APPENDIX J
BACKGROUND CALCULATION

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BACKGROUND EVALUATION

1. INTRODUCTION

This background evaluation was performed to determine background concentrations for applicable analytes detected in surface and subsurface soil, surface water, sediment, and groundwater at the Westinghouse Electric Company Hematite Site (i.e., the Site). The evaluation was performed as a part of the remedial investigation (RI) that was conducted to determine the nature and extent of contamination in various environmental media present at the Site.

2. METHODOLOGY

The methodologies presented in EPA's *Guidance for Comparing Background and Chemical Concentrations in Soil for CERCLA Sites* (EPA 540-R-01-003; OSWER 9285.7-41, September 2002) and Navy's guidance document *Handbook for Statistical Analysis of Environmental Background Data* (NAVFAC 1999) were used during the determination of background concentrations. Other reference materials that were used during this evaluation are as follows:

- *Risk Assessment Guidance Document for Superfund*, Part A (EPA 1989)
- *Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities* (EPA 1992)
- *Guidance for Conducting Risk Assessments and Related Risk Activities for the DOE-ORO Environmental Management Program* (University of Tennessee, 1999).
- *Nondetects and Data Analysis - Statistics for Censored Environmental Data* (Helsel, R. Dennis 2005)

The following methodologies were implemented during the background evaluation:

- Collection of background samples for various environmental media
- Review of both site and background sampling results for all analytes
- Screening of analytes for various environmental media based on the Site sampling results
- Comparison of Site and background sampling results for each applicable analyte
- Determination of background concentrations for each applicable analyte in each environmental media.

Each of these steps is summarized in the following sections.

2.1 Collection of Background Samples for Various Environmental Media

This step of the background evaluation process involved identifying sampling locations that were appropriate for use as background. Sampling locations were selected to approximate the same basic characteristics as the Site sampling locations but in areas that could not have received releases from the site.

Surface soil samples from the Hematite Site and several off-site locations were collected and analyzed as part of the RI. Sampling and analysis methods for surface soil samples were described in Section 2 of the RI Report. Section 3.2.3 of the RI Report describes the soil types associated with the site (USDA 2003).

The soil survey for Jefferson County indicates that off-site soil samples collected from the location to the east of the site (south of the U.S. National Guard Armory – Fig. 2.7 in the RI Report) are from the Kaintuck soil series. These soils are well-drained, coarse loamy alluvium associated with flood plain deposits. The Kaintuck soil series is also present at the site along the Joachim Creek floodplain.

Off-site surface soil samples were also collected approximately 2.5 miles southwest of the Hematite Site adjacent to Highway P (Fig. 2.7 in the RI Report). Soils in this area belong to the Useful and Freeburg soil series. The Freeburg soil series is present at the site. Although the Useful soil series is not found within the site boundary, it is similar to the Freeburg silt loam and the Horsecreek silt loam, both of which are mapped on the Hematite site.

It is apparent that surface soil samples from both background locations are from a group of soil series also found on the Hematite Site or, in the case of the Useful soil series, are closely related to soils found on site. Therefore, analytical results for contaminants in background soils should provide a valid basis for comparison with similar data obtained from site soils.

In addition to the samples collected at off-site locations, candidates for inclusion in the background dataset also include site samples from areas believed to be non-impacted, and sampling locations with no detections of organics located outside the current boundaries of known contamination (e.g., for groundwater, wells outside the actual or suspected groundwater contaminant plume area). These "background locations" were selected based on the conceptual site model, knowledge of on-site and off-site potential contaminant sources, the nature and extent of known soil and groundwater contamination, and other factors relevant to an understanding of the Site.

2.1.1 Collection of Soil Samples

Background soil samples were collected from two areas near the Site to establish representative concentrations of naturally occurring constituents in soil. Fifteen background soil locations were sampled. Eight background soil sampling locations (BG-08 through BG-15) representative of the terrace strata were located along Highway P approximately 2.5 miles southwest of the Site. Seven background soil sampling locations (BG-01 through BG-07) representative of the alluvial strata were located at the U.S. National Guard Armory, located east and north of the Site near the junction of State Road P and State Road A.

The search for background areas focused on identification of a non-impacted area(s) that were appropriate for obtaining background samples to be used to estimate the background gamma count rates and soil concentrations for uranium, thorium, and other naturally occurring radionuclides potentially present at the Site. These locations are also assumed to be representative of background chemical contaminants of potential concern (CCOPC).

A total of thirty-two background soil samples were collected and analyzed. Fifteen of the background soil samples were grab samples collected from 0 to 0.5 feet below ground surface (bgs) and fifteen of the samples were composites collected from 1 to 4 feet bgs. Two duplicate samples were also collected. Consistent with sampling in impacted areas of the Site, the soil samples were scanned with GM and NaI detectors to provide background count rate information for detectors that were being used to scan potentially impacted samples collected during the RI.

2.1.2 Collection of Surface Water Samples

Background (upstream) surface water samples were collected at four locations during the implementation of the *Surface Water and Sediment Investigation* Task Specific Work Plan (TSWP). These background surface water sampling locations correspond to the Northeast Site Creek Tributary (US-01-SW), Lake Virginia Tributary (US-02-SW), Site Spring (US-03-SW), and Joachim Creek (US-05-SW). The Northeast Site Creek and the Lake Virginia tributary samples were collected north and west of State Route P. The Site Spring sample was collected at its discharge to the Site Pond. The Joachim Creek background sample was collected approximately 1/4-mile upstream from the Site. These locations are hydraulically upgradient of the Site.

The surface water samples were grab samples collected at mid-depth in moving water at the main flow line of the creek to represent the entire cross section of the applicable creek. The sampling crew selected the most appropriate sampling location near the planned location that exhibited the greatest degree of cross-sectional homogeneity. Since mixing is primarily attributed to turbulence and water velocity, the crew sampled immediately downstream of a mixing zone to ensure good vertical mixing, where applicable. The upstream surface water sample from the site pond was a grab sample of water entering Site Pond from Site Spring.

2.1.3 Collection of Sediment Samples

Background (upstream) sediment samples were collected from two locations during the Remedial Investigation field activities. These background sediment sampling locations correspond to the East Lake Tributary (US-04-SS) and Joachim Creek (US-05-SS), and are located hydraulically upgradient of the Hematite Site. The sampling crew collected the grab samples in depositional areas along the main flow line of the water body because contaminants tend to concentrate in the fine-grained sediments in depositional zones. However, an inadequate number of background sediment samples were available to perform a statistical evaluation. Hence, this evaluation did not utilize the background sediment sampling results during the determination of background values. The background concentrations determined for subsurface soil will be used as the background concentrations for sediment.

2.1.4 Collection of Groundwater Samples

Monitoring wells BR-12-JC and BR-12-RB were installed and sampled to provide groundwater samples representative of background conditions in the Jefferson City and Roubidoux formations, respectively. These wells were sampled during the site-wide groundwater monitoring event which was conducted from December 2004 to January 2005. However, given that only one sample was collected from each of these wells, this evaluation utilized all available site groundwater data to determine if other unimpacted wells could serve as background wells for the site. If sufficient data was available, the sampling results for those wells were then used to determine the background concentrations for each groundwater unit at the site.

2.2 Review of Site and Background Sampling Results

The sampling results for both site and background samples were reduced and evaluated prior to performing the statistical analysis. The data were evaluated following the general guidance provided in EPA's *Guidance for Data Quality Assessment* (EPA 2000) to ensure that they are of the right type and quality for use. Quality control samples were removed from each of the datasets. Only unfiltered groundwater results were used in the background calculations for groundwater.

2.3 Analyte Screening for Various Environmental Media

The sampling results that were collected as a part of the site investigation process were used to determine analytes requiring background values for each environmental medium. Under this step, the sampling results for each analyte were screened against appropriate screening criteria in the following media: surface soil (0-0.5 ft depth), subsurface soil (>0.5 ft depth), surface water, sediment, and the groundwater hydrostratigraphic units identified as the Overburden, Jefferson City Formation, and Roubidoux Formation. The analyte screenings were conducted in two steps: (1) a frequency of detection screen and (2) a weight-of-evidence screen.

2.3.1 Frequency of Detection Screen

The first screen, the frequency of detection screen, involved determining the frequency of detection for each analyte in samples from each media. Those analytes with a frequency of detection equal to or less than 5% for a particular media were not retained for further screening. Those analytes with a frequency of detection of more than 5% for a particular media were carried forward to the second screen.

2.3.2 Weight-of-Evidence Screen

The final screen to identify applicable analytes to be included in the evaluation, the weight-of-evidence screen, is intended to eliminate those analytes that clearly are not site related. The weight-of-evidence screen generally eliminates those chemicals that are essential nutrients (i.e., calcium, sodium, potassium, and magnesium) and may also eliminate chemicals that are infrequently detected if they are determined not to be site-related. Unless the presence of an infrequently detected chemical is expected based on historical site information, or is possible due to the existence of a "hot spot," those chemicals with a low frequency of detection in a particular media were eliminated from additional analyses. However, this evaluation only screened

contaminants that are essential nutrients. Any chemicals that passed both screens were carried forward for the background evaluation.

2.4 Comparison of Background and Site Sampling Results

Site and background sampling results for each media were compared to determine if background locations were not site-impacted and were appropriate for use as background locations. For this evaluation, probability plots (i.e., cumulative distribution curves) were used for comparing analyte concentrations in a particular media within the known impacted areas to concentrations in the background dataset. The probability plot provides a graph of concentration values versus their cumulative probabilities and is used for identifying and segregating different populations. If the probability plots supported the conclusion that the impacted and background dataset represent separate populations, the background locations were considered appropriate for use as background.

2.5 Statistical Determination of Background Values

There are a variety of statistical approaches that are applicable to calculating background criteria, depending on the number of samples available and the distribution type of the data. This evaluation uses an upper-end statistic, the 95% upper tolerance limit (95% UTL), to represent background. The 95% UTL represents a value that 95% of the population will fall below with 95% confidence. Use of the 95% UTL is a reasonable approach for this site because it includes at least 95% of the distribution of observations from the background dataset with a 95% confidence and so is sufficiently robust to account for variability that naturally exists within the population of background concentrations. The 95% UTL method is recommended in *Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities* (EPA 1992) and in other EPA guidance (EPA 1989). In addition, use of the 95% UTL for background screening is also consistent with EPA's *Guidance for Comparing Background and Chemical Concentrations in Soil for CERCLA Sites* (EPA 540-R-01-003; OSWERR 9285.7-41, September 2002).

The method used for determination of background values depends on sample size, the distribution type (i.e., parametric or nonparametric), and the detection frequency for each analyte. To ensure that the 95% UTL represents background conditions, there must be an adequate number of background samples. If there are insufficient detected sample results (i.e., <5 samples), the maximum detected value was used as the background concentration for that analyte.

Prior to the calculation of the background 95% UTL concentration, the data were reviewed through the use of graphical analysis methods such as boxplots to determine if there were outliers in the dataset. As a rule, results were not deleted as outliers unless there was a very compelling reason (i.e., suspected field or laboratory problems or it is an extreme outlier).

The process of calculating the 95% UTL concentration for each analyte began with the determination of the frequency of detection and the distribution type (parametric or nonparametric). A parametric UTL was calculated for those background sample sets that are normally or lognormally distributed. A nonparametric UTL was calculated when the distribution of the background sample set was unknown. A description of how the background criteria were calculated based on the frequency of detection and the sample distribution is presented below:

1) For non-radiological samples, non-detect sample results were substituted by half of the detection limit, and then, based on the distribution type, 95% UTLs were determined. For radiological sample results, non-detect sample results were used as reported.
2) When the background frequency of detection exceeded 50%, the 95% UTL concentration was determined based on the best-fit distribution for each analyte.
3) If the frequency of detection is < 50% there is little confidence that the background distribution can be adequately characterized using statistical methods. Under these conditions, the sample distribution type cannot be identified and the 95% UTL cannot be calculated, so the maximum detected concentration in the background dataset was used as the background criteria for that analyte.

The EPA software package ProUCL (Version 3.0) and *Minitab 13 for Windows*, a comprehensive statistical and graphical analysis software package created by Minitab, Inc. (Release 13.32, 2002), were used to test the hypothesis that the data are normally or lognormally distributed (based on the Shapiro Wilk test, histograms and boxplots of the data). If the best-fit distribution was determined to be normal or lognormal, then the background 95% UTL concentrations were calculated parametrically using Minitab. The parametric 95% UTL concentration was then compared to the maximum detected background concentration and the smaller of these two concentrations was used as the background criteria. The use of the lower of the two concentrations (95% UTL versus the maximum detected) is consistent with the method outlined in the *Guidance for Conducting Risk Assessments and Related Risk Activities for the DOE-ORO Environmental Management Program* (University of Tennessee, 1999).

If the results indicated that the best-fit distribution is neither normal nor lognormal at the 95% level of confidence, then the background 95% UTL concentrations were based on a nonparametric distribution. Note that for sample sizes ≤ 59, the nonparametric 95% UTL concentrations (and therefore the background criteria) are equal to the maximum detected concentrations.

3. RESULTS OF BACKGROUND EVALUATION

The background evaluation was performed for each applicable analyte present in surface and subsurface soil, surface water, groundwater, and sediment at the Site. The following sections of the report summarize the results of the evaluation for each selected analyte in each medium.

3.1 Identification of Applicable Analytes to be Included in the Background Evaluation

The sampling results for each analyte at the site were evaluated by two types of screening: (1) a frequency of detection screen and (2) a weight-of-evidence screen. Attachments A, B, C, and D of this report present the results of screening processes for surface soil, subsurface soil, surface water and groundwater, respectively. Due to the limited number of background sediment samples, this evaluation did not utilize the background sampling results for sediment during the determination of background values. The background concentrations determined for subsurface soil will be used as the background concentrations for sediment.

Table 1 summarizes the results of screening process. Note that the weight-of-evidence screen generally eliminated those chemicals that are essential nutrients (i.e., calcium, sodium,

potassium, and magnesium) and also eliminated chemicals that are infrequently detected if they were determined not to be site-related.

Table 1. Applicable Analytes in Various Media

Environmental Medium	Type of Analyte	Name of Applicable Analyte
Surface Soil	Radionuclides	Actinium-228, Bismuth-212, Bismuth-214, Cesium-137, Lead-212, Lead-214, Neptunium-237, Plutonium-238, Plutonium 239/240, Protactinium-234, Technetium-99, Thorium-228, Thorium-230, Thorium-232, Thorium-234, Uranium-234, Uranium-235, and Uranium-238
	Metals	Aluminum, Antimony, Arsenic, Barium, Beryllium, Cadmium, Chromium, Cobalt, Copper, Iron, Lead, Manganese, Mercury, Nickel, Selenium, Thallium, Vanadium, and Zinc
	VOCs	Perchloroethylene
	Pesticides PAHs PCBs	4,4'-DDT, Acenaphthene, Anthracene, Arochlor 1260, Benz[e]acephenanthrylene, Benzanthracene, Benzo[a]pyrene, Benzo[k]fluoranthene, Chrysene, Endosulfan II, Endrin, Indeno(1,2,3-cd)pyrene, PCB-1254, and Pyrene
	BNAs	Benzyl butyl phthalate, Bis(2-ethylhexyl)phthalate, Carbazole, Di-n-butyl phthalate, Di-n-octyl phthalate, Fluoranthene, Fluorene, Hexachlorobenzene, Isophorone, and Naphthalene
Subsurface Soil	Radionuclides	Actinium-228, Bismuth-214, Lead-212, Lead-214, Plutonium 239/240, Technetium-99, Thorium-228, Thorium-230, Thorium-232, Thorium-234, Uranium-234, Uranium-235, and Uranium-238.
	Metals	Aluminum, Antimony, Arsenic, Barium, Beryllium, Cadmium, Chromium, Cobalt, Copper, Iron, Lead, Manganese, Mercury, Nickel, Selenium, Silver, Vanadium, and Zinc
	VOCs	1,1-Dichloroethane, 2-Propanone, cis-1,2-Dichloroethene, Methylchloroform, Perchloroethylene, Trichloroethene, and Vinylidene chloride
	Pesticides	None
	PAHs	None
	PCBs	None
	BNAs	Bis(2-ethylhexyl)phthalate and Fluoranthene
Surface Water	Radionuclides	Uranium-234, Uranium-235, and Uranium-238.
	Metals	Aluminum, Arsenic, Barium, Chromium, Cobalt, Copper, Iron, Lead, Manganese, Nickel, Vanadium, and Zinc
	VOCs	cis-1,2-Dichloroethene, Perchloroethylene, and Trichloroethene
	Pesticides	None
	PAHs	None
	PCBs	None
	BNAs	Fluoranthene
Groundwater - Overburden	Radionuclides	Neptunium-237, Radium-226, Radium-228, Technetium-99, Thorium-228, Thorium-230, Thorium-232, Uranium-234, Uranium-235, and Uranium-238
	Metals	Aluminum, Arsenic, Barium, Chromium, Cobalt, Copper, Iron, Lead, Manganese, Nickel Selenium, Vanadium, and Zinc
	VOCs	1,1,2 – Trichloroethane, 1,1-Dichloroethane, Chloroethene, cis-1,2-Dichloroethene, Ethylene Dichloride, Methlchloroform, Methylene Chloride, Perchloroethylene, trans-1,2-Dichloroethene, Trichloroethene and Vinylidene Chloride
	BNAs	Bis(2-ethylhexyl)phthalate

Table 1. Applicable Analytes in Various Media (Cont'd)

Environmental Medium	Type of Analyte	Name of Applicable Analyte
Groundwater - Jefferson City	Radionuclides	Radium-226, Radium-228, Thorium-228, Thorium-230, Thorium-232, Uranium-234, Uranium-235, and Uranium-238
	Metals	Aluminum, Arsenic, Barium, Cobalt, Iron, Manganese, Nickel, and Zinc
	VOCs	1,1-Dichloroethane, 2-Propanone, Chloroethene, cis-1,2-Dichloroethene, Ethylene Dichloride, Methyl Ethyl Ketone, Methylchloroform, Perchloroethylene, Toluene, trans-1,2-Dichloroethene, Trichloroethene, and Vinylidene Chloride
	BNAs	None
Groundwater - Roubidoux	Radionuclides	Radium-226, Thorium-228, Thorium-232, Uranium-234, Uranium-235, and Uranium-238
	Metals	Aluminum, Arsenic, Barium, Iron, Manganese, and Zinc
	VOCs	Methylene Chloride and Trichloroethene
	BNAs	None

3.2 Results of Comparison Between Site and Background Sampling Information

Probability plots were developed for comparing concentrations of the applicable analytes in a particular media collected from the site to the concentrations in the background dataset. During this evaluation, probability plots were drawn for those analytes for which an adequate number (>5) of detected background samples were available. In addition, lognormal probability plots are included for those analytes that were determined to have a lognormal distribution. When site and background data represent the same population of data, the cumulative distribution for the combined data lie approximately along a straight line on the normal probability plot. When the plot indicates there are two line segments, this is interpreted as indicating there is a distinct difference in the two populations, i.e., background and site populations.

3.2.1 Surface Soil

A comparison of site and background surface soil data was conducted by plotting the cumulative distribution of the data for each radiological and metal analyte on normal probability paper. Each plot includes both the site and background data for a particular radiological or metal analyte based on the distribution of sampling results. However, no probability plot was drawn for analytes with a non-parametric distribution of sampling results. These probability plots are presented in Attachment E.

Based on this approach, the normal probability plots for the radiological analytes Bi-214, Pb-214, and U-234 show two distinct line segments, allowing the background and site data to be easily distinguished. The plots for the other radiological analytes indicate there is more overlap in the site and background datasets. For example, the majority of both the site and background data lie along one line segment for Ac-228, Th-228, Th-230, Th-232, and U-238 indicating that the range of concentrations of these analytes are very similar for the site and background locations. For all radiological analytes, there are significant similarities between the off-site background data set and a large percentage of surface soil results from site samples. As can be seen when reviewing the probability plots, in all cases, except for outliers that represent impacted samples, the bulk of site data is within the range of background plotted for off-site samples.

Differences in the site and background data can be identified on the probability plots for the metal analytes arsenic, barium, beryllium, chromium, copper, lead, manganese, nickel, and selenium. For aluminum, cobalt, iron, and vanadium, there is considerable overlap in the data. Based on the probability plots, the elevated concentrations of these remaining metals present in some site samples may not be site-related but instead may be characteristic of natural conditions.

3.2.2 Subsurface Soil

Attachment F provides a comparison of site and background subsurface soil data by showing the cumulative distribution of the data for radiological and metal analytes on normal probability paper. Based on the distribution of sampling results, probability plots were developed for the following radiological analytes in subsurface soil: Ac-228, Bi-214, Pb-212, Pb-214, Th-228, Th-230, Th-232, U-234, U-235, and U-238. Each plot includes both the site and background data for a particular radiological or metal analyte.

Based on these plots there is a clear difference in the distributions of the background and site data for Ac-228, Bi-214, Pb-212, and Pb-214, although no threshold could be identified. For these analytes, very few site locations fell outside the range of concentrations for the background data. Differences in the site and background datasets could also be identified on the plots for U-234, U-235, U-238, Th-228, Th-230, and Th-232, although to a lesser extent than the other analytes. For U-234, U-235, and U-238, a threshold concentration could be identified.

Probability plots were developed for the following metal analytes in subsurface soil: arsenic, barium, beryllium, copper, lead, manganese, nickel, and vanadium. Differences in the site and background datasets could be identified on the plots for arsenic, barium, copper, lead, manganese, and nickel, although for the most part the site data was within the range of the background concentrations. There was considerable overlap of background and site sampling results for beryllium and vanadium in subsurface soil.

3.2.3 Surface Water

Based on the distribution of sampling results, probability plots were developed for three radiological analytes in surface water: U-234, U-235, and U-238. Each plot includes both the site and background data for a particular radiological. Attachment G presented the probability plots for those three radionuclides.

Based on the normal probability plots for all three uranium analytes, results of only one site sample (SW-01-SW) fall outside the range of concentrations for the background data. Hence, to distinguish background from site data the plots were examined for an inflection point, or threshold, that could represent the upper limit of the background population. If an inflection point was present, it was interpreted to represent the upper limit of the background population. Those samples falling to the left of the inflection point on all plots were included during the determination of background concentrations. Based on the inflection point, six site-sampling results (including all site surface water sample results except for SW-01-SW) were included with the five background sampling results during the determination of background for surface water at the Site.

Probability plots were developed for the following metal analytes in surface water: aluminum, barium, and manganese. Like radiological analytes, results of only one site sample (SW-01-SW) fall outside the range of concentrations for the background data. Therefore, six site-sampling

results (including all site surface water sample results except for SW-01-SW) were included with the five background sampling results during the determination of background for surface water.

3.2.4 Groundwater

A comparison of site and background groundwater sampling results was performed for all three hydrostratigraphic units: the Overburden, Jefferson City Formation, and Roubidoux Formation. Results of the comparisons for each unit are summarized in the following sections.

3.2.4.1 Overburden

Probability plots were developed that included all available data for radionuclides in the Overburden. Eight plots were created, one for each of the following radionuclides: Np-237, Tc-99, Th-228, Th-230, Th-232, U-234, U-235, and U-238. (Insufficient data was available for the two remaining radionuclides, Ra-226 and Ra-228, to create meaningful probability plots.) In addition, probability plots were developed for the five metals (aluminum, barium, iron, manganese, and zinc) and three organic compounds (cis-1,2-DCE, perchloroethylene, and TCE) that passed the background screening and exceeded a detection frequency of 50% in the Overburden. Although background values are not developed for organic compounds, the VOC probability plots are used to assist in identifying the potential background wells. These probability plots are presented in Attachment H.

In order to determine which wells may be appropriate to use as background wells, all data (site and background) are plotted together rather than segregated as was done previously for the soil and surface water data. To distinguish background from site data, the plots were examined for an inflection point, or threshold, that could represent the upper limit of the background population. Only those wells falling to the left of the inflection point on the probability plots were identified as potential background wells for that analyte.

Based on an interpretation of the inflection point on each probability plot, this evaluation identified fourteen wells to be included in the background well dataset for the Overburden. The dataset includes three wells that are upgradient (northwest) of the site boundaries (GW-NB50, GW-NB57A, and GW-NB57B), three side-gradient wells (GW-NB46, GW-NB71, and GW-NB79) plus the following five onsite/downgradient wells: GW-NB63, GW-NB66, GW-NB67, GW-NB82, and GW-RR05. This list is limited to those wells that were below the threshold on all the probability plots and that also did not have VOC contamination above screening levels. One additional side-gradient well (GW-SW07) and two additional onsite/downgradient wells (GW-CB02 and GW-NB81) were also included in the background dataset. Each of these wells only exceeded the probability plot thresholds for one analyte (zinc in GW-SW07 and barium in GW-CB02 and GW-NB81) and the levels of zinc and barium in these wells were well below their MCLs.

3.2.4.2 Jefferson City Formation

Probability plots were developed for two of the radionuclides in the Jefferson City Formation that passed the frequency of detection screening: U-234and U-238. The remaining radionuclides were detected at frequencies below 50% or had fewer than 5 samples and so were not plotted. In addition, probability plots were developed for four metals that passed the frequency of detection

and weight-of-evidence screenings and that had detection frequencies exceeding 50%: barium, iron, manganese and zinc. Although background values are not developed for organic compounds, probability plots were developed for five VOCs (1,1-dichloroethane, cis-1,2-DCE, perchloroethylene, trichloroethene, and vinylidene chloride) to assist in identifying the potential background wells. The probability plots for the Jefferson City Formation are provided in Attachment I.

Those wells plotting to the left of the inflection point on each of the probability plots were identified as potential background wells for that analyte. The results were then compared in order to determine which wells would be most appropriate as background wells for all analytes. Based on the five VOC plots, concentrations for the following six wells plot to the left of the inflection points and do not exceed MCLs: BR1JC, BR2JC, BR3JC, BR5JC, BR11JC, and BR12JC. Of these wells, 4 plotted to the left of the inflection point on both the U-234 and U-238 probability plots: BR1JC, BR2JC, BR5JC, and BR11JC. Concentrations in BR12JC, the expected background well, plotted to the right of the inflection point on both the U-234 and U-238 plots. However, because radionuclides are not present at significant levels in the Jefferson City Formation, it was difficult to distinguish between the background and site populations using the probability plot method. The concentrations of U-234 and U-238 in BR12JC are very low and likely fall within the range of background. Table 2 provides a comparison of the Jefferson City Formation groundwater results with MCLs. Based on this comparison, although elevated concentrations of several VOCs are present in the Jefferson City Formation, radionuclides are not present at significant levels. Because BR12JC is located upgradient of the site and appears unimpacted by VOCs, metals, and radionuclides, it was retained as a potential background well.

Based on the probability plots for the metals, the concentrations detected in wells BR12JC, BR5JC, and BR11JC plot to the left of the inflection points on all plots. Therefore, these wells are retained as potential background wells for the Jefferson City Formation. Concentrations in the other two potential background wells, BR1JC and BR2JC, plot to the right of the inflection points on the probability plots for barium, iron, and zinc. However, because these analytes are naturally abundant and, in the case of barium and zinc, the concentrations are well below their MCLs, these two wells were also retained as potential background wells for the Jefferson City Formation.

Based on the above interpretation of probability plots, five wells were identified as appropriate to use as background wells for the Jefferson City Formation. The dataset includes one upgradient well (BR12JC), two side-gradient wells (BR1JC and BR5JC) and two downgradient wells (BR2JC and BR11JC). These wells are all screened within the same water-bearing formation and are either located upgradient of the site (BR12JC) or are in areas sufficiently distant from the Site to have not been impacted by site activities.

Table 2. Comparison of Jefferson City Sampling Results with MCLs

Analyte	Units	Number of Samples	Detection Frequency	Detected Concentrations		Drinking Water MCLs
				Minimum	Maximum	
1,1-Dichloroethane	ug/L	16	56%	3.4	350	-
2-Propanone	ug/L	16	6%	9.9	9.9	-
Chloroethene	ug/L	16	31%	1.9	180	2
cis-1,2-Dichloroethene	ug/L	16	56%	7.8	2400	70
Ethylene Dichloride	ug/L	16	6%	3.9	3.9	-
Methyl ethyl ketone	ug/L	16	6%	29	29	-
Methylchloroform	ug/L	16	13%	1.3	6.9	-
Perchloroethylene	ug/L	16	56%	6	2200	5
Toluene	ug/L	16	6%	3.7	3.7	1000
Trans-1,2-Dichloroethene	ug/L	16	19%	3.1	27	100
Trichloroethene	ug/L	16	56%	20	7700	5
Vinylidene chloride	ug/L	16	50%	9.1	240	7
Arsenic	ug/L	15	20%	14	23	10
Barium	ug/L	15	100%	57	540	2000
Iron	ug/L	15	80%	110	16000	300[a]
Manganese	ug/L	15	100%	3.6	1700	50[a]
Zinc	ug/L	15	73%	7.3	69	5000[a]
Radium 226	pCi/L	3	100%	1.38	1.62	5
Radium-228	pCi/L	3	67%	0.85	1.29	-
Thorium-228	pCi/L	15	13%	0.11	1.00	-
Thorium-230	pCi/L	15	7%	0.69	0.69	-
Thorium-232	pCi/L	15	13%	0.04	0.74	-
Uranium-234	pCi/L	15	100%	0.10	6.03	-
Uranium-235	pCi/L	15	47%	0.05	0.16	-
Uranium-238	pCi/L	15	93%	0.15	1.72	-

[a] Secondary MCL

3.2.4.3 Roubidoux Formation

Probability plots were developed for the Roubidoux Formation groundwater for the following radionuclides: U-234, U-235, and U-238. These plots are provided in Attachment J. The metals aluminum, arsenic, barium, iron, manganese, and zinc were retained through the frequency-of-detection screening for the Roubidoux Formation groundwater. Probability plots for barium, iron, manganese, and zinc are included in Attachment J. Probability plots for aluminum and arsenic were not developed because their detection frequencies were too low. Similarly, probability plots were not developed for the two VOCs passing the frequency-of-detection screen (methylene chloride and TCE) because their frequencies of detection were too low.

Due to the low concentrations of these analytes throughout the Roubidoux Formation, it was difficult to distinguish between the background and site populations using the probability plot method. No inflection points were observed on the plots for barium. Distinct inflection points could be discerned on the plots for manganese and iron. Although less distinct, inflection points could be observed on the probability plots for U-234, U-235 and U-238. The concentrations in three wells (BR03RB, BR04RB, and BR08RB) plotted to the left of the inflection points on all

probability plots. Based on their locations with respect to the Site, and the predominant groundwater flow direction, BR03RB (upgradient) is appropriate for use as background. BR08RB is a Jefferson City-Roubidoux contact zone well and so may not be appropriate for use as a Roubidoux background well. BR04RB is located directly downgradient of the site, within 1000 ft of the facility, but appears to be currently unimpacted. At this time there is insufficient data available from BR03RB and BR04RB to statistically develop background values for the Roubidoux Formation. Table 3 provides a comparison of the Roubidoux groundwater sampling results with the MCLs. Because it does not appear that significant levels of contamination exist in the Roubidoux Formation groundwater, background values may not be needed for the Roubidoux Formation.

Table 3. Comparison of Roubidoux Sampling Results with MCLs

Analyte	Units	Number of Samples	Detection Frequency	Detected Concentrations		Drinking Water MCLs
				Minimum	Maximum	
Trichloroethene	ug/L	10	20%	1.3	1.9	5
Arsenic	ug/L	10	10%	46	62	10
Barium	ug/L	10	100%	65	140	2000
Iron	ug/L	10	80%	110	750	300[a]
Manganese	ug/L	10	100%	3.7	19	50[a]
Zinc	ug/L	10	50%	6.7	150	5000[a]
Radium 226	pCi/L	3	67%	0.73	1.10	5
Thorium-228	pCi/L	10	10%	0.14	0.14	-
Thorium-232	pCi/L	10	20%	0.06	0.12	-
Uranium-234	pCi/L	10	100%	2.07	12.40	-
Uranium-235	pCi/L	10	70%	0.05	0.09	-
Uranium-238	pCi/L	10	100%	0.19	1.22	-

[a] Secondary MCL

3.3 Results of Background Concentrations

The results of the background analyte concentrations for various environmental media are presented in the following section.

3.3.1 Background Concentrations for Surface Soil

Table 4 presents the results of the background sample concentrations for each applicable analyte present in the surface soil.

Table 4. Results of Background Concentrations for Surface Soil

Applicable Analytes	Detect?	Number of Samples	Concentration		Distribution Flag[1]	UTL_{95}	Site-Specific Background[2]
			Maximum	Minimum			
Radionuclides (unit is pCi/g)							
Actinium-228	Detect	12	1.43	0.767	N	1.8	1.43
	ND	3	0.82	0.53			
Bismuth-212	Detect	1	2.05	2.05	O	2.05	2.05
	ND	14	2.04	-0.609			
Bismuth-214	Detect	14	1.1	0.528	L	1.35	1.1
	ND	1	0.472	0.472			
Cesium-137	Detect	3	0.161	0.0698	O	0.16	0.16
	ND	12	0.235	-0.0711			
Lead-212	Detect	15	1.44	0.576	N	1.84	1.44
Lead-214	Detect	15	1.13	0.581	N	1.26	1.13
Neptunium-237	Detect	1	0.0134	0.0134	O	0.0134	0.013
	ND	15	0.109	-0.00433			
Plutonium 238	ND	15	0.00462	-0.0035	--	NR	NR
Plutonium 239/240	Detect	2	0.0224	0.0181	O	0.02	0.02
	ND	13	0.00475	-0.00131			
Protactinium-234	ND	15	14.1	-14.2	--	NR	NR
Technetium-99	No background sample was collected for this analyte.						NC
Thorium-228	Detect	15	1.35	0.661	L	1.73	1.35
Thorium-230	Detect	15	1.39	0.708	L	1.71	1.39
Thorium-232	Detect	15	1.32	0.665	L	1.65	1.32
Thorium-234	Detect	1	2.2	2.2	O	2.2	2.2
	ND	14	2.6	-0.807			
Uranium-234	Detect	15	0.968	0.533	L	1.25	0.97
Uranium-235	Detect	12	0.0695	0.0168	X	0.07	0.07
	ND	3	0.406	-0.328			
Uranium-238	Detect	15	0.996	0.554	N	1.21	1.00
Metal (Unit is mg/kg)							
Aluminum	Detect	15	17000	4500	L	29551	17000
Antimony	ND	15	1.2	0.95	--	NR	NR
Arsenic	Detect	15	9.6	5.1	N	10.94	9.6
Barium	Detect	15	330	97	L	604	330
Beryllium	Detect	14	0.77	0.39	N	0.98	0.77
	ND	1	0.36	0.36			
Cadmium	Detect	7	0.6	0.28	O	0.6	0.6
	ND	8	0.52	0.24			
Chromium	Detect	15	17	8	N	20.22	17
Cobalt	Detect	15	17	4.8	N	17.10	17
Copper	Detect	15	13	7.6	L	14.4	13
Iron	Detect	15	26000	9700	L	38793	26000
Lead	Detect	15	81	12	L	115	81
Manganese	Detect	15	1100	240	N	1175	1100

Table 4. Results of Background Concentrations for Surface Soil (Cont'd)

Applicable Analytes	Detect?	Number of Samples	Concentration		Distribution Flag[1]	UTL_{95}	Site-Specific Background[2]
			Maximum	Minimum			
Mercury	Detect	8	0.042	0.029	X	0.04	0.04
	ND	7	0.03	0.024			
Nickel	Detect	15	14	7.4	N	16.92	14
Selenium	Detect	9	0.97	0.6	N	1.18	0.97
	ND	6	1.3	0.62			
Thallium	ND	15	2.1	0.95	--	NR	NR
Vanadium	Detect	15	39	16	L	58.50	39
Zinc	Detect	15	310	33	X	310	310
VOCs (Unit is ug/kg)							
Perchloroethylene	ND	15	7.4	6	-	NR	NR
PEST, PAHs, PCBs (Unit is ug/kg)							
4,4'-DDT	No background sampling was conducted for these analytes.						NC
Acenaphthene							
Anthracene							
Arochlor 1260							
Benz[e]acephenanthrylene							
Benzanthracene							
Benzo[a]pyrene							
Benzo[k]fluoranthene							
Chrysene							
Endosulfan II							
Endrin							
Indeno(1,2,3-cd)pyrene							
PCB-1254							
Pyrene							
BNAs (Unit is ug/kg)							
Benzyl butyl phthalate	No background sampling was conducted for these analytes.						NC
Bis(2-ethylhexyl)phthalate							
Carbazole							
Di-n-butyl phthalate							
Di-n-octyl phthalate							
Fluoranthene							
Fluorene							
Hexachlorobenzene							
Isophorone							
Naphthalene							

1 N = Normal; L = Lognormal; X = Nonparametric; O = Very few detected samples to determine distribution
2 Smaller of maximum detected concentration and UTL_{95}
ND = Non-Detect
NR = Not Reported. No detected results for that Analyte
NC= Not Calculated
-- Due to non-detect sampling results, no distribution flag was assigned.
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3.3.2 Background Concentrations for Subsurface Soil

Table 5 presents the results of the background concentrations for each applicable analyte present in the subsurface soil. As mentioned earlier, this evaluation did not attempt to determine the sediment background with only two sediment background sample results. The results for subsurface soil background criteria will be used as the background criteria for sediment.

Table 5. Results of Background Concentrations for Subsurface Soil/Sediment

Applicable Analytes	Detect?	Number of Samples	Concentration		Distribution Flag[1]	UTL_{95}	Site-Specific Background[2]
			Maximum	Minimum			
Radionuclides (unit is pCi/g)							
Actinium-228	Detect	10	1.83	0.68	N	1.99	1.83
	ND	5	0.98	0.77			
Bismuth-214	Detect	15	1.15	0.68	N	1.29	1.15
Lead-212	Detect	15	1.70	0.76	N	1.95	1.7
Lead-214	Detect	15	1.21	0.76	N	1.31	1.21
Plutonium 239/240	ND	15	0.01	0.00	--	NR	NR
Technetium-99	No background sample was collected for this analyte.						NC
Thorium-228	Detect	15	1.33	0.83	N	1.49	1.33
Thorium-230	Detect	15	1.30	0.82	N	1.47	1.30
Thorium-232	Detect	15	1.32	0.83	N	1.52	1.32
Thorium-234	Detect	2	4.03	3.35	O	4.03	4.03
	ND	13	1.91	-1.00			
Uranium-234	Detect	15	0.92	0.66	N	1.03	0.92
Uranium-235	Detect	15	0.08	0.03	N	0.1	0.08
Uranium-238	Detect	15	0.99	0.65	N	1.13	0.99
Metal (Unit is mg/kg)							
Aluminum	Detect	15	17000	5800	X	17000	17000
Arsenic	Detect	15	9.8	5.5	N	10.67	9.8
Barium	Detect	15	320	80	L	354.09	320
Beryllium	Detect	15	0.92	0.49	N	1.08	0.92
Cadmium	Detect	2	0.72	0.25	O	0.72	0.72
	ND	13	0.5	0.24			
Chromium	Detect	15	24	11	X	24	24
Cobalt	Detect	15	14	6.3	X	14	14
Copper	Detect	15	13	8.5	N	14.97	13
Iron	Detect	15	24000	12000	X	24000	24000
Lead	Detect	15	90	15	L	121	90
Manganese	Detect	15	960	320	N	1112.86	960
Mercury	Detect	8	0.053	0.027	X	0.053	0.053
	ND	7	0.026	0.023			
Nickel	Detect	15	17	11	N	18.10	17
Selenium	Detect	4	0.85	0.61	O	0.85	0.85
	ND	11	1.2	0.57			
Vanadium	Detect	15	40	19	L	55.20	40
Zinc	Detect	15	370	35	X	370	370

Table 5. Results of Background Concentrations for Subsurface Soil/Sediment (Cont'd)

Applicable Analytes	Detect?	Number of Samples	Concentration		Distribution Flag[1]	UTL_{95}	Site-Specific Background[2]
			Maximum	Minimum			
VOCs (Unit is ug/kg)							
1,1-Dichloroethane	ND	15	0%	6.6	5.7	NR	NR
2-Propanone	ND	15	0%	13	11	NR	NR
cis-1,2-Dichloroethene	ND	15	0%	6.6	5.7	NR	NR
Methylchloroform	ND	15	0%	6.6	5.7	NR	NR
Perchloroethylene	ND	15	0%	6.6	5.7	NR	NR
Trichloroethene	ND	15	0%	6.6	5.7	NR	NR
Vinylidene chloride	ND	15	0%	6.6	5.7	NR	NR
PEST, PAHs, PCBs (Unit is ug/kg)							
None							
BNAs (Unit is ug/kg)							
Bis(2-ethylhexyl)phthalate	No Background Sampling was conducted for these analytes.						NC
Fluoranthene							

1 N = Normal; L = Lognormal; X = Nonparametric; O = Very few detected samples to determine distribution
2 Smaller of maximum detected concentration and UTL_{95}
ND = Non-Detect
NR = Not Reported. No detected results for that Analyte
NC= Not Calculated
-- Due to non-detect sampling results, no distribution flag was assigned.

3.3.3 Background Concentrations for Surface Water

Based on the comparison between site and background surface water sampling results, all background samples (5) and six site sampling results were used during the determination of surface water background for the Site. Table 6 presents the results of the background concentrations for each applicable analyte present in the surface water.

Table 6. Results of Background Concentrations for Surface Water

Applicable Analytes	Detect?	Number of Samples	Concentration		Dist Flag[1]	UTL_{95}	Site-Specific Background[2]
			Maximum	Minimum			
Radionuclides (Unit is pCi/L)							
Uranium-234	Detect	11	0.76	0.44	N	2.03	0.76
Uranium-235	Detect	9	0.11	0.03	N	0.17	0.10
	ND	2	0.01	0.004			
Uranium-238	Detect	11	0.82	0.15	L	1.37	0.82
Metal (Unit is mg/L)							
Aluminum	Detect	8	0.98	0.1	N	1.02	0.98
	ND	3	0.1	0.1			
Arsenic	ND	5	0.01	0.01	--	NR	NR

Table 6. Results of Background Concentrations for Surface Water (Cont'd)

Applicable Analytes	Detect?	Number of Samples	Concentration		Dist Flag[1]	UTL_{95}	Site-Specific Background[2]
			Maximum	Minimum			
Barium	Detect	11	0.14	0.07	N	0.21	0.14
Chromium	ND	5	0.004	0.004	--	NR	NR
Cobalt	ND	5	0.002	0.002	--	NR	NR
Copper	ND	5	0.01	0.01	--	NR	NR
Iron	Detect	7	1	0.11	X	1	1
	ND	4	0.1	0.1			
Lead	ND	5	0.003	0.003	--	NR	NR
Manganese	Detect	11	0.38	0.015	L	0.77	0.38
Nickel	ND	5	0.005	0.005	--	NR	NR
Vanadium	ND	5	0.01	0.01	--	NR	NR
Zinc	ND	5	0.006	0.006	--	NR	NR
VOCs (Unit is ug/L)							
cis-1,2-Dichloroethene	ND	5	5	5	--	NR	NR
Perchloroethylene	ND	5	5	5	--	NR	NR
Trichloroethene	ND	5	5	5	--	NR	NR
PEST, PAHs, PCBs (Unit is ug/L)							
None							
BNAs (Unit is ug/L)							
Fluoranthene	ND	5	10	9.4	--	NR	NR

1 N = Normal; L = Lognormal; X = Nonparametric; O = Very few detected samples to determine distribution
2 Smaller of maximum detected concentration and UTL_{95}
ND = Non-Detect
NR = Not Reported. No detected results for that Analyte
NC= Not Calculated
-- Due to non-detect sampling results, no distribution flag was assigned.

3.3.4 Background Concentrations for Groundwater

This evaluation attempted to determine the background concentrations of applicable analytes in three hydrostratigraphic units (Overburden, Jefferson City Formation, and Roubidoux Formation). Table 7 presents the results of the background concentration evaluation for radionuclides and metals in Overburden groundwater. Tables 8 and 9 present the results of the background concentration evaluation for radionuclide and metal analytes in Jefferson City and Roubidoux Formation groundwater, respectively. Although background values were not developed for the Roubidoux, the range of concentrations observed in two potential background wells at the site are provided as a guide to the expected background conditions. Tables 7, 8 and 9 also list the MCLs and secondary MCLs for comparison to the background concentrations..

Table 7. Background Concentrations for Groundwater in Overburden

Applicable Analyte	Number of Samples	Frequency of Detection	Maximum Detected Concentration	Dist Flag[a]	UTL_{95}	Drinking Water MCLs	Site-Specific Background[1]
Radionuclides (unit is pCi/L)							
Neptunium-237	6	0%	---	---	---	---	NR
Radium 226	1	100%	0.26	O	---	5	0.26
Radium-228	1	0%	---	---	---	---	NR
Technetium-99	14	0%	---	---	---	---	NR
Thorium-228	14	0%	---	---	---	---	NR
Thorium-230	14	0%	---	---	---	---	NR
Thorium-232	14	14%	0.067	O	---	---	0.067
Uranium-234	14	71%	1.68	L	1.85	---	1.68
Uranium-235	14	36%	0.067	O	---	---	0.067
Uranium-238	14	71%	0.81	L	0.86	---	0.81
Metal (Unit is ug/L)							
Aluminum	14	27%	1100	O	---	50 to 200[b]	1100
Arsenic	14	0%	---	---	---	10	NR
Barium	14	100%	390	L	439	2000	390
Chromium	14	0%	---	---	---	100	NR
Cobalt	14	13%	2.4	O	---	---	2.4
Copper	14	7%	20	O	---	1000[b]	20
Iron	14	78%	34000	X	34000	300[b]	34000
Lead	14	21%	8.2	O	---	15[c]	8.2
Manganese	14	93%	3300	N	4141	50[c]	3300
Nickel	14	14%	31	O	---	---	31
Selenium	14	0%	---	---	---	50	NR
Vanadium	14	0%	---	---	---	---	NR
Zinc	14	50%	210	X	210	5000[b]	210

[a] Distribution Flag: N = Normal; L = Lognormal; X = Nonparametric;
O = Insufficient detected samples to determine distribution
1 Smaller of maximum detected concentration and UTL_{95}
[b] Secondary Drinking Water Standard
[c] Action Level (treatment)
NR = Not Reported. Analyte was not detected in background dataset.

Table 8. Background Concentrations for Groundwater in the Jefferson City Formation

Applicable Analyte	Number of Samples	Detection Frequency	Maximum Detected Concentration	Dist Flag[a]	UTL_{95}	Drinking Water MCLs	Site-Specific Background[1]
Radionuclide (unit is pCi/L)							
Radium 226	2	100%	1.4	---	---	5	1.4
Radium-228	2	50%	0.85	---	---	---	0.85
Thorium-228	5	40%	1.00	O	---	---	1.00
Thorium-230	5	20%	0.69	O	---	---	0.69
Thorium-232	5	40%	0.74	O	---	---	0.74
Uranium-234	5	100%	4.45	N	7.63	---	4.45
Uranium-235	5	40%	0.07	O	---	---	0.07
Uranium-238	5	100%	1.21	N	2.16	---	1.21
Metal (Unit is ug/L)							
Aluminum	5	60%	320	N	696	50 to 200[b]	320
Arsenic	5	0%	---	---	---	10	NR
Barium	5	100%	540	L	2107	2000	540
Cobalt	5	20%	2.2	O	---	---	2.2
Iron	5	100%	2100	N	3542	300[b]	2100
Manganese	5	100%	80	L	245	50[c]	80
Nickel	5	20%	5.1	O	---	---	5.1
Zinc	5	40%	69	O	---	5000[b]	69

[a] Distribution Flag: N = Normal; L = Lognormal; X=Nonparametric; O = Insufficient detected samples to determine distribution

1 Smaller of maximum detected concentration and UTL_{95}

[b] Secondary Drinking Water Standard; [c] Action Level (treatment)

NR = Not Reported. Analyte was not detected in background dataset.

Table 9. Concentrations Reported for Potential Background Wells in the Roubidoux Formation

Applicable Analyte	Drinking Water MCLs	Concentrations in Potential Background Wells[a]	
		Minimum	Maximum
Radionuclide (unit is pCi/L)			
Thorium-228		-0.001 U	0.03 U
Thorium-230	---	-0.04 U	0.02 U
Thorium-232	---	0.02 U	0.02 U
Uranium-234	---	2.07	3.28
Uranium-235	---	0.05	0.06 U
Uranium-238	---	0.19	0.24
Metal (Unit is ug/L)			
Aluminum	50 to 200[b]	100 U	100 U
Arsenic	10	10 U	10 U
Barium	2000	65	100
Iron	300[b]	100 U	100 U
Manganese	50[c]	2.4 U	3.7
Zinc	5000[b]	6 U	150

[a] Wells BR03RB and BR04RB

[b] Secondary Drinking Water Standard; [c] Action Level (treatment)

[d] No Radium-226 or Radium-228 analysis was conducted for BR03RB or BR04RB.

U= Nondetect

4. CONCLUSION

The background evaluation was performed to determine background concentrations for applicable analytes present in surface and subsurface soil, surface water, sediment, and groundwater at the Site. As a part of this evaluation, background locations were identified and media-specific sampling activities were conducted. Secondly, the evaluation performed two data screens (frequency of detection screen and weight-of-evidence screen) to identify media-specific analytes that were applicable for use in the background evaluation. A probability plot graphical method was then used to differentiate site versus background sampling results for different analytes in various environmental media, and to determine an appropriate background dataset. The background datasets for surface water and groundwater include fewer detected samples. As a result, the sampling results that were not impacted by the site contamination were identified, and were included with the background dataset to determine the background concentrations for applicable analytes present in surface water and groundwater. Based on the distribution of the background dataset, 95% UTLs were determined for each applicable analyte in a particular medium. The smaller value of 95% UTL and the maximum detected concentration was considered to be the background concentration for that analyte in that medium. The background concentration was not determined for those analytes that were not detected in the background samples. Table 10 presents the results of background concentrations for each applicable analyte present at various environmental media at the Site.

Table 10: Background Concentrations for Applicable Analytes

Types of Analyte	Applicable Analyte	Background Concentrations				
		Surface Soil	Subsurface Soil	Surface Water	Overburden Groundwater	Jeff erson City Formation Groundwater
Units		pCi/g		pCi/L		
Radionuclides	Actinium-228	1.8	1.83	-	-	-
	Bismuth-212	2.05	2.62	-	-	-
	Bismuth-214	1.1	1.15	-	-	-
	Cesium-137	0.16	-	-	-	-
	Lead-212	1.44	1.7	-	-	-
	Lead-214	1.13	1.21	-	-	-
	Neptunium-237	0.01	0.01	-	-	-
	Plutonium-239/240	0.02	-	-	-	-
	Radium-226				0.26	1.4
	Radium-228				-	0.85
	Thorium-228	1.35	1.33	-	-	1.00
	Thorium-230	1.39	1.30	-	-	0.69
	Thorium-232	1.32	1.32	-	0.067	0.74
	Thorium-234	2.2	4.03	-	-	-
	Uranium-234	0.97	0.92	0.76	1.68	4.45
	Uranium-235	0.07	0.08	0.10	0.067	0.07
	Uranium-238	1	0.99	0.82	0.81	1.21
Units		mg/kg		mg/L	ug/L	
Metals	Aluminum	17000	17000	0.98	1100	320
	Arsenic	9.6	9.8	-	-	-
	Barium	330	320	0.14	390	540
	Beryllium	0.77	0.92	-	-	-
	Chromium	17	24	-	-	-
	Cadmium	0.6	0.72	-		
	Cobalt	17	14		2.4	2.2
	Copper	13	13	-	20	-
	Iron	26000	24000	1	34000	2100
	Lead	81	90	-	8.2	-
	Manganese	1100	960	0.38	3300	80
	Mercury	0.04	0.05	-	-	-
	Nickel	14	17	-	31	5.1
	Selenium	0.97	0.85	-	-	-
	Vanadium	39	40	-	-	-
	Zinc	310	370	-	210	69

ATTACHMENT A
RESULTS OF SCREENING FOR SURFACE SOIL

Attachment A

Table A-1. Results of Screening for Surface Soil - Radionuclides

Radionuclides	Detect?	Number of Samples	Frequency of Detection	Concentration (pCi/g)		Retained for Background Evaluation
				Maximum	Minimum	
Actinium-228	Detect	78	68%	36.4	0.587	**Yes**
	ND	37		1.62	-0.0535	
Americium-241	Detect	4	3%	3.12	1.04	No
	ND	111		3.8	-1.77	
Beryllium-7	ND	115	0%	1.6	-2.32	No
Bismuth-212	Detect	15	13%	41.6	0.182	**Yes**
	ND	100		3.39	-1.16	
Bismuth-214	Detect	101	88%	1.71	0.372	**Yes**
	ND	14		1.12	0.166	
Cesium-137	Detect	50	43%	1.79	0.122	**Yes**
	ND	65		0.309	-0.298	
Cobalt-60	ND	115	0%	0.13	-0.177	No
Lead-212	Detect	102	89%	41.2	0.18	**Yes**
	ND	13		2.14	0.0592	
Lead-214	Detect	108	94%	1.97	0.438	**Yes**
	ND	7		0.924	0.117	
Neptunium-237	Detect	10	8%	0.584	0.0184	**Yes**
	ND	113		0.215	-39.6	
Plutonium 238	Detect	2	7%	0.0222	0.00019	**Yes**
	ND	28		0.00714	-0.00394	
Plutonium 239/240	Detect	8	27%	0.0334	0.00706	**Yes**
	ND	22		0.012	-0.00173	
Potassium-40	Detect	105	91%	23.7	3.45	**Yes**
	ND	10		17.7	0.418	
Protactinium-234	Detect	18	16%	2200	30.5	**Yes**
	ND	97		83.1	-11	
Technetium-99	Detect	62	54%	17100	0.902	**Yes**
	ND	53		22.3	-0.293	
Thorium-228	Detect	5	100%	1.21	0.316	**Yes**
Thorium-230	Detect	5	100%	1.21	0.415	**Yes**
Thorium-232	Detect	5	100%	1.1	0.281	**Yes**
Thorium-234	Detect	55	48%	705	1.91	**Yes**
	ND	60		9.81	-0.484	
Uranium-234	Detect	10	100%	472	0.759	**Yes**
Uranium-235	Detect	47	38%	308	0.026	**Yes**
	ND	77		11.8	-0.285	
Uranium-238	Detect	10	100%	74.3	0.373	**Yes**

ND = Non Detect

Table A-2. Results of Screening for Surface Soil - Metals

Metal	Detect?	Number of Samples	Frequency of Detection	Concentration (mg/kg)		Retained for Background Evaluation
				Maximum	Minimum	
Aluminum	Detect	115	100%	24000	2000	**Yes**
Antimony	Detect	20	17%	21	0.94	**Yes**
	ND	95		8.4	0.87	
Arsenic	Detect	115	100%	160	1.1	**Yes**
Barium	Detect	115	100%	1500	24	**Yes**
Beryllium	Detect	107	93%	5.8	0.35	**Yes**
	ND	8		0.38	0.33	
Cadmium	Detect	70	61%	11	0.23	**Yes**
	ND	45		3.3	0.22	
Calcium	Detect	115	100%	250000	860	No
Chromium	Detect	115	100%	280	4.9	**Yes**
Cobalt	Detect	115	100%	300	0.86	**Yes**
Copper	Detect	115	100%	1800	5.6	**Yes**
Iron	Detect	115	100%	61000	1600	**Yes**
Lead	Detect	115	100%	1400	3.7	**Yes**
Magnesium	Detect	115	100%	53000	790	No
Manganese	Detect	115	100%	4400	41	**Yes**
Mercury	Detect	89	77%	3.4	0.024	**Yes**
	ND	26		2.8	0.022	
Nickel	Detect	115	100%	300	5.3	**Yes**
Potassium	Detect	115	100%	8000	380	No
Selenium	Detect	82	71%	4.1	0.58	**Yes**
	ND	33		2.9	0.54	
Silver	Detect	5	4%	1.1	0.57	No
	ND	110		2	0.54	
Sodium	Detect	35	30%	3300	120	No
	ND	80		2200	120	
Thallium	Detect	9	8%	2.2	0.97	**Yes**
	ND	106		5.4	0.87	
Vanadium	Detect	115	100%	45	5.4	**Yes**
Zinc	Detect	115	100%	1300	19	**Yes**

ND = Non Detect

Attachment A

Table A-3. Results of Screening for Surface Soil - VOCs

VOCs	Detect?	Number of Samples	Frequency of Detection	Concentration (ug/kg)		Retained for Background Evaluation
				Maximum	Minimum	
1,1,2,2-Tetrachloroethane	ND	115	0%	8.2	5.4	No
1,1,2-Trichloroethane	ND	115	0%	8.2	5.4	No
1,1-Dichloroethane	ND	115	0%	8.2	5.4	No
1,2,4-Trichlorobenzene	ND	115	0%	8.2	5.4	No
1,2-Dibromo-3-chloropropane	ND	115	0%	8.2	5.4	No
1,2-Dichloropropane	ND	115	0%	8.2	5.4	No
2-Hexanone	ND	115	0%	16	11	No
2-Propanone	Detect	3	3%	8.5	7	No
	ND	112		16	11	
4-Methyl-2-pentanone	ND	115	0%	16	11	No
Benzene	ND	115	0%	8.2	5.4	No
Bromodichloromethane	ND	115	0%	8.2	5.4	No
Carbon disulfide	ND	115	0%	8.2	5.4	No
Chlorobenzene	ND	115	0%	8.2	5.4	No
Chlorodibromomethane	ND	115	0%	8.2	5.4	No
Chloroethene	ND	115	0%	16	11	No
cis-1,2-Dichloroethene	ND	115	0%	8.2	5.4	No
cis-1,3-Dichloropropene	ND	115	0%	8.2	5.4	No
Ethenyl ester acetic acid	ND	115	0%	16	11	No
Ethyl chloride	ND	115	0%	16	11	No
Ethylbenzene	ND	115	0%	8.2	5.4	No
Ethylene dibromide	ND	115	0%	8.2	5.4	No
Ethylene dichloride	ND	115	0%	8.2	5.4	No
Methyl bromide	ND	115	0%	16	11	No
Methyl chloride	ND	115	0%	16	11	No
Methyl ethyl ketone	ND	115	0%	16	11	No
Methylchloroform	ND	115	0%	8.2	5.4	No
Methylene chloride[1]	Detect	92	80%	8.1	1.1	No
	ND	23		6.5	1.2	
m-Xylene & p-Xylene	ND	115	0%	8.2	5.4	No
O-Xylene	ND	115	0%	8.2	5.4	No
Perchloroethylene	Detect	9	8%	34	1.6	**Yes**
	ND	106		8.2	5.4	
Styrene	ND	115	0%	8.2	5.4	No
Tetrachloromethane	ND	115	0%	8.2	5.4	No
Toluene	Detect	2	2%	2.1	1.6	No
	ND	113		8.2	5.4	
trans-1,2-Dichloroethene	ND	115	0%	8.2	5.4	No
trans-1,3-Dichloropropene	ND	115	0%	8.2	5.4	No
Tribromomethane	ND	115	0%	8.2	5.4	No
Trichloroethene	Detect	1	1%	1.3	1.3	No
	ND	114		8.2	5.4	No
Trichloromethane	ND	115	0%	8.2	5.4	No
Vinylidene chloride	ND	115	0%	8.2	5.4	No

ND = Non Detect

1 Very common laboratory analyte, hence not retained for background evaluation.

Table A-4. Results of Screening for Surface Soil - PAHs, PESTs, and PCBs

PAHs, PESTs, and PCBs	Detect?	Number of Samples	Frequency of Detection	Concentration (ug/kg)		Retained for Background Evaluation
				Maximum	Minimum	
4,4'-DDD	Detect	2	2%	2.2	0.46	No
	ND	113		2.7	1.8	
4,4'-DDE	Detect	4	3%	4.7	0.32	No
	ND	111		2.7	1.8	
4,4'-DDT	Detect	10	9%	25	1.4	**Yes**
	ND	105		2.7	1.8	
Acenaphthene	Detect	18	16%	410	12	**Yes**
	ND	98		1600	360	
Aldrin	ND	115	0%	2.7	1.8	No
alpha-BHC	Detect	1	1%	31	31	No
	ND	114		2.7	1.8	
Anthracene	Detect	19	17%	1100	29	**Yes**
	ND	96		780	360	
Arochlor 1242	ND	115	0%	200	36	No
Arochlor 1248	ND	115	0%	200	36	No
Arochlor 1260	Detect	25	22%	560	3.6	**Yes**
	ND	90		55	36	
Arochlor-1016	ND	115	0%	200	36	No
Arochlor-1221	ND	115	0%	400	72	No
Arochlor-1232	ND	115	0%	200	36	No
Benz[e]acephenanthrylene	Detect	85	74%	12000	20	**Yes**
	ND	30		460	390	
Benzanthracene	Detect	80	70%	6400	18	**Yes**
	ND	35		460	390	
Benzo[a]pyrene	Detect	79	69%	7000	16	**Yes**
	ND	36		460	390	
Benzo[k]fluoranthene	Detect	51	44%	3800	25	**Yes**
	ND	64		780	380	
Chlorodane	ND	115	0%	27	18	No
Chrysene	Detect	79	69%	8200	18	**Yes**
	ND	36		460	390	
Dibenz[a,h]anthracene	Detect	4	3%	440	35	No
	ND	113		4200	200	
Dieldrin	Detect	3	3%	7	1.4	No
	ND	112		2.7	1.8	
Endosulfan I	Detect	1	1%	0.79	0.79	No
	ND	114		2.7	1.8	
Endosulfan II	Detect	7	6%	4.2	0.16	**Yes**
	ND	108		2.7	1.8	
Endrin	Detect	10	9%	21	0.3	**Yes**
	ND	105		2.7	1.8	
Heptachlor	Detect	1	1%	11	11	No
	ND	114		2.7	1.8	
Heptachlor epoxide	ND	115	0%	2.7	1.8	No
Indeno(1,2,3-cd)pyrene	Detect	46	40%	5800	29	**Yes**
	ND	69		780	360	

Table A-4. Results of Screening for Surface Soil - PAHs, PESTs, and PCBs

PAHs, PESTs, and PCBs	Detect?	Number of Samples	Frequency of Detection	Concentration (ug/kg)		Retained for Background Evaluation
				Maximum	Minimum	
Lindane	ND	115	0%	2.7	1.8	No
Methoxychlor	ND	115	0%	14	9	No
PCB-1254	Detect	14	12%	540	21	**Yes**
	ND	101		200	36	
Pyrene	Detect	68	59%	38000	39	**Yes**
	ND	47		460	380	
Toxaphene	ND	115	0%	140	90	No

ND = Non Detect

Table A-5. Results of Screening for Surface Soil - BNAs

BNAs	Detect?	Number of Samples	Frequency of Detection	Concentration (ug/kg)		Retained for Background Evaluation
				Maximum	Minimum	
1,1'-Oxybis[2-ethane]	ND	345	0%	4200	360	No
1,2-Dichlorobenzene	ND	345	0%	4200	360	No
2,4,5-Trichlorophenol	ND	345	0%	21000	1800	No
2,4,6-Trichlorophenol	ND	345	0%	4200	360	No
2,4-Dichlorophenol	ND	345	0%	4200	360	No
2,4-Dimethylphenol	ND	345	0%	4200	360	No
2,4-Dinitrophenol	ND	345	0%	21000	1800	No
2,4-Dinitrotoluene	ND	345	0%	4200	360	No
2-Chlorophenol	ND	345	0%	4200	360	No
2-Methyl-1,3-dinitrobenzene	ND	345	0%	4200	360	No
2-Methylphenol	ND	345	0%	4200	360	No
3,3'-Dichlorobenzidine	ND	345	0%	21000	1800	No
4-Chlorobenzenamine	ND	239	0%	4200	360	No
Benzoic Acid	ND	232	0%	21000	1800	No
Benzyl butyl phthalate	Detect	139	38%	220	29	**Yes**
	ND	226		4200	360	
Bis(2-ethylhexyl)phthalate	Detect	138	39%	4700	79	**Yes**
	ND	212		4200	360	
Carbazole	Detect	231	50%	1000	22	**Yes**
	ND	230		1600	360	
Diethyl phthalate	ND	230	0%	4200	360	No
Di-n-butyl phthalate	Detect	117	36%	3900	26	**Yes**
	ND	211		4200	370	
Di-n-octyl phthalate	Detect	207	48%	350	84	**Yes**
	ND	228		4200	360	
Fluoranthene	Detect	131	49%	14000	16	**Yes**
	ND	139		440	390	
Fluorene	Detect	117	35%	530	19	**Yes**
	ND	215		1600	360	
Hexachlorobenzene	Detect	230	40%	40	40	**Yes**
	ND	344		4200	360	
Hexachlorocyclopentadiene	ND	231	0%	4200	360	No
Hexachloroethane	ND	230	0%	4200	360	No
Isophorone	Detect	126	35%	200	200	**Yes**
	ND	232		4200	360	
Naphthalene	Detect	233	41%	100	25	**Yes**
	ND	337		4200	360	
Nitrobenzene	ND	345	0%	4200	360	No
N-Nitrosodiphenylamine	ND	345	0%	4200	360	No
n-Nitrosodipropylamine	ND	345	0%	4200	360	No
p-Dichlorobenzene	ND	345	0%	4200	360	No
Pentachlorophenol	ND	230	0%	21000	1800	No
Phenol	ND	115	0%	4200	360	No

ND = Non Detect

ATTACHMENT B
RESULTS OF SCREENING FOR SUBSURFACE SOIL

Table B-1. Results of Screening for Subsurface Soil - Radionuclides

Radionuclides	Detect?	Number of Samples	Frequency of Detection	Concentration (pCi/g)		Retained for Background Evaluation
				Maximum	Minimum	
Actinium-228	Detect	192	50%	2.38	0.562	**Yes**
	ND	190		1.4	-0.157	
Americium-241	Detect	10	3%	0.265	0.00282	No
	ND	386		0.747	-0.716	
Beryllium-7	Detect	1	0%	1.24	1.24	No
	ND	381		1.45	-2.14	
Bismuth-212	Detect	15	4%	4.4	1.81	No
	ND	367		3.3	-1.7	
Bismuth-214	Detect	294	77%	1.53	0.264	**Yes**
	ND	88		0.637	-0.223	
Cesium-137	Detect	1	0%	0.171	0.171	No
	ND	381		0.256	-0.241	
Cobalt-60	Detect	4	1%	0.19	0.12	No
	ND	378		0.189	-0.205	
Lead-212	Detect	327	86%	2.33	0.186	**Yes**
	ND	55		0.291	-0.0416	
Lead-214	Detect	342	90%	1.36	0.268	**Yes**
	ND	40		0.528	-0.0522	
Neptunium-237	Detect	7	2%	0.353	0.00507	No
	ND	382		13.4	-26.3	
Plutonium 238	Detect	1	4%	0.00445	0.00445	No
	ND	25		0.00856	-0.00328	
Plutonium 239/240	Detect	8	31%	0.00783	0.00266	**Yes**
	ND	18		0.00753	-0.00226	
Potassium-40	Detect	345	90%	22.8	2.2	**Yes**
	ND	37		3	0.136	
Protactinium-234	Detect	4	1%	80	45	No
	ND	378		31.2	-25.7	
Technetium-99	Detect	51	14%	131	0.785	**Yes**
	ND	301		1.45	-0.828	
Thorium-228	Detect	32	100%	2.39	0.542	**Yes**
Thorium-230	Detect	32	100%	1.74	0.675	**Yes**
Thorium-232	Detect	32	100%	2.5	0.418	**Yes**
Thorium-234	Detect	25	7%	71	2.34	**Yes**
	ND	357		2.74	-1.9	
Uranium-234	Detect	31	100%	604	0.494	**Yes**
Uranium-235	Detect	44	11%	23.1	0.0228	**Yes**
	ND	339		1.2	-0.539	
Uranium-238	Detect	31	100%	27.2	0.474	**Yes**

ND = Non Detect

Table B-2. Results of Screening for Subsurface Soil - Metals

VOCs	Detect?	Number of Samples	Freq of Detection	Concentration (mg/kg)		Retained for Background Evaluation
				Maximum	Minimum	
Aluminum	Detect	376	100%	27000	680	**Yes**
Antimony	Detect	13	3%	1.8	1	No
	ND	363		1.2	0.85	
Arsenic	Detect	376	100%	24	1.1	**Yes**
Barium	Detect	376	100%	790	9.6	**Yes**
Beryllium	Detect	327	87%	2.8	0.35	**Yes**
	ND	49		0.38	0.32	
Cadmium	Detect	57	15%	4.7	0.22	**Yes**
	ND	319		0.59	0.21	
Calcium	Detect	376	100%	190000	300	No
Chromium	Detect	376	100%	49	5.8	**Yes**
Cobalt	Detect	376	100%	54	1.7	**Yes**
Copper	Detect	376	100%	38	1.5	**Yes**
Iron	Detect	376	100%	35000	2100	**Yes**
Lead	Detect	376	100%	680	3.8	**Yes**
Magnesium	Detect	376	100%	77000	160	No
Manganese	Detect	376	100%	5700	20	**Yes**
Mercury	Detect	95	25%	0.54	0.02	**Yes**
	ND	281		0.029	0.013	
Nickel	Detect	376	100%	97	2.7	**Yes**
Potassium	Detect	373	99%	4400	120	No
	ND	3		120	110	
Selenium	Detect	217	58%	2.9	0.55	**Yes**
	ND	159		1.5	0.53	
Silver	Detect	1	0%	0.85	0.85	No
	ND	375		0.74	0.53	
Sodium	Detect	47	13%	1600	130	No
	ND	329		150	110	
Thallium	Detect	78	21%	2.6	0.99	**Yes**
	ND	298		5.4	0.85	
Vanadium	Detect	376	100%	56	8	**Yes**
Zinc	Detect	376	100%	850	18	**Yes**

ND = Non Detect

Table B-3. Results of Screening for Subsurface Soil - VOCs

VOCs	Detect?	Number of Samples	Frequency of Detection	Concentration (ug/kg)		Retained for Background Evaluation?
				Maximum	Minimum	
1,1,2,2-Tetrachloroethane	ND	376	0%	810000	5.3	No
1,1,2-Trichloroethane	ND	376	0%	810000	5.3	No
1,1-Dichloroethane	Detect	45	12%	310	1.6	**Yes**
	ND	344		810000	5.3	
1,2,4-Trichlorobenzene	Detect	1	0%	2.5	2.5	No
	ND	376		810000	5.3	
1,2-Dibromo-3-chloropropane	ND	376	0%	810000	5.3	No
1,2-Dichloropropane	ND	376	0%	810000	5.3	No
2-Hexanone	ND	376	0%	1600000	11	No
2-Propanone	Detect	103	27%	1300	7.5	**Yes**
	ND	284		1600000	11	
4-Methyl-2-pentanone	ND	376	0%	1600000	11	No
Benzene	ND	376	0%	810000	5.3	No
Bromodichloromethane	ND	376	0%	810000	5.3	No
Carbon disulfide	Detect	7	2%	290	1.5	No
	ND	370		810000	5.3	
Chlorobenzene	ND	376	0%	810000	5.3	No
Chlorodibromomethane	ND	376	0%	810000	5.3	No
Chloroethene	Detect	12	3%	15	1.6	No
	ND	371		1600000	11	
cis-1,2-Dichloroethene	Detect	69	18%	430	1.5	**Yes**
	ND	316		810000	5.3	
cis-1,3-Dichloropropene	ND	376	0%	810000	5.3	No
Ethenyl ester acetic acid	ND	376	0%	1600000	11	No
Ethyl chloride	Detect	2	1%	29	3.1	No
	ND	375		1600000	11	
Ethylbenzene	ND	376	0%	810000	5.3	No
Ethylene dibromide	ND	376	0%	810000	5.3	No
Ethylene dichloride	Detect	4	1%	9.7	1.9	No
	ND	376		810000	5.3	
Methyl bromide	ND	376	0%	1600000	11	No
Methyl chloride	ND	376	0%	1600000	11	No
Methyl ethyl ketone	Detect	14	4%	46	7	No
	ND	364		1600000	11	
Methylchloroform	Detect	25	6%	690	1.3	**Yes**
	ND	365		810000	5.3	
Methylene chloride[1]	Detect	173	44%	3200	0.97	No
	ND	218		810000	5.4	
m-Xylene & p-Xylene	ND	376	0%	810000	5.3	No
O-Xylene	ND	376	0%	810000	5.3	No
Perchloroethylene	Detect	122	32%	7700000	1.1	**Yes**
	ND	255		58	5.3	
Styrene	ND	376	0%	810000	5.3	No
Tetrachloromethane	Detect	1	0%	45	45	No
	ND	376		810000	5.3	

Table B-3. Results of Screening for Subsurface Soil - VOCs

VOCs	Detect?	Number of Samples	Frequency of Detection	Concentration (ug/kg)		Retained for Background Evaluation?
				Maximum	Minimum	
Toluene	Detect	17	4%	15	1.3	No
	ND	362		810000	5.3	
trans-1,2-Dichloroethene	Detect	6	2%	22	1.7	No
	ND	375		810000	5.3	
trans-1,3-Dichloropropene	ND	376	0%	810000	5.3	No
Tribromomethane	ND	376	0%	810000	5.3	No
Trichloroethene	Detect	95	25%	4800	1.2	**Yes**
	ND	290		810000	5.3	
Trichloromethane	Detect	2	1%	12	5.5	No
	ND	376		810000	5.3	
Vinylidene chloride	Detect	46	12%	3600	1.6	**Yes**
	ND	349		810000	5.3	

ND = Non Detect

1 Very common laboratory analyte. Hence not retained for background evaluation.

Table B-4. Results of Screening for Subsurface Soil - PAHs, PESTs, and PCBs

PAHs, PESTs, and PCBs	Detect?	Number of Samples	Frequency of Detection	Concentration (ug/kg)		Retained for Background Screen?
				Maximum	Minimum	
4,4'-DDD	ND	376	0%	2.5	1.8	No
4,4'-DDE	Detect	1	0%	3	3	No
	ND	375		2.5	1.8	
4,4'-DDT	Detect	2	1%	1.1	0.73	No
	ND	374		2.5	1.8	
Acenaphthene	Detect	8	2%	740	9.2	No
	ND	368		490	350	
Aldrin	ND	376	0%	2.5	1.8	No
alpha-BHC	Detect	4	1%	1.3	0.12	No
	ND	372		2.5	1.8	
Anthracene	Detect	7	2%	420	21	No
	ND	369		490	350	
Arochlor 1242	ND	376	0%	49	35	No
Arochlor 1248	ND	376	0%	49	35	No
Arochlor 1260	Detect	2	1%	4.1	3.2	No
	ND	374		49	35	
Aroclor-1016	ND	376	0%	49	35	No
Arochlor-1221	ND	376	0%	98	71	No
Arochlor-1232	ND	376	0%	49	35	No
Benz[e]acephenanthrylene	Detect	18	5%	1800	19	No
	ND	358		490	350	
Benzanthracene	Detect	17	5%	630	18	No
	ND	359		490	350	
Benzo[a]pyrene	Detect	14	4%	780	23	No
	ND	362		490	350	
Benzo[k]fluoranthene	Detect	10	3%	620	37	No
	ND	366		490	350	
Chlorodane	ND	376	0%	25	18	No
Chrysene	Detect	16	4%	1000	18	No
	ND	360		490	350	
Dibenz[a,h]anthracene	ND	376	0%	820	350	No
Dieldrin	ND	376	0%	2.5	1.8	No
Endosulfan I	ND	376	0%	2.5	1.8	No
Endosulfan II	Detect	1	0%	0.8	0.8	No
	ND	375		2.5	1.8	
Endrin	Detect	1	0%	0.65	0.65	No
	ND	375		2.5	1.8	
Heptachlor	ND	376	0%	2.5	1.8	No
Heptachlor epoxide	ND	376	0%	2.5	1.8	No
Indeno(1,2,3-cd)pyrene	Detect	5	1%	360	63	No
	ND	371		820	350	
Lindane	Detect	2	1%	0.23	0.2	No
	ND	374		2.5	1.8	
Methoxychlor	ND	376	0%	12	8.8	No
PCB-1254	Detect	2	1%	67	22	No
	ND	374		49	35	
Pyrene	Detect	16	4%	7800	43	No
	ND	360		490	350	
Toxaphene	ND	376	0%	120	88	No

ND = Non Detect

Attachment B

Table B-5. Results of Screening for Subsurface Soil - BNAs

BNAs	Detect?	Number of Samples	Frequency of Detection	Concentration (ug/kg)		Retained for Background Evaluation
				Maximum	Minimum	
1,1'-Oxybis[2-ethane]	ND	376	0%	820	350	No
1,2-Dichlorobenzene	ND	376	0%	820	350	No
2,4,5-Trichlorophenol	ND	376	0%	4100	1800	No
2,4,6-Trichlorophenol	ND	376	0%	820	350	No
2,4-Dichlorophenol	ND	376	0%	820	350	No
2,4-Dimethylphenol	ND	376	0%	820	350	No
2,4-Dinitrophenol	ND	376	0%	4100	1800	No
2,4-Dinitrotoluene	ND	376	0%	820	350	No
2-Chlorophenol	ND	376	0%	820	350	No
2-Methyl-1,3-dinitrobenzene	ND	376	0%	820	350	No
2-Methylphenol	Detect	1	0%	34	34	No
	ND	375		820	350	
3,3'-Dichlorobenzidine	ND	376	0%	4100	1800	No
4-Chlorobenzenamine	ND	376	0%	820	350	No
Benzoic Acid	ND	376	0%	4100	1800	No
Benzyl butyl phthalate	Detect	3	1%	1500	110	No
	ND	373		820	350	
Bis(2-ethylhexyl)phthalate	Detect	27	7%	2400	81	**Yes**
	ND	349		490	350	
Carbazole	Detect	5	1%	250	48	No
	ND	371		490	350	
Diethyl phthalate	ND	376	0%	820	350	No
Di-n-butyl phthalate	Detect	1	0%	280	280	No
	ND	375		820	350	
Di-n-octyl phthalate	Detect	1	0%	93	93	No
	ND	375		820	350	
Fluoranthene	Detect	23	6%	3500	17	**Yes**
	ND	353		490	350	
Fluorene	Detect	5	1%	500	25	No
	ND	371		490	350	
Hexachlorobenzene	ND	376	0%	820	350	No
Hexachlorocyclopentadiene	ND	376	0%	820	350	No
Hexachloroethane	Detect	4	1%	430	25	No
	ND	372		820	350	
Isophorone	ND	376	0%	820	350	No
Naphthalene	Detect	1	0%	19	19	No
	ND	375		820	350	
Nitrobenzene	ND	376	0%	820	350	No
N-Nitrosodiphenylamine	ND	376	0%	820	350	No
n-Nitrosodipropylamine	ND	376	0%	820	350	No
p-Dichlorobenzene	ND	376	0%	820	350	No
Pentachlorophenol	ND	376	0%	4100	1800	No
Phenol	ND	376	0%	820	350	No

ND = Non Detect

ATTACHMENT C
RESULTS OF SCREENING FOR SURFACE WATER

Table C-1. Results of Screening for Surface Water - Radionuclides

Radionuclides	Detect?	Number of Samples	Frequency of Detection	Concentration (pCi/L)		Retained for Background Evaluation
				Maximum	Minimum	
Technetium-99	ND	7	0%	2.39	-0.978	No
Thorium-228	ND	7	0%	0.0864	0.0087	No
Thorium-230	ND	7	0%	0.0368	-0.0104	No
Thorium-232	ND	7	0%	0.0293	-0.0102	No
Uranium-234	Detect	7	100%	29.6	0.483	Yes
Uranium-235	Detect	6	86%	1.24	0.0545	Yes
	ND	1		0.00439	0.00439	
Uranium-238	Detect	7	100%	4.77	0.152	Yes

ND = Non-Detect

Table C-2. Results of Screening for Surface Water - Metals

Metal	Detect?	Number of Samples	Freq of Detection	Concentration (mg/L)		Retained for Background Evaluation
				Maximum	Minimum	
Aluminum	Detect	5	71%	19	0.1	**Yes**
	ND	2		0.1	0.1	
Antimony	ND	7	0%	0.02	0.02	No
Arsenic	Detect	1	14%	0.011	0.011	**Yes**
	ND	6		0.01	0.01	
Barium	Detect	7	100%	0.63	0.069	**Yes**
Beryllium	ND	7	0%	0.0026	0.0026	No
Cadmium	ND	7	0%	0.002	0.002	No
Calcium	Detect	7	100%	66	45	No
Chromium	Detect	1	14%	0.026	0.026	**Yes**
	ND	6		0.004	0.004	
Cobalt	Detect	1	14%	0.017	0.017	**Yes**
	ND	6		0.002	0.002	
Copper	Detect	1	14%	0.055	0.055	**Yes**
	ND	6		0.01	0.01	
Iron	Detect	4	57%	23	0.15	**Yes**
	ND	3		0.1	0.1	
Lead	Detect	1	14%	0.068	0.068	**Yes**
	ND	6		0.003	0.003	
Magnesium	Detect	7	100%	40	28	No
Manganese	Detect	7	100%	1.3	0.015	**Yes**
Mercury	ND	7	0%	0.0002	0.0002	No
Nickel	Detect	1	14%	0.031	0.031	**Yes**
	ND	6		0.005	0.005	
Potassium	Detect	7	100%	5	1.4	No
Selenium	ND	7	0%	0.005	0.005	No
Silver	ND	7	0%	0.01	0.01	No
Sodium	Detect	7	100%	11	7.6	No
Thallium	ND	7	0%	0.01	0.01	No
Vanadium	Detect	1	14%	0.045	0.045	**Yes**
	ND	6		0.01	0.01	
Zinc	Detect	3	43%	0.35	0.012	**Yes**
	ND	4		0.006	0.006	

ND = Non Detect

Table C-3. Results of Screening for Surface Water - VOCs

VOCs	Detect?	Number of Samples	Frequency of Detection	Concentration (ug/L)		Retained for Background Evaluation
				Maximum	Minimum	
1,1,2,2-Tetrachloroethane	ND	7	0%	5	5	No
1,1,2-Trichloroethane	ND	7	0%	5	5	No
1,1-Dichloroethane	ND	7	0%	5	5	No
1,2,4-Trichlorobenzene	ND	7	0%	5	5	No
1,2-Dibromo-3-chloropropane	ND	7	0%	5	5	No
1,2-Dichloropropane	ND	7	0%	5	5	No
2-Hexanone	ND	7	0%	10	10	No
2-Propanone	ND	7	0%	10	10	No
4-Methyl-2-pentanone	ND	7	0%	10	10	No
Benzene	ND	7	0%	5	5	No
Bromodichloromethane	ND	7	0%	5	5	No
Carbon disulfide	ND	7	0%	5	5	No
Chlorobenzene	ND	7	0%	5	5	No
Chlorodibromomethane	ND	7	0%	5	5	No
Chloroethene	ND	7	0%	10	10	No
cis-1,2-Dichloroethene	Detect	2	29%	4.4	0.66	**Yes**
	ND	5		5	5	
cis-1,3-Dichloropropene	ND	7	0%	5	5	No
Ethenyl ester acetic acid	ND	7	0%	10	10	No
Ethyl chloride	ND	7	0%	10	10	No
Ethylbenzene	ND	7	0%	5	5	No
Ethylene dibromide	ND	7	0%	5	5	No
Ethylene dichloride	ND	7	0%	5	5	No
Methyl bromide	ND	7	0%	10	10	No
Methyl chloride	ND	7	0%	10	10	No
Methyl ethyl ketone	ND	7	0%	10	10	No
Methylchloroform	ND	7	0%	5	5	No
Methylene chloride [1]	Detect	3	43%	2.6	1.1	No
	ND	4		5	5	
m-Xylene & p-Xylene	ND	7	0%	5	5	No
O-Xylene	ND	7	0%	5	5	No
Perchloroethylene	1	3	43%	2.1	0.73	**Yes**
	ND	4		5	5	
Styrene	ND	7	0%	5	5	No
Tetrachloromethane	ND	7	0%	5	5	No
Toluene	ND	7	0%	5	5	No
trans-1,2-Dichloroethene	ND	7	0%	5	5	No
trans-1,3-Dichloropropene	ND	7	0%	5	5	No
Tribromomethane	ND	7	0%	5	5	No
Trichloroethene	1	2	29%	0.84	0.64	Yes
	ND	5		5	5	
Trichloromethane	ND	7	0%	5	5	No
Vinylidene chloride	ND	7	0%	5	5	No

ND = Non Detect

1 Very common laboratory analyte. Hence not retained for background evaluation.

Table C-4. Results of Screening for Surface Water - PAHs, PESTs, and PCBs

PAHs, PESTs, and PCBs	Detect?	Number of Samples	Freq of Detection	Concentration (ug/L)		Retained for Background Evaluation
				Maximum	Minimum	
4,4'-DDD	ND	7	0%	0.054	0.048	No
4,4'-DDE	ND	7	0%	0.054	0.048	No
4,4'-DDT	ND	7	0%	0.054	0.048	No
Acenaphthene	ND	7	0%	10	9.4	No
Aldrin	ND	7	0%	0.054	0.048	No
alpha-BHC	ND	7	0%	0.054	0.048	No
Anthracene	ND	7	0%	10	9.4	No
Arochlor 1242	ND	7	0%	1.1	0.96	No
Arochlor 1248	ND	7	0%	1.1	0.96	No
Arochlor 1260	ND	7	0%	1.1	0.96	No
Aroclor-1016	ND	7	0%	1.1	0.96	No
Aroclor-1221	ND	7	0%	2.2	1.9	No
Aroclor-1232	ND	7	0%	1.1	0.96	No
Benz[e]acephenanthrylene	ND	7	0%	10	9.4	No
Benzanthracene	ND	7	0%	10	9.4	No
Benzo[a]pyrene	ND	7	0%	10	9.4	No
Benzo[k]fluoranthene	ND	7	0%	10	9.4	No
Chlorodane	ND	7	0%	0.54	0.48	No
Chrysene	ND	7	0%	10	9.4	No
Dibenz[a,h]anthracene	ND	7	0%	10	9.4	No
Dieldrin	ND	7	0%	0.054	0.048	No
Endosulfan I	ND	7	0%	0.054	0.048	No
Endosulfan II	ND	7	0%	0.054	0.048	No
Endrin	ND	7	0%	0.054	0.048	No
Heptachlor	ND	7	0%	0.054	0.048	No
Heptachlor epoxide	ND	7	0%	0.054	0.048	No
Indeno(1,2,3-cd)pyrene	ND	7	0%	10	9.4	No
Lindane	ND	7	0%	0.054	0.048	No
Methoxychlor	ND	7	0%	0.27	0.24	No
PCB-1254	ND	7	0%	1.1	0.96	No
Pyrene	ND	7	0%	10	9.4	No
Toxaphene	ND	7	0%	2.7	2.4	No

ND = Non Detect

Table C-5. Results of Screening for Surface Water - BNAs

BNAs	Detect?	Number of Samples	Frequency of Detection	Concentration (ug/L)		Retained for Background Evaluation
				Maximum	Minimum	
1,1'-Oxybis[2-ethane]	ND	7	0%	10	9.4	No
1,2-Dichlorobenzene	ND	7	0%	10	9.4	No
2,4,5-Trichlorophenol	ND	7	0%	52	47	No
2,4,6-Trichlorophenol	ND	7	0%	10	9.4	No
2,4-Dichlorophenol	ND	7	0%	10	9.4	No
2,4-Dimethylphenol	ND	7	0%	10	9.4	No
2,4-Dinitrophenol	ND	7	0%	52	47	No
2,4-Dinitrotoluene	ND	7	0%	10	9.4	No
2-Chlorophenol	ND	7	0%	10	9.4	No
2-Methyl-1,3-dinitrobenzene	ND	7	0%	10	9.4	No
2-Methylphenol	ND	7	0%	10	9.4	No
3,3'-Dichlorobenzidine	ND	7	0%	52	47	No
4-Chlorobenzenamine	ND	7	0%	10	9.4	No
Benzoic Acid	ND	7	0%	52	47	No
Benzyl butyl phthalate	ND	7	0%	10	9.4	No
Bis(2-ethylhexyl)phthalate	ND	7	0%	10	9.4	No
Carbazole	ND	7	0%	10	9.4	No
Diethyl phthalate	ND	7	0%	10	9.4	No
Di-n-butyl phthalate	ND	7	0%	10	9.4	No
Di-n-octyl phthalate	ND	7	0%	10	9.4	No
Fluoranthene	Detect	1	14%	0.97	0.97	**Yes**
	ND	6		10	9.4	
Fluorene	ND	7	0%	10	9.4	No
Hexachlorobenzene	ND	7	0%	10	9.4	No
Hexachlorocyclopentadiene	ND	7	0%	10	9.4	No
Hexachloroethane	ND	7	0%	10	9.4	No
Isophorone	ND	7	0%	10	9.4	No
Naphthalene	ND	7	0%	10	9.4	No
Nitrobenzene	ND	7	0%	10	9.4	No
N-Nitrosodiphenylamine	ND	7	0%	10	9.4	No
n-Nitrosodipropylamine	ND	7	0%	10	9.4	No
p-Dichlorobenzene	ND	7	0%	10	9.4	No
Pentachlorophenol	ND	7	0%	52	47	No
Phenol	ND	7	0%	10	9.4	No

ND = Non Detect

ATTACHMENT D
RESULTS OF SCREENING FOR GROUNDWATER

Table D-1. Results of Screening for Overburden Well Data

Analyte	Detection Frequency	Concentrations				Retained for Weight-of-Evidence Screen	Retained for Background Evaluation
		Detects		Nondetects			
		MIN	MAX	MIN	MAX		
Radionuclides (pCi/L)							
Americium-241	4%	0.03	0.03	-0.01	0.02	No	---
Neptunium-237	9%	0.02	0.09	-0.01	0.01	**Yes**	Yes
Plutonium 238	0%			-0.02	0.02	No	---
Plutonium 239/240	0%			-0.01	0.01	No	---
Radium 226	60%	0.26	0.76	0.05	0.33	**Yes**	Yes
Radium-228	20%	0.92	0.97	-0.09	0.54	**Yes**	Yes
Technetium-99	30%	8.99	5100.00	-2.83	13.40	**Yes**	Yes
Thorium-228	22%	0.09	1.10	-0.03	0.13	**Yes**	Yes
Thorium-230	13%	0.21	1.00	-0.07	0.16	**Yes**	Yes
Thorium-232	35%	0.01	0.83	0.00	0.06	**Yes**	Yes
Uranium-234	85%	0.05	315.00	0.01	0.12	**Yes**	Yes
Uranium-235	32%	0.02	16.50	-0.04	0.05	**Yes**	Yes
Uranium-238	80%	0.04	56.30	0.00	0.06	**Yes**	Yes
Metals (ug/L)							
Aluminum	51%	110	16000	100	100	**Yes**	Yes
Antimony	0%	0	0	20	20	No	---
Arsenic	10%	10	130	10	10	**Yes**	Yes
Barium	100%	27	1300	0	0	**Yes**	Yes
Beryllium	0%	0	0	2.6	2.6	No	---
Cadmium	1%	3.5	3.5	2	2	No	---
Calcium	100%	9600	260000	0	0	Yes	No
Chromium	11%	5.9	37	4	4	**Yes**	Yes
Cobalt	28%	2	42	2	2	**Yes**	Yes
Copper	6%	19	39	10	10	**Yes**	Yes
Iron	83%	130	38000	100	320	**Yes**	Yes
Lead	18%	3.3	59	3	3	**Yes**	Yes
Magnesium	99%	2200	130000	34000	34000	Yes	No
Manganese	99%	1.4	13000	4.6	4.6	**Yes**	Yes
Mercury	0%	0	0	0.2	0.2	No	---
Nickel	49%	5	150	5	5	**Yes**	Yes
Potassium	86%	1000	17000	1000	1000	Yes	No
Selenium	8%	5.1	9.5	5	5	**Yes**	Yes
Silver	0%	0	0	10	10	No	---
Sodium	100%	4200	190000	0	0	Yes	No
Thallium	3%	11	26	10	10	No	---
Vanadium	6%	18	44	10	10	**Yes**	Yes
Zinc	72%	7.1	650	6	6.9	**Yes**	Yes
Volatile Organic Compounds (ug/L)							
1,1,2,2-Tetrachloroethane	0%			5	25000	No	---
1,1,2-Trichloroethane	6%	1.4	8.4	5	25000	**Yes**	Yes
1,1-Dichloroethane	45%	1.3	610	5	25000	**Yes**	Yes
1,2,4-Trichlorobenzene	0%			5	25000	No	---
1,2-Dibromo-3-chloropropane	0%			5	25000	No	---
1,2-Dichloropropane	0%			5	25000	No	---
2-Hexanone	0%			10	50000	No	---
2-Propanone	2%	52	76	10	50000	No	---

Table D-1. Results of Screening for Overburden Well Data

Analyte	Detection Frequency	Concentrations				Retained for Weight-of-Evidence Screen	Retained for Background Evaluation
		Detects		Nondetects			
		MIN	MAX	MIN	MAX		
4-Methyl-2-pentanone	0%			10	50000	No	---
Benzene	2%	1.3	4.8	5	25000	No	---
Bromodichloromethane	0%			5	25000	No	---
Carbon disulfide	5%	1	8	5	25000	No	---
Chlorobenzene	0%			5	25000	No	---
Chlorodibromomethane	0%			5	25000	No	---
Chloroethene (i.e., vinyl chloride)	14%	1.5	1000	10	50000	**Yes**	Yes
cis-1,2-Dichloroethene	57%	1	19000	5	25000	**Yes**	Yes
cis-1,3-Dichloropropene	0%			5	25000	No	---
Ethenyl ester acetic acid	0%			10	50000	No	---
Ethyl chloride (i.e., chloroethane)	1%	52	52	10	50000	No	---
Ethylbenzene	0%			5	25000	No	---
Ethylene dibromide	0%			5	25000	No	---
Ethylene dichloride (i.e., 1,2-DCE)	7%	1.1	8.7	5	25000	**Yes**	Yes
Methyl bromide	0%			10	50000	No	---
Methyl chloride	0%			10	50000	No	---
Methyl ethyl ketone	0%			10	50000	No	---
Methylchloroform	8%	2.2	85	5	25000	**Yes**	Yes
Methylene chloride	13%	2.5	1200	5	25000	**Yes**	Yes
m-Xylene & p-Xylene	0%			5	25000	No	---
O-Xylene	1%	3.7	3.7	5	25000	No	---
Perchloroethylene	61%	1.4	200000	5	1200	**Yes**	Yes
Styrene	0%			5	25000	No	---
Tetrachloromethane	0%			5	25000	No	---
Toluene	2%	1.4	1.7	2.8	25000	No	---
trans-1,2-Dichloroethene	18%	1.4	630	5	25000	**Yes**	Yes
trans-1,3-Dichloropropene	0%			5	25000	No	---
Tribromomethane	0%			5	25000	No	---
Trichloroethene	60%	1.2	18000	5	25000	**Yes**	Yes
Trichloromethane	5%	1.5	6.8	5	25000	No	---
Vinylidene chloride	42%	1.1	5100	5	2500	**Yes**	Yes
Semivolatile Organic Compounds - Base Neutral Acids (ug/L)							
1,1'-Oxybis[2-ethane]	0%			9.4	11	No	---
1,2-Dichlorobenzene	0%			9.4	11	No	---
2,4,5-Trichlorophenol	0%			47	56	No	---
2,4,6-Trichlorophenol	0%			9.4	11	No	---
2,4-Dichlorophenol	0%			9.4	11	No	---
2,4-Dimethylphenol	0%			9.4	11	No	---
2,4-Dinitrophenol	0%			47	56	No	---
2,4-Dinitrotoluene	0%			9.4	11	No	---
2-Chlorophenol	0%			9.4	11	No	---
2-Methyl-1,3-dinitrobenzene	0%			9.4	11	No	---
2-Methylphenol	0%			9.4	11	No	---
3,3'-Dichlorobenzidine	0%			47	56	No	---
4-Chlorobenzenamine	0%			9.4	11	No	---
Benzoic Acid	0%			47	56	No	---
Benzyl butyl phthalate	0%			9.4	11	No	---

Table D-1. Results of Screening for Overburden Well Data

Analyte	Detection Frequency	Concentrations				Retained for Weight-of-Evidence Screen	Retained for Background Evaluation
		Detects		Nondetects			
		MIN	MAX	MIN	MAX		
Bis(2-ethylhexyl)phthalate	21%	4	26	9.4	11	**Yes**	Yes
Carbazole	0%			9.4	11	No	---
Diethyl phthalate	0%			9.4	11	No	---
Di-n-butyl phthalate	0%			9.4	11	No	---
Di-n-octyl phthalate	0%			9.4	11	No	---
Fluoranthene	0%			9.4	11	No	---
Fluorene	0%			9.4	11	No	---
Hexachlorobenzene	0%			9.4	11	No	---
Hexachlorocyclopentadiene	0%			9.4	11	No	---
Hexachloroethane	3%	6.5	6.5	9.4	11	No	---
Isophorone	0%			9.4	11	No	---
Naphthalene	0%			9.4	11	No	---
Nitrobenzene	0%			9.4	11	No	---
N-Nitrosodiphenylamine	0%			9.4	11	No	---
n-Nitrosodipropylamine	0%			9.4	11	No	---
p-Dichlorobenzene	0%			9.4	11	No	---
Pentachlorophenol	0%			47	56	No	---
Phenol	5%	2.1	9.8	9.4	11	No	---

Note: No PCBs, PAHs, or Pesticides were detected in the Overburden so they are not included in this table.

Table D-2. Results of Screening for Jefferson City Well Data

Analyte	Detection Frequency	Concentrations				Retained for Weight-of-Evidence Screen	Retained for Background Evaluation
		Detects		Nondetects			
		MIN	MAX	MIN	MAX		
Radionuclides (pCi/L)							
Americium-241	0%			0.00	0.01	No	---
Neptunium-237	0%			-0.01	0.00	No	---
Plutonium 238	0%			0.00	0.00	No	---
Plutonium 239/240	0%			0.00	0.01	No	---
Radium 226	100%	1.38	1.62			Yes	**Yes**
Radium-228	67%	0.85	1.29	0.24	0.24	Yes	**Yes**
Technetium-99	0%			-1.66	9.25	No	---
Thorium-228	13%	0.11	1.00	-0.02	0.13	Yes	**Yes**
Thorium-230	7%	0.69	0.69	-0.05	0.09	Yes	**Yes**
Thorium-232	13%	0.04	0.74	0.00	0.04	Yes	**Yes**
Uranium-234	100%	0.10	6.03			Yes	**Yes**
Uranium-235	47%	0.05	0.16	0.00	0.04	Yes	**Yes**
Uranium-238	93%	0.15	1.72	0.03	0.03	Yes	**Yes**
Metals (ug/L)							
Aluminum	39%	170	580	100	100	Yes	**Yes**
Antimony	0%	0	0	20	20	No	---
Arsenic	17%	14	23	10	10	Yes	**Yes**
Barium	100%	57	540	0	0	Yes	**Yes**
Beryllium	0%	0	0	2.6	2.6	No	---
Cadmium	0%	0	0	2	2	No	---
Calcium	100%	6700	84000	0	0	Yes	No
Chromium	0%	0	0	4	4	No	---
Cobalt	22%	2.2	7.1	2	2	Yes	**Yes**
Copper	0%	0	0	10	10	No	---
Iron	72%	110	16000	100	190	Yes	**Yes**
Lead	0%	0	0	3	3	No	---
Magnesium	100%	24000	52000	0	0	Yes	No
Manganese	94%	3.6	1700	13	13	Yes	**Yes**
Mercury	0%	0	0	0.2	0.2	No	---
Nickel	44%	5.5	67	5	5	Yes	**Yes**
Potassium	100%	1300	69000	0	0	Yes	No
Selenium	0%	0	0	5	5	No	---
Silver	0%	0	0	10	10	No	---
Sodium	100%	2600	63000	0	0	Yes	No
Thallium	0%	0	0	10	10	No	---
Vanadium	0%	0	0	10	10	No	---
Zinc	67%	7.3	69	6	6	Yes	**Yes**
Volatile Organic Compounds (ug/L)							
1,1,2,2-Tetrachloroethane	0%			5	250	No	---
1,1,2-Trichloroethane	0%			5	250	No	---
1,1-Dichloroethane	56%	3.4	350	5	5	**Yes**	Yes
1,2,4-Trichlorobenzene	0%			5	250	No	---
1,2-Dibromo-3-chloropropane	0%			5	250	No	---
1,2-Dichloropropane	0%			5	250	No	---
2-Hexanone	0%			10	500	No	---

Table D-2. Results of Screening for Jefferson City Well Data

Analyte	Detection Frequency	Concentrations				Retained for Weight-of-Evidence Screen	Retained for Background Evaluation
		Detects		Nondetects			
		MIN	MAX	MIN	MAX		
2-Propanone	6%	9.9	9.9	10	500	**Yes**	Yes
4-Methyl-2-pentanone	0%			10	500	No	---
Benzene	0%			5	250	No	---
Bromodichloromethane	0%			5	250	No	---
Carbon disulfide	0%			5	250	No	---
Chlorobenzene	0%			5	250	No	---
Chlorodibromomethane	0%			5	250	No	---
Chloroethene	31%	1.9	180	10	500	**Yes**	Yes
cis-1,2-Dichloroethene	56%	7.8	2400	5	5	**Yes**	Yes
cis-1,3-Dichloropropene	0%			5	250	No	---
Ethenyl ester acetic acid	0%			10	500	No	---
Ethyl chloride	0%			10	500	No	---
Ethylbenzene	0%			5	250	No	---
Ethylene dibromide	0%			5	250	No	---
Ethylene dichloride	6%	3.9	3.9	5	250	**Yes**	Yes
Methyl bromide	0%			10	500	No	---
Methyl chloride	0%			10	500	No	---
Methyl ethyl ketone	6%	29	29	10	500	**Yes**	Yes
Methylchloroform	13%	1.3	6.9	5	250	**Yes**	Yes
Methylene chloride	0%			5	250	No	---
m-Xylene & p-Xylene	0%			5	250	No	---
O-Xylene	0%			5	250	No	---
Perchloroethylene	56%	6	2200	5	5	**Yes**	Yes
Styrene	0%			5	250	No	---
Tetrachloromethane	0%			5	250	No	---
Toluene	6%	3.7	3.7	5	250	**Yes**	Yes
trans-1,2-Dichloroethene	19%	3.1	27	5	250	**Yes**	Yes
trans-1,3-Dichloropropene	0%			5	250	No	---
Tribromomethane	0%			5	250	No	---
Trichloroethene	56%	20	7700	5	5	**Yes**	Yes
Trichloromethane	0%			5	250	No	---
Vinylidene chloride	50%	9.1	240	5	5	**Yes**	Yes

Note: No PCBs, PAHs, Pesticides, or BNAs were detected in the Jefferson City so they are not included in this table.

Table D-3. Result of Screening for Roubidoux Well Data

Analyte	Detection Frequency	Concentrations				Retained for Weight-of-Evidence Screen	Retained for Background Evaluation
		Detects		Nondetects			
		MIN	MAX	MIN	MAX		
Radionuclides (pCi/L)							
Americium-241	0%			0.00	0.02	No	---
Neptunium-237	0%			-0.01	0.01	No	---
Plutonium 238	0%			0.00	0.00	No	---
Plutonium 239/240	0%			0.00	0.02	No	---
Radium 226	67%	0.73	1.10	-0.01	-0.01	**Yes**	Yes
Radium-228	0%			0.18	0.54	No	---
Technetium-99	0%			-0.27	6.42	No	---
Thorium-228	10%	0.14	0.14	-0.01	0.11	**Yes**	Yes
Thorium-230	0%			-0.05	0.11	No	---
Thorium-232	20%	0.06	0.12	0.00	0.02	**Yes**	Yes
Uranium-234	100%	2.07	12.40			**Yes**	Yes
Uranium-235	70%	0.05	0.09	0.01	0.06	**Yes**	Yes
Uranium-238	100%	0.19	1.22			**Yes**	Yes
Metals (ug/L)							
Aluminum	31%	110	1100	100	100	**Yes**	Yes
Antimony	0%	0	0	20	20	No	---
Arsenic	15%	46	62	10	10	**Yes**	Yes
Barium	100%	65	140	0	0	**Yes**	Yes
Beryllium	0%	0	0	2.6	2.6	No	---
Cadmium	0%	0	0	2	2	No	---
Calcium	100%	56000	79000	0	0	**Yes**	No
Chromium	0%	0	0	4	4	No	---
Cobalt	0%	0	0	2	2	No	---
Copper	0%	0	0	10	10	No	---
Iron	69%	110	740	100	100	**Yes**	Yes
Lead	0%	0	0	3	3	No	---
Magnesium	100%	28000	39000	0	0	**Yes**	No
Manganese	77%	3.7	17	2.4	11	**Yes**	Yes
Mercury	0%	0	0	0.2	0.2	No	---
Nickel	0%	0	0	5	5	No	---
Potassium	100%	1600	4500	0	0	**Yes**	No
Selenium	0%	0	0	5	5	No	---
Silver	0%	0	0	10	10	No	---
Sodium	100%	1600	7100	0	0	**Yes**	No
Thallium	0%	0	0	10	10	No	---
Vanadium	0%	0	0	10	10	No	---
Zinc	38%	6.7	150	6	6	**Yes**	Yes
Volatile Organic Compounds (ug/L)							
1,1,2,2-Tetrachloroethane	0%			5	5	No	---
1,1,2-Trichloroethane	0%			5	5	No	---
1,1-Dichloroethane	0%			5	5	No	---
1,2,4-Trichlorobenzene	0%			5	5	No	---
1,2-Dibromo-3-chloropropane	0%			5	5	No	---
1,2-Dichloropropane	0%			5	5	No	---

Table D-3. Result of Screening for Roubidoux Well Data

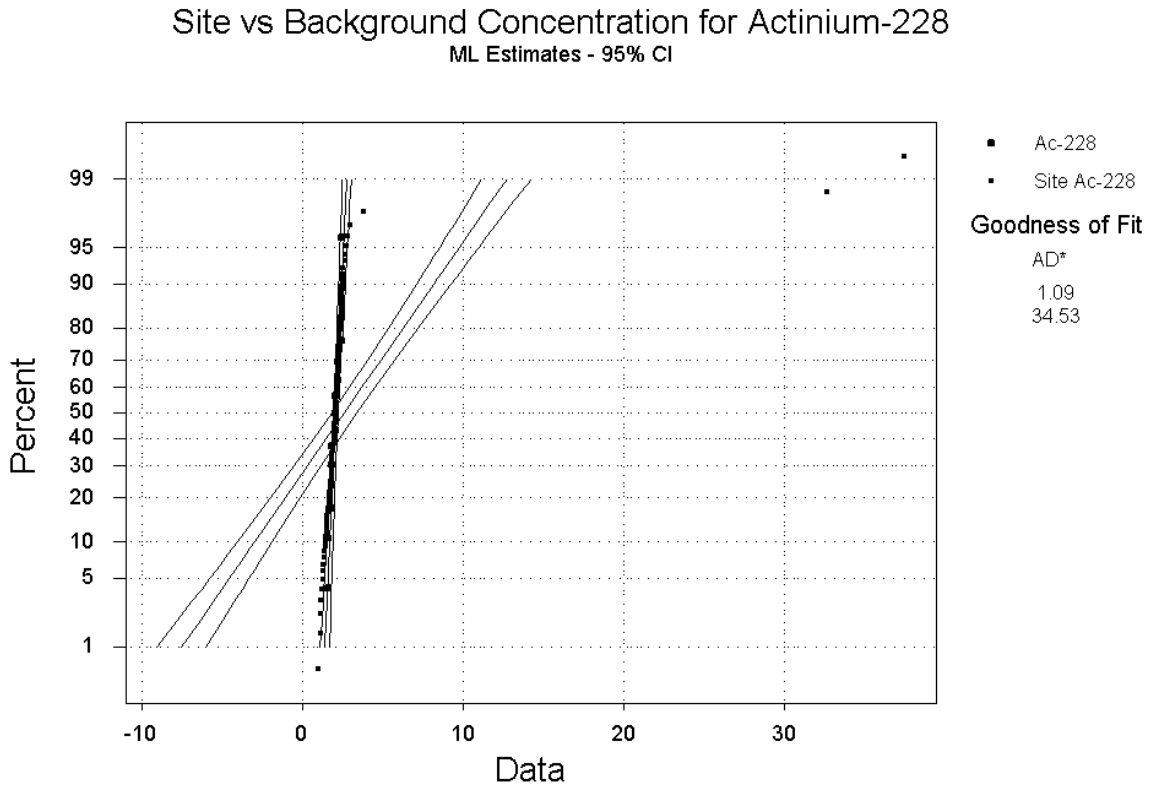
Analyte	Detection Frequency	Concentrations				Retained for Weight-of-Evidence Screen	Retained for Background Evaluation
		Detects		Nondetects			
		MIN	MAX	MIN	MAX		
2-Hexanone	0%			10	10	No	---
2-Propanone	0%			10	10	No	---
4-Methyl-2-pentanone	0%			10	10	No	---
Benzene	0%			5	5	No	---
Bromodichloromethane	0%			5	5	No	---
Carbon disulfide	0%			5	5	No	---
Chlorobenzene	0%			5	5	No	---
Chlorodibromomethane	0%			5	5	No	---
Chloroethene	0%			10	10	No	---
cis-1,2-Dichloroethene	0%			5	5	No	---
cis-1,3-Dichloropropene	0%			5	5	No	---
Ethenyl ester acetic acid	0%			10	10	No	---
Ethyl chloride	0%			10	10	No	---
Ethylbenzene	0%			5	5	No	---
Ethylene dibromide	0%			5	5	No	---
Ethylene dichloride	0%			5	5	No	---
Methyl bromide	0%			10	10	No	---
Methyl chloride	0%			10	10	No	---
Methyl ethyl ketone	0%			10	10	No	---
Methylchloroform	0%			5	5	No	---
Methylene chloride	33%	3.1	4	5	7.6	**Yes**	Yes
m-Xylene & p-Xylene	0%			5	5	No	---
O-Xylene	0%			5	5	No	---
Perchloroethylene	0%			5	5	No	---
Styrene	0%			5	5	No	---
Tetrachloromethane	0%			5	5	No	---
Toluene	0%			5	5	No	---
trans-1,2-Dichloroethene	0%			5	5	No	---
trans-1,3-Dichloropropene	0%			5	5	No	---
Tribromomethane	0%			5	5	No	---
Trichloroethene	20%	1.3	1.9	5	5	**Yes**	Yes
Trichloromethane	0%			5	5	No	---
Vinylidene chloride	0%			5	5	No	---

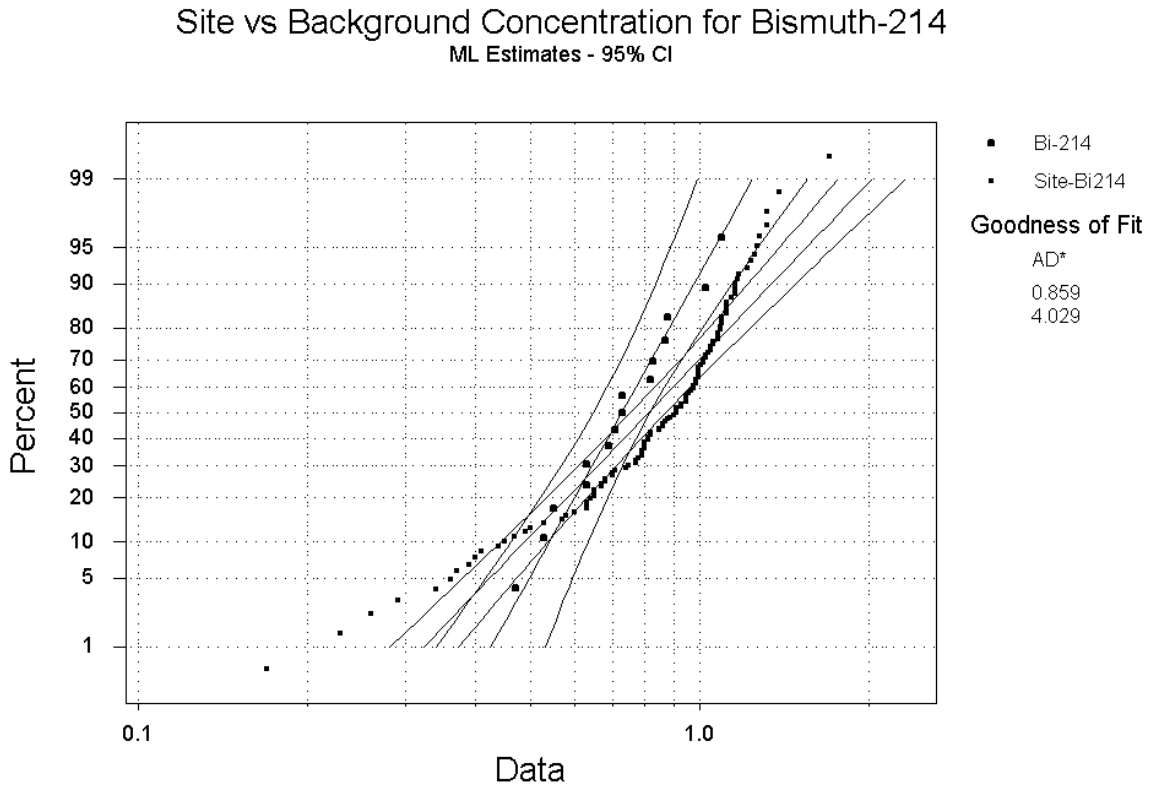
Note: No PCBs, PAHs, Pesticides, or BNAs were detected in the Roubidoux so they are not included in this table.

ATTACHMENT E

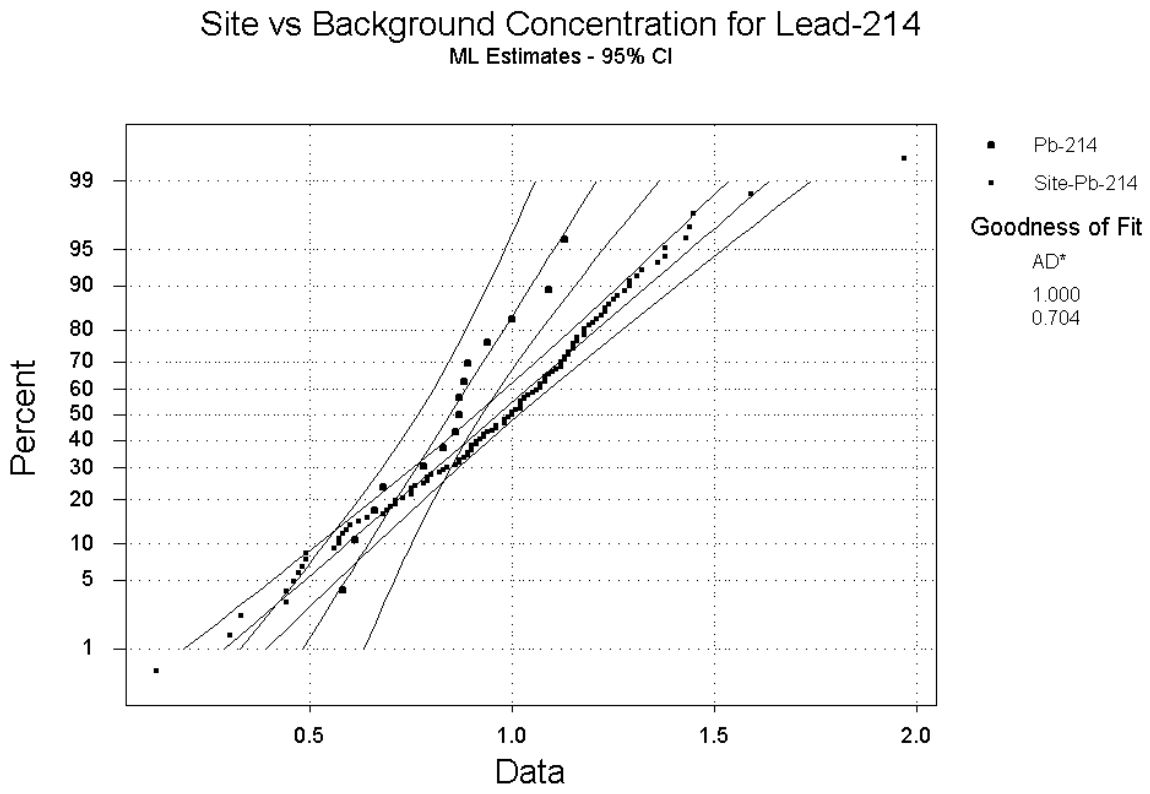
COMPARISON OF SITE AND BACKGROUND SURFACE SOIL SAMPLING RESULTS USING PROBABILITY PLOTS

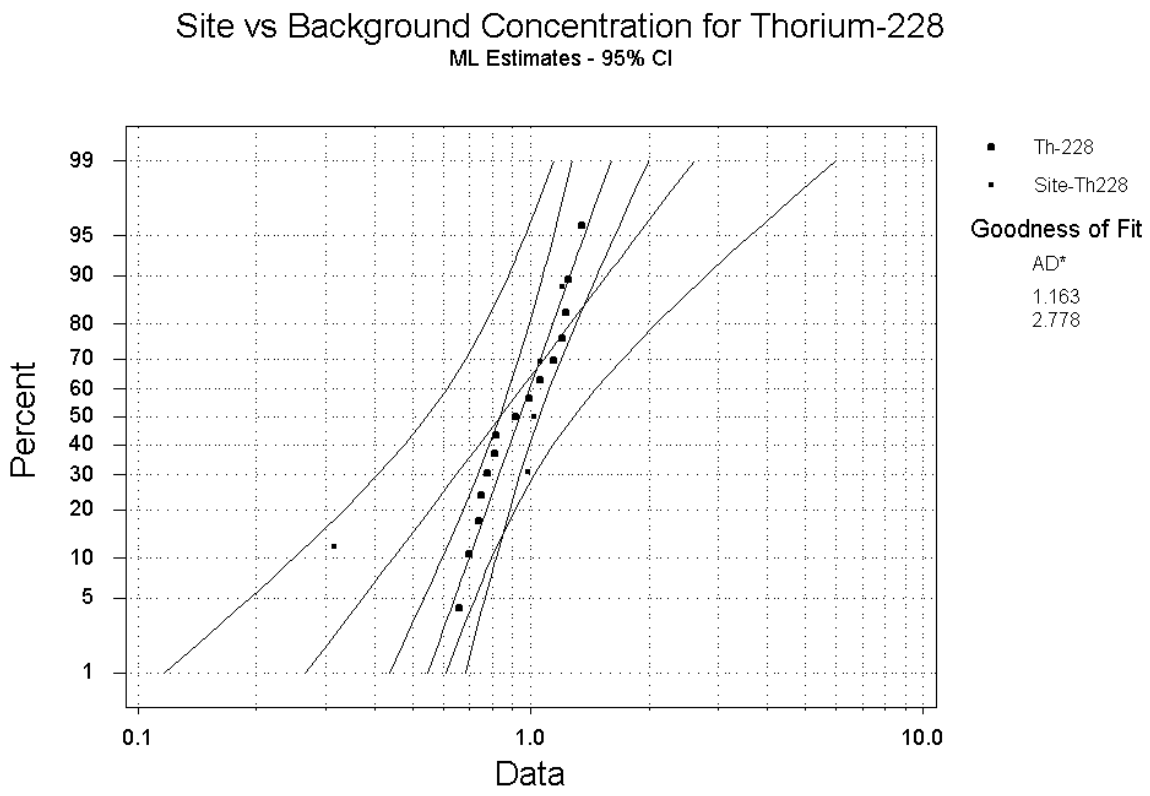
Attachment E
Probability Plots for Surface Soil Analytes

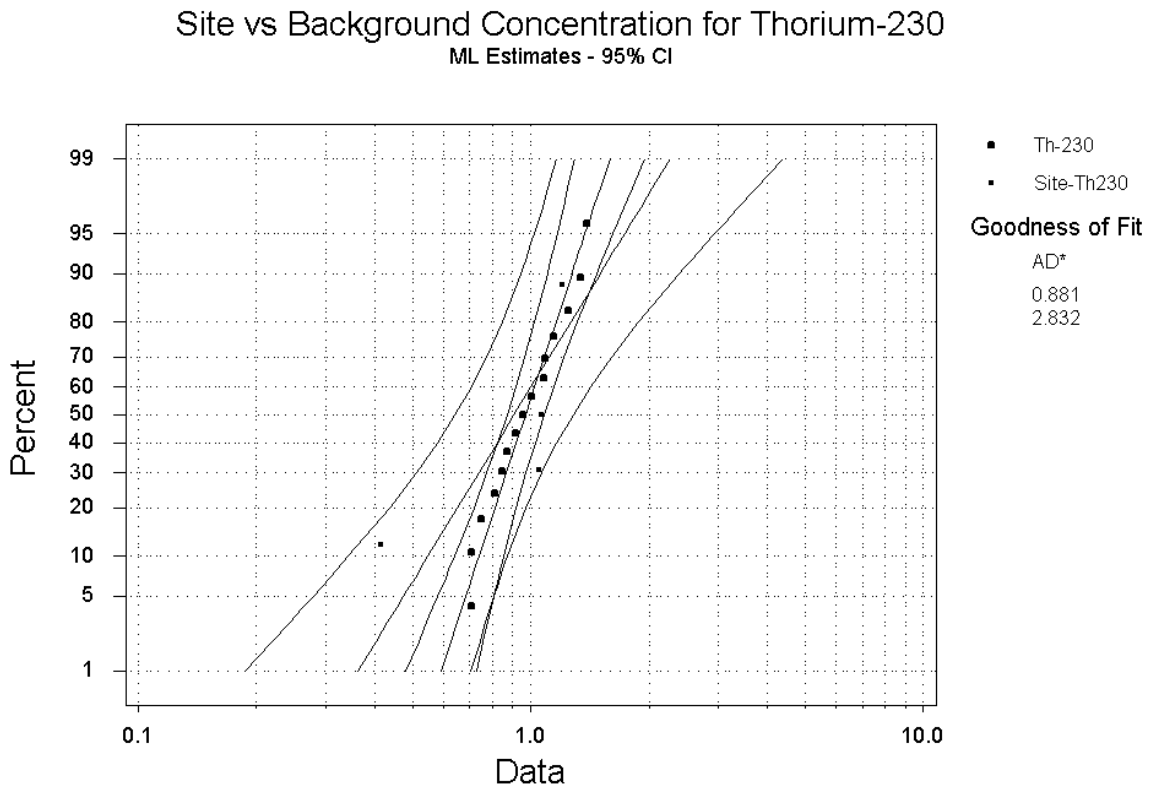


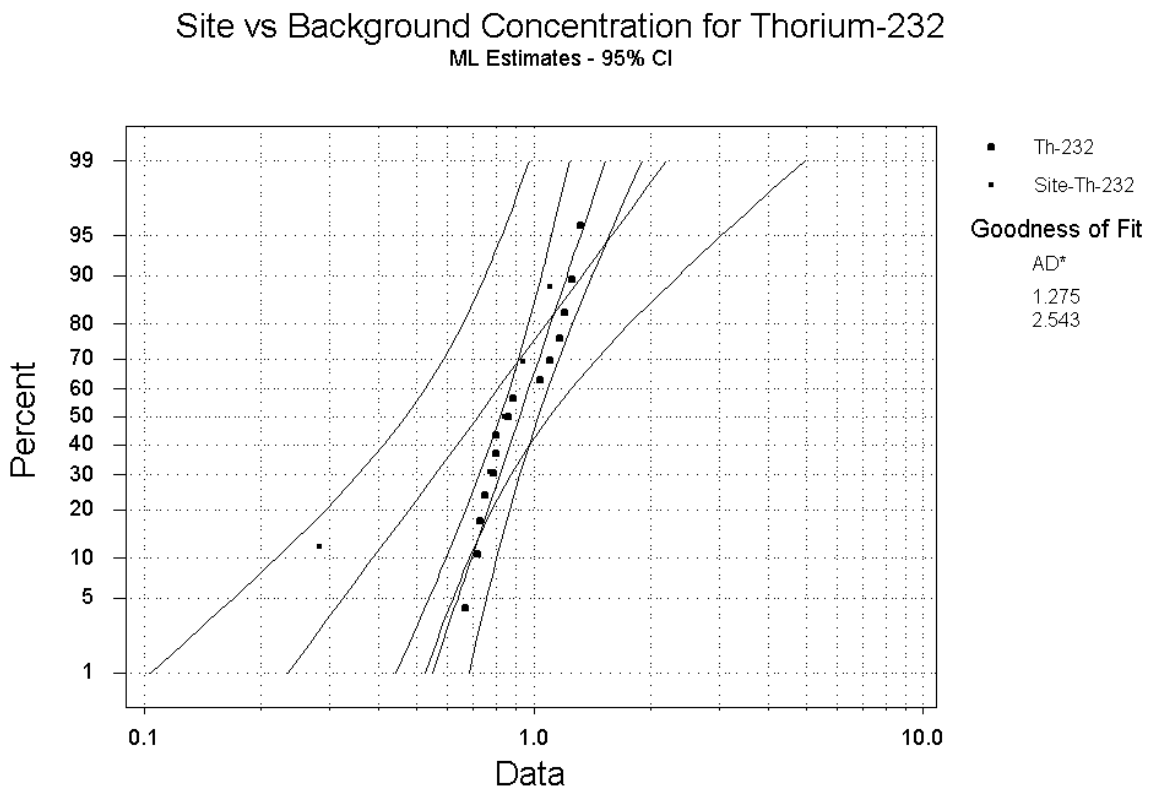


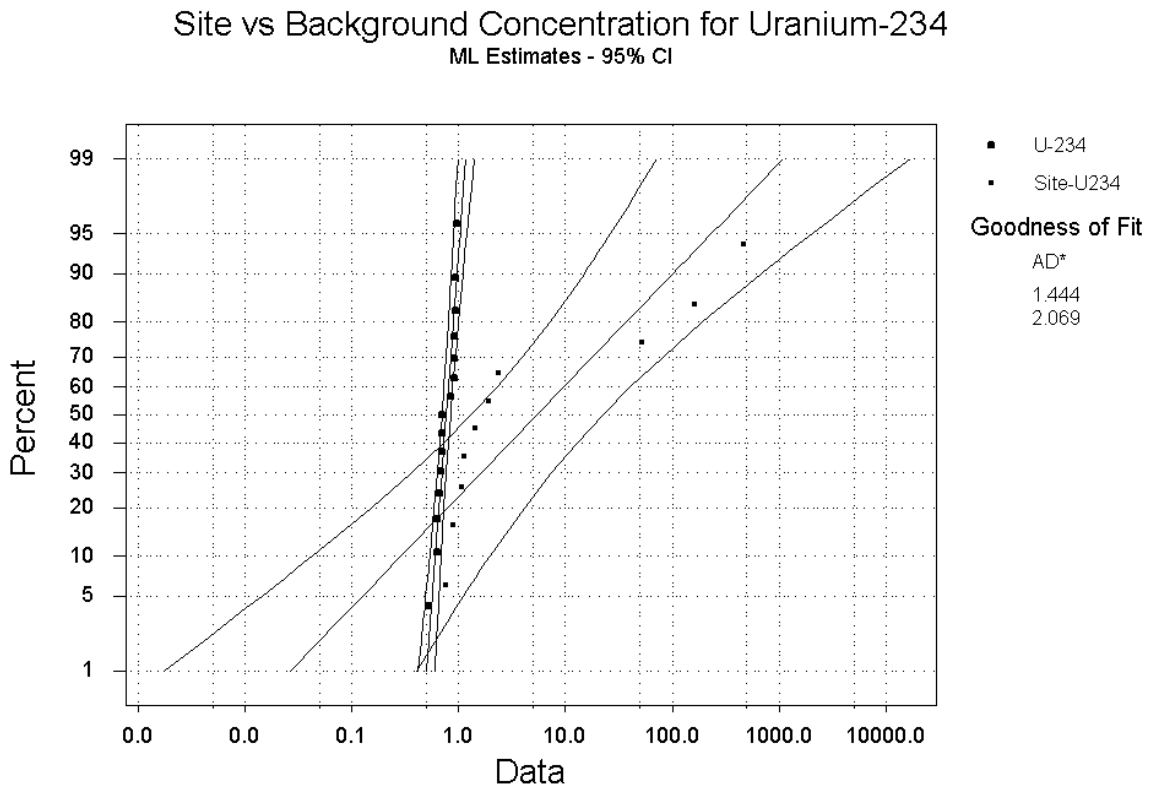
Attachment E
Probability Plots for Surface Soil Analytes

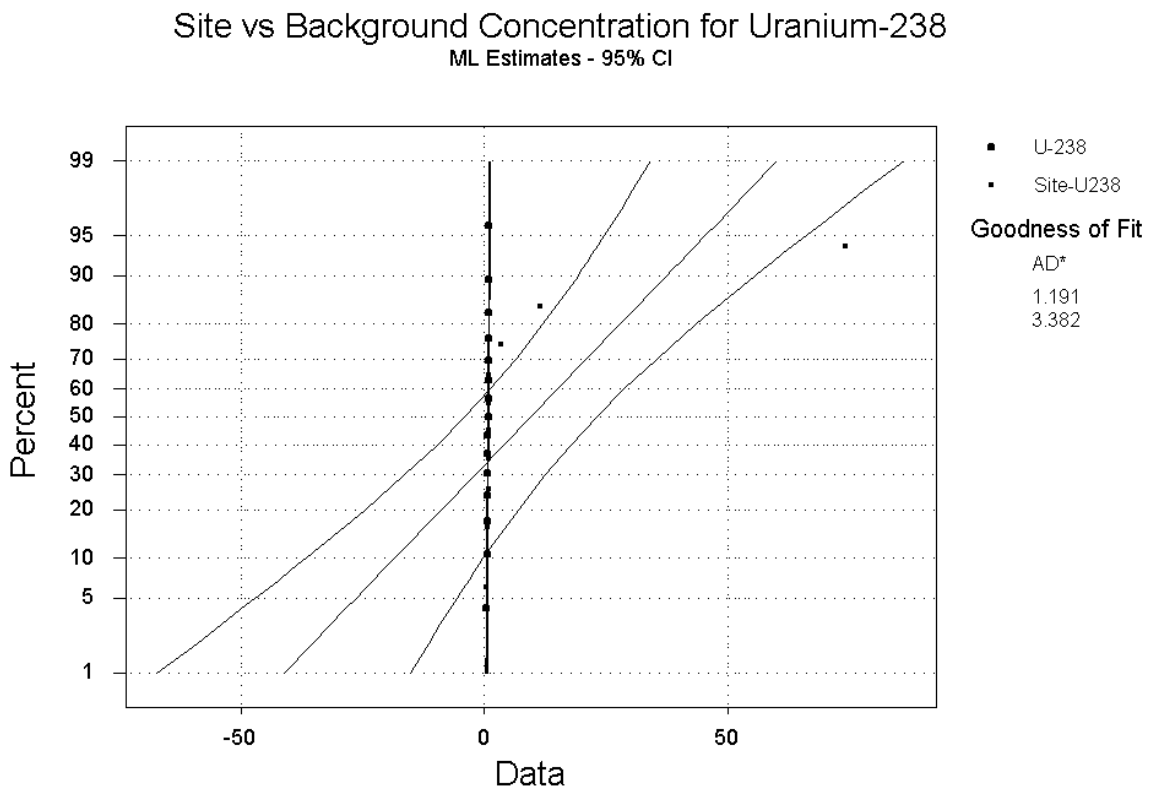


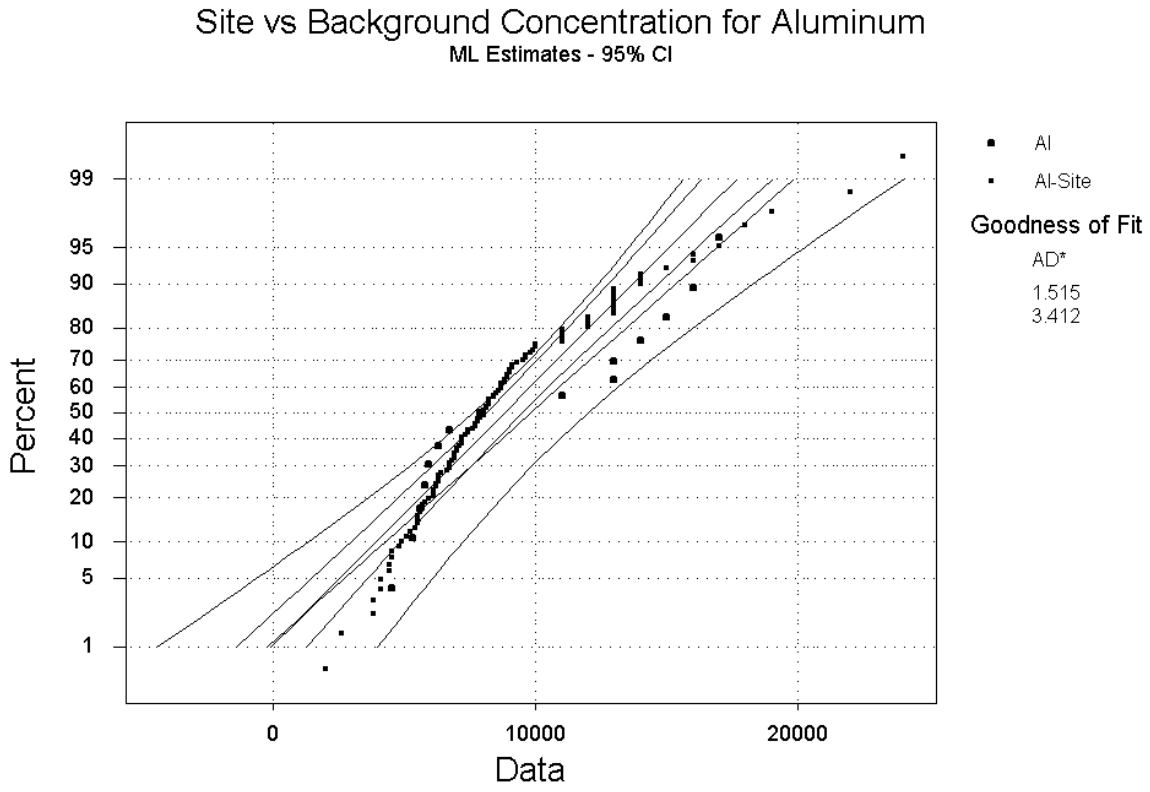


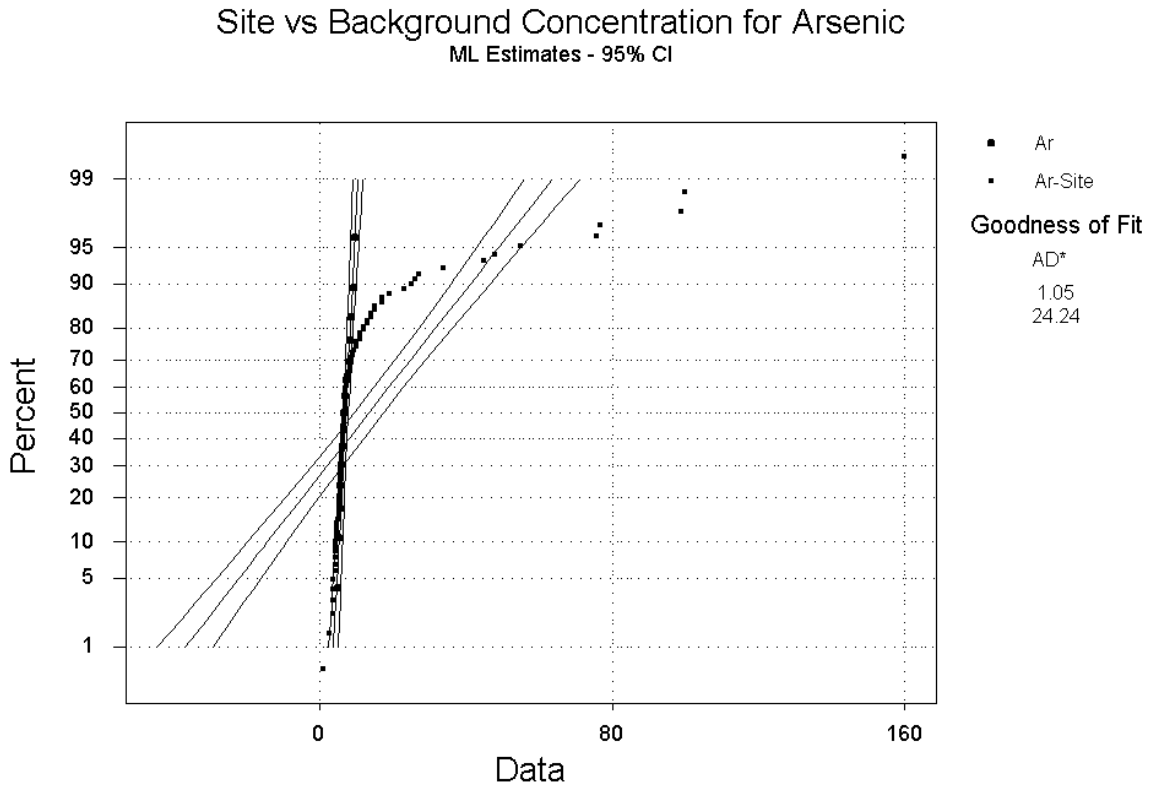

Site vs Background Concentration for Thorium-230
ML Estimates - 95% CI
Percent
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
1.0
10.0
Data
Th-230
Site-Th230
Goodness of Fit
AD*
0.881
2.832

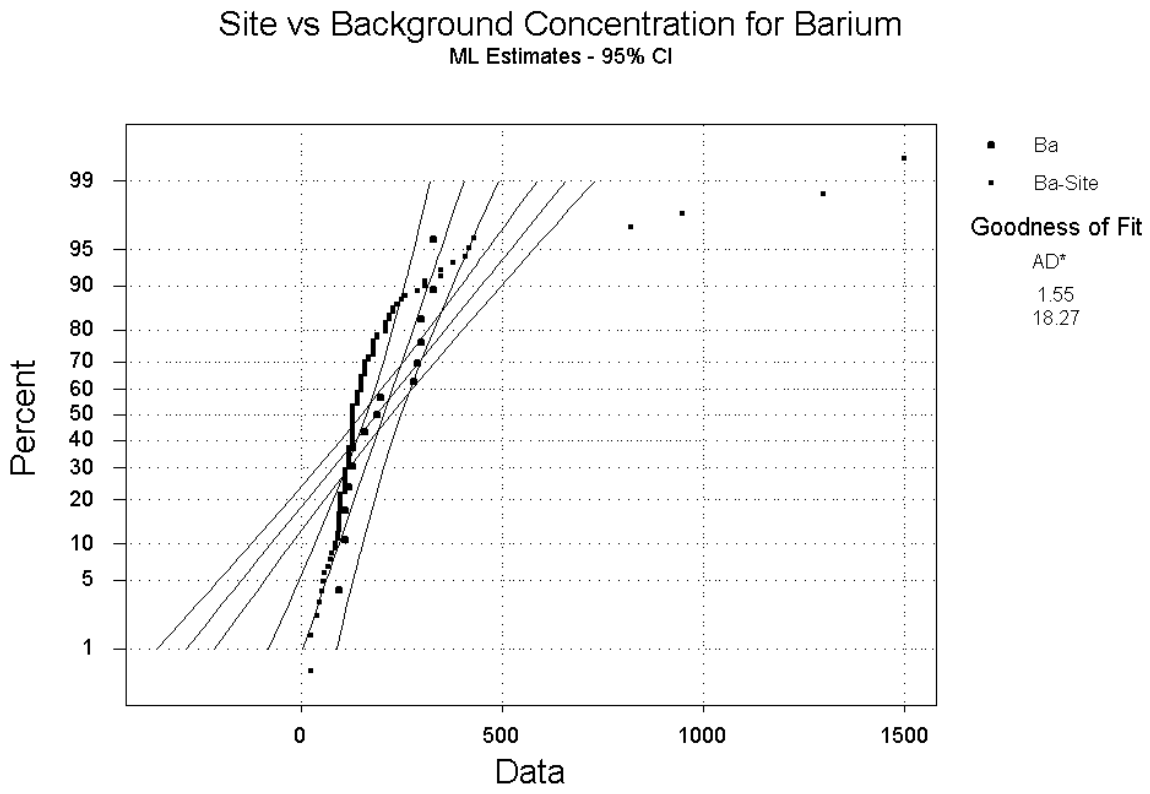

Site vs Background Concentration for Thorium-232
ML Estimates - 95% CI
Percent
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
1.0
10.0
Data
Th-232
Site-Th-232
Goodness of Fit
AD*
1.275
2.543

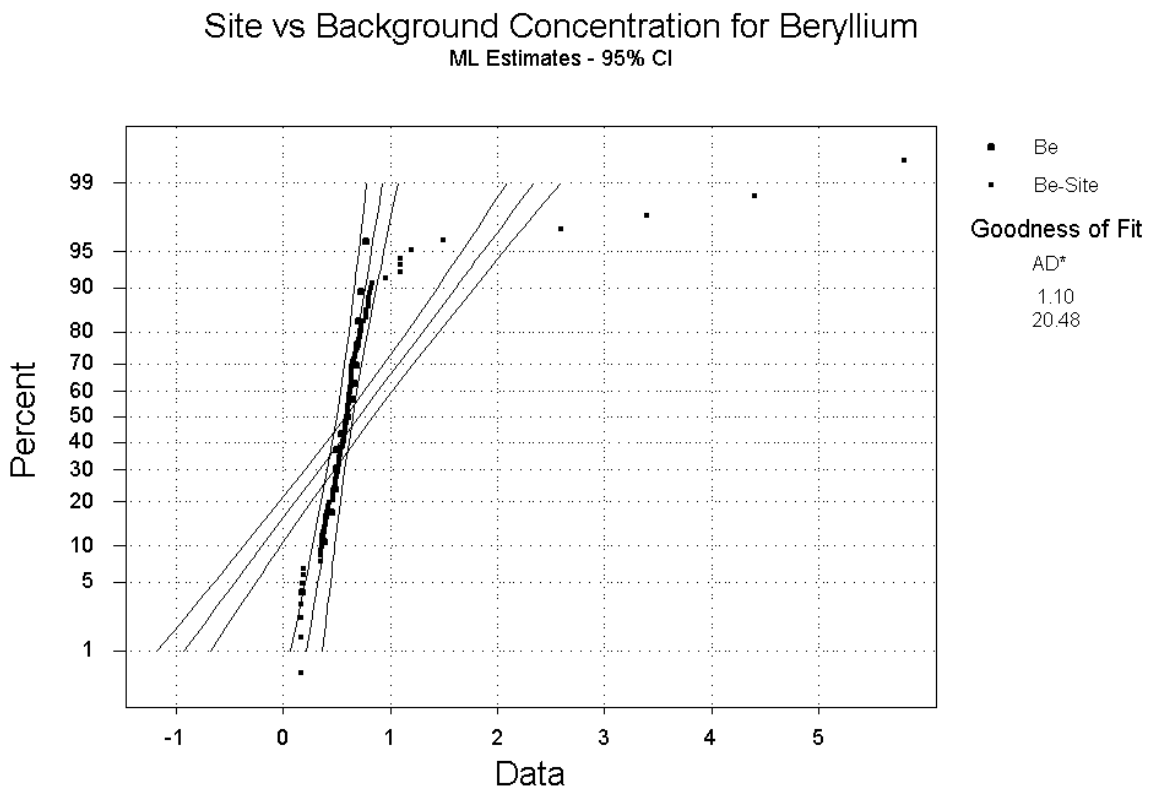

Site vs Background Concentration for Uranium-234
ML Estimates - 95% CI
Percent
99
95
90
80
70
60
50
40
30
20
10
5
1
0.0
0.0
0.1
1.0
10.0
100.0
1000.0
10000.0
Data
U-234
Site-U234
Goodness of Fit
AD*
1.444
2.069

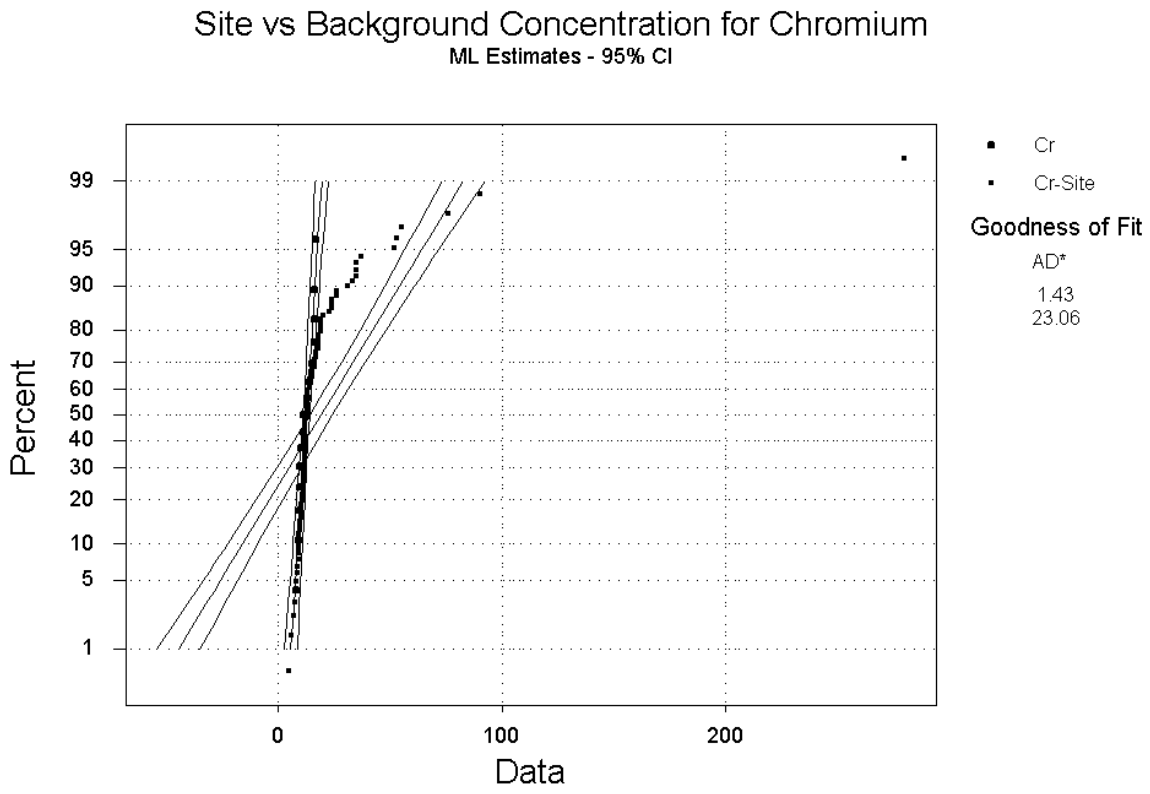

Site vs Background Concentration for Uranium-238
ML Estimates - 95% CI
Percent
99
95
90
80
70
60
50
40
30
20
10
5
1
-50
0
50
Data
U-238
Site-U238
Goodness of Fit
AD*
1.191
3.382

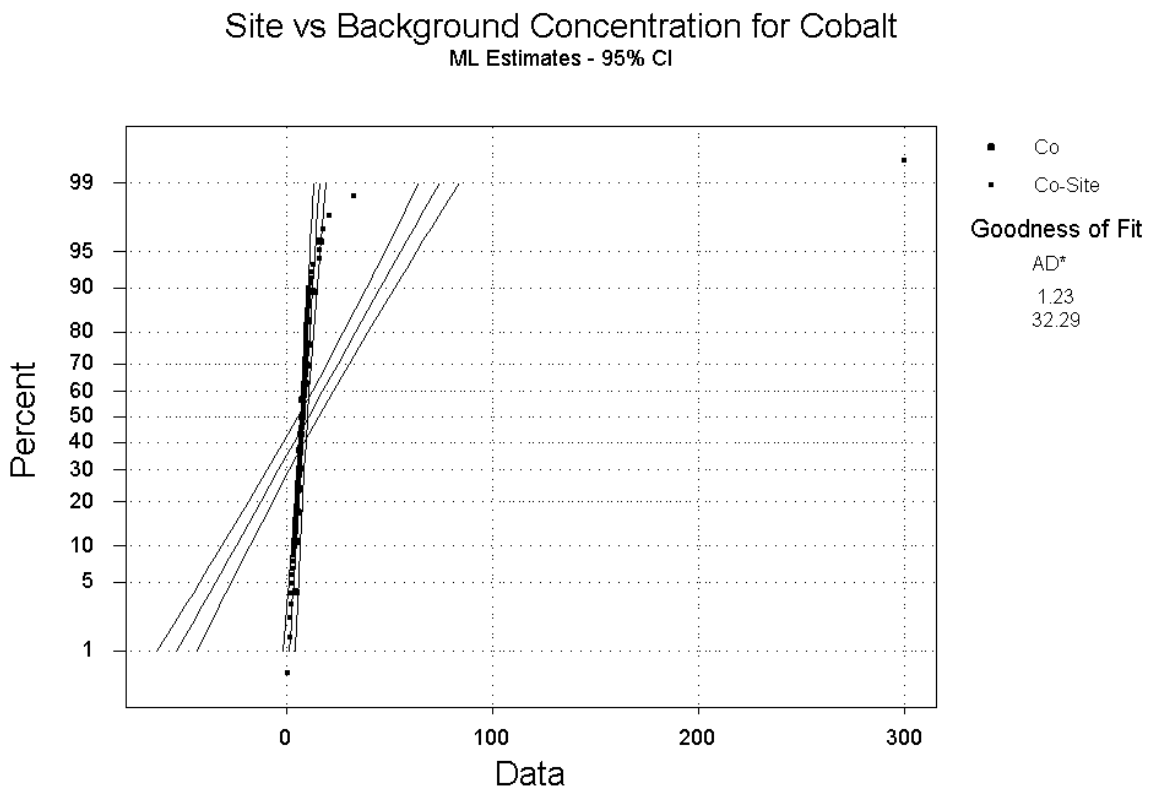

Site vs Background Concentration for Aluminum
ML Estimates - 95% CI
Percent
99
95
90
80
70
60
50
40
30
20
10
5
1
0
10000
20000
Data
Al
Al-Site
Goodness of Fit
AD*
1.515
3.412

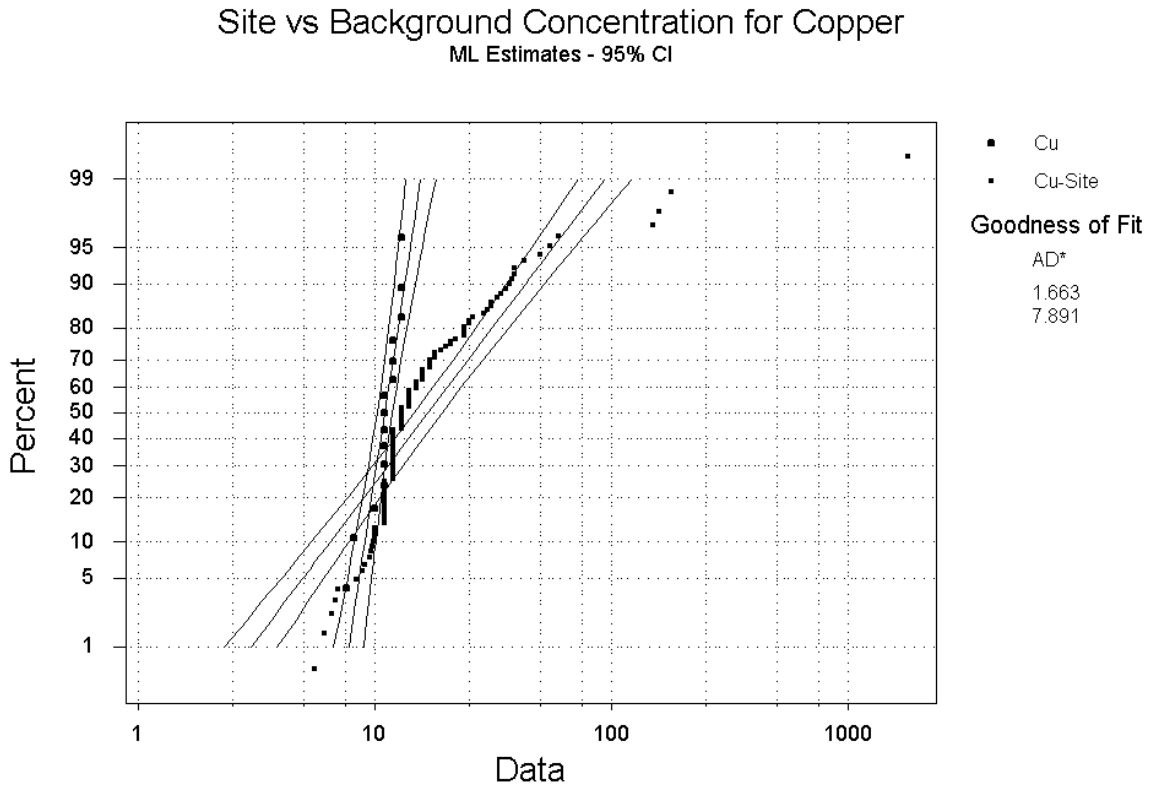

Site vs Background Concentration for Arsenic
ML Estimates - 95% CI
Percent
99
95
90
80
70
60
50
40
30
20
10
5
1
0
80
160
Data
Ar
Ar-Site
Goodness of Fit
AD*
1.05
24.24

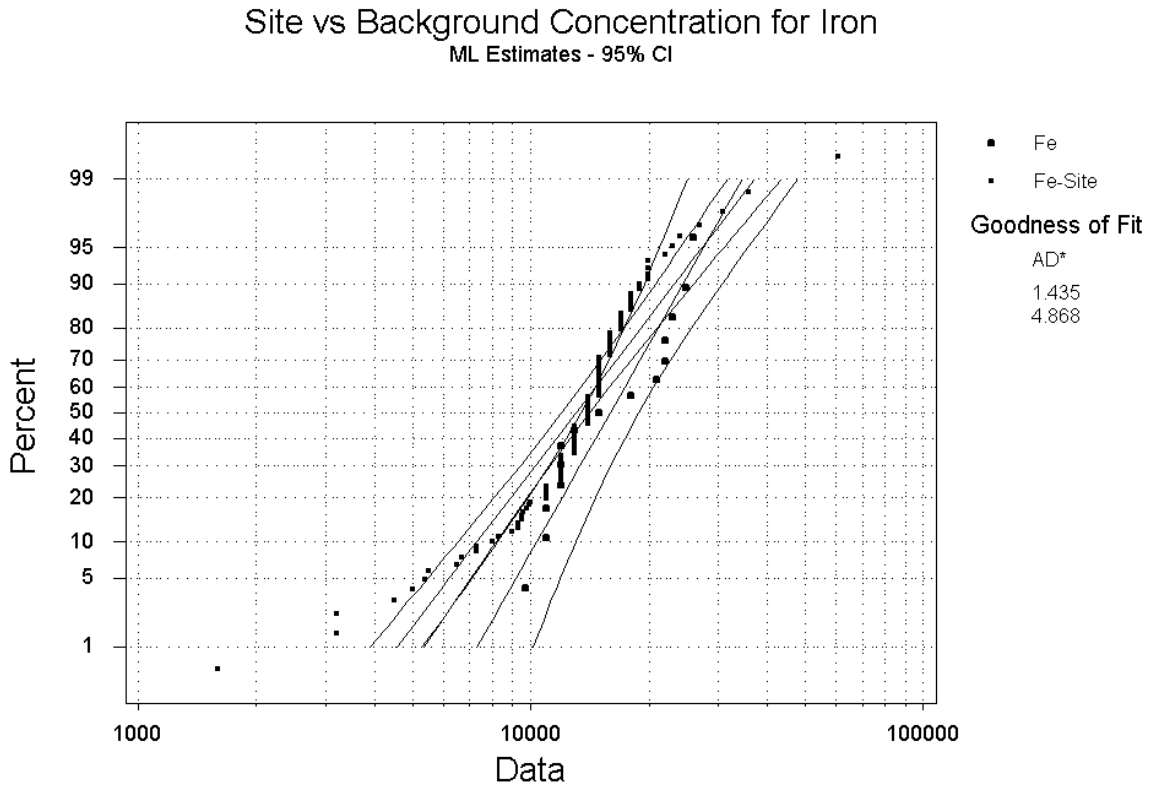

Site vs Background Concentration for Barium
ML Estimates - 95% CI
Percent
99
95
90
80
70
60
50
40
30
20
10
5
1
0
500
1000
1500
Data
Ba
Ba-Site
Goodness of Fit
AD*
1.55
18.27

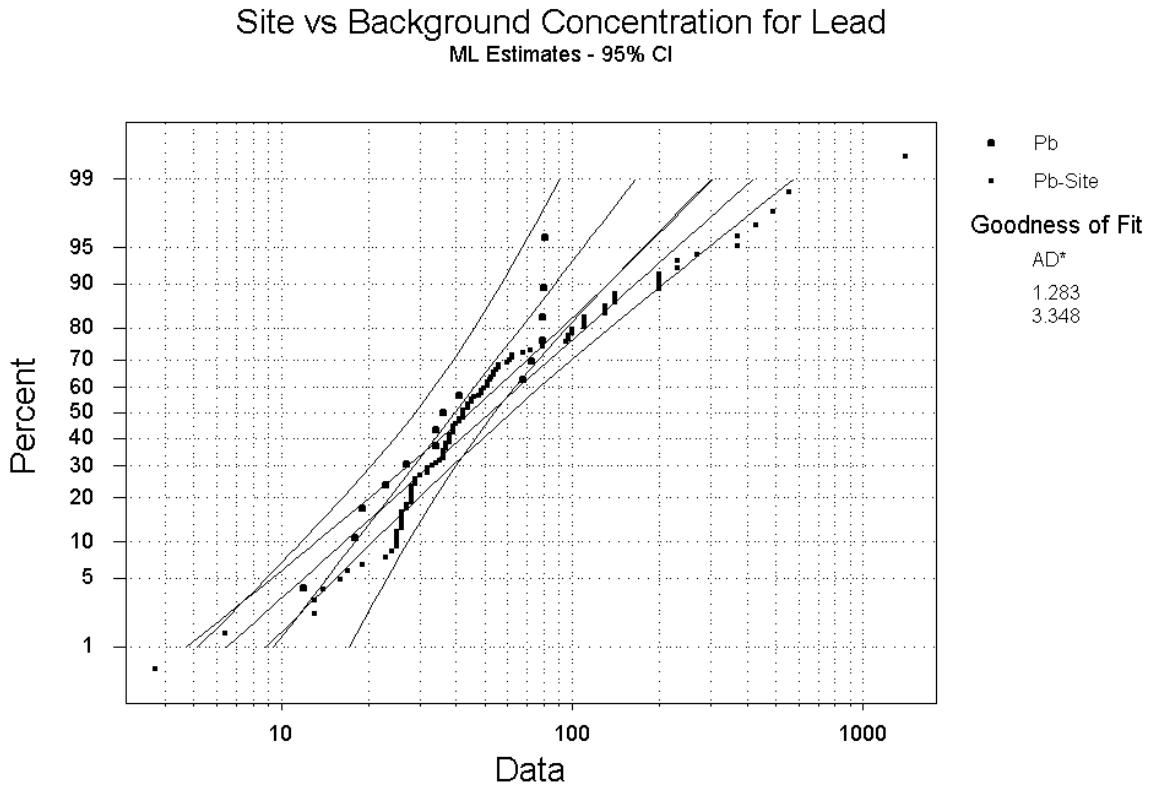

Site vs Background Concentration for Beryllium
ML Estimates - 95% CI
Percent
99
95
90
80
70
60
50
40
30
20
10
5
1
-1
0
1
2
3
4
5
Data
Be
Be-Site
Goodness of Fit
AD*
1.10
20.48

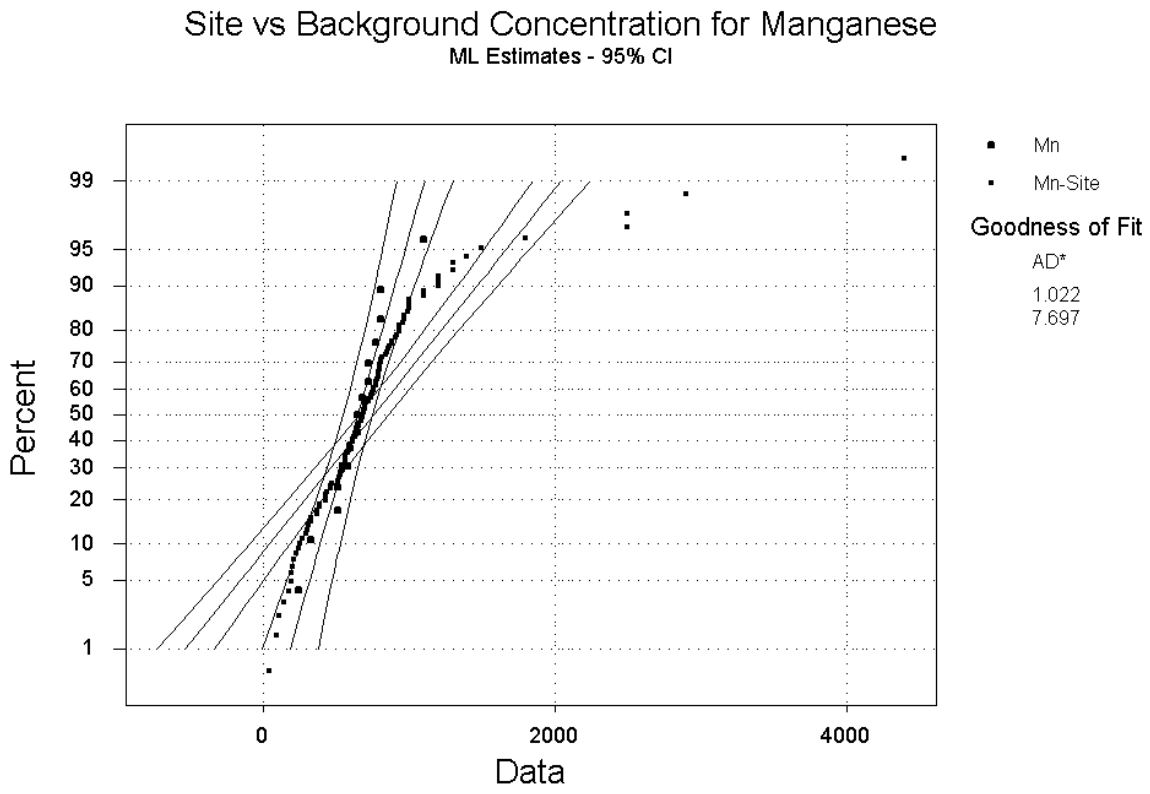

Site vs Background Concentration for Chromium
ML Estimates - 95% CI
Percent
99
95
90
80
70
60
50
40
30
20
10
5
1
0
100
200
Data
Cr
Cr-Site
Goodness of Fit
AD*
1.43
23.06

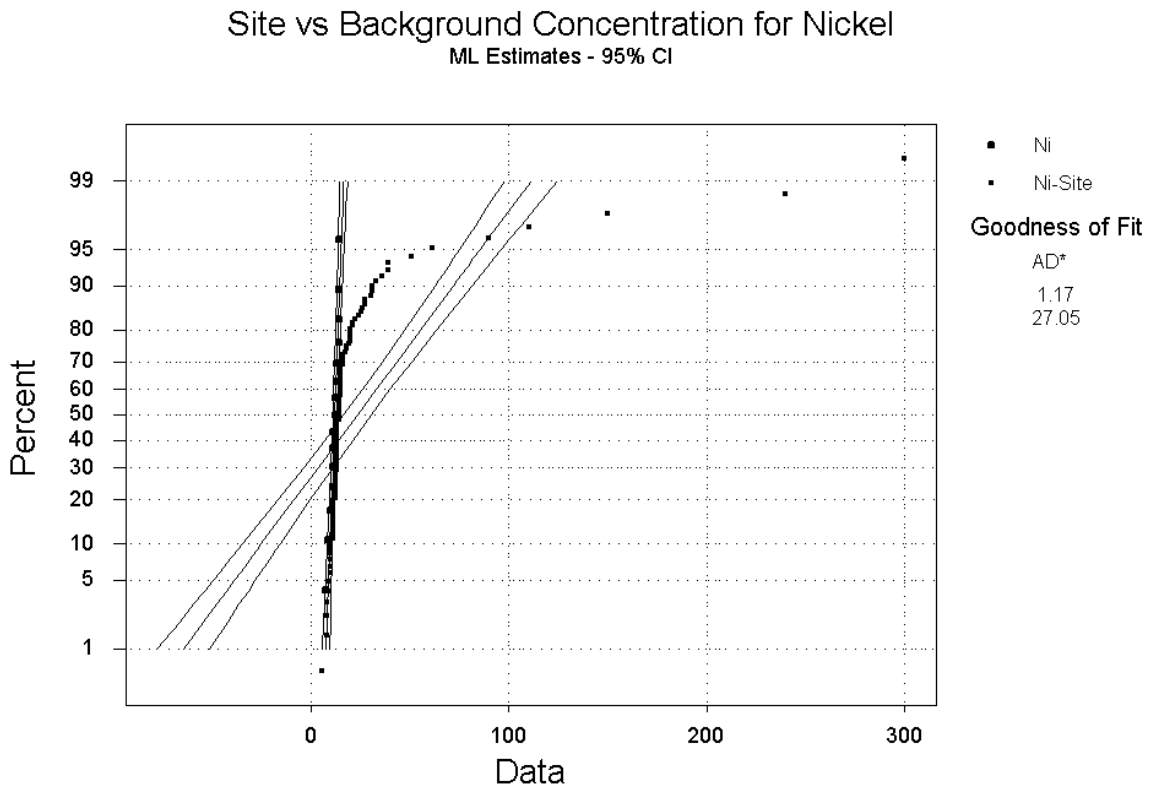

Site vs Background Concentration for Cobalt
ML Estimates - 95% CI
Percent
99
95
90
80
70
60
50
40
30
20
10
5
1
0
100
200
300
Data
Co
Co-Site
Goodness of Fit
AD*
1.23
32.29

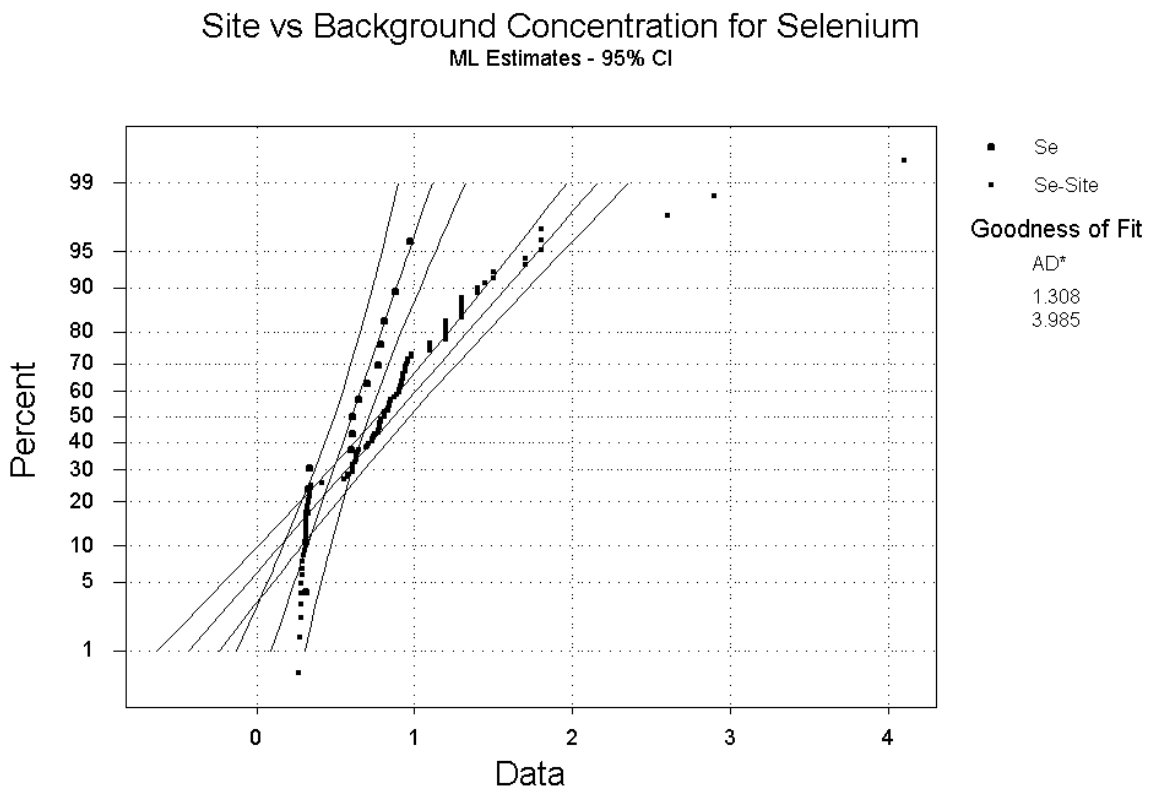

Site vs Background Concentration for Copper
ML Estimates - 95% CI
Percent
99
95
90
80
70
60
50
40
30
20
10
5
1
1
10
100
1000
Data
Cu
Cu-Site
Goodness of Fit
AD*
1.663
7.891

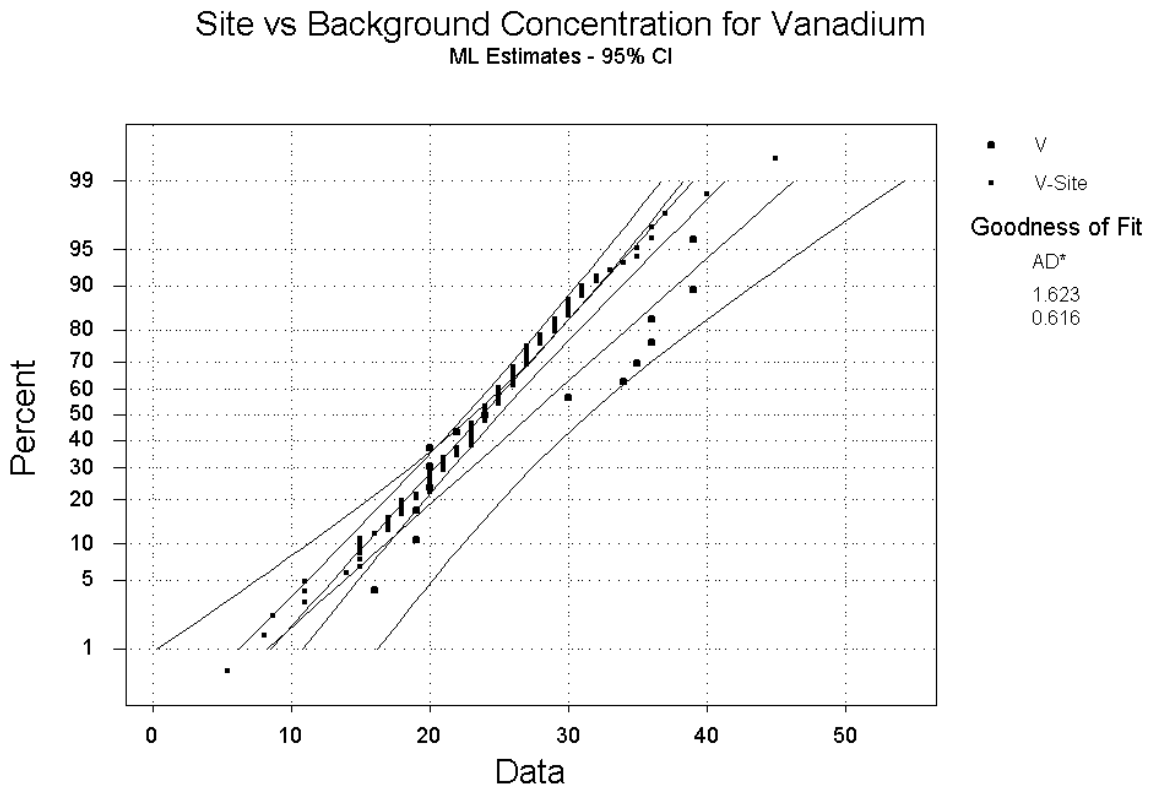

Site vs Background Concentration for Iron
ML Estimates - 95% CI
Percent
99
95
90
80
70
60
50
40
30
20
10
5
1
1000
10000
100000
Data
Fe
Fe-Site
Goodness of Fit
AD*
1.435
4.868


Site vs Background Concentration for Lead
ML Estimates - 95% CI
Percent
99
95
90
80
70
60
50
40
30
20
10
5
1
10
100
1000
Data
Pb
Pb-Site
Goodness of Fit
AD*
1.283
3.348


Site vs Background Concentration for Manganese
ML Estimates - 95% CI
Percent
99
95
90
80
70
60
50
40
30
20
10
5
1
0
2000
4000
Data
Mn
Mn-Site
Goodness of Fit
AD*
1.022
7.697


Site vs Background Concentration for Nickel
ML Estimates - 95% CI
Percent
99
95
90
80
70
60
50
40
30
20
10
5
1
0
100
200
300
Data
Ni
Ni-Site
Goodness of Fit
AD*
1.17
27.05

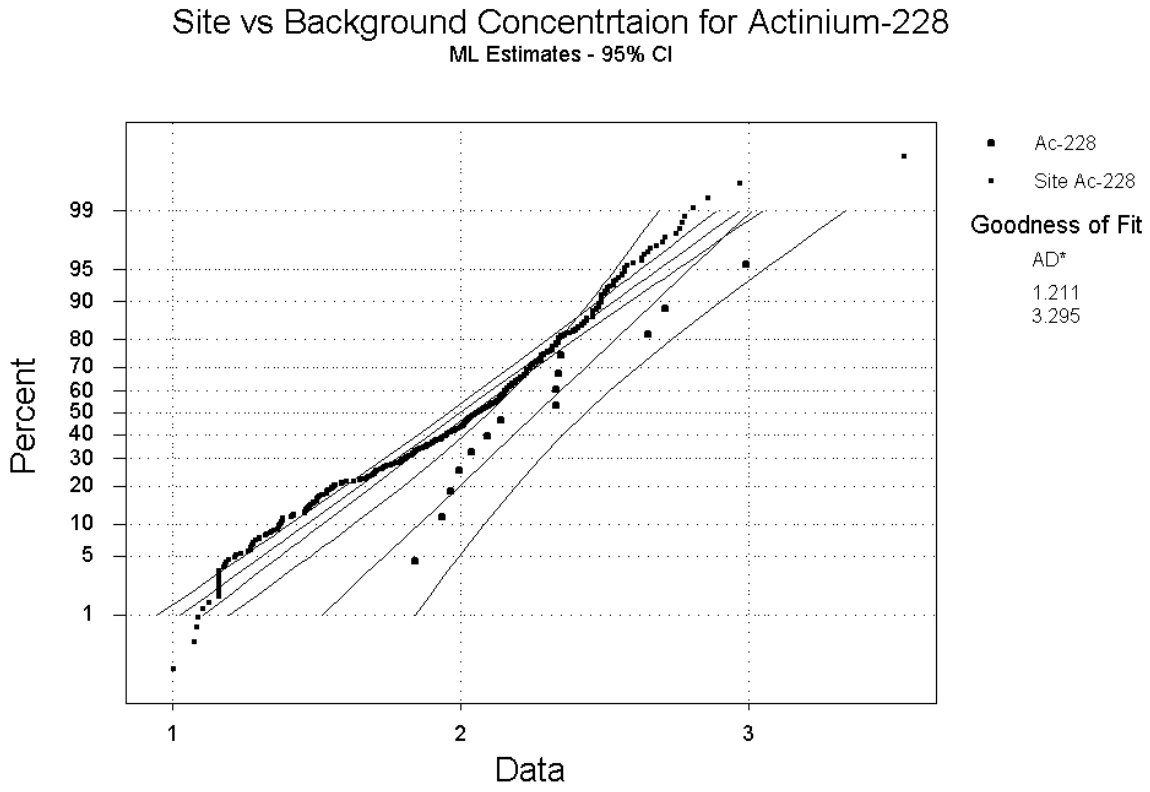

Site vs Background Concentration for Selenium
ML Estimates - 95% CI
Percent
99
95
90
80
70
60
50
40
30
20
10
5
1
0
1
2
3
4
Data
Se
Se-Site
Goodness of Fit
AD*
1.308
3.985

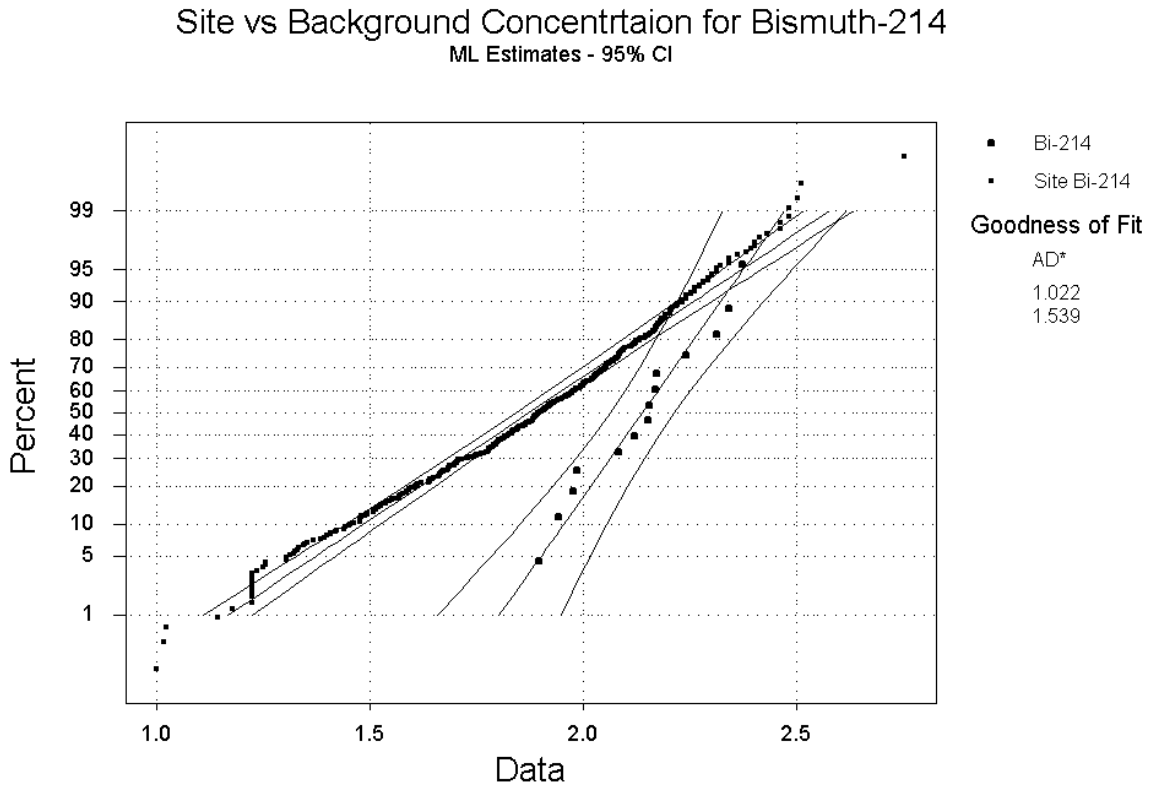

Site vs Background Concentration for Vanadium
ML Estimates - 95% CI
Percent
99
95
90
80
70
60
50
40
30
20
10
5
1
0
10
20
30
40
50
Data
V
V-Site
Goodness of Fit
AD*
1.623
0.616

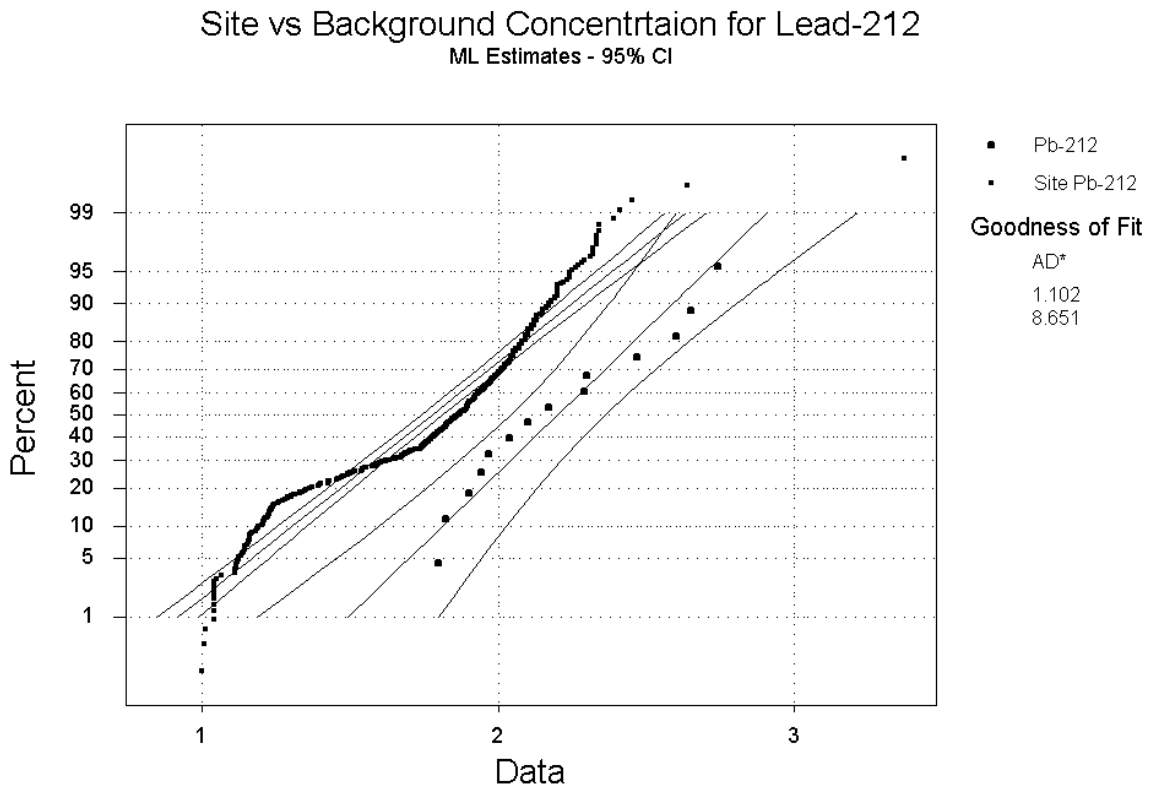
ATTACHMENT F

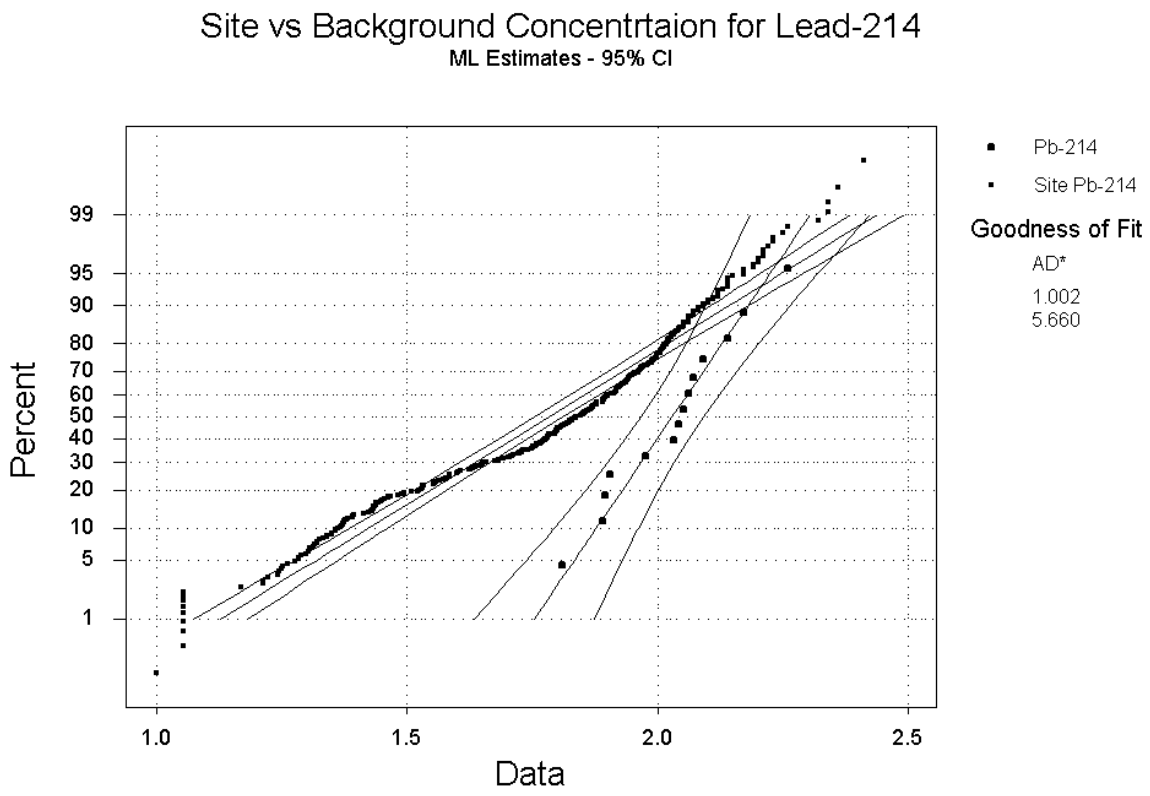
COMPARISON OF SITE AND BACKGROUND SUBSURFACE SOIL SAMPLING RESULTS USING PROBABILITY PLOTS

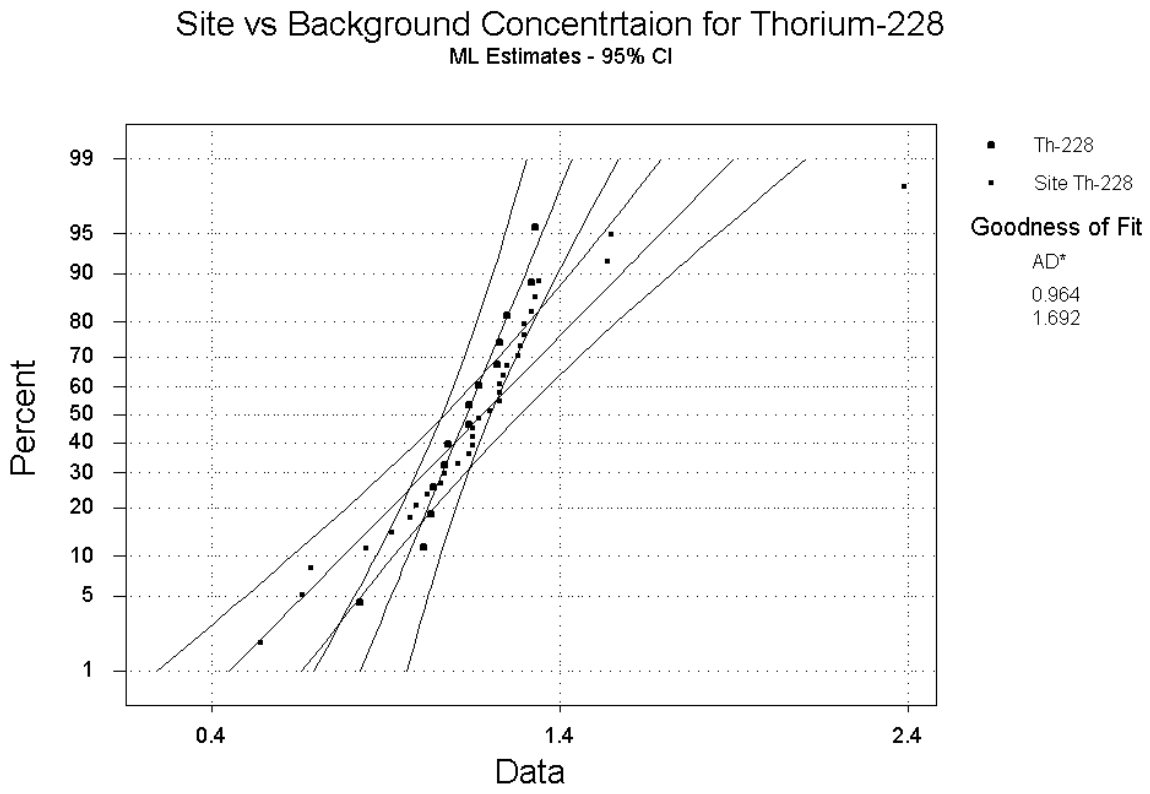
Attachment F
Probability Plots for Subsurface Soil Analytes

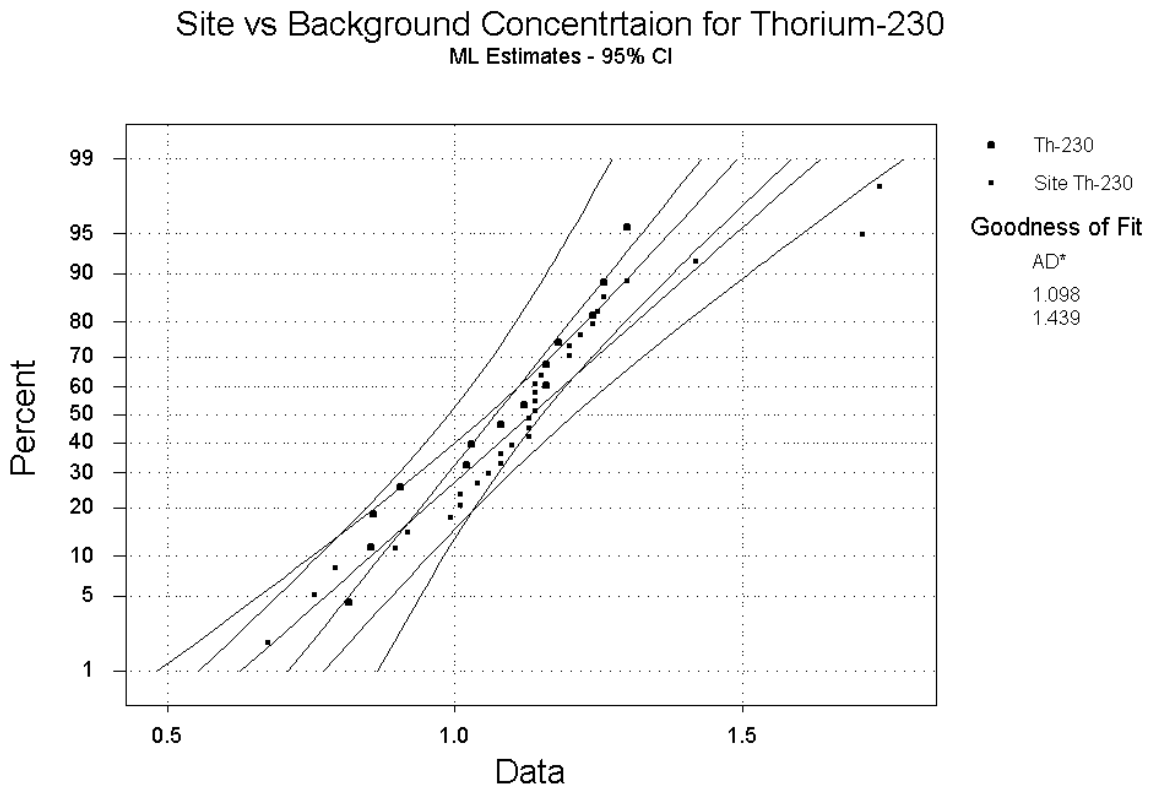


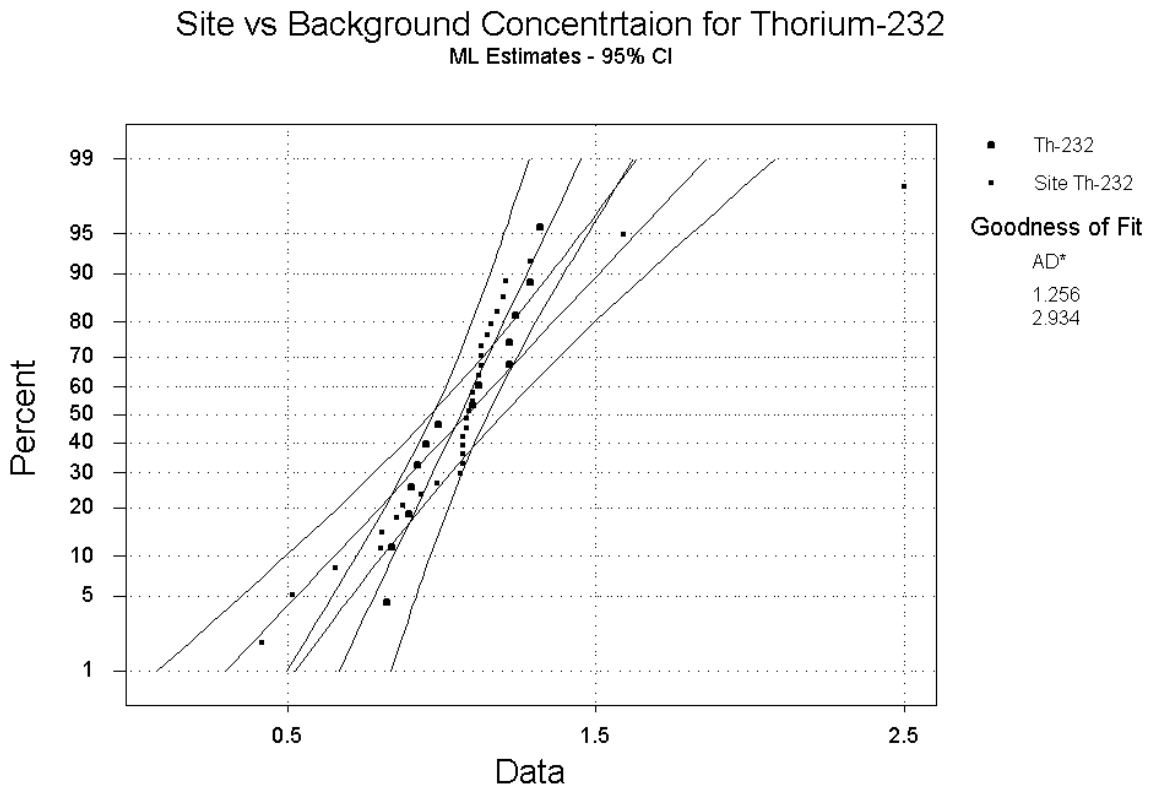


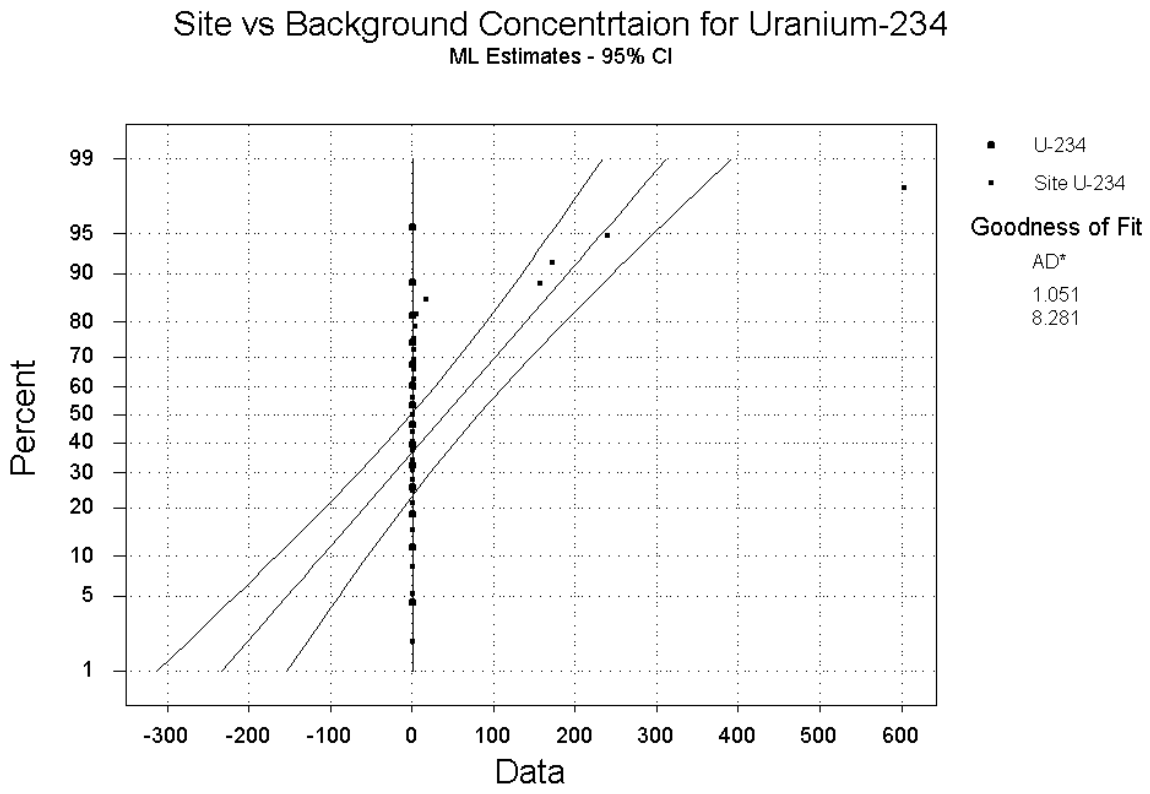

Site vs Background Concentrtaion for Lead-212
ML Estimates - 95% CI
Percent
99
95
90
80
70
60
50
40
30
20
10
5
1
1
2
3
Data
Pb-212
Site Pb-212
Goodness of Fit
AD*
1.102
8.651

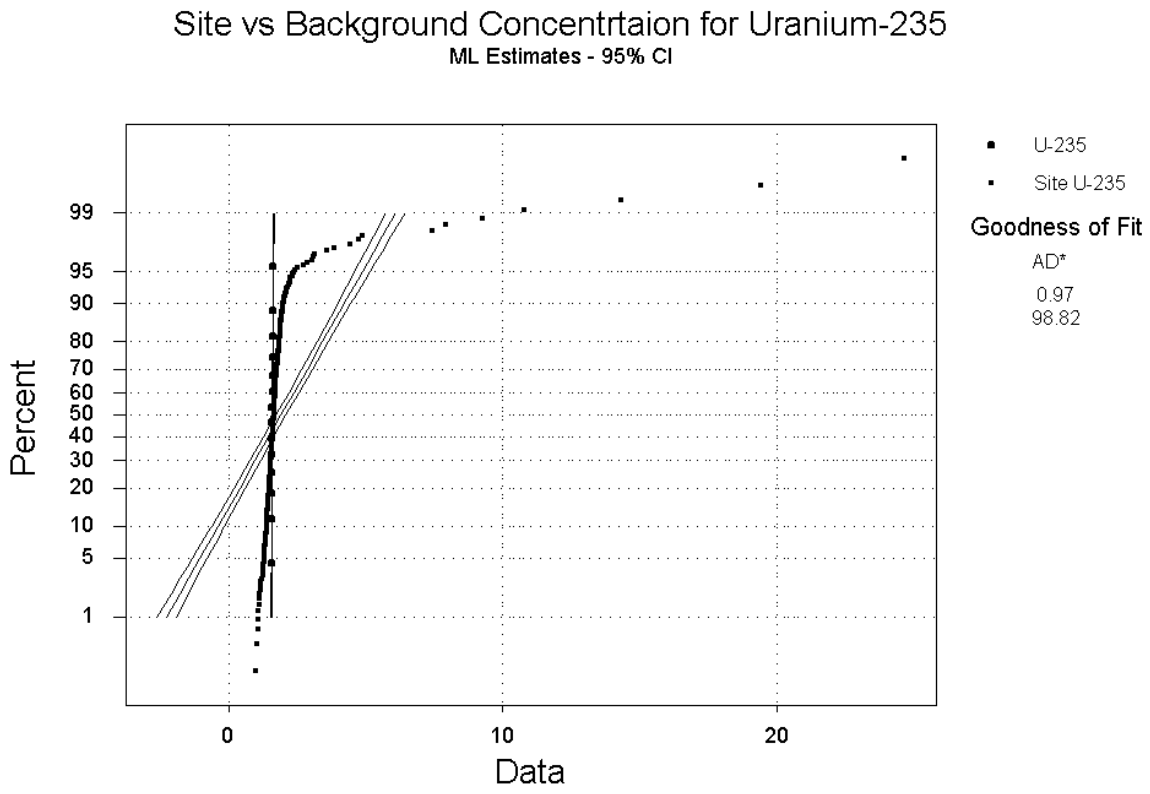

Site vs Background Concentrtaion for Lead-214
ML Estimates - 95% CI
Percent
99
95
90
80
70
60
50
40
30
20
10
5
1
1.0
1.5
2.0
2.5
Data
Pb-214
Site Pb-214
Goodness of Fit
AD*
1.002
5.660

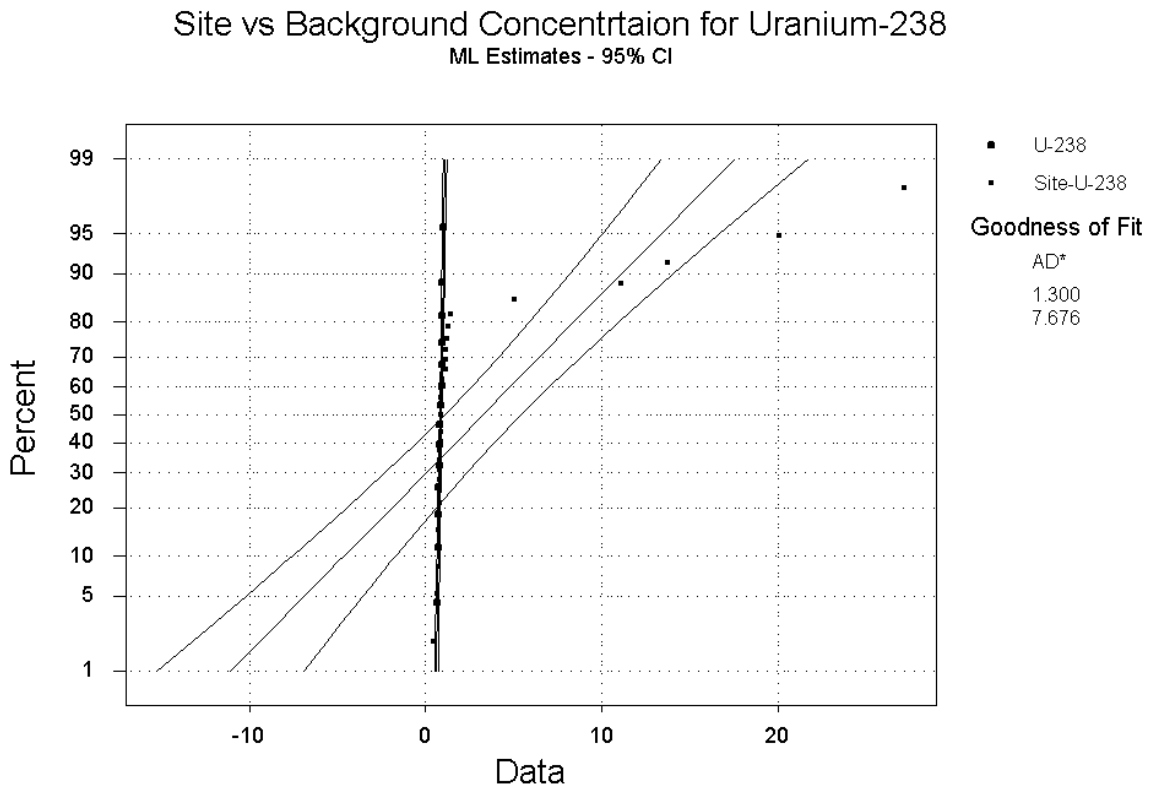

Site vs Background Concentrtaion for Thorium-228
ML Estimates - 95% CI
Percent
99
95
90
80
70
60
50
40
30
20
10
5
1
0.4
1.4
2.4
Data
Th-228
Site Th-228
Goodness of Fit
AD*
0.964
1.692

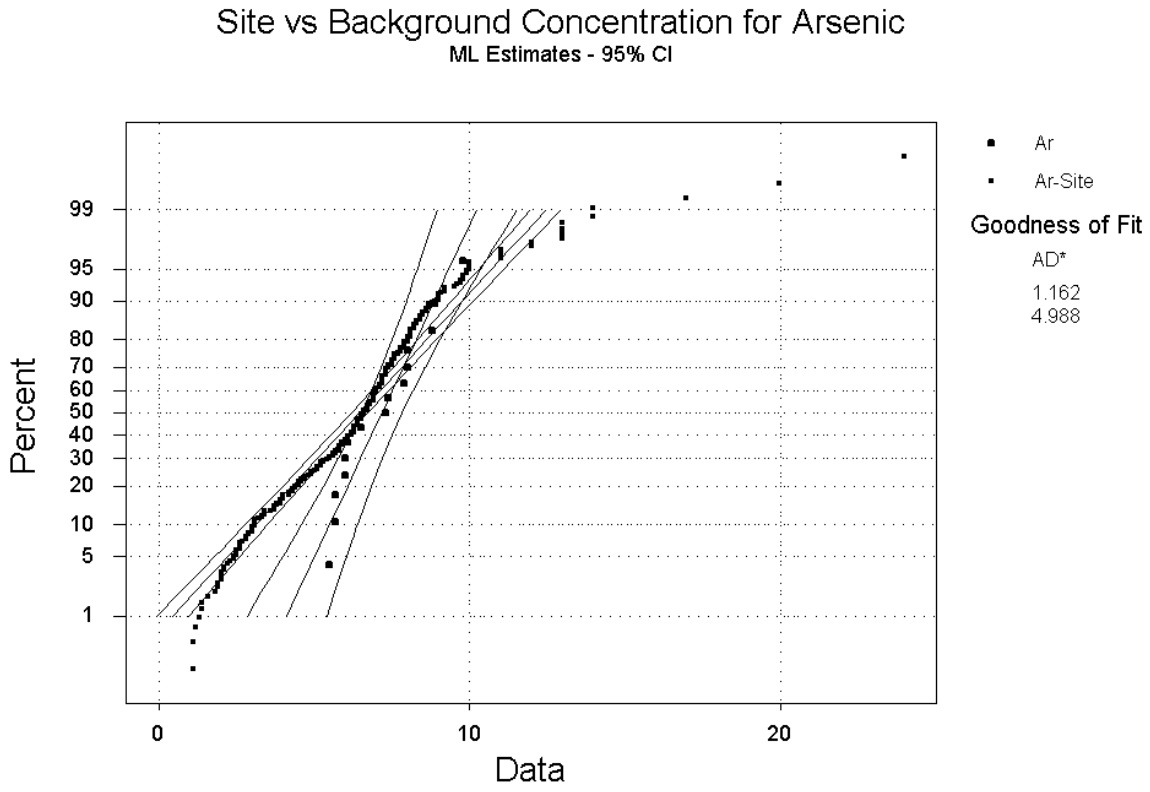

Site vs Background Concentrtaion for Thorium-230
ML Estimates - 95% CI
Percent
99
95
90
80
70
60
50
40
30
20
10
5
1
0.5
1.0
1.5
Data
Th-230
Site Th-230
Goodness of Fit
AD*
1.098
1.439

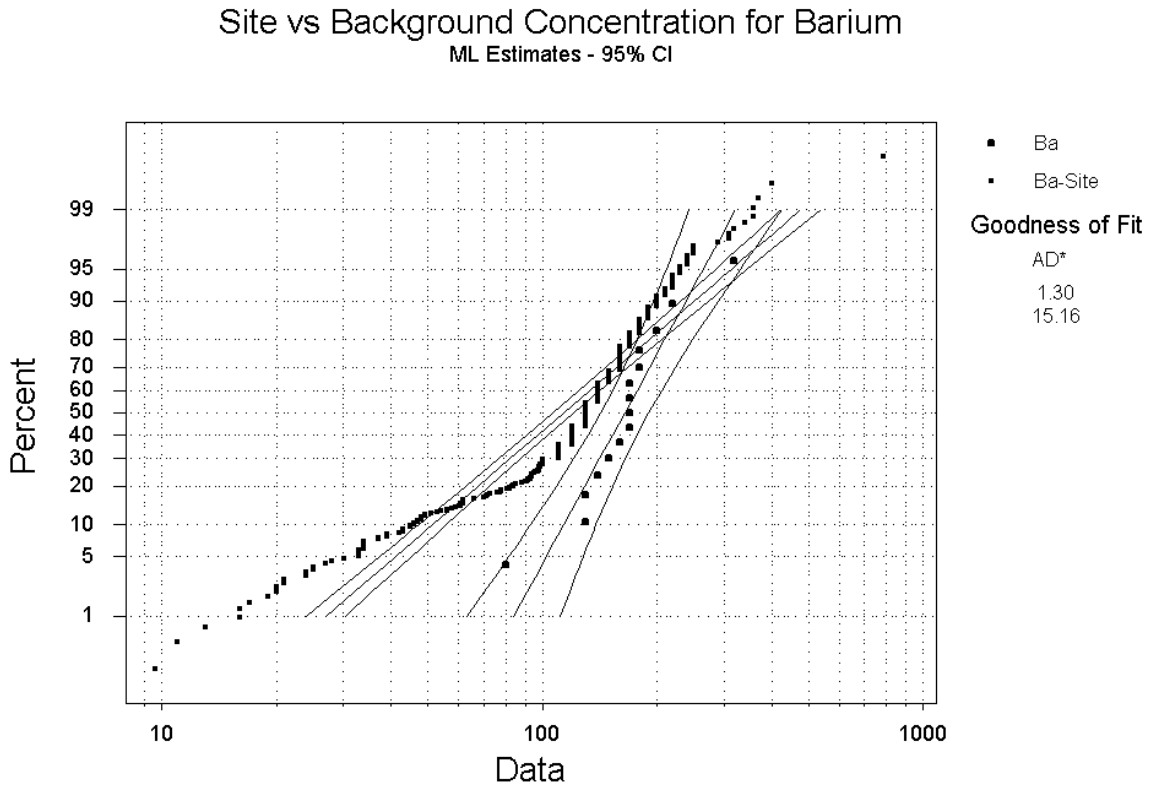

Site vs Background Concentrtaion for Thorium-232
ML Estimates - 95% CI
Percent
99
95
90
80
70
60
50
40
30
20
10
5
1
0.5
1.5
2.5
Data
Th-232
Site Th-232
Goodness of Fit
AD*
1.256
2.934

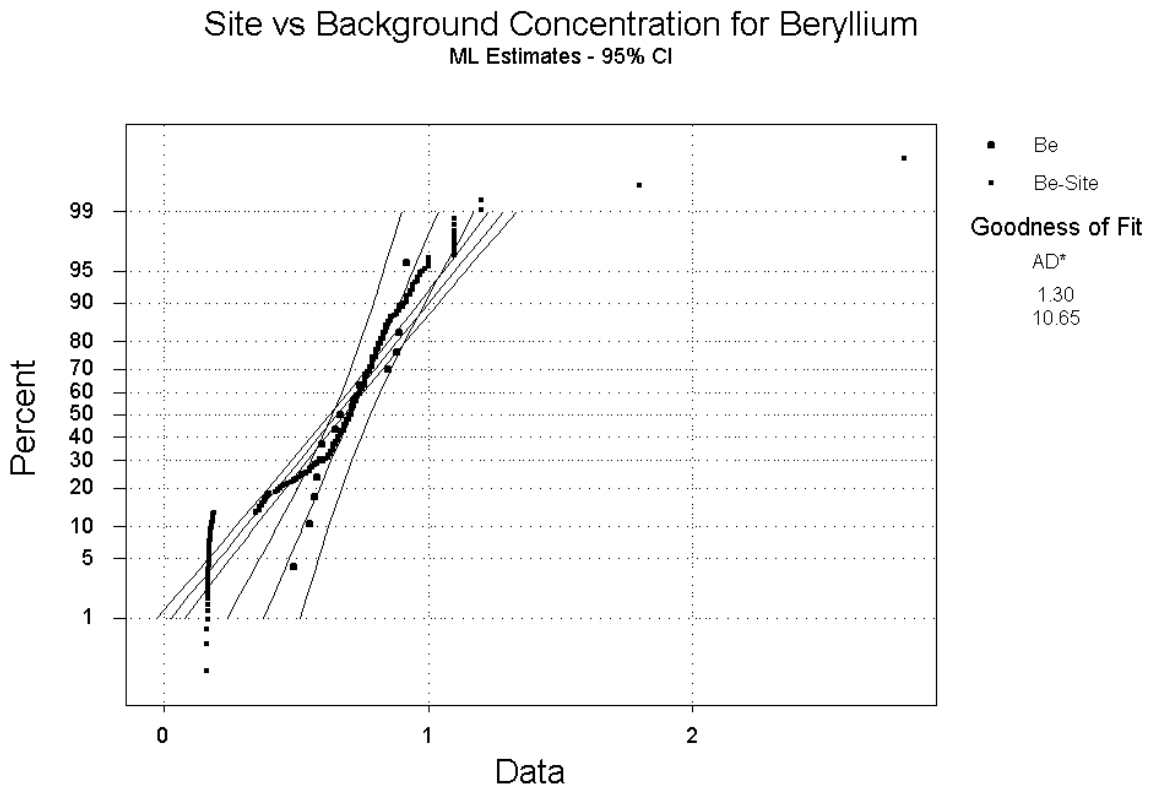

Site vs Background Concentrtaion for Uranium-234
ML Estimates - 95% CI
Percent
99
95
90
80
70
60
50
40
30
20
10
5
1
-300
-200
-100
0
100
200
300
400
500
600
Data
U-234
Site U-234
Goodness of Fit
AD*
1.051
8.281

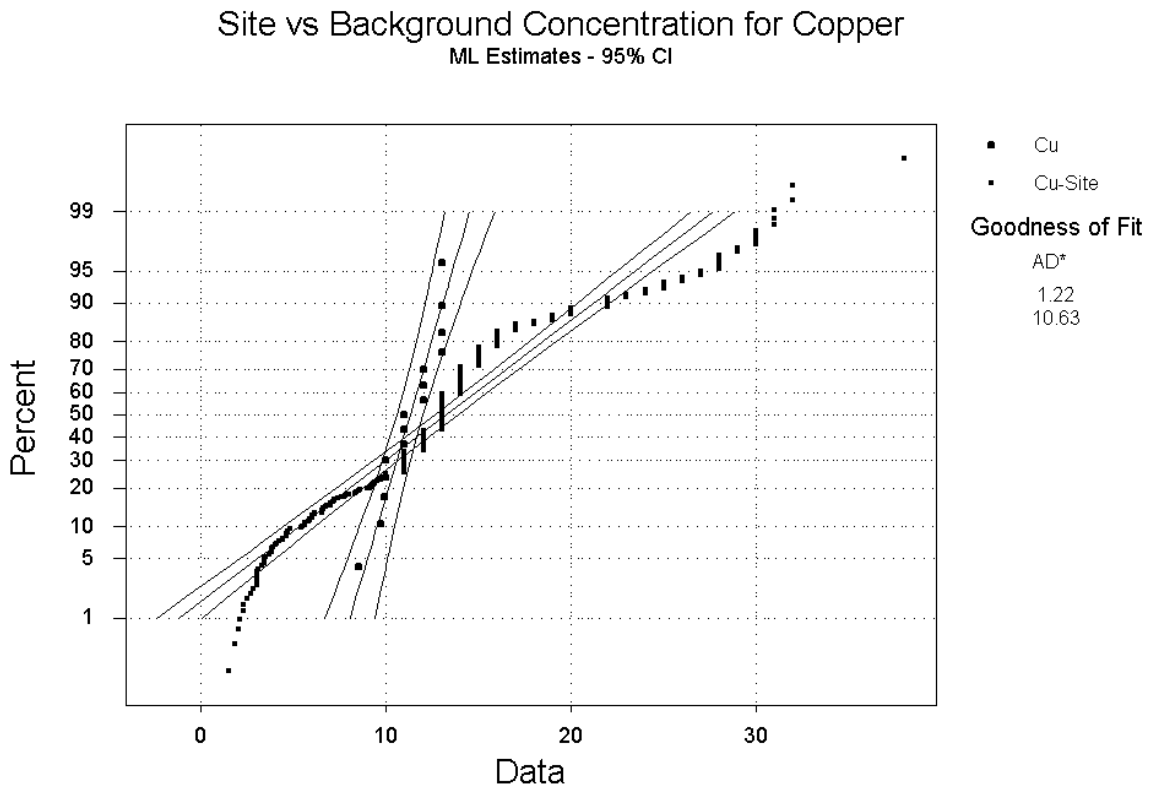

Site vs Background Concentrtaion for Uranium-235
ML Estimates - 95% CI
Percent
99
95
90
80
70
60
50
40
30
20
10
5
1
0
10
20
Data
U-235
Site U-235
Goodness of Fit
AD*
0.97
98.82

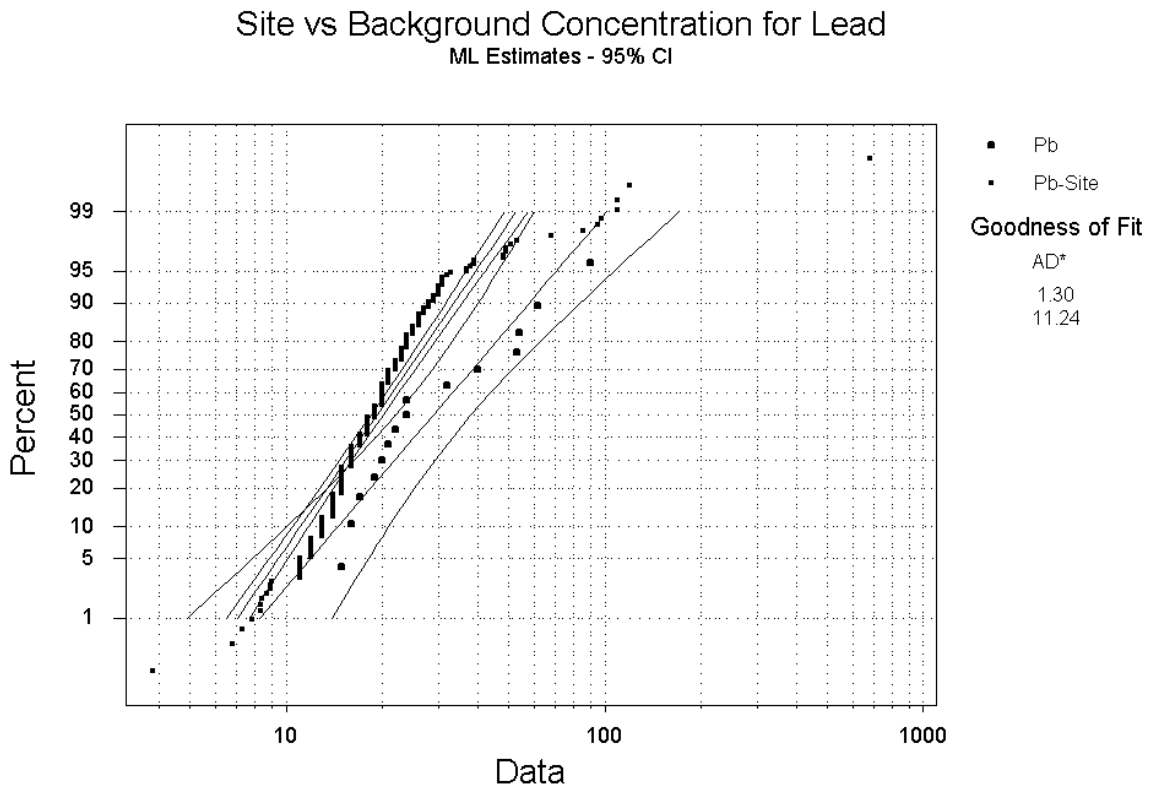

Site vs Background Concentrtaion for Uranium-238
ML Estimates - 95% CI
Percent
99
95
90
80
70
60
50
40
30
20
10
5
1
-10
0
10
20
Data
U-238
Site-U-238
Goodness of Fit
AD*
1.300
7.676

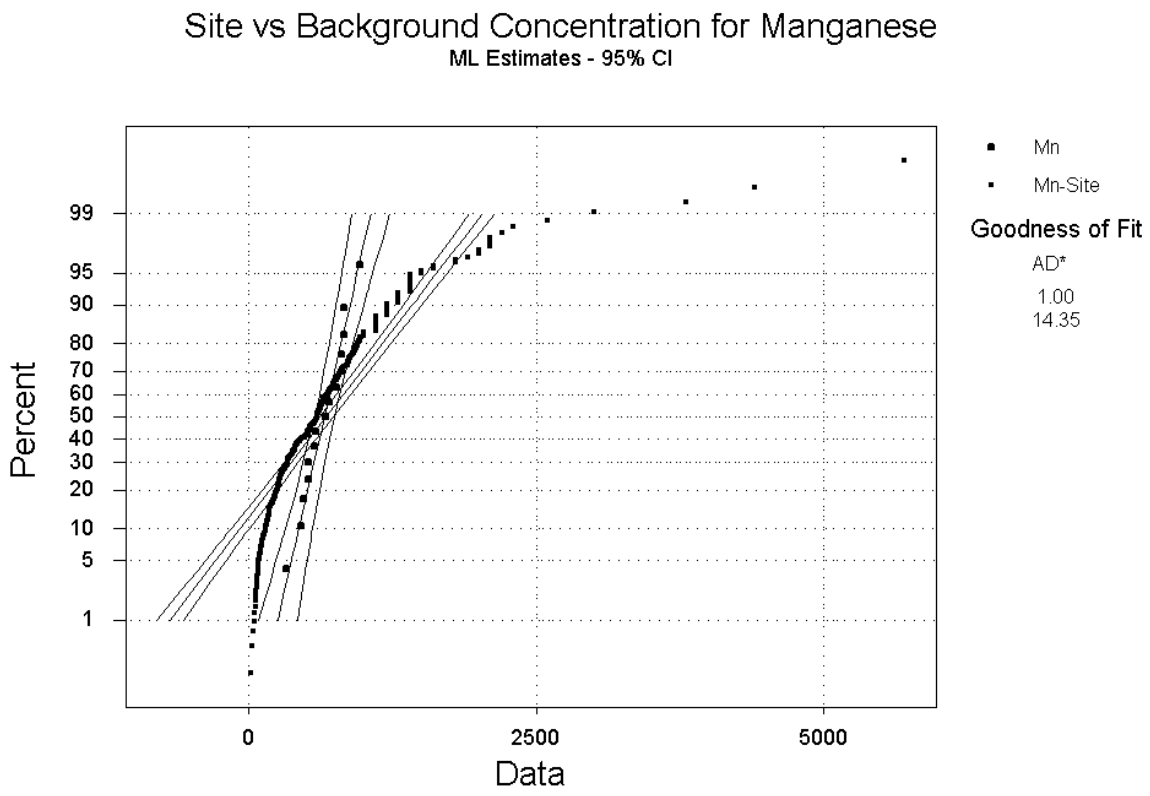

Site vs Background Concentration for Arsenic
ML Estimates - 95% CI
Percent
99
95
90
80
70
60
50
40
30
20
10
5
1
0
10
20
Data
Ar
Ar-Site
Goodness of Fit
AD*
1.162
4.988

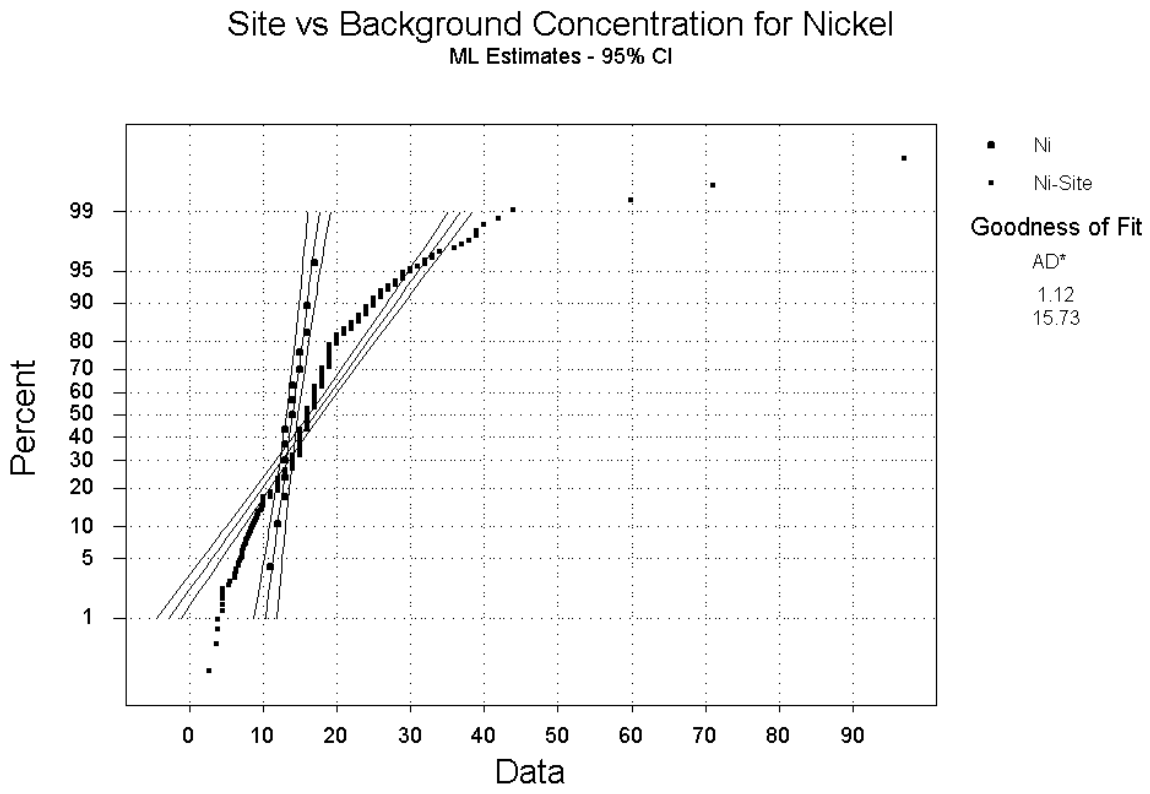

Site vs Background Concentration for Barium
ML Estimates - 95% CI
Percent
99
95
90
80
70
60
50
40
30
20
10
5
1
10
100
1000
Data
Ba
Ba-Site
Goodness of Fit
AD*
1.30
15.16

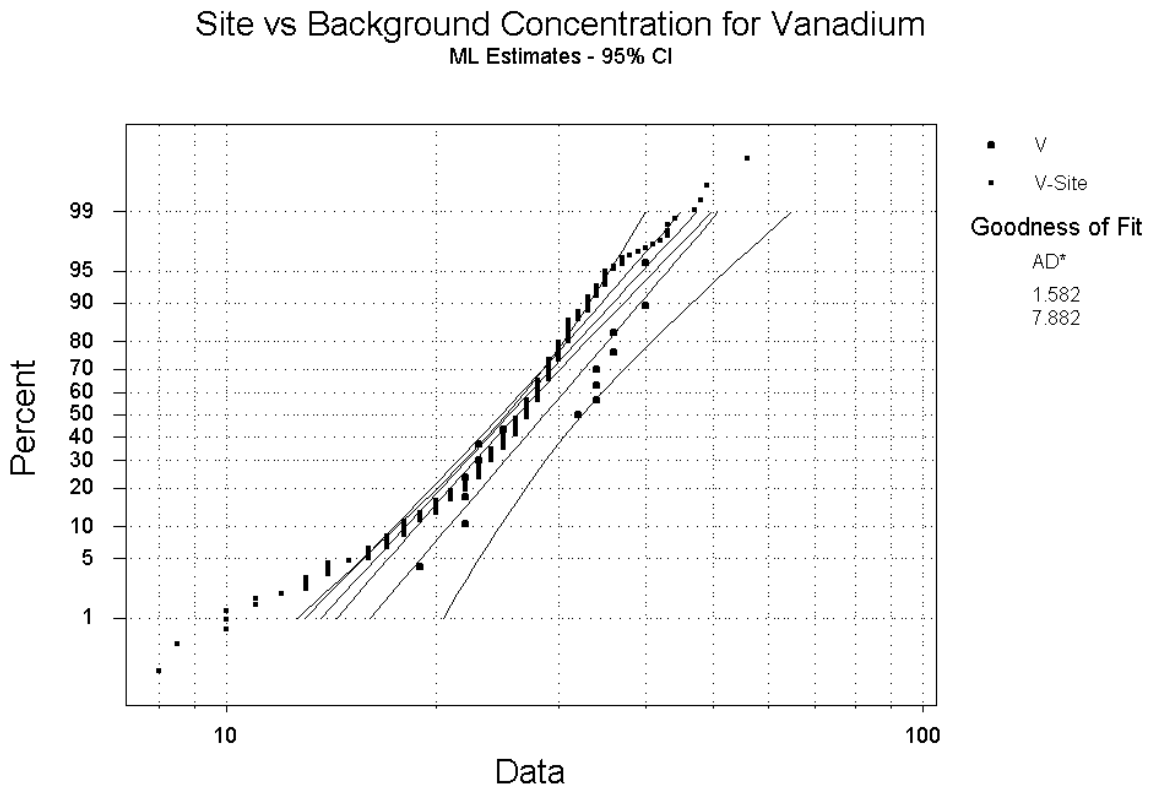

Site vs Background Concentration for Beryllium
ML Estimates - 95% CI
Percent
99
95
90
80
70
60
50
40
30
20
10
5
1
0
1
2
Data
Be
Be-Site
Goodness of Fit
AD*
1.30
10.65


Site vs Background Concentration for Copper
ML Estimates - 95% CI
Percent
99
95
90
80
70
60
50
40
30
20
10
5
1
0
10
20
30
Data
Cu
Cu-Site
Goodness of Fit
AD*
1.22
10.63


Site vs Background Concentration for Lead
ML Estimates - 95% CI
Percent
99
95
90
80
70
60
50
40
30
20
10
5
1
10
100
1000
Data
Pb
Pb-Site
Goodness of Fit
AD*
1.30
11.24

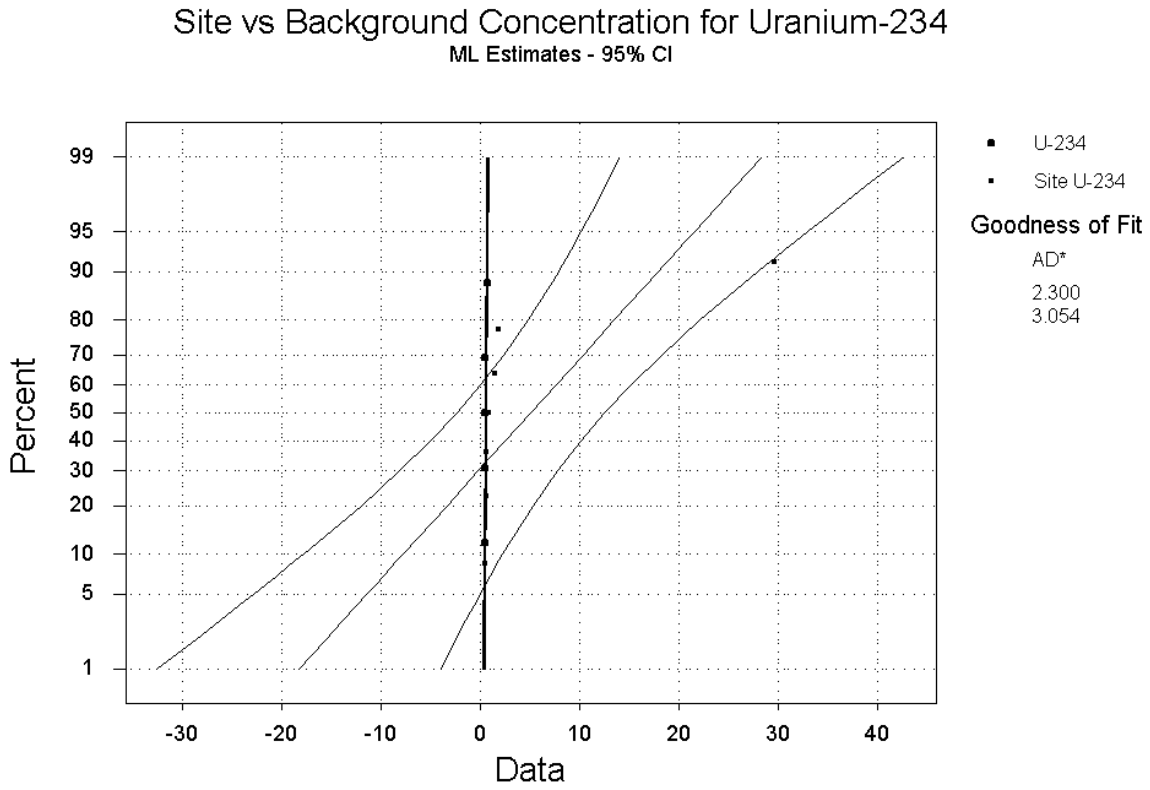

Site vs Background Concentration for Manganese
ML Estimates - 95% CI
Percent
99
95
90
80
70
60
50
40
30
20
10
5
1
0
2500
5000
Data
Mn
Mn-Site
Goodness of Fit
AD*
1.00
14.35

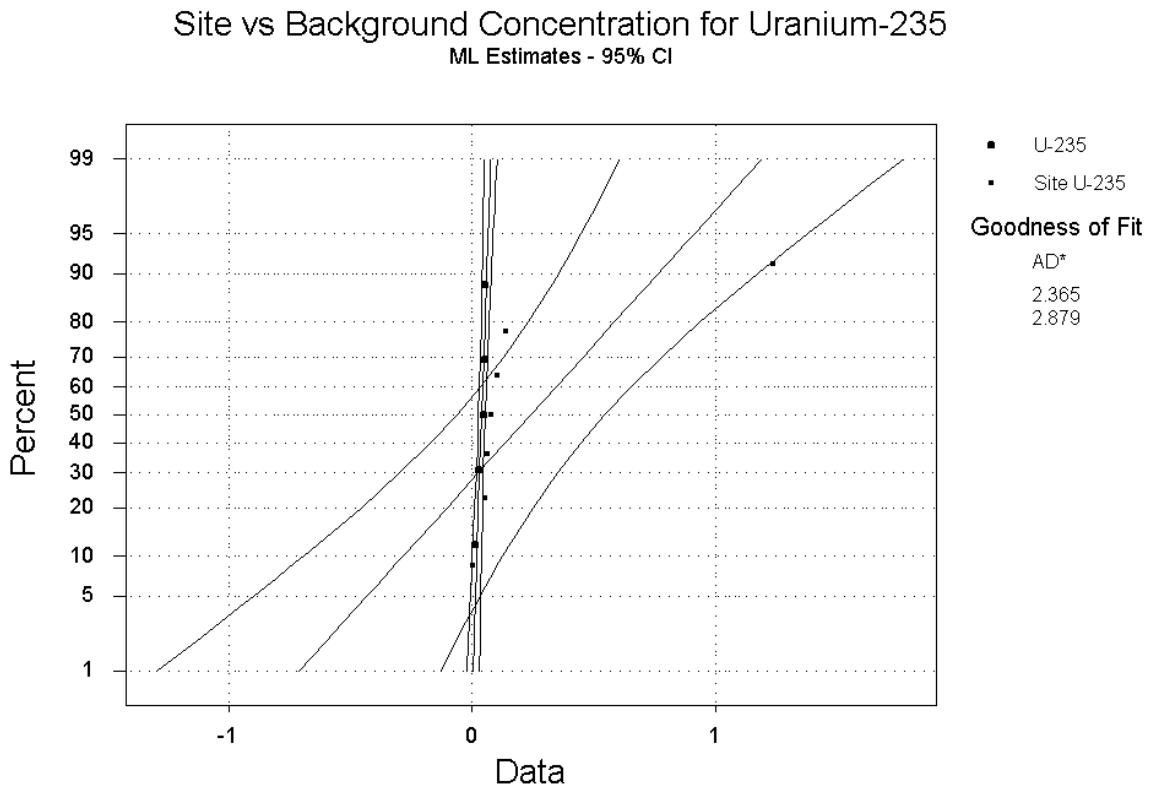

Site vs Background Concentration for Nickel
ML Estimates - 95% CI
Percent
99
95
90
80
70
60
50
40
30
20
10
5
1
0
10
20
30
40
50
60
70
80
90
Data
Ni
Ni-Site
Goodness of Fit
AD*
1.12
15.73

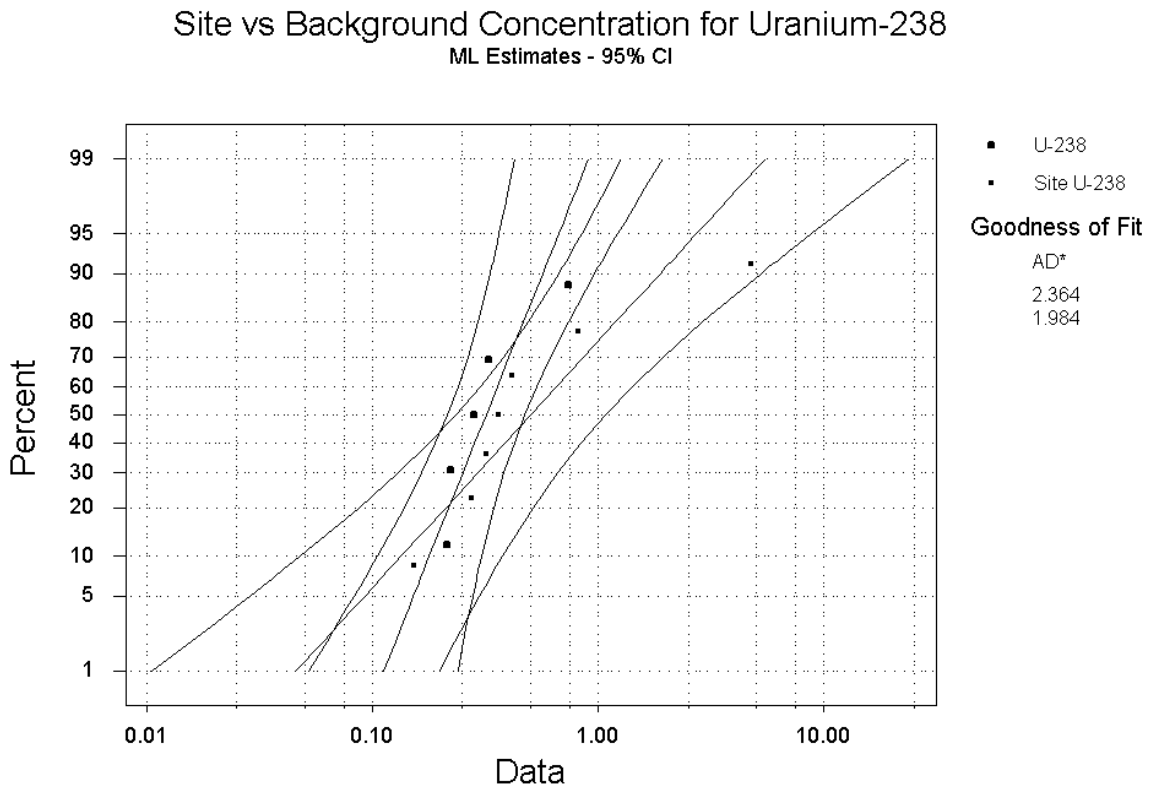

Site vs Background Concentration for Vanadium
ML Estimates - 95% CI
Percent
99
95
90
80
70
60
50
40
30
20
10
5
1
10
100
Data
V
V-Site
Goodness of Fit
AD*
1.582
7.882

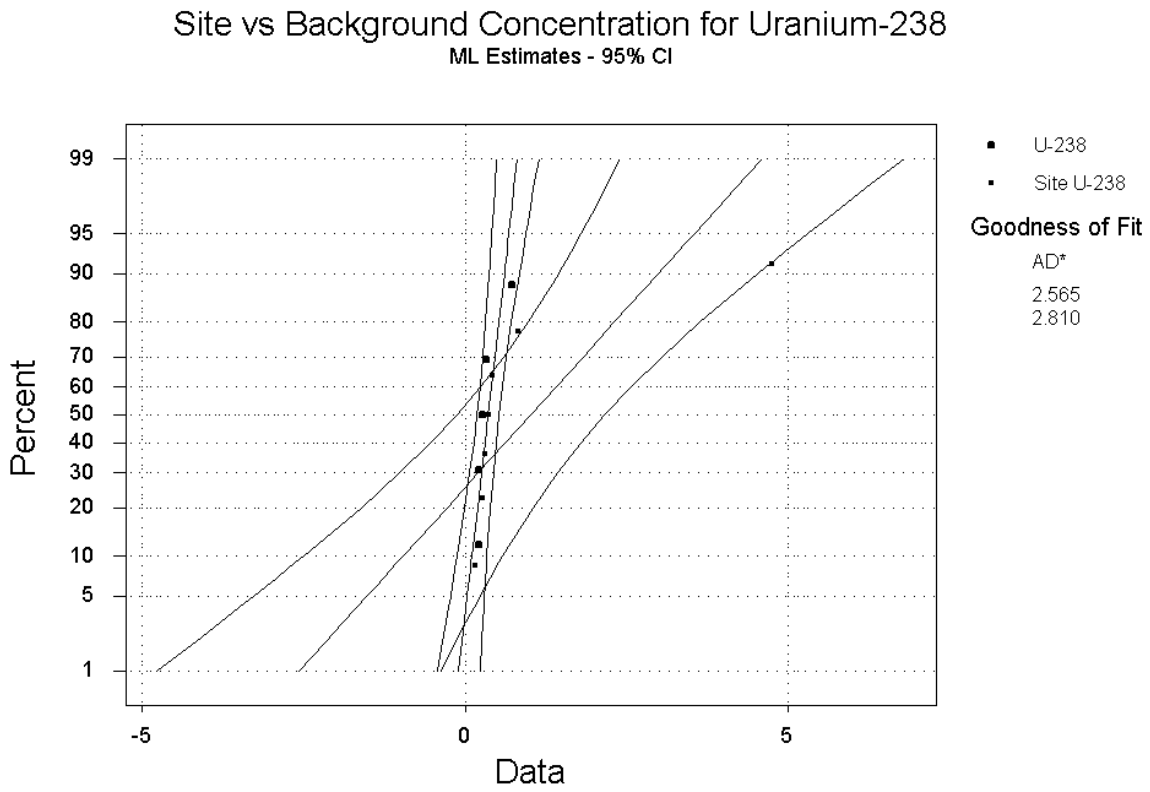
ATTACHMENT G

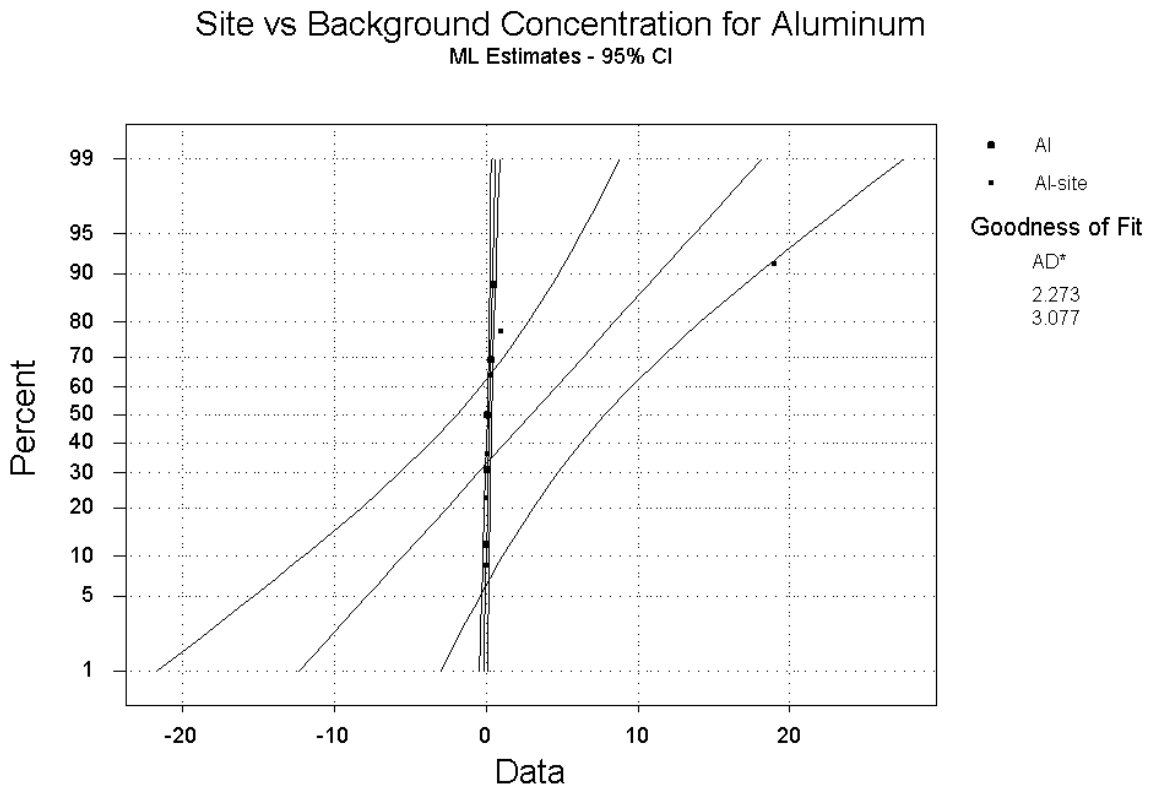
COMPARISON OF SITE AND BACKGROUND SURFACE WATER SAMPLING RESULTS USING PROBABILITY PLOTS

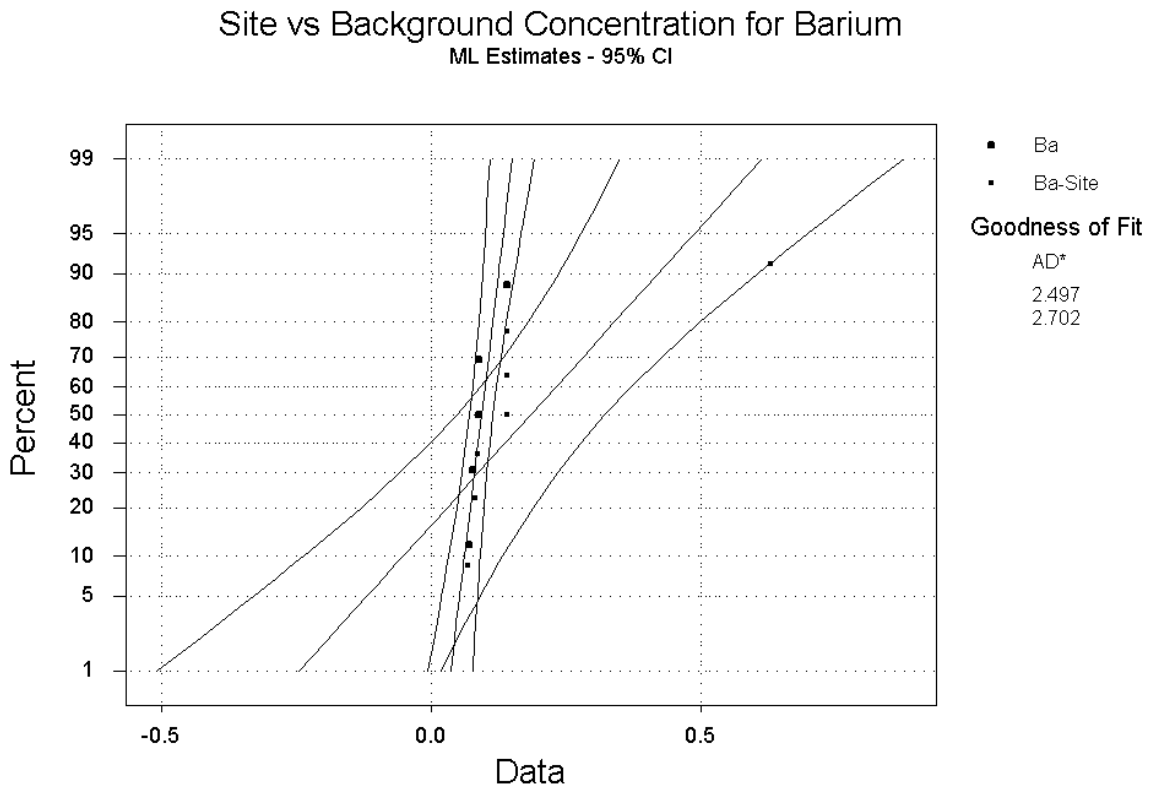

Site vs Background Concentration for Uranium-234
ML Estimates - 95% CI
Percent
99
95
90
80
70
60
50
40
30
20
10
5
1
-30
-20
-10
0
10
20
30
40
Data
U-234
Site U-234
Goodness of Fit
AD*
2.300
3.054

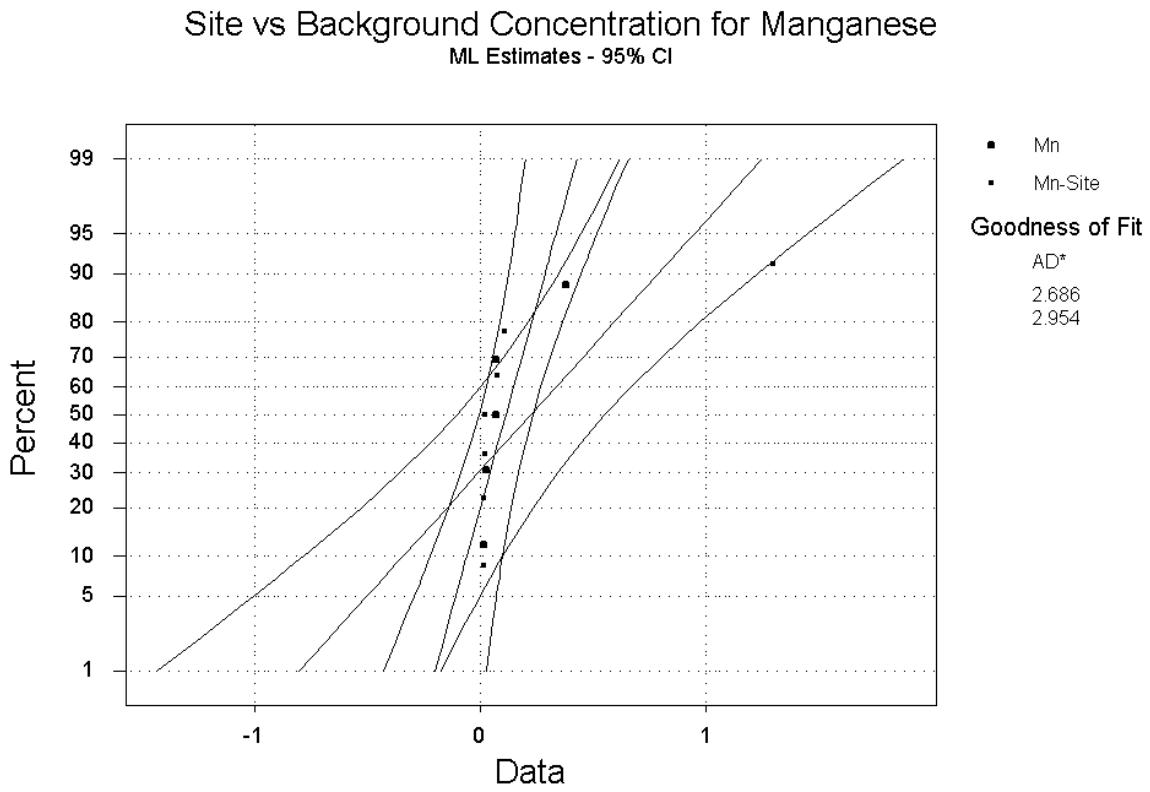

Site vs Background Concentration for Uranium-235
ML Estimates - 95% CI
Percent
99
95
90
80
70
60
50
40
30
20
10
5
1
-1
0
1
Data
U-235
Site U-235
Goodness of Fit
AD*
2.365
2.879


Site vs Background Concentration for Uranium-238
ML Estimates - 95% CI
Percent
99
95
90
80
70
60
50
40
30
20
10
5
1
0.01
0.10
1.00
10.00
Data
U-238
Site U-238
Goodness of Fit
AD*
2.364
1.984


Site vs Background Concentration for Uranium-238
ML Estimates - 95% CI
Percent
99
95
90
80
70
60
50
40
30
20
10
5
1
-5
0
5
Data
U-238
Site U-238
Goodness of Fit
AD*
2.565
2.810


Site vs Background Concentration for Aluminum
ML Estimates - 95% CI
Percent
99
95
90
80
70
60
50
40
30
20
10
5
1
-20
-10
0
10
20
Data
Al
Al-site
Goodness of Fit
AD*
2.273
3.077


Site vs Background Concentration for Barium
ML Estimates - 95% CI
Percent
99
95
90
80
70
60
50
40
30
20
10
5
1
-0.5
0.0
0.5
Data
Ba
Ba-Site
Goodness of Fit
AD*
2.497
2.702

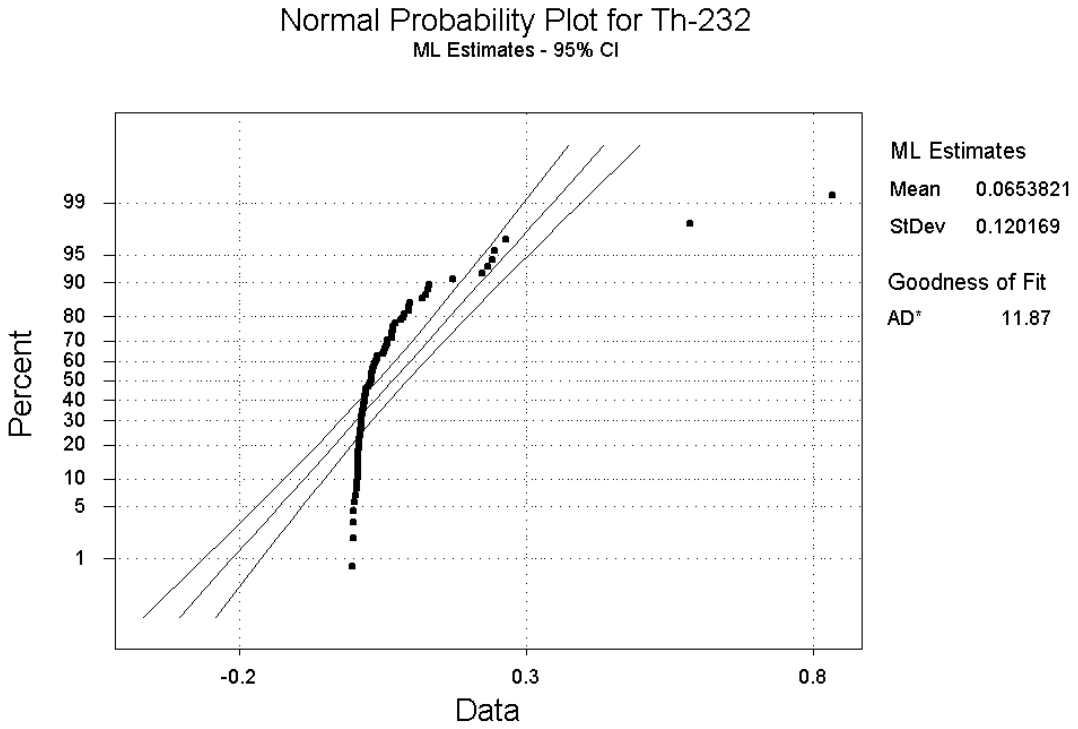

Site vs Background Concentration for Manganese
ML Estimates - 95% CI
Percent
99
95
90
80
70
60
50
40
30
20
10
5
1
-1
0
1
Data
Mn
Mn-Site
Goodness of Fit
AD*
2.686
2.954

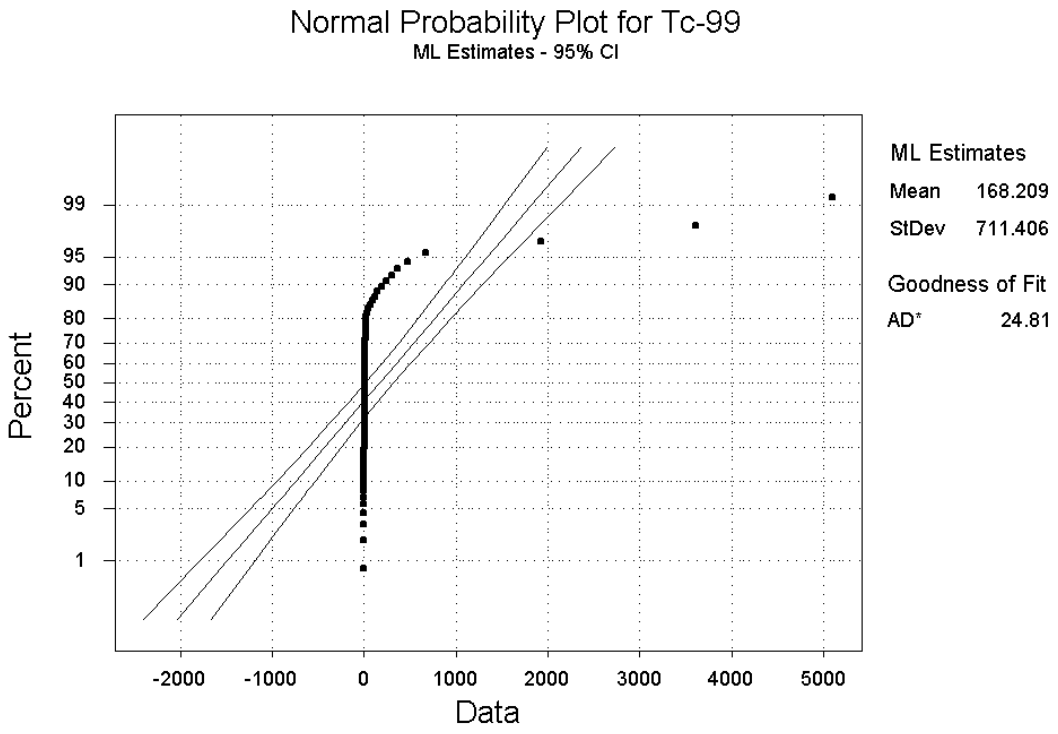
ATTACHMENT H

DETERMINATION OF BACKGROUND DATA FROM SITE GROUNDWATER OVERBURDEN FORMATION SAMPLING RESULTS USING PROBABILITY PLOTS

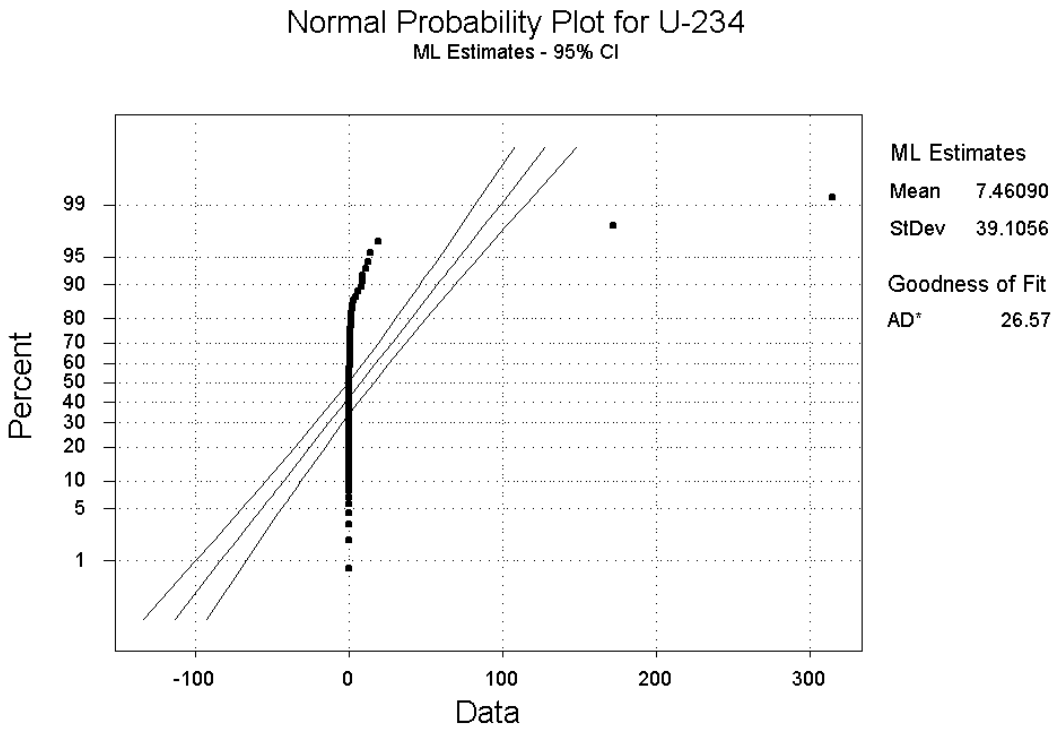
Attachment H
Probability Plots for Groundwater Applicable Analytes

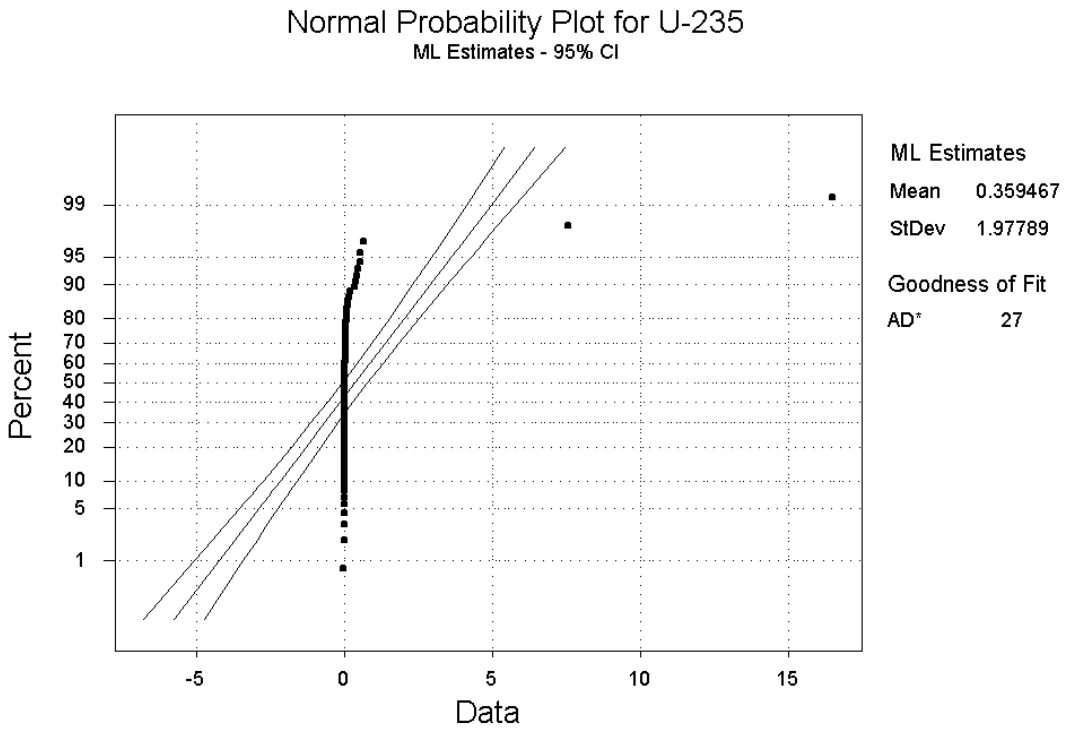
Overburden: Radionuclide



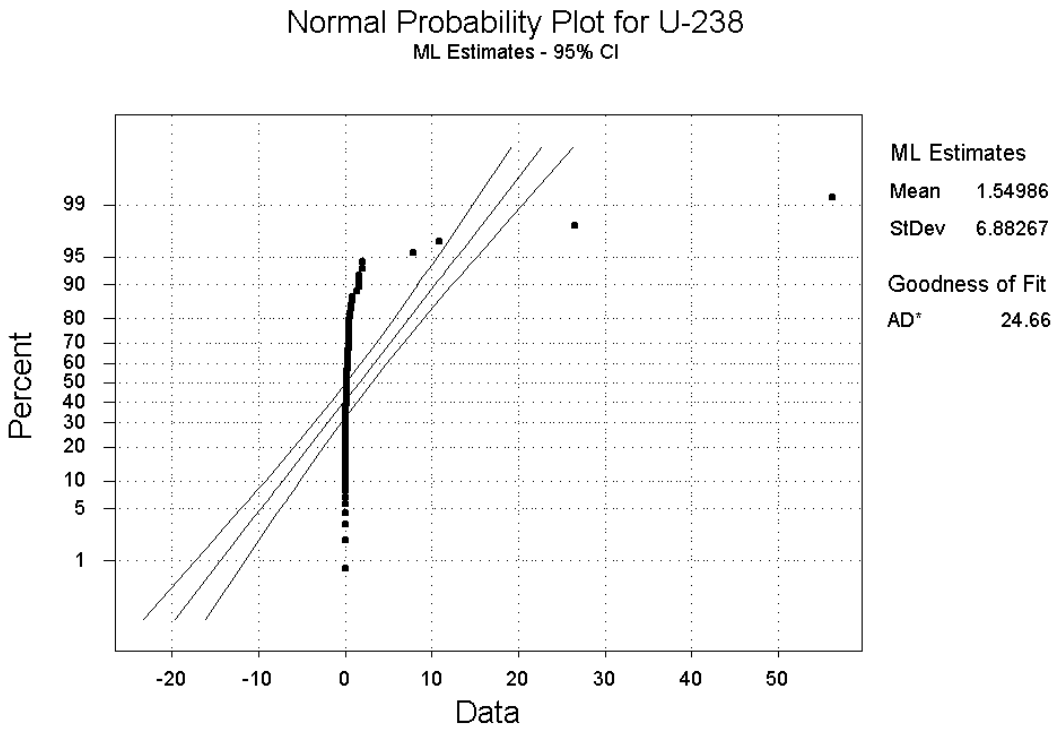


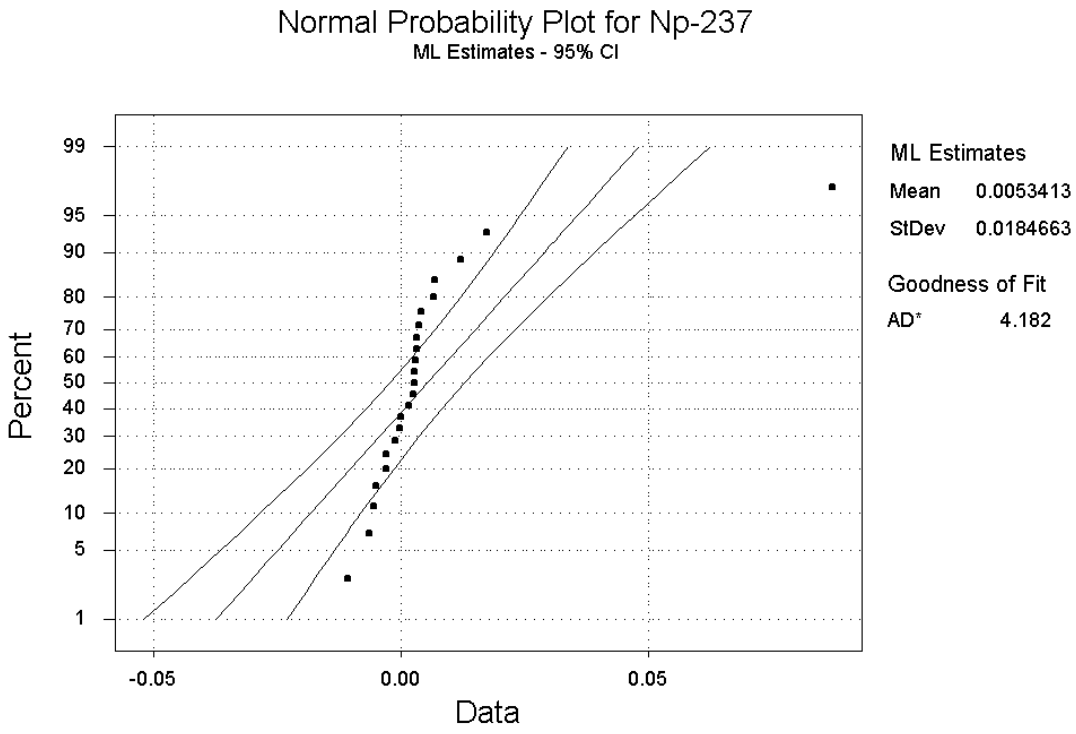
Attachment H
Probability Plots for Groundwater Applicable Analytes



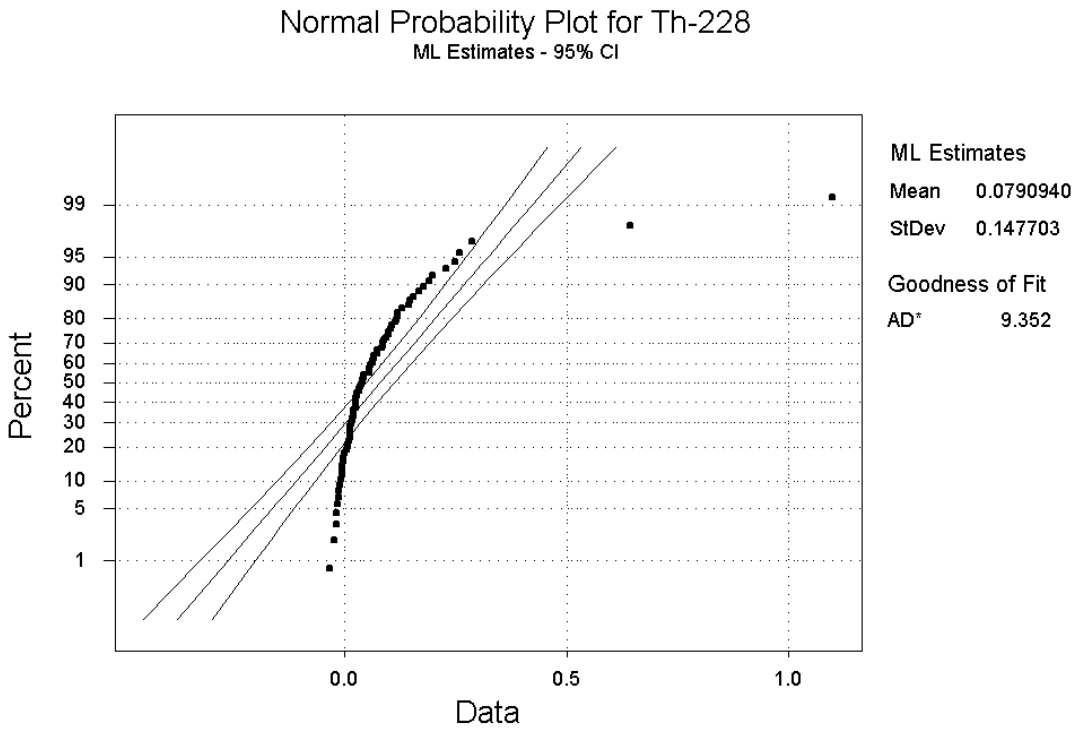


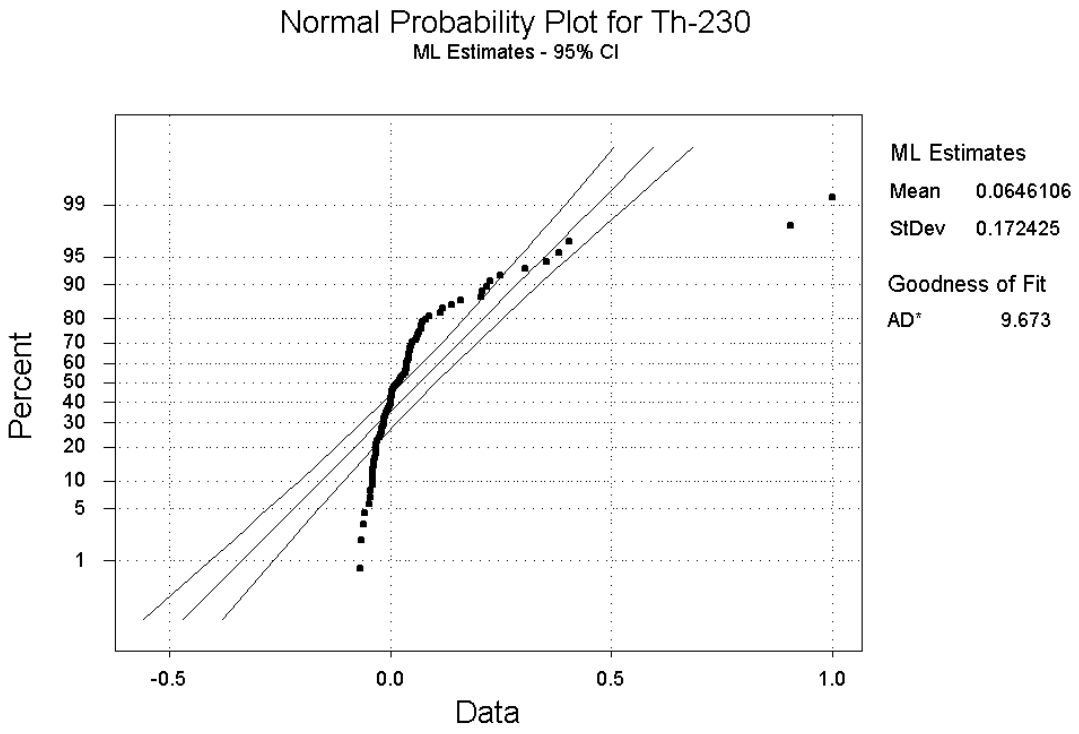
Attachment H
Probability Plots for Groundwater Applicable Analytes



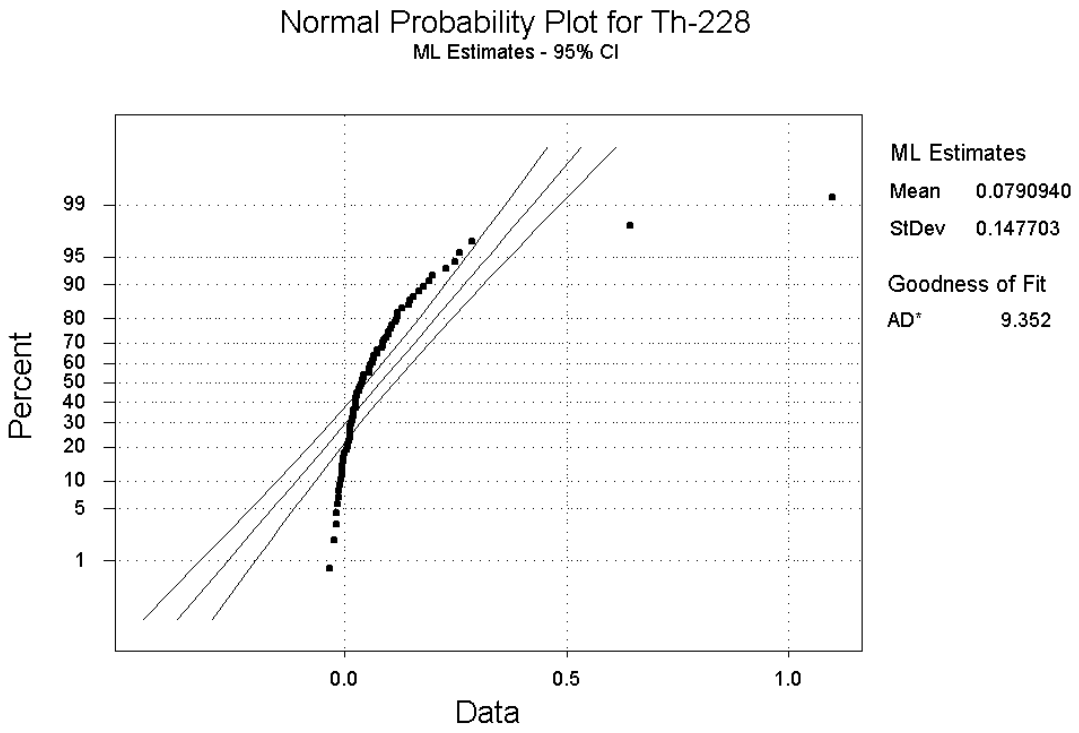


Attachment H
Probability Plots for Groundwater Applicable Analytes



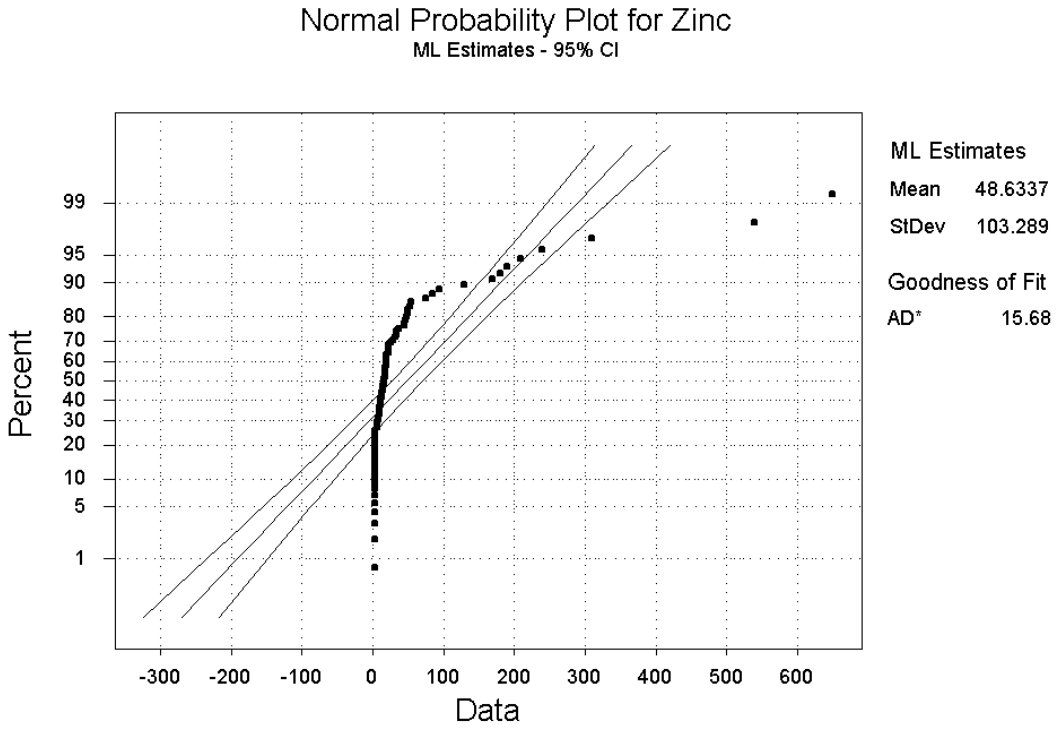


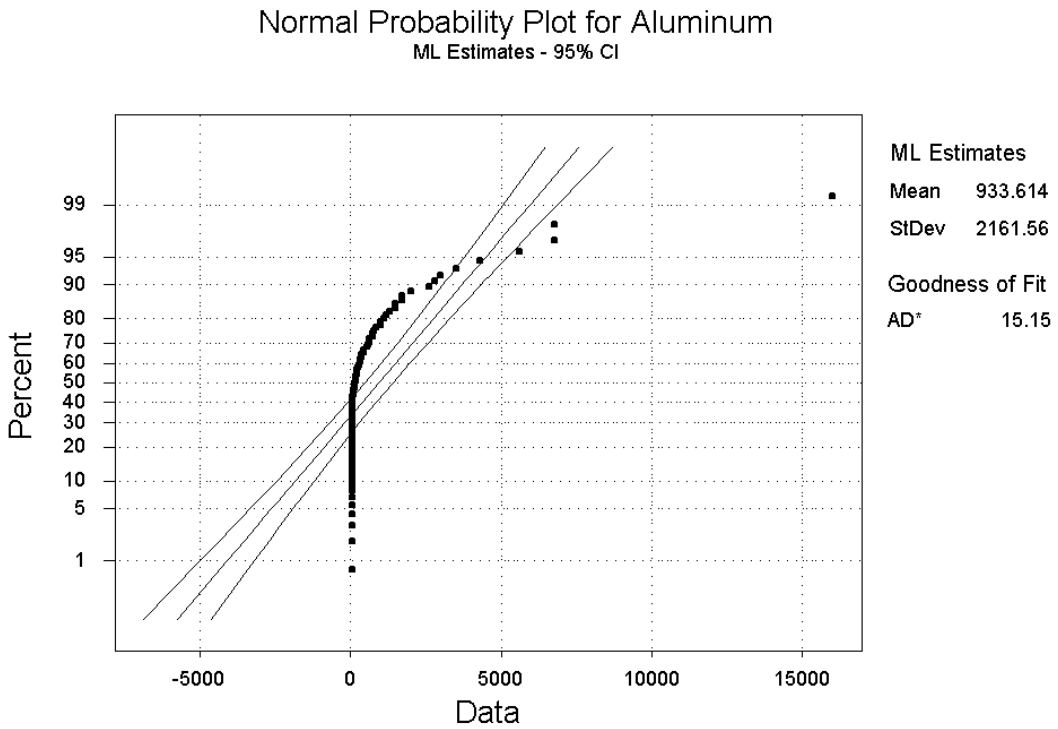
Attachment H
Probability Plots for Groundwater Applicable Analytes



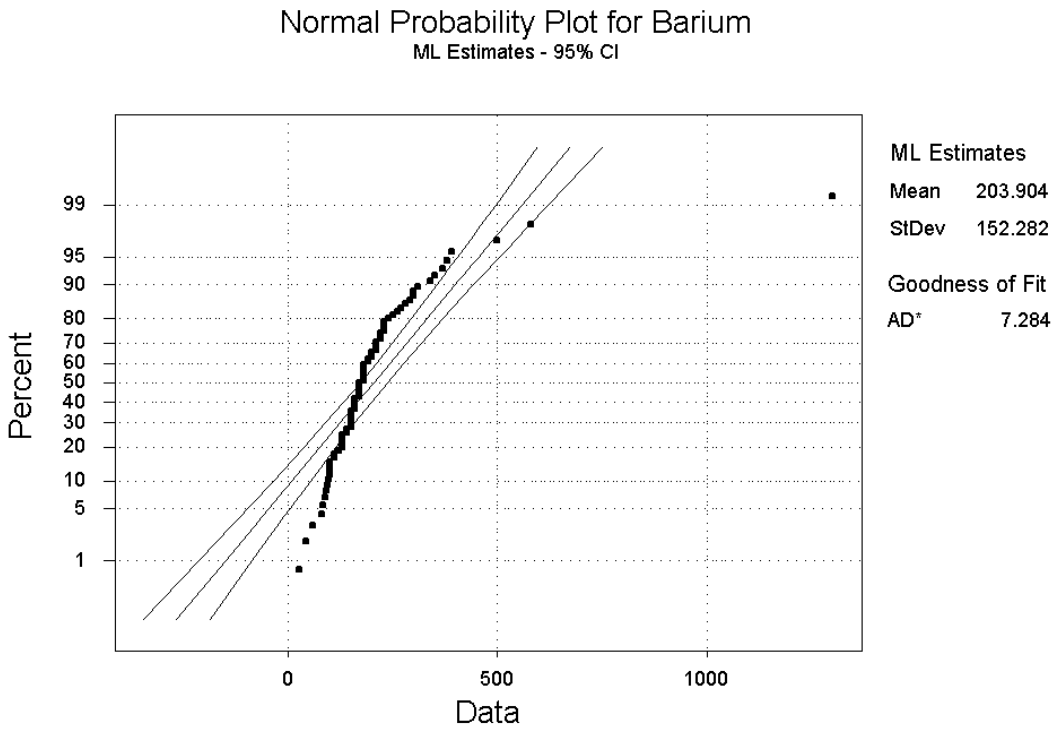
Attachment H
Probability Plots for Groundwater Applicable Analytes

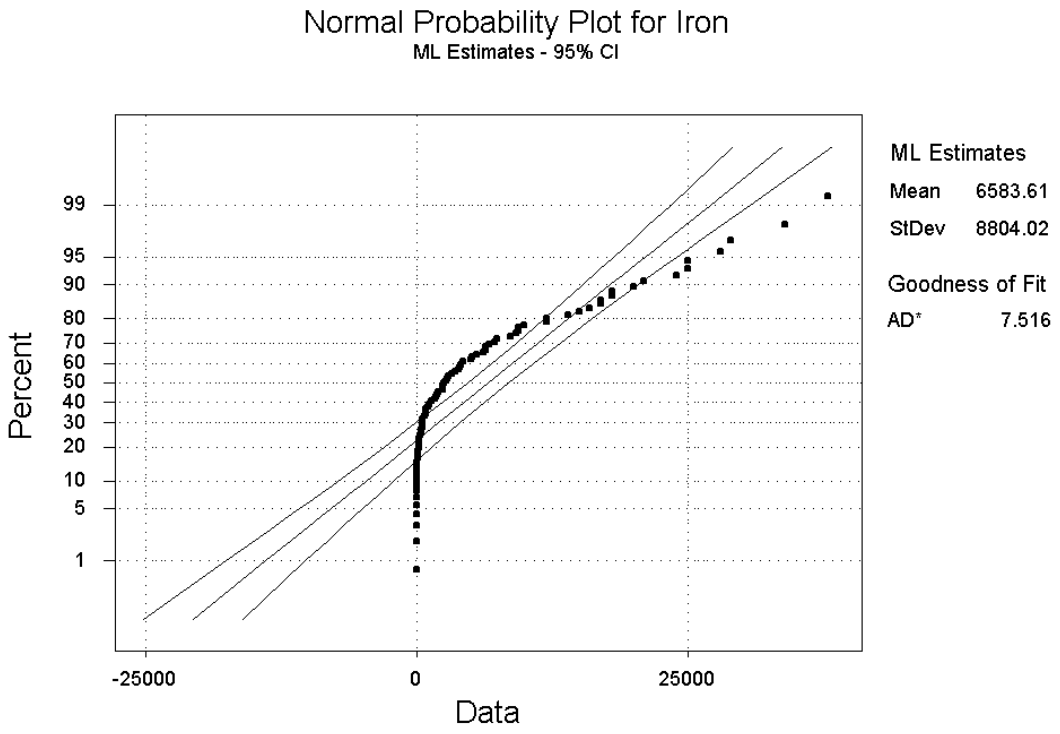
Overburden: Metal



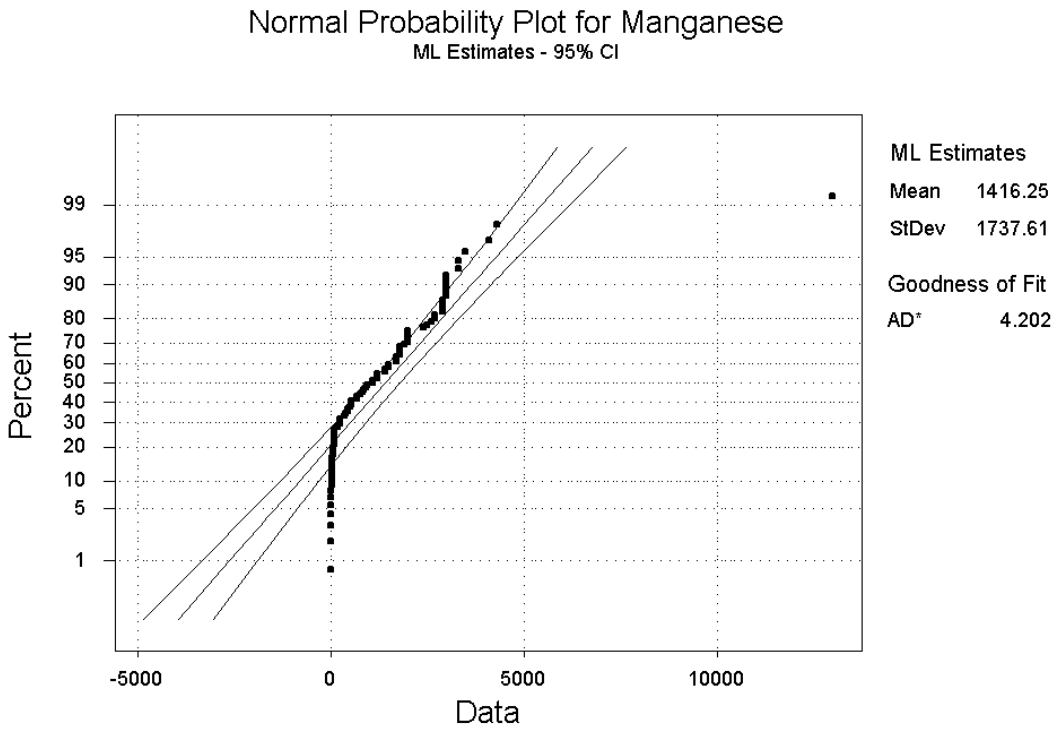


Attachment H
Probability Plots for Groundwater Applicable Analytes



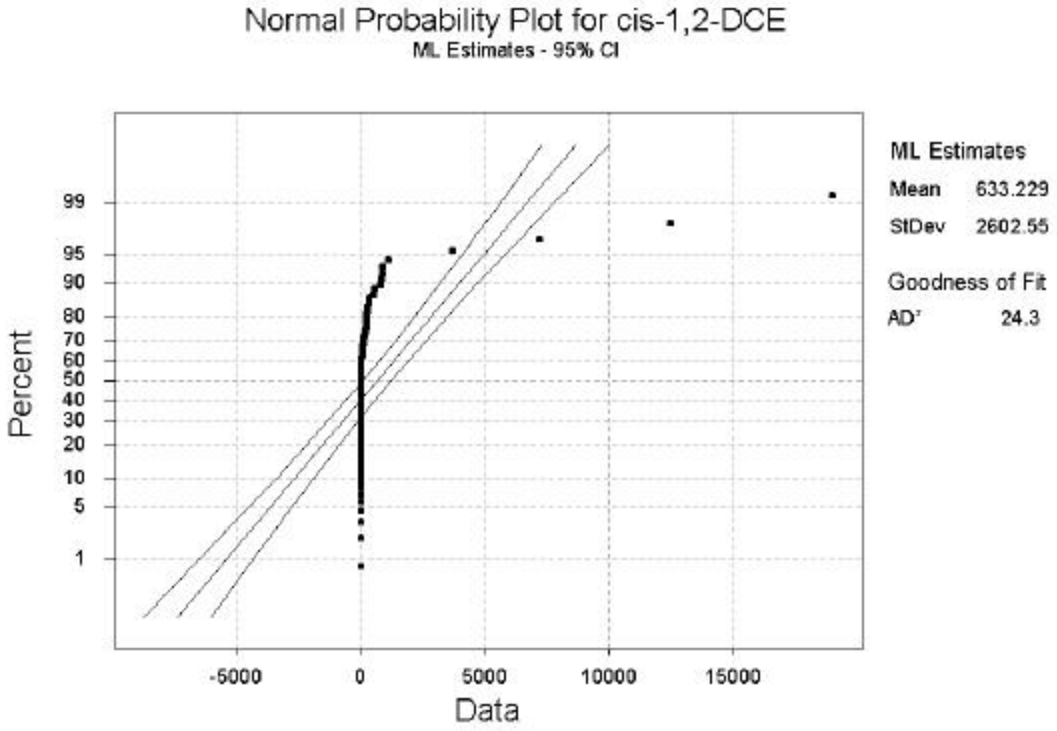


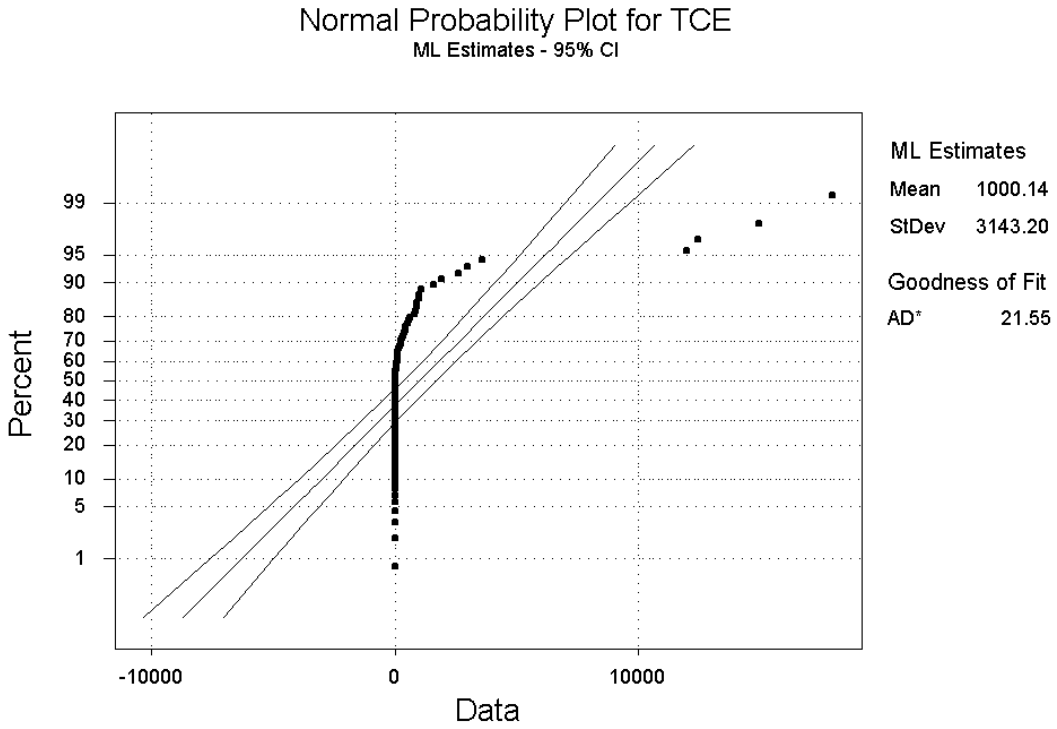
Attachment H
Probability Plots for Groundwater Applicable Analytes



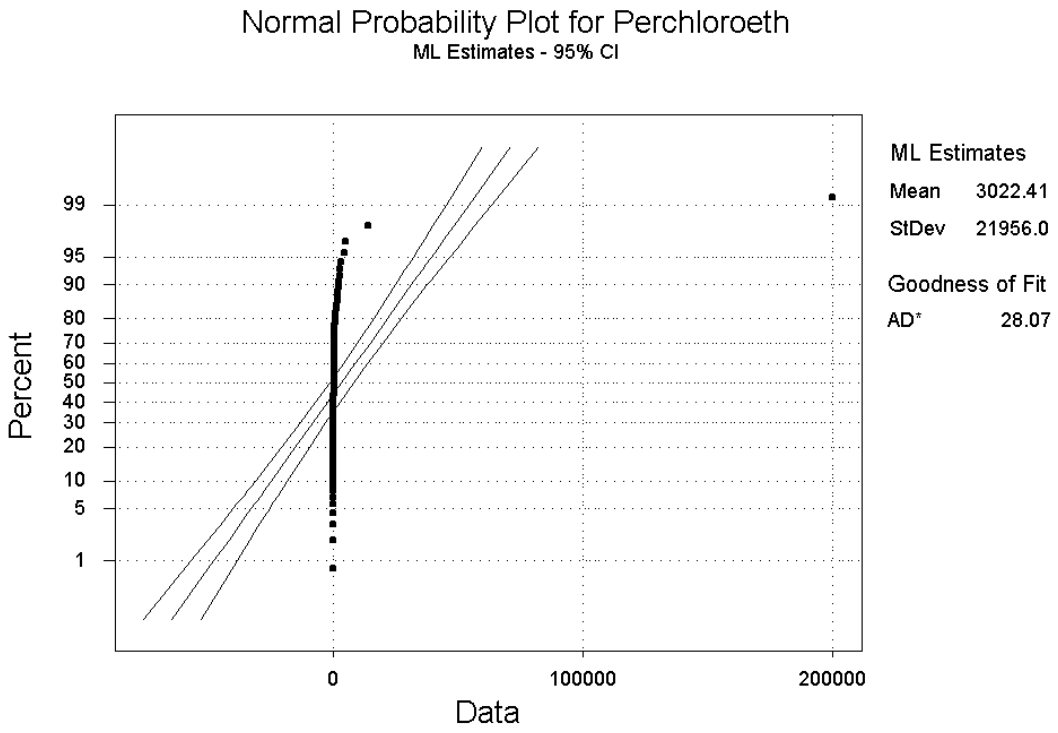
Attachment H
Probability Plots for Groundwater Applicable Analytes

Overburden: VOC





Attachment H
Probability Plots for Groundwater Applicable Analytes

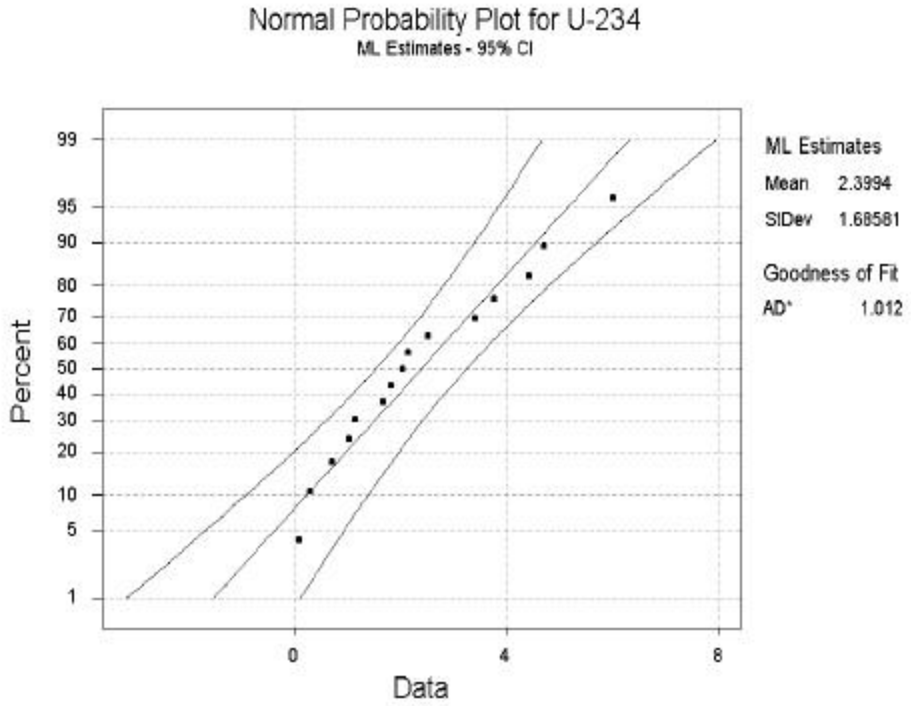


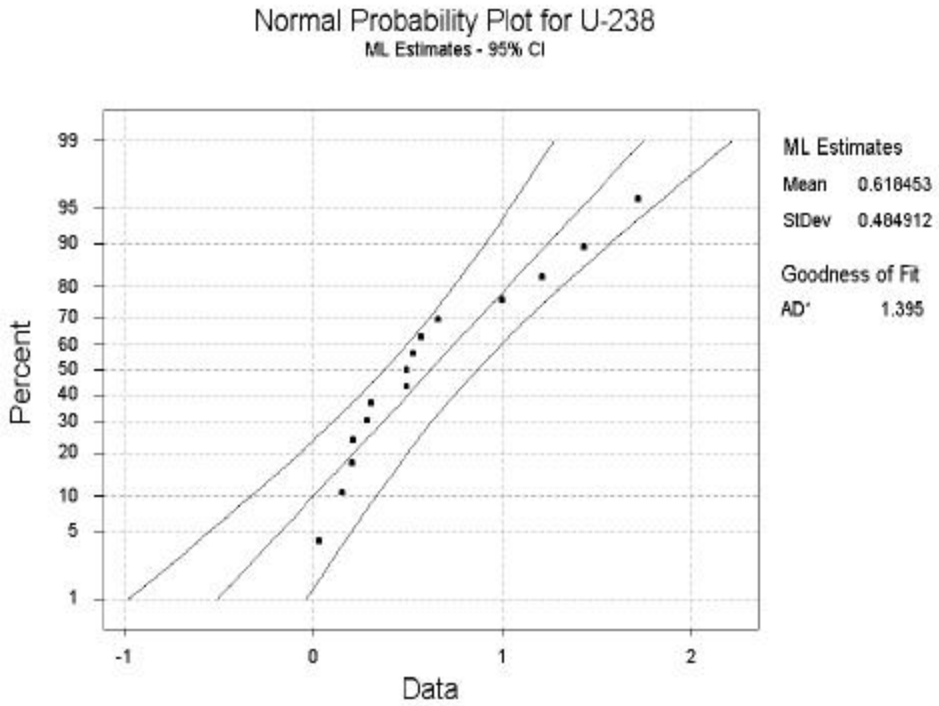
ATTACHMENT I

DETERMINATION OF BACKGROUND DATA FROM SITE GROUNDWATER JEFFERSON CITY FORMATION SAMPLING RESULTS USING PROBABILITY PLOTS

Attachment I
Probability Plots for Groundwater Applicable Analytes

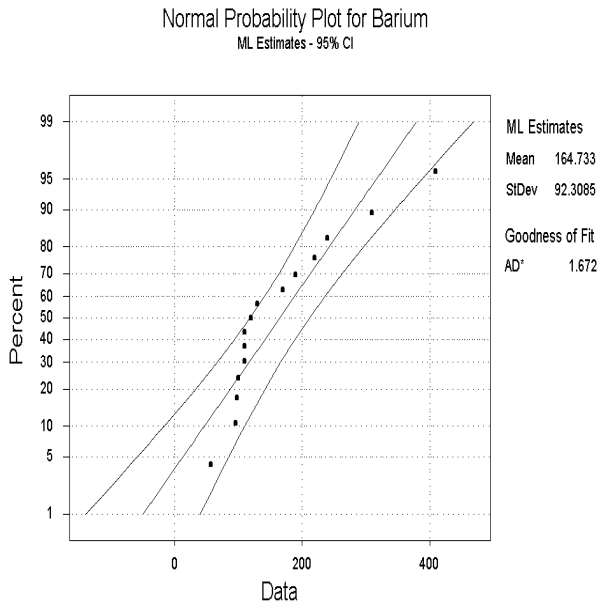
Jefferson City Formation - Radionuclide

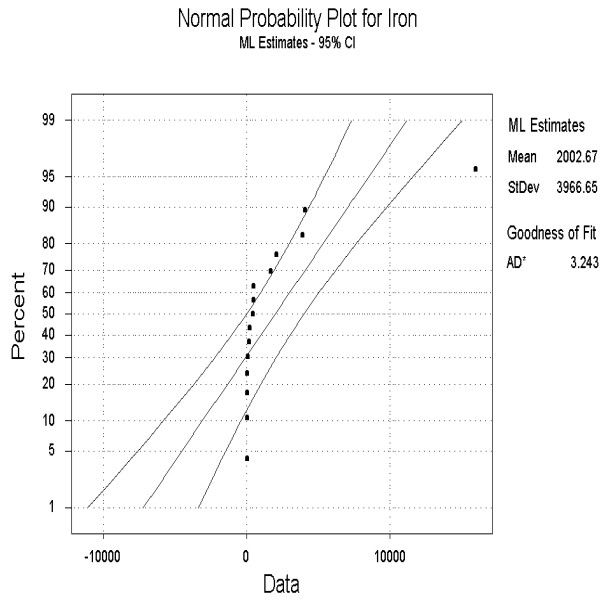


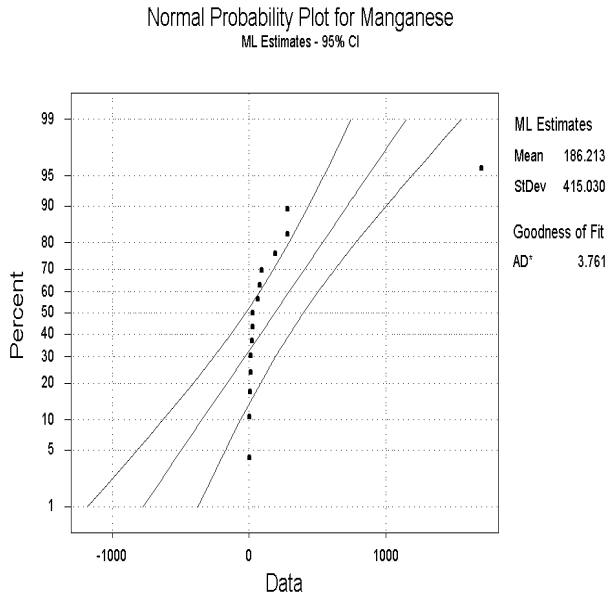


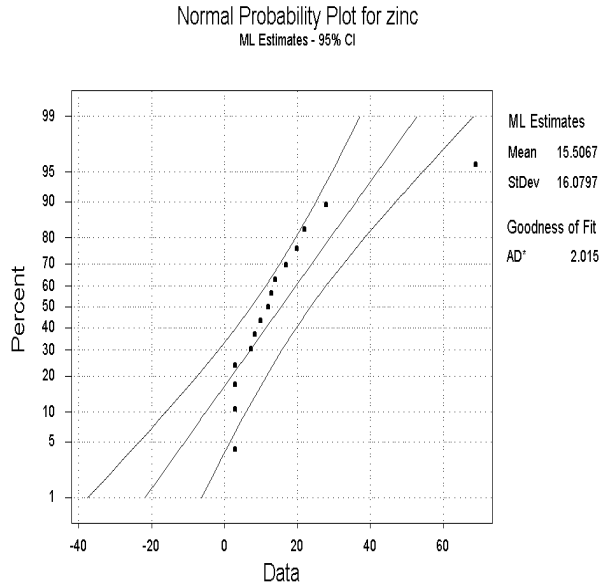
Attachment I
Probability Plots for Groundwater Applicable Analytes

Jefferson City Formation - Metal



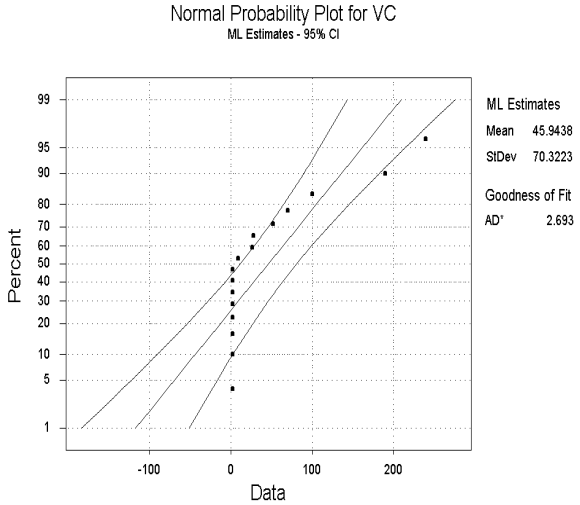


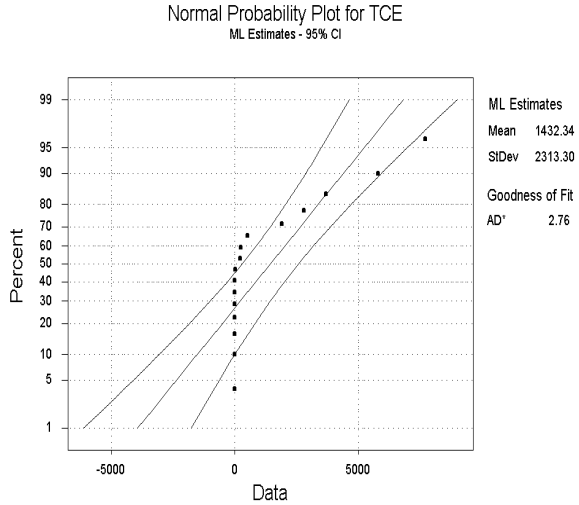


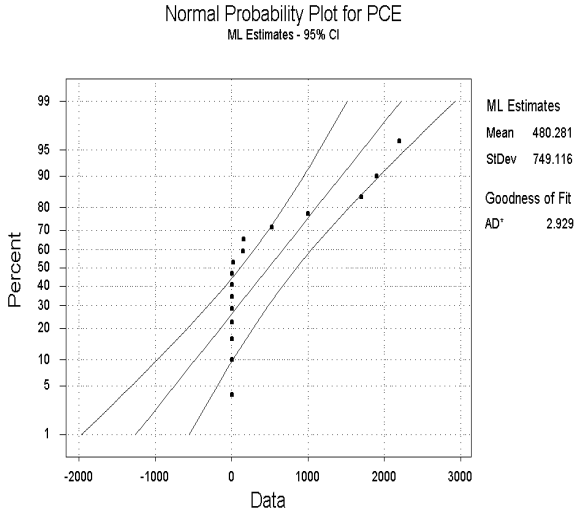


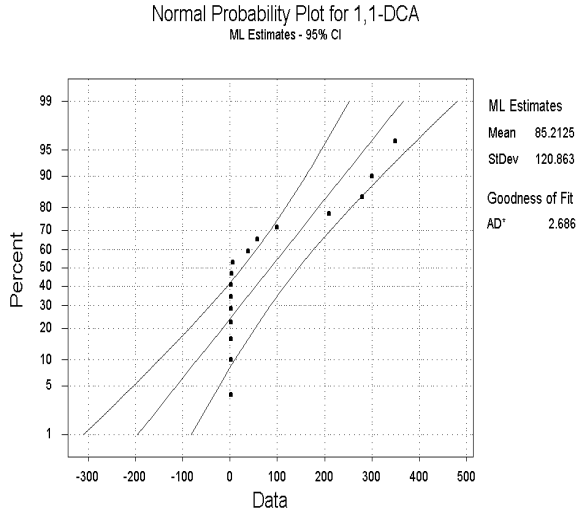
Attachment I
Probability Plots for Groundwater Applicable Analytes

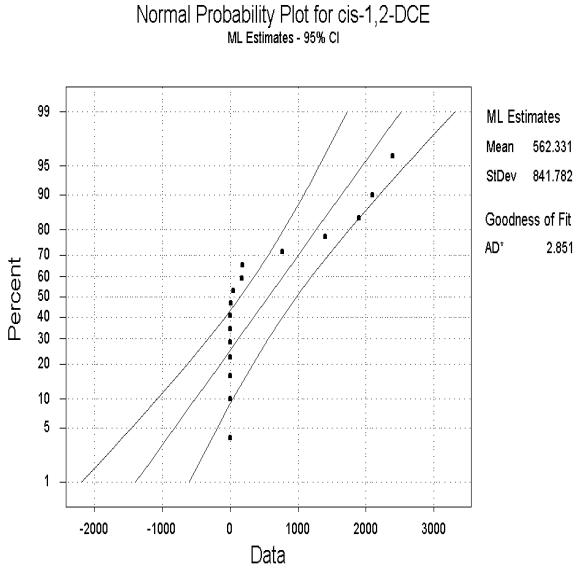
Jefferson City Formation - VOC









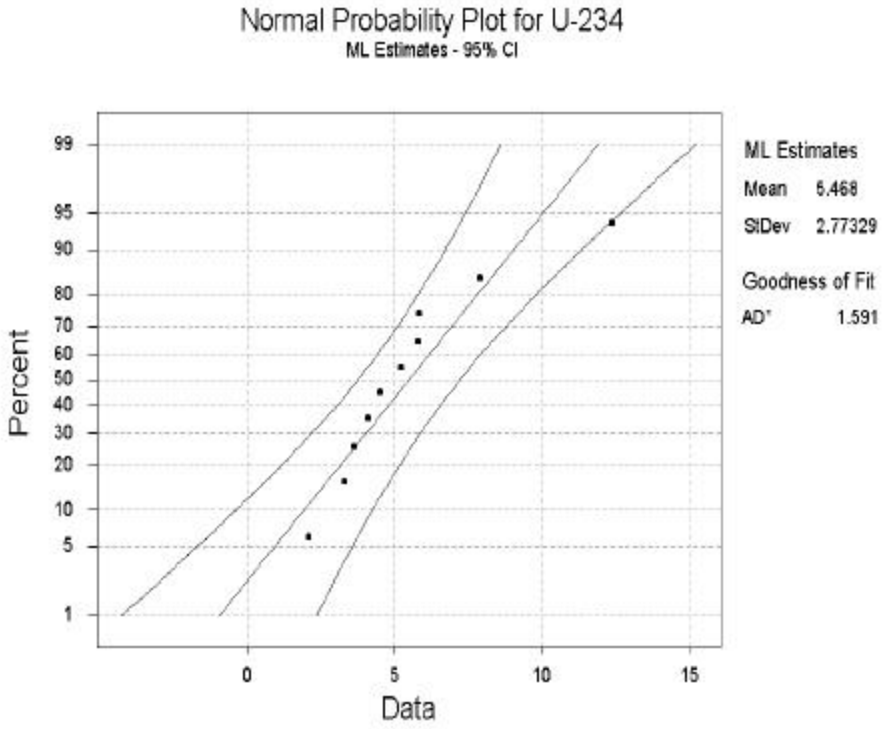


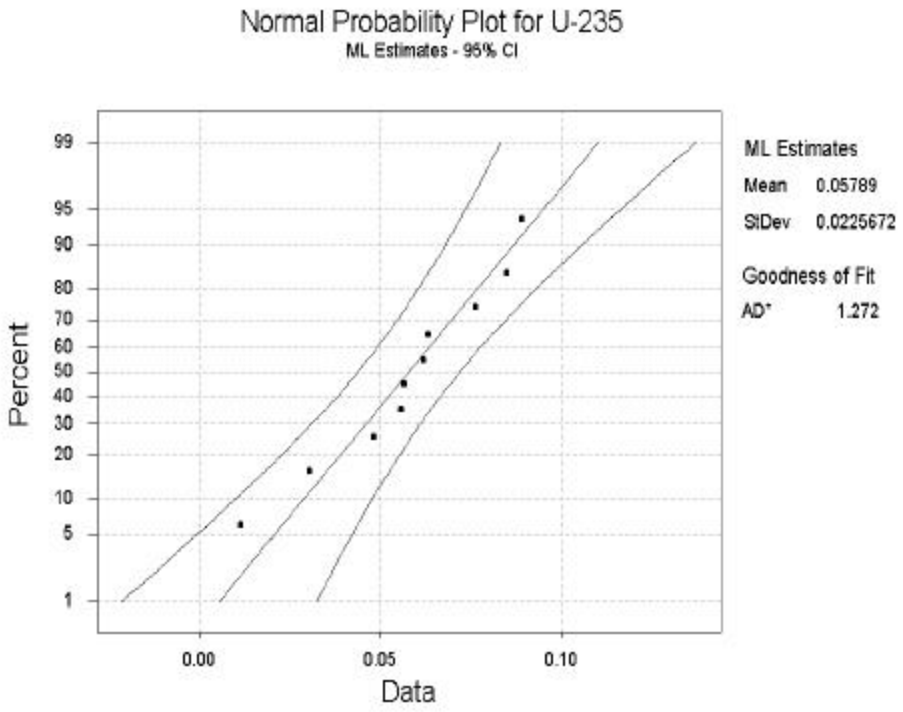
ATTACHMENT J

DETERMINATION OF BACKGROUND DATA FROM SITE GROUNDWATER ROUBIDOUX FORMATION SAMPLING RESULTS USING PROBABILITY PLOTS

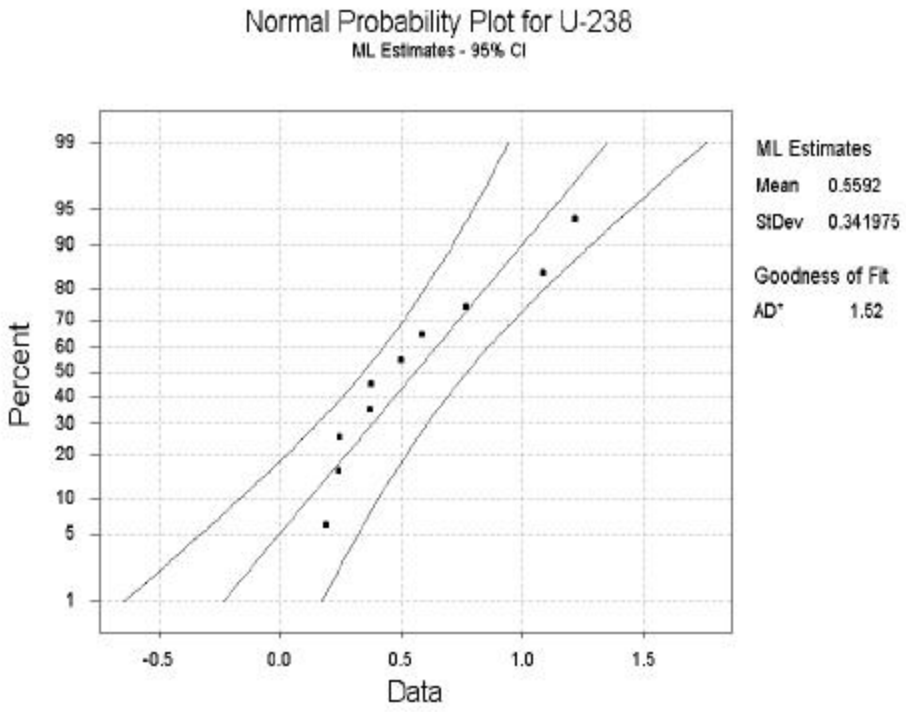
Attachment J
Probability Plots for Groundwater Applicable Analytes

Roubidoux Formation - Radionuclide



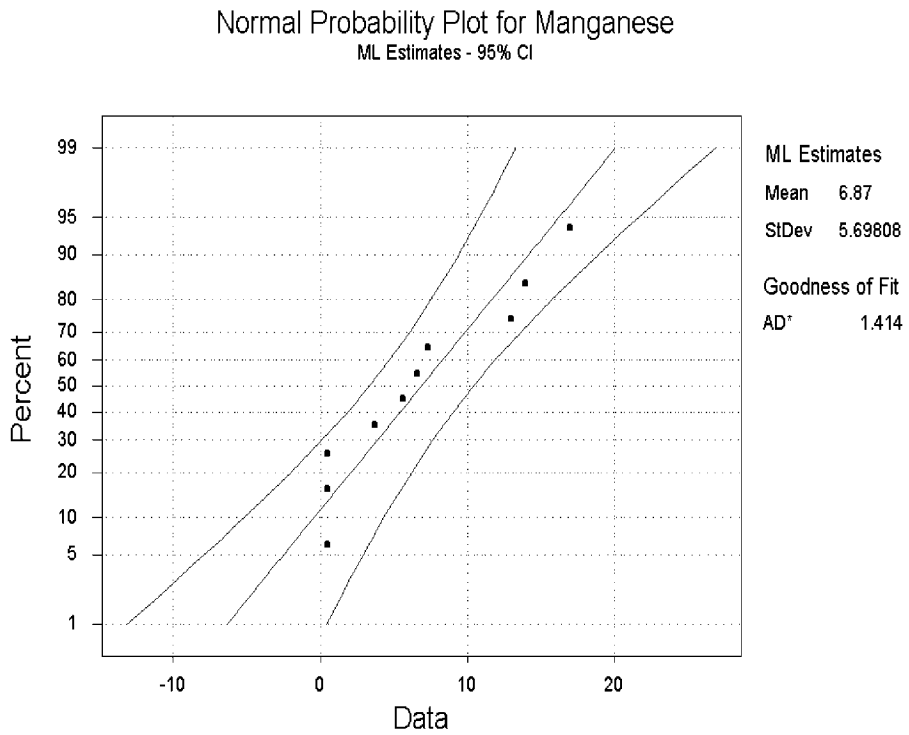


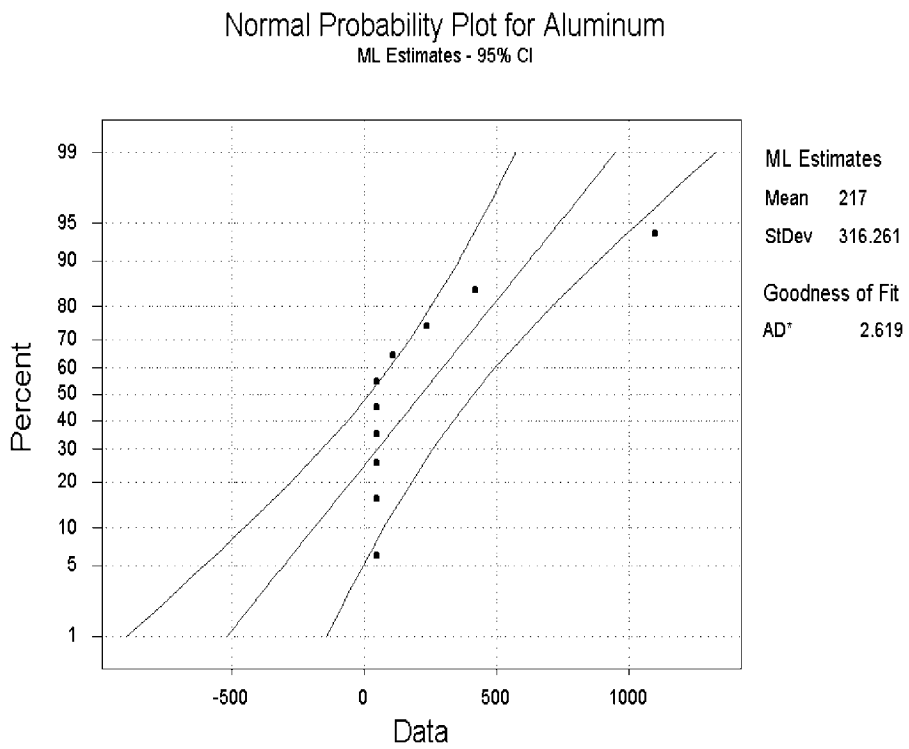
Attachment J
Probability Plots for Groundwater Applicable Analytes



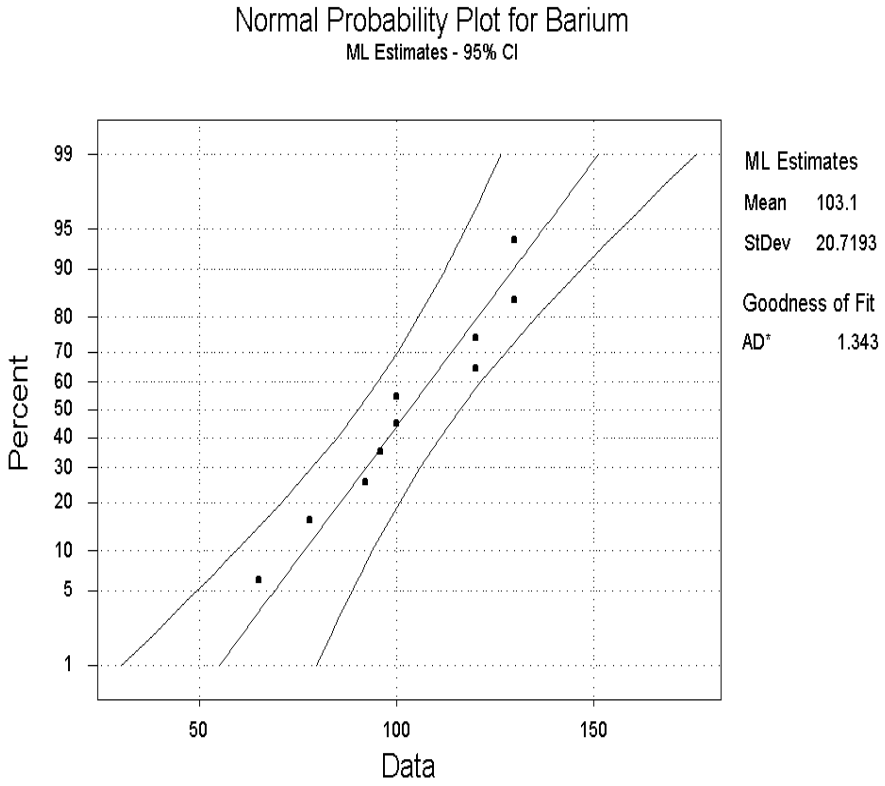
Attachment J
Probability Plots for Groundwater Applicable Analytes

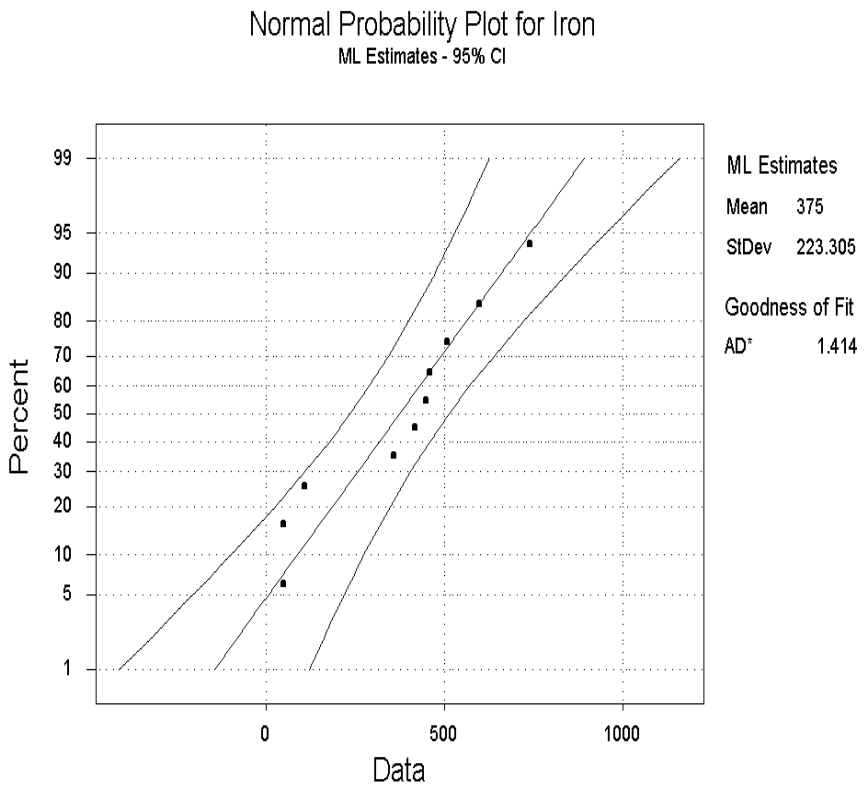
Roubidoux Formation - Metal





Attachment J
Probability Plots for Groundwater Applicable Analytes





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