BACKGROUND MONITORING REPORT ALERT LEVELS AND AQUIFER QUALITY LIMITS CITY OF PHOENIX SR 85 LANDFILL BUCKEYE, ARIZONA

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LIST OF ACRONYMS AND ABBREVIATIONS

Ag	Silver
AL	Alert Level
ANOVA	Analysis of Variance
As	Arsenic
AWQS	Aquifer Water Quality Standard
Ba	Barium
Cd	Cadmium
CFR	Code of Federal Regulations
COC	Chain of Custody
Cr	Chromium
Cu	Copper
EPA	U.S. Environmental Protection Agency
Hg	Mercury
mg/L	Milligrams per Liter
LN	Log-normal Distribution
MW	Monitor Well
MWH	MWH Laboratories
N	Normal Distribution
Ni	Nickel
Pb	Lead
POC	Point of Compliance
PQL	Practical Quantitation Limit
QA/QC	Quality Assurance/Quality Control
RCRA	Resource Conservation Recovery Act
RL	Reporting Limit
SAP	Sampling and Analysis Plan
Se	Selenium
SMCL	Secondary Maximum Contaminant Level
SOW	Scope of Work
SR	State Route
TDS	Total Dissolved Solids
TL	95% Threshold Limit
URS	URS Corporation
VOC	Volatile Organic Compounds
Zn	Zinc

1.0 INTRODUCTION

The purpose of this study is to establish alert levels (AL) specific to Cell 1 at the State Route 85 (SR 85) Landfill for the City of Phoenix, located in southwestern Maricopa County. The City of Phoenix (City) began accepting municipal solid waste in Cell 1 on January 2, 2006 (Figure 1). The municipal solid waste stream at the SR 85 Landfill will be similar to the waste stream received at the now closed Skunk Creek Landfill.

The background monitoring report is a result of four new wells constructed to monitor groundwater quality in the area of the SR 85 Landfill. In preparation for the opening of the first cell of the landfill, URS Corporation (URS) completed the installation of two up-gradient and two down-gradient monitor wells during the period beginning December 20, 2004 and February 17, 2005 (URS, 2005). The down-gradient monitor wells were completed first and designated Monitor Well-3 (MW-3) and MW-4, followed by the completion of the up-gradient wells designated MW-1 and MW-2 (Figure 2). Figure 3 shows the groundwater level and the direction of groundwater flow in Cell 1. The four monitor wells were used to collect background groundwater quality samples. The two down-gradient wells will be used for compliance and assessment monitoring. Sampling and analysis of data collected from MW-1, MW-2, MW-3, and MW-4 was according to the U.S. Environmental Protection Agency (EPA) 40 Code of Federal Regulations (CFR) Section 258.53.

This report provides data for background monitoring of Point of Compliance (POC) monitoring wells, development of AL, and presents the applicable statistics. AL are necessary for interpretations of data obtained during compliance and assessment monitoring, to identify possible discharges from the landfill, and to track identified groundwater impacts and plan corrective actions.

The work in this study was conducted under contract with the City of Phoenix, Project No. 1680001.

This Background Monitoring Report is organized as follows.

- Chapter 2 describes the project background.
- Chapter 3 discusses sampling collection procedures.
- Chapter 4 discusses the comparison of data among wells.
- Chapter 5 discusses the AL and Aquifer Water Quality Standards (AWQS).
- Chapter 6 describes compliance monitoring.

- Chapter 7 describes the quality assurance/quality control (QA/QC) methods used throughout the study.
- Chapter 8 summarizes and provides conclusions for the study.

2.0 PROJECT BACKGROUND

2.1 SITE LOCATION AND DESCRIPTION

The SR 85 Landfill is located approximately 17 miles south of Interstate 10, west of SR 85, and south of Patterson Road in Buckeye, Arizona (Figure 1). The first cell of the landfill began receiving municipal solid waste on January 2, 2006.

2.2 BACKGROUND MONITORING AND SAMPLE SIZE ASSESSMENT

The original Scope of Work (SOW) for this project was to obtain samples from each of the four wells sampled for this study at 12 monthly intervals, for a total of 48 samples. It was intended that the data from the four wells would be combined into a single background dataset, which would provide the appropriate AL for the down-gradient wells. In accordance with the SOW, 12 consecutive months of groundwater samples were collected from MW-1, MW-2, MW-3, and MW-4 by URS for the City. The down-gradient wells (MW-3 and MW-4) were sampled beginning in January 2005, immediately after well installation was complete, and concluding in December 2005. The up-gradient wells (MW-1 and MW-2) were sampled upon the completion of the wells' installation, beginning in February 2005 and concluding in January 2006.

Table 1 includes the parameters as required by 40 CFR Part 258 for this study. Groundwater sampling was conducted according to the protocol specified in the groundwater Sampling and Analysis Plan (SAP) (URS, 2003a). The 19 months of data collected from MW-1, MW-2, MW-3, and MW-4 represent the ambient or "background" groundwater quality. A complete set of reported water quality results are attached on a compact disk as Appendix A.

2.2.1 Multiple Comparisons Among Wells

The data were analyzed to assess the suitability of combining the data from MW-1, MW-2, MW-3, and MW-4 into a single dataset that would establish background groundwater quality levels for each water quality parameter. This combined dataset would have provided 48 sample points from which to calculate a set of AL common to both down-gradient wells.

However, initial statistical analysis of the data revealed statistically significant differences in water quality among the waters at the four wells. Significant differences were detected not only between up-gradient water and down-gradient water but also between waters at the two down-gradient wells and between the waters at the two up-gradient wells. The observed differences indicate different chemical properties of the groundwaters sampled by the different wells. These chemical differences preclude the combination of the data from the four wells into a single

dataset according to the initial plan. Consequently, background must be established for each well individually at SR 85. The initial dataset provided 12 sample points for each constituent analyzed for this study at MW-1, MW-2, MW-3, and MW-4. As will be described below, the initial dataset required more data points in order to meet the criteria for AL at each monitor well, based on data from each individual well. Details of the multiple comparisons based on a larger dataset than the initial dataset will be given in Section 4.2.

2.2.2 Criteria for Sample Size

Specific statistical objectives are a fundamental part of an AL. For the present purpose, an example will suffice to indicate the need for statistical objectives. An AL may be stated as the upper bound of the interval containing 95% of the population of background concentrations of a given constituent. Because the 95^{th} percentile must be calculated from a finite dataset, a confidence must be placed on the upper 95^{th} percentile, to be reasonably assured that the upper bound is high enough to actually cover 95% of the data. The final estimated 95% upper bound depends on the desired confidence. Usually, a confidence of 95% is appropriate and commonly accepted by regulatory agencies. Then, if no discharge were to occur, there would be a 5% chance of a false alert.

Statistical intervals described above are known as 95%/95% tolerance intervals and have been selected to provide AL, in cases allowed by the data. For brevity, such tolerance intervals will be denoted more simply as 95% tolerance intervals. In order to achieve these statistical objectives at each monitor well, regardless of specific details of the data, 19 data points would be needed for each constituent at each monitor well (EPA, 1992a). To this end, the initial dataset was expanded by seven additional samples, collected at monthly intervals at each of the four wells. The up-gradient wells were included in the supplemental sample set in order to complement the comparisons of water quality among the wells.

2.2.3 Supplemental Data Collection

The supplemental seven months of data collection began on June 28, 2006 and ended on December 21, 2006, proceeding at monthly intervals. Analyses included all the initial investigation analyses. Sodium and chloride, which were not analyzed in the initial investigation, were also analyzed to provide additional comparisons among wells. The same sampling and quality assurance procedures were used as before as dictated in the original SAP.

3.0 SAMPLE COLLECTION PROCEDURES

Groundwater samples were collected from four monitor wells on SR 85 Landfill property and tested for concentrations of general water quality indicator parameters, major ions, trace metals, and volatile organic compounds (VOC). The sampling field activities were performed using protocols established in the groundwater SAP developed specifically for this project (URS, 2003a). The following summarizes the sampling protocol.

3.1 FIELD SAMPLING ACTIVITIES

The SOW originally planned for 12 consecutive months of groundwater sampling for MW-1, MW-2, MW-3, and MW-4 to provide valid data to conduct a statistical analysis to determine background water quality levels. However, after the sampling concluded and data was analyzed, seven additional monthly samples of each well were needed to achieve a nonparametric 95% tolerance interval.

- Initial samples of MW-3 and MW-4 were collected from January 2005 through December 2005.
- Initial samples of MW-1 and MW-2 were collected from February 2005 through January 2006.
- The additional seven months of samples needed from each well included in this study were collected from June 2006 though December 2006.

3.1.1 Sample Collection Point and Purging

The wells sampled for this study were all equipped with dedicated pumps, which were used to evacuate and sample the wells. The wells were purged to evacuate stagnant water in the well casing prior to obtaining representative aquifer groundwater samples. URS staff pumped the wells for 30 to 40 minutes as part of normal well operations prior to the sample collections. The purge time was used to evacuate three well casing volumes of well water according to SAP procedures. The purged water was allowed to flow into an adjacent wash onsite or 25 feet from the well head. Samples were collected from a water spigot located near the well head of each well.

3.1.2 Sample Collection Summary

URS staff collected field water quality parameters including pH, conductivity, turbidity, and temperature during the purging process to assess aquifer water quality stability. Samples were

collected when water quality parameters had stabilized after 30 to 40 minutes of purging. The equipment used for field water quality parameters consisted of:

- YSI 556 MPS Meter for pH, Electrical Conductivity, and temperature
- Hach 2100P Turbidity Meter

The water quality instruments used were field calibrated prior to each field visit and were decontaminated prior to any sample collection between wells, according to manufacturer's instructions.

MWH Laboratories, Inc. (MWH) in Scottsdale, Arizona, provided the sample bottles, which were cleaned and prepared with the appropriate preservatives, prior to use. The samples were collected directly into the laboratory prepared bottles. Disposable nitrile gloves were used during sampling to prevent any cross contamination. As required by 40 CFR Part 258, samples were not filtered during collection or prior to analysis.

Once the samples were collected, each sample bottle was immediately labeled with a location, well identifier, date and time of sample. MWH provided labels with type of analysis, and preservative attached to the appropriate bottle. The samples were then placed in an ice cooler for transport to the City of Phoenix Landfill transfer station, on 27th Avenue in Phoenix, Arizona. City staff then contacted MWH to pick up the samples. The samples were submitted along with a chain of custody (COC).

4.0 COMPARISON OF DATA AMONG WELLS

The intent of the background sampling was to establish a set of data that can be considered background for each well. The first 12 sampling events were collected from January 20, 2005 through December 1, 2005, prior to initial landfill operation. The remaining seven sampling events were conducted from June 28, 2006 through December 21, 2006, after the landfill opened on January 2, 2006. The reported analytical results for MW-1, MW-2, MW-3, and MW-4 collected in the 19 sampling events can be considered, as at least a subsample of background for that well.

If the data do not exhibit statistically significant differences between up-gradient wells, the up-gradient data can be pooled to provide a larger background dataset. If also, the data do not exhibit statistically significant differences in water quality among up-gradient and down-gradient wells, the data from all wells can be combined into a single background dataset. However, after analyzing the data, it was concluded that each well requires an individual background dataset, specific to each well.

4.1 GENERAL OBSERVATIONS

The present section discusses exceedences of Drinking Water AWQS for samples collected during background monitoring of MW-1, MW-2, MW-3, and MW-4 for general chemistry, metals and organic compounds. The reported exceedences are summarized in Table 2, 2A and 2B. Table 2A gives the number of exceedences of the AWQS for the four wells included in this study. Table 2B gives the maximum concentration associated with the exceedences listed in Table 2A.

Of particular interest to this investigation are the exceedances of the AWQS for lead (Pb) and nickel (Ni). The reported Pb concentration exceeded the corresponding AWQS once in each up-gradient well sampled, while no exceedences for Pb occurred at down-gradient wells. The maximum reported Pb concentration in the up-gradient and down-gradient waters were nominally 0.0600 and 0.0050 milligrams per liter (mg/L), respectively. However, as implied in Section 4.2, the differences in Pb concentrations between the up-gradient and down-gradient waters are not statistically significant (the median reported concentrations are clustered around 0.0025 mg/L for all waters). It would be imprudent to speculate too much on the reasons for the larger maximum concentrations of Pb observed in the up-gradient waters. However, they could be manifestations of rare but possible down-gradient background concentrations. If so, such concentrations would be expected in future samples from down-gradient wells. Similar qualitative remarks may be made with regard to the exceedance of the corresponding AWQS for Ni at MW-4.

The reported nitrate concentrations were exceeded much more frequently in the up-gradient wells than the down-gradient wells. The nitrate exceedences in MW-1 and MW-2 are most likely due to agricultural activities in the locality of the landfill. The fluoride AWQS was exceeded more often at the down-gradient well MW-3 than in the other three wells sampled.

Total dissolved solids (TDS) are consistently greater than the secondary maximum contaminant levels (SMCL) of 500 mg/L, set by the EPA. The minimum TDS values were 3,470 mg/L, 2,980 mg/L, 1,660 mg/L, and 1,750 mg/L at MW-1, MW-2, MW-3 and MW-4, respectively. TDS is important as an aesthetic quality of drinking water. Concentrations exceeding 500 mg/L may cause the water to taste brackish.

Concentrations of each organic constituent sampled were reported below the laboratory reporting limits (RL), except for acetone and chloromethane. As will be explained in more detail in Section 5.2.3, the detections of acetone and chloromethane were results of laboratory contamination.

For future reference, concentrations of silver (Ag) were reported one time in three separate wells: MW-1 was 0.0007 mg/L, MW-2 was 0.0009 mg/L, and MW- 3 was 0.001 mg/L. No Ag concentrations were reported above the RL for MW-4. There is no established AWQS for Ag but there is a SMCL of 0.10 mg/L.

4.2 INORGANIC CONSTITUENTS: METALS AND GENERAL CHEMISTRY

A comparison of inorganic constituents was made among the four wells using the initial 12 months of data. These comparisons have been repeated using the full 19 month dataset. The statistical method Analysis of Variance (ANOVA) was used for this purpose. Parametric ANOVA, based on the normal distribution, was used wherever possible. In most cases, however, the tests for normality and (or) equal variances failed, in which cases the nonparametric ANOVA on Ranks (a statistical test) was performed. If a parametric ANOVA indicated the presence of significant differences among wells for a particular constituent at a significance level of 0.05, the differences were identified using the Holm-Sidak multiple comparison procedure. The Holm-Sidak procedure maintains an overall significance level of 0.05. If the ANOVA on Ranks method indicated differences at a significance level of 0.05, then these differences were identified using the Tukey multiple comparison procedure that maintains an overall significance level of 0.05. All calculations were made with the commercially available statistical software SigmaStat (SigmaStat, 2004).

Table 3 gives a summary of the comparisons among wells (based on 19 months of data). Entered for each pair of wells are the constituents, metals, and general chemistry properties, for which ANOVA indicates significant differences.

Because of the differences summarized in Table 3, compliance in down-gradient wells cannot be evaluated by comparison with up-gradient well data. Furthermore, differences noted between MW-3 and MW-4 suggest that the data for these two wells should not be pooled to provide a background dataset for down-gradient groundwater. The only alternative is to use the dataset for each well as a background dataset for that well only. Therefore, there are 19 observations for each inorganic constituent for each down-gradient well.

4.3 VOLITALE OGANIC CARBONS

With two exceptions, all of the organic constituents analyzed for were reported below the laboratory RL for the four wells in this study. As will be discussed in more detail in Section 5.2.3, the two exceptions are due to laboratory contamination. Consequently, no statistical comparisons were made among wells for the organic constituents.

5.0 ALERT LEVELS AND AQUIFER WATER QUALITY STANDARDS

An AWQS is a maximum concentration of a chemical constituent of groundwater, acceptable to the regulating agency. AWQS is a widely applicable standard and will be used for this SR 85 Landfill study.

An AL is designed to identify a possible discharge from the landfill that results in a statistically significant increase above the background concentration of a chemical constituent. Such possible increases are the objective of compliance monitoring. If a statistically significant increase of any constituent shown to be attributed to the landfill occurs, an assessment monitoring program would begin.

5.1 GENERAL CONCEPT AND DEVELOPMENT

AL are proposed herein for all of the organic constituents listed in Table 1, and the Resource Conservation and Recovery Act (RCRA) metals: arsenic (As), barium (Ba), cadmium (Cd), chromium (Cr), lead (Pb), mercury (Hg), selenium (Se), and for copper (Cu), nickel (Ni), silver (Ag), and zinc (Zn). Cu, Ni, and Zn were added because the City of Phoenix is accepting treated biosolids from City waste water treatment plants. Separate sets of AL are proposed for the two down-gradient wells, MW-3 and MW-4 due to the statistical differences between the water quality of the two wells.

A tolerance interval is one of two types of statistical intervals described in Subpart E, ¶5.9.3. The upper limits of one-sided 95% tolerance intervals are proposed as the preferred AL. A one-sided tolerance interval for a given constituent has the property that a specified proportion, P, of the population would be less than the upper limit (TL) of the tolerance interval with a specified confidence C. Because each TL is based on a finite sample size, an exact upper percentile, P, of the population of values cannot be established with perfect precision. Consequently, it is necessary to fix an acceptable confidence that the tolerance interval would contain a proportion, P, of the population. The one-sided tolerance intervals proposed herein are based on P = 95% and C = 95%. As noted previously, such an interval is designated here as a 95% TL.

Because a tolerance interval is designed to cover all but a small percentage of background values, observations during compliance monitoring can, but should rarely, exceed the TL unless there is a discharge from the landfill. TL are also useful for the comparison of compliance data to groundwater protection standards.

Not all datasets allow a tolerance interval to be calculated. In particular, datasets with no values above laboratory RL cannot be used to develop tolerance intervals. Where sufficient data exist,

there are two types of tolerance intervals: parametric and nonparametric. A parametric tolerance interval is based on the mean and standard deviation provided the data can be assumed to come from a normally distributed population. Nonparametric toleration intervals are developed from the ordered statistics of the data. These considerations are described in more detail below and in Appendix B.

5.2 DEVELOPMENT OF TOLERANCE LIMITS

As noted previously, background data were collected at monthly intervals in two sets from four landfill monitoring wells at the landfill for 19 months. A sample size of 19 background data points is available for each constituent analyzed in each down-gradient monitor well. The data have been analyzed in accordance with guidelines developed by the EPA (EPA, 1989; 1992) and adopted by reference in Chapter 5, Subpart E of 40 CFR Part 258.

5.2.1 Procedures

Procedures for calculating TL are described elsewhere (EPA, 1989; 1992a) and are not repeated here in detail. However, summaries of the general features of the calculations are given below and complete calculations are presented in Appendix B.

The particular statistical procedure for computing a TL for a given constituent depends on two features of the data:

(1) The manner in which the data are distributed

With regard to the distribution of data, there are two possibilities in practice:

(1a) The data adhere closely to either a normal or a logarithmic normal distribution. Such distributions are “parametric” because they can be described completely by known or estimated parameters, e.g., the mean and the standard deviation. Then the TL can be computed from estimates of the mean and standard deviation of the data. Such estimates are called “parametric.” For constituents that are parametrically distributed AL are proposed as the 95% TL. That is, 95% of the population of values for a constituent will be less than the 95% TL with a confidence of 95%.

If the data are normally distributed, the 95 % TL is calculated from:

$$95\%\ TL = M + 2.423 \times S$$

Where M and S are the mean and standard deviation of the particular dataset, respectively. The constant 2.423 is appropriate for a sample size of 19 data points and a one-sided tolerance interval with P = 95% and C= 95% (EPA, 1989).

If the data are log-normally distributed, the above equation is applicable to the logarithm of the data values, with M and S being the mean and standard deviation of the transformed data.

(1b) The data cannot be considered as either normally or log-normally distributed. In this case, the tolerance interval must be calculated using non-parametric methods. With the nonparametric method, the TL is placed equal to the ***maximum*** value in the dataset. With 19 sample points, the expected coverage of the tolerance interval is 95%. The expansion of the data collection program to 19 months, as discussed in Section 1.1, was based on the criterion that 19 data points are needed for a nonparametric one-sided 95% tolerance interval.

(2) The number of quantitated (reportable) values

For many constituents, the background concentrations are so low that the dataset contains censored data, i.e., results that are reported as less than a RL. A censored data value could be any number less than the indicated RL. With regard to the second feature (2), the parametric method is generally useful only if the fraction of censored data is less than half of the complete dataset. Furthermore, even if the fraction of censored data were less than 50%, the parametric method would not be valid unless the data could be shown to follow either a normal or a log-normal distribution.

(2a) For datasets in which most but not all data are censored, it is usually best to use the nonparametric method to estimate the TL, as described above.

(2b) For each metal for which where the fraction of censored data is 100%, the AL is taken to be the average of the practical quantitation limit (PQL) of the constituent and the AWQS. This choice serves two purposes. First, such an AL is smaller than the AWQS sufficiently to be protective of the standard. Second, the chance of a false positive is reduced to an acceptable level by placing the AL sufficiently above the RL.

(2c) No pertinent detection of any VOC occurred in the background data for SR 85. Because of the similarity of waste streams at the SR 85 and Skunk Creek Landfills, the AL previously established and approved by ADEQ

for the VOC at Skunk Creek (EMCON, 2001) are proposed herein for SR 85 with minor revisions as discussed in Section 5.2.3 and as noted in Table 10.

5.2.2 Alert Levels for Metals

EPA has concluded that for a dataset with 15% or fewer censored data points, the results of parametric statistical tests will not be substantially affected if the censored data points are replaced by one-half of the PQL. When more than 15% of the data are censored, the treatment of the censored data becomes more crucial (EPA, 1992a). Table 4 contains a summary of the number of samples, by well, in which the reported concentrations were reported as censored data.

The data for Cd and Hg for both wells are censored. Consequently, a tolerance interval cannot be calculated, and method (2b) applies. Likewise, method (2b) is applicable to Se for MW-3 and to Ag for MW-4. The nonparametric method must be used to obtain the AL for Se for MW-4 and for Ag for MW-3. Further evaluations must be made for the possible applicability of the parametric method of calculating AL for As, Ba, Cr, Pb, Cu, Ni and Zn.

Because the data for As, Ba, Cr, Pb and Zn for both MW-3 and MW-4 and Ni for MW-4 had fewer than 15% censored data, the censored data were replaced by one-half the PQL. These datasets were tested for normality and log-normality by the Shapiro-Wilk test, as recommended by EPA (EPA, 1992a). Table 5 summarizes the results of the Shapiro-Wilk test for normality and log-normality of the data for As, Ba, Cr, Pb, and Zn for both wells MW-3 and MW-4 and for Ni for MW-4. The non-parametric method is indicated for As for MW-4 and for Cr for MW-3 and MW-4. The parametric method is indicated for As for MW-3 and for Ba, Pb and Zn for MW-3 and MW-4 and for Ni for MW-4. As indicated by N and LN the parametric method is based either on the normal distribution (N) or the log-normal distribution (LN).

The Cu data for MW-3 and MW-4 and the Ni data for MW-3 have more than 15% censored data. For these three cases, a replacement of censored data by one-half the PQL cannot be used with prudence. However, in these cases, the fractions of censored data are less than 50%, and EPA has recommended procedures for testing normality (and log-normality) and for making valid estimates of the mean and standard deviation of any underlying normal distributions (EPA, 1992a). The EPA procedure for testing normality (or log-normality) involves two distinct way of plotting the ordered data:

Plot Type I. The censored data points are given arbitrary but distinct ranks. The normal quantile of a data point is the value of the standard normal variable with probability r/(n+1), where n is the number of sample points (19) and r is the rank of the data point. For censored data points, r ranges from 1 to h, the number of censored data points, and for the non-censored data, r ranges from h+1 to n. The non-censored data are then plotted vs. their corresponding normal quantile. If the probability plot is reasonably linear, the distribution may be assumed to be approximately normal, and the mean and standard deviation may be estimated using Cohen's method (EPA, 1989, 1992a). In this case, normality (or log-normality) indicates that the censored data are merely extensions of the distribution exhibited by the non-censored data. Cohen's method provides a means of estimating the mean and standard deviation of the entire data set, including the unknown censored points, based on the non-censored data.

Plot Type II. The censored data are ignored for this plot, and only the non-censored data are ranked, i.e., for Plot Type II the size of the data set is n – h, and r ranges 1 to n – h. The non-censored data are plotted vs. the normal quantile of the non-censored data. If the probability plot is reasonably linear, the non-censored data can be assumed to be approximately normal, and the mean and standard deviation of the entire dataset can be estimated using Atchison's method (EPA, 1992a). Atchison's method is based on the assumption that the censored data are actually zero. Atchison's method, adjusts the mean and standard deviation of the non-censored data to account for the fraction of samples with zero concentration.

The results of the probability plots of Types I and II, described above, are summarized in Table 6. Tabulated are the coefficients of variation (R^2) and P–values of the least-squares linear fit of the normal quantiles vs. the data. R^2 is a measure of how well the straight line fits the data, and P is the probability of concluding that there is not an association between the normal quantiles and the data. Generally, if R^2 is > 0.9 and P < 0.05, one may conclude a meaningful linear relationship and normality of the data. Usually, the larger the value of R^2 and the smaller the value of P, the more nearly a linear relationship is indicated. However, the probability plots should be examined visually as verification of the conclusion.

The Cu data for MW-3 does not exhibit an acceptable normal or log-normal character in either a Type I or Type II plot. Consequently, the AL for Cu for MW-3 must be calculated using the non-parametric method. The Cu data for MW-4, however, exhibits a good linear relationship between the normal quantile and the logarithm of the data in the Type I plot. The actual Type I plot for this case is included in Appendix B and confirms this conclusion. The AL for Cu for MW-4 was calculated using Cohen's method.

The Ni data for MW-3 shows a good linear relationship between the normal quantiles and the logarithm of the data on a Type I plot. The plot is included in Appendix B. Consequently, the AL for Ni for MW-3 is calculated using Cohen's method.

Tables 7 and 8 summarize the AL for each of the 11 metals for MW-3 and MW-4, respectively. The distribution type is also given in the two AL tables. Normal or log-normal distributions indicate that the parametric method was used; an undetermined distribution indicates that the AL is the numerical average of the PQL and the AWQS.

5.2.3 Alert Levels for Organic Compounds

Acetone was reported in general trip-blank samples, but in no groundwater samples. The acetone in the trip-blank samples may be attributed to laboratory contamination.

The only organic constituent to be detected in a groundwater sample was chloromethane (methyl chloride). Chloromethane was detected during the October 2005 sampling period only. The reported concentrations were slightly above the RL. Table 9 summarizes the samples in which chloromethane was detected. The fact that chloromethane was detected in a trip blank for MW-1, indicates that the detections of chloromethane were the result of laboratory contamination. For chloromethane, the PQL, AWQS, and AL are the same value (0.5 µg/L). Consequently, if chloromethane should be detected during compliance monitoring, the concentration would exceed the AL and AWQS. In that event, possible contamination of the sample as a result of laboratory practices should be scrutinized.

It was concluded that there was no detection of any organic constituent that would be pertinent to background groundwater quality at SR 85. Consequently statistical analysis of organic data is not possible.

The AL for organic constituents are proposed in Table 10 and are taken to be the same as the AL for the Skunk Creek Landfill with minor revisions. The Skunk Creek AL were approved as a Type III change on May 22, 2001. This rationale for using the same organic AL is based on the similarity of the two waste streams at SR 85 and Skunk Creek. As noted in Table 10 the AL for three constituents were raised to match the PQL. The AL for 2-Hexanone and 4-Methyl-2-Pentanone were raised from 2.0 µg/L to 10 µg/L. The AL for Methylene Chloride was raised from 2.0 µg/L to 3.0 µg/L. The AL for Chloromethane was lowered from 5.0 µg/L ъ 0.5 µg/L to match the PQL and the AWQS of 0.5 µg/L.

6.0 COMPLIANCE MONITORING

The monitoring program presented in this section complies with the requirements set forth in the EPA's Subtitle D regulations, *EPA Criteria for Municipal Solid Waste Landfills* (40 CFR Part 258.54; 56 FR 51016, October 9, 1991; amended at 57 FR 28627, June 26, 1992.)

6.1 COMPLIANCE MONITORING

Once the established AL have been approved, semi-annual compliance monitoring of the down-gradient wells (MW-3 and MW-4) will commence. The semi-annual compliance samples will be collected according to the City of Phoenix SAP and include all the constituents of Tables 7, 8, and 10 and the General Chemistry constituents listed in Table 1. The laboratory analyses from each well will be compared to the established AL (Tables 7, 8, and 10) to determine if any constituents are present at a level above the established AL. If an exceedence is detected and verified, assessment monitoring should begin.

Verification of an exceedence of an AL is important. An exceedence might be caused by several possible errors. While this is not the place for a thorough listing of possible errors, some examples will be useful. Errors might be caused by laboratory contamination or reagents, analytical equipment, or sample bottles. Errors in analytical calibration and hand calculations can also occur. Data can be incorrectly entered in a database. Errors might also be caused by improper sample collection or violations of COC procedures.

If the AL exceedence is the result of an error in the laboratory or field, this will be noted in the operating record. The operating record will include a narrative of the analysis of each exceedence, conclusions, data, and corrective actions proposed to avoid errors that could lead to future false alerts.

If the observed exceedence is not due to error, an assessment monitoring program may possibly commence.

6.2 ASSESSMENT MONITORING

As quoted in 40 CFR Part 258.55, "Assessment monitoring is required whenever a statistically significant increase over background has been detected for one or more of the constituents listed in the Appendix I to this part or in the alternative listed approved in accordance with 258.54(a)(2)" (URS, 2003b). The assessment monitoring program involves the analysis of a somewhat larger list of chemicals than analyzed in the compliance monitoring. The assessment monitoring program will conform to 40 CFR Part 258.55(a)-(f) of the federal solid waste regulations.

7.0 QUALITY ASSURANCE/QUALITY CONTROL PROCEDURES

The QA/QC process was conducted both internally and externally for this SR 85 Landfill study. QC procedures were followed according to the EPA's Quality Assurance Project Plan (EPA, 2001). This section describes the QA/QC processes that were conducted during the sample collection, data review process, and the results of the data validation. URS data validation was conducted on the laboratory analytical data packages received for the groundwater samples collected from monitor wells MW-1, MW-2, MW-3, and MW-4.

The information and data presented summarizes the laboratory analytical results from MW-1, MW-2, MW-3, and MW-4. The SOW proposed sampling of groundwater quality from four monitor wells for laboratory analysis. These water quality sampling results are the product of 19 months of sampling conducted by URS from January 2005 through December 2006.

7.1 FIELD QC SAMPLES

MWH was responsible for providing the prepared bottles for sampling with the appropriate QC measures for all field sampling events. This included one to two duplicates and two to three trip blanks per sampling event. A field duplicate sample is a second sample collected at the same location as the original sample but contained in a separate bottle. Duplicate samples are collected simultaneously or in immediate succession, using identical recovery techniques, and treated in an identical manner during storage, transportation, and analysis.

The duplicate samples were collected to assess the precision of the laboratory reporting. QC samples are given a fictitious sample identification number and sampling time. The true identity of each duplicate is recorded on the well sampling form and the logbook.

Trip blanks are bottles prepared in an identical method as the original field sample bottles. Trip blanks are filled with groundwater from one or more monitor wells during each sampling event. Trip blanks are used to measure any possible contamination in the laboratory. Trip blanks were labeled the same as the original samples with the exception of a TB annotation on the label.

7.2 QA/QC REVIEW PROCESS

To provide a high degree of QA/QC for this study, URS conducted a two-phase QC analysis. Phase 1, an internal QC review, consisted of a thorough detail check of analytical data reported by MWH to the City, which the City staff entered into spreadsheets and turned over to URS for analysis. These data were then used by URS as a basis for several statistical analyses. The data entered into ANOVA were also validated to assure proper transfer of data. The report, figures, and tables were detail checked for consistency, as well.

Phase 2 consisted of conducting validation of the reported analytical data (from MWH) by an independent technical reviewer. The data validation was conducted at the URS Denver office, by a chemist trained and experienced in data validation. The data validation assessment is used to determine if the laboratory followed proper protocol and QC procedures as dictated in the EPA National Functional Guidelines for Inorganic Data Review (EPA, 2004) and EPA National Functional Guidelines for Organic Data Review (EPA, 1999). The data validation process concluded that the reported data was 100% usable for the purpose intended. The chemist provided a Data Validation Report (Appendix C).

8.0 SUMMARY AND CONCLUSIONS

The SR 85 Landfill is located in Maricopa County, Arizona, on Patterson Road southwest of SR 85. Cell 1 of SR 85 began operation on January 2, 2006. The SR 85 Landfill will receive municipal solid waste similar to the waste received by the Skunk Creek Landfill, which is now closed. Groundwater monitoring is required at all such landfills, for the purpose of tracking groundwater quality and detecting any possible discharge of contamination to the local groundwater as a result of contamination in the waste stream. In order to detect possible contamination and distinguish it from naturally occurring or previously existing contamination, alert levels must be established for various possible contaminants. An alert level (AL) is a concentration of a possible contaminant, which if exceeded in the groundwater would indicate a possible discharge from the landfill.

URS was retained by the City of Phoenix to characterize background groundwater quality at the SR 85 Landfill and to propose AL specific to Cell 1 of the landfill. For this purpose, four groundwater monitoring wells were installed, two up-gradient of Cell 1 and two down-gradient of Cell 1. The two down-gradient wells, MW-3 and MW-4, will be used during operation of Cell 1 for compliance and assessment monitoring. A groundwater background sampling program was conducted between January 2005 and December 2006. Samples were collected at monthly intervals in two stages; 19 data points were obtained for each monitoring well. The data were to be used to establish AL for specific possible groundwater contaminants.

The resulting background dataset base has been evaluated. This report presents the data, the alert level analysis and the proposed alert levels. The final alert levels must be approved by the Arizona Department of Environmental Quality. AL are proposed herein for two essentially different types of chemical constituents: metals and volatile organic compounds (VOC). The chemical constitution of natural groundwater is determined by its contact with the subsurface rock, which is inorganic in nature. Many metals are frequently found in the rock and therefore in the natural groundwater. VOC on the other hand are not naturally occurring and would not be found in natural groundwater.

Wherever possible, alert levels for existing chemical constituents in the groundwater should be based on the statistics of quantitative data. However no VOC were detected in groundwater at SR 85 over the 19-month background groundwater investigation. (Three samples did have small concentrations of a VOC in a single sampling event, but the presence of the VOC was attributed to sources at the laboratory.) If a VOC was in the groundwater, its concentration was below the PQL. Without quantitative data, statistics cannot be developed, and alert levels must be based on a non-statistical rationale. Such a rationale is provided in conjunction with the now-closed Skunk

Creek Landfill. Alert levels for the VOC have been previously established and are in use at the Skunk Creek Landfill. Because of the similarity of the waste streams at Skunk Creek and SR 85, it would be consistent to adopt the same VOC alert levels at SR 85. The proposed AL for the VOC are found in Table 10. Minor revisions were made to four VOC constituents as noted in Table 10 and Section 5.2.3.

Alert levels for metals are proposed herein based on the concept of a 95% tolerance interval. A 95% tolerance interval is a statistical interval constructed such that 95% of the concentrations of a given metal would be less than the upper limit of the interval, with a confidence of 95%. The upper limit of the 95% tolerance interval would be the alert level. By this construction, there would be a 5% chance that the concentration of the particular metal would exceed the alert level, even though a discharge had not occurred. Any such exceedance, when verified, would trigger a monitoring plan to verify and assess the possible discharge.

Alert levels are proposed herein for the following metals: arsenic (As), barium (Ba), cadmium (Cd), chromium (Cr), lead (Pb), mercury (Hg), selenium (Se), silver (Ag), copper (Cu), nickel (Ni) and zinc (Zn). The proposed AL are given in Tables 7 and 8 for the down-gradient wells MW-3 and MW-4, respectively.

Summary of Alert Levels for RCRA Metals

Constituent	AWQS* (mg/L)	MW-3 Alert Level (mg/L)	MW-4 Alert Level (mg/L)
Ag	**	0.05	0.05
As	0.05	0.0092	0.0092
Ba	2.0	0.0720	0.0790
Cd	0.005	0.0028	0.0028
Cr	0.10	0.0210	0.0230
Cu	None	0.0210	0.0220
Hg	0.002	0.0011	0.0011
Ni	0.10	0.0170	0.12
Pb	0.05	0.0052	0.0052
Se	0.05	0.0280	0.0071
Zn	None	0.35	0.35

* = Aquifer Water Quality Standards
** = Secondary Maximum Contaminant Level 0.10 mg/L

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TABLES

Table 1
Constituents for Background Monitoring

General Chemistry	
Total Alkalinity (as CaCO3)	Nitrate as Nitrogen
Fluoride	Total Dissolved Solids (TDS)
Chloride *	
Metals	
Antimony	Magnesium
Arsenic	Mercury
Barium	Nickel
Beryllium	Potassium
Cadmium	Selenium
Calcium	Silver
Chromium	Sodium *
Cobalt	Vanadium
Copper	Thallium
Lead	Zinc
Volatile Organic Compounds	
1,1,1,2-Tetrachloroethane	Carbon tetrachloride
1,1,1-Trichloroethane	Chlorobenzene
1,1,2,2-Tetrachloroethane	Chloroethane
1,1,2-Trichloroethane	Chloroform
1,1-Dichloroethane	Chloromethane
1,1-Dichloroethene	cis-1,2-Dichloroethene
1,2,3-Trichloropropane	cis-1,3-Dichloropropene
1,2-Dibromo-3-chloropropane	Dibromochloromethane
1,2-Dibromoethane (edb)	Dibromomethane
1,2-Dichlorobenzene	Ethylbenzene
1,2-Dichloroethane	Iodomethane
1,2-Dichloropropane	Methylene chloride
1,4-Dichlorobenzene	Styrene
2-Butanone	Tetrachloroethene
2-Hexanone	Toluene
4-Methyl-2-pentanone	Total xylenes
Acetone	trans-1,2-Dichloroethene
Acrylonitrile	trans-1,3-Dichloropropene
Benzene	trans-1,4-Dichloro-2-butene
Bromochloromethane	Trichloroethene
Bromodichloromethane	Trichlorofluoromethane
Bromoform	Vinyl acetate
Bromomethane	Vinyl chloride
Carbon disulfide	

*Supplemental Investigation Only

Table 2
Summary of Exceedances of AWQS
for the
19 - Month Data Set

Table 2A

		Number of Observations = AWQS			
Constituent	AWQS (mg/L)	**MW-1**	**MW-2**	**MW-3**	**MW-4**
F	4.0	0	0	18	1
NO_3 (as N)	10.0	18	18	1	0
Pb	0.05	1	1	0	0
Ni	0.1	0	0	0	1

Table 2B

		Maximum mg/L = AWQS			
Constituent	AWQS (mg/L)	**MW-1**	**MW-2**	**MW-3**	**MW-4**
F	4.0	-	-	5.4	4.0
NO_3 (as N)	10.0	32.0	15.0	13.0	-
Pb	0.05	0.053	0.068	-	-
Ni	0.1	-	-	-	0.11

Table 3
Constituents* for Which Statistically Significant Differences Occur With an Overall Significance Level of 0.05 Among Wells

	MW-1	MW-2	MW-3	MW-4
MW-1		TA, F, K, Na, Mg	TA, F, N, TDS, Cl, Ca, Mg, K, Na, As, Ba	TA, F, N, TDS, Cl, Ca, Mg, Na
MW-2			F, N, TDS, Cl, Ca, Mg, K, Na, As, Ba	TA, N, TDS, Ca, K, Na, Mg
MW-3				TA, F, K, As, Ba Ca, Mg

* Definition of symbols in Table 3:
TA = Total alkalinity (as calcium carbonate)
F = Fluoride
N = Nitrate (as Nitrogen)
Cl = Chlorine
TDS = Total dissolved solids
Ca = Calcium
Mg = Magnesium
K = Potassium
Na = Sodium
As = Arsenic
Ba = Barium

Table 4
Number of Samples[1] With Censored[2] Concentrations of Metals

Metal	MW-1	MW-2	MW-3	MW-4
As	1	0	0	0
Ag	18	18	18	19
Ba	0	0	0	0
Cd	19	18	19	19
Cr	1	1	0	0
Cu	4	4	9	9
Hg	19	19	19	19
Ni	1	2	8	1
Pb	0	0	0	0
Se	16	2	19	17
Zn	0	5	2	2

1. In a data set of 19 samples.
2. Reported as less than the reporting limit.

Table 5
Results of the Shapiro -Wilk Normality Test

	W (Distribution Type)	
	MW-3	**MW-4**
As	0.968 (N)	0.807 (NP)
Ba	0.953 (N)	0.941 (N)
Cr	0.831 (NP)	0.844 (NP)
Ni	See Table 6	0.942 (LN)
Pb	0.904 (N)	0.950 (N)
Zn	0.916 (LN)	0.940 (LN)

W = Shapiro-Wilk Test Statistic.
Data are normal (N) or Log-normal (LN) if W $\geq$ 0.901,
Otherwise a Non-parametric (NP) distribution is indicated.

Table 6
Results of Distribution Evaluation by Probability Plots

A. Cu for MW-3

	R^2 (P)	
Probability Plot Type	**Normal Quantile vs Data**	**Normal Quantile vs Log Data**
I	0.53 (0.016)	0.74 (0.001)
II	0.43 (0.039)	0.65 (0.005)

B. Cu for MW-4

	R^2 (P)	
Probability Plot Type	**Normal Quantile vs Data**	**Normal Quantile vs Log Data**
I	0.81 (<0.001)	0.96 (<0.001)
II	0.70 (0.003)	0.90 (<0.001)

C. Ni for MW-3

	R^2 (P)	
Probability Plot Type	**Normal Quantile vs Data**	**Normal Quantile vs Log Data**
I	0.89 (<0.001)	0.95 (<0.001)
II	0.81 (<0.001)	0.91 (<0.001)

Table 7
Well MW-3
Summary of Alert Levels for Metals
With an Indication of the Procedure Followed

Constituent	Fraction of Censored Data (%)	Distribution Type	Alert Level (mg/L)	AWQS* (mg/L)
Ag	95	Undetermined	0.05	**
As	0	Normal	0.0092	0.05
Ba	0	Normal	0.0720	2.0
Cd	100	Undetermined	0.0028	0.005
Cr	0	Nonparametric	0.0210	0.1
Cu	47	Nonparametric	0.0210	None
Hg	100	Undetermined	0.0011	0.002
Ni	42	Log-normal	0.0170	0.1
Pb	0	Normal	0.0052	0.05
Se	100	Nonparametric	0.0280	0.05
Zn	11	Log-normal	0.35	None

* = Aquifer Water Quality Standards
** = Secondary Maximum Contaminant Level 0.10 mg/L

Table 8
Well MW-4
Summary of Alert Levels for Metals
With an Indication of the Procedure Followed

Constituent	Fraction of Censored Data (%)	Distribution Type	Alert Level (mg/L)	AWQS* (mg/L)
Ag	100	Undetermined	0.05	**
As	0	Nonparametric	0.0092	0.05
Ba	0	Normal	0.0790	2.0
Cd	100	Undetermined	0.0028	0.005
Cr	0	Nonparametric	0.0230	0.1
Cu	47	Log-normal	0.0220	None
Hg	100	Undetermined	0.0011	0.002
Ni	5	Log-normal	0.12	0.1
Pb	0	Normal	0.0052	0.05
Se	89	Nonparametric	0.0071	0.05
Zn	11	Log-normal	0.35	None

* = Aquifer Water Quality Standards
** = Secondary Maximum Contaminant Level 0.10 mg/L

Table 9
Summary of Detected Concentrations of Chloromethane (mg/L)
October 2005

Well	Trip Blank	Field Duplicate	Field Original
MW-1	0.5	0.6	0.6
MW-2	<0.5	-	0.6
MW-3	<0.5	-	0.5
MW-4	-	-	<0.5

Table 10
Well MW-3 and MW-4
Summary of Alert Levels for Organic Constituents

Constituent	PQL [1]	AWQS (µg/L)	SR85 Alert Levels [2] (µg/L)
1,1,1,2-Tetrachloroethane	0.5	None	2.0
1,1,1-Trichloroethane	0.5	200	2.0
1,1,2,2-Tetrachloroethane	0.5	None	2.0
1,1,2-Trichloroethane	0.5	5.0	2.0
1,1-Dichloroethane	0.5	None	2.0
1,1-Dichloroethene	0.5	7.0	2.0
1,2,3-Trichloropropane	0.5	None	2.0
1,2-Dibromo-3-chloropropane	0.01	0.20	0.20
1,2-Dibromoethane (edb)	0.01	0.05	0.05
1,2-Dichlorobenzene	0.5	600	2.0
1,2-Dichloroethane	0.5	5.0	2.0
1,2-Dichloropropane	0.5	5.0	2.0
1,4-Dichlorobenzene	0.5	75	2.0
2-Butanone	10	None	10
2-Hexanone	10	None	10 [3]
4-Methyl-2-pentanone	10	None	10 [3]
Acetone	10	None	50
Acrylonitrile	50	None	50
Benzene	0.5	5.0	2.0
Bromochloromethane	0.5	None	2.0
Bromodichloromethane	0.5	100	2.0
Bromoform	0.5	100	2.0
Bromomethane	0.5	None	5.0
Carbon disulfide	0.5	None	2.0
Carbon tetrachloride	0.5	5.0	2.0
Chlorobenzene	0.5	100	2.0
Chloroethane	0.5	None	5.0
Chloroform	0.5	100	2.0
Chloromethane	0.5	0.50	0.5 [4]
cis-1,2-Dichloroethene	0.5	70	2.0
cis-1,3-Dichloropropene	0.5	None	2.0
Dibromochloromethane	0.5	None	2.0
Dibromomethane	0.5	None	2.0
Ethylbenzene	0.5	700	2.0
Iodomethane	0.1	None	2.0
Methylene chloride	3.0	5.0	3.0 [3]
Styrene	0.5	100	2.0
Tetrachloroethene	0.5	5.0	2.0
Toluene	0.5	1000	2.0
Total xylenes	1.5	10000	6.0
trans-1,2-Dichloroethene	0.5	100	2.0
trans-1,3-Dichloropropene	0.5	None	2.0
trans-1,4-Dichloro-2-butene	10	None	10
Trichloroethene	0.5	5.0	2.0
Trichlorofluoromethane	0.5	None	2.0
Vinyl acetate	10	None	10
Vinyl chloride	0.5	2.0	2.0

1. Practical Quantitative Limit
2. Based on Skunk Creek Alert Levels.
3. Alert Levels Raised to match the PQL
4. Alert Levels Lowered to match the PQL

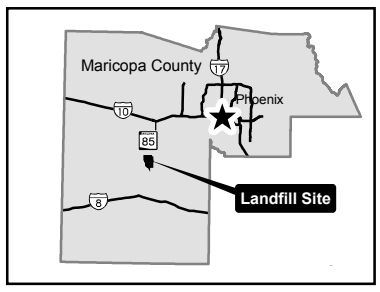
FIGURES

Figure 1
Regional Location Map

Legend

- Landfill Perimeter
- Town of Buckeye
- Town of Gila Bend

General Location



N

0 1 2 3 4
Miles

URS

Map Produced 04/28/05

Source:
United States Geologic Survey, Ajo 1x2 Degree Quadrangle Map, 1969.
United States Geologic Survey, Phoenix 1x2 Degree Quadrangle Map, 1969.
Arizona State Land Department, 1997.

P:\City_of_Phoenix\SR_85_Landfill_Design\Monitor Wells\GIS\mxds\SR-85_Wells_Figure1_v2.mxd

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MW-1
MW-2
MW-3
MW-4
Cell 1
Cell 2
Cell 3
Future Cells
T2S
T3S
R5W
R4W
80
85
ARIZONA
Little Rainbow Wash
Rainbow
Eight-Mile Canal
Old U.S. Highway 80
Gila River
COTTON CENTER NW
COTTON CEN
ARIZONA
7.5 MINUTE SE

Figure 2
Monitor Well Location Map

Legend

- Landfill Site Perimeter
- Cell Development Boundary
- Township Range Section
- MW-1 Location for Monitor Wells

Source:
Monitor Well Survey: Kiewit Western Co., 2005
USGS 7.5 Minute Quadrangle, Cotton Center, 1991.
USGS 7.5 Minute Quadrangle, Cotton Center NW, 1991.
Arizona Department of Water Resources, 2002.

0 0.25 0.5 1
Scale In Miles

N

URS

P:\City_of_Phoenix\SR_85_Landfill_Design\Monitor Wells\GIS\mxds\Groundwater_Contour_Map_Fig.3

MW-1
MW-2
MW-3
MW-4
Cell 1
Cell 2
Cell 3
Future Cells
80
ARIZONA 85
T2S
T3S
R5W
R4W
Cotton Gin
LANDING STRIP
HIGHWAY
CANAL
EIGHTY
Rainbow
Well 809
Well 785
Well 752
Well 750
Well 820
Well 802
Well 631
Well 861
Well 738
Well 748
Well 751
Well 816
Well 857
Hedge 864
BM 745X
BM 742
310
320
330
775
764
798
828
868
846
859
863
817
785
782
749
706
728
747
733
720
710
760
800
840
880
900
947
909
LANDING STRIP 857

Figure 3
Groundwater Contour Map

Legend

- Landfill Site Perimeter
- Cell Development Boundary
- Groundwater Level Contour
- Township Range Section
- Groundwater Flow Direction
- MW-1 Location for Monitor Wells

0 0.25 0.5 1 Miles

N

URS

Source:
Monitor Well Survey: Kiewit Western Co., 2005
USGS 7.5 Minute Quadrangle, Cotton Center, 1991.
USGS 7.5 Minute Quadrangle, Cotton Center NW, 1991.
Arizona Department of Water Resources, 2002.

APPENDIX A

GROUNDWATER QUALITY ANALYTICAL DATA

- **Organic Chemicals**
- **Metals, Field Original Samples Only**
- **General Chemistry, Field Original Samples Only**
- **Laboratory Analytical Data (CD)**

Note: Metals data, with the exception of Ca, Mg, K, and Na are tabulated to four decimal places. In all cased full precisions as reported by the laboratory were used in the statical analysis.

SR 85 Metals Background Data Set (mg/l) Field Original Samples Only

	1-Well	2-Sample Date	3-Sb	4-As	5-Ba	6-Be
1	MW-1	1/5/2006	<0.0010	0.0065	0.0520	<0.0010
2	MW-1	2/22/2005	<0.0010	0.0063	0.0730	<0.0010
3	MW-1	3/2/2005	<0.0010	0.0064	0.0740	<0.0010
4	MW-1	4/13/2005	<0.0010	0.0062	0.0600	<0.0010
5	MW-1	5/3/2005	<0.0010	0.0068	0.0610	<0.0010
6	MW-1	6/1/2005	<0.0010	0.0050	0.0530	<0.0010
7	MW-1	7/6/2005	<0.0010	0.0050	0.0580	<0.0010
8	MW-1	8/9/2005	<0.0040	<0.0050	0.0510	<0.0040
9	MW-1	9/7/2005	<0.0010	0.0031	0.0330	<0.0010
10	MW-1	10/10/2005	<0.0050	0.0061	0.0660	<0.0010
11	MW-1	11/1/2005	<0.0010	0.0064	0.0640	<0.0010
12	MW-1	12/1/2005	<0.0010	0.0063	0.0620	<0.0010
13	MW-1	6/28/2006	<0.0010	0.0041	0.0600	<0.0010
14	MW-1	7/20/2006	<0.0010	0.0052	0.0750	<0.0010
15	MW-1	8/17/2006	<0.0010	0.0049	0.0720	<0.0010
16	MW-1	9/21/2006	<0.0010	0.0047	0.0880	<0.0010
17	MW-1	10/19/2006	<0.0010	0.0046	0.0850	<0.0010
18	MW-1	11/16/2006	<0.0010	0.0069	0.0800	<0.0010
19	MW-1	12/21/2006	<0.0010	0.0042	0.0780	<0.0010
20	MW-2	1/5/2006	<0.0010	0.0059	0.0550	<0.0010
21	MW-2	2/22/2005	<0.0010	0.0048	0.0540	<0.0010
22	MW-2	3/2/2005	<0.0010	0.0050	0.0520	<0.0010
23	MW-2	4/13/2005	<0.0010	0.0054	0.0670	<0.0010
24	MW-2	5/3/2005	<0.0010	0.0062	0.0710	<0.0010
25	MW-2	6/1/2005	<0.0010	0.0041	0.0530	<0.0010
26	MW-2	7/6/2005	<0.0010	0.0052	0.0680	<0.0010
27	MW-2	8/9/2005	<0.0050	0.0033	0.0510	<0.0010
28	MW-2	9/7/2005	0.0031	0.0033	0.0760	<0.0010
29	MW-2	10/10/2005	<0.0050	0.0064	0.0750	<0.0010
30	MW-2	11/1/2005	<0.0010	0.0054	0.0660	<0.0010
31	MW-2	12/1/2005	<0.0010	0.0060	0.0590	<0.0010
32	MW-2	6/28/2006	<0.0010	0.0034	0.0600	<0.0010
33	MW-2	7/20/2006	<0.0010	0.0040	0.1000	<0.0010
34	MW-2	8/17/2006	<0.0010	0.0045	0.0740	<0.0010
35	MW-2	9/21/2006	<0.0010	0.0044	0.0770	<0.0010
36	MW-2	10/19/2006	<0.0010	0.0044	0.0750	<0.0010
37	MW-2	11/16/2006	<0.0010	0.0068	0.0660	<0.0010
38	MW-2	12/21/2006	<0.0010	0.0043	0.0570	<0.0010
39	MW-3	1/20/2005	<0.0010	0.0053	0.0540	<0.0010
40	MW-3	2/22/2005	<0.0010	0.0069	0.0480	<0.0010
41	MW-3	3/2/2005	<0.0010	0.0068	0.0540	<0.0010
42	MW-3	4/13/2005	<0.0010	0.0071	0.0610	<0.0010
43	MW-3	5/3/2005	<0.0010	0.0074	0.0550	<0.0010
44	MW-3	6/1/2005	<0.0010	0.0056	0.0440	<0.0010
45	MW-3	7/6/2005	<0.0010	0.0074	0.0520	<0.0010

SR 85 Metals Background Data Set (mg/l) Field Original Samples Only

	7-Co	8-Cd	9-Ca	10-Cr	11-Cu	12-Pb
1	<0.0020	<0.0005	290.0	0.0019	<0.0020	0.0042
2	<0.0020	<0.0005	350.0	0.0019	0.0021	0.0100
3	<0.0020	<0.0005	360.0	0.0022	0.0032	0.0010
4	<0.0020	<0.0005	410.0	0.0028	0.0035	0.0042
5	<0.0020	<0.0005	410.0	0.0083	<0.0020	0.0039
6	<0.0020	<0.0005	440.0	0.0037	<0.0020	0.0034
7	<0.0020	<0.0005	410.0	0.0018	0.0120	0.0110
8	<0.0020	<0.0020	430.0	<0.0050	<0.0080	0.0230
9	<0.0020	<0.0005	340.0	0.0012	0.0064	0.0530
10	<0.0020	<0.0005	310.0	0.0240	0.0046	0.0150
11	<0.0020	<0.0005	290.0	0.0025	0.0024	0.0032
12	<0.0020	<0.0005	290.0	0.0018	0.0032	0.0009
13	<0.0020	<0.0005	300.0	0.0051	0.0021	0.0011
14	<0.0020	<0.0005	330.0	0.0061	0.0027	0.0006
15	<0.0020	<0.0005	340.0	0.0084	0.0041	0.0006
16	<0.0020	<0.0005	360.0	0.0029	0.0025	0.0006
17	<0.0020	<0.0005	400.0	0.0039	0.0069	0.0006
18	<0.0020	<0.0005	400.0	0.0026	0.0028	0.0008
19	<0.0020	<0.0005	430.0	0.0072	0.0024	0.0002
20	<0.0020	<0.0005	260.0	0.0023	0.0031	0.0025
21	<0.0020	0.0005	230.0	0.0024	0.1200	0.0330
22	<0.0020	<0.0005	230.0	0.0019	<0.0020	0.0026
23	<0.0020	<0.0005	330.0	0.0022	<0.0020	0.0120
24	<0.0020	<0.0005	320.0	0.0050	<0.0020	0.0047
25	<0.0020	<0.0005	330.0	0.0023	0.0081	0.0260
26	<0.0020	<0.0005	340.0	0.0031	0.0120	0.0680
27	<0.0020	<0.0025	340.0	<0.0050	0.0100	0.0170
28	<0.0100	<0.0005	350.0	0.0062	0.0049	0.0140
29	<0.0020	<0.0005	340.0	0.0290	0.0033	0.0023
30	<0.0020	<0.0005	270.0	0.0027	0.0170	0.0250
31	<0.0020	<0.0005	270.0	0.0022	0.0056	0.0034
32	<0.0020	<0.0005	350.0	0.0036	<0.002	0.0006
33	<0.0020	<0.0005	390.0	0.0060	0.0088	0.0029
34	<0.0020	<0.0005	400.0	0.0059	0.0022	0.0002
35	<0.0020	<0.0005	410.0	0.0027	0.0025	0.0005
36	<0.0020	<0.0005	410.0	0.0033	0.0095	0.0003
37	<0.0020	<0.0005	360.0	0.0027	0.0046	0.0008
38	<0.0020	<0.0005	350.0	0.0051	0.0029	0.0003
39	<0.0020	<0.0005	110.0	0.0025	<0.0040	0.0021
40	<0.0020	<0.0005	110.0	0.0028	0.0030	0.0055
41	<0.0020	<0.0005	110.0	0.0026	<0.0020	0.0030
42	<0.0020	<0.0005	110.0	0.0036	<0.0020	0.0036
43	<0.0020	<0.0005	100.0	0.0060	<0.0020	0.0025
44	<0.0020	<0.0005	110.0	0.0033	0.0039	0.0031
45	<0.0020	<0.0005	110.0	0.0035	0.0026	0.0018

SR 85 Metals Background Data Set (mg/l) Field Original Samples Only

	13-Mg	14-Hg	15-Ni	16-K	17-Se	18-Ag
1	110.0	<0.0002	0.0072	10.0	<0.0050	<0.0005
2	120.0	<0.0002	0.0130	12.0	<0.0050	<0.0005
3	120.0	<0.0002	0.0150	12.0	<0.0050	<0.0005
4	140.0	<0.0002	0.0130	13.0	0.0067	<0.0005
5	140.0	<0.0002	0.0200	13.0	<0.0050	<0.0005
6	150.0	<0.0002	0.0180	15.0	0.0073	<0.0005
7	150.0	<0.0002	0.0150	12.0	<0.0050	<0.0005
8	160.0	<0.0002	<0.0200	11.0	<0.0250	<0.0020
9	120.0	<0.0002	0.0081	11.0	<0.0050	<0.0005
10	110.0	<0.0002	0.0390	9.8	<0.0050	0.0007
11	110.0	<0.0002	0.0089	9.9	<0.0050	<0.0005
12	100.0	<0.0002	0.0081	9.3	<0.0050	<0.0005
13	110.0	<0.0002	0.0250	11.0	<0.0050	<0.0005
14	120.0	<0.0002	0.0120	12.0	<0.005	<0.0005
15	120.0	<0.0002	0.0140	11.0	<0.005	<0.0005
16	130.0	<0.0002	0.0150	11.0	<0.005	<0.0005
17	130.0	<0.0002	0.0130	11.0	<0.005	<0.0005
18	150.0	<0.0002	0.0170	12.0	0.0050	<0.0005
19	150.0	<0.0002	0.0170	14.0	<0.005	<0.0005
20	26.0	<0.0002	0.0150	15.0	0.0083	<0.0005
21	23.0	<0.0002	0.0096	13.0	0.0076	<0.0005
22	24.0	<0.0002	0.0090	14.0	0.0071	<0.0005
23	28.0	<0.0002	0.0110	17.0	0.0086	<0.0005
24	27.0	<0.0002	0.0150	17.0	<0.0050	<0.0005
25	27.0	<0.0002	0.0120	18.0	0.0140	<0.0005
26	28.0	<0.0002	0.0120	16.0	0.0076	<0.0005
27	29.0	<0.0002	<0.0250	16.0	<0.0250	<0.0025
28	29.0	<0.0002	<0.0250	17.0	0.0100	<0.0025
29	29.0	<0.0002	0.0450	16.0	0.0080	0.0009
30	25.0	<0.0002	0.0170	15.0	0.0077	<0.0005
31	25.0	<0.0002	0.0150	14.0	0.0082	<0.0005
32	28.0	<0.0002	0.0260	18.0	0.0110	<0.0005
33	30.0	<0.0002	0.0170	20.0	0.0098	<0.0005
34	33.0	<0.0002	0.0150	19.0	0.0110	<0.0005
35	31.0	<0.0002	0.0200	18.0	0.0100	<0.0005
36	30.0	<0.0002	0.0220	18.0	0.0110	<0.0005
37	29.0	<0.0002	0.0230	18.0	0.0100	<0.0005
38	27.0	<0.0002	0.0220	21.0	0.0094	<0.0005
39	9.4	<0.0002	<0.0050	9.8	<0.0050	<0.0005
40	9.6	<0.0002	<0.0050	10.0	<0.0050	<0.0005
41	9.6	<0.0002	<0.0050	10.0	<0.0050	<0.0005
42	9.6	<0.0002	<0.0050	10.0	<0.0050	<0.0005
43	9.0	<0.0002	0.0052	9.4	<0.0050	<0.0005
44	9.5	<0.0002	<0.0050	10.0	<0.0050	<0.0005
45	9.6	<0.0002	<0.0050	9.2	<0.0050	<0.0005

SR 85 Metals Background Data Set (mg/l) Field Original Samples Only

	19-V	20-Tl	21-Zn	22-Na
1	0.0060	<0.0010	0.0120	--
2	0.0050	<0.0010	0.6200	--
3	0.0055	<0.0010	0.1200	--
4	0.0054	<0.0010	0.1100	--
5	0.0054	<0.0010	0.0650	--
6	0.0055	<0.0010	0.0300	--
7	0.0053	<0.0010	0.0670	--
8	0.0050	<0.0040	0.0880	--
9	0.0053	<0.0010	0.0270	--
10	0.0061	<0.0010	0.0460	--
11	0.0058	<0.0010	0.0280	--
12	0.0062	<0.0010	0.0110	--
13	0.0044	<0.0010	0.0110	730.0
14	0.0057	<0.0010	0.0091	--
15	0.0060	<0.0010	0.0150	830.0
16	0.0059	<0.0010	0.0096	770.0
17	0.0060	<0.0010	0.0180	870.0
18	0.0059	<0.0010	0.0190	800.0
19	0.0055	<0.0010	0.0100	790.0
20	0.0025	<0.0010	0.0140	--
21	<0.0020	<0.0010	0.2800	--
22	<0.0020	<0.0010	0.2500	--
23	0.0022	<0.0010	0.1400	--
24	0.0020	<0.0010	0.1300	--
25	<0.0020	<0.0010	0.0500	--
26	0.0020	<0.0010	0.0430	--
27	0.0026	<0.0010	0.0260	--
28	0.0025	<0.0010	<0.0250	--
29	0.0025	<0.0010	0.0068	--
30	0.0021	<0.0010	0.0190	--
31	0.0022	<0.0010	0.0080	--
32	0.0044	<0.0010	<0.005	920.0
33	0.0023	<0.0010	0.0130	--
34	0.0024	<0.0010	<0.0050	990.0
35	0.0021	<0.0010	<0.005	990.0
36	0.0021	<0.0010	0.0110	1100.0
37	0.0022	<0.0010	0.0086	930.0
38	<0.002	<0.0010	<0.005	850.0
39	<0.0030	<0.0010	0.2900	--
40	0.0024	<0.0010	0.2500	--
41	0.0027	<0.0010	0.0370	--
42	0.0029	<0.0010	0.0420	--
43	0.0029	<0.0010	0.0200	--
44	0.0025	<0.0010	0.0170	--
45	0.0029	<0.0010	0.0150	--

SR 85 Metals Background Data Set (mg/l) Field Original Samples Only

	1-Well	2-Sample Date	3-Sb	4-As	5-Ba	6-Be
46	MW-3	8/9/2005	<0.0010	0.0062	0.0430	<0.0010
47	MW-3	9/7/2005	<0.0010	0.0075	0.0600	<0.0010
48	MW-3	10/10/2005	<0.0050	0.0075	0.0570	<0.0010
49	MW-3	11/1/2005	<0.0010	0.0063	0.0730	<0.0010
50	MW-3	12/1/2005	<0.0010	0.0075	0.0610	<0.0010
51	MW-3	6/28/2006	<0.0010	0.0062	0.0530	<0.0010
52	MW-3	7/20/2006	<0.0010	0.0064	0.0620	<0.0010
53	MW-3	8/17/2006	<0.0010	0.0076	0.0550	<0.0010
54	MW-3	9/21/2006	<0.0010	0.0083	0.0590	<0.0010
55	MW-3	10/19/2006	<0.0010	0.0086	0.0560	<0.0010
56	MW-3	11/16/2006	<0.0010	0.0080	0.0570	<0.0010
57	MW-3	12/21/2006	<0.0010	0.0073	0.0510	<0.0010
58	MW-4	1/24/2005	<0.0010	0.0092	0.0670	<0.0010
59	MW-4	2/22/2005	<0.0010	0.0052	0.0560	<0.0010
60	MW-4	3/2/2005	<0.0010	0.0051	0.0620	<0.0010
61	MW-4	4/13/2005	<0.0010	0.0051	0.0620	<0.0010
62	MW-4	5/3/2005	<0.0010	0.0050	0.0630	<0.0010
63	MW-4	6/1/2005	<0.0050	0.0051	0.0610	<0.0050
64	MW-4	7/6/2005	<0.0010	0.0046	0.0580	<0.0010
65	MW-4	8/9/2005	<0.0010	0.0042	0.0440	<0.0010
66	MW-4	9/7/2005	<0.0010	0.0050	0.0640	<0.0010
67	MW-4	10/10/2005	<0.0050	0.0051	0.0590	<0.0010
68	MW-4	11/1/2005	<0.0010	0.0045	0.0750	<0.0010
69	MW-4	12/1/2005	<0.0010	0.0053	0.0610	<0.0010
70	MW-4	6/28/2006	<0.0010	0.0041	0.0580	<0.0010
71	MW-4	7/20/2006	<0.0010	0.0051	0.0640	<0.0010
72	MW-4	8/17/2006	<0.0010	0.0043	0.0590	<0.0010
73	MW-4	9/21/2006	<0.0010	0.0062	0.0680	<0.0010
74	MW-4	10/19/2006	<0.0010	0.0054	0.0720	<0.0010
75	MW-4	11/16/2006	<0.0010	0.0059	0.0720	<0.0010
76	MW-4	12/21/2006	<0.0010	0.0046	0.0660	<0.0010

SR 85 Metals Background Data Set (mg/l) Field Original Samples Only

	7-Co	8-Cd	9-Ca	10-Cr	11-Cu	12-Pb
46	<0.0020	<0.0005	110.0	0.0026	0.0031	0.0026
47	<0.0020	<0.0005	110.0	0.0031	0.0031	0.0015
48	<0.0020	<0.0005	110.0	0.0210	<0.0020	0.0016
49	<0.0020	<0.0005	110.0	0.0041	0.0045	0.0027
50	<0.0020	<0.0005	110.0	0.0036	0.0210	0.0018
51	<0.0020	<0.0005	100.0	0.0050	<0.002	0.0004
52	<0.0020	<0.0005	110.0	0.0055	<0.002	0.0008
53	<0.0020	<0.0005	110.0	0.0068	<0.002	0.0005
54	<0.0020	<0.0005	100.0	0.0045	<0.002	0.0006
55	<0.0020	<0.0005	110.0	0.0043	0.0031	0.0005
56	<0.0020	<0.0005	110.0	0.0040	0.0021	0.0004
57	<0.0020	<0.0005	100.0	0.0061	0.0023	0.0003
58	<0.0020	<0.0005	180.0	0.0026	0.0056	0.0030
59	<0.0020	<0.0005	170.0	0.0021	<0.0020	0.0019
60	<0.0020	<0.0005	170.0	0.0022	<0.0020	0.0016
61	<0.0020	<0.0005	150.0	0.0036	<0.0020	0.0018
62	<0.0020	<0.0005	160.0	0.0039	<0.0020	0.0016
63	<0.0100	<0.0025	170.0	0.0057	0.0160	0.0052
64	<0.0020	<0.0005	150.0	0.0031	0.0035	0.0013
65	<0.0020	<0.0005	150.0	0.0017	0.0036	0.0037
66	<0.0020	<0.0005	150.0	0.0021	0.0091	0.0046
67	<0.0020	<0.0005	150.0	0.0230	<0.0020	0.0009
68	<0.0020	<0.0005	140.0	0.0030	0.0030	0.0010
69	<0.0020	<0.0005	150.0	0.0023	<0.0020	0.0005
70	<0.0020	<0.0005	180.0	0.0041	<0.002	0.0017
71	<0.0020	<0.0005	180.0	0.0046	0.0022	0.0008
72	<0.0020	<0.0005	180.0	0.0067	<0.002	0.0003
73	<0.0020	<0.0005	180.0	0.0034	0.0041	0.0008
74	<0.0020	<0.0005	190.0	0.0031	0.0041	0.0003
75	<0.0020	<0.0005	190.0	0.0025	0.0021	0.0002
76	<0.0020	<0.0005	170.0	0.0047	<.002	0.0002

SR 85 Metals Background Data Set (mg/l) Field Original Samples Only

	13-Mg	14-Hg	15-Ni	16-K	17-Se	18-Ag
46	9.6	<0.0002	0.0057	9.2	<0.0050	<0.0005
47	9.6	<0.0002	<0.0050	9.4	<0.0050	<0.0005
48	9.4	<0.0002	0.0150	8.9	<0.0050	0.0010
49	9.5	<0.0002	0.0057	9.2	<0.0050	<0.0005
50	9.5	<0.0002	<0.0050	9.4	<0.0050	<0.0005
51	9.3	<0.0002	0.0080	9.5	<0.0050	<0.0005
52	9.4	<0.0002	0.0053	10.0	<0.0050	<0.0005
53	9.5	<0.0002	0.0071	9.5	<0.005	<0.0005
54	9.2	<0.0002	0.0086	9.2	<0.005	<0.0005
55	9.2	<0.0002	0.0074	8.9	<0.005	<0.0005
56	9.5	<0.0002	0.0100	9.2	<0.005	<0.0005
57	9.3	<0.0002	0.0084	10.0	<0.005	<0.0005
58	18.0	<0.0002	0.0067	12.0	<0.0050	<0.0005
59	17.0	<0.0002	0.0067	12.0	<0.0050	<0.0005
60	16.0	<0.0002	0.0069	12.0	<0.0050	<0.0005
61	15.0	<0.0002	0.0083	11.0	<0.0050	<0.0005
62	16.0	<0.0002	0.0097	11.0	0.0070	<0.0005
63	17.0	<0.0002	<0.0250	12.0	<0.0250	<0.0025
64	15.0	<0.0002	0.0130	10.0	<0.0050	<0.0005
65	15.0	<0.0002	0.0670	9.8	<0.0050	<0.0005
66	15.0	<0.0002	0.0180	10.0	<0.0050	<0.0005
67	15.0	<0.0002	0.0280	9.9	<0.0050	<0.0005
68	15.0	<0.0002	0.0140	10.0	<0.0050	<0.0005
69	14.0	<0.0002	0.0110	9.8	<0.0050	<0.0005
70	18.0	<0.0002	0.1100	11.0	<0.0050	<0.0005
71	18.0	<0.0002	0.0330	11.0	<0.005	<0.0005
72	19.0	<0.0002	0.0140	11.0	<0.005	<0.0005
73	18.0	<0.0002	0.0410	11.0	0.0071	<0.0005
74	18.0	<0.0002	0.0280	11.0	<0.005	<0.0005
75	18.0	<0.0002	0.0260	11.0	<0.005	<0.0005
76	17.0	<0.0002	0.0240	13.0	<0.005	<0.0005

SR 85 Metals Background Data Set (mg/l) Field Original Samples Only

	19-V	20-Tl	21-Zn	22-Na
46	0.0031	<0.0010	0.0170	--
47	0.0027	<0.0010	0.0098	--
48	0.0031	<0.0010	0.0150	--
49	0.0028	<0.0010	0.0260	--
50	0.0031	<0.0010	0.0270	--
51	<.003	<0.0010	<0.005	490.0
52	0.0029	<0.0010	0.0072	--
53	0.0030	<0.0010	<0.0050	530.0
54	0.0029	<0.0010	0.0073	500.0
55	0.0030	<0.0010	0.0082	510.0
56	0.0029	<0.0010	0.0069	490.0
57	0.0027	<0.0010	0.0054	440.0
58	<0.0030	<0.0010	0.1400	--
59	<0.0020	<0.0010	0.0850	--
60	0.0021	<0.0010	0.0890	--
61	0.0020	<0.0010	0.0420	--
62	<0.0040	<0.0010	0.0460	--
63	0.0021	<0.0050	0.1100	--
64	<0.0020	<0.0010	0.0200	--
65	0.0024	<0.0010	0.0150	--
66	<0.0020	<0.0010	0.0310	--
67	0.0023	<0.0010	0.0088	--
68	<0.0020	<0.0010	0.0088	--
69	0.0021	<0.0010	0.0061	--
70	<0.003	<0.0010	0.0089	470.0
71	<0.002	<0.0010	0.0150	--
72	<0.002	<0.0010	<0.0050	500.0
73	<0.002	<0.0010	0.0057	490.0
74	<0.002	<0.0010	0.0072	510.0
75	<0.002	<0.0010	0.0073	500.0
76	<0.002	<0.0010	<0.005	450.0

General Chemistry Data Set (mg/l) Field Original Samples Only

	1-Well ID	2-Sample Date	3-Tot. Alk.	4-F	5-NO3 as N	6-TDS
1	MW-1	1/5/2006	186.00	0.590	15.00	3470.0
2	MW-1	2/22/2005	174.00	0.560	20.00	3740.0
3	MW-1	3/2/2005	176.00	0.570	19.00	3660.0
4	MW-1	4/13/2005	175.00	0.520	26.00	4480.0
5	MW-1	5/3/2005	183.00	0.560	25.00	4560.0
6	MW-1	6/1/2005	190.00	0.430	32.00	5060.0
7	MW-1	7/6/2005	203.00	0.570	21.00	5260.0
8	MW-1	8/9/2005	178.00	0.520	25.00	5180.0
9	MW-1	9/7/2005	180.00	0.600	20.00	4270.0
10	MW-1	10/10/2005	189.00	0.400	17.00	3610.0
11	MW-1	11/1/2005	190.00	0.670	2.00	3560.0
12	MW-1	12/1/2005	203.00	0.610	13.50	3820.0
13	MW-1	6/28/2006	178.00	0.060	15.00	3500.0
14	MW-1	7/20/2006	177.00	0.560	18.00	3670.0
15	MW-1	8/17/2006	123.00	0.340	20.00	3740.0
16	MW-1	9/21/2006	166.00	0.580	19.00	3640.0
17	MW-1	10/19/2006	165.00	0.630	18.00	3840.0
18	MW-1	11/16/2006	169.00	0.620	19.00	4800.0
19	MW-1	12/21/2006	163.00	0.580	20.00	4640.0
20	MW-2	1/5/2006	78.00	3.200	12.00	3150.0
21	MW-2	2/22/2005	79.60	3.300	13.00	3060.0
22	MW-2	3/2/2005	78.70	3.600	12.00	2980.0
23	MW-2	4/13/2005	95.20	2.830	15.00	3700.0
24	MW-2	5/3/2005	97.00	2.700	14.00	3690.0
25	MW-2	6/1/2005	93.90	2.900	15.00	3610.0
26	MW-2	7/6/2005	89.00	2.700	13.00	3820.0
27	MW-2	8/9/2005	86.40	2.760	12.00	3770.0
28	MW-2	9/7/2005	86.60	2.600	12.00	3980.0
29	MW-2	10/10/2005	85.70	2.980	12.40	3680.0
30	MW-2	11/1/2005	79.60	3.560	3.10	3320.0
31	MW-2	12/1/2005	85.20	3.200	11.40	3350.0
32	MW-2	6/28/2006	88.00	2.300	12.00	3680.0
33	MW-2	7/20/2006	88.00	2.700	13.00	3870.0
34	MW-2	8/17/2006	59.00	1.900	14.00	4010.0
35	MW-2	9/21/2006	86.00	3.800	14.00	3790.0
36	MW-2	10/19/2006	84.00	3.400	13.00	3840.0
37	MW-2	11/16/2006	79.00	3.400	13.00	3590.0
38	MW-2	12/21/2006	85.00	3.100	14.00	3950.0
39	MW-3	1/20/2005	96.50	4.200	2.80	1740.0
40	MW-3	2/22/2005	95.90	4.300	3.50	1740.0
41	MW-3	3/2/2005	96.70	4.500	3.10	1730.0
42	MW-3	4/13/2005	101.00	4.140	3.00	1700.0
43	MW-3	5/3/2005	103.00	4.000	2.80	1720.0
44	MW-3	6/1/2005	117.00	4.400	3.10	1700.0
45	MW-3	7/6/2005	96.60	4.300	3.02	1720.0

General Chemistry Data Set (mg/l) Field Original Samples Only

	7-Cl	8-Ca	9-Mg	10-K	11-Zn	12-Na
1	--	290.0	110.0	10.00	0.1200	--
2	--	350.0	120.0	12.00	0.6200	--
3	--	360.0	120.0	12.00	0.1200	--
4	--	410.0	140.0	13.00	0.1100	--
5	--	410.0	140.0	13.00	0.0650	--
6	--	440.0	150.0	15.00	0.0300	--
7	--	410.0	150.0	12.00	0.0670	--
8	--	430.0	160.0	11.00	0.0880	--
9	--	340.0	120.0	11.00	0.0270	--
10	--	310.0	110.0	9.80	0.0460	--
11	--	290.0	110.0	9.90	0.0280	--
12	--	290.0	100.0	9.30	0.0110	--
13	1590.0	300.0	110.0	11.00	0.0110	730.0
14	--	330.0	120.0	12.00	0.0091	--
15	1520.0	340.0	120.0	11.00	0.0150	830.0
16	1620.0	360.0	130.0	11.00	0.0096	770.0
17	1600.0	400.0	130.0	11.00	0.0180	870.0
18	1770.0	400.0	150.0	12.00	0.0190	800.0
19	1760.0	430.0	150.0	14.00	0.0100	790.0
20	--	260.0	26.0	15.00	0.0140	--
21	--	230.0	23.0	13.00	0.2800	--
22	--	230.0	24.0	14.00	0.2500	--
23	--	330.0	28.0	17.00	0.1400	--
24	--	320.0	27.0	17.00	0.1300	--
25	--	330.0	27.0	18.00	0.0500	--
26	--	340.0	28.0	16.00	0.0430	--
27	--	340.0	29.0	16.00	0.0260	--
28	--	350.0	29.0	17.00	<0.0250	--
29	--	340.0	29.0	16.00	0.0068	--
30	--	270.0	25.0	15.00	0.0190	--
31	--	270.0	25.0	14.00	0.0080	--
32	1550.0	350.0	28.0	18.00	<0.005	920.0
33	--	390.0	30.0	20.00	0.0130	--
34	1480.0	400.0	33.0	19.00	<0.0050	990.0
35	1510.0	410.0	31.0	18.00	<0.005	990.0
36	1500.0	410.0	30.0	18.00	0.0110	1100.0
37	1470.0	360.0	29.0	18.00	0.0086	930.0
38	1390.0	350.0	27.0	21.00	<0.005	850.0
39	--	110.0	9.4	9.80	0.2900	--
40	--	110.0	9.6	10.00	0.2500	--
41	--	110.0	9.6	10.00	0.0370	--
42	--	110.0	9.6	10.00	0.0420	--
43	--	100.0	9.0	9.40	0.0200	--
44	--	110.0	9.5	10.00	0.0170	--
45	--	110.0	9.6	9.20	0.0150	--

General Chemistry Data Set (mg/l) Field Original Samples Only

	1-Well ID	2-Sample Date	3-Tot. Alk.	4-F	5-NO3 as N	6-TDS
46	MW-3	8/9/2005	95.10	4.060	2.90	1660.0
47	MW-3	9/7/2005	95.30	4.100	13.00	1710.0
48	MW-3	10/10/2005	97.10	4.540	3.10	1730.0
49	MW-3	11/1/2005	96.60	4.850	3.30	1740.0
50	MW-3	12/1/2005	102.00	4.400	3.19	2230.0
51	MW-3	6/28/2006	90.00	4.200	2.80	1720.0
52	MW-3	7/20/2006	98.00	4.400	2.90	1670.0
53	MW-3	8/17/2006	75.00	3.500	3.30	1700.0
54	MW-3	9/21/2006	93.00	5.200	3.00	1780.0
55	MW-3	10/19/2006	93.00	5.300	2.90	1700.0
56	MW-3	11/16/2006	92.00	5.400	2.90	1680.0
57	MW-3	12/21/2006	94.00	4.700	2.90	2130.0
58	MW-4	1/24/2005	115.00	2.800	2.80	2030.0
59	MW-4	2/22/2005	112.00	3.000	6.50	1920.0
60	MW-4	3/2/2005	113.00	3.000	5.30	1900.0
61	MW-4	4/13/2005	118.00	2.990	4.70	1790.0
62	MW-4	5/3/2005	120.00	2.800	4.90	1880.0
63	MW-4	6/1/2005	125.00	3.100	4.80	1850.0
64	MW-4	7/6/2005	113.00	2.900	4.60	1820.0
65	MW-4	8/9/2005	111.00	3.020	4.30	1750.0
66	MW-4	9/7/2005	110.00	3.100	4.40	1760.0
67	MW-4	10/10/2005	111.00	3.360	4.40	1790.0
68	MW-4	11/1/2005	112.00	3.750	5.40	1800.0
69	MW-4	12/1/2005	119.00	3.360	4.17	1950.0
70	MW-4	6/28/2006	102.00	2.100	4.30	2000.0
71	MW-4	7/20/2006	111.00	2.700	4.70	1970.0
72	MW-4	8/17/2006	112.00	2.500	4.30	2080.0
73	MW-4	9/21/2006	107.00	3.100	4.40	2000.0
74	MW-4	10/19/2006	99.00	3.700	5.00	2180.0
75	MW-4	11/16/2006	101.00	4.000	4.80	2040.0
76	MW-4	12/21/2006	101.00	3.300	4.70	2190.0

General Chemistry Data Set (mg/l) Field Original Samples Only

	7-Cl	8-Ca	9-Mg	10-K	11-Zn	12-Na
46	--	110.0	9.6	9.20	0.0170	--
47	--	110.0	9.6	9.40	0.0098	--
48	--	110.0	9.4	8.90	0.0150	--
49	--	110.0	9.5	9.20	0.0260	--
50	--	110.0	9.5	9.40	0.0270	--
51	763.0	100.0	9.3	9.50	<0.005	490.0
52	--	110.0	9.4	10.00	0.0072	--
53	778.0	110.0	9.5	9.50	<0.0050	530.0
54	768.0	100.0	9.2	9.20	0.0073	500.0
55	780.0	110.0	9.2	8.90	0.0082	510.0
56	783.0	110.0	9.5	9.20	0.0069	490.0
57	762.0	100.0	9.3	10.00	0.0054	440.0
58	--	180.0	18.0	12.00	0.0140	--
59	--	170.0	17.0	12.00	0.0850	--
60	--	170.0	16.0	12.00	0.0890	--
61	--	150.0	15.0	11.00	0.0420	--
62	--	160.0	16.0	11.00	0.0460	--
63	--	170.0	17.0	12.00	0.1100	--
64	--	150.0	15.0	10.00	0.0200	--
65	--	150.0	15.0	9.80	0.0150	--
66	--	150.0	15.0	10.00	0.0310	--
67	--	150.0	15.0	9.90	0.0088	--
68	--	140.0	15.0	10.00	0.0088	--
69	--	150.0	14.0	9.80	0.0061	--
70	805.0	180.0	18.0	11.00	0.0089	470.0
71	--	180.0	18.0	11.00	0.0150	--
72	829.0	180.0	19.0	11.00	<0.0050	500.0
73	821.0	180.0	18.0	11.00	0.0057	490.0
74	830.0	190.0	18.0	11.00	0.0072	510.0
75	846.0	190.0	18.0	11.00	0.0073	500.0
76	816.0	170.0	17.0	13.00	<0.005	450.0

APPENDIX B

STATISTICAL ANALYSIS CALCULATIONS

A. Descriptive Statistics if Background Data
B. Multiple Comparisons Among Wells
C. Shapiro-Wilk Normality Tests
D. Treatments of Largely Censored Data
E. One-Sided 95% Tolerance Limits

Appendix B
Part A.
Descriptive Statistics of
Background Data for SR 85 Landfill

1. RCRA metals for MW-1
2. RCRA metals for MW-2
3. RCRA metals for MW-3
4. RCRA metals for MW-4
5. Metals Cu, Ni, Zn, for MW-3
6. Metals Cu, Ni, Zn for MW-4
7. General chemistry constituents for MW-1
8. General chemistry constituents for MW-2
9. General chemistry constituents for MW-3
10. General chemistry constituents for MW-4

All concentrations are in units of mg/L.

Descriptive Statistics of RCRA Metals for MW-1
SR 85 Landfill Background Data

Censored data are treated here as missing, and are not replaced.

Column	Size	Censored	Mean	Std Dev	Std. Error	95% C.I. of Mean
As	19	1	0.00548	0.00109	0.000257	0.000542
Ba	19	0	0.0655	0.0135	0.00309	0.00650
Cd	19	19	--	--	--	--
Cr	19	1	0.00491	0.00529	0.00125	0.00263
Pb	19	0	0.00723	0.0126	0.00290	0.00609
Hg	19	19	--	--	--	--
Se	19	16	--	--	--	--
Ag	19	18	--	--	--	--

Column	Range	Max	Min	Median	5%	95%
As	0.00380	0.00690	0.00310	0.00565	0.00350	0.00686
Ba	0.0550	0.0880	0.0330	0.0640	0.0411	0.0867
Cd	--	--	--	--	--	--
Cr	0.0228	0.0240	0.00120	0.00285	0.00144	0.0178
Pb	0.0528	0.0530	0.000200	0.00320	0.000380	0.0395
Hg	--	--	--	--	--	--
Se	0.00230	0.00730	0.00500	--	--	--
Ag	--	0.0007	--	--	--	--

Descriptive Statistics of RCRA Metals for MW-2
SR 85 Landfill Background Data

Censored data are here treated as missing and are not replaced.

Column	Size	Censored	Mean	Std Dev	Std. Error	C.I. of Mean
As	19	0	0.00488	0.00106	0.000243	0.000511
Ba	19	0	0.0661	0.0121	0.00279	0.00585
Cd	19	18	--	--	--	--
Cr	19	1	0.00492	0.00618	0.00146	0.00308
Pb	19	0	0.0114	0.0171	0.00392	0.00823
Hg	19	19	--	--	--	--
Se	19	2	0.00937	0.00177	0.000429	0.000909
Ag	19	18	--	--	--	--

Column	Range	Max	Min	Median	5%	95%
As	0.00350	0.00680	0.00330	0.00480	0.00330	0.00662
Ba	0.0490	0.1000	0.0510	0.0660	0.0515	0.0897
Cd	0.000	0.000500	0.000500	--	--	--
Cr	0.0271	0.0290	0.00190	0.00290	0.00202	0.0199
Pb	0.0678	0.0680	0.000200	0.00290	0.000245	0.0523
Hg	--	--	--	--	--	--
Se	0.00690	0.0140	0.00710	0.00940	0.00727	0.0130
Ag	--	0.0009	--	--	--	--

Descriptive Statistics of RCRA Metals for MW-3
SR 85 Landfill Background Data

Censored data are here treated as missing, and are not replaced

Column	Size	Censored	Mean	Std Dev	Std. Error	95% C.I. of Mean
As	19	0	0.00705	0.000875	0.000201	0.000422
Ba	19	0	0.0555	0.00681	0.00156	0.00328
Cd	19	19	--	--	--	--
Cr	19	0	0.00499	0.00408	0.000936	0.00197
Pb	19	0	0.00186	0.00138	0.000316	0.000664
Hg	19	19	--	--	--	--
Se	19	19	--	--	--	--
Ag	19	18	--	--	--	--

Column	Range	Max	Min	Median	5%	95%
As	0.00330	0.00860	0.00530	0.00730	0.00544	0.00847
Ba	0.0300	0.0730	0.0430	0.0550	0.0435	0.0680
Cd	--	--	--	--	--	--
Cr	0.0185	0.0210	0.00250	0.00400	0.00255	0.0146
Pb	0.00520	0.00550	0.000300	0.00180	0.000345	0.00464
Hg	--	--	--	--	--	--
Se	--	--	--	--	--	--
Ag	--	0.001	--	--	--	--

Descriptive Statistics of RCRA Metals for MW-4
SR 85 Landfill Background Data

Censored data are here treayed as missing, and are not replaced.

Column	Size	Censored	Mean	Std Dev	Std. Error	95% C.I. of Mean
As	19	0	0.00521	0.00110	0.000253	0.000532
Ba	19	0	0.0627	0.00690	0.00158	0.00333
Cd	19	19	--	--	--	--
Cr	19	0	0.00444	0.00468	0.00107	0.00226
Pb	19	0	0.00165	0.00147	0.000338	0.000711
Hg	19	19	--	--	--	--
Se	19	17	--	--	--	--
Ag	19	19	--	--	--	--

Column	Range	Max	Min	Median	5%	95%
As	0.00510	0.00920	0.00410	0.00510	0.00415	0.00785
Ba	0.0310	0.0750	0.0440	0.0620	0.0494	0.0736
Cd	--	--	--	--	--	--
Cr	0.0213	0.0230	0.00170	0.00310	0.00188	0.0157
Pb	0.00500	0.00520	0.000200	0.00130	0.000200	0.00493
Hg	--	--	--	--	--	--
Se	0.000100	0.00710	0.00700	--	--	--
Ag	--	--	--	--	--	--

Descriptive Statistics: Cu, Ni, Zn for MW-3.

A "_mod" suffix indicates that the censored data have been replaced by 1/2 the PQL

A "_Det" suffix indicates that censored data have been treated as missing, and the indicated ststistics have been calculated for data > PQL for use with Cohen's method.

Data source: MW-3 Cu, Ni, Zn Data in SR852005&2006

Column	Size	Missing	Mean	Std Dev
Cu_mod	19	0	0.00309	0.00448
Ni_mod	19	0	0.00560	0.00344
Zn_mod	19	0	0.0424	0.0812
Log Cu_mod	19	0	-2.689	0.344
Log Ni_mod	19	0	-2.327	0.262
Log Zn_mod	19	0	-1.789	0.550
Cu_Det	19	9	0.00487	0.00571
Ni_Det	19	8	0.00785	0.00283
Zn_Det	19	2	0.0471	0.0848
Log Cu_Det	19	9	-2.438	0.285
Log Ni_Det	19	8	-2.126	0.138
Log Zn_Det	19	2	-1.694	0.498

Column	Max	Min
Cu_mod	0.0210	0.001000
Ni_mod	0.0150	0.00250
Zn_mod	0.290	0.00250
Log Cu_mod	-1.678	-3.000
Log Ni_mod	-1.824	-2.602
Log Zn_mod	-0.538	-2.602
Cu_Det	0.0210	0.00210
Ni_Det	0.0150	0.00520
Zn_Det	0.290	0.00540
Log Cu_Det	-1.678	-2.678
Log Ni_Det	-1.824	-2.284
Log Zn_Det	-0.538	-2.268

Descriptive Statistics: Cu, Ni, Zn for MW-4.

A "_mod" suffix indicates that the censored data have been replaced by 1/2 the PQL

A "_Det" suffix indicates that censored data have been treated as missing, and the indicated statistics have been calculated for data > PQL for use with Cohen's method.

Data source: MW-4 Cu, Ni, Zn Data in SR852005&2006

Column	Size	Missing	Mean	Std Dev
Cu_mod	19	0	0.00328	0.00374
Ni_mod	19	0	0.0251	0.0254
Zn_mod	19	0	0.0343	0.0413
Log Cu_mod	19	0	-2.664	0.380
Log Ni_mod	19	0	-1.743	0.341
Log Zn_mod	19	0	-1.769	0.540
Cu_Det	19	9	0.00533	0.00426
Ni_Det	19	1	0.0258	0.0260
Zn_Det	19	2	0.0380	0.0421
Log Cu_Det	19	9	-2.362	0.272
Log Ni_Det	19	1	-1.734	0.349
Log Zn_Det	19	2	-1.671	0.481

Column	Max	Min
Cu_mod	0.0160	0.001000
Ni_mod	0.110	0.00670
Zn_mod	0.140	0.00250
Log Cu_mod	-1.796	-3.000
Log Ni_mod	-0.959	-2.174
Log Zn_mod	-0.854	-2.602
Cu_Det	0.0160	0.00210
Ni_Det	0.110	0.00670
Zn_Det	0.140	0.00570
Log Cu_Det	-1.796	-2.678
Log Ni_Det	-0.959	-2.174
Log Zn_Det	-0.854	-2.244

Descriptive Statistics For General Chemistry Components
SR 85 Landfill Background Data for MW-1

Column	Size	Missing	Mean	Std Dev	Std. Error	95% C.I. of Mean
Tot. Alk.	19	0	177.263	17.346	3.979	8.360
F	19	0	0.525	0.139	0.0319	0.0669
NO3 as N	19	0	19.184	6.031	1.383	2.907
TDS	19	0	4131.579	617.569	141.680	297.659
Cl	19	13	1643.333	100.133	40.879	105.083
Ca	19	0	362.632	52.371	12.015	25.242
Mg	19	0	128.421	17.721	4.065	8.541
K	19	0	11.579	1.456	0.334	0.702
Zn	19	0	0.0692	0.138	0.0316	0.0665
Na	19	13	798.333	48.339	19.734	50.729

Column	Range	Max	Min	Median	5%	95%
Tot. Alk.	80.000	203.000	123.000	178.000	141.000	203.000
F	0.610	0.670	0.0600	0.570	0.186	0.652
NO3 as N	30.000	32.000	2.000	19.000	7.175	29.300
TDS	1790.000	5260.000	3470.000	3820.000	3483.500	5224.000
Cl	250.000	1770.000	1520.000	1610.000	1520.000	1770.000
Ca	150.000	440.000	290.000	360.000	290.000	435.500
Mg	60.000	160.000	100.000	120.000	104.500	155.500
K	5.700	15.000	9.300	11.000	9.525	14.550
Zn	0.611	0.620	0.00910	0.0270	0.00933	0.395
Na	140.000	870.000	730.000	795.000	730.000	870.000

Descriptive Statistics For General Chemistry Components
SR 85 Landfill Background Data for MW-2

Column	Size	Missing	Mean	Std Dev	Std. Error	95% C.I. of Mean
Tot. Alk.	19	0	84.416	8.236	1.889	3.969
F	19	0	2.996	0.474	0.109	0.228
NO3 as N	19	0	12.521	2.512	0.576	1.211
TDS	19	0	3623.158	309.050	70.901	148.957
Cl	19	13	1483.333	53.541	21.858	56.188
Ca	19	0	330.526	55.725	12.784	26.859
Mg	19	0	27.789	2.485	0.570	1.198
K	19	0	16.842	2.089	0.479	1.007
Zn	19	5	0.0714	0.0929	0.0248	0.0536
Na	19	13	963.333	84.774	34.609	88.965

Column	Range	Max	Min	Median	5%	95%
Tot. Alk.	38.000	97.000	59.000	85.700	67.550	96.190
F	1.900	3.800	1.900	2.980	2.080	3.710
NO3 as N	11.900	15.000	3.100	13.000	6.835	15.000
TDS	1030.000	4010.000	2980.000	3690.000	3016.000	3996.500
Cl	160.000	1550.000	1390.000	1490.000	1390.000	1550.000
Ca	180.000	410.000	230.000	340.000	230.000	410.000
Mg	10.000	33.000	23.000	28.000	23.450	32.100
K	8.000	21.000	13.000	17.000	13.450	20.550
Zn	0.273	0.280	0.00680	0.0225	0.00704	0.274
Na	250.000	1100.000	850.000	960.000	850.000	1100.000

Descriptive Statistics For General Chemistry Components
SR 85 Landfill Background Data for MW-3

Column	Size	Missing	Mean	Std Dev	Std. Error	95% C.I. of Mean
Tot. Alk.	19	0	96.200	7.722	1.771	3.722
F	19	0	4.447	0.476	0.109	0.229
NO3 as N	19	0	3.553	2.296	0.527	1.106
TDS	19	0	1763.158	150.409	34.506	72.495
Cl	19	13	772.333	9.136	3.730	9.588
Ca	19	0	107.895	4.189	0.961	2.019
Mg	19	0	9.437	0.171	0.0392	0.0823
K	19	0	9.516	0.393	0.0902	0.190
Zn	19	2	0.0471	0.0848	0.0206	0.0436
Na	19	13	493.333	30.111	12.293	31.599

Column	Range	Max	Min	Median	5%	95%
Tot. Alk.	42.000	117.000	75.000	96.500	81.750	110.700
F	1.900	5.400	3.500	4.400	3.725	5.355
NO3 as N	10.200	13.000	2.800	3.000	2.800	8.725
TDS	570.000	2230.000	1660.000	1720.000	1664.500	2185.000
Cl	21.000	783.000	762.000	773.000	762.000	783.000
Ca	10.000	110.000	100.000	110.000	100.000	110.000
Mg	0.600	9.600	9.000	9.500	9.090	9.600
K	1.100	10.000	8.900	9.400	8.900	10.000
Zn	0.285	0.290	0.00540	0.0170	0.00592	0.276
Na	90.000	530.000	440.000	495.000	440.000	530.000

Descriptive Statistics For General Chemistry Components
SR 85 Landfill Background Data For MW-4

Column	Size	Missing	Mean	Std Dev	Std. Error	95% C.I. of Mean
Tot. Alk.	19	0	111.158	6.906	1.584	3.329
F	19	0	3.083	0.444	0.102	0.214
NO3 as N	19	0	4.656	0.701	0.161	0.338
TDS	19	0	1931.579	134.547	30.867	64.850
Cl	19	13	824.500	13.982	5.708	14.673
Ca	19	0	166.316	15.709	3.604	7.572
Mg	19	0	16.526	1.504	0.345	0.725
K	19	0	10.974	0.915	0.210	0.441
Zn	19	2	0.0306	0.0332	0.00806	0.0171
Na	19	13	486.667	22.509	9.189	23.622

Column	Range	Max	Min	Median	5%	95%
Tot. Alk.	26.000	125.000	99.000	112.000	99.900	122.750
F	1.900	4.000	2.100	3.020	2.280	3.888
NO3 as N	3.700	6.500	2.800	4.700	3.417	6.005
TDS	440.000	2190.000	1750.000	1920.000	1754.500	2185.500
Cl	41.000	846.000	805.000	825.000	805.000	846.000
Ca	50.000	190.000	140.000	170.000	144.500	190.000
Mg	5.000	19.000	14.000	17.000	14.450	18.550
K	3.200	13.000	9.800	11.000	9.800	12.550
Zn	0.104	0.110	0.00570	0.0150	0.00584	0.103
Na	60.000	510.000	450.000	495.000	450.000	510.000

Appendix B
Part B.
Multiple Comparisons Among Wells by Analysis of Variance

Dependent Variables:

1. Arsenic (As)
2. Barium (Ba)
3. Chromium (Cr)
4. Lead (Pb)
5. Total Alkalinity (as $CaCO_3$)
6. Fluoride (F)
7. Nitrate (NO_3 as N)
8. Total Dissolved Solids (TDS)
9. Chloride (Cl)
10. Calcium (Ca)
11. Magnesium (Mg)
12. Potassium (K)
13. Sodium (Na)

All concentrations are in units of mg/L.

One Way Analysis of Variance

Data source: SR85 Metals: Basic Data Set, Sorted by Well in SR852005&2006

Dependent Variable: As

Normality Test: Passed (P = 0.546)

Equal Variance Test: Passed (P = 0.711)

Group Name	N	Missing	Mean	Std Dev	SEM
MW-1	19	1	0.00548	0.00109	0.000257
MW-2	19	0	0.00488	0.00106	0.000243
MW-3	19	0	0.00705	0.000875	0.000201
MW-4	19	0	0.00521	0.00110	0.000253

Source of Variation	DF	SS	MS	F	P
Between Groups	3	0.0000524	0.0000175	16.303	<0.001
Residual	71	0.0000761	0.00000107		
Total	74	0.000128			

The differences in the mean values among the treatment groups are greater than would be expected by chance; there is a statistically significant difference (P = <0.001).

Power of performed test with alpha = 0.050: 1.000

All Pairwise Multiple Comparison Procedures (Holm-Sidak method):
Overall significance level = 0.05

Comparisons for factor: **Well**

Comparison	Diff of Means	t	Unadjusted P	Critical Level	Significant?
MW-3 vs. MW-2	0.00216	6.441	0.0000000122	0.009	Yes
MW-3 vs. MW-4	0.00184	5.469	0.000000638	0.010	Yes
MW-3 vs. MW-1	0.00156	4.594	0.0000184	0.013	Yes
MW-1 vs. MW-2	0.000599	1.760	0.0828	0.017	No
MW-4 vs. MW-2	0.000326	0.972	0.335	0.025	No
MW-1 vs. MW-4	0.000273	0.801	0.426	0.050	No

One Way Analysis of Variance

Data source: SR85 Metals: Basic Data Set, Sorted by Well in SR852005&2006

Dependent Variable: Ba

Normality Test: Passed (P = 0.355)

Equal Variance Test: Failed (P < 0.050)

Test execution ended by user request, ANOVA on Ranks begun

Kruskal-Wallis One Way Analysis of Variance on Ranks

Data source: SR85 Metals: Basic Data Set, Sorted by Well in SR852005&2006

Group	N	Missing	Median	25%	75%
MW-1	19	0	0.0640	0.0585	0.0747
MW-2	19	0	0.0660	0.0555	0.0747
MW-3	19	0	0.0550	0.0522	0.0597
MW-4	19	0	0.0620	0.0590	0.0668

H = 13.403 with 3 degrees of freedom. (P = 0.004)

The differences in the median values among the treatment groups are greater than would be expected by chance; there is a statistically significant difference (P = 0.004)

To isolate the group or groups that differ from the others use a multiple comparison procedure.

All Pairwise Multiple Comparison Procedures (Tukey Test):

Comparison	Diff of Ranks	q	P<0.05
MW-1 vs MW-3	428.500	4.452	Yes
MW-1 vs MW-4	60.500	0.629	No
MW-1 vs MW-2	15.000	0.156	Do Not Test
MW-2 vs MW-3	413.500	4.296	Yes
MW-2 vs MW-4	45.500	0.473	Do Not Test
MW-4 vs MW-3	368.000	3.823	Yes

Note: The multiple comparisons on ranks do not include an adjustment for ties.

A result of "Do Not Test" occurs for a comparison when no significant difference is found between the two rank sums that enclose that comparison. For example, if you had four rank sums sorted in order, and found no significant difference between rank sums 4 vs. 2, then you would not test 4 vs. 3 and 3 vs. 2, but still test 4 vs. 1 and 3 vs. 1 (4 vs. 3 and 3 vs. 2 are enclosed by 4 vs. 2: 4 3 2 1). Note that not testing the enclosed rank sums is a procedural rule, and a result of Do Not Test should be treated as if there is no significant difference between the rank sums, even though one may appear to exist.

One Way Analysis of Variance

Data source: SR85 Metals: Basic Data Set, Sorted by Well in SR852005&2006

Dependent Variable: Cr

Normality Test: Failed ($P < 0.050$)

Test execution ended by user request, ANOVA on Ranks begun

Kruskal-Wallis One Way Analysis of Variance on Ranks

Data source: SR85 Metals: Basic Data Set, Sorted by Well in SR852005&2006

Group	N	Missing	Median	25%	75%
MW-1	19	1	0.00285	0.00190	0.00610
MW-2	19	1	0.00290	0.00230	0.00590
MW-3	19	0	0.00400	0.00315	0.00537
MW-4	19	0	0.00310	0.00235	0.00447

$H = 3.099$ with 3 degrees of freedom. ($P = 0.377$)

The differences in the median values among the treatment groups are not great enough to exclude the possibility that the difference is due to random sampling variability; there is not a statistically significant difference ($P = 0.377$)

One Way Analysis of Variance

Data source: SR85 Metals: Basic Data Set, Sorted by Well in SR852005&2006

Dependent Variable: Pb

Normality Test: Failed ($P < 0.050$)

Test execution ended by user request, ANOVA on Ranks begun

Kruskal-Wallis One Way Analysis of Variance on Ranks

Data source: SR85 Metals: Basic Data Set, Sorted by Well in SR852005&2006

Group	N	Missing	Median	25%	75%
MW-1	19	0	0.00320	0.000650	0.00855
MW-2	19	0	0.00290	0.000650	0.0162
MW-3	19	0	0.00180	0.000525	0.00267
MW-4	19	0	0.00130	0.000575	0.00187

$H = 5.959$ with 3 degrees of freedom. ($P = 0.114$)

The differences in the median values among the treatment groups are not great enough to exclude the possibility that the difference is due to random sampling variability; there is not a statistically significant difference ($P = 0.114$)

One Way Analysis of Variance

Data source: General Chemistry Data FO Only in GenChem2005&2006

Dependent Variable: Tot. Alk.

Normality Test: Failed (P < 0.050)

Test execution ended by user request, ANOVA on Ranks begun

Kruskal-Wallis One Way Analysis of Variance on Ranks

Data source: General Chemistry Data FO Only in GenChem2005&2006

Group	N	Missing	Median	25%	75%
MW-3	19	0	96.500	93.250	97.775
MW-4	19	0	112.000	107.750	114.500
MW-1	19	0	178.000	170.250	188.250
MW-2	19	0	85.700	79.600	88.000

H = 65.498 with 3 degrees of freedom. (P = <0.001)

The differences in the median values among the treatment groups are greater than would be expected by chance; there is a statistically significant difference (P = <0.001)

To isolate the group or groups that differ from the others use a multiple comparison procedure.

All Pairwise Multiple Comparison Procedures (Tukey Test):

Comparison	Diff of Ranks	q	P<0.05
MW-1 vs MW-2	1042.000	10.825	Yes
MW-1 vs MW-3	736.500	7.651	Yes
MW-1 vs MW-4	383.500	3.984	Yes
MW-4 vs MW-2	658.500	6.841	Yes
MW-4 vs MW-3	353.000	3.667	Yes
MW-3 vs MW-2	305.500	3.174	No

Note: The multiple comparisons on ranks do not include an adjustment for ties.

One Way Analysis of Variance

Data source: General Chemistry Data FO Only in GenChem2005&2006

Dependent Variable: F

Normality Test: Failed (P < 0.050)

Test execution ended by user request, ANOVA on Ranks begun

Kruskal-Wallis One Way Analysis of Variance on Ranks

Data source: General Chemistry Data FO Only in GenChem2005&2006

Group	N	Missing	Median	25%	75%
MW-3	19	0	4.400	4.155	4.660
MW-4	19	0	3.020	2.825	3.345
MW-1	19	0	0.570	0.520	0.597
MW-2	19	0	2.980	2.700	3.375

H = 62.642 with 3 degrees of freedom. (P = <0.001)

The differences in the median values among the treatment groups are greater than would be expected by chance; there is a statistically significant difference (P = <0.001)

To isolate the group or groups that differ from the others use a multiple comparison procedure.

All Pairwise Multiple Comparison Procedures (Tukey Test):

Comparison	Diff of Ranks	q	P<0.05
MW-3 vs MW-1	1076.500	11.183	Yes
MW-3 vs MW-2	549.500	5.709	Yes
MW-3 vs MW-4	514.000	5.340	Yes
MW-4 vs MW-1	562.500	5.844	Yes
MW-4 vs MW-2	35.500	0.369	No
MW-2 vs MW-1	527.000	5.475	Yes

Note: The multiple comparisons on ranks do not include an adjustment for ties.

One Way Analysis of Variance

Data source: General Chemistry Data FO Only in GenChem2005&2006

Dependent Variable: NO3 as N

Normality Test: Failed (P < 0.050)

Test execution ended by user request, ANOVA on Ranks begun

Kruskal-Wallis One Way Analysis of Variance on Ranks

Data source: General Chemistry Data FO Only in GenChem2005&2006

Group	N	Missing	Median	25%	75%
MW-3	19	0	3.000	2.900	3.167
MW-4	19	0	4.700	4.300	4.875
MW-1	19	0	19.000	17.250	20.750
MW-2	19	0	13.000	12.000	14.000

H = 54.967 with 3 degrees of freedom. (P = <0.001)

The differences in the median values among the treatment groups are greater than would be expected by chance; there is a statistically significant difference (P = <0.001)

To isolate the group or groups that differ from the others use a multiple comparison procedure.

All Pairwise Multiple Comparison Procedures (Tukey Test):

Comparison	Diff of Ranks	q	P<0.05
MW-1 vs MW-3	942.000	9.786	Yes
MW-1 vs MW-4	661.500	6.872	Yes
MW-1 vs MW-2	302.500	3.143	No
MW-2 vs MW-3	639.500	6.644	Yes
MW-2 vs MW-4	359.000	3.730	Yes
MW-4 vs MW-3	280.500	2.914	No

Note: The multiple comparisons on ranks do not include an adjustment for ties.

One Way Analysis of Variance

Data source: General Chemistry Data FO Only in GenChem2005&2006

Dependent Variable: TDS

Normality Test: Failed (P < 0.050)

Test execution ended by user request, ANOVA on Ranks begun

Kruskal-Wallis One Way Analysis of Variance on Ranks

Data source: General Chemistry Data FO Only in GenChem2005&2006

Group	N	Missing	Median	25%	75%
MW-3	19	0	1720.000	1700.000	1740.000
MW-4	19	0	1920.000	1805.000	2022.500
MW-1	19	0	3820.000	3645.000	4620.000
MW-2	19	0	3690.000	3410.000	3835.000

H = 61.549 with 3 degrees of freedom. (P = <0.001)

The differences in the median values among the treatment groups are greater than would be expected by chance; there is a statistically significant difference (P = <0.001)

To isolate the group or groups that differ from the others use a multiple comparison procedure.

All Pairwise Multiple Comparison Procedures (Tukey Test):

Comparison	Diff of Ranks	q	P<0.05
MW-1 vs MW-3	928.500	9.646	Yes
MW-1 vs MW-4	643.500	6.685	Yes
MW-1 vs MW-2	128.000	1.330	No
MW-2 vs MW-3	800.500	8.316	Yes
MW-2 vs MW-4	515.500	5.355	Yes
MW-4 vs MW-3	285.000	2.961	No

Note: The multiple comparisons on ranks do not include an adjustment for ties.

One Way Analysis of Variance

Data source: General Chemistry Data FO Only in GenChem2005&2006

Dependent Variable: Cl

Normality Test: Failed (P < 0.050)

Test execution ended by user request, ANOVA on Ranks begun

Kruskal-Wallis One Way Analysis of Variance on Ranks

Data source: General Chemistry Data FO Only in GenChem2005&2006

Group	N	Missing	Median	25%	75%
MW-3	19	13	773.000	763.000	780.000
MW-4	19	13	825.000	816.000	830.000
MW-1	19	13	1610.000	1590.000	1760.000
MW-2	19	13	1490.000	1470.000	1510.000

H = 21.367 with 3 degrees of freedom. (P = <0.001)

The differences in the median values among the treatment groups are greater than would be expected by chance; there is a statistically significant difference (P = <0.001)

To isolate the group or groups that differ from the others use a multiple comparison procedure.

All Pairwise Multiple Comparison Procedures (Tukey Test):

Comparison	Diff of Ranks	q	P<0.05
MW-1 vs MW-3	107.000	6.178	Yes
MW-1 vs MW-4	71.000	4.099	Yes
MW-1 vs MW-2	34.000	1.963	No
MW-2 vs MW-3	73.000	4.215	Yes
MW-2 vs MW-4	37.000	2.136	No
MW-4 vs MW-3	36.000	2.078	No

Note: The multiple comparisons on ranks do not include an adjustment for ties.

One Way Analysis of Variance

Data source: SR85 Metals: Basic Data Set, Sorted by Well in GenChem2005&2006

Dependent Variable: Ca

Normality Test: Failed ($P < 0.050$)

Test execution ended by user request, ANOVA on Ranks begun

Kruskal-Wallis One Way Analysis of Variance on Ranks

Data source: SR85 Metals: Basic Data Set, Sorted by Well in SR852005&2006

Group	N	Missing	Median	25%	75%
MW-1	19	0	360.000	315.000	410.000
MW-2	19	0	340.000	282.500	357.500
MW-3	19	0	110.000	110.000	110.000
MW-4	19	0	170.000	150.000	180.000

$H = 64.592$ with 3 degrees of freedom. ($P = <0.001$)

The differences in the median values among the treatment groups are greater than would be expected by chance; there is a statistically significant difference ($P = <0.001$)

To isolate the group or groups that differ from the others use a multiple comparison procedure.

All Pairwise Multiple Comparison Procedures (Tukey Test):

Comparison	Diff of Ranks	q	P<0.05
MW-1 vs MW-3	958.500	9.958	Yes
MW-1 vs MW-4	597.500	6.207	Yes
MW-1 vs MW-2	112.000	1.164	No
MW-2 vs MW-3	846.500	8.794	Yes
MW-2 vs MW-4	485.500	5.044	Yes
MW-4 vs MW-3	361.000	3.750	Yes

Note: The multiple comparisons on ranks do not include an adjustment for ties.

One Way Analysis of Variance

Data source: SR85 Metals: Basic Data Set, Sorted by Well in SR852005&2006

Dependent Variable: Mg

Normality Test: Failed (P < 0.050)

Test execution ended by user request, ANOVA on Ranks begun

Kruskal-Wallis One Way Analysis of Variance on Ranks

Data source: SR85 Metals: Basic Data Set, Sorted by Well in SR852005&2006

Group	N	Missing	Median	25%	75%
MW-1	19	0	120.000	112.500	147.500
MW-2	19	0	28.000	26.250	29.000
MW-3	19	0	9.500	9.325	9.600
MW-4	19	0	17.000	15.000	18.000

H = 70.516 with 3 degrees of freedom. (P = <0.001)

The differences in the median values among the treatment groups are greater than would be expected by chance; there is a statistically significant difference (P = <0.001)

To isolate the group or groups that differ from the others use a multiple comparison procedure.

All Pairwise Multiple Comparison Procedures (Tukey Test):

Comparison	Diff of Ranks	q	P<0.05
MW-1 vs MW-3	1083.000	11.251	Yes
MW-1 vs MW-4	722.000	7.501	Yes
MW-1 vs MW-2	361.000	3.750	Yes
MW-2 vs MW-3	722.000	7.501	Yes
MW-2 vs MW-4	361.000	3.750	Yes
MW-4 vs MW-3	361.000	3.750	Yes

Note: The multiple comparisons on ranks do not include an adjustment for ties.

One Way Analysis of Variance

Data source: SR85 Metals: Basic Data Set, Sorted by Well in SR852005&2006

Dependent Variable: K

Normality Test: Failed (P < 0.050)

Test execution ended by user request, ANOVA on Ranks begun

Kruskal-Wallis One Way Analysis of Variance on Ranks

Data source: SR85 Metals: Basic Data Set, Sorted by Well. Corrections in SR852005&2006

Group	N	Missing	Median	25%	75%
MW-1	19	0	11.000	11.000	12.000
MW-2	19	0	17.000	15.250	18.000
MW-3	19	0	9.400	9.200	10.000
MW-4	19	0	11.000	10.000	11.750

H = 57.495 with 3 degrees of freedom. (P = <0.001)

The differences in the median values among the treatment groups are greater than would be expected by chance; there is a statistically significant difference (P = <0.001)

To isolate the group or groups that differ from the others use a multiple comparison procedure.

All Pairwise Multiple Comparison Procedures (Tukey Test):

Comparison	Diff of Ranks	q	P<0.05
MW-2 vs MW-3	1020.000	10.596	Yes
MW-2 vs MW-4	604.000	6.275	Yes
MW-2 vs MW-1	512.000	5.319	Yes
MW-1 vs MW-3	508.000	5.277	Yes
MW-1 vs MW-4	92.000	0.956	No
MW-4 vs MW-3	416.000	4.322	Yes

Note: The multiple comparisons on ranks do not include an adjustment for ties.

One Way Analysis of Variance

Data source: General Chemistry Data FO Only in GenChem2005&2006

Dependent Variable: Na

Normality Test: Passed (P = 0.121)

Equal Variance Test: Passed (P = 0.070)

Group Name	N	Missing	Mean	Std Dev	SEM
MW-3	19	13	493.333	30.111	12.293
MW-4	19	13	486.667	22.509	9.189
MW-1	19	13	798.333	48.339	19.734
MW-2	19	13	963.333	84.774	34.609

Source of Variation	DF	SS	MS	F	P
Between Groups	3	998312.500	332770.833	121.708	<0.001
Residual	20	54683.333	2734.167		
Total	23	1052995.833			

The differences in the mean values among the treatment groups are greater than would be expected by chance; there is a statistically significant difference (P = <0.001).

Power of performed test with alpha = 0.050: 1.000

All Pairwise Multiple Comparison Procedures (Holm-Sidak method):
Overall significance level = 0.05

Comparisons for factor: **Well ID**

Comparison	Diff of Means	t	Unadjusted P	Critical Level	Significant?
MW-2 vs. MW-4	476.667	15.789	9.313E-013	0.009	Yes
MW-2 vs. MW-3	470.000	15.568	1.210E-012	0.010	Yes
MW-1 vs. MW-4	311.667	10.324	0.00000000185	0.013	Yes
MW-1 vs. MW-3	305.000	10.103	0.00000000266	0.017	Yes
MW-2 vs. MW-1	165.000	5.466	0.0000238	0.025	Yes
MW-3 vs. MW-4	6.667	0.221	0.827	0.050	No

Appendix B
Part C.
Shapiro-Wilk Normality Test for
MW-3 and MW-4

1. MW-3: As, Ba, Cr, Pb, Zn
2. MW-4: AS, Ba, Cr, Pb, Ni, Zn

Only the data sets for As, Ba, Cr, Pb, and Zn in for MW-3 and As, Ba, Cr, Pb, Ni and Zn for MW-4 may be tested for normality using the Shapiro-Wilk test. The data sets for all other RCRA metals have a preponderance of censored data and must be treated non-parametrically. The Shapiro-Wilk test is the preferred test of EPA for normality (EPA, July 1992).
The spreadsheets follow the format of the example given on page 11 of "Statistical Analysis of Ground-Water Data at RCRA Facilities, Draft Addendum to Interim Final Guidance" (EPA, July 1992).
The test statistic is W. For 19 data points, the critical W at a significance level of 0.05 is 0.901. If $W \geq 0.901$ there is evidence of normality. If $W < 0.901$, it is concluded that the data are not from a normal distribution. If the test rejects the hypothesis of normality, the logarithm is the concentration data is tested for normality.

$$W = \{B/S\sqrt{(18)}\}^2$$

Where B is given above W in the spreadsheets.

All concentrations are in units of mg/L.

Shapiro-Wilk Normality Test for MW-3 Metals

	1-As	2-Ba	3-log10(Cr)	4-Pb	5-a	6-Asup
1	0.0053	0.0540	-2.6021	0.0021	0.4808	0.0053
2	0.0069	0.0480	-2.5528	0.0055	0.3232	0.0056
3	0.0068	0.0540	-2.5850	0.0030	0.2561	0.0062
4	0.0071	0.0610	-2.4437	0.0036	0.2059	0.0062
5	0.0074	0.0550	-2.2218	0.0025	0.1641	0.0063
6	0.0056	0.0440	-2.4815	0.0031	0.1271	0.0064
7	0.0074	0.0520	-2.4559	0.0018	0.0932	0.0068
8	0.0062	0.0430	-2.5850	0.0026	0.0612	0.0069
9	0.0075	0.0600	-2.5086	0.0015	0.0303	0.0071
10	0.0075	0.0570	-1.6778	0.0016		0.0073
11	0.0063	0.0730	-2.3872	0.0027		0.0074
12	0.0075	0.0610	-2.4437	0.0018		0.0074
13	0.0062	0.0530	-2.3010	0.0004		0.0075
14	0.0064	0.0620	-2.2596	0.0008		0.0075
15	0.0076	0.0550	-2.1675	0.0005		0.0075
16	0.0083	0.0590	-2.3468	0.0006		0.0076
17	0.0086	0.0560	-2.3665	0.0005		0.0080
18	0.0080	0.0570	-2.3979	0.0004		0.0083
19	0.0073	0.0510	-2.2147	0.0003		0.0086
20						
21						
22						
23						

Shapiro-Wilk Normality Test for MW-3 Metals

	7-Asdwn	8-Asdwn-Asup	9-Asb	10-Baup	11-Badwn	12-Baup-Badwn
1	0.00860	0.00330	0.00159	0.0430	0.0730	0.03000
2	0.00830	0.00270	0.00087	0.0440	0.0620	0.01800
3	0.00800	0.00180	0.00046	0.0480	0.0610	0.01300
4	0.00760	0.00140	0.00029	0.0510	0.0610	0.01000
5	0.00750	0.00120	0.00020	0.0520	0.0600	0.00800
6	0.00750	0.00110	0.00014	0.0530	0.0590	0.00600
7	0.00750	0.00070	0.00007	0.0540	0.0570	0.00300
8	0.00740	0.00050	0.00003	0.0540	0.0570	0.00300
9	0.00740	0.00030	0.00001	0.0550	0.0560	0.00100
10	0.00730	0.00000	--	0.0550	0.0550	0.00000
11	0.00710	-0.00030	--	0.0560	0.0550	-0.00100
12	0.00690	-0.00050	--	0.0570	0.0540	-0.00300
13	0.00680	-0.00070	--	0.0570	0.0540	-0.00300
14	0.00640	-0.00110	--	0.0590	0.0530	-0.00600
15	0.00630	-0.00120	--	0.0600	0.0520	-0.00800
16	0.00620	-0.00140	--	0.0610	0.0510	-0.01000
17	0.00620	-0.00180	--	0.0610	0.0480	-0.01300
18	0.00560	-0.00270	--	0.0620	0.0440	-0.01800
19	0.00530	-0.00330	--	0.0730	0.0430	-0.03000
20			--			
21		B=	0.00365			B=
22		W=	0.96778			W=
23						

Shapiro-Wilk Normality Test for MW-3 Metals

	13-Bab	14-log10(Cr)up	15-log10(Cr)dwn	16-LCrdwn - lCrup	17-LCrb	18-Pbup
1	0.01442	-2.6021	-1.6778	0.9243	0.44439	0.0003
2	0.00582	-2.5850	-2.1675	0.4175	0.13495	0.0004
3	0.00333	-2.5850	-2.2147	0.3704	0.09485	0.0004
4	0.00206	-2.5528	-2.2218	0.3310	0.06815	0.0005
5	0.00131	-2.5086	-2.2596	0.2490	0.04086	0.0005
6	0.00076	-2.4815	-2.3010	0.1805	0.02294	0.0006
7	0.00028	-2.4559	-2.3468	0.1091	0.01017	0.0008
8	0.00018	-2.4437	-2.3665	0.0772	0.00472	0.0015
9	0.00003	-2.4437	-2.3872	0.0565	0.00171	0.0016
10	--	-2.3979	-2.3979	0.0000	--	0.0018
11	--	-2.3872	-2.4437	-0.0565	--	0.0018
12	--	-2.3665	-2.4437	-0.0772	--	0.0021
13	--	-2.3468	-2.4559	-0.1091	--	0.0025
14	--	-2.3010	-2.4815	-0.1805	--	0.0026
15	--	-2.2596	-2.5086	-0.2490	--	0.0027
16	--	-2.2218	-2.5528	-0.3310	--	0.0030
17	--	-2.2147	-2.5850	-0.3704	--	0.0031
18	--	-2.1675	-2.5850	-0.4175	--	0.0036
19	--	-1.6778	-2.6021	-0.9243	--	0.0055
20						
21	0.02820			B=	0.82274	
22	0.95260			W=	0.83115	
23						

Shapiro-Wilk Normality Test for MW-3 Metals

	19-Pbdwn	20-Pbdwn - Pbup	21-Pbb	22-Cr	23-Crup	24-Crdwn
1	0.0055	0.00520	0.00250	0.0025	0.0025	0.02100
2	0.0036	0.00320	0.00103	0.0028	0.0026	0.00680
3	0.0031	0.00270	0.00069	0.0026	0.0026	0.00610
4	0.0030	0.00250	0.00051	0.0036	0.0028	0.00600
5	0.0027	0.00220	0.00036	0.0060	0.0031	0.00550
6	0.0026	0.00200	0.00025	0.0033	0.0033	0.00500
7	0.0025	0.00170	0.00016	0.0035	0.0035	0.00450
8	0.0021	0.00060	0.00004	0.0026	0.0036	0.00430
9	0.0018	0.00020	0.00001	0.0031	0.0036	0.00410
10	0.0018	0.00000	--	0.0210	0.0040	0.00400
11	0.0016	-0.00020	--	0.0041	0.0041	0.00360
12	0.0015	-0.00060	--	0.0036	0.0043	0.00360
13	0.0008	-0.00170	--	0.0050	0.0045	0.00350
14	0.0006	-0.00200	--	0.0055	0.0050	0.00330
15	0.0005	-0.00220	--	0.0068	0.0055	0.00310
16	0.0005	-0.00250	--	0.0045	0.0060	0.00280
17	0.0004	-0.00270	--	0.0043	0.0061	0.00260
18	0.0004	-0.00320	--	0.0040	0.0068	0.00260
19	0.0003	-0.00520	--	0.0061	0.0210	0.00250
20						
21		B=	0.00556			
22		W=	0.90437			
23						

Shapiro-Wilk Normality Test for MW-3 Metals

	25-Crdwn - Crup	26-Crb
1	0.0185	0.00889
2	0.0042	0.00136
3	0.0035	0.00090
4	0.0032	0.00066
5	0.0024	0.00039
6	0.0017	0.00022
7	0.0010	0.00009
8	0.0007	0.00004
9	0.0005	0.00002
10	0.0000	--
11	-0.0005	--
12	-0.0007	--
13	-0.0010	--
14	-0.0017	--
15	-0.0024	--
16	-0.0032	--
17	-0.0035	--
18	-0.0042	--
19	-0.0185	--
20		
21	B=	0.0126
22	W=	0.5274
23		

MW-3, Zn Wilkes Test

	1-Zn	2-Zn_mod	3-a	4-Zn_modup	5-Zn_moddwn	6-down - up
1	0.2900	0.2900	0.4808	2.5000e-3	0.2900	0.2875
2	0.2500	0.2500	0.3232	2.5000e-3	0.2500	0.2475
3	0.0370	0.0370	0.2561	5.4000e-3	0.0420	0.0366
4	0.0420	0.0420	0.2059	6.9000e-3	0.0370	0.0301
5	0.0200	0.0200	0.1641	7.2000e-3	0.0270	0.0198
6	0.0170	0.0170	0.1271	7.3000e-3	0.0260	0.0187
7	0.0150	0.0150	0.0932	8.2000e-3	0.0200	0.0118
8	0.0170	0.0170	0.0612	9.8000e-3	0.0170	7.2000e-3
9	0.0098	0.0098	0.0303	0.0150	0.0170	2.0000e-3
10	0.0150	0.0150		0.0150	0.0150	0.0000
11	0.0260	0.0260		0.0170	0.0150	-2.0000e-3
12	0.0270	0.0270		0.0170	0.0098	-7.2000e-3
13	<0.005	0.0025		0.0200	0.0082	-0.0118
14	0.0072	0.0072		0.0260	0.0073	-0.0187
15	<0.0050	0.0025		0.0270	0.0072	-0.0198
16	0.0073	0.0073		0.0370	0.0069	-0.0301
17	0.0082	0.0082		0.0420	0.0054	-0.0366
18	0.0069	0.0069		0.2500	0.0025	-0.2475
19	0.0054	0.0054		0.2900	0.0025	-0.2875
20						
21						B=
22						W=

MW-3, Zn Wilkes Test

	7-Zn_modb	8-LogZn_modup	9-LogZn_moddwn	10-Log dwn-Logup	11-LogZnb
1	0.1382	-2.6021	-0.5376	2.0645	0.9926
2	0.0800	-2.6021	-0.6021	2.0000	0.6464
3	9.3733e-3	-2.2676	-1.3768	0.8909	0.2281
4	6.1976e-3	-2.1612	-1.4318	0.7294	0.1502
5	3.2492e-3	-2.1427	-1.5686	0.5740	0.0942
6	2.3768e-3	-2.1367	-1.5850	0.5517	0.0701
7	1.0998e-3	-2.0862	-1.6990	0.3872	0.0361
8	4.4064e-4	-2.0088	-1.7696	0.2392	0.0146
9	6.0600e-5	-1.8239	-1.7696	0.0544	1.6470e-3
10		-1.8239	-1.8239	0.0000	
11	--	-1.7696	-1.8239	-0.0544	--
12	--	-1.7696	-2.0088	-0.2392	--
13	--	-1.6990	-2.0862	-0.3872	--
14	--	-1.5850	-2.1367	-0.5517	--
15	--	-1.5686	-2.1427	-0.5740	--
16	--	-1.4318	-2.1612	-0.7294	--
17	--	-1.3768	-2.2676	-0.8909	--
18	--	-0.6021	-2.6021	-2.0000	--
19	--	-0.5376	-2.6021	-2.0645	--
20					
21	0.2410			B=	2.2340
22	0.4892			W=	0.9164

Shapiro-Wilk Normality Test For MW-4 Metals

	1-As	2-Ba	3-Cr	4-Pb	5-a	6-log10(As)up
1	0.0092	0.0670	0.0026	0.0030	0.4808	-2.3872
2	0.0052	0.0560	0.0021	0.0019	0.3232	-2.3768
3	0.0051	0.0620	0.0022	0.0016	0.2561	-2.3665
4	0.0051	0.0620	0.0036	0.0018	0.2059	-2.3468
5	0.0050	0.0630	0.0039	0.0016	0.1641	-2.3372
6	0.0051	0.0610	0.0057	0.0052	0.1271	-2.3372
7	0.0046	0.0580	0.0031	0.0013	0.0932	-2.3010
8	0.0042	0.0440	0.0017	0.0037	0.0612	-2.3010
9	0.0050	0.0640	0.0021	0.0046	0.0303	-2.2924
10	0.0051	0.0590	0.0230	0.0009		-2.2924
11	0.0045	0.0750	0.0030	0.0010		-2.2924
12	0.0053	0.0610	0.0023	0.0005		-2.2924
13	0.0041	0.0580	0.0041	0.0017		-2.2924
14	0.0051	0.0640	0.0046	0.0008		-2.2840
15	0.0043	0.0590	0.0067	0.0003		-2.2757
16	0.0062	0.0680	0.0034	0.0008		-2.2676
17	0.0054	0.0720	0.0031	0.0003		-2.2291
18	0.0059	0.0720	0.0025	0.0002		-2.2076
19	0.0046	0.0660	0.0047	0.0002		-2.0362
20						
21						
22						

Shapiro-Wilk Normality Test For MW-4 Metals

	7-log10(As)dwn	8-LAsdwn -LAsup	9-LAsb	10-Baup	11-Badwn	12-Badwn - Baup
1	-2.0362	0.3510	0.16876	0.0440	0.0750	0.0310
2	-2.2076	0.1691	0.05467	0.0560	0.0720	0.0160
3	-2.2291	0.1374	0.03518	0.0580	0.0720	0.0140
4	-2.2676	0.0792	0.01630	0.0580	0.0680	0.0100
5	-2.2757	0.0615	0.01010	0.0590	0.0670	0.0080
6	-2.2840	0.0532	0.00677	0.0590	0.0660	0.0070
7	-2.2924	0.0086	0.00080	0.0610	0.0640	0.0030
8	-2.2924	0.0086	0.00053	0.0610	0.0640	0.0030
9	-2.2924	0.0000	0.00000	0.0620	0.0630	0.0010
10	-2.2924	0.0000	--	0.0620	0.0620	0.0000
11	-2.2924	0.0000	--	0.0630	0.0620	-0.0010
12	-2.3010	-0.0086	--	0.0640	0.0610	-0.0030
13	-2.3010	-0.0086	--	0.0640	0.0610	-0.0030
14	-2.3372	-0.0532	--	0.0660	0.0590	-0.0070
15	-2.3372	-0.0615	--	0.0670	0.0590	-0.0080
16	-2.3468	-0.0792	--	0.0680	0.0580	-0.0100
17	-2.3665	-0.1374	--	0.0720	0.0580	-0.0140
18	-2.3768	-0.1691	--	0.0720	0.0560	-0.0160
19	-2.3872	-0.3510	--	0.0750	0.0440	-0.0310
20						
21		B=	0.29311			B=
22		W=	0.80719			W=

Shapiro-Wilk Normality Test For MW-4 Metals

	13-Bab	14-Log10(Cr)up	15-Log10(Cr)dwn	16-LCrdwn - LCryp	17-LCrb
1	0.01490	-2.7696	-1.6383	1.1313	0.5439
2	0.00517	-2.6778	-2.1739	0.5039	0.1628
3	0.00359	-2.6778	-2.2441	0.4337	0.1111
4	0.00206	-2.6576	-2.3279	0.3297	0.0679
5	0.00131	-2.6383	-2.3372	0.3010	0.0494
6	0.00089	-2.6021	-2.3872	0.2148	0.0273
7	0.00028	-2.5850	-2.4089	0.1761	0.0164
8	0.00018	-2.5229	-2.4437	0.0792	4.8459e-3
9	0.00003	-2.5086	-2.4685	0.0401	1.2156e-3
10	--	-2.5086	-2.5086	0.0000	--
11	--	-2.4685	-2.5086	-0.0401	--
12	--	-2.4437	-2.5229	-0.0792	--
13	--	-2.4089	-2.5850	-0.1761	--
14	--	-2.3872	-2.6021	-0.2148	--
15	--	-2.3372	-2.6383	-0.3010	--
16	--	-2.3279	-2.6576	-0.3297	--
17	--	-2.2441	-2.6778	-0.4337	--
18	--	-2.1739	-2.6778	-0.5039	--
19	--	-1.6383	-2.7696	-1.1313	--
20					--
21	0.02842			B=	0.9849
22	0.94102			W=	0.8442

Shapiro-Wilk Normality Test For MW-4 Metals

	18-log10(col(Pb)up	19-log10(col(Pb)dwn	20-Pbdwn - Pbup	21-Pbb	22-Asup
1	-3.6990	-2.2840	1.4150	0.6803	0.0041
2	-3.6990	-2.3372	1.3617	0.4401	0.0042
3	-3.5229	-2.4318	1.0911	0.2794	0.0043
4	-3.5229	-2.5229	1.0000	0.2059	0.0045
5	-3.3010	-2.7212	0.5798	0.0951	0.0046
6	-3.0969	-2.7447	0.3522	0.0448	0.0046
7	-3.0969	-2.7696	0.3274	0.0305	0.0050
8	-3.0458	-2.7959	0.2499	0.0153	0.0050
9	-3.0000	-2.7959	0.2041	0.0062	0.0051
10	-2.8861	-2.8861	0.0000	--	0.0051
11	-2.7959	-3.0000	-0.2041	--	0.0051
12	-2.7959	-3.0458	-0.2499	--	0.0051
13	-2.7696	-3.0969	-0.3274	--	0.0051
14	-2.7447	-3.0969	-0.3522	--	0.0052
15	-2.7212	-3.3010	-0.5798	--	0.0053
16	-2.5229	-3.5229	-1.0000	--	0.0054
17	-2.4318	-3.5229	-1.0911	--	0.0059
18	-2.3372	-3.6990	-1.3617	--	0.0062
19	-2.2840	-3.6990	-1.4150	--	0.0092
20					
21			B=	1.7976	
22			W=	0.9498	

Shapiro-Wilk Normality Test For MW-4 Metals

	23-Asdwn	24-Asdwn - Asup	25-Asb	26-Crup	27-Crdwn	28-Crdwn-Crup
1	0.0092	5.1000e-3	2.4521e-3	0.0017	0.0230	0.0213
2	0.0062	2.0000e-3	6.4640e-4	0.0021	0.0067	0.0046
3	0.0059	1.6000e-3	4.0976e-4	0.0021	0.0057	0.0036
4	0.0054	9.0000e-4	1.8531e-4	0.0022	0.0047	0.0025
5	0.0053	7.0000e-4	1.1487e-4	0.0023	0.0046	0.0023
6	0.0052	6.0000e-4	7.6260e-5	0.0025	0.0041	0.0016
7	0.0051	1.0000e-4	9.3200e-6	0.0026	0.0039	0.0013
8	0.0051	1.0000e-4	6.1200e-6	0.0030	0.0036	0.0006
9	0.0051	0.0000	0.0000	0.0031	0.0034	0.0003
10	0.0051	0.0000	--	0.0031	0.0031	0.0000
11	0.0051	0.0000	--	0.0034	0.0031	-0.0003
12	0.0050	-1.0000e-4	--	0.0036	0.0030	-0.0006
13	0.0050	-1.0000e-4	--	0.0039	0.0026	-0.0013
14	0.0046	-6.0000e-4	--	0.0041	0.0025	-0.0016
15	0.0046	-7.0000e-4	--	0.0046	0.0023	-0.0023
16	0.0045	-9.0000e-4	--	0.0047	0.0022	-0.0025
17	0.0043	-1.6000e-3	--	0.0057	0.0021	-0.0036
18	0.0042	-2.0000e-3	--	0.0067	0.0021	-0.0046
19	0.0041	-5.1000e-3	--	0.0230	0.0017	-0.0213
20						
21		B=	3.9001e-3			B=
22		W=	0.6946			W=

Shapiro-Wilk Normality Test For MW-4 Metals

	29-Crb
1	0.0102
2	0.00149
3	0.00092
4	0.00051
5	0.00038
6	0.00020
7	0.00012
8	0.00004
9	0.00001
10	--
11	--
12	--
13	--
14	--
15	--
16	--
17	--
18	--
19	--
20	
21	0.0139
22	0.4908

MW-4 Ni Data for Wilkes Test

	1-Ni	2-Nimod	3-a	4-Nimodup	5-Nimod down	6-down - up
1	0.0067	0.0067	0.4808	6.7000e-3	0.1100	0.1033
2	0.0067	0.0067	0.3232	6.7000e-3	0.0670	0.0603
3	0.0069	0.0069	0.2561	6.9000e-3	0.0410	0.0341
4	0.0083	0.0083	0.2059	8.3000e-3	0.0330	0.0247
5	0.0097	0.0097	0.1641	9.7000e-3	0.0280	0.0183
6	<0.0250	0.0125	0.1271	0.0110	0.0280	0.0170
7	0.0130	0.0130	0.0932	0.0125	0.0260	0.0135
8	0.0670	0.0670	0.0612	0.0130	0.0240	0.0110
9	0.0180	0.0180	0.0303	0.0140	0.0180	4.0000e-3
10	0.0280	0.0280		0.0140	0.0140	0.0000
11	0.0140	0.0140		0.0180	0.0140	-4.0000e-3
12	0.0110	0.0110		0.0240	0.0130	-0.0110
13	0.1100	0.1100		0.0260	0.0125	-0.0135
14	0.0330	0.0330		0.0280	0.0110	-0.0170
15	0.0140	0.0140		0.0280	9.7000e-3	-0.0183
16	0.0410	0.0410		0.0330	8.3000e-3	-0.0247
17	0.0280	0.0280		0.0410	6.9000e-3	-0.0341
18	0.0260	0.0260		0.0670	6.7000e-3	-0.0603
19	0.0240	0.0240		0.1100	6.7000e-3	-0.1033
20						
21						B=
22						W=

MW-4 Ni Data for Wilkes Test

	7-Ni b	8-Log Ni	9-LogNi up	10-Log Ni Down	11-Log down-Logup
1	0.0497	-2.1739	-2.1739	-0.9586	1.2153
2	0.0195	-2.1739	-2.1739	-1.1739	1.0000
3	8.7330e-3	-2.1612	-2.1612	-1.3872	0.7739
4	5.0857e-3	-2.0809	-2.0809	-1.4815	0.5994
5	3.0030e-3	-2.0132	-2.0132	-1.5528	0.4604
6	2.1607e-3	-1.9031	-1.9586	-1.5528	0.4058
7	1.2582e-3	-1.8861	-1.9031	-1.5850	0.3181
8	6.7320e-4	-1.1739	-1.8861	-1.6198	0.2663
9	1.2120e-4	-1.7447	-1.8539	-1.7447	0.1091
10	--	-1.5528	-1.8539	-1.8539	0.0000
11	--	-1.8539	-1.7447	-1.8539	-0.1091
12	--	-1.9586	-1.6198	-1.8861	-0.2663
13	--	-0.9586	-1.5850	-1.9031	-0.3181
14	--	-1.4815	-1.5528	-1.9586	-0.4058
15	--	-1.8539	-1.5528	-2.0132	-0.4604
16	--	-1.3872	-1.4815	-2.0809	-0.5994
17	--	-1.5528	-1.3872	-2.1612	-0.7739
18	--	-1.5850	-1.1739	-2.1739	-1.0000
19	--	-1.6198	-0.9586	-2.1739	-1.2153
20					
21	0.0902				B=
22	0.6997				W=

MW-4 Ni Data for Wilkes Test

	12-Log Ni b
1	0.5843
2	0.3232
3	0.1982
4	0.1234
5	0.0755
6	0.0516
7	0.0296
8	0.0163
9	3.3071e-3
10	--
11	--
12	--
13	--
14	--
15	--
16	--
17	--
18	--
19	--
20	
21	1.4055
22	0.9420

MW-4 Zn Data for Wilkes Test

	1-Zn	2-Znmod	3-a	4-Znmod up	5-Znmod down	6-down - up
1	0.1400	0.1400	0.4808	2.5000e-3	0.1400	0.1375
2	0.0850	0.0850	0.3232	2.5000e-3	0.1100	0.1075
3	0.0890	0.0890	0.2561	5.7000e-3	0.0890	0.0833
4	0.0420	0.0420	0.2059	6.1000e-3	0.0850	0.0789
5	0.0460	0.0460	0.1641	7.2000e-3	0.0460	0.0388
6	0.1100	0.1100	0.1271	7.3000e-3	0.0420	0.0347
7	0.0200	0.0200	0.0932	8.8000e-3	0.0310	0.0222
8	0.0150	0.0150	0.0612	8.8000e-3	0.0200	0.0112
9	0.0310	0.0310	0.0303	8.9000e-3	0.0150	6.1000e-3
10	0.0088	0.0088		0.0150	0.0150	0.0000
11	0.0088	0.0088		0.0150	8.9000e-3	-6.1000e-3
12	0.0061	0.0061		0.0200	8.8000e-3	-0.0112
13	0.0089	0.0089		0.0310	8.8000e-3	-0.0222
14	0.0150	0.0150		0.0420	7.3000e-3	-0.0347
15	<0.0050	2.5000e-3		0.0460	7.2000e-3	-0.0388
16	0.0057	0.0057		0.0850	6.1000e-3	-0.0789
17	0.0072	0.0072		0.0890	5.7000e-3	-0.0833
18	0.0073	0.0073		0.1100	2.5000e-3	-0.1075
19	<0.005	2.5000e-3		0.1400	2.5000e-3	-0.1375
20						
21						B=
22						W=

MW-4 Zn Data for Wilkes Test

	7-Zn b	8-Log Zn	9-LogZn up	10-Log Zn down	11-Log down - Log up
1	0.0661	-0.8539	-2.6021	-0.8539	1.7482
2	0.0347	-1.0706	-2.6021	-0.9586	1.6435
3	0.0213	-1.0506	-2.2441	-1.0506	1.1935
4	0.0162	-1.3768	-2.2147	-1.0706	1.1441
5	6.3671e-3	-1.3372	-2.1427	-1.3372	0.8054
6	4.4104e-3	-0.9586	-2.1367	-1.3768	0.7599
7	2.0690e-3	-1.6990	-2.0555	-1.5086	0.5469
8	6.8544e-4	-1.8239	-2.0555	-1.6990	0.3565
9	1.8483e-4	-1.5086	-2.0506	-1.8239	0.2267
10	--	-2.0555	-1.8239	-1.8239	0.0000
11	--	-2.0555	-1.8239	-2.0506	-0.2267
12	--	-2.2147	-1.6990	-2.0555	-0.3565
13	--	-2.0506	-1.5086	-2.0555	-0.5469
14	--	-1.8239	-1.3768	-2.1367	-0.7599
15	--	-2.6021	-1.3372	-2.1427	-0.8054
16	--	-2.2441	-1.0706	-2.2147	-1.1441
17	--	-2.1427	-1.0506	-2.2441	-1.1935
18	--	-2.1367	-0.9586	-2.6021	-1.6435
19	--	-2.6021	-0.8539	-2.6021	-1.7482
20					
21	0.1521				B=
22	0.7549				W=

MW-4 Zn Data for Wilkes Test

	12-LogZn b
1	0.8405
2	0.5312
3	0.3057
4	0.2356
5	0.1322
6	0.0966
7	0.0510
8	0.0218
9	6.8690e-3
10	--
11	--
12	--
13	--
14	--
15	--
16	--
17	--
18	--
19	--
20	
21	2.2213
22	0.9403

Appendix B
Part D.
Treatment of Largely Censored Data Sets

1. Cohen's Method and application to Ni for MW-3 and Cu for MW-4.
2. Probability plot analysis for Cu and Ni for MW-3 and for Cu for MW-4. Regression tables and plots.

Cohen's Method
For
Estimating the Mean and Standard Deviation of a Censored Data Set
From the
Mean and Standard Deviation of the Non-censored Data

Cohen's Method assumes that the underlying distribution is normal. The method can be applied to either the data or the logarithm of the data. Cohen's method is not applicable to any distribution that is not normal. It is based on the assumption that the censored data are an extension of the distribution exhibited by the non-censored data.

Let:
n = the total number of observations
m = the number of data points ≥ PQL, i.e. the number of non-censored data points
Md = the average of the non-censored data
Sd = the standard deviation of the non-censored data
M = the estimated mean of the distribution, including censored data
S = the estimated standard deviation of the distribution, including censored data

Put
h = (n-m)/n, the fraction of censored, i.e. non-detected data

$g = [Sd/(Md - PQL)]^2$

Table A-5 (EPA, 192a) gives a parameter λ which depends on h and g. Obtain λ from Table A-5, by double interpolation if necessary.

The estimated mean and standard deviation of the data set, including censored and non-censored data are calculated fro the following:

$M = Md - \lambda(Md - PQL)$

$S^2 = Sd^2 + \lambda(Md - PQL)^2$, and S is the square root of S^2

Applications of Cohen's Method

Ni for MW-3

A Type I probability plot for the log of the Ni data indicates log-normality. The probability plot (Figure C-1) and the associated regression report are included in at the end of this section of Appendix C. From the descriptive reports may be read:

Md = -2.126 and Sd = 0.138, on the $\log_{10}$ scale, and m = 11. The fraction of censored data points is 8/19 or

h = 0.421

For Ni the PQL = 0.005 or $\log_{10}$ PQL = -2.301.

$g = [0.138/ (-2.126 + 2.30103)]^2 = 0.6218$

From table A-5 (EPA, 1992a) the following sub-table for λ results:

	h		
g	0.40	0.421	0.45
0.60	0.7320	$\lambda 1$	0.8625
0.6218		λ	
0.65	0.7412	$\lambda 2$	0.8729

By double interpolation:

$\lambda 1 = [(0.421 - 0.40)/ 0.05](0.8625 - 0.7320) + 0.7320 = 0.7868$
$\lambda 2 = (0.420)(0.8729 - 0.7412) + 0.7412 = 0.7965$

$\lambda = [(0.6218 - 0.60)/0/05](0.7965 - 0.7868) + 0.7868 = 0.7910$

$M = -2.126 - (0.7910)(-2.126 + 2.301) = -2.2644$
$S^2 = (0.138)^2 + (0.7910)(-2.126 + 2.301)^2 = 0.04327$
$S = 0.208$

The M and S values so calculated are used to calculate the 95% TL for Ni for MW-3.

Cu for MW-4

A Type I probability plot for the log of the Cu data indicates log-normality. The probability plot (Figure C-2) and the associated regression report are included in at the end of this section of Appendix C. From the descriptive reports may be read:

Md = - 2.362 and Sd = 0.272, on the $\log_{10}$ scale, and m = 10 . The fraction of censored data points is 9/19 or

h = 0.474

For Cu the PQL = 0.002 or $\log_{10}$ PQL = -2.6990

$g = (0.272)^2 / (-2.362 + 2.699)^2 = 0.6514$

From table A-5 (EPA, 1992a) the following sub-table for λ results:

	h		
g	0.45	0.474	0.50
0.65	0.8729	$\lambda 1$	1.0188
0.6514		λ	
0.70	0.8832	$\lambda 2$	1.0303

By double interpolation:

$\lambda 1 = (0.48)(1.0188 - 0.8729) + 0.8729 = 0.9429$
$\lambda 2 = (0.48)(1.0303 - 0.8832) + 0.8832 = 0.9538$

$\lambda = 0.028(0.9538 - 0.9429) + 0.9429 = 0.9432$

$M = -2.362 - (0.9432)(-2.362 + 2.699) = -2.6799$
$S^2 = (0.272)^2 + (0.9432)(-2.362 + 2.699)^2 = 0.1811$
$S = 0.4256$

The M and S values so calculated are used to calculate the 95% TL for Cu for MW-4.

Probability Plot Type I

Linear Regression for Testing Normality of Censored Cu Data, MW-3

Data source: MW-3 Worksheet for Cu & Ni Normality in SR852005&2006
Normal Quantiles vs. Cu Data

Cu Q cnsrd = 0.348 + (67.519 * Cu Sorted)

N = 10.000 Missing Observations = 9

R = 0.730 Rsqr = 0.533 Adj Rsqr = 0.475

Standard Error of Estimate = 0.382

	Coefficient	Std. Error	t	P
Constant	0.348	0.163	2.140	0.065
Cu Sorted	67.519	22.323	3.025	0.016

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	1.338	1.338	9.148	0.016
Residual	8	1.170	0.146		
Total	9	2.509	0.279		

Normality Test: Passed (P = 0.747)

Constant Variance Test: Passed (P = 0.733)

Power of performed test with alpha = 0.050: 0.691

The power of the performed test (0.691) is below the desired power of 0.800.
Less than desired power indicates you are more likely to not detect a difference when one actually exists. Be cautious in over-interpreting the lack of difference found here.

Probability Plot Type I

Linear Regression for Testing Lognormality of Censored Cu Data, MW-3

Data source: MW-3 Worksheet for Cu & Ni Normality in SR852005&2006
Normal Quantile vs. Log_{10} Cu data

Cu Q cnsrd = 4.561 + (1.593 * logCu)

N = 10.000 Missing Observations = 9

R = 0.858 Rsqr = 0.737 Adj Rsqr = 0.704

Standard Error of Estimate = 0.287

	Coefficient	Std. Error	t	P
Constant	4.561	0.826	5.525	<0.001
logCu sorted	1.593	0.337	4.734	0.001

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	1.849	1.849	22.410	0.001
Residual	8	0.660	0.0825		
Total	9	2.509	0.279		

Normality Test: Passed (P = 0.250)

Constant Variance Test: Passed (P = 0.425)

Power of performed test with alpha = 0.050: 0.926

Probability Plot Type II

Linear Regression for Testing Normality of Non-Censored Cu Data, MW-3

Data source: MW-3 Worksheet for Cu & Ni Normality in SR852005&2006
Normal Quantiles of Non-censored data set vs Cu data

Cu Q Detct = -0.465 + (95.560 * Cu Sorted)

N = 10.000 Missing Observations = 9

R = 0.657 Rsqr = 0.431 Adj Rsqr = 0.360

Standard Error of Estimate = 0.665

	Coefficient	Std. Error	t	P
Constant	-0.465	0.283	-1.646	0.138
Cu Sorted	95.560	38.799	2.463	0.039

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	2.681	2.681	6.066	0.039
Residual	8	3.536	0.442		
Total	9	6.217	0.691		

Normality Test: Passed (P = 0.822)

Constant Variance Test: Passed (P = 0.733)

Power of performed test with alpha = 0.050: 0.549

The power of the performed test (0.549) is below the desired power of 0.800.
Less than desired power indicates you are more likely to not detect a difference when one actually exists. Be cautious in over-interpreting the lack of difference found here.

Probability Plot Type II

Linear Regression for Testing Lognormality of Non-censored Cu Data; MW-3.

Data source: MW-3 Worksheet for Cu & Ni Normality in SR852005&2006
Normal Quantiles vs. non-censored Log_{10} Cu data

Cu Q Detct = 5.728 + (2.349 * logCu sorted)

N = 10.000 Missing Observations = 9

R = 0.804 Rsqr = 0.647 Adj Rsqr = 0.603

Standard Error of Estimate = 0.524

	Coefficient	Std. Error	t	P
Constant	5.728	1.506	3.804	0.005
logCu sorted	2.349	0.614	3.827	0.005

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	4.021	4.021	14.648	0.005
Residual	8	2.196	0.274		
Total	9	6.217	0.691		

Normality Test: Passed (P = 0.735)

Constant Variance Test: Passed (P = 0.535)

Power of performed test with alpha = 0.050: 0.836

Probability Plot Type I

Linear Regression for Testing Normality of Censored Ni Data; MW-3.

Data source: MW-3 Worksheet for Cu & Ni Normality in SR852005&2006
Normal Quantiles vs. Ni Data

Ni Q cnsrd = -0.848 + (184.874 * Ni srttd)

N = 11.000 Missing Observations = 8

R = 0.941 Rsqr = 0.886 Adj Rsqr = 0.873

Standard Error of Estimate = 0.198

	Coefficient	Std. Error	t	P
Constant	-0.848	0.184	-4.610	0.001
Ni srttd	184.874	22.156	8.344	<0.001

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	2.740	2.740	69.624	<0.001
Residual	9	0.354	0.0394		
Total	10	3.094	0.309		

Normality Test: Passed (P = 0.736)

Constant Variance Test: Passed (P = 0.188)

Power of performed test with alpha = 0.050: 0.999

Probability Plot Type I

Linear Regression for Testing Lognormality of Censord Ni Data; MW-3

Data source: MW-3 Worksheet for Cu & Ni Normality in SR852005&2006
Normal Quantiles vs. Log_{10} Ni Data

Ni Q cnsrd = 8.986 + (3.942 * Log Ni sorted)

N = 11.000 Missing Observations = 8

R = 0.977 Rsqr = 0.954 Adj Rsqr = 0.949

Standard Error of Estimate = 0.125

	Coefficient	Std. Error	t	P
Constant	8.986	0.613	14.656	<0.001
Log Ni sorted	3.942	0.288	13.697	<0.001

Analysis of Variance:

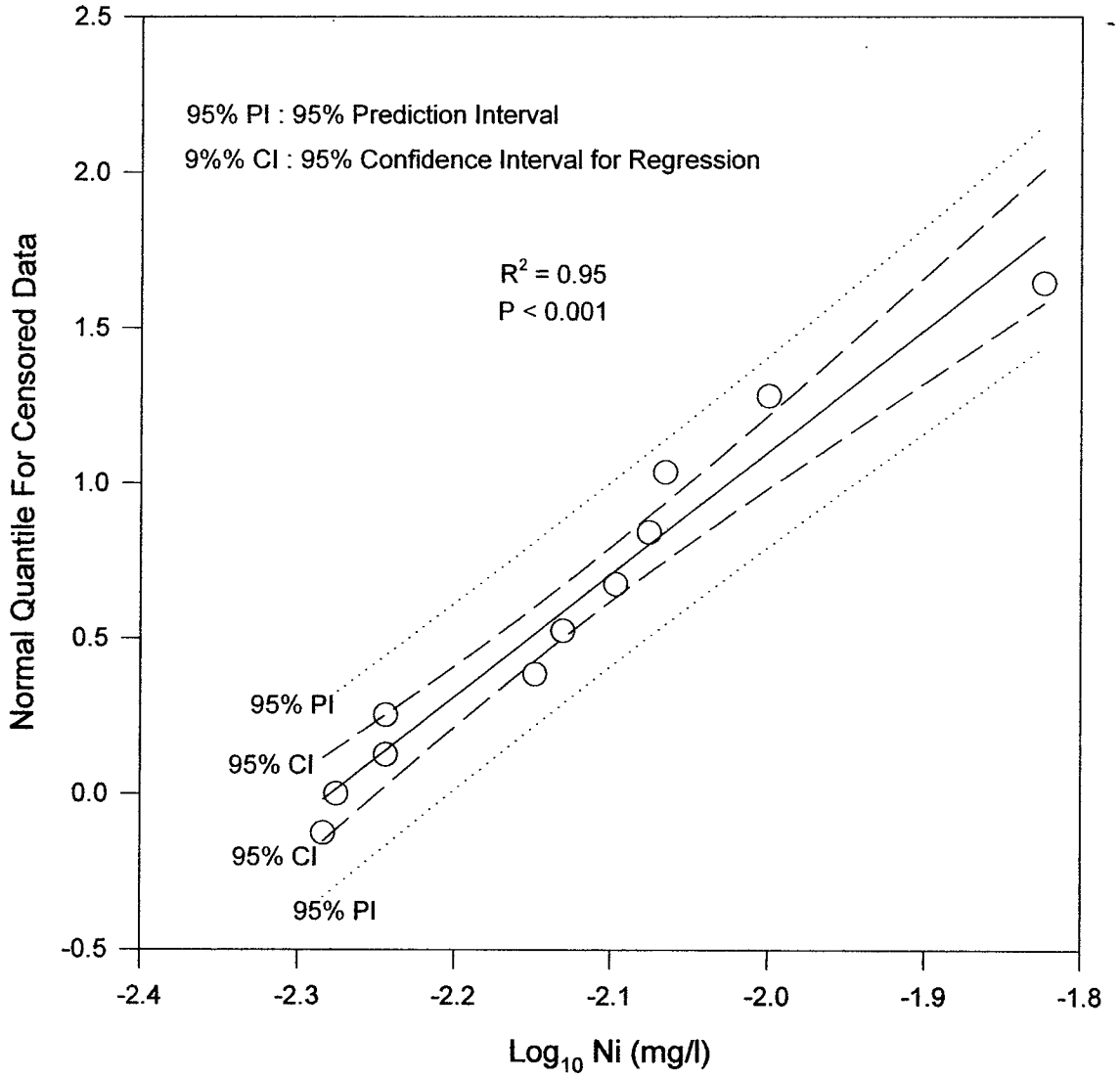
	DF	SS	MS	F	P
Regression	1	2.953	2.953	187.602	<0.001
Residual	9	0.142	0.0157		
Total	10	3.094	0.309		

Normality Test: Passed (P = 0.380)

Constant Variance Test: Failed (P = 0.047)

Power of performed test with alpha = 0.050: 1.000

Probability Plot Type I
Of Log_{10} Ni (mg/l) for MW-3
Censored Data Set



Probability Plot Type II

Linear Regression for Testing Normality of Non-censored Ni Data; MW-3.

Data source: MW-3 Worksheet for Cu & Ni Normality in SR852005&2006
Normal Quantiles vs. non-censored Log_{10} Ni data

Ni Q Det = -2.098 + (267.050 * Ni srttd)

N = 11.000 Missing Observations = 8

R = 0.899 Rsqr = 0.809 Adj Rsqr = 0.788

Standard Error of Estimate = 0.387

	Coefficient	**Std. Error**	**t**	**P**
Constant	-2.098	0.359	-5.840	<0.001
Ni srttd	267.050	43.248	6.175	<0.001

Analysis of Variance:

	DF	**SS**	**MS**	**F**	**P**
Regression	1	5.717	5.717	38.129	<0.001
Residual	9	1.349	0.150		
Total	10	7.067	0.707		

Normality Test: Passed (P = 0.470)

Constant Variance Test: Passed (P = 0.149)

Power of performed test with alpha = 0.050: 0.986

Probability Plot Type II

Linear Regression for Testing Lognormality of Non-censored Ni Data; MW-3

Data source: MW-3 Worksheet for Cu & Ni Normality in SR852005&2006
Normal Quantiles vs. non-censored Log_{10} Ni data

Ni Q Det = 12.389 + (5.826 * Log Ni sorted)

N = 11.000 Missing Observations = 8

R = 0.955 Rsqr = 0.913 Adj Rsqr = 0.903

Standard Error of Estimate = 0.262

	Coefficient	Std. Error	t	P
Constant	12.389	1.280	9.679	<0.001
Log Ni sorted	5.826	0.601	9.698	<0.001

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	6.449	6.449	94.049	<0.001
Residual	9	0.617	0.0686		
Total	10	7.067	0.707		

Normality Test: Passed (P = 0.428)

Constant Variance Test: Failed (P = 0.026)

Power of performed test with alpha = 0.050: 1.000

Probability Plot Type I

Linear RegressionFor Testing Normality of Censored Cu Data; MW-4.

Data source: MW-4 Cu Data in SR852005&2006
Normal Quantiles vs. Cu Data

Qcnsrd = 0.0822 + (111.556 * Cu srtd)

N = 10.000 Missing Observations = 9

R = 0.900 Rsqr = 0.809 Adj Rsqr = 0.786

Standard Error of Estimate = 0.244

	Coefficient	Std. Error	t	P
Constant	0.0822	0.128	0.642	0.539
Cu srtd	111.556	19.141	5.828	<0.001

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	2.030	2.030	33.967	<0.001
Residual	8	0.478	0.0598		
Total	9	2.509	0.279		

Normality Test: Passed (P = 0.667)

Constant Variance Test: Passed (P = 0.707)

Power of performed test with alpha = 0.050: 0.973

Probability Plot Type I

Linear Regression for Testing Lognormality of Censored Cu Data; MW-4

Data source: MW-4 Cu Data in SR852005&2006
Normal Quantile vs. Log_{10} Cu data

Qcnsrd = 5.158 + (1.897 * Log Cu Srtd)

N = 10.000 Missing Observations = 9

R = 0.977 Rsqr = 0.955 Adj Rsqr = 0.949

Standard Error of Estimate = 0.119

	Coefficient	Std. Error	t	P
Constant	5.158	0.348	14.824	<0.001
Log Cu Srtd	1.897	0.146	12.955	<0.001

Analysis of Variance:

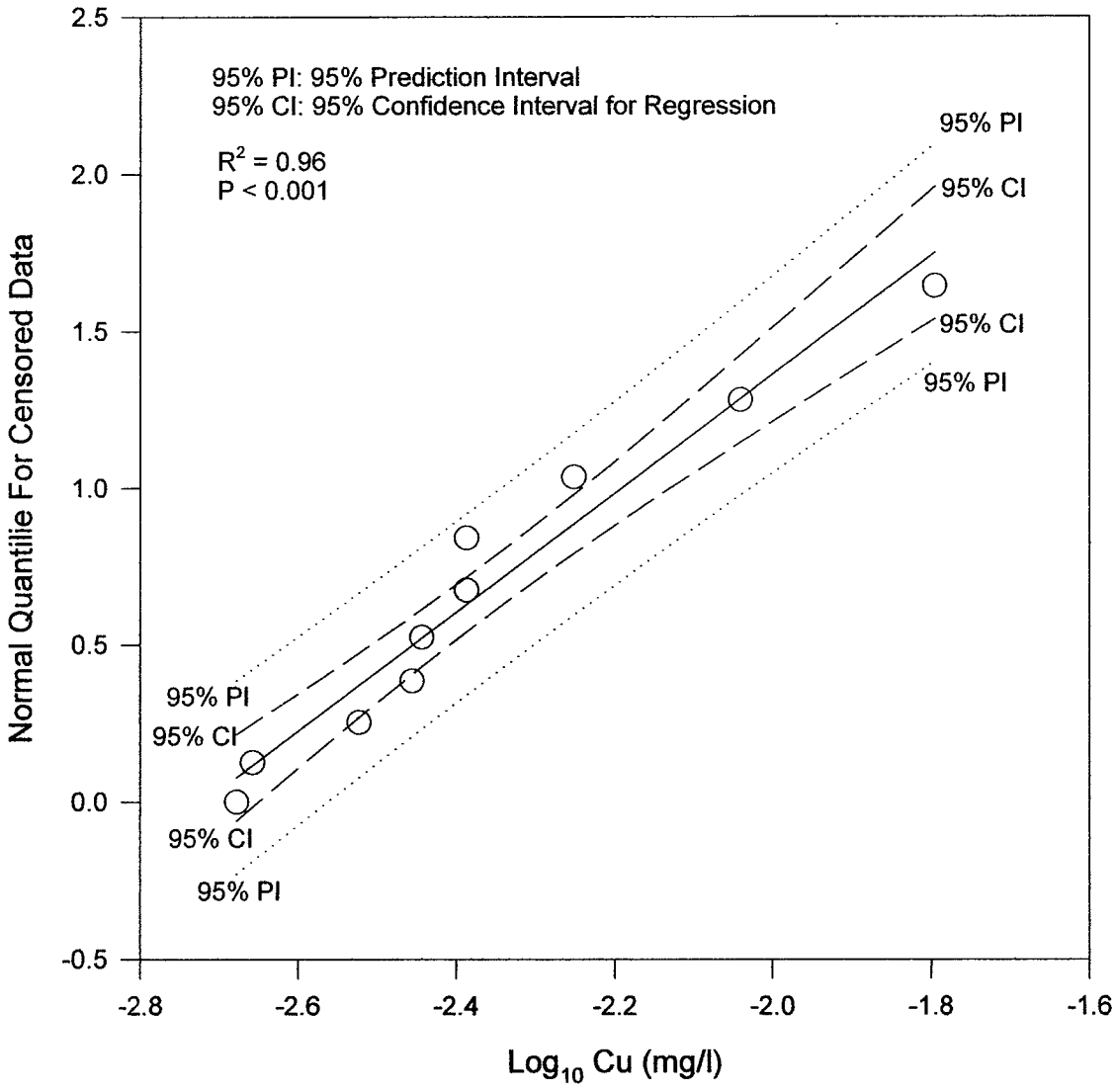
	DF	SS	MS	F	P
Regression	1	2.395	2.395	167.839	<0.001
Residual	8	0.114	0.0143		
Total	9	2.509	0.279		

Normality Test: Passed (P = 0.521)

Constant Variance Test: Passed (P = 0.811)

Power of performed test with alpha = 0.050: 1.000

Probability Plot Type I
Of Log_{10} Cu (mg/l) For MW-4
Censored Data Set



Probability Plot Type II

Linear Regression for Testing Normality of Non-censored Cu Data, MW-4

Data source: MW-4 Cu Data in SR852005&2006
Normal Quantiles vs. Non-censored data set for Cu data

QDet = -0.871 + (163.433 * Cu srtd)

N = 10.000 Missing Observations = 9

R = 0.837 Rsqr = 0.701 Adj Rsqr = 0.664

Standard Error of Estimate = 0.482

	Coefficient	**Std. Error**	**t**	**P**
Constant	-0.871	0.252	-3.452	0.009
Cu srtd	163.433	37.733	4.331	0.003

Analysis of Variance:

	DF	**SS**	**MS**	**F**	**P**
Regression	1	4.358	4.358	18.760	0.003
Residual	8	1.858	0.232		
Total	9	6.217	0.691		

Normality Test: Passed (P = 0.735)

Constant Variance Test: Passed (P = 0.946)

Power of performed test with alpha = 0.050: 0.894

Probability Plot Type II

Linear Regression for Testing Lognormality of Noncensored Cu Data, MW-4

Data source: MW-4 Cu Data in SR852005&2006
Normal Quantiles vs. non-censored Log_{10} Cu data

QDet = 6.858 + (2.903 * Log Cu Srtd)

N = 10.000 Missing Observations = 9

R = 0.950 Rsqr = 0.902 Adj Rsqr = 0.890

Standard Error of Estimate = 0.276

	Coefficient	Std. Error	t	P
Constant	6.858	0.803	8.545	<0.001
Log Cu Srtd	2.903	0.338	8.596	<0.001

Analysis of Variance:

	DF	SS	MS	F	P
Regression	1	5.609	5.609	73.890	<0.001
Residual	8	0.607	0.0759		
Total	9	6.217	0.691		

Normality Test: Passed (P = 0.746)

Constant Variance Test: Passed (P = 0.607)

Power of performed test with alpha = 0.050: 0.998

Appendix B
Part E.
One-sided 95% Tolerance Limits
for Sample Size 19

1. Parametric Tolerance Limits
   For a sample size of 19, TL is calculated from

$$95\%TL = M + S \times 2.423$$

where, M and S are the mean and standard deviation of the data, and the constant 2.423 is the appropriate factor for a coverage of 95% with a confidence of 95% (EPA, June 1992). Parametric tolerance limits are given on the spreadsheet, which shows the calculation. The statistics in the spreadsheet are from the descriptive statistics in Part A of this appendix. In the spreadsheet, N and LN indicate normal and log-normal distributions, respectively.

If the data are distributed log-normal, the same equation applies, but with M and S now denoting the mean and standard deviation of the transformed data. The TL of the original data is the antilog of the TL for the logarithmic data.

2. Non-Parametric Tolerance Limits

For a sample of 19 data points, the estimate of the tolerance limit is the maximum of the data set. The tolerance interval than has an expected coverage of 95%, and the minimum coverage with 95% confidence is 85.4%.

Non-Parametric Tolerance Limits		
Well	Metal	TL = Maximum
MW-3	Cr	0.021
MW-3	Cu	0.021
MW-4	As	0.0092
MW-4	Cr	0.023

All concentrations are in units of mg/L.

Spread Sheet For Parametric 95%TL

	1-Well	2-Metal	3-Type	4-Mean	5-StdDev	6	7-95% TL
1	MW-3	As	N	0.00705	0.000875	0.0092	0.00917
2	MW-3	Ba	N	0.05550	0.006810	0.0720	0.07200
3	MW-3	Pb	N	0.00186	0.001380	0.0052	0.00520
4	MW-3	Zn	LN	-1.78900	0.5500	-0.4563	0.34966
5	MW-3	Ni	LN	-2.2644	0.2080	-1.7604	0.01736
6	MW-4	Ba	N	0.06270	0.006900	0.0794	0.07942
7	MW-4	Pb	N	0.00165	0.001470	0.0052	0.00521
8	MW-4	Zn	LN	-1.7690	0.5400	-0.4606	0.34627
9	MW-4	Ni	LN	-1.7430	0.3410	-0.9168	0.12113
10	MW-4	Cu	LN	-2.6799	0.4256	-1.6487	0.02246

APPENDIX C

DATA VALIDATION REPORT

Data Verification Memorandum

URS

7720 N. 16th Street
Suite 100
Phoenix, Arizona 85020
602.371.1100 Tel
602.371.1615 Fax

Action	Info	File
To	Canda Lorson, Project Manager	23443678
From	Catherine Storey, Denver Chemist	
Date	March 29, 2007	
Subject	Data Verification of SR85 Landfill – Monthly Sampling (2005 and 2006)	
	MWH Order Nos: 141460, 141654, 143430, 143880, 146240, 147542, 149243, 151373, 154110, 155993, 157203, 158609, 160344, 162476, 163924, 164756, 166073, 177607, 179450, 181673, 184700, 186936, 189077 and 191701.	

This report summarizes the verification of analytical data for 192 aqueous samples and 36 aqueous field duplicate samples. The sample identification numbers and sample collection dates are summarized in Table 1 for the 2005 sampling and in Table 2 for the 2006 sampling. The samples were analyzed for total metals (EPA Methods 200.7, 200.8, and 245.1), general chemistry parameters (Methods SM2320B/E310.1, SM4500-C, EPA 353.2, SM2540C/E160.1), DBCP and EDB by Modified EPA Method 8011 (EPA 504.1), and Volatile Organics HSL (EPA 8260). Samples collected in June 2006 through Dec 2006 were also analyzed for Chemical Oxygen Demand (COD) by EPA 410.4. The samples were sent to MWH Laboratories of Monrovia, California (MWH), ADHS License No. AZ0455.

The following comments refer to MWH's performance in meeting the quality assurance and control specifications outlined in the analytical methods and the criteria specified in the EPA documents: National Functional Guidelines for Inorganic Data Review (Oct 2004) and National Functional Guidelines for Organic Data Review (Oct 1999). The data were reviewed in accordance with the project specific URS Standard Operating Procedures (SOPs). The qualifiers and reason codes used to identify data that did not meet the criteria set forth in the previously referenced documents are listed in Appendix A.

A list of the data review parameters is given in Sections 2.0 through 5.0. A preceding "?" signifies areas where issues were raised during the course of the validation review, and should be considered to determine any impact on data quality and usability.

1.0 Executive Summary

With the following exceptions, MWH recorded the cooler temperatures upon receipt for the samples collected from January 20, 2005 through December 21, 2006 to be within the acceptable range of 4 degrees Celsius (°C) +/- 2 °C:

- The cooler temperature was not recorded for the samples collected on June 1, 2005 or on December 1, 2005. Because the samples were received by the laboratory on the day of collection, data qualification was not considered to be necessary.

- The cooler temperature for the samples received July 6, 2005 was 15°C. The samples were received by the laboratory on the day of collection and it was noted that frozen blue ice was present in the cooler. It appears that the samples had not had time to cool down before the laboratory received them and therefore the qualification of data was not considered to be necessary.
- The laboratory did not document the cooler temperature for the samples received on October 11, 2005. The samples were collected the previous day. As no temperature issues were identified by the laboratory, it was not considered to be necessary to qualify sample data.

With the exceptions in the table below, the data are acceptable in all areas of review.

Data Package	Samples	Analyte	Qualification	Bias Direction	Section
Total Metals					
179450	85A-JY06 85B-JY06 85C-JY06 85D-JY06 85F-JY06 85G-JY06 85G-JY06DUP	Calcium	m	Indeterminate	2.4
Data Package	**Samples**	**Analyte**	**Qualification**	**Bias Direction**	**Section**
General Chemistry Parameters					
149243	85A-M05 85C-M05 85D-M05 85F-M05 85G-M05	Nitrate + Nitrite	J m	high	3.4
151373	85A-JY05 85B-JY05 85C-JY05 85D-JY05 85F-JY05 85G-JY05	Alkalinity	J/UJ m	low	3.4
181673	85A-AG06 85B-AG06 85C-AG06 85D-AG06 85E-AG06 85F-AG06	Alkalinity	J m	low	3.4

184700	85A-SP06 85B-SP06 85C-SP06 85D-SP06 85E-SP06 85F-SP06	Nitrate + Nitrite	J m	high	3.4
186936	85A-OC06 85B-OC06 85C-OC06 85D-OC06 85E-OC06 85F-OC06	Alkalinity	J m	high	3.4
189077	85A-NV06 85B-NV06 85C-NV06 85D-NV06 85E-NV06 85F-NV06	Alkalinity	J m	low	3.4
191701	85A-DC06 85B-DC06 85C-DC06 85D-DC06 85E-DC06 85F-DC06	Alkalinity	J m	low	3.4

Volatile Organics by EPA Method 8260

Data Package	Samples	Analyte	Qualification	Bias Direction	Section
149243	85A-M05	Vinyl Acetate	UJ m	low	5.4
151373	85A-JY05	Bromoform	UJ m	low	5.4
154110	85A-AG05	2-Butanone	UJ m	low	5.4
		2-Hexanone			
		MIBK			
		Acetone			
		Vinyl Acetate			

155993	85C-SP05	2-Butanone Acetone Vinyl Acetate	UJ m	low	5.4
160344	85A-NV05	Styrene Vinyl Acetate	UJ m	low	5.4
162476	85A-OC05	Acetone	UJ m	low	5.4
166073	85A-106	Acetone	UJ m	low	5.4
179450	85G-JY06 85G-JY06DUP	Acetone	UJ m	low	5.4
189077	85A-NV06	Styrene	UJ m	low	5.4
143430	85A-F05 85ATB-F05 85B-F05 85BTB-F05 85C-F05 85CTB-F05 85D-F05 85DTB-F05 85F-F05 85FTB-F05 85G-F05 85GTB-F05	Bromoform Vinyl acetate Dibromochloromethane	UJ l	low	5.5
143880	85ATB-M05 85B-M05 85BTB-M05 85C-M05 85CTB-M05 85D-M05 85DTB-M05 85F-M05	Bromoform Vinyl acetate Dibromochloromethane	UJ l	low	5.5

143880	85A-M05 85G-M05 85FTB-M05 85GTB-M05	1,1,1,2-Tetrachloroethane	UJ l	low	5.5
		Acetone			
		Bromoform			
		Carbon Tetrachloride			
		Dibromochloromethane			
		Methyl Bromide			
		Methyl Chloride			
		Trichlorofluoromethane			
		Vinyl Chloride			
166073	85A-106 85ATB-106 85B-106 85BTB-106 85C-106 85CTB-106 85D-106 85DTB-106 85F-106	Acetone	UJ l	low	5.5
177607	85A-JN06 85ATB-JN06 85B-JN06 85BTB-JN06 85C-JN06 85CTB-JN06 85D-JN06 85F-JN06 85FTB-JN06 85G-JN06	Carbon Disulfide	UJ l	low	5.5
		Styrene			
181673	85A-AG06 85ATB-AG06 85B-AG06 85C-AG06 85D-AG06 85E-AG06 85ETB-AG06 85F-AG06 85FTB-AG06	Acetone	UJ l	low	5.5

All data are useable for their intended purpose. Because no data points were rejected, the analytical completeness for this data group is 100%.

2.0 Total Metals

Data Completeness
Holding Times and Preservation

Blanks
? Matrix Spike/Matrix Spike Duplicates (MS/MSD)
Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD)
Field Duplicate

2.1 Data Completeness

The analyses were performed as requested on the Chain-of-Custody Records. Data qualification was not required.

2.2 Holding Times and Preservation

The samples were analyzed within the method specified holding time. Data qualification was not required.

2.3 Blanks

The associated method blanks were reported as non-detect for all target metals. Data qualification was not required.

2.4 Matrix Spike/Matrix Spike Duplicates (MS/MSD)

The MS/MSD analyses were performed on 2005 project samples 85A-F05 (Feb 2005), 85A-M05 (Mar 2005), 85A-A05 (April 2005), 85A-M05 (May 2005), 85A-M05 (June 2005), 85A-JY05 (July 2005), 85A-AG05 (Aug 2005), 85C-SP05 (Sept 2005), 85A-OC05 (Oct 2005), 85A-NV05 (Nov 2005), and 85A-DC05 (Dec 2005). The MS/MSD analyses were performed on 2006 project samples 85A-106 (Jan 2006), 85F-JN06 (June 2006), 85G-JY06 (July 2006), 85E-AG06 (Aug 2006), 85F-SP06 (Sept 2006), 85A-OC06 (Oct 2006), 85A-NV06 (Nov 2006), and 85F-DC06 (Dec 2006). With the exceptions listed below, the MS/MSD percent recoveries were within the laboratory established control limits.

Data Package	Batch	Metal	RPD (%R)	Acceptance Limits (%)	Affected Samples	Qualification	Reason Code
179450	326434	Calcium	**22.3**	15%	85A-JY06 85B-JY06 85C-JY06 85D-JY06 85F-JY06 85G-JY06 85G-JY06DUP	J/UJ	m

The Relative Percent Difference (RPD) between the MS and the MSD exceeded the acceptance criterion for calcium in the MS and MSD performed on sample 85G-JY06 (July 2006). Although the recoveries are in control at 90% and 113%, the expected level of precision has not been met

and the results are qualified as noted in the table above. The "m" qualifier has been used although the reason for qualification is a precision failure rather than an accuracy failure.

Recoveries for magnesium, sodium, and calcium exceeded acceptance criteria in the MS and MSD performed on sample 85A-NV06 (Nov 2006). However, the unspiked sample contained each of these analytes at a concentration greater than four times the spike level. Therefore the spike level is considered inappropriate for assessing accuracy and the data were not qualified.

2.5 Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD)

The LCS/LCSD percent recoveries were within the method specified control limits.

2.6 Field Duplicate (FD)

The FD pairs for the 2005 monitoring rounds were: 85C-F05/85D-F05 (Feb 2005), 85C-M05/85D-M05 and 85A-M05/85B-M05 (Mar 2005), 85A-A05/85B-A05 (April 2005), 85A-M05/85B-M05 and 85C-M05/85D-M05 (May 2005), 85A-M05/85D-M05 (June 2005), 85A-JY05/85B-JY05 (July 2005), 85A-AG05/85B-AG05 (August 2005), 85G-SP05/85F-SP05 and 85C-SP05/85D-SP05 (September 2005), 85A-OC05/85B-OC05 and 85C-OC05/85D-OC05 (October 2005), 85A-NV05/85B-NV05 and 85C-NV05/85D-NV05 (November 2005), and 85A-OC05/85B-OC05, 85C-DC05/85D-DC05 and 85A-DC05/85B-DC05 (December 2005).

The FD pairs for the 2006 monitoring rounds were: 85A-106/85B-106 (January 2006), 85C-JN06/85D-JN06 and 85F-JN06/85G-JN06 (June 2006), 85F-JY06/85G-JY06 (July 2006), 85A-AG06/85D-AG06 and 85B-AG06/85F-AG06 (August 2006), 85A-SP06/85B-SP06 and 85C-SP06/85D-SP06 (September 2006), 85A-OC06/85B-OC06 and 85C-OC06/85D-OC06 (October 2006), 85A-NV06/85B-NV06 and 85C-NV06/85D-NV06 (November 2006), and 85A-DC06/85B-DC06 and 85C-DC06/85D-DC06 (December 2006).

No significant differences were noted for the field duplicate pairs. Data qualification was not considered necessary.

3.0 General Chemistry Parameters

Data Completeness
Holding Times and Preservation
Blanks
? Matrix Spike/Matrix Spike Duplicates (MS/MSD)
Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD)
Laboratory Duplicate
Field Duplicate

3.1 Data Completeness

The analyses were performed as requested on the Chain-of-Custody Records. Data qualification was not required.

The laboratory did not report TDS for the samples collected December 1, 2005. Resampling was performed on December 20, 2005 for TDS analysis only.

3.2 Holding Times and Preservation

All samples were analyzed within the method specified holding times. Data qualification was not required.

3.3 Blanks

The associated method blanks were reported as non-detect for all target analytes. Data qualification was not required.

3.4 Matrix Spike/Matrix Spike Duplicates (MS/MSD)

The MS/MSD analyses were performed on 2005 project samples 85A-F05 (Feb 2005), 85A-M05 (Mar 2005), 85A-A05 (April 2005), 85A-M05 (May 2005), 85A-M05 (June 2005), 85A-JY05 (July 2005), 85A-AG05 (Aug 2005), 85C-SP05 (Sept 2005), 85A-OC05 (Oct 2005), 85A-NV05 (Nov 2005), and 85A-DC05 (Dec 2005). The MS/MSD analyses were performed on 2006 project samples 85A-106 (Jan 2006), 85F-JN06 (June 2006), 85G-JY06 (July 2006), 85E-AG06 (Aug 2006), 85F-SP06 (Sept 2006), 85A-OC06 (Oct 2006), 85A-NV06 (Nov 2006), and 85F-DC06 (Dec 2006). With the exceptions listed in the following table, the MS/MSD percent recoveries were within the laboratory-established control limits.

Data Package	Batch	Analyte	MS/MSD (%R)	Acceptance Limits (%)	Affected Samples	Qualification	Reason Code
June 2005 149243	274420	Nitrate + Nitrite	**111/109**	90-110%	85A-M05 85C-M05 85D-M05 85F-M05 85G-M05	J	m
July 2005 151373	278642	Alkalinity	**53/53**	80-120%	85A-JY05 85B-JY05 85C-JY05 85D-JY05 85F-JY05 85G-JY05	J/UJ	m

Aug 2006 181673	330912	Alkalinity	**60/78**	80-120%	85A-AG06 85B-AG06 85C-AG06 85D-AG06 85E-AG06 85F-AG06	J	m
Sept 2006 184700	336899	Nitrate + Nitrite	**114/94**	90-110%	85A-SP06 85B-SP06 85C-SP06 85D-SP06 85E-SP06 85F-SP06	J	m
Oct 2006 186936	339387	Alkalinity	**134/137**	80-120%	85A-OC06 85B-OC06 85C-OC06 85D-OC06 85E-OC06 85F-OC06	J	m
Nov 2006 189077	342552	Alkalinity	**55/81**	80-120%	85A-NV06 85B-NV06 85C-NV06 85D-NV06 85E-NV06 85F-NV06	J	m
Dec 2006 191701	345785	Alkalinity	**56/58**	80-120%	85A-DC06 85B-DC06 85C-DC06 85D-DC06 85E-DC06 85F-DC06	J	m

3.5 Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD)

The LCS/LCSD percent recoveries and RPD values were within the method specified control limits. Data qualification was not considered necessary.

3.6 Laboratory Duplicate (LD)

Laboratory duplicates were performed for the Total Dissolved Solids (TDS) analysis on samples 85A-F05 (Feb 2005), 85A-M05 (Mar 2005), 85A-A05 (April 2005), 85A-M05 (May 2005), 85A-M05 (June 2005), 85A-JY05 (July 2005), 85A-AG05 (Aug 2005), 85C-SP05 (Sept 2005), 85A-OC05 (Oct 2005), 85A-NV05 (Nov 2005), 85A-DC05 (Dec 2005), 85A-106 (Jan 2006), 85F-JN06 (June 2006), 85G-JY06 (July 2006), 85E-AG06 (Aug 2006), 85F-SP06 (Sept 2006), 85A-OC06 (Oct 2006), 85A-NV06 (Nov 2006), and 85F-DC06 (Dec 2006). With the exception listed

below, all RPDs were within the method specified control limit of 20%. Data qualification was not considered necessary.

The TDS Laboratory Duplicate for sample 85A-DC05 (Dec 2005) exceeded the 20% criterion with RPD of 37%. However, this sample was also collected as a field duplicate (85B-DC05), and the difference between the TDS results for the sample and the field duplicate are below 20%. Therefore no data qualification is recommended based on the laboratory duplicate.

3.7 Field Duplicate (FD)

The FD pairs for the 2005 monitoring rounds were: 85C-F05/85D-F05 (Feb 2005), 85C-M05/85D-M05 and 85A-M05/85B-M05 (Mar 2005), 85A-A05/85B-A05 (April 2005), 85A-M05/85B-M05 and 85C-M05/85D-M05 (May 2005), 85A-M05/85D-M05 (June 2005), 85A-JY05/85B-JY05 (July 2005), 85A-AG05/85B-AG05 (August 2005), 85G-SP05/85F-SP05 and 85C-SP05/85D-SP05 (September 2005), 85A-OC05/85B-OC05 and 85C-OC05/85D-OC05 (October 2005), 85A-NV05/85B-NV05 and 85C-NV05/85D-NV05 (November 2005), and 85A-OC05/85B-OC05, 85C-DC05/85D-DC05 and 85A-DC05/85B-DC05 (December 2005).

The FD pairs for the 2006 monitoring rounds were: 85A-106/85B-106 (January 2006), 85C-JN06/85D-JN06 and 85F-JN06/85G-JN06 (June 2006), 85F-JY06/85G-JY06 (July 2006), 85A-AG06/85D-AG06 and 85B-AG06/85F-AG06 (August 2006), 85A-SP06/85B-SP06 and 85C-SP06/85D-SP06 (September 2006), 85A-OC06/85B-OC06 and 85C-OC06/85D-OC06 (October 2006), 85A-NV06/85B-NV06 and 85C-NV06/85D-NV06 (November 2006), and 85A-DC06/85B-DC06 and 85C-DC06/85D-DC06 (December 2006).

No significant differences were noted for the field duplicate pairs. Data qualification was not considered necessary.

4.0 DBCP and EDB by Modified Method 8011 Parameters

Data Completeness
Holding Times and Preservation
Blanks
Matrix Spike/Matrix Spike Duplicates (MS/MSD)
Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD)
Field Duplicate

4.1 Data Completeness

The analyses were performed as requested on the Chain-of-Custody Records. Data qualification was not required.

4.2 Holding Times and Preservation

All samples were analyzed within the method specified holding times. Data qualification was not required.

4.3 Blanks

The associated method blanks were reported as non-detect for all target analytes. Data qualification was not required.

4.4 Matrix Spike/Matrix Spike Duplicates (MS/MSD)

The MS/MSD analyses were performed on 2005 project samples 85A-F05 (Feb 2005), 85A-M05 (Mar2005), 85A-A05 (April 2005), 85A-M05 (May 2005), 85A-M05 (June 2005), 85A-JY05 (July 2005), 85A-AG05 (Aug 2005), 85C-SP05 (Sept 2005), 85A-OC05 (Oct 2005), 85A-NV05 (Nov 2005), and 85A-DC05 (Dec 2005). The MS/MSD analyses were performed on 2006 project samples 85A-106 (Jan 2006), 85F-JN06 (June 2006), 85G-JY06 (July 2006), 85E-AG06 (Aug 2006), 85F-SP06 (Sept 2006), 85A-OC06 (Oct 2006), 85A-NV06 (Nov 2006), and 85F-DC06 (Dec 2006). The MS/MSD percent recoveries were within the laboratory established control limits; no qualification of data was required.

4.5 Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD)

The LCS/LCSD percent recoveries and RPD values were within the method specified control limits. Data qualification was not required.

4.6 Field Duplicate (FD)

The FD pairs for the 2005 monitoring rounds were: 85C-F05/85D-F05 (Feb 2005), 85C-M05/85D-M05 and 85A-M05/85B-M05 (Mar 2005), 85A-A05/85B-A05 (April 2005), 85A-M05/85B-M05 and 85C-M05/85D-M05 (May 2005), 85A-M05/85D-M05 (June 2005), 85A-JY05/85B-JY05 (July 2005), 85A-AG05/85B-AG05 (August 2005), 85G-SP05/85F-SP05 and 85C-SP05/85D-SP05 (September 2005), 85A-OC05/85B-OC05 and 85C-OC05/85D-OC05 (October 2005), 85A-NV05/85B-NV05 and 85C-NV05/85D-NV05 (November 2005), and 85A-OC05/85B-OC05, 85C-DC05/85D-DC05 and 85A-DC05/85B-DC05 (December 2005).

The FD pairs for the 2006 monitoring rounds were: 85A-106/85B-106 (January 2006), 85C-JN06/85D-JN06 and 85F-JN06/85G-JN06 (June 2006), 85F-JY06/85G-JY06 (July 2006), 85A-AG06/85D-AG06 and 85B-AG06/85F-AG06 (August 2006), 85A-SP06/85B-SP06 and 85C-SP06/85D-SP06 (September 2006), 85A-OC06/85B-OC06 and 85C-OC06/85D-OC06 (October 2006), 85A-NV06/85B-NV06 and 85C-NV06/85D-NV06 (November 2006), and 85A-DC06/85B-DC06 and 85C-DC06/85D-DC06 (December 2006).

No significant differences were noted for the field duplicate pairs. Data qualification was not considered necessary.

5.0 Volatile Organics by Method 8260 Parameters

Data Completeness
Holding Times and Preservation
? Blanks

?Matrix Spike/Matrix Spike Duplicates (MS/MSD)
? Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD)
Field Duplicate

5.1 Data Completeness

The analyses were performed as requested on the Chain-of-Custody Records. Data qualification was not required.

One sample, MW-4TB-HOLD, collected January 20, 2005, was not analyzed for Volatile Organics by Method 8260 per the chain of custody. No qualification of data was required.

5.2 Holding Times and Preservation

All samples were analyzed within the method specified holding times. Data qualification was not required.

5.3 Blanks

The associated method blanks were reported as non-detect for all target analytes. Data qualification was not required.

The trip blanks collected on May 3, 2005, June 1, 2005, July 6, 2005, January 25, 2006, October 19, 2006, November 16, 2006 and December 21, 2006 all contained acetone above the reporting limit. The results for samples associated with these trip blanks were not qualified because acetone was not detected in any field sample associated with these trip blanks.

The trip blank SR85ATB-OC05, collected October 10, 2005, contained methyl chloride at a concentration equal to the reporting limit. Methyl chloride was also detected at a similar concentration in all the field samples collected that day. Methyl chloride was not detected above the reporting limit in the two other trip blanks collected on 10/10/2005, SR85CTB-OC05 and SR85GTB-OC05. Because the reviewer could not determine which samples were associated with each trip blank, only the results for SR85A-OC05 have been qualified as estimated (J y) and the qualification has not been extended to the other samples in this batch. However, it should be noted that the concentrations of methyl chloride in all samples collected on this date are approximately the same as the concentration reported in SR85ATB-OC05.

5.4 Matrix Spike/Matrix Spike Duplicates (MS/MSD)

The MS/MSD analyses were performed on 2005 project samples 85A-F05 (Feb 2005), 85A-M05 (Mar 2005), 85A-A05 (April 2005), 85A-M05 (May 2005), 85A-M05 (June 2005), 85A-JY05 (July 2005), 85A-AG05 (Aug 2005), 85C-SP05 (Sept 2005), 85A-OC05 (Oct 2005), 85A-NV05 (Nov 2005), and 85A-DC05 (Dec 2005). The MS/MSD analyses were performed on 2006 project samples 85A-106 (Jan 2006), 85F-JN06 (June 2006), 85G-JY06 (July 2006), 85E-AG06 (Aug 2006), 85F-SP06 (Sept 2006), 85A-OC06 (Oct 2006), 85A-NV06 (Nov 2006), and 85F-DC06

(Dec 2006). With the exceptions listed in the following table, the MS/MSD percent recoveries were within the laboratory established control limits.

Data Package	QC Batch	Analyte	MS/MSD (%R)	Acceptance Limits (%)	Affected Samples	Qualification	Reason Code
June 2005 149243	274725	Vinyl acetate	**67/61**	70-130%	85A-M05	UJ	m
July 2005 151373	279903	Bromoform	**69/70**	70-130%	85A-JY05	UJ	m
Aug 2005 154110	284369	2-Butanone	**66/41**	70-130%	85A-AG05	UJ	m
		2-Hexanone	**81/53**				
		MIBK	**77/51**				
		Acetone	**52/31**				
		Vinyl Acetate	**34/29**				
Sep 2005 155993	287717	2-Butanone	**100/70 ***	70-130%	SR85C-SP05	UJ	m
		Acetone	**81/62**				
		Vinyl Acetate	**65/50**				
Nov 2005 160344	295093	Styrene	**19/76**	70-130%	SR85A-NV05	UJ	m
		Vinyl Acetate	**46/81**				
Dec 2005 162476	300619	Acetone	**58/65**	70-130%	85A-OC05	UJ	m
Jan 2006 166073	305061	Acetone	**66/72**	70-130%	85A-106	J/UJ	m

Data Package	QC Batch	Analyte	MS/MSD (%R)	Acceptance Limits (%)	Affected Samples	Qualification	Reason Code
July 2006 179450	327892	Acetone	**62/63**	70-130%	85G-JY06 85G-JY06DUP	UJ	m
Nov 2006 189077	343229	Styrene	**59/105**	70-130%	85A-NV06	UJ	m

* Although 2-Butanone recovery in the MSD performed on sample SR85C-SP05 (Sept 2005) rounds up to 70%, the results for this analyte in the environmental sample were qualified because the RPD of 35% indicated a high level of imprecision for this analyte in the MS and MSD.

Iodomethane recoveries in the MS and MSD performed on sample 85A-M05 (May 2005) were 146% and 147%, respectively. Although these recoveries exceed the laboratory control limits of 70-130%, the data were not qualified because the potential bias was high and iodomethane was not detected in any sample.

Recovery for 1,4-Dichlorobenzene in the MSD performed on sample 85A-AG05 (August 2005) was 141%. Although this recovery is greater than the laboratory upper control limit of 130%, the data were not qualified because the MS was in control at 115% and this analyte was not detected in the environmental sample.

1,4-Dichlorobenzene, iodomethane, trichlorofluoromethane and total xylene recoveries exceeded 130% in the MSD performed on sample SR85C-SP05. Data were not qualified because the MS recoveries were in control, the potential bias was high, and these analytes were not detected in the associated samples.

5.5 Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD)

The LCS/LCSD percent recoveries and RPD values were within the laboratory-specified control limits of 80-120% with the following exceptions.

Data Package	Batch	Analyte	LCS or LCSD Recovery (%)	Affected Samples	Qualification	Reason Code
Feb 2005 143430	264417	Bromoform	65.2	85A-F05 85ATB-F05 85B-F05 85BTB-F05 85C-F05 85CTB-F05 85D-F05	UJ	l
		Vinyl acetate	58.5			

		Dibromochloro-methane	74.2	85DTB-F05 85F-F05 85FTB-F05 85G-F05 85GTB-F05		
Mar 2005 143880	264417	Bromoform	65.2	85ATB-M05 85B-M05 85BTB-M05 85C-M05 85CTB-M05 85D-M05 85DTB-M05 85F-M05	UJ	l
		Vinyl acetate	58.5			
		Dibromochloro-methane	74.2			
Mar 2005 143880	264431	1,1,1,2-Tetrachloroethane	78.2	85A-M05 85G-M05 85FTB-M05 85GTB-M05	UJ	l
		Acetone	79.2			
		Bromoform	75.5			
		Carbon Tetrachloride	75.8			
		Dibromochloro-methane	77.0			
		Methyl Bromide	78.5			
		Methyl Chloride	72.2			
		Trichlorofluoro-methane	76.0			
		Vinyl Chloride	72.2			
Jan 2006 166073	305061	Acetone	75.0	85A-106 85ATB-106 85B-106 85BTB-106 85C-106 85CTB-106 85D-106 85DTB-106 85F-106	J/UJ	l

Data Package	Batch	Analyte	LCS Recovery (%)	Affected Samples	Qualification	Reason Code
June 2006 177607	325032	Carbon Disulfide	77.6	85A-JN06 85ATB-JN06 85B-JN06 85BTB-JN06 85C-JN06 85CTB-JN06 85D-JN06 85F-JN06 85FTB-JN06 85G-JN06	UJ	l
		Styrene	75.2			
Aug 2006 181673	331923	Acetone	75.2	85A-AG06 85ATB-AG06 85B-AG06 85C-AG06 85D-AG06 85E-AG06 85ETB-AG06 85F-AG06 85FTB-AG06	UJ	l

The LCS associated with samples 85B, 85C, 85D, 85F, 85ATB, 85BTB, 85CTB, and 85DTB collected on April 13, 2005 demonstrated high recovery for iodomethane (132.8 %). No results were qualified since the potential bias was high and this analyte was not detected in any sample.

The LCS associated with samples collected June 1, 2005 demonstrated high recovery for iodomethane (164%). No results were qualified since the potential bias was high and this analyte was not detected in any sample.

The LCS associated with samples collected July 20, 2006 demonstrated high recovery for 1,2,3-trichloropropane (125%). No results were qualified since the potential bias was high and this analyte was not detected in any sample.

5.6 Field Duplicate (FD)

The FD pairs for the 2005 monitoring rounds were: 85C-F05/85D-F05 (Feb 2005), 85C-M05/85D-M05 and 85A-M05/85B-M05 (Mar 2005), 85A-A05/85B-A05 (April 2005), 85A-M05/85B-M05 and 85C-M05/85D-M05 (May 2005), 85A-M05/85D-M05 (June 2005), 85A-JY05/85B-JY05 (July 2005), 85A-AG05/85B-AG05 (August 2005), 85G-SP05/85F-SP05 and 85C-SP05/85D-SP05 (September 2005), 85A-OC05/85B-OC05 and 85C-OC05/85D-OC05

(October 2005), 85A-NV05/85B-NV05 and 85C-NV05/85D-NV05 (November 2005), and 85A-OC05/85B-OC05, 85C-DC05/85D-DC05 and 85A-DC05/85B-DC05 (December 2005).

The FD pairs for the 2006 monitoring rounds were: 85A-106/85B-106 (January 2006), 85C-JN06/85D-JN06 and 85F-JN06/85G-JN06 (June 2006), 85F-JY06/85G-JY06 (July 2006), 85A-AG06/85D-AG06 and 85B-AG06/85F-AG06 (August 2006), 85A-SP06/85B-SP06 and 85C-SP06/85D-SP06 (September 2006), 85A-OC06/85B-OC06 and 85C-OC06/85D-OC06 (October 2006), 85A-NV06/85B-NV06 and 85C-NV06/85D-NV06 (November 2006), and 85A-DC06/85B-DC06 and 85C-DC06/85D-DC06 (December 2006).

No significant differences were noted for the field duplicate pairs. Data qualification was not considered necessary.

Table 1
2005 Sample Identification and Collection Dates

Sample ID	Date Sampled	Laboratory ID
Data Package 141460		
MW-3	1/20/05	2501200167
MW-3 TB	1/20/05	2501200169
Data Package 141654		
MW-4	1/24/05	2501250001
MW-4 TB-HOLD	1/24/05	2501250002
Data Package 143430		
85C-F05	2/22/05	2502230049
85CTB-F05	2/22/05	2502230050
85DTB-F05	2/22/05	2502230052
85A-F05	2/22/05	2502230053
85ATB-F05	2/22/05	2502230057
85B-F05	2/22/05	2502230058
85BTB-F05	2/22/05	2502230059
85G-F05	2/22/05	2502230060
85GTB-F05	2/22/05	2502230061
85F-F05	2/22/05	2502230062
85FTB-F05	2/22/05	2502230063
Data Package 143880		
85A-M05	3/02/05	2503020164
85ATB-M05	3/02/05	2503020174
85BTB-M05	3/02/05	2503020177
85C-M05	3/02/05	2503020178
85CTB-M05	3/02/05	2503020180
85DTB-M05	3/02/05	2503020182
85F-M05	3/02/05	2503020183
85FTB-M05	3/02/05	2503020184
85G-M05	3/02/05	2503020185
85GTB-M05	3/02/05	2503020186
Data Package 146240		
85A-A05	4/13/05	2504140002
85ATB-A05	4/13/05	2504140006
85BTB-A05	4/13/05	2504140008
85C-A05	4/13/05	2504140009
85CTB-A05	4/13/05	2504140010
85D-A05	4/13/05	2504140011
85DTB-A05	4/13/05	2504140012
85F-A05	4/13/05	2504140013
85FTB-A05	4/13/05	2504140014
85G-A05	4/13/05	2504140015
85GTB-A05	4/13/05	2504140016
Data Package 147542		
85A-M05	5/04/05	2505040016
85ATB-M05	5/04/05	2505040020
85BTB-M05	5/04/05	2505040022
85C-M05	5/04/05	2505040023
85CTB-M05	5/04/05	2505040024
85DTB-M05	5/04/05	2505040030
85F-M05	5/04/05	2505040032
85FTB-M05	5/04/05	2505040033
85G-M05	5/04/05	2505040034
85GTB-M05	5/04/05	2505040035
Data Package 149243		
85A-M05	6/01/05	2506010149
85ATB-M05	6/01/05	2506010163
85B-M05	6/01/05	2506010132
85BTB-M05	6/01/05	2506010146
85C-M05	6/01/05	2506010147
85CTB-M05	6/01/05	2506010148
85DTB-M05	6/01/05	2506010165
85F-M05	6/01/05	2506010166
85FTB-M05	6/01/05	2506010167
85G-M05	6/01/05	2506010169
85GTB-M05	6/01/05	2506010170

Sample ID	Date Sampled	Laboratory ID
Data Package 151373		
85A-JY05	7/06/05	2507060240
85ATB-JY05	7/06/05	2507060266
85BTB-JY05	7/06/05	2507060229
85C-JY05	7/06/05	2507060230
85CTB-JY05	7/06/05	2507060231
85D-JY05	7/06/05	2507060232
85DTB-JY05	7/06/05	2507060234
85F-JY05	7/06/05	2507060235
85FTB-JY05	7/06/05	2507060236
85G-JY05	7/06/05	2507060237
85GTB-JY05	7/06/05	2507060239
Data Package 154110		
85A-AG05	8/9/05	2508100083
85ATB-AG05	8/9/05	2508100086
85BTB-AG05	8/9/05	2508100074
85C-AG05	8/9/05	2508100075
85CTB-AG05	8/9/05	2508100076
85D-AG05	8/9/05	2508100077
85DTB-AG05	8/9/05	2508100078
85F-AG05	8/9/05	2508100079
85FTB-AG05	8/9/05	2508100080
85G-AG05	8/9/05	2508100081
85GTB-AG05	8/9/05	2508100082
Data Package 155993		
SR85A-SP05	9/07/05	2509080031
SR85ATB-SP05	9/07/05	2509080032
SR85B-SP05	9/07/05	2509080033
SR85BTB-SP05	9/07/05	2509080035
SR85C-SP05	9/07/05	2509080036
SR85CTB-SP05	9/07/05	2509080057
SR85DTB-SP05	9/07/05	2509080059
SR85FTB-SP05	9/07/05	2509080062
SR85G-SP05	9/07/05	2509080063
SR85GTB-SP05	9/07/05	2509080065
Data Package 157203		
SR85A-SP05	9/22/05	2509220201
SR85ATB-SP05	9/22/05	2509220202
SR85B-SP05	9/22/05	2509220203
SR85BTB-SP05	9/22/05	2509220204
SR85C-SP05	9/22/05	2509220205
SR85CTB-SP05	9/22/05	2509220206
SR85DTB-SP05	9/22/05	2509220208
SR85F-SP05	9/22/05	2509220209
SR85FTB-SP05	9/22/05	2509220210
SR85GTB-SP05	9/22/05	2509220212
Data Package 158609		
SR85A-OC05	10/10/05	2510110052
SR85ATB-OC05	10/10/05	2510110083
SR85C-OC05	10/10/05	2510110085
SR85CTB-OC05	10/10/05	2510110086
SR85F-OC05	10/10/05	2510110088
SR85G-OC05	10/10/05	2510110089
SR85GTB-OC05	10/10/05	2510110090
Data Package 160344		
85A-NV05	11/01/05	2511020060
85ATB-NV05	11/01/05	2511020065
85C-NV05	11/01/05	2511020067
85CTB-NV05	11/01/05	2511020068
85F-NV05	11/01/05	2511020070
85FTB-NV05	11/01/05	2511020071
85G-NV05	11/01/05	2511020072
Data Package 146240		
85A-OC05	12/01/05	2512010070
85ATB-OC05	12/01/05	2512010076
85C-OC05	12/01/05	2512010081
85CTB-OC05	12/01/05	2512010082
85D-OC05	12/01/05	2512010083

Sample ID	Date Sampled	Laboratory ID
85F-OC05	12/01/05	2512010084
85FTB-OC05	12/01/05	2512010105
85G-OC05	12/01/05	2512010111
85GTB-OC05	12/01/05	2512010112
Data Package 162476		
85A-DC05	12/20/05	2512200159
85C-DC05	12/20/05	2512200163
85F-DC05	12/20/05	2512200178
85G-DC05	12/20/05	2512200180
Field Duplicates		
85D-F05		
85B-M05	3/02/05	2503020175
85D-M05	3/02/05	2503020181
85B-A05	4/13/05	2504140007
85B-M05	5/04/05	2505040021
85D-M05	5/04/05	2505040026
85D-M05	6/01/05	2506010164
85B-JY05	7/06/05	2507060206
85B-AG05	8/9/05	2508100073
SR85D-SP05	9/07/05	2509080058
SR85F-SP05	9/07/05	2509080061
SR85D-SP05	9/22/05	2509220207
SR85G-SP05	9/22/05	2509220211
SR85B-OC05	10/10/05	2510110084
SR85D-OC05	10/10/05	2510110087
85B-NV05	11/01/05	2511020066
85D-NV05	11/01/05	2511020069
85B-OC05	12/01/05	2512010079
85D-DC05	12/20/05	2512200177
85B-DC05	12/20/05	2512200162

Table 2
2006 Sample Identification and Collection Dates

Sample ID	Date Sampled	Laboratory ID
Data Package 164756		
85ATB-106	1/05/06	2601050146
85C-106	1/05/06	2601050148
Data Package 166073		
85A-106	1/25/06	2601250089
85ATB-106	1/25/06	2601250100
85BTB-106	1/25/06	2601250104
85C-106	1/25/06	2601250105
85CTB-106	1/25/06	2601250106
85D-106	1/25/06	2601250107
85DTB-106	1/25/06	2601250108
85F-106	1/25/06	2601250110
Data Package 177607		
85A-JN06	6/28/06	2606280242
85ATB-JN06	6/28/06	2606280246
85B-JN06	6/28/06	2606280250
85BTB-JN06	6/28/06	2606280252
85C-JN06	6/28/06	2606280253
85CTB-JN06	6/28/06	2606280254
85F-JN06	6/28/06	2606280257
85FTB-JN06	6/28/06	2606280264
Data Package 179450		
85A-JY06	7/20/06	2607200340
85ATB-JY06	7/20/06	2607200348
85B-JY06	7/20/06	2607200354
85BTB-JY06	7/20/06	2607200355
85C-JY06	7/20/06	2607200358
85CTB-JY06	7/20/06	2607200360
85DTB-JY06	7/20/06	2607200363
85F-JY06	7/20/06	2607200365
85FTB-JY06	7/20/06	2607200366
85GTB-JY06	7/20/06	2607200380

Sample ID	Date Sampled	Laboratory ID
Data Package 181673		
85A-AG06	8/17/06	2608170437
85ATB-AG06	8/17/06	2608170443
85B-AG06	8/17/06	2608170445
85C-AG06	8/17/06	2608170447
85E-AG06	8/17/06	2608170450
85ETB-AG06	8/17/06	2608170465
85F-AG06	8/17/06	2608170466
85FTB-AG06	8/17/06	2608170467
Data Package 184700		
85A-SP06	9/21/06	2609210363
85C-SP06	9/21/06	2609210370
85DTB-SP06	9/21/06	2609210376
85E-SP06	9/21/06	2609210383
85ETB-SP06	9/21/06	2609210384
85F-SP06	9/21/06	2609210389
85FTB-SP06	9/21/06	2609210398
Data Package 186936		
85A-OC06	10/19/06	2610190265
85ATB-OC06	10/19/06	2610190302
85BTB-OC06	10/19/06	2610190309
85C-OC06	10/19/06	2610190307
85E-OC06	10/19/06	2610190312
85ETB-OC06	10/19/06	2610190313
85F-OC06	10/19/06	2610190314
85FTB-OC06	10/19/06	2610250221
Data Package 189077		
85A-NV06	11/16/06	2611170019
85ATB-NV06	11/16/06	2611170023
85BTB-NV06	11/16/06	2611170025
85C-NV06	11/16/06	2611170026
85CTB-NV06	11/16/06	2611170186

Sample ID	Date Sampled	Laboratory ID
85E-NV06	11/16/06	2611170030
85F-NV06	11/16/06	2611170031
Data Package 191701		
85A-DC06	12/21/06	2612210200
85ATB-DC06	12/21/06	2612210201
85C-DC06	12/21/06	2612210205
85E-DC06	12/21/06	2612210207
85ETB-DC06	12/21/06	2612210209
85F-DC06	12/21/06	2612210212
85FTB-DC06	12/21/06	2612210218
Field Duplicates		
85B-106	1/05/06	2601050147
85B-106	1/25/06	2601250102
85D-JN06	6/28/06	2606280255
85G-JN06	6/28/06	2606280266
85D-JY06	7/20/06	2607200362
85G-JY06	7/20/06	2607200367
85D-AG06	8/17/06	2608170448
85F-AG06	8/17/06	2608170466
85B-SP06	9/21/06	2609210367
85D-SP06	9/21/06	2609210374
85B-OC06	10/19/06	2610190305
85D-OC06	10/19/06	2610190310
85B-NV06	11/16/06	2611170024
85D-NV06	11/16/06	2611170027
85B-DC06	12/21/06	2612210204
85D-DC06	12/21/06	2612210206

APPENDIX A
DATA VALIDATION QUALIFIER DEFINITIONS AND INTERPRETATION KEY ASSIGNED BY URS' DATA REVIEW TEAM

DATA QUALIFIER DEFINITIONS

U The analyte was analyzed for, but was not detected above the reported sample quantitation limit.

J The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

N The analysis indicates the presence of an analyte for which there is presumptive evidence to make a "tentative identification."

NJ The analysis indicates the presence of an analyte that has been "tentatively identified" and the associated numerical value represents its approximate concentration.

UJ The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

R The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

REASON CODE DEFINITIONS

a Analytical sequence deficiency or omission.
b Gross compound breakdown (4,4'-DDT/Endrin).
c Calibration failure; poor or unstable response.
d Laboratory duplicate imprecision.
e Laboratory duplicate control sample imprecision.
f Field duplicate imprecision.
g Poor chromatography.
h Holding time violation.
i Internal standard failure.
j Poor mass spectrographic performance.
k Serial dilution imprecision.
l Laboratory control sample recovery failure.
m Matrix spike/matrix spike duplicate recovery failure.
n Interference check sample recovery failure.
o Calibration blank contamination (metals/inorganics only).
p Preparation blank contamination (metals/inorganics only).
q Quantitation outside of linear range.
r Linearity failure in initial calibration.
s Surrogate spike recovery failure (organics only).
t Instrument tuning failure.
u No confirmation column present (GC organics only).
w Retention time (RT) outside of RT window.
x Equipment blank contamination.
y Trip blank contamination.
z Method blank contamination.
Q Other