

# Test Group Summary Report

## C17 Metals in Soil

### June 2021 PT Round

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**Issued: October 13, 2021**

## Table of Contents

1.0	The Proficiency Testing Report .....	1
2.0	Definitions .....	1
3.0	Scoring System .....	1
3.1	Homogeneity and Stability Assessment .....	2
3.2	The z score .....	2
3.2	Composite (PT) Score.....	2
3.3	Identifying Bias .....	2
3.4	Deviations from Evaluation Procedure .....	3
4.0	PT Round Specific Data Summary .....	3
4.1	Summary Statistics .....	3
4.2	z- Score Plots .....	3
4.3	Kernel Density Plots .....	3
4.4	Stability and Homogeneity Plots.....	3
	<b>Annex A Summary by Analyte .....</b>	<b>4</b>

## 1.0 The Proficiency Testing Report

The Proficiency Testing Report consists of two parts.

- *PTC Proficiency Testing Report*: This report contains participant-specific data and other confidential information. This report is emailed to participants at the end of the PT round.
- *Test Group Summary Report*: A Test Group Summary Report is created for each quantified test group at the end of the PT round. These reports contain more detailed information on the round 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 (SDPA). 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 the degree to which 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 – PT Evaluation *Procedure*, which is available on the PTC website [www.PTCCanada.org](http://www.PTCCanada.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 to minimize the impact.

### 3.2 THE Z SCORE

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

$$z - Score = \frac{(x - \bar{X})}{SDPA} \quad \text{where: } \begin{array}{l} x = \text{participant result;} \\ \bar{X} = \text{the Assigned Value;} \\ SDPA = \text{the Standard Deviation for Proficiency Assessment.} \end{array}$$

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 ( $Stdev_{rob}$ ) is calculated using reported results, obvious outliers removed;
- The regression equation standard deviation ( $Stdev_{reg}$ ) is estimated from regression equations derived from previous studies (see PROC11- *PT Regression Equations* for details);
- The SDPA is the higher of  $Stdev_{rob}$  and  $Stdev_{reg}$ ;
- 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 round involves four or two separate samples of distinct concentration 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 $\leq 2$	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 *PTC Proficiency Testing Report*.

## 4.0 PT Round Specific Data Summary

The following pages provide more detailed information about the PT round 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 are based upon the data after outliers have been removed.

### 4.1 SUMMARY STATISTICS

In addition to some of the statistics found in the customer reports, this table includes additional summary statistics such as Median, different measures of dispersion, the number of outliers removed, the number of results in the Questionable range ( $|z|$  between 2 and 3) and the Unacceptable range ( $z > 3$ ), and whether a data set was flagged for Homogeneity or Stability. This section also includes sorted scatter plots of the data for each sample.

### 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. Each bar in these plots is colour-coded to indicate the analytical method used by the participant.

### 4.3 KERNEL DENSITY PLOTS

Kernel density plots are generated for each data set. These plots are a graphical way to represent the overall data distribution and are used to visualize possible deviations from normality and unimodality.

### 4.4 STABILITY AND HOMOGENEITY PLOTS

Plots of reported result against analysis date, and reported result against order of bottling are displayed, along with the regression line. These regression analyses are used to determine if the SDPA should be adjusted due to homogeneity or stability.

# ALUMINUM

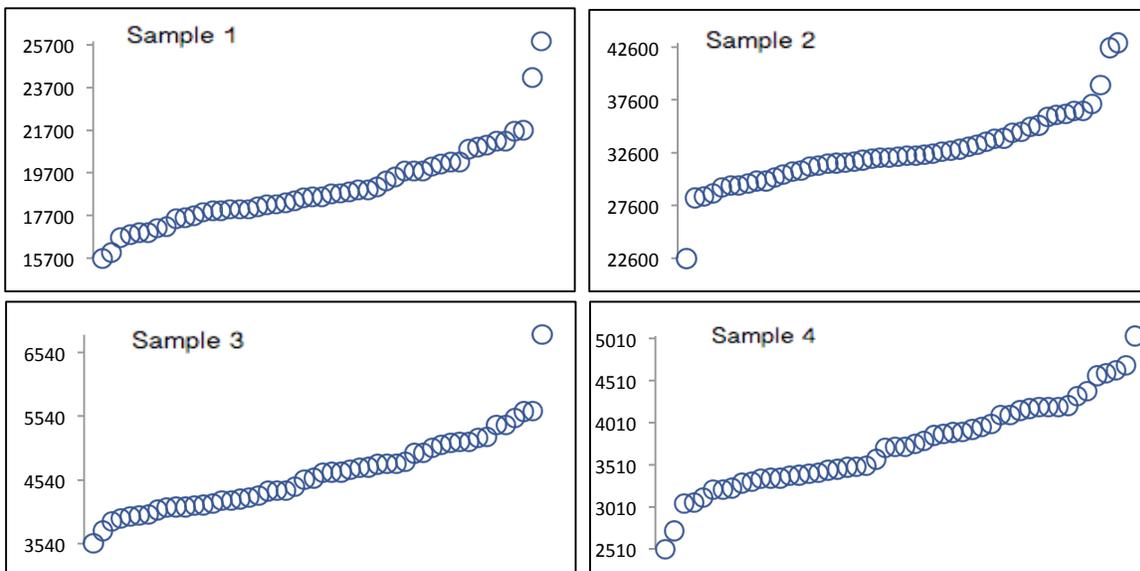
## Summary Statistics

Statistic	C17-1	C17-2	C17-3	C17-4
N	49	50	50	50
Median	18600	32300	4610	3720
Robust Mean	18900	32600	4600	3740
U	302	509	103	94
Robust Standard Deviation	1690	2880	581	530
Regression Standard Deviation	2870	4670	1000	889
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA)	2870	4670	1000	889
Outliers	1	0	0	0
z >3.0	0	0	0	0
2< z <3	1	3	1	0

## Methods Used

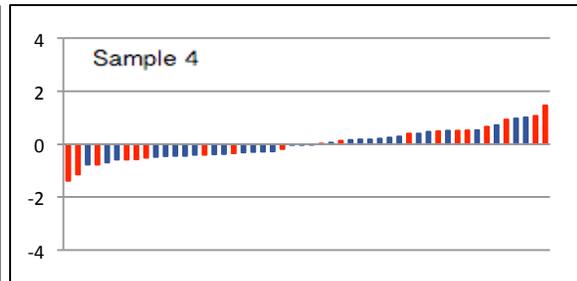
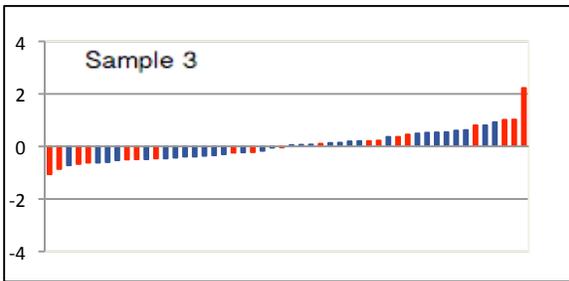
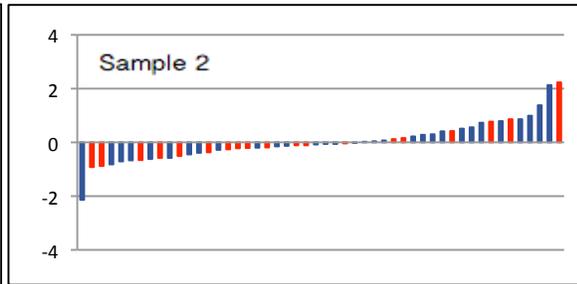
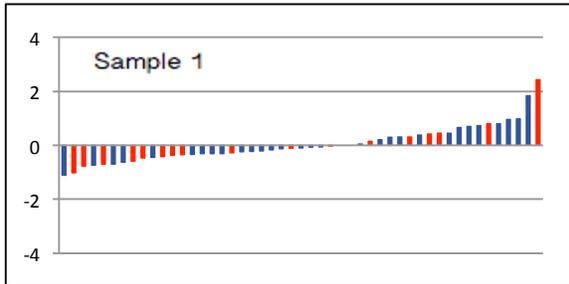
Method	C17-1	C17-2	C17-3	C17-4
ICP/MS	31	31	31	31
ICP/OES	18	19	19	19

All summary stats and the plots below are based on the data excluding any flagged outliers

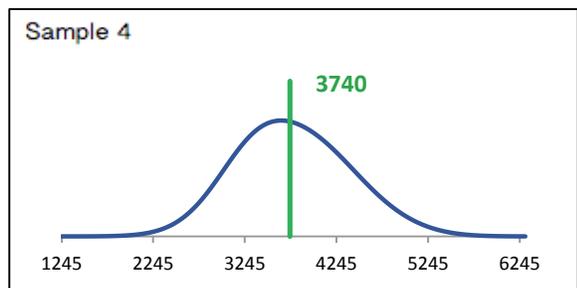
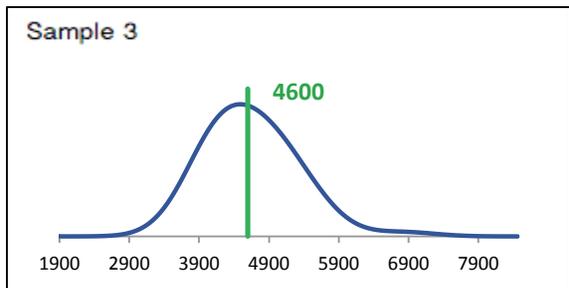
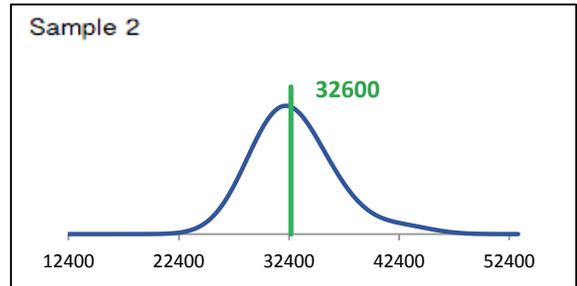
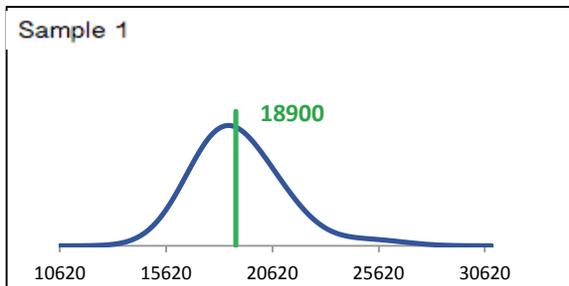


# ALUMINUM

## z-Score Plots

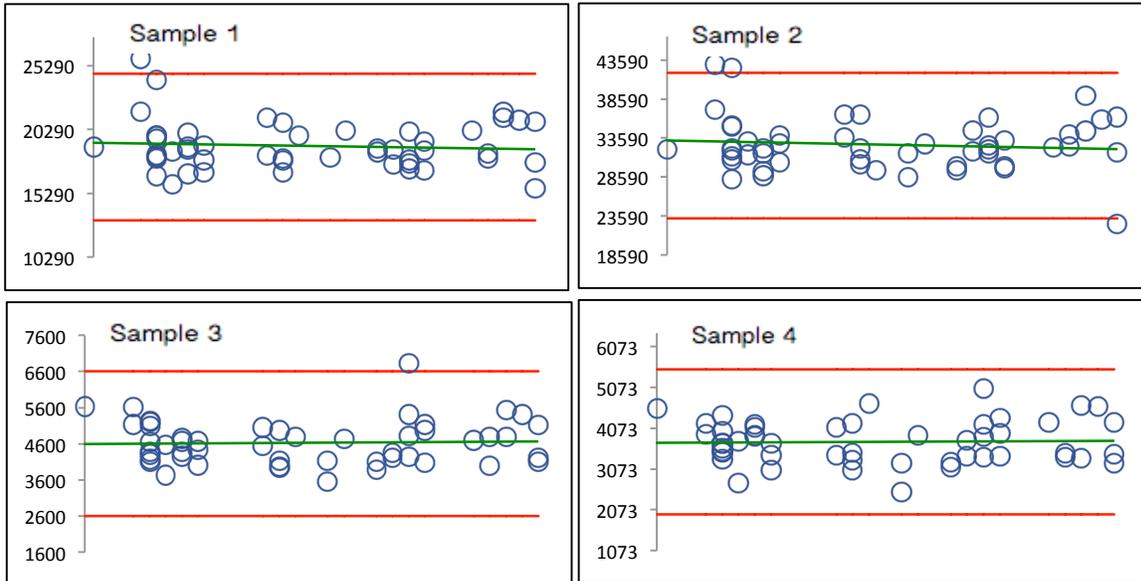


## Kernel Density Plots



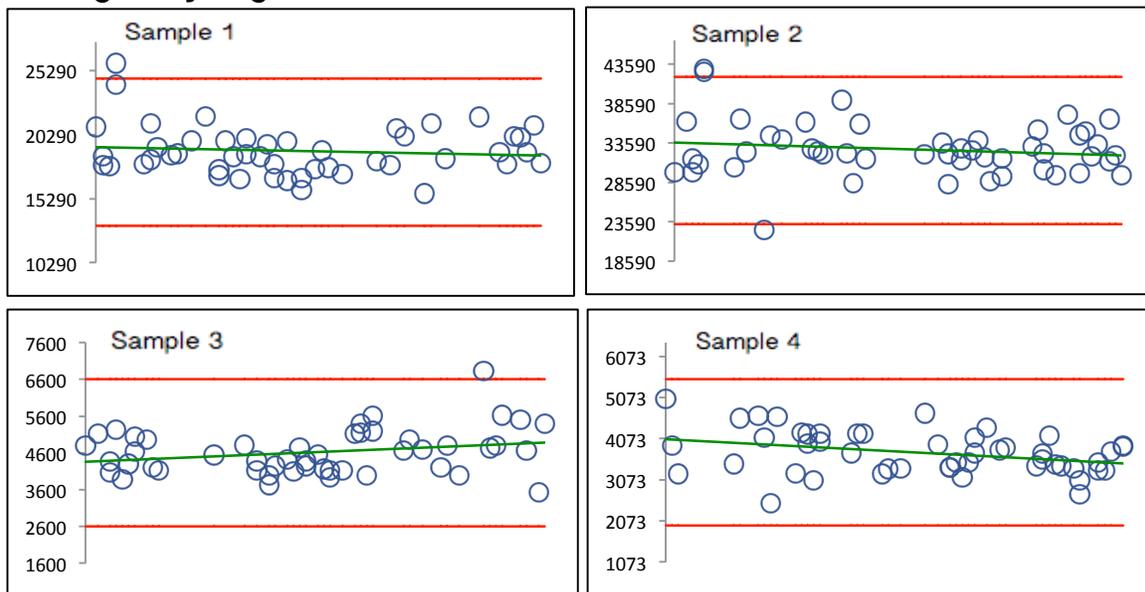
# ALUMINUM

## Stability Regression



Reported results (Y-axis) plotted against reported analysis date (X-axis)

## Homogeneity Regression



Reported results (Y-axis) plotted against bottling order (X-axis).

## ANTIMONY

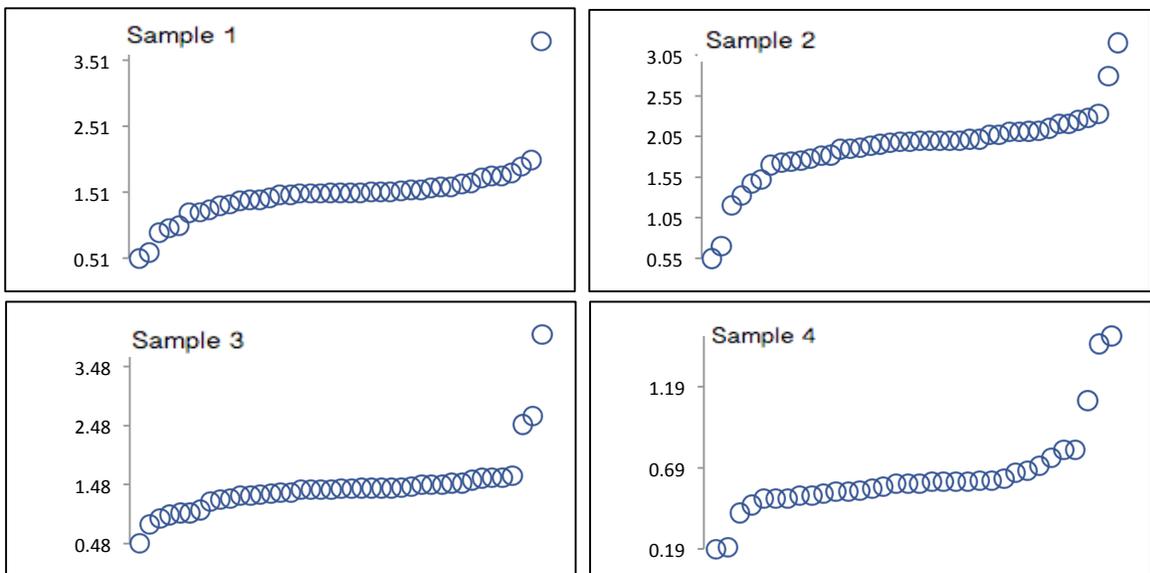
### Summary Statistics

Statistic	C17-1	C17-2	C17-3	C17-4
N	41	42	41	34
Median	1.50	1.99	1.41	0.590
Robust Mean	1.48	1.95	1.37	0.594
U	0.045	0.050	0.043	0.026
Robust Standard Deviation	0.232	0.258	0.221	0.123
Regression Standard Deviation	0.848	1.12	0.788	0.340
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA)	0.848	1.12	0.788	0.340
Outliers	0	0	0	0
z >3.0	0	0	1	0
2< z <3	1	0	0	2

### Methods Used

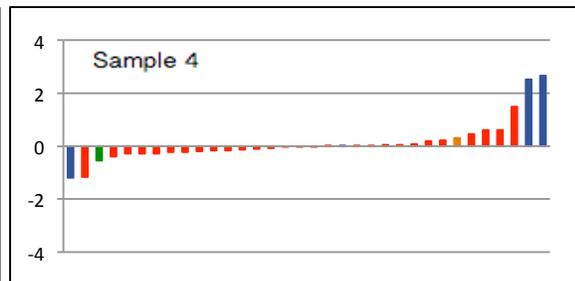
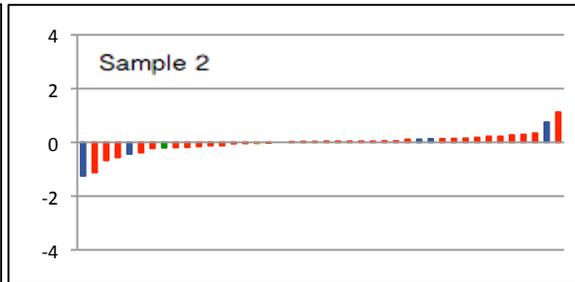
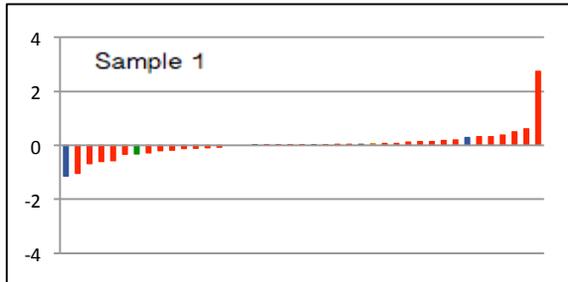
Method	C17-1	C17-2	C17-3	C17-4
ICP/OES	5	5	5	4
ICP/MS	34	35	34	28
ICPHY	1	1	1	1
AAHY	1	1	1	1

All summary stats and the plots below are based on the data excluding any flagged outliers

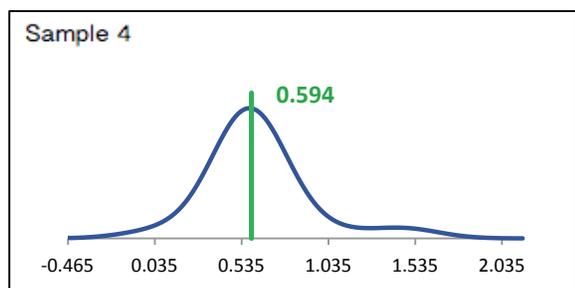
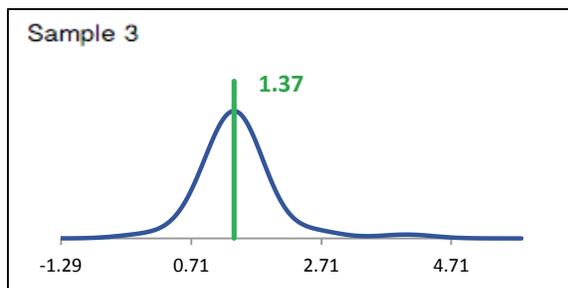
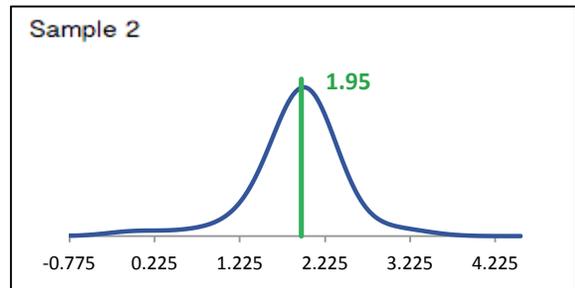
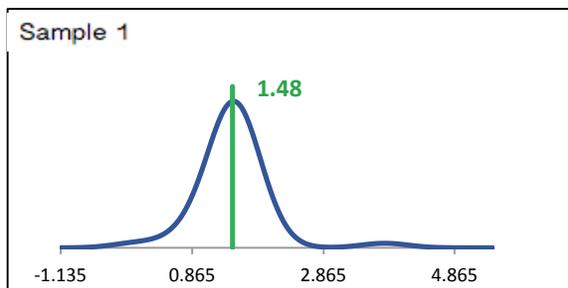


# ANTIMONY

## z-Score Plots

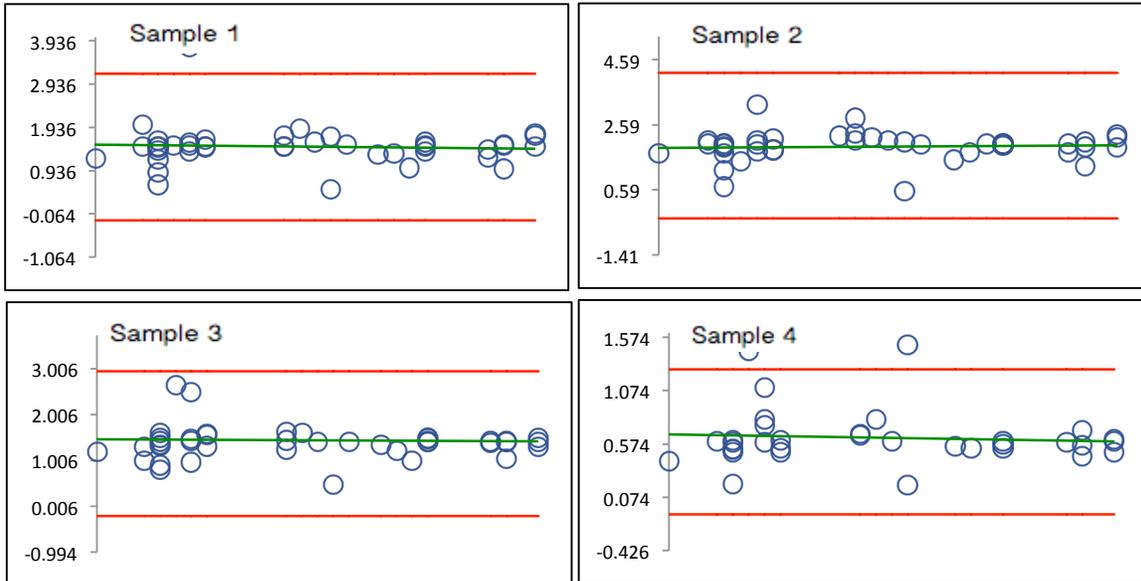


## Kernel Density Plots



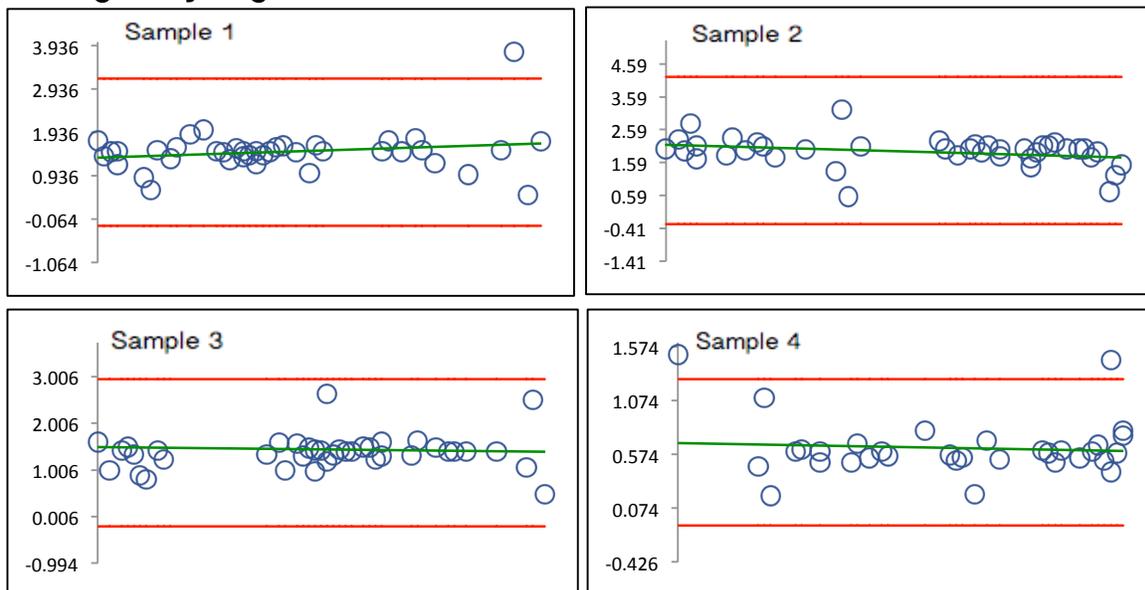
# ANTIMONY

## Stability Regression



Reported results (Y-axis) plotted against reported analysis date (X-axis)

## Homogeneity Regression



Reported results (Y-axis) plotted against bottling order (X-axis).

## ARSENIC

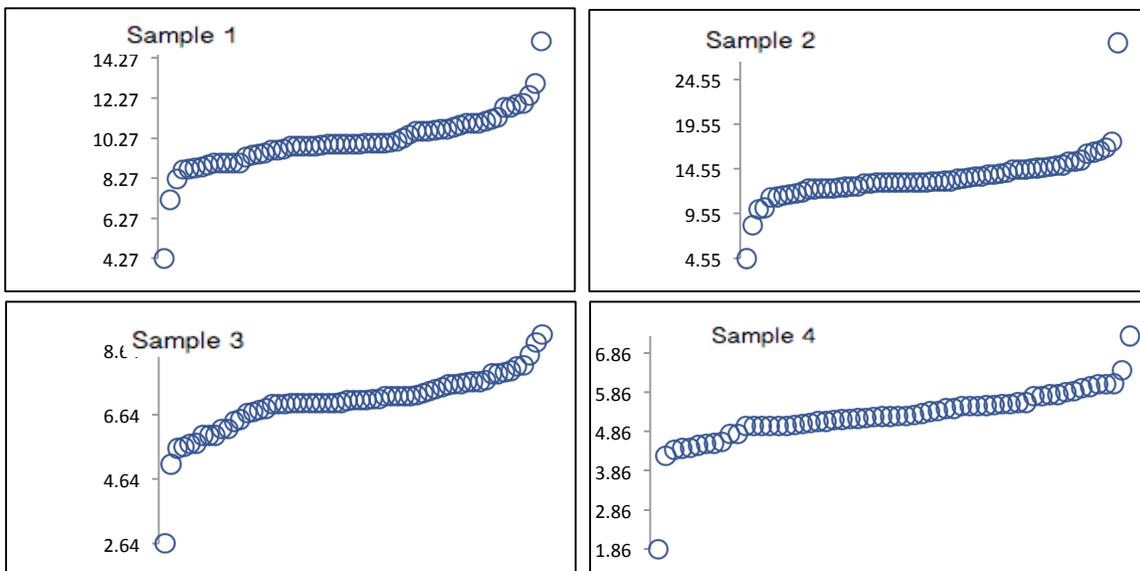
### Summary Statistics

Statistic	C17-1	C17-2	C17-3	C17-4
N	61	61	61	60
Median	9.99	13.1	7.10	5.25
Robust Mean	10.1	13.4	7.08	5.28
U	0.166	0.248	0.118	0.087
Robust Standard Deviation	1.04	1.55	0.738	0.537
Regression Standard Deviation	1.74	2.11	1.41	1.21
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA)	1.74	2.11	1.41	1.21
Outliers	0	0	0	0
z >3.0	1	2	1	0
2< z <3	1	1	0	1

### Methods Used

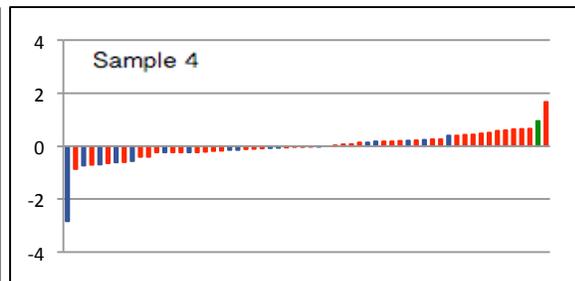
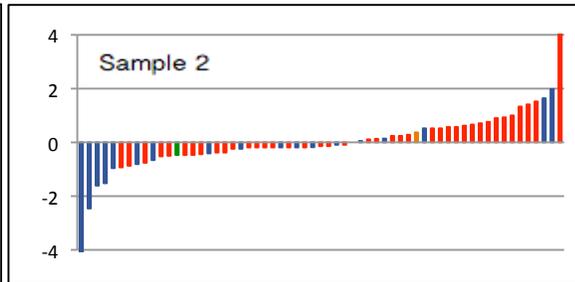
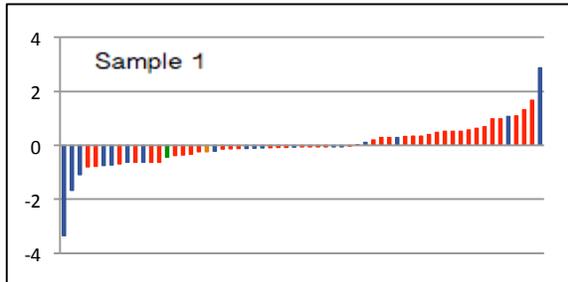
Method	C17-1	C17-2	C17-3	C17-4
ICP/OES	18	18	18	17
ICP/MS	41	41	41	41
AAHY	1	1	1	1
ICPHY	1	1	1	1

All summary stats and the plots below are based on the data excluding any flagged outliers

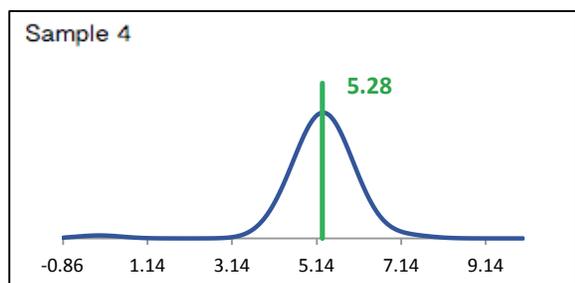
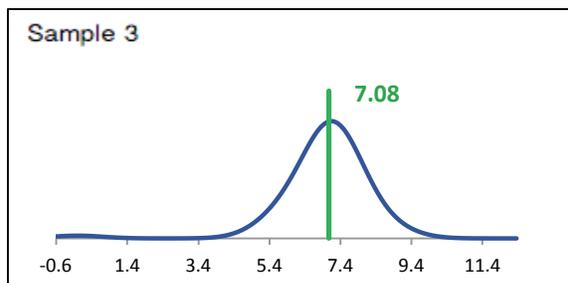
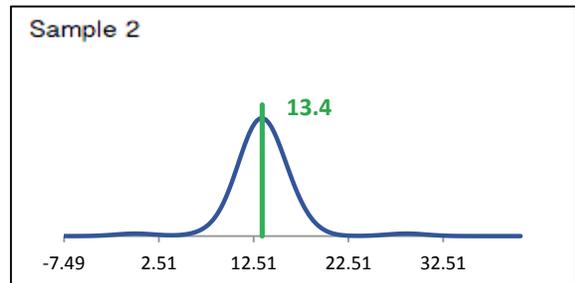
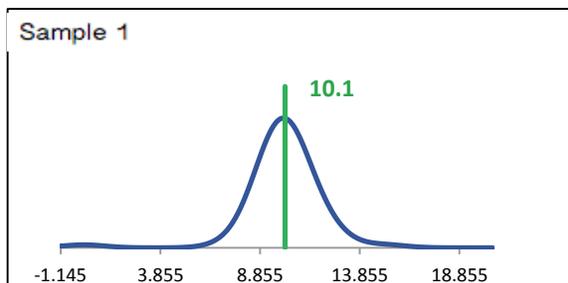


# ARSENIC

## z-Score Plots

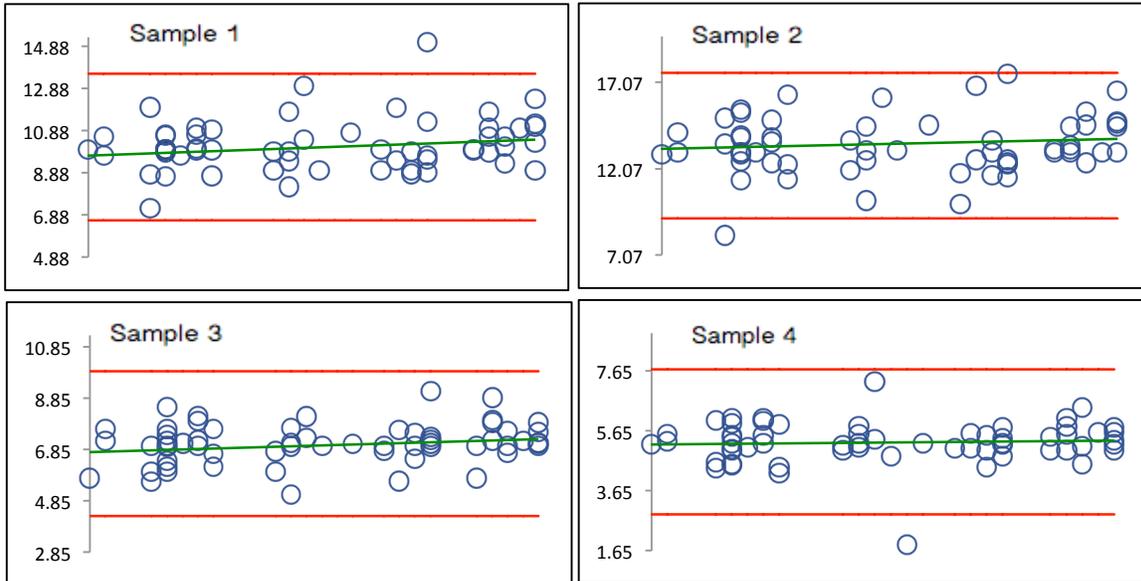


## Kernel Density Plots



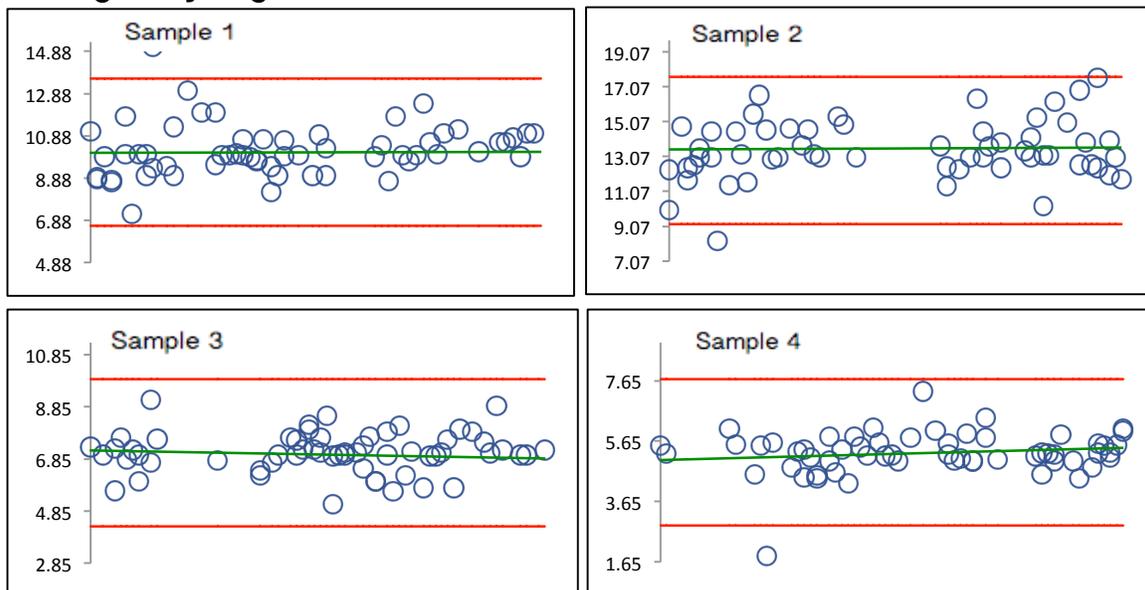
# ARSENIC

## Stability Regression



Reported results (Y-axis) plotted against reported analysis date (X-axis)

## Homogeneity Regression



Reported results (Y-axis) plotted against bottling order (X-axis).

## BARIUM

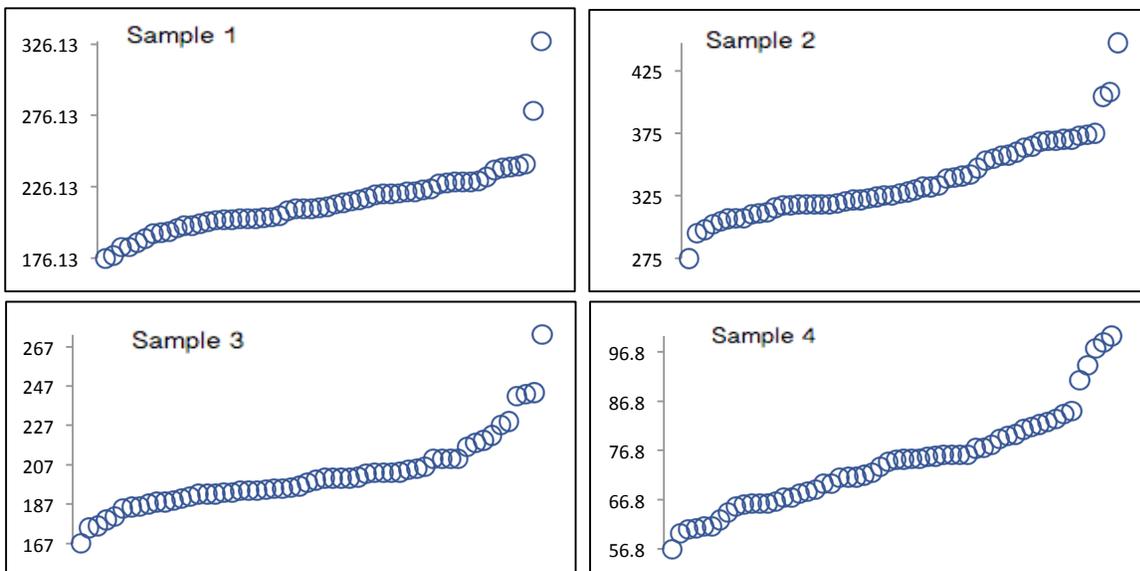
### Summary Statistics

Statistic	C17-1	C17-2	C17-3	C17-4
N	56	56	56	56
Median	212	328	199	74.6
Robust Mean	213	335	199	73.4
U	3.14	4.79	2.37	1.49
Robust Standard Deviation	18.8	28.7	14.2	8.95
Regression Standard Deviation	16.9	25.3	15.9	7.17
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA)	18.8	28.7	15.9	8.95
Outliers	0	0	0	0
z >3.0	2	1	1	0
2< z <3	0	3	4	4

### Methods Used

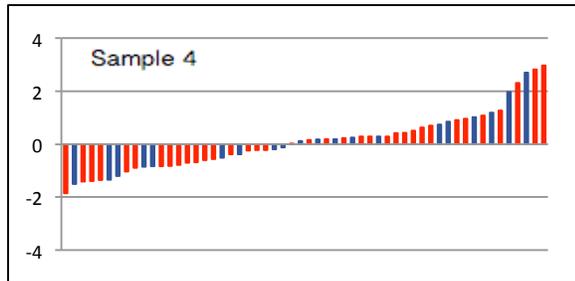
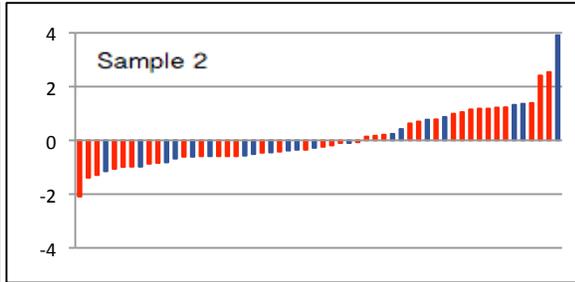
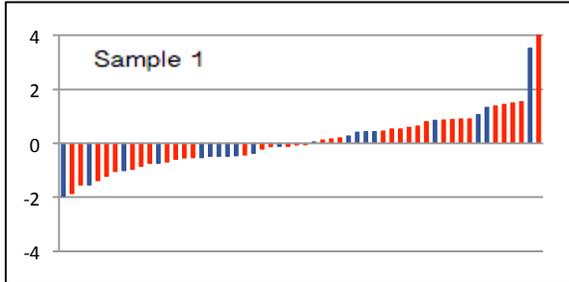
Method	C17-1	C17-2	C17-3	C17-4
ICP/OES	20	20	20	20
ICP/MS	36	36	36	36

All summary stats and the plots below are based on the data excluding any flagged outliers

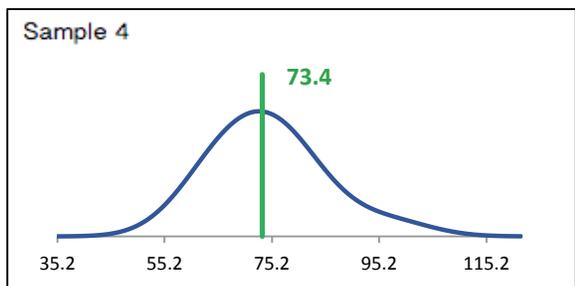
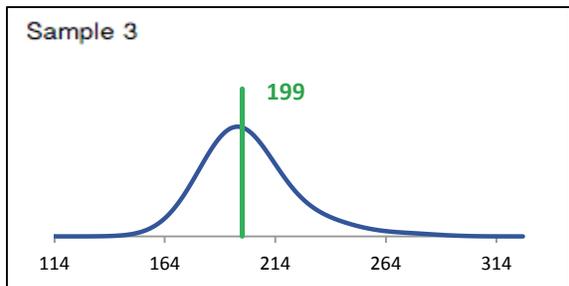
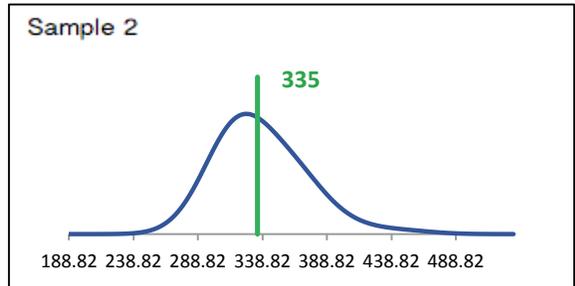
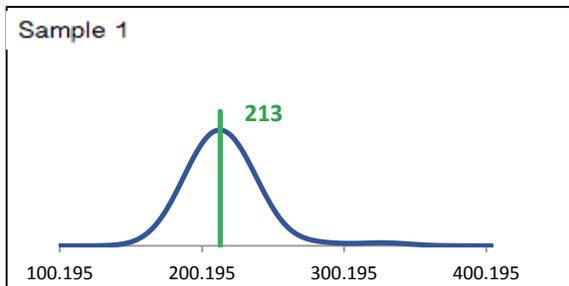


# BARIUM

## z-Score Plots

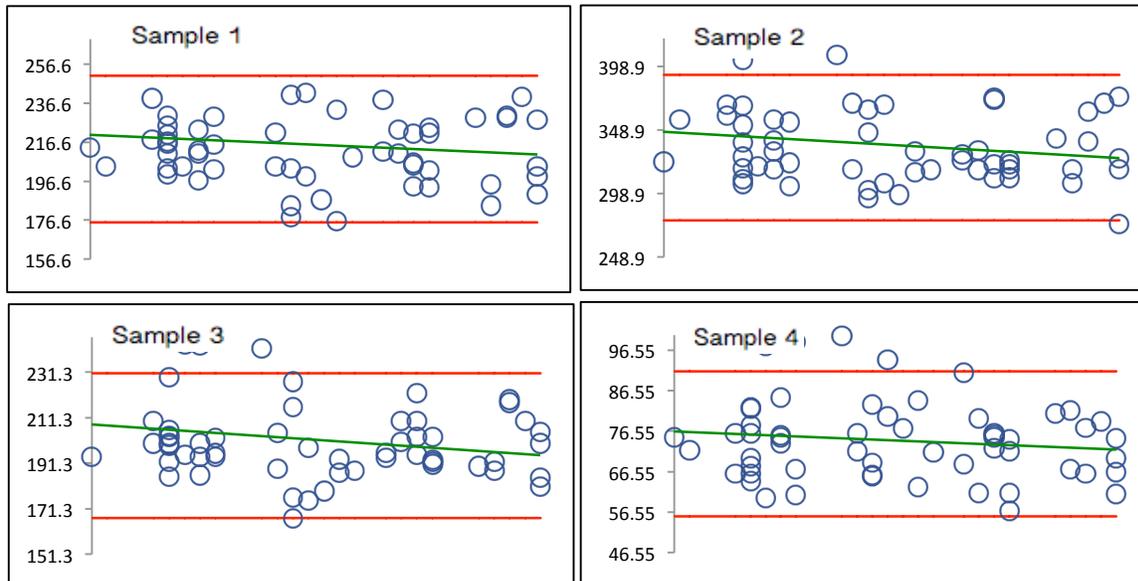


## Kernel Density Plots



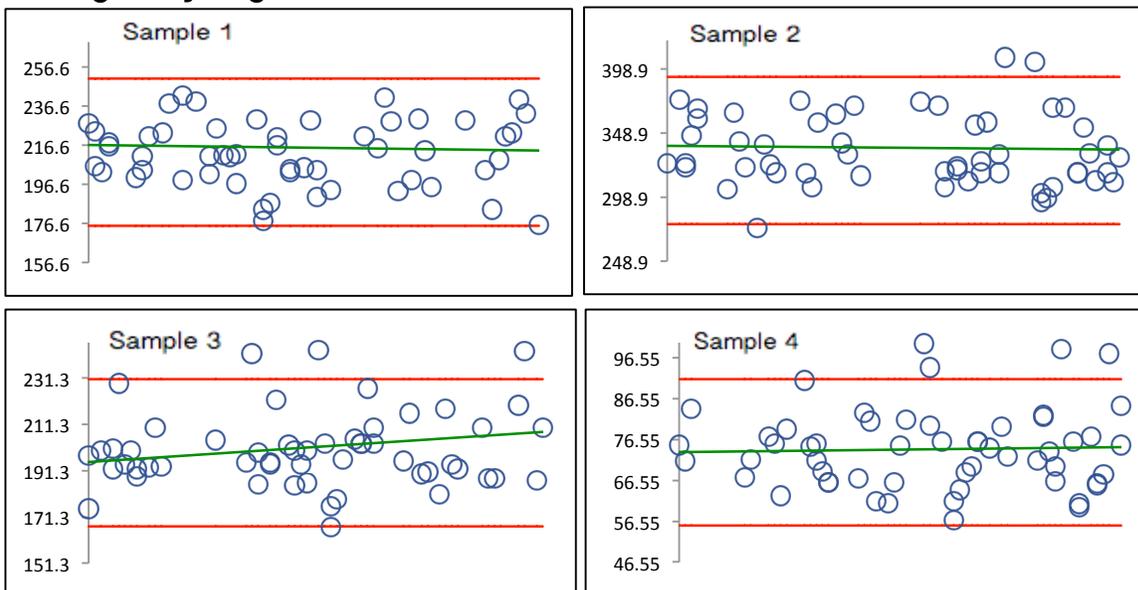
# BARIUM

## Stability Regression



Reported results (Y-axis) plotted against reported analysis date (X-axis)

## Homogeneity Regression



Reported results (Y-axis) plotted against bottling order (X-axis).

## BERYLLIUM

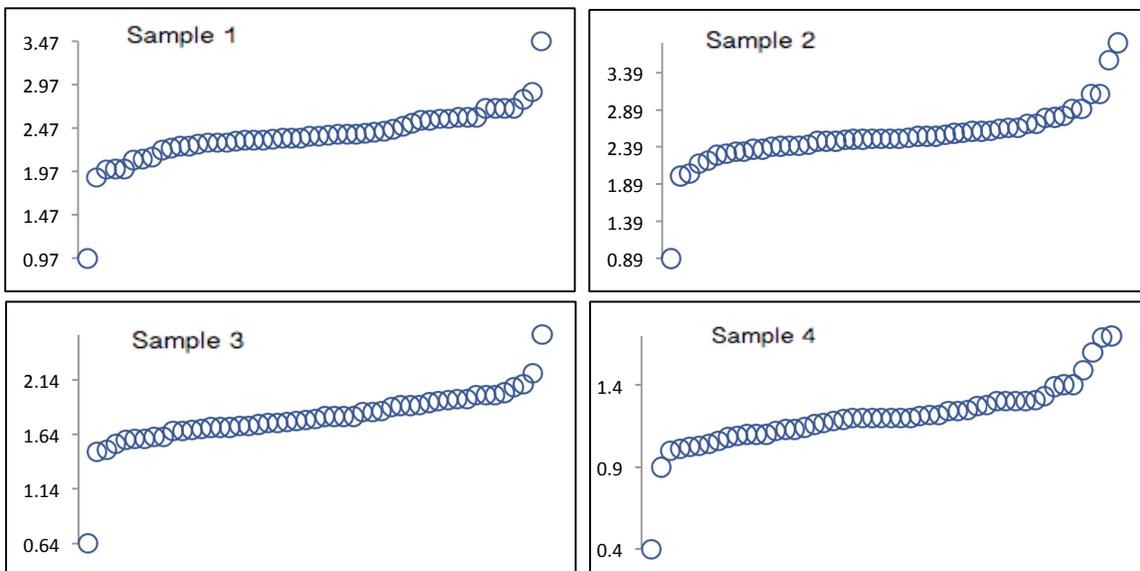
### Summary Statistics

Statistic	C17-1	C17-2	C17-3	C17-4
N	50	50	49	49
Median	2.38	2.50	1.78	1.20
Robust Mean	2.39	2.53	1.80	1.20
U	0.040	0.040	0.032	0.025
Robust Standard Deviation	0.228	0.224	0.179	0.140
Regression Standard Deviation	0.361	0.378	0.282	0.203
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA)	0.361	0.378	0.282	0.203
Outliers	0	0	0	0
z >3.0	1	2	1	1
2< z <3	1	1	1	2

### Methods Used

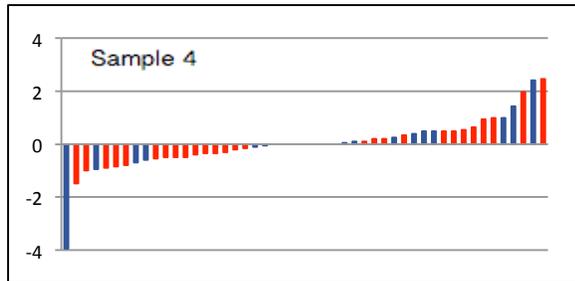
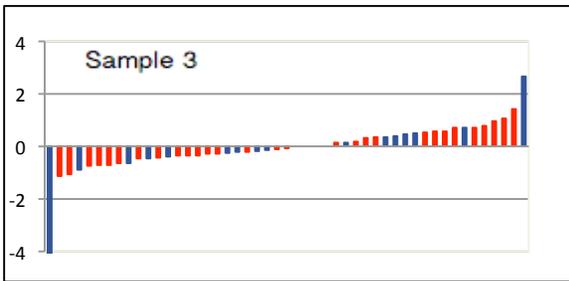
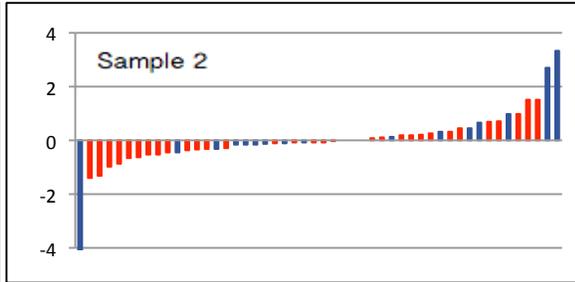
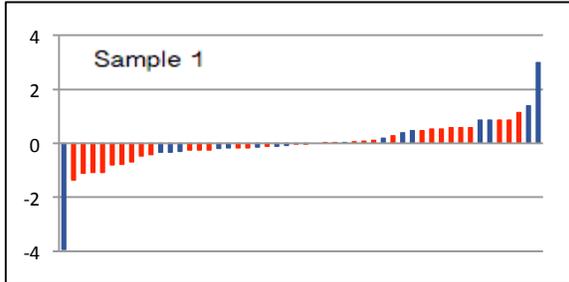
Method	C17-1	C17-2	C17-3	C17-4
ICP/OES	17	17	17	17
ICP/MS	33	33	32	32

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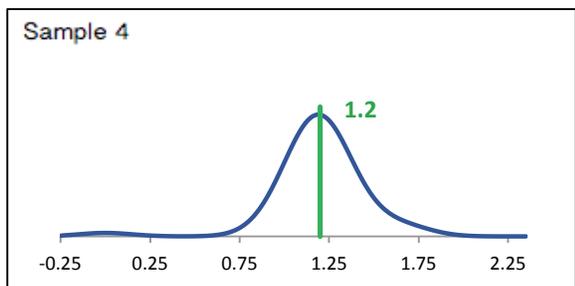
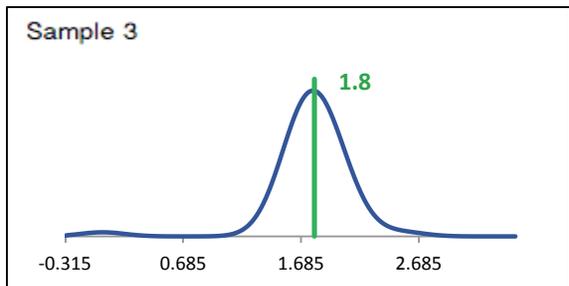
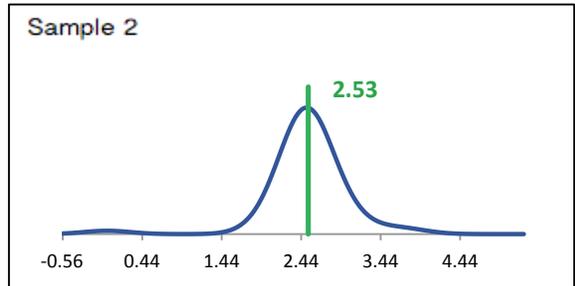
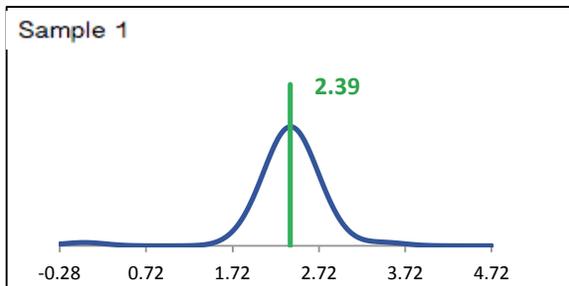


# BERYLLIUM

## z-Score Plots

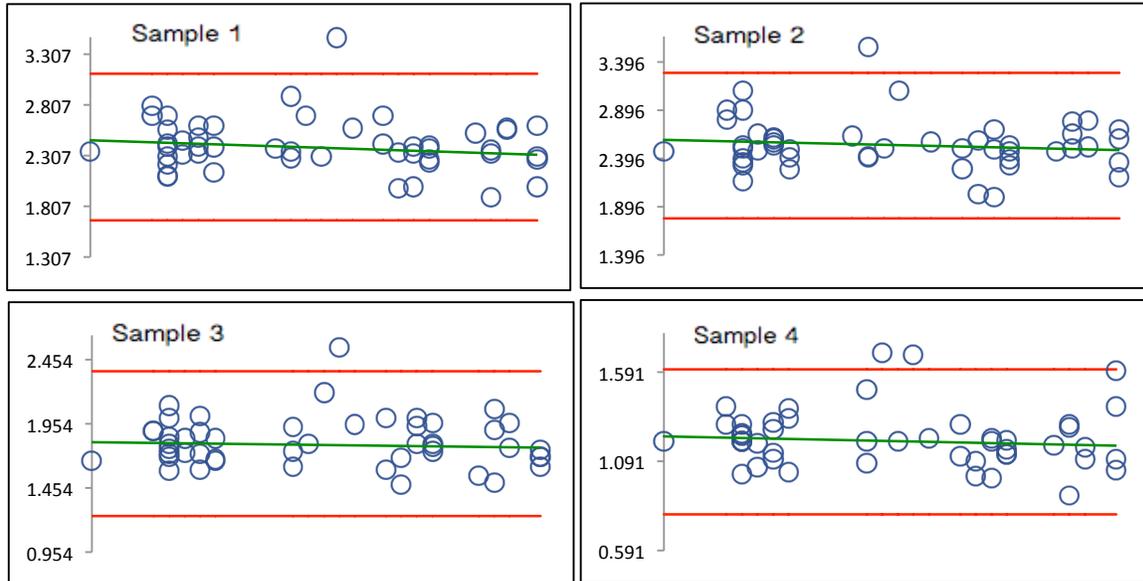


## Kernel Density Plots



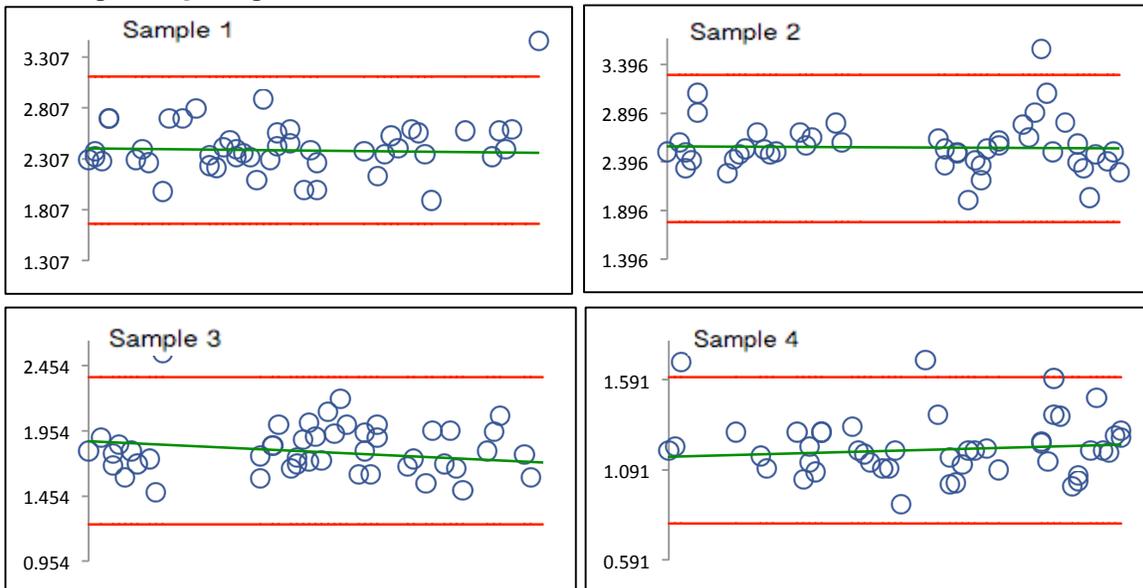
# BERYLLIUM

## Stability Regression



Reported results (Y-axis) plotted against reported analysis date (X-axis)

## Homogeneity Regression



Reported results (Y-axis) plotted against bottling order (X-axis).

## BORON

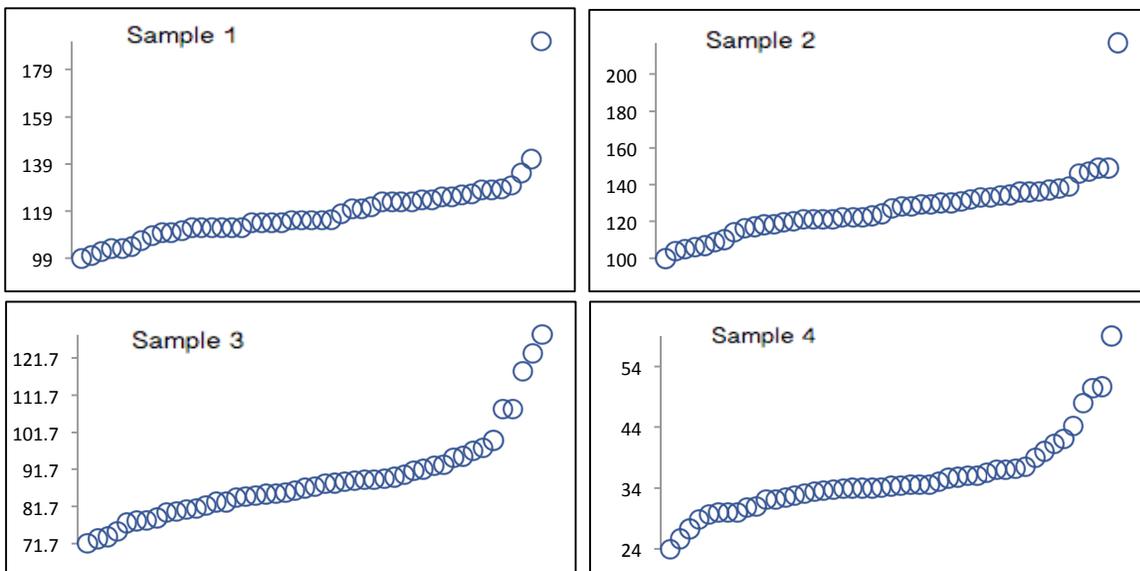
### Summary Statistics

Statistic	C17-1	C17-2	C17-3	C17-4
N	47	47	47	47
Median	115	127	87.0	34.3
Robust Mean	117	126	87.3	34.7
U	1.81	2.39	1.61	0.813
Robust Standard Deviation	9.94	13.1	8.83	4.46
Regression Standard Deviation	51.2	55.2	38.2	15.2
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA)	51.2	55.2	38.2	15.2
Outliers	0	0	0	0
z >3.0	0	0	0	0
2< z <3	0	0	0	0

### Methods Used

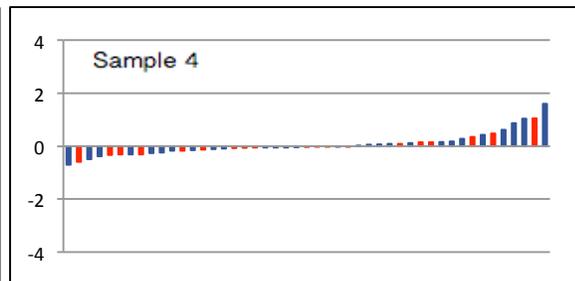
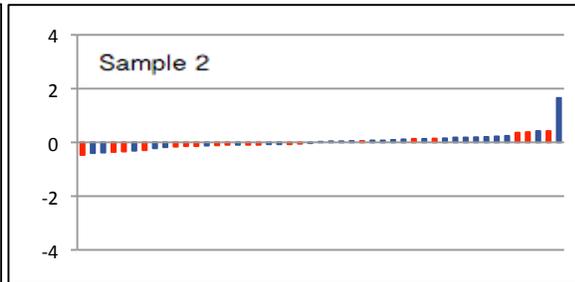
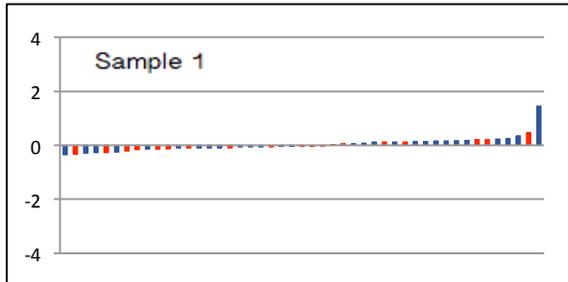
Method	C17-1	C17-2	C17-3	C17-4
ICP/MS	28	28	28	28
ICP/OES	19	19	19	19

All summary stats and the plots below are based on the data excluding any flagged outliers

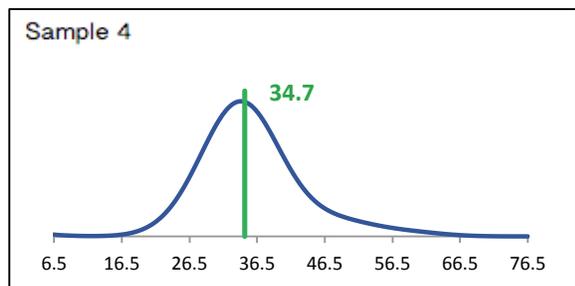
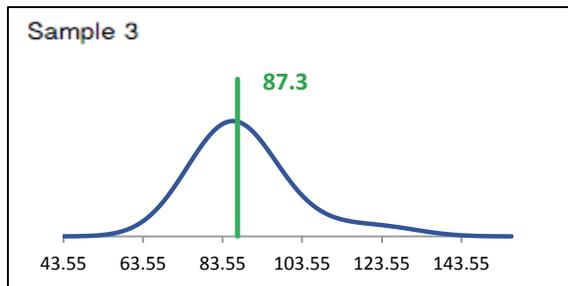
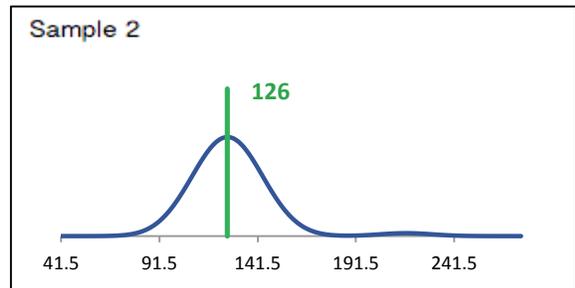
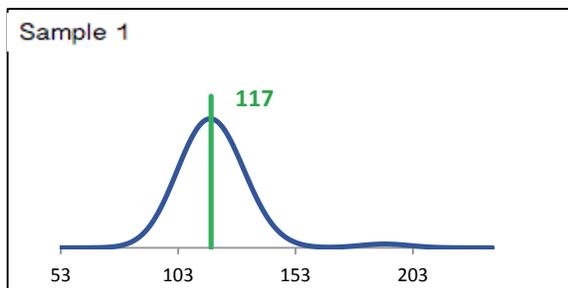


# BORON

## z-Score Plots

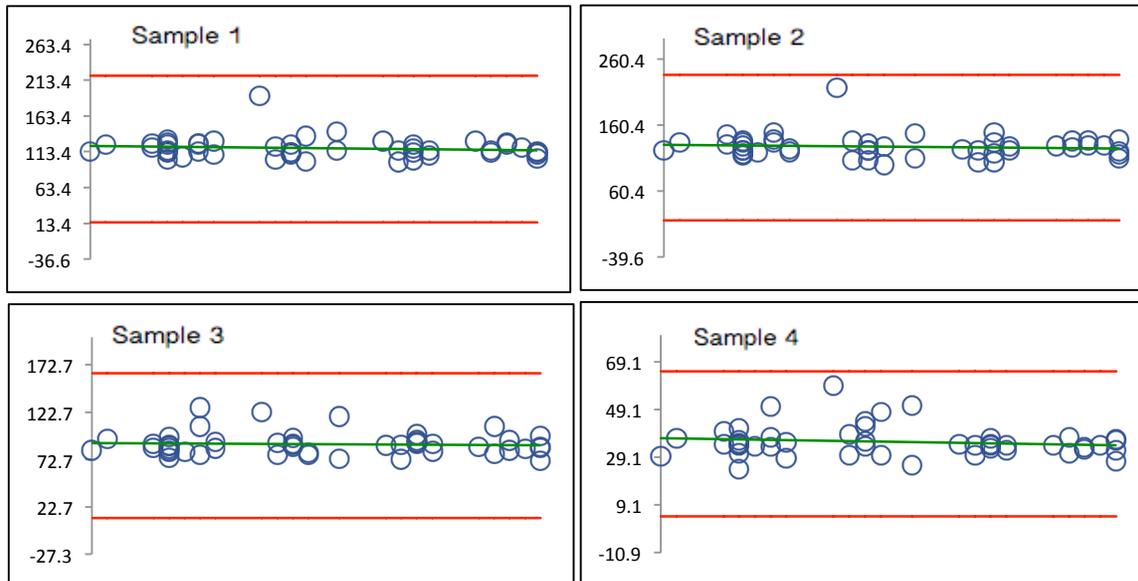


## Kernel Density Plots



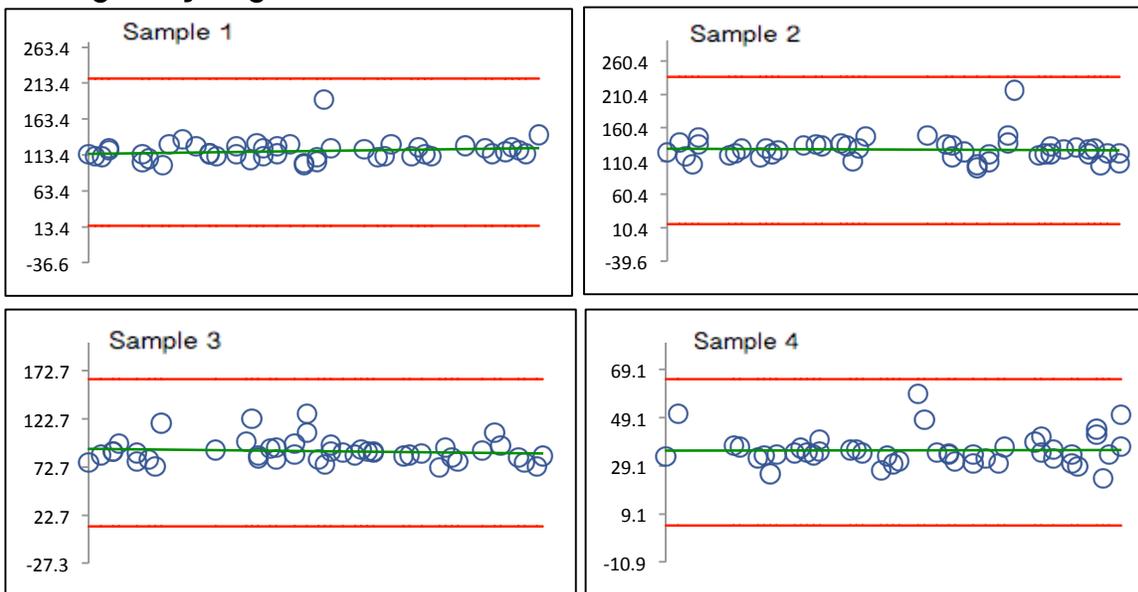
# BORON

## Stability Regression



Reported results (Y-axis) plotted against reported analysis date (X-axis)

## Homogeneity Regression



Reported results (Y-axis) plotted against bottling order (X-axis).

## CADMIUM

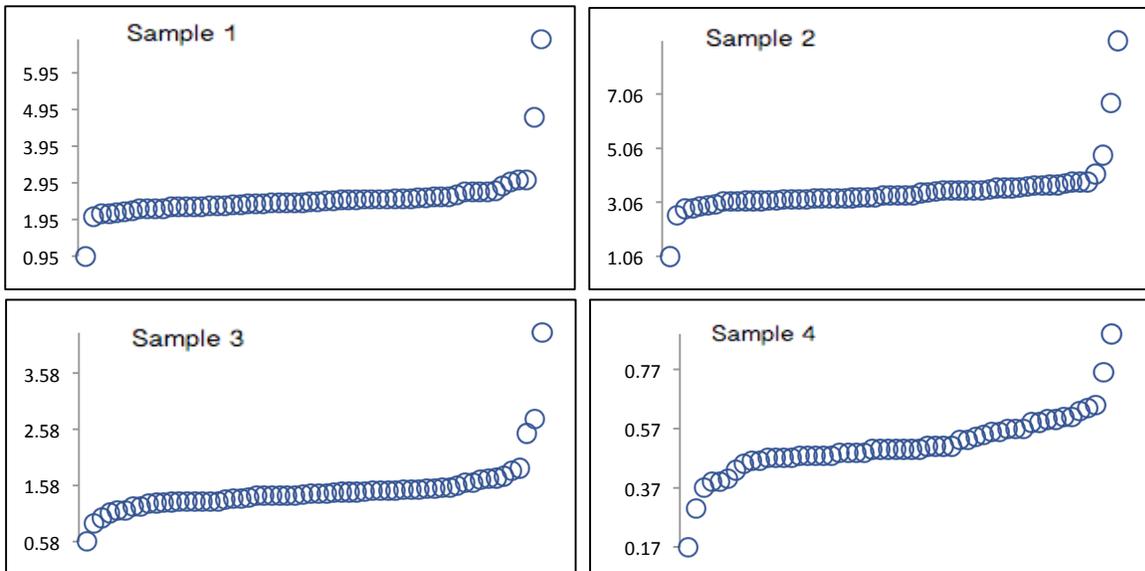
### Summary Statistics

Statistic	C17-1	C17-2	C17-3	C17-4
N	60	60	60	54
Median	2.44	3.31	1.44	0.500
Robust Mean	2.45	3.36	1.43	0.513
U	0.035	0.053	0.032	0.013
Robust Standard Deviation	0.214	0.327	0.197	0.0759
Regression Standard Deviation	0.365	0.444	0.277	0.197
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA)	0.365	0.444	0.277	0.197
Outliers	0	0	0	0
z >3.0	3	4	4	0
2< z <3	0	0	0	0

### Methods Used

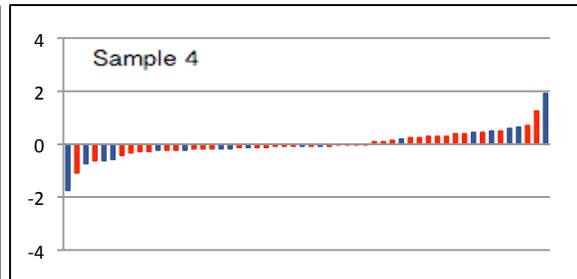
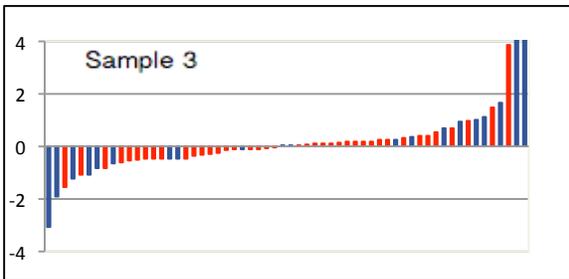
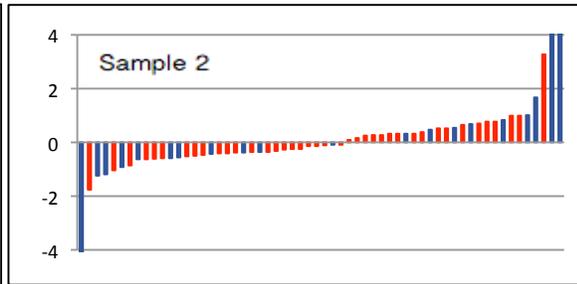
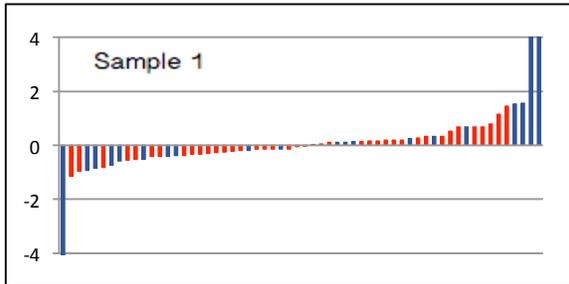
Method	C17-1	C17-2	C17-3	C17-4
ICP/OES	20	20	20	17
ICP/MS	40	40	40	37

All summary stats and the plots below are based on the data excluding any flagged outliers

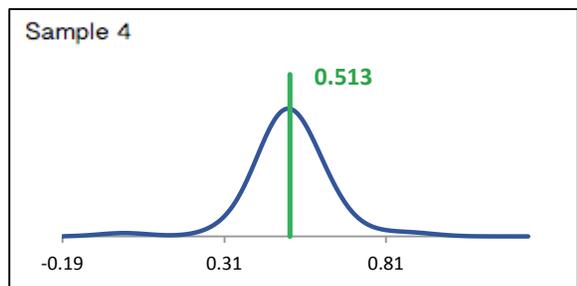
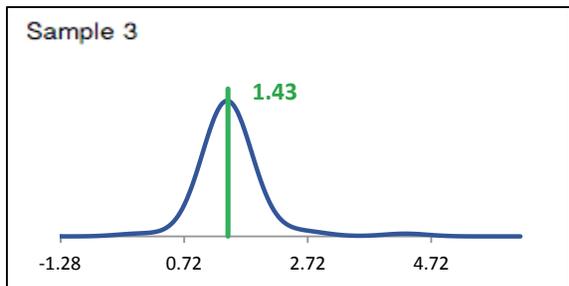
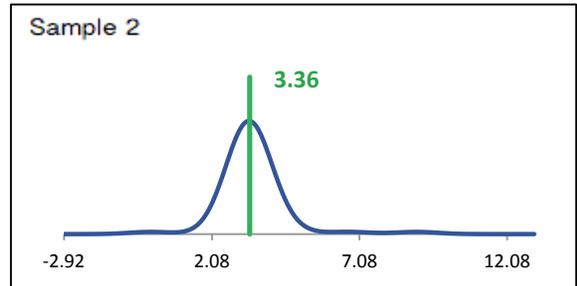
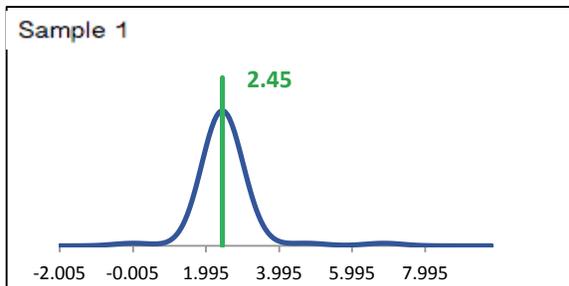


# CADMIUM

## z-Score Plots

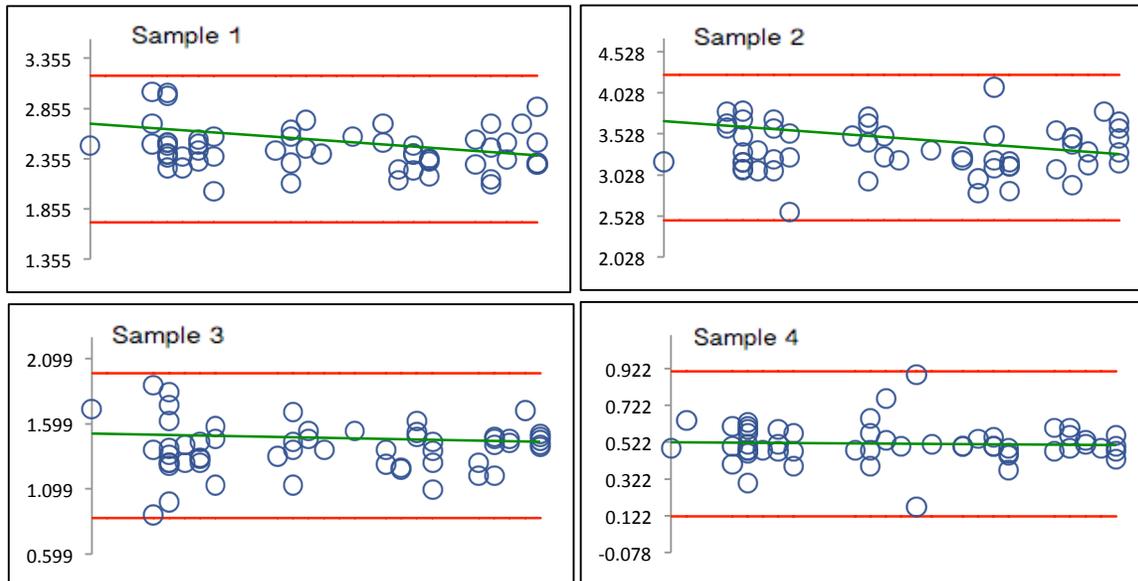


## Kernel Density Plots



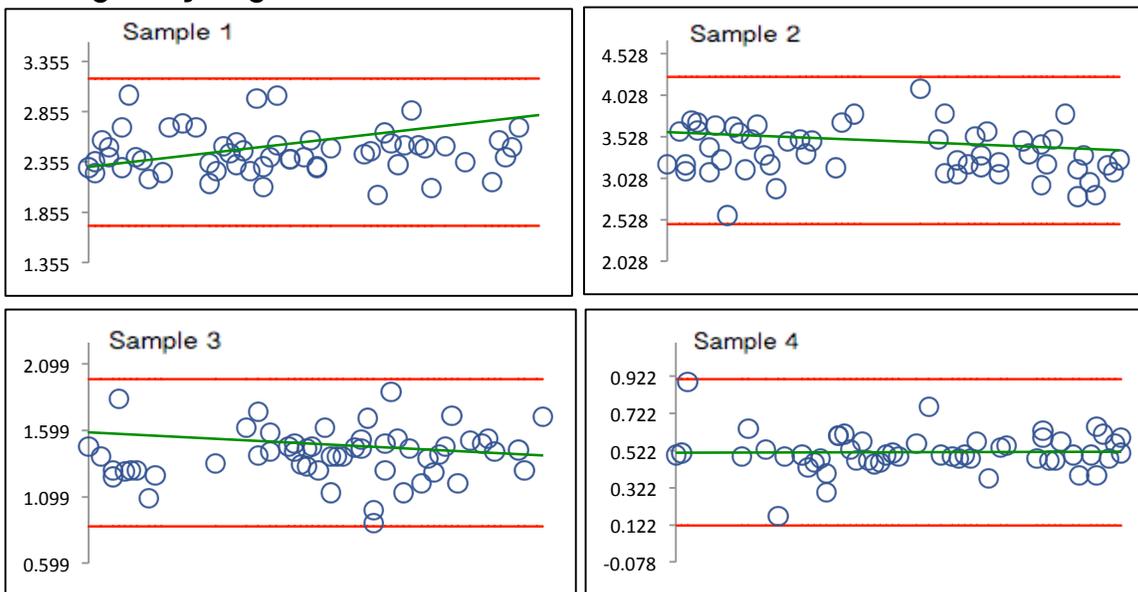
# CADMIUM

## Stability Regression



Reported results (Y-axis) plotted against reported analysis date (X-axis)

## Homogeneity Regression



Reported results (Y-axis) plotted against bottling order (X-axis).

## CHROMIUM

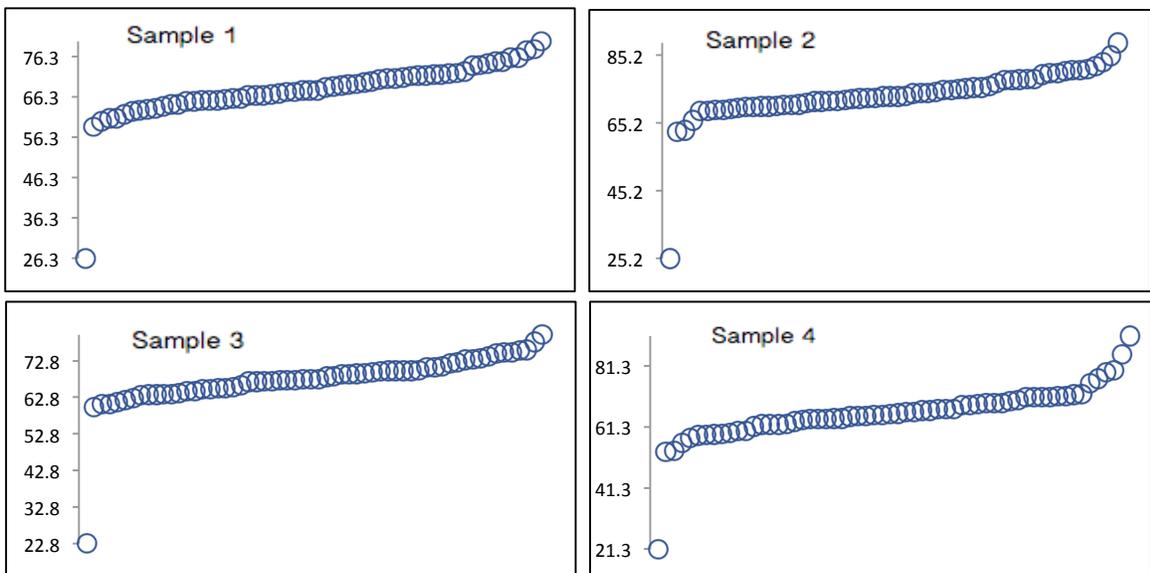
### Summary Statistics

Statistic	C17-1	C17-2	C17-3	C17-4
N	60	60	60	60
Median	67.8	73.0	67.8	65.6
Robust Mean	68.4	73.9	68.1	65.8
U	0.820	0.808	0.781	0.960
Robust Standard Deviation	5.08	5.01	4.84	5.95
Regression Standard Deviation	6.73	7.15	6.72	6.54
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA)	6.73	7.15	6.72	6.54
Outliers	0	0	0	0
z >3.0	1	1	1	2
2< z <3	0	1	0	3

### Methods Used

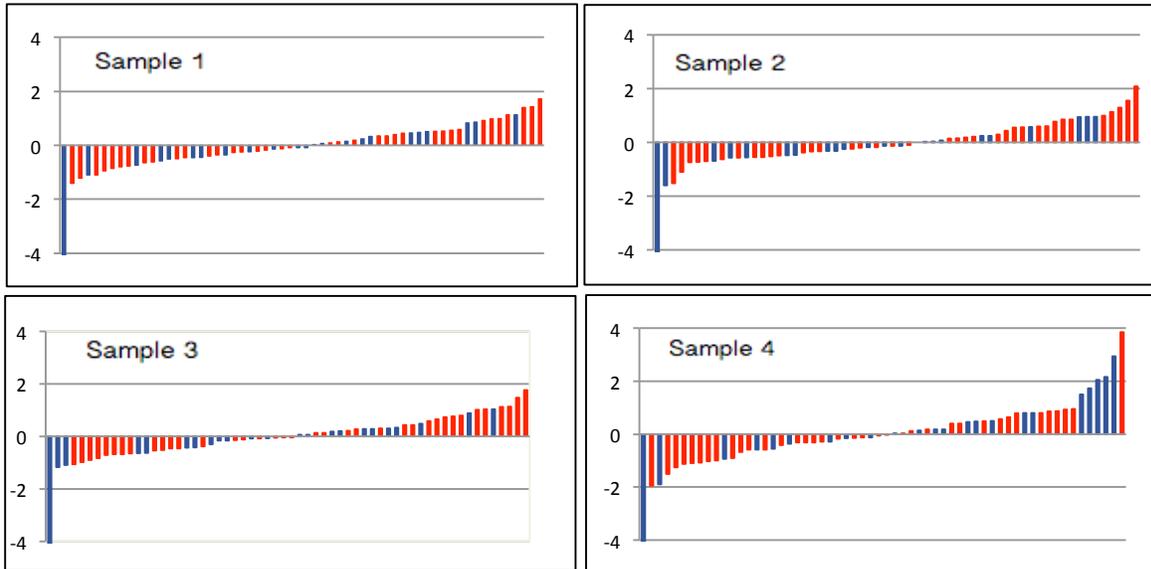
Method	C17-1	C17-2	C17-3	C17-4
ICP/OES	23	23	23	23
ICP/MS	37	37	37	37

All summary stats and the plots below are based on the data excluding any flagged outliers

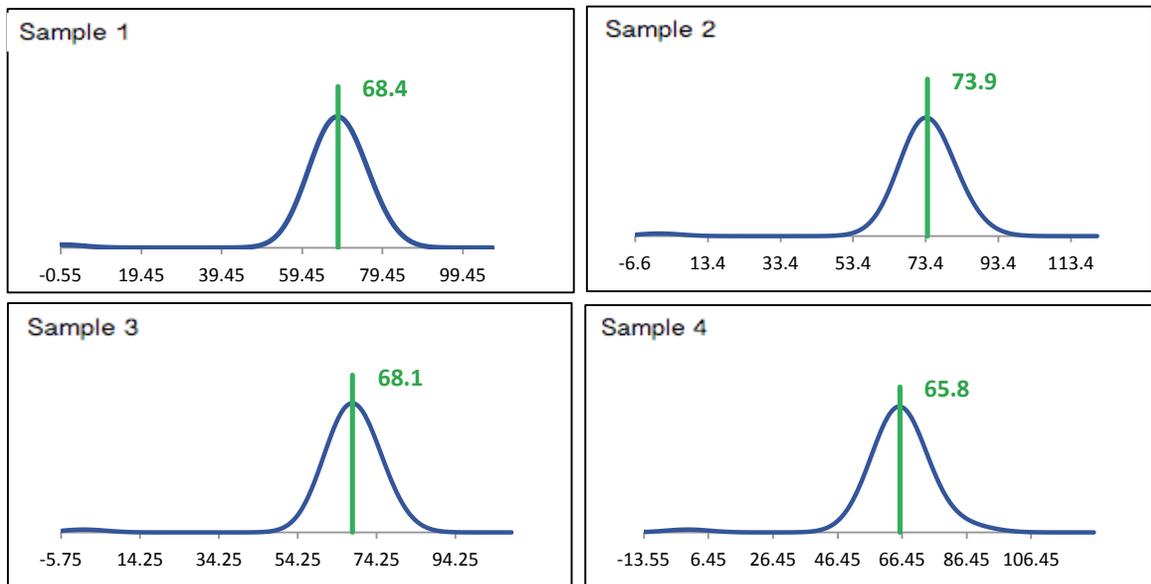


# CHROMIUM

## z-Score Plots

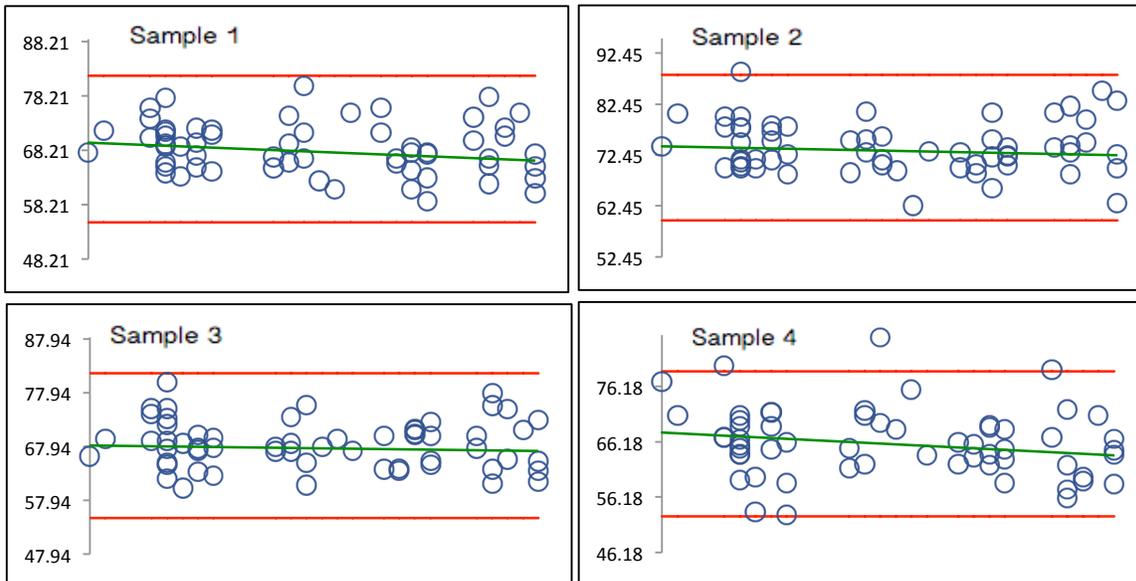


## Kernel Density Plots



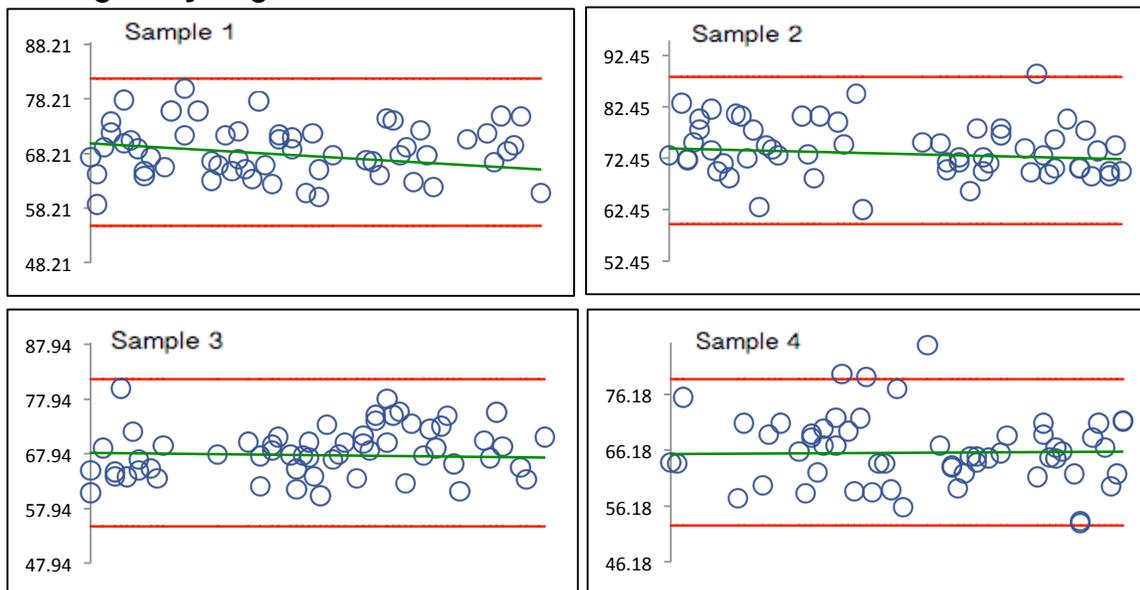
# CHROMIUM

## Stability Regression



Reported results (Y-axis) plotted against reported analysis date (X-axis)

## Homogeneity Regression



Reported results (Y-axis) plotted against bottling order (X-axis).

## COBALT

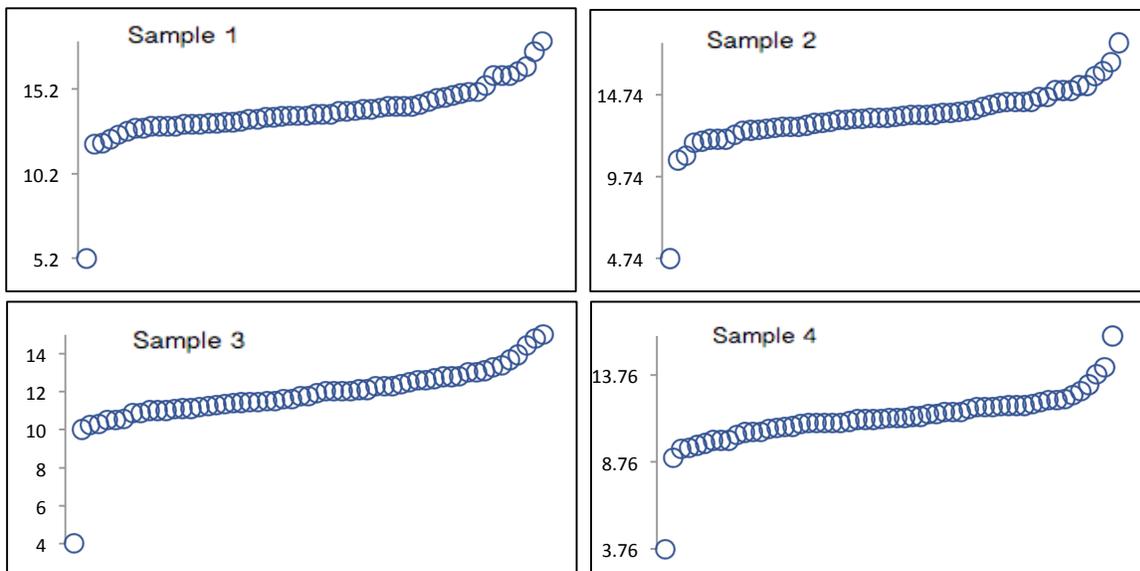
### Summary Statistics

Statistic	C17-1	C17-2	C17-3	C17-4
N	57	57	57	57
Median	13.7	13.4	11.8	11.3
Robust Mean	13.8	13.5	11.9	11.3
U	0.179	0.199	0.182	0.169
Robust Standard Deviation	1.08	1.20	1.10	1.02
Regression Standard Deviation	1.35	1.32	1.16	1.10
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA)	1.35	1.32	1.16	1.10
Outliers	0	0	0	0
z >3.0	2	2	1	2
2< z <3	1	3	3	3

### Methods Used

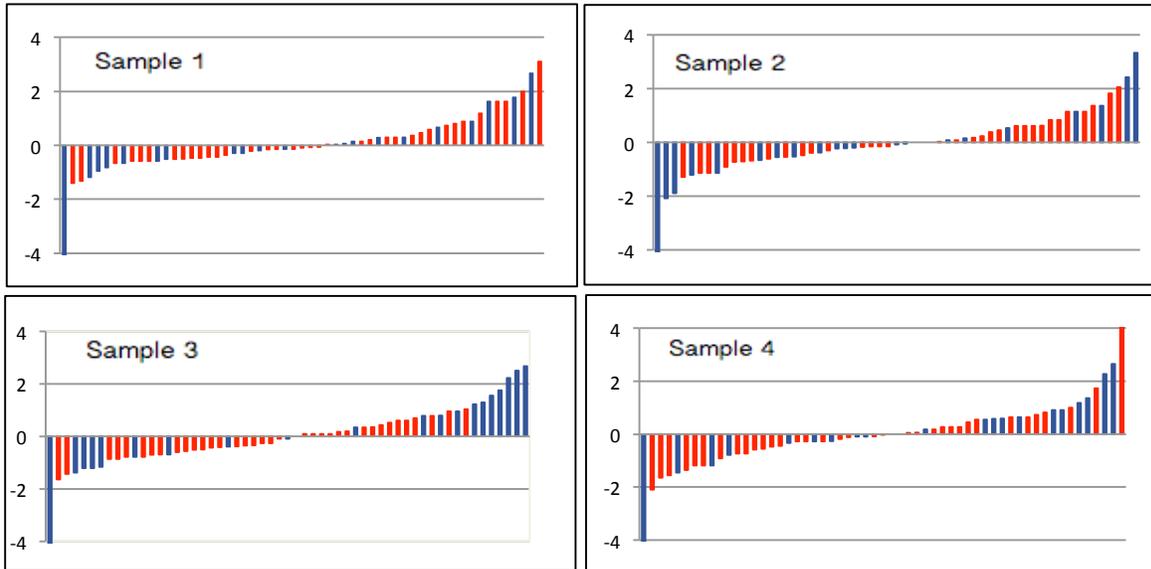
Method	C17-1	C17-2	C17-3	C17-4
ICP/OES	21	21	21	21
ICP/MS	36	36	36	36

All summary stats and the plots below are based on the data excluding any flagged outliers

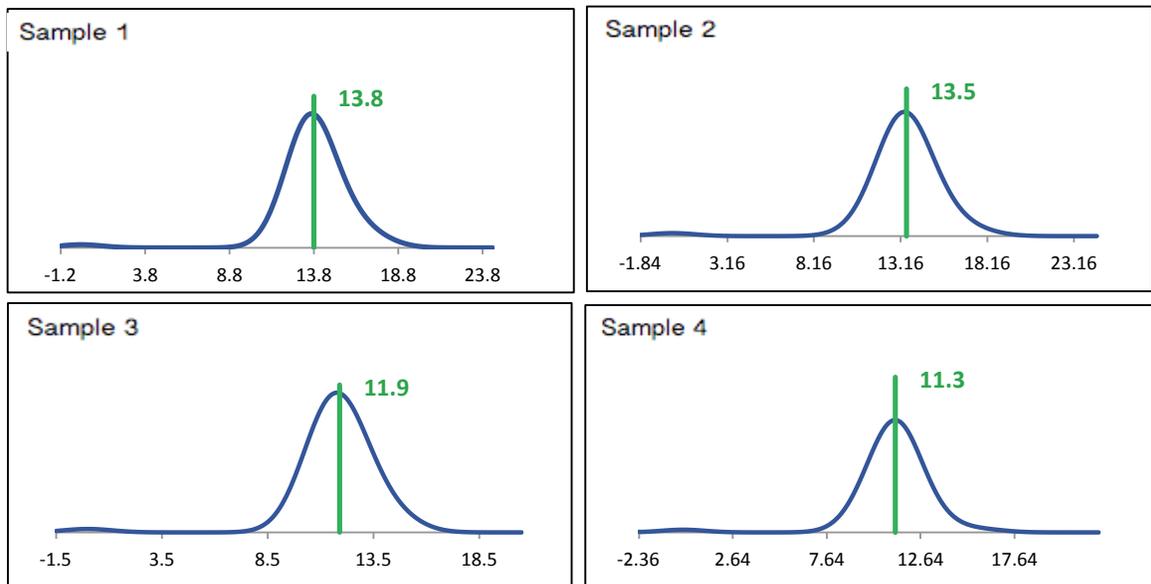


# COBALT

## z-Score Plots

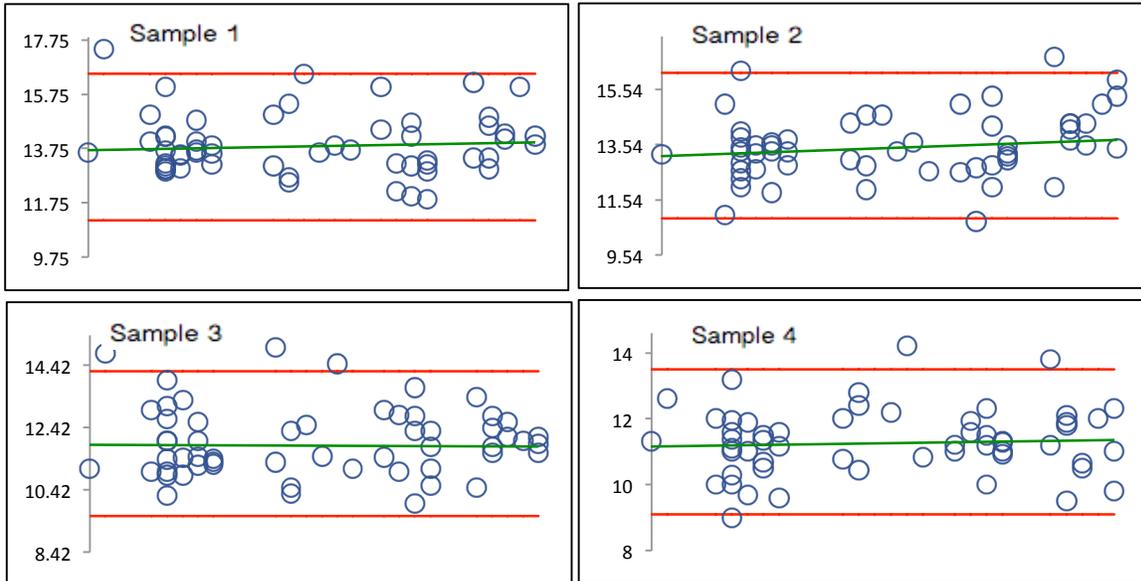


## Kernel Density Plots



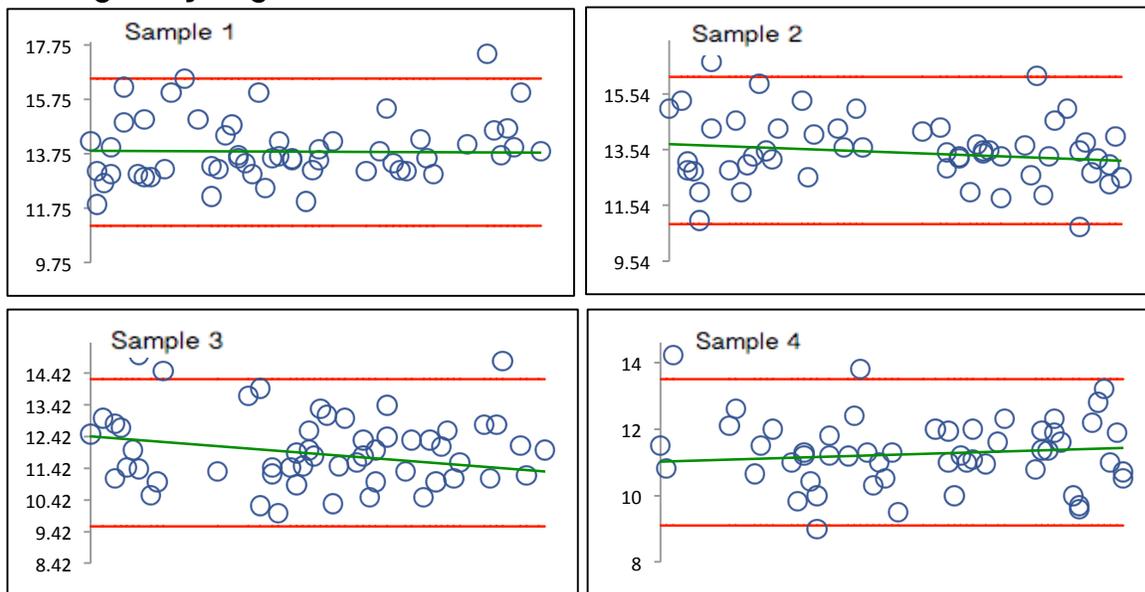
# COBALT

## Stability Regression



Reported results (Y-axis) plotted against reported analysis date (X-axis)

## Homogeneity Regression



Reported results (Y-axis) plotted against bottling order (X-axis).

## COPPER

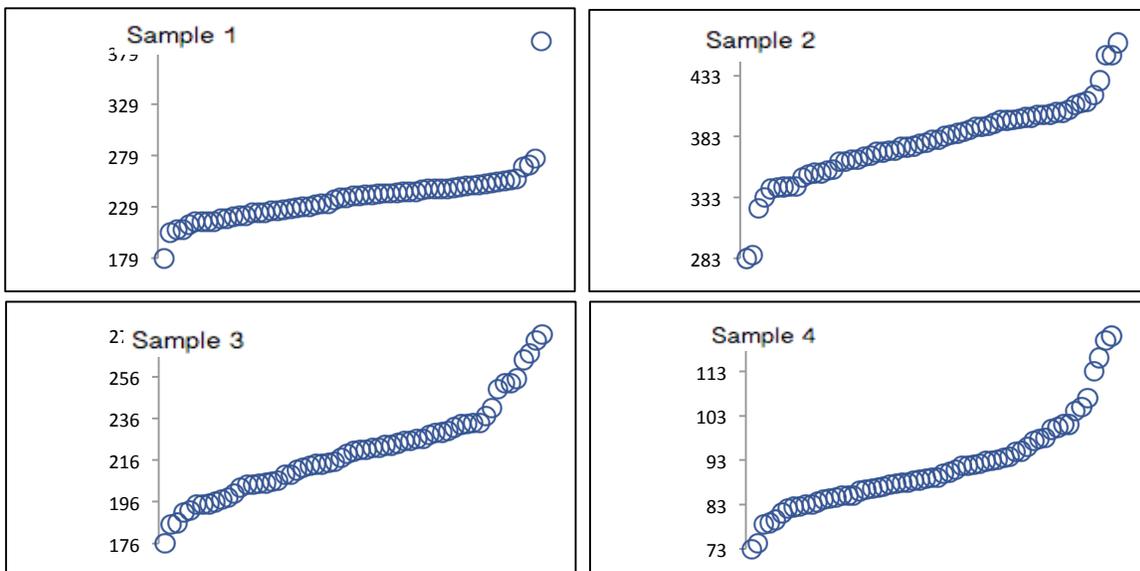
### Summary Statistics

Statistic	C17-1	C17-2	C17-3	C17-4
N	61	61	61	61
Median	240	380	220	89.0
Robust Mean	236	379	219	90.4
U	2.80	4.59	3.31	1.33
Robust Standard Deviation	17.5	28.7	20.7	8.34
Regression Standard Deviation	19.7	31.7	18.3	7.55
Stability Flag		Stability		
Homogeneity Flag				
Standard Deviation Used (SDPA)	19.7	36.0	20.7	8.34
Outliers	0	0	0	0
z >3.0	1	0	0	3
2< z <3	2	3	5	2

### Methods Used

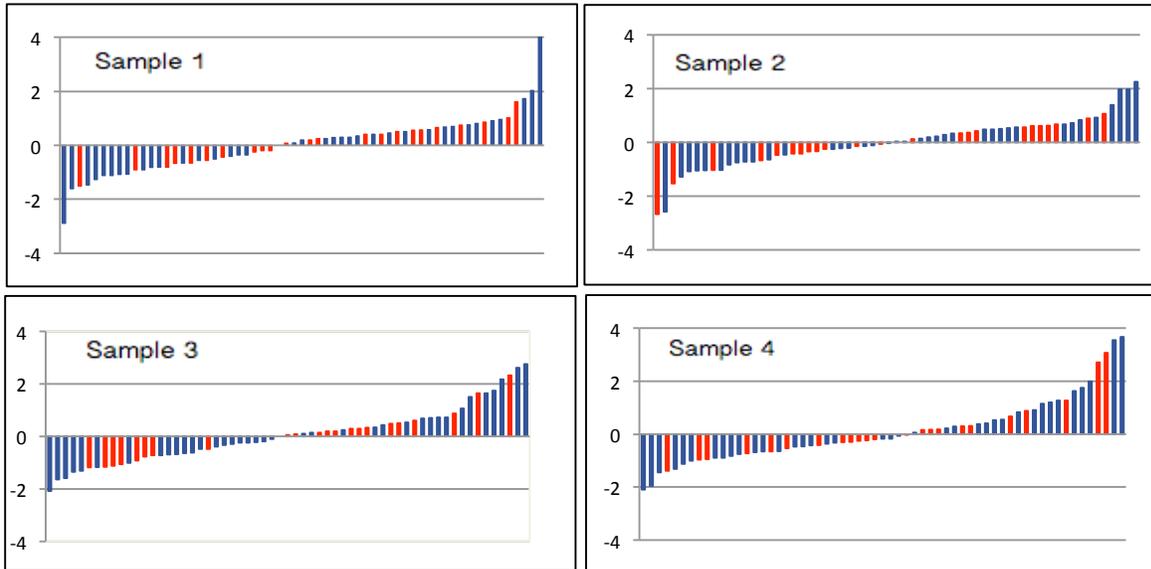
Method	C17-1	C17-2	C17-3	C17-4
ICP/MS	38	38	38	38
ICP/OES	23	23	23	23

All summary stats and the plots below are based on the data excluding any flagged outliers

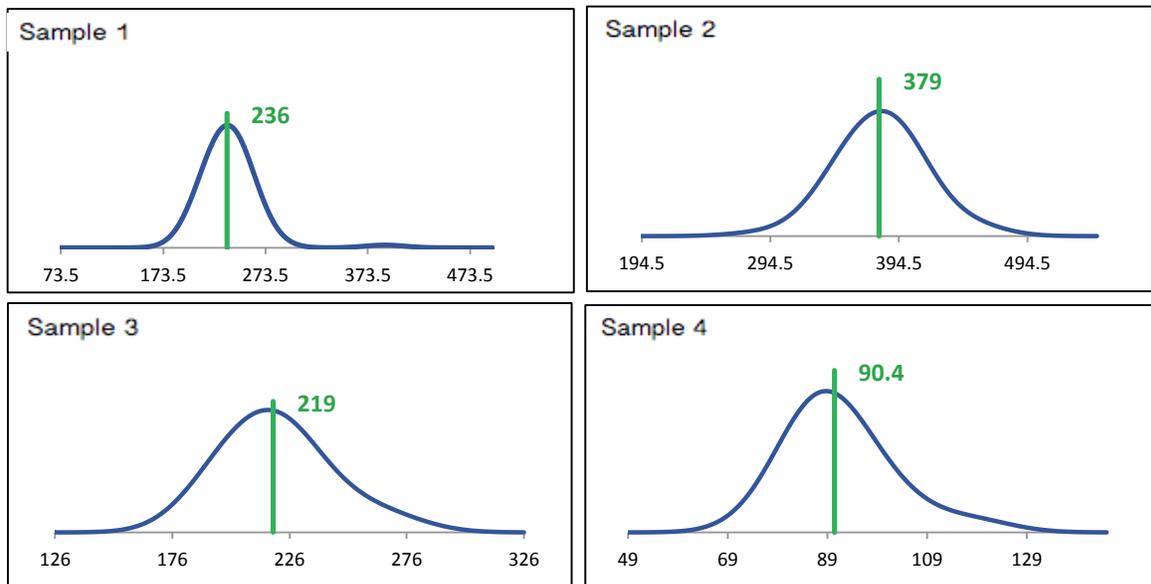


# COPPER

## z-Score Plots

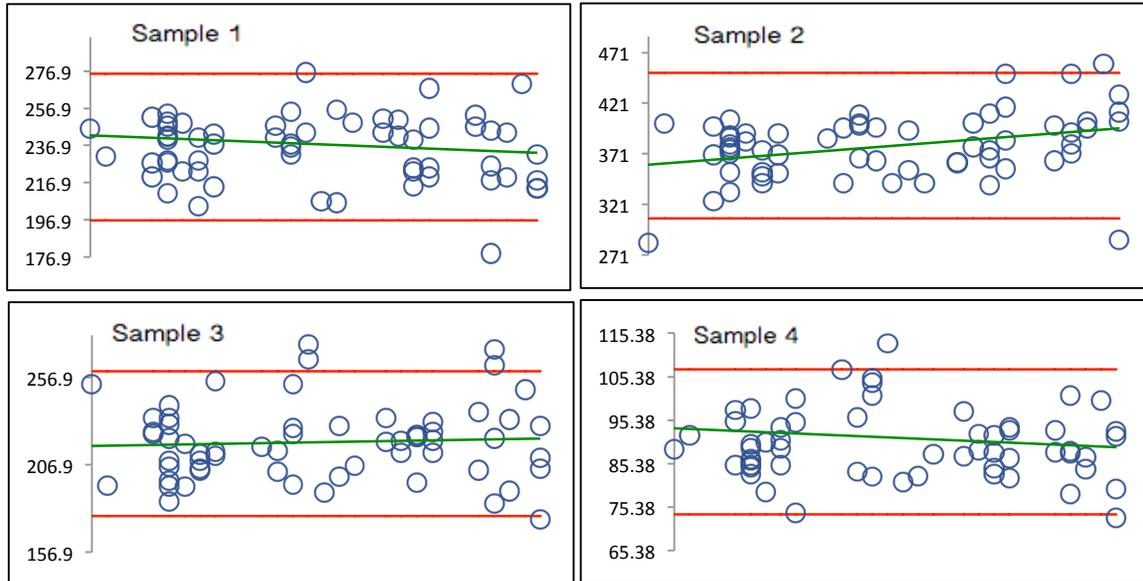


## Kernel Density Plots



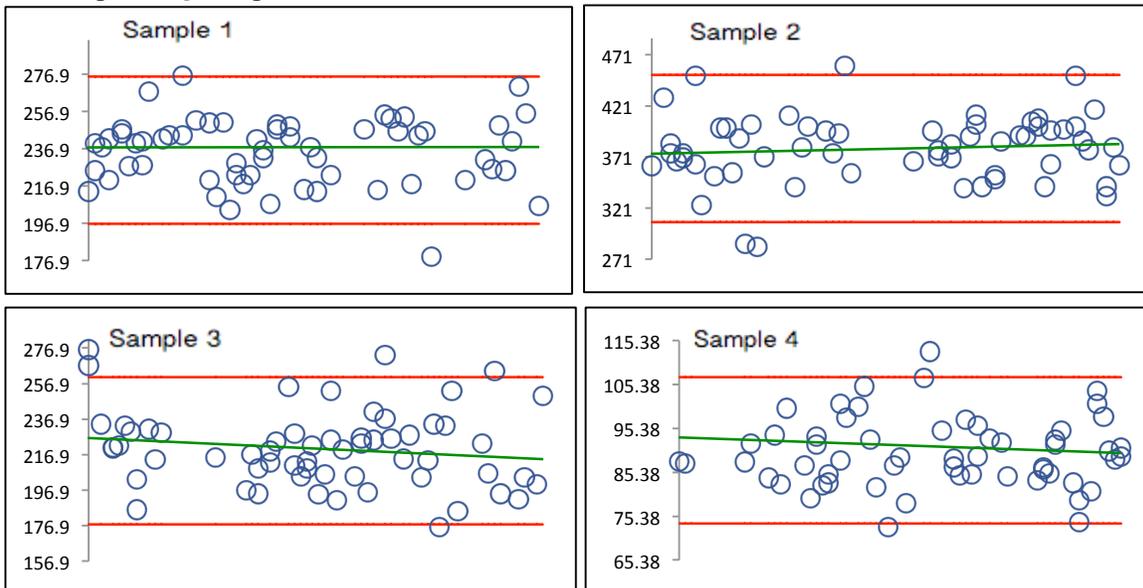
# COPPER

## Stability Regression



Reported results (Y-axis) plotted against reported analysis date (X-axis)

## Homogeneity Regression



Reported results (Y-axis) plotted against bottling order (X-axis).

# IRON

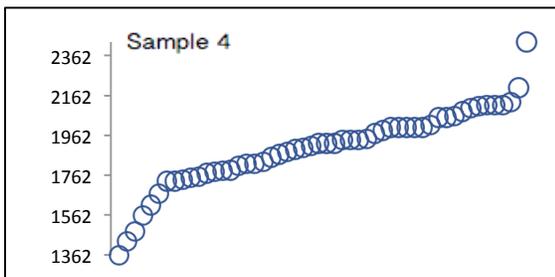
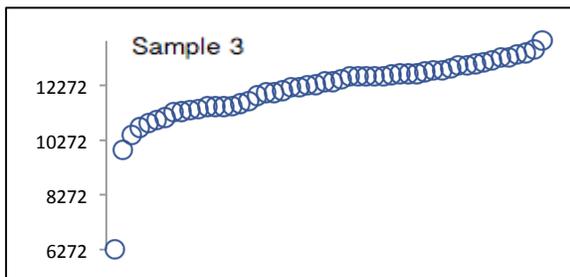
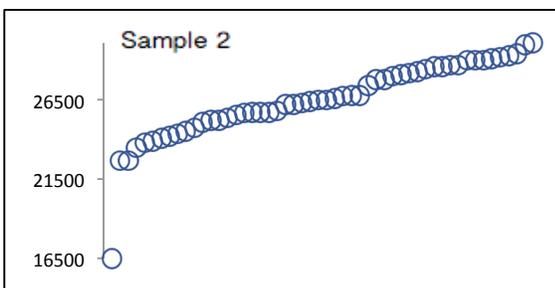
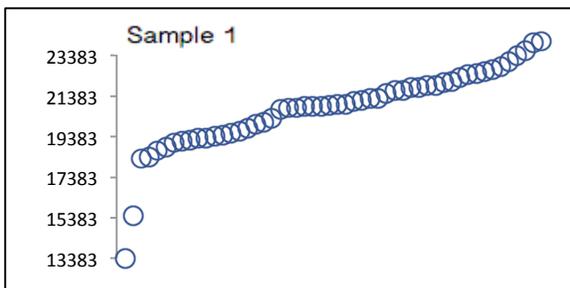
## Summary Statistics

Statistic	C17-1	C17-2	C17-3	C17-4
N	52	52	52	52
Median	21000	26500	12400	1920
Robust Mean	20900	26600	12200	1900
U	296	387	161	30.0
Robust Standard Deviation	1710	2230	928	173
Regression Standard Deviation	1910	2430	1120	174
Stability Flag				
Homogeneity Flag				Homogeneity
Standard Deviation Used (SDPA)	1910	2430	1120	192
Outliers	0	0	0	0
z >3.0	1	1	1	0
2< z <3	1	0	1	4

## Methods Used

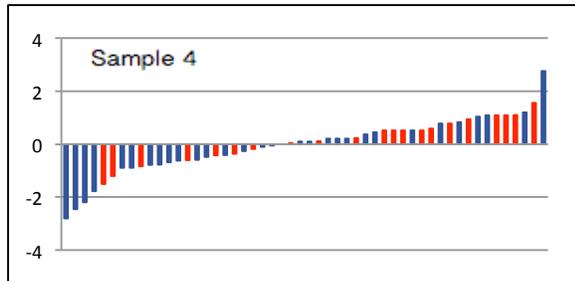
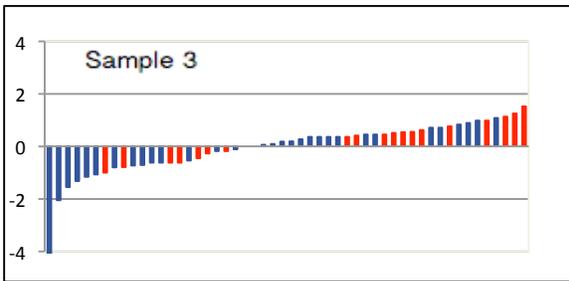
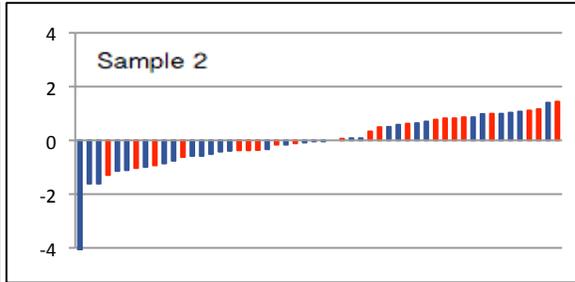
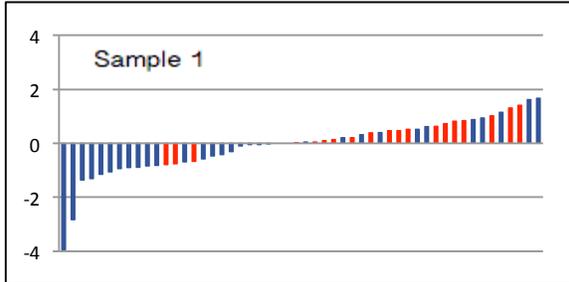
Method	C17-1	C17-2	C17-3	C17-4
ICP/MS	31	31	31	31
ICP/OES	21	21	21	21

All summary stats and the plots below are based on the data excluding any flagged outliers

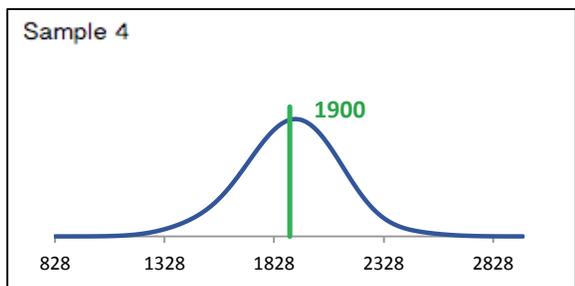
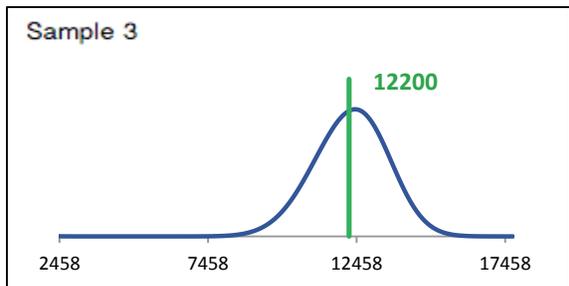
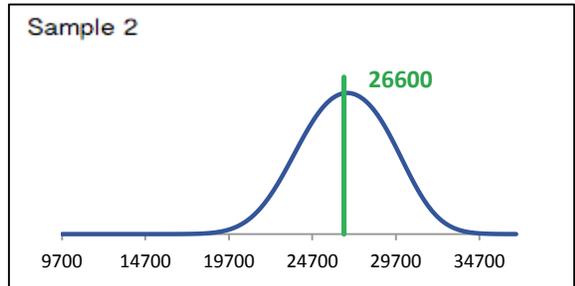
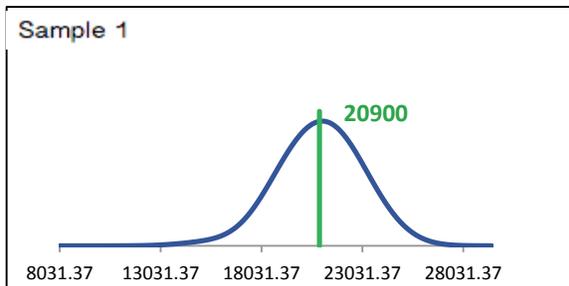


# IRON

## z-Score Plots

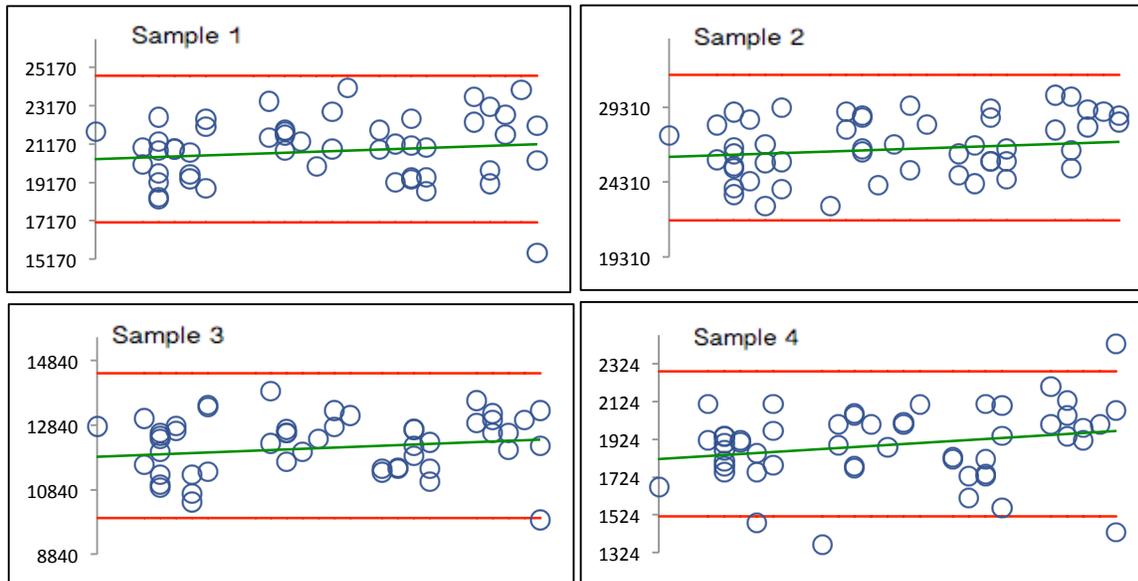


## Kernel Density Plots



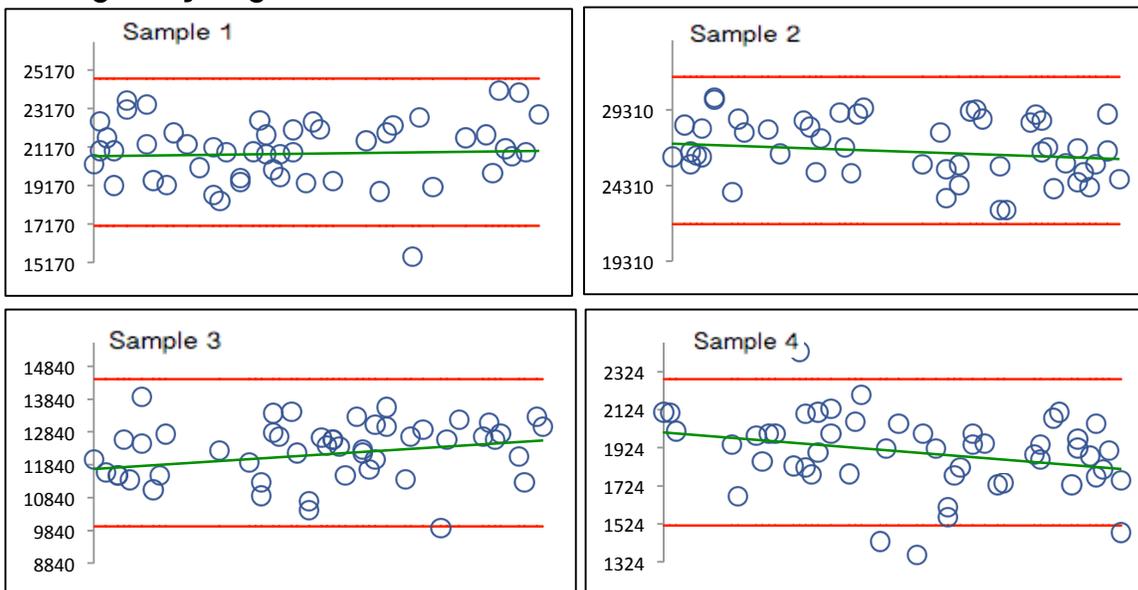
# IRON

## Stability Regression



Reported results (Y-axis) plotted against reported analysis date (X-axis)

## Homogeneity Regression



Reported results (Y-axis) plotted against bottling order (X-axis).

# LEAD

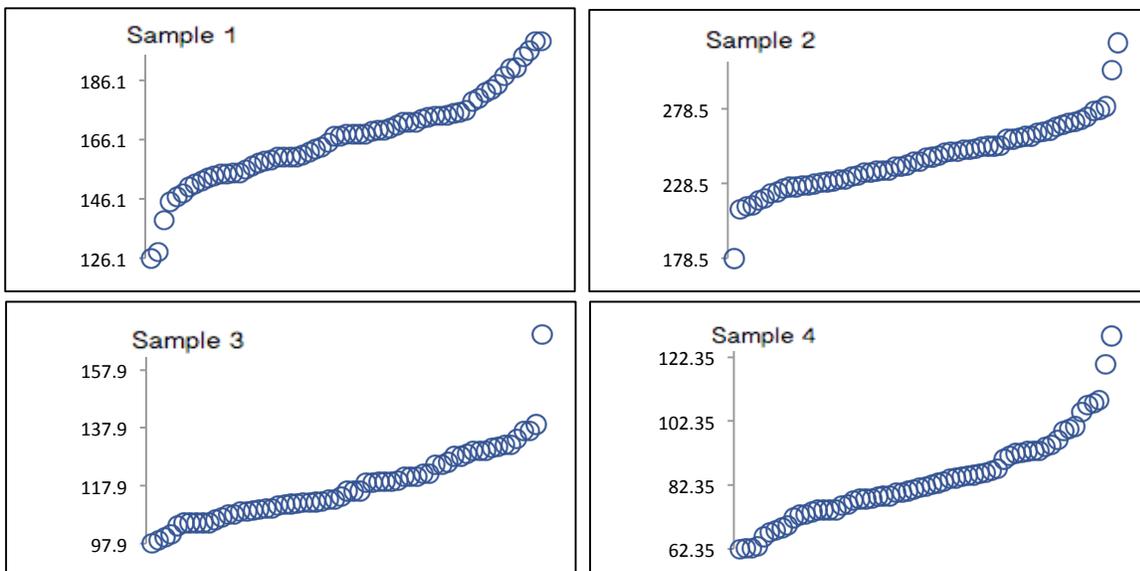
## Summary Statistics

Statistic	C17-1	C17-2	C17-3	C17-4
N	63	63	63	63
Median	168	246	116	81.9
Robust Mean	166	245	117	83.1
U	2.3	3.3	1.8	2.0
Robust Standard Deviation	14.3	21.1	11.7	12.6
Regression Standard Deviation	14.1	20.0	10.4	7.88
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA)	14.3	21.1	11.7	12.6
Outliers	0	0	0	0
z >3.0	0	2	1	1
2< z <3	5	1	0	2

## Methods Used

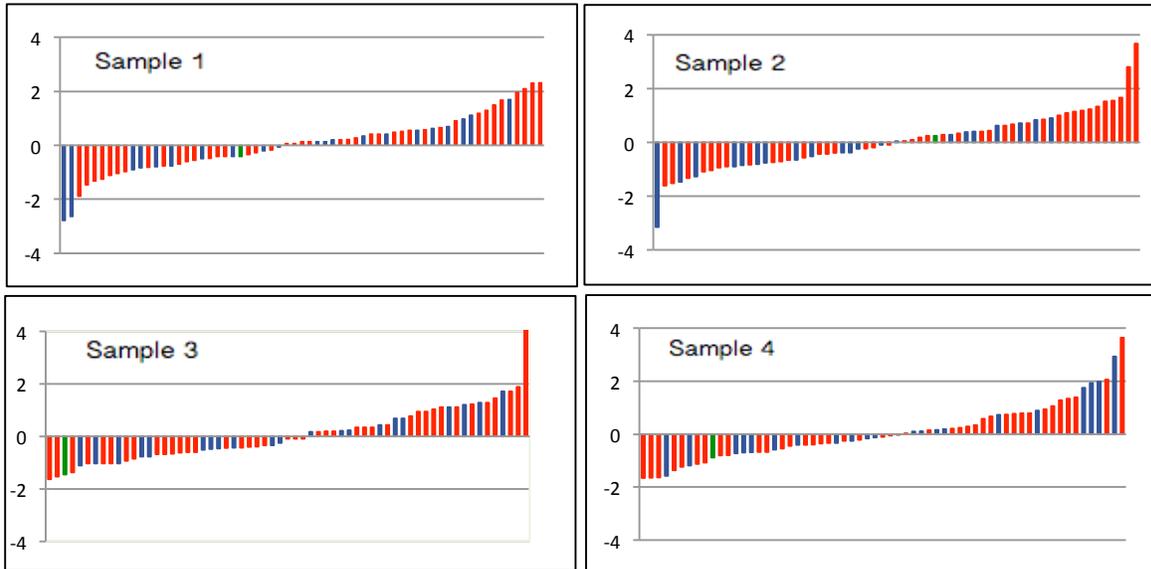
Method	C17-1	C17-2	C17-3	C17-4
ICP/OES	21	21	21	21
ICP/MS	41	41	41	41
AA	1	1	1	1

All summary stats and the plots below are based on the data excluding any flagged outliers

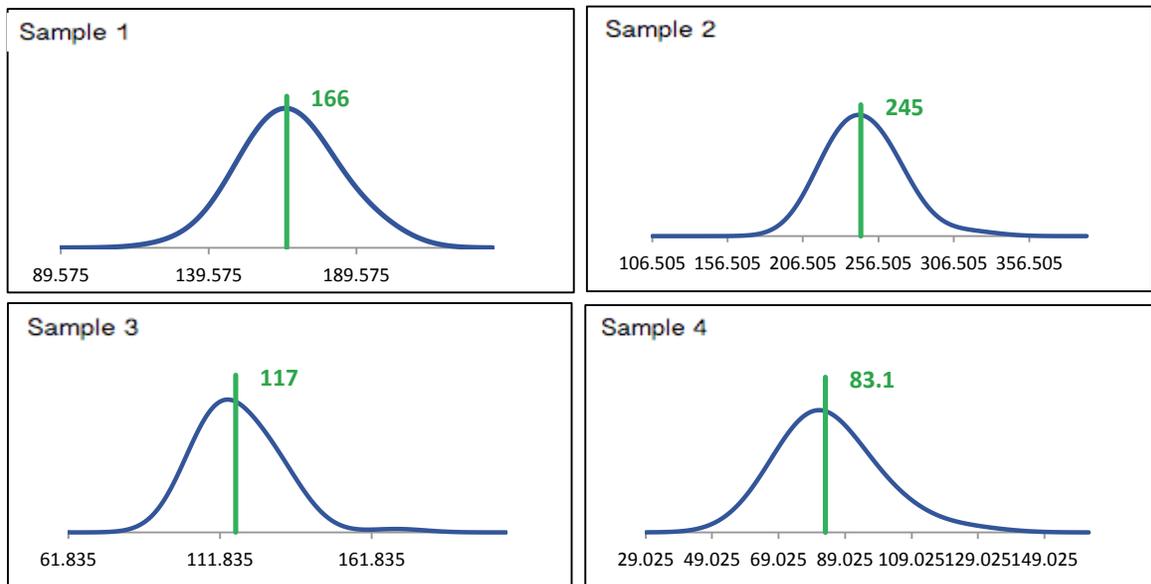


# LEAD

## z-Score Plots

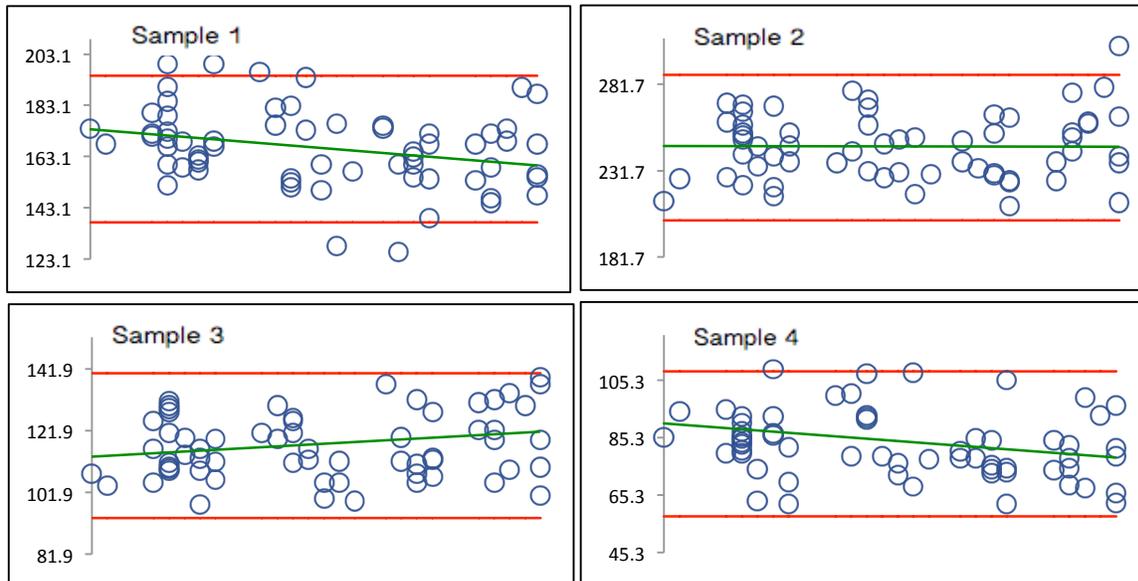


## Kernel Density Plots



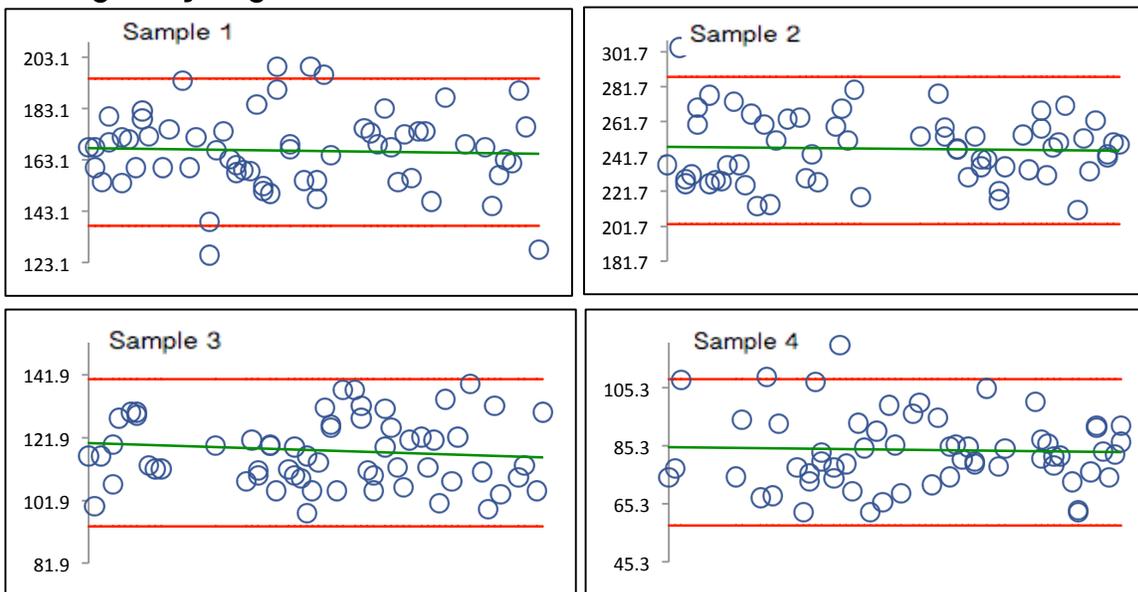
# LEAD

## Stability Regression



Reported results (Y-axis) plotted against reported analysis date (X-axis)

## Homogeneity Regression



Reported results (Y-axis) plotted against bottling order (X-axis).

## MANGANESE

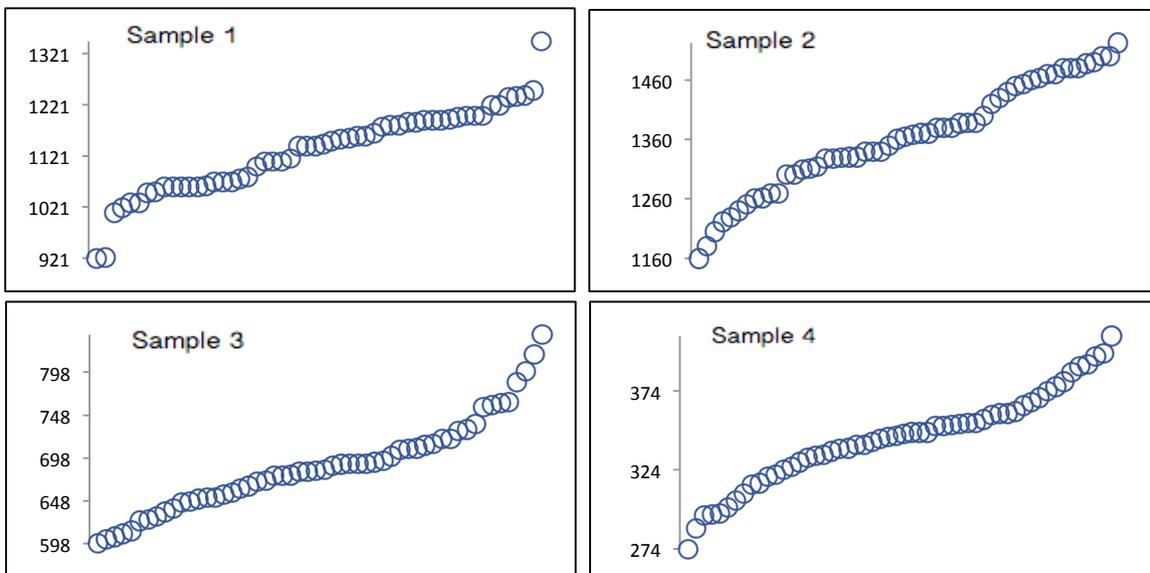
### Summary Statistics

Statistic	C17-1	C17-2	C17-3	C17-4
N	54	54	54	54
Median	1140	1370	683	346
Robust Mean	1130	1370	686	344
U	13.7	16.7	9.02	5.17
Robust Standard Deviation	80.7	98.4	53.0	30.4
Regression Standard Deviation	83.0	100	50.2	25.2
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA)	83.0	100	53.0	30.4
Outliers	0	0	0	0
z >3.0	0	0	0	0
2< z <3	3	1	3	2

### Methods Used

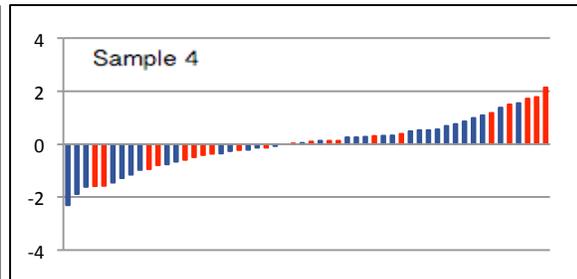
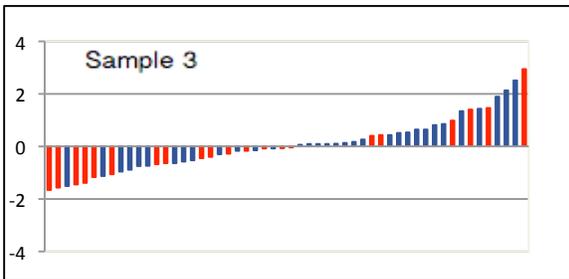
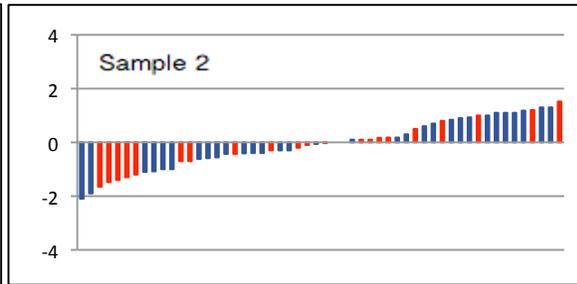
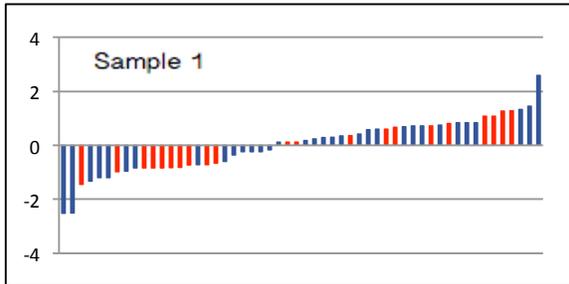
Method	C17-1	C17-2	C17-3	C17-4
ICP/MS	33	33	33	33
ICP/OES	21	21	21	21

All summary stats and the plots below are based on the data excluding any flagged outliers

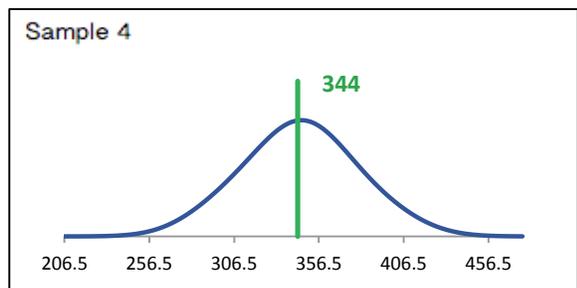
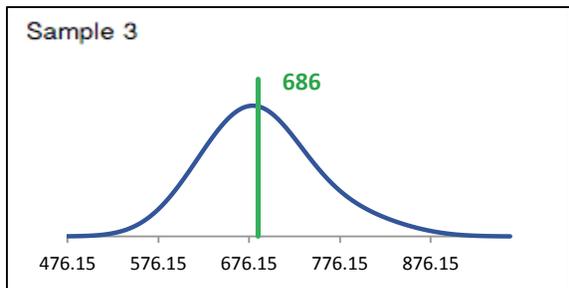
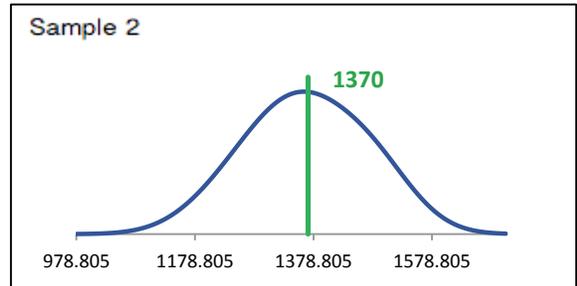
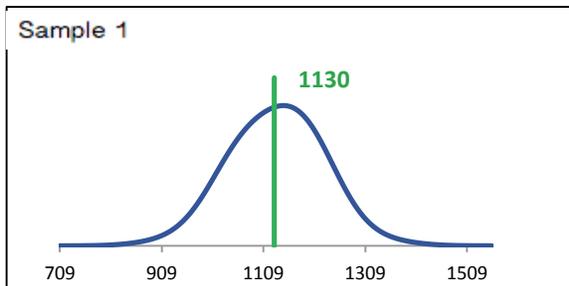


# MANGANESE

## z-Score Plots

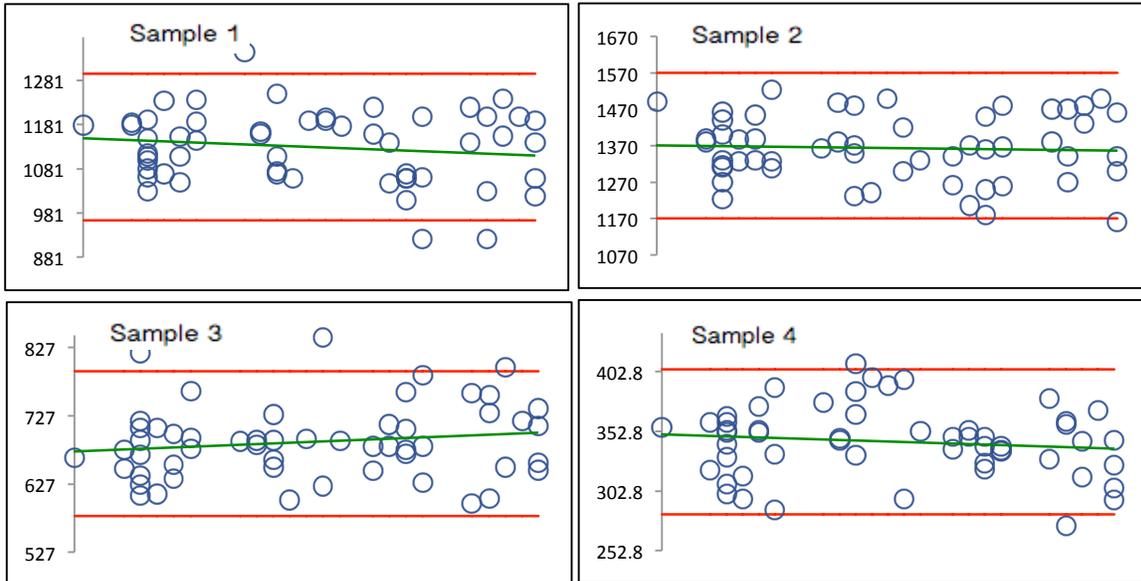


## Kernel Density Plots



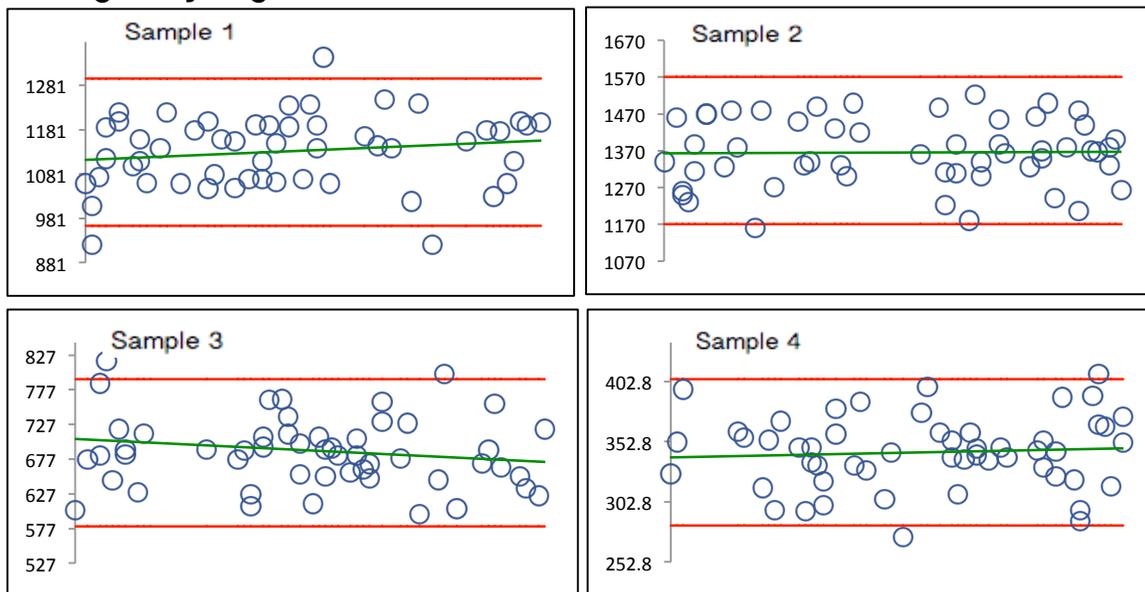
# MANGANESE

## Stability Regression



Reported results (Y-axis) plotted against reported analysis date (X-axis)

## Homogeneity Regression



Reported results (Y-axis) plotted against bottling order (X-axis).

## MERCURY

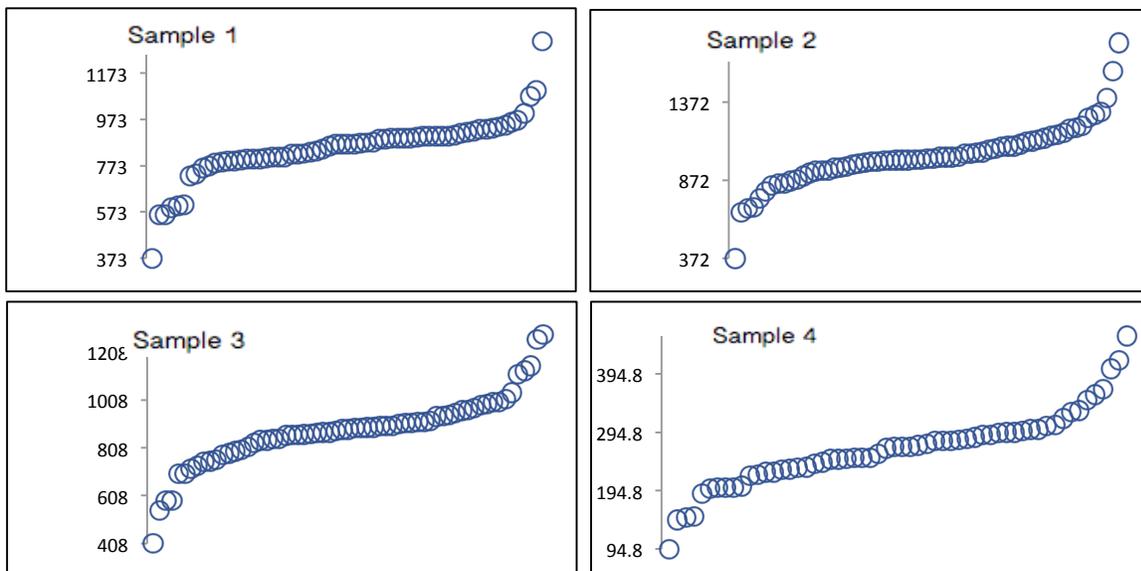
### Summary Statistics

Statistic	C17-1	C17-2	C17-3	C17-4
N	63	63	63	58
Median	866	1010	885	270
Robust Mean	854	1020	880	264
U	13.2	22.8	17.30	8.90
Robust Standard Deviation	83.6	145	110	54.2
Regression Standard Deviation	218	260	224	67.4
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA)	218	260	224	67.4
Outliers	1	1	1	1
z >3.0	0	0	0	0
2< z <3	2	3	1	4

### Methods Used

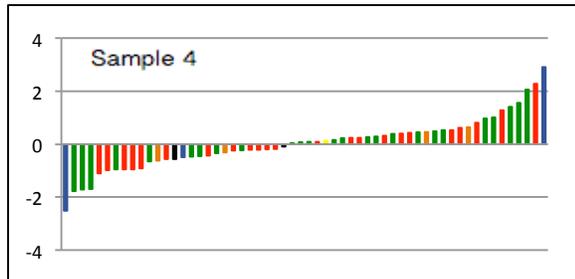
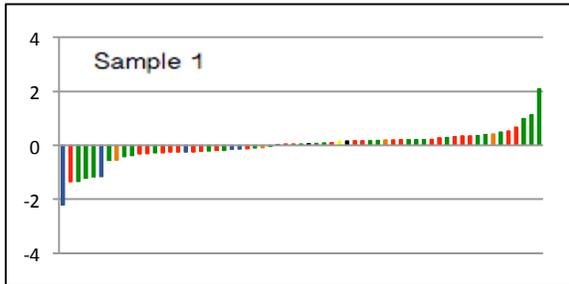
Method	C17-1	C17-2	C17-3	C17-4
ICP/OES	6	6	6	3
ICP/MS	24	24	24	23
CVAP	26	26	26	25
AF	4	4	4	4
PYRO-AA	2	2	2	2
CVAFS	1	1	1	1

All summary stats and the plots below are based on the data excluding any flagged outliers

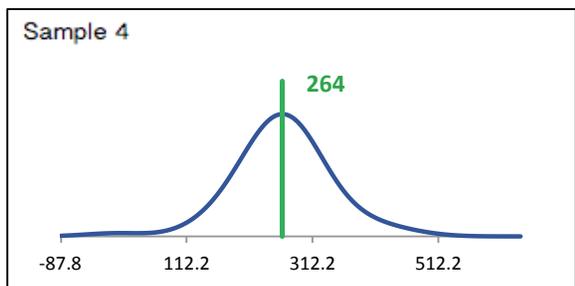
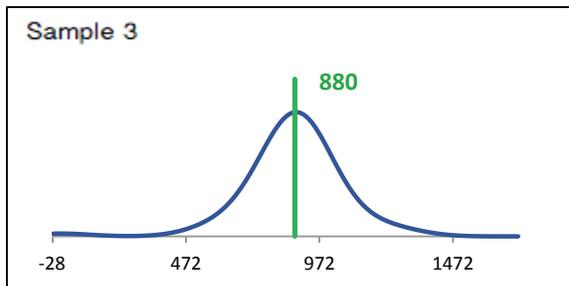
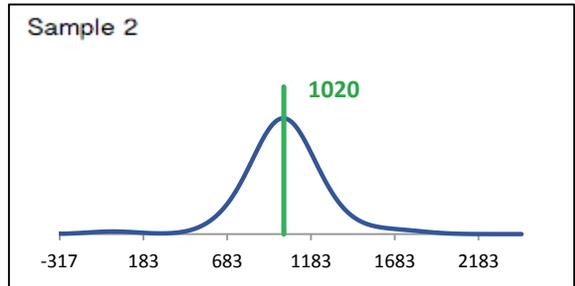
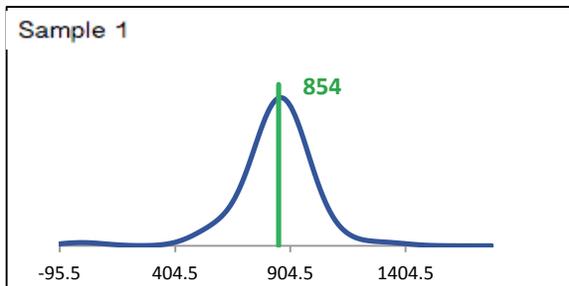


# MERCURY

## z-Score Plots

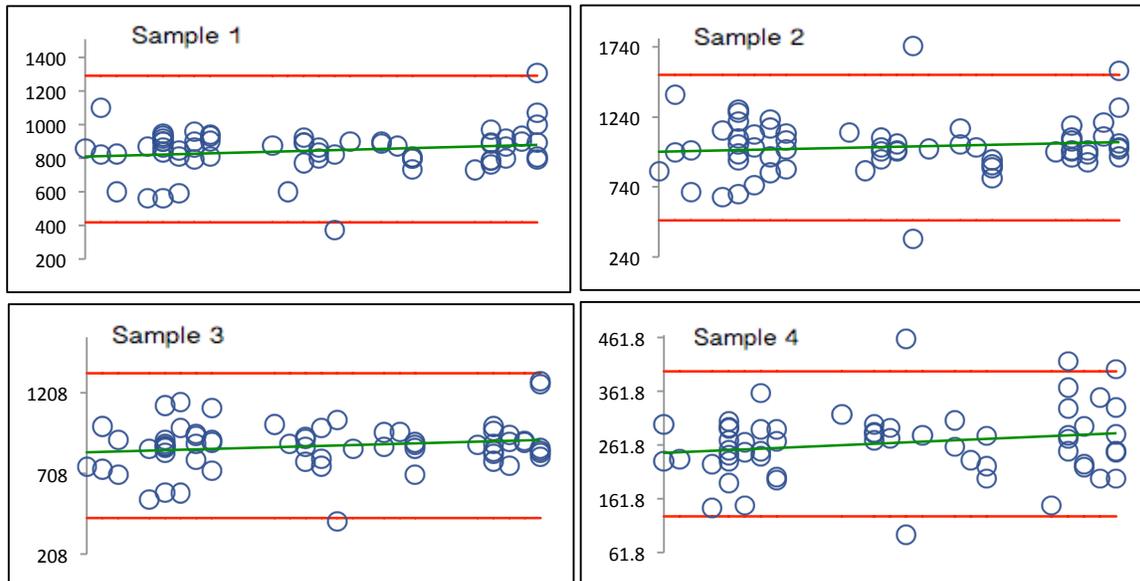


## Kernel Density Plots



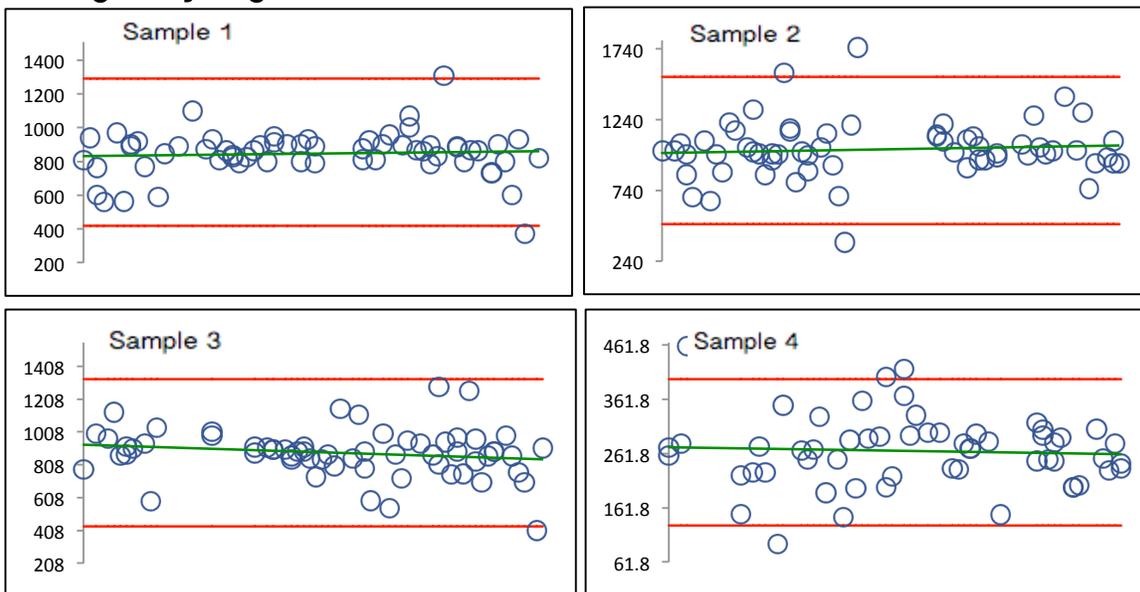
# MERCURY

## Stability Regression



Reported results (Y-axis) plotted against reported analysis date (X-axis)

## Homogeneity Regression



Reported results (Y-axis) plotted against bottling order (X-axis).

# NICKEL

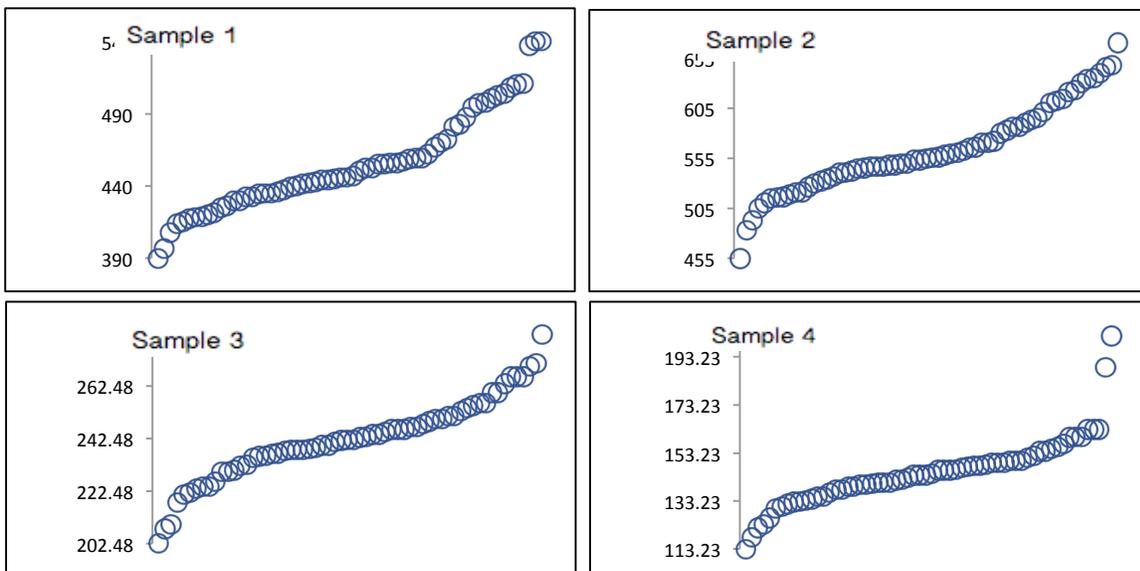
## Summary Statistics

Statistic	C17-1	C17-2	C17-3	C17-4
N	62	62	62	62
Median	447	555	242	144
Robust Mean	454	562	242	144
U	5.4	6.9	2.35	1.78
Robust Standard Deviation	34.0	43.6	14.8	11.2
Regression Standard Deviation	46.7	57.9	25.0	14.9
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA)	46.7	57.9	25.0	14.9
Outliers	0	0	0	0
z >3.0	0	0	0	2
2< z <3	0	0	0	1

## Methods Used

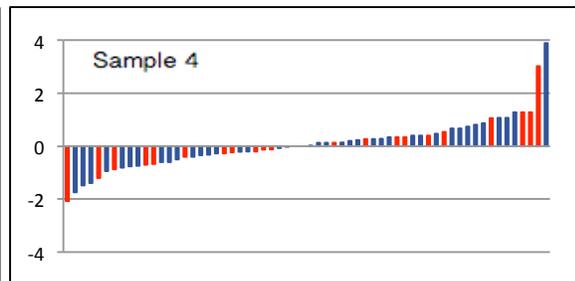
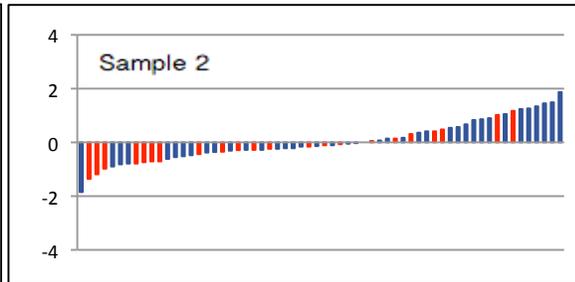
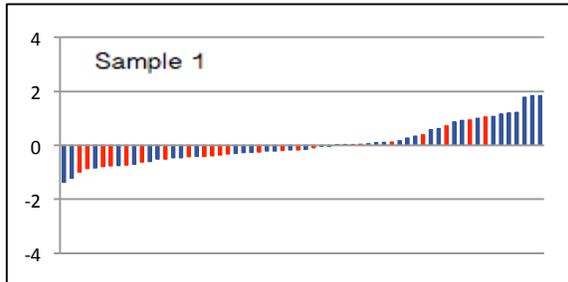
Method	C17-1	C17-2	C17-3	C17-4
ICP/MS	39	39	39	39
ICP/OES	23	23	23	23

All summary stats and the plots below are based on the data excluding any flagged outliers

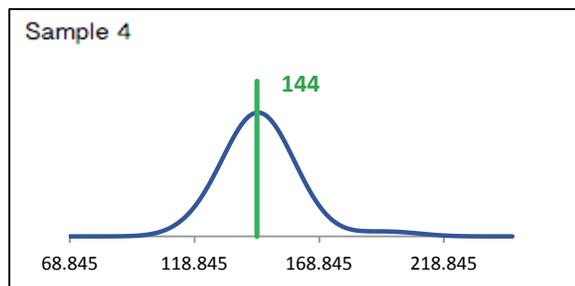
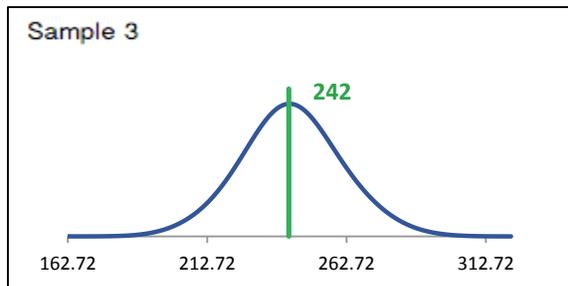
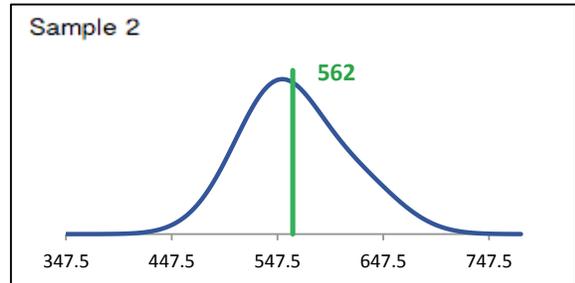
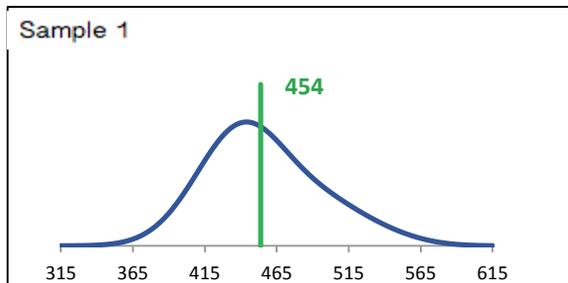


# NICKEL

## z-Score Plots

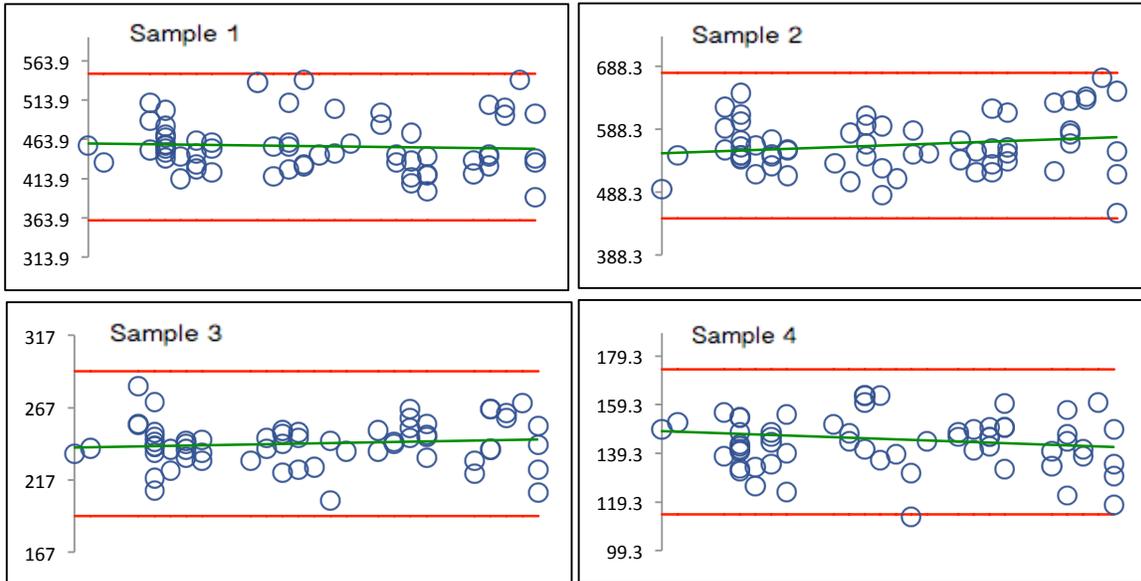


## Kernel Density Plots



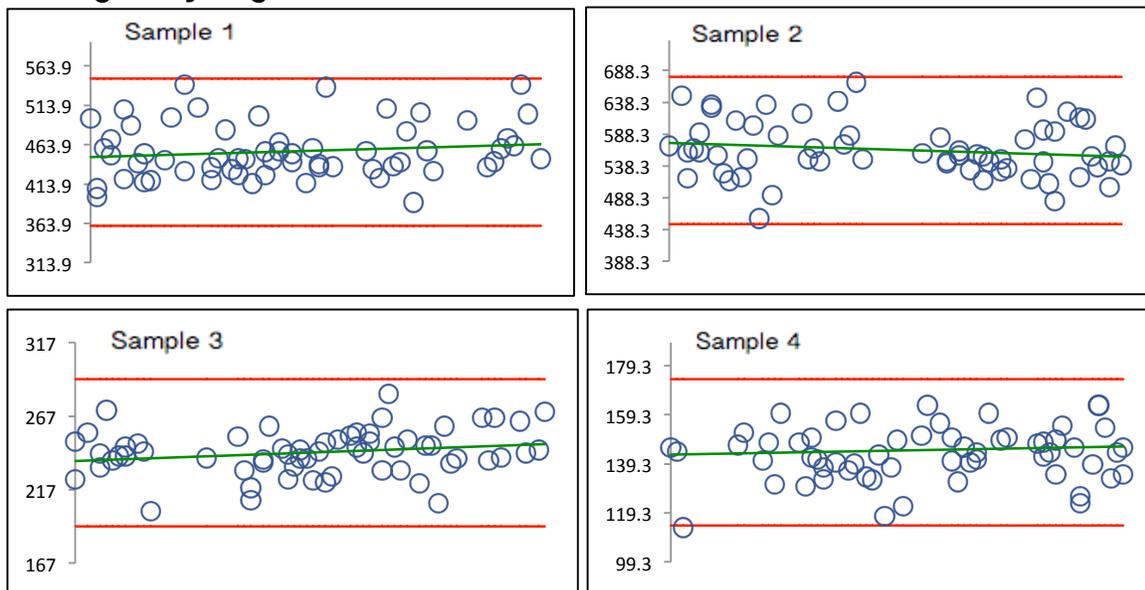
# NICKEL

## Stability Regression



Reported results (Y-axis) plotted against reported analysis date (X-axis)

## Homogeneity Regression



Reported results (Y-axis) plotted against bottling order (X-axis).

## STRONTIUM

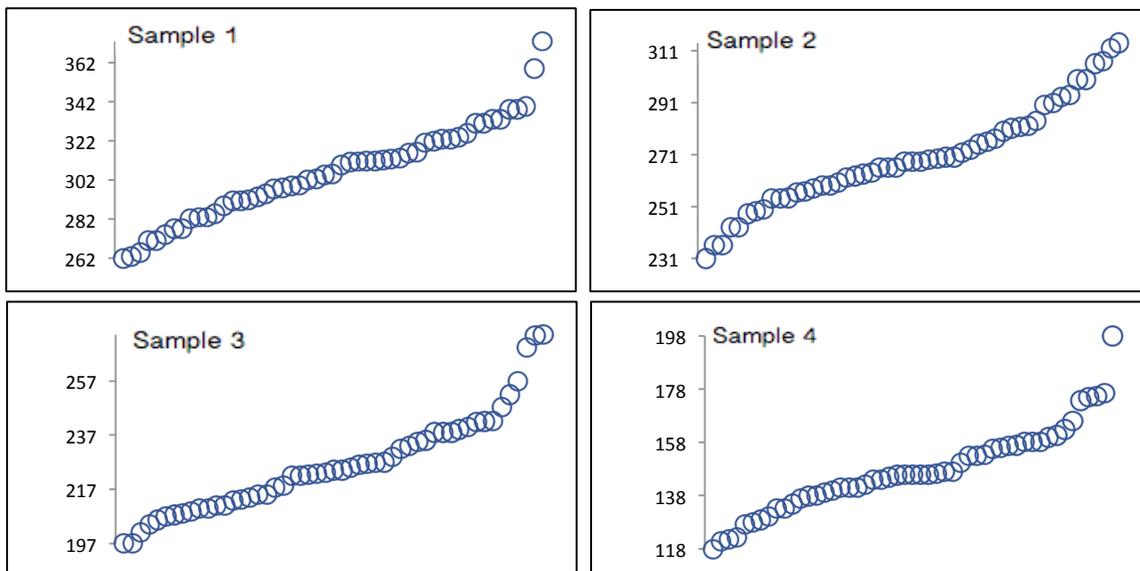
### Summary Statistics

Statistic	C17-1	C17-2	C17-3	C17-4
N	51	51	51	51
Median	305	268	224	146
Robust Mean	305	269	225	147
U	4.3	3.5	2.98	2.64
Robust Standard Deviation	24.7	19.8	17.0	15.1
Regression Standard Deviation	27.0	23.9	20.0	13.2
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA)	27.0	23.9	20.0	15.1
Outliers	0	0	0	0
z >3.0	0	0	0	1
2< z <3	1	0	3	0

### Methods Used

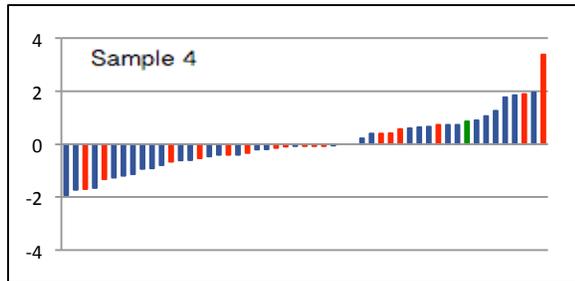
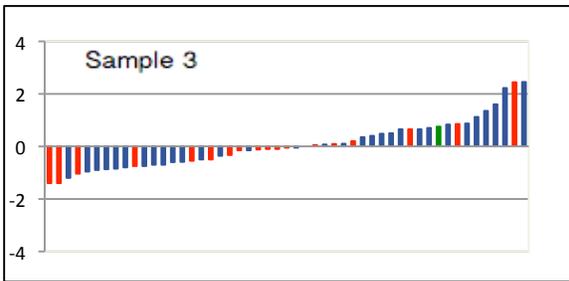
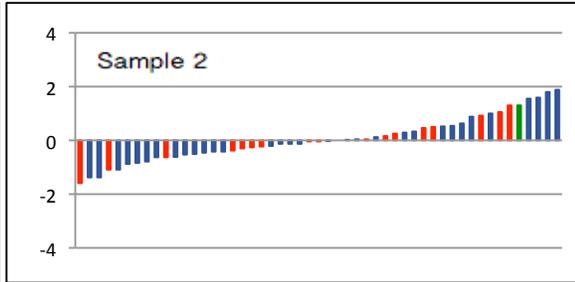
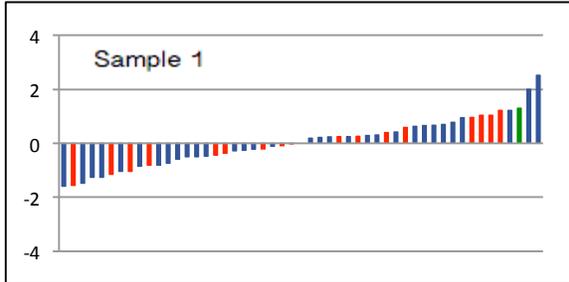
Method	C17-1	C17-2	C17-3	C17-4
ICP/MS	32	32	32	32
ICP/OES	18	18	18	18
AA	1	1	1	1

All summary stats and the plots below are based on the data excluding any flagged outliers

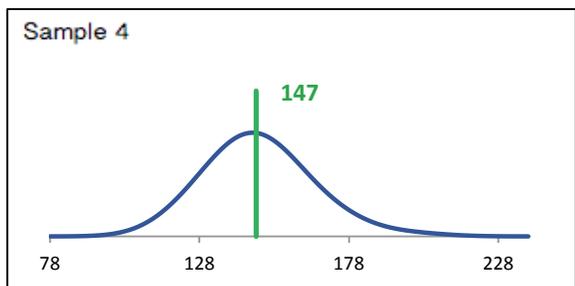
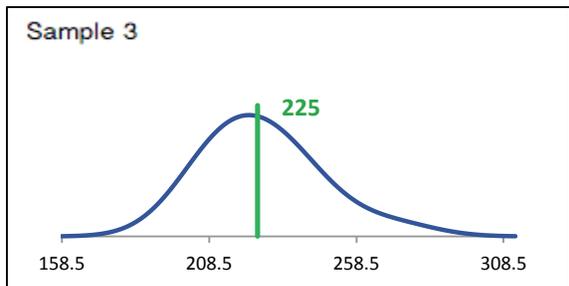
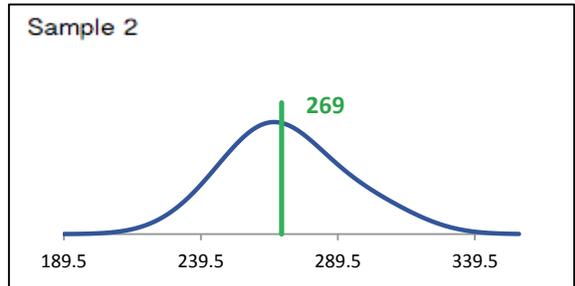
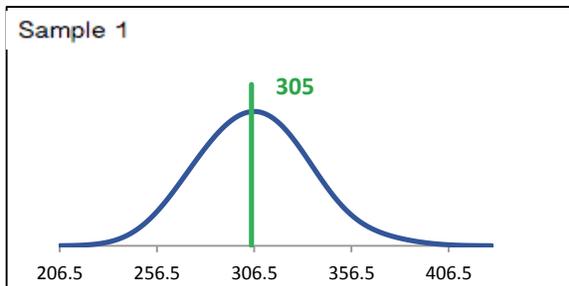


# STRONTIUM

## z-Score Plots

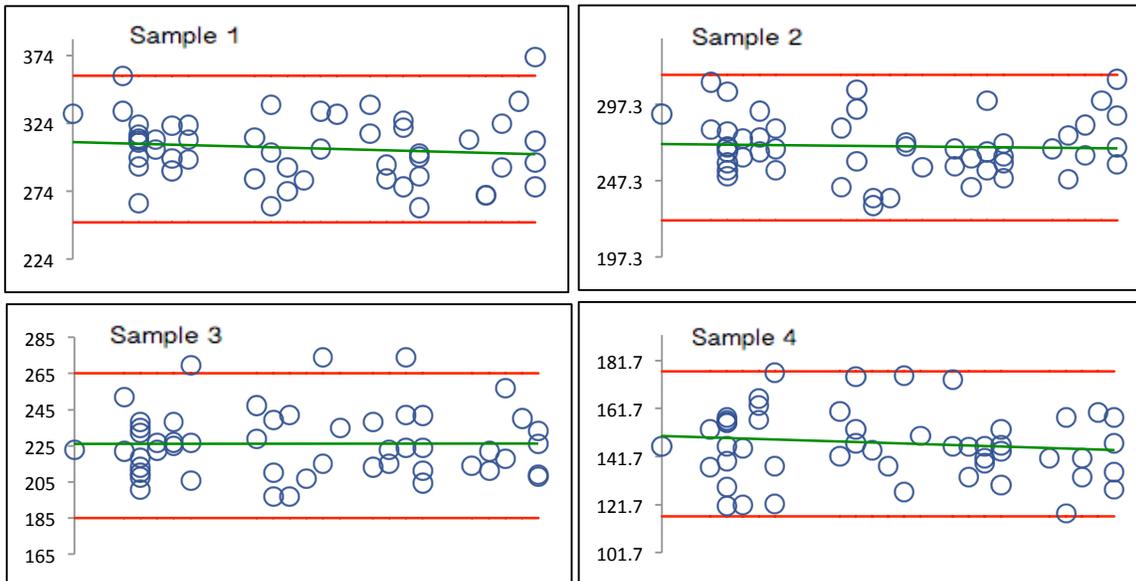


## Kernel Density Plots



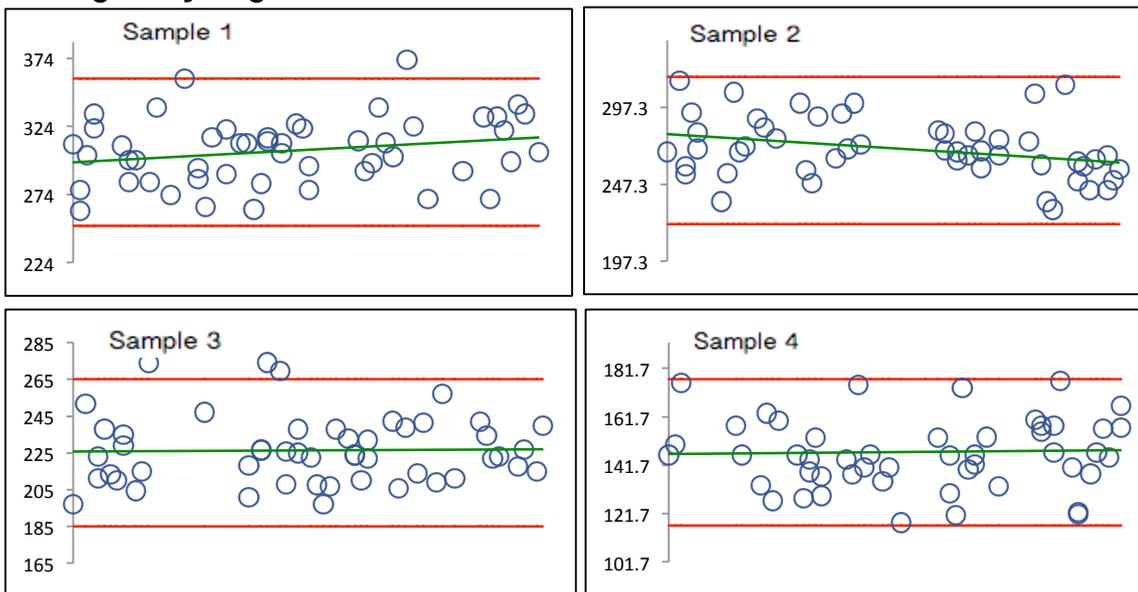
# STRONTIUM

## Stability Regression



Reported results (Y-axis) plotted against reported analysis date (X-axis)

## Homogeneity Regression



Reported results (Y-axis) plotted against bottling order (X-axis).

TIN

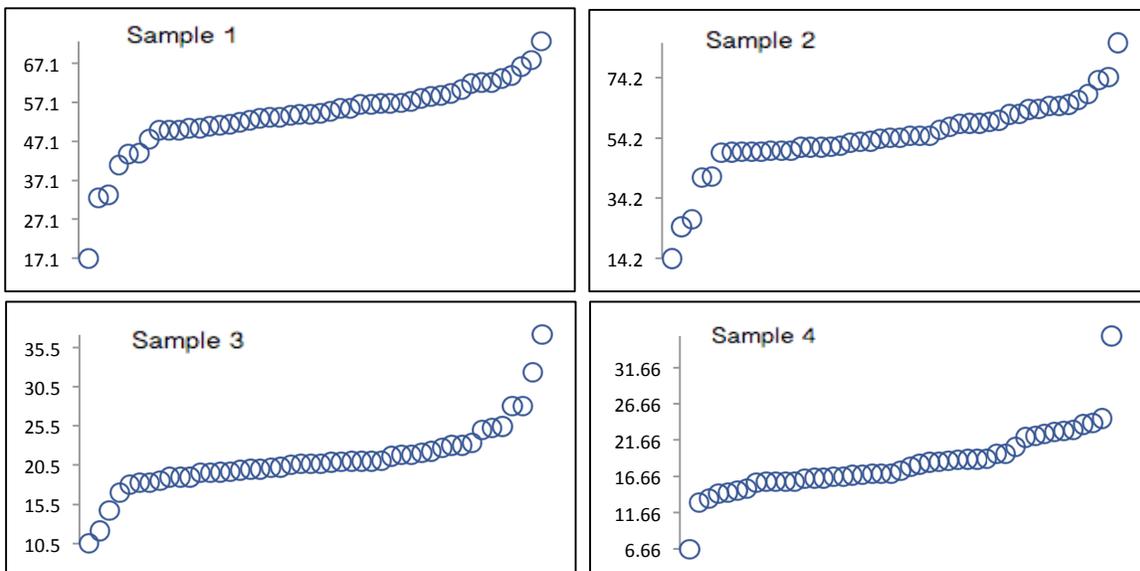
Summary Statistics

Statistic	C17-1	C17-2	C17-3	C17-4
N	46	46	46	45
Median	54.1	54.3	20.7	17.4
Robust Mean	54.5	55.5	20.9	18.2
U	1.2	1.6	0.49	0.65
Robust Standard Deviation	6.74	8.62	2.65	3.49
Regression Standard Deviation	13.7	13.9	5.62	4.99
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA)	13.7	13.9	5.62	4.99
Outliers	0	0	0	0
z >3.0	0	0	0	1
2< z <3	1	4	2	1

Methods Used

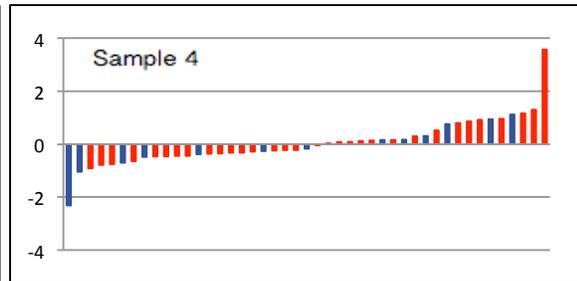
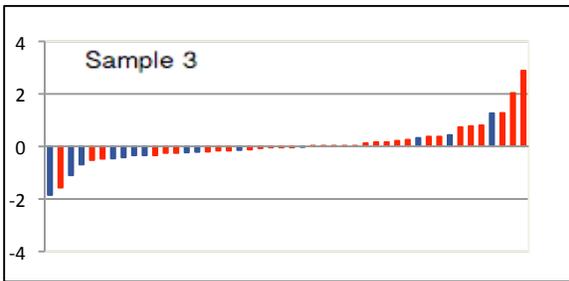
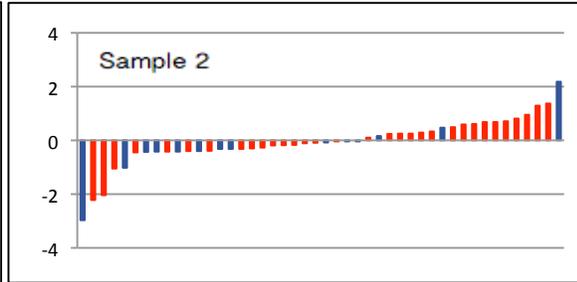
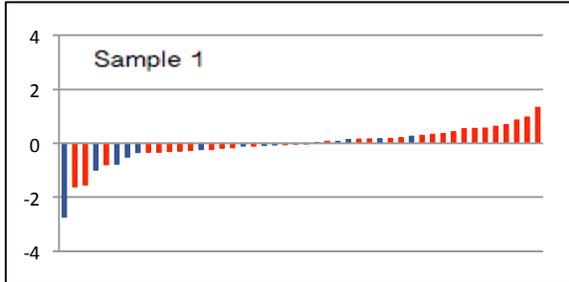
Method	C17-1	C17-2	C17-3	C17-4
ICP/OES	14	14	14	13
ICP/MS	32	32	32	32

All summary stats and the plots below are based on the data excluding any flagged outliers

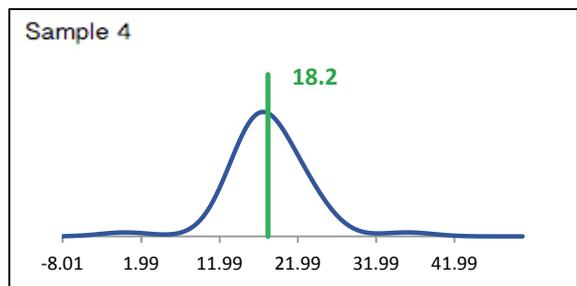
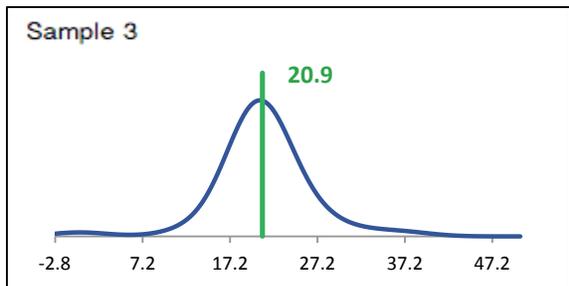
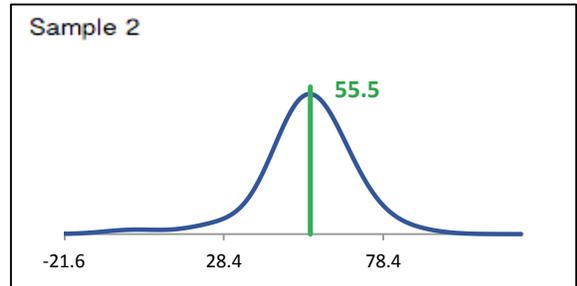
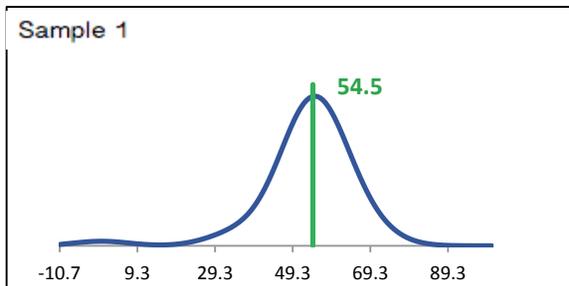


# TIN

## z-Score Plots

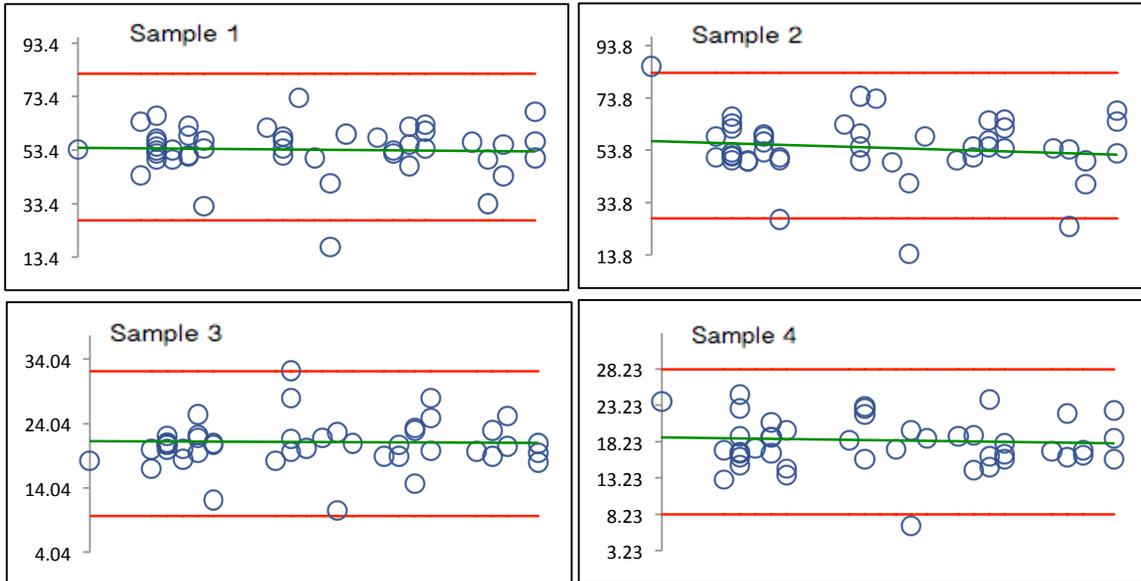


## Kernel Density Plots



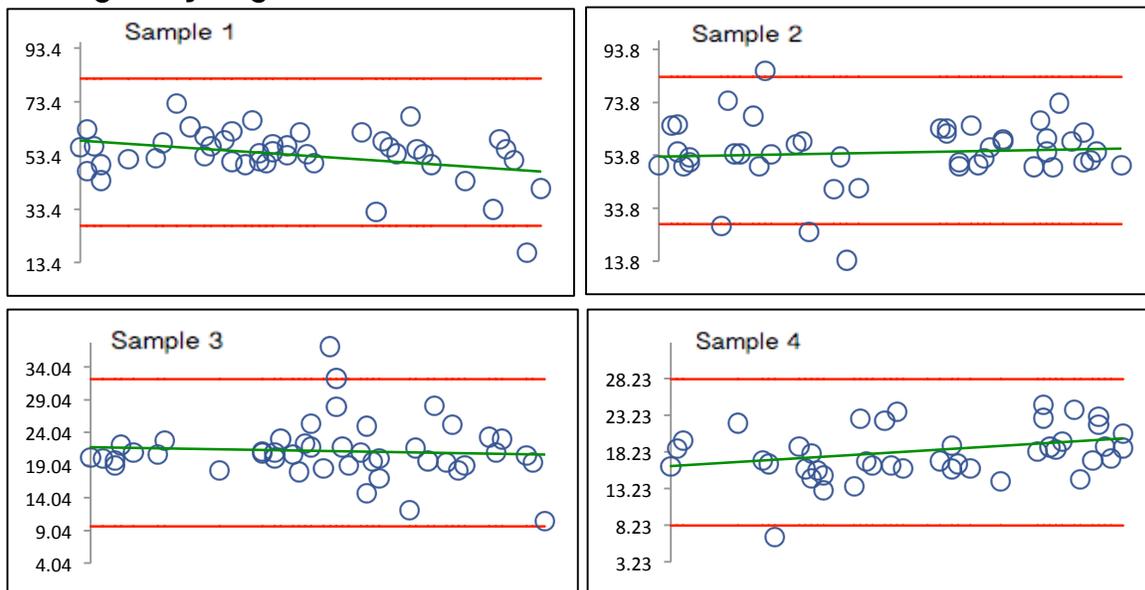
# TIN

## Stability Regression



Reported results (Y-axis) plotted against reported analysis date (X-axis)

## Homogeneity Regression



Reported results (Y-axis) plotted against bottling order (X-axis).

# TITANIUM

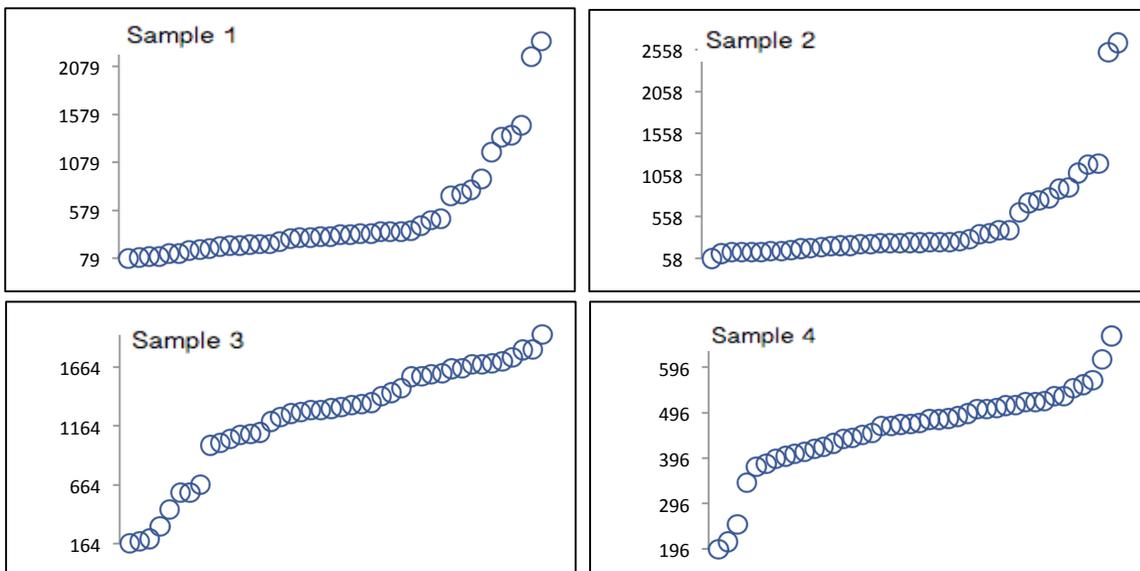
## Summary Statistics

Statistic	C17-1	C17-2	C17-3	C17-4
N	42	42	42	42
Median	315	246	1320	472
Robust Mean	387	362	1280	467
U	54.8	55.5	88.30	13.70
Robust Standard Deviation	284	288	458	71.0
Regression Standard Deviation	112	106	337	132
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA)	284	288	458	132
Outliers	0	0	0	0
z >3.0	5	2	0	0
2< z <3	1	3	4	1

## Methods Used

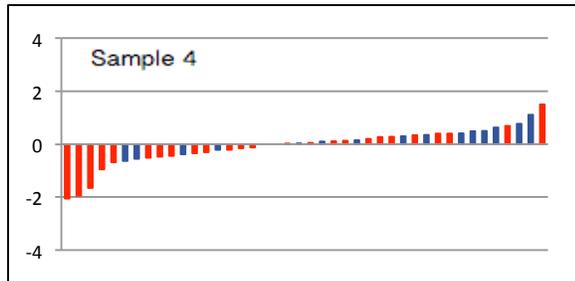
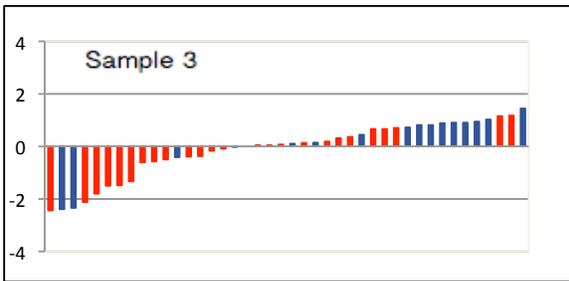
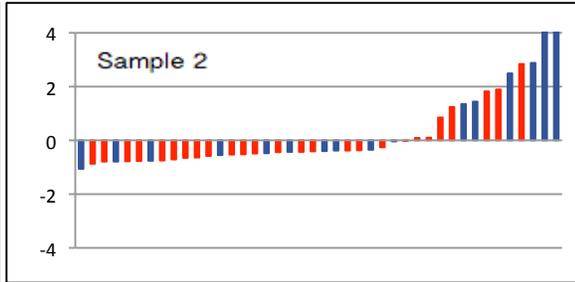
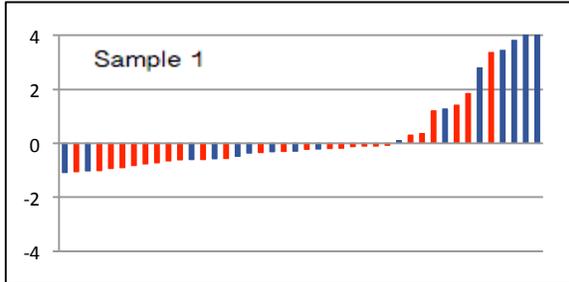
Method	C17-1	C17-2	C17-3	C17-4
ICP/OES	16	16	16	16
ICP/MS	26	26	26	26

All summary stats and the plots below are based on the data excluding any flagged outliers

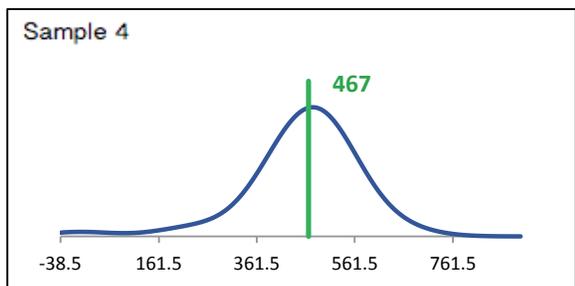
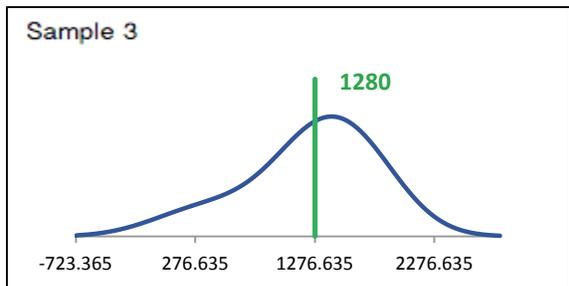
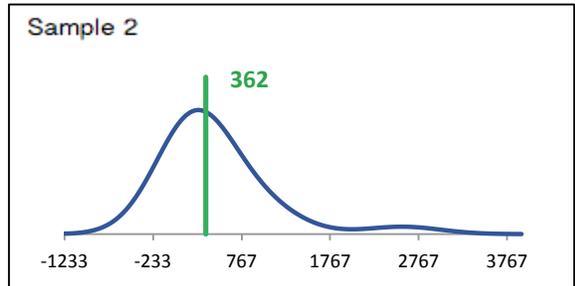
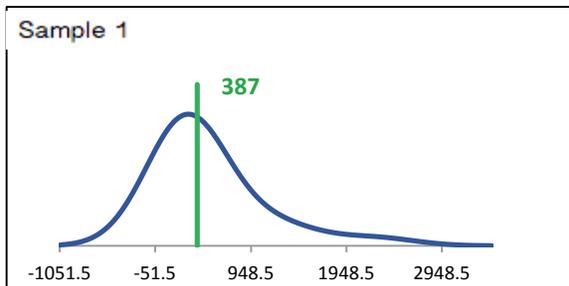


# TITANIUM

## z-Score Plots

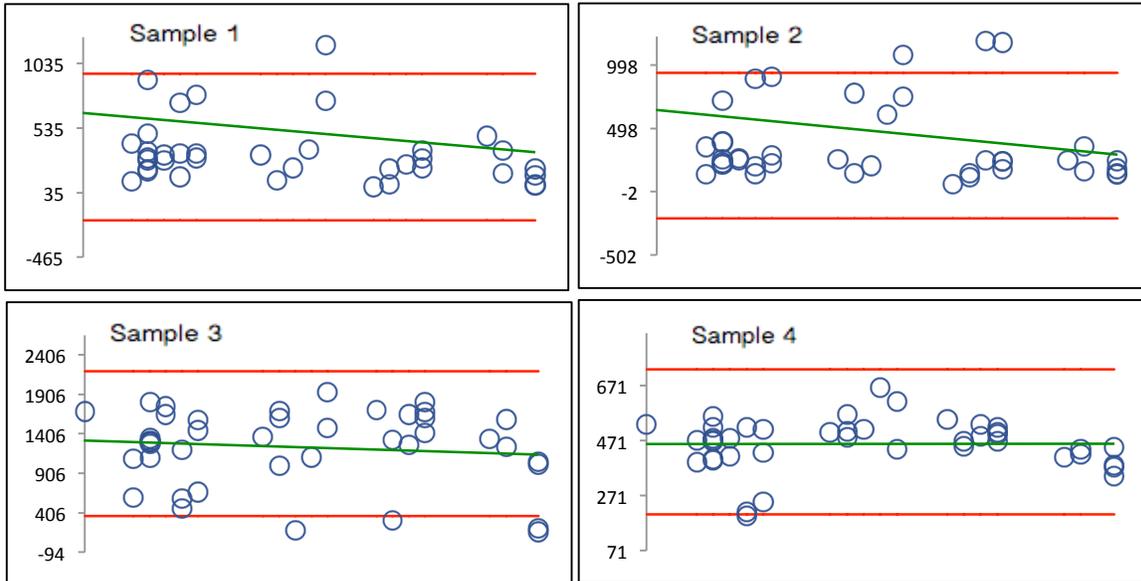


## Kernel Density Plots



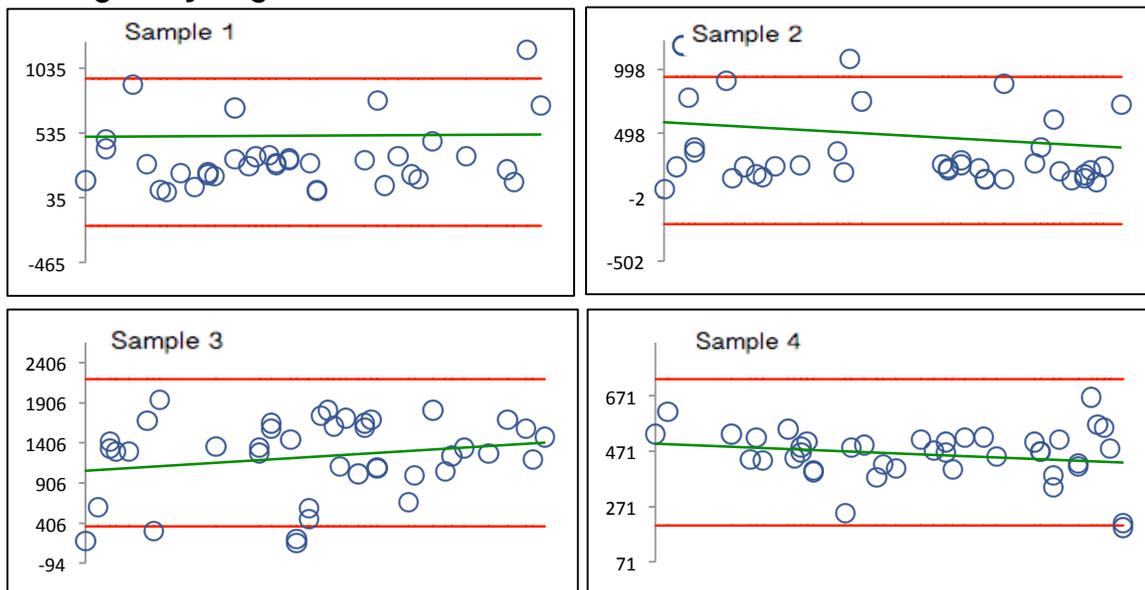
# TITANIUM

## Stability Regression



Reported results (Y-axis) plotted against reported analysis date (X-axis)

## Homogeneity Regression



Reported results (Y-axis) plotted against bottling order (X-axis).

## URANIUM

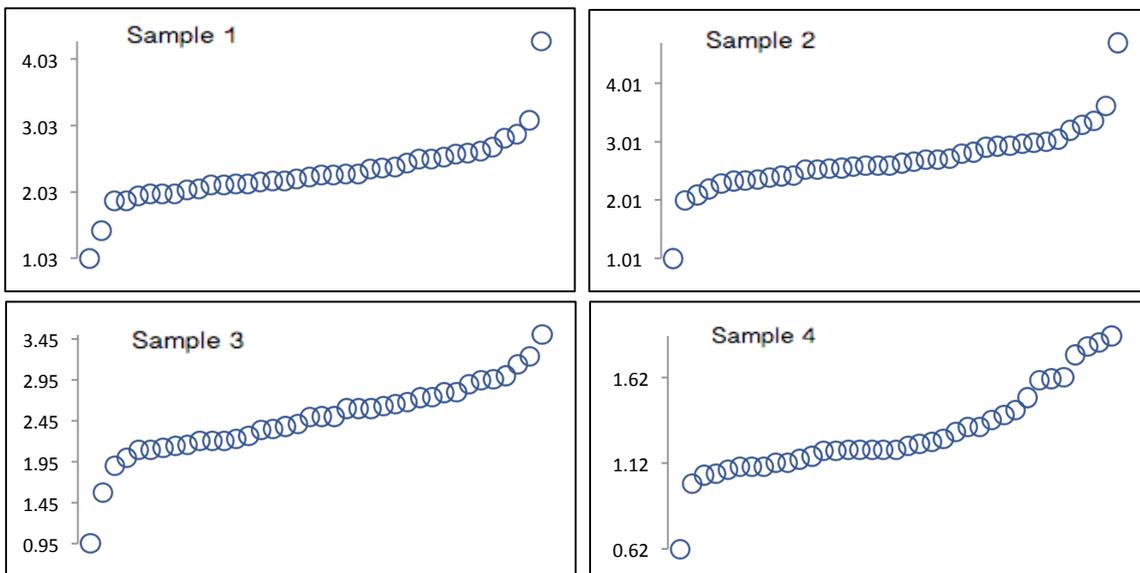
### Summary Statistics

Statistic	C17-1	C17-2	C17-3	C17-4
N	38	38	38	37
Median	2.27	2.62	2.50	1.20
Robust Mean	2.30	2.68	2.48	1.28
U	0.066	0.079	0.083	0.047
Robust Standard Deviation	0.326	0.387	0.411	0.229
Regression Standard Deviation	0.265	0.298	0.281	0.176
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA)	0.326	0.387	0.411	0.229
Outliers	1	1	1	1
z >3.0	2	2	1	0
2< z <3	2	1	2	5

### Methods Used

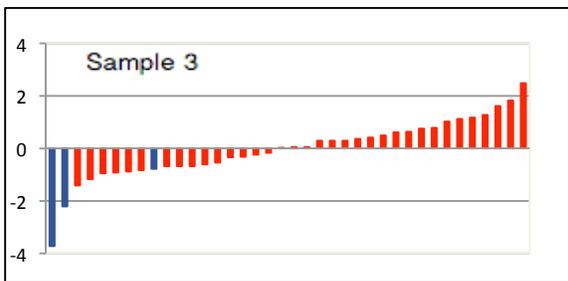
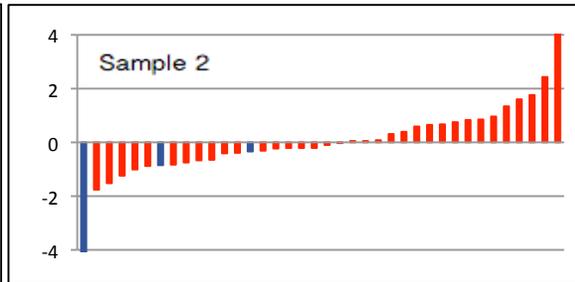
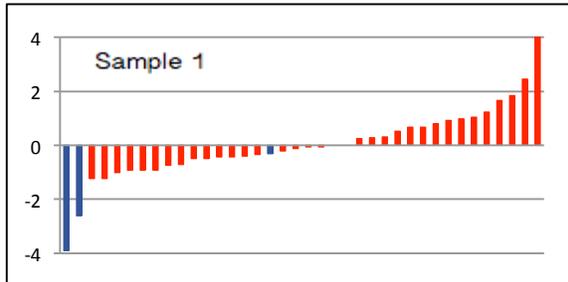
Method	C17-1	C17-2	C17-3	C17-4
ICP/OES	3	3	3	2
ICP/MS	35	35	35	35

All summary stats and the plots below are based on the data excluding any flagged outliers

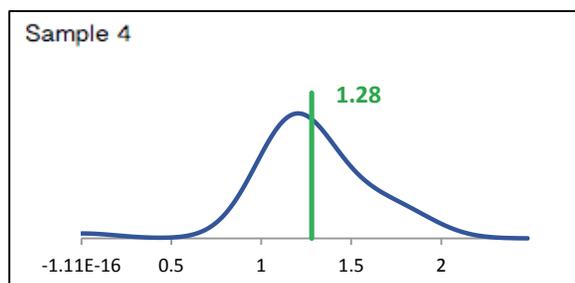
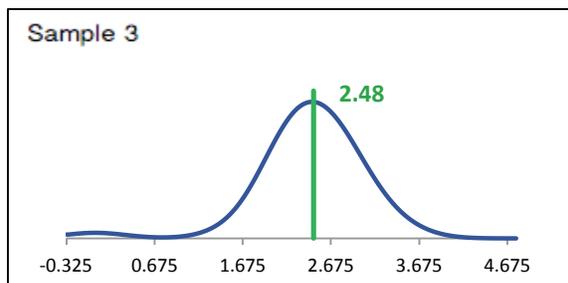
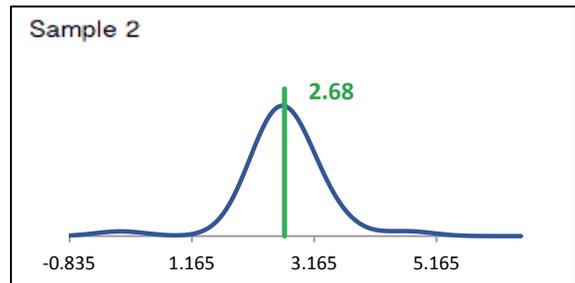
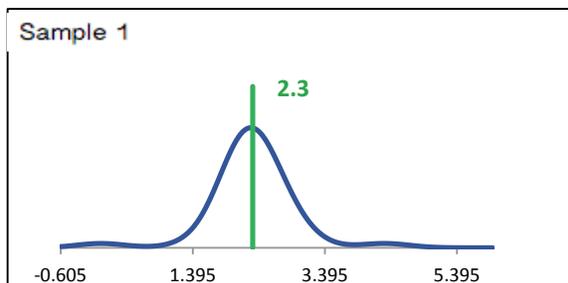


# URANIUM

## z-Score Plots

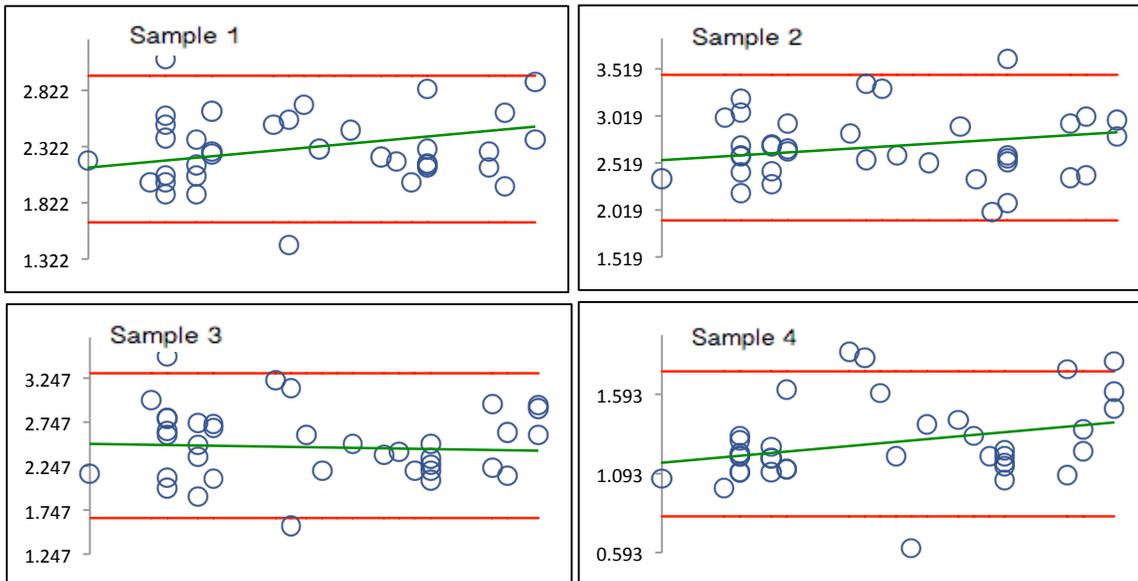


## Kernel Density Plots



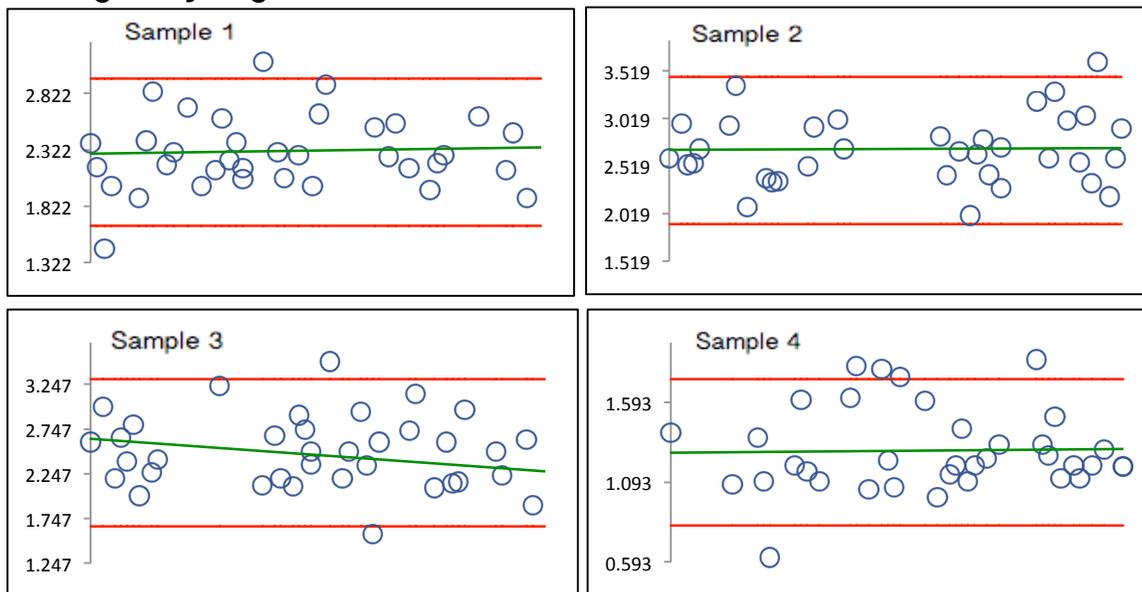
# URANIUM

## Stability Regression



Reported results (Y-axis) plotted against reported analysis date (X-axis)

## Homogeneity Regression



Reported results (Y-axis) plotted against bottling order (X-axis).

## VANADIUM

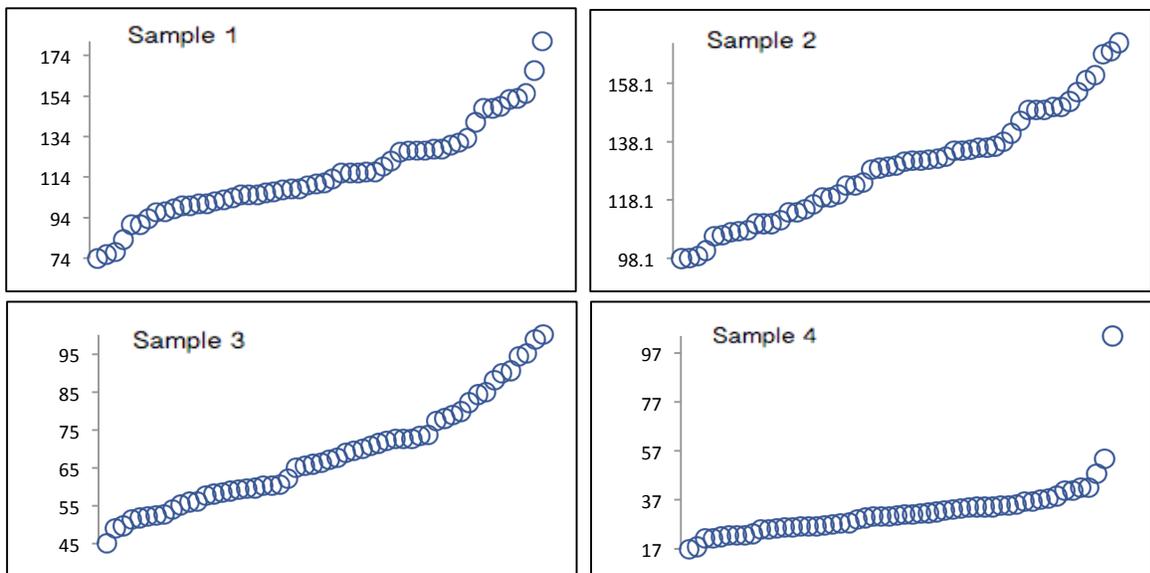
### Summary Statistics

Statistic	C17-1	C17-2	C17-3	C17-4
N	54	54	54	54
Median	111	131	66.6	30.8
Robust Mean	115	129	67.7	30.8
U	3.74	3.50	2.42	1.21
Robust Standard Deviation	22.0	20.6	14.2	7.13
Regression Standard Deviation	16.4	18.3	9.70	4.49
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA)	22.0	20.6	14.2	7.13
Outliers	0	0	0	0
z >3.0	0	0	0	2
2< z <3	2	1	2	1

### Methods Used

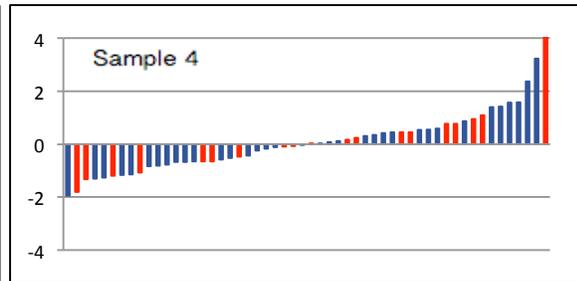
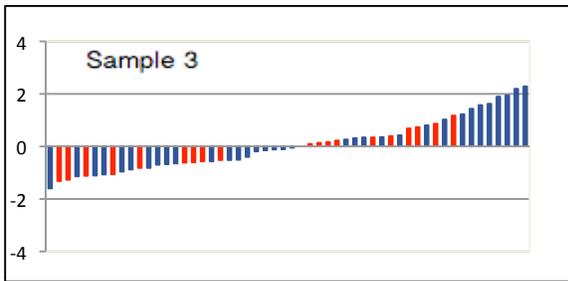
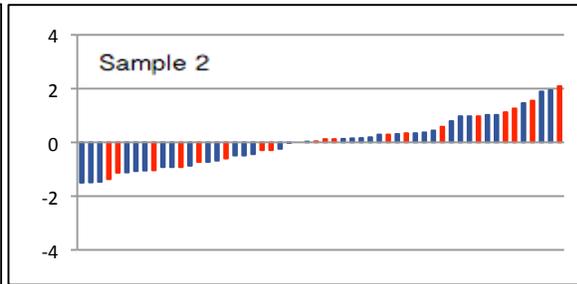
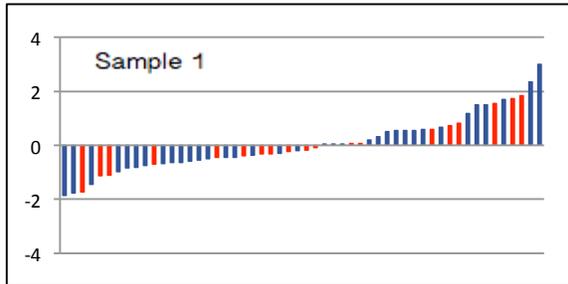
Method	C17-1	C17-2	C17-3	C17-4
ICP/MS	35	35	35	35
ICP/OES	19	19	19	19

All summary stats and the plots below are based on the data excluding any flagged outliers

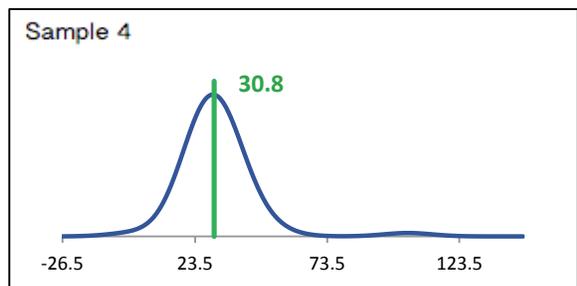
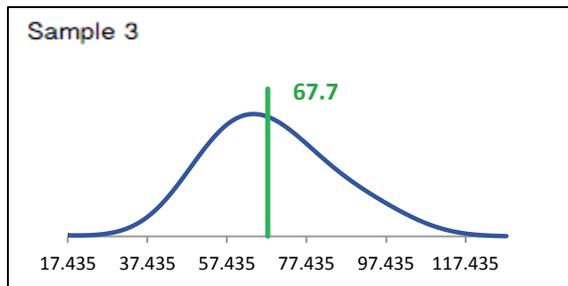
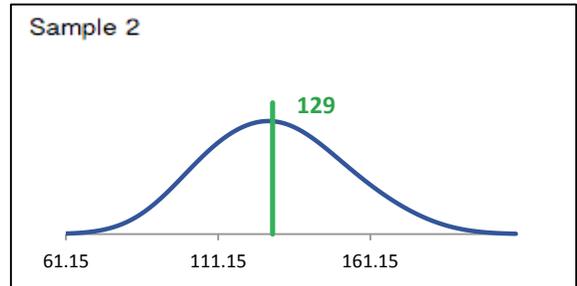
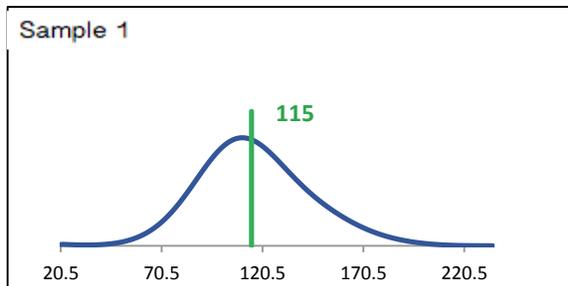


# VANADIUM

## z-Score Plots

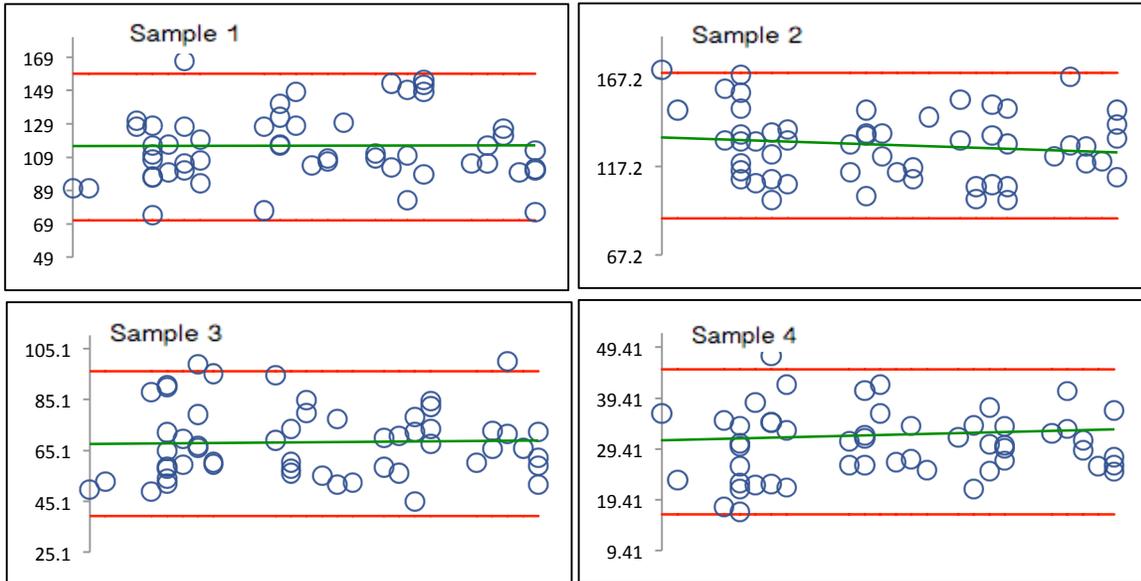


## Kernel Density Plots



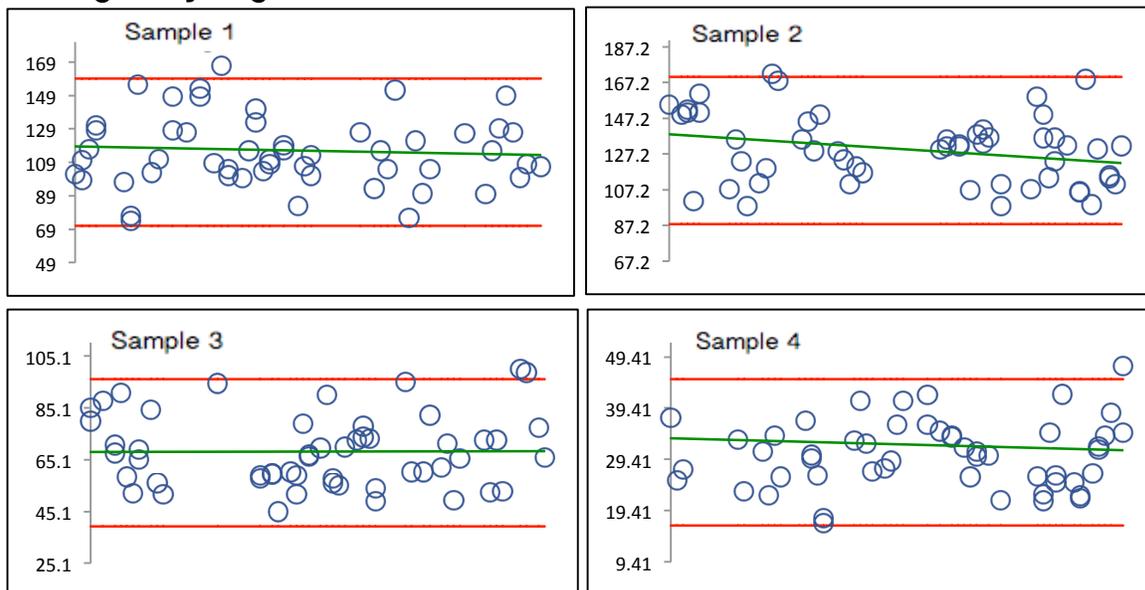
# VANADIUM

## Stability Regression



Reported results (Y-axis) plotted against reported analysis date (X-axis)

## Homogeneity Regression



Reported results (Y-axis) plotted against bottling order (X-axis).

# ZINC

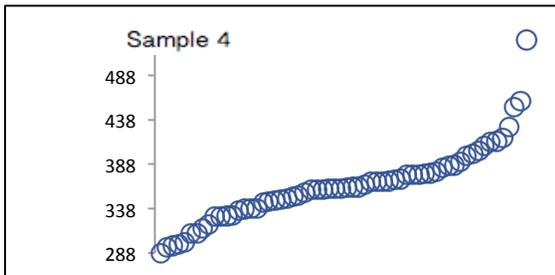
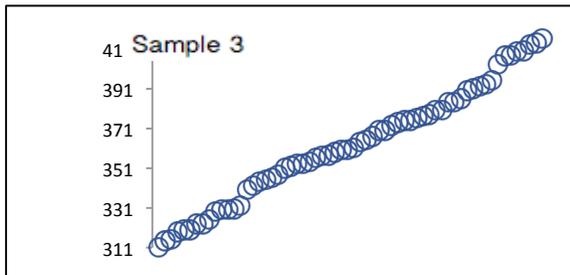
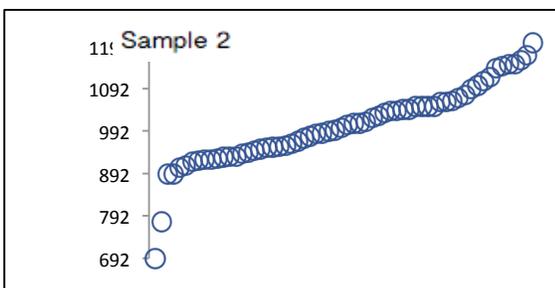
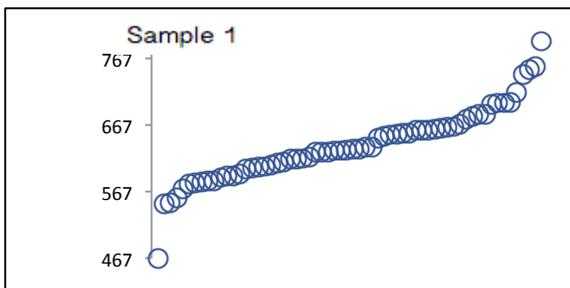
## Summary Statistics

Statistic	C17-1	C17-2	C17-3	C17-4
N	62	62	62	62
Median	631	1000	361	361
Robust Mean	635	1010	362	361
U	7.89	13.7	5.14	5.79
Robust Standard Deviation	49.7	86.1	32.4	36.5
Regression Standard Deviation	51.1	80.8	29.3	29.2
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA)	51.1	86.1	32.4	36.5
Outliers	0	0	0	0
z >3.0	2	1	0	1
2< z <3	3	2	0	2

## Methods Used

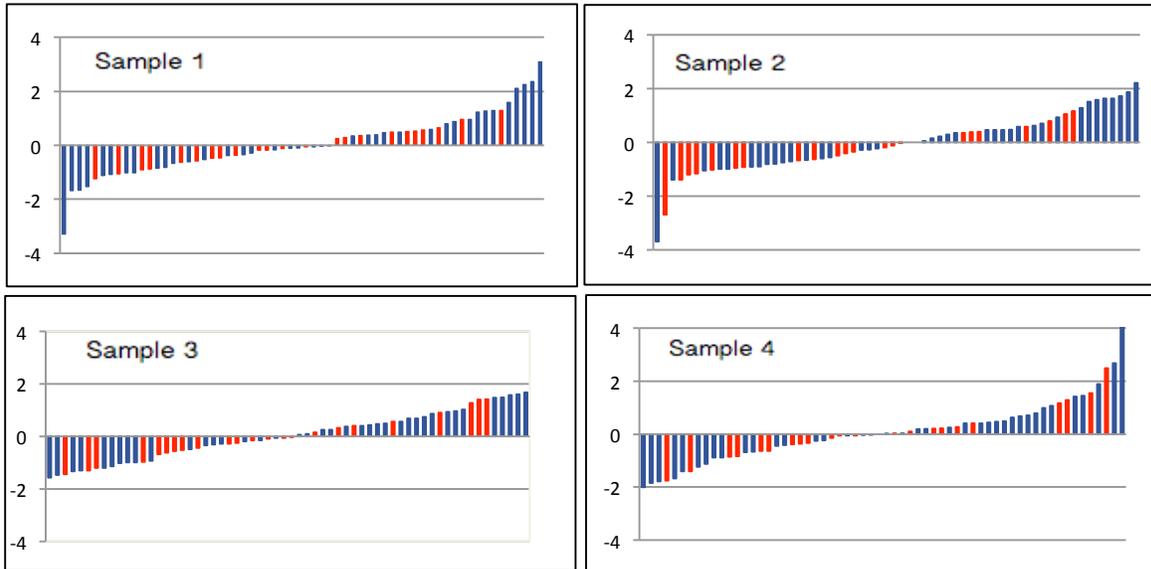
Method	C17-1	C17-2	C17-3	C17-4
ICP/MS	39	39	39	39
ICP/OES	23	23	23	23

All summary stats and the plots below are based on the data excluding any flagged outliers

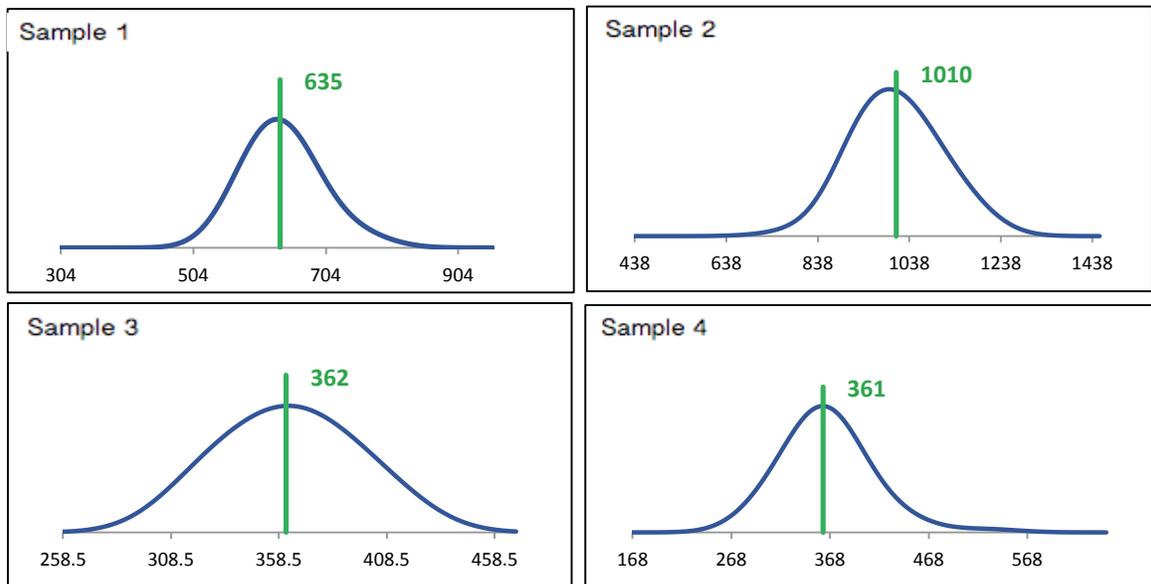


# ZINC

## z-Score Plots

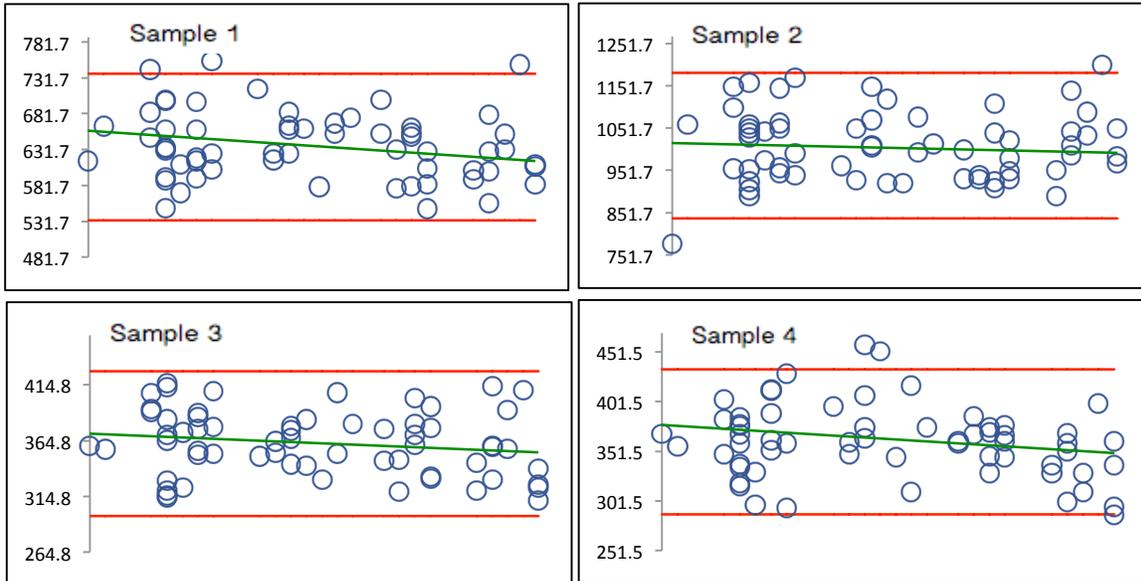


## Kernel Density Plots



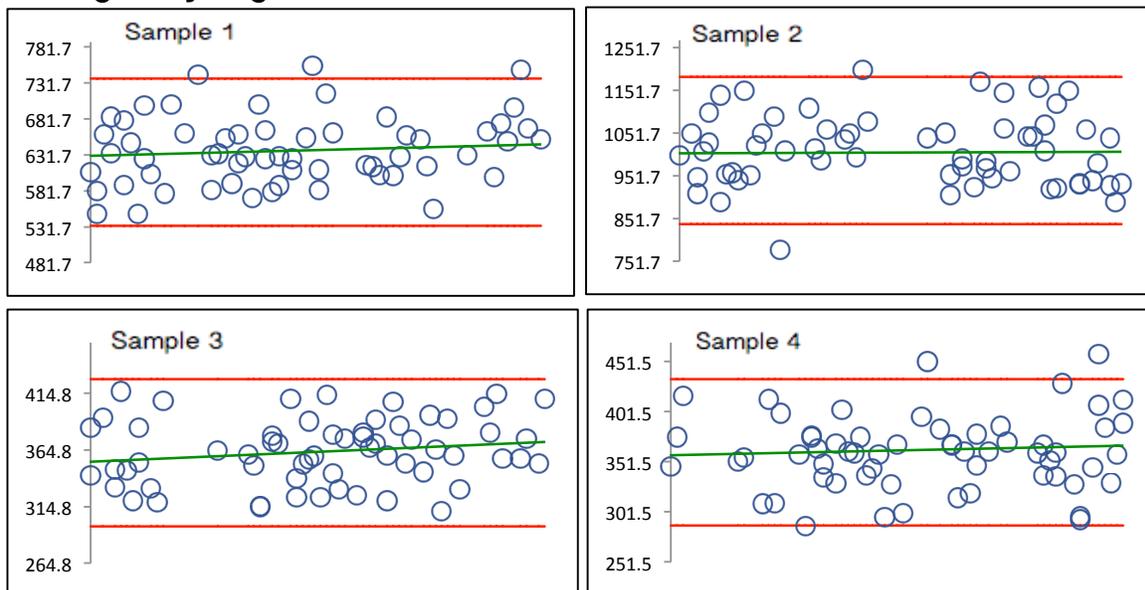
# ZINC

## Stability Regression



Reported results (Y-axis) plotted against reported analysis date (X-axis)

## Homogeneity Regression



Reported results (Y-axis) plotted against bottling order (X-axis).