMPLING DESIGN	
Primary Objective of Design	Construct a Confidence Interval on the True Median
Type of Sampling Design	Non-Parametric
Sample Placement (Location) in the Field	Simple random sampling
Formula for calculating number of sampling locations	Nonparametric Confidence Limits
Calculated total number of samples	15
Number of samples on map [a]	14
Number of selected sample areas [b]	1
Specified sampling area [c]	755.90 ft^2
Total cost of sampling [d]	$6,700.00

[a] This number may differ from the calculated number because of 1) grid edge effects, 2) adding judgment samples, or 3) selecting or unselecting sample areas.
[b] The number of selected sample areas is the number of colored areas on the map of the site. These sample areas contain the locations where samples are collected.
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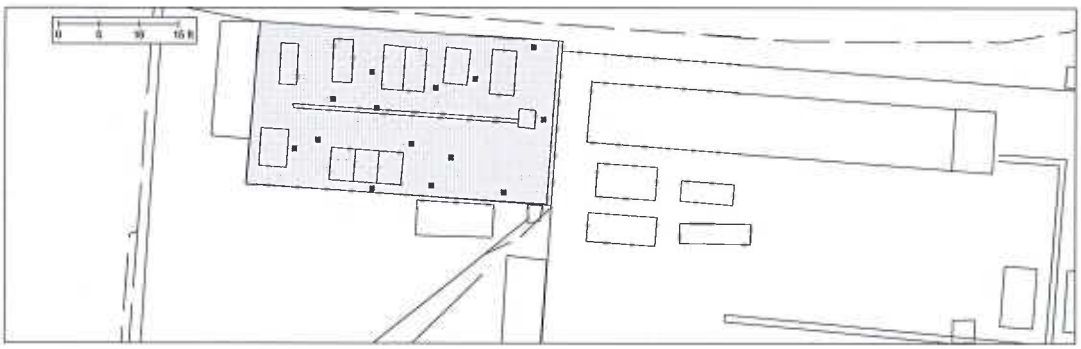
[d] Including measurement analyses and fixed overhead costs. See the Cost of Sampling section for an explanation of the costs presented here.



Area: Area 1					
X Coord	Y Coord	Label	Value	Type	Historical
4928.9658	5229.8854	GP-44	15.9	Random	
4922.1885	5239.3872	GP-51	89	Random	
4941.7431	5246.8890	GP-49	4.19	Random	

4911.9669	5234.3860	GP-55	19	Random	
4929.5215	5241.8878	GP-50	23.67	Random	
4914.8555	5235.4974	GP-54	14	Random	
4934.4101	5242.9992	GP-48	21	Random	
4921.6328	5229.4961	GP-57	24.2	Random	
4943.0000	5237.9980	GP-46	38	Random	
4926.4661	5234.9967	GP-56	43	Random	
4916.6888	5240.4986	GP-53	14	Random	
4931.3547	5233.3309	GP-45	25	Random	
4921.5774	5243.8327	GP-52	16.47	Random	
4938.0000	5229.0000	GP-43	9.1	Unknown	

Primary Sampling Objective
The primary purpose of sampling at this site is to construct a confidence interval on the true population median value. After the samples are collected and analyzed, the resulting sample values can be used to construct a two-sided confidence interval. Once the confidence interval is computed (which will be an upper and a lower threshold), you can have the specified confidence that the true population median is between the upper and lower thresholds.

Selected Sampling Approach
A non-parametric random sampling approach was used to determine the number of samples and to specify sampling locations. A parametric formula was not chosen because the conceptual model and historical information (e.g., historical data from this site or a very similar site) indicate that parametric assumptions are not true. These assumptions will be examined in post-sampling data analysis.

Both parametric and non-parametric equations rely on assumptions about the population. Typically, however, non-parametric equations require fewer assumptions and allow for more uncertainty about the statistical distribution of values at the site. The trade-off is that if the parametric assumptions are valid, the required number of samples is usually less than if a non-parametric equation was used.

Locating the sample points randomly provides data that are separated by many distances, whereas systematic samples are all equidistant apart. Therefore, random sampling provides more information about the spatial structure of the potential contamination than systematic sampling does. As with systematic sampling, random sampling also provides information regarding the mean or median value, but there is the possibility that areas of the site will not be represented with the same frequency as if uniform grid sampling were performed.

Number of Total Samples: Calculation Equation and Inputs
Two sample confidence interval calculation methods are available for when n□20 and n>20 (Conover, 1980, p. 111-117) (Gilbert, 1987,p. 141-142). In VSP, the user specifies a one-sided or two-sided CI, and the percent confidence desired to be within a specified number of percentiles of the median. A binary search is then performed on the CI equations to solve for the minimum sample size to satisfy these parameters. VSP first uses the n□20 method to determine if a solution can be found where n□20, and if not, then uses the n>20 method.

For a one-sided CI, the n□20 method follows a binomial distribution and determines the lowest value of n where the yth quantile of the sample would be equal to or above the true median at least X% of the time (Note that the sample sizes work out to be the same regardless of whether the CI will be a lower or upper tailed, so the same formula can be used for any one-sided CI). X% is the specified confidence for one-sided confidence intervals, and the average of 100% and the specified confidence for two-sided confidence intervals. The yth quantile is determined by taking 50% and subtracting the allowable number of percentiles from the median specified by the user.

For a two-sided CI, the n□20 method is the same as performing a one-sided confidence interval, but replacing the specified percent confidence with the average of 100% and the specified percent confidence. If no solution is found where n□20, a binary search is conducted using Equation (1) for a one-sided CI and Equation (2) for a two-sided interval to compute the value of r (r is the the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest), rounding r up to the next higher integer. The search is repeated until the smallest n is found where 100*2*r/n is greater than 50% minus the allowable number of percentiles from the median specified by the user.

$$r = 0.5 * n - 0.5 * w_{\alpha} \sqrt{n} \qquad (1)$$

$$r = 0.5 * n - 0.5 * w_{\alpha/2} \sqrt{n} \qquad (2)$$

Where:

n is the sample size

r is the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest

$w_{\square}$ is the specified quantile of a normal distribution, e.g. if $\square$=0.2 then $w_{\square}$ is the 0.2 quantile (20th percentile) of a normal distribution.

The n>20 method described above is an approximation method, so VSP also performs a final check using a binomial distribution in a similar manner to the n$\square$20 method, and may increase the sample size by 1 to ensure the specified confidence levels are met.

Cost of Sampling
The total cost of the completed sampling program depends on several cost inputs, some of which are fixed, and others that are based on the number of samples collected and measured. Based on the numbers of samples determined above, the estimated total cost of sampling and analysis at this site is $6,700.00, which averages out to a per sample cost of $446.67. The following table summarizes the inputs and resulting cost estimates.

COST INFORMATION			
Cost Details	**Per Analysis**	**Per Sample**	**15 Samples**
Field collection costs		$250.00	$3,750.00
Analytical costs	$130.00	$130.00	$1,950.00
Sum of Field & Analytical costs		**$380.00**	**$5,700.00**
Fixed planning and validation costs			$1,000.00
Total cost			**$6,700.00**

Data Analysis for Cr+3
The following data points were entered by the user for analysis.

Cr+3										
Rank	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
0	4.19	9.1	14	14	15.9	16.47	19	21	23.67	24.2
10	25	38	43	89						

SUMMARY STATISTICS for Cr+3	
n	14
Min	4.19
Max	89
Range	84.81
Mean	25.466
Median	20
Variance	440.29
StdDev	20.983

Std Error				5.608				
Skewness				2.3781				
Interquartile Range				14.25				
Percentiles								
1%	5%	10%	25%	50%	75%	90%	95%	99%
4.19	4.19	6.645	14	20	28.25	66	89	89

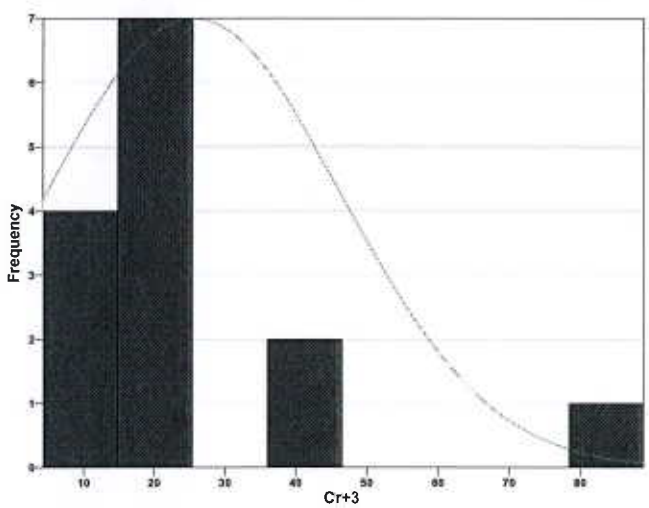
Data Plots

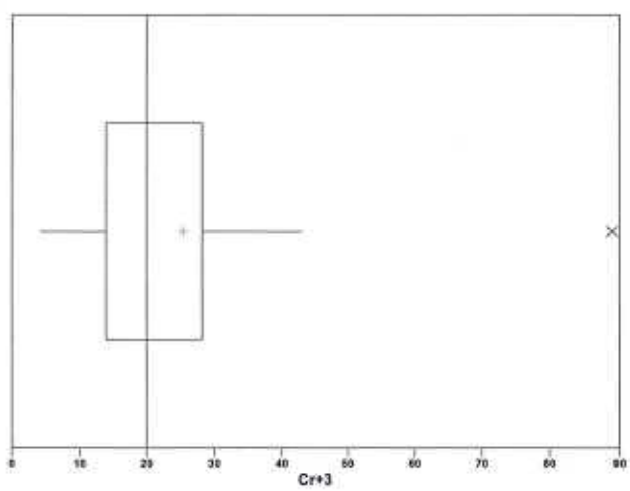
Three graphical displays of the data are shown below: the Histogram, the Box and Whiskers plot, and the Quantile-Quantile (Q-Q) plot.

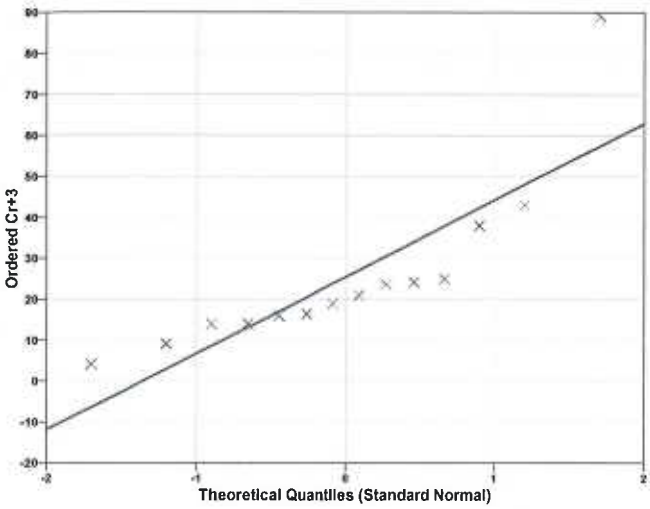
The Histogram is a plot of the fraction of the n observed data that fall within specified data "bins." A histogram is generated by dividing the x axis (range of the observed data values) into "bins" and displaying the number of data in each bin as the height of a bar for the bin. The area of the bar is the fraction of the n data values that lie within the bin. The sum of the fractions for all bins equals one. A histogram is used to assess how the n data are distributed (spread) over their range of values. If the histogram is more or less symmetric and bell shaped, then the data may be normally distributed.

The Box and Whiskers plot is composed of a central box divided by a line, and with two lines extending out from the box, called the "whiskers". The line through the box is drawn at the median of the n data observed. The two ends of the box represent the 25th and 75th percentiles of the n data values, which are also called the lower and upper quartiles, respectively, of the data set. The sample mean (mean of the n data) is shown as a "+" sign. The upper whisker extends to the largest data value that is less than the upper quartile plus 1.5 times the interquartile range (upper quartile minus the lower quartile). The lower whisker extends to the smallest data value that is greater than the lower quartile minus 1.5 times the interquartile range. Extreme data values (greater or smaller than the ends of the whiskers) are plotted individually. A Box and Whiskers plot is used to assess the symmetry of the distribution of the data set. If the distribution is symmetrical, the box is divided into two equal halves by the median, the whiskers will be the same length, and the number of extreme data points will be distributed equally on either end of the plot.

The Q-Q plot graphs the quantiles of a set of n data against the quantiles of a specific distribution. We show here only the Q-Q plot for an assumed normal distribution. The pth quantile of a distribution of data is the data value, x_p, for which a fraction p of the distribution is less than x_p. If the data plotted on the normal distribution Q-Q plot closely follow a straight line, even at the ends of the line, then the data may be assumed to be normally distributed. If the data points deviate substantially from a linear line, then the data are not normally distributed.







For more information on these three plots consult Guidance for Data Quality Assessment, EPA QA/G-9, pgs 2.3-1 through 2.3-12. (http://www.epa.gov/quality/qa-docs.html).

Two-Sided Confidence Interval on the True Median

For calculating the confidence interval, the values are ordered from smallest to largest. The confidence limits are the highest value of the r+1 and/or lowest value of the s-1 order statistics that fit the formulas below, except when the rth ordered value is tied with higher ordered values or the sth ordered value is tied with lower ordered values. If higher numbered ordered values are ties with the rth ordered value, then the closest ordered value that is lower than r will be the confidence limit. If higher-numbered ordered values are ties with the sth ordered value, then the closest ordered value that is higher than s will be the confidence limit.

Upper Two-Sided Confidence Interval

$$\sum_{s}^{1}\left(\frac{n!}{r!(n-s)!}\right)p^{0.5}(1-p)^{n-0.5} \geq 1-\alpha/2$$

Lower Two-Sided Confidence interval

$$\sum_{r}^{1}\left(\frac{n!}{r!(n-r)!}\right)p^{0.5}(1-p)^{n-0.5} \leq \alpha/2$$

Upper 95% Two-Sided Confidence Interval on the Median	43
Sample Median	20
Lower 95% Two-Sided Confidence Interval on the Median	9.1

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* - The report contents may have been modified or reformatted by end-user of software.

Elect. Bldg Cr+3 brasch

VSP Sample Design Report for Calculating a Two-Sided Confidence Interval for the Population Median Using Simple Random Sampling

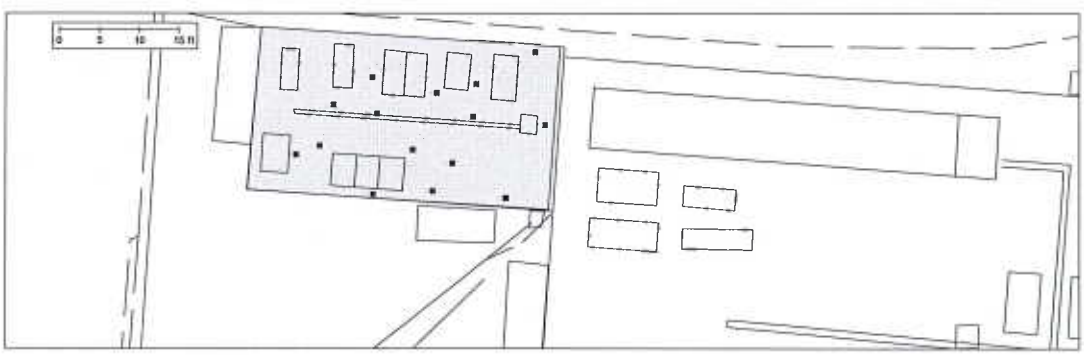
Summary

This report summarizes the sampling design used, associated statistical assumptions, as well as general guidelines for conducting post-sampling data analysis. Sampling plan components presented here include how many sampling locations to choose and where within the sampling area to collect those samples. The type of medium to sample (i.e., soil, groundwater, etc.) and how to analyze the samples (in-situ, fixed laboratory, etc.) are addressed in other sections of the sampling plan.

The following table summarizes the sampling design developed. A figure that shows sampling locations in the field and a table that lists sampling location coordinates are also provided below.

SUMMARY OF SAMPLING DESIGN	
Primary Objective of Design	Construct a Confidence Interval on the True Median
Type of Sampling Design	Non-Parametric
Sample Placement (Location) in the Field	Simple random sampling
Formula for calculating number of sampling locations	Nonparametric Confidence Limits
Calculated total number of samples	15
Number of samples on map [a]	15
Number of selected sample areas [b]	1
Specified sampling area [c]	755.90 ft^2
Total cost of sampling [d]	$6,700.00

[a] This number may differ from the calculated number because of 1) grid edge effects, 2) adding judgment samples, or 3) selecting or unselecting sample areas.
[b] The number of selected sample areas is the number of colored areas on the map of the site. These sample areas contain the locations where samples are collected.
[c] The sampling area is the total surface area of the selected colored sample areas on the map of the site.
[d] Including measurement analyses and fixed overhead costs. See the Cost of Sampling section for an explanation of the costs presented here.



Area: Area 1					
X Coord	Y Coord	Label	Value	Type	Historical
4928.9658	5229.8854	GP-44	15.9	Random	
4922.1885	5239.3872	GP-51	89	Random	
4941.7431	5246.8890	GP-49	4.19	Random	

4911.9669	5234.3860	GP-55	19	Random	
4929.5215	5241.8878	GP-50	23.67	Random	
4914.8555	5235.4974	GP-54	14	Random	
4934.4101	5242.9992	GP-48	21	Random	
4921.6328	5229.4961	GP-57	24.2	Random	
4943.0000	5237.9980	GP-46	38	Random	
4926.4661	5234.9967	GP-56	43	Random	
4916.6888	5240.4986	GP-53	14	Random	
4931.3547	5233.3309	GP-45	25	Random	
4921.5774	5243.8327	GP-52	16.47	Random	
4938.0000	5229.0000	GP-43	9.1	Unknown	
4934.0000	5239.0000	GP-47	6.5	Unknown	

Primary Sampling Objective
The primary purpose of sampling at this site is to construct a confidence interval on the true population median value. After the samples are collected and analyzed, the resulting sample values can be used to construct a two-sided confidence interval. Once the confidence interval is computed (which will be an upper and a lower threshold), you can have the specified confidence that the true population median is between the upper and lower thresholds.

Selected Sampling Approach
A non-parametric random sampling approach was used to determine the number of samples and to specify sampling locations. A parametric formula was not chosen because the conceptual model and historical information (e.g., historical data from this site or a very similar site) indicate that parametric assumptions are not true. These assumptions will be examined in post-sampling data analysis.

Both parametric and non-parametric equations rely on assumptions about the population. Typically, however, non-parametric equations require fewer assumptions and allow for more uncertainty about the statistical distribution of values at the site. The trade-off is that if the parametric assumptions are valid, the required number of samples is usually less than if a non-parametric equation was used.

Locating the sample points randomly provides data that are separated by many distances, whereas systematic samples are all equidistant apart. Therefore, random sampling provides more information about the spatial structure of the potential contamination than systematic sampling does. As with systematic sampling, random sampling also provides information regarding the mean or median value, but there is the possibility that areas of the site will not be represented with the same frequency as if uniform grid sampling were performed.

Number of Total Samples: Calculation Equation and Inputs
Two sample confidence interval calculation methods are available for when n□20 and n>20 (Conover, 1980, p. 111-117) (Gilbert, 1987,p. 141-142). In VSP, the user specifies a one-sided or two-sided CI, and the percent confidence desired to be within a specified number of percentiles of the median. A binary search is then performed on the CI equations to solve for the minimum sample size to satisfy these parameters. VSP first uses the n□20 method to determine if a solution can be found where n□20, and if not, then uses the n>20 method.

For a one-sided CI, the n□20 method follows a binomial distribution and determines the lowest value of n where the yth quantile of the sample would be equal to or above the true median at least X% of the time (Note that the sample sizes work out to be the same regardless of whether the CI will be a lower or upper tailed, so the same formula can be used for any one-sided CI). X% is the specified confidence for one-sided confidence intervals, and the average of 100% and the specified confidence for two-sided confidence intervals. The yth quantile is determined by taking 50% and subtracting the allowable number of percentiles from the median specified by the user.

For a two-sided CI, the n□20 method is the same as performing a one-sided confidence interval, but replacing the specified percent confidence with the average of 100% and the specified percent confidence. If no solution is found where n□20, a binary search is conducted using Equation (1) for a one-sided CI and Equation (2) for a two-sided interval to compute the value of r (r is the the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest), rounding r up to the next higher integer. The search is repeated until the smallest n is

found where 100*2*r/n is greater than 50% minus the allowable number of percentiles from the median specified by the user.

$$r = 0.5 * n - 0.5 * w_{\alpha} \sqrt{n} \qquad (1)$$

$$r = 0.5 * n - 0.5 * w_{\alpha/2} \sqrt{n} \qquad (2)$$

Where:

n is the sample size

r is the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest

$w_{\square}$ is the specified quantile of a normal distribution, e.g. if □=0.2 then $w_{\square}$ is the 0.2 quantile (20th percentile) of a normal distribution.

The n>20 method described above is an approximation method, so VSP also performs a final check using a binomial distribution in a similar manner to the n□20 method, and may increase the sample size by 1 to ensure the specified confidence levels are met.

Cost of Sampling
The total cost of the completed sampling program depends on several cost inputs, some of which are fixed, and others that are based on the number of samples collected and measured. Based on the numbers of samples determined above, the estimated total cost of sampling and analysis at this site is $6,700.00, which averages out to a per sample cost of $446.67. The following table summarizes the inputs and resulting cost estimates.

COST INFORMATION			
Cost Details	**Per Analysis**	**Per Sample**	**15 Samples**
Field collection costs		$250.00	$3,750.00
Analytical costs	$130.00	$130.00	$1,950.00
Sum of Field & Analytical costs		**$380.00**	**$5,700.00**
Fixed planning and validation costs			$1,000.00
Total cost			**$6,700.00**

Data Analysis for Cr+3
The following data points were entered by the user for analysis.

Cr+3										
Rank	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
0	4.19	6.5	9.1	14	14	15.9	16.47	19	21	23.67
10	24.2	25	38	43	89					

SUMMARY STATISTICS for Cr+3	
n	15
Min	4.19
Max	89
Range	84.81
Mean	24.202
Median	19

Variance	432.82
StdDev	20.804
Std Error	5.3717
Skewness	2.3889
Interquartile Range	11

Percentiles								
1%	**5%**	**10%**	**25%**	**50%**	**75%**	**90%**	**95%**	**99%**
4.19	4.19	5.576	14	19	25	61.4	89	89

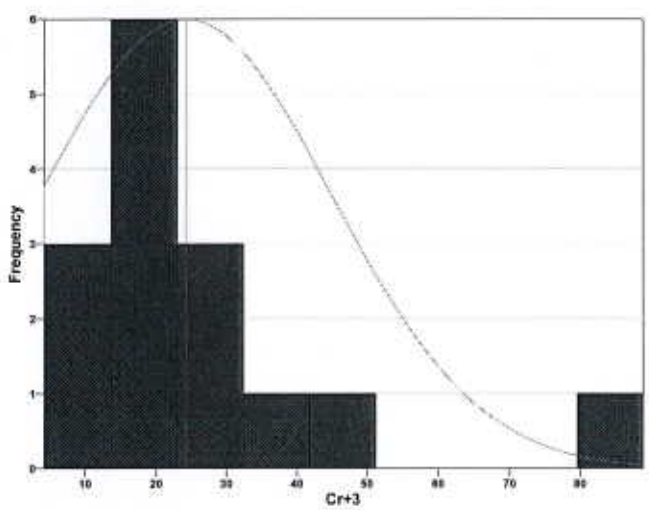
Data Plots

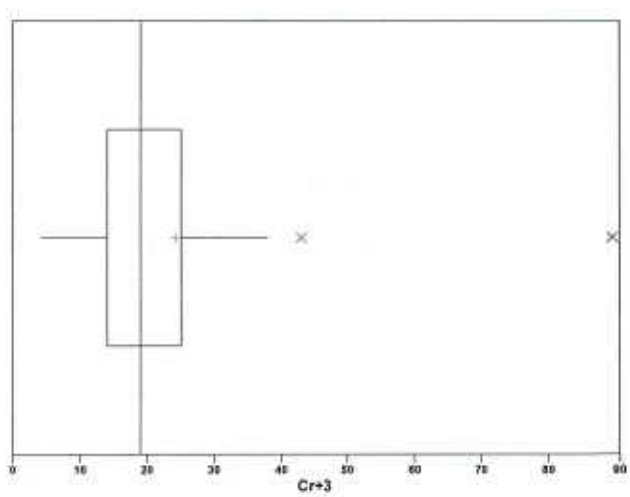
Three graphical displays of the data are shown below: the Histogram, the Box and Whiskers plot, and the Quantile-Quantile (Q-Q) plot.

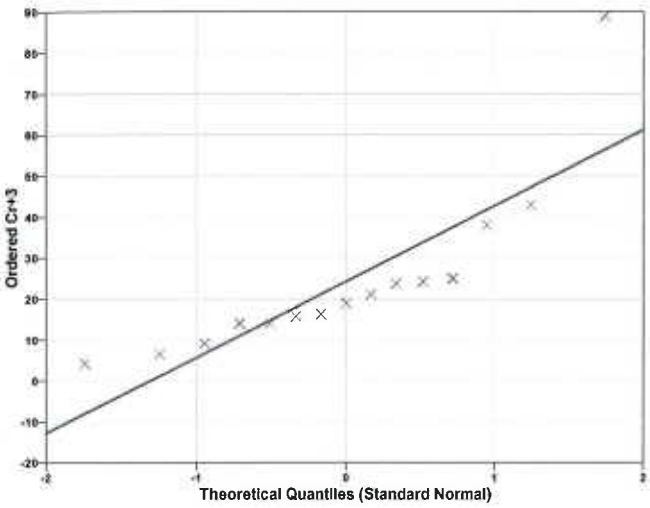
The Histogram is a plot of the fraction of the n observed data that fall within specified data "bins." A histogram is generated by dividing the x axis (range of the observed data values) into "bins" and displaying the number of data in each bin as the height of a bar for the bin. The area of the bar is the fraction of the n data values that lie within the bin. The sum of the fractions for all bins equals one. A histogram is used to assess how the n data are distributed (spread) over their range of values. If the histogram is more or less symmetric and bell shaped, then the data may be normally distributed.

The Box and Whiskers plot is composed of a central box divided by a line, and with two lines extending out from the box, called the "whiskers". The line through the box is drawn at the median of the n data observed. The two ends of the box represent the 25th and 75th percentiles of the n data values, which are also called the lower and upper quartiles, respectively, of the data set. The sample mean (mean of the n data) is shown as a "+" sign. The upper whisker extends to the largest data value that is less than the upper quartile plus 1.5 times the interquartile range (upper quartile minus the lower quartile). The lower whisker extends to the smallest data value that is greater than the lower quartile minus 1.5 times the interquartile range. Extreme data values (greater or smaller than the ends of the whiskers) are plotted individually. A Box and Whiskers plot is used to assess the symmetry of the distribution of the data set. If the distribution is symmetrical, the box is divided into two equal halves by the median, the whiskers will be the same length, and the number of extreme data points will be distributed equally on either end of the plot.

The Q-Q plot graphs the quantiles of a set of n data against the quantiles of a specific distribution. We show here only the Q-Q plot for an assumed normal distribution. The pth quantile of a distribution of data is the data value, x_n, for which a fraction p of the distribution is less than x_n. If the data plotted on the normal distribution Q-Q plot closely follow a straight line, even at the ends of the line, then the data may be assumed to be normally distributed. If the data points deviate substantially from a linear line, then the data are not normally distributed.







For more information on these three plots consult Guidance for Data Quality Assessment, EPA QA/G-9, pgs 2.3-1 through 2.3-12. (http://www.epa.gov/quality/qa-docs.html).

Two-Sided Confidence Interval on the True Median

For calculating the confidence interval, the values are ordered from smallest to largest. The confidence limits are the highest value of the r+1 and/or lowest value of the s-1 order statistics that fit the formulas below, except when the rth ordered value is tied with higher ordered values or the sth ordered value is tied with lower ordered values. If higher numbered ordered values are ties with the rth ordered value, then the closest ordered value that is lower than r will be the confidence limit. If higher-numbered ordered values are ties with the sth ordered value, then the closest ordered value that is higher than s will be the confidence limit.

Upper Two-Sided Confidence Interval

$$\sum_{s}^{1}\left(\frac{n!}{r!(n-s)!}\right)p^{0.5}(1-p)^{n-0.5} \geq 1-\alpha/2$$

Lower Two-Sided Confidence interval

$$\sum_{r}^{1}\left(\frac{n!}{r!(n-r)!}\right)p^{0.5}(1-p)^{n-0.5} \leq \alpha/2$$

Upper 95% Two-Sided Confidence Interval on the Median	38
Sample Median	19
Lower 95% Two-Sided Confidence Interval on the Median	9.1

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* - The report contents may have been modified or reformatted by end-user of software.

Elect. Bldg Cr+6

VSP Sample Design Report for Calculating a Two-Sided Confidence Interval for the Population Median Using Simple Random Sampling

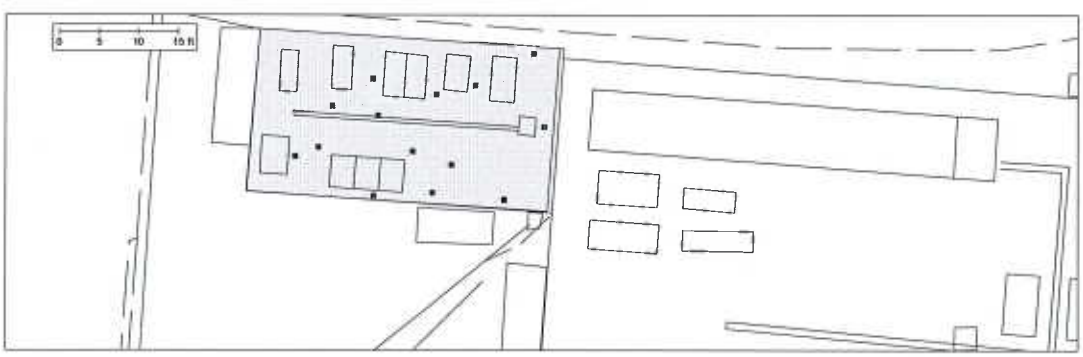
Summary

This report summarizes the sampling design used, associated statistical assumptions, as well as general guidelines for conducting post-sampling data analysis. Sampling plan components presented here include how many sampling locations to choose and where within the sampling area to collect those samples. The type of medium to sample (i.e., soil, groundwater, etc.) and how to analyze the samples (in-situ, fixed laboratory, etc.) are addressed in other sections of the sampling plan.

The following table summarizes the sampling design developed. A figure that shows sampling locations in the field and a table that lists sampling location coordinates are also provided below.

SUMMARY OF SAMPLING DESIGN	
Primary Objective of Design	Construct a Confidence Interval on the True Median
Type of Sampling Design	Non-Parametric
Sample Placement (Location) in the Field	Simple random sampling
Formula for calculating number of sampling locations	Nonparametric Confidence Limits
Calculated total number of samples	15
Number of samples on map [a]	14
Number of selected sample areas [b]	1
Specified sampling area [c]	755.90 ft^2
Total cost of sampling [d]	$6,700.00

[a] This number may differ from the calculated number because of 1) grid edge effects, 2) adding judgment samples, or 3) selecting or unselecting sample areas.
[b] The number of selected sample areas is the number of colored areas on the map of the site. These sample areas contain the locations where samples are collected.
[c] The sampling area is the total surface area of the selected colored sample areas on the map of the site.
[d] Including measurement analyses and fixed overhead costs. See the Cost of Sampling section for an explanation of the costs presented here.



Area: Area 1					
X Coord	Y Coord	Label	Value	Type	Historical
4928.9658	5229.8854	GP-44	17.1	Random	
4922.1885	5239.3872	GP-51	0.165	Random	
4941.7431	5246.8890	GP-49	3.81	Random	

4911.9669	5234.3860	GP-55	0.168	Random	
4929.5215	5241.8878	GP-50	2.33	Random	
4914.8555	5235.4974	GP-54	0.163	Random	
4934.4101	5242.9992	GP-48	0.16	Random	
4921.6328	5229.4961	GP-57	68.8	Random	
4943.0000	5237.9980	GP-46	0.155	Random	
4926.4661	5234.9967	GP-56	15	Random	
4916.6888	5240.4986	GP-53	0.165	Random	
4931.3547	5233.3309	GP-45	0.171	Random	
4921.5774	5243.8327	GP-52	0.53	Random	
4938.0000	5229.0000	GP-43	0.491	Unknown	

Primary Sampling Objective
The primary purpose of sampling at this site is to construct a confidence interval on the true population median value. After the samples are collected and analyzed, the resulting sample values can be used to construct a two-sided confidence interval. Once the confidence interval is computed (which will be an upper and a lower threshold), you can have the specified confidence that the true population median is between the upper and lower thresholds.

Selected Sampling Approach
A non-parametric random sampling approach was used to determine the number of samples and to specify sampling locations. A parametric formula was not chosen because the conceptual model and historical information (e.g., historical data from this site or a very similar site) indicate that parametric assumptions are not true. These assumptions will be examined in post-sampling data analysis.

Both parametric and non-parametric equations rely on assumptions about the population. Typically, however, non-parametric equations require fewer assumptions and allow for more uncertainty about the statistical distribution of values at the site. The trade-off is that if the parametric assumptions are valid, the required number of samples is usually less than if a non-parametric equation was used.

Locating the sample points randomly provides data that are separated by many distances, whereas systematic samples are all equidistant apart. Therefore, random sampling provides more information about the spatial structure of the potential contamination than systematic sampling does. As with systematic sampling, random sampling also provides information regarding the mean or median value, but there is the possibility that areas of the site will not be represented with the same frequency as if uniform grid sampling were performed.

Number of Total Samples: Calculation Equation and Inputs
Two sample confidence interval calculation methods are available for when n□20 and n>20 (Conover, 1980, p. 111-117) (Gilbert, 1987,p. 141-142). In VSP, the user specifies a one-sided or two-sided CI, and the percent confidence desired to be within a specified number of percentiles of the median. A binary search is then performed on the CI equations to solve for the minimum sample size to satisfy these parameters. VSP first uses the n□20 method to determine if a solution can be found where n□20, and if not, then uses the n>20 method.

For a one-sided CI, the n□20 method follows a binomial distribution and determines the lowest value of n where the yth quantile of the sample would be equal to or above the true median at least X% of the time (Note that the sample sizes work out to be the same regardless of whether the CI will be a lower or upper tailed, so the same formula can be used for any one-sided CI). X% is the specified confidence for one-sided confidence intervals, and the average of 100% and the specified confidence for two-sided confidence intervals. The yth quantile is determined by taking 50% and subtracting the allowable number of percentiles from the median specified by the user.

For a two-sided CI, the n□20 method is the same as performing a one-sided confidence interval, but replacing the specified percent confidence with the average of 100% and the specified percent confidence. If no solution is found where n□20, a binary search is conducted using Equation (1) for a one-sided CI and Equation (2) for a two-sided interval to compute the value of r (r is the the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest), rounding r up to the next higher integer. The search is repeated until the smallest n is found where 100*2*r/n is greater than 50% minus the allowable number of percentiles from the median specified by the user.

$$r = 0.5 * n - 0.5 * w_{\alpha} \sqrt{n} \qquad (1)$$

$$r = 0.5 * n - 0.5 * w_{\alpha/2} \sqrt{n} \qquad (2)$$

Where:

n is the sample size

r is the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest

$w_{\square}$ is the specified quantile of a normal distribution, e.g. if $\square$=0.2 then $w_{\square}$ is the 0.2 quantile (20th percentile) of a normal distribution.

The n>20 method described above is an approximation method, so VSP also performs a final check using a binomial distribution in a similar manner to the n$\square$20 method, and may increase the sample size by 1 to ensure the specified confidence levels are met.

Cost of Sampling
The total cost of the completed sampling program depends on several cost inputs, some of which are fixed, and others that are based on the number of samples collected and measured. Based on the numbers of samples determined above, the estimated total cost of sampling and analysis at this site is $6,700.00, which averages out to a per sample cost of $446.67. The following table summarizes the inputs and resulting cost estimates.

COST INFORMATION			
Cost Details	**Per Analysis**	**Per Sample**	**15 Samples**
Field collection costs		$250.00	$3,750.00
Analytical costs	$130.00	$130.00	$1,950.00
Sum of Field & Analytical costs		**$380.00**	**$5,700.00**
Fixed planning and validation costs			$1,000.00
Total cost			**$6,700.00**

Data Analysis for Cr+6
The following data points were entered by the user for analysis.

Cr+6										
Rank	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
0	0.155	0.16	0.163	0.165	0.165	0.168	0.171	0.491	0.53	2.33
10	3.81	15	17.1	68.8						

SUMMARY STATISTICS for Cr+6	
n	14
Min	0.155
Max	68.8
Range	68.645
Mean	7.8006
Median	0.331
Variance	339.97
StdDev	18.438

Std Error				4.9278				
Skewness				3.2074				
Interquartile Range				6.443				
Percentiles								
1%	5%	10%	25%	50%	75%	90%	95%	99%
0.155	0.155	0.1575	0.1645	0.331	6.607	42.95	68.8	68.8

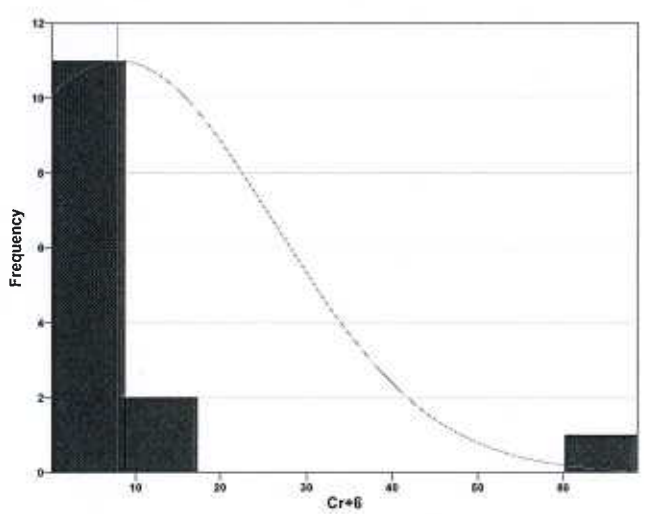
Data Plots

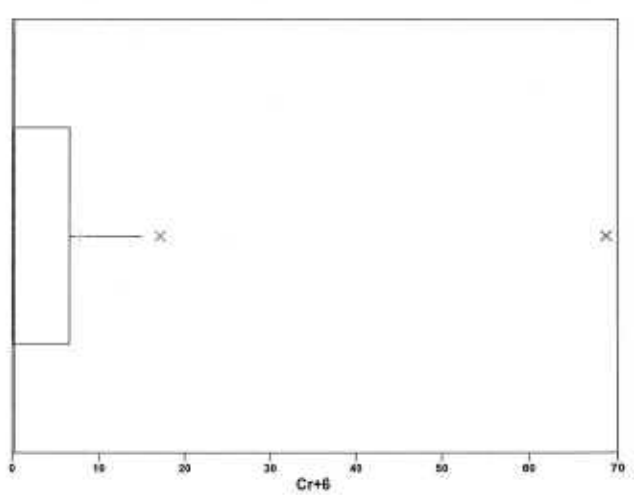
Three graphical displays of the data are shown below: the Histogram, the Box and Whiskers plot, and the Quantile-Quantile (Q-Q) plot.

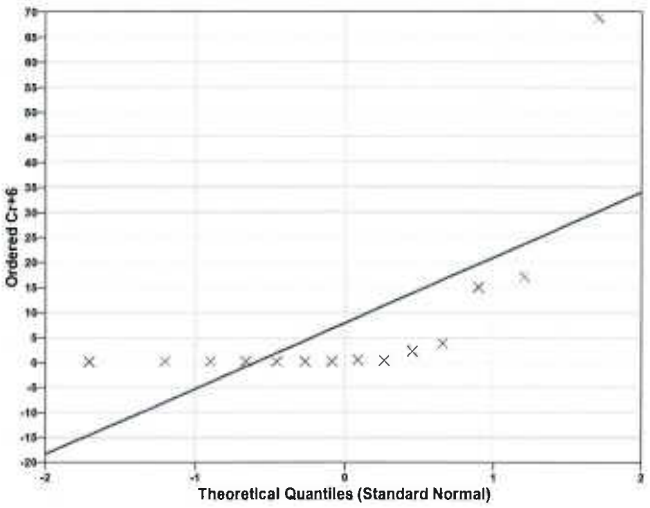
The Histogram is a plot of the fraction of the n observed data that fall within specified data "bins." A histogram is generated by dividing the x axis (range of the observed data values) into "bins" and displaying the number of data in each bin as the height of a bar for the bin. The area of the bar is the fraction of the n data values that lie within the bin. The sum of the fractions for all bins equals one. A histogram is used to assess how the n data are distributed (spread) over their range of values. If the histogram is more or less symmetric and bell shaped, then the data may be normally distributed.

The Box and Whiskers plot is composed of a central box divided by a line, and with two lines extending out from the box, called the "whiskers". The line through the box is drawn at the median of the n data observed. The two ends of the box represent the 25th and 75th percentiles of the n data values, which are also called the lower and upper quartiles, respectively, of the data set. The sample mean (mean of the n data) is shown as a "+" sign. The upper whisker extends to the largest data value that is less than the upper quartile plus 1.5 times the interquartile range (upper quartile minus the lower quartile). The lower whisker extends to the smallest data value that is greater than the lower quartile minus 1.5 times the interquartile range. Extreme data values (greater or smaller than the ends of the whiskers) are plotted individually. A Box and Whiskers plot is used to assess the symmetry of the distribution of the data set. If the distribution is symmetrical, the box is divided into two equal halves by the median, the whiskers will be the same length, and the number of extreme data points will be distributed equally on either end of the plot.

The Q-Q plot graphs the quantiles of a set of n data against the quantiles of a specific distribution. We show here only the Q-Q plot for an assumed normal distribution. The pth quantile of a distribution of data is the data value, x_p, for which a fraction p of the distribution is less than x_p. If the data plotted on the normal distribution Q-Q plot closely follow a straight line, even at the ends of the line, then the data may be assumed to be normally distributed. If the data points deviate substantially from a linear line, then the data are not normally distributed.







For more information on these three plots consult Guidance for Data Quality Assessment, EPA QA/G-9, pgs 2.3-1 through 2.3-12. (http://www.epa.gov/quality/qa-docs.html).

Two-Sided Confidence Interval on the True Median

For calculating the confidence interval, the values are ordered from smallest to largest. The confidence limits are the highest value of the r+1 and/or lowest value of the s-1 order statistics that fit the formulas below, except when the rth ordered value is tied with higher ordered values or the sth ordered value is tied with lower ordered values. If higher numbered ordered values are ties with the rth ordered value, then the closest ordered value that is lower than r will be the confidence limit. If higher-numbered ordered values are ties with the sth ordered value, then the closest ordered value that is higher than s will be the confidence limit.

Upper Two-Sided Confidence Interval

$$\sum_{s}^{1}\left(\frac{n!}{r!(n-s)!}\right)p^{0.5}(1-p)^{n-0.5} \geq 1-\alpha/2$$

Lower Two-Sided Confidence interval

$$\sum_{r}^{1}\left(\frac{n!}{r!(n-r)!}\right)p^{0.5}(1-p)^{n-0.5} \leq \alpha/2$$

Upper 95% Two-Sided Confidence Interval on the Median	17.1
Sample Median	0.331
Lower 95% Two-Sided Confidence Interval on the Median	0.16

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* - The report contents may have been modified or reformatted by end-user of software.

Electrolysis Bldg - Cr+6 Biased

VSP Sample Design Report for Calculating a Two-Sided Confidence Interval for the Population Median Using Simple Random Sampling

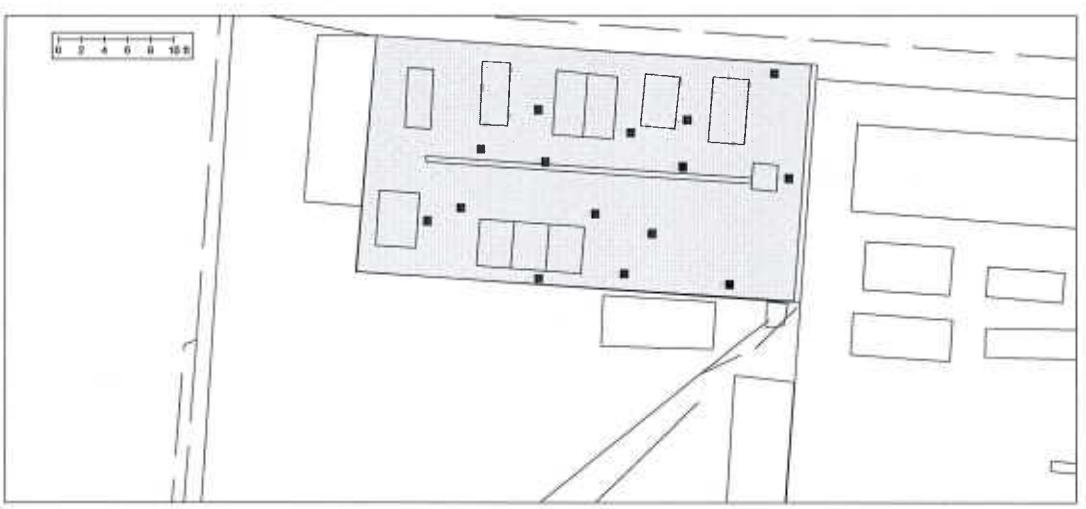
Summary

This report summarizes the sampling design used, associated statistical assumptions, as well as general guidelines for conducting post-sampling data analysis. Sampling plan components presented here include how many sampling locations to choose and where within the sampling area to collect those samples. The type of medium to sample (i.e., soil, groundwater, etc.) and how to analyze the samples (in-situ, fixed laboratory, etc.) are addressed in other sections of the sampling plan.

The following table summarizes the sampling design developed. A figure that shows sampling locations in the field and a table that lists sampling location coordinates are also provided below.

SUMMARY OF SAMPLING DESIGN	
Primary Objective of Design	Construct a Confidence Interval on the True Median
Type of Sampling Design	Non-Parametric
Sample Placement (Location) in the Field	Simple random sampling
Formula for calculating number of sampling locations	Nonparametric Confidence Limits
Calculated total number of samples	15
Number of samples on map [a]	15
Number of selected sample areas [b]	1
Specified sampling area [c]	755.90 ft^2
Total cost of sampling [d]	$6,700.00

[a] This number may differ from the calculated number because of 1) grid edge effects, 2) adding judgment samples, or 3) selecting or unselecting sample areas.
[b] The number of selected sample areas is the number of colored areas on the map of the site. These sample areas contain the locations where samples are collected.
[c] The sampling area is the total surface area of the selected colored sample areas on the map of the site.
[d] Including measurement analyses and fixed overhead costs. See the Cost of Sampling section for an explanation of the costs presented here.



Area: Area 1					
X Coord	Y Coord	Label	Value	Type	Historical

4928.9658	5229.8854	GP-44	17.1	Random	
4922.1885	5239.3872	GP-51	0.165	Random	
4941.7431	5246.8890	GP-49	3.81	Random	
4911.9669	5234.3860	GP-55	0.168	Random	
4929.5215	5241.8878	GP-50	2.33	Random	
4914.8555	5235.4974	GP-54	0.163	Random	
4934.4101	5242.9992	GP-48	0.16	Random	
4921.6328	5229.4961	GP-57	68.8	Random	
4943.0000	5237.9980	GP-46	0.155	Random	
4926.4661	5234.9967	GP-56	15	Random	
4916.6888	5240.4986	GP-53	0.165	Random	
4931.3547	5233.3309	GP-45	0.172	Random	
4921.5774	5243.8327	GP-52	0.265	Random	
4938.0000	5229.0000	GP-43	0.245	Unknown	
4934.0000	5239.0000	GP-47	0.149	Unknown	

Primary Sampling Objective
The primary purpose of sampling at this site is to construct a confidence interval on the true population median value. After the samples are collected and analyzed, the resulting sample values can be used to construct a two-sided confidence interval. Once the confidence interval is computed (which will be an upper and a lower threshold), you can have the specified confidence that the true population median is between the upper and lower thresholds.

Selected Sampling Approach
A non-parametric random sampling approach was used to determine the number of samples and to specify sampling locations. A parametric formula was not chosen because the conceptual model and historical information (e.g., historical data from this site or a very similar site) indicate that parametric assumptions are not true. These assumptions will be examined in post-sampling data analysis.

Both parametric and non-parametric equations rely on assumptions about the population. Typically, however, non-parametric equations require fewer assumptions and allow for more uncertainty about the statistical distribution of values at the site. The trade-off is that if the parametric assumptions are valid, the required number of samples is usually less than if a non-parametric equation was used.

Locating the sample points randomly provides data that are separated by many distances, whereas systematic samples are all equidistant apart. Therefore, random sampling provides more information about the spatial structure of the potential contamination than systematic sampling does. As with systematic sampling, random sampling also provides information regarding the mean or median value, but there is the possibility that areas of the site will not be represented with the same frequency as if uniform grid sampling were performed.

Number of Total Samples: Calculation Equation and Inputs
Two sample confidence interval calculation methods are available for when n□20 and n>20 (Conover, 1980, p. 111-117) (Gilbert, 1987,p. 141-142). In VSP, the user specifies a one-sided or two-sided CI, and the percent confidence desired to be within a specified number of percentiles of the median. A binary search is then performed on the CI equations to solve for the minimum sample size to satisfy these parameters. VSP first uses the n□20 method to determine if a solution can be found where n□20, and if not, then uses the n>20 method.

For a one-sided CI, the n□20 method follows a binomial distribution and determines the lowest value of n where the yth quantile of the sample would be equal to or above the true median at least X% of the time (Note that the sample sizes work out to be the same regardless of whether the CI will be a lower or upper tailed, so the same formula can be used for any one-sided CI). X% is the specified confidence for one-sided confidence intervals, and the average of 100% and the specified confidence for two-sided confidence intervals. The yth quantile is determined by taking 50% and subtracting the allowable number of percentiles from the median specified by the user.

For a two-sided CI, the n□20 method is the same as performing a one-sided confidence interval, but replacing the

specified percent confidence with the average of 100% and the specified percent confidence. If no solution is found where n□20, a binary search is conducted using Equation (1) for a one-sided CI and Equation (2) for a two-sided interval to compute the value of r (r is the the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest), rounding r up to the next higher integer. The search is repeated until the smallest n is found where 100*2*r/n is greater than 50% minus the allowable number of percentiles from the median specified by the user.

$$r = 0.5 * n - 0.5 * w_{\alpha} \sqrt{n} \qquad (1)$$

$$r = 0.5 * n - 0.5 * w_{\alpha/2} \sqrt{n} \qquad (2)$$

Where:

n is the sample size

r is the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest

$w_{\square}$ is the specified quantile of a normal distribution, e.g. if □=0.2 then $w_{\square}$ is the 0.2 quantile (20th percentile) of a normal distribution.

The n>20 method described above is an approximation method, so VSP also performs a final check using a binomial distribution in a similar manner to the n□20 method, and may increase the sample size by 1 to ensure the specified confidence levels are met.

Cost of Sampling

The total cost of the completed sampling program depends on several cost inputs, some of which are fixed, and others that are based on the number of samples collected and measured. Based on the numbers of samples determined above, the estimated total cost of sampling and analysis at this site is $6,700.00, which averages out to a per sample cost of $446.67. The following table summarizes the inputs and resulting cost estimates.

COST INFORMATION			
Cost Details	**Per Analysis**	**Per Sample**	**15 Samples**
Field collection costs		$250.00	$3,750.00
Analytical costs	$130.00	$130.00	$1,950.00
Sum of Field & Analytical costs		**$380.00**	**$5,700.00**
Fixed planning and validation costs			$1,000.00
Total cost			**$6,700.00**

Data Analysis for Cr+6

The following data points were entered by the user for analysis.

Cr+6										
Rank	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
0	0.149	0.155	0.16	0.163	0.165	0.165	0.168	0.172	0.245	0.265
10	2.33	3.81	15	17.1	68.8					

SUMMARY STATISTICS for Cr+6	
n	15
Min	0.149
Max	68.8

Range	68.651
Mean	7.2565
Median	0.172
Variance	320.09
StdDev	17.891
Std Error	4.6195
Skewness	3.3218
Interquartile Range	3.647

Percentiles								
1%	**5%**	**10%**	**25%**	**50%**	**75%**	**90%**	**95%**	**99%**
0.149	0.149	0.1526	0.163	0.172	3.81	37.78	68.8	68.8

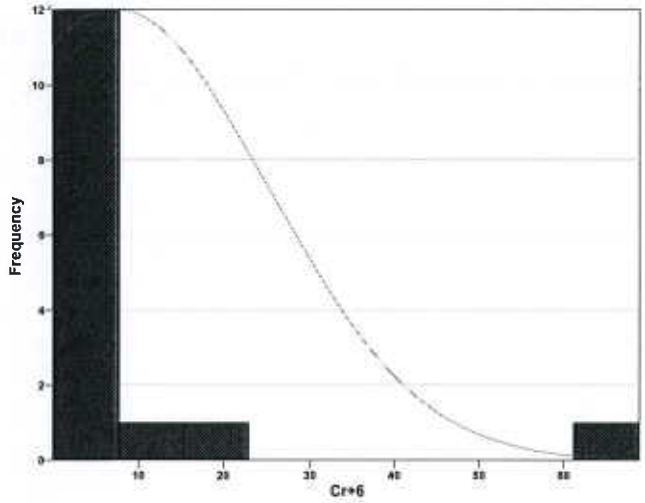
Data Plots

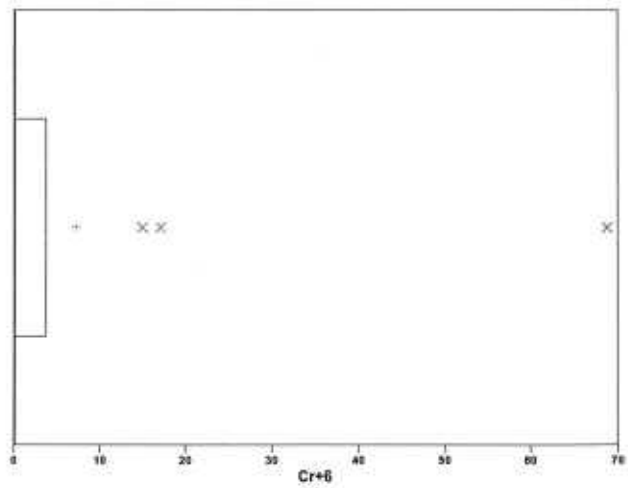
Three graphical displays of the data are shown below: the Histogram, the Box and Whiskers plot, and the Quantile-Quantile (Q-Q) plot.

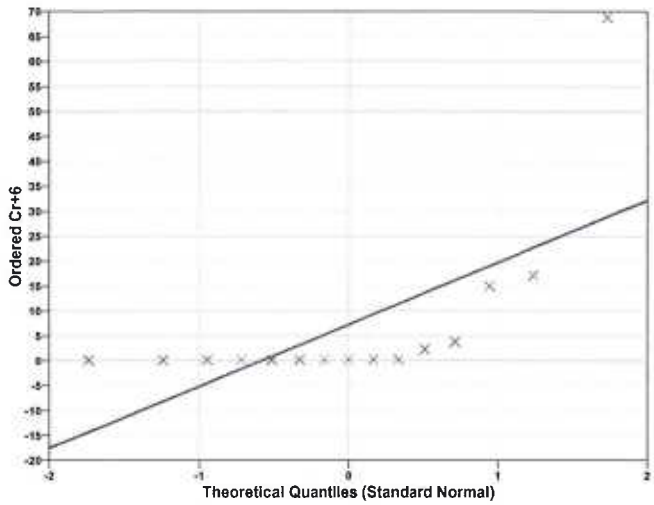
The Histogram is a plot of the fraction of the n observed data that fall within specified data "bins." A histogram is generated by dividing the x axis (range of the observed data values) into "bins" and displaying the number of data in each bin as the height of a bar for the bin. The area of the bar is the fraction of the n data values that lie within the bin. The sum of the fractions for all bins equals one. A histogram is used to assess how the n data are distributed (spread) over their range of values. If the histogram is more or less symmetric and bell shaped, then the data may be normally distributed.

The Box and Whiskers plot is composed of a central box divided by a line, and with two lines extending out from the box, called the "whiskers". The line through the box is drawn at the median of the n data observed. The two ends of the box represent the 25th and 75th percentiles of the n data values, which are also called the lower and upper quartiles, respectively, of the data set. The sample mean (mean of the n data) is shown as a "+" sign. The upper whisker extends to the largest data value that is less than the upper quartile plus 1.5 times the interquartile range (upper quartile minus the lower quartile). The lower whisker extends to the smallest data value that is greater than the lower quartile minus 1.5 times the interquartile range. Extreme data values (greater or smaller than the ends of the whiskers) are plotted individually. A Box and Whiskers plot is used to assess the symmetry of the distribution of the data set. If the distribution is symmetrical, the box is divided into two equal halves by the median, the whiskers will be the same length, and the number of extreme data points will be distributed equally on either end of the plot.

The Q-Q plot graphs the quantiles of a set of n data against the quantiles of a specific distribution. We show here only the Q-Q plot for an assumed normal distribution. The pth quantile of a distribution of data is the data value, x_n, for which a fraction p of the distribution is less than x_n. If the data plotted on the normal distribution Q-Q plot closely follow a straight line, even at the ends of the line, then the data may be assumed to be normally distributed. If the data points deviate substantially from a linear line, then the data are not normally distributed.







For more information on these three plots consult Guidance for Data Quality Assessment, EPA QA/G-9, pgs 2.3-1 through 2.3-12. (http://www.epa.gov/quality/qa-docs.html).

Two-Sided Confidence Interval on the True Median

For calculating the confidence interval, the values are ordered from smallest to largest. The confidence limits are the highest value of the r+1 and/or lowest value of the s-1 order statistics that fit the formulas below, except when the rth ordered value is tied with higher ordered values or the sth ordered value is tied with lower ordered values. If higher numbered ordered values are ties with the rth ordered value, then the closest ordered value that is lower than r will be the confidence limit. If higher-numbered ordered values are ties with the sth ordered value, then the closest ordered value that is higher than s will be the confidence limit.

Upper Two-Sided Confidence Interval

$$\sum_{s}^{1}\left(\frac{n!}{r!(n-s)!}\right)p^{0.5}(1-p)^{n-0.5} \geq 1-\alpha/2$$

Lower Two-Sided Confidence interval

$$\sum_{r}^{1}\left(\frac{n!}{r!(n-r)!}\right)p^{0.5}(1-p)^{n-0.5} \leq \alpha/2$$

Upper 95% Two-Sided Confidence Interval on the Median	15

Sample Median	0.172
Lower 95% Two-Sided Confidence Interval on the Median	0.16

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* - The report contents may have been modified or reformatted by end-user of software.

Electrical. Bldg Cu

VSP Sample Design Report for Calculating a Two-Sided Confidence Interval for the Population Median Using Simple Random Sampling

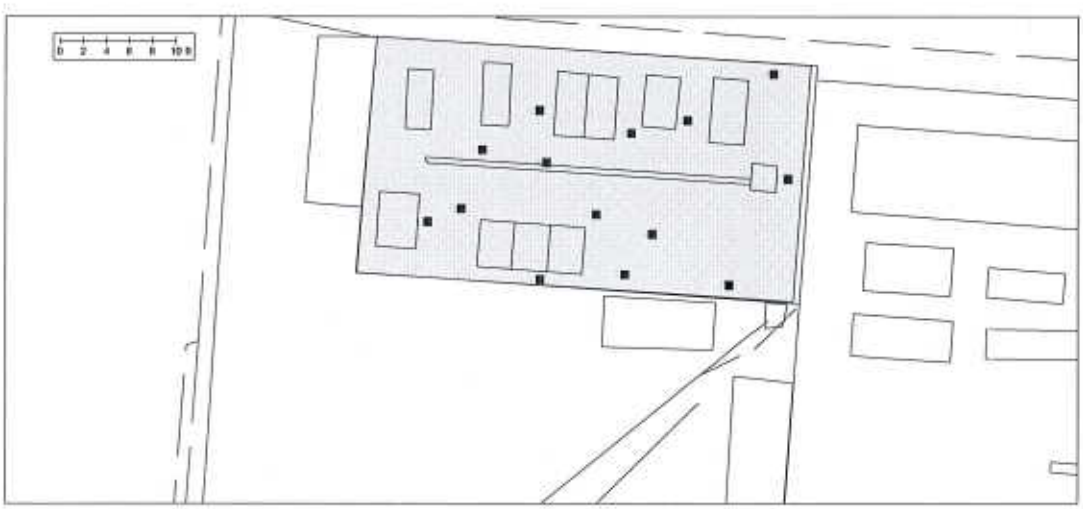
Summary

This report summarizes the sampling design used, associated statistical assumptions, as well as general guidelines for conducting post-sampling data analysis. Sampling plan components presented here include how many sampling locations to choose and where within the sampling area to collect those samples. The type of medium to sample (i.e., soil, groundwater, etc.) and how to analyze the samples (in-situ, fixed laboratory, etc.) are addressed in other sections of the sampling plan.

The following table summarizes the sampling design developed. A figure that shows sampling locations in the field and a table that lists sampling location coordinates are also provided below.

SUMMARY OF SAMPLING DESIGN	
Primary Objective of Design	Construct a Confidence Interval on the True Median
Type of Sampling Design	Non-Parametric
Sample Placement (Location) in the Field	Simple random sampling
Formula for calculating number of sampling locations	Nonparametric Confidence Limits
Calculated total number of samples	15
Number of samples on map [a]	14
Number of selected sample areas [b]	1
Specified sampling area [c]	755.90 ft^2
Total cost of sampling [d]	$6,700.00

[a] This number may differ from the calculated number because of 1) grid edge effects, 2) adding judgment samples, or 3) selecting or unselecting sample areas.
[b] The number of selected sample areas is the number of colored areas on the map of the site. These sample areas contain the locations where samples are collected.
[c] The sampling area is the total surface area of the selected colored sample areas on the map of the site.
[d] Including measurement analyses and fixed overhead costs. See the Cost of Sampling section for an explanation of the costs presented here.



Area: Area 1					
X Coord	Y Coord	Label	Value	Type	Historical

4928.9658	5229.8854	GP-44	42	Random	
4922.1885	5239.3872	GP-51	55	Random	
4941.7431	5246.8890	GP-49	21	Random	
4911.9669	5234.3860	GP-55	16	Random	
4929.5215	5241.8878	GP-50	21	Random	
4914.8555	5235.4974	GP-54	40	Random	
4934.4101	5242.9992	GP-48	36	Random	
4921.6328	5229.4961	GP-57	35	Random	
4943.0000	5237.9980	GP-46	80	Random	
4926.4661	5234.9967	GP-56	23	Random	
4916.6888	5240.4986	GP-53	52	Random	
4931.3547	5233.3309	GP-45	47	Random	
4921.5774	5243.8327	GP-52	50	Random	
4938.0000	5229.0000	GP-43	14	Unknown	

Primary Sampling Objective
The primary purpose of sampling at this site is to construct a confidence interval on the true population median value. After the samples are collected and analyzed, the resulting sample values can be used to construct a two-sided confidence interval. Once the confidence interval is computed (which will be an upper and a lower threshold), you can have the specified confidence that the true population median is between the upper and lower thresholds.

Selected Sampling Approach
A non-parametric random sampling approach was used to determine the number of samples and to specify sampling locations. A parametric formula was not chosen because the conceptual model and historical information (e.g., historical data from this site or a very similar site) indicate that parametric assumptions are not true. These assumptions will be examined in post-sampling data analysis.

Both parametric and non-parametric equations rely on assumptions about the population. Typically, however, non-parametric equations require fewer assumptions and allow for more uncertainty about the statistical distribution of values at the site. The trade-off is that if the parametric assumptions are valid, the required number of samples is usually less than if a non-parametric equation was used.

Locating the sample points randomly provides data that are separated by many distances, whereas systematic samples are all equidistant apart. Therefore, random sampling provides more information about the spatial structure of the potential contamination than systematic sampling does. As with systematic sampling, random sampling also provides information regarding the mean or median value, but there is the possibility that areas of the site will not be represented with the same frequency as if uniform grid sampling were performed.

Number of Total Samples: Calculation Equation and Inputs
Two sample confidence interval calculation methods are available for when n□20 and n>20 (Conover, 1980, p. 111-117) (Gilbert, 1987,p. 141-142). In VSP, the user specifies a one-sided or two-sided CI, and the percent confidence desired to be within a specified number of percentiles of the median. A binary search is then performed on the CI equations to solve for the minimum sample size to satisfy these parameters. VSP first uses the n□20 method to determine if a solution can be found where n□20, and if not, then uses the n>20 method.

For a one-sided CI, the n□20 method follows a binomial distribution and determines the lowest value of n where the yth quantile of the sample would be equal to or above the true median at least X% of the time (Note that the sample sizes work out to be the same regardless of whether the CI will be a lower or upper tailed, so the same formula can be used for any one-sided CI). X% is the specified confidence for one-sided confidence intervals, and the average of 100% and the specified confidence for two-sided confidence intervals. The yth quantile is determined by taking 50% and subtracting the allowable number of percentiles from the median specified by the user.

For a two-sided CI, the n□20 method is the same as performing a one-sided confidence interval, but replacing the specified percent confidence with the average of 100% and the specified percent confidence. If no solution is found where

n□20, a binary search is conducted using Equation (1) for a one-sided CI and Equation (2) for a two-sided interval to compute the value of r (r is the the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest), rounding r up to the next higher integer. The search is repeated until the smallest n is found where 100*2*r/n is greater than 50% minus the allowable number of percentiles from the median specified by the user.

$$r = 0.5 * n - 0.5 * w_{\alpha} \sqrt{n} \qquad (1)$$

$$r = 0.5 * n - 0.5 * w_{\alpha/2} \sqrt{n} \qquad (2)$$

Where:

n is the sample size

r is the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest

$w_{\square}$ is the specified quantile of a normal distribution, e.g. if □=0.2 then $w_{\square}$ is the 0.2 quantile (20th percentile) of a normal distribution.

The n>20 method described above is an approximation method, so VSP also performs a final check using a binomial distribution in a similar manner to the n□20 method, and may increase the sample size by 1 to ensure the specified confidence levels are met.

Cost of Sampling

The total cost of the completed sampling program depends on several cost inputs, some of which are fixed, and others that are based on the number of samples collected and measured. Based on the numbers of samples determined above, the estimated total cost of sampling and analysis at this site is $6,700.00, which averages out to a per sample cost of $446.67. The following table summarizes the inputs and resulting cost estimates.

COST INFORMATION			
Cost Details	**Per Analysis**	**Per Sample**	**15 Samples**
Field collection costs		$250.00	$3,750.00
Analytical costs	$130.00	$130.00	$1,950.00
Sum of Field & Analytical costs		**$380.00**	**$5,700.00**
Fixed planning and validation costs			$1,000.00
Total cost			**$6,700.00**

Data Analysis for Cu

The following data points were entered by the user for analysis.

Cu										
Rank	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
0	14	16	21	21	23	35	36	40	42	47
10	50	52	55	80						

SUMMARY STATISTICS for Cu	
n	14
Min	14
Max	80
Range	66

Mean				38				
Median				38				
Variance				336.15				
StdDev				18.334				
Std Error				4.9001				
Skewness				0.67806				
Interquartile Range				29.5				
Percentiles								
1%	**5%**	**10%**	**25%**	**50%**	**75%**	**90%**	**95%**	**99%**
14	14	15	21	38	50.5	67.5	80	80

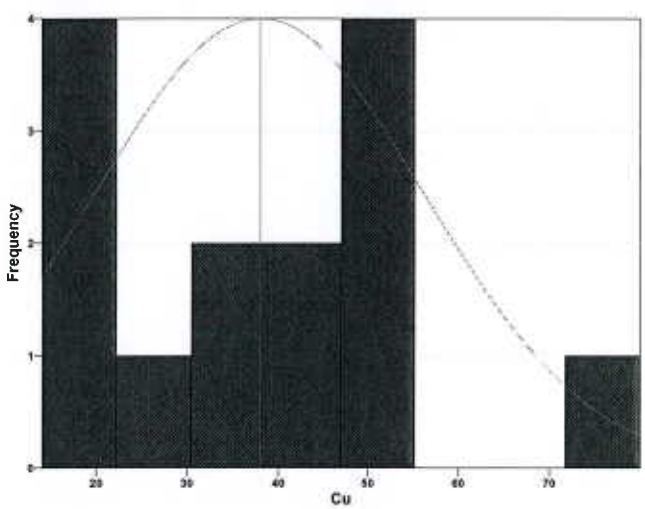
Data Plots

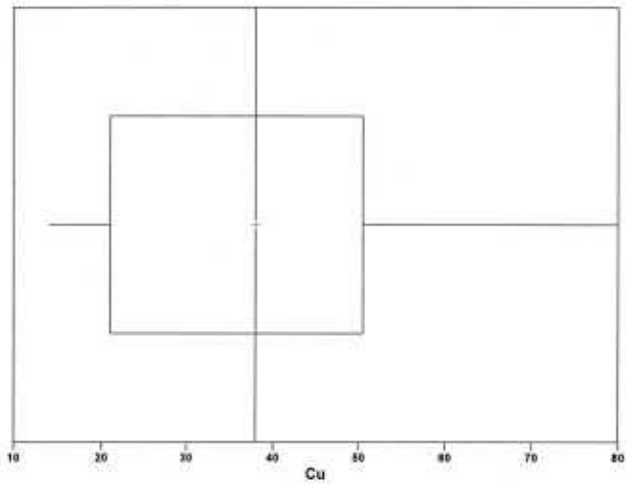
Three graphical displays of the data are shown below: the Histogram, the Box and Whiskers plot, and the Quantile-Quantile (Q-Q) plot.

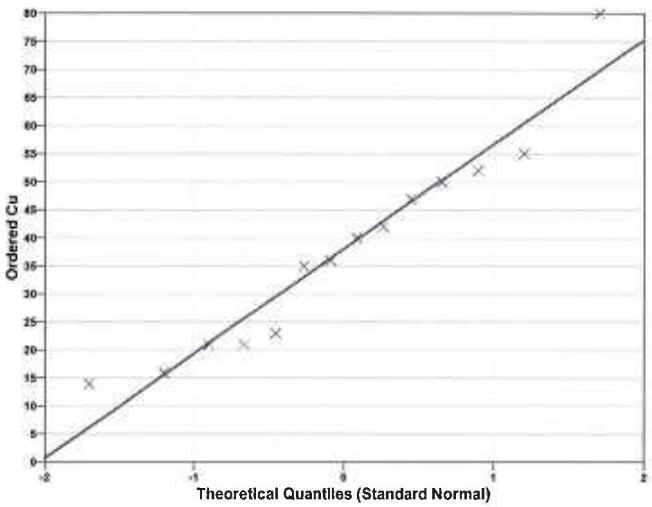
The Histogram is a plot of the fraction of the n observed data that fall within specified data "bins." A histogram is generated by dividing the x axis (range of the observed data values) into "bins" and displaying the number of data in each bin as the height of a bar for the bin. The area of the bar is the fraction of the n data values that lie within the bin. The sum of the fractions for all bins equals one. A histogram is used to assess how the n data are distributed (spread) over their range of values. If the histogram is more or less symmetric and bell shaped, then the data may be normally distributed.

The Box and Whiskers plot is composed of a central box divided by a line, and with two lines extending out from the box, called the "whiskers". The line through the box is drawn at the median of the n data observed. The two ends of the box represent the 25th and 75th percentiles of the n data values, which are also called the lower and upper quartiles, respectively, of the data set. The sample mean (mean of the n data) is shown as a "+" sign. The upper whisker extends to the largest data value that is less than the upper quartile plus 1.5 times the interquartile range (upper quartile minus the lower quartile). The lower whisker extends to the smallest data value that is greater than the lower quartile minus 1.5 times the interquartile range. Extreme data values (greater or smaller than the ends of the whiskers) are plotted individually. A Box and Whiskers plot is used to assess the symmetry of the distribution of the data set. If the distribution is symmetrical, the box is divided into two equal halves by the median, the whiskers will be the same length, and the number of extreme data points will be distributed equally on either end of the plot.

The Q-Q plot graphs the quantiles of a set of n data against the quantiles of a specific distribution. We show here only the Q-Q plot for an assumed normal distribution. The pth quantile of a distribution of data is the data value, x_n, for which a fraction p of the distribution is less than x_n. If the data plotted on the normal distribution Q-Q plot closely follow a straight line, even at the ends of the line, then the data may be assumed to be normally distributed. If the data points deviate substantially from a linear line, then the data are not normally distributed.







For more information on these three plots consult Guidance for Data Quality Assessment, EPA QA/G-9, pgs 2.3-1 through 2.3-12. (http://www.epa.gov/quality/qa-docs.html).

Two-Sided Confidence Interval on the True Median

For calculating the confidence interval, the values are ordered from smallest to largest. The confidence limits are the highest value of the r+1 and/or lowest value of the s-1 order statistics that fit the formulas below, except when the rth ordered value is tied with higher ordered values or the sth ordered value is tied with lower ordered values. If higher numbered ordered values are ties with the rth ordered value, then the closest ordered value that is lower than r will be the confidence limit. If higher-numbered ordered values are ties with the sth ordered value, then the closest ordered value that is higher than s will be the confidence limit.

Upper Two-Sided Confidence Interval

$$\sum_{s}^{1}\left(\frac{n!}{r!(n-s)!}\right)p^{0.5}(1-p)^{n-0.5} \geq 1-\alpha/2$$

Lower Two-Sided Confidence interval

$$\sum_{r}^{1}\left(\frac{n!}{r!(n-r)!}\right)p^{0.5}(1-p)^{n-0.5} \leq \alpha/2$$

Upper 95% Two-Sided Confidence Interval on the Median	55

Sample Median	38
Lower 95% Two-Sided Confidence Interval on the Median	16

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* - The report contents may have been modified or reformatted by end-user of software.

Elect. Bldg - Cu biased

VSP Sample Design Report for Calculating a Two-Sided Confidence Interval for the Population Median Using Simple Random Sampling

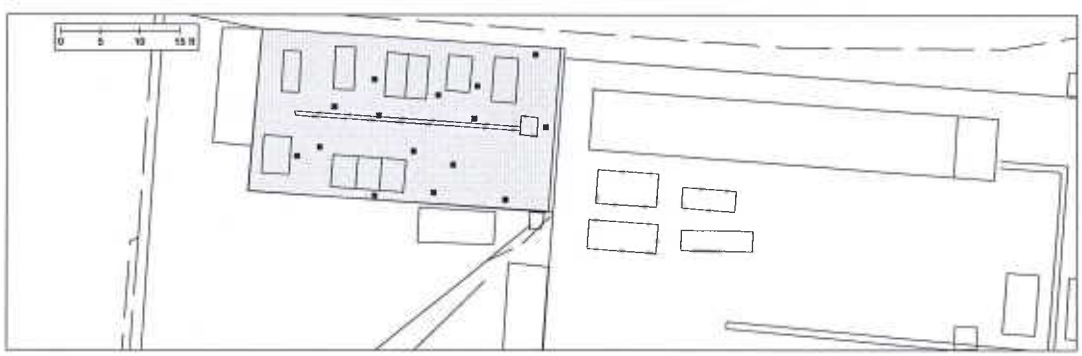
Summary

This report summarizes the sampling design used, associated statistical assumptions, as well as general guidelines for conducting post-sampling data analysis. Sampling plan components presented here include how many sampling locations to choose and where within the sampling area to collect those samples. The type of medium to sample (i.e., soil, groundwater, etc.) and how to analyze the samples (in-situ, fixed laboratory, etc.) are addressed in other sections of the sampling plan.

The following table summarizes the sampling design developed. A figure that shows sampling locations in the field and a table that lists sampling location coordinates are also provided below.

SUMMARY OF SAMPLING DESIGN	
Primary Objective of Design	Construct a Confidence Interval on the True Median
Type of Sampling Design	Non-Parametric
Sample Placement (Location) in the Field	Simple random sampling
Formula for calculating number of sampling locations	Nonparametric Confidence Limits
Calculated total number of samples	15
Number of samples on map [a]	15
Number of selected sample areas [b]	1
Specified sampling area [c]	755.90 ft^2
Total cost of sampling [d]	$6,700.00

[a] This number may differ from the calculated number because of 1) grid edge effects, 2) adding judgment samples, or 3) selecting or unselecting sample areas.
[b] The number of selected sample areas is the number of colored areas on the map of the site. These sample areas contain the locations where samples are collected.
[c] The sampling area is the total surface area of the selected colored sample areas on the map of the site.
[d] Including measurement analyses and fixed overhead costs. See the Cost of Sampling section for an explanation of the costs presented here.



Area: Area 1					
X Coord	Y Coord	Label	Value	Type	Historical
4928.9658	5229.8854	GP-44	42	Random	
4922.1885	5239.3872	GP-51	55	Random	
4941.7431	5246.8890	GP-49	21	Random	

4911.9669	5234.3860	GP-55	16	Random	
4929.5215	5241.8878	GP-50	33	Random	
4914.8555	5235.4974	GP-54	40	Random	
4934.4101	5242.9992	GP-48	36	Random	
4921.6328	5229.4961	GP-57	35	Random	
4943.0000	5237.9980	GP-46	80	Random	
4926.4661	5234.9967	GP-56	23	Random	
4916.6888	5240.4986	GP-53	52	Random	
4931.3547	5233.3309	GP-45	47	Random	
4921.5774	5243.8327	GP-52	50	Random	
4938.0000	5229.0000	GP-43	14	Unknown	
4934.0000	5239.0000	GP-47	31	Unknown	

Primary Sampling Objective
The primary purpose of sampling at this site is to construct a confidence interval on the true population median value. After the samples are collected and analyzed, the resulting sample values can be used to construct a two-sided confidence interval. Once the confidence interval is computed (which will be an upper and a lower threshold), you can have the specified confidence that the true population median is between the upper and lower thresholds.

Selected Sampling Approach
A non-parametric random sampling approach was used to determine the number of samples and to specify sampling locations. A parametric formula was not chosen because the conceptual model and historical information (e.g., historical data from this site or a very similar site) indicate that parametric assumptions are not true. These assumptions will be examined in post-sampling data analysis.

Both parametric and non-parametric equations rely on assumptions about the population. Typically, however, non-parametric equations require fewer assumptions and allow for more uncertainty about the statistical distribution of values at the site. The trade-off is that if the parametric assumptions are valid, the required number of samples is usually less than if a non-parametric equation was used.

Locating the sample points randomly provides data that are separated by many distances, whereas systematic samples are all equidistant apart. Therefore, random sampling provides more information about the spatial structure of the potential contamination than systematic sampling does. As with systematic sampling, random sampling also provides information regarding the mean or median value, but there is the possibility that areas of the site will not be represented with the same frequency as if uniform grid sampling were performed.

Number of Total Samples: Calculation Equation and Inputs
Two sample confidence interval calculation methods are available for when n□20 and n>20 (Conover, 1980, p. 111-117) (Gilbert, 1987,p. 141-142). In VSP, the user specifies a one-sided or two-sided CI, and the percent confidence desired to be within a specified number of percentiles of the median. A binary search is then performed on the CI equations to solve for the minimum sample size to satisfy these parameters. VSP first uses the n□20 method to determine if a solution can be found where n□20, and if not, then uses the n>20 method.

For a one-sided CI, the n□20 method follows a binomial distribution and determines the lowest value of n where the yth quantile of the sample would be equal to or above the true median at least X% of the time (Note that the sample sizes work out to be the same regardless of whether the CI will be a lower or upper tailed, so the same formula can be used for any one-sided CI). X% is the specified confidence for one-sided confidence intervals, and the average of 100% and the specified confidence for two-sided confidence intervals. The yth quantile is determined by taking 50% and subtracting the allowable number of percentiles from the median specified by the user.

For a two-sided CI, the n□20 method is the same as performing a one-sided confidence interval, but replacing the specified percent confidence with the average of 100% and the specified percent confidence. If no solution is found where n□20, a binary search is conducted using Equation (1) for a one-sided CI and Equation (2) for a two-sided interval to compute the value of r (r is the the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest), rounding r up to the next higher integer. The search is repeated until the smallest n is

found where 100*2*r/n is greater than 50% minus the allowable number of percentiles from the median specified by the user.

$$r = 0.5 * n - 0.5 * w_{\alpha} \sqrt{n} \qquad (1)$$

$$r = 0.5 * n - 0.5 * w_{\alpha/2} \sqrt{n} \qquad (2)$$

Where:

n is the sample size

r is the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest

$w_{\square}$ is the specified quantile of a normal distribution, e.g. if $\square$=0.2 then $w_{\square}$ is the 0.2 quantile (20th percentile) of a normal distribution.

The n>20 method described above is an approximation method, so VSP also performs a final check using a binomial distribution in a similar manner to the n$\square$20 method, and may increase the sample size by 1 to ensure the specified confidence levels are met.

Cost of Sampling
The total cost of the completed sampling program depends on several cost inputs, some of which are fixed, and others that are based on the number of samples collected and measured. Based on the numbers of samples determined above, the estimated total cost of sampling and analysis at this site is $6,700.00, which averages out to a per sample cost of $446.67. The following table summarizes the inputs and resulting cost estimates.

COST INFORMATION			
Cost Details	**Per Analysis**	**Per Sample**	**15 Samples**
Field collection costs		$250.00	$3,750.00
Analytical costs	$130.00	$130.00	$1,950.00
Sum of Field & Analytical costs		**$380.00**	**$5,700.00**
Fixed planning and validation costs			$1,000.00
Total cost			**$6,700.00**

Data Analysis for Cu
The following data points were entered by the user for analysis.

Cu										
Rank	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
0	14	16	21	23	31	33	35	36	40	42
10	47	50	52	55	80					

SUMMARY STATISTICS for Cu	
n	15
Min	14
Max	80
Range	66
Mean	38.333
Median	36

Variance	296.67
StdDev	17.224
Std Error	4.4472
Skewness	0.75577
Interquartile Range	27

Percentiles								
1%	**5%**	**10%**	**25%**	**50%**	**75%**	**90%**	**95%**	**99%**
14	14	15.2	23	36	50	65	80	80

Data Plots

Three graphical displays of the data are shown below: the Histogram, the Box and Whiskers plot, and the Quantile-Quantile (Q-Q) plot.

The Histogram is a plot of the fraction of the n observed data that fall within specified data "bins." A histogram is generated by dividing the x axis (range of the observed data values) into "bins" and displaying the number of data in each bin as the height of a bar for the bin. The area of the bar is the fraction of the n data values that lie within the bin. The sum of the fractions for all bins equals one. A histogram is used to assess how the n data are distributed (spread) over their range of values. If the histogram is more or less symmetric and bell shaped, then the data may be normally distributed.

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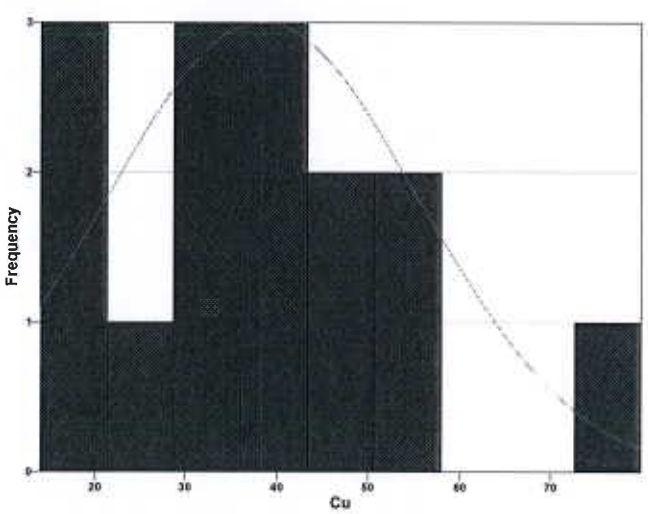
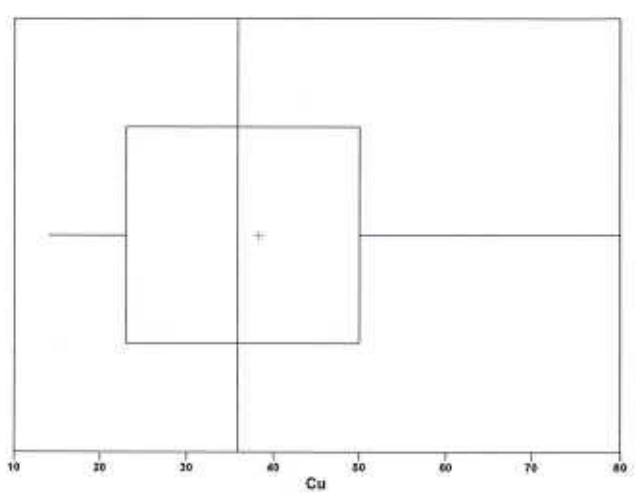
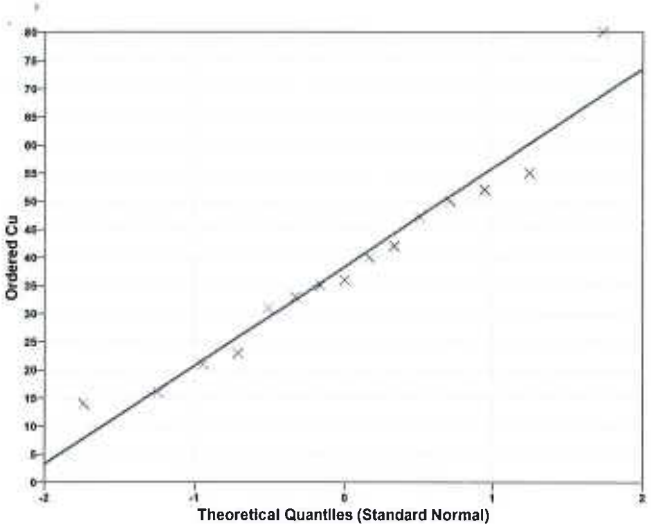
The Q-Q plot graphs the quantiles of a set of n data against the quantiles of a specific distribution. We show here only the Q-Q plot for an assumed normal distribution. The pth quantile of a distribution of data is the data value, x_n, for which a fraction p of the distribution is less than x_n. If the data plotted on the normal distribution Q-Q plot closely follow a straight line, even at the ends of the line, then the data may be assumed to be normally distributed. If the data points deviate substantially from a linear line, then the data are not normally distributed.







For more information on these three plots consult Guidance for Data Quality Assessment, EPA QA/G-9, pgs 2.3-1 through 2.3-12. (http://www.epa.gov/quality/qa-docs.html).

Two-Sided Confidence Interval on the True Median

For calculating the confidence interval, the values are ordered from smallest to largest. The confidence limits are the highest value of the r+1 and/or lowest value of the s-1 order statistics that fit the formulas below, except when the rth ordered value is tied with higher ordered values or the sth ordered value is tied with lower ordered values. If higher numbered ordered values are ties with the rth ordered value, then the closest ordered value that is lower than r will be the confidence limit. If higher-numbered ordered values are ties with the sth ordered value, then the closest ordered value that is higher than s will be the confidence limit.

Upper Two-Sided Confidence Interval

$$\sum_{s}^{1}\left(\frac{n!}{r!(n-s)!}\right)p^{0.5}(1-p)^{n-0.5} \geq 1-\alpha/2$$

Lower Two-Sided Confidence interval

$$\sum_{r}^{1}\left(\frac{n!}{r!(n-r)!}\right)p^{0.5}(1-p)^{n-0.5} \leq \alpha/2$$

Upper 95% Two-Sided Confidence Interval on the Median	52
Sample Median	36
Lower 95% Two-Sided Confidence Interval on the Median	21

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* - The report contents may have been modified or reformatted by end-user of software.

Electrolyzer Bldg Pb

VSP Sample Design Report for Calculating a Two-Sided Confidence Interval for the Population Median Using Simple Random Sampling

Summary

This report summarizes the sampling design used, associated statistical assumptions, as well as general guidelines for conducting post-sampling data analysis. Sampling plan components presented here include how many sampling locations to choose and where within the sampling area to collect those samples. The type of medium to sample (i.e., soil, groundwater, etc.) and how to analyze the samples (in-situ, fixed laboratory, etc.) are addressed in other sections of the sampling plan.

The following table summarizes the sampling design developed. A figure that shows sampling locations in the field and a table that lists sampling location coordinates are also provided below.

SUMMARY OF SAMPLING DESIGN	
Primary Objective of Design	Construct a Confidence Interval on the True Median
Type of Sampling Design	Non-Parametric
Sample Placement (Location) in the Field	Simple random sampling
Formula for calculating number of sampling locations	Nonparametric Confidence Limits
Calculated total number of samples	15
Number of samples on map [a]	14
Number of selected sample areas [b]	1
Specified sampling area [c]	755.90 ft^2
Total cost of sampling [d]	$6,700.00

[a] This number may differ from the calculated number because of 1) grid edge effects, 2) adding judgment samples, or 3) selecting or unselecting sample areas.
[b] The number of selected sample areas is the number of colored areas on the map of the site. These sample areas contain the locations where samples are collected.
[c] The sampling area is the total surface area of the selected colored sample areas on the map of the site.
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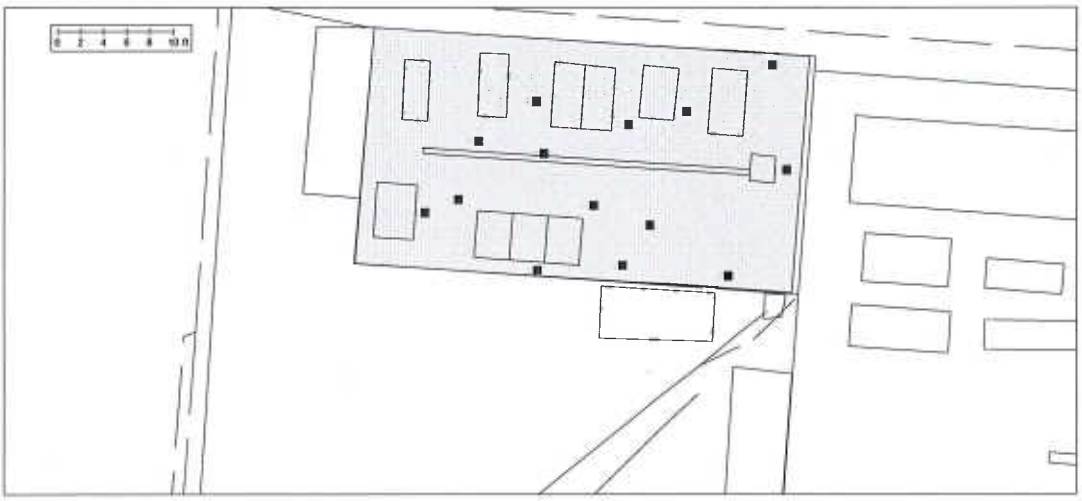


Area: Area 1					
X Coord	Y Coord	Label	Value	Type	Historical

4928.9658	5229.8854	GP-44	1.5	Random	
4922.1885	5239.3872	GP-51	15	Random	
4941.7431	5246.8890	GP-49	1.6	Random	
4911.9669	5234.3860	GP-55	3.4	Random	
4929.5215	5241.8878	GP-50	5.3	Random	
4914.8555	5235.4974	GP-54	2.1	Random	
4934.4101	5242.9992	GP-48	1.8	Random	
4921.6328	5229.4961	GP-57	1.3	Random	
4943.0000	5237.9980	GP-46	1.7	Random	
4926.4661	5234.9967	GP-56	1.7	Random	
4916.6888	5240.4986	GP-53	3.4	Random	
4931.3547	5233.3309	GP-45	1.4	Random	
4921.5774	5243.8327	GP-52	2.4	Random	
4938.0000	5229.0000	GP-43	1.1	Unknown	

Primary Sampling Objective
The primary purpose of sampling at this site is to construct a confidence interval on the true population median value. After the samples are collected and analyzed, the resulting sample values can be used to construct a two-sided confidence interval. Once the confidence interval is computed (which will be an upper and a lower threshold), you can have the specified confidence that the true population median is between the upper and lower thresholds.

Selected Sampling Approach
A non-parametric random sampling approach was used to determine the number of samples and to specify sampling locations. A parametric formula was not chosen because the conceptual model and historical information (e.g., historical data from this site or a very similar site) indicate that parametric assumptions are not true. These assumptions will be examined in post-sampling data analysis.

Both parametric and non-parametric equations rely on assumptions about the population. Typically, however, non-parametric equations require fewer assumptions and allow for more uncertainty about the statistical distribution of values at the site. The trade-off is that if the parametric assumptions are valid, the required number of samples is usually less than if a non-parametric equation was used.

Locating the sample points randomly provides data that are separated by many distances, whereas systematic samples are all equidistant apart. Therefore, random sampling provides more information about the spatial structure of the potential contamination than systematic sampling does. As with systematic sampling, random sampling also provides information regarding the mean or median value, but there is the possibility that areas of the site will not be represented with the same frequency as if uniform grid sampling were performed.

Number of Total Samples: Calculation Equation and Inputs
Two sample confidence interval calculation methods are available for when n□20 and n>20 (Conover, 1980, p. 111-117) (Gilbert, 1987,p. 141-142). In VSP, the user specifies a one-sided or two-sided CI, and the percent confidence desired to be within a specified number of percentiles of the median. A binary search is then performed on the CI equations to solve for the minimum sample size to satisfy these parameters. VSP first uses the n□20 method to determine if a solution can be found where n□20, and if not, then uses the n>20 method.

For a one-sided CI, the n□20 method follows a binomial distribution and determines the lowest value of n where the yth quantile of the sample would be equal to or above the true median at least X% of the time (Note that the sample sizes work out to be the same regardless of whether the CI will be a lower or upper tailed, so the same formula can be used for any one-sided CI). X% is the specified confidence for one-sided confidence intervals, and the average of 100% and the specified confidence for two-sided confidence intervals. The yth quantile is determined by taking 50% and subtracting the allowable number of percentiles from the median specified by the user.

For a two-sided CI, the n□20 method is the same as performing a one-sided confidence interval, but replacing the specified percent confidence with the average of 100% and the specified percent confidence. If no solution is found where

n□20, a binary search is conducted using Equation (1) for a one-sided CI and Equation (2) for a two-sided interval to compute the value of r (r is the the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest), rounding r up to the next higher integer. The search is repeated until the smallest n is found where 100*2*r/n is greater than 50% minus the allowable number of percentiles from the median specified by the user.

$$r = 0.5 * n - 0.5 * w_{\alpha} \sqrt{n} \qquad (1)$$

$$r = 0.5 * n - 0.5 * w_{\alpha/2} \sqrt{n} \qquad (2)$$

Where:

n is the sample size

r is the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest

$w_{\square}$ is the specified quantile of a normal distribution, e.g. if □=0.2 then $w_{\square}$ is the 0.2 quantile (20th percentile) of a normal distribution.

The n>20 method described above is an approximation method, so VSP also performs a final check using a binomial distribution in a similar manner to the n□20 method, and may increase the sample size by 1 to ensure the specified confidence levels are met.

Cost of Sampling

The total cost of the completed sampling program depends on several cost inputs, some of which are fixed, and others that are based on the number of samples collected and measured. Based on the numbers of samples determined above, the estimated total cost of sampling and analysis at this site is $6,700.00, which averages out to a per sample cost of $446.67. The following table summarizes the inputs and resulting cost estimates.

COST INFORMATION			
Cost Details	**Per Analysis**	**Per Sample**	**15 Samples**
Field collection costs		$250.00	$3,750.00
Analytical costs	$130.00	$130.00	$1,950.00
Sum of Field & Analytical costs		**$380.00**	**$5,700.00**
Fixed planning and validation costs			$1,000.00
Total cost			**$6,700.00**

Data Analysis for Pb

The following data points were entered by the user for analysis.

Pb										
Rank	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
0	1.1	1.3	1.4	1.5	1.6	1.7	1.7	1.8	2.1	2.4
10	3.4	3.4	5.3	15						

SUMMARY STATISTICS for Pb	
n	14
Min	1.1
Max	15
Range	13.9

Mean	3.1214
Median	1.75
Variance	12.974
StdDev	3.602
Std Error	0.96266
Skewness	3.1682
Interquartile Range	1.925

Percentiles								
1%	**5%**	**10%**	**25%**	**50%**	**75%**	**90%**	**95%**	**99%**
1.1	1.1	1.2	1.475	1.75	3.4	10.15	15	15

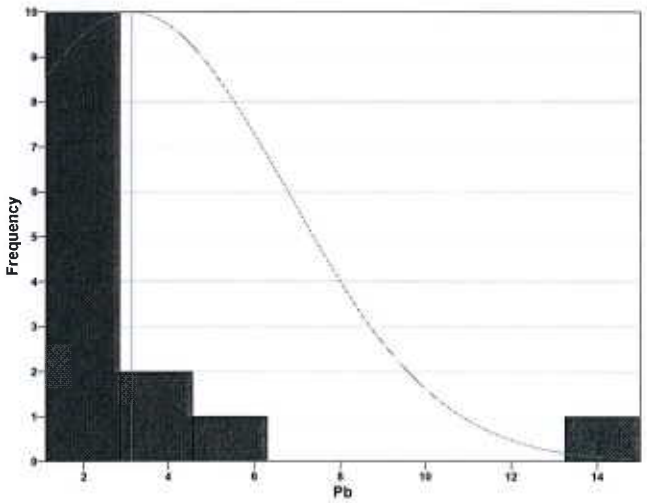
Data Plots

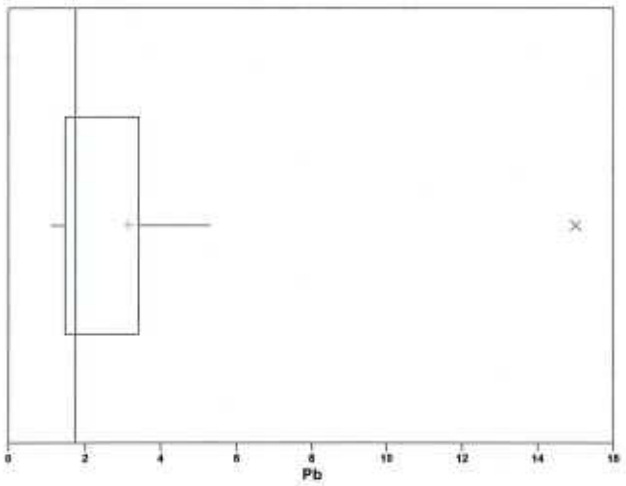
Three graphical displays of the data are shown below: the Histogram, the Box and Whiskers plot, and the Quantile-Quantile (Q-Q) plot.

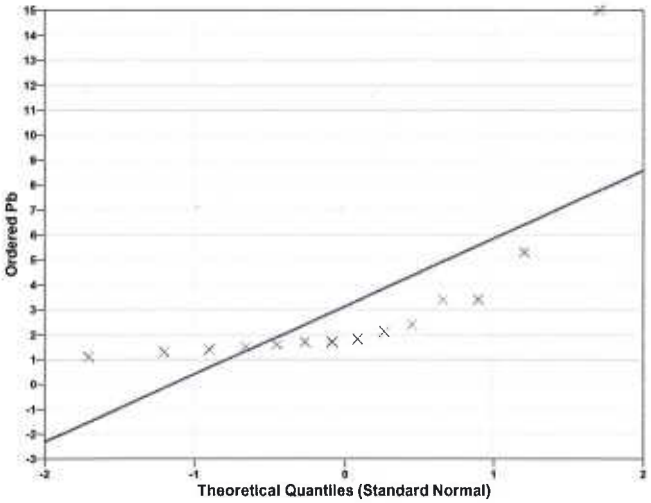
The Histogram is a plot of the fraction of the n observed data that fall within specified data "bins." A histogram is generated by dividing the x axis (range of the observed data values) into "bins" and displaying the number of data in each bin as the height of a bar for the bin. The area of the bar is the fraction of the n data values that lie within the bin. The sum of the fractions for all bins equals one. A histogram is used to assess how the n data are distributed (spread) over their range of values. If the histogram is more or less symmetric and bell shaped, then the data may be normally distributed.

The Box and Whiskers plot is composed of a central box divided by a line, and with two lines extending out from the box, called the "whiskers". The line through the box is drawn at the median of the n data observed. The two ends of the box represent the 25th and 75th percentiles of the n data values, which are also called the lower and upper quartiles, respectively, of the data set. The sample mean (mean of the n data) is shown as a "+" sign. The upper whisker extends to the largest data value that is less than the upper quartile plus 1.5 times the interquartile range (upper quartile minus the lower quartile). The lower whisker extends to the smallest data value that is greater than the lower quartile minus 1.5 times the interquartile range. Extreme data values (greater or smaller than the ends of the whiskers) are plotted individually. A Box and Whiskers plot is used to assess the symmetry of the distribution of the data set. If the distribution is symmetrical, the box is divided into two equal halves by the median, the whiskers will be the same length, and the number of extreme data points will be distributed equally on either end of the plot.

The Q-Q plot graphs the quantiles of a set of n data against the quantiles of a specific distribution. We show here only the Q-Q plot for an assumed normal distribution. The pth quantile of a distribution of data is the data value, x_n, for which a fraction p of the distribution is less than x_n. If the data plotted on the normal distribution Q-Q plot closely follow a straight line, even at the ends of the line, then the data may be assumed to be normally distributed. If the data points deviate substantially from a linear line, then the data are not normally distributed.







For more information on these three plots consult Guidance for Data Quality Assessment, EPA QA/G-9, pgs 2.3-1 through 2.3-12. (http://www.epa.gov/quality/qa-docs.html).

Two-Sided Confidence Interval on the True Median

For calculating the confidence interval, the values are ordered from smallest to largest. The confidence limits are the highest value of the r+1 and/or lowest value of the s-1 order statistics that fit the formulas below, except when the rth ordered value is tied with higher ordered values or the sth ordered value is tied with lower ordered values. If higher numbered ordered values are ties with the rth ordered value, then the closest ordered value that is lower than r will be the confidence limit. If higher-numbered ordered values are ties with the sth ordered value, then the closest ordered value that is higher than s will be the confidence limit.

Upper Two-Sided Confidence Interval

$$\sum_{s}^{1}\left(\frac{n!}{r!(n-s)!}\right)p^{0.5}(1-p)^{n-0.5} \geq 1-\alpha/2$$

Lower Two-Sided Confidence interval

$$\sum_{r}^{1}\left(\frac{n!}{r!(n-r)!}\right)p^{0.5}(1-p)^{n-0.5} \leq \alpha/2$$

Upper 95% Two-Sided Confidence Interval on the Median	5.3

Sample Median	1.75
Lower 95% Two-Sided Confidence Interval on the Median	1.3

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* - The report contents may have been modified or reformatted by end-user of software.

Electrolysis Bldg. Pb Biased

VSP Sample Design Report for Calculating a Two-Sided Confidence Interval for the Population Median Using Simple Random Sampling

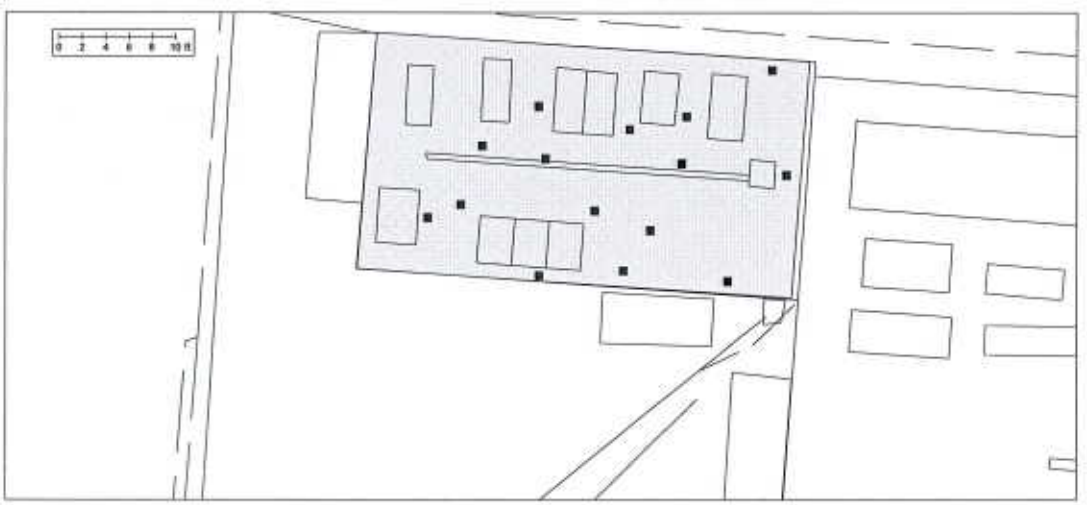
Summary

This report summarizes the sampling design used, associated statistical assumptions, as well as general guidelines for conducting post-sampling data analysis. Sampling plan components presented here include how many sampling locations to choose and where within the sampling area to collect those samples. The type of medium to sample (i.e., soil, groundwater, etc.) and how to analyze the samples (in-situ, fixed laboratory, etc.) are addressed in other sections of the sampling plan.

The following table summarizes the sampling design developed. A figure that shows sampling locations in the field and a table that lists sampling location coordinates are also provided below.

SUMMARY OF SAMPLING DESIGN	
Primary Objective of Design	Construct a Confidence Interval on the True Median
Type of Sampling Design	Non-Parametric
Sample Placement (Location) in the Field	Simple random sampling
Formula for calculating number of sampling locations	Nonparametric Confidence Limits
Calculated total number of samples	15
Number of samples on map [a]	15
Number of selected sample areas [b]	1
Specified sampling area [c]	755.90 ft^2
Total cost of sampling [d]	$6,700.00

[a] This number may differ from the calculated number because of 1) grid edge effects, 2) adding judgment samples, or 3) selecting or unselecting sample areas.
[b] The number of selected sample areas is the number of colored areas on the map of the site. These sample areas contain the locations where samples are collected.
[c] The sampling area is the total surface area of the selected colored sample areas on the map of the site.
[d] Including measurement analyses and fixed overhead costs. See the Cost of Sampling section for an explanation of the costs presented here.



Area: Area 1					
X Coord	Y Coord	Label	Value	Type	Historical

4928.9658	5229.8854	GP-44	1.5	Random	
4922.1885	5239.3872	GP-51	15	Random	
4941.7431	5246.8890	GP-49	1.6	Random	
4911.9669	5234.3860	GP-55	3.4	Random	
4929.5215	5241.8878	GP-50	5.3	Random	
4914.8555	5235.4974	GP-54	2.1	Random	
4934.4101	5242.9992	GP-48	1.8	Random	
4921.6328	5229.4961	GP-57	1.3	Random	
4943.0000	5237.9980	GP-46	1.7	Random	
4926.4661	5234.9967	GP-56	1.7	Random	
4916.6888	5240.4986	GP-53	3.4	Random	
4931.3547	5233.3309	GP-45	1.4	Random	
4921.5774	5243.8327	GP-52	2.4	Random	
4938.0000	5229.0000	GP-43	1.1	Unknown	
4934.0000	5239.0000	GP-47	1.2	Unknown	

Primary Sampling Objective
The primary purpose of sampling at this site is to construct a confidence interval on the true population median value. After the samples are collected and analyzed, the resulting sample values can be used to construct a two-sided confidence interval. Once the confidence interval is computed (which will be an upper and a lower threshold), you can have the specified confidence that the true population median is between the upper and lower thresholds.

Selected Sampling Approach
A non-parametric random sampling approach was used to determine the number of samples and to specify sampling locations. A parametric formula was not chosen because the conceptual model and historical information (e.g., historical data from this site or a very similar site) indicate that parametric assumptions are not true. These assumptions will be examined in post-sampling data analysis.

Both parametric and non-parametric equations rely on assumptions about the population. Typically, however, non-parametric equations require fewer assumptions and allow for more uncertainty about the statistical distribution of values at the site. The trade-off is that if the parametric assumptions are valid, the required number of samples is usually less than if a non-parametric equation was used.

Locating the sample points randomly provides data that are separated by many distances, whereas systematic samples are all equidistant apart. Therefore, random sampling provides more information about the spatial structure of the potential contamination than systematic sampling does. As with systematic sampling, random sampling also provides information regarding the mean or median value, but there is the possibility that areas of the site will not be represented with the same frequency as if uniform grid sampling were performed.

Number of Total Samples: Calculation Equation and Inputs
Two sample confidence interval calculation methods are available for when n□20 and n>20 (Conover, 1980, p. 111-117) (Gilbert, 1987,p. 141-142). In VSP, the user specifies a one-sided or two-sided CI, and the percent confidence desired to be within a specified number of percentiles of the median. A binary search is then performed on the CI equations to solve for the minimum sample size to satisfy these parameters. VSP first uses the n□20 method to determine if a solution can be found where n□20, and if not, then uses the n>20 method.

For a one-sided CI, the n□20 method follows a binomial distribution and determines the lowest value of n where the yth quantile of the sample would be equal to or above the true median at least X% of the time (Note that the sample sizes work out to be the same regardless of whether the CI will be a lower or upper tailed, so the same formula can be used for any one-sided CI). X% is the specified confidence for one-sided confidence intervals, and the average of 100% and the specified confidence for two-sided confidence intervals. The yth quantile is determined by taking 50% and subtracting the allowable number of percentiles from the median specified by the user.

For a two-sided CI, the n□20 method is the same as performing a one-sided confidence interval, but replacing the

specified percent confidence with the average of 100% and the specified percent confidence. If no solution is found where n□20, a binary search is conducted using Equation (1) for a one-sided CI and Equation (2) for a two-sided interval to compute the value of r (r is the the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest), rounding r up to the next higher integer. The search is repeated until the smallest n is found where 100*2*r/n is greater than 50% minus the allowable number of percentiles from the median specified by the user.

$$r = 0.5 * n - 0.5 * w_{\alpha} \sqrt{n} \qquad (1)$$

$$r = 0.5 * n - 0.5 * w_{\alpha/2} \sqrt{n} \qquad (2)$$

Where:

n is the sample size

r is the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest

$w_{\square}$ is the specified quantile of a normal distribution, e.g. if □=0.2 then $w_{\square}$ is the 0.2 quantile (20th percentile) of a normal distribution.

The n>20 method described above is an approximation method, so VSP also performs a final check using a binomial distribution in a similar manner to the n□20 method, and may increase the sample size by 1 to ensure the specified confidence levels are met.

Cost of Sampling

The total cost of the completed sampling program depends on several cost inputs, some of which are fixed, and others that are based on the number of samples collected and measured. Based on the numbers of samples determined above, the estimated total cost of sampling and analysis at this site is $6,700.00, which averages out to a per sample cost of $446.67. The following table summarizes the inputs and resulting cost estimates.

COST INFORMATION			
Cost Details	**Per Analysis**	**Per Sample**	**15 Samples**
Field collection costs		$250.00	$3,750.00
Analytical costs	$130.00	$130.00	$1,950.00
Sum of Field & Analytical costs		**$380.00**	**$5,700.00**
Fixed planning and validation costs			$1,000.00
Total cost			**$6,700.00**

Data Analysis for Pb

The following data points were entered by the user for analysis.

Pb										
Rank	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.7	1.8	2.1
10	2.4	3.4	3.4	5.3	15					

SUMMARY STATISTICS for Pb	
n	15
Min	1.1
Max	15

Range	13.9
Mean	2.9933
Median	1.7
Variance	12.294
StdDev	3.5062
Std Error	0.9053
Skewness	3.2675
Interquartile Range	2

Percentiles								
1%	**5%**	**10%**	**25%**	**50%**	**75%**	**90%**	**95%**	**99%**
1.1	1.1	1.16	1.4	1.7	3.4	9.18	15	15

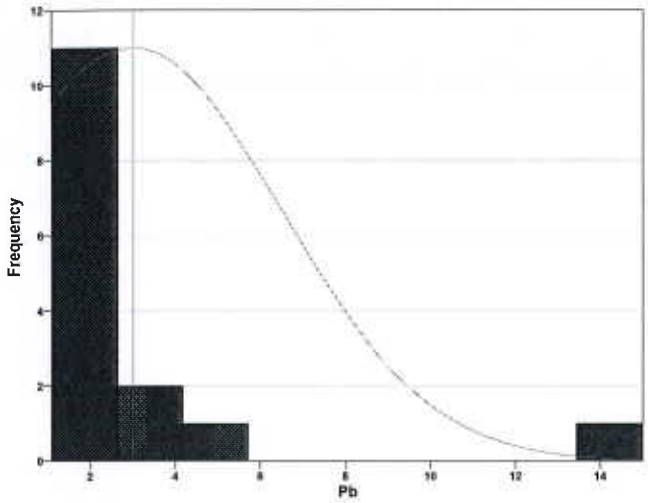
Data Plots

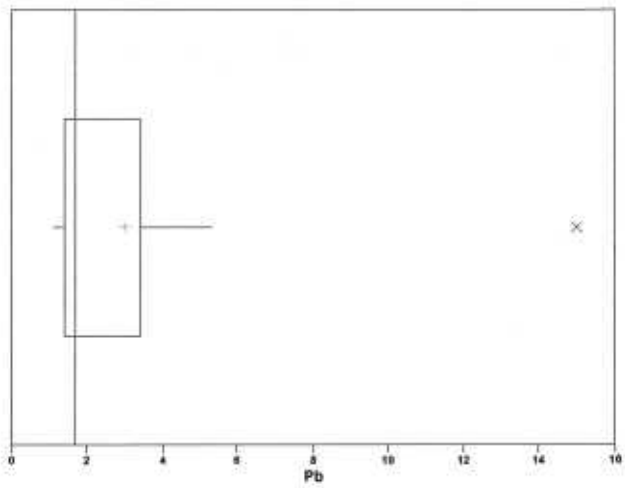
Three graphical displays of the data are shown below: the Histogram, the Box and Whiskers plot, and the Quantile-Quantile (Q-Q) plot.

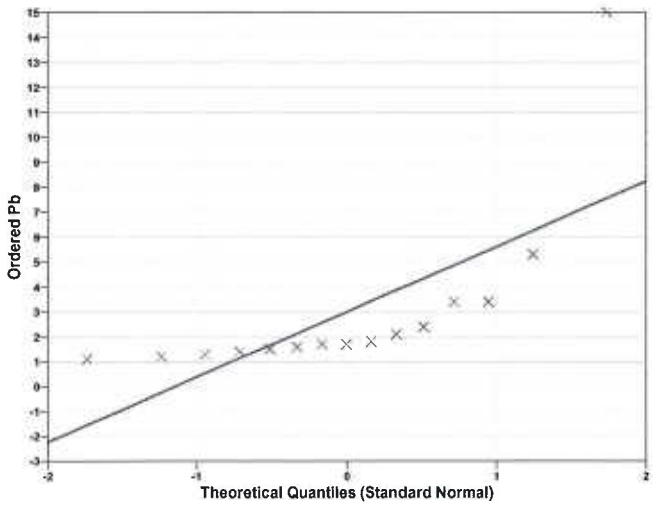
The Histogram is a plot of the fraction of the n observed data that fall within specified data "bins." A histogram is generated by dividing the x axis (range of the observed data values) into "bins" and displaying the number of data in each bin as the height of a bar for the bin. The area of the bar is the fraction of the n data values that lie within the bin. The sum of the fractions for all bins equals one. A histogram is used to assess how the n data are distributed (spread) over their range of values. If the histogram is more or less symmetric and bell shaped, then the data may be normally distributed.

The Box and Whiskers plot is composed of a central box divided by a line, and with two lines extending out from the box, called the "whiskers". The line through the box is drawn at the median of the n data observed. The two ends of the box represent the 25th and 75th percentiles of the n data values, which are also called the lower and upper quartiles, respectively, of the data set. The sample mean (mean of the n data) is shown as a "+" sign. The upper whisker extends to the largest data value that is less than the upper quartile plus 1.5 times the interquartile range (upper quartile minus the lower quartile). The lower whisker extends to the smallest data value that is greater than the lower quartile minus 1.5 times the interquartile range. Extreme data values (greater or smaller than the ends of the whiskers) are plotted individually. A Box and Whiskers plot is used to assess the symmetry of the distribution of the data set. If the distribution is symmetrical, the box is divided into two equal halves by the median, the whiskers will be the same length, and the number of extreme data points will be distributed equally on either end of the plot.

The Q-Q plot graphs the quantiles of a set of n data against the quantiles of a specific distribution. We show here only the Q-Q plot for an assumed normal distribution. The pth quantile of a distribution of data is the data value, x_n, for which a fraction p of the distribution is less than x_n. If the data plotted on the normal distribution Q-Q plot closely follow a straight line, even at the ends of the line, then the data may be assumed to be normally distributed. If the data points deviate substantially from a linear line, then the data are not normally distributed.







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Two-Sided Confidence Interval on the True Median

For calculating the confidence interval, the values are ordered from smallest to largest. The confidence limits are the highest value of the r+1 and/or lowest value of the s-1 order statistics that fit the formulas below, except when the rth ordered value is tied with higher ordered values or the sth ordered value is tied with lower ordered values. If higher numbered ordered values are ties with the rth ordered value, then the closest ordered value that is lower than r will be the confidence limit. If higher-numbered ordered values are ties with the sth ordered value, then the closest ordered value that is higher than s will be the confidence limit.

Upper Two-Sided Confidence Interval

$$\sum_{s}^{1}\left(\frac{n!}{r!(n-s)!}\right)p^{0.5}(1-p)^{n-0.5} \geq 1-\alpha/2$$

Lower Two-Sided Confidence interval

$$\sum_{r}^{1}\left(\frac{n!}{r!(n-r)!}\right)p^{0.5}(1-p)^{n-0.5} \leq \alpha/2$$

Upper 95% Two-Sided Confidence Interval on the Median	3.4

Sample Median	1.7
Lower 95% Two-Sided Confidence Interval on the Median	1.3

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* - The report contents may have been modified or reformatted by end-user of software.

Elect. Bldg N'

VSP Sample Design Report for Calculating a Two-Sided Confidence Interval for the Population Median Using Simple Random Sampling

Summary

This report summarizes the sampling design used, associated statistical assumptions, as well as general guidelines for conducting post-sampling data analysis. Sampling plan components presented here include how many sampling locations to choose and where within the sampling area to collect those samples. The type of medium to sample (i.e., soil, groundwater, etc.) and how to analyze the samples (in-situ, fixed laboratory, etc.) are addressed in other sections of the sampling plan.

The following table summarizes the sampling design developed. A figure that shows sampling locations in the field and a table that lists sampling location coordinates are also provided below.

SUMMARY OF SAMPLING DESIGN	
Primary Objective of Design	Construct a Confidence Interval on the True Median
Type of Sampling Design	Non-Parametric
Sample Placement (Location) in the Field	Simple random sampling
Formula for calculating number of sampling locations	Nonparametric Confidence Limits
Calculated total number of samples	15
Number of samples on map [a]	14
Number of selected sample areas [b]	1
Specified sampling area [c]	755.90 ft^2
Total cost of sampling [d]	$6,700.00

[a] This number may differ from the calculated number because of 1) grid edge effects, 2) adding judgment samples, or 3) selecting or unselecting sample areas.
[b] The number of selected sample areas is the number of colored areas on the map of the site. These sample areas contain the locations where samples are collected.
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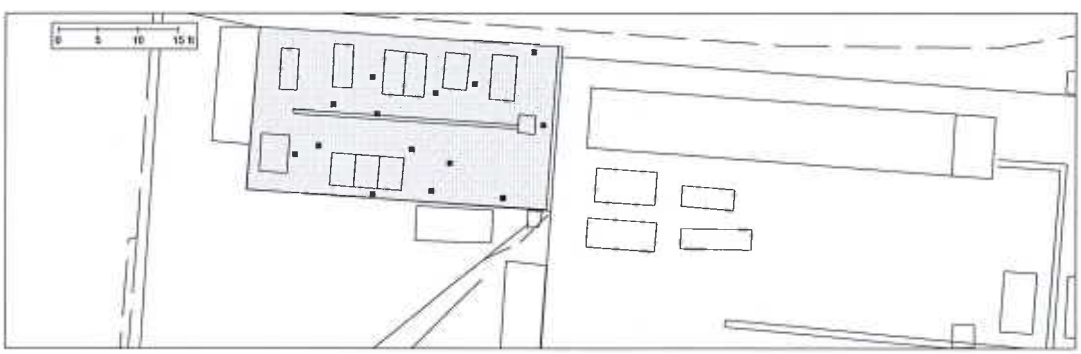

Area: Area 1					
X Coord	Y Coord	Label	Value	Type	Historical
4928.9658	5229.8854	GP-44	7.5	Random	
4922.1885	5239.3872	GP-51	19	Random	
4941.7431	5246.8890	GP-49	300	Random	

4911.9669	5234.3860	GP-55	13	Random	
4929.5215	5241.8878	GP-50	240	Random	
4914.8555	5235.4974	GP-54	14	Random	
4934.4101	5242.9992	GP-48	97	Random	
4921.6328	5229.4961	GP-57	9	Random	
4943.0000	5237.9980	GP-46	200	Random	
4926.4661	5234.9967	GP-56	15	Random	
4916.6888	5240.4986	GP-53	17	Random	
4931.3547	5233.3309	GP-45	14	Random	
4921.5774	5243.8327	GP-52	16	Random	
4938.0000	5229.0000	GP-43	5.7	Unknown	

Primary Sampling Objective
The primary purpose of sampling at this site is to construct a confidence interval on the true population median value. After the samples are collected and analyzed, the resulting sample values can be used to construct a two-sided confidence interval. Once the confidence interval is computed (which will be an upper and a lower threshold), you can have the specified confidence that the true population median is between the upper and lower thresholds.

Selected Sampling Approach
A non-parametric random sampling approach was used to determine the number of samples and to specify sampling locations. A parametric formula was not chosen because the conceptual model and historical information (e.g., historical data from this site or a very similar site) indicate that parametric assumptions are not true. These assumptions will be examined in post-sampling data analysis.

Both parametric and non-parametric equations rely on assumptions about the population. Typically, however, non-parametric equations require fewer assumptions and allow for more uncertainty about the statistical distribution of values at the site. The trade-off is that if the parametric assumptions are valid, the required number of samples is usually less than if a non-parametric equation was used.

Locating the sample points randomly provides data that are separated by many distances, whereas systematic samples are all equidistant apart. Therefore, random sampling provides more information about the spatial structure of the potential contamination than systematic sampling does. As with systematic sampling, random sampling also provides information regarding the mean or median value, but there is the possibility that areas of the site will not be represented with the same frequency as if uniform grid sampling were performed.

Number of Total Samples: Calculation Equation and Inputs
Two sample confidence interval calculation methods are available for when n□20 and n>20 (Conover, 1980, p. 111-117) (Gilbert, 1987,p. 141-142). In VSP, the user specifies a one-sided or two-sided CI, and the percent confidence desired to be within a specified number of percentiles of the median. A binary search is then performed on the CI equations to solve for the minimum sample size to satisfy these parameters. VSP first uses the n□20 method to determine if a solution can be found where n□20, and if not, then uses the n>20 method.

For a one-sided CI, the n□20 method follows a binomial distribution and determines the lowest value of n where the yth quantile of the sample would be equal to or above the true median at least X% of the time (Note that the sample sizes work out to be the same regardless of whether the CI will be a lower or upper tailed, so the same formula can be used for any one-sided CI). X% is the specified confidence for one-sided confidence intervals, and the average of 100% and the specified confidence for two-sided confidence intervals. The yth quantile is determined by taking 50% and subtracting the allowable number of percentiles from the median specified by the user.

For a two-sided CI, the n□20 method is the same as performing a one-sided confidence interval, but replacing the specified percent confidence with the average of 100% and the specified percent confidence. If no solution is found where n□20, a binary search is conducted using Equation (1) for a one-sided CI and Equation (2) for a two-sided interval to compute the value of r (r is the the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest), rounding r up to the next higher integer. The search is repeated until the smallest n is found where 100*2*r/n is greater than 50% minus the allowable number of percentiles from the median specified by the user.

$$r = 0.5 * n - 0.5 * w_{\alpha} \sqrt{n} \qquad (1)$$

$$r = 0.5 * n - 0.5 * w_{\alpha/2} \sqrt{n} \qquad (2)$$

Where:

n is the sample size

r is the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest

$w_{\square}$ is the specified quantile of a normal distribution, e.g. if $\square$=0.2 then $w_{\square}$ is the 0.2 quantile (20th percentile) of a normal distribution.

The n>20 method described above is an approximation method, so VSP also performs a final check using a binomial distribution in a similar manner to the n$\square$20 method, and may increase the sample size by 1 to ensure the specified confidence levels are met.

Cost of Sampling
The total cost of the completed sampling program depends on several cost inputs, some of which are fixed, and others that are based on the number of samples collected and measured. Based on the numbers of samples determined above, the estimated total cost of sampling and analysis at this site is $6,700.00, which averages out to a per sample cost of $446.67. The following table summarizes the inputs and resulting cost estimates.

COST INFORMATION			
Cost Details	**Per Analysis**	**Per Sample**	**15 Samples**
Field collection costs		$250.00	$3,750.00
Analytical costs	$130.00	$130.00	$1,950.00
Sum of Field & Analytical costs		**$380.00**	**$5,700.00**
Fixed planning and validation costs			$1,000.00
Total cost			**$6,700.00**

Data Analysis for Ni
The following data points were entered by the user for analysis.

Ni										
Rank	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
0	5.7	7.5	9	13	14	14	15	16	17	19
10	97	200	240	300						

SUMMARY STATISTICS for Ni	
n	14
Min	5.7
Max	300
Range	294.3
Mean	69.086
Median	15.5
Variance	10158
StdDev	100.79

Std Error				26.936				
Skewness				1.5586				
Interquartile Range				110.75				
Percentiles								
1%	5%	10%	25%	50%	75%	90%	95%	99%
5.7	5.7	6.6	12	15.5	122.8	270	300	300

Data Plots

Three graphical displays of the data are shown below: the Histogram, the Box and Whiskers plot, and the Quantile-Quantile (Q-Q) plot.

The Histogram is a plot of the fraction of the n observed data that fall within specified data "bins." A histogram is generated by dividing the x axis (range of the observed data values) into "bins" and displaying the number of data in each bin as the height of a bar for the bin. The area of the bar is the fraction of the n data values that lie within the bin. The sum of the fractions for all bins equals one. A histogram is used to assess how the n data are distributed (spread) over their range of values. If the histogram is more or less symmetric and bell shaped, then the data may be normally distributed.

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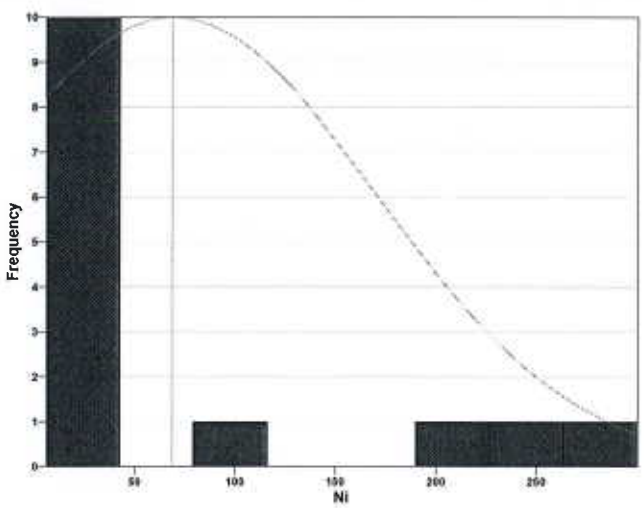
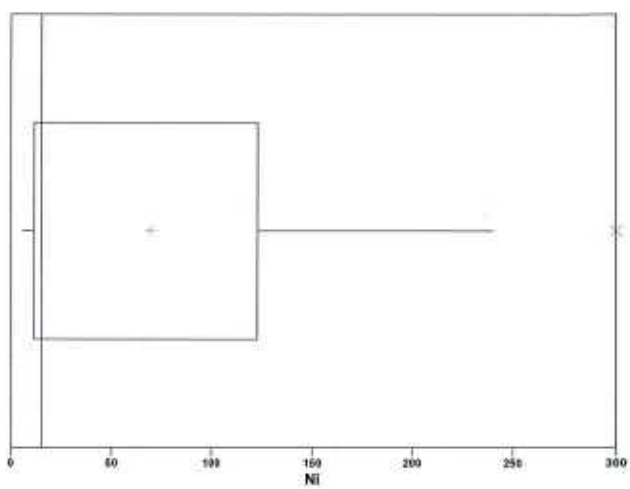
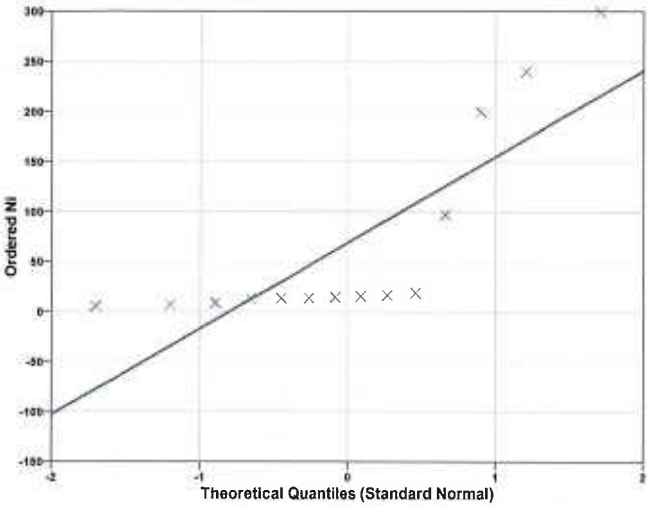
The Q-Q plot graphs the quantiles of a set of n data against the quantiles of a specific distribution. We show here only the Q-Q plot for an assumed normal distribution. The pth quantile of a distribution of data is the data value, x_p, for which a fraction p of the distribution is less than x_p. If the data plotted on the normal distribution Q-Q plot closely follow a straight line, even at the ends of the line, then the data may be assumed to be normally distributed. If the data points deviate substantially from a linear line, then the data are not normally distributed.







For more information on these three plots consult Guidance for Data Quality Assessment, EPA QA/G-9, pgs 2.3-1 through 2.3-12. (http://www.epa.gov/quality/qa-docs.html).

Two-Sided Confidence Interval on the True Median

For calculating the confidence interval, the values are ordered from smallest to largest. The confidence limits are the highest value of the r+1 and/or lowest value of the s-1 order statistics that fit the formulas below, except when the rth ordered value is tied with higher ordered values or the sth ordered value is tied with lower ordered values. If higher numbered ordered values are ties with the rth ordered value, then the closest ordered value that is lower than r will be the confidence limit. If higher-numbered ordered values are ties with the sth ordered value, then the closest ordered value that is higher than s will be the confidence limit.

Upper Two-Sided Confidence Interval

$$\sum_{s}^{1}\left(\frac{n!}{r!(n-s)!}\right)p^{0.5}(1-p)^{n-0.5} \geq 1-\alpha/2$$

Lower Two-Sided Confidence interval

$$\sum_{r}^{1}\left(\frac{n!}{r!(n-r)!}\right)p^{0.5}(1-p)^{n-0.5} \leq \alpha/2$$

Upper 95% Two-Sided Confidence Interval on the Median	240
Sample Median	15.5
Lower 95% Two-Sided Confidence Interval on the Median	7.5

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Electrolysis Bldg Ni Brisard

VSP Sample Design Report for Calculating a Two-Sided Confidence Interval for the Population Median Using Simple Random Sampling

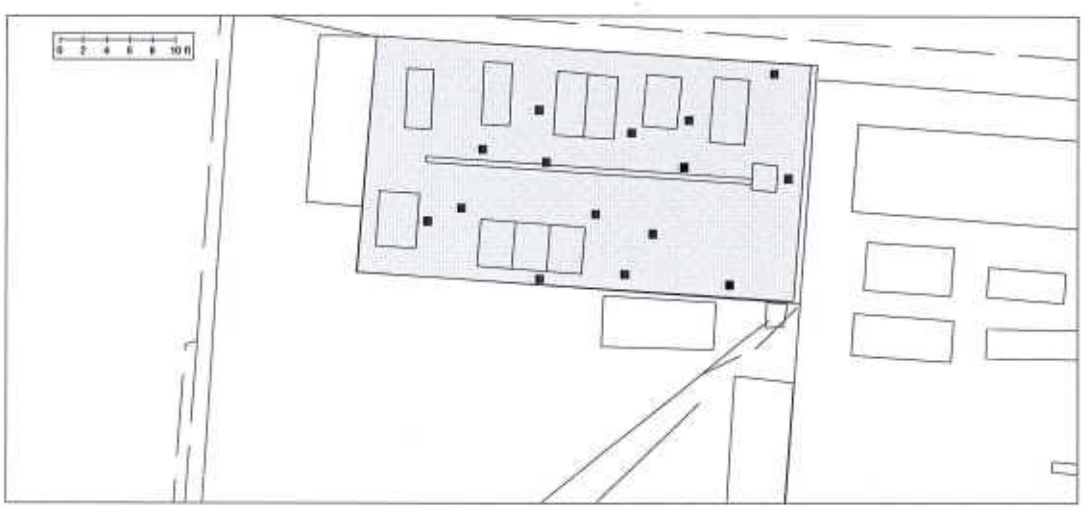
Summary

This report summarizes the sampling design used, associated statistical assumptions, as well as general guidelines for conducting post-sampling data analysis. Sampling plan components presented here include how many sampling locations to choose and where within the sampling area to collect those samples. The type of medium to sample (i.e., soil, groundwater, etc.) and how to analyze the samples (in-situ, fixed laboratory, etc.) are addressed in other sections of the sampling plan.

The following table summarizes the sampling design developed. A figure that shows sampling locations in the field and a table that lists sampling location coordinates are also provided below.

SUMMARY OF SAMPLING DESIGN	
Primary Objective of Design	Construct a Confidence Interval on the True Median
Type of Sampling Design	Non-Parametric
Sample Placement (Location) in the Field	Simple random sampling
Formula for calculating number of sampling locations	Nonparametric Confidence Limits
Calculated total number of samples	15
Number of samples on map [a]	15
Number of selected sample areas [b]	1
Specified sampling area [c]	755.90 ft^2
Total cost of sampling [d]	$6,700.00

[a] This number may differ from the calculated number because of 1) grid edge effects, 2) adding judgment samples, or 3) selecting or unselecting sample areas.
[b] The number of selected sample areas is the number of colored areas on the map of the site. These sample areas contain the locations where samples are collected.
[c] The sampling area is the total surface area of the selected colored sample areas on the map of the site.
[d] Including measurement analyses and fixed overhead costs. See the Cost of Sampling section for an explanation of the costs presented here.



Area: Area 1					
X Coord	Y Coord	Label	Value	Type	Historical

4928.9658	5229.8854	GP-44	7.5	Random	
4922.1885	5239.3872	GP-51	19	Random	
4941.7431	5246.8890	GP-49	300	Random	
4911.9669	5234.3860	GP-55	13	Random	
4929.5215	5241.8878	GP-50	240	Random	
4914.8555	5235.4974	GP-54	14	Random	
4934.4101	5242.9992	GP-48	97	Random	
4921.6328	5229.4961	GP-57	9	Random	
4943.0000	5237.9980	GP-46	200	Random	
4926.4661	5234.9967	GP-56	15	Random	
4916.6888	5240.4986	GP-53	17	Random	
4931.3547	5233.3309	GP-45	14	Random	
4921.5774	5243.8327	GP-52	16	Random	
4938.0000	5229.0000	GP-43	5.7	Unknown	
4934.0000	5239.0000	GP-47	130	Unknown	

Primary Sampling Objective
The primary purpose of sampling at this site is to construct a confidence interval on the true population median value. After the samples are collected and analyzed, the resulting sample values can be used to construct a two-sided confidence interval. Once the confidence interval is computed (which will be an upper and a lower threshold), you can have the specified confidence that the true population median is between the upper and lower thresholds.

Selected Sampling Approach
A non-parametric random sampling approach was used to determine the number of samples and to specify sampling locations. A parametric formula was not chosen because the conceptual model and historical information (e.g., historical data from this site or a very similar site) indicate that parametric assumptions are not true. These assumptions will be examined in post-sampling data analysis.

Both parametric and non-parametric equations rely on assumptions about the population. Typically, however, non-parametric equations require fewer assumptions and allow for more uncertainty about the statistical distribution of values at the site. The trade-off is that if the parametric assumptions are valid, the required number of samples is usually less than if a non-parametric equation was used.

Locating the sample points randomly provides data that are separated by many distances, whereas systematic samples are all equidistant apart. Therefore, random sampling provides more information about the spatial structure of the potential contamination than systematic sampling does. As with systematic sampling, random sampling also provides information regarding the mean or median value, but there is the possibility that areas of the site will not be represented with the same frequency as if uniform grid sampling were performed.

Number of Total Samples: Calculation Equation and Inputs
Two sample confidence interval calculation methods are available for when n□20 and n>20 (Conover, 1980, p. 111-117) (Gilbert, 1987,p. 141-142). In VSP, the user specifies a one-sided or two-sided CI, and the percent confidence desired to be within a specified number of percentiles of the median. A binary search is then performed on the CI equations to solve for the minimum sample size to satisfy these parameters. VSP first uses the n□20 method to determine if a solution can be found where n□20, and if not, then uses the n>20 method.

For a one-sided CI, the n□20 method follows a binomial distribution and determines the lowest value of n where the yth quantile of the sample would be equal to or above the true median at least X% of the time (Note that the sample sizes work out to be the same regardless of whether the CI will be a lower or upper tailed, so the same formula can be used for any one-sided CI). X% is the specified confidence for one-sided confidence intervals, and the average of 100% and the specified confidence for two-sided confidence intervals. The yth quantile is determined by taking 50% and subtracting the allowable number of percentiles from the median specified by the user.

For a two-sided CI, the n□20 method is the same as performing a one-sided confidence interval, but replacing the

specified percent confidence with the average of 100% and the specified percent confidence. If no solution is found where n□20, a binary search is conducted using Equation (1) for a one-sided CI and Equation (2) for a two-sided interval to compute the value of r (r is the the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest), rounding r up to the next higher integer. The search is repeated until the smallest n is found where 100*2*r/n is greater than 50% minus the allowable number of percentiles from the median specified by the user.

$$r = 0.5 * n - 0.5 * w_{\alpha} \sqrt{n} \qquad (1)$$

$$r = 0.5 * n - 0.5 * w_{\alpha/2} \sqrt{n} \qquad (2)$$

Where:

n is the sample size

r is the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest

$w_{\square}$ is the specified quantile of a normal distribution, e.g. if □=0.2 then $w_{\square}$ is the 0.2 quantile (20th percentile) of a normal distribution.

The n>20 method described above is an approximation method, so VSP also performs a final check using a binomial distribution in a similar manner to the n□20 method, and may increase the sample size by 1 to ensure the specified confidence levels are met.

Cost of Sampling

The total cost of the completed sampling program depends on several cost inputs, some of which are fixed, and others that are based on the number of samples collected and measured. Based on the numbers of samples determined above, the estimated total cost of sampling and analysis at this site is $6,700.00, which averages out to a per sample cost of $446.67. The following table summarizes the inputs and resulting cost estimates.

COST INFORMATION			
Cost Details	**Per Analysis**	**Per Sample**	**15 Samples**
Field collection costs		$250.00	$3,750.00
Analytical costs	$130.00	$130.00	$1,950.00
Sum of Field & Analytical costs		**$380.00**	**$5,700.00**
Fixed planning and validation costs			$1,000.00
Total cost			**$6,700.00**

Data Analysis for Ni

The following data points were entered by the user for analysis.

	Ni									
Rank	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
0	5.7	7.5	9	13	14	14	15	16	17	19
10	97	130	200	240	300					

SUMMARY STATISTICS for Ni	
n	15
Min	5.7
Max	300

Range	294.3
Mean	73.147
Median	16
Variance	9679.6
StdDev	98.385
Std Error	25.403
Skewness	1.4154
Interquartile Range	117

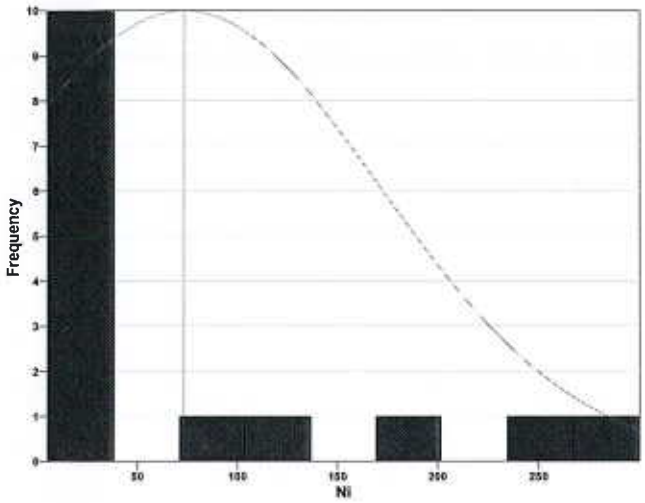
Percentiles								
1%	**5%**	**10%**	**25%**	**50%**	**75%**	**90%**	**95%**	**99%**
5.7	5.7	6.78	13	16	130	264	300	300

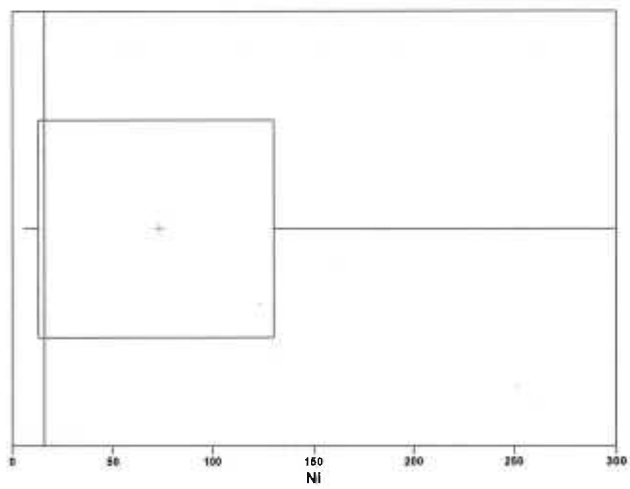
Data Plots
Three graphical displays of the data are shown below: the Histogram, the Box and Whiskers plot, and the Quantile-Quantile (Q-Q) plot.

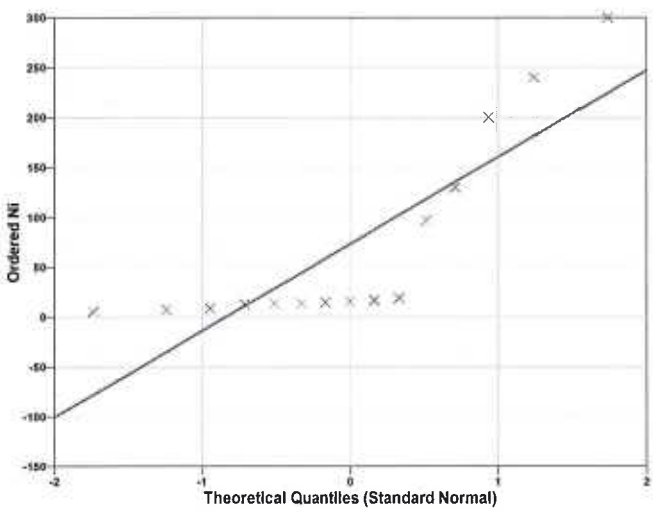
The Histogram is a plot of the fraction of the n observed data that fall within specified data "bins." A histogram is generated by dividing the x axis (range of the observed data values) into "bins" and displaying the number of data in each bin as the height of a bar for the bin. The area of the bar is the fraction of the n data values that lie within the bin. The sum of the fractions for all bins equals one. A histogram is used to assess how the n data are distributed (spread) over their range of values. If the histogram is more or less symmetric and bell shaped, then the data may be normally distributed.

The Box and Whiskers plot is composed of a central box divided by a line, and with two lines extending out from the box, called the "whiskers". The line through the box is drawn at the median of the n data observed. The two ends of the box represent the 25th and 75th percentiles of the n data values, which are also called the lower and upper quartiles, respectively, of the data set. The sample mean (mean of the n data) is shown as a "+" sign. The upper whisker extends to the largest data value that is less than the upper quartile plus 1.5 times the interquartile range (upper quartile minus the lower quartile). The lower whisker extends to the smallest data value that is greater than the lower quartile minus 1.5 times the interquartile range. Extreme data values (greater or smaller than the ends of the whiskers) are plotted individually. A Box and Whiskers plot is used to assess the symmetry of the distribution of the data set. If the distribution is symmetrical, the box is divided into two equal halves by the median, the whiskers will be the same length, and the number of extreme data points will be distributed equally on either end of the plot.

The Q-Q plot graphs the quantiles of a set of n data against the quantiles of a specific distribution. We show here only the Q-Q plot for an assumed normal distribution. The pth quantile of a distribution of data is the data value, x_p, for which a fraction p of the distribution is less than x_p. If the data plotted on the normal distribution Q-Q plot closely follow a straight line, even at the ends of the line, then the data may be assumed to be normally distributed. If the data points deviate substantially from a linear line, then the data are not normally distributed.







For more information on these three plots consult Guidance for Data Quality Assessment, EPA QA/G-9, pgs 2.3-1 through 2.3-12. (http://www.epa.gov/quality/qa-docs.html).

Two-Sided Confidence Interval on the True Median

For calculating the confidence interval, the values are ordered from smallest to largest. The confidence limits are the highest value of the r+1 and/or lowest value of the s-1 order statistics that fit the formulas below, except when the rth ordered value is tied with higher ordered values or the sth ordered value is tied with lower ordered values. If higher numbered ordered values are ties with the rth ordered value, then the closest ordered value that is lower than r will be the confidence limit. If higher-numbered ordered values are ties with the sth ordered value, then the closest ordered value that is higher than s will be the confidence limit.

Upper Two-Sided Confidence Interval

$$\sum_{s}^{1}\left(\frac{n!}{r!(n-s)!}\right)p^{0.5}(1-p)^{n-0.5} \geq 1-\alpha/2$$

Lower Two-Sided Confidence interval

$$\sum_{r}^{1}\left(\frac{n!}{r!(n-r)!}\right)p^{0.5}(1-p)^{n-0.5} \leq \alpha/2$$

Upper 95% Two-Sided Confidence Interval on the Median	200

Sample Median	16
Lower 95% Two-Sided Confidence Interval on the Median	9

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* - The report contents may have been modified or reformatted by end-user of software.

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VSP Sample Design Report for Calculating a Two-Sided Confidence Interval for the Population Median Using Simple Random Sampling

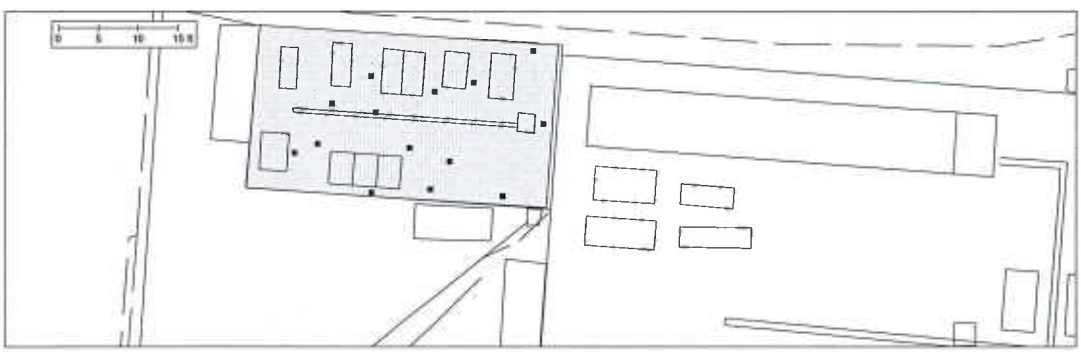
Summary

This report summarizes the sampling design used, associated statistical assumptions, as well as general guidelines for conducting post-sampling data analysis. Sampling plan components presented here include how many sampling locations to choose and where within the sampling area to collect those samples. The type of medium to sample (i.e., soil, groundwater, etc.) and how to analyze the samples (in-situ, fixed laboratory, etc.) are addressed in other sections of the sampling plan.

The following table summarizes the sampling design developed. A figure that shows sampling locations in the field and a table that lists sampling location coordinates are also provided below.

SUMMARY OF SAMPLING DESIGN	
Primary Objective of Design	Construct a Confidence Interval on the True Median
Type of Sampling Design	Non-Parametric
Sample Placement (Location) in the Field	Simple random sampling
Formula for calculating number of sampling locations	Nonparametric Confidence Limits
Calculated total number of samples	15
Number of samples on map [a]	14
Number of selected sample areas [b]	1
Specified sampling area [c]	755.90 ft^2
Total cost of sampling [d]	$6,700.00

[a] This number may differ from the calculated number because of 1) grid edge effects, 2) adding judgment samples, or 3) selecting or unselecting sample areas.
[b] The number of selected sample areas is the number of colored areas on the map of the site. These sample areas contain the locations where samples are collected.
[c] The sampling area is the total surface area of the selected colored sample areas on the map of the site.
[d] Including measurement analyses and fixed overhead costs. See the Cost of Sampling section for an explanation of the costs presented here.



Area: Area 1					
X Coord	Y Coord	Label	Value	Type	Historical
4928.9658	5229.8854	GP-44	0.28	Random	
4922.1885	5239.3872	GP-51	0.255	Random	
4941.7431	5246.8890	GP-49	0.27	Random	

4911.9669	5234.3860	GP-55	0.295	Random	
4929.5215	5241.8878	GP-50	0.275	Random	
4914.8555	5235.4974	GP-54	0.29	Random	
4934.4101	5242.9992	GP-48	0.27	Random	
4921.6328	5229.4961	GP-57	0.27	Random	
4943.0000	5237.9980	GP-46	0.25	Random	
4926.4661	5234.9967	GP-56	0.28	Random	
4916.6888	5240.4986	GP-53	0.29	Random	
4931.3547	5233.3309	GP-45	0.285	Random	
4921.5774	5243.8327	GP-52	0.29	Random	
4938.0000	5229.0000	GP-43	0.255	Unknown	

Primary Sampling Objective
The primary purpose of sampling at this site is to construct a confidence interval on the true population median value. After the samples are collected and analyzed, the resulting sample values can be used to construct a two-sided confidence interval. Once the confidence interval is computed (which will be an upper and a lower threshold), you can have the specified confidence that the true population median is between the upper and lower thresholds.

Selected Sampling Approach
A non-parametric random sampling approach was used to determine the number of samples and to specify sampling locations. A parametric formula was not chosen because the conceptual model and historical information (e.g., historical data from this site or a very similar site) indicate that parametric assumptions are not true. These assumptions will be examined in post-sampling data analysis.

Both parametric and non-parametric equations rely on assumptions about the population. Typically, however, non-parametric equations require fewer assumptions and allow for more uncertainty about the statistical distribution of values at the site. The trade-off is that if the parametric assumptions are valid, the required number of samples is usually less than if a non-parametric equation was used.

Locating the sample points randomly provides data that are separated by many distances, whereas systematic samples are all equidistant apart. Therefore, random sampling provides more information about the spatial structure of the potential contamination than systematic sampling does. As with systematic sampling, random sampling also provides information regarding the mean or median value, but there is the possibility that areas of the site will not be represented with the same frequency as if uniform grid sampling were performed.

Number of Total Samples: Calculation Equation and Inputs
Two sample confidence interval calculation methods are available for when n□20 and n>20 (Conover, 1980, p. 111-117) (Gilbert, 1987,p. 141-142). In VSP, the user specifies a one-sided or two-sided CI, and the percent confidence desired to be within a specified number of percentiles of the median. A binary search is then performed on the CI equations to solve for the minimum sample size to satisfy these parameters. VSP first uses the n□20 method to determine if a solution can be found where n□20, and if not, then uses the n>20 method.

For a one-sided CI, the n□20 method follows a binomial distribution and determines the lowest value of n where the yth quantile of the sample would be equal to or above the true median at least X% of the time (Note that the sample sizes work out to be the same regardless of whether the CI will be a lower or upper tailed, so the same formula can be used for any one-sided CI). X% is the specified confidence for one-sided confidence intervals, and the average of 100% and the specified confidence for two-sided confidence intervals. The yth quantile is determined by taking 50% and subtracting the allowable number of percentiles from the median specified by the user.

For a two-sided CI, the n□20 method is the same as performing a one-sided confidence interval, but replacing the specified percent confidence with the average of 100% and the specified percent confidence. If no solution is found where n□20, a binary search is conducted using Equation (1) for a one-sided CI and Equation (2) for a two-sided interval to compute the value of r (r is the the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest), rounding r up to the next higher integer. The search is repeated until the smallest n is found where 100*2*r/n is greater than 50% minus the allowable number of percentiles from the median specified by the user.

$$r = 0.5 * n - 0.5 * w_{\alpha} \sqrt{n} \qquad (1)$$

$$r = 0.5 * n - 0.5 * w_{\alpha/2} \sqrt{n} \qquad (2)$$

Where:

n is the sample size

r is the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest

$w_{\square}$ is the specified quantile of a normal distribution, e.g. if □=0.2 then $w_{\square}$ is the 0.2 quantile (20th percentile) of a normal distribution.

The n>20 method described above is an approximation method, so VSP also performs a final check using a binomial distribution in a similar manner to the n□20 method, and may increase the sample size by 1 to ensure the specified confidence levels are met.

Cost of Sampling
The total cost of the completed sampling program depends on several cost inputs, some of which are fixed, and others that are based on the number of samples collected and measured. Based on the numbers of samples determined above, the estimated total cost of sampling and analysis at this site is $6,700.00, which averages out to a per sample cost of $446.67. The following table summarizes the inputs and resulting cost estimates.

COST INFORMATION			
Cost Details	**Per Analysis**	**Per Sample**	**15 Samples**
Field collection costs		$250.00	$3,750.00
Analytical costs	$130.00	$130.00	$1,950.00
Sum of Field & Analytical costs		**$380.00**	**$5,700.00**
Fixed planning and validation costs			$1,000.00
Total cost			**$6,700.00**

Data Analysis for Sn
The following data points were entered by the user for analysis.

Sn										
Rank	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
0	0.25	0.255	0.255	0.27	0.27	0.27	0.275	0.28	0.28	0.285
10	0.29	0.29	0.29	0.295						

SUMMARY STATISTICS for Sn	
n	14
Min	0.25
Max	0.295
Range	0.045
Mean	0.27536
Median	0.2775
Variance	0.00020948
StdDev	0.014473

Std Error				0.0038682				
Skewness				-0.46009				
Interquartile Range				0.02375				
Percentiles								
1%	5%	10%	25%	50%	75%	90%	95%	99%
0.25	0.25	0.2525	0.2662	0.2775	0.29	0.2925	0.295	0.295

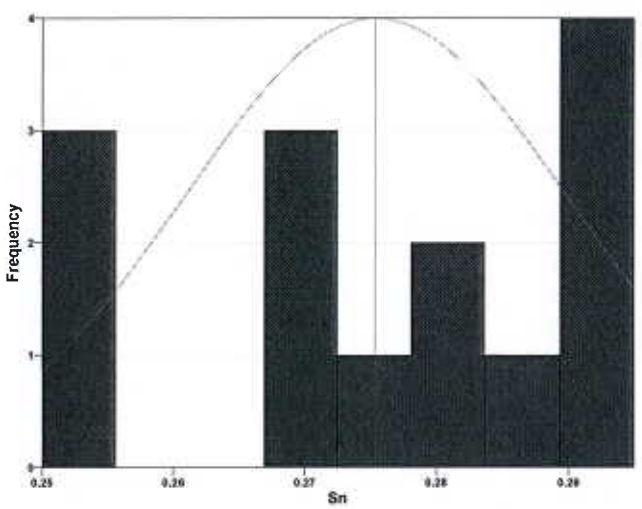
Data Plots

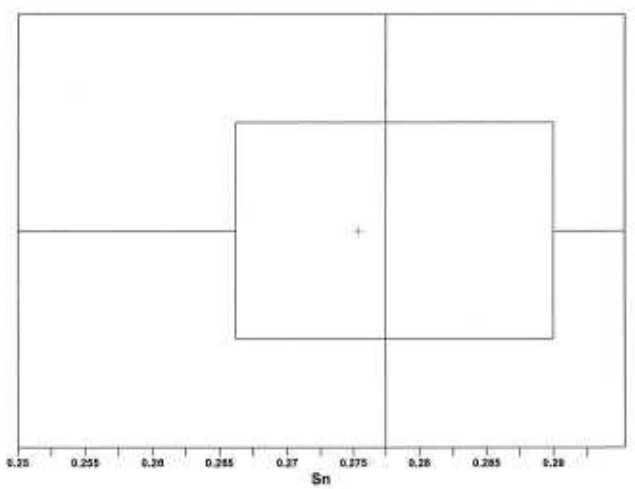
Three graphical displays of the data are shown below: the Histogram, the Box and Whiskers plot, and the Quantile-Quantile (Q-Q) plot.

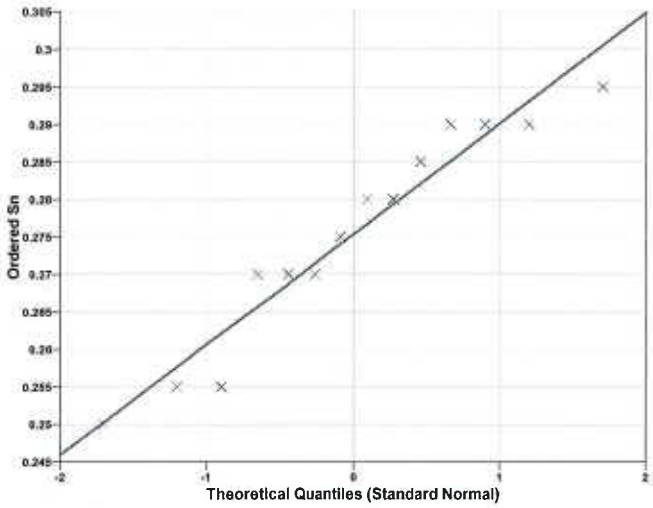
The Histogram is a plot of the fraction of the n observed data that fall within specified data "bins." A histogram is generated by dividing the x axis (range of the observed data values) into "bins" and displaying the number of data in each bin as the height of a bar for the bin. The area of the bar is the fraction of the n data values that lie within the bin. The sum of the fractions for all bins equals one. A histogram is used to assess how the n data are distributed (spread) over their range of values. If the histogram is more or less symmetric and bell shaped, then the data may be normally distributed.

The Box and Whiskers plot is composed of a central box divided by a line, and with two lines extending out from the box, called the "whiskers". The line through the box is drawn at the median of the n data observed. The two ends of the box represent the 25th and 75th percentiles of the n data values, which are also called the lower and upper quartiles, respectively, of the data set. The sample mean (mean of the n data) is shown as a "+" sign. The upper whisker extends to the largest data value that is less than the upper quartile plus 1.5 times the interquartile range (upper quartile minus the lower quartile). The lower whisker extends to the smallest data value that is greater than the lower quartile minus 1.5 times the interquartile range. Extreme data values (greater or smaller than the ends of the whiskers) are plotted individually. A Box and Whiskers plot is used to assess the symmetry of the distribution of the data set. If the distribution is symmetrical, the box is divided into two equal halves by the median, the whiskers will be the same length, and the number of extreme data points will be distributed equally on either end of the plot.

The Q-Q plot graphs the quantiles of a set of n data against the quantiles of a specific distribution. We show here only the Q-Q plot for an assumed normal distribution. The pth quantile of a distribution of data is the data value, x_p, for which a fraction p of the distribution is less than x_p. If the data plotted on the normal distribution Q-Q plot closely follow a straight line, even at the ends of the line, then the data may be assumed to be normally distributed. If the data points deviate substantially from a linear line, then the data are not normally distributed.







For more information on these three plots consult Guidance for Data Quality Assessment, EPA QA/G-9, pgs 2.3-1 through 2.3-12. (http://www.epa.gov/quality/qa-docs.html).

Two-Sided Confidence Interval on the True Median

For calculating the confidence interval, the values are ordered from smallest to largest. The confidence limits are the highest value of the r+1 and/or lowest value of the s-1 order statistics that fit the formulas below, except when the rth ordered value is tied with higher ordered values or the sth ordered value is tied with lower ordered values. If higher numbered ordered values are ties with the rth ordered value, then the closest ordered value that is lower than r will be the confidence limit. If higher-numbered ordered values are ties with the sth ordered value, then the closest ordered value that is higher than s will be the confidence limit.

Upper Two-Sided Confidence Interval

$$\sum_{s}^{1}\left(\frac{n!}{r!(n-s)!}\right)p^{0.5}(1-p)^{n-0.5} \geq 1-\alpha/2$$

Lower Two-Sided Confidence interval

$$\sum_{r}^{1}\left(\frac{n!}{r!(n-r)!}\right)p^{0.5}(1-p)^{n-0.5} \leq \alpha/2$$

Upper 95% Two-Sided Confidence Interval on the Median	0.29
Sample Median	0.2775
Lower 95% Two-Sided Confidence Interval on the Median	0.255

This report was automatically produced* by Visual Sample Plan (VSP) software version 6.1b.
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* - The report contents may have been modified or reformatted by end-user of software.

Electrolysis Bldg. Dr Briand

VSP Sample Design Report for Calculating a Two-Sided Confidence Interval for the Population Median Using Simple Random Sampling

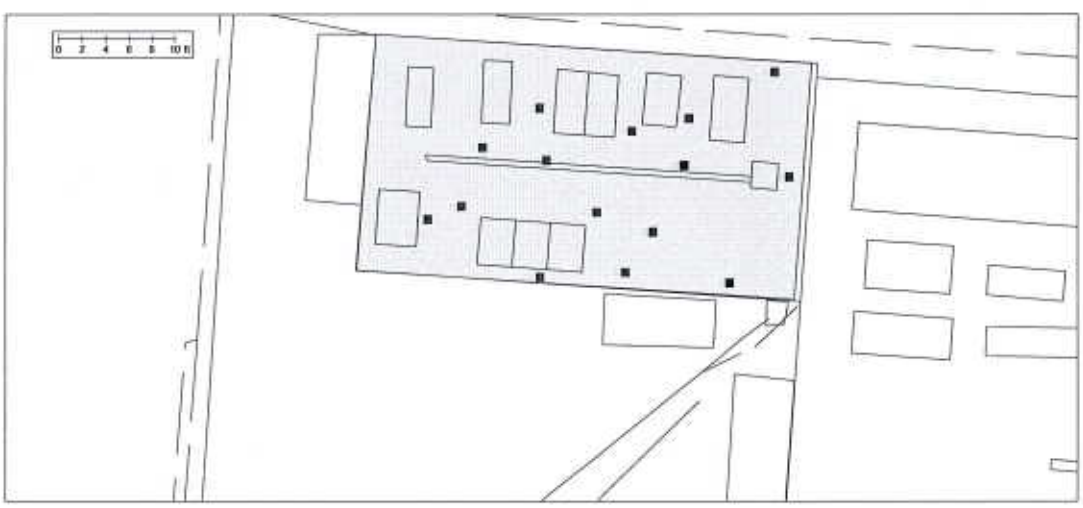
Summary

This report summarizes the sampling design used, associated statistical assumptions, as well as general guidelines for conducting post-sampling data analysis. Sampling plan components presented here include how many sampling locations to choose and where within the sampling area to collect those samples. The type of medium to sample (i.e., soil, groundwater, etc.) and how to analyze the samples (in-situ, fixed laboratory, etc.) are addressed in other sections of the sampling plan.

The following table summarizes the sampling design developed. A figure that shows sampling locations in the field and a table that lists sampling location coordinates are also provided below.

SUMMARY OF SAMPLING DESIGN	
Primary Objective of Design	Construct a Confidence Interval on the True Median
Type of Sampling Design	Non-Parametric
Sample Placement (Location) in the Field	Simple random sampling
Formula for calculating number of sampling locations	Nonparametric Confidence Limits
Calculated total number of samples	15
Number of samples on map [a]	15
Number of selected sample areas [b]	1
Specified sampling area [c]	755.90 ft^2
Total cost of sampling [d]	$6,700.00

[a] This number may differ from the calculated number because of 1) grid edge effects, 2) adding judgment samples, or 3) selecting or unselecting sample areas.
[b] The number of selected sample areas is the number of colored areas on the map of the site. These sample areas contain the locations where samples are collected.
[c] The sampling area is the total surface area of the selected colored sample areas on the map of the site.
[d] Including measurement analyses and fixed overhead costs. See the Cost of Sampling section for an explanation of the costs presented here.



Area: Area 1					
X Coord	Y Coord	Label	Value	Type	Historical

4928.9658	5229.8854	GP-44	0.28	Random	
4922.1885	5239.3872	GP-51	0.265	Random	
4941.7431	5246.8890	GP-49	0.27	Random	
4911.9669	5234.3860	GP-55	0.285	Random	
4929.5215	5241.8878	GP-50	0.275	Random	
4914.8555	5235.4974	GP-54	0.29	Random	
4934.4101	5242.9992	GP-48	0.27	Random	
4921.6328	5229.4961	GP-57	0.27	Random	
4943.0000	5237.9980	GP-46	0.28	Random	
4926.4661	5234.9967	GP-56	0.28	Random	
4916.6888	5240.4986	GP-53	0.29	Random	
4931.3547	5233.3309	GP-45	0.285	Random	
4921.5774	5243.8327	GP-52	0.29	Random	
4938.0000	5229.0000	GP-43	0.255	Unknown	
4934.0000	5239.0000	GP-47	0.255	Unknown	

Primary Sampling Objective
The primary purpose of sampling at this site is to construct a confidence interval on the true population median value. After the samples are collected and analyzed, the resulting sample values can be used to construct a two-sided confidence interval. Once the confidence interval is computed (which will be an upper and a lower threshold), you can have the specified confidence that the true population median is between the upper and lower thresholds.

Selected Sampling Approach
A non-parametric random sampling approach was used to determine the number of samples and to specify sampling locations. A parametric formula was not chosen because the conceptual model and historical information (e.g., historical data from this site or a very similar site) indicate that parametric assumptions are not true. These assumptions will be examined in post-sampling data analysis.

Both parametric and non-parametric equations rely on assumptions about the population. Typically, however, non-parametric equations require fewer assumptions and allow for more uncertainty about the statistical distribution of values at the site. The trade-off is that if the parametric assumptions are valid, the required number of samples is usually less than if a non-parametric equation was used.

Locating the sample points randomly provides data that are separated by many distances, whereas systematic samples are all equidistant apart. Therefore, random sampling provides more information about the spatial structure of the potential contamination than systematic sampling does. As with systematic sampling, random sampling also provides information regarding the mean or median value, but there is the possibility that areas of the site will not be represented with the same frequency as if uniform grid sampling were performed.

Number of Total Samples: Calculation Equation and Inputs
Two sample confidence interval calculation methods are available for when n□20 and n>20 (Conover, 1980, p. 111-117) (Gilbert, 1987,p. 141-142). In VSP, the user specifies a one-sided or two-sided CI, and the percent confidence desired to be within a specified number of percentiles of the median. A binary search is then performed on the CI equations to solve for the minimum sample size to satisfy these parameters. VSP first uses the n□20 method to determine if a solution can be found where n□20, and if not, then uses the n>20 method.

For a one-sided CI, the n□20 method follows a binomial distribution and determines the lowest value of n where the yth quantile of the sample would be equal to or above the true median at least X% of the time (Note that the sample sizes work out to be the same regardless of whether the CI will be a lower or upper tailed, so the same formula can be used for any one-sided CI). X% is the specified confidence for one-sided confidence intervals, and the average of 100% and the specified confidence for two-sided confidence intervals. The yth quantile is determined by taking 50% and subtracting the allowable number of percentiles from the median specified by the user.

For a two-sided CI, the n□20 method is the same as performing a one-sided confidence interval, but replacing the

specified percent confidence with the average of 100% and the specified percent confidence. If no solution is found where n□20, a binary search is conducted using Equation (1) for a one-sided CI and Equation (2) for a two-sided interval to compute the value of r (r is the the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest), rounding r up to the next higher integer. The search is repeated until the smallest n is found where 100*2*r/n is greater than 50% minus the allowable number of percentiles from the median specified by the user.

$$r = 0.5 * n - 0.5 * w_{\alpha} \sqrt{n} \qquad (1)$$

$$r = 0.5 * n - 0.5 * w_{\alpha/2} \sqrt{n} \qquad (2)$$

Where:

n is the sample size

r is the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest

$w_{\square}$ is the specified quantile of a normal distribution, e.g. if □=0.2 then $w_{\square}$ is the 0.2 quantile (20th percentile) of a normal distribution.

The n>20 method described above is an approximation method, so VSP also performs a final check using a binomial distribution in a similar manner to the n□20 method, and may increase the sample size by 1 to ensure the specified confidence levels are met.

Cost of Sampling

The total cost of the completed sampling program depends on several cost inputs, some of which are fixed, and others that are based on the number of samples collected and measured. Based on the numbers of samples determined above, the estimated total cost of sampling and analysis at this site is $6,700.00, which averages out to a per sample cost of $446.67. The following table summarizes the inputs and resulting cost estimates.

COST INFORMATION			
Cost Details	**Per Analysis**	**Per Sample**	**15 Samples**
Field collection costs		$250.00	$3,750.00
Analytical costs	$130.00	$130.00	$1,950.00
Sum of Field & Analytical costs		**$380.00**	**$5,700.00**
Fixed planning and validation costs			$1,000.00
Total cost			**$6,700.00**

Data Analysis for Sn

The following data points were entered by the user for analysis.

Sn										
Rank	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
0	0.255	0.255	0.265	0.27	0.27	0.27	0.275	0.28	0.28	0.28
10	0.285	0.285	0.29	0.29	0.29					

SUMMARY STATISTICS for Sn	
n	15
Min	0.255
Max	0.29

Range	0.035
Mean	0.276
Median	0.28
Variance	0.00013643
StdDev	0.01168
Std Error	0.0030158
Skewness	-0.54927
Interquartile Range	0.015

Percentiles								
1%	**5%**	**10%**	**25%**	**50%**	**75%**	**90%**	**95%**	**99%**
0.255	0.255	0.255	0.27	0.28	0.285	0.29	0.29	0.29

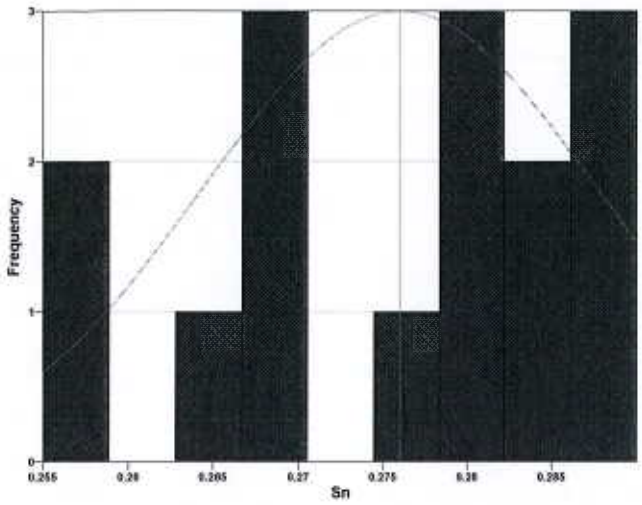
Data Plots

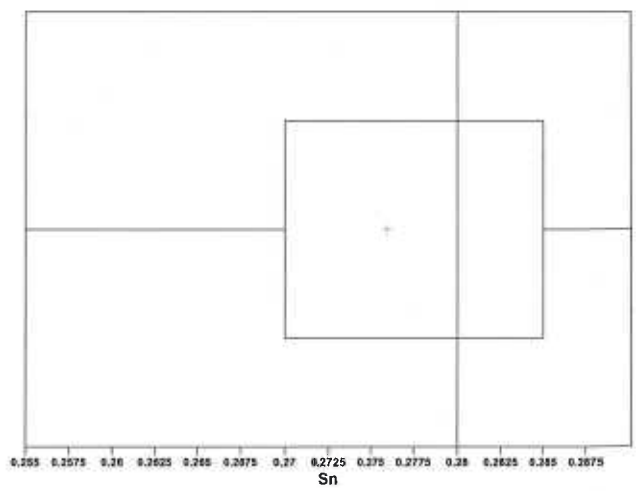
Three graphical displays of the data are shown below: the Histogram, the Box and Whiskers plot, and the Quantile-Quantile (Q-Q) plot.

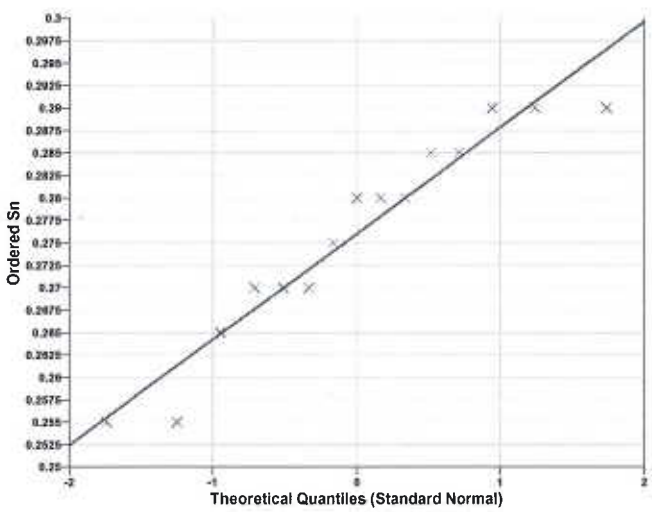
The Histogram is a plot of the fraction of the n observed data that fall within specified data "bins." A histogram is generated by dividing the x axis (range of the observed data values) into "bins" and displaying the number of data in each bin as the height of a bar for the bin. The area of the bar is the fraction of the n data values that lie within the bin. The sum of the fractions for all bins equals one. A histogram is used to assess how the n data are distributed (spread) over their range of values. If the histogram is more or less symmetric and bell shaped, then the data may be normally distributed.

The Box and Whiskers plot is composed of a central box divided by a line, and with two lines extending out from the box, called the "whiskers". The line through the box is drawn at the median of the n data observed. The two ends of the box represent the 25th and 75th percentiles of the n data values, which are also called the lower and upper quartiles, respectively, of the data set. The sample mean (mean of the n data) is shown as a "+" sign. The upper whisker extends to the largest data value that is less than the upper quartile plus 1.5 times the interquartile range (upper quartile minus the lower quartile). The lower whisker extends to the smallest data value that is greater than the lower quartile minus 1.5 times the interquartile range. Extreme data values (greater or smaller than the ends of the whiskers) are plotted individually. A Box and Whiskers plot is used to assess the symmetry of the distribution of the data set. If the distribution is symmetrical, the box is divided into two equal halves by the median, the whiskers will be the same length, and the number of extreme data points will be distributed equally on either end of the plot.

The Q-Q plot graphs the quantiles of a set of n data against the quantiles of a specific distribution. We show here only the Q-Q plot for an assumed normal distribution. The pth quantile of a distribution of data is the data value, x_n, for which a fraction p of the distribution is less than x_n. If the data plotted on the normal distribution Q-Q plot closely follow a straight line, even at the ends of the line, then the data may be assumed to be normally distributed. If the data points deviate substantially from a linear line, then the data are not normally distributed.







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Two-Sided Confidence Interval on the True Median

For calculating the confidence interval, the values are ordered from smallest to largest. The confidence limits are the highest value of the r+1 and/or lowest value of the s-1 order statistics that fit the formulas below, except when the rth ordered value is tied with higher ordered values or the sth ordered value is tied with lower ordered values. If higher numbered ordered values are ties with the rth ordered value, then the closest ordered value that is lower than r will be the confidence limit. If higher-numbered ordered values are ties with the sth ordered value, then the closest ordered value that is higher than s will be the confidence limit.

Upper Two-Sided Confidence Interval

$$\sum_{s}^{1}\left(\frac{n!}{r!(n-s)!}\right)p^{0.5}(1-p)^{n-0.5} \geq 1-\alpha/2$$

Lower Two-Sided Confidence interval

$$\sum_{r}^{1}\left(\frac{n!}{r!(n-r)!}\right)p^{0.5}(1-p)^{n-0.5} \leq \alpha/2$$

Upper 95% Two-Sided Confidence Interval on the Median	0.29

Sample Median	0.28
Lower 95% Two-Sided Confidence Interval on the Median	0.265

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* - The report contents may have been modified or reformatted by end-user of software.

Electroh. Bldg 24

VSP Sample Design Report for Calculating a Two-Sided Confidence Interval for the Population Median Using Simple Random Sampling

Summary
This report summarizes the sampling design used, associated statistical assumptions, as well as general guidelines for conducting post-sampling data analysis. Sampling plan components presented here include how many sampling locations to choose and where within the sampling area to collect those samples. The type of medium to sample (i.e., soil, groundwater, etc.) and how to analyze the samples (in-situ, fixed laboratory, etc.) are addressed in other sections of the sampling plan.

The following table summarizes the sampling design developed. A figure that shows sampling locations in the field and a table that lists sampling location coordinates are also provided below.

SUMMARY OF SAMPLING DESIGN	
Primary Objective of Design	Construct a Confidence Interval on the True Median
Type of Sampling Design	Non-Parametric
Sample Placement (Location) in the Field	Simple random sampling
Formula for calculating number of sampling locations	Nonparametric Confidence Limits
Calculated total number of samples	15
Number of samples on map [a]	14
Number of selected sample areas [b]	1
Specified sampling area [c]	755.90 ft^2
Total cost of sampling [d]	$6,700.00

[a] This number may differ from the calculated number because of 1) grid edge effects, 2) adding judgment samples, or 3) selecting or unselecting sample areas.
[b] The number of selected sample areas is the number of colored areas on the map of the site. These sample areas contain the locations where samples are collected.
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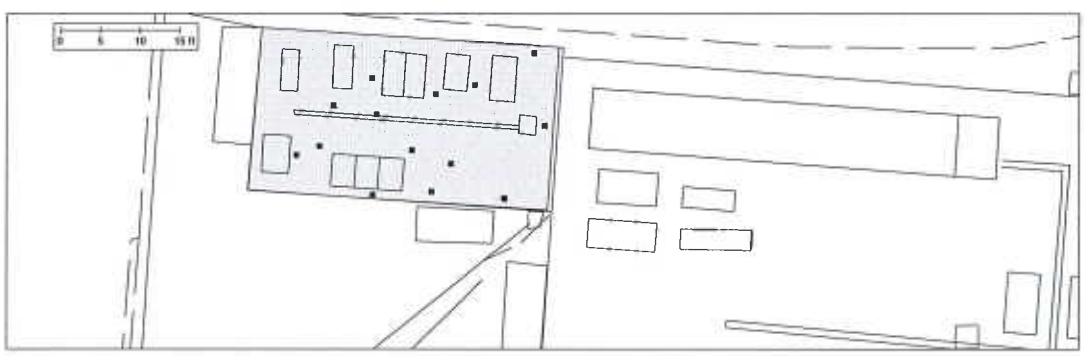
[d] Including measurement analyses and fixed overhead costs. See the Cost of Sampling section for an explanation of the costs presented here.



Area: Area 1					
X Coord	Y Coord	Label	Value	Type	Historical
4928.9658	5229.8854	GP-44	44	Random	
4922.1885	5239.3872	GP-51	71	Random	
4941.7431	5246.8890	GP-49	65	Random	

4911.9669	5234.3860	GP-55	51	Random	
4929.5215	5241.8878	GP-50	51	Random	
4914.8555	5235.4974	GP-54	39	Random	
4934.4101	5242.9992	GP-48	39	Random	
4921.6328	5229.4961	GP-57	65	Random	
4943.0000	5237.9980	GP-46	30	Random	
4926.4661	5234.9967	GP-56	75	Random	
4916.6888	5240.4986	GP-53	39	Random	
4931.3547	5233.3309	GP-45	49	Random	
4921.5774	5243.8327	GP-52	58	Random	
4938.0000	5229.0000	GP-43	30	Unknown	

Primary Sampling Objective
The primary purpose of sampling at this site is to construct a confidence interval on the true population median value. After the samples are collected and analyzed, the resulting sample values can be used to construct a two-sided confidence interval. Once the confidence interval is computed (which will be an upper and a lower threshold), you can have the specified confidence that the true population median is between the upper and lower thresholds.

Selected Sampling Approach
A non-parametric random sampling approach was used to determine the number of samples and to specify sampling locations. A parametric formula was not chosen because the conceptual model and historical information (e.g., historical data from this site or a very similar site) indicate that parametric assumptions are not true. These assumptions will be examined in post-sampling data analysis.

Both parametric and non-parametric equations rely on assumptions about the population. Typically, however, non-parametric equations require fewer assumptions and allow for more uncertainty about the statistical distribution of values at the site. The trade-off is that if the parametric assumptions are valid, the required number of samples is usually less than if a non-parametric equation was used.

Locating the sample points randomly provides data that are separated by many distances, whereas systematic samples are all equidistant apart. Therefore, random sampling provides more information about the spatial structure of the potential contamination than systematic sampling does. As with systematic sampling, random sampling also provides information regarding the mean or median value, but there is the possibility that areas of the site will not be represented with the same frequency as if uniform grid sampling were performed.

Number of Total Samples: Calculation Equation and Inputs
Two sample confidence interval calculation methods are available for when n□20 and n>20 (Conover, 1980, p. 111-117) (Gilbert, 1987,p. 141-142). In VSP, the user specifies a one-sided or two-sided CI, and the percent confidence desired to be within a specified number of percentiles of the median. A binary search is then performed on the CI equations to solve for the minimum sample size to satisfy these parameters. VSP first uses the n□20 method to determine if a solution can be found where n□20, and if not, then uses the n>20 method.

For a one-sided CI, the n□20 method follows a binomial distribution and determines the lowest value of n where the yth quantile of the sample would be equal to or above the true median at least X% of the time (Note that the sample sizes work out to be the same regardless of whether the CI will be a lower or upper tailed, so the same formula can be used for any one-sided CI). X% is the specified confidence for one-sided confidence intervals, and the average of 100% and the specified confidence for two-sided confidence intervals. The yth quantile is determined by taking 50% and subtracting the allowable number of percentiles from the median specified by the user.

For a two-sided CI, the n□20 method is the same as performing a one-sided confidence interval, but replacing the specified percent confidence with the average of 100% and the specified percent confidence. If no solution is found where n□20, a binary search is conducted using Equation (1) for a one-sided CI and Equation (2) for a two-sided interval to compute the value of r (r is the the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest), rounding r up to the next higher integer. The search is repeated until the smallest n is found where 100*2*r/n is greater than 50% minus the allowable number of percentiles from the median specified by the user.

$$r = 0.5 * n - 0.5 * w_{\alpha} \sqrt{n} \qquad (1)$$

$$r = 0.5 * n - 0.5 * w_{\alpha/2} \sqrt{n} \qquad (2)$$

Where:

n is the sample size

r is the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest

$w_{\square}$ is the specified quantile of a normal distribution, e.g. if $\square$=0.2 then $w_{\square}$ is the 0.2 quantile (20th percentile) of a normal distribution.

The n>20 method described above is an approximation method, so VSP also performs a final check using a binomial distribution in a similar manner to the n$\square$20 method, and may increase the sample size by 1 to ensure the specified confidence levels are met.

Cost of Sampling
The total cost of the completed sampling program depends on several cost inputs, some of which are fixed, and others that are based on the number of samples collected and measured. Based on the numbers of samples determined above, the estimated total cost of sampling and analysis at this site is $6,700.00, which averages out to a per sample cost of $446.67. The following table summarizes the inputs and resulting cost estimates.

COST INFORMATION			
Cost Details	**Per Analysis**	**Per Sample**	**15 Samples**
Field collection costs		$250.00	$3,750.00
Analytical costs	$130.00	$130.00	$1,950.00
Sum of Field & Analytical costs		**$380.00**	**$5,700.00**
Fixed planning and validation costs			$1,000.00
Total cost			**$6,700.00**

Data Analysis for Zinc
The following data points were entered by the user for analysis.

Zinc										
Rank	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
0	30	30	39	39	39	44	49	51	51	58
10	65	65	71	75						

SUMMARY STATISTICS for Zinc	
n	14
Min	30
Max	75
Range	45
Mean	50.429
Median	50
Variance	213.8
StdDev	14.622

Std Error				3.9079				
Skewness				0.24014				
Interquartile Range				26				
Percentiles								
1%	5%	10%	25%	50%	75%	90%	95%	99%
30	30	30	39	50	65	73	75	75

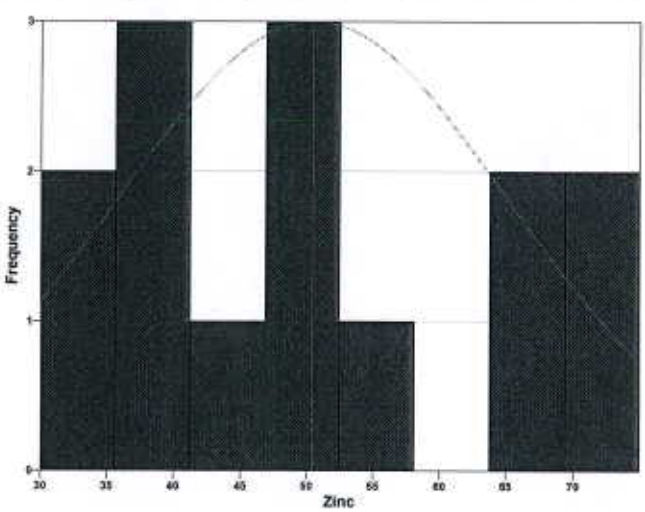
Data Plots

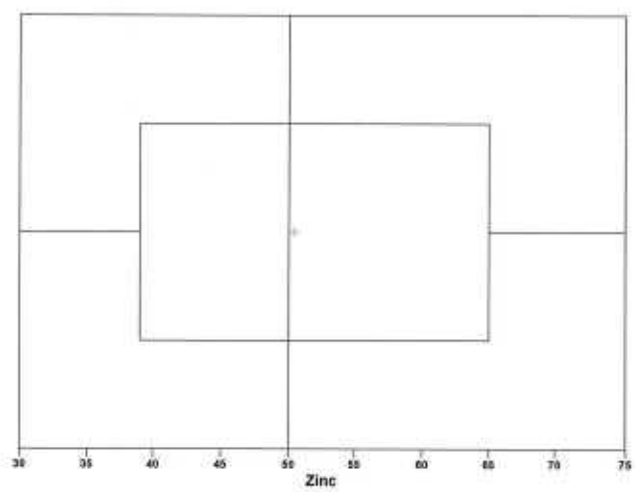
Three graphical displays of the data are shown below: the Histogram, the Box and Whiskers plot, and the Quantile-Quantile (Q-Q) plot.

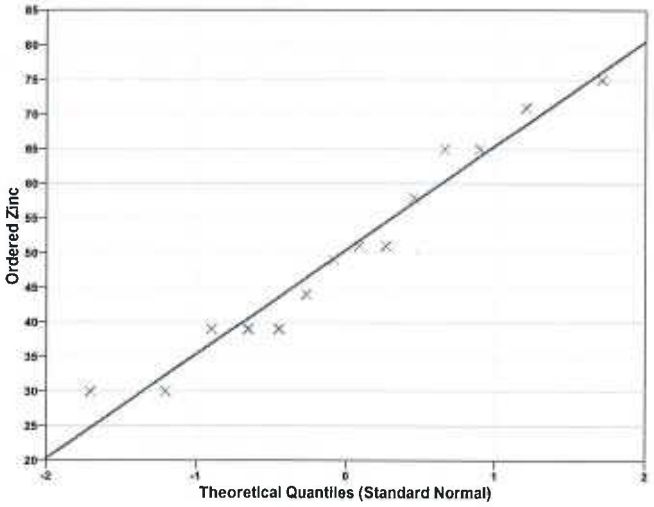
The Histogram is a plot of the fraction of the n observed data that fall within specified data "bins." A histogram is generated by dividing the x axis (range of the observed data values) into "bins" and displaying the number of data in each bin as the height of a bar for the bin. The area of the bar is the fraction of the n data values that lie within the bin. The sum of the fractions for all bins equals one. A histogram is used to assess how the n data are distributed (spread) over their range of values. If the histogram is more or less symmetric and bell shaped, then the data may be normally distributed.

The Box and Whiskers plot is composed of a central box divided by a line, and with two lines extending out from the box, called the "whiskers". The line through the box is drawn at the median of the n data observed. The two ends of the box represent the 25th and 75th percentiles of the n data values, which are also called the lower and upper quartiles, respectively, of the data set. The sample mean (mean of the n data) is shown as a "+" sign. The upper whisker extends to the largest data value that is less than the upper quartile plus 1.5 times the interquartile range (upper quartile minus the lower quartile). The lower whisker extends to the smallest data value that is greater than the lower quartile minus 1.5 times the interquartile range. Extreme data values (greater or smaller than the ends of the whiskers) are plotted individually. A Box and Whiskers plot is used to assess the symmetry of the distribution of the data set. If the distribution is symmetrical, the box is divided into two equal halves by the median, the whiskers will be the same length, and the number of extreme data points will be distributed equally on either end of the plot.

The Q-Q plot graphs the quantiles of a set of n data against the quantiles of a specific distribution. We show here only the Q-Q plot for an assumed normal distribution. The pth quantile of a distribution of data is the data value, x_p, for which a fraction p of the distribution is less than x_p. If the data plotted on the normal distribution Q-Q plot closely follow a straight line, even at the ends of the line, then the data may be assumed to be normally distributed. If the data points deviate substantially from a linear line, then the data are not normally distributed.







For more information on these three plots consult Guidance for Data Quality Assessment, EPA QA/G-9, pgs 2.3-1 through 2.3-12. (http://www.epa.gov/quality/qa-docs.html).

Two-Sided Confidence Interval on the True Median

For calculating the confidence interval, the values are ordered from smallest to largest. The confidence limits are the highest value of the r+1 and/or lowest value of the s-1 order statistics that fit the formulas below, except when the rth ordered value is tied with higher ordered values or the sth ordered value is tied with lower ordered values. If higher numbered ordered values are ties with the rth ordered value, then the closest ordered value that is lower than r will be the confidence limit. If higher-numbered ordered values are ties with the sth ordered value, then the closest ordered value that is higher than s will be the confidence limit.

Upper Two-Sided Confidence Interval

$$\sum_{s}^{1}\left(\frac{n!}{r!(n-s)!}\right)p^{0.5}(1-p)^{n-0.5} \geq 1-\alpha/2$$

Lower Two-Sided Confidence interval

$$\sum_{r}^{1}\left(\frac{n!}{r!(n-r)!}\right)p^{0.5}(1-p)^{n-0.5} \leq \alpha/2$$

Upper 95% Two-Sided Confidence Interval on the Median	71
Sample Median	50
Lower 95% Two-Sided Confidence Interval on the Median	30

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* - The report contents may have been modified or reformatted by end-user of software.

Electrol. Bldg Zu biasel

VSP Sample Design Report for Calculating a Two-Sided Confidence Interval for the Population Median Using Simple Random Sampling

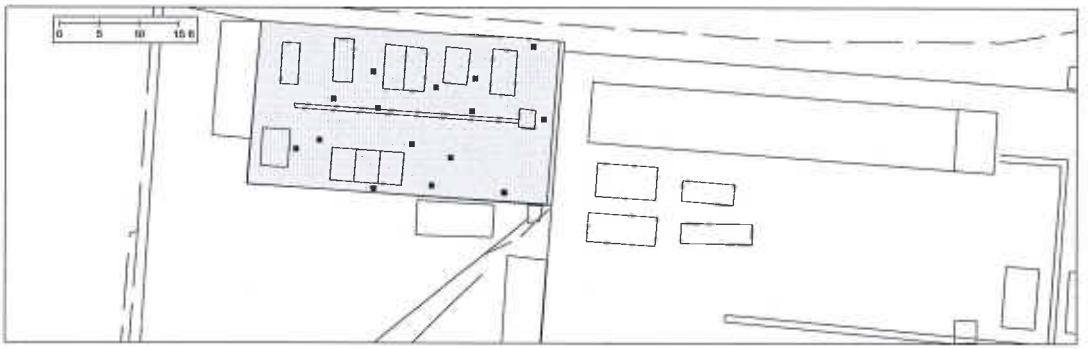
Summary

This report summarizes the sampling design used, associated statistical assumptions, as well as general guidelines for conducting post-sampling data analysis. Sampling plan components presented here include how many sampling locations to choose and where within the sampling area to collect those samples. The type of medium to sample (i.e., soil, groundwater, etc.) and how to analyze the samples (in-situ, fixed laboratory, etc.) are addressed in other sections of the sampling plan.

The following table summarizes the sampling design developed. A figure that shows sampling locations in the field and a table that lists sampling location coordinates are also provided below.

SUMMARY OF SAMPLING DESIGN	
Primary Objective of Design	Construct a Confidence Interval on the True Median
Type of Sampling Design	Non-Parametric
Sample Placement (Location) in the Field	Simple random sampling
Formula for calculating number of sampling locations	Nonparametric Confidence Limits
Calculated total number of samples	15
Number of samples on map [a]	15
Number of selected sample areas [b]	1
Specified sampling area [c]	755.90 ft^2
Total cost of sampling [d]	$6,700.00

[a] This number may differ from the calculated number because of 1) grid edge effects, 2) adding judgment samples, or 3) selecting or unselecting sample areas.
[b] The number of selected sample areas is the number of colored areas on the map of the site. These sample areas contain the locations where samples are collected.
[c] The sampling area is the total surface area of the selected colored sample areas on the map of the site.
[d] Including measurement analyses and fixed overhead costs. See the Cost of Sampling section for an explanation of the costs presented here.



Area: Area 1					
X Coord	Y Coord	Label	Value	Type	Historical
4928.9658	5229.8854	GP-44	44	Random	
4922.1885	5239.3872	GP-51	71	Random	
4941.7431	5246.8890	GP-49	65	Random	

4911.9669	5234.3860	GP-55	51	Random	
4929.5215	5241.8878	GP-50	51	Random	
4914.8555	5235.4974	GP-54	39	Random	
4934.4101	5242.9992	GP-48	39	Random	
4921.6328	5229.4961	GP-57	65	Random	
4943.0000	5237.9980	GP-46	30	Random	
4926.4661	5234.9967	GP-56	75	Random	
4916.6888	5240.4986	GP-53	39	Random	
4931.3547	5233.3309	GP-45	49	Random	
4921.5774	5243.8327	GP-52	58	Random	
4938.0000	5229.0000	GP-43	30	Unknown	
4934.0000	5239.0000	GP-47	65	Unknown	

Primary Sampling Objective
The primary purpose of sampling at this site is to construct a confidence interval on the true population median value. After the samples are collected and analyzed, the resulting sample values can be used to construct a two-sided confidence interval. Once the confidence interval is computed (which will be an upper and a lower threshold), you can have the specified confidence that the true population median is between the upper and lower thresholds.

Selected Sampling Approach
A non-parametric random sampling approach was used to determine the number of samples and to specify sampling locations. A parametric formula was not chosen because the conceptual model and historical information (e.g., historical data from this site or a very similar site) indicate that parametric assumptions are not true. These assumptions will be examined in post-sampling data analysis.

Both parametric and non-parametric equations rely on assumptions about the population. Typically, however, non-parametric equations require fewer assumptions and allow for more uncertainty about the statistical distribution of values at the site. The trade-off is that if the parametric assumptions are valid, the required number of samples is usually less than if a non-parametric equation was used.

Locating the sample points randomly provides data that are separated by many distances, whereas systematic samples are all equidistant apart. Therefore, random sampling provides more information about the spatial structure of the potential contamination than systematic sampling does. As with systematic sampling, random sampling also provides information regarding the mean or median value, but there is the possibility that areas of the site will not be represented with the same frequency as if uniform grid sampling were performed.

Number of Total Samples: Calculation Equation and Inputs
Two sample confidence interval calculation methods are available for when n□20 and n>20 (Conover, 1980, p. 111-117) (Gilbert, 1987,p. 141-142). In VSP, the user specifies a one-sided or two-sided CI, and the percent confidence desired to be within a specified number of percentiles of the median. A binary search is then performed on the CI equations to solve for the minimum sample size to satisfy these parameters. VSP first uses the n□20 method to determine if a solution can be found where n□20, and if not, then uses the n>20 method.

For a one-sided CI, the n□20 method follows a binomial distribution and determines the lowest value of n where the yth quantile of the sample would be equal to or above the true median at least X% of the time (Note that the sample sizes work out to be the same regardless of whether the CI will be a lower or upper tailed, so the same formula can be used for any one-sided CI). X% is the specified confidence for one-sided confidence intervals, and the average of 100% and the specified confidence for two-sided confidence intervals. The yth quantile is determined by taking 50% and subtracting the allowable number of percentiles from the median specified by the user.

For a two-sided CI, the n□20 method is the same as performing a one-sided confidence interval, but replacing the specified percent confidence with the average of 100% and the specified percent confidence. If no solution is found where n□20, a binary search is conducted using Equation (1) for a one-sided CI and Equation (2) for a two-sided interval to compute the value of r (r is the the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest), rounding r up to the next higher integer. The search is repeated until the smallest n is

found where 100*2*r/n is greater than 50% minus the allowable number of percentiles from the median specified by the user.

$$r = 0.5 * n - 0.5 * w_{\alpha} \sqrt{n} \qquad (1)$$

$$r = 0.5 * n - 0.5 * w_{\alpha/2} \sqrt{n} \qquad (2)$$

Where:

n is the sample size

r is the rank of the lowest value expected to fall within the confidence interval when ranking the n samples from smallest to largest

$w_{\square}$ is the specified quantile of a normal distribution, e.g. if $\square$=0.2 then $w_{\square}$ is the 0.2 quantile (20th percentile) of a normal distribution.

The n>20 method described above is an approximation method, so VSP also performs a final check using a binomial distribution in a similar manner to the n$\square$20 method, and may increase the sample size by 1 to ensure the specified confidence levels are met.

Cost of Sampling
The total cost of the completed sampling program depends on several cost inputs, some of which are fixed, and others that are based on the number of samples collected and measured. Based on the numbers of samples determined above, the estimated total cost of sampling and analysis at this site is $6,700.00, which averages out to a per sample cost of $446.67. The following table summarizes the inputs and resulting cost estimates.

COST INFORMATION			
Cost Details	**Per Analysis**	**Per Sample**	**15 Samples**
Field collection costs		$250.00	$3,750.00
Analytical costs	$130.00	$130.00	$1,950.00
Sum of Field & Analytical costs		**$380.00**	**$5,700.00**
Fixed planning and validation costs			$1,000.00
Total cost			**$6,700.00**

Data Analysis for Zinc
The following data points were entered by the user for analysis.

Zinc										
Rank	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
0	30	30	39	39	39	44	49	51	51	58
10	65	65	65	71	75					

SUMMARY STATISTICS for Zinc	
n	15
Min	30
Max	75
Range	45
Mean	51.4
Median	51

Variance	212.69
StdDev	14.584
Std Error	3.7655
Skewness	0.073547
Interquartile Range	26

Percentiles								
1%	**5%**	**10%**	**25%**	**50%**	**75%**	**90%**	**95%**	**99%**
30	30	30	39	51	65	72.6	75	75

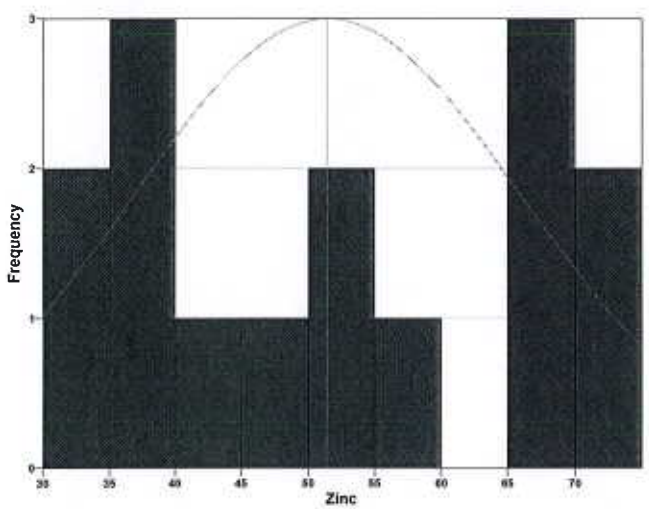
Data Plots

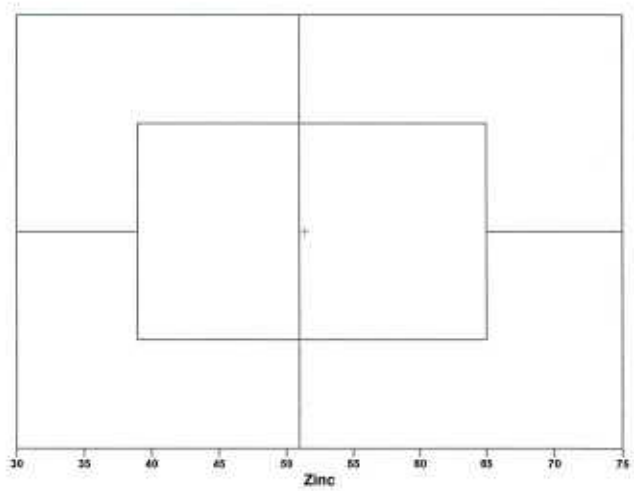
Three graphical displays of the data are shown below: the Histogram, the Box and Whiskers plot, and the Quantile-Quantile (Q-Q) plot.

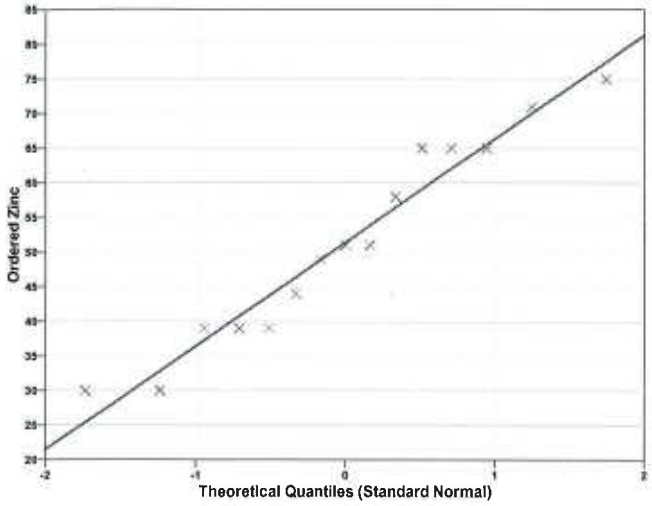
The Histogram is a plot of the fraction of the n observed data that fall within specified data "bins." A histogram is generated by dividing the x axis (range of the observed data values) into "bins" and displaying the number of data in each bin as the height of a bar for the bin. The area of the bar is the fraction of the n data values that lie within the bin. The sum of the fractions for all bins equals one. A histogram is used to assess how the n data are distributed (spread) over their range of values. If the histogram is more or less symmetric and bell shaped, then the data may be normally distributed.

The Box and Whiskers plot is composed of a central box divided by a line, and with two lines extending out from the box, called the "whiskers". The line through the box is drawn at the median of the n data observed. The two ends of the box represent the 25th and 75th percentiles of the n data values, which are also called the lower and upper quartiles, respectively, of the data set. The sample mean (mean of the n data) is shown as a "+" sign. The upper whisker extends to the largest data value that is less than the upper quartile plus 1.5 times the interquartile range (upper quartile minus the lower quartile). The lower whisker extends to the smallest data value that is greater than the lower quartile minus 1.5 times the interquartile range. Extreme data values (greater or smaller than the ends of the whiskers) are plotted individually. A Box and Whiskers plot is used to assess the symmetry of the distribution of the data set. If the distribution is symmetrical, the box is divided into two equal halves by the median, the whiskers will be the same length, and the number of extreme data points will be distributed equally on either end of the plot.

The Q-Q plot graphs the quantiles of a set of n data against the quantiles of a specific distribution. We show here only the Q-Q plot for an assumed normal distribution. The pth quantile of a distribution of data is the data value, x_n, for which a fraction p of the distribution is less than x_n. If the data plotted on the normal distribution Q-Q plot closely follow a straight line, even at the ends of the line, then the data may be assumed to be normally distributed. If the data points deviate substantially from a linear line, then the data are not normally distributed.







For more information on these three plots consult Guidance for Data Quality Assessment, EPA QA/G-9, pgs 2.3-1 through 2.3-12. (http://www.epa.gov/quality/qa-docs.html).

Two-Sided Confidence Interval on the True Median

For calculating the confidence interval, the values are ordered from smallest to largest. The confidence limits are the highest value of the r+1 and/or lowest value of the s-1 order statistics that fit the formulas below, except when the rth ordered value is tied with higher ordered values or the sth ordered value is tied with lower ordered values. If higher numbered ordered values are ties with the rth ordered value, then the closest ordered value that is lower than r will be the confidence limit. If higher-numbered ordered values are ties with the sth ordered value, then the closest ordered value that is higher than s will be the confidence limit.

Upper Two-Sided Confidence Interval

$$\sum_{s}^{1}\left(\frac{n!}{r!(n-s)!}\right)p^{0.5}(1-p)^{n-0.5} \geq 1-\alpha/2$$

Lower Two-Sided Confidence interval

$$\sum_{r}^{1}\left(\frac{n!}{r!(n-r)!}\right)p^{0.5}(1-p)^{n-0.5} \leq \alpha/2$$

Upper 95% Two-Sided Confidence Interval on the Median	65
Sample Median	51
Lower 95% Two-Sided Confidence Interval on the Median	39

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APPENDIX F

North Carolina
Department of Environment
NCDENR and Natural Resources

BROWNFIELDS AREA RECONNAISSANCE AND RECEPTOR SURVEY GUIDANCE FORM

This form was created to clarify and simplify preparing a receptor survey for a brownfield site. The form was designed to minimize unnecessary delays in processing brownfield applications. This is a guidance document only and Potential Developers may complete and submit their own receptor survey, if they desire.

General Instructions

1.) Complete "Property Characteristics" Section and all portions of other sections where an "X" has been placed in the far left column under "Applicable to Site," as determined by the DENR Brownfields Project Manager on a site specific basis.
2.) The search-radius distances to potential receptors from the Property boundary will be determined by the DENR Brownfields Project Manager on a site by site basis.
3.) Search-radius distances are measured from the site Property Boundary unless otherwise indicated by the DENR Brownfield's Project Manager.

Site: United Metal Finishing
Address: 133 Bluebell Road
City: Greensboro, North Carolina
County: Guilford

Property Characteristics

Provide Information for the following potential receptors	*Current Usage*	*Proposed Usage*
Size of Property (acres)	1.5 Acres	1.5 Acres
% of property that is wooded	0%	0%
% of property that is scrub/shrub	0%	0%
% of property that is open land	0%	0%
% of property that is grass area	0%	0%
% of property that is agricultural crops	0%	0%
% of property that is barren	0%	0%
% of property that is used for commercial or industrial usage including paved areas	100%	100%

Surrounding Properties

Applicable to Site (DENR Use Only)	*Surrounding Properties Zoning/Land Use*	*Current Usage*	*Proposed Usage*
X	North	Commercial/Industrial	Same
X	South	Commercial/Industrial	Same
X	East	Commercial/Industrial	Same
X	West	Commercial/Industrial	Same

Potential Receptors - include depth to top, construction material and diameter of the utilities, if available

Applicable to Site (DENR Use Only)	*Provide Information for the following potential receptors*	*Y/N*	*Field Verified*	*Date Verified*	*Distance*	*Direction*	*Depth*
					Complete and attach map as appropriate		
X	Is a basement or subsurface foundation within 500/1000 ft of the Property boundary?	Y	Y	10/24/11	Developed properties likely have subsurface foundations.		
X	Is a school or daycare center within 1000 ft of the Property boundary?	Y	Y	10/24/11	A daycare facility is located approximately 400 feet northwest at 3009 South Elm Street		
X	Is a storm sewer within 100/1000 ft of the Property boundary?	Y	Y	10/24/11	On-site and adjacent	North, East, South & West	Unknown
X	Is a sanitary sewer within 100/1000 ft of the Property boundary?	Y	Y	10/24/11	Adjacent	North, East, South & West	Unknown
X	Is a septic system leach field within 500/1000 ft of the Property boundary?	N	Y	10/24/11	Properties within 500 feet on city sewer		
X	Is a water line main within 100/1000 ft of Property boundary?	Y	Y	10/24/11	On-site and adjacent	North, East, South & West	Unknown
X	Is a natural gas line main within 100/1000 ft of the Property boundary?	Y	Y	10/24/11	Adjacent	North, East, South & West	Unknown
X	Is a buried telephone/ cable main within 100/1000 ft of the Property boundary?	Y	Y	10/24/11	Adjacent	North, East, South & West	Unknown
X	Is a buried electrical cable main within 100/1000 ft of Property boundary?	Y	Y	10/24/11	Adjacent	North, East, South & West	Unknown

Local Water Supply

Public: City of Greensboro Private: NA

Potable Water Supplier Name: City of Greensboro

Potable Water Supply Source: South Buffalo Creek

Distance: South Buffalo Creek 2,200 feet Direction: North

Potable Water Source Intake: South Buffalo Creek

Distance: 2,200 feet Direction: North

Water Supply Wells

Applicable to Site (DENR Use Only)	Provide Information for the following potential receptors	Y/N	Field Verified	Date Verified	Distance	Direction	Depth
					Complete and attach map as appropriate		
X	Is a public water supply well within 1 mile of the Property boundary?	N	Y	10/24/11	None identified.		N/A
X	Is a private water supply well within 1/2 mile of the Property boundary?	N	Y	10/24/11	None identified.		N/A
X	Is a irrigation supply well within 1/2 mile of the Property boundary?	N	Y	10/24/11	None identified.		N/A
X	Is a monitoring well within 1500 ft of the Property boundary?	Y	Y	10/24/11	Five groundwater monitoring wells were observed at the former gas station located at 301 West English Road and one groundwater monitoring well was observed at the property located at 211 West English Road.		

Water Bodies on Property

Applicable to Site (DENR Use Only)	Provide Information for the following potential receptors	Comments
X	Is water body naturally developed or man made?	No water bodies on the site.
X	List the uses of the water body	N/A
X	What is the source of the water for the water body	N/A
X	What is the nature of the bottom of the water body (e.g., rocky or concrete bottom, drainage ways or impoundments)	N/A
X	Are there any wetlands present on the property?	None according to the U.S. Fish and Wildlife Service National Wetlands Inventory Map

Surface Water Body

Applicable to Site (DENR Use Only)	Provide Information for the following potential receptors	Y/N	Name	Type	Distance	Direction	Depth
					Complete and attach map as appropriate		
X	Are there surface waters located within 500/1000 ft of the Property boundary?	N	N/A	N/A	N/A	N/A	N/A
	Additional water bodies, if needed						

Additional Requests/ Observations

Applicable to Site (DENR Use Only)	Provide Information for the following potential receptors	Comments

LEGEND OF STANDARD SYMBOLS

THERE MAY BE UTILITY LINES ON THIS SITE THAT ARE NOT SHOWN.
ANY UNDERGROUND IMPROVEMENTS ARE BASED ON SURFACE EVIDENCE ONLY. THIS SURVEYOR CANNOT CERTIFY TO, NOR ACCEPT LIABILITY FOR THE PRESENCE AND/OR LOCATION OF BURIED OR OTHERWISE NON-VISIBLE UTILITIES. SHOULD BE EXCAVATED AND FIELD LOCATED.

- UTILITY POLE
- GUY ANCHOR
- LIGHT POLE
- SPOT LIGHT
- ELECTRIC MANHOLE
- ELEC. SERVICE/METER
- ELECTRICAL CABINET
- HEATING/AIR UNIT
- TELEPHONE PEDESTAL
- TELEPHONE MANHOLE
- TELEPHONE VAULT
- CATV SERVICE
- CATV VAULT
- FIBER OPTIC WARNING POST
- GAS VALVE
- GAS METER
- WATER VALVE
- WATER METER
- IRRIGATION CONTROL VALVE
- BACKFLOW PREVENTOR
- WATER VALVE MANHOLE
- FIRE HYDRANT
- POST INDICATOR VALVE
- FIRE DEPT. CONNECTION
- STEAM MANHOLE
- SPRINKLER HEAD
- WELL
- SANITARY MANHOLE
- SANITARY CLEANOUT
- STORM WATER LINE
- SS — SANITARY SEWER LINE
- CO — SEWER CLEANOUT LINE
- OHW — OVERHEAD WIRES
- E — BURIED ELECTRIC LINE
- G — BURIED GAS LINE
- T — BURIED TELECOM. LINE
- W — BURIED WATER LINE
- St — BURIED STEAM LINE
- x — METAL FENCE LINE
- WOODEN FENCE LINE
- TREE LINE
- ORNAMENTAL TREE OR BUSH
- PINE TREE (SIZE NOTED)
- -or- HARDWOOD (SIZE AND TYPE NOTED)
- CONCRETE CATCH BASIN
- CAST IRON CATCH BASIN
- DROP INLET w/ GRATE / AREA DRAIN
- CONCRETE YARD DRAIN
- STORM MANHOLE
- SIGN
- MW — MONITORING WELL
- MAIL BOX
- BOLLARD
- TBM — TEMP. BENCH MARK
- SURVEY CONTROL Pt.

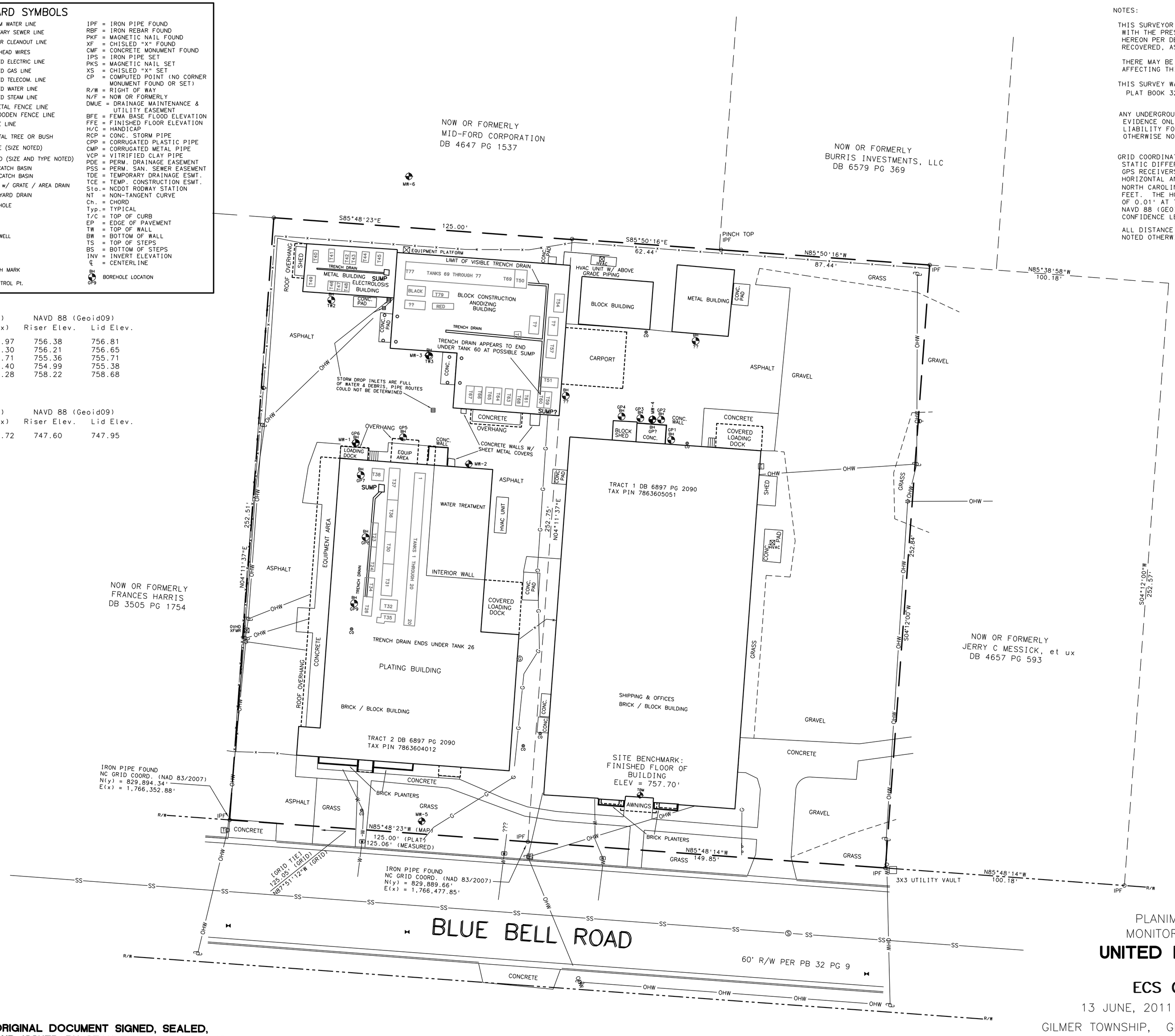
IPF = IRON PIPE FOUND
RBF = IRON REBAR FOUND
PKF = MAGNETIC NAIL FOUND
XF = CHISLED "X" FOUND
CMF = CONCRETE MONUMENT FOUND
IPS = IRON PIPE SET
PKS = MAGNETIC NAIL SET
XS = CHISLED "X" SET
CP = COMPUTED POINT (NO CORNER MONUMENT FOUND OR SET)
R/W = RIGHT OF WAY
N/F = NOW OR FORMERLY
DMUE = DRAINAGE MAINTENANCE & UTILITY EASEMENT
BFE = FEMA BASE FLOOD ELEVATION
FFE = FINISHED FLOOR ELEVATION
H/C = HANDICAP
RCP = CONC. STORM PIPE
CPP = CORRUGATED PLASTIC PIPE
CMP = CORRUGATED METAL PIPE
VCP = VITRIFIED CLAY PIPE
PDE = PERM. DRAINAGE EASEMENT
PSS = PERM. SAN. SEWER EASEMENT
TDE = TEMPORARY DRAINAGE ESMT.
TCE = TEMP. CONSTRUCTION ESMT.
Sta.= NCDOT RODWAY STATION
NT = NON-TANGENT CURVE
Ch. = CHORD
Typ.= TYPICAL
T/C = TOP OF CURB
EP = EDGE OF PAVEMENT
TW = TOP OF WALL
BW = BOTTOM OF WALL
TS = TOP OF STEPS
BS = BOTTOM OF STEPS
INV = INVERT ELEVATION
℄ = CENTERLINE
BH GP9 — BOREHOLE LOCATION

MONITORING WELL LOCATION (9-13-11):

Well	SSM Pt. #	NC Grid (NAD 83/2007) Northing(y)	Easting(x)	NAVD 88 (Geoid09) Riser Elev.	Lid Elev.
MW-1	807	830,053.84	1,766,399.97	756.38	756.81
MW-2	817	830,046.75	1,766,447.30	756.21	756.65
MW-3	810	830,091.50	1,766,428.71	755.36	755.71
MW-4	811	830,068.32	1,766,523.40	754.99	755.38
MW-5	801	829,896.73	1,766,433.28	758.22	758.68

MONITORING WELL LOCATION (2-1-12):

Well	SSM Pt. #	NC Grid (NAD 83/2007) Northing(y)	Easting(x)	NAVD 88 (Geoid09) Riser Elev.	Lid Elev.
MW-6	830	830,165.97	1,766,417.72	747.60	747.95



NOTES:

THIS SURVEYOR DID NOT CONDUCT A BOUNDARY SURVEY IN CONJUNCTION WITH THE PRESENT MAPPING. ALL BOUNDARY INFORMATION IS SHOWN HEREON PER DB 6897 PG 2090, ORIENTED TO PROPERTY MONUMENTATION RECOVERED, AS SHOWN HEREON.

THERE MAY BE EASEMENTS, RIGHTS-OF-WAY, OR OTHER MATTERS AFFECTING THIS PROPERTY WHICH ARE NOT SHOWN HEREON.

THIS SURVEY WAS PREPARED WITH ADDITIONAL REFERENCE TO: PLAT BOOK 32 PAGE 9, GUILFORD COUNTY REGISTRY.

ANY UNDERGROUND IMPROVEMENTS ARE SHOWN HEREON BASED ON SURFACE EVIDENCE ONLY. THIS SURVEYOR CANNOT CERTIFY TO NOR ACCEPT LIABILITY FOR THE PRESENCE AND/OR LOCATION OF BURIED OR OTHERWISE NON-VISIBLE UTILITIES.

GRID COORDINATES AND ELEVATIONS SHOWN HEREON WERE DERIVED BY STATIC DIFFERENTIAL GPS METHODS USING THREE ASHTECH PROMARK II GPS RECEIVERS, HOLDING NCGS MONUMENT "COLISEUM" AS A FIXED HORIZONTAL AND VERTICAL REFERENCE. COORDINATES SHOWN ARE NORTH CAROLINA STATE PLANE COORDINATES, EXPRESSED IN US SURVEY FEET. THE HORIZONTAL DATUM IS NAD 83/2007, WITH A PRECISION OF 0.01' AT THE 95% CONFIDENCE LEVEL. THE VERTICAL DATUM IS NAVD 88 (GEOID09) WITH A PRECISION OF 0.01' AT THE 95% CONFIDENCE LEVEL.

ALL DISTANCE ARE HORIZONTAL GROUND MEASUREMENTS UNLESS NOTED OTHERWISE.

SURVEYOR'S CERTIFICATE

I, STANLEY ROBERT SACKS, certify that this map was drawn under my supervision from an actual survey made under my supervision; that planimetric data is shown per an actual ground survey; and that the accuracy of planimetric data conforms to the Unites States National Map Accuracy Standards.

Witness my original signature, registration number and Seal this 1st day of FEBRUARY A.D. 2012.

NOT A CERTIFIED DOCUMENT -

SURVEYOR — REGISTRATION NUMBER L-2913

UNLESS SIGNED, SEALED AND DATED, THIS IS A PRELIMINARY PLAT NOT FOR RECORDING, SALES OR CONVEYANCES.

Sacks Surveying & Mapping, P.C.
Land Surveyors
3308-B Edgefield Road
Greensboro, NC 27409
(336) 931-0566
FAX 931-0558
SacksSurveying.com
FIRM LIC. #C-2741

ORIGINAL DOCUMENT SIGNED, SEALED, AND ISSUED BY STANLEY ROBERT SACKS, PLS L-2913, ON 1 FEBRUARY, 2012. THIS MEDIA SHALL NOT BE CONSIDERED A CERTIFIED DOCUMENT.

REVISIONS:
9-13-11 - ADDED MONITORING WELLS 1-5;
ADDED SITE BENCHMARK & GRID DATA
2-1-12 - ADDED MONITORING WELL 6

PLANIMETRIC SURVEY &
MONITORING WELL LOCATION

UNITED METAL FINISHING

PREPARED FOR

ECS CAROLINAS, LLP

13 JUNE, 2011 SCALE 1 INCH = 20 FEET

GILMER TOWNSHIP, GREENSBORO, GUILFORD COUNTY, NC

20 0 10 20 40 80
BAR GRAPH: inch = 20 ft.
DRAWING FILE NAME: 133BLUEBELL.DWG