Test Group Summary Report

C02A Metals in Water – Full Range

March 2021 PT Round (Shipped May 17)

Issued: July 15, 2021

PTC | Proficiency Testing Canada

Table of Contents

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.

Code:	The registration code that is unique to each analyte that a participant is registered for.
App:	If a participant is accredited by CALA, this three-digit number is the appendix number that the accredited method is assigned to.
N:	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.
Assigned:	The Assigned Value is the robust mean of the reported results, outliers excluded. This is often referred to as the "target" value.
±u:	The uncertainty of the assigned value.
Reported:	The result reported by the participant.
s:	The Standard Deviation of Proficiency Assessment (SDPA). This value is used to determine the acceptance limits for the PT evaluation.
z-Score:	A value assigned to each reported result that is a measure of the degree to which it deviates from the Assigned Value.
Score:	The composite score of the four results reported for each analyte. It is normalized to a score out of 100.
Bias:	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.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 to minimize the impact.

3.2 THE Z SCORE

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

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

where: x = participant result;
$\bar{X}$ = the Assigned Value;
SDPA = 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$_{rob}$) 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 x 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	C02A-1	C02A-2	C02A-3	C02A-4
N	101	101	103	101
Median	1.17	0.305	0.476	0.930
Robust Mean	1.16	0.305	0.478	0.931
U	0.0065	0.0019	0.0029	0.0049
Robust Standard Deviation	0.0524	0.0154	0.0235	0.0392
Regression Standard Deviation	0.0873	0.0229	0.0358	0.0698
Stability Flag			Stability	
Homogeneity Flag				
Standard Deviation Used (SDPA)	0.0873	0.0229	0.0551	0.0698
Outliers	6	6	4	6
|z|>3.0	1	1	5	0
2<|z|<3	4	1	5	2

Methods Used

Method	C02A-1	C02A-2	C02A-3	C02A-4
ICP/MS	76	76	77	76
ICP/OES	23	23	24	23
AA	1	1	1	1
AAG	1	1	1	1

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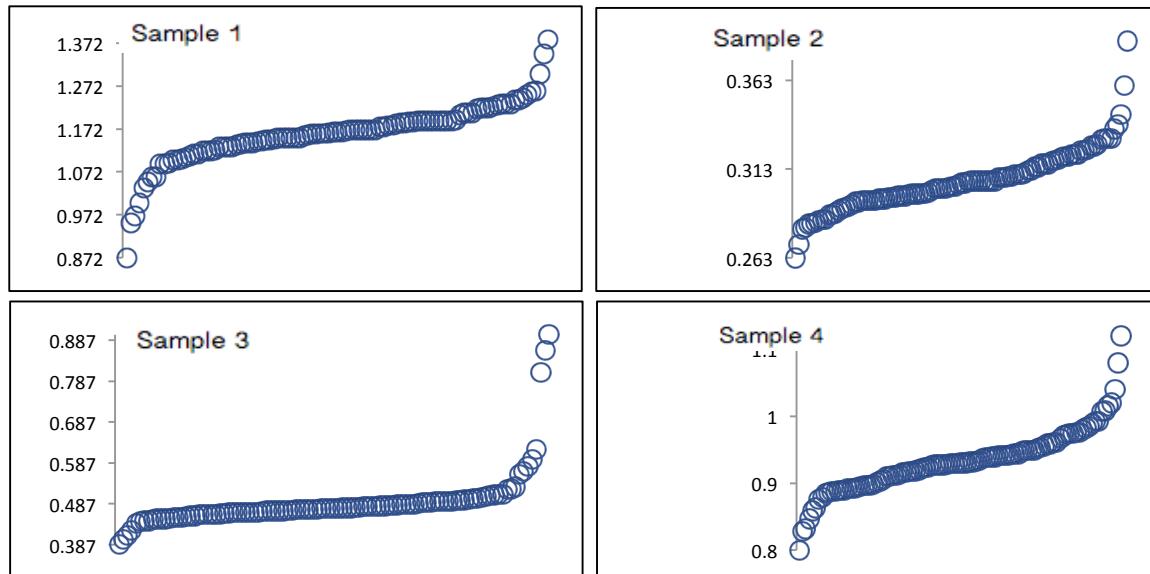
ALUMINUM

## z-Score Plots
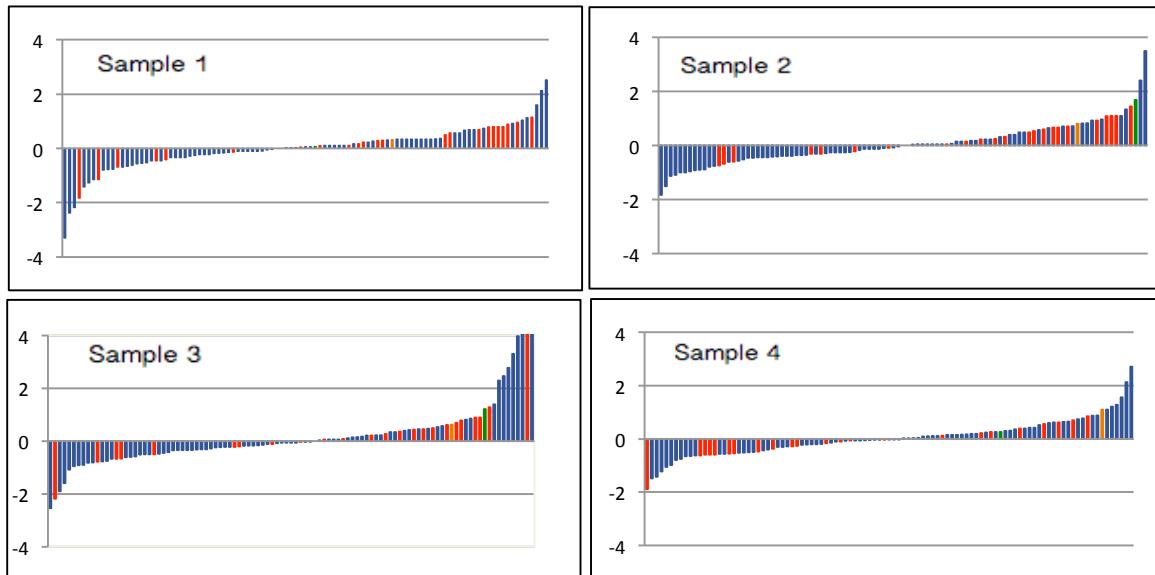
Kernel Density Plots
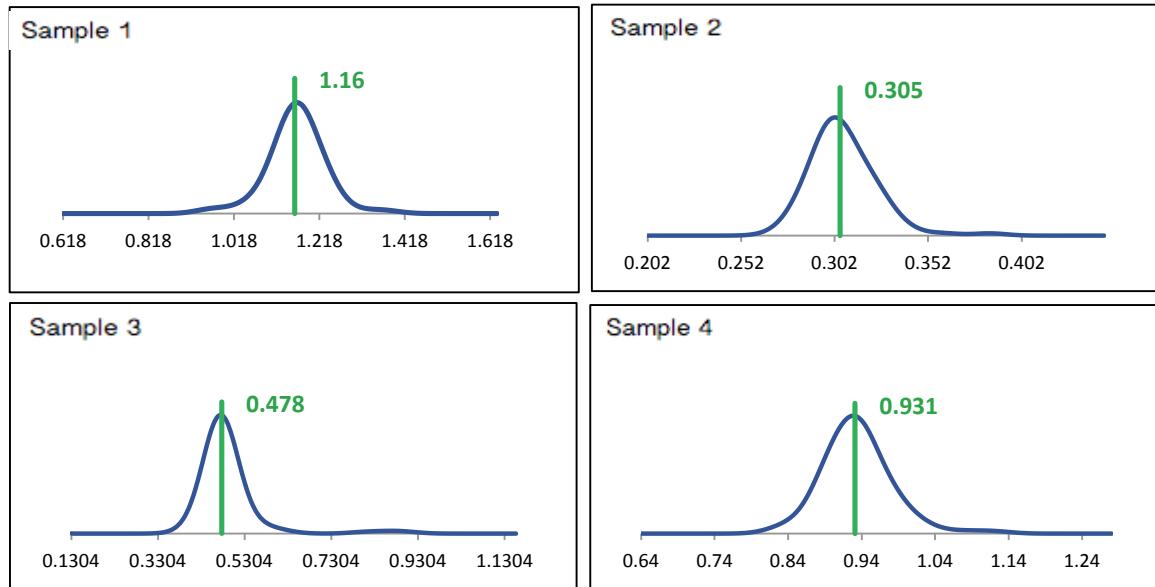
ALUMINUM

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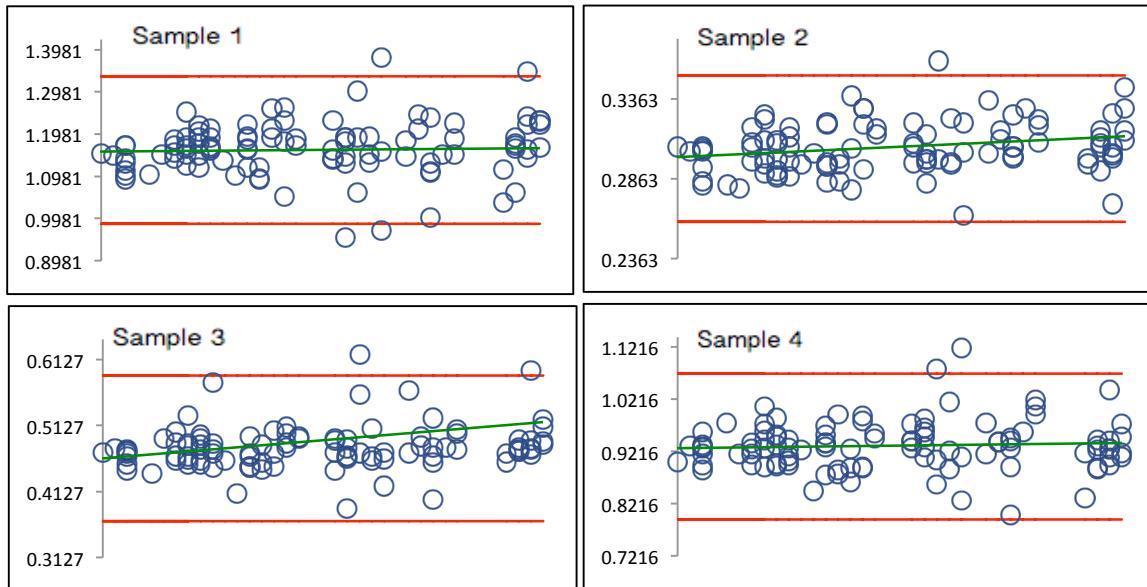
Reported results (Y-axis) plotted against reported analysis date (X-axis)

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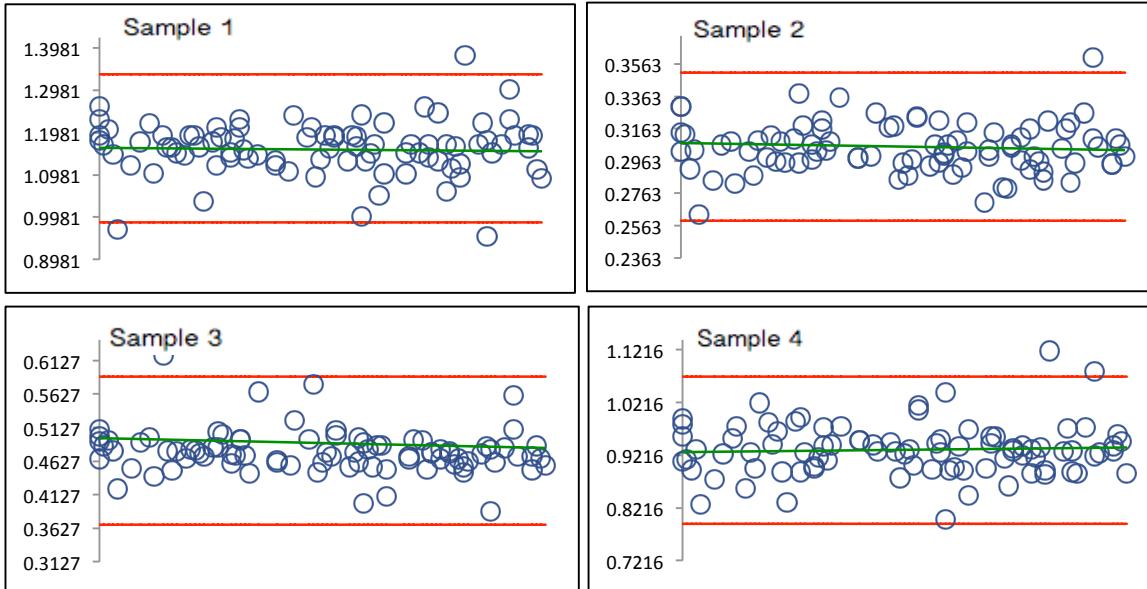
Reported results (Y-axis) plotted against bottling order (X-axis).

ANTIMONY

Summary Statistics

Statistic	C02A-1	C02A-2	C02A-3	C02A-4
N	92	88	92	92
Median	73.0	38.2	95.2	60.7
Robust Mean	72.1	38.4	95.1	61.1
U	0.727	0.265	0.589	0.388
Robust Standard Deviation	5.58	1.99	4.52	2.98
Regression Standard Deviation	7.21	3.84	9.51	6.11
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA)	7.21	3.84	9.51	6.11
Outliers	3	3	3	3
|z|>3.0	6	1	3	3
2<|z|<3	2	2	2	0

Methods Used

Method	C02A-1	C02A-2	C02A-3	C02A-4
ICP/MS	75	75	75	75
ICPHY	2	1	2	2
ICP/OES	12	9	12	12
AAHY	2	2	2	2
AAG	1	1	1	1

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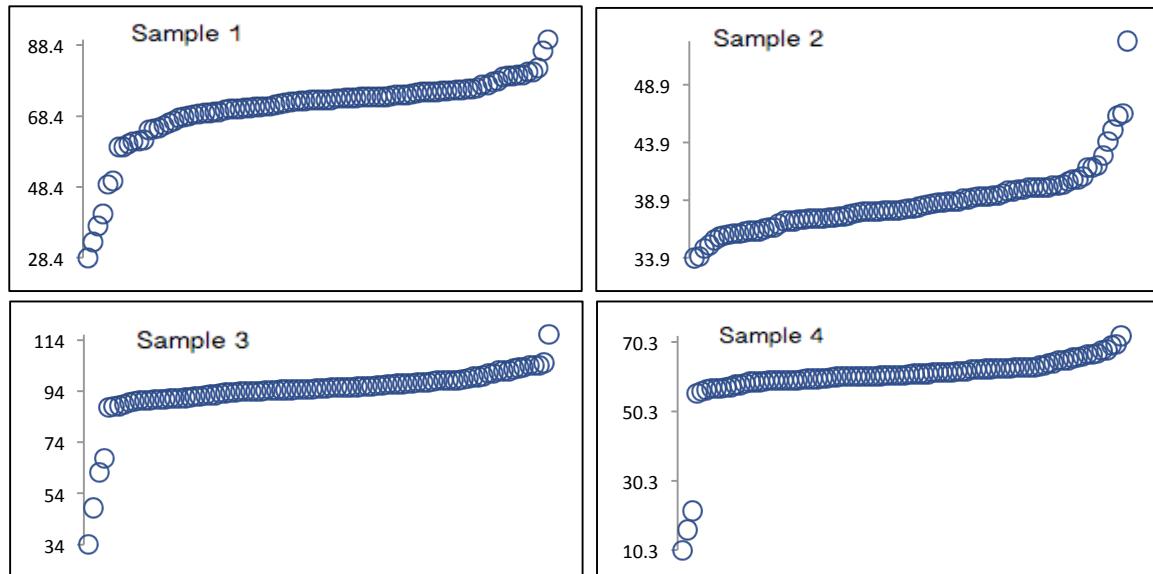
ANTIMONY

## z-Score Plots
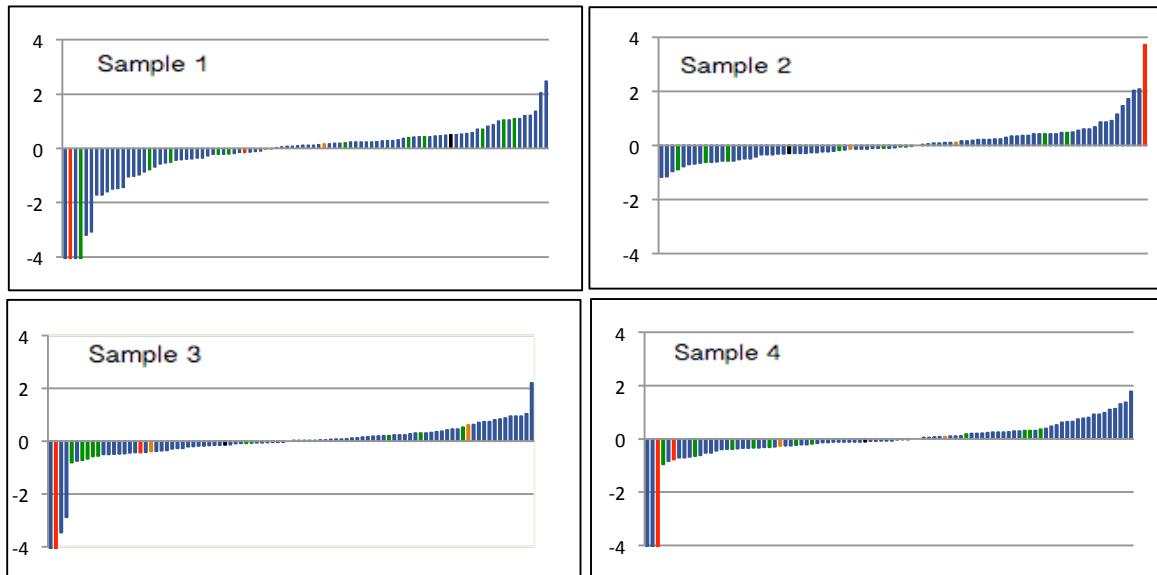
Kernel Density Plots
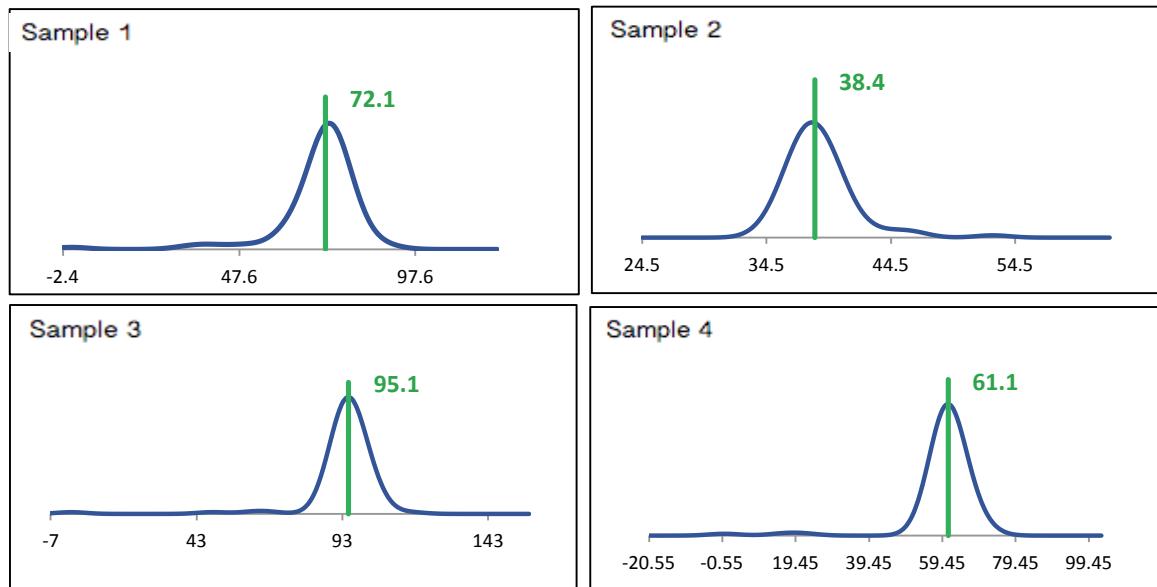
ANTIMONY

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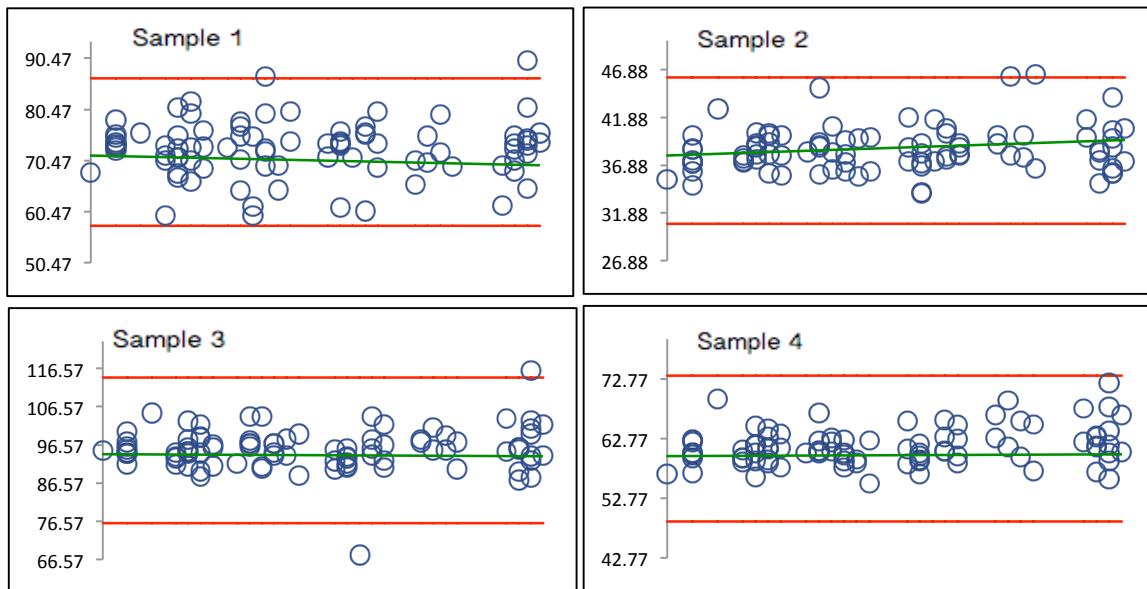
Reported results (Y-axis) plotted against reported analysis date (X-axis)

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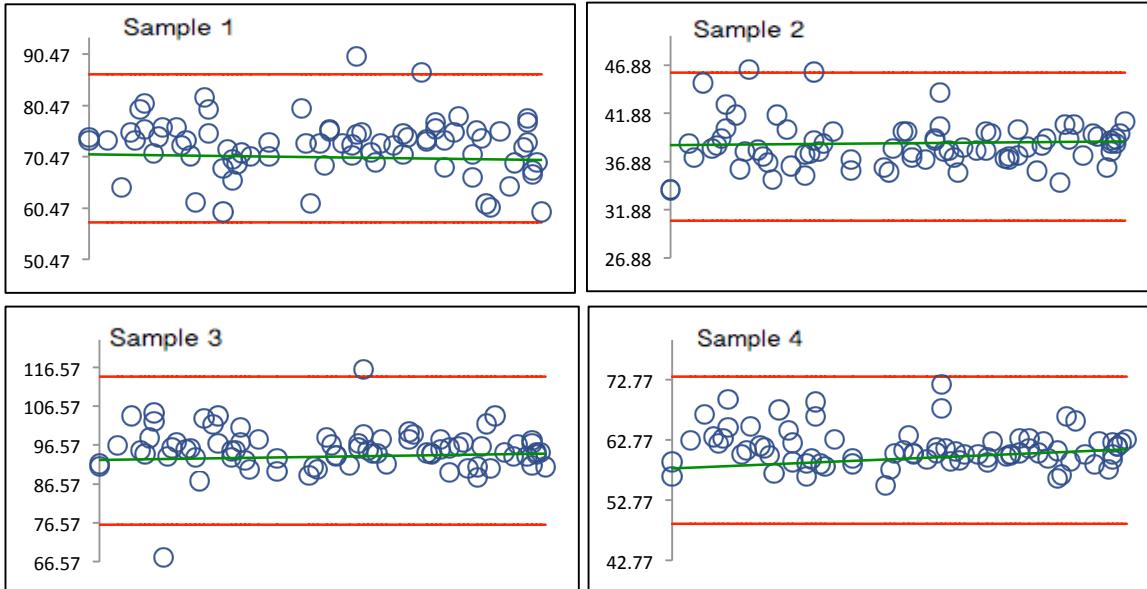
Reported results (Y-axis) plotted against bottling order (X-axis).

ARSENIC

Summary Statistics

Statistic	C02A-1	C02A-2	C02A-3	C02A-4
N	108	108	108	108
Median	41.7	91.0	77.3	55.0
Robust Mean	41.6	91.0	76.8	55.0
U	0.204	0.463	0.419	0.315
Robust Standard Deviation	1.70	3.85	3.48	2.62
Regression Standard Deviation	4.16	9.10	7.68	5.50
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA)	4.16	9.10	7.68	5.50
Outliers	4	4	4	4
|z|>3.0	5	3	4	3
2<|z|<3	0	0	0	0

Methods Used

Method	C02A-1	C02A-2	C02A-3	C02A-4
AAHY	3	3	3	3
ICP/MS	86	86	86	86
ICPHY	2	2	2	2
ICP/OES	16	16	16	16
AAG	1	1	1	1

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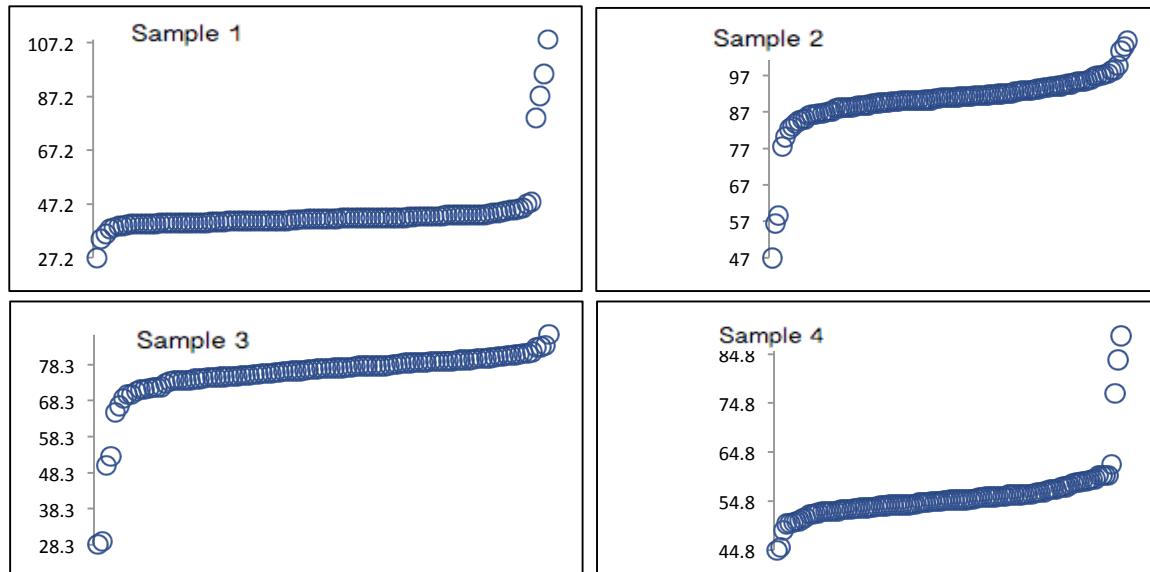
ARSENIC

## z-Score Plots
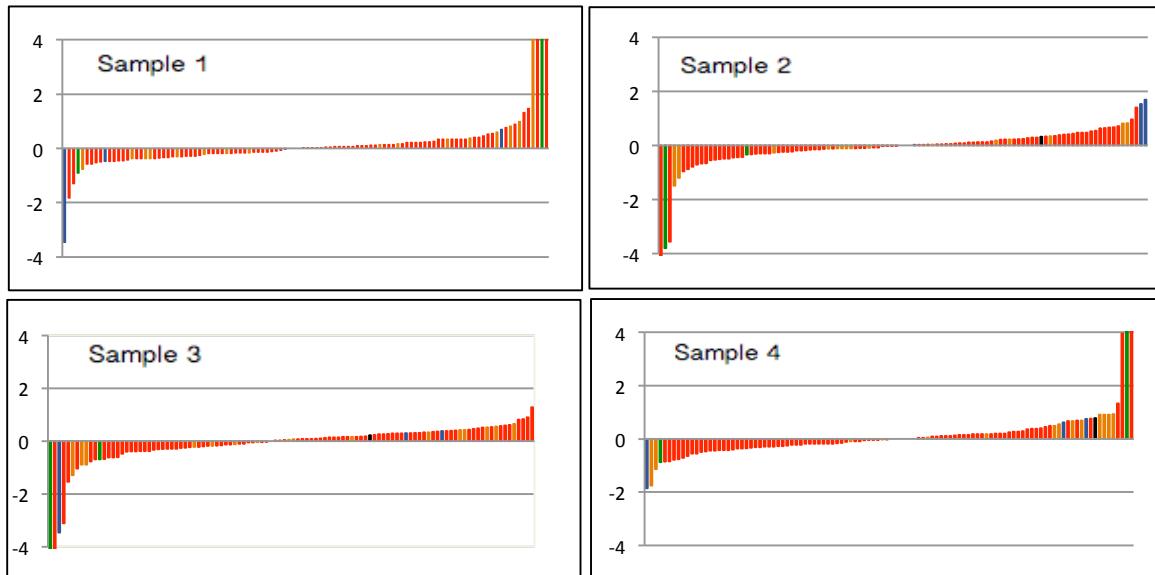
Kernel Density Plots
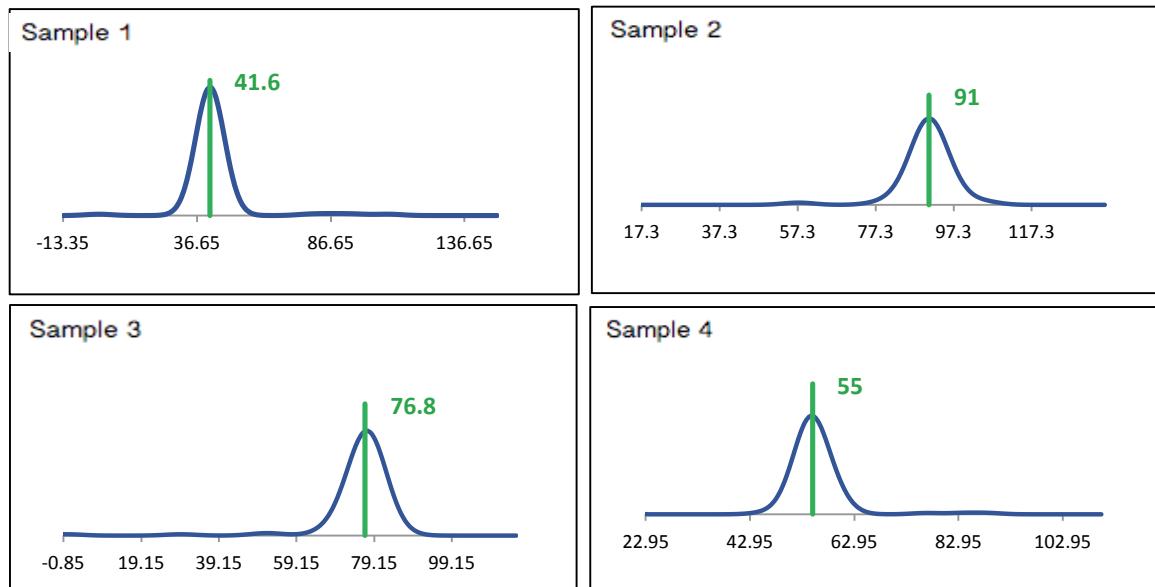
ARSENIC

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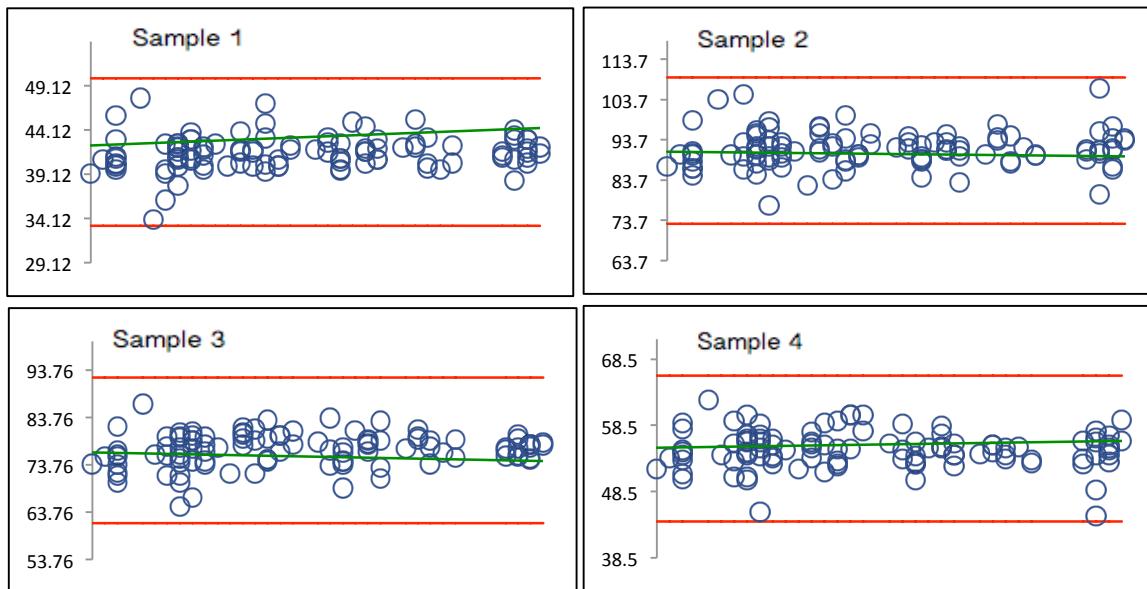
Reported results (Y-axis) plotted against reported analysis date (X-axis)

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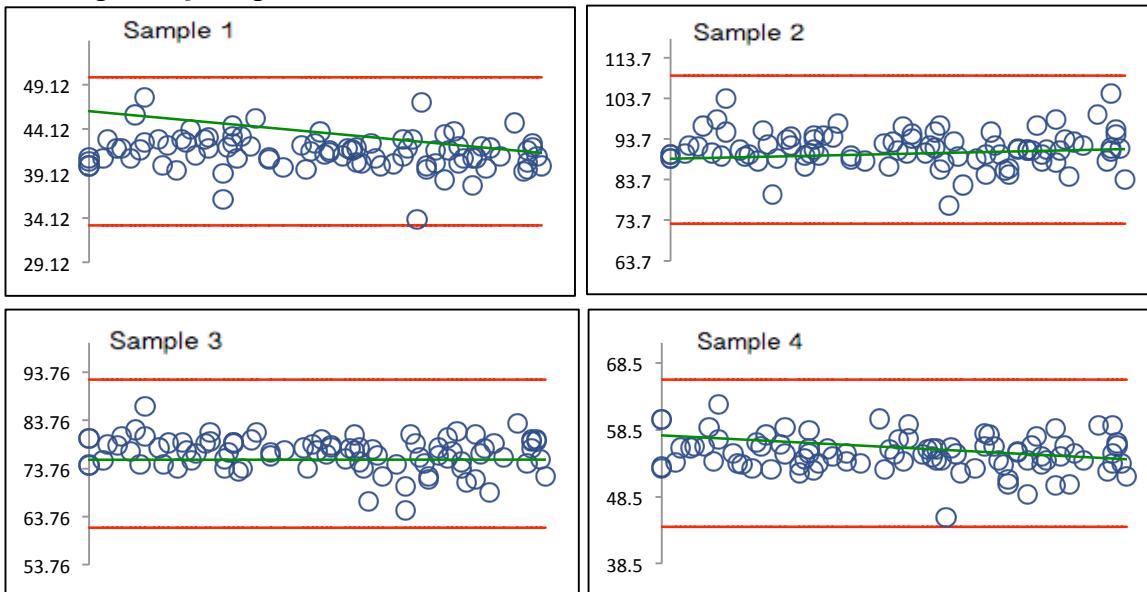
Reported results (Y-axis) plotted against bottling order (X-axis).

BARIUM

Summary Statistics

Statistic	C02A-1	C02A-2	C02A-3	C02A-4
N	104	104	103	103
Median	0.739	0.909	0.065	0.321
Robust Mean	0.737	0.911	0.065	0.322
U	0.0035	0.0052	0.0004	0.0017
Robust Standard Deviation	0.0283	0.0426	0.00324	0.0136
Regression Standard Deviation	0.0553	0.0683	0.00491	0.0242
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA)	0.0553	0.0683	0.00491	0.0242
Outliers	3	3	3	3
|z|>3.0	1	2	3	2
2<|z|<3	1	0	2	1

Methods Used
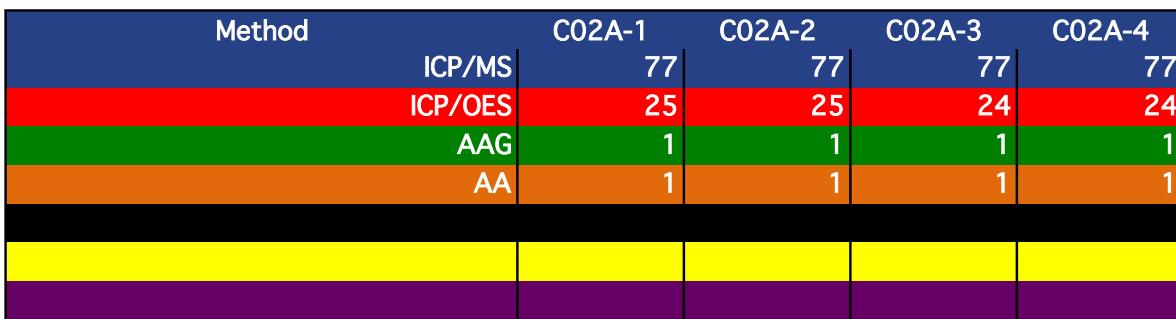
Method	C02A-1	C02A-2	C02A-3	C02A-4
ICP/MS	77	77	77	77
ICP/OES	25	25	24	24
AAG	1	1	1	1
AA	1	1	1	1

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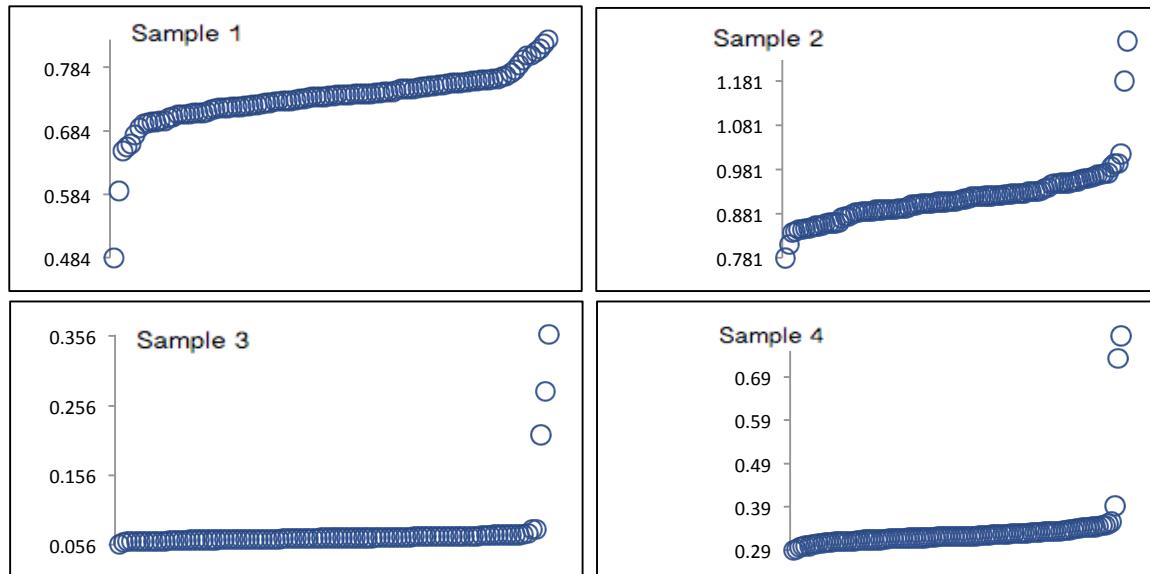
BARIUM

z-Score Plots
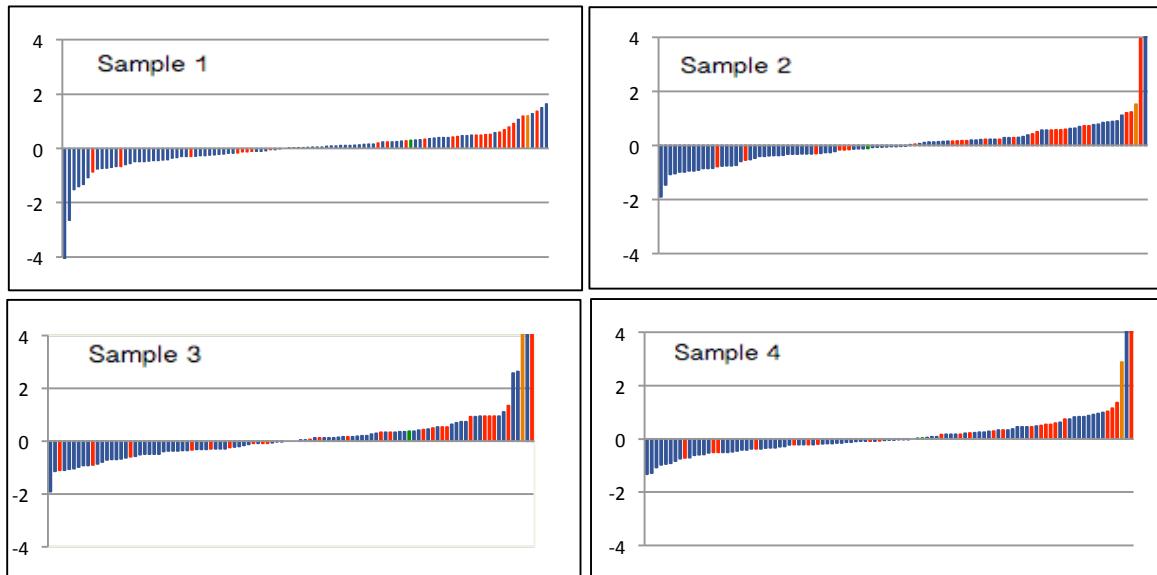

Kernel Density Plots
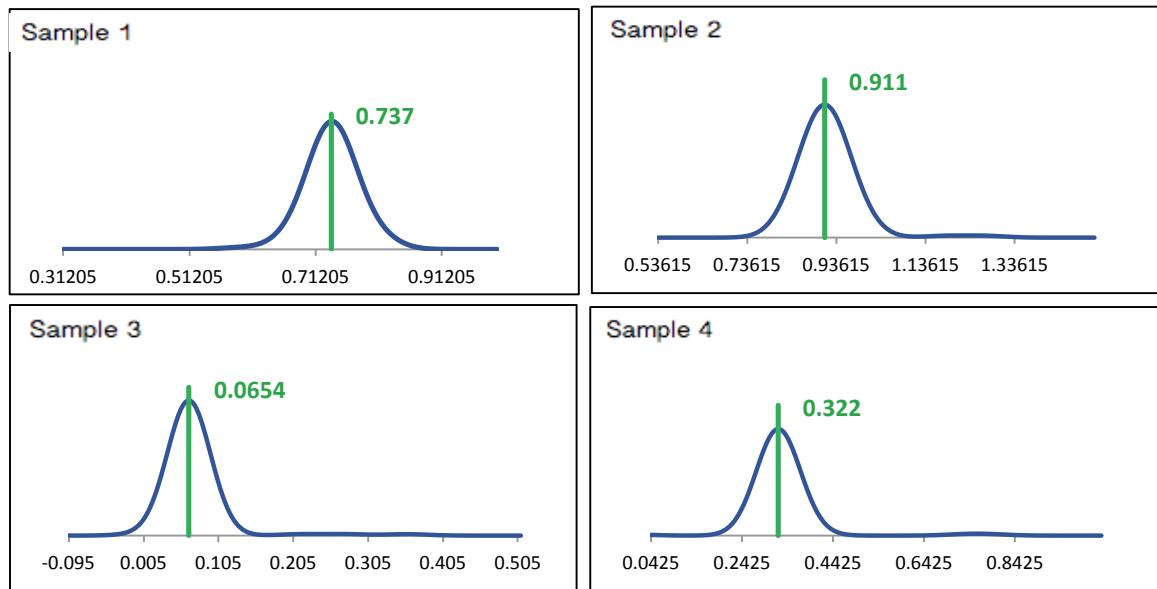
BARIUM

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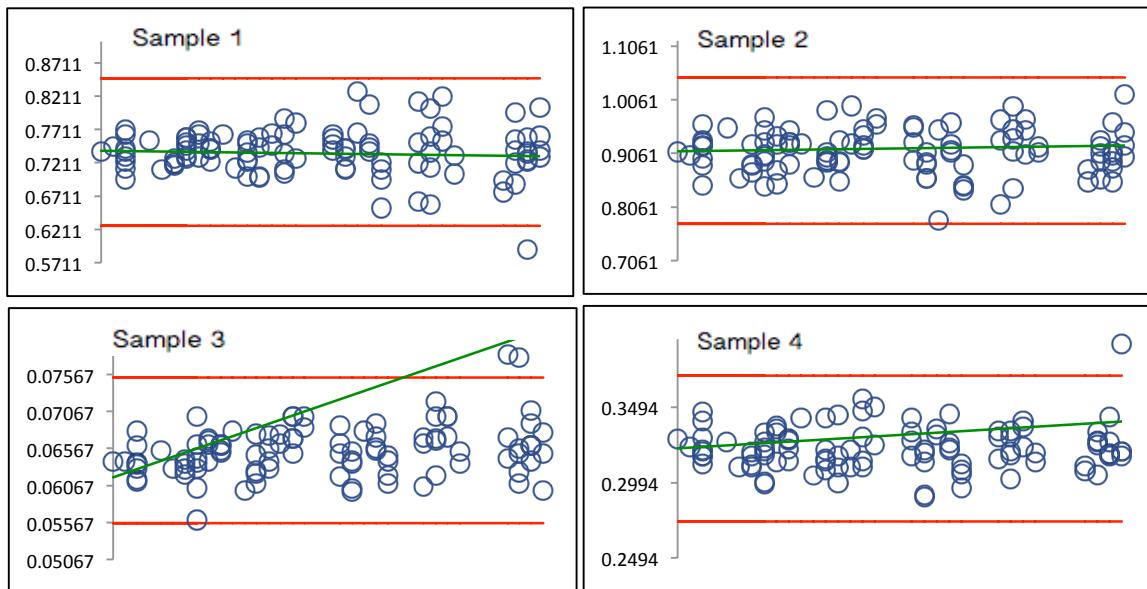
Reported results (Y-axis) plotted against reported analysis date (X-axis)

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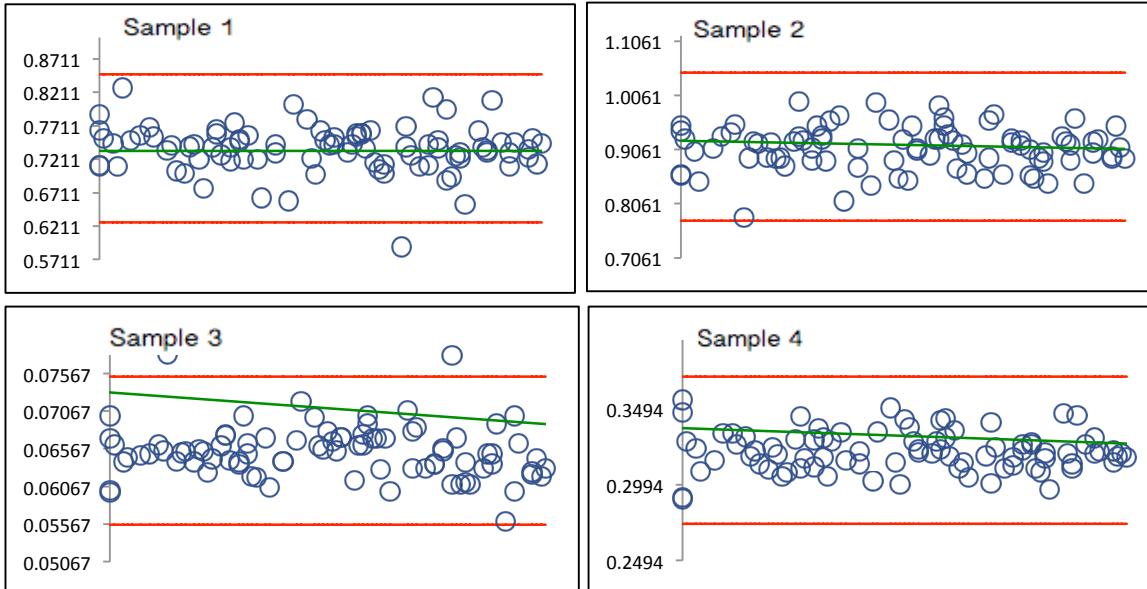
Reported results (Y-axis) plotted against bottling order (X-axis).

BERYLLIUM
Summary Statistics

Statistic	C02A-1	C02A-2	C02A-3	C02A-4
N	93	93	91	93
Median	0.0678	0.0870	0.0475	0.0549
Robust Mean	0.0677	0.0872	0.0475	0.0549
U	0.00047	0.00063	0.00035	0.00043
Robust Standard Deviation	0.00360	0.00489	0.00270	0.00328
Regression Standard Deviation	0.00508	0.00654	0.00357	0.00412
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA)	0.00508	0.00654	0.00357	0.00412
Outliers	2	2	2	2
|z|>3.0	3	3	2	1
2<|z|<3	3	3	2	6

Methods Used

Method	C02A-1	C02A-2	C02A-3	C02A-4
ICP/MS	71	71	71	71
ICP/OES	20	20	18	20
AA	1	1	1	1
AAG	1	1	1	1

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

Sample 1

Sample 2

Sample 3

Sample 4
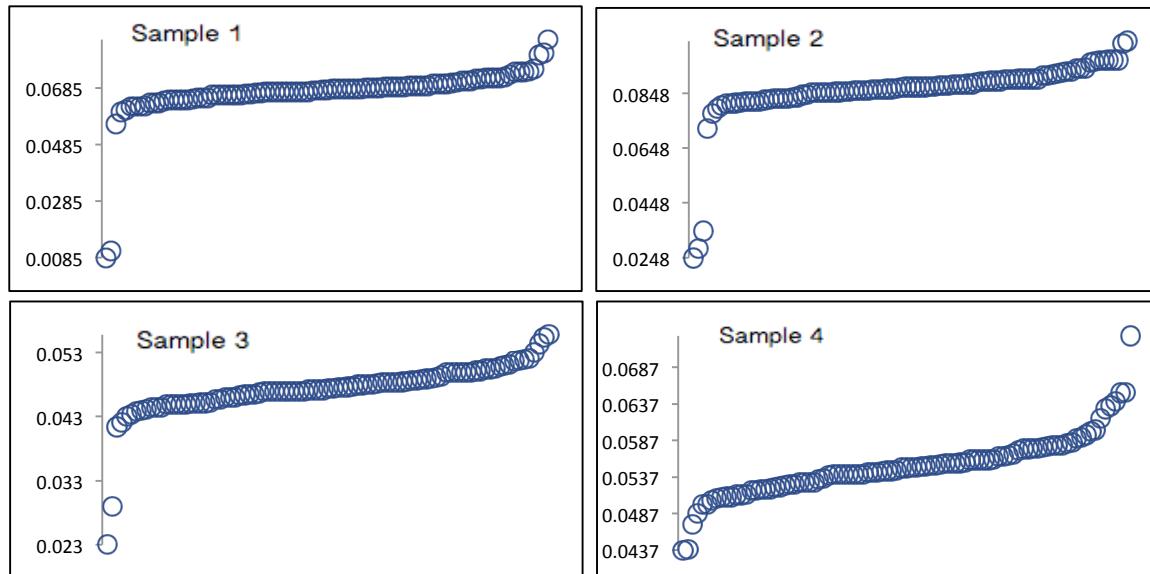
BERYLLIUM

## z-Score Plots
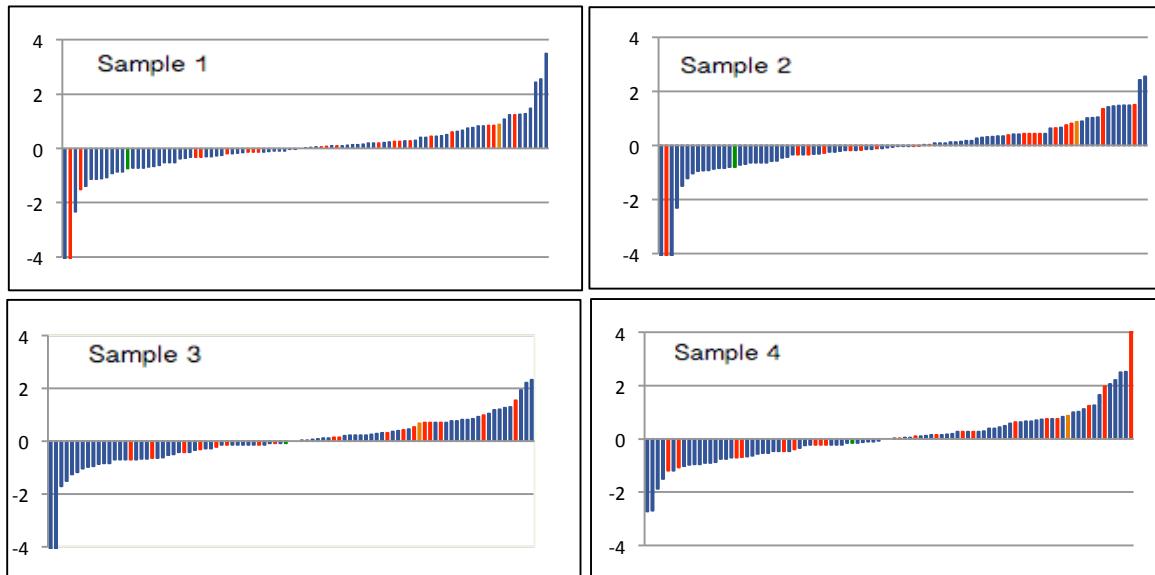
Kernel Density Plots
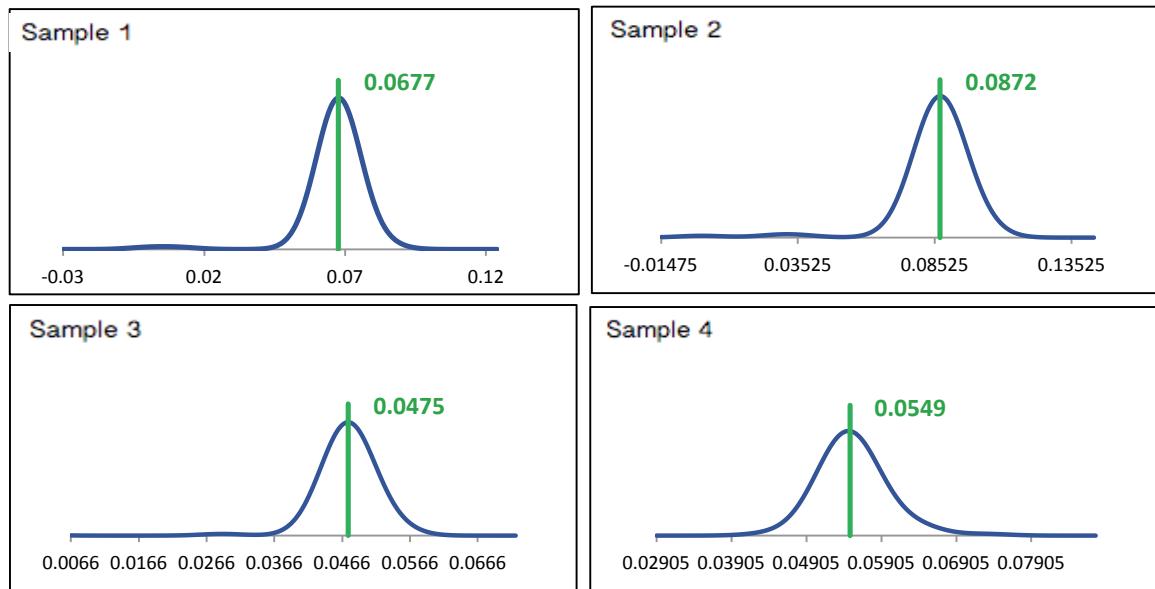
BERYLLIUM

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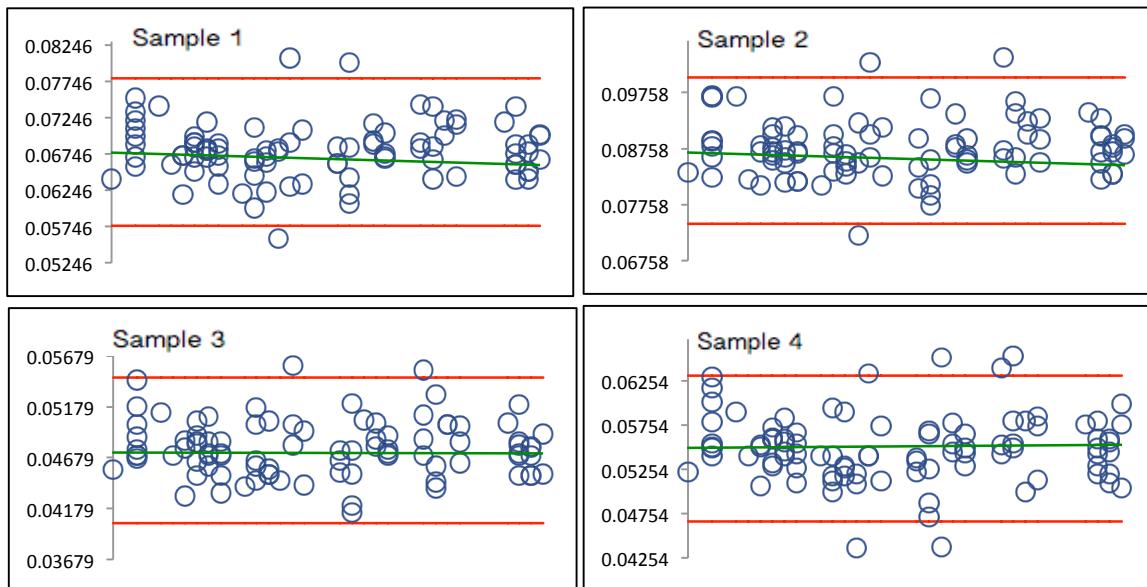
Reported results (Y-axis) plotted against reported analysis date (X-axis)

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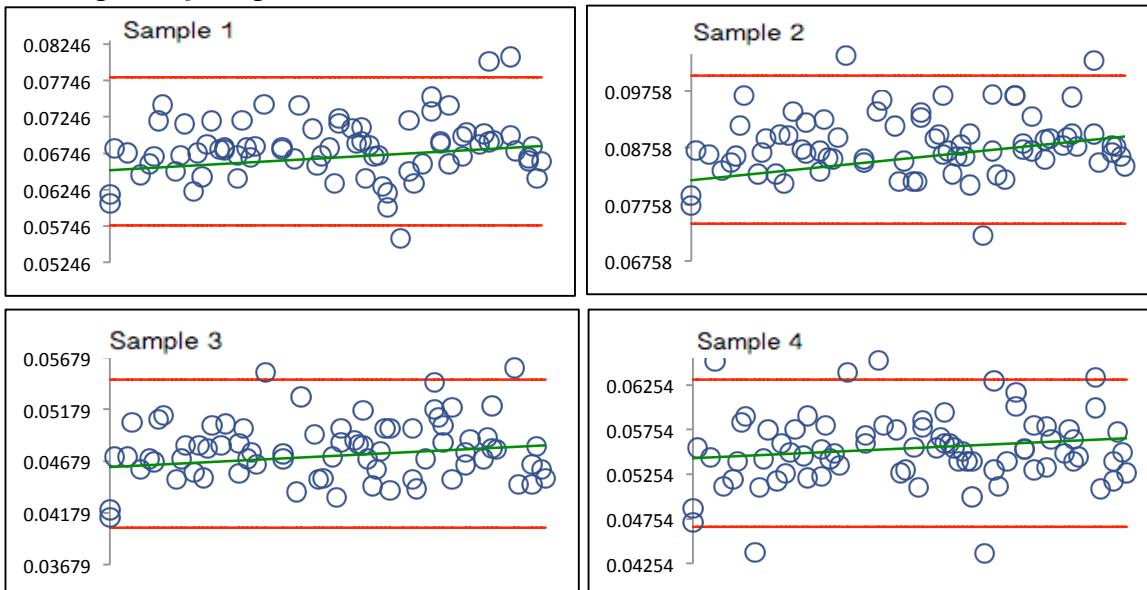
Reported results (Y-axis) plotted against bottling order (X-axis).

BORON

Summary Statistics

Statistic	C02A-1	C02A-2	C02A-3	C02A-4
N	94	94	94	94
Median	0.581	0.874	1.21	0.381
Robust Mean	0.583	0.874	1.22	0.383
U	0.00483	0.00625	0.00933	0.00324
Robust Standard Deviation	0.0375	0.0485	0.0724	0.0251
Regression Standard Deviation	0.0437	0.0655	0.0911	0.0287
Stability Flag				Stability
Homogeneity Flag				
Standard Deviation Used (SDPA)	0.0437	0.0655	0.0911	0.0306
Outliers	2	2	2	2
|z|>3.0	4	5	5	5
2<|z|<3	3	3	2	5

Methods Used

Method	C02A-1	C02A-2	C02A-3	C02A-4
ICP/OES	26	26	26	26
ICP/MS	68	68	68	68

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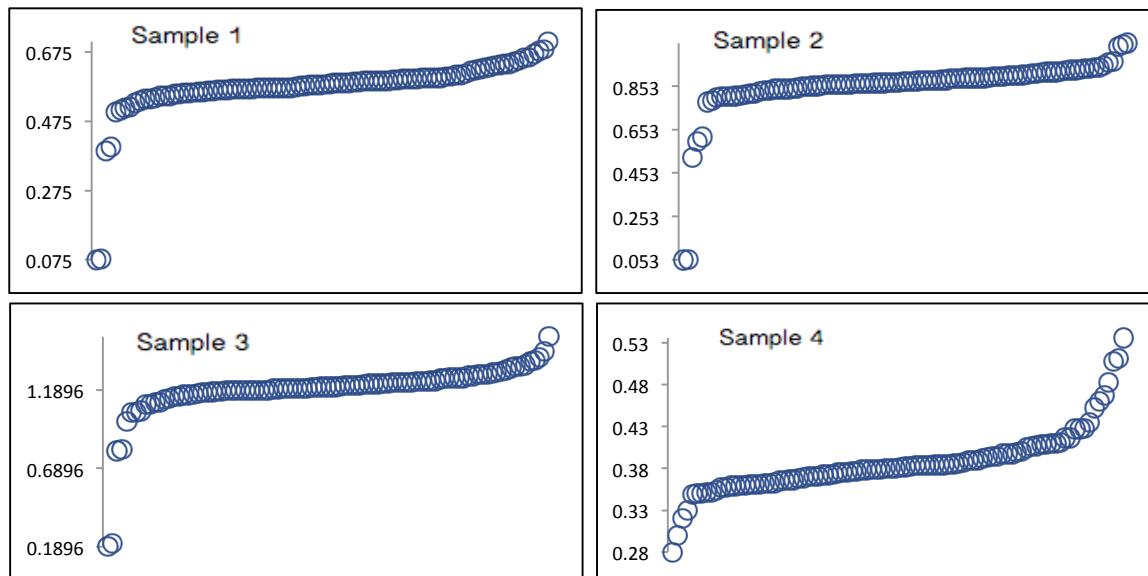
BORON

## z-Score Plots
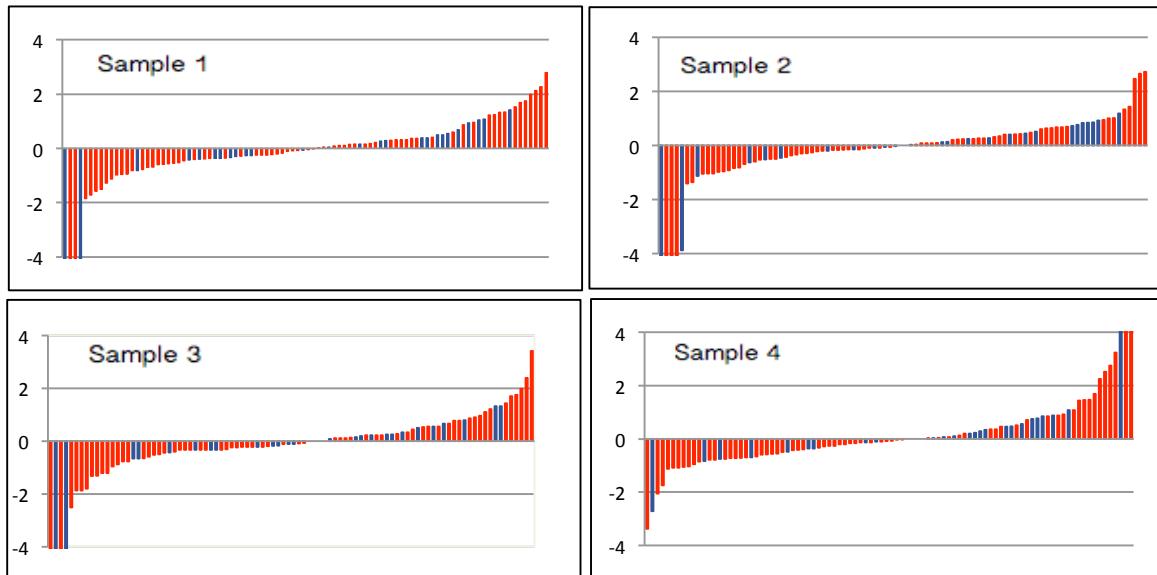
Kernel Density Plots
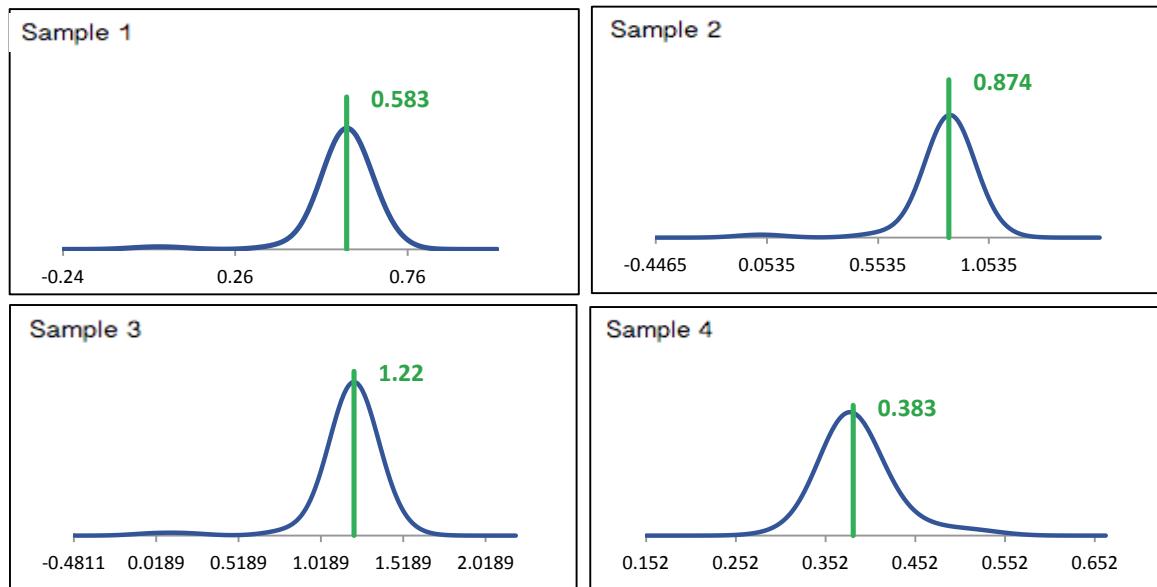
BORON

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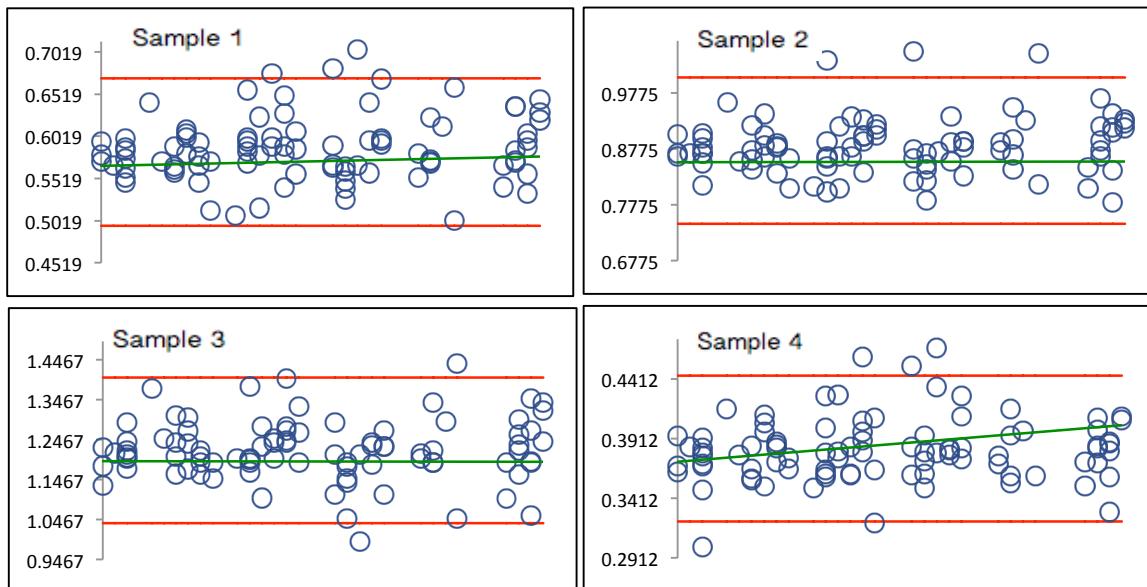
Reported results (Y-axis) plotted against reported analysis date (X-axis)

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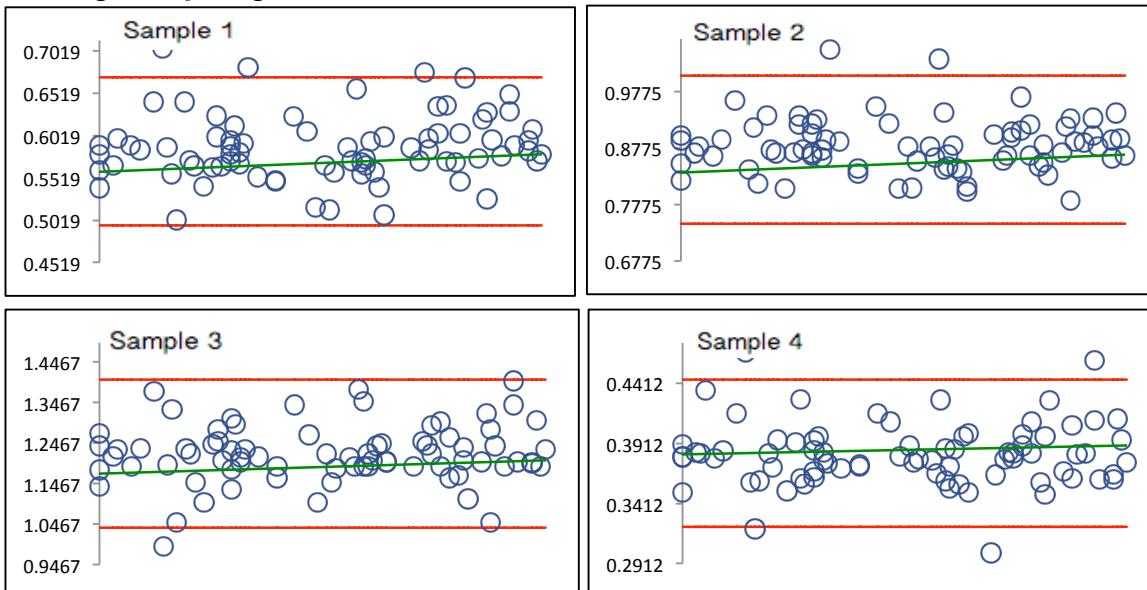
Reported results (Y-axis) plotted against bottling order (X-axis).

CADMIUM

Summary Statistics

Statistic	C02A-1	C02A-2	C02A-3	C02A-4
N	108	109	109	109
Median	0.0933	0.0503	0.0340	0.0680
Robust Mean	0.0938	0.0503	0.0342	0.0682
U	0.00038	0.00022	0.00021	0.00032
Robust Standard Deviation	0.00313	0.00183	0.00178	0.00263
Regression Standard Deviation	0.00703	0.00377	0.00257	0.00512
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA)	0.00703	0.00377	0.00257	0.00512
Outliers	3	2	2	2
|z|>3.0	2	3	3	0
2<|z|<3	1	0	3	0

Methods Used

Method	C02A-1	C02A-2	C02A-3	C02A-4
ICP/MS	80	81	81	81
ICP/OES	26	26	26	26
AA	1	1	1	1
AAG	1	1	1	1

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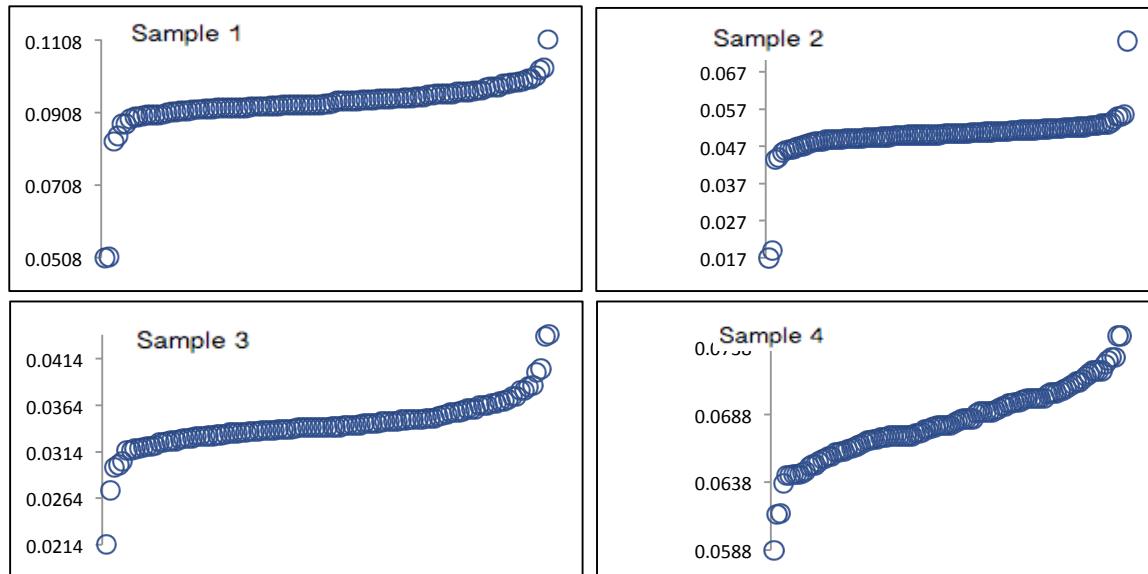
CADMIUM

## z-Score Plots
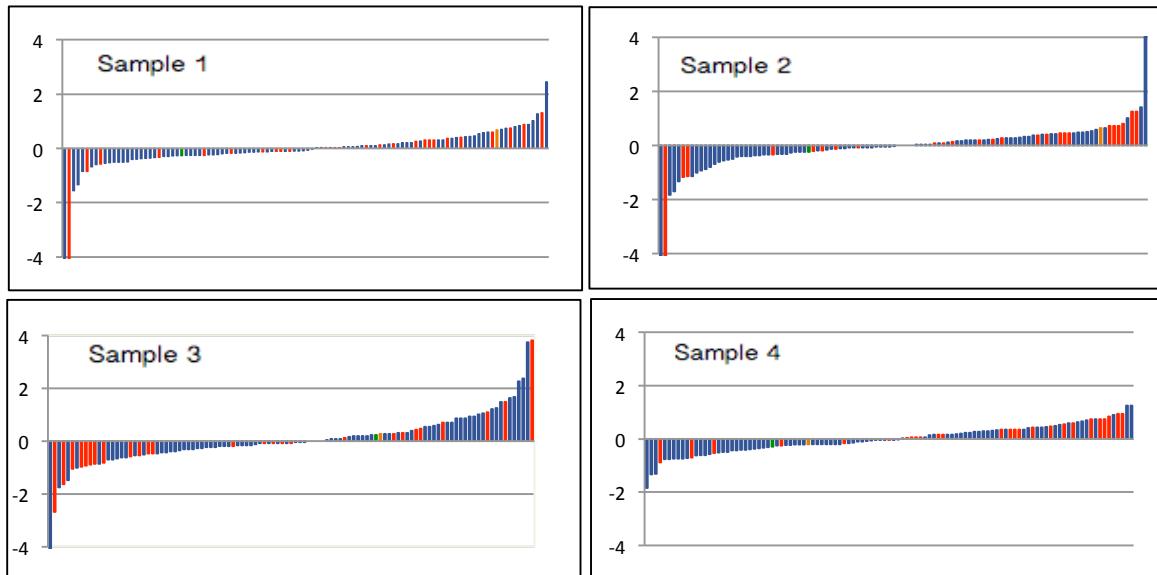
Kernel Density Plots
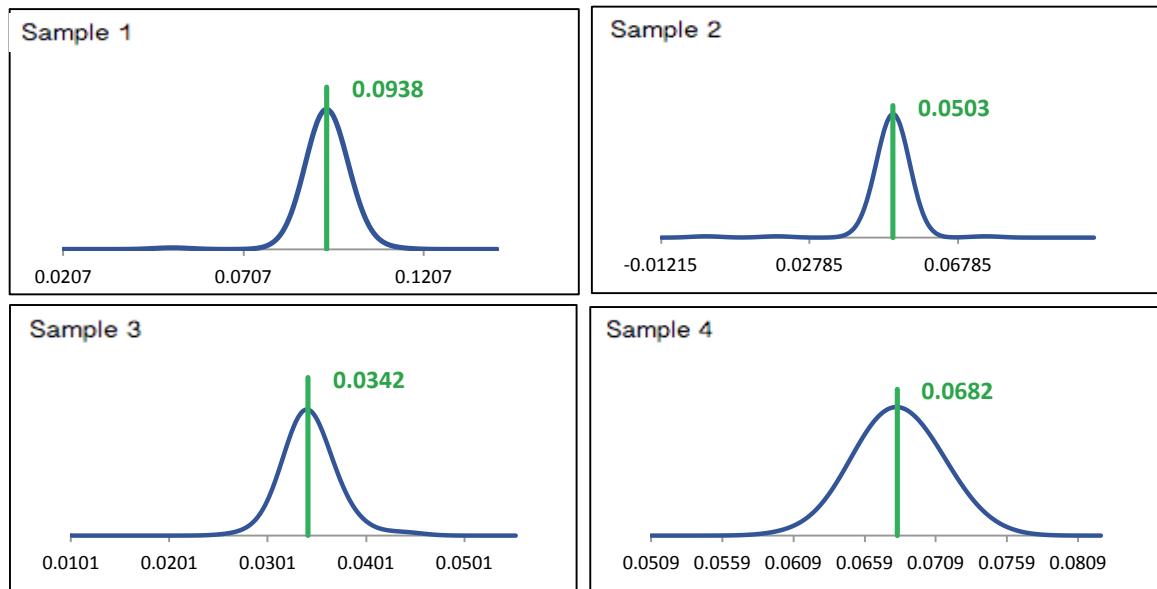
CADMIUM

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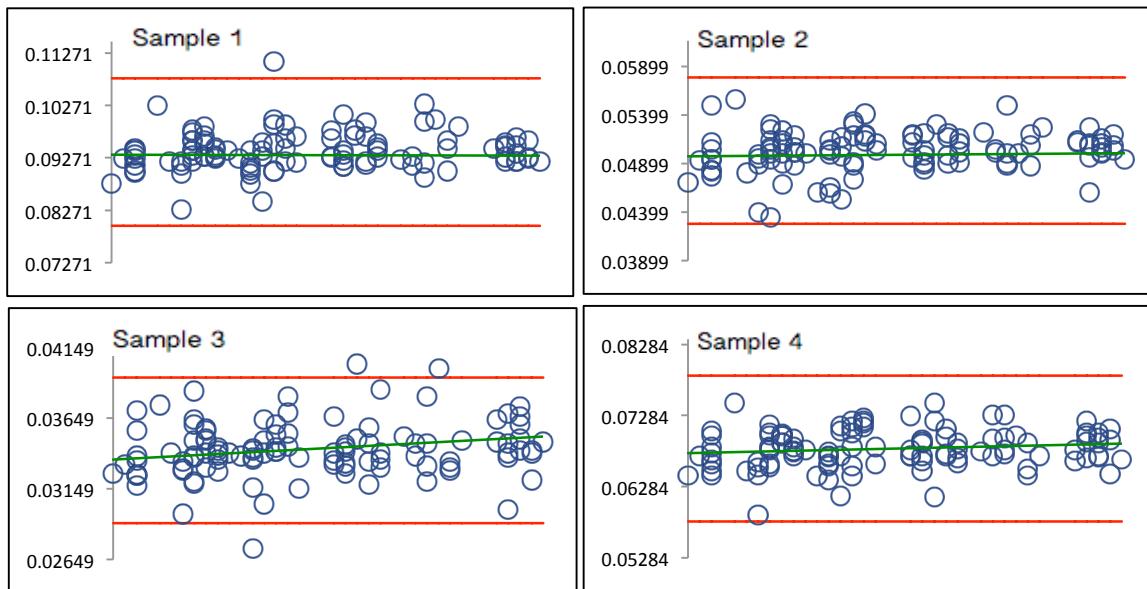
Reported results (Y-axis) plotted against reported analysis date (X-axis)

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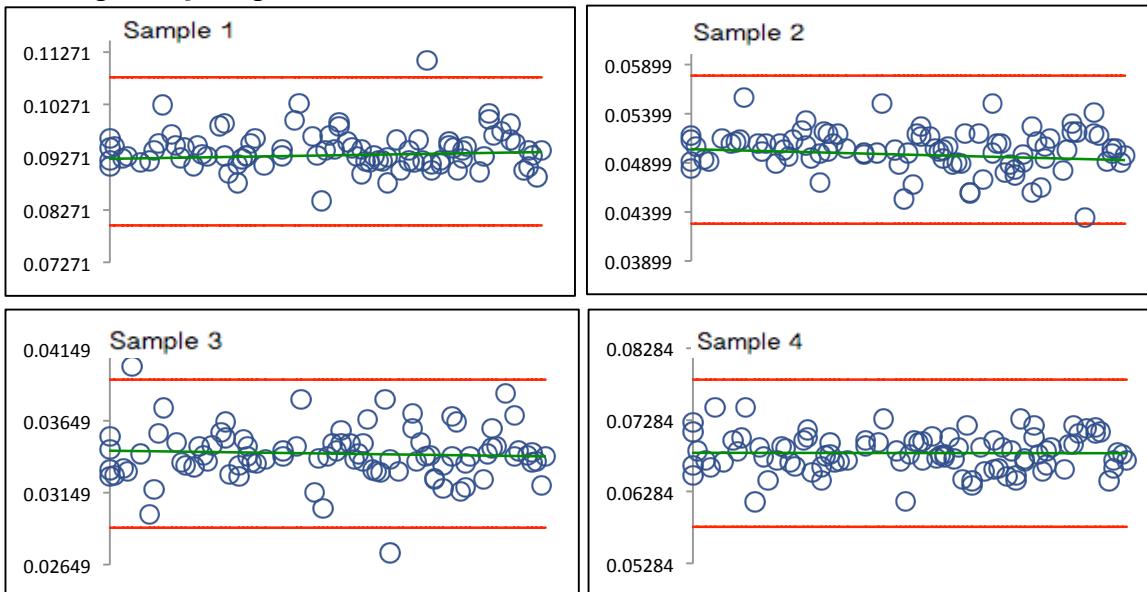
Reported results (Y-axis) plotted against bottling order (X-axis).

CHROMIUM

Summary Statistics

Statistic	C02A-1	C02A-2	C02A-3	C02A-4
N	105	105	105	105
Median	1.01	0.652	0.614	0.123
Robust Mean	1.00	0.651	0.614	0.124
U	0.00431	0.00306	0.00310	0.00060
Robust Standard Deviation	0.0353	0.0251	0.0254	0.00491
Regression Standard Deviation	0.0752	0.0488	0.0460	0.00926
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA)	0.0752	0.0488	0.0460	0.00926
Outliers	3	3	3	3
|z|>3.0	2	2	3	3
2<|z|<3	2	1	0	1

Methods Used

Method	C02A-1	C02A-2	C02A-3	C02A-4
ICP/MS	79	79	79	79
ICP/OES	24	24	24	24
AAG	1	1	1	1
AA	1	1	1	1

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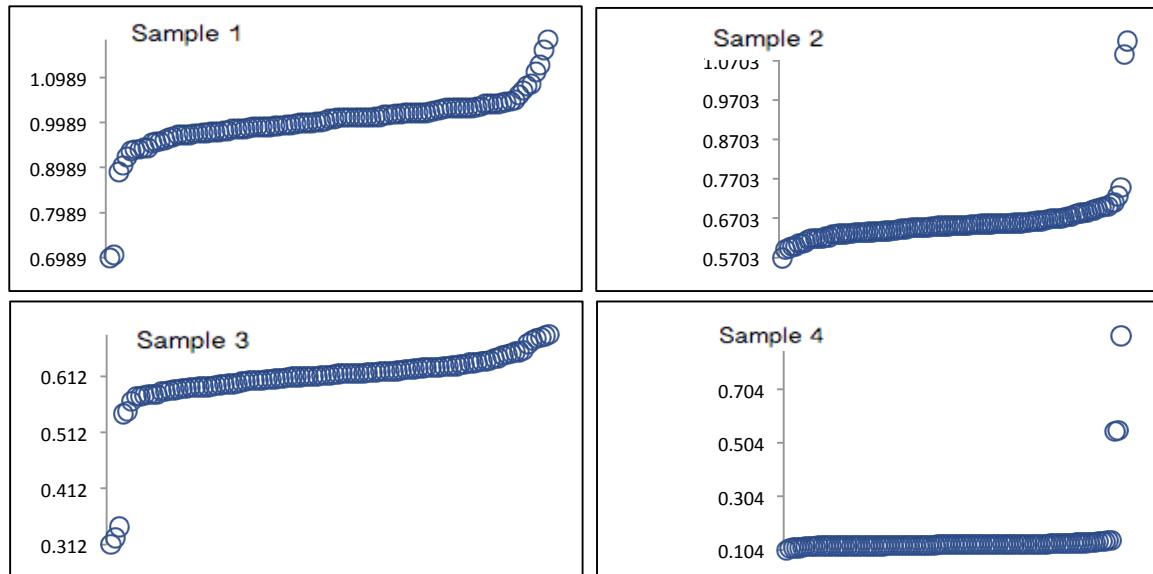
CHROMIUM

## z-Score Plots
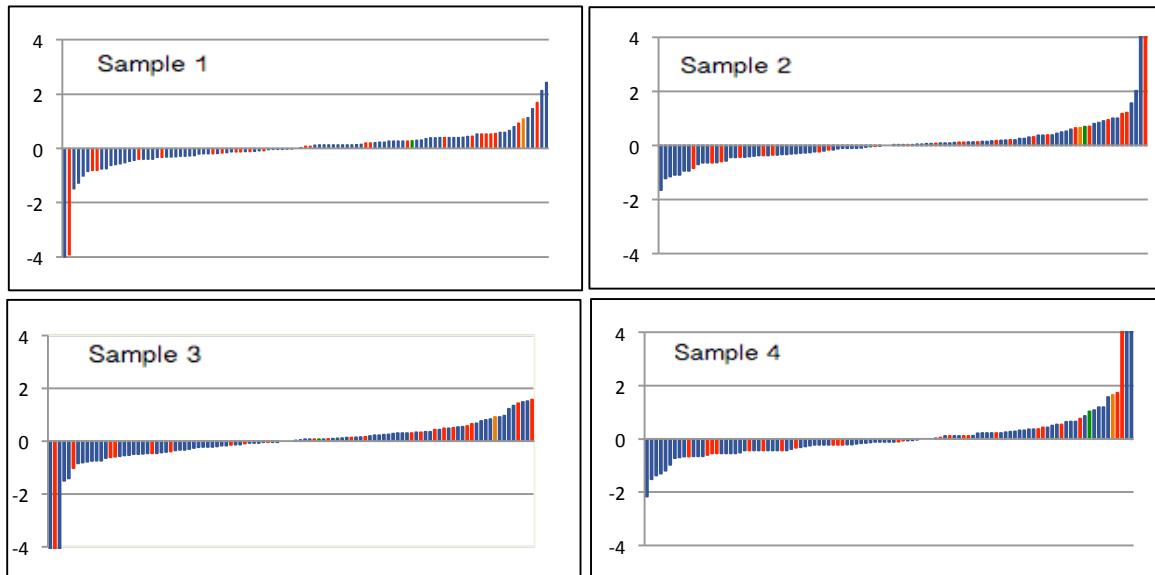
Kernel Density Plots
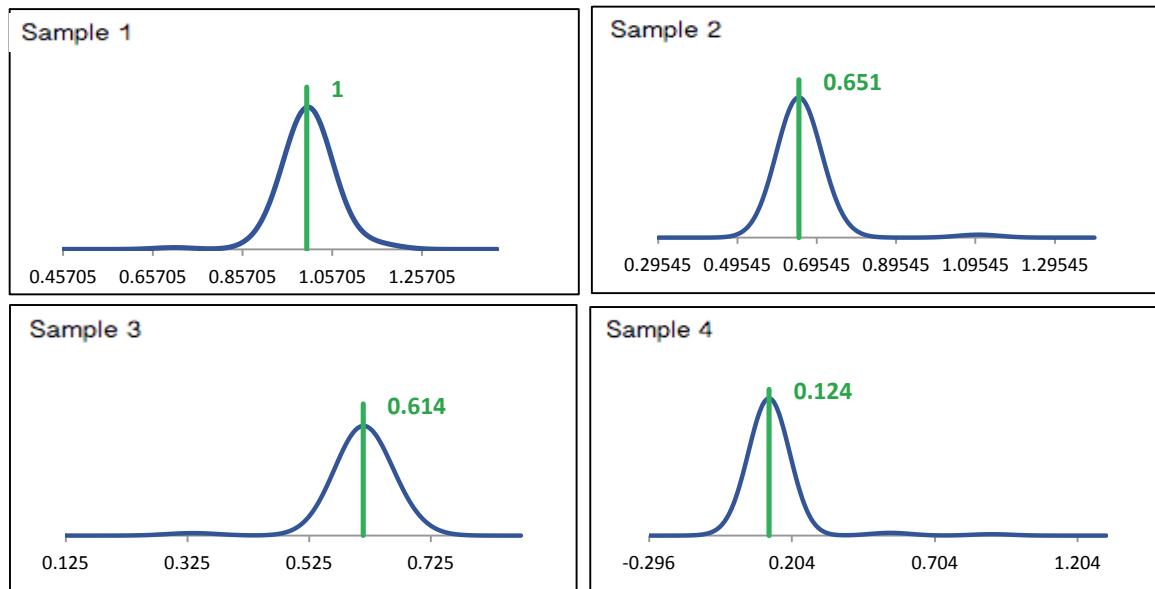
CHROMIUM

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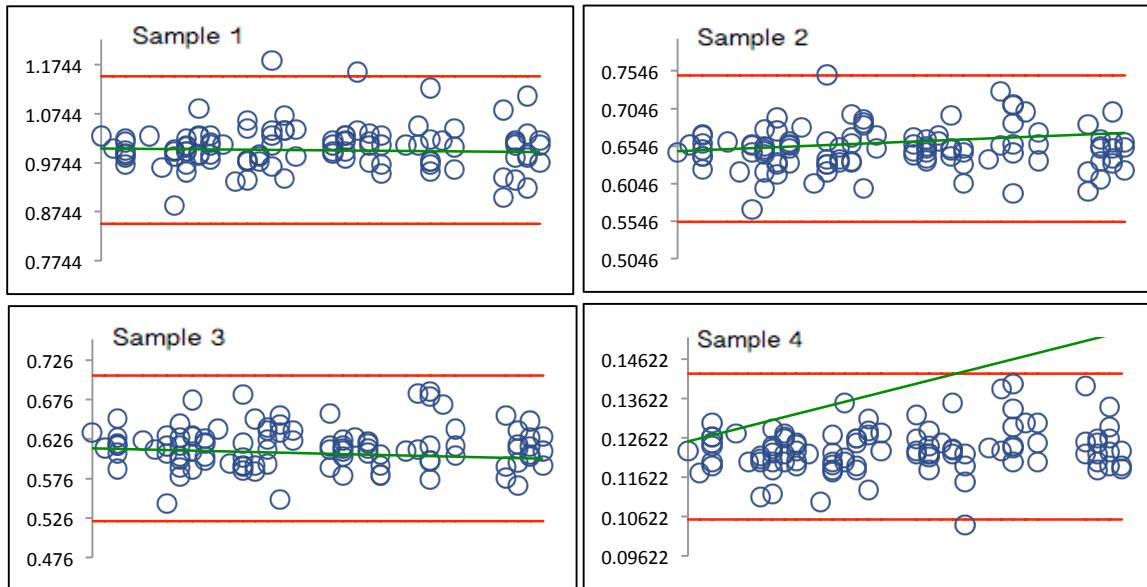
Reported results (Y-axis) plotted against reported analysis date (X-axis)

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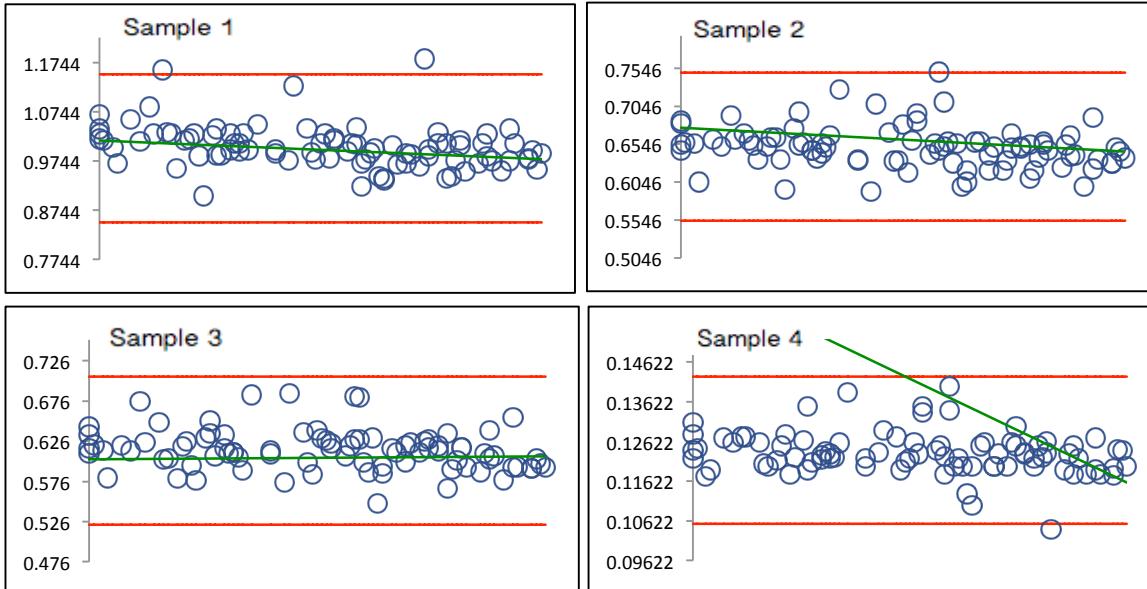
Reported results (Y-axis) plotted against bottling order (X-axis).

COBALT

Summary Statistics

Statistic	C02A-1	C02A-2	C02A-3	C02A-4
N	98	100	99	101
Median	0.896	0.255	1.21	0.607
Robust Mean	0.900	0.256	1.21	0.611
U	0.00376	0.00125	0.00623	0.00343
Robust Standard Deviation	0.0298	0.0100	0.0496	0.0276
Regression Standard Deviation	0.0675	0.0192	0.0908	0.0459
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA)	0.0675	0.0192	0.0908	0.0459
Outliers	6	4	5	3
|z|>3.0	0	2	2	0
2<|z|<3	1	0	0	2

Methods Used

Method	C02A-1	C02A-2	C02A-3	C02A-4
ICP/MS	73	74	74	75
ICP/OES	23	24	23	24
AA	1	1	1	1
AAG	1	1	1	1

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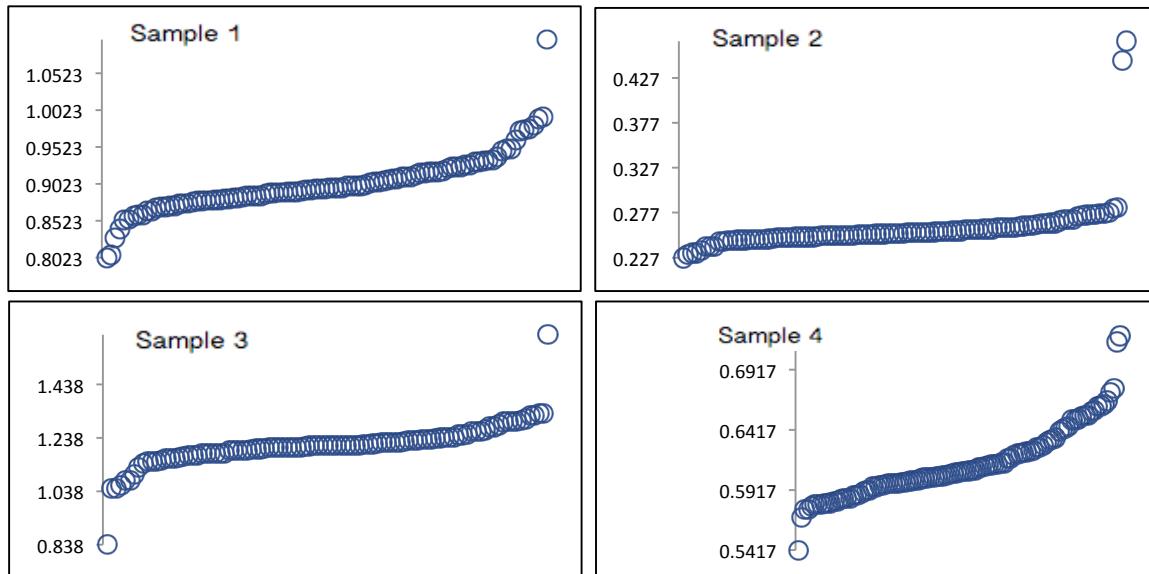
COBALT

### z-Score Plots
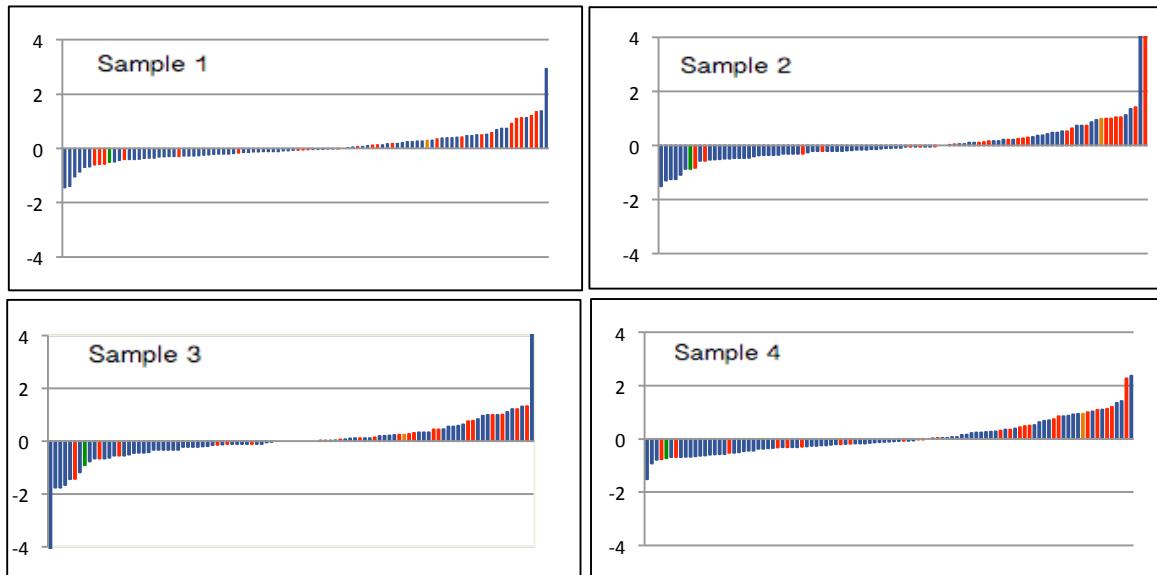
Kernel Density Plots
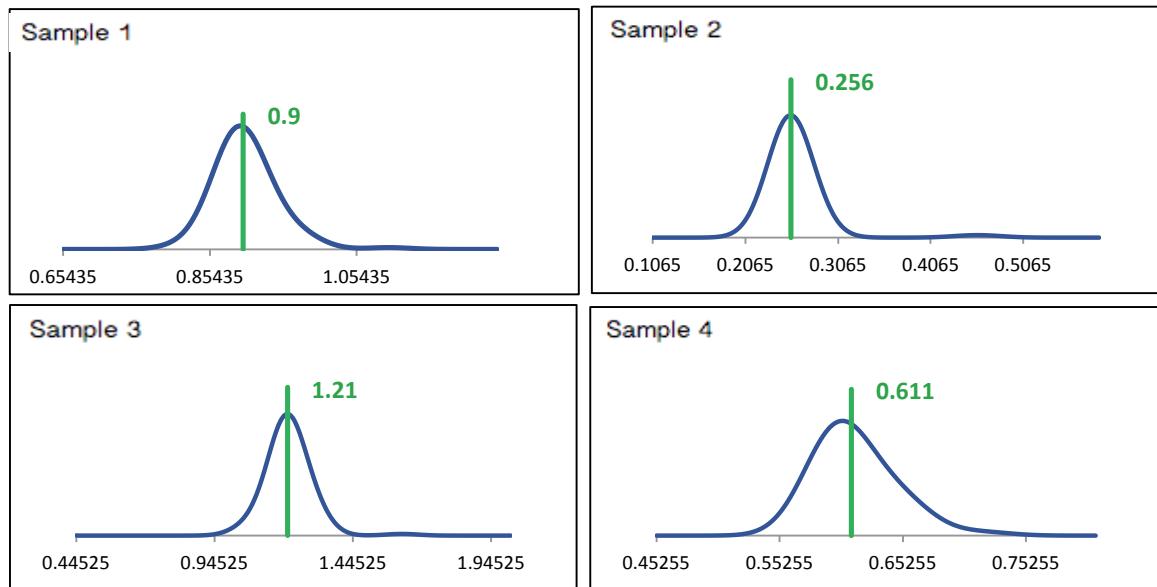
COBALT

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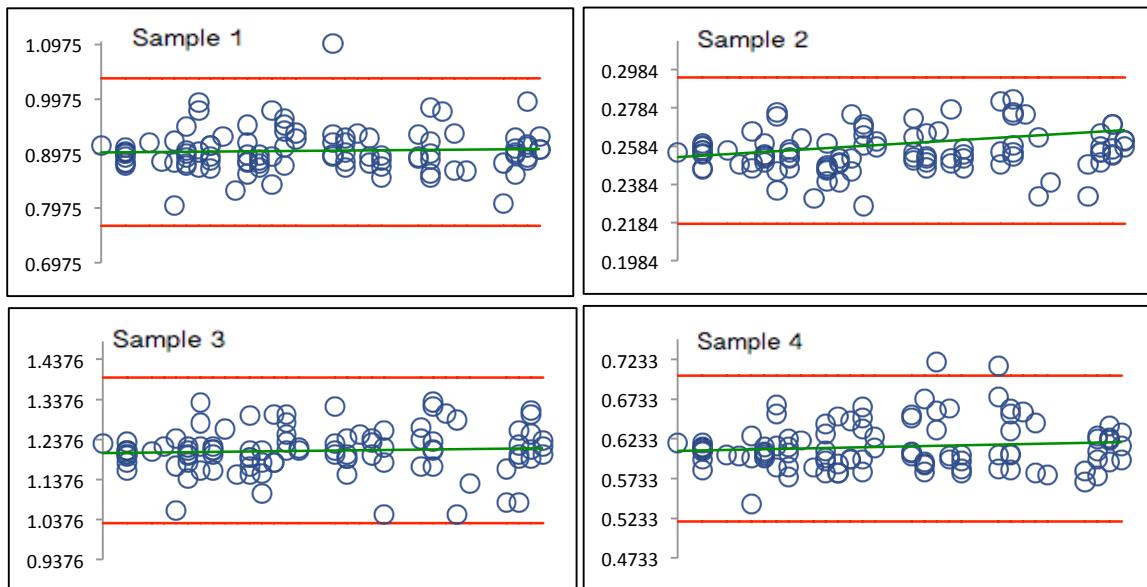
Reported results (Y-axis) plotted against reported analysis date (X-axis)

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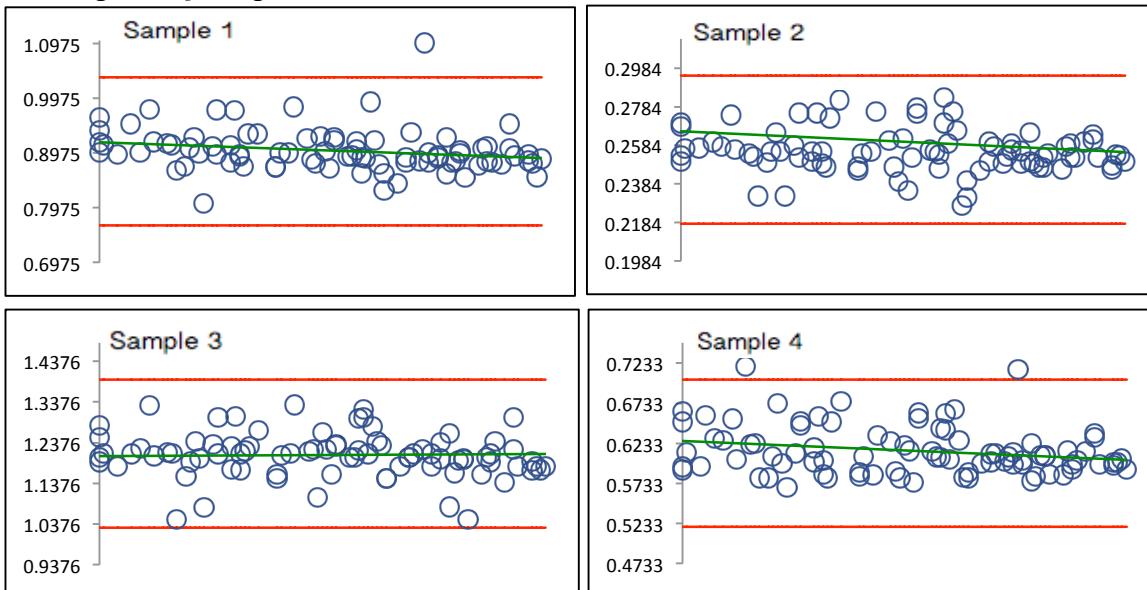
Reported results (Y-axis) plotted against bottling order (X-axis).

COPPER

Summary Statistics

Statistic	C02A-1	C02A-2	C02A-3	C02A-4
N	115	115	115	115
Median	0.750	1.05	0.495	0.256
Robust Mean	0.753	1.05	0.493	0.257
U	0.00420	0.00521	0.00277	0.00148
Robust Standard Deviation	0.0360	0.0447	0.0238	0.0127
Regression Standard Deviation	0.0565	0.0787	0.0370	0.0192
Stability Flag				
Homogeneity Flag			Homogeneity	
Standard Deviation Used (SDPA)	0.0565	0.0787	0.0468	0.0192
Outliers	3	3	3	3
|z|>3.0	3	3	2	4
2<|z|<3	4	1	1	1

Methods Used

Method	C02A-1	C02A-2	C02A-3	C02A-4
ICP/MS	85	85	85	85
ICP/OES	27	27	27	27
AA	1	1	1	1
AAG	1	1	1	1

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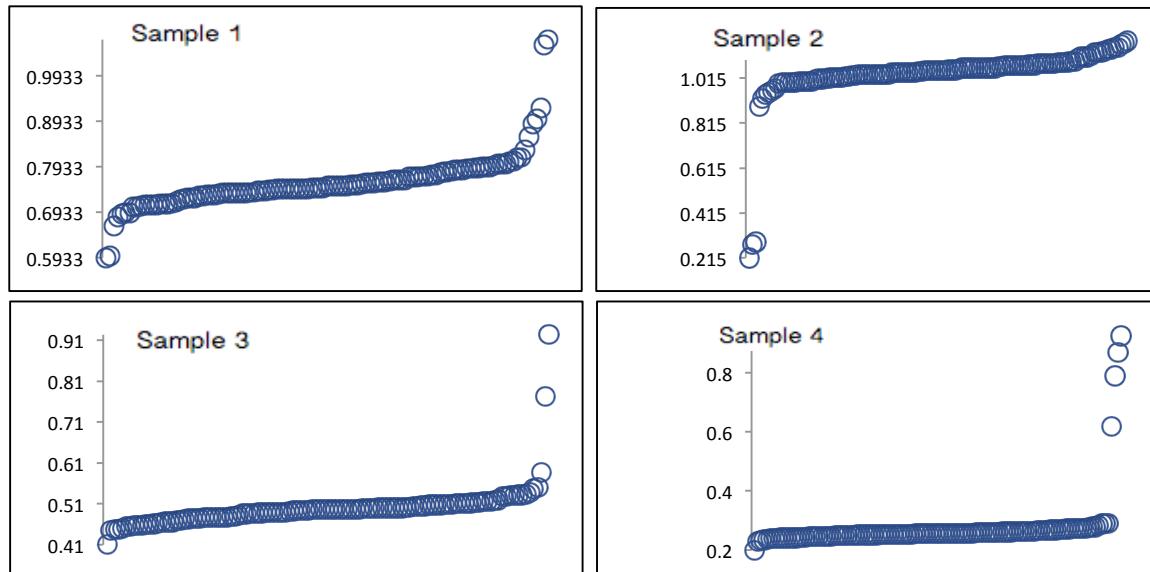
COPPER

## z-Score Plots
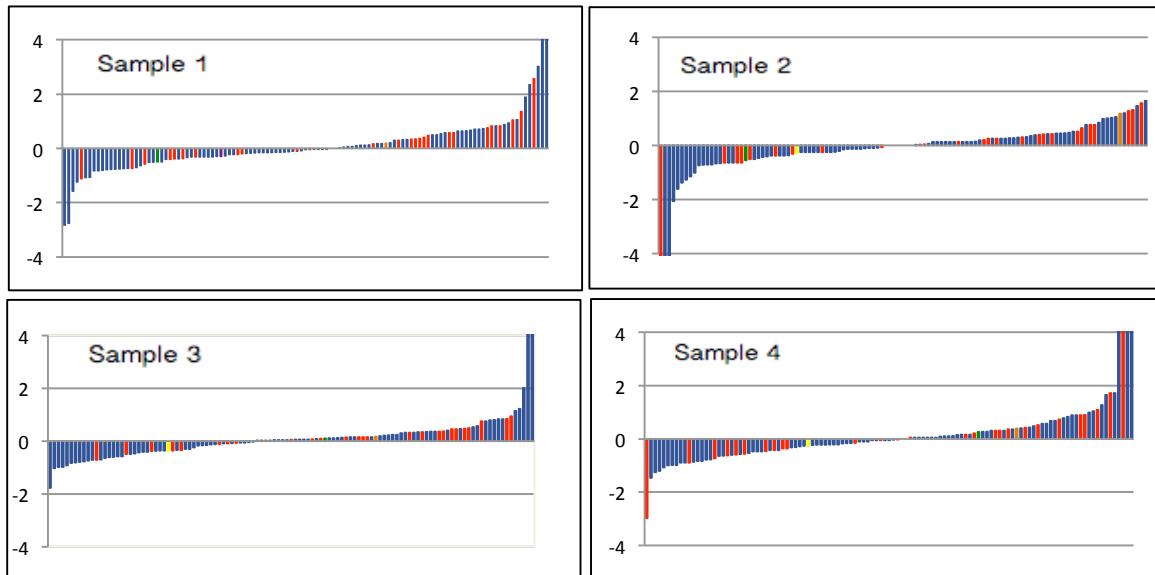
Kernel Density Plots
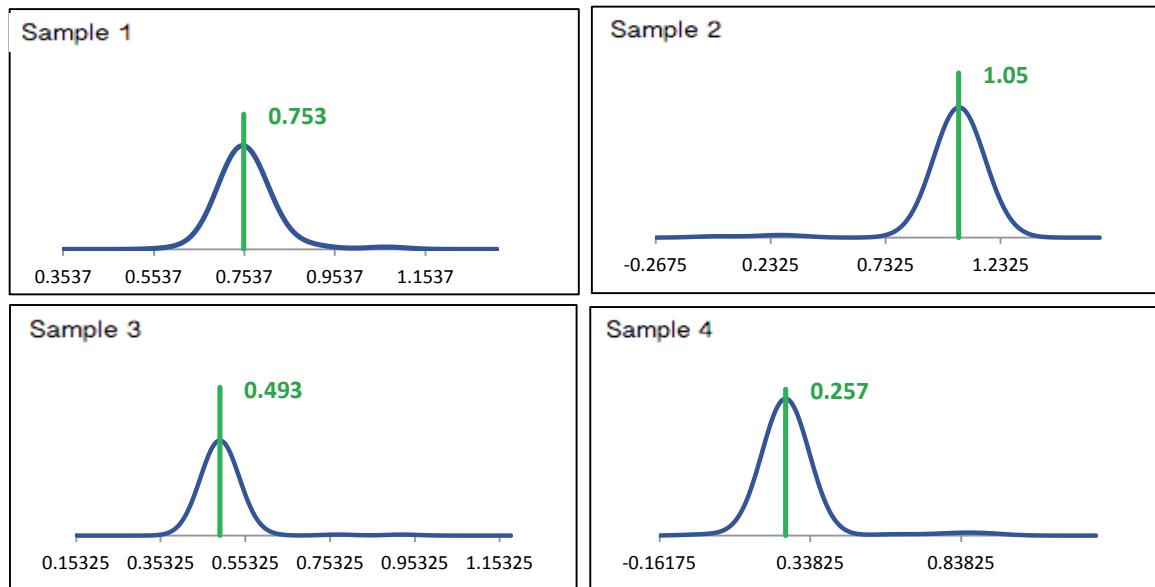
COPPER

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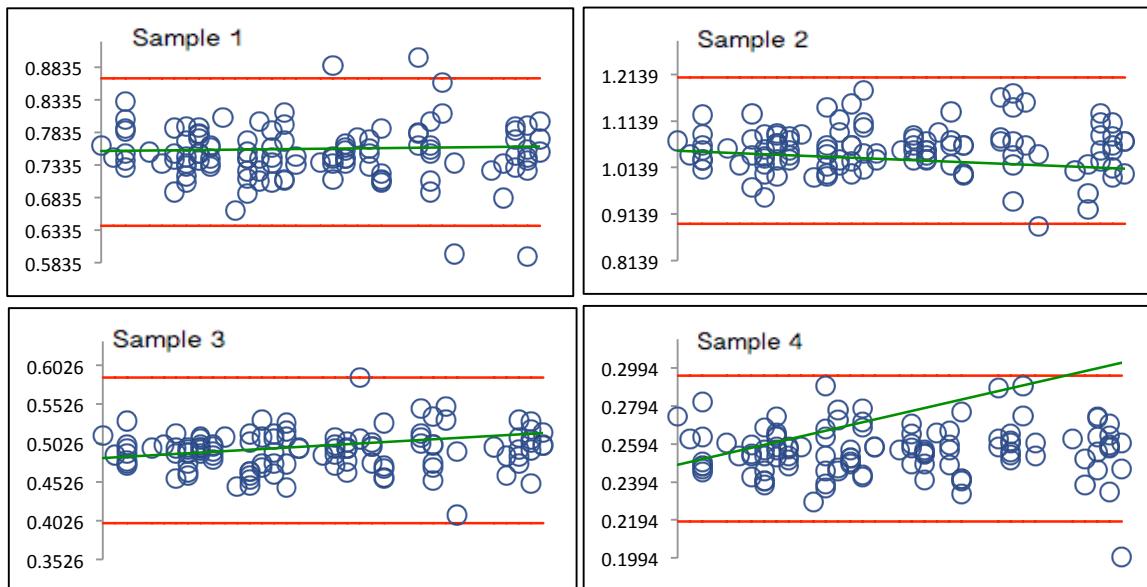
Reported results (Y-axis) plotted against reported analysis date (X-axis)

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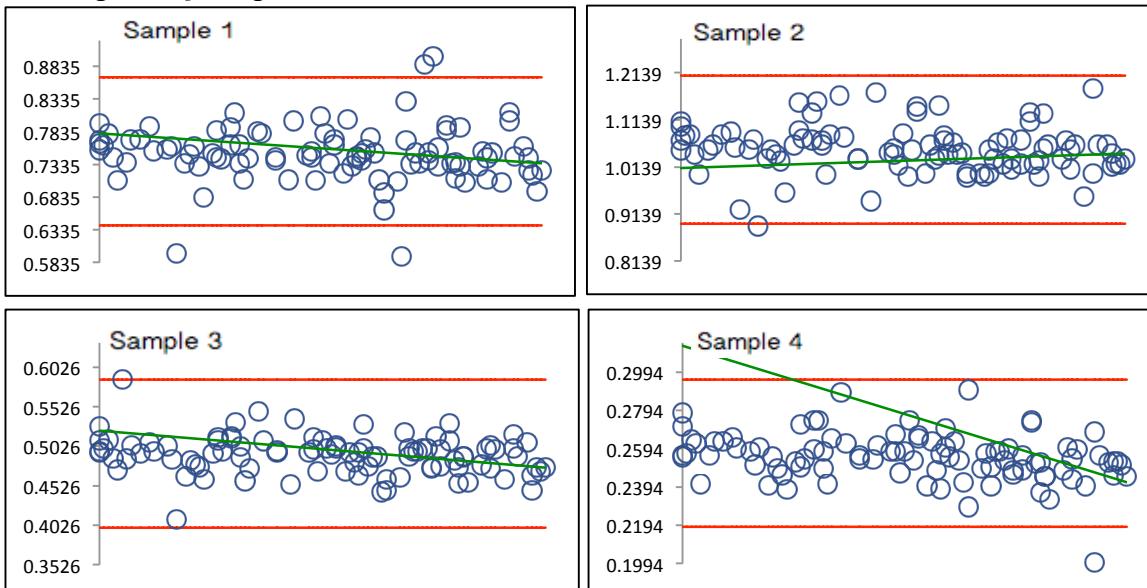
Reported results (Y-axis) plotted against bottling order (X-axis).

IRON

Summary Statistics

Statistic	C02A-1	C02A-2	C02A-3	C02A-4
N	101	111	111	111
Median	0.0800	0.600	0.899	1.13
Robust Mean	0.0802	0.601	0.897	1.13
U	0.00080	0.00339	0.00448	0.00578
Robust Standard Deviation	0.00640	0.0286	0.0378	0.0487
Regression Standard Deviation	0.00602	0.0451	0.0673	0.0844
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA)	0.00640	0.0451	0.0673	0.0844
Outliers	3	3	3	3
|z|>3.0	9	4	4	3
2<|z|<3	4	1	2	2

Methods Used
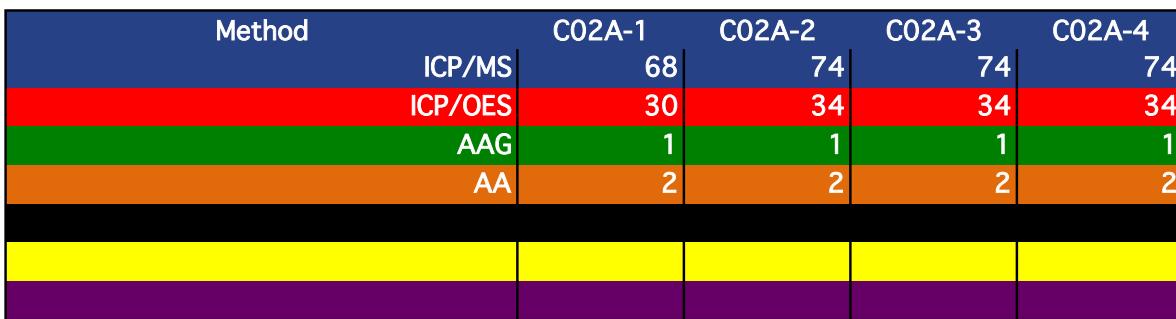
Method	C02A-1	C02A-2	C02A-3	C02A-4
ICP/MS	68	74	74	74
ICP/OES	30	34	34	34
AAG	1	1	1	1
AA	2	2	2	2

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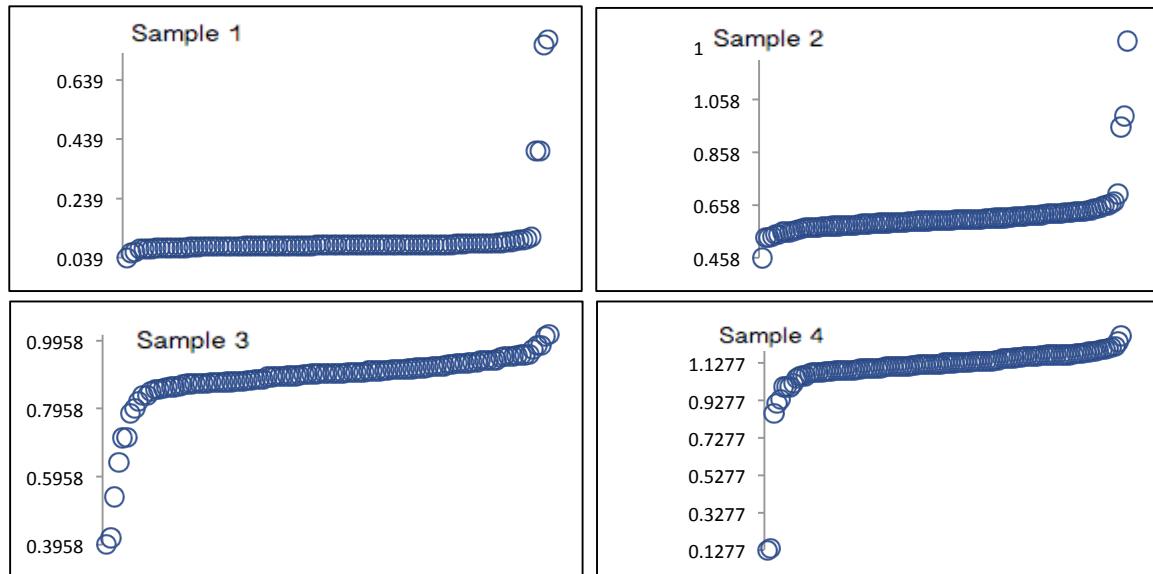
IRON

## z-Score Plots
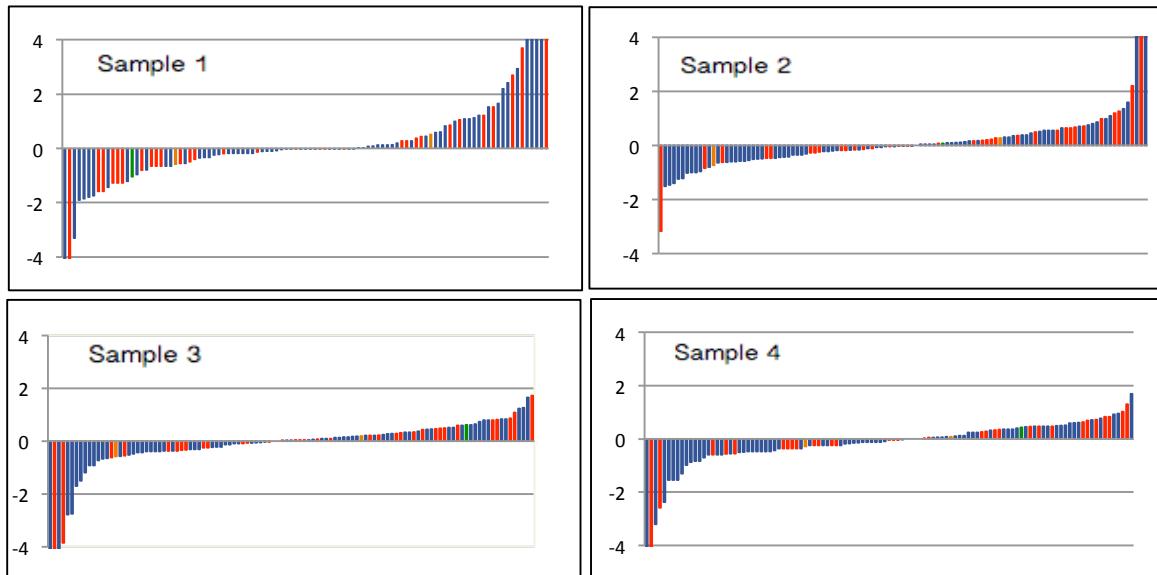
Kernel Density Plots
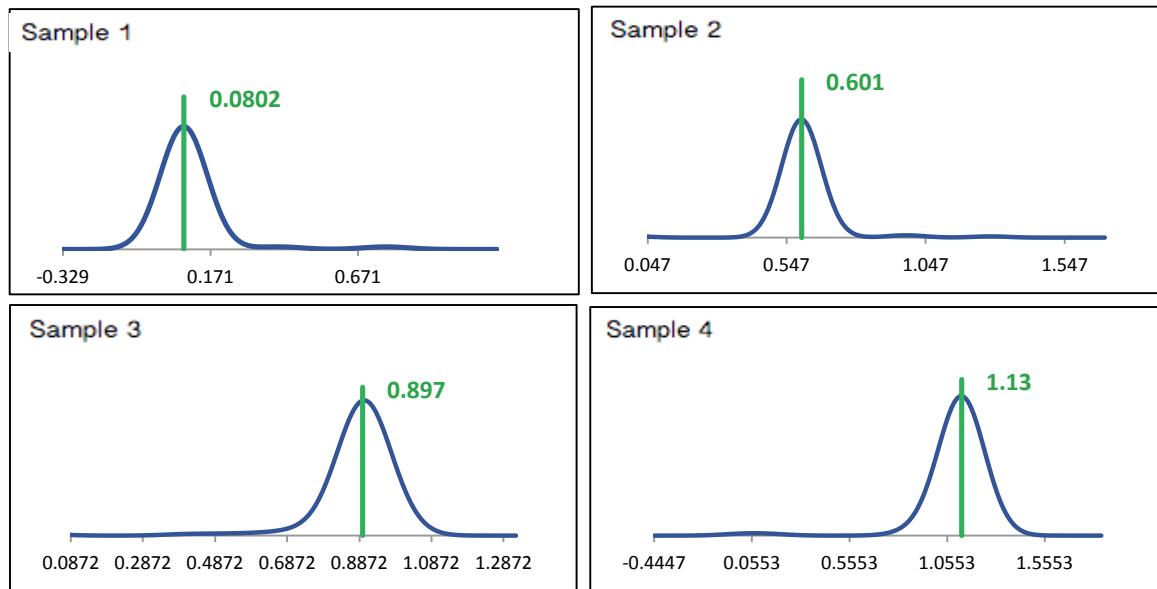
IRON

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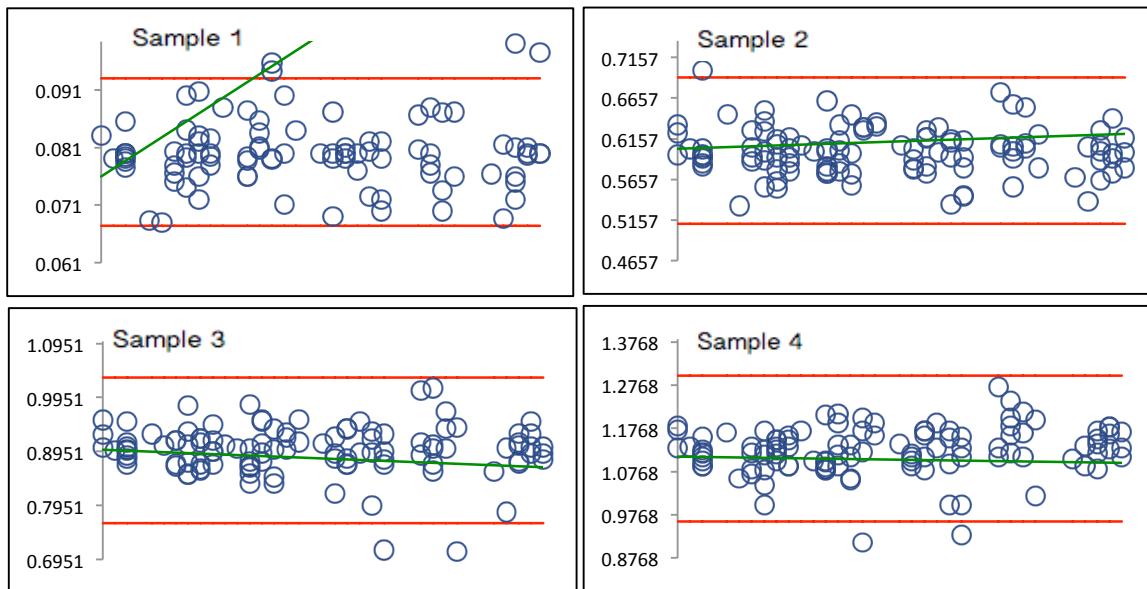
Reported results (Y-axis) plotted against reported analysis date (X-axis)

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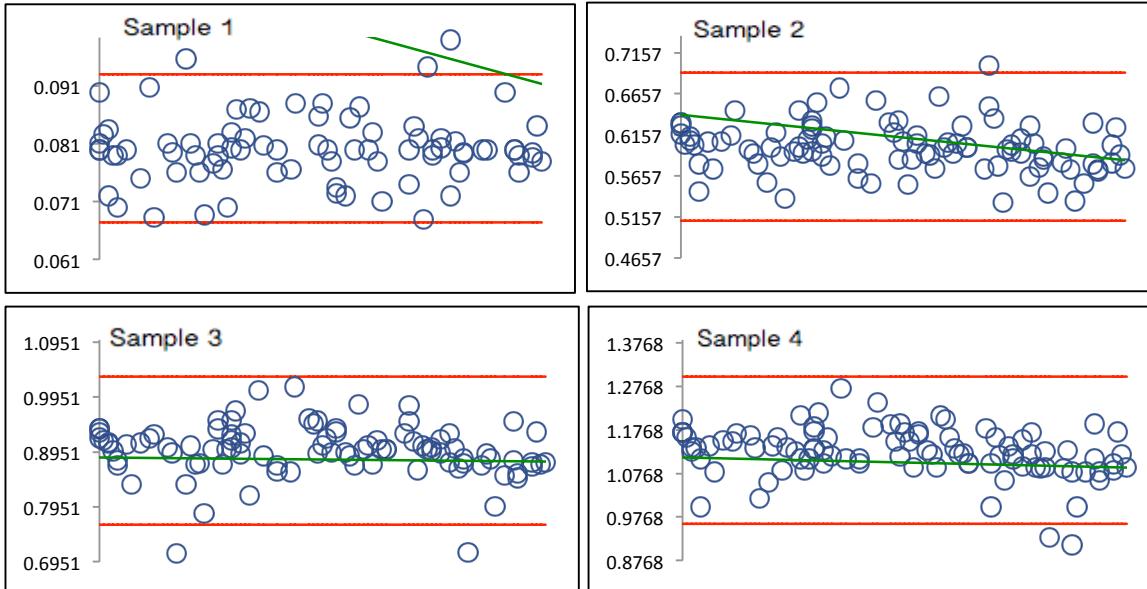
Reported results (Y-axis) plotted against bottling order (X-axis).

LEAD

Summary Statistics

Statistic	C02A-1	C02A-2	C02A-3	C02A-4
N	111	112	112	112
Median	0.0886	0.400	0.730	0.964
Robust Mean	0.0887	0.403	0.735	0.968
U	0.00049	0.00208	0.00399	0.00513
Robust Standard Deviation	0.00409	0.0176	0.0338	0.0434
Regression Standard Deviation	0.00665	0.0302	0.0551	0.0726
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA)	0.00665	0.0302	0.0551	0.0726
Outliers	3	3	3	3
|z|>3.0	6	0	4	2
2<|z|<3	2	2	1	1

Methods Used

Method	C02A-1	C02A-2	C02A-3	C02A-4
AA	1	1	1	1
ICP/MS	85	85	85	85
ICP/OES	23	24	24	24
AAG	1	1	1	1

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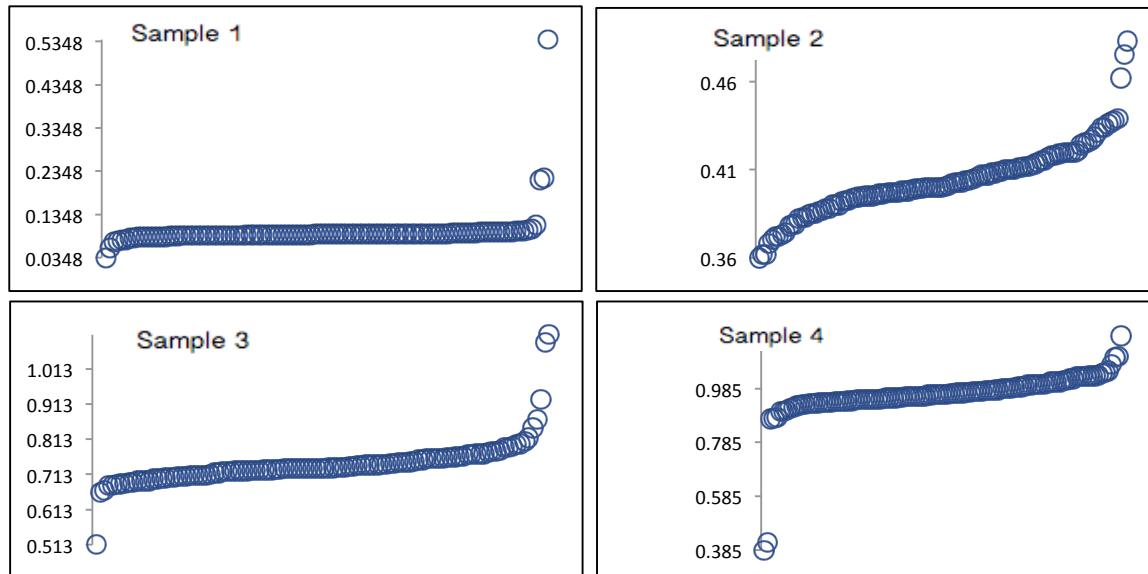
LEAD

z-Score Plots
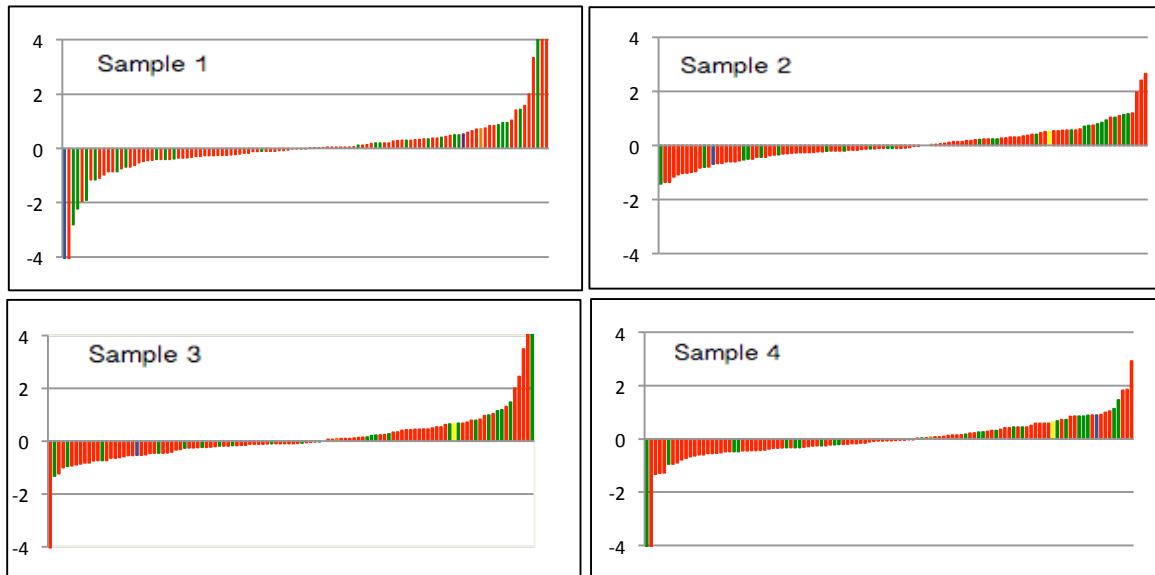
Kernel Density Plots
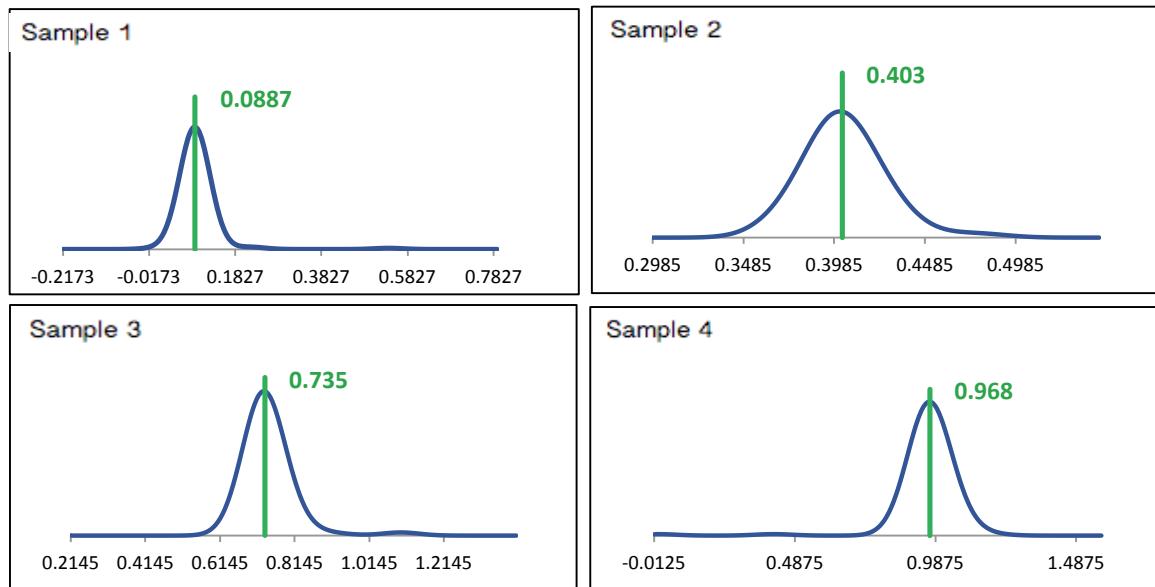
LEAD

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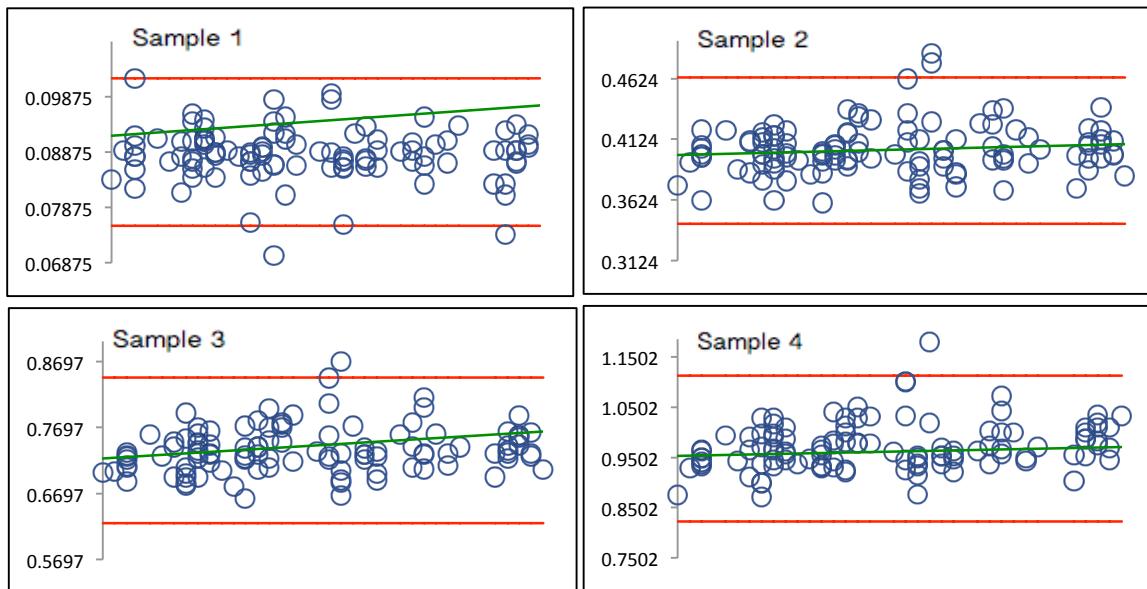
Reported results (Y-axis) plotted against reported analysis date (X-axis)

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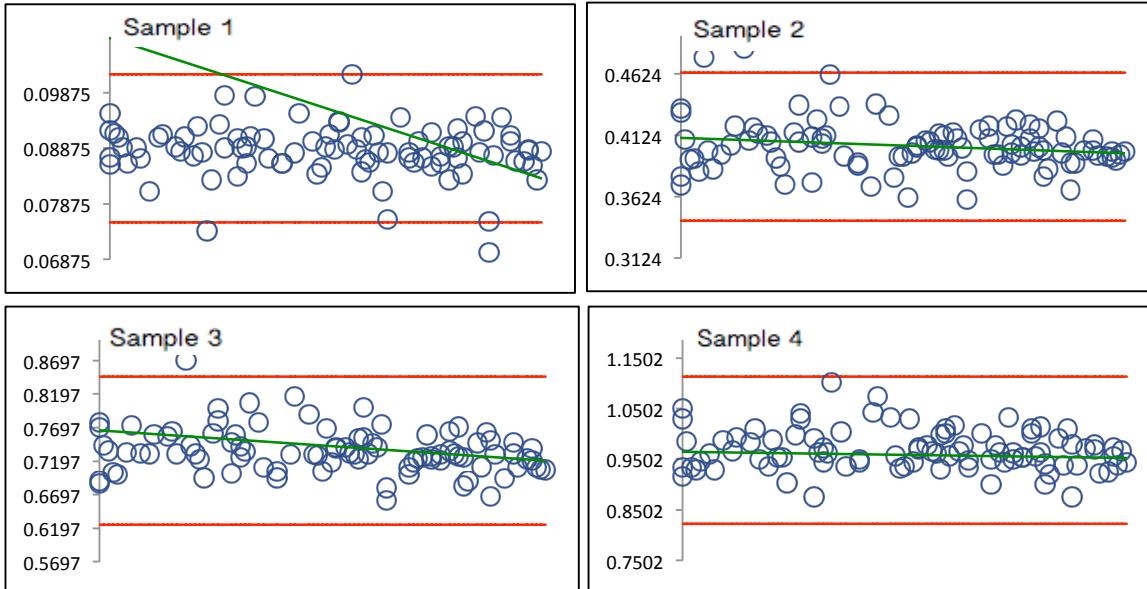
Reported results (Y-axis) plotted against bottling order (X-axis).

MANGANESE

Summary Statistics

Statistic	C02A-1	C02A-2	C02A-3	C02A-4
N	110	109	110	110
Median	0.501	0.194	0.759	0.929
Robust Mean	0.503	0.195	0.762	0.935
U	0.00267	0.00087	0.00392	0.00501
Robust Standard Deviation	0.0224	0.0072	0.0329	0.0420
Regression Standard Deviation	0.0378	0.0146	0.0571	0.0701
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA)	0.0378	0.0146	0.0571	0.0701
Outliers	4	5	4	4
|z|>3.0	4	1	4	1
2<|z|<3	3	1	0	1

Methods Used

Method	C02A-1	C02A-2	C02A-3	C02A-4
ICP/MS	75	74	75	75
ICP/OES	32	32	32	32
AA	2	2	2	2
AAG	1	1	1	1

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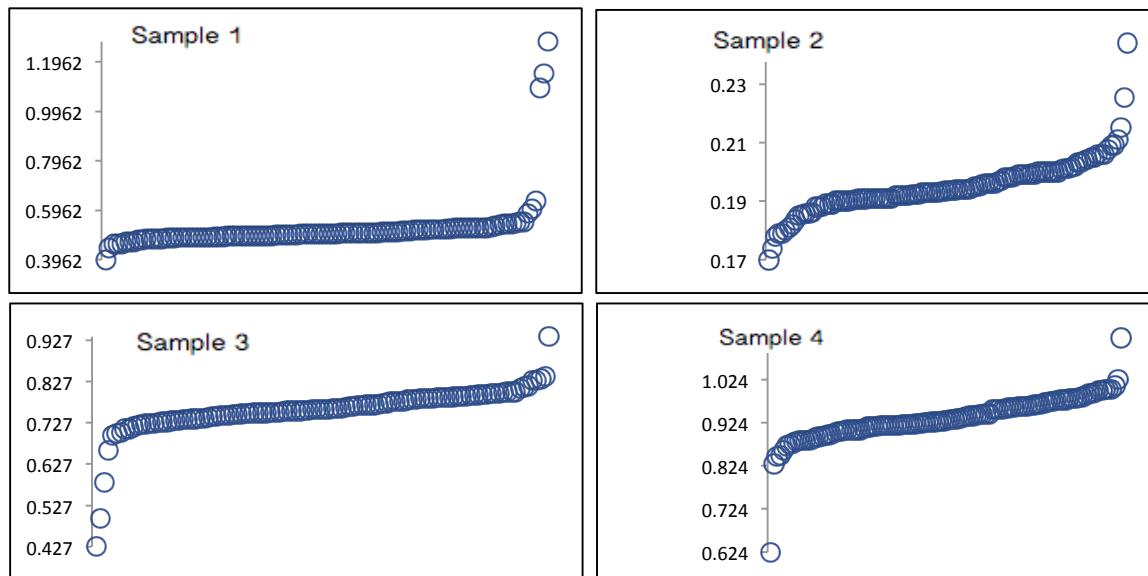
MANGANESE

z-Score Plots
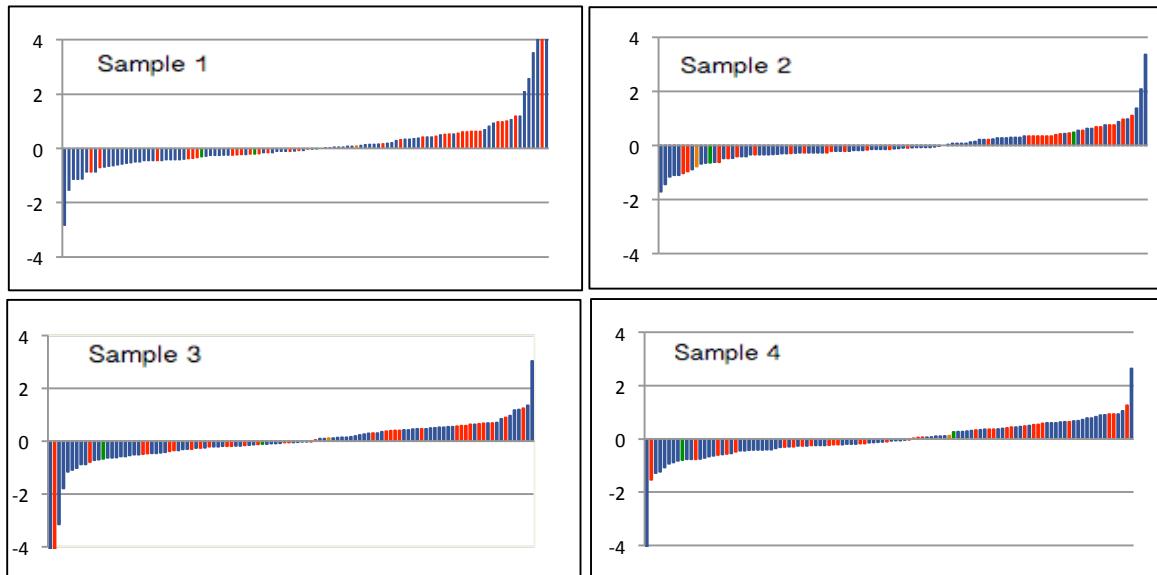
Kernel Density Plots
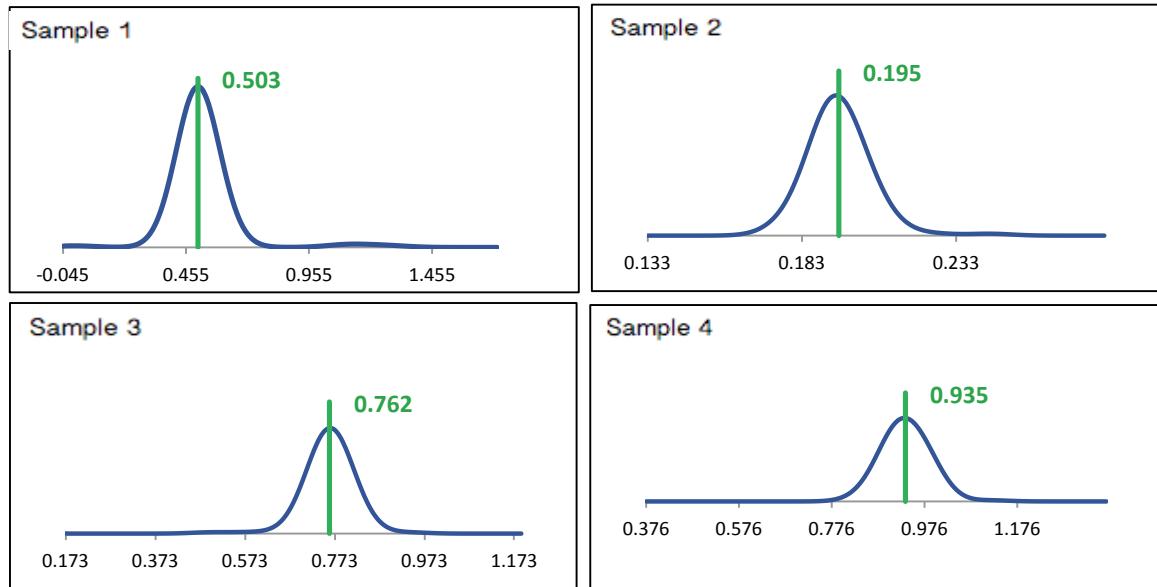
MANGANESE

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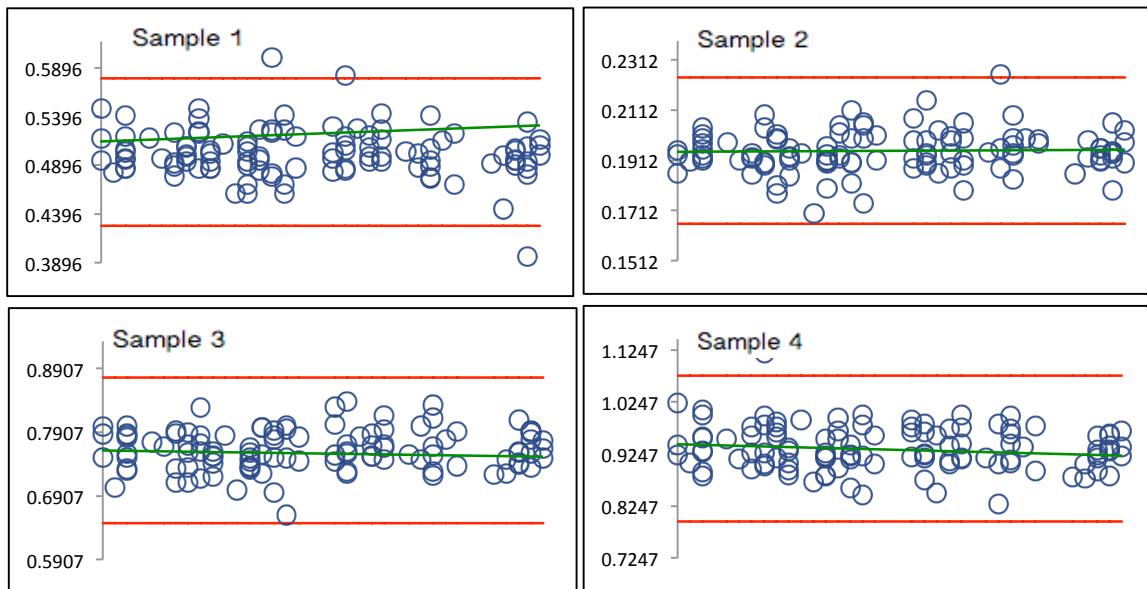
Reported results (Y-axis) plotted against reported analysis date (X-axis)

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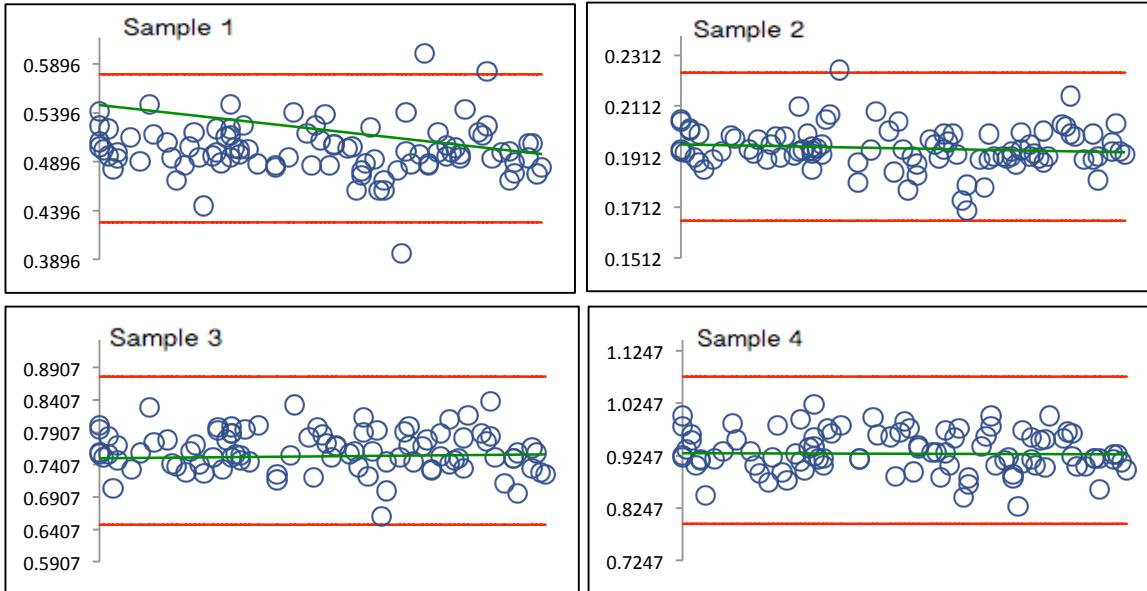
Reported results (Y-axis) plotted against bottling order (X-axis).

MOLYBDENUM

Summary Statistics

Statistic	C02A-1	C02A-2	C02A-3	C02A-4
N	101	101	101	101
Median	1.20	0.531	0.878	0.241
Robust Mean	1.20	0.533	0.875	0.240
U	0.00690	0.00321	0.00544	0.00170
Robust Standard Deviation	0.0555	0.0258	0.0437	0.0137
Regression Standard Deviation	0.0897	0.0400	0.0657	0.0180
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA)	0.0897	0.0400	0.0657	0.0180
Outliers	2	2	2	2
|z|>3.0	5	4	4	6
2<|z|<3	1	0	1	0

Methods Used

Method	C02A-1	C02A-2	C02A-3	C02A-4
ICP/MS	77	77	77	77
ICP/OES	22	22	22	22
AA	1	1	1	1
AAG	1	1	1	1

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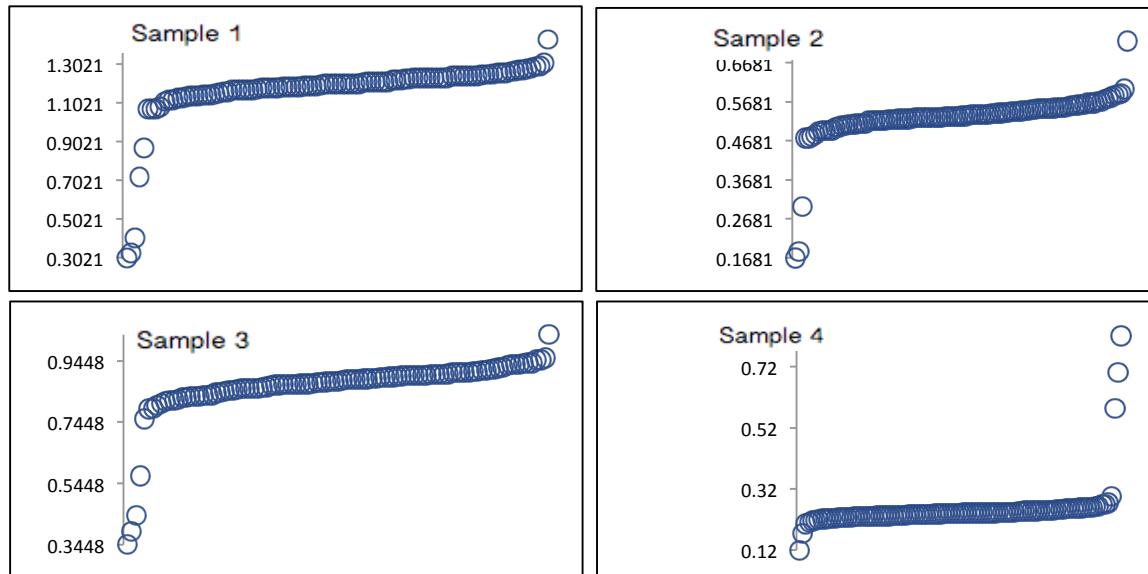
MOLYBDENUM

z-Score Plots
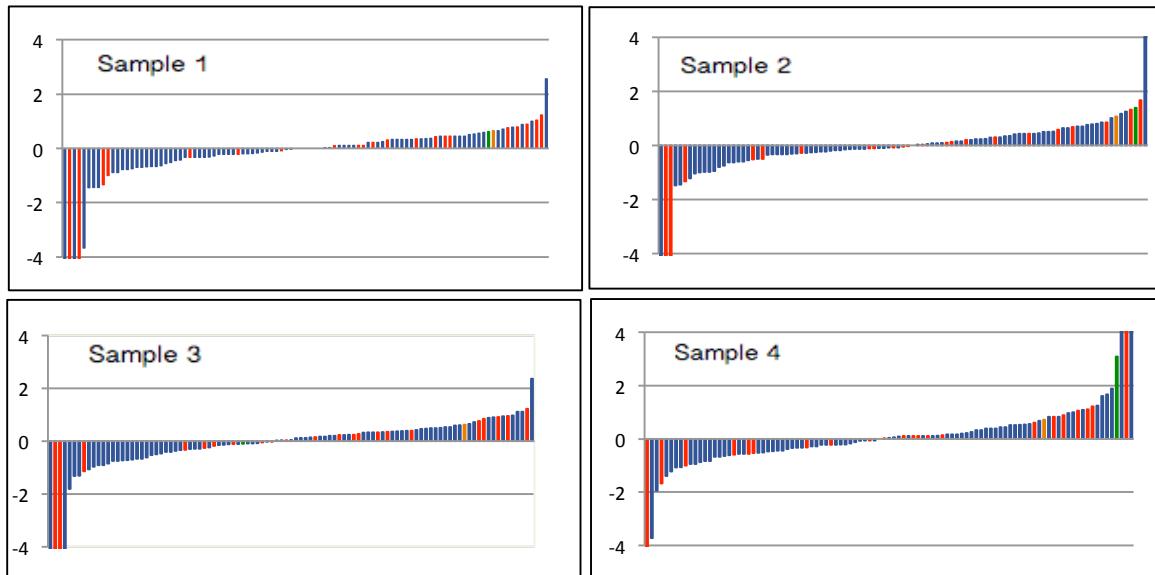
Kernel Density Plots
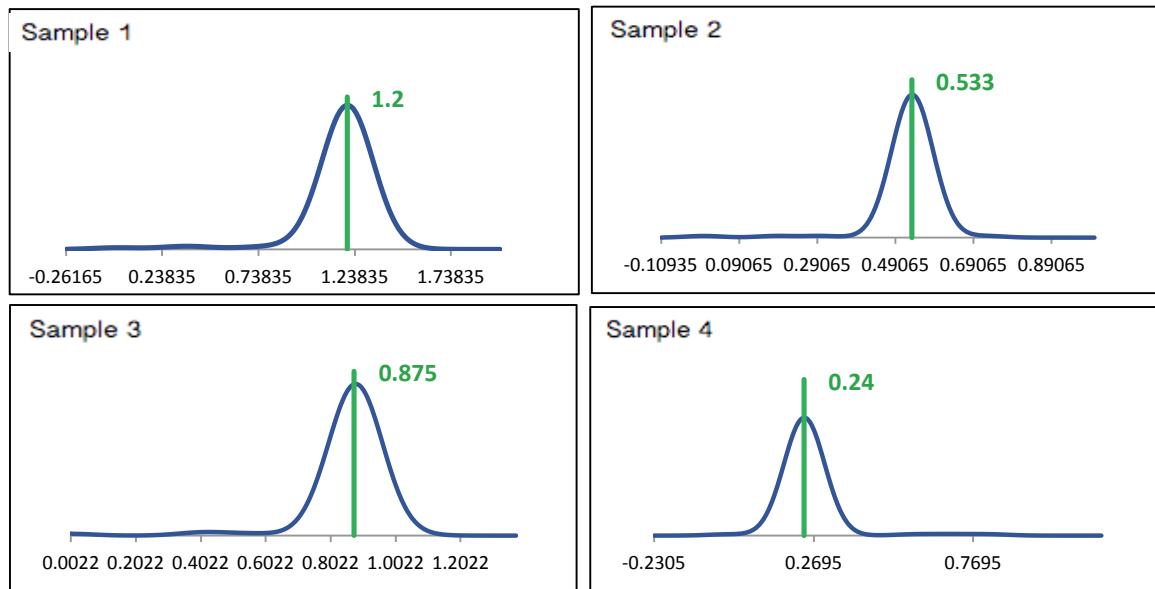
MOLYBDENUM

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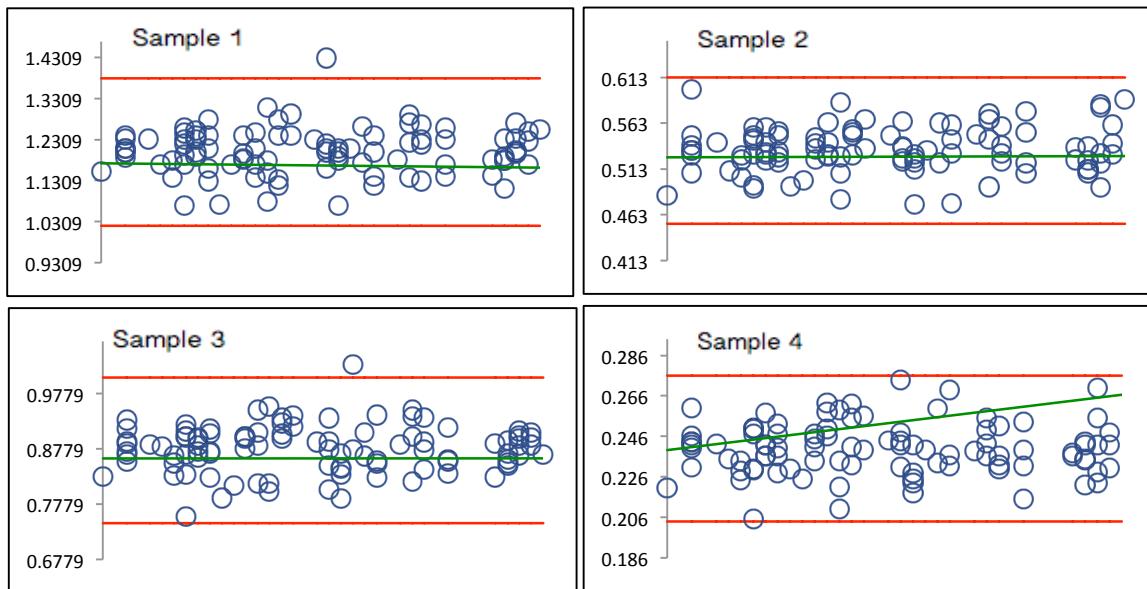
Reported results (Y-axis) plotted against reported analysis date (X-axis)

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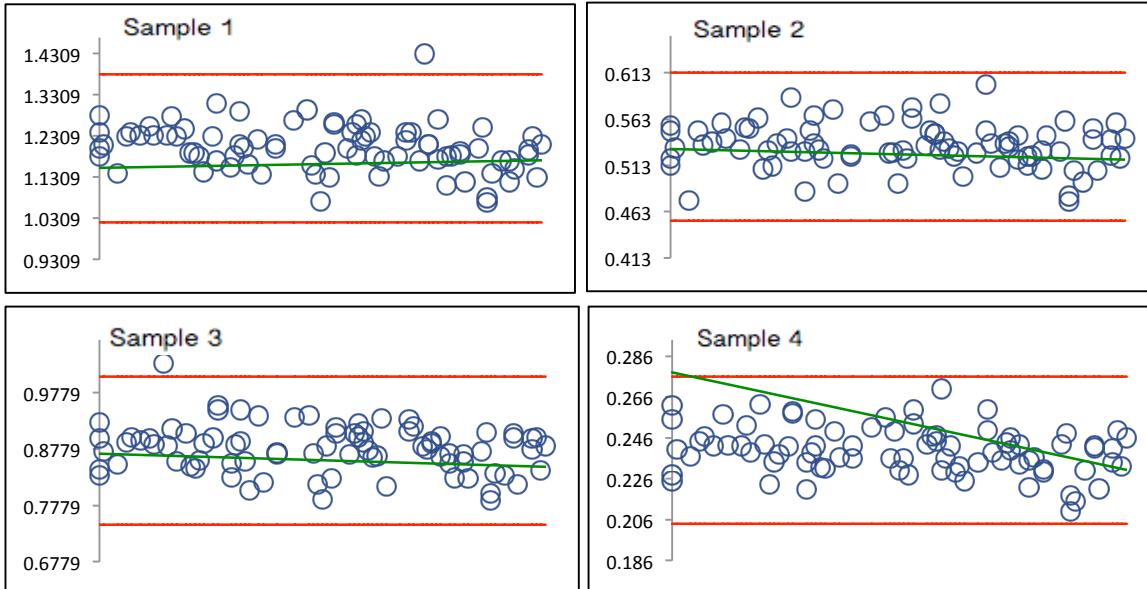
Reported results (Y-axis) plotted against bottling order (X-axis).

NICKEL

Summary Statistics

Statistic	C02A-1	C02A-2	C02A-3	C02A-4
N	104	104	106	106
Median	0.0475	0.608	0.942	0.853
Robust Mean	0.0475	0.609	0.946	0.855
U	0.00027	0.00256	0.00474	0.00435
Robust Standard Deviation	0.00223	0.0209	0.0390	0.0358
Regression Standard Deviation	0.00356	0.0457	0.0710	0.0641
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA)	0.00356	0.0457	0.0710	0.0641
Outliers	5	5	3	3
|z|>3.0	1	2	0	0
2<|z|<3	2	0	4	0

Methods Used

Method	C02A-1	C02A-2	C02A-3	C02A-4
ICP/MS	80	80	81	81
ICP/OES	22	22	23	23
AAG	1	1	1	1
AA	1	1	1	1

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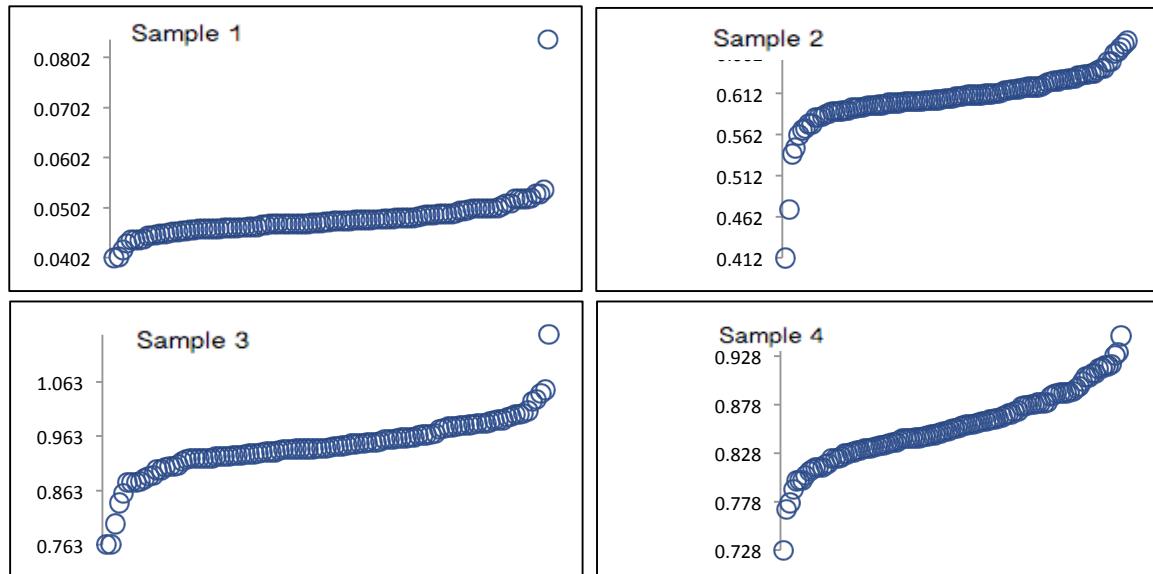
NICKEL

z-Score Plots
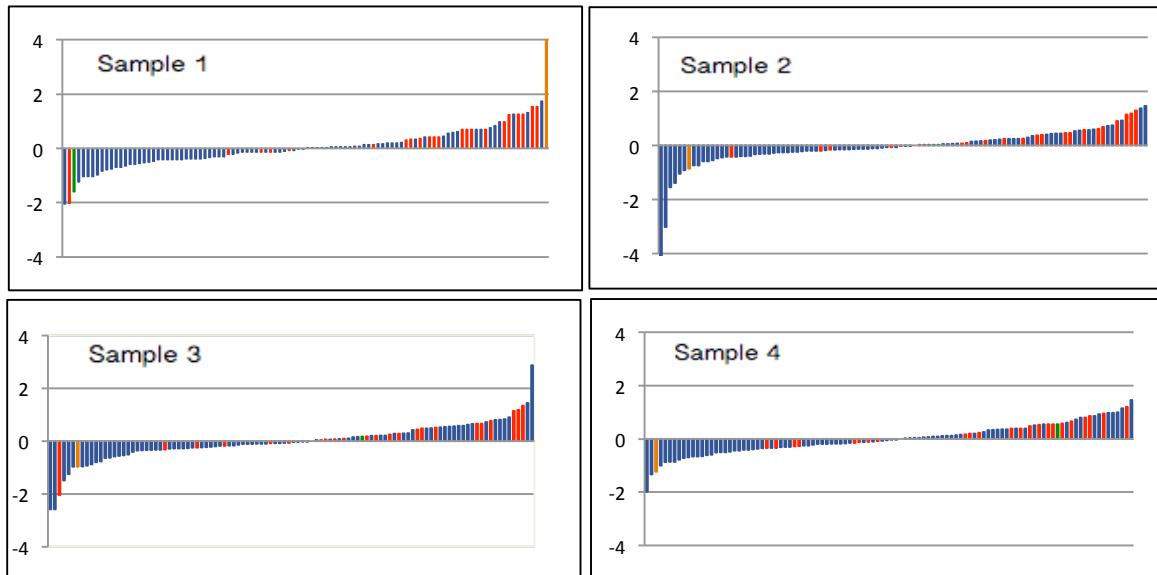
Kernel Density Plots
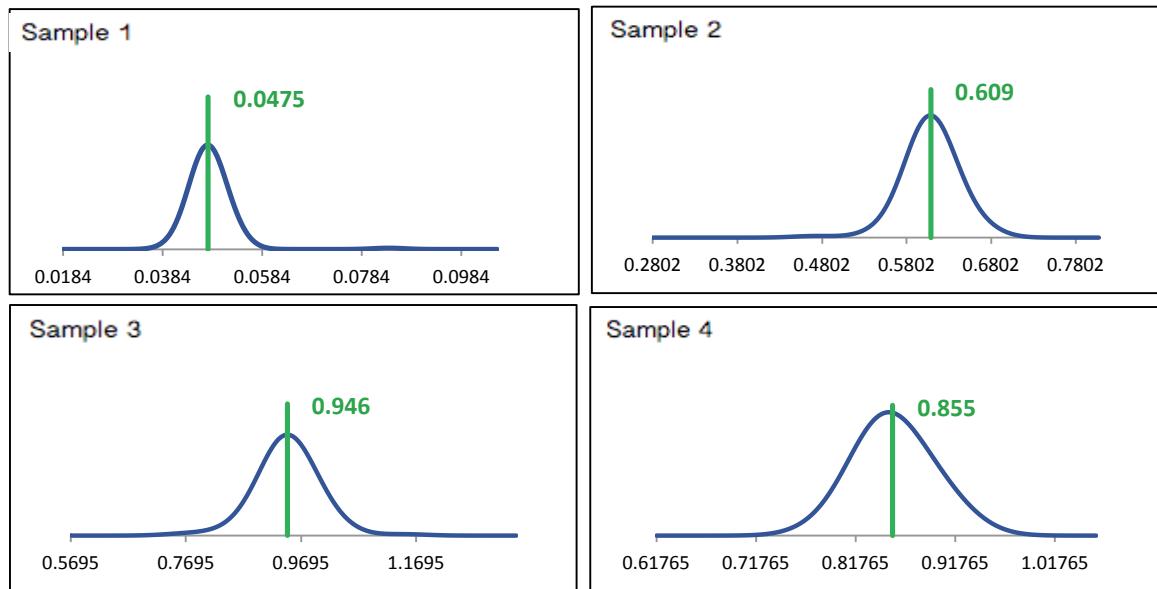
NICKEL

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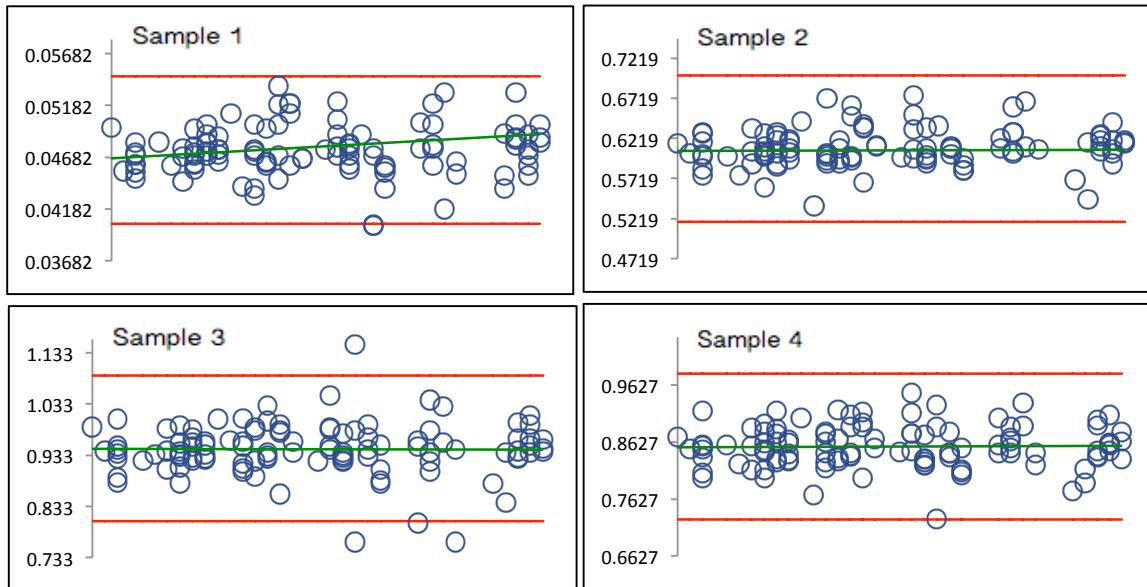
Reported results (Y-axis) plotted against reported analysis date (X-axis)

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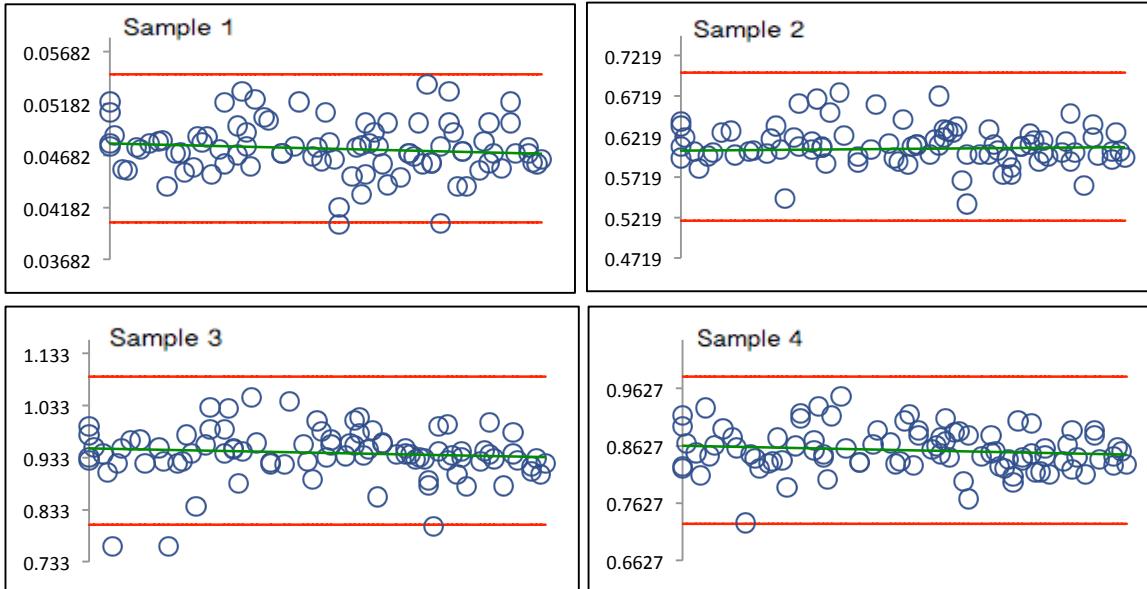
Reported results (Y-axis) plotted against bottling order (X-axis).

SELENIUM

Summary Statistics

Statistic	C02A-1	C02A-2	C02A-3	C02A-4
N	106	106	106	107
Median	76.3	56.4	98.6	46.0
Robust Mean	76.1	56.5	98.1	46.3
U	0.447	0.368	0.510	0.297
Robust Standard Deviation	3.68	3.03	4.20	2.46
Regression Standard Deviation	7.61	5.65	9.81	4.63
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA)	7.61	5.65	9.81	4.63
Outliers	3	3	3	2
lzl>3.0	3	2	4	2
2<lzl<3	1	2	1	3

Methods Used

Method	C02A-1	C02A-2	C02A-3	C02A-4
ICPHY	2	2	2	2
ICP/MS	84	84	84	85
CVAFS	1	1	1	1
AAHY	3	3	3	3
ICP/OES	15	15	15	15
AAG	1	1	1	1

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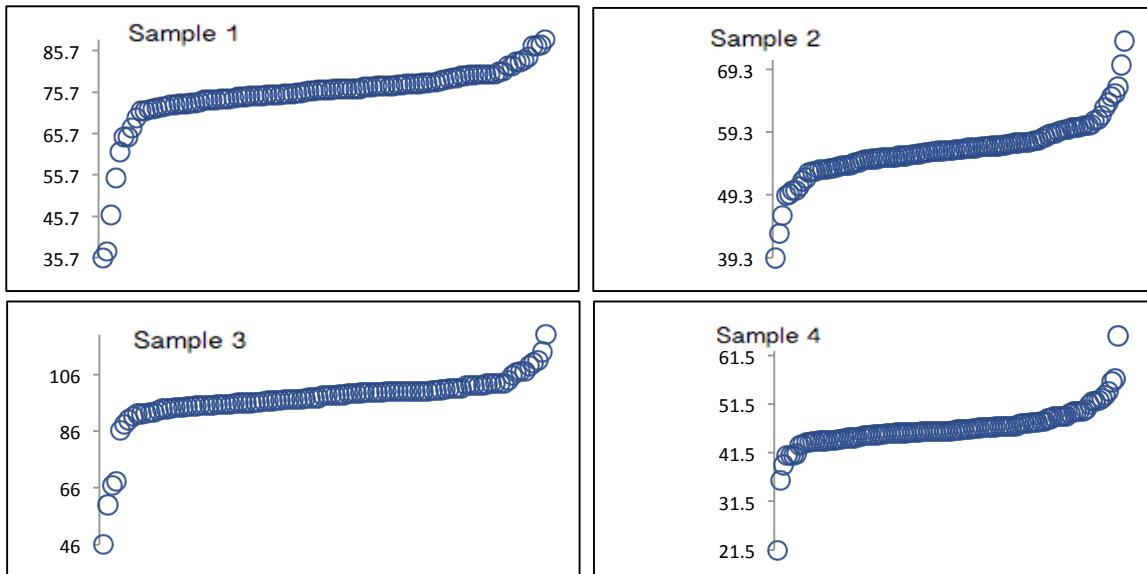
SELENIUM

## z-Score Plots
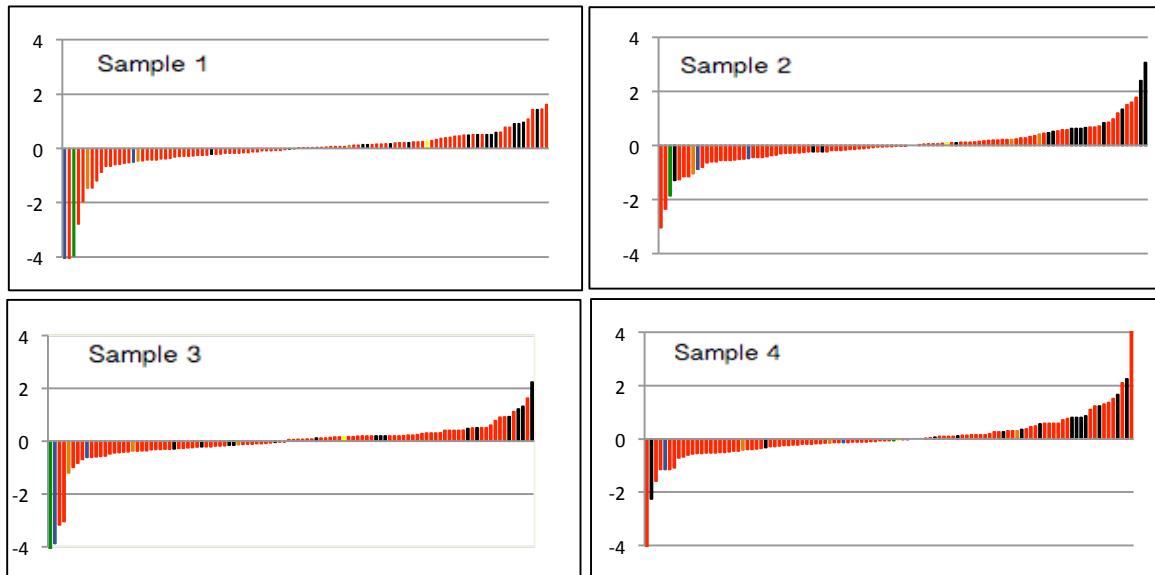
Kernel Density Plots
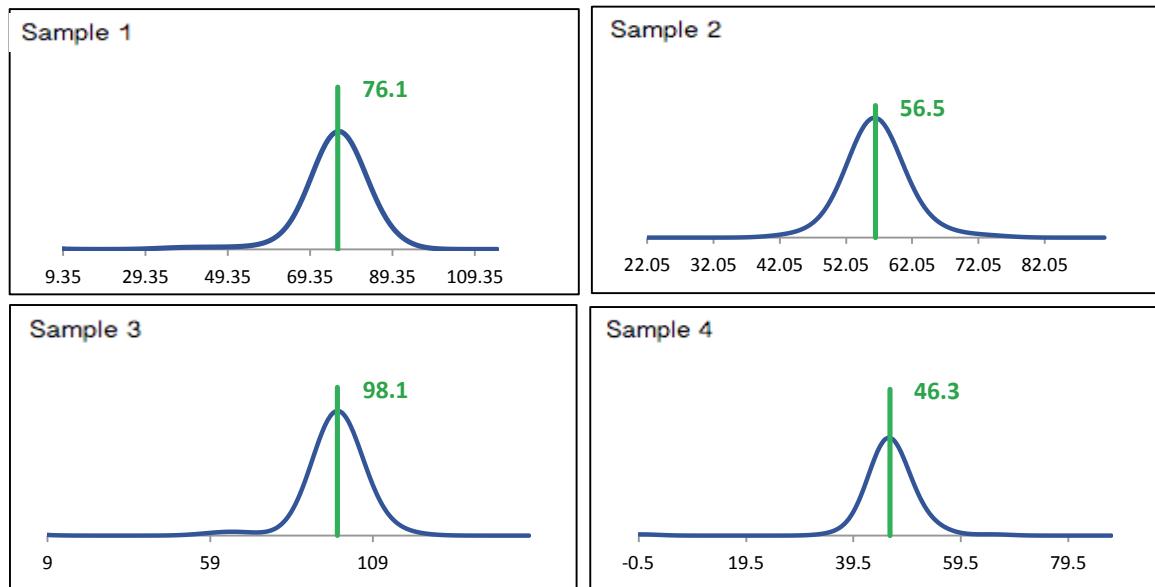
SELENIUM

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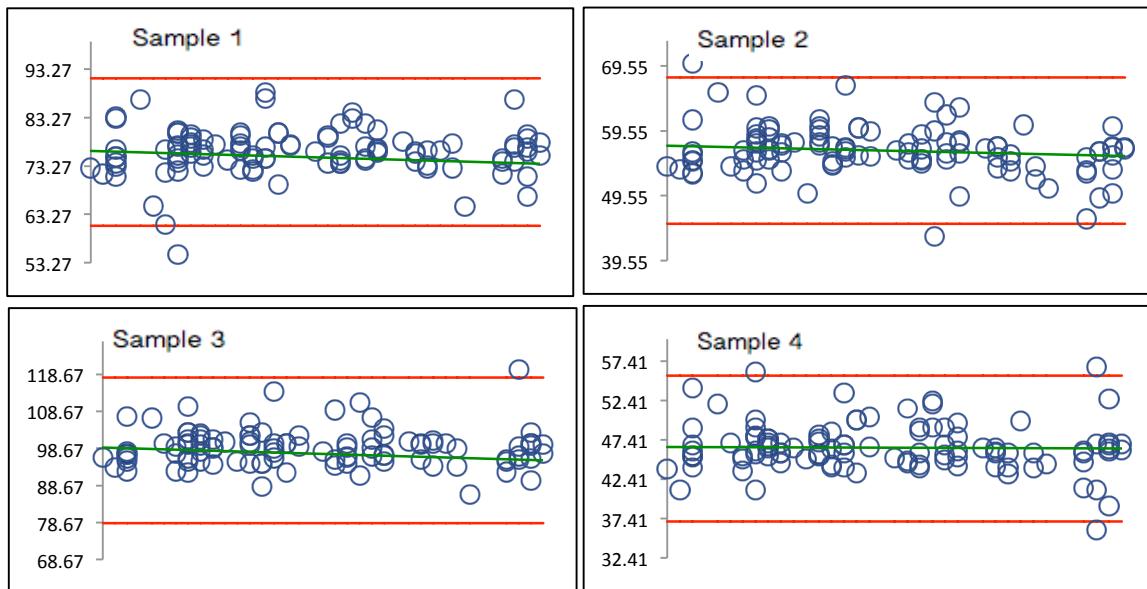
Reported results (Y-axis) plotted against reported analysis date (X-axis)

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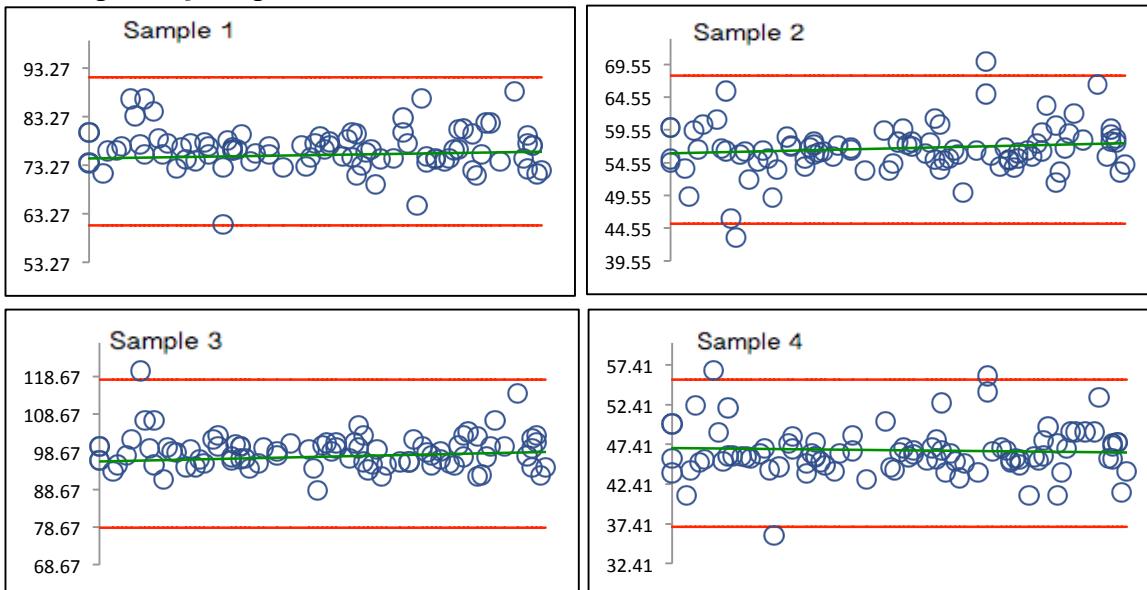
Reported results (Y-axis) plotted against bottling order (X-axis).

SILVER

Summary Statistics

Statistic	C02A-1	C02A-2	C02A-3	C02A-4
N	87	87	87	87
Median	0.0980	0.0566	0.0715	0.0380
Robust Mean	0.0983	0.0567	0.0719	0.0381
U	0.00071	0.00045	0.00056	0.00028
Robust Standard Deviation	0.00526	0.00333	0.00414	0.00211
Regression Standard Deviation	0.00737	0.00426	0.00539	0.00286
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA)	0.00737	0.00426	0.00539	0.00286
Outliers	2	2	2	2
|z|>3.0	5	5	3	4
2<|z|<3	3	3	2	1

Methods Used
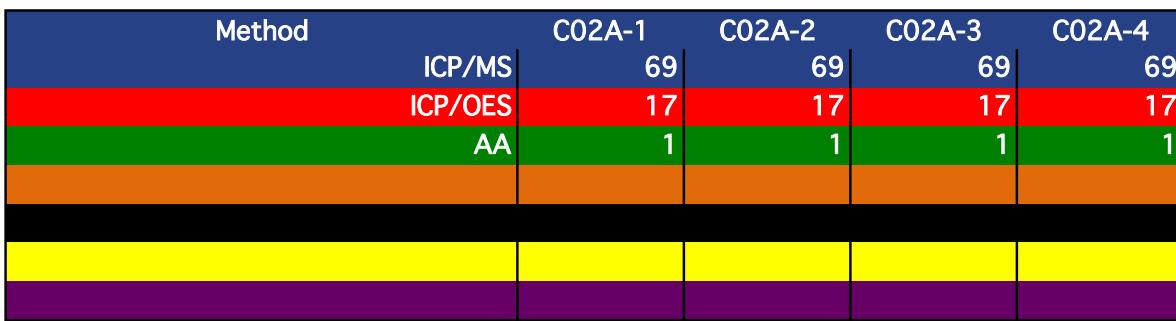
Method	C02A-1	C02A-2	C02A-3	C02A-4
ICP/MS	69	69	69	69
ICP/OES	17	17	17	17
AA	1	1	1	1

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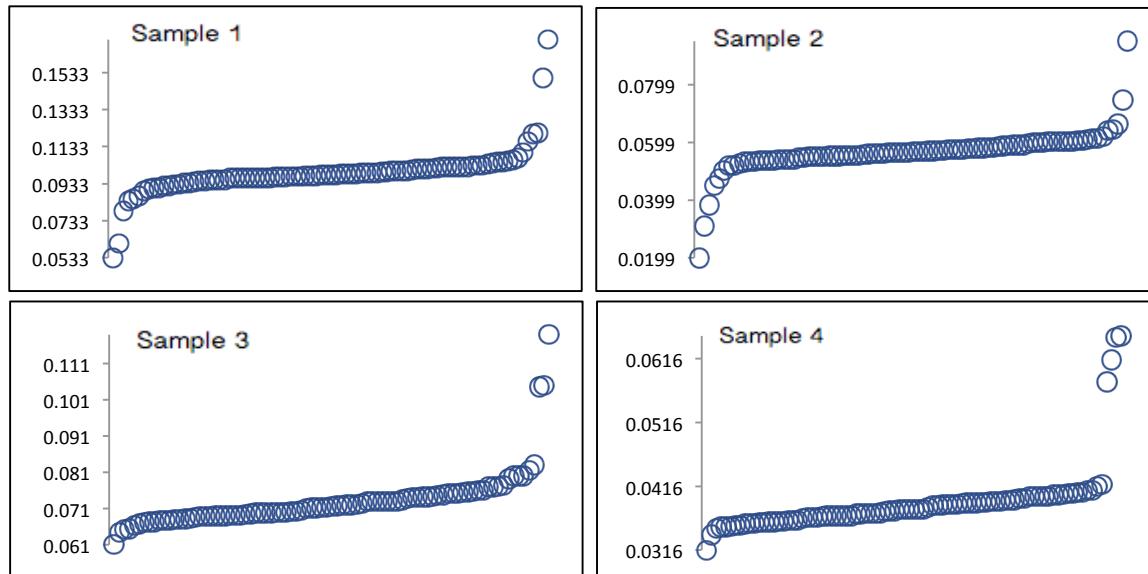
SILVER

### z-Score Plots
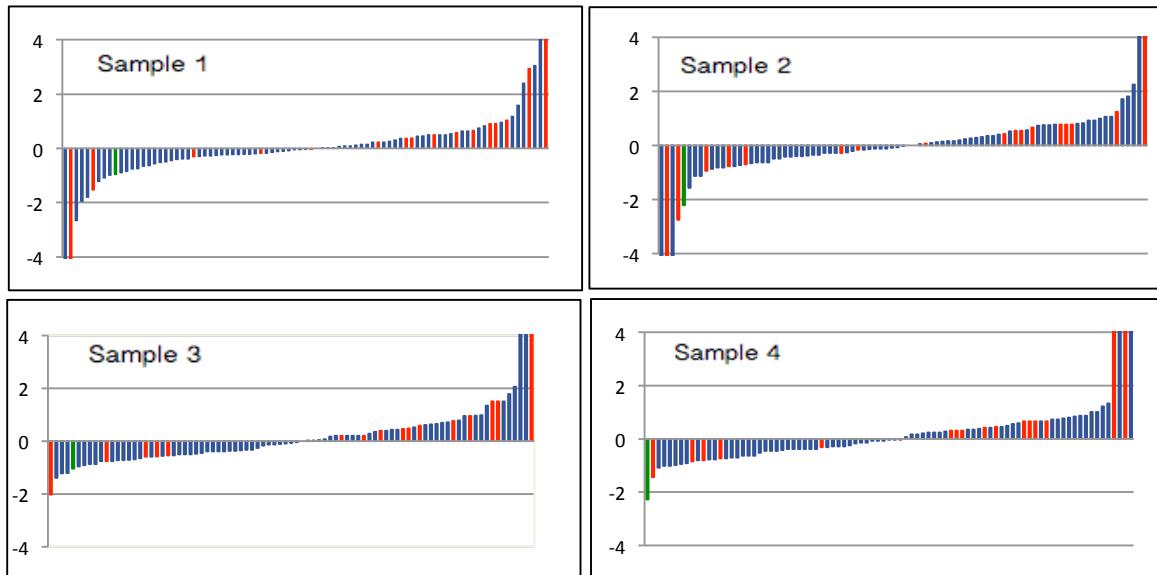
Kernel Density Plots
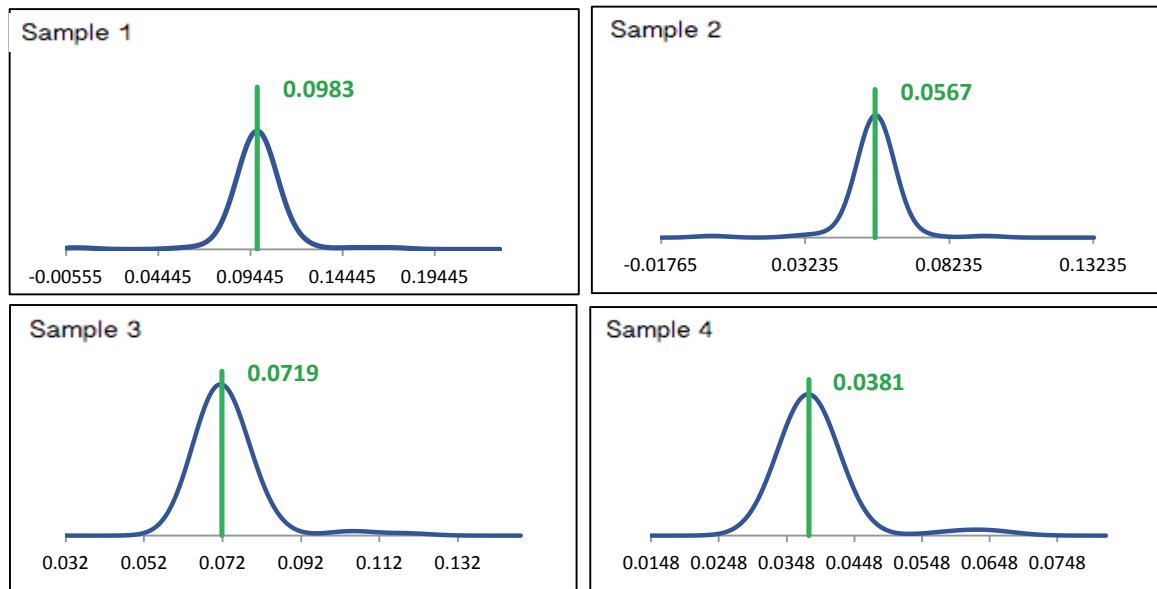
SILVER

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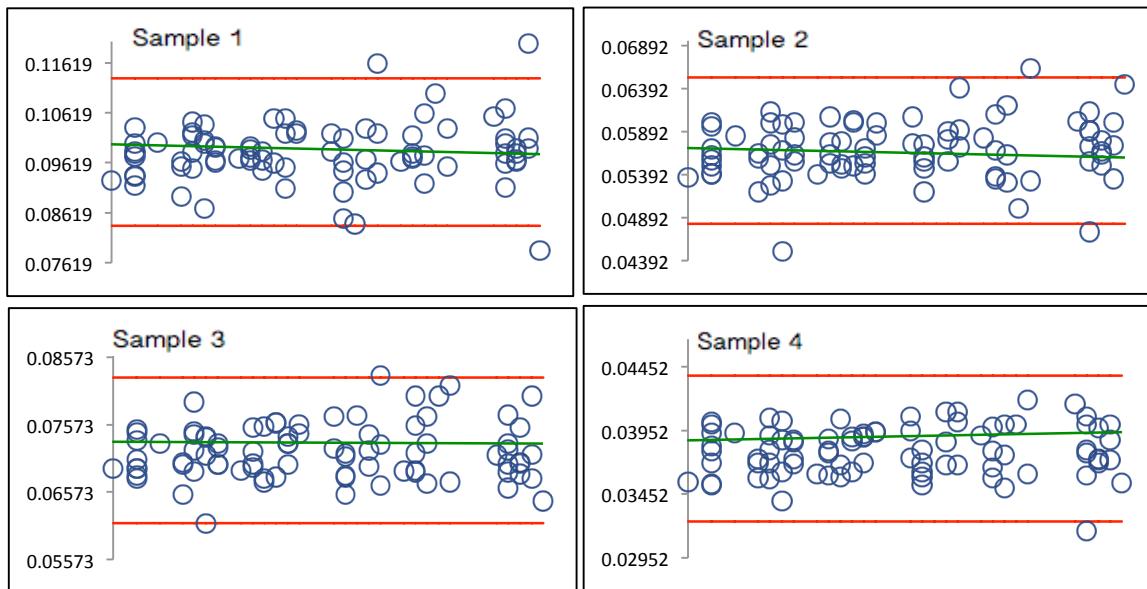
Reported results (Y-axis) plotted against reported analysis date (X-axis)

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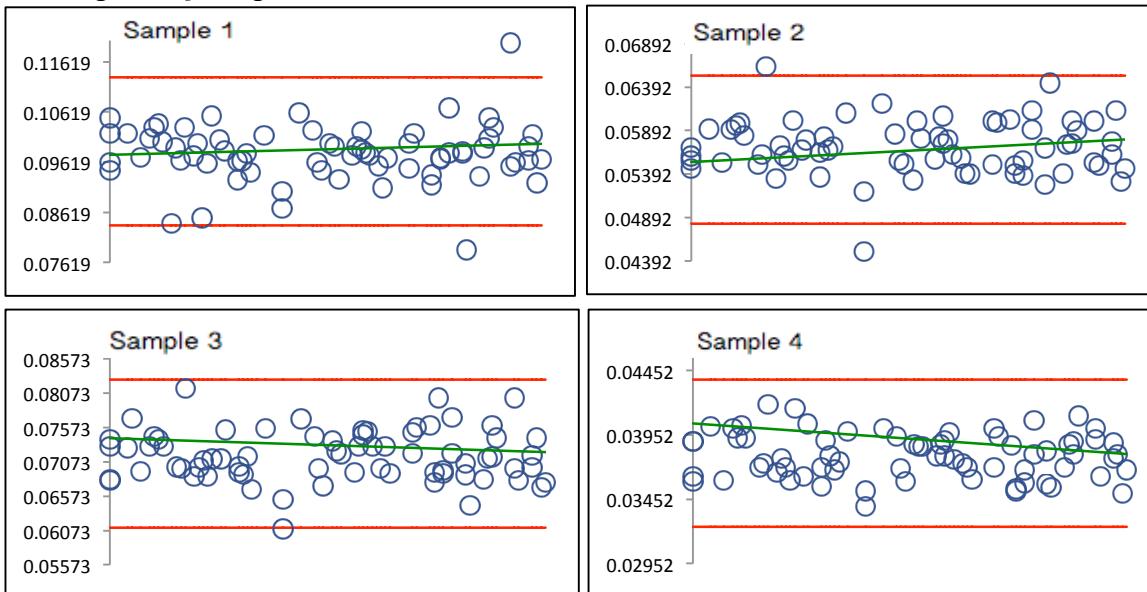
Reported results (Y-axis) plotted against bottling order (X-axis).

STRONTIUM

Summary Statistics

Statistic	C02A-1	C02A-2	C02A-3	C02A-4
N	89	90	90	90
Median	0.310	0.693	1.18	0.594
Robust Mean	0.311	0.694	1.18	0.594
U	0.00168	0.00364	0.00755	0.00307
Robust Standard Deviation	0.0127	0.0276	0.0573	0.0233
Regression Standard Deviation	0.0233	0.0520	0.0883	0.0446
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA)	0.0233	0.0520	0.0883	0.0446
Outliers	4	3	3	3
|z|>3.0	2	3	4	3
2<|z|<3	1	2	2	1

Methods Used
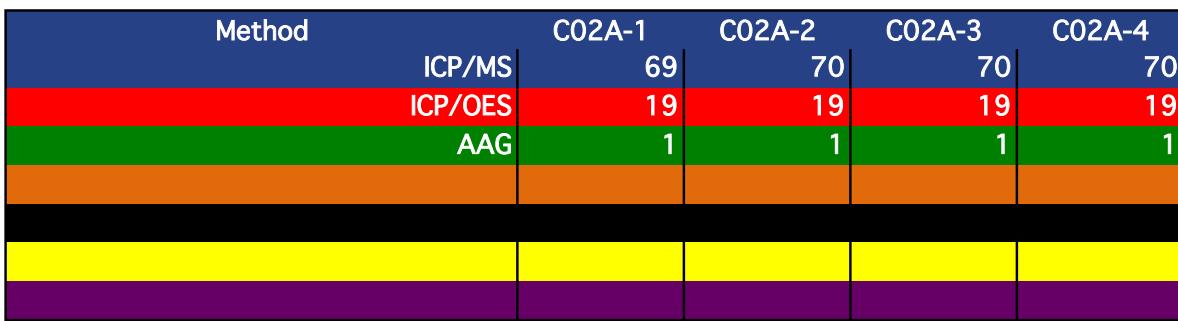
Method	C02A-1	C02A-2	C02A-3	C02A-4
ICP/MS	69	70	70	70
ICP/OES	19	19	19	19
AAG	1	1	1	1

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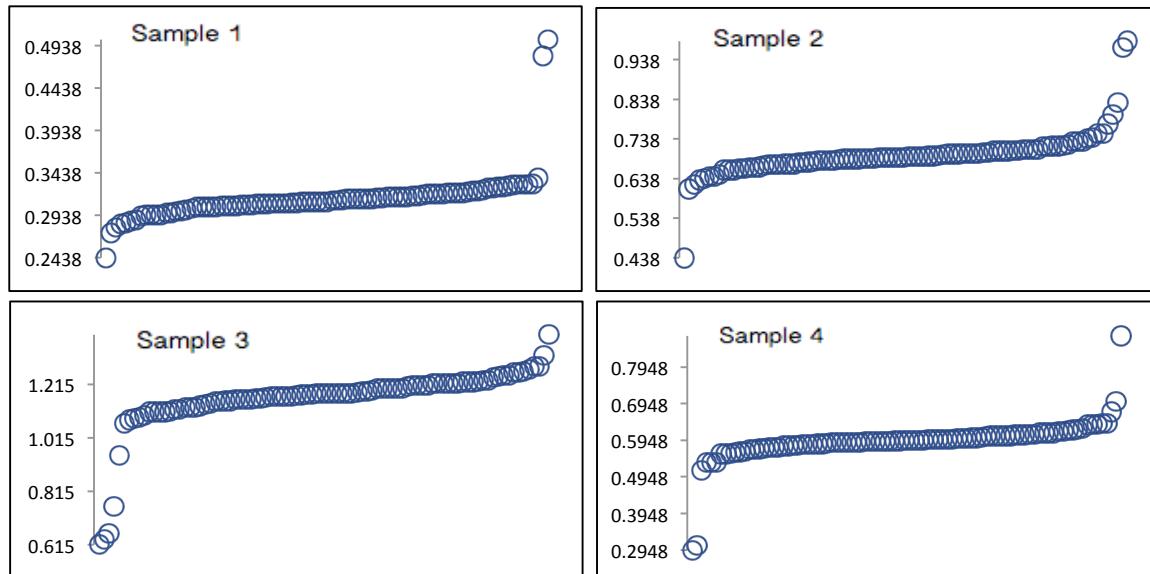
STRONTIUM

z-Score Plots
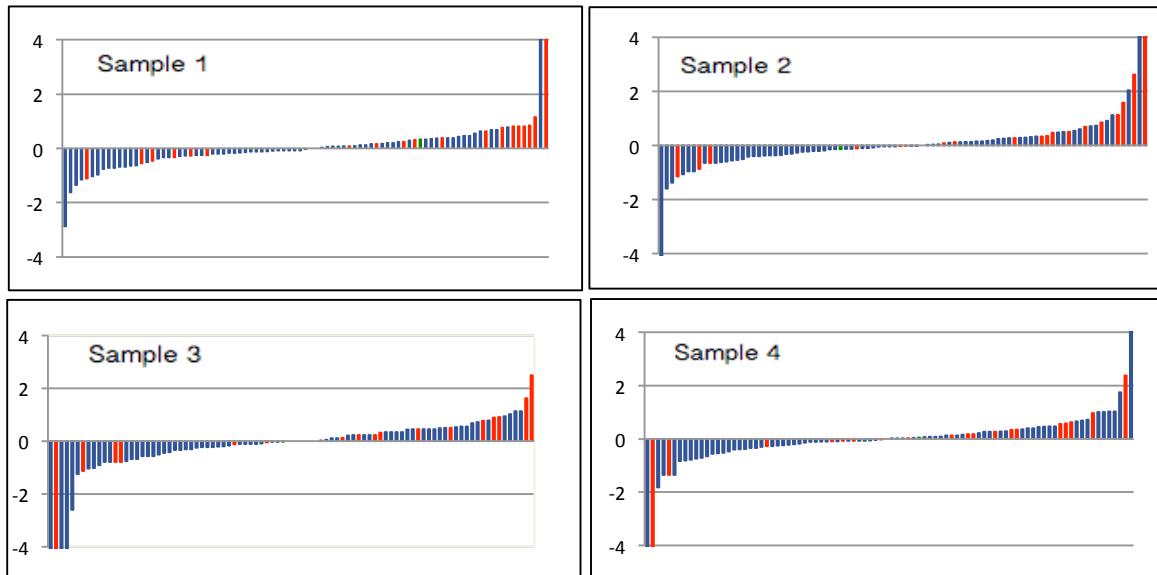
Kernel Density Plots
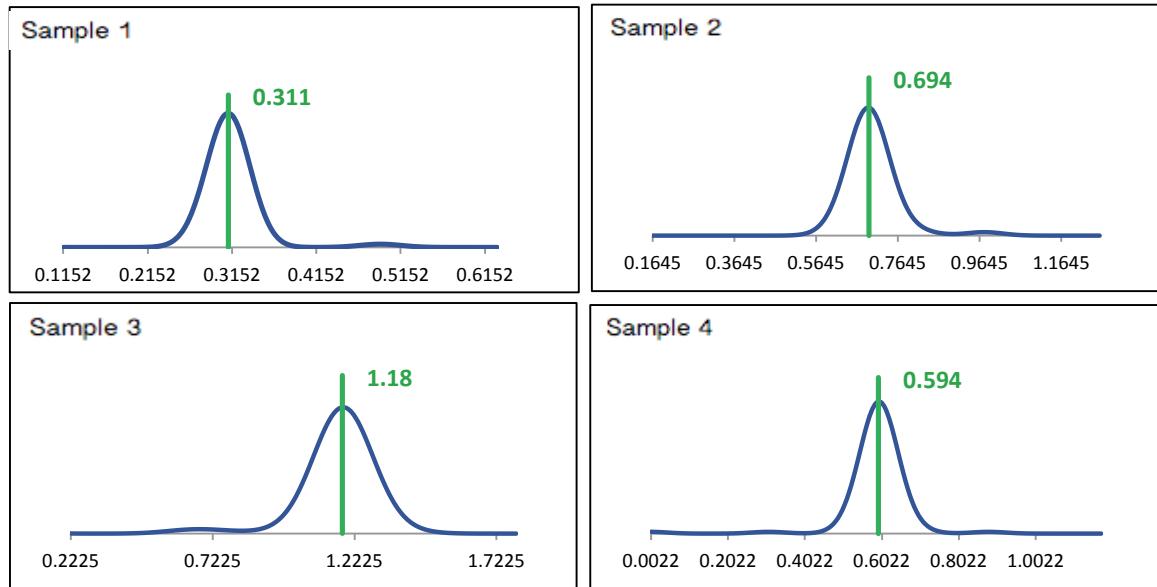
STRONTIUM

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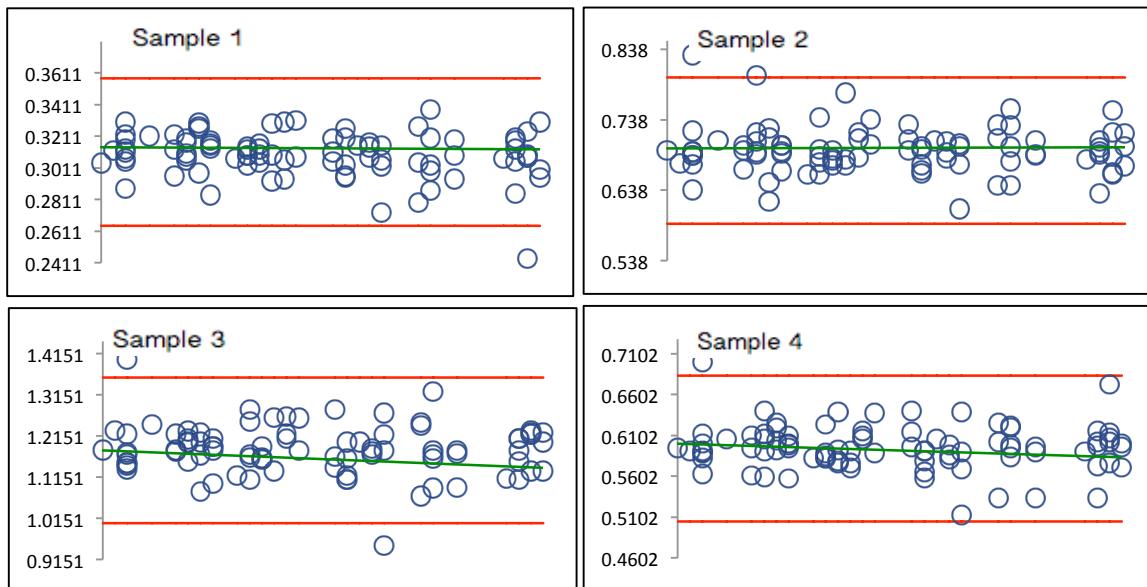
Reported results (Y-axis) plotted against reported analysis date (X-axis)

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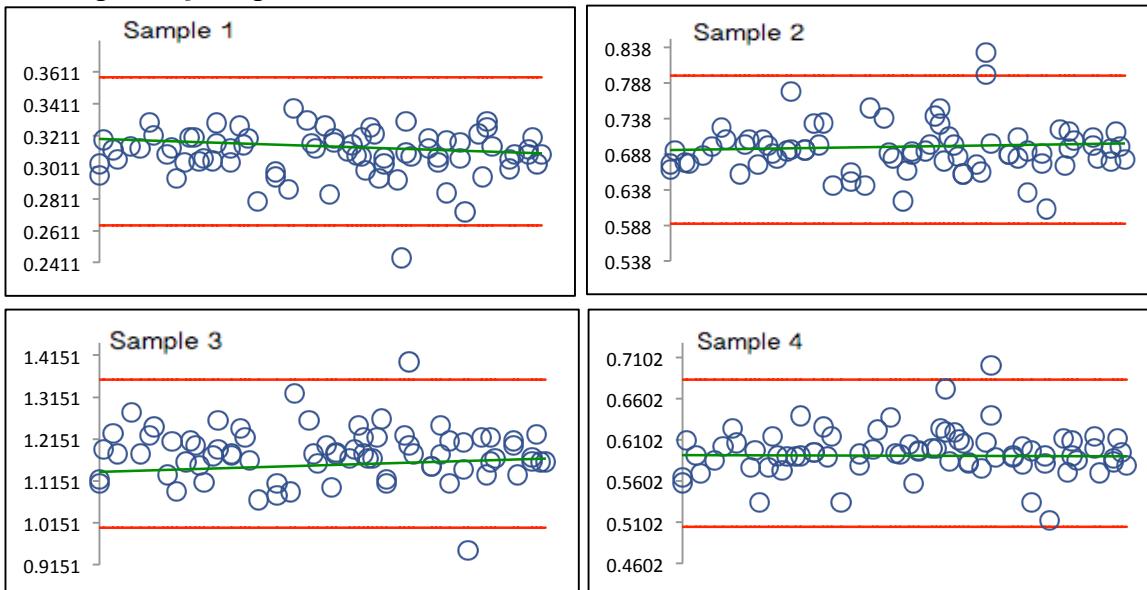
Reported results (Y-axis) plotted against bottling order (X-axis).

THALLIUM

Summary Statistics

| Statistic	C02A-1	C02A-2	C02A-3	C02A-4
N	79	81	79	78
Median	0.0820	0.0496	0.0880	0.0446
Robust Mean	0.0824	0.0494	0.0882	0.0445
U	0.00048	0.00034	0.00055	0.00032
Robust Standard Deviation	0.00342	0.00248	0.00393	0.00224
Regression Standard Deviation	0.00824	0.00494	0.00882	0.00445
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA)	0.00824	0.00494	0.00882	0.00445
Outliers	5	3	5	5
|z|>3.0	0	3	0	0
2<|z|<3	0	2	2	1

Methods Used
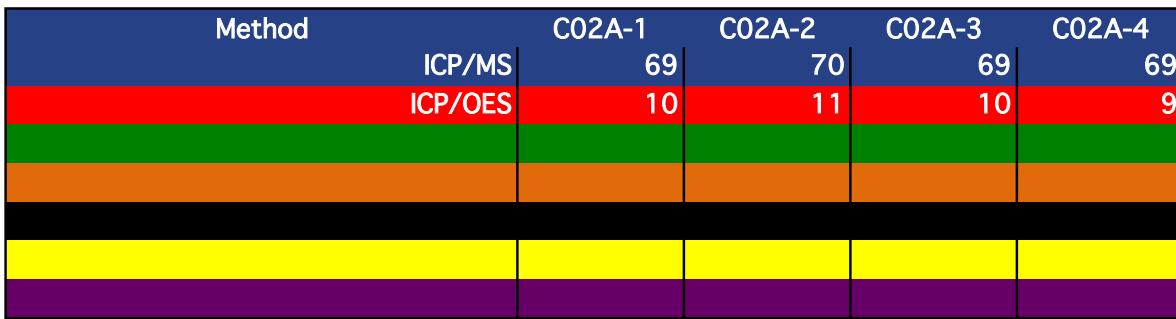
Method	C02A-1	C02A-2	C02A-3	C02A-4
ICP/MS	69	70	69	69
ICP/OES	10	11	10	9

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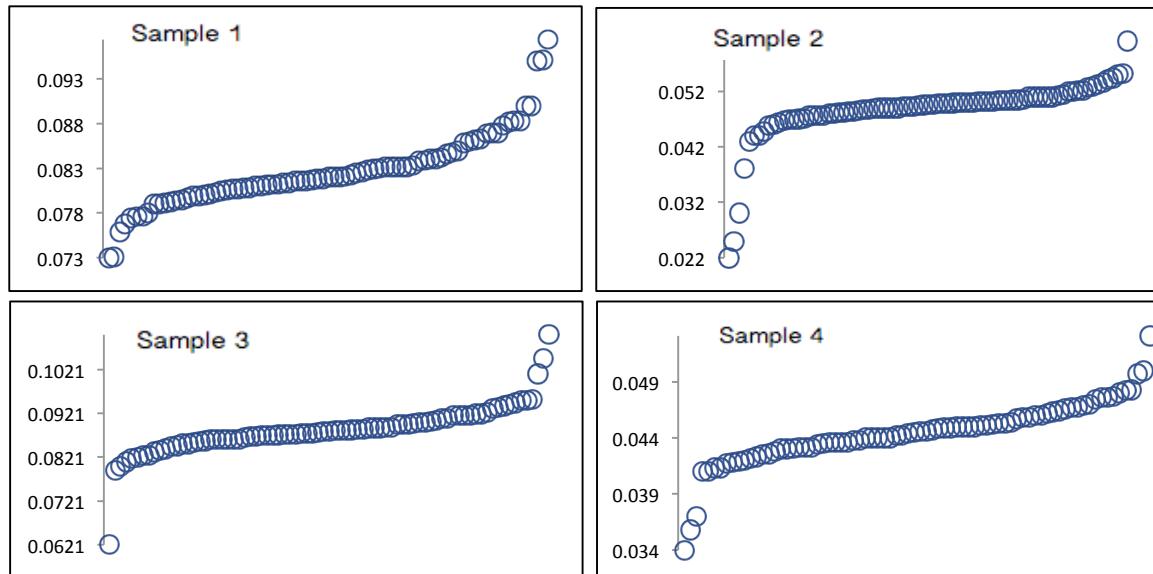
THALLIUM

## z-Score Plots
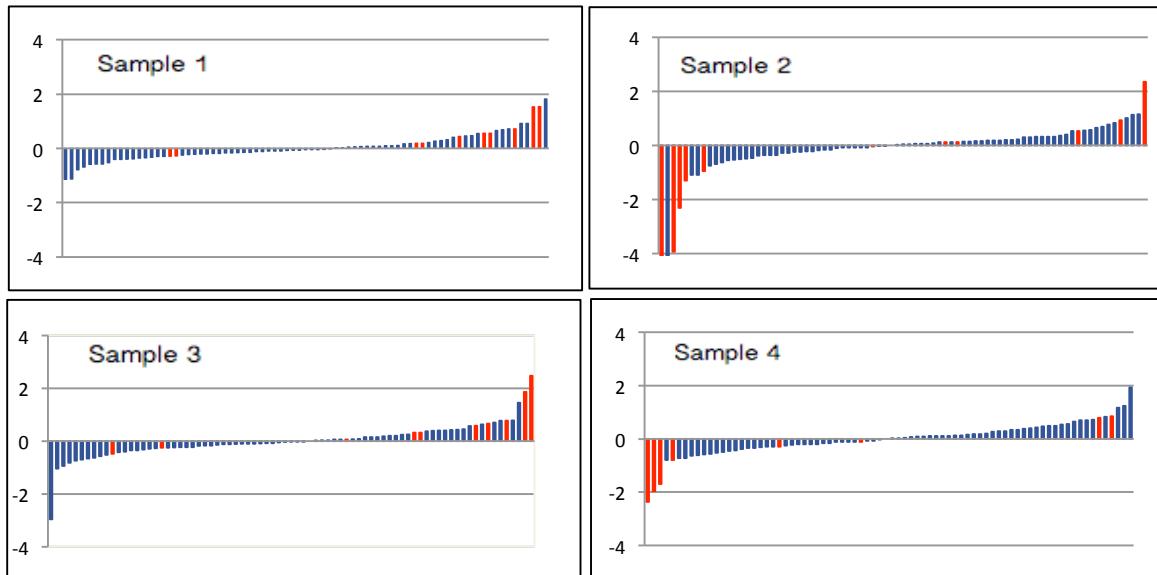
Kernel Density Plots
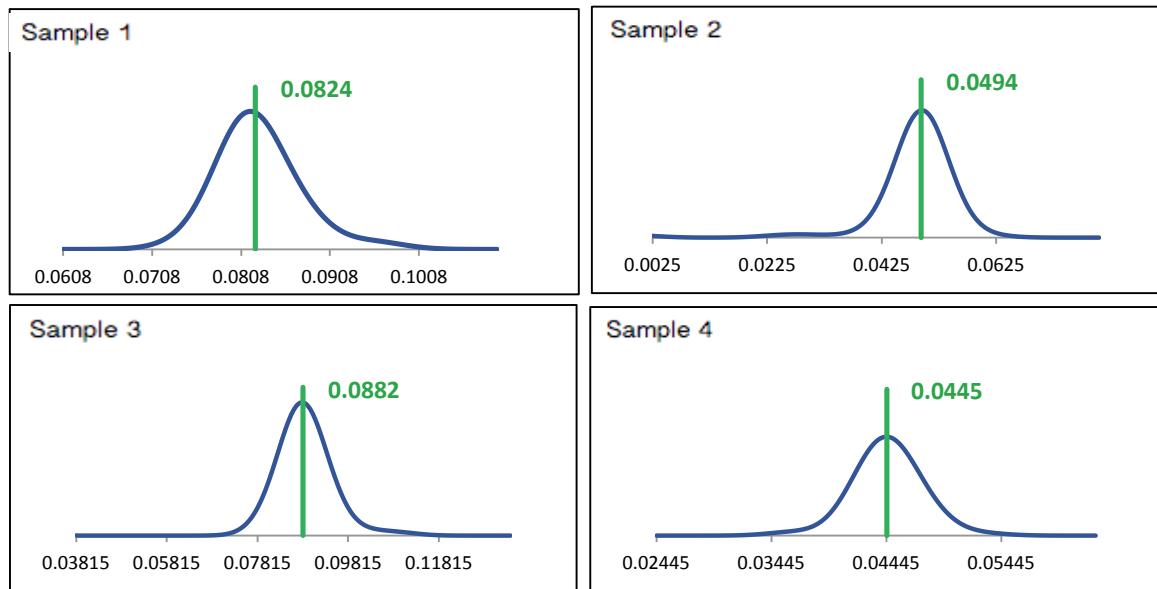
THALLIUM

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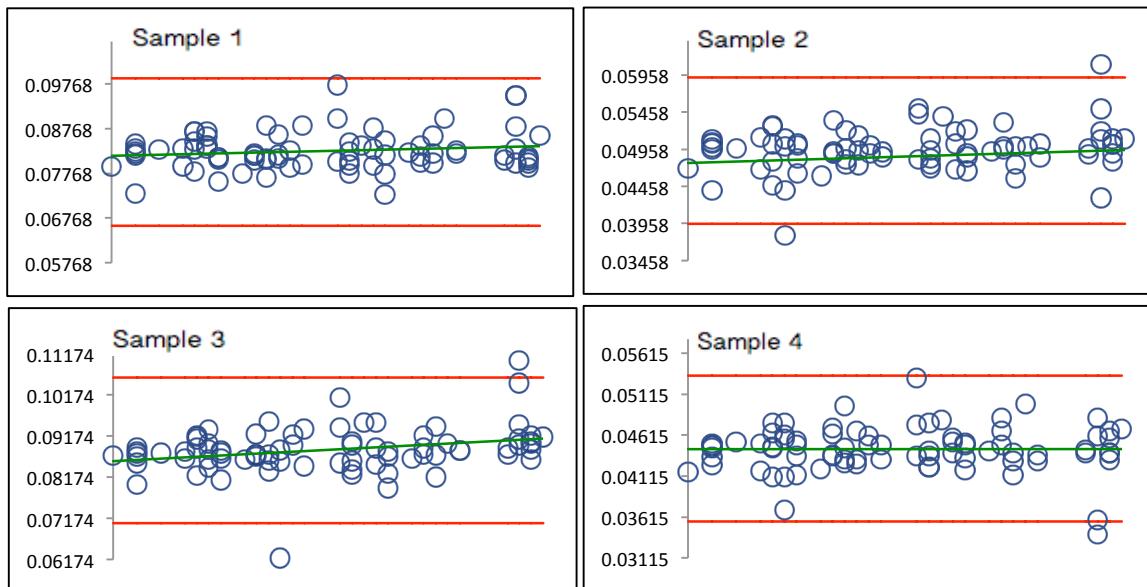
Reported results (Y-axis) plotted against reported analysis date (X-axis)

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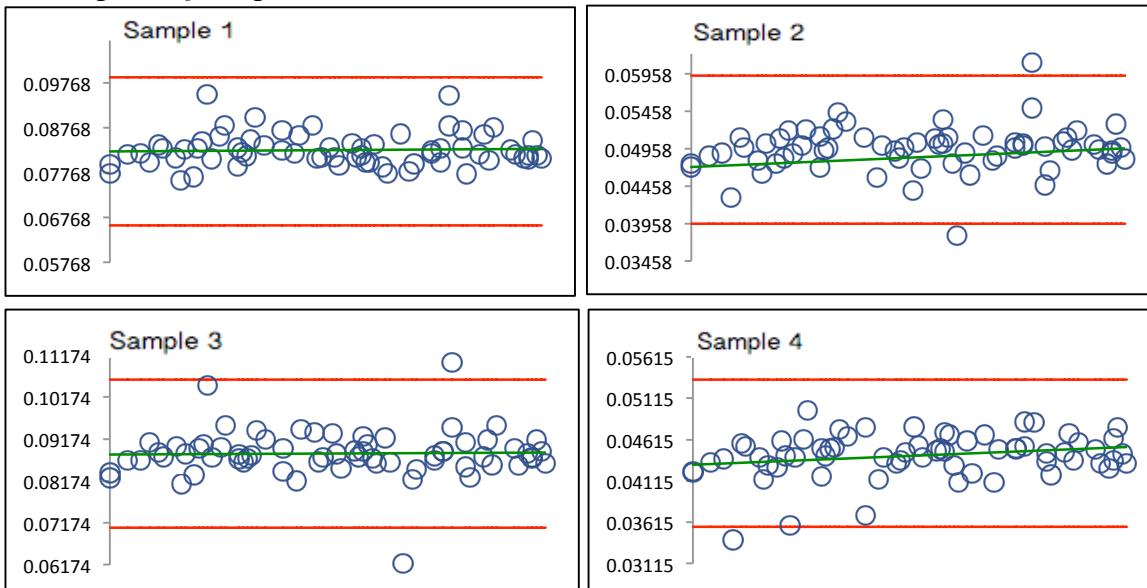
Reported results (Y-axis) plotted against bottling order (X-axis).

TIN

Summary Statistics

Statistic	C02A-1	C02A-2	C02A-3	C02A-4
N	76	76	76	75
Median	0.0880	0.0622	0.0688	0.0383
Robust Mean	0.0873	0.0620	0.0684	0.0383
U	0.00084	0.00055	0.00075	0.00032
Robust Standard Deviation	0.00586	0.00386	0.00520	0.00219
Regression Standard Deviation	0.00873	0.00620	0.00684	0.00383
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA)	0.00873	0.00620	0.00684	0.00383
Outliers	1	1	1	1
lzl>3.0	3	1	5	2
2<lzl<3	4	2	2	2

Methods Used
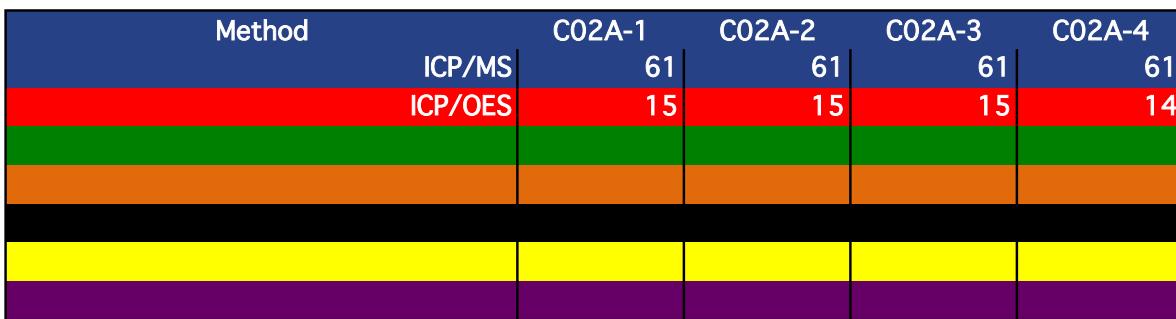
Method	C02A-1	C02A-2	C02A-3	C02A-4
ICP/MS	61	61	61	61
ICP/OES	15	15	15	14

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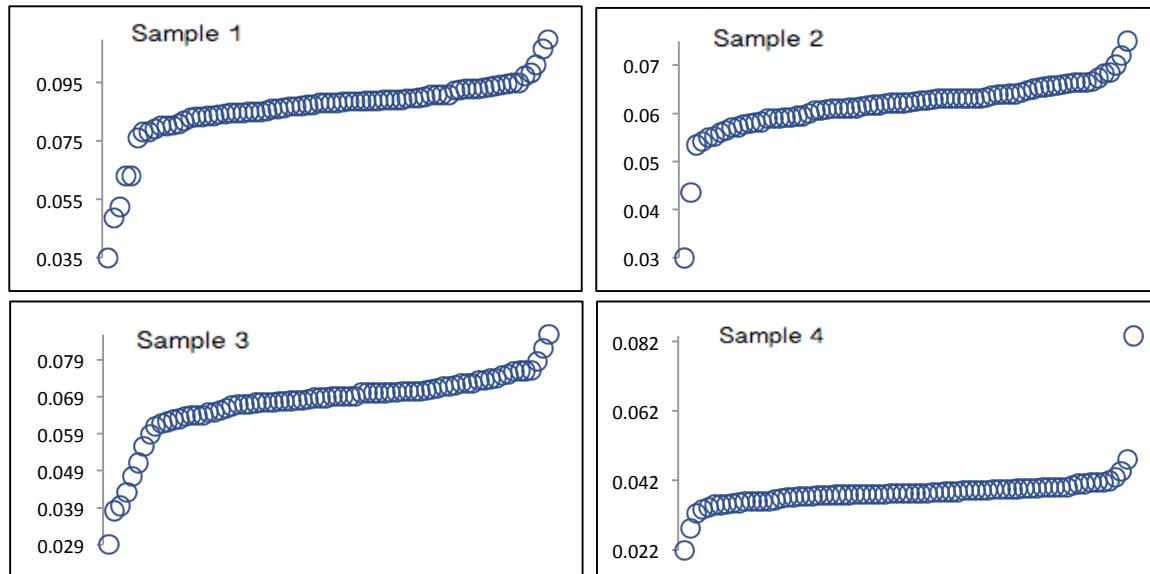
TIN

## z-Score Plots
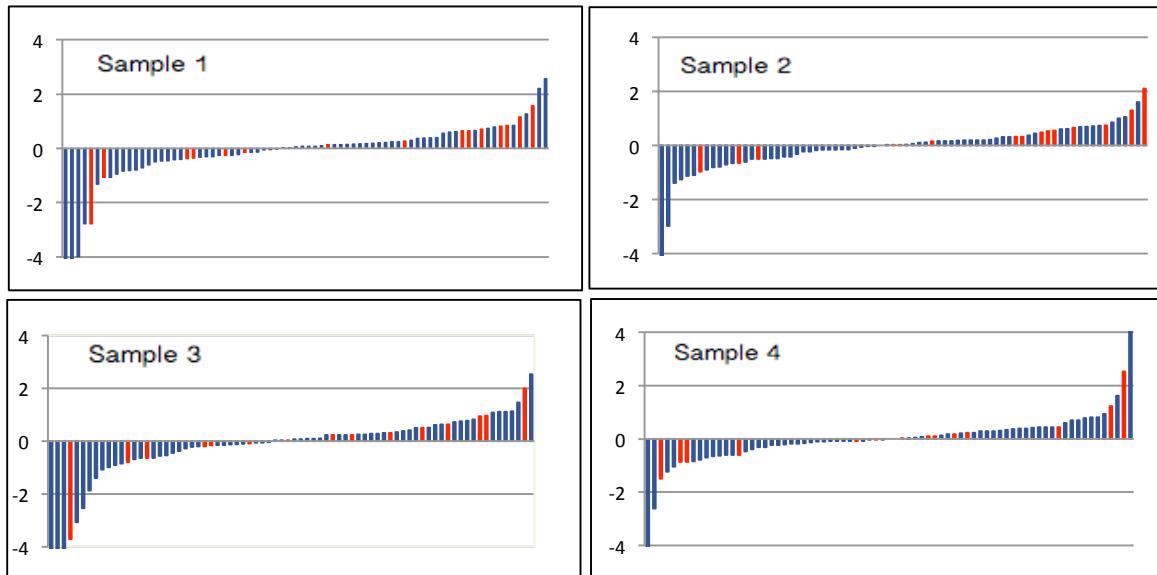
Kernel Density Plots
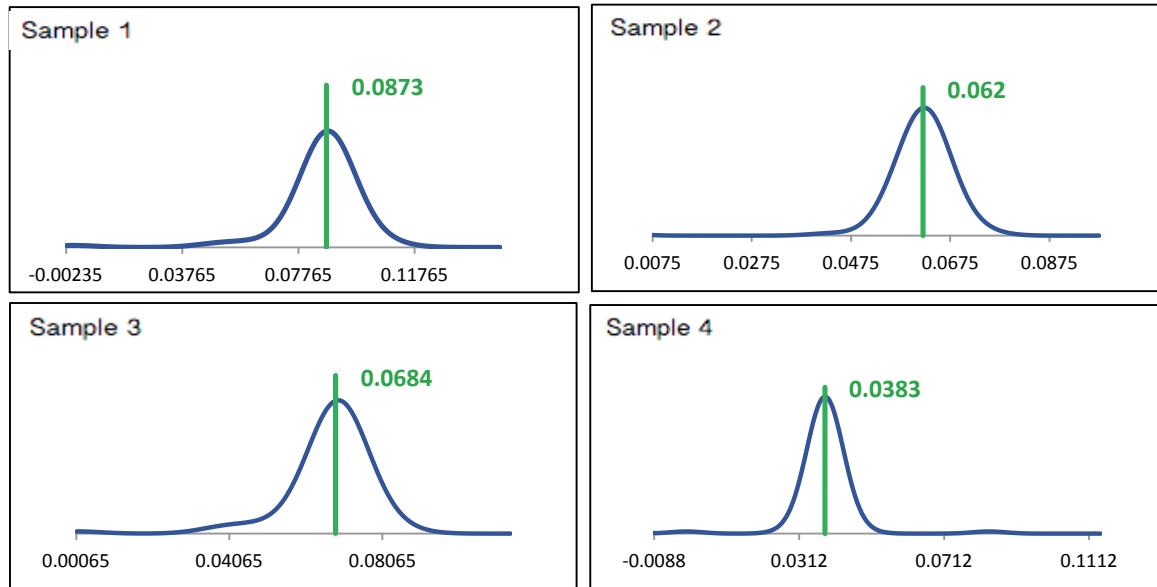
TIN

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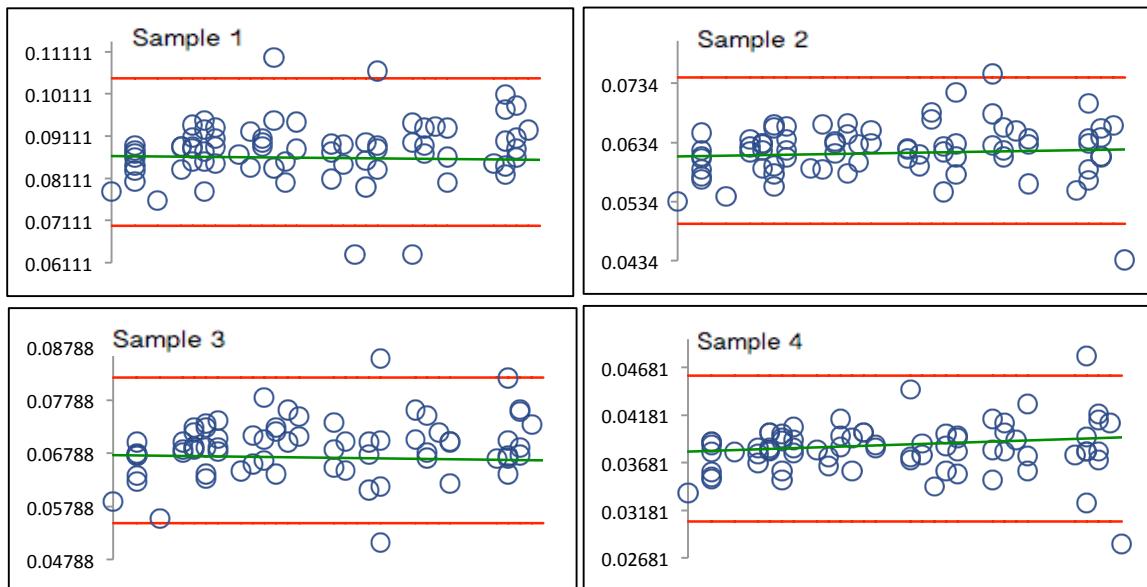
Reported results (Y-axis) plotted against reported analysis date (X-axis)

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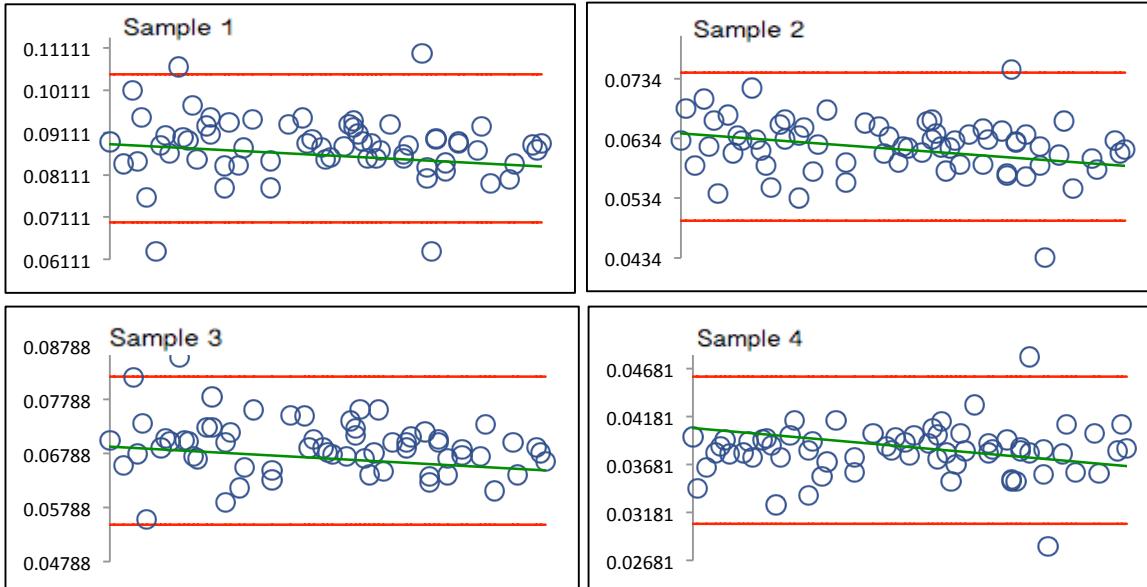
Reported results (Y-axis) plotted against bottling order (X-axis).

TITANIUM

Summary Statistics

Statistic	C02A-1	C02A-2	C02A-3	C02A-4
N	81	81	81	81
Median	0.765	0.648	0.158	1.110
Robust Mean	0.765	0.650	0.158	1.110
U	0.00510	0.00401	0.00104	0.00758
Robust Standard Deviation	0.0367	0.0289	0.0075	0.0546
Regression Standard Deviation	0.0574	0.0487	0.0119	0.0833
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA)	0.0574	0.0487	0.0119	0.0833
Outliers	1	1	1	1
|z|>3.0	3	3	3	2
2<|z|<3	2	2	4	1

Methods Used
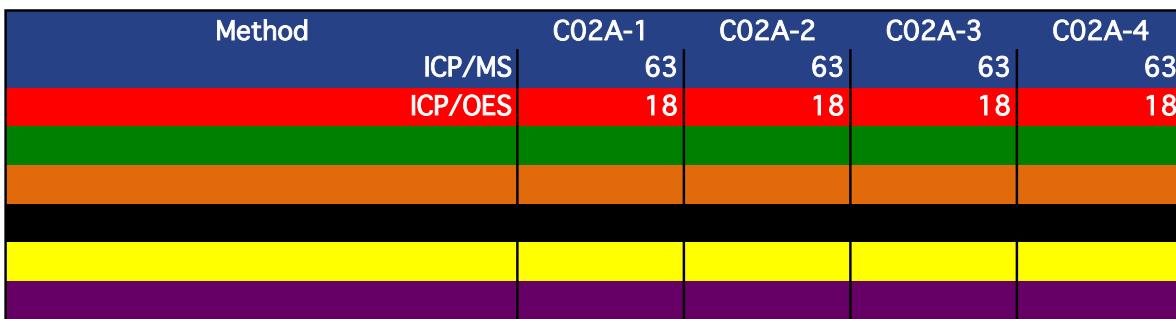
Method	C02A-1	C02A-2	C02A-3	C02A-4
ICP/MS	63	63	63	63
ICP/OES	18	18	18	18

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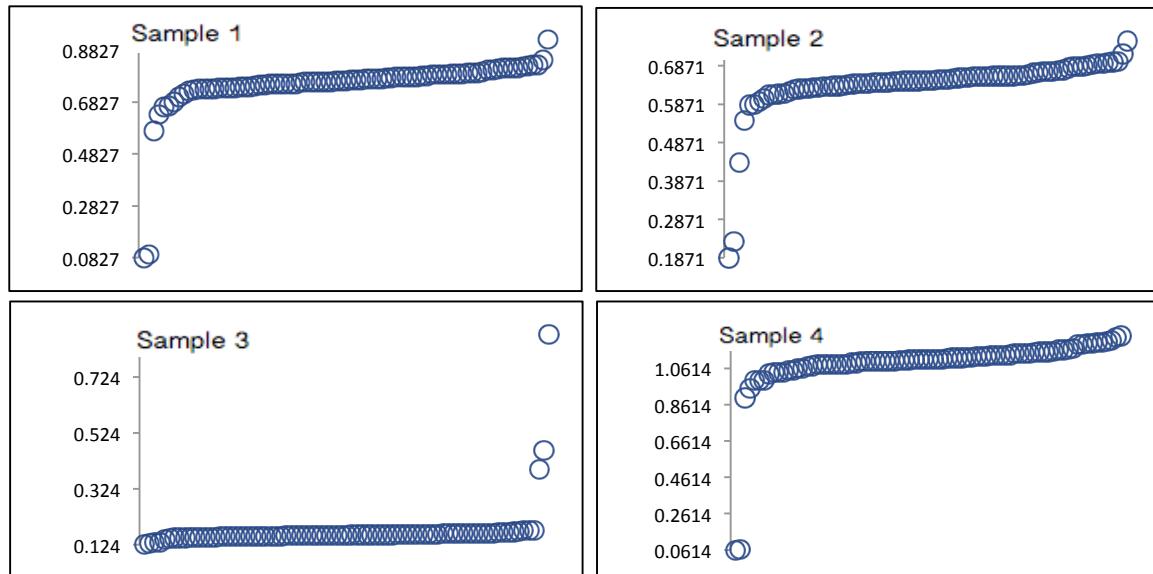
TITANIUM

## z-Score Plots
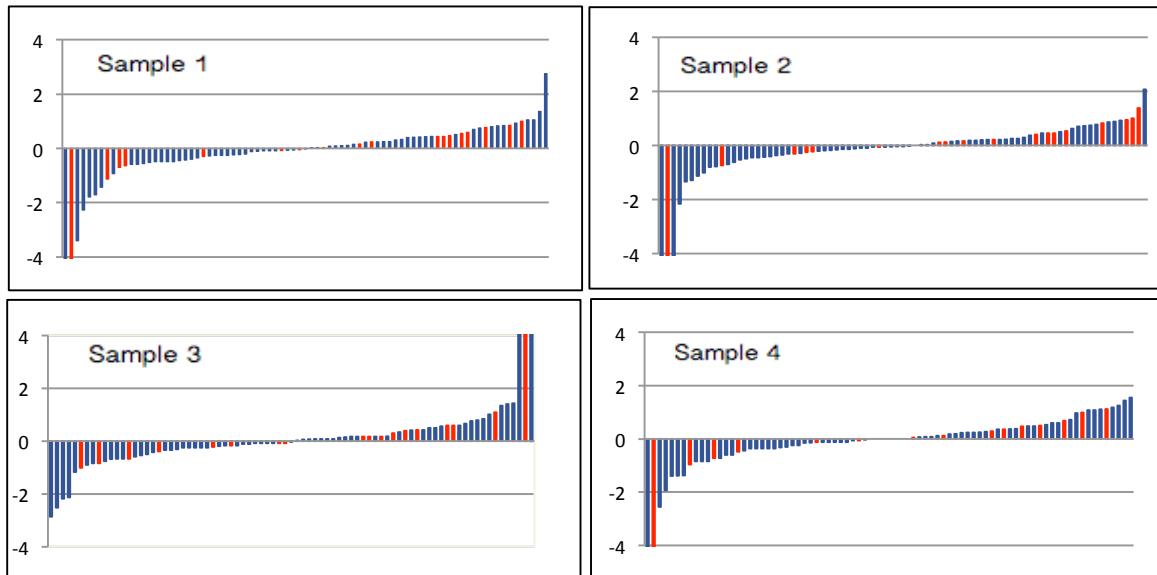
Kernel Density Plots
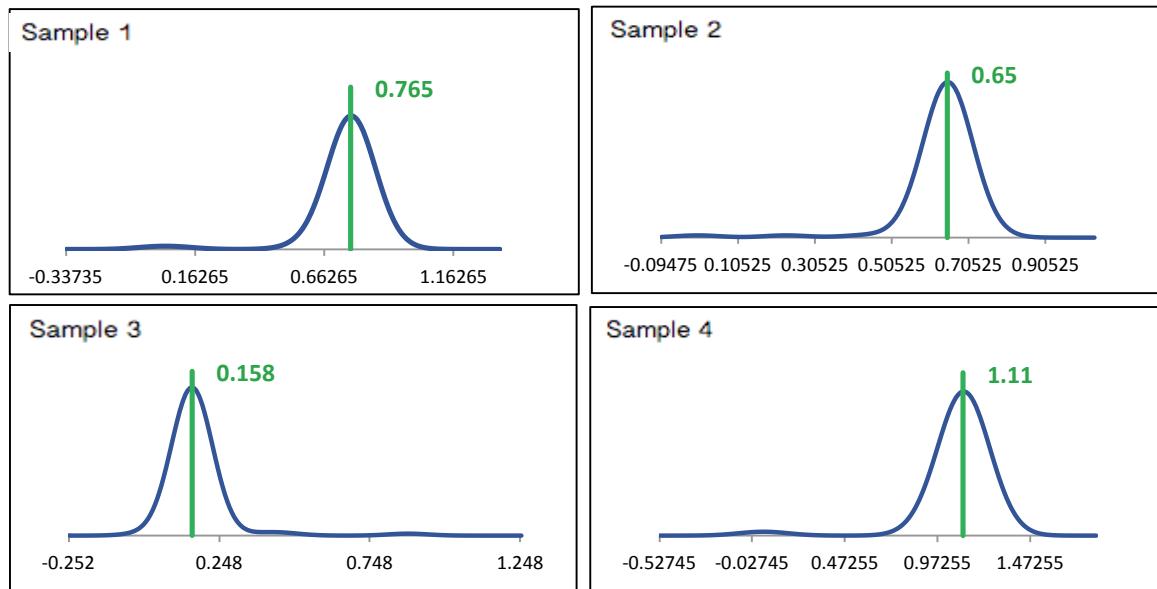
TITANIUM

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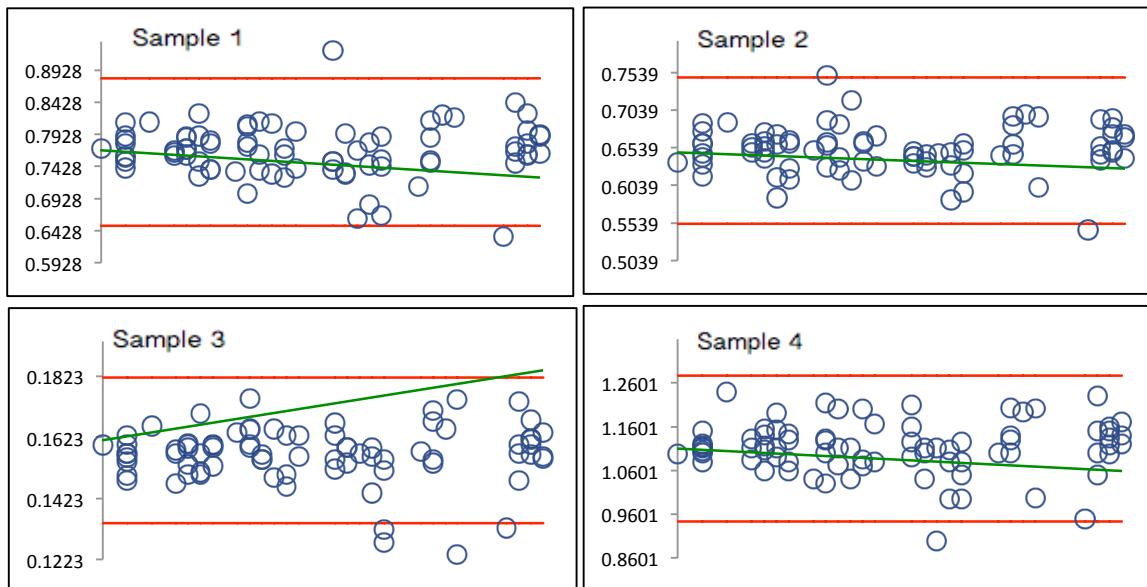
Reported results (Y-axis) plotted against reported analysis date (X-axis)

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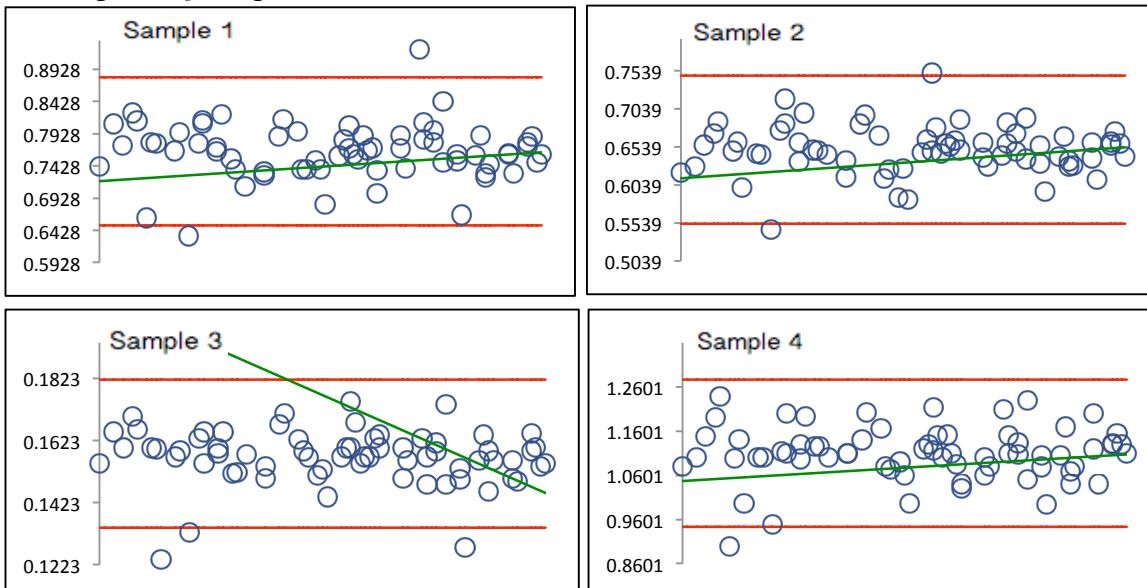
Reported results (Y-axis) plotted against bottling order (X-axis).

URANIUM
Summary Statistics

Statistic	C02A-1	C02A-2	C02A-3	C02A-4
N	84	84	84	84
Median	0.0430	0.0606	0.0568	0.0905
Robust Mean	0.0428	0.0601	0.0565	0.0907
U	0.00028	0.00039	0.00040	0.00070
Robust Standard Deviation	0.00206	0.00282	0.00292	0.00516
Regression Standard Deviation	0.00321	0.00451	0.00423	0.00680
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA)	0.00321	0.00451	0.00423	0.00680
Outliers	1	1	1	2
|z|>3.0	8	6	7	5
2<|z|<3	0	1	3	0

Methods Used

Method	C02A-1	C02A-2	C02A-3	C02A-4
ICP/OES	7	7	7	8
ICP/MS	77	77	77	76
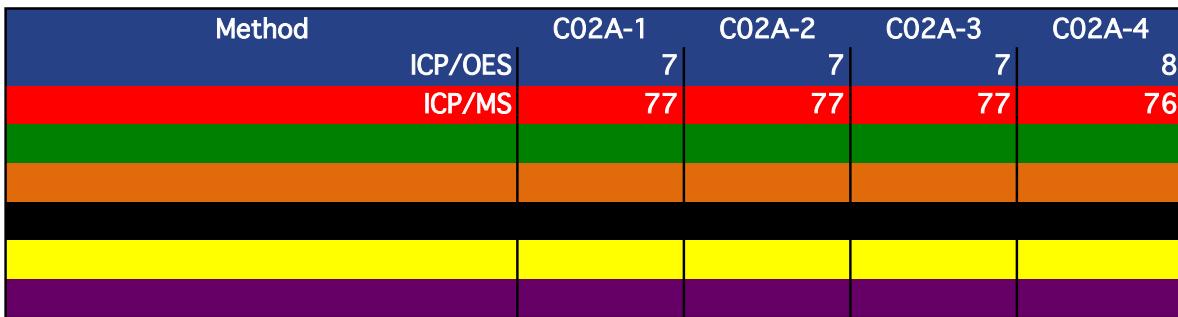
All summary stats and the plots below are based on the data excluding any flagged outliers
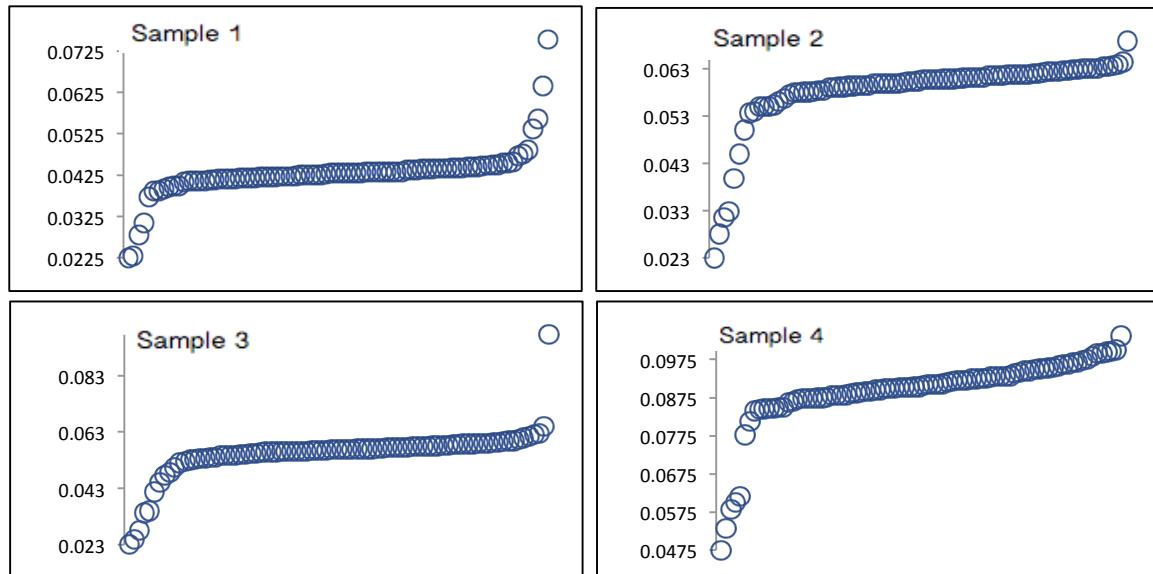
URANIUM

z-Score Plots
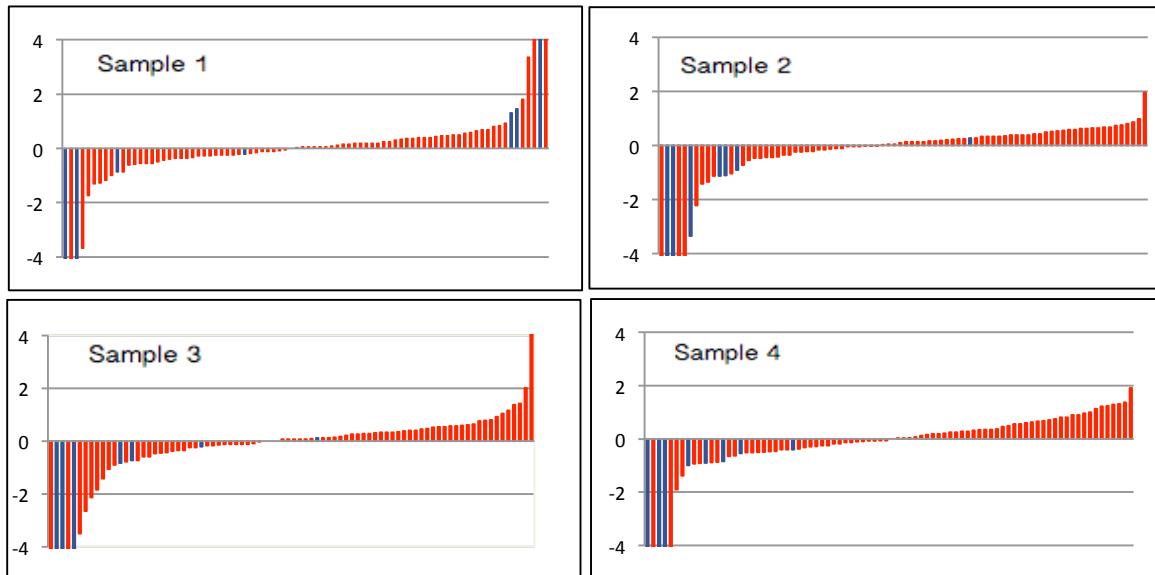
Kernel Density Plots
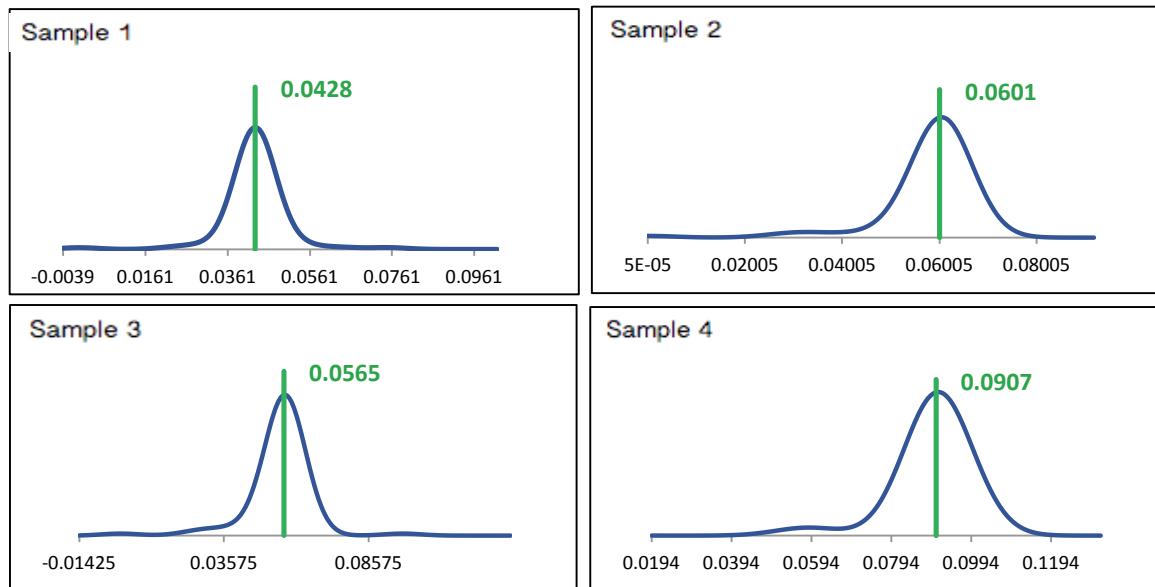
URANIUM

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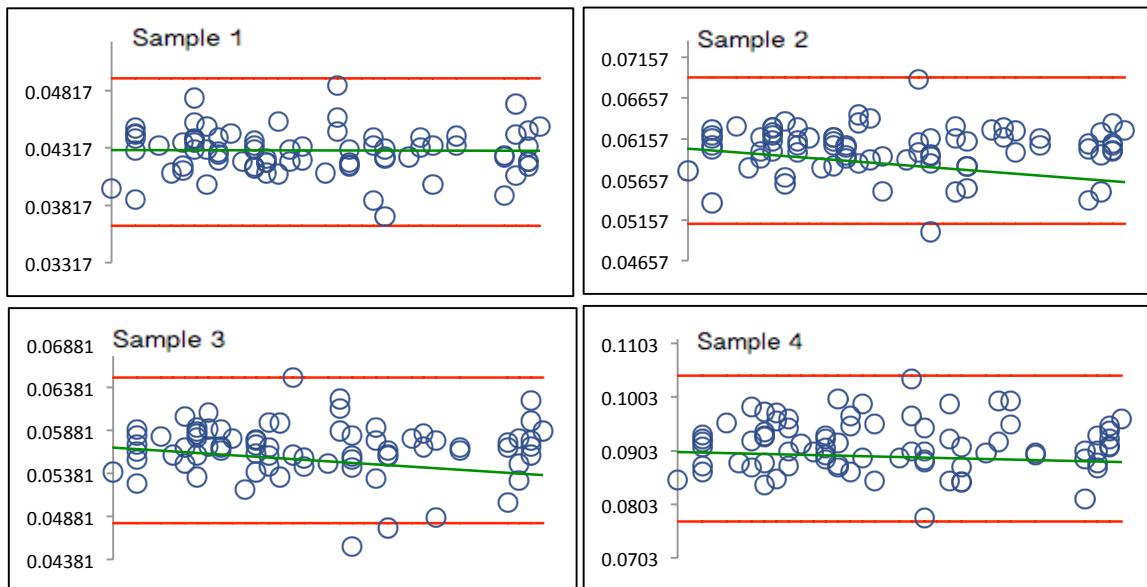
Reported results (Y-axis) plotted against reported analysis date (X-axis)

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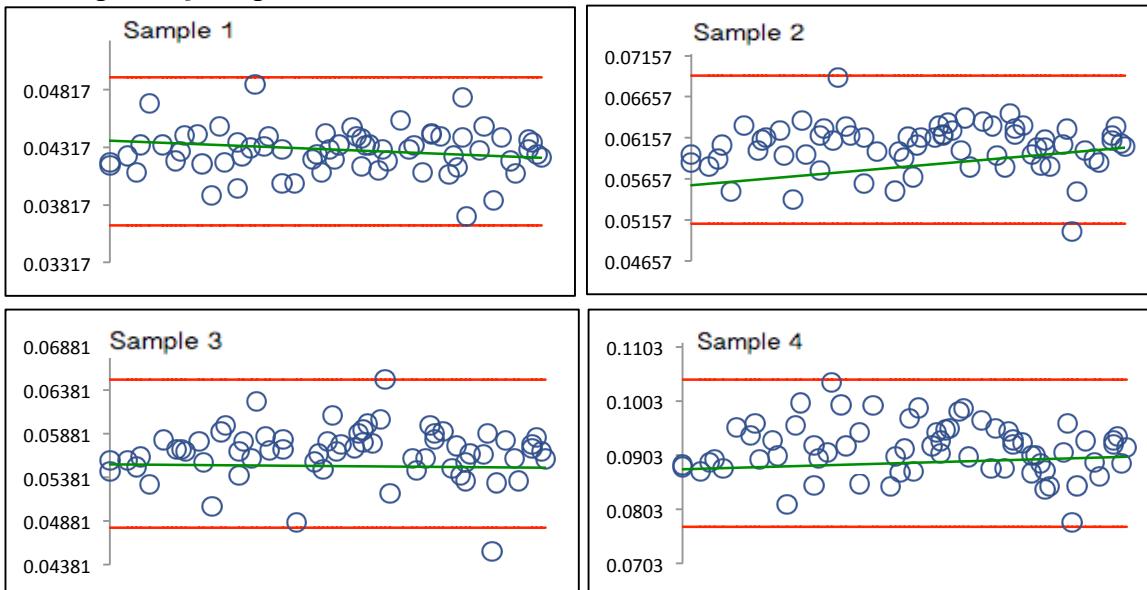
Reported results (Y-axis) plotted against bottling order (X-axis).

VANADIUM

Summary Statistics

Statistic	C02A-1	C02A-2	C02A-3	C02A-4
N	88	90	92	91
Median	0.0520	0.951	0.524	0.656
Robust Mean	0.0508	0.952	0.527	0.660
U	0.00046	0.00480	0.00276	0.00364
Robust Standard Deviation	0.00342	0.0364	0.0212	0.0278
Regression Standard Deviation	0.00381	0.0714	0.0395	0.0495
Stability Flag				
Homogeneity Flag			Homogeneity	
Standard Deviation Used (SDPA)	0.00381	0.0714	0.0401	0.0495
Outliers	6	5	3	4
|z|>3.0	7	0	3	1
2<|z|<3	8	1	1	1

Methods Used

Method	C02A-1	C02A-2	C02A-3	C02A-4
ICP/MS	70	71	72	71
ICP/OES	17	18	19	19
AAG	1	1	1	1
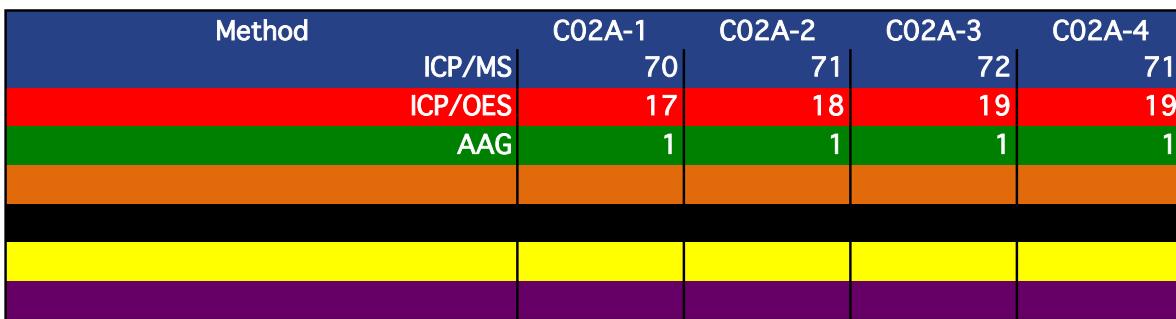
All summary stats and the plots below are based on the data excluding any flagged outliers
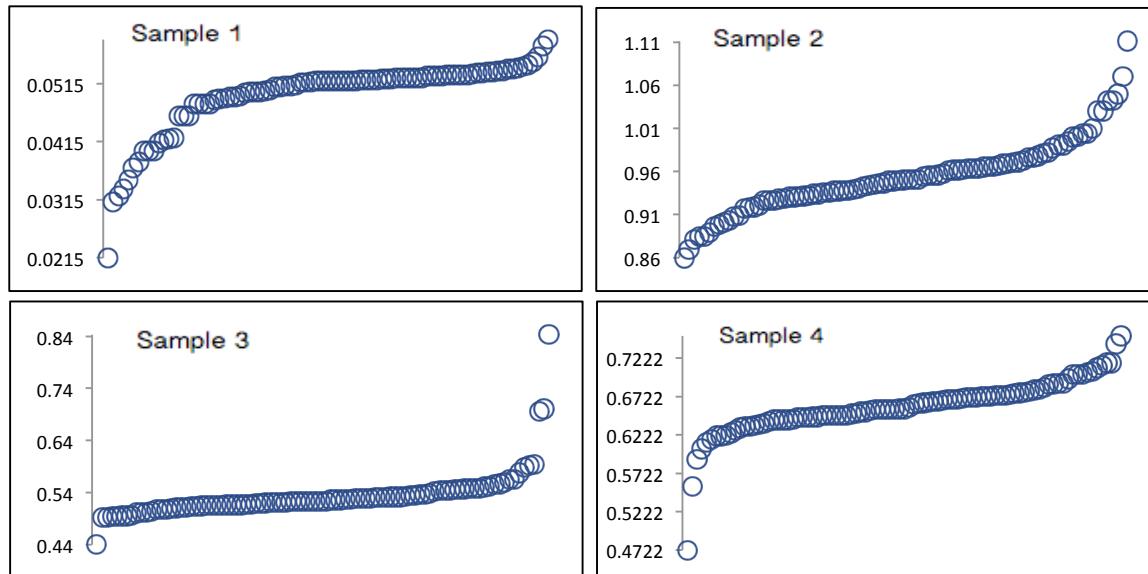
VANADIUM

## z-Score Plots
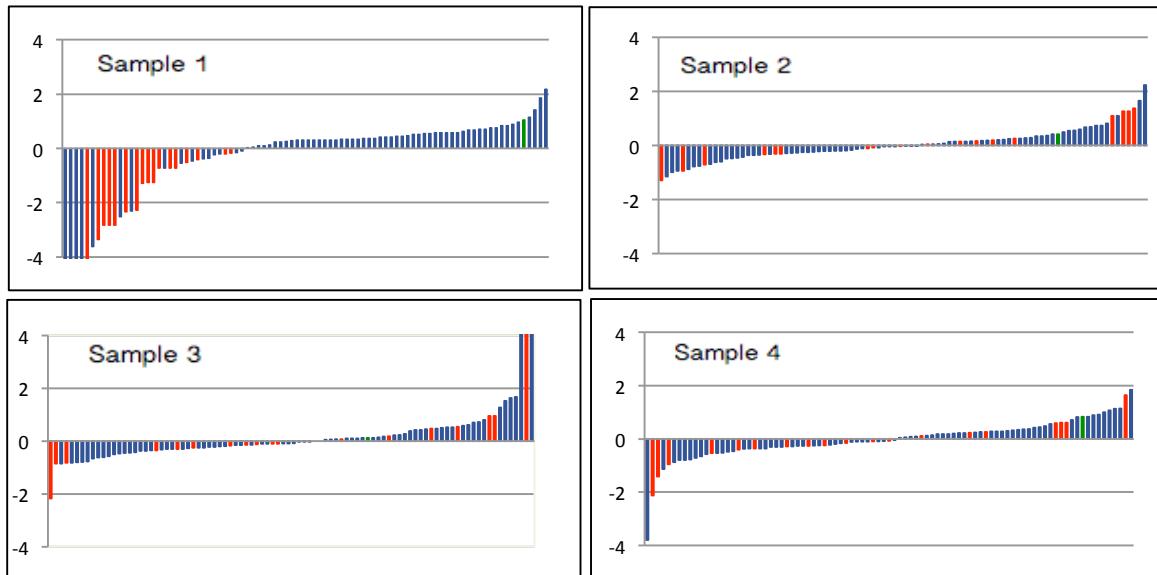
Kernel Density Plots
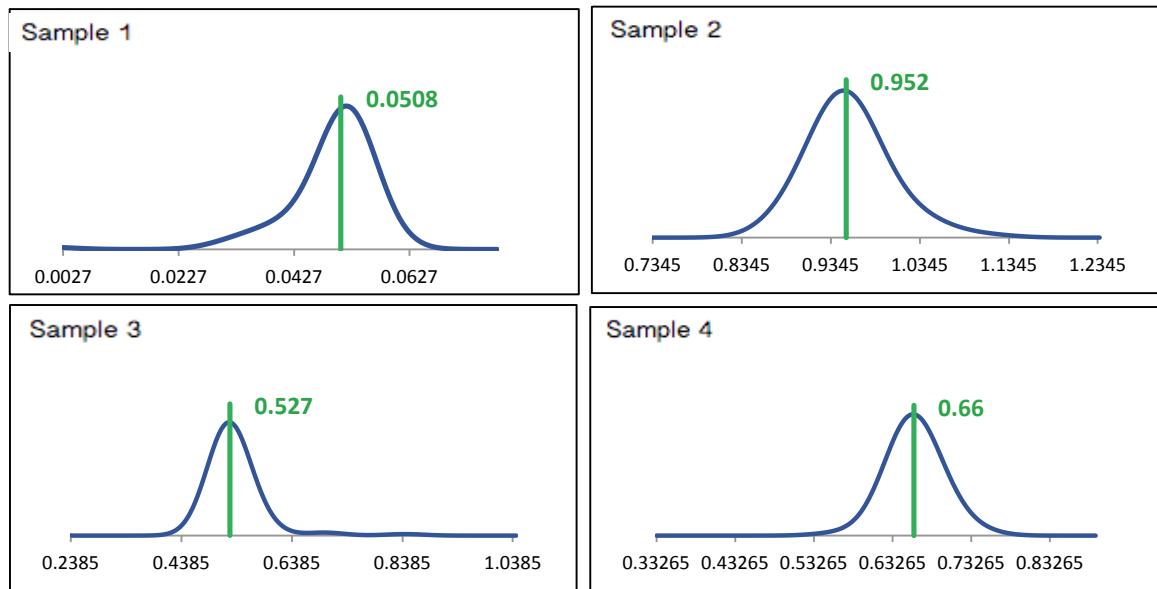
VANADIUM

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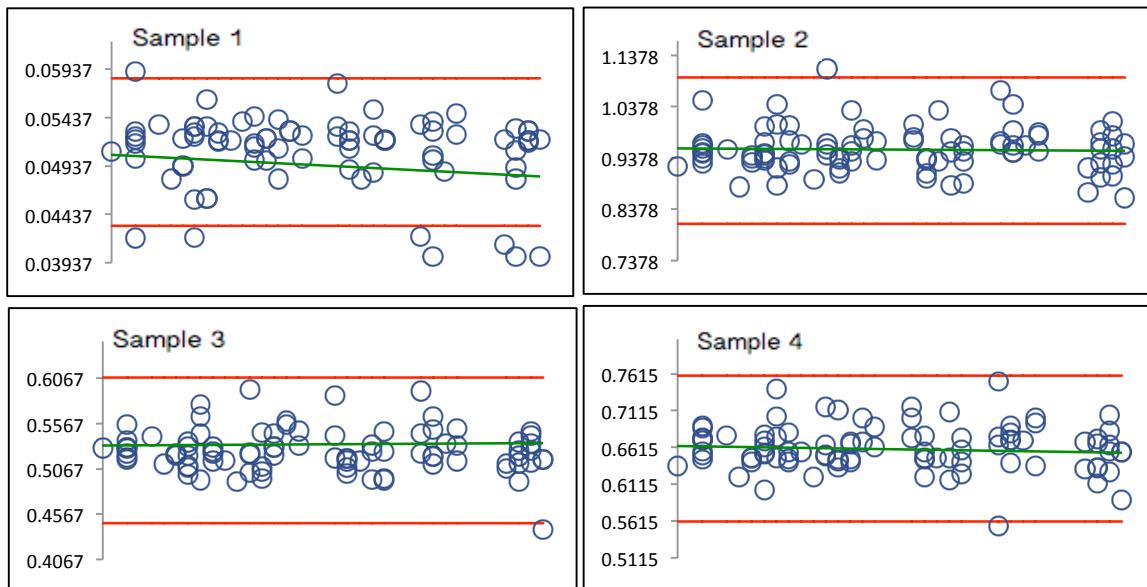
Reported results (Y-axis) plotted against reported analysis date (X-axis)

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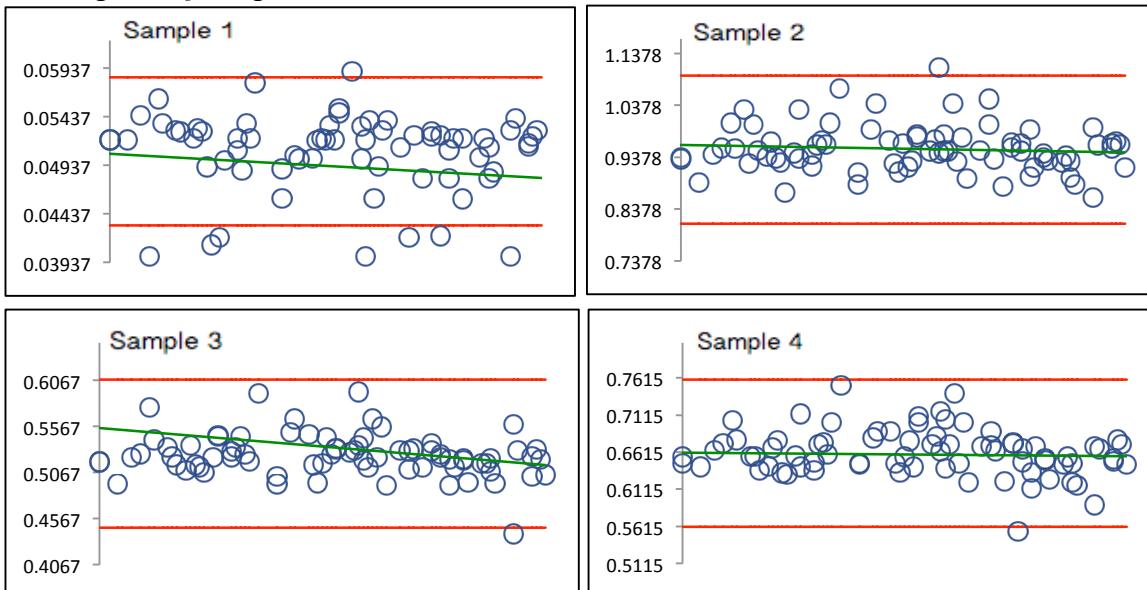
Reported results (Y-axis) plotted against bottling order (X-axis).

ZINC

Summary Statistics

Statistic	C02A-1	C02A-2	C02A-3	C02A-4
N	111	111	109	111
Median	0.470	0.666	0.0700	1.08
Robust Mean	0.471	0.669	0.0704	1.08
U	0.00273	0.00392	0.00056	0.00568
Robust Standard Deviation	0.0230	0.0330	0.00467	0.0479
Regression Standard Deviation	0.0353	0.0502	0.00528	0.0812
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA)	0.0353	0.0502	0.00528	0.0812
Outliers	4	4	4	4
$|z|>3.0$	3	3	8	3
$2<|z|<3$	1	3	4	1

Methods Used
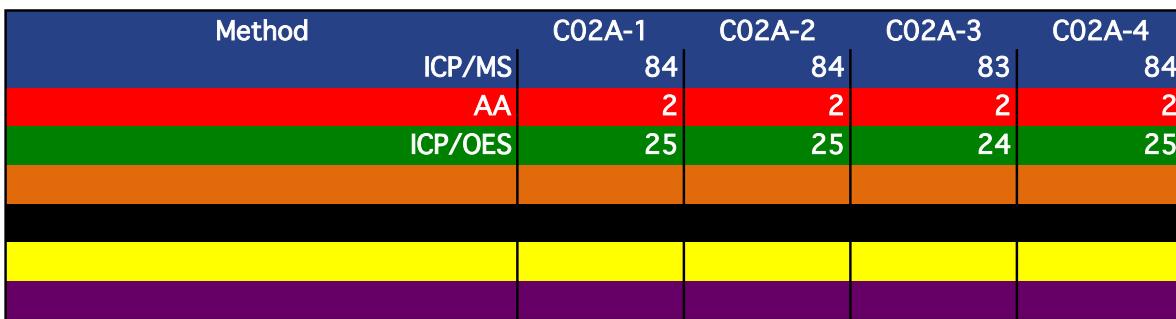
Method	C02A-1	C02A-2	C02A-3	C02A-4
ICP/MS	84	84	83	84
AA	2	2	2	2
ICP/OES	25	25	24	25

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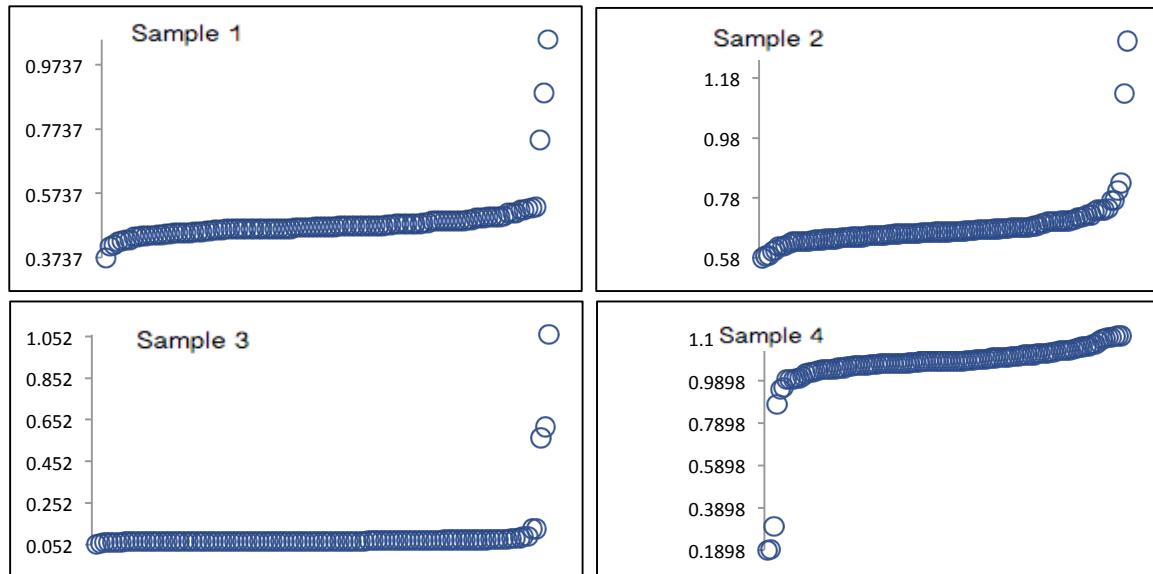
ZINC

### z-Score Plots
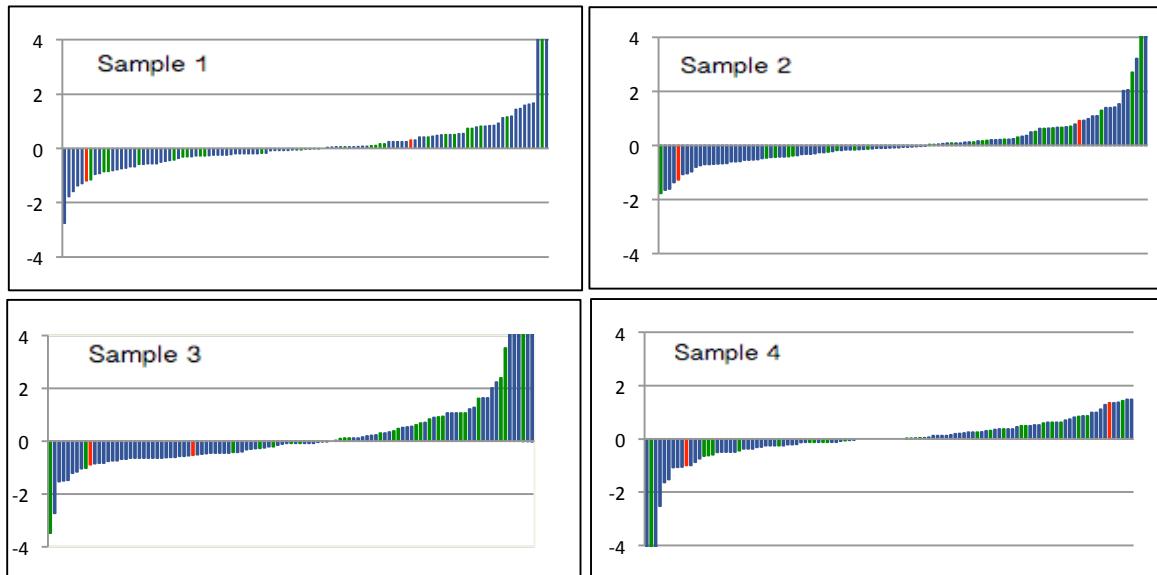
Kernel Density Plots

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).