VERIFICATION OF THE DEFENSE WASTE PROCESSING FACILITY'S (DWPF) PROCESS DIGESTION METHOD FOR THE SLUDGE BATCH 7B BLEND SAMPLE

D. R. Click
T. B. Edwards
B.J. Wiedenman

August 29, 2011

Analytical Development
Savannah River National Laboratory
Aiken, SC 29808

Prepared for the U.S. Department of Energy Under Contract Number DE-AC09-08SR22470

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LIST OF ACRONYMS

AD	Analytical Development
AR	Aqua Regia
ARG	Analytical Reference Glass
CC	Cold Chem
DI	De-Ionized
DOE	Department of Energy
DWPF	Defense Waste Processing Facility
ICP-AES	Inductively Coupled Plasma – Atomic Emission Spectroscopy
LWO	Liquid Waste Operations
PF	Sodium Peroxide/Hydroxide Fusion
SB	Sludge Batch
SME	Slurry Mix Evaporator
SRAT	Sludge Receipt and Adjustment Tank
SRNL	Savannah River National Laboratory
WAPS	Waste Acceptance Product Specification

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1.0 SUMMARY

For each sludge batch that is processed in the Defense Waste Processing Facility (DWPF), the Savannah River National Laboratory (SRNL) performs confirmation of the applicability of the digestion method to be used by the DWPF lab for elemental analysis of Sludge Receipt and Adjustment Tank (SRAT) receipt samples and SRAT product process control samples. DWPF SRAT samples are typically dissolved using a room temperature HF-HNO_3 acid dissolution (i.e., DWPF Cold Chem Method, see DWPF Procedure SW4-15.201) and then analyzed by inductively coupled plasma – atomic emission spectroscopy (ICP-AES).

This report contains the results and comparison of data generated from performing the Aqua Regia (AR), Sodium Peroxide/Hydroxide Fusion (PF) and DWPF Cold Chem (CC) method digestions of Sludge Batch 7b (SB7b) SRAT Receipt and SB7b SRAT Product samples. The SB7b SRAT Receipt and SB7b SRAT Product samples were prepared in the SRNL Shielded Cells, and the SRAT Receipt material is representative of the sludge that constitutes the SB7b Blend, the sludge expected to be in Tank 40.

Observations and results from the SRAT Receipt digestions include the following:

- Brown/red solids and white solids remained in the solutions generated from the CC digestion after all acid addition steps and dilutions were performed. The brown/red colored solids eventually dissolved.
- A statistically larger average Al concentration is seen in the PF digestions compared to the AR and CC methods with an ~3% and an ~6% relative difference in the means, respectively.
- There is not a statistical difference in the means for Th between the AR and PF digestion results but a statistical difference in the means is noted between the mean of the CC digestions and the AR and PF means with an ~22% and an ~16% relative difference in the means, respectively.
- A statistical difference in the means is noted for U between the PF results compared to the AR and CC results. The PF mean is ~5% lower than the AR results and ~7% lower than the CC result.
- A statistical difference of means is noted for the minor elements Cr, Cu, K, Li, Mg, Ti and Zr between two or more of the digestion methods.
- There is not a statistical difference in the means for Fe, Mn, or Ni, nor is there a statistical difference in the mean Na concentration obtained by the AR and CC digestion methods.

Observations and results from the SRAT Product digestions include the following:

- Brown/red solids and white solids remained in the solutions generated from the CC digestion after all acid addition steps and dilutions were performed. The brown/red colored solids eventually dissolved.
- A statistically larger average Al concentration is seen in the PF digestions compared to the AR and CC methods with an ~2% and an ~7% relative difference in the means, respectively.
- There is not a statistical difference in the means for Th between the AR and PF digestion results but a statistical difference in the means is noted between the mean of the CC digestions and the AR and PF means with an ~26% and an ~18% relative difference in the means, respectively.
- A statistical difference of means is noted for the minor elements Cu, K, Ti and Zr between two or more of the digestion methods.
- There is not a statistical difference in the means for Cr, Fe, Li, Mg, Mn, Ni, or U, nor is there a statistical difference in the mean Na concentration obtained by the AR and CC digestion methods.

Based on the results from performing three different digestion methods on SB7b sludge slurry, SRNL notes and recommends the following:

- The results from using the DWPF CC method to digest SB7b sludge slurry appear, in most cases, to be equivalent to the AR and PF digestion methods. However, Al and Th should be analyzed by the peroxide fusion method for SB7b. Visual observations indicate Fe and Mn may not be completely dissolving in the initial dilution of the sample before the final dilution is performed. For this data set, very small relative differences between the digestion methods are noted and no statistical difference is observed between the digestion methods for Fe and Mn. However, we recommend that the Fe and Mn concentration be determined using both digestion methods (CC and PF) for SB7b sludge slurry and the highest concentration between the two digestions should be used. Although K is a minor element, large relative differences are noted in this report between the different digestions and the DWPF should also monitor the K concentration.

- The DWPF CC method was originally developed to be used for SME analyses. Given continuous visual observations of solids in the CC digestions both at SRNL and DWPF, potential issues with accurate Al measurements when processing HM waste, and difficulty measuring Th accurately due to the limited solubility of Th in HF matrices, SRNL recommends that the DWPF consider a different digestion scheme that relieves some of these issues.

- The DWPF CC results from this study indicate Al and Th do not completely dissolve or precipitate as fluoride salts. Visual observations also indicate Fe and Mn may not completely dissolve using the DWPF CC method. Therefore, DWPF should consider and monitor the impact of these elements on SB7b blending operations conducted at DWPF via comparison of SRAT and SME analyses. If a consistent difference in elemental concentrations is revealed, another type of digestion (i.e. sodium peroxide/hydroxide fusion) should be used to determine the concentration of the element in question. Particular emphasis should be placed on monitoring Al, Fe, Mn, K, and Th concentrations in SB7b.

2.0 EXPERIMENTAL

The SB7b sample used for this study was the SB7b SRAT Receipt sample comprised of the following; Tank 7 sludge from sample FTF-07-11-3, Tank 51 sludge from sample HTF-51-11-28 (the Sludge Batch 7a confirmation sample), H Canyon Pu solution, and a salt solution were combined to produce a slurry with a composition to match Tank Farm projections of April 27, 2011. The material was not in the multiple steps washed as the Tank Farm would wash due to schedule constraints; instead, one "Wash", using the salt solution, was used to produce the slurry. Then, the Tank 7/Tank 51 mixture was combined with the Sludge Batch 7a Tank 40 Waste Acceptance Product Specification sample (HTF-40-11-66) to produce the SB7b. The blended sample was 71% Tank 40, 29% Tank 7/Tank 51 measured on an insoluble solids basis. The blend represented the highest projected Tank 40 heel (as of May 25, 2011) for the planned SB7b transfer.

The sludge samples were dissolved in quadruplicate in the SRNL Shielded Cells facility in a manner similar to the DWPF CC method, and by PF and AR digestion. For detailed steps of the PF digestion, see ADS procedure 2502.[1] For detailed steps of the AR digestion, see ADS procedure 2226.[2] Three replicate dissolutions of the analytical reference glass (ARG) standard were performed concurrently with each set of digestions for quality control purposes. The ARG results are then evaluated by comparing the measured results against a two sigma variation of the standard deviation associated with measured concentrations obtained from a round-robin consensus study. For the SRAT Receipt material, B, Si, Ti, and Zr (as expected) were low and flagged for being outside of the 2 sigma limits for the AR digestions. Ca was flagged for being outside the 2 sigma limits (slightly high) for the PF digestions. Ca and Fe were flagged for being outside the 2 sigma limits (slightly high) for the CC digestions. For the SRAT product material, Al, B, Si, Ti and Zr (as expected) were flagged for being outside of the 2 sigma limits for the AR digestions. All elements were within the 2 sigma limits for the CC digestions. Ca was flagged for being outside of the 2 sigma limits for the PF digestions. Additional quality control measures included ICP-AES analyses of a multi-element standard as a check for ICP-AES accuracy independent of digestions. Elements in this standard included Al, Fe, Mn, Ni, Na and S. All measured values were within 15% of the known concentrations for these elements in the standard analyzed concurrently with the PF and AR digestions.

The CC method digestion (see DWPF Procedure SW4-15.201) involved adding 25 mL of concentrated HF to radioactive sludge slurry (~3.5 g for the SRAT Receipt at 16.05 wt% total solids and ~3.5 g for the SRAT Product at 23.6 wt% total solids) and stirring for 1 hr. Then, 25 mL of concentrated HNO_3 was added and the mixture was stirred for an additional 30 minutes. Undissolved brown/red solids remained in each digestion bottle after the acid addition was complete. Each sample was then diluted with de-ionized (DI) water to 250 mL in a pre-weighed volumetric flask. The density of the solution was obtained from the weight of the 250 mL of solution. Approximately 15 g of solution was taken from the 250 mL volumetric flask and added to a 100 mL volumetric flask and subsequently diluted with DI water. Over time, all of the brown solids dissolved into the solution but white insoluble/precipitated solids remained. No attempt to recover the solids was made.

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3.0 INTRODUCTION AND RESULTS

The DWPF is currently processing and immobilizing radioactive sludge slurry into a durable borosilicate glass. The DWPF has already processed seven sludge batches (Sludge Batch 1A, Sludge Batch 1B, Sludge Batch 2, Sludge Batch 3, Sludge Batch 4, Sludge Batch 5, Sludge Batch 6) and is currently processing an eighth (Sludge Batch 7a). A sludge batch is defined as a single tank of sludge or a combination of sludges from different tanks that has been or will be qualified before being transferred to DWPF. Thus, following the sludge batch preparation plan of the Liquid Waste Organization (LWO), the qualified sludge in Tank 51 is to be blended with the heel of the previous sludge batch in Tank 40 (referred to as a "blend" composition in sludge batch planning). The sludge being qualified at the SRNL is the "blend" sample, a sludge sample that has been blended with Tank 40 material representing the heel of the previous sludge batch. The next batch of radioactive sludge slurry to be processed by the DWPF is SB7b.

The statistical results of the SB7b samples generated from this study are provided in Table A1 of Appendix A. The results from each type of digestion are summarized in Table 3-1 for the SRAT Receipt and Table 3-3 for the SRAT Product samples. The ICP-AES results of the seventeen elements that are analyzed by the DWPF lab are presented on a weight percent (wt%) of total solids basis. A statistical comparison of the means from the SRAT Receipt and SRAT Product for all three digestions could not be performed for B, Ca, Na, Si or Zr. B was less than the detection limit in the AR and PF digestions and B is leached from the borosilicate spray chamber of the ICP-AES instrument due to the presence of HF in the CC digestions and is therefore not reported. Ca is a contaminant in the PF reagents and is not included in the means with the AR and CC digestions for comparison. Na is added as part of the reagents used for PF digestions so only the means of the CC and AR digestions were compared. Si is leached from the ICP-AES instrument due to the presence of HF in the CC digestions and Si is known to not dissolve well in AR digestions. Thus, the Si value obtained from the PF data was used. Zr could not be included in a statistical comparison of all the means because the PF digestion utilizes a Zr crucible; therefore, only the AR and CC results were compared. However, the Zr result from the AR digestions was low. Zr dissolves better when HF is present and this can readily be seen from the ARG-1 analysis results. In addition, for the SRAT Receipt, the K concentrations could not be compared because K was less than the minimum detection limit in all three digestions and for the SRAT product sample, the potassium concentration was less than the minimum detection limit in the CC digestion solutions.

Statistical comparisons of the data from the three digestion methods (for B, Na, Si and Zr there are only two digestion methods) are provided in Exhibit A1 in Appendix A. The results were generated using JMP Version 7.0.2.[3] The plots of this exhibit show a 95% confidence interval for the mean (a mean diamond) of each set of measurements. For each element, the mean concentration of the samples by each digestion method is provided, and means that are not connected by the same letter in the listing of the exhibit are significantly different at a significance level of 5%. For example, consider the SRAT Receipt Al measurements. The results of the exhibit indicate that the mean of the PF results differs from the mean of the CC results. The exhibit also indicates the means for the CC results and the AR results are not statistically different and the means from the AR results and the PF results are not statistically different.

For the B, Na, Si, Zr comparisons, the JMP output from an analysis of variance of the measurements for two digestions is provided, and only the 95% confidence mean diamond of each digestion is shown. Overlap marks show for each diamond, and overlap marks in one diamond that are closer to the mean of another diamond than that diamond's overlap marks indicate that those two groups are not different at the 95% confidence level. The visual comparisons are supported by an F test that compares the means of the AR and CC digestions for Na and Zr and the means of the AR and PF digestions for B and Si. If the p value is less than 0.05, then the means are statistically different at the 5% level. From Exhibit A1, there is

no statistical difference in the AR and CC means for Na for the SRAT Product or the SRAT Receipt samples.

Summaries of the statistical comparisons of Exhibit A1 are shown in Table 3-2 and Table 3-4. Digestion methods not having the same bold font or those that are not underlined are statistically different at the 5% significance level. The less than sign indicates the digestion method with the lowest and highest mean concentration from ICP-AES measurements. Tables 3-5 through 3-8 contain the ARG-1 digestion results from the three digestion methods with a relative comparison to the known concentration of specific elements in the ARG-1 glass.

During verification of the DWPF CC method for previous sludge batches, boehmite (AlO(OH)), muscovite (K,Na)(Al, Mg, Fe)$_2$($Si_{3.1}Al_{0.9}$)O_{10}(OH)$_2$, silicon dioxide (SiO_2), dipotassium sodium aluminum fluoride ($K_2NaAl_3F_{12}$), dipotassium aluminum pentafluoride (K_2AlF_5), aluminum fluoride (AlF_3), chiolite ($Na_5Al_3F_{14}$), cryolite (Na_3AlF_6), sodium magnesium aluminum hexafluoride ($NaMgAlF_6$), iron zirconium hexafluoride ($FeZrF_6$), disodium iron aluminum heptafluoride (Na_2FeAlF_7), and calcium thorium fluoride ($Ca_{0.5}Th_{0.5}F_3$) have been found.[4] Due to the radioactivity of the samples, no attempt to recover the solids was made.

Table 3-1. Elemental concentrations of SB7b SRAT Receipt radioactive sludge slurry obtained from ICP-AES analysis of Aqua Regia, DWPF Cold Chem method and Sodium Peroxide/Hydroxide Fusion digestions. Values are presented on a weight percent (wt%) of total dried solids basis.

Digestion Method →	Aqua Regia		Na_2O_2/NaOH Fusion		DWPF Cold Chem	
Element	Avg Wt%	%RSD[#]	Avg Wt%	%RSD[#]	Avg Wt%	%RSD[#]
Al	8.48E+00	3.8E+00	8.83E+00	3.0E-01	8.14E+00	2.6E+00
B	<8.17E-03	NA	<8.10E-02	NA	NA	NA
Ca	6.38E-01	4.7E+00	7.53E-01	2.5E+00	6.62E-01	1.7E+00
Cr	4.31E-02	5.8E+00	6.04E-02	2.2E+01	4.44E-02	2.6E+00
Cu	8.00E-02	5.2E+00	4.87E-02	5.6E+00	4.44E-02	6.7E-01
Fe	1.42E+01	4.5E+00	1.43E+01	1.5E-14	1.45E+01	3.5E-01
K	<2.58E-02	NA	<2.56E-01	NA	<1.89E-01	NA
Li	2.65E-02	5.6E+00	2.34E-02	2.5E+00	2.50E-02	1.7E+00
Mg	2.85E-01	4.8E+00	2.77E-01	9.6E-01	2.96E-01	3.2E-01
Mn	3.02E+00	4.8E+00	2.98E+00	3.4E-01	3.12E+00	3.1E-01
Na	1.41E+01	4.5E+00	NA	NA	1.46E+01	3.4E-01
Ni	2.94E+00	4.6E+00	2.95E+00	3.9E-01	2.98E+00	3.4E-01
Si	4.72E-01	1.9E+01	1.06E+00	5.5E-01	NA	NA
Th	1.04E+00	4.8E+00	9.56E-01	3.2E+00	7.61E-01	9.6E+00
Ti	1.69E-02	5.2E+00	1.97E-02	7.8E-01	1.93E-02	7.4E+00
U	4.77E+00	3.7E+00	4.45E+00	1.3E+00	4.98E+00	5.7E-01
Zr	1.39E-01	1.7E+01	NA	NA	2.70E-01	8.8E-01

Averages are based upon four replicate dissolutions and ICP-AES determinations except the Peroxide Fusion averages which are based upon three replicate dissolutions and ICP-AES measurements. NA = Not Applicable.
[#]%RSD is the percent relative standard deviation for the measurements.

Table 3-2 Statistical comparison of Aqua Regia, DWPF Cold Chem method and Sodium Peroxide/Hydroxide Fusion digestions of SB7b SRAT Receipt sludge. Digestion methods not having similar bold font or those that are not underlined are statistically different at the 5% significance level. The less than sign indicates the digestion method with the lowest and highest mean concentration from ICP-AES measurements.

Element	Statistical Comparisons
Al	CC < **AR** < **PF**
B[#]	NA
Ca	AR < CC
Cr	AR < CC < PF
Cu	CC < PF < AR
Fe	AR < PF < CC
K[#]	NA
Li	PF < **CC** < **AR**
Mg	PF < **AR** < **CC**
Mn	PF < AR < CC
Na	AR < CC
Ni	AR < PF < CC
Si	AR < PF
Th	CC < PF < AR
Ti	AR < CC <PF
U	PF < AR < CC
Zr	AR < CC

[#]Below ICP-AES detection levels, less than values reported.

For the SRAT Receipt sample:

- Brown/red solids and white solids remained in the solutions generated from the CC digestion after all acid addition steps and dilutions were performed. The brown/red colored solids eventually dissolved.
- A statistically larger average Al concentration is seen in the PF digestions compared to the AR and CC methods with an ~3% and an ~6% relative difference in the means, respectively.
- There is not a statistical difference in the means for Th between the AR and PF digestions but a statistical difference in the means is noted comparing CC digestions to the AR and PF means with an ~22% and an ~16% relative difference in the means, respectively.
- A statistical difference in the means is noted for U between the PF results compared to the AR and CC results. The PF results are ~5% lower than the AR results, and ~7% lower than the CC results.
- A statistical difference of means is noted for the minor elements Cr, Cu, K, Li, Mg, Ti and Zr.
- There is not a statistical difference in the means for Fe, Mn, or Ni, nor is there a statistical difference in the mean Na concentration from the AR and CC digestions.

Table 3-5 through Table 3-8 contain the ICP-AES measured weight percent elemental results from digestion of the ARG standard performed concurrently with the SB7b SRAT samples to determine if the dissolutions were complete and the resulting analyses accurate. A statistical comparison of means from the results of digesting the glass standard (ARG-1) by all three methods was not performed due to the small number of observations. However, relative differences are listed in Tables 3-5 through 3-8. For the AR digestions, Cu and Ti were the only elements with a relative difference greater than 10% compared to the known concentration of Cu and Ti in the ARG-1 standard. The Cu concentration reported was close to the ICP-AES detection limit which explains the large relative difference. Si and Zr are not considered because the means of these elements are expected to be greater than 10% different. For the PF digestions, the Ca and Cr means were greater than 10% different than the known concentrations in ARG-1. Ca is a contaminant in the PF reagents. For the CC digestions, Ca, Cr, and Cu had means greater than 10% different than the known concentrations in ARG-1 standard.

Table 3-3 contains the elemental concentrations of the SB7b SRAT Product sample.

Table 3-3. Elemental concentrations of SB7b SRAT Product radioactive sludge slurry obtained from ICP-AES analysis of Aqua Regia, DWPF Cold Chem method and Sodium Peroxide/Hydroxide Fusion digestions. Values are presented on a weight percent (Wt%) total dried solids basis.

Digestion Method →	Aqua Regia		Na_2O_2/NaOH Fusion		DWPF Cold Chem	
Element	Avg Wt%*	%RSD[#]	Avg Wt%*	%RSD[#]	Avg Wt%*	%RSD[#]
Al	7.65E+00	2.9E+00	8.49E+00	1.3E+00	8.22E+00	5.7E+00
B	<7.97E-03	NA	<1.74E-02	NA	NA	NA
Ca	6.13E-01	4.0E+00	7.60E-01	5.3E+00	6.20E-01	4.6E+00
Cr	4.08E-02	4.3E+00	4.56E-02	3.0E+00	4.49E-02	7.0E+00
Cu	4.03E-02	3.9E+00	4.36E-02	1.7E+00	4.00E-02	4.3E+00
Fe	1.37E+01	3.5E+00	1.36E+01	8.2E-01	1.38E+01	5.3E+00
K	5.51E-02	5.1E+00	2.89E-01	1.3E+01	<1.29E-01	NA
Li	2.53E-02	4.3E+00	2.50E-02	4.2E+00	2.65E-02	7.4E+00
Mg	2.78E-01	3.9E+00	2.74E-01	1.3E+00	2.93E-01	4.9E+00
Mn	2.94E+00	3.6E+00	2.97E+00	1.0E+00	3.02E+00	5.2E+00
Na	1.49E+01	3.7E+00	NA	NA	1.51E+01	4.8E+00
Ni	2.81E+00	3.6E+00	2.76E+00	1.0E+00	2.82E+00	5.2E+00
Si	4.21E-01	1.9E+01	1.07E+00	1.0E+00	NA	NA
Th	1.06E+00	3.7E+00	9.39E-01	5.5E+00	7.27E-01	1.3E+01
Ti	1.58E-02	3.7E+00	1.90E-02	2.4E+00	1.49E-02	2.5E+00
U	4.48E+00	3.7E+00	4.26E+00	3.0E+00	4.51E+00	4.0E+00
Zr	1.50E-01	1.2E+01	NA	NA	2.54E-01	6.1E+00

*Averages are based upon four replicate dissolutions and ICP-AES determinations except the Peroxide Fusion averages which are based upon three replicate dissolutions and ICP-AES measurements. NA = Not Applicable..
[#]%RSD is the percent relative standard deviation for the measurements

A statistical comparison of means from SB7b SRAT product digestions is presented in Table 3-4.

Table 3-4. Statistical comparison of Aqua Regia, DWPF Cold Chem method and Sodium Peroxide/Hydroxide Fusion digestions of SB7b SRAT Product sludge. Digestion methods not having similar bold font or those that are not underlined are statistically different at the 5% significance level. The less than sign indicates the digestion method with the lowest and highest mean concentration from ICP-AES measurements.

	Statistical
Element	**Comparisons**
Al	AR < **CC** < **PF**
B[#]	NA
Ca	AR < CC
Cr	AR < CC < PF
Cu	CC < AR < PF
Fe	PF < AR < CC
K	AR < PF
Li	PF < AR < CC
Mg	PF < AR < CC
Mn	AR < PF < CC
Na	AR < CC
Ni	PF < AR < CC
Si	AR < PF
Th	CC < PF < AR
Ti	CC < PF < AR
U	PF < AR < CC
Zr	AR < CC

[#]Below ICP-AES detection levels, less than values reported.

Observations and results from the SRAT Product digestions include the following:

- Brown/red solids and white solids remained in the solutions generated from the CC digestion after all acid addition steps and dilutions were performed. The brown/red colored solids eventually dissolved.
- A statistically larger average Al concentration is seen in the PF digestions compared to the AR and CC methods with an ~2% and an ~7% relative difference in the means, respectively.
- There is not a statistical difference in the means for Th between the AR and PF digestions but a statistical difference in the means is noted comparing the CC digestions to the AR and PF means with an ~26% and an ~18% relative difference in the means, respectively.
- A statistical difference of means between the three digestion methods is noted for the minor elements Cu, K, Ti and Zr.
- There is not a statistical difference in the means for Cr, Fe, Li, Mg, Mn, Ni, or U, nor is there a statistical difference in the mean Na concentration from the AR and CC digestions.

The ARG digestions results are as follows. For the AR digestions, the mean B, (slightly low) Cu, and Ti results differed by more than 10% from the known concentration in the ARG-1 standard. Si and Zr are not considered because the mean results from of these elements are expected to be greater than 10% different. For the PF digestions, B, Ca and Cr means were greater than 10% different from than the known concentrations in ARG-1. Ca is a contaminant in the PF reagents. For the CC digestions, the measured Cu concentration differed by more than 10% from the known concentration, most likely because the concentration in the solutions is very near the ICP-AES detection limit which is reflected by the high %RSD reported with the measurement.

Table 3-5. Elemental concentrations of ARG standard from ICP-AES analysis of Aqua Regia, and Sodium Peroxide/Hydroxide Fusion digestions performed concurrently with SB7b SRAT Receipt Sample. Values are presented on a weight percent (Wt%) total solids basis.

Aqua Regia				
Element	**Average Wt%**	**%RSD – only one Standard Analyzed**	**Standard Value**	**%Difference (Measured *vs* Standard Value)**
Al	2.35E+00	NA	2.50E+00	-6.0
B	2.43E+00	NA	2.69E+00	-9.7
Ca	9.86E-01	NA	1.02E+00	-3.3
Cr	6.74E-02	NA	6.40E-02	5.3
Cu	5.44E-03	NA	3.00E-03	81.3
Fe	9.39E+00	NA	9.79E+00	-4.1
K	2.26E+00	NA	2.26E+00	0.0
Li	1.40E+00	NA	1.49E+00	-6.0
Mg	5.17E-01	NA	5.20E-01	-0.6
Mn	1.47E+00	NA	1.46E+00	0.7
Na	8.06E+00	NA	8.52E+00	-5.4
Ni	8.00E-01	NA	8.27E-01	-3.3
Si	9.99E-01	NA	2.24E+01	-95.5
Ti	6.17E-01	NA	6.90E-01	-10.6
Zr	2.57E-02	NA	9.60E-02	-73.2
Sodium Peroxide/Hydroxide Fusion				
Element	**Average Wt%**	**%RSD – only one Standard Analyzed**	**Standard Value**	**%Difference (Measured *vs* Standard Value)**
Al	2.59E+00	NA	2.50E+00	3.6
B	2.52E+00	NA	2.69E+00	-6.3
Ca	1.20E+00	NA	1.02E+00	17.6
Cr	7.09E-02	NA	6.40E-02	10.8
Cu	<5.04E-03	NA	3.00E-03	NA
Fe	9.97E+00	NA	9.79E+00	1.8
K	2.32E+00	NA	2.26E+00	2.7
Li	1.50E+00	NA	1.49E+00	0.7
Mg	5.33E-01	NA	5.20E-01	2.5
Mn	1.48E+00	NA	1.46E+00	1.4
Na	NA	NA	8.52E+00	NA
Ni	8.54E-01	NA	8.27E-01	3.3
Si	2.24E+01	NA	2.24E+01	0.0
Ti	7.10E-01	NA	6.90E-01	2.9
Zr	NA	NA	9.60E-02	NA

NA = Not applicable. <MDL = less than minimum detection limit.

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Table 3-6. E concentrations of ARG standard from ICP-AES analysis DWPF Cold Chem method digestions performed concurrently with SB7b SRAT Receipt Sample. Values are presented on a weight percent (Wt%) total solids basis.

DWPF Cold Chem Method*				
Element	**Average**	**%RSD**	**Known Value**	**%Difference (Measured *vs* Known Value)**
Al	2.58E+00	2.2E+00	2.50E+00	3.2
B	NA	NA	2.69E+00	NA
Ca	1.13E+00	1.3E+00	1.02E+00	10.8
Cr	7.29E-02	1.8E+00	6.40E-02	13.8
Cu	3.77E-03	2.2E+01	3.00E-03	25.7
Fe	1.05E+01	1.3E+00	9.79E+00	7.3
K	2.33E+00	3.0E-01	2.26E+00	2.9
Li	1.60E+00	1.8E+00	1.49E+00	7.4
Mg	5.56E-01	1.0E+00	5.20E-01	6.9
Mn	1.55E+00	1.4E+00	1.46E+00	5.8
Na	8.85E+00	1.1E+00	8.52E+00	3.9
Ni	8.64E-01	1.2E+00	8.27E-01	4.4
Si	NA	NA	2.24E+01	NA
Ti	7.17E-01	1.5E+00	6.90E-01	3.8
Zr	1.04E-01	2.0E+00	9.60E-02	7.8

*All averages are based upon three replicate dissolutions and ICP-AES determinations NA = Not applicable.

Table 3-7. Elemental concentrations of ARG standard from ICP-AES analysis of Aqua Regia, and Sodium Peroxide/Hydroxide Fusion digestions performed concurrently with SB7b SRAT Product sample. Values are presented on a weight percent (Wt%) total solids basis.

Aqua Regia*				
Element	**Average**	**%RSD**	**Standard Value**	**%Difference (Measured *vs* Standard Value)**
Al	2.30E+00	1.2E+00	2.50E+00	-8.0
B	2.41E+00	2.9E-01	2.69E+00	-10.6
Ca	1.04E+00	6.8E-01	1.02E+00	1.5
Cr	6.68E-02	7.4E+00	6.40E-02	4.4
Cu	2.34E-03	7.0E+00	3.00E-03	-22.2
Fe	9.78E+00	1.2E+00	9.79E+00	-0.1
K	2.09E+00	1.7E+00	2.26E+00	-7.7
Li	1.50E+00	9.4E-01	1.49E+00	0.7
Mg	5.31E-01	7.5E+00	5.20E-01	2.1
Mn	1.42E+00	1.0E+00	1.46E+00	-2.7
Na	8.48E+00	2.5E-01	8.52E+00	-0.5
Ni	8.26E-01	1.7E+00	8.27E-01	-0.1
Si	3.39E-01	1.4E+01	2.24E+01	-98.5
Ti	6.05E-01	7.2E+00	6.90E-01	-12.3
Zr	5.38E-02	1.7E+01	9.60E-02	-44.0
Sodium Peroxide/Hydroxide Fusion*				
Element	**Average**	**%RSD**	**Known Value**	**%Difference (Measured *vs* Known Value)**
Al	2.58E+00	2.5E+00	2.50E+00	3.0
B	2.50E+00	2.0E+00	2.69E+00	-8.6
Ca	1.18E+00	1.2E+00	1.02E+00	15.7
Cr	7.29E-02	3.0E+00	6.40E-02	13.8
Cu	<4.92E-03	NA	3.00E-03	NA
Fe	1.02E+01	2.1E+00	9.79E+00	3.7
K	2.30E+00	9.2E-01	2.26E+00	1.5
Li	1.51E+00	2.8E+00	1.49E+00	1.3
Mg	5.31E-01	9.3E-01	5.20E-01	2.0
Mn	1.51E+00	1.4E+00	1.46E+00	3.1
Na	NA	NA	8.52E+00	NA
Ni	8.36E-01	8.5E-01	8.27E-01	1.1
Si	2.36E+01	1.8E+00	2.24E+01	5.4
Ti	7.07E-01	1.8E+00	6.90E-01	2.5
Zr	NA	NA	9.60E-02	NA

*All averages are based upon two replicate dissolutions and ICP-AES determinations. NA = Not applicable. <MDL = less than minimum detection limit.

Table 3-8. Continuation of elemental concentrations of ARG standard from ICP-AES analysis of Aqua Regia, DWPF Cold Chem method and Sodium Peroxide/Hydroxide Fusion digestions performed concurrently with SB7b SRAT Product sample. Values are presented on a weight percent (Wt%) total solids basis.

DWPF Cold Chem Method*				
Element	**Average**	**%RSD**	**Known Value**	**%Difference (Measured *vs* Known Value)**
Al	2.45E+00	7.6E+00	2.50E+00	-2.0
B	NA	NA	2.69E+00	NA
Ca	1.07E+00	1.4E+01	1.02E+00	4.7
Cr	6.92E-02	4.6E+00	6.40E-02	8.1
Cu	3.93E-03	1.6E+01	3.00E-03	31.0
Fe	1.03E+01	6.1E+00	9.79E+00	5.1
K	2.29E+00	5.7E+00	2.26E+00	1.3
Li	1.54E+00	7.1E+00	1.49E+00	3.6
Mg	5.40E-01	1.0E+01	5.20E-01	3.8
Mn	1.52E+00	6.1E+00	1.46E+00	3.9
Na	8.98E+00	6.8E+00	8.52E+00	5.4
Ni	8.99E-01	5.9E+00	8.27E-01	8.7
Si	NA	NA	2.24E+01	NA
Ti	7.03E-01	6.2E+00	6.90E-01	1.8
Zr	1.01E-01	6.1E+00	9.60E-02	5.3

*All averages are based upon three replicate dissolutions and ICP-AES determinations NA = Not applicable. <MDL = less than minimum detection limit.

Good recoveries were observed for most elements of significant weight percent in the ARG standards. There are a few anomalies but based upon the %RSDs some of these elements were near the ICP-AES detection limit. Upon review of the SRAT Receipt, SRAT Product and ARG data it is evident that not all of the digestion issues seen with the radioactive sample are mirrored with the ARG standard. For instance, the Al in the ARG appears to dissolve well in each digestion method as well as Fe. The SRAT Receipt and SRAT Product have ~4 wt% more Fe than the ARG standard. The one and one-half hour time frame allotted for the digestion may not be sufficient for dissolving all of the Fe and Mn in the initial dilution of the samples. SB7b also contains some HM waste and some the different phases of aluminum species present in the sludge slurry (*boehmite* and *gibbsite* among others) have less solubility in acid matrices.

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4.0 CONCLUSIONS

The results from using the DWPF CC method to digest SB7b sludge slurry appear, in most cases, to be equivalent to the AR and PF digestion methods. Visual observations indicate Fe and Mn may not be completely dissolving in the initial dilution of the DWPF CC sample before the final dilution is performed. However, ICP-AES analysis indicates the Fe and Mn mean concentration from all three digestions are not statistically different. The DWPF should consider comparing the Fe and Mn results obtained from PF digestion of the SRAT Product against the DWPF CC results and using the highest average.

Aluminum (Al) and Th do not dissolve completely or are precipitated as fluoride salts. It is recommended that these elements be determined from analysis of samples digested by the PF method.

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5.0 RECOMMENDATIONS

Based on the results from performing three different digestion methods on SB7b sludge slurry, SRNL notes and recommends the following:

- The results from using the DWPF CC method performed to digest SB7b sludge slurry appear, in most cases, to be equivalent to the AR and PF digestion methods. However, Al, and Th should be analyzed by the peroxide fusion method for SB7b. Visual observations indicate Fe and Mn may not be completely dissolving in the initial dilution of the sample before the final dilution is performed. However, for this data set, very small relative differences between the digestion methods are noted and no statistical difference is observed between the digestion methods for Fe and Mn. Fe and Mn concentration should be measured from both a CC and PF digestion of SB7b sludge slurry and the highest concentration between the two digestions should be used. Although K is a minor element, large relative differences are noted in this report between the different digestions and the DWPF should also monitor the K concentration.

- The DWPF CC method was originally developed to be used for SME analyses. Given continuous visual observations of solids in the CC digestions both at SRNL and DWPF, potential issues with accurate Al measurements when processing HM waste, and difficulty measuring Th accurately due to the limited solubility of Th in HF matrices, SRNL recommends that the DWPF consider a different digestion scheme that relieves some of these issues.

- The DWPF CC results from this study indicate Al and Th do not completely dissolve or precipitate as fluoride salts. Visual observations also indicate Fe and Mn may not completely dissolve using the DWPF CC method. Therefore, DWPF should consider and monitor the impact of these elements on SB7b blending operations conducted at DWPF via comparison of SRAT and SME analyses. If a consistent difference in elemental concentrations is revealed, another type of digestion (i.e. sodium peroxide/hydroxide fusion) should be used to determine the concentration of the element in question. Particular emphasis should be placed on monitoring Al, Fe, Mn, K, and Th concentrations in SB7b.

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6.0 REFERENCES

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2. C.J. Coleman, "Aqua Regia Dissolution of Sludge for Elemental Analysis", ADS Procedure ADS-2226, Rev. 9.
3. JMP Statistical Discovery Software *v* 7.0.2; SAS Institute Inc., Cary, NC, 2008.
4. C.J. Coleman, F.M. Pennebaker, B.H. Burch and D.R. Click, "Evaluation of the DWPF Cold Chem Dissolution Method with DWPF Sludge Batch 3 Simulant", WSRC-TR-02-00496, Rev. 0. See also D.R. Click, "Evaluation of the DWPF Cold Chem Dissolution Method with Tank 7 and Tank 51 Radioactive Sludges", WSRC-TR-2003-00580. D.R. Click, C.J. Coleman, K.E. Zeigler and T.B. Edwards, "Sludge Batch Four (4) Defense Waste Processing Facility (DWPF) Process Analytical Method Verification", WSRC-STI-2006-00025 Rev. 0. D. R. Click, T. B. Edwards, and M. A. Jones. "Verification of the Defense Waste Processing Facility's (DWPF) process digestion method for the Sludge Batch 6 qualification sample", WSRC-STI-2010-00259 Rev. 0. D.R. Click, T.B. Edwards, M.A. Jones, and B.J. Wiedenman, "Verification of the Defense Waste Processing Facility's (DWPF) Process Digestion Method for the Sludge Batch 7a Qualification Sample, SRNL-STI-2011-00158 Rev. 0.

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7.0 ACKNOWLEDGEMENTS

The authors would like to acknowledge Monica Jenkins and Rita Sullivan.

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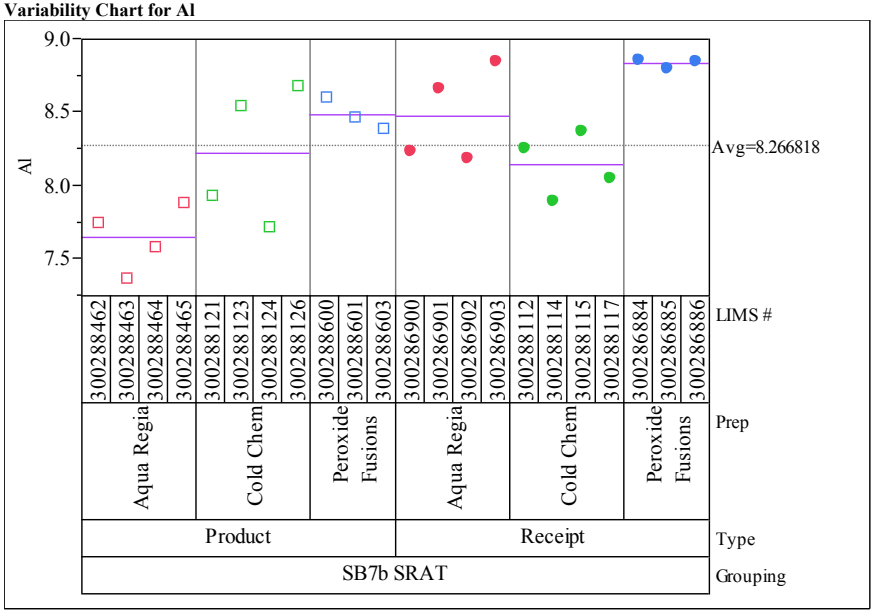
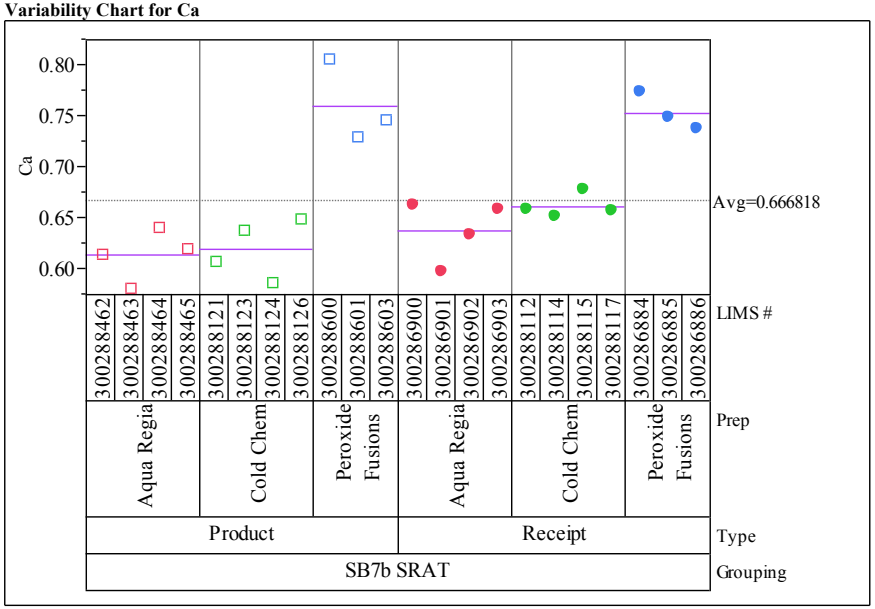
8.0 APPENDIX A. SUPPORTING INFORMATION

Element	Receipt Aqua Regia	Receipt Cold Chem	Receipt Peroxide Fusions	Statistical Comparisons	Product Aqua Regia	Product Cold Chem	Product Peroxide Fusions	Statistical Comparisons
Al	8.478	8.140	8.830	CC < AR < PF	7.645	8.218	8.487	AR < CC < PF
B	0.008	.	0.081	AR < PF	0.008	.	0.017	AR < PF
Ca	0.638	0.662	0.753	AR < CC < PF	0.614	0.620	0.760	AR < CC < PF
Cr	0.043	0.044	0.060	AR < CC < PF	0.041	0.045	0.046	AR < CC < PF
Cu	0.080	0.044	0.049	CC < PF < AR	0.040	0.040	0.044	CC < AR < PF
Fe	14.225	14.475	14.300	AR < PF < CC	13.740	13.750	13.644	PF < AR < CC
K	0.026	0.188	0.255	AR < CC < PF	0.055	0.128	0.289	AR < CC < PF
Li	0.026	0.025	0.023	PF < CC < AR	0.025	0.026	0.025	PF < AR < CC
Mg	0.285	0.296	0.277	PF < AR < CC	0.278	0.293	0.274	PF < AR < CC
Mn	3.015	3.123	2.980	PF < AR < CC	2.935	3.015	2.974	AR < PF < CC
Na	14.125	14.575	.	AR < CC	14.894	15.125	.	AR < CC
Ni	2.935	2.975	2.953	AR < PF < CC	2.815	2.823	2.757	PF < AR < CC
Si	0.472	.	1.057	AR < PF	0.420	.	1.070	AR < PF
Th	1.036	0.761	0.956	CC < PF < AR	1.063	0.727	0.940	CC < PF < AR
Ti	0.017	0.019	0.020	AR < CC <PF	0.020	0.015	0.020	CC < PF < AR
U	4.773	4.980	4.453	PF < AR < CC	4.480	4.510	4.260	PF < AR < CC
Zr	0.139	0.270	.	AR < CC	0.150	0.254	.	AR < CC

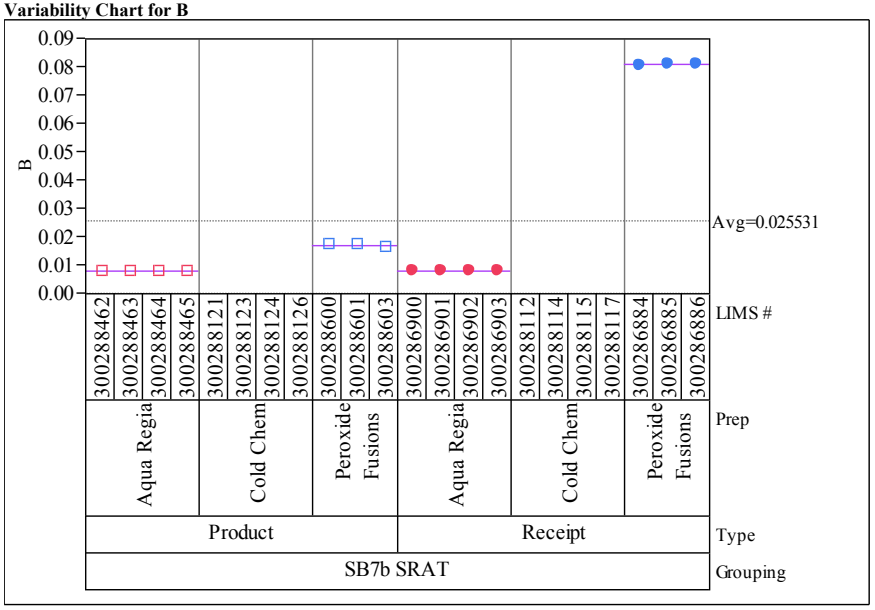
Variability Chart for Al



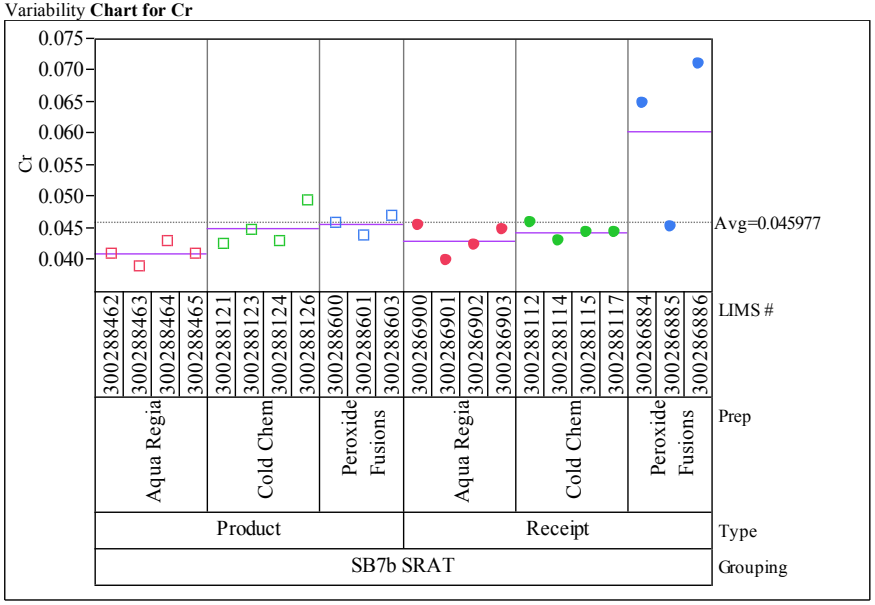
Variability Chart for Ca



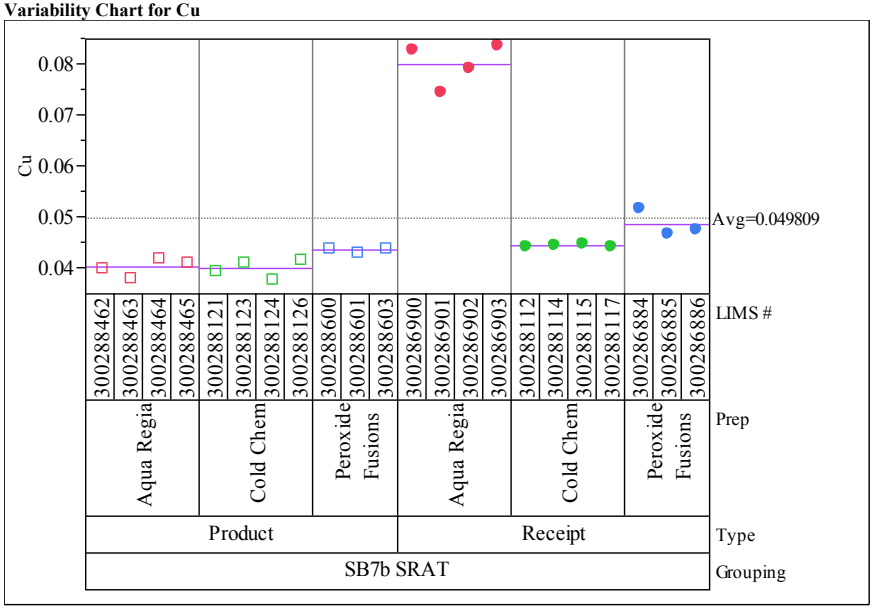
Variability Chart for B



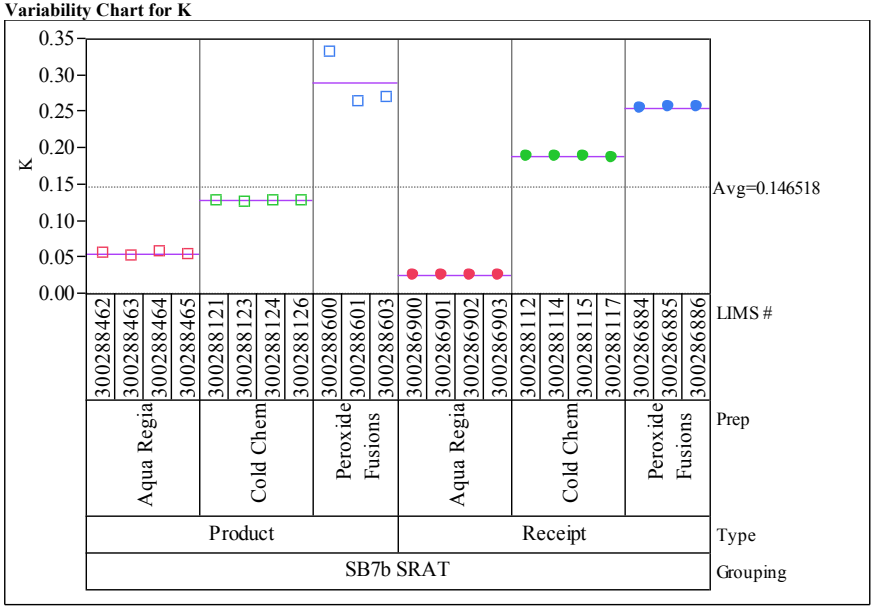
Variability **Chart for Cr**



Variability Chart for Cu



Variability Chart for K



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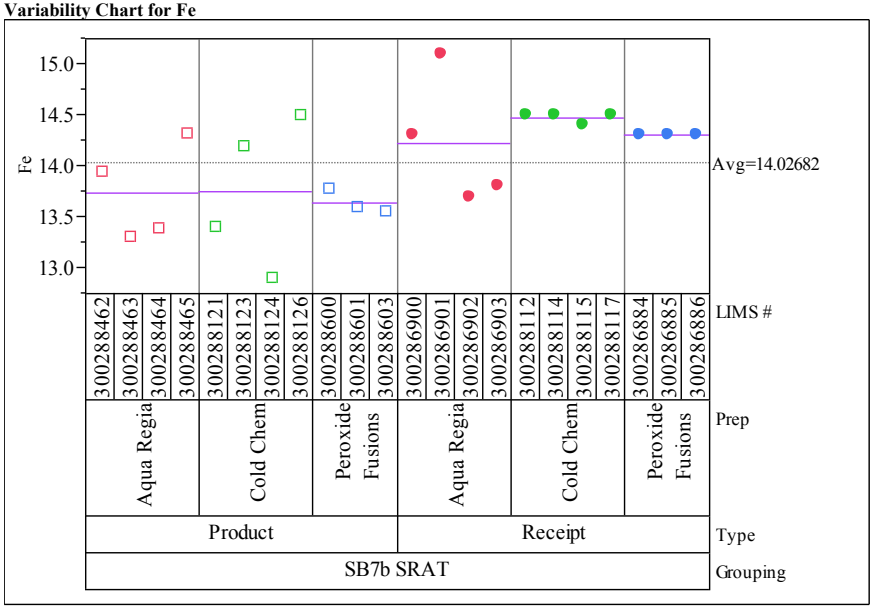
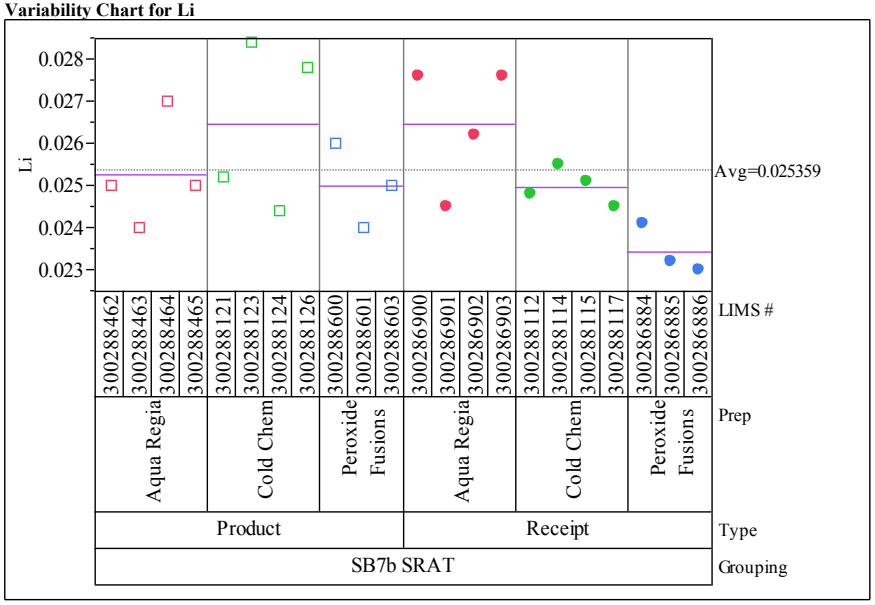
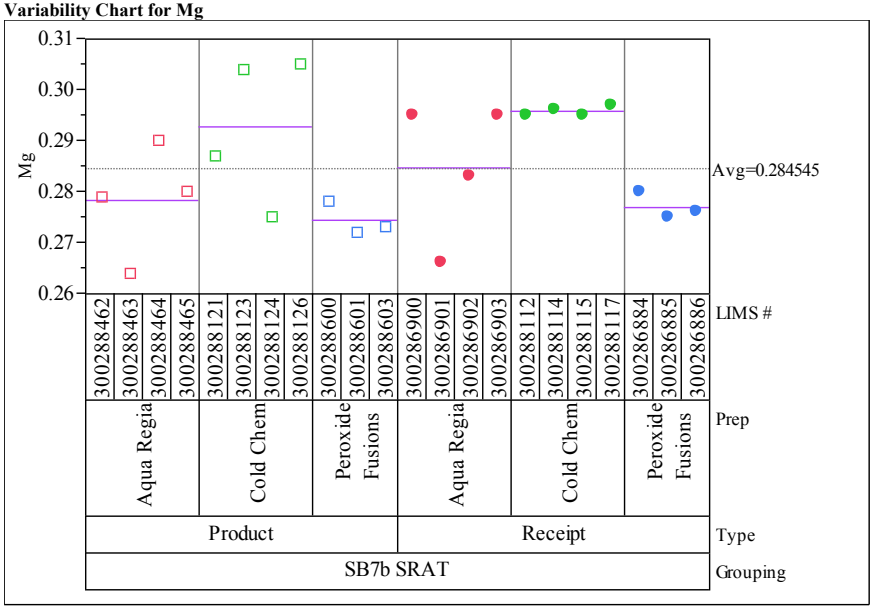


Variability Chart for Li



Variability Chart for Mg



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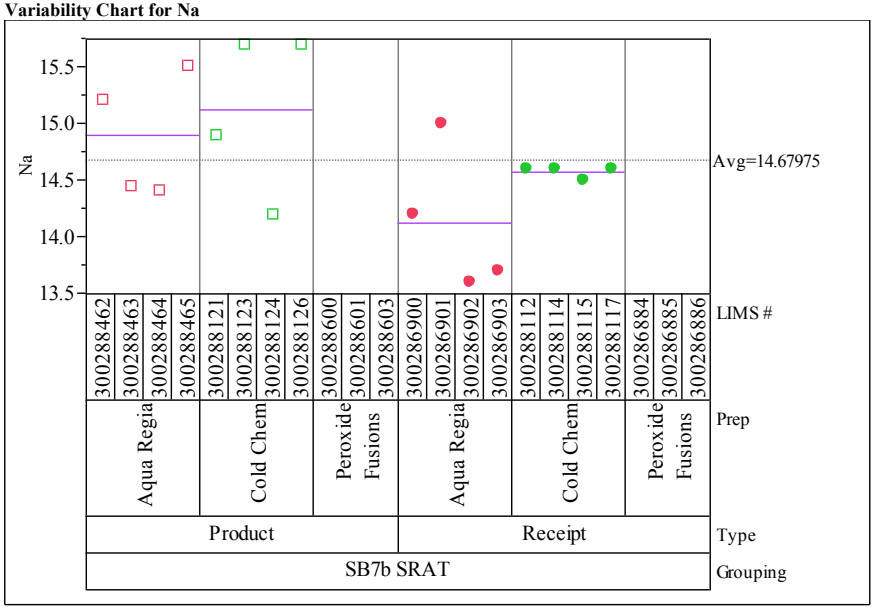

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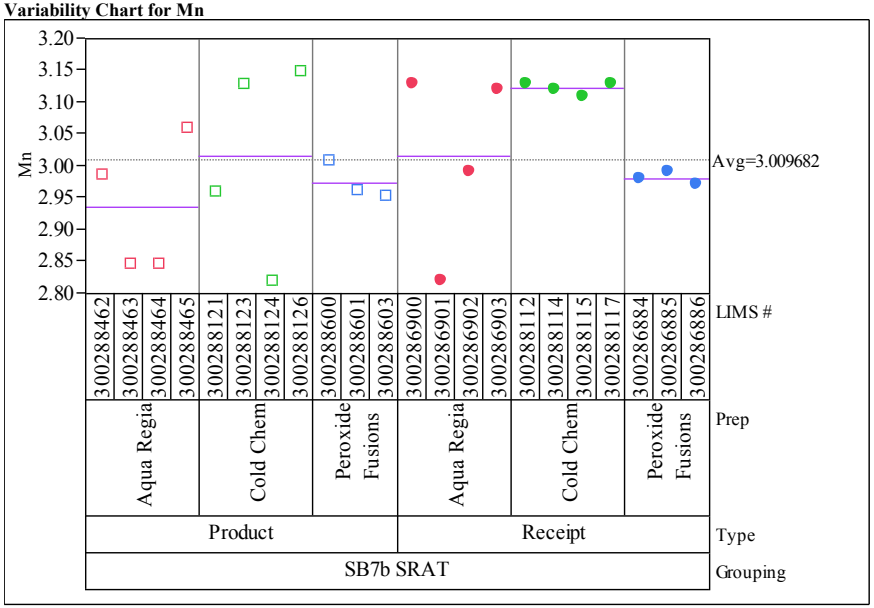
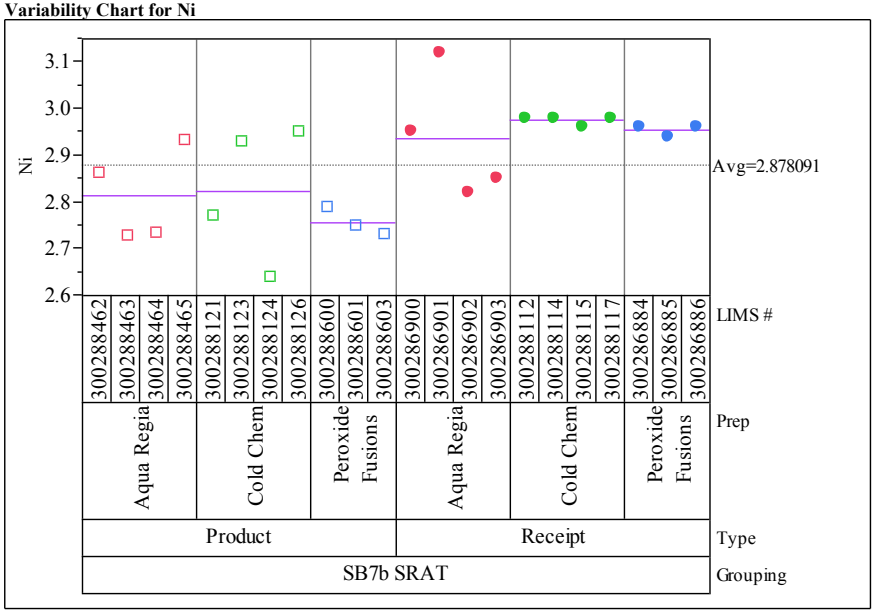
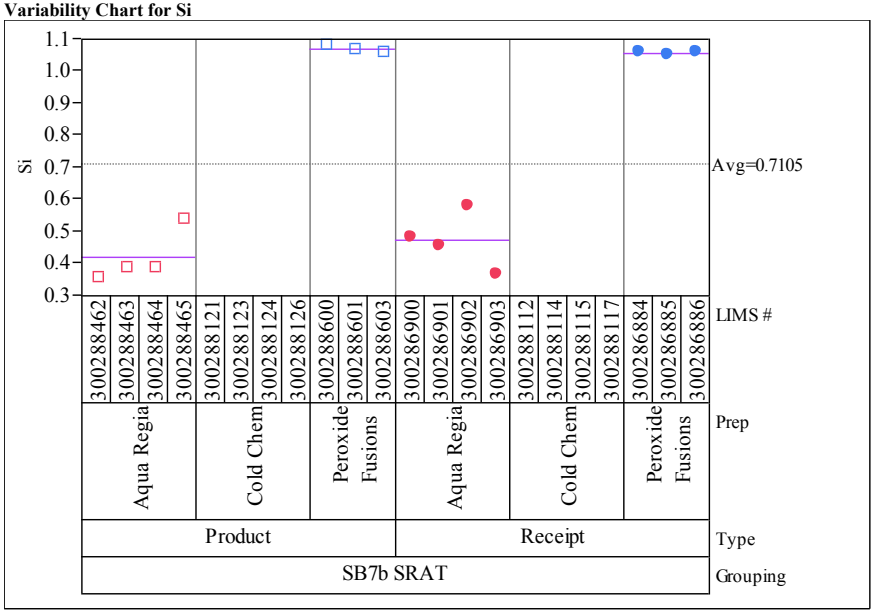


Variability Chart for Ni



Variability Chart for Si



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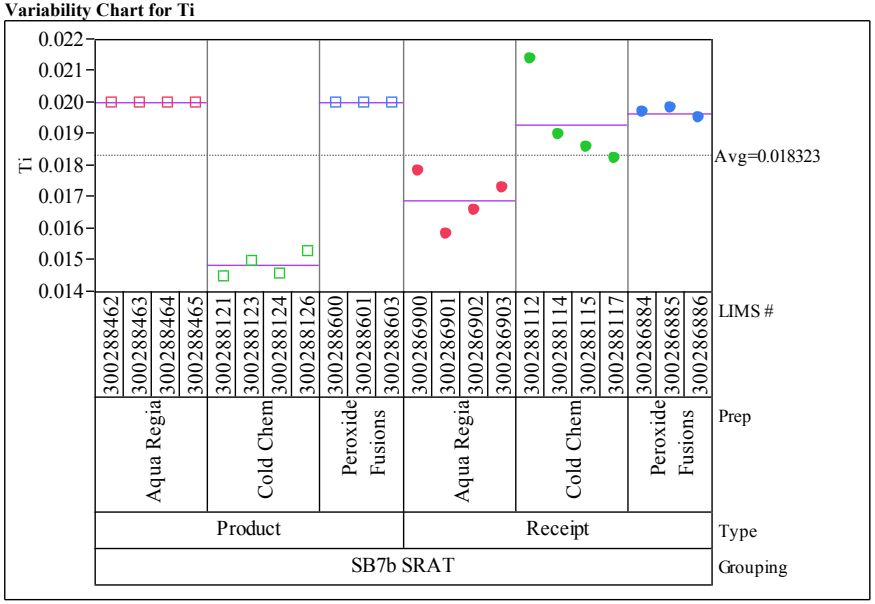
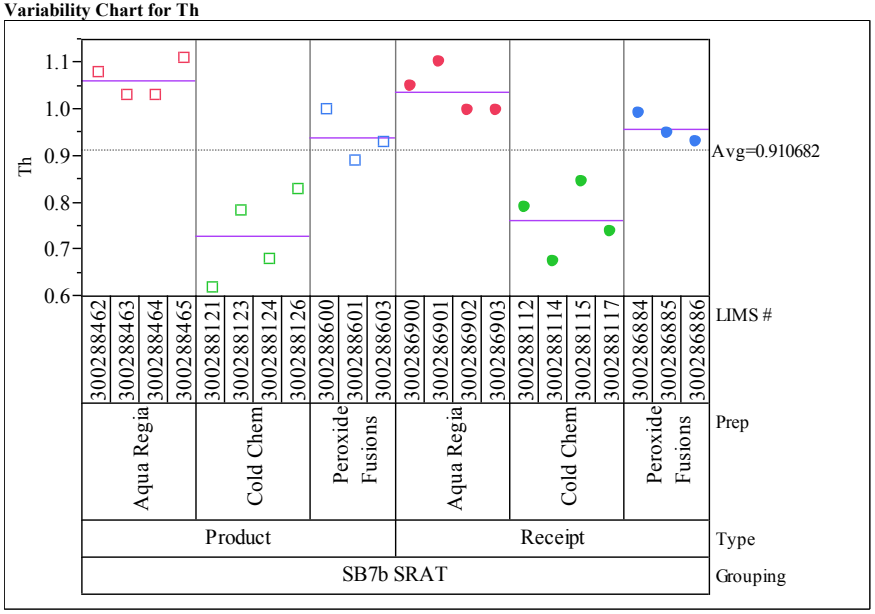
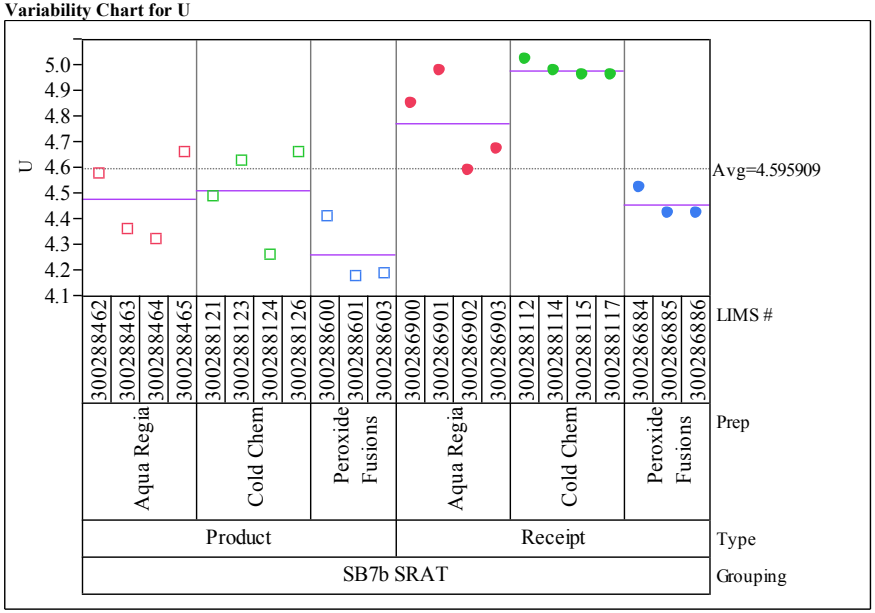


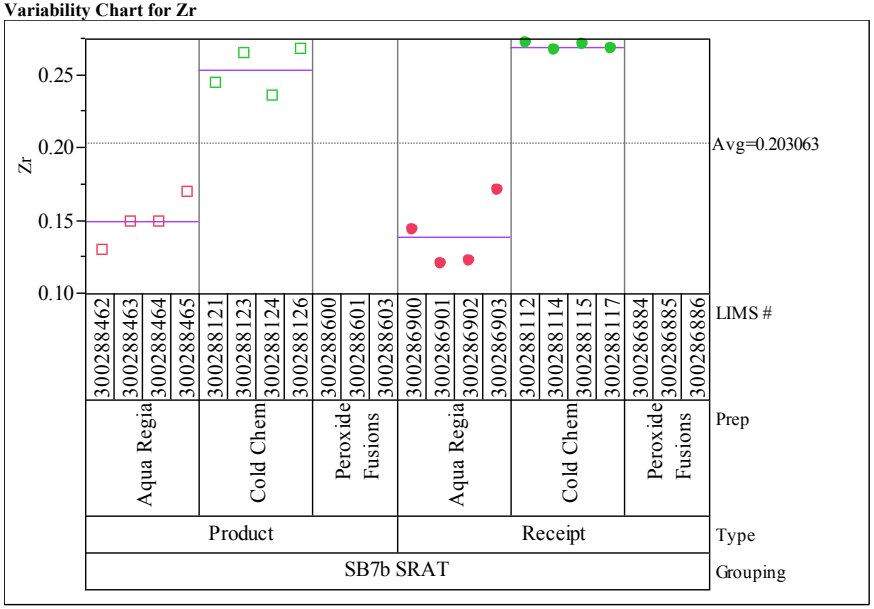
Variability Chart for Th



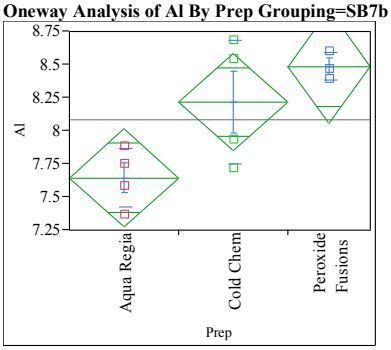
Variability Chart for U



Variability Chart for Zr



Oneway Analysis of Al By Prep Grouping=SB7b SRAT, Type=Product



Oneway Anova
Summary of Fit

Rsquare	0.61932
Adj Rsquare	0.52415
Root Mean Square Error	0.3195
Mean of Response	8.082727
Observations (or Sum Wgts)	11

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Prep	2	1.3285765	0.664288	6.5075	0.0210
Error	8	0.8166417	0.102080		
C. Total	10	2.1452182			

Means for Oneway Anova

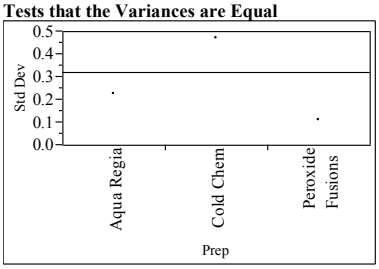
Level	Number	Mean	Std Error	Lower 95%	Upper 95%
Aqua Regia	4	7.64500	0.15975	7.2766	8.0134
Cold Chem	4	8.21750	0.15975	7.8491	8.5859
Peroxide Fusions	3	8.48667	0.18446	8.0613	8.9120

Std Error uses a pooled estimate of error variance

Means and Std Deviations

Level	Number	Mean	Std Dev	Std Err Mean	Lower 95%	Upper 95%
Aqua Regia	4	7.64500	0.220681	0.11034	7.2938	7.9962
Cold Chem	4	8.21750	0.464785	0.23239	7.4779	8.9571
Peroxide Fusions	3	8.48667	0.105987	0.06119	8.2234	8.7500

Tests that the Variances are Equal



Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
Aqua Regia	4	0.2206808	0.1700000	0.1700000
Cold Chem	4	0.4647849	0.3925000	0.3925000
Peroxide Fusions	3	0.1059874	0.0755556	0.0966667

Test	F Ratio	DFNum	DFDen	Prob > F
O'Brien[.5]	5.4182	2	8	0.0325
Brown-Forsythe	10.3737	2	8	0.0060
Levene	11.3059	2	8	0.0047
Bartlett	1.8682	2	.	0.1544

Warning: Small sample sizes. Use Caution.
Welch Anova testing Means Equal, allowing Std Devs Not Equal

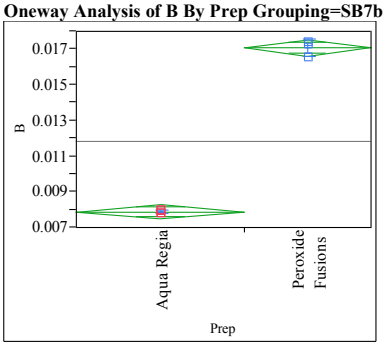
F Ratio	DFNum	DFDen	Prob > F
19.6462	2	4.9463	0.0044

Means Comparisons
Comparisons for all pairs using Tukey-Kramer HSD

Level		Mean
Peroxide Fusions	A	8.4866667
Cold Chem	A B	8.2175000
Aqua Regia	B	7.6450000

Levels not connected by same letter are significantly different.

Oneway Analysis of B By Prep Grouping=SB7b SRAT, Type=Product



Missing Rows 4

Oneway Anova
Summary of Fit

Rsquare	0.99663
Adj Rsquare	0.995956
Root Mean Square Error	0.000313
Mean of Response	0.011818
Observations (or Sum Wgts)	7

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Prep	1	0.00014514	0.000145	1478.793	<.0001
Error	5	0.00000049	9.815e-8		
C. Total	6	0.00014563			

Means for Oneway Anova

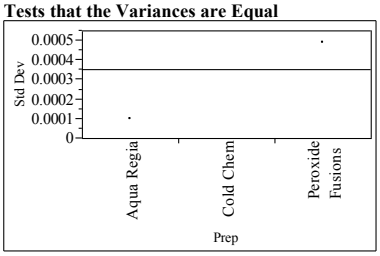
Level	Number	Mean	Std Error	Lower 95%	Upper 95%
Aqua Regia	4	0.007875	0.00016	0.00747	0.00828
Cold Chem	0	.	.	.	.
Peroxide Fusions	3	0.017076	0.00018	0.01661	0.01754

Std Error uses a pooled estimate of error variance

Means and Std Deviations

Level	Number	Mean	Std Dev	Std Err Mean	Lower 95%	Upper 95%
Aqua Regia	4	0.007875	0.000096	4.79e-5	0.00772	0.00803
Cold Chem	0	.	.	.	.	.
Peroxide Fusions	3	0.017076	0.000481	0.00028	0.01588	0.01827

Tests that the Variances are Equal



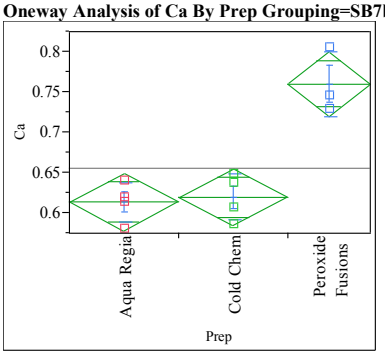
Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
Aqua Regia	4	0.0000957	0.0000750	0.0000750
Cold Chem	0	.	0.0000000	0.0000000
Peroxide Fusions	3	0.0004813	0.0003672	0.0003390

Test	F Ratio	DFNum	DFDen	Prob > F
O'Brien[.5]	2.3384	1	5	0.1868
Brown-Forsythe	2.1578	1	5	0.2018
Levene	11.5000	1	5	0.0194
Bartlett	4.4549	1	.	0.0348

Warning: Small sample sizes. Use Caution.
Welch Anova testing Means Equal, allowing Std Devs Not Equal

F Ratio	DFNum	DFDen	Prob > F
1064.9960	1	2.1192	0.0007

Oneway Analysis of Ca By Prep Grouping=SB7b SRAT, Type=Product



Oneway Anova
Summary of Fit

Rsquare	0.858524
Adj Rsquare	0.823155
Root Mean Square Error	0.030422
Mean of Response	0.655727
Observations (or Sum Wgts)	11

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Prep	2	0.04492843	0.022464	24.2733	0.0004
Error	8	0.00740375	0.000925		
C. Total	10	0.05233218			

Means for Oneway Anova

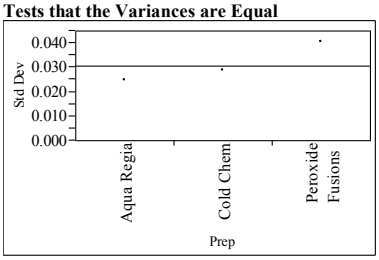
Level	Number	Mean	Std Error	Lower 95%	Upper 95%
Aqua Regia	4	0.613500	0.01521	0.57842	0.64858
Cold Chem	4	0.619750	0.01521	0.58467	0.65483
Peroxide Fusions	3	0.760000	0.01756	0.71950	0.80050

Std Error uses a pooled estimate of error variance

Means and Std Deviations

Level	Number	Mean	Std Dev	Std Err Mean	Lower 95%	Upper 95%
Aqua Regia	4	0.613500	0.024420	0.01221	0.57464	0.65236
Cold Chem	4	0.619750	0.028477	0.01424	0.57444	0.66506
Peroxide Fusions	3	0.760000	0.039887	0.02303	0.66091	0.85909

Tests that the Variances are Equal



Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
Aqua Regia	4	0.0244199	0.0162500	0.0160000
Cold Chem	4	0.0284766	0.0232500	0.0232500
Peroxide Fusions	3	0.0398873	0.0300000	0.0310000

Test	F Ratio	DFNum	DFDen	Prob > F
O'Brien[.5]	0.5822	2	8	0.5807
Brown-Forsythe	0.6804	2	8	0.5335
Levene	0.8813	2	8	0.4509
Bartlett	0.2689	2	.	0.7642

Warning: Small sample sizes. Use Caution.
Welch Anova testing Means Equal, allowing Std Devs Not Equal

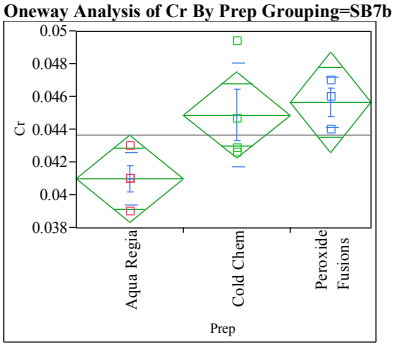
F Ratio	DFNum	DFDen	Prob > F
14.6815	2	4.5232	0.0105

Means Comparisons
Comparisons for all pairs using Tukey-Kramer HSD

Level		Mean
Peroxide Fusions	A	0.76000000
Cold Chem	B	0.61975000
Aqua Regia	B	0.61350000

Levels not connected by same letter are significantly different.

Oneway Analysis of Cr By Prep Grouping=SB7b SRAT, Type=Product



Oneway Anova
Summary of Fit

Rsquare	0.524084
Adj Rsquare	0.405104
Root Mean Square Error	0.002298
Mean of Response	0.043691
Observations (or Sum Wgts)	11

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Prep	2	0.00004652	0.000023	4.4048	0.0513
Error	8	0.00004225	5.281e-6		
C. Total	10	0.00008877			

Means for Oneway Anova

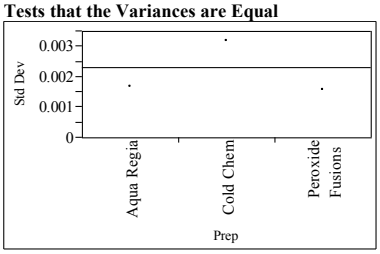
Level	Number	Mean	Std Error	Lower 95%	Upper 95%
Aqua Regia	4	0.041000	0.00115	0.03835	0.04365
Cold Chem	4	0.044900	0.00115	0.04225	0.04755
Peroxide Fusions	3	0.045667	0.00133	0.04261	0.04873

Std Error uses a pooled estimate of error variance

Means and Std Deviations

Level	Number	Mean	Std Dev	Std Err Mean	Lower 95%	Upper 95%
Aqua Regia	4	0.041000	0.001633	0.00082	0.03840	0.04360
Cold Chem	4	0.044900	0.003140	0.00157	0.03990	0.04990
Peroxide Fusions	3	0.045667	0.001528	0.00088	0.04187	0.04946

Tests that the Variances are Equal



Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
Aqua Regia	4	0.0016330	0.0010000	0.0010000
Cold Chem	4	0.0031401	0.0022500	0.0021500
Peroxide Fusions	3	0.0015275	0.0011111	0.0013333

Test	F Ratio	DFNum	DFDen	Prob > F
O'Brien[.5]	0.7659	2	8	0.4962
Brown-Forsythe	0.5384	2	8	0.6034
Levene	1.0358	2	8	0.3981
Bartlett	0.7712	2	.	0.4625

Warning: Small sample sizes. Use Caution.
Welch Anova testing Means Equal, allowing Std Devs Not Equal

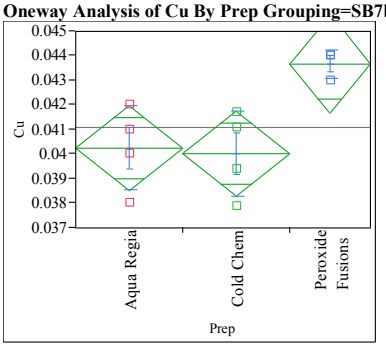
F Ratio	DFNum	DFDen	Prob > F
7.1397	2	5.0708	0.0335

Means Comparisons
Comparisons for all pairs using Tukey-Kramer HSD

Level		Mean
Peroxide Fusions	A	0.04566667
Cold Chem	A	0.04490000
Aqua Regia	A	0.04100000

Levels not connected by same letter are significantly different.

Oneway Analysis of Cu By Prep Grouping=SB7b SRAT, Type=Product



Oneway Anova
Summary of Fit

Rsquare	0.598679
Adj Rsquare	0.498349
Root Mean Square Error	0.001512
Mean of Response	0.0411
Observations (or Sum Wgts)	11

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Prep	2	0.00002728	0.000014	5.9671	0.0259
Error	8	0.00001828	2.286e-6		
C. Total	10	0.00004556			

Means for Oneway Anova

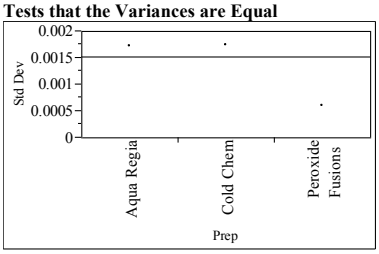
Level	Number	Mean	Std Error	Lower 95%	Upper 95%
Aqua Regia	4	0.040250	0.00076	0.03851	0.04199
Cold Chem	4	0.040025	0.00076	0.03828	0.04177
Peroxide Fusions	3	0.043667	0.00087	0.04165	0.04568

Std Error uses a pooled estimate of error variance

Means and Std Deviations

Level	Number	Mean	Std Dev	Std Err Mean	Lower 95%	Upper 95%
Aqua Regia	4	0.040250	0.001708	0.00085	0.03753	0.04297
Cold Chem	4	0.040025	0.001719	0.00086	0.03729	0.04276
Peroxide Fusions	3	0.043667	0.000577	0.00033	0.04223	0.04510

Tests that the Variances are Equal



Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
Aqua Regia	4	0.0017078	0.0012500	0.0012500
Cold Chem	4	0.0017193	0.0013750	0.0013750
Peroxide Fusions	3	0.0005774	0.0004444	0.0003333

Test	F Ratio	DFNum	DFDen	Prob > F
O'Brien[.5]	0.8060	2	8	0.4798
Brown-Forsythe	1.7246	2	8	0.2384
Levene	1.7275	2	8	0.2379
Bartlett	1.0000	2	.	0.3679

Warning: Small sample sizes. Use Caution.
Welch Anova testing Means Equal, allowing Std Devs Not Equal

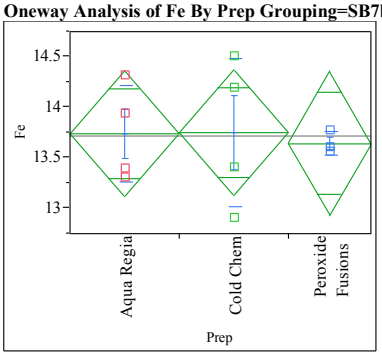
F Ratio	DFNum	DFDen	Prob > F
11.4664	2	4.8685	0.0144

Means Comparisons
Comparisons for all pairs using Tukey-Kramer HSD

Level		Mean
Peroxide Fusions	A	0.04366667
Aqua Regia	B	0.04025000
Cold Chem	B	0.04002500

Levels not connected by same letter are significantly different.

Oneway Analysis of Fe By Prep Grouping=SB7b SRAT, Type=Product



Oneway Anova
Summary of Fit

Rsquare	0.009525
Adj Rsquare	-0.23809
Root Mean Square Error	0.539209
Mean of Response	13.71727
Observations (or Sum Wgts)	11

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Prep	2	0.0223672	0.011184	0.0385	0.9624
Error	8	2.3259670	0.290746		
C. Total	10	2.3483342			

Means for Oneway Anova

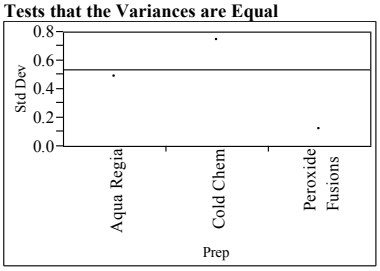
Level	Number	Mean	Std Error	Lower 95%	Upper 95%
Aqua Regia	4	13.7395	0.26960	13.118	14.361
Cold Chem	4	13.7500	0.26960	13.128	14.372
Peroxide Fusions	3	13.6440	0.31131	12.926	14.362

Std Error uses a pooled estimate of error variance

Means and Std Deviations

Level	Number	Mean	Std Dev	Std Err Mean	Lower 95%	Upper 95%
Aqua Regia	4	13.7395	0.479878	0.23994	12.976	14.503
Cold Chem	4	13.7500	0.732575	0.36629	12.584	14.916
Peroxide Fusions	3	13.6440	0.112067	0.06470	13.366	13.922

Tests that the Variances are Equal



Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
Aqua Regia	4	0.4798781	0.3920000	0.3920000
Cold Chem	4	0.7325754	0.6000000	0.6000000
Peroxide Fusions	3	0.1120669	0.0846667	0.0850000

Test	F Ratio	DFNum	DFDen	Prob > F
O'Brien[.5]	2.3848	2	8	0.1540
Brown-Forsythe	6.3057	2	8	0.0227
Levene	7.2966	2	8	0.0157
Bartlett	2.1918	2	.	0.1117

Warning: Small sample sizes. Use Caution.
Welch Anova testing Means Equal, allowing Std Devs Not Equal

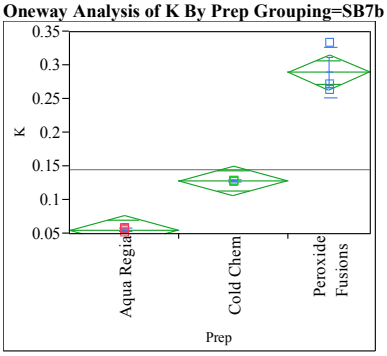
F Ratio	DFNum	DFDen	Prob > F
0.0952	2	4.3712	0.9110

Means Comparisons
Comparisons for all pairs using Tukey-Kramer HSD

Level		Mean
Cold Chem	A	13.750000
Aqua Regia	A	13.739500
Peroxide Fusions	A	13.644000

Levels not connected by same letter are significantly different.

Oneway Analysis of K By Prep Grouping=SB7b SRAT, Type=Product



Oneway Anova
Summary of Fit

Rsquare	0.970568
Adj Rsquare	0.96321
Root Mean Square Error	0.01906
Mean of Response	0.145636
Observations (or Sum Wgts)	11

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Prep	2	0.09583438	0.047917	131.9049	<.0001
Error	8	0.00290617	0.000363		
C. Total	10	0.09874055			

Means for Oneway Anova

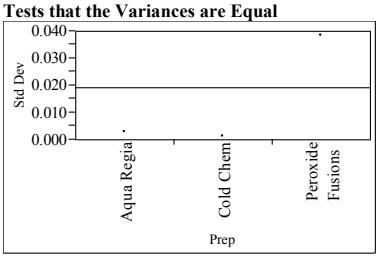
Level	Number	Mean	Std Error	Lower 95%	Upper 95%
Aqua Regia	4	0.055250	0.00953	0.03327	0.07723
Cold Chem	4	0.128250	0.00953	0.10627	0.15023
Peroxide Fusions	3	0.289333	0.01100	0.26396	0.31471

Std Error uses a pooled estimate of error variance

Means and Std Deviations

Level	Number	Mean	Std Dev	Std Err Mean	Lower 95%	Upper 95%
Aqua Regia	4	0.055250	0.002500	0.00125	0.05127	0.05923
Cold Chem	4	0.128250	0.000957	0.00048	0.12673	0.12977
Peroxide Fusions	3	0.289333	0.037978	0.02193	0.19499	0.38368

Tests that the Variances are Equal



Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
Aqua Regia	4	0.0025000	0.0017500	0.0017500
Cold Chem	4	0.0009574	0.0007500	0.0007500
Peroxide Fusions	3	0.0379781	0.0291111	0.0253333

Test	F Ratio	DFNum	DFDen	Prob > F
O'Brien[.5]	2.5730	2	8	0.1371
Brown-Forsythe	2.5047	2	8	0.1430
Levene	19.4175	2	8	0.0009
Bartlett	11.6633	2	.	<.0001

Warning: Small sample sizes. Use Caution.
Welch Anova testing Means Equal, allowing Std Devs Not Equal

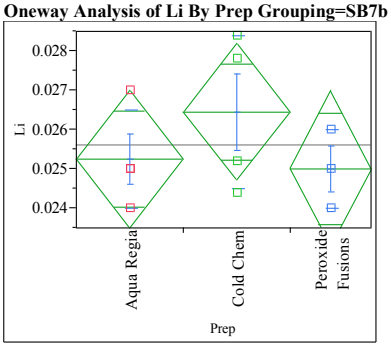
F Ratio	DFNum	DFDen	Prob > F
1275.4589	2	3.5152	<.0001

Means Comparisons
Comparisons for all pairs using Tukey-Kramer HSD

Level		Mean
Peroxide Fusions	A	0.28933333
Cold Chem	B	0.12825000
Aqua Regia	C	0.05525000

Levels not connected by same letter are significantly different.

Oneway Analysis of Li By Prep Grouping=SB7b SRAT, Type=Product



Oneway Anova
Summary of Fit

Rsquare	0.197216
Adj Rsquare	-0.00348
Root Mean Square Error	0.001506
Mean of Response	0.025618
Observations (or Sum Wgts)	11

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Prep	2	0.00000446	2.2282e-6	0.9827	0.4153
Error	8	0.00001814	2.2675e-6		
C. Total	10	0.00002260			

Means for Oneway Anova

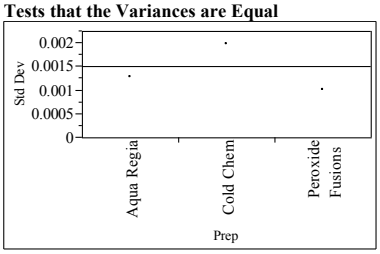
Level	Number	Mean	Std Error	Lower 95%	Upper 95%
Aqua Regia	4	0.025250	0.00075	0.02351	0.02699
Cold Chem	4	0.026450	0.00075	0.02471	0.02819
Peroxide Fusions	3	0.025000	0.00087	0.02300	0.02700

Std Error uses a pooled estimate of error variance

Means and Std Deviations

Level	Number	Mean	Std Dev	Std Err Mean	Lower 95%	Upper 95%
Aqua Regia	4	0.025250	0.001258	0.00063	0.02325	0.02725
Cold Chem	4	0.026450	0.001949	0.00097	0.02335	0.02955
Peroxide Fusions	3	0.025000	0.001000	0.00058	0.02252	0.02748

Tests that the Variances are Equal



Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
Aqua Regia	4	0.0012583	0.0008750	0.0007500
Cold Chem	4	0.0019485	0.0016500	0.0016500
Peroxide Fusions	3	0.0010000	0.0006667	0.0010000

Test	F Ratio	DFNum	DFDen	Prob > F
O'Brien[.5]	1.7959	2	8	0.2269
Brown-Forsythe	2.0948	2	8	0.1855
Levene	2.7691	2	8	0.1219
Bartlett	0.4978	2	.	0.6079

Warning: Small sample sizes. Use Caution.
Welch Anova testing Means Equal, allowing Std Devs Not Equal

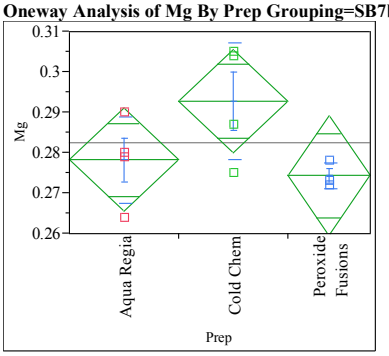
F Ratio	DFNum	DFDen	Prob > F
0.7382	2	5.2324	0.5219

Means Comparisons
Comparisons for all pairs using Tukey-Kramer HSD

Level		Mean
Cold Chem	A	0.02645000
Aqua Regia	A	0.02525000
Peroxide Fusions	A	0.02500000

Levels not connected by same letter are significantly different.

Oneway Analysis of Mg By Prep Grouping=SB7b SRAT, Type=Product



Oneway Anova
Summary of Fit

Rsquare	0.41157
Adj Rsquare	0.264463
Root Mean Square Error	0.011125
Mean of Response	0.282455
Observations (or Sum Wgts)	11

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Prep	2	0.00069256	0.000346	2.7978	0.1199
Error	8	0.00099017	0.000124		
C. Total	10	0.00168273			

Means for Oneway Anova

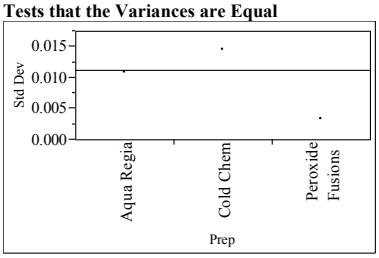
Level	Number	Mean	Std Error	Lower 95%	Upper 95%
Aqua Regia	4	0.278250	0.00556	0.26542	0.29108
Cold Chem	4	0.292750	0.00556	0.27992	0.30558
Peroxide Fusions	3	0.274333	0.00642	0.25952	0.28915

Std Error uses a pooled estimate of error variance

Means and Std Deviations

Level	Number	Mean	Std Dev	Std Err Mean	Lower 95%	Upper 95%
Aqua Regia	4	0.278250	0.010720	0.00536	0.26119	0.29531
Cold Chem	4	0.292750	0.014431	0.00722	0.26979	0.31571
Peroxide Fusions	3	0.274333	0.003215	0.00186	0.26635	0.28232

Tests that the Variances are Equal



Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
Aqua Regia	4	0.0107199	0.0071250	0.0067500
Cold Chem	4	0.0144309	0.0117500	0.0117500
Peroxide Fusions	3	0.0032146	0.0024444	0.0023333

Test	F Ratio	DFNum	DFDen	Prob > F
O'Brien[.5]	1.3460	2	8	0.3134
Brown-Forsythe	2.1885	2	8	0.1745
Levene	2.7563	2	8	0.1229
Bartlett	1.5456	2	.	0.2132

Warning: Small sample sizes. Use Caution.
Welch Anova testing Means Equal, allowing Std Devs Not Equal

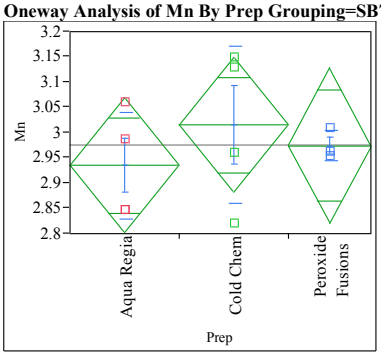
F Ratio	DFNum	DFDen	Prob > F
2.7742	2	4.607	0.1619

Means Comparisons
Comparisons for all pairs using Tukey-Kramer HSD

Level		Mean
Cold Chem	A	0.29275000
Aqua Regia	A	0.27825000
Peroxide Fusions	A	0.27433333

Levels not connected by same letter are significantly different.

Oneway Analysis of Mn By Prep Grouping=SB7b SRAT, Type=Product



Oneway Anova
Summary of Fit

Rsquare	0.106136
Adj Rsquare	-0.11733
Root Mean Square Error	0.116087
Mean of Response	2.974818
Observations (or Sum Wgts)	11

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Prep	2	0.01280097	0.006400	0.4750	0.6384
Error	8	0.10780867	0.013476		
C. Total	10	0.12060964			

Means for Oneway Anova

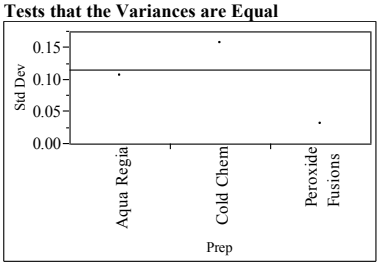
Level	Number	Mean	Std Error	Lower 95%	Upper 95%
Aqua Regia	4	2.93500	0.05804	2.8012	3.0688
Cold Chem	4	3.01500	0.05804	2.8812	3.1488
Peroxide Fusions	3	2.97433	0.06702	2.8198	3.1289

Std Error uses a pooled estimate of error variance

Means and Std Deviations

Level	Number	Mean	Std Dev	Std Err Mean	Lower 95%	Upper 95%
Aqua Regia	4	2.93500	0.105780	0.05289	2.7667	3.1033
Cold Chem	4	3.01500	0.155456	0.07773	2.7676	3.2624
Peroxide Fusions	3	2.97433	0.029501	0.01703	2.9010	3.0476

Tests that the Variances are Equal



Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
Aqua Regia	4	0.1057796	0.0880000	0.0880000
Cold Chem	4	0.1554563	0.1250000	0.1250000
Peroxide Fusions	3	0.0295014	0.0224444	0.0213333

Test	F Ratio	DFNum	DFDen	Prob > F
O'Brien[.5]	1.8779	2	8	0.2145
Brown-Forsythe	4.0354	2	8	0.0614
Levene	5.6634	2	8	0.0294
Bartlett	1.8257	2	.	0.1611

Warning: Small sample sizes. Use Caution.
Welch Anova testing Means Equal, allowing Std Devs Not Equal

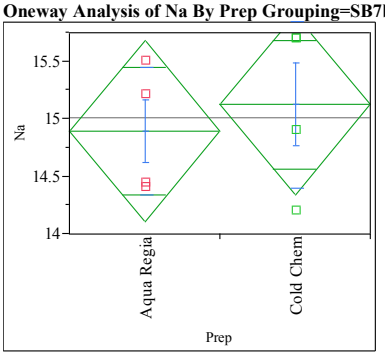
F Ratio	DFNum	DFDen	Prob > F
0.3543	2	4.5137	0.7196

Means Comparisons
Comparisons for all pairs using Tukey-Kramer HSD

Level		Mean
Cold Chem	A	3.0150000
Peroxide Fusions	A	2.9743333
Aqua Regia	A	2.9350000

Levels not connected by same letter are significantly different.

Oneway Analysis of Na By Prep Grouping=SB7b SRAT, Type=Product



Missing Rows 3

Oneway Anova
Summary of Fit

Rsquare	0.041245
Adj Rsquare	-0.11855
Root Mean Square Error	0.643016
Mean of Response	15.0095
Observations (or Sum Wgts)	8

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Prep	1	0.1067220	0.106722	0.2581	0.6296
Error	6	2.4808140	0.413469		
C. Total	7	2.5875360			

Means for Oneway Anova

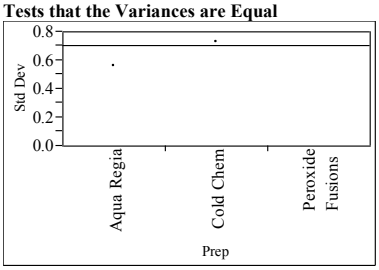
Level	Number	Mean	Std Error	Lower 95%	Upper 95%
Aqua Regia	4	14.8940	0.32151	14.107	15.681
Cold Chem	4	15.1250	0.32151	14.338	15.912
Peroxide Fusions	0	.	.	.	.

Std Error uses a pooled estimate of error variance

Means and Std Deviations

Level	Number	Mean	Std Dev	Std Err Mean	Lower 95%	Upper 95%
Aqua Regia	4	14.8940	0.551759	0.27588	14.016	15.772
Cold Chem	4	15.1250	0.722842	0.36142	13.975	16.275
Peroxide Fusions	0	.	.	.	.	.

Tests that the Variances are Equal



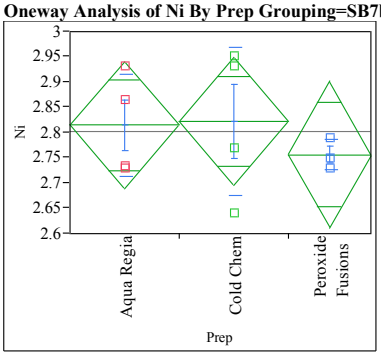
Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
Aqua Regia	4	0.5517590	0.4660000	0.4660000
Cold Chem	4	0.7228416	0.5750000	0.5750000
Peroxide Fusions	0	.	0.0000000	0.0000000

Test	F Ratio	DFNum	DFDen	Prob > F
O'Brien[.5]	0.5430	1	6	0.4890
Brown-Forsythe	0.3329	1	6	0.5850
Levene	0.4922	1	6	0.5093
Bartlett	0.1853	1	.	0.6668

Warning: Small sample sizes. Use Caution.
Welch Anova testing Means Equal, allowing Std Devs Not Equal

F Ratio	DFNum	DFDen	Prob > F
0.2581	1	5.6099	0.6308

Oneway Analysis of Ni By Prep Grouping=SB7b SRAT, Type=Product



Oneway Anova
Summary of Fit

Rsquare	0.081113
Adj Rsquare	-0.14861
Root Mean Square Error	0.109516
Mean of Response	2.801636
Observations (or Sum Wgts)	11

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Prep	2	0.00846988	0.004235	0.3531	0.7129
Error	8	0.09595067	0.011994		
C. Total	10	0.10442055			

Means for Oneway Anova

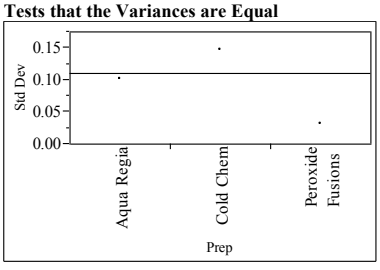
Level	Number	Mean	Std Error	Lower 95%	Upper 95%
Aqua Regia	4	2.81450	0.05476	2.6882	2.9408
Cold Chem	4	2.82250	0.05476	2.6962	2.9488
Peroxide Fusions	3	2.75667	0.06323	2.6109	2.9025

Std Error uses a pooled estimate of error variance

Means and Std Deviations

Level	Number	Mean	Std Dev	Std Err Mean	Lower 95%	Upper 95%
Aqua Regia	4	2.81450	0.100348	0.05017	2.6548	2.9742
Cold Chem	4	2.82250	0.145917	0.07296	2.5903	3.0547
Peroxide Fusions	3	2.75667	0.030551	0.01764	2.6808	2.8326

Tests that the Variances are Equal



Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
Aqua Regia	4	0.1003477	0.0835000	0.0835000
Cold Chem	4	0.1459166	0.1175000	0.1175000
Peroxide Fusions	3	0.0305505	0.0222222	0.0266667

Test	F Ratio	DFNum	DFDen	Prob > F
O'Brien[.5]	1.8618	2	8	0.2168
Brown-Forsythe	3.7174	2	8	0.0722
Levene	5.5238	2	8	0.0311
Bartlett	1.6656	2	.	0.1891

Warning: Small sample sizes. Use Caution.
Welch Anova testing Means Equal, allowing Std Devs Not Equal

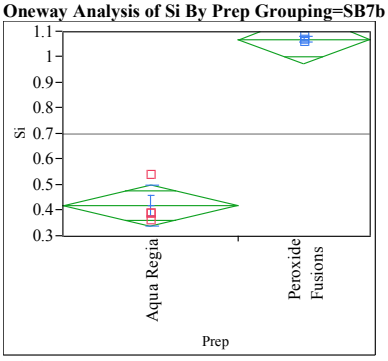
F Ratio	DFNum	DFDen	Prob > F
0.7921	2	4.5952	0.5063

Means Comparisons
Comparisons for all pairs using Tukey-Kramer HSD

Level		Mean
Cold Chem	A	2.8225000
Aqua Regia	A	2.8145000
Peroxide Fusions	A	2.7566667

Levels not connected by same letter are significantly different.

Oneway Analysis of Si By Prep Grouping=SB7b SRAT, Type=Product



Missing Rows 4

Oneway Anova
Summary of Fit

Rsquare	0.973129
Adj Rsquare	0.967754
Root Mean Square Error	0.063246
Mean of Response	0.698571
Observations (or Sum Wgts)	7

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Prep	1	0.72428571	0.724286	181.0714	<.0001
Error	5	0.02000000	0.004000		
C. Total	6	0.74428571			

Means for Oneway Anova

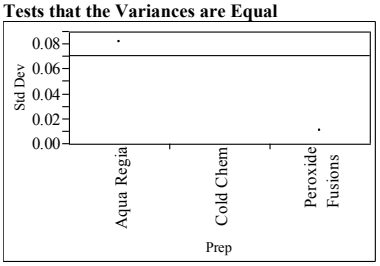
Level	Number	Mean	Std Error	Lower 95%	Upper 95%
Aqua Regia	4	0.42000	0.03162	0.33871	0.5013
Cold Chem	0	.	.	.	.
Peroxide Fusions	3	1.07000	0.03651	0.97614	1.1639

Std Error uses a pooled estimate of error variance

Means and Std Deviations

Level	Number	Mean	Std Dev	Std Err Mean	Lower 95%	Upper 95%
Aqua Regia	4	0.42000	0.081240	0.04062	0.2907	0.5493
Cold Chem	0	.	.	.	.	.
Peroxide Fusions	3	1.07000	0.010000	0.00577	1.0452	1.0948

Tests that the Variances are Equal



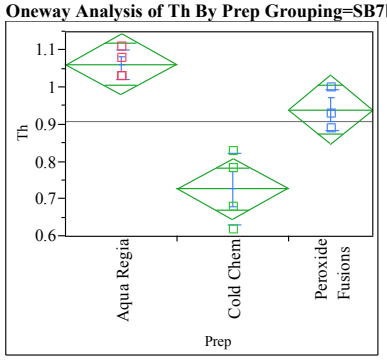
Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
Aqua Regia	4	0.0812404	0.0600000	0.0450000
Cold Chem	0	.	0.0000000	0.0000000
Peroxide Fusions	3	0.0100000	0.0066667	0.0100000

Test	F Ratio	DFNum	DFDen	Prob > F
O'Brien[.5]	1.0519	1	5	0.3521
Brown-Forsythe	0.6863	1	5	0.4452
Levene	4.4599	1	5	0.0884
Bartlett	4.8513	1	.	0.0276

Warning: Small sample sizes. Use Caution.
Welch Anova testing Means Equal, allowing Std Devs Not Equal

F Ratio	DFNum	DFDen	Prob > F
250.9901	1	3.1205	0.0004

Oneway Analysis of Th By Prep Grouping=SB7b SRAT, Type=Product



Oneway Anova
Summary of Fit

Rsquare	0.855208
Adj Rsquare	0.81901
Root Mean Square Error	0.069651
Mean of Response	0.907182
Observations (or Sum Wgts)	11

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Prep	2	0.22922789	0.114614	23.6258	0.0004
Error	8	0.03880975	0.004851		
C. Total	10	0.26803764			

Means for Oneway Anova

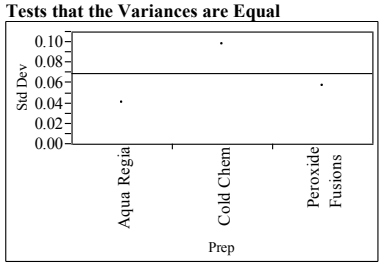
Level	Number	Mean	Std Error	Lower 95%	Upper 95%
Aqua Regia	4	1.06250	0.03483	0.98219	1.1428
Cold Chem	4	0.72725	0.03483	0.64694	0.8076
Peroxide Fusions	3	0.94000	0.04021	0.84727	1.0327

Std Error uses a pooled estimate of error variance

Means and Std Deviations

Level	Number	Mean	Std Dev	Std Err Mean	Lower 95%	Upper 95%
Aqua Regia	4	1.06250	0.039476	0.01974	0.99969	1.1253
Cold Chem	4	0.72725	0.096497	0.04825	0.57370	0.8808
Peroxide Fusions	3	0.94000	0.055678	0.03215	0.80169	1.0783

Tests that the Variances are Equal



Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
Aqua Regia	4	0.0394757	0.0325000	0.0325000
Cold Chem	4	0.0964965	0.0792500	0.0792500
Peroxide Fusions	3	0.0556776	0.0400000	0.0500000

Test	F Ratio	DFNum	DFDen	Prob > F
O'Brien[.5]	2.2531	2	8	0.1674
Brown-Forsythe	4.2922	2	8	0.0541
Levene	4.2217	2	8	0.0560
Bartlett	0.9997	2	.	0.3680

Warning: Small sample sizes. Use Caution.
Welch Anova testing Means Equal, allowing Std Devs Not Equal

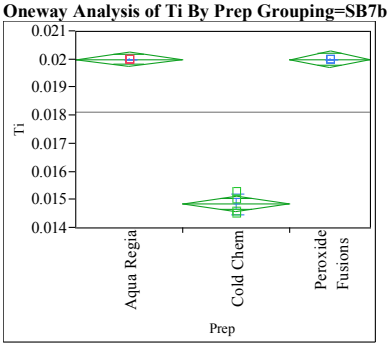
F Ratio	DFNum	DFDen	Prob > F
19.7785	2	4.5038	0.0059

Means Comparisons
Comparisons for all pairs using Tukey-Kramer HSD

Level		Mean
Aqua Regia	A	1.0625000
Peroxide Fusions	A	0.9400000
Cold Chem	B	0.7272500

Levels not connected by same letter are significantly different.

Oneway Analysis of Ti By Prep Grouping=SB7b SRAT, Type=Product



Oneway Anova
Summary of Fit

Rsquare	0.993964
Adj Rsquare	0.992455
Root Mean Square Error	0.000226
Mean of Response	0.018127
Observations (or Sum Wgts)	11

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Prep	2	0.00006751	0.000034	658.6519	<.0001
Error	8	0.00000041	5.125e-8		
C. Total	10	0.00006792			

Means for Oneway Anova

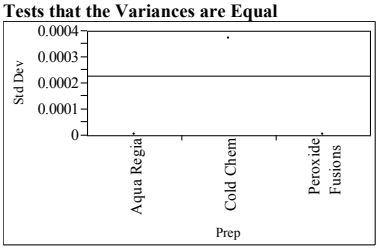
Level	Number	Mean	Std Error	Lower 95%	Upper 95%
Aqua Regia	4	0.020000	0.00011	0.01974	0.02026
Cold Chem	4	0.014850	0.00011	0.01459	0.01511
Peroxide Fusions	3	0.020000	0.00013	0.01970	0.02030

Std Error uses a pooled estimate of error variance

Means and Std Deviations

Level	Number	Mean	Std Dev	Std Err Mean	Lower 95%	Upper 95%
Aqua Regia	4	0.020000	0.000000	0.00000	0.02000	0.02000
Cold Chem	4	0.014850	0.000370	0.00018	0.01426	0.01544
Peroxide Fusions	3	0.020000	0.000000	0.00000	0.02000	0.02000

Tests that the Variances are Equal



Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
Aqua Regia	4	0.0000000	0.0000000	0.0000000
Cold Chem	4	0.0003697	0.0003000	0.0003000
Peroxide Fusions	3	0.0000000	0.0000000	0.0000000

Test	F Ratio	DFNum	DFDen	Prob > F
O'Brien[.5]	3.7208	2	8	0.0720
Brown-Forsythe	15.2727	2	8	0.0019
Levene	18.3273	2	8	0.0010
Bartlett	.	2	.	.

Warning: Small sample sizes. Use Caution.
Welch Anova testing Means Equal, allowing Std Devs Not Equal

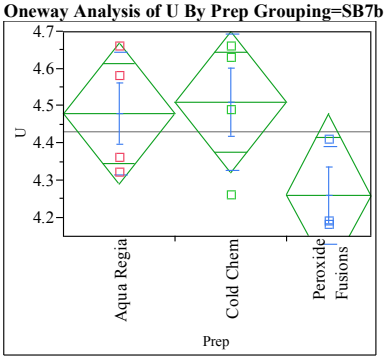
F Ratio	DFNum	DFDen	Prob > F
.	2	.	.

Means Comparisons
Comparisons for all pairs using Tukey-Kramer HSD

Level		Mean
Aqua Regia	A	0.02000000
Peroxide Fusions	A	0.02000000
Cold Chem	B	0.01485000

Levels not connected by same letter are significantly different.

Oneway Analysis of U By Prep Grouping=SB7b SRAT, Type=Product



Oneway Anova
Summary of Fit

Rsquare	0.361496
Adj Rsquare	0.20187
Root Mean Square Error	0.164317
Mean of Response	4.430909
Observations (or Sum Wgts)	11

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Prep	2	0.12229091	0.061145	2.2646	0.1662
Error	8	0.21600000	0.027000		
C. Total	10	0.33829091			

Means for Oneway Anova

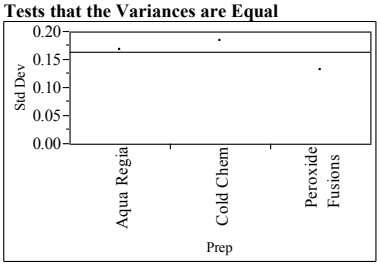
Level	Number	Mean	Std Error	Lower 95%	Upper 95%
Aqua Regia	4	4.48000	0.08216	4.2905	4.6695
Cold Chem	4	4.51000	0.08216	4.3205	4.6995
Peroxide Fusions	3	4.26000	0.09487	4.0412	4.4788

Std Error uses a pooled estimate of error variance

Means and Std Deviations

Level	Number	Mean	Std Dev	Std Err Mean	Lower 95%	Upper 95%
Aqua Regia	4	4.48000	0.165731	0.08287	4.2163	4.7437
Cold Chem	4	4.51000	0.182392	0.09120	4.2198	4.8002
Peroxide Fusions	3	4.26000	0.130000	0.07506	3.9371	4.5829

Tests that the Variances are Equal



Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
Aqua Regia	4	0.1657307	0.1400000	0.1400000
Cold Chem	4	0.1823915	0.1350000	0.1350000
Peroxide Fusions	3	0.1300000	0.1000000	0.0800000

Test	F Ratio	DFNum	DFDen	Prob > F
O'Brien[.5]	0.2388	2	8	0.7930
Brown-Forsythe	0.4110	2	8	0.6763
Levene	0.3594	2	8	0.7088
Bartlett	0.1105	2	.	0.8953

Warning: Small sample sizes. Use Caution.
Welch Anova testing Means Equal, allowing Std Devs Not Equal

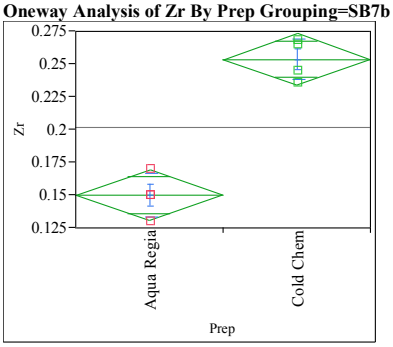
F Ratio	DFNum	DFDen	Prob > F
2.6031	2	5.258	0.1638

Means Comparisons
Comparisons for all pairs using Tukey-Kramer HSD

Level		Mean
Cold Chem	A	4.5100000
Aqua Regia	A	4.4800000
Peroxide Fusions	A	4.2600000

Levels not connected by same letter are significantly different.

Oneway Analysis of Zr By Prep Grouping=SB7b SRAT, Type=Product



Missing Rows 3

Oneway Anova
Summary of Fit

Rsquare	0.933712
Adj Rsquare	0.922665
Root Mean Square Error	0.015922
Mean of Response	0.20175
Observations (or Sum Wgts)	8

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Prep	1	0.02142450	0.021424	84.5148	<.0001
Error	6	0.00152100	0.000254		
C. Total	7	0.02294550			

Means for Oneway Anova

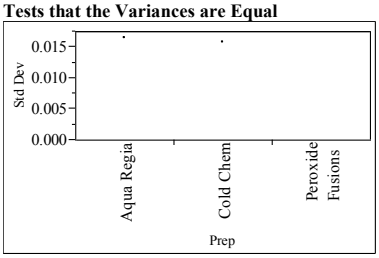
Level	Number	Mean	Std Error	Lower 95%	Upper 95%
Aqua Regia	4	0.150000	0.00796	0.13052	0.16948
Cold Chem	4	0.253500	0.00796	0.23402	0.27298
Peroxide Fusions	0	.	.	.	.

Std Error uses a pooled estimate of error variance

Means and Std Deviations

Level	Number	Mean	Std Dev	Std Err Mean	Lower 95%	Upper 95%
Aqua Regia	4	0.150000	0.016330	0.00816	0.12402	0.17598
Cold Chem	4	0.253500	0.015503	0.00775	0.22883	0.27817
Peroxide Fusions	0	.	.	.	.	.

Tests that the Variances are Equal



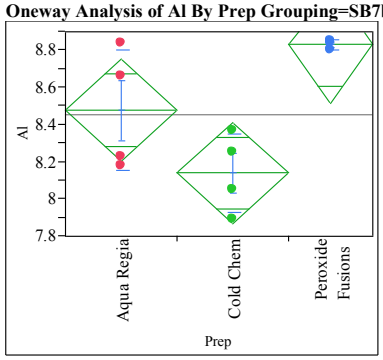
Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
Aqua Regia	4	0.0163299	0.0100000	0.0100000
Cold Chem	4	0.0155027	0.0130000	0.0130000
Peroxide Fusions	0	.	0.0000000	0.0000000

Test	F Ratio	DFNum	DFDen	Prob > F
O'Brien[.5]	0.0157	1	6	0.9044
Brown-Forsythe	0.2379	1	6	0.6430
Levene	0.2427	1	6	0.6398
Bartlett	0.0069	1	.	0.9336

Warning: Small sample sizes. Use Caution.
Welch Anova testing Means Equal, allowing Std Devs Not Equal

F Ratio	DFNum	DFDen	Prob > F
84.5148	1	5.9839	<.0001

Oneway Analysis of Al By Prep Grouping=SB7b SRAT, Type=Receipt



Oneway Anova
Summary of Fit

Rsquare	0.645092
Adj Rsquare	0.556365
Root Mean Square Error	0.237559
Mean of Response	8.450909
Observations (or Sum Wgts)	11

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Prep	2	0.8206159	0.410308	7.2705	0.0159
Error	8	0.4514750	0.056434		
C. Total	10	1.2720909			

Means for Oneway Anova

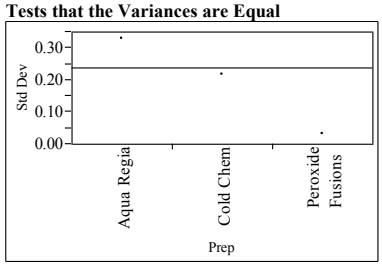
Level	Number	Mean	Std Error	Lower 95%	Upper 95%
Aqua Regia	4	8.47750	0.11878	8.2036	8.7514
Cold Chem	4	8.14000	0.11878	7.8661	8.4139
Peroxide Fusions	3	8.83000	0.13715	8.5137	9.1463

Std Error uses a pooled estimate of error variance

Means and Std Deviations

Level	Number	Mean	Std Dev	Std Err Mean	Lower 95%	Upper 95%
Aqua Regia	4	8.47750	0.323767	0.16188	7.9623	8.9927
Cold Chem	4	8.14000	0.212603	0.10630	7.8017	8.4783
Peroxide Fusions	3	8.83000	0.026458	0.01528	8.7643	8.8957

Tests that the Variances are Equal



Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
Aqua Regia	4	0.3237669	0.2725000	0.2725000
Cold Chem	4	0.2126029	0.1700000	0.1700000
Peroxide Fusions	3	0.0264575	0.0200000	0.0200000

Test	F Ratio	DFNum	DFDen	Prob > F
O'Brien[.5]	3.6496	2	8	0.0748
Brown-Forsythe	10.2523	2	8	0.0062
Levene	11.6207	2	8	0.0043
Bartlett	3.2327	2	.	0.0395

Warning: Small sample sizes. Use Caution.
Welch Anova testing Means Equal, allowing Std Devs Not Equal

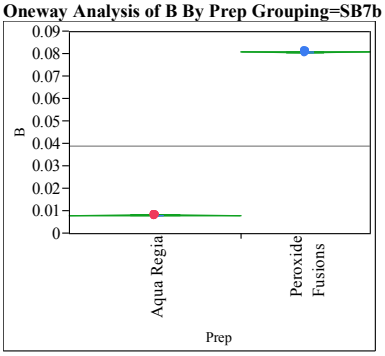
F Ratio	DFNum	DFDen	Prob > F
19.6278	2	4.1146	0.0079

Means Comparisons
Comparisons for all pairs using Tukey-Kramer HSD

Level			Mean
Peroxide Fusions	A		8.8300000
Aqua Regia	A	B	8.4775000
Cold Chem		B	8.1400000

Levels not connected by same letter are significantly different.

Oneway Analysis of B By Prep Grouping=SB7b SRAT, Type=Receipt



Missing Rows 4

Oneway Anova
Summary of Fit

Rsquare	0.999962
Adj Rsquare	0.999955
Root Mean Square Error	0.000262
Mean of Response	0.039244
Observations (or Sum Wgts)	7

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Prep	1	0.00905157	0.009052	131892.6	<.0001
Error	5	0.00000034	6.863e-8		
C. Total	6	0.00905191			

Means for Oneway Anova

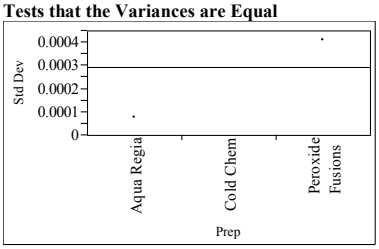
Level	Number	Mean	Std Error	Lower 95%	Upper 95%
Aqua Regia	4	0.008102	0.00013	0.00777	0.00844
Cold Chem	0	.	.	.	.
Peroxide Fusions	3	0.080767	0.00015	0.08038	0.08116

Std Error uses a pooled estimate of error variance

Means and Std Deviations

Level	Number	Mean	Std Dev	Std Err Mean	Lower 95%	Upper 95%
Aqua Regia	4	0.008102	0.000074	3.71e-5	0.00798	0.00822
Cold Chem	0	.	.	.	.	.
Peroxide Fusions	3	0.080767	0.000404	0.00023	0.07976	0.08177

Tests that the Variances are Equal



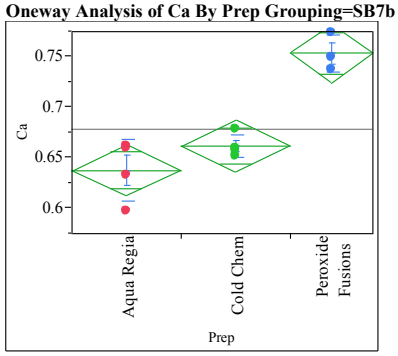
Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
Aqua Regia	4	0.0000741	0.0000525	0.0000525
Cold Chem	0	.	0.0000000	0.0000000
Peroxide Fusions	3	0.0004041	0.0003111	0.0002333

Test	F Ratio	DFNum	DFDen	Prob > F
O'Brien[.5]	2.3670	1	5	0.1845
Brown-Forsythe	0.8409	1	5	0.4012
Levene	13.7319	1	5	0.0139
Bartlett	4.8239	1	.	0.0281

Warning: Small sample sizes. Use Caution.
Welch Anova testing Means Equal, allowing Std Devs Not Equal

F Ratio	DFNum	DFDen	Prob > F
94595.678	1	2.1012	<.0001

Oneway Analysis of Ca By Prep Grouping=SB7b SRAT, Type=Receipt



Oneway Anova
Summary of Fit

Rsquare	0.865427
Adj Rsquare	0.831784
Root Mean Square Error	0.021864
Mean of Response	0.677909
Observations (or Sum Wgts)	11

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Prep	2	0.02459449	0.012297	25.7237	0.0003
Error	8	0.00382442	0.000478		
C. Total	10	0.02841891			

Means for Oneway Anova

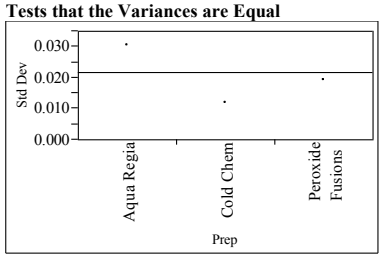
Level	Number	Mean	Std Error	Lower 95%	Upper 95%
Aqua Regia	4	0.637750	0.01093	0.61254	0.66296
Cold Chem	4	0.661500	0.01093	0.63629	0.68671
Peroxide Fusions	3	0.753333	0.01262	0.72422	0.78244

Std Error uses a pooled estimate of error variance

Means and Std Deviations

Level	Number	Mean	Std Dev	Std Err Mean	Lower 95%	Upper 95%
Aqua Regia	4	0.637750	0.030126	0.01506	0.58981	0.68569
Cold Chem	4	0.661500	0.011387	0.00569	0.64338	0.67962
Peroxide Fusions	3	0.753333	0.018877	0.01090	0.70644	0.80023

Tests that the Variances are Equal



Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
Aqua Regia	4	0.0301261	0.0227500	0.0227500
Cold Chem	4	0.0113871	0.0082500	0.0070000
Peroxide Fusions	3	0.0188768	0.0137778	0.0163333

Test	F Ratio	DFNum	DFDen	Prob > F
O'Brien[.5]	1.1041	2	8	0.3772
Brown-Forsythe	1.5656	2	8	0.2668
Levene	1.8718	2	8	0.2154
Bartlett	1.0986	2	.	0.3333

Warning: Small sample sizes. Use Caution.
Welch Anova testing Means Equal, allowing Std Devs Not Equal

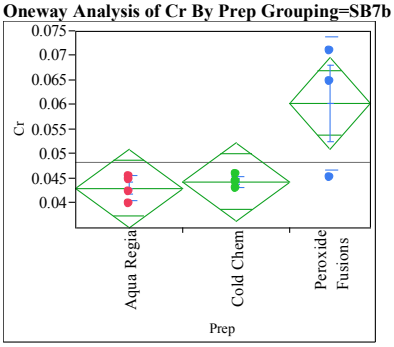
F Ratio	DFNum	DFDen	Prob > F
27.3596	2	4.2734	0.0037

Means Comparisons
Comparisons for all pairs using Tukey-Kramer HSD

Level		Mean
Peroxide Fusions	A	0.75333333
Cold Chem	B	0.66150000
Aqua Regia	B	0.63775000

Levels not connected by same letter are significantly different.

Oneway Analysis of Cr By Prep Grouping=SB7b SRAT, Type=Receipt



Oneway Anova
Summary of Fit

Rsquare	0.610576
Adj Rsquare	0.51322
Root Mean Square Error	0.00696
Mean of Response	0.048264
Observations (or Sum Wgts)	11

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Prep	2	0.00060762	0.000304	6.2716	0.0230
Error	8	0.00038754	0.000048		
C. Total	10	0.00099517			

Means for Oneway Anova

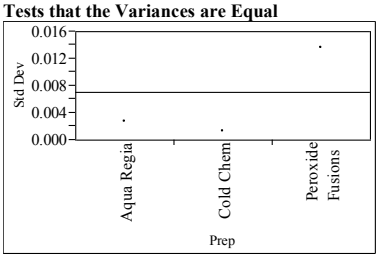
Level	Number	Mean	Std Error	Lower 95%	Upper 95%
Aqua Regia	4	0.043075	0.00348	0.03505	0.05110
Cold Chem	4	0.044375	0.00348	0.03635	0.05240
Peroxide Fusions	3	0.060367	0.00402	0.05110	0.06963

Std Error uses a pooled estimate of error variance

Means and Std Deviations

Level	Number	Mean	Std Dev	Std Err Mean	Lower 95%	Upper 95%
Aqua Regia	4	0.043075	0.002498	0.00125	0.03910	0.04705
Cold Chem	4	0.044375	0.001144	0.00057	0.04255	0.04620
Peroxide Fusions	3	0.060367	0.013507	0.00780	0.02681	0.09392

Tests that the Variances are Equal



Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
Aqua Regia	4	0.0024985	0.0019750	0.0019750
Cold Chem	4	0.0011442	0.0007250	0.0007250
Peroxide Fusions	3	0.0135072	0.0101111	0.0107333

Test	F Ratio	DFNum	DFDen	Prob > F
O'Brien[.5]	2.4783	2	8	0.1453
Brown-Forsythe	6.3180	2	8	0.0226
Levene	10.8086	2	8	0.0053
Bartlett	6.1042	2	.	0.0022

Warning: Small sample sizes. Use Caution.
Welch Anova testing Means Equal, allowing Std Devs Not Equal

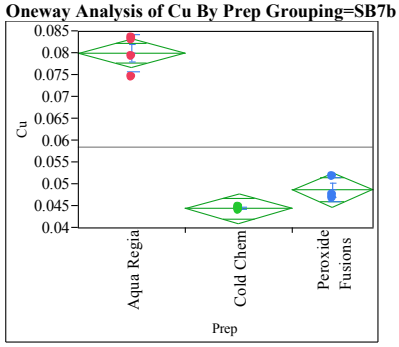
F Ratio	DFNum	DFDen	Prob > F
2.1970	2	3.6319	0.2370

Means Comparisons
Comparisons for all pairs using Tukey-Kramer HSD

Level		Mean
Peroxide Fusions	A	0.06036667
Cold Chem	B	0.04437500
Aqua Regia	B	0.04307500

Levels not connected by same letter are significantly different.

Oneway Analysis of Cu By Prep Grouping=SB7b SRAT, Type=Receipt



Oneway Anova
Summary of Fit

Rsquare	0.977384
Adj Rsquare	0.97173
Root Mean Square Error	0.002912
Mean of Response	0.058518
Observations (or Sum Wgts)	11

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Prep	2	0.00293150	0.001466	172.8629	<.0001
Error	8	0.00006783	8.479e-6		
C. Total	10	0.00299934			

Means for Oneway Anova

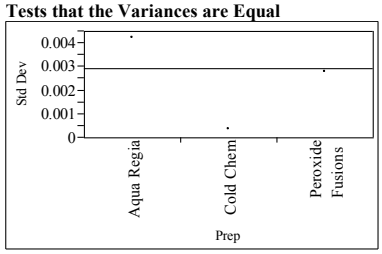
Level	Number	Mean	Std Error	Lower 95%	Upper 95%
Aqua Regia	4	0.080000	0.00146	0.07664	0.08336
Cold Chem	4	0.044425	0.00146	0.04107	0.04778
Peroxide Fusions	3	0.048667	0.00168	0.04479	0.05254

Std Error uses a pooled estimate of error variance

Means and Std Deviations

Level	Number	Mean	Std Dev	Std Err Mean	Lower 95%	Upper 95%
Aqua Regia	4	0.080000	0.004190	0.00209	0.07333	0.08667
Cold Chem	4	0.044425	0.000299	0.00015	0.04395	0.04490
Peroxide Fusions	3	0.048667	0.002730	0.00158	0.04188	0.05545

Tests that the Variances are Equal



Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
Aqua Regia	4	0.0041897	0.0032000	0.0032000
Cold Chem	4	0.0002986	0.0002250	0.0002250
Peroxide Fusions	3	0.0027301	0.0020889	0.0018667

Test	F Ratio	DFNum	DFDen	Prob > F
O'Brien[.5]	1.5275	2	8	0.2742
Brown-Forsythe	2.7520	2	8	0.1232
Levene	5.3045	2	8	0.0342
Bartlett	5.0015	2	.	0.0067

Warning: Small sample sizes. Use Caution.
Welch Anova testing Means Equal, allowing Std Devs Not Equal

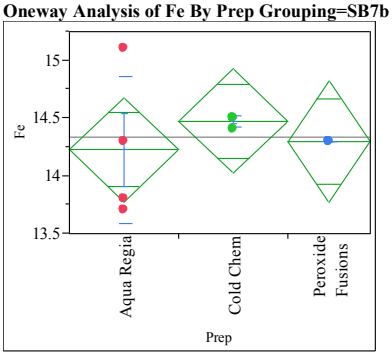
F Ratio	DFNum	DFDen	Prob > F
121.7612	2	3.2471	0.0009

Means Comparisons
Comparisons for all pairs using Tukey-Kramer HSD

Level		Mean
Aqua Regia	A	0.08000000
Peroxide Fusions	B	0.04866667
Cold Chem	B	0.04442500

Levels not connected by same letter are significantly different.

Oneway Analysis of Fe By Prep Grouping=SB7b SRAT, Type=Receipt



Oneway Anova
Summary of Fit

Rsquare	0.095539
Adj Rsquare	-0.13058
Root Mean Square Error	0.392906
Mean of Response	14.33636
Observations (or Sum Wgts)	11

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Prep	2	0.1304545	0.065227	0.4225	0.6692
Error	8	1.2350000	0.154375		
C. Total	10	1.3654545			

Means for Oneway Anova

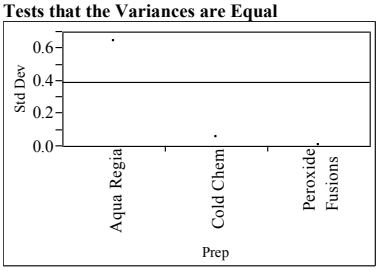
Level	Number	Mean	Std Error	Lower 95%	Upper 95%
Aqua Regia	4	14.2250	0.19645	13.772	14.678
Cold Chem	4	14.4750	0.19645	14.022	14.928
Peroxide Fusions	3	14.3000	0.22684	13.777	14.823

Std Error uses a pooled estimate of error variance

Means and Std Deviations

Level	Number	Mean	Std Dev	Std Err Mean	Lower 95%	Upper 95%
Aqua Regia	4	14.2250	0.639661	0.31983	13.207	15.243
Cold Chem	4	14.4750	0.050000	0.02500	14.395	14.555
Peroxide Fusions	3	14.3000	2.18e-15	1.3e-15	14.300	14.300

Tests that the Variances are Equal



Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
Aqua Regia	4	0.6396614	0.4750000	0.4750000
Cold Chem	4	0.0500000	0.0375000	0.0250000
Peroxide Fusions	3	2.176e-15	1.776e-15	0.0000000

Test	F Ratio	DFNum	DFDen	Prob > F
O'Brien[.5]	1.9155	2	8	0.2091
Brown-Forsythe	4.7592	2	8	0.0435
Levene	6.4377	2	8	0.0216
Bartlett	59.9663	2	.	<.0001

Warning: Small sample sizes. Use Caution.
Welch Anova testing Means Equal, allowing Std Devs Not Equal

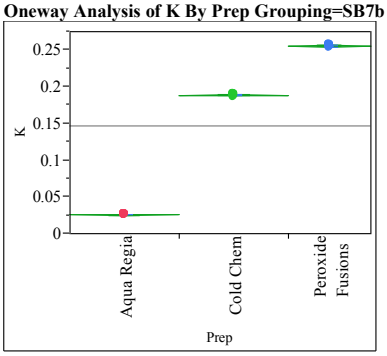
F Ratio	DFNum	DFDen	Prob > F
21.0236	2	4	0.0075

Means Comparisons
Comparisons for all pairs using Tukey-Kramer HSD

Level		Mean
Cold Chem	A	14.475000
Peroxide Fusions	A	14.300000
Aqua Regia	A	14.225000

Levels not connected by same letter are significantly different.

Oneway Analysis of K By Prep Grouping=SB7b SRAT, Type=Receipt



Oneway Anova
Summary of Fit

Rsquare	0.999945
Adj Rsquare	0.999931
Root Mean Square Error	0.000833
Mean of Response	0.1474
Observations (or Sum Wgts)	11

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Prep	2	0.10096466	0.050482	72680.02	<.0001
Error	8	0.00000556	6.946e-7		
C. Total	10	0.10097022			

Means for Oneway Anova

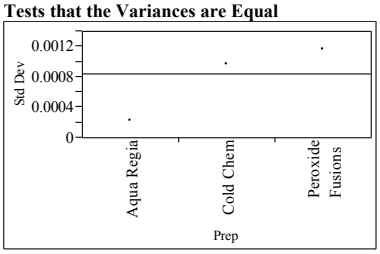
Level	Number	Mean	Std Error	Lower 95%	Upper 95%
Aqua Regia	4	0.025600	0.00042	0.02464	0.02656
Cold Chem	4	0.188250	0.00042	0.18729	0.18921
Peroxide Fusions	3	0.255333	0.00048	0.25422	0.25644

Std Error uses a pooled estimate of error variance

Means and Std Deviations

Level	Number	Mean	Std Dev	Std Err Mean	Lower 95%	Upper 95%
Aqua Regia	4	0.025600	0.000216	0.00011	0.02526	0.02594
Cold Chem	4	0.188250	0.000957	0.00048	0.18673	0.18977
Peroxide Fusions	3	0.255333	0.001155	0.00067	0.25246	0.25820

Tests that the Variances are Equal



Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
Aqua Regia	4	0.0002160	0.0001500	0.0001500
Cold Chem	4	0.0009574	0.0007500	0.0007500
Peroxide Fusions	3	0.0011547	0.0008889	0.0006667

Test	F Ratio	DFNum	DFDen	Prob > F
O'Brien[.5]	1.3300	2	8	0.3172
Brown-Forsythe	0.9462	2	8	0.4277
Levene	5.3895	2	8	0.0329
Bartlett	2.5410	2	.	0.0788

Warning: Small sample sizes. Use Caution.
Welch Anova testing Means Equal, allowing Std Devs Not Equal

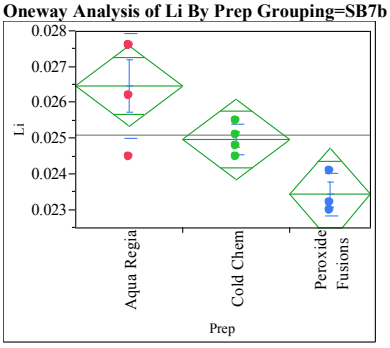
F Ratio	DFNum	DFDen	Prob > F
91164.396	2	3.4179	<.0001

Means Comparisons
Comparisons for all pairs using Tukey-Kramer HSD

Level		Mean
Peroxide Fusions	A	0.25533333
Cold Chem	B	0.18825000
Aqua Regia	C	0.02560000

Levels not connected by same letter are significantly different.

Oneway Analysis of Li By Prep Grouping=SB7b SRAT, Type=Receipt



Oneway Anova
Summary of Fit

Rsquare	0.673347
Adj Rsquare	0.591684
Root Mean Square Error	0.000984
Mean of Response	0.0251
Observations (or Sum Wgts)	11

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Prep	2	0.00001596	7.9792e-6	8.2454	0.0114
Error	8	0.00000774	9.6771e-7		
C. Total	10	0.00002370			

Means for Oneway Anova

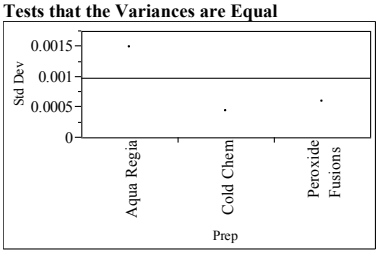
Level	Number	Mean	Std Error	Lower 95%	Upper 95%
Aqua Regia	4	0.026475	0.00049	0.02534	0.02761
Cold Chem	4	0.024975	0.00049	0.02384	0.02611
Peroxide Fusions	3	0.023433	0.00057	0.02212	0.02474

Std Error uses a pooled estimate of error variance

Means and Std Deviations

Level	Number	Mean	Std Dev	Std Err Mean	Lower 95%	Upper 95%
Aqua Regia	4	0.026475	0.001473	0.00074	0.02413	0.02882
Cold Chem	4	0.024975	0.000427	0.00021	0.02430	0.02565
Peroxide Fusions	3	0.023433	0.000586	0.00034	0.02198	0.02489

Tests that the Variances are Equal



Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
Aqua Regia	4	0.0014728	0.0011250	0.0011250
Cold Chem	4	0.0004272	0.0003250	0.0003250
Peroxide Fusions	3	0.0005859	0.0004444	0.0004333

Test	F Ratio	DFNum	DFDen	Prob > F
O'Brien[.5]	1.6860	2	8	0.2449
Brown-Forsythe	2.2361	2	8	0.1693
Levene	3.4896	2	8	0.0814
Bartlett	1.9834	2	.	0.1376

Warning: Small sample sizes. Use Caution.
Welch Anova testing Means Equal, allowing Std Devs Not Equal

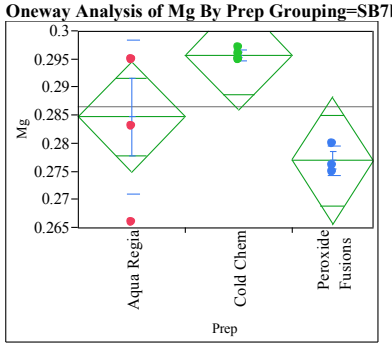
F Ratio	DFNum	DFDen	Prob > F
9.3019	2	4.4504	0.0257

Means Comparisons
Comparisons for all pairs using Tukey-Kramer HSD

Level		Mean
Aqua Regia	A	0.02647500
Cold Chem	A B	0.02497500
Peroxide Fusions	B	0.02343333

Levels not connected by same letter are significantly different.

Oneway Analysis of Mg By Prep Grouping=SB7b SRAT, Type=Receipt



Oneway Anova
Summary of Fit

Rsquare	0.518046
Adj Rsquare	0.397557
Root Mean Square Error	0.008526
Mean of Response	0.286636
Observations (or Sum Wgts)	11

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Prep	2	0.00062505	0.000313	4.2995	0.0540
Error	8	0.00058150	0.000073		
C. Total	10	0.00120655			

Means for Oneway Anova

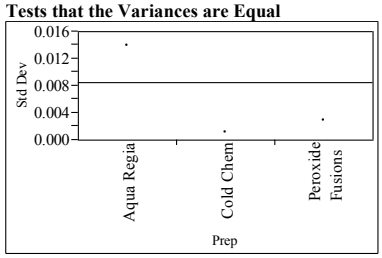
Level	Number	Mean	Std Error	Lower 95%	Upper 95%
Aqua Regia	4	0.284750	0.00426	0.27492	0.29458
Cold Chem	4	0.295750	0.00426	0.28592	0.30558
Peroxide Fusions	3	0.277000	0.00492	0.26565	0.28835

Std Error uses a pooled estimate of error variance

Means and Std Deviations

Level	Number	Mean	Std Dev	Std Err Mean	Lower 95%	Upper 95%
Aqua Regia	4	0.284750	0.013720	0.00686	0.26292	0.30658
Cold Chem	4	0.295750	0.000957	0.00048	0.29423	0.29727
Peroxide Fusions	3	0.277000	0.002646	0.00153	0.27043	0.28357

Tests that the Variances are Equal



Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
Aqua Regia	4	0.0137204	0.0102500	0.0102500
Cold Chem	4	0.0009574	0.0007500	0.0007500
Peroxide Fusions	3	0.0026458	0.0020000	0.0020000

Test	F Ratio	DFNum	DFDen	Prob > F
O'Brien[.5]	1.8963	2	8	0.2118
Brown-Forsythe	3.7088	2	8	0.0725
Levene	5.6388	2	8	0.0297
Bartlett	6.3672	2	.	0.0017

Warning: Small sample sizes. Use Caution.
Welch Anova testing Means Equal, allowing Std Devs Not Equal

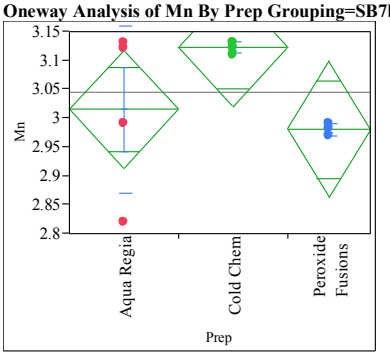
F Ratio	DFNum	DFDen	Prob > F
58.5623	2	3.5639	0.0019

Means Comparisons
Comparisons for all pairs using Tukey-Kramer HSD

Level		Mean
Cold Chem	A	0.29575000
Aqua Regia	A B	0.28475000
Peroxide Fusions	B	0.27700000

Levels not connected by same letter are significantly different.

Oneway Analysis of Mn By Prep Grouping=SB7b SRAT, Type=Receipt



Oneway Anova
Summary of Fit

Rsquare	0.388701
Adj Rsquare	0.235877
Root Mean Square Error	0.089005
Mean of Response	3.044545
Observations (or Sum Wgts)	11

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Prep	2	0.04029773	0.020149	2.5434	0.1396
Error	8	0.06337500	0.007922		
C. Total	10	0.10367273			

Means for Oneway Anova

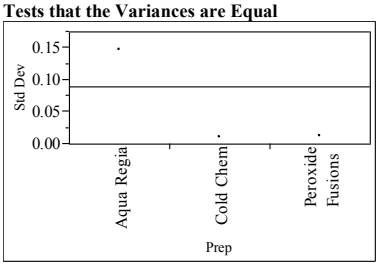
Level	Number	Mean	Std Error	Lower 95%	Upper 95%
Aqua Regia	4	3.01500	0.04450	2.9124	3.1176
Cold Chem	4	3.12250	0.04450	3.0199	3.2251
Peroxide Fusions	3	2.98000	0.05139	2.8615	3.0985

Std Error uses a pooled estimate of error variance

Means and Std Deviations

Level	Number	Mean	Std Dev	Std Err Mean	Lower 95%	Upper 95%
Aqua Regia	4	3.01500	0.144799	0.07240	2.7846	3.2454
Cold Chem	4	3.12250	0.009574	0.00479	3.1073	3.1377
Peroxide Fusions	3	2.98000	0.010000	0.00577	2.9552	3.0048

Tests that the Variances are Equal



Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
Aqua Regia	4	0.1447987	0.1100000	0.1100000
Cold Chem	4	0.0095743	0.0075000	0.0075000
Peroxide Fusions	3	0.0100000	0.0066667	0.0100000

Test	F Ratio	DFNum	DFDen	Prob > F
O'Brien[.5]	2.1186	2	8	0.1827
Brown-Forsythe	4.9960	2	8	0.0391
Levene	7.3700	2	8	0.0153
Bartlett	8.1808	2	.	0.0003

Warning: Small sample sizes. Use Caution.
Welch Anova testing Means Equal, allowing Std Devs Not Equal

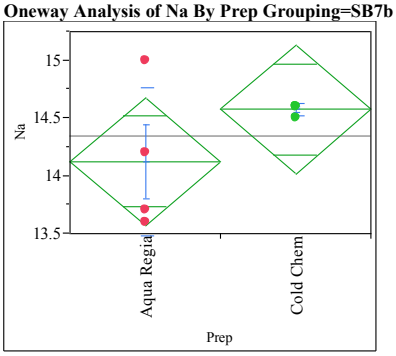
F Ratio	DFNum	DFDen	Prob > F
158.4136	2	4.7318	<.0001

Means Comparisons
Comparisons for all pairs using Tukey-Kramer HSD

Level		Mean
Cold Chem	A	3.1225000
Aqua Regia	A	3.0150000
Peroxide Fusions	A	2.9800000

Levels not connected by same letter are significantly different.

Oneway Analysis of Na By Prep Grouping=SB7b SRAT, Type=Receipt



Missing Rows 3

Oneway Anova
Summary of Fit

Rsquare	0.246951
Adj Rsquare	0.121443
Root Mean Square Error	0.453689
Mean of Response	14.35
Observations (or Sum Wgts)	8

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Prep	1	0.4050000	0.405000	1.9676	0.2103
Error	6	1.2350000	0.205833		
C. Total	7	1.6400000			

Means for Oneway Anova

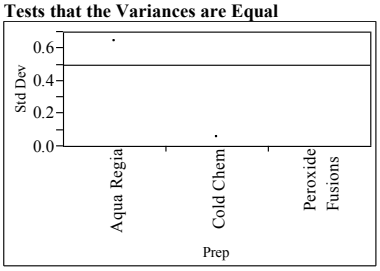
Level	Number	Mean	Std Error	Lower 95%	Upper 95%
Aqua Regia	4	14.1250	0.22684	13.570	14.680
Cold Chem	4	14.5750	0.22684	14.020	15.130
Peroxide Fusions	0	.	.	.	.

Std Error uses a pooled estimate of error variance

Means and Std Deviations

Level	Number	Mean	Std Dev	Std Err Mean	Lower 95%	Upper 95%
Aqua Regia	4	14.1250	0.639661	0.31983	13.107	15.143
Cold Chem	4	14.5750	0.050000	0.02500	14.495	14.655
Peroxide Fusions	0	.	.	.	.	.

Tests that the Variances are Equal



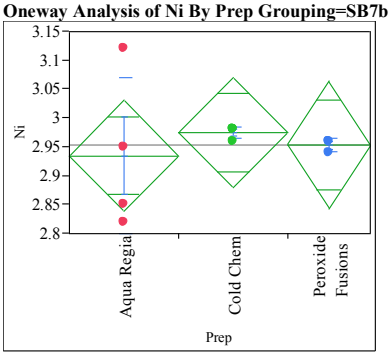
Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
Aqua Regia	4	0.6396614	0.4750000	0.4750000
Cold Chem	4	0.0500000	0.0375000	0.0250000
Peroxide Fusions	0	.	0.0000000	0.0000000

Test	F Ratio	DFNum	DFDen	Prob > F
O'Brien[.5]	2.2457	1	6	0.1846
Brown-Forsythe	5.3407	1	6	0.0602
Levene	7.0268	1	6	0.0380
Bartlett	9.5753	1	.	0.0020

Warning: Small sample sizes. Use Caution.
Welch Anova testing Means Equal, allowing Std Devs Not Equal

F Ratio	DFNum	DFDen	Prob > F
1.9676	1	3.0367	0.2542

Oneway Analysis of Ni By Prep Grouping=SB7b SRAT, Type=Receipt



Oneway Anova
Summary of Fit

Rsquare	0.054643
Adj Rsquare	-0.1817
Root Mean Square Error	0.083267
Mean of Response	2.954545
Observations (or Sum Wgts)	11

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Prep	2	0.00320606	0.001603	0.2312	0.7987
Error	8	0.05546667	0.006933		
C. Total	10	0.05867273			

Means for Oneway Anova

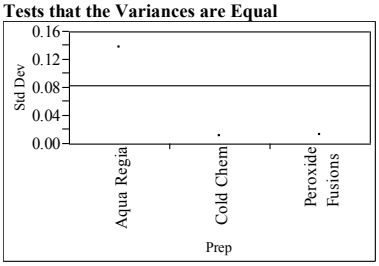
Level	Number	Mean	Std Error	Lower 95%	Upper 95%
Aqua Regia	4	2.93500	0.04163	2.8390	3.0310
Cold Chem	4	2.97500	0.04163	2.8790	3.0710
Peroxide Fusions	3	2.95333	0.04807	2.8425	3.0642

Std Error uses a pooled estimate of error variance

Means and Std Deviations

Level	Number	Mean	Std Dev	Std Err Mean	Lower 95%	Upper 95%
Aqua Regia	4	2.93500	0.135277	0.06764	2.7197	3.1503
Cold Chem	4	2.97500	0.010000	0.00500	2.9591	2.9909
Peroxide Fusions	3	2.95333	0.011547	0.00667	2.9246	2.9820

Tests that the Variances are Equal



Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
Aqua Regia	4	0.1352775	0.1000000	0.1000000
Cold Chem	4	0.0100000	0.0075000	0.0050000
Peroxide Fusions	3	0.0115470	0.0088889	0.0066667

Test	F Ratio	DFNum	DFDen	Prob > F
O'Brien[.5]	1.8793	2	8	0.2143
Brown-Forsythe	4.4452	2	8	0.0503
Levene	5.7325	2	8	0.0285
Bartlett	7.5441	2	.	0.0005

Warning: Small sample sizes. Use Caution.
Welch Anova testing Means Equal, allowing Std Devs Not Equal

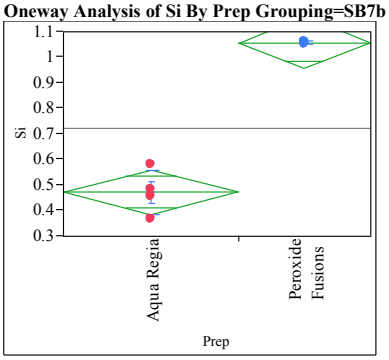
F Ratio	DFNum	DFDen	Prob > F
3.0503	2	4.5949	0.1435

Means Comparisons
Comparisons for all pairs using Tukey-Kramer HSD

Level		Mean
Cold Chem	A	2.9750000
Peroxide Fusions	A	2.9533333
Aqua Regia	A	2.9350000

Levels not connected by same letter are significantly different.

Oneway Analysis of Si By Prep Grouping=SB7b SRAT, Type=Receipt



Missing Rows 4

Oneway Anova
Summary of Fit

Rsquare	0.962297
Adj Rsquare	0.954756
Root Mean Square Error	0.067793
Mean of Response	0.722429
Observations (or Sum Wgts)	7

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Prep	1	0.58650430	0.586504	127.6151	<.0001
Error	5	0.02297942	0.004596		
C. Total	6	0.60948371			

Means for Oneway Anova

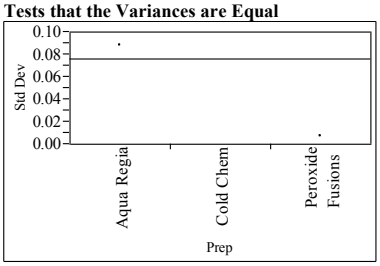
Level	Number	Mean	Std Error	Lower 95%	Upper 95%
Aqua Regia	4	0.47175	0.03390	0.38462	0.5589
Cold Chem	0	.	.	.	.
Peroxide Fusions	3	1.05667	0.03914	0.95605	1.1573

Std Error uses a pooled estimate of error variance

Means and Std Deviations

Level	Number	Mean	Std Dev	Std Err Mean	Lower 95%	Upper 95%
Aqua Regia	4	0.47175	0.087393	0.04370	0.3327	0.6108
Cold Chem	0	.	.	.	.	.
Peroxide Fusions	3	1.05667	0.005774	0.00333	1.0423	1.0710

Tests that the Variances are Equal



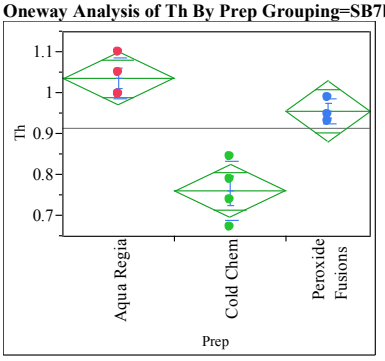
Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
Aqua Regia	4	0.0873933	0.0602500	0.0602500
Cold Chem	0	.	0.0000000	0.0000000
Peroxide Fusions	3	0.0057735	0.0044444	0.0033333

Test	F Ratio	DFNum	DFDen	Prob > F
O'Brien[.5]	1.4622	1	5	0.2806
Brown-Forsythe	3.2747	1	5	0.1301
Levene	3.1779	1	5	0.1347
Bartlett	6.8771	1	.	0.0087

Warning: Small sample sizes. Use Caution.
Welch Anova testing Means Equal, allowing Std Devs Not Equal

F Ratio	DFNum	DFDen	Prob > F
178.1444	1	3.0349	0.0009

Oneway Analysis of Th By Prep Grouping=SB7b SRAT, Type=Receipt



Oneway Anova
Summary of Fit

Rsquare	0.863068
Adj Rsquare	0.828835
Root Mean Square Error	0.056129
Mean of Response	0.914182
Observations (or Sum Wgts)	11

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Prep	2	0.15885422	0.079427	25.2115	0.0004
Error	8	0.02520342	0.003150		
C. Total	10	0.18405764			

Means for Oneway Anova

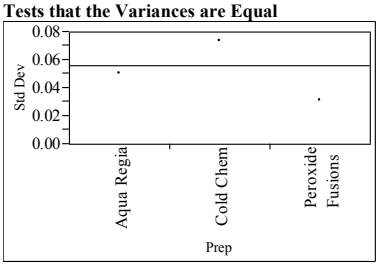
Level	Number	Mean	Std Error	Lower 95%	Upper 95%
Aqua Regia	4	1.03600	0.02806	0.97128	1.1007
Cold Chem	4	0.76075	0.02806	0.69603	0.8255
Peroxide Fusions	3	0.95633	0.03241	0.88161	1.0311

Std Error uses a pooled estimate of error variance

Means and Std Deviations

Level	Number	Mean	Std Dev	Std Err Mean	Lower 95%	Upper 95%
Aqua Regia	4	1.03600	0.049450	0.02473	0.95731	1.1147
Cold Chem	4	0.76075	0.073082	0.03654	0.64446	0.8770
Peroxide Fusions	3	0.95633	0.030370	0.01753	0.88089	1.0318

Tests that the Variances are Equal



Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
Aqua Regia	4	0.0494503	0.0390000	0.0390000
Cold Chem	4	0.0730816	0.0552500	0.0552500
Peroxide Fusions	3	0.0303699	0.0224444	0.0253333

Test	F Ratio	DFNum	DFDen	Prob > F
O'Brien[.5]	0.9312	2	8	0.4329
Brown-Forsythe	1.0278	2	8	0.4006
Levene	1.3762	2	8	0.3064
Bartlett	0.6958	2	.	0.4987

Warning: Small sample sizes. Use Caution.
Welch Anova testing Means Equal, allowing Std Devs Not Equal

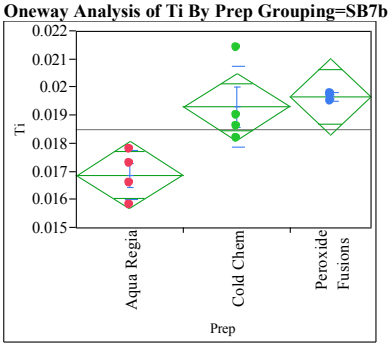
F Ratio	DFNum	DFDen	Prob > F
17.2954	2	5.2486	0.0049

Means Comparisons
Comparisons for all pairs using Tukey-Kramer HSD

Level		Mean
Aqua Regia	A	1.0360000
Peroxide Fusions	A	0.9563333
Cold Chem	B	0.7607500

Levels not connected by same letter are significantly different.

Oneway Analysis of Ti By Prep Grouping=SB7b SRAT, Type=Receipt



Oneway Anova
Summary of Fit

Rsquare	0.66892
Adj Rsquare	0.58615
Root Mean Square Error	0.001032
Mean of Response	0.018518
Observations (or Sum Wgts)	11

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Prep	2	0.00001720	8.6011e-6	8.0817	0.0120
Error	8	0.00000851	1.0643e-6		
C. Total	10	0.00002572			

Means for Oneway Anova

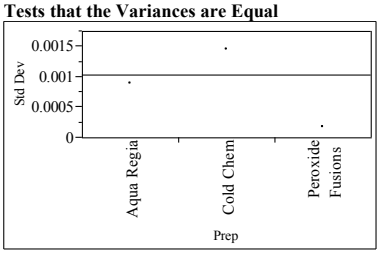
Level	Number	Mean	Std Error	Lower 95%	Upper 95%
Aqua Regia	4	0.016875	0.00052	0.01569	0.01806
Cold Chem	4	0.019300	0.00052	0.01811	0.02049
Peroxide Fusions	3	0.019667	0.00060	0.01829	0.02104

Std Error uses a pooled estimate of error variance

Means and Std Deviations

Level	Number	Mean	Std Dev	Std Err Mean	Lower 95%	Upper 95%
Aqua Regia	4	0.016875	0.000869	0.00043	0.01549	0.01826
Cold Chem	4	0.019300	0.001438	0.00072	0.01701	0.02159
Peroxide Fusions	3	0.019667	0.000153	8.82e-5	0.01929	0.02005

Tests that the Variances are Equal



Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
Aqua Regia	4	0.0008694	0.0006750	0.0006750
Cold Chem	4	0.0014376	0.0010500	0.0009000
Peroxide Fusions	3	0.0001528	0.0001111	0.0001333

Test	F Ratio	DFNum	DFDen	Prob > F
O'Brien[.5]	0.8892	2	8	0.4480
Brown-Forsythe	0.9336	2	8	0.4321
Levene	2.6963	2	8	0.1273
Bartlett	2.8442	2	.	0.0582

Warning: Small sample sizes. Use Caution.
Welch Anova testing Means Equal, allowing Std Devs Not Equal

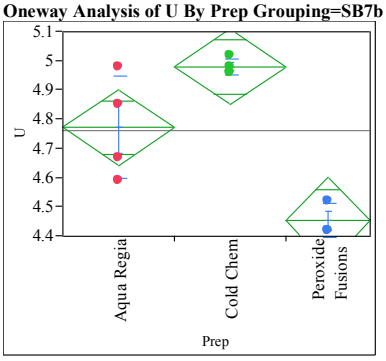
F Ratio	DFNum	DFDen	Prob > F
17.1540	2	4.2116	0.0095

Means Comparisons
Comparisons for all pairs using Tukey-Kramer HSD

Level		Mean
Peroxide Fusions	A	0.01966667
Cold Chem	A	0.01930000
Aqua Regia	B	0.01687500

Levels not connected by same letter are significantly different.

Oneway Analysis of U By Prep Grouping=SB7b SRAT, Type=Receipt



Oneway Anova
Summary of Fit

Rsquare	0.823719
Adj Rsquare	0.779649
Root Mean Square Error	0.112884
Mean of Response	4.760909
Observations (or Sum Wgts)	11

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Prep	2	0.47634924	0.238175	18.6911	0.0010
Error	8	0.10194167	0.012743		
C. Total	10	0.57829091			

Means for Oneway Anova

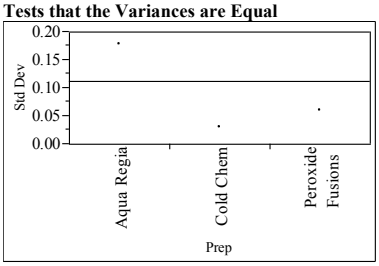
Level	Number	Mean	Std Error	Lower 95%	Upper 95%
Aqua Regia	4	4.77250	0.05644	4.6423	4.9027
Cold Chem	4	4.98000	0.05644	4.8498	5.1102
Peroxide Fusions	3	4.45333	0.06517	4.3030	4.6036

Std Error uses a pooled estimate of error variance

Means and Std Deviations

Level	Number	Mean	Std Dev	Std Err Mean	Lower 95%	Upper 95%
Aqua Regia	4	4.77250	0.175950	0.08797	4.4925	5.0525
Cold Chem	4	4.98000	0.028284	0.01414	4.9350	5.0250
Peroxide Fusions	3	4.45333	0.057735	0.03333	4.3099	4.5968

Tests that the Variances are Equal



Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
Aqua Regia	4	0.1759498	0.1425000	0.1425000
Cold Chem	4	0.0282843	0.0200000	0.0200000
Peroxide Fusions	3	0.0577350	0.0444444	0.0333333

Test	F Ratio	DFNum	DFDen	Prob > F
O'Brien[.5]	3.2165	2	8	0.0944
Brown-Forsythe	6.9551	2	8	0.0178
Levene	9.9973	2	8	0.0067
Bartlett	3.5460	2	.	0.0288

Warning: Small sample sizes. Use Caution.
Welch Anova testing Means Equal, allowing Std Devs Not Equal

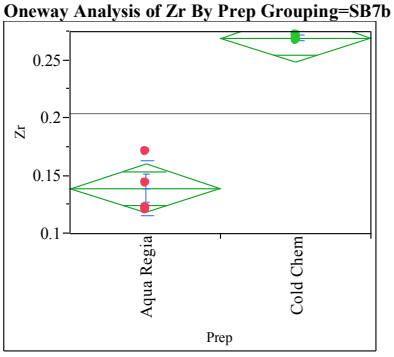
F Ratio	DFNum	DFDen	Prob > F
91.0739	2	3.8604	0.0006

Means Comparisons
Comparisons for all pairs using Tukey-Kramer HSD

Level		Mean
Cold Chem	A	4.9800000
Aqua Regia	A	4.7725000
Peroxide Fusions	B	4.4533333

Levels not connected by same letter are significantly different.

Oneway Analysis of Zr By Prep Grouping=SB7b SRAT, Type=Receipt



Missing Rows 3

Oneway Anova
Summary of Fit

Rsquare	0.951867
Adj Rsquare	0.943845
Root Mean Square Error	0.01691
Mean of Response	0.204375
Observations (or Sum Wgts)	8

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Prep	1	0.03393013	0.033930	118.6541	<.0001
Error	6	0.00171575	0.000286		
C. Total	7	0.03564588			

Means for Oneway Anova

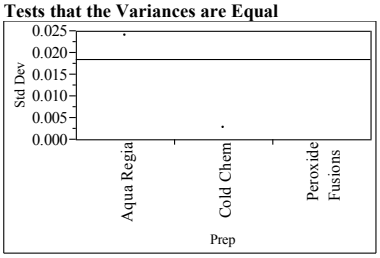
Level	Number	Mean	Std Error	Lower 95%	Upper 95%
Aqua Regia	4	0.139250	0.00846	0.11856	0.15994
Cold Chem	4	0.269500	0.00846	0.24881	0.29019
Peroxide Fusions	0	.	.	.	.

Std Error uses a pooled estimate of error variance

Means and Std Deviations

Level	Number	Mean	Std Dev	Std Err Mean	Lower 95%	Upper 95%
Aqua Regia	4	0.139250	0.023796	0.01190	0.10139	0.17711
Cold Chem	4	0.269500	0.002380	0.00119	0.26571	0.27329
Peroxide Fusions	0	.	.	.	.	.

Tests that the Variances are Equal



Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
Aqua Regia	4	0.0237960	0.0182500	0.0182500
Cold Chem	4	0.0023805	0.0020000	0.0020000
Peroxide Fusions	0	.	0.0000000	0.0000000

Test	F Ratio	DFNum	DFDen	Prob > F
O'Brien[.5]	2.6050	1	6	0.1577
Brown-Forsythe	6.0501	1	6	0.0491
Levene	8.6224	1	6	0.0261
Bartlett	8.3264	1	.	0.0039

Warning: Small sample sizes. Use Caution.
Welch Anova testing Means Equal, allowing Std Devs Not Equal

F Ratio	DFNum	DFDen	Prob > F
118.6541	1	3.06	0.0015

Distribution
M.J. Barnes, 773-A
J.M. Bricker, 704-27S
C.J. Coleman, 773-A
T.B. Edwards, 773-42A
M.T. Feller, 704-28S
T.L. Fellinger, 704-26S
C.M. Gregory, 773-A
C.C. Herman, 999-W
E.W. Holtzscheiter, 704-15S
J.F. Iaukea, 704-30S
P.L. Lee, 773-A
S.L. Marra, 773-A
R.T. McNew, 704-S
R.N. Mahannah, 704-28S
A.B. Osteen, 704-28S
J.E. Occhipinti, 704-S
J.M. Pareizs, 773-A
D.K. Peeler, 999-W
H.M. Pittman, 704-27S
J.W. Ray, 704-S
D.C. Sherburne, 704-S
A.V. Staub, 704-27S
M.E. Stone, 999-W
B.J. Wiedenman, 773-A