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November 9, 2007

U.S. Environmental Protection Agency - Region II
290 Broadway – 22nd Floor
New York, New York 10007-1866

Attn: Mr. Adolph Everett, P.E.
Chief, RCRA Programs Branch

Re: Contract N62470-02-D-3052
Navy CLEAN, District III
Contract Task Order (CTO) 0121
U.S. Naval Activity Puerto Rico (NAPR)
Navy Responses to EPA Comments dated September 24, 2007 Enclosure #2
Naval Activity Puerto Rico
EPA I.D. No. PR2170027203

Dear Mr. Everett:

Baker Environmental, Inc. (Baker), on behalf of the Navy, is pleased to provide you with the Navy responses to EPA Comments dated September 24, 2007 Enclosure #2 for your review. These responses reflect the results of the September 20, 2007 conference call between the Navy, EPA, Baker and TechLaw, inc. in which the EPA preliminary comments on the Navy response to comments dated July 20, 2007 on the EPA Comments dated May 29, 2007 were discussed. These responses are on the Draft Phase I RCRA Facility Investigation Report for SWMU 68, Naval Activity Puerto Rico dated March 26, 2007 and the Final RCRA Facility Investigation Report for SWMU 14, Naval Activity Puerto Rico dated March 23, 2007.

Upon EPA review and approval of the attached response to comments the appropriate revisions to the above mentioned documents for EPA review and approval.

As discussed in the September 20, 2007 conference call the Navy will develop and submit an addendum to the Revised Final Summary Report for Environmental Background Concentrations of Inorganic Compounds dated October 17, 2006 upon EPA approval of the attached responses.

If you have questions regarding this submittal, please contact Mr. Mark E. Davidson at (843) 743-2135. Additional distribution has been made as indicated below.

Sincerely,

BAKER ENVIRONMENTAL, INC.

Mark E. Kimes, P.E.
Activity Manager
MEK/lp
Attachments

cc: Ms. Jean Mann, NAVFAC Atlantic – Code AQ119 (letter only)
Mr. David Criswell, BRAC Program Management Office SE (letter only)
Mr. Jeffrey G. Meyers, Navy BRAC PMO SE (letter only)
Mr. Mark Davidson, Navy BRAC PMO SE
Mr. Pedro Ruiz, NAPR
Mr. Tim Gordon, US EPA Region II
Mr. Andrew Dorn, TechLaw Inc.
Mr. Carl Soderberg, US EPA Caribbean Office
Mr. Manny Vargas, PR EQB
Ms. Josefina Gonzalez, PR EQB
Mr. Felix Lopez, U.S. F&WS
Mr. John Swenfurth, CH2M Hill Tampa

NAVY RESPONSES TO EPA COMMENTS DATED SEPTEMBER 24, 2007 ON THE NAVY RESPONSES DATED JULY 20, 2007 ON EPA COMMENTS DATED MAY 29, 2007

EPA GENERAL COMMENT

EPA has completed its review of the responses submitted on July 20, 2007 by Baker Environmental on behalf of the Navy. Those responses address EPA's May 29, 2007 Comments on the Draft Phase I RFI Report for SWMU 68 (former Southern Fire Training Area), and Draft Final RFI Report for SWMU 14 (former "Crash-Crew" Fire Training Area). EPA has determined that the response to comments on the SWMU 14 and SWMU 68 RFI Reports are not fully acceptable. Comments on the Navy's responses are given in the enclosed Technical Review prepared for EPA by our consultant, TechLaw, Inc. EPA concurs with those comments. The EPA comments were discussed with the Navy and Baker Environmental during a conference held on September 20, 2007. Based on that conference call, please submit by 45 days from the date of your receipt of this letter a revised responses to comments for SWMU 14 and for SWMU 68, addressing comments given in the enclosed Technical Review dated August 21, 2007, and the results of the September 20, 2007 Conference Call. As discussed during the September 14, 2007 conference call, because additional work is to be implemented as part of the SWMU 14 and SWMU 68 RFIs, revised RFI reports do not need to be submitted at this time; however, those revised report shall be submitted within 60 days of completion of all additional work required to be implemented as part of those RFIs.

Navy Response to EPA General Comment:

Comment noted. Responses to TechLaw comments are provided below.

TECH LAW GENERAL COMMENTS

TechLaw General Comment No. 1:

1. The Navy's responses to EPA's General Comment regarding the validity and use of the October 17, 2006 "Revised Final Summary for Environmental Background Concentrations for Inorganic Constituents Report" (Background Report) is not adequate at this time. The EPA noted that "the base-wide background concentrations for arsenic, lead, and particularly vanadium … may not be fully representative of natural background conditions in the SWMU 68 area and/or may have been impacted by contaminant releases." Specifically, the EPA states that three of the subsurface soil samples used in the Background Report "were collected during the 2004 Environmental Conditions of Property (ECP) investigations at what subsequently became identified as SWMU 68" and that "all [three samples] may have been impacted by contamination, based on reported indications of 'DRO' (diesel range organics) in those samples." In addition, the EPA notes that there is no rationale provided in the Background Report as to why vanadium would occur naturally at such high concentrations at this site.

   In response, the Navy provides a statistical comparison to U.S. Geological Survey (USGS) vanadium data for Puerto Rico. The logic of comparing 19 vanadium sample results to 292 vanadium sample results is unclear. The text on page 2 states "As evidenced by Table 1, the range of vanadium concentrations within the NAPR background data set falls within the range of concentrations within the USGS data set." The USGS data set is so large, taking into account the

entire island of Puerto Rico, and the range is so broad that it appears that any data would fall within this range. In addition, this does not appear to address the question of the site specific concentrations at SWMU 68, which may pose a current or future risk to residential or industrial users.

Based on this, it appears that supplemental discussion is necessary for this response. First, the Navy should address more specifically those samples identified above by EPA and discuss whether they may themselves be impacted by contamination. Second, additional information regarding the USGS data should be provided to confirm that this data is an adequate standard for comparison to base-wide data. Finally, additional discussion is necessary to address EPA's concern regarding the lack of rationale provided as to why vanadium would occur naturally at such high concentrations at this site.

Navy Response to TechLaw General Comment No. 1:

The NAPR's background surface soil data set of vanadium concentrations range from 123 to 223 mg/kg, which falls within roughly the bottom two-thirds of the USGS data for the island. With the exception of 6 data points (out of 293), all vanadium concentrations exceed its human-health screening level of 7.8 mg/kg (using $1/10^{th}$ of the USEPA Region IX Residential Soil Preliminary Remediation Goal of 78 mg/kg for noncarcinogens as a conservative measure). The attached table provides the USGS data for vanadium. Vanadium is a trace metal present in igneous rocks (GEOCHEMISTRY by Arthur H. Brownlow, Prentice-Hall, Inc., 1979, page 385). The Puerto Rico regional geology and soil types include volcaniclastic and sedimentary rocks that have been locally intruded by igneous rocks (see http://capp.water.usgs.gov/gwa/ch_n/N-PR_VItext1.html and attached figure obtained from http://capp.water.usgs.gov/gwa/ch_n/gif/N073.gif showing the geological rock types across the entire island of Puerto Rico) as one of the primary components, therefore it is not unexpected to find that its naturally-occurring concentrations across the island are elevated, and can therefore frequently exceed its Region IX PRG.

The USGS data was obtained from "Analytical Results for Stream Sediment and Soil Samples from the Commonwealth of Puerto Rico, Isla de Culebra, and Isla de Vieques", U.S. Department of the Interior Geological Survey, 1992. This data was obtained during the preparation of the Corrective Measures Study (CMS) Report for SWMU 9 (Baker Environmental, Inc., 2003) and reported as semi-quantitative because the concentrations were only reported as 50, 70, 100, 150, 200, 300, 500, 700, 1000, and 1500 depending on certain pre-assigned intervals within which the reading was obtained. The precision of the analytical method was reported to be approximately ± one reporting interval at the 83 percent confidence level and ± two reporting intervals at the 96 percent confidence interval in the CMS report. The data was deemed acceptable by the USEPA for its intended purpose as a gross measure of the background levels of vanadium and other metals in the soil of Puerto Rico, and the report was subsequently accepted as final. Furthermore, the USGS data is considered to be an adequate standard for gross comparison purposes and has been used by other agencies such as the ATSDR for public health assessment of soil pathway exposure at Puerto Rico (see http://www.atsdr.cdc.gov/HAC/PHA/islandevieques/idv_p4.html). Therefore, the Navy believes that this data can be used for the purposes of gross quantitative comparison to background levels. By comparing the NAPR data set to the range of USGS data it is apparent that even the highest detected concentration of vanadium in the NAPR data set is well within the USGS data range, even assuming that the latter is semi-quantitative and may include statistical outliers.

Regarding the three samples collected in the SWMU 68 area, their concentrations of vanadium are not elevated compared to the range of NAPR background data. Note the following characteristics of the samples and their vanadium concentrations:

- Samples 14E-SB02-02 and 14E-SB03-02 at SWMU 68 (ECP-14) included in background "clay" subsurface soil data set contained vanadium concentrations of 140 mg/kg and 120 mg/kg, respectively.
- Sample 14E-SB01-04 sample included in the background "sand or silt" subsurface soil data contained a vanadium concentration of 78 mg/kg.

The removal of these data points would raise the background screening level for vanadium. Therefore, these data points are being retained as a conservative measure.

TechLaw General Comment No. 2a:

2. The Navy does not provide sufficient information regarding the summary statistics for either the Background Report data or the site specific data. Without additional information regarding these statistics, the following concerns were identified:

   Table 2, Summary Statistics and Results – Vanadium in NAPR Background and SWMU 68 Surface Soil, states that the surface soil data for vanadium is normally distributed. Based on Figure 1, Probability Plot of Vanadium in NAPR Background Surface Soil, this appears inaccurate. Figure 1 appears to show left skewness and/or potentially a mixture of several normal distributions.

Navy Response to TechLaw General Comment No. 2a:

As evidenced by the attached descriptive statistics summary reports, generated using NCSS statistical software (see Tables 1-A and 1-B), the NAPR background vanadium surface soil data set follows a normal and lognormal distribution (based on the Shapiro-Wilk test; non-transformed data were used to test if data are normally distributed [Table 1-A], while log-transformed data were used to test if data are lognormal [Table 1-B]. USEPA ProUCL Version 3.00.02 software calculations (included as Table 1-C) also show that the NAPR background vanadium surface soil data set follows a normal and lognormal distribution, as well as a gamma distribution. Based on a review of the probability plots for each distribution (see Figures 1-A through 1-C), the data appear to fit either a normal or gamma distribution the best.

The Navy agrees that the surface soil probability plots shown in Figures 1-B and 1-C exhibit what appears to be a mixture of several different populations (as evidenced by multiple inflection points). However, when a break (i.e., inflection point) occurs within the data set, you do not see a segment with a gradual slope followed by a segment with a steeper slope (i.e., the slope of each segment with multiple data points are either similar to the preceding segment or more gradual than the preceding segment). In this case, the inflection points should not be considered background delimiters (NFESC, 2003 and 2004).

The pattern observed in Figures 1-B and 1-C may be attributable to the relatively low sample size of the NAPR background vanadium surface soil data set (n = 19). It is noted that background data sets can be composed of multiple natural subpopulations due to factors such as variations in physical characteristics of the soil (the NAPR background surface soil data set for inorganics are lumped into a single data set with no consideration given to physical characteristics such as grain size). Therefore, the appearance of the probability plots depicted in Figures 1-B and 1-C also may be explained by the presence of multiple natural subpopulations within the NAPR background vanadium surface soil data set. Regardless of the reason for the appearance of several subpopulations within the data set, all data points within each apparent subpopulation fall near or on the predicted quantile lines (see Figures 1-B and 1-C). The absence of data points above the predicted quantile lines for each distribution at the upper concentration range of the data is not indicative a contaminated population.

References:

Naval Facilities Engineering Service Center (NFESC). 2003. Guidance for Environmental background Analysis. Volume II: Sediment. UG-2059-ENV.

NFESC. 2004. Guidance for Environmental Background Analysis. Volume III: Groundwater. UG-2059-ENV.

TechLaw General Comment No. 2b:

> Table 3, Summary Statistics and Results – Vanadium in NAPR Background and SWMU 68 Subsurface Soil, and Table 4, Summary Statistics and Results – Vanadium in NAPR Background and SWMU 68 Groundwater, indicate that the subsurface soil and groundwater data are lognormally distributed. However, Figure 2, Probability Plot of Vanadium in NAPR Background Subsurface Soil, and Figure 3, Probability Plot of Vanadium in NAPR Background Groundwater, are labeled "Normal Distribution." These figures should be log plots.

Navy Response to TechLaw General Comment No. 2b:

As evidenced by the attached descriptive statistics summary reports generated using NCSS statistical software (see Tables 2-A and 2-B), the NAPR background vanadium subsurface soil data set (clay soil type) follows a normal and lognormal distribution (based on Shapiro-Wilks test; non-transformed data are used to test if data are normally distributed [Table 2-A], while log-transformed data are used to test if data are lognormal [Table 2-B]. USEPA ProUCL Version 3.00.02 software calculations (included as Table 2-C) also show that the NAPR background vanadium surface soil data set follows a normal and lognormal distribution, as well as a gamma distribution. Probability plots assuming a normal distribution (Figure 2-A for non-transformed data and Figure 2-B for log-transformed data) and the probability plot assuming a gamma distribution (Figure 2-C) indicate that the NAPR background subsurface soil data set is best described by a lognormal distribution.

The NAPR background vanadium groundwater data set does not follow a normal distribution (see Tables 3-A [NCSS descriptive statistical summary report and 3-B [ProUCL Version 3.00.02 software calculations]). Descriptive statistical evaluations performed on log-transformed groundwater data (see Table 3-C), as well as ProUCL calculations (see Table 3-B), indicate that the NAPR background groundwater data set is lognormal. ProUCL calculations (see Table 3-B) also show that the NAPR background groundwater data set follows a gamma distribution. Based on a review of the probability plots for each distribution fit by the data (see Figures 3-A [lognormal distribution] and 3-B [gamma distribution]), the NAPR background vanadium groundwater data can best be described as a lognormal distribution.

The NAPR background subsurface soil and groundwater probability plots provided with the Navy's response to EPA comments dated July 20, 2007 use a log scale for the y-axis. Therefore, it is appropriate to use "normal distribution" quantiles on the x-axis. Note that the lognormal probability plots provided in this response to comments (i.e., Figures 2-B and 3-A) plot log-transformed data against "normal distribution" quantiles. Both plotting methods (non-transformed data plotted on a log scale and log-transformed data plotted on a linear scale) yield the same figure.

TechLaw General Comment No. 2c:

> Finally, it appears that in parts of the analysis, the Navy compares different types of distributions to one another. For example, in Table 6, Summary Statistics and Results – Arsenic in NAPR Background and SWMU 68 Subsurface Soil, gamma and lognormal distributions are compared. In addition, Figure 7, Probability Plot of Arsenic in NAPR Background and SWMU 68 Subsurface Soil, compares both these data sets on a plot labeled "Normal Distribution."

Navy Response to TechLaw General Comment No. 2c:

The distributions shown on Table 6 (included with the Navy responses to EPA comments dated July 20, 2007) immediately below the 95 percent UCL concentration (lognormal distribution for the SWMU 68 data set and gamma distribution for the NAPR background data set) represent the distributions assumed by ProUCL Version 3.00.02 for the calculation of the 95 percent UCL values for each individual data set.

As evidenced by NCSS descriptive statistics summary reports for the combined NAPR background and SWMU 68 arsenic subsurface soil data set data set using non-transformed data and log-transformed data (see Tables 18-A and 18-B), the combined data set does not follow a normal or lognormal distribution. ProUCL Version 3.00.02 summary calculations also indicate that the combined data set does not follow a normal or lognormal distribution, nor does the combined data set follow a gamma distribution. Pro UCL Version 3.00.02 indicates that the distribution is non-parametric. Although the combined data set does not fit a normal,

lognormal, or gamma distribution, the best fit of these three distributions appears to be a normal or gamma distribution (see Figures 4-A, 4-B, and 4-C). The probability plot included with the Navy responses to EPA comments dated August 20, 2007 plotted arsenic concentrations on a log scale. While a plot of data on a log scale using "normal distribution quantiles" is appropriate for lognormal distributions, the data appear to fit a normal or gamma distribution the best. Therefore, the normal or gamma distribution probability plot is more appropriate for this data set. It is noted that conclusions regarding subsurface soil arsenic concentrations at SWMU 68 do not change based on this line of evidence. Each assumed distribution indicates the presence of a contaminated subpopulation at the upper concentration range (all data points within this contaminated subpopulation are from the SWMU 68 data set).

The Navy acknowledges that different distributions are shown on tables and figures for the same data set (including the NAPR background and SWMU 68 arsenic subsurface soil data set). As discussed above, the distributions shown under the 95 percent UCL concentrations within the various statistical summary tables provided with the Navy's responses to comments dated July 20, 2007 (i.e., Tables 2, 3, 4, 5, 6,and 11) represent the distributions assumed by Pro UCL Version 3.00.02 for the calculation of the recommended 95 percent UCL values. Distributions are also shown within the statistical summary tables under the "test for normality" column. Tests for normality are conducted on non-transformed and log transformed data using the Shapiro-Wilk test. If both data sets (SWMU-specific and background) exhibit a normal distribution or if both data sets exhibit a lognormal distribution, statistical evaluations on the mean of the distributions can be performed using parametric procedures (e.g., two-sample t test). Therefore, the criteria used to identify the distributions listed in this column are based on which distribution fits both individual data sets. For a given data set, the distribution shown may not represent the best fit of the data. However, based on the Shapiro-Wilk test, the data do fit the distribution listed. Finally, the various probability plots include distribution-specific quantiles on the x-axis. The probability plots included with the Navy's response to comments dated July 20, 2007 represent plots for the distributions that best describe the data sets in question (based on professional judgement). For combined data sets, such as the NAPR background and SWMU 68 arsenic subsurface soil data set, distributions shown within statistical summary tables are based on each individual data set, while the distributions shown on the x-axis of the probability plots are based on the combined data set. As such, the distributions shown within the statistical summary tables for each individual distribution may not match the distribution shown on the probability plots for the combined data set.

TechLaw General Comment No. 2d:

> For each data set presented in this document, provide summary statistics regarding distributions, skewness, kurtosis, correlation coefficients, etc. In addition, update the probability plots as discussed above where discrepancies are present. Finally, discuss why the same element has different distributions at the site and please provide rationale as to why this information can be compared in the manner currently presented.

Navy Response to TechLaw General Comment No. 2d:

Tables summarizing descriptive statistics for each data set presented in the Navy's response to comments dated August 20, 2007 are provided as attachments. A summary of the tables provided are listed below.

NAPR Background Vanadium Surface Soil Data Set:

- Table 1-A: NCSS descriptive statistical summary report using non-transformed data
- Table 1-B: NCSS descriptive statistical summary report using log-transformed data
- Table 1-C: ProUCL Version 3.00.02 summary calculations

NAPR Background Vanadium Subsurface Soil Data Set:

- Table 2-A: NCSS descriptive statistical summary report using non-transformed data
- Table 2-B: NCSS descriptive statistical summary report using log-transformed data
- Table 2-C: ProUCL Version 3.00.02 summary calculations

NAPR Background Vanadium Groundwater Data Set:

- Table 3-A: NCSS descriptive statistical summary report using non-transformed data
- Table 3-B: ProUCL Version 3.00.02 summary calculations
- Table 3-C: NCSS descriptive statistical summary report using log-transformed data

SWMU 68 Vanadium Surface Soil Data Set:

- Table 4-A: NCSS descriptive statistical summary report using non-transformed data
- Table 4-B: NCSS descriptive statistical summary report using log-transformed data
- Table 4-C: ProUCL Version 3.00.02 summary calculations

SWMU 68 Vanadium Subsurface Soil Data Set:

- Table 5-A: NCSS descriptive statistical summary report using non-transformed data
- Table 5-B: NCSS descriptive statistical summary report using log-transformed data
- Table 5-C: ProUCL Version 3.00.02 summary calculations

SWMU 68 Vanadium Groundwater Data Set.

- Table 6-A: NCSS descriptive statistical summary report using non-transformed data
- Table 6-B: NCSS descriptive statistical summary report using log-transformed data
- Table 6-C: ProUCL Version 3.00.02 summary calculations

SWMU 14 Vanadium Surface Soil Data Set:

- Table 7-A: NCSS descriptive statistical summary report using non-transformed data
- Table 7-B: NCSS descriptive statistical summary report using log-transformed data
- Table 7-C: ProUCL Version 3.00.02 summary calculations

SWMU 14 Vanadium Subsurface Soil Data Set:

- Table 8-A: NCSS descriptive statistical summary report using non-transformed data
- Table 8-B: NCSS descriptive statistical summary report using log-transformed data
- Table 8-C: ProUCL Version 3.00.02 summary calculations

SWMU 14 Vanadium Groundwater Data Set:

- Table 9-A: NCSS descriptive statistical summary report using non-transformed data
- Table 9-B: NCSS descriptive statistical summary report using log-transformed data
- Table 9-C: ProUCL Version 3.00.02 summary calculations

NAPR Background Arsenic Surface Soil Data Set:

- Table 10-A: NCSS descriptive statistical summary report using non-transformed data
- Table 10-B: NCSS descriptive statistical summary report using log-transformed data
- Table 10-C: ProUCL Version 3.00.02 summary calculations

NAPR Background Arsenic Subsurface Soil Data Set:

- Table 11-A: NCSS descriptive statistical summary report using non-transformed data
- Table 11-B: NCSS descriptive statistical summary report using log-transformed data
- Table 11-C: ProUCL Version 3.00.02 summary calculations

SWMU 68 Arsenic Surface Soil Data Set:

- Table 12-A: NCSS descriptive statistical summary report using non-transformed data
- Table 12-B: NCSS descriptive statistical summary report using log-transformed data
- Table 12-C: ProUCL Version 3.00.02 summary calculations

SWMU 68 Arsenic Subsurface Soil Data Set:

- Table 13-A: NCSS descriptive statistical summary report using non-transformed data
- Table 13-B: NCSS descriptive statistical summary report using log-transformed data
- Table 13-C: ProUCL Version 3.00.02 summary calculations

Combined NAPR Background and SWMU 14 Vanadium Surface Soil Data Set:

- Table 14-A: NCSS descriptive statistical summary report using non-transformed data
- Table 14-B: NCSS descriptive statistical summary report using log-transformed data
- Table 14-C: ProUCL Version 3.00.02 summary calculations

Combined NAPR Background and SWMU 14 Vanadium Subsurface Soil Data Set:

- Table 15-A: NCSS descriptive statistical summary report using non-transformed data
- Table 15-B: NCSS descriptive statistical summary report using log-transformed data
- Table 15-C: ProUCL Version 3.00.02 summary calculations

Combined NAPR Background and SWMU 14 Vanadium Groundwater Soil Data Set:

- Table 16-A: NCSS descriptive statistical summary report using non-transformed data
- Table 16-B: NCSS descriptive statistical summary report using log-transformed data
- Table 16-C: ProUCL Version 3.00.02 summary calculations

Combined NAPR Background and SWMU 68 Arsenic Surface Soil Soil Data Set:

- Table 17-A: NCSS descriptive statistical summary report using non-transformed data
- Table 17-B: NCSS descriptive statistical summary report using log-transformed data
- Table 17-C: ProUCL Version 3.00.02 summary calculations

Combined NAPR Background and SWMU 68 Arsenic Subsurface Soil Data Set:

- Table 18-A: NCSS descriptive statistical summary report using non-transformed data
- Table 18-B: NCSS descriptive statistical summary report using log-transformed data
- Table 18-C: ProUCL Version 3.00.02 summary calculations

As illustrated by the NCSS statistical summary reports and ProUCl Version 3.00.02 calculations, many of the data sets fit more than one distribution. This is most likely due to the small samples size of each data set (a larger sample size will generally improve the accuracy of the estimation procedure). For example, it may be difficult to detect assumption violations (i.e., nonnormality) when the sample size is small even when present. Probability plots (constructed by plotting analytical data versus expected quantiles of a given distribution) were used to determine which distribution represents the best fit of the data. The use of probability plots in statistical evaluation of background concentrations is explained in detail within Navy guidance documents for environmental background analysis available at http://web.ead.anl.gov/ecorisk/related/.

It is noted that this comment requests that probability plots included with the Navy's response to comments dated July 29 be updated to fix discrepancies. A discussion of the various distributions shown on statistical summary tables and probability plots was presented in the Navy response to General Comment No. 2 above. With the exception of the probability plots for the NAPR background and SWMU 68 arsenic subsurface soil data set (see Figures 4-A though 4-C), revisions to the various probability plots are not necessary.

TechLaw General Comment No. 3:

3. As described in the tables provided, the term "positive detections" is not adequately defined. Define this term and discuss how the detection limits are treated within these statistical tests.

Navy Response to TechLaw General Comment No. 3:

The term "positive detections" was used in a single table included as part of the Navy's response to EPA comments dated July 20, 2007 (i.e., Table 7). This term refers to "detected concentrations".

TechLaw Specific Comment No. 1:

1. **Navy Response to EPA Comment No. 1, SWMU 68, Page 3.** The third paragraph of this response concludes with "For each medium, the maximum, mean, and 95% UCL background concentration exceeds maximum, mean, and 95% UCL concentrations for SWMU 68." This statement is incorrect. As stated in Section 5.3, Subsurface Soils, of the Phase I RCRA Facility Investigation Report for SWMU 68, NAPR dated March 26, 2007 (SWMU 68 Report), and as reiterated by the EPA General Comment, "vanadium exceeded its background screening level at … one location." Please revise this response to account for this discrepancy.

Navy Response to TechLaw Specific Comment No. 1:

The Navy agrees with this comment. A revision to this statement is provided in italics below:

> *The descriptive statistics presented in each table also support the conclusions of the distributional statistics. For surface soil and groundwater, the maximum, mean, and 95% UCL concentrations for the background surface soil and groundwater data sets exceed maximum, mean, and 95% UCL concentrations for the SWMU 68 surface soil and groundwater data sets. Mean and 95% UCL concentrations for the background subsurface soil data set (clay soil type) also exceed mean and 95% UCL concentrations for the SWMU 68 surface soil data set, while the maximum SWMU 68 subsurface soil concentration (440 mg/kg) is only slightly elevated above the maximum background concentration (410 mg/kg).*

TechLaw Specific Comment No. 1 (contd.):

> In addition, since vanadium does exceed background chemical levels in this subsurface sample, further discussion is necessary to adequately respond to EPA Comment No. 2 for SWMU 68. Specifically, the Navy should provide additional discussion as to the potential human health risks resulting from vanadium in the subsurface soil.

Navy Response to TechLaw Specific Comment No. 1 (contd.):

The Navy respectfully disagrees with this comment. A statistical evaluation of the background and SWMU 68 vanadium subsurface soil data sets was presented within the Navy's response to comments dated July 20, 2007 (Table 3). The statistical method evaluating the mean of the distributions (two-sample t-test) and the right-tail of the distributions (quantile test and slippage test) concluded that vanadium concentrations in SWMU 68 subsurface soil are not statistically elevated above background concentrations.

TechLaw Specific Comment No. 2:

2. **Navy Response to TechLaw Specific Comment No. 6, SWMU 68, Page 9.** This response is not adequate at this time. As indicated in TechLaw's original comment, the arsenic contamination identified on the northern portion of the site was not adequately bounded to the north in the initial investigation. The final sentence of TechLaw's comment states "If this statement cannot be supported by a statistical analysis, identify additional arsenic characterization and remediation as an activity for future work at SWMU 68." Based on the statistical analyses presented, the arsenic contamination located at the northern portion of this site is not representative of natural background concentrations. Therefore, additional characterization of this contamination is warranted, specifically to define the extent of contamination to the north.

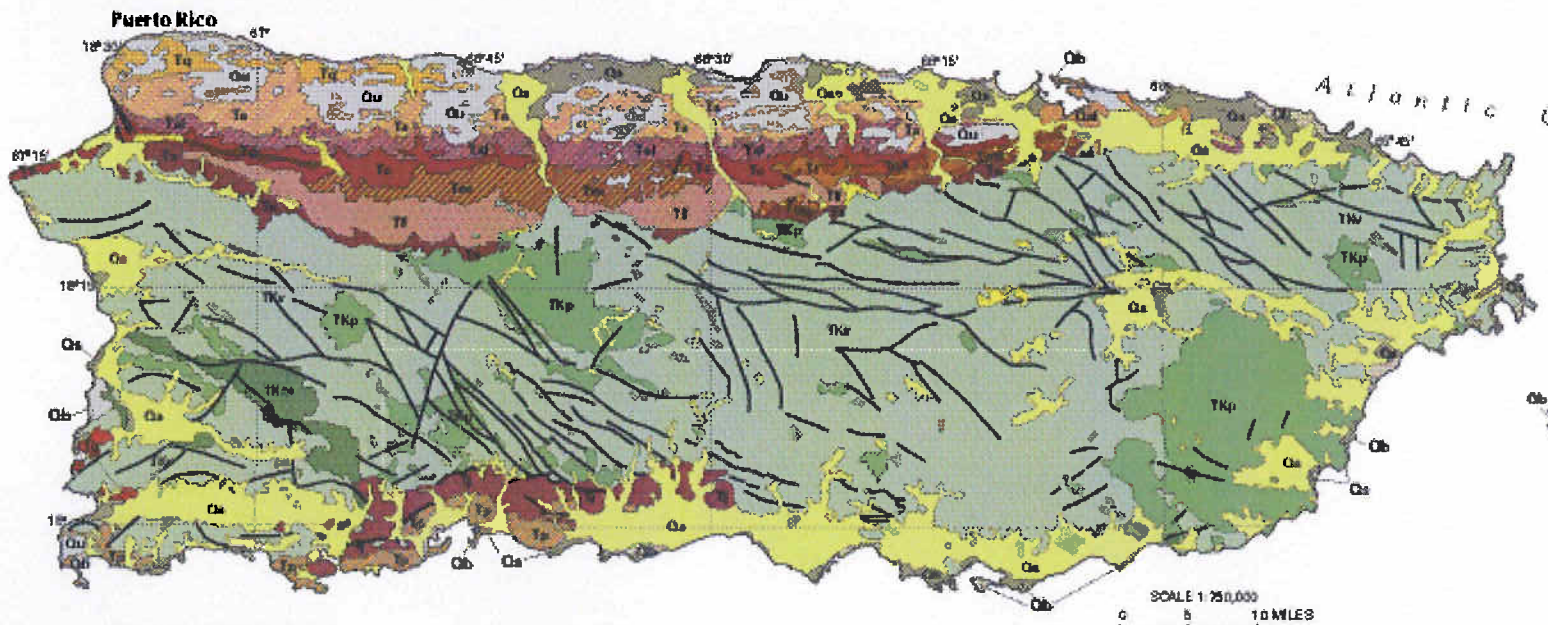
Navy Response to TechLaw Specific Comment No. 2:

The Navy agrees with this comment. Five surface soil samples were collected on September 27, 2007 to further characterize/bound arsenic concentrations within the northern portion of the site. Samples locations, depicted on Figure 5, were agreed upon during a conference call held on September 20, 2007 between EPA, Navy, Tech Law, and Baker personnel. The range of arsenic concentrations for these five samples is less than detection limit (of 0.01 mg/kg) to 1.9 mg/kg. These concentrations are less than the Upper Limit of the Mean NAPR Basewide Surface Soil Background value of 2.65 mg/kg. Based on these results, it can be concluded that the extent of arsenic contamination has been adequately defined. The results from this additional

characterization (see attached summary of results from the laboratory) will be provided in the Revised Phase I RFI Report for SWMU 68.

PUERTO RICO GEOLOGICAL MAP

Figure 73. Puerto Rico is dominated by a central cordillera, or mountain axis, of faulted, folded volcaniclastic and sedimentary rocks intruded by igneous rocks that are overlain by limestones on the north and the south. Alluvial coastal plain and valley-fill deposits are present in a discontinuous belt around the periphery of the island. St. Croix, St. Thomas, and St. John consist largely of volcaniclastic and sedimentary rocks. On these islands, alluvial materials fill the lower reaches of bedrock valleys and surrounding bays. A central plain on St. Croix is underlain by marl and limestone and minor alluvial deposits.



EXPLANATION

Quaternary deposits
- Qa — Alluvium
- Ql — Landslide deposits
- Qb — Beach deposits
- Qs — Swamp and marsh deposits
- Qal — Artificial fill
- Qu — Undifferentiated surficial deposits

Pliocene and Miocene rocks
- Tq — Quebradillas Limestone
- Tp — Ponce Limestone

Miocene rocks
- Ta — Aymamón Limestone
- Tal — Aguada (Los Puertos) Limestone
- Tg — Guanajibo Formation
- Tc — Cibao Formation
- Tm — Montebello Limestone Member
- Tqa — Quebrada Arenas Limestone Member—Includes Miranda Sand Member
- Tr — Rio Indio Limestone Member—Includes Almirante Sur Lentil
- Tgu — Guajataca Member

Miocene and Oligocene deposits
- Tmc — Mucarabones Sand
- Tj — Juana Díaz Formation
- Tll — Lares Formation
- Ts — San Sebastián Formation

Eocene, Paleocene, and Cretaceous rocks
- TKv — Volcanic and sedimentary rocks
- TKp — Plutonic rocks—Mostly quartz diorite and granodiorite
- TKm — Metamorphic (serpentinite), sedimentary, and igneous rocks

Fault

Modified from:

Briggs, R.P., and Akers, J.P., 1965, Hydrogeologic map of Puerto Rico and adjacent islands: U.S. Geological Survey Hydrologic Investigations Atlas HA–197, scale 1:240,000, 1 sheet

Monroe, W.H., 1980, Geology of the middle Tertiary formations of Puerto Rico: U.S. Geological Survey Professional Paper 953, 93 p.

R.D. Krushensky, written commun., 1993.

Base modified from U. S. Geological Survey digital data.

source: http://capp.water.usgs.gov/gwa/ch_n/gif/N073.gif

St. Thomas, St. John

Quaternary deposits
- Qalb — Alluvium—Includes beach deposits

Cretaceous rocks
- Kh — Hans Lollik Formation
- Kt — Tutu Formation—Includes unnamed intrusive igneous rocks
- Ko — Outer Brass Limestone
- Kl — Louisenhoj Formation
- Kwi — Water Island Formation—Includes unnamed intrusive igneous rocks
- Kd — Dioritic rocks

Fault

Islas de Vieques, Culebra

Quaternary deposits
- Qa — Alluvium
- Qb — Beach deposits

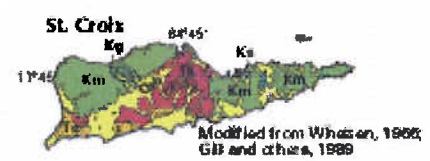
Pliocene rocks
- Tld — Unnamed limestone and dolomitic

Miocene and Oligocene rocks
- TKp — Intrusive rocks

Eocene, Paleocene, and Cretaceous rocks
- TKs — Andesite, tuff, and breccia, and minor limestone

Fault

Caribbean Sea



St. Croix

Quaternary deposits
- Qab — Alluvium, minor beach deposits

Pliocene rocks
- Ts — Post-Kingshill carbonate rocks

Miocence rocks
- Tk — Kingshill Limestone

Cretaceous rocks
- Kg — Fountain Gabbro
- Ks — Southgate Diorite
- Km — Mount Eagle Group volcaniclastic sediments

STATISTICAL CALCULATIONS AND PLOTS

Table 1-A
NAPR Background Vanadium Surface Soil Descriptive Statistics Report: Non-transformed Data

Summary Section of Vanadium when area=2b

Count	Mean	Standard Deviation	Standard Error	Minimum	Maximum	Range
19	148.3263	64.26712	14.74389	35	270	235

Variation Section of Vanadium when area=2b

Parameter	Variance	Standard Deviation	Unbiased Std Dev	Std Error of Mean	Interquartile Range	Range
Value	4130.263	64.26712	65.16549	14.74389	104.8	235
Std Error	992.3357	10.91829		2.504828		
95% LCL	2358.176	48.56105		11.14067		
95% UCL	9032.563	95.0398		21.80363		

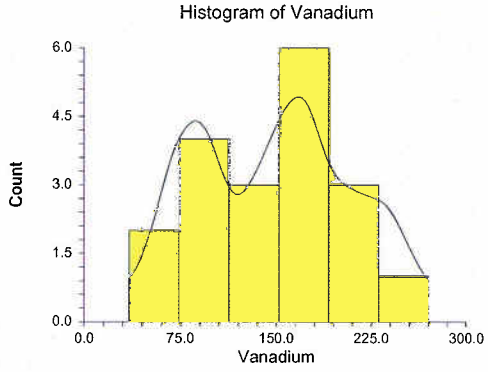
Skewness and Kurtosis Section of Vanadium when area=2b

Parameter	Skewness	Kurtosis	Fisher's g1	Fisher's g2	Coefficient of Variation	Coefficient of Dispersion
Value	0.091557	2.09677	9.959916E-02	-0.7983933	0.433282	0.3408325
Std Error	0.3376397	0.3530754			6.391407E-02	

Normality Test Section of Vanadium when area=2b

Test Name	Test Value	Prob Level	10% Critical Value	5% Critical Value	Decision (5%)
Shapiro-Wilk W	0.9678807	0.7334189			Can't reject normality
Anderson-Darling	0.2739785	0.6644605			Can't reject normality
Martinez-Iglewicz	1.004185		1.226978	1.380602	Can't reject normality
Kolmogorov-Smirnov	0.1270807		0.181	0.197	Can't reject normality
D'Agostino Skewness	0.2018836	0.8400077	1.645	1.960	Can't reject normality
D'Agostino Kurtosis	-0.8418	0.399874	1.645	1.960	Can't reject normality
D'Agostino Omnibus	0.7495	0.687474	4.605	5.991	Can't reject normality

Plots Section of Vanadium when area=2b



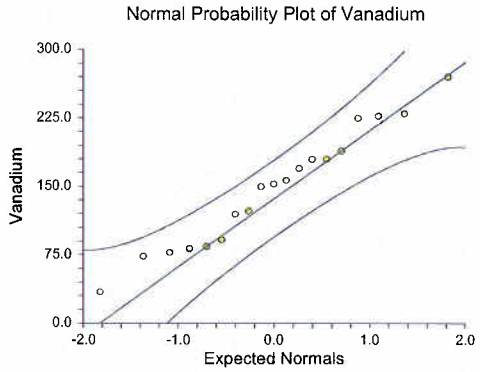


Table 1-B
NAPR Background Vanadium Surface Soil Descriptive Statistics Report: Log-transformed Data

Summary Section of logVn when area=2b

Count	Mean	Standard Deviation	Standard Error	Minimum	Maximum	Range
19	2.124211	0.2253963	5.170947E-02	1.54	2.43	0.89

Variation Section of logVn when area=2b

Parameter	Variance	Standard Deviation	Unbiased Std Dev	Std Error of Mean	Interquartile Range	Range
Value	5.080351E-02	0.2253963	0.2285471	5.170947E-02	0.35	0.89
Std Error	1.782036E-02	5.590551E-02		0.0128256		
95% LCL	2.900629E-02	0.1703123		3.907233E-02		
95% UCL	0.1111033	0.3333216		7.646923E-02		

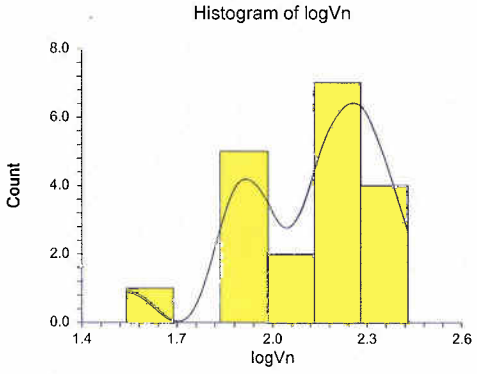
Skewness and Kurtosis Section of logVn when area=2b

Parameter	Skewness	Kurtosis	Fisher's g1	Fisher's g2	Coefficient of Variation	Coefficient of Dispersion
Value	-0.8638182	3.337756	-0.9396941	0.8440884	0.1061083	0.0791888
Std Error	0.4064494	0.8595881			2.013732E-02	

Normality Test Section of logVn when area=2b

Test Name	Test Value	Prob Level	10% Critical Value	5% Critical Value	Decision (5%)
Shapiro-Wilk W	0.9228745	0.1279055			Can't reject normality
Anderson-Darling	0.5096087	0.1976409			Can't reject normality
Martinez-Iglewicz	1.138322		1.226978	1.380602	Can't reject normality
Kolmogorov-Smirnov	0.1240618		0.181	0.197	Can't reject normality
D'Agostino Skewness	-1.790339	7.339946E-02	1.645	1.960	Can't reject normality
D'Agostino Kurtosis	0.9864	0.323915	1.645	1.960	Can't reject normality
D'Agostino Omnibus	4.1784	0.123787	4.605	5.991	Can't reject normality

Plots Section of logVn when area=2b



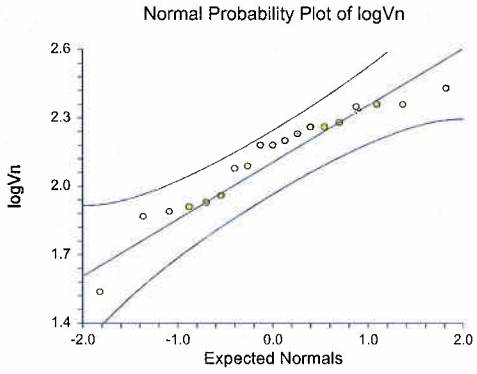
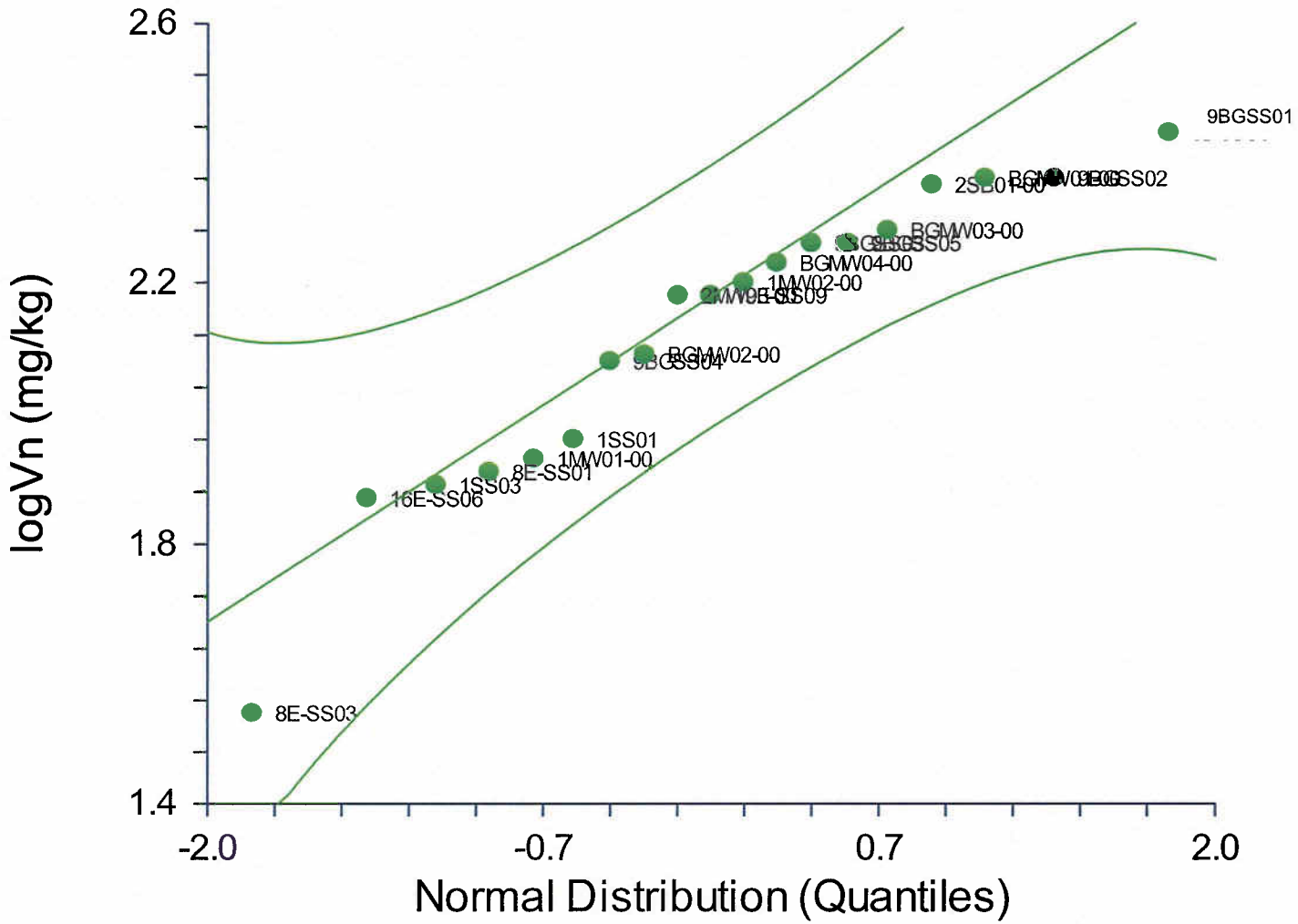


Table 1-C
ProUCL Version 3.00.02 Calculations for NAPR Background Vanadium Surface Soil Data Set

Data File		
Variable:	Vanadium	
Raw Statistics		
Number of Observations	19	
Number of Missing Data	0	
Number of Valid Observations	19	
Number of Distinct Observations	18	
Minimum	35	
Maximum	270	
Mean	148.3263	
Standard Deviation	64.26712	
Variance	4130.263	
Coefficient of Variation	0.433282	
Skewness	0.099599	
Too Few Distinct Observations?	NO	
Normal Statistics		
Lilliefors Test Statisitic	N/R	Shapiro Wilk method yields a more accurate result
Lilliefors 5% Critical Value	N/R	Shapiro Wilk method yields a more accurate result
Shapiro-Wilk Test Statisitic	0.968094	
Shapiro-Wilk 5% Critical Value	0.901	
5% Normality Test Result	NORMAL	Data are normal at 5% significance level
95% Student's-t UCL	173.8932	
Gamma Statistics		
k hat	4.716369	
k star (bias corrected)	4.006767	
Theta hat	31.44926	
Theta star	37.01895	
nu hat	179.222	
nu star	152.2571	
5% Approximate Chi Square Value	124.7296	
Adjusted Level of Significance	0.03687	
Adjusted Chi Square Value	122.5532	
Anderson-Darling Test Statistic	0.373674	
Anderson-Darling 5% Critical Value	0.743148	
Anderson-Darling 5% Gamma Test Result	AD GAMMA	Data follow gamma distribution at 5% signifcance level.
Kolmogrov-Smirnov Test Statistic	0.149768	
Kolmogrov-Smirnov 5% Critical Value	0.199037	
Kolmogrov-Smirnov 5% Gamma Test Result	KS GAMMA	Data follow gamma distribution at 5% signifcance level
5% Gamma Test Result	GAMMA	Data follow gamma distribution at 5% signifcance level
95% Approximate Gamma UCL	181.0616	
95% Adjusted Gamma UCL	184.277	

Table 1-C
ProUCL Version 3.00.02 Calculations for NAPR Background Vanadium Surface Soil Data Set

Lognormal Statistics		
Minimum of log data	3.555348	
Maximum of log data	5.598422	
Mean of log data	4.889671	
Standard Deviation of log data	0.516921	
Variance of log data	0.267208	
Lilliefors Test Statisitic	N/R	Shapiro Wilk method yields a more accurate result
Lilliefors 5% Critical Value	N/R	Shapiro Wilk method yields a more accurate result
Shapiro-Wilk Test Statisitic	0.925405	
Shapiro-Wilk 5% Critical Value	0.901	
5% Lognormality Test Result	LOGNORMAL	Data are lognormal at 5% significance level
MLE Mean	151.908	
MLE Standard Deviation	84.07413	
MLE Coefficient of Variation	0.553454	
MLE Skewness	1.829893	
MLE Median	132.9099	
MLE 80% Quantile	205.7105	
MLE 90% Quantile	258.2466	
MLE 95% Quantile	311.0665	
MLE 99% Quantile	442.3185	
MVU Estimate of Median	131.9782	
MVU Estimate of Mean	150.7246	
MVU Estimate of Standard Deviation	81.13267	
MVU Estimate of SE of Mean	18.55069	
95% H-UCL	194.574	
95% Chebyshev (MVUE) UCL	231.5852	
97.5% Chebyshev (MVUE) UCL	266.5736	
99% Chebyshev (MVUE) UCL	335.3016	
Non-parametric Statisitics		
95% CLT UCL	172.5779	
95% Adjusted-CLT UCL	172.9378	
95% Modified-t UCL	173.9493	
95% Jackknife UCL	173.8932	
95% Chebyshev (Mean, Sd) UCL	212.5934	
97.5% Chebyshev (Mean, Sd) UCL	240.4019	
99% Chebyshev (Mean, Sd) UCL	295.0262	
Bootstrap Statistics		
Number of Bootstrap Runs	2000	
95% Standard Bootstrap UCL	171.6982	
95% Bootstrap-t UCL	174.3519	
95% Hall's Bootstrap UCL	174.3874	
95% Percentile Bootstrap UCL	170.8	
95% BCA Bootstrap UCL	171.2	



Curved lines indicate 95% Confidence Intervals

FIGURE 1-A
PROBABILITY PLOT OF VANADIUM IN NAPR BACKGROUND SURFACE SOIL: LOGNORMAL DISTRIBUTION (LOG TRANSFOMED DATA)

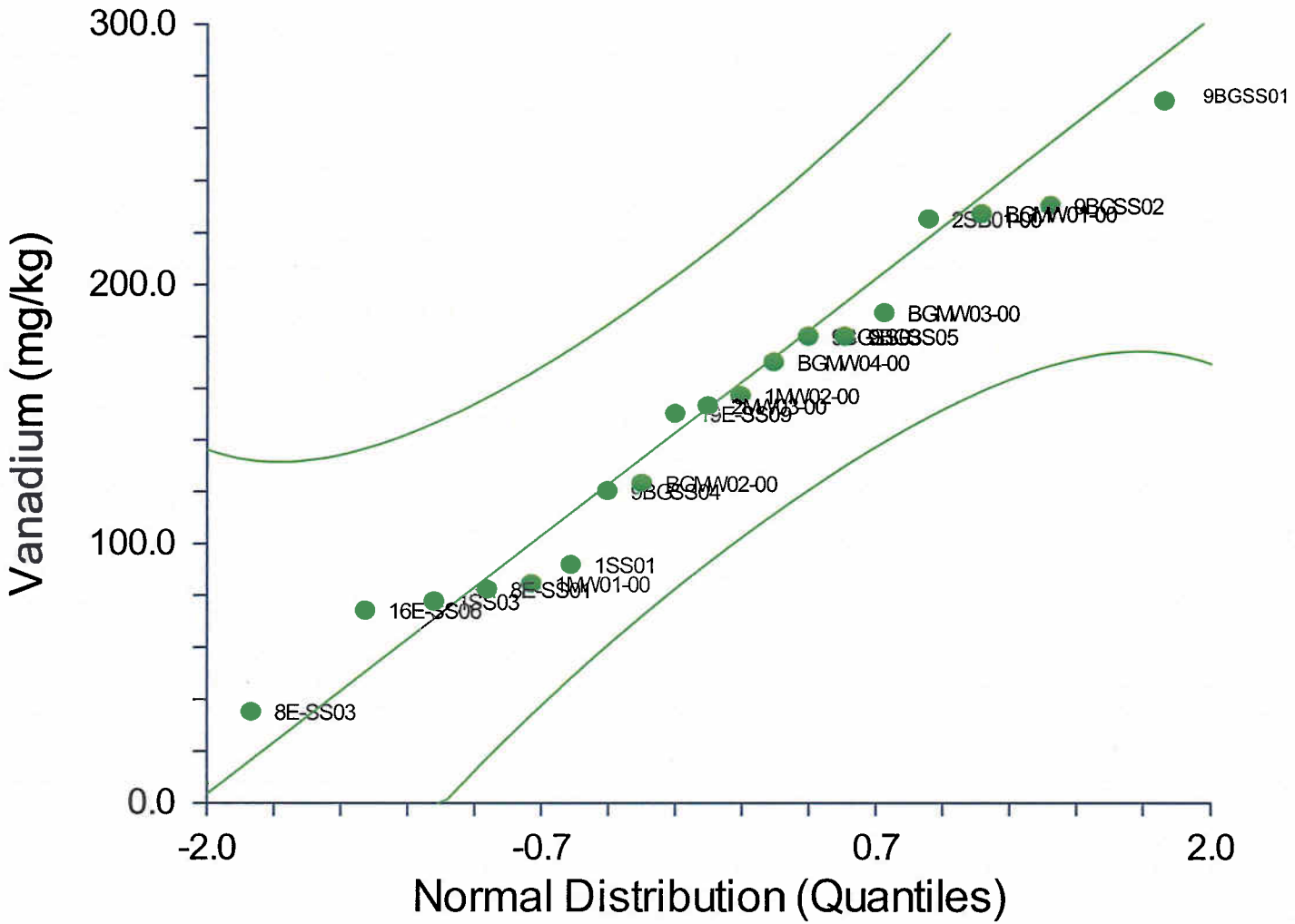
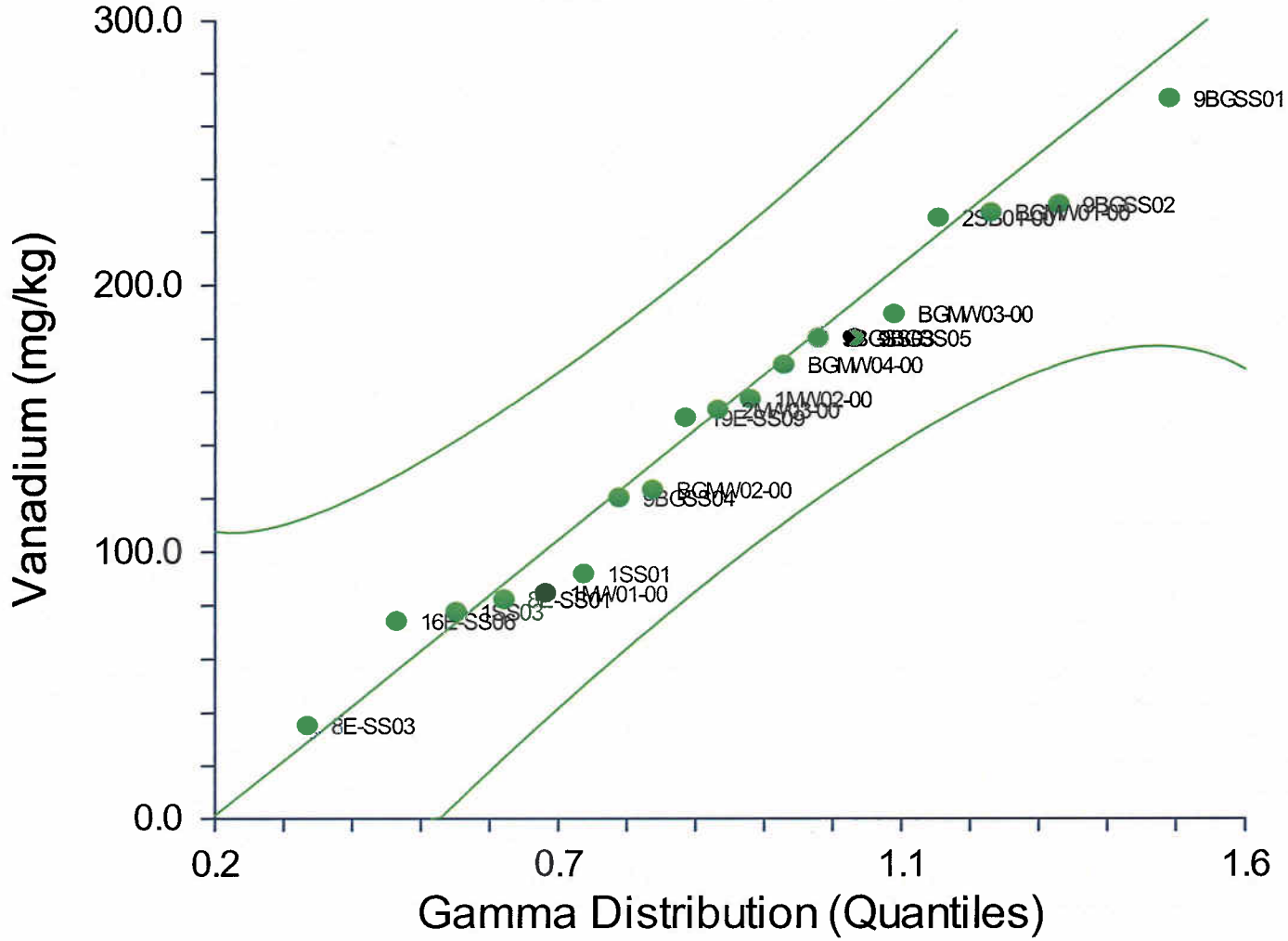


FIGURE 1-B
PROBABILITY PLOT OF VANADIUM IN NAPR BACKGROUND SURFACE SOIL: NORMAL DISTRIBUTION (NON-TRANSFORMED DATA)

Curved lines indicate 95% Confidence Intervals



Curved lines indicate 95% Confidence Intervals

FIGURE 1-C
PROBABILITY PLOT OF VANADIUM IN NAPR BACKGROUND SURFACE SOIL: GAMMA DISTRIBUTION (NON-TRANSFORMED DATA)

Table 2-A
NAPR Background Vanadium Subsurface Soil Descriptive Statistics Report: Non-transformed Data

Summary Section of Vanadium when area=2b

Count	Mean	Standard Deviation	Standard Error	Minimum	Maximum	Range
19	208.5737	112.7439	25.86524	25	410	385

Variation Section of Vanadium when area=2b

Parameter	Variance	Standard Deviation	Unbiased Std Dev	Std Error of Mean	Interquartile Range	Range
Value	12711.2	112.7439	114.3199	25.86524	140	385
Std Error	3296.062	20.67222		4.742533		
95% LCL	7257.464	85.19075		19.5441		
95% UCL	27798.4	166.7285		38.25014		

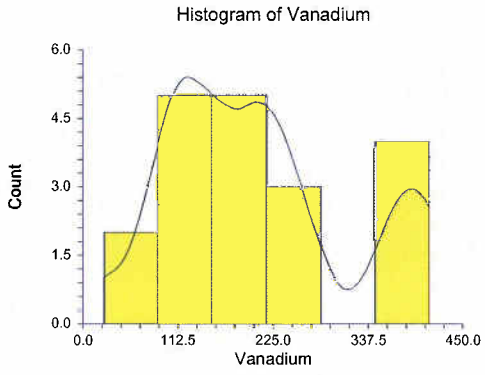
Skewness and Kurtosis Section of Vanadium when area=2b

Parameter	Skewness	Kurtosis	Fisher's g1	Fisher's g2	Coefficient of Variation	Coefficient of Dispersion
Value	0.5042081	2.277531	0.5484967	-0.5591504	0.5405473	0.4376579
Std Error	0.3424757	0.6789525			7.133722E-02	

Normality Test Section of Vanadium when area=2b

Test Name	Test Value	Prob Level	10% Critical Value	5% Critical Value	Decision (5%)
Shapiro-Wilk W	0.9315135	0.1846664			Can't reject normality
Anderson-Darling	0.5156905	0.190914			Can't reject normality
Martinez-Iglewicz	0.9972859		1.226978	1.380602	Can't reject normality
Kolmogorov-Smirnov	0.1406851		0.181	0.197	Can't reject normality
D'Agostino Skewness	1.087042	0.2770183	1.645	1.960	Can't reject normality
D'Agostino Kurtosis	-0.4652	0.641798	1.645	1.960	Can't reject normality
D'Agostino Omnibus	1.3981	0.497068	4.605	5.991	Can't reject normality

Plots Section of Vanadium when area=2b



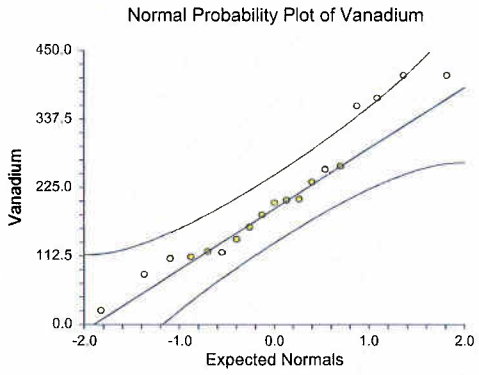


Table 2-B
NAPR Background Vanadium Subsurface Soil Descriptive Statistics Report: Log-transformed Data

Summary Section of logVn when area=2b

Count	Mean	Standard Deviation	Standard Error	Minimum	Maximum	Range
19	2.24421	0.2904272	6.662857E-02	1.4	2.61	1.21

Variation Section of logVn when area=2b

Parameter	Variance	Standard Deviation	Unbiased Std Dev	Std Error of Mean	Interquartile Range	Range
Value	8.434796E-02	0.2904272	0.2944869	6.662857E-02	0.33	1.21
Std Error	3.772785E-02	9.185647E-02		2.107332E-02		
95% LCL	0.0481585	0.2194505		5.034539E-02		
95% UCL	0.1844624	0.4294909		9.853196E-02		

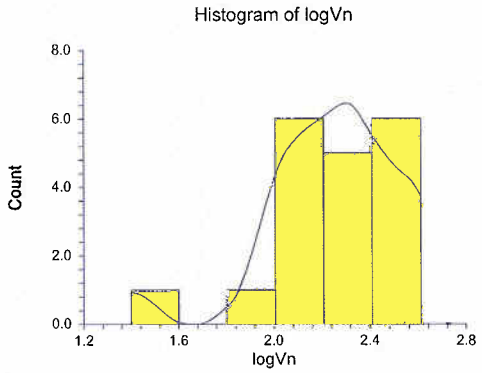
Skewness and Kurtosis Section of logVn when area=2b

Parameter	Skewness	Kurtosis	Fisher's g1	Fisher's g2	Coefficient of Variation	Coefficient of Dispersion
Value	-1.131336	4.801269	-1.23071	2.781091	0.1294117	9.107552E-02
Std Error	0.3657092	1.259006			3.126088E-02	

Normality Test Section of logVn when area=2b

Test Name	Test Value	Prob Level	10% Critical Value	5% Critical Value	Decision (5%)
Shapiro-Wilk W	0.9021138	5.313879E-02			Can't reject normality
Anderson-Darling	0.4713977	0.2451051			Can't reject normality
Martinez-Iglewicz	1.271577		1.226978	1.380602	Can't reject normality
Kolmogorov-Smirnov	0.1039271		0.181	0.197	Can't reject normality
D'Agostino Skewness	-2.260597	2.378426E-02	1.645	1.960	Reject normality
D'Agostino Kurtosis	2.0644	0.038982	1.645	1.960	Reject normality
D'Agostino Omnibus	9.3720	0.009224	4.605	5.991	Reject normality

Plots Section of logVn when area=2b



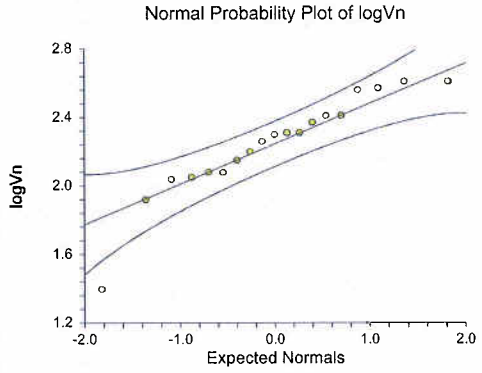


Table 2-C

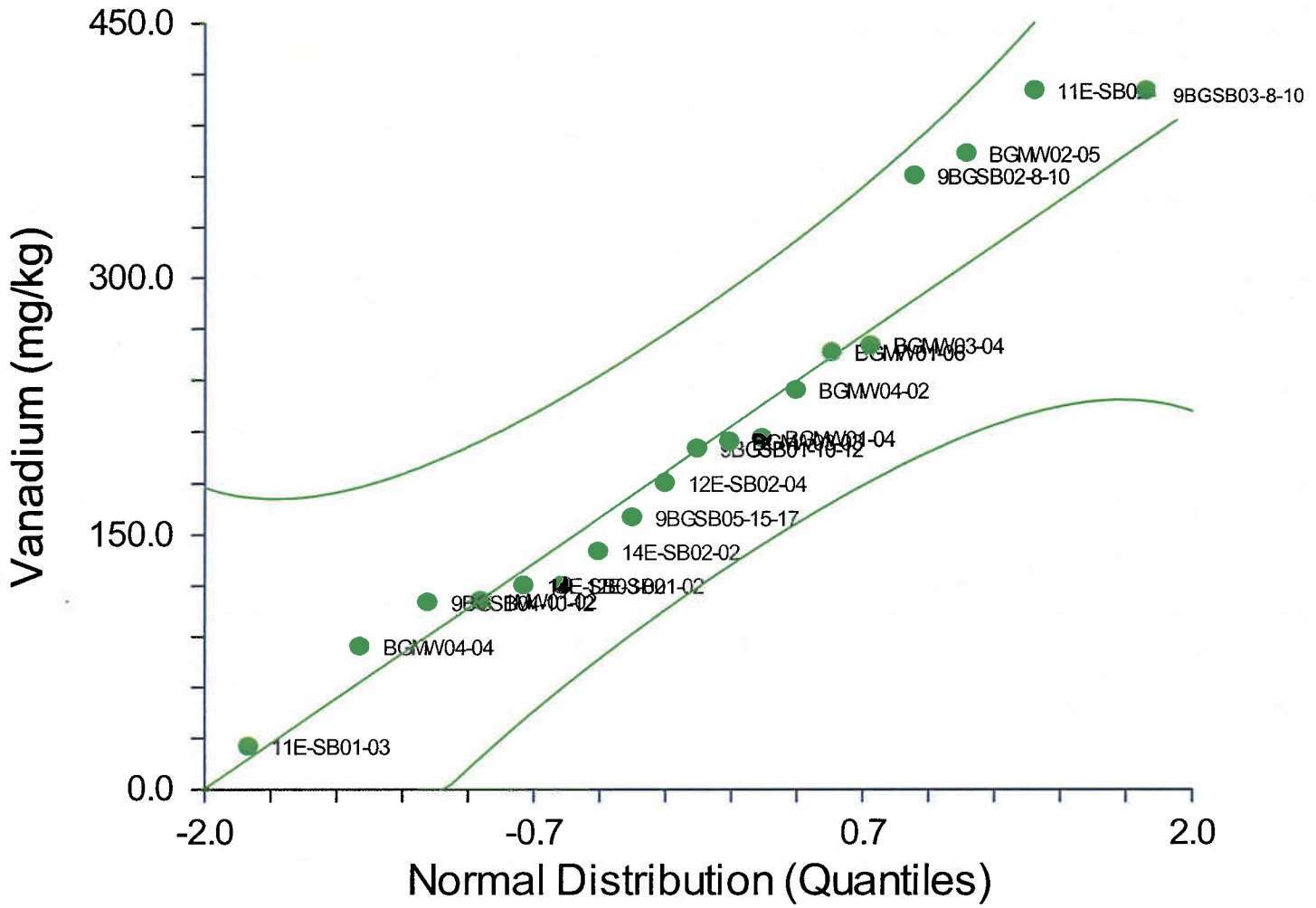
ProUCL Version 3.00.02 Calculations for NAPR Background Vanadium Subsurface Soil Data Set

Data File		
Variable:	Vanadium	
Raw Statistics		
Number of Observations	19	
Number of Missing Data	0	
Number of Valid Observations	19	
Number of Distinct Observations	17	
Minimum	25	
Maximum	410	
Mean	208.5737	
Standard Deviation	112.7439	
Variance	12711.2	
Coefficient of Variation	0.540547	
Skewness	0.548497	
Too Few Distinct Observations?	NO	
Normal Statistics		
Lilliefors Test Statisitic	N/R	Shapiro Wilk method yields a more accurate result
Lilliefors 5% Critical Value	N/R	Shapiro Wilk method yields a more accurate result
Shapiro-Wilk Test Statisitic	0.931626	
Shapiro-Wilk 5% Critical Value	0.901	
5% Normality Test Result	NORMAL	Data are normal at 5% significance level
95% Student's-t UCL	253.4256	
Gamma Statistics		
k hat	3.055688	
k star (bias corrected)	2.608299	
Theta hat	68.25752	
Theta star	79.96542	
nu hat	116.1161	
nu star	99.11534	
5% Approximate Chi Square Value	77.14392	
Adjusted Level of Significance	0.03687	
Adjusted Chi Square Value	75.45032	
Anderson-Darling Test Statistic	0.286719	
Anderson-Darling 5% Critical Value	0.747973	
Anderson-Darling 5% Gamma Test Result	AD GAMMA	Data follow gamma distribution at 5% signifcance level.
Kolmogrov-Smirnov Test Statistic	0.103575	
Kolmogrov-Smirnov 5% Critical Value	0.199957	
Kolmogrov-Smirnov 5% Gamma Test Result	KS GAMMA	Data follow gamma distribution at 5% signifcance level
5% Gamma Test Result	GAMMA	Data follow gamma distribution at 5% signifcance level
95% Approximate Gamma UCL	267.9777	
95% Adjusted Gamma UCL	273.9929	

Table 2-C

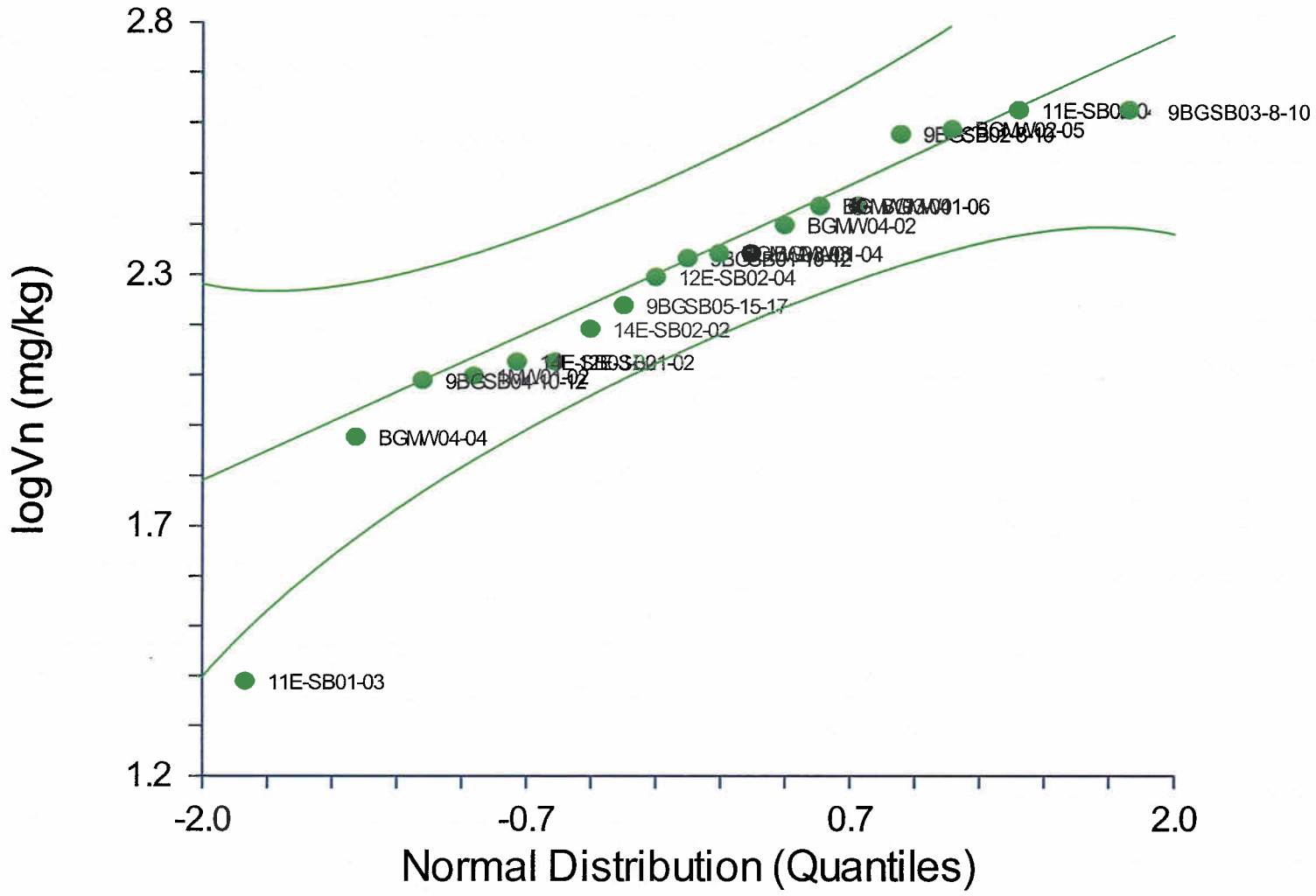
ProUCL Version 3.00.02 Calculations for NAPR Background Vanadium Subsurface Soil Data Set

Lognormal Statistics		
Minimum of log data	3.218876	
Maximum of log data	6.016157	
Mean of log data	5.167829	
Standard Deviation of log data	0.670385	
Variance of log data	0.449416	
Lilliefors Test Statisitic	N/R	Shapiro Wilk method yields a more accurate result
Lilliefors 5% Critical Value	N/R	Shapiro Wilk method yields a more accurate result
Shapiro-Wilk Test Statisitic	0.903169	
Shapiro-Wilk 5% Critical Value	0.901	
5% Lognormality Test Result	LOGNORMAL	Data are lognormal at 5% significance level
MLE Mean	219.7603	
MLE Standard Deviation	165.5361	
MLE Coefficient of Variation	0.753257	
MLE Skewness	2.687168	
MLE Median	175.5334	
MLE 80% Quantile	309.2979	
MLE 90% Quantile	415.4134	
MLE 95% Quantile	528.8013	
MLE 99% Quantile	834.7606	
MVU Estimate of Median	173.4684	
MVU Estimate of Mean	216.6973	
MVU Estimate of Standard Deviation	155.4014	
MVU Estimate of SE of Mean	35.33492	
95% H-UCL	310.8669	
95% Chebyshev (MVUE) UCL	370.7186	
97.5% Chebyshev (MVUE) UCL	437.3638	
99% Chebyshev (MVUE) UCL	568.2753	
Non-parametric Statisitics		
95% CLT UCL	251.1182	
95% Adjusted-CLT UCL	254.5959	
95% Modified-t UCL	253.9681	
95% Jackknife UCL	253.4256	
95% Chebyshev (Mean, Sd) UCL	321.3176	
97.5% Chebyshev (Mean, Sd) UCL	370.102	
99% Chebyshev (Mean, Sd) UCL	465.9295	
Bootstrap Statistics		
Number of Bootstrap Runs	2000	
95% Standard Bootstrap UCL	250.9341	
95% Bootstrap-t UCL	259.4211	
95% Hall's Bootstrap UCL	254.6022	
95% Percentile Bootstrap UCL	248.6263	
95% BCA Bootstrap UCL	256.2	



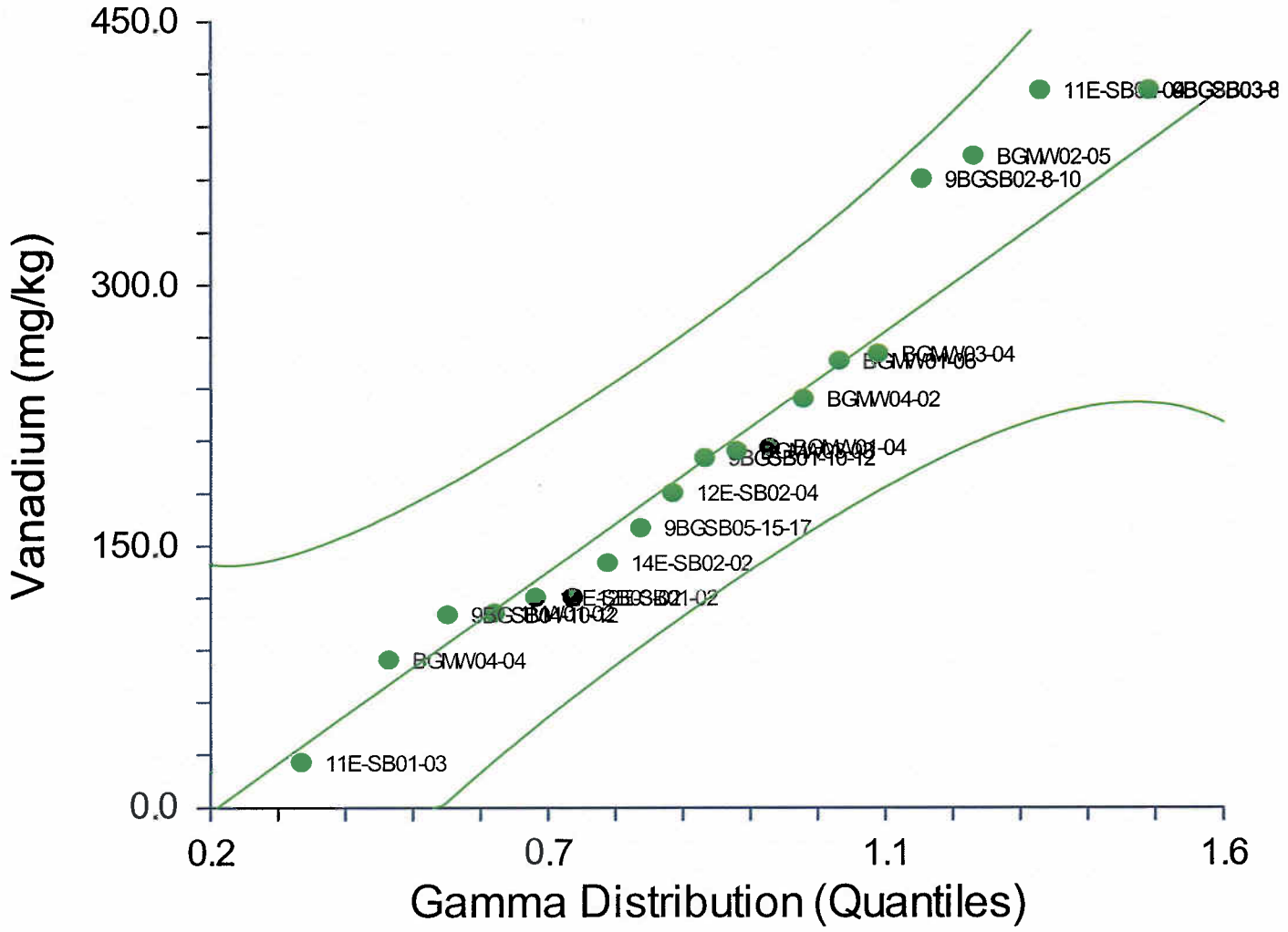
Curved lines indicate 95% Confidence Intervals

FIGURE 2-A
PROBABILITY PLOT OF VANADIUM IN NAPR BACKGROUND SUBSURFACE SOIL (CLAY SOIL TYPE): NORMAL DISTRIBUTION (NON-TRANSFORMED DATA)



Curved lines indicate 95% Confidence Intervals

FIGURE 2-B
PROBABILITY PLOT OF VANADIUM IN NAPR BACKGROUND SUBSURFACE SOIL (CLAY TYPE SOIL) : LOGNORMAL DISTRIBUTION (LOG TRANSFORMED DATA)



Curved lines indicate 95% Confidence Intervals

FIGURE 2-C
PROBABILITY PLOT OF VANADIUM IN NAPR BACKGROUND SUBSURFACE SOIL (CLAY SOIL TYPE): GAMMA DISTRIBUTION (NON-TRANSFORMED DATA)

Table 3-A
NAPR Background Vanadium Groundwater Descriptive Statistics Report: Non-transformed Data

Summary Section of Vanadium when area=2b

Count	Mean	Standard Deviation	Standard Error	Minimum	Maximum	Range
12	160.8542	169.2838	48.86803	1.7	549	547.3

Variation Section of Vanadium when area=2b

Parameter	Variance	Standard Deviation	Unbiased Std Dev	Std Error of Mean	Interquartile Range	Range
Value	28657.01	169.2838	173.1699	48.86803	269.3	547.3
Std Error	12271.65	51.2593		14.79729		
95% LCL	14380.77	119.9198		34.61787		
95% UCL	82612.14	287.4233		82.97195		

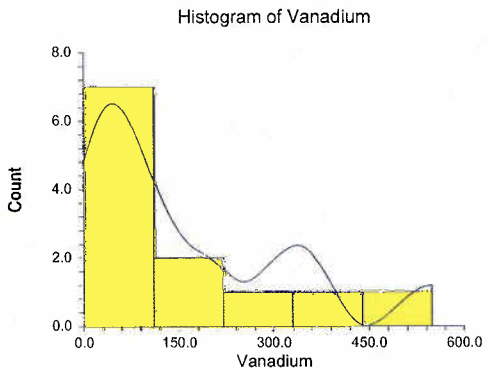
Skewness and Kurtosis Section of Vanadium when area=2b

Parameter	Skewness	Kurtosis	Fisher's g1	Fisher's g2	Coefficient of Variation	Coefficient of Dispersion
Value	1.104347	3.200522	1.268798	1.05194	1.052406	1.395113
Std Error	0.5397369	1.52274			0.2043965	

Normality Test Section of Vanadium when area=2b

Test Name	Test Value	Prob Level	10% Critical Value	5% Critical Value	Decision (5%)
Shapiro-Wilk W	0.8557974	4.332187E-02			Reject normality
Anderson-Darling	0.6935546	7.016848E-02			Can't reject normality
Martinez-Iglewicz	1.553783		1.356672	1.719144	Can't reject normality
Kolmogorov-Smirnov	0.217067		0.222	0.242	Can't reject normality
D'Agostino Skewness	1.966938	4.919033E-02	1.645	1.960	Reject normality
D'Agostino Kurtosis	0.9861	0.324096	1.645	1.960	Can't reject normality
D'Agostino Omnibus	4.8412	0.088869	4.605	5.991	Can't reject normality

Plots Section of Vanadium when area=2b



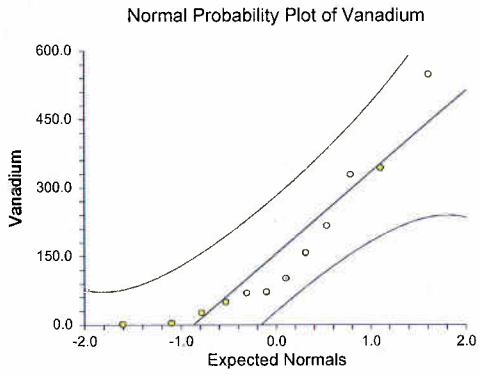


Table 3-B

ProUCL Version 3.00.02 Calculations for NAPR Background Vanadium Groundwater Data Set

Data File		
Variable:	Vanadium	
Raw Statistics		
Number of Observations	12	
Number of Missing Data	0	
Number of Valid Observations	12	
Number of Distinct Observations	12	
Minimum	1.7	
Maximum	549	
Mean	160.8542	
Standard Deviation	169.2838	
Variance	28657.01	
Coefficient of Variation	1.052406	
Skewness	1.268798	
Too Few Distinct Observations?	NO	
Normal Statistics		
Lilliefors Test Statisitic	N/R	Shapiro Wilk method yields a more accurate result
Lilliefors 5% Critical Value	N/R	Shapiro Wilk method yields a more accurate result
Shapiro-Wilk Test Statisitic	0.855776	
Shapiro-Wilk 5% Critical Value	0.859	
5% Normality Test Result	NOT NORMAL	Data not normal at 5% significance level
95% Student's-t UCL	248.6155	
Gamma Statistics		
k hat	0.710273	
k star (bias corrected)	0.588261	
Theta hat	226.468	
Theta star	273.4404	
nu hat	17.04656	
nu star	14.11825	
5% Approximate Chi Square Value	6.651241	
Adjusted Level of Significance	0.02896	
Adjusted Chi Square Value	5.886144	
Anderson-Darling Test Statistic	0.188692	
Anderson-Darling 5% Critical Value	0.768673	
Anderson-Darling 5% Gamma Test Result	AD GAMMA	Data follow gamma distribution at 5% signifcance level.
Kolmogrov-Smirnov Test Statistic	0.106667	
Kolmogrov-Smirnov 5% Critical Value	0.255425	
Kolmogrov-Smirnov 5% Gamma Test Result	KS GAMMA	Data follow gamma distribution at 5% signifcance level
5% Gamma Test Result	GAMMA	Data follow gamma distribution at 5% signifcance level
95% Approximate Gamma UCL	341.437	
95% Adjusted Gamma UCL	385.8179	

Table 3-B

ProUCL Version 3.00.02 Calculations for NAPR Background Vanadium Groundwater Data Set

Lognormal Statistics		
Minimum of log data	0.530628	
Maximum of log data	6.308098	
Mean of log data	4.23136	
Standard Deviation of log data	1.757937	
Variance of log data	3.090343	
Lilliefors Test Statisitic	N/R	Shapiro Wilk method yields a more accurate result
Lilliefors 5% Critical Value	N/R	Shapiro Wilk method yields a more accurate result
Shapiro-Wilk Test Statisitic	0.899768	
Shapiro-Wilk 5% Critical Value	0.859	
5% Lognormality Test Result	LOGNORMAL	Data are lognormal at 5% significance level
MLE Mean	322.6383	
MLE Standard Deviation	1477.973	
MLE Coefficient of Variation	4.580898	
MLE Skewness	109.8711	
MLE Median	68.81076	
MLE 80% Quantile	303.936	
MLE 90% Quantile	658.7272	
MLE 95% Quantile	1240.372	
MLE 99% Quantile	4106.483	
MVU Estimate of Median	60.41819	
MVU Estimate of Mean	250.3989	
MVU Estimate of Standard Deviation	563.6144	
MVU Estimate of SE of Mean	138.9871	
95% H-UCL	3392.536	
95% Chebyshev (MVUE) UCL	856.2296	
97.5% Chebyshev (MVUE) UCL	1118.373	
99% Chebyshev (MVUE) UCL	1633.303	
Non-parametric Statisitics		
95% CLT UCL	241.2349	
95% Adjusted-CLT UCL	260.3602	
95% Modified-t UCL	251.5987	
95% Jackknife UCL	248.6155	
95% Chebyshev (Mean, Sd) UCL	373.865	
97.5% Chebyshev (Mean, Sd) UCL	466.0349	
99% Chebyshev (Mean, Sd) UCL	647.0849	
Bootstrap Statistics		
Number of Bootstrap Runs	2000	
95% Standard Bootstrap UCL	237.9678	
95% Bootstrap-t UCL	290.982	
95% Hall's Bootstrap UCL	264.1317	
95% Percentile Bootstrap UCL	240.2208	
95% BCA Bootstrap UCL	256.1875	

Table 3-C
NAPR Background Vanadium Groundwater Descriptive Statistics Report: Log-transformed Data

Summary Section of logVn when area=2b

Count	Mean	Standard Deviation	Standard Error	Minimum	Maximum	Range
12	1.838333	0.7637091	0.2204638	0.23	2.74	2.51

Variation Section of logVn when area=2b

Parameter	Variance	Standard Deviation	Unbiased Std Dev	Std Error of Mean	Interquartile Range	Range
Value	0.5832515	0.7637091	0.7812406	0.2204638	0.9775	2.51
Std Error	0.2339316	0.2165938		6.252524E-02		
95% LCL	0.2926894	0.5410078		0.1561755		
95% UCL	1.681391	1.296685		0.3743207		

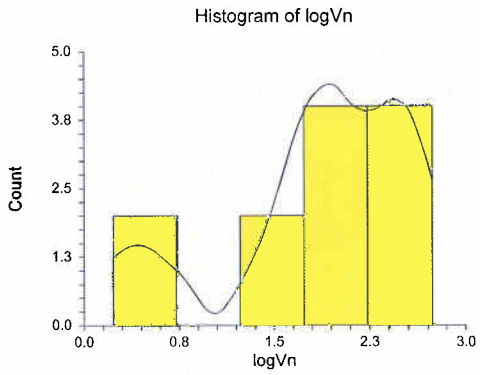
Skewness and Kurtosis Section of logVn when area=2b

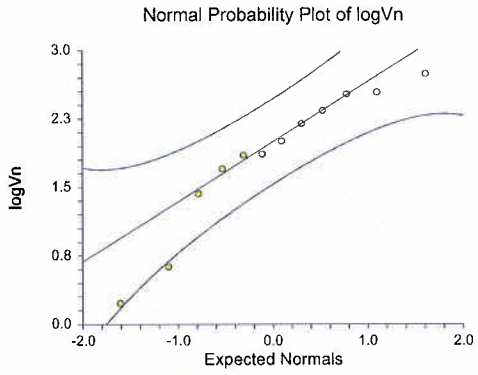
Parameter	Skewness	Kurtosis	Fisher's g1	Fisher's g2	Coefficient of Variation	Coefficient of Dispersion
Value	-0.9424917	2.9304	-1.08284	0.6227469	0.4154356	0.2852234
Std Error	0.4682522	1.472257			0.1208625	

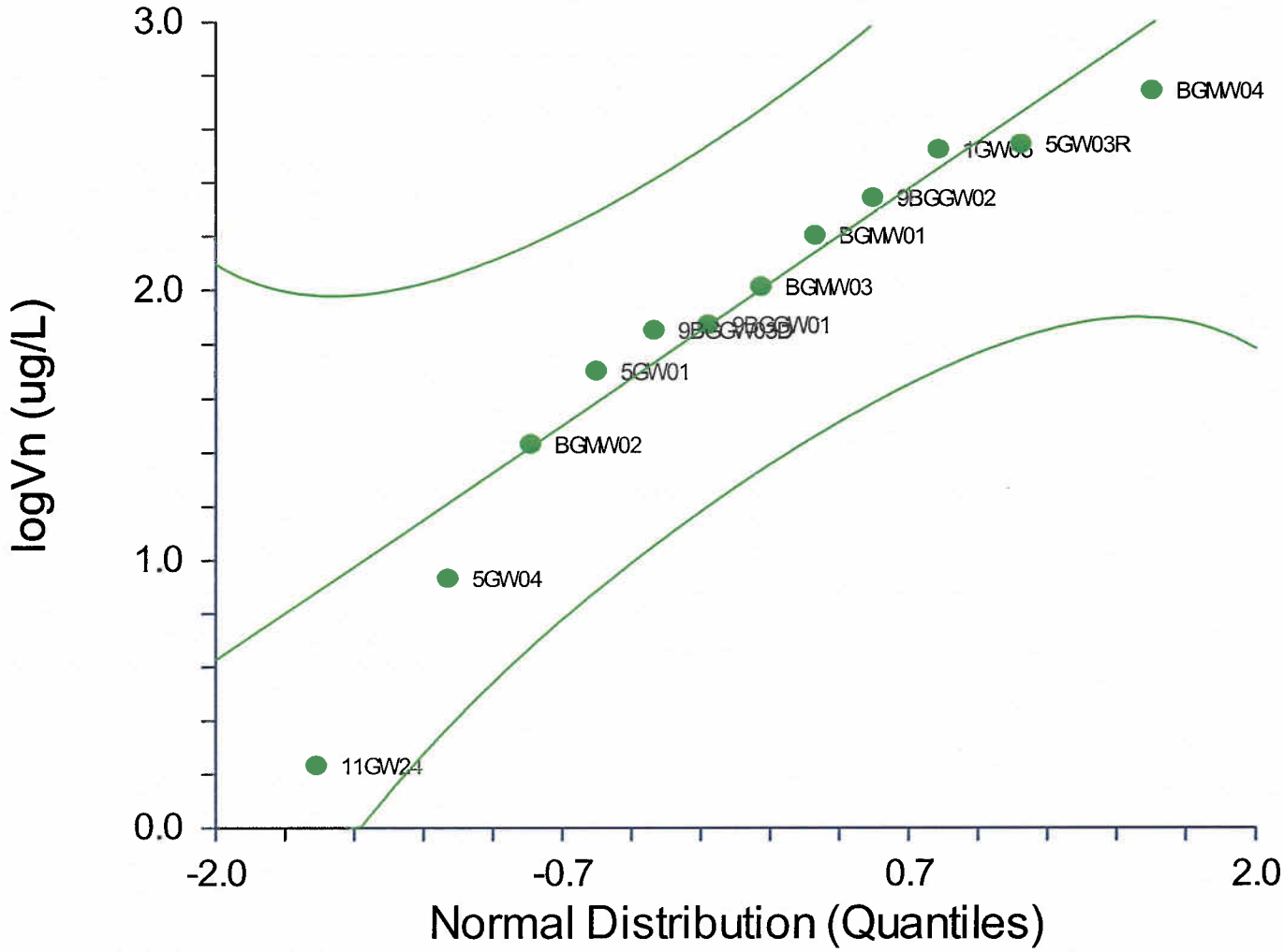
Normality Test Section of logVn when area=2b

Test Name	Test Value	Prob Level	10% Critical Value	5% Critical Value	Decision (5%)
Shapiro-Wilk W	0.900183	0.1594843			Can't reject normality
Anderson-Darling	0.4951501	0.2145125			Can't reject normality
Martinez-Iglewicz	1.150831		1.356672	1.719144	Can't reject normality
Kolmogorov-Smirnov	0.1188726		0.222	0.242	Can't reject normality
D'Agostino Skewness	-1.703616	8.845277E-02	1.645	1.960	Can't reject normality
D'Agostino Kurtosis	0.7023	0.482489	1.645	1.960	Can't reject normality
D'Agostino Omnibus	3.3955	0.183091	4.605	5.991	Can't reject normality

Plots Section of logVn when area=2b

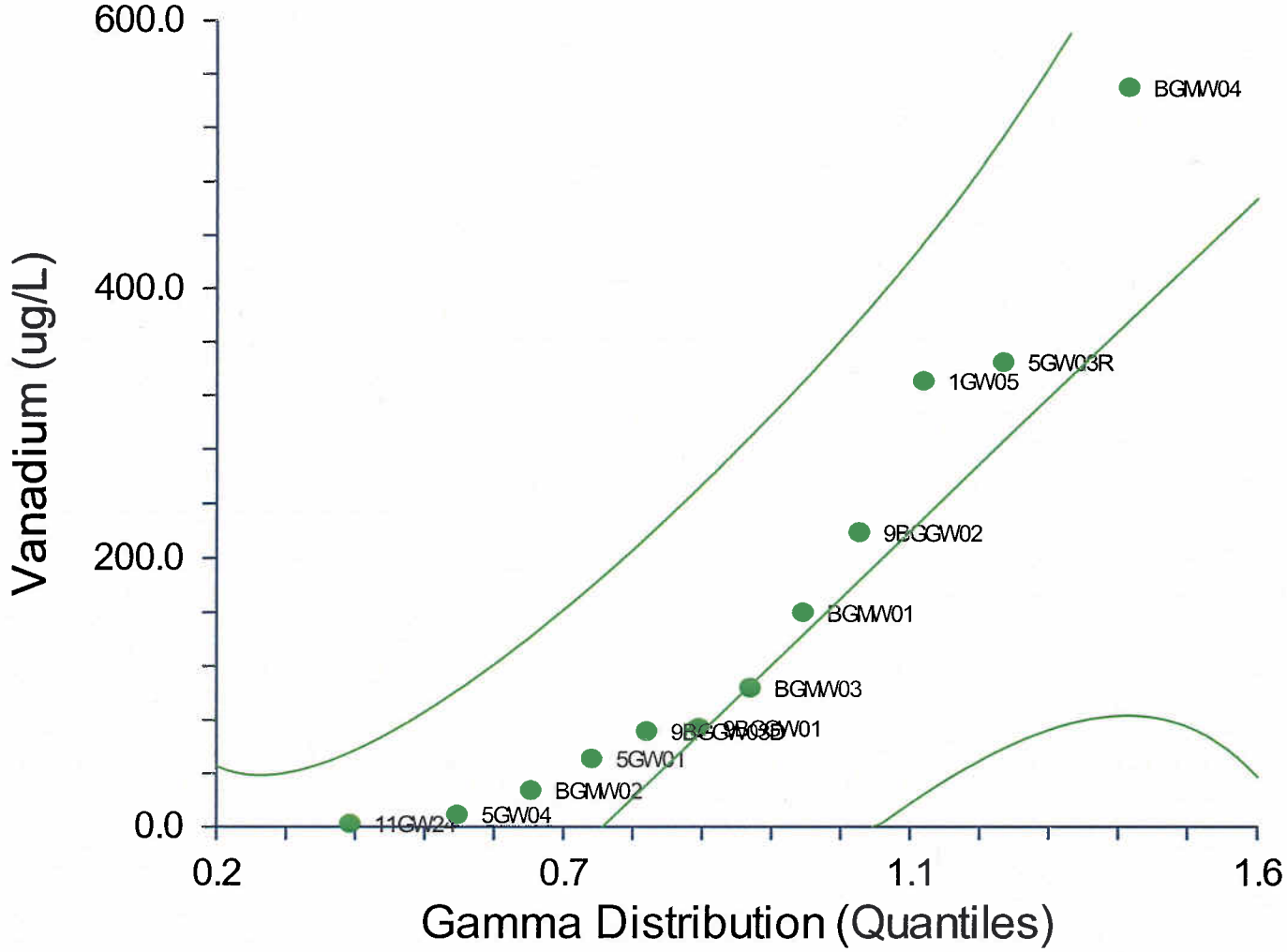






Curved lines indicate 95% Confidence Intervals

FIGURE 3-A
PROBABILITY PLOT OF VANADIUM IN NAPR BACKGROUND GROUNDWATER: LOGNORMAL DISTRIBUTION (LOG TRANSFORMED DATA)



Curved lines indicate 95% Confidence Intervals

FIGURE 3-B
PROBABILITY PLOT OF VANADIUM IN NAPR BACKGROUND GROUNDWATER: GAMMA DISTRIBUTION (NON-TRANSFORMED DATA)

Table 4-A
SWMU 68 Vanadium Surface Soil Descriptive Statistics Report: Non-transformed Data

Summary Section of Vanadium

Count	Mean	Standard Deviation	Standard Error	Minimum	Maximum	Range
13	107.3846	33.46027	9.28021	65	170	105

Variation Section of Vanadium

Parameter	Variance	Standard Deviation	Unbiased Std Dev	Std Error of Mean	Interquartile Range	Range
Value	1119.59	33.46027	34.16386	9.28021	51	105
Std Error	332.0954	7.018082		1.946466		
95% LCL	575.7068	23.99389		6.654708		
95% UCL	3050.8	55.23405		15.31917		

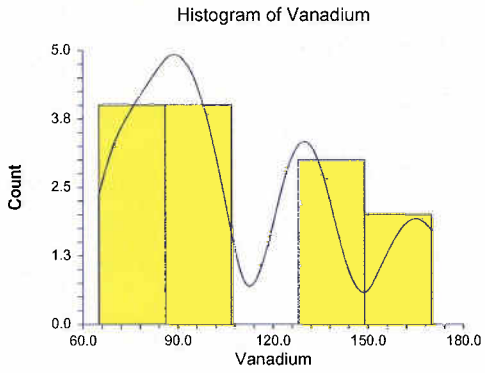
Skewness and Kurtosis Section of Vanadium

Parameter	Skewness	Kurtosis	Fisher's g1	Fisher's g2	Coefficient of Variation	Coefficient of Dispersion
Value	0.5938529	2.143803	0.6742928	-0.6531007	0.3115928	0.2765957
Std Error	0.4440889	0.7349622			3.843434E-02	

Normality Test Section of Vanadium

Test Name	Test Value	Prob Level	10% Critical Value	5% Critical Value	Decision (5%)
Shapiro-Wilk W	0.9108908	0.1886034			Can't reject normality
Anderson-Darling	0.5179861	0.1884298			Can't reject normality
Martinez-Iglewicz	1.08349		1.328902	1.637564	Can't reject normality
Kolmogorov-Smirnov	0.2027208		0.215	0.234	Can't reject normality
D'Agostino Skewness	1.127301	0.2596152	1.645	1.960	Can't reject normality
D'Agostino Kurtosis	-0.4602	0.645337	1.645	1.960	Can't reject normality
D'Agostino Omnibus	1.4826	0.476485	4.605	5.991	Can't reject normality

Plots Section of Vanadium



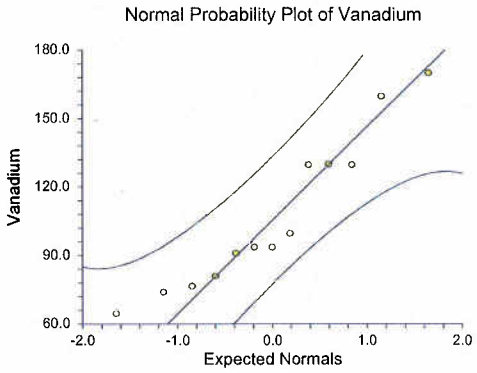


Table 4-B
SWMU 68 Vanadium Surface Soil Descriptive Statistics Report: Log-transformed Data

Summary Section of logVn

Count	Mean	Standard Deviation	Standard Error	Minimum	Maximum	Range
13	2.010769	0.1304774	3.618793E-02	1.81	2.23	0.42

Variation Section of logVn

Parameter	Variance	Standard Deviation	Unbiased Std Dev	Std Error of Mean	Interquartile Range	Range
Value	1.702436E-02	0.1304774	0.133221	3.618793E-02	0.21	0.42
Std Error	4.578118E-03	2.481056E-02		6.881211E-03		
95% LCL	8.754135E-03	9.356353E-02		2.594986E-02		
95% UCL	4.639013E-02	0.2153837		5.973668E-02		

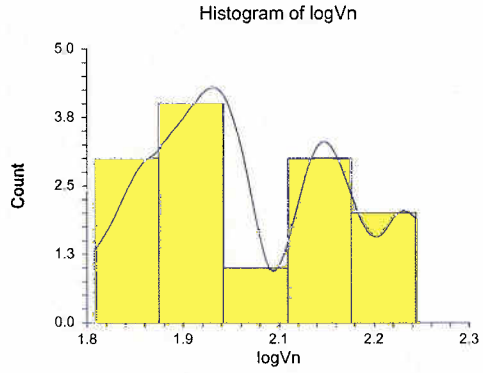
Skewness and Kurtosis Section of logVn

Parameter	Skewness	Kurtosis	Fisher's g1	Fisher's g2	Coefficient of Variation	Coefficient of Dispersion
Value	0.2463724	1.940104	0.2797446	-0.9642053	6.488931E-02	5.271379E-02
Std Error	0.4111204	0.4367677			8.509257E-03	

Normality Test Section of logVn

Test Name	Test Value	Prob Level	10% Critical Value	5% Critical Value	Decision (5%)
Shapiro-Wilk W	0.9481639	0.5707464			Can't reject normality
Anderson-Darling	0.3364082	0.5055389			Can't reject normality
Martinez-Iglewicz	1.021526		1.328902	1.637564	Can't reject normality
Kolmogorov-Smirnov	0.1611168		0.215	0.234	Can't reject normality
D'Agostino Skewness	0.4759117	0.6341373	1.645	1.960	Can't reject normality
D'Agostino Kurtosis	-0.8646	0.387233	1.645	1.960	Can't reject normality
D'Agostino Omnibus	0.9741	0.614435	4.605	5.991	Can't reject normality

Plots Section of logVn



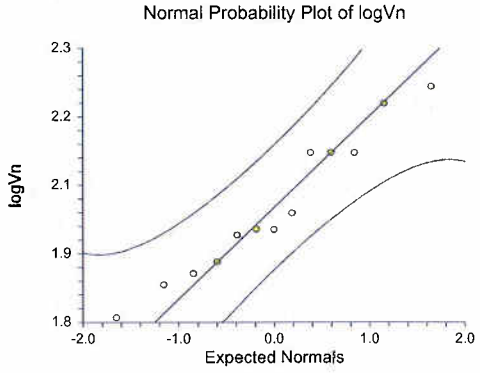
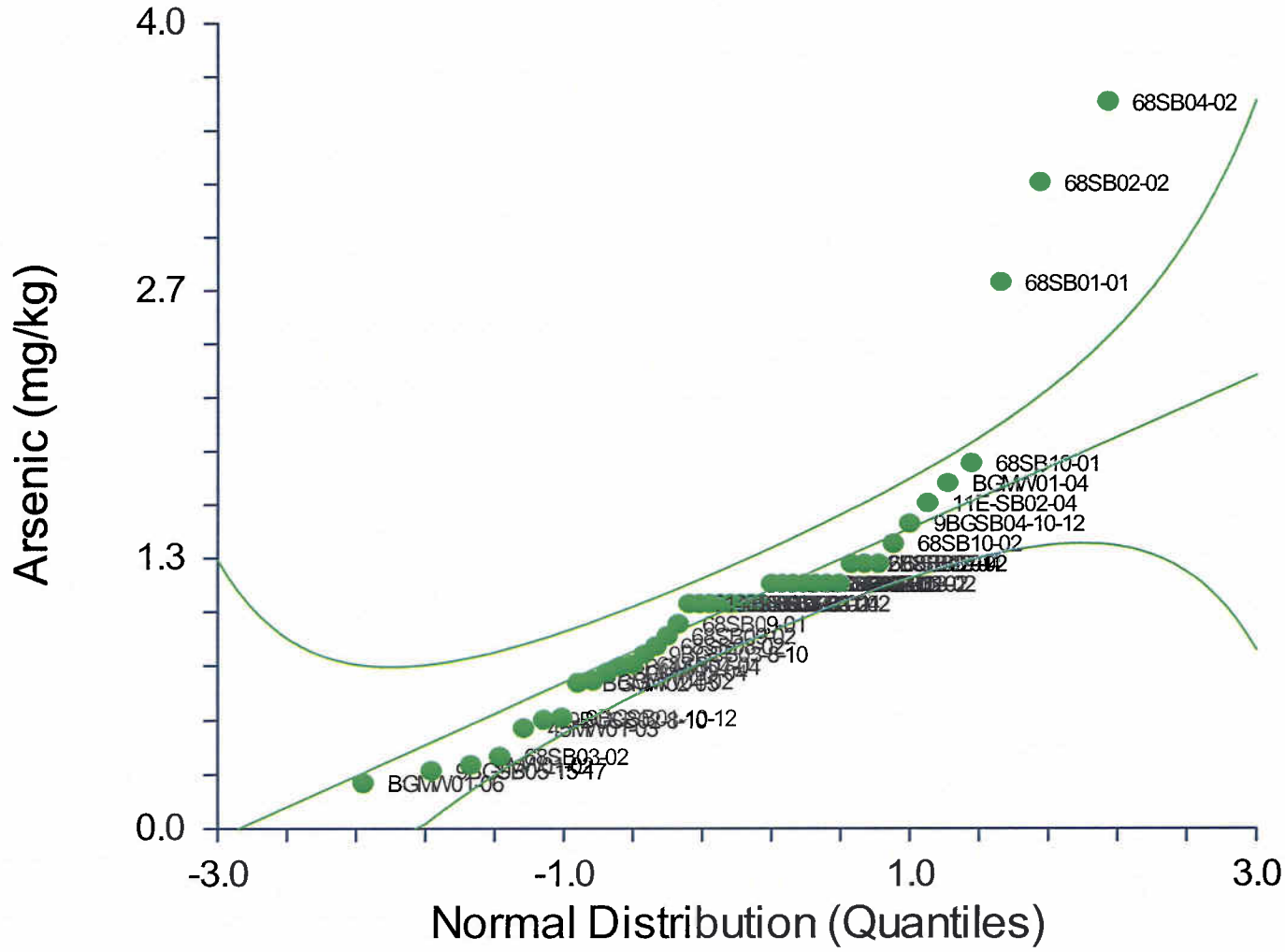


Table 4-C
ProUCL Version 3.00.02 Calculations for SWMU 68 Vanadium Surface Soil Data Set

Data File		
Variable:	Vanadium	
Raw Statistics		
Number of Observations	13	
Number of Missing Data	0	
Number of Valid Observations	13	
Number of Distinct Observations	10	
Minimum	65	
Maximum	170	
Mean	107.3846	
Standard Deviation	33.46027	
Variance	1119.59	
Coefficient of Variation	0.311593	
Skewness	0.674293	
Too Few Distinct Observations?	NO	
Normal Statistics		
Lilliefors Test Statisitic	N/R	Shapiro Wilk method yields a more accurate result
Lilliefors 5% Critical Value	N/R	Shapiro Wilk method yields a more accurate result
Shapiro-Wilk Test Statisitic	0.91084	
Shapiro-Wilk 5% Critical Value	0.866	
5% Normality Test Result	NORMAL	Data are normal at 5% significance level
95% Student's-t UCL	123.9246	
Gamma Statistics		
k hat	11.76063	
k star (bias corrected)	9.097922	
Theta hat	9.130854	
Theta star	11.8032	
nu hat	305.7764	
nu star	236.546	
5% Approximate Chi Square Value	201.9349	
Adjusted Level of Significance	0.03009	
Adjusted Chi Square Value	197.3787	
Anderson-Darling Test Statistic	0.423921	
Anderson-Darling 5% Critical Value	0.733668	
Anderson-Darling 5% Gamma Test Result	AD GAMMA	Data follow gamma distribution at 5% signifcance level.
Kolmogrov-Smirnov Test Statistic	0.174612	
Kolmogrov-Smirnov 5% Critical Value	0.236596	
Kolmogrov-Smirnov 5% Gamma Test Result	KS GAMMA	Data follow gamma distribution at 5% signifcance level
5% Gamma Test Result	GAMMA	Data follow gamma distribution at 5% signifcance level
95% Approximate Gamma UCL	125.7901	
95% Adjusted Gamma UCL	128.6937	

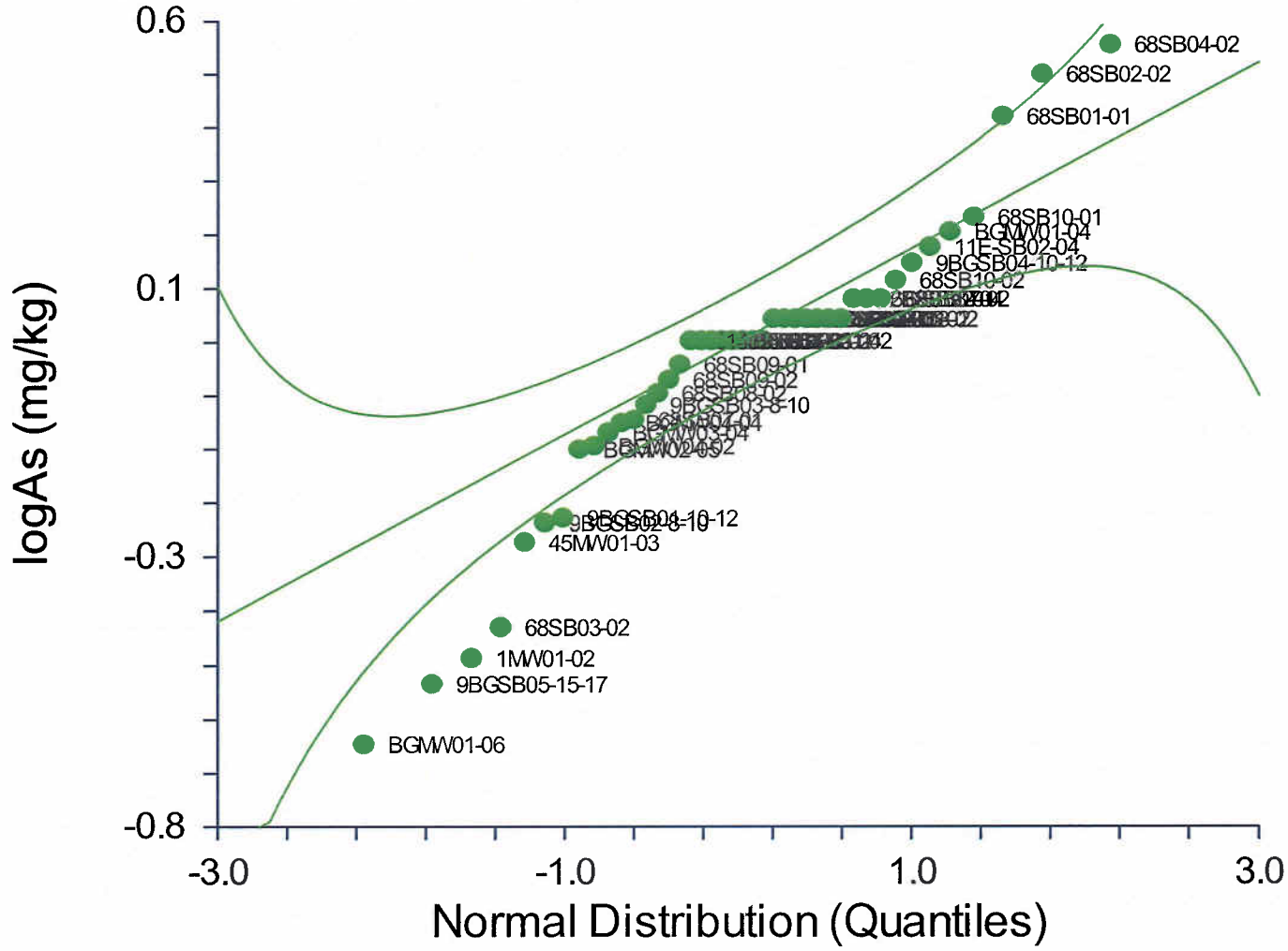
Table 4-C
ProUCL Version 3.00.02 Calculations for SWMU 68 Vanadium Surface Soil Data Set

Lognormal Statistics		
Minimum of log data	4.174387	
Maximum of log data	5.135798	
Mean of log data	4.6333	
Standard Deviation of log data	0.303341	
Variance of log data	0.092016	
Lilliefors Test Statisitic	N/R	Shapiro Wilk method yields a more accurate result
Lilliefors 5% Critical Value	N/R	Shapiro Wilk method yields a more accurate result
Shapiro-Wilk Test Statisitic	0.944494	
Shapiro-Wilk 5% Critical Value	0.866	
5% Lognormality Test Result	LOGNORMAL	Data are lognormal at 5% significance level
MLE Mean	107.6955	
MLE Standard Deviation	33.43464	
MLE Coefficient of Variation	0.310455	
MLE Skewness	0.961288	
MLE Median	102.8529	
MLE 80% Quantile	132.9036	
MLE 90% Quantile	151.8805	
MLE 95% Quantile	169.4058	
MLE 99% Quantile	208.2777	
MVU Estimate of Median	102.4895	
MVU Estimate of Mean	107.3013	
MVU Estimate of Standard Deviation	32.89281	
MVU Estimate of SE of Mean	9.119714	
95% H-UCL	127.3569	
95% Chebyshev (MVUE) UCL	147.0533	
97.5% Chebyshev (MVUE) UCL	164.2539	
99% Chebyshev (MVUE) UCL	198.0413	
Non-parametric Statisitics		
95% CLT UCL	122.6492	
95% Adjusted-CLT UCL	124.5037	
95% Modified-t UCL	124.2139	
95% Jackknife UCL	123.9246	
95% Chebyshev (Mean, Sd) UCL	147.8361	
97.5% Chebyshev (Mean, Sd) UCL	165.3395	
99% Chebyshev (Mean, Sd) UCL	199.7215	
Bootstrap Statistics		
Number of Bootstrap Runs	2000	
95% Standard Bootstrap UCL	122.0552	
95% Bootstrap-t UCL	126.8135	
95% Hall's Bootstrap UCL	124.4735	
95% Percentile Bootstrap UCL	122.1538	
95% BCA Bootstrap UCL	124.1538	



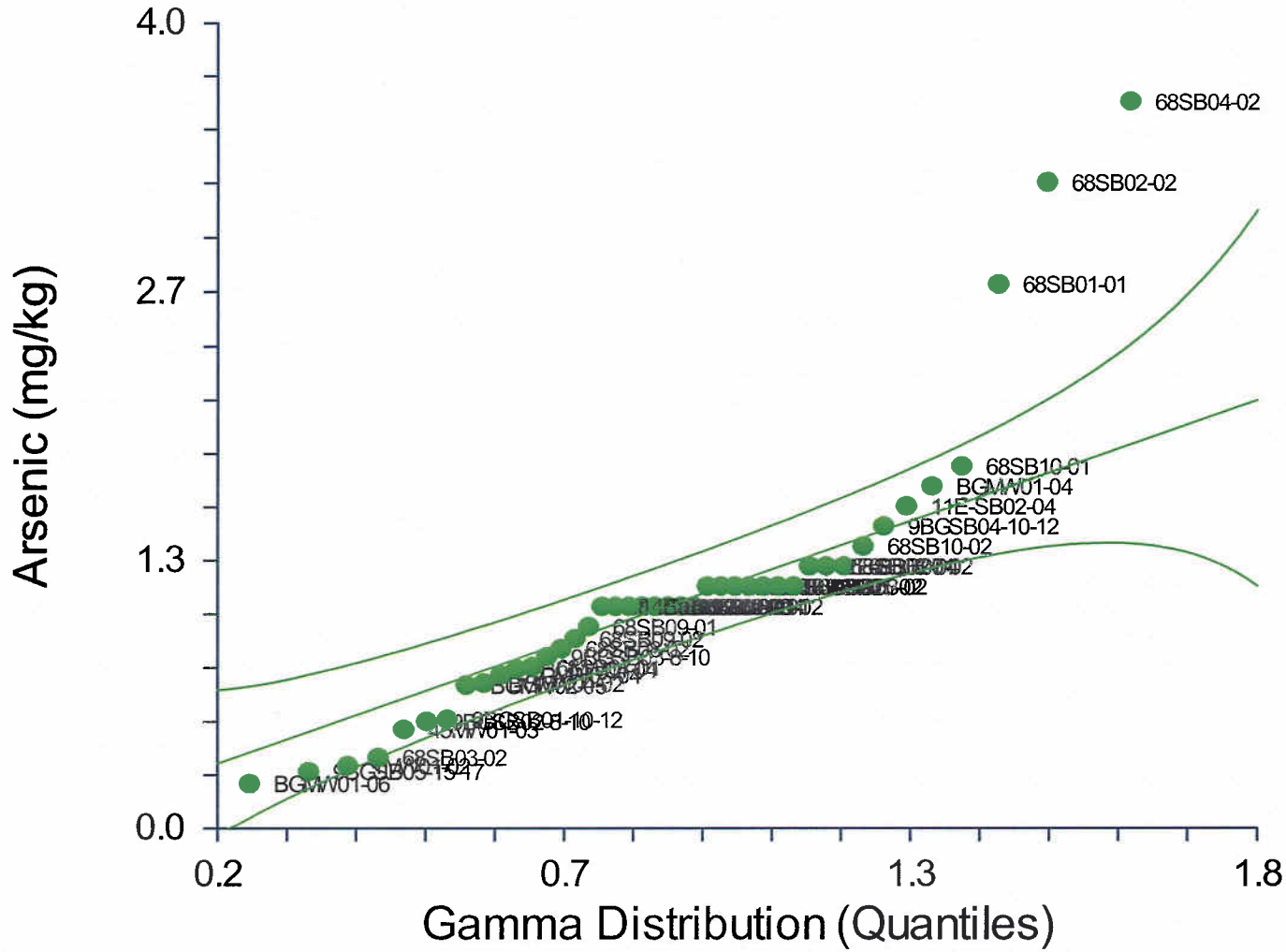
Curved lines indicate 95% Confidence Intervals

FIGURE 4-A
PROBABILITY PLOT OF ARSENIC IN NAPR BACKGROUND AND SWMU 68 SUBSURFACE SOIL (CLAY SOIL TYPE): NORMAL DISTRIBUTION (NON-TRANSFORMED DATA)



Curved lines indicate 95% Confidence Intervals

FIGURE 4-B
PROBABILITY PLOT OF ARSENIC IN NAPR BACKGROUND AND SWMU 68 SUBSURFACE SOIL (CLAY SOIL TYPE): LOGNORMAL DISTRIBUTION (LOG TRANSFORMED DATA)



Curved lines indicate 95% Confidence Intervals

FIGURE 4-C
PROBABILITY PLOT OF ARSENIC IN NAPR BACKGROUND AND SWMU 68 SUBSURFACE SOIL (CLAY SOIL TYPE): GAMMA DISTRIBUTION (NON-TRANSFORMED DATA)

Table 5-A
SWMU 68 Vanadium Subsurface Soil Descriptive Statistics Report: Non-transformed Data

Summary Section of Vanadium

Count	Mean	Standard Deviation	Standard Error	Minimum	Maximum	Range
23	135.7826	77.94168	16.25196	48	440	392

Variation Section of Vanadium

Parameter	Variance	Standard Deviation	Unbiased Std Dev	Std Error of Mean	Interquartile Range	Range
Value	6074.905	77.94168	78.83212	16.25196	55	392
Std Error	4065.015	36.87886		7.689774		
95% LCL	3633.641	60.27969		12.56918		
95% UCL	12169.37	110.3149		23.00224		

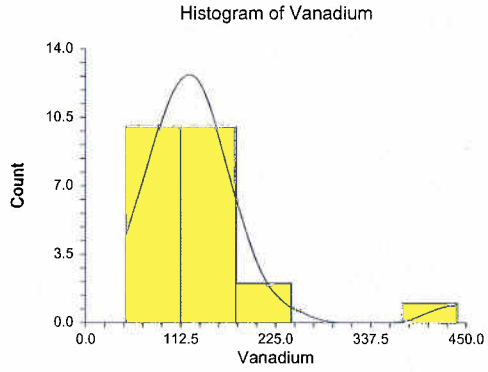
Skewness and Kurtosis Section of Vanadium

Parameter	Skewness	Kurtosis	Fisher's g1	Fisher's g2	Coefficient of Variation	Coefficient of Dispersion
Value	2.636454	11.29848	2.824075	10.74666	0.5740181	0.3757246
Std Error	0.5750282	6.356428			0.1421093	

Normality Test Section of Vanadium

Test Name	Test Value	Prob Level	10% Critical Value	5% Critical Value	Decision (5%)
Shapiro-Wilk W	0.7215979	2.70405E-05			Reject normality
Anderson-Darling	1.735188	1.922944E-04			Reject normality
Martinez-Iglewicz	3.538427		1.189616	1.303046	Reject normality
Kolmogorov-Smirnov	0.2175544		0.166	0.18	Reject normality
D'Agostino Skewness	4.366063	1.265059E-05	1.645	1.960	Reject normality
D'Agostino Kurtosis	3.9502	0.000078	1.645	1.960	Reject normality
D'Agostino Omnibus	34.6664	0.000000	4.605	5.991	Reject normality

Plots Section of Vanadium



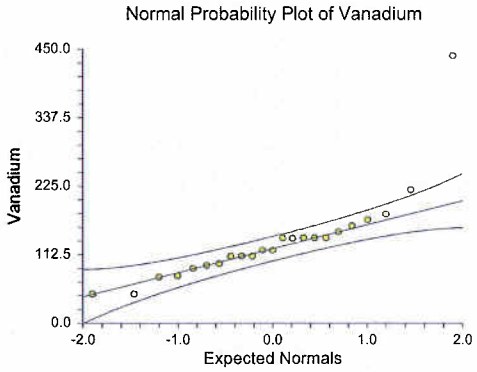


Table 5-B
SWMU 68 Vanadium Subsurface Soil Descriptive Statistics Report: Log-transformed Data

Summary Section of logVn

Count	Mean	Standard Deviation	Standard Error	Minimum	Maximum	Range
23	2.083913	0.2045558	4.265284E-02	1.68	2.64	0.96

Variation Section of logVn

Parameter	Variance	Standard Deviation	Unbiased Std Dev	Std Error of Mean	Interquartile Range	Range
Value	4.184308E-02	0.2045558	0.2068928	4.265284E-02	0.2	0.96
Std Error	1.586123E-02	5.482895E-02		1.143263E-02		
95% LCL	2.502801E-02	0.1582024		3.298748E-02		
95% UCL	8.382089E-02	0.2895184		6.036875E-02		

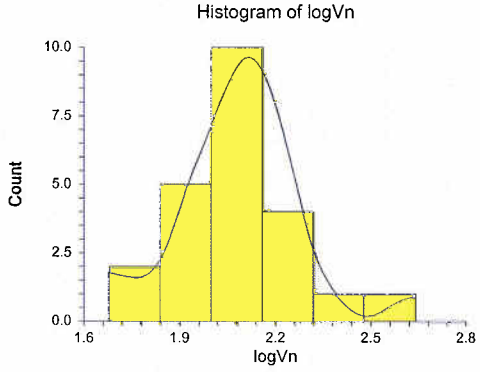
Skewness and Kurtosis Section of logVn

Parameter	Skewness	Kurtosis	Fisher's g1	Fisher's g2	Coefficient of Variation	Coefficient of Dispersion
Value	0.2663772	4.304867	0.2853337	1.95469	9.815948E-02	7.002509E-02
Std Error	0.5604206	1.033039			1.841931E-02	

Normality Test Section of logVn

Test Name	Test Value	Prob Level	10% Critical Value	5% Critical Value	Decision (5%)
Shapiro-Wilk W	0.941343	0.1920348			Can't reject normality
Anderson-Darling	0.5315828	0.1743128			Can't reject normality
Martinez-Iglewicz	1.312778		1.189616	1.303046	Reject normality
Kolmogorov-Smirnov	0.1124495		0.166	0.18	Can't reject normality
D'Agostino Skewness	0.6254185	0.5316964	1.645	1.960	Can't reject normality
D'Agostino Kurtosis	1.7626	0.077970	1.645	1.960	Can't reject normality
D'Agostino Omnibus	3.4979	0.173960	4.605	5.991	Can't reject normality

Plots Section of logVn



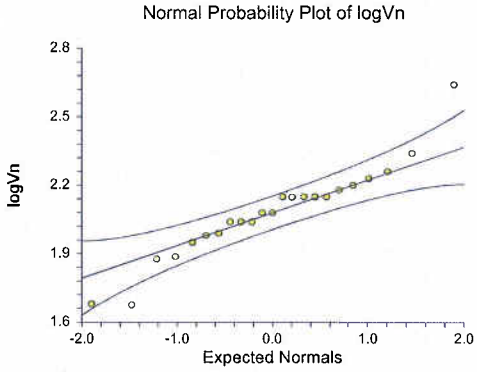


Table 5-C

ProUCL Version 3.00.02 Calculations for SWMU 68 Vanadium Subsurface Soil Data Set

Data File		
Variable:	Vanadium	
Raw Statistics		
Number of Observations	12	
Number of Missing Data	0	
Number of Valid Observations	12	
Number of Distinct Observations	12	
Minimum	1.7	
Maximum	549	
Mean	160.8542	
Standard Deviation	169.2838	
Variance	28657.01	
Coefficient of Variation	1.052406	
Skewness	1.268798	
Too Few Distinct Observations?	NO	
Normal Statistics		
Lilliefors Test Statisitic	N/R	Shapiro Wilk method yields a more accurate result
Lilliefors 5% Critical Value	N/R	Shapiro Wilk method yields a more accurate result
Shapiro-Wilk Test Statisitic	0.855776	
Shapiro-Wilk 5% Critical Value	0.859	
5% Normality Test Result	NOT NORMAL	Data not normal at 5% significance level
95% Student's-t UCL	248.6155	
Gamma Statistics		
k hat	0.710273	
k star (bias corrected)	0.588261	
Theta hat	226.468	
Theta star	273.4404	
nu hat	17.04656	
nu star	14.11825	
5% Approximate Chi Square Value	6.651241	
Adjusted Level of Significance	0.02896	
Adjusted Chi Square Value	5.886144	
Anderson-Darling Test Statistic	0.188692	
Anderson-Darling 5% Critical Value	0.768673	
Anderson-Darling 5% Gamma Test Result	AD GAMMA	Data follow gamma distribution at 5% signifcance level.
Kolmogrov-Smirnov Test Statistic	0.106667	
Kolmogrov-Smirnov 5% Critical Value	0.255425	
Kolmogrov-Smirnov 5% Gamma Test Result	KS GAMMA	Data follow gamma distribution at 5% signifcance level
5% Gamma Test Result	GAMMA	Data follow gamma distribution at 5% signifcance level
95% Approximate Gamma UCL	341.437	
95% Adjusted Gamma UCL	385.8179	

Table 5-C

ProUCL Version 3.00.02 Calculations for SWMU 68 Vanadium Subsurface Soil Data Set

Lognormal Statistics		
Minimum of log data	0.530628	
Maximum of log data	6.308098	
Mean of log data	4.23136	
Standard Deviation of log data	1.757937	
Variance of log data	3.090343	
Lilliefors Test Statisitic	N/R	Shapiro Wilk method yields a more accurate result
Lilliefors 5% Critical Value	N/R	Shapiro Wilk method yields a more accurate result
Shapiro-Wilk Test Statisitic	0.899768	
Shapiro-Wilk 5% Critical Value	0.859	
5% Lognormality Test Result	LOGNORMAL	Data are lognormal at 5% significance level
MLE Mean	322.6383	
MLE Standard Deviation	1477.973	
MLE Coefficient of Variation	4.580898	
MLE Skewness	109.8711	
MLE Median	68.81076	
MLE 80% Quantile	303.936	
MLE 90% Quantile	658.7272	
MLE 95% Quantile	1240.372	
MLE 99% Quantile	4106.483	
MVU Estimate of Median	60.41819	
MVU Estimate of Mean	250.3989	
MVU Estimate of Standard Deviation	563.6144	
MVU Estimate of SE of Mean	138.9871	
95% H-UCL	3392.536	
95% Chebyshev (MVUE) UCL	856.2296	
97.5% Chebyshev (MVUE) UCL	1118.373	
99% Chebyshev (MVUE) UCL	1633.303	
Non-parametric Statisitics		
95% CLT UCL	241.2349	
95% Adjusted-CLT UCL	260.3602	
95% Modified-t UCL	251.5987	
95% Jackknife UCL	248.6155	
95% Chebyshev (Mean, Sd) UCL	373.865	
97.5% Chebyshev (Mean, Sd) UCL	466.0349	
99% Chebyshev (Mean, Sd) UCL	647.0849	
Bootstrap Statistics		
Number of Bootstrap Runs	2000	
95% Standard Bootstrap UCL	237.9678	
95% Bootstrap-t UCL	290.982	
95% Hall's Bootstrap UCL	264.1317	
95% Percentile Bootstrap UCL	240.2208	
95% BCA Bootstrap UCL	256.1875	

Table 6-A
SWMU 68 Vanadium Groundwater Descriptive Statistics Report: Non-transformed Data

Summary Section of Vanadium

Count	Mean	Standard Deviation	Standard Error	Minimum	Maximum	Range
7	82.71429	76.36036	28.8615	17	210	193

Variation Section of Vanadium

Parameter	Variance	Standard Deviation	Unbiased Std Dev	Std Error of Mean	Interquartile Range	Range
Value	5830.905	76.36036	79.59438	28.8615	136	193
Std Error	2142.182	19.83688		7.497635		
95% LCL	2421.242	49.20611		18.59816		
95% UCL	28274.61	168.1506		63.55494		

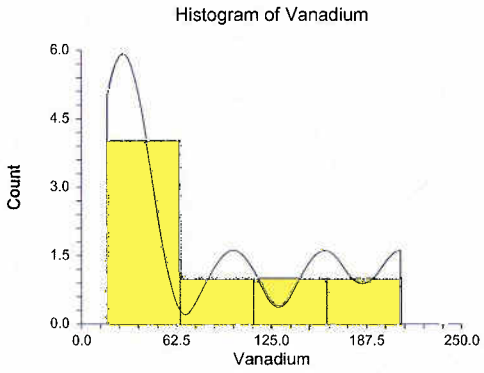
Skewness and Kurtosis Section of Vanadium

Parameter	Skewness	Kurtosis	Fisher's g1	Fisher's g2	Coefficient of Variation	Coefficient of Dispersion
Value	0.7324719	1.944797	0.9493921	-0.7324863	0.9231822	1.659664
Std Error	0.7233825	1.199087			0.2036593	

Normality Test Section of Vanadium

Test Name	Test Value	Prob Level	10% Critical Value	5% Critical Value	Decision (5%)
Shapiro-Wilk W	0.8337027	8.673336E-02			Can't reject normality
Anderson-Darling					
Martinez-Iglewicz	5.086565		1.637634	2.832024	Reject normality
Kolmogorov-Smirnov	0.3096763		0.28	0.304	Reject normality
D'Agostino Skewness	0		1.645	1.960	
D'Agostino Kurtosis		1.000000	1.645	1.960	
D'Agostino Omnibus			4.605	5.991	

Plots Section of Vanadium



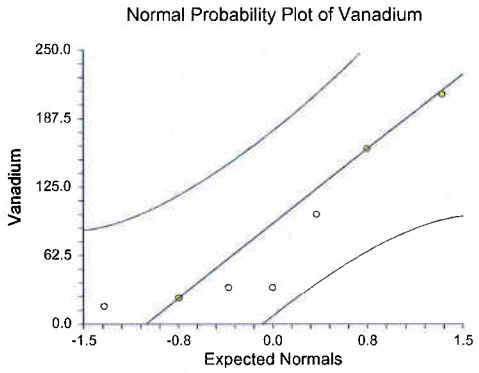


Table 6-B
SWMU 68 Vanadium Groundwater Descriptive Statistics Report: Log-transformed Data

Summary Section of logVn

Count	Mean	Standard Deviation	Standard Error	Minimum	Maximum	Range
7	1.741429	0.4269047	0.1613548	1.23	2.32	1.09

Variation Section of logVn

Parameter	Variance	Standard Deviation	Unbiased Std Dev	Std Error of Mean	Interquartile Range	Range
Value	0.1822476	0.4269047	0.444985	0.1613548	0.82	1.09
Std Error	4.696437E-02	7.778979E-02		2.940178E-02		
95% LCL	7.567702E-02	0.2750946		0.103976		
95% UCL	0.8837361	0.9400724		0.355314		

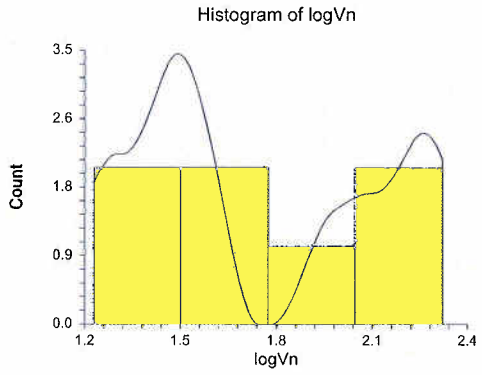
Skewness and Kurtosis Section of logVn

Parameter	Skewness	Kurtosis	Fisher's g1	Fisher's g2	Coefficient of Variation	Coefficient of Dispersion
Value	0.2487555	1.464848	0.3224239	-1.884364	0.2451463	0.2222222
Std Error	0.6539189	0.4537639			0.030907	

Normality Test Section of logVn

Test Name	Test Value	Prob Level	10% Critical Value	5% Critical Value	Decision (5%)
Shapiro-Wilk W	0.9035528	0.3530407			Can't reject normality
Anderson-Darling					
Martinez-Iglewicz	1.073011		1.637634	2.832024	Can't reject normality
Kolmogorov-Smirnov	0.2612201		0.28	0.304	Can't reject normality
D'Agostino Skewness	0		1.645	1.960	
D'Agostino Kurtosis		1.000000	1.645	1.960	
D'Agostino Omnibus			4.605	5.991	

Plots Section of logVn



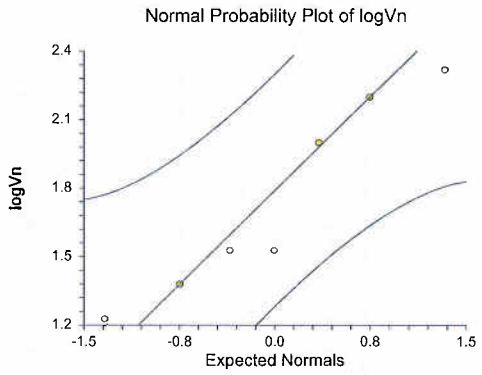


Table 6-C

ProUCL Version 3.00.02 Calculations for SWMU 68 Vanadium Groundwater Data Set

Data File		
Variable:	Vanadium	
Raw Statistics		
Number of Observations	7	
Number of Missing Data	0	
Number of Valid Observations	7	
Number of Distinct Observations	6	
Minimum	17	
Maximum	210	
Mean	82.71429	
Standard Deviation	76.36036	
Variance	5830.905	
Coefficient of Variation	0.923182	
Skewness	0.949392	
Too Few Distinct Observations?	NO	
Normal Statistics		
Lilliefors Test Statisitic	N/R	Shapiro Wilk method yields a more accurate result
Lilliefors 5% Critical Value	N/R	Shapiro Wilk method yields a more accurate result
Shapiro-Wilk Test Statisitic	0.83351	
Shapiro-Wilk 5% Critical Value	0.803	
5% Normality Test Result	NORMAL	Data are normal at 5% significance level
95% Student's-t UCL	138.7974	
Gamma Statistics		
k hat	1.385779	
k star (bias corrected)	0.887112	
Theta hat	59.68794	
Theta star	93.23998	
nu hat	19.4009	
nu star	12.41956	
5% Approximate Chi Square Value	5.503608	
Adjusted Level of Significance	0.01584	
Adjusted Chi Square Value	4.197089	
Anderson-Darling Test Statistic	0.480241	
Anderson-Darling 5% Critical Value	0.72267	
Anderson-Darling 5% Gamma Test Result	AD GAMMA	Data follow gamma distribution at 5% signifcance level.
Kolmogrov-Smirnov Test Statistic	0.30068	
Kolmogrov-Smirnov 5% Critical Value	0.317602	
Kolmogrov-Smirnov 5% Gamma Test Result	KS GAMMA	Data follow gamma distribution at 5% signifcance level
5% Gamma Test Result	GAMMA	Data follow gamma distribution at 5% signifcance level
95% Approximate Gamma UCL	186.6549	
95% Adjusted Gamma UCL	244.759	

Table 6-C

ProUCL Version 3.00.02 Calculations for SWMU 68 Vanadium Groundwater Data Set

Lognormal Statistics		
Minimum of log data	2.833213	
Maximum of log data	5.347108	
Mean of log data	4.013063	
Standard Deviation of log data	0.985003	
Variance of log data	0.970232	
Lilliefors Test Statisitic	N/R	Shapiro Wilk method yields a more accurate result
Lilliefors 5% Critical Value	N/R	Shapiro Wilk method yields a more accurate result
Shapiro-Wilk Test Statisitic	0.903249	
Shapiro-Wilk 5% Critical Value	0.803	
5% Lognormality Test Result	LOGNORMAL	Data are lognormal at 5% significance level
MLE Mean	89.85332	
MLE Standard Deviation	115.0177	
MLE Coefficient of Variation	1.280061	
MLE Skewness	5.937632	
MLE Median	55.31603	
MLE 80% Quantile	127.1529	
MLE 90% Quantile	196.1328	
MLE 95% Quantile	279.6093	
MLE 99% Quantile	546.8533	
MVU Estimate of Median	51.58077	
MVU Estimate of Mean	82.2181	
MVU Estimate of Standard Deviation	82.57656	
MVU Estimate of SE of Mean	30.73904	
95% H-UCL	390.779	
95% Chebyshev (MVUE) UCL	216.2065	
97.5% Chebyshev (MVUE) UCL	274.1834	
99% Chebyshev (MVUE) UCL	388.0677	
Non-parametric Statisitics		
95% CLT UCL	130.1872	
95% Adjusted-CLT UCL	141.2534	
95% Modified-t UCL	140.5235	
95% Jackknife UCL	138.7974	
95% Chebyshev (Mean, Sd) UCL	208.5187	
97.5% Chebyshev (Mean, Sd) UCL	262.9543	
99% Chebyshev (Mean, Sd) UCL	369.8826	
Bootstrap Statistics		
Number of Bootstrap Runs	2000	
95% Standard Bootstrap UCL	126.4721	
95% Bootstrap-t UCL	202.0416	
95% Hall's Bootstrap UCL	139.8958	
95% Percentile Bootstrap UCL	127.2857	
95% BCA Bootstrap UCL	135.2857	

Table 7-A
SWMU 14 Vanadium Surface Soil Descriptive Statistics Report: Non-transformed Data

Summary Section of Vanadium

Count	Mean	Standard Deviation	Standard Error	Minimum	Maximum	Range
4	246	69.69457	34.84729	187	323	136

Variation Section of Vanadium

Parameter	Variance	Standard Deviation	Unbiased Std Dev	Std Error of Mean	Interquartile Range	Range
Value	4857.333	69.69457	75.64662	34.84729	127	136
Std Error	1007.071	10.21754		5.108768		
95% LCL	1558.769	39.48125		19.74062		
95% UCL	67526.96	259.8595		129.9297		

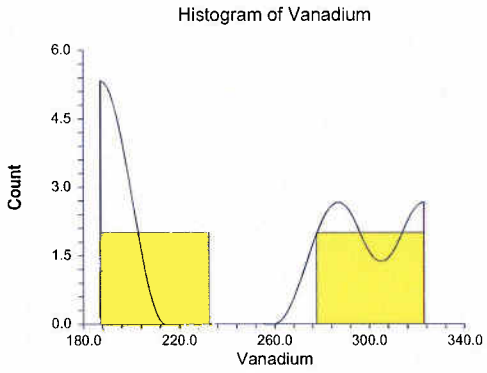
Skewness and Kurtosis Section of Vanadium

Parameter	Skewness	Kurtosis	Fisher's g1	Fisher's g2	Coefficient of Variation	Coefficient of Dispersion
Value	0.1304066	1.171943	0.2258708	-4.710428	0.2833113	0.2489451
Std Error	0.939472	0.2076379			3.779547E-02	

Normality Test Section of Vanadium

Test Name	Test Value	Prob Level	10% Critical Value	5% Critical Value	Decision (5%)
Shapiro-Wilk W	0.831894	0.1727946			Can't reject normality
Anderson-Darling					
Martinez-Iglewicz	1.169482		2.288353	7.591605	Can't reject normality
Kolmogorov-Smirnov	0.3013772		0.346	0.376	Can't reject normality
D'Agostino Skewness	0		1.645	1.960	
D'Agostino Kurtosis		1.000000	1.645	1.960	
D'Agostino Omnibus			4.605	5.991	

Plots Section of Vanadium



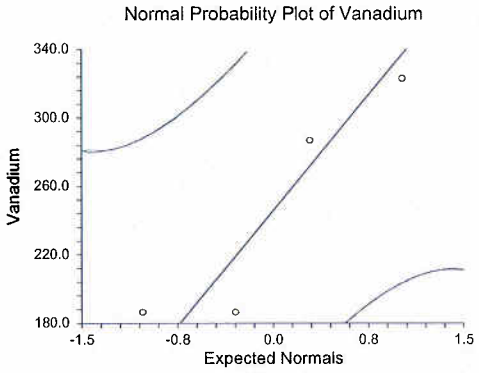


Table 7-B
SWMU 14 Vanadium Surface Soil Descriptive Statistics Report: Log-transformed Data

Summary Section of logVn

Count	Mean	Standard Deviation	Standard Error	Minimum	Maximum	Range
4	2.3775	0.1257975	6.289873E-02	2.27	2.51	0.24

Variation Section of logVn

Parameter	Variance	Standard Deviation	Unbiased Std Dev	Std Error of Mean	Interquartile Range	Range
Value	0.015825	0.1257975	0.1365408	6.289873E-02	0.2275	0.24
Std Error	2.54235E-03	1.429053E-02		7.145267E-03		
95% LCL	5.078407E-03	7.126294E-02		3.563147E-02		
95% UCL	0.2200002	0.4690418		0.2345209		

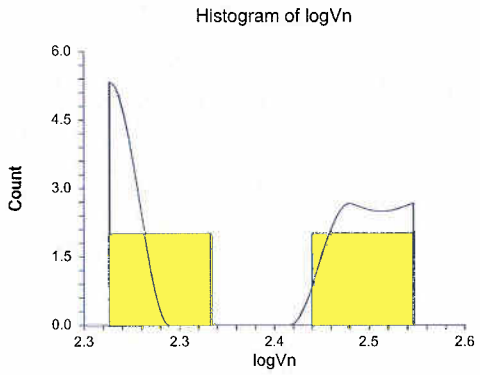
Skewness and Kurtosis Section of logVn

Parameter	Skewness	Kurtosis	Fisher's g1	Fisher's g2	Coefficient of Variation	Coefficient of Dispersion
Value	7.794213E-02	1.103239	0.1349997	-5.225708	5.291165E-02	4.545455E-02
Std Error	0.9625317	0.1165022			4.127271E-03	

Normality Test Section of logVn

Test Name	Test Value	Prob Level	10% Critical Value	5% Critical Value	Decision (5%)
Shapiro-Wilk W	0.8137095	0.1291666			Can't reject normality
Anderson-Darling					
Martinez-Iglewicz	1.175692		2.288353	7.591605	Can't reject normality
Kolmogorov-Smirnov	0.3035994		0.346	0.376	Can't reject normality
D'Agostino Skewness	0		1.645	1.960	
D'Agostino Kurtosis		1.000000	1.645	1.960	
D'Agostino Omnibus			4.605	5.991	

Plots Section of logVn



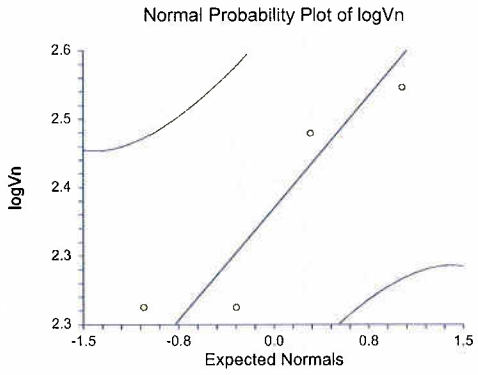


Table 7-C

ProUCL Version 3.00.02 Calculations for SWMU 14 Vanadium Surface Soil Data Set

Data File		
Variable:	Vanadium	
Raw Statistics		
Number of Observations	4	
Number of Missing Data	0	
Number of Valid Observations	4	
Number of Distinct Observations	3	
Minimum	187	
Maximum	323	
Mean	246	
Standard Deviation	69.69457	
Variance	4857.333	
Coefficient of Variation	0.283311	
Skewness	0.225871	
Too Few Distinct Observations?	NO	
Normal Statistics		
Lilliefors Test Statisitic	N/R	Shapiro Wilk method yields a more accurate result
Lilliefors 5% Critical Value	N/R	Shapiro Wilk method yields a more accurate result
Shapiro-Wilk Test Statisitic	0.833824	
Shapiro-Wilk 5% Critical Value	0.748	
5% Normality Test Result	NORMAL	Data are normal at 5% significance level
95% Student's-t UCL	328.0083	
Gamma Statistics		
k hat	16.56183	
k star (bias corrected)	4.307125	
Theta hat	14.85343	
Theta star	57.11466	
nu hat	132.4947	
nu star	34.457	
5% Approximate Chi Square Value	22.02776	
Adjusted Level of Significance	N/A	
Adjusted Chi Square Value	N/A	
Anderson-Darling Test Statistic	0.527344	
Anderson-Darling 5% Critical Value	0.657093	
Anderson-Darling 5% Gamma Test Result	AD GAMMA	Data follow gamma distribution at 5% signifcance level.
Kolmogrov-Smirnov Test Statistic	0.337305	
Kolmogrov-Smirnov 5% Critical Value	0.394477	
Kolmogrov-Smirnov 5% Gamma Test Result	KS GAMMA	Data follow gamma distribution at 5% signifcance level
5% Gamma Test Result	GAMMA	Data follow gamma distribution at 5% signifcance level
95% Approximate Gamma UCL	384.8063	
95% Adjusted Gamma UCL	N/A	

Table 7-C

ProUCL Version 3.00.02 Calculations for SWMU 14 Vanadium Surface Soil Data Set

Lognormal Statistics		
Minimum of log data	5.231109	
Maximum of log data	5.777652	
Mean of log data	5.474838	
Standard Deviation of log data	0.285539	
Variance of log data	0.081533	
Lilliefors Test Statisitic	N/R	Shapiro Wilk method yields a more accurate result
Lilliefors 5% Critical Value	N/R	Shapiro Wilk method yields a more accurate result
Shapiro-Wilk Test Statisitic	0.818434	
Shapiro-Wilk 5% Critical Value	0.748	
5% Lognormality Test Result	LOGNORMAL	Data are lognormal at 5% significance level
MLE Mean	248.5401	
MLE Standard Deviation	72.43939	
MLE Coefficient of Variation	0.29146	
MLE Skewness	0.899138	
MLE Median	238.6118	
MLE 80% Quantile	303.7238	
MLE 90% Quantile	344.3835	
MLE 95% Quantile	381.6676	
MLE 99% Quantile	463.5908	
MVU Estimate of Median	236.1874	
MVU Estimate of Mean	245.9745	
MVU Estimate of Standard Deviation	69.81078	
MVU Estimate of SE of Mean	34.90357	
95% H-UCL	419.2968	
95% Chebyshev (MVUE) UCL	398.1157	
97.5% Chebyshev (MVUE) UCL	463.9472	
99% Chebyshev (MVUE) UCL	593.2607	
Non-parametric Statisitics		
95% CLT UCL	303.3187	
95% Adjusted-CLT UCL	307.5238	
95% Modified-t UCL	328.6642	
95% Jackknife UCL	328.0083	
95% Chebyshev (Mean, Sd) UCL	397.8958	
97.5% Chebyshev (Mean, Sd) UCL	463.6212	
99% Chebyshev (Mean, Sd) UCL	592.7261	
Bootstrap Statistics		
Number of Bootstrap Runs	2000	
95% Standard Bootstrap UCL	N/R	Not enough distinct data warning
95% Bootstrap-t UCL	N/R	Not enough distinct data warning
95% Hall's Bootstrap UCL	N/R	Not enough distinct data warning
95% Percentile Bootstrap UCL	N/R	Not enough distinct data warning
95% BCA Bootstrap UCL	N/R	Not enough distinct data warning

Table 8-A
SWMU 14 Vanadium Subsurface Soil Descriptive Statistics Report: Non-transformed Data

Summary Section of Vanadium

Count	Mean	Standard Deviation	Standard Error	Minimum	Maximum	Range
23	135.7826	77.94168	16.25196	48	440	392

Variation Section of Vanadium

Parameter	Variance	Standard Deviation	Unbiased Std Dev	Std Error of Mean	Interquartile Range	Range
Value	6074.905	77.94168	78.83212	16.25196	55	392
Std Error	4065.015	36.87886		7.689774		
95% LCL	3633.641	60.27969		12.56918		
95% UCL	12169.37	110.3149		23.00224		

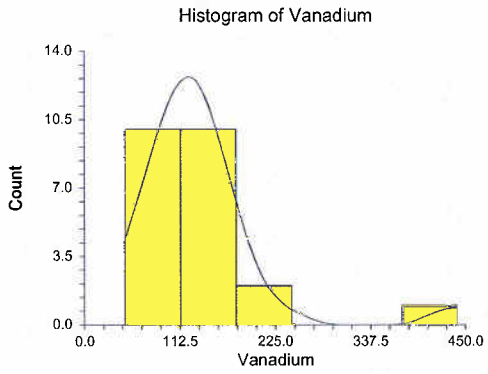
Skewness and Kurtosis Section of Vanadium

Parameter	Skewness	Kurtosis	Fisher's g1	Fisher's g2	Coefficient of Variation	Coefficient of Dispersion
Value	2.636454	11.29848	2.824075	10.74666	0.5740181	0.3757246
Std Error	0.5750282	6.356428			0.1421093	

Normality Test Section of Vanadium

Test Name	Test Value	Prob Level	10% Critical Value	5% Critical Value	Decision (5%)
Shapiro-Wilk W	0.7215979	2.70405E-05			Reject normality
Anderson-Darling	1.735188	1.922944E-04			Reject normality
Martinez-Iglewicz	3.538427		1.189616	1.303046	Reject normality
Kolmogorov-Smirnov	0.2175544		0.166	0.18	Reject normality
D'Agostino Skewness	4.366063	1.265059E-05	1.645	1.960	Reject normality
D'Agostino Kurtosis	3.9502	0.000078	1.645	1.960	Reject normality
D'Agostino Omnibus	34.6664	0.000000	4.605	5.991	Reject normality

Plots Section of Vanadium



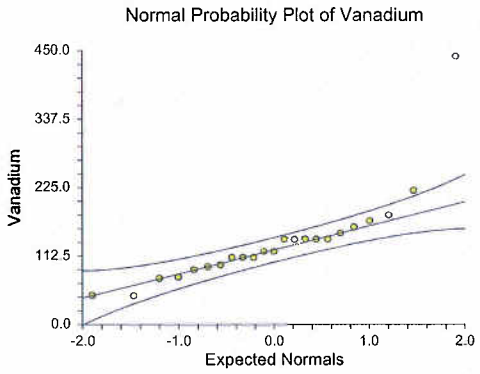


Table 8-B
SWMU 14 Vanadium Subsurface Soil Descriptive Statistics Report: Log-transformed Data

Summary Section of logVn

Count	Mean	Standard Deviation	Standard Error	Minimum	Maximum	Range
23	2.083913	0.2045558	4.265284E-02	1.68	2.64	0.96

Variation Section of logVn

Parameter	Variance	Standard Deviation	Unbiased Std Dev	Std Error of Mean	Interquartile Range	Range
Value	4.184308E-02	0.2045558	0.2068928	4.265284E-02	0.2	0.96
Std Error	1.586123E-02	5.482895E-02		1.143263E-02		
95% LCL	2.502801E-02	0.1582024		3.298748E-02		
95% UCL	8.382089E-02	0.2895184		6.036875E-02		

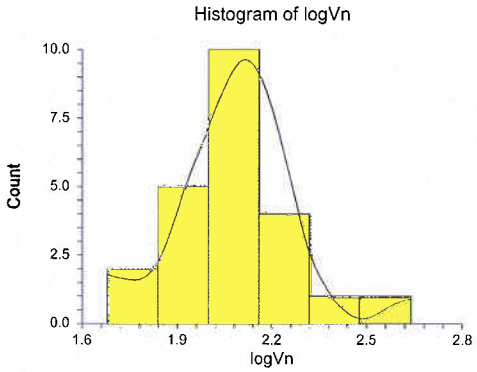
Skewness and Kurtosis Section of logVn

Parameter	Skewness	Kurtosis	Fisher's g1	Fisher's g2	Coefficient of Variation	Coefficient of Dispersion
Value	0.2663772	4.304867	0.2853337	1.95469	9.815948E-02	7.002509E-02
Std Error	0.5604206	1.033039			1.841931E-02	

Normality Test Section of logVn

Test Name	Test Value	Prob Level	10% Critical Value	5% Critical Value	Decision (5%)
Shapiro-Wilk W	0.941343	0.1920348			Can't reject normality
Anderson-Darling	0.5315828	0.1743128			Can't reject normality
Martinez-Iglewicz	1.312778		1.189616	1.303046	Reject normality
Kolmogorov-Smirnov	0.1124495		0.166	0.18	Can't reject normality
D'Agostino Skewness	0.6254185	0.5316964	1.645	1.960	Can't reject normality
D'Agostino Kurtosis	1.7626	0.077970	1.645	1.960	Can't reject normality
D'Agostino Omnibus	3.4979	0.173960	4.605	5.991	Can't reject normality

Plots Section of logVn



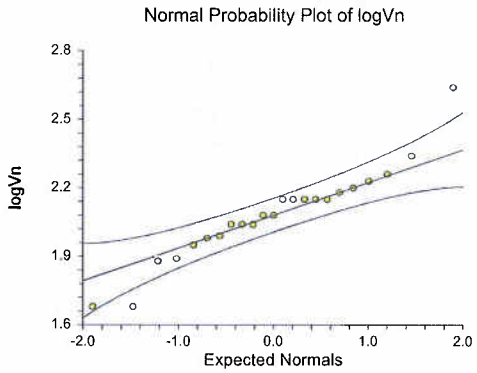


Table 8-C

ProUCL Version 3.00.02 Calculations for SWMU 14 Vanadium Subsurface Soil Data Set

Data File		
Variable:	Vanadium	
Raw Statistics		
Number of Observations	14	
Number of Missing Data	0	
Number of Valid Observations	14	
Number of Distinct Observations	13	
Minimum	86.8	
Maximum	320	
Mean	182.3286	
Standard Deviation	66.85965	
Variance	4470.213	
Coefficient of Variation	0.366699	
Skewness	0.507565	
Too Few Distinct Observations?	NO	
Normal Statistics		
Lilliefors Test Statisitic	N/R	Shapiro Wilk method yields a more accurate result
Lilliefors 5% Critical Value	N/R	Shapiro Wilk method yields a more accurate result
Shapiro-Wilk Test Statisitic	0.965099	
Shapiro-Wilk 5% Critical Value	0.874	
5% Normality Test Result	NORMAL	Data are normal at 5% significance level
95% Student's-t UCL	213.9734	
Gamma Statistics		
k hat	7.921514	
k star (bias corrected)	6.271666	
Theta hat	23.01688	
Theta star	29.07179	
nu hat	221.8024	
nu star	175.6066	
5% Approximate Chi Square Value	145.9532	
Adjusted Level of Significance	0.03122	
Adjusted Chi Square Value	142.3682	
Anderson-Darling Test Statistic	0.171019	
Anderson-Darling 5% Critical Value	0.735968	
Anderson-Darling 5% Gamma Test Result	AD GAMMA	Data follow gamma distribution at 5% signifcance level.
Kolmogrov-Smirnov Test Statistic	0.111939	
Kolmogrov-Smirnov 5% Critical Value	0.22893	
Kolmogrov-Smirnov 5% Gamma Test Result	KS GAMMA	Data follow gamma distribution at 5% signifcance level
5% Gamma Test Result	GAMMA	Data follow gamma distribution at 5% signifcance level
95% Approximate Gamma UCL	219.3724	
95% Adjusted Gamma UCL	224.8964	

Table 8-C

ProUCL Version 3.00.02 Calculations for SWMU 14 Vanadium Subsurface Soil Data Set

Lognormal Statistics		
Minimum of log data	4.463607	
Maximum of log data	5.768321	
Mean of log data	5.141365	
Standard Deviation of log data	0.378336	
Variance of log data	0.143138	
Lilliefors Test Statisitic	N/R	Shapiro Wilk method yields a more accurate result
Lilliefors 5% Critical Value	N/R	Shapiro Wilk method yields a more accurate result
Shapiro-Wilk Test Statisitic	0.977416	
Shapiro-Wilk 5% Critical Value	0.874	
5% Lognormality Test Result	LOGNORMAL	Data are lognormal at 5% significance level
MLE Mean	183.6321	
MLE Standard Deviation	72.03658	
MLE Coefficient of Variation	0.392287	
MLE Skewness	1.237231	
MLE Median	170.949	
MLE 80% Quantile	235.3466	
MLE 90% Quantile	277.974	
MLE 95% Quantile	318.5338	
MLE 99% Quantile	412.1451	
MVU Estimate of Median	170.077	
MVU Estimate of Mean	182.6425	
MVU Estimate of Standard Deviation	70.31824	
MVU Estimate of SE of Mean	18.77737	
95% H-UCL	225.7196	
95% Chebyshev (MVUE) UCL	264.4912	
97.5% Chebyshev (MVUE) UCL	299.9072	
99% Chebyshev (MVUE) UCL	369.475	
Non-parametric Statisitics		
95% CLT UCL	211.7205	
95% Adjusted-CLT UCL	214.3105	
95% Modified-t UCL	214.3774	
95% Jackknife UCL	213.9734	
95% Chebyshev (Mean, Sd) UCL	260.2177	
97.5% Chebyshev (Mean, Sd) UCL	293.9204	
99% Chebyshev (Mean, Sd) UCL	360.1228	
Bootstrap Statistics		
Number of Bootstrap Runs	2000	
95% Standard Bootstrap UCL	211.009	
95% Bootstrap-t UCL	216.9115	
95% Hall's Bootstrap UCL	219.2078	
95% Percentile Bootstrap UCL	211.3571	
95% BCA Bootstrap UCL	213.3857	

Table 9-A
SWMU 14 Vanadium Groundwater Descriptive Statistics Report: Non-transformed Data

Summary Section of Vanadium

Count	Mean	Standard Deviation	Standard Error	Minimum	Maximum	Range
2	66.6	10.46518	7.4	59.2	74	14.8

Variation Section of Vanadium

Parameter	Variance	Standard Deviation	Unbiased Std Dev	Std Error of Mean	Interquartile Range	Range
Value	109.52	10.46518	13.11616	7.4	14.8	14.8
Std Error	4.549127E-07	3.073735E-08		2.173459E-08		
95% LCL	21.79986	4.669032		3.301504		
95% UCL	111519.6	333.9456		236.1352		

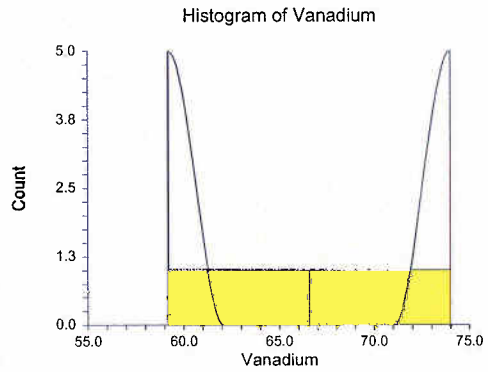
Skewness and Kurtosis Section of Vanadium

Parameter	Skewness	Kurtosis	Fisher's g1	Fisher's g2	Coefficient of Variation	Coefficient of Dispersion
Value					0.1571348	0.1111111
Std Error					1.234568E-02	

Normality Test Section of Vanadium

Test Name	Test Value	Prob Level	10% Critical Value	5% Critical Value	Decision (5%)
Shapiro-Wilk W					
Anderson-Darling					
Martinez-Iglewicz	1.805		5.323102	81.61262	Can't reject normality
Kolmogorov-Smirnov	0.2602499		0.437	0.472	Can't reject normality
D'Agostino Skewness	0		1.645	1.960	
D'Agostino Kurtosis		1.000000	1.645	1.960	
D'Agostino Omnibus			4.605	5.991	

Plots Section of Vanadium



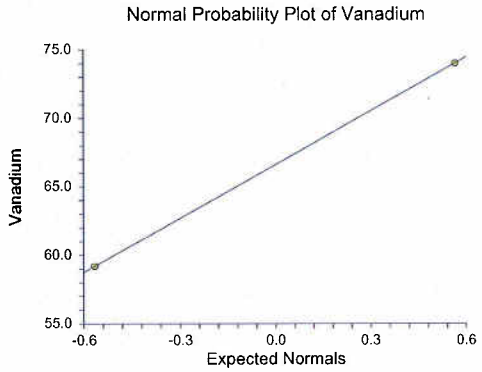


Table 9-B
SWMU 14 Vanadium Groundwater Descriptive Statistics Report: Log-transformed Data

Summary Section of logVn

Count	Mean	Standard Deviation	Standard Error	Minimum	Maximum	Range
2	1.82	7.071068E-02	0.05	1.77	1.87	0.1

Variation Section of logVn

Parameter	Variance	Standard Deviation	Unbiased Std Dev	Std Error of Mean	Interquartile Range	Range
Value	0.005	7.071068E-02	8.862269E-02	0.05	0.1	0.1
Std Error	2.949905E-11	2.949905E-10		2.085898E-10		
95% LCL	9.952455E-04	3.154751E-02		2.230746E-02		
95% UCL	5.091291	2.256389		1.595508		

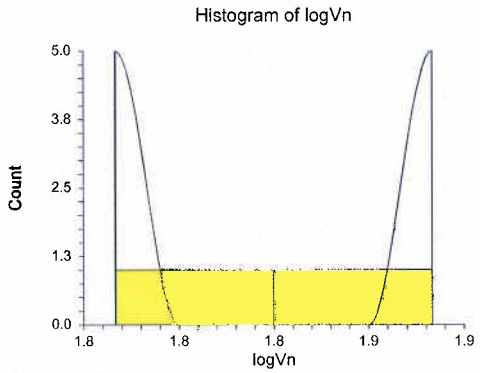
Skewness and Kurtosis Section of logVn

Parameter	Skewness	Kurtosis	Fisher's g1	Fisher's g2	Coefficient of Variation	Coefficient of Dispersion
Value					3.885202E-02	2.747253E-02
Std Error					7.547397E-04	

Normality Test Section of logVn

Test Name	Test Value	Prob Level	10% Critical Value	5% Critical Value	Decision (5%)
Shapiro-Wilk W					
Anderson-Darling					
Martinez-Iglewicz	1.805		5.323102	81.61262	Can't reject normality
Kolmogorov-Smirnov	0.2602499		0.437	0.472	Can't reject normality
D'Agostino Skewness	0		1.645	1.960	
D'Agostino Kurtosis		1.000000	1.645	1.960	
D'Agostino Omnibus			4.605	5.991	

Plots Section of logVn



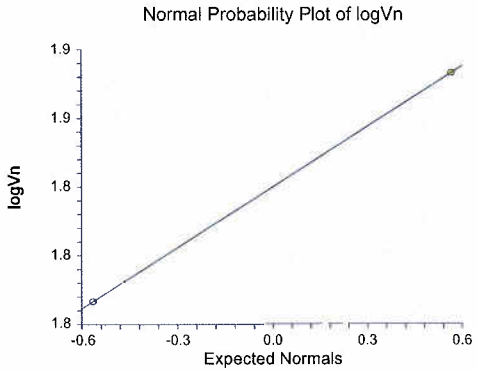


Table 9-C

ProUCL Version 3.00.02 Calculations for SWMU 14 Vanadium Groundwater Data Set

Data File		
Variable:	Vanadium	
Raw Statistics		
Number of Observations	2	
Number of Missing Data	0	
Number of Valid Observations	2	
Number of Distinct Observations	2	
Minimum	59.2	
Maximum	74	
Mean	66.6	
Standard Deviation	10.46518	
Variance	109.52	
Coefficient of Variation	0.1571348	
Skewness	N/A	Too few observations to calculate
Too Few Distinct Observations?	YES	Too Few Observations To Calculate UCLs
Normal Statistics		
Lilliefors Test Statisitic	N/A	Too Few Distinct Observations To Calculate
Lilliefors 5% Critical Value	N/R	Shapiro Wilk method yields a more accurate result
Shapiro-Wilk Test Statisitic		
Shapiro-Wilk 5% Critical Value		
5% Normality Test Result		
95% Student's-t UCL	N/A	Too Few Observations To Calculate UCLs
Gamma Statistics		
k hat	0	
k star (bias corrected)	0	
Theta hat	0	
Theta star	0	
nu hat	0	
nu star	0	
5% Approximate Chi Square Value	N/A	
Adjusted Level of Significance	N/A	
Adjusted Chi Square Value	N/A	
Anderson-Darling Test Statistic	0	
Anderson-Darling 5% Critical Value	0	
Anderson-Darling 5% Gamma Test Result	NOT AD GAMMA	Data not gamma distributed at 5% significance level
Kolmogrov-Smirnov Test Statistic	0	
Kolmogrov-Smirnov 5% Critical Value	0	
Kolmogrov-Smirnov 5% Gamma Test Result	NOT KS GAMMA	Data not gamma distributed at 5% significance level
5% Gamma Test Result	NOT GAMMA	Data not gamma distributed at 5% significance level
95% Approximate Gamma UCL	N/A	Too Few Observations To Calculate UCLs
95% Adjusted Gamma UCL	N/A	Too Few Observations To Calculate UCLs

Table 9-C

ProUCL Version 3.00.02 Calculations for SWMU 14 Vanadium Groundwater Data Set

Lognormal Statistics		
Minimum of log data	4.0809215	
Maximum of log data	4.3040651	
Mean of log data	4.1924933	
Standard Deviation of log data	0.1577863	
Variance of log data	0.0248965	
Lilliefors Test Statisitic	N/A	Too Few Distinct Observations To Calculate UCLs
Lilliefors 5% Critical Value	N/R	Shapiro Wilk method yields a more accurate result
Shapiro-Wilk Test Statisitic		
Shapiro-Wilk 5% Critical Value		
5% Lognormality Test Result		
MLE Mean	1E+300	
MLE Standard Deviation	1.5E+135	
MLE Coefficient of Variation	2.6E-308	
MLE Skewness	1.7E-306	
MLE Median	2.4E-308	
MLE 80% Quantile	2.121995791E-314	
MLE 90% Quantile	2.6E-308	
MLE 95% Quantile	2.6E-308	
MLE 99% Quantile	1.5E+300	
MVU Estimate of Median	1.5E+135	
MVU Estimate of Mean	6.7E+01	
MVU Estimate of Standard Deviation	1.0E+01	
MVU Estimate of SE of Mean	7.4E+00	
95% H-UCL	N/A	Too Few Observations To Calculate UCLs
95% Chebyshev (MVUE) UCL	N/A	Too Few Observations To Calculate UCLs
97.5% Chebyshev (MVUE) UCL	N/A	Too Few Observations To Calculate UCLs
99% Chebyshev (MVUE) UCL	N/A	Too Few Observations To Calculate UCLs
Non-parametric Statisitics		
95% CLT UCL	N/A	Too Few Observations To Calculate UCLs
95% Adjusted-CLT UCL	N/A	Too Few Observations To Calculate UCLs
95% Modified-t UCL	N/A	Too Few Observations To Calculate UCLs
95% Jackknife UCL	N/A	Too Few Observations To Calculate UCLs
95% Chebyshev (Mean, Sd) UCL	N/A	Too Few Observations To Calculate UCLs
97.5% Chebyshev (Mean, Sd) UCL	N/A	Too Few Observations To Calculate UCLs
99% Chebyshev (Mean, Sd) UCL	N/A	Too Few Observations To Calculate UCLs
Bootstrap Statistics		
Number of Bootstrap Runs	2000	
95% Standard Bootstrap UCL	N/A	Too Few Observations To Calculate UCLs
95% Bootstrap-t UCL	N/A	Too Few Observations To Calculate UCLs
95% Hall's Bootstrap UCL	N/A	Too Few Observations To Calculate UCLs
95% Percentile Bootstrap UCL	N/A	Too Few Observations To Calculate UCLs
95% BCA Bootstrap UCL	N/A	Too Few Observations To Calculate UCLs

Table 10-A
NAPR Background Arsenic Surface Soil Descriptive Statistics Report: Non-transformed Data

Summary Section of Arsenic

Count	Mean	Standard Deviation	Standard Error	Minimum	Maximum	Range
20	1.1765	0.7622096	0.1704352	0.21	2.5	2.29

Variation Section of Arsenic

Parameter	Variance	Standard Deviation	Unbiased Std Dev	Std Error of Mean	Interquartile Range	Range
Value	0.5809634	0.7622096	0.7723002	0.1704352	1.47875	2.29
Std Error	0.1068986	9.917053E-02		0.0221752		
95% LCL	0.3359977	0.579653		0.1296144		
95% UCL	1.239352	1.113262		0.2489329		

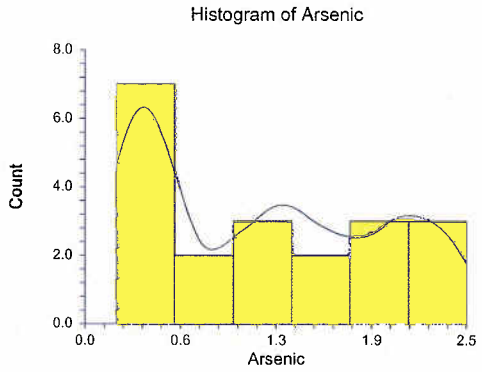
Skewness and Kurtosis Section of Arsenic

Parameter	Skewness	Kurtosis	Fisher's g1	Fisher's g2	Coefficient of Variation	Coefficient of Dispersion
Value	0.2793536	1.677137	0.3025336	-1.352361	0.647862	0.5682608
Std Error	0.3484124	0.3061334			9.065705E-02	

Normality Test Section of Arsenic

Test Name	Test Value	Prob Level	10% Critical Value	5% Critical Value	Decision (5%)
Shapiro-Wilk W	0.9098819	6.340596E-02			Can't reject normality
Anderson-Darling	0.6217786	0.1055212			Can't reject normality
Martinez-Iglewicz	0.9852704		1.216194	1.357297	Can't reject normality
Kolmogorov-Smirnov	0.1626089		0.176	0.192	Can't reject normality
D'Agostino Skewness	0.6231254	0.5332021	1.645	1.960	Can't reject normality
D'Agostino Kurtosis	-2.1066	0.035149	1.645	1.960	Reject normality
D'Agostino Omnibus	4.8262	0.089538	4.605	5.991	Can't reject normality

Plots Section of Arsenic



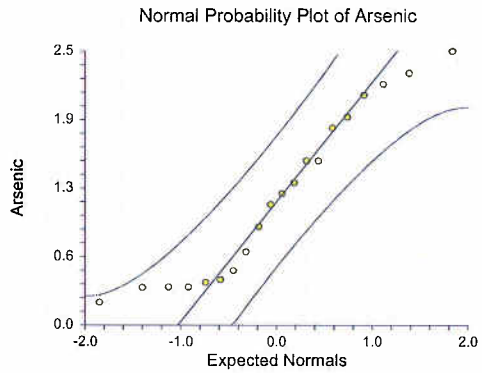


Table 10-B
NAPR Background Arsenic Surface Soil Descriptive Statistics Report: Log-transformed Data

Summary Section of logAs

Count	Mean	Standard Deviation	Standard Error	Minimum	Maximum	Range
20	-0.04092	0.3423907	0.0765609	-0.6778	0.3979	1.0757

Variation Section of logAs

Parameter	Variance	Standard Deviation	Unbiased Std Dev	Std Error of Mean	Interquartile Range	Range
Value	0.1172314	0.3423907	0.3469236	0.0765609	0.6751	1.0757
Std Error	2.168612E-02	4.478626E-02		1.001451E-02		
95% LCL	6.780028E-02	0.2603849		5.822383E-02		
95% UCL	0.2500862	0.5000862		0.1118227		

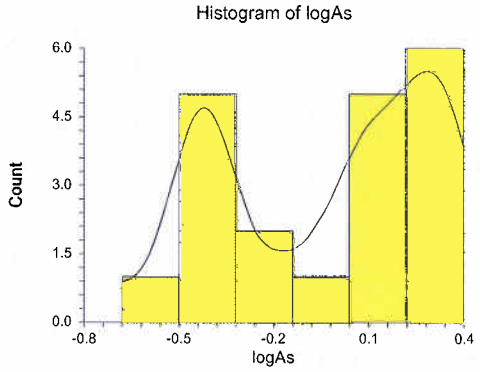
Skewness and Kurtosis Section of logAs

Parameter	Skewness	Kurtosis	Fisher's g1	Fisher's g2	Coefficient of Variation	Coefficient of Dispersion
Value	-0.3314635	1.684393	-0.3589673	-1.342899	-8.36732	4.830514
Std Error	0.3749861	0.3622152			14.9655	

Normality Test Section of logAs

Test Name	Test Value	Prob Level	10% Critical Value	5% Critical Value	Decision (5%)
Shapiro-Wilk W	0.9081049	5.865692E-02			Can't reject normality
Anderson-Darling	0.7137942	6.254464E-02			Can't reject normality
Martinez-Iglewicz	0.981611		1.216194	1.357297	Can't reject normality
Kolmogorov-Smirnov	0.1404167		0.176	0.192	Can't reject normality
D'Agostino Skewness	-0.7370863	0.4610699	1.645	1.960	Can't reject normality
D'Agostino Kurtosis	-2.0800	0.037530	1.645	1.960	Reject normality
D'Agostino Omnibus	4.8695	0.087619	4.605	5.991	Can't reject normality

Plots Section of logAs



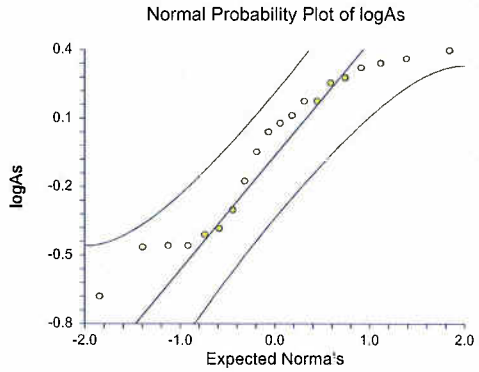


Table 10-C

ProUCL Version 3.00.02 Calculations for NAPR Background Arsenic Surface Soil Data Set

Data File		
Variable:	Arsenic	
Raw Statistics		
Number of Observations	20	
Number of Missing Data	0	
Number of Valid Observations	20	
Number of Distinct Observations	18	
Minimum	0.21	
Maximum	2.5	
Mean	1.1765	
Standard Deviation	0.7622096	
Variance	0.5809634	
Coefficient of Variation	0.6478619	
Skewness	0.3025336	
Too Few Distinct Observations?	NO	
Normal Statistics		
Lilliefors Test Statisitic	N/R	Shapiro Wilk method yields a more accurate result
Lilliefors 5% Critical Value	N/R	Shapiro Wilk method yields a more accurate result
Shapiro-Wilk Test Statisitic	0.9098921	
Shapiro-Wilk 5% Critical Value	0.905	
5% Normality Test Result	NORMAL	Data are normal at 5% significance level
95% Student's-t UCL	1.4712051	
Gamma Statistics		
k hat	2.0987521	
k star (bias corrected)	1.8172726	
Theta hat	0.5605712	
Theta star	0.6473987	
nu hat	83.950084	
nu star	72.690904	
5% Approximate Chi Square Value	54.054954	
Adjusted Level of Significance	0.038	
Adjusted Chi Square Value	52.785192	
Anderson-Darling Test Statistic	0.6488891	
Anderson-Darling 5% Critical Value	0.7519281	
Anderson-Darling 5% Gamma Test Result	AD GAMMA	Data follow gamma distribution at 5% signifcance level.
Kolmogrov-Smirnov Test Statistic	0.1509598	
Kolmogrov-Smirnov 5% Critical Value	0.1960033	
Kolmogrov-Smirnov 5% Gamma Test Result	KS GAMMA	Data follow gamma distribution at 5% signifcance level
5% Gamma Test Result	GAMMA	Data follow gamma distribution at 5% signifcance level
95% Approximate Gamma UCL	1.5821094	
95% Adjusted Gamma UCL	1.6201674	

Table 10-C

ProUCL Version 3.00.02 Calculations for NAPR Background Arsenic Surface Soil Data Set

Lognormal Statistics		
Minimum of log data	-1.560648	
Maximum of log data	0.9162907	
Mean of log data	-0.094221	
Standard Deviation of log data	0.7883963	
Variance of log data	0.6215688	
Lilliefors Test Statisitic	N/R	Shapiro Wilk method yields a more accurate result
Lilliefors 5% Critical Value	N/R	Shapiro Wilk method yields a more accurate result
Shapiro-Wilk Test Statisitic	0.9081306	
Shapiro-Wilk 5% Critical Value	0.905	
5% Lognormality Test Result	LOGNORMAL	Data are lognormal at 5% significance level
MLE Mean	1E+00	
MLE Standard Deviation	1.2E+00	
MLE Coefficient of Variation	9.3E-01	
MLE Skewness	3.6E+00	
MLE Median	9.1E-01	
MLE 80% Quantile	1.8E+00	
MLE 90% Quantile	2.5E+00	
MLE 95% Quantile	3.3E+00	
MLE 99% Quantile	5.7E+00	
MVU Estimate of Median	9.0E-01	
MVU Estimate of Mean	1.2E+00	
MVU Estimate of Standard Deviation	1.1E+00	
MVU Estimate of SE of Mean	2.3E-01	
95% H-UCL	1.8876411	
95% Chebyshev (MVUE) UCL	2.2302084	
97.5% Chebyshev (MVUE) UCL	2.6682975	
99% Chebyshev (MVUE) UCL	3.5288386	
Non-parametric Statisitics		
95% CLT UCL	1.456841	
95% Adjusted-CLT UCL	1.4691607	
95% Modified-t UCL	1.4731267	
95% Jackknife UCL	1.4712051	
95% Chebyshev (Mean, Sd) UCL	1.91941	
97.5% Chebyshev (Mean, Sd) UCL	2.2408677	
99% Chebyshev (Mean, Sd) UCL	2.8723092	
Bootstrap Statistics		
Number of Bootstrap Runs	2000	
95% Standard Bootstrap UCL	1.4435643	
95% Bootstrap-t UCL	1.4779457	
95% Hall's Bootstrap UCL	1.4403817	
95% Percentile Bootstrap UCL	1.45075	
95% BCA Bootstrap UCL	1.48025	

Table 11-A
NAPR Background Arsenic Subsurface Soil Descriptive Statistics Report: Non-transformed Data

Summary Section of Arsenic

Count	Mean	Standard Deviation	Standard Error	Minimum	Maximum	Range
19	0.8947368	0.4528719	0.1038959	0.22	1.7	1.48

Variation Section of Arsenic

Parameter	Variance	Standard Deviation	Unbiased Std Dev	Std Error of Mean	Interquartile Range	Range
Value	0.205093	0.4528719	0.4592024	0.1038959	0.67	1.48
Std Error	4.545772E-02	7.097693E-02		1.628322E-02		
95% LCL	0.1170979	0.3421957		7.850509E-02		
95% UCL	0.4485224	0.6697181		0.1536439		

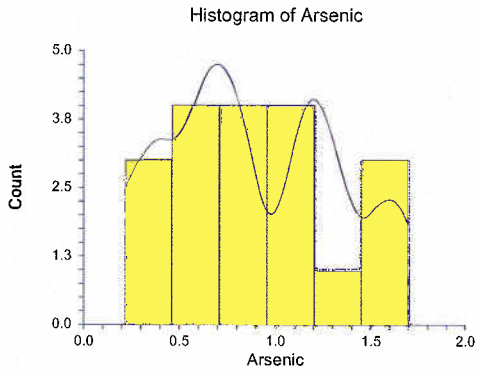
Skewness and Kurtosis Section of Arsenic

Parameter	Skewness	Kurtosis	Fisher's g1	Fisher's g2	Coefficient of Variation	Coefficient of Dispersion
Value	0.209574	1.933399	0.2279825	-1.014619	0.506151	0.4723518
Std Error	0.3281766	0.3279706			7.089994E-02	

Normality Test Section of Arsenic

Test Name	Test Value	Prob Level	10% Critical Value	5% Critical Value	Decision (5%)
Shapiro-Wilk W	0.9524221	0.4340645			Can't reject normality
Anderson-Darling	0.3230748	0.526621			Can't reject normality
Martinez-Iglewicz	1.003591		1.226978	1.380602	Can't reject normality
Kolmogorov-Smirnov	0.1182928		0.181	0.197	Can't reject normality
D'Agostino Skewness	0.4605467	0.6451239	1.645	1.960	Can't reject normality
D'Agostino Kurtosis	-1.2403	0.214852	1.645	1.960	Can't reject normality
D'Agostino Omnibus	1.7505	0.416751	4.605	5.991	Can't reject normality

Plots Section of Arsenic



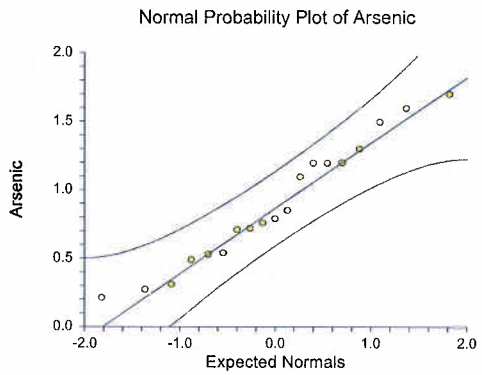


Table 11-B
NAPR Background Arsenic Subsurface Soil Descriptive Statistics Report: Log-transformed Data

Summary Section of logAs

Count	Mean	Standard Deviation	Standard Error	Minimum	Maximum	Range
19	-0.1132737	0.2611853	5.992001E-02	-0.6576	0.2304	0.888

Variation Section of logAs

Parameter	Variance	Standard Deviation	Unbiased Std Dev	Std Error of Mean	Interquartile Range	Range
Value	6.821773E-02	0.2611853	0.2648363	5.992001E-02	0.3549	0.888
Std Error	1.854233E-02	5.019965E-02		1.151659E-02		
95% LCL	3.894895E-02	0.1973549		4.527631E-02		
95% UCL	0.1491869	0.3862472		8.861118E-02		

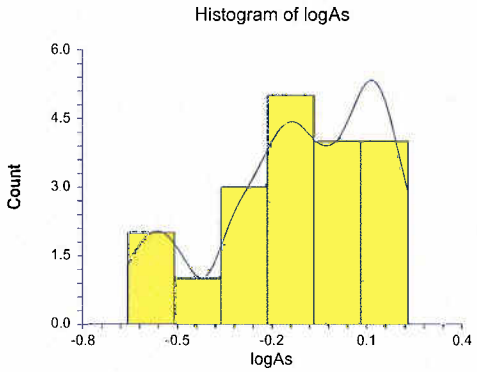
Skewness and Kurtosis Section of logAs

Parameter	Skewness	Kurtosis	Fisher's g1	Fisher's g2	Coefficient of Variation	Coefficient of Dispersion
Value	-0.6083623	2.403743	-0.6617995	-0.3921045	-2.305789	-2.012541
Std Error	0.3299892	0.6824729			1.060931	

Normality Test Section of logAs

Test Name	Test Value	Prob Level	10% Critical Value	5% Critical Value	Decision (5%)
Shapiro-Wilk W	0.933055	0.1971072			Can't reject normality
Anderson-Darling	0.4472803	0.2801879			Can't reject normality
Martinez-Iglewicz	0.9982665		1.226978	1.380602	Can't reject normality
Kolmogorov-Smirnov	9.411665E-02		0.181	0.197	Can't reject normality
D'Agostino Skewness	-1.298678	0.1940546	1.645	1.960	Can't reject normality
D'Agostino Kurtosis	-0.2336	0.815267	1.645	1.960	Can't reject normality
D'Agostino Omnibus	1.7411	0.418711	4.605	5.991	Can't reject normality

Plots Section of logAs



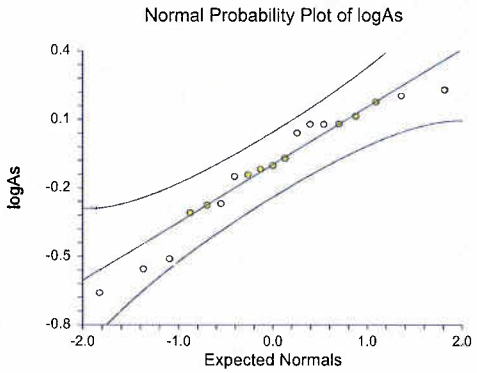


Table 11-C

ProUCL Version 3.00.02 Calculations for NAPR Background Arsenic Subsurface Soil Data Set

Data File		
Variable:	Arsenic	
Raw Statistics		
Number of Observations	19	
Number of Missing Data	0	
Number of Valid Observations	19	
Number of Distinct Observations	17	
Minimum	0.22	
Maximum	1.7	
Mean	0.8947368	
Standard Deviation	0.4528719	
Variance	0.205093	
Coefficient of Variation	0.506151	
Skewness	0.2279825	
Too Few Distinct Observations?	NO	
Normal Statistics		
Lilliefors Test Statisitic	N/R	Shapiro Wilk method yields a more accurate result
Lilliefors 5% Critical Value	N/R	Shapiro Wilk method yields a more accurate result
Shapiro-Wilk Test Statisitic	0.9525456	
Shapiro-Wilk 5% Critical Value	0.901	
5% Normality Test Result	NORMAL	Data are normal at 5% significance level
95% Student's-t UCL	1.074899	
Gamma Statistics		
k hat	3.5002125	
k star (bias corrected)	2.9826351	
Theta hat	0.2556236	
Theta star	0.299982	
nu hat	133.00807	
nu star	113.34013	
5% Approximate Chi Square Value	89.758776	
Adjusted Level of Significance	0.03687	
Adjusted Chi Square Value	87.925358	
Anderson-Darling Test Statistic	0.3337278	
Anderson-Darling 5% Critical Value	0.7466394	
Anderson-Darling 5% Gamma Test Result	AD GAMMA	Data follow gamma distribution at 5% signifcance level.
Kolmogrov-Smirnov Test Statistic	0.142454	
Kolmogrov-Smirnov 5% Critical Value	0.1996148	
Kolmogrov-Smirnov 5% Gamma Test Result	KS GAMMA	Data follow gamma distribution at 5% signifcance level
5% Gamma Test Result	GAMMA	Data follow gamma distribution at 5% signifcance level
95% Approximate Gamma UCL	1.1298014	
95% Adjusted Gamma UCL	1.15336	

Table 11-C

ProUCL Version 3.00.02 Calculations for NAPR Background Arsenic Subsurface Soil Data Set

Lognormal Statistics		
Minimum of log data	-1.514128	
Maximum of log data	0.5306283	
Mean of log data	-0.260822	
Standard Deviation of log data	0.6014243	
Variance of log data	0.3617111	
Lilliefors Test Statisitic	N/R	Shapiro Wilk method yields a more accurate result
Lilliefors 5% Critical Value	N/R	Shapiro Wilk method yields a more accurate result
Shapiro-Wilk Test Statisitic	0.9332223	
Shapiro-Wilk 5% Critical Value	0.901	
5% Lognormality Test Result	LOGNORMAL	Data are lognormal at 5% significance level
MLE Mean	9E-01	
MLE Standard Deviation	6.1E-01	
MLE Coefficient of Variation	6.6E-01	
MLE Skewness	2.3E+00	
MLE Median	7.7E-01	
MLE 80% Quantile	1.3E+00	
MLE 90% Quantile	1.7E+00	
MLE 95% Quantile	2.1E+00	
MLE 99% Quantile	3.1E+00	
MVU Estimate of Median	7.6E-01	
MVU Estimate of Mean	9.1E-01	
MVU Estimate of Standard Deviation	5.8E-01	
MVU Estimate of SE of Mean	1.3E-01	
95% H-UCL	1.2465117	
95% Chebyshev (MVUE) UCL	1.4895712	
97.5% Chebyshev (MVUE) UCL	1.7390162	
99% Chebyshev (MVUE) UCL	2.2290026	
Non-parametric Statisitics		
95% CLT UCL	1.0656305	
95% Adjusted-CLT UCL	1.0714368	
95% Modified-t UCL	1.0758047	
95% Jackknife UCL	1.074899	
95% Chebyshev (Mean, Sd) UCL	1.3476088	
97.5% Chebyshev (Mean, Sd) UCL	1.5435668	
99% Chebyshev (Mean, Sd) UCL	1.9284884	
Bootstrap Statistics		
Number of Bootstrap Runs	2000	
95% Standard Bootstrap UCL	1.0604263	
95% Bootstrap-t UCL	1.0809798	
95% Hall's Bootstrap UCL	1.0662234	
95% Percentile Bootstrap UCL	1.0678947	
95% BCA Bootstrap UCL	1.0705263	

Table 12-A
SWMU 68 Arsenic Surface Soil Descriptive Statistics Report: Non-transformed Data

Summary Section of Arsenic

Count	Mean	Standard Deviation	Standard Error	Minimum	Maximum	Range
13	1.693846	0.6556109	0.1818337	0.92	3.4	2.48

Variation Section of Arsenic

Parameter	Variance	Standard Deviation	Unbiased Std Dev	Std Error of Mean	Interquartile Range	Range
Value	0.4298256	0.6556109	0.6693967	0.1818337	0.7	2.48
Std Error	0.2250551	0.2427324		6.732185E-02		
95% LCL	0.2210216	0.4701294		0.1303904		
95% UCL	1.171243	1.08224		0.3001594		

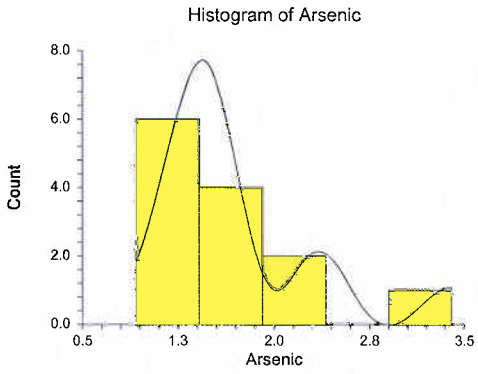
Skewness and Kurtosis Section of Arsenic

Parameter	Skewness	Kurtosis	Fisher's g1	Fisher's g2	Coefficient of Variation	Coefficient of Dispersion
Value	1.469928	4.56399	1.669036	3.043184	0.3870546	0.2810256
Std Error	0.5809764	2.484794			0.07458	

Normality Test Section of Arsenic

Test Name	Test Value	Prob Level	10% Critical Value	5% Critical Value	Decision (5%)
Shapiro-Wilk W	0.83075	1.618682E-02			Reject normality
Anderson-Darling	0.9397453	1.733756E-02			Reject normality
Martinez-Iglewicz	2.879251		1.328902	1.637564	Reject normality
Kolmogorov-Smirnov	0.2654862		0.215	0.234	Reject normality
D'Agostino Skewness	2.559434	1.048427E-02	1.645	1.960	Reject normality
D'Agostino Kurtosis	1.9928	0.046285	1.645	1.960	Reject normality
D'Agostino Omnibus	10.5219	0.005190	4.605	5.991	Reject normality

Plots Section of Arsenic



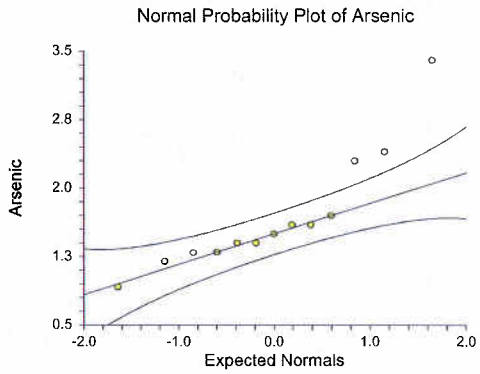


Table 12-B
SWMU 68 Arsenic Surface Soil Descriptive Statistics Report: Log-transformed Data

Summary Section of logAs

Count	Mean	Standard Deviation	Standard Error	Minimum	Maximum	Range
13	0.2039308	0.147439	4.089223E-02	-0.0362	0.5315	0.5677

Variation Section of logAs

Parameter	Variance	Standard Deviation	Unbiased Std Dev	Std Error of Mean	Interquartile Range	Range
Value	2.173827E-02	0.147439	0.1505393	4.089223E-02	0.18215	0.5677
Std Error	8.969886E-03	4.301891E-02		0.0119313		
95% LCL	1.117809E-02	0.1057265		2.932325E-02		
95% UCL	5.923519E-02	0.2433828		6.750225E-02		

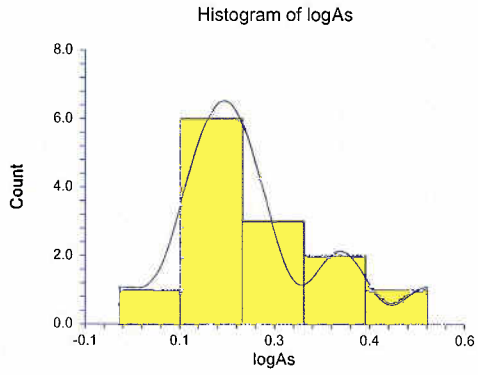
Skewness and Kurtosis Section of logAs

Parameter	Skewness	Kurtosis	Fisher's g1	Fisher's g2	Coefficient of Variation	Coefficient of Dispersion
Value	0.7284083	3.213438	0.8270742	0.9805227	0.7229857	0.5892631
Std Error	0.467473	1.27195			0.1459658	

Normality Test Section of logAs

Test Name	Test Value	Prob Level	10% Critical Value	5% Critical Value	Decision (5%)
Shapiro-Wilk W	0.9332952	0.3760917			Can't reject normality
Anderson-Darling	0.4827455	0.2300249			Can't reject normality
Martinez-Iglewicz	1.277758		1.328902	1.637564	Can't reject normality
Kolmogorov-Smirnov	0.1979929		0.215	0.234	Can't reject normality
D'Agostino Skewness	1.368943	0.1710172	1.645	1.960	Can't reject normality
D'Agostino Kurtosis	0.9673	0.333391	1.645	1.960	Can't reject normality
D'Agostino Omnibus	2.8097	0.245406	4.605	5.991	Can't reject normality

Plots Section of logAs



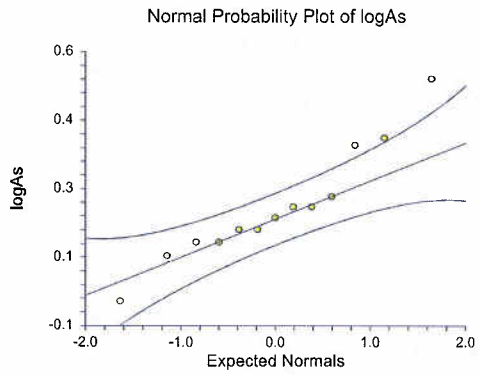


Table 12-C

ProUCL Version 3.00.02 Calculations for SWMU 68 Arsenic Surface Soil Data Set

Data File		
Variable:	Arsenic	
Raw Statistics		
Number of Observations	13	
Number of Missing Data	0	
Number of Valid Observations	13	
Number of Distinct Observations	10	
Minimum	0.92	
Maximum	3.4	
Mean	1.6938462	
Standard Deviation	0.6556109	
Variance	0.4298256	
Coefficient of Variation	0.3870546	
Skewness	1.6690356	
Too Few Distinct Observations?	NO	
Normal Statistics		
Lilliefors Test Statisitic	N/R	Shapiro Wilk method yields a more accurate result
Lilliefors 5% Critical Value	N/R	Shapiro Wilk method yields a more accurate result
Shapiro-Wilk Test Statisitic	0.8309622	
Shapiro-Wilk 5% Critical Value	0.866	
5% Normality Test Result	NOT NORMAL	Data not normal at 5% significance level
95% Student's-t UCL	2.0179262	
Gamma Statistics		
k hat	8.8747044	
k star (bias corrected)	6.8779778	
Theta hat	0.1908623	
Theta star	0.246271	
nu hat	230.74232	
nu star	178.82742	
5% Approximate Chi Square Value	148.89216	
Adjusted Level of Significance	0.03009	
Adjusted Chi Square Value	145.00162	
Anderson-Darling Test Statistic	0.613668	
Anderson-Darling 5% Critical Value	0.7342329	
Anderson-Darling 5% Gamma Test Result	AD GAMMA	Data follow gamma distribution at 5% signifcance level.
Kolmogrov-Smirnov Test Statistic	0.2203016	
Kolmogrov-Smirnov 5% Critical Value	0.2368665	
Kolmogrov-Smirnov 5% Gamma Test Result	KS GAMMA	Data follow gamma distribution at 5% signifcance level
5% Gamma Test Result	GAMMA	Data follow gamma distribution at 5% signifcance level
95% Approximate Gamma UCL	2.0343995	
95% Adjusted Gamma UCL	2.0889845	

Table 12-C

ProUCL Version 3.00.02 Calculations for SWMU 68 Arsenic Surface Soil Data Set

Lognormal Statistics		
Minimum of log data	-0.083382	
Maximum of log data	1.2237754	
Mean of log data	0.4696051	
Standard Deviation of log data	0.3394847	
Variance of log data	0.1152499	
Lilliefors Test Statisitic	N/R	Shapiro Wilk method yields a more accurate result
Lilliefors 5% Critical Value	N/R	Shapiro Wilk method yields a more accurate result
Shapiro-Wilk Test Statisitic	0.9335375	
Shapiro-Wilk 5% Critical Value	0.866	
5% Lognormality Test Result	LOGNORMAL	Data are lognormal at 5% significance level
MLE Mean	2E+00	
MLE Standard Deviation	5.9E-01	
MLE Coefficient of Variation	3.5E-01	
MLE Skewness	1.1E+00	
MLE Median	1.6E+00	
MLE 80% Quantile	2.1E+00	
MLE 90% Quantile	2.5E+00	
MLE 95% Quantile	2.8E+00	
MLE 99% Quantile	3.5E+00	
MVU Estimate of Median	1.6E+00	
MVU Estimate of Mean	1.7E+00	
MVU Estimate of Standard Deviation	5.8E-01	
MVU Estimate of SE of Mean	1.6E-01	
95% H-UCL	2.0505395	
95% Chebyshev (MVUE) UCL	2.3873049	
97.5% Chebyshev (MVUE) UCL	2.6905863	
99% Chebyshev (MVUE) UCL	3.2863239	
Non-parametric Statisitics		
95% CLT UCL	1.992936	
95% Adjusted-CLT UCL	2.0828752	
95% Modified-t UCL	2.0319549	
95% Jackknife UCL	2.0179262	
95% Chebyshev (Mean, Sd) UCL	2.4864411	
97.5% Chebyshev (Mean, Sd) UCL	2.8293975	
99% Chebyshev (Mean, Sd) UCL	3.5030691	
Bootstrap Statistics		
Number of Bootstrap Runs	2000	
95% Standard Bootstrap UCL	1.9701573	
95% Bootstrap-t UCL	2.1745492	
95% Hall's Bootstrap UCL	2.3273063	
95% Percentile Bootstrap UCL	2.0030769	
95% BCA Bootstrap UCL	2.08	

Table 13-A
SWMU 68 Arsenic Subsurface Soil Descriptive Statistics Report: Non-transformed Data

Summary Section of Arsenic

Count	Mean	Standard Deviation	Standard Error	Minimum	Maximum	Range
23	1.381739	0.7635602	0.1592133	0.35	3.6	3.25

Variation Section of Arsenic

Parameter	Variance	Standard Deviation	Unbiased Std Dev	Std Error of Mean	Interquartile Range	Range
Value	0.5830241	0.7635602	0.7722834	0.1592133	0.2	3.25
Std Error	0.2589504	0.2398051		5.000281E-02		
95% LCL	0.3487298	0.5905335		0.1231347		
95% UCL	1.167925	1.080706		0.2253428		

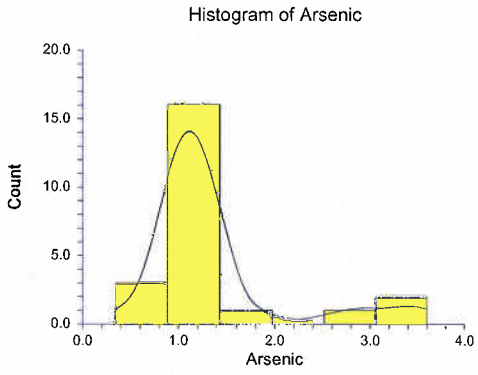
Skewness and Kurtosis Section of Arsenic

Parameter	Skewness	Kurtosis	Fisher's g1	Fisher's g2	Coefficient of Variation	Coefficient of Dispersion
Value	1.832552	5.537201	1.962964	3.50391	0.552608	0.3762846
Std Error	0.6276536	3.049341			7.608239E-02	

Normality Test Section of Arsenic

Test Name	Test Value	Prob Level	10% Critical Value	5% Critical Value	Decision (5%)
Shapiro-Wilk W	0.7130446	2.076623E-05			Reject normality
Anderson-Darling	2.997072	1.597732E-07			Reject normality
Martinez-Iglewicz	18.39851		1.189616	1.303046	Reject normality
Kolmogorov-Smirnov	0.3252341		0.166	0.18	Reject normality
D'Agostino Skewness	3.450713	5.591082E-04	1.645	1.960	Reject normality
D'Agostino Kurtosis	2.4432	0.014558	1.645	1.960	Reject normality
D'Agostino Omnibus	17.8766	0.000131	4.605	5.991	Reject normality

Plots Section of Arsenic



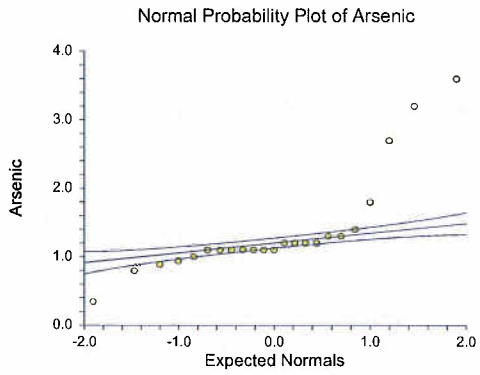


Table 13-B
SWMU 68 Arsenic Subsurface Soil Descriptive Statistics Report: Log-transformed Data

Summary Section of logAs

Count	Mean	Standard Deviation	Standard Error	Minimum	Maximum	Range
23	9.123044E-02	0.2055314	4.285625E-02	-0.4559	0.5563	1.0122

Variation Section of logAs

Parameter	Variance	Standard Deviation	Unbiased Std Dev	Std Error of Mean	Interquartile Range	Range
Value	4.224315E-02	0.2055314	0.2078795	4.285625E-02	0.0725	1.0122
Std Error	1.726491E-02	5.939792E-02		1.238532E-02		
95% LCL	0.0252673	0.1589569		3.314481E-02		
95% UCL	0.0846223	0.2908991		6.065666E-02		

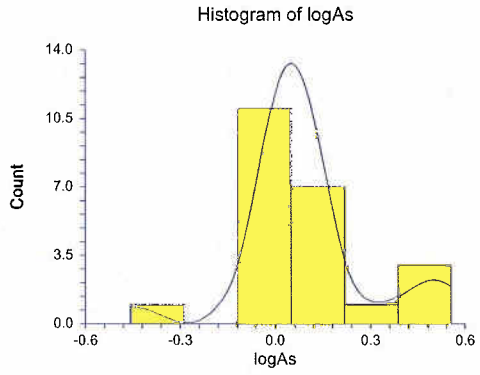
Skewness and Kurtosis Section of logAs

Parameter	Skewness	Kurtosis	Fisher's g1	Fisher's g2	Coefficient of Variation	Coefficient of Dispersion
Value	0.2080792	4.841882	0.2228869	2.629795	2.252882	2.962298
Std Error	0.6731301	1.671525			1.087244	

Normality Test Section of logAs

Test Name	Test Value	Prob Level	10% Critical Value	5% Critical Value	Decision (5%)
Shapiro-Wilk W	0.8452955	2.238116E-03			Reject normality
Anderson-Darling	1.742992	1.840071E-04			Reject normality
Martinez-Iglewicz	8.14878		1.189616	1.303046	Reject normality
Kolmogorov-Smirnov	0.2386955		0.166	0.18	Reject normality
D'Agostino Skewness	0.4900216	0.6241186	1.645	1.960	Can't reject normality
D'Agostino Kurtosis	2.0929	0.036359	1.645	1.960	Reject normality
D'Agostino Omnibus	4.6203	0.099246	4.605	5.991	Can't reject normality

Plots Section of logAs



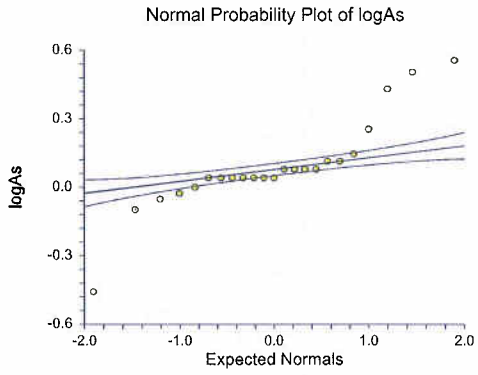


Table 13-C

ProUCL Version 3.00.02 Calculations for SWMU 68 Arsenic Subsurface Soil Data Set

Data File		
Variable:	Arsenic	
Raw Statistics		
Number of Observations	23	
Number of Missing Data	0	
Number of Valid Observations	23	
Number of Distinct Observations	13	
Minimum	0.35	
Maximum	3.6	
Mean	1.3817391	
Standard Deviation	0.7635602	
Variance	0.5830241	
Coefficient of Variation	0.552608	
Skewness	1.9629641	
Too Few Distinct Observations?	NO	
Normal Statistics		
Lilliefors Test Statisitic	N/R	Shapiro Wilk method yields a more accurate result
Lilliefors 5% Critical Value	N/R	Shapiro Wilk method yields a more accurate result
Shapiro-Wilk Test Statisitic	0.7122762	
Shapiro-Wilk 5% Critical Value	0.914	
5% Normality Test Result	NOT NORMAL	Data not normal at 5% significance level
95% Student's-t UCL	1.6551313	
Gamma Statistics		
k hat	4.5738532	
k star (bias corrected)	4.0062492	
Theta hat	0.3020952	
Theta star	0.344896	
nu hat	210.39725	
nu star	184.28746	
5% Approximate Chi Square Value	153.88018	
Adjusted Level of Significance	0.0389	
Adjusted Chi Square Value	151.86833	
Anderson-Darling Test Statistic	2.0564271	
Anderson-Darling 5% Critical Value	0.7476009	
Anderson-Darling 5% Gamma Test Result	NOT AD GAMMA	Data not gamma distributed at 5% significance level
Kolmogrov-Smirnov Test Statistic	0.2713383	
Kolmogrov-Smirnov 5% Critical Value	0.1822164	
Kolmogrov-Smirnov 5% Gamma Test Result	NOT KS GAMMA	Data not gamma distributed at 5% significance level
5% Gamma Test Result	NOT GAMMA	Data not gamma distributed at 5% significance level
95% Approximate Gamma UCL	1.6547757	
95% Adjusted Gamma UCL	1.6766971	

Table 13-C

ProUCL Version 3.00.02 Calculations for SWMU 68 Arsenic Subsurface Soil Data Set

Lognormal Statistics		
Minimum of log data	-1.049822	
Maximum of log data	1.2809338	
Mean of log data	0.2100611	
Standard Deviation of log data	0.4732685	
Variance of log data	0.2239831	
Lilliefors Test Statisitic	N/R	Shapiro Wilk method yields a more accurate result
Lilliefors 5% Critical Value	N/R	Shapiro Wilk method yields a more accurate result
Shapiro-Wilk Test Statisitic	0.8449766	
Shapiro-Wilk 5% Critical Value	0.914	
5% Lognormality Test Result	NOT LOGNORMAL	Data not lognormal at 5% significance level
MLE Mean	1E+00	
MLE Standard Deviation	6.9E-01	
MLE Coefficient of Variation	5.0E-01	
MLE Skewness	1.6E+00	
MLE Median	1.2E+00	
MLE 80% Quantile	1.8E+00	
MLE 90% Quantile	2.3E+00	
MLE 95% Quantile	2.7E+00	
MLE 99% Quantile	3.7E+00	
MVU Estimate of Median	1.2E+00	
MVU Estimate of Mean	1.4E+00	
MVU Estimate of Standard Deviation	6.7E-01	
MVU Estimate of SE of Mean	1.4E-01	
95% H-UCL	1.6806835	
95% Chebyshev (MVUE) UCL	1.9840658	
97.5% Chebyshev (MVUE) UCL	2.2486453	
99% Chebyshev (MVUE) UCL	2.7683606	
Non-parametric Statisitics		
95% CLT UCL	1.6436217	
95% Adjusted-CLT UCL	1.7132536	
95% Modified-t UCL	1.6659925	
95% Jackknife UCL	1.6551313	
95% Chebyshev (Mean, Sd) UCL	2.0757338	
97.5% Chebyshev (Mean, Sd) UCL	2.3760259	
99% Chebyshev (Mean, Sd) UCL	2.9658914	
Bootstrap Statistics		
Number of Bootstrap Runs	2000	
95% Standard Bootstrap UCL	1.6380357	
95% Bootstrap-t UCL	1.7727706	
95% Hall's Bootstrap UCL	1.804604	
95% Percentile Bootstrap UCL	1.63	
95% BCA Bootstrap UCL	1.7086957	

Table 14-A
NAPR Background and SWMU 14 Vanadium Surface Soil Descriptive Statistics Report: Non-transformed Data

Summary Section of Vanadium

Count	Mean	Standard Deviation	Standard Error	Minimum	Maximum	Range
23	165.313	73.99039	15.42806	35	323	288

Variation Section of Vanadium

Parameter	Variance	Standard Deviation	Unbiased Std Dev	Std Error of Mean	Interquartile Range	Range
Value	5474.578	73.99039	74.83569	15.42806	133.4	288
Std Error	1377.664	13.16598		2.745296		
95% LCL	3274.562	57.22379		11.93198		
95% UCL	10966.78	104.7224		21.83613		

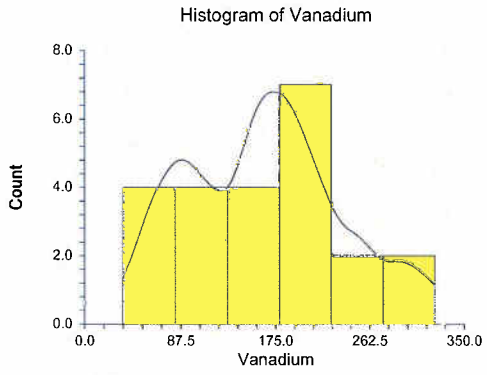
Skewness and Kurtosis Section of Vanadium

Parameter	Skewness	Kurtosis	Fisher's g1	Fisher's g2	Coefficient of Variation	Coefficient of Dispersion
Value	0.262433	2.45651	0.2811088	-0.368959	0.4475774	0.3421483
Std Error	0.2938473	0.4594516			6.196658E-02	

Normality Test Section of Vanadium

Test Name	Test Value	Prob Level	10% Critical Value	5% Critical Value	Decision (5%)
Shapiro-Wilk W	0.9727729	0.7549804			Can't reject normality
Anderson-Darling	0.2609804	0.7081472			Can't reject normality
Martinez-Iglewicz	0.9870005		1.189616	1.303046	Can't reject normality
Kolmogorov-Smirnov	0.1135632		0.166	0.18	Can't reject normality
D'Agostino Skewness	0.6162977	0.5376981	1.645	1.960	Can't reject normality
D'Agostino Kurtosis	-0.2439	0.807304	1.645	1.960	Can't reject normality
D'Agostino Omnibus	0.4393	0.802795	4.605	5.991	Can't reject normality

Plots Section of Vanadium



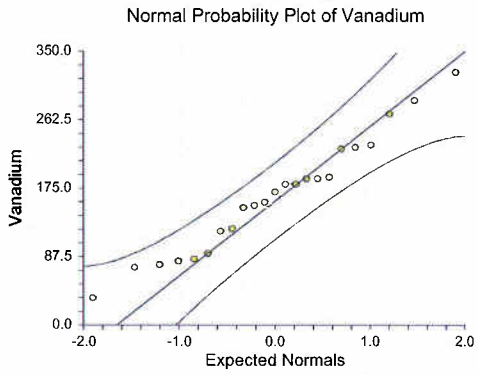


Table 14-B
NAPR Background and SWMU 14 Vanadium Surface Soil Descriptive Statistics Report: Log-transformed Data

Summary Section of logVn

Count	Mean	Standard Deviation	Standard Error	Minimum	Maximum	Range
23	2.168261	0.2309989	4.816659E-02	1.54	2.51	0.97

Variation Section of logVn

Parameter	Variance	Standard Deviation	Unbiased Std Dev	Std Error of Mean	Interquartile Range	Range
Value	5.336047E-02	0.2309989	0.2336379	4.816659E-02	0.39	0.97
Std Error	1.756551E-02	0.0537695		1.121171E-02		
95% LCL	3.191701E-02	0.1786533		3.725179E-02		
95% UCL	0.1068927	0.3269446		6.817266E-02		

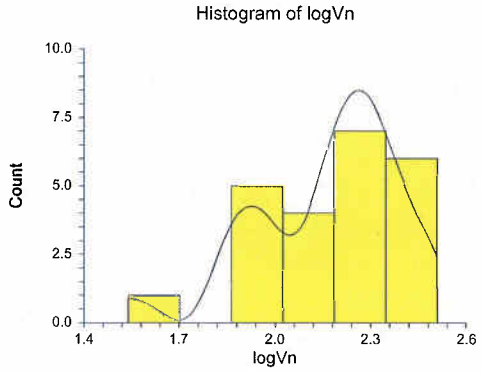
Skewness and Kurtosis Section of logVn

Parameter	Skewness	Kurtosis	Fisher's g1	Fisher's g2	Coefficient of Variation	Coefficient of Dispersion
Value	-0.8631571	3.492356	-0.9245828	0.9332476	0.1065365	7.759798E-02
Std Error	0.4014658	0.9345259			1.890028E-02	

Normality Test Section of logVn

Test Name	Test Value	Prob Level	10% Critical Value	5% Critical Value	Decision (5%)
Shapiro-Wilk W	0.9324008	0.1232389			Can't reject normality
Anderson-Darling	0.5627346	0.1455484			Can't reject normality
Martinez-Iglewicz	1.189847		1.189616	1.303046	Can't reject normality
Kolmogorov-Smirnov	0.1289608		0.166	0.18	Can't reject normality
D'Agostino Skewness	-1.901515	5.723454E-02	1.645	1.960	Can't reject normality
D'Agostino Kurtosis	1.1102	0.266931	1.645	1.960	Can't reject normality
D'Agostino Omnibus	4.8482	0.088557	4.605	5.991	Can't reject normality

Plots Section of logVn



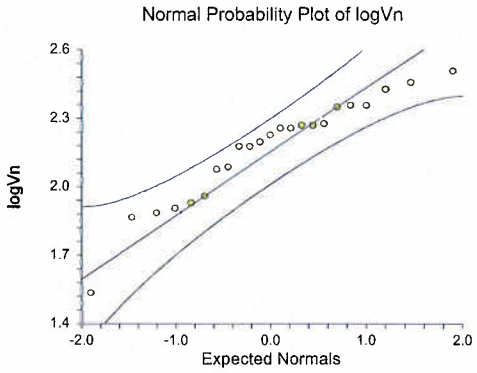


Table 14-C
ProUCL Version 3.00.02 Calculations for NAPR Background and SWMU 14 Vanadium Surface Soil Data Set

Data File		
Variable:	Vanadium	
Raw Statistics		
Number of Observations	23	
Number of Missing Data	0	
Number of Valid Observations	23	
Number of Distinct Observations	21	
Minimum	35	
Maximum	323	
Mean	165.313	
Standard Deviation	73.99039	
Variance	5474.578	
Coefficient of Variation	0.447577	
Skewness	0.281109	
Too Few Distinct Observations?	NO	
Normal Statistics		
Lilliefors Test Statisitic	N/R	Shapiro Wilk method yields a more accurate result
Lilliefors 5% Critical Value	N/R	Shapiro Wilk method yields a more accurate result
Shapiro-Wilk Test Statisitic	0.972973	
Shapiro-Wilk 5% Critical Value	0.914	
5% Normality Test Result	NORMAL	Data are normal at 5% significance level
95% Student's-t UCL	191.8053	
Gamma Statistics		
k hat	4.455366	
k star (bias corrected)	3.903217	
Theta hat	37.10425	
Theta star	42.35302	
nu hat	204.9468	
nu star	179.548	
5% Approximate Chi Square Value	149.55	
Adjusted Level of Significance	0.0389	
Adjusted Chi Square Value	147.5677	
Anderson-Darling Test Statistic	0.362621	
Anderson-Darling 5% Critical Value	0.747904	
Anderson-Darling 5% Gamma Test Result	AD GAMMA	Data follow gamma distribution at 5% signifcance level.
Kolmogrov-Smirnov Test Statistic	0.13542	
Kolmogrov-Smirnov 5% Critical Value	0.182254	
Kolmogrov-Smirnov 5% Gamma Test Result	KS GAMMA	Data follow gamma distribution at 5% signifcance level
5% Gamma Test Result	GAMMA	Data follow gamma distribution at 5% signifcance level
95% Approximate Gamma UCL	198.4729	
95% Adjusted Gamma UCL	201.1391	

Table 14-C
ProUCL Version 3.00.02 Calculations for NAPR Background and SWMU 14 Vanadium Surface Soil Data Set

Lognormal Statistics		
Minimum of log data	3.555348	
Maximum of log data	5.777652	
Mean of log data	4.991439	
Standard Deviation of log data	0.530258	
Variance of log data	0.281173	
Lilliefors Test Statisitic	N/R	Shapiro Wilk method yields a more accurate result
Lilliefors 5% Critical Value	N/R	Shapiro Wilk method yields a more accurate result
Shapiro-Wilk Test Statisitic	0.934301	
Shapiro-Wilk 5% Critical Value	0.914	
5% Lognormality Test Result	LOGNORMAL	Data are lognormal at 5% significance level
MLE Mean	169.3599	
MLE Standard Deviation	96.5029	
MLE Coefficient of Variation	0.56981	
MLE Skewness	1.894437	
MLE Median	147.1481	
MLE 80% Quantile	230.3286	
MLE 90% Quantile	290.8537	
MLE 95% Quantile	352.0289	
MLE 99% Quantile	505.1315	
MVU Estimate of Median	146.2511	
MVU Estimate of Mean	168.2028	
MVU Estimate of Standard Deviation	93.49383	
MVU Estimate of SE of Mean	19.41636	
95% H-UCL	212.4179	
95% Chebyshev (MVUE) UCL	252.8367	
97.5% Chebyshev (MVUE) UCL	289.4579	
99% Chebyshev (MVUE) UCL	361.3931	
Non-parametric Statisitics		
95% CLT UCL	190.6899	
95% Adjusted-CLT UCL	191.6562	
95% Modified-t UCL	191.956	
95% Jackknife UCL	191.8053	
95% Chebyshev (Mean, Sd) UCL	232.5624	
97.5% Chebyshev (Mean, Sd) UCL	261.6613	
99% Chebyshev (Mean, Sd) UCL	318.8203	
Bootstrap Statistics		
Number of Bootstrap Runs	2000	
95% Standard Bootstrap UCL	189.8882	
95% Bootstrap-t UCL	191.865	
95% Hall's Bootstrap UCL	191.0534	
95% Percentile Bootstrap UCL	191.1217	
95% BCA Bootstrap UCL	192.1043	

Table 15-A
NAPR Background and SWMU 14 Vanadium Subsurface Soil Descriptive Statistics Report: Non-transformed Data

Summary Section of Vanadium

Count	Mean	Standard Deviation	Standard Error	Minimum	Maximum	Range
33	197.4394	95.60114	16.64202	25	410	385

Variation Section of Vanadium

Parameter	Variance	Standard Deviation	Unbiased Std Dev	Std Error of Mean	Interquartile Range	Range
Value	9139.579	95.60114	96.35083	16.64202	128	385
Std Error	2205.847	16.31539		2.840144		
95% LCL	5910.75	76.88141		13.38334		
95% UCL	15989.85	126.451		22.01229		

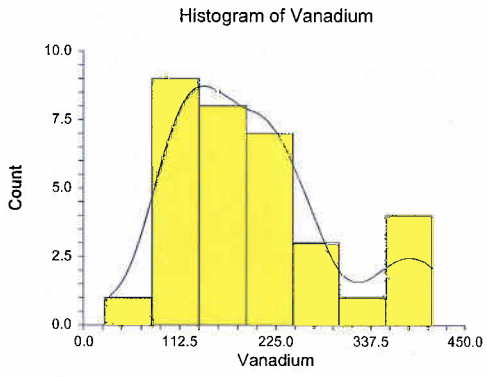
Skewness and Kurtosis Section of Vanadium

Parameter	Skewness	Kurtosis	Fisher's g1	Fisher's g2	Coefficient of Variation	Coefficient of Dispersion
Value	0.7022846	2.922261	0.7361789	0.1155058	0.484205	0.4054714
Std Error	0.2707885	0.6874573			5.148256E-02	

Normality Test Section of Vanadium

Test Name	Test Value	Prob Level	10% Critical Value	5% Critical Value	Decision (5%)
Shapiro-Wilk W	0.9412898	7.406573E-02			Can't reject normality
Anderson-Darling	0.6658632	8.212885E-02			Can't reject normality
Martinez-Iglewicz	1.078414		1.136248	1.207987	Can't reject normality
Kolmogorov-Smirnov	0.1178273		0.139	0.152	Can't reject normality
D'Agostino Skewness	1.796993	7.233671E-02	1.645	1.960	Can't reject normality
D'Agostino Kurtosis	0.3824	0.702135	1.645	1.960	Can't reject normality
D'Agostino Omnibus	3.3754	0.184940	4.605	5.991	Can't reject normality

Plots Section of Vanadium



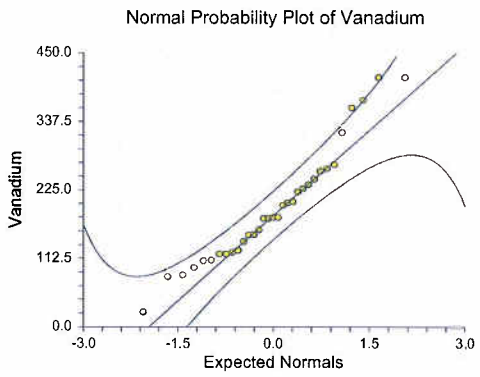


Table 15-B
NAPR Background and SWMU 14 Vanadium Subsurface Soil Descriptive Statistics Report: Log-transformed Data

Summary Section of logVn

Count	Mean	Standard Deviation	Standard Error	Minimum	Maximum	Range
33	2.24	0.2423195	4.218242E-02	1.4	2.61	1.21

Variation Section of logVn

Parameter	Variance	Standard Deviation	Unbiased Std Dev	Std Error of Mean	Interquartile Range	Range
Value	5.871875E-02	0.2423195	0.2442198	4.218242E-02	0.315	1.21
Std Error	2.182798E-02	6.369571E-02		0.011088		
95% LCL	0.0379746	0.1948707		3.392264E-02		
95% UCL	0.1027294	0.3205143		5.579438E-02		

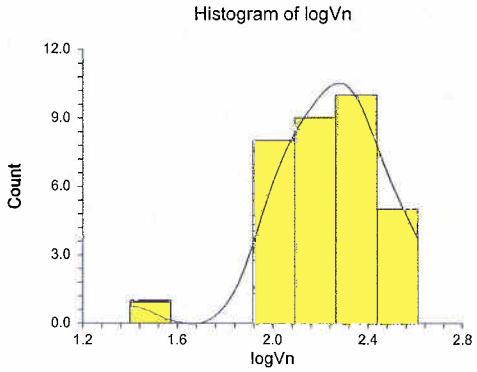
Skewness and Kurtosis Section of logVn

Parameter	Skewness	Kurtosis	Fisher's g1	Fisher's g2	Coefficient of Variation	Coefficient of Dispersion
Value	-1.076267	5.560238	-1.128211	3.201655	0.1081784	7.857335E-02
Std Error	0.5130842	1.11004			2.118899E-02	

Normality Test Section of logVn

Test Name	Test Value	Prob Level	10% Critical Value	5% Critical Value	Decision (5%)
Shapiro-Wilk W	0.9242535	2.407255E-02			Reject normality
Anderson-Darling	0.4205344	0.3243868			Can't reject normality
Martinez-Iglewicz	1.29928		1.136248	1.207987	Reject normality
Kolmogorov-Smirnov	6.497888E-02		0.139	0.152	Can't reject normality
D'Agostino Skewness	-2.585286	9.729831E-03	1.645	1.960	Reject normality
D'Agostino Kurtosis	2.5367	0.011190	1.645	1.960	Reject normality
D'Agostino Omnibus	13.1186	0.001417	4.605	5.991	Reject normality

Plots Section of logVn



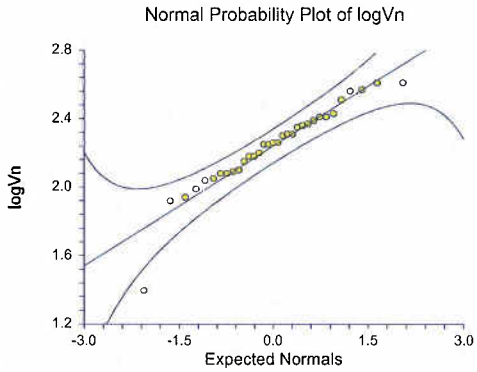


Table 15-C

ProUCL Version 3.00.02 Calculations for NAPR Background and SWMU 14 Vanadium Subsurface Soil Data Set

Data File		
Variable:	Vanadium	
Raw Statistics		
Number of Observations	33	
Number of Missing Data	0	
Number of Valid Observations	33	
Number of Distinct Observations	29	
Minimum	25	
Maximum	410	
Mean	197.43939	
Standard Deviation	95.601144	
Variance	9139.5787	
Coefficient of Variation	0.484205	
Skewness	0.7361789	
Too Few Distinct Observations?	NO	
Normal Statistics		
Lilliefors Test Statisitic	N/R	Shapiro Wilk method yields a more accurate result
Lilliefors 5% Critical Value	N/R	Shapiro Wilk method yields a more accurate result
Shapiro-Wilk Test Statisitic	0.9383506	
Shapiro-Wilk 5% Critical Value	0.931	
5% Normality Test Result	NORMAL	Data are normal at 5% significance level
95% Student's-t UCL	225.62913	
Gamma Statistics		
k hat	4.040247	
k star (bias corrected)	3.6931539	
Theta hat	48.868149	
Theta star	53.460917	
nu hat	266.6563	
nu star	243.74816	
5% Approximate Chi Square Value	208.59584	
Adjusted Level of Significance	0.0419	
Adjusted Chi Square Value	206.92492	
Anderson-Darling Test Statistic	0.2437163	
Anderson-Darling 5% Critical Value	0.7512612	
Anderson-Darling 5% Gamma Test Result	AD GAMMA	Data follow gamma distribution at 5% signifcance level.
Kolmogrov-Smirnov Test Statistic	0.0634102	
Kolmogrov-Smirnov 5% Critical Value	0.1538971	
Kolmogrov-Smirnov 5% Gamma Test Result	KS GAMMA	Data follow gamma distribution at 5% signifcance level
5% Gamma Test Result	GAMMA	Data follow gamma distribution at 5% signifcance level
95% Approximate Gamma UCL	230.71164	
95% Adjusted Gamma UCL	232.57464	

Table 15-C

ProUCL Version 3.00.02 Calculations for NAPR Background and SWMU 14 Vanadium Subsurface Soil Data Set

Lognormal Statistics		
Minimum of log data	3.2188758	
Maximum of log data	6.0161572	
Mean of log data	5.1566022	
Standard Deviation of log data	0.557784	
Variance of log data	0.3111229	
Lilliefors Test Statisitic	N/R	Shapiro Wilk method yields a more accurate result
Lilliefors 5% Critical Value	N/R	Shapiro Wilk method yields a more accurate result
Shapiro-Wilk Test Statisitic	0.9275005	
Shapiro-Wilk 5% Critical Value	0.931	
5% Lognormality Test Result	NOT LOGNORMAL	Data not lognormal at 5% significance level
MLE Mean	2E+02	
MLE Standard Deviation	1.2E+02	
MLE Coefficient of Variation	6.0E-01	
MLE Skewness	2.0E+00	
MLE Median	1.7E+02	
MLE 80% Quantile	2.8E+02	
MLE 90% Quantile	3.6E+02	
MLE 95% Quantile	4.3E+02	
MLE 99% Quantile	6.4E+02	
MVU Estimate of Median	1.7E+02	
MVU Estimate of Mean	2.0E+02	
MVU Estimate of Standard Deviation	1.2E+02	
MVU Estimate of SE of Mean	2.1E+01	
95% H-UCL	246.22481	
95% Chebyshev (MVUE) UCL	291.82664	
97.5% Chebyshev (MVUE) UCL	330.82395	
99% Chebyshev (MVUE) UCL	407.42663	
Non-parametric Statisitics		
95% CLT UCL	224.81309	
95% Adjusted-CLT UCL	227.09192	
95% Modified-t UCL	225.98458	
95% Jackknife UCL	225.62913	
95% Chebyshev (Mean, Sd) UCL	269.98029	
97.5% Chebyshev (Mean, Sd) UCL	301.36879	
99% Chebyshev (Mean, Sd) UCL	363.02543	
Bootstrap Statistics		
Number of Bootstrap Runs	2000	
95% Standard Bootstrap UCL	224.42765	
95% Bootstrap-t UCL	228.1853	
95% Hall's Bootstrap UCL	226.67684	
95% Percentile Bootstrap UCL	226.43939	
95% BCA Bootstrap UCL	226.41515	

Table 16-A
NAPR Background and SWMU 14 Vanadium Groundwater Descriptive Statistics Report: Non-transformed Data

Summary Section of Vanadium

Count	Mean	Standard Deviation	Standard Error	Minimum	Maximum	Range
14	147.3893	159.4621	42.61804	1.7	549	547.3

Variation Section of Vanadium

Parameter	Variance	Standard Deviation	Unbiased Std Dev	Std Error of Mean	Interquartile Range	Range
Value	25428.16	159.4621	162.5553	42.61804	201.5	547.3
Std Error	11453.25	50.78741		13.57351		
95% LCL	13363.98	115.6027		30.89611		
95% UCL	65997.72	256.9002		68.65947		

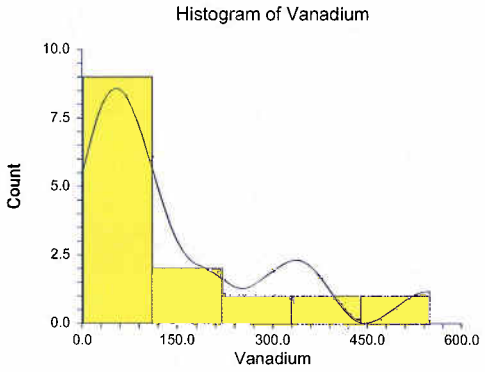
Skewness and Kurtosis Section of Vanadium

Parameter	Skewness	Kurtosis	Fisher's g1	Fisher's g2	Coefficient of Variation	Coefficient of Dispersion
Value	1.340752	3.840242	1.507311	1.832175	1.081911	1.445592
Std Error	0.5666562	1.917996			0.1826875	

Normality Test Section of Vanadium

Test Name	Test Value	Prob Level	10% Critical Value	5% Critical Value	Decision (5%)
Shapiro-Wilk W	0.8166431	8.07699E-03			Reject normality
Anderson-Darling	1.047372	9.416016E-03			Reject normality
Martinez-Iglewicz	2.412705		1.305415	1.57245	Reject normality
Kolmogorov-Smirnov	0.2524925		0.208	0.226	Reject normality
D'Agostino Skewness	2.408358	1.602447E-02	1.645	1.960	Reject normality
D'Agostino Kurtosis	1.4864	0.137180	1.645	1.960	Can't reject normality
D'Agostino Omnibus	8.0095	0.018229	4.605	5.991	Reject normality

Plots Section of Vanadium



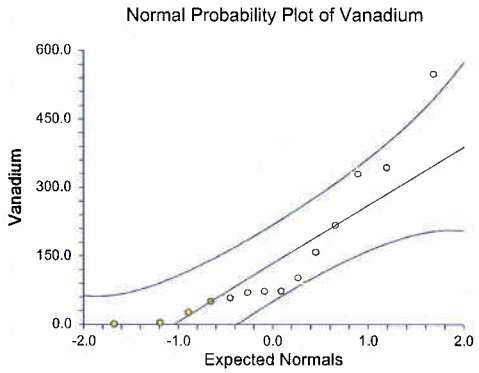


Table 16-B
NAPR Background and SWMU 14 Vanadium Groundwater Descriptive Statistics Report: Log-transformed Data

Summary Section of logVn

Count	Mean	Standard Deviation	Standard Error	Minimum	Maximum	Range
14	1.835714	0.7028154	0.1878353	0.23	2.74	2.51

Variation Section of logVn

Parameter	Variance	Standard Deviation	Unbiased Std Dev	Std Error of Mean	Interquartile Range	Range
Value	0.4939494	0.7028154	0.7164484	0.1878353	0.7525	2.51
Std Error	0.2043967	0.2056447		5.496086E-02		
95% LCL	0.2595992	0.5095088		0.136172		
95% UCL	1.282025	1.132265		0.3026107		

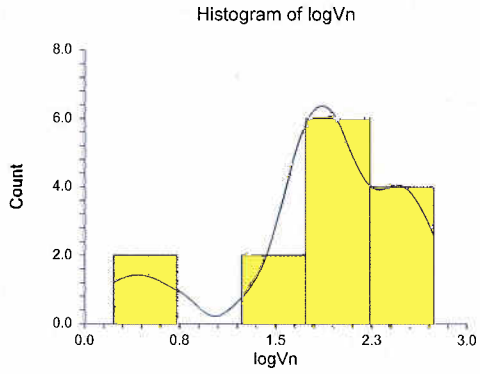
Skewness and Kurtosis Section of logVn

Parameter	Skewness	Kurtosis	Fisher's g1	Fisher's g2	Coefficient of Variation	Coefficient of Dispersion
Value	-1.005146	3.397235	-1.130013	1.177733	0.3828566	0.2574484
Std Error	0.3951913	1.582167			0.1076213	

Normality Test Section of logVn

Test Name	Test Value	Prob Level	10% Critical Value	5% Critical Value	Decision (5%)
Shapiro-Wilk W	0.8970571	0.1022285			Can't reject normality
Anderson-Darling	0.5937985	0.1212686			Can't reject normality
Martinez-Iglewicz	1.173538		1.305415	1.57245	Can't reject normality
Kolmogorov-Smirnov	0.1377257		0.208	0.226	Can't reject normality
D'Agostino Skewness	-1.877331	6.047267E-02	1.645	1.960	Can't reject normality
D'Agostino Kurtosis	1.1168	0.264065	1.645	1.960	Can't reject normality
D'Agostino Omnibus	4.7717	0.092011	4.605	5.991	Can't reject normality

Plots Section of logVn



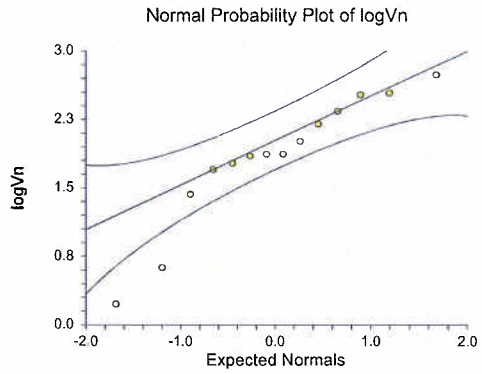


Table 16-C

ProUCL Version 3.00.02 Calculations for NAPR Background and SWMU 14 Vanadium Groundwater Data Set

Data File		
Variable:	Vanadium	
Raw Statistics		
Number of Observations	14	
Number of Missing Data	0	
Number of Valid Observations	14	
Number of Distinct Observations	14	
Minimum	1.7	
Maximum	549	
Mean	147.38929	
Standard Deviation	159.4621	
Variance	25428.162	
Coefficient of Variation	1.0819111	
Skewness	1.507311	
Too Few Distinct Observations?	NO	
Normal Statistics		
Lilliefors Test Statisitic	N/R	Shapiro Wilk method yields a more accurate result
Lilliefors 5% Critical Value	N/R	Shapiro Wilk method yields a more accurate result
Shapiro-Wilk Test Statisitic	0.816852	
Shapiro-Wilk 5% Critical Value	0.874	
5% Normality Test Result	NOT NORMAL	Data not normal at 5% significance level
95% Student's-t UCL	222.86299	
Gamma Statistics		
k hat	0.7765674	
k star (bias corrected)	0.6577791	
Theta hat	189.79588	
Theta star	224.07109	
nu hat	21.743886	
nu star	18.417815	
5% Approximate Chi Square Value	9.6920925	
Adjusted Level of Significance	0.03122	
Adjusted Chi Square Value	8.8624155	
Anderson-Darling Test Statistic	0.2663521	
Anderson-Darling 5% Critical Value	0.7694872	
Anderson-Darling 5% Gamma Test Result	AD GAMMA	Data follow gamma distribution at 5% signifcance level.
Kolmogrov-Smirnov Test Statistic	0.1304046	
Kolmogrov-Smirnov 5% Critical Value	0.2373286	
Kolmogrov-Smirnov 5% Gamma Test Result	KS GAMMA	Data follow gamma distribution at 5% signifcance level
5% Gamma Test Result	GAMMA	Data follow gamma distribution at 5% signifcance level
95% Approximate Gamma UCL	280.08283	
95% Adjusted Gamma UCL	306.30348	

Table 16-C

ProUCL Version 3.00.02 Calculations for NAPR Background and SWMU 14 Vanadium Groundwater Data Set

Lognormal Statistics		
Minimum of log data	0.5306283	
Maximum of log data	6.3080984	
Mean of log data	4.2258077	
Standard Deviation of log data	1.6177207	
Variance of log data	2.6170203	
Lilliefors Test Statisitic	N/R	Shapiro Wilk method yields a more accurate result
Lilliefors 5% Critical Value	N/R	Shapiro Wilk method yields a more accurate result
Shapiro-Wilk Test Statisitic	0.896638	
Shapiro-Wilk 5% Critical Value	0.874	
5% Lognormality Test Result	LOGNORMAL	Data are lognormal at 5% significance level
MLE Mean	3E+02	
MLE Standard Deviation	9.0E+02	
MLE Coefficient of Variation	3.6E+00	
MLE Skewness	5.6E+01	
MLE Median	6.8E+01	
MLE 80% Quantile	2.7E+02	
MLE 90% Quantile	5.5E+02	
MLE 95% Quantile	9.8E+02	
MLE 99% Quantile	2.9E+03	
MVU Estimate of Median	6.2E+01	
MVU Estimate of Mean	2.1E+02	
MVU Estimate of Standard Deviation	4.5E+02	
MVU Estimate of SE of Mean	1.0E+02	
95% H-UCL	1479.4247	
95% Chebyshev (MVUE) UCL	664.73504	
97.5% Chebyshev (MVUE) UCL	860.54453	
99% Chebyshev (MVUE) UCL	1245.1744	
Non-parametric Statisitics		
95% CLT UCL	217.48972	
95% Adjusted-CLT UCL	235.83451	
95% Modified-t UCL	225.7244	
95% Jackknife UCL	222.86299	
95% Chebyshev (Mean, Sd) UCL	333.15701	
97.5% Chebyshev (Mean, Sd) UCL	413.53885	
99% Chebyshev (Mean, Sd) UCL	571.43342	
Bootstrap Statistics		
Number of Bootstrap Runs	2000	
95% Standard Bootstrap UCL	215.40361	
95% Bootstrap-t UCL	270.56513	
95% Hall's Bootstrap UCL	239.46466	
95% Percentile Bootstrap UCL	217.97143	
95% BCA Bootstrap UCL	237.94286	

Table 17-A
NAPR Background and SWMU 68 Arsenic Surface Soil Descriptive Statistics Report: Non-transformed Data

Summary Section of Arsenic

Count	Mean	Standard Deviation	Standard Error	Minimum	Maximum	Range
33	1.380303	0.7563264	0.1316595	0.21	3.4	3.19

Variation Section of Arsenic

Parameter	Variance	Standard Deviation	Unbiased Std Dev	Std Error of Mean	Interquartile Range	Range
Value	0.5720296	0.7563264	0.7622573	0.1316595	1.065	3.19
Std Error	0.137923	0.1289474		2.244686E-02		
95% LCL	0.3699431	0.6082295		0.1058792		
95% UCL	1.000775	1.000388		0.1741451		

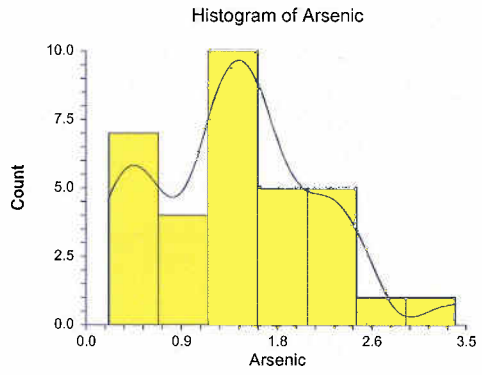
Skewness and Kurtosis Section of Arsenic

Parameter	Skewness	Kurtosis	Fisher's g1	Fisher's g2	Coefficient of Variation	Coefficient of Dispersion
Value	0.3961434	2.91845	0.4152624	0.1110469	0.5479423	0.4166667
Std Error	0.329096	0.6285032			7.118813E-02	

Normality Test Section of Arsenic

Test Name	Test Value	Prob Level	10% Critical Value	5% Critical Value	Decision (5%)
Shapiro-Wilk W	0.9583691	0.2323453			Can't reject normality
Anderson-Darling	0.3808461	0.4016794			Can't reject normality
Martinez-Iglewicz	0.9982794		1.136248	1.207987	Can't reject normality
Kolmogorov-Smirnov	8.989289E-02		0.139	0.152	Can't reject normality
D'Agostino Skewness	1.054502	0.2916534	1.645	1.960	Can't reject normality
D'Agostino Kurtosis	0.3768	0.706343	1.645	1.960	Can't reject normality
D'Agostino Omnibus	1.2539	0.534210	4.605	5.991	Can't reject normality

Plots Section of Arsenic



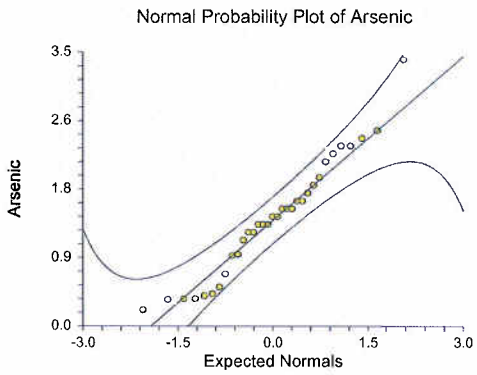


Table 17-B
NAPR Background and SWMU 68 Arsenic Surface Soil Descriptive Statistics Report: Log-transformed Data

Summary Section of logAs

Count	Mean	Standard Deviation	Standard Error	Minimum	Maximum	Range
33	5.553636E-02	0.3041692	5.294906E-02	-0.6778	0.5315	1.2093

Variation Section of logAs

Parameter	Variance	Standard Deviation	Unbiased Std Dev	Std Error of Mean	Interquartile Range	Range
Value	0.0925189	0.3041692	0.3065544	5.294906E-02	0.3769	1.2093
Std Error	2.089146E-02	0.0485667		8.454378E-03		
95% LCL	5.983384E-02	0.2446096		4.258106E-02		
95% UCL	0.1618634	0.4023224		7.003535E-02		

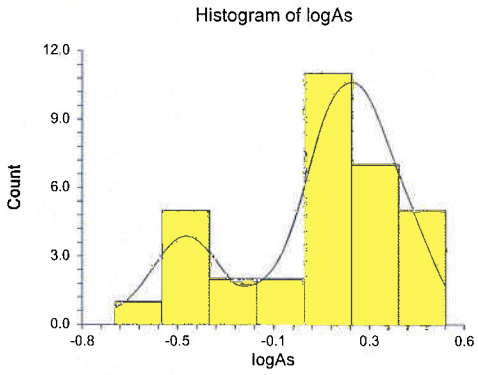
Skewness and Kurtosis Section of logAs

Parameter	Skewness	Kurtosis	Fisher's g1	Fisher's g2	Coefficient of Variation	Coefficient of Dispersion
Value	-0.8157052	2.682638	-0.8550736	-0.1648276	5.476937	1.535437
Std Error	0.3136887	0.7949222			5.551764	

Normality Test Section of logAs

Test Name	Test Value	Prob Level	10% Critical Value	5% Critical Value	Decision (5%)
Shapiro-Wilk W	0.904401	6.942422E-03			Reject normality
Anderson-Darling	1.340354	1.791027E-03			Reject normality
Martinez-Iglewicz	1.11856		1.136248	1.207987	Can't reject normality
Kolmogorov-Smirnov	0.1673691		0.139	0.152	Reject normality
D'Agostino Skewness	-2.050048	4.035974E-02	1.645	1.960	Reject normality
D'Agostino Kurtosis	-0.0057	0.995429	1.645	1.960	Can't reject normality
D'Agostino Omnibus	4.2027	0.122289	4.605	5.991	Can't reject normality

Plots Section of logAs



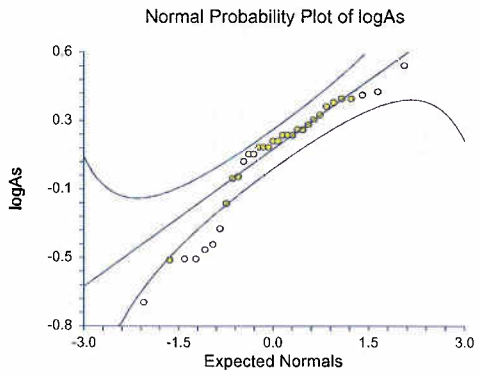


Table 17-C

ProUCL Version 3.00.02 Calculations for NAPR Background and SWMU 68 Arsenic Surface Soil Data Set

Data File		
Variable:	Arsenic	
Raw Statistics		
Number of Observations	33	
Number of Missing Data	0	
Number of Valid Observations	33	
Number of Distinct Observations	24	
Minimum	0.21	
Maximum	3.4	
Mean	1.380303	
Standard Deviation	0.7563264	
Variance	0.5720296	
Coefficient of Variation	0.5479423	
Skewness	0.4152624	
Too Few Distinct Observations?	NO	
Normal Statistics		
Lilliefors Test Statisitic	N/R	Shapiro Wilk method yields a more accurate result
Lilliefors 5% Critical Value	N/R	Shapiro Wilk method yields a more accurate result
Shapiro-Wilk Test Statisitic	0.9569043	
Shapiro-Wilk 5% Critical Value	0.931	
5% Normality Test Result	NORMAL	Data are normal at 5% significance level
95% Student's-t UCL	1.6033196	
Gamma Statistics		
k hat	2.727066	
k star (bias corrected)	2.4993529	
Theta hat	0.5061495	
Theta star	0.5522642	
nu hat	179.98636	
nu star	164.95729	
5% Approximate Chi Square Value	136.25465	
Adjusted Level of Significance	0.0419	
Adjusted Chi Square Value	134.91332	
Anderson-Darling Test Statistic	0.8300218	
Anderson-Darling 5% Critical Value	0.7548256	
Anderson-Darling 5% Gamma Test Result	NOT AD GAMMA	Data not gamma distributed at 5% significance level
Kolmogrov-Smirnov Test Statistic	0.1585262	
Kolmogrov-Smirnov 5% Critical Value	0.1545235	
Kolmogrov-Smirnov 5% Gamma Test Result	NOT KS GAMMA	Data not gamma distributed at 5% significance level
5% Gamma Test Result	NOT GAMMA	Data not gamma distributed at 5% significance level
95% Approximate Gamma UCL	1.6710699	
95% Adjusted Gamma UCL	1.687684	

Table 17-C

ProUCL Version 3.00.02 Calculations for NAPR Background and SWMU 68 Arsenic Surface Soil Data Set

Lognormal Statistics		
Minimum of log data	-1.560648	
Maximum of log data	1.2237754	
Mean of log data	0.1278926	
Standard Deviation of log data	0.7003898	
Variance of log data	0.4905459	
Lilliefors Test Statisitic	N/R	Shapiro Wilk method yields a more accurate result
Lilliefors 5% Critical Value	N/R	Shapiro Wilk method yields a more accurate result
Shapiro-Wilk Test Statisitic	0.9023228	
Shapiro-Wilk 5% Critical Value	0.931	
5% Lognormality Test Result	NOT LOGNORMAL	Data not lognormal at 5% significance level
MLE Mean	1E+00	
MLE Standard Deviation	1.2E+00	
MLE Coefficient of Variation	8.0E-01	
MLE Skewness	2.9E+00	
MLE Median	1.1E+00	
MLE 80% Quantile	2.1E+00	
MLE 90% Quantile	2.8E+00	
MLE 95% Quantile	3.6E+00	
MLE 99% Quantile	5.8E+00	
MVU Estimate of Median	1.1E+00	
MVU Estimate of Mean	1.4E+00	
MVU Estimate of Standard Deviation	1.1E+00	
MVU Estimate of SE of Mean	1.9E-01	
95% H-UCL	1.8823329	
95% Chebyshev (MVUE) UCL	2.2686776	
97.5% Chebyshev (MVUE) UCL	2.6275867	
99% Chebyshev (MVUE) UCL	3.3325941	
Non-parametric Statisitics		
95% CLT UCL	1.5968637	
95% Adjusted-CLT UCL	1.6070331	
95% Modified-t UCL	1.6049058	
95% Jackknife UCL	1.6033196	
95% Chebyshev (Mean, Sd) UCL	1.9541936	
97.5% Chebyshev (Mean, Sd) UCL	2.2025165	
99% Chebyshev (Mean, Sd) UCL	2.6902987	
Bootstrap Statistics		
Number of Bootstrap Runs	2000	
95% Standard Bootstrap UCL	1.5983078	
95% Bootstrap-t UCL	1.6096268	
95% Hall's Bootstrap UCL	1.6124175	
95% Percentile Bootstrap UCL	1.5909091	
95% BCA Bootstrap UCL	1.5913636	

Table 18-A
NAPR Background and SWMU 68 Arsenic Subsurface Soil Descriptive Statistics Report: Non-transformed Data

Summary Section of Arsenic

Count	Mean	Standard Deviation	Standard Error	Minimum	Maximum	Range
42	1.161429	0.6804932	0.1050024	0.22	3.6	3.38

Variation Section of Arsenic

Parameter	Variance	Standard Deviation	Unbiased Std Dev	Std Error of Mean	Interquartile Range	Range
Value	0.4630711	0.6804932	0.6846549	0.1050024	0.5175	3.38
Std Error	0.1775268	0.1844697		2.846429E-02		
95% LCL	0.3135029	0.5599133		8.639649E-02		
95% UCL	0.7529755	0.8677416		0.1338954		

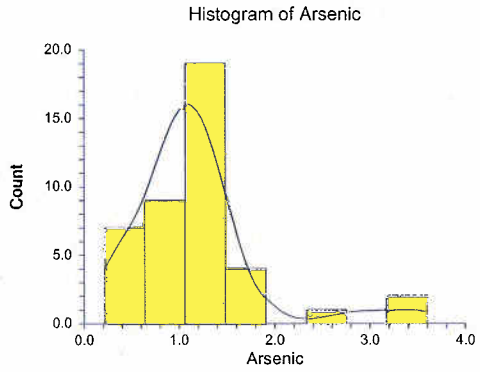
Skewness and Kurtosis Section of Arsenic

Parameter	Skewness	Kurtosis	Fisher's g1	Fisher's g2	Coefficient of Variation	Coefficient of Dispersion
Value	1.82558	7.172794	1.893901	4.873484	0.5859106	0.3770563
Std Error	0.3208108	2.385222			8.194274E-02	

Normality Test Section of Arsenic

Test Name	Test Value	Prob Level	10% Critical Value	5% Critical Value	Decision (5%)
Shapiro-Wilk W	0.8112553	7.763407E-06			Reject normality
Anderson-Darling	2.411032	4.274871E-06			Reject normality
Martinez-Iglewicz	2.633379		1.109805	1.168068	Reject normality
Kolmogorov-Smirnov	0.2288436		0.124	0.135	Reject normality
D'Agostino Skewness	4.125501	3.699294E-05	1.645	1.960	Reject normality
D'Agostino Kurtosis	3.2794	0.001040	1.645	1.960	Reject normality
D'Agostino Omnibus	27.7743	0.000001	4.605	5.991	Reject normality

Plots Section of Arsenic



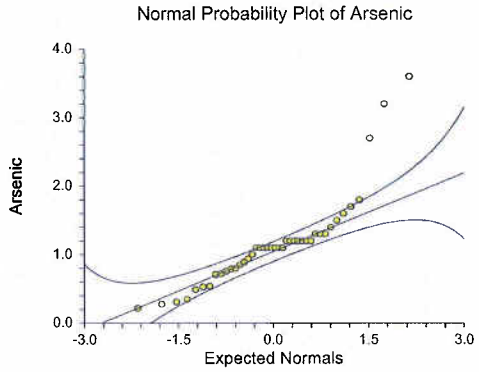


Table 18-B
NAPR Background and SWMU 68 Arsenic Subsurface Soil Descriptive Statistics Report: Log-transformed Data

Summary Section of logAs

Count	Mean	Standard Deviation	Standard Error	Minimum	Maximum	Range
42	-1.283333E-03	0.2514551	3.880036E-02	-0.6576	0.5563	1.2139

Variation Section of logAs

Parameter	Variance	Standard Deviation	Unbiased Std Dev	Std Error of Mean	Interquartile Range	Range
Value	6.322965E-02	0.2514551	0.2529929	3.880036E-02	0.2205	1.2139
Std Error	1.648493E-02	0.0463566		7.152979E-03		
95% LCL	4.280699E-02	0.2068985		3.192513E-02		
95% UCL	0.1028144	0.3206469		4.947688E-02		

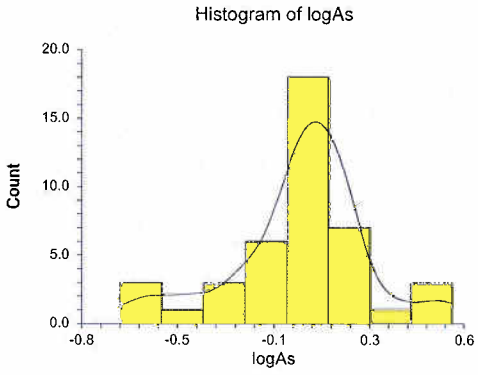
Skewness and Kurtosis Section of logAs

Parameter	Skewness	Kurtosis	Fisher's g1	Fisher's g2	Coefficient of Variation	Coefficient of Dispersion
Value	-0.487716	3.854839	-0.5059686	1.12377	-195.939	4.085634
Std Error	0.329077	0.8399986			5845.759	

Normality Test Section of logAs

Test Name	Test Value	Prob Level	10% Critical Value	5% Critical Value	Decision (5%)
Shapiro-Wilk W	0.9297507	1.270681E-02			Reject normality
Anderson-Darling	1.404676	1.244659E-03			Reject normality
Martinez-Iglewicz	1.486569		1.109805	1.168068	Reject normality
Kolmogorov-Smirnov	0.1626329		0.124	0.135	Reject normality
D'Agostino Skewness	-1.411125	0.1582077	1.645	1.960	Can't reject normality
D'Agostino Kurtosis	1.4752	0.140153	1.645	1.960	Can't reject normality
D'Agostino Omnibus	4.1676	0.124459	4.605	5.991	Can't reject normality

Plots Section of logAs



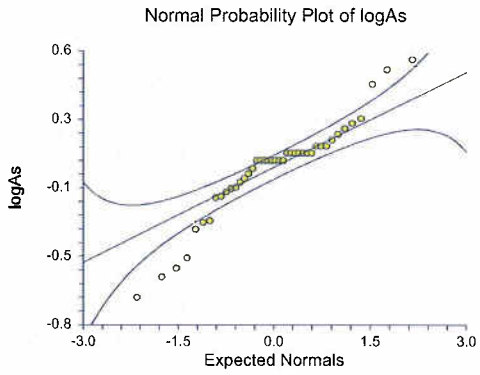


Table 18-C
ProUCL Version 3.00.02 Calculations for NAPR Background and SWMU 68 Arsenic Subsurface Soil Data Set

Data File		
Variable:	Arsenic	
Raw Statistics		
Number of Observations	42	
Number of Missing Data	0	
Number of Valid Observations	42	
Number of Distinct Observations	27	
Minimum	0.22	
Maximum	3.6	
Mean	1.161429	
Standard Deviation	0.680493	
Variance	0.463071	
Coefficient of Variation	0.585911	
Skewness	1.893901	
Too Few Distinct Observations?	NO	
Normal Statistics		
Lilliefors Test Statisitic	N/R	Shapiro Wilk method yields a more accurate result
Lilliefors 5% Critical Value	N/R	Shapiro Wilk method yields a more accurate result
Shapiro-Wilk Test Statisitic	0.795858	
Shapiro-Wilk 5% Critical Value	0.942	
5% Normality Test Result	NOT NORMAL	Data not normal at 5% significance level
95% Student's-t UCL	1.338135	
Gamma Statistics		
k hat	3.434074	
k star (bias corrected)	3.204656	
Theta hat	0.338207	
Theta star	0.362419	
nu hat	288.4622	
nu star	269.1911	
5% Approximate Chi Square Value	232.1883	
Adjusted Level of Significance	0.044286	
Adjusted Chi Square Value	230.9684	
Anderson-Darling Test Statistic	1.211794	
Anderson-Darling 5% Critical Value	0.754012	
Anderson-Darling 5% Gamma Test Result	NOT AD GAMMA	Data not gamma distributed at 5% significance level
Kolmogrov-Smirnov Test Statistic	0.156994	
Kolmogrov-Smirnov 5% Critical Value	0.137185	
Kolmogrov-Smirnov 5% Gamma Test Result	NOT KS GAMMA	Data not gamma distributed at 5% significance level
5% Gamma Test Result	NOT GAMMA	Data not gamma distributed at 5% significance level
95% Approximate Gamma UCL	1.34652	
95% Adjusted Gamma UCL	1.353632	

Table 18-C
ProUCL Version 3.00.02 Calculations for NAPR Background and SWMU 68 Arsenic Subsurface Soil Data Set

Lognormal Statistics		
Minimum of log data	-1.51413	
Maximum of log data	1.280934	
Mean of log data	-0.00296	
Standard Deviation of log data	0.579013	
Variance of log data	0.335256	
Lilliefors Test Statisitic	N/R	Shapiro Wilk method yields a more accurate result
Lilliefors 5% Critical Value	N/R	Shapiro Wilk method yields a more accurate result
Shapiro-Wilk Test Statisitic	0.907019	
Shapiro-Wilk 5% Critical Value	0.942	
5% Lognormality Test Result	NOT LOGNORMAL	Data not lognormal at 5% significance level
MLE Mean	1.179004	
MLE Standard Deviation	0.74408	
MLE Coefficient of Variation	0.631109	
MLE Skewness	2.144695	
MLE Median	0.997047	
MLE 80% Quantile	1.626301	
MLE 90% Quantile	2.098187	
MLE 95% Quantile	2.584465	
MLE 99% Quantile	3.833684	
MVU Estimate of Median	0.993075	
MVU Estimate of Mean	1.173584	
MVU Estimate of Standard Deviation	0.727871	
MVU Estimate of SE of Mean	0.111551	
95% H-UCL	1.40741	
95% Chebyshev (MVUE) UCL	1.659824	
97.5% Chebyshev (MVUE) UCL	1.870221	
99% Chebyshev (MVUE) UCL	2.283504	
Non-parametric Statisitics		
95% CLT UCL	1.334142	
95% Adjusted-CLT UCL	1.36693	
95% Modified-t UCL	1.343249	
95% Jackknife UCL	1.338135	
95% Chebyshev (Mean, Sd) UCL	1.619123	
97.5% Chebyshev (Mean, Sd) UCL	1.817168	
99% Chebyshev (Mean, Sd) UCL	2.206189	
Bootstrap Statistics		
Number of Bootstrap Runs	2000	
95% Standard Bootstrap UCL	1.336824	
95% Bootstrap-t UCL	1.384571	
95% Hall's Bootstrap UCL	1.433022	
95% Percentile Bootstrap UCL	1.342619	
95% BCA Bootstrap UCL	1.377143	

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 2
290 BROADWAY
NEW YORK, NY 10007-1866

MAY 29 2007

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Mr. Mark E. Davidson
US Navy
BRAC PMO SE
P.O. Box 190010
North Charleston, SC 29419-9010

Re: Naval Activity Puerto Rico (NAPR), formerly Naval Station Roosevelt Roads, EPA I.D. Number PRD2170027203,

1) Draft RFI Report for SWMU 68 (former Southern Fire Training Area), dated March 26, 2007;

2) Final RFI Report for SWMU 14 (former "Crash-Crew" Fire Training Area), dated March 23, 2007;

Dear Mr. Davidson:

This letter is addressed to you as the Navy's designated project coordinator pursuant to the January 29, 2007 RCRA Administrative Order on Consent ("the Consent Order") between the United States Environmental Protection Agency (EPA) and the U.S. Navy (the Navy). EPA Region 2 has completed its reviews of the above documents, which were submitted on behalf of the Navy, pursuant to the requirements of the Consent Order. Based upon our reviews, EPA has the following comments. Additional comments are also given in the two enclosed Technical Reviews prepared for EPA by our consultant, TechLaw, Inc.

Draft Phase I RFI Report for SWMU 68 (former Southern Fire Training Area)

EPA does not fully concur with the conclusions and recommendations made in Section 6.0 of the Draft Phase I RFI Report (the Report) for SWMU 68 (former Southern Fire Training Area), submitted on behalf of the Navy by Mr. Mark Kimes' (of Baker Environmental) letter of March 26, 2007. Specifically, EPA does not fully concur with the statement in Section 6.1 that "...it is concluded that no impact to the groundwater is present due to past Navy operations." Also, EPA does not concur with the statement in Section 6.2 of the Report that "No additional investigations are warranted..."

While EPA does concur with the recommendation given in Section 6.2 of the Report that due to "the presence of lead in the surface soil.....a very limited remedial action for surface soil (excavation and disposal with confirmatory sampling) is warranted", EPA is concerned that no actions are proposed to address vanadium in the surface and subsurface soils and the groundwater.

EPA notes that although lead concentration of 53 mg/kg found in the surface soil at 68SB08, exceeded the Region IX residential PRG of 40 mg/kg and the base-wide background concentration of 22 mg/kg indicated in the October 17, 2006 "Revised Final Summary for Environmental Background Concentrations for Inorganic Constituents Report" (the Background Report), lead concentrations in the other 10 surface soil samples at SWMU 68 were below both the PRGs and the site-wide background concentrations. Whereas the vanadium concentrations found at SWMU 68 exceeded the corresponding industrial and/or residential PRGs in all 11 of the surface soils samples analyzed and in all 22 of the subsurface soil samples analyzed. Likewise in the groundwater at SWMU 68 the vanadium concentration exceeds its tap water PRG of 3.6 ug/l in all 7 of the samples analyzed. While the maximum vanadium groundwater concentration measured in the groundwater at SWMU 68 of 210 ug/L (estimated) is less than the base-wide background concentration indicated in the October 17, 2006 "Revised Final Summary for Environmental Background Concentrations for Inorganic Constituents Report" (the Background Report), that maximum concentration (210 ug/L) is more than 50 times greater than the corresponding tap water PRG of 3.6 ug/l vanadium. EPA is concerned that the vanadium concentrations measured at SWMU 68 may not be fully ascribable to natural background concentrations. It should further be noted that the deeper subsurface soil sample (68SB04-02) collected at 12-14 feet below grade in boring 68SB04, had a vanadium concentration of 440 mg/kg, which exceeds not only the corresponding residential and industrial PRGs of 7.8 and 102 respectively, but also the indicated "background" concentration of 434 mg/kg established in the Background Report.

In addition, arsenic was found in all 11 surface soil samples at SWMU 68 at concentrations exceeding the Region IX residential PRG, and exceeding the industrial PRG at 4 of the 11 locations. Yet only 1 of the surface soil samples (68SB02) exceeded the base-wide background surface soil concentration for arsenic of 2.65 mg/kg indicated in the October 17, 2006 Background Report. However, 3 of the 11 subsurface surface soil samples (locations 68SB01, SB02 and SB04), found arsenic concentrations exceeding both the Region IX residential and the industrial PRGs and the base-wide background concentration for subsurface soils of 1.59 mg/kg arsenic, indicated in the October 17, 2006 Background Report.

EPA notes that none of the base-wide surface soil and groundwater background samples (in the 2006 Background Report) were collected in the vicinity of SWMU 68; however, 3 of the base-wide subsurface soil background samples (14E-SB-02-02, 14E-SB03-02, and 14 E-SB01-04) were collected during the 2004 Environmental Conditions of Property (ECP) investigations at what subsequently became identified as SWMU 68, and all 3 may have been impacted by contamination, based on reported indications of "DRO" (diesel range organics) in those samples.

EPA also notes that the October 17, 2006 Background Report offered no explanation as to why such elevated vanadium concentrations would be naturally occurring. Thus EPA is concerned that the base-wide background concentrations for arsenic, lead, and particularly vanadium, established in the October 17, 2006 Background Report, may not be fully representative of natural background conditions in the SWMU 68 area and/or may have been impacted by contaminant releases.

Prior to our approving the Draft Phase I RFI report and its conclusion in Section 6.1 of the Report that "It is evident from analysis obtained during the Phase I RFI investigation that there has been very little impact on the environment due to Navy activities at SWMU 68." (Section 6.1), EPA requests that the Navy submit, within 45 days of your receipt of this letter, the following:

1) a proposal for implementing additional background sampling for vanadium in surface and subsurface soils and groundwater, in order to more conclusively determine whether or not the elevated vanadium concentrations measured in the surface and subsurface soils and groundwater at SWMU 68 are in-fact natural occurring and not the result of releases from SWMU 68 (or another SWMU or AOC),

2) a proposal for addressing the potential human health risks resulting from vanadium in the surface and subsurface soils and in groundwater at SWMU 68, if the additional background sampling does not more conclusively demonstrate that the vanadium concentrations encountered at SWMU 68 are attributable to natural occurring conditions;

3) a proposal for addressing the potential human health risks resulting from lead and arsenic in the surface and subsurface soils at SWMU 68; and

4) written responses and/or an addendum to the SWMU 68 Draft Phase I RFI Report, which address the additional comments given in the enclosed Technical Review, prepared for us by our consultant, TechLaw, Inc.

Final RFI Report for SWMU 14 (former "Crash-Crew" Fire Training Area)

EPA has completed its review of the Final RFI Report for SWMU 14 (former "Crash-Crew" Fire Training Area), submitted on behalf of the Navy by Mr. Mark Kimes' (of Baker Environmental) letter of March 23, 2007, and determined that it is not fully acceptable. Section 8.12 of the SWMU 14 RFI Report (Conclusions and Recommendations), states that there are unacceptable potential risks a present from benzene and vanadium in the groundwater and from possible ingestion of, and dermal contact with, vanadium at elevated concentrations in surface and subsurface soils. However, no clear recommendations are made with regards to addressing those indicated potential risks.

As discussed previously for SWMU 68, EPA is concerned that the base-wide background concentrations for vanadium, established in the October 17, 2006 Background Report, may not be fully representative of natural background conditions. EPA notes that the October 17, 2006 Background Report offered no explanation as to why such elevated vanadium concentrations would be naturally occurring.

In addition, in Section 8.2 (Conclusions and Recommendations) of the SWMU 14 RFI Report, it is recommended that "...soil samples be collected from the [drainage] ditch [leading from the original fire training pit to a freshwater wetland] to determine if a release has ever occurred." However, no proposal for such sampling was included with the RFI Report and no time frame for submitting it is given.

Prior to our approving the RFI Report for SWMU 14, EPA requests that the Navy submit, within 45 days of your receipt of this letter, the following:

1) a proposal for sampling the drainage ditch leading from the original fire training pit to a freshwater wetland, to determine if a release has ever occurred;

2) a proposal for completing an ecological risk evaluation, to evaluate potential impacts caused by releases from SWMU 14, including impacts from releases found in the drainage ditch leading from the original fire training pit to a freshwater wetland, if releases are found;

3) a proposal for additional background sampling for vanadium in surface and subsurface soils and groundwater to be implemented so as to more conclusively determine whether or not the elevated vanadium concentrations measured in the surface and subsurface soils and groundwater at SWMU 14 are in-fact natural occurring, and not the result of releases from SWMU 14 (or another SWMU or AOC);

4) a proposal for addressing the potential human health risks resulting from vanadium in the surface and subsurface soils and groundwater at SWMU 14, should that additional background sampling not more conclusively demonstrate that the vanadium concentrations encountered at SWMU 14 are attributable to natural occurring conditions;

5) a proposal for addressing the potential human health risks associated with the dissolved benzene in the groundwater impacted by SWMU 14 releases; and

6) written responses and/or an addendum to the SWMU 14 RFI Report, which addresses the additional comments given in the enclosed Technical Review, prepared by our consultant, TechLaw, Inc.

If you have any questions, please telephone me at (212) 637- 4167.

Sincerely yours,

Timothy R. Gordon
Remedial Project Manager,
Caribbean Section
RCRA Programs Branch

Enclosure (2)

cc: Ms. Yarissa Martinez, P.R. Environmental Quality Board, with encl.
Mr. Julio I. Rodriguez Colon, P.R. Environmental Quality Board, with encl.
Mr. Pedro Ruiz, Naval Activity Puerto Rico, with encl.
Mr. Dave Criswell, US Navy, BRAC PMO, w/o encl.
Mr. Jeffrey Meyers, US Navy, BRAC PMO, with encl.
Mr. Mark Kimes, Baker Environmental, with encl.
Mr.Matt Lary, TechLaw Inc., w/o encl.
Mr. Felix Lopez, USF&WS, w/o encl.

ENCL. 1

TECHNICAL REVIEW OF THE NAVAL ACTIVITY PUERTO RICO PHASE I RCRA FACILITY INVESTIGATION REPORT FOR SWMU 68 DATED MARCH 26, 2007

NAVAL ACTIVITY PUERTO RICO
CEIBA, PUERTO RICO
EPA ID No. PR2170027203

Submitted to:

U.S. Environmental Protection Agency
Region 2
290 Broadway
New York, NY 10007-1866

Submitted by:

TechLaw, Inc.
One Penn Plaza, Suite 2509
New York, NY 10119

EPA Task Order No.	**002**
Contract No.	**EP-W-07-018**
TechLaw TOM	**Matt Lary**
Telephone No.	**913-484-6706**
EPA TOPO	**Timothy Gordon**
Telephone No.	**212-637-4167**

May 21, 2007

TECHNICAL REVIEW OF THE NAVAL ACTIVITY PUERTO RICO PHASE I RCRA FACILITY INVESTIGATION REPORT FOR SWMU 68 DATED MARCH 26, 2007

NAVAL ACTIVITY PUERTO RICO
CEIBA, PUERTO RICO
EPA ID No. PR2170027203

The following comments were generated based on review of the March 26, 2007 Phase I RCRA Facility Investigation Report for SWMU 68 (Report), Naval Activity Puerto Rico (NAPR) Ceiba, Puerto Rico.

GENERAL COMMENTS

1. This Report does not include a discussion of investigation derived wastes (IDW) or associated IDW sampling. According to Section 3.5.2 of the approved Work Plan, two IDW samples were to be collected, and these samples were to be analyzed to provide information necessary to properly dispose of any IDW generated. Provide discussion related to IDW during the investigation and rationale for any deviations from the approved Work Plan.

2. This Report does not provide discussion regarding decontamination activities associated with this investigation. According to Section 3.5.3 of the approved Work Plan, decontamination was to take place "in accordance with the EPA approved RCRA Facility Investigation Work Plans." Revise the report to include a discussion of decontamination activities conducted during this investigation.

SPECIFIC COMMENTS

1. **Section 4.0 2006 RCRA Facility Investigation Activities, Page 4-1:** This section does not include a discussion of the apparent soil boring (SB) 03 collapse and resulting lack of groundwater samples at this location. According to the field notes presented in Appendix A.1, SB 03 collapsed and a temporary well (TW) could not be installed. Section 4.0, however, states that a TW was not installed at SB 03 "due to a lack of water because of the lean clay observed in the boring samples." Revise the document to address this discrepancy by including a discussion and explanation of the collapse at SB 03.

2. **Section 4.1 Soil Boring Advancement and Temporary Well Installation, Page 4-1:** This section indicates that 10-foot screens were used in the TWs; however, Section 3.2, Monitor Well Installation Program, in the approved Work Plan, states that 5-foot screens would be installed. Revise the Report to address this discrepancy.

3. **Section 4.2.2 Groundwater, Page 4-2:** This section does not provide sufficient rationale for excluding certain analyses for groundwater samples collected from TW 01,

TECHNICAL REVIEW OF NAVY RESPONSE TO COMMENTS FOR RCRA FACILITY INVESTIGATION REPORT SWMU 14 - FIRE TRAINING AREA DATED MARCH 23, 2007

NAVAL ACTIVITY PUERTO RICO
CEIBA, PUERTO RICO
EPA ID No. PR2170027203

The following comments were generated based on review of the March 23, 2007 Final RCRA Facility Investigation Report for SWMU 14 - Fire Training Area, Naval Activity Puerto Rico Ceiba, Puerto Rico.

GENERAL COMMENTS

1. **Evaluation of Response to EPA General Comment 1:** The Navy's response to Comment 1 appears to be partially adequate. The Navy stated that it would incorporate discussion into Section 6.3.1, Potential Human Receptors, to clarify why only future resident adults, and not future resident children, are being evaluated for inhalation of volatiles in the groundwater. The statement added to the discussion, "Exposure to groundwater as a potable source will be assessed, which includes exposure via ingestion and dermal contact and inhalation while showering (adults only) or bathing," does not clarify why inhalation exposures to children are not being addressed. Revise the document to clarify why exposures to future resident children are not being assessed.

2. **Evaluation of Response to EPA General Comment 2:** The Navy's response to Comment 2 appears to be partially adequate. The Navy indicated that it would update the Human Health Risk Assessment (HHRA) to include vapor intrusion from contaminated groundwater for future resident receptors. The reports text was adequately updated to reflect this determination; however, Appendix H, Table 1, Selection of Exposure Pathways, still does not identify future adult residents and future construction workers as potential receptors based on the vapor migration to indoor air pathway. Update Appendix H, Table 1 to agree with the comment response and the report text.

SPECIFIC COMMENTS

1. **Evaluation of Response to EPA Specific Comment 8:** The Navy's response to Comment 8 appears to be partially adequate. The Navy stated that it would clarify Section 6.4.3, Dermal Absorption Efficiency, to indicate that this analysis was not used in the HHRA, but rather was included for the readers' benefit. The sentences added to the beginning and end of this section provide clarification while also appearing to conflict with the bulk of the discussion. Specifically, statements indicating that factors "were obtained," rather than "can be obtained," lead the reader to believe this analysis was conducted for this HHRA. Modify this section further to more clearly identify the Dermal Absorption Efficiency section as reference information that was not included in HHRA efforts.

Baker Environmental, Inc.
A Unit of Michael Baker Corporation

Airside Business Park
100 Airside Drive
Moon Township, PA 15108
Office: 412-269-6300
Fax: 412-375-3995

July 20, 2007

U.S. Environmental Protection Agency - Region II
290 Broadway – 22nd Floor
New York, New York 10007-1866

Attn: Mr. Adolph Everett, P.E.
Chief, RCRA Programs Branch

Re: Contract N62470-02-D-3052
Navy CLEAN, District III
Contract Task Orders (CTO) 0121 and 0110
U.S. Naval Activity Puerto Rico (NAPR)
Navy Responses to EPA Comments dated May 29, 2007
EPA I.D. No. PR2170027203

Dear Mr. Everett:

Baker Environmental, Inc. (Baker), on behalf of the Navy, is pleased to provide you with the attached Navy Responses to EPA Comments dated May 29, 2007. These comments were on the Draft Phase I RCRA Facility Investigation Report for SWMU 68, Naval Activity Puerto Rico dated March 26, 2007; and the Final RCRA Facility Investigation Report for SWMU 14, Naval Activity Puerto Rico dated March 23, 2007.

Upon EPA approval of the Navy response to comments the Navy will modify the documents as outlined in the responses and submit Final documents for the sites covered in the EPA comments. If you have questions regarding this submittal, please contact Mr. Mark E. Davidson at (843) 743-2135. Additional distribution has been made as indicated below.

Sincerely,

BAKER ENVIRONMENTAL, INC.

Mark E. Kimes, P.E.
Activity Manager

MEK/lp
Attachments

cc: Ms. Jean Mann, NAVFAC Atlantic – Code AQ119 (letter only)
Mr. David Criswell, BRAC PMO SE (letter only)
Mr. Jeffrey G. Meyers, Navy BRAC PMO SE (letter only)
Mr. Mark Davidson, Navy BRAC PMO SE (1 copy)
Mr. Pedro Ruiz, NAPR (1 copy)
Mr. Tim Gordon, US EPA Region II (1 copy)
Mr. Matt Larry, TechLaw Inc. (1 copy)
Mr. Carl Soderberg, US EPA Caribbean Office (1 copy)
Mr. Manny Vargas, PR EQB (1 copy)
Ms. Yarissa Martinez, PR EQB (1 copy)
Mr. Felix Lopez, U.S. F&WS (1 copy)
Mr. John Swenfurth, CH2M Hill Tampa (1 copy)

NAVY RESPONSES TO EPA COMMENTS DATED MAY 29, 2007

EPA COMENTS ON THE NAVAL ACTIVITY PUERTO RICO PHASE I RCRA FACILITY INVESTIGATION REPORT FOR SWMU 68 – FORMER SOUTHERN FIRE TRAINING AREA DATED MARCH 26, 2007

Draft Phase I RFI Report for SWMU 68 (former Southern Fire Training Area)

EPA does not fully concur with the conclusions and recommendations made in Section 6.0 of the Draft Phase I RFI Report (the Report) for SWMU 68 (former Southern Fire Training Area), submitted on behalf of the Navy by Mr. Mark Kimes' (of Baker Environmental) letter of March 26, 2007. Specifically, EPA does not fully concur with the statement in Section 6.1 that " . . . it is concluded that no impact to the groundwater is present due to past Navy operations." Also, EPA does not concur with the statement in Section 6.2 of the Report that "No additional investigations are warranted ... "

While EPA does concur with the recommendation given in Section 6.2 of the Report that due to "the presence of lead in the surface soil . . . . . .a very limited remedial action for surface soil (excavation and disposal with confirmatory sampling) is warranted", EPA is concerned that no actions are proposed to address vanadium in the surface and subsurface soils and the groundwater.

EPA notes that although lead concentration of 53 mg/kg found in the surface soil at 68SB08, exceeded the Region IX residential PRG of 40 mg/kg and the base-wide background concentration of 22 mg/kg indicated in the October 17, 2006 "Revised Final Summary for Environmental Background Concentrations for Inorganic Constituents Report" (the Background Report), lead concentrations in the other 10 surface soil samples at SWMU 68 were below both the PRGs and the site-wide background concentrations. Whereas the vanadium concentrations found at SWMU 68 exceeded the corresponding industrial and/or residential PRGs in all 11 of the surface soils samples analyzed and in all 22 of the subsurface soil samples analyzed. Likewise in the groundwater at SWMU 68 the vanadium concentration exceeds its tap water PRG of 3.6 ug/l in all 7 of the samples analyzed. While the maximum vanadium groundwater concentration measured in the groundwater at SWMU 68 of 210 ug/L (estimated) is less than the base-wide background concentration indicated in the October 17, 2006 "Revised Final Summary for Environmental Background Concentrations for Inorganic Constituents Report" (the Background Report), that maximum concentration (210 ug/L) is more than 50 times greater than the corresponding tap water PRG of 3.6 ug/l vanadium. EPA is concerned that the vanadium concentrations measured at SWMU 68 may not be fully ascribable to natural background concentrations. It should further be noted that the deeper subsurface soil sample (68SB04-02) collected at 12-14 feet below grade in boring 68SB04, had a vanadium concentration of 440 mg/kg, which exceeds not only the corresponding residential and industrial PRGs of 7.8 and 102 respectively, but also the indicated "background" concentration of 434 mg/kg established in the Background Report.

In addition, arsenic was found in all 11 surface soil samples at SWMU 68 at concentrations exceeding the Region IX residential PRG, and exceeding the industrial PRG at 4 of the 11 locations. Yet only one of the surface soil samples (68SB02) exceeded the base-wide background surface soil concentration for arsenic of 2.65 mg/kg indicated in the October 17, 2006 Background Report. However, 3 of the 11 subsurface surface soil samples (locations 68SB01, SB02 and SB04), found arsenic concentrations exceeding both the Region IX residential and the

industrial PRGs and the base-wide background concentration for subsurface soils of 1.59 mg/kg arsenic, indicated in the October 17, 2006 Background Report.

EPA notes that none of the base-wide surface soil and groundwater background samples (in the 2006 Background Report) were collected in the vicinity of SWMU 68; however, 3 of the base-wide subsurface soil background samples (14E-SB-02-02, 14E-SB03-02,and 14 E-SB0I-04) were collected during the 2004 Environmental Conditions of Property (ECP) investigations at what subsequently became identified as SWMU 68, and all 3 may have been impacted by contamination, based on reported indications of "DRO" (diesel range organics) in those samples.

EPA also notes that the October 17, 2006 Background Report offered no explanation as to why such elevated vanadium concentrations would be naturally occurring. Thus EPA is concerned that the base-wide background concentrations for arsenic, lead, and particularly vanadium, established in the October 17, 2006 Background Report, may not be fully representative of natural background conditions in the SWMU 68 area and/or may have been impacted by contaminant releases.

Navy Response to EPA General Comment: The USEPA concerns discussed above are addressed in the Responses to USEPA Comment Nos. 1 through 4 below for SWMU 68.

Prior to our approving the Draft Phase I RFI report and its conclusion in Section 6.1 of the Report that "It is evident from analysis obtained during the Phase I RFI investigation that there has been very little impact on the environment due to Navy activities at SWMU 68." (Section 6.1), EPA requests that the Navy submit, within 45 days of your receipt of this letter, the following:

1) a proposal for implementing additional background sampling for vanadium in surface and subsurface soils and groundwater, in order to more conclusively determine whether or not the elevated vanadium concentrations measured in the surface and subsurface soils and groundwater at SWMU 68 are in-fact natural occurring and not the result of releases from SWMU 68 (or another SWMU or AOC);

Navy Response to EPA Comment #1: The Navy does not believe that additional background sampling is warranted to demonstrate that vanadium concentrations measured in SWMU 68 soils and groundwater are naturally occurring. A comparison of the vanadium background surface soil analytical data summarized in the Revised Final Summary Report for Environmental Background Concentrations of Inorganic Compounds (Baker, 2006) to USGS vanadium data for Puerto Rico is shown in Table 1. The USGS data were previously presented and discussed in the document entitled Final Corrective Measures Study Investigation Report for SWMU 9 (Baker, 2003). As evidenced by Table 1, the range of vanadium concentrations within the NAPR background data set falls within the range of concentrations within the USGS data set. This comparison indicates that the NAPR background surface soil data are representative of background conditions for Puerto Rico.

A probability plot of the NAPR background surface soil vanadium data set (see Figure 1) supports the conclusion that the background surface soil data are representative of background conditions. A probability plot is a graph of concentration values plotted against their cumulative probabilities. Probability plots can be used to estimate background concentration ranges by identifying outliers and differentiating between separate populations within the data set (i.e., a population that represents background conditions and a population that represents contamination). A continuous straight-line plot with no large gaps indicates that the data represent a naturally occurring population. An inflection point or discontinuity in a probability plot may indicate the

threshold separating two populations in the data set. If concentrations in the upper range depart from the line or trend shown on the probability plot (i.e., a distinct increase in slope), then the upper range of the concentration distribution likely represents a separate population (i.e., contamination). As evidenced by Figure 1, the upper range of concentration values within the surface soil background data set do not deviate in an upward direction from the trend shown on the probability plot, supporting the conclusion that the NAPR background surface soil data set is representative of background conditions.

USGS background data for subsurface soil and groundwater are not available; therefore, a comparison of NAPR background subsurface soil and groundwater vanadium concentrations to island-wide background data could not be performed. However, identical to surface soil, probability plots for the NAPR background subsurface soil and groundwater vanadium data (see Figures 2 and 3, respectively) indicate that the subsurface soil and groundwater background data sets represent a single population with no indication of contamination (i.e., upper range of concentration values do not deviate in an upward direction).

The discussion presented above demonstrates that the NAPR background vanadium data sets for surface soil, subsurface soil, and groundwater are representative of background conditions. Statistical comparisons of the SWMU 68 vanadium surface soil, subsurface soil, and groundwater analytical data to NAPR background analytical data can be used to determine if concentrations in SWMU 68 abiotic media are elevated above background conditions. The statistical comparisons, conducted in accordance with Navy guidance (NFESC, 2002 and 2004), are presented in Tables 2, 3, and 4, respectively for surface soil, subsurface soil, and groundwater. As evidenced by the tables, the statistical methods evaluating the mean of the distributions (Satterthwaite's t-test or two-sample t-test), as well as the statistical methods evaluating the right-tail of the distributions (quantile test and slippage test) concluded that the distribution of vanadium concentrations in each media are not statistically elevated above background concentrations, indicating that this metal is not likely to be site-related. The descriptive statistics presented in each table also support the conclusion of the distributional statistics. For each medium, the maximum, mean, and 95% UCL background concentration exceeds maximum, mean, and 95% UCL concentrations for SWMU 68.

In summary, the Navy does not believe that additional background sampling is warranted to demonstrate that vanadium concentrations measured in SWMU 68 soils and groundwater are naturally occurring. The Navy believes that the evaluations presented above adequately demonstrate that the NAPR background surface soil, subsurface soil, and groundwater data sets are representative of background conditions. Furthermore, descriptive and distributional statistics indicate that vanadium concentrations in SWMU 68 surface soil, subsurface soil, and groundwater are equivalent to background concentrations.

References:

Baker Environmental In. (Baker). 2006. Final Summary Report for Environmental Background Concentrations of Inorganic Compounds, Naval Activity Puerto Rico, Ceiba, Puerto Rico. September 15, 2006.

Baker. 2003. Final Corrective Measures Study Investigation Report for SWMU 9, Naval Station Roosevelt Roads, Ceiba, Puerto Rico. April 25, 2003.

Naval Facilities Engineering Command (NFESC). 2004. Guidance for Environmental Background Analysis: Volume III: Groundwater. NFESC User's Guide UG-2059-ENV. April 2004.

NFESC. 2002. Guidance for Environmental Background Analysis. Volume I: Soil. NFESC User's Guide UG-2049-ENV. April 2003.

2) a proposal for addressing the potential human health risks resulting from vanadium in the surface and subsurface soils and in groundwater at SWMU 68, if the additional background sampling does not more conclusively demonstrate that the vanadium concentrations encountered at SWMU 68 are attributable to natural occurring conditions;

Navy Response to EPA Comment #2: Based on the discussion presented in the Response to Comment No. 1 above, the Navy does not believe that a proposal to address potential human health risks from vanadium in SWMU 68 surface soil, subsurface soil, and groundwater is warranted. The discussion presented evidence demonstrating that vanadium concentrations in the NAPR background surface soil, subsurface soil, and groundwater data sets, as well as vanadium concentrations in the SWMU 68 surface soil, subsurface soil and groundwater data sets are representative of background conditions. Navy policy on the use of background chemical levels states that "the action level for the remediation of sites should be risk-based, should not be below background levels, and should target the risk associated with the chemicals of concern or contaminant concentration exceeding background chemical levels."

3) a proposal for addressing the potential human health risks resulting from lead and arsenic in the surface and subsurface soils at SWMU 68; and

Navy Response to EPA Comment #3: Responses to the request to submit a proposal for addressing the potential human health risks resulting from lead and arsenic in the surface and subsurface soils at SWMU 68 are presented separately below.

Lead

The residential and industrial soil screening values for noncarcinogenic compounds that were used in the comparison to SWMU 68 surface and subsurface soil analytical data were derived by dividing the USEPA Region IX residential and industrial soil preliminary remediation goals (PRGs) (USEPA 2004) by a factor of 10. For most noncarcinogenic compounds, USEPA Region IX PRGs are based on a target hazard quotient [HQ] of 1.0. By dividing the PRGs for noncarcinogenic compounds by a factor of 10, potential synergistic effects among these compounds are accounted for. However, the Region IX residential and industrial PRGs for lead are Action Levels (USEPA, 1994) that are not based on an HQ of 1.0. Therefore, the Draft Phase I RFI Report mistakenly applied a factor of 10 to each value.

When the correct soil screening values are applied to the analytical data (residential and industrial soil Action Levels [400 mg/kg and 800 mg/kg, respectively], none of the lead concentrations in the SWMU-specific soil samples (Phase I RFI Report and ECP surface and subsurface soil samples) exceed the USEPA residential and industrial soil Action Levels. Given that (1) all lead detections at SWMU 68 are less than the USEPA residential and industrial soil Action Levels, and (2) lead concentrations have been delineated at the SWMU, the limited remedial action for surface soil recommended in Section 6.2 of the Draft Phase I RFI Report is not warranted. Therefore, Tables 5-1 and 5-2 and associated text in Sections 5.2 and 6.1 will be revised to reflect the correct USEPA Region IX soil PRG values (Action Levels). The text in Section 6.2 also will

be revised to eliminate the recommendation for a limited remedial action for surface soil (excavation and disposal with confirmation sampling) to address potential human health risks since all surface soil lead detections are less than the residential and industrial soil Action Levels

Although remediation addressing potential human health risks from lead in surface soil is not warranted based on the discussion presented above, a comparison of the Phase II RFI and ECP surface soil analytical data to an ecological-based soil screening value indicates that remediation is warranted to address potential ecological risks. Lead concentrations detected in two surface soil samples collected during the ECP investigation (230 mg/kg in 14E-SS01 and 150 mg/kg in 14E-SS04 [see Appendix D of the Phase I RFI report]) exceed a literature-based surface soil toxicological threshold for this metal (120 mg/kg). The toxicological threshold represents a ecological soil screening level (Eco SSL) for terrestrial plants (USEPA, 2005). Lead concentrations in these two samples also are elevated above NAPR background surface soil concentrations. Therefore, the text within Section 6.0 of the Phase I RFI Report will be revised to include a recommendation for a limited removal action for surface soil to address potential ecological risks. Revisions will include a comparison of the ECP surface soil analytical data to ecological-based soil screening values and background concentrations to ensure that other chemicals detected in samples collected during the ECP investigation do not warrant remediation to address potential ecological risks.

The revisions to the Phase I RFI Report indicated above will be completed once concurrence is reached with the USEPA for all responses related to SWMU 68. A proposal addressing the potential ecological risks resulting from lead (and any other chemical identified during revisions to the Phase I RFI Report) in surface soil at SWMU 68 also will be prepared at this time.

Arsenic

Probability plots for the NAPR background surface and subsurface soil arsenic data sets are included as Figures 4 and 5. As evidenced by the figures, the upper range of concentration values within both data sets do not deviate in an upward direction from the trend shown on the probability plots, indicating that the NAPR background surface and subsurface soil data sets are representative of background conditions.

Statistical comparisons of the SWMU 68 surface soil and subsurface soil arsenic analytical data to NAPR background analytical data for arsenic are presented in Tables 5 and 6, respectively. As evidenced by Table 5, the statistical method evaluating the mean of the distributions (Gehan test) concluded that arsenic concentrations in SWMU 68 surface soil are elevated above background concentrations. However, the statistical methods evaluating the right-tail of the distribution (quantile test and slippage test) concluded that SWMU 68 arsenic concentrations in surface soil are not elevated above background concentrations. To further evaluate the SWMU 68 surface soil arsenic analytical data, a probability plot based on a combined SWMU 68 and NAPR background data set was prepared (see Figure 6). As evidenced by the figure, the upper range of concentrations values for the combined data set (comprised of SWMU 68 analytical data) do not deviate in an upward direction from the trend shown on the plot. This indicates that the SWMU 68 and background surface soil data represent a single population with no indication of contamination.

The conclusions drawn from the subsurface soil statistical comparisons (see Table 6) also are contradictory. The statistical method evaluating the mean of the distributions (Gehan test) concluded that arsenic concentrations in SWMU 68 subsurface soil are elevated above background concentrations. However, the statistical methods evaluating the right-tail of the

distribution (quantile test and slippage test) concluded that SWMU 68 arsenic concentrations in subsurface soil are not elevated above background. A probability plot based on a combined SWMU 68 and NAPR background data set support the conclusion of the Gehan test (see Figure 7). The upper range of concentration values depart in an upward direction from the trend shown on the probability plot (a distinct increase in slope), indicating that this portion of the concentration distribution (comprised of SWMU 68 analytical data) represents a separate population. In this case, the lower range concentrations are likely to represent background conditions, while the upper range concentrations are likely to represent contamination.

The distributional statistics (Table 6) and probability plot for the combined SWMU 68 and NAPR background subsurface soil data set (Figure 7) indicate that arsenic concentrations in SWMU 68 subsurface soil are elevated above background concentrations. In order to evaluate potential human health risks from arsenic in soil at SWMU 68, preliminary risk calculations were performed under a future residential exposure scenario. To present a complete exposure scenario, arsenic concentrations in surface and subsurface soil were evaluated together by combining surface and subsurface soil analytical data from the Phase II ECP Report and the Draft Phase I RFI Report to form a total soil data set. However, analytical results for samples collected from depths greater than 10 feet below ground surface (bgs) were eliminated from this combined data set because residential exposures beyond this depth are not likely. USEPA ProUCL Version 3.00.02 software was used to determine the distribution of the data set and calculate the exposure point concentration (EPC). The distribution and EPC (95 percent Upper Confidence Limit of the mean) for arsenic are presented in Table 7, while exposure parameters used in the preliminary risk calculations are presented in Table 8. The results of the preliminary risk calculations are presented in Tables 9 (future adult resident) and 10 (future child resident). As evidenced by Tables 9 and 10, there are no unacceptable carcinogenic or noncarcinogenic risks calculated from potential exposure to arsenic in soil at SWMU 68. Furthermore, the low carcinogenic and noncarcinogenic risk levels calculated demonstrate that arsenic in soil would not be a risk driver if a baseline human health risk assessment (HHRA) was conducted.

In summary, distributional statistics and probability plots indicate that arsenic concentrations in SWMU 68 subsurface soil are elevated above background concentrations. However, preliminary risk calculations indicate that there are no unacceptable carcinogenic or noncarcinogenic risks associated with this metal. Therefore, the Navy does not believe that a proposal addressing the potential human health risks resulting from arsenic in the surface and subsurface soils at SWMU 68 is warranted.

References:

United States Environmental Protection Agency (USEPA). (2005). Ecological Soil Screening Levels for Lead (Interim Final). Office of Solid Waste and Emergency Response, Washington, D.C. OSWER Directive 9285.7-70.

USEPA. 2004. United States Environmental Protection Agency Region IX Preliminary Remediation Goals. http://www.epa.gov/region09/waste/sfund/prg/index.htm. October 2004.

USEPA. 1994. Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities. OSWER Directive No. 9355.4-12. Office of Emergency and Remedial Response, Washington, D.C. EPA/540/F-94/043, PB94-963282.

4) written responses and/or an addendum to the SWMU 68 Draft Phase I RFI Report, which address the additional comments given in the enclosed Technical Review, prepared for us by our consultant, TechLaw, Inc.

Navy Response to EPA Comment #4: Written responses to the TechLaw, Inc. comments are provided as an attachment to this response to comments. The Draft Phase I RFI Report will be revised to address Navy responses to these comments once concurrence is reached with the USEPA for all responses to comments related to SWMU 68.

TECHLAW, Inc. COMENTS ON THE NAVAL ACTIVITY PUERTO RICO PHASE I RCRA FACILITY INVESTIGATION REPORT FOR SWMU 68 – FORMER SOUTHERN FIRE TRAINING AREA DATED MARCH 26, 2007

GENERAL COMMENTS

1. This Report does not include a discussion of investigation derived wastes (IDW) or associated IDW sampling. According to Section 3.5.2 of the approved Work Plan, two IDW samples were to be collected, and these samples were to be analyzed to provide information necessary to properly dispose of any IDW generated. Provide discussion related to IDW during the investigation and rationale for any deviations from the approved Work Plan.

Navy Response to TechLaw General Comment #1: Soil cuttings from the subsurface soil sampling, as well as from the temporary monitor wells, were placed back into the boring from which they came since no significant contamination was encountered. No IDW samples were collected during this investigation, since no soil cuttings were generated and disposable drilling and sampling equipment was used (GeoProbe liners, disposable stainless-steel spoons, and peristaltic tubing) therefore no liquid decontamination was required and no fluids were generated. The report will be updated to include a discussion pertaining to no IDW sample collection.

2. This Report does not provide discussion regarding decontamination activities associated with this investigation. According to Section 3.5.3 of the approved Work Plan, decontamination was to take place "in accordance with the EPA approved RCRA Facility Investigation Work Plans." Revise the report to include a discussion of decontamination activities conducted during this investigation.

Navy Response to TechLaw General Comment #2: As discussed previously, no decontamination activities were conducted during this investigation because disposable sampling equipment and drilling equipment were used. The report will be updated providing a discussion of the use of disposable equipment resulting in no decontamination activities.

SPECIFIC COMMENTS

1. **Section 4.0 2006 RCRA Facility Investigation Activities, Page 4-1:** This section does not include a discussion of the apparent soil boring (SB) 03 collapse and resulting lack of groundwater samples at this location. According to the field notes presented in Appendix A.l, SB 03 collapsed and a temporary well (TW) could not be installed. Section 4.0, however, states that a TW was not installed at SB 03 "due to a lack of water because of

the lean clay observed in the boring samples." Revise the document to address this discrepancy by including a discussion and explanation of the collapse at SB 03.

Navy Response to TechLaw Specific Comment #1: A temporary well was not installed in SB 03 due to the lack of water found during drilling. As indicated on the boring log, a very lean white and red clay was encountered throughout much of the borehole. The boring was left open overnight to determine water production in the clay. A significant rain event overnight resulted in water accumulation in the boring from surface water runoff caused by the rain event. Sand and silt located within the first five feet of the boring were washed down the borehole. The report will be updated providing a more detailed discussion of SB 03.

2. **Section 4.1 Soil Boring Advancement and Temporary Well Installation, Page 4-1:** This section indicates that 10-foot screens were used in the TWs; however, Section 3.2, Monitor Well Installation Program, in the approved Work Plan, states that 5-foot screens would be installed. Revise the Report to address this discrepancy.

Navy Response to TechLaw Specific Comment #2: A longer screen was placed in the boreholes for the temporary wells because of the lack of a definitive water bearing zone observed. A longer screen was used to potentially allow for more water recovery during groundwater sampling. The report will be modified to reflect this field decision.

3. **Section 4.2.2 Groundwater, Page 4-2:** This section does not provide sufficient rationale for excluding certain analyses for groundwater samples collected from TW 01, 02, and 09. According to this section, the low flow conditions at the site required that these three samples undergo a more limited chemical analysis. Provide additional discussion in this section as to the rationale used for determining which specific analyses to exclude in each of the three samples.

Navy Response to TechLaw Specific Comment #3: The rationale for sample collection at low water producing temporary wells went as follows:

Volatile Organic Compounds first;
Total Petroleum Hydrocarbons, Diesel Range Organics, second;
Total Petroleum Hydrocarbons, Gasoline Range Organics, third;
Polyaromatic Hydrocarbons, fourth;
Dissolved Metals, fifth;
Polychlorinated Biphenyls, sixth;
Semi-Volatile Organic Compounds, seventh;
Cyanide, eighth;
Sulfide, ninth;
Total Metals, tenth.

The only exception to this rationale was the mixing of some bottles collected at TW 01 and TW02 due to their close proximity to each other. An attempt was made to cover each parameter set between the two locations. The report will be updated to reflect the sample collection rationale for the low producing temporary wells.

4. **Section 4.2.2 Groundwater, Page 4-2:** There is a discrepancy regarding which analyses were conducted on the groundwater sample from TW 02. Section 4.2.2, as well as supporting information in Table 4-1 Summary of 2006 RFI Surface Soil, Subsurface Soil,

and Groundwater Sampling and Analysis, indicates that TW 02 was not analyzed for dissolved metals. Section 5.4 Groundwater and Table 5-3, Summary of Detected Results - Groundwater, however, present results for dissolved metals. Additionally, the field log included in Appendix A.l indicates that dissolved metals were analyzed for this sample. Address this discrepancy by revising the appropriate section and corresponding table.

Navy Response to TechLaw Specific Comment #4: Dissolved metals were collected at temporary well TW 02 and a revised Table 4-1 will be provided showing the dissolved metals concentrations for TW 02.

5. **Section 4.3.5 Equipment Rinsates, Page 4-4:** It does not appear that enough rinsate samples were collected during this investigation. According to Section 3.4.2 of the approved Work Plan, as defined by EPA guidance, the rinsate sampling frequency was to be "one sample per day per media or one sample per 20 individual media samples collected, whichever is more frequent." Based upon the number of sampling days (three each for soil and groundwater), a minimum of six rinsate samples should have been collected. However, according to Section 4.3.5, only three rinsate samples were collected, while Appendix A.2 identifies five rinsate samples that were collected. Additionally, according to Appendix A.2 Chain of Custody, rinsate samples were not collected prior to using the equipment each day, but rather were collected at the end of the day. Add discussion related to potential error associated with the timing of sampling and the lack of sufficient samples collected.

Navy Response to TechLaw Specific Comment #5: Since disposable sampling equipment was used and no sampling equipment was decontaminated in the field, the equipment rinsates were only used to determine residual impacts from the clean disposable equipment and not to verify decontamination procedures. The timing of equipment rinsate sample collection therefore is irrelevant. The additional day(s) to collect groundwater from the low producing temporary wells was not factored into the total number of equipment rinsates collected. The report will be updated to include the rationale for equipment rinsate sample collection.

6. **Section 6.1 Conclusions, Page 6-1:** This section states that "arsenic is naturally occurring at NAPR, and statistical comparison testing *may* conclude that the concentrations found are not significantly above background." The sampling results presented in Section 5.0 Nature and Extent of Contamination identify a cluster of several samples above both residential preliminary remediation goals (PRGs) and background screening levels on the northern portion of the Site. Since this contamination is generally located on the northern portion of the site, and has not been adequately bounded to the north by additional sampling, the statistical comparison testing results supporting the above statement should be included in the Report. If this statement cannot be supported by a statistical analysis, identify additional arsenic characterization and remediation as an activity for future work at SWMU 68.

Navy Response to TechLaw Specific Comment #6: A discussion and statistical analysis related to arsenic concentrations in SWMU 68 surface and subsurface soil was previously presented in the Response to USEPA Comment No. 3 for SWMU 68. The discussion includes results of statistical evaluations comparing SWMU 68 surface and subsurface soil analytical data to NAPR background analytical data, as well as preliminary risk calculations performed under a future residential exposure scenario.

EPA COMENTS ON THE NAVAL ACTIVITY PUERTO RICO
FINAL RCRA FACILITY INVESTIGATION REPORT FOR SWMU 14 – FORMER "CRASH-CREW" FIRE TRAINING AREA
DATED MARCH 26, 2007

Final RFI Report for SWMU 14 (former "Crash-Crew" Fire Training Area)

EPA has completed its review of the Final RFI Report for SWMU 14 (former "Crash-Crew" Fire Training Area), submitted on behalf of the Navy by Mr. Mark Kimes' (of Baker Environmental) letter of March 23, 2007, and determined that it is not fully acceptable. Section 8.12 of the SWMU 14 RFI Report (Conclusions and Recommendations), states that there are unacceptable potential risks a present from benzene and vanadium in the groundwater and from possible ingestion of, and dermal contact with, vanadium at elevated concentrations in surface and subsurface soils. However, no clear recommendations are made with regards to addressing those indicated potential risks.

As discussed previously for SWMU 68, EPA is concerned that the base-wide background concentrations for vanadium, established in the October 17, 2006 Background Report, may not be fully representative of natural background conditions. EPA notes that the October 17, 2006 Background Report offered no explanation as to why such elevated vanadium concentrations would be naturally occurring.

In addition, in Section 8.2 (Conclusions and Recommendations) of the SWMU 14 RFI Report, it is recommended that " ... soil samples be collected from the [drainage] ditch [leading from the original fire training pit to a freshwater wetland] to determine if a release has ever occurred." However, no proposal for such sampling was included with the RFI Report and no time frame for submitting it is given.

Navy Response to EPA General Comment: The USEPA concerns discussed above are addressed in the Responses to USEPA Comment Nos. 1 through 6 below for SWMU 14.

Prior to our approving the RFI Report for SWMU 14, EPA requests that the Navy submit, within 45 days of your receipt of this letter, the following:

1) a proposal for sampling the drainage ditch leading from the original fire training pit to a freshwater wetland, to determine if a release has ever occurred;

Navy Response to EPA Comment #1: A draft additional data collection work plan in support of the ecological risk assessment (ERA) at SWMU 14 will be submitted to the USEPA on or before July 20, 2007. The draft work plan will present a proposed drainage ditch soil sampling and analytical program.

2) a proposal for completing an ecological risk evaluation, to evaluate potential impacts caused by releases from SWMU 14, including impacts from releases found in the drainage ditch leading from the original fire training pit to a freshwater wetland, if releases are found;

Navy Response to EPA Comment #2: The screening-level ecological risk assessment (SERA), included as Section 7 of the Final RFI Report for SWMU 14, will be revised to include an evaluation of the drainage ditch soil analytical data. Step 3a of the Navy ERA process (refinement of conservative exposure assumptions) also will be conducted and included with the

revised SERA. The draft additional data collection work plan discussed in the Response to USEPA Comment No. 1 above for SWMU 14 will include a schedule for completion of the ERA through Step 3a of the Navy ERA process.

3) a proposal for additional background sampling for vanadium in surface and subsurface soils and groundwater to be implemented so as to more conclusively determine whether or not the elevated vanadium concentrations measured in the surface and subsurface soils and groundwater at SWMU 14 are in-fact natural occurring, and not the result of releases from SWMU 14 (or another SWMU or AOC);

Navy Response to EPA Comment #3: The Navy does not believe that additional background sampling is warranted to demonstrate that vanadium concentrations measured in SWMU 14 soils and groundwater are naturally occurring. As discussed in the Response to USEPA Comment No. 1 above for SWMU 68, the range of vanadium detections in the NAPR background surface soil data set fall within the range of vanadium detections in the USGS data set for Puerto Rico. The probability plots for NAPR background surface soil, subsurface soil, and groundwater (see Figures 1, 2, and 3) also demonstrate that the NAPR background data sets are representative of background conditions.

4) a proposal for addressing the potential human health risks resulting from vanadium in the surface and subsurface soils and groundwater at SWMU 14, should that additional background sampling not more conclusively demonstrate that the vanadium concentrations encountered at SWMU 14 are attributable to natural occurring conditions;

Navy Response to EPA Comment #4: the Navy does not believe that a proposal to address potential human health risks from vanadium in SWMU 14 surface soil, subsurface soil, and groundwater is warranted. A statistical comparison of the SWMU 14 vanadium subsurface soil analytical data to NAPR background subsurface soil analytical data is presented in Table 11. The statistical methods evaluating the mean of the distributions (two-sample t-test) and right tail of the distribution (quantile test and slippage test) concluded that the distribution of vanadium concentrations in SWMU 14 subsurface soil are not statistically elevated above background subsurface soil concentrations. A probability plot based on a combined SWMU 14 and NAPR background vanadium subsurface soil data set (see Figure 8) also indicates that the SWMU 14 subsurface soil are representative of background conditions. As evidenced by the figure, the upper range of concentrations values for the combined data set (which includes SWMU 14 analytical data) do not deviate in an upward direction from the trend shown on the plot. This indicates that the SWMU 14 and NAPR background subsurface soil data represent a single population with no indication of contamination.

Statistical comparisons of the SWMU 14 vanadium surface soil and groundwater data to NAPR background surface soil and groundwater data could not be performed due to the low number of data points within the SWMU 14 data sets (4 for surface soil and 2 for groundwater). However, surface soil and groundwater probability plots based on the combined data sets (see Figures 9 and 10, respectively) demonstrate that the SWMU 14 and NAPR background surface soil and groundwater data sets represent single populations with no indication of contamination. It is noted that there is some scatter above the trend shown on the groundwater probability plot throughout most of the concentration distribution; however, no clear deviation in an upward direction is evident. The scatter is likely due to the inclusion of analytical data for background samples 5GW04 (non-detect result) and 11GW24 (an apparent outlier).

In summary, the probability plots for the NAPR background data sets demonstrate that the NAPR surface soil, subsurface soil, and groundwater background data sets are representative of background conditions (see the Response to USEPA Comment No. 3 above for SWMU 14). Furthermore, the statistical comparisons performed on the SWMU 14 and NAPR background subsurface soil data sets indicate that subsurface soil concentrations in SWMU 14 subsurface soil are not elevated above background conditions. Finally, probability plots based on combined SWMU 14 and NAPR background surface soil, subsurface soil, and ground water data sets do not indicate that SWMU 14 concentrations are elevated above background concentrations. Based on this analysis, the Navy does not believe that a proposal to address potential human health risks from vanadium in SWMU 14 surface soil, subsurface soil, and groundwater is warranted.

5) a proposal for addressing the potential human health risks associated with the dissolved benzene in the groundwater impacted by SWMU 14 releases; and

Navy Response to EPA Comment #5: A proposal addressing potential human health risks associated with the dissolved benzene in SWMU14 groundwater will be prepared once the ERA presented in the Final Phase II RFI Report is revised to include analytical results for soil samples collected from the drainage ditch. This will ensure that all potential human health and ecological risks are addressed concurrently.

6) written responses and/or an addendum to the SWMU 14 RFI Report, which addresses the additional comments given in the enclosed Technical Review, prepared by our consultant, TechLaw, Inc.

Navy Response to EPA Comment #6: Written responses to the TechLaw, Inc. comments are provided as an attachment to this response to comments. Based on these responses, revisions to the Final Phase II RFI Report are not necessary.

TECHLAW, Inc. COMENTS ON THE NAVAL ACTIVITY PUERTO RICO RCRA FACILITY INVESTIGATION REPORT FOR SWMU 14 – FIRE TRAINING AREA DATED MARCH 23, 2007

GENERAL COMMENTS

1. **Evaluation of Response to EPA General Comment 1:** The Navy's response to Comment 1 appears to be partially adequate. The Navy stated that it would incorporate discussion into Section 6.3.1, Potential Human Receptors, to clarify why only future resident adults, and not future resident children, are being evaluated for inhalation of volatiles in the groundwater. The statement added to the discussion, "Exposure to groundwater as a potable source will be assessed, which includes exposure via ingestion and dermal contact and inhalation while showering (adults only) or bathing," does not clarify why inhalation exposures to children are not being addressed. Revise the document to clarify why exposures to future resident children are not being assessed.

Navy Response to TechLaw General Comment #1: Section 6.3.1 was previously revised and incorporated into the March 23, 2007 Final document in response to the January 18, 2007 EPA General Comment 1. Specifically, the following text was added to the fourth paragraph of Section 6.3.1:

"Exposure to groundwater as a potable source will be assessed, which includes exposure via ingestion and dermal contact and inhalation while showering (adults only) or bathing. Inhalation of volatiles in groundwater while showering was evaluated only for the future residential adult. Young children are not expected to shower and therefore, are not evaluated for exposure to inhalation of VOCs in groundwater. Rather, young children are evaluated for dermal contact exposure to groundwater while bathing."

2. **Evaluation of Response to EPA General Comment 2:** The Navy's response to Comment 2 appears to be partially adequate. The Navy indicated that it would update the Human Health Risk Assessment (HHRA) to include vapor intrusion from contaminated groundwater for future resident receptors. The reports text was adequately updated to reflect this determination; however, Appendix H, Table 1, Selection of Exposure Pathways, still does not identify future adult residents and future construction workers as potential receptors based on the vapor migration to indoor air pathway. Update Appendix H, Table 1 to agree with the comment response and the report text.

Navy Response to TechLaw General Comment #2: Table 1 of Appendix H was previously revised and incorporated into the March 23, 2007 Final document in response to the January 18, 2007 EPA General Comment 2. Specifically, in the column titled "Type of Analysis" in the final version of Table 1, the word *qualitative* was changed to *quantitative* for the future residents to indicate that this pathway was quantitatively evaluated in the final HHRA.

SPECIFIC COMMENTS

1. **Evaluation of Response to EPA Specific Comment 8:** The Navy's response to Comment 8 appears to be partially adequate. The Navy stated that it would clarify Section 6.4.3, Dermal Absorption Efficiency, to indicate that this analysis was not used in the HHRA, but rather was included for the readers' benefit. The sentences added to the beginning and end of this section provide clarification while also appearing to conflict with the bulk of the discussion. Specifically, statements indicating that factors "were obtained," rather than "can be obtained," lead the reader to believe this analysis was conducted for this HHRA. Modify this section further to more clearly identify the Dermal Absorption Efficiency section as reference information that was not included in HHRA efforts.

Navy Response to TechLaw Specific Comment #1: Comment noted. However, the text will not be revised based on the following rationale. It is recognized that the numerical values for the toxicity criteria did not change (based on the assumption of 100% absorption efficiency for each COPC), thus leading the reader to infer that there was no analysis conducted of dermal absorption efficiency. However, as Section 6.4.3 appropriately indicates, the analysis was conducted and the steps outlined in the guidance were applied when examining all toxicity criteria for use in the HHRA. The last sentence of the paragraph states that the oral to dermal adjustment factors used in HHRA for SWMU 14 were all 100 percent, not that the analysis was not conducted. Therefore, the use of the statement, "were obtained," accurately represents that the analysis was conducted.

TABLES

TABLE 1
COMPARISON OF NAPR BACKGROUND VANADIUM SURFACE SOIL CONCENTRATIONS TO USGS ISLAND-WIDE ANALYTICAL DATA FOR PUERTO RICO
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

NAPR Background					USGS Island-Wide				
No. of Positive Detections/No. of Samples	**Range of Positive Detections (mg/kg)**	**Range of Non-Detects (mg/kg)**	**Maximum Detected Concentration (mg/kg)**	**Arithmatic Mean (mg/kg)**	**No. of Positive Detections/No. of Samples**	**Range of Positive Detections (mg/kg)**	**Range of Non-Detects (mg/kg)**	**Maximum Detected Concentration (mg/kg)**	**Arithmatic Mean (mg/kg)**
19/19	35 - 270	NA	270	148	292/292	50 - 1,500	NA	1,500	393

NA = Not applicable (vanadium was detected in each sample)
mg/kg = milligrams per kilogram
USGS = United States Geological Survey
NAPR = Naval Activity Puerto Rico

TABLE 2
SUMMARY STATISTICS AND RESULTS - VANADIUM IN NAPR BACKGROUND AND SWMU 68 SURFACE SOIL
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	Population [1]	Descriptive Statistics [2]						Test for Normality [4]	Test for Homogeneity of Variance [5]	Distributional Statistics		
		Frequency of Detection	Range of Detections	Range of Non-Detections	Mean	SE	95% UCL [3]			Mean/Median of the Distribution	Right Tail of the Distribution [6]	
											Quantile Test	Slippage Test
Vanadium	SWMU 68	13/13	65 - 170	NA	107	9.3	124 (Normal Distribution)	Normal at α = 0.05 (p = 0.1886)	Variances are not equal at α = 0.05 (p = 0.0254)	Satterthwaite's t-test [7]; Not elevated at α = 0.05 (p = 0.9870); Power = 0.000041)	Not elevated at α = 0.05	Not elevated at α = 0.05
	Background	19/19	35 - 270	NA	148	14.7	174 (Normal Distribution)	Normal at α = 0.05 (p = 0.9679)				

Notes:

95% UCL = 95% Upper Confidence Limit of the mean
NA = Not applicable
SE = Standard error
SWMU = Solid Waste Management Unit
NAPR = Naval Activity Puerto Rico
α = Significance level (for the distributional statistics, α represents the probability criteria [0.05] for rejecting the null hypothesis that data sets were sampled from the same population)

[1] SWMU 68 surface soil data taken from Baker (2007) and LANTDIV (2004); background data taken from Baker (2006).
[2] Units in mg/kg.
[3] 95% Upper Conficence Limit was calculated using USEPA ProUCL Version 3.00.02 software.
[4] Normality verified by Shapiro-Wilks test. The test for normality was performed because each data set (SWMU 68 and background) has less than fifteen percent non-detected results.
[5] Homogeneity of variance verified by F test. The test for homogeneity of variance was performed because each data set (SWMU 68 and background) exhibits a normal distribution and has less than fifteen percent non-detected results.
[6] Quantile and slippage tests only determine whether or not a particular contaminant is likely present at equivalent or elevated concentrations relative to background.
[7] Satterthwaite's t-test was used because: (a) there are less than fifteen percent non-detected results in the combined data set (SWMU 68 and background); (b) each data set has a normal distribution; and (c) the SWMU 68 and background data set variances are not equal.

References:

Baker Environmental, Inc. (2007). Draft Phase I RCRA Facility Investigation Report for SWMU 68, Naval Activity Puerto Rico, Ceiba, Puerto Rico. March 26, 2007.
Baker. (2006). Revised Final Summary Report for Environmental Background Concentrations of Inorganic Compounds, Naval Activity Puerto Rico, Ceiba, Puerto Rico. October 17, 2006.
Naval Facilities Engineering Command, Atlantic Division (LANTDIV). 2004. Draft Phase II Environmental Condition of Property (ECP) Report, Naval Activity Puerto Rico, Ceiba, Puerto Rico. March 31, 2004.
Naval Facilities Engineering Command (NFESC). 2002. Guidance for Environmental Background Analysis. Volume 1: Soil. NFESC user's Guide UG-209-ENV. April 2002.

TABLE 3
SUMMARY STATISTICS AND RESULTS - VANADIUM IN NAPR BACKGROUND AND SWMU 68 SUBSURFACE SOIL
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	Population [1]	Descriptive Statistics [2]						Test for Normality [4]	Test for Homogeneity of Variance [5]	Distributional Statistics		
		Frequency of Detection	Range of Detections	Range of Non-Detections	Mean	SE	95% UCL [3]			Mean/Median of the Distribution	Right Tail of the Distribution [6]	
											Quantile Test	Slippage Test
Vanadium	SWMU 68	23/23	48 - 440	NA	136	16.3	163 (Gamma Distribution)	Lognormal at α = 0.05 (p = 0.1920)	Variances are equal at α = 0.05 (p = 0.1193)	Two-sample t-test [7]; Not elevated at α = 0.05 (p = 0.9787; Power = 0.000106)	Not elevated at α = 0.05	Not elevated at α = 0.05
	Background [1]	19/19	25 - 410	NA	209	25.9	253 (Normal Distribution)	Lognormal at α = 0.05 (p = 0.0531)				

Notes:

95% UCL = 95% Upper Confidence Limit of the mean
NA = Not applicable
SE = Standard error
SWMU = Solid Waste Management Unit
NAPR = Naval Activity Puerto Rico
α = Significance level (for the distributional statistics, α represents the probability criteria [0.05] for rejecting the null hypothesis that data sets were sampled from the same population)

[1] SWMU 68 subsurface soil data taken from Baker (2007) and LANTDIV (2004); background data (clay soil type) taken from Baker (2006).
[2] Units in mg/kg.
[3] 95% Upper Conficence Limit was calculated using USEPA ProUCL Version 3.00.02 software.
[4] Normality verified by Shapiro-Wilks test. The test for normality was performed because each data set (SWMU 68 and background) has less than fifteen percent non-detected results.
[5] Homogeneity of variance verified by F test. The test for homogeneity of variance was performed because each data set (SWMU 68 and background) exhibits a lognormal distribution and has less than fifteen percent non-detected results.
[6] Quantile and slippage tests only determine whether or not a particular contaminant is likely present at equivalent or elevated concentrations relative to background.
[7] Two sample t-test was used because: (a) there are less than fifteen percent non-detected results in the combined data sets (reference area and background); (b) each data set has a lognormal distribution; and (c) the SWMU 68 and background data set distributions have equal variances.

References:

Baker Environmental, Inc. (2007). Draft Phase I RCRA Facility Investigation Report for SWMU 68, Naval Activity Puerto Rico, Ceiba, Puerto Rico. March 26, 2007.
Baker. (2006). Revised Final Summary Report for Environmental Background Concentrations of Inorganic Compounds, Naval Activity Puerto Rico, Ceiba, Puerto Rico. October 17, 2006.
Naval Facilities Engineering Command, Atlantic Division (LANTDIV). 2004. Draft Phase II Environmental Condition of Property (ECP) Report, Naval Activity Puerto Rico, Ceiba, Puerto Rico. March 31, 2004.

TABLE 4
SUMMARY STATISTICS AND RESULTS - VANADIUM IN NAPR BACKGROUND AND SWMU 68 GROUNDWATER
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	Population [1]	Descriptive Statistics [2]						Test for Normality [5]	Test for Homogeneity of Variance [6]	Distributional Statistics		
		Frequency of Detection	Range of Detections	Range of Non-Detections	Mean [3]	SE	95% UCL [4]			Mean/Median of the Distribution	Right Tail of the Distribution [7]	
											Quantile Test	Slippage Test
Vanadium	SWMU 68	7/7	17J - 210J	NA	83	28.9	139 (Normal Distribution)	Lognormal at α = 0.05 (p = 0.3530)	Variances are equal at α = 0.05 (p = 0.1653)	Two-sample t-test [8]; Not elevated at α = 0.05 (p = 0.6185; Power = 0.0262)	Not elevated at α = 0.05	Not elevated at α = 0.05
	Background	11/12	1.7J - 549	8.5U - 8.5U	161	47.0	341 (Gamma Distribution)	Lognormal at α = 0.05 (p = 0.1595)				

Notes:

J = Estimated value
U = Not detected value
95% UCL = 95% Upper Confidence Limit of the mean
NA = Not applicable
SE = Standard error
NAPR = Naval Activity Puerto Rico
SWMU = Solid Waste Management Unit
α = Significance level (for the distributional statistics, α represents the probability criteria [0.05] for rejecting the null hypothesis that data sets were sampled from the same population)

[1] SWMU 68 subsurface soil data taken from Baker (2007); background data (clay soil type) taken from Baker (2006).
[2] Units in ug/L.
[3] Mean based on 1/2 non-detected values.
[4] 95% Upper Conficence Limit was calculated using USEPA ProUCL Version 3.00.02 software. The reporting limit for the non-detected value within the background data set was used in the derivation of the background groundwater 95% UCL.
[5] Normality verified by Shapiro-Wilks test. the test for normality was performed because each data set (SWMU 68 and background) has less than fifteen percent non-detected results.
[6] Homogeneity of variance verified by F test. The test for homogeneity of variance was performed because each data set (SWMU 68 and background) exhibits a lognormal distribution and has less than fifteen percent non-detected results.
[7] Quantile and slippage tests only determine whether or not a particular contaminant is likely present at equivalent or elevated concentrations relative to background. It is noted that the SWMU 68 and background groundwater data sets were evaluated using the quantile test even though the SWMU 68 data set data set has less than ten data points (Navy guidance [NFESC, 2002] recommends a minimum of ten data points for each data set).
[8] Two sample t-test was used because: (a) there are less than fifteen percent non-detected results in the combined data sets (SWMU 68 and background); (b) each data set has a lognormal distribution; and (c) the SWMU 68 and background data set distributions have equal variances.

References:

Baker Environmental, Inc. (2007). Draft Phase I RCRA Facility Investigation Report for SWMU 68, Naval Activity Puerto Rico, Ceiba, Puerto Rico. March 26, 2007.
Baker. (2006). Revised Final Summary Report for Environmental Background Concentrations of Inorganic Compounds, Naval Activity Puerto Rico, Ceiba, Puerto Rico. October 17, 2006.

TABLE 5
SUMMARY STATISTICS AND RESULTS - ARSENIC IN NAPR BACKGROUND AND SWMU 68 SURFACE SOIL
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	Population [1]	Descriptive Statistics [2]						Test for Normality [5]	Test for Homogeneity of Variance [6]	Distributional Statistics		
		Frequency of Detection	Range of Detections	Range of Non-Detections	Mean [3]	SE	95% UCL [4]			Mean/Median of the Distribution	Right Tail of the Distribution [7]	
											Quantile Test	Slippage Test
Arsenic	SWMU 68	13/13	0.92J - 3.4	NA	1.69	0.18	2.03 (Gamma Distribution)	Test was not performed	Test was not performed	Gehan test [8], G(1.794)>Z(1.645), Elevated at $\alpha = 0.05$	Not elevated at $\alpha = 0.05$	Not elevated at $\alpha = 0.05$
	Background	14/20	0.21J - 2.5J	0.69UJ - 1.8U	1.18	0.17	1.47 (Normal Distribution)	Test was not performed				

Notes:

J = Estimated value
U = Not detected value
UJ = Not detected, estimated value
NA = Not applicable
SE = Standard error
SWMU = Solid Waste Management Unit
NAPR = Naval Activity Puerto Rico
95% UCL = 95% Upper Confidence Limit of the mean
α = Significance level (for the distributional statistics, α represents the probability criteria [0.05] for rejecting the null hypothesis that data sets were sampled from the same population)

[1] SWMU 68 subsurface soil data taken from Baker (2007) and LANTDIV (2004); background data taken from Baker (2006).
[2] Units in mg/kg.
[3] Mean based on 1/2 non-detected values.
[4] 95% Upper Conficence Limit was calculated using USEPA ProUCL Version 3.00.02 software.
[5] The test for normality was not performed because the NAPR background data set has greater than 15 percent non-detected results.
[6] The test for homogeneity of variance was not performed because the NAPR background data set has greater than 15 percent non-detected results.
[7] Quantile and slippage tests only determine whether or not a particular contaminant is likely present at equivalent or elevated concentrations relative to background.
[8] The Gehan test was used because: (a) the number of non-detected results in the combined data set (NAPR background and SWMU 68) is greater than fifteen percent but does not exceed fifty percent; and (b) there is more than one reporting limit for the non-detected values.

References:

Baker Environmental, Inc. (2007). Draft Phase I RCRA Facility Investigation Report for SWMU 68, Naval Activity Puerto Rico, Ceiba, Puerto Rico. March 26, 2007.
Baker. (2006). Revised Final Summary Report for Environmental Background Concentrations of Inorganic Compounds, Naval Activity Puerto Rico, Ceiba, Puerto Rico. October 17, 2006.
Naval Facilities Engineering Command, Atlantic Division (LANTDIV). 2004. Draft Phase II Environmental Condition of Property (ECP) Report, Naval Activity Puerto Rico, Ceiba, Puerto Rico. March 31, 2004.

TABLE 6
SUMMARY STATISTICS AND RESULTS - ARSENIC IN NAPR BACKGROUND AND SWMU 68 SUBSURFACE SOIL
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	Population [1]	Descriptive Statistics [2]						Test for Normality [5]	Test for Homogeneity of Variance [6]	Distributional Statistics		
		Frequency of Detection	Range of Detections	Range of Non-Detections	Mean [3]	SE	95% UCL [4]			Mean/Median of the Distribution	Right Tail of the Distribution [7]	
											Quantile Test	Slippage Test
Arsenic	SWMU 68	20/23	0.35J - 3.6	1.1U - 1.2U	1.31	0.17	1.648 (Lognormal)	Test was not performed	Test was not performed	Gehan Test [8], G(3.008)>Z(1.645), Elevated at α = 0.05	Not elevated at α = 0.05	Not elevated at α = 0.05
	Background	13/19	0.28J - 1.7	0.22UJ - 1.3U	0.73	0.10	0.94 (Gamma Distribution)	Test was not performed				

Notes:

J = Estimated value
U = Not detected value
UJ = Not detected, estimated value
SE = Standard error
95% UCL = 95% Upper Confidence Limit of the mean
SWMU = Solid Waste Management Unit
NAPR = Naval Activity Puerto Rico
α = Significance level (for the distributional statistics, α represents the probability criteria [0.05] for rejecting the null hypothesis that data sets were sampled from the same population)

[1] SWMU 68 surface soil data taken from Baker (2007) and LANTDIV (2004); background data (clay soil type) taken from Baker (2006).
[2] Units in mg/kg.
[3] Mean based on 1/2 non-detected values.
[4] 95% Upper Conficence Limit was calculated using USEPA ProUCL Version 3.00.02 software.
[5] The test for normality was not performed because the NAPR background data set has greater than 15 percent non-detected results.
[6] The test for homogeneity of variance was not performed because the NAPR background data set has greater than 15 percent non-detected results.
[7] Quantile and slippage tests only determine whether or not a particular contaminant is likely present at equivalent or elevated concentrations relative to background.
[8] The Gehan test was used because: (a) the number of non-detected results in the combined data set (NAPR background and SWMU 68) is greater than fifteen percent but does not exceed fifty percent; and (b) there is more than one reporting limit for the non-detected values.

References:

Baker Environmental, Inc. (2007). Draft Phase I RCRA Facility Investigation Report for SWMU 68, Naval Activity Puerto Rico, Ceiba, Puerto Rico. March 26, 2007.
Baker. (2006). Revised Final Summary Report for Environmental Background Concentrations of Inorganic Compounds, Naval Activity Puerto Rico, Ceiba, Puerto Rico. October 17, 2006.
Naval Facilities Engineering Command, Atlantic Division (LANTDIV). 2004. Draft Phase II Environmental Condition of Property (ECP) Report, Naval Activity Puerto Rico, Ceiba, Puerto Rico. March 31, 2004.

TABLE 7
TOTAL SOIL DATA AND COPC SELECTION SUMMARY - SWMU 68
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Contaminant	Criteria [1]	Contaminant Frequency / Range / Location			COPC Selection		Exposure Concentration Selection		
	Region IX Residential Soil PRG Values	No. of Positive Detects / No. of Samples	Range of Positive Detections	Location of Maximum Detection	Selected as a COPC?	Rationale for Selection or Deletion	95% UCL [3] (ProUCL)	Exposure Concentration	Rationale for Concentration Selection
Inorganics (mg/kg)									
Arsenic	0.390 C	22/25	0.8 J - 2.7	68SB01-01	YES	ASL	1.51 (N)	1.51	95% Student's-t UCL

Notes:

UCL - Upper Confidence Limit
PRG - Preliminary Remediation Goal
COPC - Chemical of Potential Concern
mg/kg - milligram per kilogram
C = Carcinogenic
J - Analyte present - Reported value is estimated

Rationale Codes:

(ASL) Above Screening Level

Shaded constituents were identified as COPCs for quantitative risk evaluation.

(1) All non-carcinogenic criteria were divided by 10 to account for potential additive effects of chemicals.
USEPA Region IX Residential Soil COC Screening Value (derived from USEPA Region IX PRG Table)

(2) ProUCL was used to calculate the 95% UCL and distribution (>4 samples):
(N) - Normal distribution

TABLE 8
SUMMARY OF EXPOSURE PARAMETERS - SWMU 68
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Parameter	Units	Future Adult Residents RME	Future Young Child Residents RME
Soil			
Ingestion Rate of Soil (IR-S)	mg/day	100 USEPA, 1991	200 USEPA, 1991
Fraction Ingested from Source (Fi)	NA	1 Prof Judge	1 Prof Judge
Exposure Frequency (EF)	days/year	350 USEPA, 1991	350 USEPA, 1991
Exposure Duration (ED)	years	24 USEPA, 1997	6 USEPA, 1997
Exposure Time (ET)	hours/day	24 Prof Judge	24 Prof Judge
Surface Area Available for Contact (SA)	cm2/day	5,700 USEPA, 1997	2,800 USEPA, 1997
Respiration Rate (RR)	m3/hour	1.27 USEPA, 1997	0.69 USEPA, 1997
Conversion Factor (CF)	kg/mg	1.00E-06 USEPA, 1989	1.00E-06 USEPA, 1989
Averaging Time (Non-Cancer) (AT-N)	days	8,760 USEPA, 1989	2,190 USEPA, 1989
Other Parameters			
Body Weight (BW)	kg	70 USEPA, 1997	15 USEPA, 1997
Soil to Skin Adherence Factor (AF)	mg/cm2	0.07 USEPA, 1997	0.2 USEPA, 1997
Particulate Emission Factor (PEF)	m3/kg	1.32E+09 Cowherd, et al., 1995	1.32E+09 Cowherd, et al., 1995
Averaging Time (Cancer) (AT-C)	days	25,550 USEPA, 1989	25,550 USEPA, 1989

Notes:

RME - Reasonalble Maximum Exposure

ABS - Absorption Factors
USEPA, 2004: Risk Assessment Guidance for Superfund Vol 1, Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment). EPA/540/R-99/005.
The following USEPA Region III default absorbance factors will be applied in the absence of reference values from USEPA, 2001 to estimate dermal intake of COPCs in soil and sediment (USEPA, 1995):
0.05% and 3.0% - VOAs (chemical specific)
1.0% - Inorganics
3.0% - Dioxins / Furans

Prof Judge - Professional Judgment

Cowherd, et al., 1995: Rapid Assessment of Exposure to Particulate Emissions from Surface Contamination. OHEA. EPA/600/8-85/002.
USEPA, 1989. Risk Assessment Guidance for Superfund, Volume I - Human Health Evaluation Manual (Part A) Interim Final.
USEPA, 1991. Risk Assessment Guidance for Superfund, Volume I - Human Health Evaluation Manual Supplemental Gudiance. "Standard Default Exposure Factors."
USEPA, 1997. Exposure Factors Handbook. Vol. 1: General Factors. ORD. EPA/600/P-95/002Fa.

TABLE 9
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - SWMU 68
REASONABLE MAXIMUM EXPOSURE
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Scenario Timeframe: Future
Receptor Population: Residents
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Total Soil	Total Soil	Total Soil	Arsenic	1.1E-06	--	1.3E-07	--	1.2E-06	Skin / CVS	<0.01	--	<0.01	<0.01
			Chemical Total	1.1E-06	--	1.3E-07	--	1.2E-06		<0.01	--	<0.01	<0.01
		Exposure Point Total						1.2E-06					<0.01
	Exposure Medium Total							1.2E-06					<0.01
	Air	Fugative Dust	Arsenic	--	2.5E-09	--	--	2.5E-09	NA	--	--	--	--
			Chemical Total	--	2.5E-09	--	--	2.5E-09		--	--	--	--
		Exposure Point Total						2.5E-09					--
	Exposure Medium Total							2.5E-09					--
Total Soil Total								**1.19E-06**					**<0.01**
Adult Residents Total								**1.19E-06**					**<0.01**

Total Risk Across Total Soil	1.2E-06	Total Hazard Index Across Total Soil	<0.01
Total Risk Across All Media and All Exposure Routes	1.2E-06	oss All Media and All Exposure Routes	0.0

Notes:
Target Organ Abbreviations:
CVS = Cardiovascular System

Oral and Dermal Exposure Routes:

Oral / Dermal Cardiovascular System HI =	<0.01
Oral / Dermal Skin HI =	<0.01

TABLE 10
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - SWMU 68
REASONABLE MAXIMUM EXPOSURE

Scenario Timeframe: Future
Receptor Population: Residents
Receptor Age: Young Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Total Soil	Total Soil	Total Soil	Arsenic	2.5E-06	--	2.1E-07	--	2.7E-06	Skin / CVS	0.06	--	<0.01	0.07
			Chemical Total	2.5E-06	--	2.1E-07	--	2.7E-06		0.06	--	<0.01	0.07
		Exposure Point Total						2.7E-06					0.07
	Exposure Medium Total							2.7E-06					0.07
	Air	Fugative Dust	Arsenic	--	1.6E-09	--	--	1.6E-09	NA	--	--	--	--
			Chemical Total	--	1.6E-09	--	--	1.6E-09		--	--	--	--
		Exposure Point Total						1.6E-09					--
	Exposure Medium Total							1.6E-09					--
Total Soil Total								**2.69E-06**					**0.07**
Young Child Residents Total								**2.69E-06**					**0.07**

Total Risk Across Total Soil	2.7E-06	Total Hazard Index Across Total Soil	0.1
Total Risk Across All Media and All Exposure Routes	2.7E-06	oss All Media and All Exposure Routes	0.1

Notes:
Target Organ Abbreviations:
CVS = Cardiovascular System

Oral and Dermal Exposure Routes:

Oral / Dermal Cardiovascular System HI =	0.1
Oral / Dermal Skin HI =	0.1

TABLE 11
SUMMARY STATISTICS AND RESULTS - VANADIUM IN NAPR BACKGROUND AND SWMU 14 SUBSURFACE SOIL
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	Population [1]	Descriptive Statistics [2]						Test for Normality [4]	Test for Homogeneity of Variance [5]	Distributional Statistics		
		Frequency of Detection	Range of Detections	Range of Non-Detections	Mean	SE	95% UCL [3]			Mean/Median of the Distribution	Right Tail of the Distribution [6]	
											Quantile Test	Slippage Test
Vanadium	SWMU 14	14/14	86.8J - 320J	NA	182	17.9	214 (Normal Distribution)	Normal at α = 0.05 (p = 0.8045)	Variances are equal at α = 0.05 (p = 0.0603)	Two sample t-test [7]; Not elevated at α = 0.05 (p = 0.7778); Power = 0.008136)	Not elevated at α = 0.05	Not elevated at α = 0.05
	Background	19/19	25 - 410	NA	209	25.9	253 (Normal Distribution)	Normal at α = 0.05 (p = 0.1847)				

Notes:

95% UCL = 95% Upper Confidence Limit of the mean
J = Estimated value
NA = Not applicable
SE = Standard error
SWMU = Solid Waste Management Unit
NAPR = Naval Activity Puerto Rico
α = Significance level (for the distributional statistics, α represents the probability criteria [0.05] for rejecting the null hypothesis that data sets were sampled from the same population)

[1] SWMU 14 subsurface soil data taken from Baker (2007); background data (clay soil type) taken from Baker (2006).
[2] Units in mg/kg.
[3] 95% Upper Conficence Limit was calculated using USEPA ProUCL Version 3.00.02 software.
[4] Normality verified by Shapiro-Wilks test. The test for normality was performed because each data set (SWMU 14 and background) has less than fifteen percent non-detected results.
[5] Homogeneity of variance verified by F test. The test for homogeneity of variance was performed because each data set (SWMU 14 and background) exhibits a normal distribution and has less than fifteen percent non-detected results.
[6] Quantile and slippage tests only determine whether or not a particular contaminant is likely present at equivalent or elevated concentrations relative to background.
[7] Two sample t-test was used because: (a) there are less than fifteen percent non-detected results in the combined data sets (SWMU 14 and background); (b) each data set has a normal distribution; and (c) the SWMU 14 and background data set distributions have equal variances.

References:

Baker Environmental, Inc. (2007). Final Phase II RCRA Facility Investigation Report for SWMU 14, Naval Activity Puerto Rico, Ceiba, Puerto Rico. March 23, 2007.
Baker. (2006). Revised Final Summary Report for Environmental Background Concentrations of Inorganic Compounds, Naval Activity Puerto Rico, Ceiba, Puerto Rico. October 17, 2006.

FIGURES

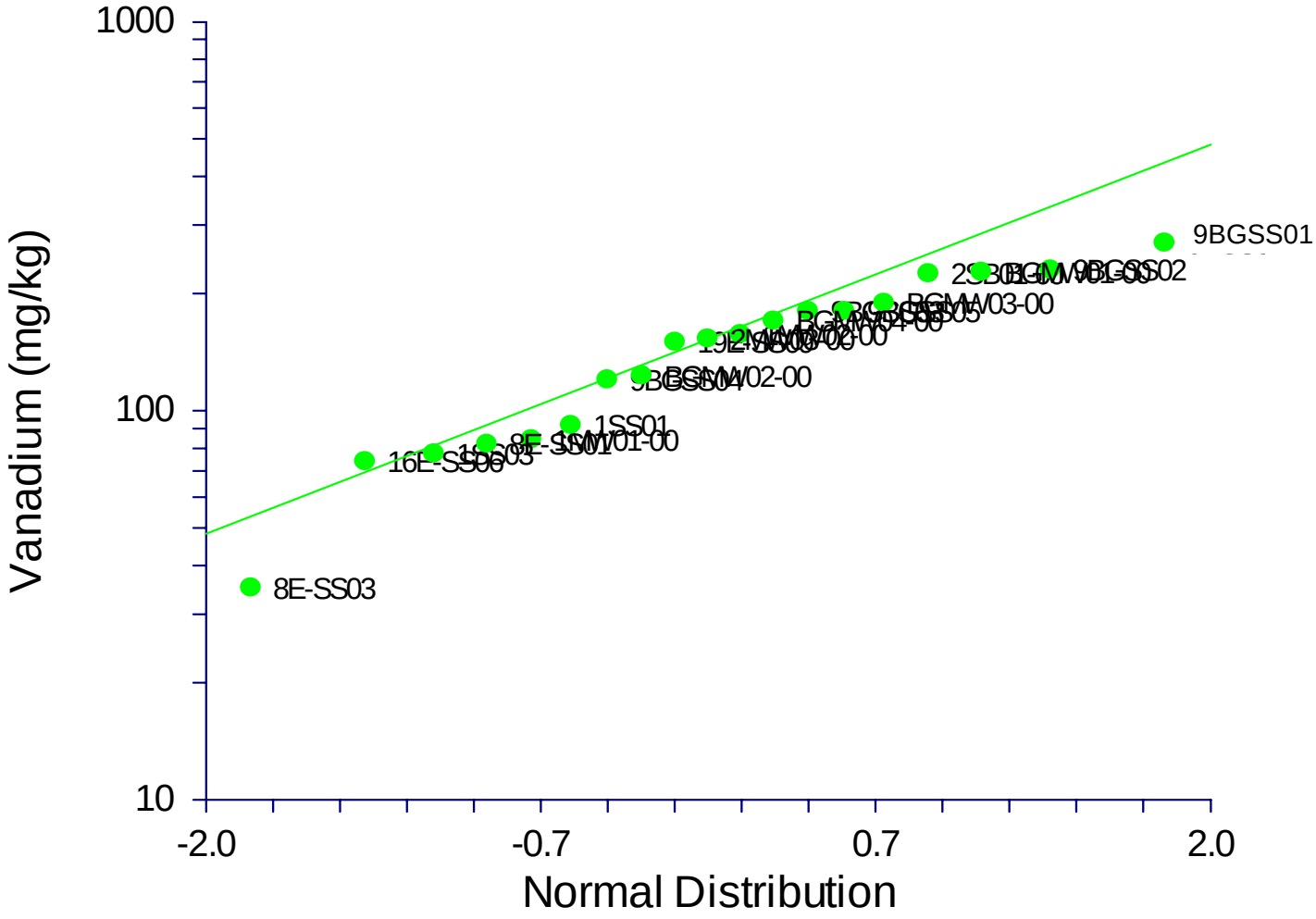


FIGURE 1
PROBABILITY PLOT OF VANADIUM IN NAPR
BACKGROUND SURFACE SOIL
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

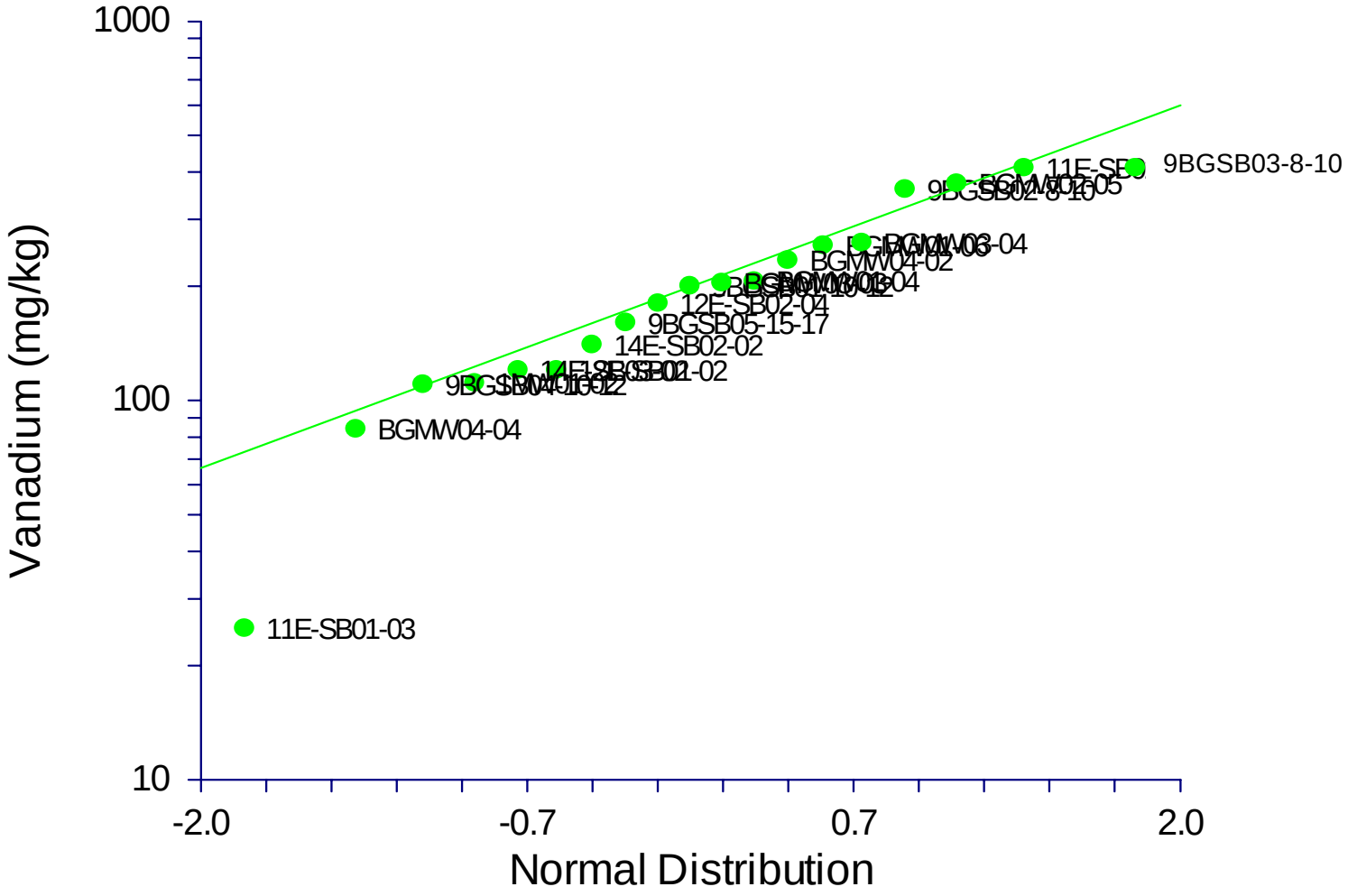


FIGURE 2
PROBABILITY PLOT OF VANADIUM IN NAPR
BACKGROUND SUBSURFACE SOIL
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

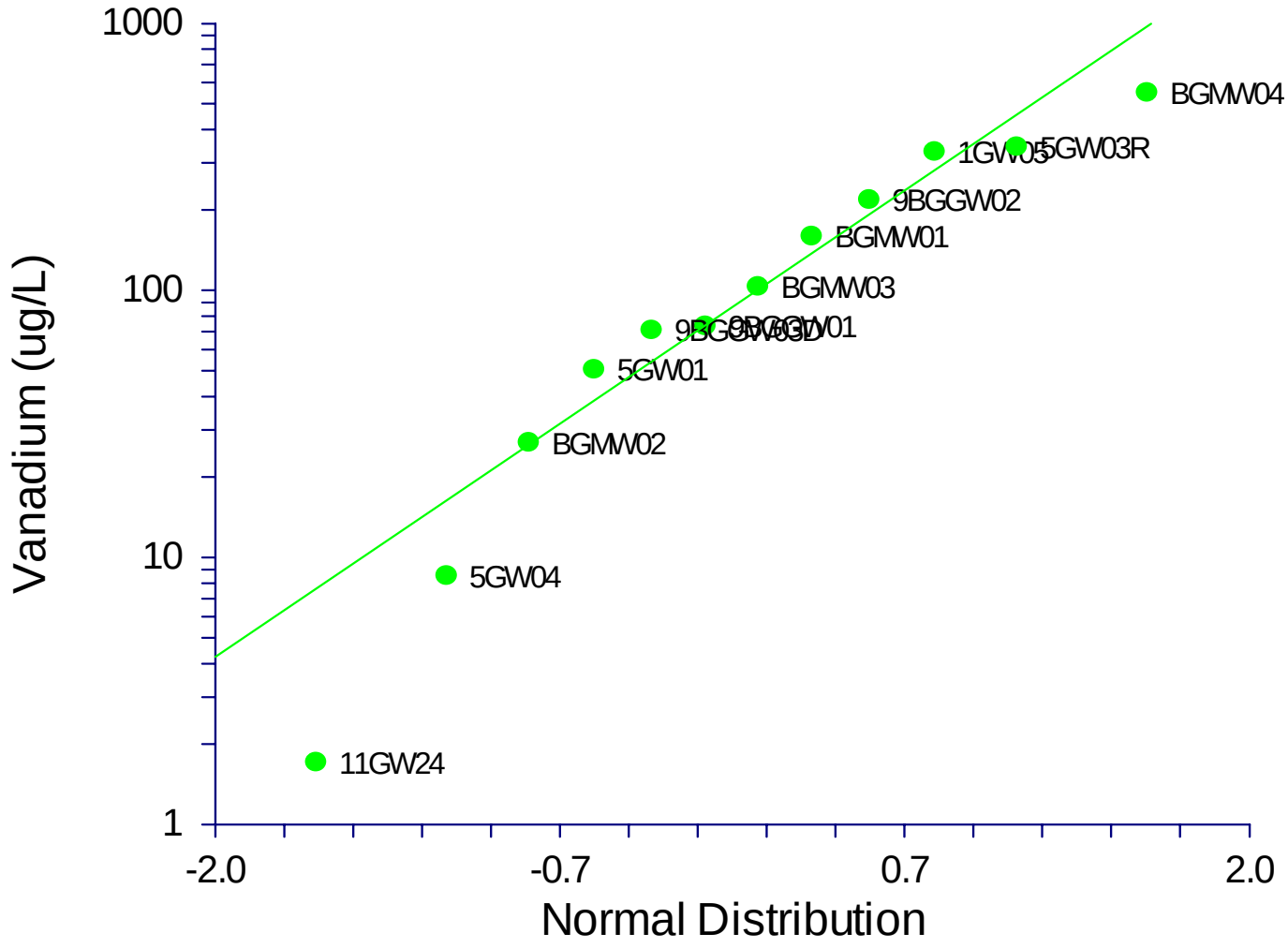


FIGURE 3
PROBABILITY PLOT OF VANADIUM IN NAPR
BACKGROUND GROUNDWATER
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

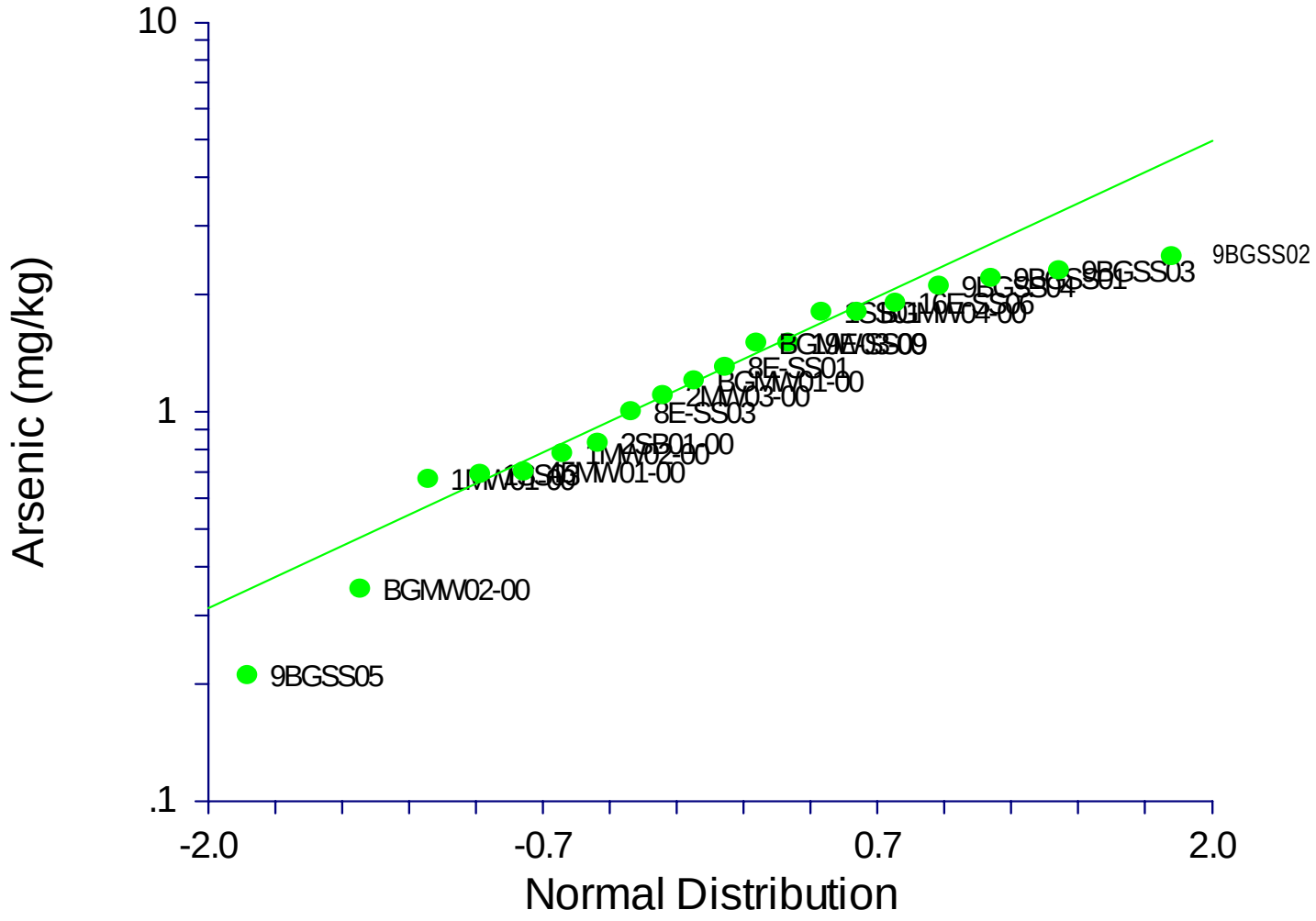


FIGURE 4
PROBABILITY PLOT OF ARSENIC IN NAPR
BACKGROUND SURFACE SOIL
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

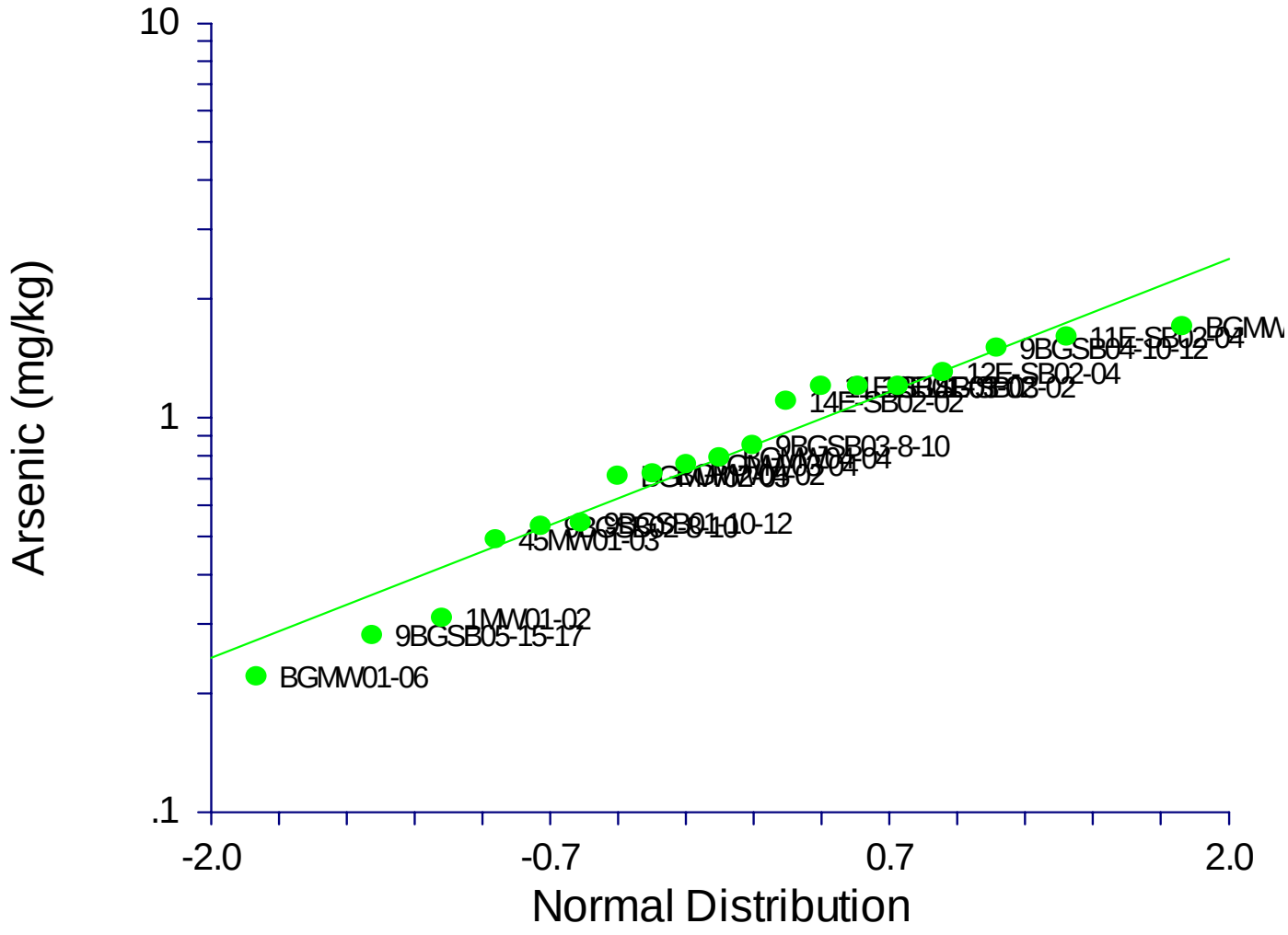


FIGURE 5
PROBABILITY PLOT OF ARSENIC IN NAPR
BACKGROUND SUBSURFACE SOIL
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

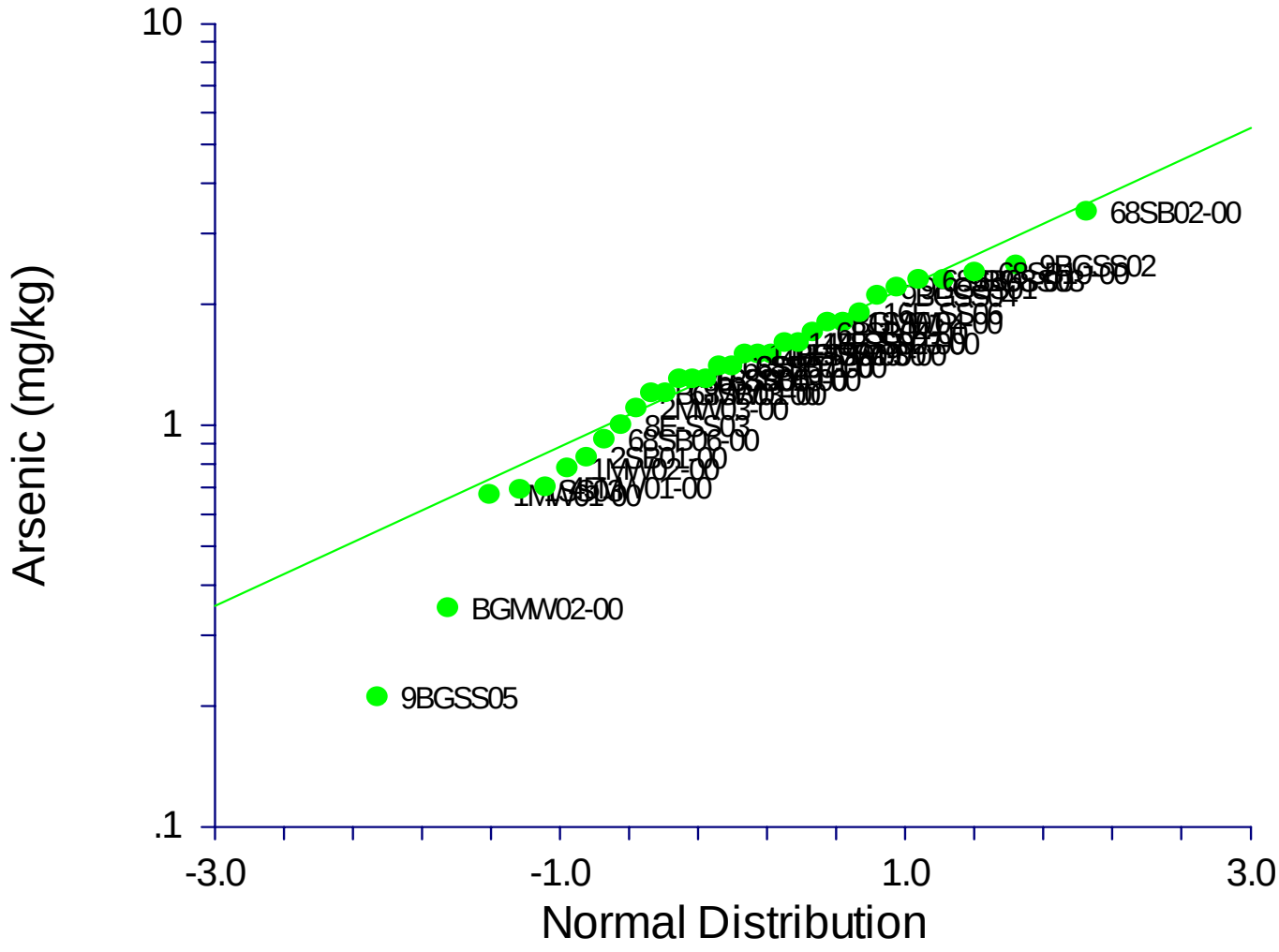


FIGURE 6
PROBABILITY PLOT OF ARSENIC IN NAPR
BACKGROUND AND SWMU 68 SURFACE SOIL
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

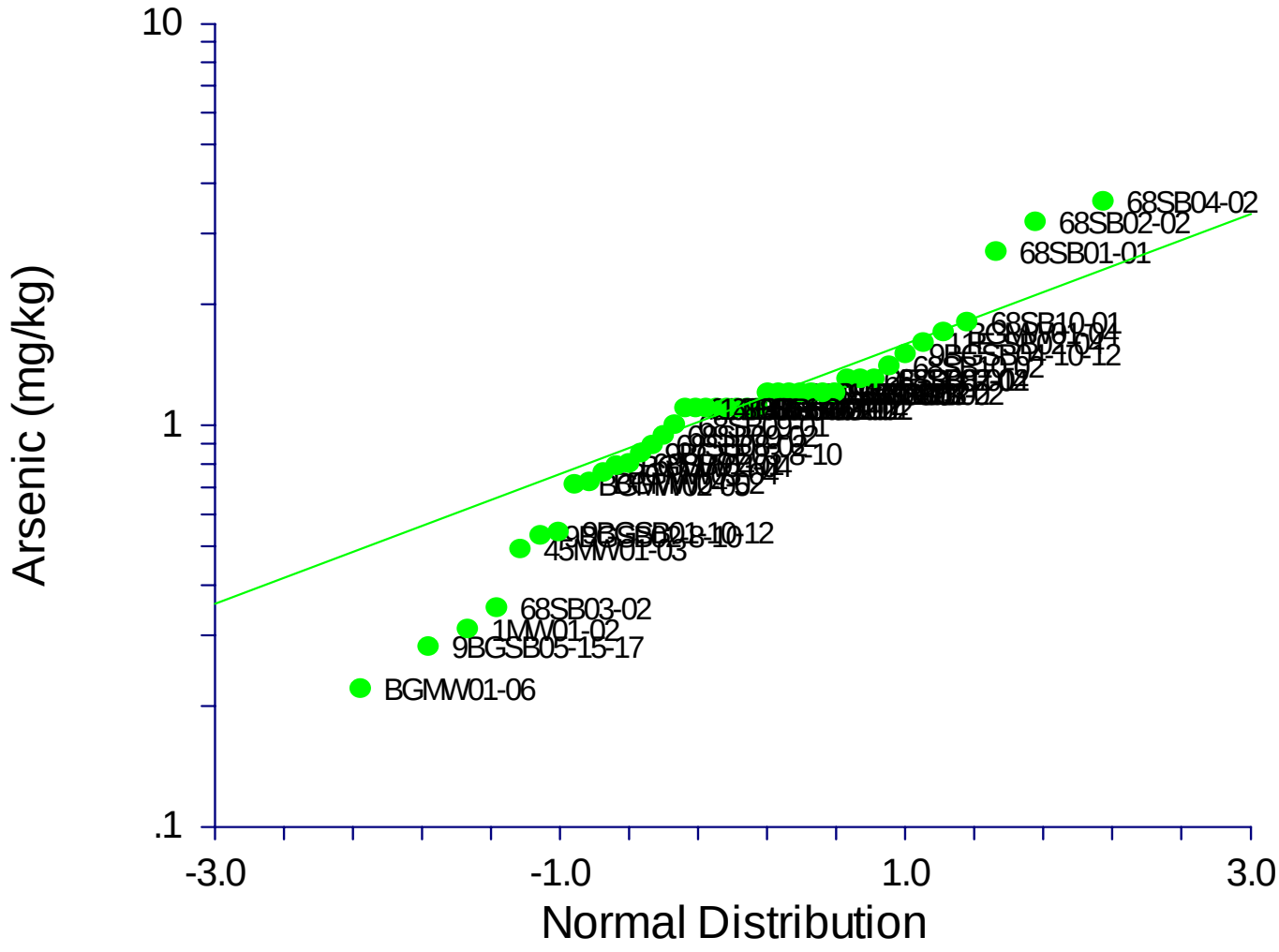


FIGURE 7
PROBABILITY PLOT OF ARSENIC IN NAPR
BACKGROUND AND SWMU 68 SUBSURFACE SOIL
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

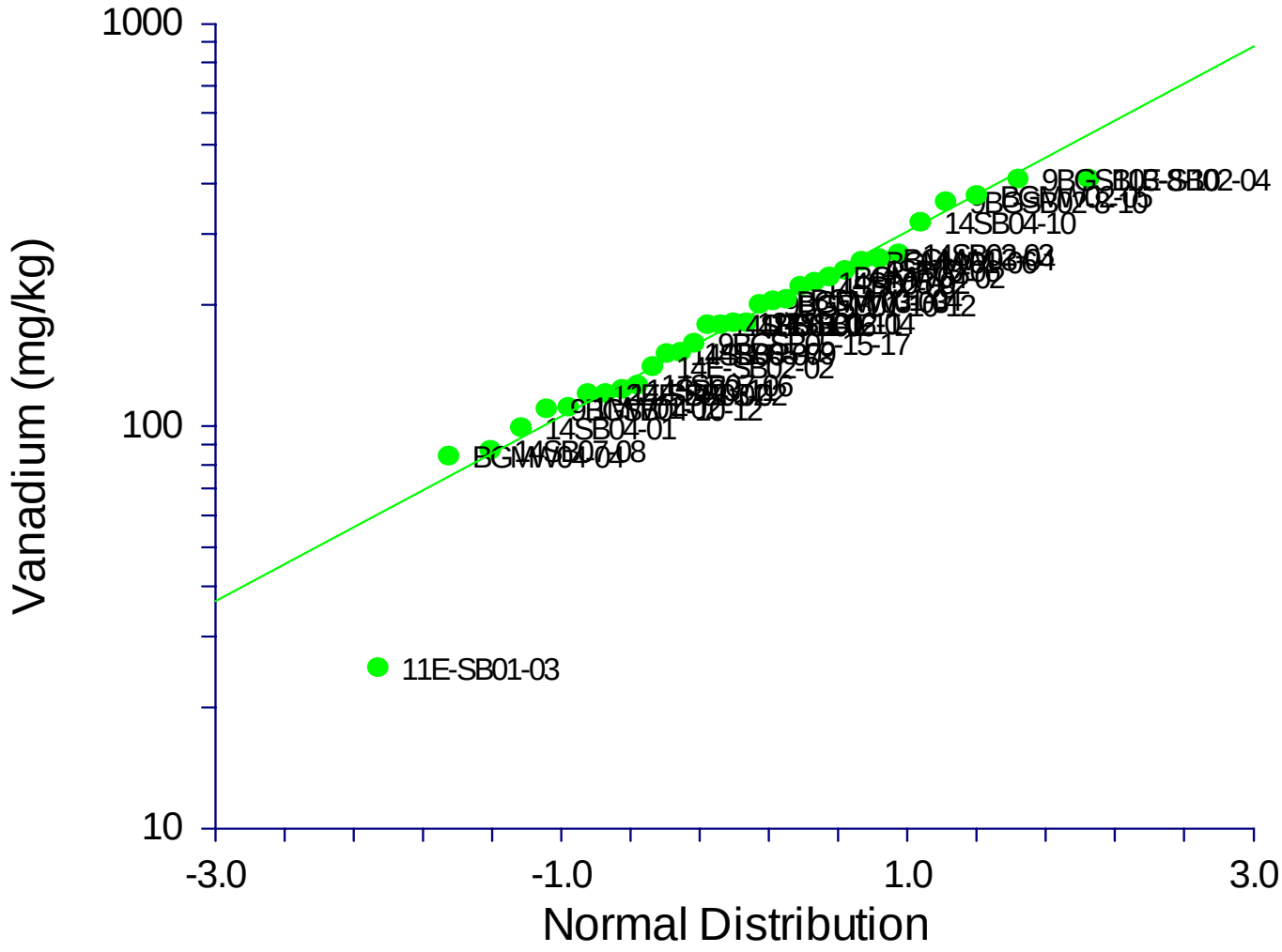


FIGURE 8
PROBABILITY PLOT OF VANADIUM IN NAPR
BACKGROUND AND SWMU 14 SUBSURFACE SOIL
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

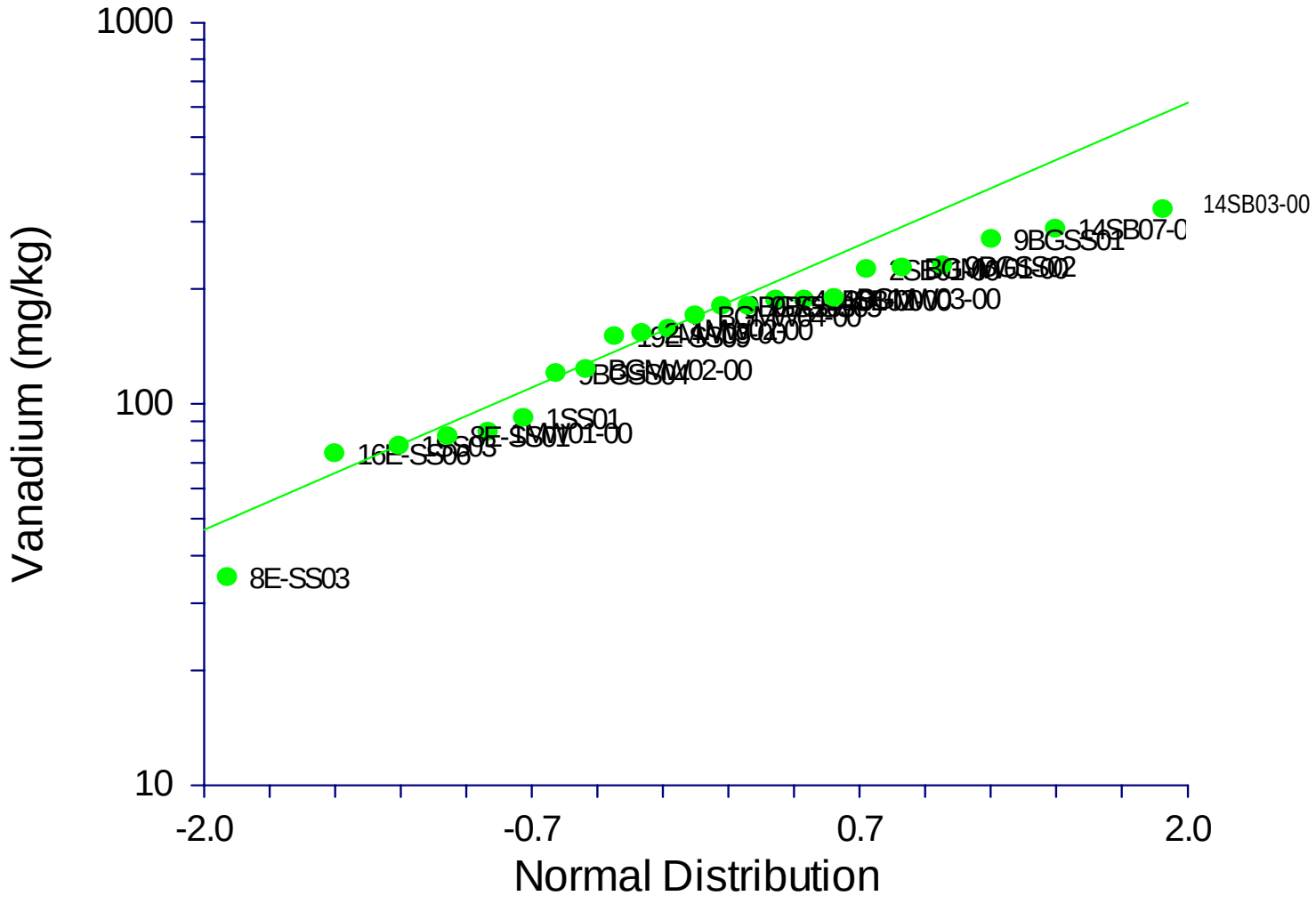


FIGURE 9
PROBABILITY PLOT OF VANADIUM IN NAPR
BACKGROUND AND SWMU 14 SURFACE SOIL
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

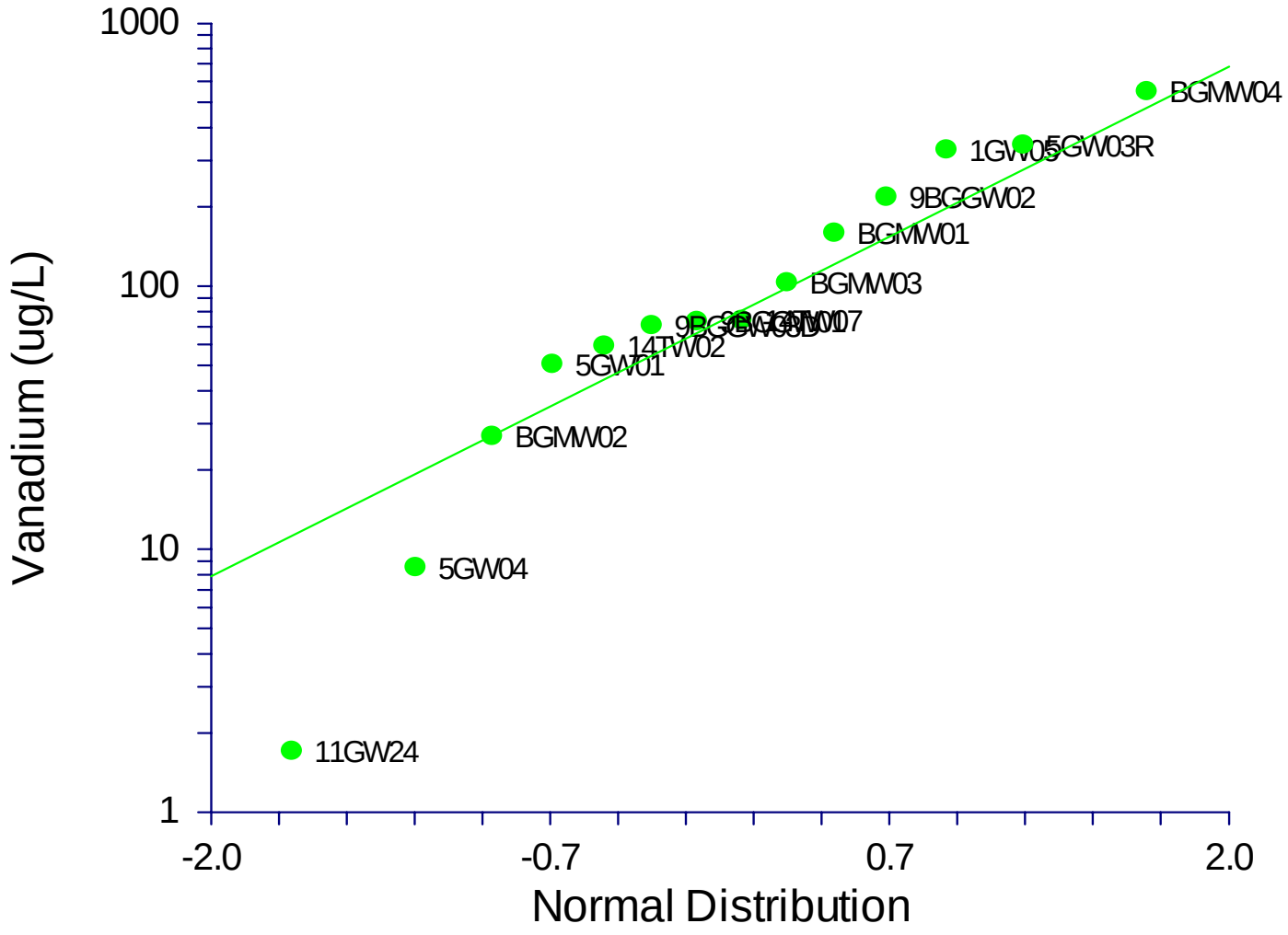


FIGURE 10
PROBABILITY PLOT OF VANADIUM IN NAPR
BACKGROUND AND SWMU 14 GROUNDWATER
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 2
290 BROADWAY
NEW YORK, NY 10007-1866

SEP 24 2007

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Mr. Mark E. Davidson
US Navy
BRAC PMO SE
4130 Faber Place Drive
Suite 202
North Charleston, SC 29405

Re: Naval Activity Puerto Rico (NAPR), formerly Naval Station Roosevelt Roads, EPA I.D. Number PRD2170027203,

1) August 2, 2007 Navy Responses to EPA Comments on Draft Phase I RFI Reports for SWMUs 16, 42, and AOC A;

2) July 20, 2007 Navy Responses to EPA Comments on Draft Final RFI Report for SWMU 14 (former "Crash-Crew" Fire Training Area), and SWMU 68 (former Southern Fire Training Area);

3) July 20, 2007 Draft Additional Data Collection Work Plan in Support of Ecological Risk Assessment for SWMU 14; and

4) Navy Responses to EPA's June 28, 2007 Comments on Draft Phase I RFI Reports on SWMUs 27, 28, and 29.

Dear Mr. Davidson:

This letter is addressed to you as the Navy's designated project coordinator pursuant to the January 29, 2007 RCRA Administrative Order on Consent ("the Consent Order") between the United States Environmental Protection Agency (EPA) and the U.S. Navy (the Navy). EPA Region 2 has completed its reviews of the above documents, which were submitted on behalf of the Navy, pursuant to the requirements of the Consent Order. Based upon our reviews, EPA has the following comments. Additional comments are also given in the three enclosed Technical Reviews prepared for EPA by our consultant, TechLaw, Inc.

Responses to EPA Comments on Draft Phase I RFI Reports for SWMUs 16, 42, and AOC A

EPA has completed its review of the Responses submitted on August 2, 2007 by Baker Environmental on behalf of the Navy. Those responses address EPA's June 11, 2007 Comments on the Draft Phase I RFI Reports for SWMUs 16, 42, and AOC A. EPA has determined that the Response to comments on the SWMU 16 RFI Report are acceptable; however, EPA does not fully concur with the Response to comments on the SWMU 42 and AOC A RFI Reports. Comments on the Navy's Responses are given in the enclosed Technical Review prepared for EPA by our consultant, TechLaw, Inc. EPA concurs with those comments. Those comments, and approaches to addressing them, especially those regarding natural background conditions for certain inorganic constituents, including arsenic and vanadium, were discussed with the Navy and Baker Environmental during a conference call held on September 20, 2007. Based on that conference call, please submit by 60 days from the date of your receipt of this letter, the following:

1) a revised Phase I RFI Report for SWMU 16, or Addendum to the Phase I RFI Reports, to reflect the revisions described in the Responses submitted on August 2, 2007 by Baker Environmental on behalf of the Navy; and

2) revised Responses and revised Draft Phase I RFI Reports for SWMU 42 and AOC A, or Addendums to those Phase I RFI Reports, addressing comments given in the enclosed Technical Review dated September 7, 2007, and the results of the September 20, 2007 Conference Call.

Responses to EPA Comments on Draft Final RFI Report for SWMU 14 and Draft Phase I RFI Report for SWMU 68:

EPA has completed its review of the Responses submitted on July 20, 2007 by Baker Environmental on behalf of the Navy. Those responses address EPA's May 29, 2007 Comments on the Draft Phase I RFI Report for SWMU 68 (former Southern Fire Training Area), and Draft Final RFI Report for SWMU 14 (former "Crash-Crew" Fire Training Area). EPA has determined that the Response to comments on the SWMU 14 and SWMU 68 RFI Reports are not fully acceptable. Comments on the Navy's Responses are given in the enclosed Technical Review prepared for EPA by our consultant, TechLaw, Inc. EPA concurs with those comments. The EPA comments were discussed with the Navy and Baker Environmental during a conference call held on September 20, 2007. Based on that conference call, please submit by 45 days from the date of your receipt of this letter a revised Responses to Comments for SWMU 14 and for SWMU 68, addressing comments given in the enclosed Technical Review dated August 21, 2007, and the results of the September 20, 2007 Conference Call. As discussed during the September 14, 2007 Conference Call, because additional work is to be implemented as part of the SWMU 14 and SWMU 68 RFIs, revised RFI reports do not need to be submitted at this time; however, those revised reports shall be submitted within 60 days of completion of all additional work required to be implemented as part of those RFIs.

Draft Additional Data Collection Work Plan in Support of Ecological Risk Assessment for SWMU 14

EPA has completed its review of the above work plan submitted on July 20, 2007 by Baker Environmental on behalf of the Navy. EPA has determined that the Draft Additional Data Collection Work Plan in Support of Ecological Risk Assessment for SWMU 14 is not fully acceptable. Comments on the draft work plan are given in the enclosed Technical Review prepared for EPA by our consultant, TechLaw, Inc. EPA concurs with those comments. Please submit by 45 days from the date of your receipt of this letter a revised work plan, addressing comments given in the enclosed Technical Review dated August 22, 2007

Navy Responses to EPA's June 28, 2007 Comments on Draft Phase I RFI Reports on SWMUs 27, 28, and 29.

As discussed with the Navy and Baker Environmental during the conference call held on September 20, 2007, please submit by 45 days from your receipt of this letter, either revised draft Phase I RFI Reports on SWMUs 27, 28, and 29 or Addendums to those Reports, and Responses to the comments given in EPA's June 28, 2007 letter, and the results of the September 20, 2007 Conference Call.

If you have any questions, please telephone me at (212) 637- 4167.

Sincerely yours,

Timothy R. Gordon
Remedial Project Manager
Caribbean Section
RCRA Programs Branch

Enclosures (3)

cc: Ms. Josefina Gonzalez, PREQB w/encls.
Mr. Julio I. Rodriguez Colon, PREQB w/encls.
Mr. Pedro Ruiz, Naval Activity Puerto Rico, w/encls.
Mr. Dave Criswell, US Navy, BRAC PMO, w/o encls.
Mr. Mark Kimes, Baker Environmental, w/encls.
Mr.Andrew Dorn, TechLaw Inc., w/o encls.
Mr. Felix Lopez, USF&WS, w/o encls.

Encl. #1

REVISED TECHNICAL REVIEW OF THE RESPONES DATED AUGUST 2, 2007 TO EPA AND TECHLAW COMMENTS NAVAL ACTIVITY PUERTO RICO DRAFT PHASE I RCRA FACILITY INVESTIGATION REPORT FOR SWMU 16, 42, and AOC A

NAVAL ACTIVITY PUERTO RICO
CEIBA, PUERTO RICO
EPA ID No. PR2170027203

Submitted to:

U.S. Environmental Protection Agency
Region 2
290 Broadway
New York, NY 10007-1866

Submitted by:

TechLaw, Inc.
One Penn Plaza, Suite 2509
New York, NY 10119

September 7, 2007

TECHNICAL REVIEW OF THE RESPONES DATED AUGUST 2, 2007 TO EPA AND TECHLAW COMMENTS NAVAL ACTIVITY PUERTO RICO DRAFT PHASE I RCRA FACILITY INVESTIGATION REPORT FOR SWMU 16, 42, and AOC A

DRAFT PHASE I RCRA FACILITY INVESTIGATION REPORT FOR SWMU 42 (REPORT)

GENERAL COMMENTS

Navy Response to EPA General Comment (regarding acrolein), Page 2 of 20: The Navy's response has partially addressed this comment. More information is required to assess why acrolein is not present. It is suggested that the Navy either validate their data or provide more information about the timeframe for acrolein application. The argument that acrolein was applied in a manner consistent with application does not preclude the need to evaluate this chemical since RCRA requires that all releases of hazardous waste or constituents be addressed.

Navy Response to EPA General Comment (regarding copper), Page 2 of 20: The Navy's response has not adequately addressed this comment. The response has not addressed the comment regarding copper as it only describes the results for vanadium. Ensure that the Report is revised as originally requested in Specific Comment 8.

Navy Response to EPA General Comment (regarding arsenic and vanadium in soil), Page 3 of 20: The Navy's response has not adequately addressed this comment. The comment discusses the probability plots for arsenic and vanadium used in evaluating the Upper Limit of Means (ULM) but does not adequately explain what these plots show or why they appear to show several populations. Probability plots are useful in visually determining whether a small data set follows a normal distribution and estimates the mean and standard deviation. However, these plots, although they fall below the accepted background concentration ULM, do not verify that there is no contamination. For example, *Figure 1 - Arsenic in Surface Soil* appears to show three separate populations and it is difficult to reconcile that all three populations are not reflective of arsenic contamination in surface soil although they do appear to fall below 2.59 mg/kg.

In addition, it is unclear why the data in *Figure 2 - Arsenic in Subsurface Soil* appears to form step patterns. These step patterns may be the result of different sampling rounds and/or reflect differing reporting limits. For example, the data included in the Table 3-1 of the October 2006 Background Report (Background Report) shows that the data was collected in 1999, 2000 and 2004. It is also unclear which data is shown in Figure 2. Is the arsenic subsurface soils data from the clay, fine sand/silt or weathered data? Arsenic subsurface soils also appear to show that there is some arsenic contamination in subsurface soils although below the ULM.

The vanadium background data raises similar questions related to sample collection times, reporting limit differences and the presence of multiple populations reflective of contamination. Please provide an explanation about why the probability plots differ from traditional probability plots; why they appear to show several different data populations; and acknowledge that the data may show arsenic and vanadium contamination, even though the concentrations are below the reported "background" levels. EPA has developed guidance to make valid comparisons between background concentrations and concentrations measured in soil samples at Superfund and RCRA sites. [EPA. 2002. Guidance for Comparing Background and Chemical Concentrations in Soil for CERCLA Sites. EPA 540-R-01-003. September 2002]. The background comparisons should be consistent with that guidance.

Navy Response to EPA General Comment (regarding a proposal for human health risks for potential exposure to lagoon sediment), Page 4 of 20: The Navy's response has partially addressed this comment. The response appears to address the comment for arsenic, vanadium and copper. However, more information is needed on acrolein. Please refer to the first comment discussing the Navy's response regarding acrolein. Furthermore, unless prior agreements have been made and/or the property is already restricted from residential development, please provide justification for the absence of an evaluation of future risk which would include an unrestricted land use scenario (i.e., consider performing the baseline human health risk assessment [HHRA] assuming that institutional or land use controls [IC/LUCs] are not in place and effective in precluding exposure) or quantitatively evaluate risk and hazard under residential land use conditions.

Navy Response to EPA General Comment (regarding unacceptable human health risks from potential exposure to lagoon sediment), Page 5 of 20: The Navy's response has not adequately addressed this comment. It is difficult to agree with the Navy's conclusion that the NAPR background groundwater set is representative of background conditions. The probability plot in Figure 5 appears to show several different populations of data reflected on the plot, but there is no discussion of potential contamination in groundwater although the concentrations are below the accepted background levels. Please refer to the General Comment response above regarding arsenic and vanadium in soil.

Navy Response to EPA General Comment (regarding a recommendation for Corrective Action Complete), Page 5 of 20: The Navy's response has partially addressed this comment. There does not appear to be a risk for arsenic, vanadium and copper at this time. However, more information is needed on acrolein. Please refer to the first general comment regarding the Navy's response concerning acrolein.

Navy Response to EPA General Comment (regarding background levels of vanadium in groundwater, Page 5 of 20: The Navy's response has not addressed this comment. It is difficult to agree with the Navy's conclusion that that the NAPR background groundwater set is representative of background conditions. The probability plot in Figure 5 appears to show several different populations of data reflected on the plot. Please refer to the General Comment response above regarding arsenic and vanadium in soil

SPECIFIC COMMENTS

1. **Section 4.1 Soil Boring Advancement and Temporary Well Installation:** The Navy's response has partially addressed Specific Comment 1. The sampling locations in Figure 4-1 of the Report vary from the proposed locations shown in Figure 3-5 of the approved Work Plan. If the soil borings are located as specified in the Work Plan, as stated in Navy's response, revise Figure 4-1 to show the actual sampling locations.

TECHNICAL REVIEW OF THE RESPONES DATED AUGUST 2, 2007
TO EPA AND TECHLAW COMMENTS
NAVAL ACTIVITY PUERTO RICO
DRAFT PHASE I RCRA FACILITY INVESTIGATION REPORT FOR
SWMU 16, 42, and AOC A

DRAFT PHASE I RCRA FACILITY INVESTIGATION REPORT FOR AOC A (REPORT)

SPECIFIC COMMENTS

4. **Section 4.2.2 Concrete Chip Samples:** The Navy's response has partially addressed Specific Comment 4. According to Section 3.6, Concrete Chip Sampling and Analysis Program of the Work Plan "if during the ½ inch deep sample collection procedure the field team has an indication that contamination may be below the top ½ inch, an additional sample will be collected from ½ inch to 1 ½ inches or deeper pending site conditions." Revise the RFI Report to provide the rationale for not collecting additional deeper concrete chip samples.

7. **Section 4.3.5 Equipment Rinsates:** The Navy's response has partially addressed Specific Comment 7. The Logbook in Appendix A.1 does not indicate whether the disposable stainless steel spoons were re-used for each sampling location. Furthermore, the response does not clarify why the equipment rinsate sample was collected a day before the concrete sampling, when the chisel would appear to be a non-disposable piece of equipment. Ensure that the report is revised as requested in Specific Comment 7.

8. **Section 5.5.2 STL Savannah SDG 22098-2:** The Navy's response has not addressed Specific Comment 8. The response has not explained why the sampling results for chip samples AOCACC02, AOCACC06, and AOCACC05 should be strictly qualified based on an equipment rinsate sample collected a day before the sampling date. As stated in Specific Comment 7, equipment blanks are collected to verify that non-disposable equipment have been adequately decontaminated. It does not appear appropriate to use an equipment rinsate sample collected a day before the environmental sample collection date to quantify data. Ensure that the Report is revised as requested in Specific Comment 8.

10. **Tables:** The Navy's response has partially addressed Specific Comment 10. Ensure that the Report is revised as requested in Specific Comment 10.

Encl. #2

NAVAL ACTIVITY PUERTO RICO
CEIBA, PUERTO RICO
EPA ID NO. PR2170027203

TECHNICAL REVIEW OF THE NAVY RESPONSES TO COMMENTS DATED MAY 29, 2007 (SWMU NOS. 14 AND 68)

DATED JULY 20, 2007

Submitted to:

U.S. Environmental Protection Agency
Region 2
290 Broadway
New York, NY 10007-1866

Submitted by:

TechLaw, Inc.
One Penn Plaza, Suite 2509
New York, NY 10119

Task Order No.	**002**
Contract No.	**EP-W-07-018**
U.S. EPA TOPO	**Timothy Gordon**
Telephone No.	**212-637-4167**
TechLaw TOM	**Andrew Dorn**
Telephone No.	**312-345-8963**

August 21, 2007

NAVAL ACTIVITY PUERTO RICO
CEIBA, PUERTO RICO
EPA ID NO. PR2170027203

TECHNICAL REVIEW OF THE NAVY RESPONSES TO COMMENTS DATED MAY 29, 2007 (SWMU NOS. 14 AND 68)

DATED JULY 20, 2007

The following comments were generated based on review of the July 20, 2007 *Navy Responses to Comments dated May 29, 2007*. Except as noted in the General and Specific Comments below, the Navy's responses to comments are adequate.

GENERAL COMMENTS

1. The Navy's responses to EPA's General Comment regarding the validity and use of the October 17, 2006 "Revised Final Summary for Environmental Background Concentrations for Inorganic Constituents Report" (Background Report) is not adequate at this time. The EPA noted that "the base-wide background concentrations for arsenic, lead, and particularly vanadium … may not be fully representative of natural background conditions in the SWMU 68 area and/or may have been impacted by contaminant releases." Specifically, the EPA states that three of the subsurface soil samples used in the Background Report "were collected during the 2004 Environmental Conditions of Property (ECP) investigations at what subsequently became identified as SWMU 68" and that "all [three samples] may have been impacted by contamination, based on reported indications of 'DRO' (diesel range organics) in those samples." In addition, the EPA notes that there is no rationale provided in the Background Report as to why vanadium would occur naturally at such high concentrations at this site.

   In response, the Navy provides a statistical comparison to U.S. Geological Survey (USGS) vanadium data for Puerto Rico. The logic of comparing 19 vanadium sample results to 292 vanadium sample results is unclear. The text on page 2 states "As evidenced by Table 1, the range of vanadium concentrations within the NAPR background data set falls within the range of concentrations within the USGS data set." The USGS data set is so large, taking into account the entire island of Puerto Rico, and the range is so broad that it appears that any data would fall within this range. In addition, this does not appear to address the question of the site specific concentrations at SWMU 68, which may pose a current or future risk to residential or industrial users.

Based on this, it appears that supplemental discussion is necessary for this response. First, the Navy should address more specifically those samples identified above by EPA and discuss whether they may themselves be impacted by contamination. Second, additional information regarding the USGS data should be provided to confirm that this data is an adequate standard for comparison to base-wide data. Finally, additional discussion is necessary to address EPA's concern regarding the lack of rationale provided as to why vanadium would occur naturally at such high concentrations at this site.

2. The Navy does not provide sufficient information regarding the summary statistics for either the Background Report data or the site specific data. Without additional information regarding these statistics, the following concerns were identified:

Table 2, Summary Statistics and Results – Vanadium in NAPR Background and SWMU 68 Surface Soil, states that the surface soil data for vanadium is normally distributed. Based on Figure 1, Probability Plot of Vanadium in NAPR Background Surface Soil, this appears inaccurate. Figure 1 appears to show left skewness and/or potentially a mixture of several normal distributions.

Table 3, Summary Statistics and Results – Vanadium in NAPR Background and SWMU 68 Subsurface Soil, and Table 4, Summary Statistics and Results – Vanadium in NAPR Background and SWMU 68 Groundwater, indicate that the subsurface soil and groundwater data are lognormally distributed. However, Figure 2, Probability Plot of Vanadium in NAPR Background Subsurface Soil, and Figure 3, Probability Plot of Vanadium in NAPR Background Groundwater, are labeled "Normal Distribution." These figures should be log plots.

Finally, it appears that in parts of the analysis, the Navy compares different types of distributions to one another. For example, in Table 6, Summary Statistics and Results – Arsenic in NAPR Background and SWMU 68 Subsurface Soil, gamma and lognormal distributions are compared. In addition, Figure 7, Probability Plot of Arsenic in NAPR Background and SWMU 68 Subsurface Soil, compares both these data sets on a plot labeled "Normal Distribution."

For each data set presented in this document, provide summary statistics regarding distributions, skewness, kurtosis, correlation coefficients, etc. In addition, update the probability plots as discussed above where discrepancies are present. Finally, discuss why the same element has different distributions at the site and please provide rationale as to why this information can be compared in the manner currently presented.

3. As described in the tables provided, the term "positive detections" is not adequately defined. Define this term and discuss how the detection limits are treated within these statistical tests.

SPECIFIC COMMENTS

1. **Navy Response to EPA Comment No. 1, SWMU 68, Page 3.** The third paragraph of this response concludes with "For each medium, the maximum, mean, and 95% UCL background concentration exceeds maximum, mean, and 95% UCL concentrations for SWMU 68." This statement is incorrect. As stated in Section 5.3, Subsurface Soils, of the Phase I RCRA Facility Investigation Report for SWMU 68, NAPR dated March 26, 2007 (SWMU 68 Report), and as reiterated by the EPA General Comment, "vanadium exceeded its background screening level at ... one location." Please revise this response to account for this discrepancy.

   In addition, since vanadium does exceed background chemical levels in this subsurface sample, further discussion is necessary to adequately respond to EPA Comment No. 2 for SWMU 68. Specifically, the Navy should provide additional discussion as to the potential human health risks resulting from vanadium in the subsurface soil.

2. **Navy Response to TechLaw Specific Comment No. 6, SWMU 68, Page 9.** This response is not adequate at this time. As indicated in TechLaw's original comment, the arsenic contamination identified on the northern portion of the site was not adequately bounded to the north in the initial investigation. The final sentence of TechLaw's comment states "If this statement cannot be supported by a statistical analysis, identify additional arsenic characterization and remediation as an activity for future work at SWMU 68." Based on the statistical analyses presented, the arsenic contamination located at the northern portion of this site is not representative of natural background concentrations. Therefore, additional characterization of this contamination is warranted, specifically to define the extent of contamination to the north

Encl. #3

NAVAL ACTIVITY PUERTO RICO
CEIBA, PUERTO RICO
EPA ID NO. PR2170027203

TECHNICAL REVIEW OF THE Draft Additional Data Collection Work Plan in Support of Ecological Risk Assessment, SWMU 14

DATED JULY 20, 2007

Submitted to:

U.S. Environmental Protection Agency
Region 2
290 Broadway
New York, NY 10007-1866

Submitted by:

TechLaw, Inc.
One Penn Plaza, Suite 2509
New York, NY 10119

Task Order No.	**002**
Contract No.	**EP-W-07-018**
U.S. EPA TOPO	**Timothy Gordon**
Telephone No.	**212-637-4167**
TechLaw TOM	**Andrew Dorn**
Telephone No.	**312-345-8963**

August 22, 2007

NAVAL ACTIVITY PUERTO RICO
CEIBA, PUERTO RICO
EPA ID NO. PR2170027203

TECHNICAL REVIEW OF THE Draft Additional Data Collection Work Plan in Support of Ecological Risk Assessment, SWMU 14

DATED JULY 20, 2007

Please find below TechLaw's review of the *Draft Additional Data Collection Work Plan in Support of Ecological Risk Assessment, SWMU 14* (WP), Naval Activity Puerto Rico EPA I.D. No. PR2170027203 Ceiba, Puerto Rico, dated July 20, 2007.

The WP provides only a partial sampling approach to address the data gaps in the Screening Ecological Risk Assessment (SERA) and generate data in support of the Baseline Ecological Risk Assessment (BERA). Several technical issues are identified below, which will require further clarification before the WP can be implemented.

GENERAL COMMENTS

1. The WP addresses data gaps from past studies. These data gaps were large enough that a full evaluation of ecological risk from exposure to soil, surface water and sediment could not be completed. The WP proposes only to collect additional soil samples without obtaining surface water and sediment samples. The WP describes a "somewhat phased" approach pending the proposed soil sample results. It is indicated that additional media may be sampled only if the soil analysis yields concentrations above 'ecologically important values'. The most 'valued ecological resource' in the area is the adjacent wetland (PEM1). It is critically important to sample the entire flow pathway from SWMU 14 to and including the wetland. The analytical results (soil sediment and surface water) will then provide the data to assess the ecological risk concerns with the wetland. Revise the WP to include a surface water and sediment sampling component for the wetland.

2. The WP refers to 'ecologically important concentrations' several times (Subsection 1.1, second paragraph) without clearly defining the meaning of this term. It is later defined (Subsection 2.4.3, pg 2-6) as 'concentrations that are greater than soil screening values and statistically elevated above background concentrations'. This definition indicates that 1) the soil screening values have already been identified, and 2) a method has been developed to establish background concentrations and make statistical comparisons. Both the soil screening levels and background evaluation method need to be described to complete the WP. Several resources were referenced (e.g., Baker, 2006 'Final Summary Report for Environmental Background Concentrations of Inorganic Compounds') without

describing how these resources would be used with the new data. The WP needs to be revised to provide a complete list of soil screening values (and their sources) and to describe the method for background comparisons that will be used in the revised SERA and BERA.

3. It is unclear in the WP how the fire pit will be handled in the future (refer to Subsection 2.3). It is unknown if the pit will remain as is or will be returned to a more natural setting. Future use is an important consideration to the SERA/BERA process as it may affect the choice of assessment and measurement endpoints. If SWMU 14 is to retain a physically disturbed character, then potential for ecological risk can be placed into context with the surrounding land use. On the other hand, if SWMU 14 were to transition to more valuable habitat, then a more thorough evaluation of risk may be warranted since exposure settings could change over time. Please revise the WP to describe the anticipated future land use for SWMU 14 and whether this use would affect the scope of work described in the WP.

4. Excluding groundwater from the ERA process is not well supported. The general statements describing the groundwater setting (bullet points on page 2-5) are not supported by quantitative groundwater flow information. A groundwater connection to the adjacent wetland cannot be excluded in the absence of groundwater flow pathway information. Please update the WP to include more substantial information to support the position that groundwater does not represent an exposure point for ecological receptors.

5. The WP indicates that samples will be analyzed for a targeted set of chemicals (PAHs and metals) which were detected in earlier studies. It is suggested that the organic carbon (OC) content and pH of the soil samples be measured. The OC content will provide an indication of bioavailability for the PAHs if the soil were to become sediment. Certain metals (e.g., aluminum) also become bioavailable at specified pH levels. Integrating chemical concentrations with OC and pH will help support more definitive risk conclusions. It is suggested that these two parameters be included in the analysis program.

6. The WP proposes to analyze a single surface soil sample for dioxins/furans. It appears that this minimalist approach is attributable to the lack of a source associated with past activities at the pit. Regardless, the WP needs to clearly state the rationale behind the decision to analyze only one surface soil sample for dioxins/furans.

7. The WP needs to be thoroughly revised in order to link the figures to the text. It is unclear what purpose the figures serve and why certain types of information are provided within them (e.g., polygons of information in Figure 1-2). It is also suggested that the location of the PEM wetland be clarified in Figure 3-1 in order to place the proposed sampling program in relation to the target wetland. Please revise the WP and include only those figures with relevant information to the project.

8. Table 2-1 summarizes the previous SERA findings. However, in order to better understand the potential risk conditions, it is suggested that the actual calculated HQs for those detected chemicals with HQs > 1 be presented. This additional information will highlight which chemicals are the import risk drivers. Please revise Table 2-1 to include the actual, calculated HQs for the detected chemicals.