stats only

96-01-MSWLF
2-8-01

OPERATION/CONSTRUCTION MANAGERS

**Municipal Services**

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CIVIL/SANITARY ENGINEERS

**Engineering Company, P.A.**

PO Box 349, Boone, North Carolina 28607 (828) 262-1767

July 26, 2001

Fac/Perm/Co ID# 96-01 Date 7/19/12 Doc ID# DIN

Carson Johnson

JUL 2001 Received Solid Waste Section

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

Re: Groundwater Sampling and Statistical Analysis
Wayne County Closed Sanitary Landfill (Dudley)
MESCO Project No. G01016.0

Dear Mr. Rose:

Municipal Engineering Services Company, P.A. (MESCO) completed the statistical analyses for the Wayne County Closed Sanitary Landfill located in Dudley, North Carolina. The purpose of these analyses is to determine, in comparison to background levels, statistical significance of constituents detected during the February-2001 sampling event.

## Statistical Analysis Methodology

### Metals

The only metal detected at the entire site during the February 8, 2001 sampling event was mercury. Therefore an inter-well statistical analysis was only conducted upon the appendix II metal. Monitoring well MW-1 was defined as the background well, and an upper tolerance limit (UTL) with 95% coverage was computed for the detected constituent from the background data at a 95% confidence level. For mercury, 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.

Mercury was tested for statistical significance by interwell analyses by the Poisson tolerance limit method because the %ND was greater than 90%.

**VOCs**

All historical Appendix I VOC detections in the background well MW-1 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 VOCs that had been found to be 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 determine its baseline levels. Baseline levels in this context are defined as the background level derived from the data in a given downgradient well.

## Results

Interwell analysis was only performed on the detected Appendix II metal mercury. 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). Mercury's concentration fell below the upper Poisson tolerance limit therefore; concentrations of mercury in MW-8 have not significantly increased over the background. An intra-well analysis conducted upon mercury in MW-8 through generation of a Shewhart-CUSUM control chart also showed no statistically significant increase over it's own background levels.

Concentration vs. Time graphs for metals were formulated and examined in an effort to determine if trends exist in the original laboratory data. Interestingly the lack of metal detections during this winter's (Feb.2001) sampling event mirror's last winters (Feb. 2000). Therefore an apparent seasonal trend may be in development and future data will prove useful in the determination of any such trend. The spike of concentrations of metals such as vanadium and chromium, which were believed to be outliers during the last statistical analysis, fell to below detection levels during this sampling event. The very inconsistent metal detections make it unlikely that the closed landfill has contributed inorganic compounds to the downgradient groundwater.

All wells that showed Appendix I VOC detections exceeded the expected number of VOC detections determined from the background data, indicating the possible presence of contamination in those wells at a 95% confidence level. The herbicide 2,4-D Acid was detected within MW-4 at a concentration well below the Maximum Contaminant Level (MCL). However, due to methodology constraints and lack of sufficient Appendix II background well (MW-1) data MW-4 cannot be definitively considered statistically impacted at this time. In an effort to eliminate the spatial variation that often confounds upgradient versus downgradient comparisons an Intra-well analysis was conducted upon the wells with VOC detections. The enclosed Shewhart-CUSUM charts illustrate no statistical significance against their own background levels. However, the statistical insignificance may not

necessarily suggest no occurrence of contamination resulted from the closed landfill. Intra-well comparison is based on the assumption that the site had no previous contamination prior to the inception of the monitoring. The background laboratory results beginning with September of 1994 illustrate that previous contamination does exist; therefore we can only confidently ascertain that a significant increase of VOCs didn't occur during this sampling event.

Time series plots for MW-2, MW-6, and MW-8 show consistent historical detections of the VOC chlorobenzene at concentrations below the MCL. The relative locations of these 3 impacted wells make it unlikely that a single external source of chlorobenzene contributed to the possible release. Chlorobenzenes are used mainly as intermediates in the synthesis of pesticides and other chemicals. The moderately persistent low soluble compound is released into the environment through the dispersive nature of their uses and to a much lower degree waste disposal. Although a Mann-Kendall trend analysis determined that no trend in chlorobenzene concentrations over time is evident within MW-2, MW-6, and MW-8 a decreasing trend is expected within MW-2 since a the cohesive cap was completed in May 1999. Furthermore through natural attenuation and chlorobenzenes propensity to evaporate from surface waters any amount migrating to the nearby streams would rapidly be reduced and negate any potential human or environmental exposure.

The Appendix II insecticides dieldrin and endosulfan II were detected within MW-2 and MW-8 respectively for the first time since the implementation of the assessment-monitoring program. The concentration of these VOCs is very slightly over the detection limit and future samples will dictate weather they are of an anomalous nature.

## Conclusion

Mercury was the only metal detected during this sampling event. Although mercury was found in MW-8 slightly above the MCL it was found to not be statistically significant by inter and intrawell analysis. An apparent seasonal trend continues which could partially explain the increased concentrations of metals found during the summer sampling events. VOCs were detected within MW-2, MW-6 and MW-8 in concentrations above the background established by upgradient MW-1 but were found not to be above their own historical background levels. Overall, the observed levels of VOCs are still significantly higher than the background levels in MW-1. This coupled with the fact that the particular detections are chlorinated compounds, which are commonly found in groundwater sampled from contaminated municipal solid waste sites, suggests that an impact from the closed landfill is still present. However, a close examination of the time-series plots for historically detected VOCs suggests that the levels of VOCs are not increasing. This is also reflected by the fact that no intra-well analyses showed significant increase of VOC levels. Since the landfill has ceased operation, levels of VOCs are expected to decrease. Monitoring well MW-7 located at the SW corner of the capped closed landfill has historically never had a single VOC detection; therefore MESCO suggests the suspension of Appendix II sampling of MW-7 (see enclosed chart). In accordance with 15A NCAC 13B .1634 (b), this well will continue to be sampled semi-annually for the Appendix I list. The remaining wells in the monitoring plan will continue the program of semi-annual assessment monitoring. The Wayne County Closed Landfill is scheduled to be sampled again in August 2001 by Environment I of Greenville, NC. The results report and 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. Lloyd Cook
Wayne County

**Exceedance Scan**
**Wayne County Closed Landfill (Dudley)**

| Well ID | Parameter Name [1] | Sample Date | Result | Unit | PQL [2] | MCL [3] | Exceedance |
|---|---|---|---|---|---|---|---|
| MW-2 | Chlorobenzene | 2/8/01 | 30.00 | ug/l | 5 | 50 | |
| MW-2 | Dieldrin | 2/8/01 | 0.12 | ug/l | 0.1 | - | |
| MW-4 | 2,4-D Acid | 2/8/01 | 4.00 | ug/l | 2 | 70 | |
| MW-6 | Chlorobenzene | 2/8/01 | 12.00 | ug/l | 5 | 50 | |
| MW-6 | Xylene | 2/8/01 | 48.00 | ug/l | 5 | 530 | |
| **MW-8** | **Mercury** | **2/8/01** | **0.0012** | **mg/l** | **0.0005** | **0.0011** | **0.0001** |
| MW-8 | Chlorobenzene | 2/8/01 | 13.00 | ug/l | 5 | 50 | |
| MW-8 | Endosulfan II | 2/8/01 | 0.21 | ug/l | 0.1 | - | |

[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**
**Wayne County Closed Sanitary Landfill (Dudley)**

**Background Well: MW-1**

**Mercury, total**

| %ND | Normality | Method | ND Adj. | Upper Limit (a = 95%) | Unit |
|---|---|---|---|---|---|
| 100 | - | Poisson tolerance interval | ND | 1.5 | ug/l |

| Well | Result | Significance |
|---|---|---|
| **MW-8** | 1.2 | no |

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

**Summary of Pooled VOCs in Background Well (MW-1)**
**Wayne County Closed Sanitary Landfill (Dudley)**

| Constituent | Samples | NDs | % NDs |
|---|---|---|---|
| 1,1,1,2-Tetrachloroethane | 16 | 16 | 100.00 |
| 1,1,1-Trichloroethane | 16 | 16 | 100.00 |
| 1,1,2,2-Tetrachloroethane | 16 | 16 | 100.00 |
| 1,1,2-Trichloroethane | 16 | 16 | 100.00 |
| 1,1-Dichloroethane | 16 | 16 | 100.00 |
| 1,1-Dichloroethene | 16 | 16 | 100.00 |
| 1,2,3-Trichloropropane | 16 | 16 | 100.00 |
| 1,2-Dibromo-3-chloropropane | 16 | 16 | 100.00 |
| 1,2-Dibromoethane | 16 | 16 | 100.00 |
| 1,2-Dichlorobenzene | 16 | 16 | 100.00 |
| 1,2-Dichloroethane | 16 | 16 | 100.00 |
| 1,2-Dichloropropane | 16 | 16 | 100.00 |
| 1,4-Dichlorobenzene | 16 | 16 | 100.00 |
| 2-Butanone | 16 | 16 | 100.00 |
| 2-Hexanone | 16 | 16 | 100.00 |
| 4-Methyl-2-Pentanone | 16 | 16 | 100.00 |
| Acetone | 16 | 16 | 100.00 |
| Acrylonitrile | 16 | 16 | 100.00 |
| Benzene | 16 | 16 | 100.00 |
| Bromochloromethane | 16 | 16 | 100.00 |
| Bromodichloromethane | 16 | 16 | 100.00 |
| Bromoform | 16 | 16 | 100.00 |
| Bromomethane | 16 | 16 | 100.00 |
| Carbon disulfide | 16 | 16 | 100.00 |
| Carbon tetrachloride | 16 | 16 | 100.00 |
| Chlorobenzene | 16 | 16 | 100.00 |
| Chloroethane | 16 | 16 | 100.00 |
| Chloroform | 16 | 16 | 100.00 |
| Chloromethane | 16 | 16 | 100.00 |
| cis-1,2-Dichloroethene | 16 | 16 | 100.00 |
| cis-1,3-Dichloropropene | 16 | 16 | 100.00 |
| Chlorodibromomethane | 16 | 16 | 100.00 |
| Dibromomethane | 16 | 16 | 100.00 |
| Ethylbenzene | 16 | 16 | 100.00 |
| Iodomethane | 16 | 16 | 100.00 |
| Dichloromethane | 16 | 16 | 100.00 |
| Styrene | 16 | 16 | 100.00 |
| Tetrachloroethylene | 16 | 16 | 100.00 |
| Toluene | 16 | 16 | 100.00 |
| trans-1,2-Dichloroethene | 16 | 16 | 100.00 |
| trans-1,3-Dichloropropene | 16 | 16 | 100.00 |
| trans-1,4-Dichloro-2-butene | 16 | 16 | 100.00 |
| Trichloroethylene | 16 | 16 | 100.00 |
| Trichlorofluoromethane | 16 | 16 | 100.00 |
| Vinyl acetate | 16 | 16 | 100.00 |
| Vinyl chloride | 16 | 16 | 100.00 |
| Xylene | 16 | 16 | 100.00 |
| **Total** | **752** | **752** | **100.00** |

**Intra-Well Analysis Summary (VOCs & Metals)**
**Wayne County Closed Sanitary Landfill (Dudley)**

| Well | Mercury | Chlorobenzene | Xylene |
|---|---|---|---|
| MW-2 | | no | |
| MW-6 | | no | no |
| MW-8 | no | no | |

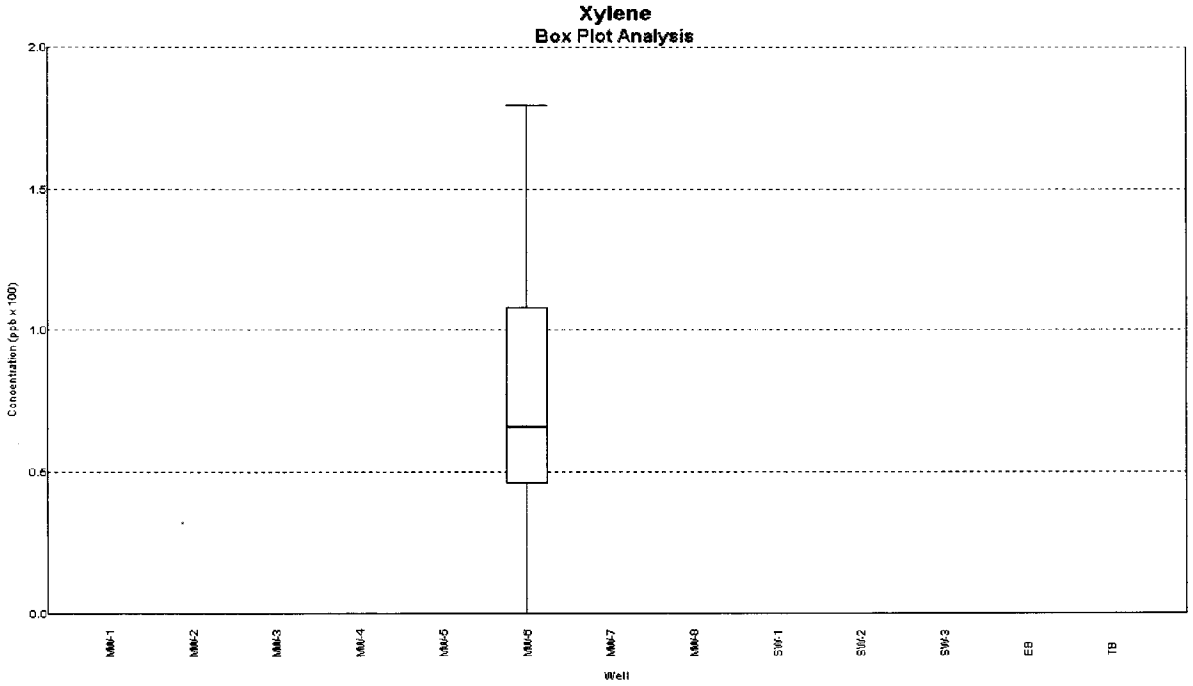
EXPLANATION

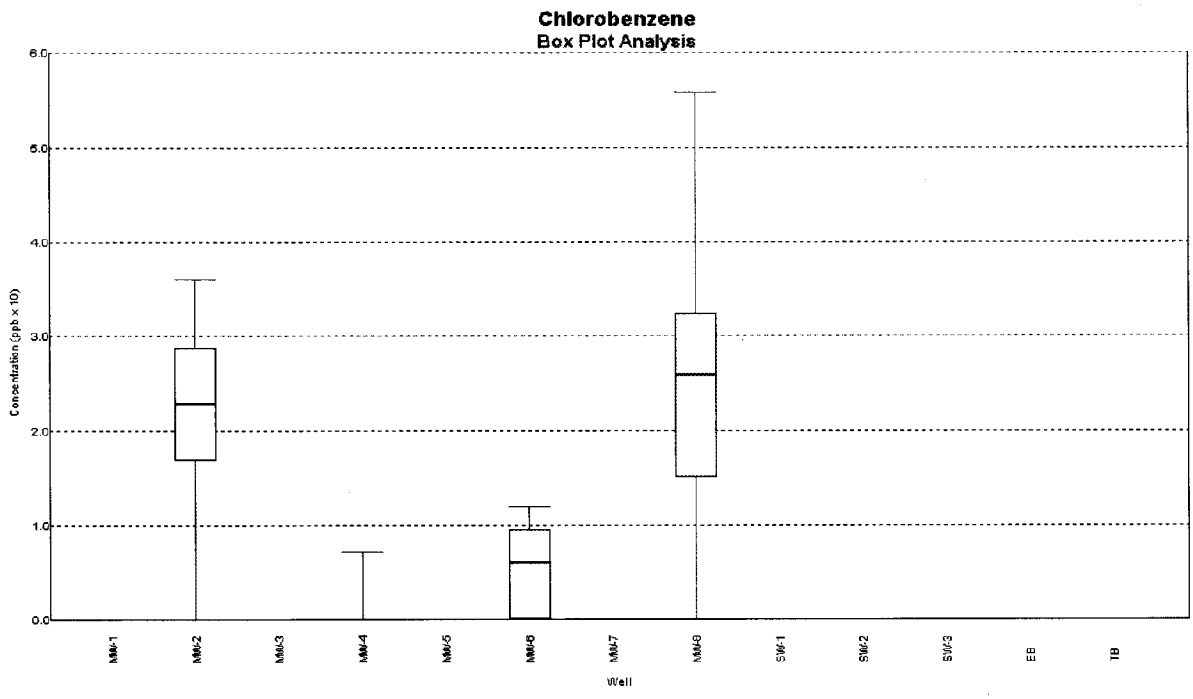
yes=detection statistically significant by intrawell analysis

no=detection not statistically significant by intrawell analysis

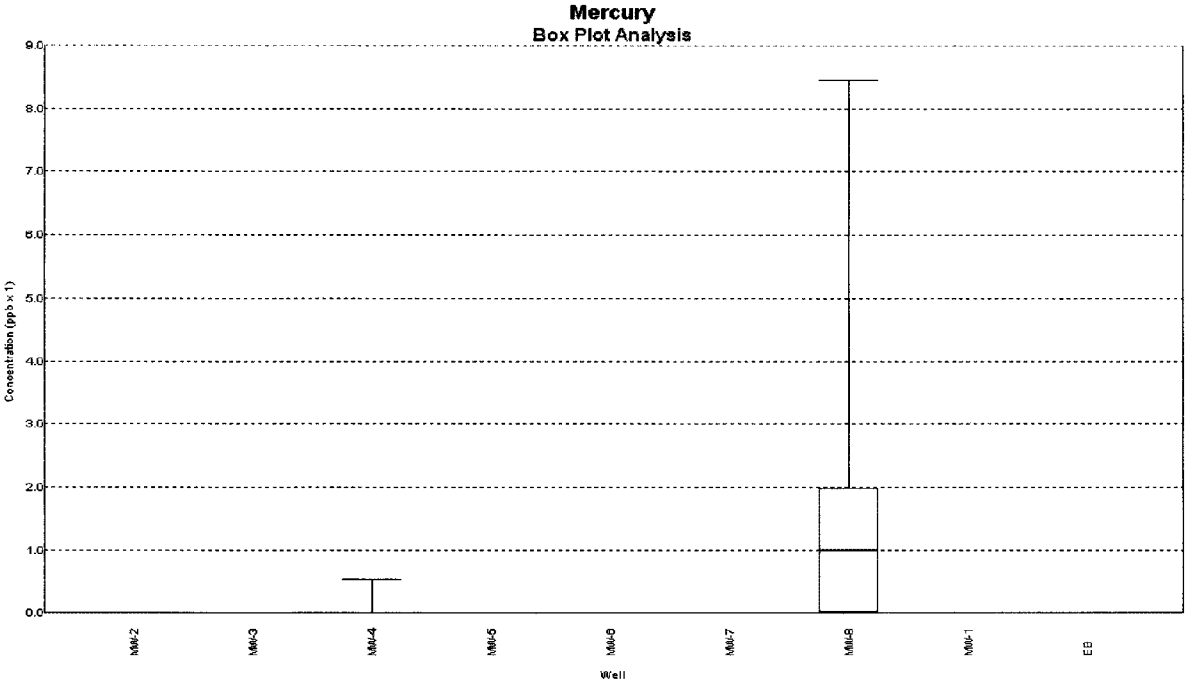
**No constituent has statistically increased by Shewart-CUSUM Control chart.**

**Box Plots for Select Constituents**
**Wayne County Closed Sanitary Landfill (Dudley)**

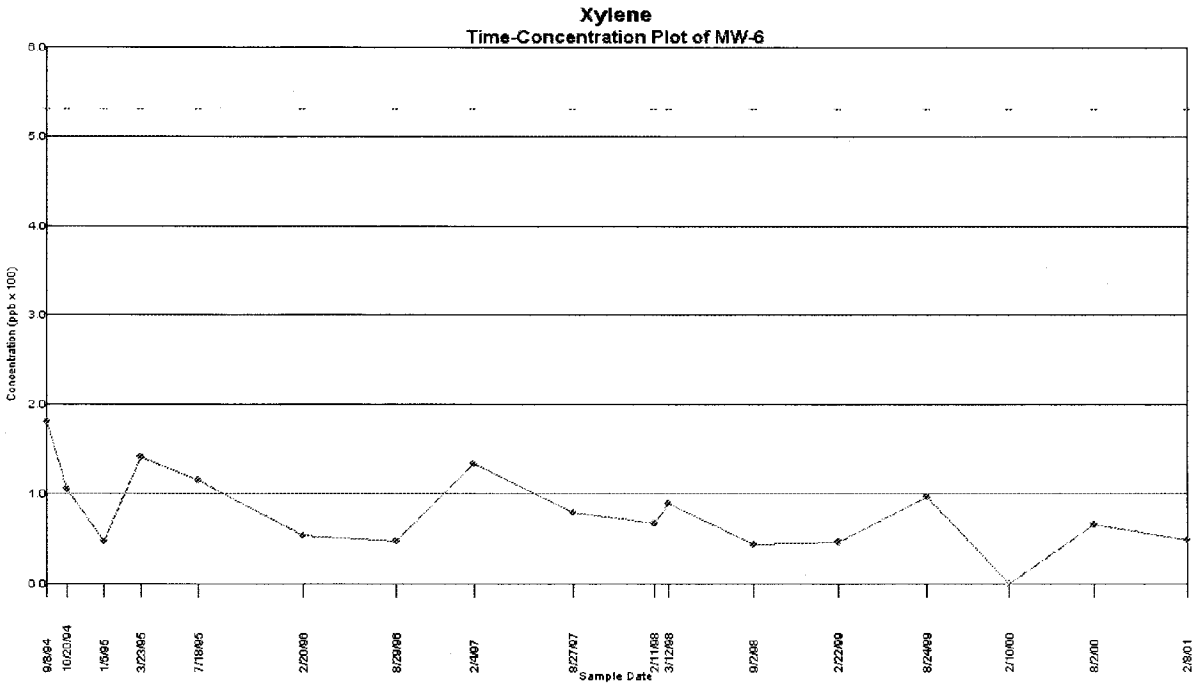


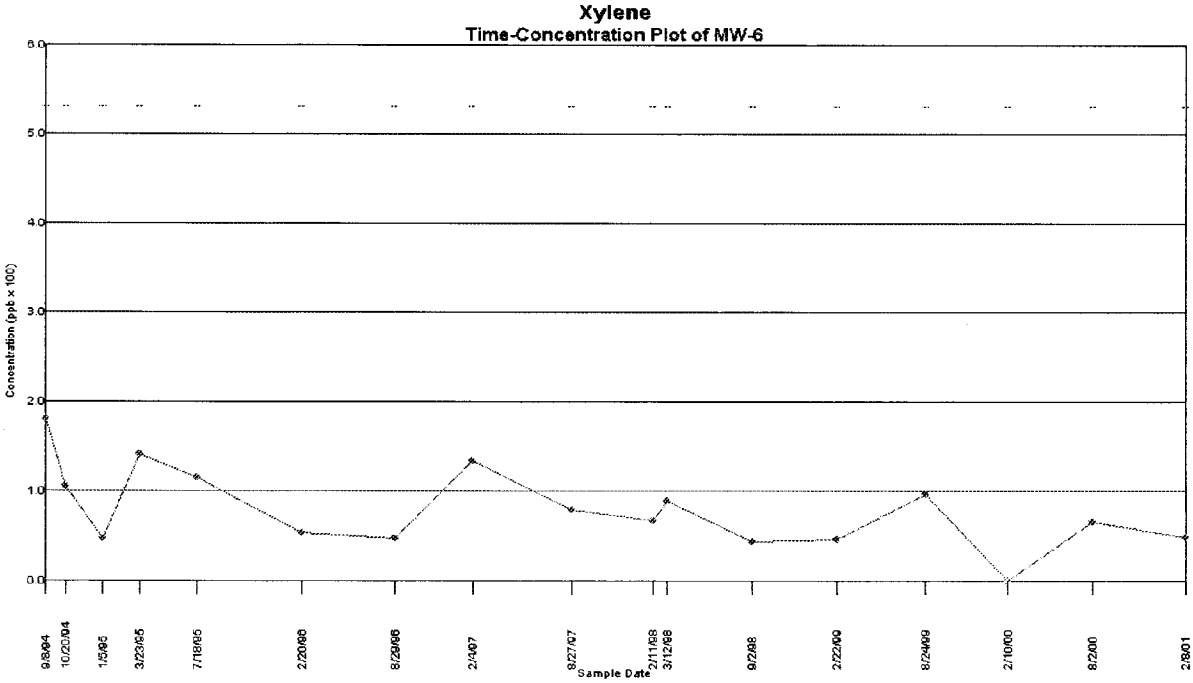
**Box Plots for Select Constituents**
**Wayne County Closed Sanitary Landfill (Dudley)**



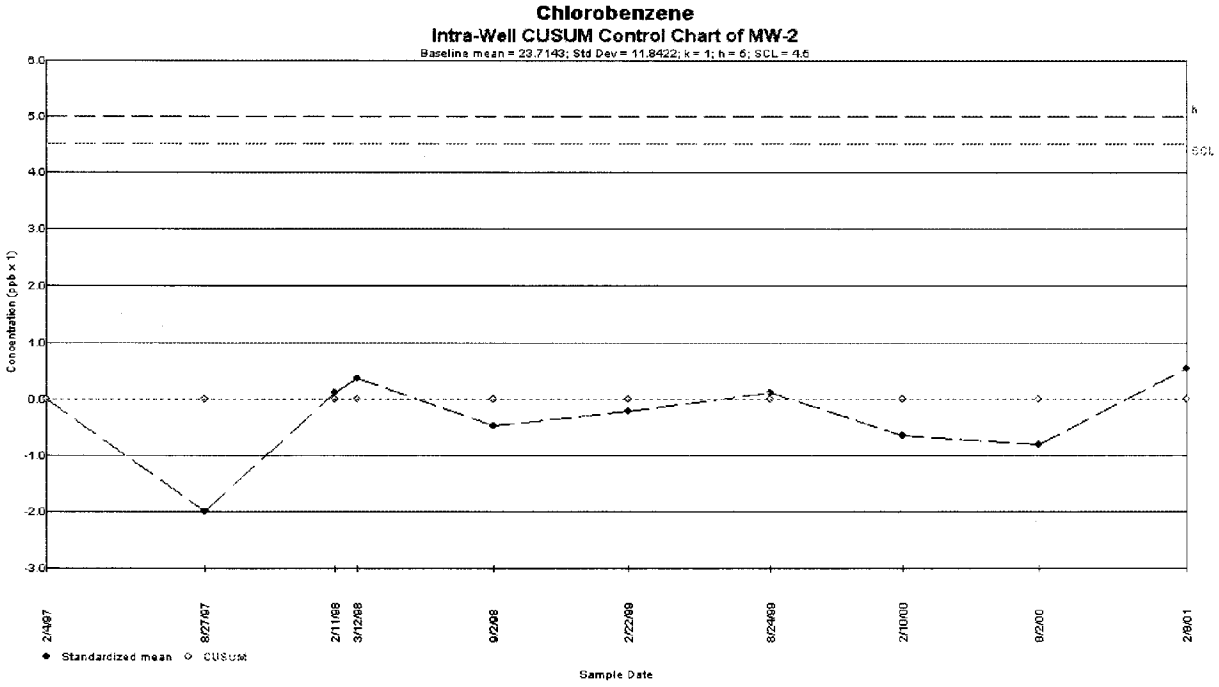
**Time Series Plots for Select Constituents**
**Wayne County Closed Sanitary Landfill (Dudley)**

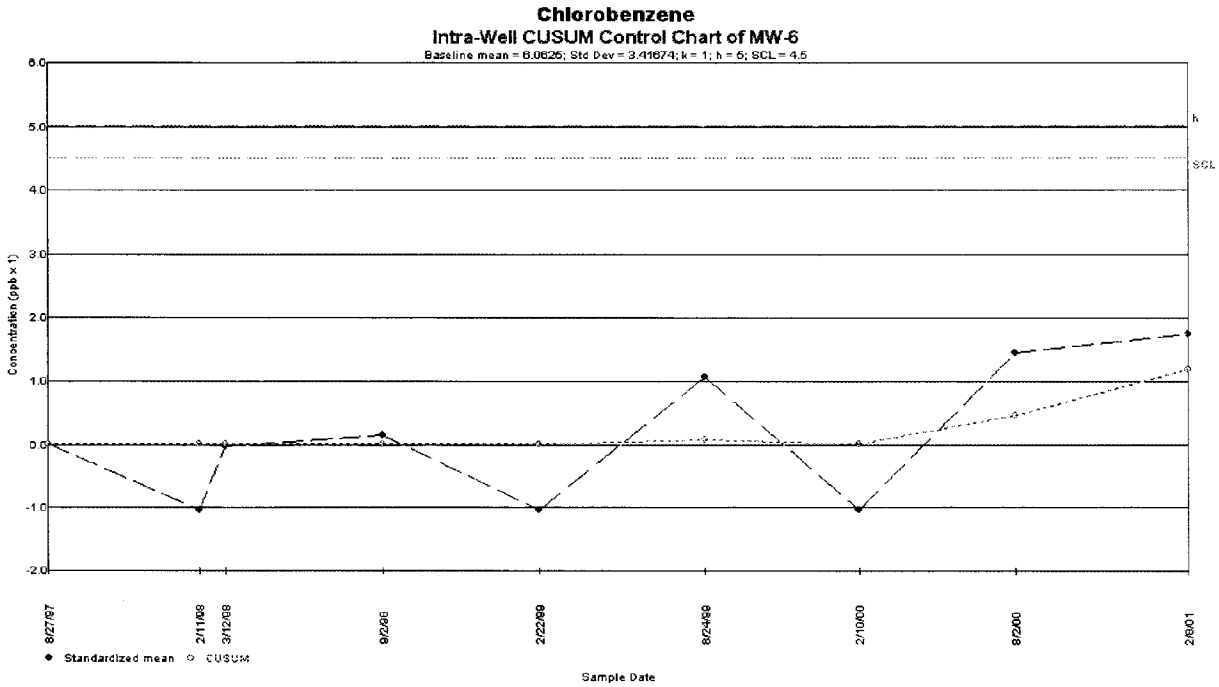


**Time Series Plots for Select Constituents**
**Wayne County Closed Sanitary Landfill (Dudley)**

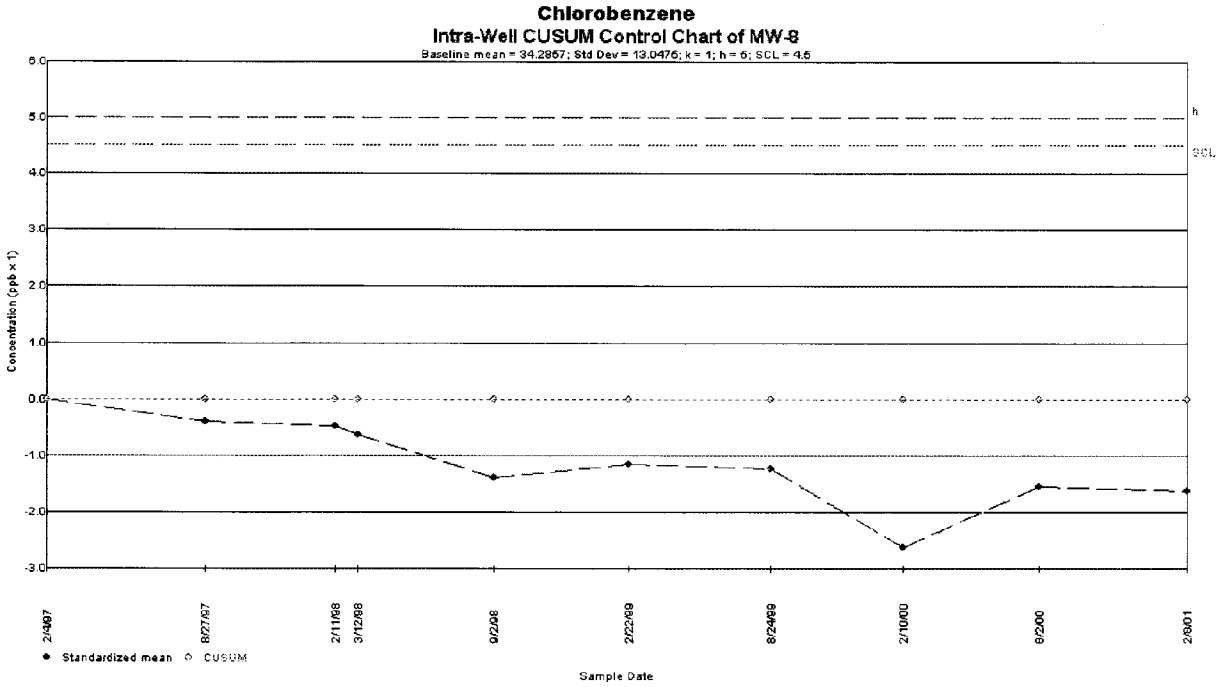


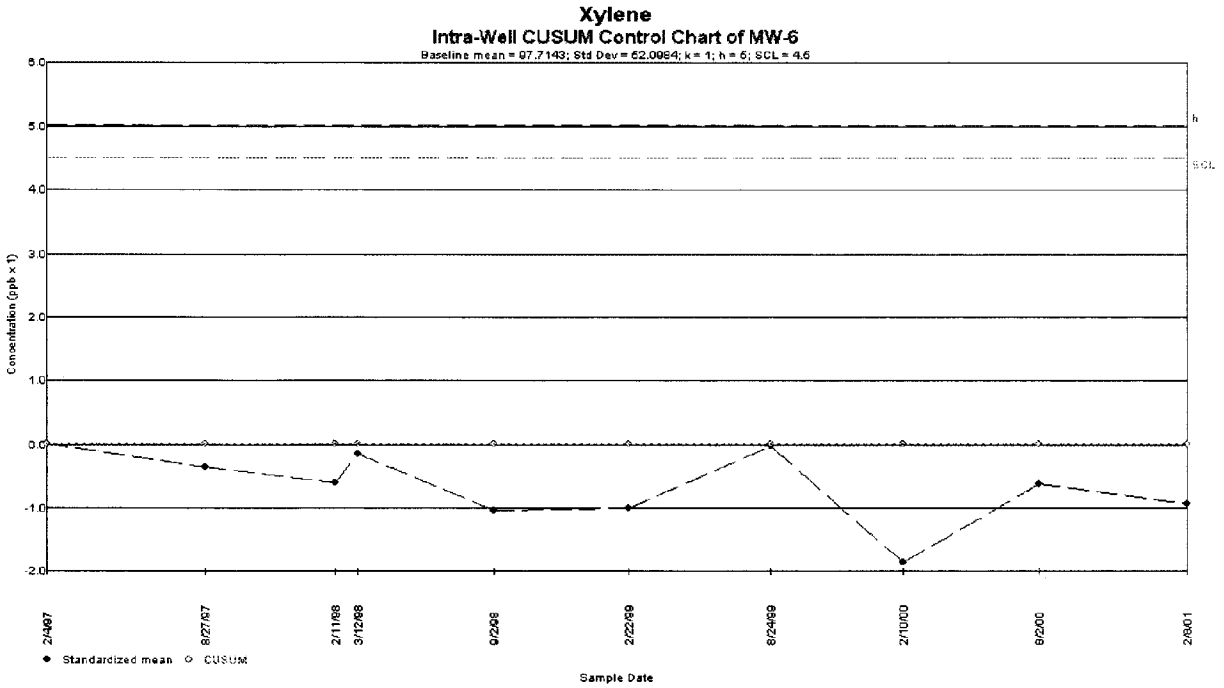
**Shewhart-CUSUM charts for selected constituents**
**Wayne County Closed Sanitary Landfill (Dudley)**



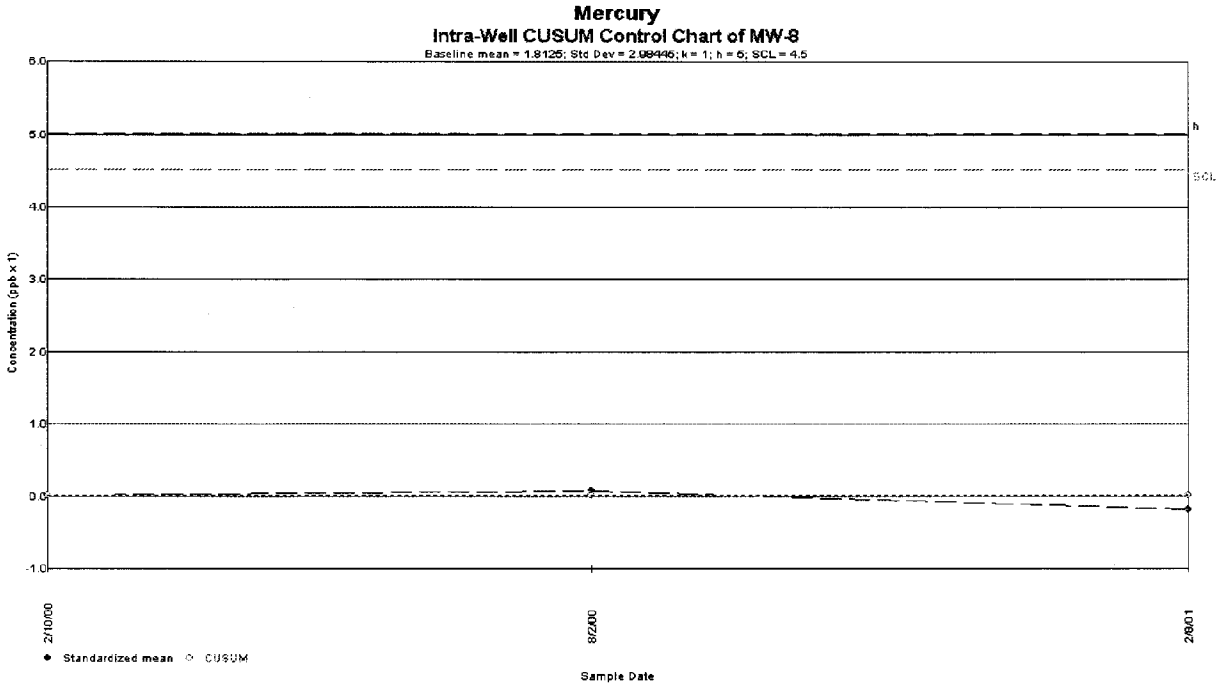



**Shewhart-CUSUM charts for selected constituents**
**Wayne County Closed Sanitary Landfill (Dudley)**



**Shewart-CUSUM charts for selected constituents**
**Wayne County Closed Sanitary Landfill (Dudley)**



**MW-7 Historical Laboratory Data Summary**
**Wayne County Closed Sanitary Landfill (Dudley)**

| Date | Well | Metals Tested | VOCs Tested | Metal Detections | VOC Detections | Metal Exceedance | VOC Exceedance |
|---|---|---|---|---|---|---|---|
| | MW-7 | | | | | | |
| 9/8/94 | MW-7 | 15 | 46 | 4 | 0 | 1 | 0 |
| 10/20/94 | MW-7 | 15 | 47 | 0 | 0 | 0 | 0 |
| 1/5/95 | MW-7 | 15 | 47 | 0 | 0 | 0 | 0 |
| 3/23/95 | MW-7 | 15 | 47 | 0 | 0 | 0 | 0 |
| 7/18/95 | MW-7 | 19 | 191 | 1 | 0 | 0 | 0 |
| 2/20/96 | MW-7 | 15 | 47 | 3 | 0 | 0 | 0 |
| 8/29/96 | MW-7 | 15 | 47 | 3 | 0 | 1 | 0 |
| 2/4/97 | MW-7 | 15 | 47 | 1 | 0 | 0 | 0 |
| 8/27/97 | MW-7 | 15 | 47 | 3 | 0 | 2 | 0 |
| 2/11/98 | MW-7 | 15 | 47 | 4 | 0 | 2 | 0 |
| 3/12/98 | MW-7 | 4 | 192 | 0 | 0 | 0 | 0 |
| 9/2/98 | MW-7 | 16 | 49 | 4 | 0 | 2 | 0 |
| 10/29/98 | MW-7 | 1 | 2 | 0 | 0 | 0 | 0 |
| 12/2/98 | MW-7 | 1 | 2 | 0 | 0 | 0 | 0 |
| 2/22/99 | MW-7 | 19 | 198 | 4 | 0 | 1 | 0 |
| 8/24/99 | MW-7 | 16 | 153 | 0 | 0 | 0 | 0 |
| 2/10/00 | MW-7 | 19 | 146 | 0 | 0 | 0 | 0 |
| 8/2/00 | MW-7 | 16 | 153 | 7 | 0 | 2 | 0 |
| 2/8/01 | MW-7 | 19 | 192 | 0 | 0 | 0 | 0 |
| **Total** | | **265** | **1700** | **34** | **0** | **11** | **0** |

# Basic Statistics

# Basic Statistics
## Parameter: Mercury

| | |
|---|---|
| Total Observations | 17 |
| Total Non-Detects | 11 |
| Pooled Mean | 1.36471 |
| Pooled Std Dev | 2.01803 |
| Background Mean | 0.5 |
| Background Std Dev | 0 |

## Background Wells
There is 1 background well

| Well | Samples | Non-Detects | % ND | Total |
|---|---|---|---|---|
| MW-1 | 6 | 6 | 100 | 3 |

| Well | Mean | Std Dev | Std Err | Rank Sum | Rank Mean |
|---|---|---|---|---|---|
| MW-1 | 0.5 | 0 | 0 | 36 | 6 |

## Compliance Wells
There is 1 compliance well

| Well | Samples | Non-Detects | % ND | Total |
|---|---|---|---|---|
| MW-8 | 11 | 5 | 45.4545 | 20.2 |

| Well | Mean | Std Dev | Dif From Bkg | Std Err | Rank Sum | Rank Mean |
|---|---|---|---|---|---|---|
| MW-8 | 1.83636 | 2.413 | 1.33636 | 0.999916 | 459 | 41.7273 |

## Analysis of Variance Statistics

| | |
|---|---|
| SS Wells | 6.93337 |
| SS Total | 65.1588 |

## Kruskal-Wallis Statistics

| | |
|---|---|
| Non-Detect Rank | 6 |
| Background Rank Sum | 36 |
| Background Rank Mean | 6 |
| H Statistic | 705.561 |
| H Adjusted for Ties | 966.004 |

# Basic Statistics
## Parameter: Chlorobenzene

| | |
|---|---|
| Total Observations | 67 |
| Total Non-Detects | 25 |
| Pooled Mean | 14.9403 |
| Pooled Std Dev | 12.1062 |
| Background Mean | 5 |
| Background Std Dev | 0 |

## Background Wells
There is 1 background well

| Well | Samples | Non-Detects | % ND | Total |
|---|---|---|---|---|
| MW-1 | 16 | 16 | 100 | 80 |

| Well | Mean | Std Dev | Std Err | Rank Sum | Rank Mean |
|---|---|---|---|---|---|
| MW-1 | 5 | 0 | 0 | 208 | 13 |

## Compliance Wells
There are 3 compliance wells

| Well | Samples | Non-Detects | % ND | Total |
|---|---|---|---|---|
| MW-8 | 17 | 1 | 5.88235 | 438 |
| MW-2 | 17 | 2 | 11.7647 | 372 |
| MW-6 | 17 | 6 | 35.2941 | 111 |

| Well | Mean | Std Dev | Dif From Bkg | Std Err | Rank Sum | Rank Mean |
|---|---|---|---|---|---|---|
| MW-8 | 25.7647 | 12.4926 | 20.7647 | 2.80245 | 2444 | 143.765 |
| MW-2 | 21.8824 | 9.27788 | 16.8824 | 2.80245 | 2276 | 133.882 |
| MW-6 | 6.52941 | 3.5698 | 1.52941 | 2.80245 | 1504 | 88.4706 |

## Analysis of Variance Statistics

| | |
|---|---|
| SS Wells | 5594.7 |
| SS Total | 9672.92 |

## Kruskal-Wallis Statistics

| | |
|---|---|
| Non-Detect Rank | 13 |
| Background Rank Sum | 208 |
| Background Rank Mean | 13 |
| H Statistic | 1881.62 |
| H Adjusted for Ties | 1984.58 |

# Basic Statistics
## Parameter: Dieldrin

| | |
|---|---|
| Total Observations | 7 |
| Total Non-Detects | 6 |
| Pooled Mean | 0.0171429 |
| Pooled Std Dev | 0.0453557 |
| Background Mean | 0 |
| Background Std Dev | 0 |

## Background Wells
There is 1 background well

| Well | Samples | Non-Detects | % ND | Total |
|---|---|---|---|---|
| MW-1 | 2 | 2 | 100 | 0 |

| Well | Mean | Std Dev | Std Err | Rank Sum | Rank Mean |
|---|---|---|---|---|---|
| MW-1 | 0 | 0 | 0 | 7 | 3.5 |

## Compliance Wells
There is 1 compliance well

| Well | Samples | Non-Detects | % ND | Total |
|---|---|---|---|---|
| MW-2 | 5 | 4 | 80 | 0.12 |

| Well | Mean | Std Dev | Dif From Bkg | Std Err | Rank Sum | Rank Mean |
|---|---|---|---|---|---|---|
| MW-2 | 0.024 | 0.0536656 | 0.024 | 0.0401597 | 49 | 9.8 |

## Analysis of Variance Statistics

| | |
|---|---|
| SS Wells | 0.000822857 |
| SS Total | 0.0123429 |

## Kruskal-Wallis Statistics

| | |
|---|---|
| Non-Detect Rank | 3.5 |
| Background Rank Sum | 7 |
| Background Rank Mean | 3.5 |
| H Statistic | 84.15 |
| H Adjusted for Ties | 224.4 |

# Basic Statistics
## Parameter: Dieldrin

| | |
|---|---|
| Total Observations | 7 |
| Total Non-Detects | 6 |
| Pooled Mean | 0.0171429 |
| Pooled Std Dev | 0.0453557 |
| Background Mean | 0 |
| Background Std Dev | 0 |

## Background Wells
There is 1 background well

| Well | Samples | Non-Detects | % ND | Total |
|---|---|---|---|---|
| MW-1 | 2 | 2 | 100 | 0 |

| Well | Mean | Std Dev | Std Err | Rank Sum | Rank Mean |
|---|---|---|---|---|---|
| MW-1 | 0 | 0 | 0 | 7 | 3.5 |

## Compliance Wells
There is 1 compliance well

| Well | Samples | Non-Detects | % ND | Total |
|---|---|---|---|---|
| MW-2 | 5 | 4 | 80 | 0.12 |

| Well | Mean | Std Dev | Dif From Bkg | Std Err | Rank Sum | Rank Mean |
|---|---|---|---|---|---|---|
| MW-2 | 0.024 | 0.0536656 | 0.024 | 0.0401597 | 49 | 9.8 |

## Analysis of Variance Statistics

| | |
|---|---|
| SS Wells | 0.000822857 |
| SS Total | 0.0123429 |

## Kruskal-Wallis Statistics

| | |
|---|---|
| Non-Detect Rank | 3.5 |
| Background Rank Sum | 7 |
| Background Rank Mean | 3.5 |
| H Statistic | 84.15 |
| H Adjusted for Ties | 224.4 |

# Basic Statistics
## Parameter: Endosulfan II

| | |
|---|---|
| Total Observations | 7 |
| Total Non-Detects | 6 |
| Pooled Mean | 0.03 |
| Pooled Std Dev | 0.0793725 |
| Background Mean | 0 |
| Background Std Dev | 0 |

## Background Wells
There is 1 background well

| Well | Samples | Non-Detects | % ND | Total |
|---|---|---|---|---|
| MW-1 | 2 | 2 | 100 | 0 |

| Well | Mean | Std Dev | Std Err | Rank Sum | Rank Mean |
|---|---|---|---|---|---|
| MW-1 | 0 | 0 | 0 | 7 | 3.5 |

## Compliance Wells
There is 1 compliance well

| Well | Samples | Non-Detects | % ND | Total |
|---|---|---|---|---|
| MW-8 | 5 | 4 | 80 | 0.21 |

| Well | Mean | Std Dev | Dif From Bkg | Std Err | Rank Sum | Rank Mean |
|---|---|---|---|---|---|---|
| MW-8 | 0.042 | 0.0939149 | 0.042 | 0.0702794 | 49 | 9.8 |

## Analysis of Variance Statistics

| | |
|---|---|
| SS Wells | 0.00252 |
| SS Total | 0.0378 |

## Kruskal-Wallis Statistics

| | |
|---|---|
| Non-Detect Rank | 3.5 |
| Background Rank Sum | 7 |
| Background Rank Mean | 3.5 |
| H Statistic | 84.15 |
| H Adjusted for Ties | 224.4 |

# Interwell Analyses for Metals

# Poisson Tolerance Limit
## Parameter: Mercury

Poisson Count of 6 background Samples = 3
Degrees of Freedom = 8

### 95% Confidence Values
Chi-Squared Value (95% Confidence) = 15.5073
Lambda (from Zack's formula) = 1.29228
Smallest Degrees of Freedom = 8
Upper Tolerance Limit (95%) = 3

### 99% Confidence Values
Chi-Squared Value (99% Confidence) = 20.0902
Lambda (from Zack's formula) = 1.67418
Smallest Degrees of Freedom = 12
Upper Tolerance Limit (99%) = 5

| | Date | Result | Impacted 95% | Impacted 99% |
|---|---|---|---|---|
| **MW-8** | 7/18/95 | 3.7 | TRUE | FALSE |
| | 2/20/96 | 8.5 | TRUE | TRUE |
| | 3/12/98 | ND<0.5 | FALSE | FALSE |
| | 9/2/98 | ND<0.5 | FALSE | FALSE |
| | 10/29/98 | ND<0.5 | FALSE | FALSE |
| | 12/2/98 | 1 | FALSE | FALSE |
| | 2/22/99 | ND<0.5 | FALSE | FALSE |
| | 8/24/99 | 1.3 | FALSE | FALSE |
| | 2/10/00 | ND<0.5 | FALSE | FALSE |
| | 8/2/00 | 2 | FALSE | FALSE |
| | 2/8/01 | 1.2 | FALSE | FALSE |