Test Group Summary Report
C77 Pesticides in Soil
June 2021 PT Round

Issued: October 13, 2021

PTC | **Proficiency Testing Canada**

Table of Contents

1.0   The Proficiency Testing Report

The Proficiency Testing Report consists of two parts.

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

2.0   Definitions

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

Code: The registration code that is unique to each analyte that a participant is registered for.

App: If a participant is accredited by CALA, this three-digit number is the appendix number that the accredited method is assigned to.

N: The number of participants results that were used to calculate the summary statistics. This excludes qualified data (e.g., <) and any results that were flagged as outliers.

Assigned: The Assigned Value is the robust mean of the reported results, outliers excluded. This is often referred to as the "target" value.

±u: The uncertainty of the assigned value.

Reported: The result reported by the participant.

s: The Standard Deviation of Proficiency Assessment (SDPA). This value is used to determine the acceptance limits for the PT evaluation.

z-Score: A value assigned to each reported result that is a measure of the degree to which it deviates from the Assigned Value.

Score: The composite score of the four results reported for each analyte. It is normalized to a score out of 100.

Bias: A flag assigned if bias is detected using the re-scaled *z*-score procedure.

3.0   Scoring System

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

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

3.1 HOMOGENEITY AND STABILITY ASSESSMENT

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

3.2 THE Z SCORE

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

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

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

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

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

- The inter-laboratory Robust standard deviation (Stdev$_{rob}$) is calculated using reported results, obvious outliers removed;
- The regression equation standard deviation (Stdev$_{reg}$) is estimated from regression equations derived from previous studies (see PROC11- *PT Regression Equations* for details);
- The SDPA is the higher of Stdev$_{rob}$ and Stdev$_{reg}$;
- When a laboratory reports its detection limit, s will be estimated using a pooled variance procedure that uses both the inter-laboratory data and the reported detection limit.

3.2 COMPOSITE (PT) SCORE

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

Acceptable PT Scores equal or exceed 70.

3.3 IDENTIFYING BIAS

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

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

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

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

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

3.4   DEVIATIONS FROM EVALUATION PROCEDURE

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

4.0 PT Round Specific Data Summary

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

4.1   SUMMARY STATISTICS

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

4.2   *z* - SCORE PLOTS

The *z*-scores for each sample are ranked in increasing order and plotted. When the data is normally distributed, the plot should show a slight sigmoidal curve, with an equal number of points above zero as below. Each bar in these plots is colour-coded to indicate the analytical method used by the participant.

4.3   KERNEL DENSITY PLOTS

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

4.4   STABILITY AND HOMOGENEITY PLOTS

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

4,4'-DDT (P,P'-DDT)

Summary Statistics

Statistic	C77-1	C77-2	C77-3	C77-4
N	12	12	12	12
Median	403	195	109	281
Robust Mean	384	200	108	281
U	22.5	9.7	10	15.0
Robust Standard Deviation	62.3	27.0	27.0	41.6
Regression Standard Deviation	88.8	47.5	26.9	65.6
Stability Flag	Stability			Stability
Homogeneity Flag				
Standard Deviation Used (SDPA)	180	47.5	27.0	71.7
Outliers	0	0	0	0
|z|>3.0	0	0	0	0
2<|z|<3	0	1	0	0

Methods Used

Method	C77-1	C77-2	C77-3	C77-4
GC/ECD	4	4	4	4
GC/MS	4	4	4	4
GC/MS/MS	2	2	2	2
GC/ECD/SHKE	1	1	1	1
GC/MSHR	1	1	1	1

All summary stats and the plots below are based on the data excluding any flagged outliers
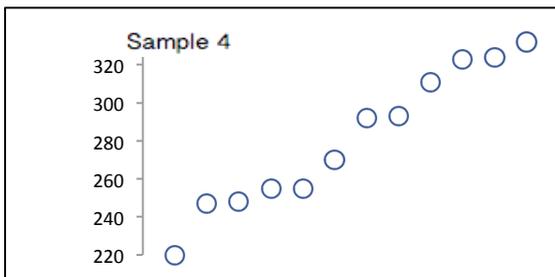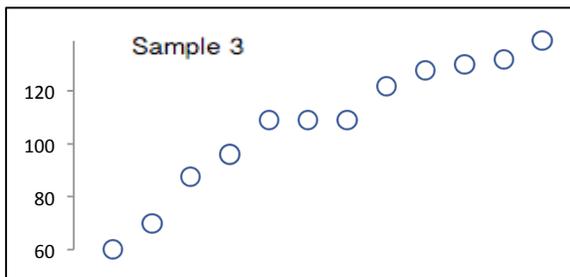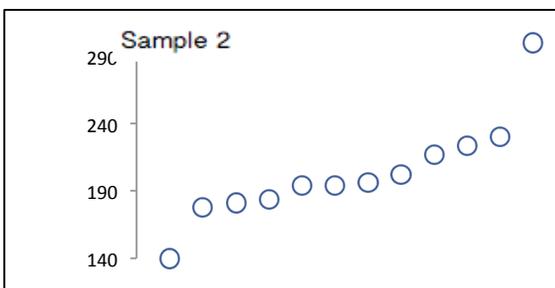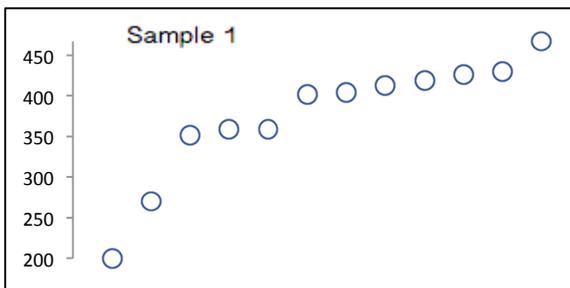
4,4'-DDT (P,P'-DDT)

z-Score Plots
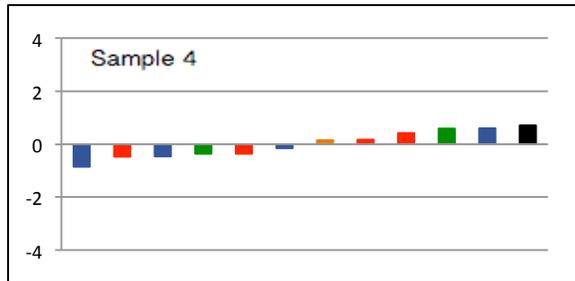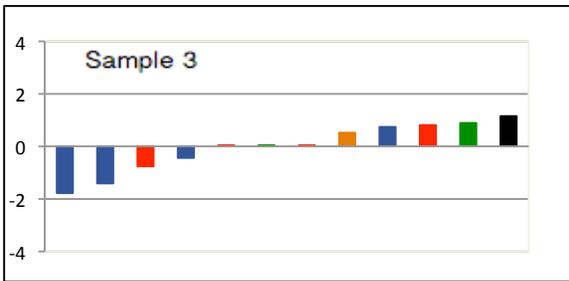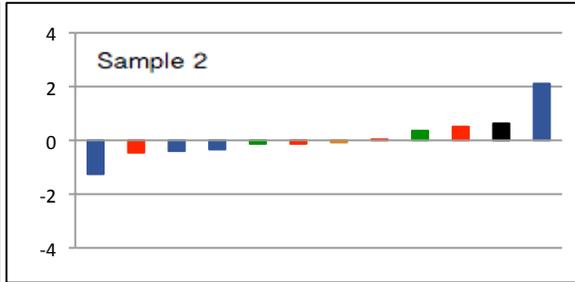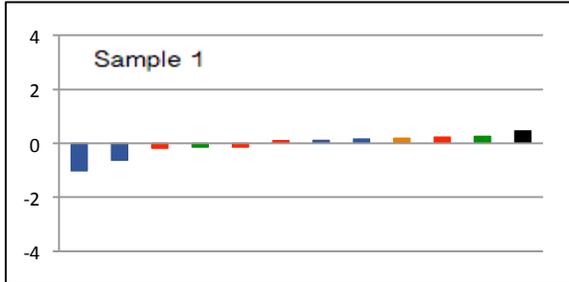

Kernel Density Plots
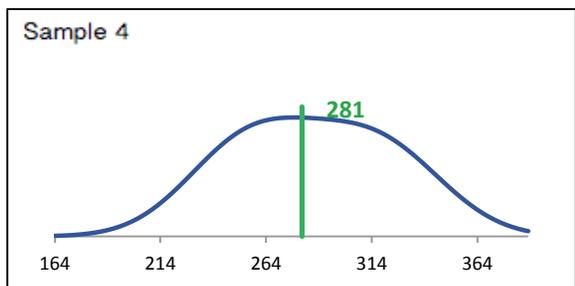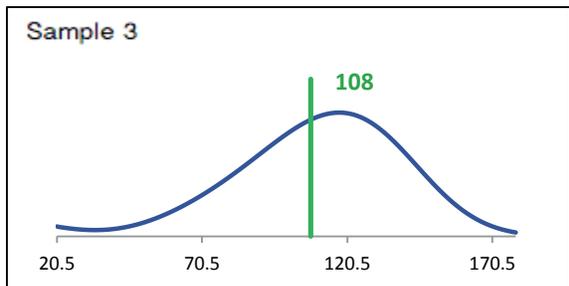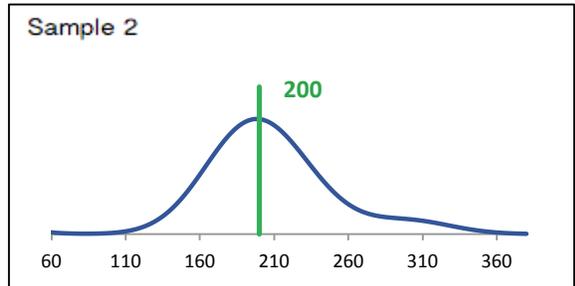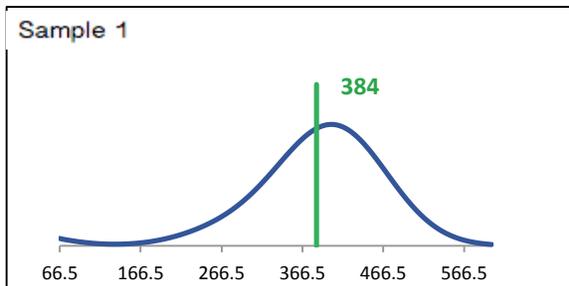
4,4'-DDT (P,P'-DDT)

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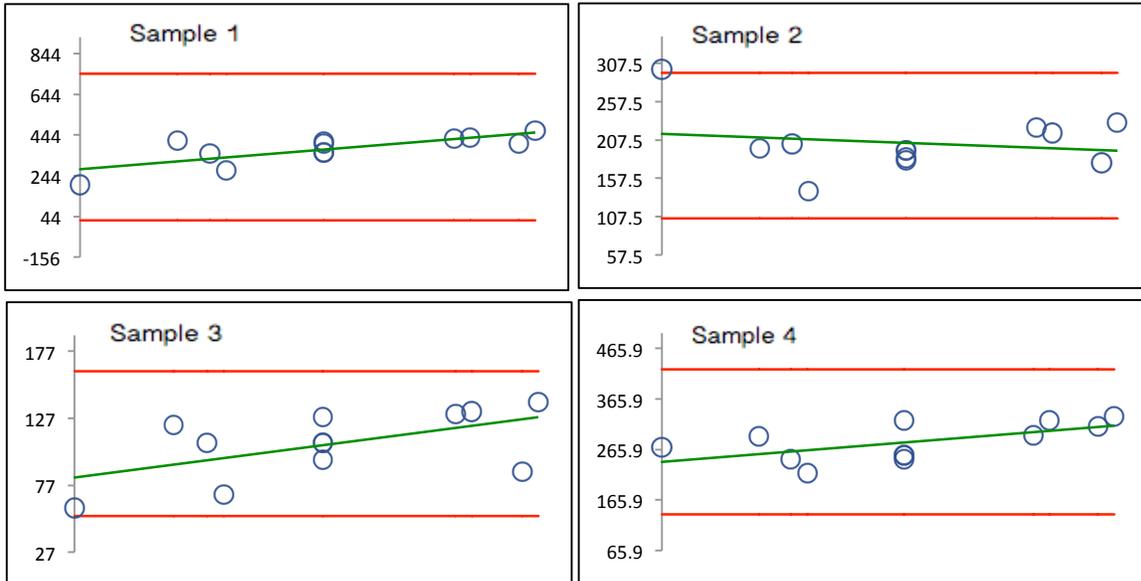
Reported results (Y-axis) plotted against reported analysis date (X-axis)

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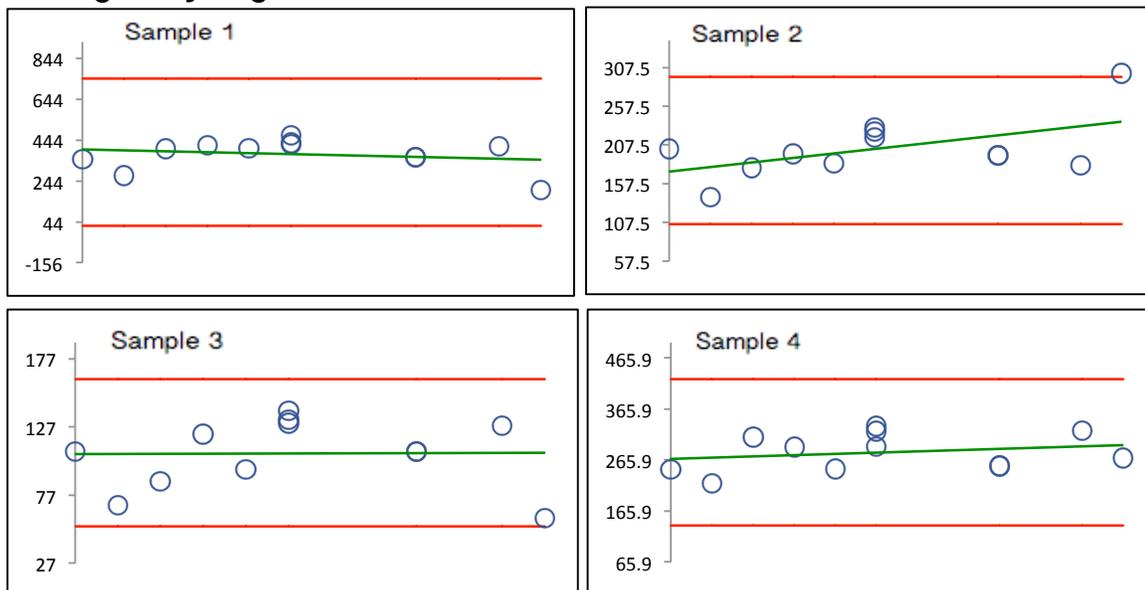
Reported results (Y-axis) plotted against bottling order (X-axis).

ALDRIN

Summary Statistics

Statistic	C77-1	C77-2	C77-3	C77-4
N	12	12	12	12
Median	225	381	66.9	160
Robust Mean	221	374	68.1	163
U	9.0	11.5	3.4	4.8
Robust Standard Deviation	25.0	32.0	9.28	13.4
Regression Standard Deviation	46.5	77.6	15.6	34.8
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA)	46.5	77.6	15.6	34.8
Outliers	0	0	0	0
$|z|>3.0$	0	1	1	0
$2<|z|<3$	0	0	0	0

Methods Used

Method	C77-1	C77-2	C77-3	C77-4
GC/ECD	4	4	4	4
GC/ECD/SHKE	1	1	1	1
GC/MS	4	4	4	4
GC/MSHR	1	1	1	1
GC/MS/MS	2	2	2	2

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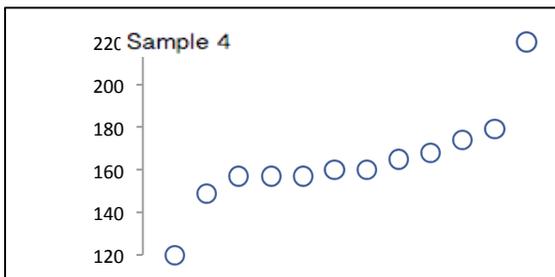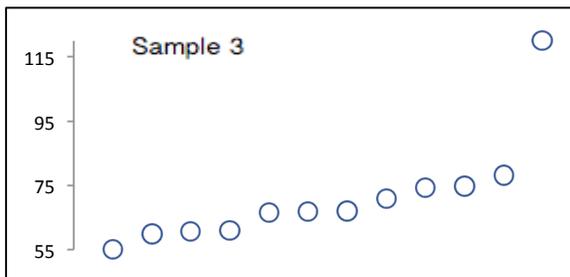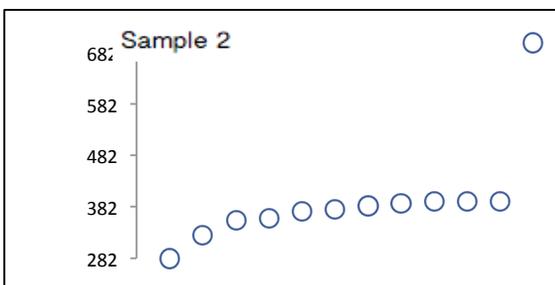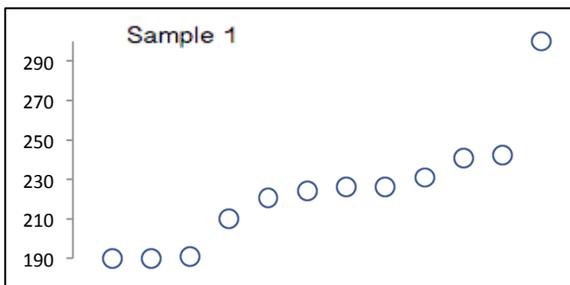
ALDRIN

## z-Score Plots
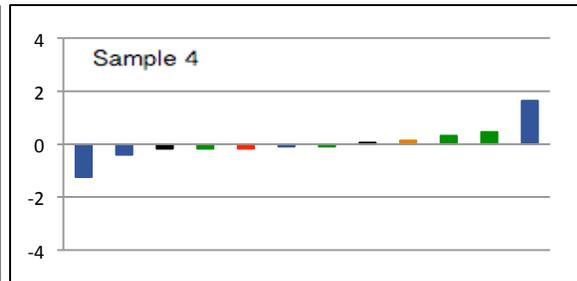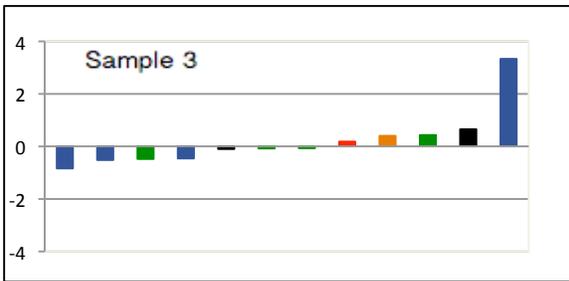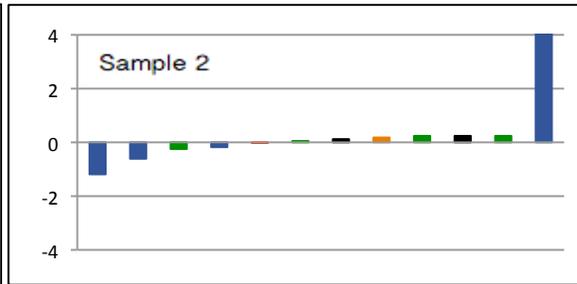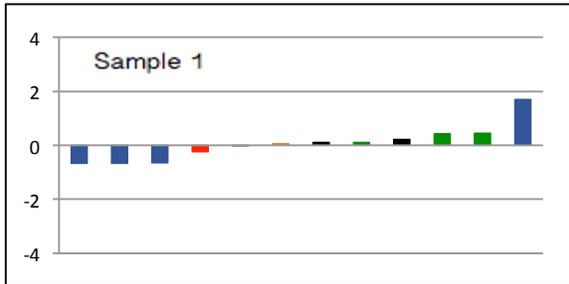
Kernel Density Plots
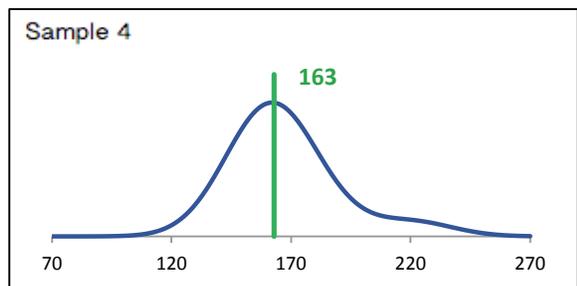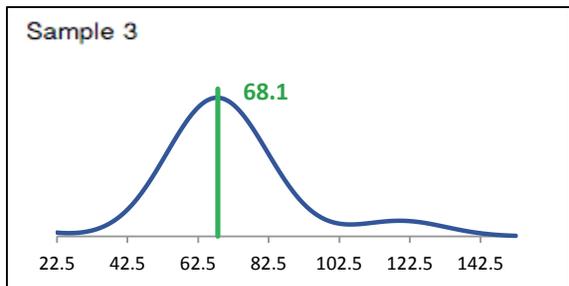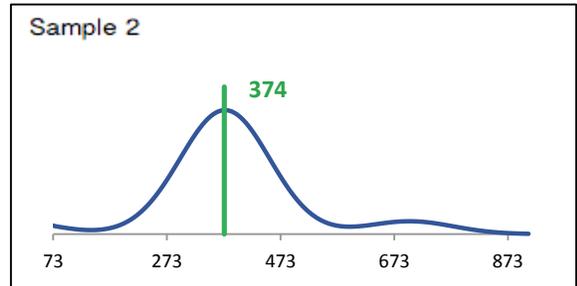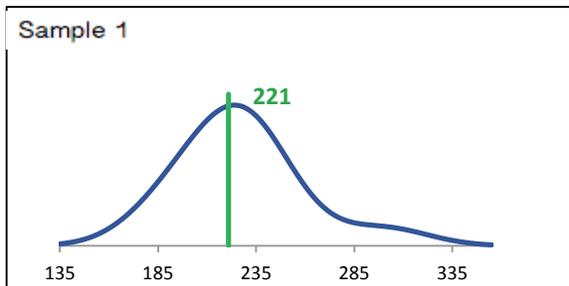
ALDRIN

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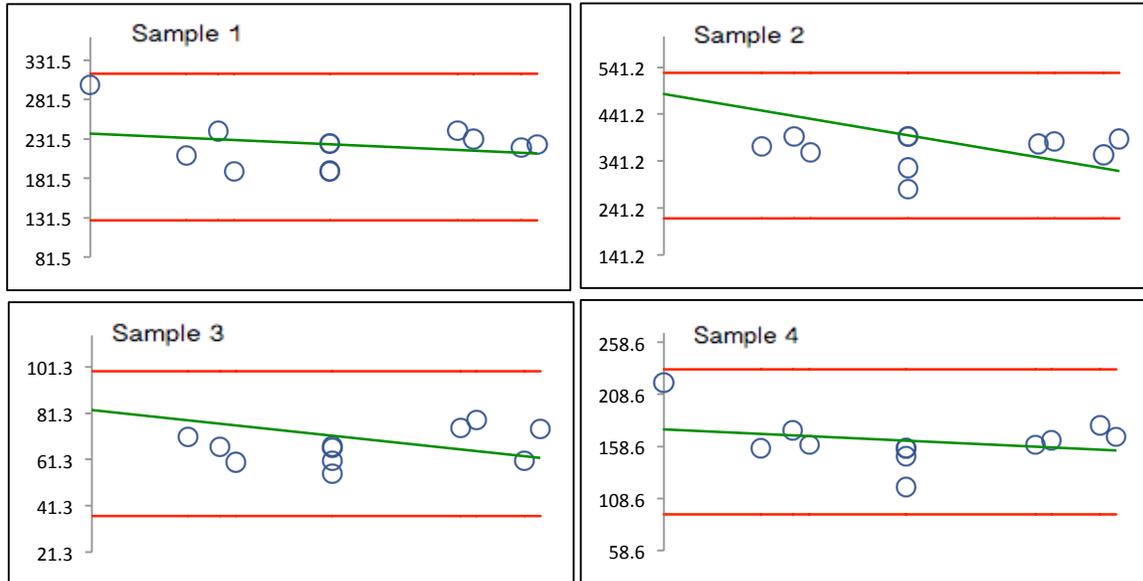
Reported results (Y-axis) plotted against reported analysis date (X-axis)

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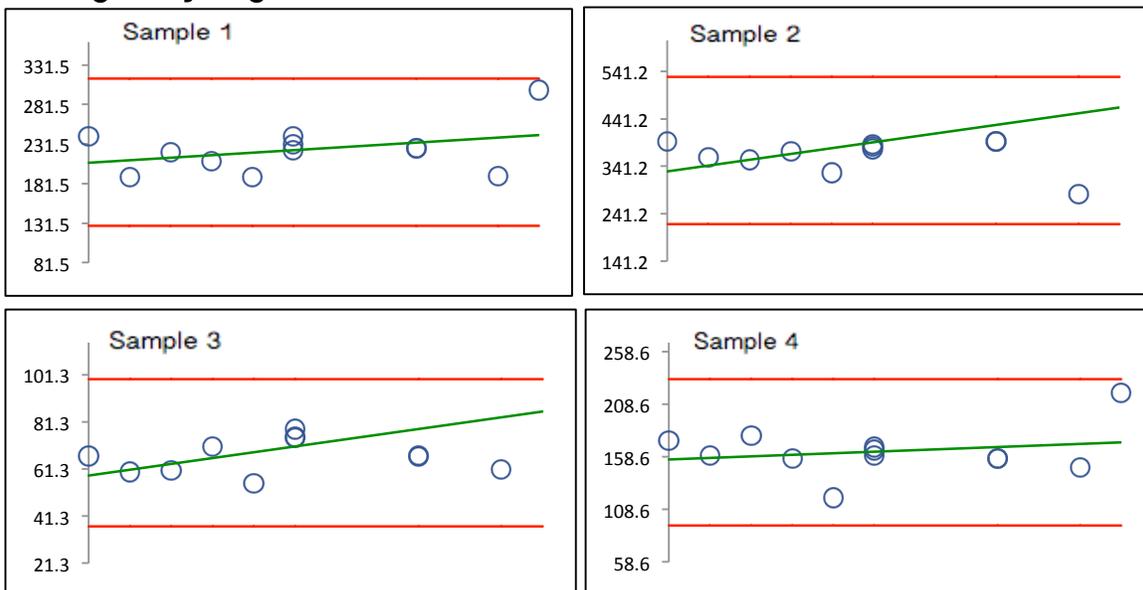
Reported results (Y-axis) plotted against bottling order (X-axis).

ALPHA-BHC

Summary Statistics

Statistic	C77-1	C77-2	C77-3	C77-4
N	12	12	12	12
Median	102	214	339	75.7
Robust Mean	100	210	331	75.4
U	4.7	10.7	16.6	4.0
Robust Standard Deviation	12.9	29.6	46.00	11.1
Regression Standard Deviation	23.1	45.3	69.6	18.3
Stability Flag				
Homogeneity Flag	Homogeneity			
Standard Deviation Used (SDPA)	32.8	45.3	69.6	18.3
Outliers	0	0	0	0
|z|>3.0	0	0	0	0
2<|z|<3	0	0	0	0

Methods Used

Method	C77-1	C77-2	C77-3	C77-4
GC/ECD	4	4	4	4
GC/ECD/SHKE	1	1	1	1
GC/MSHR	1	1	1	1
GC/MS	4	4	4	4
GC/MS/MS	2	2	2	2

All summary stats and the plots below are based on the data excluding any flagged outliers
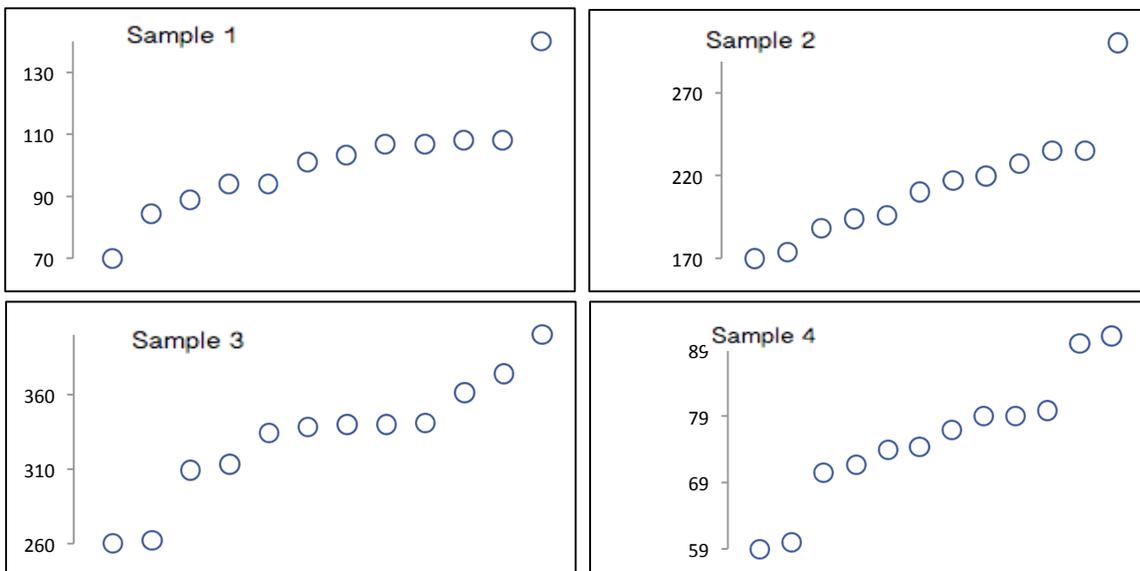
# ALPHA-BHC

z-Score Plots
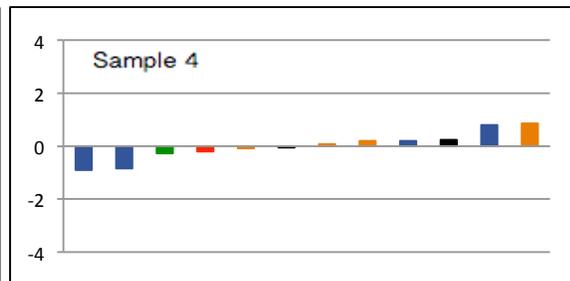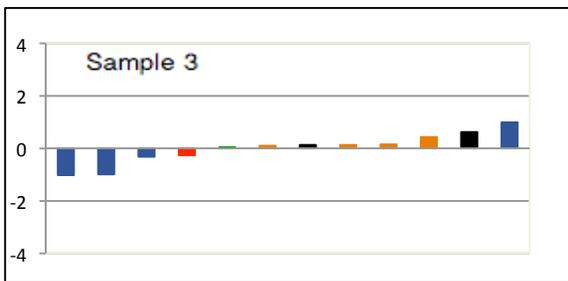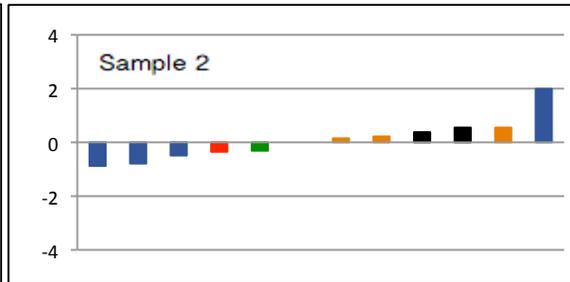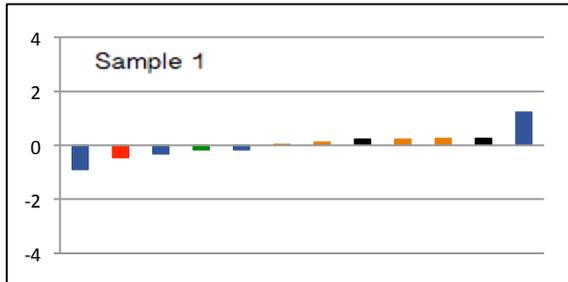
Kernel Density Plots
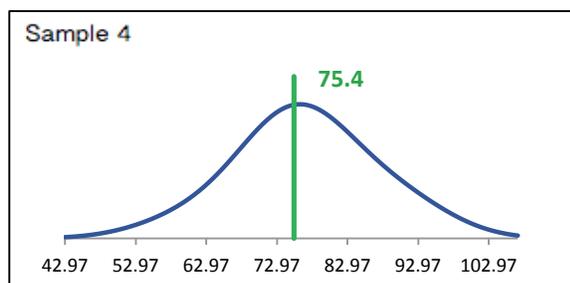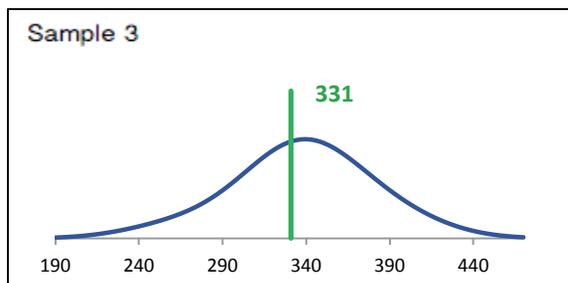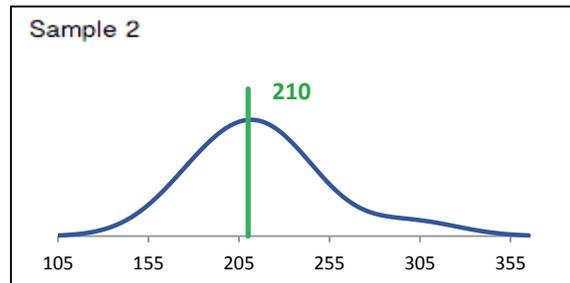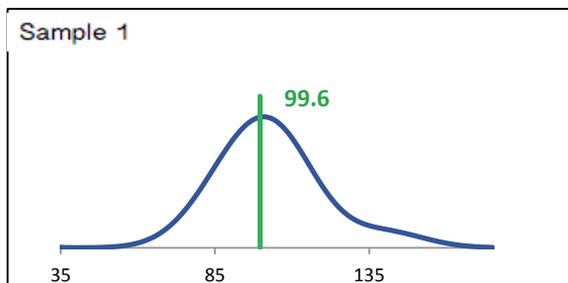
ALPHA-BHC

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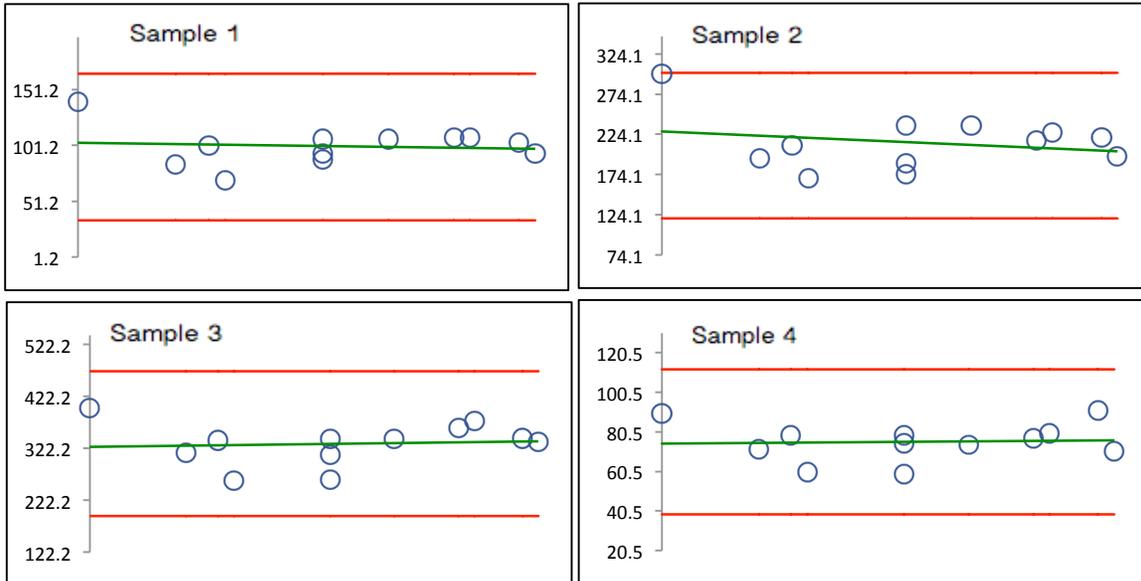
Reported results (Y-axis) plotted against reported analysis date (X-axis)

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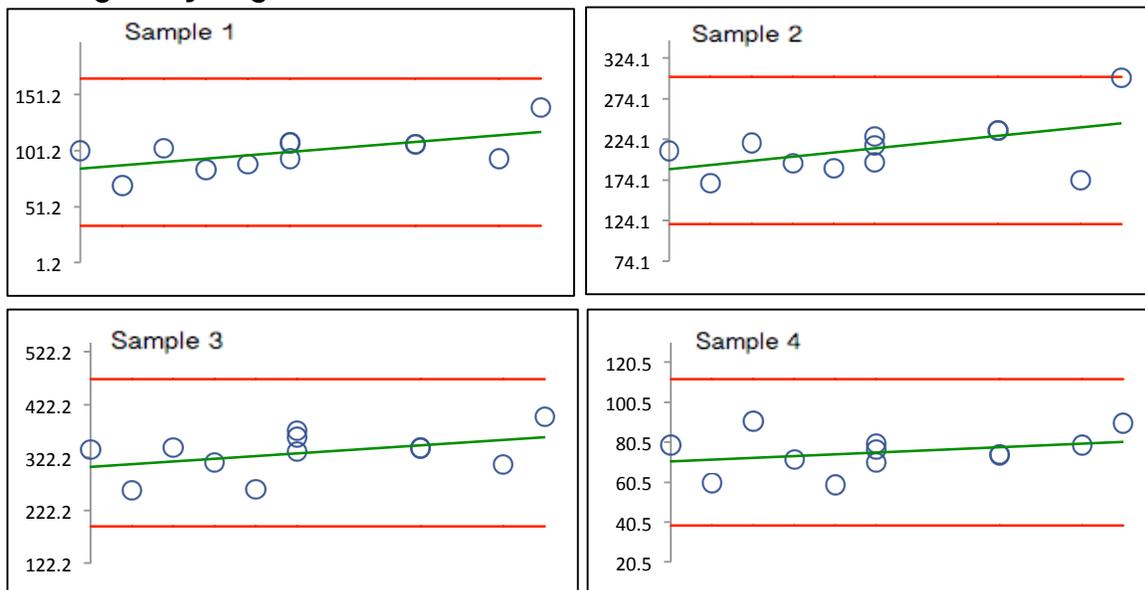
Reported results (Y-axis) plotted against bottling order (X-axis).

ALPHA-CHLORDANE

Summary Statistics

| Statistic	C77-1	C77-2	C77-3	C77-4
N	12	12	12	12
Median	388	98.5	218	271
Robust Mean	385	95.8	225	269
U	23.3	4.0	10.0	11.1
Robust Standard Deviation	64.5	11.1	27.6	30.8
Regression Standard Deviation	72.9	18.7	42.9	51.1
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA)	72.9	18.7	42.9	51.1
Outliers	0	0	0	0
|z|>3.0	0	0	0	0
2<|z|<3	0	0	0	0

Methods Used

Method	C77-1	C77-2	C77-3	C77-4
GC/ECD	4	4	4	4
GC/MS/MS	2	2	2	2
GC/MS	4	4	4	4
GC/ECD/SHKE	1	1	1	1
GC/MSHR	1	1	1	1

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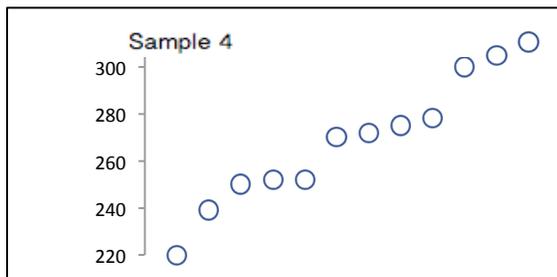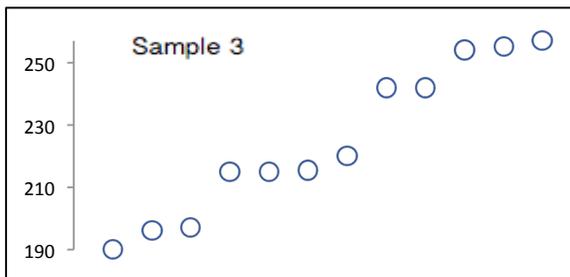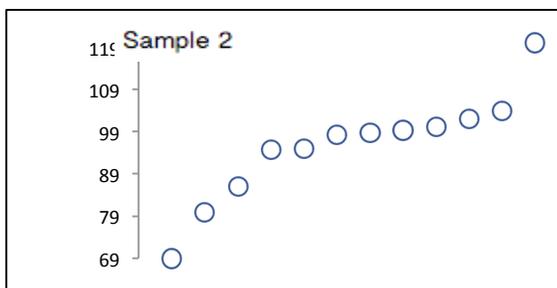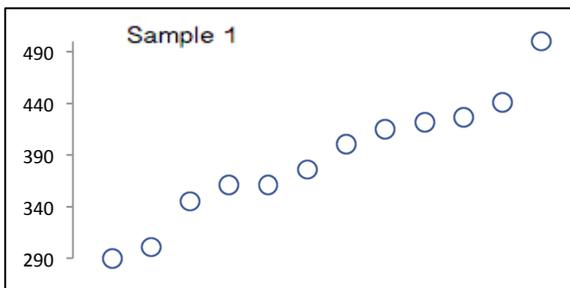
ALPHA-CHLORDANE

z-Score Plots
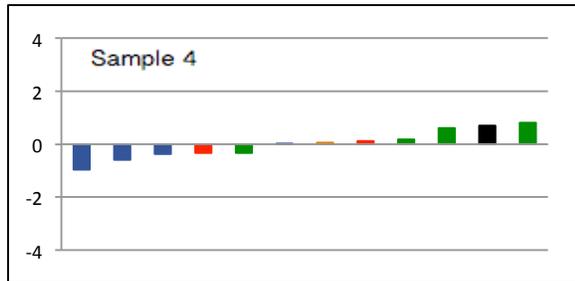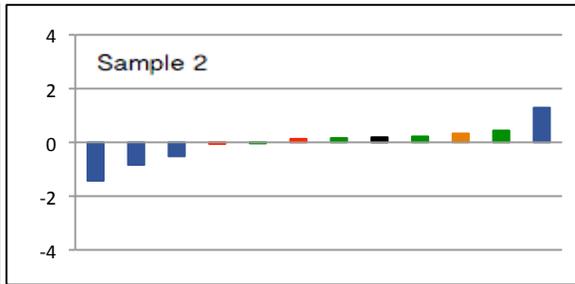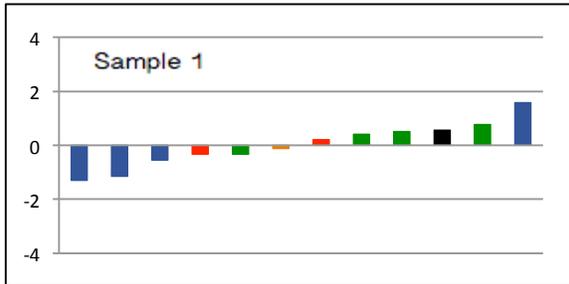
Kernel Density Plots
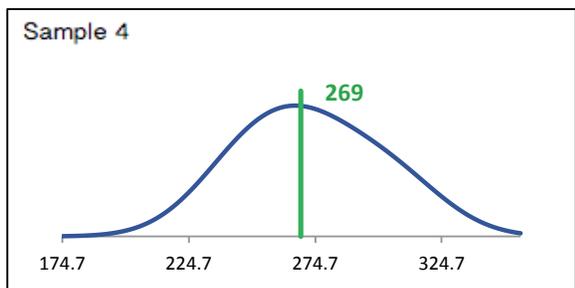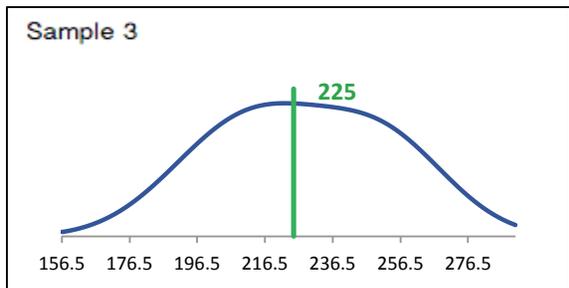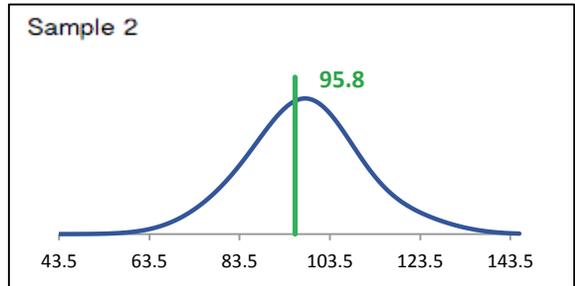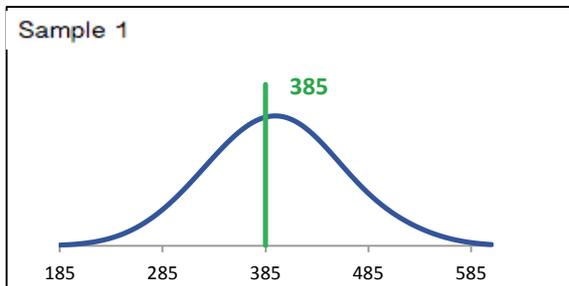
ALPHA-CHLORDANE

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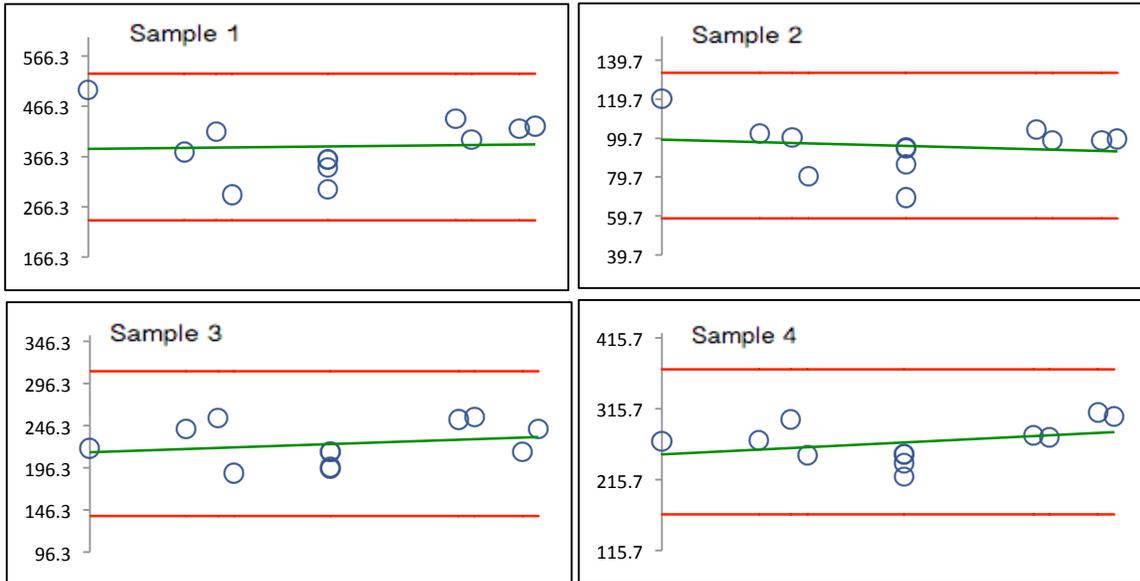
Reported results (Y-axis) plotted against reported analysis date (X-axis)

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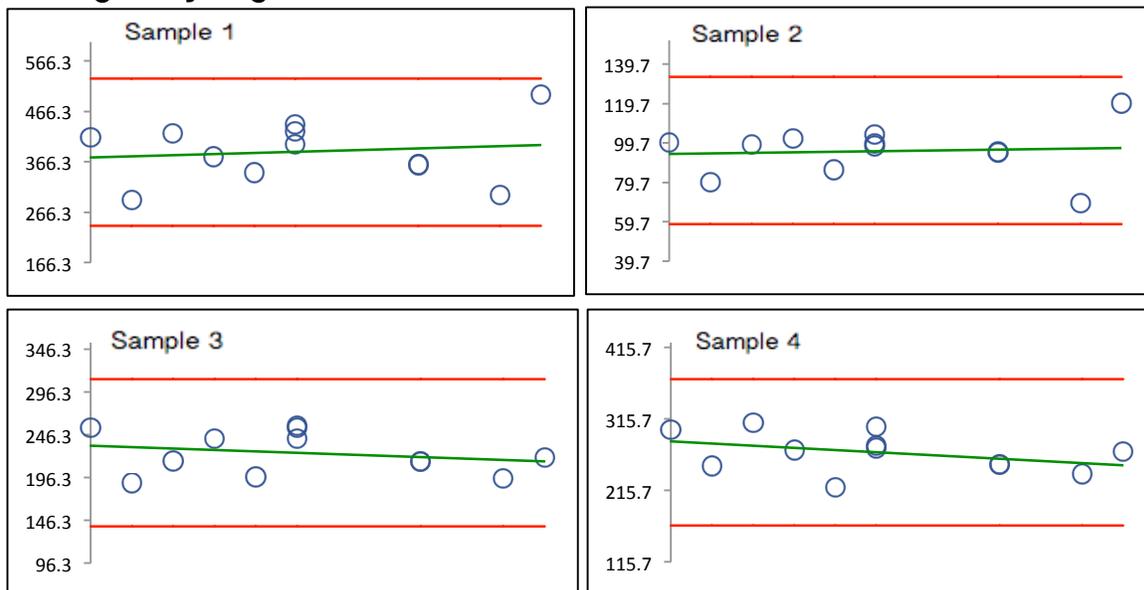
Reported results (Y-axis) plotted against bottling order (X-axis).

BETA-BHC

Summary Statistics

Statistic	C77-1	C77-2	C77-3	C77-4
N	12	12	12	12
Median	307	119	191	228
Robust Mean	313	125	197	230
U	22.0	7.9	12.0	13.5
Robust Standard Deviation	61.0	21.9	33.3	37.4
Regression Standard Deviation	65.4	31.7	44.7	50.6
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA)	65.4	31.7	44.7	50.6
Outliers	0	0	0	0
|z|>3.0	0	0	0	0
2<|z|<3	1	0	0	0

Methods Used

Method	C77-1	C77-2	C77-3	C77-4
GC/ECD	4	4	4	4
GC/ECD/SHKE	1	1	1	1
GC/MS	4	4	4	4
GC/MS/MS	2	2	2	2
GC/MSHR	1	1	1	1

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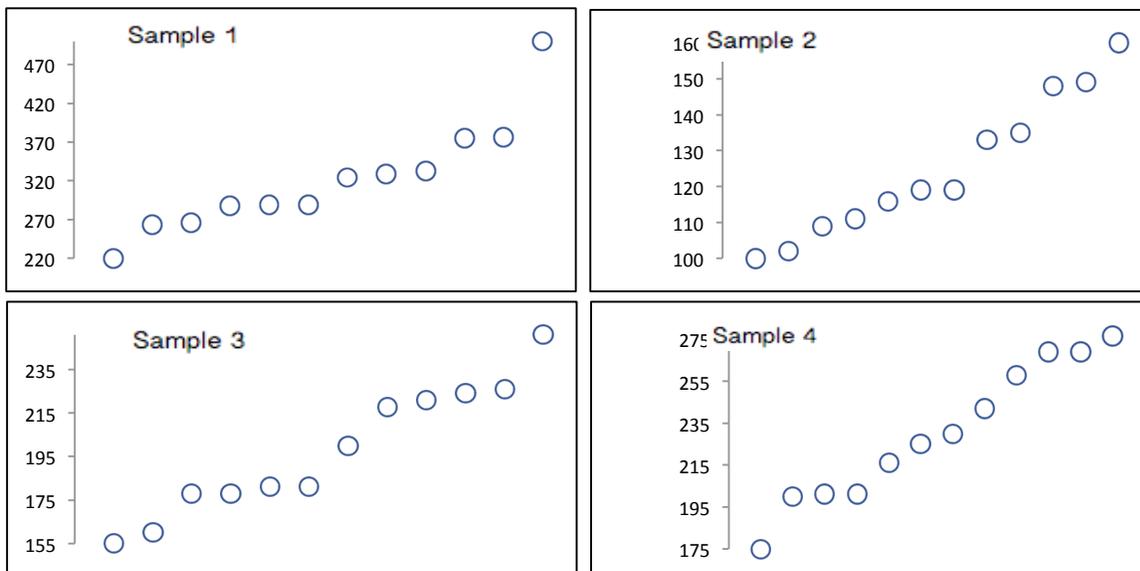
BETA-BHC

## z-Score Plots
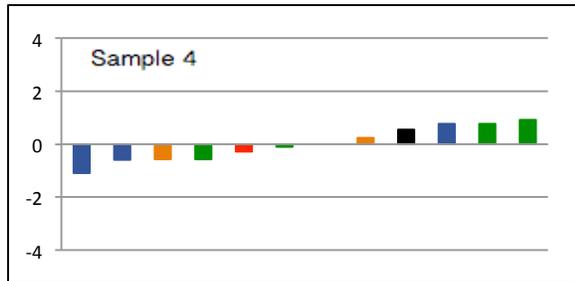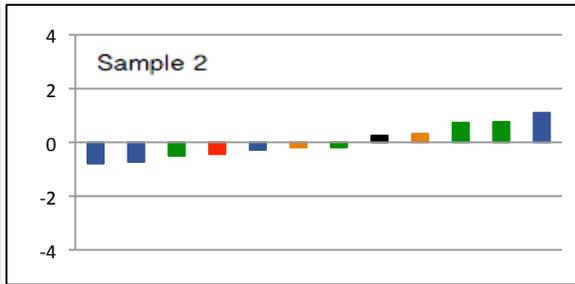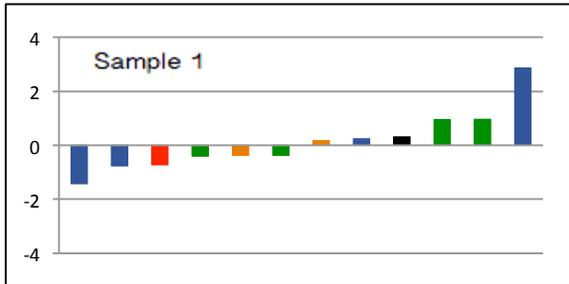
Kernel Density Plots
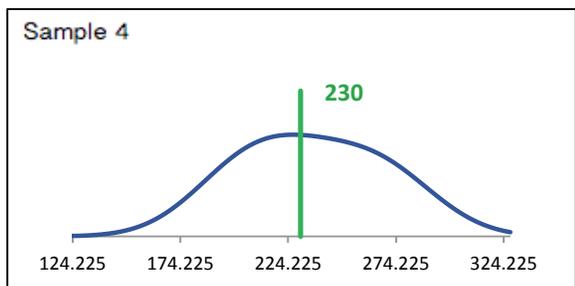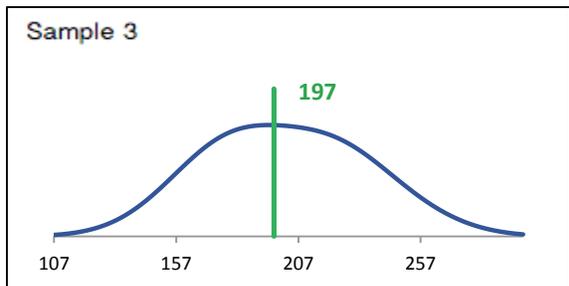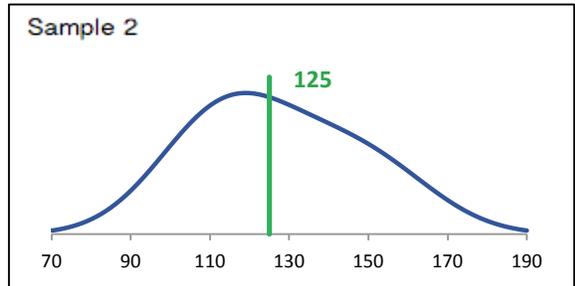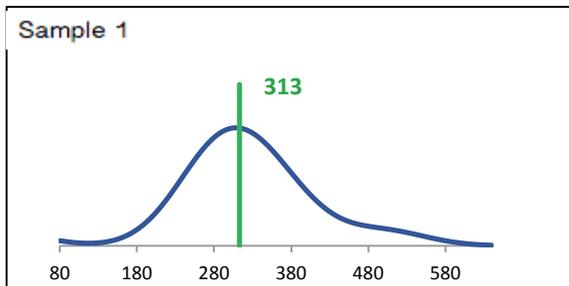
BETA-BHC

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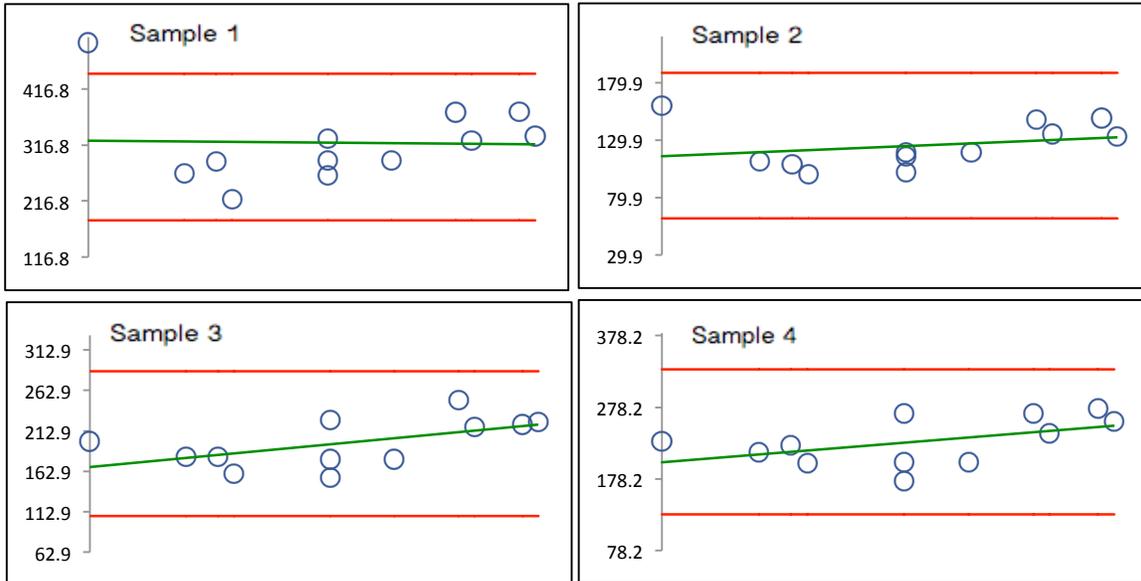
Reported results (Y-axis) plotted against reported analysis date (X-axis)

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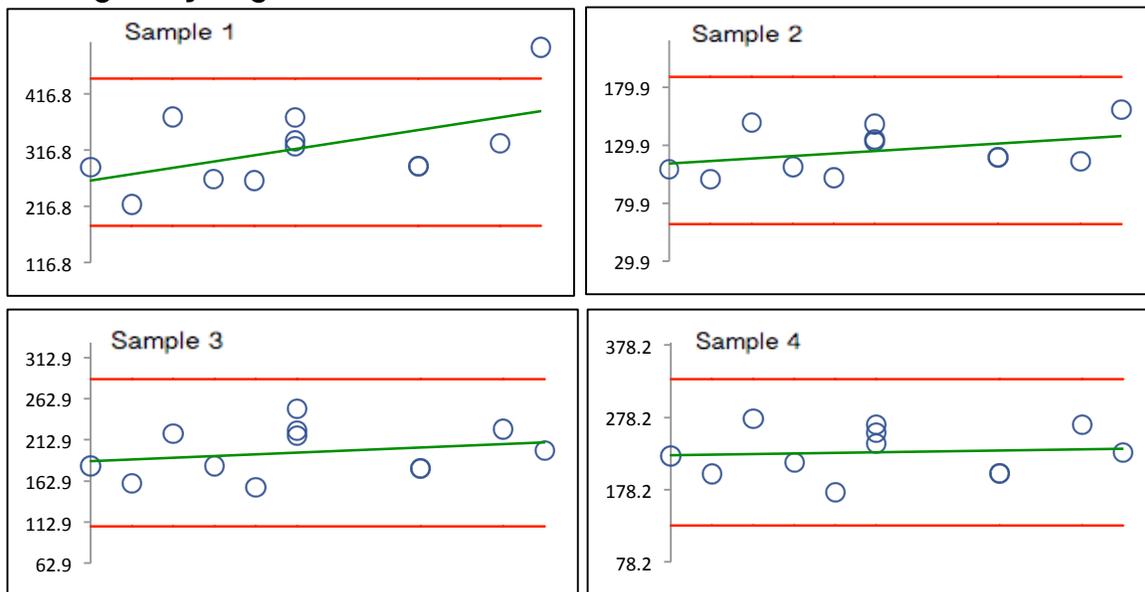
Reported results (Y-axis) plotted against bottling order (X-axis).

DIELDRIN

Summary Statistics

Statistic	C77-1	C77-2	C77-3	C77-4
N	12	12	12	12
Median	244	100	329	176
Robust Mean	252	102	335	178
U	14.0	6.9	15.9	8.5
Robust Standard Deviation	38.9	19.0	44.2	23.5
Regression Standard Deviation	46.1	21.1	60.0	33.7
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA)	46.1	21.1	60.0	33.7
Outliers	0	0	0	0
|z|>3.0	0	0	0	0
2<|z|<3	0	0	0	0

Methods Used

Method	C77-1	C77-2	C77-3	C77-4
GC/ECD	5	5	5	5
GC/ECD/SHKE	1	1	1	1
GC/MSHR	1	1	1	1
GC/MS/MS	2	2	2	2
GC/MS	3	3	3	3

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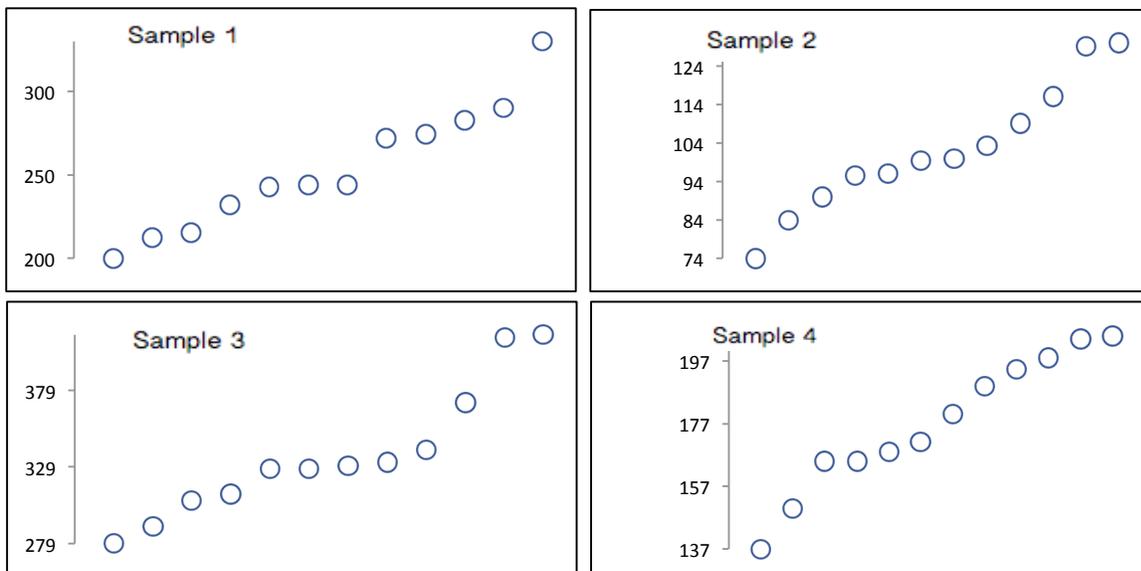
DIELDRIN

z-Score Plots
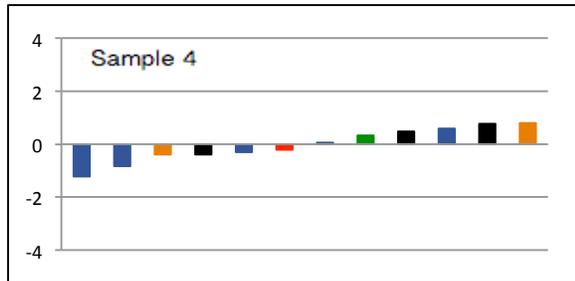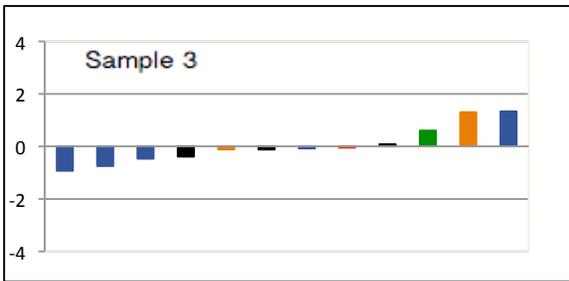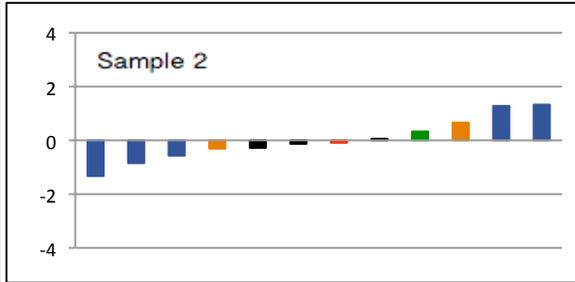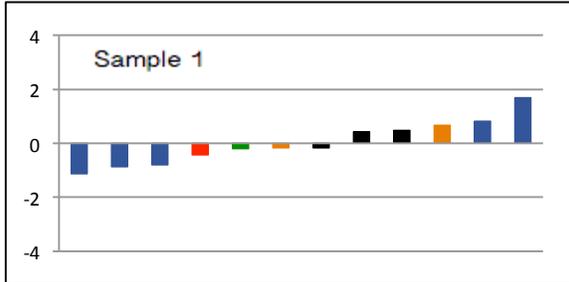
Kernel Density Plots
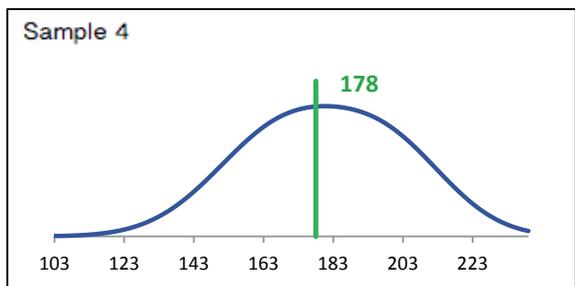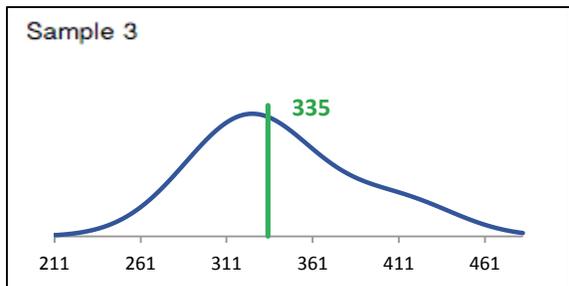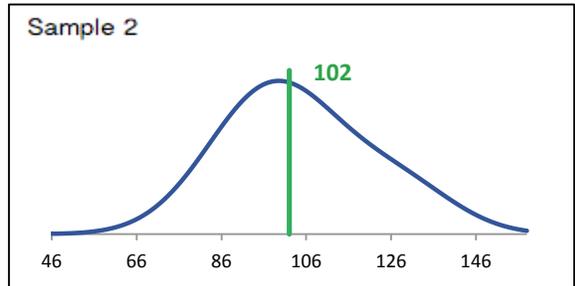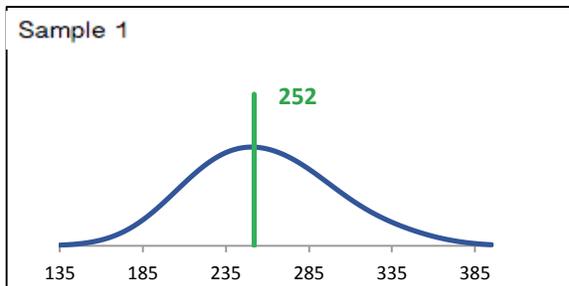
DIELDRIN

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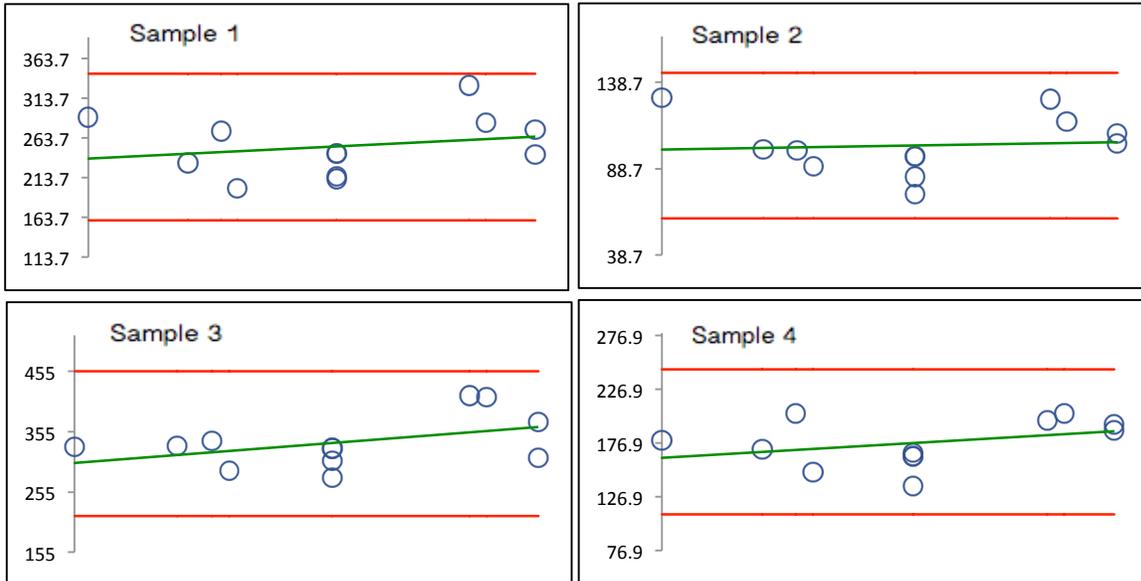
Reported results (Y-axis) plotted against reported analysis date (X-axis)

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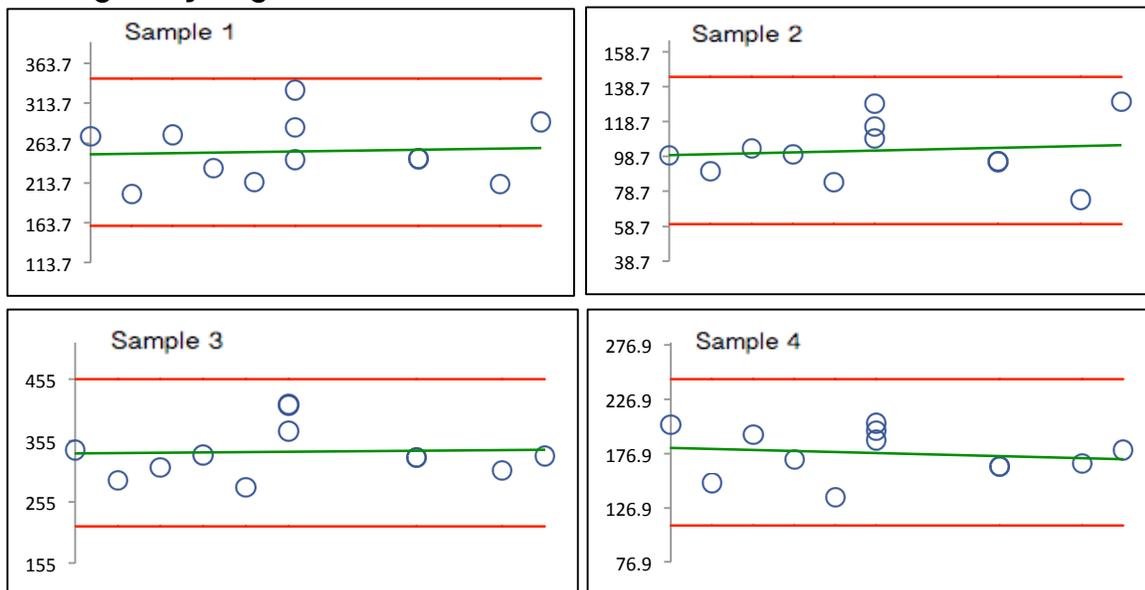
Reported results (Y-axis) plotted against bottling order (X-axis).

ENDOSULFAN I (A-ENDOSULFAN)

Summary Statistics

Statistic	C77-1	C77-2	C77-3	C77-4
N	12	12	12	12
Median	82.2	246	184	60
Robust Mean	82.9	248	184	60
U	7.2	10.9	9.1	3.2
Robust Standard Deviation	19.9	30.1	25.1	8.78
Regression Standard Deviation	20.2	50.2	38.7	16.0
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA)	20.2	50.2	38.7	16.0
Outliers	0	0	0	0
|z|>3.0	0	0	0	0
2<|z|<3	0	0	0	0

Methods Used

Method	C77-1	C77-2	C77-3	C77-4
GC/ECD	5	5	5	5
GC/ECD/SHKE	1	1	1	1
GC/MSHR	1	1	1	1
GC/MS	3	3	3	3
GC/MS/MS	2	2	2	2

All summary stats and the plots below are based on the data excluding any flagged outliers
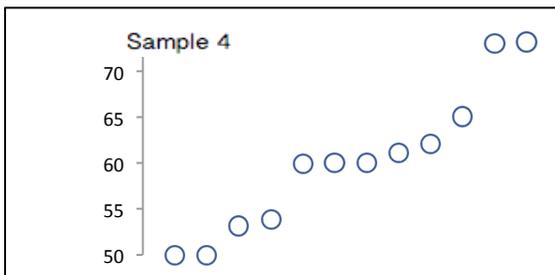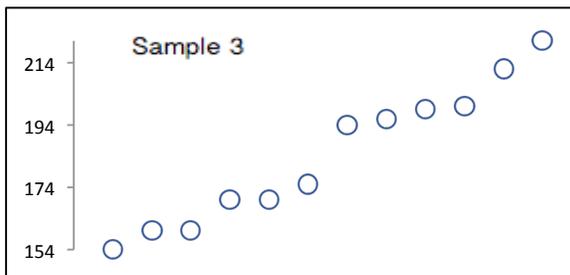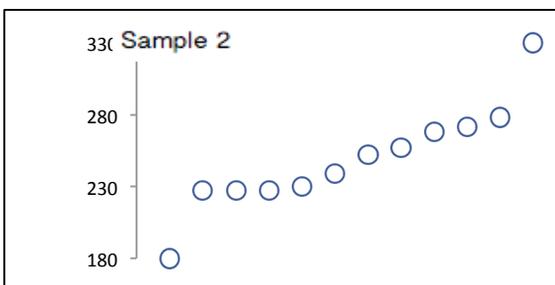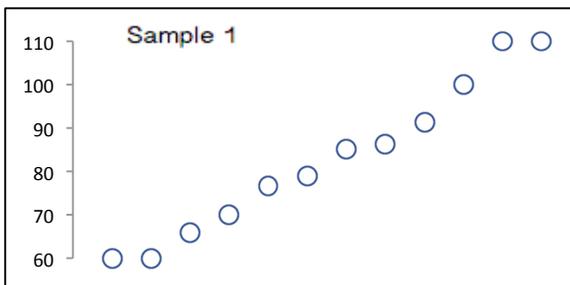
ENDOSULFAN I (A-ENDOSULFAN)

z-Score Plots
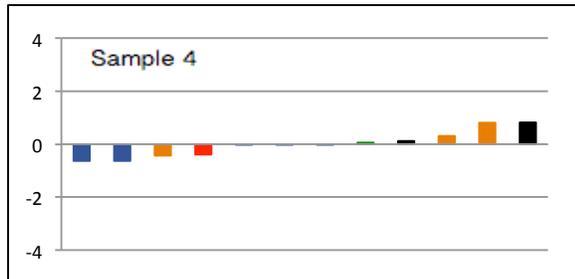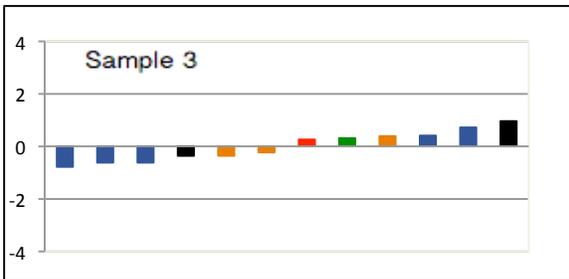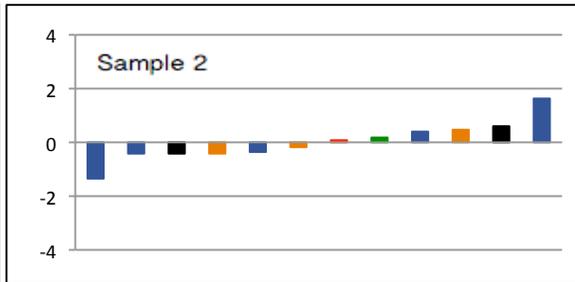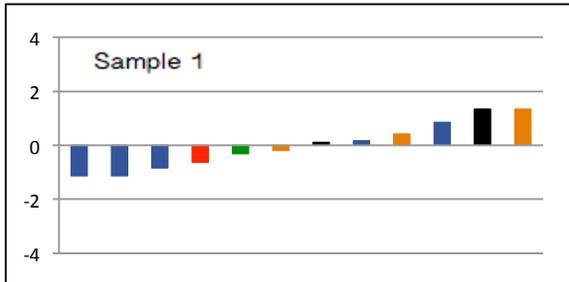
Kernel Density Plots

ENDOSULFAN I (A-ENDOSULFAN)

Stability Regression

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

Homogeneity Regression

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

ENDOSULFAN II (B-ENDOSULFAN)

Summary Statistics

Statistic	C77-1	C77-2	C77-3	C77-4
N	12	12	12	12
Median	96.6	292	151	72.4
Robust Mean	99.1	296	150	72.9
U	7.2	15.0	4.9	2.7
Robust Standard Deviation	20.0	41.7	13.7	7.57
Regression Standard Deviation	23.3	63.3	33.7	18.0
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA)	23.3	63.3	33.7	18.0
Outliers	0	0	0	0
$|z|>3.0$	0	1	0	0
$2<|z|<3$	0	0	0	0

Methods Used

Method	C77-1	C77-2	C77-3	C77-4
GC/ECD	5	5	5	5
GC/MSHR	1	1	1	1
GC/MS	3	3	3	3
GC/MS/MS	2	2	2	2
GC/ECD/SHKE	1	1	1	1

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

ENDOSULFAN II (B-ENDOSULFAN)

z-Score Plots

Kernel Density Plots

ENDOSULFAN II (B-ENDOSULFAN)

Stability Regression

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

Homogeneity Regression

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

ENDOSULFAN II (B-ENDOSULFAN)

Summary Statistics

Statistic	C77-1	C77-2	C77-3	C77-4
N	12	12	12	12
Median	96.6	292	151	72.4
Robust Mean	99.1	296	150	72.9
U	7.2	15.0	4.9	2.7
Robust Standard Deviation	20.0	41.7	13.7	7.57
Regression Standard Deviation	23.3	63.3	33.7	18.0
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA)	23.3	63.3	33.7	18.0
Outliers	0	0	0	0
|z|>3.0	0	1	0	0
2<|z|<3	0	0	0	0

Methods Used

Method	C77-1	C77-2	C77-3	C77-4
GC/ECD	5	5	5	5
GC/MSHR	1	1	1	1
GC/MS	3	3	3	3
GC/MS/MS	2	2	2	2
GC/ECD/SHKE	1	1	1	1

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

ENDOSULFAN II (B-ENDOSULFAN)

z-Score Plots

Kernel Density Plots

ENDOSULFAN II (B-ENDOSULFAN)

Stability Regression

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

Homogeneity Regression

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

ENDRIN
Summary Statistics

Statistic	C77-1	C77-2	C77-3	C77-4
N	12	12	12	11
Median	107	218	341	80.2
Robust Mean	108	219	335	78.3
U	7.1	14.9	25.2	4.8
Robust Standard Deviation	19.6	41.3	69.8	12.6
Regression Standard Deviation	22.7	38.7	55.2	18.4
Stability Flag			Stability	
Homogeneity Flag				
Standard Deviation Used (SDPA)	22.7	41.3	128.0	18.4
Outliers	0	0	0	1
$|z|>3.0$	0	0	0	0
$2<|z|<3$	1	1	0	1

Methods Used

Method	C77-1	C77-2	C77-3	C77-4
GC/ECD	5	5	5	4
GC/MS	3	3	3	3
GC/MS/MS	2	2	2	2
GC/ECD/SHKE	1	1	1	1
GC/MSHR	1	1	1	1

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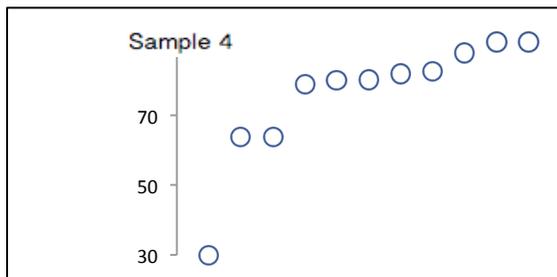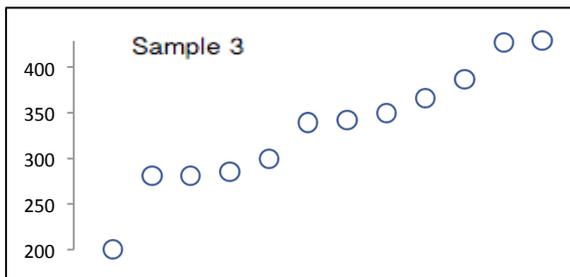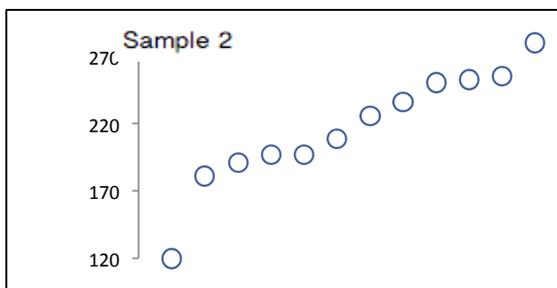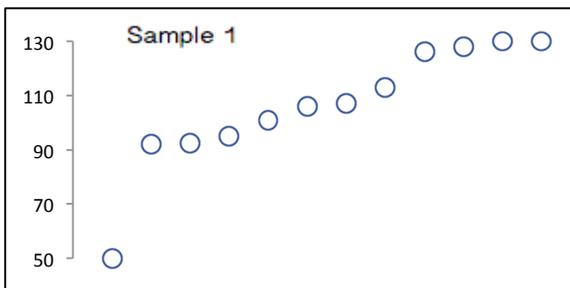
ENDRIN

z-Score Plots
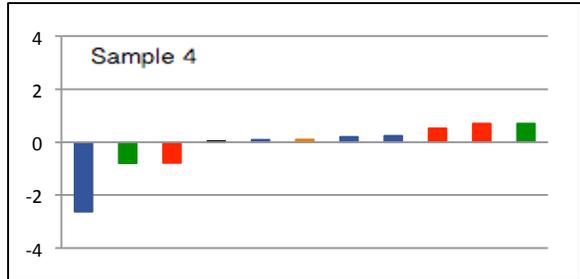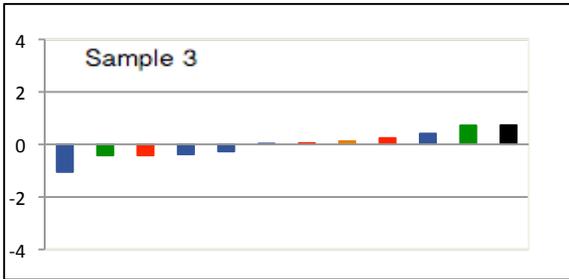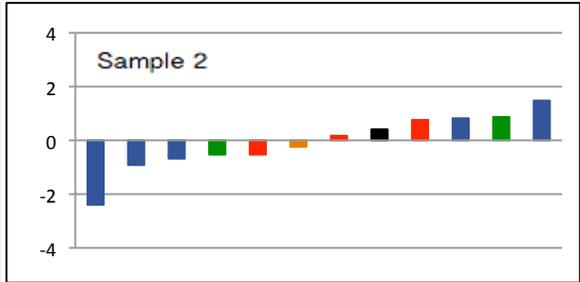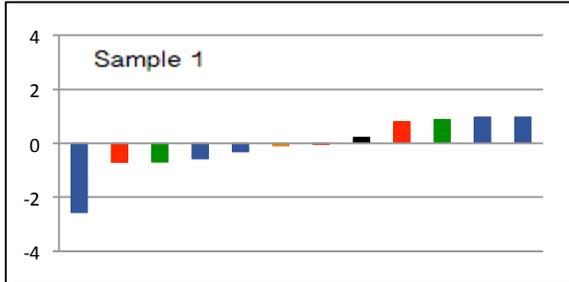
Kernel Density Plots
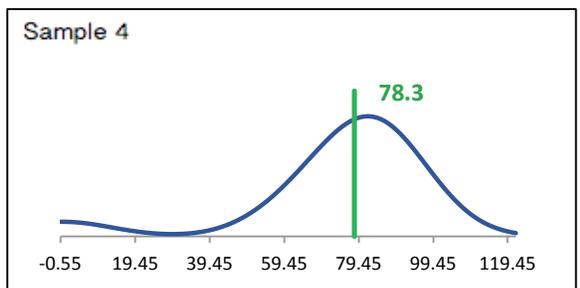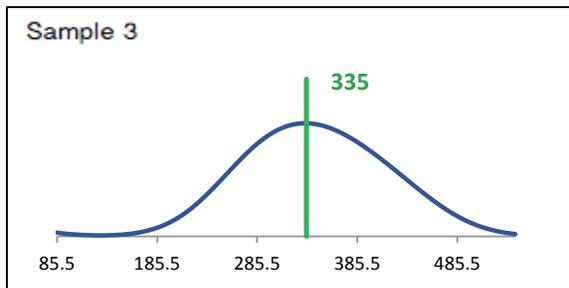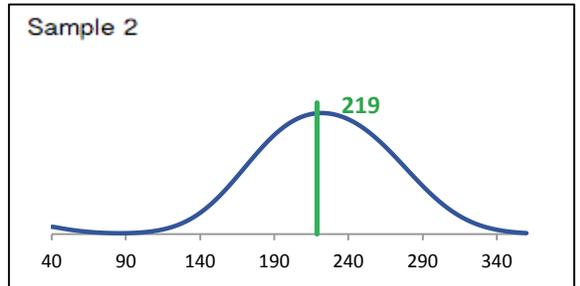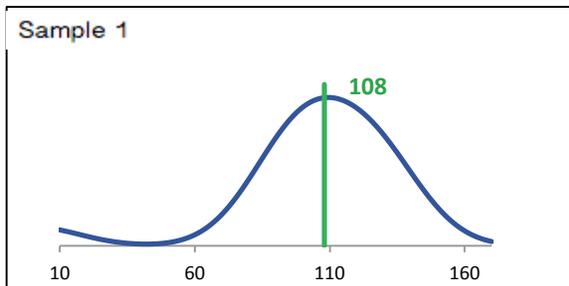
ENDRIN

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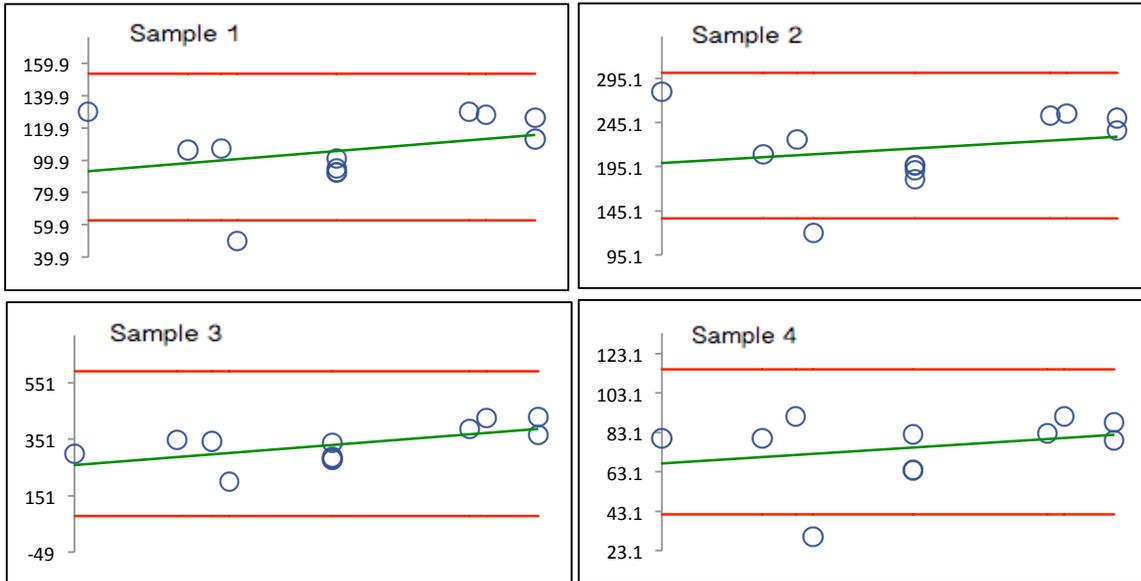
Reported results (Y-axis) plotted against reported analysis date (X-axis)

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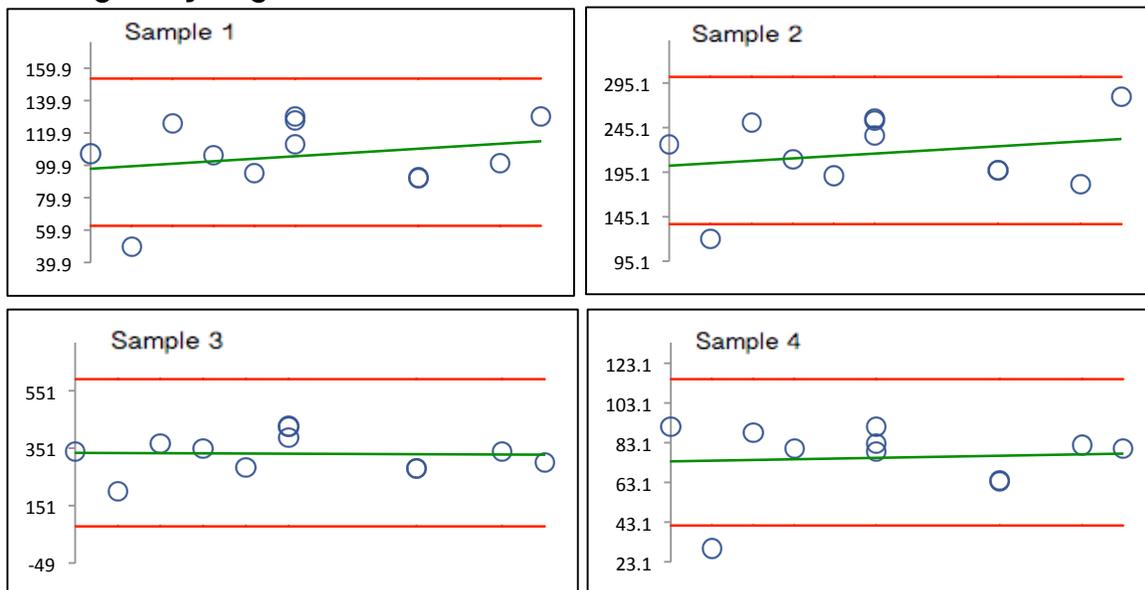
Reported results (Y-axis) plotted against bottling order (X-axis).

LINDANE (GAMMA-BHC)

Summary Statistics

Statistic	C77-1	C77-2	C77-3	C77-4
N	12	12	12	12
Median	108	255	372	77.9
Robust Mean	106	245	381	79.3
U	5.8	14.4	22.3	3.6
Robust Standard Deviation	16.0	39.8	61.9	9.9
Regression Standard Deviation	26.7	53.9	80.6	21.5
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA)	26.7	53.9	80.6	21.5
Outliers	0	0	0	0
|z|>3.0	0	0	0	0
2<|z|<3	0	0	0	0

Methods Used

Method	C77-1	C77-2	C77-3	C77-4
GC/ECD	4	4	4	4
GC/ECD/SHKE	1	1	1	1
GC/MS	4	4	4	4
GC/MS/MS	2	2	2	2
GC/MSHR	1	1	1	1

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

# LINDANE (GAMMA-BHC)

## z-Score Plots
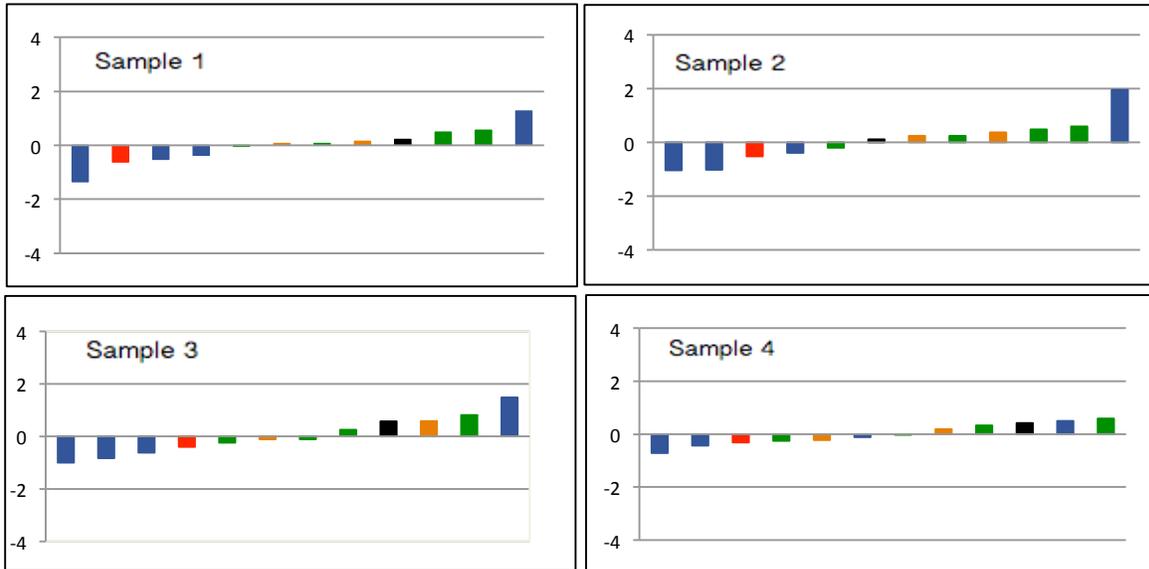
Kernel Density Plots
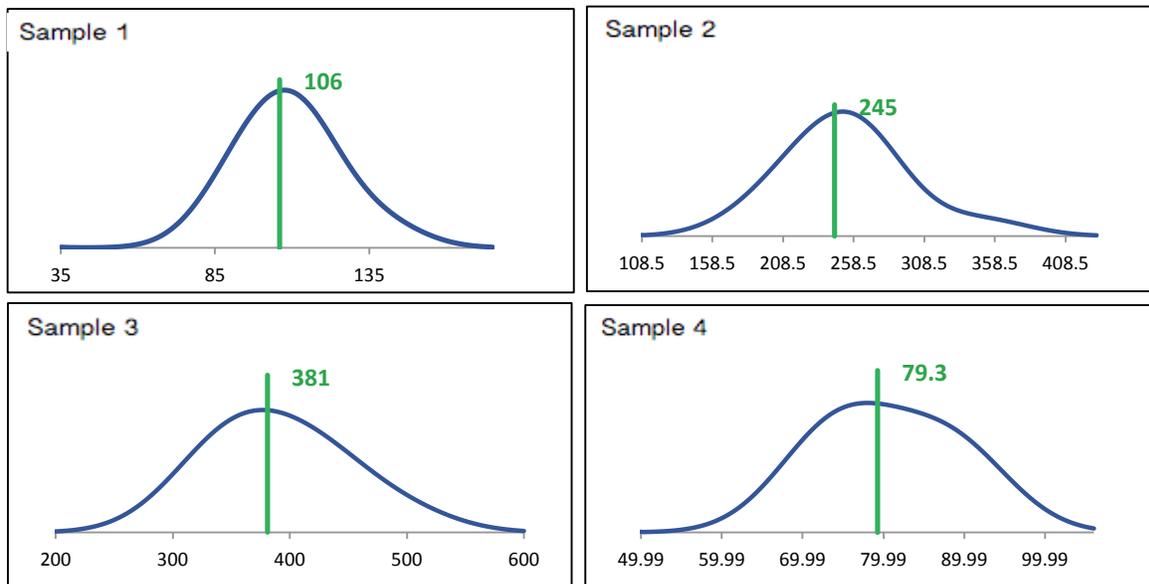
LINDANE (GAMMA-BHC)

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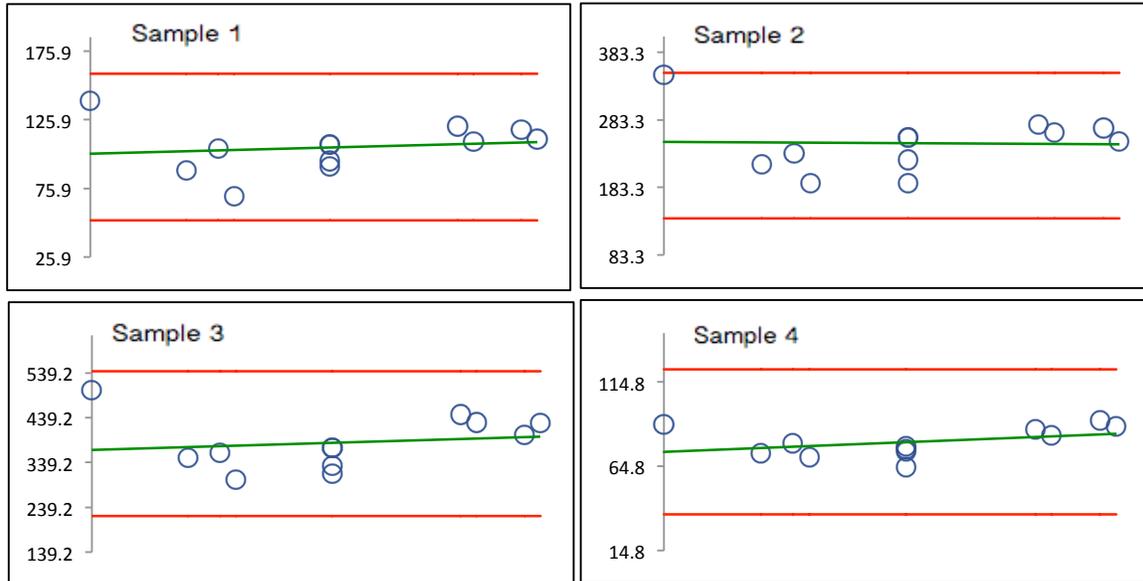
Reported results (Y-axis) plotted against reported analysis date (X-axis)

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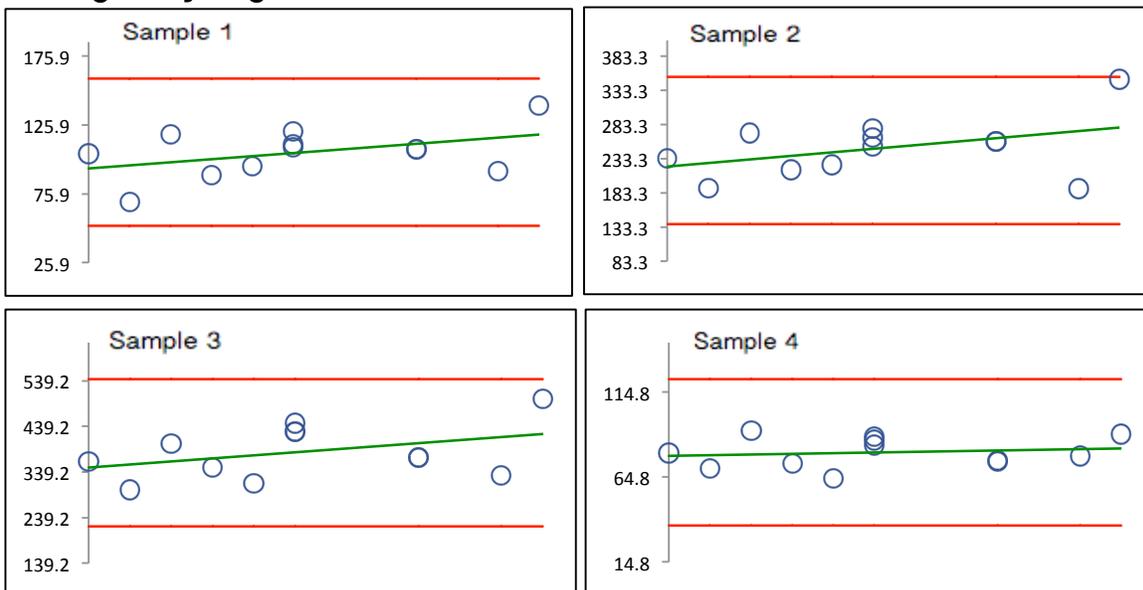
Reported results (Y-axis) plotted against bottling order (X-axis).

GAMMA-CHLORDANE

Summary Statistics

Statistic	C77-1	C77-2	C77-3	C77-4
N	11	11	11	11
Median	221	121	315	149
Robust Mean	206	117	320	146
U	12.1	5.3	16.6	7.0
Robust Standard Deviation	32.0	14.1	44.1	18.5
Regression Standard Deviation	36.4	21.6	55.4	26.5
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA)	36.4	21.6	55.4	26.5
Outliers	0	0	0	0
$|z|>3.0$	0	0	0	0
$2<|z|<3$	0	0	0	0

Methods Used

Method	C77-1	C77-2	C77-3	C77-4
GC/ECD	3	3	3	3
GC/ECD/SHKE	1	1	1	1
GC/MS/MS	2	2	2	2
GC/MS	4	4	4	4
GC/MSHR	1	1	1	1

All summary stats and the plots below are based on the data excluding any flagged outliers
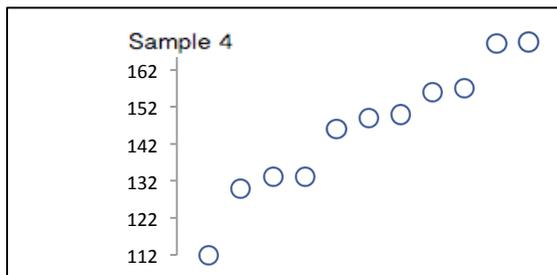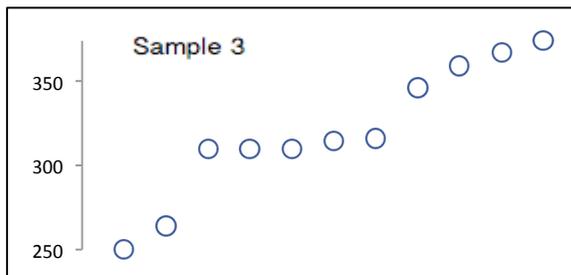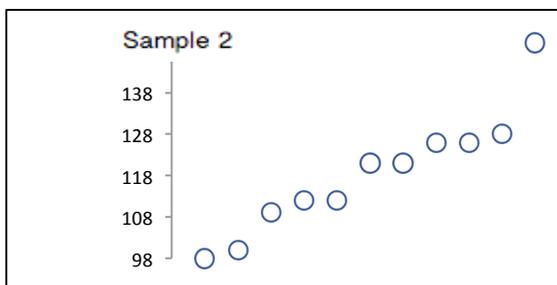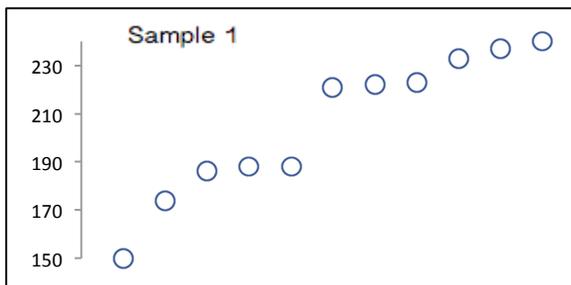
# GAMMA-CHLORDANE

z-Score Plots
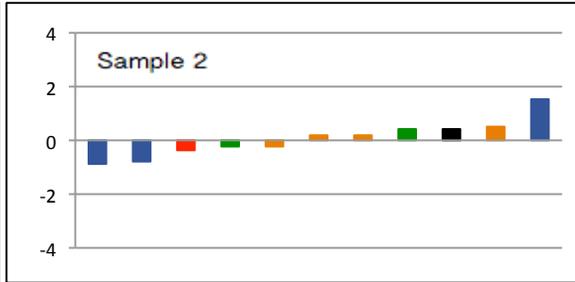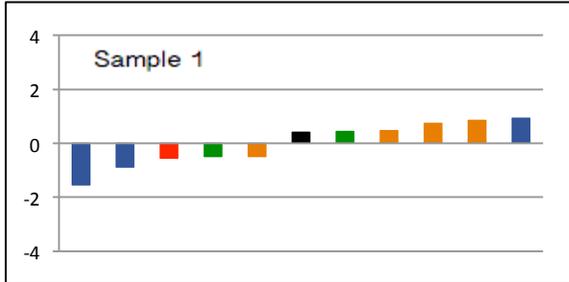

Kernel Density Plots
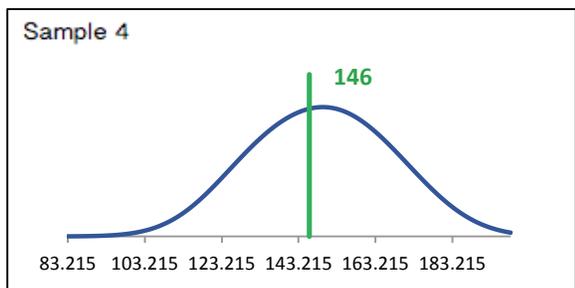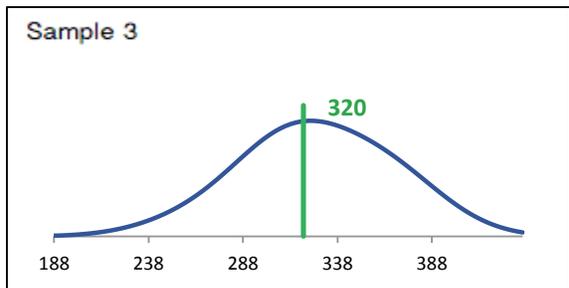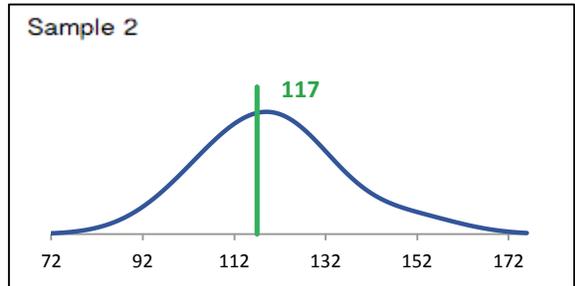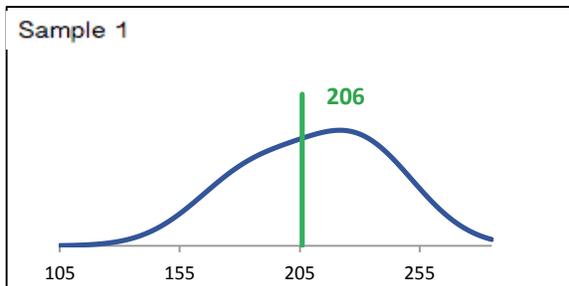
GAMMA-CHLORDANE

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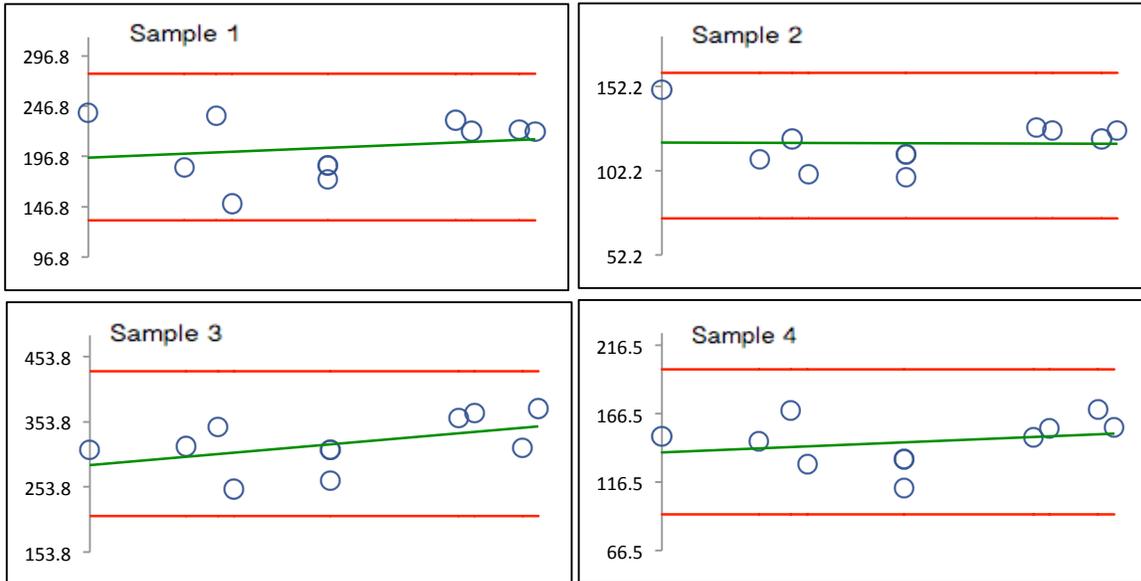
Reported results (Y-axis) plotted against reported analysis date (X-axis)

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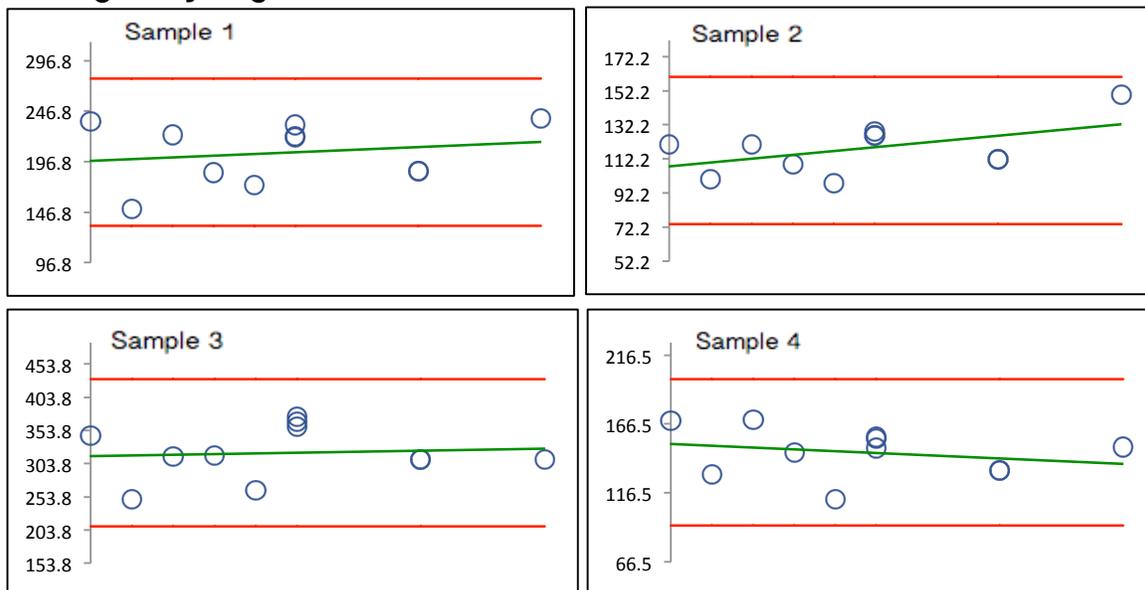
Reported results (Y-axis) plotted against bottling order (X-axis).

HEPTACHLOR

Summary Statistics

Statistic	C77-1	C77-2	C77-3	C77-4
N	12	12	12	12
Median	121	254	63.0	90.0
Robust Mean	121	246	64.9	90.2
U	5.6	11.8	3.0	1.6
Robust Standard Deviation	15.5	32.7	8.43	4.54
Regression Standard Deviation	25.7	49.6	15.0	19.8
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA)	25.7	49.6	15.0	19.8
Outliers	0	0	0	0
|z|>3.0	0	0	0	0
2<|z|<3	0	0	0	0

Methods Used

Method	C77-1	C77-2	C77-3	C77-4
GC/ECD	4	4	4	4
GC/MS	4	4	4	4
GC/MS/MS	2	2	2	2
GC/ECD/SHKE	1	1	1	1
GC/MSHR	1	1	1	1

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

HEPTACHLOR

z-Score Plots
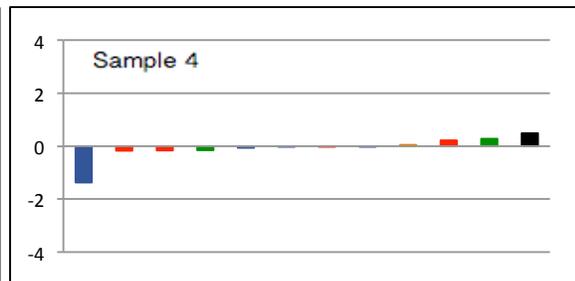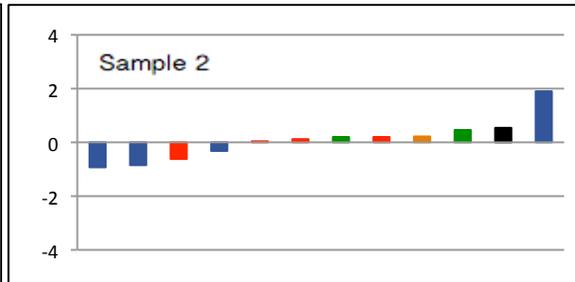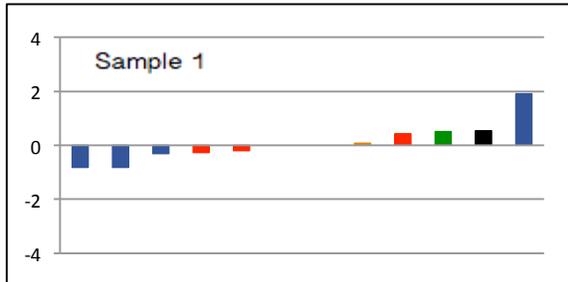
Kernel Density Plots
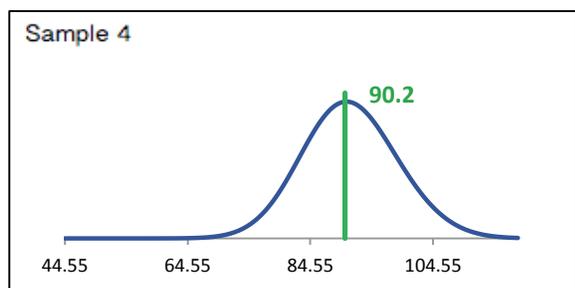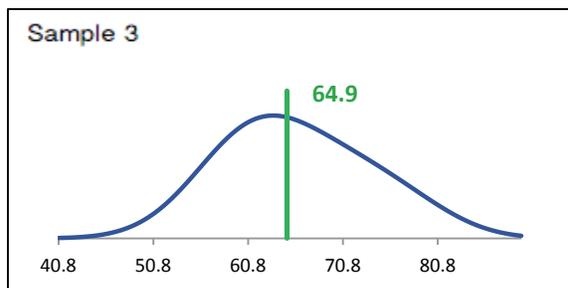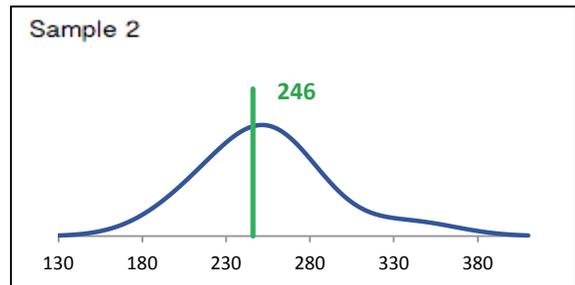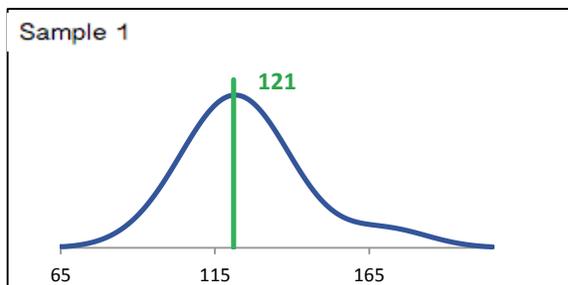
HEPTACHLOR

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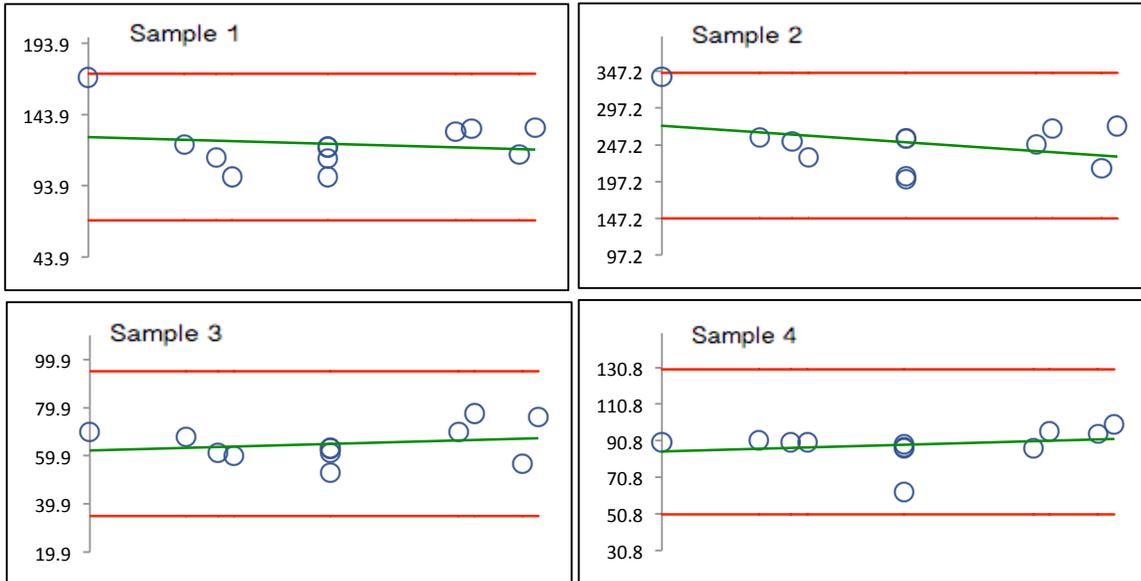
Reported results (Y-axis) plotted against reported analysis date (X-axis)

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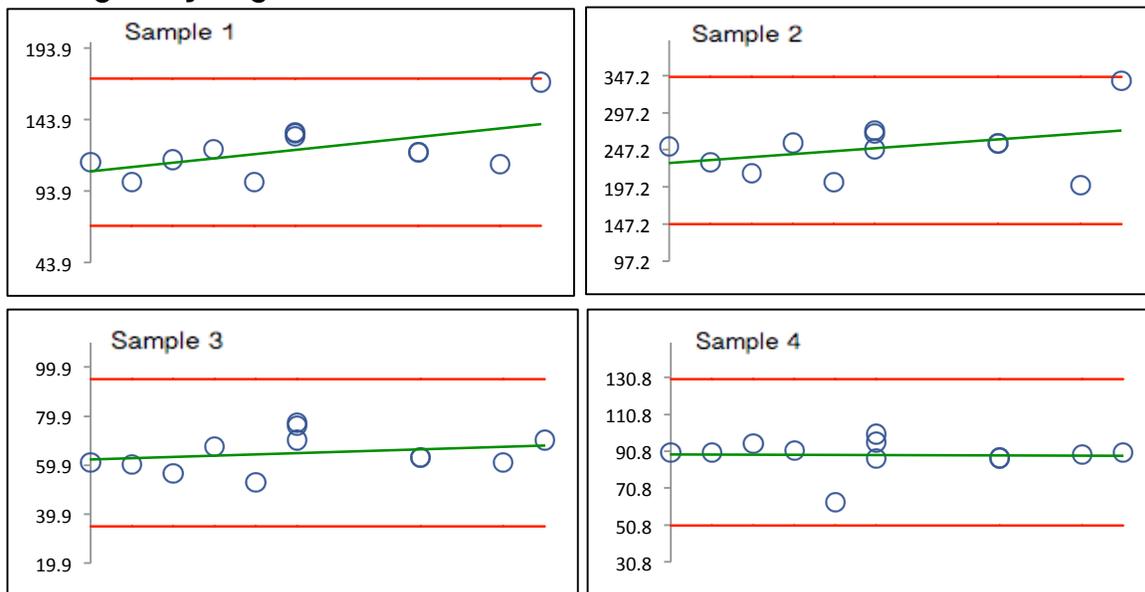
Reported results (Y-axis) plotted against bottling order (X-axis).

HEPTACHLOR EPOXIDE

Summary Statistics

Statistic	C77-1	C77-2	C77-3	C77-4
N	11	11	11	11
Median	159	70.2	319	113
Robust Mean	162	72.1	320	117
U	6.4	3.1	15.5	4.0
Robust Standard Deviation	17.1	8.25	41.1	10.5
Regression Standard Deviation	31.4	15.3	59.5	23.3
Stability Flag				
Homogeneity Flag	Homogeneity	Homogeneity	Homogeneity	
Standard Deviation Used (SDPA)	57.2	31.3	157	23.3
Outliers	0	0	0	0
|z|>3.0	0	0	0	0
2<|z|<3	0	0	0	0

Methods Used

Method	C77-1	C77-2	C77-3	C77-4
GC/ECD	4	4	4	4
GC/ECD/SHKE	1	1	1	1
GC/MS/MS	2	2	2	2
GC/MS	3	3	3	3
GC/MSHR	1	1	1	1

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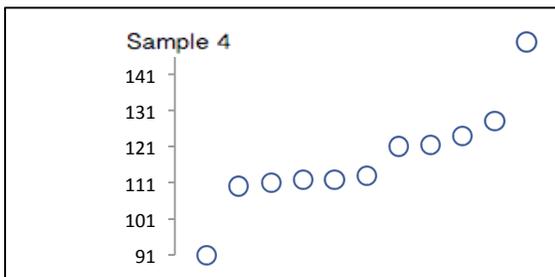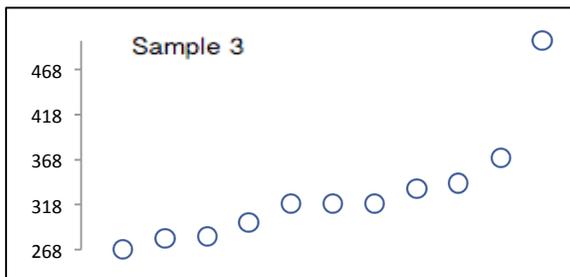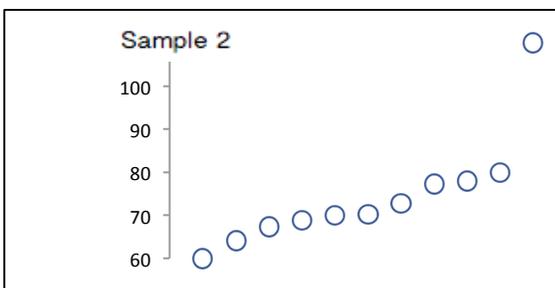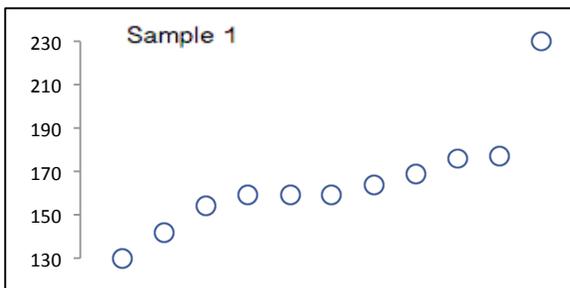
HEPTACHLOR EPOXIDE

## z-Score Plots
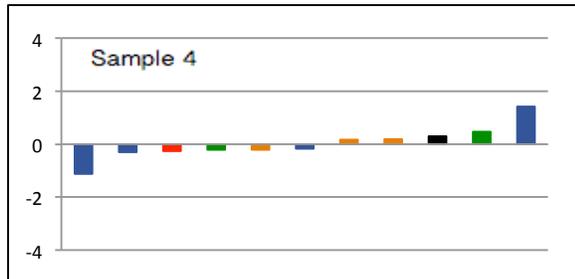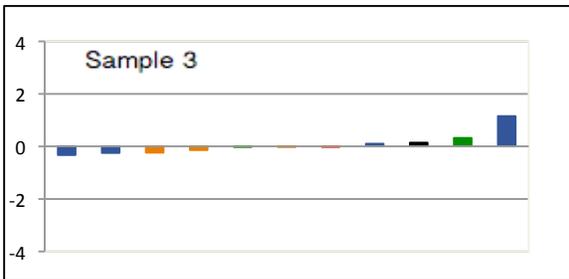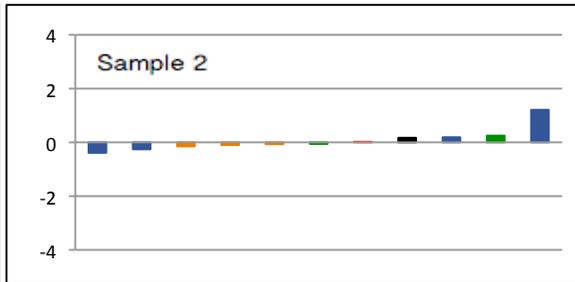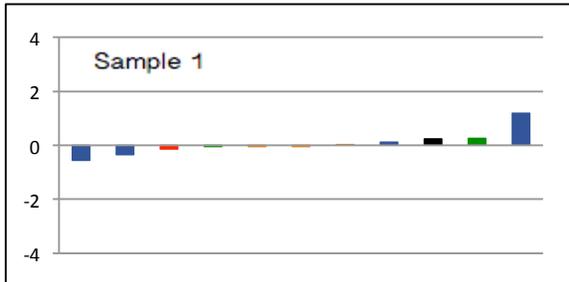
Kernel Density Plots
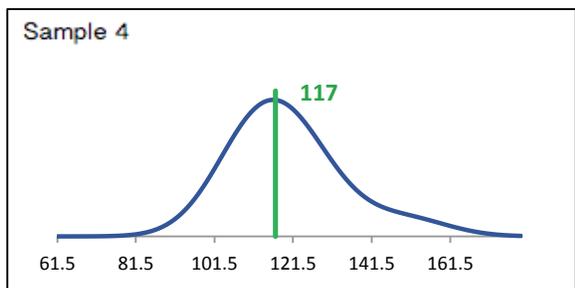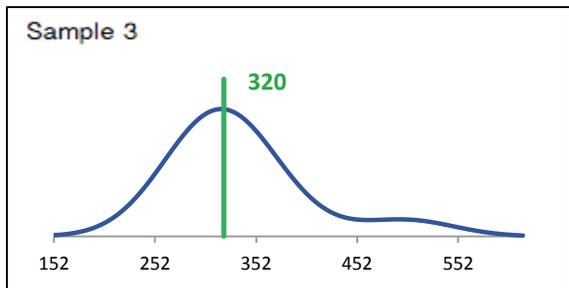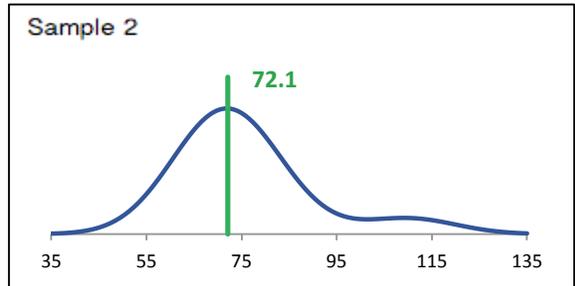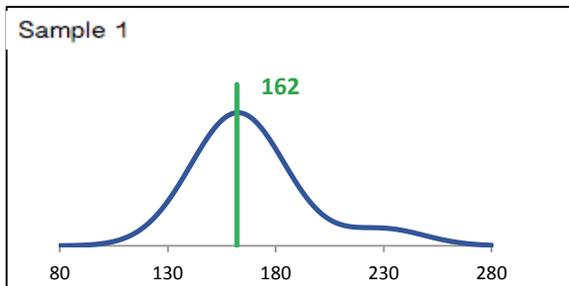
HEPTACHLOR EPOXIDE

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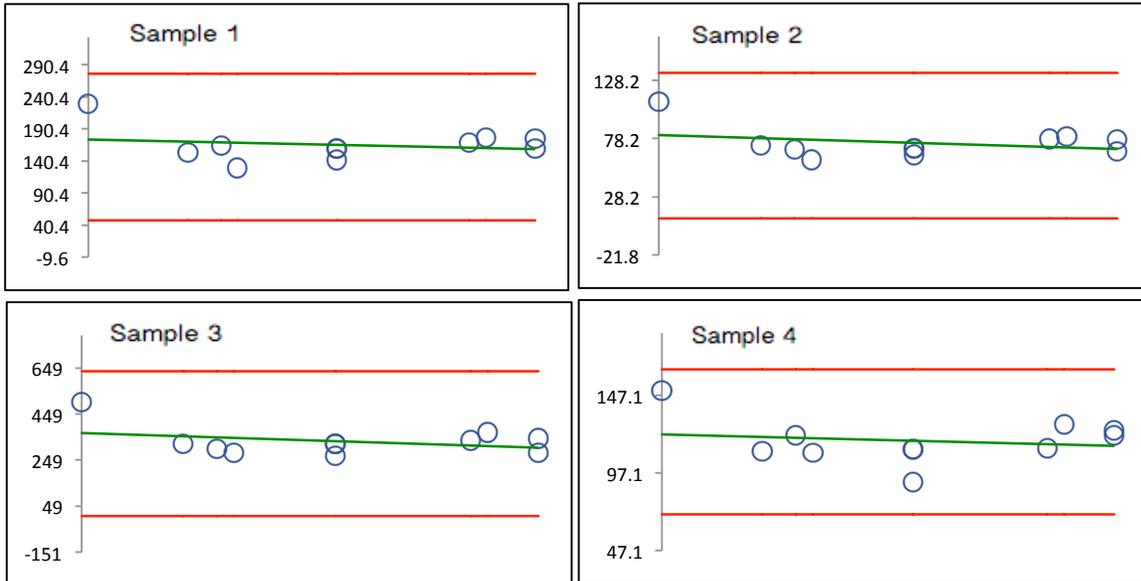
Reported results (Y-axis) plotted against reported analysis date (X-axis)

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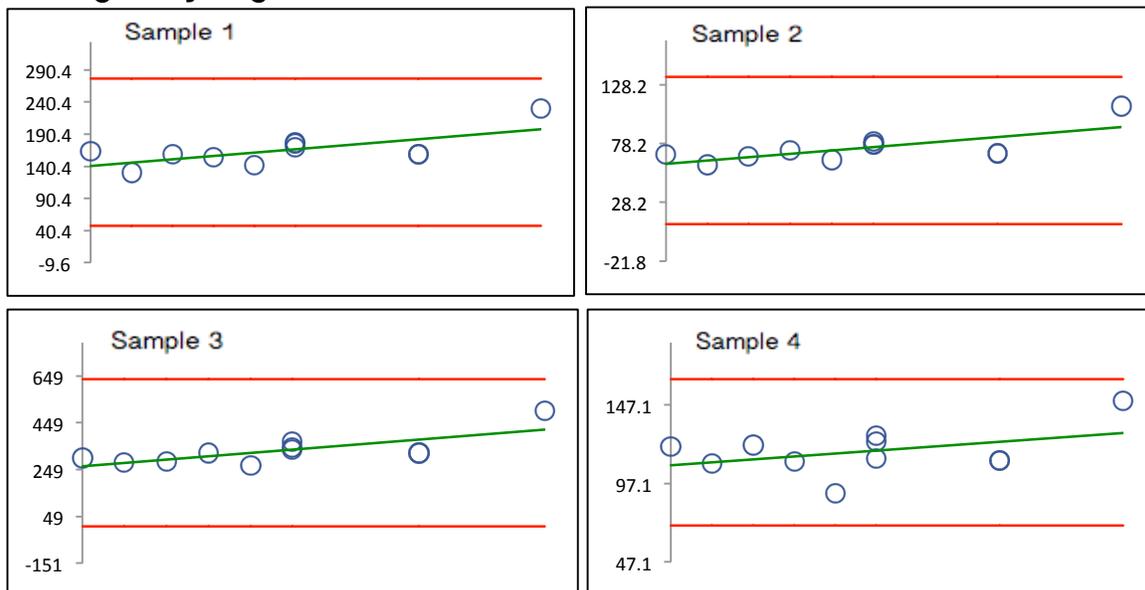
Reported results (Y-axis) plotted against bottling order (X-axis).

4,4'-METHOXYCHLOR (P,P'-METHOXYCHLOR)

Summary Statistics

Statistic	C77-1	C77-2	C77-3	C77-4
N	11	11	11	11
Median	435	228	137	313
Robust Mean	393	230	147	291
U	31.8	17.4	13.8	23.3
Robust Standard Deviation	84.5	46.2	36.5	61.9
Regression Standard Deviation	112	68.0	45.7	84.4
Stability Flag	Stability		Stability	
Homogeneity Flag				
Standard Deviation Used (SDPA)	135.0	68.0	60.0	84.4
Outliers	0	0	0	0
|z|>3.0	0	0	0	0
2<|z|<3	0	0	0	0

Methods Used

Method	C77-1	C77-2	C77-3	C77-4
GC/ECD	4	4	4	4
GC/MS/MS	2	2	2	2
GC/MS	3	3	3	3
GC/ECD/SHKE	1	1	1	1
GC/MSHR	1	1	1	1

All summary stats and the plots below are based on the data excluding any flagged outliers
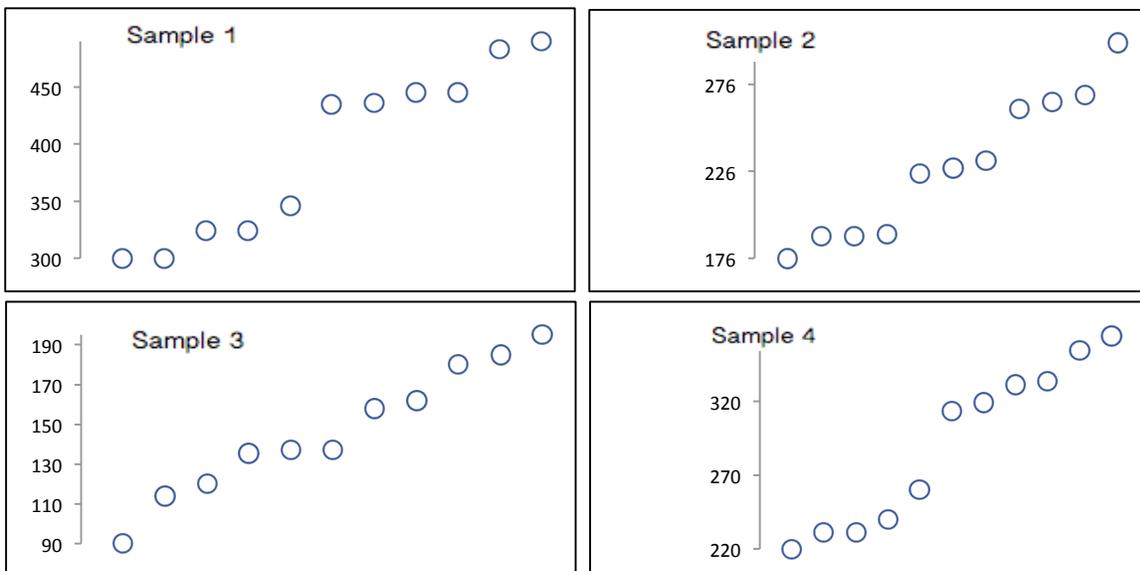
4,4'-METHOXYCHLOR (P,P'-METHOXYCHLOR)

z-Score Plots
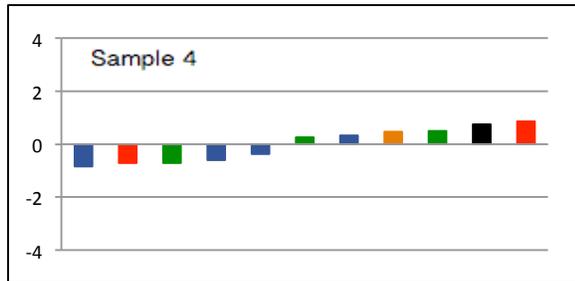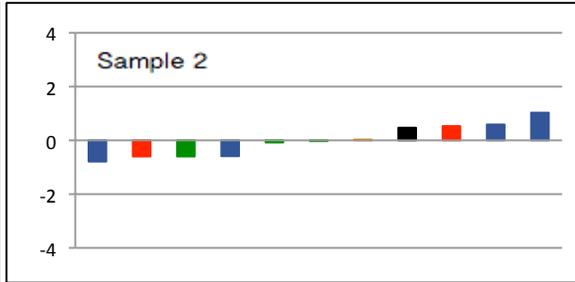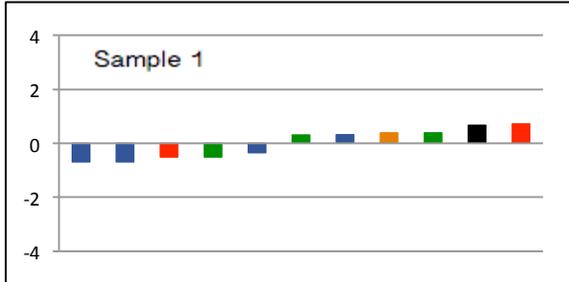

Kernel Density Plots
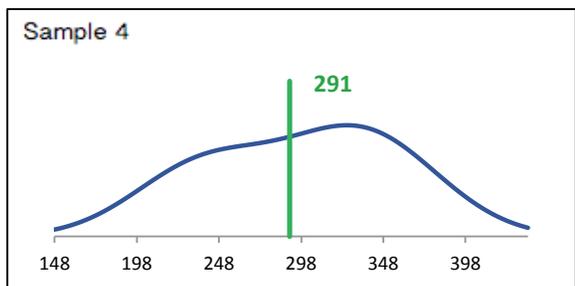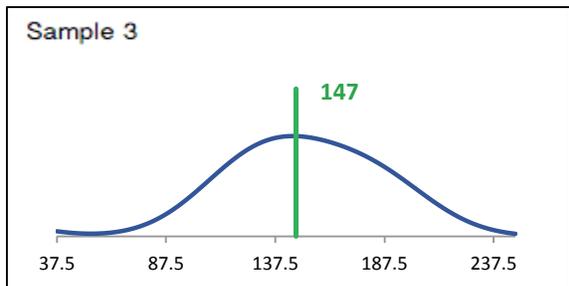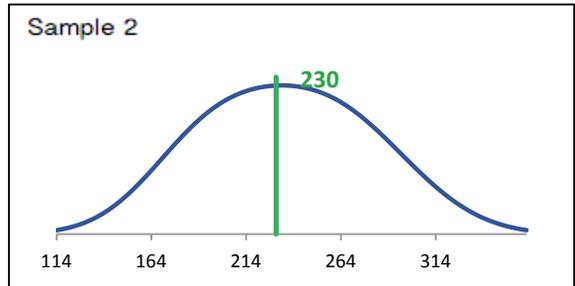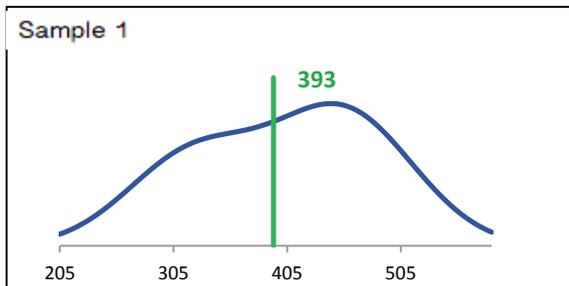
4,4'-METHOXYCHLOR (P,P'-METHOXYCHLOR)

Stability Regression

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

Homogeneity Regression

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