Test Group Summary Report
CO2A Metals in Water–Full Range
October 2024 PT Round

Issued: November 27, 2024

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 is 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 - *Conformity assessment- General requirements for the competence of proficiency testing providers*, 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.

4.5   BOX-AND-WHISKER PLOTS

Box-and-Whisker plots are another way to display the distribution of the data. The box denotes the first and third quartile and the whiskers are the 5th and 95th percentile.

4.6   HISTORIC COMPARISON PLOT

The Historic Comparison Plot is a plot of robust mean against robust standard deviation for the previous ten PT rounds as well as the current PT round. This plot can be used to identify possible changes in the sample formulation.
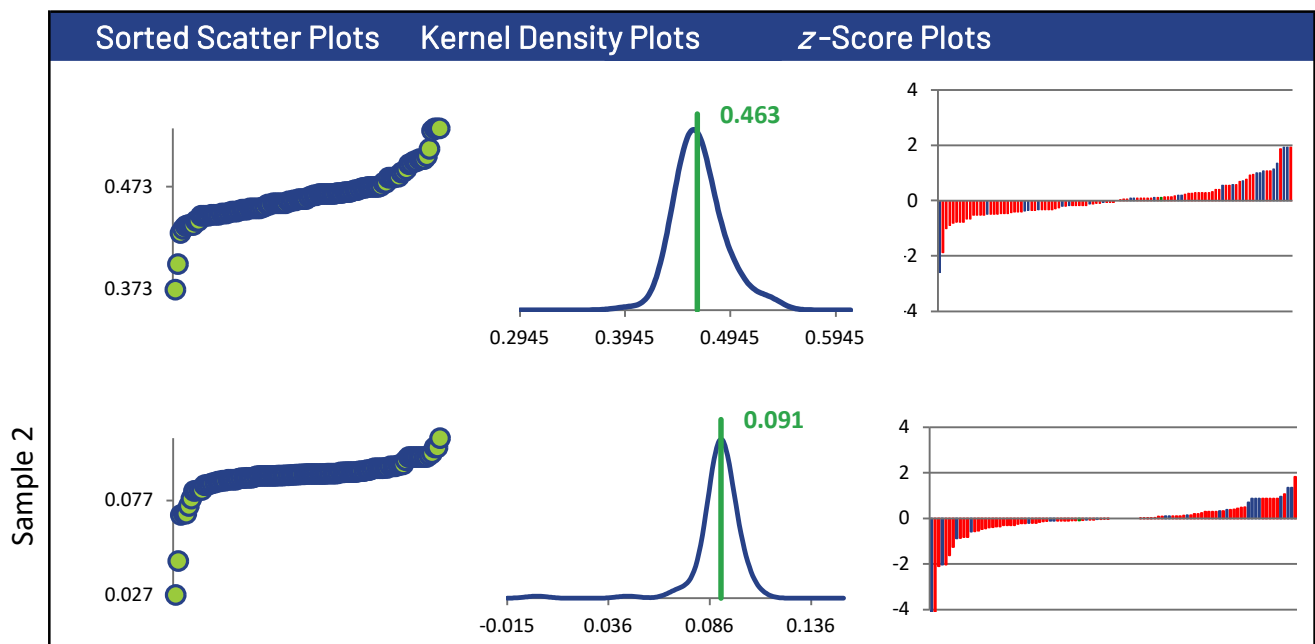
ALUMINUM

Summary Statistics

Statistic	C02A-1	C02A-2	C02A-3	C02A-4
N	104	102	104	74
Median mg/L	0.462	0.0910	1.26	0.00375
Robust Mean mg/L	0.463	0.0910	1.26	0.00391
U mg/L	0.00235	0.000578	0.00561	0.000155
Robust Standard Deviation mg/L	0.0192	0.00467	0.0458	0.00107
Regression Standard Deviation mg/L	0.0347	0.00683	0.0945	0.000293
Stability Flag		Stability		
Homogeneity Flag				
Standard Deviation Used (SDPA) mg/L	0.0347	0.0104	0.0945	0.00107
Outliers	1	2	1	3
|z|>3.0	0	2	0	8
2<|z|<3	1	3	0	4

Methods Used

Method	C02A-1	C02A-2	C02A-3	C02A-4
ICP/OES (Blue)	24	23	24	15
ICP/MS (Red)	79	78	79	59
AA FLAME (Green)	1	1	1	0

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

ALUMINUM

ALUMINUM

Stability Assessment | Homogeneity Assessment

Sample 4

Stability assessments are regression analysis of reported result against date of analysis.

Homogeneity assessments are regression analysis of reported result against bottling order.
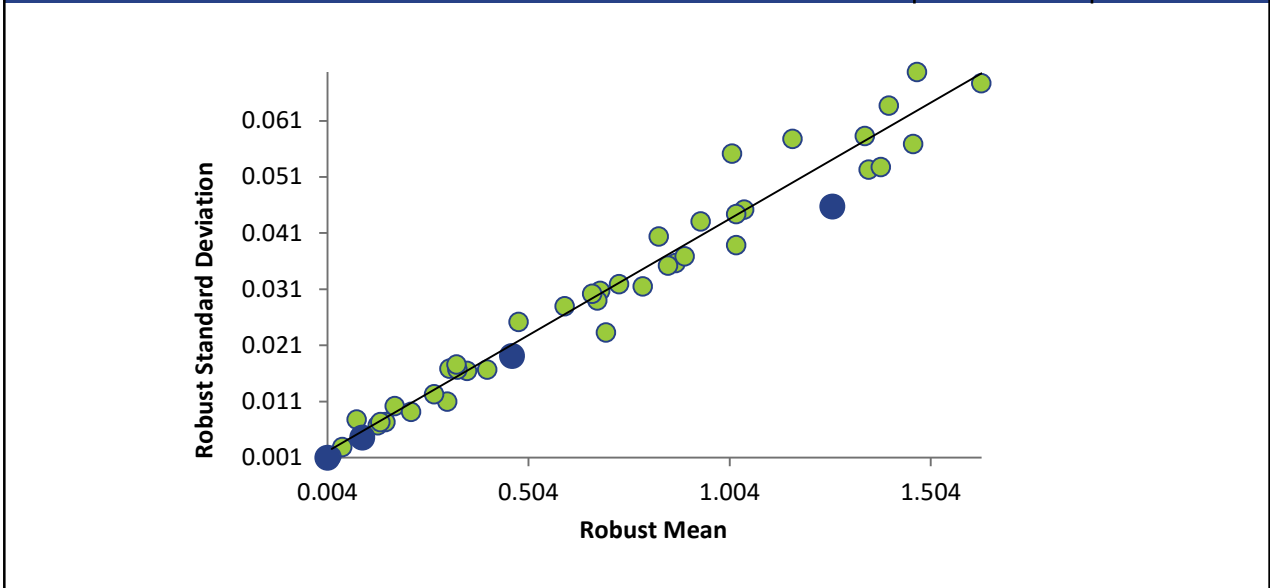
Box and Whisker Plots

Sample 1   Sample 2   Sample 3   Sample 4
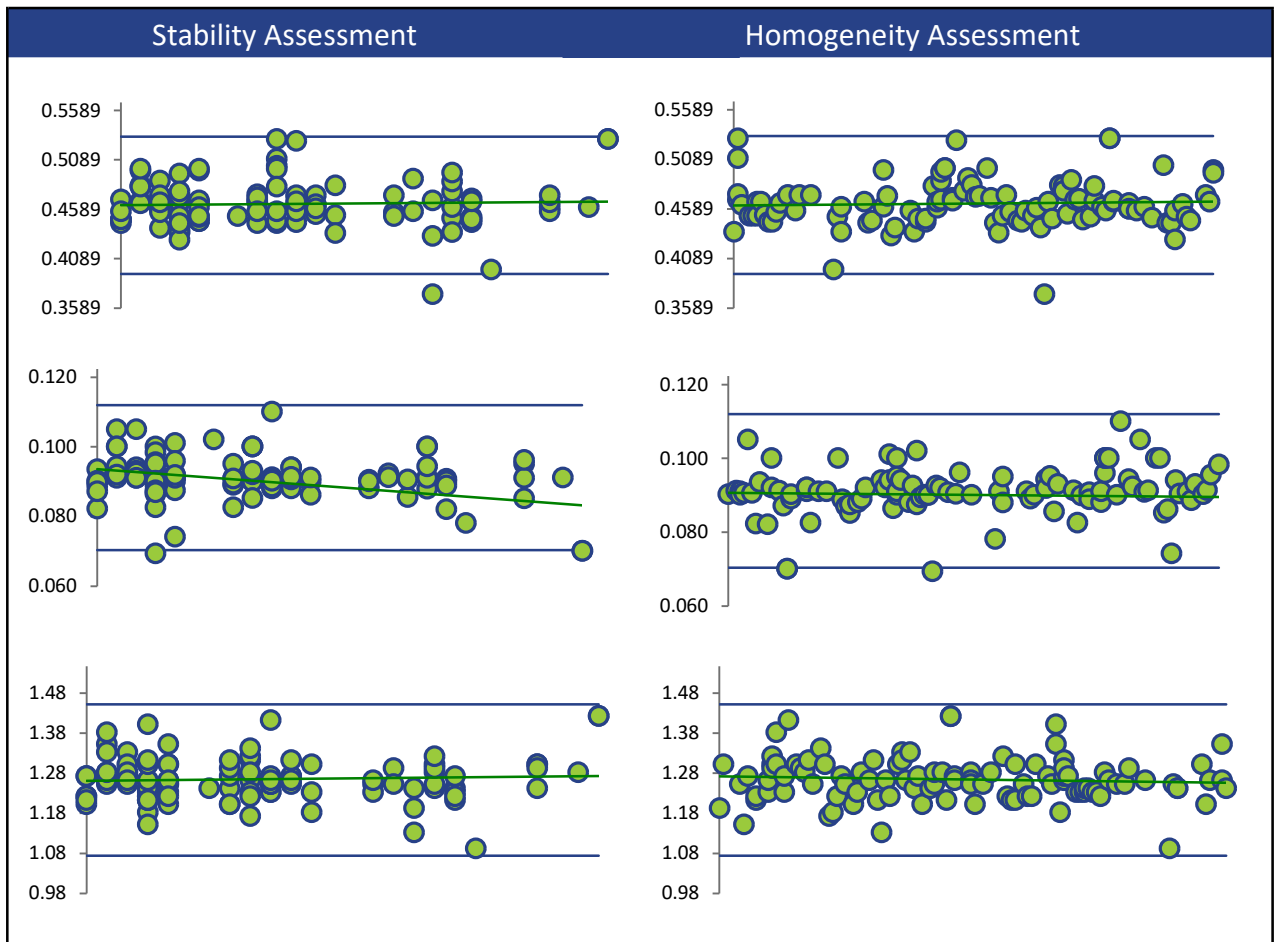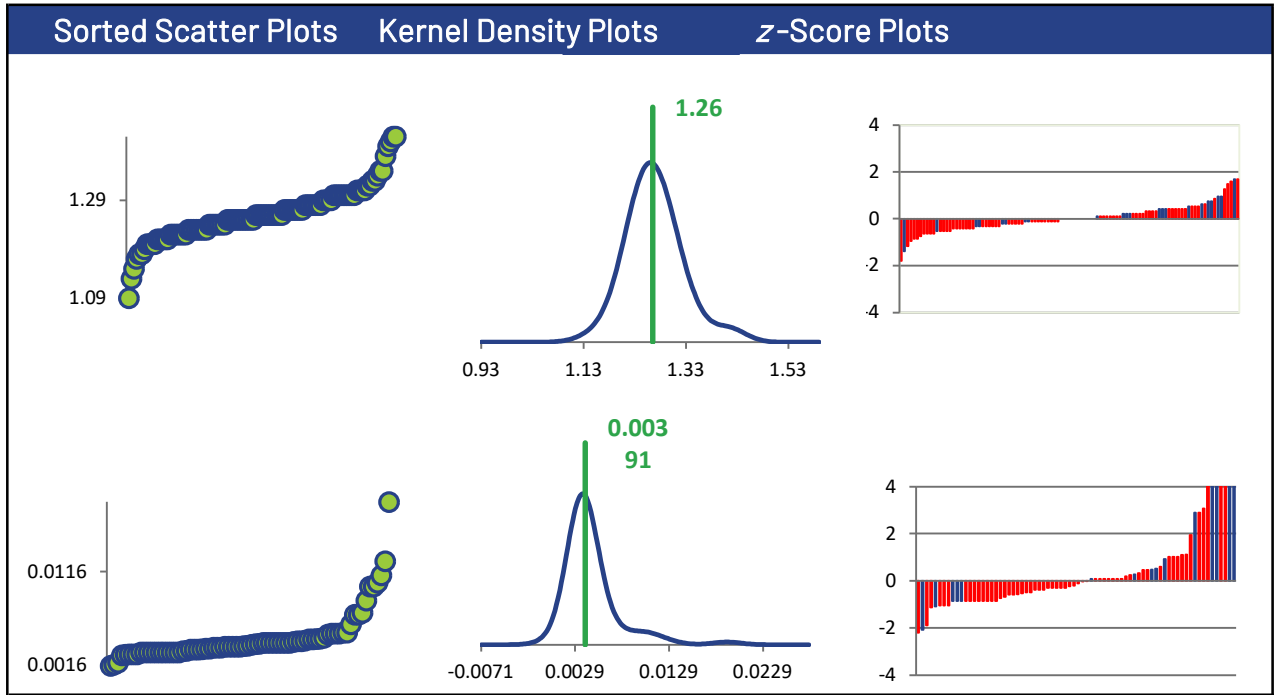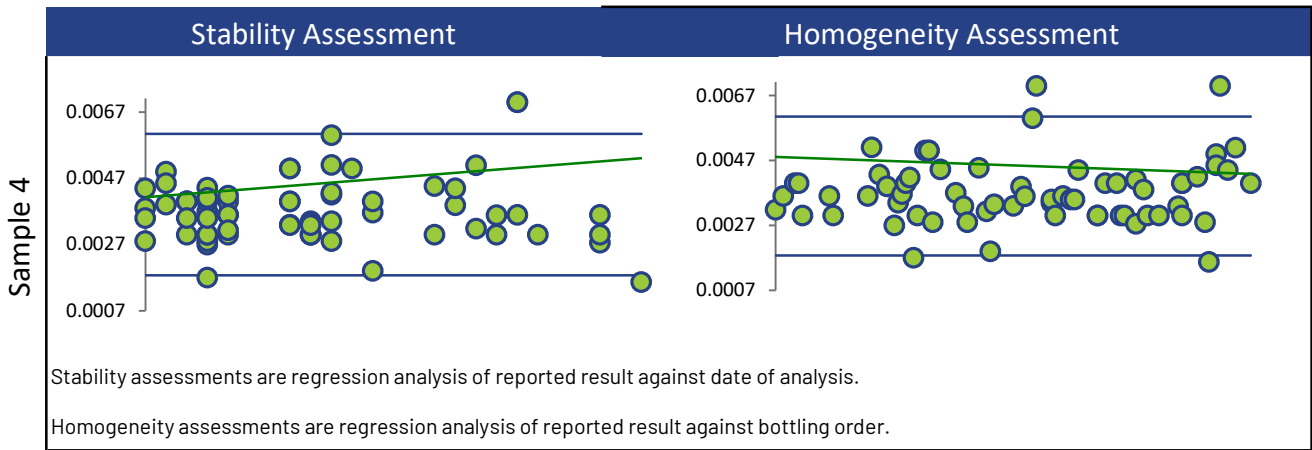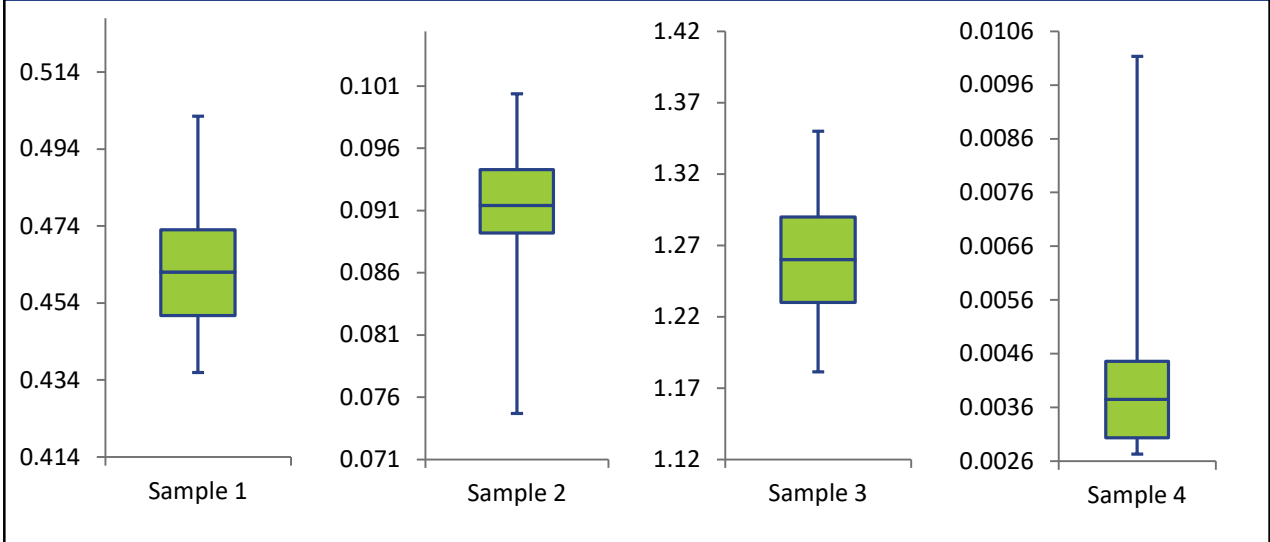
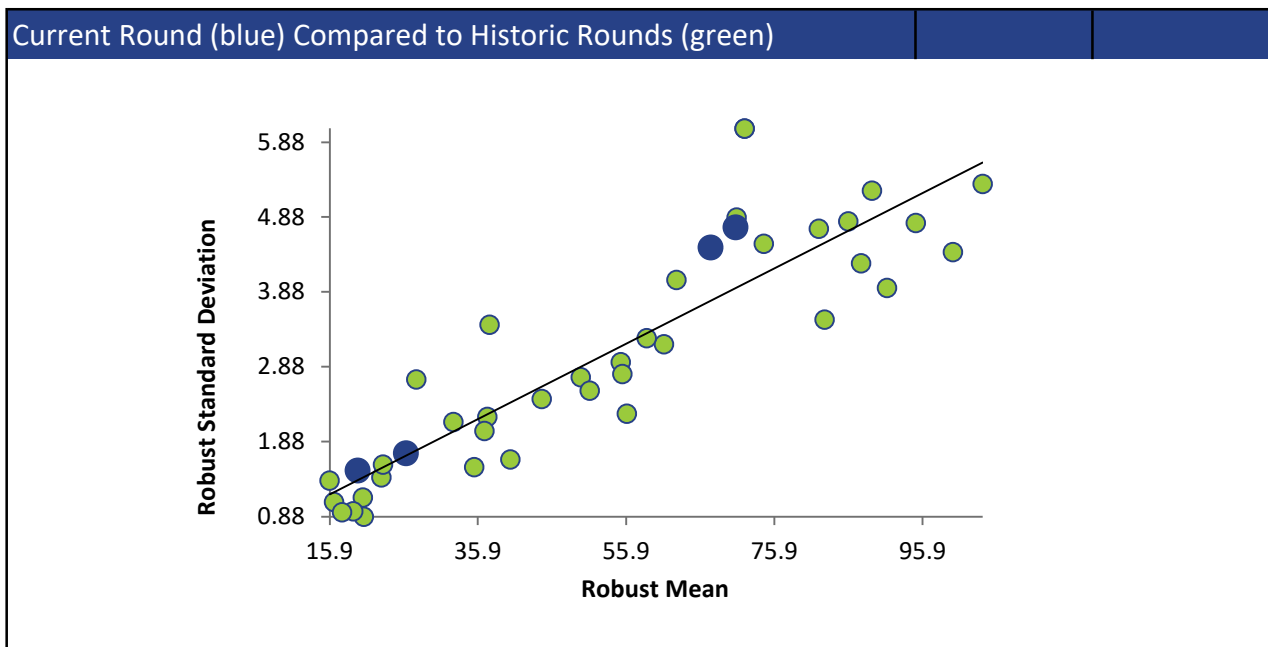## Current Round (blue) Compared to Historic Rounds (green)

ANTIMONY

Summary Statistics

Statistic	C02A-1	C02A-2	C02A-3	C02A-4
N	91	89	91	90
Median mg/L	67.5	26.2	70.5	19.8
Robust Mean mg/L	67.3	26.2	70.7	19.7
U mg/L	0.586	0.228	0.621	0.196
Robust Standard Deviation mg/L	4.47	1.72	4.74	1.49
Regression Standard Deviation mg/L	6.73	2.62	7.07	1.97
Stability Flag		Stability		
Homogeneity Flag				
Standard Deviation Used (SDPA) mg/L	6.73	4.05	7.07	1.97
Outliers	3	4	3	3
|z|>3.0	2	3	5	1
2<|z|<3	2	0	2	5

Methods Used

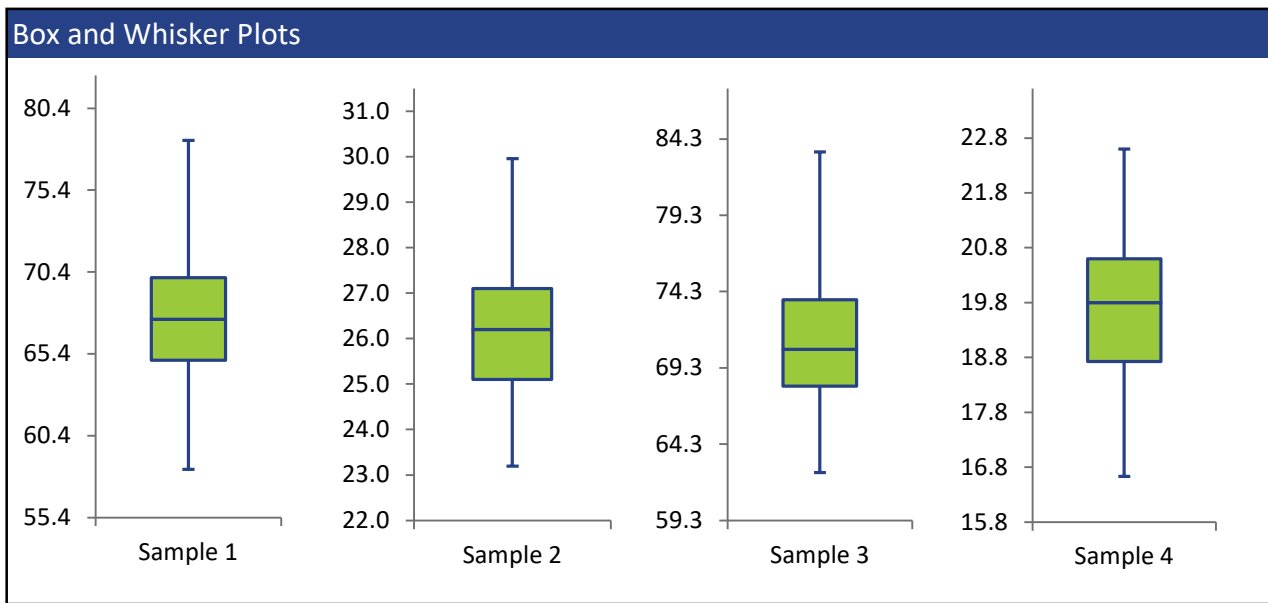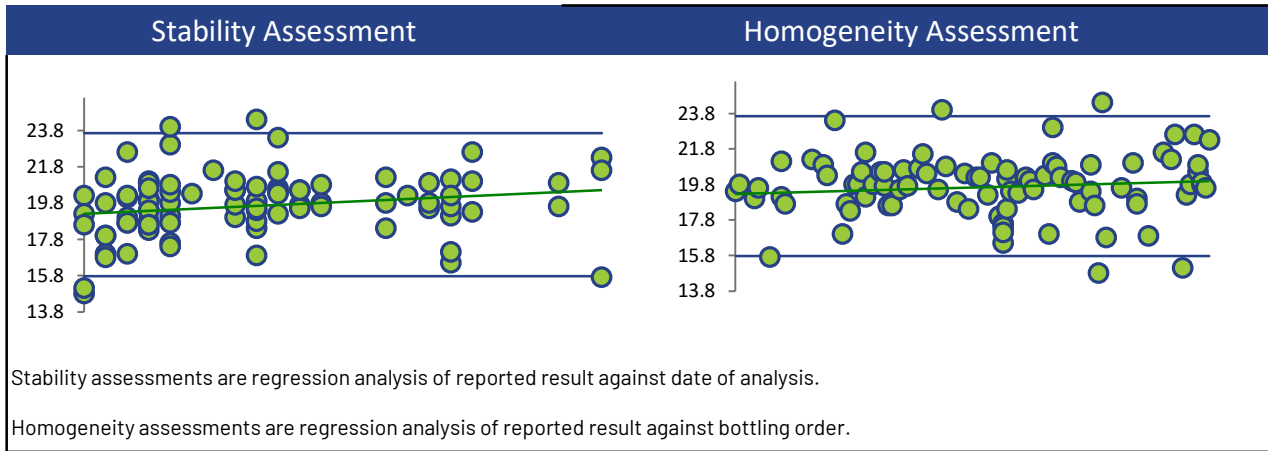| Method	C02A-1	C02A-2	C02A-3	C02A-4
ICP/MS (Blue)	80	78	80	80
HYDRIDE AA (Red)	1	2	1	1
ICP/OES (Green)	9	8	9	8
HYDRIDE ICP (Orange)	1	1	1	1

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

ANTIMONY

ANTIMONY

Stability Assessment | Homogeneity Assessment
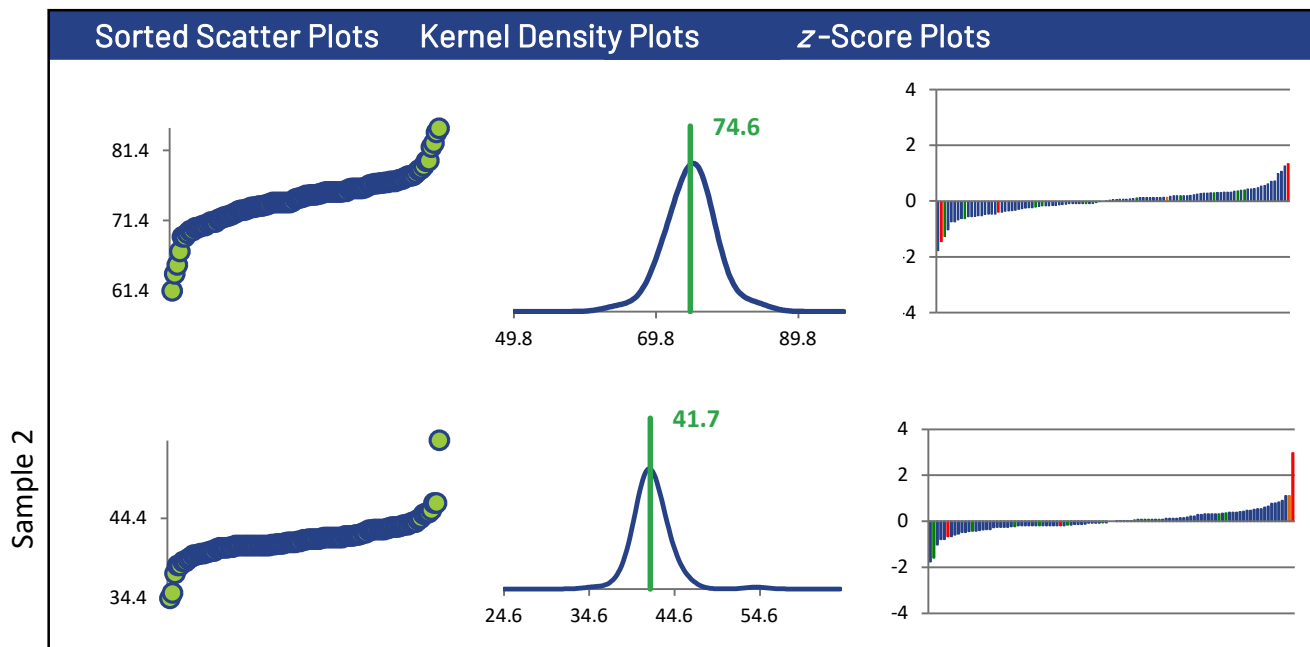

Stability assessments are regression analysis of reported result against date of analysis.

Homogeneity assessments are regression analysis of reported result against bottling order.

Box and Whisker Plots

Current Round (blue) Compared to Historic Rounds (green)
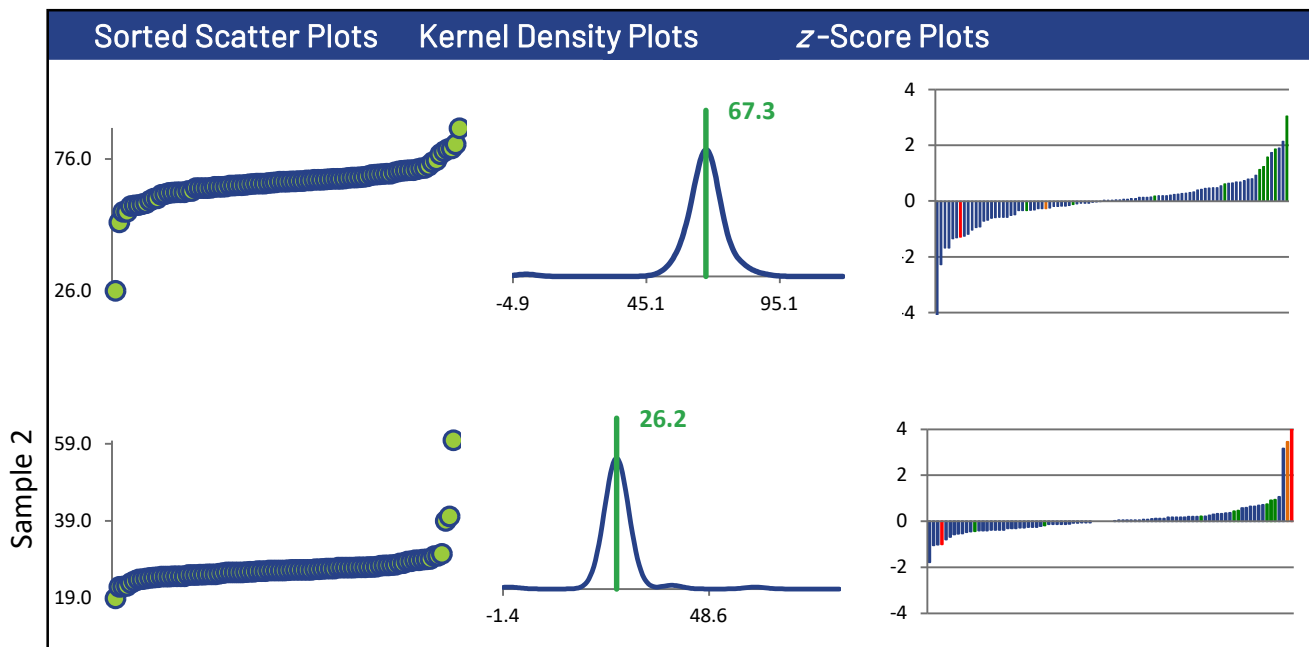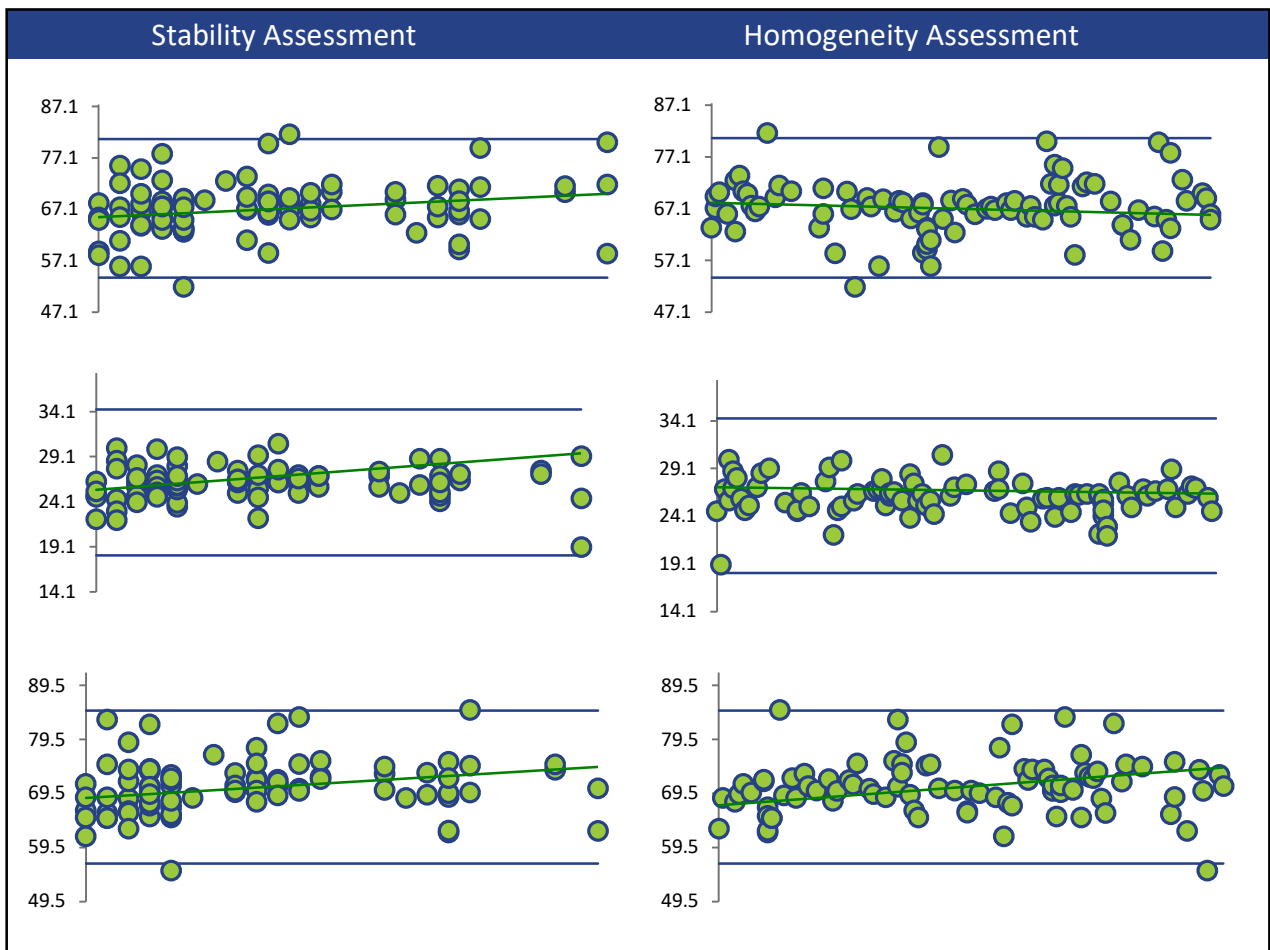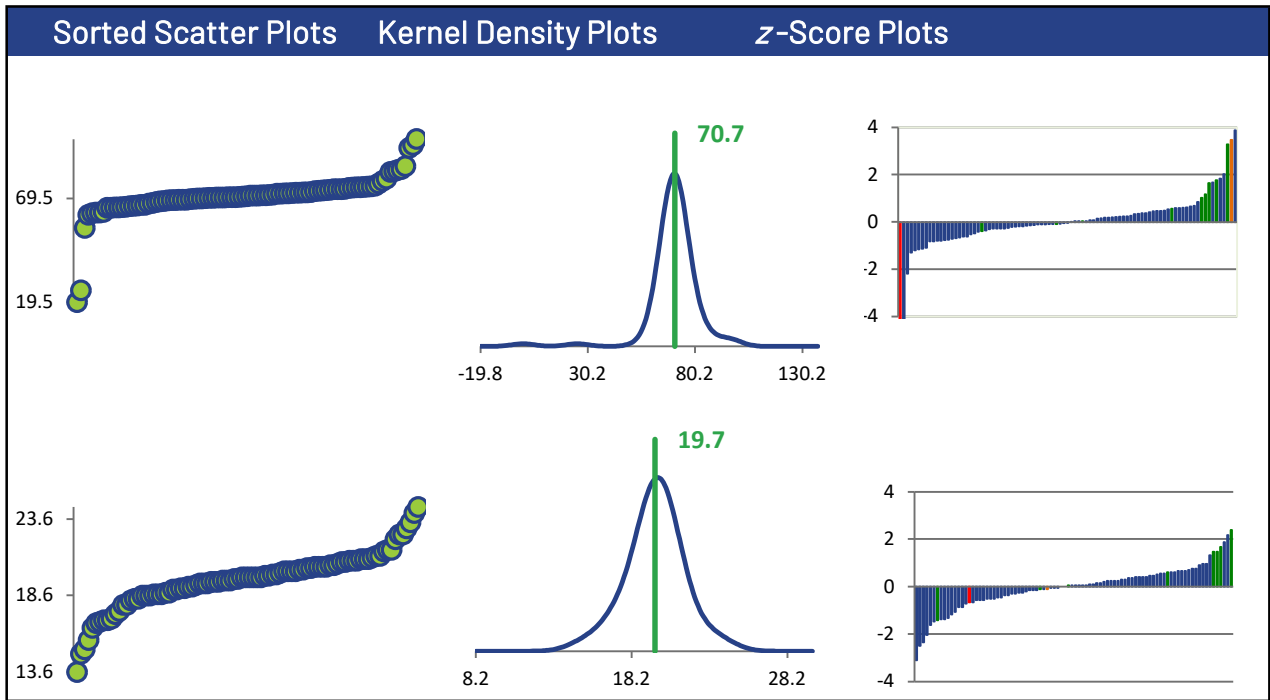
ARSENIC

Summary Statistics

Statistic	C02A-1	C02A-2	C02A-3	C02A-4
N	105	104	105	104
Median mg/L	75.0	41.7	78.7	6.55
Robust Mean mg/L	74.6	41.7	78.7	6.58
U mg/L	0.364	0.190	0.422	0.0525
Robust Standard Deviation mg/L	2.98	1.55	3.46	0.428
Regression Standard Deviation mg/L	7.46	4.17	7.87	0.658
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA) mg/L	7.46	4.17	7.87	0.658
Outliers	4	5	4	4
|z|>3.0	0	0	0	3
2<|z|<3	0	1	1	3

Methods Used

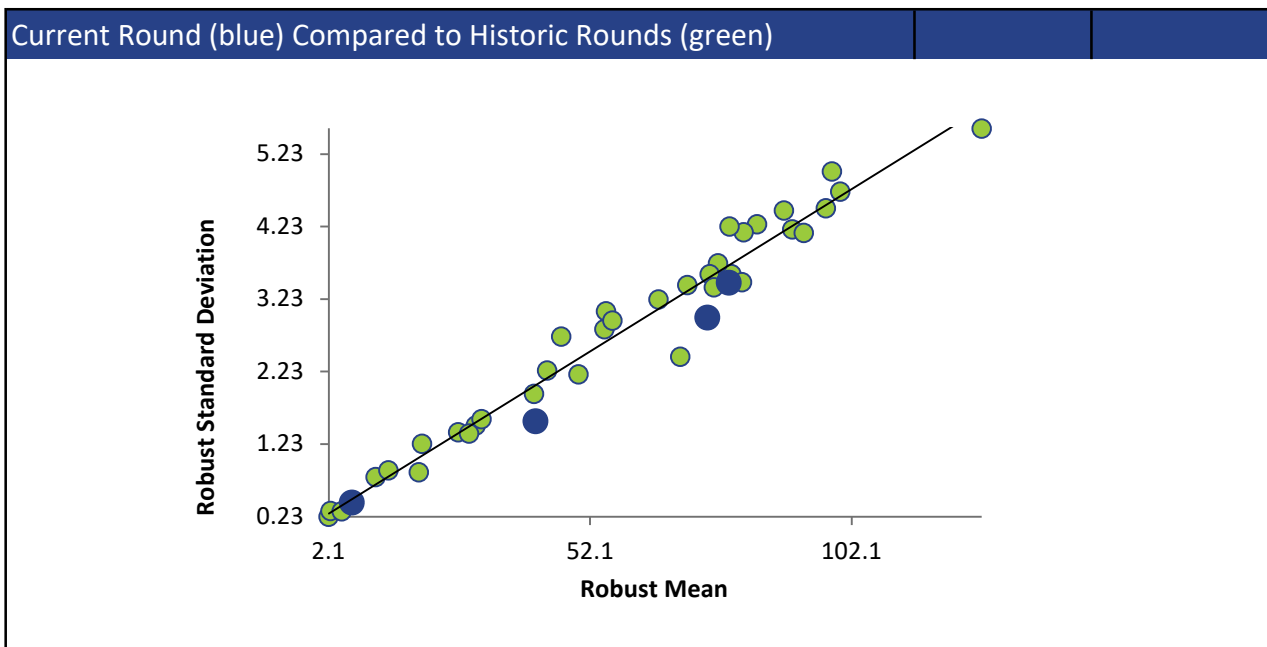| Method	C02A-1	C02A-2	C02A-3	C02A-4
ICP/MS (Blue)	89	88	89	90
HYDRIDE AA (Red)	3	3	3	3
ICP/OES (Green)	12	12	12	11
HYDRIDE ICP (Orange)	1	1	1	0

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

ARSENIC

Sorted Scatter Plots	Kernel Density Plots	z-Score Plots

Stability Assessment   Homogeneity Assessment

ARSENIC

Stability Assessment	Homogeneity Assessment

Sample 4

Stability assessments are regression analysis of reported result against date of analysis.

Homogeneity assessments are regression analysis of reported result against bottling order.

Box and Whisker Plots

Sample 1 Sample 2 Sample 3 Sample 4

Current Round (blue) Compared to Historic Rounds (green)

Robust Standard Deviation

Robust Mean

BARIUM

Summary Statistics

Statistic	C02A-1	C02A-2	C02A-3	C02A-4
N	107	105	106	101
Median mg/L	0.655	0.399	1.36	0.0214
Robust Mean mg/L	0.653	0.399	1.36	0.0215
U mg/L	0.00327	0.00209	0.00710	0.000101
Robust Standard Deviation mg/L	0.0271	0.0171	0.0585	0.000815
Regression Standard Deviation mg/L	0.0490	0.0299	0.102	0.00161
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA) mg/L	0.0490	0.0299	0.102	0.00161
Outliers	0	1	1	1
|z|>3.0	1	1	0	0
2<|z|<3	0	1	2	1

Methods Used

Method	C02A-1	C02A-2	C02A-3	C02A-4
ICP/MS (Blue)	83	82	82	80
ICP/OES (Red)	23	22	23	20
AA FLAME (Green)	1	1	1	1

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

BARIUM

BARIUM

Stability Assessment	Homogeneity Assessment

Stability assessments are regression analysis of reported result against date of analysis.

Homogeneity assessments are regression analysis of reported result against bottling order.
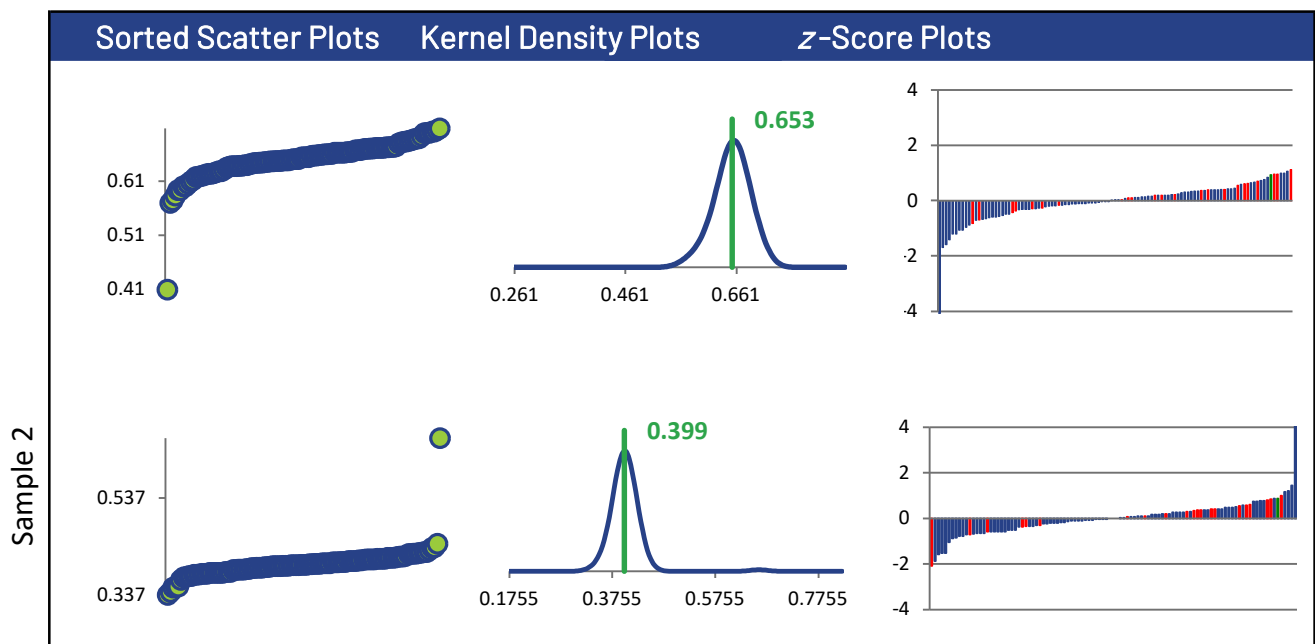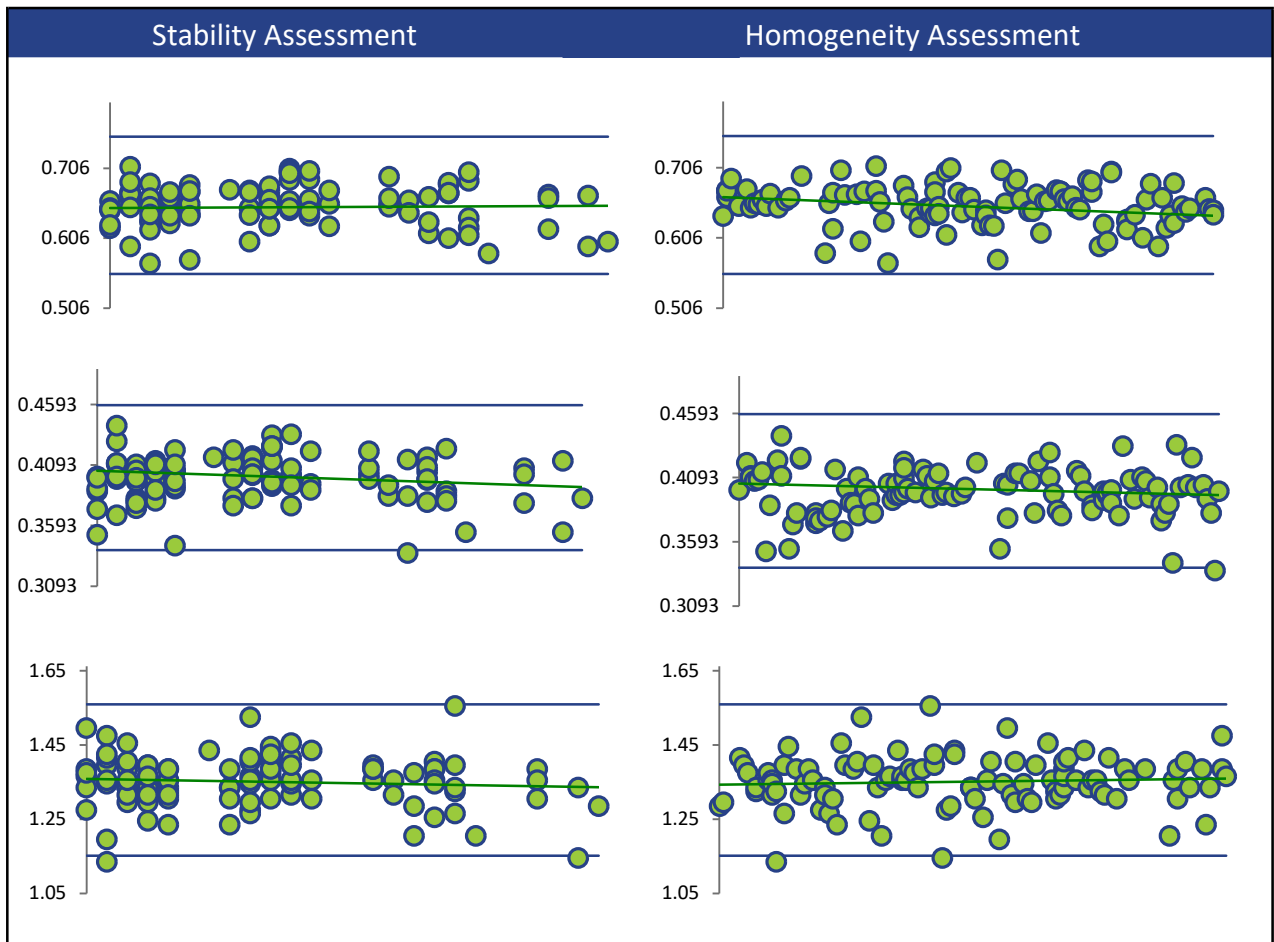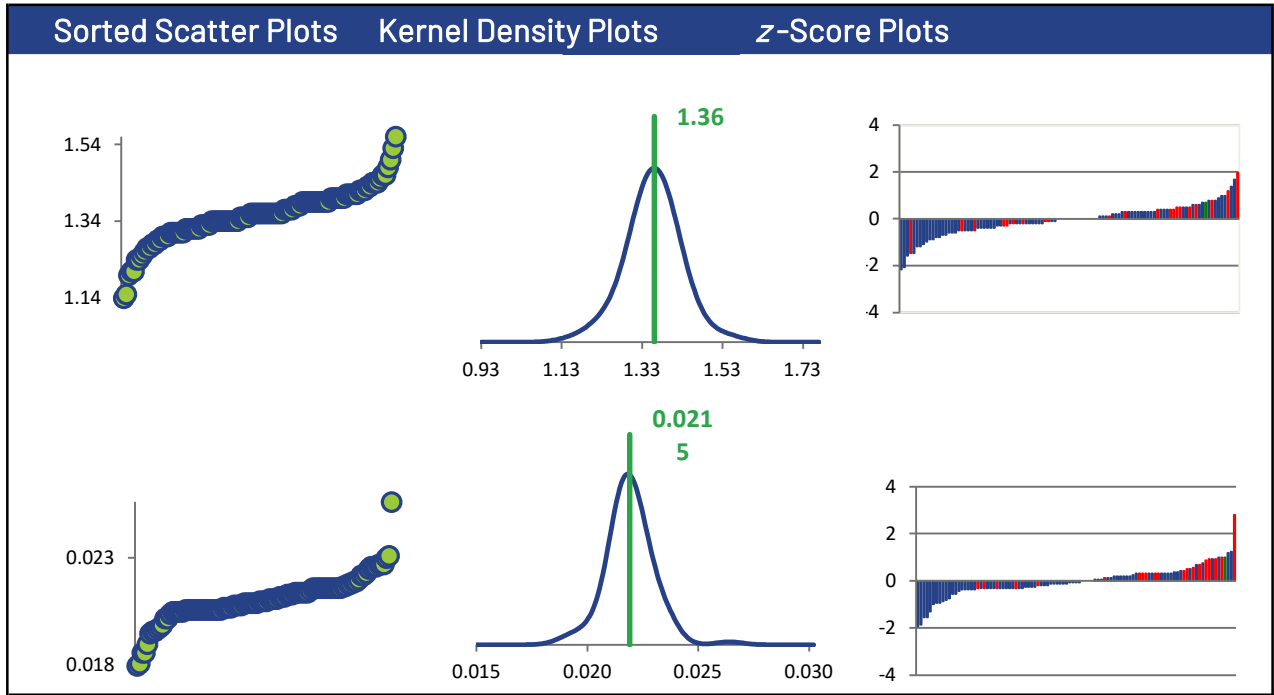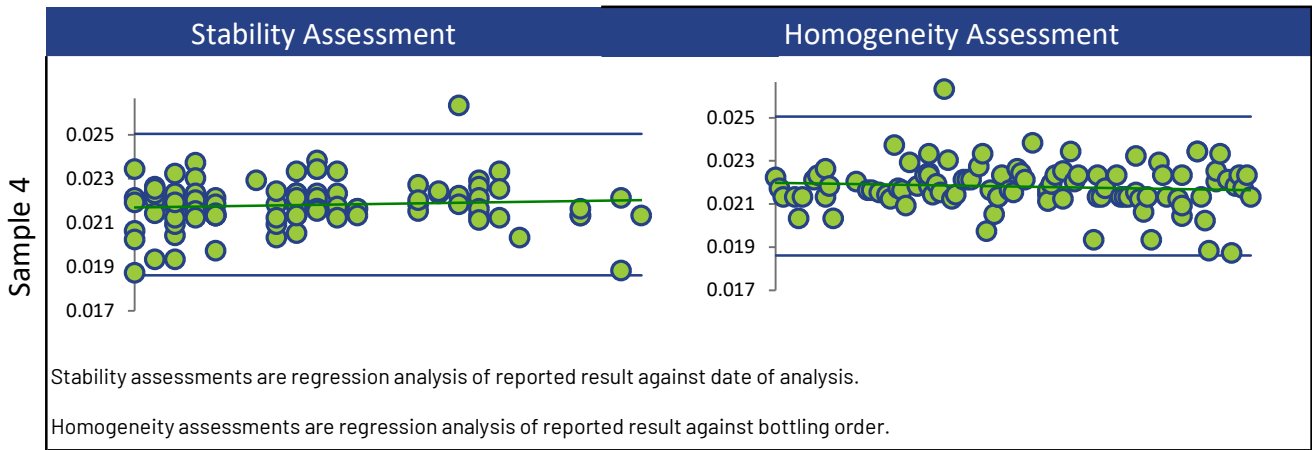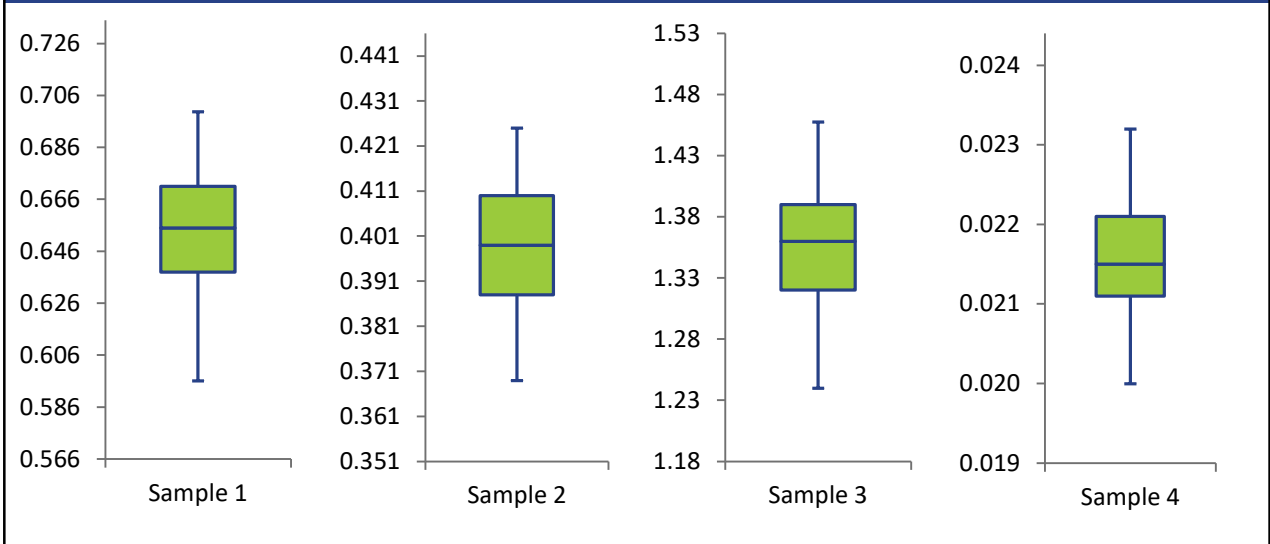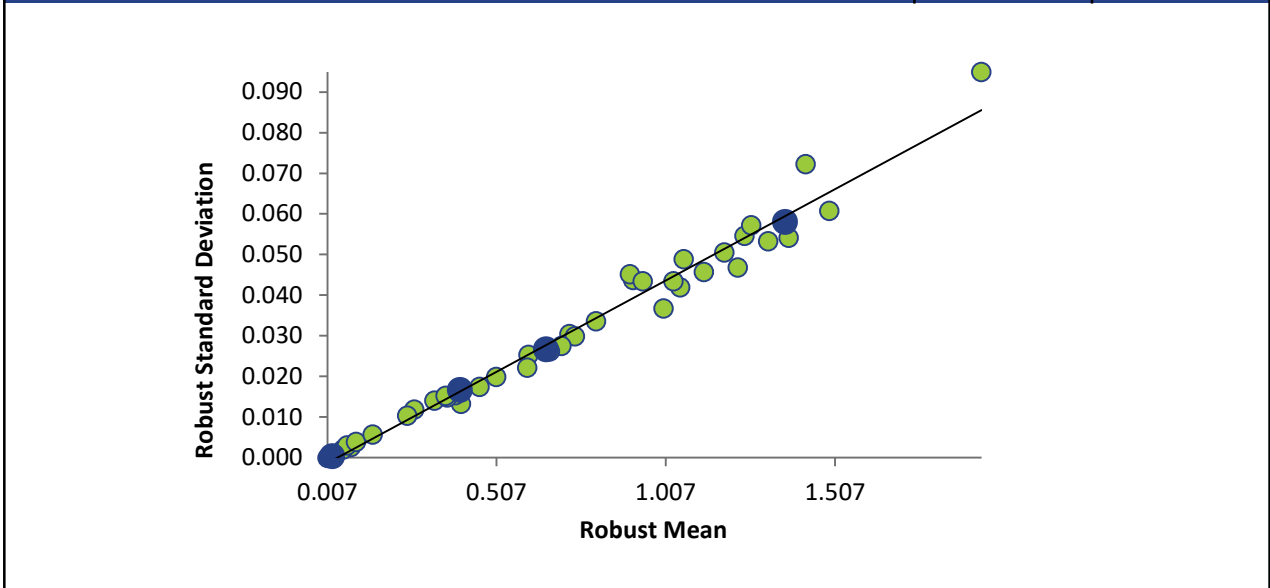
Box and Whisker Plots

Current Round (blue) Compared to Historic Rounds (green)

BERYLLIUM

Summary Statistics

Statistic	C02A-1	C02A-2	C02A-3	C02A-4
N	96	95	96	96
Median mg/L	0.381	0.0840	0.824	0.0455
Robust Mean mg/L	0.382	0.0838	0.830	0.0456
U mg/L	0.00176	0.000477	0.00471	0.000267
Robust Standard Deviation mg/L	0.0138	0.00372	0.0369	0.00209
Regression Standard Deviation mg/L	0.0287	0.00629	0.0622	0.00342
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA) mg/L	0.0287	0.00629	0.0622	0.00342
Outliers	1	2	1	0
|z|>3.0	0	1	1	0
2<|z|<3	1	1	1	2

Methods Used

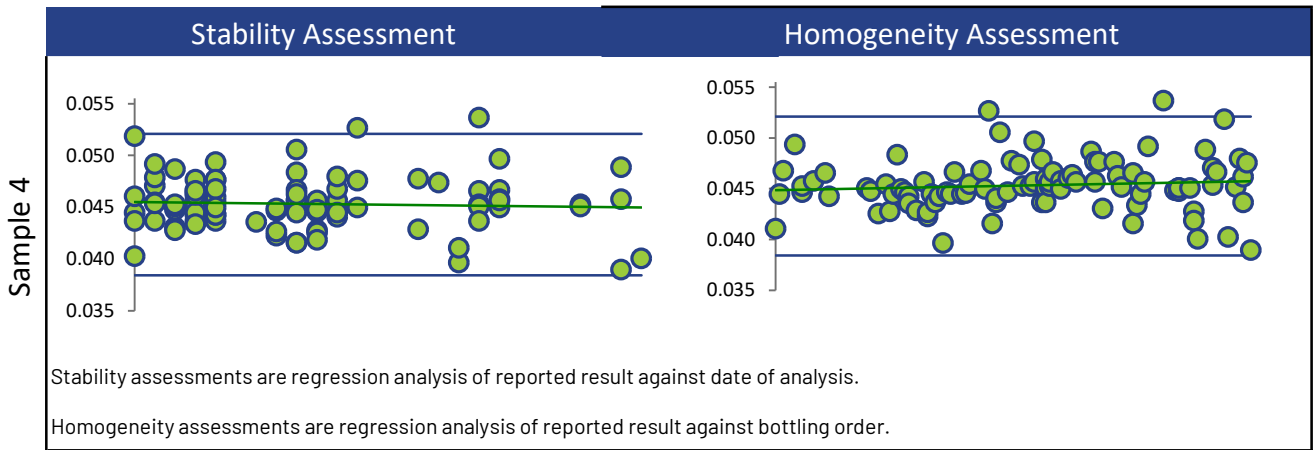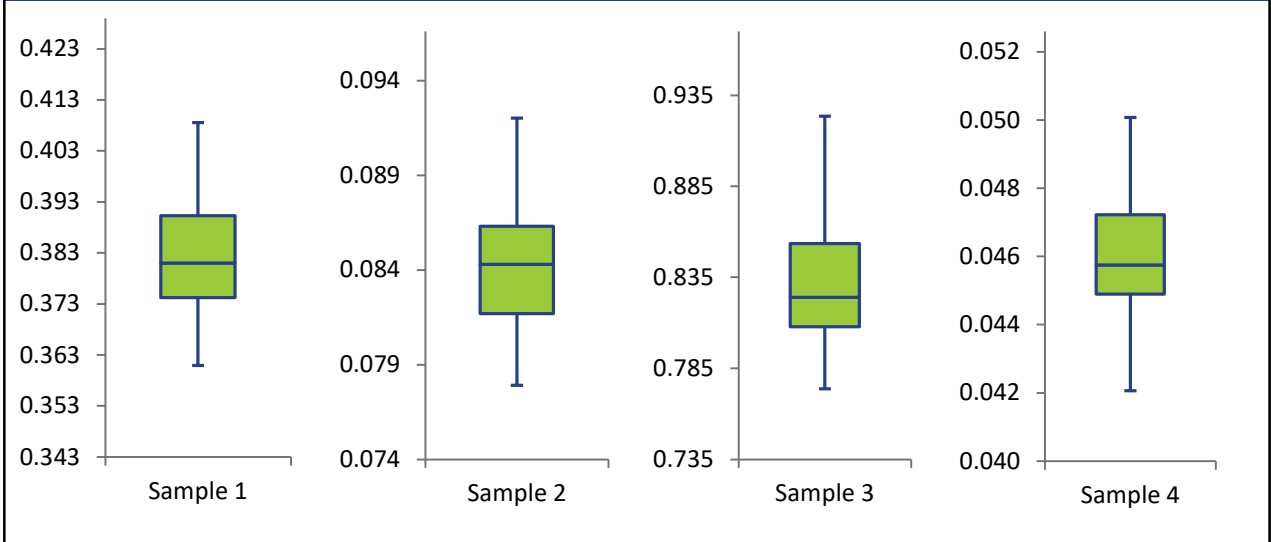| Method	C02A-1	C02A-2	C02A-3	C02A-4
ICP/OES (Blue)	19	19	19	18
ICP/MS (Red)	76	75	76	77
AA FLAME (Green)	1	1	1	1

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

BERYLLIUM

BERYLLIUM

Stability Assessment	Homogeneity Assessment

Stability assessments are regression analysis of reported result against date of analysis.

Homogeneity assessments are regression analysis of reported result against bottling order.
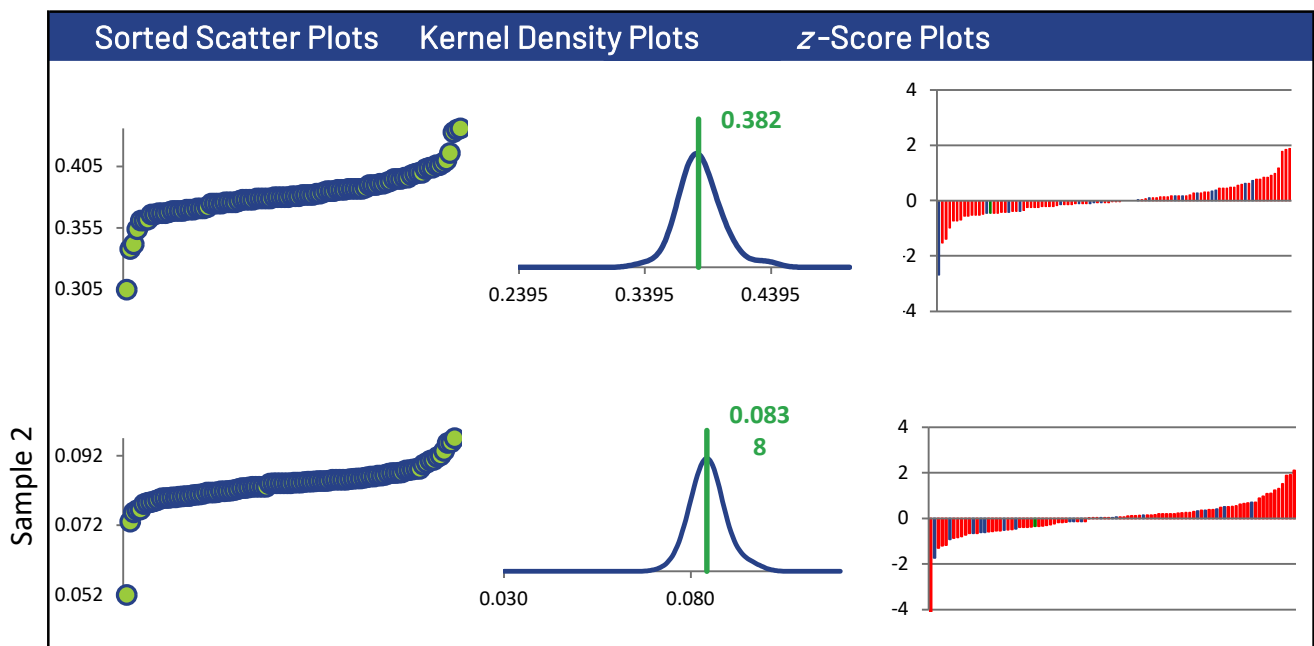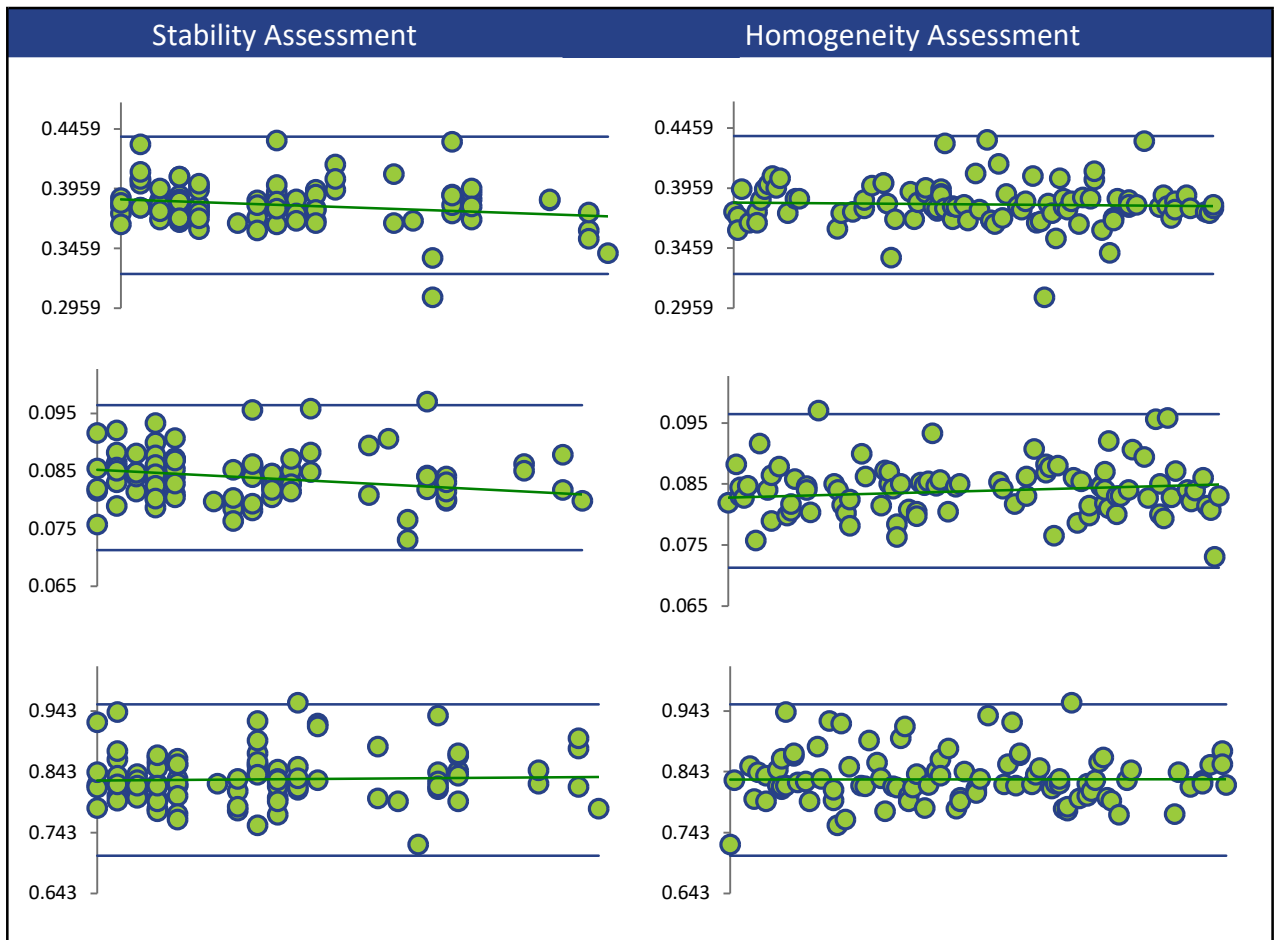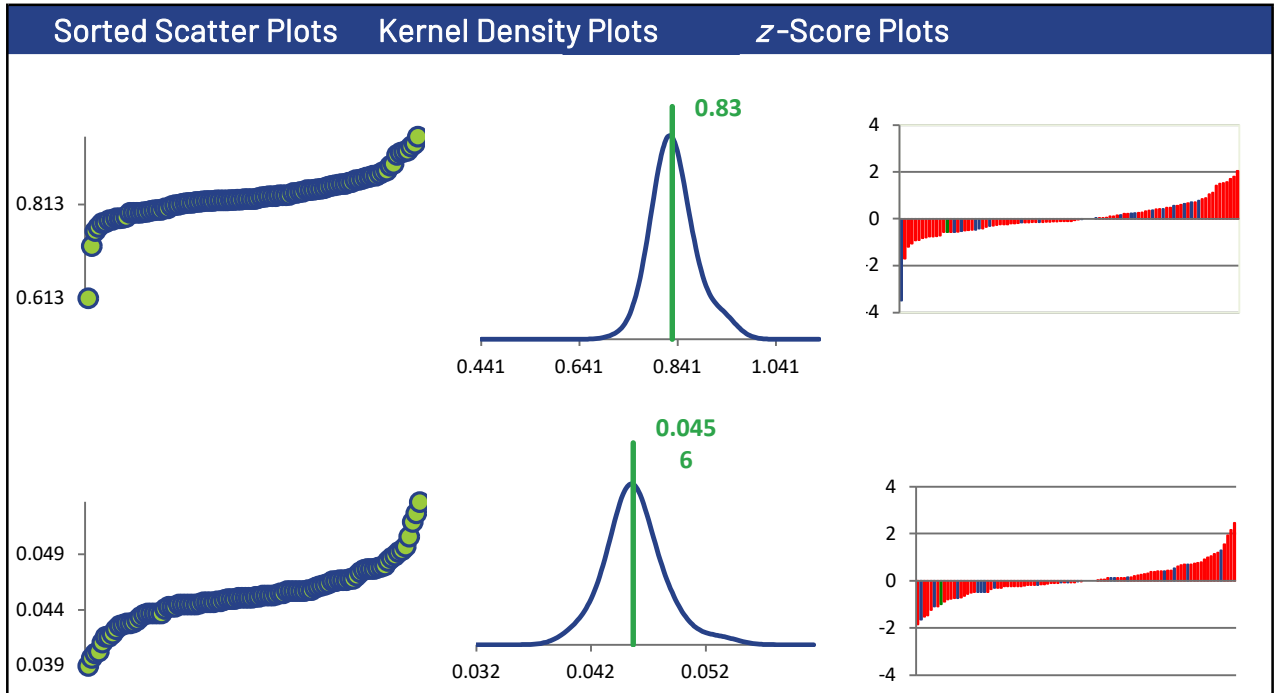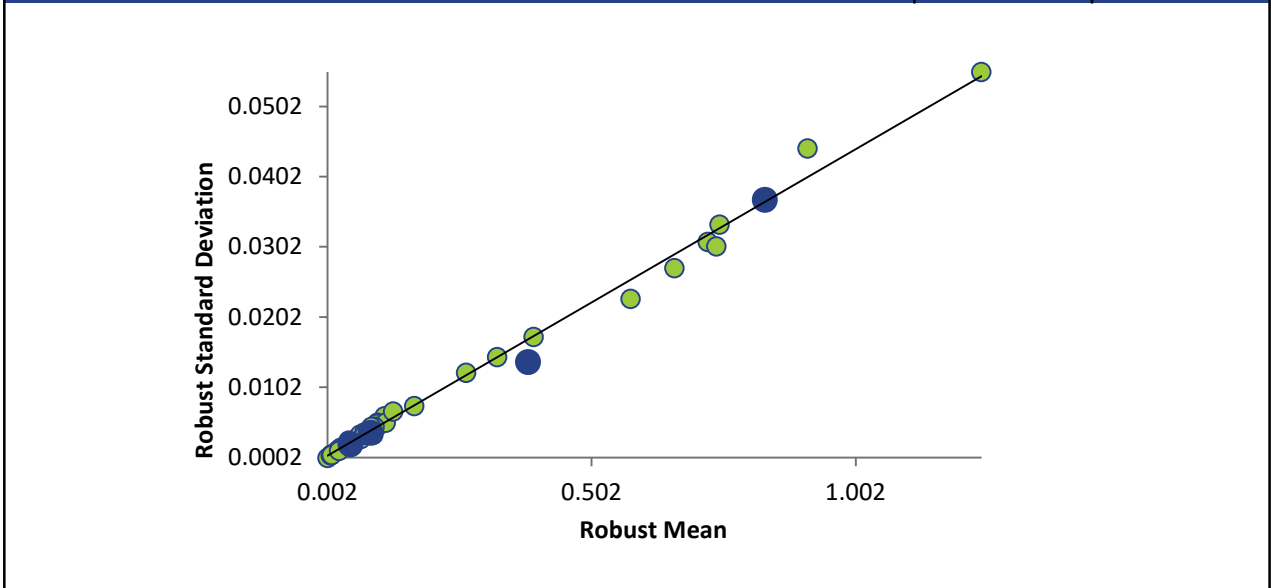
Box and Whisker Plots

Current Round (blue) Compared to Historic Rounds (green)

BORON

Summary Statistics

Statistic	C02A-1	C02A-2	C02A-3	C02A-4
N	98	96	98	83
Median mg/L	0.690	0.428	1.21	0.0391
Robust Mean mg/L	0.690	0.430	1.21	0.0403
U mg/L	0.00428	0.00272	0.00917	0.000742
Robust Standard Deviation mg/L	0.0339	0.0213	0.0726	0.00541
Regression Standard Deviation mg/L	0.0518	0.0322	0.0905	0.00302
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA) mg/L	0.0518	0.0322	0.0905	0.00541
Outliers	0	1	0	0
|z|>3.0	1	1	3	4
2<|z|<3	2	3	4	7

Methods Used

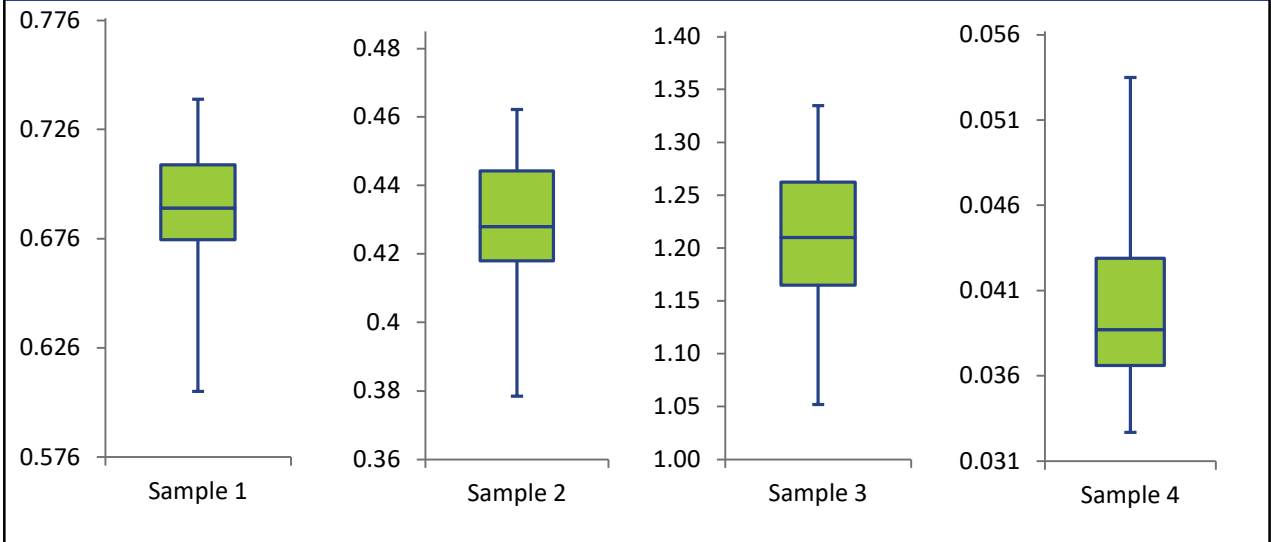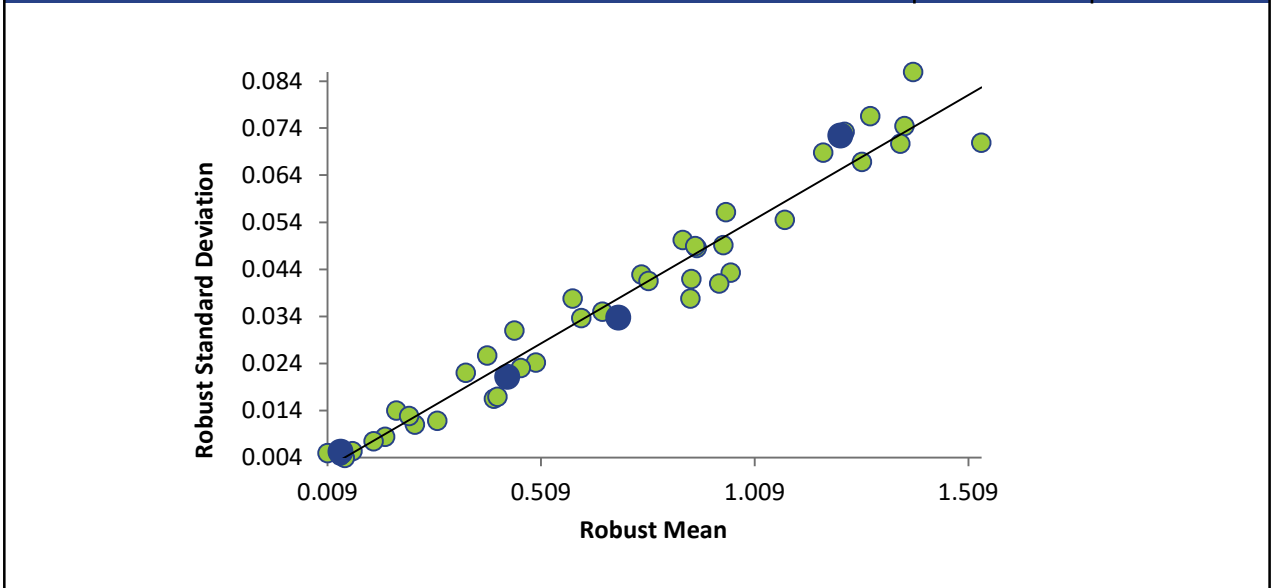| Method	C02A-1	C02A-2	C02A-3	C02A-4
ICP/MS (Blue)	75	73	75	67
ICP/OES (Red)	23	23	23	16

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

BORON

| Sorted Scatter Plots | Kernel Density Plots | z-Score Plots |

| Stability Assessment | Homogeneity Assessment |

BORON

Stability Assessment	Homogeneity Assessment

Stability assessments are regression analysis of reported result against date of analysis.

Homogeneity assessments are regression analysis of reported result against bottling order.
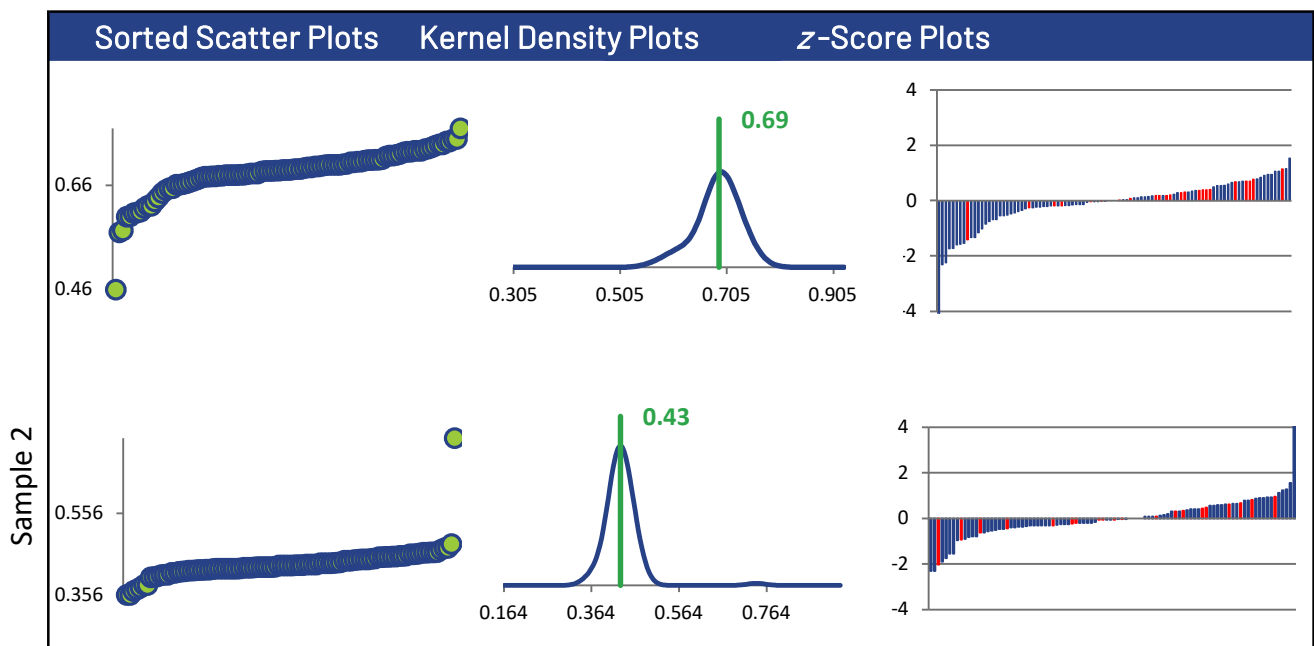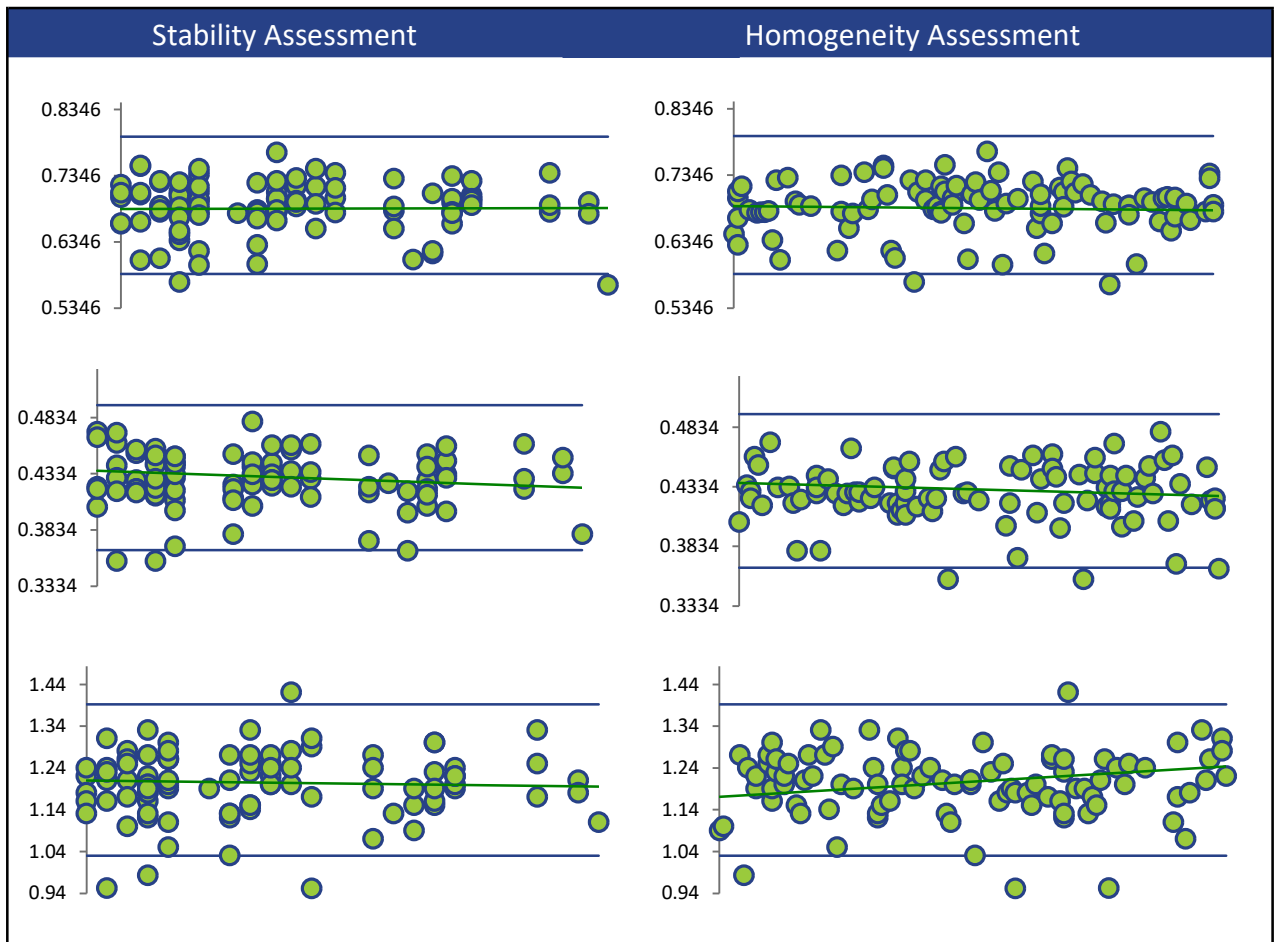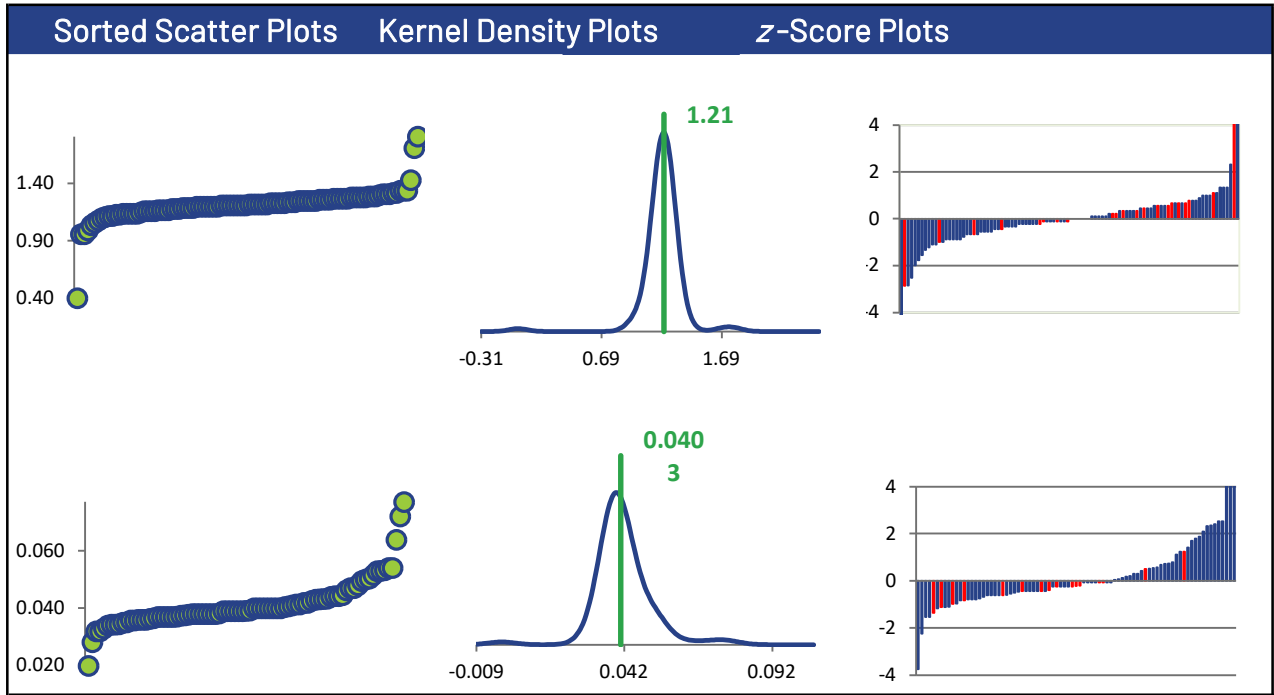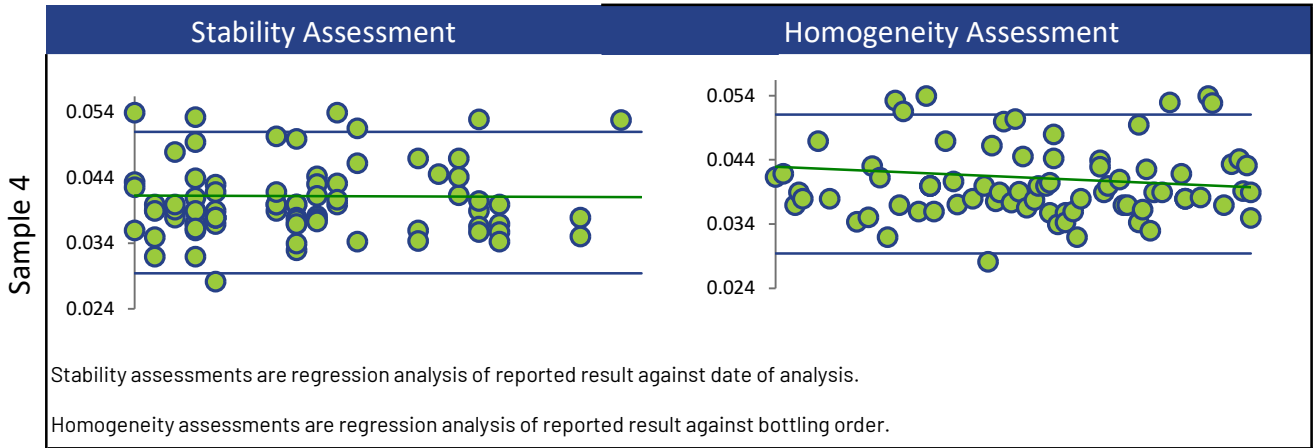
Box and Whisker Plots

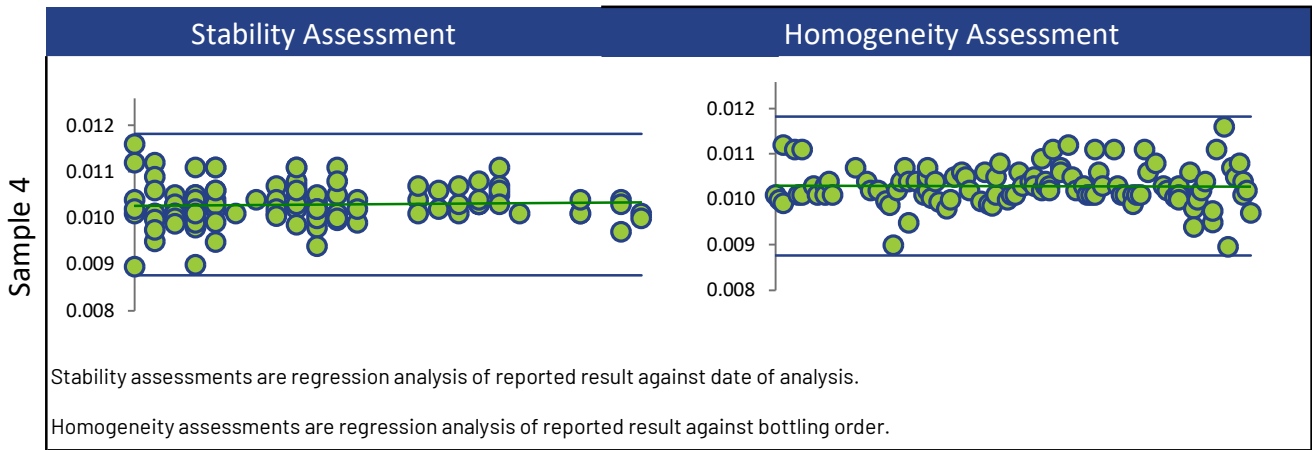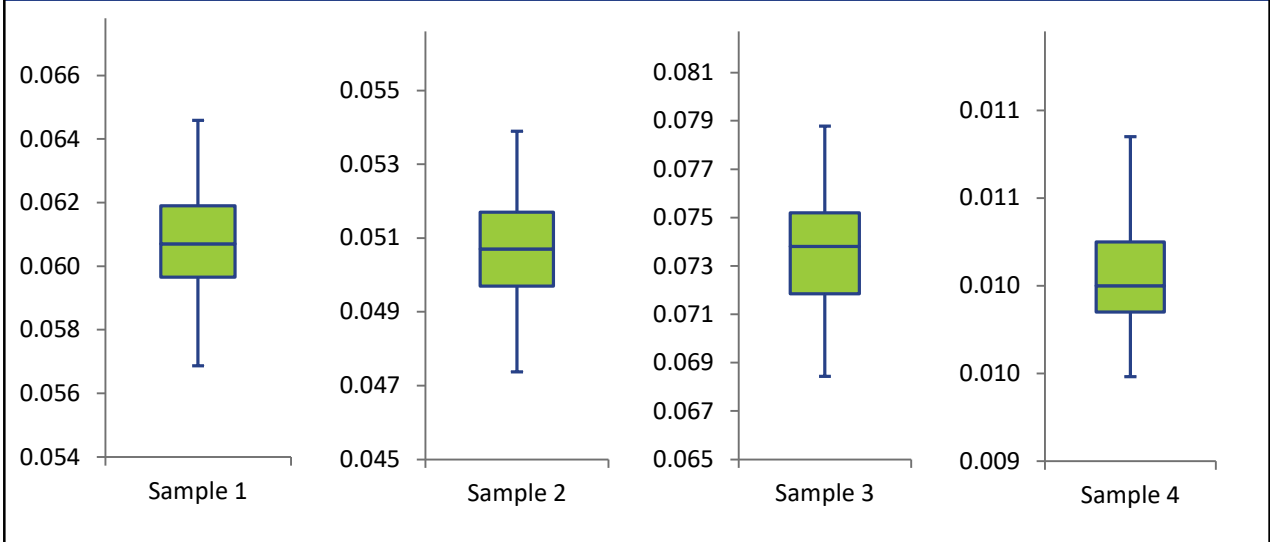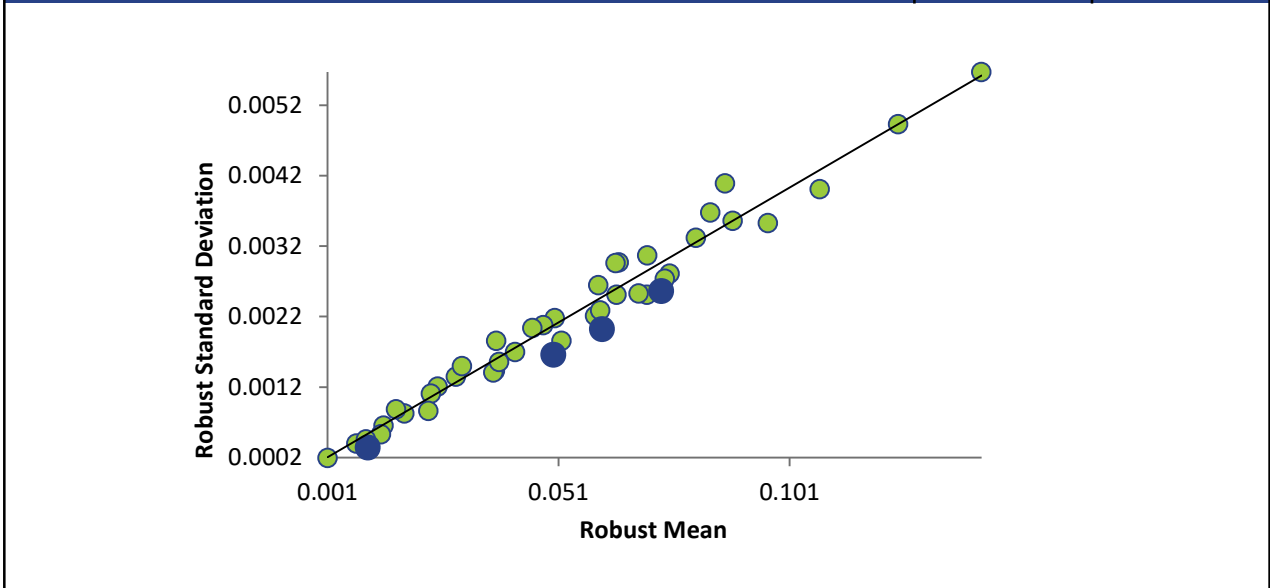## Current Round (blue) Compared to Historic Rounds (green)

CADMIUM

Summary Statistics

Statistic	C02A-1	C02A-2	C02A-3	C02A-4
N	115	115	115	112
Median mg/L	0.0609	0.0504	0.0740	0.0102
Robust Mean mg/L	0.0609	0.0504	0.0737	0.0102
U mg/L	0.000237	0.000195	0.000300	0.0000417
Robust Standard Deviation mg/L	0.00203	0.00167	0.00257	0.000353
Regression Standard Deviation mg/L	0.00457	0.00378	0.00553	0.000764
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA) mg/L	0.00457	0.00378	0.00553	0.000764
Outliers	0	0	0	2
|z|>3.0	0	3	1	0
2<|z|<3	1	0	2	0

Methods Used

Method	C02A-1	C02A-2	C02A-3	C02A-4
ICP/MS (Blue)	88	88	88	88
ICP/OES (Red)	25	25	25	23
AA FLAME (Green)	1	1	1	1
AA GRAPHITE (Orange)	1	1	1	0

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

CADMIUM

	Sorted Scatter Plots	Kernel Density Plots	z-Score Plots
Sample 3		**0.0737**	
Sample 4		**0.0102**	

	Stability Assessment	Homogeneity Assessment
Sample 1		
Sample 2		
Sample 3		

CADMIUM

Stability Assessment | Homogeneity Assessment

Sample 4

Stability assessments are regression analysis of reported result against date of analysis.

Homogeneity assessments are regression analysis of reported result against bottling order.
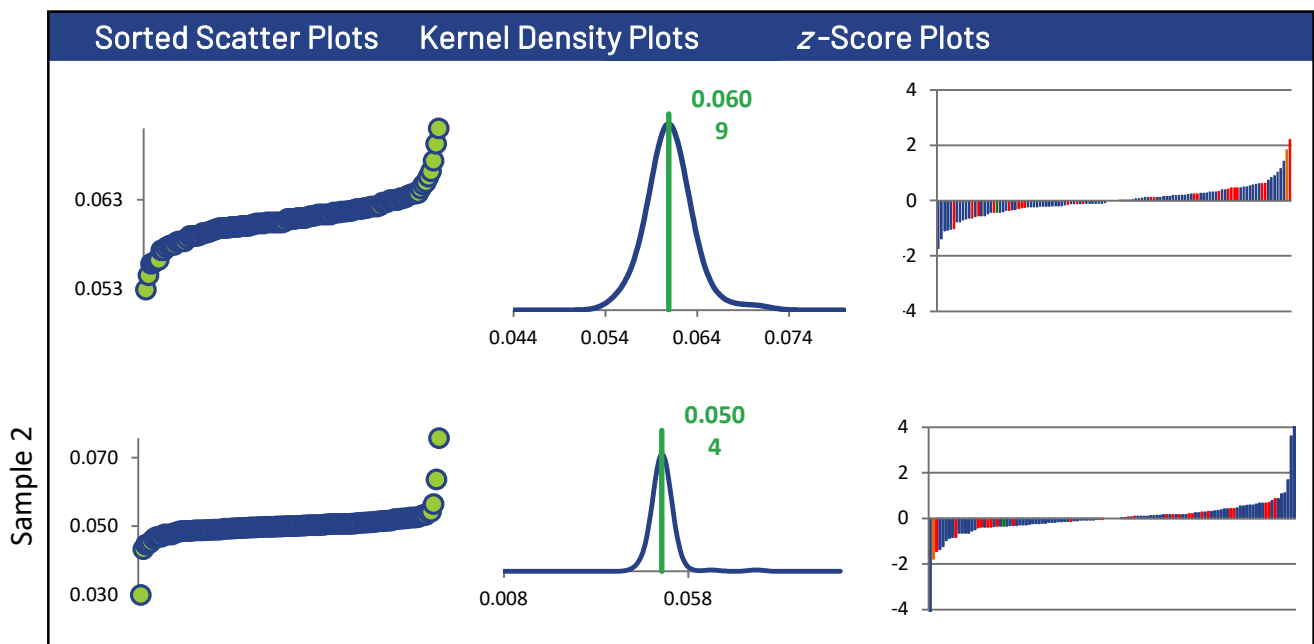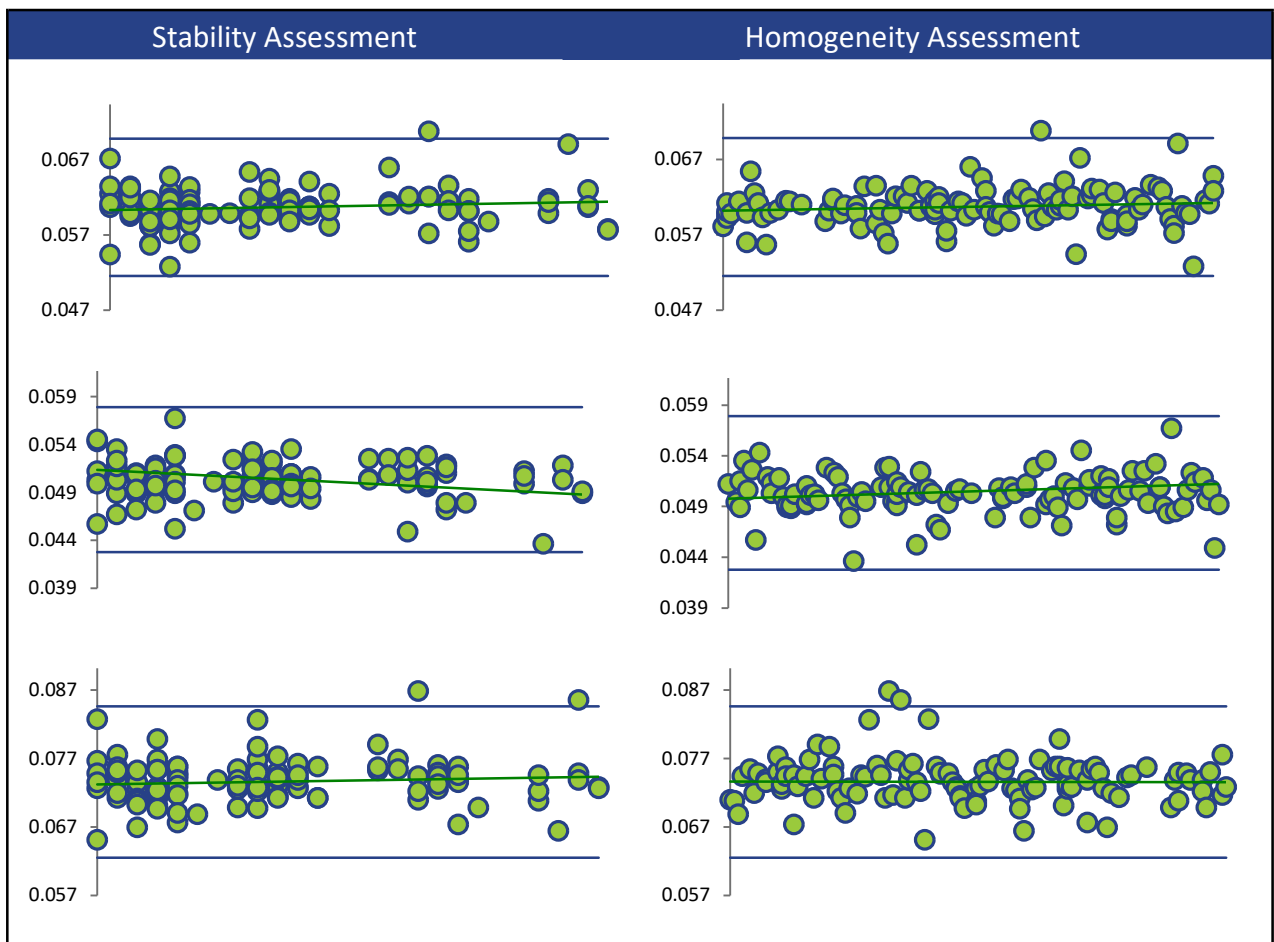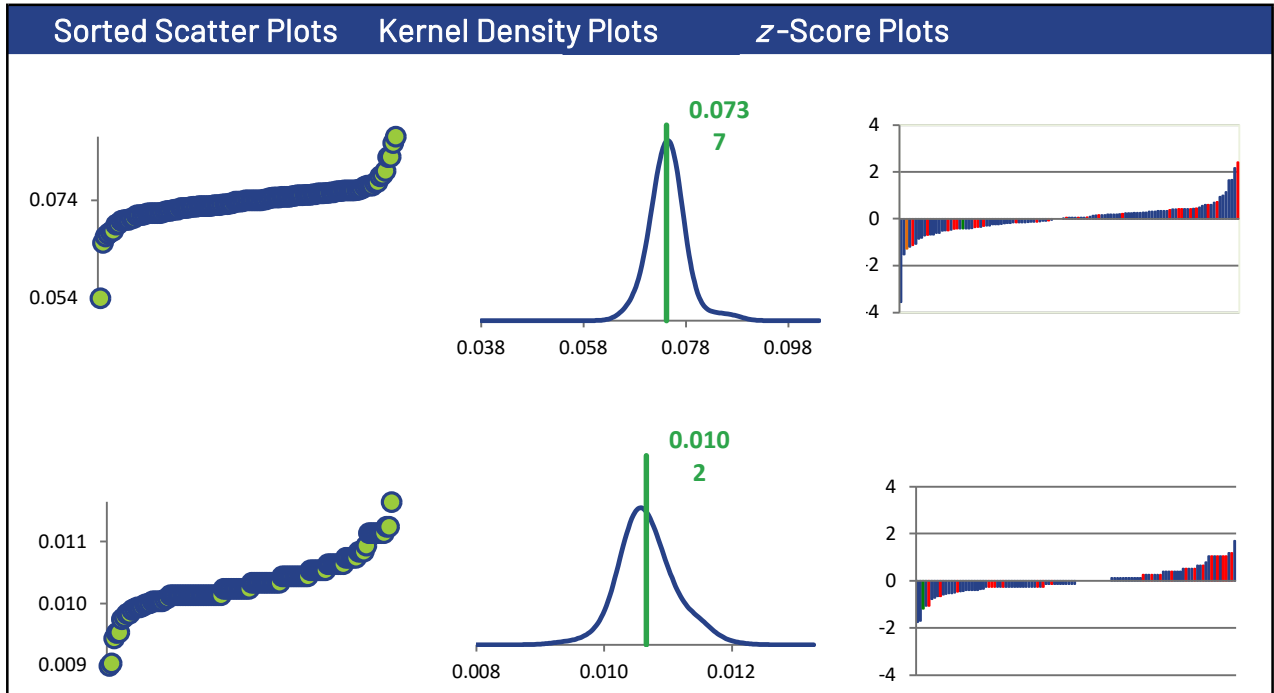
Box and Whisker Plots

Current Round (blue) Compared to Historic Rounds (green)

CHROMIUM

Summary Statistics

Statistic	C02A-1	C02A-2	C02A-3	C02A-4
N	110	109	110	111
Median mg/L	0.877	0.363	1.16	0.0286
Robust Mean mg/L	0.876	0.364	1.15	0.0285
U mg/L	0.00359	0.00160	0.00526	0.000147
Robust Standard Deviation mg/L	0.0301	0.0134	0.0441	0.00124
Regression Standard Deviation mg/L	0.0657	0.0273	0.0865	0.00214
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA) mg/L	0.0657	0.0273	0.0865	0.00214
Outliers	1	2	1	0
|z|>3.0	0	0	1	3
2<|z|<3	1	1	0	1

Methods Used

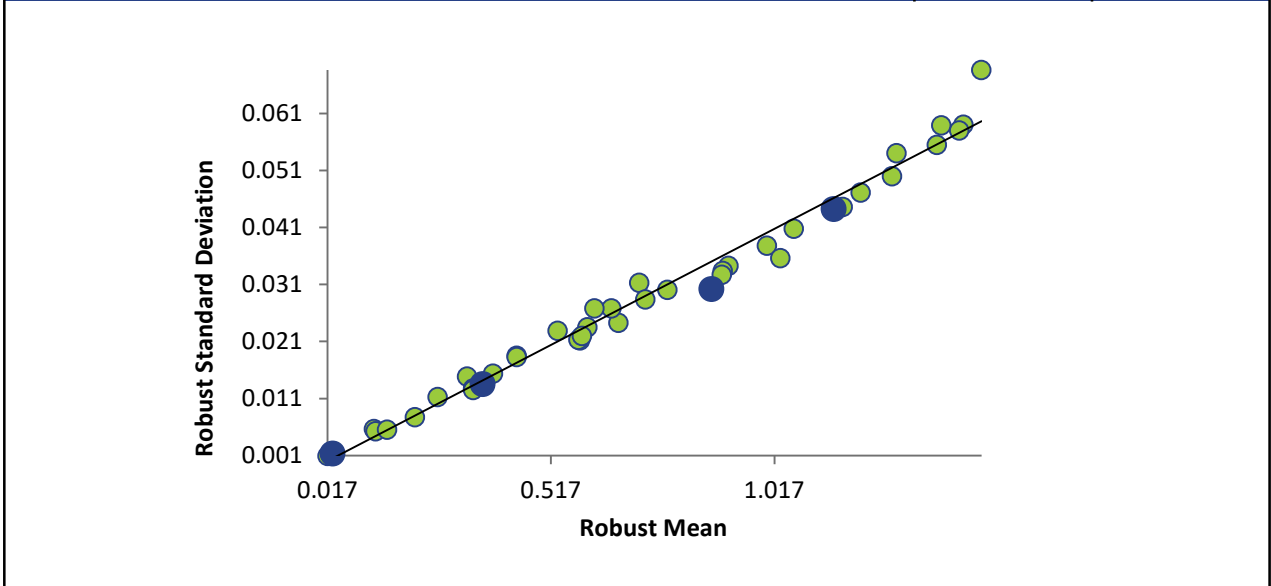| Method	C02A-1	C02A-2	C02A-3	C02A-4
ICP/OES (Blue)	24	24	24	24
ICP/MS (Red)	84	83	84	85
AA FLAME (Green)	2	2	2	2

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

CHROMIUM
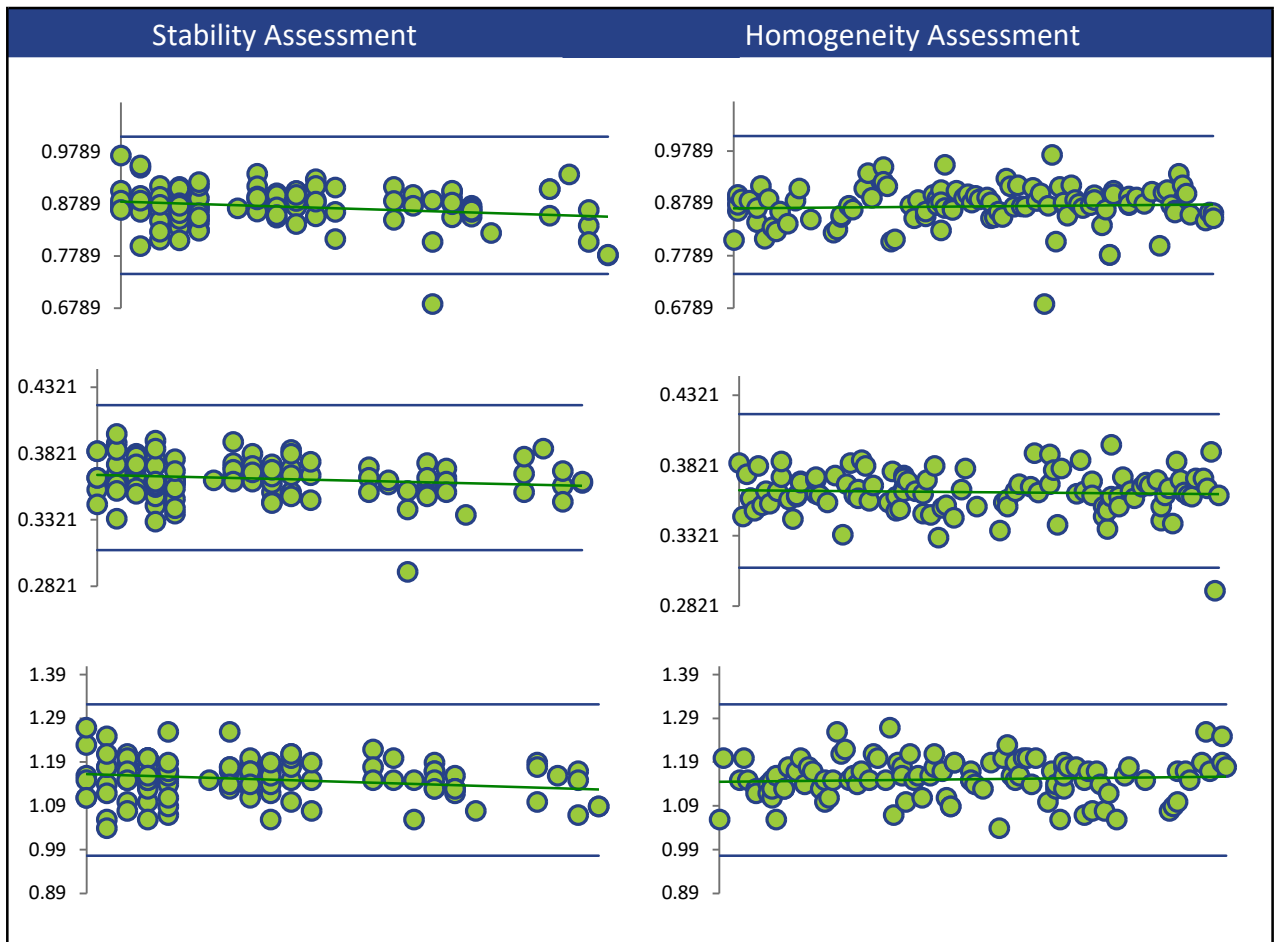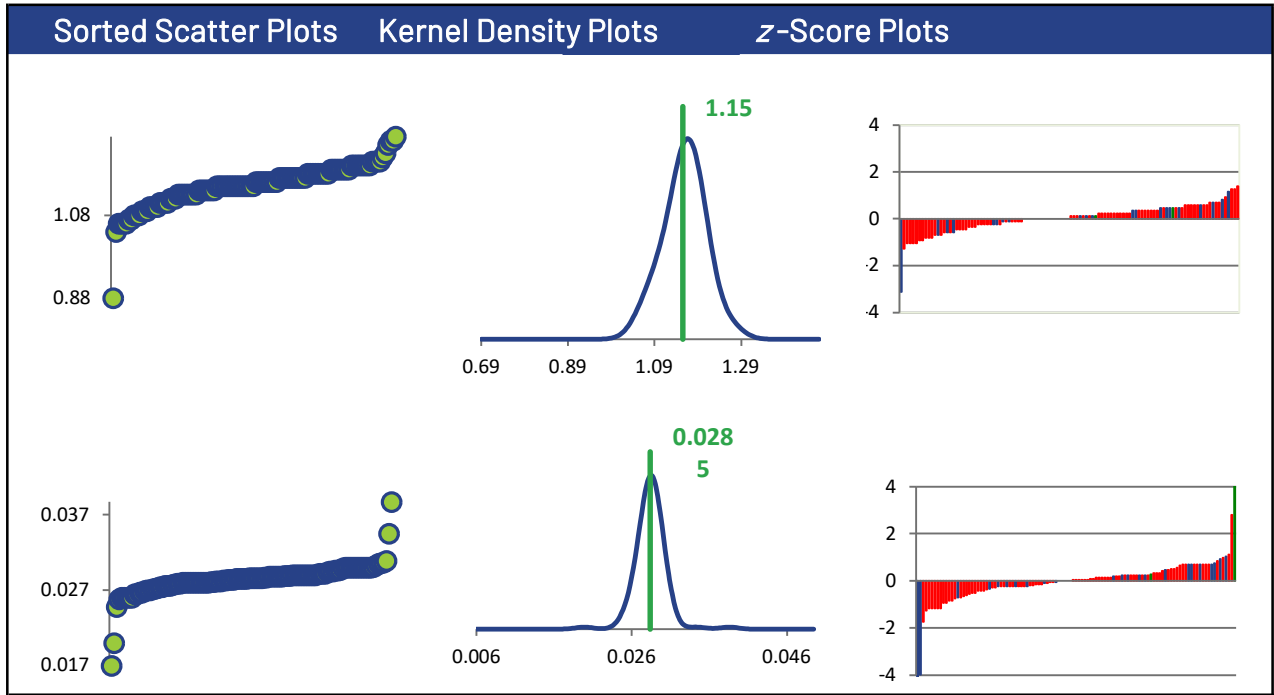
CHROMIUM
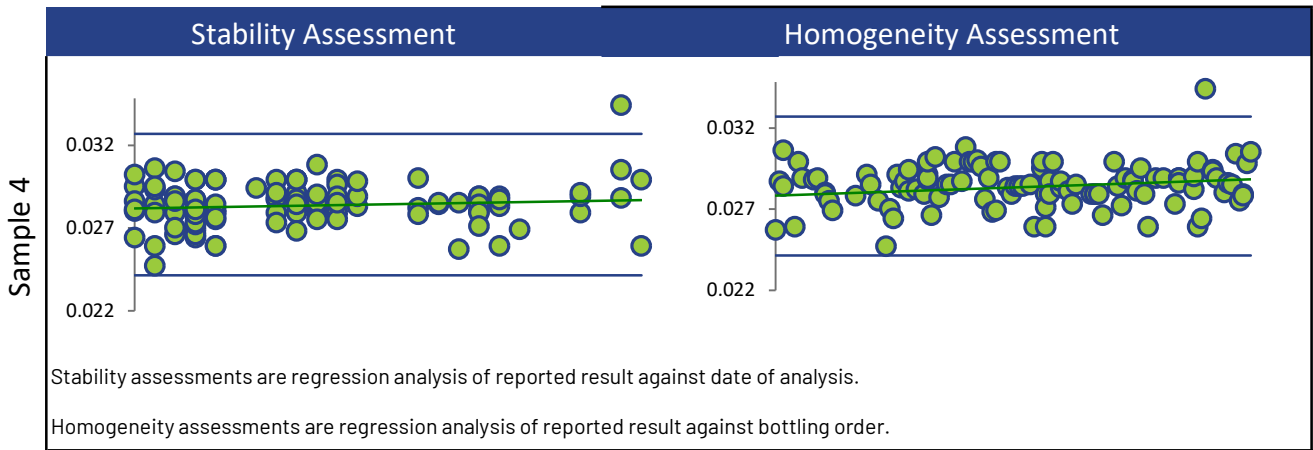
Stability Assessment | Homogeneity Assessment

Sample 4

Stability assessments are regression analysis of reported result against date of analysis.

Homogeneity assessments are regression analysis of reported result against bottling order.

Box and Whisker Plots

Sample 1 | Sample 2 | Sample 3 | Sample 4

Current Round (blue) Compared to Historic Rounds (green)

Robust Standard Deviation
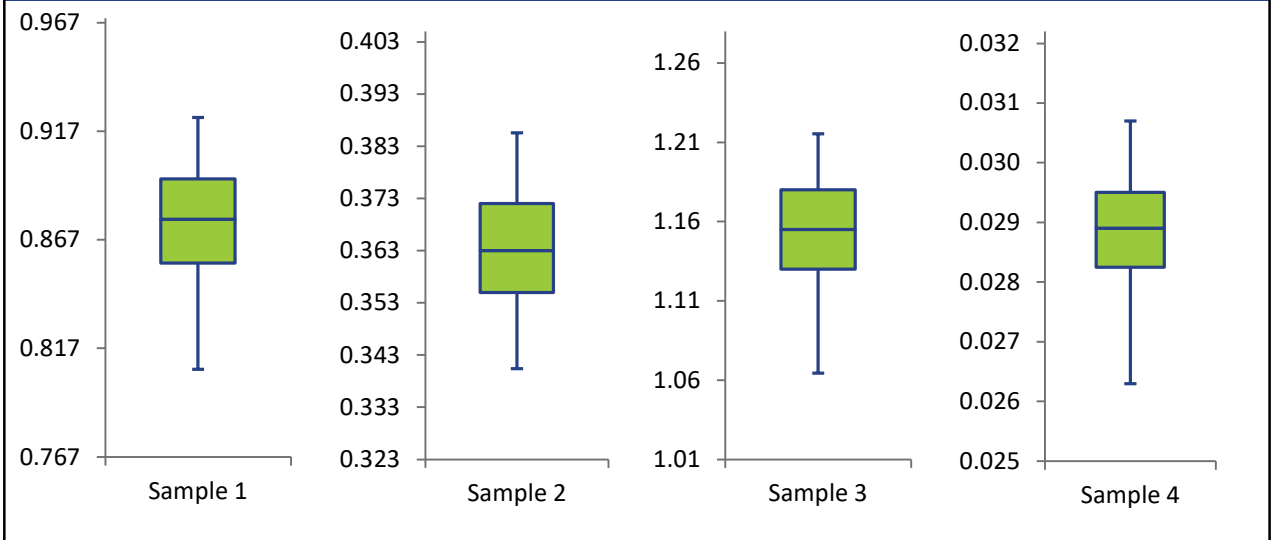
Robust Mean

COBALT

Summary Statistics

Statistic	C02A-1	C02A-2	C02A-3	C02A-4
N	109	109	108	108
Median mg/L	0.757	0.436	0.868	0.0400
Robust Mean mg/L	0.756	0.436	0.864	0.0398
U mg/L	0.00342	0.00192	0.00416	0.000179
Robust Standard Deviation mg/L	0.0286	0.0160	0.0346	0.00149
Regression Standard Deviation mg/L	0.0567	0.0327	0.0648	0.00299
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA) mg/L	0.0567	0.0327	0.0648	0.00299
Outliers	0	0	1	0
|z|>3.0	1	3	1	2
2<|z|<3	0	1	0	2

Methods Used

Method	C02A-1	C02A-2	C02A-3	C02A-4
ICP/MS (Blue)	84	84	83	84
ICP/OES (Red)	23	23	23	22
AA FLAME (Green)	2	2	2	2

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

COBALT

COBALT

Stability Assessment	Homogeneity Assessment

Stability assessments are regression analysis of reported result against date of analysis.

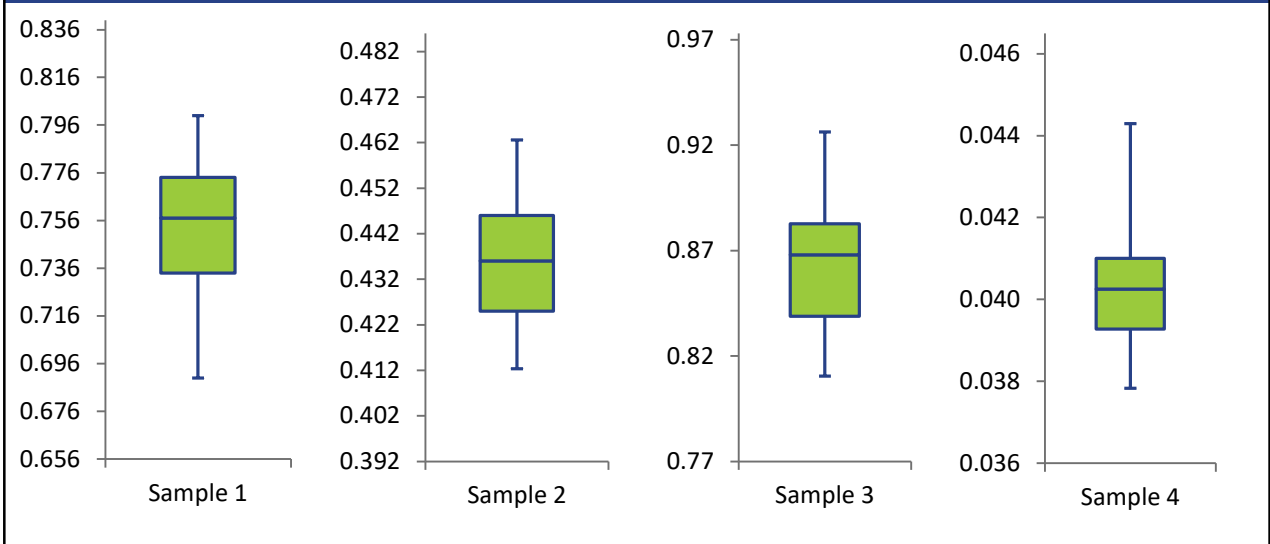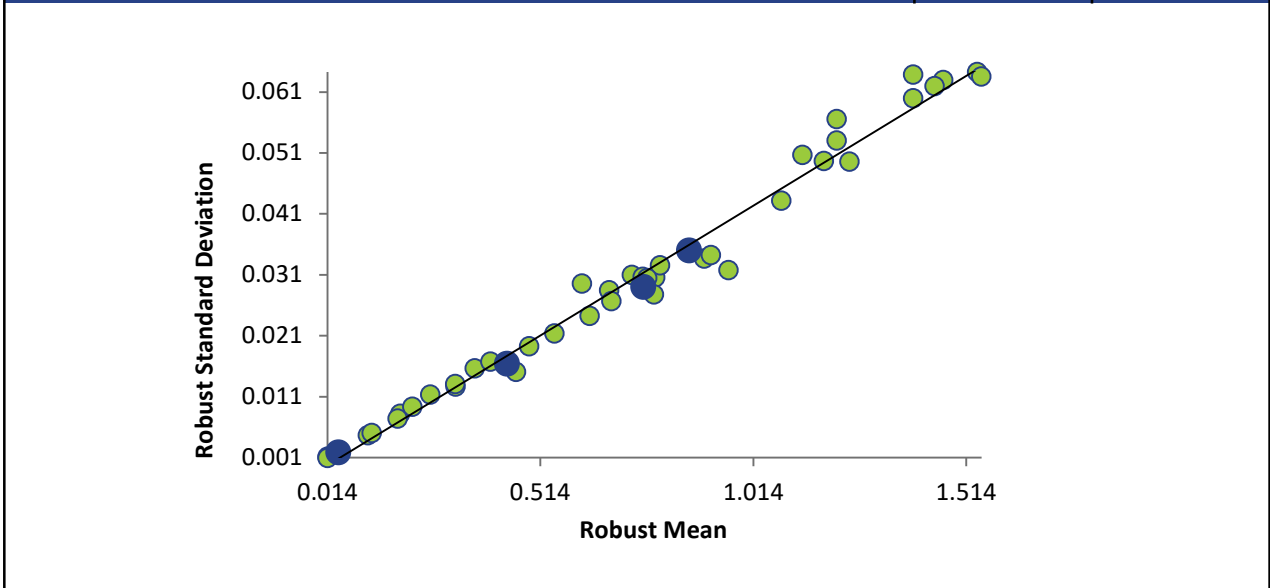Homogeneity assessments are regression analysis of reported result against bottling order.
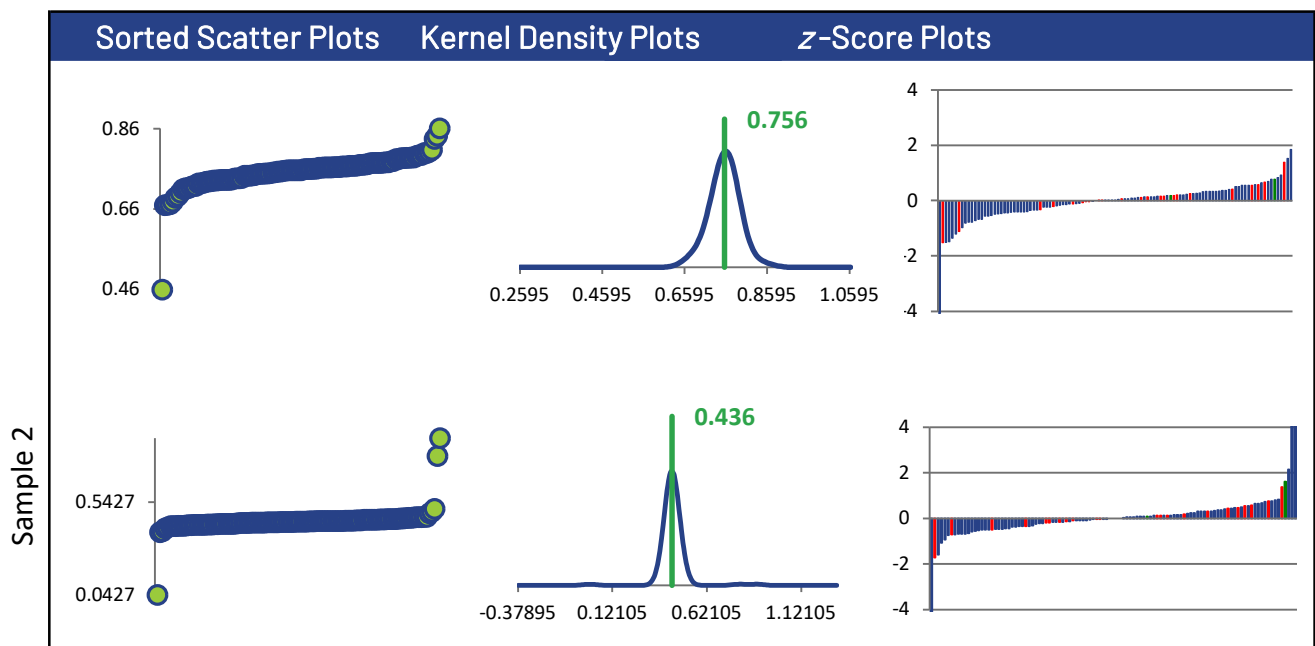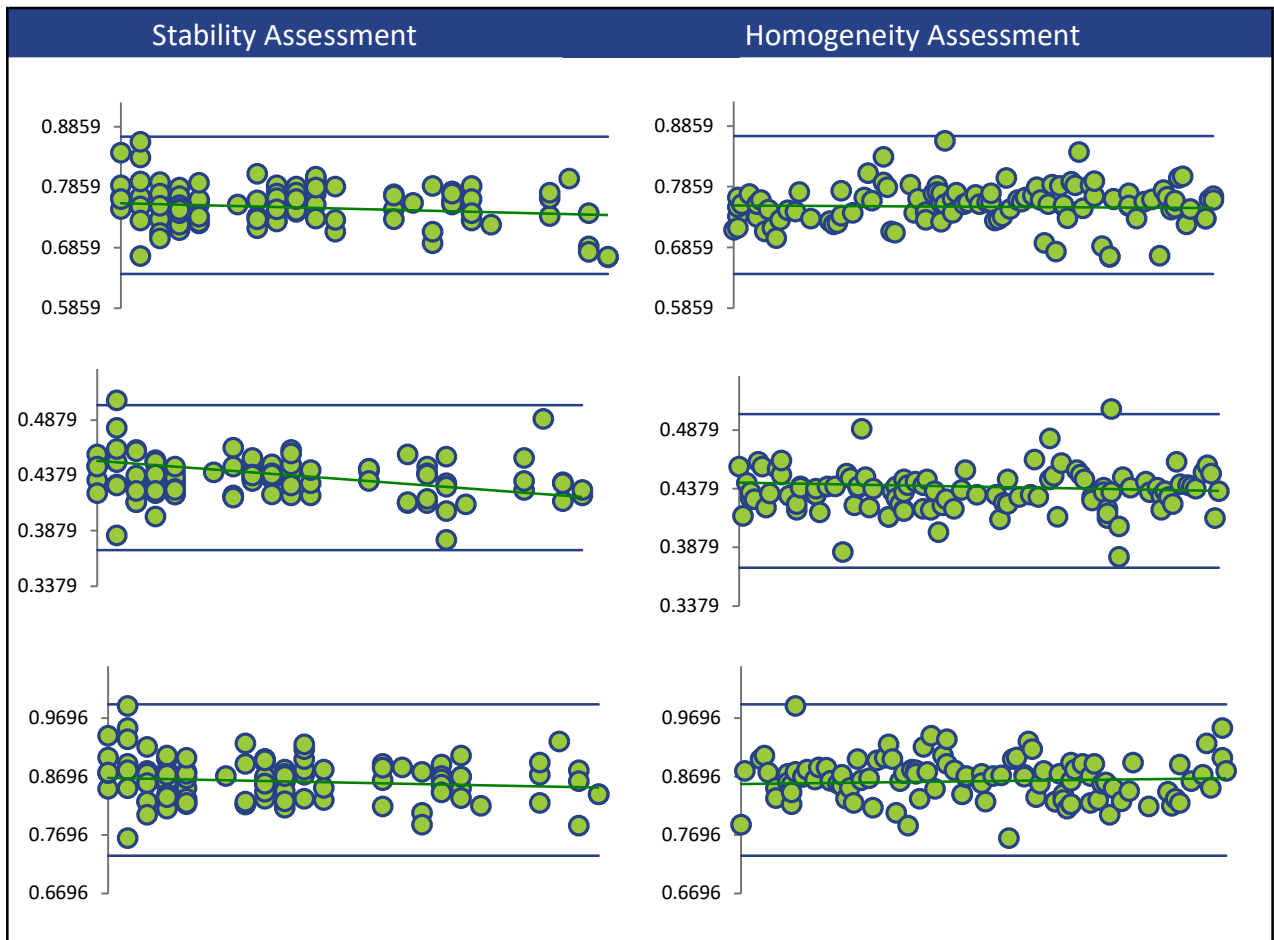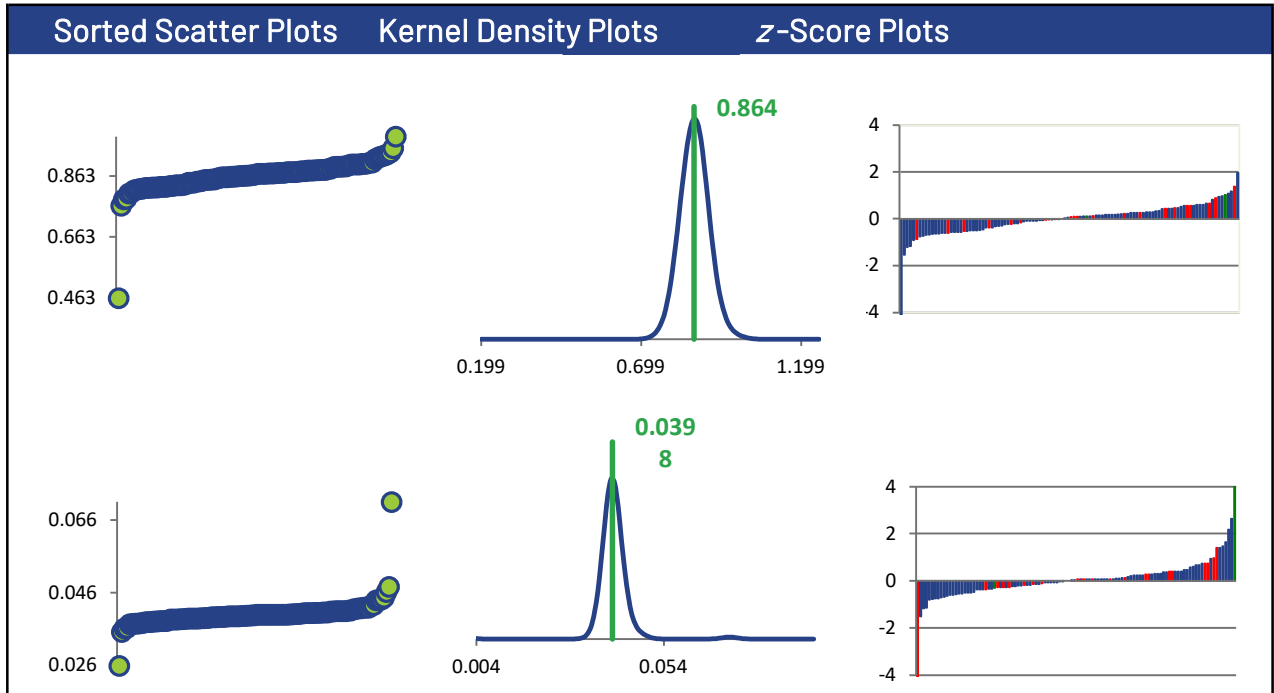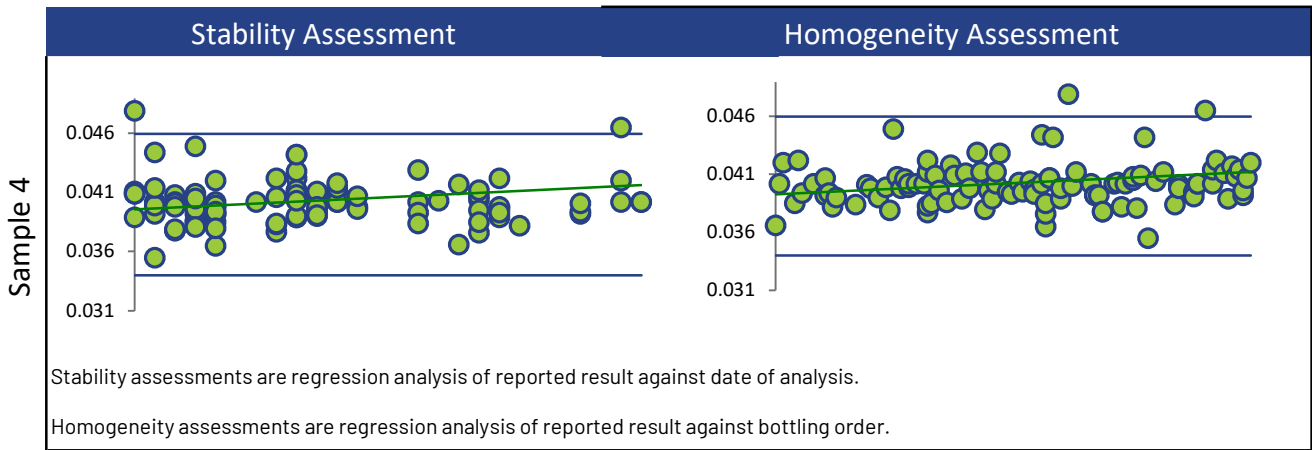
Box and Whisker Plots

Current Round (blue) Compared to Historic Rounds (green)

COPPER

Summary Statistics

Statistic	C02A-1	C02A-2	C02A-3	C02A-4
N	117	116	117	117
Median mg/L	0.446	0.146	1.11	0.0466
Robust Mean mg/L	0.446	0.146	1.11	0.0468
U mg/L	0.00209	0.000769	0.00573	0.000232
Robust Standard Deviation mg/L	0.0181	0.00663	0.0496	0.00201
Regression Standard Deviation mg/L	0.0335	0.0110	0.0833	0.00351
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA) mg/L	0.0335	0.0110	0.0833	0.00351
Outliers	1	2	1	1
|z|>3.0	0	0	0	1
2<|z|<3	1	2	1	1

Methods Used

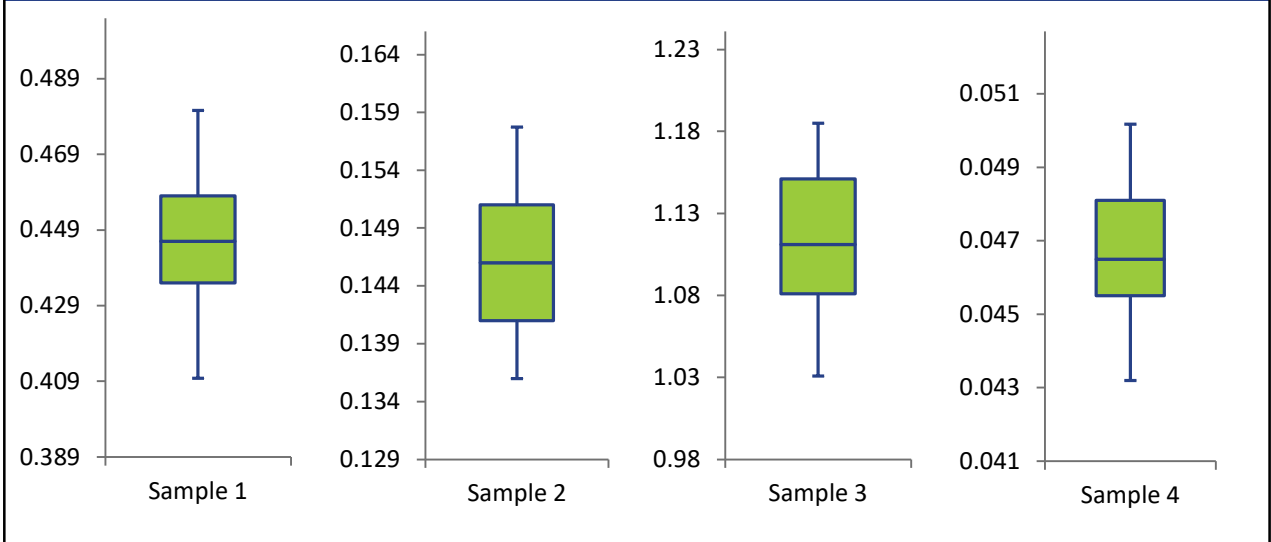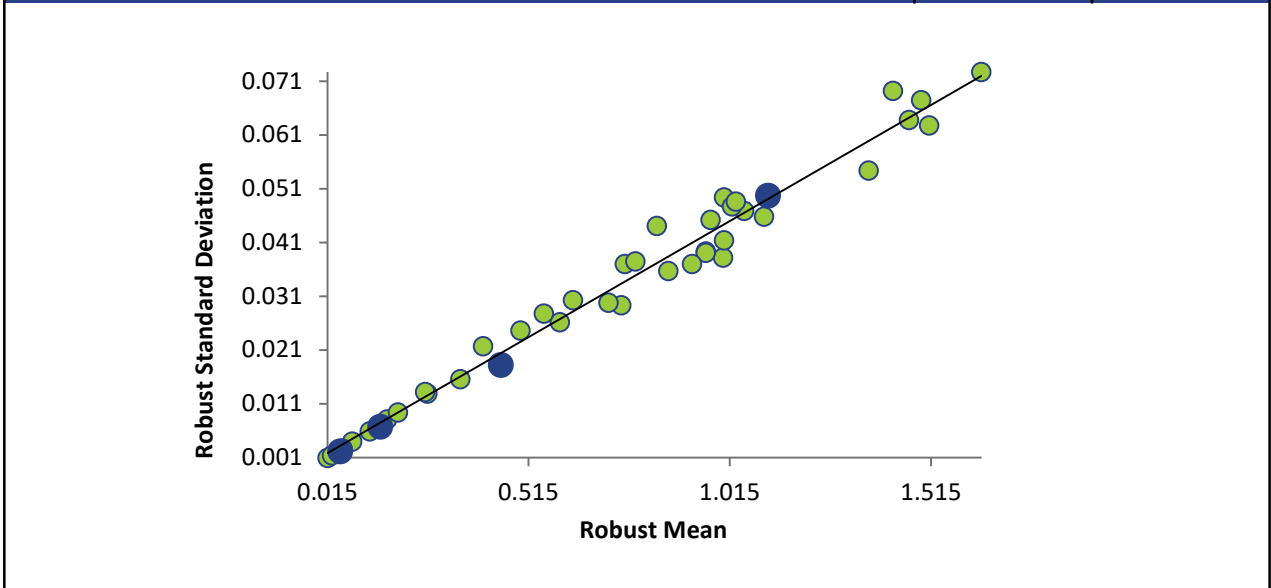| Method	C02A-1	C02A-2	C02A-3	C02A-4
ICP/OES (Blue)	27	27	27	26
ICP/MS (Red)	88	87	88	89
AA FLAME (Green)	2	2	2	2

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

COPPER

Sorted Scatter Plots	Kernel Density Plots	z-Score Plots

Sample 3 — scatter, kernel density peak at **1.11**, z-score plot

Sample 4 — scatter, kernel density peak at **0.0468**, z-score plot

Stability Assessment	Homogeneity Assessment

Sample 1

Sample 2

Sample 3

COPPER

Stability Assessment	Homogeneity Assessment

Stability assessments are regression analysis of reported result against date of analysis.

Homogeneity assessments are regression analysis of reported result against bottling order.
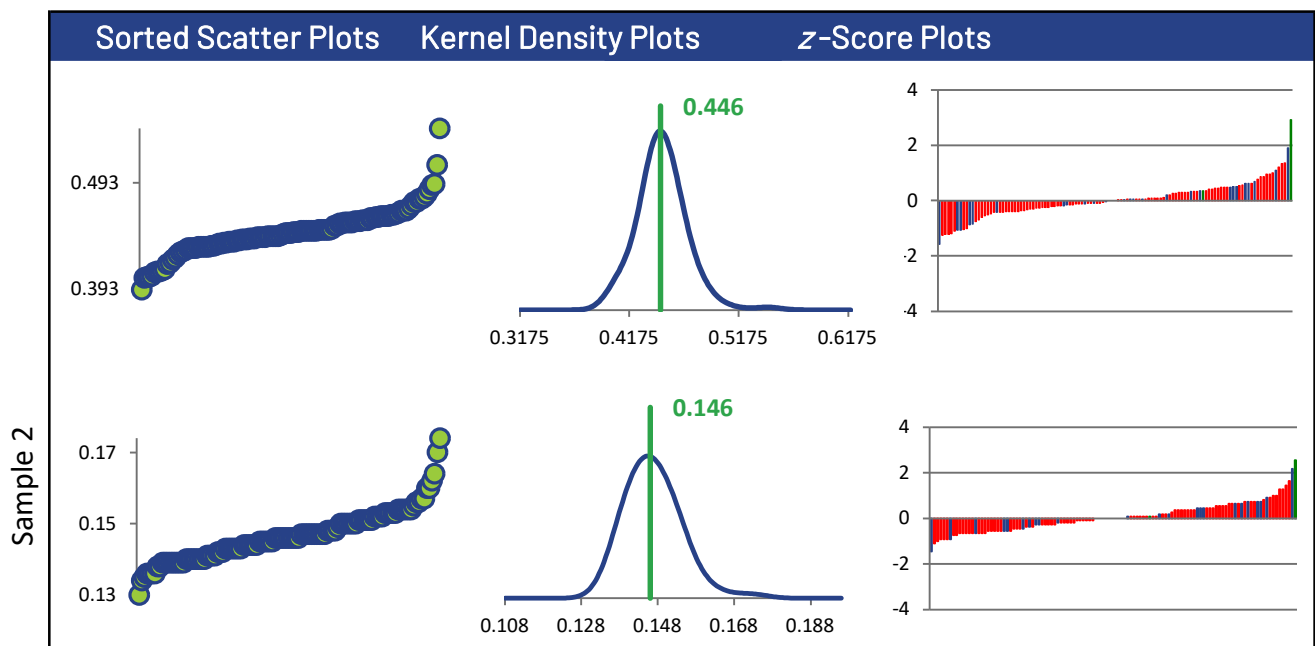
Box and Whisker Plots

Current Round (blue) Compared to Historic Rounds (green)

IRON

Summary Statistics

Statistic	C02A-1	C02A-2	C02A-3	C02A-4
N	112	111	111	102
Median mg/L	0.728	0.484	1.42	0.0490
Robust Mean mg/L	0.721	0.482	1.41	0.0490
U mg/L	0.00410	0.00249	0.00698	0.000400
Robust Standard Deviation mg/L	0.0347	0.0210	0.0588	0.00323
Regression Standard Deviation mg/L	0.0541	0.0361	0.106	0.00368
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA) mg/L	0.0541	0.0361	0.106	0.00368
Outliers	0	1	1	0
|z|>3.0	2	1	0	8
2<|z|<3	4	3	2	4

Methods Used

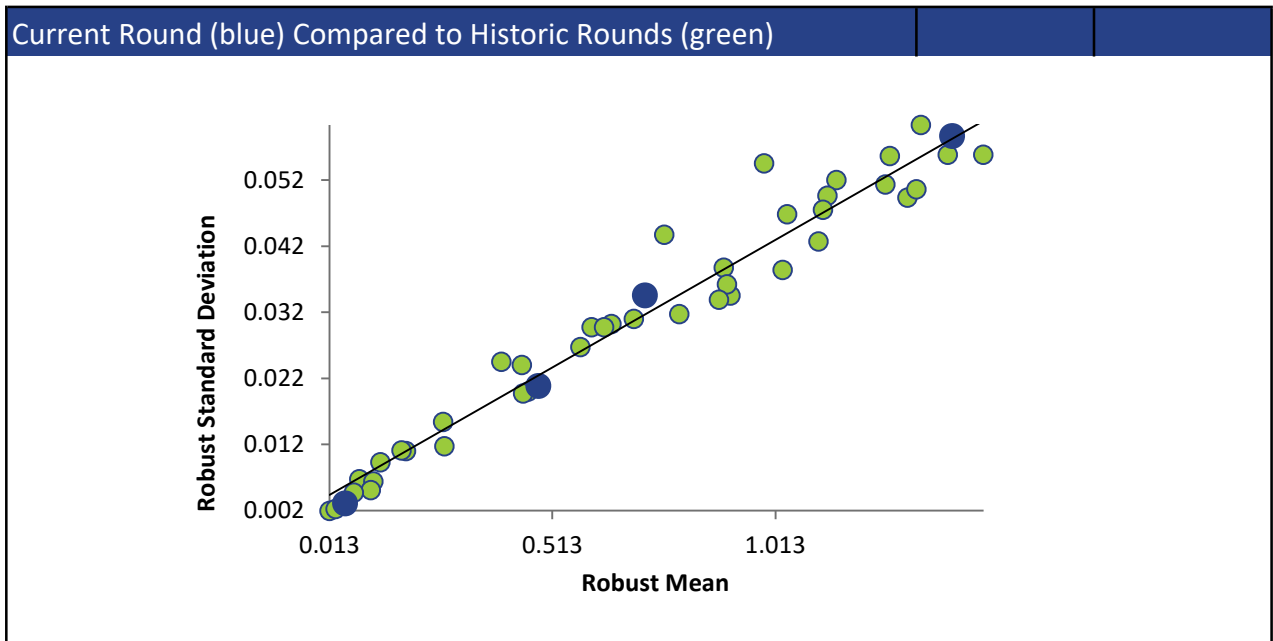| Method	C02A-1	C02A-2	C02A-3	C02A-4
ICP/OES (Blue)	31	31	31	27
ICP/MS (Red)	80	79	79	74
AA FLAME (Green)	1	1	1	1

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

IRON

IRON

Stability Assessment	Homogeneity Assessment

Stability assessments are regression analysis of reported result against date of analysis.

Homogeneity assessments are regression analysis of reported result against bottling order.

Box and Whisker Plots
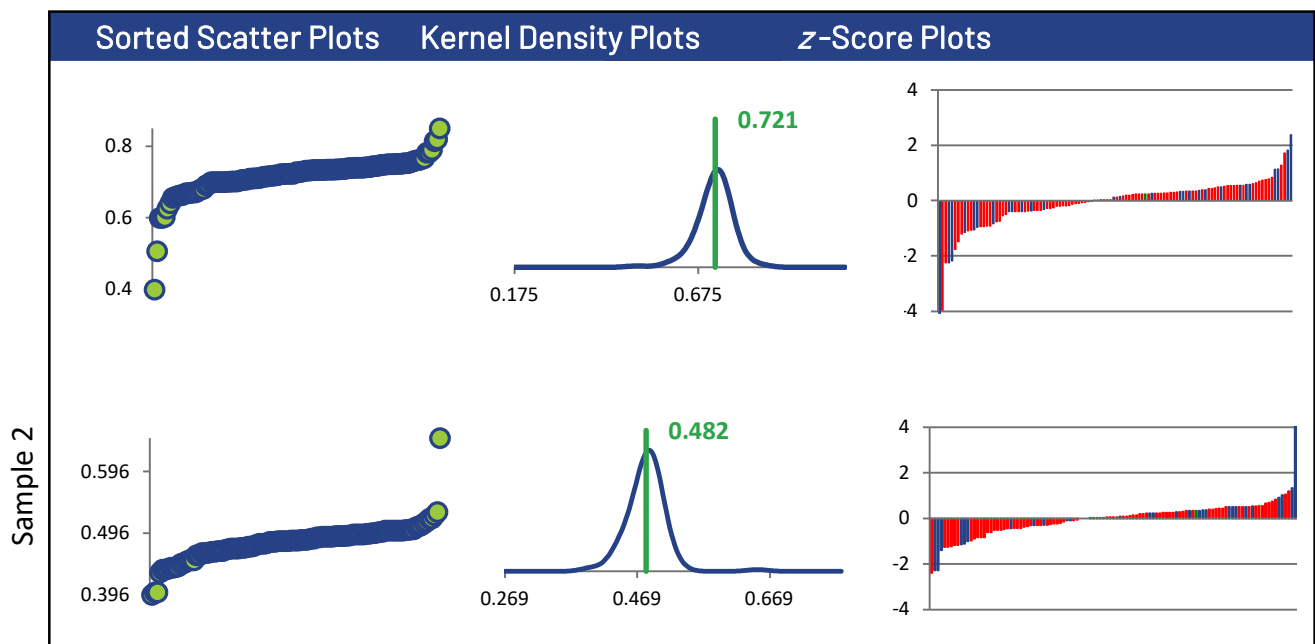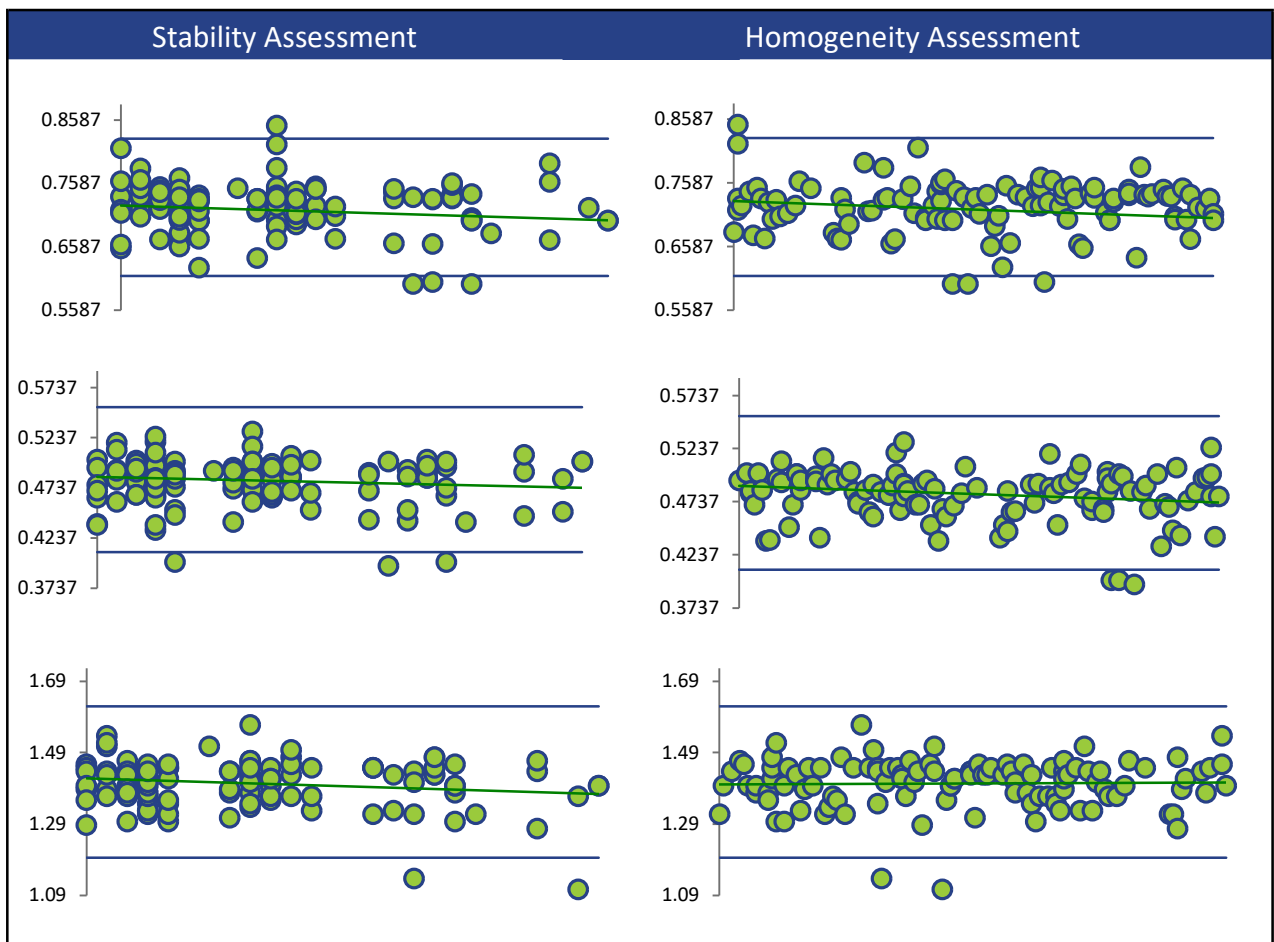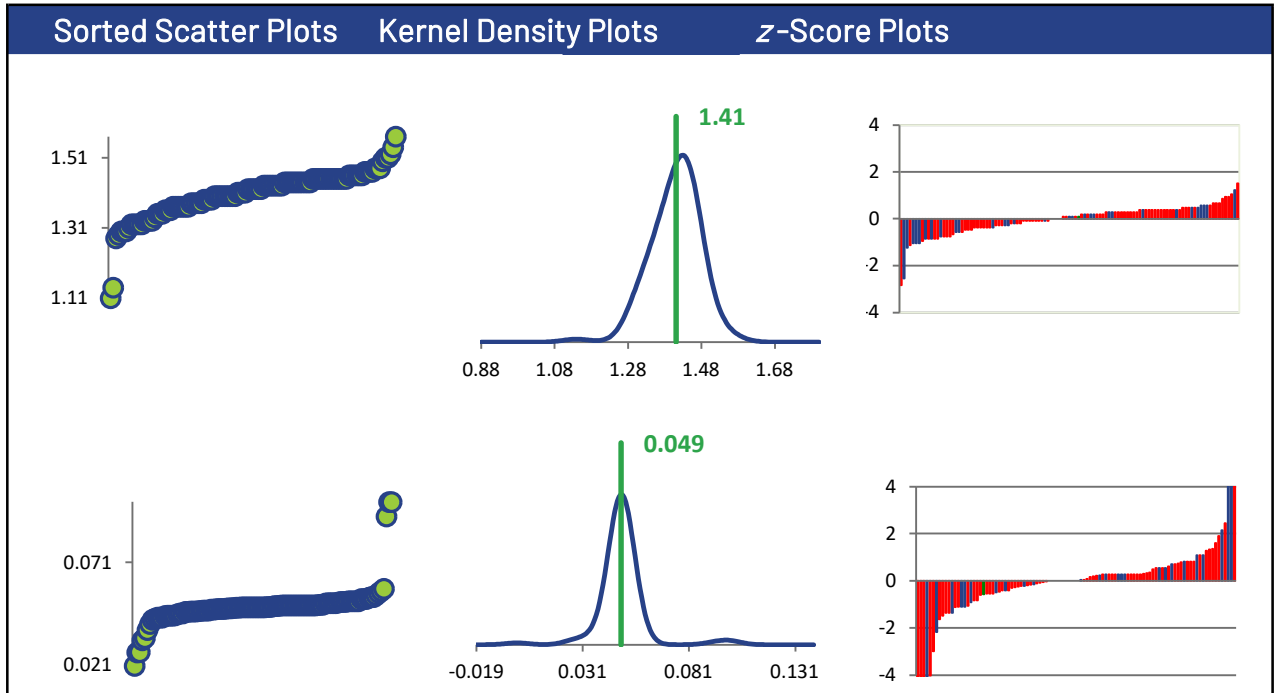
Current Round (blue) Compared to Historic Rounds (green)
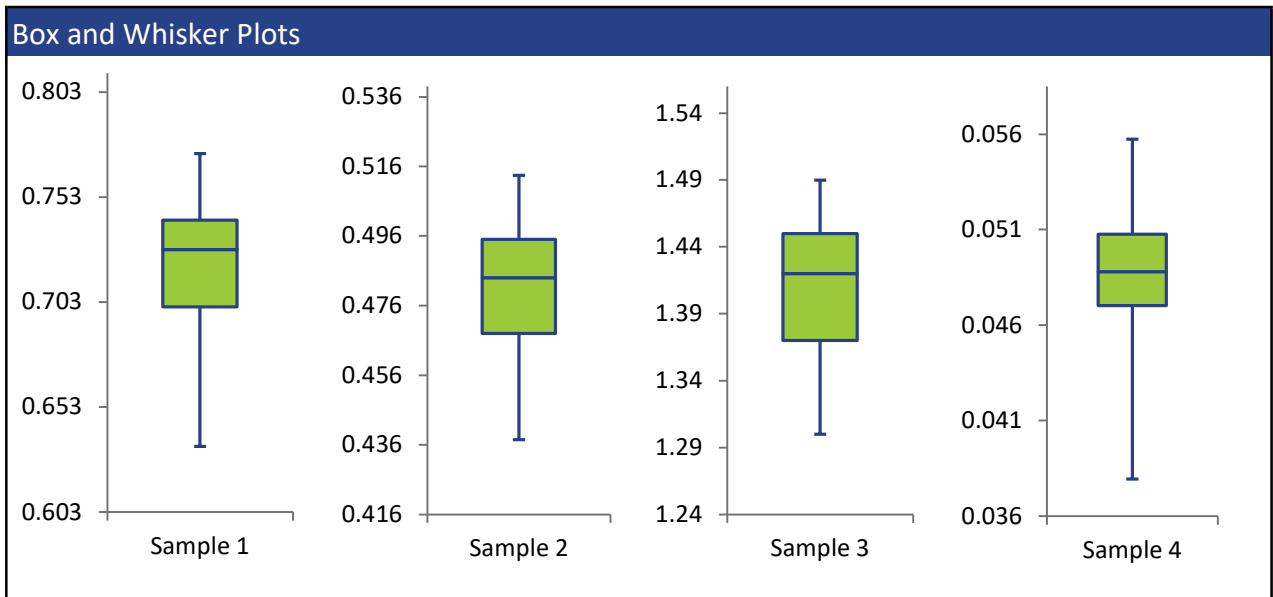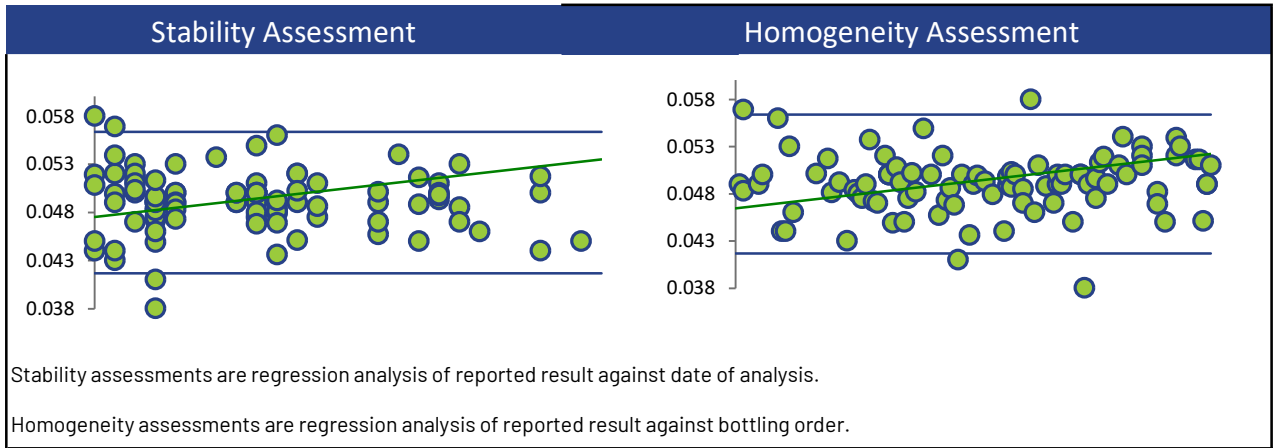
LEAD

Summary Statistics

Statistic	C02A-1	C02A-2	C02A-3	C02A-4
N	116	114	116	115
Median mg/L	0.464	0.0471	1.26	0.0377
Robust Mean mg/L	0.464	0.0470	1.26	0.0378
U mg/L	0.00201	0.000232	0.00545	0.000207
Robust Standard Deviation mg/L	0.0173	0.00198	0.0470	0.00178
Regression Standard Deviation mg/L	0.0348	0.00352	0.0947	0.00283
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA) mg/L	0.0348	0.00352	0.0947	0.00283
Outliers	1	2	1	1
$|z|>3.0$	1	3	1	1
$2<|z|<3$	0	1	0	2

Methods Used

Method	C02A-1	C02A-2	C02A-3	C02A-4
ICP/OES (Blue)	24	23	24	22
ICP/MS (Red)	90	89	90	91
AA FLAME (Green)	1	1	1	1
AA GRAPHITE (Orange)	1	1	1	1

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

LEAD

LEAD

Stability Assessment	Homogeneity Assessment

Stability assessments are regression analysis of reported result against date of analysis.

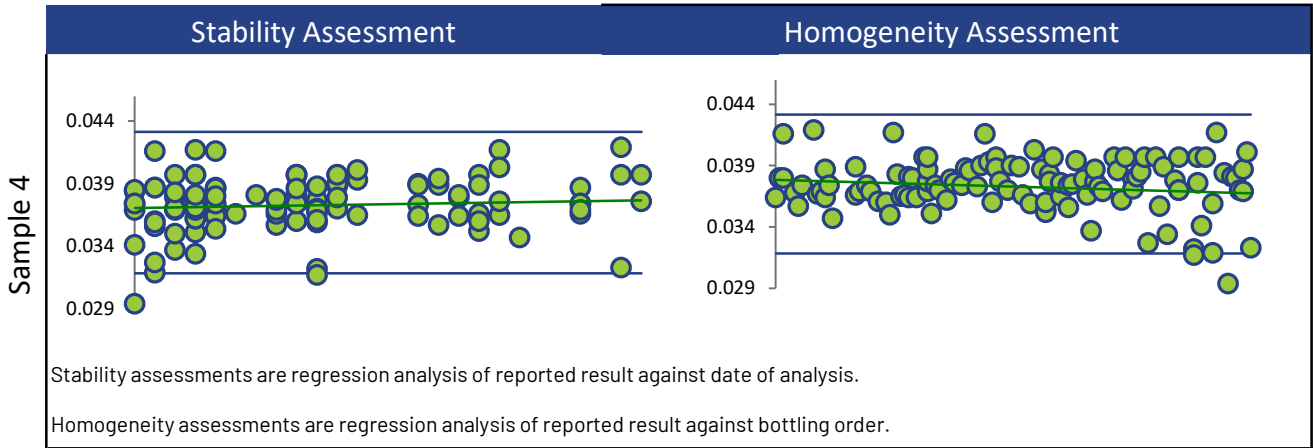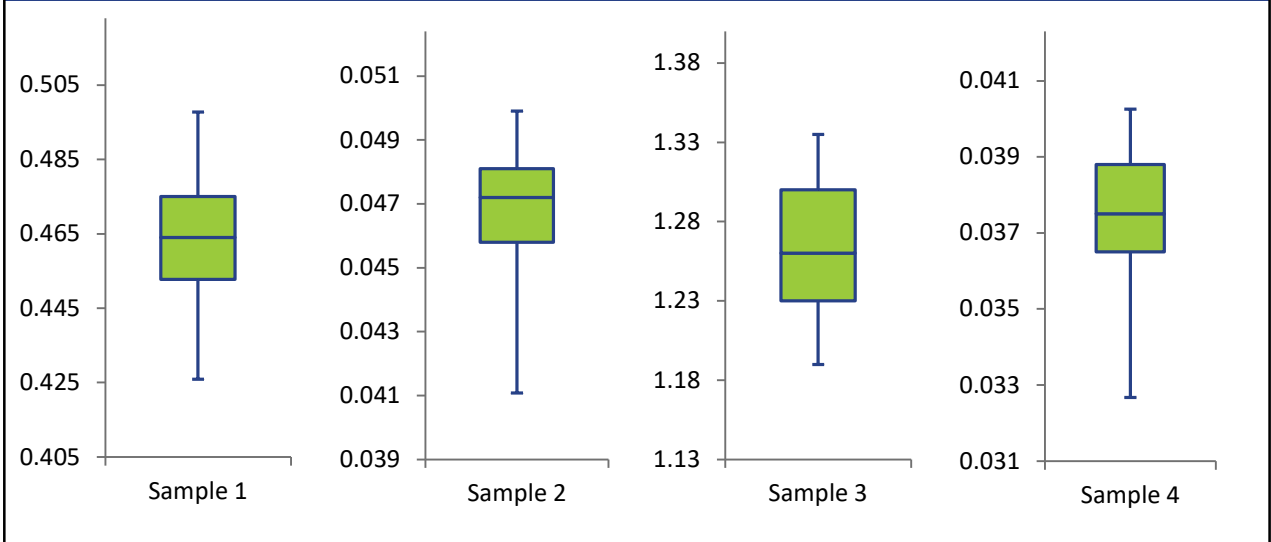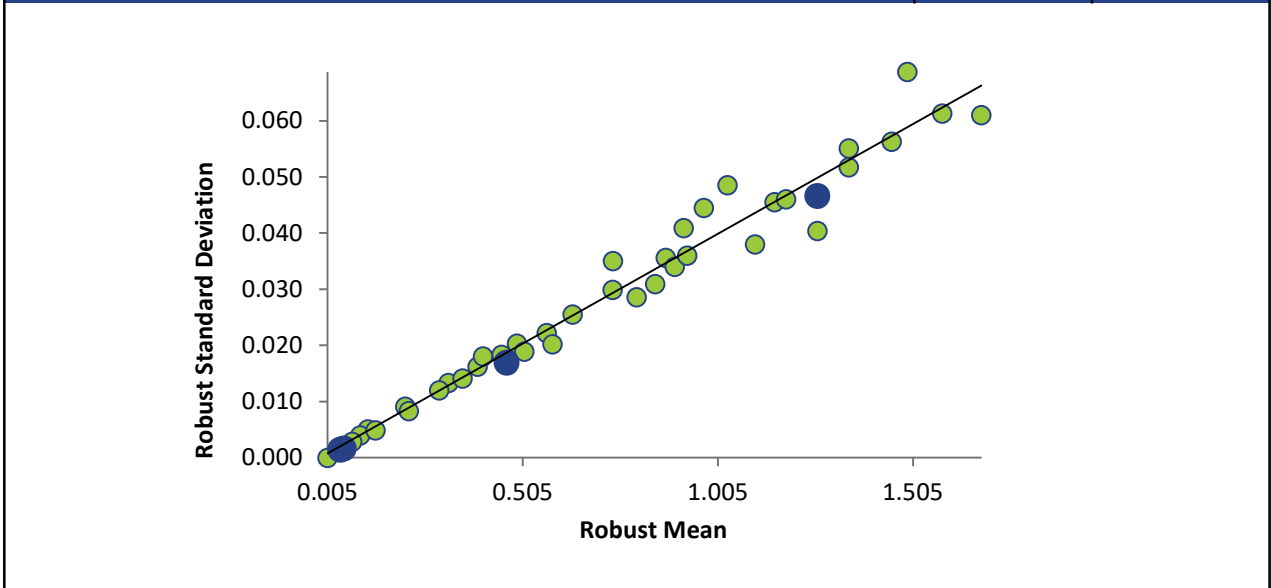Homogeneity assessments are regression analysis of reported result against bottling order.
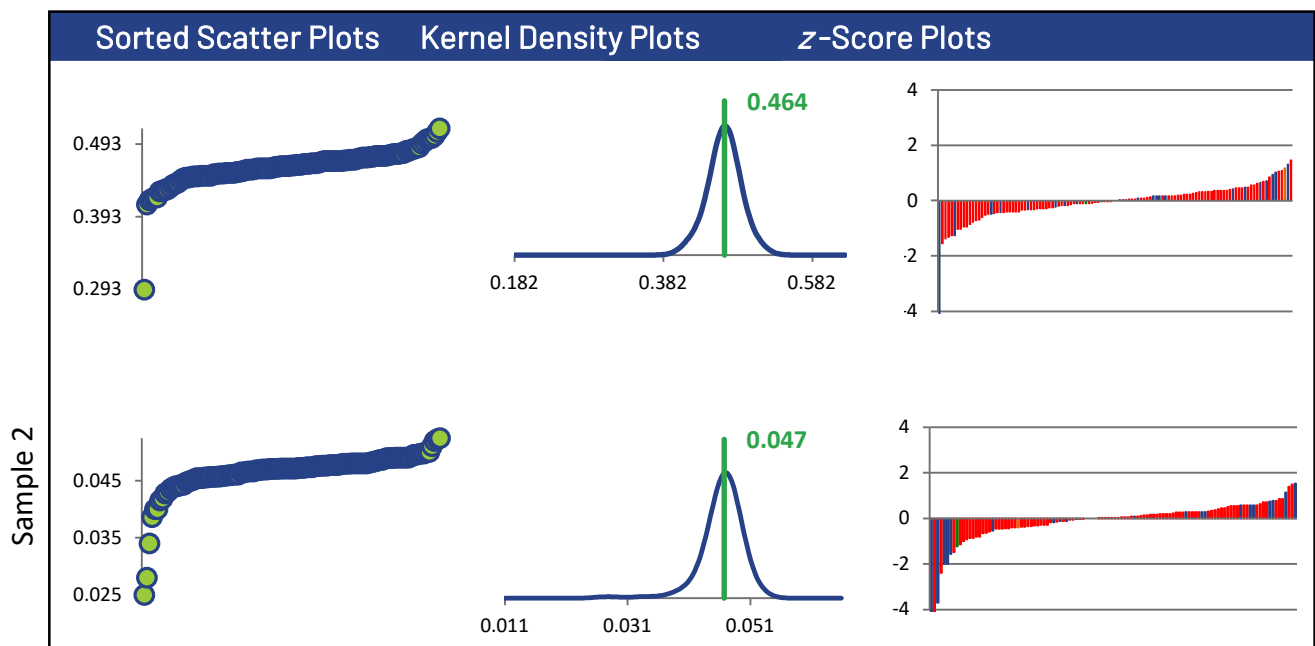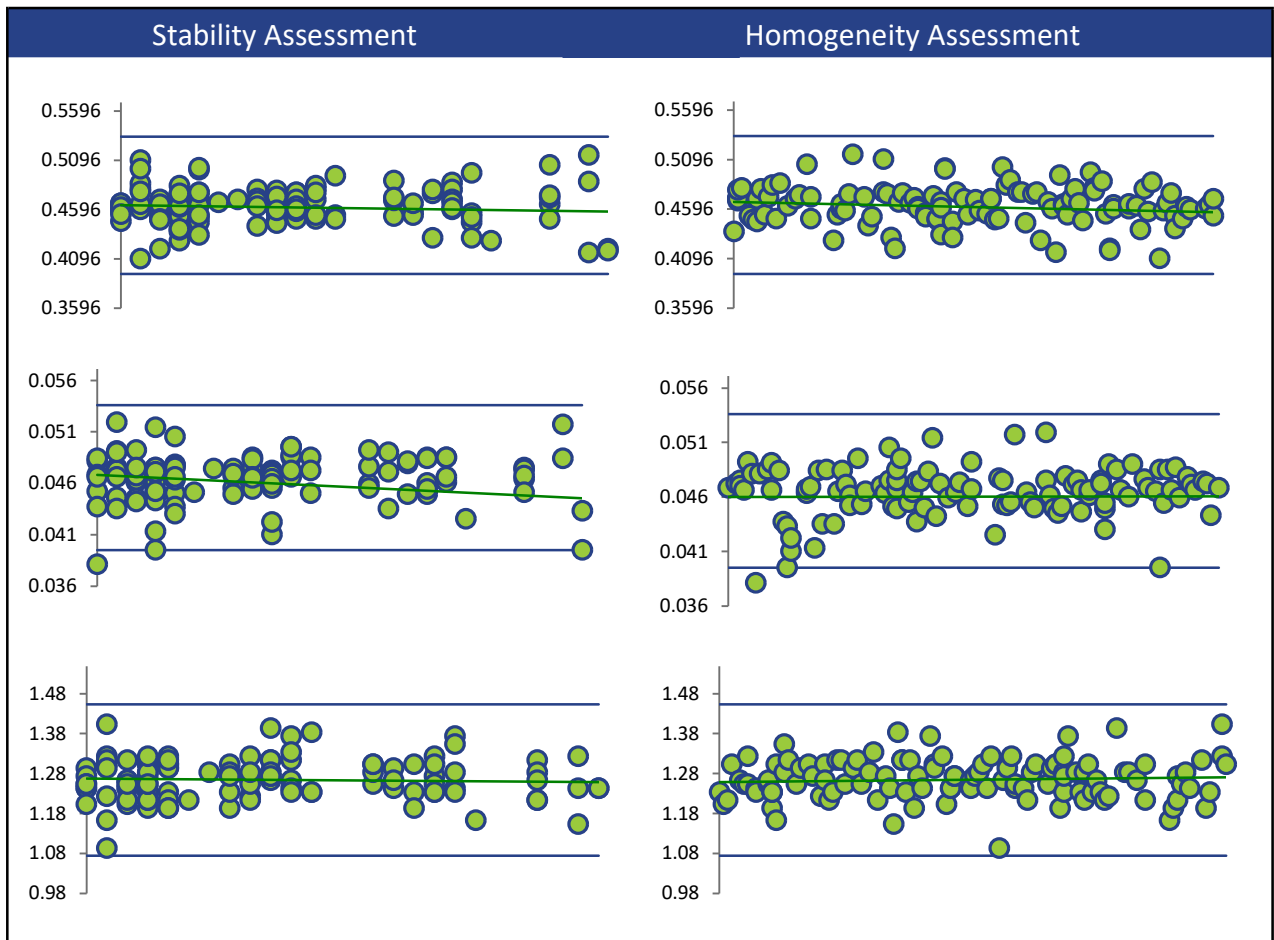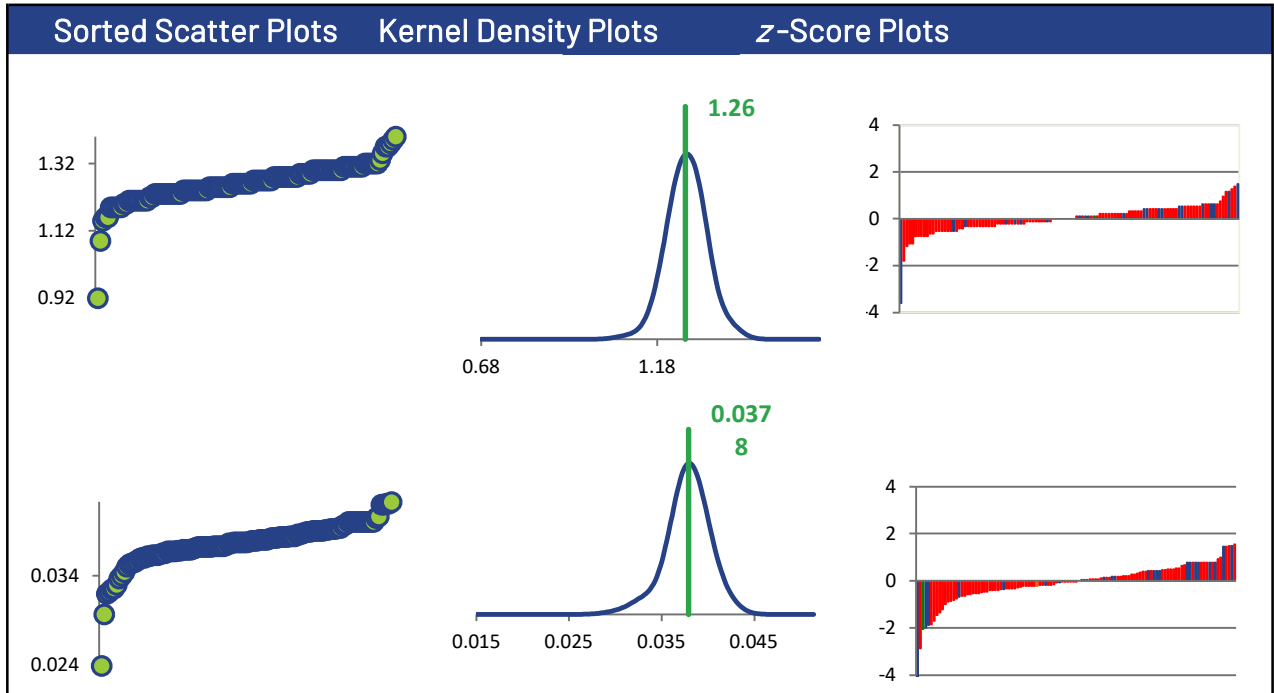
Box and Whisker Plots

Current Round (blue) Compared to Historic Rounds (green)

MANGANESE

Summary Statistics

Statistic	C02A-1	C02A-2	C02A-3	C02A-4
N	108	107	109	109
Median mg/L	0.821	0.419	0.834	0.0286
Robust Mean mg/L	0.819	0.418	0.834	0.0284
U mg/L	0.00350	0.00186	0.00384	0.000146
Robust Standard Deviation mg/L	0.0291	0.0154	0.0321	0.00122
Regression Standard Deviation mg/L	0.0614	0.0313	0.0626	0.00213
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA) mg/L	0.0614	0.0313	0.0626	0.00213
Outliers	1	2	0	0
|z|>3.0	0	0	2	0
2<|z|<3	1	2	1	1

Methods Used

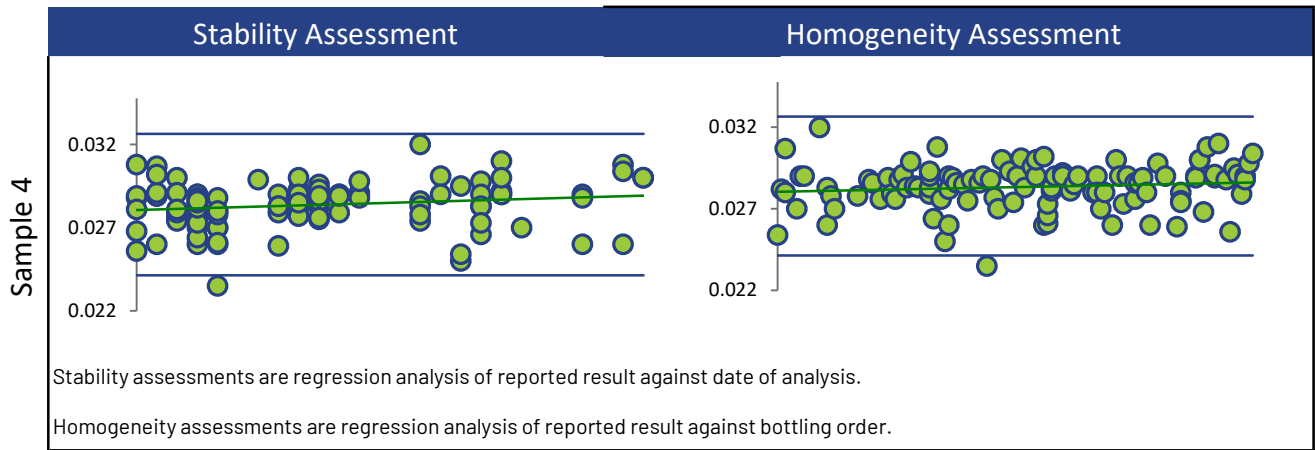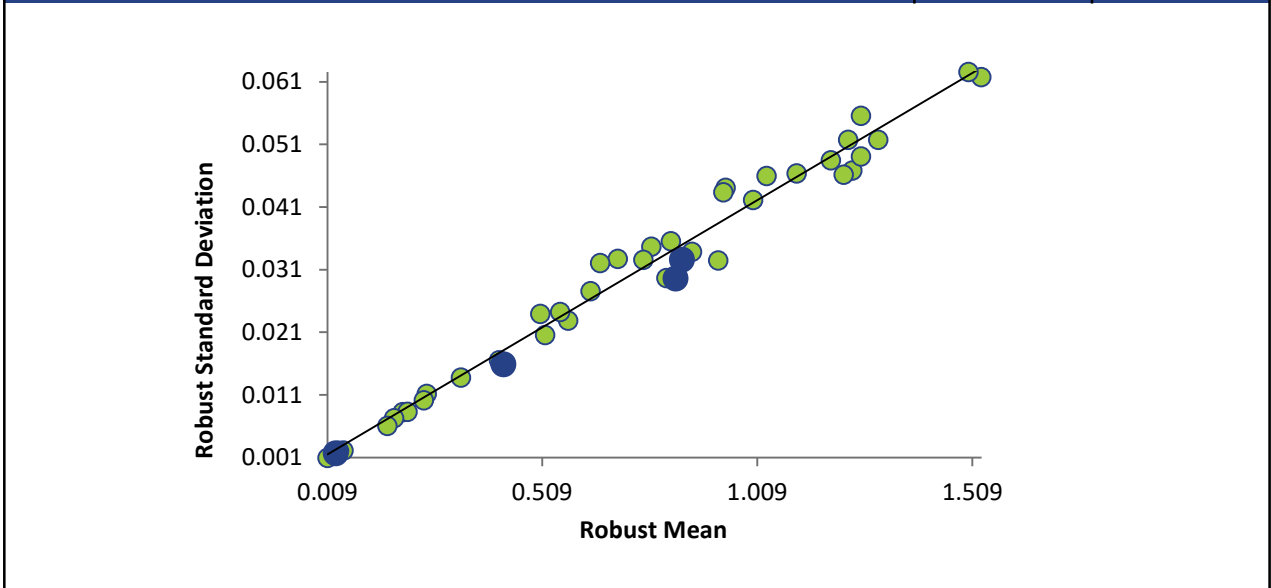| Method	C02A-1	C02A-2	C02A-3	C02A-4
ICP/MS (Blue)	79	78	79	79
ICP/OES (Red)	28	28	29	29
AA FLAME (Green)	1	1	1	1

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

MANGANESE
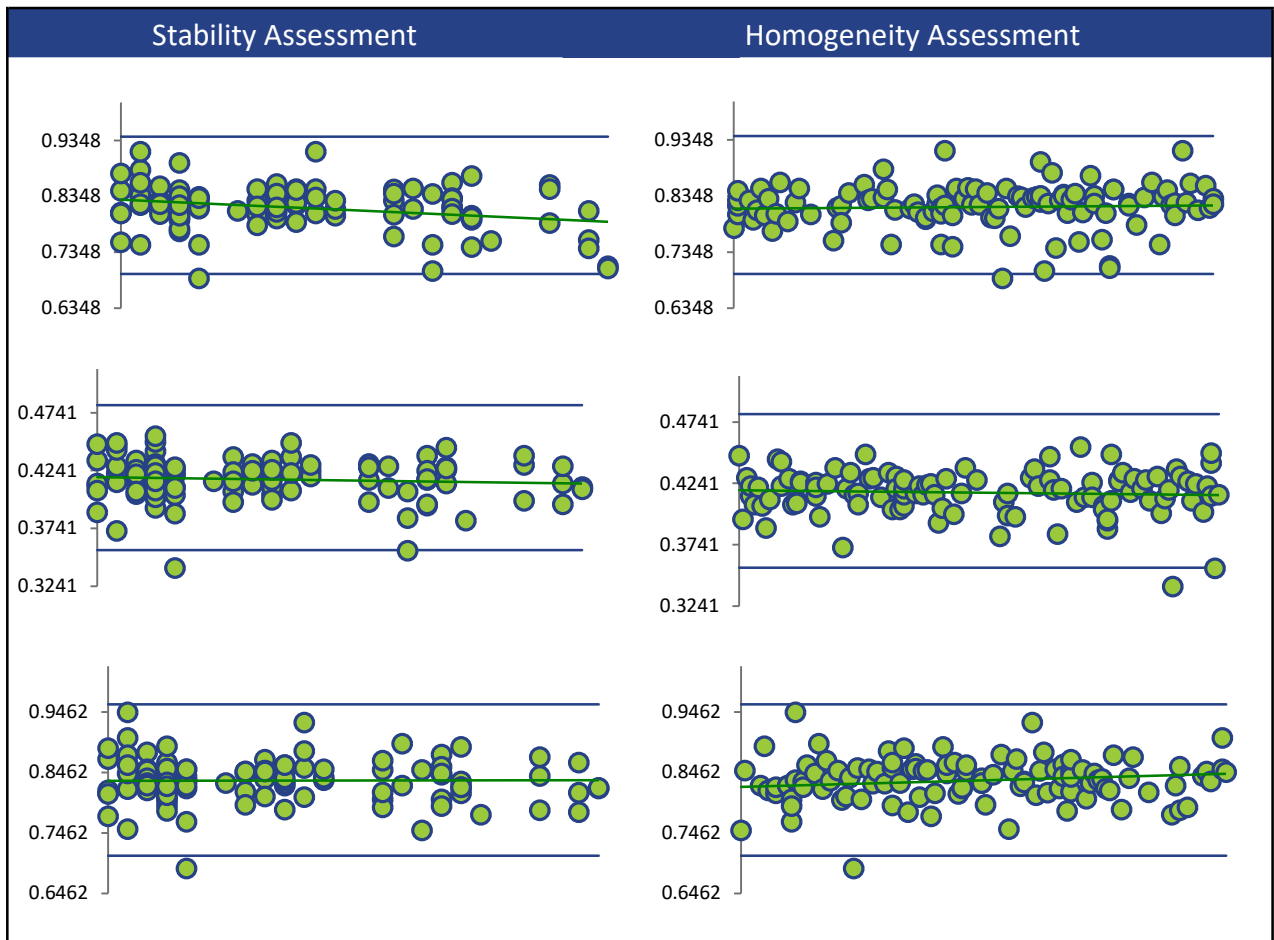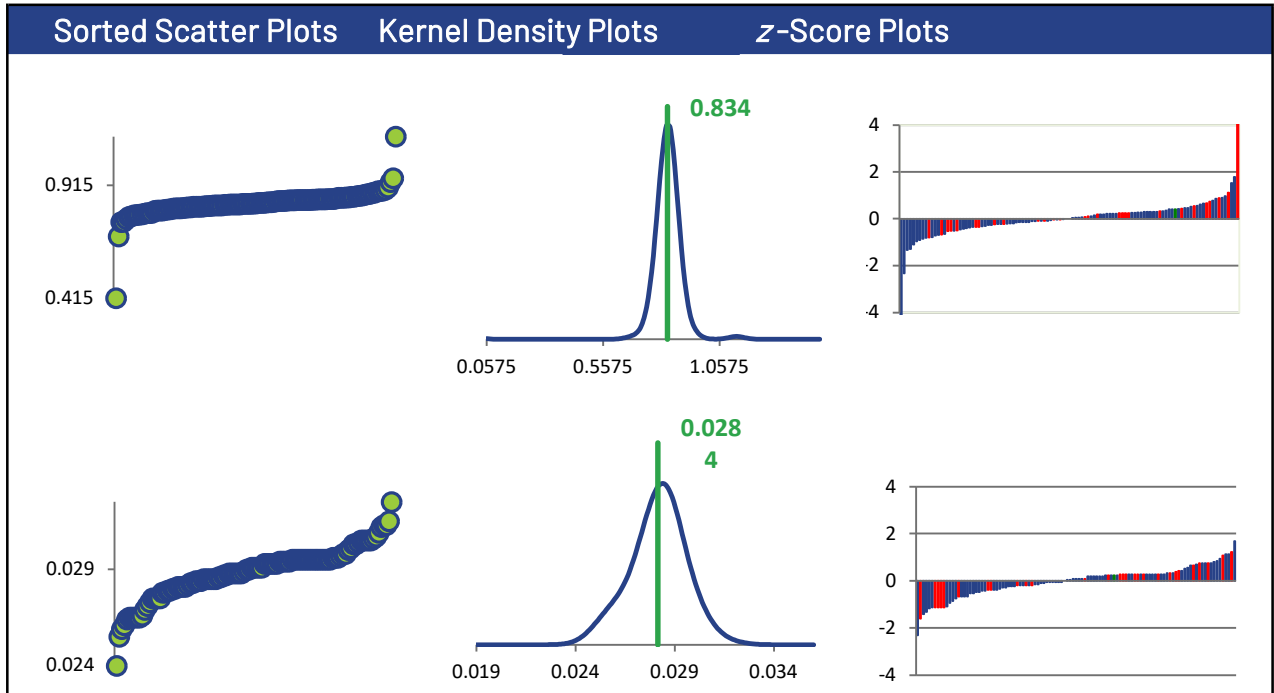
MANGANESE

Stability Assessment	Homogeneity Assessment

Sample 4

Stability assessments are regression analysis of reported result against date of analysis.

Homogeneity assessments are regression analysis of reported result against bottling order.

Box and Whisker Plots

Sample 1   Sample 2   Sample 3   Sample 4

Current Round (blue) Compared to Historic Rounds (green)

Robust Standard Deviation
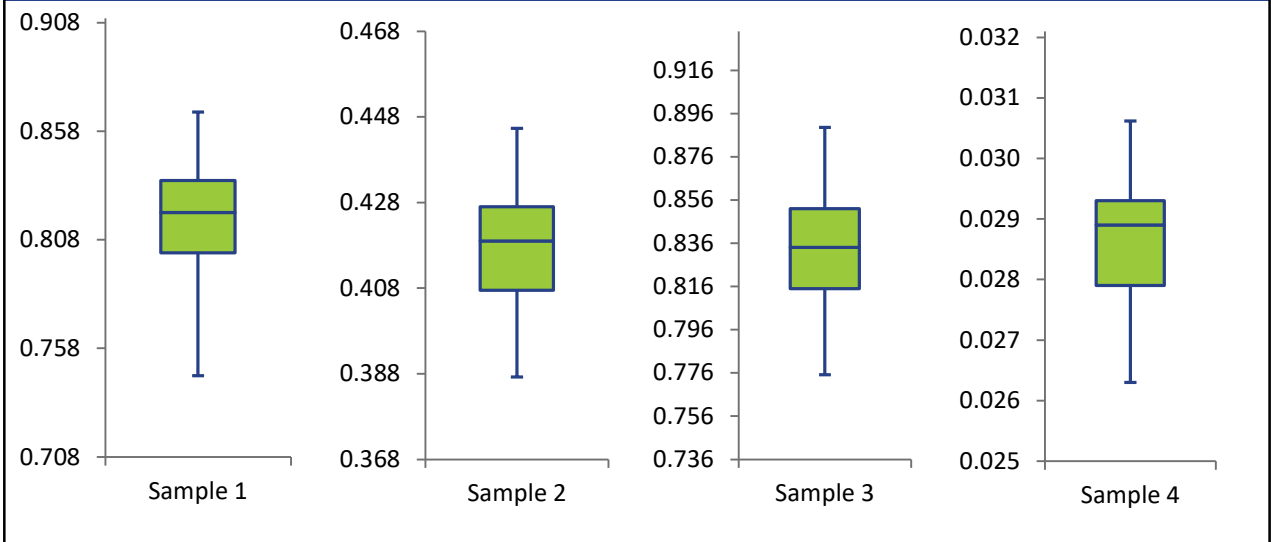
Robust Mean

MOLYBDENUM

Summary Statistics

Statistic	C02A-1	C02A-2	C02A-3	C02A-4
N	104	103	104	100
Median mg/L	0.708	0.232	1.16	0.00800
Robust Mean mg/L	0.703	0.231	1.16	0.00842
U mg/L	0.00387	0.00143	0.00647	0.000140
Robust Standard Deviation mg/L	0.0316	0.0116	0.0528	0.00112
Regression Standard Deviation mg/L	0.0527	0.0173	0.0867	0.000631
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA) mg/L	0.0527	0.0173	0.0867	0.00112
Outliers	1	2	1	0
|z|>3.0	1	1	1	15
2<|z|<3	1	2	4	2

Methods Used

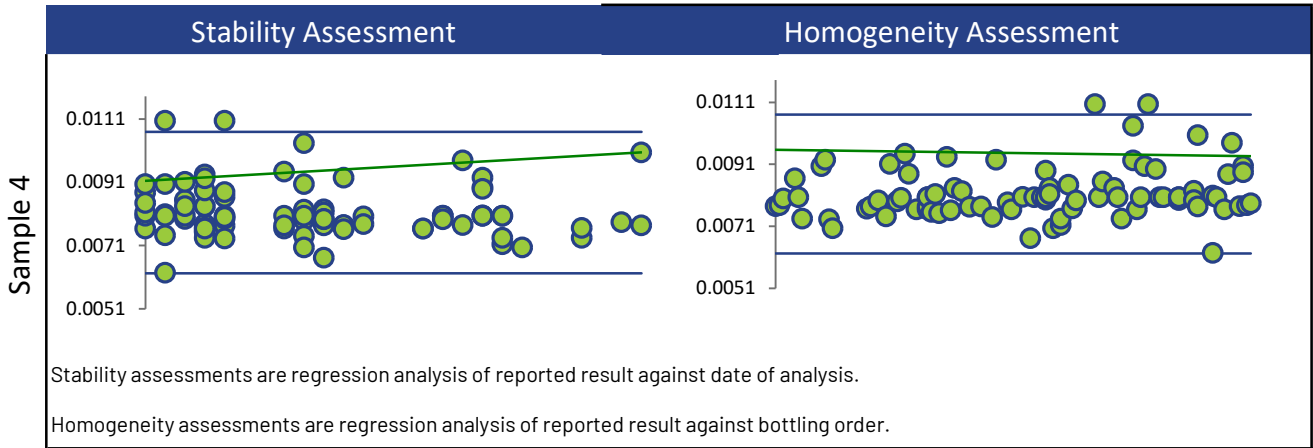| Method	C02A-1	C02A-2	C02A-3	C02A-4
ICP/OES (Blue)	20	20	20	16
ICP/MS (Red)	83	82	83	83
AA FLAME (Green)	1	1	1	1

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

MOLYBDENUM
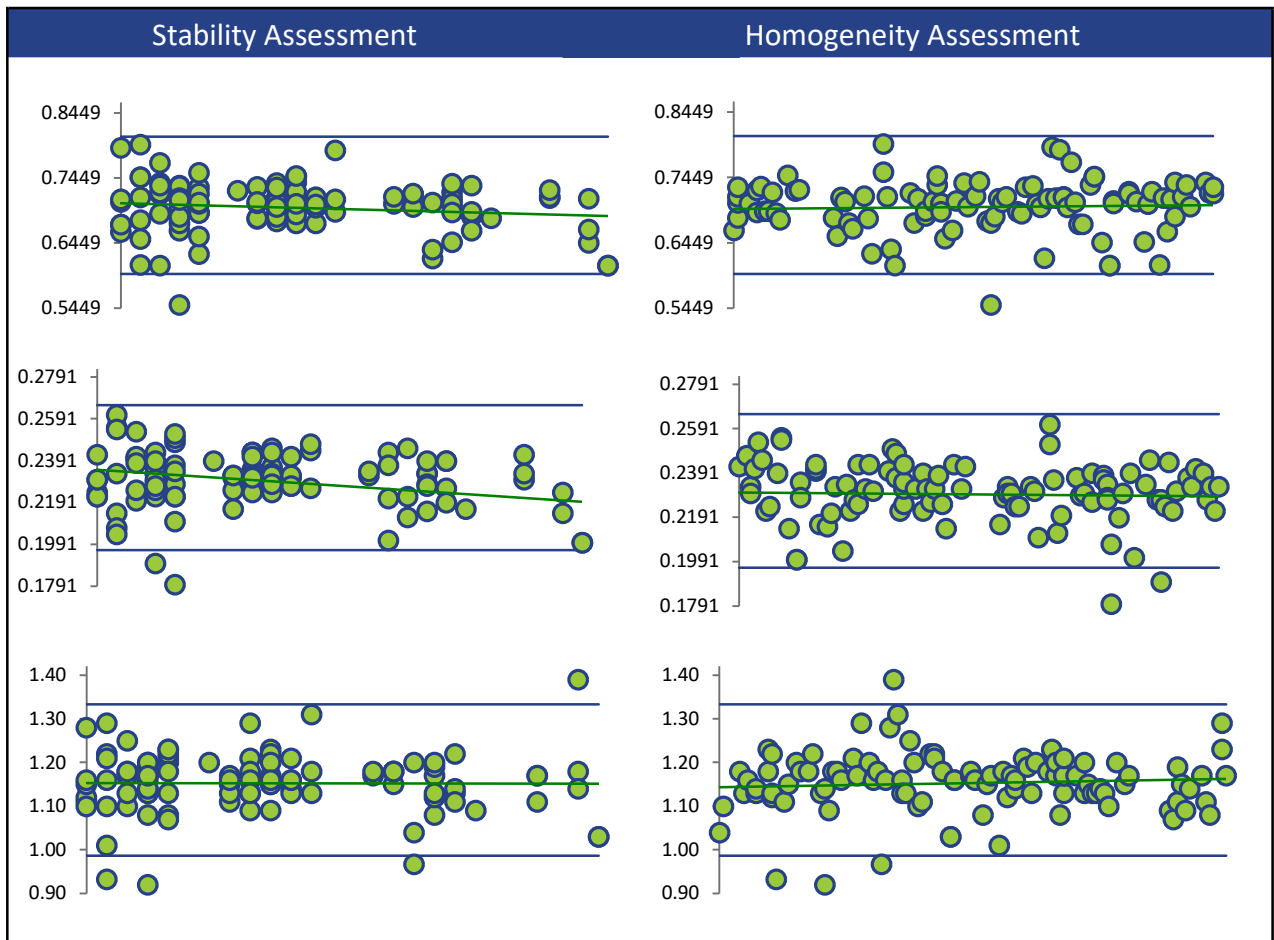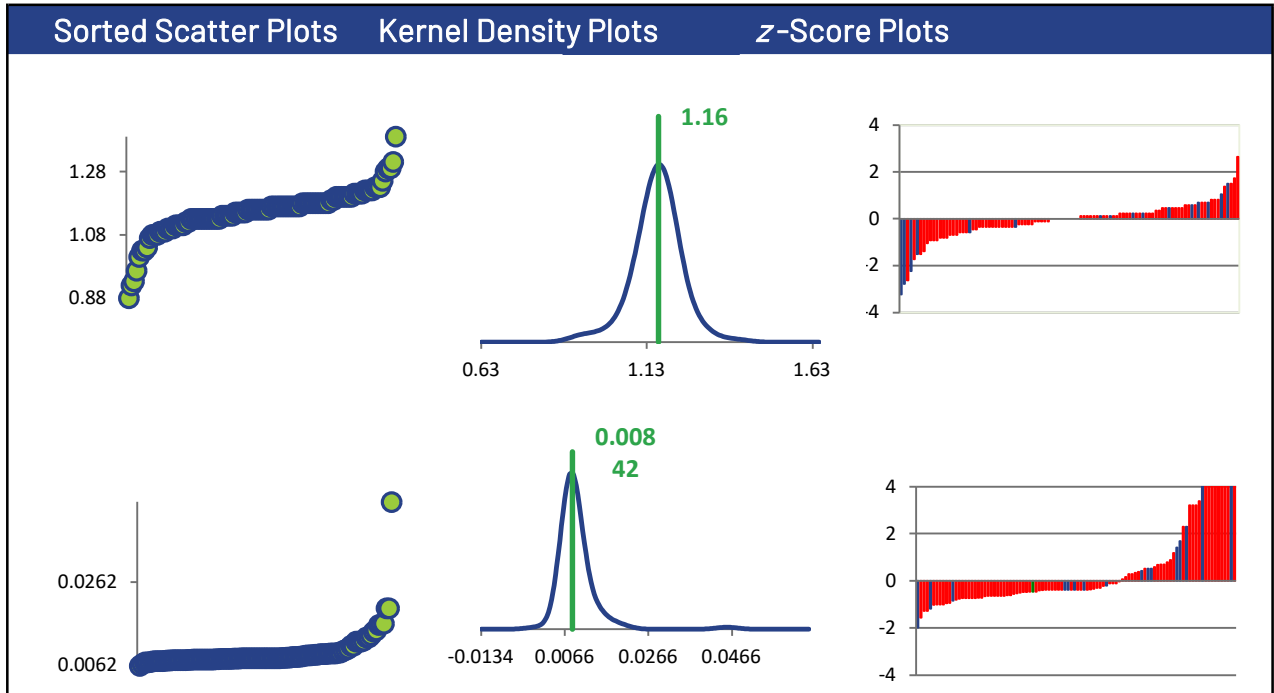
MOLYBDENUM

Stability Assessment | Homogeneity Assessment

Sample 4

Stability assessments are regression analysis of reported result against date of analysis.

Homogeneity assessments are regression analysis of reported result against bottling order.

Box and Whisker Plots

Sample 1 — Sample 2 — Sample 3 — Sample 4

Current Round (blue) Compared to Historic Rounds (green)

Robust Standard Deviation
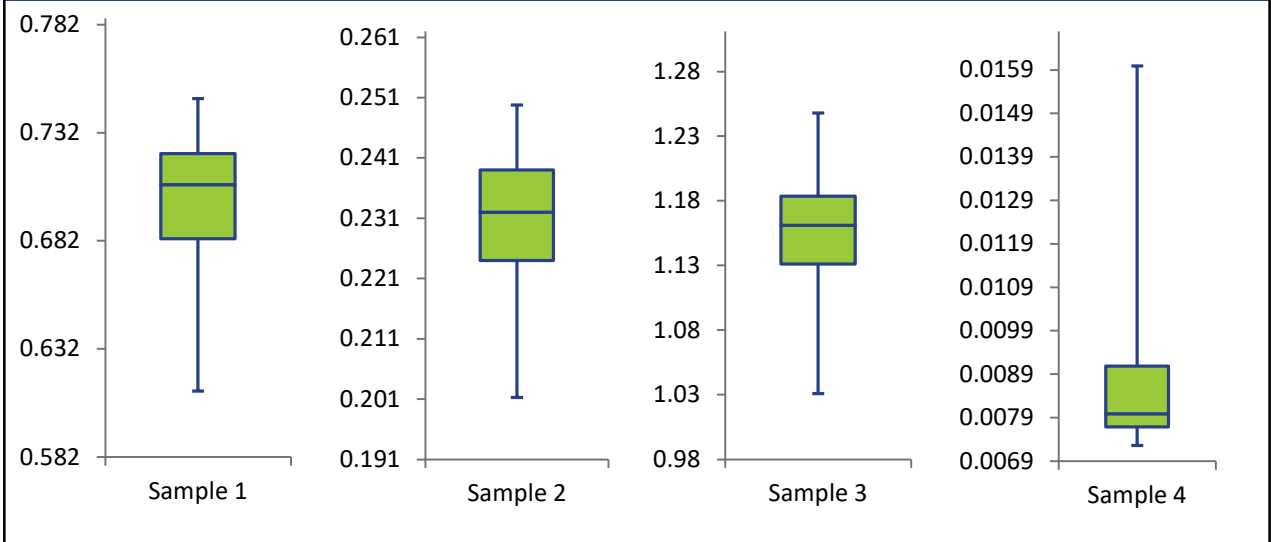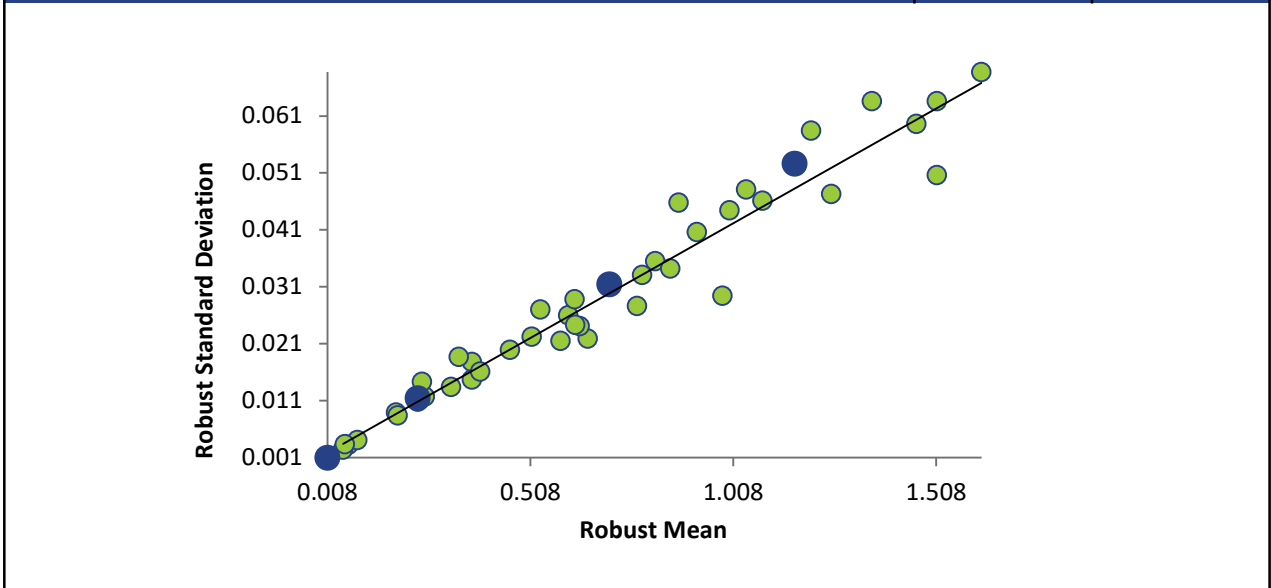
Robust Mean

NICKEL

Summary Statistics

Statistic	C02A-1	C02A-2	C02A-3	C02A-4
N	110	110	110	110
Median mg/L	0.604	0.269	1.22	0.0454
Robust Mean mg/L	0.603	0.268	1.21	0.0455
U mg/L	0.00246	0.00118	0.00577	0.000225
Robust Standard Deviation mg/L	0.0206	0.00993	0.0484	0.00189
Regression Standard Deviation mg/L	0.0453	0.0201	0.0910	0.00341
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA) mg/L	0.0453	0.0201	0.0910	0.00341
Outliers	1	1	1	1
|z|>3.0	1	2	1	0
2<|z|<3	0	0	0	0

Methods Used

Method	C02A-1	C02A-2	C02A-3	C02A-4
ICP/OES (Blue)	23	23	23	22
ICP/MS (Red)	86	86	86	87
AA FLAME (Green)	1	1	1	1

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

NICKEL

Sorted Scatter Plots	Kernel Density Plots	z-Score Plots

Sample 3

1.21

Sample 4

0.0455

Stability Assessment | Homogeneity Assessment

Sample 1

Sample 2

Sample 3

NICKEL

Stability Assessment	Homogeneity Assessment

Stability assessments are regression analysis of reported result against date of analysis.

Homogeneity assessments are regression analysis of reported result against bottling order.
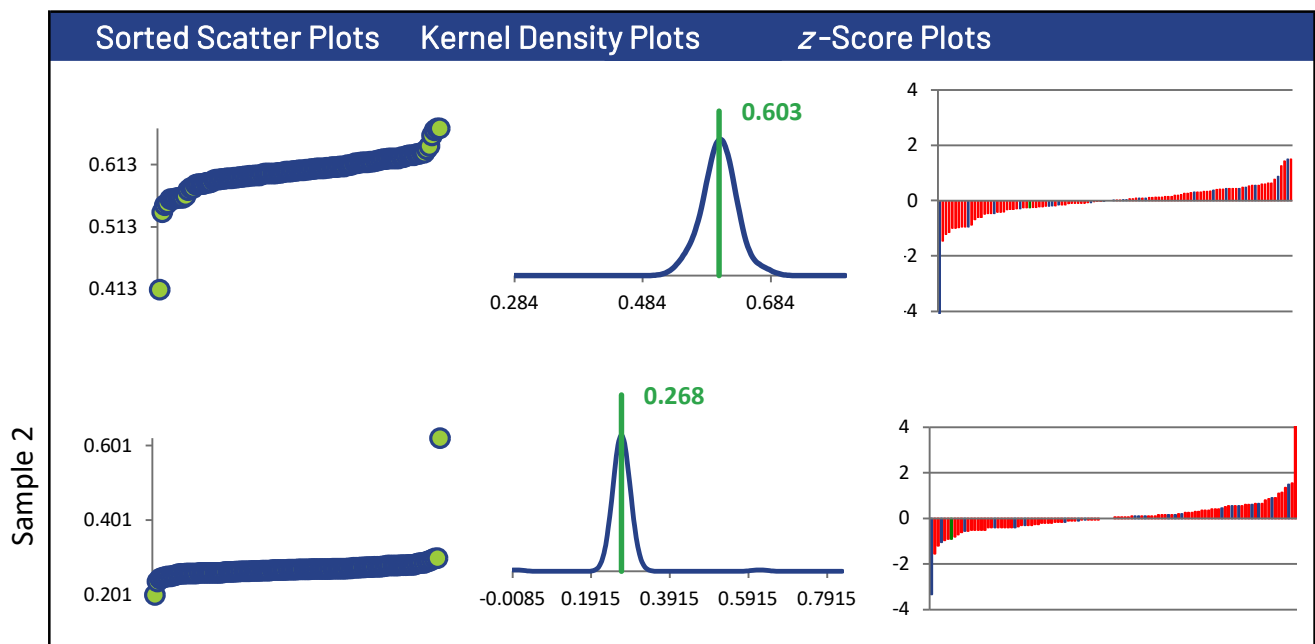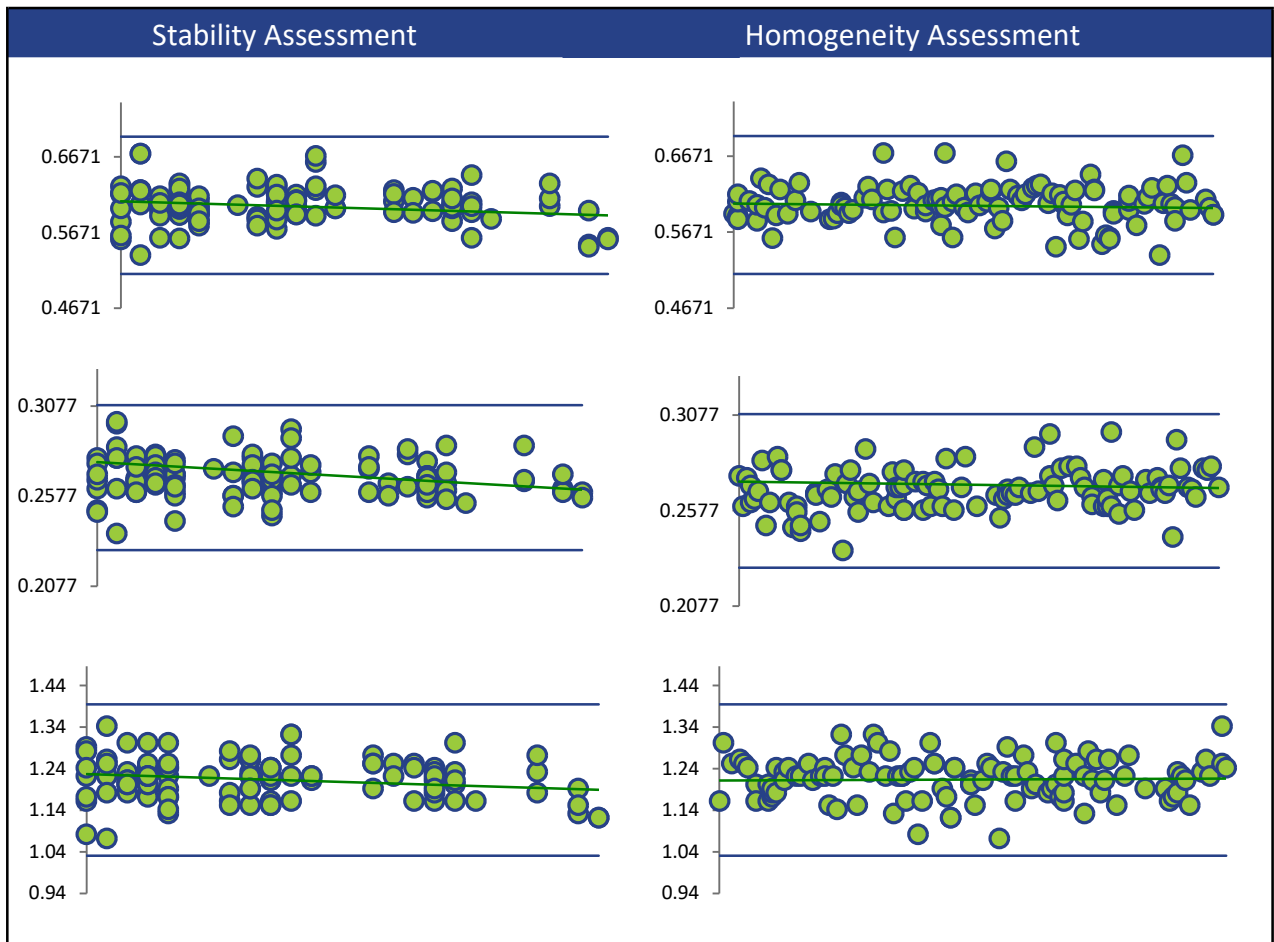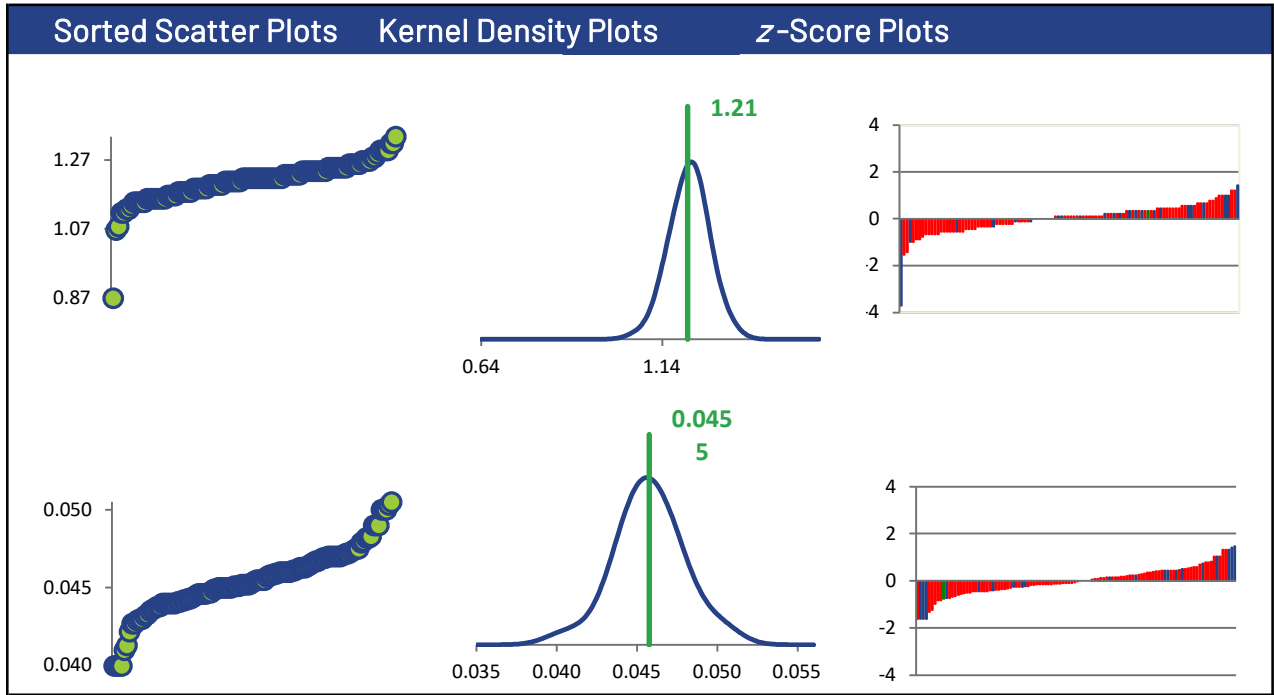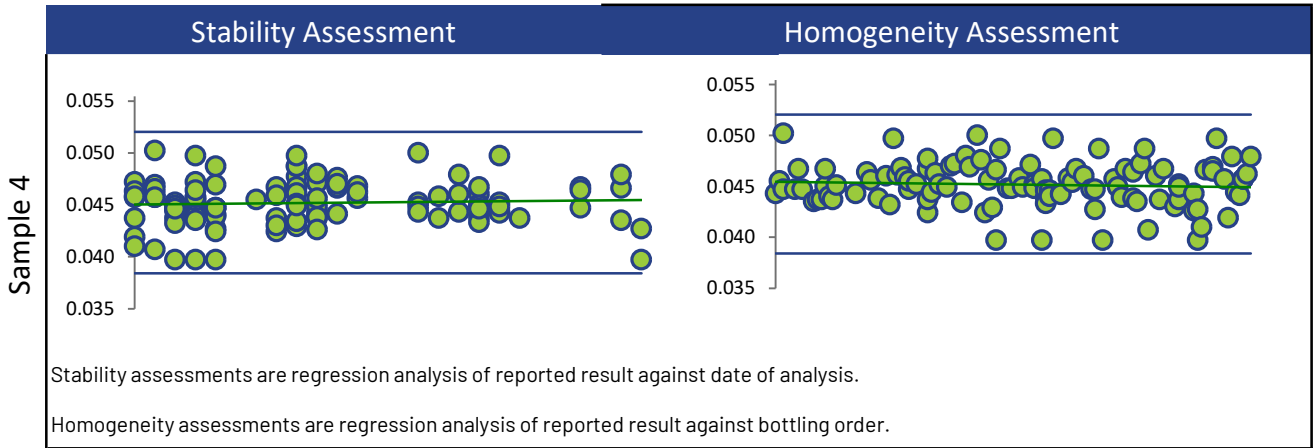
Box and Whisker Plots
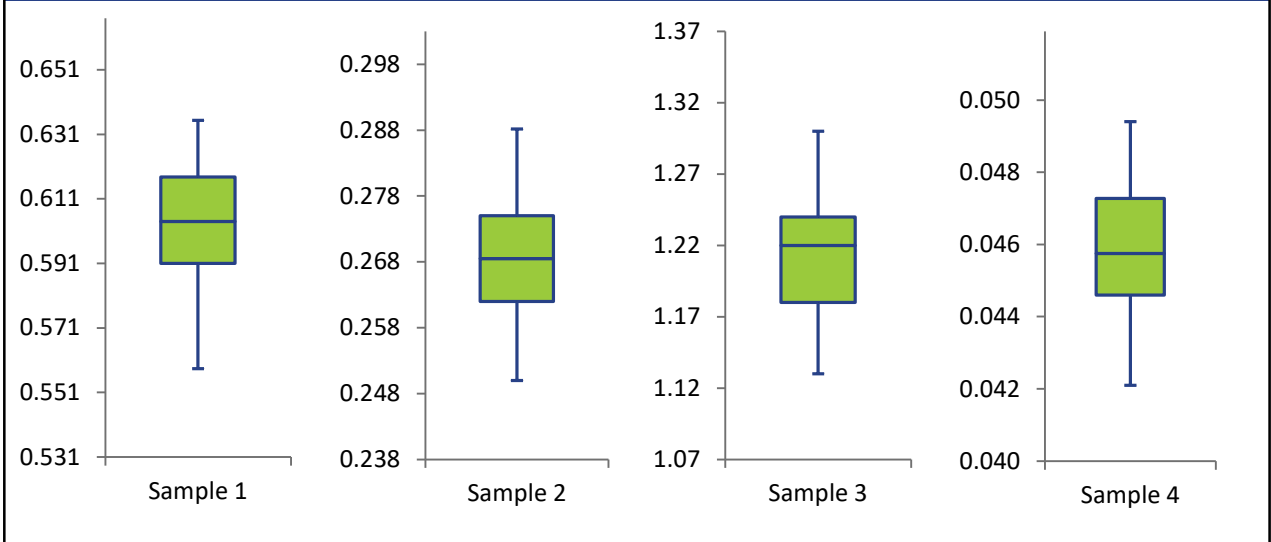
Current Round (blue) Compared to Historic Rounds (green)
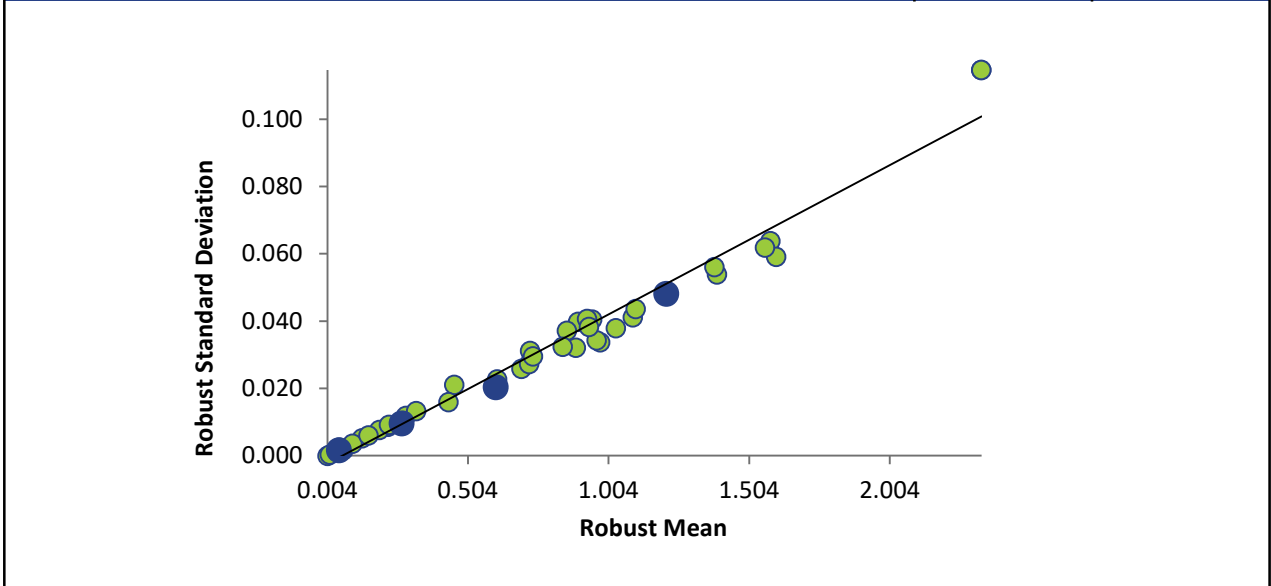
SELENIUM

Summary Statistics

Statistic	C02A-1	C02A-2	C02A-3	C02A-4
N	107	106	107	105
Median mg/L	61.2	34.5	95.0	15.6
Robust Mean mg/L	61.4	34.5	95.3	15.6
U mg/L	0.383	0.260	0.534	0.126
Robust Standard Deviation mg/L	3.17	2.14	4.42	1.03
Regression Standard Deviation mg/L	6.14	3.45	9.53	1.56
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA) mg/L	6.14	3.45	9.53	1.56
Outliers	2	3	2	2
|z|>3.0	2	3	1	1
2<|z|<3	0	0	1	2

Methods Used

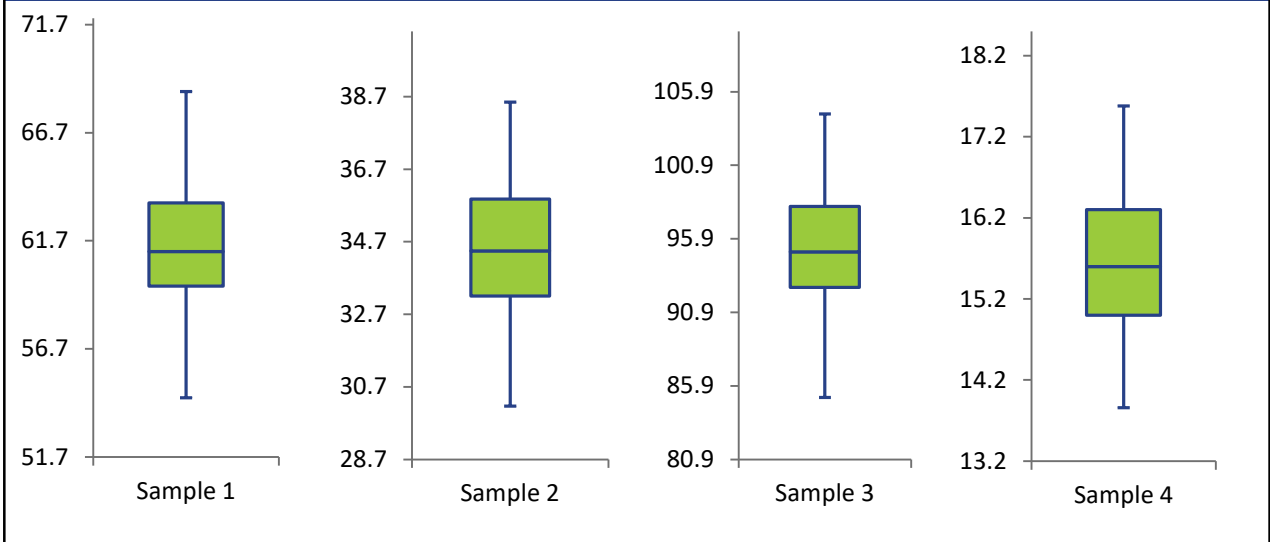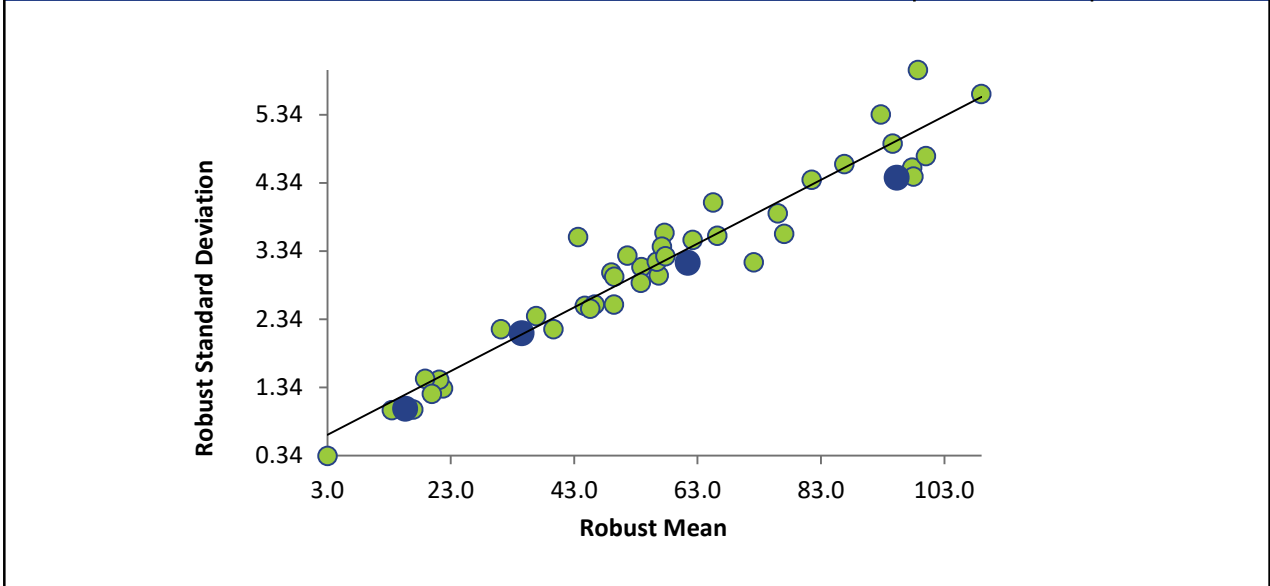| Method	C02A-1	C02A-2	C02A-3	C02A-4
ICP/MS (Blue)	89	88	89	89
ICP/OES (Red)	12	12	12	10
HYDRIDE AA (Green)	3	3	3	3
ATOMIC FLUORESCENCE SPECTROMETER (Orange)	1	1	1	1
R ATOMIC FLUORESCENCE SPECTROPHOTOMETRY (Black)	1	1	1	1
HYDRIDE ICP (Yellow)	1	1	1	1

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

Sorted Scatter Plots   Kernel Density Plots   z-Score Plots

SELENIUM

Sorted Scatter Plots	Kernel Density Plots	z-Score Plots

Stability Assessment	Homogeneity Assessment

SELENIUM

Stability Assessment | Homogeneity Assessment

Sample 4

Stability assessments are regression analysis of reported result against date of analysis.

Homogeneity assessments are regression analysis of reported result against bottling order.
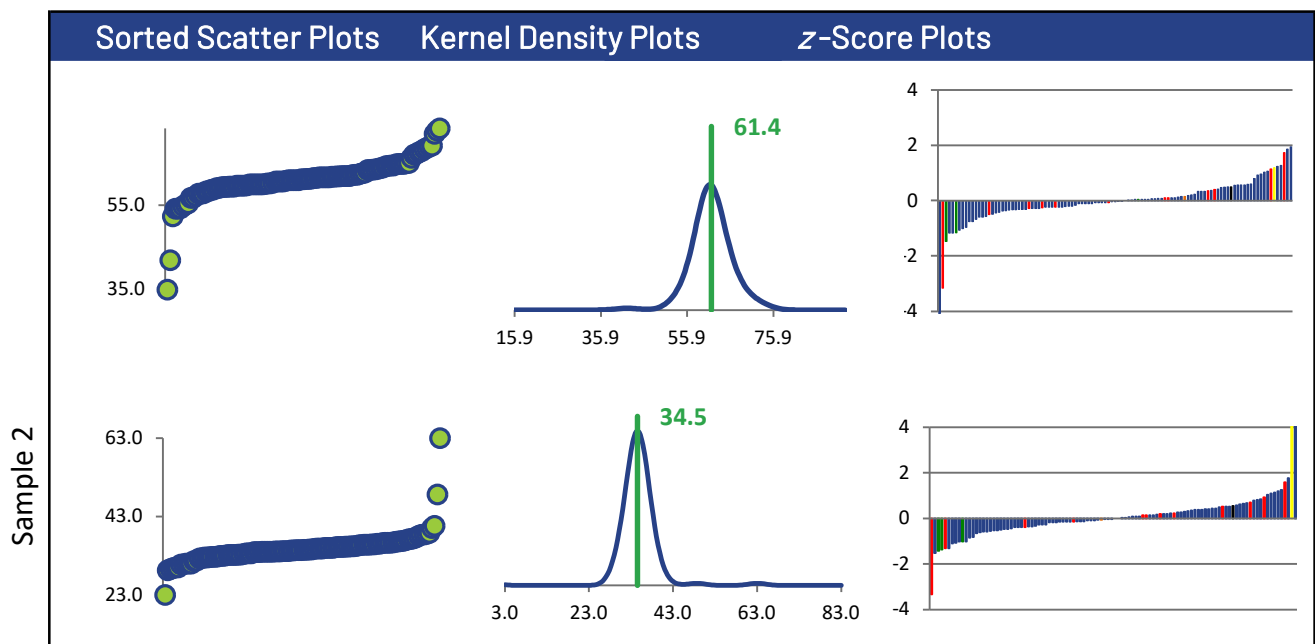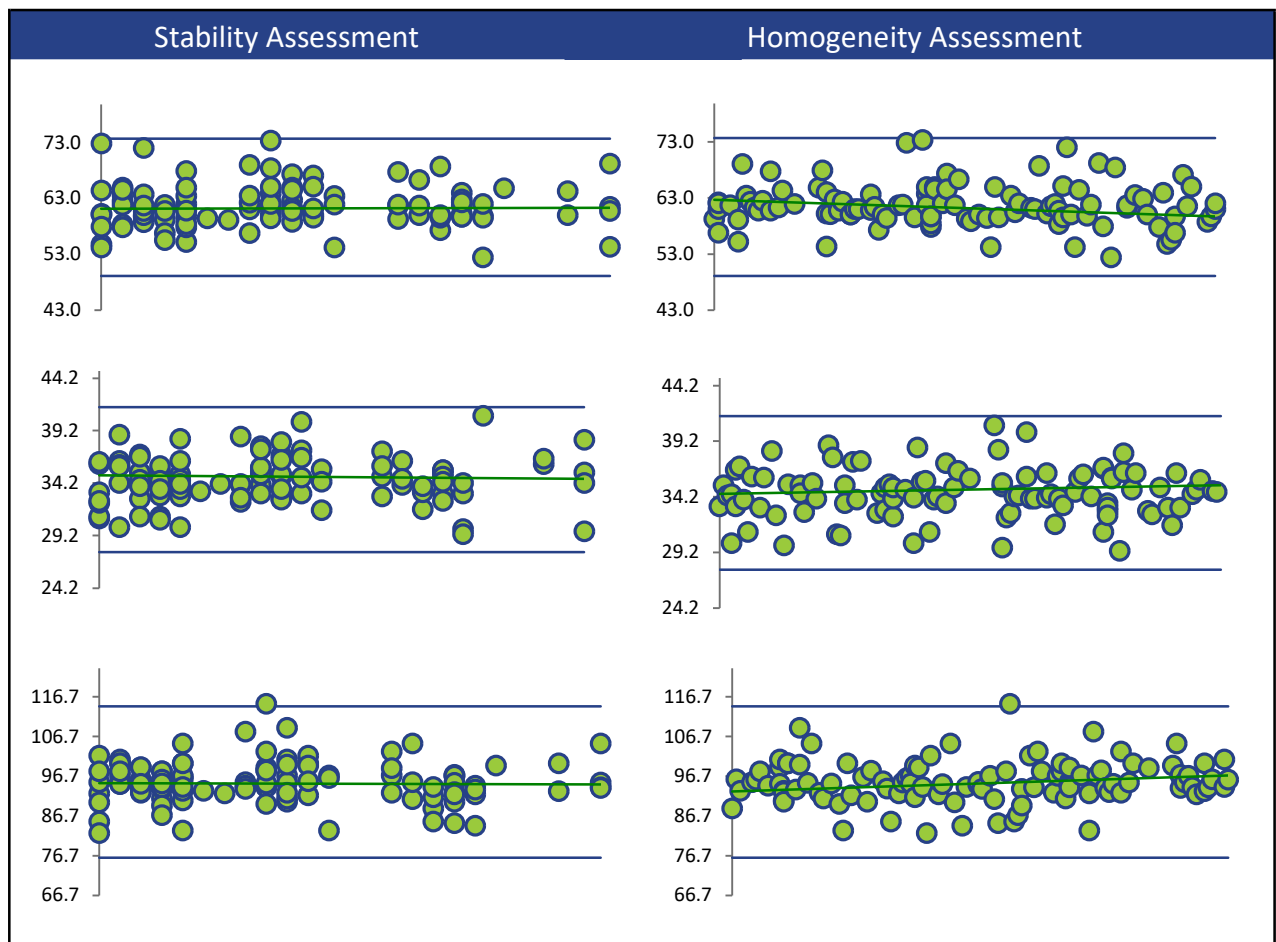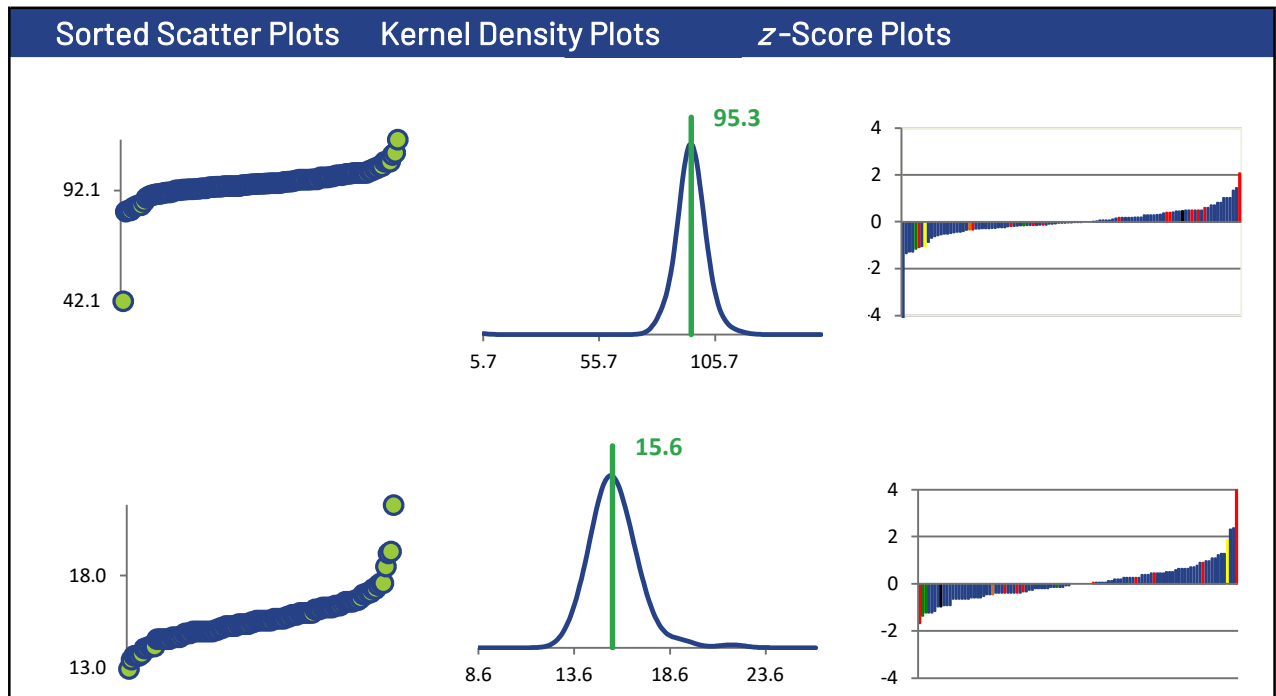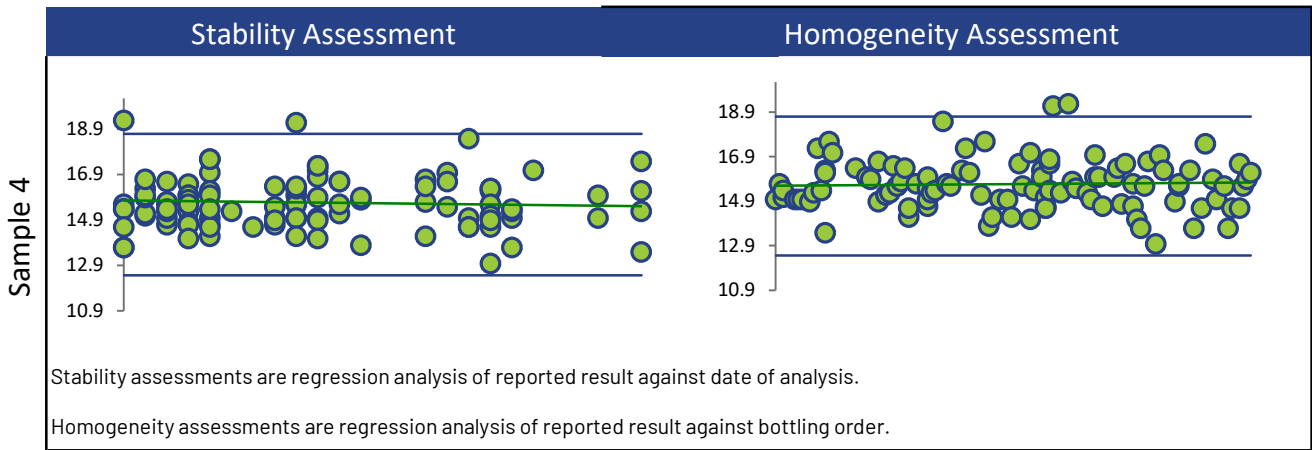
Box and Whisker Plots

Current Round (blue) Compared to Historic Rounds (green)

SILVER

Summary Statistics

Statistic	C02A-1	C02A-2	C02A-3	C02A-4
N	90	90	90	90
Median mg/L	0.0558	0.0450	0.0519	0.0253
Robust Mean mg/L	0.0561	0.0448	0.0516	0.0255
U mg/L	0.000350	0.000260	0.000300	0.000302
Robust Standard Deviation mg/L	0.00266	0.00197	0.00228	0.00229
Regression Standard Deviation mg/L	0.00421	0.00336	0.00387	0.00191
Stability Flag				
Homogeneity Flag				Homogeneity
Standard Deviation Used (SDPA) mg/L	0.00421	0.00336	0.00387	0.00816
Outliers	0	0	0	0
|z|>3.0	2	3	2	0
2<|z|<3	3	4	3	0

Methods Used

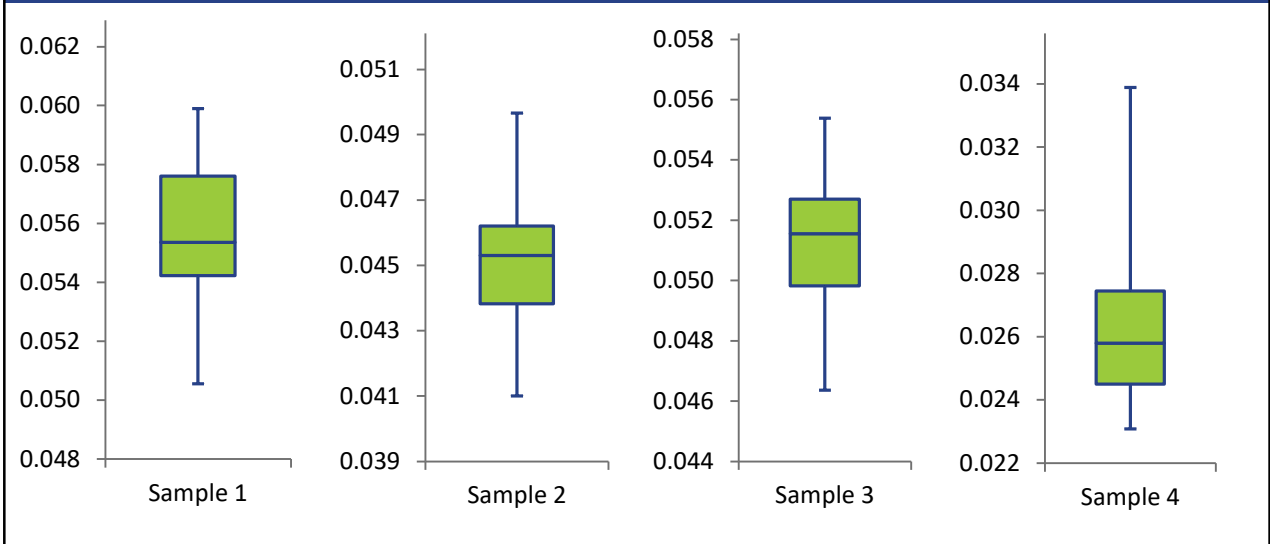| Method	C02A-1	C02A-2	C02A-3	C02A-4
ICP/MS (Blue)	73	73	73	73
ICP/OES (Red)	16	16	16	16
AA FLAME (Green)	1	1	1	1

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

SILVER

SILVER

Stability Assessment	Homogeneity Assessment

Stability assessments are regression analysis of reported result against date of analysis.

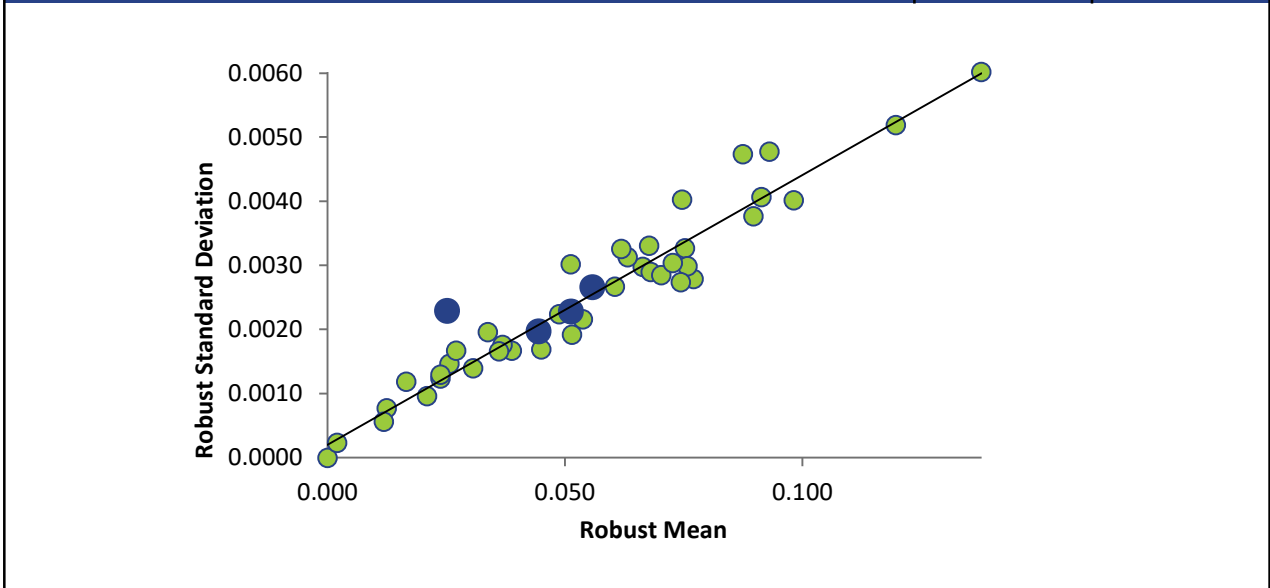Homogeneity assessments are regression analysis of reported result against bottling order.
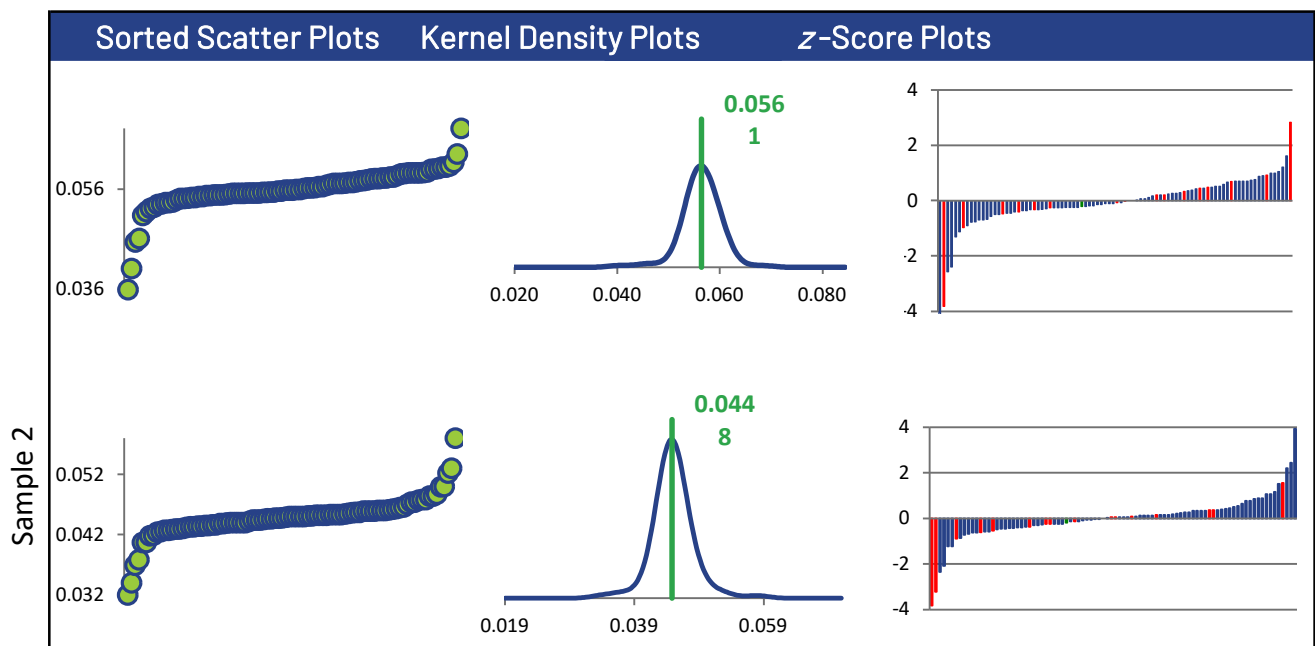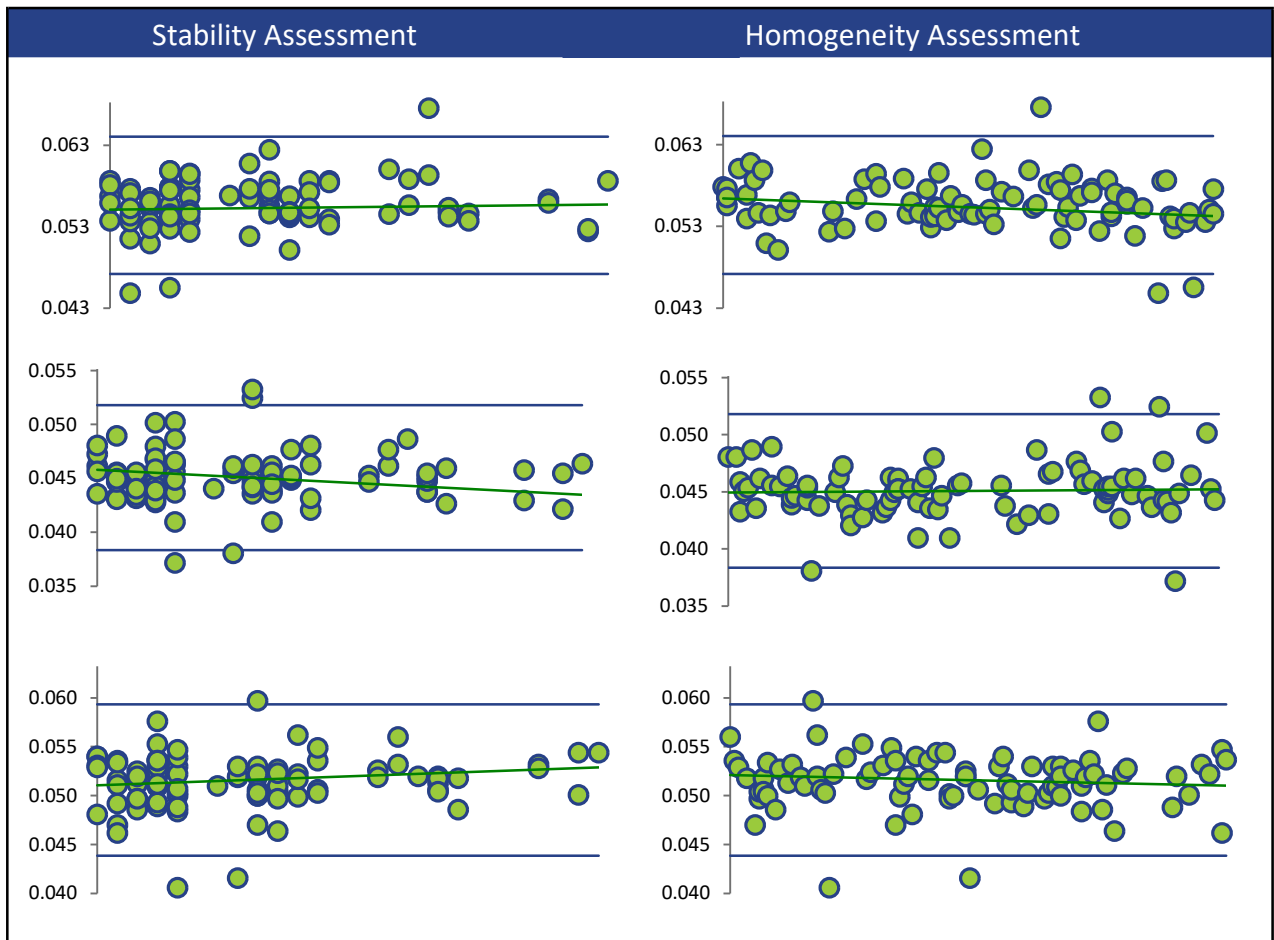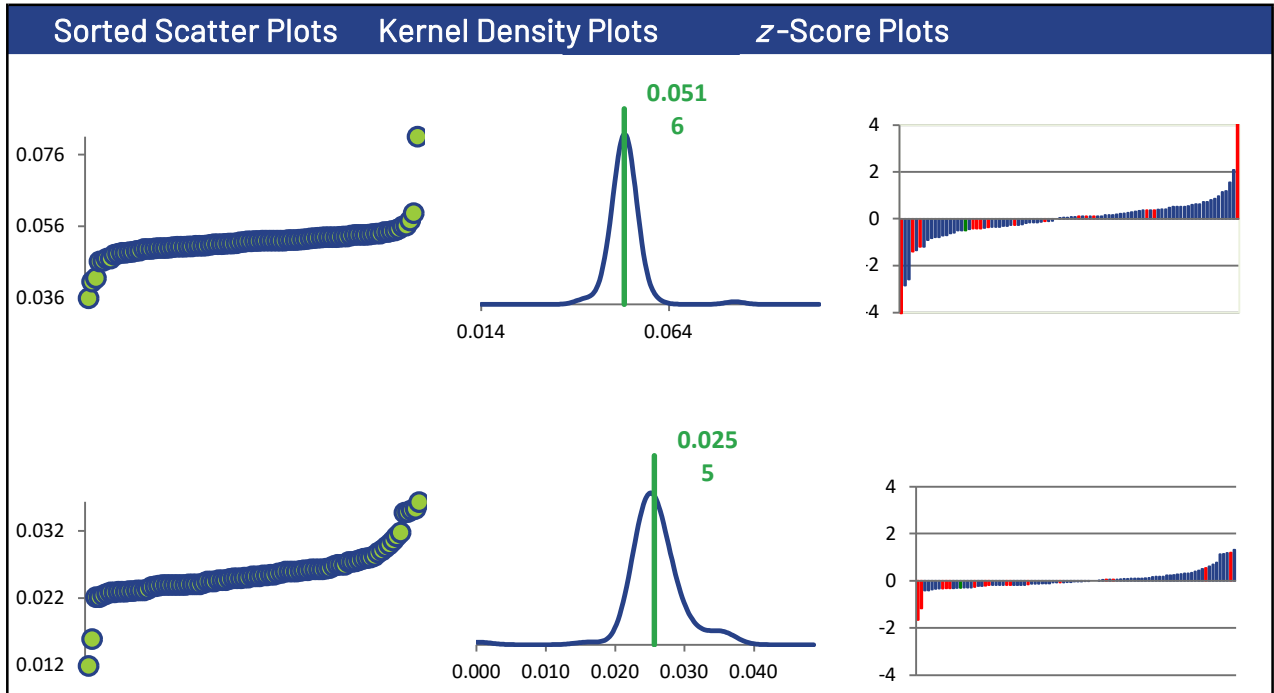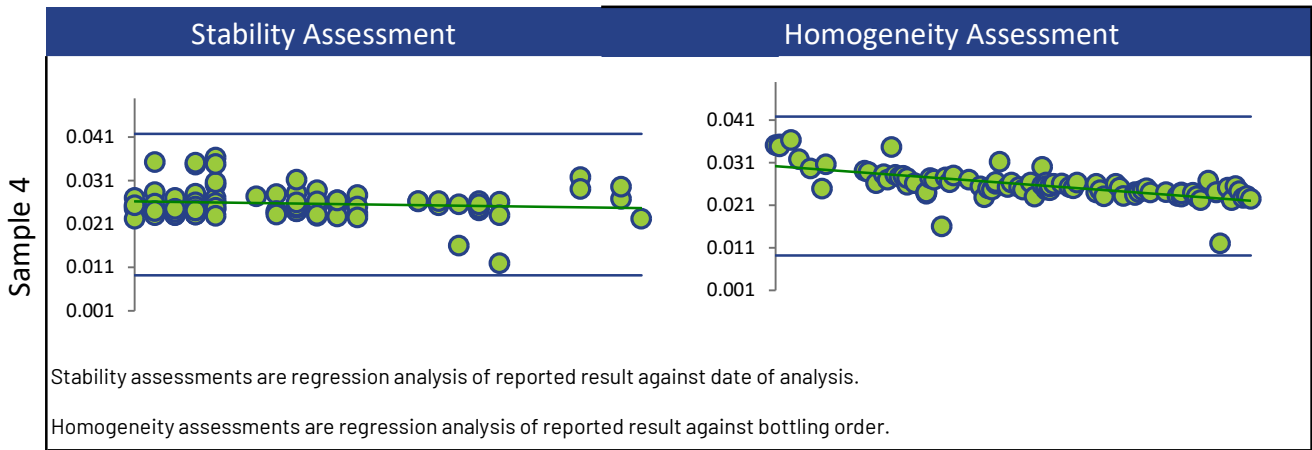
Box and Whisker Plots

Current Round (blue) Compared to Historic Rounds (green)

STRONTIUM

Summary Statistics

Statistic	C02A-1	C02A-2	C02A-3	C02A-4
N	91	91	92	80
Median mg/L	0.391	0.358	1.55	0.00321
Robust Mean mg/L	0.392	0.358	1.55	0.00324
U mg/L	0.00207	0.00199	0.00783	0.0000314
Robust Standard Deviation mg/L	0.0158	0.0152	0.0601	0.000225
Regression Standard Deviation mg/L	0.0294	0.0268	0.116	0.000243
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA) mg/L	0.0294	0.0268	0.116	0.000243
Outliers	2	2	1	2
|z|>3.0	0	3	2	4
2<|z|<3	0	1	1	2

Methods Used

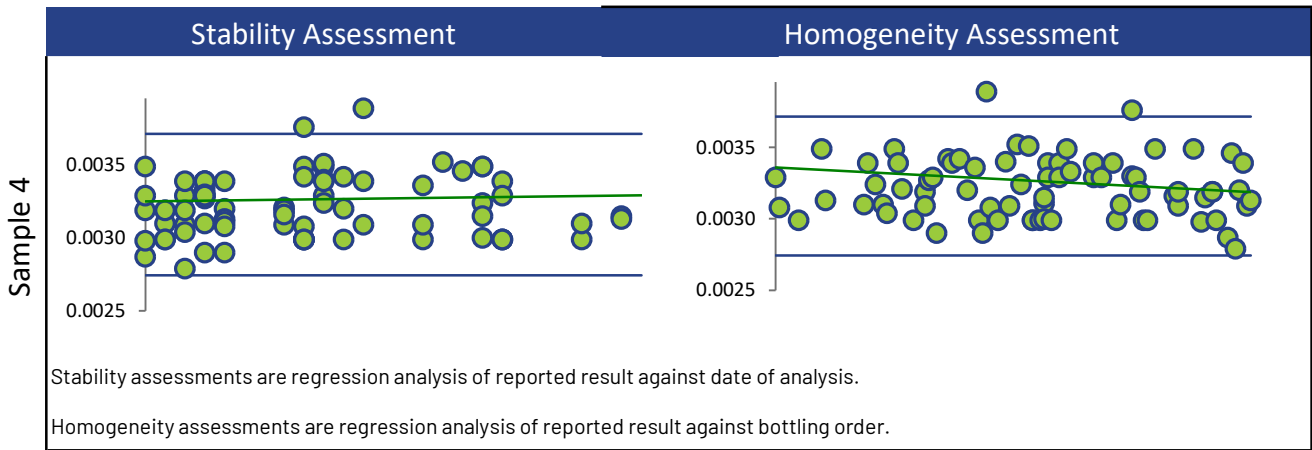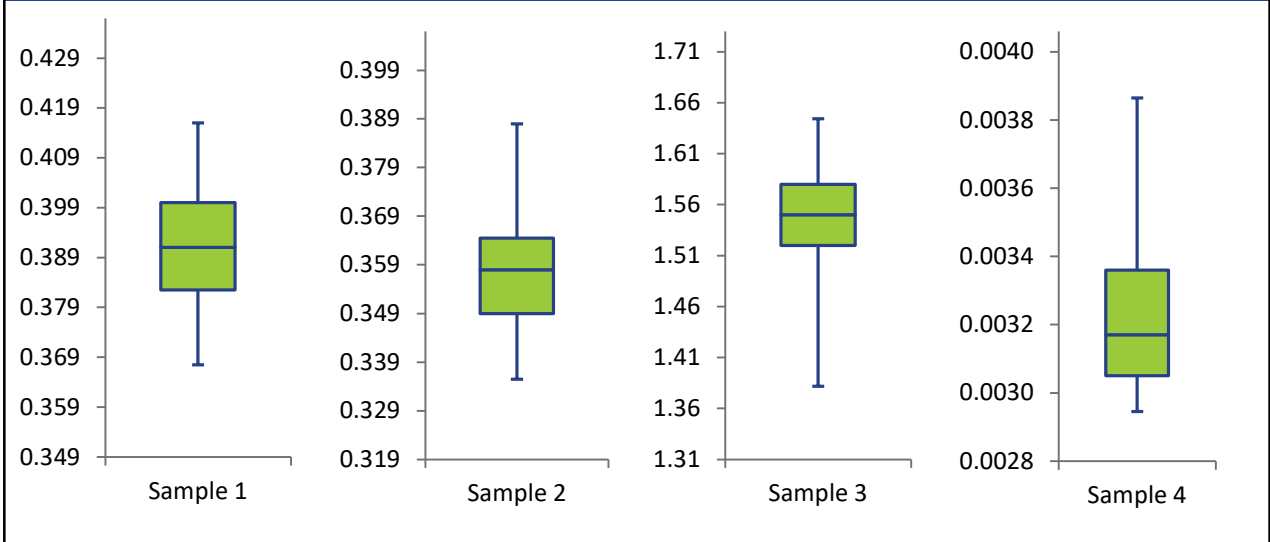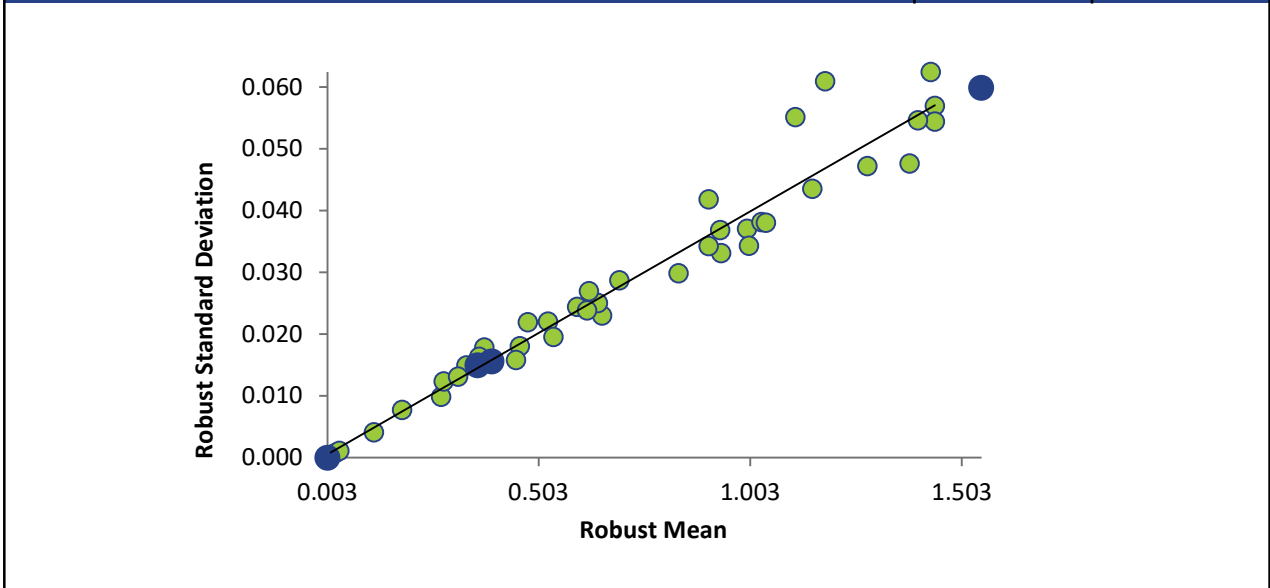| Method	C02A-1	C02A-2	C02A-3	C02A-4
ICP/MS (Blue)	74	73	74	67
ICP/OES (Red)	17	18	18	13

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

STRONTIUM

STRONTIUM

Stability Assessment | Homogeneity Assessment

Sample 4

Stability assessments are regression analysis of reported result against date of analysis.

Homogeneity assessments are regression analysis of reported result against bottling order.

Box and Whisker Plots

Sample 1   Sample 2   Sample 3   Sample 4
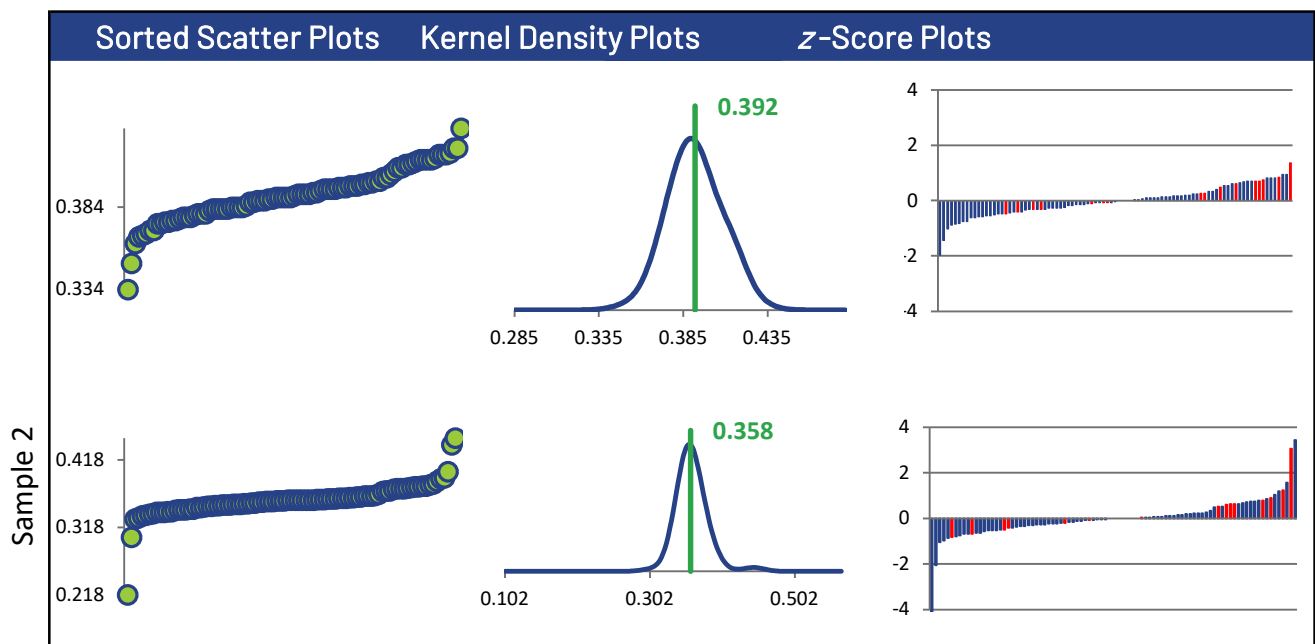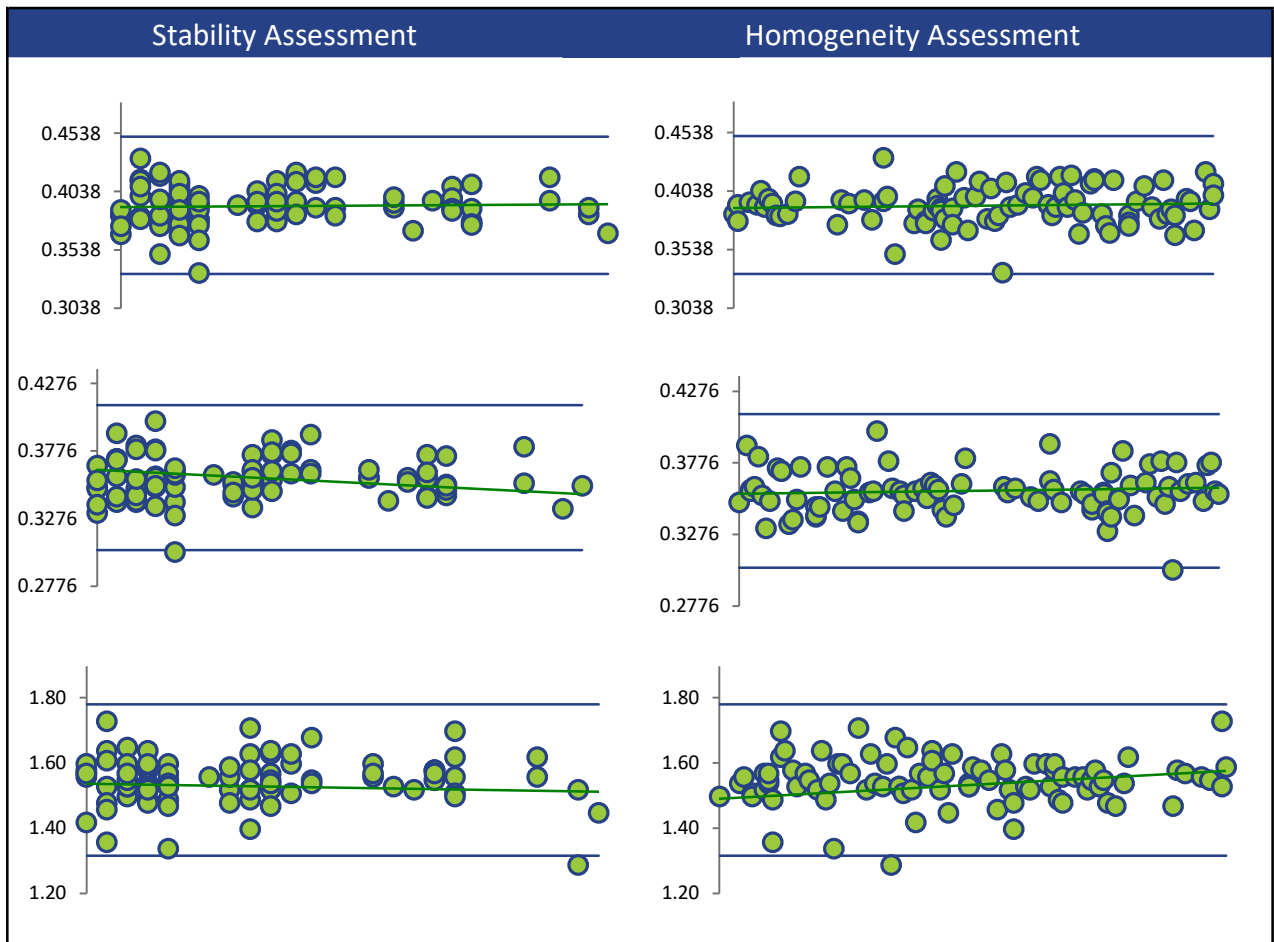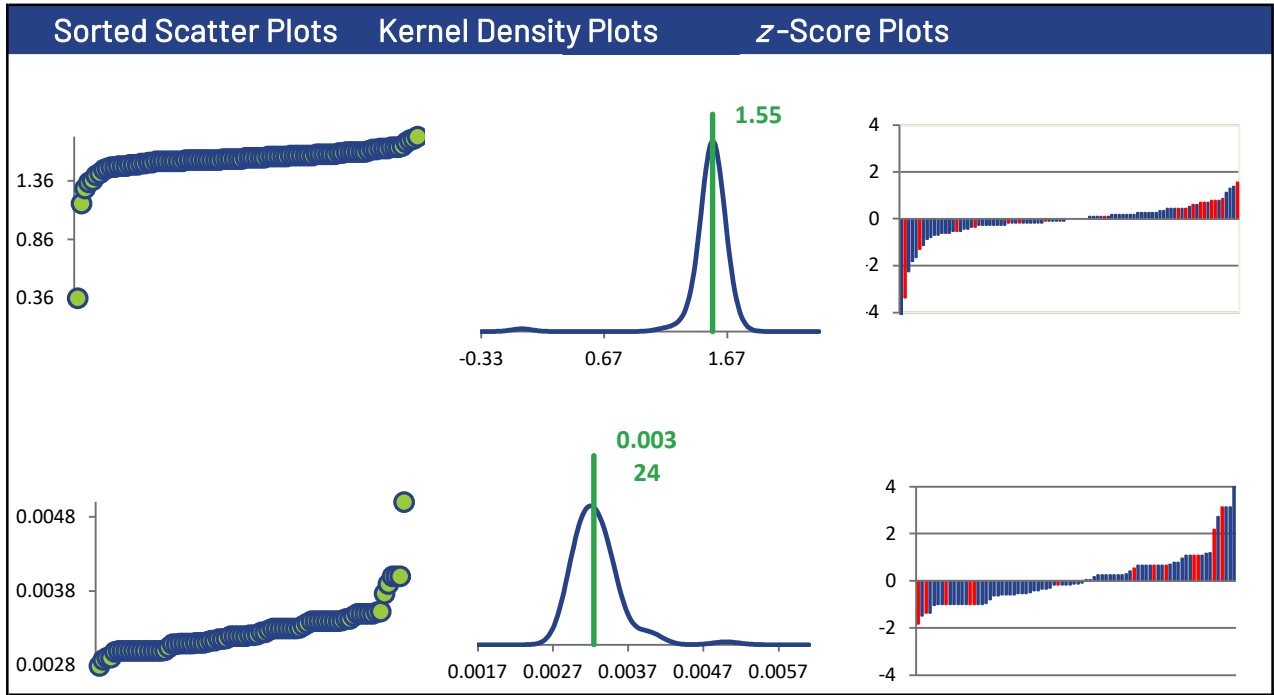
Current Round (blue) Compared to Historic Rounds (green)

THALLIUM

Summary Statistics

Statistic	C02A-1	C02A-2	C02A-3	C02A-4
N	88	87	88	88
Median mg/L	0.944	0.315	1.06	0.0405
Robust Mean mg/L	0.947	0.315	1.06	0.0407
U mg/L	0.00456	0.00159	0.00532	0.000263
Robust Standard Deviation mg/L	0.0342	0.0119	0.0399	0.00197
Regression Standard Deviation mg/L	0.0947	0.0315	0.106	0.00407
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA) mg/L	0.0947	0.0315	0.106	0.00407
Outliers	1	2	1	0
|z|>3.0	0	1	0	2
2<|z|<3	1	1	0	0

Methods Used

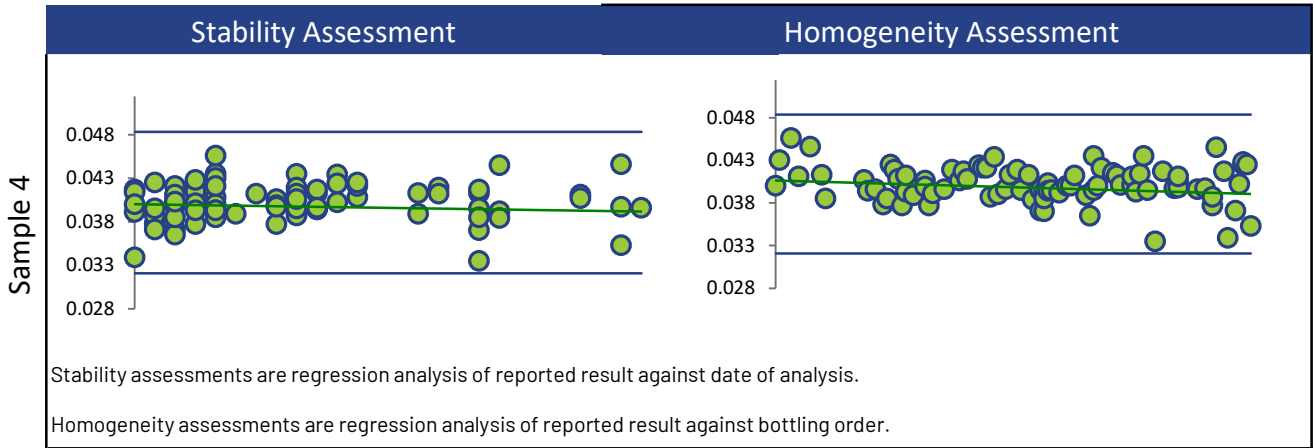| Method	C02A-1	C02A-2	C02A-3	C02A-4
ICP/OES (Blue)	13	13	13	12
ICP/MS (Red)	75	74	75	76

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

THALLIUM

THALLIUM

Stability Assessment / Homogeneity Assessment

Stability assessments are regression analysis of reported result against date of analysis.

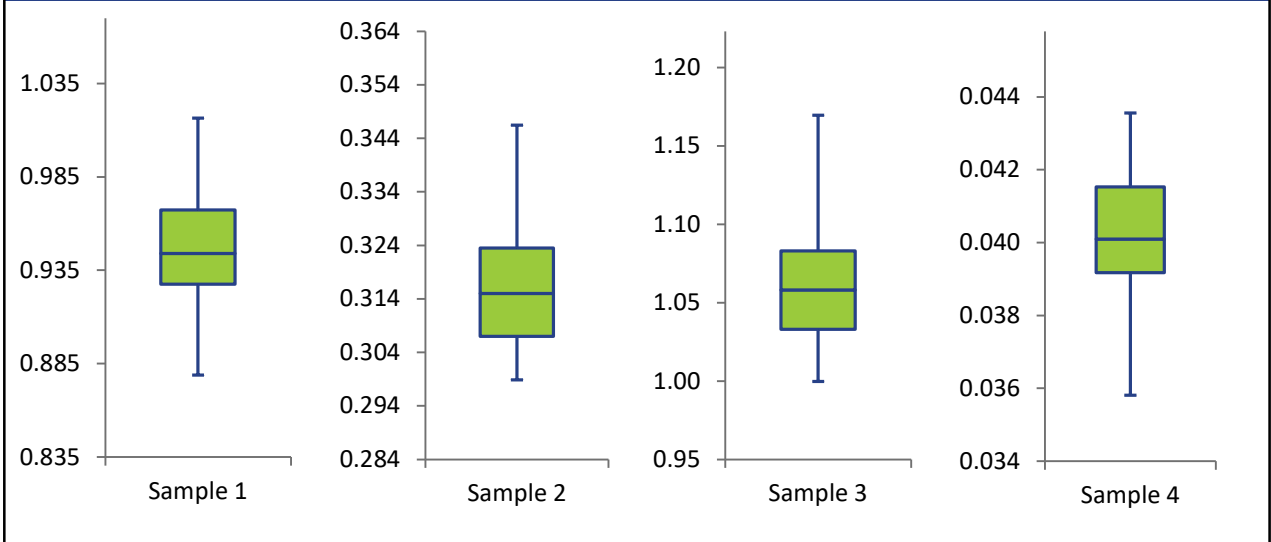Homogeneity assessments are regression analysis of reported result against bottling order.
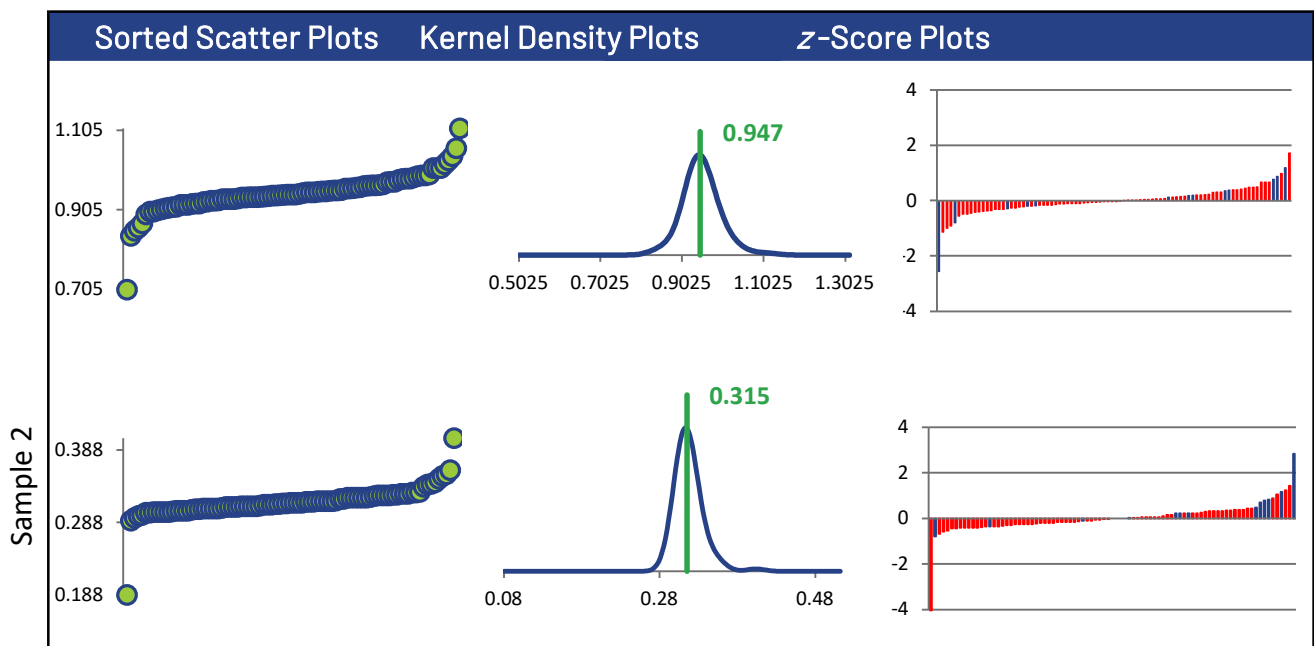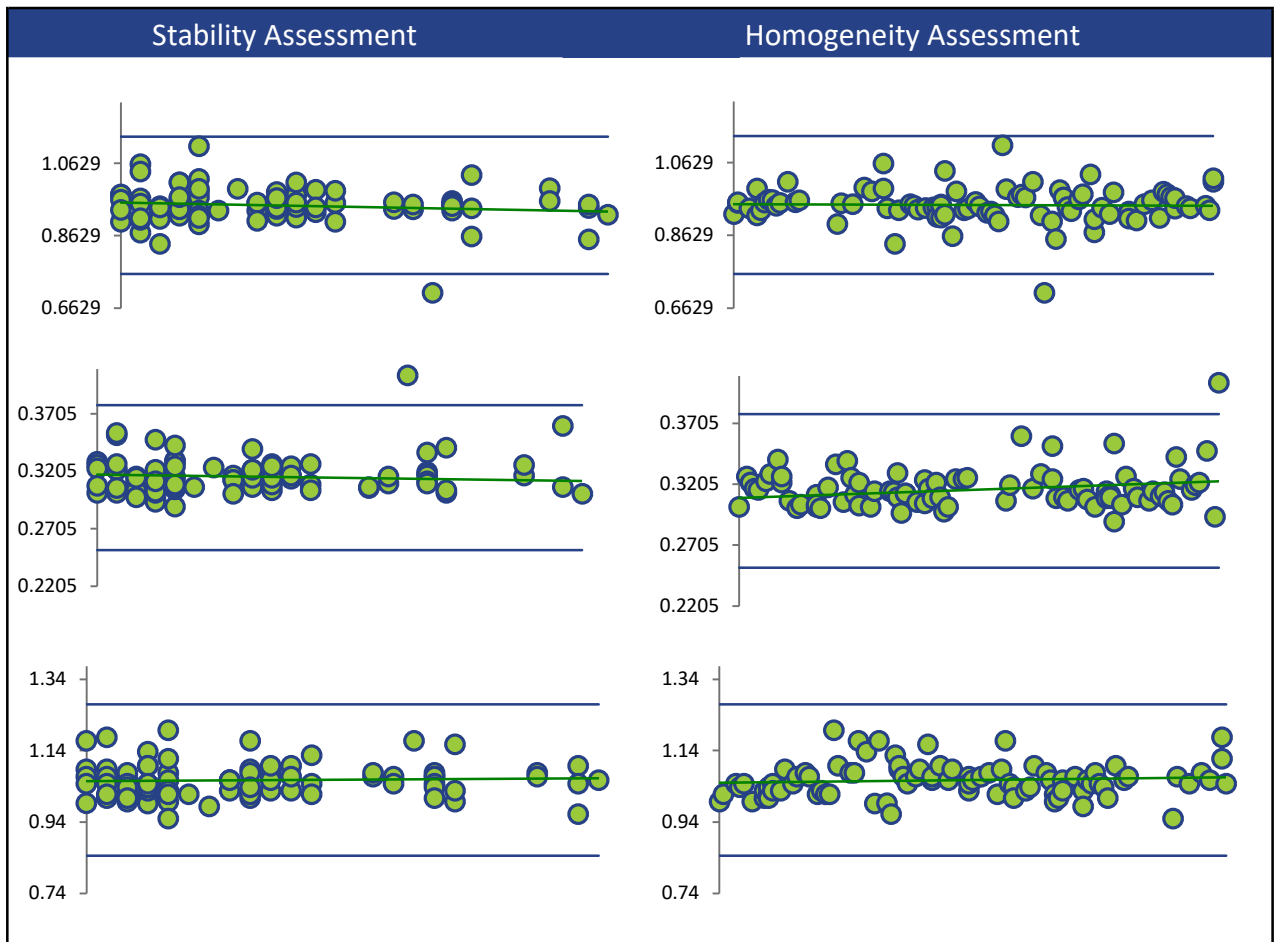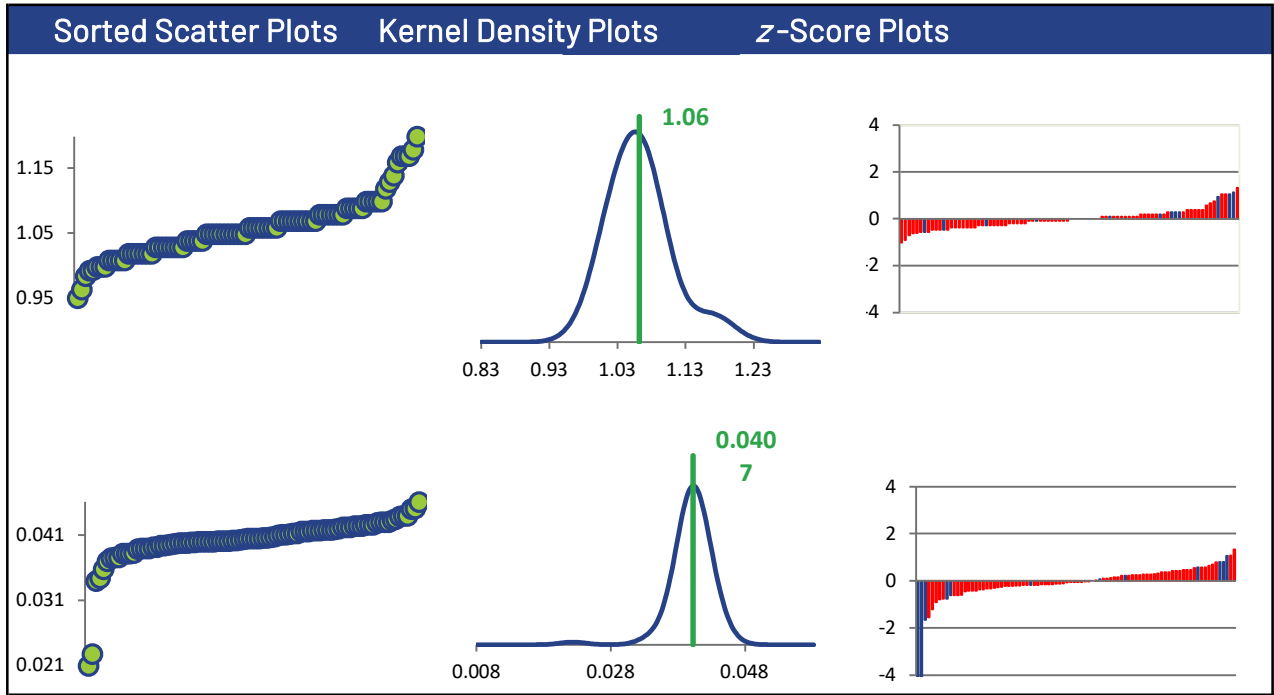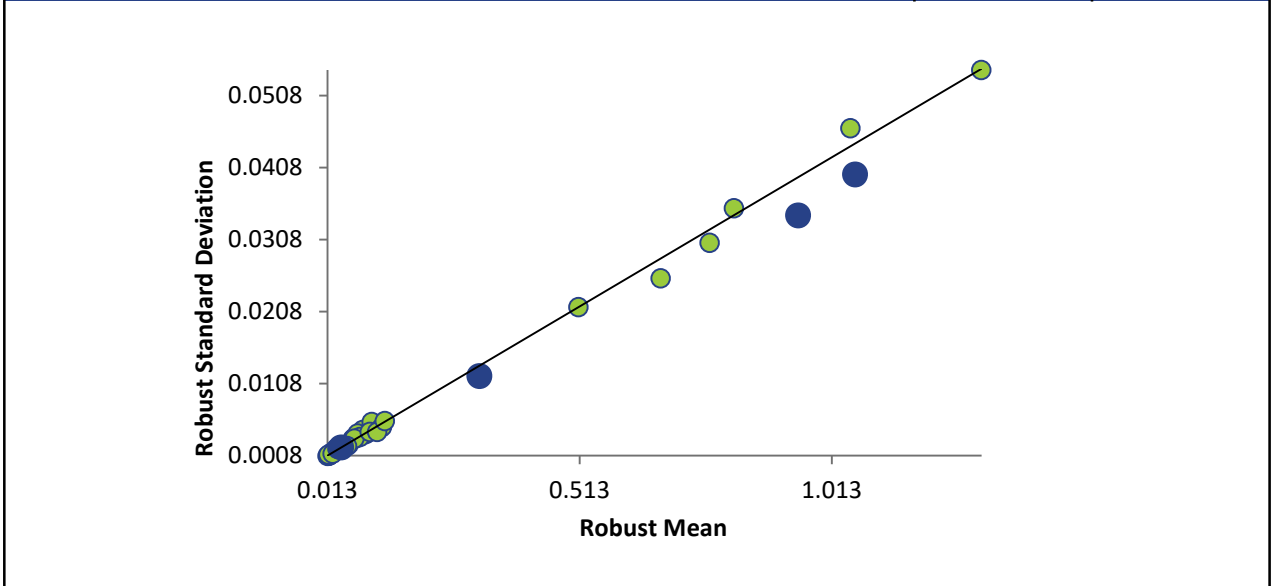
Box and Whisker Plots

Current Round (blue) Compared to Historic Rounds (green)

TIN

Summary Statistics

Statistic	C02A-1	C02A-2	C02A-3	C02A-4
N	81	78	82	74
Median mg/L	0.0690	0.0325	0.0719	0.00967
Robust Mean mg/L	0.0684	0.0323	0.0712	0.00958
U mg/L	0.000535	0.000259	0.000504	0.0000854
Robust Standard Deviation mg/L	0.00385	0.00183	0.00365	0.000588
Regression Standard Deviation mg/L	0.00684	0.00323	0.00712	0.000958
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA) mg/L	0.00684	0.00323	0.00712	0.000958
Outliers	0	0	0	0
|z|>3.0	1	3	2	3
2<|z|<3	1	2	1	1

Methods Used

Method	C02A-1	C02A-2	C02A-3	C02A-4
ICP/MS (Blue)	66	65	66	64
ICP/OES (Red)	15	13	16	10

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

TIN

TIN

Stability Assessment	Homogeneity Assessment

Stability assessments are regression analysis of reported result against date of analysis.

Homogeneity assessments are regression analysis of reported result against bottling order.

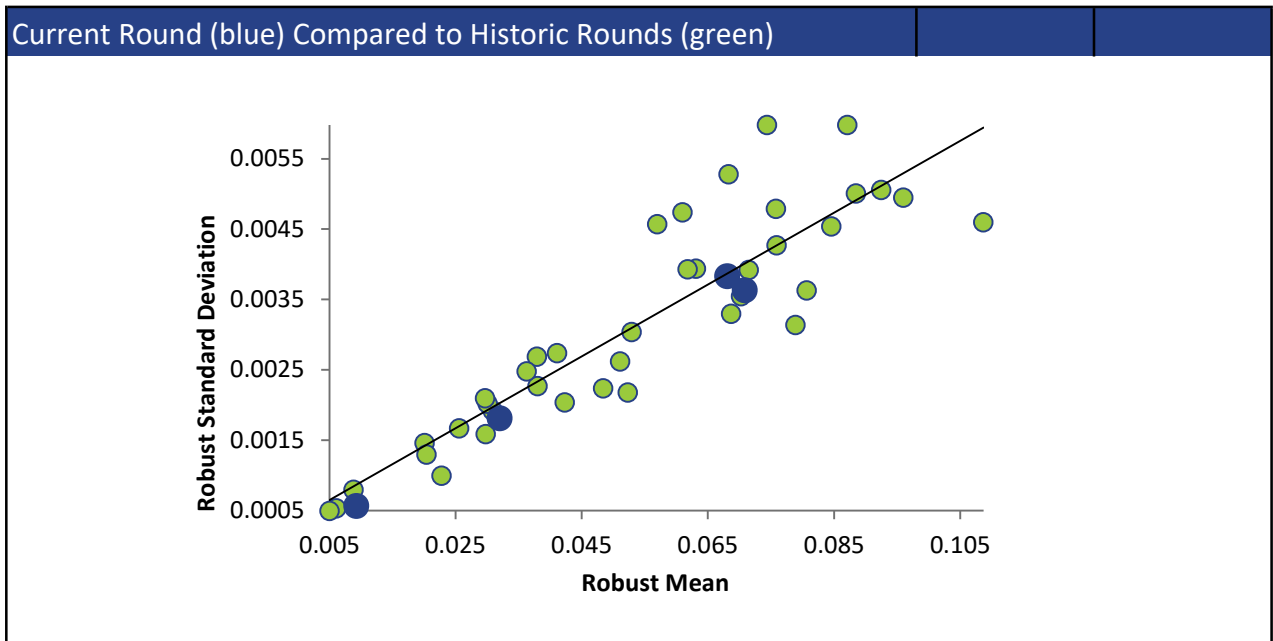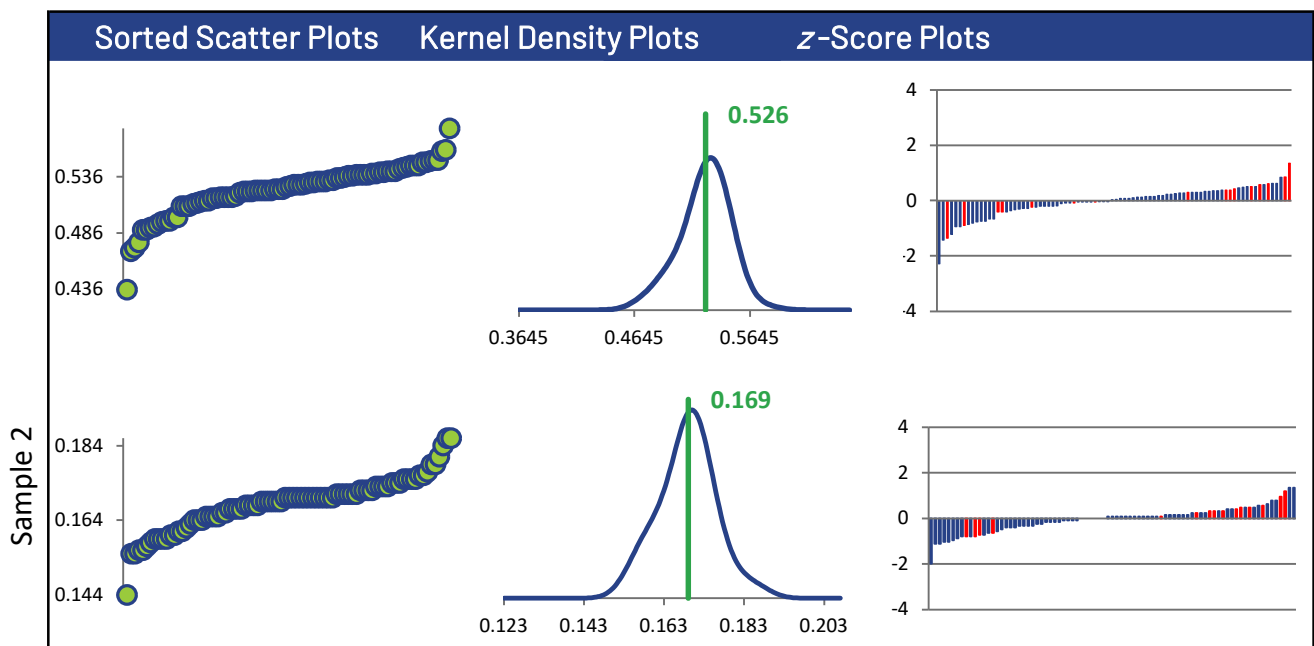## Box and Whisker Plots
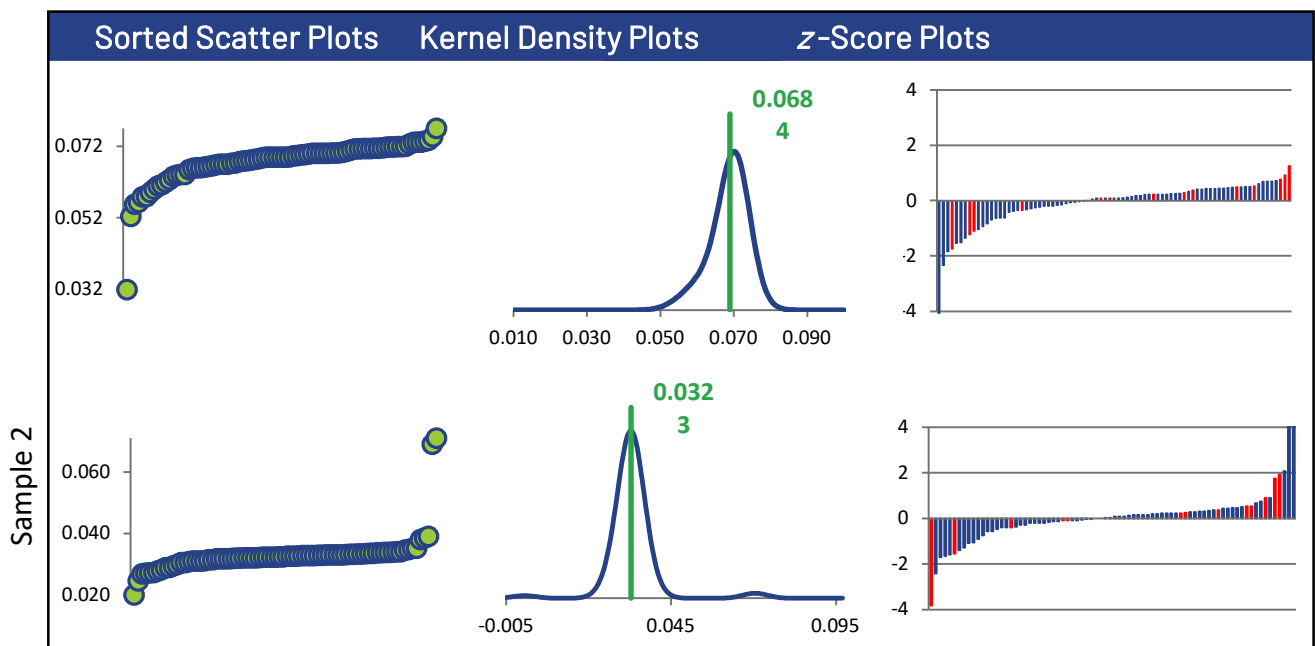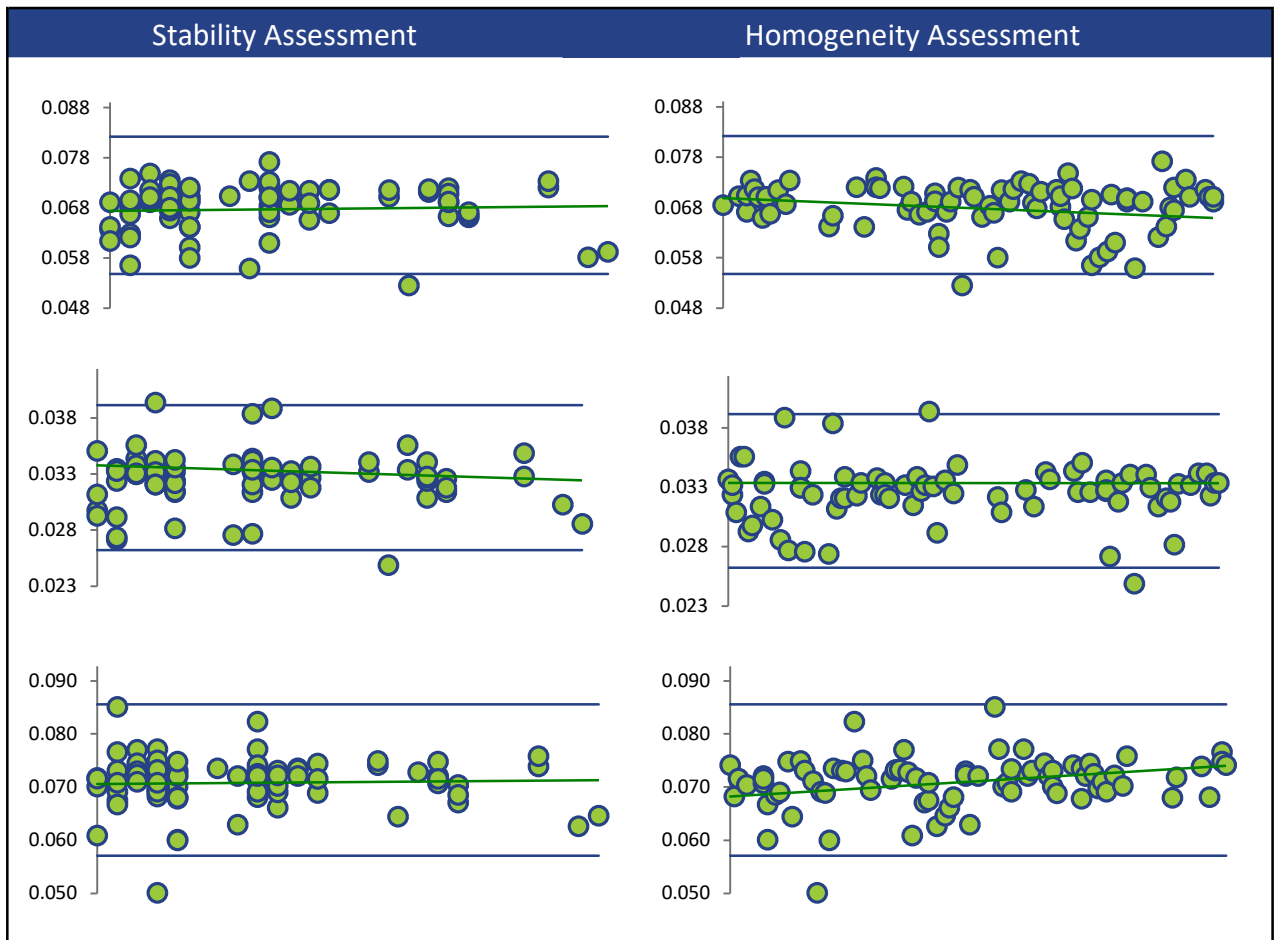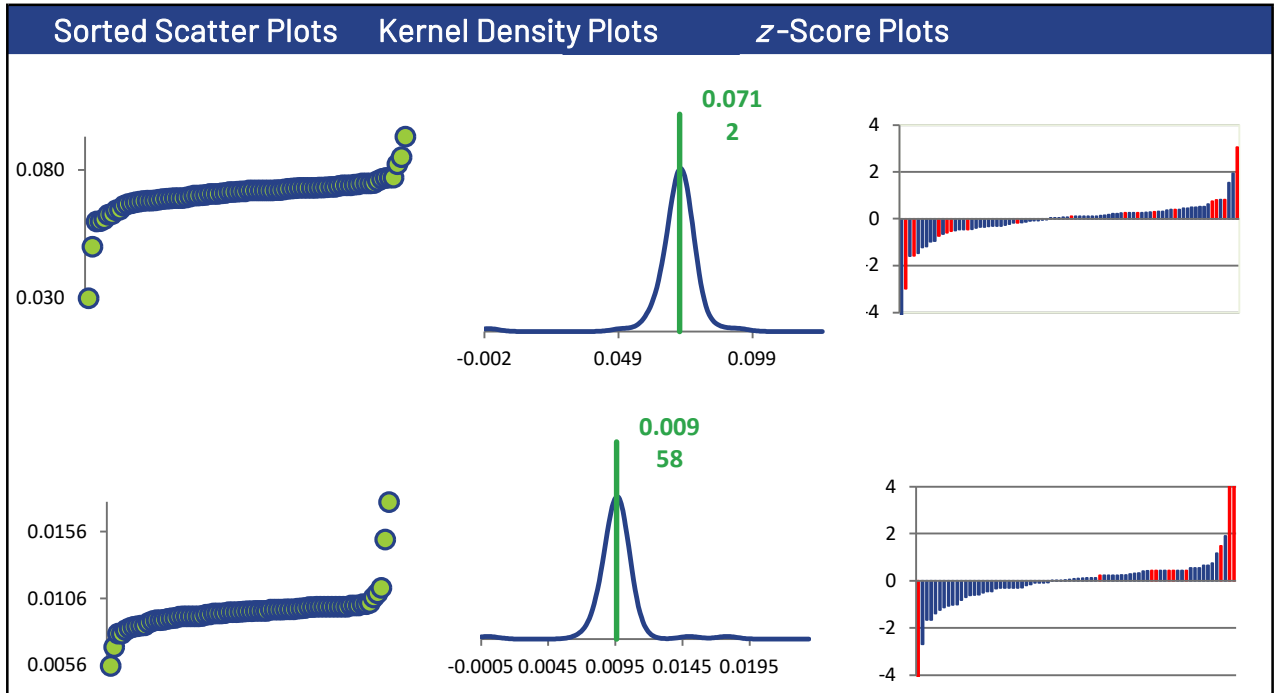
Current Round (blue) Compared to Historic Rounds (green)
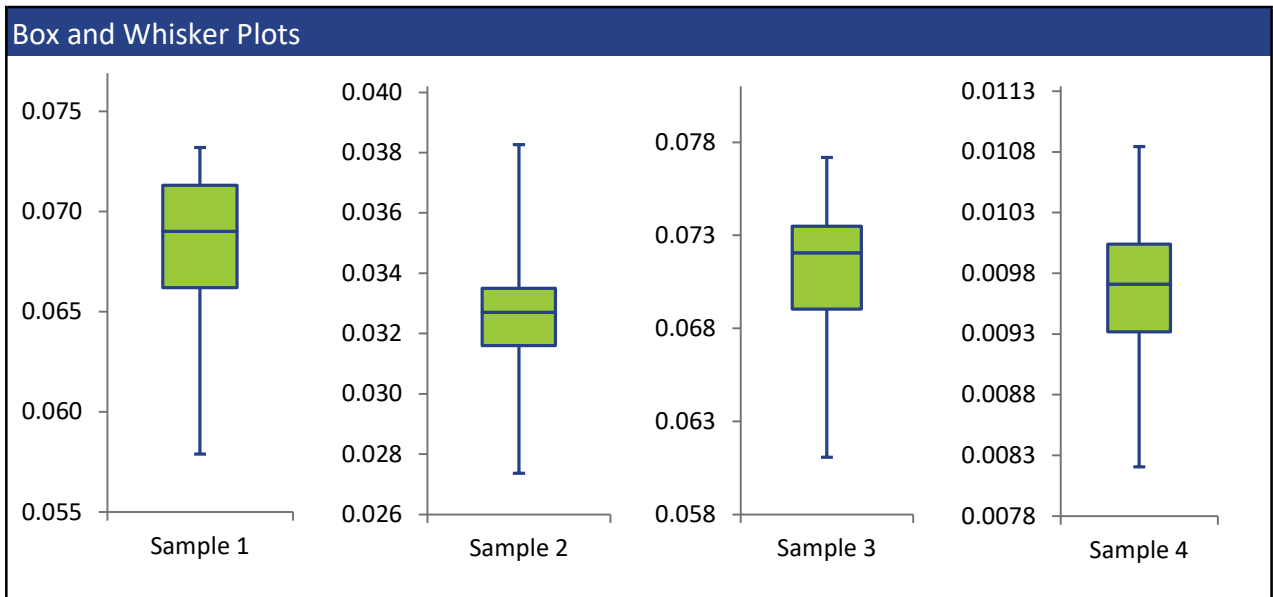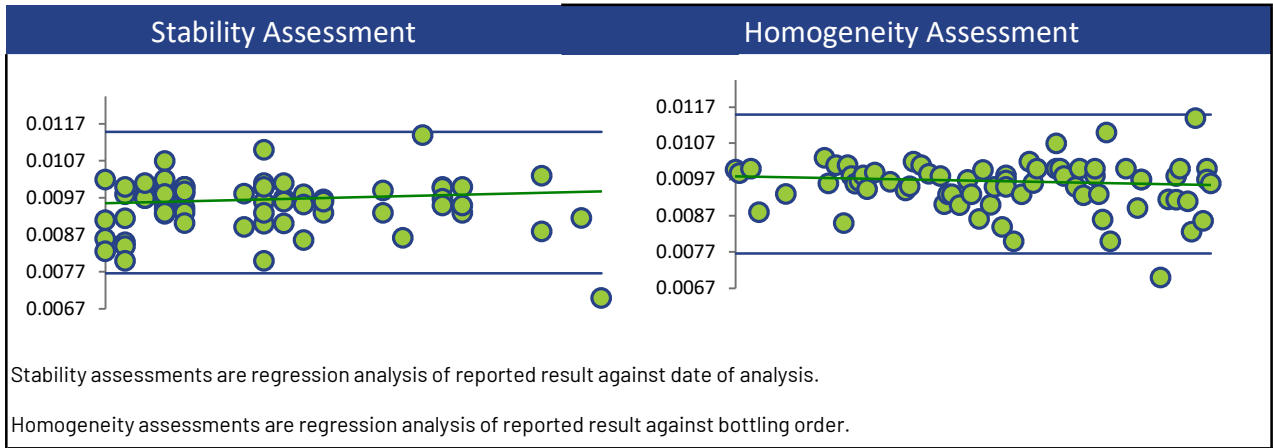
TITANIUM

Summary Statistics

Statistic	C02A-1	C02A-2	C02A-3	C02A-4
N	84	83	84	83
Median mg/L	0.528	0.170	1.37	0.0458
Robust Mean mg/L	0.526	0.169	1.37	0.0458
U mg/L	0.00262	0.000893	0.00702	0.000237
Robust Standard Deviation mg/L	0.0192	0.00651	0.0515	0.00173
Regression Standard Deviation mg/L	0.0394	0.0126	0.102	0.00344
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA) mg/L	0.0394	0.0126	0.102	0.00344
Outliers	1	2	1	0
|z|>3.0	0	0	0	0
2<|z|<3	1	0	0	2

Methods Used

Method	C02A-1	C02A-2	C02A-3	C02A-4
ICP/MS (Blue)	68	67	68	68
ICP/OES (Red)	16	16	16	15

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

TITANIUM

TITANIUM

Stability Assessment | Homogeneity Assessment

Stability assessments are regression analysis of reported result against date of analysis.

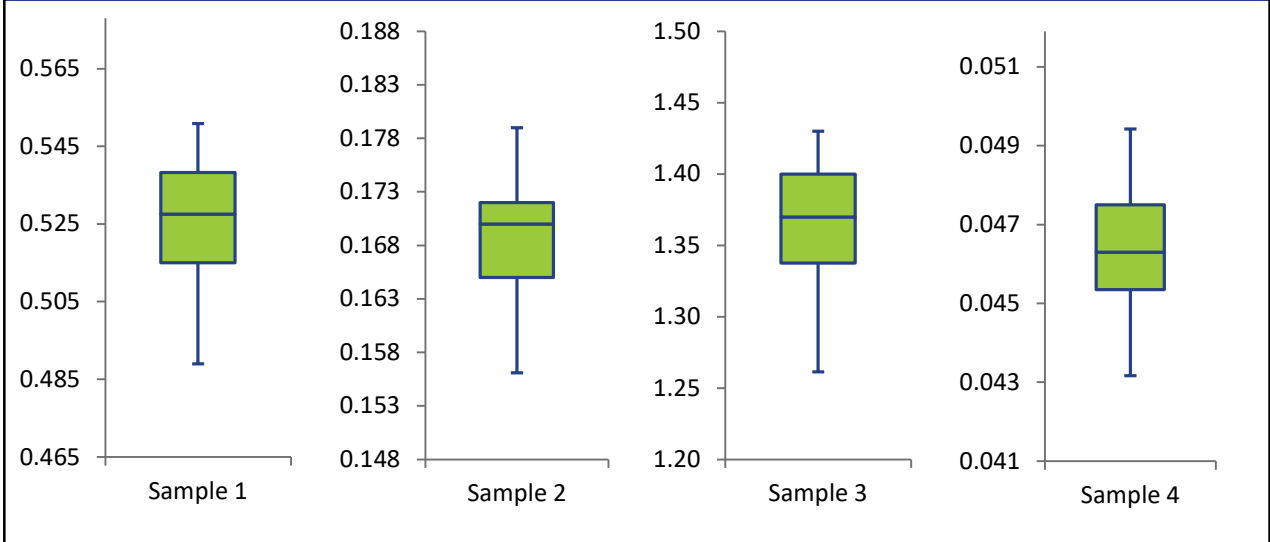Homogeneity assessments are regression analysis of reported result against bottling order.
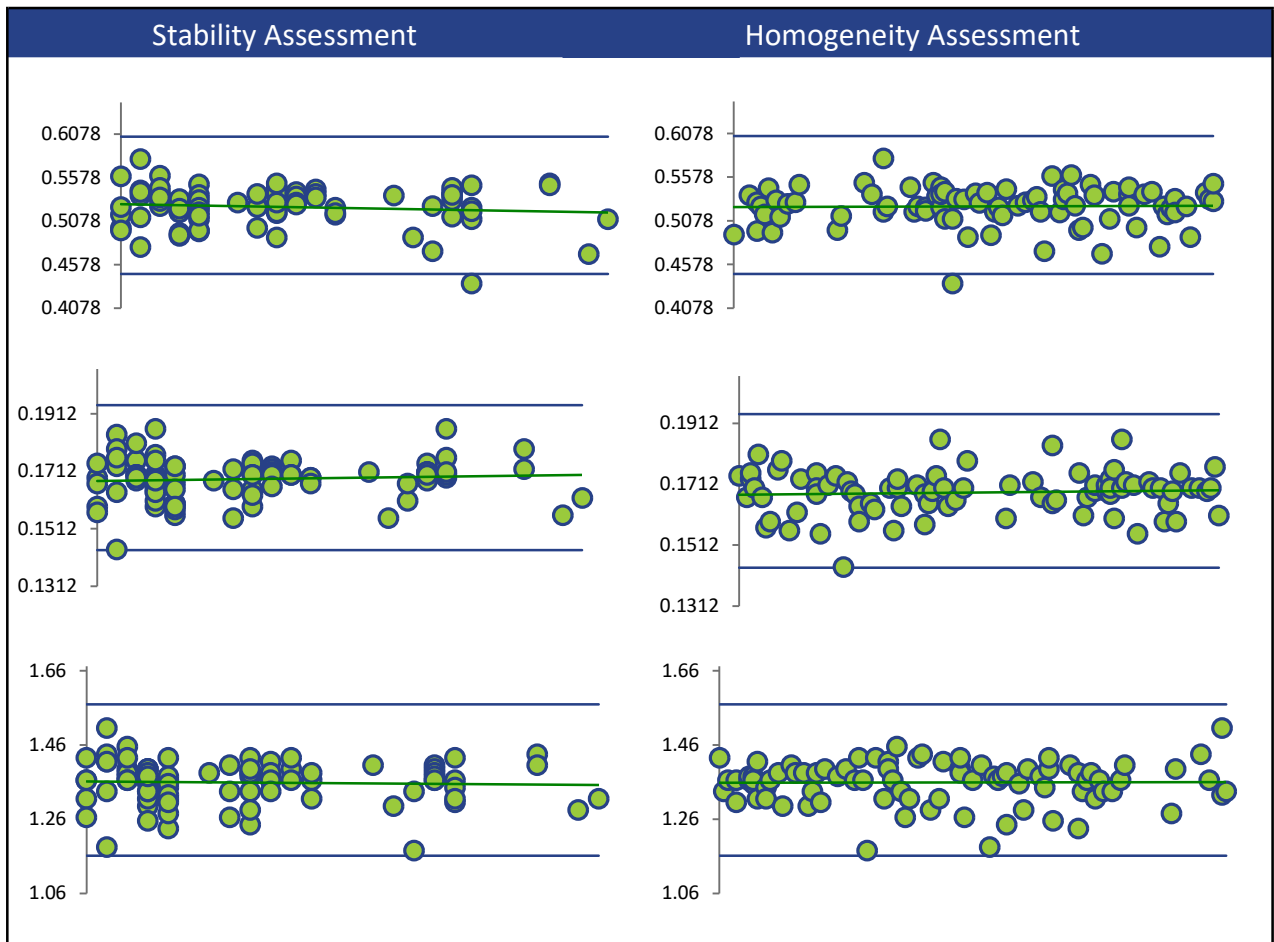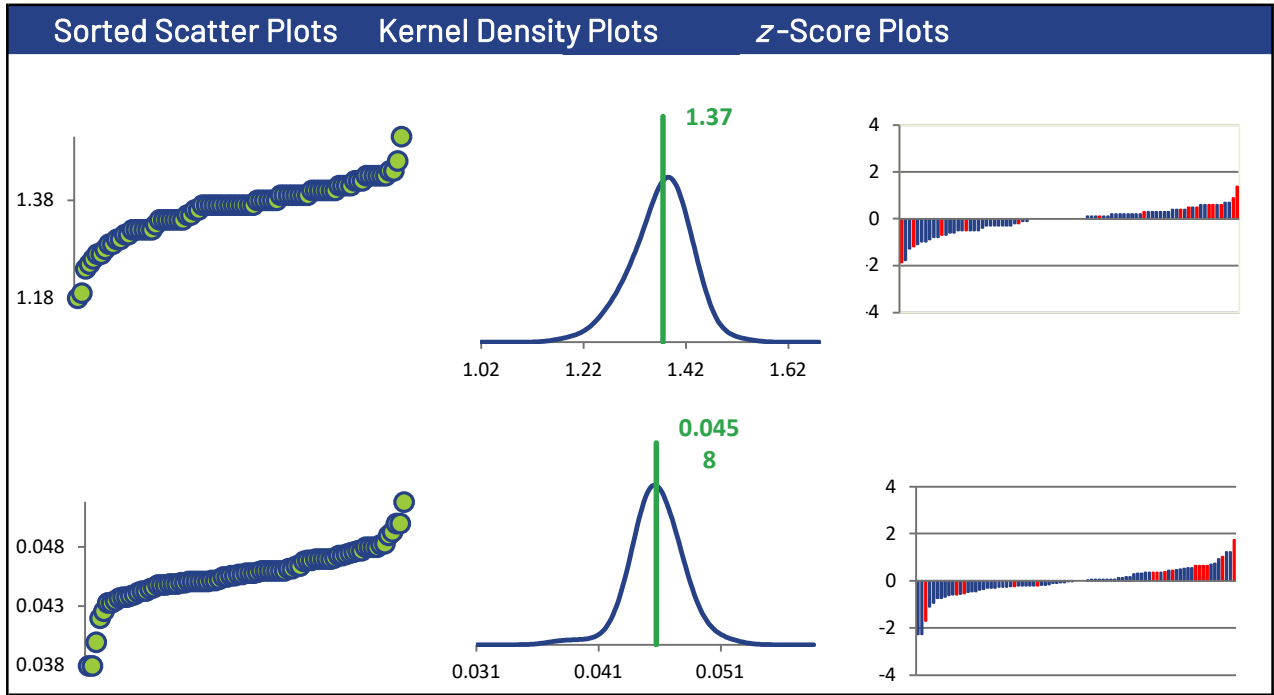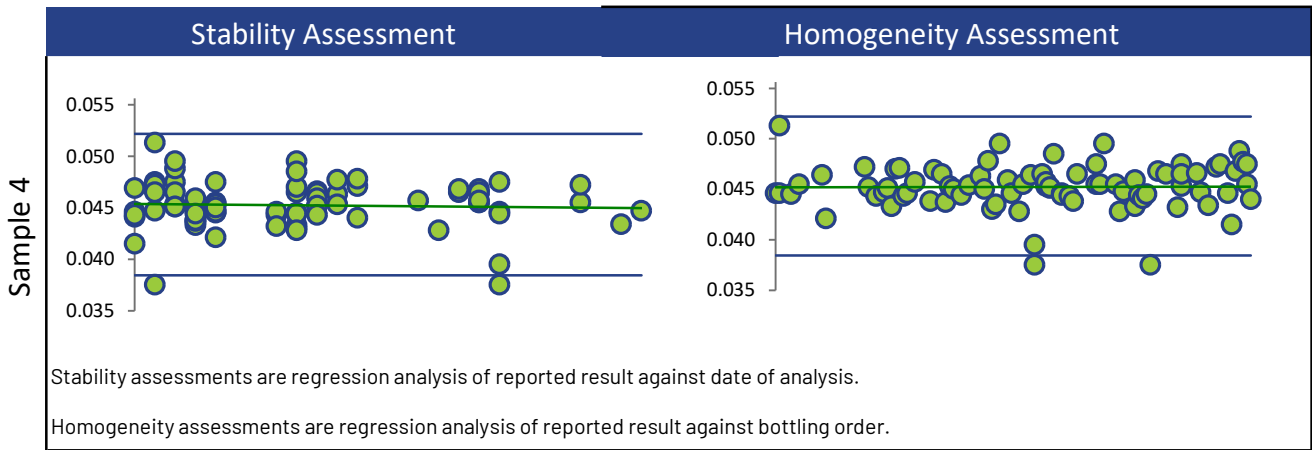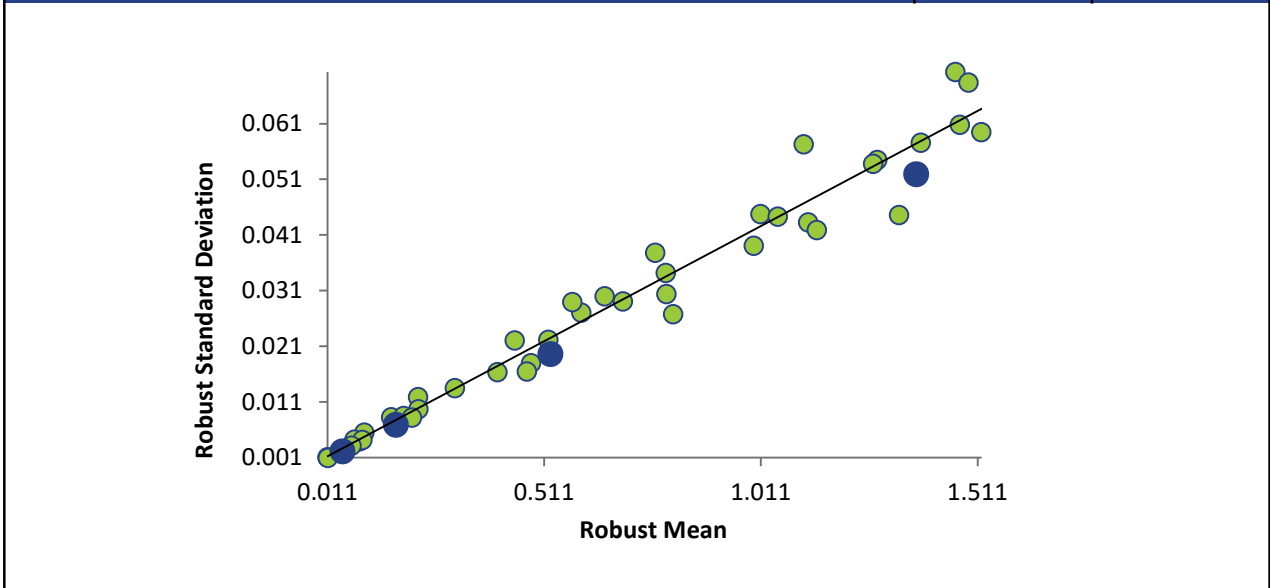
Box and Whisker Plots

Current Round (blue) Compared to Historic Rounds (green)

URANIUM

Summary Statistics

Statistic	C02A-1	C02A-2	C02A-3	C02A-4
N	88	88	87	87
Median mg/L	0.0708	0.0503	0.0982	0.00550
Robust Mean mg/L	0.0706	0.0499	0.0973	0.00550
U mg/L	0.000510	0.000380	0.000697	0.0000515
Robust Standard Deviation mg/L	0.00383	0.00285	0.00520	0.000384
Regression Standard Deviation mg/L	0.00529	0.00374	0.00730	0.000413
Stability Flag		Stability		
Homogeneity Flag				Homogeneity
Standard Deviation Used (SDPA) mg/L	0.00529	0.00512	0.00730	0.00115
Outliers	1	1	2	1
$|z|>3.0$	1	5	0	3
$2<|z|<3$	2	0	0	0

Methods Used

Method	C02A-1	C02A-2	C02A-3	C02A-4
ICP/MS (Blue)	82	81	81	82
ICP/OES (Red)	6	7	6	5

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

URANIUM

URANIUM

Stability Assessment	Homogeneity Assessment

Stability assessments are regression analysis of reported result against date of analysis.

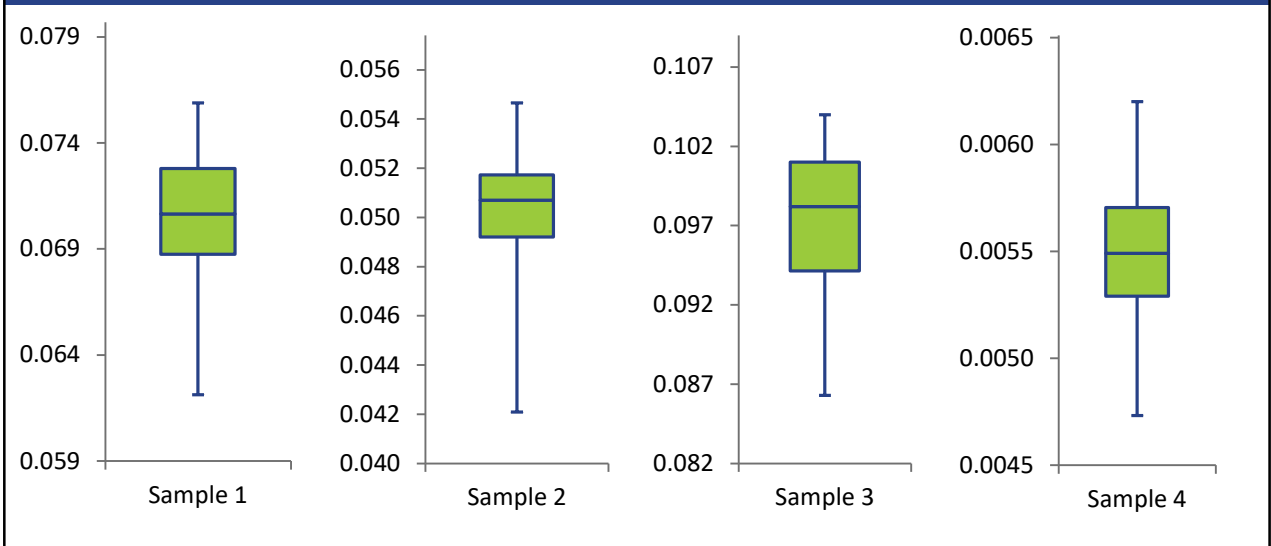Homogeneity assessments are regression analysis of reported result against bottling order.
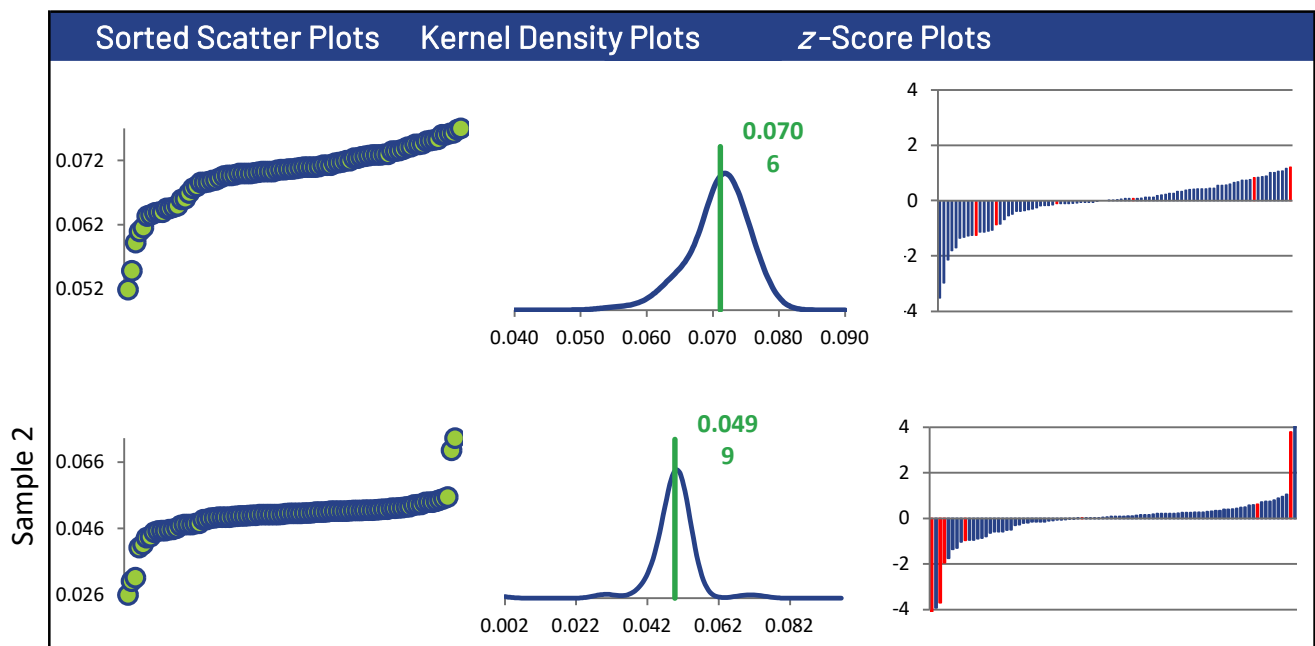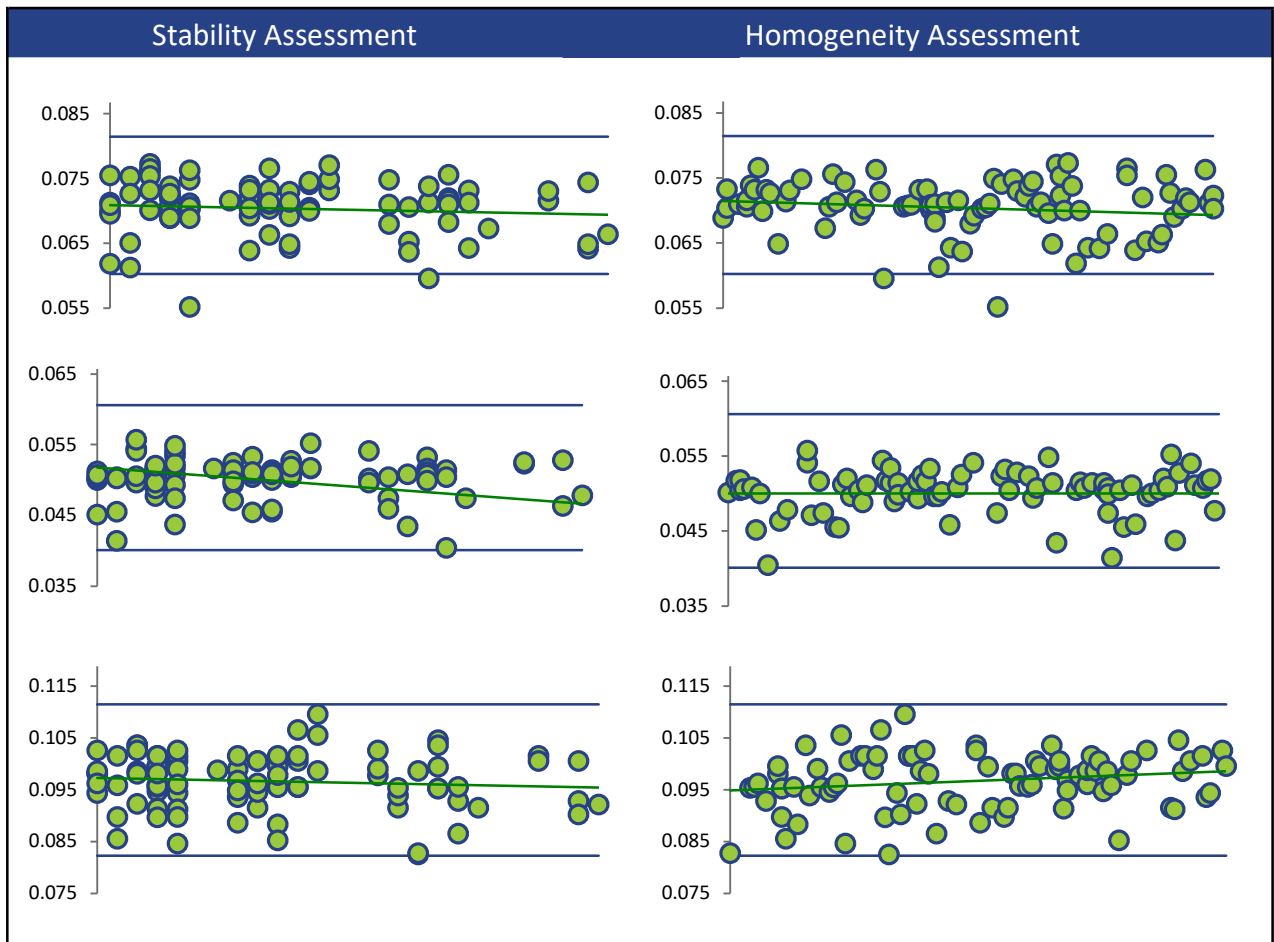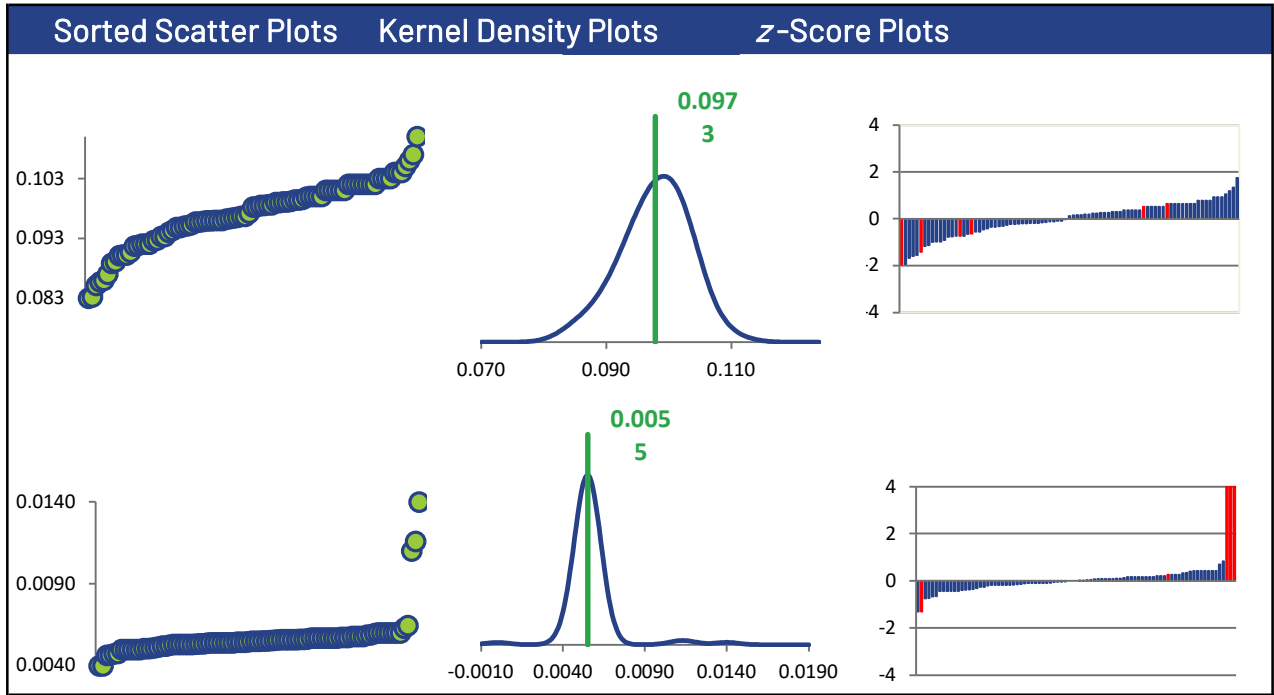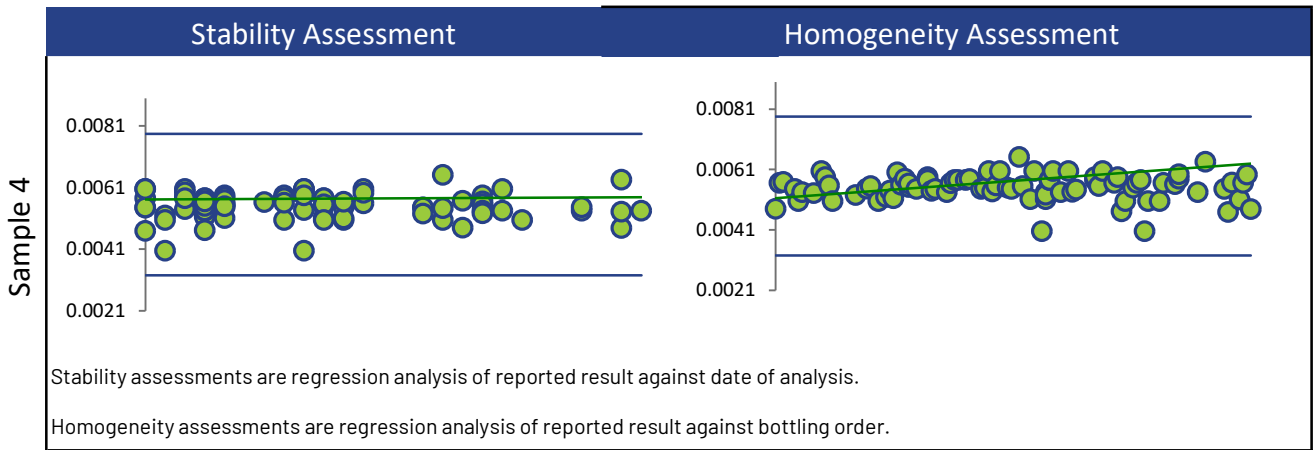
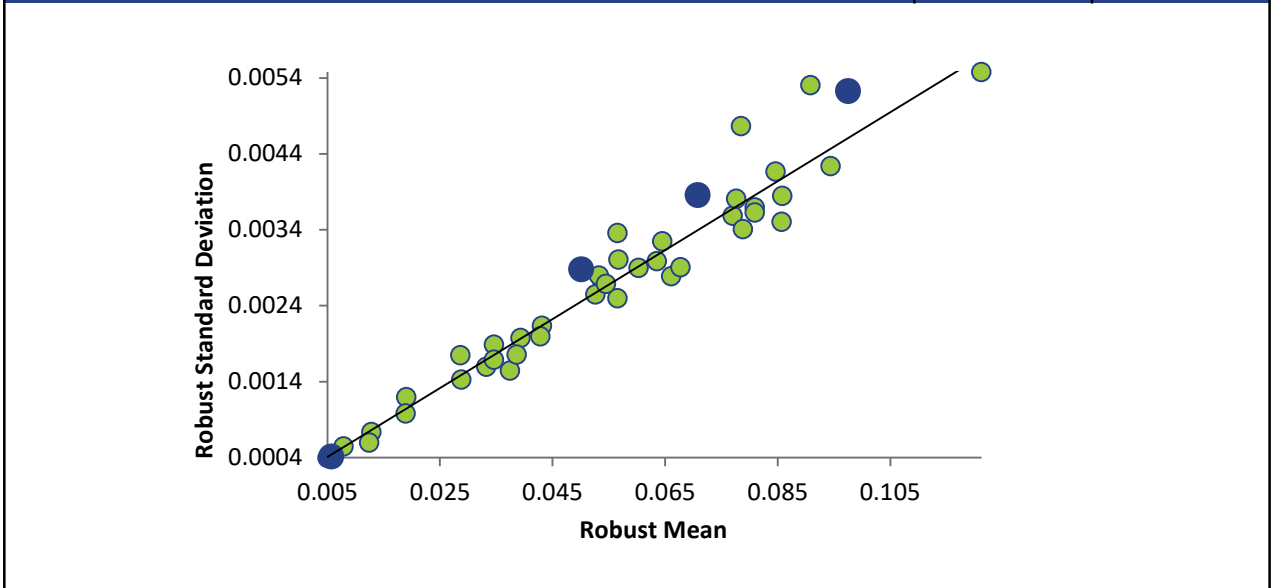## Box and Whisker Plots

Current Round (blue) Compared to Historic Rounds (green)

VANADIUM

Summary Statistics

Statistic	C02A-1	C02A-2	C02A-3	C02A-4
N	96	97	96	95
Median mg/L	0.679	0.481	1.15	0.0311
Robust Mean mg/L	0.677	0.480	1.14	0.0313
U mg/L	0.00318	0.00212	0.00563	0.000140
Robust Standard Deviation mg/L	0.0249	0.0167	0.0441	0.00109
Regression Standard Deviation mg/L	0.0508	0.0360	0.0858	0.00235
Stability Flag				Stability
Homogeneity Flag				
Standard Deviation Used (SDPA) mg/L	0.0508	0.0360	0.0858	0.00270
Outliers	1	0	1	0
|z|>3.0	2	4	0	1
2<|z|<3	0	0	1	2

Methods Used

Method	C02A-1	C02A-2	C02A-3	C02A-4
ICP/OES (Blue)	18	18	18	17
ICP/MS (Red)	78	79	78	78

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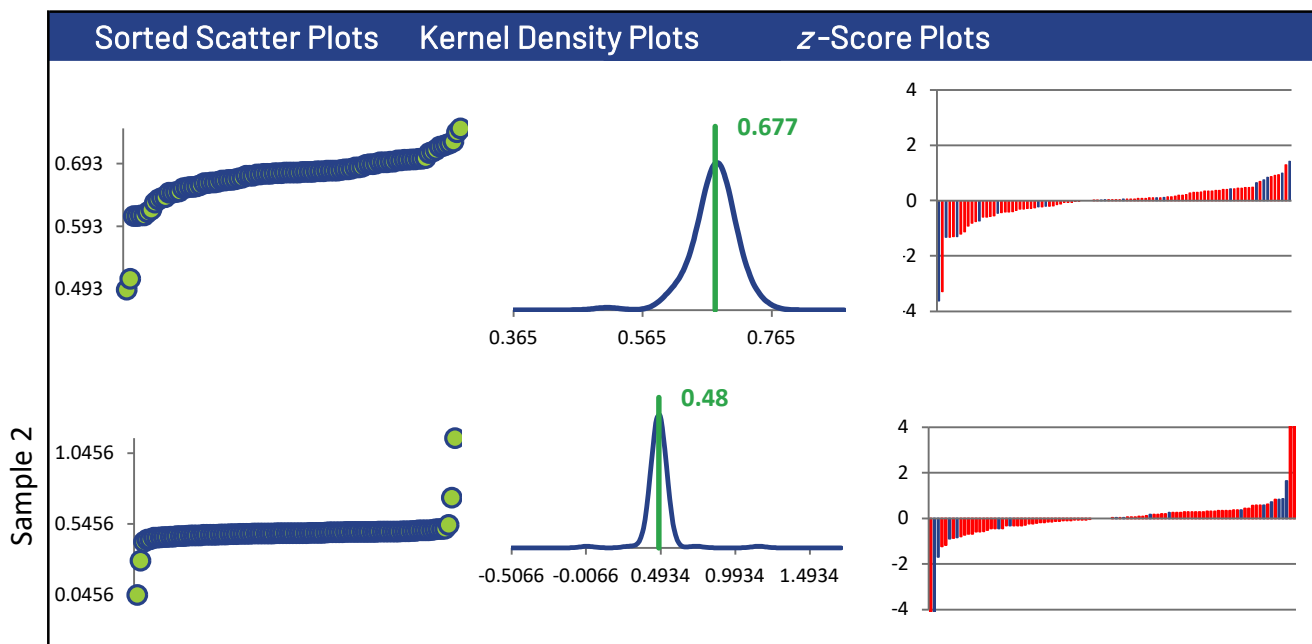
VANADIUM

VANADIUM

Stability Assessment	Homogeneity Assessment

Stability assessments are regression analysis of reported result against date of analysis.

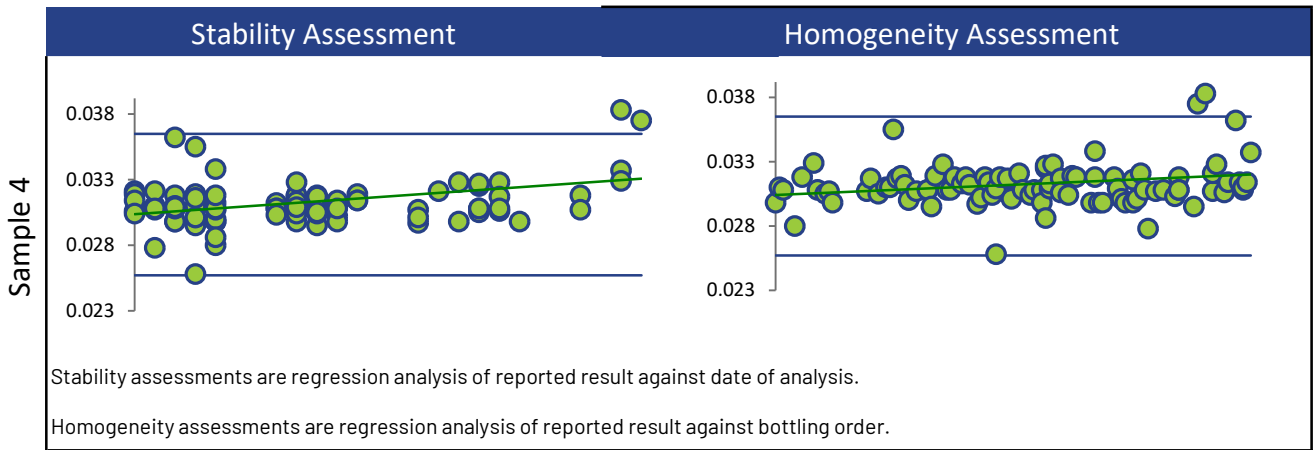Homogeneity assessments are regression analysis of reported result against bottling order.
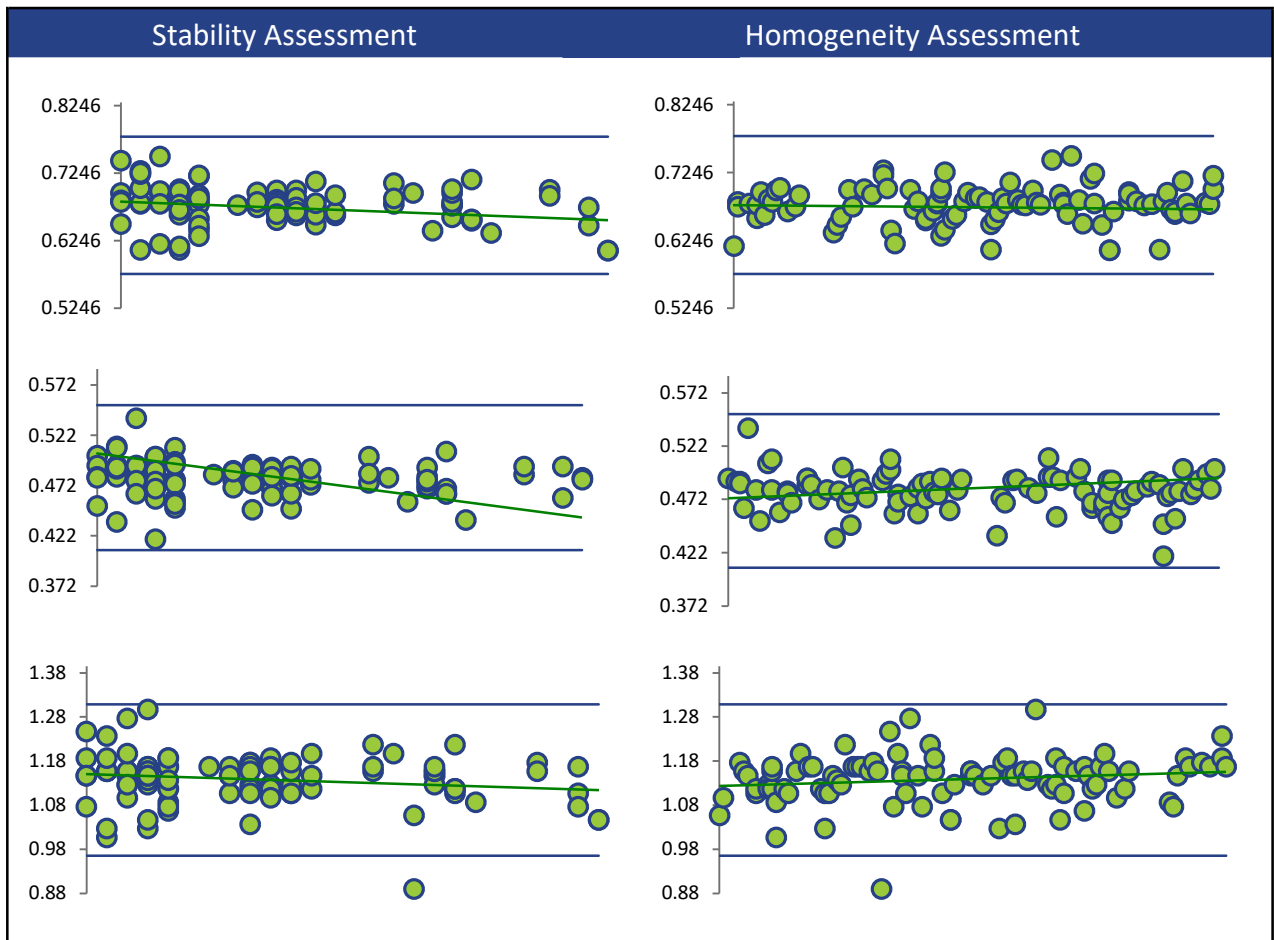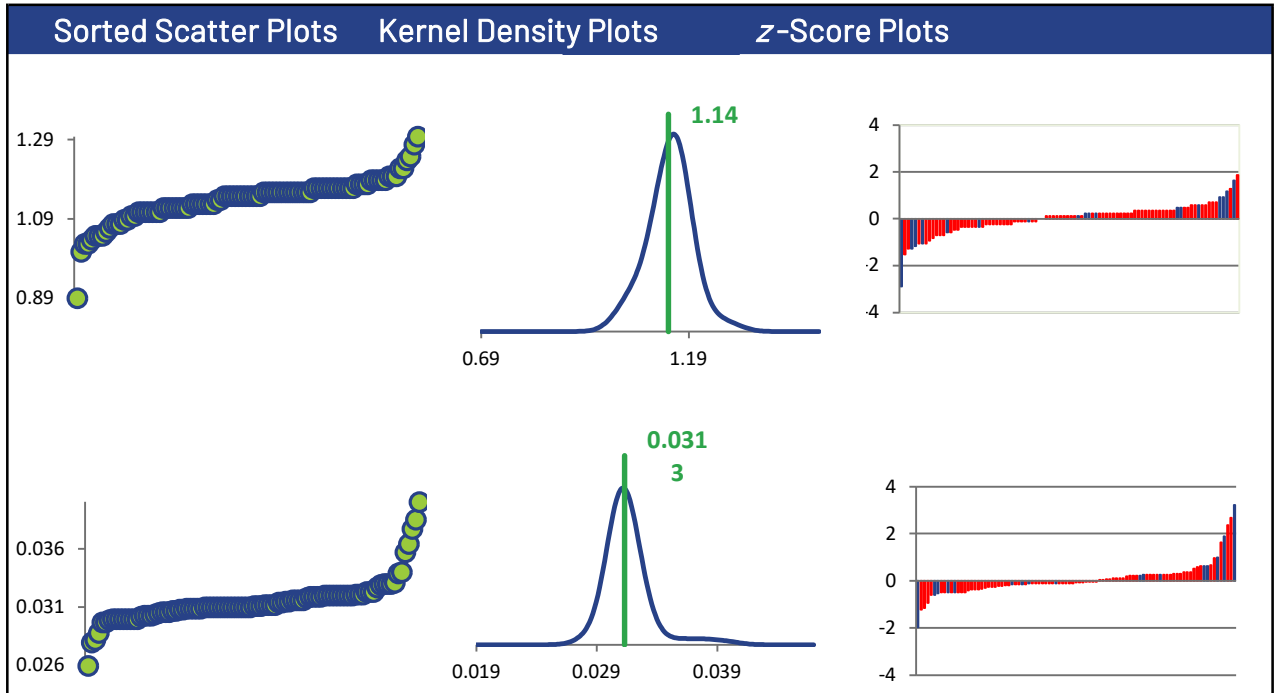
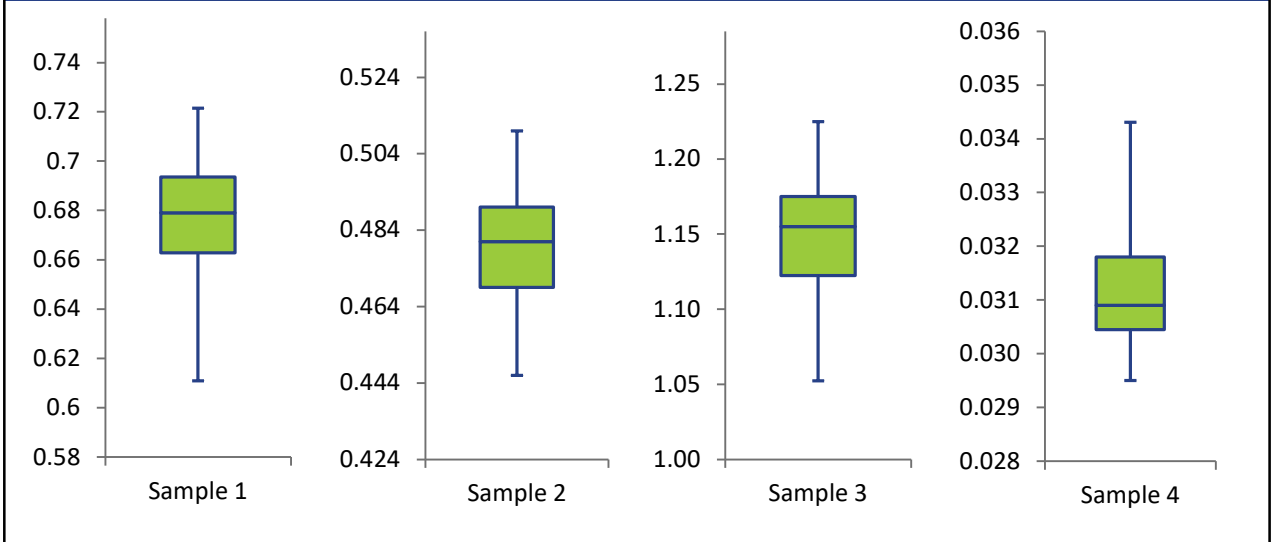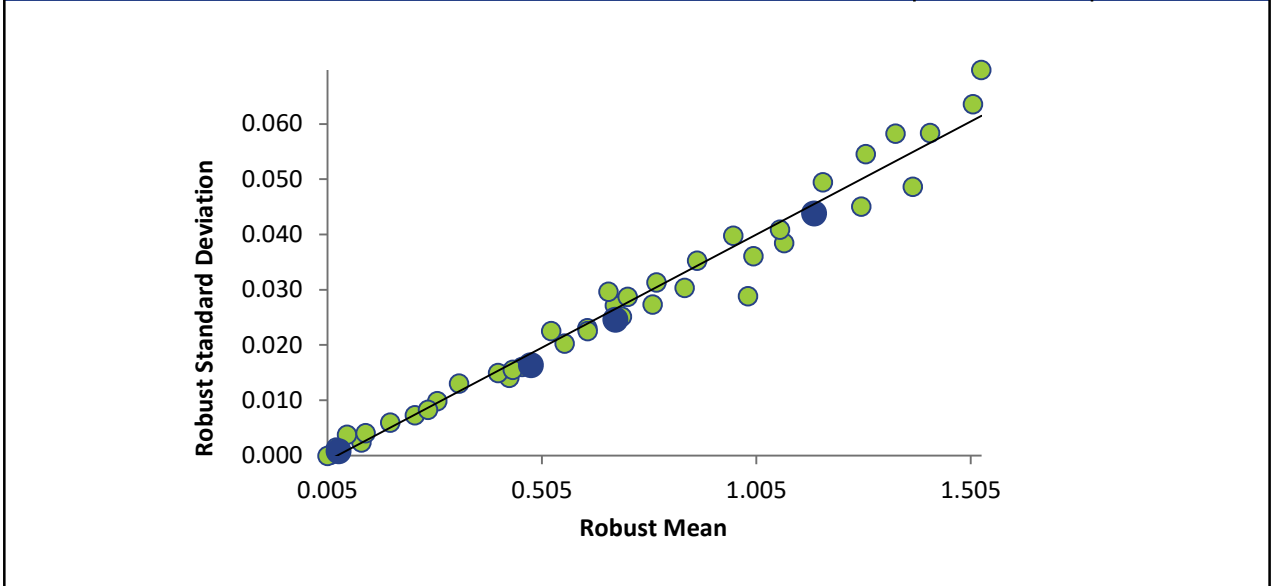## Box and Whisker Plots

Current Round (blue) Compared to Historic Rounds (green)

ZINC

Summary Statistics

Statistic	C02A-1	C02A-2	C02A-3	C02A-4
N	113	111	113	112
Median mg/L	0.925	0.0632	1.34	0.0573
Robust Mean mg/L	0.926	0.0636	1.34	0.0576
U mg/L	0.00456	0.000392	0.00722	0.000356
Robust Standard Deviation mg/L	0.0388	0.00330	0.0614	0.00301
Regression Standard Deviation mg/L	0.0694	0.00477	0.101	0.00432
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA) mg/L	0.0694	0.00477	0.101	0.00432
Outliers	1	2	1	1
|z|>3.0	0	3	0	2
2<|z|<3	1	2	1	2

Methods Used

Method	C02A-1	C02A-2	C02A-3	C02A-4
ICP/OES (Blue)	24	23	24	23
ICP/MS (Red)	86	85	86	86
AA FLAME (Green)	3	3	3	3

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

ZINC

Sorted Scatter Plots	Kernel Density Plots	z-Score Plots

Stability Assessment	Homogeneity Assessment

ZINC

Stability Assessment	Homogeneity Assessment

Stability assessments are regression analysis of reported result against date of analysis.

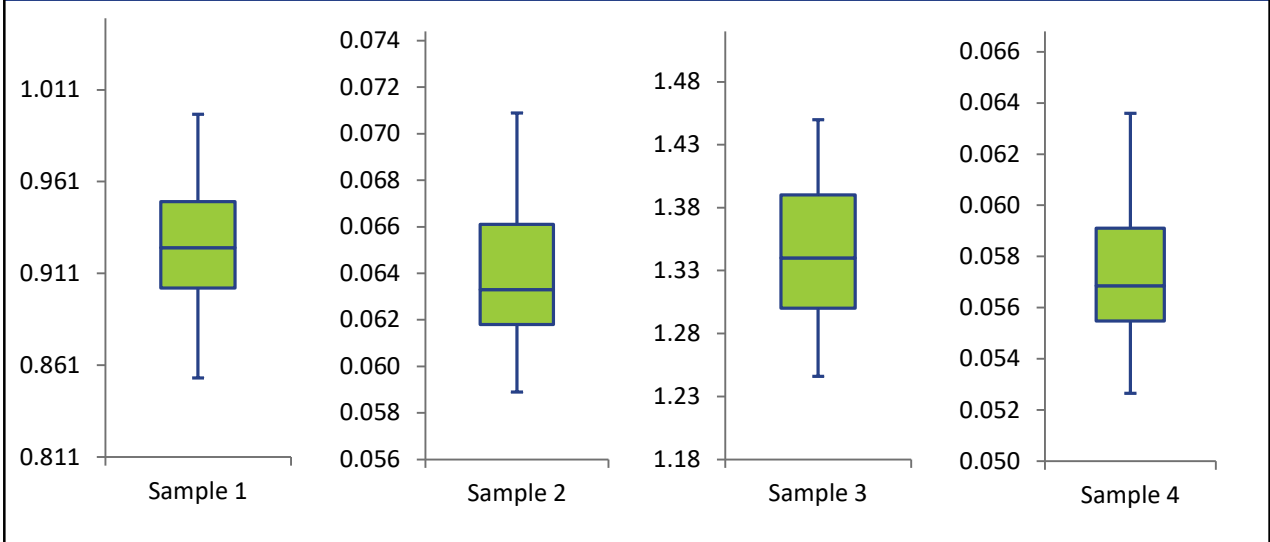Homogeneity assessments are regression analysis of reported result against bottling order.

Box and Whisker Plots

Current Round (blue) Compared to Historic Rounds (green)