

Test Group Summary Report

C73 Residual Solvents in Oil

March 2020 PT Round

Issued: June 16, 2020

Table of Contents

1.0	The Proficiency Testing Report	1
2.0	Definitions	1
3.0	Scoring System	1
3.1	Homogeneity and Stability Assessment	2
3.2	The z score	2
3.2	Composite (PT) Score	2
3.3	Identifying Bias	2
3.4	Deviations from Evaluation Procedure	3
4.0	Study Specific Data Summary	3
4.1	Overall Data Distribution	3
4.2	z-Score Plots	3
4.3	Statistical Summary by Method	3
5.0	Summary by Analyte	4

1.0 The Proficiency Testing Report

The Proficiency Testing Report consists of two parts.

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

2.0 Definitions

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

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

3.0 Scoring System

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

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

3.1 HOMOGENEITY AND STABILITY ASSESSMENT

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

3.2 THE Z SCORE

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

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

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

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

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

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

3.2 COMPOSITE (PT) SCORE

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

Acceptable PT Scores equal or exceed 70.

3.3 IDENTIFYING BIAS

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

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

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

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

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

3.4 DEVIATIONS FROM EVALUATION PROCEDURE

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

4.0 Study Specific Data Summary

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

4.1 OVERALL DATA DISTRIBUTION

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

4.2 z-SCORE PLOTS

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

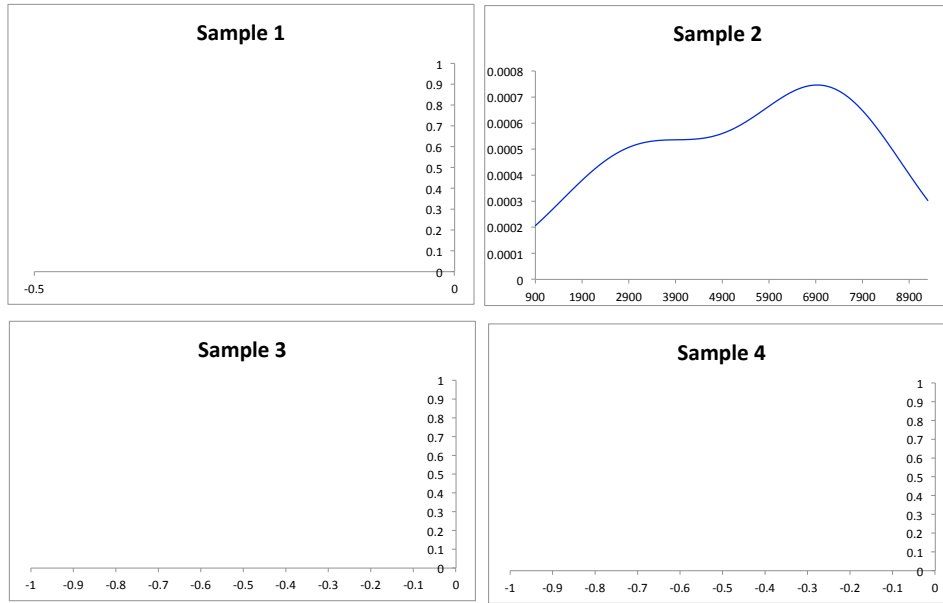
4.3 STATISTICAL SUMMARY BY METHOD

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

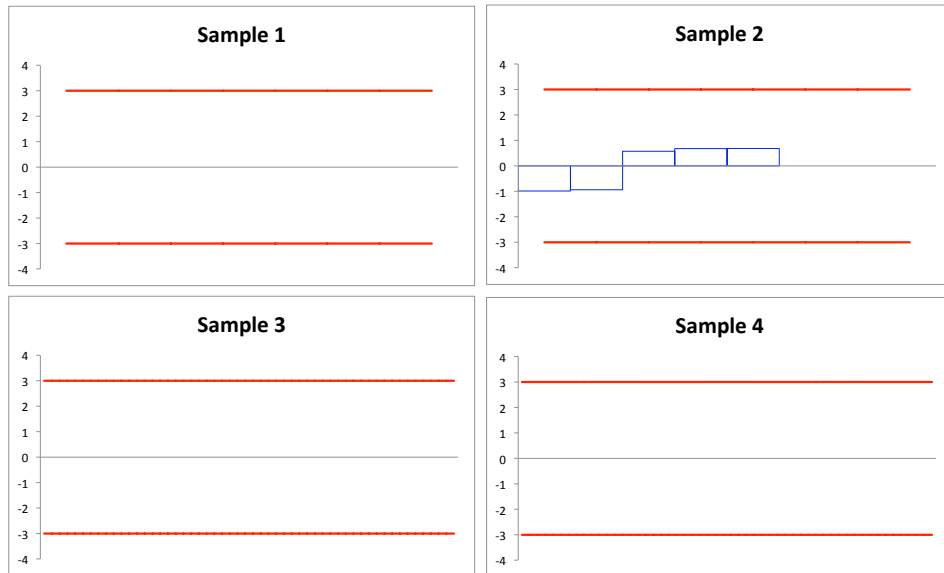
In addition to this, z -Score plots are provided for the four most common methods. As these plots use the Assigned Value and Standard Deviation for Proficiency Assessment estimated using all of the data, any method that does not have approximately the same number of positive and negative z -scores is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

1-Butanol (n-Butanol)

Kernel Density Plots



z-Score Plots

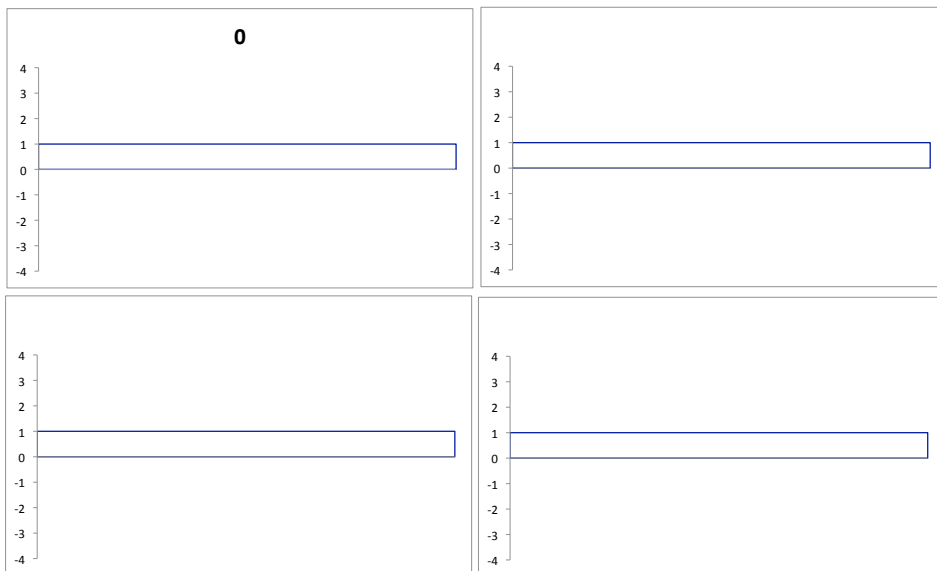


Summary Statistics by Four Most Common Methods

Sample 2					
Method	All*	0			
Median	5490	#NUM!	0	0	0
Stdev	2510	0	0	0	0
Number	5	0	0	0	0
z > 3	0	0	0	0	0
z 2 - 3	0	0	0	0	0

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

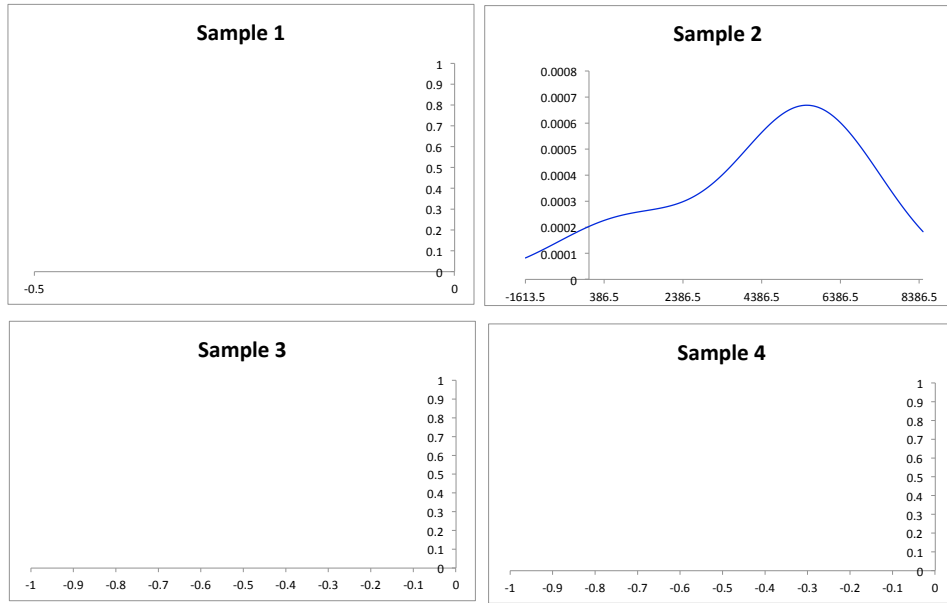
z-Score Plots by Method - Sample 4



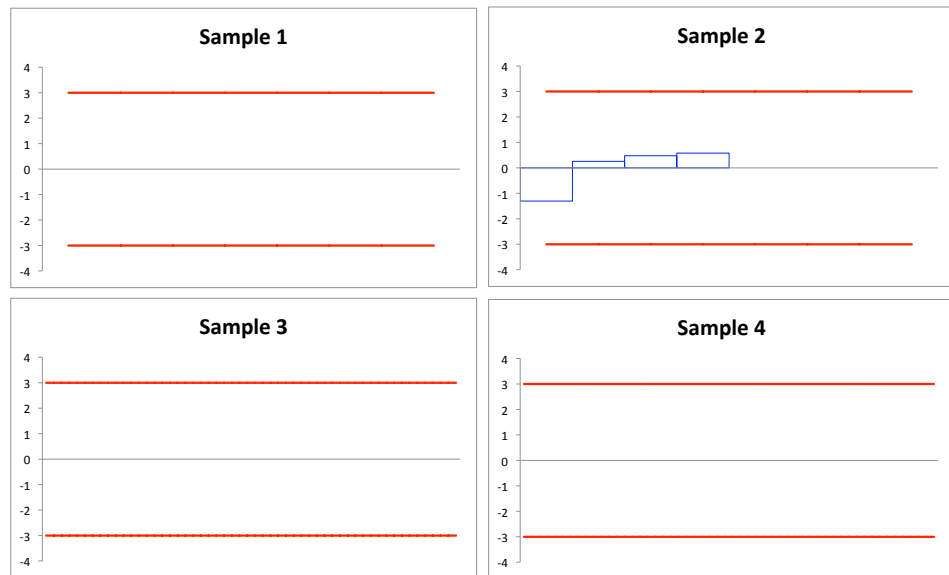
There were too few reported results to provide a valid evaluation.

1-Pentanol

Kernel Density Plots



z-Score Plots

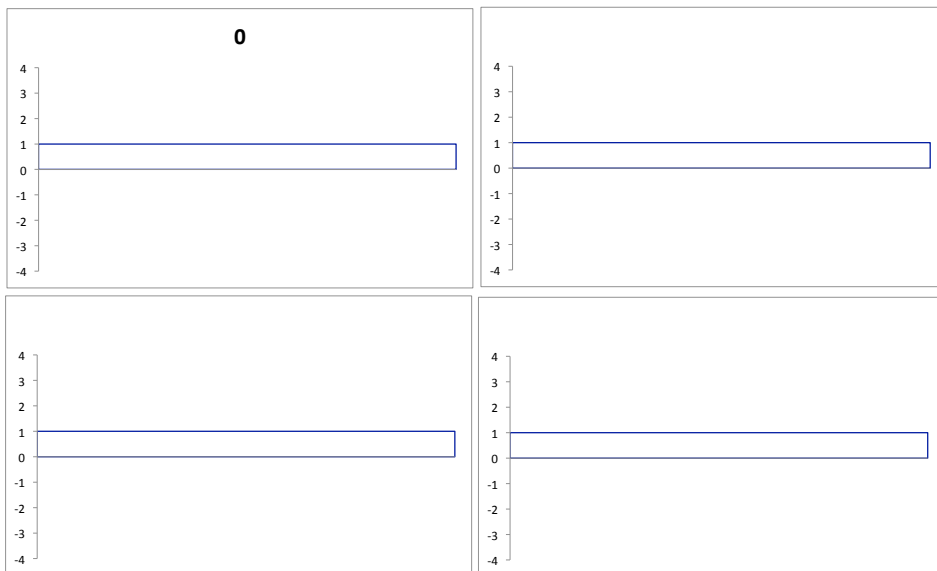


Summary Statistics by Four Most Common Methods

Sample 2					
Method	All*	0			
Median	4410	#NUM!	0	0	0
Stdev	2680	0	0	0	0
Number	4	0	0	0	0
z > 3	0	0	0	0	0
z 2 - 3	0	0	0	0	0

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

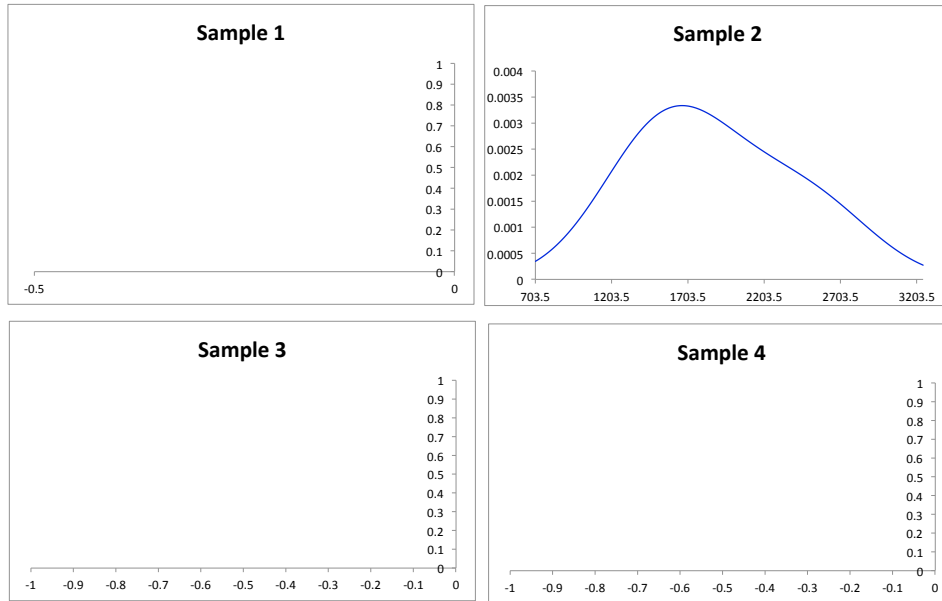
z-Score Plots by Method - Sample 4



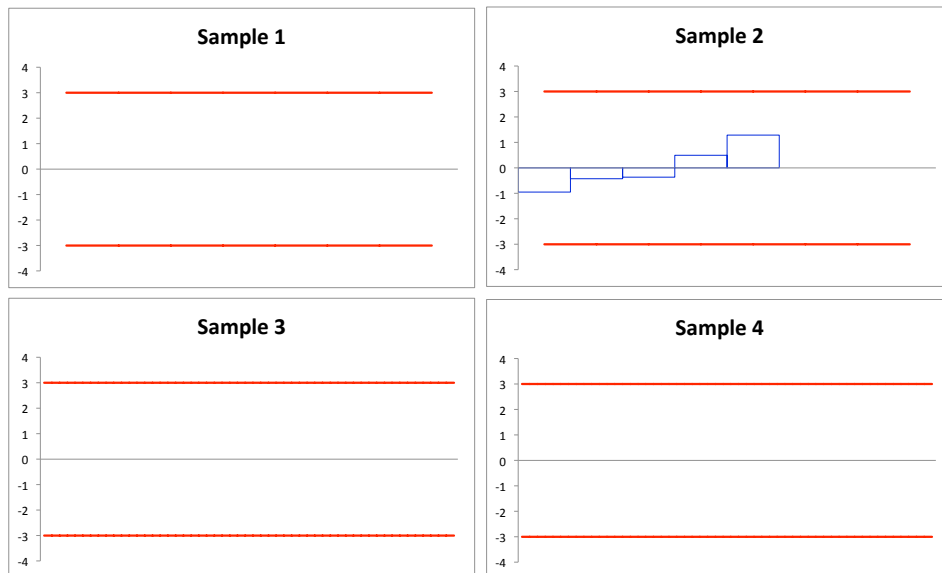
There were too few reported results to provide a valid evaluation.

1-Propanol (Propanol)

Kernel Density Plots



z-Score Plots

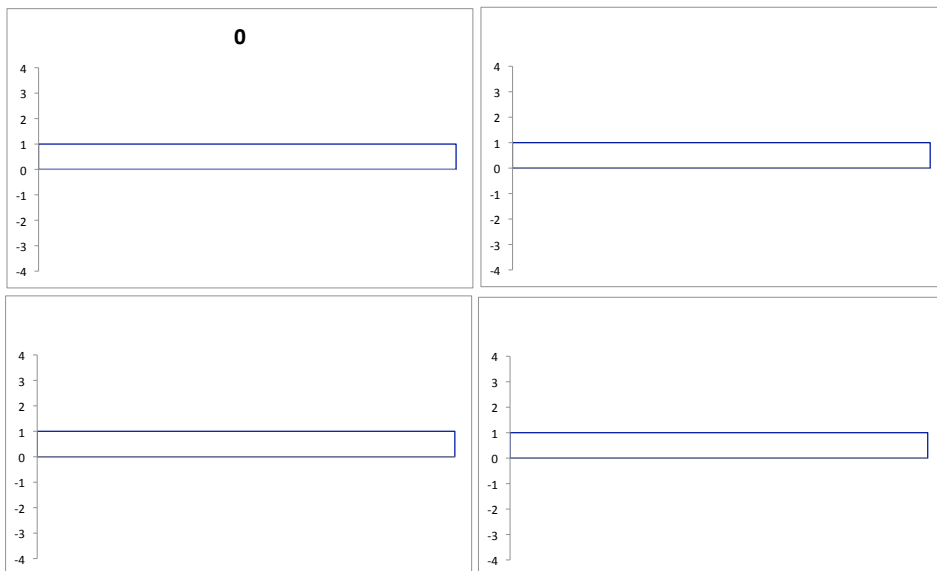


Summary Statistics by Four Most Common Methods

Sample 2					
Method	All*	0			
Median	1880	#NUM!	0	0	0
Stdev	569	0	0	0	0
Number	5	0	0	0	0
z > 3	0	0	0	0	0
z 2 - 3	0	0	0	0	0

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

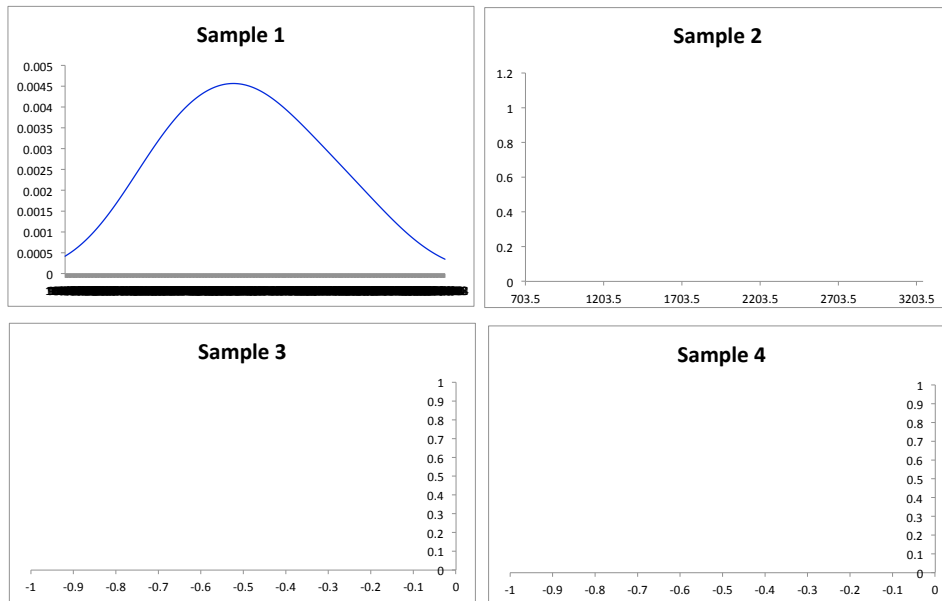
z-Score Plots by Method - Sample 4



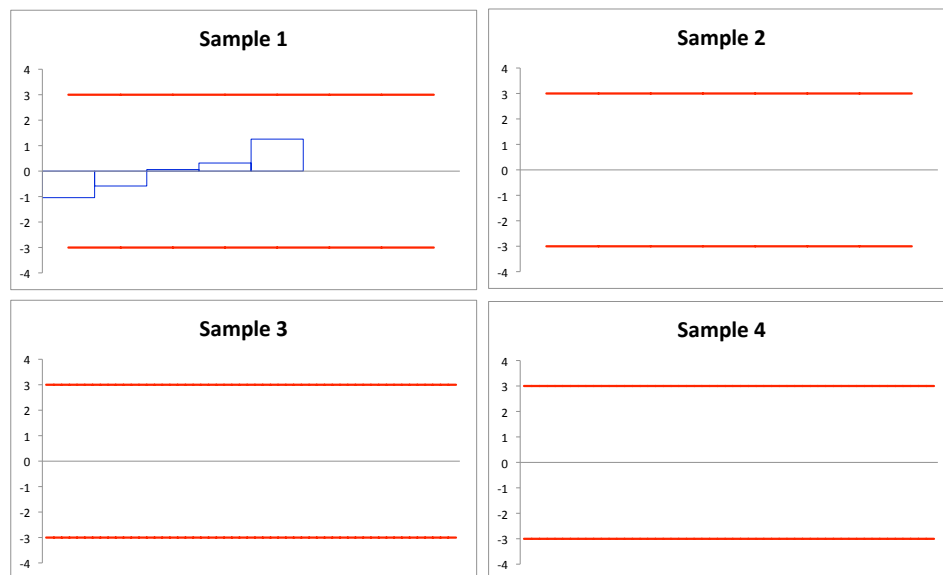
There were too few reported results to provide a valid evaluation.

2-Propanol (Isopropyl alcohol)

Kernel Density Plots



z-Score Plots

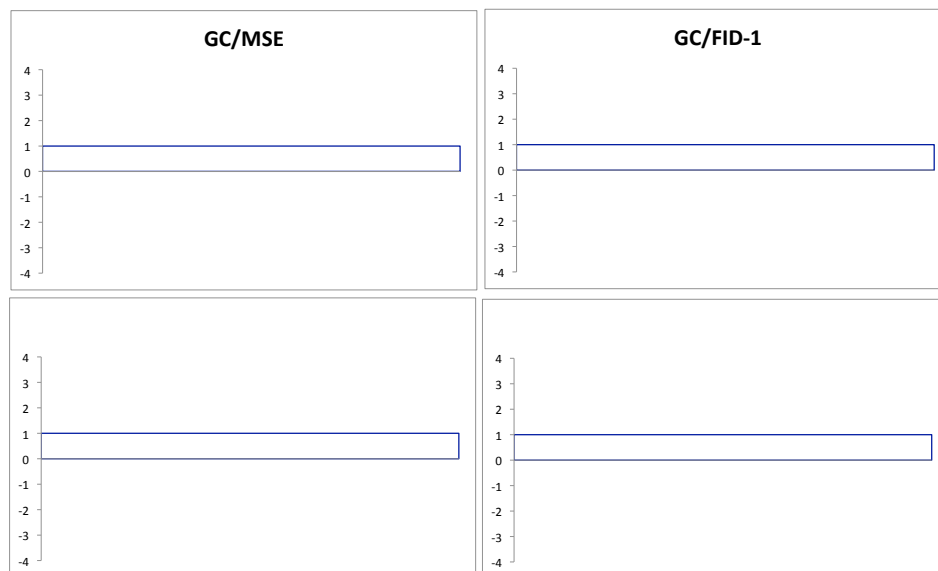


Summary Statistics by Four Most Common Methods

Sample 1					
Method	All*	GC/MSE	GC/FID-1		
Median	974	#NUM!	0	0	0
Stdev	402	0	0	0	0
Number	0	0	0	0	0
z >3	0	0	0	0	0
z 2 - 3	0	0	0	0	0

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

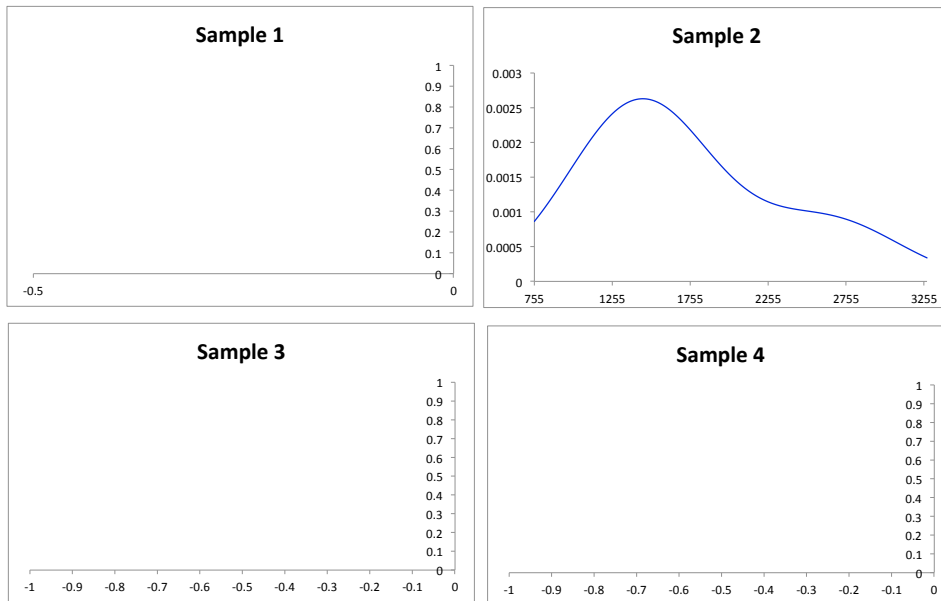
z-Score Plots by Method - Sample 4



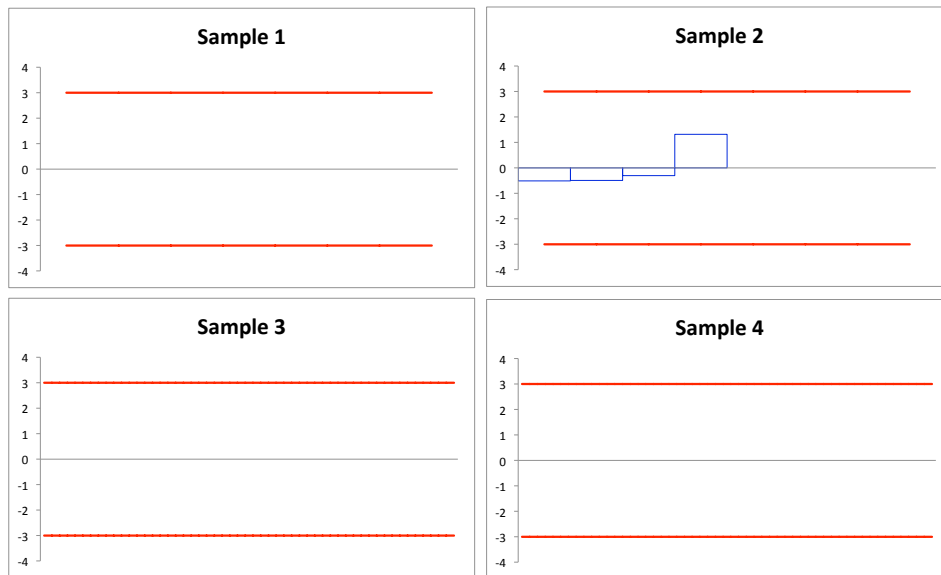
There were too few reported results to provide a valid evaluation.

3-Methyl-1-butanol

Kernel Density Plots



z-Score Plots

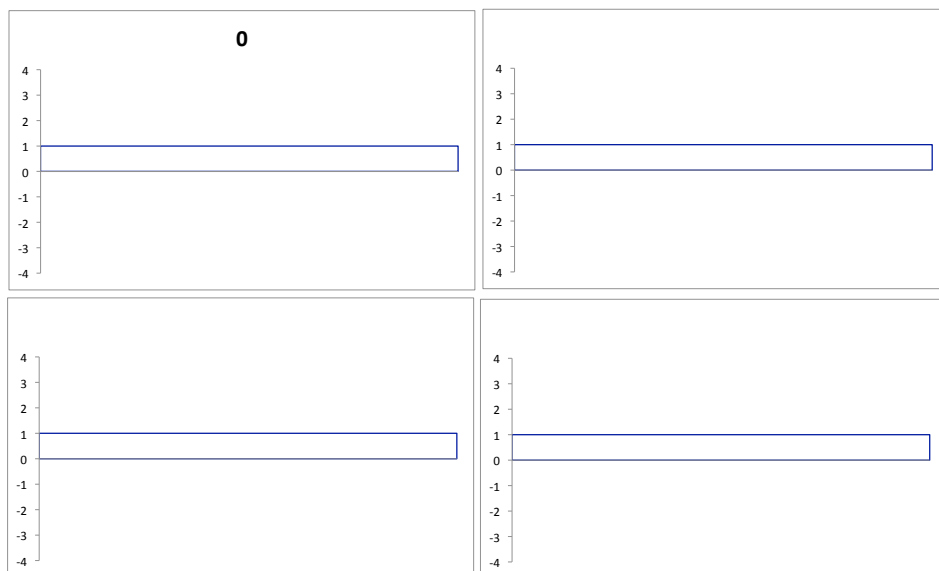


Summary Statistics by Four Most Common Methods

Sample 2					
Method	All*	0			
Median	1740	#NUM!	0	0	0
Stdev	688	0	0	0	0
Number	4	0	0	0	0
z > 3	0	0	0	0	0
z 2 - 3	0	0	0	0	0

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

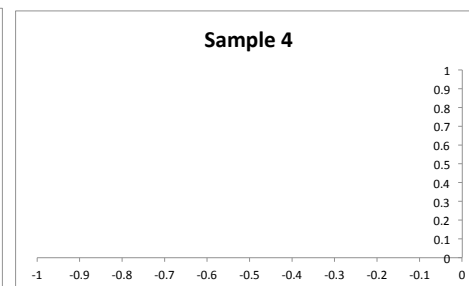
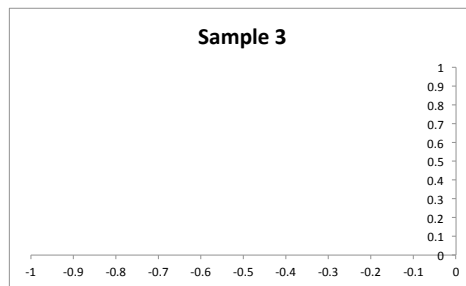
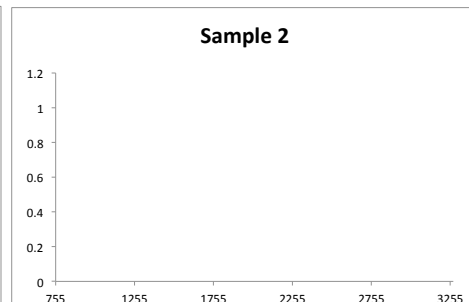
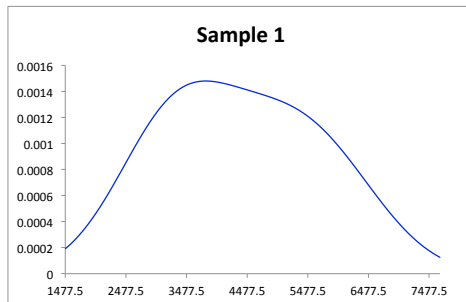
z-Score Plots by Method - Sample 4



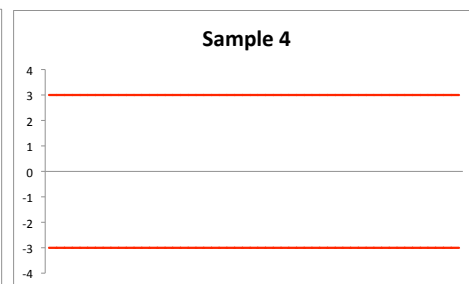
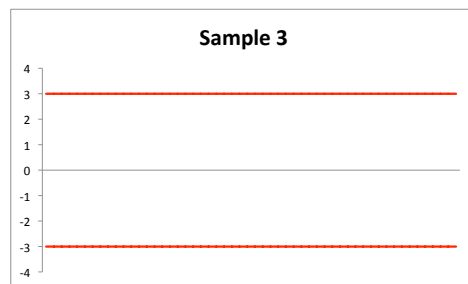
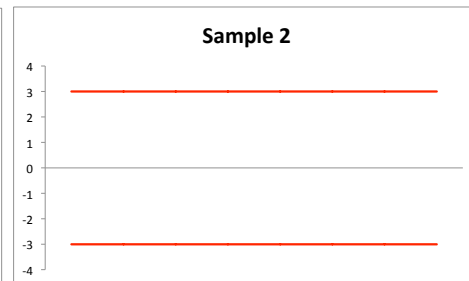
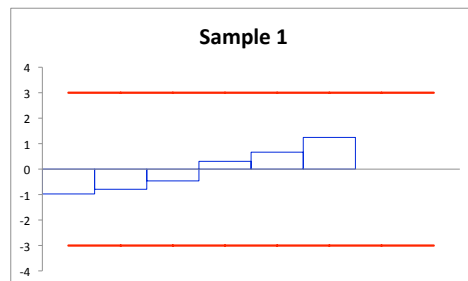
There were too few reported results to provide a valid evaluation.

Acetone (2-Propanone)

Kernel Density Plots



z-Score Plots

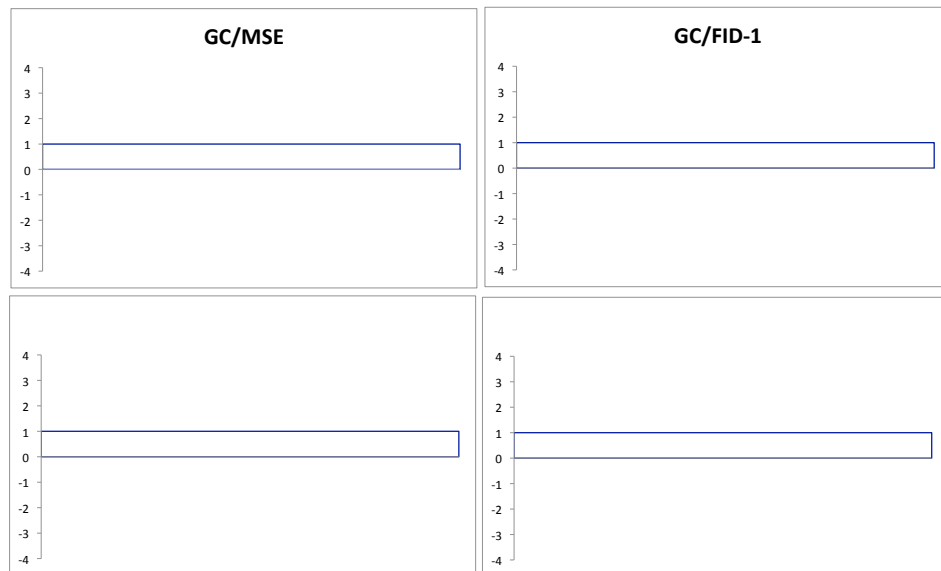


Summary Statistics by Four Most Common Methods

Sample 1					
Method	All*	GC/MSE	GC/FID-1		
Median	4380	4800	3280	0	0
Stdev	1390	1230	0	0	0
Number	6	5	1	0	0
z > 3	0	0	0	0	0
z 2 - 3	0	0	0	0	0

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

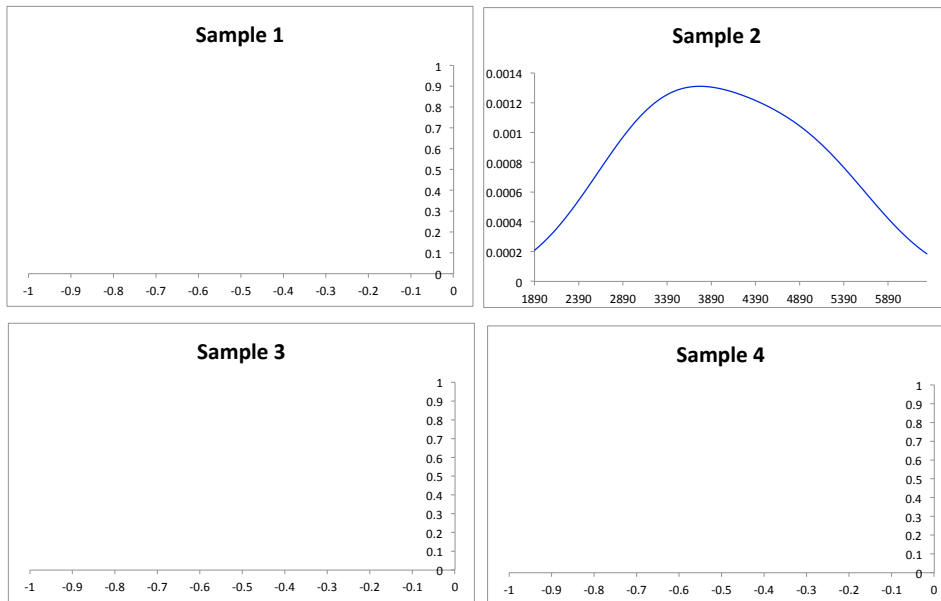
z-Score Plots by Method - Sample 4



There were too few reported results to provide a valid evaluation.

Butane

Kernel Density Plots



z-Score Plots

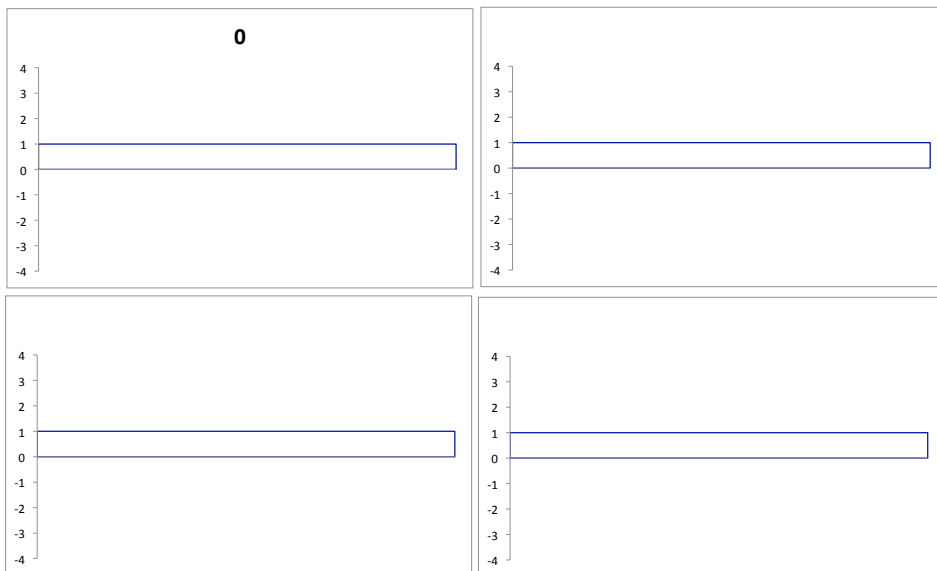


Summary Statistics by Four Most Common Methods

Sample 2					
Method	All*	0			
Median	4040	#NUM!	0	0	0
Stdev	1100	0	0	0	0
Number	4	0	0	0	0
z > 3	0	0	0	0	0
z 2 - 3	0	0	0	0	0

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

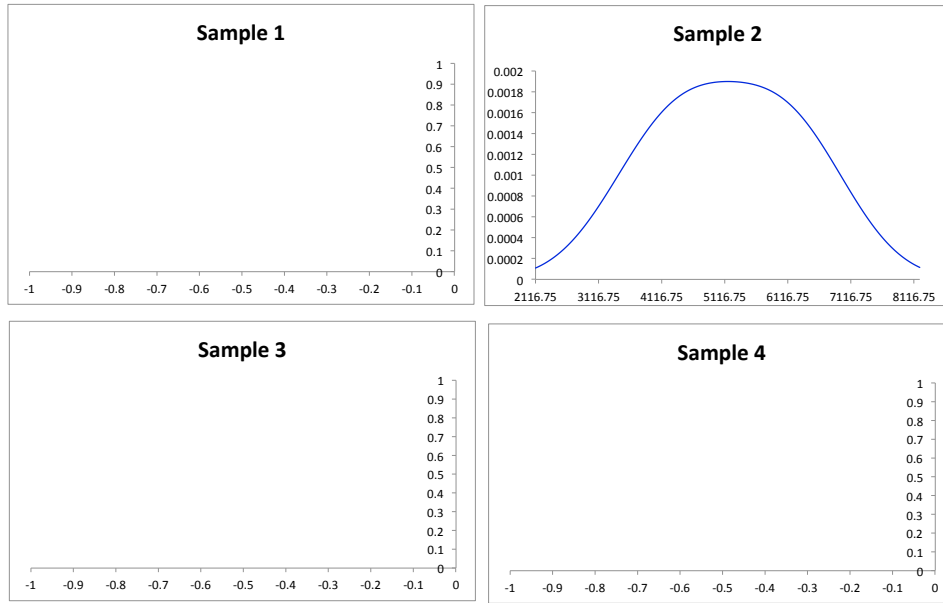
z-Score Plots by Method - Sample 4



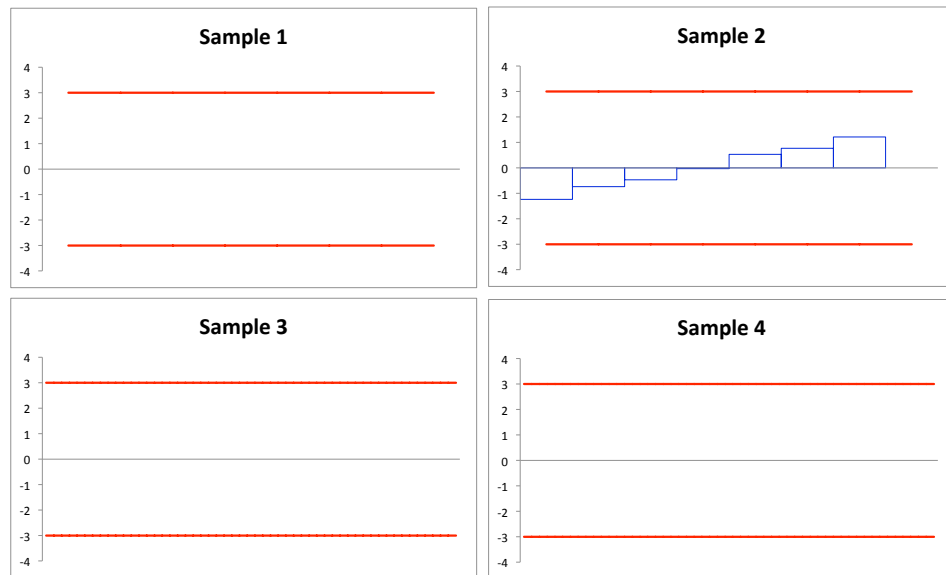
There were too few reported results to provide a valid evaluation.

Ethanol

Kernel Density Plots



z-Score Plots

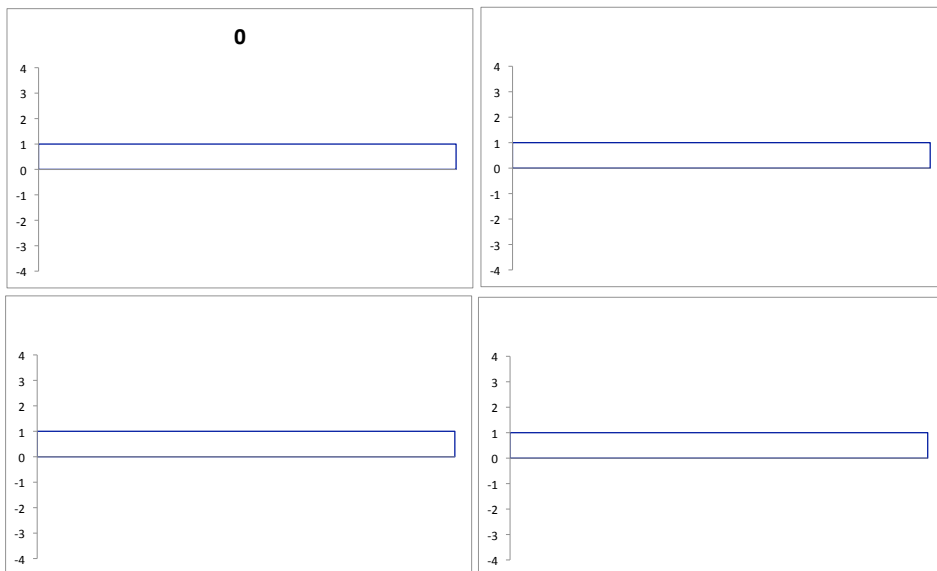


Summary Statistics by Four Most Common Methods

Sample 2					
Method	All*	0			
Median	5180	#NUM!	0	0	0
Stdev	1240	0	0	0	0
Number	7	0	0	0	0
z > 3	0	0	0	0	0
z 2 - 3	0	0	0	0	0

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

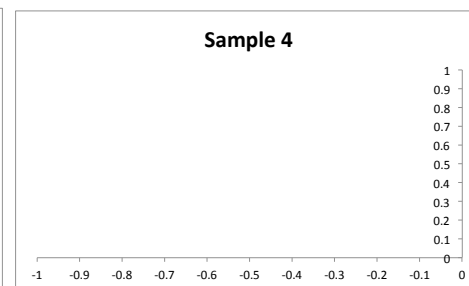
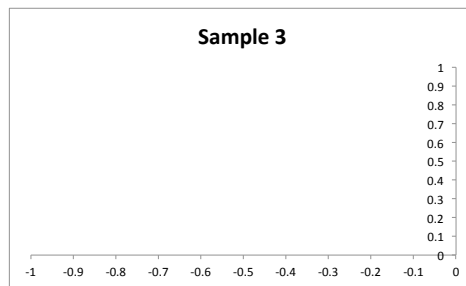
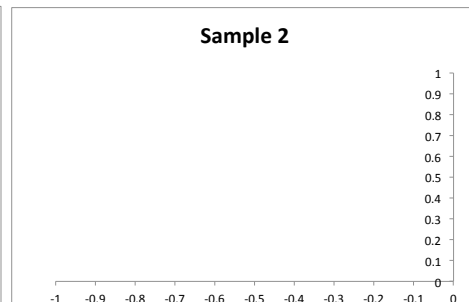
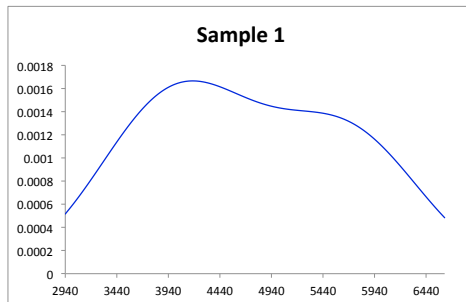
z-Score Plots by Method - Sample 4



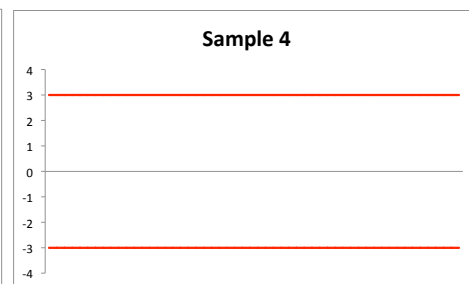
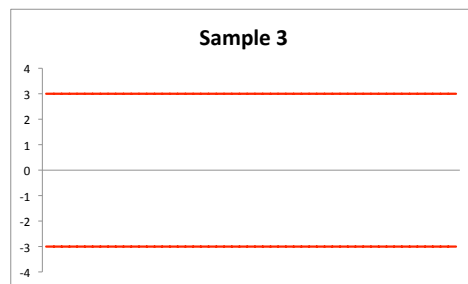
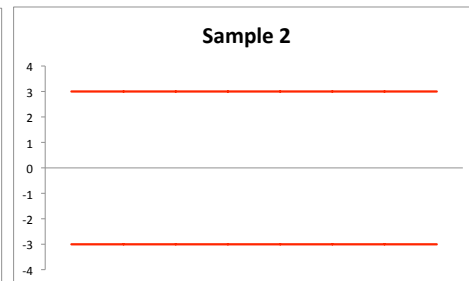
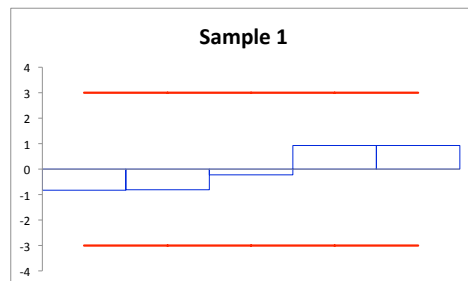
There were too few reported results to provide a valid evaluation.

Ethyl acetate

Kernel Density Plots



z-Score Plots

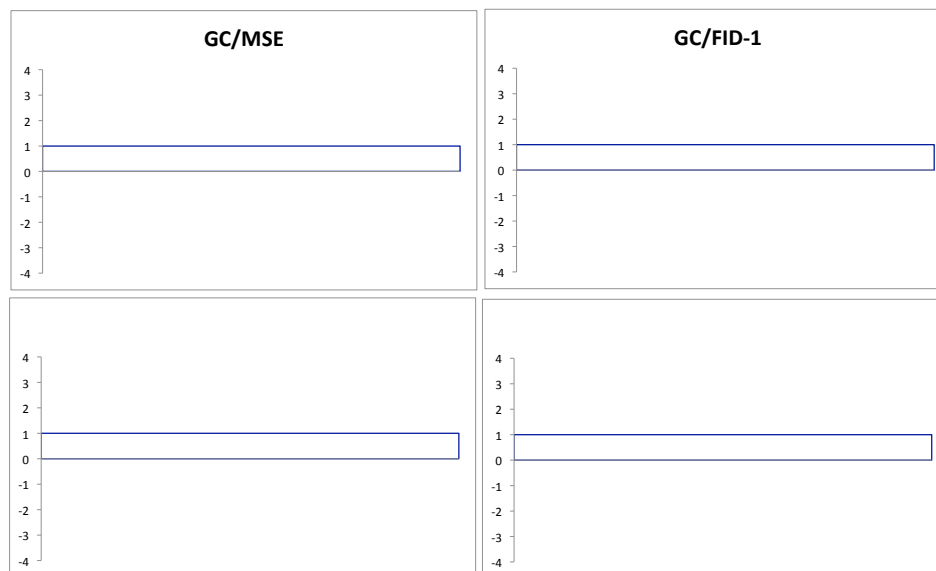


Summary Statistics by Four Most Common Methods

Sample 1					
Method	All*	GC/MSE	GC/FID-1		
Median	4730	4790	4490	0	0
Stdev	1050	1060	0	0	0
Number	5	4	1	0	0
z > 3	0	0	0	0	0
z 2 - 3	0	0	0	0	0

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

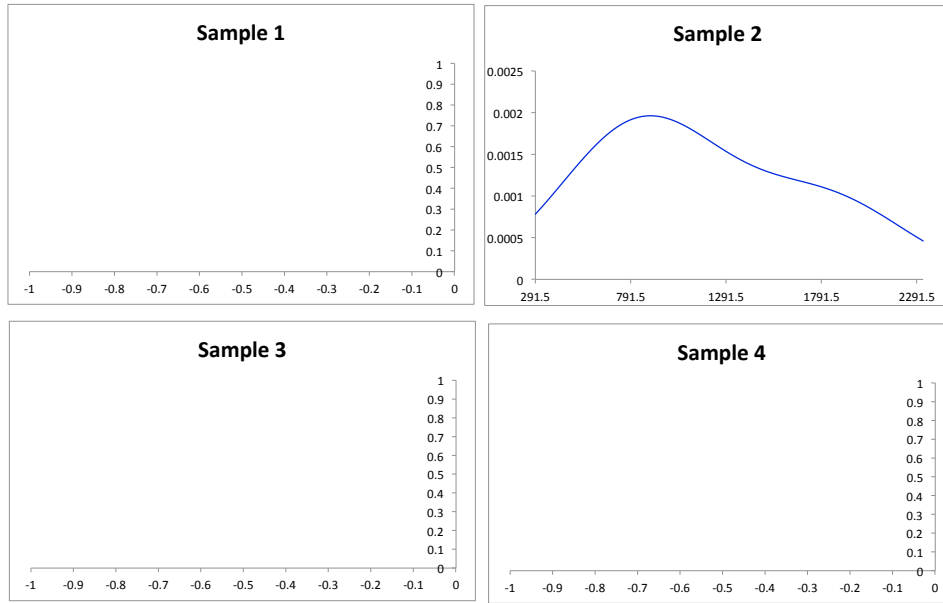
z-Score Plots by Method - Sample 4



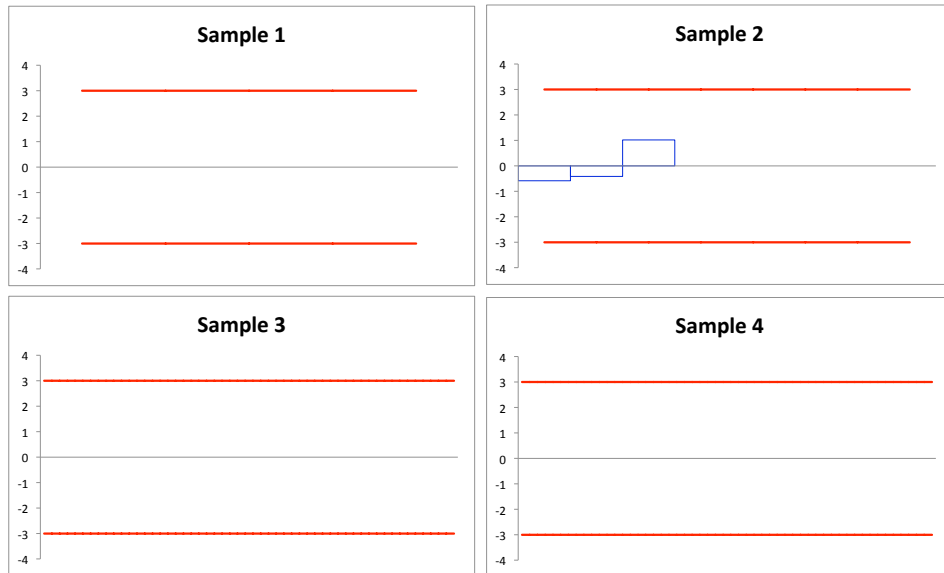
There were too few reported results to provide a valid evaluation.

Ethyl ether

Kernel Density Plots



z-Score Plots

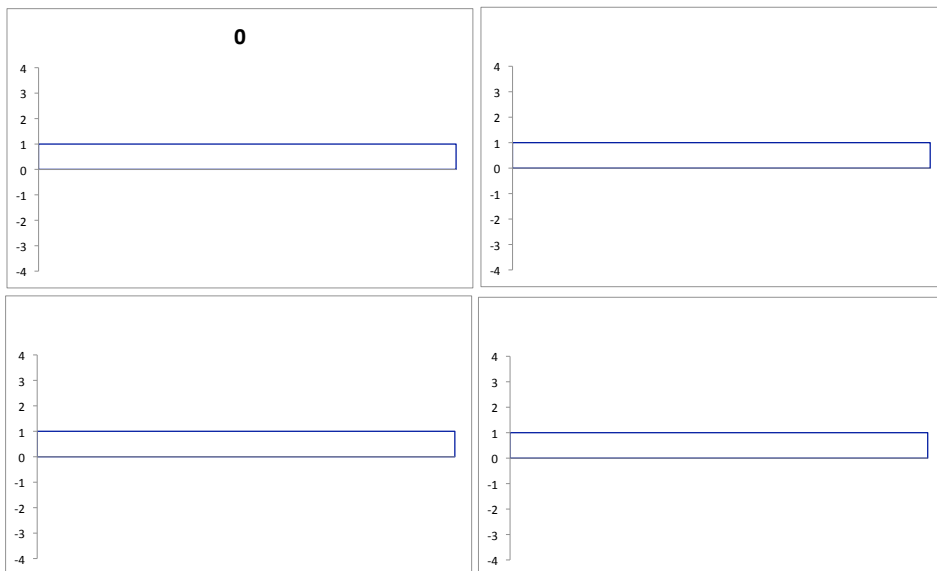


Summary Statistics by Four Most Common Methods

Sample 2					
Method	All*	0			
Median	1170	#NUM!	0	0	0
Stdev	634	0	0	0	0
Number	3	0	0	0	0
z > 3	0	0	0	0	0
z 2 - 3	0	0	0	0	0

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

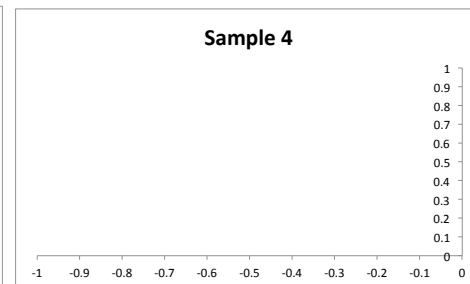
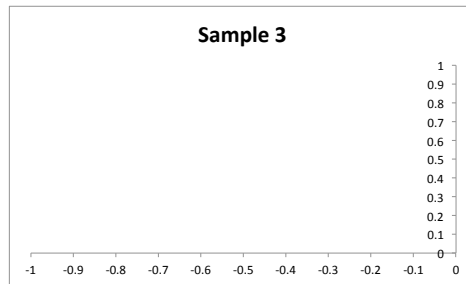
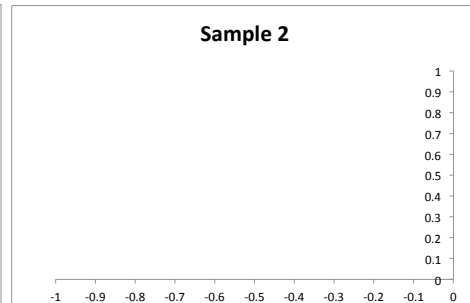
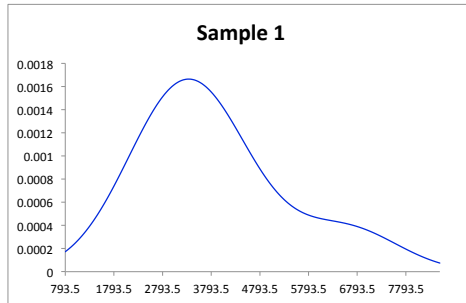
z-Score Plots by Method - Sample 4



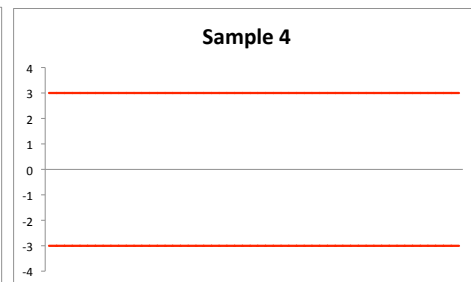
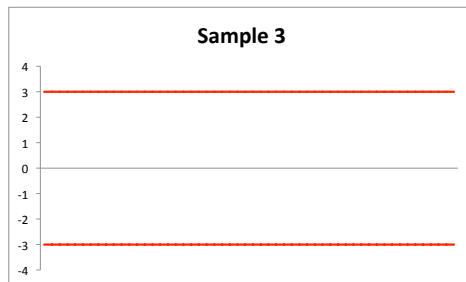
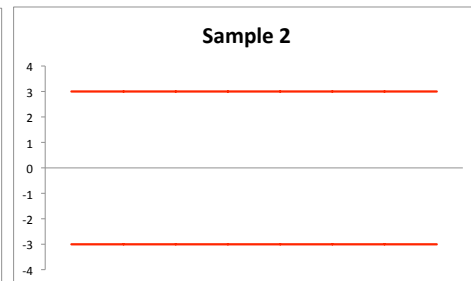
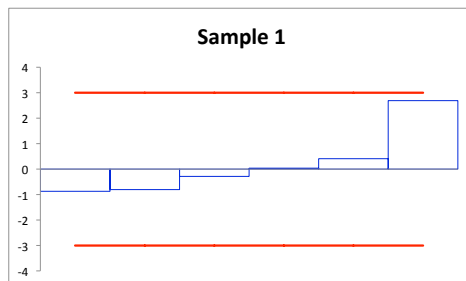
There were too few reported results to provide a valid evaluation.

Heptane

Kernel Density Plots



z-Score Plots

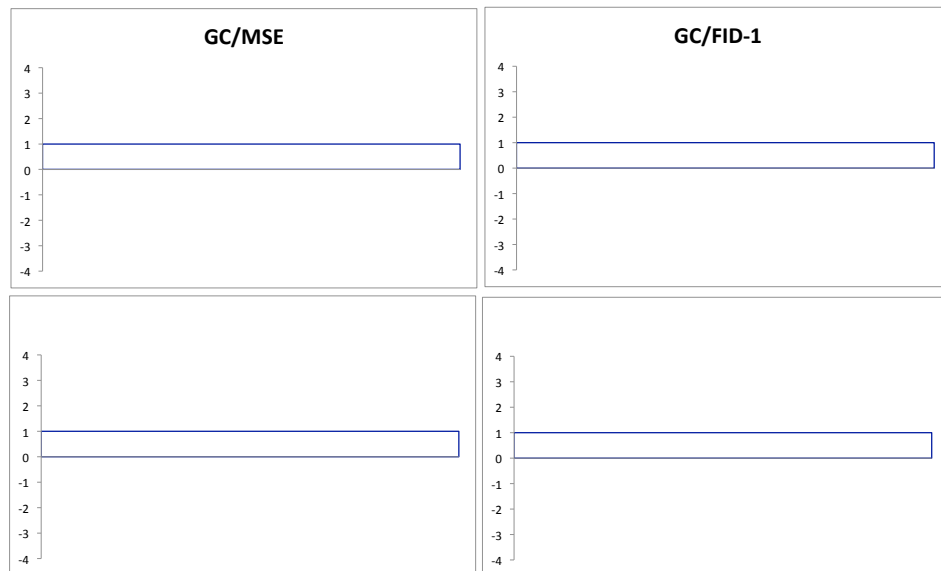


Summary Statistics by Four Most Common Methods

Sample 1					
Method	All*	GC/MSE	GC/FID-1		
Median	3660	3700	2790	0	0
Stdev	1080	1480	0	0	0
Number	6	5	1	0	0
z > 3	0	0	0	0	0
z 2 - 3	1	1	0	0	0

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

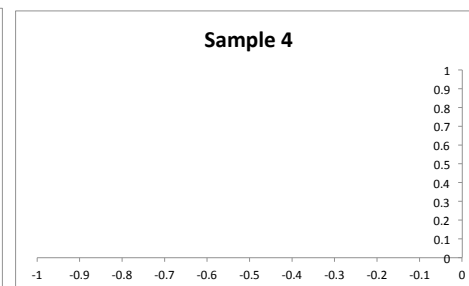
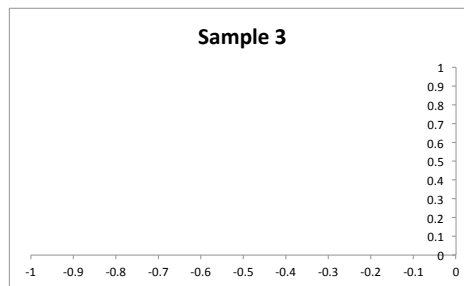
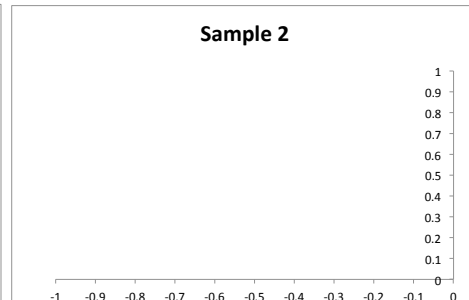
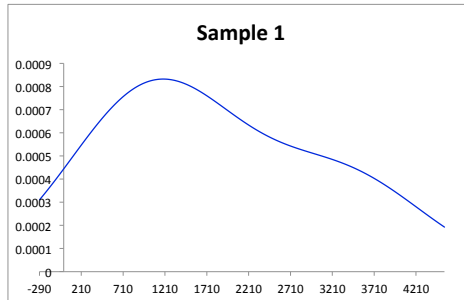
z-Score Plots by Method - Sample 4



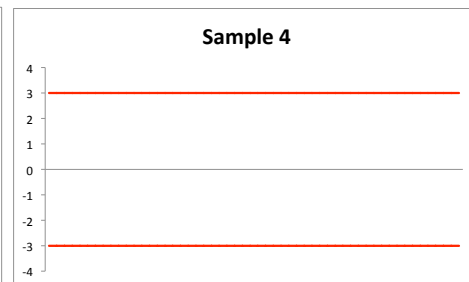
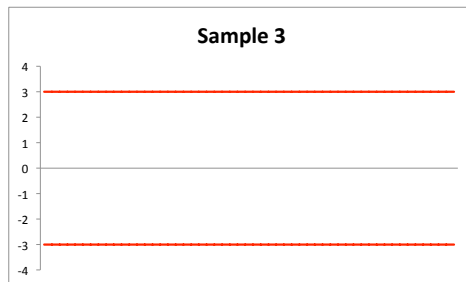
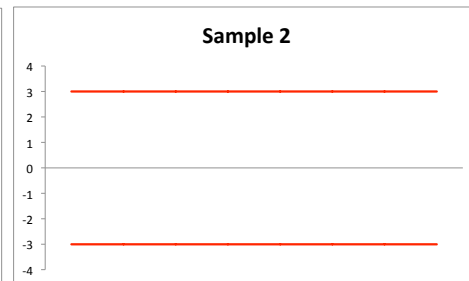
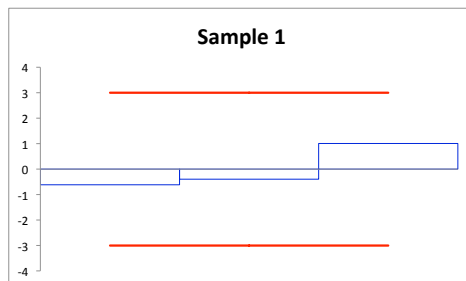
There were too few reported results to provide a valid evaluation.

Isobutanol (2-Methyl-1-propanol)

Kernel Density Plots



z-Score Plots

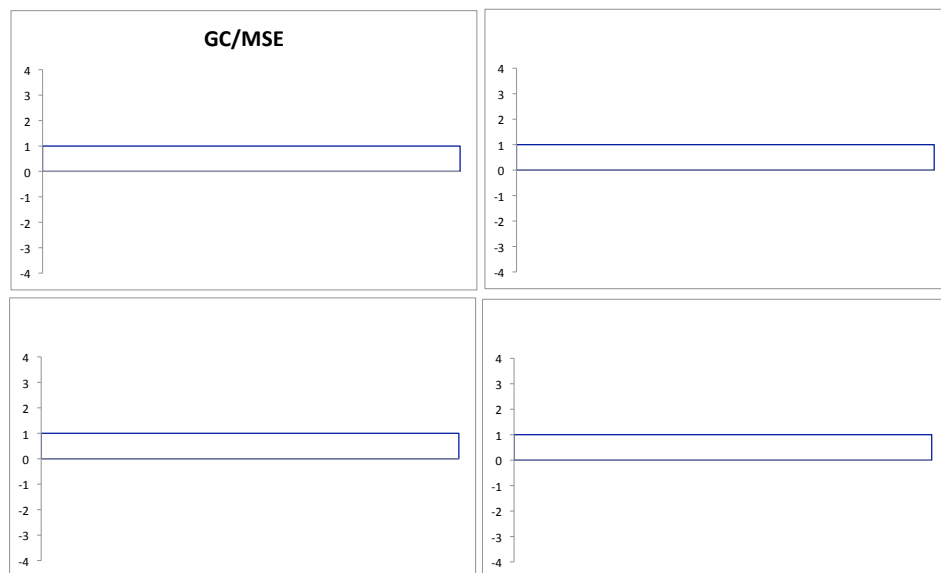


Summary Statistics by Four Most Common Methods

Sample 1					
Method	All*	GC/MSE			
Median	1840	1250	0	0	0
Stdev	1490	1310	0	0	0
Number	3	3	0	0	0
z > 3	0	0	0	0	0
z 2 - 3	0	0	0	0	0

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

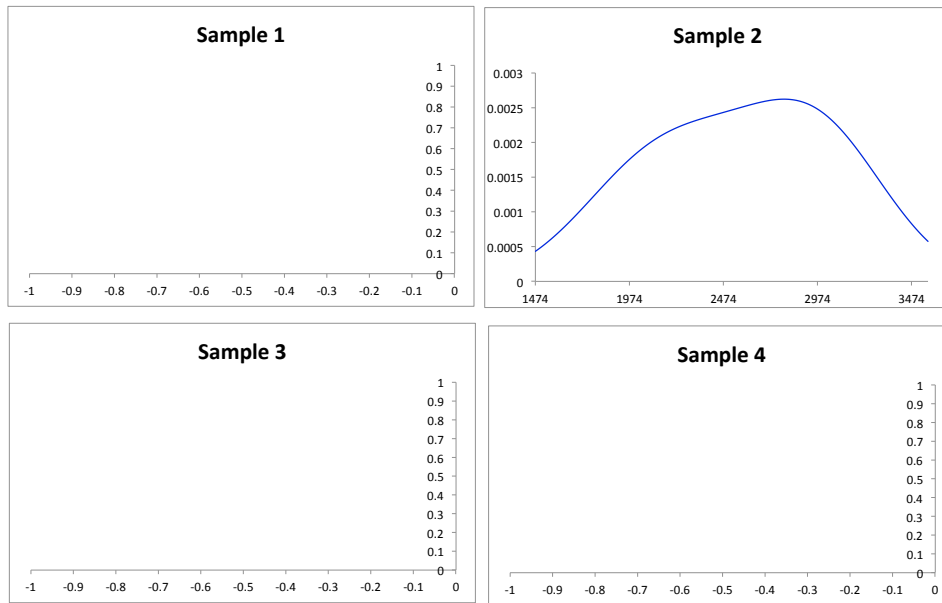
z-Score Plots by Method - Sample 4



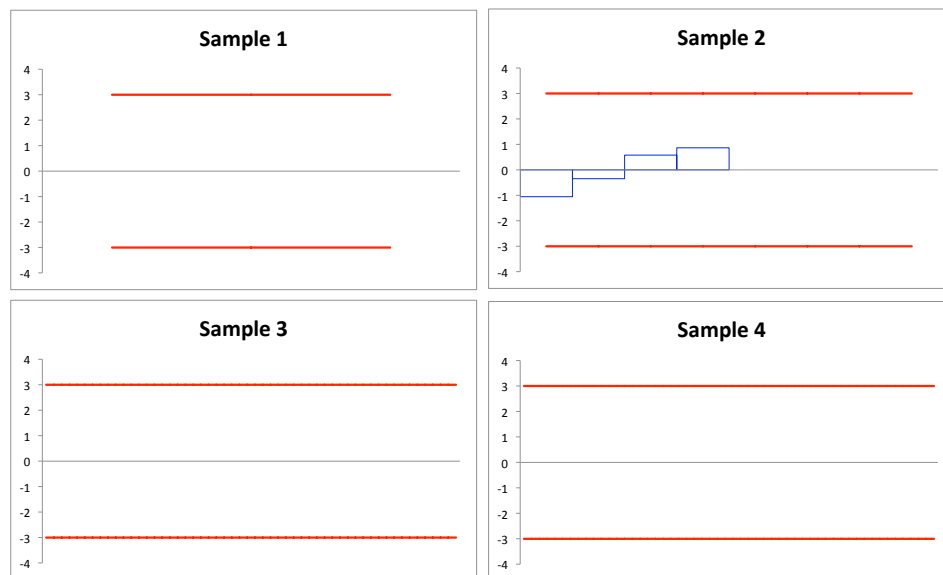
There were too few reported results to provide a valid evaluation.

Isobutyl acetate

Kernel Density Plots



z-Score Plots

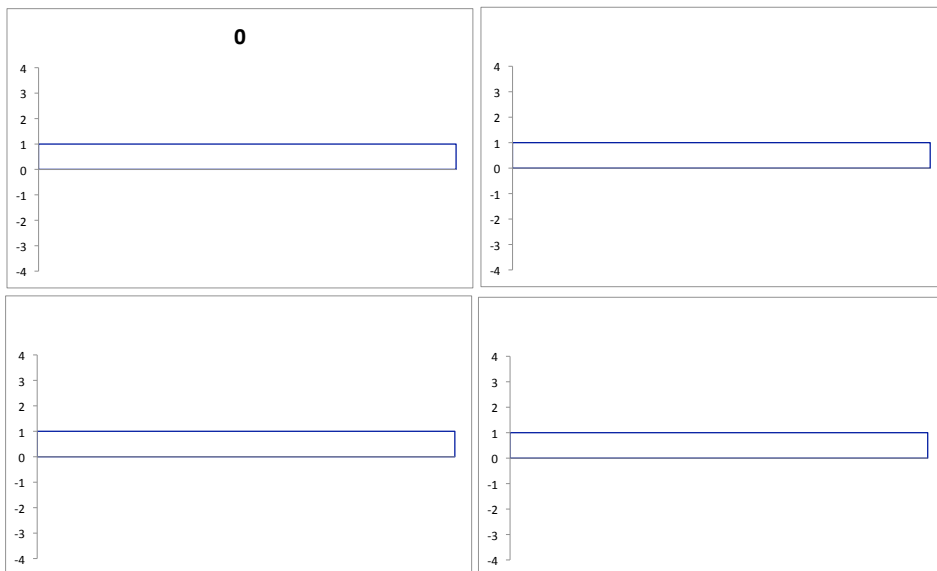


Summary Statistics by Four Most Common Methods

Sample 2					
Method	All*	0			
Median	2570	#NUM!	0	0	0
Stdev	542	0	0	0	0
Number	4	0	0	0	0
z > 3	0	0	0	0	0
z 2 - 3	0	0	0	0	0

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

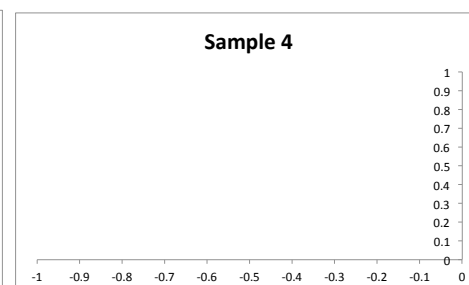
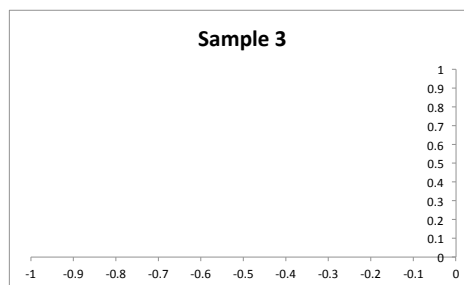
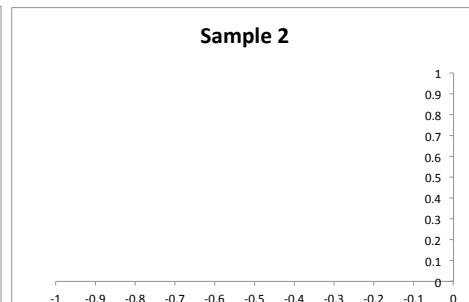
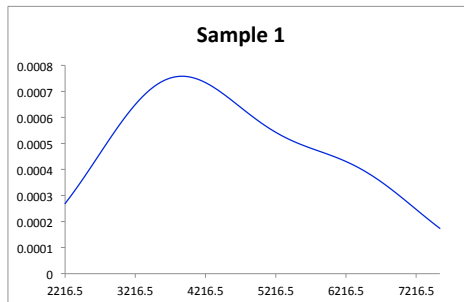
z-Score Plots by Method - Sample 4



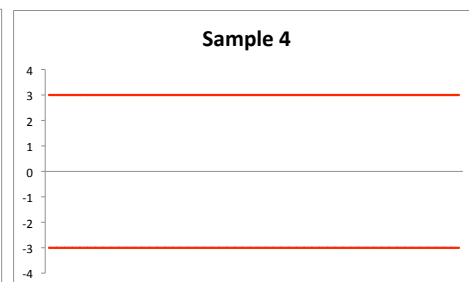
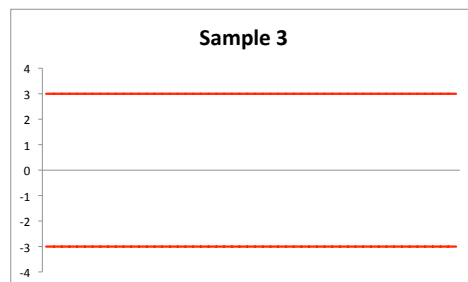
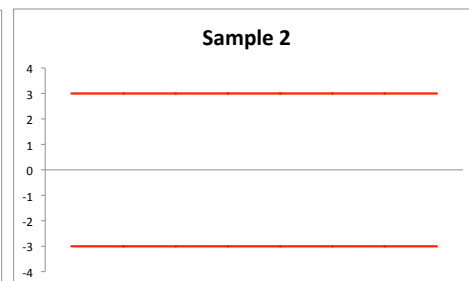
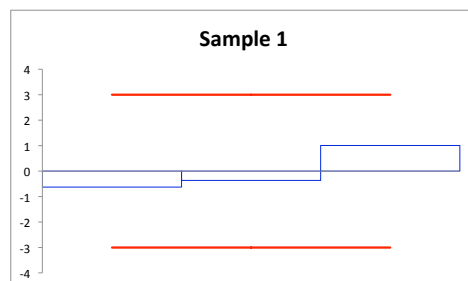
There were too few reported results to provide a valid evaluation.

Isopropyl acetate

Kernel Density Plots



z-Score Plots

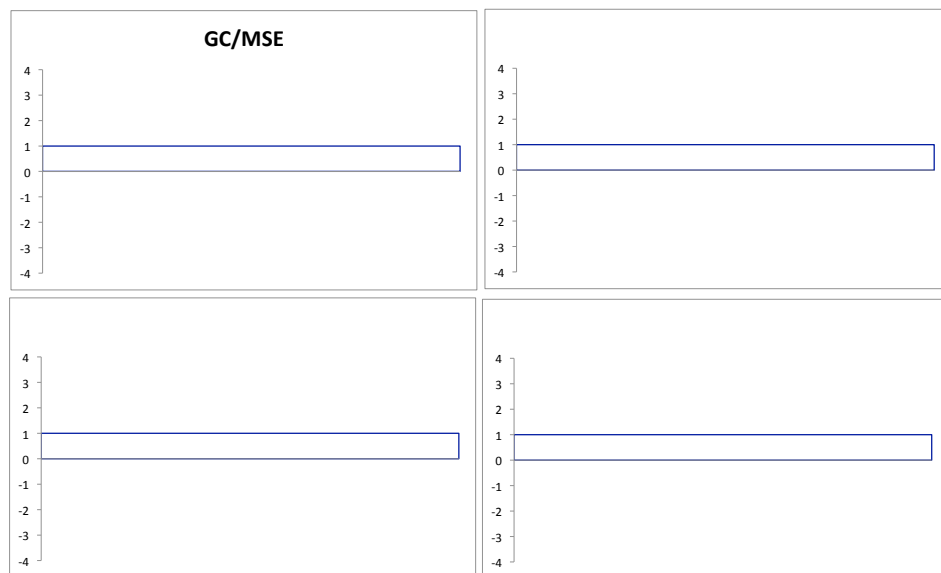


Summary Statistics by Four Most Common Methods

Sample 1					
Method	All*	GC/MSE			
Median	4580	3980	0	0	0
Stdev	1630	1430	0	0	0
Number	3	3	0	0	0
z > 3	0	0	0	0	0
z 2 - 3	0	0	0	0	0

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

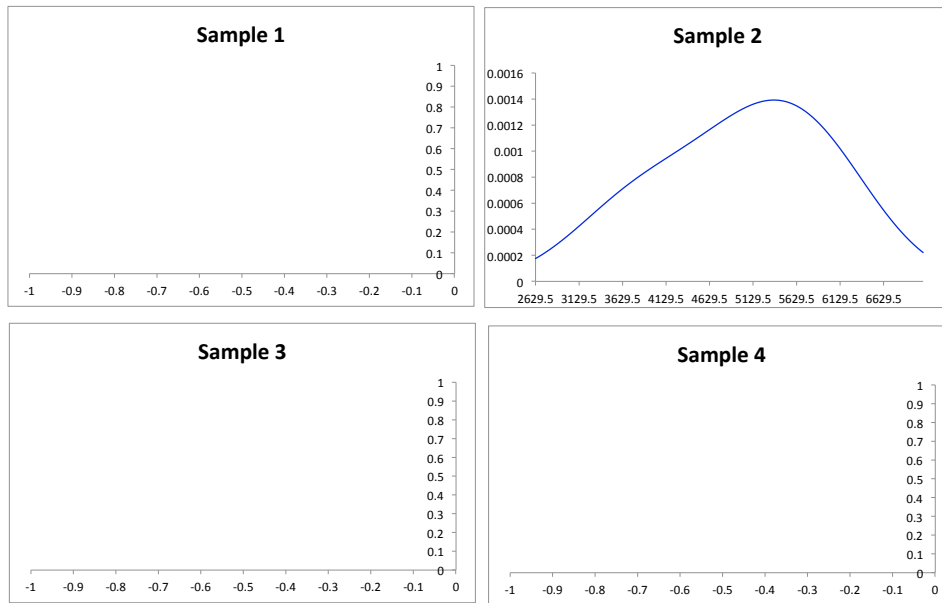
z-Score Plots by Method - Sample 4



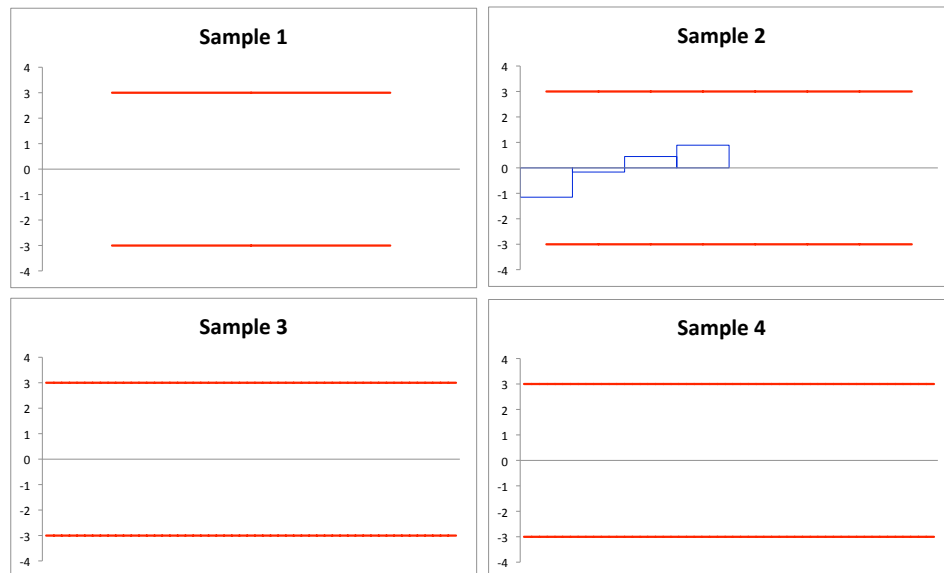
There were too few reported results to provide a valid evaluation.

Methyl acetate

Kernel Density Plots



z-Score Plots

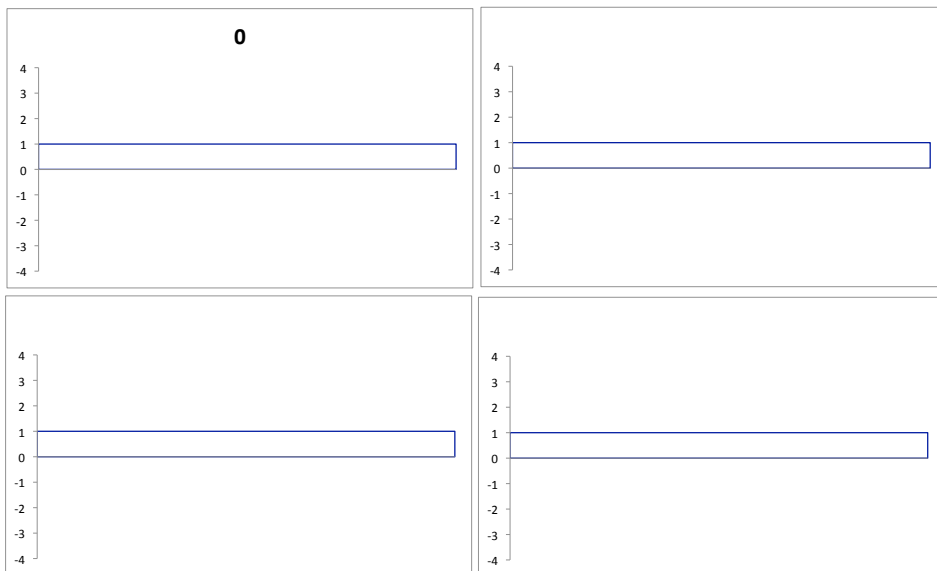


Summary Statistics by Four Most Common Methods

Sample 2					
Method	All*	0			
Median	5000	#NUM!	0	0	0
Stdev	1090	0	0	0	0
Number	4	0	0	0	0
z > 3	0	0	0	0	0
z 2 - 3	0	0	0	0	0

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

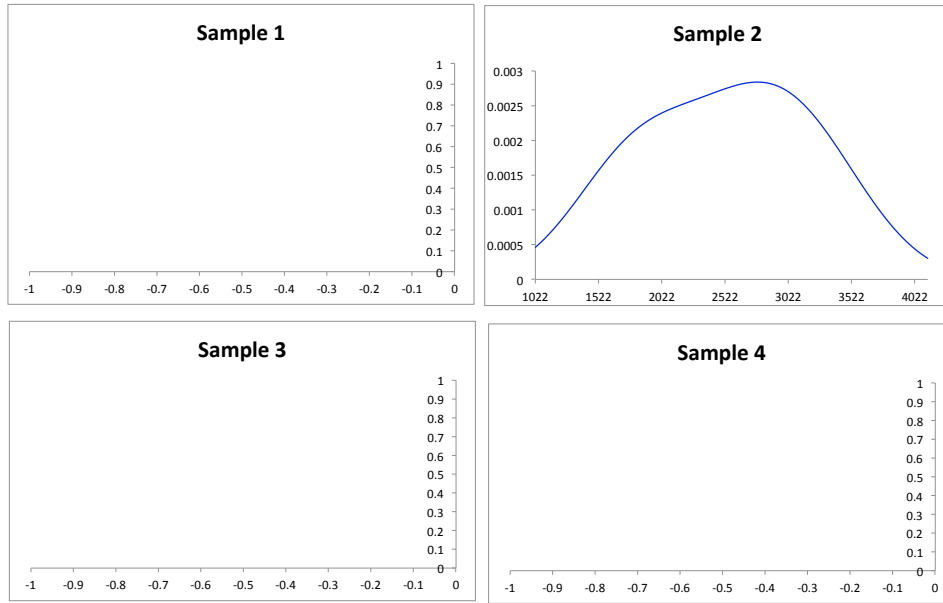
z-Score Plots by Method - Sample 4



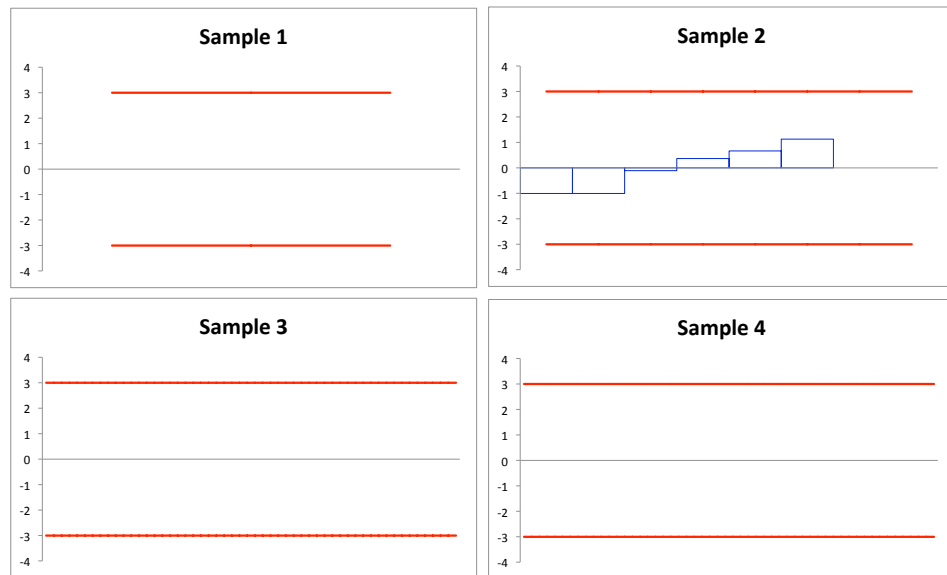
There were too few reported results to provide a valid evaluation.

Pentane

Kernel Density Plots



z-Score Plots

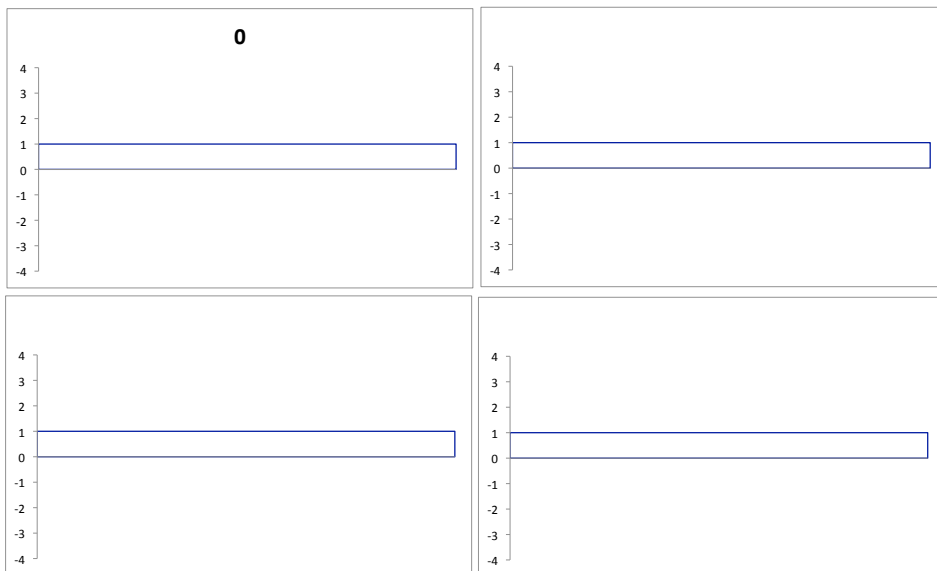


Summary Statistics by Four Most Common Methods

Sample 2					
Method	All*	0			
Median	2530	#NUM!	0	0	0
Stdev	726	0	0	0	0
Number	6	0	0	0	0
z > 3	0	0	0	0	0
z 2 - 3	0	0	0	0	0

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

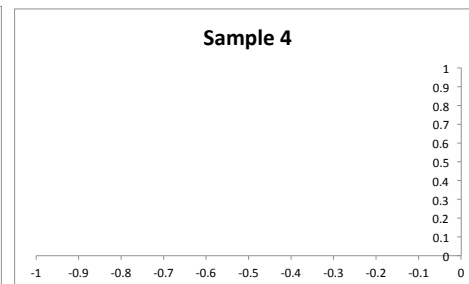
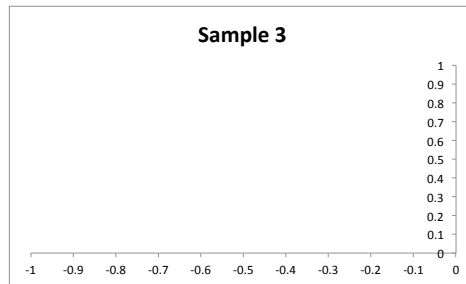
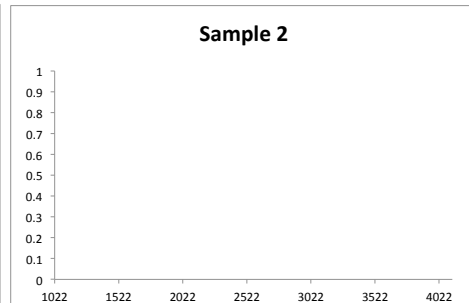
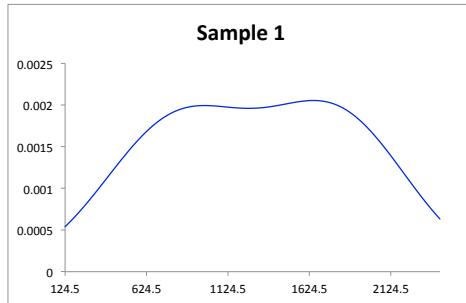
z-Score Plots by Method - Sample 4



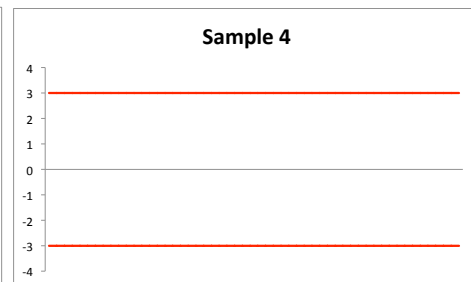
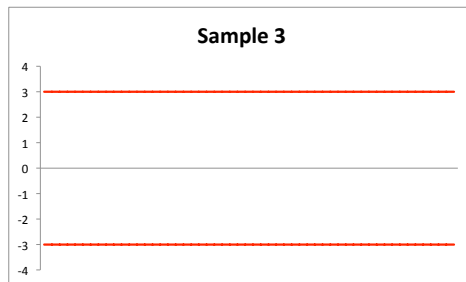
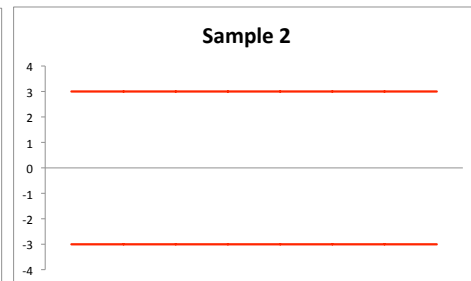
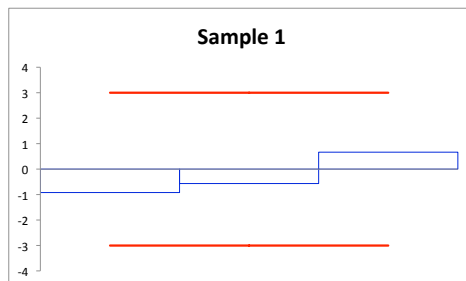
There were too few reported results to provide a valid evaluation.

Propane

Kernel Density Plots



z-Score Plots

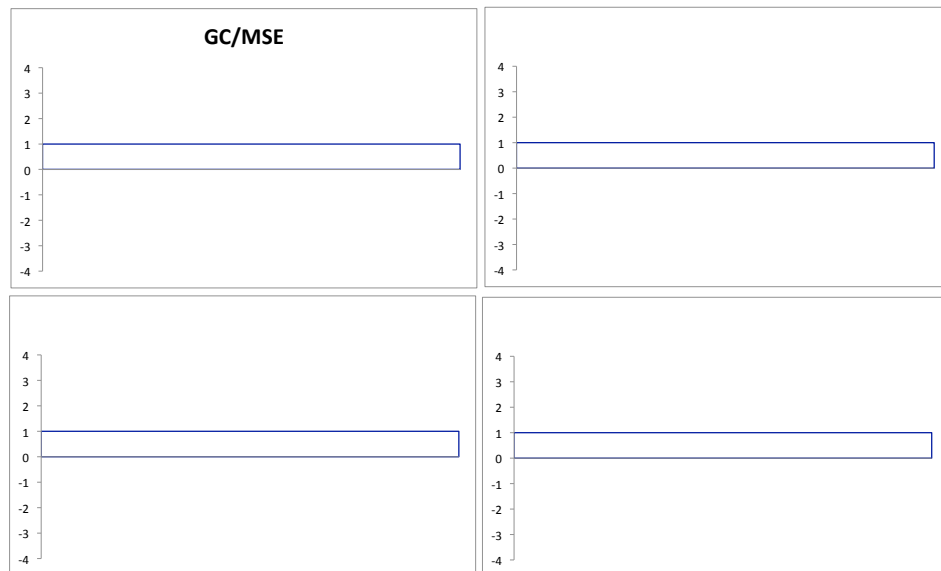


Summary Statistics by Four Most Common Methods

Sample 1					
Method	All*	GC/MSE			
Median	1300	1330	0	0	0
Stdev	650	573	0	0	0
Number	4	4	0	0	0
z > 3	0	0	0	0	0
z 2 - 3	0	0	0	0	0

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

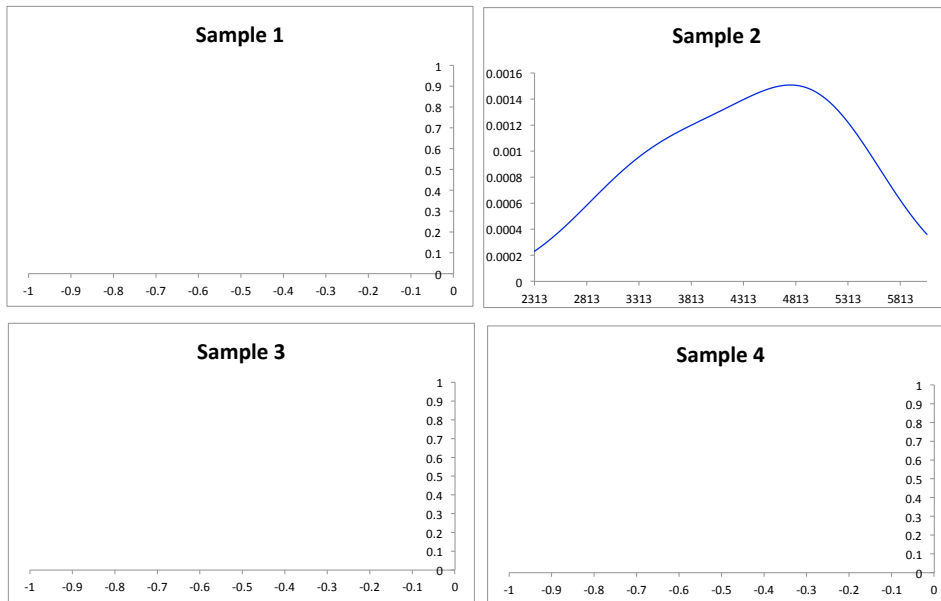
z-Score Plots by Method - Sample 4



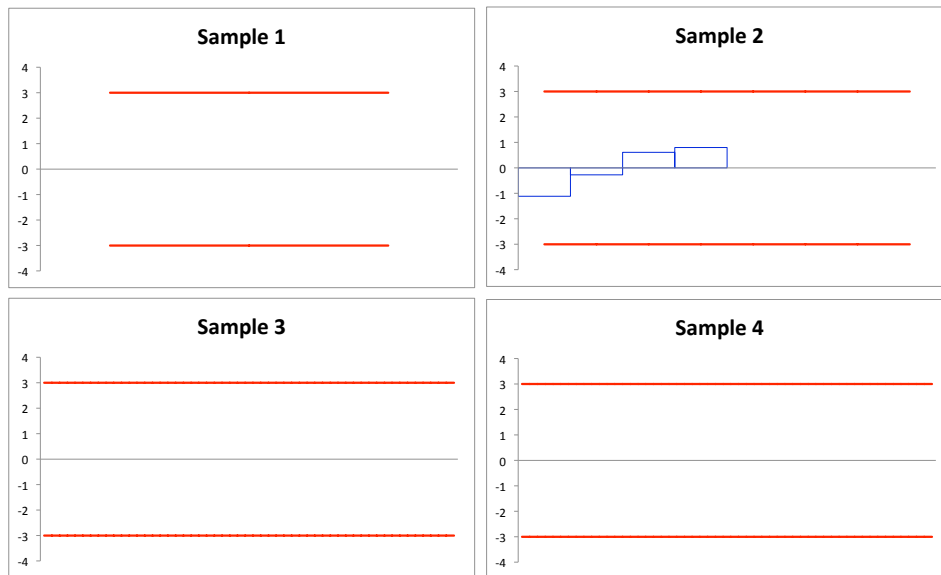
There were too few reported results to provide a valid evaluation.

Propyl acetate

Kernel Density Plots



z-Score Plots

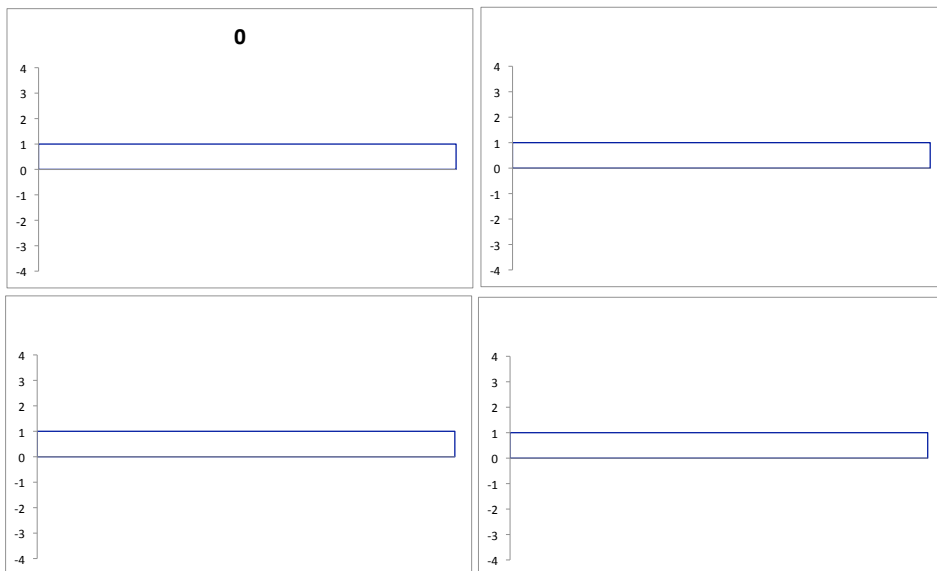


Summary Statistics by Four Most Common Methods

Sample 2					
Method	All*	0			
Median	4350	#NUM!	0	0	0
Stdev	981	0	0	0	0
Number	4	0	0	0	0
z > 3	0	0	0	0	0
z 2 - 3	0	0	0	0	0

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

z-Score Plots by Method - Sample 4



There were too few reported results to provide a valid evaluation.