

Test Group Summary Report

C39 Inorganics by TCLP

June 2021 PT Round

Issued: October 13, 2021

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1.0 The Proficiency Testing Report

The Proficiency Testing Report consists of two parts.

- *PTC Proficiency Testing Report*: This report contains participant-specific 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>$\pm U$:</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.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:

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

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 ≤ 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.

ARSENIC

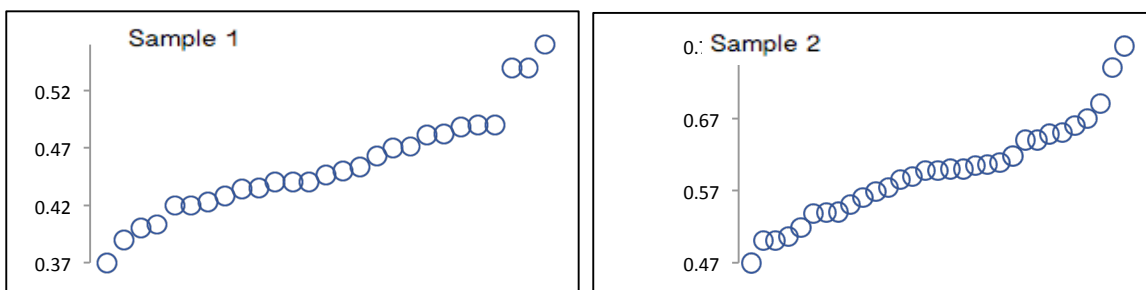
Summary Statistics

Statistic	C39-1	C39-2	C39-3	C39-4
N	27	31	0	0
Median	0.446	0.597		
Robust Mean	0.452	0.593		
U	0.0102	0.0151		
Robust Standard Deviation	0.0423	0.0671		
Regression Standard Deviation				
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA)	0.0423	0.0671		
Outliers	1	0	0	0
$ z > 3.0$	0	0	0	0
$2 < z < 3$	3	2	0	0

Methods Used

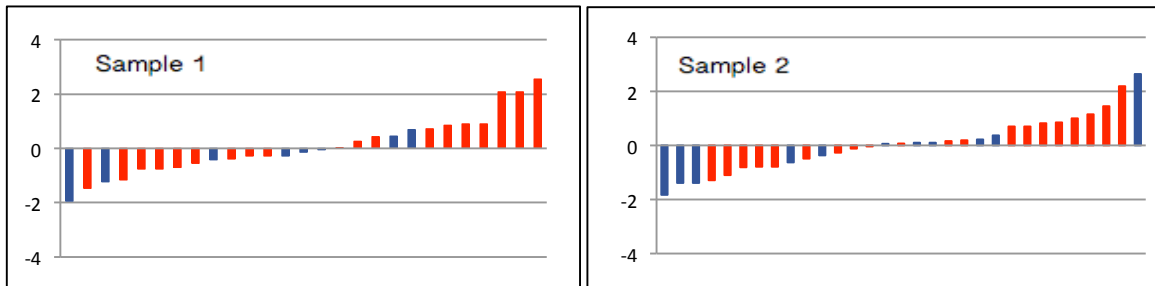
Method	C39-1	C39-2	C39-3	C39-4
ICP/OES	8	11	0	0
ICP/MS	19	20	0	0

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

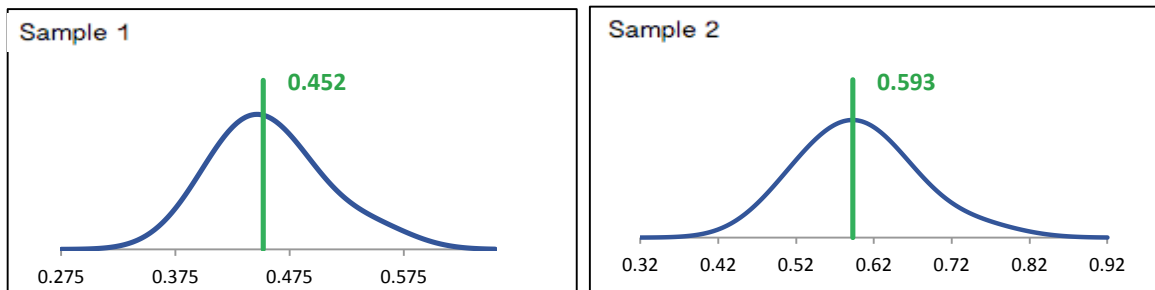


ARSENIC

z-Score Plots

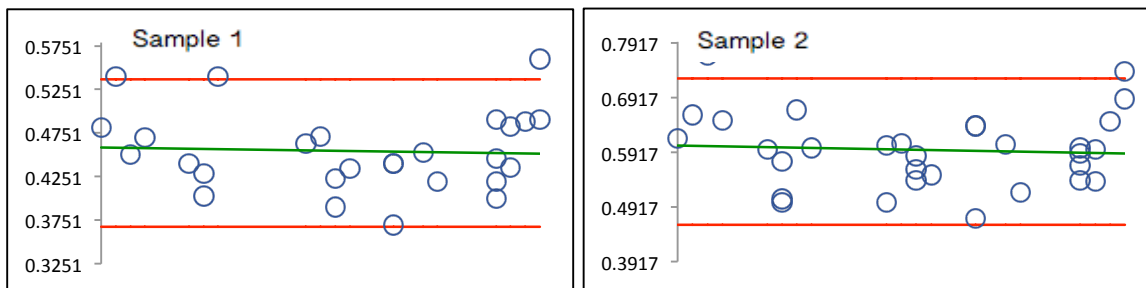


Kernel Density Plots



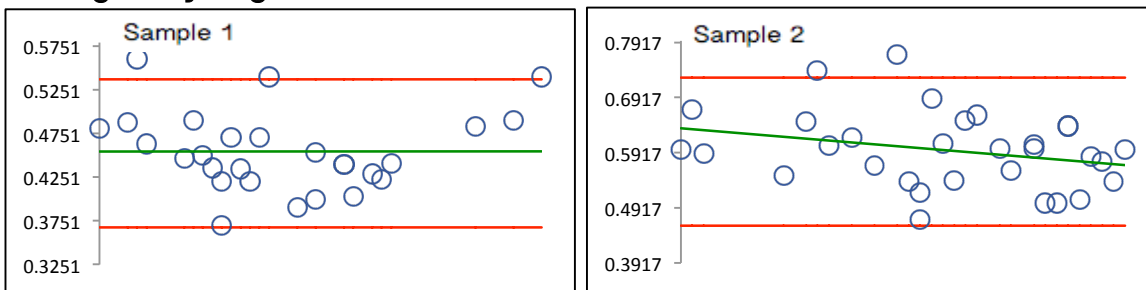
ARSENIC

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

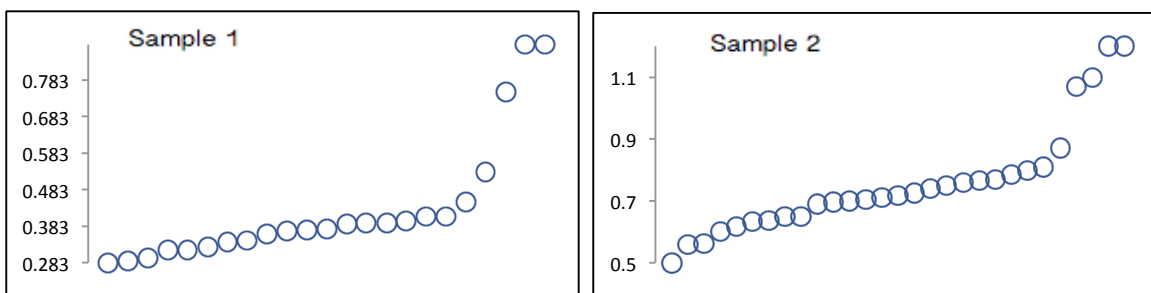
Summary Statistics

Statistic	C39-1	C39-2	C39-3	C39-4
N	23	29	0	0
Median	0.376	0.717		
Robust Mean	0.384	0.727		
U	0.0205	0.0283		
Robust Standard Deviation	0.0787	0.122		
Regression Standard Deviation				
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA)	0.0787	0.122		
Outliers	0	0	0	0
$ z > 3.0$	3	3	0	0
$2 < z < 3$	0	1	0	0

Methods Used

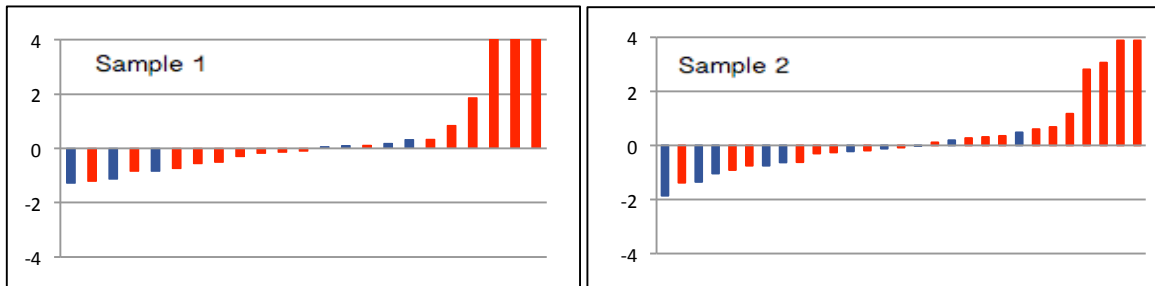
Method	C39-1	C39-2	C39-3	C39-4
ICP/OES	7	10	0	0
ICP/MS	16	19	0	0

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

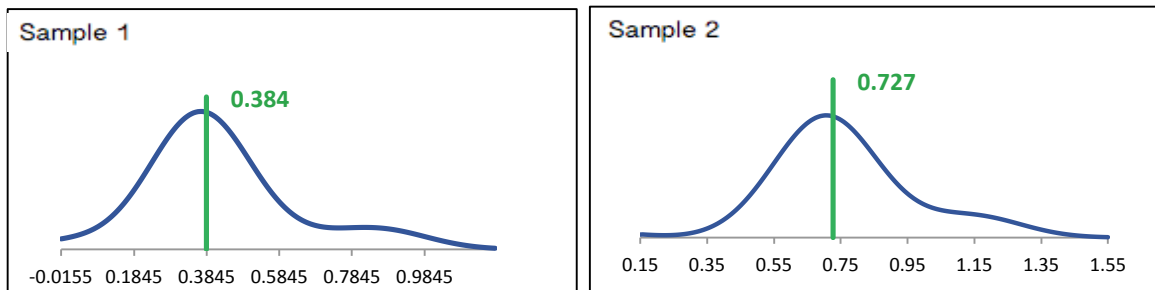


BARIUM

z-Score Plots

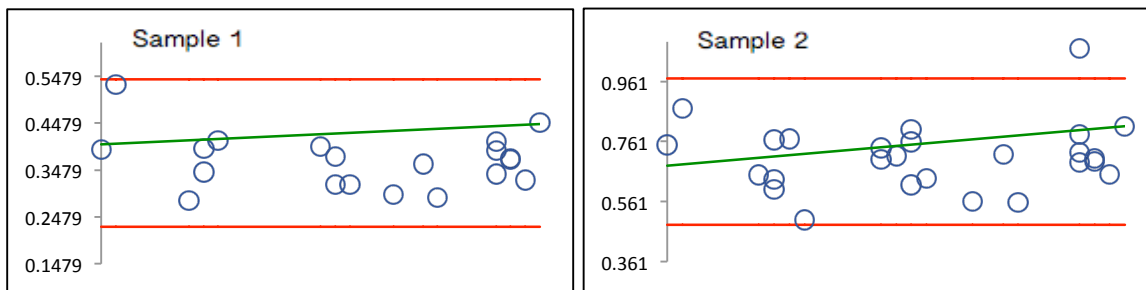


Kernel Density Plots



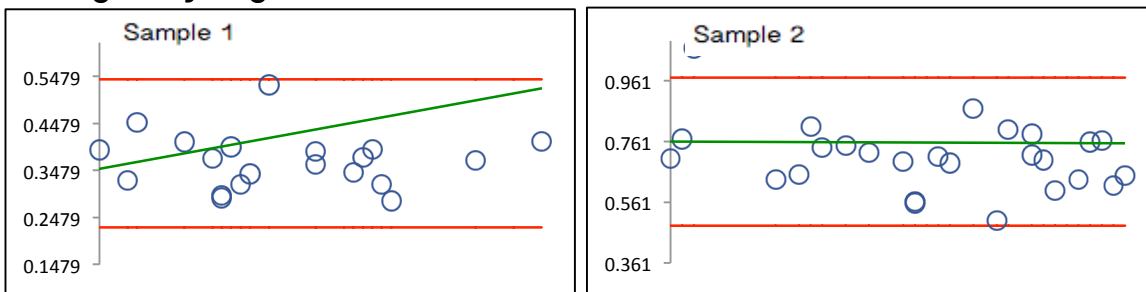
BARIUM

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).

BORON

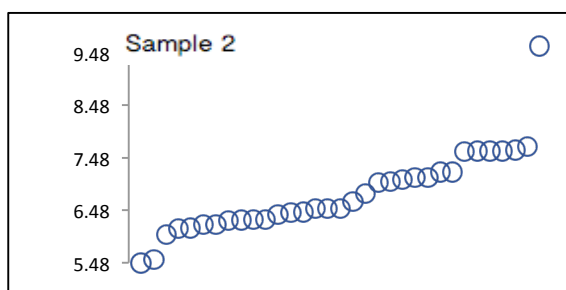
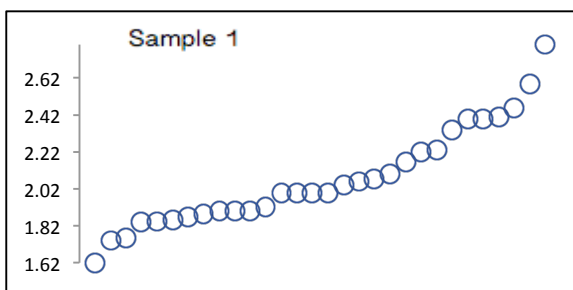
Summary Statistics

Statistic	C39-1	C39-2	C39-3	C39-4
N	30	33	0	0
Median	2.00	6.51		
Robust Mean	2.06	6.75		
U	0.0621	0.151		
Robust Standard Deviation	0.272	0.692		
Regression Standard Deviation				
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA)	0.272	0.692		
Outliers	0	0	0	0
$ z > 3.0$	0	1	0	0
$2 < z < 3$	1	0	0	0

Methods Used

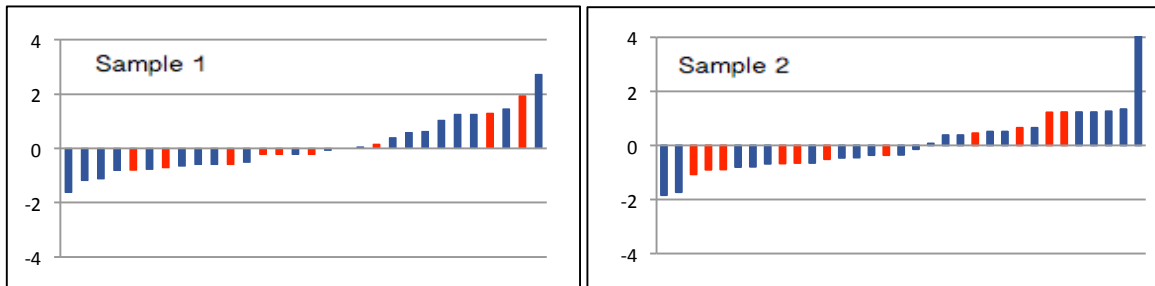
Method	C39-1	C39-2	C39-3	C39-4
ICP/MS	20	22	0	0
ICP/OES	10	11	0	0

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

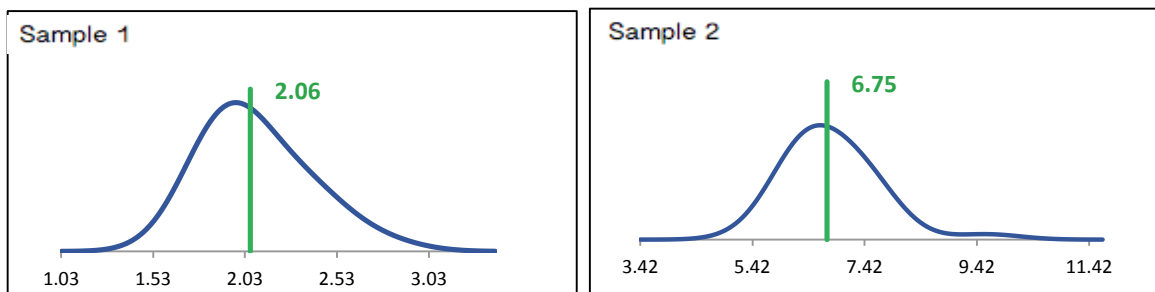


BORON

z-Score Plots

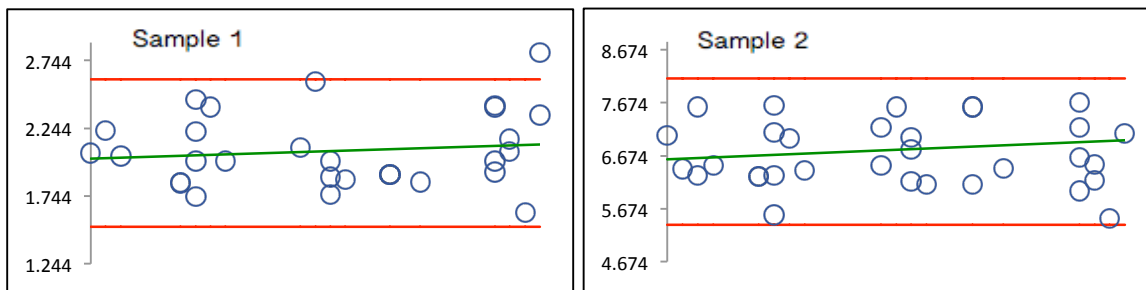


Kernel Density Plots



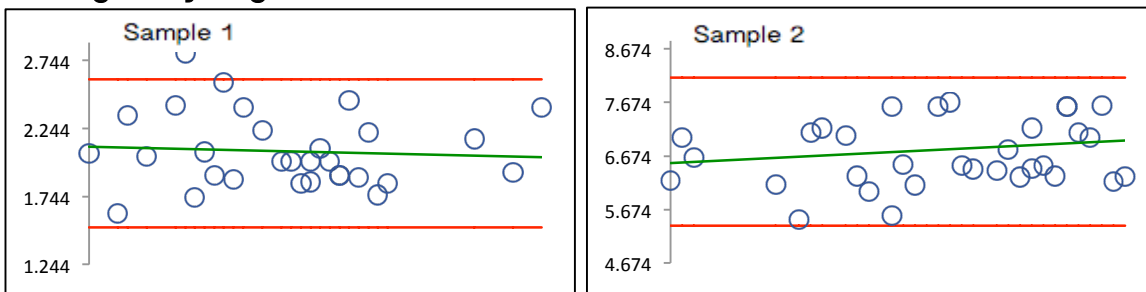
BORON

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

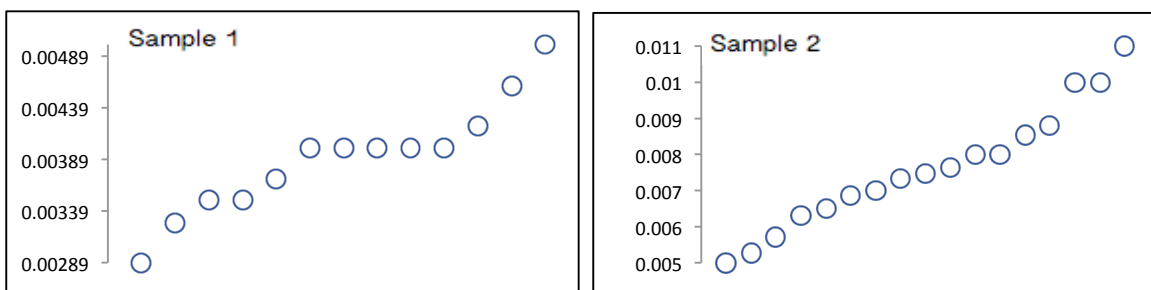
Summary Statistics

Statistic	C39-1	C39-2	C39-3	C39-4
N	13	17	0	0
Median	0.00400	0.00748		
Robust Mean	0.00389	0.00757		
U	0.00019	0.00055		
Robust Standard Deviation	0.000534	0.00182		
Regression Standard Deviation				
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA)	0.000534	0.00182		
Outliers	0	0	0	0
$ z > 3.0$	0	0	0	0
$2 < z < 3$	1	0	0	0

Methods Used

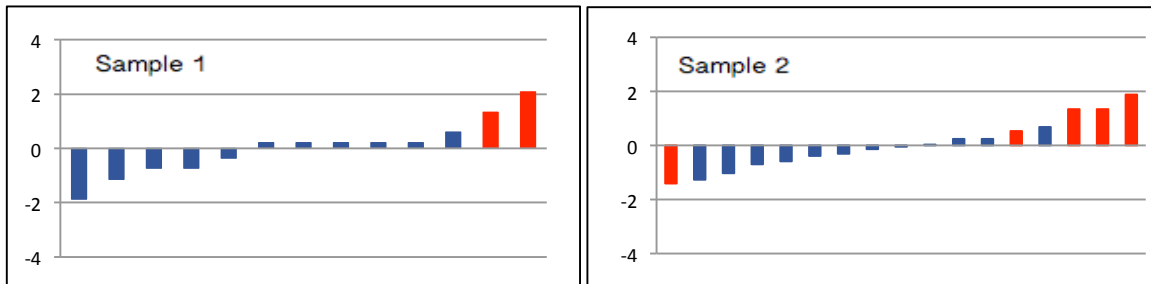
Method	C39-1	C39-2	C39-3	C39-4
ICP/MS	11	12	0	0
ICP/OES	2	5	0	0

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

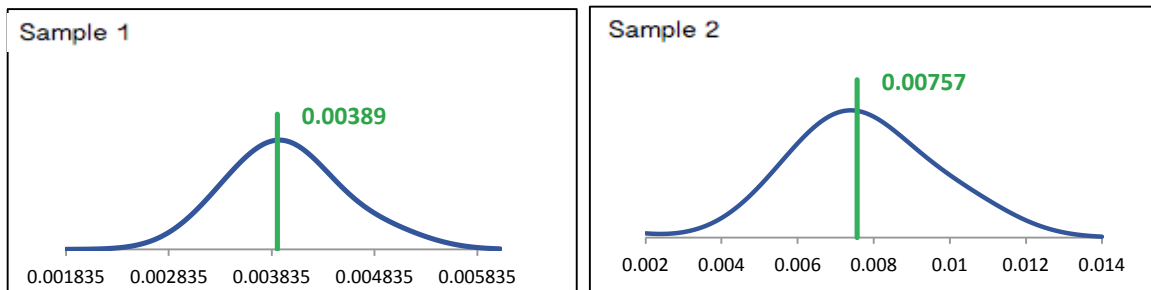


CADMIUM

z-Score Plots

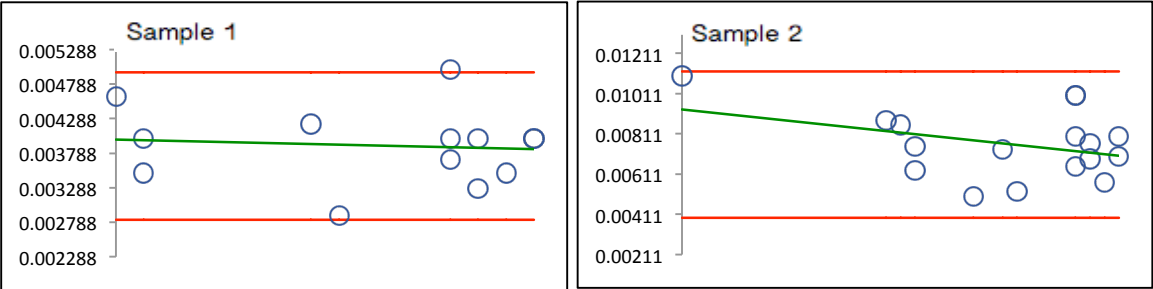


Kernel Density Plots



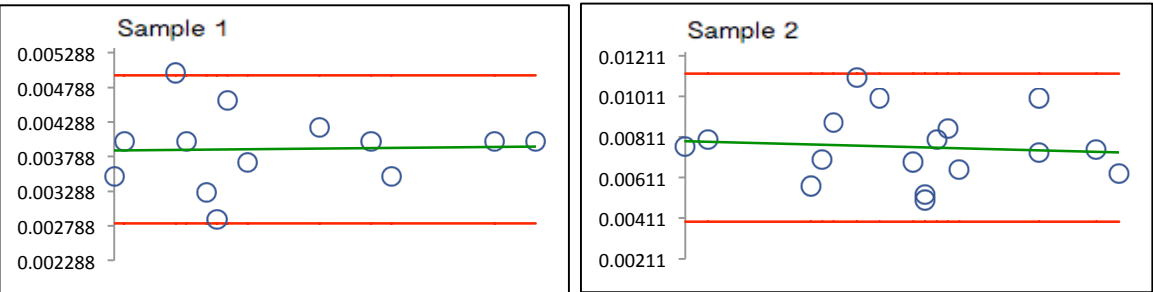
CADMIUM

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

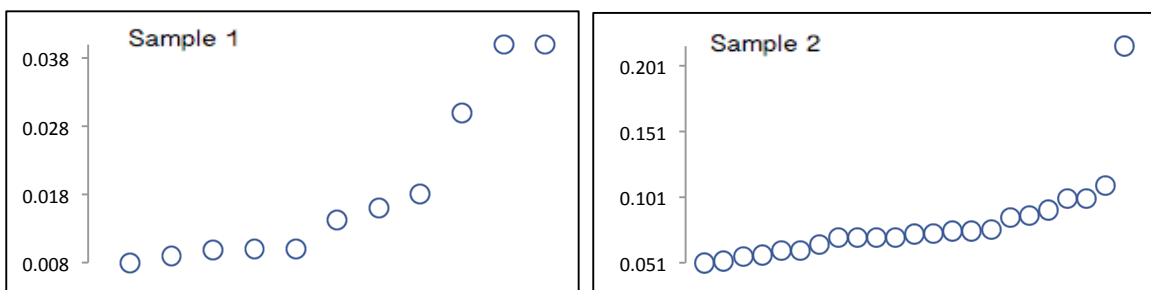
Summary Statistics

Statistic	C39-1	C39-2	C39-3	C39-4
N	11	23	0	0
Median	0.0142	0.0730		
Robust Mean	0.0182	0.0748		
U	0.00490	0.00474		
Robust Standard Deviation	0.0130	0.0182		
Regression Standard Deviation				
Stability Flag	Stability			
Homogeneity Flag				
Standard Deviation Used (SDPA)	0.0215	0.0182		
Outliers	0	0	0	0
$ z > 3.0$	0	1	0	0
$2 < z < 3$	0	0	0	0

Methods Used

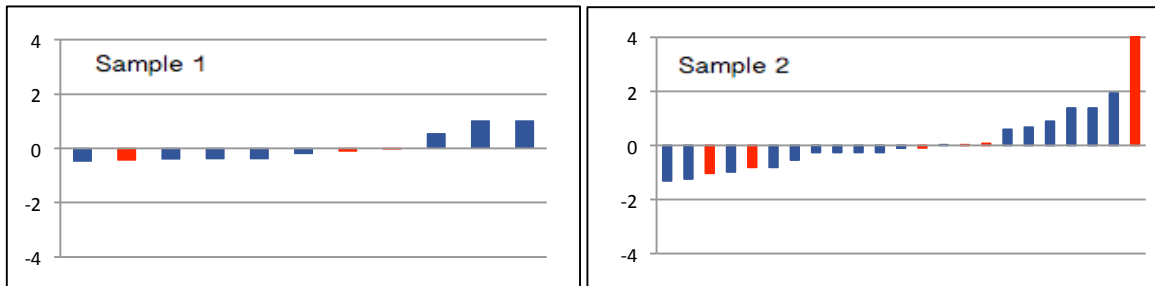
Method	C39-1	C39-2	C39-3	C39-4
ICP/MS	8	17	0	0
ICP/OES	3	6	0	0

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

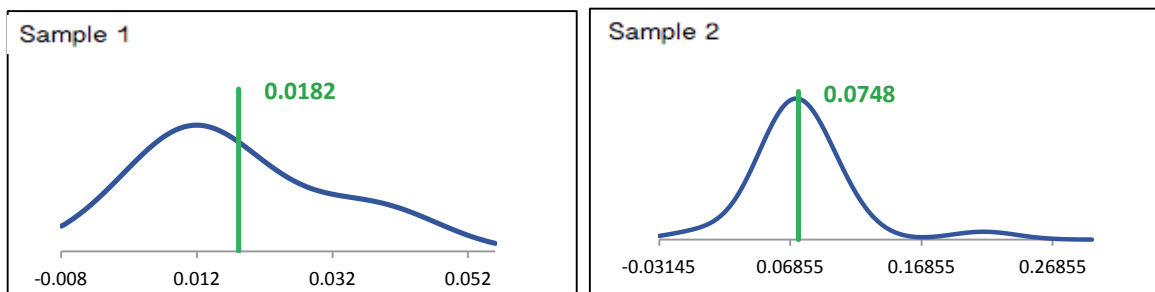


CHROMIUM

z-Score Plots

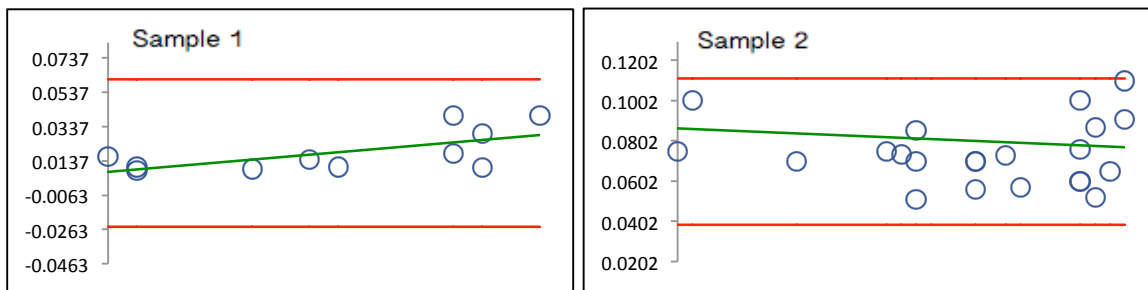


Kernel Density Plots



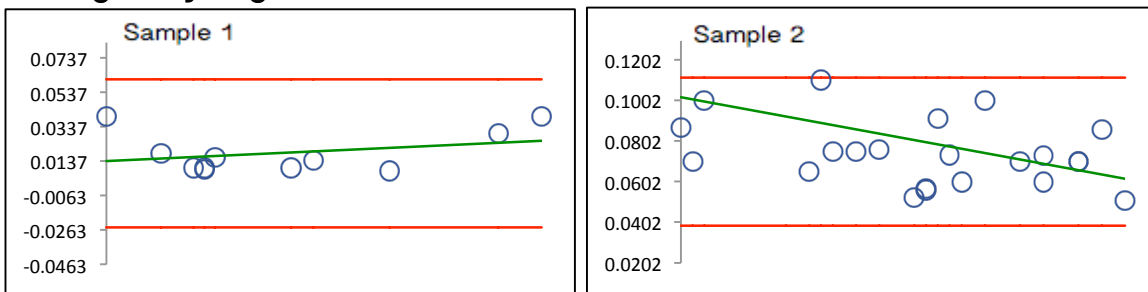
CHROMIUM

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).

CYANIDE (WAD)

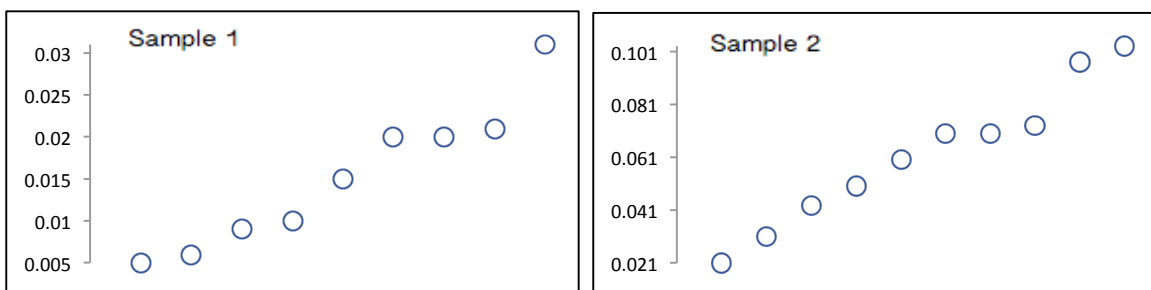
Summary Statistics

Statistic	C39-1	C39-2	C39-3	C39-4
N	9	10	0	0
Median	0.0150	0.0650		
Robust Mean	0.0150	0.0618		
U	0.00378	0.0119		
Robust Standard Deviation	0.00907	0.0300		
Regression Standard Deviation				
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA)	0.00907	0.0300		
Outliers	0	0	0	0
$ z > 3.0$	0	0	0	0
$2 < z < 3$	0	0	0	0

Methods Used

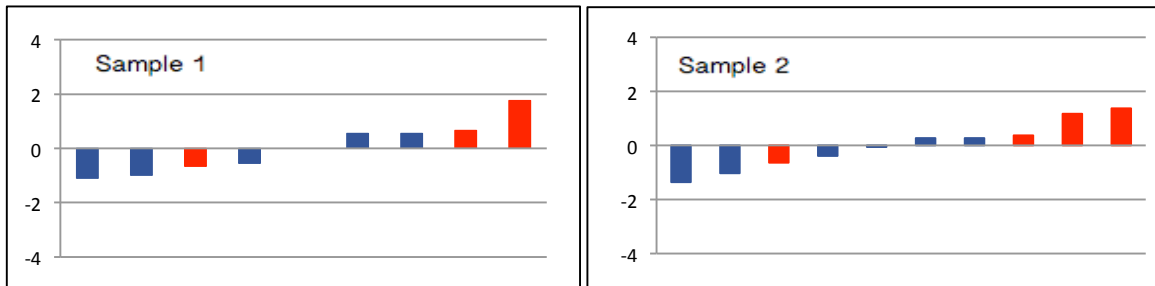
Method	C39-1	C39-2	C39-3	C39-4
CLR-A	5	6	0	0
COLOR	4	4	0	0

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

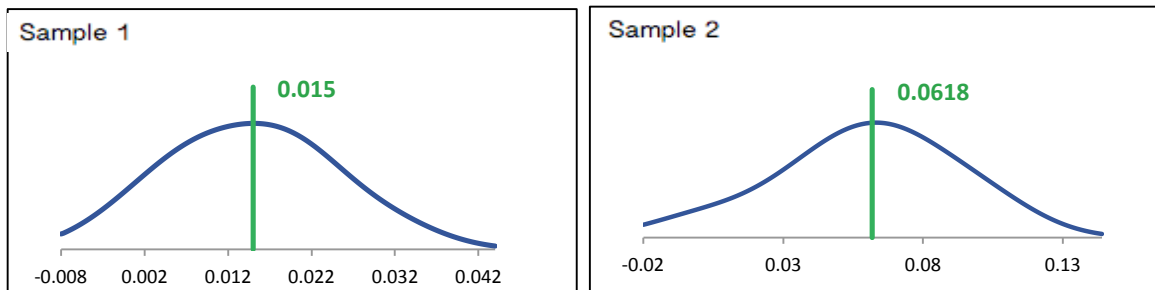


CYANIDE (WAD)

z-Score Plots

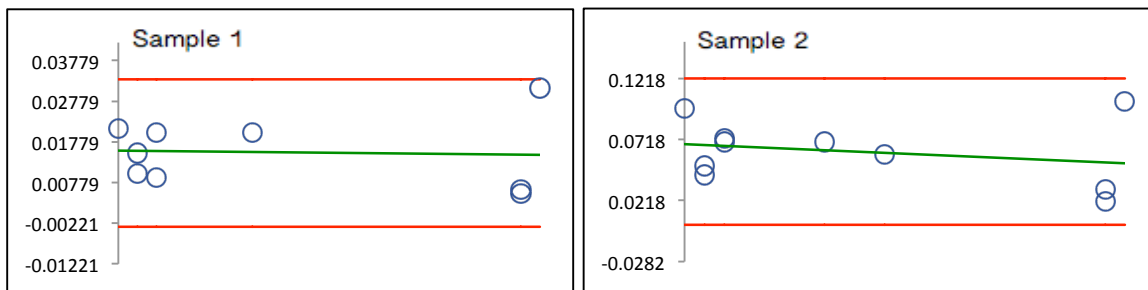


Kernel Density Plots



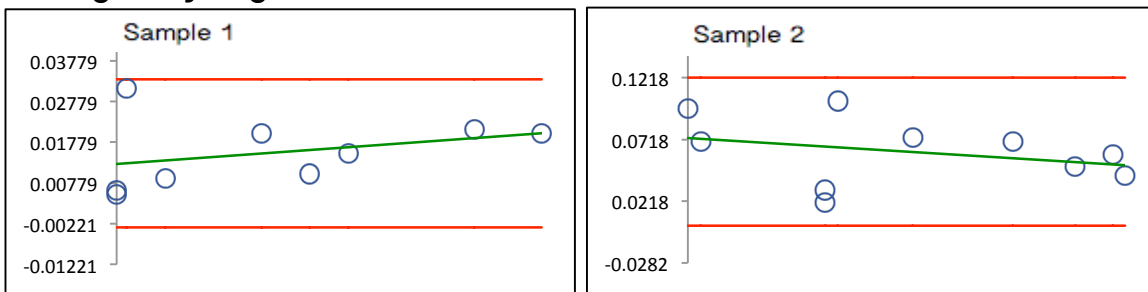
CYANIDE (WAD)

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).

FLUORIDE

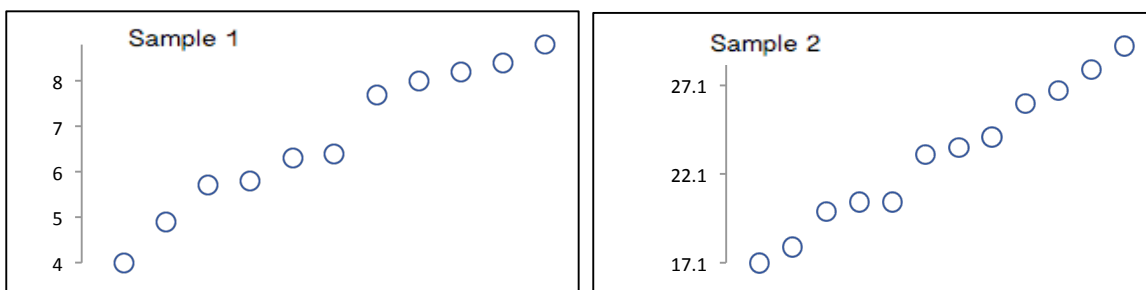
Summary Statistics

Statistic	C39-1	C39-2	C39-3	C39-4
N	11	12	0	0
Median	6.40	23.4		
Robust Mean	6.76	23.1		
U	0.667	1.62		
Robust Standard Deviation	1.77	4.48		
Regression Standard Deviation				
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA)	1.77	4.48		
Outliers	0	0	0	0
$ z > 3.0$	0	0	0	0
$2 < z < 3$	0	0	0	0

Methods Used

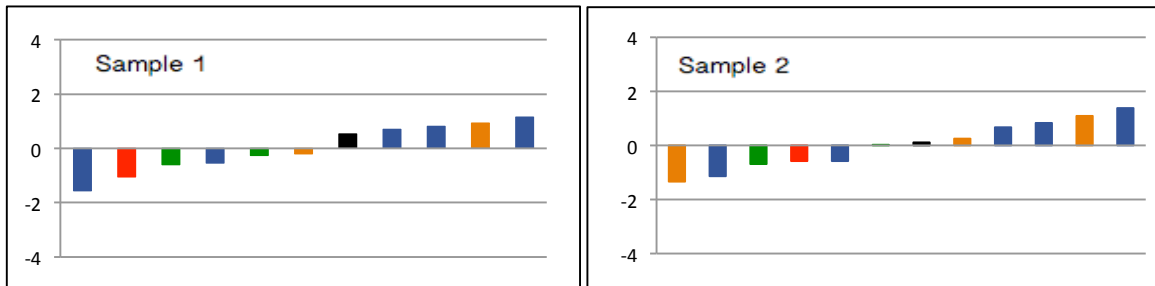
Method	C39-1	C39-2	C39-3	C39-4
SIE	5	5	0	0
TITR	1	1	0	0
COLOR	2	2	0	0
IC	2	3	0	0
ISE	1	1	0	0

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

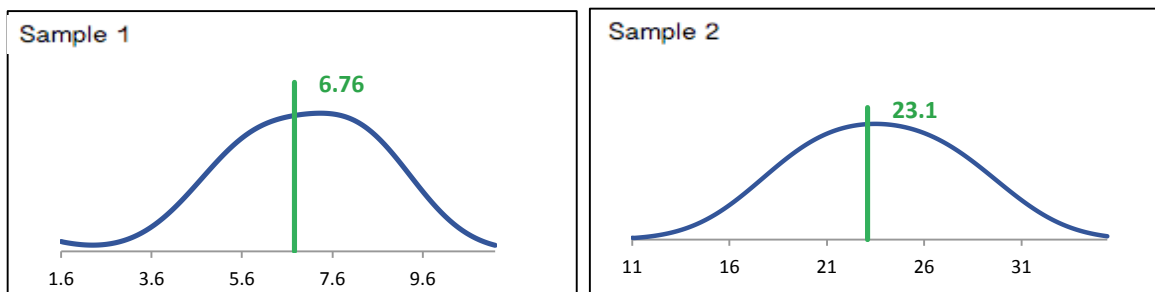


FLUORIDE

z-Score Plots

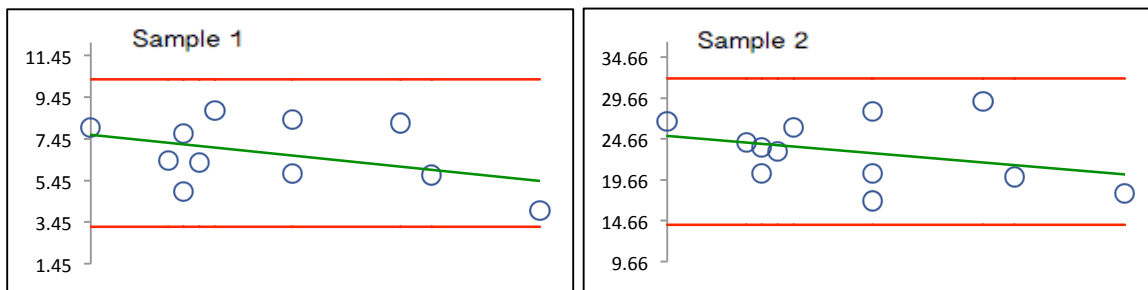


Kernel Density Plots



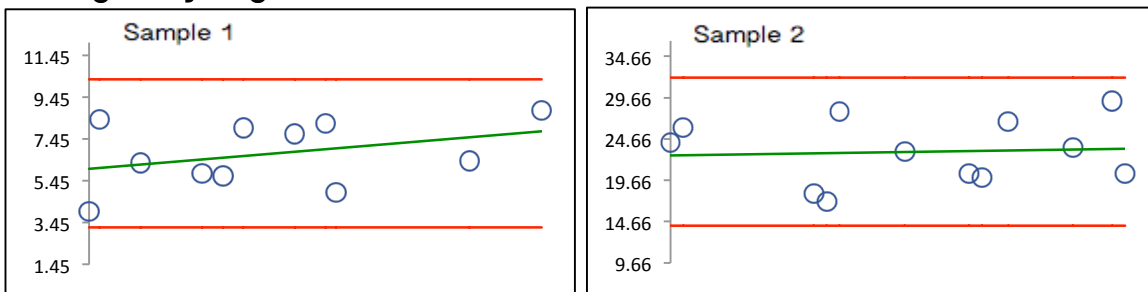
FLUORIDE

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

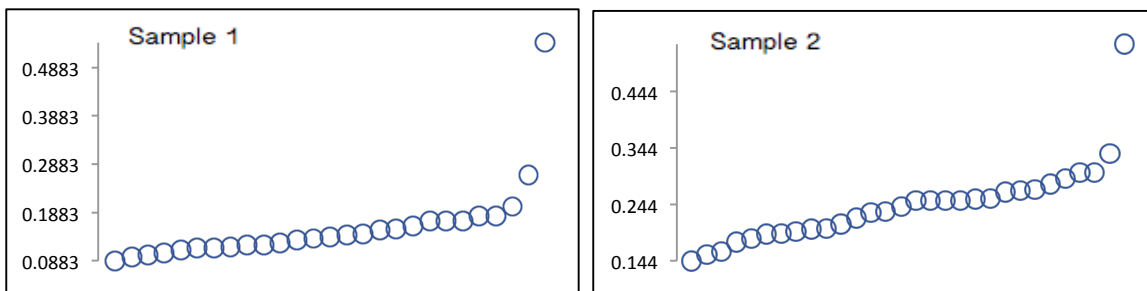
Summary Statistics

Statistic	C39-1	C39-2	C39-3	C39-4
N	27	30	0	0
Median	0.138	0.245		
Robust Mean	0.142	0.235		
U	0.00897	0.0122		
Robust Standard Deviation	0.0373	0.0533		
Regression Standard Deviation				
Stability Flag				
Homogeneity Flag		Homogeneity		
Standard Deviation Used (SDPA)	0.0373	0.0989		
Outliers	0	0	0	0
$ z > 3.0$	2	0	0	0
$2 < z < 3$	0	1	0	0

Methods Used

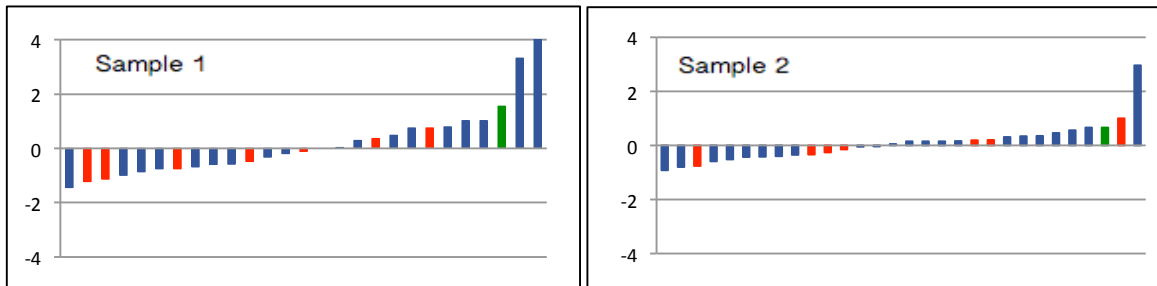
Method	C39-1	C39-2	C39-3	C39-4
ICP/MS	19	22	0	0
ICP/OES	7	7	0	0
AA	1	1	0	0

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

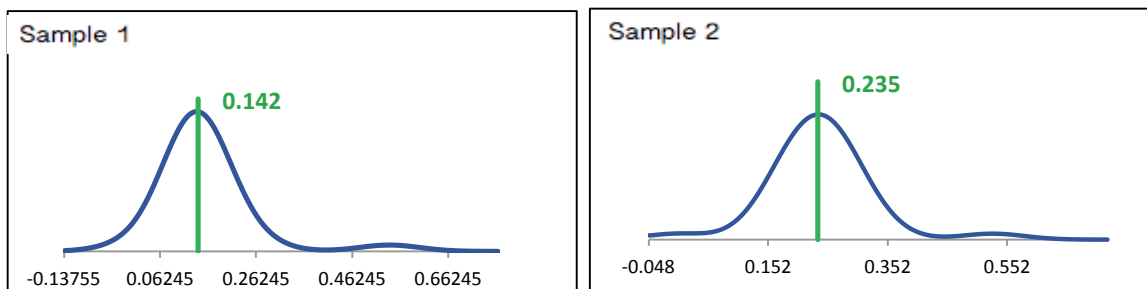


LEAD

z-Score Plots

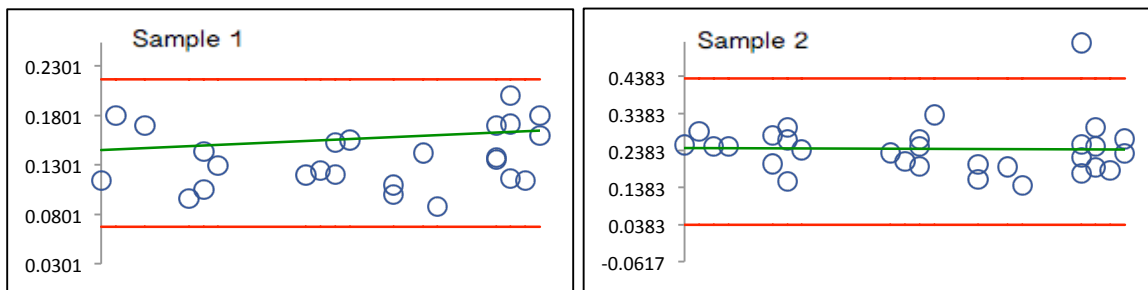


Kernel Density Plots



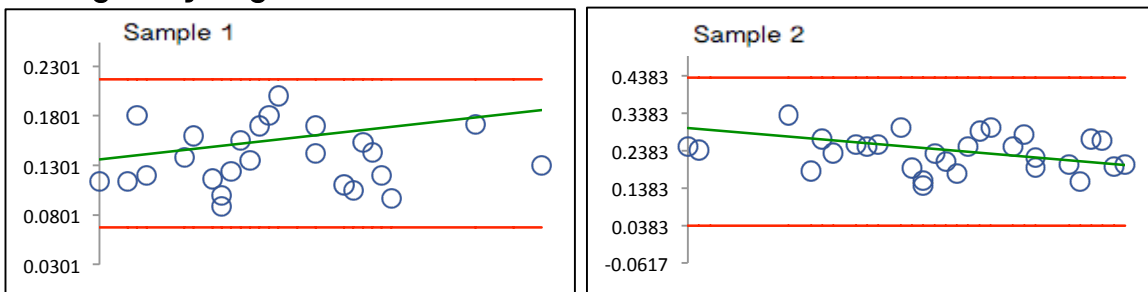
LEAD

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).

MERCURY

Summary Statistics

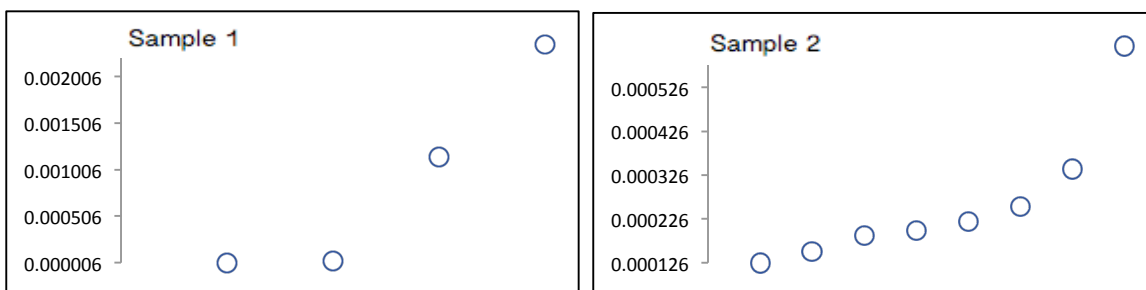
Excluded

Statistic	C39-1	C39-2	C39-3	C39-4
N	4	8	0	0
Median	0.000587	0.000210		
Robust Mean	0.000883	0.000233		
U	0.00079	0.000045		
Robust Standard Deviation	0.00126	0.000102		
Regression Standard Deviation				
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA)	0.00126	0.000102		
Outliers	0	0	0	0
$ z > 3.0$	0	1	0	0
$2 < z < 3$	0	0	0	0

Methods Used

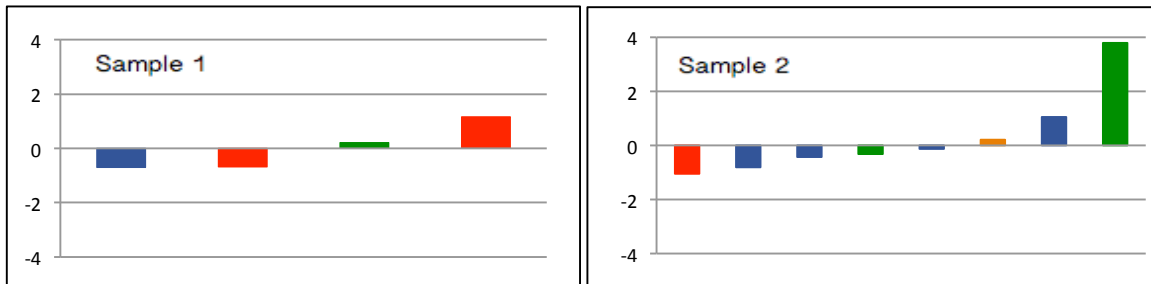
Method	C39-1	C39-2	C39-3	C39-4
CVAP	1	4	0	0
ICP/MS	2	1	0	0
CVAFS	1	2	0	0
ICP/OES	0	1	0	0

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

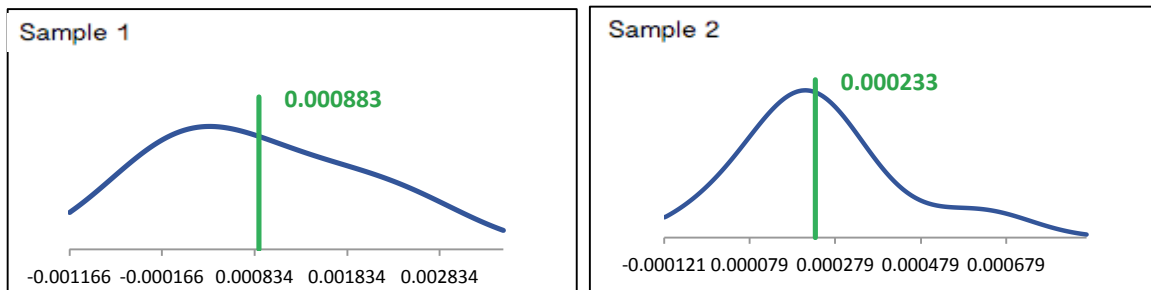


MERCURY

z-Score Plots

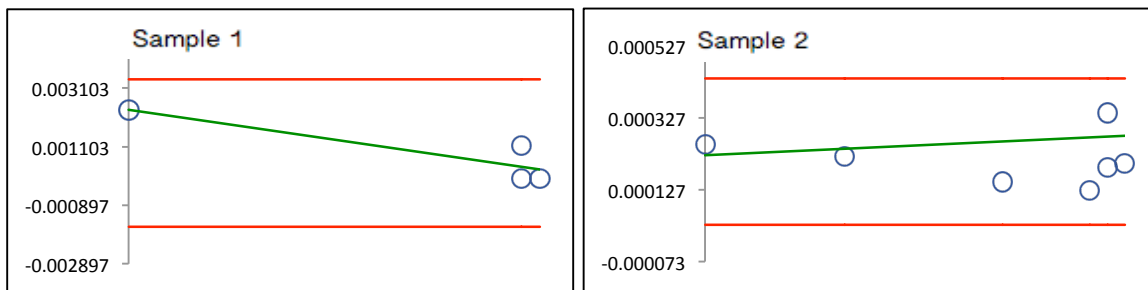


Kernel Density Plots



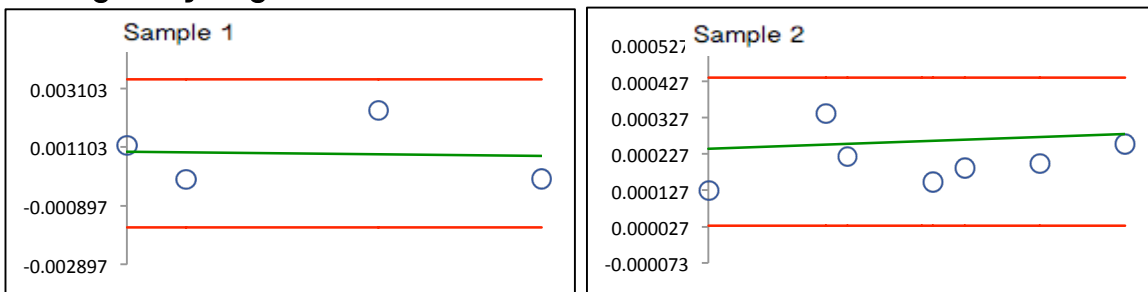
MERCURY

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).

NITRATE

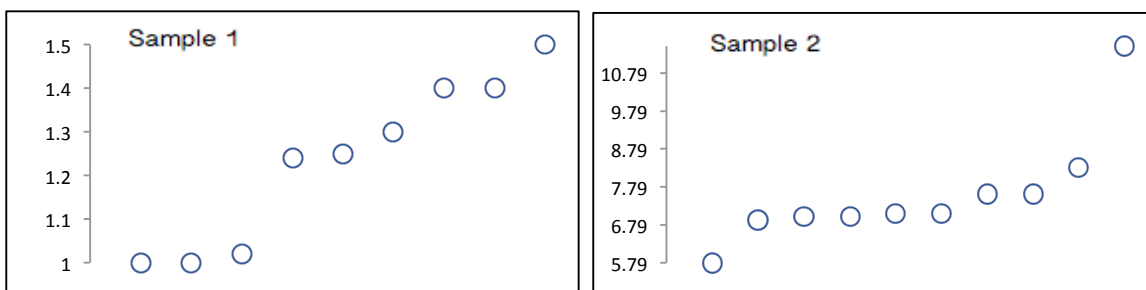
Summary Statistics

Statistic	C39-1	C39-2	C39-3	C39-4
N	9	10	0	0
Median	1.25	7.09		
Robust Mean	1.23	7.32		
U	0.089	0.312		
Robust Standard Deviation	0.214	0.790		
Regression Standard Deviation				
Stability Flag	Stability			
Homogeneity Flag				
Standard Deviation Used (SDPA)	0.423	0.790		
Outliers	0	0	0	0
$ z > 3.0$	0	1	0	0
$2 < z < 3$	0	0	0	0

Methods Used

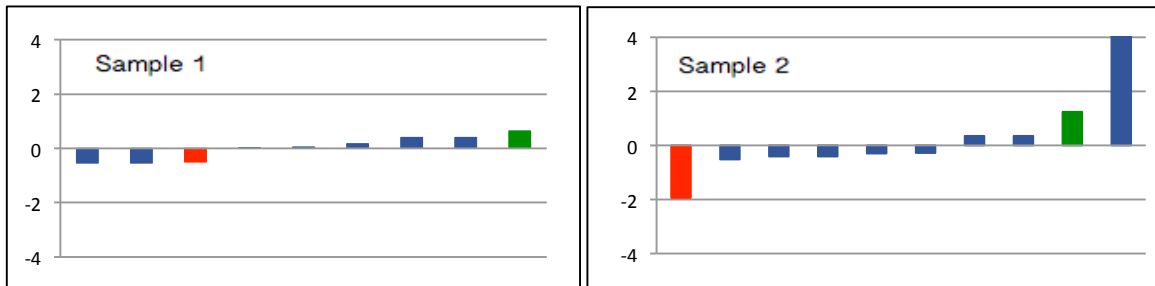
Method	C39-1	C39-2	C39-3	C39-4
IC	7	8	0	0
COLOR	1	1	0	0
CLR-A	1	1	0	0

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

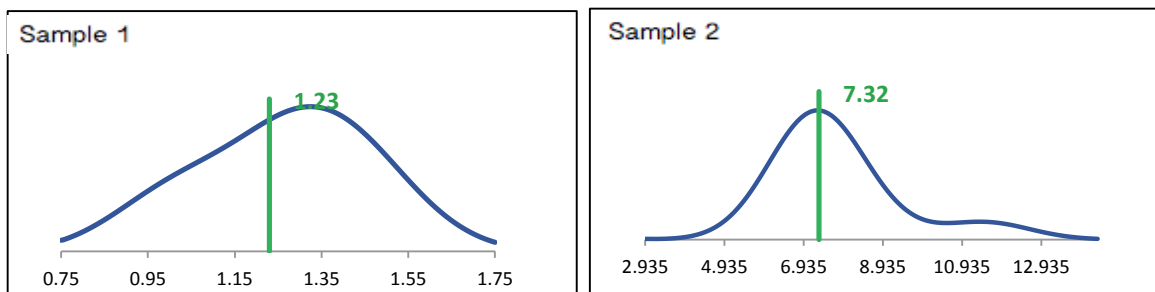


NITRATE

z-Score Plots

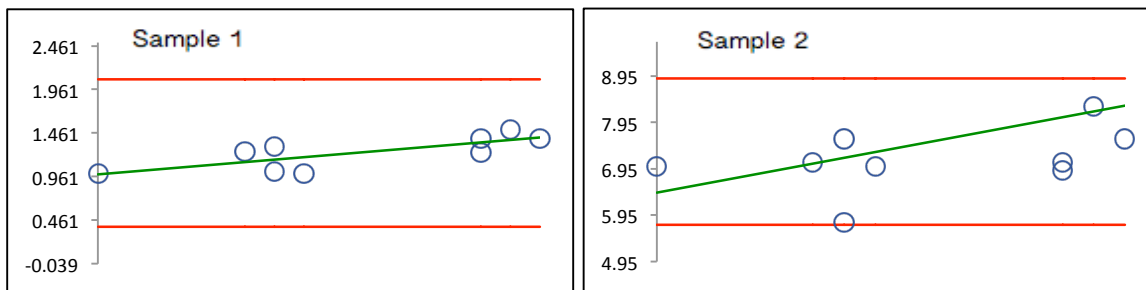


Kernel Density Plots



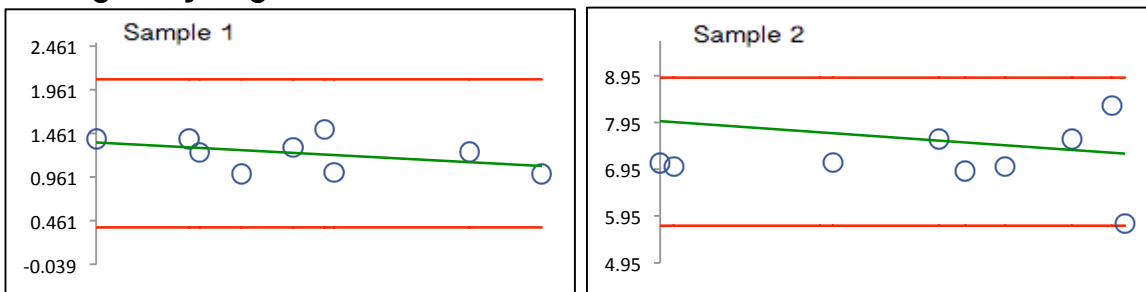
NITRATE

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).

NITRATE PLUS NITRITE

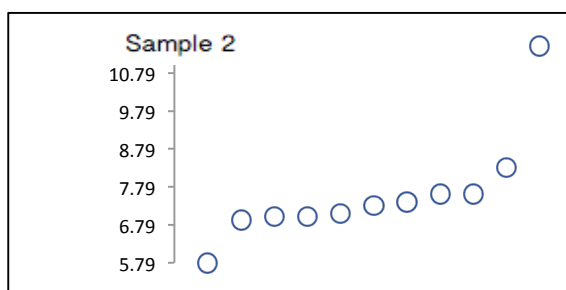
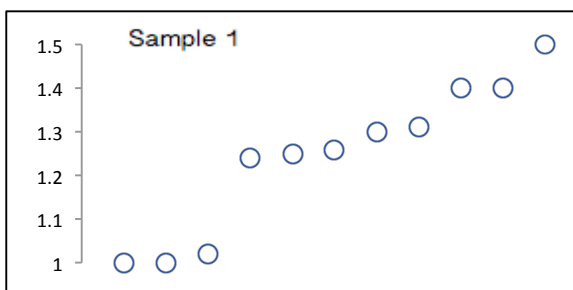
Summary Statistics

Statistic	C39-1	C39-2	C39-3	C39-4
N	11	11	0	0
Median	1.26	7.30		
Robust Mean	1.24	7.35		
U	0.073	0.258		
Robust Standard Deviation	0.194	0.684		
Regression Standard Deviation				
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA)	0.194	0.684		
Outliers	0	0	0	0
$ z > 3.0$	0	1	0	0
$2 < z < 3$	0	1	0	0

Methods Used

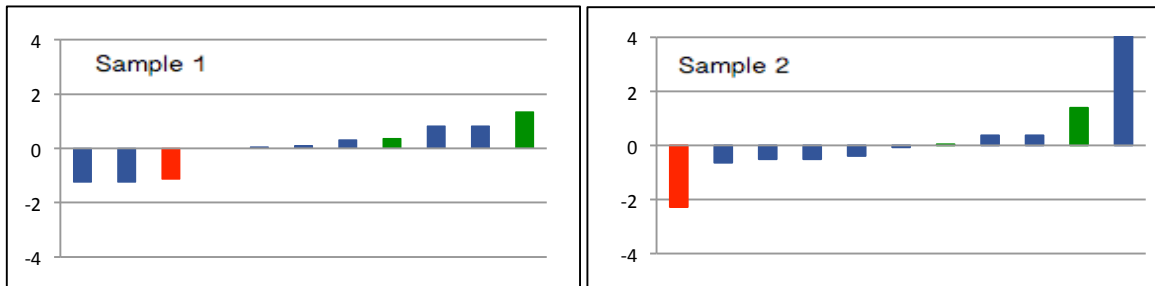
Method	C39-1	C39-2	C39-3	C39-4
IC	8	8	0	0
COLOR	1	1	0	0
CLR-A	2	2	0	0

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

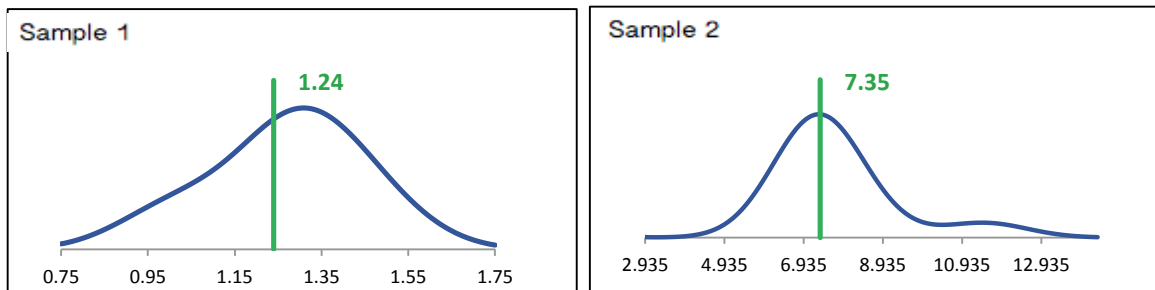


NITRATE PLUS NITRITE

z-Score Plots

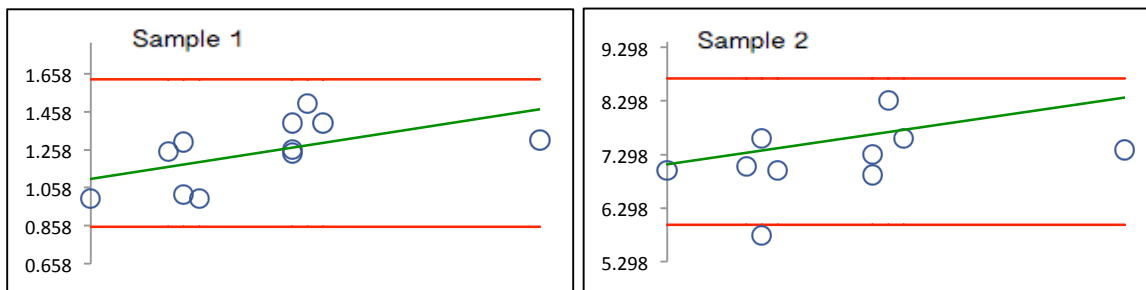


Kernel Density Plots



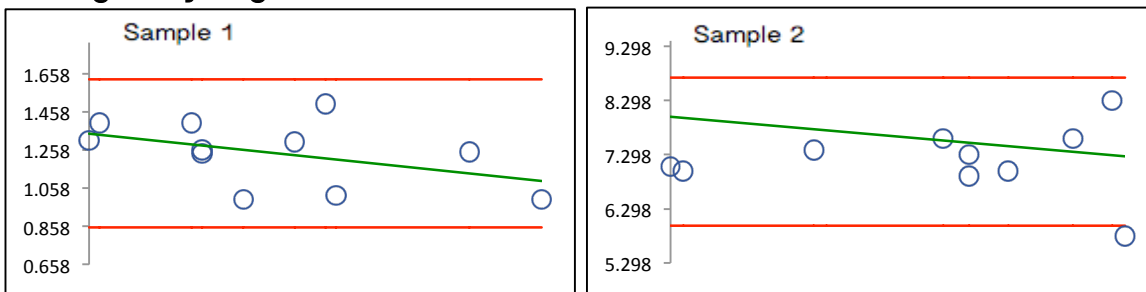
NITRATE PLUS NITRITE

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

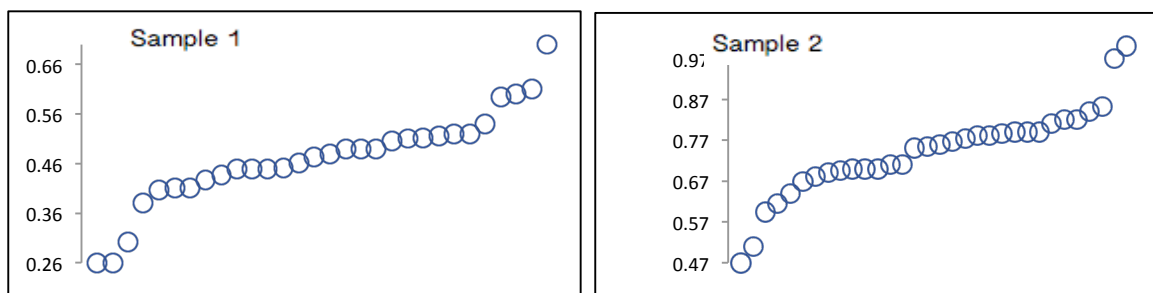
Summary Statistics

Statistic	C39-1	C39-2	C39-3	C39-4
N	30	32	0	0
Median	0.477	0.757		
Robust Mean	0.474	0.742		
U	0.018	0.020		
Robust Standard Deviation	0.0791	0.0882		
Regression Standard Deviation				
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA)	0.0791	0.0882		
Outliers	0	0	0	0
$ z > 3.0$	0	1	0	0
$2 < z < 3$	4	3	0	0

Methods Used

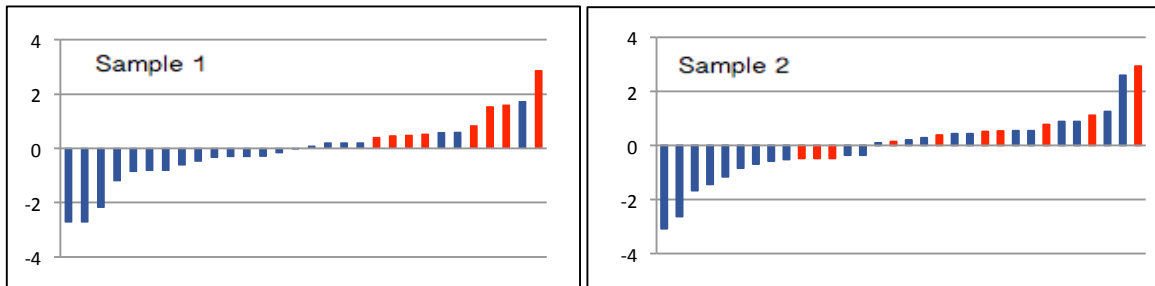
Method	C39-1	C39-2	C39-3	C39-4
ICP/MS	22	22	0	0
ICP/OES	8	10	0	0

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

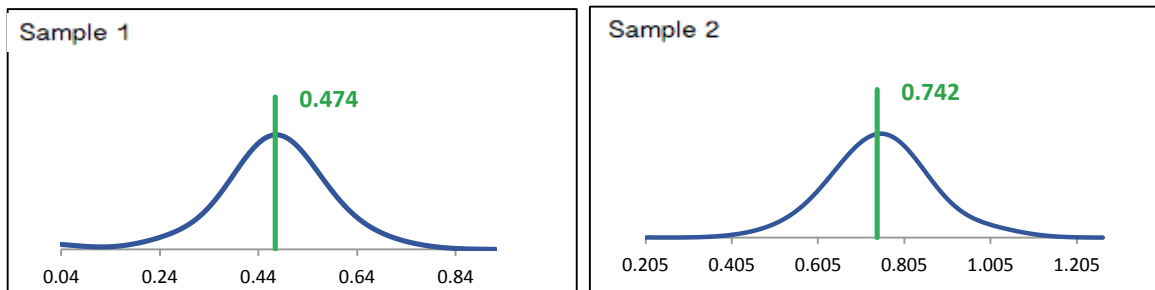


SELENIUM

z-Score Plots

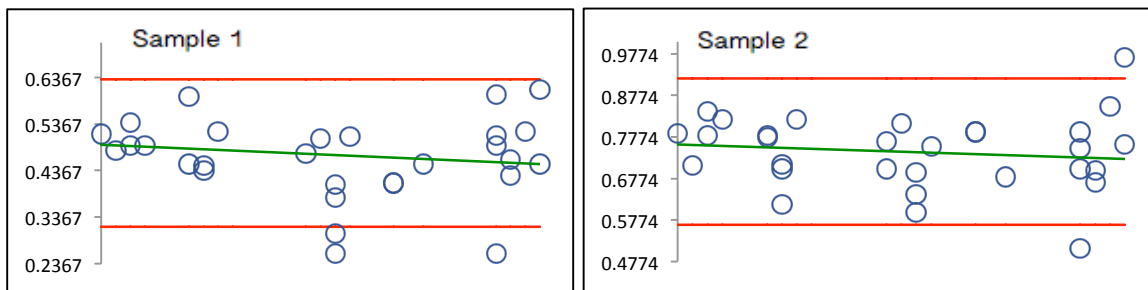


Kernel Density Plots



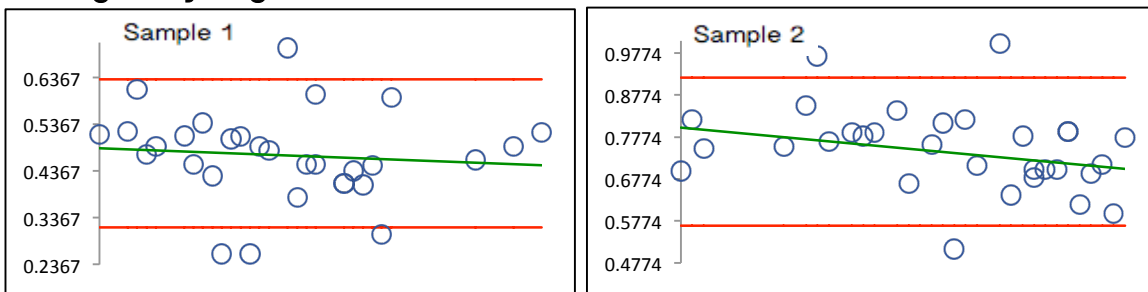
SELENIUM

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

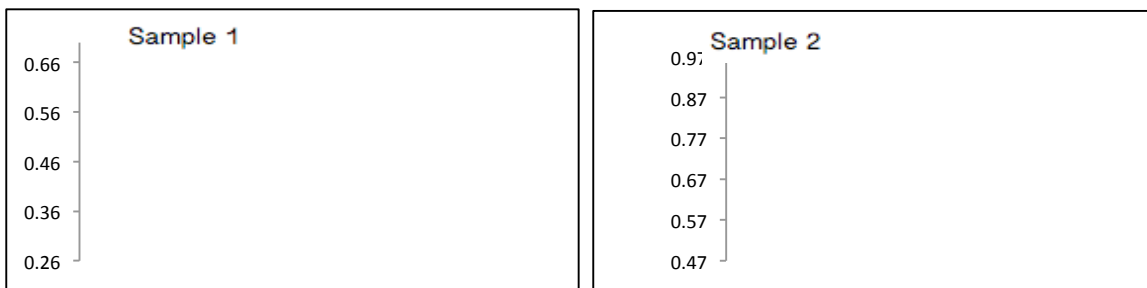
Summary Statistics

Statistic		Excluded C39-1	Excluded C39-2	C39-3	C39-4
N		2	3	0	0
Median		0.00120	0.00050		
Robust Mean		0.00120	0.00052		
U		0.00170	0.00024		
Robust Standard Deviation		0.00192	0.000335		
Regression Standard Deviation					
Stability Flag		#DIV/0!			
Homogeneity Flag		#DIV/0!			
Standard Deviation Used (SDPA)		#DIV/0!	0.000335		
Outliers		0	0	0	0
z >3.0		0	0	0	0
2< z <3		0	0	0	0

Methods Used

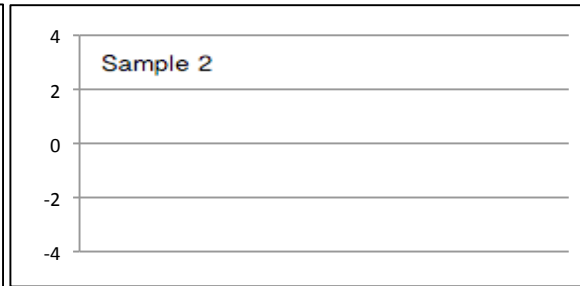
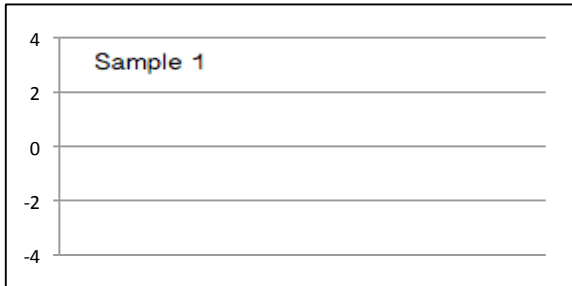
Method	C39-1	C39-2	C39-3	C39-4
ICP/MS	2	3	0	0

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

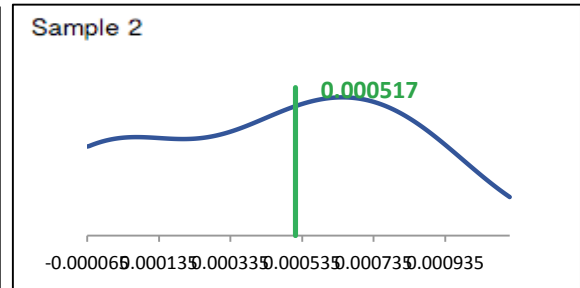
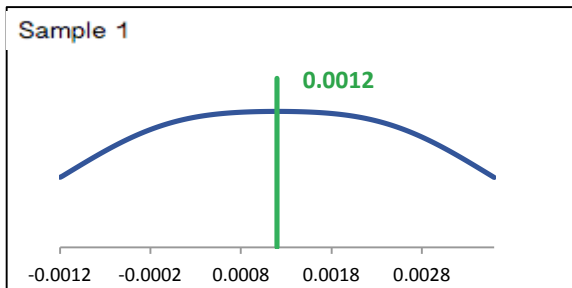


SILVER

z-Score Plots

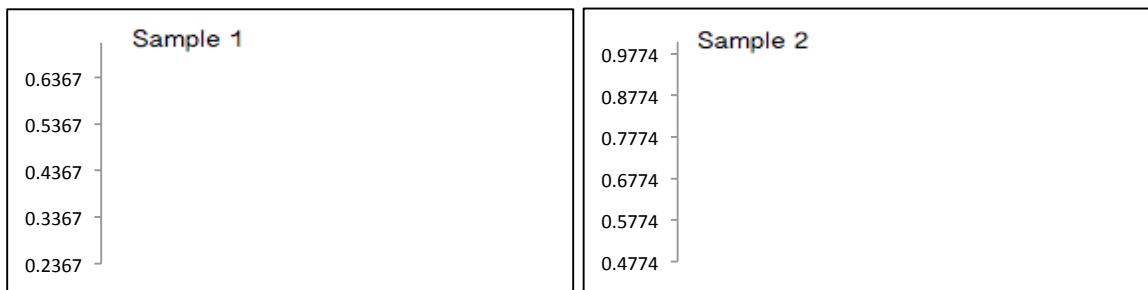


Kernel Density Plots



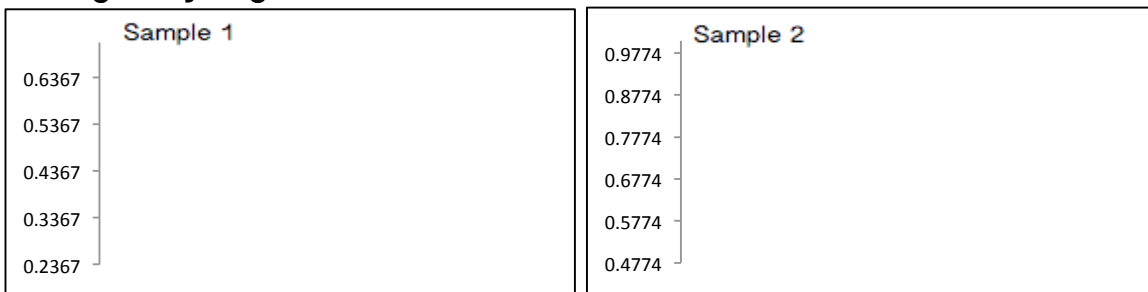
SILVER

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).

URANIUM

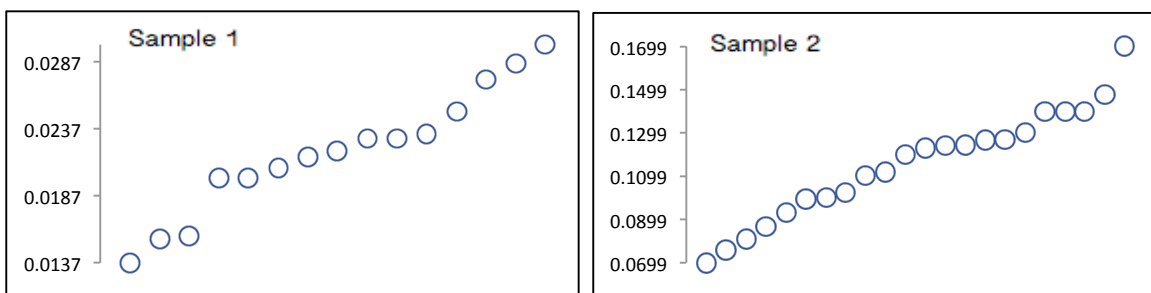
Summary Statistics

Statistic	C39-1	C39-2	C39-3	C39-4
N	15	22	0	0
Median	0.0220	0.122		
Robust Mean	0.0220	0.115		
U	0.00170	0.00709		
Robust Standard Deviation	0.00526	0.0266		
Regression Standard Deviation				
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA)	0.00526	0.0266		
Outliers	1	0	0	0
$ z > 3.0$	0	0	0	0
$2 < z < 3$	0	1	0	0

Methods Used

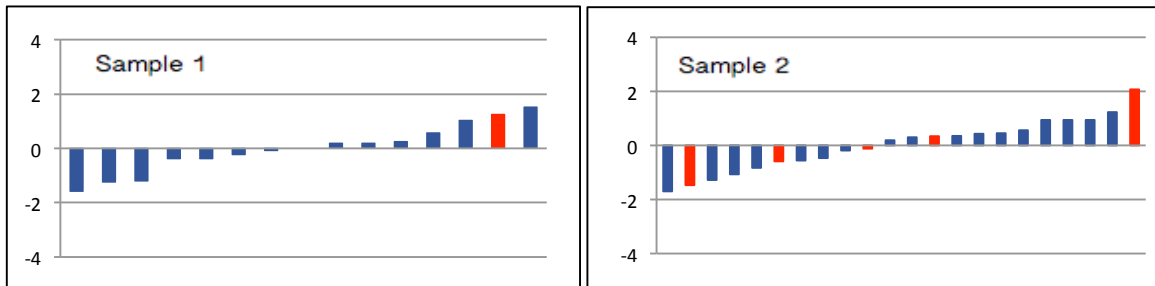
Method	C39-1	C39-2	C39-3	C39-4
ICP/MS	13	17	0	0
ICP/OES	2	5	0	0

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

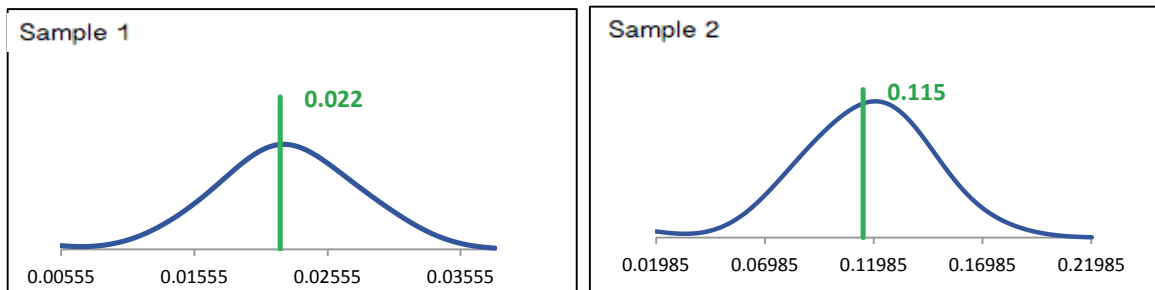


URANIUM

z-Score Plots

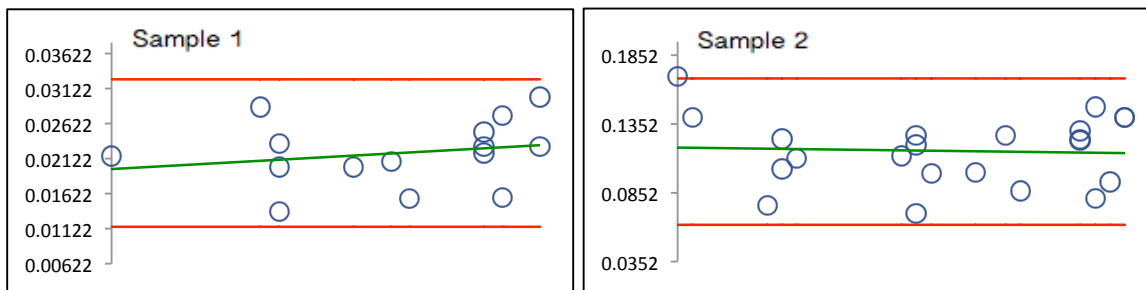


Kernel Density Plots



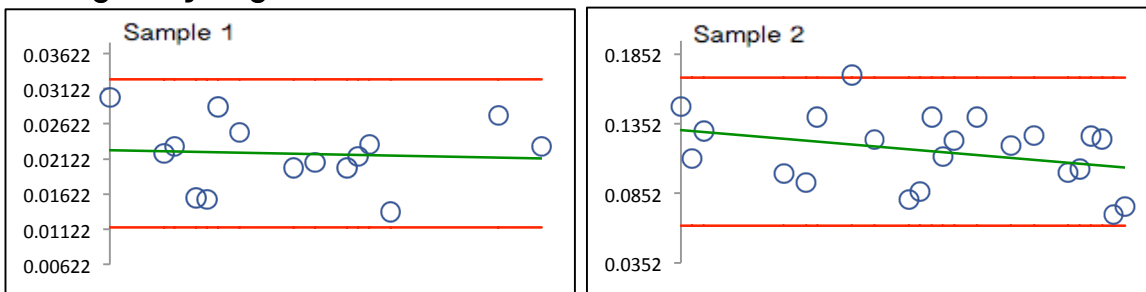
URANIUM

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).