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Patricia McFadden, Remedial Project Manager
Engineering Field Activity West
Naval Facilities Engineering Command
San Bruno, California

TECHNICAL MEMORANDUM
ESTIMATION OF AMBIENT METAL CONCENTRATIONS IN SHALLOW GROUNDWATER

ALAMEDA POINT
ALAMEDA, CALIFORNIA

August 1998

Prepared By
TETRA TECH EM INC.
10670 White Rock Road Suite 100
Rancho Cordova, California 95670
(916) 852-8300

Matt Udell, Project Manager

CONTENTS

FIGURES

TABLES

Table **Page**

1.0 INTRODUCTION

This technical memorandum describes Navy's approach for estimating the concentrations of ambient metals in shallow groundwater at Alameda Point and presents the ambient metals concentrations determined for the shallow groundwater. The term "shallow groundwater" refers to the first water-bearing zone at Alameda Point. The second water-bearing zone was not evaluated due to extensive salt water intrusion. The estimated concentrations of ambient metals are intended for use in the baseline human health risk assessment (HHRA), ecological risk assessment (ERA), and the remedial investigation (RI) of the Installation Restoration Program (IRP) sites at Alameda Point. The approach for estimating the concentrations of ambient metals in groundwater documented in this technical memorandum was discussed and agreed upon during technical and base realignment and closure (BRAC) cleanup team (BCT) meetings between the Navy and the regulatory agencies in April and May, 1998.

1.1 PURPOSE

Inorganic constituents in groundwater may be naturally occurring, the result of contamination by a potentially responsible party (PRP), or anthropogenic (resulting from human activities unrelated to a PRP). Since inorganic constituents occur naturally in groundwater, it is important to determine if naturally occurring inorganic constituents, specifically metals, are chemicals of concern (COC). COCs are an integral part of the baseline HHRA and ERA. Metals are COCs when detected in groundwater samples above the estimated background concentration. The term "background" is typically used to describe naturally occurring levels of inorganic constituents in groundwater. A distinction between the term "background" and the term "ambient" will be made later in this section. Comparing the IR site data to background data is designed to (1) limit remediation of chemicals that are present in the environment due to natural or non-PRP causes, and (2) focus the RI on contamination that poses a risk to human health or the environment. Finally, if remediation is required at a site, background values are considered when establishing cleanup goals.

Metals occur naturally in groundwater, the concentrations of which vary among locations. These inherent variations in metals concentrations can potentially arise from several factors, including (1) differences in overlying soil characteristics in the recharge zone, (2) differences in subsurface hydrostratigraphy, (3) differences in geochemistry, and (4) position within the groundwater flow system.

Some concentrations of metals in groundwater at Alameda Point may not be naturally occurring, but are unrelated to Naval activities at Alameda Point. A review of the history of Alameda Point construction indicates that almost the entire facility is located on marshland, tidal flats, and bay margin (submerged land) that has been filled with sediment dredged from the Oakland Inner Harbor, San Francisco Bay, and the ship channel/ Seaplane Lagoon area. The species and concentration of metals present in the fill sediment are not known, but may have been impacted by industrial activities along the Oakland Bayshore and Alameda Island pre-fill bay margins. Because the term "background" typically refers to concentrations that are present naturally, it is more appropriate to use the term "ambient" to describe the concentrations of metals that are not related to site-specific contamination. The term "ambient" is used in this technical memorandum to describe levels of inorganic constituents in groundwater that are unrelated to site-specific Naval activities.

Because ambient concentrations in groundwater are expected to vary among locations within a single hydrostratigraphic unit, it is appropriate to consider ambient concentrations as a distribution of values rather than a single value due to the natural variation of metals in the environment. For the purpose of screening potential COCs for risk assessment, it is often more practical to use a single value (a high value on the upper end of the ambient distribution) to determine whether the levels of inorganic constituents at an IR site are significantly higher than ambient concentrations. Use of a value at the low end or middle of the ambient distribution might suggest risk due to naturally occurring metals. This approach is more straightforward than trying to compare the distribution of the ambient data to the distribution of the IR site data. The ambient concentrations discussed and presented in this memorandum represent the estimated high value on the upper end of the ambient distribution. When comparing the ambient concentrations presented in this document to IR site data in future risk assessments, the distribution of the concentrations of ambient metals will also be considered.

1.2 APPROACH

During technical meetings between the Navy and regulatory agencies held on April 28 and 29, 1998, the BCT decided to follow a statistical approach for the determination of the concentrations of ambient metals in groundwater similar to that used to determine the concentrations of ambient metals in soils at Alameda Point (Tetra tech EM Inc. [TtEMI] 1997). This simplified approach was followed because of the transitory nature of groundwater and the following factors arising from the construction of Alameda Point:

- The presence of anthropogenic metals in fill sediment
- The slow leaching of both naturally-occurring and anthropogenic metals from the marine sediments into the groundwater
- The marine-derived fill sediment was placed in a column of sea water which now serves as the aquifer material for the first water bearing zone
- The disequilibrium of groundwater chemistry due to the slow flushing of saline connate water from the pore spaces and the large geochemical gradients that occur within small horizontal and vertical distances
- Existing and potential future sea water intrusion induced by remediation- or supply-based pumping

In consultation with the BCT, the Navy proposed estimating the concentration limits of ambient metals in the following manner:

- Select well locations that appear to be unaffected by IR site-related contamination to create an initial data set to be used to determine ambient concentrations of metals
- Compare all organic groundwater data from the initial data set to the 1996 tap water preliminary remediation goals (PRG) to exclude impacted wells
- Examine the initial data set using probability plots and Rosner's test to exclude outlier concentrations of metals
- Test the remaining data (without outliers) for normality using a statistical graphics program
- Prepare summary statistics and estimate the ambient concentrations of metals from the tested data set

Sections 2 and 3 of this report provide a detailed description of the process used to develop the ambient metals data set and the statistical procedure used to estimate the concentrations of ambient metals in groundwater at Alameda Point.

2.0 MONITORING WELL SELECTION AND DATABASE COMPILATION

Beginning in 1991, a number of environmental and geotechnical studies were conducted at Alameda Point in an effort to characterize environmental contamination that may have been caused by past activities at the air station. Over 260 monitoring wells were installed during these previous investigations. These monitoring wells form the monitoring well network that was sampled for at least four quarters and was used to develop the ambient metals data set discussed in this report.

The data set used to determine the concentrations of ambient metals in groundwater was limited to groundwater samples collected from the first water-bearing zone. Groundwater samples collected from the second water-bearing zone were not included in the data set due to extensive saltwater intrusion and the inherent inability of analytical methods to detect trace metals in the presence of very high levels of marine salts.

Prior to the development of the current approach to estimate ambient metals concentrations in groundwater, four wells within the monitoring network (MBG-1, MBG-2, MBG-3, and MBG-4) were identified as ambient wells. However, based on our current approach these wells are not considered representative of shallow groundwater conditions at Alameda Point due to limited coverage and the small size of the data set. To achieve better lateral coverage and to expand the population of wells to be considered in estimating ambient concentrations, a working meeting was held between the Navy and regulatory agencies on May 11, 1998 to identify potential ambient wells using the criteria discussed below.

Monitoring wells were designated on a location-by-location basis as potential ambient wells if they met the following criteria:

- The well must not be located at an IR site that contains metals contamination based on site history
- The well must be located upgradient or cross-gradient from known sources of contamination at Alameda Point
- The well must not be located within any existing or previously identified organic contaminant plume
- The well must not be contaminated by any organic compound during any sampling event unless the detection was infrequent and the concentration was below 1996 tap water PRGs for the given compound

Based on the May 11, 1998 technical meeting and a subsequent comparison of potential ambient wells to tap water PRGs, 35 wells were identified as being unaffected by IR site-related groundwater contamination. These wells are referred to in this report as "unaffected wells". The 35 unaffected wells are as follows:

DRA-01	M013-A	M06-03	M108-A	M15-03
M003-E	M014-A	M06-05	M110-A	MBG-1
M006-A	M015-A	M07C-08	M117-E	MBG-2
M007-A	M025-E	M103-A	M12-02	MBG-3
M008-A	M026-A	M105-A	M12-04	MW530-3
M010-A	M026-E	M106-A	M13-08	MWOR-4
M012-A	M031-A	M107-A	M15-01	MWC2-1

Figures 1 through 3 show the locations of all wells initially screened (black symbol) and the locations of the 35 unaffected wells (red symbol) in each region of Alameda Point in relation to IR sites, contaminant plumes, and the direction of groundwater flow.

Filtered metals data, analyzed using Contract Laboratory Program (CLP) methodology, were used to constitute the ambient metals data set. Unfiltered metals data were not used due to large variations in turbidity values typically associated with unfiltered samples. Each of the 35 wells was sampled at least four times during the quarterly sampling; therefore, up to 188 separate measured concentrations were potentially available for each metal. However, fewer concentrations were available for hexavalent chromium due to infrequent analysis and for molybdenum due to analytical difficulties. A copy of the ambient data set was transmitted to the BCT for their review.

A question was raised by the BCT following their review, concerning the number of wells with reporting or method detection limits (MDL) that exceeded the 1996 tap water PRGs. After reviewing the data set, at least one chemical in all 35 wells yielded an MDL or reporting limit which exceeded the chemical-specific PRG. It is important to note that no chemical was actually detected above PRGs; only the numerical laboratory MDLs (without an actual chemical detected) exceeded a chemical-specific PRG.

Based on the aforementioned analysis, a discussion was held at the May 19, 1998 BCT meeting regarding wells with chemical-specific MDLs above PRGs. The BCT decided to retain all wells with a chemical-specific MDL exceeding the respective PRG due to the following factors:

- The MDLs represent the technologic limits of current (1998) analytical methods (the data were collected from 1991 to 1995),
- The low potential for a release in the vicinity of a proposed well, since the monitoring wells selected are not located near an IR site,

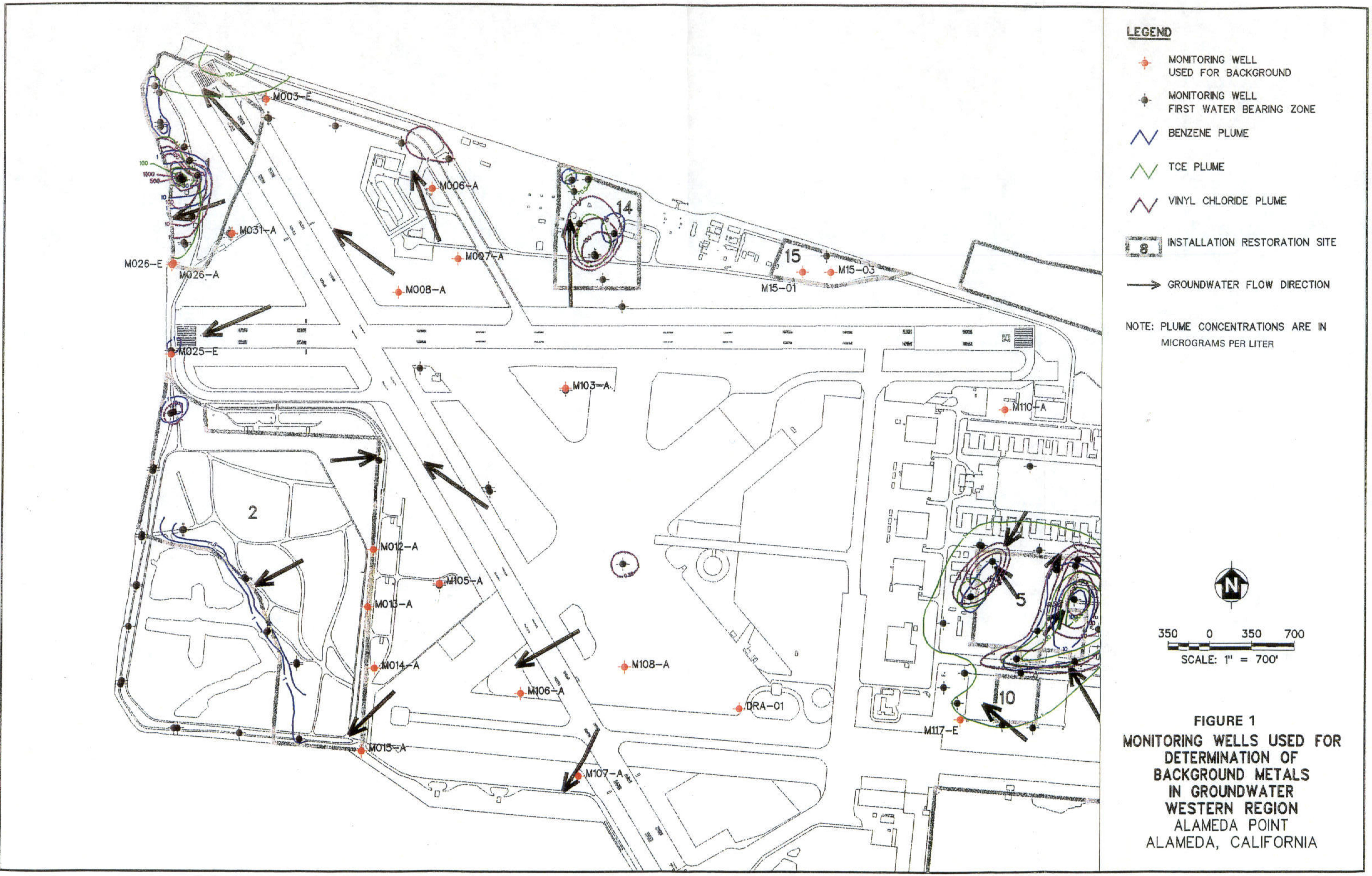

FIGURE 1
MONITORING WELLS USED FOR DETERMINATION OF BACKGROUND METALS IN GROUNDWATER WESTERN REGION
ALAMEDA POINT
ALAMEDA, CALIFORNIA

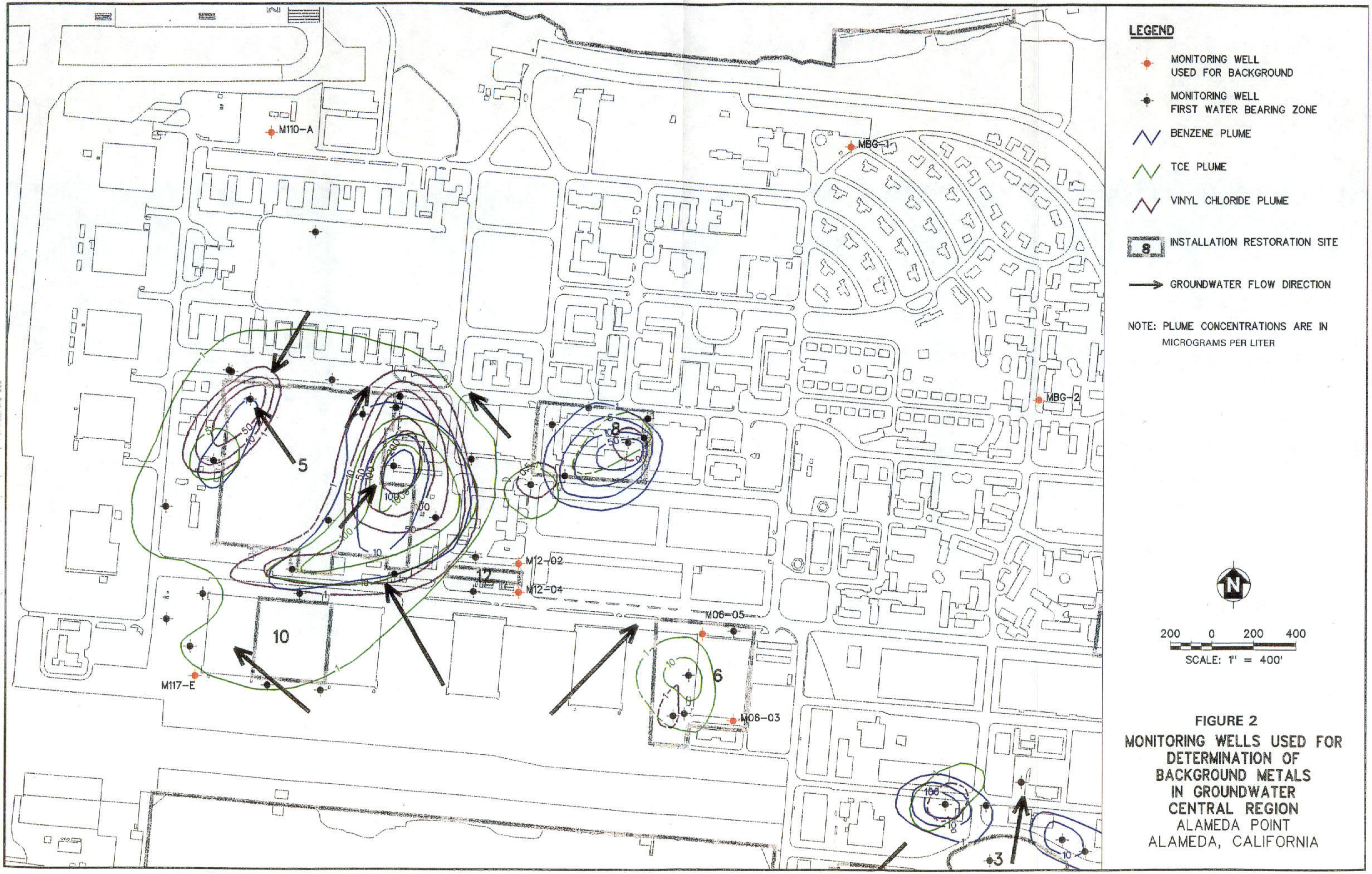

FIGURE 2
MONITORING WELLS USED FOR DETERMINATION OF BACKGROUND METALS IN GROUNDWATER CENTRAL REGION
ALAMEDA POINT
ALAMEDA, CALIFORNIA

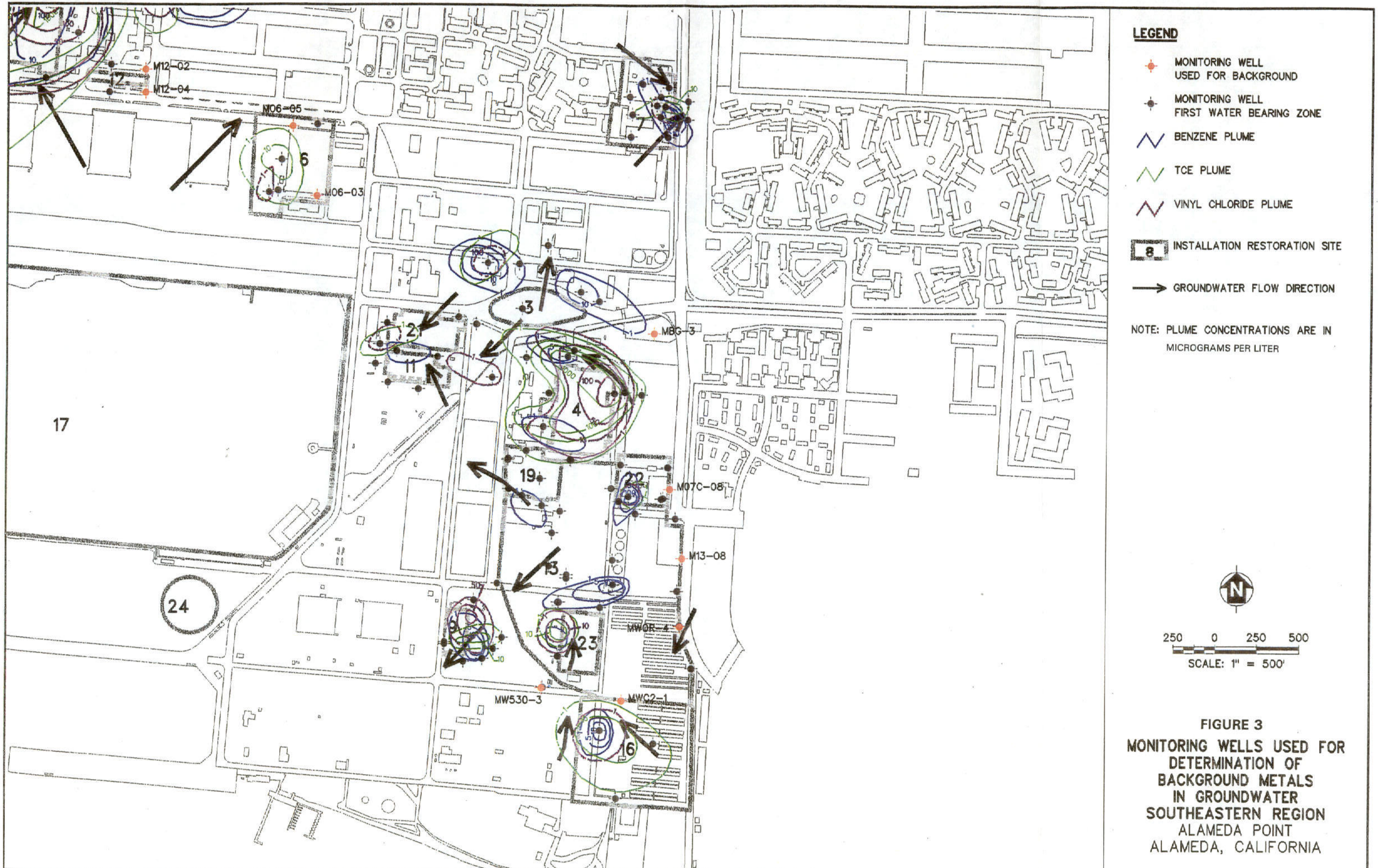

FIGURE 3

MONITORING WELLS USED FOR DETERMINATION OF BACKGROUND METALS IN GROUNDWATER SOUTHEASTERN REGION

ALAMEDA POINT

ALAMEDA, CALIFORNIA

- The lack of a potential relationship between the undetected organic chemical and metals in groundwater,

- The fact that the Navy is screening for a potential release and not conducting a risk assessment for nondetected organics in groundwater.

In those cases where a metal was not detected in a groundwater sample, the BCT decided to use a value of one-half the chemical-specific reported detection limit to include in the data set.

3.0 STATISTICAL ANALYSIS

Statistical procedures consistent with U.S. Environmental Protection Agency (EPA) and Department of Toxic Substances Control (DTSC) guidance documents (EPA 1989; DTSC 1992, 1994) and current practices in the environmental industry were used to estimate ambient concentrations of metals in groundwater. The statistical analysis consisted of the following four steps:

- Nondetected data were substituted with numerical values at one-half the reported detection limit depending on the detection frequency.

- Outliers were identified and excluded from the data set.

- Data sets for metals with high detection frequencies were tested for normality

- Data were statistically summarized based on their probability distribution, and ambient screening concentrations were determined from the data.

Each of these steps is discussed separately below.

3.1 TREATMENT OF NONDETECTED DATA

Before the upper limits of the concentrations of ambient metals could be estimated, the data set for all metals required special preparation to assign numerical values to nondetected results. Typically, nondetected results are assigned numerical values equal to one-half of the reported detection limit, which varies from sample to sample due to dilution factors and variations in analytical instrument response. For all chemicals, a value of one-half the reported detection limit was substituted for each nondetected data point per agreements reached in the April and May 1998 BCT meetings.

3.2 EXCLUSION OF OUTLIERS

In any population, a few values may be significantly higher or lower than the main population, and can cause disproportionate statistical effects. To avoid these disproportionate effects, values that were significantly higher than others were identified as outliers and were excluded from the data set before estimating ambient concentrations.

Potential outliers in the data set were first visually identified using probability plots. A probability plot is a graph of values, ordered from lowest to highest, and plotted against cumulative percentile. The horizontal axis is scaled in units of the variable (in this case concentration), and the vertical axis is scaled in units of cumulative percent. The horizontal scale can be plotted either as a linear scale (cumulative percent versus concentration) or as a lognormal scale (cumulative percent versus the logarithm of concentration). Populations of data that plot as a straight line in a linear concentration scale are referred to as normally distributed, and populations that plot as a straight line on a logarithmic concentration scale are referred to as lognormally distributed.

Probability plots were constructed at an appropriate scale (normal or lognormal) for each metal, using up to 188 sample concentrations. Potential outliers for each metal were then visually identified as values that plotted a significant distance from the straight line along which the majority of the data were clustered. Rosner's test, described in EPA's Guidance for Data Quality Assessment (EPA 1996), was performed for those metals that appeared to be potential outliers based on visual inspection of the data. Rosner's test may be used with normally or lognormally distributed data. Rosner's test calculates a test value using the mean and standard deviation of the data set after removal of the suspected outlier. The calculated test value is then compared to a critical value corresponding to a particular level of significance and sample size (number of samples in a population). If the test value exceeds the critical value, the test value is considered an outlier and removed from the population. The test is repeated, iteratively removing test values, until the test value no longer exceeds the critical value. It should be noted that because the data points considered as anomalously high concentrations may also represent extreme values of actual ambient concentrations, exclusion of these data points may lead to conservative (low) estimates of ambient concentrations.

The original data set contained up to 188 samples for each metal. These data were lognormally transformed and detected values were plotted on a cumulative frequency chart. The following metals appeared to contain outliers after visual inspection of the lognormally transformed data plots: aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, lead, manganese, nickel, vanadium, and zinc. Rosner's test was used to determine if the highest detected concentrations of these metals were outliers. The results of Rosner's test indicated that the preceding list of metals did not contain outliers in their data subsets with the potential exceptions of: aluminum, cobalt, nickel, lead, vanadium, and zinc.

The outliers for aluminum, cobalt, nickel, lead, vanadium, and zinc were associated with samples from the following wells collected on the dates listed:

Well Identification	Sample Date	Chemicals with Potential Outliers
MW530-3	8/24/90	Aluminum, Cobalt, Copper, Nickel, Lead, Vanadium
MWC2-1	8/29/90	Aluminum, Cobalt, Copper, Nickel, Lead, Vanadium
MWOR-4	8/27/90	Aluminum, Cobalt, Copper, Nickel, Lead, Vanadium
M008-A	7/1/91	Aluminum
M014-A	9/25/91	Aluminum, Cobalt, Nickel, Lead, Vanadium, Zinc
M117-E	3/7/95	Zinc
M003-E	5/3/95	Lead
DRA-01	3/7/95	Zinc
M107-A	3/4/95	Nickel
M110-A	3/5/95	Lead, Nickel, Zinc
M15-03	3/8/95	Zinc

Review of the laboratory reports for the first six wells listed above revealed that the samples from the corresponding quarters had not been filtered, artificially elevating metal concentrations. Therefore, analytical results for those wells (for the above-listed dates only) were removed from the groundwater ambient data set for all metals. The March 1995 sample for M003-E had an anomalously high lead detection, the basis for which could not be determined. The May 1995 sample for well DRA-01 had a detection of zinc that was high and perhaps more representative of saline water in the second water-bearing zone. Therefore, samples from wells M003-E and DRA-01 collected on the above-listed dates were also removed.

The remaining samples did not have any apparent explanation for the anomalous results, although samples from M107-A and M110-A for March 1995 were reported as turbid, which may explain the higher hits of nickel, lead, and zinc. However, there is no apparent contamination near these wells and no indication of laboratory problems with the samples. Wells M107-A, M110-A, and M15-03 were sampled before and after the detections of the apparent outliers, and all results were low to nondetected with low detection limits. Therefore, although there are anomalously high hits of lead, nickel, and zinc in these wells, the samples were retained in the ambient metals data set.

Based upon the previous discussion of exclusion of outliers, the final data set for each metal may contain up to 180 groundwater samples. However, the actual population of a metal subset (maximum population of 180 data points) may be limited by the frequency of detection for a specific metal. For example, although 180 groundwater samples are available from the ambient metals data set, the metal nickel was only detected 13 times yielding a frequency of detection of 13/180.

3.3 NORMALITY TESTING

After the removal of outliers, the data set was subjected to normality testing to objectively evaluate the distribution of the data. Normality testing is an analytical technique used to judge whether a data set is distributed normally or lognormally. The assumption of normality was tested using the Wilks-Shapiro Rank-Its plots. The normality tests were conducted using only detected values, which requires at least 5 values to provide a distribution. Graphical results of the normality tests are provided in the Attachment to this report for each metal with at least five detected results. Metals with fewer than five detected results were evaluated assuming a normal distribution.

3.4 ESTIMATION OF AMBIENT METALS CONCENTRATIONS

After treating nondetected values and removing outliers from the ambient metals data set, the data for each metal were statistically summarized to calculate mean concentrations and the ambient screening concentration (the 80^{th} percent lower confidence limit of the 95^{th} percentile of the distribution [80 LCL/95]). All data summaries were conducted on the natural-log transformed data, unless the data were normally distributed, in which case the data summaries were performed on untransformed data. The 80 LCL/95 concentration was calculated using the formula presented in Statistical Methods for Environmental Pollution Monitoring (Gilbert 1987). The concentration at the 95^{th} upper confidence limit (UCL) of the mean was also calculated for information purposes.

4.0 SUMMARY OF FINDINGS

Estimated ambient metals concentrations at both the 80 LCL/95 and 95 UCL for shallow groundwater at Alameda Point, statistical features of the data sets, and relevant water quality criteria are listed in Table

TABLE 1
AMBIENT CONCENTRATIONS OF METALS IN SHALLOW GROUNDWATER
ALAMEDA POINT

Inorganic Chemical [1]	Reported Detection Limit (ug/L)	Frequency of Detection	Minimum Detected Concentration (ug/L)	Maximum Detected Concentration (ug/L)	Mean Concentration (ug/L)	95 UCL Concentration (ug/L)	80 LCL/95 Concentration (ug/L)	MCL[2] (ug/L)
Aluminum	8.4-223	51/176	3	3970	32.12	96.2	439.13	1000
Antimony	2-37.5	12/176	2.5	47.8	5.83	11.8	45.77	6
Arsenic	1.9-100	94/179	2	40.7	4.54	8	28.39	50
Barium	4.3-55.4	144/176	2.3	1260	34.06	123.3	574.73	1000
Beryllium	0.1-3.7	18/176	0.94	3	0.49	1	3.83	4
Cadmium	0.2-8.0	16/176	0.32	6.5	0.53	1.3	5.38	5
Calcium	898-1370	176/180	620	513000	17865	78223	379269	NA
Hexavalent Chromium-n	100	1/3	4	4	34.7	100.6	NA	NA
Chromium	0.6-32	23/176	0.74	82.8	1.54	3.4	13.79	50
Cobalt	2.3-17.2	6/176	2.5	10.5	3.5	4.6	11.57	NA
Copper	0.4-69.7	54/176	2.1	27.3	3.97	7.5	27.48	1000
Iron	4.8-363	119/180	7.2	24400	108.58	1624	7135	300
Lead	0.8-20	18/180	1.2	28.4	0.91	1.3	3.88	NA
Magnesium	NA	180/180	549	1070000	15092	103358	500168	NA
Manganese	1.1-12.3	172/180	1.1	2480	86.01	1171	5213	50
Mercury-n	0.1-0.29	3/180	0.2	0.3	0.1	0.1	0.15	2
Molybdenum	2.0-25.4	5/100	3.1	19.4	4.59	5.6	11.52	NA
Nickel	1.7-49.1	13/180	2.7	151	5.6	7.4	19.06	100
Potassium	763-2340	175/180	1200	505000	14314	40552	182153	NA
Selenium-n	1.9-54	1/180	2.5	2.5	1.58	1.9	5.97	50
Silver-n	0.4-5.4	2/170	2.4	4.8	1.48	1.6	3.33	100
Sodium	NA	180/180	4600	8160000	198988	937369	4539829	NA
Thallium-n	1.7-76	3/175	3.6	5.2	2.21	2.3	5.8	2
Vanadium	1.4-19.5	69/180	2	50.8	4.97	8.4	28.65	NA
Zinc	0.5-32.8	55/180	2.8	46800	4.87	10.5	42.91	5000

Notes:
MCL = Maximum contaminant level
NA = Not available
NC = Not calculated

ug/L = microgram per liter
80 LCL/95 = 80th lower confidence limit on the 95th percentile of the distribution
95 UCL = 95th upper confidence limit

[1] The statistics for chemicals denoted with an "-n" are based on a normal distribution; too few detections were available to determine probability distribution.
[2] Groundwater MCLs required to support municipal supply are based on the Water Quality Control Plan, San Francisco Bay Basin, Region 2 (RWQCB 1995)

1. Wilks-Shapiro Rank-Its plots that support evaluation of normality are included in the Attachment to this report. The estimated concentrations of ambient metals in groundwater at the 80 LCL/95, in many cases, exceeded the maximum contaminant level (MCL) for municipal supply (RWQCB 1995). Estimated concentrations for antimony, cadmium, iron, manganese, and thallium exceeded their respective MCLs.

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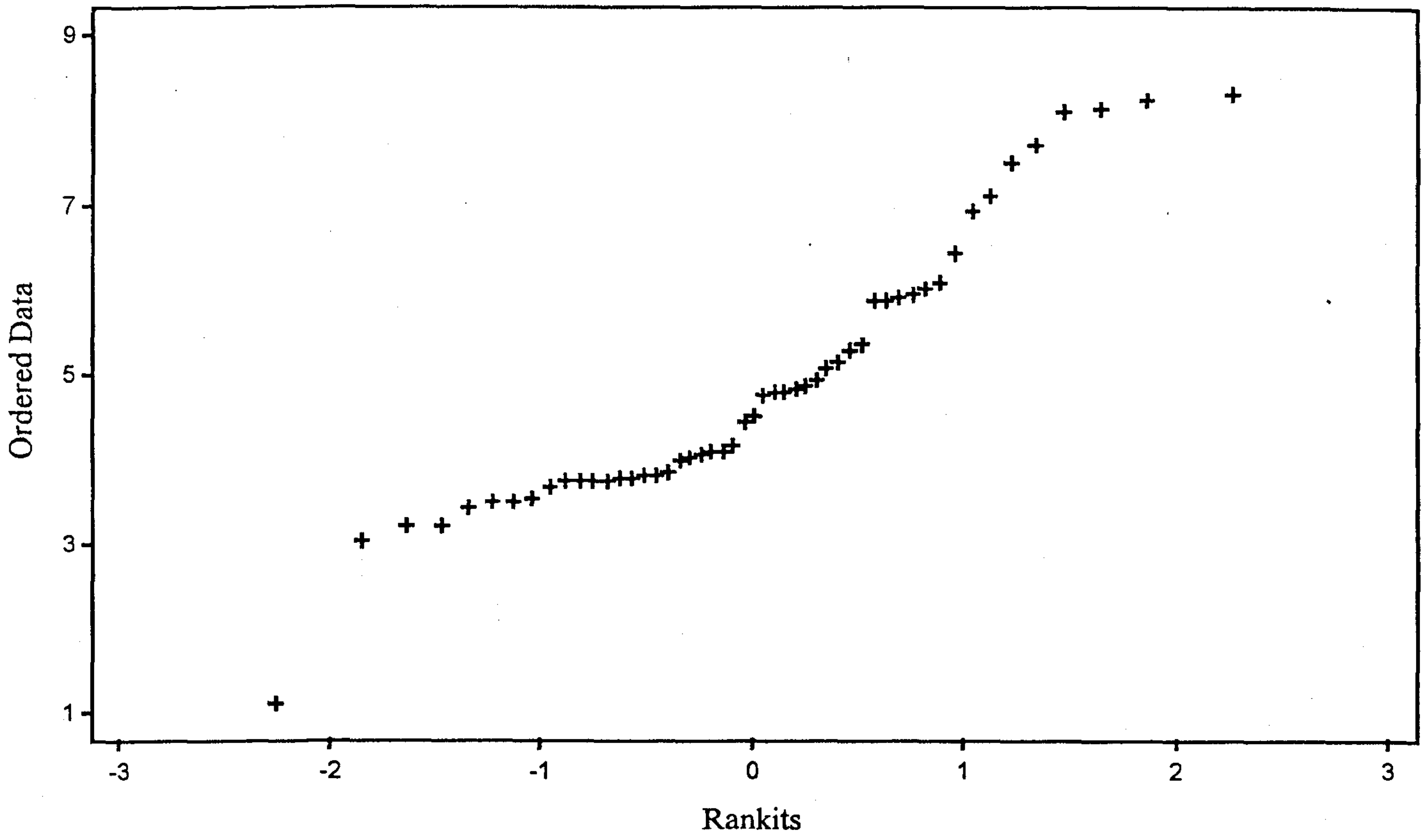
ATTACHMENT

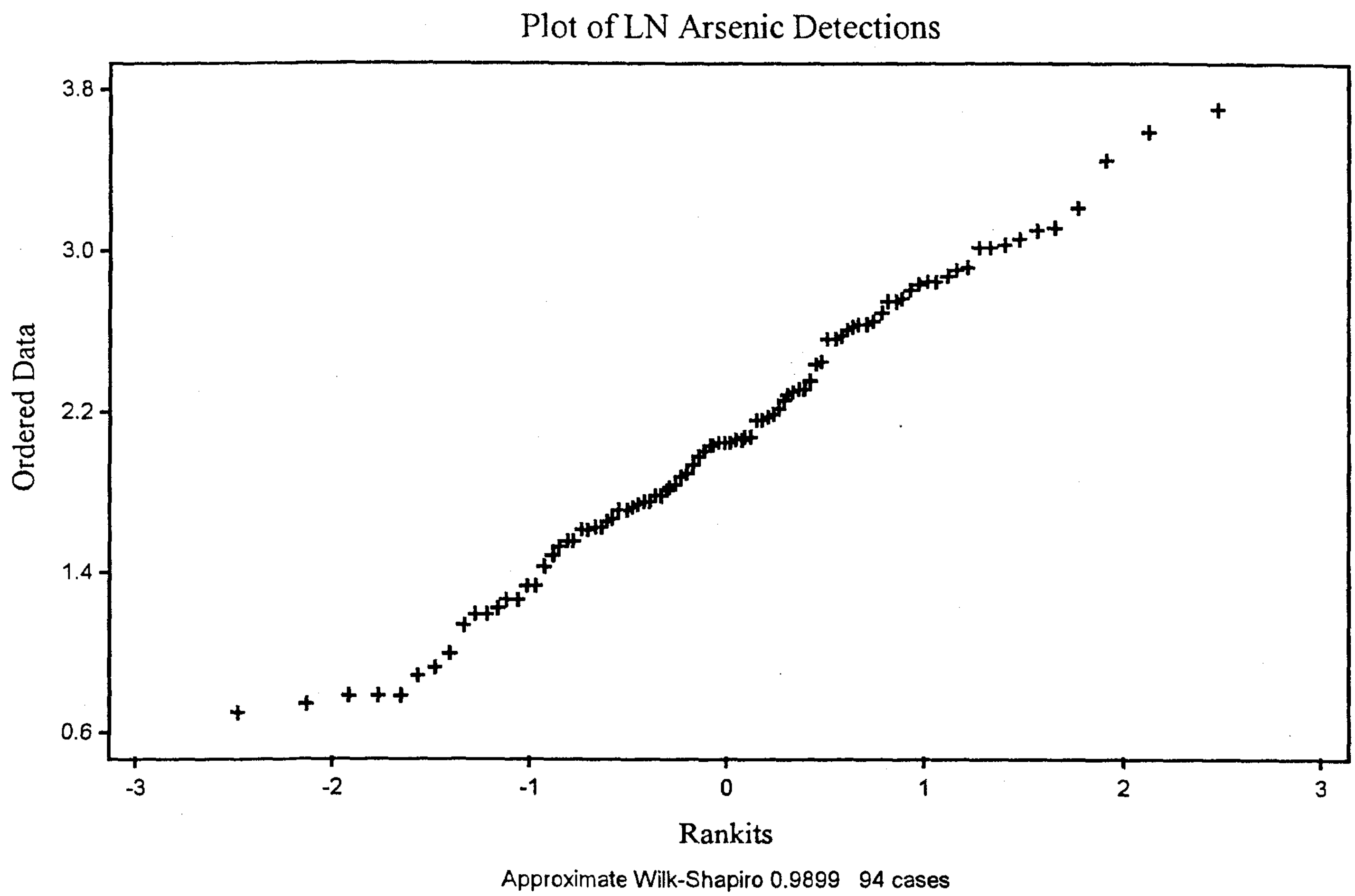
WILKS-SHAPIRO RANK-ITS PLOTS FOR NORMALITY TESTING OF AMBIENT METALS IN GROUNDWATER

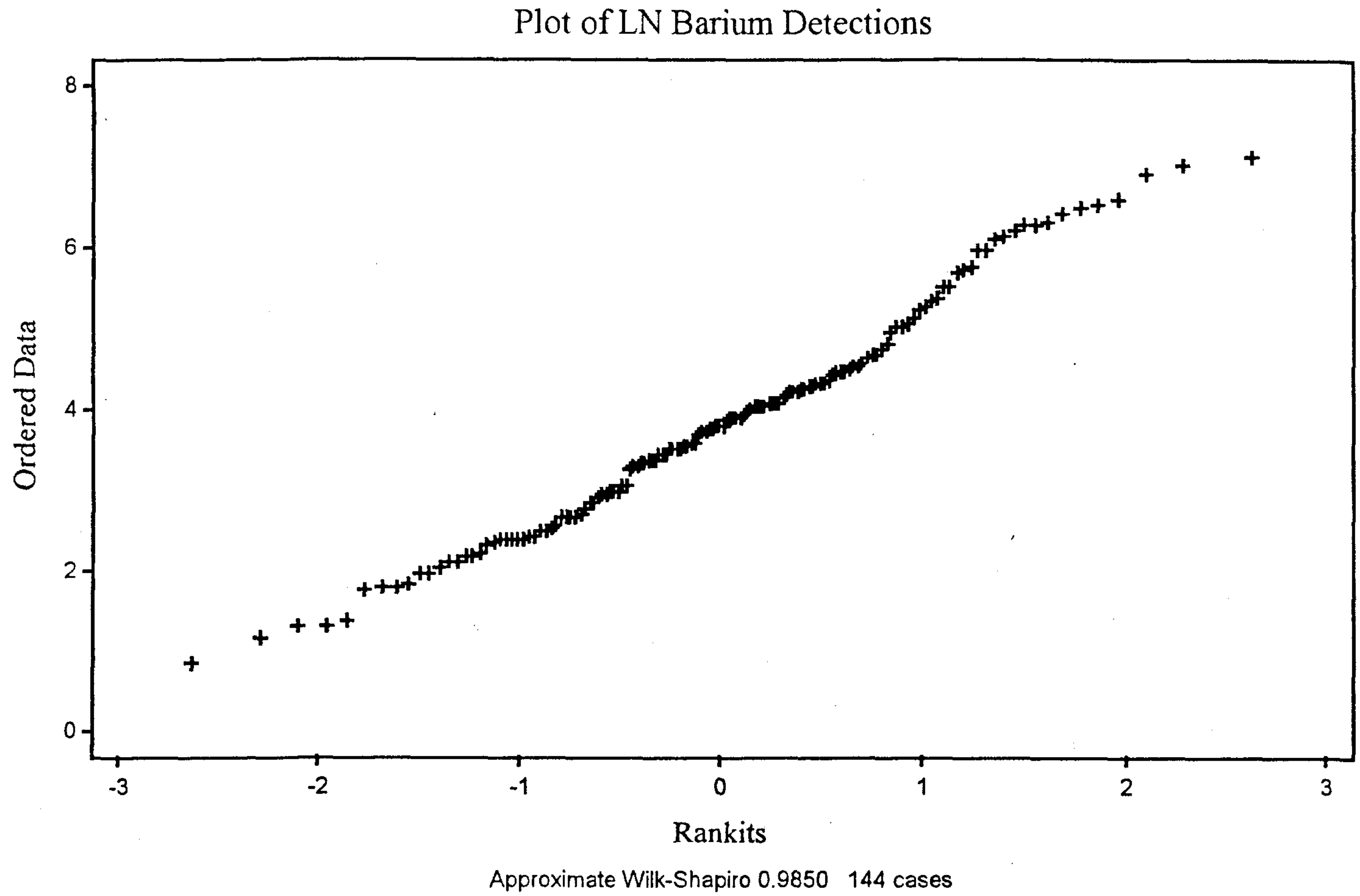
(25 pages)

Plot of LN Aluminum Detections

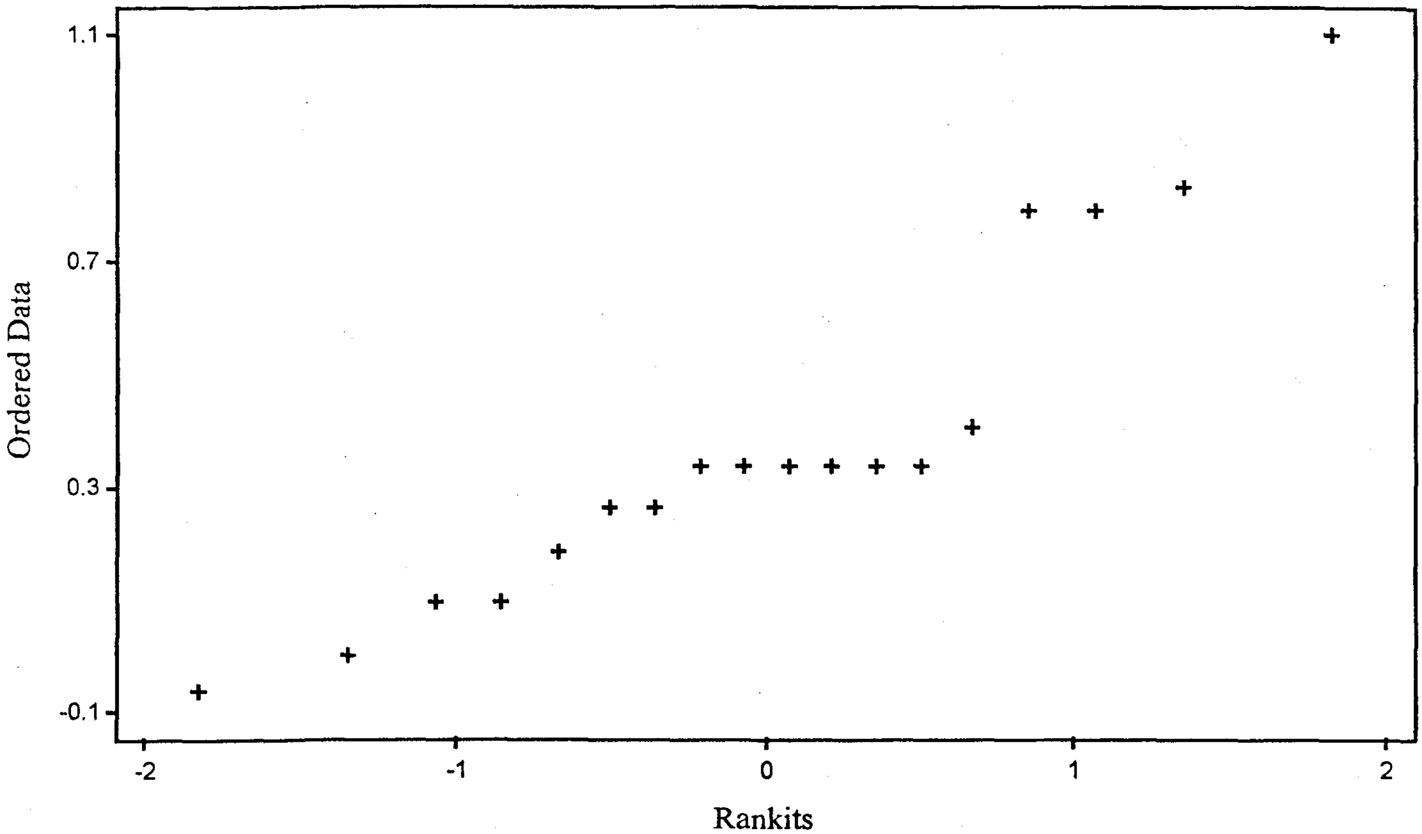


Approximate Wilk-Shapiro 0.9229 51 cases

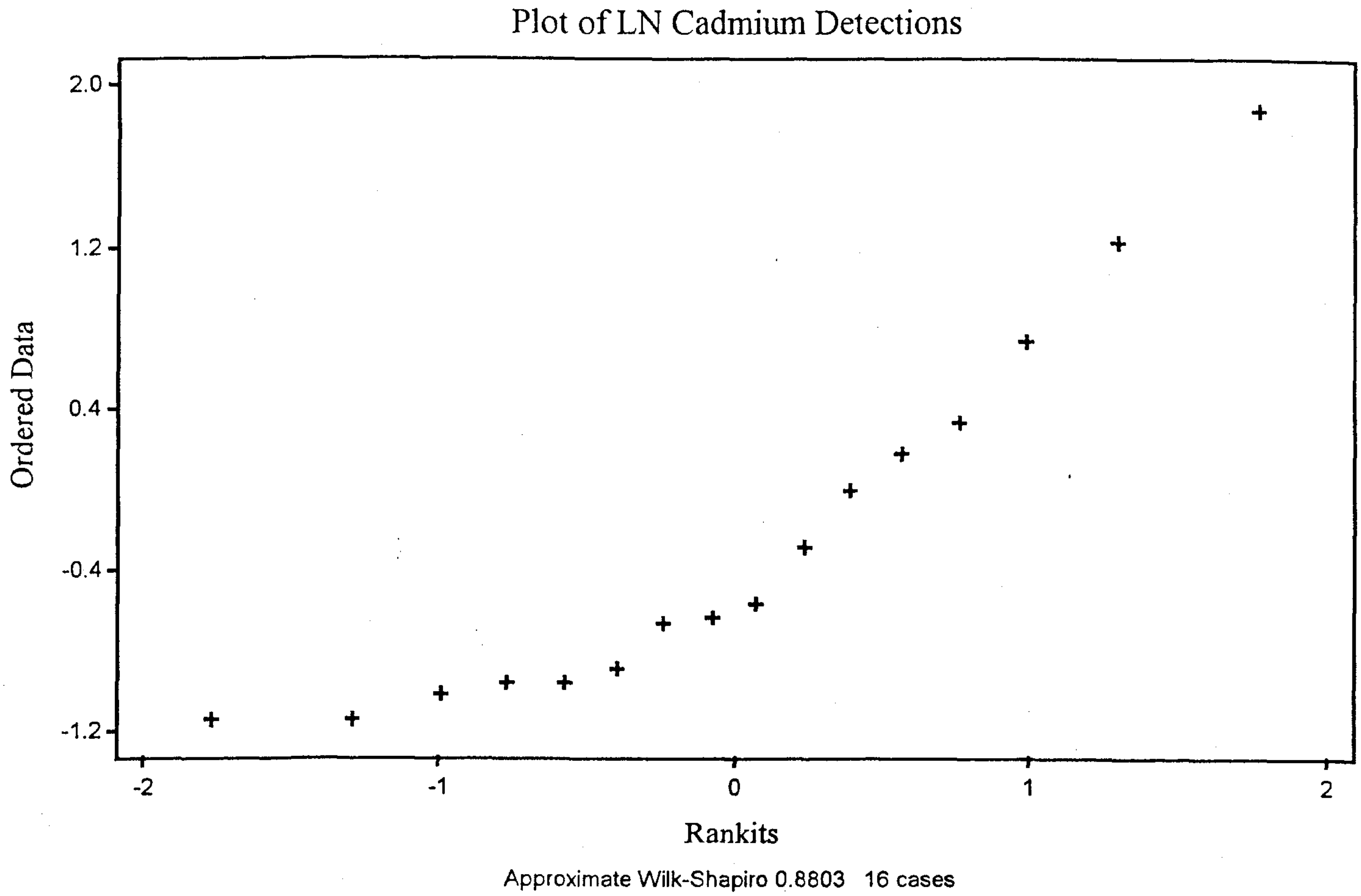

Plot of LN Arsenic Detections
Ordered Data
3.8
3.0
2.2
1.4
0.6
-3
-2
-1
0
1
2
3
Rankits
Approximate Wilk-Shapiro 0.9899 94 cases



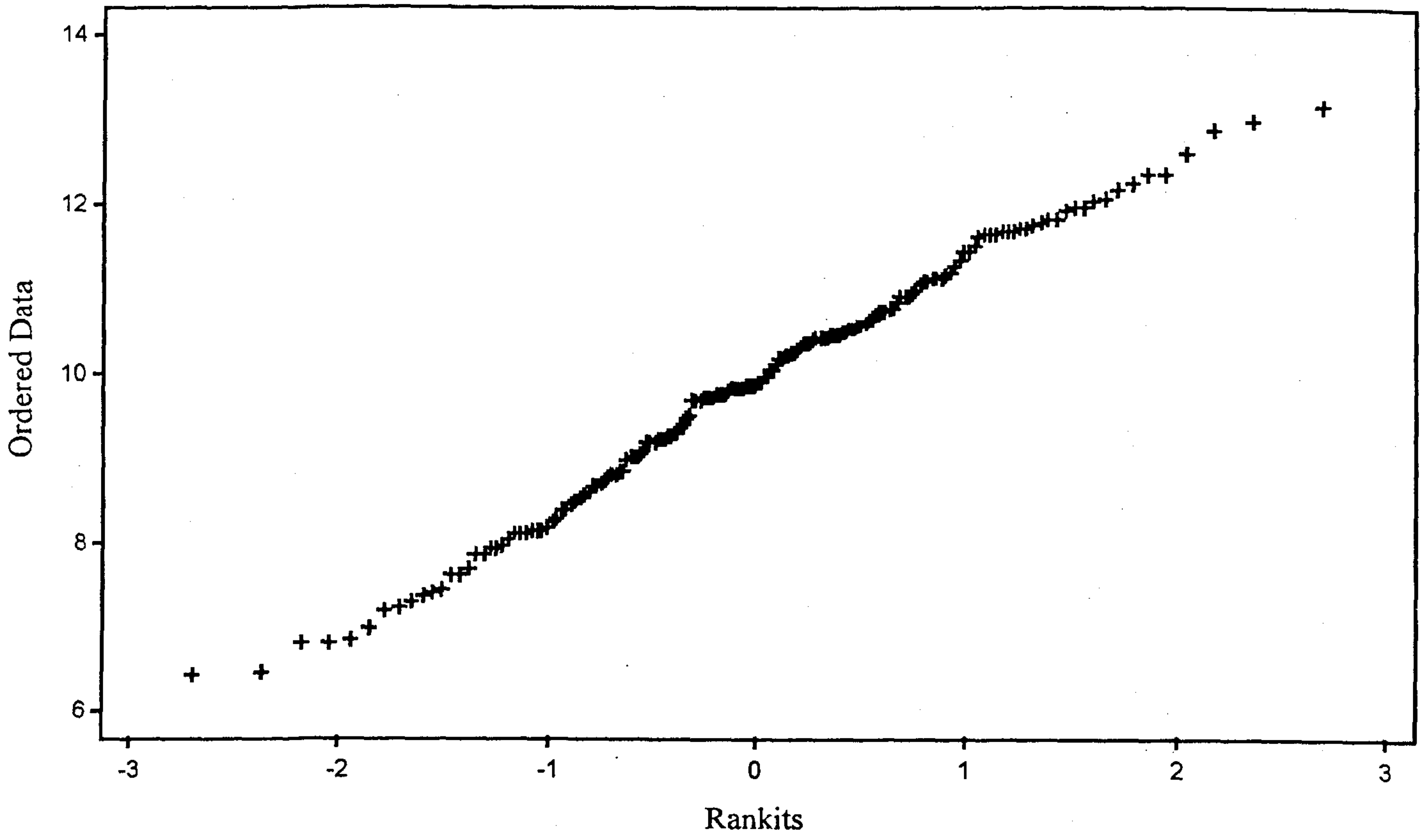
Plot of LN Beryllium Detections



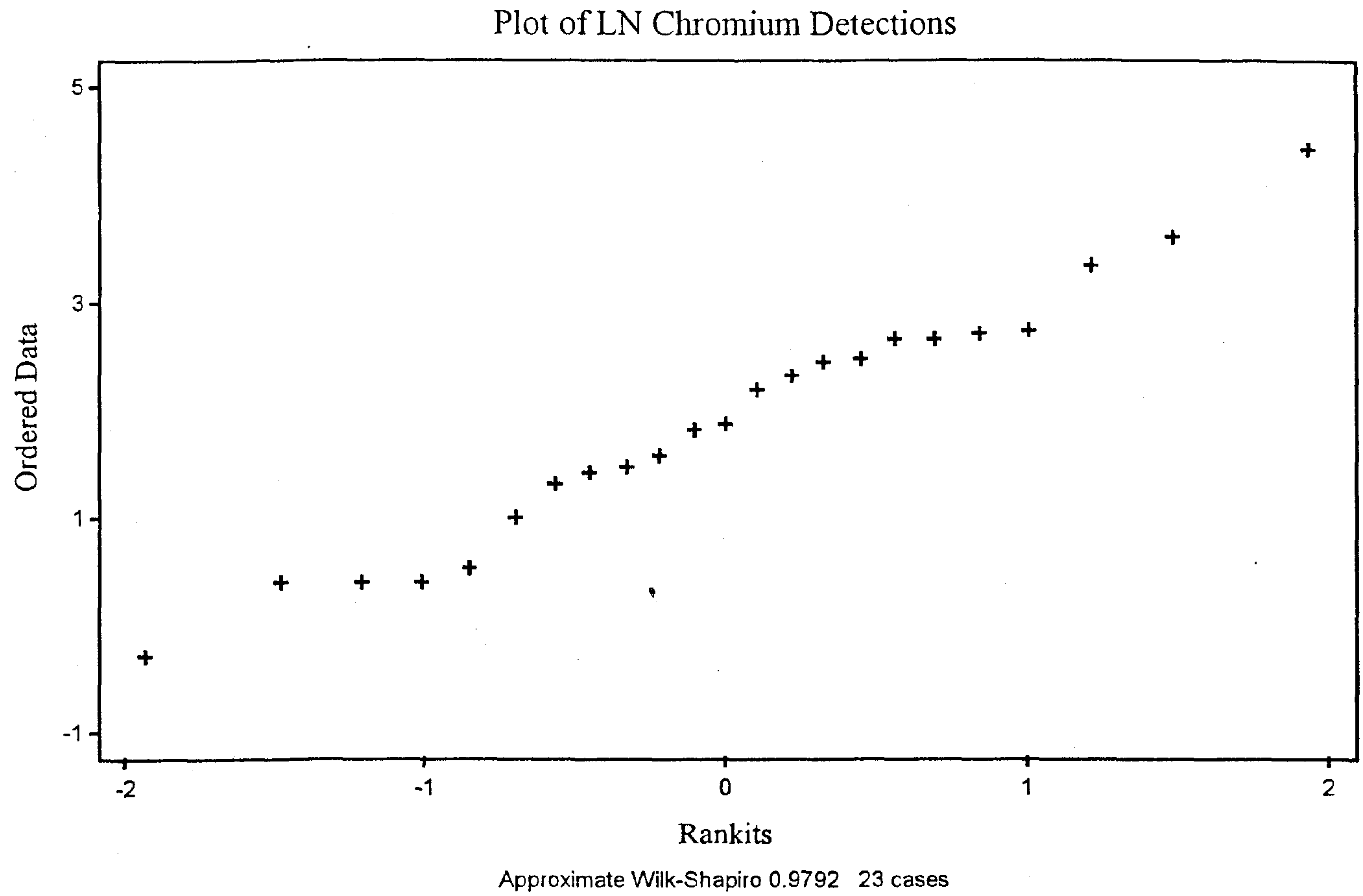
Approximate Wilk-Shapiro 0.8874   18 cases

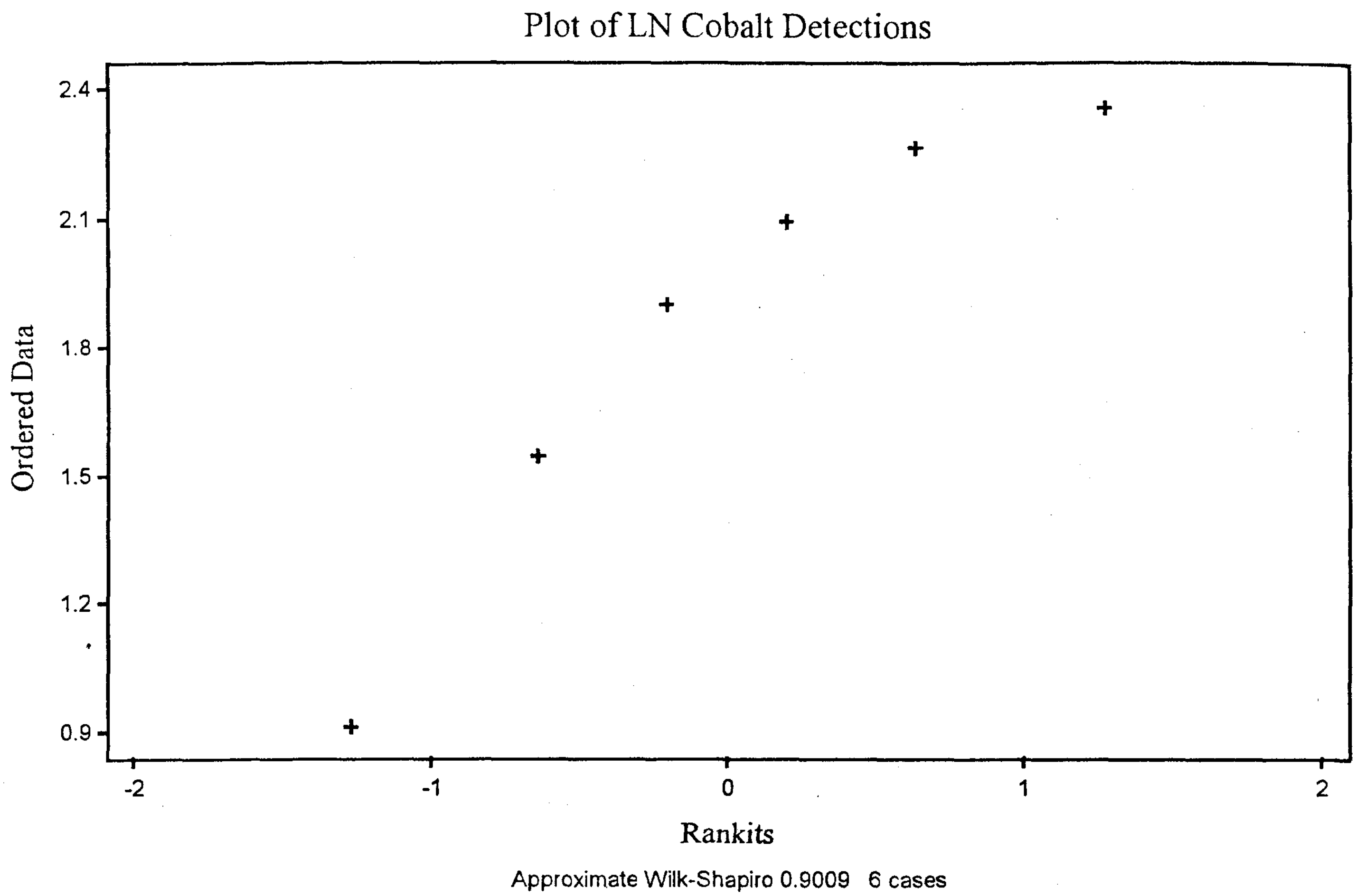

Plot of LN Cadmium Detections
Ordered Data
2.0
1.2
0.4
-0.4
-1.2
-2
-1
0
1
2
Rankits
Approximate Wilk-Shapiro 0.8803 16 cases

Plot of LN Calcium Detections

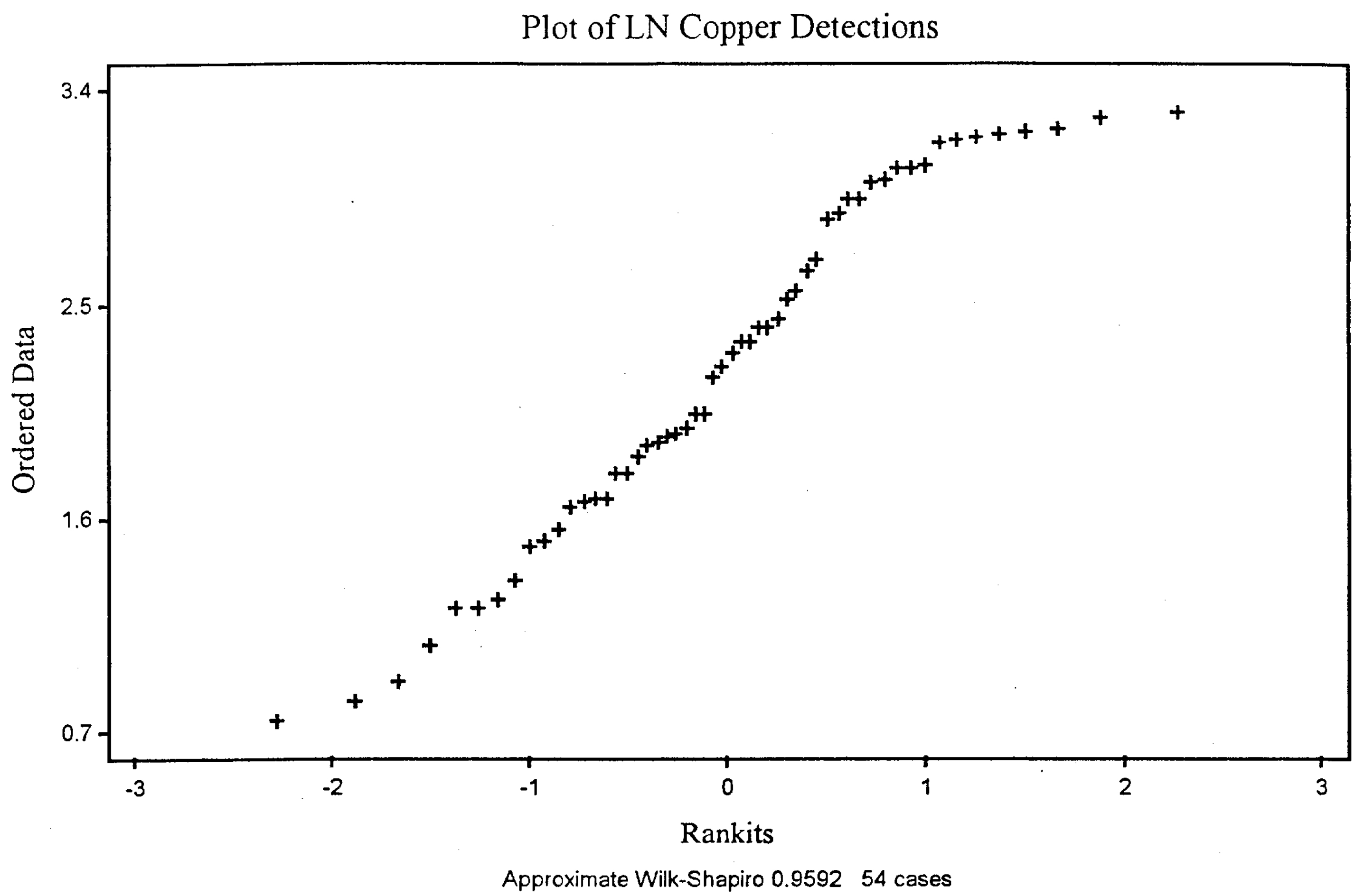


Approximate Wilk-Shapiro 0.9913   176 cases

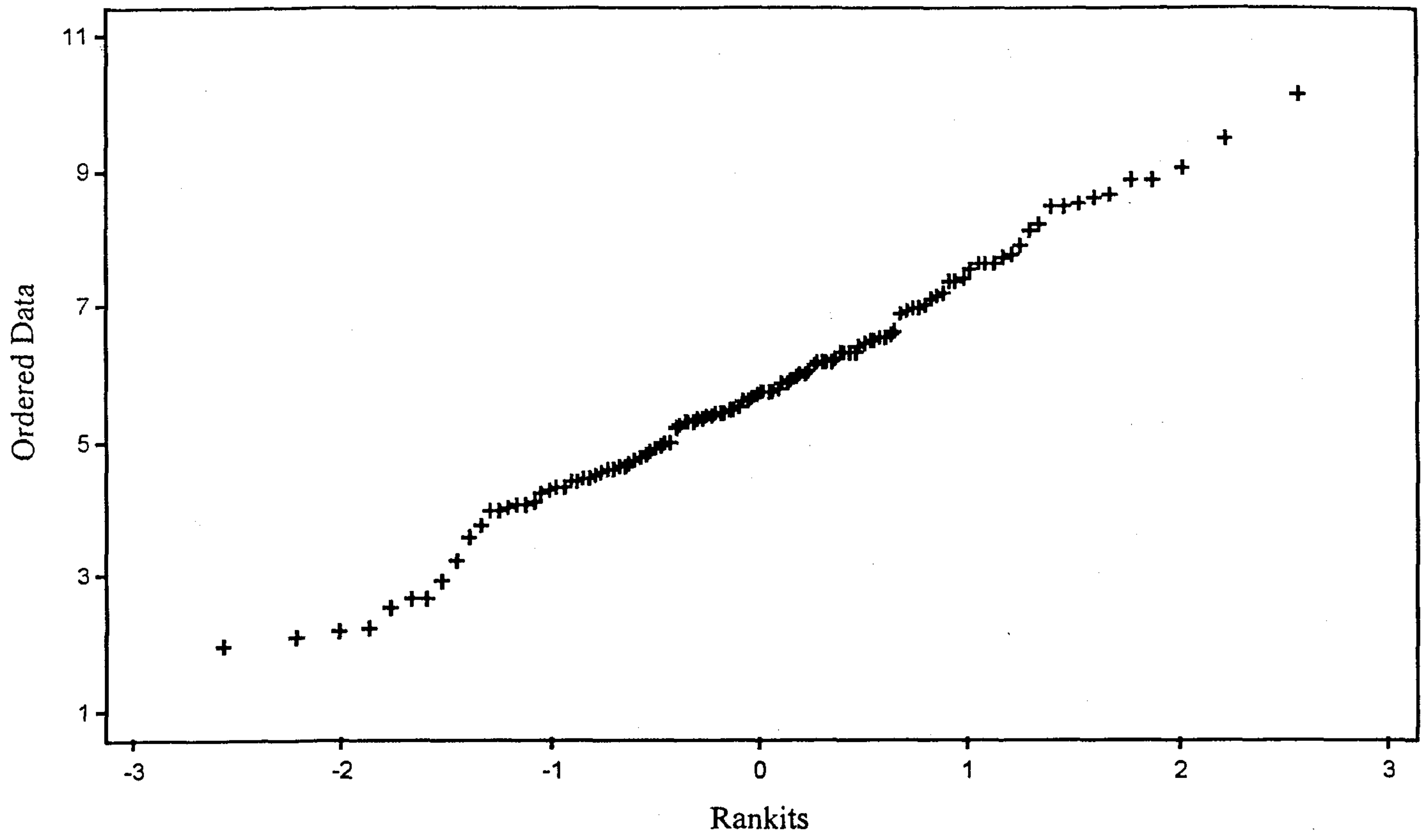

Plot of LN Chromium Detections
5
3
1
-1
Ordered Data
-2
-1
0
1
2
Rankits
Approximate Wilk-Shapiro 0.9792 23 cases



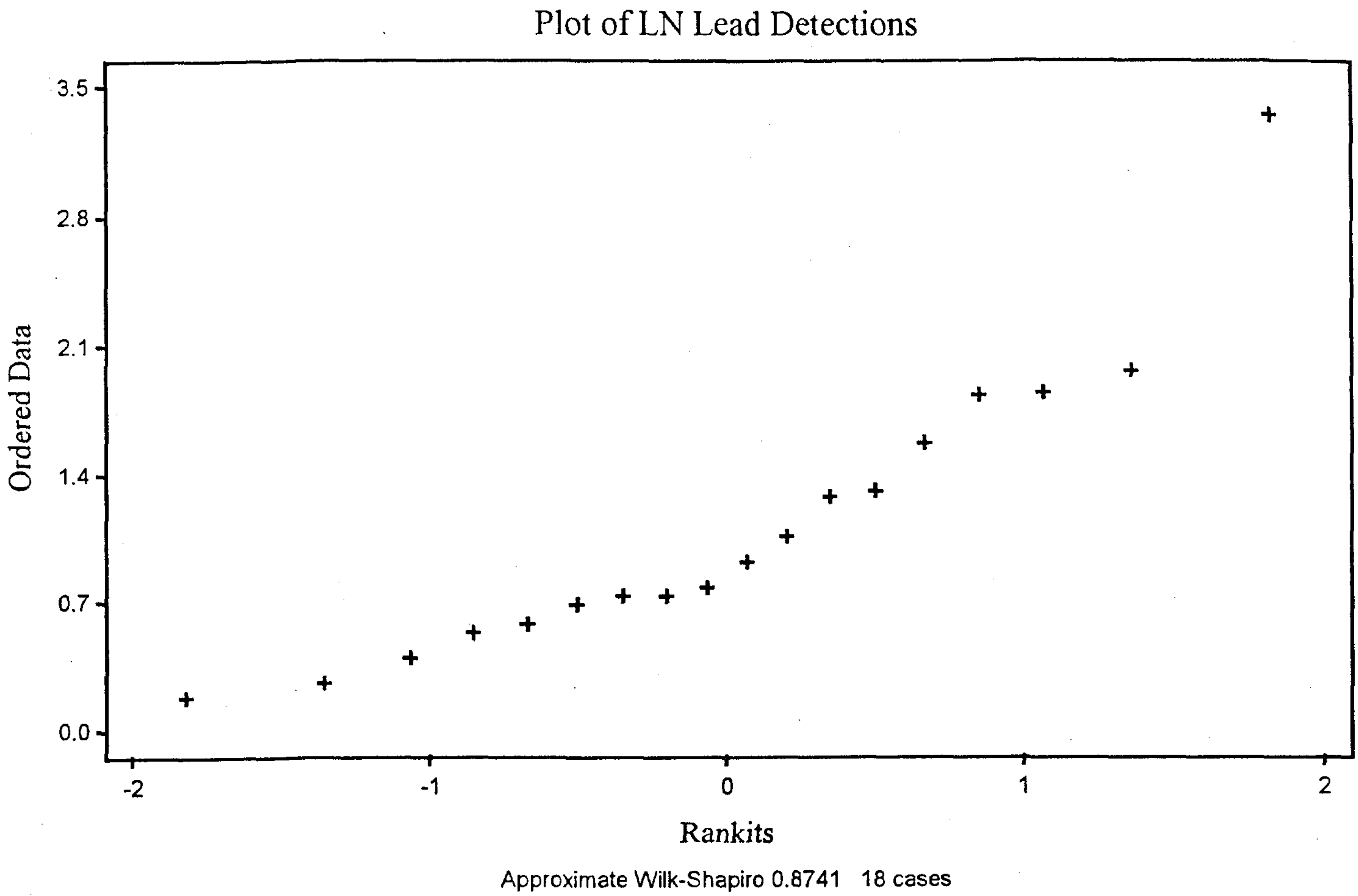
Plot of LN Cobalt Detections
Ordered Data
2.4
2.1
1.8
1.5
1.2
0.9
-2
-1
0
1
2
Rankits
Approximate Wilk-Shapiro 0.9009 6 cases


Plot of LN Copper Detections
Ordered Data
3.4
2.5
1.6
0.7
-3
-2
-1
0
1
2
3
Rankits
Approximate Wilk-Shapiro 0.9592   54 cases

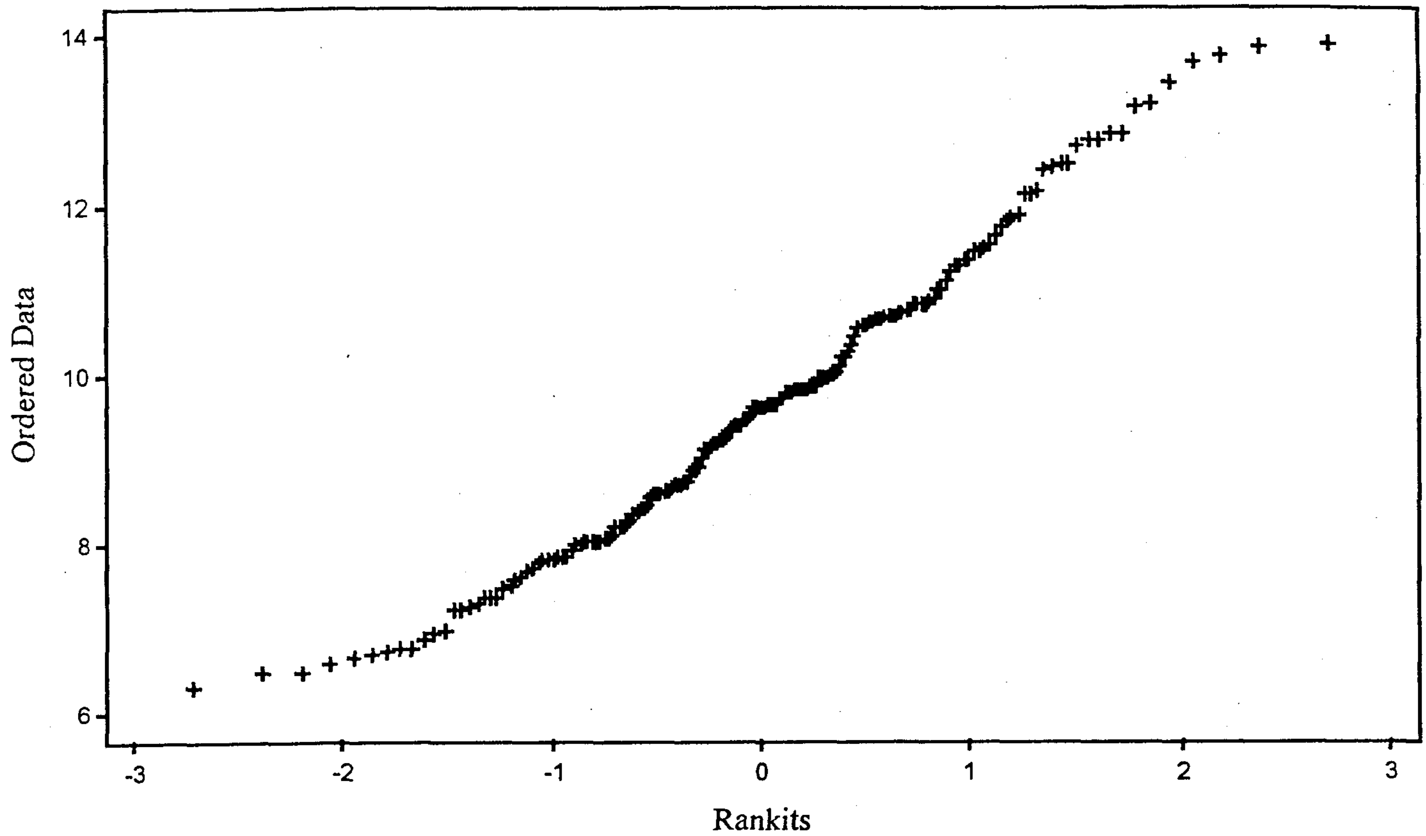
Plot of LN Iron Detections



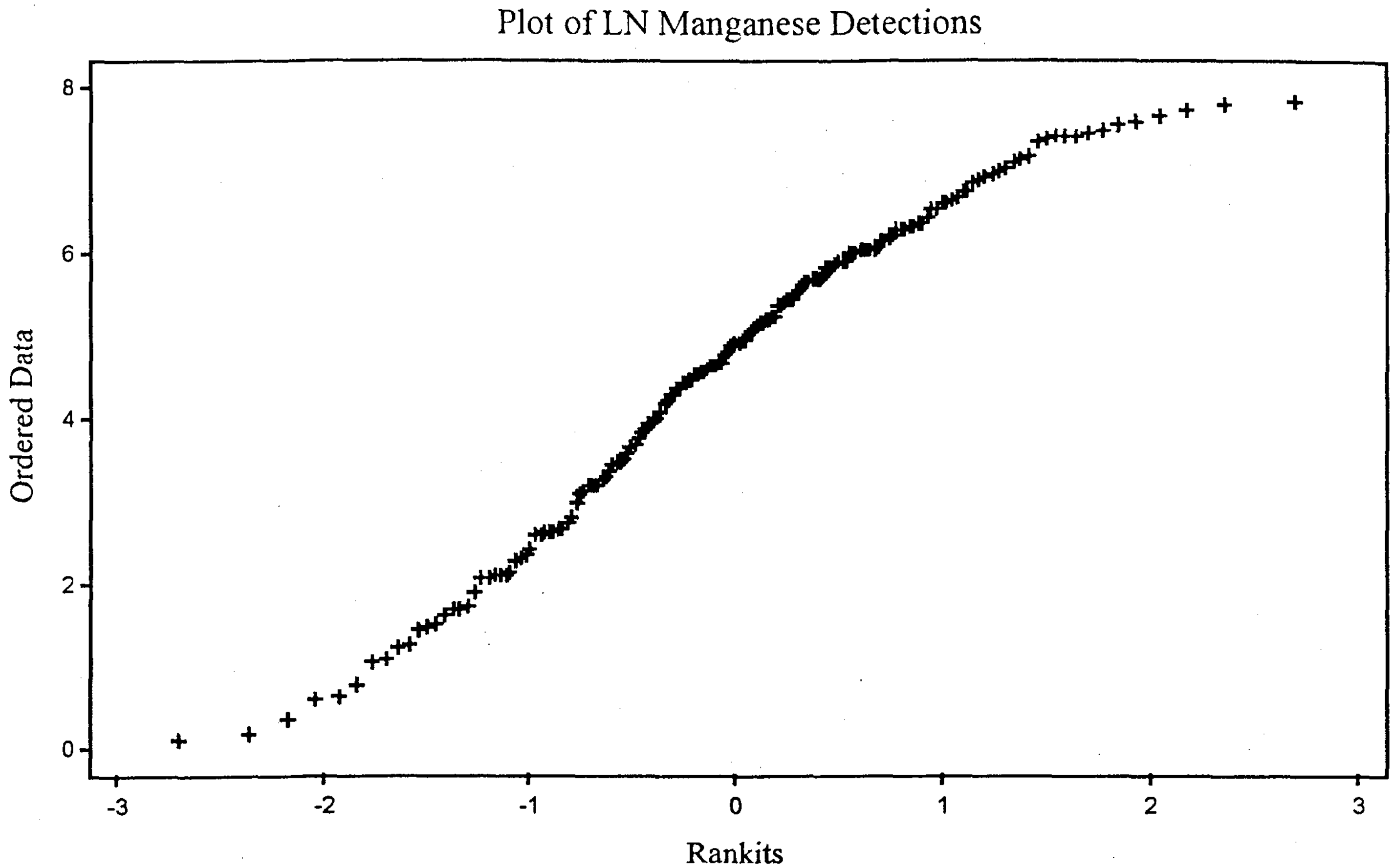
Approximate Wilk-Shapiro 0.9915   119 cases


Plot of LN Lead Detections
Ordered Data
3.5
2.8
2.1
1.4
0.7
0.0
-2
-1
0
1
2
Rankits
Approximate Wilk-Shapiro 0.8741 18 cases

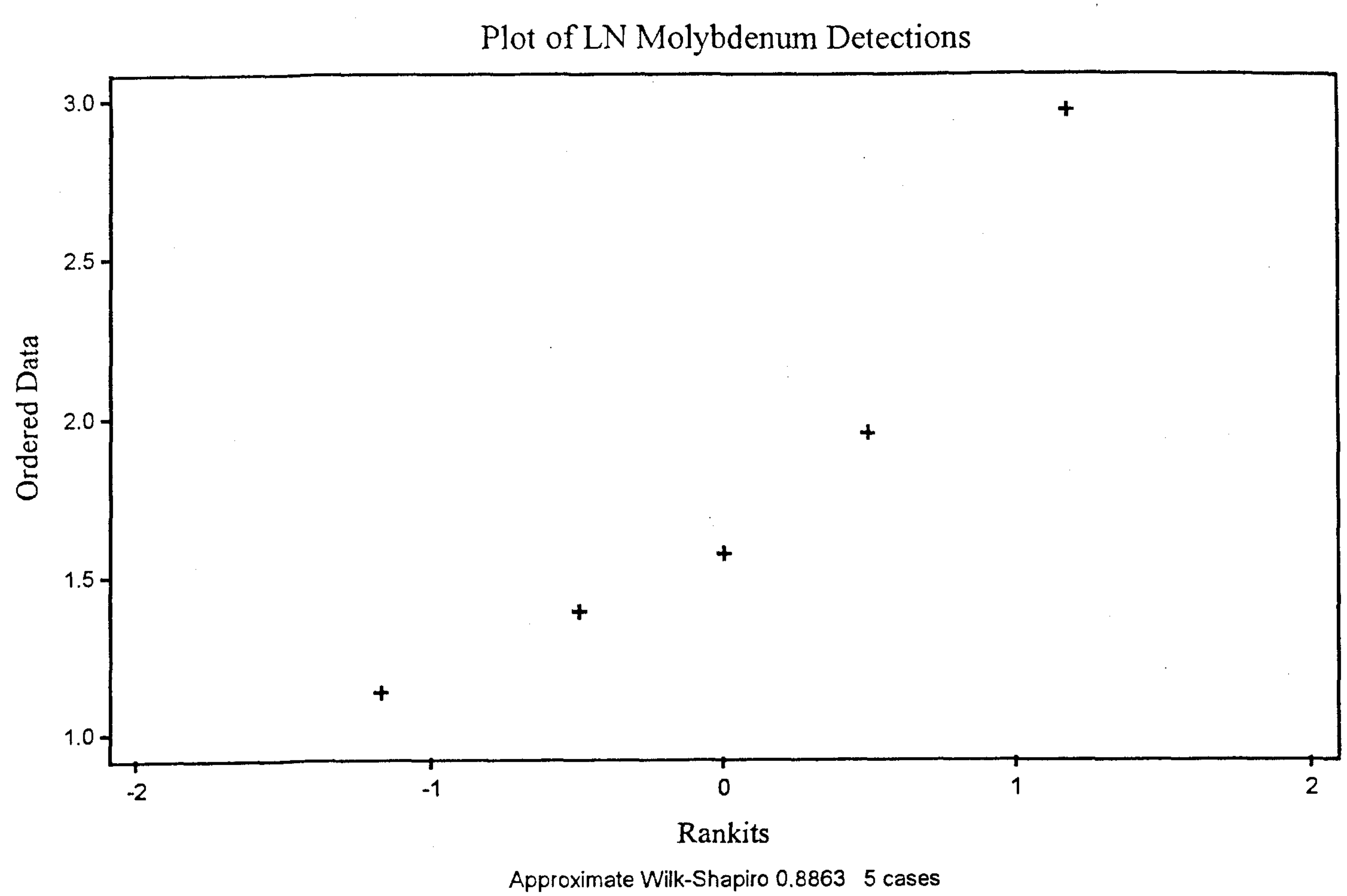
Plot of LN Magnesium Detections



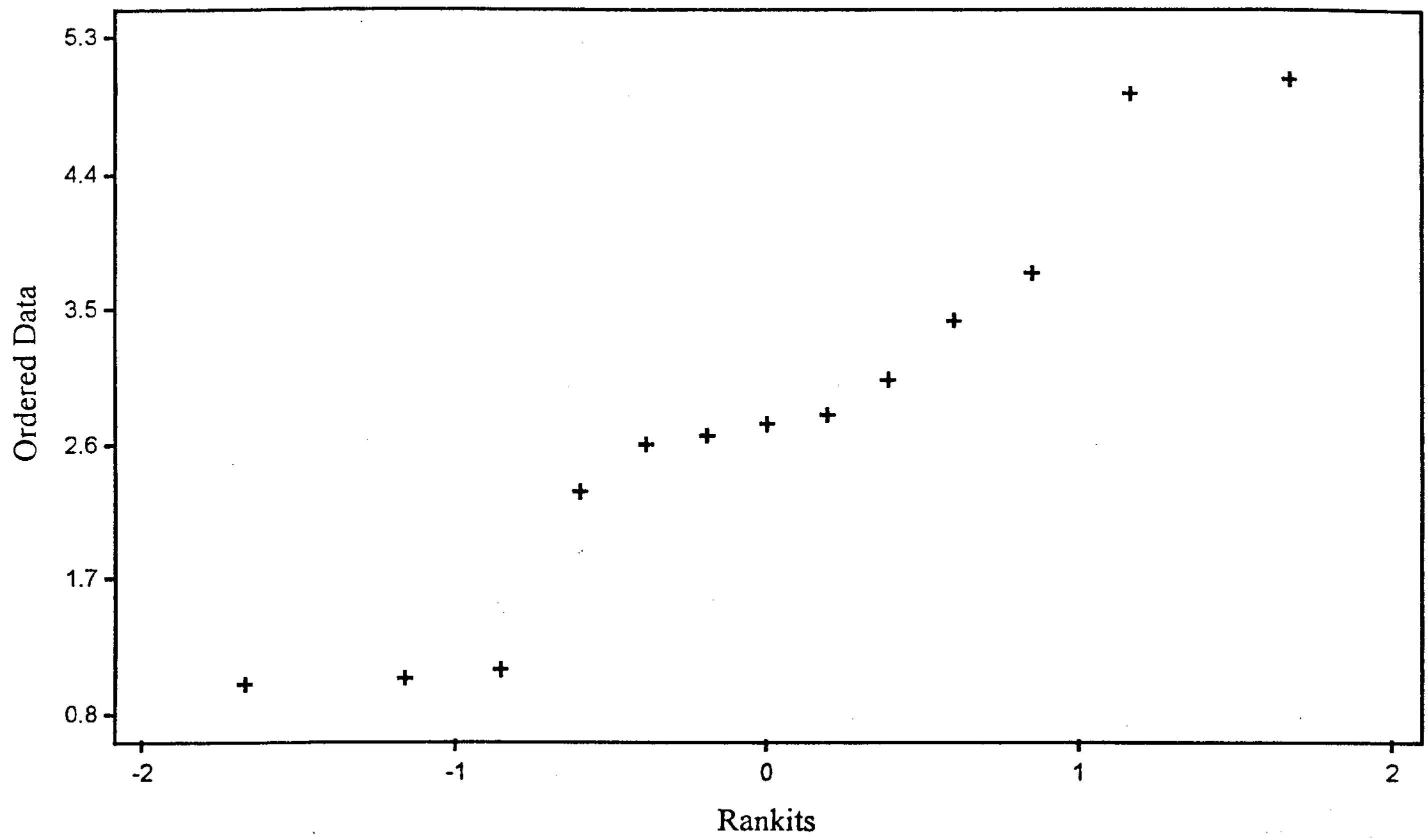
Approximate Wilk-Shapiro 0.9836 180 cases



Approximate Wilk-Shapiro 0.9703 172 cases

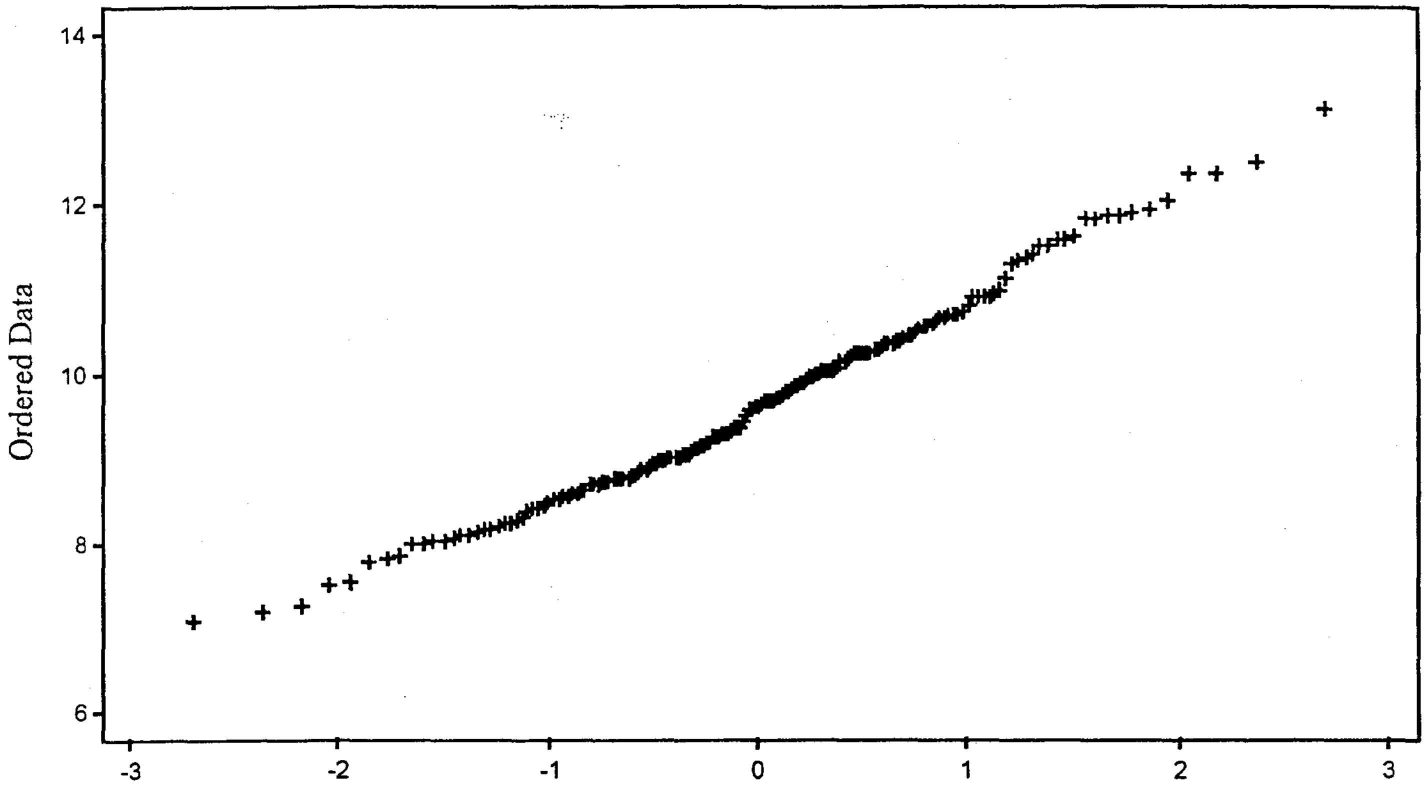

Plot of LN Molybdenum Detections
Ordered Data
3.0
2.5
2.0
1.5
1.0
-2
-1
0
1
2
Rankits
Approximate Wilk-Shapiro 0.8863 5 cases

Plot of LN Nickel Detections

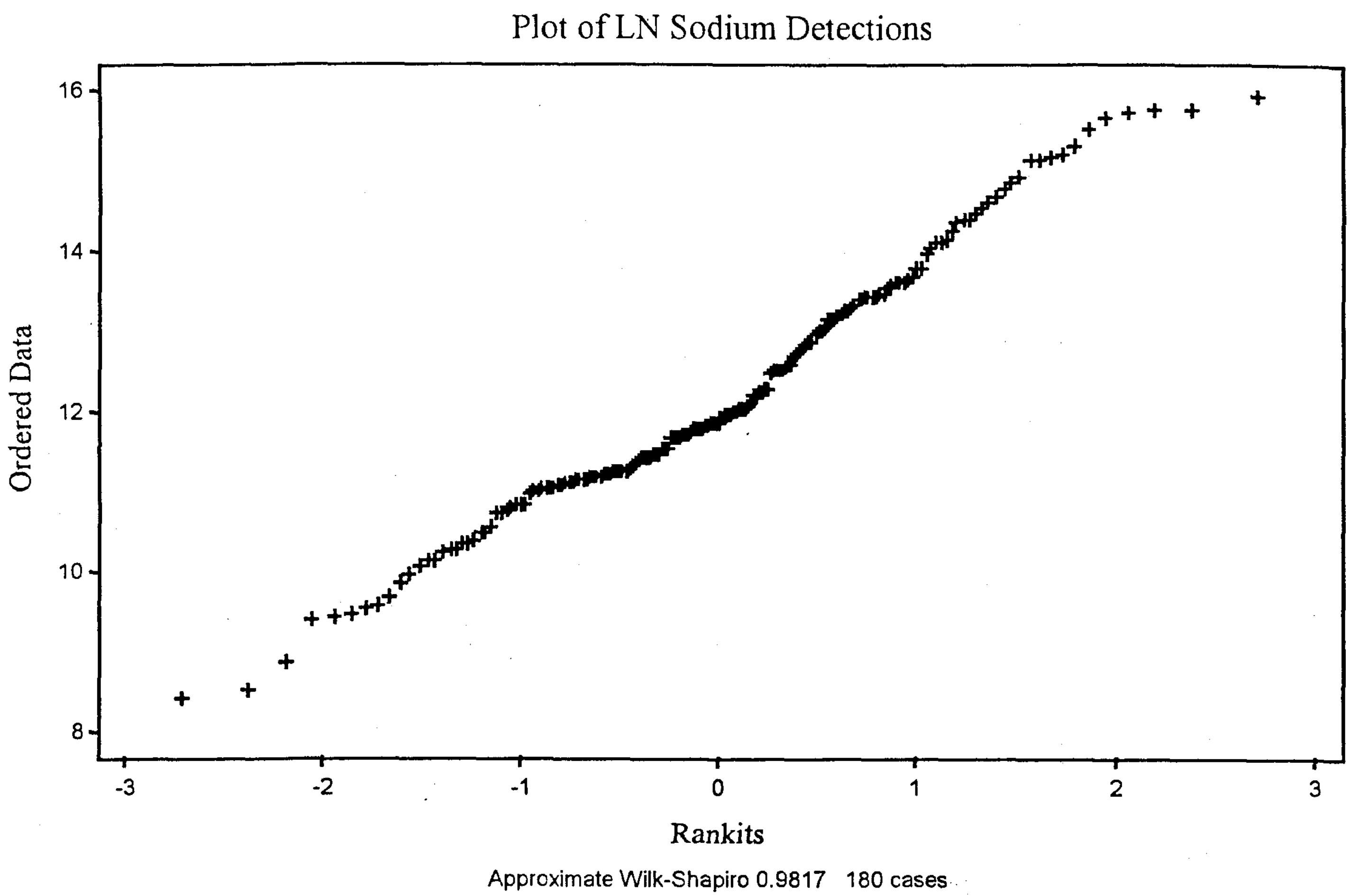


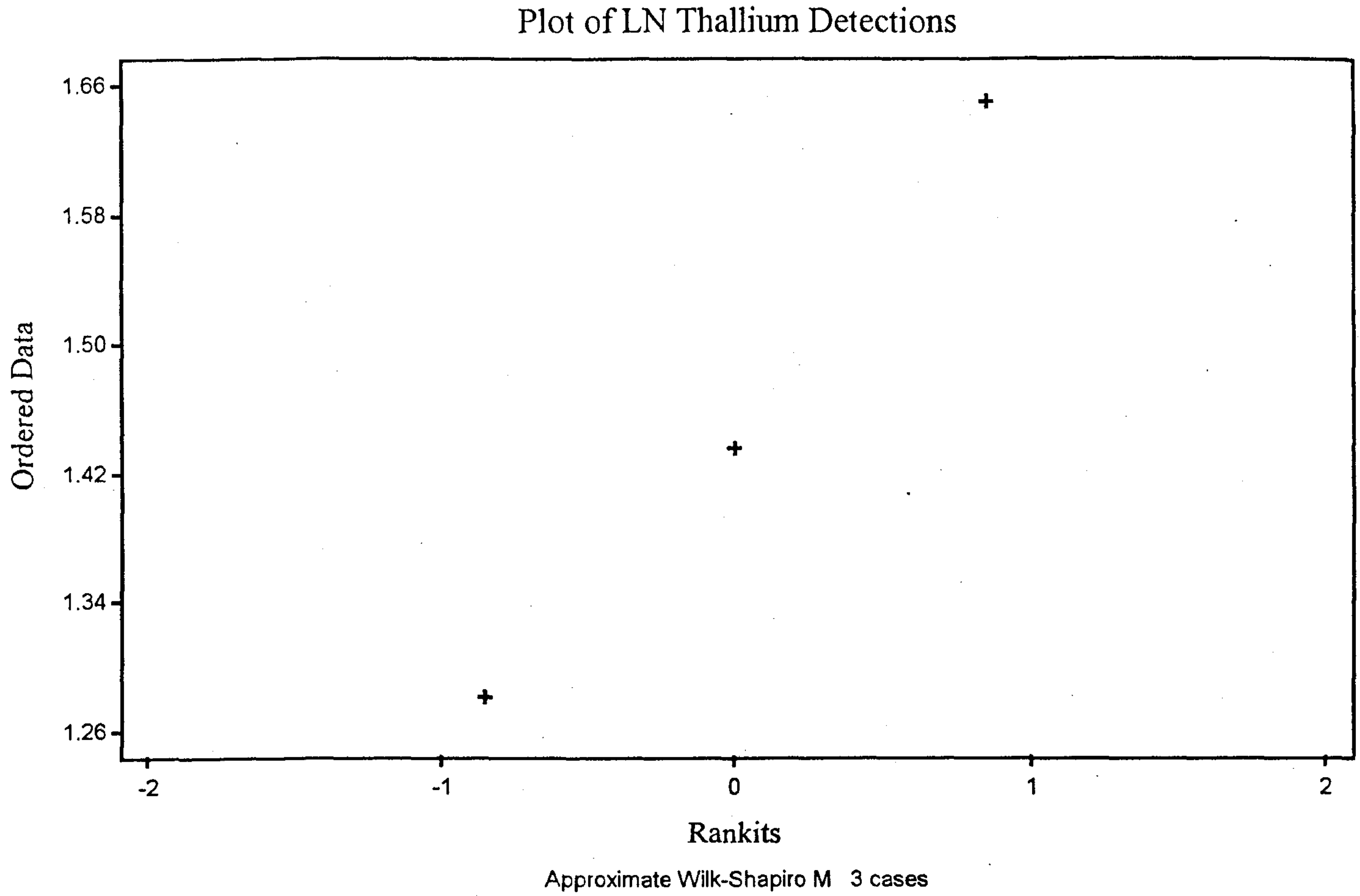
Approximate Wilk-Shapiro 0.9368   13 cases

Plot of LN Potassium Detections

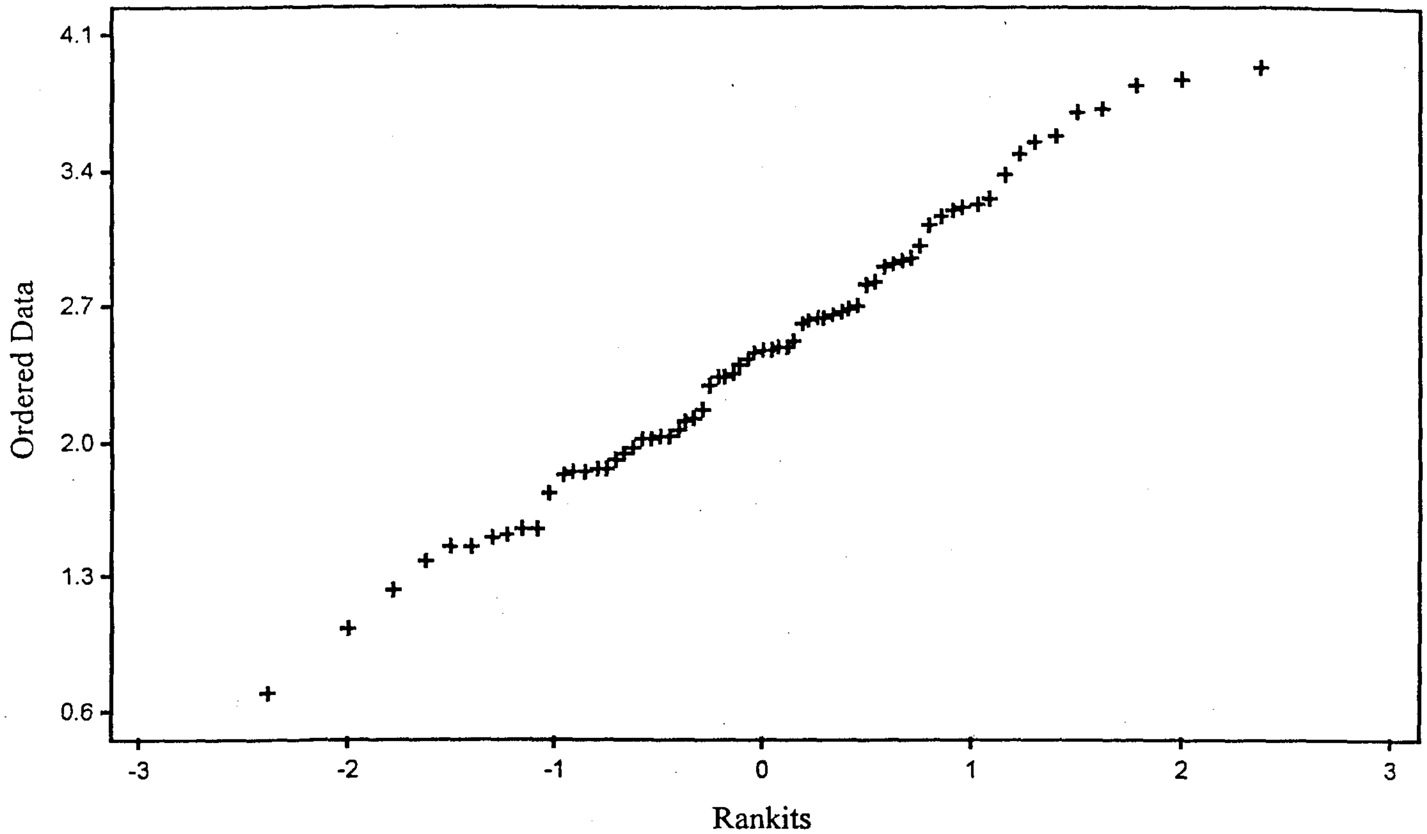


Approximate Wilk-Shapiro 0.9872   175 cases

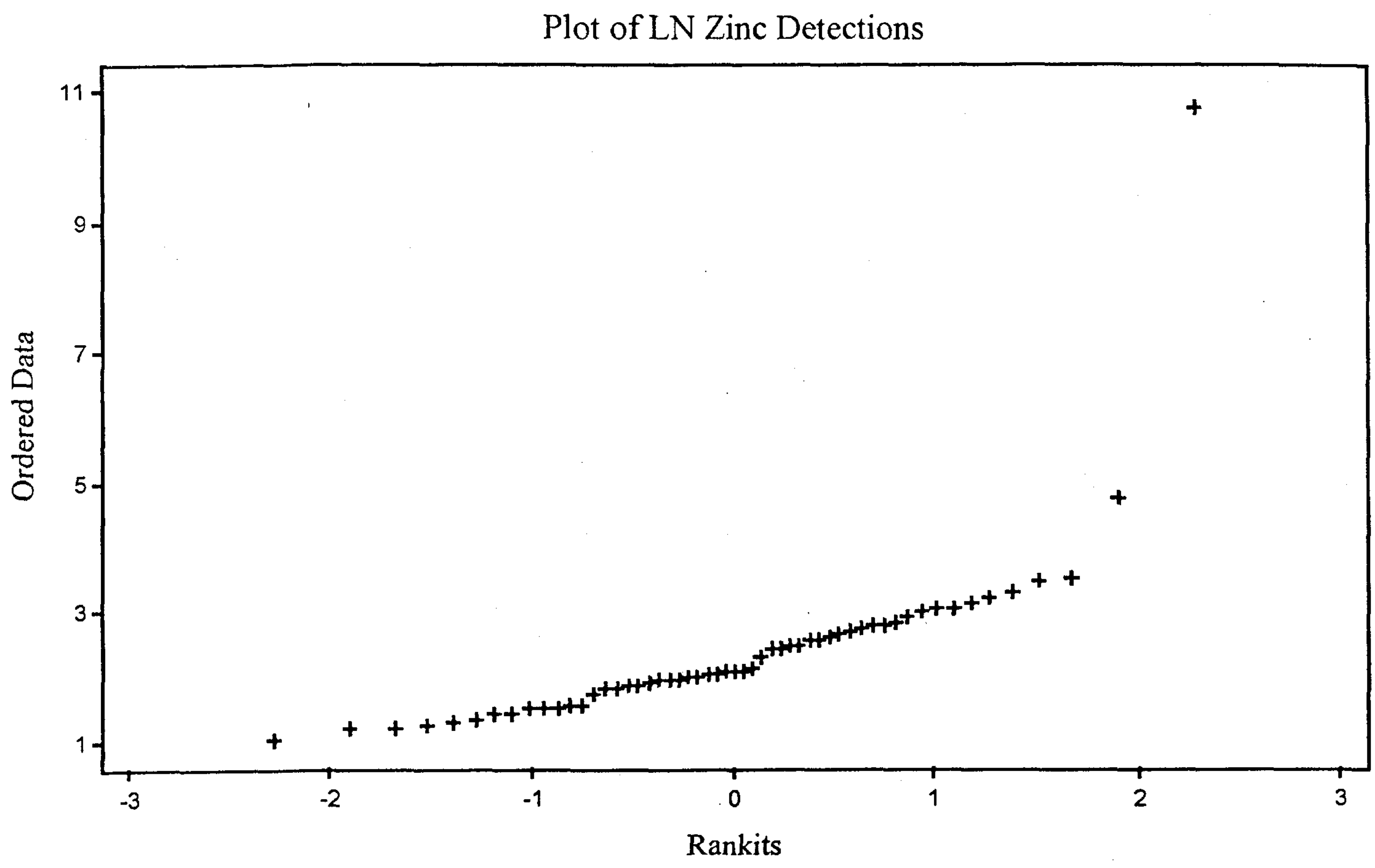

Plot of LN Sodium Detections
Ordered Data
16
14
12
10
8
-3
-2
-1
0
1
2
3
Rankits
Approximate Wilk-Shapiro 0.9817 180 cases


Plot of LN Thallium Detections
Ordered Data
1.66
1.58
1.50
1.42
1.34
1.26
-2
-1
0
1
2
Rankits
Approximate Wilk-Shapiro M   3 cases

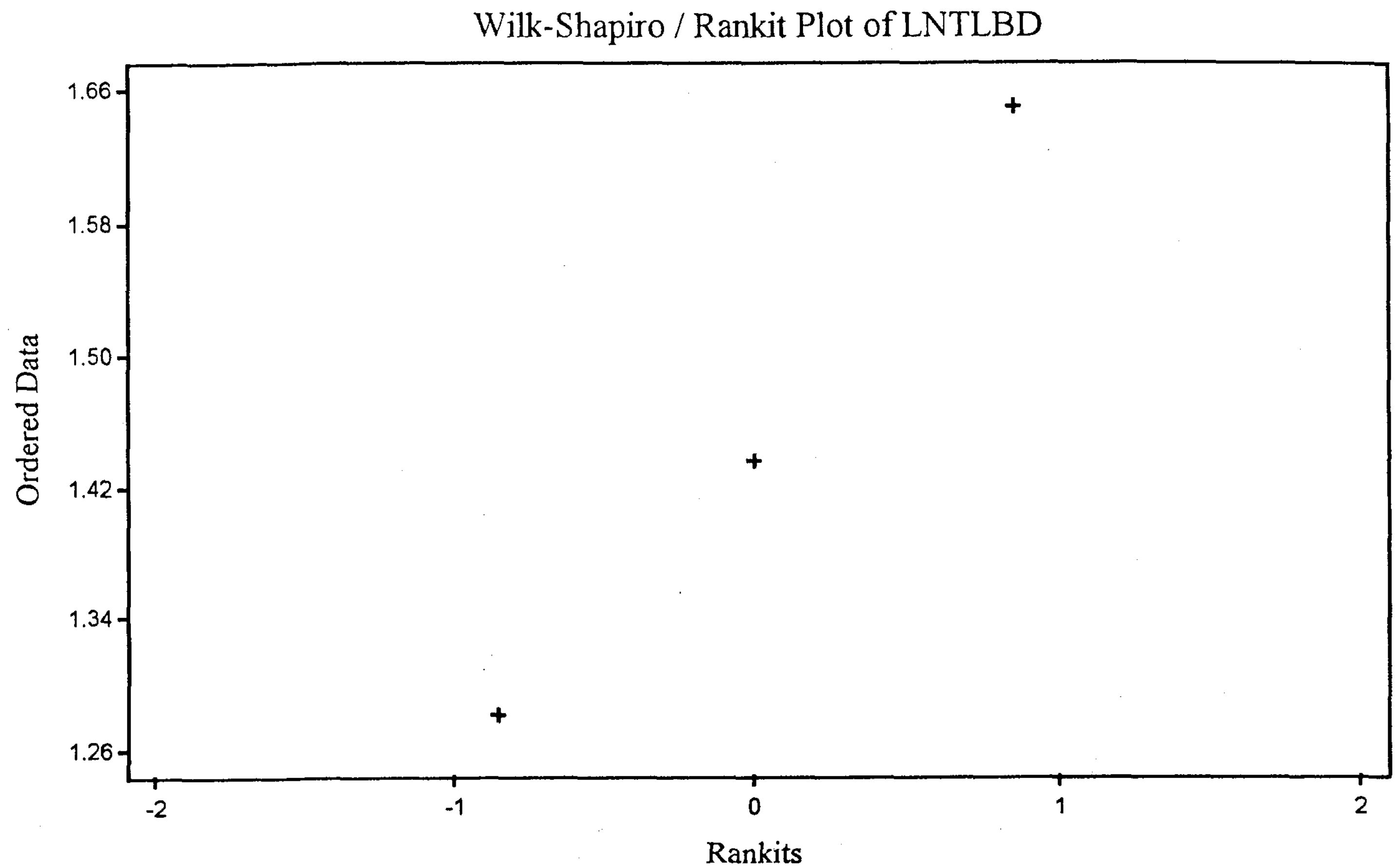
Plot of LN Vanadium Detections



Approximate Wilk-Shapiro 0.9912   69 cases



Approximate Wilk-Shapiro 0.5771   55 cases



Approximate Wilk-Shapiro M 3 cases

DESCRIPTIVE STATISTICS

	AGB	AGBD	ALB	ALBD	ASB
N	170	2	176	51	179
MISSING	10	178	4	129	1
LO 95% CI	1.3530	M	76.640	230.20	5.8885
MEAN	1.4919	3.6000	162.98	511.96	6.9721
UP 95% CI	1.6309	M	249.33	793.72	8.0557
SD	0.9176	1.6971	580.39	1001.8	7.3465
MINIMUM	0.2000	2.4000	3.0000	3.0000	0.9500
MAXIMUM	4.8000	4.8000	3970.0	3970.0	50.000

	ASBD	BAB	BABD	BEB	BEBD
N	94	176	144	176	18
MISSING	86	4	36	4	162
LO 95% CI	8.5706	71.314	85.612	0.6393	1.2612
MEAN	10.084	100.30	120.25	0.7175	1.5300
UP 95% CI	11.597	129.28	154.90	0.7957	1.7988
SD	7.3891	194.81	210.31	0.5259	0.5406
MINIMUM	2.0000	2.1500	2.3000	0.0500	0.9400
MAXIMUM	40.700	1260.0	1260.0	3.0000	3.0000

	BGBD	CAB	CABD	CDB	CDBD
N	3	180	176	176	16
MISSING	177	0	4	4	164
LO 95% CI	0.1232	35884	36734	0.8171	0.3933
MEAN	0.2667	46739	47789	0.9551	1.2581
UP 95% CI	0.4101	57594	58843	1.0931	2.1230
SD	0.0577	73805	74309	0.9276	1.6230
MINIMUM	0.2000	449.00	620.00	0.1000	0.3200
MAXIMUM	0.3000	513000	513000	6.5000	6.5000

	COB	COBD	CR6B	CR6BD	CRB
N	176	6	3	1	176
MISSING	4	174	177	179	4
LO 95% CI	3.8049	3.8388	-31.307	M	2.1031
MEAN	4.2031	7.0167	34.667	4.0000	3.2054
UP 95% CI	4.6013	10.195	100.64	M	4.3077
SD	2.6767	3.0281	26.558	M	7.4096
MINIMUM	1.1500	2.5000	4.0000	4.0000	0.3000
MAXIMUM	10.500	10.500	50.000	4.0000	82.800

	CRBD	CUB	CUBD	FEB	FEBD
N	23	176	54	180	119
MISSING	157	4	126	0	61
LO 95% CI	4.8949	5.2723	9.7983	448.37	678.96
MEAN	12.541	6.2557	11.950	800.75	1199.8
UP 95% CI	20.187	7.2390	14.102	1153.1	1720.7
SD	17.681	6.6101	7.8833	2395.8	2869.3
MINIMUM	0.7400	0.2000	2.1000	2.4000	7.2000
MAXIMUM	82.800	34.850	27.300	24400	24400

	HGB	KB	KBD	LNAGB	LNAGBD
N	180	180	175	170	2
MISSING	0	0	5	10	178
LO 95% CI	0.0970	23982	24680	0.0517	M
MEAN	0.1007	32184	33080	0.1629	1.2220
UP 95% CI	0.1044	40386	41480	0.2740	M
SD	0.0252	55764	56302	0.7342	0.4901
MINIMUM	0.0500	381.50	1200.0	-1.6094	0.8755

MAXIMUM	0.3000	505000	505000	1.5686	1.5686

	LNALB	LNALBD	LNASB	LNASBD	LNBAB
N	176	51	179	94	176
MISSING	4	129	1	86	4
LO 95% CI	3.2751	4.4439	1.3833	1.9323	3.3179
MEAN	3.4696	4.8890	1.5186	2.0748	3.5281
UP 95% CI	3.6641	5.3341	1.6538	2.2174	3.7383
SD	1.3076	1.5825	0.9168	0.6961	1.4129
MINIMUM	1.0986	1.0986	-0.0513	0.6931	0.7655
MAXIMUM	8.2865	8.2865	3.9120	3.7062	7.1389

	LNBABD	LNBEB	LNBEBD	LNBGBD	LNCAB
N	144	176	18	3	180
MISSING	36	4	162	177	0
LO 95% CI	3.6047	-0.8645	0.2218	-1.9207	9.5659
MEAN	3.8291	-0.7117	0.3760	-1.3391	9.7906
UP 95% CI	4.0535	-0.5589	0.5303	-0.7576	10.015
SD	1.3622	1.0272	0.3102	0.2341	1.5277
MINIMUM	0.8329	-2.9957	-0.0619	-1.6094	6.1070
MAXIMUM	7.1389	1.0986	1.0986	-1.2040	13.148

	LNCABD	LNCDB	LNCDBD	LNCOB	LNCOBD
N	176	176	16	176	6
MISSING	4	4	164	4	174
LO 95% CI	9.6537	-0.8000	-0.7280	1.1626	1.2809
MEAN	9.8695	-0.6282	-0.2456	1.2516	1.8452
UP 95% CI	10.085	-0.4563	0.2369	1.3407	2.4094
SD	1.4508	1.1552	0.9054	0.5986	0.5376
MINIMUM	6.4297	-2.3026	-1.1394	0.1398	0.9163
MAXIMUM	13.148	1.8718	1.8718	2.3514	2.3514

	LNCRB	LNCRBD	LNCUB	LNCUBD	LNFEB
N	176	23	176	54	180
MISSING	4	157	4	126	0
LO 95% CI	0.2717	1.3852	1.2355	2.0368	4.3797
MEAN	0.4345	1.8886	1.3794	2.2378	4.6875
UP 95% CI	0.5974	2.3920	1.5232	2.4387	4.9953
SD	1.0949	1.1641	0.9671	0.7363	2.0926
MINIMUM	-1.2040	-0.3011	-1.6094	0.7419	0.8755
MAXIMUM	4.4164	4.4164	3.5511	3.3069	10.102

	LNFEBD	LNHGB	LNKB	LNKBD	LNMGBD
N	119	180	180	175	180
MISSING	61	0	0	5	0
LO 95% CI	5.4601	-2.3459	9.3819	9.4768	9.3645
MEAN	5.7601	-2.3167	9.5690	9.6534	9.6219
UP 95% CI	6.0601	-2.2874	9.7560	9.8299	9.8794
SD	1.6528	0.1986	1.2718	1.1833	1.7504
MINIMUM	1.9741	-2.9957	5.9441	7.0901	6.3081
MAXIMUM	10.102	-1.2040	13.132	13.132	13.883

	LNMNB	LNMNBD	LNMOB	LNMOBD	LNNABD
N	180	172	100	5	180
MISSING	0	8	80	175	0
LO 95% CI	4.1527	4.3456	1.4322	0.9104	11.971
MEAN	4.4545	4.6332	1.5235	1.7995	12.201
UP 95% CI	4.7564	4.9207	1.6149	2.6886	12.431
SD	2.0522	1.9107	0.4604	0.7160	1.5637
MINIMUM	-0.5978	0.0953	0.0000	1.1314	8.4338
MAXIMUM	7.8160	7.8160	2.9653	2.9653	15.915

	LNNIB	LNNIBD	LNPBB	LNPBBD	LNSBB
N	180	13	180	18	176
MISSING	0	167	0	162	4
LO 95% CI	1.6319	2.0059	-0.2029	0.7262	1.6105
MEAN	1.7221	2.7937	-0.0960	1.1136	1.7638
UP 95% CI	1.8122	3.5816	0.0108	1.5010	1.9170
SD	0.6127	1.3038	0.7265	0.7791	1.0299
MINIMUM	-0.1625	0.9933	-0.9163	0.1823	0.0000
MAXIMUM	5.0173	5.0173	3.3464	3.3464	3.8670

	LNSBBD	LNTLB	LNTLBD	LNVAB	LNVABD
N	12	175	3	180	69
MISSING	168	5	177	0	111
LO 95% CI	1.2856	0.3717	0.9962	1.4747	2.2807
MEAN	1.9419	0.4680	1.4549	1.6035	2.4564
UP 95% CI	2.5981	0.5642	1.9136	1.7323	2.6321
SD	1.0329	0.6452	0.1847	0.8758	0.7314
MINIMUM	0.9163	-0.1625	1.2809	-0.3567	0.6931
MAXIMUM	3.8670	3.6376	1.6487	3.9279	3.9279

	LNZNB	LNZNBD	MGBD	MNB	MNBD
N	180	55	180	180	172
MISSING	0	125	0	0	8
LO 95% CI	1.4230	2.0423	46191	271.06	284.33
MEAN	1.5830	2.4090	71357	348.27	364.35
UP 95% CI	1.7430	2.7757	96524	425.49	444.37
SD	1.0880	1.3566	171107	525.00	531.67
MINIMUM	-1.3863	1.0296	549.00	0.5500	1.1000
MAXIMUM	10.754	10.754	1.070E+06	2480.0	2480.0

	MOB	MOBD	NABD	NIB	NIBD
N	100	5	180	180	13
MISSING	80	175	0	0	167
LO 95% CI	4.5822	-0.6839	488431	5.4795	5.3274
MEAN	5.0130	7.6600	692808	7.7119	35.392
UP 95% CI	5.4438	16.004	897184	9.9443	65.457
SD	2.1712	6.7200	1.390E+06	15.178	49.752
MINIMUM	1.0000	3.1000	4600.0	0.8500	2.7000
MAXIMUM	19.400	19.400	8.160E+06	151.00	151.00

	PBB	PBBD	SBB	SBBD	SEB
N	180	18	176	12	180
MISSING	0	162	4	168	0
LO 95% CI	1.0269	1.4225	8.0028	2.4948	1.2588
MEAN	1.4150	4.5222	9.1710	12.467	1.5814
UP 95% CI	1.8031	7.6220	10.339	22.439	1.9040
SD	2.6386	6.2333	7.8530	15.695	2.1933
MINIMUM	0.4000	1.2000	1.0000	2.5000	0.9500
MAXIMUM	28.400	28.400	47.800	47.800	27.000

	SEBD	TLB	TLBD	VAB	VABD
N	1	175	3	180	69
MISSING	179	5	177	0	111
LO 95% CI	M	1.7082	2.3254	6.4114	12.345
MEAN	2.5000	2.2200	4.3333	7.7758	15.125
UP 95% CI	M	2.7318	6.3412	9.1403	17.904
SD	M	3.4307	0.8083	9.2769	11.570
MINIMUM	2.5000	0.8500	3.6000	0.7000	2.0000
MAXIMUM	2.5000	38.000	5.2000	50.800	50.800

	ZNB	ZNBD
N	180	55

MISSING	0	125
LO 95% CI	-246.12	-841.64
MEAN	266.87	863.86
UP 95% CI	779.85	2569.4
SD	3487.8	6308.8
MINIMUM	0.2500	2.8000
MAXIMUM	46800	46800