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Fac/Perm/Co ID #	Date	Doc ID#
pc	6/13/01	DIN

July 10, 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

JUL 2001 Received Solid Waste Section

Re: Groundwater Sampling and Statistical Analysis
Alexander County Closed Sanitary Landfill
MESCO Project No. G01002.0

Dear Mr. Rose:

Municipal Engineering Services Company, P.A. (MESCO) completed the statistical analyses for the Alexander County Closed Sanitary Landfill located near Taylorsville, North Carolina. The purpose of these analyses is to determine, in comparison to background levels, statistical significance of constituents detected during the December-2000 sampling event.

Statistical Analysis Methodology

Metals

An inter-well statistical analysis was conducted upon metals detected during the December 11-12, 2000 sampling event. Monitoring well MW-1A was defined as the single background well as proposed in the last statistical analysis report dated February 2, 2001. This modification to the statistical approach was conducted since data compiled for upgradient MW-1 consistently yielded detections of various constituents, therefore making it difficult to statistically detect true contamination due to the increase of false negatives. An upper tolerance limit (UTL) with 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.

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-1A were eliminated and a statistical analysis was

not conducted upon these wells. Twelve metals were tested for statistical significance. For chromium, the parametric tolerance limit with an appropriate ND adjustment was used on the log of the original data as its %ND was less than 50% and the data was "log-normally" distributed. The Poisson tolerance limit was used for antimony, arsenic, selenium, and silver because their %ND was greater than 90%. For barium, lead and vanadium the parametric tolerance limit with an appropriate ND adjustment was utilized since the data was normally distributed and its %ND was less than 50%. Although zinc was found below 15% ND it's background data failed the Shapiro-Wilks normality test. This necessitated zinc to be analyzed with the all the remaining metals by the non-parametric tolerance interval method.

VOCs

All historical VOC detections in the background well MW-1A were pooled in order to determine the total number of detections, from which the expected number of detections in a single down gradient monitoring point (y^*) was derived by utilizing the Poisson prediction interval. The parameter y^* is defined by the following equation:

$$y^* = cy + \frac{t^2 c}{2} + tc\sqrt{y\left(1+\frac{1}{c}\right)+\frac{t^2}{4}}$$

where

$c = 1/n$ (n =number of background samples)
t = one-sided value of students t-Statistic at 95% confidence [a]
y = number of events observed in n previous samples
y^* = expected number of events in a single future sample

[a] Gibbons, R.D., 1994, Statistical methods for groundwater monitoring: John Wiley & Sons, Inc., p.12.

For each monitoring location showing any VOC detections, the number of detected VOCs was counted with each detection being considered a "hit". The number was then compared with the expected number of detections derived from the background VOC data. The value of Student's t-Statistic was derived from tabulated values included in Gibbons (1994).

Intrawell Analyses

For those constituents that had been found statistically significant by the interwell analysis, further analyses were conducted to determine whether the statistical significance was caused by spatial variability. Shewhart-CUSUM control charts were generated for each of the triggered constituents to define its baseline levels, which are defined in this context as the background levels derived from the data in a given downgradient well. It's important to note that Shewhart-CUSUM control charts requires a minimum of eight independent historical sampling events and a detection rate greater than 25% (%ND≤75%). Due to these requirements, Shewhart-CUSUM charts could only be generated for zinc within MW-5.

Results

Interwell analysis was performed on 12 metals detected during the December 2000 sampling event. Historical data compiled for monitoring wells MW-1A 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	As	Ba	Be	Ni	Va	Zn
MW-5						x
MW-11				x		x
MW-12		x	x	x	x	x
SW-5	x					x

X=level significantly higher than the background level

The metal zinc was found at statistically significant levels above the background within MW-5, MW-11, MW-12, and SW-5. However due to the absence of normality in the background well data the proper parametric tolerance statistical approach could not be conducted. This could possibly increase the false positive rate and erroneously indicate levels of zinc above the background when in actuality it is not. Zinc within MW-5 was further analyzed to determine if the statistical significance was caused by spatial variability. A Shewhart-CUSUM chart was constructed for intrawell comparison and found to be not significant when compared to it's own background levels. Concentrations of zinc have historically been found to be elevated during the first few sampling events after a monitoring well has been installed at the closed landfill site. Therefore, it's expected that zinc concentrations within MW-11 and MW-12 will decrease in subsequent sampling events.

Monitoring well (MW-12), recently installed approximately 256 feet N7W of MW-7, exhibited several metal detections that exceeded the background levels during this sampling event. This was the first time the new set of monitoring wells (MW-9 to MW-15) were sampled therefore no trend or intrawell analyses could be completed at this time. Turbidity was determined visually in the field for each monitoring well sampled and the results were included in the field data sheet previously submitted with the groundwater sampling report dated May 3, 2001. Monitoring well MW-12 was properly developed upon completion but continues to be considerably more turbid in comparison to the other wells. Therefore, elevated metals in this region are likely caused by the altered water chemistry as a result of well construction and not waste related. Further evidence to support this conclusion is the absence of metals within MW-7, that is located considerably upgradient and closer to the waste perimeter.

The Poisson prediction interval analysis conducted for VOCs shows evidence of groundwater contamination at 95% confidence level within MW-3, MW-7, MW-11 and MW-12. All of these wells are located in the north portion of the landfill that was closed prior to October 9, 1991 therefore a cohesive cap was never required. MW-12 installed downgradient of MW-7 had the most VOC detections upon the entire site. Concentrations of benzene, dichloromethane and 1,4-dichlorobenzene were found above the groundwater standard but interestingly weren't detected within MW-7. Furthermore, historically MW-7 has not detected benzene since 1995, dichloromethane since 1997, and 1,4-dichlorobenzene never. An apparent plume of benzene and cis-1,2-dichloroethene has also been detected migrating from the waste perimeter in the north 20-west direction from MW-3 towards MW-11. Monitoring well MW-3 continues to exhibit detectable concentrations of the same VOCs found since the implementation of the monitoring plan. The calculated flow rates developed for the north region is extremely slow ranging from a mere 0.10 ft/yr. in MW-7 to 0.63 ft/yr. in MW-3 indicating that if indeed contamination is present consistent VOC detections in subsequent sampling events would be expected.

Conclusion

The statistical analysis results on metals and VOCs suggests that groundwater may have been impacted by the closed landfill specifically in the north portion near the transfer station. The groundwater is believed to be contaminated by a release of leachate originating in the portion of the landfill that lacks a cohesive cap. The leachate release mechanism is most likely rainfall that is infiltrating through the landfill waste and percolates downward and outward from the landfill toward the groundwater. Based upon a waste and cover evaluation conducted during each sampling event the suspected source area is currently being used for construction and demolition debris (C&D). No erosion features, nonconformities or seeps of leachate have been noticeable during the field investigations. The drainage basin located between MW-7 and MW-12 is designed to accumulate a large proportion of run off during large precipitation events but has been dry during visits in Oct. and Dec. of 2000 and June of 2001.

The higher incidence and concentrations of VOC detected in MW-12 than MW-7 lead to a preliminary investigation to determine the cause. The transfer station is located in close proximity to MW-12 and the designed septic system distribution box is only approximately 50 feet west but perpendicular to the localized groundwater flow direction. Although unlikely, the transfer facility could possibly have a contributing factor to the detections found within MW-12 but not enough information is available at this time to ascertain such a conclusion. However, this was the first

sampling event conducted upon the newly installed monitoring wells so future sampling data will be very useful in determination of the nature and extent of contamination at the closed landfill.

The Alexander County Closed Landfill was again sampled for Appendix I list of compounds on June 12 & 13, 2001 by MESCO. The results report and interwell/intrawell statistical analysis will be submitted to the section upon completion. 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. Rick French
Alexander County

Exceedance Scan
Alexander County Closed Landfill

Well ID	Parameter Name [1]	Sample Date	Result	Unit	PQL [2]	MCL [3]	Exceedance
MW-1	Zinc, total	12/12/00	0.047	mg/l	0.01	2.1	
MW-1	Nickel, total	12/12/00	0.015	mg/l	0.005	0.1	
MW-1	Copper, total	12/12/00	0.0024	mg/l	0.002	1	
MW-1	Cobalt, total	12/12/00	0.014	mg/l	0.005	-	
MW-1	Chromium, total	12/12/00	0.0057	mg/l	0.002	0.05	
MW-1	Barium, total	12/12/00	0.042	mg/l	0.005	2	
MW-1	cis-1,2-Dichloroethene	12/12/00	9.7	ug/l	5	70	
MW-1	1,1-Dichloroethane	12/12/00	17	ug/l	5	700	
MW-1A	Zinc, total	12/11/00	0.31	mg/l	0.01	2.1	
MW-1A	Vanadium	12/11/00	0.32	mg/l	0.005	-	
MW-1A	**Nickel, total**	**12/11/00**	**0.26**	**mg/l**	**0.005**	**0.1**	**0.16**
MW-1A	**Mercury**	**12/11/00**	**0.02**	**mg/l**	**0.0002**	**0.0011**	**0.0189**
MW-1A	**Lead, total**	**12/11/00**	**0.058**	**mg/l**	**0.005**	**0.015**	**0.043**
MW-1A	Copper, total	12/11/00	0.26	mg/l	0.002	1	
MW-1A	Cobalt, total	12/11/00	0.77	mg/l	0.005	-	
MW-1A	**Chromium, total**	**12/11/00**	**0.34**	**mg/l**	**0.002**	**0.05**	**0.29**
MW-1A	Beryllium, total	12/11/00	0.0069	mg/l	0.001	-	
MW-1A	Barium, total	12/11/00	0.96	mg/l	0.005	2	
MW-1A	Arsenic, total	12/11/00	0.016	mg/l	0.005	0.05	
MW-3	Zinc, total	12/11/00	0.035	mg/l	0.01	2.1	
MW-3	Nickel, total	12/11/00	0.016	mg/l	0.005	0.1	
MW-3	Cobalt, total	12/11/00	0.0068	mg/l	0.005	-	
MW-3	Chromium, total	12/11/00	0.0049	mg/l	0.002	0.05	
MW-3	Barium, total	12/11/00	0.048	mg/l	0.005	2	
MW-3	Antimony, total	12/11/00	0.005	mg/l	0.005	-	
MW-3	cis-1,2-Dichloroethene	12/11/00	26	ug/l	5	70	
MW-3	Carbon disulfide	12/11/00	29	ug/l	10	-	
MW-3	**Benzene**	**12/11/00**	**10**	**ug/l**	**5**	**1**	**9**
MW-3	1,4-Dichlorobenzene	12/11/00	7.4	ug/l	5	75	
MW-4R	Zinc, total	12/11/00	0.046	mg/l	0.01	2.1	
MW-4R	Selenium, total	12/11/00	0.0057	mg/l	0.005	0.05	
MW-4R	Nickel, total	12/11/00	0.014	mg/l	0.005	0.1	
MW-4R	Cobalt, total	12/11/00	0.2	mg/l	0.005	-	
MW-4R	Chromium, total	12/11/00	0.0023	mg/l	0.002	0.05	
MW-4R	Barium, total	12/11/00	0.12	mg/l	0.005	2	
MW-4R	Antimony, total	12/11/00	0.0059	mg/l	0.005	-	
MW-4R	cis-1,2-Dichloroethene	12/11/00	15	ug/l	5	70	
MW-4R	1,1-Dichloroethane	12/11/00	15	ug/l	5	700	
MW-5	Zinc, total	12/11/00	0.39	mg/l	0.01	2.1	
MW-5	Vanadium	12/11/00	0.18	mg/l	0.005	-	
MW-5	**Nickel, total**	**12/11/00**	**0.15**	**mg/l**	**0.005**	**0.1**	**0.05**
MW-5	**Lead, total**	**12/11/00**	**0.022**	**mg/l**	**0.005**	**0.015**	**0.007**
MW-5	Copper, total	12/11/00	0.14	mg/l	0.002	1	
MW-5	Cobalt, total	12/11/00	0.071	mg/l	0.005	-	
MW-5	**Chromium, total**	**12/11/00**	**0.26**	**mg/l**	**0.002**	**0.05**	**0.21**
MW-5	Beryllium, total	12/11/00	0.0076	mg/l	0.001	-	
MW-5	Barium, total	12/11/00	0.31	mg/l	0.005	2	
MW-5	Arsenic, total	12/11/00	0.0088	mg/l	0.005	0.05	
MW-5	Antimony, total	12/11/00	0.0057	mg/l	0.005	-	
MW-5	cis-1,2-Dichloroethene	12/11/00	7.2	ug/l	5	70	
MW-5	1,1-Dichloroethane	12/11/00	11	ug/l	5	700	

Well ID	Parameter Name [1]	Sample Date	Result	Unit	PQL [2]	MCL [3]	Exceedance
MW-6	Zinc, total	12/11/00	0.021	mg/l	0.01	2.1	
MW-6	Vanadium	12/11/00	0.0058	mg/l	0.005	-	
MW-6	Silver, total	12/11/00	0.0022	mg/l	0.002	0.018	
MW-6	Nickel, total	12/11/00	0.016	mg/l	0.005	0.1	
MW-6	Mercury	12/11/00	0.001	mg/l	0.0002	0.0011	
MW-6	Copper, total	12/11/00	0.0029	mg/l	0.002	1	
MW-6	Cobalt, total	12/11/00	0.069	mg/l	0.005	-	
MW-6	Chromium, total	12/11/00	0.011	mg/l	0.002	0.05	
MW-6	Barium, total	12/11/00	0.1	mg/l	0.005	2	
MW-6	cis-1,2-Dichloroethene	12/11/00	7.6	ug/l	5	70	
MW-7	Zinc, total	12/12/00	0.029	mg/l	0.01	2.1	
MW-7	Chromium, total	12/12/00	0.01	mg/l	0.002	0.05	
MW-7	Barium, total	12/12/00	0.012	mg/l	0.005	2	
MW-7	cis-1,2-Dichloroethene	12/12/00	7	ug/l	5	70	
MW-7	Carbon disulfide	12/12/00	13	ug/l	10	-	
MW-7	1,1-Dichloroethane	12/12/00	15	ug/l	5	700	
MW-8	Zinc, total	12/12/00	0.032	mg/l	0.01	2.1	
MW-8	Vanadium	12/12/00	0.0064	mg/l	0.005	-	
MW-8	Nickel, total	12/12/00	0.01	mg/l	0.005	0.1	
MW-8	**Mercury**	**12/12/00**	**0.0021**	**mg/l**	**0.0002**	**0.0011**	**0.001**
MW-8	Copper, total	12/12/00	0.0044	mg/l	0.002	1	
MW-8	Cobalt, total	12/12/00	0.0068	mg/l	0.005	-	
MW-8	Chromium, total	12/12/00	0.0076	mg/l	0.002	0.05	
MW-8	Barium, total	12/12/00	0.11	mg/l	0.005	2	
MW-9	Zinc, total	12/11/00	0.027	mg/l	0.01	2.1	
MW-9	Vanadium	12/11/00	0.015	mg/l	0.005	-	
MW-9	Selenium, total	12/11/00	0.0078	mg/l	0.005	0.05	
MW-9	Nickel, total	12/11/00	0.084	mg/l	0.005	0.1	
MW-9	Copper, total	12/11/00	0.0071	mg/l	0.002	1	
MW-9	Cobalt, total	12/11/00	0.028	mg/l	0.005	-	
MW-9	Chromium, total	12/11/00	0.032	mg/l	0.002	0.05	
MW-9	Barium, total	12/11/00	0.18	mg/l	0.005	2	
MW-9	cis-1,2-Dichloroethene	12/11/00	15	ug/l	5	70	
MW-9	1,1-Dichloroethane	12/11/00	5.2	ug/l	5	700	
MW-10	Zinc, total	12/11/00	0.024	mg/l	0.01	2.1	
MW-10	Tin, total	12/11/00	0.0051	mg/l	0.005	-	
MW-10	Nickel, total	12/11/00	0.0074	mg/l	0.005	0.1	
MW-10	Copper, total	12/11/00	0.003	mg/l	0.002	1	
MW-10	Chromium, total	12/11/00	0.0089	mg/l	0.002	0.05	
MW-10	Barium, total	12/11/00	0.03	mg/l	0.005	2	
MW-11	Zinc, total	12/11/00	0.56	mg/l	0.01	2.1	
MW-11	Vanadium	12/11/00	0.34	mg/l	0.005	-	
MW-11	**Nickel, total**	**12/11/00**	**0.38**	**mg/l**	**0.005**	**0.1**	**0.28**
MW-11	**Lead, total**	**12/11/00**	**0.034**	**mg/l**	**0.005**	**0.015**	**0.019**
MW-11	Copper, total	12/11/00	0.19	mg/l	0.002	1	
MW-11	Cobalt, total	12/11/00	0.34	mg/l	0.005	-	
MW-11	**Chromium, total**	**12/11/00**	**0.66**	**mg/l**	**0.002**	**0.05**	**0.61**
MW-11	Beryllium, total	12/11/00	0.011	mg/l	0.001	-	
MW-11	Barium, total	12/11/00	0.83	mg/l	0.005	2	
MW-11	Arsenic, total	12/11/00	0.01	mg/l	0.005	0.05	
MW-11	cis-1,2-Dichloroethene	12/11/00	28	ug/l	5	70	
MW-11	**Benzene**	**12/11/00**	**5.2**	**ug/l**	**5**	**1**	**4.2**
MW-11	1,1-Dichloroethane	12/11/00	11	ug/l	5	700	

Well ID	Parameter Name [1]	Sample Date	Result	Unit	PQL [2]	MCL [3]	Exceedance
MW-12	Zinc, total	12/11/00	1.3	mg/l	0.01	2.1	
MW-12	Vanadium	12/11/00	0.83	mg/l	0.005	-	
MW-12	**Nickel, total**	**12/11/00**	**0.84**	**mg/l**	**0.005**	**0.1**	**0.74**
MW-12	Mercury	12/11/00	0.00053	mg/l	0.0002	0.0011	
MW-12	**Lead, total**	**12/11/00**	**0.095**	**mg/l**	**0.005**	**0.015**	**0.08**
MW-12	Copper, total	12/11/00	0.35	mg/l	0.002	1	
MW-12	Cobalt, total	12/11/00	0.37	mg/l	0.005	-	
MW-12	**Chromium, total**	**12/11/00**	**1**	**mg/l**	**0.002**	**0.05**	**0.95**
MW-12	Beryllium, total	12/11/00	0.045	mg/l	0.001	-	
MW-12	**Barium, total**	**12/11/00**	**5.3**	**mg/l**	**0.005**	**2**	**3.3**
MW-12	Arsenic, total	12/11/00	0.0096	mg/l	0.005	0.05	
MW-12	**Dichloromethane**	**12/11/00**	**13**	**ug/l**	**5**	**5**	**8**
MW-12	cis-1,2-Dichloroethene	12/11/00	10	ug/l	5	70	
MW-12	**Benzene**	**12/11/00**	**7**	**ug/l**	**5**	**1**	**6**
MW-12	1,4-Dichlorobenzene	12/11/00	6.3	ug/l	5	75	
MW-12	1,1-Dichloroethane	12/11/00	17	ug/l	5	700	
MW-13	Zinc, total	12/11/00	0.074	mg/l	0.01	2.1	
MW-13	Vanadium	12/11/00	0.033	mg/l	0.005	-	
MW-13	Tin, total	12/11/00	0.011	mg/l	0.005	-	
MW-13	Nickel, total	12/11/00	0.052	mg/l	0.005	0.1	
MW-13	Copper, total	12/11/00	0.063	mg/l	0.002	1	
MW-13	Cobalt, total	12/11/00	0.18	mg/l	0.005	-	
MW-13	Chromium, total	12/11/00	0.04	mg/l	0.002	0.05	
MW-13	Barium, total	12/11/00	0.11	mg/l	0.005	2	
MW-13	Antimony, total	12/11/00	0.0053	mg/l	0.005	-	
MW-14	Zinc, total	12/12/00	0.12	mg/l	0.01	2.1	
MW-14	Vanadium	12/12/00	0.018	mg/l	0.005	-	
MW-14	Nickel, total	12/12/00	0.03	mg/l	0.005	0.1	
MW-14	Copper, total	12/12/00	0.032	mg/l	0.002	1	
MW-14	Cobalt, total	12/12/00	0.031	mg/l	0.005	-	
MW-14	Chromium, total	12/12/00	0.019	mg/l	0.002	0.05	
MW-14	Barium, total	12/12/00	0.11	mg/l	0.005	2	
MW-14	cis-1,2-Dichloroethene	12/12/00	11	ug/l	5	70	
MW-14	1,1-Dichloroethane	12/12/00	9.4	ug/l	5	700	
MW-15	Zinc, total	12/11/00	0.054	mg/l	0.01	2.1	
MW-15	Vanadium	12/11/00	0.037	mg/l	0.005	-	
MW-15	Nickel, total	12/11/00	0.021	mg/l	0.005	0.1	
MW-15	Mercury	12/11/00	0.00035	mg/l	0.0002	0.0011	
MW-15	Copper, total	12/11/00	0.042	mg/l	0.002	1	
MW-15	Cobalt, total	12/11/00	0.065	mg/l	0.005	-	
MW-15	Chromium, total	12/11/00	0.021	mg/l	0.002	0.05	
MW-15	Barium, total	12/11/00	0.11	mg/l	0.005	2	
MW-15	1,1-Dichloroethane	12/11/00	27	ug/l	5	700	
SW-3	Cobalt, total	12/12/00	0.013	mg/l	0.005	-	
SW-3	Barium, total	12/12/00	0.032	mg/l	0.005	2	
SW-5	Zinc, total	12/12/00	0.47	mg/l	0.01	2.1	
SW-5	Vanadium	12/12/00	0.25	mg/l	0.005	-	
SW-5	**Nickel, total**	**12/12/00**	**0.14**	**mg/l**	**0.005**	**0.1**	**0.04**
SW-5	**Lead, total**	**12/12/00**	**0.056**	**mg/l**	**0.005**	**0.015**	**0.041**
SW-5	Copper, total	12/12/00	0.076	mg/l	0.002	1	
SW-5	Cobalt, total	12/12/00	0.15	mg/l	0.005	-	
SW-5	**Chromium, total**	**12/12/00**	**0.47**	**mg/l**	**0.002**	**0.05**	**0.42**
SW-5	Beryllium, total	12/12/00	0.01	mg/l	0.001	-	

Well ID	Parameter Name [1]	Sample Date	Result	Unit	PQL [2]	MCL [3]	Exceedance
SW-5	Barium, total	12/12/00	1.1	mg/l	0.005	2	
SW-5	Arsenic, total	12/12/00	0.031	mg/l	0.005	0.05	
SW-5	Antimony, total	12/12/00	0.0056	mg/l	0.005	-	
SW-5	Carbon disulfide	12/12/00	150	ug/l	10	-	

[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 Analyses Summary
Alexander County Landfill

Background Well: MW-1A

Antimony, total

%ND	Normality	Method	ND Adj.	Upper Limit (α = 95%)	Unit
100.00	-	Poisson tolerance interval	ND	25	ug/l

Well	Result	Significance
MW-3	5	no
MW-4R	5.9	no
MW-5	5.7	no
MW-13	5.3	no
SW-5	5.6	no

Arsenic, total

%ND	Normality	Method	ND Adj.	Upper Limit (α = 95%)	Unit
91.67	-	Poisson tolerance interval	ND	17	ug/l

Well	Result	Significance
SW-5	31	yes

Barium, total

%ND	Normality	Method	ND Adj.	Upper Limit (α = 95%)	Unit
25.00	normal	Parametric tolerance interval	1/2 ND	1447	ug/l

Well	Result	Significance
MW-12	5300	yes
SW-5	1100	no

Beryllium, total

%ND	Normality	Method	ND Adj.	Upper Limit (α = 95%)	Unit
58.33	-	Non-parametric tolerance interval	½ ND	12.5	ug/l

Well	Result	Significance
MW-5	7.6	no
MW-11	11	no
MW-12	45	yes
SW-5	10	no

Chromium, total

%ND	Normality	Method	ND Adj.	Upper Limit (α = 95%)	Unit
8.33	log-normal	Parametric tolerance interval	½ ND	9.15851	log[ug/l]

Well	Result	Significance
MW-11	6.5	no
MW-12	6.9	no
SW-5	6.2	no

Copper, total

%ND	Normality	Method	ND Adj.	Upper Limit (α = 95%)	Unit
50.00	-	Non-parametric tolerance interval	½ ND	354.13	ug/l

Well	Result	Significance
MW-12	350.0	no

Lead, total

%ND	Normality	Method	ND Adj.	Upper Limit (α = 95%)	Unit
33.33	normal	Parametric tolerance interval	Cohen	128	ug/l

Well	Result	Significance
MW-12	95	no

Nickel, total

%ND	Normality	Method	ND Adj.	Upper Limit (α = 95%)	Unit
41.67	no	Non-parametric tolerance interval	½ ND	260	ug/l

Well	Result	Significance
MW-11	380	yes
MW-12	840	yes

Selenium, total

%ND	Normality	Method	ND Adj.	Upper Limit (α = 95%)	Unit
100	-	Poisson tolerance interval	ND	19.5	ug/l

Well	Result	Significance
MW-4R	5.7	no
MW-9	7.8	no

Silver, total

%ND	Normality	Method	ND Adj.	Upper Limit (α = 95%)	Unit
100	-	Poisson tolerance interval	ND	12.5	ug/l

Well	Result	Significance
MW-6	2.2	no

Vanadium

%ND	Normality	Method	ND Adj.	Upper Limit (α = 95%)	Unit
33.33	normal	Parametric tolerance interval	½ ND	471.3	ug/l

Well	Result	Significance
MW-11	340	no
MW-12	830	yes

Zinc, total

%ND	Normality	Method	ND Adj.	Upper Limit (α = 95%)	Unit
8.33	no	Non-parametric tolerance interval	½ ND	320	ug/l

Well	Result	Significance
MW-5	390	yes
MW-11	560	yes
MW-12	1300	yes
SW-5	470	yes

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

Summary of Pooled VOCs in Background Well MW-1A
Alexander County Closed Landfill

Constituent	Samples	NDs	% NDs
1,1,1,2-Tetrachloroethane	12	12	100.00
1,1,1-Trichloroethane	12	12	100.00
1,1,2,2-Tetrachloroethane	12	12	100.00
1,1,2-Trichloroethane	12	12	100.00
1,1-Dichloroethane	12	11	91.67
1,1-Dichloroethene	12	12	100.00
1,2,3-Trichloropropane	12	12	100.00
1,2-Dibromo-3-chloropropane	12	12	100.00
1,2-Dibromoethane	12	12	100.00
1,2-Dichlorobenzene	12	12	100.00
1,2-Dichloroethane	12	12	100.00
1,2-Dichloropropane	12	12	100.00
1,4-Dichlorobenzene	12	12	100.00
2-Butanone	12	12	100.00
2-Hexanone	12	12	100.00
4-Methyl-2-Pentanone	12	12	100.00
Acetone	12	12	100.00
Acrylonitrile	12	12	100.00
Benzene	12	12	100.00
Bromochloromethane	12	12	100.00
Bromodichloromethane	12	12	100.00
Bromoform	12	12	100.00
Bromomethane	12	12	100.00
Carbon disulfide	12	12	100.00
Carbon tetrachloride	12	12	100.00
Chlorobenzene	12	12	100.00
Chloroethane	12	12	100.00
Chloroform	12	12	100.00
Chloromethane	12	12	100.00
cis-1,2-Dichloroethene	12	12	100.00
cis-1,3-Dichloropropene	12	12	100.00
Chlorodibromomethane	12	12	100.00
Dibromomethane	12	12	100.00
Ethylbenzene	12	12	100.00
Iodomethane	12	12	100.00
Dichloromethane	12	12	100.00
Styrene	12	12	100.00
Tetrachloroethylene	12	12	100.00
Toluene	12	12	100.00
trans-1,2-Dichloroethene	12	12	100.00
trans-1,3-Dichloropropene	12	12	100.00
trans-1,4-Dichloro-2-butene	11	11	100.00
Trichloroethylene	12	12	100.00
Trichlorofluoromethane	12	12	100.00
Vinyl acetate	11	11	100.00
Vinyl chloride	12	12	100.00
Xylene	12	10	83.33
Total	**562**	**559**	**99.47**

Poisson Prediction Interval Based upon Pooled Background VOCs
Alexander County Closed Landfill

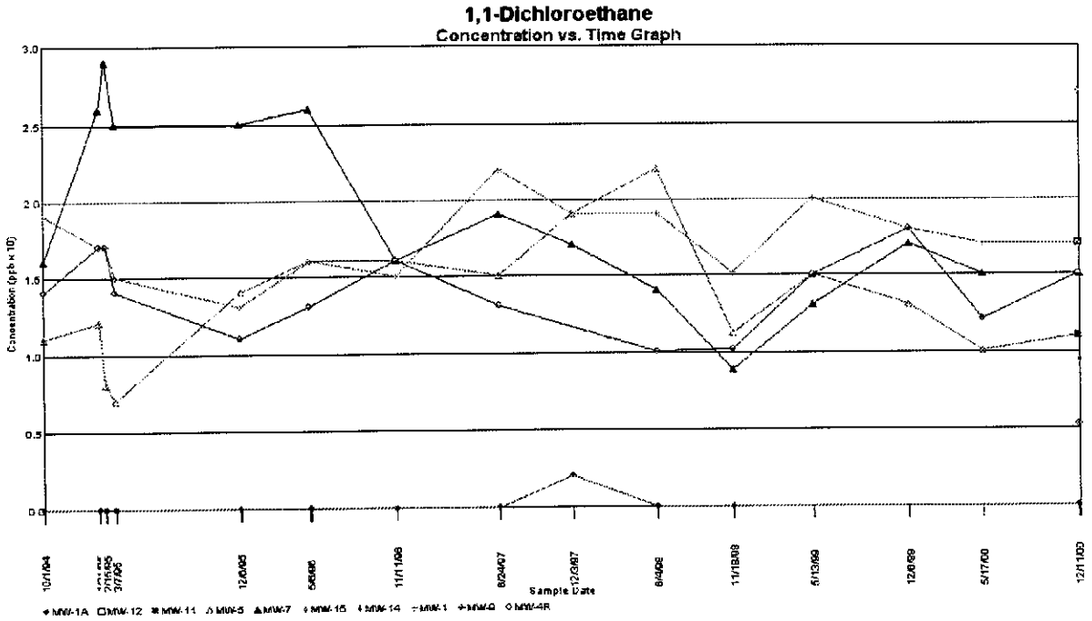
All detected VOCs (Background Well: MW-1A)

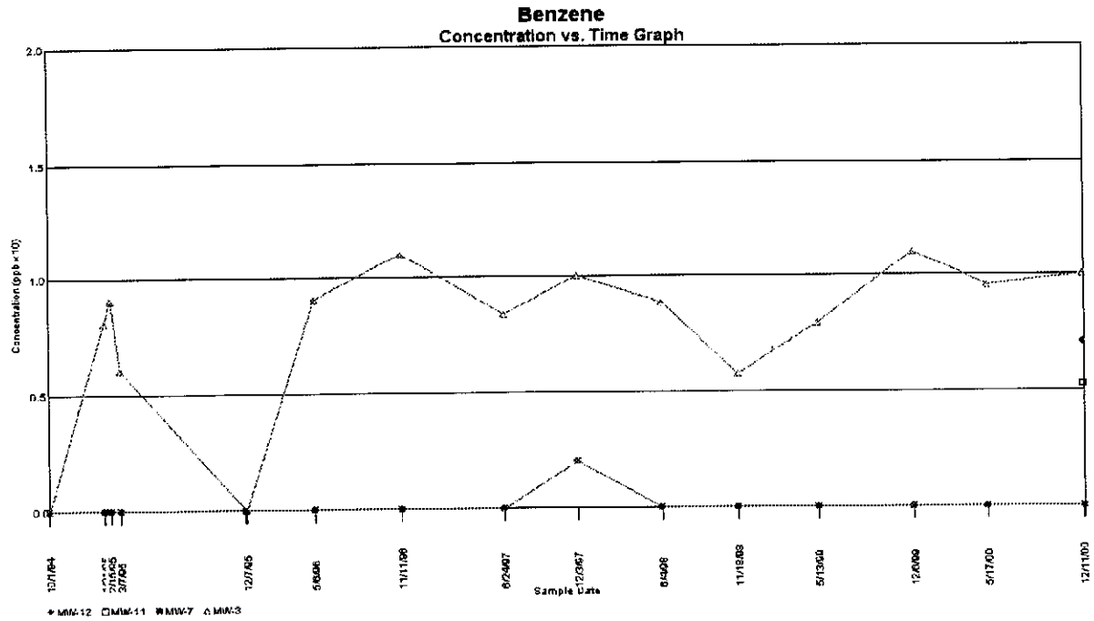
Constituent	MW-1	MW-3	MW-4R	MW-5	MW-6	MW-7	MW-9	MW-11	MW-12	MW-14	MW-15	SW-5
1,1-Dichloroethane	x		x	x		x	x	x	x	x	x	
1,4-Dichlorobenzene		x							x			
Benzene		x						x	x			
Carbon disulfide		x				x						x
cis-1,2-Dichloroethene	x	x	x	x	x	x	x	x	x	x		
Dichloromethane									x			
Detection(s) per Scan	2.00	4.00	2.00	2.00	1.00	3.00	2.00	3.00	5.00	2.00	1.00	1.00

Total number of sampling events [n] = 11.96
Total number of detections in background wells [y] = 3
Number of comparisons (downgradient wells) [k] = 16
One-sided value of Student's t-statistic (95% confidence) [t] = 3.559
Expected number of detections in a single future sample [y*] = **2.71**

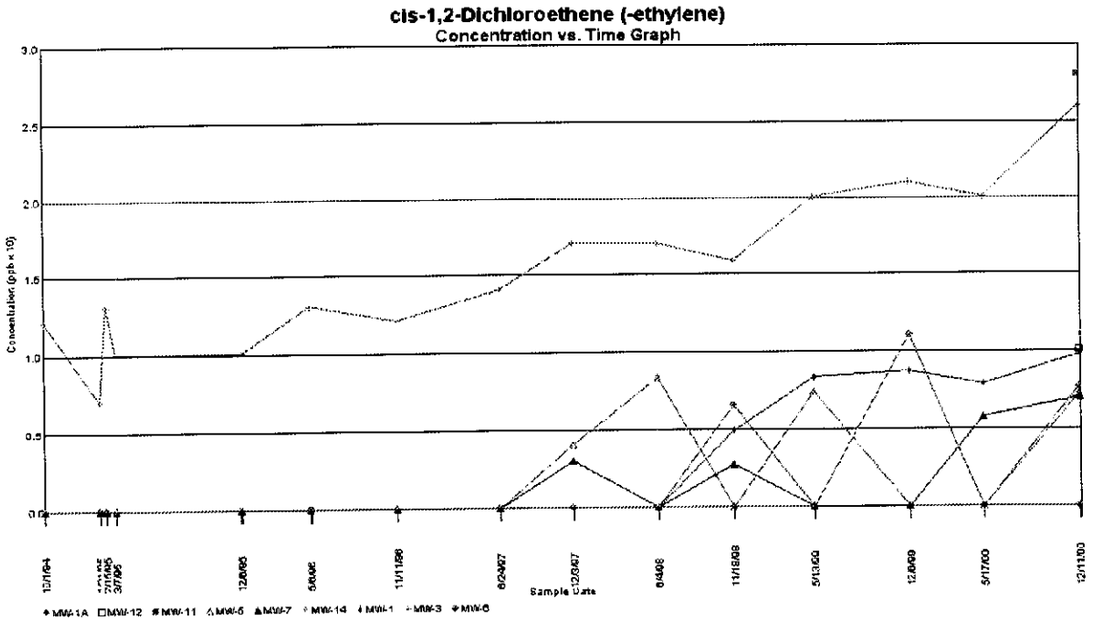
Statistically significant VOC detections at 95% confidence level at MW-3, MW-7, MW-11, MW-12.

Time Series Plot for Select Constituents (VOC)
Alexander County Closed Landfill

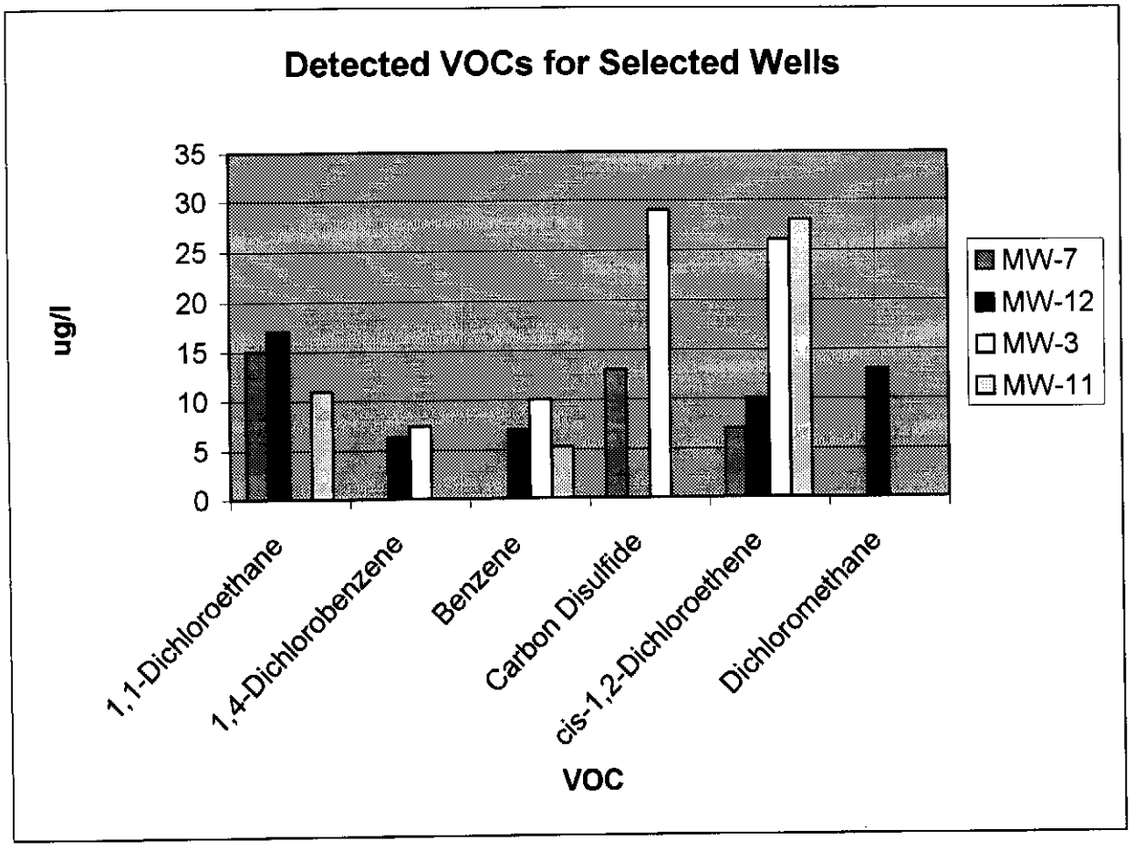




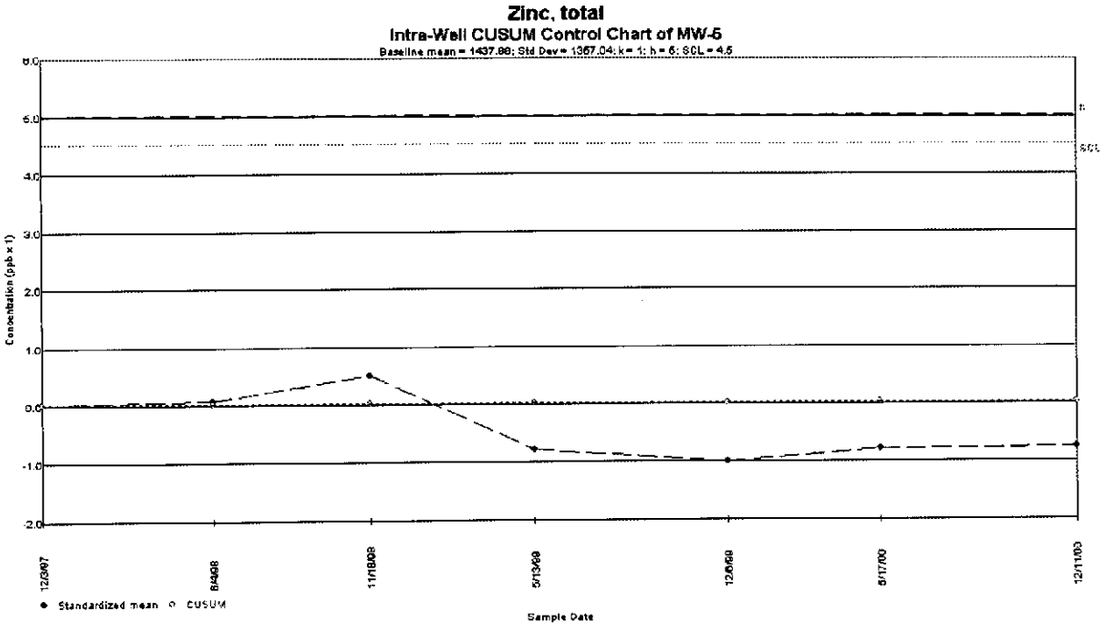
Time Series Plot for Select Constituents (VOC)
Alexander County Closed Landfill



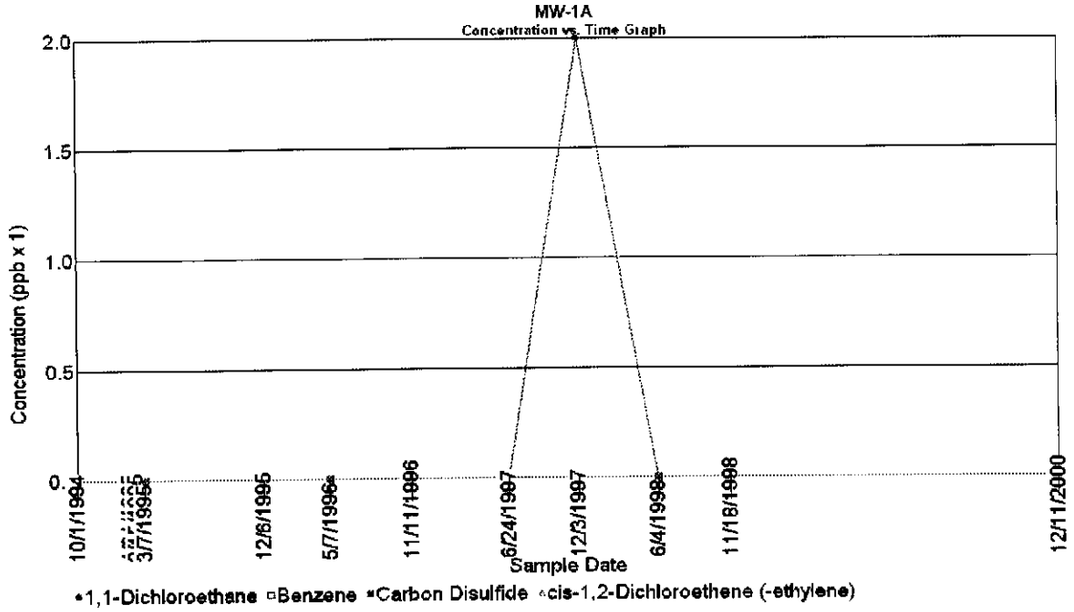
Charts for Select Constituents (VOC)
Alexander County Closed Landfill



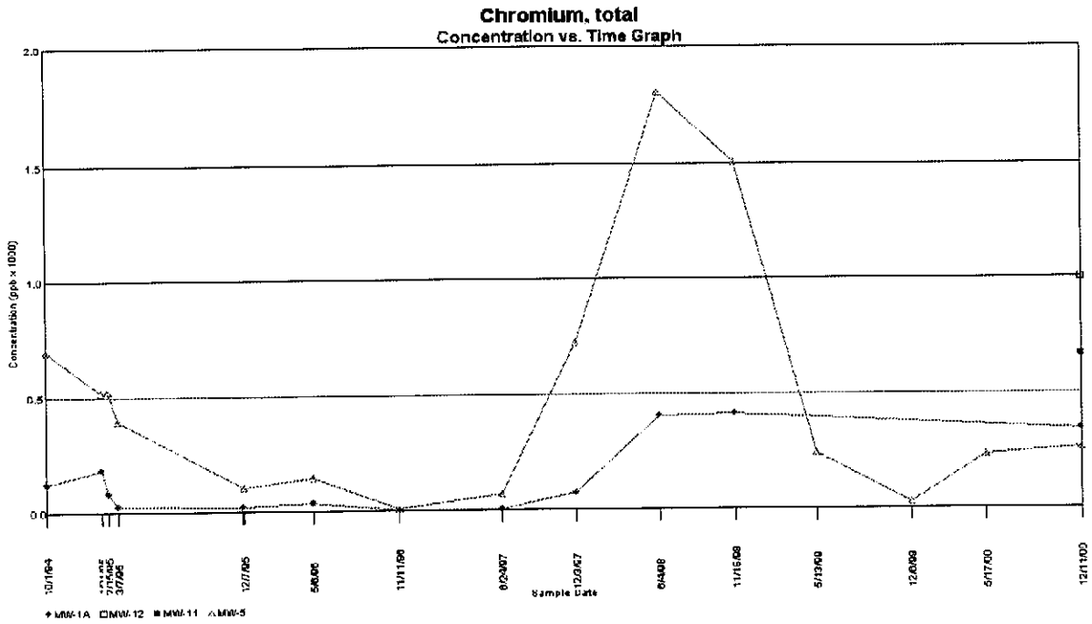
Shewhart-CUSUM Control Charts for Select Metals
Alexander County Closed Landfill

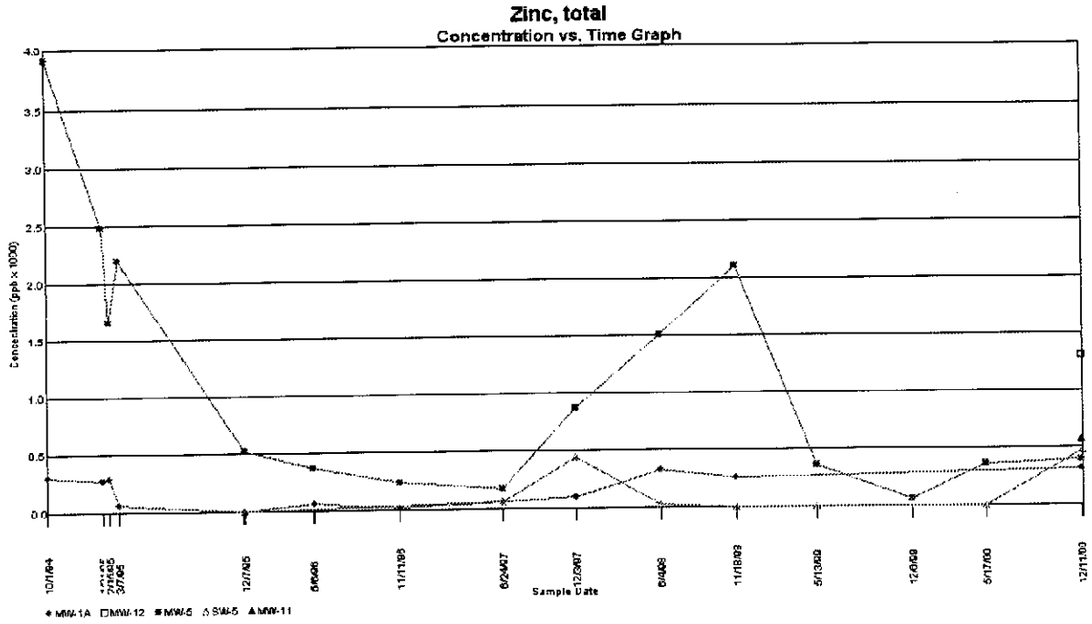


Time Series Plot for Select Constituents (VOC)
Background Well
Alexander County Closed Landfill

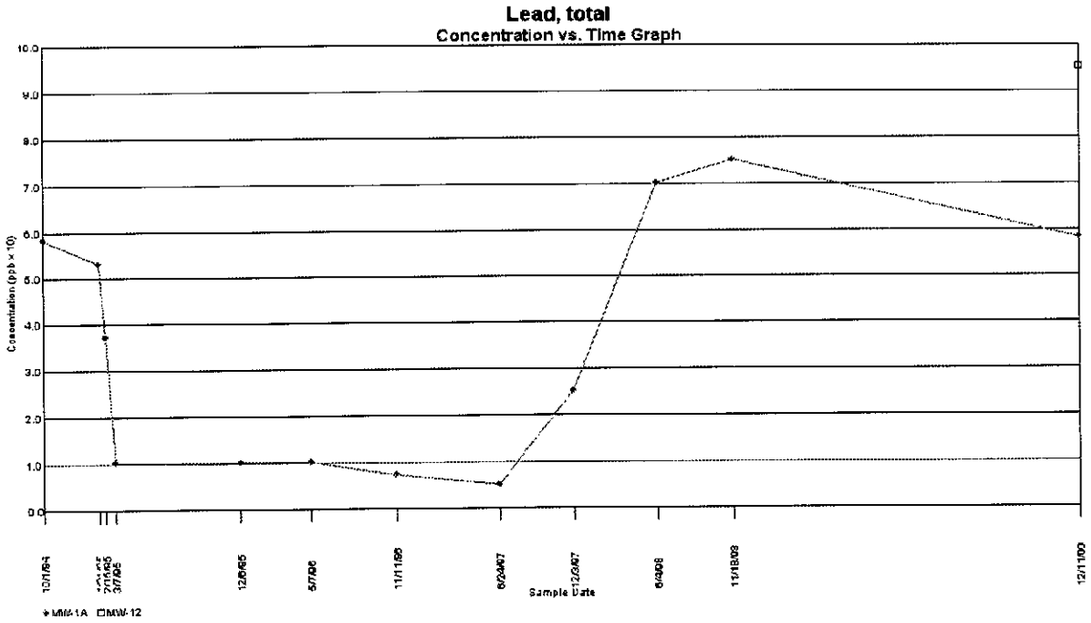


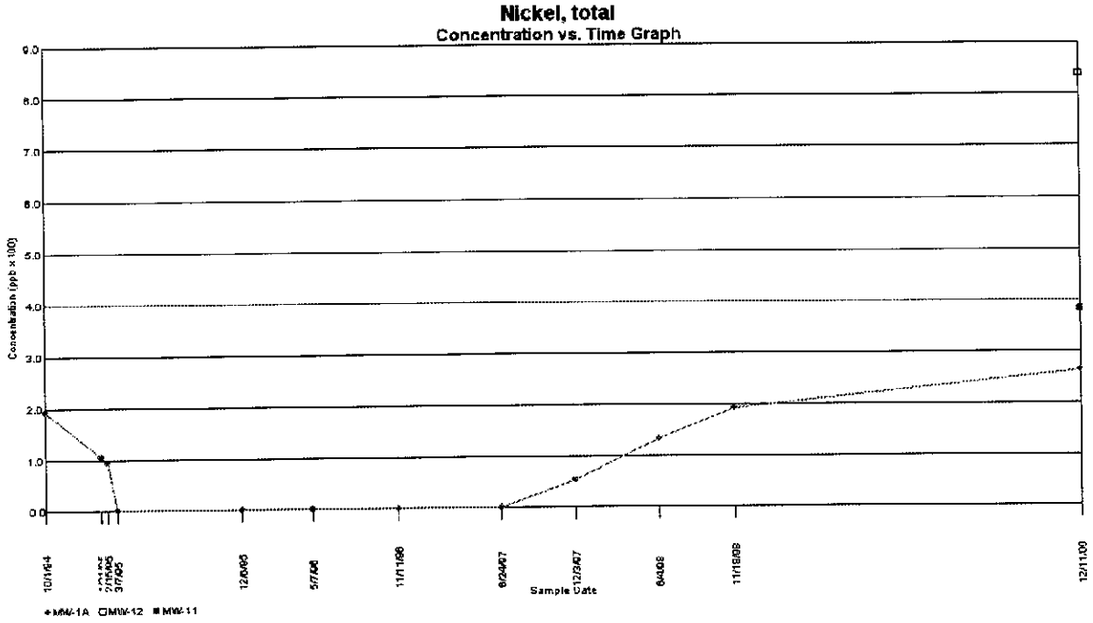
Time Series Plot for Select Constituents (Metals)
Alexander County Closed Landfill



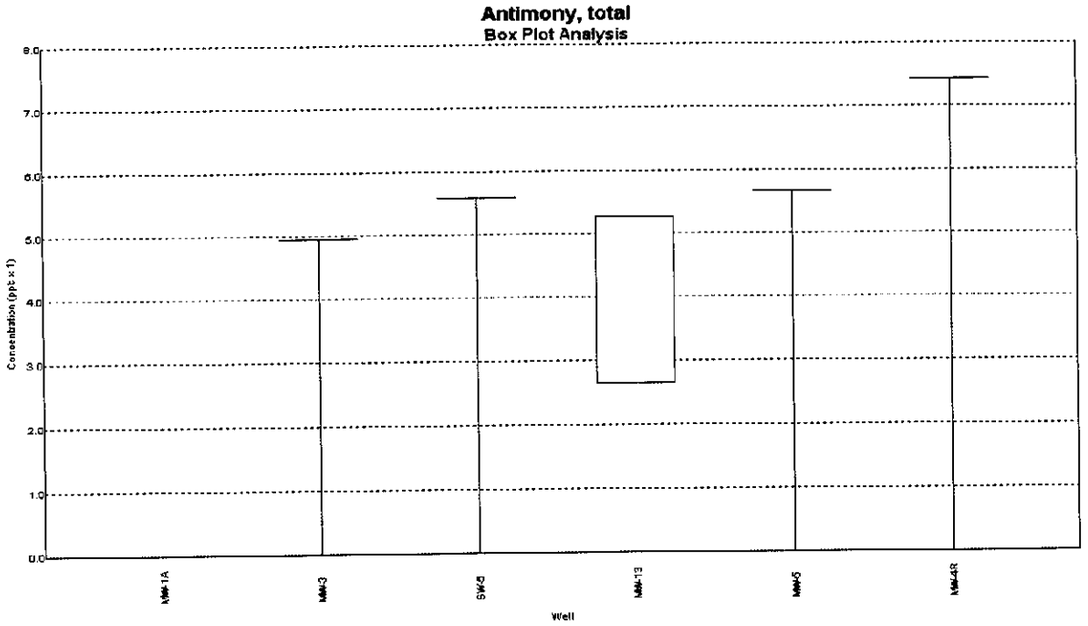


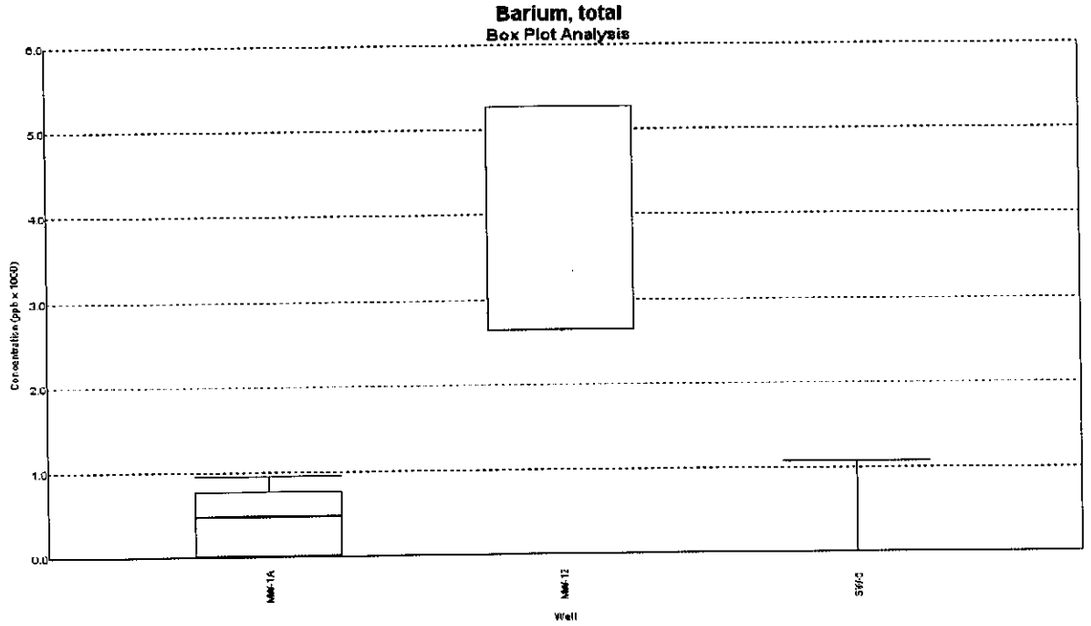
Time Series Plot for Select Constituents (Metals)
Alexander County Closed Landfill



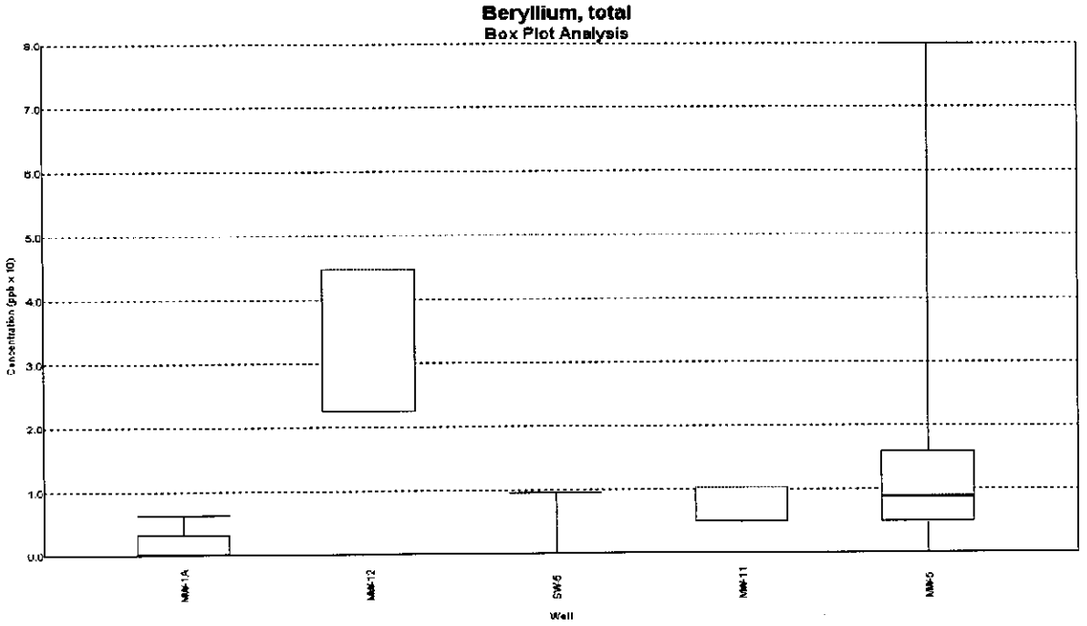


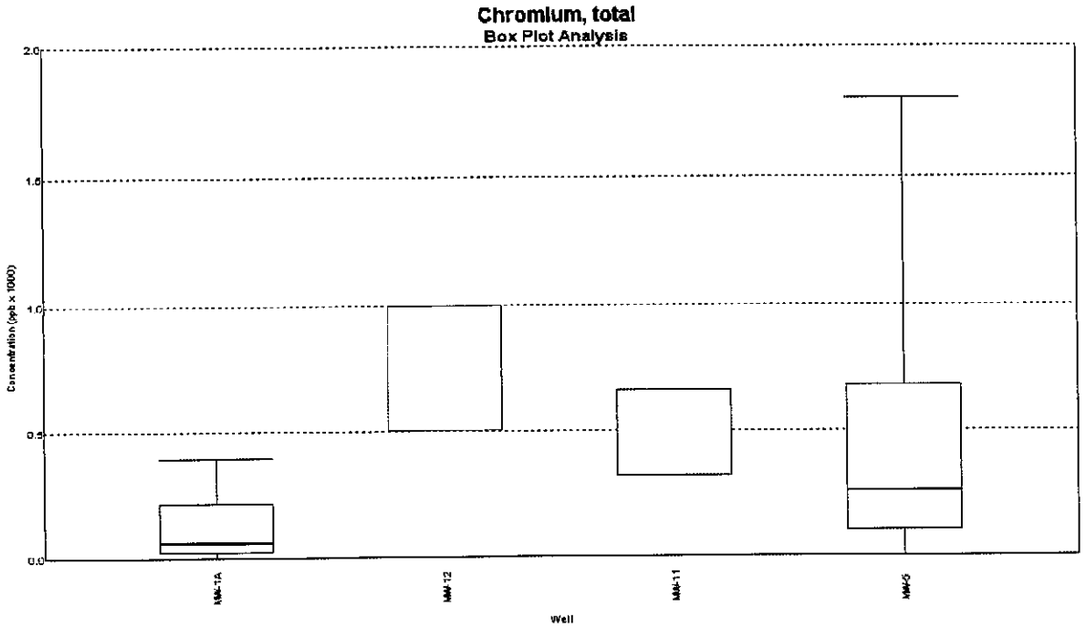
Box Plots for Select Constituents (Metals)
Alexander County Closed Landfill



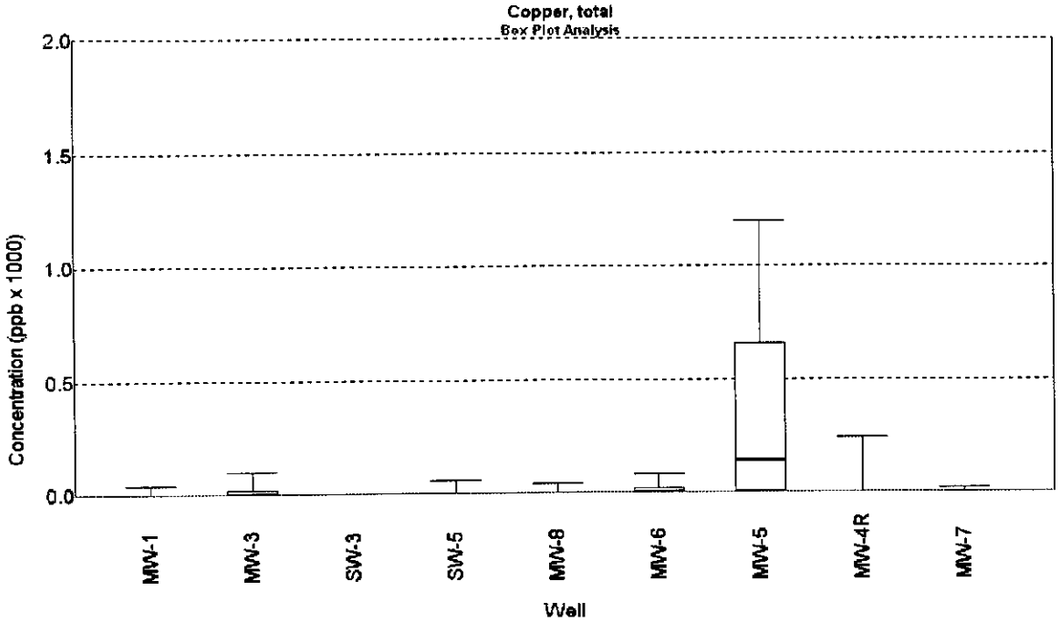


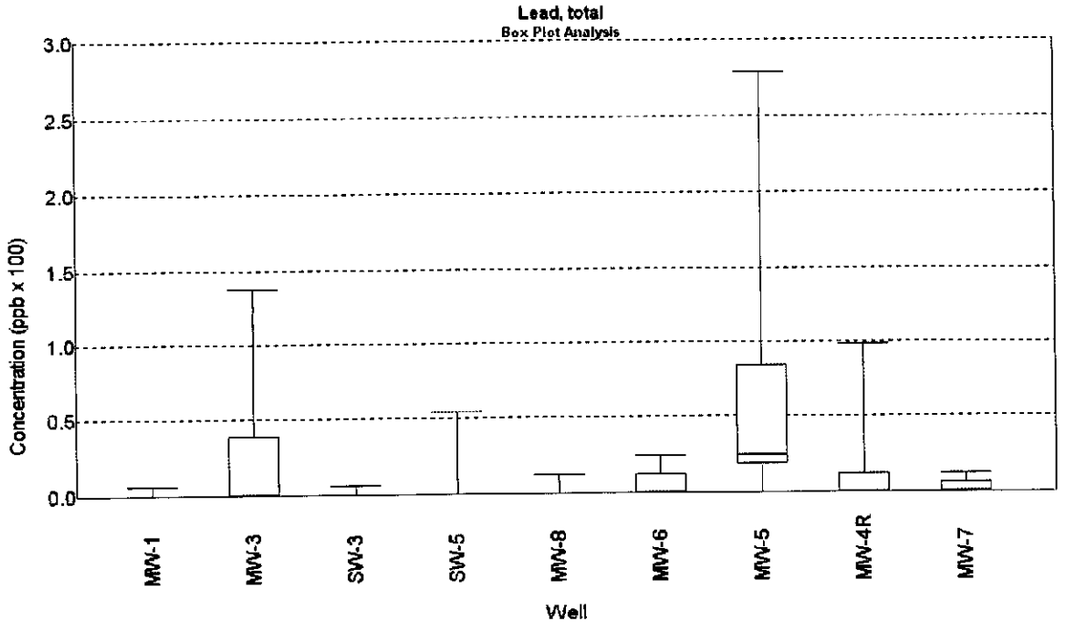
Box Plots for Select Constituents (Metals)
Alexander County Closed Landfill



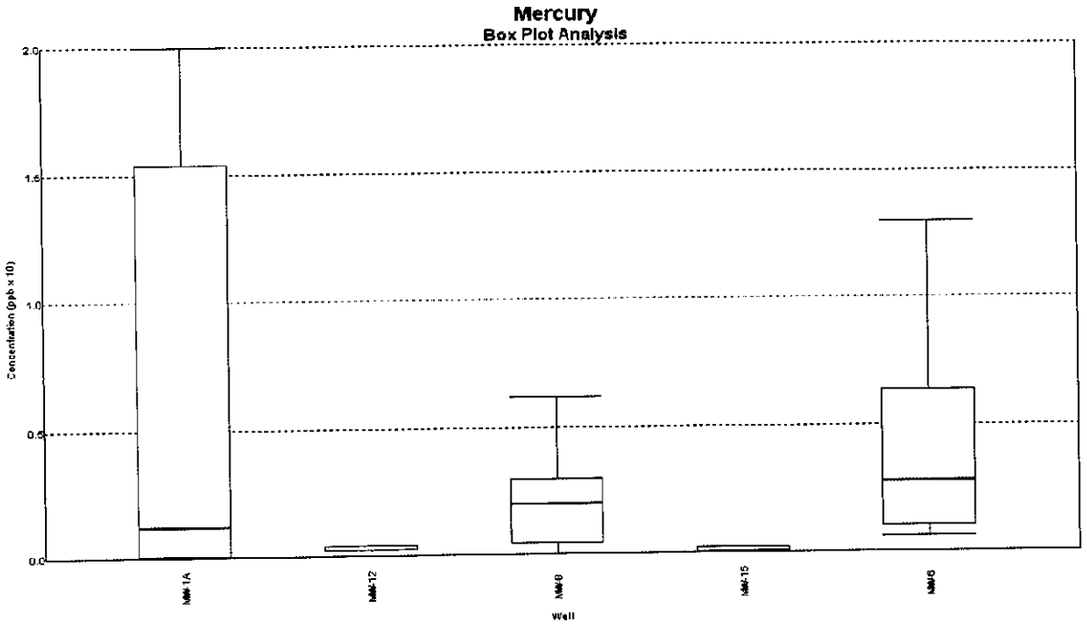


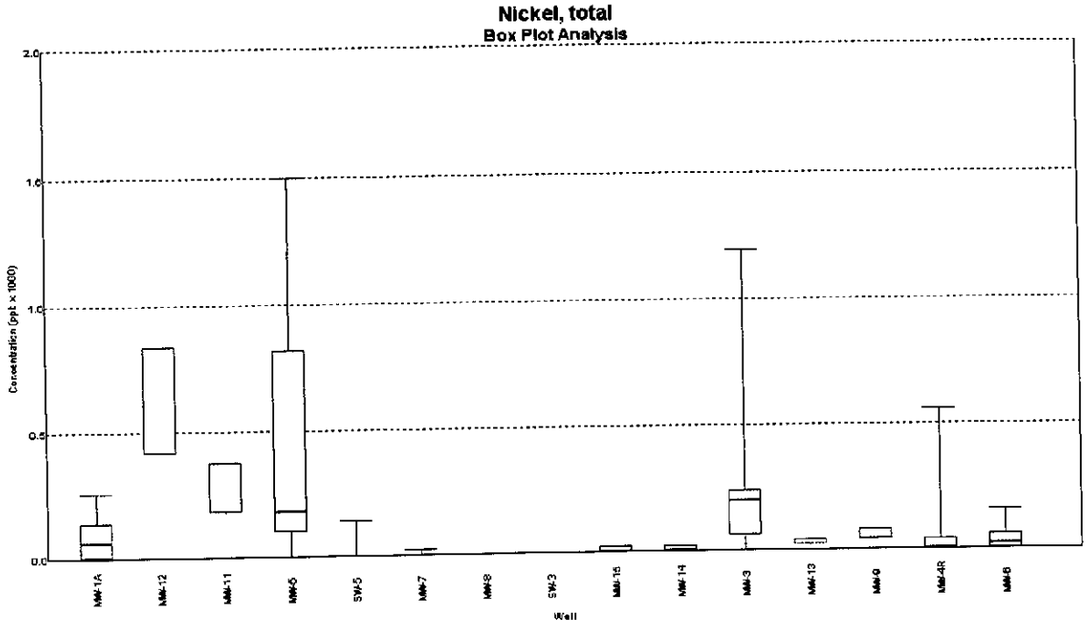
Box Plots for Select Constituents (Metals)
Alexander County Closed Landfill



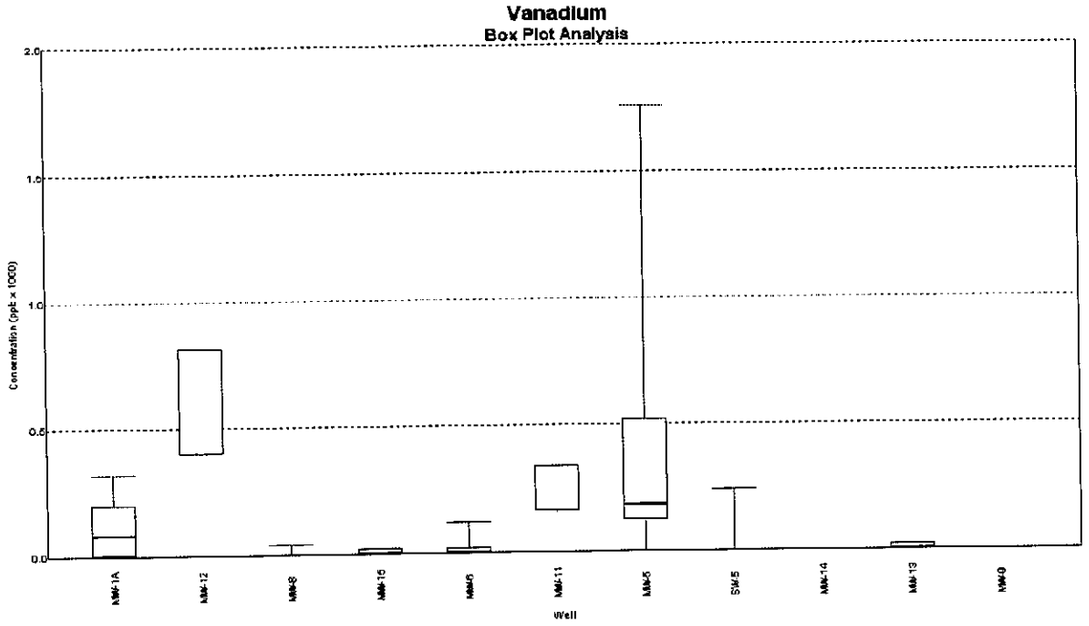


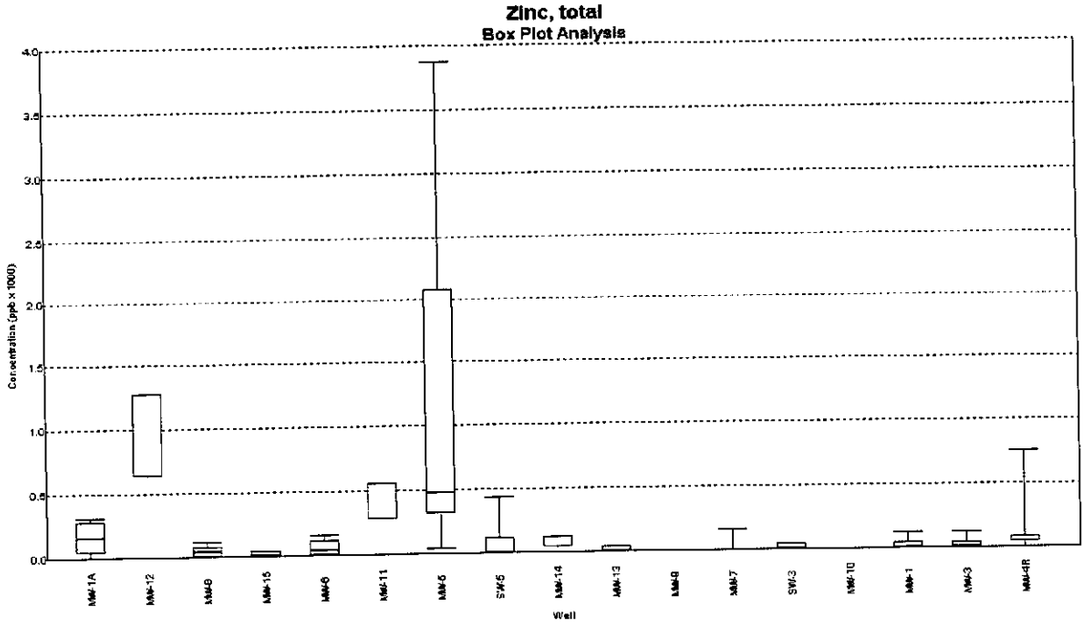
Box Plots for Select Constituents (Metals)
Alexander County Closed Landfill



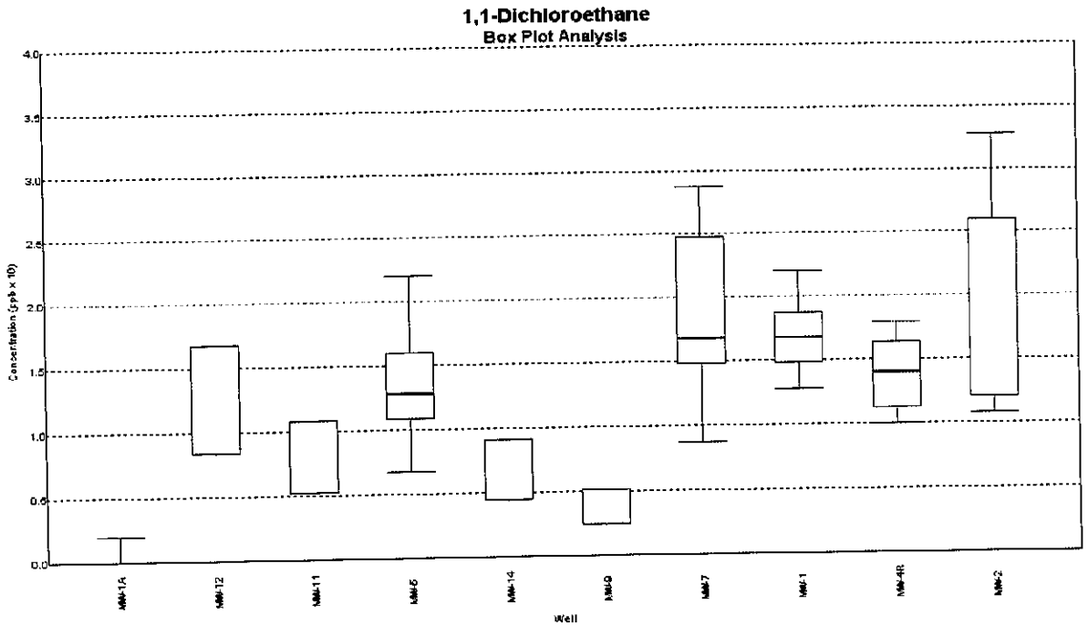


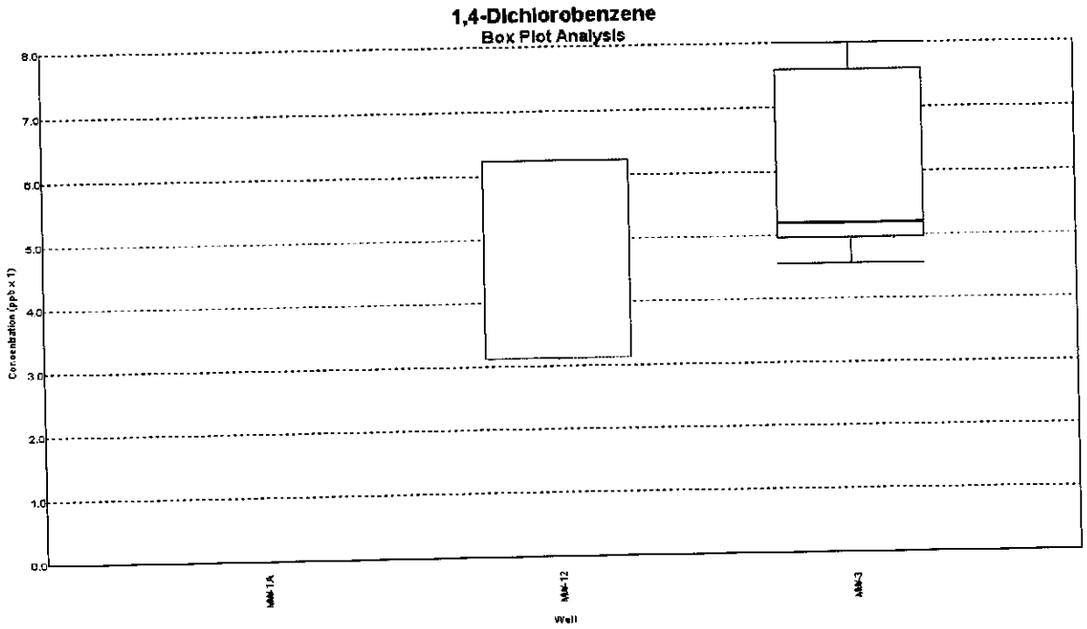
Box Plots for Select Constituents (Metals)
Alexander County Closed Landfill



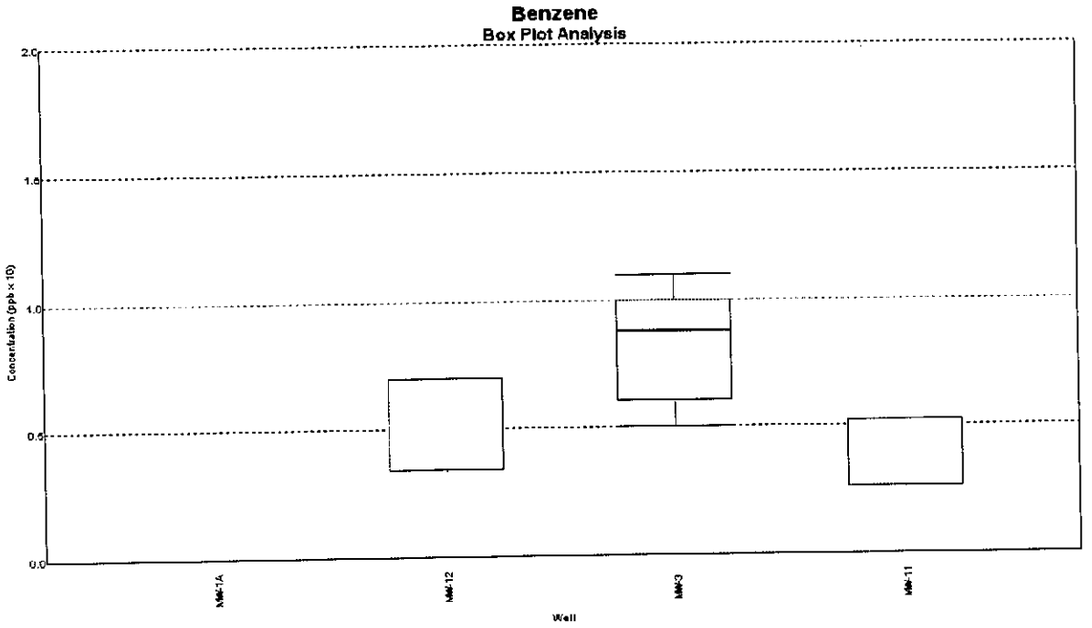


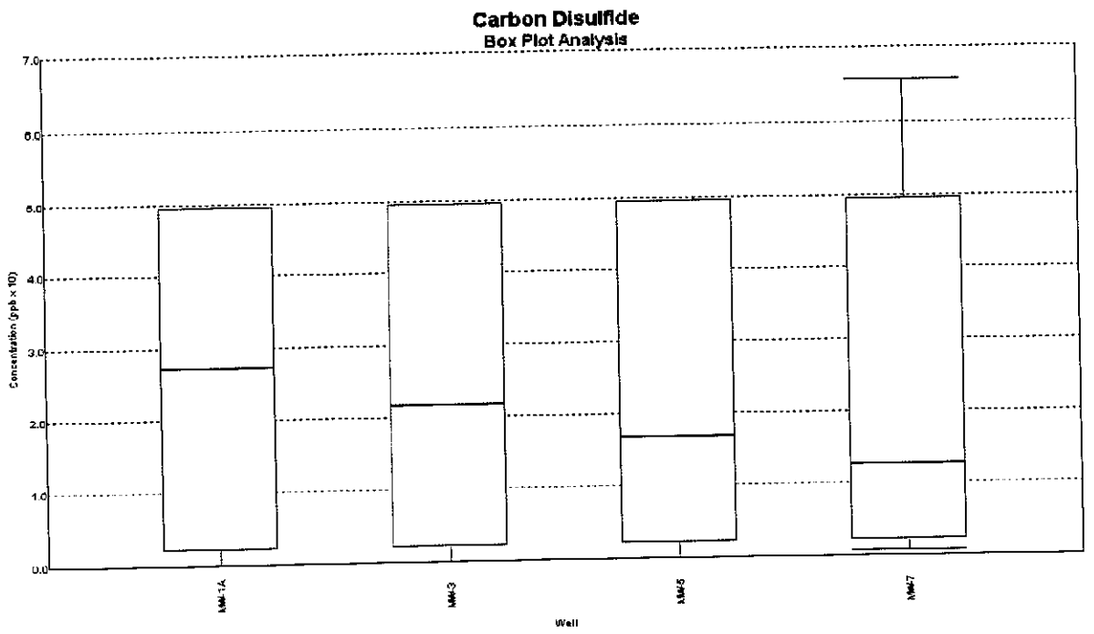
Box Plots for Select Constituents (VOC)
Alexander County Closed Landfill



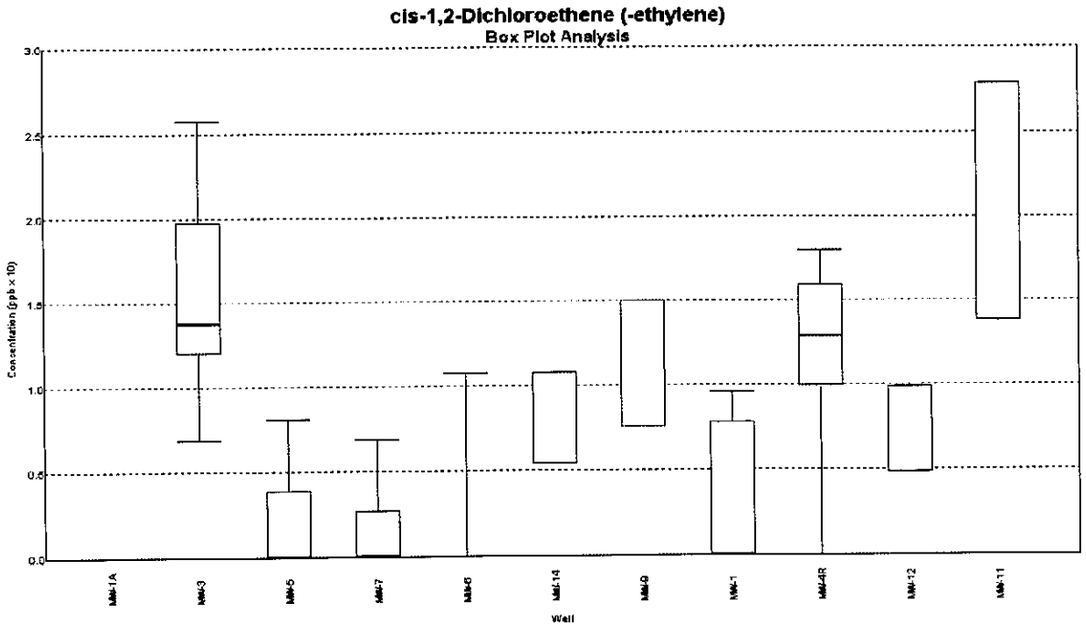


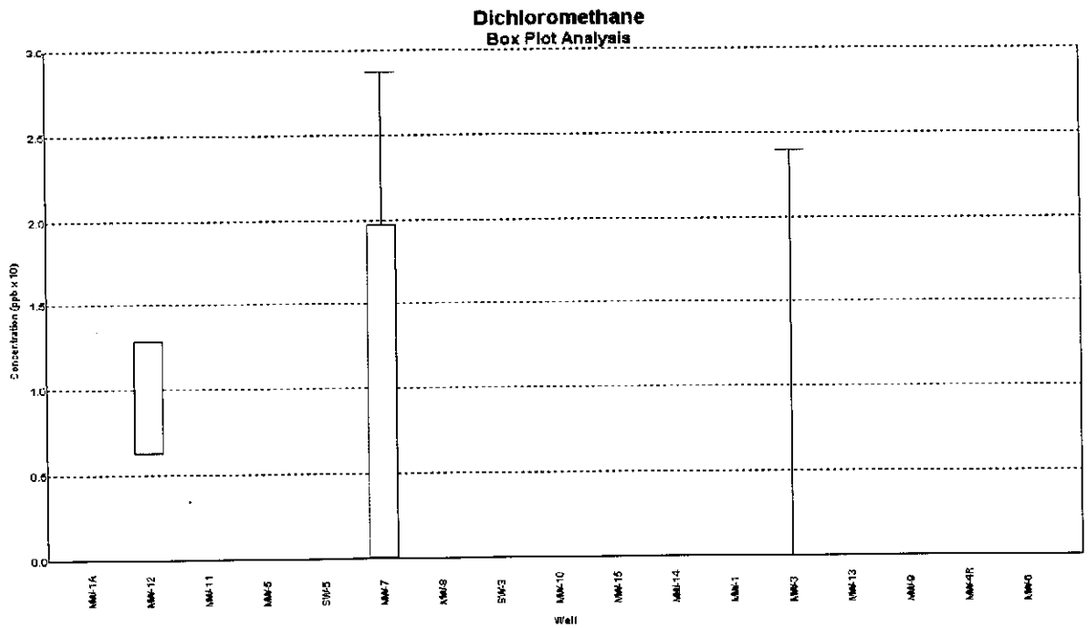
Box Plots for Select Constituents (VOC)
Alexander County Closed Landfill





Box Plots for Select Constituents (VOC)
Alexander County Closed Landfill





Basic Statistics

Basic Statistics
Parameter: Antimony, total

Total Observations	147
Total Non-Detects	138
Pooled Mean	13.2034
Pooled Std Dev	11.44
Background Mean	15.8333
Background Std Dev	12.5831

Background Wells
There is 1 background well

Well	Samples	Non-Detects	% ND	Total
MW-1A	12	12	100	190

Well	Mean	Std Dev	Std Err	Rank Sum	Rank Mean
MW-1A	15.8333	12.5831	4.5978	834	69.5

Compliance Wells
There are 16 compliance wells

Well	Samples	Non-Detects	% ND	Total
MW-3	15	14	93.3333	205
MW-4R	15	13	86.6667	208.4
MW-5	15	14	93.3333	205.7
MW-6	15	15	100	205
MW-7	15	14	93.3333	206.8
MW-8	15	14	93.3333	205.4
SW-3	15	15	100	205
SW-5	8	7	87.5	65.6
MW-10	1	1	100	5
MW-11	1	1	100	5
MW-12	1	1	100	5
MW-13	1	0	0	5.3
MW-15	1	1	100	5
MW-9	1	1	100	5
MW-14	1	1	100	5
MW-1	15	14	93.3333	208.7

Well	Mean	Std Dev	Dif From Bkg	Std Err	Rank Sum	Rank Mean
MW-3	13.6667	12.0218	-2.16667	4.5978	1126	75.0667
MW-4R	13.8933	11.8644	-1.94	4.5978	1221.5	81.4333
MW-5	13.7133	11.9871	-2.12	4.5978	1130	75.3333
MW-6	13.6667	12.0218	-2.16667	4.5978	1042.5	69.5
MW-7	13.7867	11.9378	-2.04667	4.5978	1132	75.4667
MW-8	13.6933	12.0016	-2.14	4.5978	1128	75.2
SW-3	13.6667	12.0218	-2.16667	4.5978	1042.5	69.5
SW-5	8.2	8.81103	-7.63333	5.41856	642.5	80.3125
MW-10	5	0	-10.8333	12.3562	69.5	69.5
MW-11	5	0	-10.8333	12.3562	69.5	69.5
MW-12	5	0	-10.8333	12.3562	69.5	69.5
MW-13	5.3	0	-10.5333	12.3562	154	154
MW-15	5	0	-10.8333	12.3562	69.5	69.5

MW-9	5	0	-10.8333	12.3562	69.5	69.5
MW-14	5	0	-10.8333	12.3562	69.5	69.5
MW-1	13.9133	11.8683	-1.92	4.5978	1134	75.6

Analysis of Variance Statistics

SS Wells	786.471
SS Total	19107.6

Kruskal-Wallis Statistics

Non-Detect Rank	69.5
Background Rank Sum	834
Background Rank Mean	69.5
H Statistic	15.0599
H Adjusted for Ties	87.2214

Basic Statistics
Parameter: Arsenic, total

Total Observations	147
Total Non-Detects	137
Pooled Mean	7.61088
Pooled Std Dev	3.82829
Background Mean	9.66667
Background Std Dev	4.6188

Background Wells
There is 1 background well

Well	Samples	Non-Detects	% ND	Total
MW-1A	12	11	91.6667	116

Well	Mean	Std Dev	Std Err	Rank Sum	Rank Mean
MW-1A	9.66667	4.6188	1.50432	918	76.5

Compliance Wells
There are 16 compliance wells

Well	Samples	Non-Detects	% ND	Total
MW-3	15	15	100	105
MW-4R	15	15	100	105
MW-5	15	9	60	137.2
MW-6	15	15	100	120
MW-7	15	15	100	105
MW-8	15	15	100	105
SW-3	15	15	100	105
SW-5	8	7	87.5	71
MW-10	1	1	100	5
MW-11	1	0	0	10
MW-12	1	0	0	9.6
MW-13	1	1	100	5
MW-15	1	1	100	5
MW-9	1	1	100	5
MW-14	1	1	100	5
MW-1	15	15	100	105

Well	Mean	Std Dev	Dif From Bkg	Std Err	Rank Sum	Rank Mean
MW-3	7	2.53546	-2.66667	1.50432	1035	69
MW-4R	7	2.53546	-2.66667	1.50432	1035	69
MW-5	9.14667	5.11103	-0.52	1.50432	1551	103.4
MW-6	8	4.14039	-1.66667	1.50432	1035	69
MW-7	7	2.53546	-2.66667	1.50432	1035	69
MW-8	7	2.53546	-2.66667	1.50432	1035	69
SW-3	7	2.53546	-2.66667	1.50432	1035	69
SW-5	8.875	9.10945	-0.791667	1.77286	644	80.5
MW-10	5	0	-4.66667	4.04275	69	69
MW-11	10	0	0.333333	4.04275	158	158
MW-12	9.6	0	-0.0666667	4.04275	157	157
MW-13	5	0	-4.66667	4.04275	69	69
MW-15	5	0	-4.66667	4.04275	69	69

MW-9	5	0	-4.66667	4.04275	69	69
MW-14	5	0	-4.66667	4.04275	69	69
MW-1	7	2.53546	-2.66667	1.50432	1035	69

Analysis of Variance Statistics

SS Wells	178.484
SS Total	2139.74

Kruskal-Wallis Statistics

Non-Detect Rank	69
Background Rank Sum	918
Background Rank Mean	76.5
H Statistic	28.0162
H Adjusted for Ties	147.052

Basic Statistics
Parameter: Barium, total

Total Observations	147
Total Non-Detects	42
Pooled Mean	429
Pooled Std Dev	647.173
Background Mean	590.333
Background Std Dev	296.303

Background Wells
There is 1 background well

Well	Samples	Non-Detects	% ND	Total
MW-1A	12	3	25	7084

Well	Mean	Std Dev	Std Err	Rank Sum	Rank Mean
MW-1A	590.333	296.303	166.358	1251.5	104.292

Compliance Wells
There are 16 compliance wells

Well	Samples	Non-Detects	% ND	Total
MW-3	15	5	33.3333	4053
MW-4R	15	5	33.3333	5210
MW-5	15	2	13.3333	17944
MW-6	15	4	26.6667	7333
MW-7	15	5	33.3333	2941
MW-8	15	6	40	3629
SW-3	15	5	33.3333	3397
SW-5	8	1	12.5	1852
MW-10	1	0	0	30
MW-11	1	0	0	830
MW-12	1	0	0	5300
MW-13	1	0	0	110
MW-15	1	0	0	110
MW-9	1	0	0	180
MW-14	1	0	0	110
MW-1	15	6	40	2950

Well	Mean	Std Dev	Dif From Bkg	Std Err	Rank Sum	Rank Mean
MW-3	270.2	192.728	-320.133	166.358	1179.5	78.6333
MW-4R	347.333	364.544	-243	166.358	1277.5	85.1667
MW-5	1196.27	1038.27	605.933	166.358	1901	126.733
MW-6	488.867	358.923	-101.467	166.358	1505	100.333
MW-7	196.067	223.451	-394.267	166.358	839.5	55.9667
MW-8	241.933	192.171	-348.4	166.358	1077	71.8
SW-3	226.467	237.256	-363.867	166.358	889.5	59.3
SW-5	231.5	385.847	-358.833	196.055	627.5	78.4375
MW-10	30	0	-560.333	447.074	60	60
MW-11	830	0	239.667	447.074	146	146
MW-12	5300	0	4709.67	447.074	161	161
MW-13	110	0	-480.333	447.074	108	108
MW-15	110	0	-480.333	447.074	109	109

MW-9	180	0	-410.333	447.074	123	123
MW-14	110	0	-480.333	447.074	110	110
MW-1	196.667	223.102	-393.667	166.358	752	50.1333

Analysis of Variance Statistics

SS Wells	3.71646e+007
SS Total	6.11497e+007

Kruskal-Wallis Statistics

Non-Detect Rank	21.5
Background Rank Sum	1251.5
Background Rank Mean	104.292
H Statistic	156.983
H Adjusted for Ties	160.73

Basic Statistics
Parameter: Beryllium, total

Total Observations	147
Total Non-Detects	109
Pooled Mean	5.07347
Pooled Std Dev	11.0988
Background Mean	4.6
Background Std Dev	6.67546

Background Wells
There is 1 background well

Well	Samples	Non-Detects	% ND	Total
MW-1A	12	7	58.3333	55.2

Well	Mean	Std Dev	Std Err	Rank Sum	Rank Mean
MW-1A	4.6	6.67546	3.8831	1079	89.9167

Compliance Wells
There are 16 compliance wells

Well	Samples	Non-Detects	% ND	Total
MW-3	15	13	86.6667	49.6
MW-4R	15	12	80	47
MW-5	15	1	6.66667	279.2
MW-6	15	12	80	49.5
MW-7	15	7	46.6667	54.3
MW-8	15	15	100	44
SW-3	15	15	100	44
SW-5	8	7	87.5	18
MW-10	1	1	100	1
MW-11	1	0	0	11
MW-12	1	0	0	45
MW-13	1	1	100	1
MW-15	1	1	100	1
MW-9	1	1	100	1
MW-14	1	1	100	1
MW-1	15	15	100	44

Well	Mean	Std Dev	Dif From Bkg	Std Err	Rank Sum	Rank Mean
MW-3	3.30667	6.09302	-1.29333	3.8831	995	66.3333
MW-4R	3.13333	6.10464	-1.46667	3.8831	1059	70.6
MW-5	18.6133	25.1417	14.0133	3.8831	2166	144.4
MW-6	3.3	6.04684	-1.3	3.8831	1071	71.4
MW-7	3.62	6.15678	-0.98	3.8831	1441	96.0667
MW-8	2.93333	6.12334	-1.66667	3.8831	825	55
SW-3	2.93333	6.12334	-1.66667	3.8831	825	55
SW-5	2.25	3.15096	-2.35	4.57628	537	67.125
MW-10	1	0	-3.6	10.4355	55	55
MW-11	11	0	6.4	10.4355	153	153
MW-12	45	0	40.4	10.4355	159	159
MW-13	1	0	-3.6	10.4355	55	55
MW-15	1	0	-3.6	10.4355	55	55

MW-9	1	0	-3.6	10.4355	55	55
MW-14	1	0	-3.6	10.4355	55	55
MW-1	2.93333	6.12334	-1.66667	3.8831	825	55

Analysis of Variance Statistics

SS Wells	4916.86
SS Total	17984.9

Kruskal-Wallis Statistics

Non-Detect Rank	55
Background Rank Sum	1079
Background Rank Mean	89.9167
H Statistic	108.369
H Adjusted for Ties	182.955

Basic Statistics
Parameter: Chromium, total

Total Observations	147
Total Non-Detects	39
Pooled Mean	95.4616
Pooled Std Dev	242.136
Background Mean	141
Background Std Dev	155.803

Background Wells
There is 1 background well

Well	Samples	Non-Detects	% ND	Total
MW-1A	12	1	8.33333	1692

Well	Mean	Std Dev	Std Err	Rank Sum	Rank Mean
MW-1A	141	155.803	72.8002	1400	116.667

Compliance Wells
There are 16 compliance wells

Well	Samples	Non-Detects	% ND	Total
MW-3	15	3	20	501.5
MW-4R	15	4	26.6667	506.8
MW-5	15	0	0	7211
MW-6	15	1	6.66667	1153
MW-7	15	2	13.3333	287.1
MW-8	15	3	20	186.4
SW-3	15	13	86.6667	101.18
SW-5	8	7	87.5	490.67
MW-10	1	0	0	8.9
MW-11	1	0	0	660
MW-12	1	0	0	1000
MW-13	1	0	0	40
MW-15	1	0	0	21
MW-9	1	0	0	32
MW-14	1	0	0	19
MW-1	15	5	33.3333	122.3

Well	Mean	Std Dev	Dif From Bkg	Std Err	Rank Sum	Rank Mean
MW-3	33.4333	48.343	-107.567	72.8002	1184	78.9333
MW-4R	33.7867	71.5236	-107.213	72.8002	1075	71.6667
MW-5	480.733	529.185	339.733	72.8002	2109	140.6
MW-6	76.8667	86.9391	-64.1333	72.8002	1673	111.533
MW-7	19.14	13.0754	-121.86	72.8002	1290	86
MW-8	12.4267	9.32182	-128.573	72.8002	1048	69.8667
SW-3	6.74533	5.74792	-134.255	72.8002	452	30.1333
SW-5	61.3338	165.152	-79.6662	85.7959	293	36.625
MW-10	8.9	0	-132.1	195.645	74	74
MW-11	660	0	519	195.645	156	156
MW-12	1000	0	859	195.645	159	159
MW-13	40	0	-101	195.645	124	124
MW-15	21	0	-120	195.645	105	105

MW-9	32	0	-109	195.645	119	119
MW-14	19	0	-122	195.645	100	100
MW-1	8.15333	6.21241	-132.847	72.8002	797	53.1333

Analysis of Variance Statistics

SS Wells	3.96675e+006
SS Total	8.55998e+006

Kruskal-Wallis Statistics

Non-Detect Rank	20
Background Rank Sum	1400
Background Rank Mean	116.667
H Statistic	203.251
H Adjusted for Ties	207.117

Basic Statistics
Parameter: Copper, total

Total Observations	147
Total Non-Detects	87
Pooled Mean	120.092
Pooled Std Dev	172.384
Background Mean	164.917
Background Std Dev	87.0605

Background Wells
There is 1 background well

Well	Samples	Non-Detects	% ND	Total
MW-1A	12	6	50	1979

Well	Mean	Std Dev	Std Err	Rank Sum	Rank Mean
MW-1A	164.917	87.0605	58.6415	1118	93.1667

Compliance Wells
There are 16 compliance wells

Well	Samples	Non-Detects	% ND	Total
MW-3	15	9	60	1339.1
MW-4R	15	9	60	1351.4
MW-5	15	3	20	5765
MW-6	15	8	53.3333	1400.3
MW-7	15	9	60	1227
MW-8	15	10	66.6667	1226.2
SW-3	15	14	93.3333	1166
SW-5	8	7	87.5	320
MW-10	1	0	0	3
MW-11	1	0	0	190
MW-12	1	0	0	350
MW-13	1	0	0	63
MW-15	1	0	0	42
MW-9	1	0	0	7.1
MW-14	1	0	0	32
MW-1	15	12	80	1192.4

Well	Mean	Std Dev	Dif From Bkg	Std Err	Rank Sum	Rank Mean
MW-3	89.2733	87.2155	-75.6433	58.6415	1136	75.7333
MW-4R	90.0933	99.4184	-74.8233	58.6415	1143	76.2
MW-5	384.333	383.367	219.417	58.6415	1914	127.6
MW-6	93.3533	83.4092	-71.5633	58.6415	1228	81.8667
MW-7	81.8	89.498	-83.1167	58.6415	1116	74.4
MW-8	81.7467	90.2743	-83.17	58.6415	1017	67.8
SW-3	77.7333	92.5723	-87.1833	58.6415	728	48.5333
SW-5	40	69.059	-124.917	69.1097	449	56.125
MW-10	3	0	-161.917	157.594	103	103
MW-11	190	0	25.0833	157.594	148	148
MW-12	350	0	185.083	157.594	155	155
MW-13	63	0	-101.917	157.594	136	136
MW-15	42	0	-122.917	157.594	132	132

MW-9	7.1	0	-157.817	157.594	108	108
MW-14	32	0	-132.917	157.594	129	129
MW-1	79.4933	91.6125	-85.4233	58.6415	875	58.3333

Analysis of Variance Statistics

SS Wells	1.35828e+006
SS Total	4.33859e+006

Kruskal-Wallis Statistics

Non-Detect Rank	44
Background Rank Sum	1118
Background Rank Mean	93.1667
H Statistic	111.085
H Adjusted for Ties	140.132

Basic Statistics
Parameter: Lead, total

Total Observations	147
Total Non-Detects	90
Pooled Mean	20.1139
Pooled Std Dev	33.8463
Background Mean	34.8333
Background Std Dev	26.7474

Background Wells
There is 1 background well

Well	Samples	Non-Detects	% ND	Total
MW-1A	12	4	33.3333	418

Well	Mean	Std Dev	Std Err	Rank Sum	Rank Mean
MW-1A	34.8333	26.7474	11.6345	1311	109.25

Compliance Wells
There are 16 compliance wells

Well	Samples	Non-Detects	% ND	Total
MW-3	15	8	53.3333	500
MW-4R	15	8	53.3333	244.5
MW-5	15	2	13.3333	929
MW-6	15	8	53.3333	163.2
MW-7	15	10	66.6667	122.4
MW-8	15	13	86.6667	114
SW-3	15	13	86.6667	106.2
SW-5	8	6	75	97.45
MW-10	1	1	100	5
MW-11	1	0	0	34
MW-12	1	0	0	95
MW-13	1	1	100	5
MW-15	1	1	100	5
MW-9	1	1	100	5
MW-14	1	1	100	5
MW-1	15	13	86.6667	108

Well	Mean	Std Dev	Dif From Bkg	Std Err	Rank Sum	Rank Mean
MW-3	33.3333	44.6473	-1.5	11.6345	1354	90.2667
MW-4R	16.3	24.2726	-18.5333	11.6345	1239	82.6
MW-5	61.9333	70.7455	27.1	11.6345	1965	131
MW-6	10.88	6.45769	-23.9533	11.6345	1239	82.6
MW-7	8.16	2.38711	-26.6733	11.6345	1024	68.2667
MW-8	7.6	2.84856	-27.2333	11.6345	821.5	54.7667
SW-3	7.08	2.48055	-27.7533	11.6345	803.5	53.5667
SW-5	12.1813	18.0085	-22.6521	13.7114	538	67.25
MW-10	5	0	-29.8333	31.2669	45.5	45.5
MW-11	34	0	-0.833333	31.2669	141	141
MW-12	95	0	60.1667	31.2669	154	154
MW-13	5	0	-29.8333	31.2669	45.5	45.5
MW-15	5	0	-29.8333	31.2669	45.5	45.5

MW-9	5	0	-29.8333	31.2669	45.5	45.5
MW-14	5	0	-29.8333	31.2669	45.5	45.5
MW-1	7.2	2.48424	-27.6333	11.6345	806.5	53.7667

Analysis of Variance Statistics

SS Wells	49939.9
SS Total	167254

Kruskal-Wallis Statistics

Non-Detect Rank	45.5
Background Rank Sum	1311
Background Rank Mean	109.25
H Statistic	118.037
H Adjusted for Ties	153.192

Basic Statistics
Parameter: Nickel, total

Total Observations	147
Total Non-Detects	74
Pooled Mean	127.795
Pooled Std Dev	239.389
Background Mean	105.583
Background Std Dev	72.0637

Background Wells
There is 1 background well

Well	Samples	Non-Detects	% ND	Total
MW-1A	12	5	41.6667	1267

Well	Mean	Std Dev	Std Err	Rank Sum	Rank Mean
MW-1A	105.583	72.0637	77.7632	1119.5	93.2917

Compliance Wells
There are 16 compliance wells

Well	Samples	Non-Detects	% ND	Total
MW-3	15	1	6.66667	4126
MW-4R	15	5	33.3333	1208
MW-5	15	2	13.3333	6827
MW-6	15	6	40	951
MW-7	15	12	80	670
MW-8	15	12	80	633
SW-3	15	13	86.6667	627.4
SW-5	8	7	87.5	400
MW-10	1	0	0	7.4
MW-11	1	0	0	380
MW-12	1	0	0	840
MW-13	1	0	0	52
MW-15	1	0	0	21
MW-9	1	0	0	84
MW-14	1	0	0	30
MW-1	15	11	73.3333	662

Well	Mean	Std Dev	Dif From Bkg	Std Err	Rank Sum	Rank Mean
MW-3	275.067	310.968	169.483	77.7632	1968.5	131.233
MW-4R	80.5333	134.714	-25.05	77.7632	1341.5	89.4333
MW-5	455.133	500.678	349.55	77.7632	1939	129.267
MW-6	63.4	40.3835	-42.1833	77.7632	1288	85.8667
MW-7	44.6667	22.4425	-60.9167	77.7632	755	50.3333
MW-8	42.2	24.7486	-63.3833	77.7632	726	48.4
SW-3	41.8267	25.298	-63.7567	77.7632	666.5	44.4333
SW-5	50	41.6619	-55.5833	91.6448	397.5	49.6875
MW-10	7.4	0	-98.1833	208.982	87	87
MW-11	380	0	274.417	208.982	150	150
MW-12	840	0	734.417	208.982	158	158
MW-13	52	0	-53.5833	208.982	115	115
MW-15	21	0	-84.5833	208.982	106	106

MW-9	84	0	-21.5833	208.982	124	124
MW-14	30	0	-75.5833	208.982	110	110
MW-1	44.1333	21.9768	-61.45	77.7632	806.5	53.7667

Analysis of Variance Statistics

SS Wells	3.126e+006
SS Total	8.36684e+006

Kruskal-Wallis Statistics

Non-Detect Rank	37.5
Background Rank Sum	1119.5
Background Rank Mean	93.2917
H Statistic	172.012
H Adjusted for Ties	197.16

Basic Statistics
Parameter: Selenium, total

Total Observations	147
Total Non-Detects	145
Pooled Mean	10.0238
Pooled Std Dev	6.86127
Background Mean	11.6667
Background Std Dev	7.48736

Background Wells
There is 1 background well

Well	Samples	Non-Detects	% ND	Total
MW-1A	12	12	100	140

Well	Mean	Std Dev	Std Err	Rank Sum	Rank Mean
MW-1A	11.6667	7.48736	2.75818	876	73

Compliance Wells
There are 16 compliance wells

Well	Samples	Non-Detects	% ND	Total
MW-3	15	15	100	155
MW-4R	15	14	93.3333	155.7
MW-5	15	15	100	155
MW-6	15	15	100	155
MW-7	15	15	100	155
MW-8	15	15	100	155
SW-3	15	15	100	155
SW-5	8	8	100	55
MW-10	1	1	100	5
MW-11	1	1	100	5
MW-12	1	1	100	5
MW-13	1	1	100	5
MW-15	1	1	100	5
MW-9	1	0	0	7.8
MW-14	1	1	100	5
MW-1	15	15	100	155

Well	Mean	Std Dev	Dif From Bkg	Std Err	Rank Sum	Rank Mean
MW-3	10.3333	7.18795	-1.33333	2.75818	1095	73
MW-4R	10.38	7.15304	-1.28667	2.75818	1182	78.8
MW-5	10.3333	7.18795	-1.33333	2.75818	1095	73
MW-6	10.3333	7.18795	-1.33333	2.75818	1095	73
MW-7	10.3333	7.18795	-1.33333	2.75818	1095	73
MW-8	10.3333	7.18795	-1.33333	2.75818	1095	73
SW-3	10.3333	7.18795	-1.33333	2.75818	1095	73
SW-5	6.875	5.3033	-4.79167	3.25054	584	73
MW-10	5	0	-6.66667	7.41238	73	73
MW-11	5	0	-6.66667	7.41238	73	73
MW-12	5	0	-6.66667	7.41238	73	73
MW-13	5	0	-6.66667	7.41238	73	73
MW-15	5	0	-6.66667	7.41238	73	73

MW-9	7.8	0	-3.86667	7.41238	161	161
MW-14	5	0	-6.66667	7.41238	73	73
MW-1	10.3333	7.18795	-1.33333	2.75818	1095	73

Analysis of Variance Statistics

SS Wells	280.048
SS Total	6873.25

Kruskal-Wallis Statistics

Non-Detect Rank	73
Background Rank Sum	876
Background Rank Mean	73
H Statistic	6.72344
H Adjusted for Ties	166.981

Basic Statistics
Parameter: Silver, total

Total Observations	147
Total Non-Detects	144
Pooled Mean	5.38571
Pooled Std Dev	3.70692
Background Mean	6.5
Background Std Dev	3.80191

Background Wells
There is 1 background well

Well	Samples	Non-Detects	% ND	Total
MW-1A	12	12	100	78

Well	Mean	Std Dev	Std Err	Rank Sum	Rank Mean
MW-1A	6.5	3.80191	1.47005	870	72.5

Compliance Wells
There are 16 compliance wells

Well	Samples	Non-Detects	% ND	Total
MW-3	15	15	100	84
MW-4R	15	14	93.3333	84.5
MW-5	15	14	93.3333	84
MW-6	15	14	93.3333	84.2
MW-7	15	15	100	84
MW-8	15	15	100	84
SW-3	15	15	100	84
SW-5	8	8	100	27
MW-10	1	1	100	2
MW-11	1	1	100	2
MW-12	1	1	100	2
MW-13	1	1	100	2
MW-15	1	1	100	2
MW-9	1	1	100	2
MW-14	1	1	100	2
MW-1	15	15	100	84

Well	Mean	Std Dev	Dif From Bkg	Std Err	Rank Sum	Rank Mean
MW-3	5.6	3.85079	-0.9	1.47005	1087.5	72.5
MW-4R	5.63333	3.81944	-0.866667	1.47005	1175	78.3333
MW-5	5.6	3.85079	-0.9	1.47005	1176	78.4
MW-6	5.61333	3.83776	-0.886667	1.47005	1174	78.2667
MW-7	5.6	3.85079	-0.9	1.47005	1087.5	72.5
MW-8	5.6	3.85079	-0.9	1.47005	1087.5	72.5
SW-3	5.6	3.85079	-0.9	1.47005	1087.5	72.5
SW-5	3.375	2.87539	-3.125	1.73247	580	72.5
MW-10	2	0	-4.5	3.95064	72.5	72.5
MW-11	2	0	-4.5	3.95064	72.5	72.5
MW-12	2	0	-4.5	3.95064	72.5	72.5
MW-13	2	0	-4.5	3.95064	72.5	72.5
MW-15	2	0	-4.5	3.95064	72.5	72.5

MW-9	2	0	-4.5	3.95064	72.5	72.5
MW-14	2	0	-4.5	3.95064	72.5	72.5
MW-1	5.6	3.85079	-0.9	1.47005	1087.5	72.5

Analysis of Variance Statistics

SS Wells	133.314
SS Total	2006.22

Kruskal-Wallis Statistics

Non-Detect Rank	72.5
Background Rank Sum	870
Background Rank Mean	72.5
H Statistic	4.02131
H Adjusted for Ties	67.0382

Basic Statistics
Parameter: Tin, total

Total Observations	37
Total Non-Detects	35
Pooled Mean	83.5432
Pooled Std Dev	175.3
Background Mean	75
Background Std Dev	108.513

Background Wells
There is 1 background well

Well	Samples	Non-Detects	% ND	Total
MW-1A	3	3	100	225

Well	Mean	Std Dev	Std Err	Rank Sum	Rank Mean
MW-1A	75	108.513	169.525	54	18

Compliance Wells
There are 16 compliance wells

Well	Samples	Non-Detects	% ND	Total
MW-3	3	3	100	225
MW-4R	3	3	100	225
MW-5	3	3	100	1025
MW-6	3	3	100	225
MW-7	3	3	100	225
MW-8	3	3	100	225
SW-3	3	3	100	225
SW-5	3	3	100	225
MW-10	1	0	0	5.1
MW-11	1	1	100	5
MW-12	1	1	100	5
MW-13	1	0	0	11
MW-15	1	1	100	5
MW-9	1	1	100	5
MW-14	1	1	100	5
MW-1	3	3	100	225

Well	Mean	Std Dev	Dif From Bkg	Std Err	Rank Sum	Rank Mean
MW-3	75	108.513	0	169.525	54	18
MW-4R	75	108.513	0	169.525	54	18
MW-5	341.667	570.183	266.667	169.525	54	18
MW-6	75	108.513	0	169.525	54	18
MW-7	75	108.513	0	169.525	54	18
MW-8	75	108.513	0	169.525	54	18
SW-3	75	108.513	0	169.525	54	18
SW-5	75	108.513	0	169.525	54	18
MW-10	5.1	0	-69.9	239.745	36	36
MW-11	5	0	-70	239.745	18	18
MW-12	5	0	-70	239.745	18	18
MW-13	11	0	-64	239.745	37	37
MW-15	5	0	-70	239.745	18	18

MW-9	5	0	-70	239.745	18	18
MW-14	5	0	-70	239.745	18	18
MW-1	75	108.513	0	169.525	54	18

Analysis of Variance Statistics

SS Wells	244115
SS Total	1.10628e+006

Kruskal-Wallis Statistics

Non-Detect Rank	18
Background Rank Sum	54
Background Rank Mean	18
H Statistic	5.53058
H Adjusted for Ties	36

Basic Statistics
Parameter: Vanadium

Total Observations	147
Total Non-Detects	71
Pooled Mean	93.6959
Pooled Std Dev	231.411
Background Mean	134.25
Background Std Dev	120.353

Background Wells
There is 1 background well

Well	Samples	Non-Detects	% ND	Total
MW-1A	12	4	33.3333	1611

Well	Mean	Std Dev	Std Err	Rank Sum	Rank Mean
MW-1A	134.25	120.353	73.9861	1237	103.083

Compliance Wells
There are 16 compliance wells

Well	Samples	Non-Detects	% ND	Total
MW-3	15	9	60	501
MW-4R	15	6	40	1009
MW-5	15	0	0	6904
MW-6	15	5	33.3333	636.8
MW-7	15	7	46.6667	448
MW-8	15	8	53.3333	414
SW-3	15	13	86.6667	321
SW-5	8	7	87.5	320
MW-10	1	1	100	5
MW-11	1	0	0	340
MW-12	1	0	0	830
MW-13	1	0	0	33
MW-15	1	0	0	37
MW-9	1	0	0	15
MW-14	1	0	0	18
MW-1	15	11	73.3333	330.5

Well	Mean	Std Dev	Dif From Bkg	Std Err	Rank Sum	Rank Mean
MW-3	33.4	27.9867	-100.85	73.9861	1012	67.4667
MW-4R	67.2667	147.158	-66.9833	73.9861	1297	86.4667
MW-5	460.267	546.435	326.017	73.9861	2188	145.867
MW-6	42.4533	38.1673	-91.7967	73.9861	1287	85.8
MW-7	29.8667	15.8829	-104.383	73.9861	1182	78.8
MW-8	27.6	20.3096	-106.65	73.9861	999	66.6
SW-3	21.4	17.9794	-112.85	73.9861	684	45.6
SW-5	40	85.7321	-94.25	87.1934	400	50
MW-10	5	0	-129.25	198.832	36	36
MW-11	340	0	205.75	198.832	152	152
MW-12	830	0	695.75	198.832	159	159
MW-13	33	0	-101.25	198.832	119	119
MW-15	37	0	-97.25	198.832	122	122

MW-9	15	0	-119.25	198.832	105	105
MW-14	18	0	-116.25	198.832	110	110
MW-1	22.0333	18.235	-112.217	73.9861	777	51.8

Analysis of Variance Statistics

SS Wells	3.07439e+006
SS Total	7.81847e+006

Kruskal-Wallis Statistics

Non-Detect Rank	36
Background Rank Sum	1237
Background Rank Mean	103.083
H Statistic	157.48
H Adjusted for Ties	177.474

Basic Statistics
Parameter: Zinc, total

Total Observations	147
Total Non-Detects	33
Pooled Mean	199.408
Pooled Std Dev	492.822
Background Mean	170.917
Background Std Dev	123.851

Background Wells
There is 1 background well

Well	Samples	Non-Detects	% ND	Total
MW-1A	12	1	8.33333	2051

Well	Mean	Std Dev	Std Err	Rank Sum	Rank Mean
MW-1A	170.917	123.851	147.097	1293	107.75

Compliance Wells
There are 16 compliance wells

Well	Samples	Non-Detects	% ND	Total
MW-3	15	6	40	886
MW-4R	15	1	6.66667	1777
MW-5	15	0	0	17106
MW-6	15	4	26.6667	1164
MW-7	15	2	13.3333	1021
MW-8	15	3	20	869
SW-3	15	8	53.3333	454
SW-5	8	4	50	1060
MW-10	1	0	0	24
MW-11	1	0	0	560
MW-12	1	0	0	1300
MW-13	1	0	0	74
MW-15	1	0	0	54
MW-9	1	0	0	27
MW-14	1	0	0	120
MW-1	15	4	26.6667	766

Well	Mean	Std Dev	Dif From Bk	Std Err	Rank Sum	Rank Mean
MW-3	59.0667	36.1356	-111.85	147.097	917	61.1333
MW-4R	118.467	184.141	-52.45	147.097	1415	94.3333
MW-5	1140.4	1125.12	969.483	147.097	2198	146.533
MW-6	77.6	50.3868	-93.3167	147.097	1160	77.3333
MW-7	68.0667	39.409	-102.85	147.097	1252	83.4667
MW-8	57.9333	37.2299	-112.983	147.097	1118	74.5333
SW-3	30.2667	20.0516	-140.65	147.097	584	38.9333
SW-5	132.5	197.206	-38.4167	173.356	514	64.25
MW-10	24	0	-146.917	395.312	56	56
MW-11	560	0	389.083	395.312	152	152
MW-12	1300	0	1129.08	395.312	155	155
MW-13	74	0	-96.9167	395.312	104	104
MW-15	54	0	-116.917	395.312	87	87

MW-9	27	0	-143.917	395.312	57	57
MW-14	120	0	-50.9167	395.312	123	123
MW-1	51.0667	31.306	-119.85	147.097	972	64.8

Analysis of Variance Statistics

SS Wells	1.6707e+007
SS Total	3.54596e+007

Kruskal-Wallis Statistics

Non-Detect Rank	17
Background Rank Sum	1293
Background Rank Mean	107.75
H Statistic	181.622
H Adjusted for Ties	183.698

Interwell Analyses for Metals

Poisson Tolerance Limit
Parameter: Antimony, total

Poisson Count of 12 background Samples = 190
Degrees of Freedom = 382

95% Confidence Values
Chi-Squared Value (95% Confidence) = 428.573
Lambda (from Zack's formula) = 17.8572
Smallest Degrees of Freedom = 52
Upper Tolerance Limit (95%) = 25

99% Confidence Values
Chi-Squared Value (99% Confidence) = 449.227
Lambda (from Zack's formula) = 18.7178
Smallest Degrees of Freedom = 60
Upper Tolerance Limit (99%) = 29

	Date	Result	Impacted 95%	Impacted 99%
MW-3	10/1/94	ND<10	FALSE	FALSE
	1/31/95	ND<30	TRUE	TRUE
	2/15/95	ND<30	TRUE	TRUE
	3/7/95	ND<30	TRUE	TRUE
	12/7/95	ND<30	TRUE	TRUE
	5/6/96	ND<30	TRUE	TRUE
	11/11/96	ND<5	FALSE	FALSE
	6/24/97	ND<5	FALSE	FALSE
	12/3/97	ND<5	FALSE	FALSE
	6/4/98	ND<5	FALSE	FALSE
	11/18/98	ND<5	FALSE	FALSE
	5/13/99	ND<5	FALSE	FALSE
	12/6/99	ND<5	FALSE	FALSE
	5/17/00	ND<5	FALSE	FALSE
	12/11/00	5	FALSE	FALSE
MW-4R	10/1/94	ND<10	FALSE	FALSE
	1/31/95	ND<30	TRUE	TRUE
	2/15/95	ND<30	TRUE	TRUE
	3/7/95	ND<30	TRUE	TRUE
	12/6/95	ND<30	TRUE	TRUE
	5/6/96	ND<30	TRUE	TRUE
	11/11/96	ND<5	FALSE	FALSE
	6/24/97	ND<5	FALSE	FALSE
	12/3/97	ND<5	FALSE	FALSE
	6/4/98	ND<5	FALSE	FALSE
	11/18/98	ND<5	FALSE	FALSE
	5/13/99	ND<5	FALSE	FALSE
	12/6/99	ND<5	FALSE	FALSE
	5/17/00	7.5	FALSE	FALSE
	12/11/00	5.9	FALSE	FALSE
MW-5	10/1/94	ND<10	FALSE	FALSE
	1/31/95	ND<30	TRUE	TRUE
	2/15/95	ND<30	TRUE	TRUE

	3/7/95	ND<30	TRUE	TRUE
	12/7/95	ND<30	TRUE	TRUE
	5/6/96	ND<30	TRUE	TRUE
	11/11/96	ND<5	FALSE	FALSE
	6/24/97	ND<5	FALSE	FALSE
	12/3/97	ND<5	FALSE	FALSE
	6/4/98	ND<5	FALSE	FALSE
	11/18/98	ND<5	FALSE	FALSE
	5/13/99	ND<5	FALSE	FALSE
	12/6/99	ND<5	FALSE	FALSE
	5/17/00	ND<5	FALSE	FALSE
	12/11/00	5.7	FALSE	FALSE
SW-5	12/7/95	ND<30	TRUE	TRUE
	6/24/97	ND<5	FALSE	FALSE
	12/3/97	ND<5	FALSE	FALSE
	6/4/98	ND<5	FALSE	FALSE
	11/18/98	ND<5	FALSE	FALSE
	5/13/99	ND<5	FALSE	FALSE
	5/17/00	ND<5	FALSE	FALSE
	12/12/00	5.6	FALSE	FALSE
MW-13	12/11/00	5.3	FALSE	FALSE

Poisson Tolerance Limit
Parameter: Arsenic, total

Poisson Count of 12 background Samples = 116
Degrees of Freedom = 234

95% Confidence Values
Chi-Squared Value (95% Confidence) = 270.684
Lambda (from Zack's formula) = 11.2785
Smallest Degrees of Freedom = 36
Upper Tolerance Limit (95%) = 17

99% Confidence Values
Chi-Squared Value (99% Confidence) = 287.247
Lambda (from Zack's formula) = 11.9686
Smallest Degrees of Freedom = 43
Upper Tolerance Limit (99%) = 20.5

	Date	Result	Impacted 95%	Impacted 99%
SW-5	12/7/95	ND<10	FALSE	FALSE
	6/24/97	ND<5	FALSE	FALSE
	12/3/97	ND<5	FALSE	FALSE
	6/4/98	ND<5	FALSE	FALSE
	11/18/98	ND<5	FALSE	FALSE
	5/13/99	ND<5	FALSE	FALSE
	5/17/00	ND<5	FALSE	FALSE
	12/12/00	31	TRUE	TRUE

Shapiro-Wilks Test of Normality

Parameter: Barium, total

Background Wells

Normality Test of Parameter Concentrations

K = 6; Samples = 12

i	x(i)	x(n-i+1)	x(n-1+1)-x(i)	a(n-i+1)	b(i)
1	29	1000	971	0.5475	531.622
2	250	960	710	0.3325	236.075
3	250	830	580	0.2347	136.126
4	250	807	557	0.1586	88.3402
5	270	720	450	0.0922	41.49
6	290	678	388	0.0303	11.7564
7	678	290	-388		
8	720	270	-450		
9	807	250	-557		
10	830	250	-580		
11	960	250	-710		
12	1000	29	-971		

Sum of b values = 1045.41
Sample Standard Deviation = 336.003
W Statistic = 0.880024
5% Critical value of 0.859 is less than 0.880024
Data is normally distributed at 95% level of significance
1% Critical value of 0.805 is less than 0.880024
Data is normally distributed at 99% level of significance

Parametric Tolerance Interval Analysis

Parameter: Barium, total

Background mean = 527.833
Background standard deviation = 336.003
One-sided normal tolerance factor at 95% confidence = 2.736
Tolerance factor calculation follows USEPA 1989 Guidance
Upper tolerance limit = 1447.14

Well	Date	Result	Impacted
SW-5	12/7/95	ND<250	FALSE
	6/24/97	40	FALSE
	12/3/97	43	FALSE
	6/4/98	38	FALSE
	11/18/98	33	FALSE
	5/13/99	42	FALSE
	5/17/00	56	FALSE
	12/12/00	1100	FALSE
MW-12	12/11/00	5300	TRUE

Non-Parametric Tolerance Interval

Parameter: Beryllium, total

Total Percent Non-Detects = 40.5405%
Background Samples (n) = 12
Maximum Background Concentration = 12.5
Minimum Coverage = 77.9%
Average Coverage = 92.3077%

Well	Sample	Result	Impacted
SW-5	12/7/95	ND<1	FALSE
SW-5	6/24/97	ND<0.5	FALSE
SW-5	12/3/97	ND<0.5	FALSE
SW-5	6/4/98	ND<0.5	FALSE
SW-5	11/18/98	ND<0.5	FALSE
SW-5	5/13/99	ND<0.5	FALSE
SW-5	5/17/00	ND<0.5	FALSE
SW-5	12/12/00	10	FALSE
MW-12	12/11/00	45	TRUE
MW-11	12/11/00	11	FALSE
MW-5	10/1/94	80	TRUE
MW-5	1/31/95	19	TRUE
MW-5	2/15/95	16	TRUE
MW-5	3/7/95	16	TRUE
MW-5	12/7/95	5	FALSE
MW-5	5/6/96	4	FALSE
MW-5	11/11/96	9	FALSE
MW-5	6/24/97	2	FALSE
MW-5	12/3/97	16	TRUE
MW-5	6/4/98	13	TRUE
MW-5	11/18/98	78	TRUE
MW-5	5/13/99	6	FALSE
MW-5	12/6/99	ND<0.5	FALSE
MW-5	5/17/00	6.6	FALSE
MW-5	12/11/00	7.6	FALSE

Shapiro-Wilks Test of Normality

Parameter: Chromium, total

Background Wells

Normality Test of Parameter Concentrations

K = 6; Samples = 12

i	x(i)	x(n-i+1)	x(n-1+1)-x(i)	a(n-i+1)	b(i)
1	0	6.01616	6.01616	0.5475	3.29385
2	1.09861	5.99146	4.89285	0.3325	1.62687
3	3.04452	5.82895	2.78442	0.2347	0.653504
4	3.21888	5.20401	1.98513	0.1586	0.314842
5	3.49651	4.78749	1.29098	0.0922	0.119029
6	4.30407	4.40672	0.102654	0.0303	0.00311042
7	4.40672	4.30407	-0.102654		
8	4.78749	3.49651	-1.29098		
9	5.20401	3.21888	-1.98513		
10	5.82895	3.04452	-2.78442		
11	5.99146	1.09861	-4.89285		
12	6.01616	0	-6.01616		

Sum of b values = 6.0112
Sample Standard Deviation = 1.90377
W Statistic = 0.906358
5% Critical value of 0.859 is less than 0.906358
Data is normally distributed at 95% level of significance
1% Critical value of 0.805 is less than 0.906358
Data is normally distributed at 99% level of significance

Parametric Tolerance Interval Analysis

Parameter: Chromium, total

Background mean = 3.94978
Background standard deviation = 1.90377
One-sided normal tolerance factor at 95% confidence = 2.736
Tolerance factor calculation follows USEPA 1989 Guidance
Upper tolerance limit = 9.15851

Well	Date	Result	Impacted
SW-5	12/7/95	ND<1.60944	FALSE
	6/24/97	ND<0	FALSE
	12/3/97	ND<0	FALSE
	6/4/98	ND<0	FALSE
	11/18/98	ND<-1.09362	FALSE
	5/13/99	ND<0	FALSE
	5/17/00	ND<0	FALSE
	12/12/00	6.15273	FALSE
MW-12	12/11/00	6.90776	FALSE
MW-11	12/11/00	6.49224	FALSE

Shapiro-Wilks Test of Normality

Parameter: Copper, total

Background Wells

Normality Test of Parameter Concentrations

K = 6; Samples = 12

i	x(i)	x(n-i+1)	x(n-1+1)-x(i)	a(n-i+1)	b(i)
1	5	260	255	0.5475	139.612
2	11	260	249	0.3325	82.7925
3	68	210	142	0.2347	33.3274
4	100	160	60	0.1586	9.516
5	100	100	0	0.0922	0
6	100	100	0	0.0303	0
7	100	100	0		
8	100	100	0		
9	160	100	-60		
10	210	68	-142		
11	260	11	-249		
12	260	5	-255		

Sum of b values = 265.248
Sample Standard Deviation = 84.5381
W Statistic = 0.894968
5% Critical value of 0.859 is less than 0.894968
Data is normally distributed at 95% level of significance
1% Critical value of 0.805 is less than 0.894968
Data is normally distributed at 99% level of significance

Parametric Tolerance Interval Analysis

Parameter: Copper, total

Background mean = 122.833
Background standard deviation = 84.5381
One-sided normal tolerance factor at 95% confidence = 2.736
Tolerance factor calculation follows USEPA 1989 Guidance
Upper tolerance limit = 354.13

Well	Date	Result	Impacted
MW-12	12/11/00	350	FALSE

Shapiro-Wilks Test of Normality

Parameter: Lead, total

Background Wells

Normality Test of Parameter Concentrations

K = 6; Samples = 12

i	x(i)	x(n-i+1)	x(n-1+1)-x(i)	a(n-i+1)	b(i)
1	5	75	70	0.5475	38.325
2	7	70	63	0.3325	20.9475
3	10	58	48	0.2347	11.2656
4	10	58	48	0.1586	7.6128
5	10	53	43	0.0922	3.9646
6	25	37	12	0.0303	0.3636
7	37	25	-12		
8	53	10	-43		
9	58	10	-48		
10	58	10	-48		
11	70	7	-63		
12	75	5	-70		

Sum of b values = 82.4791
Sample Standard Deviation = 26.7474
W Statistic = 0.864433
5% Critical value of 0.859 is less than 0.864433
Data is normally distributed at 95% level of significance
1% Critical value of 0.805 is less than 0.864433
Data is normally distributed at 99% level of significance

Parametric Tolerance Interval Analysis

Parameter: Lead, total

Background mean = 26.9
Background standard deviation = 36.8654
One-sided normal tolerance factor at 95% confidence = 2.736
Tolerance factor calculation follows USEPA 1989 Guidance
Upper tolerance limit = 127.764

Well	Date	Result	Impacted
MW-12	12/11/00	95	FALSE

Non-Parametric Tolerance Interval

Parameter: Nickel, total

Total Percent Non-Detects = 35.7143%
Background Samples (n) = 12
Maximum Background Concentration = 260
Minimum Coverage = 77.9%
Average Coverage = 92.3077%

Well	Sample	Result	Impacted
MW-12	12/11/00	840	TRUE
MW-11	12/11/00	380	TRUE

Poisson Tolerance Limit
Parameter: Selenium, total

Poisson Count of 12 background Samples = 140
Degrees of Freedom = 282

95% Confidence Values
Chi-Squared Value (95% Confidence) = 322.167
Lambda (from Zack's formula) = 13.4236
Smallest Degrees of Freedom = 41
Upper Tolerance Limit (95%) = 19.5

99% Confidence Values
Chi-Squared Value (99% Confidence) = 340.17
Lambda (from Zack's formula) = 14.1738
Smallest Degrees of Freedom = 49
Upper Tolerance Limit (99%) = 23.5

	Date	Result	Impacted 95%	Impacted 99%
MW-9	12/11/00	7.8	FALSE	FALSE
MW-4R	10/1/94	ND<10	FALSE	FALSE
	1/31/95	ND<20	TRUE	FALSE
	2/15/95	ND<20	TRUE	FALSE
	3/7/95	ND<20	TRUE	FALSE
	12/6/95	ND<20	TRUE	FALSE
	5/6/96	ND<20	TRUE	FALSE
	11/11/96	ND<5	FALSE	FALSE
	6/24/97	ND<5	FALSE	FALSE
	12/3/97	ND<5	FALSE	FALSE
	6/4/98	ND<5	FALSE	FALSE
	11/18/98	ND<5	FALSE	FALSE
	5/13/99	ND<5	FALSE	FALSE
	12/6/99	ND<5	FALSE	FALSE
	5/17/00	ND<5	FALSE	FALSE
	12/11/00	5.7	FALSE	FALSE

Poisson Tolerance Limit

Parameter: Silver, total

Poisson Count of 12 background Samples = 78
Degrees of Freedom = 158

95% Confidence Values

Chi-Squared Value (95% Confidence) = 188.332
Lambda (from Zack's formula) = 7.84715
Smallest Degrees of Freedom = 27
Upper Tolerance Limit (95%) = 12.5

99% Confidence Values

Chi-Squared Value (99% Confidence) = 202.269
Lambda (from Zack's formula) = 8.42788
Smallest Degrees of Freedom = 33
Upper Tolerance Limit (99%) = 15.5

	Date	Result	Impacted 95%	Impacted 99%
MW-6	10/1/94	ND<10	FALSE	FALSE
	1/31/95	ND<10	FALSE	FALSE
	2/15/95	ND<10	FALSE	FALSE
	3/7/95	ND<10	FALSE	FALSE
	12/6/95	ND<10	FALSE	FALSE
	5/6/96	ND<10	FALSE	FALSE
	11/11/96	ND<5	FALSE	FALSE
	6/24/97	ND<5	FALSE	FALSE
	12/3/97	ND<2	FALSE	FALSE
	6/4/98	ND<2	FALSE	FALSE
	11/18/98	ND<2	FALSE	FALSE
	5/13/99	ND<2	FALSE	FALSE
	12/6/99	ND<2	FALSE	FALSE
	5/17/00	ND<2	FALSE	FALSE
	12/11/00	2.2	FALSE	FALSE

Shapiro-Wilks Test of Normality

Parameter: Vanadium

Background Wells

Normality Test of Parameter Concentrations

K = 6; Samples = 12

i	x(i)	x(n-i+1)	x(n-1+1)-x(i)	a(n-i+1)	b(i)
1	2.5	330	327.5	0.5475	179.306
2	6	320	314	0.3325	104.405
3	20	270	250	0.2347	58.675
4	20	200	180	0.1586	28.548
5	20	165	145	0.0922	13.369
6	85	110	25	0.0303	0.7575
7	110	85	-25		
8	165	20	-145		
9	200	20	-180		
10	270	20	-250		
11	320	6	-314		
12	330	2.5	-327.5		

Sum of b values = 385.061
Sample Standard Deviation = 125.108
W Statistic = 0.861188
5% Critical value of 0.859 is less than 0.861188
Data is normally distributed at 95% level of significance
1% Critical value of 0.805 is less than 0.861188
Data is normally distributed at 99% level of significance

Parametric Tolerance Interval Analysis

Parameter: Vanadium

Background mean = 129.042
Background standard deviation = 125.108
One-sided normal tolerance factor at 95% confidence = 2.736
Tolerance factor calculation follows USEPA 1989 Guidance
Upper tolerance limit = 471.336

Well	Date	Result	Impacted
MW-12	12/11/00	830	TRUE
MW-11	12/11/00	340	FALSE

Non-Parametric Tolerance Interval

Parameter: Zinc, total

Total Percent Non-Detects = 13.5135%
Background Samples (n) = 12
Maximum Background Concentration = 320
Minimum Coverage = 77.9%
Average Coverage = 92.3077%

Well	Sample	Result	Impacted
MW-12	12/11/00	1300	TRUE
MW-11	12/11/00	560	TRUE
MW-5	10/1/94	3910	TRUE
MW-5	1/31/95	2480	TRUE
MW-5	2/15/95	1650	TRUE
MW-5	3/7/95	2190	TRUE
MW-5	12/7/95	510	TRUE
MW-5	5/6/96	363	FALSE
MW-5	11/11/96	230	FALSE
MW-5	6/24/97	170	TRUE
MW-5	12/3/97	860	TRUE
MW-5	6/4/98	1500	TRUE
MW-5	11/18/98	2100	TRUE
MW-5	5/13/99	350	FALSE
MW-5	12/6/99	53	TRUE
MW-5	5/17/00	350	TRUE
MW-5	12/11/00	390	TRUE
SW-5	12/7/95	ND<25	FALSE
SW-5	6/24/97	61	FALSE
SW-5	12/3/97	430	TRUE
SW-5	6/4/98	19	FALSE
SW-5	11/18/98	ND<5	FALSE
SW-5	5/13/99	ND<5	FALSE
SW-5	5/17/00	ND<5	FALSE
SW-5	12/12/00	470	TRUE