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OPERATION/CONSTRUCTION MANAGERS
Municipal Services
PO Box 97, Garner, North Carolina 27529 (919) 772-5393

CIVIL/SANITARY ENGINEERS
Engineering Company, P.A.
PO Box 349, Boone, North Carolina 28607 (828) 262-1767

April 17, 2001

Mr. Larry Rose
Solid Waste Section
Division of Waste Management
North Carolina Department of Environment and Natural Resources
401 Oberlin Road, Suite 150
Raleigh, NC 27605

APR 2001

Re: Groundwater Sampling and Statistical Analysis
Cherokee County Subtitle D Lined Landfill
MESCO Project No. G01006.0

Dear Mr. Rose:

Municipal Engineering Services Company, P.A. (MESCO) completed the statistical analyses for the Cherokee County Subtitle D Lined Landfill located in Marble, North Carolina. The purpose of these analyses is to determine, in comparison to background levels, statistical significance of constituents detected during the October-2000 sampling event.

The Appendix 1 laboratory analyses conducted by Pace Analytical Services Incorporated of Asheville, NC reveal only metal detections with no VOCs discovered. The metals chromium, cadmium, lead and/or nickel were found in exceedance of the North Carolina Groundwater Standard within MW-3, MW-4, and background well MW-1.

Statistical Analysis Methodology

Metals

A preliminary data screening was conducted upon the metals detected in all monitoring locations. Detected metals with concentrations found below that of the background well MW-1 were eliminated and a statistical analysis was not conducted upon these wells. An inter-well statistical analysis was conducted upon metals detected during the October 23-26, 2000 sampling event. Monitoring well MW-1 was defined as the background well, and an upper tolerance limit (UTL) with a 95% coverage was computed for each detected constituent from the background data at a 95% confidence level. For each tested constituent, an appropriate statistical analysis method was selected based on the percentages of non-detects (%ND) in the historical background data. The following table (Table 1) summarizes the methods used for four different %ND ranges.

Table 1. Statistical Analysis Methods for Various %ND Ranges

%ND	Analysis Method	ND Substitution
%ND<15%	Parametric tolerance limit	1/2 ND
15%<%ND<50%	Parametric tolerance limit	Cohen or 1/2 ND
50%<%ND<90%	Non-parametric tolerance limit	1/2 ND
90%<%ND	Poisson tolerance limit	-

NOTE: For parametric tolerance interval, normality of the background data was checked by the Shapiro-Wilks normality test, as the method requires that the data be normally distributed.

Results

A total of thirteen metals were tested for statistical significance. For lead, nickel, vanadium, and zinc the parametric tolerance limit was utilized as their %NDs were less than 50% and the data were either normally or "log-normally" distributed. For arsenic and silver the Poisson tolerance limit method was employed as its %ND exceeded 90%. For all other constituents, the non- parametric tolerance interval method was used with proper NDs substitution. Historical data compiled for monitoring well MW-1 was used as the baseline. Data distributions were reviewed using time series and box and whiskers plots (enclosed charts). Table 2 summarizes those metals that were found statistically significant by interwell comparison analysis.

Table2. Interwell Analyses Summary

Well	Sb	As	Be	Cd	Cr	Ni	Zn
MW-3	x	x	x	x	x	x	x
MW-4		x			x	x	x

x=level significantly higher than the background level

Metals with concentrations above background monitoring well MW-1 were found predominately within MW-3 and MW-4. Both of these wells are located near the south east corner of the cell and approximately due south of the leachate lagoon. However, after close examination of time series plots for MW-3 and MW-4 several metal concentrations didn't conform to the pattern established by previous historical sampling events. This is indicative of the presence of possible outliers. A Dixon's test for outliers was performed upon the suspected metals within MW-3 and MW-4 and the results show at a 5% significance level that the detections of the metals arsenic, beryllium, cadmium, chromium, nickel and zinc are indeed outliers.

A few noteworthy observations were made concerning the comparison of metal concentrations found within the leachate lagoon and MW-3 and MW-4. The metals arsenic and chromium haven't been detected in the lagoon during the last 3 sampling events. All levels of metals within the leachate lagoon samples were found below the concentrations found within MW-3 and MW-4. This makes it very likely that the source of the metals detected within the monitoring wells is not waste related and probably just inherent in the geochemistry of the area.

Further analysis to determine whether the statistical significance was caused by spatial variability by intra-well analysis couldn't be conducted at this time because Shewhart-CUSUM control charts requires a minimum of eight historical sampling events. This event was only the ninth therefore this event will serve as the origination point for the CUSUM and Standardized mean lines for the tenth and subsequent future events to compare to.

Conclusion

The statistical analysis results continue to indicate no signs of contamination at the Cherokee County Subtitle D Lined Landfill. Although metals were found in statistically significant concentrations in MW-3 and MW-4 by interwell analysis, the lack of any VOC detection suggests no conclusive evidence of a contaminate plume originating from the landfill. The interwell analysis results are probably biased and misleading because several of the latest laboratory results were determined to be outliers. Intrawell statistical analysis will be able to be conducted following the next sampling event and a more accurate assessment of metal concentrations will be possible. Pace Analytical Services of Asheville is scheduled to continue detection sampling for Appendix I during the month of April 2001. If you have any questions or comments regarding this report, please contact me at (919) 772-5393.

Sincerely,
MUNICIPAL ENGINEERING SERVICES CO., P.A.

Jonathan Pfohl
Environmental Technician

Enclosures

cc: Mr. Robert Allen
Cherokee County

Exceedance Scan
Cherokee County Subtitle D Lined Landfill

Well ID	Parameter Name [1]	Sample Date	Result	Unit	PQL [2]	MCL [3]	Exceedance
EB	Silver, total	10/23/00	0.0023	mg/l	0.002	0.018	
TB	Carbon disulfide	10/23/00	24	ug/l	5	-	
LEACHATE	Barium, total	10/24/00	0.4	mg/l	0.005	2	
LEACHATE	Beryllium, total	10/24/00	0.0029	mg/l	0.002	-	
LEACHATE	Cadmium, total	10/24/00	0.0032	mg/l	0.001	0.005	
LEACHATE	Nickel, total	10/24/00	0.013	mg/l	0.005	0.1	
LEACHATE	Zinc, total	10/24/00	0.019	mg/l	0.01	2.1	
MW-1	Barium, total	10/24/00	0.24	mg/l	0.005	2	
MW-1	Beryllium, total	10/24/00	0.0058	mg/l	0.002	-	
MW-1	**Cadmium, total**	**10/24/00**	**0.013**	**mg/l**	**0.001**	**0.005**	**0.008**
MW-1	**Chromium, total**	**10/24/00**	**0.092**	**mg/l**	**0.005**	**0.05**	**0.042**
MW-1	Cobalt, total	10/24/00	0.053	mg/l	0.005	-	
MW-1	Copper, total	10/24/00	0.18	mg/l	0.005	1	
MW-1	**Lead, total**	**10/24/00**	**0.032**	**mg/l**	**0.01**	**0.015**	**0.017**
MW-1	Nickel, total	10/24/00	0.07	mg/l	0.005	0.1	
MW-1	Tin, total	10/24/00	0.028	mg/l	0.01	-	
MW-1	Vanadium	10/24/00	0.089	mg/l	0.005	-	
MW-1	Zinc, total	10/24/00	0.17	mg/l	0.01	2.1	
MW-2	Barium, total	10/23/00	0.016	mg/l	0.005	2	
MW-2	Silver, total	10/23/00	0.0036	mg/l	0.002	0.018	
MW-3	Antimony, total	10/24/00	0.013	mg/l	0.01	-	
MW-3	Arsenic, total	10/24/00	0.019	mg/l	0.01	0.05	
MW-3	Barium, total	10/24/00	1.6	mg/l	0.005	2	
MW-3	Beryllium, total	10/24/00	0.027	mg/l	0.002	-	
MW-3	**Cadmium, total**	**10/24/00**	**0.04**	**mg/l**	**0.001**	**0.005**	**0.035**
MW-3	**Chromium, total**	**10/24/00**	**0.33**	**mg/l**	**0.005**	**0.05**	**0.28**
MW-3	Cobalt, total	10/24/00	0.19	mg/l	0.005	-	
MW-3	Copper, total	10/24/00	0.13	mg/l	0.005	1	
MW-3	**Lead, total**	**10/24/00**	**0.13**	**mg/l**	**0.01**	**0.015**	**0.115**
MW-3	**Nickel, total**	**10/24/00**	**0.25**	**mg/l**	**0.005**	**0.1**	**0.15**
MW-3	Vanadium	10/24/00	0.25	mg/l	0.005	-	
MW-3	Zinc, total	10/24/00	0.98	mg/l	0.01	2.1	
MW-4	Arsenic, total	10/24/00	0.04	mg/l	0.01	0.05	
MW-4	Barium, total	10/24/00	1.1	mg/l	0.005	2	
MW-4	Beryllium, total	10/24/00	0.012	mg/l	0.002	-	
MW-4	**Cadmium, total**	**10/24/00**	**0.013**	**mg/l**	**0.001**	**0.005**	**0.008**
MW-4	**Chromium, total**	**10/24/00**	**0.17**	**mg/l**	**0.005**	**0.05**	**0.12**
MW-4	Cobalt, total	10/24/00	0.078	mg/l	0.005	-	
MW-4	Copper, total	10/24/00	0.057	mg/l	0.005	1	
MW-4	**Lead, total**	**10/24/00**	**0.03**	**mg/l**	**0.01**	**0.015**	**0.015**
MW-4	**Nickel, total**	**10/24/00**	**0.18**	**mg/l**	**0.005**	**0.1**	**0.08**
MW-4	Thallium, total	10/24/00	0.0023	mg/l	0.002	-	
MW-4	Vanadium	10/24/00	0.12	mg/l	0.005	-	
MW-4	Zinc, total	10/24/00	0.44	mg/l	0.01	2.1	
MW-5	Barium, total	10/24/00	0.037	mg/l	0.005	2	
MW-5	Beryllium, total	10/24/00	0.0026	mg/l	0.002	-	

Well ID	Parameter Name [1]	Sample Date	Result	Unit	PQL [2]	MCL [3]	Exceedance
MW-5	Cobalt, total	10/24/00	0.0073	mg/l	0.005	-	
MW-5	Copper, total	10/24/00	0.034	mg/l	0.005	1	
MW-5	Nickel, total	10/24/00	0.018	mg/l	0.005	0.1	
MW-5	Vanadium	10/24/00	0.0057	mg/l	0.005	-	
MW-5	Zinc, total	10/24/00	0.043	mg/l	0.01	2.1	
MW-6D	Barium, total	10/26/00	0.0082	mg/l	0.005	2	
MW-6D	Beryllium, total	10/26/00	0.0026	mg/l	0.002	-	
MW-6D	Zinc, total	10/26/00	0.011	mg/l	0.01	2.1	
MW-6S	Barium, total	10/23/00	0.048	mg/l	0.005	2	
MW-6S	Cobalt, total	10/23/00	0.0053	mg/l	0.005	-	
MW-6S	Nickel, total	10/23/00	0.0063	mg/l	0.005	0.1	
MW-6S	Silver, total	10/23/00	0.0041	mg/l	0.002	0.018	
MW-6S	Zinc, total	10/23/00	0.017	mg/l	0.01	2.1	
MW-7	Barium, total	10/24/00	0.01	mg/l	0.005	2	
MW-7	Beryllium, total	10/24/00	0.0025	mg/l	0.002	-	
SW-1	Barium, total	10/23/00	0.014	mg/l	0.005	2	
SW-1	Silver, total	10/23/00	0.0029	mg/l	0.002	0.018	
SW-2	Barium, total	10/23/00	0.012	mg/l	0.005	2	

[1] Table only contains detected constituents.

[2] PQL = Practical Quantitation Limit

[3] MCL = Maximum Contaminant Level (North Carolina Groundwater Standard)

Statistical Analyses Summary

Inter-Well Analysis Summary
Cherokee County Subtitle D Lined Landfill

Background Well: MW-1

Antimony, total

%ND	Normality	Method	ND Adj.	Upper Limit (a = 95%)	Unit
88.889	-	Non-parametric tolerance interval	1/2 ND	10	ug/l

Well	Result	Significance
MW-3	13	yes

Arsenic, total

%ND	Normality	Method	ND Adj.	Upper Limit (a = 95%)	Unit
100	-	Poisson tolerance interval	ND	14	ug/l

Well	Result	Significance
MW-3	19	yes
MW-4	40	yes

Barium, total

%ND	Normality	Method	ND Adj.	Upper Limit (a = 95%)	Unit
22.22	no	Non-parametric tolerance interval	Cohen	3000	ug/l

Well	Result	Significance
MW-3	1600	no
MW-4	1100	no

Beryllium, total

%ND	Normality	Method	ND Adj.	Upper Limit (a = 95%)	Unit
55.556	no	Non-parametric tolerance interval	1/2 ND	12	ug/l

Well	Result	Significance
MW-3	27	yes
MW-4	12	no

Cadmium, total

%ND	Normality	Method	ND Adj.	Upper Limit (a = 95%)	Unit
66.67	no	Non-parametric tolerance interval	1/2 ND	13	ug/l

Well	Result	Significance
MW-3	40	yes

Chromium, total

%ND	Normality	Method	ND Adj.	Upper Limit (a = 95%)	Unit
11.11	normal	Parametric Tolerance interval	1/2ND	113.709	ug/l

Well	Result	Significance
MW-3	330	yes
MW-4	170	yes

Cobalt, total

%ND	Normality	Method	ND Adj.	Upper Limit (a = 95%)	Unit
0.00	no	Non-parametric tolerance interval	1/2 ND	531	ug/l

Well	Result	Significance
MW-3	190	no
MW-4	78	no

Lead, total

%ND	Normality	Method	ND Adj.	Upper Limit (a = 95%)	Unit
33.33	log-normal	Parametric Tolerance interval	1/2ND	7.2039	log[ug/l]

Well	Result	Significance
MW-3	4.86753	no

Nickel, total

%ND	Normality	Method	ND Adj.	Upper Limit (a = 95%)	Unit
44.44	normal	Parametric Tolerance interval	Cohen	104.849	ug/l

Well	Result	Significance
MW-3	250	yes
MW-4	180	yes

Silver, total

%ND	Normality	Method	ND Adj.	Upper Limit (a = 95%)	Unit
100	-	Poisson tolerance interval	ND	5.0	ug/l

Well	Result	Significance
MW-2	3.6	no
MW-6S	4.1	no
SW-1	2.9	no

Thallium, total

%ND	Normality	Method	ND Adj.	Upper Limit (a = 95%)	Unit
77.78	-	Non-parametric tolerance interval	1/2 ND	3	ug/l

Well	Result	Significance
MW-4	2.3	no

Vanadium

%ND	Normality	Method	ND Adj.	Upper Limit (a = 95%)	Unit
33.33	log-normal	Parametric Tolerance interval	1/2ND	6.7748	log[ug/l]

Well	Result	Significance
MW-3	5.52146	no
MW-4	4.78749	no

Zinc, total

%ND	Normality	Method	ND Adj.	Upper Limit (a = 95%)	Unit
0	normal	Parametric Tolerance interval	1/2 ND	409.224	ug/l

Well	Result	Significance
MW-3	980	yes
MW-4	440	yes

NOTE: Bold-faced monitoring points indicate detected levels exceed North Carolina Groundwater Standard.

Inter-Well Analysis Summary (Metals)
Cherokee County Subtitle D Lined Landfill

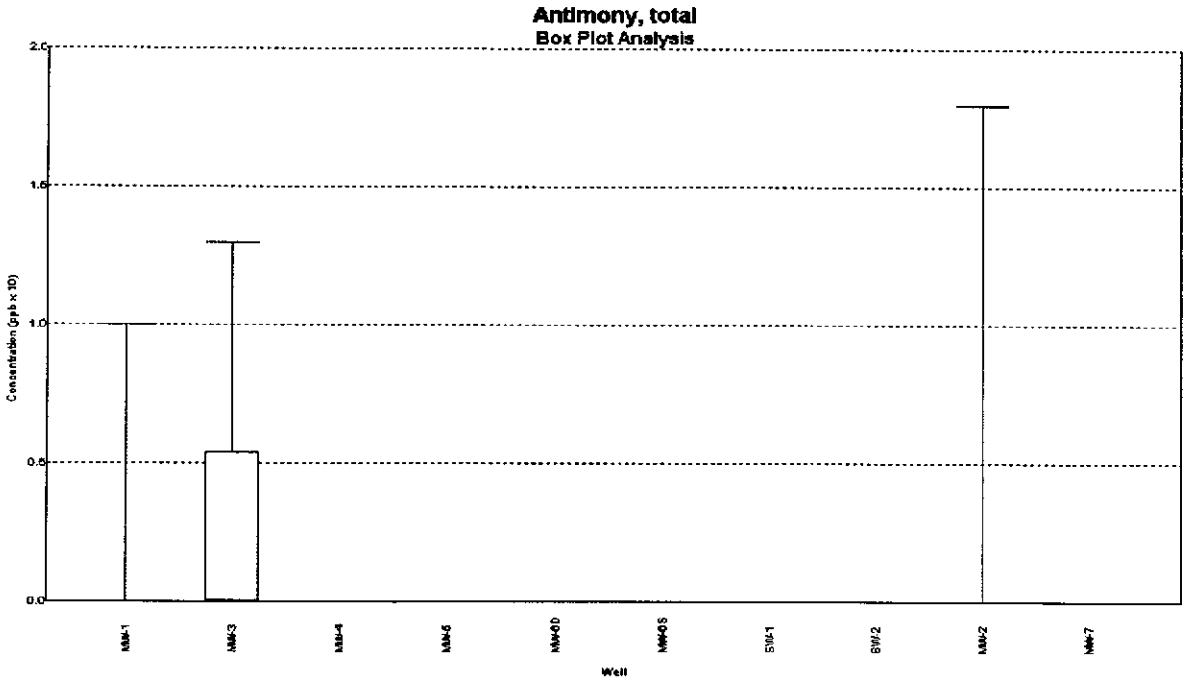
Well	Antimony	Arsenic	Beryllium	Cadmium	Chromium	Nickel	Zinc
MW-3	yes	yes	no	no	no	no	no
MW-4		no			yes	yes	no

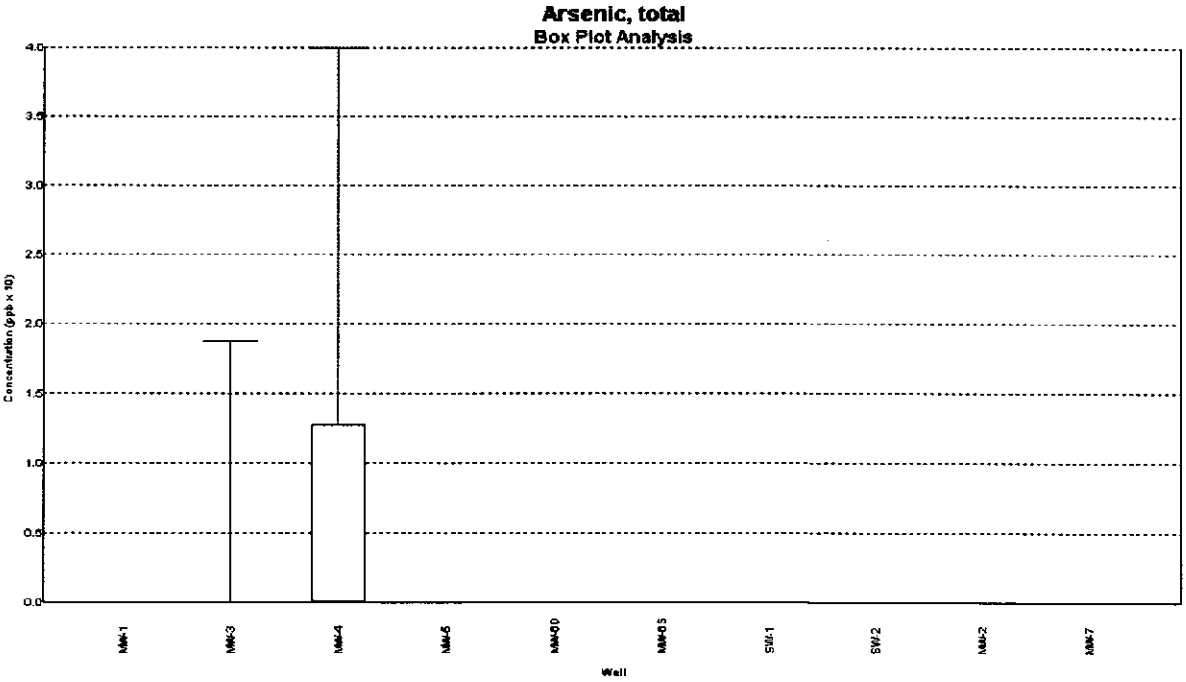
EXPLANATION

yes=detection statistically significant by interwell analysis

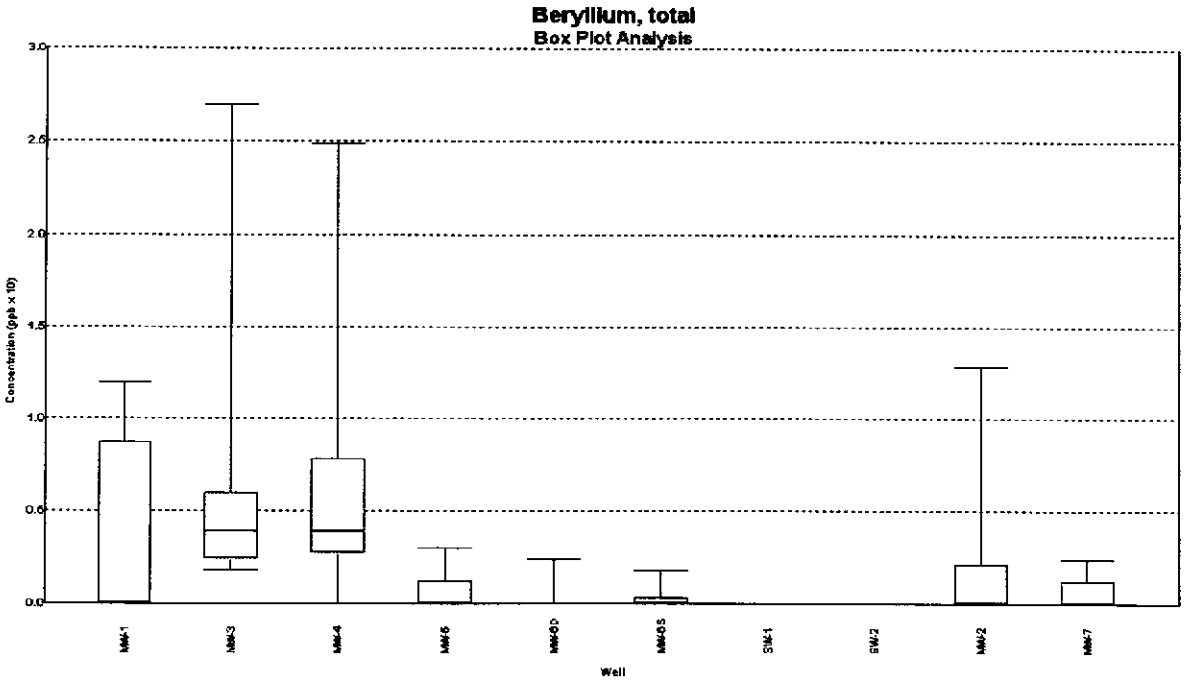
no=detection statistically significant by interwell analysis but outlier discovered in October 2000 sampling event

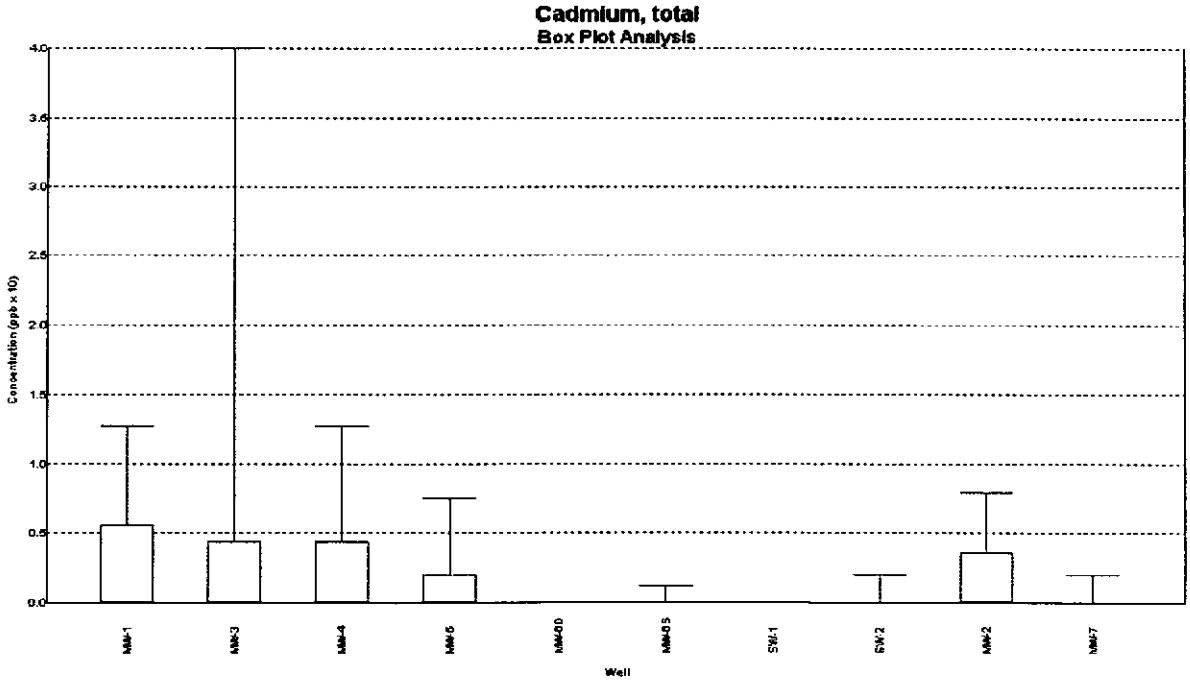
Box Plots for Select Constituents
Cherokee County Subtitle D Lined Landfill



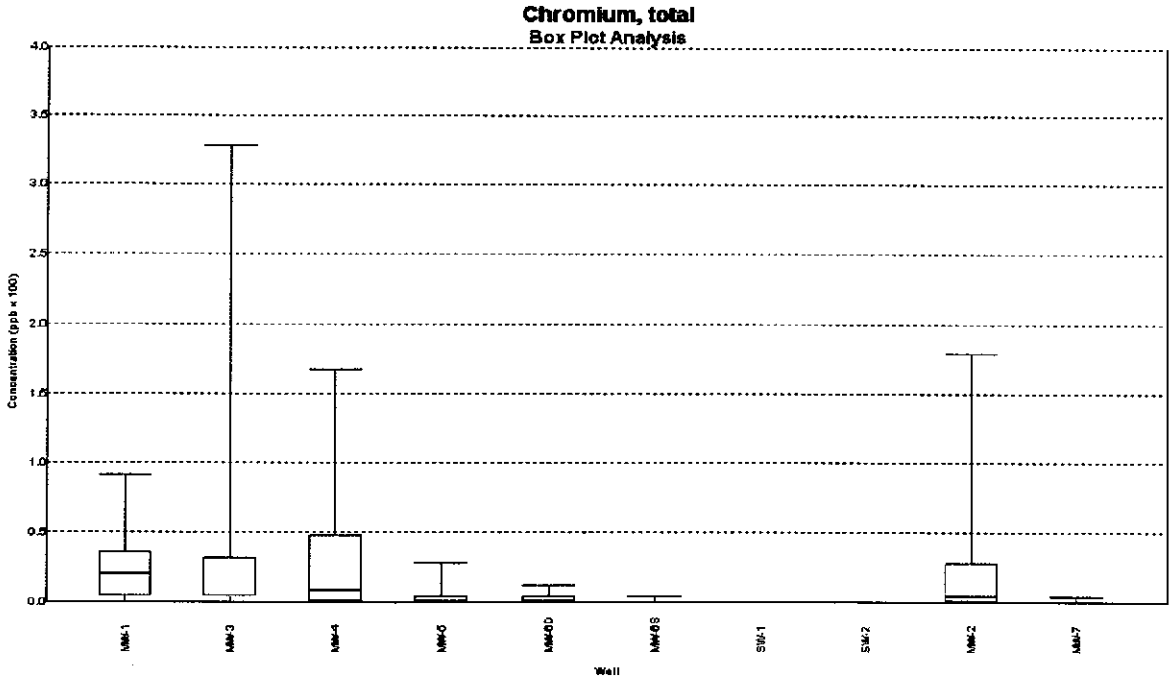


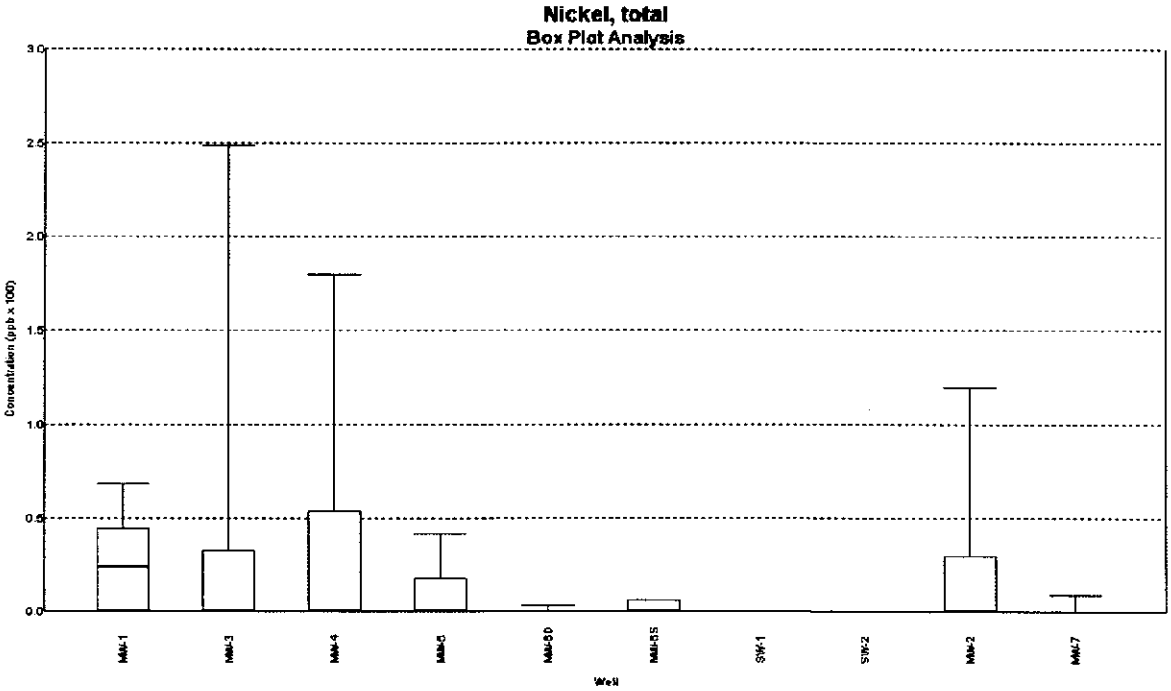
Box Plots for Select Constituents
Cherokee County Subtitle D Lined Landfill



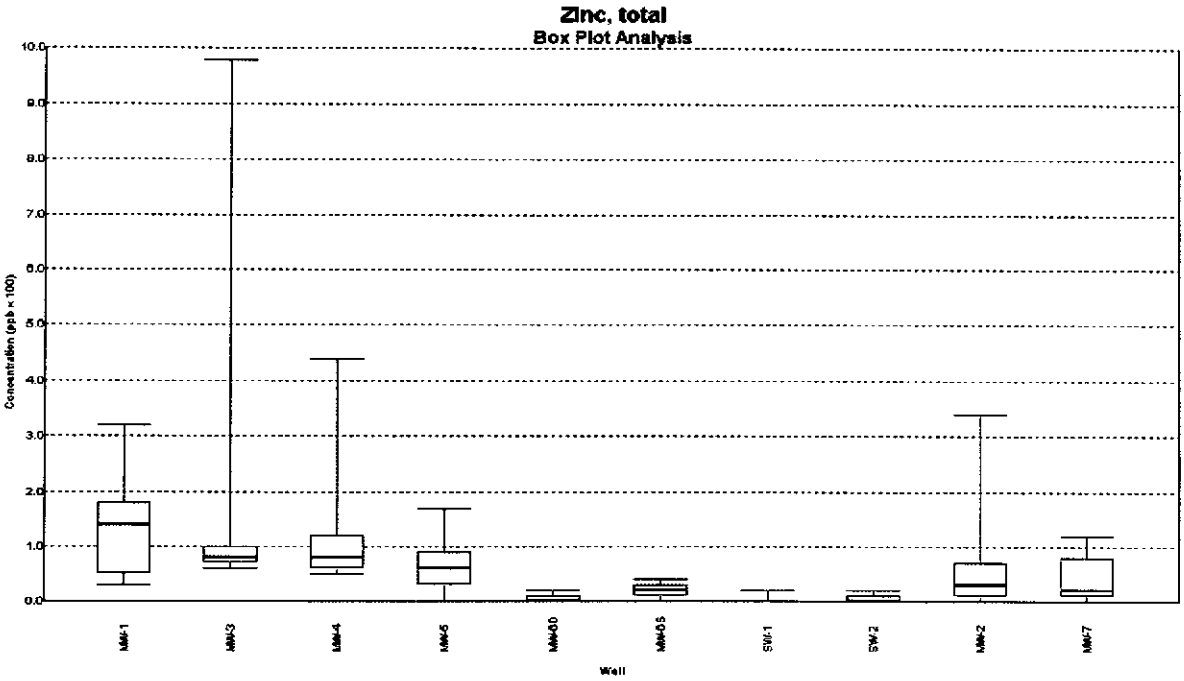


Box Plots for Select Constituents
Cherokee County Subtitle D Lined Landfill

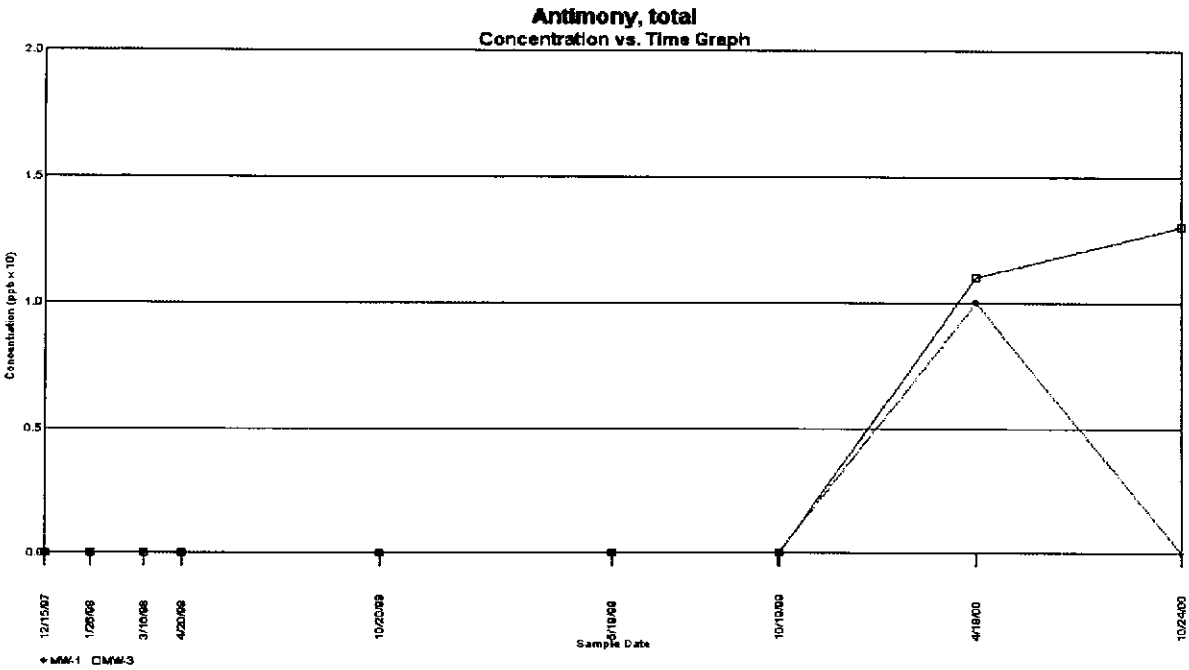


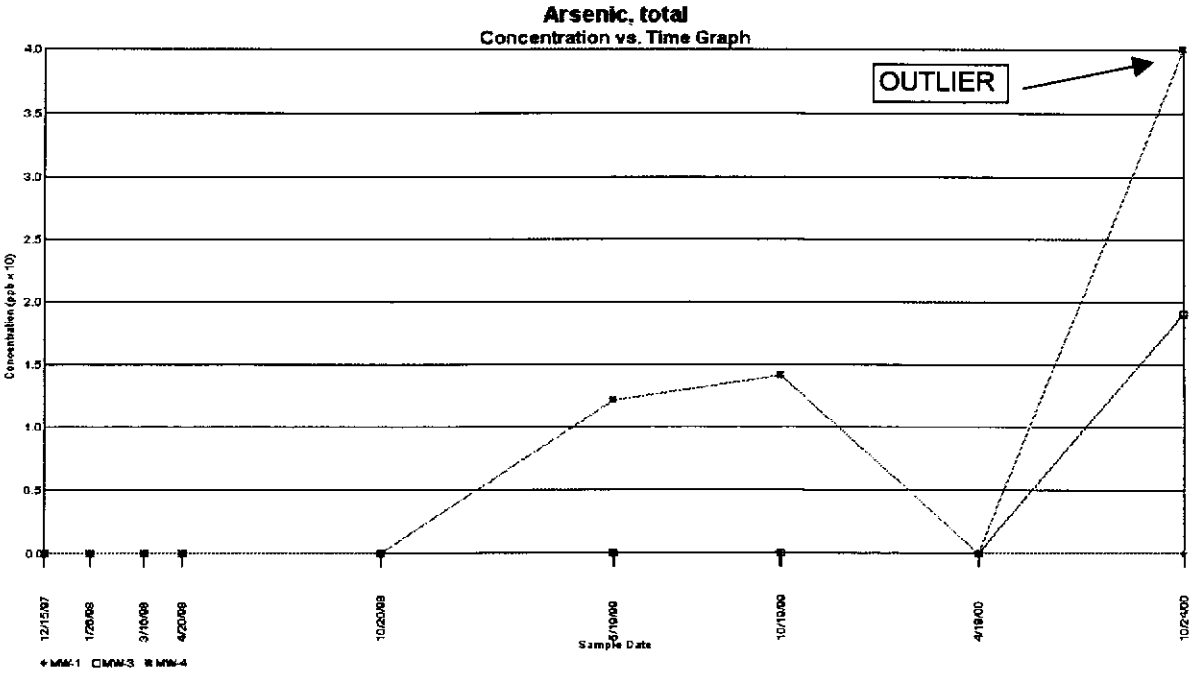


Box Plots for Select Constituents
Cherokee County Subtitle D Lined Landfill

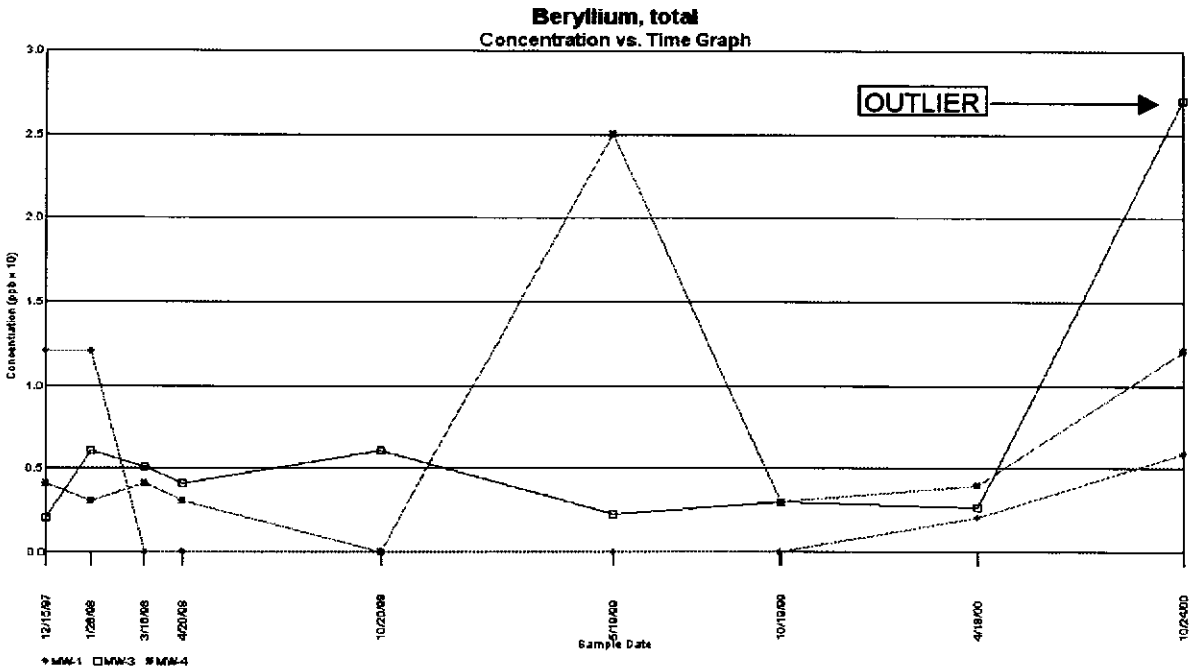


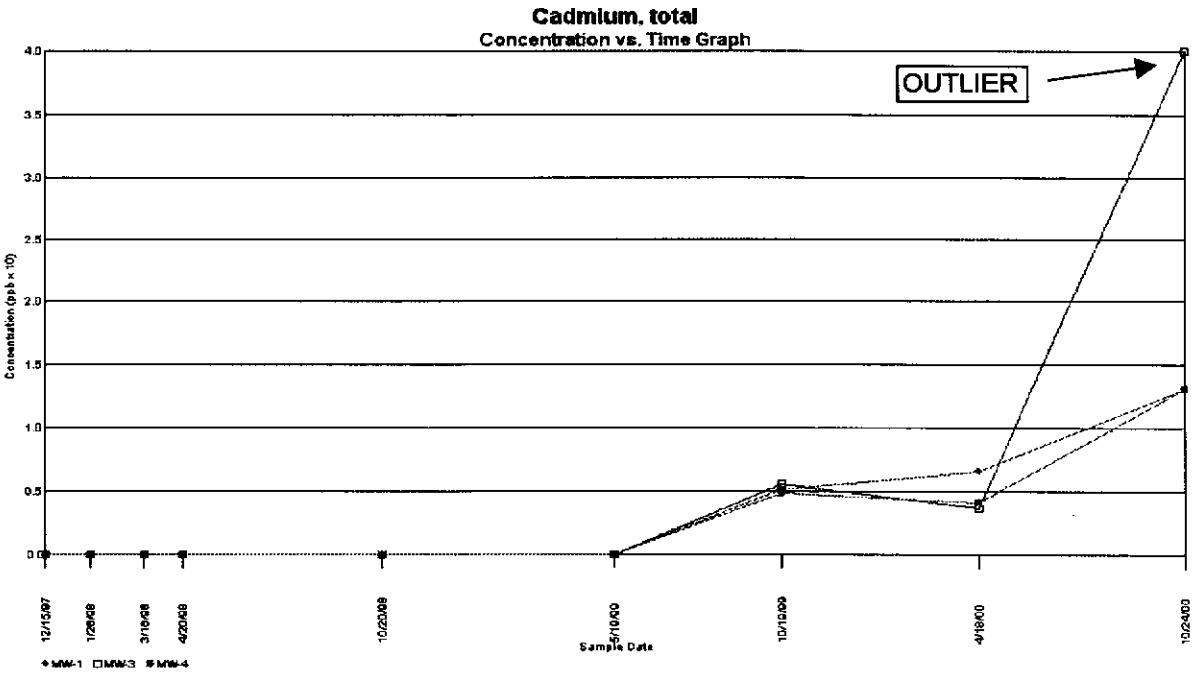
Time Series Plots for Select Constituents
Cherokee County Subtitle D Lined Landfill



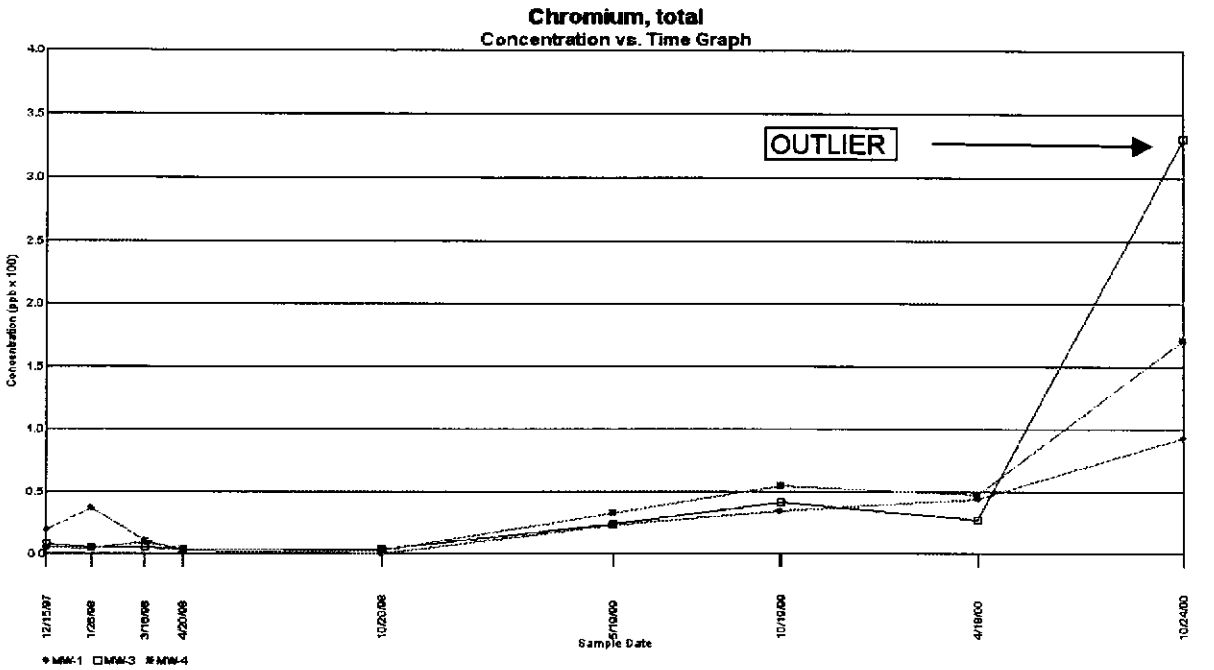


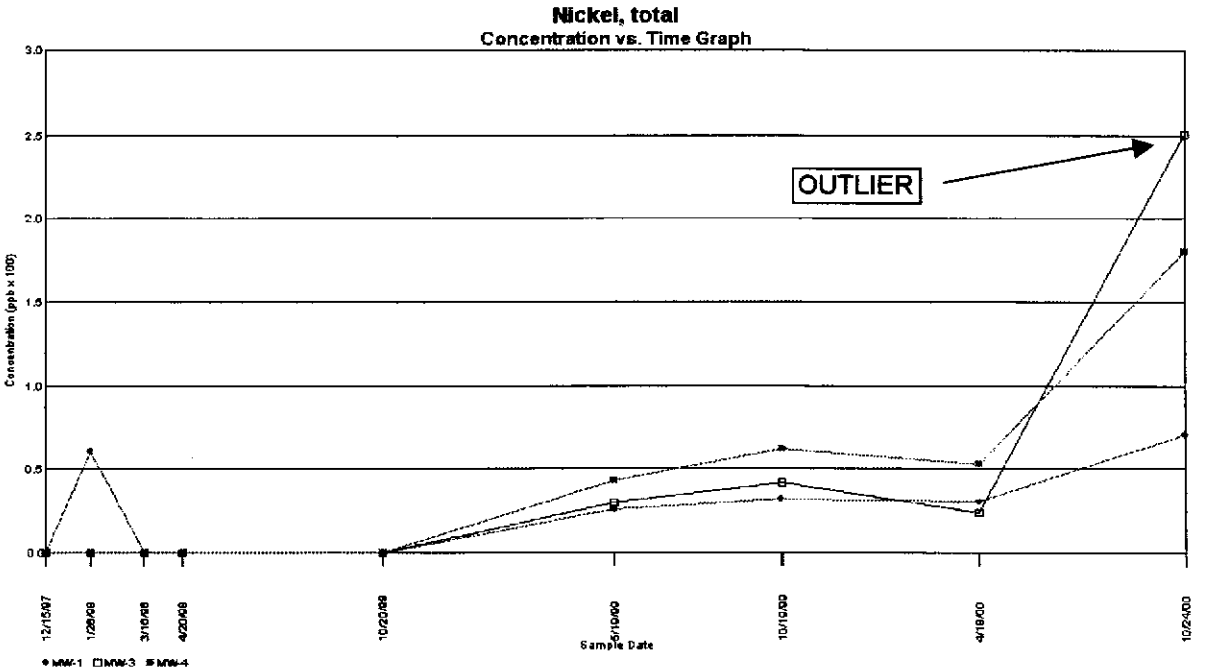
Time Series Plots for Select Constituents
Cherokee County Subtitle D Lined Landfill



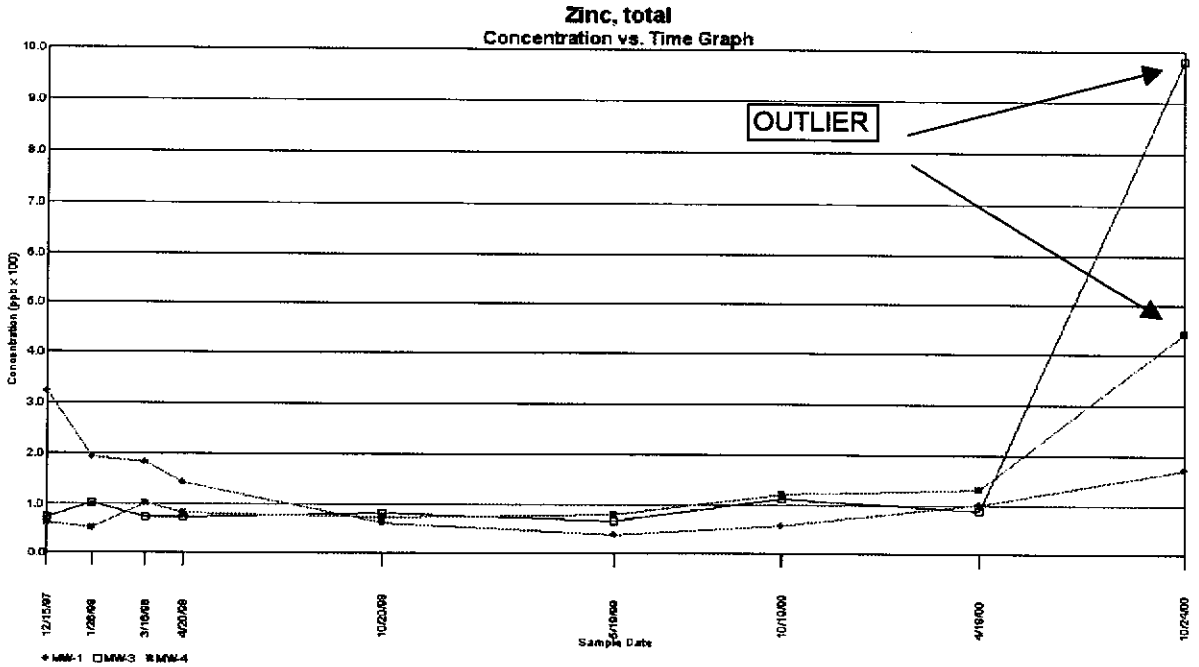


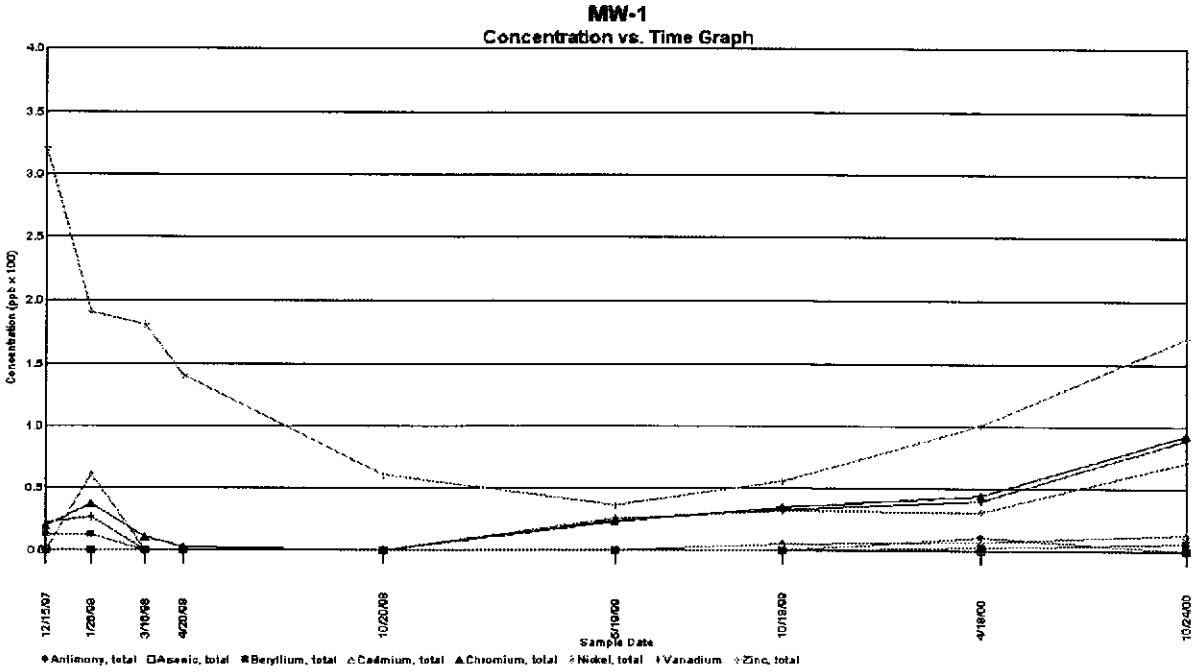
Time Series Plots for Select Constituents
Cherokee County Subtitle D Lined Landfill





Time Series Plots for Select Constituents
Cherokee County Subtitle D Lined Landfill





Basic Statistics

Basic Statistics
Parameter: Antimony, total

Total Observations	93
Total Non-Detects	89
Pooled Mean	6.46237
Pooled Std Dev	3.74038
Background Mean	6.11111
Background Std Dev	3.68932

Background Wells
There is 1 background well

Well	Samples	Non-Detects	% ND	Total
MW-1	9	8	88.8889	55

Well	Mean	Std Dev	Std Err	Rank Sum	Rank Mean
MW-1	6.11111	3.68932	0	461	51.2222

Compliance Wells
There are 13 compliance wells

Well	Samples	Non-Detects	% ND	Total
MW-3	9	7	77.7778	59
MW-4	9	9	100	55
MW-5	9	9	100	55
MW-6D	9	9	100	55
MW-6S	9	9	100	55
SW-1	9	9	100	55
SW-2	9	9	100	55
MW-2	9	8	88.8889	65
MW-7	8	8	100	52
Pendergrass	1	1	100	10
Rathbone	1	1	100	10
Solesbee	1	1	100	10
Van Buskirk	1	1	100	10

Well	Mean	Std Dev	Dif From Bkg	Std Err	Rank Sum	Rank Mean
MW-3	6.55556	4.30439	0.444444	1.85554	520	57.7778
MW-4	6.11111	3.68932	0	1.85554	405	45
MW-5	6.11111	3.68932	0	1.85554	405	45
MW-6D	6.11111	3.68932	0	1.85554	405	45
MW-6S	6.11111	3.68932	0	1.85554	405	45
SW-1	6.11111	3.68932	0	1.85554	405	45
SW-2	6.11111	3.68932	0	1.85554	405	45
MW-2	7.22222	5.1908	1.11111	1.85554	464	51.5556
MW-7	6.5	3.74166	0.388889	1.91265	360	45
Pendergrass	10	0	3.88889	4.14912	45	45
Rathbone	10	0	3.88889	4.14912	45	45
Solesbee	10	0	3.88889	4.14912	45	45
Van Buskirk	10	0	3.88889	4.14912	45	45

Analysis of Variance Statistics

SS Wells	63.1183
SS Total	1287.12

Kruskal-Wallis Statistics

Non-Detect Rank	45
Background Rank Sum	461
Background Rank Mean	51.2222
H Statistic	7.9515
H Adjusted for Ties	64.3474

Basic Statistics
Parameter: Arsenic, total

Total Observations	93
Total Non-Detects	89
Pooled Mean	7.84946
Pooled Std Dev	4.41821
Background Mean	7.22222
Background Std Dev	2.63523

Background Wells
There is 1 background well

Well	Samples	Non-Detects	% ND	Total
MW-1	9	9	100	65

Well	Mean	Std Dev	Std Err	Rank Sum	Rank Mean
MW-1	7.22222	2.63523	0	405	45

Compliance Wells
There are 13 compliance wells

Well	Samples	Non-Detects	% ND	Total
MW-3	9	8	88.8889	74
MW-4	9	6	66.6667	101
MW-5	9	9	100	65
MW-6D	9	9	100	65
MW-6S	9	9	100	65
SW-1	9	9	100	65
SW-2	9	9	100	65
MW-2	9	9	100	65
MW-7	8	8	100	60
Pendergrass	1	1	100	10
Rathbone	1	1	100	10
Solesbee	1	1	100	10
Van Buskirk	1	1	100	10

Well	Mean	Std Dev	Dif From Bkg	Std Err	Rank Sum	Rank Mean
MW-3	8.22222	4.7111	1	2.15307	463	51.4444
MW-4	11.2222	11.3554	4	2.15307	577	64.1111
MW-5	7.22222	2.63523	0	2.15307	405	45
MW-6D	7.22222	2.63523	0	2.15307	405	45
MW-6S	7.22222	2.63523	0	2.15307	405	45
SW-1	7.22222	2.63523	0	2.15307	405	45
SW-2	7.22222	2.63523	0	2.15307	405	45
MW-2	7.22222	2.63523	0	2.15307	405	45
MW-7	7.5	2.67261	0.277778	2.21934	360	45
Pendergrass	10	0	2.77778	4.81442	45	45
Rathbone	10	0	2.77778	4.81442	45	45
Solesbee	10	0	2.77778	4.81442	45	45
Van Buskirk	10	0	2.77778	4.81442	45	45

Analysis of Variance Statistics

SS Wells	147.892
SS Total	1795.89

Kruskal-Wallis Statistics

Non-Detect Rank	45
Background Rank Sum	405
Background Rank Mean	45
H Statistic	9.95043
H Adjusted for Ties	80.5238

Basic Statistics
Parameter: Barium, total

Total Observations	93
Total Non-Detects	33
Pooled Mean	422.09
Pooled Std Dev	835.503
Background Mean	622.222
Background Std Dev	1052.78

Background Wells
There is 1 background well

Well	Samples	Non-Detects	% ND	Total
MW-1	9	2	22.2222	5600

Well	Mean	Std Dev	Std Err	Rank Sum	Rank Mean
MW-1	622.222	1052.78	0	589	65.4444

Compliance Wells
There are 13 compliance wells

Well	Samples	Non-Detects	% ND	Total
MW-3	9	0	0	15530
MW-4	9	0	0	12240
MW-5	9	4	44.4444	815
MW-6D	9	6	66.6667	528.4
MW-6S	9	3	33.3333	691
SW-1	9	6	66.6667	538.3
SW-2	9	6	66.6667	532.4
MW-2	9	2	22.2222	1661
MW-7	8	1	12.5	1071.3
Pendergrass	1	1	100	5
Rathbone	1	1	100	5
Solesbee	1	1	100	5
Van Buskirk	1	0	0	32

Well	Mean	Std Dev	Dif From Bk	Std Err	Rank Sum	Rank Mean
MW-3	1725.56	1367.22	1103.33	305.549	828	92
MW-4	1360	1049.8	737.778	305.549	829	92.1111
MW-5	90.5556	52.8798	-531.667	305.549	392	43.5556
MW-6D	58.7111	48.9735	-563.511	305.549	240	26.6667
MW-6S	76.7778	27.6305	-545.444	305.549	441	49
SW-1	59.8111	47.7407	-562.411	305.549	247	27.4444
SW-2	59.1556	48.468	-563.067	305.549	243	27
MW-2	184.556	183.406	-437.667	305.549	548	60.8889
MW-7	133.912	168.248	-488.31	314.953	469	58.625
Pendergrass	5	0	-617.222	683.228	17	17
Rathbone	5	0	-617.222	683.228	17	17
Solesbee	5	0	-617.222	683.228	17	17
Van Buskirk	32	0	-590.222	683.228	58	58

Analysis of Variance Statistics

SS Wells	3.10325e+007
SS Total	6.4222e+007

Kruskal-Wallis Statistics

Non-Detect Rank	17
Background Rank Sum	589
Background Rank Mean	65.4444
H Statistic	149.844
H Adjusted for Ties	156.846

Basic Statistics
Parameter: Beryllium, total

Total Observations	93
Total Non-Detects	61
Pooled Mean	2.91828
Pooled Std Dev	4.18041
Background Mean	4.31111
Background Std Dev	4.60121

Background Wells
There is 1 background well

Well	Samples	Non-Detects	% ND	Total
MW-1	9	5	55.5556	38.8

Well	Mean	Std Dev	Std Err	Rank Sum	Rank Mean
MW-1	4.31111	4.60121	0	524	58.2222

Compliance Wells
There are 13 compliance wells

Well	Samples	Non-Detects	% ND	Total
MW-3	9	0	0	57.7
MW-4	9	1	11.1111	58.8
MW-5	9	7	77.7778	15.6
MW-6D	9	8	88.8889	13.6
MW-6S	9	7	77.7778	14
SW-1	9	9	100	13
SW-2	9	9	100	13
MW-2	9	6	66.6667	26.4
MW-7	8	5	62.5	12.5
Pendergrass	1	1	100	2
Rathbone	1	1	100	2
Solesbee	1	1	100	2
Van Buskirk	1	1	100	2

Well	Mean	Std Dev	Dif From Bk	Std Err	Rank Sum	Rank Mean
MW-3	6.41111	7.87471	2.1	1.88155	807	89.6667
MW-4	6.53333	7.57842	2.22222	1.88155	776	86.2222
MW-5	1.73333	0.768115	-2.57778	1.88155	390	43.3333
MW-6D	1.51111	0.633333	-2.8	1.88155	332	36.8889
MW-6S	1.55556	0.527046	-2.75556	1.88155	365	40.5556
SW-1	1.44444	0.527046	-2.86667	1.88155	279	31
SW-2	1.44444	0.527046	-2.86667	1.88155	279	31
MW-2	2.93333	3.81314	-1.37778	1.88155	445	49.4444
MW-7	1.5625	0.623212	-2.74861	1.93946	387	48.375
Pendergrass	2	0	-2.31111	4.20727	31	31
Rathbone	2	0	-2.31111	4.20727	31	31
Solesbee	2	0	-2.31111	4.20727	31	31
Van Buskirk	2	0	-2.31111	4.20727	31	31

Analysis of Variance Statistics

SS Wells	349.227
SS Total	1607.78

Kruskal-Wallis Statistics

Non-Detect Rank	31
Background Rank Sum	524
Background Rank Mean	58.2222
H Statistic	96.3029
H Adjusted for Ties	134.154

Basic Statistics
Parameter: Cadmium, total

Total Observations	93
Total Non-Detects	74
Pooled Mean	2.1871
Pooled Std Dev	4.53911
Background Mean	3.38889
Background Std Dev	4.16667

Background Wells
There is 1 background well

Well	Samples	Non-Detects	% ND	Total
MW-1	9	6	66.6667	30.5

Well	Mean	Std Dev	Std Err	Rank Sum	Rank Mean
MW-1	3.38889	4.16667	0	522	58

Compliance Wells
There are 13 compliance wells

Well	Samples	Non-Detects	% ND	Total
MW-3	9	6	66.6667	55.1
MW-4	9	6	66.6667	27.9
MW-5	9	6	66.6667	17.6
MW-6D	9	9	100	9
MW-6S	9	8	88.8889	9.3
SW-1	9	9	100	9
SW-2	9	8	88.8889	10
MW-2	9	6	66.6667	21.6
MW-7	8	6	75	9.4
Pendergrass	1	1	100	1
Rathbone	1	1	100	1
Solesbee	1	1	100	1
Van Buskirk	1	1	100	1

Well	Mean	Std Dev	Dif From Bk	Std Err	Rank Sum	Rank Mean
MW-3	6.12222	12.8056	2.73333	2.16945	519	57.6667
MW-4	3.1	4.00562	-0.288889	2.16945	517	57.4444
MW-5	1.95556	2.21761	-1.43333	2.16945	500	55.5556
MW-6D	1	0	-2.38889	2.16945	337.5	37.5
MW-6S	1.03333	0.1	-2.35556	2.16945	385	42.7778
SW-1	1	0	-2.38889	2.16945	337.5	37.5
SW-2	1.11111	0.333333	-2.27778	2.16945	387	43
MW-2	2.4	2.56953	-0.988889	2.16945	513	57
MW-7	1.175	0.361544	-2.21389	2.23622	399	49.875
Pendergrass	1	0	-2.38889	4.85105	37.5	37.5
Rathbone	1	0	-2.38889	4.85105	37.5	37.5
Solesbee	1	0	-2.38889	4.85105	37.5	37.5
Van Buskirk	1	0	-2.38889	4.85105	37.5	37.5

Analysis of Variance Statistics

SS Wells	222.354
SS Total	1895.52

Kruskal-Wallis Statistics

Non-Detect Rank	37.5
Background Rank Sum	522
Background Rank Mean	58
H Statistic	34.9123
H Adjusted for Ties	70.3526

Basic Statistics
Parameter: Chromium, total

Total Observations	93
Total Non-Detects	44
Pooled Mean	16.7581
Pooled Std Dev	43.2723
Background Mean	28.7778
Background Std Dev	27.9767

Background Wells
There is 1 background well

Well	Samples	Non-Detects	% ND	Total
MW-1	9	1	11.1111	259

Well	Mean	Std Dev	Std Err	Rank Sum	Rank Mean
MW-1	28.7778	27.9767	0	723.5	80.3889

Compliance Wells
There are 13 compliance wells

Well	Samples	Non-Detects	% ND	Total
MW-3	9	0	0	444
MW-4	9	0	0	326
MW-5	9	5	55.5556	57.4
MW-6D	9	6	66.6667	46
MW-6S	9	5	55.5556	32
SW-1	9	9	100	25
SW-2	9	9	100	25
MW-2	9	2	22.2222	274
MW-7	8	4	50	29.1
Pendergrass	1	1	100	5
Rathbone	1	0	0	26
Solesbee	1	1	100	5
Van Buskirk	1	1	100	5

Well	Mean	Std Dev	Dif From Bk	Std Err	Rank Sum	Rank Mean
MW-3	49.3333	106.097	20.5556	20.3464	725	80.5556
MW-4	36.2222	54.055	7.44444	20.3464	735	81.6667
MW-5	6.37778	9.65839	-22.4	20.3464	405.5	45.0556
MW-6D	5.11111	3.78961	-23.6667	20.3464	365	40.5556
MW-6S	3.55556	1.81046	-25.2222	20.3464	366.5	40.7222
SW-1	2.77778	2.10819	-26	20.3464	202.5	22.5
SW-2	2.77778	2.10819	-26	20.3464	202.5	22.5
MW-2	30.4444	57.5546	1.66667	20.3464	642	71.3333
MW-7	3.6375	1.697	-25.1403	20.9726	356	44.5
Pendergrass	5	0	-23.7778	45.4959	22.5	22.5
Rathbone	26	0	-2.77778	45.4959	90	90
Solesbee	5	0	-23.7778	45.4959	22.5	22.5
Van Buskirk	5	0	-23.7778	45.4959	22.5	22.5

Analysis of Variance Statistics

SS Wells	25100.9
SS Total	172269

Kruskal-Wallis Statistics

Non-Detect Rank	22.5
Background Rank Sum	723.5
Background Rank Mean	80.3889
H Statistic	136.608
H Adjusted for Ties	152.782

Basic Statistics
Parameter: Cobalt, total

Total Observations	93
Total Non-Detects	33
Pooled Mean	35.3086
Pooled Std Dev	74.9712
Background Mean	128.222
Background Std Dev	193.681

Background Wells
There is 1 background well

Well	Samples	Non-Detects	% ND	Total
MW-1	9	0	0	1154

Well	Mean	Std Dev	Std Err	Rank Sum	Rank Mean
MW-1	128.222	193.681	0	755	83.8889

Compliance Wells
There are 13 compliance wells

Well	Samples	Non-Detects	% ND	Total
MW-3	9	0	0	834
MW-4	9	0	0	565
MW-5	9	1	11.1111	90.3
MW-6D	9	7	77.7778	35
MW-6S	9	0	0	124.8
SW-1	9	8	88.8889	25
SW-2	9	9	100	25
MW-2	9	1	11.1111	325.3
MW-7	8	3	37.5	85.3
Pendergrass	1	1	100	5
Rathbone	1	1	100	5
Solesbee	1	1	100	5
Van Buskirk	1	1	100	5

Well	Mean	Std Dev	Dif From Bkg	Std Err	Rank Sum	Rank Mean
MW-3	92.6667	57.8857	-35.5556	31.6737	823	91.4444
MW-4	62.7778	37.9697	-65.4444	31.6737	788	87.5556
MW-5	10.0333	7.78042	-118.189	31.6737	494	54.8889
MW-6D	3.88889	2.66667	-124.333	31.6737	227	25.2222
MW-6S	13.8667	13.3101	-114.356	31.6737	560	62.2222
SW-1	2.77778	2.10819	-125.444	31.6737	182	20.2222
SW-2	2.77778	2.10819	-125.444	31.6737	153	17
MW-2	36.1444	44.3671	-92.0778	31.6737	611	67.8889
MW-7	10.6625	7.84837	-117.56	32.6485	370	46.25
Pendergrass	5	0	-123.222	70.8245	17	17
Rathbone	5	0	-123.222	70.8245	17	17
Solesbee	5	0	-123.222	70.8245	17	17
Van Buskirk	5	0	-123.222	70.8245	17	17

Analysis of Variance Statistics

SS Wells	160458
SS Total	517103

Kruskal-Wallis Statistics

Non-Detect Rank	17
Background Rank Sum	755
Background Rank Mean	83.8889
H Statistic	186.502
H Adjusted for Ties	195.217

Basic Statistics
Parameter: Lead, total

Total Observations	93
Total Non-Detects	54
Pooled Mean	17.3011
Pooled Std Dev	22.4523
Background Mean	38.8889
Background Std Dev	50.081

Background Wells
There is 1 background well

Well	Samples	Non-Detects	% ND	Total
MW-1	9	3	33.3333	350

Well	Mean	Std Dev	Std Err	Rank Sum	Rank Mean
MW-1	38.8889	50.081	0	619.5	68.8333

Compliance Wells
There are 13 compliance wells

Well	Samples	Non-Detects	% ND	Total
MW-3	9	1	11.1111	349
MW-4	9	2	22.2222	168
MW-5	9	5	55.5556	114
MW-6D	9	6	66.6667	103
MW-6S	9	6	66.6667	96
SW-1	9	9	100	65
SW-2	9	9	100	65
MW-2	9	4	44.4444	159
MW-7	8	5	62.5	100
Pendergrass	1	1	100	10
Rathbone	1	1	100	10
Solesbee	1	1	100	10
Van Buskirk	1	1	100	10

Well	Mean	Std Dev	Dif From Bkg	Std Err	Rank Sum	Rank Mean
MW-3	38.7778	36.7041	-0.111111	9.90671	757.5	84.1667
MW-4	18.6667	8.88819	-20.2222	9.90671	640	71.1111
MW-5	12.6667	9.31397	-26.2222	9.90671	451.5	50.1667
MW-6D	11.4444	8.4278	-27.4444	9.90671	403	44.7778
MW-6S	10.6667	5.56776	-28.2222	9.90671	401	44.5556
SW-1	7.22222	2.63523	-31.6667	9.90671	247.5	27.5
SW-2	7.22222	2.63523	-31.6667	9.90671	247.5	27.5
MW-2	17.6667	14.0624	-21.2222	9.90671	537	59.6667
MW-7	12.5	5.50325	-26.3889	10.2116	385.5	48.1875
Pendergrass	10	0	-28.8889	22.1521	27.5	27.5
Rathbone	10	0	-28.8889	22.1521	27.5	27.5
Solesbee	10	0	-28.8889	22.1521	27.5	27.5
Van Buskirk	10	0	-28.8889	22.1521	27.5	27.5

Analysis of Variance Statistics

SS Wells	11487.8
SS Total	46377.6

Kruskal-Wallis Statistics

Non-Detect Rank	27.5
Background Rank Sum	619.5
Background Rank Mean	68.8333
H Statistic	99.2311
H Adjusted for Ties	123.379

Basic Statistics
Parameter: Nickel, total

Total Observations	93
Total Non-Detects	66
Pooled Mean	39.4559
Pooled Std Dev	34.6128
Background Mean	46.2222
Background Std Dev	14.8221

Background Wells
There is 1 background well

Well	Samples	Non-Detects	% ND	Total
MW-1	9	4	44.4444	416

Well	Mean	Std Dev	Std Err	Rank Sum	Rank Mean
MW-1	46.2222	14.8221	0	609	67.6667

Compliance Wells
There are 13 compliance wells

Well	Samples	Non-Detects	% ND	Total
MW-3	9	5	55.5556	593
MW-4	9	5	55.5556	585
MW-5	9	5	55.5556	342
MW-6D	9	8	88.8889	270
MW-6S	9	5	55.5556	279.4
SW-1	9	9	100	270
SW-2	9	9	100	270
MW-2	9	5	55.5556	400
MW-7	8	7	87.5	224
Pendergrass	1	1	100	5
Rathbone	1	1	100	5
Solesbee	1	1	100	5
Van Buskirk	1	1	100	5

Well	Mean	Std Dev	Dif From Bkg	Std Err	Rank Sum	Rank Mean
MW-3	65.8889	69.8023	19.6667	15.7829	545.5	60.6111
MW-4	65	43.3935	18.7778	15.7829	563.5	62.6111
MW-5	38	16.6508	-8.22222	15.7829	519.5	57.7222
MW-6D	30	23.7171	-16.2222	15.7829	344	38.2222
MW-6S	31.0444	22.4947	-15.1778	15.7829	481.5	53.5
SW-1	30	23.7171	-16.2222	15.7829	301.5	33.5
SW-2	30	23.7171	-16.2222	15.7829	301.5	33.5
MW-2	44.4444	33.7347	-1.77778	15.7829	536.5	59.6111
MW-7	28	23.5554	-18.2222	16.2686	315.5	39.4375
Pendergrass	5	0	-41.2222	35.2916	33.5	33.5
Rathbone	5	0	-41.2222	35.2916	33.5	33.5
Solesbee	5	0	-41.2222	35.2916	33.5	33.5
Van Buskirk	5	0	-41.2222	35.2916	33.5	33.5

Analysis of Variance Statistics

SS Wells	21665.6
SS Total	110220

Kruskal-Wallis Statistics

Non-Detect Rank	33.5
Background Rank Sum	609
Background Rank Mean	67.6667
H Statistic	57.825
H Adjusted for Ties	89.9835

Basic Statistics
Parameter: Silver, total

Total Observations	93
Total Non-Detects	84
Pooled Mean	4.8828
Pooled Std Dev	22.9811
Background Mean	1.44444
Background Std Dev	0.527046

Background Wells
There is 1 background well

Well	Samples	Non-Detects	% ND	Total
MW-1	9	9	100	13

Well	Mean	Std Dev	Std Err	Rank Sum	Rank Mean
MW-1	1.44444	0.527046	0	382.5	42.5

Compliance Wells
There are 13 compliance wells

Well	Samples	Non-Detects	% ND	Total
MW-3	9	7	77.7778	18.5
MW-4	9	9	100	13
MW-5	9	9	100	13
MW-6D	9	9	100	13
MW-6S	9	6	66.6667	46.1
SW-1	9	8	88.8889	13.9
SW-2	9	9	100	13
MW-2	9	7	77.7778	77.6
MW-7	8	7	87.5	225
Pendergrass	1	1	100	2
Rathbone	1	1	100	2
Solesbee	1	1	100	2
Van Buskirk	1	1	100	2

Well	Mean	Std Dev	Dif From Bkg	Std Err	Rank Sum	Rank Mean
MW-3	2.05556	1.5899	0.611111	11.0494	493.5	54.8333
MW-4	1.44444	0.527046	0	11.0494	382.5	42.5
MW-5	1.44444	0.527046	0	11.0494	382.5	42.5
MW-6D	1.44444	0.527046	0	11.0494	382.5	42.5
MW-6S	5.12222	7.28591	3.67778	11.0494	557	61.8889
SW-1	1.54444	0.701981	0.1	11.0494	437	48.5556
SW-2	1.44444	0.527046	0	11.0494	382.5	42.5
MW-2	8.62222	20.7842	7.17778	11.0494	498.5	55.3889
MW-7	28.125	75.1065	26.6806	11.3895	401.5	50.1875
Pendergrass	2	0	0.555556	24.7072	42.5	42.5
Rathbone	2	0	0.555556	24.7072	42.5	42.5
Solesbee	2	0	0.555556	24.7072	42.5	42.5
Van Buskirk	2	0	0.555556	24.7072	42.5	42.5

Analysis of Variance Statistics

SS Wells	5185.45
SS Total	48588.2

Kruskal-Wallis Statistics

Non-Detect Rank	42.5
Background Rank Sum	382.5
Background Rank Mean	42.5
H Statistic	18.6438
H Adjusted for Ties	70.848

Basic Statistics
Parameter: Thallium, total

Total Observations	93
Total Non-Detects	74
Pooled Mean	1.72366
Pooled Std Dev	0.949759
Background Mean	1.66667
Background Std Dev	0.707107

Background Wells
There is 1 background well

Well	Samples	Non-Detects	% ND	Total
MW-1	9	7	77.7778	15

Well	Mean	Std Dev	Std Err	Rank Sum	Rank Mean
MW-1	1.66667	0.707107	0	443.5	49.2778

Compliance Wells
There are 13 compliance wells

Well	Samples	Non-Detects	% ND	Total
MW-3	9	4	44.4444	22
MW-4	9	5	55.5556	19.3
MW-5	9	9	100	13
MW-6D	9	6	66.6667	15
MW-6S	9	7	77.7778	16
SW-1	9	9	100	13
SW-2	9	9	100	13
MW-2	9	7	77.7778	14
MW-7	8	7	87.5	12
Pendergrass	1	1	100	2
Rathbone	1	1	100	2
Solesbee	1	1	100	2
Van Buskirk	1	1	100	2

Well	Mean	Std Dev	Dif From Bk	Std Err	Rank Sum	Rank Mean
MW-3	2.44444	1.81046	0.777778	0.454912	620	68.8889
MW-4	2.14444	1.69197	0.477778	0.454912	571.5	63.5
MW-5	1.44444	0.527046	-0.222222	0.454912	337.5	37.5
MW-6D	1.66667	0.5	0	0.454912	501	55.6667
MW-6S	1.77778	0.971825	0.111111	0.454912	447.5	49.7222
SW-1	1.44444	0.527046	-0.222222	0.454912	337.5	37.5
SW-2	1.44444	0.527046	-0.222222	0.454912	337.5	37.5
MW-2	1.55556	0.527046	-0.111111	0.454912	451.5	50.1667
MW-7	1.5	0.534522	-0.166667	0.468912	349.5	43.6875
Pendergrass	2	0	0.333333	1.01721	37.5	37.5
Rathbone	2	0	0.333333	1.01721	37.5	37.5
Solesbee	2	0	0.333333	1.01721	37.5	37.5
Van Buskirk	2	0	0.333333	1.01721	37.5	37.5

Analysis of Variance Statistics

SS Wells	9.41907
SS Total	82.988

Kruskal-Wallis Statistics

Non-Detect Rank	37.5
Background Rank Sum	443.5
Background Rank Mean	49.2778
H Statistic	37.1606
H Adjusted for Ties	74.8833

Basic Statistics
Parameter: Vanadium

Total Observations	93
Total Non-Detects	65
Pooled Mean	16.1742
Pooled Std Dev	32.0845
Background Mean	27.2222
Background Std Dev	26.262

Background Wells
There is 1 background well

Well	Samples	Non-Detects	% ND	Total
MW-1	9	3	33.3333	245

Well	Mean	Std Dev	Std Err	Rank Sum	Rank Mean
MW-1	27.2222	26.262	0	667	74.1111

Compliance Wells
There are 13 compliance wells

Well	Samples	Non-Detects	% ND	Total
MW-3	9	4	44.4444	360
MW-4	9	4	44.4444	250
MW-5	9	5	55.5556	112.7
MW-6D	9	7	77.7778	83
MW-6S	9	9	100	60
SW-1	9	9	100	60
SW-2	9	9	100	60
MW-2	9	4	44.4444	211.4
MW-7	8	7	87.5	42.1
Pendergrass	1	1	100	5
Rathbone	1	1	100	5
Solesbee	1	1	100	5
Van Buskirk	1	1	100	5

Well	Mean	Std Dev	Dif From Bkg	Std Err	Rank Sum	Rank Mean
MW-3	40	79.2512	12.7778	15.2206	585	65
MW-4	27.7778	36.6428	0.555556	15.2206	595	66.1111
MW-5	12.5222	13.0491	-14.7	15.2206	511	56.7778
MW-6D	9.22222	7.18988	-18	15.2206	407	45.2222
MW-6S	6.66667	5	-20.5556	15.2206	297	33
SW-1	6.66667	5	-20.5556	15.2206	297	33
SW-2	6.66667	5	-20.5556	15.2206	297	33
MW-2	23.4889	41.0378	-3.73333	15.2206	578	64.2222
MW-7	5.2625	0.742462	-21.9597	15.689	313	39.125
Pendergrass	5	0	-22.2222	34.0343	33	33
Rathbone	5	0	-22.2222	34.0343	33	33
Solesbee	5	0	-22.2222	34.0343	33	33
Van Buskirk	5	0	-22.2222	34.0343	33	33

Analysis of Variance Statistics

SS Wells	12348.5
SS Total	94706

Kruskal-Wallis Statistics

Non-Detect Rank	33
Background Rank Sum	667
Background Rank Mean	74.1111
H Statistic	71.2432
H Adjusted for Ties	108.171

Basic Statistics
Parameter: Zinc, total

Total Observations	93
Total Non-Detects	25
Pooled Mean	68.043
Pooled Std Dev	119.777
Background Mean	138.889
Background Std Dev	89.19

Background Wells
There is 1 background well

Well	Samples	Non-Detects	% ND	Total
MW-1	9	0	0	1250

Well	Mean	Std Dev	Std Err	Rank Sum	Rank Mean
MW-1	138.889	89.19	0	780	86.6667

Compliance Wells
There are 13 compliance wells

Well	Samples	Non-Detects	% ND	Total
MW-3	9	0	0	1632
MW-4	9	0	0	1127
MW-5	9	1	11.1111	623
MW-6D	9	4	44.4444	124
MW-6S	9	1	11.1111	224
SW-1	9	8	88.8889	110
SW-2	9	5	55.5556	129
MW-2	9	2	22.2222	644
MW-7	8	2	25	381
Pendergrass	1	0	0	16
Rathbone	1	1	100	10
Solesbee	1	1	100	10
Van Buskirk	1	0	0	48

Well	Mean	Std Dev	Dif From Bkg	Std Err	Rank Sum	Rank Mean
MW-3	181.333	299.887	42.4444	53.5436	755	83.8889
MW-4	125.222	120.987	-13.6667	53.5436	760	84.4444
MW-5	69.2222	47.6597	-69.6667	53.5436	624	69.3333
MW-6D	13.7778	4.49382	-125.111	53.5436	259	28.7778
MW-6S	24.8889	10.1912	-114	53.5436	433	48.1111
SW-1	12.2222	4.40959	-126.667	53.5436	153	17
SW-2	14.3333	5.14782	-124.556	53.5436	249	27.6667
MW-2	71.5556	104.21	-67.3333	53.5436	524	58.2222
MW-7	47.625	42.3925	-91.2639	55.1915	438	54.75
Pendergrass	16	0	-122.889	119.727	42	42
Rathbone	10	0	-128.889	119.727	13	13
Solesbee	10	0	-128.889	119.727	13	13
Van Buskirk	48	0	-90.8889	119.727	66	66

Analysis of Variance Statistics

SS Wells	300686
SS Total	1.31988e+006

Kruskal-Wallis Statistics

Non-Detect Rank	13
Background Rank Sum	780
Background Rank Mean	86.6667
H Statistic	180.732
H Adjusted for Ties	184.307

Interwell Analyses for Metals

Non-Parametric Tolerance Interval
Parameter: Antimony, total

Total Percent Non-Detects = 83.3333%
Background Samples (n) = 9
Maximum Background Concentration = 10
Minimum Coverage = 71.7%
Average Coverage = 90%

Well	Sample	Result	Impacted
MW-3	12/15/97	ND<1.5	FALSE
MW-3	1/26/98	ND<1.5	FALSE
MW-3	3/16/98	ND<1.5	FALSE
MW-3	4/20/98	ND<1.5	FALSE
MW-3	10/20/98	ND<1.5	FALSE
MW-3	5/19/99	ND<5	FALSE
MW-3	10/19/99	ND<5	FALSE
MW-3	4/18/00	11	TRUE
MW-3	10/24/00	13	TRUE

Poisson Tolerance Limit
Parameter: Arsenic, total

Poisson Count of 9 background Samples = 65
Degrees of Freedom = 132

95% Confidence Values
Chi-Squared Value (95% Confidence) = 159.814
Lambda (from Zack's formula) = 8.87853
Smallest Degrees of Freedom = 30
Upper Tolerance Limit (95%) = 14

99% Confidence Values
Chi-Squared Value (99% Confidence) = 172.711
Lambda (from Zack's formula) = 9.59505
Smallest Degrees of Freedom = 36
Upper Tolerance Limit (99%) = 17

	Date	Result	Impacted 95%	Impacted 99%
MW-3	12/15/97	ND<5	FALSE	FALSE
	1/26/98	ND<5	FALSE	FALSE
	3/16/98	ND<5	FALSE	FALSE
	4/20/98	ND<5	FALSE	FALSE
	10/20/98	ND<5	FALSE	FALSE
	5/19/99	ND<10	FALSE	FALSE
	10/19/99	ND<10	FALSE	FALSE
	4/18/00	ND<10	FALSE	FALSE
	10/24/00	19	TRUE	TRUE
MW-4	12/15/97	ND<5	FALSE	FALSE
	1/26/98	ND<5	FALSE	FALSE
	3/16/98	ND<5	FALSE	FALSE
	4/20/98	ND<5	FALSE	FALSE
	10/20/98	ND<5	FALSE	FALSE
	5/19/99	12	FALSE	FALSE
	10/19/99	14	FALSE	FALSE
	4/18/00	ND<10	FALSE	FALSE
	10/24/00	40	TRUE	TRUE

Dixon's Test for Outliers

Parameter: Arsenic, total

Well: MW-4

For 9 Samples
5% Level of Significance

Iteration	Highest	Lowest	Critical	Outlier
1	0.693333	0	0.512	40
2	0.173913	0	0.554	None

Well	Date	Conc.	Outlier
MW-4	12/15/97	ND<2.5	FALSE
	1/26/98	ND<2.5	FALSE
	3/16/98	ND<2.5	FALSE
	4/20/98	ND<2.5	FALSE
	10/20/98	ND<2.5	FALSE
	5/19/99	12	FALSE
	10/19/99	14	FALSE
	4/18/00	ND<5	FALSE
	10/24/00	40	TRUE

Non-Parametric Tolerance Interval
Parameter: Barium, total

Total Percent Non-Detects = 7.40741%
Background Samples (n) = 9
Maximum Background Concentration = 3000
Minimum Coverage = 71.7%
Average Coverage = 90%

Well	Sample	Result	Impacted
MW-3	12/15/97	2200	FALSE
MW-3	1/26/98	4000	TRUE
MW-3	3/16/98	2800	FALSE
MW-3	4/20/98	1400	FALSE
MW-3	10/20/98	2900	FALSE
MW-3	5/19/99	140	FALSE
MW-3	10/19/99	210	FALSE
MW-3	4/18/00	280	FALSE
MW-3	10/24/00	1600	FALSE
MW-4	12/15/97	3200	TRUE
MW-4	1/26/98	2400	FALSE
MW-4	3/16/98	2200	FALSE
MW-4	4/20/98	1100	FALSE
MW-4	10/20/98	1400	FALSE
MW-4	5/19/99	210	FALSE
MW-4	10/19/99	300	FALSE
MW-4	4/18/00	330	FALSE
MW-4	10/24/00	1100	FALSE

Non-Parametric Tolerance Interval
Parameter: Beryllium, total

Total Percent Non-Detects = 22.2222%
Background Samples (n) = 9
Maximum Background Concentration = 12
Minimum Coverage = 71.7%
Average Coverage = 90%

Well	Sample	Result	Impacted
MW-3	12/15/97	2	FALSE
MW-3	1/26/98	6	FALSE
MW-3	3/16/98	5	FALSE
MW-3	4/20/98	4	FALSE
MW-3	10/20/98	6	FALSE
MW-3	5/19/99	2.2	FALSE
MW-3	10/19/99	2.9	FALSE
MW-3	4/18/00	2.6	FALSE
MW-3	10/24/00	27	TRUE
MW-4	12/15/97	4	FALSE
MW-4	1/26/98	3	FALSE
MW-4	3/16/98	4	FALSE
MW-4	4/20/98	3	FALSE
MW-4	10/20/98	ND<0.5	FALSE
MW-4	5/19/99	25	TRUE
MW-4	10/19/99	2.9	FALSE
MW-4	4/18/00	3.9	FALSE
MW-4	10/24/00	12	FALSE

Dixon's Test for Outliers

Parameter: Beryllium, total

Well: MW-3

For 9 Samples
5% Level of Significance

Iteration	Highest	Lowest	Critical	Outlier
1	0.846774	0.05	0.512	27
2	0	0.05	0.554	None

Well	Date	Conc.	Outlier
MW-3	12/15/97	2	FALSE
	1/26/98	6	FALSE
	3/16/98	5	FALSE
	4/20/98	4	FALSE
	10/20/98	6	FALSE
	5/19/99	2.2	FALSE
	10/19/99	2.9	FALSE
	4/18/00	2.6	FALSE
	10/24/00	27	TRUE

Non-Parametric Tolerance Interval
Parameter: Cadmium, total

Total Percent Non-Detects = 66.6667%
Background Samples (n) = 9
Maximum Background Concentration = 13
Minimum Coverage = 71.7%
Average Coverage = 90%

Well	Sample	Result	Impacted
MW-3	12/15/97	ND<0.5	FALSE
MW-3	1/26/98	ND<0.5	FALSE
MW-3	3/16/98	ND<0.5	FALSE
MW-3	4/20/98	ND<0.5	FALSE
MW-3	10/20/98	ND<0.5	FALSE
MW-3	5/19/99	ND<0.5	FALSE
MW-3	10/19/99	5.5	FALSE
MW-3	4/18/00	3.6	FALSE
MW-3	10/24/00	40	TRUE

Dixon's Test for Outliers

Parameter: Cadmium, total

Well: MW-3

For 9 Samples
5% Level of Significance

Iteration	Highest	Lowest	Critical	Outlier
1	0.884615	0	0.512	40
2	0.422222	0	0.554	None

Well	Date	Conc.	Outlier
MW-3	12/15/97	ND<1	FALSE
	1/26/98	ND<1	FALSE
	3/16/98	ND<1	FALSE
	4/20/98	ND<1	FALSE
	10/20/98	ND<1	FALSE
	5/19/99	ND<1	FALSE
	10/19/99	5.5	FALSE
	4/18/00	3.6	FALSE
	10/24/00	40	TRUE

Dixon's Test for Outliers

Parameter: Chromium, total

Well: MW-3

For 9 Samples
5% Level of Significance

Iteration	Highest	Lowest	Critical	Outlier
1	0.883792	0	0.512	330
2	0.368421	0	0.554	None

Well	Date	Conc.	Outlier
MW-3	12/15/97	7	FALSE
	1/26/98	5	FALSE
	3/16/98	5	FALSE
	4/20/98	3	FALSE
	10/20/98	3	FALSE
	5/19/99	23	FALSE
	10/19/99	41	FALSE
	4/18/00	27	FALSE
	10/24/00	330	TRUE

Shapiro-Wilks Test of Normality

Parameter: Chromium, total

Background Wells

Normality Test of Parameter Concentrations

K = 4; Samples = 9

i	x(i)	x(n-i+1)	x(n-1+1)-x(i)	a(n-i+1)	b(i)
1	0.5	92	91.5	0.5888	53.8752
2	2	43	41	0.3244	13.3004
3	10	36	26	0.1976	5.1376
4	19	34	15	0.0947	1.4205
5	22	22	0		
6	34	19	-15		
7	36	10	-26		
8	43	2	-41		
9	92	0.5	-91.5		

Sum of b values = 73.7337
Sample Standard Deviation = 28.0392
W Statistic = 0.864395
5% Critical value of 0.829 is less than 0.864395
Data is normally distributed at 95% level of significance
1% Critical value of 0.764 is less than 0.864395
Data is normally distributed at 99% level of significance

Parametric Tolerance Interval Analysis
Parameter: Chromium, total

Background mean = 28.7222
Background standard deviation = 28.0392
One-sided normal tolerance factor at 95% confidence = 3.031
Tolerance factor calculation follows USEPA 1989 Guidance
Upper tolerance limit = 113.709

Well	Date	Result	Impacted
MW-3	12/15/97	7	FALSE
	1/26/98	5	FALSE
	3/16/98	5	FALSE
	4/20/98	3	FALSE
	10/20/98	3	FALSE
	5/19/99	23	FALSE
	10/19/99	41	FALSE
	4/18/00	27	FALSE
	10/24/00	330	TRUE
MW-4	12/15/97	5	FALSE
	1/26/98	4	FALSE
	3/16/98	9	FALSE
	4/20/98	3	FALSE
	10/20/98	2	FALSE
	5/19/99	32	FALSE
	10/19/99	54	FALSE
	4/18/00	47	FALSE
	10/24/00	170	TRUE

Non-Parametric Tolerance Interval
Parameter: Cobalt, total

Total Percent Non-Detects = 0%
Background Samples (n) = 9
Maximum Background Concentration = 531
Minimum Coverage = 71.7%
Average Coverage = 90%

Well	Sample	Result	Impacted
MW-3	12/15/97	146	FALSE
MW-3	1/26/98	93	FALSE
MW-3	3/16/98	141	FALSE
MW-3	4/20/98	90	FALSE
MW-3	10/20/98	86	FALSE
MW-3	5/19/99	26	FALSE
MW-3	10/19/99	36	FALSE
MW-3	4/18/00	26	FALSE
MW-3	10/24/00	190	FALSE
MW-4	12/15/97	92	FALSE
MW-4	1/26/98	55	FALSE
MW-4	3/16/98	143	FALSE
MW-4	4/20/98	64	FALSE
MW-4	10/20/98	50	FALSE
MW-4	5/19/99	26	FALSE
MW-4	10/19/99	35	FALSE
MW-4	4/18/00	22	FALSE
MW-4	10/24/00	78	FALSE

Shapiro-Wilks Test of Normality

Parameter: Lead, total

Background Wells

Normality Test of Parameter Concentrations

K = 4; Samples = 9

i	x(i)	x(n-i+1)	x(n-1+1)-x(i)	a(n-i+1)	b(i)
1	0.916291	4.99043	4.07414	0.5888	2.39885
2	0.916291	4.60517	3.68888	0.3244	1.19667
3	1.60944	3.46574	1.8563	0.1976	0.366804
4	2.63906	3.04452	0.405465	0.0947	0.0383975
5	2.77259	2.77259	0		
6	3.04452	2.63906	-0.405465		
7	3.46574	1.60944	-1.8563		
8	4.60517	0.916291	-3.68888		
9	4.99043	0.916291	-4.07414		

Sum of b values = 4.00073
Sample Standard Deviation = 1.46176
W Statistic = 0.936341
5% Critical value of 0.829 is less than 0.936341
Data is normally distributed at 95% level of significance
1% Critical value of 0.764 is less than 0.936341
Data is normally distributed at 99% level of significance

Parametric Tolerance Interval Analysis
Parameter: Lead, total

Background mean = 2.77328
Background standard deviation = 1.46176
One-sided normal tolerance factor at 95% confidence = 3.031
Tolerance factor calculation follows USEPA 1989 Guidance
Upper tolerance limit = 7.20389

Well	Date	Result	Impacted
MW-3	12/15/97	3.71357	FALSE
	1/26/98	3.7612	FALSE
	3/16/98	3.78419	FALSE
	4/20/98	3.46574	FALSE
	10/20/98	2.99573	FALSE
	5/19/99	ND<1.60944	FALSE
	10/19/99	2.70805	FALSE
	4/18/00	2.63906	FALSE
	10/24/00	4.86753	FALSE

Shapiro-Wilks Test of Normality

Parameter: Nickel, total

Background Wells

Normality Test of Parameter Concentrations

K = 4; Samples = 9

i	x(i)	x(n-i+1)	x(n-1+1)-x(i)	a(n-i+1)	b(i)
1	25	70	45	0.5888	26.496
2	30	60	30	0.3244	9.732
3	31	50	19	0.1976	3.7544
4	50	50	0	0.0947	0
5	50	50	0		
6	50	50	0		
7	50	31	-19		
8	60	30	-30		
9	70	25	-45		

Sum of b values = 39.9824
Sample Standard Deviation = 14.8221
W Statistic = 0.909554
5% Critical value of 0.829 is less than 0.909554
Data is normally distributed at 95% level of significance
1% Critical value of 0.764 is less than 0.909554
Data is normally distributed at 99% level of significance

Parametric Tolerance Interval Analysis
Parameter: Nickel, total

Background mean = 43.2
Background standard deviation = 20.3396
One-sided normal tolerance factor at 95% confidence = 3.031
Tolerance factor calculation follows USEPA 1989 Guidance
Upper tolerance limit = 104.849

Well	Date	Result	Impacted
MW-3	12/15/97	ND<50	FALSE
	1/26/98	ND<50	FALSE
	3/16/98	ND<50	FALSE
	4/20/98	ND<50	FALSE
	10/20/98	ND<50	FALSE
	5/19/99	29	FALSE
	10/19/99	41	FALSE
	4/18/00	23	FALSE
	10/24/00	250	TRUE
MW-4	12/15/97	ND<50	FALSE
	1/26/98	ND<50	FALSE
	3/16/98	ND<50	FALSE
	4/20/98	ND<50	FALSE
	10/20/98	ND<50	FALSE
	5/19/99	42	FALSE
	10/19/99	61	FALSE
	4/18/00	52	FALSE
	10/24/00	180	TRUE

Dixon's Test for Outliers

Parameter: Nickel, total

Well: MW-3

For 9 Samples
5% Level of Significance

Iteration	Highest	Lowest	Critical	Outlier
1	0.904977	0.222222	0.512	250
2	0	0.222222	0.554	None

Well	Date	Conc.	Outlier
MW-3	12/15/97	ND<50	FALSE
	1/26/98	ND<50	FALSE
	3/16/98	ND<50	FALSE
	4/20/98	ND<50	FALSE
	10/20/98	ND<50	FALSE
	5/19/99	29	FALSE
	10/19/99	41	FALSE
	4/18/00	23	FALSE
	10/24/00	250	TRUE

Poisson Tolerance Limit
Parameter: Silver, total

Poisson Count of 9 background Samples = 13
Degrees of Freedom = 28

95% Confidence Values
Chi-Squared Value (95% Confidence) = 41.3372
Lambda (from Zack's formula) = 2.29651
Smallest Degrees of Freedom = 12
Upper Tolerance Limit (95%) = 5

99% Confidence Values
Chi-Squared Value (99% Confidence) = 48.2782
Lambda (from Zack's formula) = 2.68212
Smallest Degrees of Freedom = 16
Upper Tolerance Limit (99%) = 7

	Date	Result	Impacted 95%	Impacted 99%
MW-6S	12/15/97	ND<1	FALSE	FALSE
	1/26/98	ND<1	FALSE	FALSE
	3/16/98	10	TRUE	TRUE
	4/20/98	23	TRUE	TRUE
	10/19/98	ND<1	FALSE	FALSE
	5/19/99	ND<2	FALSE	FALSE
	10/18/99	ND<2	FALSE	FALSE
	4/18/00	ND<2	FALSE	FALSE
	10/23/00	4.1	FALSE	FALSE
SW-1	12/15/97	ND<1	FALSE	FALSE
	1/26/98	ND<1	FALSE	FALSE
	3/16/98	ND<1	FALSE	FALSE
	4/20/98	ND<1	FALSE	FALSE
	10/19/98	ND<1	FALSE	FALSE
	5/19/99	ND<2	FALSE	FALSE
	10/18/99	ND<2	FALSE	FALSE
	4/18/00	ND<2	FALSE	FALSE
	10/23/00	2.9	FALSE	FALSE
MW-2	1/7/98	ND<2	FALSE	FALSE
	1/26/98	ND<1	FALSE	FALSE
	3/16/98	ND<1	FALSE	FALSE
	4/20/98	ND<1	FALSE	FALSE
	10/20/98	ND<1	FALSE	FALSE
	5/19/99	ND<2	FALSE	FALSE
	10/19/99	ND<2	FALSE	FALSE
	4/18/00	64	TRUE	TRUE
	10/23/00	3.6	FALSE	FALSE

Non-Parametric Tolerance Interval
Parameter: Thallium, total

Total Percent Non-Detects = 66.6667%
Background Samples (n) = 9
Maximum Background Concentration = 3
Minimum Coverage = 71.7%
Average Coverage = 90%

Well	Sample	Result	Impacted
MW-4	12/15/97	1	FALSE
MW-4	1/26/98	ND<0.5	FALSE
MW-4	3/16/98	ND<0.5	FALSE
MW-4	4/20/98	ND<0.5	FALSE
MW-4	10/20/98	ND<0.5	FALSE
MW-4	5/19/99	5	TRUE
MW-4	10/19/99	5	TRUE
MW-4	4/18/00	ND<1	FALSE
MW-4	10/24/00	2.3	FALSE

Shapiro-Wilks Test of Normality

Parameter: Vanadium

Background Wells

Normality Test of Parameter Concentrations

K = 4; Samples = 9

i	x(i)	x(n-i+1)	x(n-1+1)-x(i)	a(n-i+1)	b(i)
1	0.916291	4.48864	3.57235	0.5888	2.1034
2	0.916291	3.66356	2.74727	0.3244	0.891215
3	0.916291	3.46574	2.54945	0.1976	0.50377
4	3.04452	3.2581	0.213574	0.0947	0.0202255
5	3.13549	3.13549	0		
6	3.2581	3.04452	-0.213574		
7	3.46574	0.916291	-2.54945		
8	3.66356	0.916291	-2.74727		
9	4.48864	0.916291	-3.57235		

Sum of b values = 3.51861
Sample Standard Deviation = 1.36251
W Statistic = 0.833628
5% Critical value of 0.829 is less than 0.833628
Data is normally distributed at 95% level of significance
1% Critical value of 0.764 is less than 0.833628
Data is normally distributed at 99% level of significance

Parametric Tolerance Interval Analysis
Parameter: Vanadium

Background mean = 2.64499
Background standard deviation = 1.36251
One-sided normal tolerance factor at 95% confidence = 3.031
Tolerance factor calculation follows USEPA 1989 Guidance
Upper tolerance limit = 6.77476

Well	Date	Result	Impacted
MW-4	12/15/97	ND<2.30259	FALSE
	1/26/98	ND<0.916291	FALSE
	3/16/98	ND<0.916291	FALSE
	4/20/98	ND<0.916291	FALSE
	10/20/98	1.60944	FALSE
	5/19/99	3.13549	FALSE
	10/19/99	3.58352	FALSE
	4/18/00	3.43399	FALSE
	10/24/00	4.78749	FALSE
MW-3	12/15/97	ND<2.30259	FALSE
	1/26/98	1.94591	FALSE
	3/16/98	ND<0.916291	FALSE
	4/20/98	ND<0.916291	FALSE
	10/20/98	ND<0.916291	FALSE
	5/19/99	2.94444	FALSE
	10/19/99	3.4012	FALSE
	4/18/00	2.94444	FALSE
	10/24/00	5.52146	FALSE

Shapiro-Wilks Test of Normality
Parameter: Zinc, total
Background Wells
Normality Test of Parameter Concentrations
K = 4; Samples = 9

i	x(i)	x(n-i+1)	x(n-1+1)-x(i)	a(n-i+1)	b(i)
1	35	320	285	0.5888	167.808
2	55	190	135	0.3244	43.794
3	60	180	120	0.1976	23.712
4	100	170	70	0.0947	6.629
5	140	140	0		
6	170	100	-70		
7	180	60	-120		
8	190	55	-135		
9	320	35	-285		

Sum of b values = 241.943
Sample Standard Deviation = 89.19
W Statistic = 0.919821
5% Critical value of 0.829 is less than 0.919821
Data is normally distributed at 95% level of significance
1% Critical value of 0.764 is less than 0.919821
Data is normally distributed at 99% level of significance

Parametric Tolerance Interval Analysis
Parameter: Zinc, total

Background mean = 138.889
Background standard deviation = 89.19
One-sided normal tolerance factor at 95% confidence = 3.031
Tolerance factor calculation follows USEPA 1989 Guidance
Upper tolerance limit = 409.224

Well	Date	Result	Impacted
MW-4	12/15/97	60	FALSE
	1/26/98	50	FALSE
	3/16/98	100	FALSE
	4/20/98	80	FALSE
	10/20/98	70	FALSE
	5/19/99	77	FALSE
	10/19/99	120	FALSE
	4/18/00	130	FALSE
	10/24/00	440	TRUE
MW-3	12/15/97	70	FALSE
	1/26/98	100	FALSE
	3/16/98	70	FALSE
	4/20/98	70	FALSE
	10/20/98	80	FALSE
	5/19/99	65	FALSE
	10/19/99	110	FALSE
	4/18/00	87	FALSE
	10/24/00	980	TRUE

Dixon's Test for Outliers

Parameter: Zinc, total

Well: MW-3

For 9 Samples
5% Level of Significance

Iteration	Highest	Lowest	Critical	Outlier
1	0.956044	0.111111	0.512	980
2	0.25	0.142857	0.554	None

Well	Date	Conc.	Outlier
MW-3	12/15/97	70	FALSE
	1/26/98	100	FALSE
	3/16/98	70	FALSE
	4/20/98	70	FALSE
	10/20/98	80	FALSE
	5/19/99	65	FALSE
	10/19/99	110	FALSE
	4/18/00	87	FALSE
	10/24/00	980	TRUE

Dixon's Test for Outliers

Parameter: Zinc, total

Well: MW-4

For 9 Samples
5% Level of Significance

Iteration	Highest	Lowest	Critical	Outlier
1	0.815789	0.125	0.512	440
2	0.142857	0.142857	0.554	None

Well	Date	Conc.	Outlier
MW-4	12/15/97	60	FALSE
	1/26/98	50	FALSE
	3/16/98	100	FALSE
	4/20/98	80	FALSE
	10/20/98	70	FALSE
	5/19/99	77	FALSE
	10/19/99	120	FALSE
	4/18/00	130	FALSE
	10/24/00	440	TRUE