

Test Group Summary Report

C02A Metals in Water–Full Range

March 2020 PT Round

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1.0 The Proficiency Testing Report

The Proficiency Testing Report consists of two parts.

- *PTC Proficiency Testing Report:* This report contains participant-specific evaluations and other confidential information. This report is emailed to participants at the end of the study.
- *Test Group Summary Report:* A Test Group Summary Report is created for each test group at the end of the study. These reports contain more detailed information on the study than are found in the participant-specific PTC Proficiency Testing Report. These reports do not contain any confidential information and are made available on the PTC web site.

2.0 Definitions

The participant-specific PTC Proficiency Testing Report contains some terms that new participants may not be familiar with.

<i>Code:</i>	The registration code that is unique to each analyte that a participant is registered for.
<i>App:</i>	If a participant is accredited by CALA, this three digit number is the appendix number that the accredited method is assigned to.
<i>N:</i>	The number of participants results that were used to calculate the summary statistics. This excludes qualified data (e.g., <) and any results that were flagged as outliers.
<i>Assigned:</i>	The Assigned Value is the robust mean of the reported results, outliers excluded. This is often referred to as the “target” value.
<i>±u:</i>	The uncertainty of the assigned value.
<i>Reported:</i>	The result reported by the participant.
<i>s:</i>	The Standard Deviation of Proficiency Assessment. This value is used to determine the acceptance limits for the PT evaluation.
<i>z-Score:</i>	A value assigned to each reported result that is a measure of how much it deviates from the Assigned Value.
<i>Score:</i>	The composite score of the four results reported for each analyte. It is normalized to a score out of 100.
<i>Bias:</i>	A flag assigned if bias is detected using the re-scaled z-score procedure.

3.0 Scoring System

Participant performance is evaluated for each proficiency testing sample by a quantitative method that is consistent with ISO/IEC 17043:2010 *Conformity assessment – General requirements for proficiency testing*, the *International Harmonized Protocol for Proficiency Testing of (Chemical) Analytical Laboratories* (2006), and ISO 13528:2015 *Statistical methods for use in proficiency testing by interlaboratory comparisons*.

The following is a brief description of the evaluation procedure used by PTC. The detailed evaluation procedure is described in PROC09 - *Procedures*, which is available on the PTC website www.PTCanada.org).

3.1 HOMOGENEITY AND STABILITY ASSESSMENT

Homogeneity and stability are assessed using participant data. Regression analysis is performed on reported result against order of sample production (Homogeneity) and reported result against date of analysis (Stability). If the slope is significantly different than zero for either then the Standard Deviation of Proficiency Assessment (s) is increased until the impact is minimized.

3.2 THE Z SCORE

A "z-score" is calculated for each reported result as follows:

$$z = \frac{(x - \bar{X})}{s}$$

where: x = participant's result;
 \bar{X} = the Assigned Value for the sample;
 s = the Standard Deviation for Proficiency Assessment.

The assigned value \bar{X} is generally estimated from the inter-laboratory Robust mean after outliers due to obvious gross errors (e.g., reported in wrong units) have been removed.

The Standard Deviation for Proficiency Assessment, s , is determined as follows:

- The inter-laboratory Robust standard deviation (stdev) is calculated using reported results, obvious outliers removed;
- The expected inter-laboratory standard deviation ($s!$) is estimated from regression equations derived from previous studies (see PROC11- *PT Regression Equations* for details);
- If $s!$ is higher than stdev then $s!$ is used in the z score equation;
- If $s!$ is lower than stdev then stdev is used in the z score equation;
- When a laboratory reports its detection limit, s will be estimated using a pooled variance procedure that uses both the inter-laboratory data and the reported detection limit.

3.2 COMPOSITE (PT) SCORE

Since each PT study involves four or two separate samples of distinct concentrations for each test, it is necessary to calculate a composite PT score for each test to determine overall performance. The composite score is calculated by first averaging the absolute z-scores for the four results and then calculating a final score as $100 + (-15 \times \text{avg } |z|)$.

Acceptable PT Scores equal or exceed 70.

3.3 IDENTIFYING BIAS

The proficiency testing report provides flags for bias. These are determined using the re-scaled z-score procedure.

$$RSZ = \frac{\sum z}{\sqrt{N}}$$

where z = the z -score
 N = the number of samples

Flags are assigned for each test group/parameter combination as follows:

$RSZ \geq -2$ and ≤ 2	no flag assigned
$RSZ > 2$	H (High)
$RSZ > 3$	VH (Very High)
$RSZ < -2$	L (LOW)
$RSZ < -3$	VL (Very Low)

3.4 DEVIATIONS FROM EVALUATION PROCEDURE

Other than changes to the Standard Deviation of Proficiency Assessment due to homogeneity or stability flags, any deviation from the published evaluation procedure is described on the cover page(s) of the final PT report.

4.0 Study Specific Data Summary

The following pages provide more detailed information about the study indicated in the cover page of this report than is found in the participant-specific PTC Proficiency Testing Report. The graphical representations and the statistical summaries by method are based upon the data after outliers have been removed.

4.1 OVERALL DATA DISTRIBUTION

Kernel density plots are generated for each data set. These plots are a statistical way to represent the overall data distribution and are used to visualize deviations from normality and bi-modality.

4.2 z-SCORE PLOTS

The z -scores for each sample are ranked in increasing order and plotted. When the data is normally distributed, the plot should show a slight sigmoidal curve, with an equal number of points above zero as below.

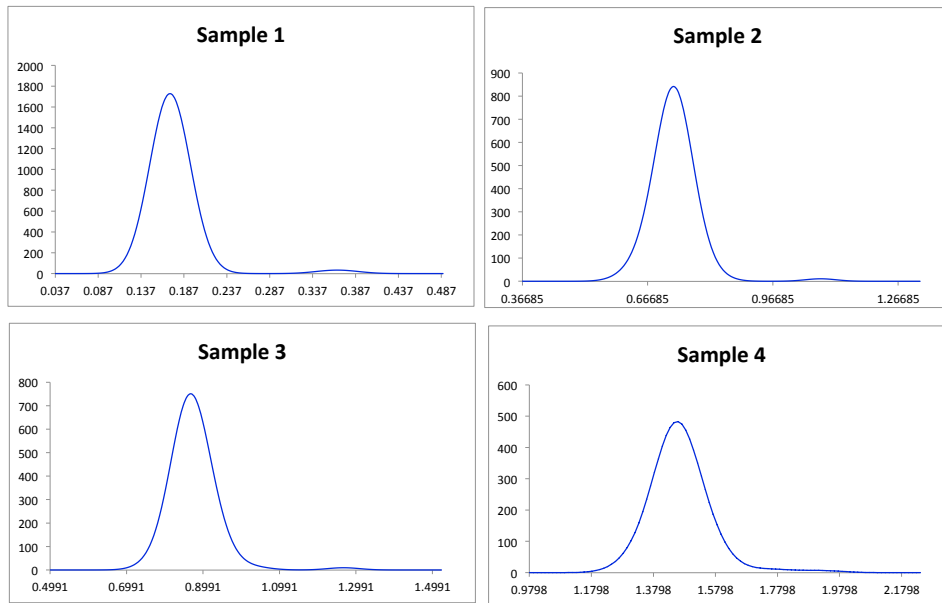
4.3 STATISTICAL SUMMARY BY METHOD

Statistical summaries are provided for the four most commonly reported methods. The statistics included in these tables for mean and standard deviation are the mathematical values, not the robust values. As such, there will be slight differences between these and those displayed in the participant specific PTC Proficiency Testing Report.

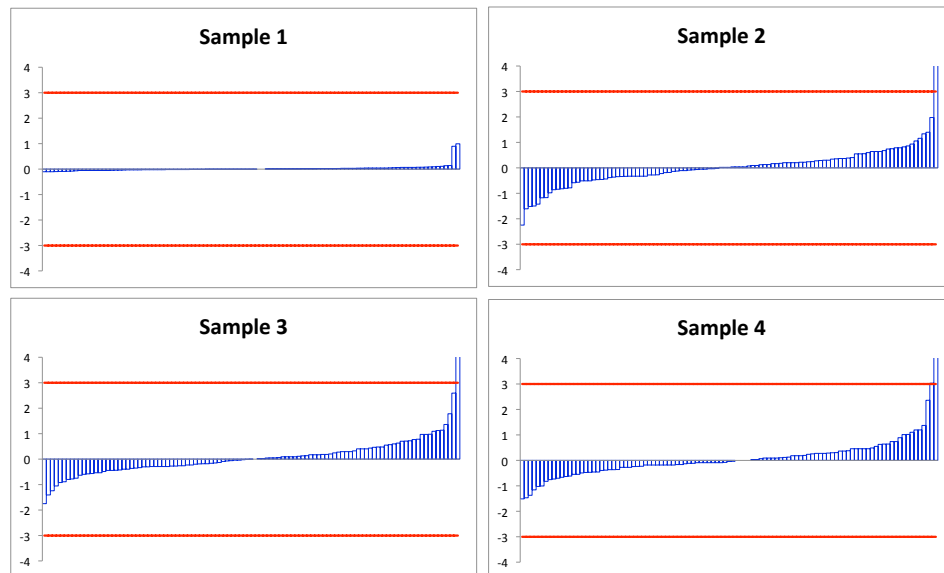
In addition to this, z -Score plots are provided for the four most common methods. As these plots use the Assigned Value and Standard Deviation for Proficiency Assessment estimated using all of the data, any method that does not have approximately the same number of positive and negative z -scores is an indication that the method may be biased relative to other methods.

Aluminum

Kernel Density Plots



z-Score Plots



Summary Statistics by Four Most Common Methods

Sample 1					
Method	All*	ICP/MS	ICP/OES	AAG	
Median	0.171	0.171	0.17	0.181	0
Stdev	0.206	0.00924	0.0426	0.104	0
Number	105	76	26	3	0
z > 3	0	0	0	0	0
z 2 - 3	0	0	0	0	0

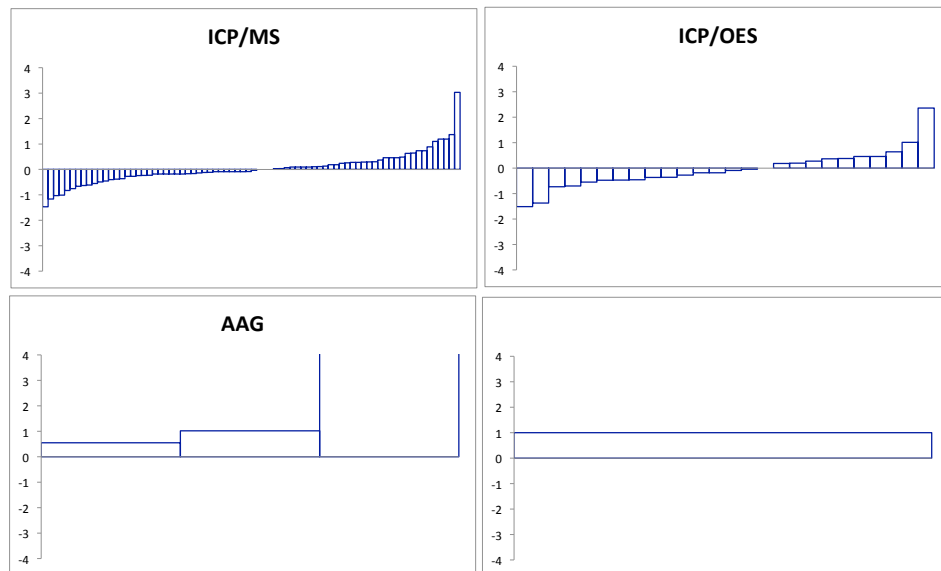
Sample 2					
Method	All*	ICP/MS	ICP/OES	AAG	
Median	0.728	0.729	0.718	0.786	0
Stdev	0.0546	0.0315	0.0465	0.184	0
Number	105	76	26	3	0
z > 3	1	0	0	1	0
z 2 - 3	1	0	1	0	0

Sample 3					
Method	All*	ICP/MS	ICP/OES	AAG	
Median	0.869	0.868	0.859	0.958	0
Stdev	0.0652	0.0328	0.0579	0.205	0
Number	105	76	26	3	0
z > 3	1	0	0	1	0
z 2 - 3	1	0	1	0	0

Sample 4					
Method	All*	ICP/MS	ICP/OES	AAG	
Median	1.46	1.45	1.45	1.57	0
Stdev	0.109	0.0682	0.0826	0.221	0
Number	105	76	26	3	0
z > 3	2	1	0	1	0
z 2 - 3	1	0	1	0	0

* Values for the median and standard deviation are the robust mean and acceptance limit deviation. For method statistics, the arithmetic mean and standard deviation are used.

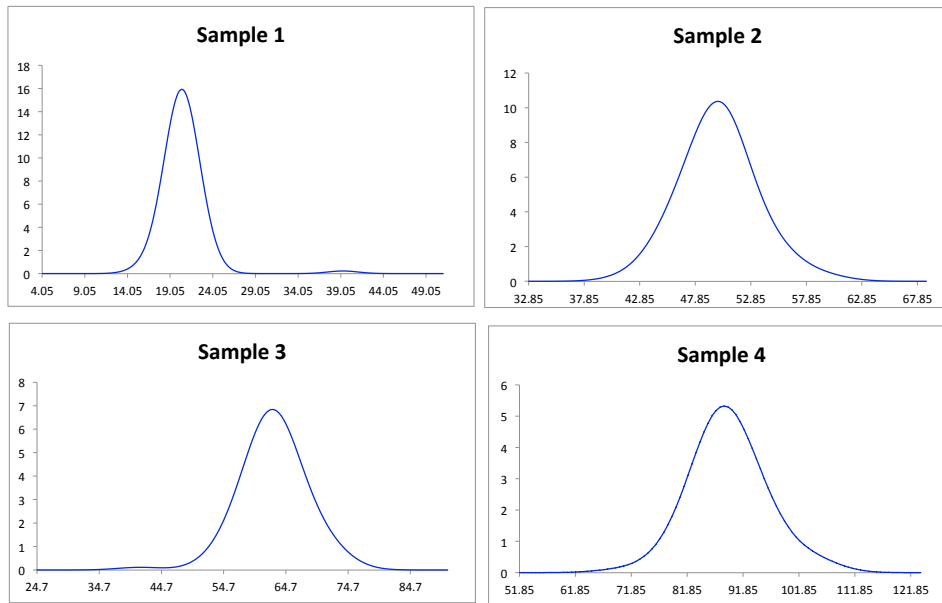
z-Score Plots by Method - Sample 4



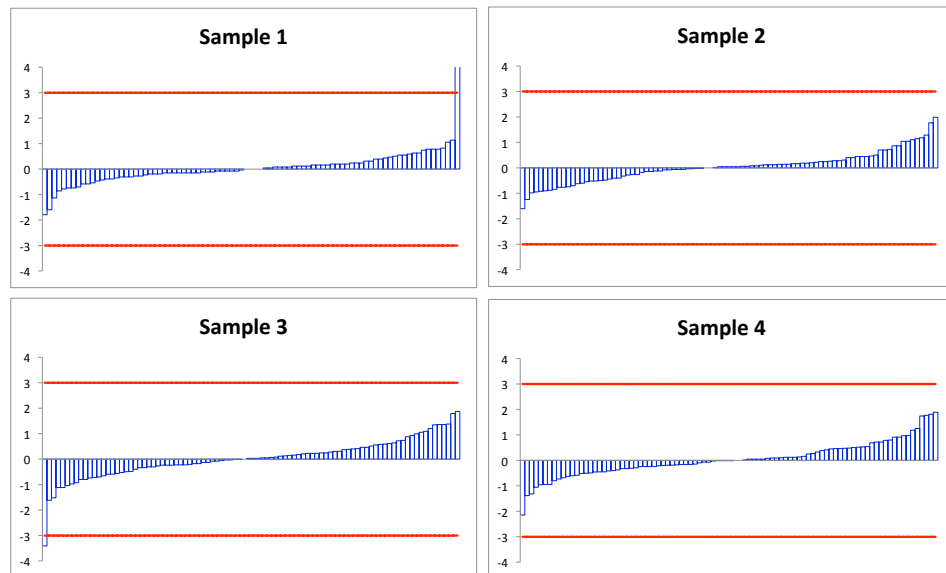
Evaluation for samples 1 was adjusted for stability flag.

Antimony

Kernel Density Plots



z-Score Plots



Summary Statistics by Four Most Common Methods

Sample 1					
Method	All*	ICP/MS	ICP/OES	AAG	AAHY
Median	20.4	20.4	20	29.6	20.7
Stdev	2.56	1.11	2.01	13.7	0
Number	87	74	9	2	1
z > 3	1	0	0	1	0
z 2 - 3	0	0	0	0	0

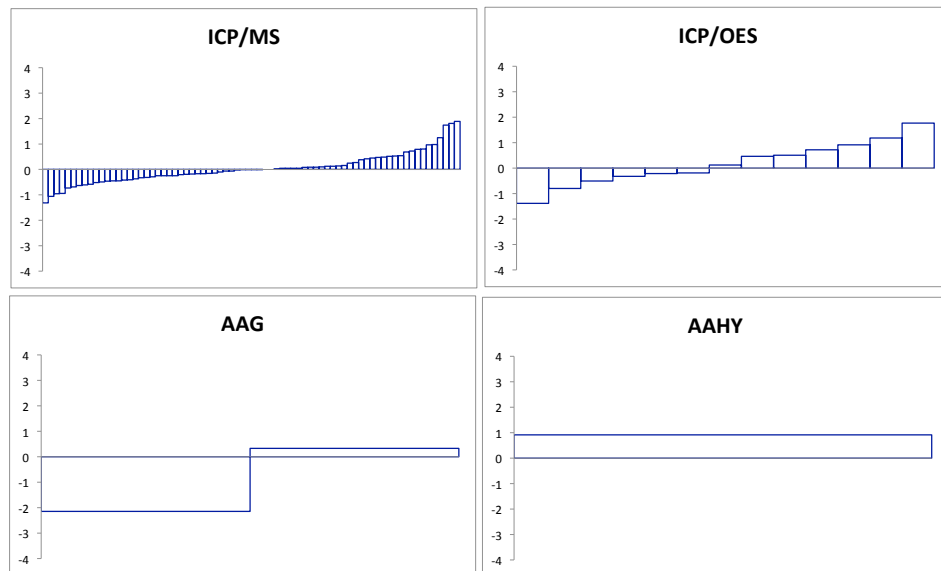
Sample 2					
Method	All*	ICP/MS	ICP/OES	AAG	AAHY
Median	49.8	50	49.3	50.1	55.5
Stdev	4.98	2.77	4.65	0.778	0
Number	91	74	12	2	1
z > 3	0	0	0	0	0
z 2 - 3	0	0	0	0	0

Sample 3					
Method	All*	ICP/MS	ICP/OES	AAG	AAHY
Median	62.5	62.8	60	52.1	70.9
Stdev	6.25	3.89	5.78	15.4	0
Number	92	74	13	2	1
z > 3	1	0	0	1	0
z 2 - 3	0	0	0	0	0

Sample 4					
Method	All*	ICP/MS	ICP/OES	AAG	AAHY
Median	88.9	88.8	90	80.8	97
Stdev	8.89	5.38	7.68	15.6	0
Number	92	74	13	2	1
z > 3	0	0	0	0	0
z 2 - 3	1	0	0	1	0

* Values for the median and standard deviation are the robust mean and acceptance limit deviation. For method statistics, the arithmetic mean and standard deviation are used.

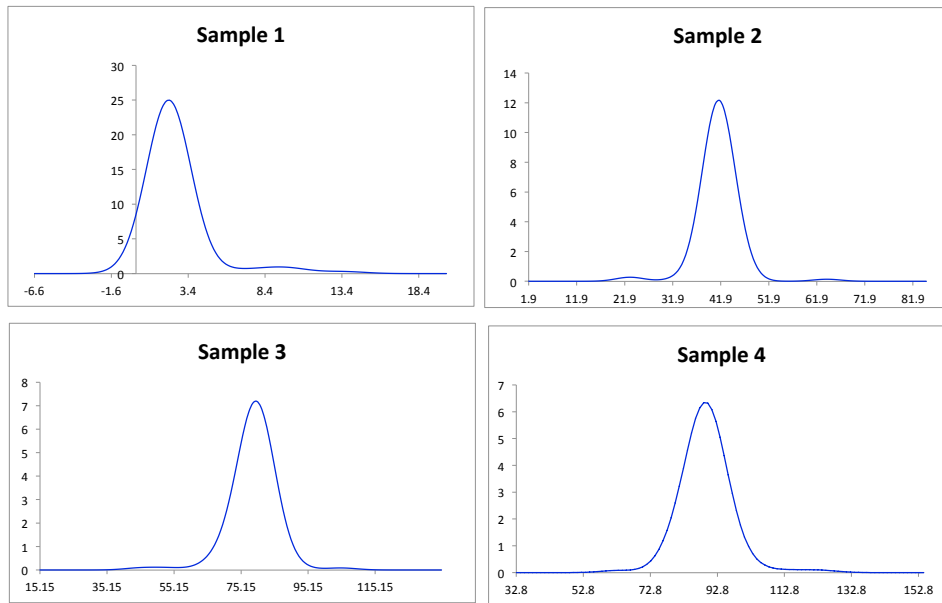
z-Score Plots by Method - Sample 4



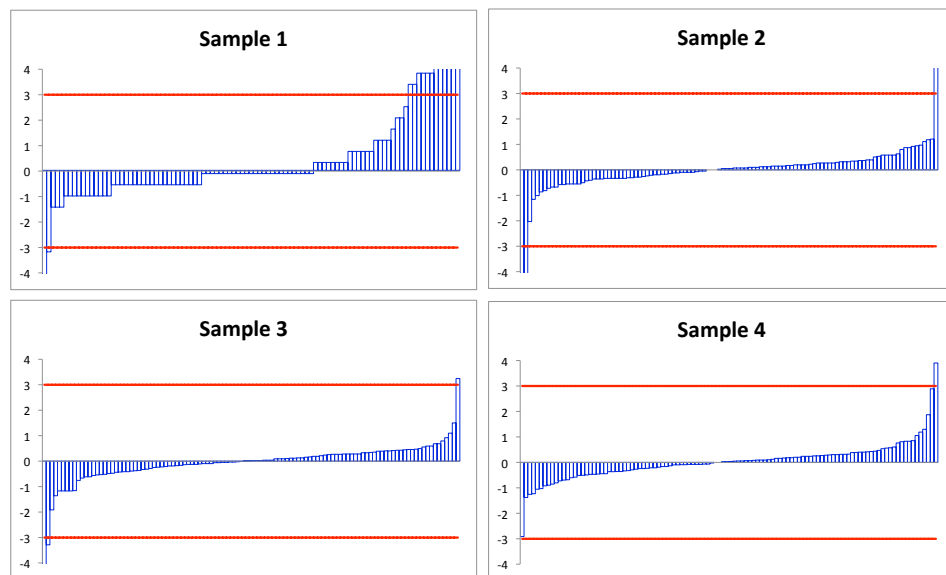
Evaluation for sample 1 was adjusted for stability flag.

Arsenic

Kernel Density Plots



z-Score Plots



Summary Statistics by Four Most Common Methods

Sample 1					
Method	All*	ICP/MS	ICP/OES	AAG	AAHY
Median	2.13	2.1	3	2.1	1.75
Stdev	0.228	0.662	3.95	6.58	0.495
Number	97	84	7	3	2
z > 3	14	6	5	1	1
z 2 - 3	3	2	1	0	0

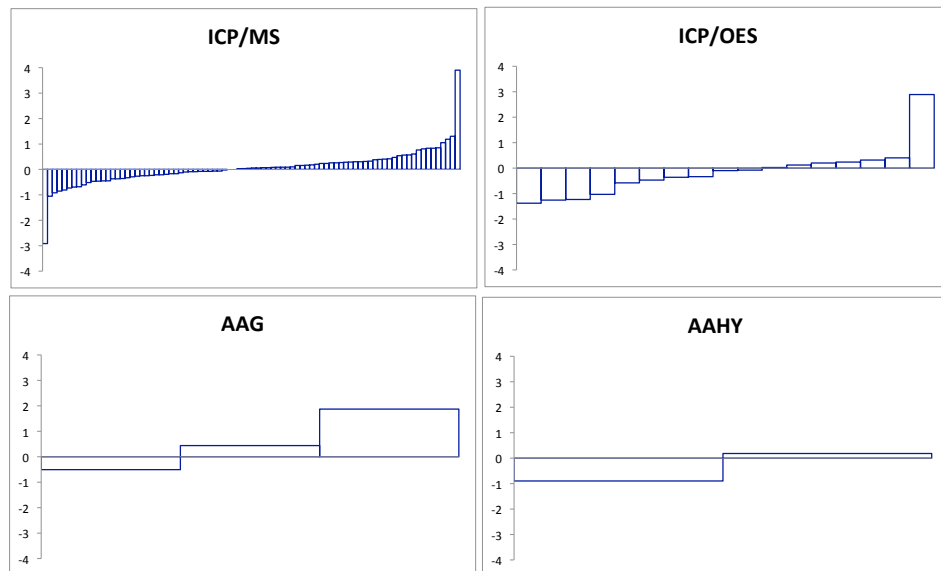
Sample 2					
Method	All*	ICP/MS	ICP/OES	AAG	AAHY
Median	41.4	41.8	40.9	39.6	40
Stdev	4.14	3.7	2.37	10	3.89
Number	110	86	17	3	2
z > 3	3	2	0	1	0
z 2 - 3	1	0	1	0	0

Sample 3					
Method	All*	ICP/MS	ICP/OES	AAG	AAHY
Median	79.3	79.5	79	77.8	78.5
Stdev	7.93	5.99	5.48	2.42	5.8
Number	110	86	17	3	2
z > 3	3	2	0	0	0
z 2 - 3	0	0	0	0	0

Sample 4					
Method	All*	ICP/MS	ICP/OES	AAG	AAHY
Median	89.2	89.7	88.3	93.1	86
Stdev	8.92	6.24	8.7	10.7	6.79
Number	110	86	17	3	2
z > 3	1	1	0	0	0
z 2 - 3	2	1	1	0	0

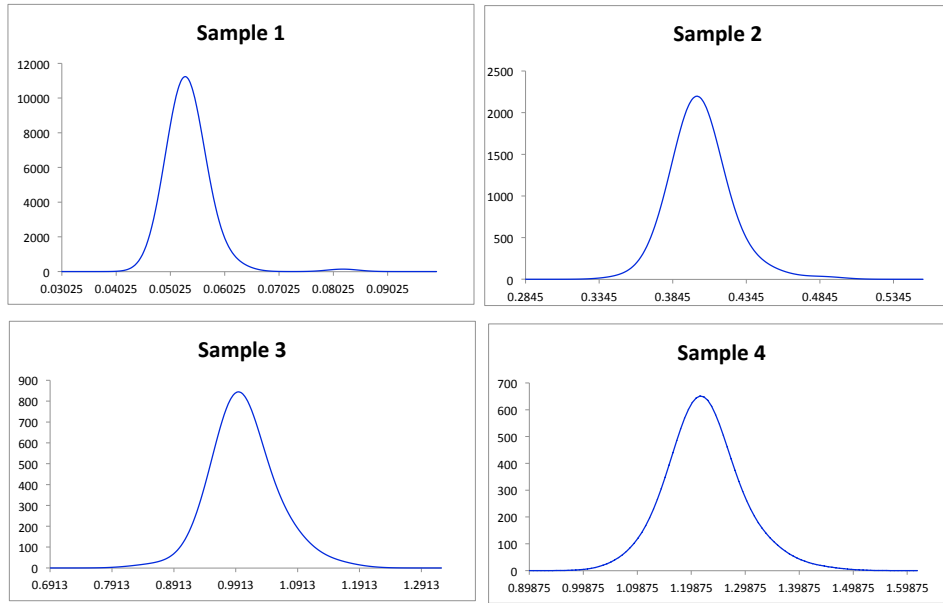
* Values for the median and standard deviation are the robust mean and acceptance limit deviation. For method statistics, the arithmetic mean and standard deviation are used.

z-Score Plots by Method - Sample 4

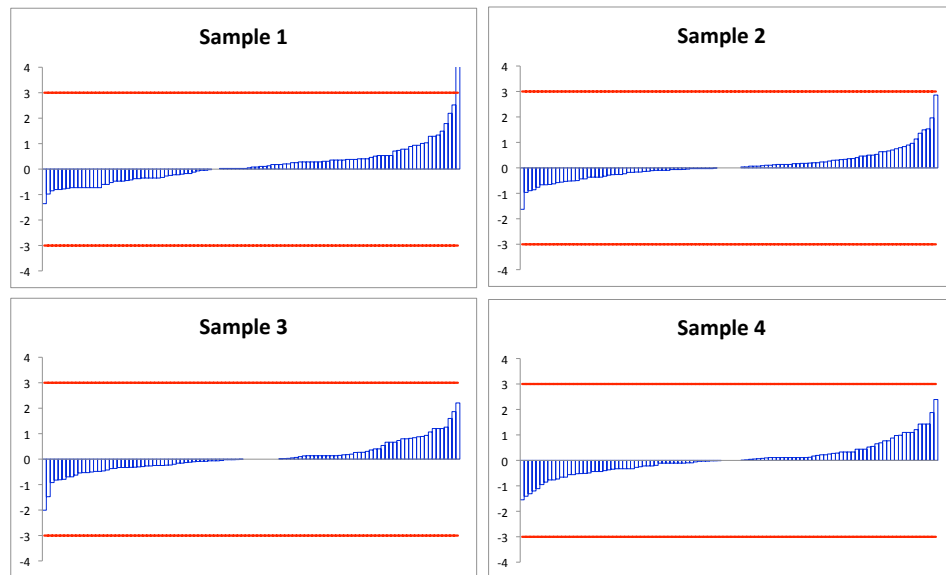


Barium

Kernel Density Plots



Z-Score Plots



Summary Statistics by Four Most Common Methods

Sample 1					
Method	All*	ICP/MS	ICP/OES	AAG	
Median	0.0529	0.0532	0.0532	0.0529	0
Stdev	0.00397	0.0024	0.00628	0	0
Number	106	77	28	1	0
z > 3	1	0	1	0	0
z 2 - 3	2	1	1	0	0

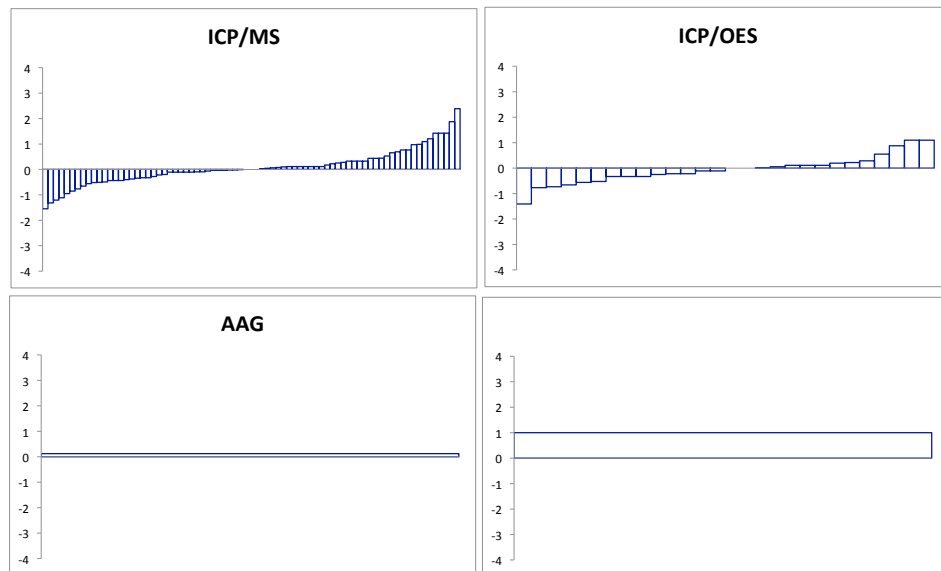
Sample 2					
Method	All*	ICP/MS	ICP/OES	AAG	
Median	0.401	0.401	0.404	0.393	0
Stdev	0.0301	0.0158	0.0237	0	0
Number	106	77	28	1	0
z > 3	0	0	0	0	0
z 2 - 3	1	0	1	0	0

Sample 3					
Method	All*	ICP/MS	ICP/OES	AAG	
Median	1	1	1	0.991	0
Stdev	0.075	0.0461	0.048	0	0
Number	106	77	28	1	0
z > 3	0	0	0	0	0
z 2 - 3	2	2	0	0	0

Sample 4					
Method	All*	ICP/MS	ICP/OES	AAG	
Median	1.22	1.22	1.22	1.23	0
Stdev	0.0913	0.0621	0.0503	0	0
Number	106	77	28	1	0
z > 3	0	0	0	0	0
z 2 - 3	1	1	0	0	0

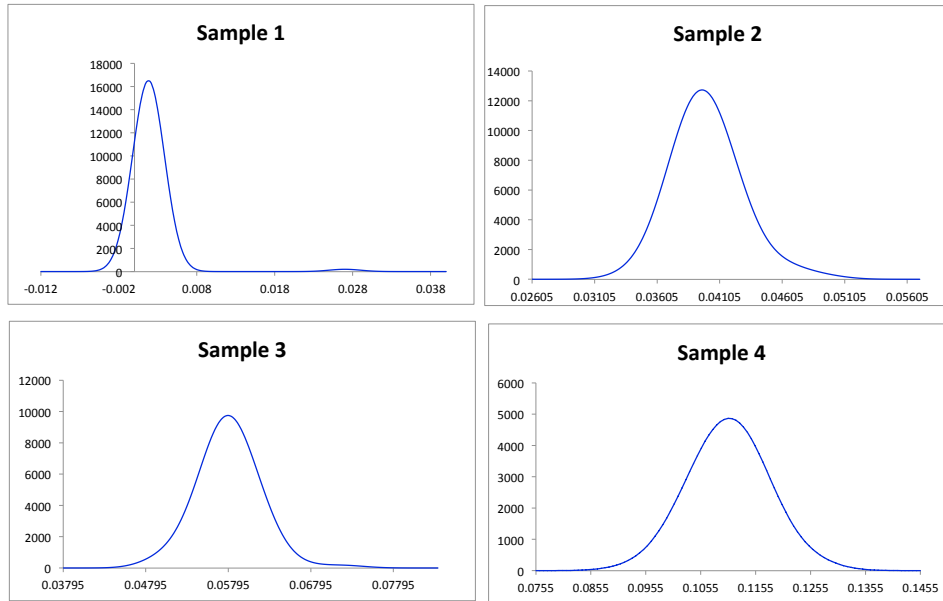
* Values for the median and standard deviation are the robust mean and acceptance limit deviation. For method statistics, the arithmetic mean and standard deviation are used.

z-Score Plots by Method - Sample 4

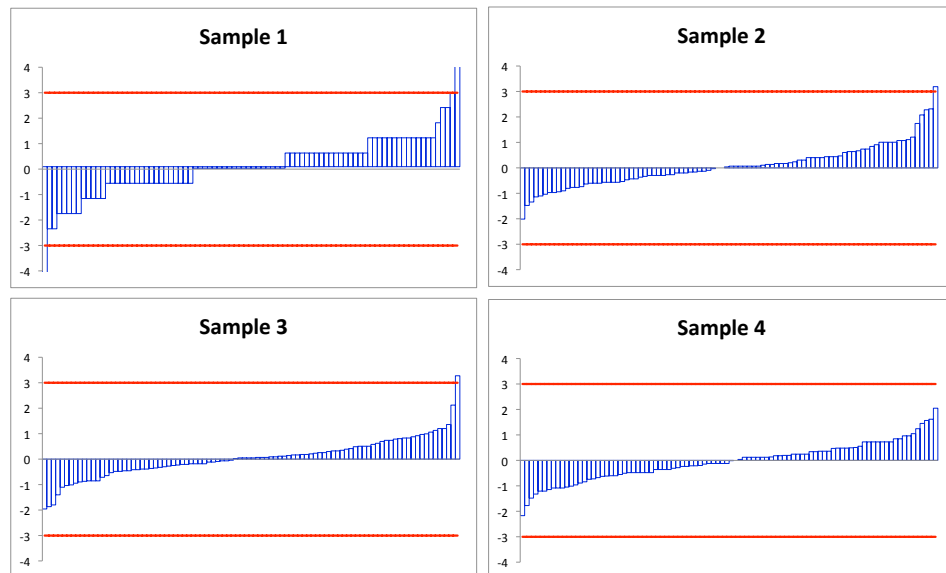


Beryllium

Kernel Density Plots



z-Score Plots



Summary Statistics by Four Most Common Methods

Sample 1					
Method	All*	ICP/MS	ICP/OES	AAG	
Median	0.00181	0.0018	0.0018	0.0015	0
Stdev	0.000168	0.00016	0.00596	0	0
Number	86	67	18	1	0
z > 3	2	0	2	0	0
z 2 - 3	5	4	1	0	0

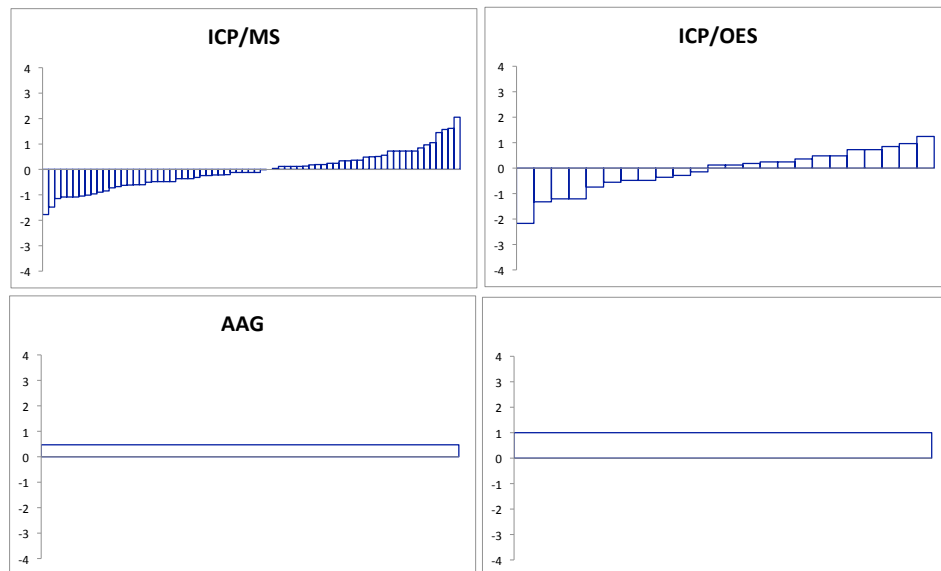
Sample 2					
Method	All*	ICP/MS	ICP/OES	AAG	
Median	0.0398	0.0397	0.04	0.0392	0
Stdev	0.00298	0.00262	0.00229	0	0
Number	92	69	22	1	0
z > 3	1	1	0	0	0
z 2 - 3	4	3	1	0	0

Sample 3					
Method	All*	ICP/MS	ICP/OES	AAG	
Median	0.0578	0.058	0.058	0.0583	0
Stdev	0.00434	0.00345	0.00339	0	0
Number	94	69	24	1	0
z > 3	1	1	0	0	0
z 2 - 3	1	1	0	0	0

Sample 4					
Method	All*	ICP/MS	ICP/OES	AAG	
Median	0.111	0.11	0.112	0.115	0
Stdev	0.00829	0.00617	0.00686	0	0
Number	94	69	24	1	0
z > 3	0	0	0	0	0
z 2 - 3	2	1	1	0	0

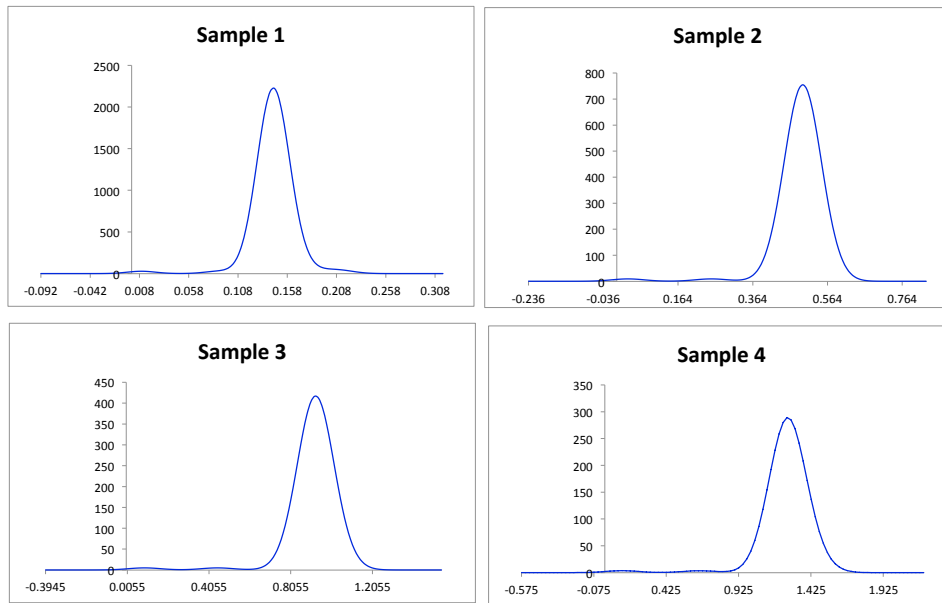
* Values for the median and standard deviation are the robust mean and acceptance limit deviation. For method statistics, the arithmetic mean and standard deviation are used.

z-Score Plots by Method - Sample 4

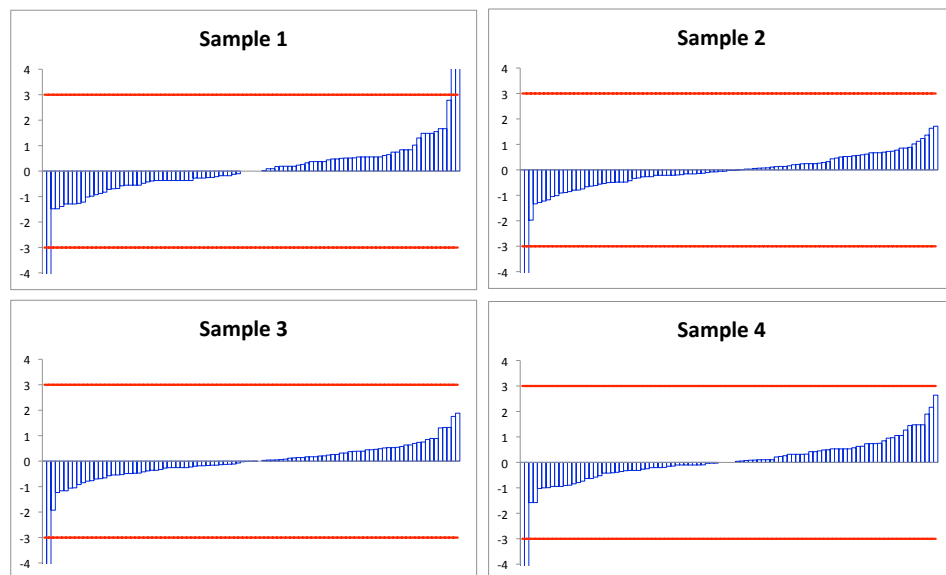


Boron

Kernel Density Plots



z-Score Plots



Summary Statistics by Four Most Common Methods

Sample 1					
Method	All*	ICP/MS	ICP/OES		
Median	0.144	0.144	0.141	0	0
Stdev	0.0108	0.0196	0.0186	0	0
Number	97	69	28	0	0
z > 3	4	2	2	0	0
z 2 - 3	1	1	0	0	0

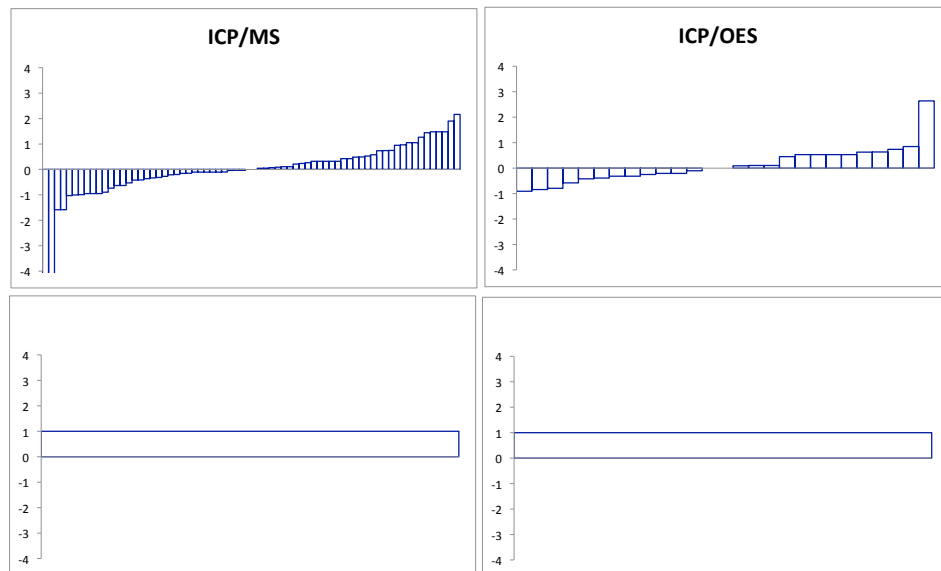
Sample 2					
Method	All*	ICP/MS	ICP/OES		
Median	0.498	0.498	0.496	0	0
Stdev	0.0374	0.068	0.0207	0	0
Number	97	70	27	0	0
z > 3	2	2	0	0	0
z 2 - 3	0	0	0	0	0

Sample 3					
Method	All*	ICP/MS	ICP/OES		
Median	0.928	0.927	0.919	0	0
Stdev	0.0696	0.124	0.0339	0	0
Number	97	70	27	0	0
z > 3	2	2	0	0	0
z 2 - 3	0	0	0	0	0

Sample 4					
Method	All*	ICP/MS	ICP/OES		
Median	1.26	1.26	1.26	0	0
Stdev	0.0948	0.171	0.0676	0	0
Number	97	70	27	0	0
z > 3	2	2	0	0	0
z 2 - 3	2	1	1	0	0

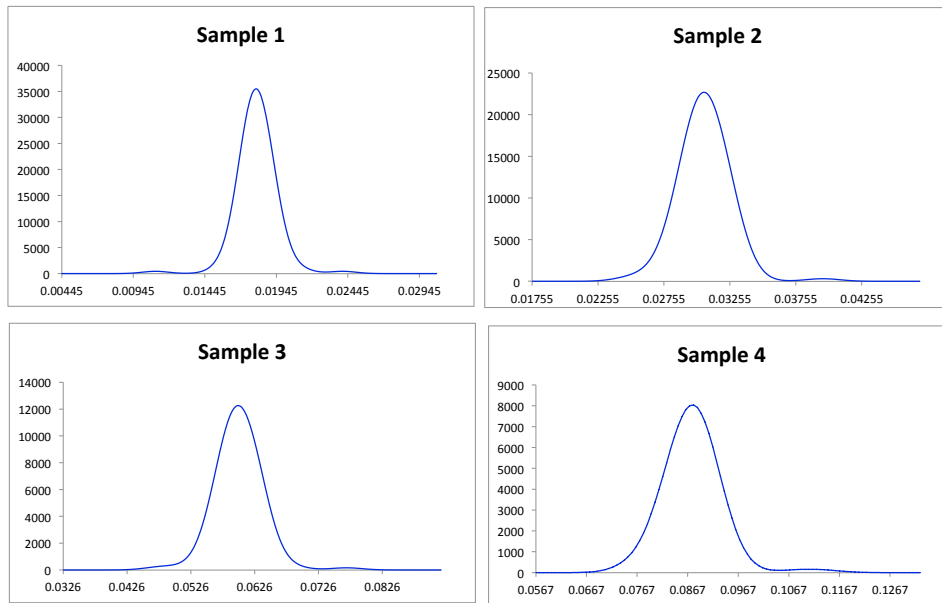
* Values for the median and standard deviation are the robust mean and acceptance limit deviation. For method statistics, the arithmetic mean and standard deviation are used.

z-Score Plots by Method - Sample 4

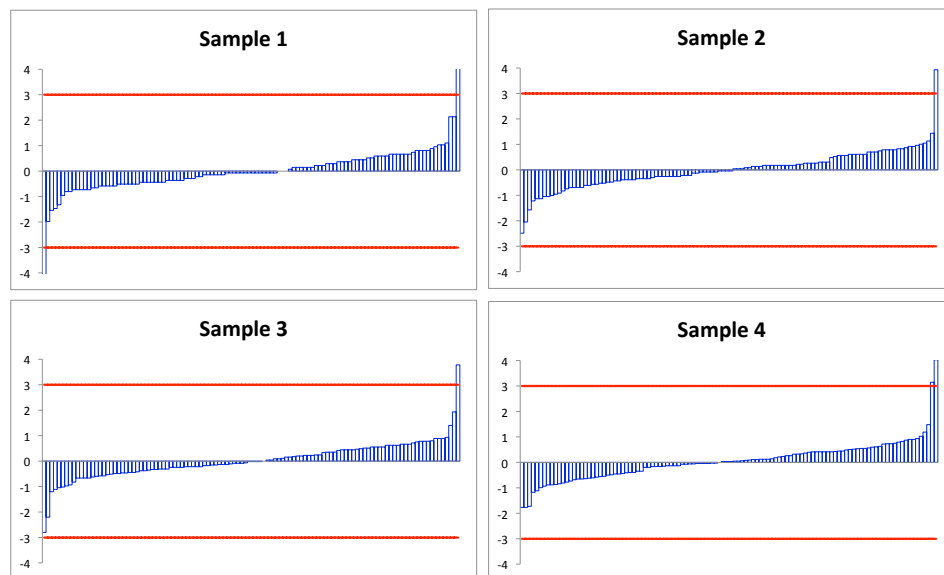


Cadmium

Kernel Density Plots



z-Score Plots



Summary Statistics by Four Most Common Methods

Sample 1					
Method	All*	ICP/MS	ICP/OES	AAG	
Median	0.0181	0.018	0.018	0.0176	0
Stdev	0.00136	0.000795	0.00203	0.0000707	0
Number	112	80	30	2	0
z > 3	2	0	2	0	0
z 2 - 3	2	1	1	0	0

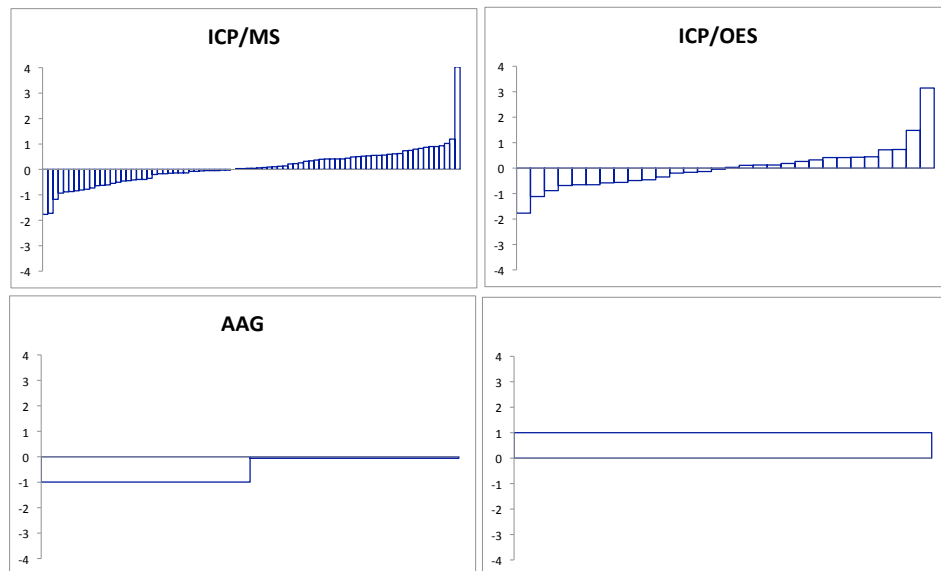
Sample 2					
Method	All*	ICP/MS	ICP/OES	AAG	
Median	0.0306	0.0308	0.0298	0.0305	0
Stdev	0.00229	0.00133	0.00254	0.00099	0
Number	112	80	30	2	0
z > 3	1	0	1	0	0
z 2 - 3	2	1	1	0	0

Sample 3					
Method	All*	ICP/MS	ICP/OES	AAG	
Median	0.06	0.0599	0.0601	0.0566	0
Stdev	0.0045	0.00281	0.00443	0.00276	0
Number	112	80	30	2	0
z > 3	1	0	1	0	0
z 2 - 3	2	1	1	0	0

Sample 4					
Method	All*	ICP/MS	ICP/OES	AAG	
Median	0.0873	0.0876	0.0873	0.0839	0
Stdev	0.00655	0.00489	0.00569	0.00431	0
Number	112	80	30	2	0
z > 3	2	1	1	0	0
z 2 - 3	0	0	0	0	0

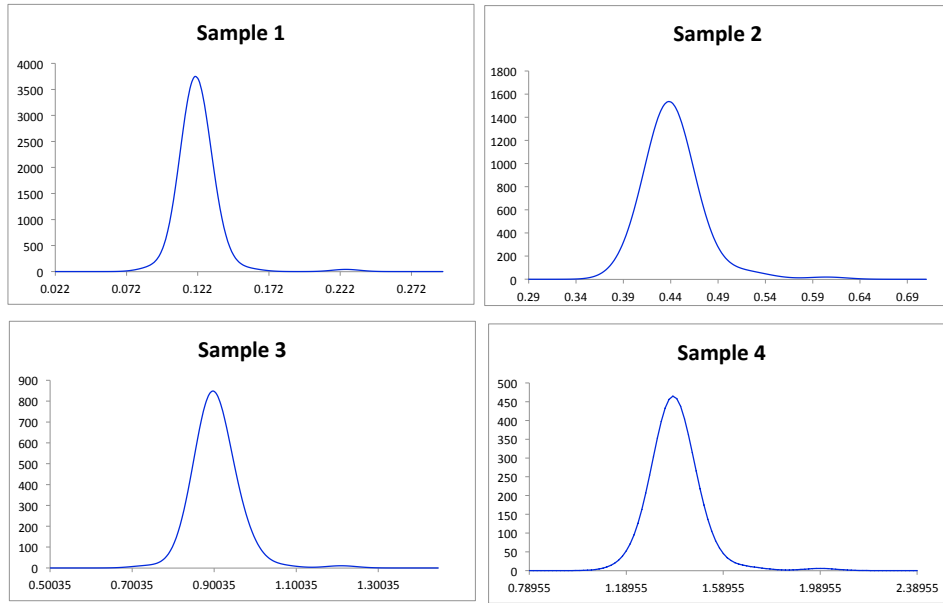
* Values for the median and standard deviation are the robust mean and acceptance limit deviation. For method statistics, the arithmetic mean and standard deviation are used.

z-Score Plots by Method - Sample 4

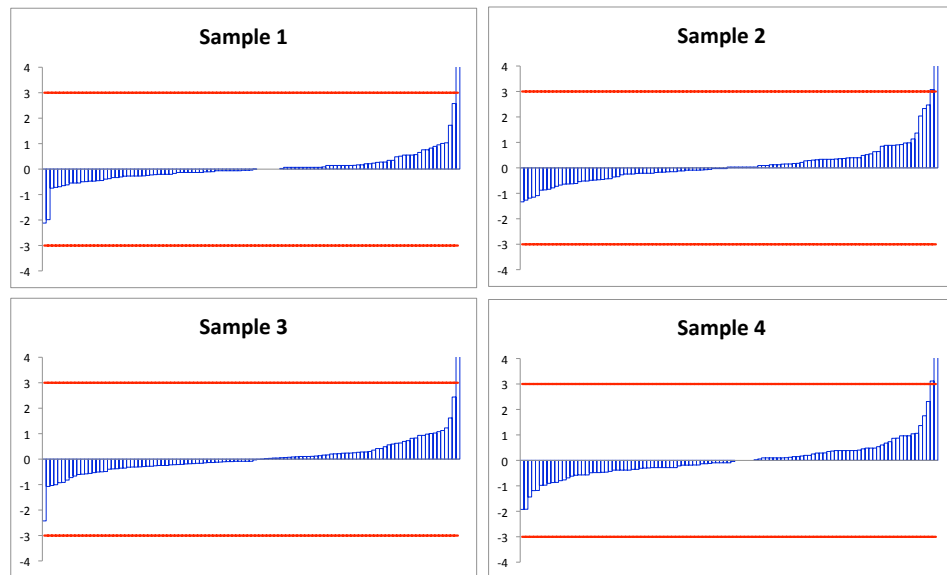


Chromium

Kernel Density Plots



z-Score Plots



Summary Statistics by Four Most Common Methods

Sample 1					
Method	All*	ICP/MS	ICP/OES	AAG	AA
Median	0.121	0.12	0.121	0.124	0.159
Stdev	0.0146	0.0132	0.0104	0.00884	0
Number	109	78	28	2	1
z > 3	1	1	0	0	0
z 2 - 3	2	0	1	0	1

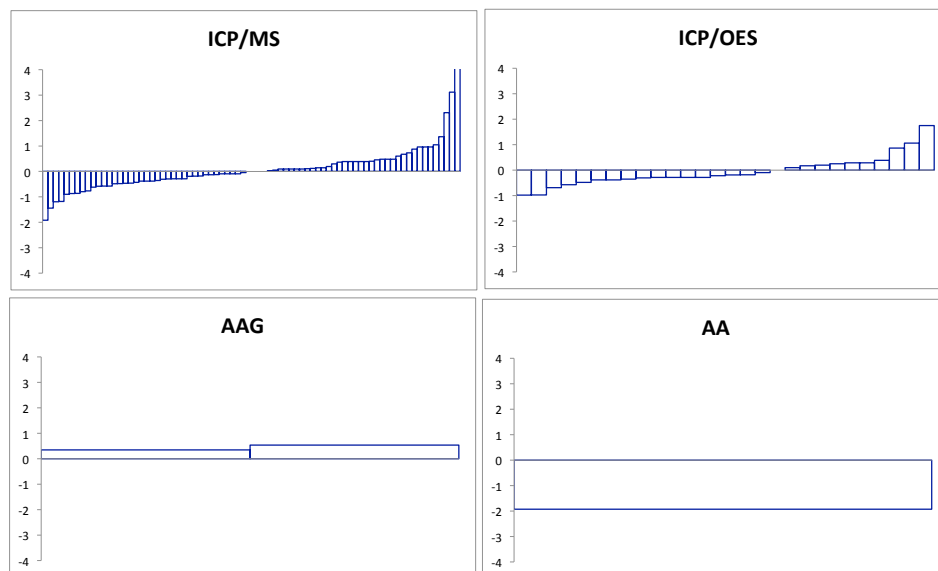
Sample 2					
Method	All*	ICP/MS	ICP/OES	AAG	AA
Median	0.439	0.44	0.438	0.431	0.471
Stdev	0.0329	0.0225	0.0404	0.025	0
Number	109	78	28	2	1
z > 3	2	1	1	0	0
z 2 - 3	3	1	2	0	0

Sample 3					
Method	All*	ICP/MS	ICP/OES	AAG	AA
Median	0.901	0.895	0.902	0.936	0.887
Stdev	0.0676	0.0523	0.047	0.046	0
Number	109	78	28	2	1
z > 3	1	1	0	0	0
z 2 - 3	2	1	1	0	0

Sample 4					
Method	All*	ICP/MS	ICP/OES	AAG	AA
Median	1.39	1.39	1.37	1.44	1.19
Stdev	0.104	0.102	0.0608	0.014	0
Number	109	78	28	2	1
z > 3	2	2	0	0	0
z 2 - 3	1	1	0	0	0

* Values for the median and standard deviation are the robust mean and acceptance limit deviation. For method statistics, the arithmetic mean and standard deviation are used.

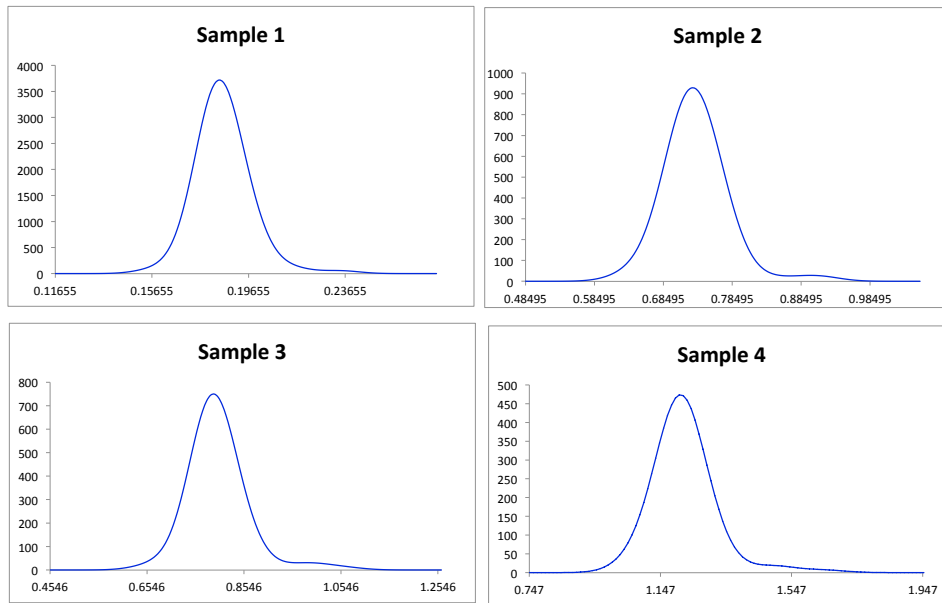
z-Score Plots by Method - Sample 4



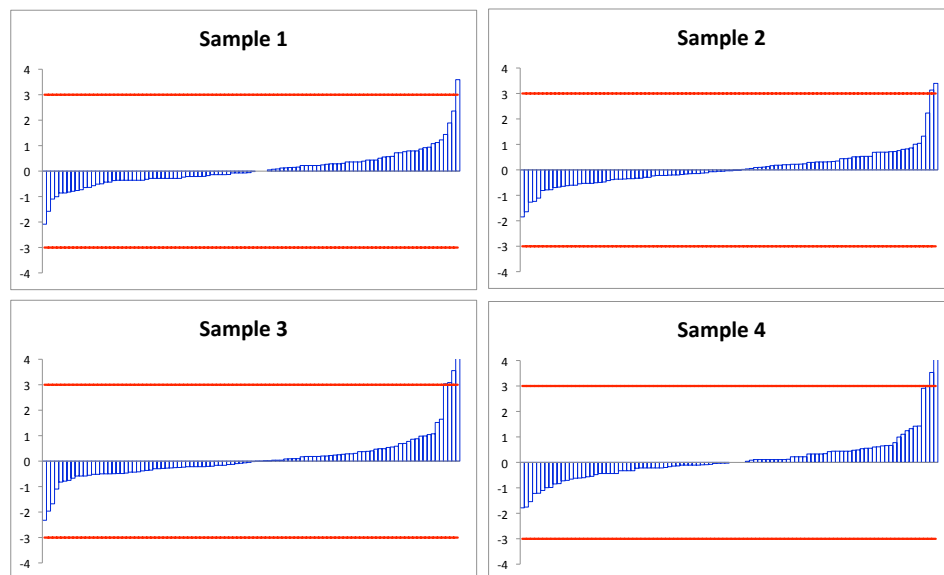
Evaluation for sample 1 was adjusted for stability flag.

Cobalt

Kernel Density Plots



z-Score Plots



Summary Statistics by Four Most Common Methods

Sample 1					
Method	All*	ICP/MS	ICP/OES	AAG	
Median	0.185	0.184	0.186	0.19	0
Stdev	0.0139	0.00859	0.0127	0	0
Number	102	73	27	1	0
z > 3	1	0	1	0	0
z 2 - 3	2	1	0	0	0

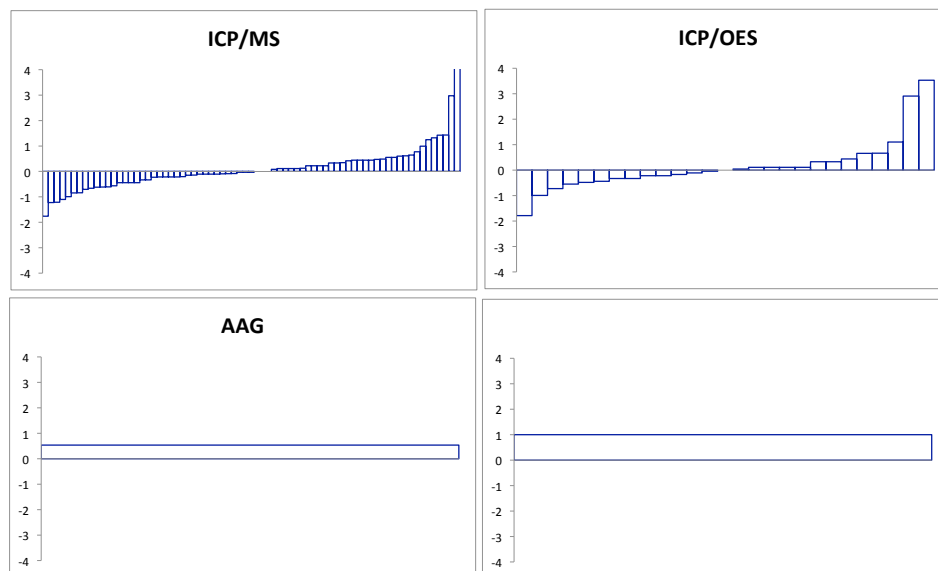
Sample 2					
Method	All*	ICP/MS	ICP/OES	AAG	
Median	0.729	0.728	0.725	0.739	0
Stdev	0.0546	0.0376	0.0472	0	0
Number	102	73	27	1	0
z > 3	2	1	1	0	0
z 2 - 3	1	1	0	0	0

Sample 3					
Method	All*	ICP/MS	ICP/OES	AAG	
Median	0.795	0.791	0.797	0.801	0
Stdev	0.0596	0.0509	0.0635	0	0
Number	102	73	27	1	0
z > 3	4	2	2	0	0
z 2 - 3	1	1	0	0	0

Sample 4					
Method	All*	ICP/MS	ICP/OES	AAG	
Median	1.21	1.21	1.21	1.26	0
Stdev	0.0907	0.0813	0.0952	0	0
Number	102	73	27	1	0
z > 3	2	1	1	0	0
z 2 - 3	2	1	1	0	0

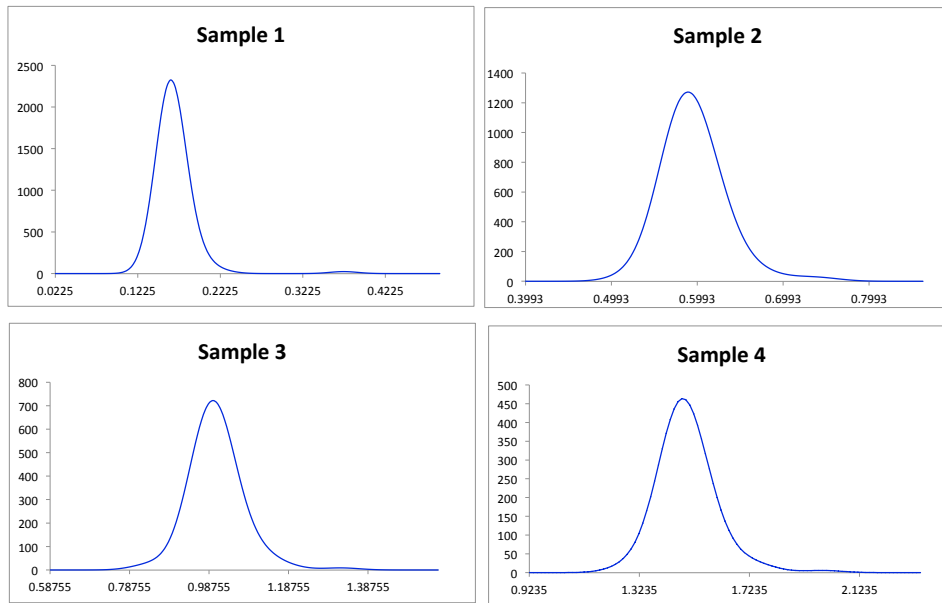
* Values for the median and standard deviation are the robust mean and acceptance limit deviation. For method statistics, the arithmetic mean and standard deviation are used.

z-Score Plots by Method - Sample 4

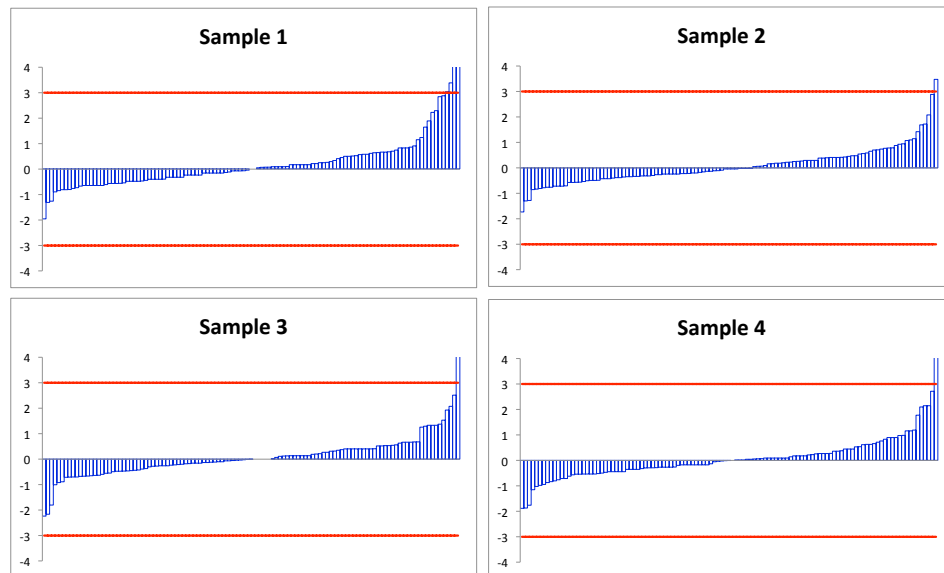


Copper

Kernel Density Plots



Z-Score Plots



Summary Statistics by Four Most Common Methods

Sample 1					
Method	All*	ICP/MS	ICP/OES	AA	AAG
Median	0.163	0.163	0.161	0.182	0.164
Stdev	0.0122	0.0111	0.0406	0.032	0
Number	115	83	29	2	1
z > 3	4	1	2	1	0
z 2 - 3	4	3	1	0	0

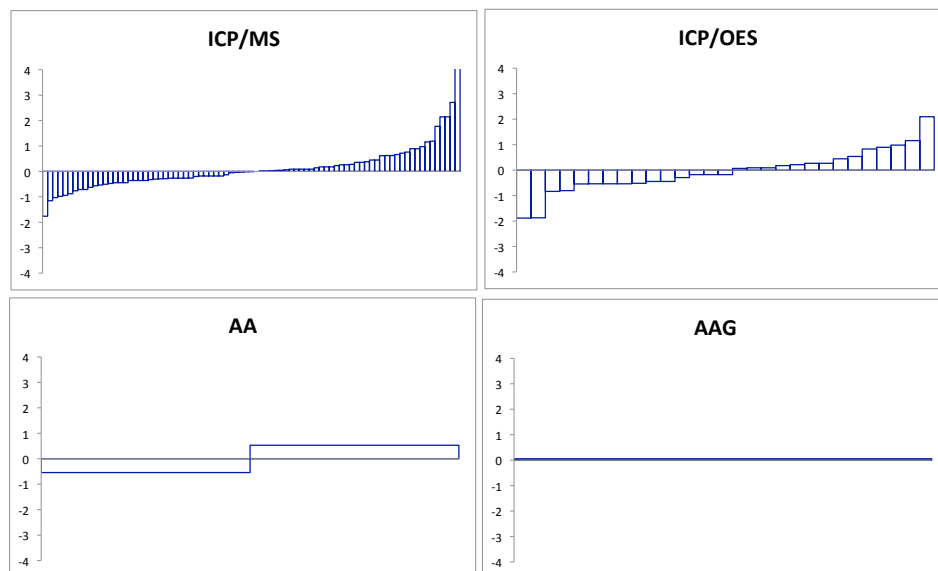
Sample 2					
Method	All*	ICP/MS	ICP/OES	AA	AAG
Median	0.592	0.591	0.581	0.579	0.573
Stdev	0.0444	0.0327	0.0349	0.0323	0
Number	115	83	29	2	1
z > 3	1	1	0	0	0
z 2 - 3	2	1	1	0	0

Sample 3					
Method	All*	ICP/MS	ICP/OES	AA	AAG
Median	1	1	0.992	1.05	0.965
Stdev	0.0752	0.06	0.0644	0.0686	0
Number	115	83	29	2	1
z > 3	1	1	0	0	0
z 2 - 3	4	2	2	0	0

Sample 4					
Method	All*	ICP/MS	ICP/OES	AA	AAG
Median	1.49	1.49	1.47	1.49	1.5
Stdev	0.112	0.0968	0.0928	0.0849	0
Number	115	83	29	2	1
z > 3	1	1	0	0	0
z 2 - 3	4	3	1	0	0

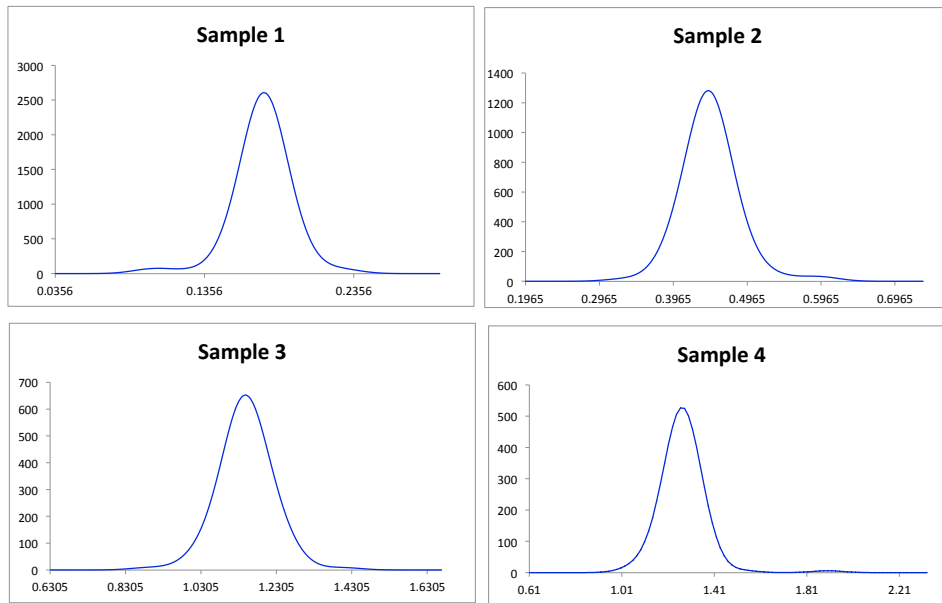
* Values for the median and standard deviation are the robust mean and acceptance limit deviation. For method statistics, the arithmetic mean and standard deviation are used.

z-Score Plots by Method - Sample 4

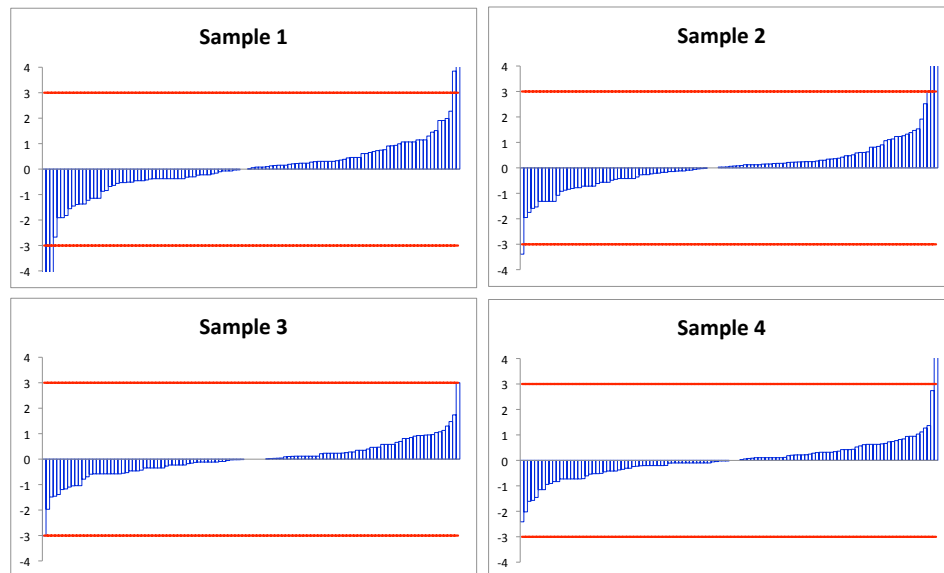


Iron

Kernel Density Plots



z-Score Plots



Summary Statistics by Four Most Common Methods

Sample 1					
Method	All*	ICP/MS	ICP/OES	AA	AAG
Median	0.175	0.177	0.17	0.164	0.173
Stdev	0.0131	0.0127	0.0238	0.00995	0
Number	114	73	37	3	1
z > 3	5	1	4	0	0
z 2 - 3	2	2	0	0	0

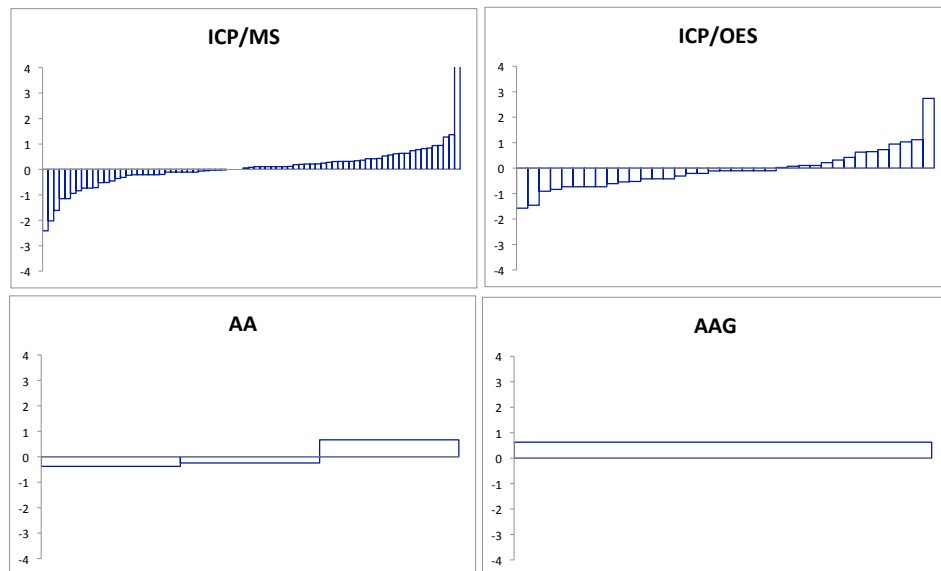
Sample 2					
Method	All*	ICP/MS	ICP/OES	AA	AAG
Median	0.444	0.449	0.438	0.446	0.443
Stdev	0.0333	0.0313	0.0409	0.0482	0
Number	116	75	37	3	1
z > 3	4	2	2	0	0
z 2 - 3	1	1	0	0	0

Sample 3					
Method	All*	ICP/MS	ICP/OES	AA	AAG
Median	1.15	1.15	1.13	1.22	1.15
Stdev	0.0863	0.0621	0.0694	0.0828	0
Number	116	75	37	3	1
z > 3	2	1	1	0	0
z 2 - 3	0	0	0	0	0

Sample 4					
Method	All*	ICP/MS	ICP/OES	AA	AAG
Median	1.27	1.28	1.26	1.25	1.33
Stdev	0.0953	0.0953	0.0748	0.054	0
Number	116	75	37	3	1
z > 3	1	1	0	0	0
z 2 - 3	3	2	1	0	0

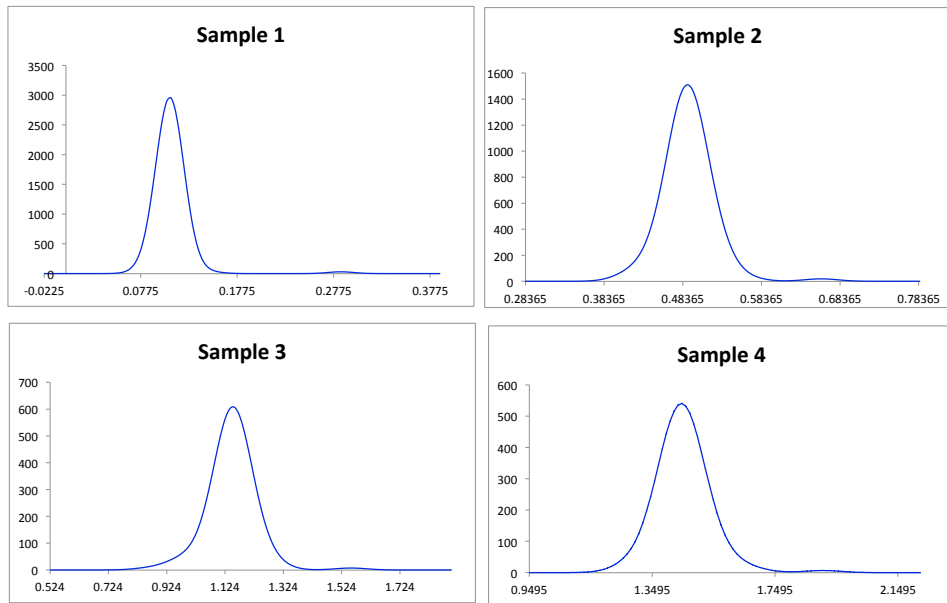
* Values for the median and standard deviation are the robust mean and acceptance limit deviation. For method statistics, the arithmetic mean and standard deviation are used.

z-Score Plots by Method - Sample 4

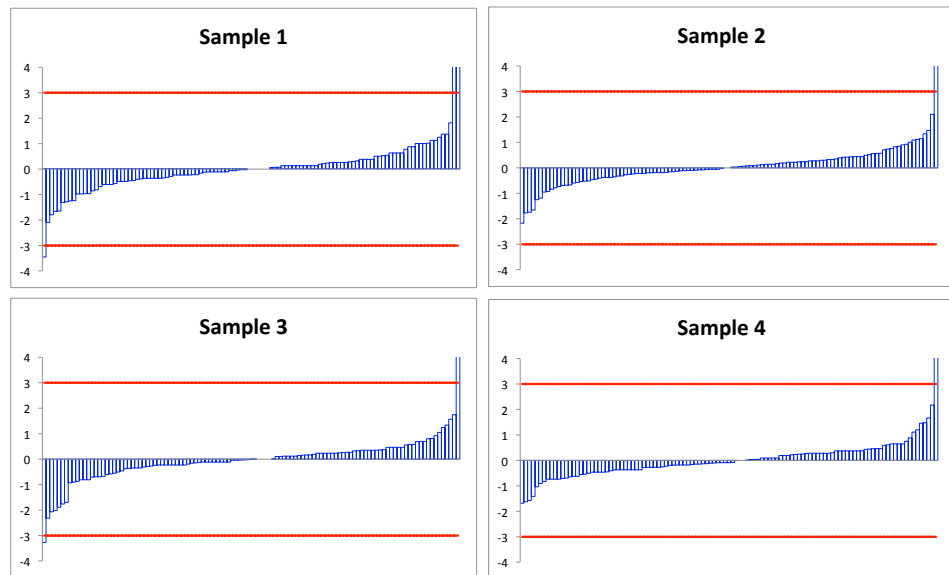


Lead

Kernel Density Plots



z-Score Plots



Summary Statistics by Four Most Common Methods

Sample 1					
Method	All*	ICP/MS	ICP/OES	AAG	
Median	0.108	0.108	0.108	0.107	0
Stdev	0.00808	0.00553	0.0365	0	0
Number	112	84	26	2	0
z > 3	3	0	3	0	0
z 2 - 3	1	1	0	0	0

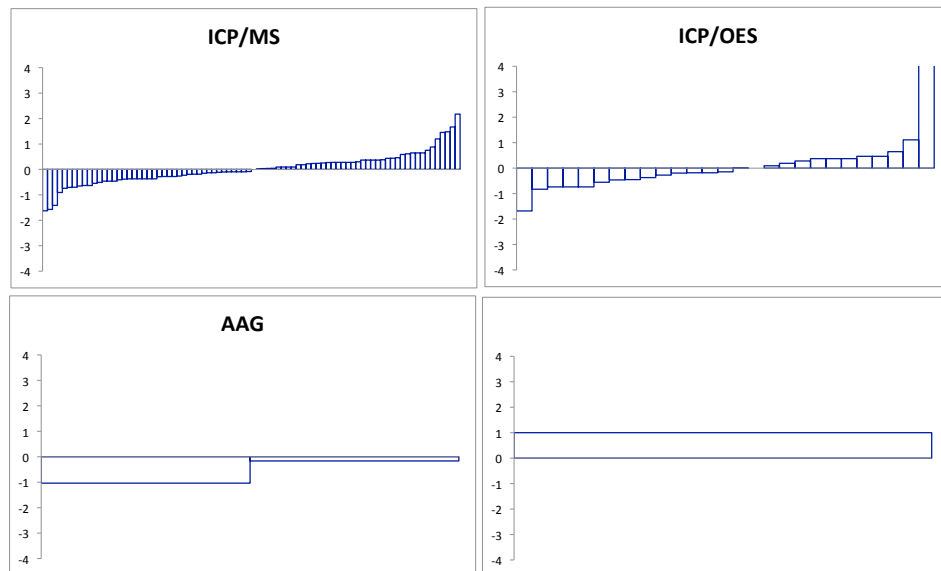
Sample 2					
Method	All*	ICP/MS	ICP/OES	AAG	
Median	0.489	0.488	0.492	0.486	0
Stdev	0.0367	0.0234	0.0421	0.0125	0
Number	113	84	27	2	0
z > 3	1	0	1	0	0
z 2 - 3	2	2	0	0	0

Sample 3					
Method	All*	ICP/MS	ICP/OES	AAG	
Median	1.15	1.15	1.16	1.11	0
Stdev	0.0861	0.0607	0.108	0.0553	0
Number	113	84	27	2	0
z > 3	2	0	2	0	0
z 2 - 3	3	3	0	0	0

Sample 4					
Method	All*	ICP/MS	ICP/OES	AAG	
Median	1.45	1.45	1.43	1.38	0
Stdev	0.108	0.0675	0.109	0.0664	0
Number	113	84	27	2	0
z > 3	1	0	1	0	0
z 2 - 3	1	1	0	0	0

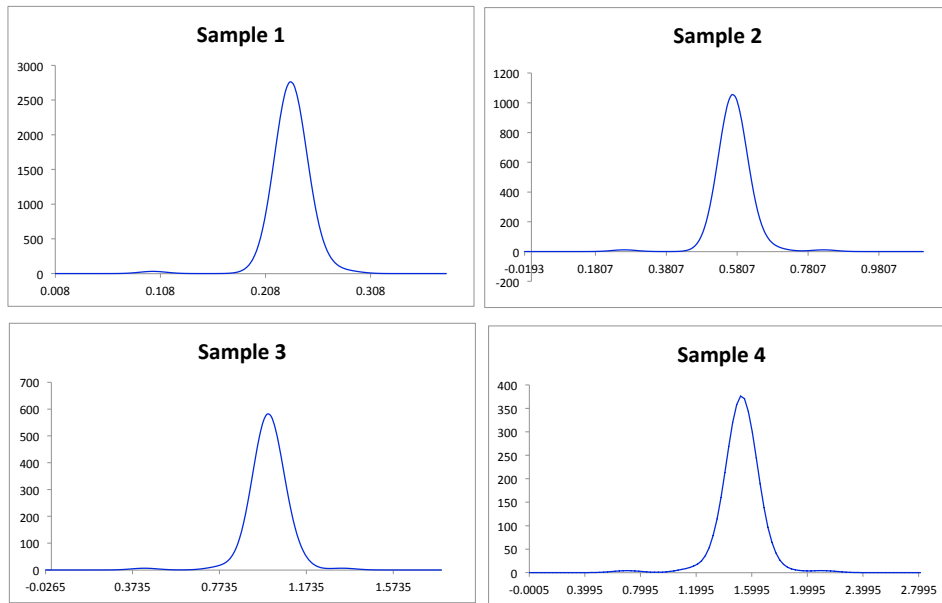
* Values for the median and standard deviation are the robust mean and acceptance limit deviation. For method statistics, the arithmetic mean and standard deviation are used.

z-Score Plots by Method - Sample 4

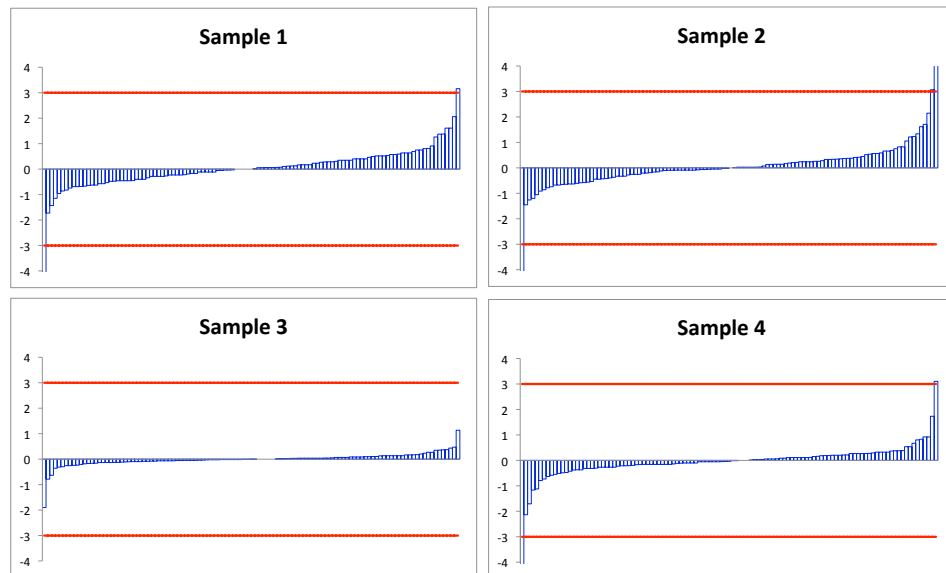


Manganese

Kernel Density Plots



z-Score Plots



Summary Statistics by Four Most Common Methods

Sample 1					
Method	All*	ICP/MS	ICP/OES	AA	AAG
Median	0.232	0.233	0.231	0.224	0.237
Stdev	0.0174	0.0187	0.0137	0.000283	0
Number	113	75	35	2	1
z > 3	2	1	1	0	0
z 2 - 3	1	1	0	0	0

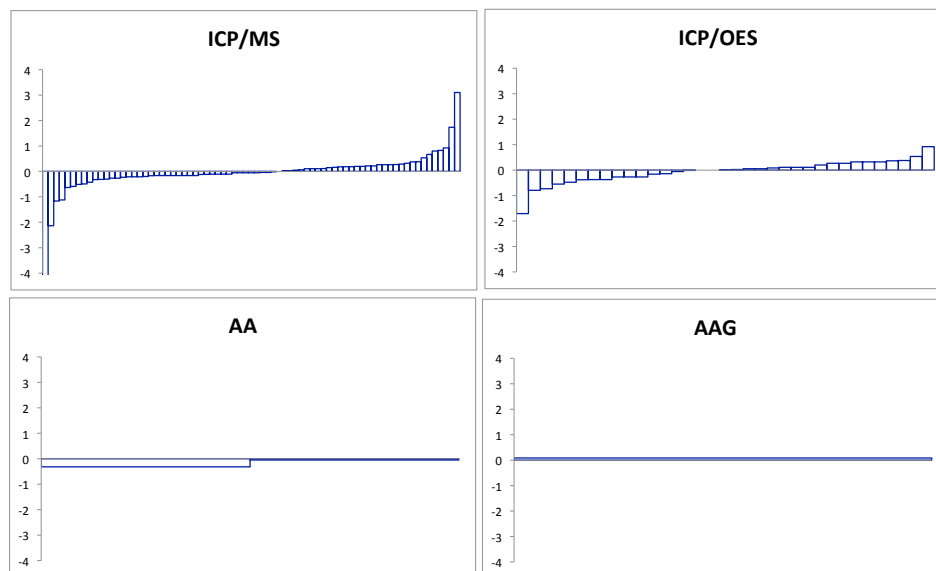
Sample 2					
Method	All*	ICP/MS	ICP/OES	AA	AAG
Median	0.569	0.57	0.567	0.565	0.696
Stdev	0.0427	0.0463	0.0253	0.0138	0.183
Number	114	75	35	2	2
z > 3	3	2	0	0	1
z 2 - 3	1	1	0	0	0

Sample 3					
Method	All*	ICP/MS	ICP/OES	AA	AAG
Median	1	0.997	1	0.967	1.01
Stdev	0.3	0.0918	0.0611	0.0107	0
Number	113	75	35	2	1
z > 3	0	0	0	0	0
z 2 - 3	0	0	0	0	0

Sample 4					
Method	All*	ICP/MS	ICP/OES	AA	AAG
Median	1.53	1.52	1.53	1.5	1.55
Stdev	0.187	0.147	0.0857	0.0354	0
Number	113	75	35	2	1
z > 3	2	2	0	0	0
z 2 - 3	1	1	0	0	0

* Values for the median and standard deviation are the robust mean and acceptance limit deviation. For method statistics, the arithmetic mean and standard deviation are used.

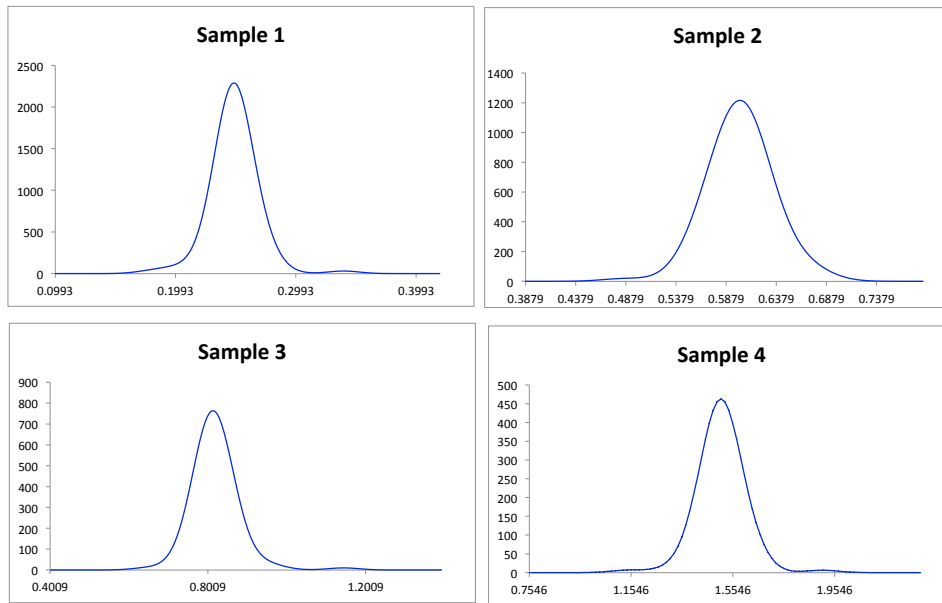
z-Score Plots by Method - Sample 4



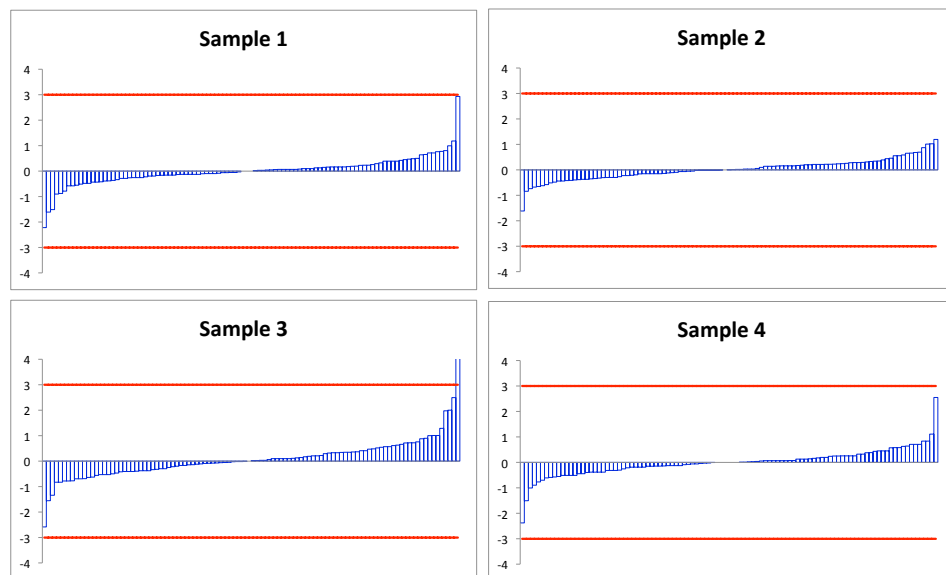
Evaluations for samples 3 and 4 were adjusted for stability flags.

Molybdenum

Kernel Density Plots



Z-Score Plots



Summary Statistics by Four Most Common Methods

Sample 1					
Method	All*	ICP/MS	ICP/OES	AAG	
Median	0.248	0.248	0.25	0.272	0
Stdev	0.031	0.0155	0.0221	0	0
Number	103	76	26	1	0
z > 3	0	0	0	0	0
z 2 - 3	2	1	1	0	0

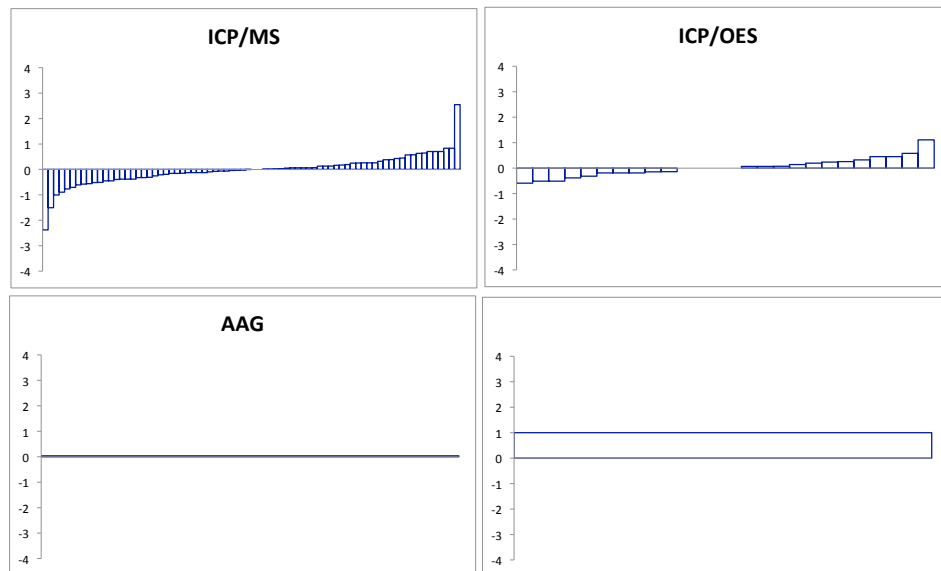
Sample 2					
Method	All*	ICP/MS	ICP/OES	AAG	
Median	0.601	0.601	0.606	0.582	0
Stdev	0.0704	0.0301	0.0268	0	0
Number	103	76	26	1	0
z > 3	0	0	0	0	0
z 2 - 3	0	0	0	0	0

Sample 3					
Method	All*	ICP/MS	ICP/OES	AAG	
Median	0.814	0.813	0.818	0.975	0
Stdev	0.0638	0.0417	0.048	0.241	0
Number	104	76	26	2	0
z > 3	1	0	0	1	0
z 2 - 3	3	1	2	0	0

Sample 4					
Method	All*	ICP/MS	ICP/OES	AAG	
Median	1.51	1.51	1.51	1.52	0
Stdev	0.156	0.0919	0.0585	0	0
Number	103	76	26	1	0
z > 3	0	0	0	0	0
z 2 - 3	2	2	0	0	0

* Values for the median and standard deviation are the robust mean and acceptance limit deviation. For method statistics, the arithmetic mean and standard deviation are used.

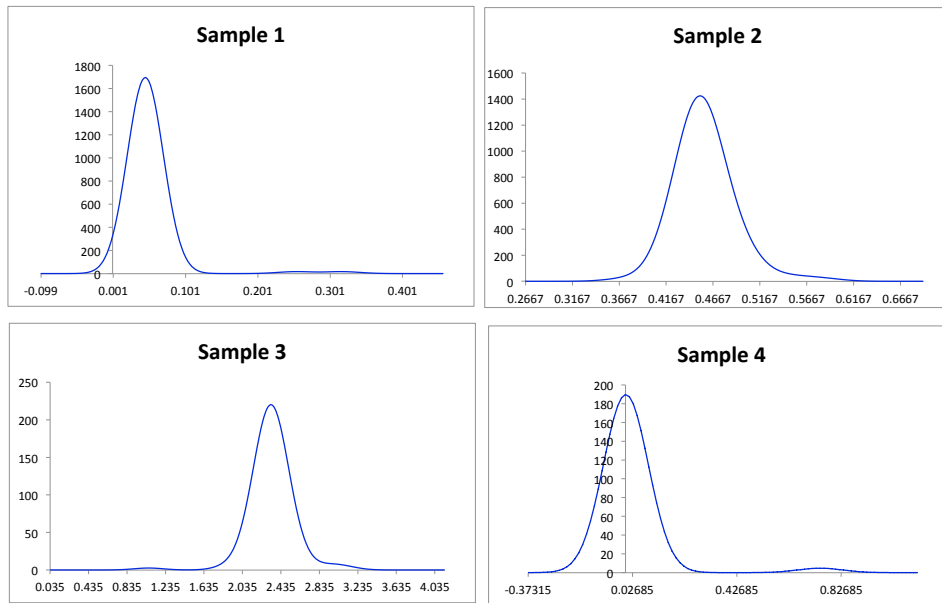
z-Score Plots by Method - Sample 4



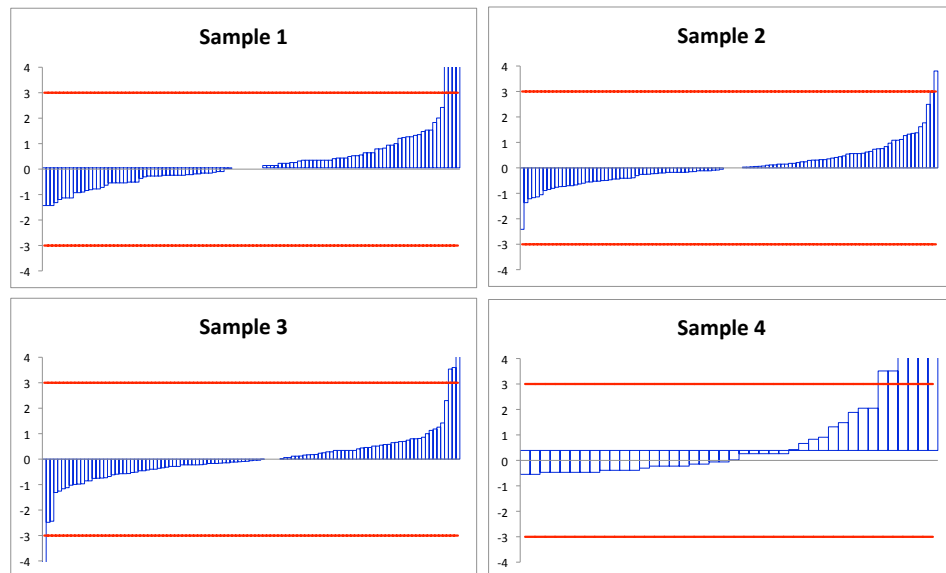
Evaluations for all samples were adjusted for stability flags.

Nickel

Kernel Density Plots



z-Score Plots



Summary Statistics by Four Most Common Methods

Sample 1					
Method	All*	ICP/MS	ICP/OES	AAG	
Median	0.045	0.045	0.045	0.045	0
Stdev	0.00337	0.00303	0.0536	0.121	0
Number	108	79	26	3	0
z > 3	4	1	2	1	0
z 2 - 3	1	1	0	0	0

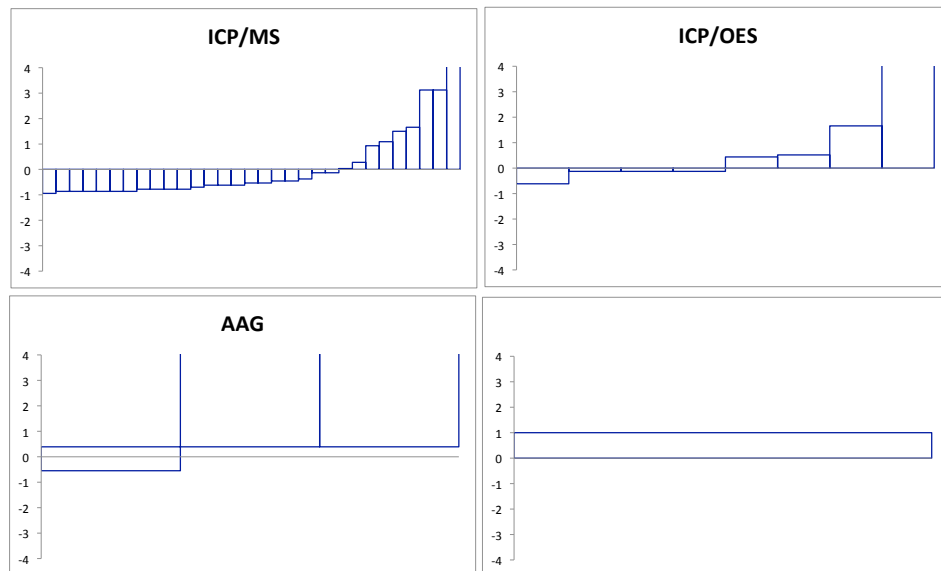
Sample 2					
Method	All*	ICP/MS	ICP/OES	AAG	
Median	0.455	0.452	0.457	0.446	0
Stdev	0.0341	0.0257	0.0331	0.049	0
Number	109	79	27	3	0
z > 3	1	0	1	0	0
z 2 - 3	3	2	0	1	0

Sample 3					
Method	All*	ICP/MS	ICP/OES	AAG	
Median	2.34	2.32	2.34	2.26	0
Stdev	0.175	0.173	0.292	0.0607	0
Number	109	79	27	3	0
z > 3	4	2	2	0	0
z 2 - 3	3	3	0	0	0

Sample 4					
Method	All*	ICP/MS	ICP/OES	AAG	
Median	0.00116	0.0005	0.00135	0.0076	0
Stdev	0.00123	0.00189	0.00204	0.429	0
Number	42	31	8	3	0
z > 3	6	3	1	2	0
z 2 - 3	0	0	0	0	0

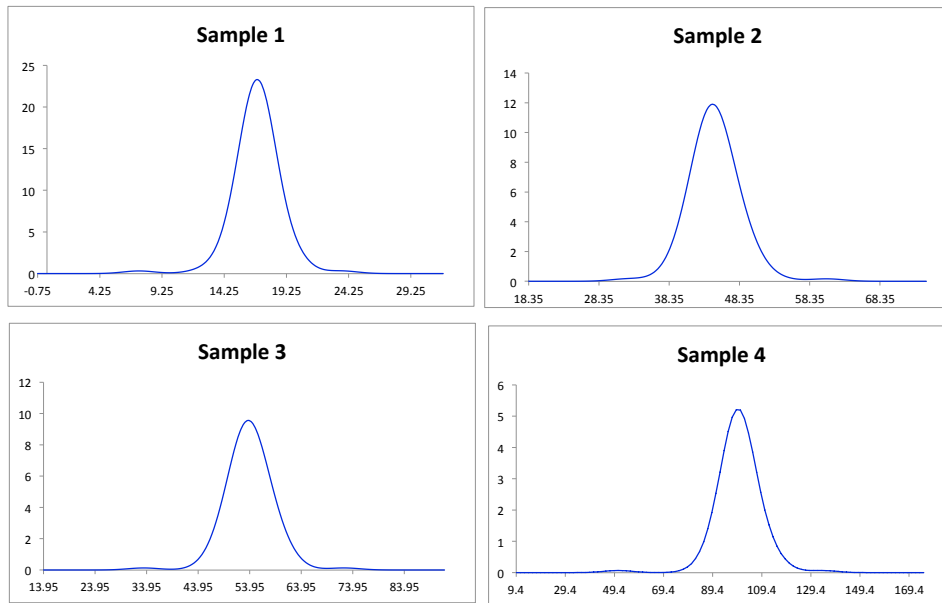
* Values for the median and standard deviation are the robust mean and acceptance limit deviation. For method statistics, the arithmetic mean and standard deviation are used.

z-Score Plots by Method - Sample 4

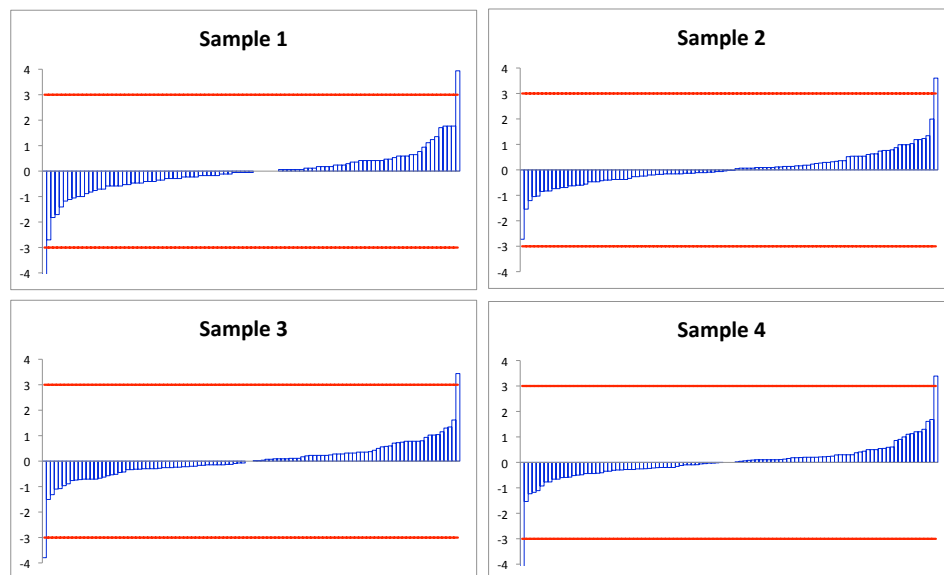


Selenium

Kernel Density Plots



z-Score Plots



Summary Statistics by Four Most Common Methods

Sample 1					
Method	All*	ICP/MS	ICP/OES	AAHY	AAG
Median	17	17	16	16	17.4
Stdev	1.7	1.26	2.06	0.99	0
Number	99	84	11	2	1
z > 3	2	1	0	0	0
z 2 - 3	1	0	1	0	0

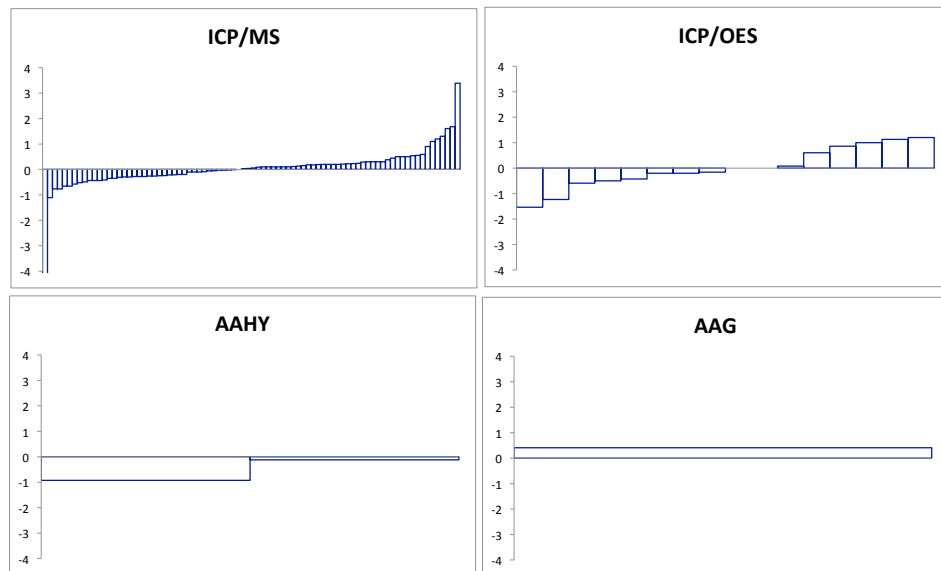
Sample 2					
Method	All*	ICP/MS	ICP/OES	AAHY	AAG
Median	44.7	45	43.3	42.2	43.6
Stdev	4.47	3.23	3.68	1.06	0
Number	105	84	16	2	1
z > 3	1	1	0	0	0
z 2 - 3	1	1	0	0	0

Sample 3					
Method	All*	ICP/MS	ICP/OES	AAHY	AAG
Median	53.8	54.1	52.7	51	53.9
Stdev	5.38	3.55	6.26	1.7	0
Number	105	84	16	2	1
z > 3	2	1	1	0	0
z 2 - 3	0	0	0	0	0

Sample 4					
Method	All*	ICP/MS	ICP/OES	AAHY	AAG
Median	100	101	99.2	94.8	104
Stdev	10	8.16	8	5.73	0
Number	105	84	16	2	1
z > 3	2	2	0	0	0
z 2 - 3	0	0	0	0	0

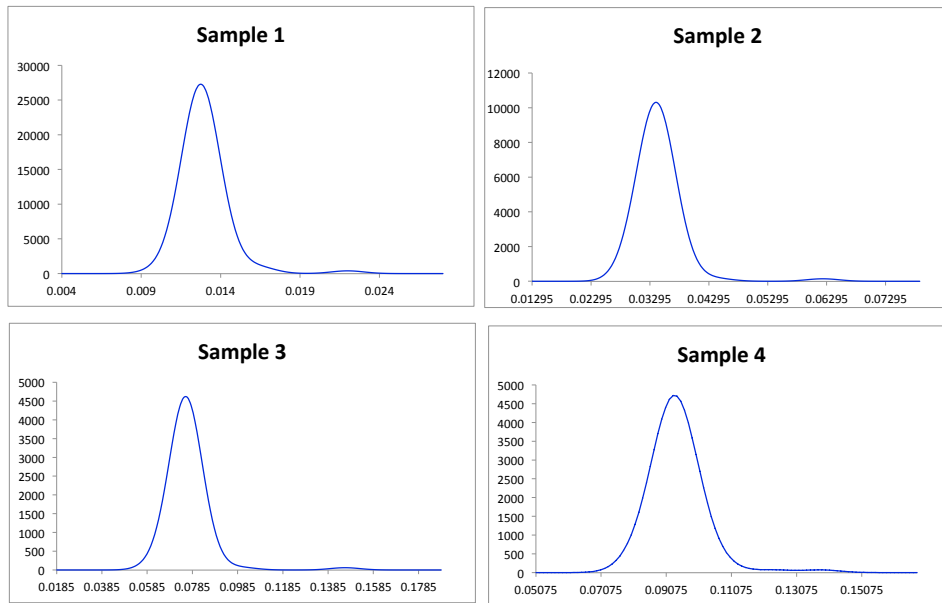
* Values for the median and standard deviation are the robust mean and acceptance limit deviation. For method statistics, the arithmetic mean and standard deviation are used.

z-Score Plots by Method - Sample 4

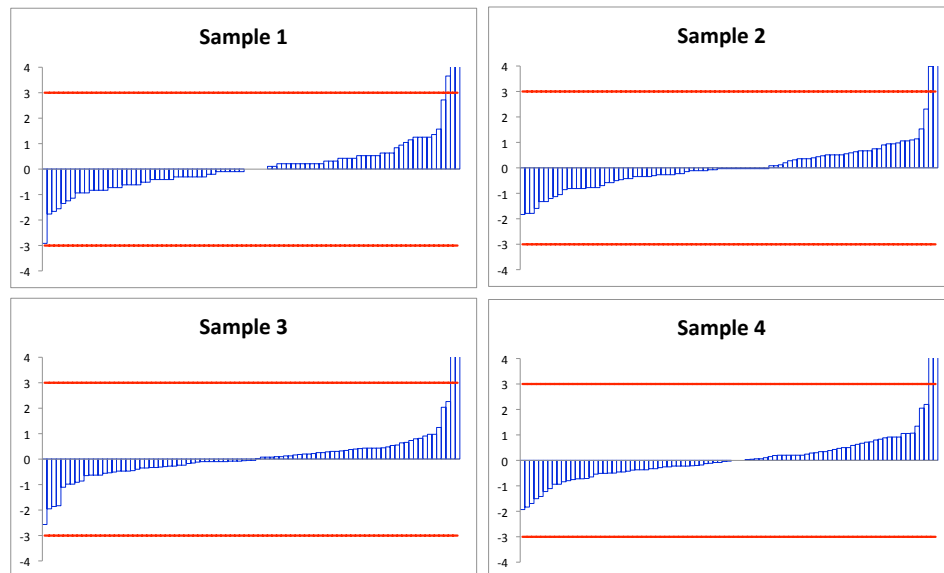


Silver

Kernel Density Plots



z-Score Plots



Summary Statistics by Four Most Common Methods

Sample 1					
Method	All*	ICP/MS	ICP/OES	AA	
Median	0.0128	0.0127	0.013	0	0
Stdev	0.000959	0.00086	0.00241	0	0
Number	89	69	20	0	0
z > 3	3	1	2	0	0
z 2 - 3	2	1	1	0	0

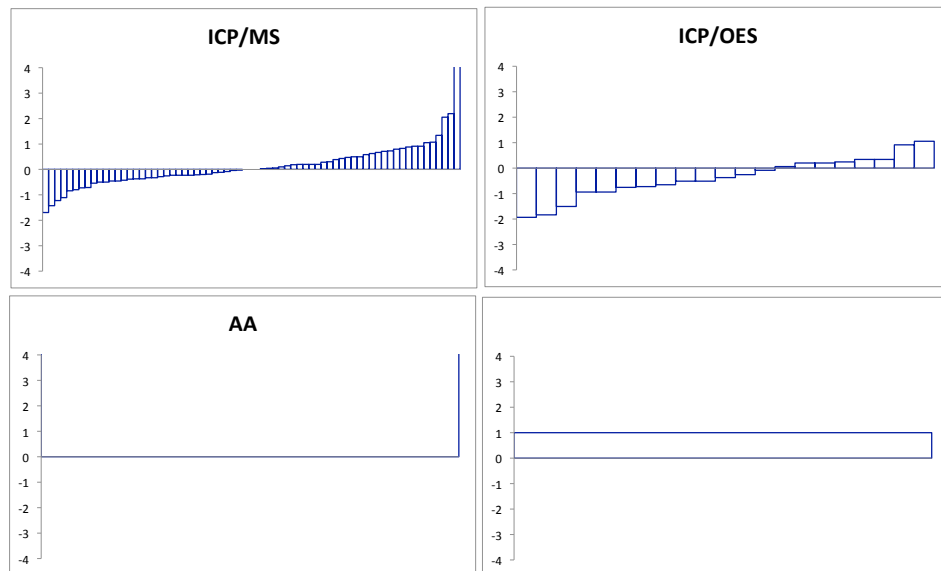
Sample 2					
Method	All*	ICP/MS	ICP/OES	AA	
Median	0.0341	0.034	0.034	0.0623	0
Stdev	0.00256	0.00224	0.00217	0	0
Number	89	68	20	1	0
z > 3	2	1	0	1	0
z 2 - 3	1	1	0	0	0

Sample 3					
Method	All*	ICP/MS	ICP/OES	AA	
Median	0.0756	0.076	0.075	0.146	0
Stdev	0.00567	0.00502	0.00388	0	0
Number	90	69	20	1	0
z > 3	2	1	0	1	0
z 2 - 3	3	3	0	0	0

Sample 4					
Method	All*	ICP/MS	ICP/OES	AA	
Median	0.0936	0.0936	0.091	0.139	0
Stdev	0.00702	0.00605	0.00565	0	0
Number	91	69	21	1	0
z > 3	2	1	0	1	0
z 2 - 3	2	2	0	0	0

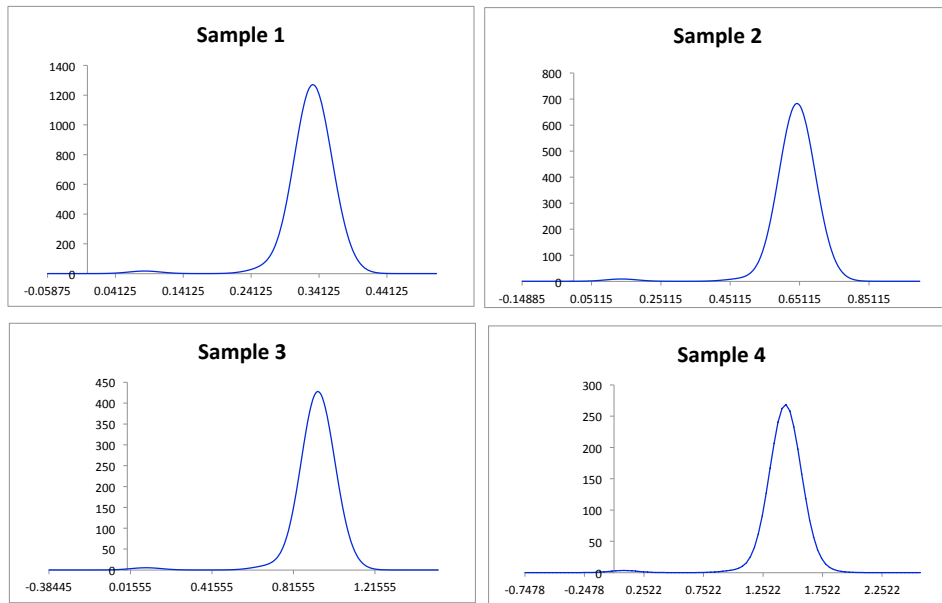
* Values for the median and standard deviation are the robust mean and acceptance limit deviation. For method statistics, the arithmetic mean and standard deviation are used.

z-Score Plots by Method - Sample 4

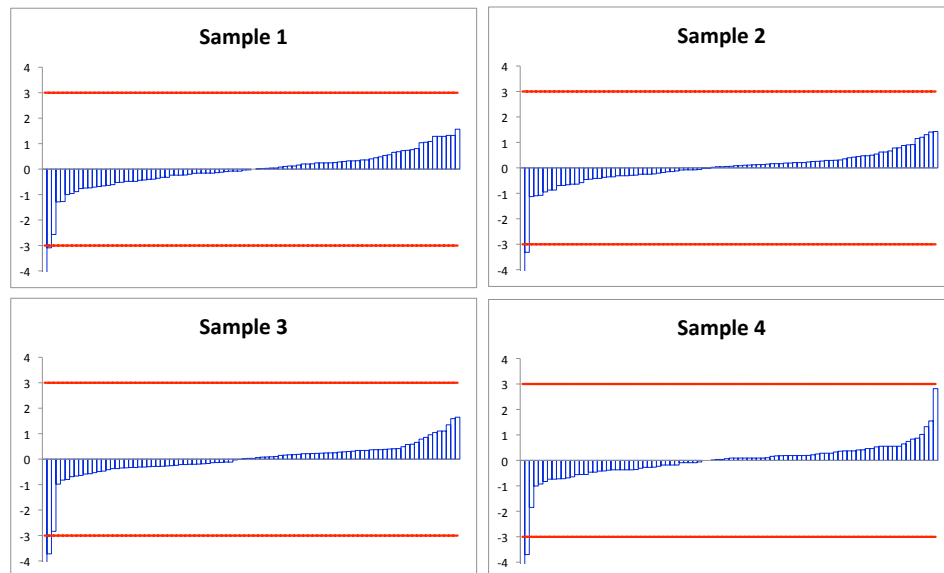


Strontium

Kernel Density Plots



z-Score Plots



Summary Statistics by Four Most Common Methods

Sample 1					
Method	All*	ICP/MS	ICP/OES	AAG	
Median	0.332	0.332	0.332	0.322	0
Stdev	0.0249	0.0176	0.0212	0	0
Number	92	68	22	1	0
z > 3	2	1	0	0	0
z 2 - 3	1	0	1	0	0

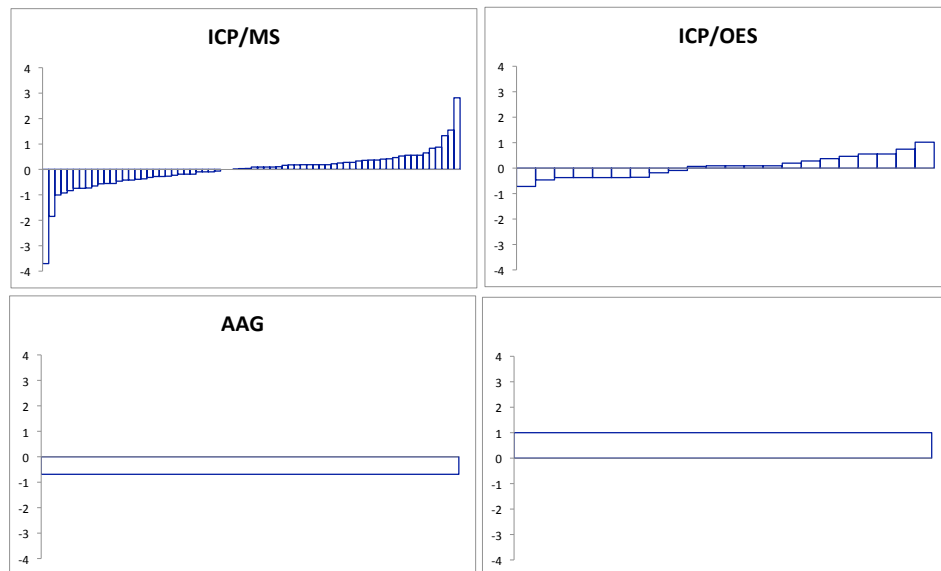
Sample 2					
Method	All*	ICP/MS	ICP/OES	AAG	
Median	0.642	0.645	0.649	0.588	0
Stdev	0.0482	0.0312	0.0295	0	0
Number	92	68	22	1	0
z > 3	2	1	0	0	0
z 2 - 3	0	0	0	0	0

Sample 3					
Method	All*	ICP/MS	ICP/OES	AAG	
Median	0.933	0.934	0.945	0.864	0
Stdev	0.0699	0.0533	0.0343	0	0
Number	92	68	22	1	0
z > 3	2	1	0	0	0
z 2 - 3	1	1	0	0	0

Sample 4					
Method	All*	ICP/MS	ICP/OES	AAG	
Median	1.44	1.45	1.45	1.37	0
Stdev	0.108	0.0843	0.0477	0	0
Number	92	68	22	1	0
z > 3	2	1	0	0	0
z 2 - 3	1	1	0	0	0

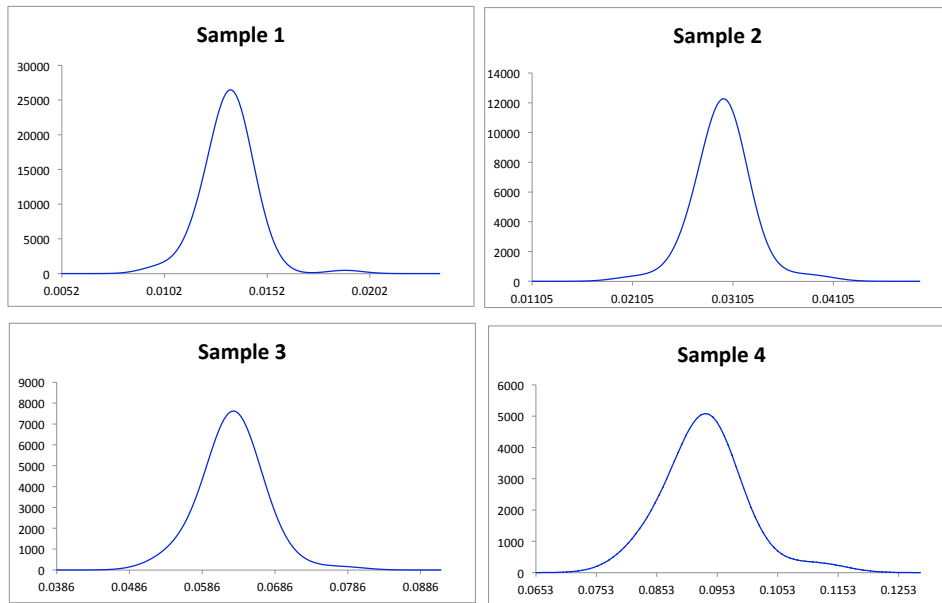
* Values for the median and standard deviation are the robust mean and acceptance limit deviation. For method statistics, the arithmetic mean and standard deviation are used.

z-Score Plots by Method - Sample 4

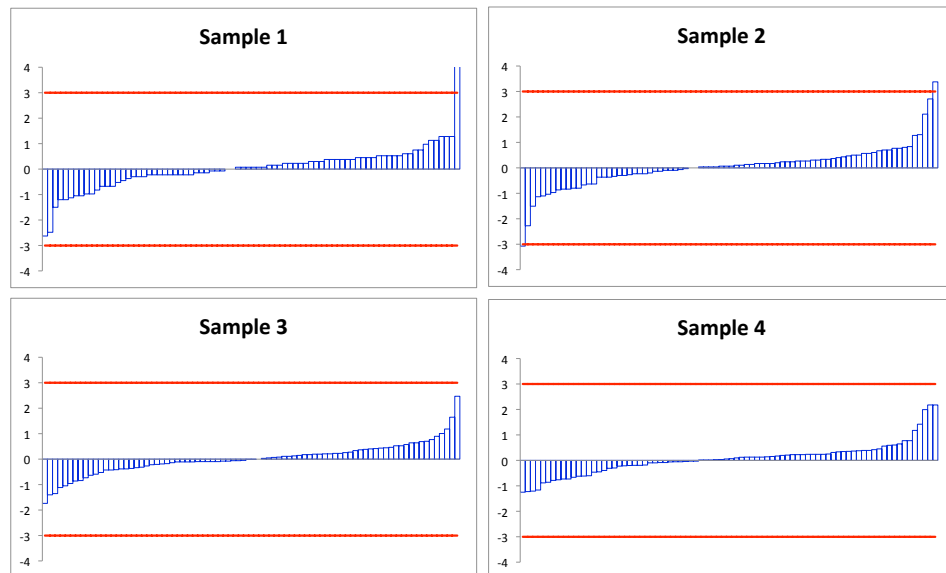


Thallium

Kernel Density Plots



z-Score Plots



Summary Statistics by Four Most Common Methods

Sample 1					
Method	All*	ICP/MS	ICP/OES		
Median	0.0133	0.0134	0.0137	0	0
Stdev	0.00133	0.000793	0.0026	0	0
Number	80	70	10	0	0
z > 3	1	0	1	0	0
z 2 - 3	2	0	2	0	0

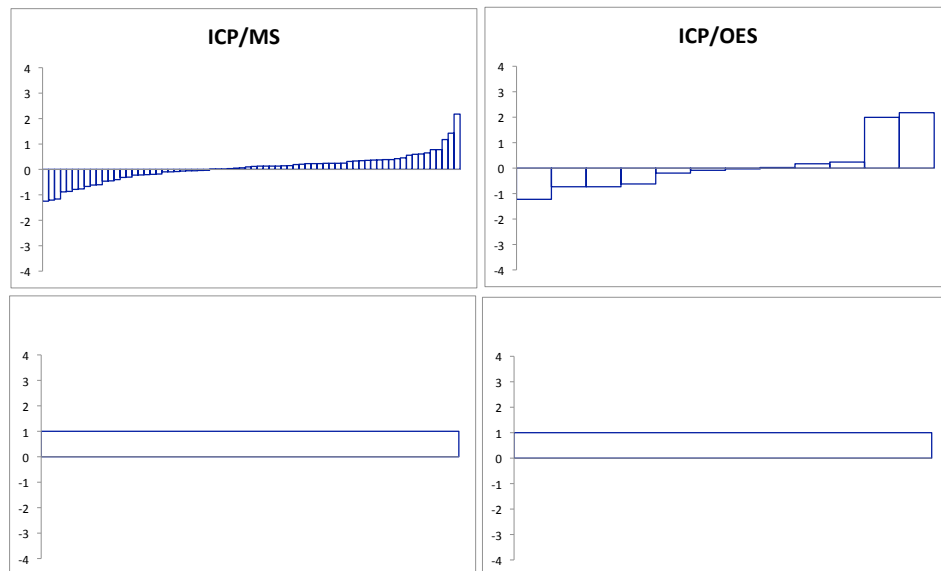
Sample 2					
Method	All*	ICP/MS	ICP/OES		
Median	0.0299	0.0301	0.0309	0	0
Stdev	0.00299	0.00159	0.00565	0	0
Number	82	70	12	0	0
z > 3	2	0	2	0	0
z 2 - 3	3	0	3	0	0

Sample 3					
Method	All*	ICP/MS	ICP/OES		
Median	0.0627	0.0627	0.0617	0	0
Stdev	0.00627	0.00321	0.00697	0	0
Number	82	70	12	0	0
z > 3	0	0	0	0	0
z 2 - 3	1	0	1	0	0

Sample 4					
Method	All*	ICP/MS	ICP/OES		
Median	0.0928	0.0938	0.0923	0	0
Stdev	0.00928	0.00523	0.00959	0	0
Number	82	70	12	0	0
z > 3	0	0	0	0	0
z 2 - 3	2	1	1	0	0

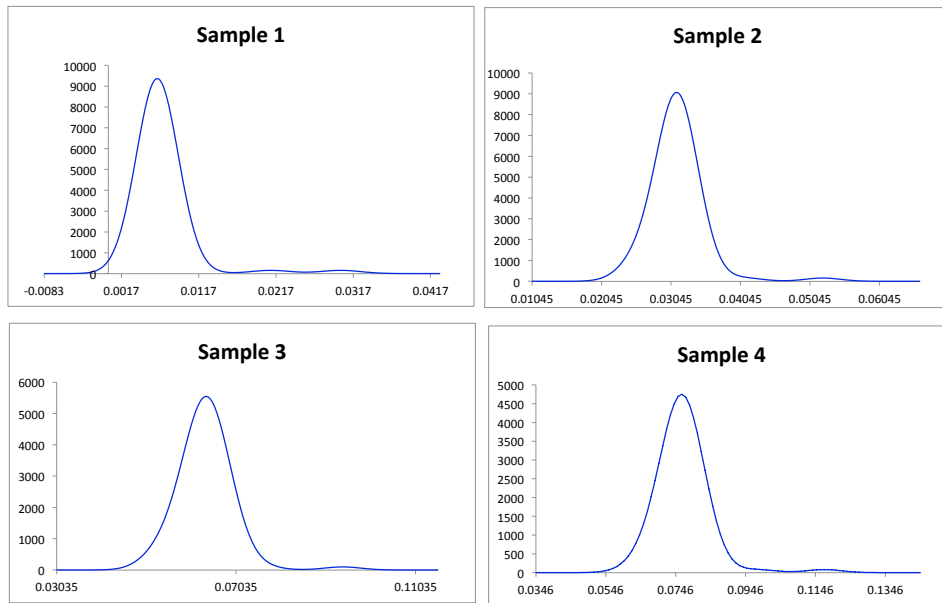
* Values for the median and standard deviation are the robust mean and acceptance limit deviation. For method statistics, the arithmetic mean and standard deviation are used.

z-Score Plots by Method - Sample 4

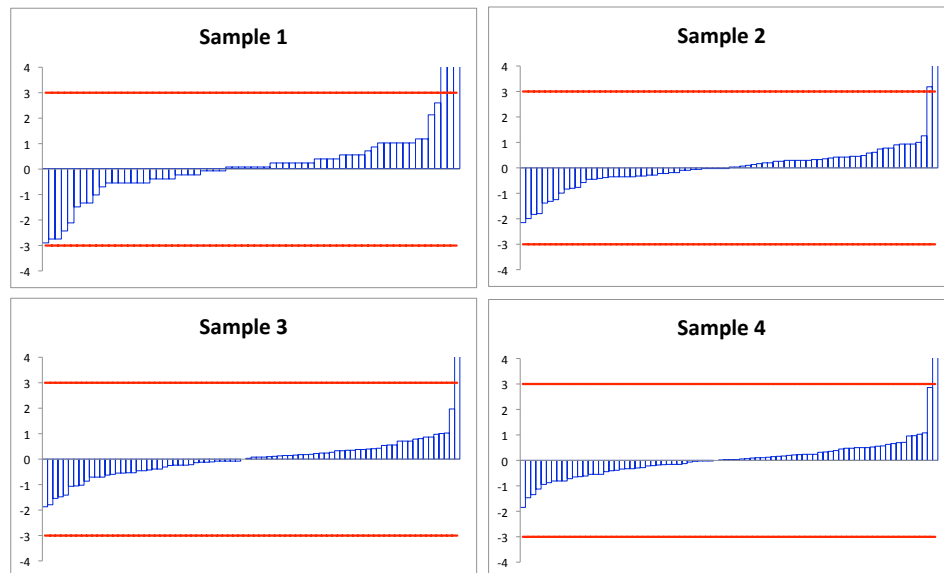


Tin

Kernel Density Plots



z-Score Plots



Summary Statistics by Four Most Common Methods

Sample 1					
Method	All*	ICP/MS	ICP/OES		
Median	0.00636	0.0064	0.0071	0	0
Stdev	0.000636	0.00316	0.00543	0	0
Number	66	59	7	0	0
z > 3	3	1	2	0	0
z 2 - 3	7	5	2	0	0

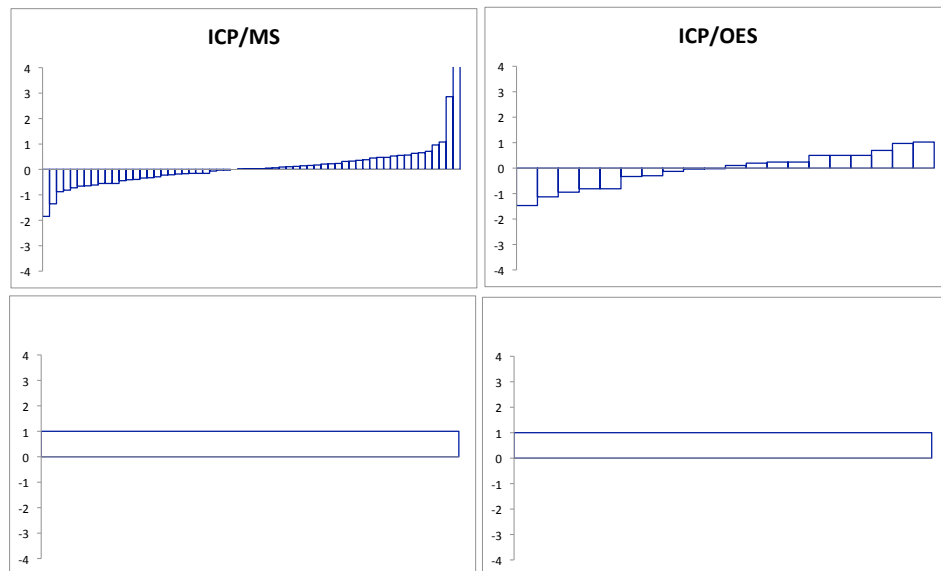
Sample 2					
Method	All*	ICP/MS	ICP/OES		
Median	0.0311	0.0311	0.0315	0	0
Stdev	0.00311	0.00335	0.00394	0	0
Number	76	60	16	0	0
z > 3	2	1	1	0	0
z 2 - 3	1	0	1	0	0

Sample 3					
Method	All*	ICP/MS	ICP/OES		
Median	0.0635	0.0636	0.064	0	0
Stdev	0.00635	0.00562	0.00523	0	0
Number	80	60	20	0	0
z > 3	1	1	0	0	0
z 2 - 3	0	0	0	0	0

Sample 4					
Method	All*	ICP/MS	ICP/OES		
Median	0.0762	0.0764	0.0765	0	0
Stdev	0.00762	0.00719	0.0053	0	0
Number	80	60	20	0	0
z > 3	1	1	0	0	0
z 2 - 3	1	1	0	0	0

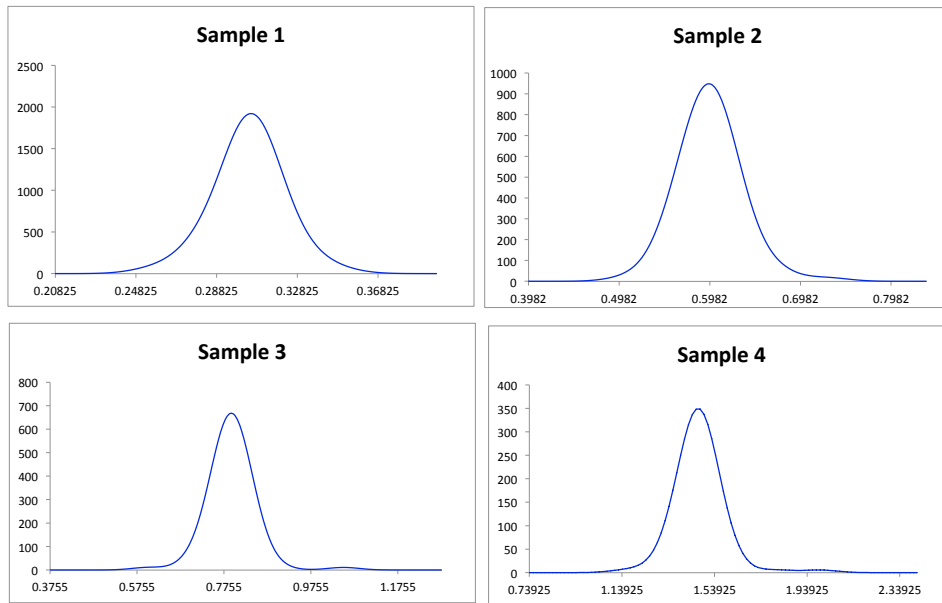
* Values for the median and standard deviation are the robust mean and acceptance limit deviation. For method statistics, the arithmetic mean and standard deviation are used.

z-Score Plots by Method - Sample 4

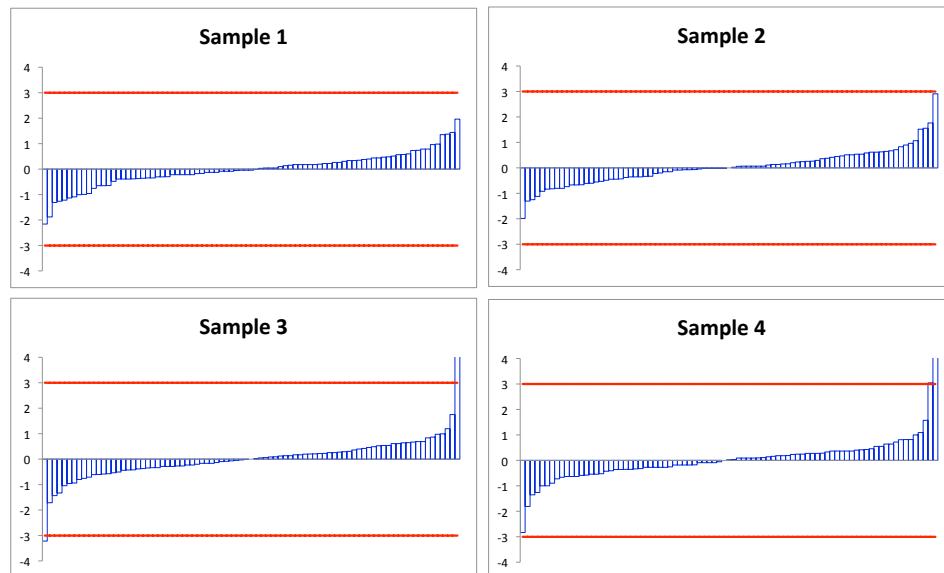


Titanium

Kernel Density Plots



z-Score Plots



Summary Statistics by Four Most Common Methods

Sample 1					
Method	All*	ICP/MS	ICP/OES		
Median	0.305	0.304	0.306	0	0
Stdev	0.0229	0.0163	0.0139	0	0
Number	85	64	21	0	0
z > 3	0	0	0	0	0
z 2 - 3	1	1	0	0	0

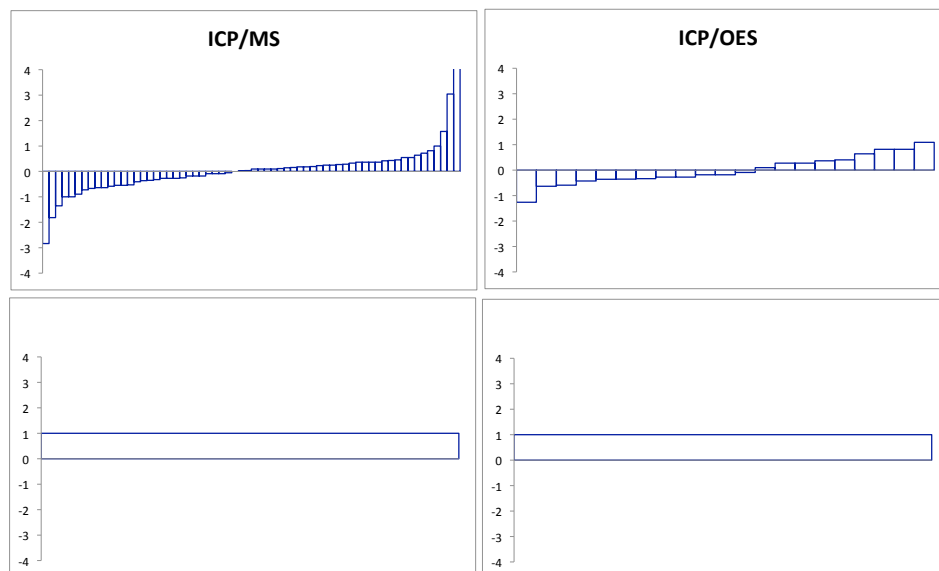
Sample 2					
Method	All*	ICP/MS	ICP/OES		
Median	0.597	0.597	0.6	0	0
Stdev	0.0448	0.0333	0.0268	0	0
Number	85	64	21	0	0
z > 3	0	0	0	0	0
z 2 - 3	1	1	0	0	0

Sample 3					
Method	All*	ICP/MS	ICP/OES		
Median	0.792	0.793	0.79	0	0
Stdev	0.0594	0.0538	0.0334	0	0
Number	85	64	21	0	0
z > 3	2	2	0	0	0
z 2 - 3	0	0	0	0	0

Sample 4					
Method	All*	ICP/MS	ICP/OES		
Median	1.47	1.48	1.45	0	0
Stdev	0.11	0.107	0.0628	0	0
Number	85	64	21	0	0
z > 3	2	2	0	0	0
z 2 - 3	1	1	0	0	0

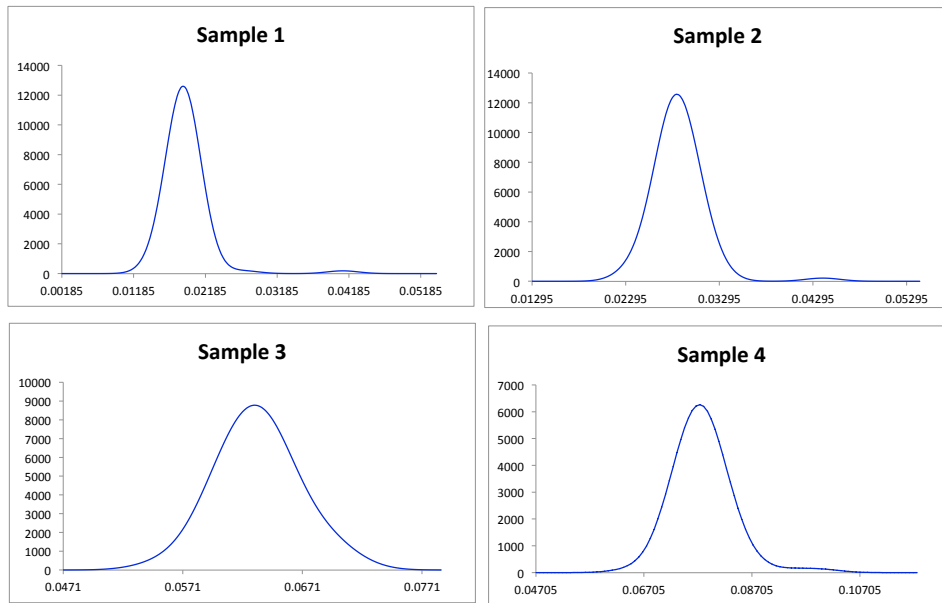
* Values for the median and standard deviation are the robust mean and acceptance limit deviation. For method statistics, the arithmetic mean and standard deviation are used.

z-Score Plots by Method - Sample 4

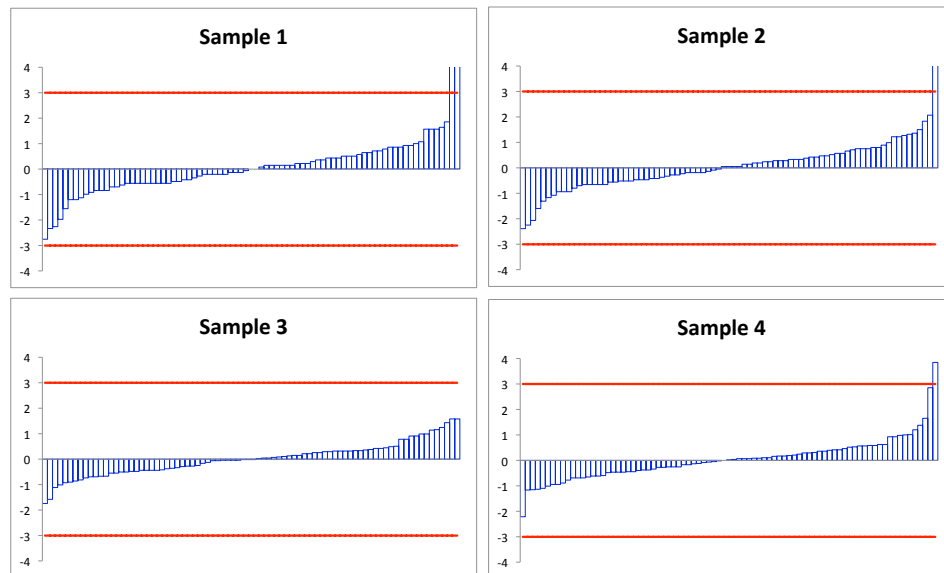


Uranium

Kernel Density Plots



z-Score Plots



Summary Statistics by Four Most Common Methods

Sample 1					
Method	All*	ICP/MS	ICP/OES		
Median	0.0188	0.0188	0.0179	0	0
Stdev	0.00141	0.00151	0.00984	0	0
Number	81	75	6	0	0
z > 3	2	1	1	0	0
z 2 - 3	3	1	2	0	0

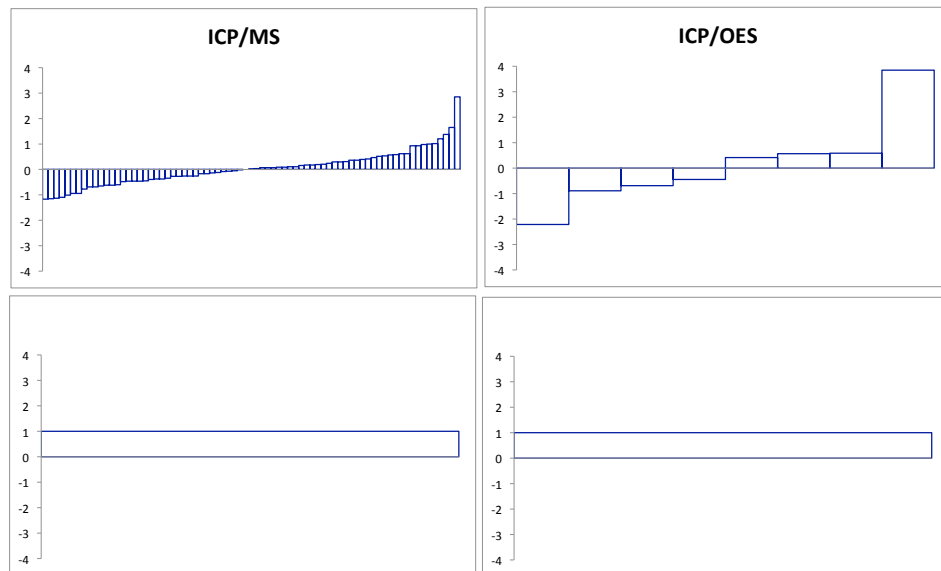
Sample 2					
Method	All*	ICP/MS	ICP/OES		
Median	0.0284	0.0285	0.0263	0	0
Stdev	0.00213	0.00166	0.0077	0	0
Number	81	75	6	0	0
z > 3	1	0	1	0	0
z 2 - 3	4	2	2	0	0

Sample 3					
Method	All*	ICP/MS	ICP/OES		
Median	0.0633	0.0632	0.0639	0	0
Stdev	0.00475	0.00288	0.00518	0	0
Number	82	75	7	0	0
z > 3	0	0	0	0	0
z 2 - 3	0	0	0	0	0

Sample 4					
Method	All*	ICP/MS	ICP/OES		
Median	0.0776	0.0777	0.0775	0	0
Stdev	0.00582	0.00402	0.0103	0	0
Number	83	75	8	0	0
z > 3	1	0	1	0	0
z 2 - 3	2	1	1	0	0

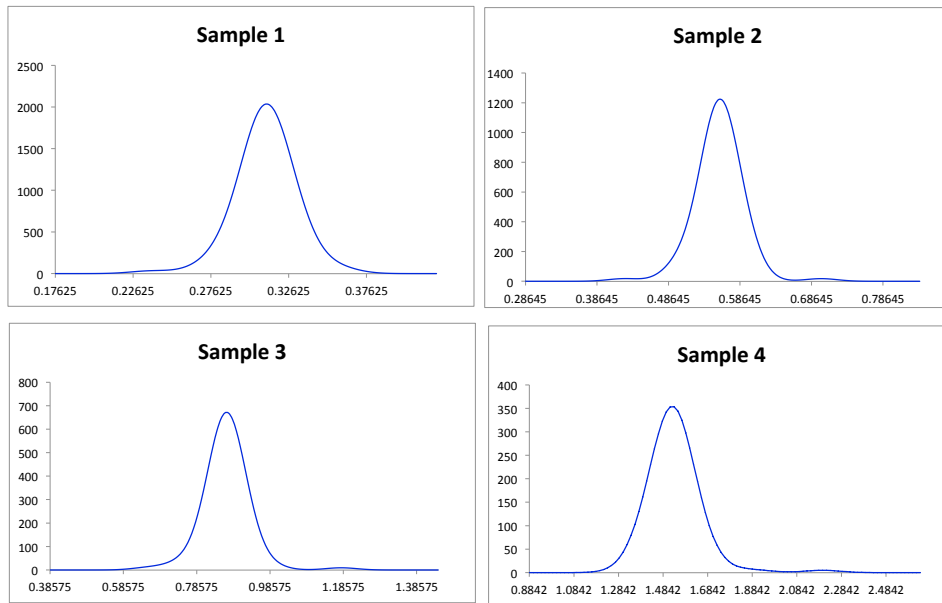
* Values for the median and standard deviation are the robust mean and acceptance limit deviation. For method statistics, the arithmetic mean and standard deviation are used.

z-Score Plots by Method - Sample 4

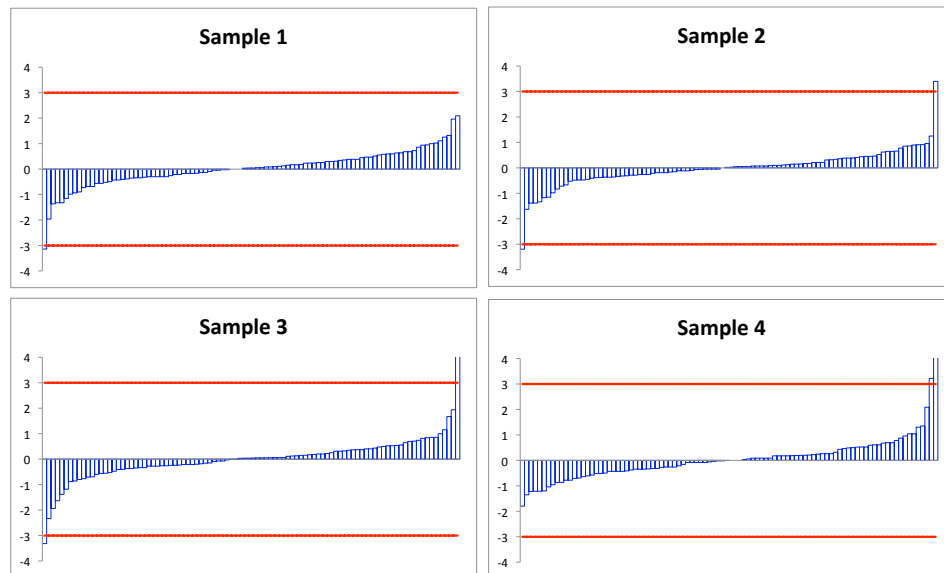


Vanadium

Kernel Density Plots



Z-Score Plots



Summary Statistics by Four Most Common Methods

Sample 1					
Method	All*	ICP/MS	ICP/OES	AAG	
Median	0.311	0.312	0.311	0.278	0
Stdev	0.0234	0.0146	0.0185	0.0576	0
Number	96	72	22	2	0
z > 3	1	0	0	1	0
z 2 - 3	1	1	0	0	0

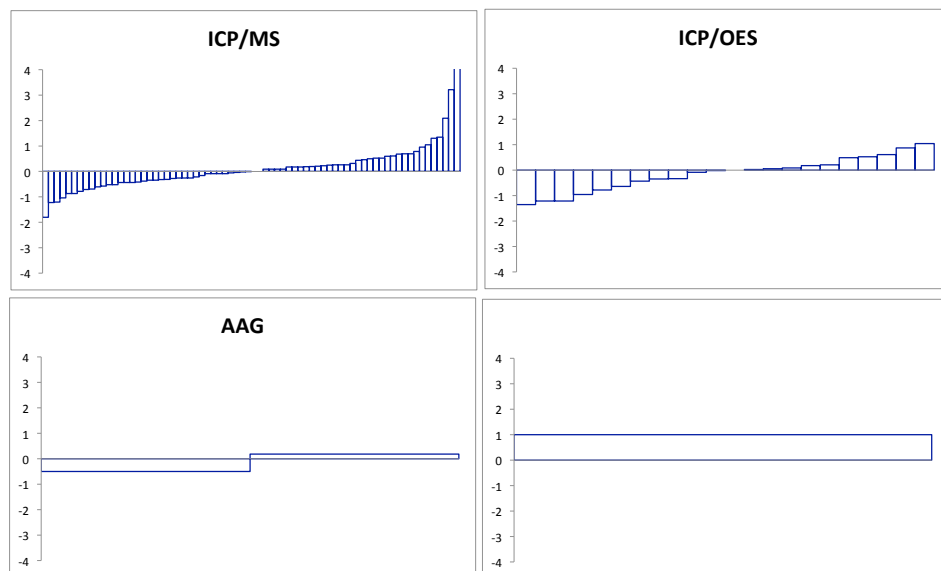
Sample 2					
Method	All*	ICP/MS	ICP/OES	AAG	
Median	0.558	0.559	0.556	0.501	0
Stdev	0.0418	0.0269	0.0266	0.108	0
Number	96	72	22	2	0
z > 3	2	1	0	1	0
z 2 - 3	0	0	0	0	0

Sample 3					
Method	All*	ICP/MS	ICP/OES	AAG	
Median	0.866	0.869	0.862	0.76	0
Stdev	0.0649	0.0557	0.0435	0.155	0
Number	96	72	22	2	0
z > 3	2	1	0	1	0
z 2 - 3	1	1	0	0	0

Sample 4					
Method	All*	ICP/MS	ICP/OES	AAG	
Median	1.53	1.53	1.53	1.51	0
Stdev	0.115	0.115	0.0773	0.0554	0
Number	96	72	22	2	0
z > 3	2	2	0	0	0
z 2 - 3	1	1	0	0	0

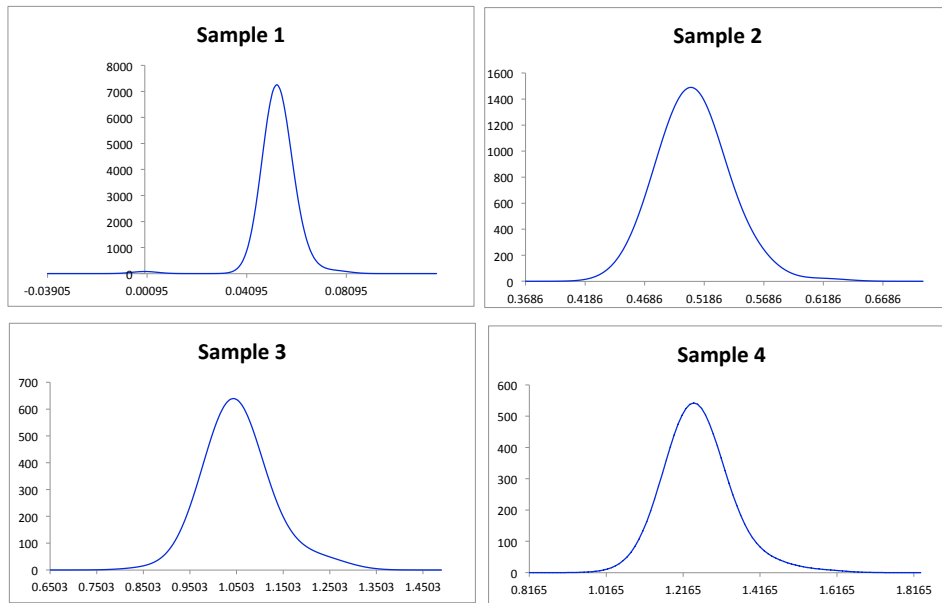
* Values for the median and standard deviation are the robust mean and acceptance limit deviation. For method statistics, the arithmetic mean and standard deviation are used.

z-Score Plots by Method - Sample 4

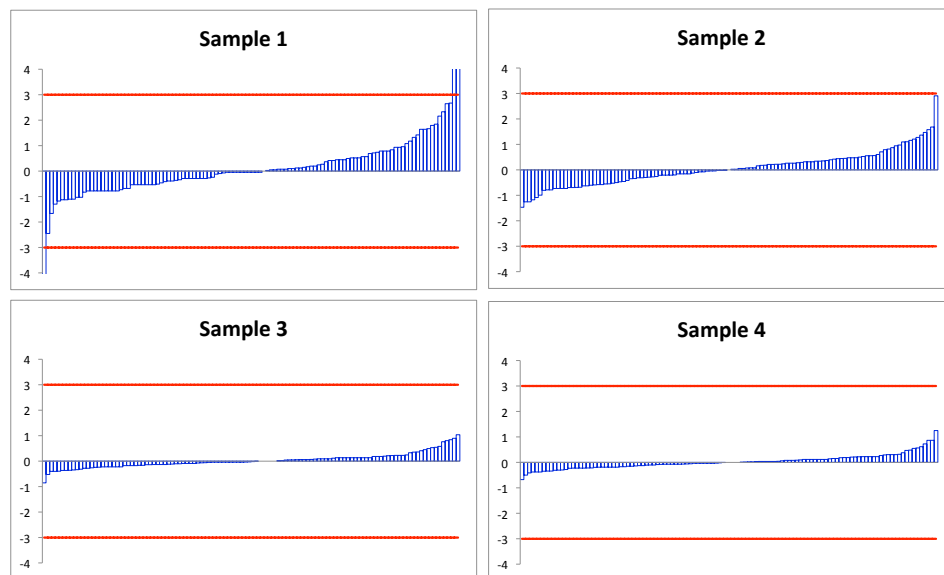


Zinc

Kernel Density Plots



z-Score Plots



Summary Statistics by Four Most Common Methods

Sample 1					
Method	All*	ICP/MS	ICP/OES	AA	
Median	0.0532	0.0534	0.0517	0.0487	0
Stdev	0.00408	0.00382	0.00636	0.0305	0
Number	114	83	28	3	0
z > 3	3	1	1	1	0
z 2 - 3	5	3	2	0	0

Sample 2					
Method	All*	ICP/MS	ICP/OES	AA	
Median	0.508	0.511	0.503	0.502	0
Stdev	0.0381	0.0239	0.0323	0.0137	0
Number	115	84	28	3	0
z > 3	0	0	0	0	0
z 2 - 3	1	0	1	0	0

Sample 3					
Method	All*	ICP/MS	ICP/OES	AA	
Median	1.05	1.05	1.03	1.03	0
Stdev	0.222	0.0674	0.057	0.00205	0
Number	114	84	28	2	0
z > 3	0	0	0	0	0
z 2 - 3	0	0	0	0	0

Sample 4					
Method	All*	ICP/MS	ICP/OES	AA	
Median	1.25	1.25	1.26	1.24	0
Stdev	0.264	0.0798	0.062	0.0747	0
Number	114	84	28	2	0
z > 3	0	0	0	0	0
z 2 - 3	0	0	0	0	0

* Values for the median and standard deviation are the robust mean and acceptance limit deviation. For method statistics, the arithmetic mean and standard deviation are used.

z-Score Plots by Method - Sample 4

