INITIAL SLUDGE BATCH 4 TANK 40 DECANT VARIABILITY STUDY WITH FRIT 510

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May 2008

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Aiken, SC 29808

Prepared for the U.S. Department of Energy Under
Contract Number DEAC09-96SR18500

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EXECUTIVE SUMMARY

Sludge Batch 4 (SB4) is currently being processed in the Defense Waste Processing Facility (DWPF) using Frit 510. The slurry pumps in Tank 40 are experiencing in–leakage of bearing water, which is causing the sludge slurry feed in Tank 40 to become dilute at a rapid rate. Currently, the DWPF is removing this dilution water by performing caustic boiling during the Sludge Receipt and Adjustment Tank (SRAT) cycle. In order to alleviate prolonged SRAT cycle times that may eventually impact canister production rates, decant scenarios of 100, 150, and 200 kilogallons of supernate were proposed for Tank 40 during the DWPF March outage. Based on the results of the preliminary assessment issued by the Savannah River National Laboratory (SRNL), the Liquid Waste Organization (LWO) issued a Technical Task Request (TTR) for SRNL to (i) perform a more detailed evaluation using updated SB4 compositional information and (ii) assess the viability of Frit 510 and determine any potential impacts on the SB4 system. As defined in the TTR, LWO requested that SRNL validate the sludge–only SB4 flowsheet and the coupled operations flowsheet using the 100K gallon decant volume as well as the addition of 3 wt% sodium on a calcined oxide basis.

Approximately 12 historical glasses were identified during a search of the ComPro™ database that are located within at least one of the five glass regions defined by the proposed SB4 flowsheet options. While these glasses meet the requirements of a variability study there was some concern that the compositional coverage did not adequately bound all cases. Therefore, SRNL recommended that a supplemental experimental variability study be performed to support the various SB4 flowsheet options that may be implemented for future SB4 operations in DWPF. Eighteen glasses were selected based on nominal sludge projections representing the current as well as the proposed flowsheets over a WL interval of interest to DWPF (32–42%). The intent of the experimental portion of the variability study is to demonstrate that the glasses of the Frit 510–modified SB4 compositional region (Cases #1–5) are both acceptable relative to the Environmental Assessment (EA) reference glass and predictable by the current DWPF process control models for durability.

Frit 510 is a viable option for the processing of SB4 after a Tank 40 decant and the addition of products from the Actinide Removal Process (ARP). The addition of ARP did not have any negative impacts on the acceptability and predictability of the variability study glasses. The results of the variability study indicate that all of the study glasses (both quenched and centerline canister cooled (ccc)) have normalized releases for boron that are well below the reference EA glass (16.695 g/L). The durabilities of all of the study glasses are predictable using the current Product Composition Control System (PCCS) durability models with the exception of SB4VAR24ccc (Case #2 at 41%). PCCS is not applicable to non–homogeneous glasses (i.e. glasses containing crystals such as acmite and nepheline), thus SB4VAR24ccc should not be predictable as it contains nepheline.

The presence of nepheline has been confirmed in both SB4VAR13ccc and SB4VAR24ccc by X–ray diffraction (XRD). These two glasses are the first results which indicate that the current nepheline discriminator value of 0.62 is not conservative. The nepheline discriminator was implemented into PCCS for SB4 based on the fact that all of the historical glasses evaluated with nepheline values of 0.62 or greater did not contain nepheline via XRD analysis. Although these two glasses do cause some concern over the use of the 0.62 nepheline value for future DWPF glass systems, the impact to the current SB4 system is of little concern. More specifically, the formation of nepheline was observed in glasses targeting 41 or 42% WL. Current processing of the Frit 510–SB4 system in DWPF has nominally targeted 34% WL. For the SB4 variability study glasses targeting these lower WLs, nepheline formation was not observed and the minimal difference in PCT response between quenched and ccc versions supported its absence.

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LIST OF ABBREVIATIONS

AD	Analytical Development
ANOVA	Analysis of Variance
ARM	Approved Reference Material
ARP	Actinide Removal Process
B Del Gp	ΔGp value for boron
bc	Bias–Corrected
ccc	Centerline Canister Cooling
CPC	Chemical Processing Cell
DWPF	Defense Waste Processing Facility
EA	Environmental Assessment
ICP-AES	Inductively Coupled Plasma–Atomic Emission Spectroscopy
ID	Identification
LM	Lithium Metaborate
LWO	Liquid Waste Organization
MAR	Measure Acceptability Region
NL[B]	Normalized Boron Release
NL[Li]	Normalized Lithium Release
NL[Na]	Normalized Sodium Release
NL[Si]	Normalized Silicon Release
PCCS	Product Composition Control System
PCT	Product Consistency Test
PF	Sodium Peroxide Fusion
ppm	Parts per million
PSAL	Process Science Analytical Laboratory
SB4	Sludge Batch 4
SME	Slurry Mix Evaporator
SRAT	Sludge Receipt and Adjustment Tank
SRNL	Savannah River National Laboratory
T_L Pred	Liquidus Temperature Prediction
TTR	Technical Task Request
U_{std}	Uranium Standard
Visc Pred	Viscosity Prediction
VS	Variability Study
WL	Waste Loading
XRD	X–ray Diffraction

1.0 Introduction

Sludge Batch 4 (SB4) is currently being processed in the Defense Waste Processing Facility (DWPF) using Frit 510. The slurry pumps in Tank 40 are experiencing in–leakage of bearing water, which is causing the sludge slurry feed in Tank 40 to become dilute at a rapid rate. Currently, the DWPF is removing this dilution water by performing caustic boiling during the Sludge Receipt and Adjustment Tank (SRAT) cycle. In order to alleviate prolonged SRAT cycle times that may eventually impact canister production rates, decant scenarios of varying amounts of supernate have been proposed for Tank 40. The Savannah River National Laboratory (SRNL) has issued a preliminary assessment evaluating the possible downstream impacts of three (100, 150, and 200 kilogallon) decant scenarios on DWPF glass formulation and the Chemical Processing Cell (CPC).[1] Based on the results of the preliminary assessment issued by the Savannah River National Laboratory (SRNL), the Liquid Waste Organization (LWO) issued a Technical Task Request (TTR) for SRNL to (i) perform a more detailed evaluation using updated SB4 compositional information and (ii) assess the viability of Frit 510 and determine any potential impacts on the SB4 system.[2] As defined in the TTR, LWO requested that SRNL validate the sludge–only SB4 flowsheet and the coupled operations flowsheet using the 100K gallon decant volume as well as the addition of 3 wt% sodium on a calcined oxide basis.

The following five nominal SB4 sludge compositions were identified to support this study[a,3]:

Case #1: SB4 Nominal
Case #2: SB4 after the 100K gallon decant
Case #3: SB4 after the 100K gallon decant with a 3 wt% Na_2O addition
Case #4: SB4 after the 100K gallon decant and with addition of Actinide Removal Process (ARP) J
Case #5: SB4 after the 100K gallon decant with the addition of 3 wt% Na_2O and ARP J

These potential SB4 flowsheet modifications (i.e., 100K gallon decant, potential addition of Na_2O, and/or transitioning to a coupled operations flowsheet) resulted in compositional shifts in the SB4 system as described in WSRC-STI-2008-00017.[3] Nominal sludge compositions (i.e. without any variation in the concentration of individual components) for each case were coupled with the nominal Frit 510 composition over a waste loading (WL) interval of 25–50% in order to define the glass regions of interest. The projected operating windows determined in the assessment suggested that Frit 510 remains a viable option for processing SB4 following the Tank 40 decant based on either a sludge–only or coupled operations flowsheet. In addition, the Na_2O addition was also determined to be viable if melt rate was reduced due to the decrease in Na_2O content after the decant. With respect to the SB4 variability study, approximately 12 historical glasses were identified during a search of the ComPro™ database that are located within at least one of the five glass regions defined by the proposed SB4 flowsheet options.[4] While these glasses meet the requirements of a variability study there was some concern that the compositional coverage did not adequately bound all cases. Therefore, SRNL recommended that a supplemental, experimental variability study be performed to support the various SB4 flowsheet options that may be implemented for future SB4 operations in DWPF. Eighteen glasses were selected based on nominal sludge projections representing the current as well as the proposed flowsheets over a WL interval of interest to DWPF (32–42%). The glass selection strategy used to define these glass compositions is described in detail in WSRC-STI-2008-

[a] Compositional projections of SB4 with the 100K gallon decant and SB4 with the 100K gallon decant and a 3 wt% Na_2O addition were provided by LWO, while SRNL subsequently added the ARP/MCU stream to these compositions to assess the scenarios. Compositional information for ARP additions was obtained from X-CLC-S-00113, Rev. 0, Actinide Removal Process Material Balance Calculation with Low Curie Salt Feed, S.G. Subosits, 9/24/2004. Details of these compositions used in this assessment are provided in WSRC-STI-2008-00017.

00017.[3] These eighteen glasses were fabricated and characterized using chemical composition analysis, X–ray Diffraction (XRD) and the Product Consistency Test (PCT).

2.0 Objective

The intent of the experimental portion of the variability study is to demonstrate that the glasses of the Frit 510–modified SB4 compositional region (Cases #1–5) are both acceptable relative to the Environmental Assessment (EA) reference glass and predictable by the current process control models for durability.[5-7]

3.0 Experimental Procedure

3.1 Target Glass Compositions

Target glass compositions of the eighteen SB4 Tank 40 decant variability study glasses are presented in Table 1. The glass identification (ID) represents both the case number (see Section 1.0) and the waste loading. For the glass SB4VAR11, "SB4VAR" refers to the SB4 Variability Study, "1" refers to Case #1 (SB4 Nominal) and "1" refers to the first or lowest WL (34%), whereas SB4VAR54 represents Case #5 (SB4 after the 100K gallon decant with the addition of 3 wt% Na_2O and ARP J) at the highest WL (41%), and so on.

3.2 Glass Fabrication

Each variability study glass was prepared from the proper proportions of reagent–grade metal oxides, carbonates, H_3BO_3, and salts in 150 g batches.[8] The raw materials were thoroughly mixed and placed into a 95% platinum / 5% gold, 250 ml crucible. Batched materials were placed into a high–temperature furnace at the target melt temperature of 1150°C.[9] The crucible was removed from the furnace after an isothermal hold at 1150°C for 1 hour. The molten glass was quenched by pouring the liquid onto a clean, stainless steel plate. The glass pour patty was used as a sampling stock for the various property measurements (i.e., chemical composition, durability testing and XRD).

Approximately 25 g of each glass was heat–treated to simulate cooling along the centerline of a DWPF–type canister to gauge the effects of thermal history on the product performance.[7] This cooling schedule is referred to as the centerline canister cooling (ccc) curve.

3.3 Property Measurements

3.3.1 Compositional Analysis

To confirm that the as–fabricated glasses met the target compositions, a representative sample from each glass was submitted to the SRNL Process Science Analytical Laboratory (PSAL) for chemical analysis under the auspices of an analytical plan (SRNL-SCS-2008-00003).[10] Two dissolution techniques were utilized by PSAL, sodium peroxide fusion (PF) and lithium–metaborate (LM). Samples prepared by LM were used to measure silver (Ag), aluminum (Al), barium (Ba), calcium (Ca), cadmium (Cd), cerium (Ce), cobalt (Co), chromium (Cr), copper (Cu), iron (Fe), potassium (K), lanthanum (La), magnesium (Mg), manganese (Mn), sodium (Na), niobium (Nb), nickel (Ni), phosphorous (P), lead (Pb), sulfur (S), strontium (Sr), thorium (Th), titanium (Ti), uranium (U), zinc (Zn), and zirconium (Zr) concentrations. Samples prepared by PF were used to measure boron (B), lithium (Li) and silicon (Si) concentrations. Each glass was prepared in duplicate for each cation dissolution technique (PF and LM). It should be noted that several of the elements in this list (e.g., Ag, Cd, Co, Nb, and Th) are not present in these glasses or are present at very small concentrations. For each study glass, measurements were obtained from samples prepared in duplicate by each of these dissolution methods. All of the prepared samples were analyzed (twice for each element of interest) by Inductively Coupled Plasma–Atomic Emission Spectroscopy (ICP–AES) with the instrumentation being re–calibrated between the duplicate analyses. The analytical plan was developed in such a way as to provide the opportunity to evaluate potential sources of bias and error. Glass standards were also intermittently measured to assess the performance of the ICP–AES instrument over the course of these analyses.

3.3.2 PCT

A 7–day PCT was performed in triplicate on each quenched and ccc glass to assess chemical durability using Method A of the PCT procedure (ASTM C1285-97).[11] Also included in the experimental test matrix was the EA glass, the Approved Reference Material (ARM) glass, and blanks from the sample cleaning batch. Samples were ground, washed, and prepared according to the standard procedure.[11,12] The resulting solutions were sampled (filtered and acidified) and analyzed by PSAL under the auspices of an analytical plan (SRNL-SCS-2008-00050).[13] Samples of a multi–element, standard solution were also included in the analytical plan (as a check on the accuracy of the ICP–AES). Normalized release rates were calculated based on target, measured, and bias–corrected (bc) compositions using the average of the logs of the leachate concentrations.

3.3.3 XRD

Representative samples of quenched and ccc glasses were submitted to SRNL Analytical Development (AD) for XRD analysis. Samples were analyzed under conditions providing a detection limit of approximately 0.5 vol%, i.e. no crystals can be detected if the amount in the sample is less than ~0.5 vol%.

Table 1. Target Compositions of the SB4 Tank 40 Decant Variability Study Glasses

Glass ID	Case #1			Case #2				Case #3			Case #4				Case #5			
	SB4VAR11	SB4VAR12	SB4VAR13	SB4VAR21	SB4VAR22	SB4VAR23	SB4VAR24	SB4VAR31	SB4VAR32	SB4VAR33	SB4VAR41	SB4VAR42	SB4VAR43	SB4VAR44	SB4VAR51	SB4VAR52	SB4VAR53	SB4VAR54
Frit	**510**	**510**	**510**	**510**	**510**	**510**	**510**	**510**	**510**	**510**	**510**	**510**	**510**	**510**	**510**	**510**	**510**	**510**
WL	**34**	**38**	**42**	**32**	**35**	**38**	**41**	**32**	**36**	**40**	**32**	**35**	**38**	**41**	**32**	**35**	**38**	**41**
Al_2O_3	8.46	9.46	10.46	8.31	9.09	9.86	10.64	8.00	9.01	10.01	8.00	8.75	9.50	10.25	7.71	8.43	9.15	9.88
B_2O_3	9.24	8.68	8.12	9.52	9.10	8.68	8.26	9.52	8.96	8.40	9.52	9.10	8.68	8.26	9.52	9.10	8.68	8.26
BaO	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.02	0.03	0.03	0.02	0.03	0.03	0.03	0.02	0.03	0.03	0.03
CaO	0.93	1.04	1.15	0.91	1.00	1.09	1.17	0.88	0.99	1.10	0.88	0.97	1.05	1.13	0.85	0.93	1.01	1.09
Ce_2O_3	0.02	0.02	0.03	0.02	0.02	0.03	0.03	0.02	0.02	0.03	0.02	0.03	0.03	0.03	0.02	0.02	0.03	0.03
Cr_2O_3	0.05	0.06	0.07	0.05	0.06	0.06	0.07	0.05	0.06	0.06	0.05	0.06	0.06	0.07	0.05	0.05	0.06	0.06
CuO	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Fe_2O_3	9.62	10.75	11.88	9.47	10.36	11.25	12.14	9.13	10.27	11.41	9.20	10.06	10.92	11.79	8.87	9.70	10.53	11.37
K_2O	0.12	0.13	0.15	0.12	0.13	0.14	0.15	0.11	0.13	0.14	0.11	0.12	0.13	0.15	0.11	0.12	0.13	0.14
La_2O_3	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Li_2O	5.28	4.96	4.64	5.44	5.20	4.96	4.72	5.44	5.12	4.80	5.44	5.20	4.96	4.72	5.44	5.20	4.96	4.72
MgO	0.91	1.02	1.13	0.90	0.98	1.07	1.15	0.87	0.97	1.08	0.86	0.94	1.02	1.10	0.83	0.90	0.98	1.06
MnO	1.93	2.16	2.39	1.90	2.08	2.26	2.44	1.83	2.06	2.29	1.88	2.06	2.23	2.41	1.82	1.99	2.16	2.33
Na_2O	12.26	12.76	13.26	10.98	11.26	11.54	11.82	11.93	12.42	12.92	11.34	11.66	11.97	12.28	12.25	12.65	13.04	13.44
NiO	0.54	0.60	0.66	0.53	0.58	0.63	0.68	0.51	0.57	0.63	0.52	0.57	0.62	0.67	0.50	0.55	0.60	0.65
PbO	0.02	0.02	0.03	0.02	0.02	0.02	0.03	0.02	0.02	0.03	0.02	0.02	0.03	0.03	0.02	0.02	0.02	0.03
SO_4	0.45	0.50	0.55	0.32	0.35	0.38	0.41	0.32	0.36	0.40	0.35	0.38	0.41	0.45	0.35	0.38	0.41	0.45
SiO_2	47.10	44.41	41.72	48.49	46.47	44.46	42.44	48.46	45.77	43.07	48.46	46.44	44.42	42.40	48.43	46.40	44.38	42.36
TiO_2	0.01	0.01	0.02	0.01	0.01	0.02	0.02	0.01	0.01	0.02	0.43	0.47	0.51	0.55	0.43	0.47	0.51	0.55
U_3O_8	2.94	3.28	3.63	2.89	3.16	3.43	3.70	2.79	3.13	3.48	2.80	3.06	3.32	3.59	2.70	2.95	3.21	3.46
ZnO	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.02	0.03	0.03	0.03
ZrO_2	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.04	0.03	0.03	0.03	0.04

4.0 Results and Discussion

4.1 Statistical Review of Chemical Composition Measurements

Table A1 in Appendix A provides the elemental concentration measurements derived from the samples prepared using LM, and Table A3 in Appendix A provides the measurements derived from the samples prepared using PF. Measurements for standards (Batch 1 and a uranium standard, U_{std}) that were included in the PSAL analytical plan along with the study glasses are also provided in these two tables.

The elemental concentrations were converted to oxide concentrations by multiplying the values for each element by the gravimetric factor for the corresponding oxide (Table A2 and Table A4). During this process, an elemental concentration that was determined to be below the detection limit of the analytical procedures used by the PSAL was reduced to half of that detection limit as the oxide concentration was determined.

In the following sections, the analytical sequences of the measurements are explored, the measurements of the standards are investigated and used for bias correction, the measurements for each glass are reviewed, the average chemical compositions (measured and bias–corrected) for each glass are determined, and comparisons are made between the measurements and the targeted compositions for the glasses.

4.1.1 Measurements in Analytical Sequence

Exhibit A1 in Appendix A provides plots of the measurements generated by the PSAL for samples prepared using the LM method. The plots are in analytical sequence with different symbols and colors being used to represent each of the study and standard glasses. Similar plots are provided in Exhibit A2 in Appendix A for the samples prepared using the PF method. These plots include all of the measurement data from Tables A1 and A3. While looking for obvious patterns in these plots is difficult, a relatively small value for NiO (0.078 wt%) for one of the uranium standard glasses (U_{std}LM2-122) does stand out. Otherwise, a review of these plots indicates no significant patterns or trends in the analytical process over the course of these measurements. Better opportunities for such reviews are provided in the discussions that follow.

4.1.2 Batch 1 and Uranium Standard Results

In this section, the PSAL measurements of the chemical compositions of the Batch 1 and uranium standard (U_{std}) glasses are reviewed. These measurements are investigated across the ICP analytical blocks, and the results are used to bias correct the measurements for the study glasses.

Exhibit A3 in Appendix A provides statistical analyses of the Batch 1 and U_{std} results generated by the LM prep method by analytical set and calibration block/sub–block for each oxide of interest. The results include analysis of variance (ANOVA) investigations looking for statistically significant differences between the means of these groups for each of the oxides for each of the standards. The results from the statistical tests for the Batch 1 standard may be summarized as follows: the Al_2O_3, CaO, Ce_2O_3 (a detection limit effect), Cr_2O_3, CuO, Fe_2O_3, K_2O, MgO, Na_2O, NiO, TiO_2, and ZrO_2 measurements indicate a significant ICP calibration effect on the block averages at the 5% significance level. For the U_{std}, the Al_2O_3, CaO, Ce_2O_3 (a detection limit effect), Cr_2O_3, Fe_2O_3, K_2O, MgO, Na_2O, SiO_2, TiO_2, and U_3O_8 measurements indicate a significant ICP calibration effect on the block averages at the 5% significance level. The reference values for the oxide concentrations of the standards are given in the header for each set of measurements in the exhibit.

Exhibit A4 in Appendix A provides a similar set of analyses for the measurements derived from samples prepared via the PF method. The results from the statistical tests for the Batch 1 standard may be summarized as follows: the Li_2O measurements indicate significant ICP calibration effects on the block averages at the 5% significance level. For the U_{std}, the Li_2O measurements indicate significant ICP calibration effects on the block averages at the 5% significance level. The reference values for the oxide concentrations of the standards are given in the header for each set of measurements in the exhibit.

Some of these results provide incentive for adjusting the measurements by the effects of the ICP calibration. Therefore, the oxide measurements of the study glasses are bias corrected for the effect of the ICP calibration on each of the analytical blocks and sub–blocks. The basis for the bias correction is presented as part of Exhibits A3 and A4 – the average measurement for Batch 1 for each ICP block/sub–block for Al_2O_3, B_2O_3, BaO, CaO, Cr_2O_3, CuO, Fe_2O_3, Li_2O, MgO, MnO, Na_2O, NiO, SiO_2, and TiO_2 and the average measurement for U_{std} for each ICP set/block for U_3O_8. Thus, the Batch 1 results serve as the basis for bias correcting all of the selected oxides except uranium. The U_{std} results were used to bias correct for uranium. The Batch 1 results were used to conduct the bias correction as long as the reference value for the oxide concentration in the Batch 1 glass was greater than or equal to 0.1 wt%. Thus, applying this approach and based upon the information in the exhibits, the Batch 1 results were used to bias correct the Al_2O_3, B_2O_3, BaO, CaO, Cr_2O_3, CuO, Fe_2O_3, K_2O, Li_2O, MgO, MnO, Na_2O, NiO, SiO_2, and TiO_2 measurements. No bias correction was conducted for Ce_2O_3, La_2O_3, PbO, SO_4, ThO_2, ZnO, or ZrO_2.

The bias correction was conducted as follows. For each oxide, let $\bar{a}_{ij}$ be the average measurement for the ith oxide at analytical block j for Batch 1 (or U_{std} for uranium), and let t_i be the reference value for the ith oxide for Batch 1 (or for U_{std} if uranium). (The averages and reference values are provided in Exhibits A3 and A4.) Let $\bar{c}_{ijk}$ be the average measurement for the ith oxide at analytical block j for the kth glass. The bias adjustment was conducted as follows

$$\bar{c}_{ijk} \bullet \left(1 - \frac{\bar{a}_{ij} - t_i}{\bar{a}_{ij}}\right) = \bar{c}_{ijk} \bullet \frac{t_i}{\bar{a}_{ij}}$$

Bias–corrected measurements are indicated by a "bc" suffix, and such adjustments were performed for all of the oxides of this study except for Ce_2O_3, La_2O_3, PbO, SO_4, ThO_2, ZnO, and ZrO_2. Both measured and measured "bc" values are included in the discussion that follows. Since no bias correction was performed on Ce_2O_3, La_2O_3, PbO, SO_4, ThO_2, ZnO, and ZrO_2, the original values are included for completeness (e.g., to allow a sum of oxides to be computed for the bias–corrected results).

4.1.3 Composition Measurements by Glass Identifier

Exhibits A5 and A6 in Appendix A provide plots of the oxide concentration measurements by Glass ID (including Batch 1 and U_{std}) by analytical solution ID for the LM and PF preparation methods, respectively, for each set of analyses. Different symbols and colors are used to represent the different glasses. These plots show the individual measurements across the duplicates of each preparation method and the two ICP calibrations within each analytical set. A review of the plots presented in these exhibits reveals the repeatability of the four individual, oxide values for each glass. The Al_2O_3 results in set 1 for SB4VAR23 show differences that appear to be due to a dissolution effect for this glass. Although Al_2O_3 differences are observed, all of the data were used to compute measured and measured bias corrected compositional views. A considerable amount of scatter is observed in the Fe_2O_3 results for both sets of analyses. These issues will not have any impact on the conclusions of this report.

4.1.4 Measured versus Targeted Compositions

The four measurements for each oxide of each glass (over both preparation methods) were averaged to determine a representative chemical composition for each glass. These determinations were conducted both for the measured and for the bias–corrected data. A sum of oxides was also computed for each glass based upon both the measured and bias–corrected values. Exhibit A7 in Appendix A provides plots showing results for each glass for each oxide to help highlight the comparisons among the measured, bias–corrected, and targeted values.

Some observations from the plots of Exhibit A7 are offered: In general, there were some difficulties in reaching the targeted concentrations for Fe_2O_3 (measured values generally lower than targeted) and SiO_2 (measured values generally higher than targeted). In addition, the SO_4 concentration for SB4VAR21 appears to be low (53% below its targeted value). Table A4 in Appendix A provides a summary of the average compositions as well as the targeted compositions and some associated differences and relative differences. Notice that the targeted sums of oxides for the standard glasses are not 100% due to incomplete coverage of the oxides in the Batch 1 and U_{std} glasses. All of the oxide sums (both measured and bias–corrected) for the study glasses fall within the interval of 95 to 105 wt%. Entries in Table A4 show the relative differences between the measured or bias–corrected values and the targeted values. These differences are shaded when they are greater than or equal to 5%. Overall, the comparisons between the measured and targeted compositions suggest only minor difficulties in reaching the targeted compositions for some of the oxides for some of the glasses.

4.1.5 MAR Assessment of the SB4/Decant Variability Study (VS) Glasses

Another assessment that can be made for these SB4 VS glasses is how well they satisfy the Measurement Acceptability Region (MAR) criteria of DWPF's Product Composition Control System (PCCS). All of the glasses that were selected for this study satisfied these criteria. That is, the targeted composition for each of these glasses fell within the MAR of PCCS as described in WSRC-STI-2008-00017.[3] In this section, the results of the MAR assessment of the measured and measured bias–corrected compositions for these glasses are presented along with the results for the targeted compositions.

Table 2 provides the percent waste loading (%WL), the frit, the glass identifier with compositional view, the B Del Gp Value (ΔGp value for boron), the normalized leachate for boron in grams/Liter (NL[B (g/L)]), the liquidus temperature prediction in degrees Celsius (T_L Pred (ºC)), the viscosity prediction in Poise (Visc Pred (P)), the sum of oxides (in wt%), the Al_2O_3 concentration (in wt%), the Na_2SO_4 concentration (in wt%), and the total alkali concentration (R_2O) as a wt%, the nepheline value, and the overall MAR assessment.[b] With the exception of SB4VAR54 (target and measured bc), all of the MAR results for these glass compositional views indicate that they would pass the PCCS

[b] Although the PCCS limit of 0.88 wt% Na_2SO_4 was not used during the MAR assessment, both the projected and measured Na_2SO_4 concentrations for all SB4 cases meet this criterion.

MAR and be both processable and acceptable by the DWPF. As for the SB4VAR54 glass, it was noted during the glass selection process that the targeted composition failed the low viscosity criterion.[3] The measured composition has a slightly higher predicted viscosity (27.2 Poise) as compared to both the target and measured bias corrected compositional views of 24.4 and 24.6 Poise respectively, which both fail the low viscosity constraint.

Table 2. Results of MAR Assessment of SB4 VS Glasses for Measured, Bias–Corrected, and Targeted Compositional Views

Glass ID	%WL	Compositional View	B Del Gp Value	NL[B (g/L)]	T_L Pred (°C)	Visc Pred (P)	Sum of Oxides	Al_2O_3 wt%	Na_2SO_4 wt%	R_2O wt%	Nepheline Value	MAR Status
SB4VAR11	**34**	**measured**	-9.991	0.81	885.6	39.7	98.5	8.54	0.61	17.48	0.69	All Constraints Met
SB4VAR11	**34**	**measured bc**	-10.107	0.85	896.6	37.4	100.4	8.69	0.61	17.71	0.70	All Constraints Met
SB4VAR11	**34**	**targeted**	-10.169	0.87	897.6	35.1	99.6	8.46	0.66	17.66	0.69	All Constraints Met
SB4VAR12	**38**	**measured**	-9.743	0.73	944.8	35.2	100.0	9.49	0.66	17.52	0.67	All Constraints Met
SB4VAR12	**38**	**measured bc**	-9.935	0.79	940.3	34.3	101.2	9.70	0.66	17.83	0.67	All Constraints Met
SB4VAR12	**38**	**targeted**	-10.110	0.85	941.9	30.0	99.5	9.46	0.74	17.85	0.67	All Constraints Met
SB4VAR13	**42**	**measured**	-9.854	0.77	960.6	33.3	100.6	10.39	0.75	17.87	0.65	All Constraints Met
SB4VAR13	**42**	**measured bc**	-9.867	0.77	977.8	29.2	100.4	10.57	0.75	17.94	0.64	All Constraints Met
SB4VAR13	**42**	**targeted**	-10.052	0.83	981.9	25.2	99.4	10.46	0.82	18.05	0.64	All Constraints Met
SB4VAR21	**32**	**measured**	-8.994	0.53	893.3	53.5	100.5	8.37	0.22	16.37	0.72	All Constraints Met
SB4VAR21	**32**	**measured bc**	-9.041	0.55	909.3	47.6	99.9	8.51	0.22	16.46	0.72	All Constraints Met
SB4VAR21	**32**	**targeted**	-9.206	0.58	909.9	44.6	99.7	8.31	0.47	16.54	0.72	All Constraints Met
SB4VAR22	**35**	**measured**	-8.831	0.50	944.3	49.1	101.3	9.05	0.51	16.38	0.71	All Constraints Met
SB4VAR22	**35**	**measured bc**	-8.953	0.53	945.1	45.0	100.2	9.26	0.51	16.55	0.70	All Constraints Met
SB4VAR22	**35**	**targeted**	-9.070	0.55	947.6	41.0	99.7	9.09	0.51	16.59	0.70	All Constraints Met
SB4VAR23	**38**	**measured**	-8.495	0.43	966.7	47.6	99.3	10.29	0.52	16.32	0.68	All Constraints Met
SB4VAR23	**38**	**measured bc**	-8.511	0.44	983.6	42.1	99.1	10.47	0.52	16.39	0.67	All Constraints Met
SB4VAR23	**38**	**targeted**	-8.933	0.52	982.4	37.4	99.6	9.86	0.56	16.64	0.68	All Constraints Met
SB4VAR24	**41**	**measured**	-8.602	0.45	988.2	41.6	98.5	10.63	0.56	16.46	0.66	All Constraints Met
SB4VAR24	**41**	**measured bc**	-8.680	0.47	999.9	39.1	100.5	10.82	0.56	16.66	0.66	All Constraints Met
SB4VAR24	**41**	**targeted**	-8.796	0.49	1014.7	33.8	99.6	10.64	0.60	16.69	0.65	All Constraints Met
SB4VAR31	**32**	**measured**	-10.068	0.84	872.7	39.6	99.4	8.09	0.46	17.40	0.71	All Constraints Met
SB4VAR31	**32**	**measured bc**	-10.095	0.85	875.3	35.8	98.3	8.11	0.46	17.39	0.71	All Constraints Met
SB4VAR31	**32**	**targeted**	-10.123	0.86	877.6	38.1	99.7	8.01	0.47	17.49	0.71	All Constraints Met
SB4VAR32	**36**	**measured**	-9.924	0.79	922.3	35.9	99.7	9.09	0.52	17.54	0.68	All Constraints Met
SB4VAR32	**36**	**measured bc**	-10.024	0.82	923.9	31.3	98.9	9.11	0.52	17.59	0.68	All Constraints Met
SB4VAR32	**36**	**targeted**	-10.054	0.83	924.5	33.0	99.6	9.01	0.53	17.67	0.68	All Constraints Met
SB4VAR33	**40**	**measured**	-9.801	0.75	952.6	28.3	97.2	9.78	0.55	17.42	0.65	All Constraints Met
SB4VAR33	**40**	**measured bc**	-10.057	0.83	949.9	25.7	97.4	10.15	0.55	17.86	0.65	All Constraints Met

Table 2 cont. Results of MAR Assessment of SB4 VS Glasses for Measured, Bias–Corrected, and Targeted Compositional Views

Glass ID	%WL	Compositional View	B Del Gp Value	NL[B (g/L)]	T_L Pred (°C)	Visc Pred (P)	Sum of Oxides	Al_2O_3 wt%	Na_2SO_4 wt%	R_2O wt%	Nepheline Value	MAR Status w/o Na2SO4
SB4VAR33	**40**	**targeted**	-9.986	0.81	967.1	28.0	99.6	10.01	0.59	17.86	0.65	All Constraints Met
SB4VAR41	**32**	**measured**	-9.468	0.65	889.0	48.2	102.1	8.14	0.49	16.96	0.72	All Constraints Met
SB4VAR41	**32**	**measured bc**	-9.598	0.69	889.9	44.0	101.0	8.32	0.49	17.14	0.71	All Constraints Met
SB4VAR41	**32**	**targeted**	-9.546	0.67	894.8	41.6	99.7	8.00	0.51	16.90	0.71	All Constraints Met
SB4VAR42	**35**	**measured**	-9.094	0.56	932.5	43.9	100.0	8.68	0.52	16.59	0.70	All Constraints Met
SB4VAR42	**35**	**measured bc**	-9.217	0.59	933.0	40.1	99.0	8.88	0.52	16.76	0.69	All Constraints Met
SB4VAR42	**35**	**targeted**	-9.441	0.64	931.3	37.8	99.6	8.75	0.56	16.98	0.69	All Constraints Met
SB4VAR43	**38**	**measured**	-8.936	0.52	969.1	40.3	100.4	9.41	0.59	16.65	0.68	All Constraints Met
SB4VAR43	**38**	**measured bc**	-9.119	0.56	964.3	39.3	101.6	9.63	0.59	16.95	0.68	All Constraints Met
SB4VAR43	**38**	**targeted**	-9.336	0.62	965.1	34.1	99.6	9.50	0.61	17.07	0.67	All Constraints Met
SB4VAR44	**41**	**measured**	-9.033	0.54	970.0	38.6	98.5	10.26	0.61	16.90	0.66	All Constraints Met
SB4VAR44	**41**	**measured bc**	-9.110	0.56	981.9	36.4	100.5	10.44	0.61	17.11	0.66	All Constraints Met
SB4VAR44	**41**	**targeted**	-9.231	0.59	996.1	30.4	99.6	10.25	0.66	17.15	0.65	All Constraints Met
SB4VAR51	**32**	**measured**	-10.210	0.89	861.1	38.6	98.9	7.79	0.49	17.57	0.71	All Constraints Met
SB4VAR51	**32**	**measured bc**	-10.432	0.97	856.6	37.2	100.2	7.96	0.49	17.91	0.71	All Constraints Met
SB4VAR51	**32**	**targeted**	-10.417	0.97	864.4	35.8	99.7	7.71	0.51	17.80	0.71	All Constraints Met
SB4VAR52	**35**	**measured**	-10.152	0.87	893.1	36.7	99.2	8.58	0.53	17.74	0.69	All Constraints Met
SB4VAR52	**35**	**measured bc**	-10.261	0.91	904.3	34.6	101.1	8.73	0.53	17.97	0.69	All Constraints Met
SB4VAR52	**35**	**targeted**	-10.393	0.96	899.2	31.8	99.6	8.43	0.56	17.96	0.69	All Constraints Met
SB4VAR53	**38**	**measured**	-10.392	0.96	907.9	33.4	100.4	9.17	0.57	18.18	0.67	All Constraints Met
SB4VAR53	**38**	**measured bc**	-10.414	0.97	924.3	29.4	100.1	9.33	0.57	18.25	0.67	All Constraints Met
SB4VAR53	**38**	**targeted**	-10.371	0.95	931.3	28.0	99.6	9.16	0.61	18.13	0.67	All Constraints Met
SB4VAR54	**41**	**measured**	-10.124	0.86	956.7	27.2	99.4	9.86	0.64	18.05	0.65	All Constraints Met
SB4VAR54	**41**	**measured bc**	-10.238	0.90	957.3	24.6	98.5	10.09	0.64	18.23	0.64	lvisc
SB4VAR54	**41**	**targeted**	-10.347	0.94	960.8	24.4	99.6	9.88	0.66	18.30	0.64	lvisc

4.2 Crystallization

4.2.1 Visual Observations

Prior to discussing the visual observations, a brief explanation of the terms used to describe the as–fabricated (quenched) and ccc glasses is necessary. “Surface” refers to the top of the sample that has not touched the steel plate during quenching or the walls of the crucible during the ccc treatment. The term “bulk” refers to the cross–section of the glass sample. “Homogeneous” indicates that there is no crystallization evident on the surface or in the bulk of the glass. Other terms such as “haze”, “clusters”, and/or “silver/metallic patches” imply that the surface or bulk of the glass contains crystals or some other characteristic feature. “Black and shiny” implies that crystallization is not apparent to the un–aided eye.

The surface and bulk of each as–fabricated (quenched) glass were “black and shiny,” which indicates that the glasses are free of crystallization and homogeneous.

Crystallization is much more prevalent in the ccc glasses given that the kinetics for crystallization are more favorable during the slow cooling of the ccc treatment. Only three of the ccc glasses were determined to be homogeneous based on visual observations as shown in Table 3, which is not surprising as these glasses had a target WL of only 32%. The remainder of the ccc glasses did contain some degree of crystallization on the surface, characterized by “haze” and “silver/metallic patches.” Historically, metallic–like features on the surface of DWPF glasses are due to the precipitation of spinels during the slower cooling process. Crystallization was not present in the bulk of any glasses, except SB4VAR24 (Case #2 at 41% WL), which contained patches of silver/metallic crystals on the surface that extended 3 mm into the bulk.

4.2.2 XRD

Each of the quenched glasses is amorphous (within the detection limit of the instrument), which corresponds to the visual observations (Section 4.2.1). Two of the ccc samples contain crystalline material, while all others are amorphous (within the detection limit of the instrument). Both nepheline and trevorite were detected in samples SB4VAR13ccc (Case #1 at 42% WL) and SB4VAR24ccc (Case #2 at 41% WL). A representative pattern[c] of an amorphous sample is shown in Figure 1, while the XRD patterns of the glasses containing nepheline and trevorite are shown in Figure 2 and Figure 3. The presence of nepheline was not expected in SB4VAR13ccc or SB4VAR24ccc. The MAR assessments suggest that the nepheline discriminator values of these glasses are well above the 0.62 value currently being used to delineate compositions that are prone to nepheline formation from those that are not. These data are the initial results that suggest that the current nepheline discriminator and the use of the 0.62 values may not be conservative for specific compositional regions. As nepheline is present in these two glasses, a negative impact on the PCT response is anticipated.

[c] The remainder of the XRD patterns (quenched and ccc) can be viewed in the laboratory notebook for the SB4 variability study on pages 116-118 (WSRC-NB-2006-00168).

Table 3. Visual Observations of the CCC Glasses

Glass ID	Frit	WL	Visual Observations		XRD
			Surface	Bulk	
SB4VAR11	510	34	Light haze	Clean	Amorphous
SB4VAR12		38	Light/shiny haze, three silver/metallic patches of crystals	Clean	Amorphous
SB4VAR13		42	Haze, large patches of silver/metallic crystals	Clean	Nepheline and Trevorite
SB4VAR21		32	Very light crystals	Clean	Amorphous
SB4VAR22		35	Silver haze with crystals	Clean	Amorphous
SB4VAR23		38	Silver haze, several patches of silver/metallic patches	Clean	Amorphous
SB4VAR24		41	Crystals, large patches of silver/metallic crystals	Crystal patches extend ⅛" into bulk	Nepheline and Trevorite
SB4VAR31		32	Black and shiny	Clean	Amorphous
SB4VAR32		36	Shiny, silver metallic haze	Clean	Amorphous
SB4VAR33		40	Haze, several silver/metallic patches of crystals	Clean	Amorphous
SB4VAR41		32	Black and shiny	Clean	Amorphous
SB4VAR42		35	Silver haze, few patches of silver crystals	Clean	Amorphous
SB4VAR43		38	Silver haze, few patches of silver crystals	Clean	Amorphous
SB4VAR44		41	Silver haze, few patches of silver crystals	Clean	Amorphous
SB4VAR51		32	Black and shiny	Clean	Amorphous
SB4VAR52		35	Silver haze	Clean	Amorphous
SB4VAR53		38	Silver haze, few patches of silver crystals	Clean	Amorphous
SB4VAR54		41	Large patches of silver crystals	Clean	Amorphous

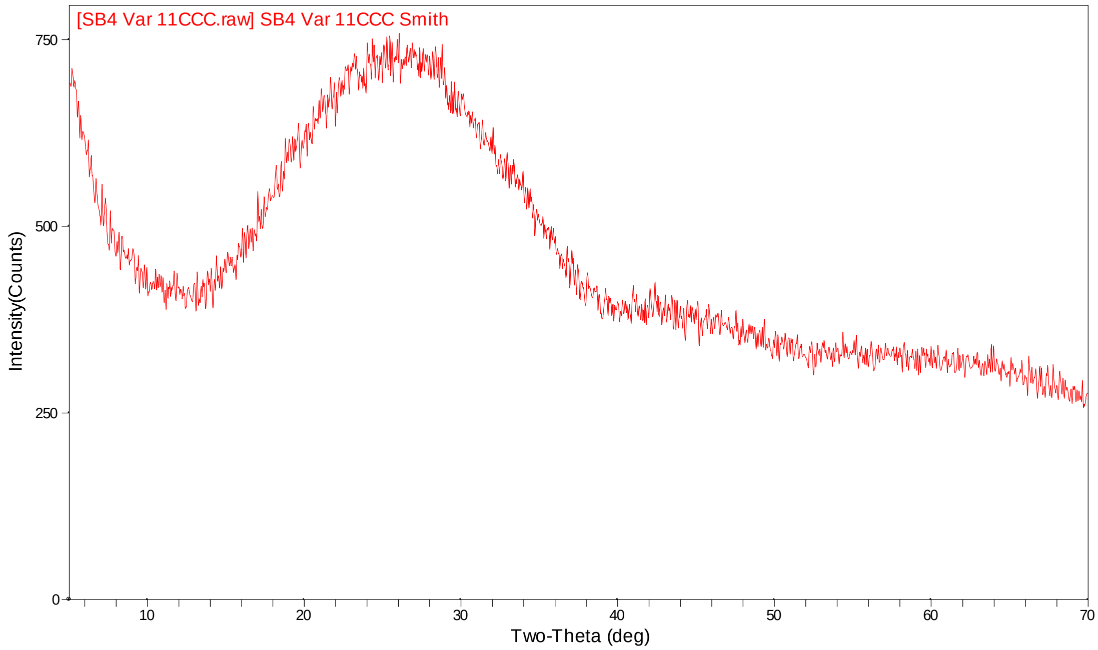

Figure 1. XRD pattern of the ccc version of the SB4VAR11 glass (Case #1 at 34% WL).

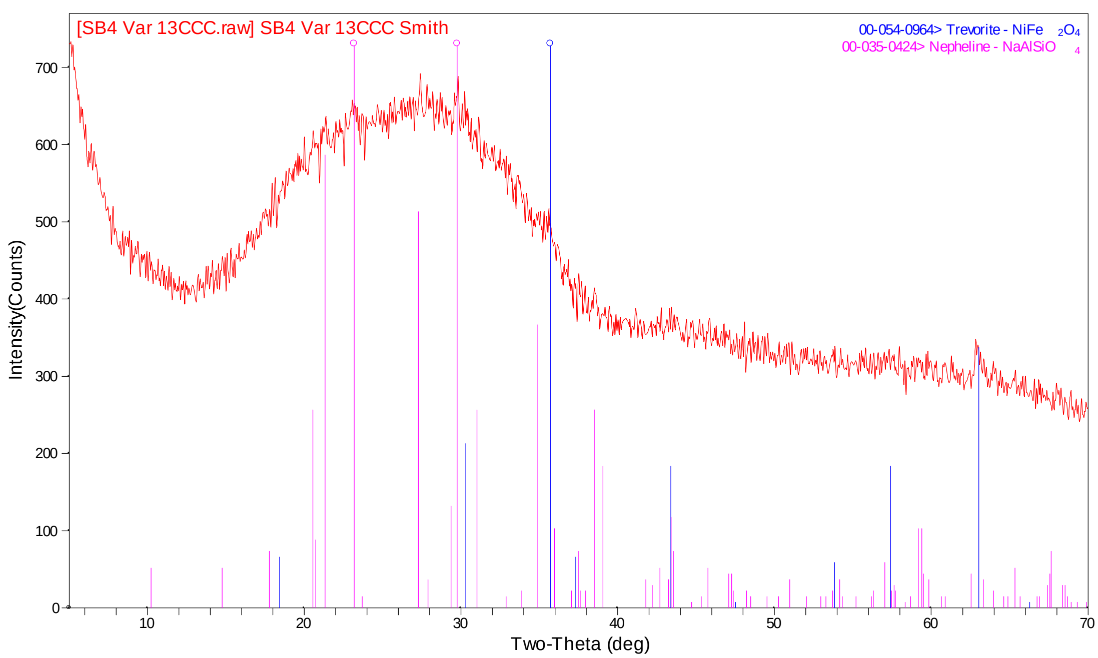

Figure 2. XRD pattern of the ccc version of the SB4VAR13 glass (Case #1 at 42% WL).

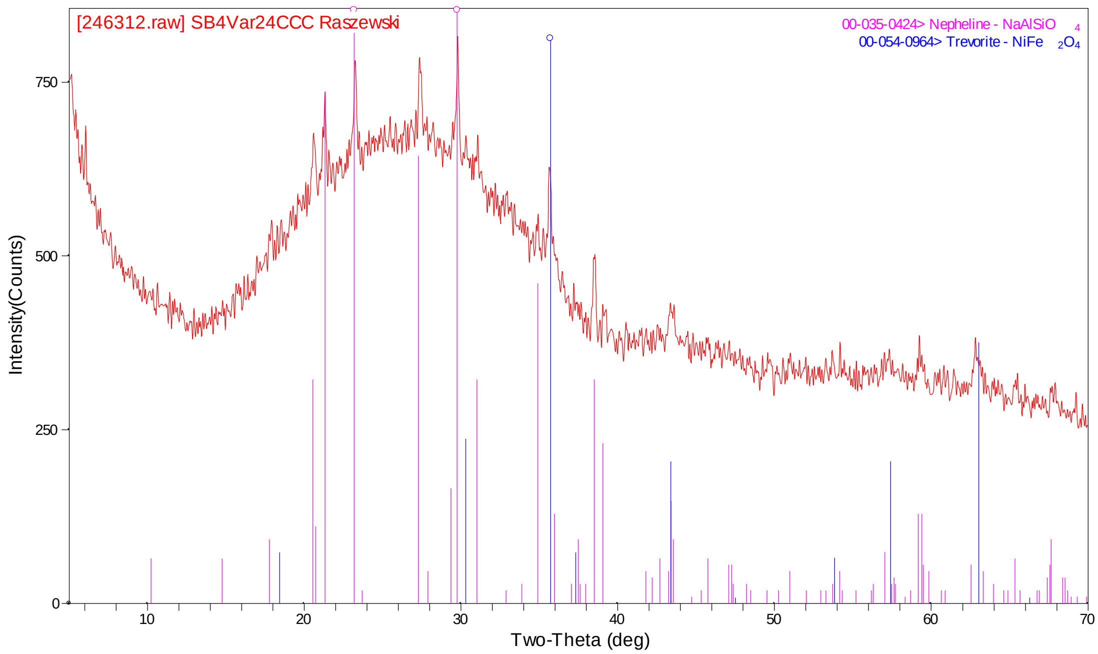

Figure 3. XRD pattern of the ccc version of the SB4VAR24 glass (Case #2 at 41% WL).

4.3 Statistical Review of PCT Results

Table B1 in Appendix B provides the elemental leachate concentration measurements determined by the PSAL for the solution samples generated by the PCTs. One of the quality control checkpoints for the PCT procedure is solution–weight loss over the course of the 7–day test. None of these PCT results indicated a solution–weight loss problem. Any measurement in Table B1 below the detection limit of the analytical procedure (indicated by a "<") was replaced by ½ of the detection limit in subsequent analyses. In addition to adjustments for detection limits, the values were adjusted for the dilution factors: the values for the study glasses, the blanks, and the ARM glass in Table B1 were multiplied by 1.6667 to determine the values in parts per million (ppm) and the values for EA were multiplied by 16.6667. Table B2 in Appendix B provides the resulting measurements.

In the following sections, the analytical sequence of the measurements is explored, the measurements of the standards are investigated and used to assess the overall accuracy of the ICP measurement process, the measurements for each glass are reviewed, plots are provided that explore the effects of heat treatment on the PCTs for these glasses, the PCTs are normalized using the compositions (targeted, measured, and bias–corrected) presented in Table A4, and the normalized PCTs are compared to durability predictions for these compositions generated from the current DWPF models.[14]

4.3.1 Measurements in Analytical Sequence

Exhibit B1 in Appendix B provides plots of the leachate (ppm) concentrations in analytical sequence as generated by the PSAL for all of the data and for the data from only the study glasses. A different color and symbol are used for each study glass or standard. No issues are observed in these plots.

4.3.2 Results for the Samples of the Multi–Element Solution Standard

Exhibit B2 in Appendix B provides analyses of the PSAL measurements of the samples of the multi–element solution standard by analytical set and ICP calibration block. An ANOVA investigating for statistically significant differences among the block averages for these samples for each element of interest is included in these exhibits. There was no indication of a statistically significant (at a 5% level) difference among the averages of these measurements for any of the elements of interest. Averaging the measured concentrations for each set of triplicates helps to minimize the impact of any potential ICP–AES effects.

Table 4 summarizes the average measurements and the reference values for the 4 primary elements of interest. The results indicate consistent and accurate measurements from the PSAL processes used to conduct these analyses.

Table 4. Results from Samples of the Multi–Element Solution Standard

Analytical Set/Block	Avg B (ppm)	Avg Li (ppm)	Avg Na (ppm)	Avg Si (ppm)
q/1	20.2	10.0	81.2	49.4
q/2	20.3	9.8	80.1	50.6
q/3	19.4	9.9	80.4	50.4
r/1	20.1	9.8	79.3	50.0
r/2	20.4	9.8	80.1	52.0
r/3	20.8	10.0	80.7	51.5
Grand Average	20.2	9.9	80.3	50.7
Reference Value	20	10	81	50
% difference	1.03%	-1.22%	-0.85%	1.30%

4.3.3 Measurements by Glass Identifier

Exhibit B3 in Appendix B provides plots (grouped by analytical set) of the leachate concentrations for each type of submitted sample: the study glasses by heat treatment and the standards (EA, ARM, the multi–element solution standard, and blanks). Exhibit B4 in Appendix B provide plots of the leachate concentrations for the PCT results of just the study glasses by heat treatment. These plots allow for the assessment of the repeatability of the measurements, which suggests some scatter in the triplicate values for some analytes for some of the glasses. Also, note that some differences between the values for the two heat treatments for some glasses are evident. More will be said regarding comparisons between the heat treatments in the discussions that follow.

4.3.4 Normalized PCT Results

PCT leachate concentrations are typically normalized using the cation composition (expressed as a weight percent) in the glass to obtain a grams per liter (g/L) leachate concentration. The normalization of the PCTs is usually conducted using the measured compositions of the glasses. This is the preferred normalization process for the PCTs. For completeness, the targeted cation and the bias–corrected cation compositions were also used to conduct this normalization.

As is the usual convention, the common logarithm of the normalized PCT (normalized leachate, NL) for each element of interest was determined and used for comparison. To accomplish this computation, one must

1.) Determine the common logarithm of the elemental parts per million (ppm) leachate concentration for each of the triplicates and each of the elements of interest (these values are provided in Table B2 of Appendix B),

2.) Average the common logarithms over the triplicates for each element of interest, and then

Normalizing Using Measured Composition (preferred method)

3a.) Subtract a quantity equal to 1 plus the common logarithm of the average cation measured concentration (expressed as a weight percent of the glass) from the average computed in step 2.

Or Normalizing Using Target Composition

3b.) Subtract a quantity equal to 1 plus the common logarithm of the target cation concentration (expressed as a weight percent of the glass) from the average computed in step 2.

Or Normalizing Using Measured Bias–Corrected Composition

3c.) Subtract a quantity equal to 1 plus the common logarithm of the measured bias–corrected cation concentration (expressed as a weight percent of the glass) from the average computed in step 2.

Exhibit B5 in Appendix B provides scatter plots for these results and offers an opportunity to investigate the consistency in the leaching across the elements for the glasses of this study. All combinations of the normalizations of the PCTs (i.e., those generated using the targeted, measured, and bias–corrected compositional views) and both heat treatments are represented in the series of scatter plots. Consistency in the leaching across the elements is typically demonstrated by a high degree of linear correlation among the values for pairs of these elements. The smallest correlation in this plot is that for Li and Si, with a value of ~95%.

Table 5 summarizes the normalized PCTs for the glasses of this study, which are listed by glass identifier. The following sections discuss the two primary objectives of the variability study: (1) acceptability of the glasses with respect to the EA glass and (2) applicability of the current PCCS durability models for the measured PCT responses.

Table 5. Normalized PCTs by Glass ID/Compositional View

Glass ID	WL (%)	Sludge Case	Heat Treatment	Compositional View	Nepheline Assessment	log NL[B (g/L)]	log NL[Li (g/L)]	log NL[Na (g/L)]	log NL [Si(g/L)]	NL[B (g/L)]	NL[Li (g/L)]	NL[Na (g/L)]	NL[Si (g/L)]
ARM	.			reference	0.753	-0.276	-0.208	-0.270	-0.537	0.53	0.62	0.54	0.29
ARM	.			reference	0.753	-0.324	-0.249	-0.300	-0.565	0.47	0.56	0.50	0.27
EA	.			reference	0.704	1.243	0.973	1.116	0.597	17.52	9.40	13.05	3.96
EA	.			reference	0.704	1.241	0.959	1.108	0.597	17.41	9.10	12.83	3.95
SB4VAR11	34	Case 1	ccc	measured	0.694	-0.157	-0.143	-0.199	-0.344	0.70	0.72	0.63	0.45
SB4VAR11	34	Case 1	ccc	measured bc	0.695	-0.166	-0.164	-0.199	-0.350	0.68	0.69	0.63	0.45
SB4VAR11	34	Case 1	ccc	targeted	0.694	-0.164	-0.159	-0.199	-0.344	0.69	0.69	0.63	0.45
SB4VAR11	34	Case 1	quenched	measured	0.694	-0.144	-0.140	-0.175	-0.346	0.72	0.72	0.67	0.45
SB4VAR11	34	Case 1	quenched	measured bc	0.695	-0.154	-0.161	-0.175	-0.352	0.70	0.69	0.67	0.45
SB4VAR11	34	Case 1	quenched	targeted	0.694	-0.152	-0.156	-0.175	-0.346	0.70	0.70	0.67	0.45
SB4VAR12	38	Case 1	ccc	measured	0.673	-0.128	-0.126	-0.124	-0.342	0.74	0.75	0.75	0.45
SB4VAR12	38	Case 1	ccc	measured bc	0.673	-0.138	-0.147	-0.126	-0.347	0.73	0.71	0.75	0.45
SB4VAR12	38	Case 1	ccc	targeted	0.667	-0.132	-0.135	-0.132	-0.334	0.74	0.73	0.74	0.46
SB4VAR12	38	Case 1	quenched	measured	0.673	-0.101	-0.116	-0.120	-0.325	0.79	0.77	0.76	0.47
SB4VAR12	38	Case 1	quenched	measured bc	0.673	-0.110	-0.137	-0.123	-0.330	0.78	0.73	0.75	0.47
SB4VAR12	38	Case 1	quenched	targeted	0.667	-0.105	-0.125	-0.129	-0.316	0.79	0.75	0.74	0.48
SB4VAR13	42	Case 1	ccc	measured	0.651	0.175	0.132	0.042	-0.244	1.49	1.36	1.10	0.57
SB4VAR13	42	Case 1	ccc	measured bc	0.644	0.188	0.123	0.042	-0.233	1.54	1.33	1.10	0.58
SB4VAR13	42	Case 1	ccc	targeted	0.638	0.189	0.131	0.037	-0.221	1.55	1.35	1.09	0.60
SB4VAR13	42	Case 1	quenched	measured	0.651	-0.094	-0.098	-0.071	-0.349	0.80	0.80	0.85	0.45
SB4VAR13	42	Case 1	quenched	measured bc	0.644	-0.081	-0.106	-0.071	-0.339	0.83	0.78	0.85	0.46
SB4VAR13	42	Case 1	quenched	targeted	0.638	-0.080	-0.099	-0.076	-0.327	0.83	0.80	0.84	0.47
SB4VAR21	32	Case 2	ccc	measured	0.723	-0.200	-0.152	-0.218	-0.365	0.63	0.70	0.61	0.43
SB4VAR21	32	Case 2	ccc	measured bc	0.717	-0.187	-0.161	-0.217	-0.355	0.65	0.69	0.61	0.44
SB4VAR21	32	Case 2	ccc	targeted	0.715	-0.190	-0.151	-0.225	-0.351	0.65	0.71	0.60	0.45
SB4VAR21	32	Case 2	quenched	measured	0.723	-0.198	-0.142	-0.208	-0.366	0.63	0.72	0.62	0.43
SB4VAR21	32	Case 2	quenched	measured bc	0.717	-0.184	-0.150	-0.207	-0.355	0.65	0.71	0.62	0.44
SB4VAR21	32	Case 2	quenched	targeted	0.715	-0.188	-0.141	-0.215	-0.351	0.65	0.72	0.61	0.45
SB4VAR22	35	Case 2	ccc	measured	0.706	-0.186	-0.136	-0.184	-0.365	0.65	0.73	0.65	0.43
SB4VAR22	35	Case 2	ccc	measured bc	0.698	-0.173	-0.145	-0.187	-0.354	0.67	0.72	0.65	0.44
SB4VAR22	35	Case 2	ccc	targeted	0.696	-0.173	-0.139	-0.191	-0.347	0.67	0.73	0.64	0.45
SB4VAR22	35	Case 2	quenched	measured	0.706	-0.170	-0.125	-0.192	-0.360	0.68	0.75	0.64	0.44
SB4VAR22	35	Case 2	quenched	measured bc	0.698	-0.157	-0.134	-0.195	-0.350	0.70	0.73	0.64	0.45
SB4VAR22	35	Case 2	quenched	targeted	0.696	-0.157	-0.128	-0.200	-0.343	0.70	0.75	0.63	0.45
SB4VAR23	38	Case 2	ccc	measured	0.676	-0.140	-0.104	-0.163	-0.347	0.73	0.79	0.69	0.45
SB4VAR23	38	Case 2	ccc	measured bc	0.669	-0.126	-0.112	-0.162	-0.337	0.75	0.77	0.69	0.46
SB4VAR23	38	Case 2	ccc	targeted	0.675	-0.138	-0.117	-0.170	-0.340	0.73	0.76	0.68	0.46
SB4VAR23	38	Case 2	quenched	measured	0.676	-0.156	-0.112	-0.168	-0.360	0.70	0.77	0.68	0.44
SB4VAR23	38	Case 2	quenched	measured bc	0.669	-0.142	-0.121	-0.168	-0.350	0.72	0.76	0.68	0.45
SB4VAR23	38	Case 2	quenched	targeted	0.675	-0.154	-0.125	-0.175	-0.353	0.70	0.75	0.67	0.44

Table 4 cont. Normalized PCTs by Glass ID/Compositional View

Glass ID	WL (%)	Sludge Case	Heat Treatment	Compositional View	Nepheline Assessment	log NL[B (g/L)]	log NL[Li (g/L)]	log NL[Na (g/L)]	log NL [Si(g/L)]	NL[B (g/L)]	NL[Li (g/L)]	NL[Na (g/L)]	NL[Si (g/L)]
SB4VAR24	**41**	**Case 2**	**ccc**	**measured**	0.659	0.257	0.230	0.054	-0.223	1.81	1.70	1.13	0.60
SB4VAR24	**41**	**Case 2**	**ccc**	**measured bc**	0.660	0.247	0.209	0.055	-0.228	1.77	1.62	1.13	0.59
SB4VAR24	**41**	**Case 2**	**ccc**	**targeted**	0.654	0.251	0.218	0.049	-0.217	1.78	1.65	1.12	0.61
SB4VAR24	**41**	**Case 2**	**quenched**	**measured**	0.659	-0.109	-0.090	-0.140	-0.341	0.78	0.81	0.72	0.46
SB4VAR24	**41**	**Case 2**	**quenched**	**measured bc**	0.660	-0.118	-0.111	-0.140	-0.346	0.76	0.77	0.72	0.45
SB4VAR24	**41**	**Case 2**	**quenched**	**targeted**	0.654	-0.115	-0.102	-0.146	-0.335	0.77	0.79	0.71	0.46
SB4VAR31	**32**	**Case 3**	**ccc**	**measured**	0.708	-0.175	-0.153	-0.196	-0.343	0.67	0.70	0.64	0.45
SB4VAR31	**32**	**Case 3**	**ccc**	**measured bc**	0.706	-0.170	-0.168	-0.188	-0.334	0.68	0.68	0.65	0.46
SB4VAR31	**32**	**Case 3**	**ccc**	**targeted**	0.709	-0.170	-0.156	-0.198	-0.343	0.68	0.70	0.63	0.45
SB4VAR31	**32**	**Case 3**	**quenched**	**measured**	0.708	-0.143	-0.138	-0.180	-0.328	0.72	0.73	0.66	0.47
SB4VAR31	**32**	**Case 3**	**quenched**	**measured bc**	0.706	-0.137	-0.153	-0.172	-0.319	0.73	0.70	0.67	0.48
SB4VAR31	**32**	**Case 3**	**quenched**	**targeted**	0.709	-0.137	-0.141	-0.182	-0.328	0.73	0.72	0.66	0.47
SB4VAR32	**36**	**Case 3**	**ccc**	**measured**	0.682	-0.134	-0.123	-0.153	-0.330	0.73	0.75	0.70	0.47
SB4VAR32	**36**	**Case 3**	**ccc**	**measured bc**	0.680	-0.136	-0.145	-0.145	-0.321	0.73	0.72	0.72	0.48
SB4VAR32	**36**	**Case 3**	**ccc**	**targeted**	0.681	-0.132	-0.132	-0.154	-0.327	0.74	0.74	0.70	0.47
SB4VAR32	**36**	**Case 3**	**quenched**	**measured**	0.682	-0.137	-0.136	-0.162	-0.333	0.73	0.73	0.69	0.46
SB4VAR32	**36**	**Case 3**	**quenched**	**measured bc**	0.680	-0.140	-0.158	-0.154	-0.324	0.73	0.69	0.70	0.47
SB4VAR32	**36**	**Case 3**	**quenched**	**targeted**	0.681	-0.135	-0.144	-0.163	-0.330	0.73	0.72	0.69	0.47
SB4VAR33	**40**	**Case 3**	**ccc**	**measured**	0.655	-0.088	-0.101	-0.071	-0.304	0.82	0.79	0.85	0.50
SB4VAR33	**40**	**Case 3**	**ccc**	**measured bc**	0.646	-0.083	-0.116	-0.080	-0.299	0.83	0.77	0.83	0.50
SB4VAR33	**40**	**Case 3**	**ccc**	**targeted**	0.653	-0.084	-0.103	-0.086	-0.312	0.83	0.79	0.82	0.49
SB4VAR33	**40**	**Case 3**	**quenched**	**measured**	0.655	-0.108	-0.109	-0.083	-0.314	0.78	0.78	0.83	0.49
SB4VAR33	**40**	**Case 3**	**quenched**	**measured bc**	0.646	-0.103	-0.125	-0.091	-0.309	0.79	0.75	0.81	0.49
SB4VAR33	**40**	**Case 3**	**quenched**	**targeted**	0.653	-0.104	-0.111	-0.097	-0.322	0.79	0.77	0.80	0.48
SB4VAR41	**32**	**Case 4**	**ccc**	**measured**	0.721	-0.170	-0.119	-0.196	-0.338	0.68	0.76	0.64	0.46
SB4VAR41	**32**	**Case 4**	**ccc**	**measured bc**	0.714	-0.157	-0.128	-0.199	-0.328	0.70	0.75	0.63	0.47
SB4VAR41	**32**	**Case 4**	**ccc**	**targeted**	0.715	-0.159	-0.118	-0.195	-0.320	0.69	0.76	0.64	0.48
SB4VAR41	**32**	**Case 4**	**quenched**	**measured**	0.721	-0.191	-0.139	-0.197	-0.364	0.64	0.73	0.63	0.43
SB4VAR41	**32**	**Case 4**	**quenched**	**measured bc**	0.714	-0.178	-0.148	-0.200	-0.354	0.66	0.71	0.63	0.44
SB4VAR41	**32**	**Case 4**	**quenched**	**targeted**	0.715	-0.181	-0.138	-0.196	-0.346	0.66	0.73	0.64	0.45
SB4VAR42	**35**	**Case 4**	**ccc**	**measured**	0.703	-0.162	-0.114	-0.167	-0.342	0.69	0.77	0.68	0.45
SB4VAR42	**35**	**Case 4**	**ccc**	**measured bc**	0.695	-0.148	-0.123	-0.170	-0.332	0.71	0.75	0.68	0.47
SB4VAR42	**35**	**Case 4**	**ccc**	**targeted**	0.695	-0.159	-0.124	-0.178	-0.334	0.69	0.75	0.66	0.46
SB4VAR42	**35**	**Case 4**	**quenched**	**measured**	0.703	-0.161	-0.122	-0.166	-0.348	0.69	0.75	0.68	0.45
SB4VAR42	**35**	**Case 4**	**quenched**	**measured bc**	0.695	-0.148	-0.131	-0.169	-0.337	0.71	0.74	0.68	0.46
SB4VAR42	**35**	**Case 4**	**quenched**	**targeted**	0.695	-0.159	-0.132	-0.177	-0.339	0.69	0.74	0.67	0.46
SB4VAR43	**38**	**Case 4**	**ccc**	**measured**	0.684	-0.160	-0.124	-0.165	-0.356	0.69	0.75	0.68	0.44
SB4VAR43	**38**	**Case 4**	**ccc**	**measured bc**	0.684	-0.169	-0.145	-0.168	-0.361	0.68	0.72	0.68	0.44
SB4VAR43	**38**	**Case 4**	**ccc**	**targeted**	0.674	-0.162	-0.133	-0.178	-0.345	0.69	0.74	0.66	0.45
SB4VAR43	**38**	**Case 4**	**quenched**	**measured**	0.684	-0.144	-0.113	-0.139	-0.340	0.72	0.77	0.73	0.46
SB4VAR43	**38**	**Case 4**	**quenched**	**measured bc**	0.684	-0.154	-0.134	-0.142	-0.345	0.70	0.73	0.72	0.45

Table 4 cont. Normalized PCTs by Glass ID/Compositional View

Glass ID	WL (%)	Sludge Case	Heat Treatment	Compositional View	Nepheline Assessment	log NL[B (g/L)]	log NL[Li (g/L)]	log NL[Na (g/L)]	log NL [Si(g/L)]	NL[B (g/L)]	NL[Li (g/L)]	NL[Na (g/L)]	NL[Si (g/L)]
SB4VAR43	**38**	**Case 4**	**quenched**	**targeted**	0.674	-0.147	-0.122	-0.152	-0.330	0.71	0.75	0.71	0.47
SB4VAR44	**41**	**Case 4**	**ccc**	**measured**	0.659	-0.062	-0.037	-0.108	-0.325	0.87	0.92	0.78	0.47
SB4VAR44	**41**	**Case 4**	**ccc**	**measured bc**	0.660	-0.072	-0.058	-0.108	-0.330	0.85	0.88	0.78	0.47
SB4VAR44	**41**	**Case 4**	**ccc**	**targeted**	0.653	-0.062	-0.050	-0.112	-0.316	0.87	0.89	0.77	0.48
SB4VAR44	**41**	**Case 4**	**quenched**	**measured**	0.659	-0.140	-0.111	-0.143	-0.351	0.72	0.78	0.72	0.45
SB4VAR44	**41**	**Case 4**	**quenched**	**measured bc**	0.660	-0.150	-0.132	-0.143	-0.357	0.71	0.74	0.72	0.44
SB4VAR44	**41**	**Case 4**	**quenched**	**targeted**	0.653	-0.140	-0.124	-0.147	-0.343	0.72	0.75	0.71	0.45
SB4VAR51	**32**	**Case 5**	**ccc**	**measured**	0.708	-0.163	-0.115	-0.172	-0.329	0.69	0.77	0.67	0.47
SB4VAR51	**32**	**Case 5**	**ccc**	**measured bc**	0.707	-0.172	-0.136	-0.175	-0.334	0.67	0.73	0.67	0.46
SB4VAR51	**32**	**Case 5**	**ccc**	**targeted**	0.708	-0.169	-0.128	-0.175	-0.330	0.68	0.75	0.67	0.47
SB4VAR51	**32**	**Case 5**	**quenched**	**measured**	0.708	-0.162	-0.131	-0.169	-0.340	0.69	0.74	0.68	0.46
SB4VAR51	**32**	**Case 5**	**quenched**	**measured bc**	0.707	-0.171	-0.152	-0.172	-0.345	0.67	0.70	0.67	0.45
SB4VAR51	**32**	**Case 5**	**quenched**	**targeted**	0.708	-0.168	-0.143	-0.172	-0.341	0.68	0.72	0.67	0.46
SB4VAR52	**35**	**Case 5**	**ccc**	**measured**	0.688	-0.143	-0.115	-0.148	-0.331	0.72	0.77	0.71	0.47
SB4VAR52	**35**	**Case 5**	**ccc**	**measured bc**	0.690	-0.153	-0.136	-0.147	-0.336	0.70	0.73	0.71	0.46
SB4VAR52	**35**	**Case 5**	**ccc**	**targeted**	0.688	-0.147	-0.128	-0.150	-0.328	0.71	0.74	0.71	0.47
SB4VAR52	**35**	**Case 5**	**quenched**	**measured**	0.688	-0.144	-0.119	-0.144	-0.337	0.72	0.76	0.72	0.46
SB4VAR52	**35**	**Case 5**	**quenched**	**measured bc**	0.690	-0.154	-0.140	-0.144	-0.342	0.70	0.72	0.72	0.46
SB4VAR52	**35**	**Case 5**	**quenched**	**targeted**	0.688	-0.148	-0.132	-0.147	-0.333	0.71	0.74	0.71	0.46
SB4VAR53	**38**	**Case 5**	**ccc**	**measured**	0.674	-0.152	-0.118	-0.135	-0.341	0.70	0.76	0.73	0.46
SB4VAR53	**38**	**Case 5**	**ccc**	**measured bc**	0.667	-0.138	-0.127	-0.134	-0.331	0.73	0.75	0.73	0.47
SB4VAR53	**38**	**Case 5**	**ccc**	**targeted**	0.667	-0.136	-0.120	-0.134	-0.326	0.73	0.76	0.73	0.47
SB4VAR53	**38**	**Case 5**	**quenched**	**measured**	0.674	-0.147	-0.120	-0.104	-0.343	0.71	0.76	0.79	0.45
SB4VAR53	**38**	**Case 5**	**quenched**	**measured bc**	0.667	-0.133	-0.128	-0.103	-0.332	0.74	0.74	0.79	0.47
SB4VAR53	**38**	**Case 5**	**quenched**	**targeted**	0.667	-0.131	-0.121	-0.103	-0.328	0.74	0.76	0.79	0.47
SB4VAR54	**41**	**Case 5**	**ccc**	**measured**	0.649	0.009	0.003	-0.049	-0.286	1.02	1.01	0.89	0.52
SB4VAR54	**41**	**Case 5**	**ccc**	**measured bc**	0.640	0.022	-0.006	-0.052	-0.275	1.05	0.99	0.89	0.53
SB4VAR54	**41**	**Case 5**	**ccc**	**targeted**	0.645	0.008	-0.006	-0.054	-0.282	1.02	0.99	0.88	0.52
SB4VAR54	**41**	**Case 5**	**quenched**	**measured**	0.649	-0.106	-0.102	-0.086	-0.323	0.78	0.79	0.82	0.47
SB4VAR54	**41**	**Case 5**	**quenched**	**measured bc**	0.640	-0.092	-0.111	-0.089	-0.313	0.81	0.77	0.81	0.49
SB4VAR54	**41**	**Case 5**	**quenched**	**targeted**	0.645	-0.106	-0.111	-0.092	-0.320	0.78	0.77	0.81	0.48

4.3.5 Acceptability of the SB4 VS Glasses

The NL [B] for each quenched and ccc glass is well below that of the reference EA glass (16.695 g/L).[12] For the quenched glasses, the NL [B] (based on measured bc compositions) ranges from 0.65 g/L (SB4VAR21) to 0.83 g/L (SB4VAR13). Within each SB4 post–decant option, the general trend observed for the quenched glasses is a gradual decrease in durability with increasing WL. For example, in Case #1 (SB4 nominal pre–decant) the NL [B] for glasses targeting 34, 38, and 42% WL are 0.70, 0.78, and 0.83 g/L, respectively and in Case #2 (SB4 after the 100K decant), the NL [B] for glasses targeting 32, 35, 38, 41% WL are 0.65, 0.70, 0.72, and 0.76 g/L, respectively. Similar trends are also observed for Cases #3, #4, and #5. Regardless of the SB4 option or targeted WL, the durabilities of the quenched Frit 510–based glasses are very acceptable.

With respect to the ccc versions of the variability study glasses, the NL [B] (based on measured bc compositions) range from 0.65 g/L (SB4VAR21ccc) to 1.77 g/L (SB4VAR24ccc). As in the quenched glasses, the PCT responses for all of the ccc glasses are acceptable relative to the EA reference glass (16.695 g/L). A gradual decrease in durability with increasing WL (within a specific option) is observed. For example, the NL [B] of the Case #1 ccc glasses are 0.68, 0.73, and 1.54 g/L for the 34, 38, and 41% WL targets and for Case #2, the NL [B] of the 32, 35, 38, and 41% WL glasses are 0.65, 0.67, 0.75, and 1.77 g/L. Again, all of the NL [B] values are very acceptable relative to EA and the durability trend as a function of WL is consistent for both quenched and ccc glasses.

One primary difference is observed for two of the ccc glasses, specifically SB4VAR13ccc (Case #1 at 42% WL) and SB4VAR24ccc (Case #2 at 41% WL). Although the PCT responses are acceptable, there is a considerable increase (a factor of approximately 2) in the PCT response as the WL is raised to the maximum level considered in this study. Consider Figure 4 which shows the log NL [B] for the Case #1 (Frit 510–SB4 nominal (pre–decant)) glasses as a function of WL, compositional view, and thermal treatment (quenched and ccc). There is very little difference (no practical significance) between the quenched and ccc glasses targeting 34 and 38% WL; however, a significant and potentially practical difference exists between the quenched and ccc versions of the glass at 42% WL. More specifically, the NL [B] of the SB4VAR12ccc (Case #1 at 38% WL) is 0.73 g/L, while SB4VAR13ccc (Case #1 at 42% WL) has a NL [B] of 1.54 g/L. This same trend is observed for Case #2 (post 100K decant) as the NL [B] of the ccc glasses at 38 and 41% WL are 0.75 and 1.77 g/L, respectively. The magnitude of the decrease in durability for these two glasses is inconsistent with the general differences of the lower WL glasses within their respective options. Such a trend in NL [B] would suggest that nepheline formation may be responsible for the lower durabilities of these glasses. In fact, nepheline formation was observed in both SB4VAR13ccc and SB4VAR24ccc (refer to Section 4.2.2). While the increased NL [B] of SB4VAR44ccc (Case #4 at 41% WL) and SB4VAR54ccc (Case #5 at 41%) would suggest the presence of nepheline, none was detected with XRD. Due to the detection limit of the instrument, these results indicate that the PCT response of a sample may be more sensitive to the presence of nepheline than XRD.

Although not an issue in terms of acceptability, the fact that nepheline was detected in two of the study glasses are the first results which indicate that the current nepheline discriminator value of 0.62 is not conservative. The nepheline discriminator was implemented into PCCS for SB4 based on the fact that all of the historical glasses evaluated with nepheline values of 0.62 or greater did not contain nepheline via XRD analysis.[15] During that assessment, glasses were identified with nepheline discriminator values less than 0.62 that were not characterized by the formation of nepheline upon slow cooling. These results suggest that there was either a compositional or thermal (kinetic) effect not fully captured in the discriminator but at that point the 0.62 value was deemed to be conservative. The current results (XRD patterns and PCT response for SB4VAR13 and SB4VAR24) suggest that the discriminator is not conservative within this glass compositional region. These results have altered concurrent experimental studies that continue to focus on both compositional and heat treatment effects for nepheline formation in an attempt to gain a more fundamental understanding of its formation and impacts to DWPF type glasses.

Although these two glasses do cause some concern over the continued use of the 0.62 nepheline value to predict nepheline in ccc glasses for future DWPF glass systems, the impact on the current DWPF operating window for the SB4 system is of little concern. Nepheline was only observed in glasses targeting 41 or 42% WL. Current processing of the Frit 510–SB4 system in DWPF has nominally targeted 34% WL. For those SB4 variability study glasses targeting these lower WLs, nepheline formation was not observed and the minimal difference in PCT response between quenched and ccc versions supported its absence. It should also be noted that the glasses targeting the higher WLs in the two "post decanted" systems (Case #3 and Case #4) did not formally show nepheline formation via XRD results, but a comparison of the quenched and ccc PCT response do suggest crystallization may be present below the detection limit of the X–ray diffractometer.

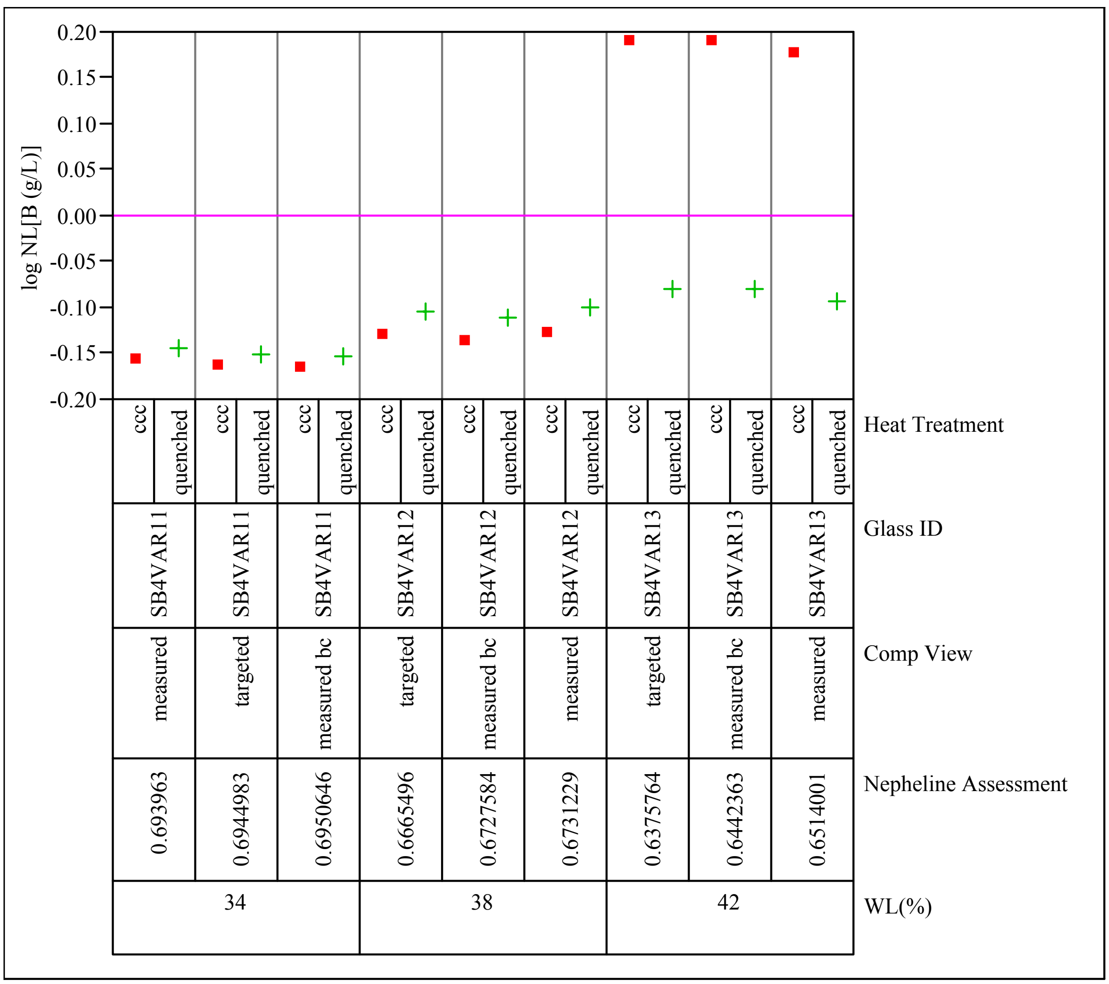

Figure 4. Effect of heat treatment on log NL[B (g/L)] for Case #1.

4.3.6 Predicted versus Measured PCTs

As discussed in Section 4.3.5 and shown in Table 5, the durabilities of the SB4/Decant VS glasses are all very acceptable when compared to the durability of EA, which meets one objective of the variability study. The second objective is to evaluate the applicability of the current durability model to the compositional region of interest. The term applicability refers to the ability of the current durability model to predict the PCT response of the study glasses. Note that the current durability model is only valid for homogeneous glasses and is not expected to predict the PCT response of glasses containing crystallization that would significantly alter the response (i.e., nepheline). Non–homogeneous glasses (based on XRD analysis) in this study include SB4VAR13ccc (Case #1 at 42% WL) and SB4VAR24ccc (Case #2 at 41% WL).

Exhibit B8 in Appendix B provides plots of the DWPF models that relate the logarithm of the normalized PCT (for each element of interest) to a linear function of a free energy of hydration term (ΔG_p, kcal/100g glass) derived for all of the glass compositional views and heat treatments.[14] Prediction limits (at a 95% confidence) for an individual PCT result are also plotted along with the linear fit. The EA and ARM results are also indicated on these plots. Exhibit B9 in Appendix B provides a version of these plots for the quenched glasses only and Exhibit B10 in Appendix B provides a version for ccc glasses only. While all of these glasses show acceptable PCT responses, some points fall above the confidence limits for the ccc versions of the study glasses.

Figure 5 provides a closer look at the PCT response that falls above the confidence interval, which is the ccc version of glass SB4VAR24. The PCT response for the quenched version of this glass is also included on the plot along with the EA and ARM results. The points lying above the 95% confidence interval are associated with the three compositional views (target, measured and measured bc) of SB4VAR24ccc. As previously mentioned, SB4VAR24ccc contains nepheline, which is the cause for the higher PCT response and the inability of the ΔG_P model to predict the NL [B]. Implementation of the nepheline discriminator in DWPF's PCCS is the primary mechanism to avoid the production of a glass that precipitates nepheline upon slow cooling, thus creating a potentially unacceptable glass.

Although the PCT response for the SB4VAR24ccc glass is acceptable, there is currently no tool or model within the DWPF's process control system that would have prevented this glass (as well as SB4VAR13) from being processed. As previously mentioned, targeted WLs for the Frit 510–SB4 system have been approximately 34%, so a comfortable processing margin exists for the operating window since nepheline formed only in glasses targeting a WL of either 41 or 42% WL. These data do identify the need for a better understanding of the current nepheline discriminator over DWPF compositions of interest.

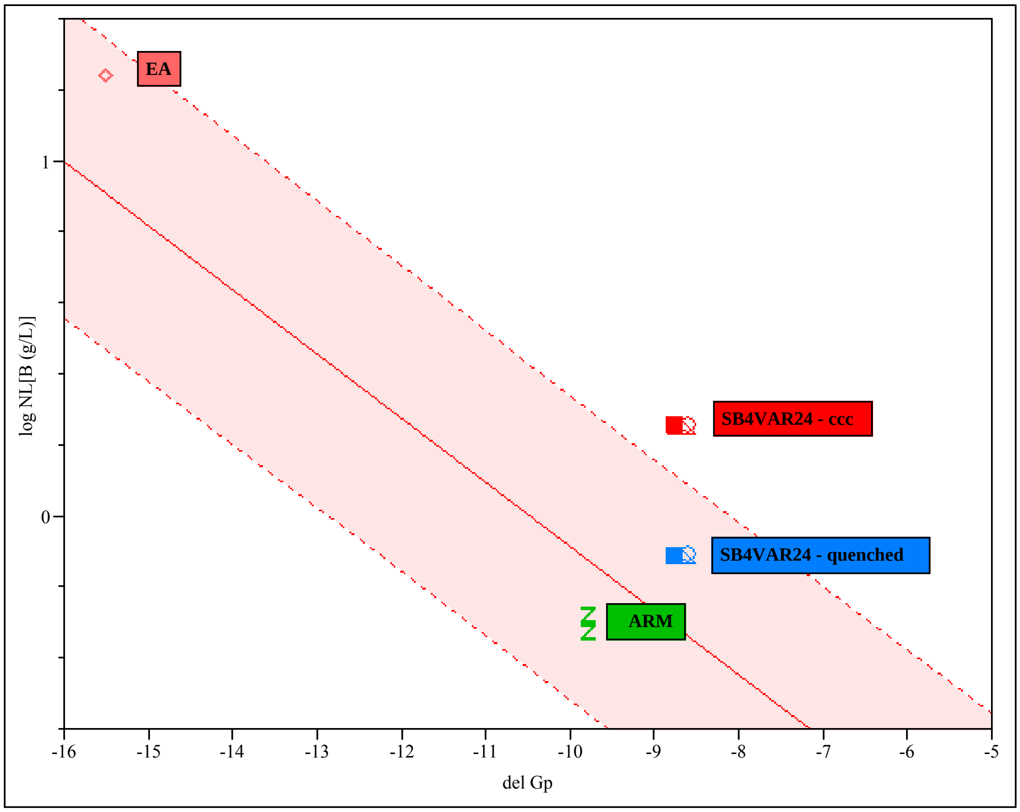

Figure 5. Log NL[B (g/L) versus B Del Gp model with a 95% confidence interval for individual PCTs.

4.4 A Review of the Nepheline Assessments for DWPF's SB4 Process Batches

In order to evaluate the potential impacts of the two non–conservative data points from this study on DWPF operations with SB4 (pre–Tank 40 decant), values of the nepheline discriminator for the SB4 SME batches 402 through 436 that have been processed by the DWPF were assessed. These values were obtained from the Sample_Date Folder maintained by the DWPF Chem Group on the WG09 server and are shown in Table 6. The smallest nepheline discriminator value the DWPF has recorded as part of the SB4 processing to date is 0.704, which is well above the 0.62 nominal limit for this constraint as well as being above the 0.654 value of the SB4VAR24 glass of this study.

Table 6. Nepheline Discriminator Values Recorded by DWPF during the Processing of SB4

SME Batch	402	403	404	405	406	407	408	409	410	411	412	413
Nepheline Value	0.719	0.743	0.727	0.742	0.726	0.735	0.723	0.722	0.725	0.719	0.717	0.723
SME Batch	414	415	416	417	418	419	420	421	422	423	424	425
Nepheline Value	0.721	0.752	0.729	0.728	0.730	0.712	0.720	0.732	0.731	0.724	0.711	0.707
SME Batch	426	427	428	429	430	431	432	433	434	435	436	
Nepheline Value	0.723	0.717	0.704	0.722	0.722	0.709	0.719	0.721	0.722	0.727	0.735	

The nepheline values predicted by the actual DWPF SME analytical data in combination with the data of the study glasses provide no indication that the production glasses within the Frit 510–SB4 are not acceptable. To support this statement, SRNL fabricated five supplemental glasses based on the specific SB4 SME batch information from WG09. Specifically, elemental compositional information from SME batches 434 and 435[d] were obtained from WG09, converted to oxides, and normalized. The SME data suggested that the WLs for these two Frit 510–SB4 nominal (pre–Tank 40 decant) glasses were approximately 33 and 32%, respectively. In addition to these two specific glasses three other glasses were made using the nominal Case #1 variability study composition coupled with Frit 510 at WLs of ~32, 33, and 34% WL.[e] The target and measured compositions of these five supplemental glasses are shown in Table 7 and Table 8.[f] The nomenclature for these pre–decant glasses can be summarized as follows:

1.) SB4PS1: Nominal glass targeting the measured composition of SME batch 434 (normalized)
2.) SB4PS2: Nominal glass targeting the measured composition of SME batch 435 (normalized)
3.) SB4PS3: Nominal glass targeting a Frit 510 – SB4 Case #1 glass at 32% WL
4.) SB4PS4: Nominal glass targeting a Frit 510 – SB4 Case #1 glass at 33% WL
5.) SB4PS5: Nominal glass targeting a Frit 510 – SB4 Case #1 glass at 34% WL

Table 9 summarizes the PCT results (normalized to the target compositions) of both the quenched and ccc versions of these five supplemental glasses. The results indicate that all of the glasses are acceptable and predictable[g] regardless of thermal history (quenched or ccc). The NL [B] ranges from 0.41 g/L (SB4PS1ccc) to 0.52 g/L (SB4PS3 quenched and SB4PS4 ccc). When comparing the quenched glasses to their ccc counterparts, there is very little (if any) difference between the PCT response, which suggests that the ccc glasses are void of nepheline. These results have also been confirmed by XRD.[h,i] The PCT responses of these supplemental glasses are comparable to the lower WL glasses of the initial 18 variability study glasses. More specifically, the PCT responses of the quenched and ccc SB4VAR11 (Case #1, pre–Tank 40 decant glass at 34% WL) are 0.70 and 0.68 NL [B], respectively. Again, these data coupled with nepheline values predicted by the actual SME analytical data and the measured PCT response from the study glasses indicate that the production glasses are void of nepheline and are very acceptable regardless of the thermal history. Even though the PCT responses for the higher WL post–Tank 40 decant study glasses are acceptable and no nepheline was observed via XRD, it is recommended that DWPF continue to target lower WLs during processing of SB4.

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[d] It should be noted that SB4 pour stream samples were also pulled during processing of these two SME batches. The first pour stream sample was pulled on 3/12/08 during the processing SME 434. The second pour stream sample was pulled on 3/18/08 during the processing SME 435. The two pour stream samples have been transported to SRNL, but have not been characterized.

[e] The Al_2O_3, Fe_2O_3, Na_2O and U_3O_8 content of each SME batch were compared. All of the variability study glasses and supplemental glasses have compositions that are within the bounds of the SME batch compositions, with the exception of 2 glasses (SB4VAR24 and SB4VAR54). Both of these glasses targeted higher WLs (41%), so they are not expected to fall within the bounds of the SME batches. A comparison of the data is shown in Appendix C, Table C1.

[f] No analytical plan was used as guidance for the chemical composition measurements, so there are no measured bc values. The measured compositions in Table 8 are an average of the values obtained by the LM and PF methods.

[g] For more information see page 135 of WSRC-NB-2006-00168.

[h] The XRD patterns of the supplemental glasses (ccc) can be viewed in the laboratory notebook for the SB4 variability study on page 132 (WSRC-NB-2006-00168).

[i] During the testing of the supplemental glasses, replicates of SB4VAR13ccc (Case #1 at 42% WL) and SB4VAR24ccc (Case #2 at 41% WL) were fabricated and tested to confirm reproducibility. While the composition and PCT results correspond to the previous values, the XRD patterns *do not* indicate the presence of nepheline (see pages 132 and 134 of WSRC-SB-2006-00168 for the PCT and XRD results). We have recognized the issues and will integrate these results into future nepheline testing.

Table 7. Target Compositions of the SB4PS Glasses

Glass ID	SB4PS1	SB4PS2	SB4PS3	SB4PS4	SB4PS5
Frit	**SME 434**	**SME 435**	**510**	**510**	**510**
WL			**31.7**	**33.2**	**34**
Al_2O_3	7.61	7.37	7.92	8.29	8.49
B_2O_3	8.53	8.77	9.56	9.35	9.24
CaO	0.84	0.79	0.87	0.91	0.93
Cr_2O_3	0.05	0.04	0.05	0.05	0.05
CuO	0.01	0.00	0.02	0.02	0.02
Fe_2O_3	8.07	8.03	9.00	9.42	9.65
K_2O	0.08	0.02	0.11	0.12	0.12
Li_2O	5.19	5.31	5.46	5.34	5.28
MgO	0.79	0.85	0.85	0.89	0.92
MnO	1.43	1.57	1.81	1.89	1.94
Na_2O	12.12	11.98	11.99	12.18	12.28
NiO	0.45	0.46	0.50	0.52	0.54
SO_4	0.44	0.42	0.42	0.44	0.45
SiO_2	51.37	51.48	48.66	47.65	47.11
TiO_2	0.09	0.07	0.01	0.01	0.01
U_3O_8	2.73	2.68	2.75	2.88	2.94
ZrO_2	0.19	0.15	0.03	0.03	0.03

Table 8. Measured Compositions of the SB4PS Glasses

Glass ID	SB4PS1	SB4PS2	SB4PS3	SB4PS4	SB4PS5
Frit	**SME 434**	**SME 435**	**510**	**510**	**510**
WL			**31.7**	**33.2**	**34**
Al_2O_3	7.69	7.41	7.89	8.61	8.51
B_2O_3	8.87	9.29	9.71	9.60	9.42
CaO	0.82	0.77	0.85	0.91	0.89
Cr_2O_3	0.07	0.05	0.05	0.06	0.06
CuO	0.02	0.01	0.02	0.03	0.03
Fe_2O_3	7.80	7.91	8.66	9.47	9.33
K_2O	0.08	0.02	0.12	0.12	0.11
Li_2O	5.19	5.46	5.49	5.43	5.27
MgO	0.78	0.83	0.83	0.91	0.91
MnO	1.43	1.58	1.80	1.96	1.94
Na_2O	12.47	12.30	12.40	13.00	12.39
NiO	0.41	0.43	0.45	0.49	0.50
SO_4	0.39	0.39	0.39	0.40	0.41
SiO_2	51.25	51.93	48.72	47.94	46.87
TiO_2	0.09	0.07	0.02	0.02	0.02
U_3O_8	2.73	2.67	2.68	2.94	2.92
ZrO_2	0.00	0.14	0.02	0.02	0.02

Table 9. Normalized* PCT Responses of the Frit 510 – SB4 Supplemental Glasses (quenched and ccc)

Sample	NL (g/L)			
	B	Li	Na	Si
SB4PS-1	0.44	0.43	0.62	0.46
SB4PS-1-ccc	0.41	0.41	0.61	0.45
SB4PS-2	0.44	0.43	0.63	0.46
SB4PS-2-ccc	0.42	0.42	0.61	0.45
SB4PS-3	0.52	0.45	0.69	0.48
SB4PS-3-ccc	0.49	0.44	0.66	0.48
SB4PS-4	0.49	0.43	0.66	0.47
SB4PS-4-ccc	0.52	0.45	0.70	0.50
SB4PS-5	0.50	0.44	0.74	0.48
SB4PS-5-ccc	0.50	0.44	0.71	0.49

*Based on measured compositions

5.0 Conclusions

Frit 510 is a viable option for the processing of SB4 after a Tank 40 decant and the addition of products from the Actinide Removal Process (ARP). The addition of ARP did not have any negative impacts on the acceptability and predictability of the variability study glasses.

The durabilities of all of the study glasses (both quenched and ccc) are well below that of the NL [B] reference EA glass (16.695 g/L). For the quenched glasses, the NL [B] (based on measured bc compositions) ranges from 0.65 g/L (SB4VAR21) to 0.83 g/L (SB4VAR13). With respect to the ccc versions of the variability study glasses, the NL [B] (based on measured bc compositions) range from 0.65 g/L (SB4VAR21ccc) to 1.77 g/L (SB4VAR24ccc). A gradual decrease in durability is observed with increasing WL for the quenched glasses. Although a similar trend is observed for the ccc glasses, the primary distinction is the magnitude of the difference at higher WLs. The durabilities of all of the study glasses are predictable using the current Product Composition Control System (PCCS) durability models with the exception of SB4VAR24ccc (Case #2 at 41%). PCCS is not applicable to non–homogeneous glasses (i.e. glasses containing crystals such as acmite and nepheline), thus SB4VAR24ccc should not be predictable as it contains nepheline.

The presence of nepheline has been confirmed in both SB4VAR13ccc and SB4VAR24ccc by X–ray diffraction (XRD). These two glasses are the first results which indicate that the current nepheline discriminator value of 0.62 is not conservative. The nepheline discriminator was implemented into PCCS for SB4 based on the fact that all of the historical glasses evaluated with nepheline values of 0.62 or greater did not contain nepheline via XRD analysis. Although these two glasses do cause some concern over the use of the 0.62 nepheline value for future DWPF glass systems, the impact to the current SB4 system is of little concern. Specifically, the formation of nepheline was observed in glasses targeting 41 or 42% WL. Current processing of the Frit 510–SB4 system in DWPF has nominally targeted 34% WL. For the SB4 variability study glasses targeting these lower WLs, nepheline formation was not observed and the minimal difference in PCT response between quenched and ccc versions supported its absence.

6.0 References

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APPENDIX A

TABLES AND EXHIBITS SUPPORTING THE ANALYSIS OF THE CHEMICAL COMPOSITION MEASUREMENTS OF THE SB4/DECANT VARIABILITY STUDY GLASSES

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Table A1. Measured Elemental Concentrations (wt%) for Samples Prepared Using Lithium Metaborate (part 1)

Set	Glass ID	Block	Sub-Block	Sequence	Lab ID	Ag (wt%)	Al (wt%)	Ba (wt%)	Ca (wt%)	Cd (wt%)	Ce (wt%)	Co (wt%)	Cr (wt%)	Cu (wt%)	Fe (wt%)	K (wt%)	La (wt%)	Mg (wt%)	Mn (wt%)
1	Batch 1	1	1	1	BCHLM1-111	<0.100	2.55	0.124	0.834	<0.010	0.019	<0.010	0.071	0.297	9.14	3.09	<0.100	0.821	1.38
1	U std	1	1	2	UstdLM1-111	<0.100	2.07	<0.010	0.896	<0.010	<0.010	<0.010	0.158	<0.010	9.24	2.87	<0.100	0.705	2.2
1	SB4VAR51	1	1	3	M04LM11	<0.100	4.05	0.017	0.569	<0.010	0.017	<0.010	0.035	0.021	6.08	0.094	<0.100	0.486	1.44
1	SB4VAR42	1	1	4	M05LM11	<0.100	4.6	0.02	0.654	<0.010	0.019	<0.010	0.038	0.022	7.01	0.111	<0.100	0.558	1.65
1	SB4VAR43	1	1	5	M06LM21	<0.100	5.1	0.025	0.724	<0.010	0.021	<0.010	0.035	0.024	7.85	0.118	<0.100	0.609	1.86
1	SB4VAR41	1	1	6	M01LM21	<0.100	4.38	0.018	0.615	<0.010	0.017	<0.010	0.037	0.019	6.54	0.107	<0.100	0.501	1.55
1	SB4VAR54	1	1	7	M03LM11	<0.100	5.28	0.023	0.736	<0.010	0.02	<0.010	0.041	0.025	8.01	0.119	<0.100	0.628	1.88
1	SB4VAR51	1	1	8	M04LM21	<0.100	4.22	0.019	0.588	<0.010	0.016	<0.010	0.035	0.023	6.22	0.103	<0.100	0.485	1.47
1	SB4VAR54	1	1	9	M03LM21	<0.100	5.22	0.023	0.737	<0.010	0.02	<0.010	0.041	0.024	7.81	0.121	<0.100	0.635	1.84
1	Batch 1	1	1	10	BCHLM1-112	<0.100	2.58	0.128	0.838	<0.010	0.018	<0.010	0.073	0.298	9.09	3.06	<0.100	0.844	1.37
1	U std	1	1	11	UstdLM1-112	<0.100	2.09	<0.010	0.905	<0.010	<0.010	<0.010	0.163	<0.010	9.27	2.93	<0.100	0.729	2.2
1	SB4VAR41	1	1	12	M01LM11	<0.100	4.31	0.019	0.616	<0.010	0.018	<0.010	0.038	0.02	6.21	0.108	<0.100	0.517	1.48
1	SB4VAR22	1	1	13	M12LM11	<0.100	4.79	0.023	0.681	<0.010	0.015	<0.010	0.045	0.022	6.89	0.106	<0.100	0.615	1.57
1	SB4VAR43	1	1	14	M06LM11	<0.100	4.99	0.026	0.712	<0.010	0.021	<0.010	0.036	0.025	7.29	0.17	<0.100	0.622	1.71
1	SB4VAR12	1	1	15	M15LM11	<0.100	5.08	0.02	0.703	<0.010	0.016	<0.010	0.041	0.023	7.33	0.127	<0.100	0.606	1.68
1	SB4VAR22	1	1	16	M12LM21	<0.100	4.75	0.023	0.674	<0.010	0.014	<0.010	0.044	0.022	6.74	0.109	<0.100	0.605	1.58
1	SB4VAR12	1	1	17	M15LM21	<0.100	5.03	0.021	0.703	<0.010	0.016	<0.010	0.042	0.022	7.22	0.114	<0.100	0.618	1.65
1	SB4VAR42	1	1	18	M05LM21	<0.100	4.55	0.021	0.668	<0.010	0.019	<0.010	0.038	0.022	6.81	0.109	<0.100	0.569	1.6
1	Batch 1	1	1	19	BCHLM1-113	<0.100	2.6	0.129	0.864	<0.010	0.019	<0.010	0.074	0.306	9.36	2.97	<0.100	0.852	1.41
1	U std	1	1	20	UstdLM1-113	<0.100	2.11	<0.010	0.909	<0.010	<0.010	<0.010	0.164	<0.010	9.63	2.85	<0.100	0.728	2.29
1	Batch 1	1	2	1	BCHLM1-121	<0.100	2.49	0.127	0.833	<0.010	0.02	<0.010	0.072	0.302	8.76	3.02	<0.100	0.829	1.28
1	U std	1	2	2	UstdLM1-121	<0.100	2.04	<0.010	0.883	<0.010	<0.010	<0.010	0.159	<0.010	9.53	2.83	<0.100	0.708	2.23
1	SB4VAR22	1	2	3	M12LM22	<0.100	4.85	0.023	0.683	<0.010	0.016	<0.010	0.043	0.021	7.26	0.109	<0.100	0.579	1.66
1	SB4VAR42	1	2	4	M05LM12	<0.100	4.64	0.021	0.656	<0.010	0.02	<0.010	0.038	0.022	6.99	0.11	<0.100	0.554	1.6
1	SB4VAR51	1	2	5	M04LM22	<0.100	4.14	0.02	0.585	<0.010	0.018	<0.010	0.035	0.022	6.05	0.1	<0.100	0.475	1.4
1	SB4VAR54	1	2	6	M03LM22	<0.100	5.18	0.023	0.736	<0.010	0.022	<0.010	0.041	0.023	7.82	0.119	<0.100	0.615	1.77
1	SB4VAR51	1	2	7	M04LM12	<0.100	4.07	0.018	0.574	<0.010	0.018	<0.010	0.035	0.021	6.03	0.094	<0.100	0.475	1.4
1	SB4VAR12	1	2	8	M15LM22	<0.100	4.95	0.021	0.686	<0.010	0.017	<0.010	0.042	0.021	7.56	0.109	<0.100	0.6	1.69
1	SB4VAR43	1	2	9	M06LM12	<0.100	4.88	0.027	0.698	<0.010	0.022	<0.010	0.035	0.024	7.91	0.166	<0.100	0.596	1.83
1	Batch 1	1	2	10	BCHLM1-122	<0.100	2.46	0.126	0.845	<0.010	0.02	<0.010	0.072	0.299	9.77	2.89	<0.100	0.827	1.43
1	U std	1	2	11	UstdLM1-122	<0.100	2.04	<0.010	0.886	<0.010	<0.010	<0.010	0.16	<0.010	9.93	2.83	<0.100	0.704	2.34
1	SB4VAR41	1	2	12	M01LM22	<0.100	4.16	0.019	0.608	<0.010	0.019	<0.010	0.037	0.018	6.42	0.105	<0.100	0.488	1.49
1	SB4VAR22	1	2	13	M12LM12	<0.100	4.77	0.023	0.668	<0.010	0.016	<0.010	0.044	0.021	7.64	0.102	<0.100	0.586	1.71
1	SB4VAR42	1	2	14	M05LM22	<0.100	4.58	0.021	0.65	<0.010	0.02	<0.010	0.038	0.021	7.47	0.105	<0.100	0.555	1.73
1	SB4VAR12	1	2	15	M15LM12	<0.100	5.02	0.021	0.709	<0.010	0.017	<0.010	0.041	0.022	8.33	0.125	<0.100	0.576	1.89
1	SB4VAR43	1	2	16	M06LM22	<0.100	4.96	0.026	0.697	<0.010	0.022	<0.010	0.035	0.023	8.38	0.112	<0.100	0.602	1.96
1	SB4VAR41	1	2	17	M01LM12	<0.100	4.38	0.02	0.604	<0.010	0.019	<0.010	0.038	0.019	6.71	0.103	<0.100	0.509	1.56
1	SB4VAR54	1	2	18	M03LM12	<0.100	5.2	0.023	0.733	<0.010	0.022	<0.010	0.041	0.024	7.95	0.117	<0.100	0.618	1.84
1	Batch 1	1	2	19	BCHLM1-123	<0.100	2.47	0.123	0.842	<0.010	0.019	<0.010	0.071	0.295	8.88	2.94	<0.100	0.817	1.3
1	U std	1	2	20	UstdLM1-123	<0.100	2.04	<0.010	0.881	<0.010	<0.010	<0.010	0.158	<0.010	9.15	2.83	<0.100	0.699	2.15
1	Batch 1	2	1	1	BCHLM1-211	<0.100	2.52	0.126	0.853	<0.010	0.02	<0.010	0.072	0.3	8.72	3.01	<0.100	0.814	1.32
1	U std	2	1	2	UstdLM1-211	<0.100	2.08	<0.010	0.908	<0.010	<0.010	<0.010	0.16	<0.010	8.99	2.93	<0.100	0.707	2.15
1	SB4VAR11	2	1	3	M02LM21	<0.100	4.5	0.02	0.632	<0.010	0.017	<0.010	0.04	0.02	6.4	0.1	<0.100	0.54	1.46
1	SB4VAR53	2	1	4	M11LM11	<0.100	4.84	0.023	0.708	<0.010	0.02	<0.010	0.041	0.022	6.95	0.156	<0.100	0.567	1.65
1	SB4VAR44	2	1	5	M08LM11	<0.100	5.44	0.026	0.773	<0.010	0.022	<0.010	0.042	0.025	7.66	0.13	<0.100	0.634	1.85
1	SB4VAR52	2	1	6	M09LM11	<0.100	4.61	0.021	0.643	<0.010	0.019	<0.010	0.039	0.02	6.58	0.098	<0.100	0.549	1.56
1	SB4VAR13	2	1	7	M14LM21	<0.100	5.46	0.026	0.769	<0.010	0.02	<0.010	0.042	0.025	7.8	0.113	<0.100	0.667	1.81
1	SB4VAR23	2	1	8	M10LM11	<0.100	5.66	0.024	0.734	<0.010	0.017	<0.010	0.039	0.025	7.23	0.114	<0.100	0.63	1.69
1	SB4VAR23	2	1	9	M10LM21	<0.100	5.12	0.023	0.726	<0.010	0.017	<0.010	0.037	0.023	7.29	0.122	<0.100	0.604	1.71
1	SB4VAR24	2	1	10	M07LM11	<0.100	5.62	0.025	0.812	<0.010	0.021	<0.010	0.04	0.025	7.68	0.15	<0.100	0.642	1.84
1	Batch 1	2	1	11	BCHLM1-212	<0.100	2.53	0.126	0.838	<0.010	0.019	<0.010	0.072	0.299	8.32	3.02	<0.100	0.81	1.26
1	U std	2	1	12	UstdLM1-212	<0.100	2.08	<0.010	0.907	<0.010	<0.010	<0.010	0.159	<0.010	8.51	2.89	<0.100	0.694	2.05

Table A1. Measured Elemental Concentrations (wt%) for Samples Prepared Using Lithium Metaborate (part 1)

Set	Glass ID	Block	Sub-Block	Sequence	Lab ID	Ag (wt%)	Al (wt%)	Ba (wt%)	Ca (wt%)	Cd (wt%)	Ce (wt%)	Co (wt%)	Cr (wt%)	Cu (wt%)	Fe (wt%)	K (wt%)	La (wt%)	Mg (wt%)	Mn (wt%)
1	SB4VAR13	2	1	13	M14LM11	<0.100	5.49	0.026	0.777	<0.010	0.021	<0.010	0.042	0.024	7.59	0.116	<0.100	0.674	1.76
1	SB4VAR11	2	1	14	M02LM11	<0.100	4.5	0.019	0.632	<0.010	0.016	<0.010	0.038	0.019	6.06	0.111	<0.100	0.518	1.4
1	SB4VAR21	2	1	15	M13LM21	<0.100	4.42	0.021	0.633	<0.010	0.015	<0.010	0.038	0.02	5.86	0.099	<0.100	0.522	1.36
1	SB4VAR53	2	1	16	M11LM21	<0.100	4.79	0.023	0.712	<0.010	0.02	<0.010	0.04	0.024	6.65	0.117	<0.100	0.567	1.59
1	SB4VAR52	2	1	17	M09LM21	<0.100	4.43	0.021	0.64	<0.010	0.019	<0.010	0.039	0.02	6.29	0.095	<0.100	0.536	1.49
1	SB4VAR44	2	1	18	M08LM21	<0.100	5.28	0.026	0.765	<0.010	0.022	<0.010	0.048	0.024	7.05	0.117	<0.100	0.638	1.7
1	SB4VAR24	2	1	19	M07LM21	<0.100	5.56	0.025	0.807	<0.010	0.021	<0.010	0.042	0.025	7.74	0.18	<0.100	0.663	1.84
1	SB4VAR21	2	1	20	M13LM11	<0.100	4.38	0.021	0.624	<0.010	0.015	<0.010	0.038	0.02	6.1	0.098	<0.100	0.526	1.41
1	Batch 1	2	1	21	BCHLM1-213	<0.100	2.51	0.125	0.854	<0.010	0.019	<0.010	0.072	0.303	8.45	2.96	<0.100	0.812	1.28
1	U std	2	1	22	UstdLM1-213	<0.100	2.06	<0.010	0.911	<0.010	<0.010	<0.010	0.157	<0.010	8.7	2.84	<0.100	0.689	2.08
1	Batch 1	2	2	1	BCHLM1-221	<0.100	2.51	0.128	0.847	<0.010	0.019	<0.010	0.073	0.299	8.82	2.98	<0.100	0.815	1.34
1	U std	2	2	2	UstdLM1-221	<0.100	2.06	<0.010	0.924	<0.010	<0.010	<0.010	0.158	<0.010	8.96	2.84	<0.100	0.698	2.14
1	SB4VAR24	2	2	3	M07LM22	<0.100	5.68	0.027	0.807	<0.010	0.021	<0.010	0.043	0.024	7.84	0.18	<0.100	0.666	1.87
1	SB4VAR13	2	2	4	M14LM12	<0.100	5.51	0.028	0.789	<0.010	0.02	<0.010	0.042	0.024	7.81	0.118	<0.100	0.676	1.8
1	SB4VAR24	2	2	5	M07LM12	<0.100	5.64	0.026	0.822	<0.010	0.021	<0.010	0.041	0.025	7.91	0.151	<0.100	0.639	1.89
1	SB4VAR23	2	2	6	M10LM12	<0.100	5.81	0.025	0.752	<0.010	0.017	<0.010	0.038	0.025	7.39	0.117	<0.100	0.628	1.72
1	SB4VAR52	2	2	7	M09LM12	<0.100	4.62	0.023	0.642	<0.010	0.019	<0.010	0.04	0.02	6.72	0.096	<0.100	0.549	1.59
1	SB4VAR21	2	2	8	M13LM22	<0.100	4.42	0.023	0.617	<0.010	0.014	<0.010	0.038	0.02	6.28	0.095	<0.100	0.528	1.45
1	SB4VAR23	2	2	9	M10LM22	<0.100	5.2	0.024	0.739	<0.010	0.017	<0.010	0.037	0.023	7.3	0.124	<0.100	0.602	1.71
1	SB4VAR11	2	2	10	M02LM12	<0.100	4.53	0.021	0.631	<0.010	0.016	<0.010	0.038	0.019	6.35	0.11	<0.100	0.518	1.46
1	Batch 1	2	2	11	BCHLM1-222	<0.100	2.65	0.128	0.846	<0.010	0.019	<0.010	0.073	0.301	8.77	3.01	<0.100	0.823	1.34
1	U std	2	2	12	UstdLM1-222	<0.100	2.1	<0.010	0.89	<0.010	<0.010	<0.010	0.16	<0.010	8.85	2.86	<0.100	0.701	2.12
1	SB4VAR53	2	2	13	M11LM22	<0.100	4.87	0.025	0.702	<0.010	0.02	<0.010	0.041	0.023	6.66	0.115	<0.100	0.568	1.59
1	SB4VAR44	2	2	14	M08LM12	<0.100	5.59	0.027	0.774	<0.010	0.022	<0.010	0.042	0.025	7.26	0.129	<0.100	0.635	1.77
1	SB4VAR52	2	2	15	M09LM22	<0.100	4.5	0.023	0.634	<0.010	0.019	<0.010	0.039	0.02	6.26	0.093	<0.100	0.54	1.48
1	SB4VAR11	2	2	16	M02LM22	<0.100	4.54	0.022	0.628	<0.010	0.016	<0.010	0.04	0.02	6.43	0.098	<0.100	0.541	1.48
1	SB4VAR44	2	2	17	M08LM22	<0.100	5.4	0.028	0.763	<0.010	0.022	<0.010	0.049	0.024	7.6	0.116	<0.100	0.65	1.84
1	SB4VAR21	2	2	18	M13LM12	<0.100	4.49	0.023	0.629	<0.010	0.014	<0.010	0.038	0.02	6.3	0.096	<0.100	0.531	1.46
1	SB4VAR13	2	2	19	M14LM22	<0.100	5.54	0.027	0.77	<0.010	0.02	<0.010	0.042	0.024	7.85	0.115	<0.100	0.663	1.82
1	SB4VAR53	2	2	20	M11LM12	<0.100	4.91	0.024	0.712	<0.010	0.019	<0.010	0.04	0.022	6.95	0.159	<0.100	0.568	1.65
1	Batch 1	2	2	21	BCHLM1-223	<0.100	2.5	0.127	0.859	<0.010	0.019	<0.010	0.072	0.301	8.21	2.88	<0.100	0.813	1.25
1	U std	2	2	22	UstdLM1-223	<0.100	2.12	<0.010	0.895	<0.010	<0.010	<0.010	0.156	<0.010	8.96	2.88	<0.100	0.694	2.14
2	Batch 1	1	1	1	BCHLM2-111		2.49	0.126	0.834	<0.010	0.011	<0.010	0.073	0.295	9.33	2.49	<0.100	0.819	1.42
2	U std	1	1	2	UstdLM2-111		2.03	<0.010	0.892	<0.010	0.001	<0.010	0.162	<0.010	9.5	2.22	<0.100	0.71	2.27
2	SB5-01	1	1	3	N02LM11		5.73	0.031	2.41	0.014	0.084	<0.010	0.077	<0.010	6.26	0.014	<0.100	0.263	1.51
2	SB5-05	1	1	4	N07LM11		5.12	0.035	2.5	0.013	0.052	<0.010	0.087	<0.010	6.87	0.013	<0.100	0.296	1.66
2	SB5-04	1	1	5	N03LM21		5.89	0.033	0.463	0.016	0.057	<0.010	0.077	0.01	6.15	0.012	<0.100	0.273	1.5
2	SB5-04	1	1	6	N03LM11		5.9	0.033	0.47	0.016	0.058	<0.010	0.078	0.011	6.09	0.012	<0.100	0.276	1.5
2	SB5-12	1	1	7	N13LM21		4.21	0.038	0.568	0.017	0.126	<0.010	0.109	0.011	6.85	0.016	<0.100	0.326	1.71
2	SB5-02	1	1	8	N12LM21		5.76	0.032	1.47	0.014	0.083	<0.010	0.08	<0.010	5.79	0.012	<0.100	0.271	1.43
2	SB5-11	1	1	9	N14LM11		4.18	0.037	1.57	0.018	0.126	<0.010	0.098	0.011	6.54	0.016	<0.100	0.316	1.63
2	SB5-07	1	1	10	N15LM21		5.07	0.035	1.5	0.015	0.083	<0.010	0.086	0.01	6.51	0.018	<0.100	0.295	1.6
2	Batch 1	1	1	11	BCHLM2-112		2.44	0.126	0.839	<0.010	0.011	<0.010	0.074	0.298	9.18	2.51	<0.100	0.824	1.4
2	U std	1	1	12	UstdLM1-112		2.04	<0.010	0.89	<0.010	0.066	<0.010	0.162	<0.010	9.47	2.22	<0.100	0.705	2.28
2	SB5-02	1	1	13	N12LM11		5.75	0.032	1.43	0.014	0.084	<0.010	0.083	<0.010	6	0.011	<0.100	0.271	1.47
2	SB5-11	1	1	14	N14LM21		4.13	0.038	1.56	0.018	0.126	<0.010	0.096	0.011	6.96	0.017	<0.100	0.322	1.75
2	SB4VAR33	1	1	15	N05LM21		5.18	0.023	0.747	<0.010	0.019	<0.010	0.038	0.024	7.44	0.126	<0.100	0.619	1.76
2	SB5-05	1	1	16	N07LM21		5.11	0.034	2.55	0.012	0.051	<0.010	0.085	<0.010	6.42	0.017	<0.100	0.289	1.56
2	SB5-12	1	1	17	N13LM11		4.18	0.038	0.576	0.017	0.125	<0.010	0.109	0.01	6.82	0.016	<0.100	0.325	1.71
2	SB4VAR33	1	1	18	N05LM11		5.17	0.023	0.745	<0.010	0.02	<0.010	0.038	0.023	7.58	0.117	<0.100	0.635	1.79
2	SB5-01	1	1	19	N02LM21		5.96	0.032	2.56	0.014	0.087	<0.010	0.078	<0.010	6.32	0.013	<0.100	0.271	1.53
2	SB5-07	1	1	20	N15LM11		5.03	0.035	1.54	0.016	0.085	<0.010	0.089	0.014	6.75	0.014	<0.100	0.305	1.65

Table A1. Measured Elemental Concentrations (wt%) for Samples Prepared Using Lithium Metaborate (part 1)

Set	Glass ID	Block	Sub-Block	Sequence	Lab ID	Ag (wt%)	Al (wt%)	Ba (wt%)	Ca (wt%)	Cd (wt%)	Ce (wt%)	Co (wt%)	Cr (wt%)	Cu (wt%)	Fe (wt%)	K (wt%)	La (wt%)	Mg (wt%)	Mn (wt%)
2	Batch 1	1	1	21	BCHLM2-113		2.53	0.126	0.85	<0.010	0.011	<0.010	0.073	0.3	9.28	2.51	<0.100	0.827	1.41
2	U std	1	1	22	UstdLM2-113		2.04	<0.010	0.896	<0.010	0.073	<0.010	0.161	<0.010	9.5	2.22	<0.100	0.702	2.28
2	Batch 1	1	2	1	BCHLM2-121		2.49	0.126	0.84	<0.010	0.01	<0.010	0.073	0.3	8.63	2.49	<0.100	0.828	1.3
2	U std	1	2	2	UstdLM2-121		2.03	<0.010	0.892	<0.010	0	<0.010	0.161	<0.010	8.72	2.21	<0.100	0.707	2.08
2	SB5-12	1	2	3	N13LM22		4.13	0.037	0.568	0.015	0.125	<0.010	0.108	0.011	6.48	0.016	<0.100	0.326	1.61
2	SB5-05	1	2	4	N07LM22		5.02	0.032	2.46	0.009	0.05	<0.010	0.083	<0.010	6.47	0.017	<0.100	0.286	1.55
2	SB4VAR33	1	2	5	N05LM22		5.19	0.021	0.747	<0.010	0.019	<0.010	0.037	0.023	7.43	0.127	<0.100	0.62	1.74
2	SB4VAR33	1	2	6	N05LM12		5.17	0.022	0.734	<0.010	0.019	<0.010	0.038	0.022	7.57	0.114	<0.100	0.629	1.76
2	SB5-01	1	2	7	N02LM12		5.83	0.029	2.33	0.011	0.082	<0.010	0.074	<0.010	5.8	0.013	<0.100	0.257	1.39
2	SB5-04	1	2	8	N03LM12		5.83	0.032	0.464	0.014	0.057	<0.010	0.077	0.011	5.95	0.012	<0.100	0.273	1.44
2	SB5-01	1	2	9	N02LM22		5.87	0.03	2.42	0.012	0.085	<0.010	0.077	<0.010	5.87	0.012	<0.100	0.267	1.41
2	SB5-07	1	2	10	N15LM12		4.9	0.033	1.48	0.013	0.084	<0.010	0.086	0.014	6.5	0.014	<0.100	0.299	1.57
2	Batch 1	1	2	11	BCHLM2-122		2.44	0.123	0.832	<0.010	0.01	<0.010	0.071	0.298	8.95	2.47	<0.100	0.817	1.34
2	U std	1	2	12	UstdLM2-122		2.07	<0.010	0.882	<0.010	0.028	<0.010	0.157	<0.010	9.5	2.18	<0.100	0.688	2.26
2	SB5-04	1	2	13	N03LM22		5.76	0.031	0.469	0.013	0.056	<0.010	0.075	0.01	6.19	0.012	<0.100	0.264	1.5
2	SB5-11	1	2	14	N14LM22		4.17	0.037	1.52	0.016	0.125	<0.010	0.094	0.011	6.83	0.017	<0.100	0.317	1.68
2	SB5-05	1	2	15	N07LM12		5.03	0.034	2.43	0.01	0.052	<0.010	0.087	<0.010	6.64	0.013	<0.100	0.299	1.59
2	SB5-02	1	2	16	N12LM12		5.7	0.031	1.38	0.012	0.082	<0.010	0.083	<0.010	5.89	0.011	<0.100	0.274	1.42
2	SB5-11	1	2	17	N14LM12		4.09	0.037	1.47	0.016	0.126	<0.010	0.099	0.011	6.65	0.016	<0.100	0.325	1.63
2	SB5-02	1	2	18	N12LM22		5.66	0.031	1.37	0.012	0.083	<0.010	0.081	<0.010	5.73	0.012	<0.100	0.276	1.38
2	SB5-12	1	2	19	N13LM12		4.11	0.037	0.569	0.015	0.125	<0.010	0.109	0.01	7.43	0.016	<0.100	0.329	1.83
2	SB5-07	1	2	20	N15LM22		5.01	0.034	1.46	0.013	0.082	<0.010	0.086	0.01	7.13	0.017	<0.100	0.297	1.72
2	Batch 1	1	2	21	BCHLM2-123		2.53	0.126	0.832	<0.010	0.01	<0.010	0.073	0.295	9.61	2.45	<0.100	0.832	1.44
2	U std	1	2	22	UstdLM2-123		2.04	<0.010	0.877	<0.010	0	<0.010	0.164	<0.010	9.81	2.16	<0.100	0.724	2.3
2	Batch 1	2	1	1	BCHLM2-211		2.49	0.129	0.873	<0.010	0.013	<0.010	0.075	0.311	8.99	2.6	<0.100	0.826	1.35
2	U std	2	1	2	UstdLM2-211		2.04	<0.010	0.927	<0.010	0.002	<0.010	0.163	<0.010	9.32	2.31	<0.100	0.704	2.21
2	SB4VAR32	2	1	3	N11LM21		4.66	0.022	0.722	<0.010	0.018	<0.010	0.041	0.023	6.82	0.119	<0.100	0.563	1.58
2	SB4VAR31	2	1	4	N06LM11		4.14	0.021	0.628	<0.010	0.018	<0.010	0.038	0.02	6.01	0.091	<0.100	0.53	1.39
2	SB5-03	2	1	5	N09LM11		5.72	0.033	1.38	0.014	0.089	<0.010	0.08	0.012	6.05	0.01	<0.100	0.271	1.47
2	SB5-09	2	1	6	N04LM11		4.17	0.036	2.43	0.015	0.084	<0.010	0.09	0.011	7.38	0.021	<0.100	0.315	1.75
2	SB5-03	2	1	7	N09LM21		5.79	0.034	1.39	0.014	0.091	<0.010	0.082	0.013	6.37	0.008	<0.100	0.278	1.55
2	SB4VAR32	2	1	8	N11LM11		4.75	0.022	0.711	<0.010	0.018	<0.010	0.047	0.022	7.6	0.116	<0.100	0.569	1.74
2	SB5-10	2	1	9	N08lLM11		4.27	0.038	1.57	0.018	0.126	<0.010	0.084	0.011	7.55	0.019	<0.100	0.316	1.85
2	Batch 1	2	1	10	BCHLM2-212		2.52	0.127	0.867	<0.010	0.013	<0.010	0.074	0.305	9.48	2.6	<0.100	0.818	1.42
2	U std	2	1	11	UstdLM2-212		2.05	<0.010	0.944	<0.010	0.002	<0.010	0.166	<0.010	9.23	2.36	<0.100	0.719	2.19
2	SB5-08	2	1	12	N10LM21		4.83	0.037	0.533	0.014	0.056	<0.010	0.088	0.01	6.6	0.012	<0.100	0.299	1.58
2	SB5-06	2	1	13	N01LM11		4.99	0.037	1.42	0.015	0.094	<0.010	0.083	0.011	6.88	0.013	<0.100	0.305	1.65
2	SB4VAR31	2	1	14	N06LM21		4.22	0.021	0.636	<0.010	0.018	<0.010	0.038	0.02	6.42	0.106	<0.100	0.514	1.49
2	SB5-10	2	1	15	N08LM21		4.17	0.039	1.46	0.018	0.128	<0.010	0.085	0.011	7	0.018	<0.100	0.32	1.72
2	SB5-08	2	1	16	N10LM11		5.03	0.038	0.564	0.016	0.056	<0.010	0.093	0.012	6.72	0.078	<0.100	0.31	1.61
2	SB5-09	2	1	17	N04LM21		4.16	0.038	2.3	0.016	0.088	<0.010	0.094	0.011	7.16	0.016	<0.100	0.329	1.68
2	SB5-06	2	1	18	N01LM21		5.21	0.033	1.54	0.013	0.088	<0.010	0.075	0.01	6.75	0.013	<0.100	0.278	1.52
2	Batch 1	2	1	19	BCHLM2-213		2.54	0.129	0.881	<0.010	0.013	<0.010	0.075	0.313	9.36	2.63	<0.100	0.824	1.41
2	U std	2	1	20	UstdLM2-213		2.05	<0.010	0.933	<0.010	0.002	<0.010	0.165	<0.010	9.92	2.33	<0.100	0.71	2.35
2	Batch 1	2	2	1	BCHLM2-221		2.62	0.127	0.853	<0.010	0.01	<0.010	0.073	0.302	8.77	2.53	<0.100	0.836	1.31
2	U std	2	2	2	UstdLM2-221		2.21	<0.010	0.906	<0.010	<0.010	<0.010	0.163	<0.010	9.38	2.23	<0.100	0.721	2.22
2	SB4VAR31	2	2	3	N06LM22		4.4	0.019	0.622	<0.010	0.015	<0.010	0.035	0.016	6.11	0.104	<0.100	0.517	1.41
2	SB4VAR32	2	2	4	N11LM22		4.91	0.02	0.692	<0.010	0.016	<0.010	0.039	0.018	7.18	0.11	<0.100	0.578	1.64
2	SB5-10	2	2	5	N08LM12		4.39	0.036	1.6	0.015	0.121	<0.010	0.081	<0.010	7.16	0.018	<0.100	0.314	1.74
2	SB5-06	2	2	6	N01LM22		5.21	0.033	1.56	0.011	0.089	<0.010	0.078	<0.010	6.74	0.012	<0.100	0.297	1.6
2	SB4VAR31	2	2	7	N06LM12		4.37	0.019	0.609	<0.010	0.016	<0.010	0.036	0.016	6.15	0.087	<0.100	0.538	1.41
2	SB5-09	2	2	8	N04LM12		4.43	0.034	2.59	0.012	0.081	<0.010	0.089	<0.010	7.28	0.021	<0.100	0.32	1.71

Table A1. Measured Elemental Concentrations (wt%) for Samples Prepared Using Lithium Metaborate (part 1)

Set	Glass ID	Block	Sub-Block	Sequence	Lab ID	Ag (wt%)	Al (wt%)	Ba (wt%)	Ca (wt%)	Cd (wt%)	Ce (wt%)	Co (wt%)	Cr (wt%)	Cu (wt%)	Fe (wt%)	K (wt%)	La (wt%)	Mg (wt%)	Mn (wt%)
2	SB5-08	2	2	9	N10LM12		5.27	0.037	0.541	0.014	0.052	<0.010	0.092	<0.010	6.73	0.073	<0.100	0.314	1.59
2	Batch 1	2	2	10	BCHLM2-222		2.66	0.128	0.859	<0.010	0.01	<0.010	0.073	0.304	8.91	2.53	<0.100	0.843	1.31
2	U std	2	2	11	UstdLM2-222		2.2	<0.010	0.928	<0.010	<0.010	<0.010	0.164	<0.010	9.39	2.26	<0.100	0.731	2.2
2	SB5-03	2	2	12	N09LM12		6.14	0.032	1.55	0.012	0.086	<0.010	0.081	<0.010	5.85	0.008	<0.100	0.282	1.41
2	SB5-10	2	2	13	N08LM22		4.41	0.037	1.62	0.016	0.122	<0.010	0.085	<0.010	6.99	0.015	<0.100	0.33	1.71
2	SB5-09	2	2	14	N04LM22		4.34	0.038	2.58	0.014	0.085	<0.010	0.096	<0.010	6.63	0.014	<0.100	0.348	1.57
2	SB5-03	2	2	15	N09LM22		5.96	0.034	1.51	0.013	0.089	<0.010	0.085	<0.010	5.59	0.007	<0.100	0.298	1.36
2	SB5-08	2	2	16	N10LM22		5.01	0.037	0.513	0.012	0.054	<0.010	0.089	<0.010	6.59	0.01	<0.100	0.314	1.48
2	SB5-06	2	2	17	N01LM12		5.19	0.036	1.56	0.012	0.092	<0.010	0.083	<0.010	6.51	0.012	<0.100	0.315	1.56
2	SB4VAR32	2	2	18	N11LM12		4.92	0.021	0.677	<0.010	0.016	<0.010	0.046	0.018	6.72	0.106	<0.100	0.6	1.55
2	Batch 1	2	2	19	BCHLM2-223		2.62	0.134	0.833	<0.010	0.011	<0.010	0.077	0.304	8.91	2.48	<0.100	0.888	1.34
2	U std	2	2	20	UstdLM2-223		2.2	<0.010	0.881	<0.010	<0.010	<0.010	0.173	<0.010	9.16	2.17	<0.100	0.767	2.18

Table A2. Measured Elemental Concentrations (wt%) for Samples Prepared Using Lithium Metaborate (part 2)

Set	Glass ID	Block	Sub-Block	Sequence	Lab ID	Na (wt%)	Nb (wt%)	Ni (wt%)	P (wt%)	Pb (wt%)	S (wt%)	Si (wt%)	Sr (wt%)	Th (wt%)	Ti (wt%)	U (wt%)	Zn (wt%)	Zr (wt%)
1	Batch 1	1	1	1	BCHLM1-111	6.68	0.035	0.549	<0.100	<0.020	<0.100		<0.010	<0.100	0.389	<0.100	<0.010	0.062
1	U std	1	1	2	UstdLM1-111	8.71	0.052	0.789	<0.100	<0.020	<0.100		<0.010	<0.100	0.565	1.97	<0.010	<0.010
1	SB4VAR51	1	1	3	M04LM11	8.83	0.025	0.355	<0.100	0.02	0.109		<0.010	<0.100	0.238	2.21	0.013	0.016
1	SB4VAR42	1	1	4	M05LM11	8.51	0.028	0.408	<0.100	0.023	0.116		<0.010	<0.100	0.267	2.52	0.017	0.019
1	SB4VAR43	1	1	5	M06LM21	8.82	0.032	0.445	<0.100	0.024	0.135		<0.010	<0.100	0.314	2.81	0.019	0.02
1	SB4VAR41	1	1	6	M01LM21	8.64	0.025	0.363	<0.100	0.02	0.11		<0.010	<0.100	0.238	2.38	0.014	0.019
1	SB4VAR54	1	1	7	M03LM11	9.93	0.033	0.46	<0.100	0.025	0.144		<0.010	<0.100	0.32	2.9	0.023	0.024
1	SB4VAR51	1	1	8	M04LM21	9.23	0.025	0.352	<0.100	0.02	0.113		<0.010	<0.100	0.242	2.29	0.014	0.019
1	SB4VAR54	1	1	9	M03LM21	9.88	0.033	0.46	<0.100	0.025	0.147		<0.010	<0.100	0.32	2.88	0.022	0.024
1	Batch 1	1	1	10	BCHLM1-112	6.85	0.034	0.564	<0.100	<0.020	<0.100		<0.010	<0.100	0.395	<0.100	<0.010	0.064
1	U std	1	1	11	UstdLM1-112	8.64	0.052	0.818	<0.100	<0.020	<0.100		<0.010	<0.100	0.578	2	<0.010	<0.010
1	SB4VAR41	1	1	12	M01LM11	8.55	0.026	0.375	<0.100	0.021	0.112		<0.010	<0.100	0.243	2.35	0.015	0.019
1	SB4VAR22	1	1	13	M12LM11	8.29	<0.020	0.436	<0.100	0.023	0.117		<0.010	<0.100	0.015	2.6	0.018	0.016
1	SB4VAR43	1	1	14	M06LM11	8.78	0.033	0.462	<0.100	0.026	0.14		<0.010	<0.100	0.312	2.73	0.021	0.021
1	SB4VAR12	1	1	15	M15LM11	9.54	<0.020	0.425	<0.100	0.02	0.15		<0.010	<0.100	0.012	2.73	0.017	0.02
1	SB4VAR22	1	1	16	M12LM21	8.27	<0.020	0.428	<0.100	0.022	0.114		<0.010	<0.100	0.015	2.58	0.017	0.016
1	SB4VAR12	1	1	17	M15LM21	9.44	<0.020	0.441	<0.100	0.021	0.152		<0.010	<0.100	0.013	2.73	0.018	0.021
1	SB4VAR42	1	1	18	M05LM21	8.36	0.029	0.419	<0.100	0.023	0.122		<0.010	<0.100	0.274	2.48	0.019	0.02
1	Batch 1	1	1	19	BCHLM1-113	6.84	0.035	0.57	<0.100	<0.020	<0.100		<0.010	<0.100	0.4	<0.100	<0.010	0.065
1	U std	1	1	20	UstdLM1-113	8.63	0.052	0.812	<0.100	<0.020	<0.100		<0.010	<0.100	0.574	2.01	<0.010	<0.010
1	Batch 1	1	2	1	BCHLM1-121	6.56	0.039	0.557	<0.100	<0.020	<0.100		<0.010	<0.100	0.388	<0.100	<0.010	0.063
1	U std	1	2	2	UstdLM1-121	8.53	0.056	0.793	<0.100	<0.020	<0.100		<0.010	<0.100	0.552	1.93	<0.010	<0.010
1	SB4VAR22	1	2	3	M12LM22	8.31	<0.020	0.411	<0.100	0.022	0.114		<0.010	<0.100	0.017	2.58	0.016	0.016
1	SB4VAR42	1	2	4	M05LM12	8.63	0.032	0.401	<0.100	0.023	0.115		<0.010	<0.100	0.265	2.46	0.017	0.019
1	SB4VAR51	1	2	5	M04LM22	9.11	0.029	0.342	<0.100	<0.020	0.111		<0.010	<0.100	0.234	2.18	0.014	0.019
1	SB4VAR54	1	2	6	M03LM22	9.88	0.036	0.448	<0.100	0.025	0.14		<0.010	<0.100	0.31	2.76	0.021	0.024
1	SB4VAR51	1	2	7	M04LM12	8.93	0.029	0.347	<0.100	0.02	0.107		<0.010	<0.100	0.234	2.14	0.013	0.017
1	SB4VAR12	1	2	8	M15LM22	9.08	<0.020	0.426	<0.100	0.02	0.148		<0.010	<0.100	0.015	2.56	0.017	0.021
1	SB4VAR43	1	2	9	M06LM12	8.44	0.036	0.443	<0.100	0.024	0.13		<0.010	<0.100	0.306	2.63	0.021	0.021
1	Batch 1	1	2	10	BCHLM1-122	6.35	0.038	0.551	<0.100	<0.020	<0.100		<0.010	<0.100	0.385	<0.100	<0.010	0.064
1	U std	1	2	11	UstdLM1-122	8.42	0.055	0.792	<0.100	<0.020	<0.100		<0.010	<0.100	0.557	1.92	<0.010	<0.010
1	SB4VAR41	1	2	12	M01LM22	8.08	0.029	0.351	<0.100	0.02	0.109		<0.010	<0.100	0.231	2.21	0.014	0.019
1	SB4VAR22	1	2	13	M12LM12	8	<0.020	0.418	<0.100	0.022	0.114		<0.010	<0.100	0.017	2.56	0.017	0.016
1	SB4VAR42	1	2	14	M05LM22	8.25	0.032	0.404	<0.100	0.023	0.115		<0.010	<0.100	0.267	2.46	0.019	0.02
1	SB4VAR12	1	2	15	M15LM12	9.07	<0.020	0.406	<0.100	<0.020	0.143		<0.010	<0.100	0.015	2.69	0.017	0.02
1	SB4VAR43	1	2	16	M06LM22	8.44	0.036	0.437	<0.100	0.024	0.129		<0.010	<0.100	0.305	2.71	0.019	0.02
1	SB4VAR41	1	2	17	M01LM12	8.51	0.029	0.366	<0.100	0.02	0.11		<0.010	<0.100	0.238	2.36	0.015	0.019
1	SB4VAR54	1	2	18	M03LM12	9.73	0.037	0.449	<0.100	0.025	0.143		<0.010	<0.100	0.313	2.82	0.023	0.024
1	Batch 1	1	2	19	BCHLM1-123	6.53	0.037	0.543	<0.100	<0.020	<0.100		<0.010	<0.100	0.384	<0.100	<0.010	0.063
1	U std	1	2	20	UstdLM1-123	8.43	0.055	0.782	<0.100	<0.020	<0.100		<0.010	<0.100	0.552	1.91	<0.010	<0.010
1	Batch 1	2	1	1	BCHLM1-211	6.6	0.036	0.547	<0.100	<0.020	<0.100		<0.010	<0.100	0.387	<0.100	<0.010	0.064
1	U std	2	1	2	UstdLM1-211	8.67	0.053	0.788	<0.100	<0.020	<0.100		<0.010	<0.100	0.558	1.96	<0.010	<0.010
1	SB4VAR11	2	1	3	M02LM21	9.16	<0.020	0.388	<0.100	0.022	0.14		<0.010	<0.100	0.011	2.4	0.019	0.02
1	SB4VAR53	2	1	4	M11LM11	9.8	0.031	0.428	<0.100	0.025	0.13		<0.010	<0.100	0.286	2.58	0.019	0.022
1	SB4VAR44	2	1	5	M08LM11	9.06	0.032	0.438	<0.100	0.028	0.139		<0.010	<0.100	0.3	2.9	0.024	0.023
1	SB4VAR52	2	1	6	M09LM11	9.49	0.03	0.404	<0.100	0.022	0.125		<0.010	<0.100	0.276	2.47	0.019	0.02
1	SB4VAR13	2	1	7	M14LM21	9.68	<0.020	0.465	<0.100	0.028	0.17		<0.010	<0.100	0.014	2.95	0.022	0.024

Table A2. Measured Elemental Concentrations (wt%) for Samples Prepared Using Lithium Metaborate (part 2)

Set	Glass ID	Block	Sub-Block	Sequence	Lab ID	Na (wt%)	Nb (wt%)	Ni (wt%)	P (wt%)	Pb (wt%)	S (wt%)	Si (wt%)	Sr (wt%)	Th (wt%)	Ti (wt%)	U (wt%)	Zn (wt%)	Zr (wt%)
1	SB4VAR23	2	1	8	M10LM11	8.32	<0.020	0.438	<0.100	0.025	0.121		<0.010	<0.100	0.014	2.75	0.021	0.022
1	SB4VAR23	2	1	9	M10LM21	8.27	<0.020	0.418	<0.100	0.024	0.116		<0.010	<0.100	0.014	2.7	0.02	0.02
1	SB4VAR24	2	1	10	M07LM11	8.6	<0.020	0.419	<0.100	0.027	0.126		<0.010	<0.100	0.013	2.96	0.021	0.024
1	Batch 1	2	1	11	BCHLM1-212	6.63	0.034	0.544	<0.100	<0.020	<0.100		<0.010	<0.100	0.384	<0.100	<0.010	0.064
1	U std	2	1	12	UstdLM1-212	8.54	0.052	0.782	<0.100	<0.020	<0.100		<0.010	<0.100	0.558	1.93	<0.010	<0.010
1	SB4VAR13	2	1	13	M14LM11	9.57	<0.020	0.466	<0.100	0.029	0.17		<0.010	<0.100	0.014	2.93	0.022	0.024
1	SB4VAR11	2	1	14	M02LM11	8.97	<0.020	0.369	<0.100	0.021	0.139		<0.010	<0.100	0.01	2.37	0.016	0.019
1	SB4VAR21	2	1	15	M13LM21	7.93	<0.020	0.373	<0.100	0.021	<0.100		<0.010	<0.100	0.012	2.32	0.016	0.019
1	SB4VAR53	2	1	16	M11LM21	9.33	0.031	0.416	<0.100	0.026	0.127		<0.010	<0.100	0.286	2.56	0.02	0.022
1	SB4VAR52	2	1	17	M09LM21	8.99	0.03	0.394	<0.100	0.023	0.114		<0.010	<0.100	0.273	2.37	0.018	0.022
1	SB4VAR44	2	1	18	M08LM21	8.71	0.033	0.452	<0.100	0.029	0.134		<0.010	<0.100	0.303	2.8	0.024	0.025
1	SB4VAR24	2	1	19	M07LM21	8.45	<0.020	0.444	<0.100	0.029	0.129		<0.010	<0.100	0.014	2.97	0.022	0.024
1	SB4VAR21	2	1	20	M13LM11	7.86	<0.020	0.377	<0.100	0.022	<0.100		<0.010	<0.100	0.012	2.31	0.017	0.02
1	Batch 1	2	1	21	BCHLM1-213	6.51	0.034	0.542	<0.100	<0.020	<0.100		<0.010	<0.100	0.383	<0.100	<0.010	0.064
1	U std	2	1	22	UstdLM1-213	8.42	0.051	0.777	<0.100	<0.020	<0.100		<0.010	<0.100	0.556	1.92	<0.010	<0.010
1	Batch 1	2	2	1	BCHLM1-221	6.72	0.038	0.549	<0.100	<0.020	<0.100		<0.010	<0.100	0.386	<0.100	<0.010	0.063
1	U std	2	2	2	UstdLM1-221	8.61	0.055	0.779	<0.100	<0.020	<0.100		<0.010	<0.100	0.561	1.97	<0.010	<0.010
1	SB4VAR24	2	2	3	M07LM22	8.85	<0.020	0.448	<0.100	0.029	0.127		<0.010	<0.100	0.014	3.05	0.022	0.023
1	SB4VAR13	2	2	4	M14LM12	9.73	<0.020	0.468	<0.100	0.028	0.17		<0.010	<0.100	0.014	2.97	0.022	0.023
1	SB4VAR24	2	2	5	M07LM12	8.72	<0.020	0.418	<0.100	0.027	0.124		<0.010	<0.100	0.013	3.03	0.021	0.023
1	SB4VAR23	2	2	6	M10LM12	8.64	<0.020	0.437	<0.100	0.024	0.117		<0.010	<0.100	0.014	2.82	0.021	0.021
1	SB4VAR52	2	2	7	M09LM12	9.51	0.033	0.403	<0.100	0.023	0.119		<0.010	<0.100	0.276	2.49	0.018	0.019
1	SB4VAR21	2	2	8	M13LM22	8.02	<0.020	0.379	<0.100	0.022	<0.100		<0.010	<0.100	0.012	2.35	0.016	0.018
1	SB4VAR23	2	2	9	M10LM22	8.48	<0.020	0.416	<0.100	0.023	0.114		<0.010	<0.100	0.013	2.78	0.02	0.019
1	SB4VAR11	2	2	10	M02LM12	9.04	<0.020	0.369	<0.100	0.021	0.137		<0.010	<0.100	0.01	2.41	0.016	0.018
1	Batch 1	2	2	11	BCHLM1-222	7.02	0.037	0.548	<0.100	<0.020	<0.100		<0.010	<0.100	0.386	<0.100	<0.010	0.063
1	U std	2	2	12	UstdLM1-222	8.8	0.055	0.794	<0.100	<0.020	<0.100		<0.010	<0.100	0.561	1.97	<0.010	<0.010
1	SB4VAR53	2	2	13	M11LM22	9.6	0.034	0.418	<0.100	0.025	0.127		<0.010	<0.100	0.283	2.63	0.02	0.021
1	SB4VAR44	2	2	14	M08LM12	9.35	0.035	0.44	<0.100	0.028	0.138		<0.010	<0.100	0.298	2.97	0.023	0.022
1	SB4VAR52	2	2	15	M09LM22	9.32	0.033	0.402	<0.100	0.023	0.116		<0.010	<0.100	0.277	2.4	0.018	0.021
1	SB4VAR11	2	2	16	M02LM22	9.23	<0.020	0.391	<0.100	0.022	0.135		<0.010	<0.100	0.01	2.41	0.019	0.019
1	SB4VAR44	2	2	17	M08LM22	9.01	0.036	0.463	<0.100	0.029	0.137		<0.010	<0.100	0.305	2.89	0.024	0.024
1	SB4VAR21	2	2	18	M13LM12	8.25	<0.020	0.38	<0.100	0.021	<0.100		<0.010	<0.100	0.012	2.4	0.017	0.018
1	SB4VAR13	2	2	19	M14LM22	9.91	<0.020	0.461	<0.100	0.028	0.164		<0.010	<0.100	0.013	2.98	0.022	0.023
1	SB4VAR53	2	2	20	M11LM12	10.04	0.033	0.428	<0.100	0.025	0.127		<0.010	<0.100	0.284	2.61	0.019	0.021
1	Batch 1	2	2	21	BCHLM1-223	6.64	0.037	0.544	<0.100	<0.020	<0.100		<0.010	<0.100	0.384	<0.100	<0.010	0.063
1	U std	2	2	22	UstdLM1-223	8.89	0.054	0.771	<0.100	<0.020	<0.100		<0.010	<0.100	0.545	1.99	<0.010	<0.010
2	Batch 1	1	1	1	BCHLM2-111	6.59	0.03	0.551	<0.100	<0.020	<0.100	23.9	<0.010	<0.100	0.387	<0.100	<0.010	0.062
2	U std	1	1	2	UstdLM2-111	8.36	0.048	0.793	<0.100	<0.020	<0.100	21.2	<0.010	<0.100	0.563	1.93	<0.010	<0.010
2	SB5-01	1	1	3	N02LM11	9.83	<0.010	0.705	<0.100	<0.020	<0.100	21.3	0.096	<0.100	<0.010	2.26	<0.010	0.065
2	SB5-05	1	1	4	N07LM11	10.1	<0.010	0.802	<0.100	<0.020	<0.100	21.3	0.108	<0.100	0.01	2.59	<0.010	0.073
2	SB5-04	1	1	5	N03LM21	10.8	<0.010	0.724	<0.100	<0.020	<0.100	20.7	0.089	<0.100	<0.010	2.34	<0.010	0.068
2	SB5-04	1	1	6	N03LM11	10.8	<0.010	0.729	<0.100	<0.020	<0.100	20.8	0.09	<0.100	0.01	2.34	<0.010	0.068
2	SB5-12	1	1	7	N13LM21	10.5	<0.010	0.882	<0.100	<0.020	0.102	20.9	0.109	<0.100	0.011	2.74	<0.010	0.08
2	SB5-02	1	1	8	N12LM21	9.96	<0.010	0.72	<0.100	<0.020	<0.100	21.2	0.09	<0.100	0.011	2.26	<0.010	0.067
2	SB5-11	1	1	9	N14LM11	9.95	<0.010	0.864	<0.100	<0.020	0.102	20.3	0.112	<0.100	0.011	2.67	<0.010	0.082
2	SB5-07	1	1	10	N15LM21	10.1	<0.010	0.778	<0.100	<0.020	<0.100	20.9	0.108	<0.100	0.01	2.58	<0.010	0.071

Table A2. Measured Elemental Concentrations (wt%) for Samples Prepared Using Lithium Metaborate (part 2)

Set	Glass ID	Block	Sub-Block	Sequence	Lab ID	Na (wt%)	Nb (wt%)	Ni (wt%)	P (wt%)	Pb (wt%)	S (wt%)	Si (wt%)	Sr (wt%)	Th (wt%)	Ti (wt%)	U (wt%)	Zn (wt%)	Zr (wt%)
2	Batch 1	1	1	11	BCHLM2-112	6.37	0.029	0.551	<0.100	<0.020	<0.100	23.6	<0.010	<0.100	0.386	<0.100	<0.010	0.063
2	U std	1	1	12	UstdLM1-112	8.42	0.047	0.795	<0.100	<0.020	<0.100	21.4	<0.010	<0.100	0.564	1.93	<0.010	<0.010
2	SB5-02	1	1	13	N12LM11	9.83	<0.010	0.732	<0.100	<0.020	<0.100	21.4	0.091	<0.100	0.011	2.29	<0.010	0.065
2	SB5-11	1	1	14	N14LM21	9.67	<0.010	0.884	<0.100	<0.020	0.104	20.8	0.113	<0.100	0.011	2.69	<0.010	0.082
2	SB4VAR33	1	1	15	N05LM21	9.26	<0.010	0.432	<0.100	0.026	0.127	19.8	<0.010	<0.100	0.013	2.79	<0.010	0.02
2	SB5-05	1	1	16	N07LM21	10.1	<0.010	0.777	<0.100	<0.020	<0.100	20.8	0.11	<0.100	0.011	2.55	<0.010	0.071
2	SB5-12	1	1	17	N13LM11	10.2	<0.010	0.879	<0.100	<0.020	0.1	20.8	0.111	<0.100	0.011	2.71	<0.010	0.079
2	SB4VAR33	1	1	18	N05LM11	9.26	<0.010	0.447	<0.100	0.026	0.124	19.8	<0.010	<0.100	0.014	2.81	<0.010	0.021
2	SB5-01	1	1	19	N02LM21	10.19	<0.010	0.739	<0.100	<0.020	<0.100	21.9	0.099	<0.100	<0.010	2.38	<0.010	0.062
2	SB5-07	1	1	20	N15LM11	9.9	<0.010	0.816	<0.100	<0.020	0.102	21	0.107	<0.100	0.01	2.56	<0.010	0.072
2	Batch 1	1	1	21	BCHLM2-113	6.69	0.029	0.553	<0.100	<0.020	<0.100	24.1	<0.010	<0.100	0.388	<0.100	<0.010	0.064
2	U std	1	1	22	UstdLM2-113	8.37	0.047	0.794	<0.100	<0.020	<0.100	21.3	<0.010	<0.100	0.558	1.94	<0.010	<0.010
2	Batch 1	1	2	1	BCHLM2-121	6.6	0.029	0.551	<0.100	<0.020	<0.100	23.2	<0.010	<0.100	0.389	<0.100	<0.010	0.062
2	U std	1	2	2	UstdLM2-121	8.56	0.047	0.79	<0.100	<0.020	<0.100	21.5	<0.010	<0.100	0.564	1.94	<0.010	<0.010
2	SB5-12	1	2	3	N13LM22	10.3	<0.010	0.878	<0.100	<0.020	<0.100	21.2	0.108	<0.100	<0.010	2.69	<0.010	0.078
2	SB5-05	1	2	4	N07LM22	10	<0.010	0.772	<0.100	<0.020	<0.100	20.6	0.109	<0.100	<0.010	2.54	<0.010	0.07
2	SB4VAR33	1	2	5	N05LM22	9.29	<0.010	0.429	<0.100	0.024	0.122	19.7	<0.010	<0.100	0.012	2.8	<0.010	0.019
2	SB4VAR33	1	2	6	N05LM12	9.26	<0.010	0.444	<0.100	0.025	0.123	19.7	<0.010	<0.100	0.013	2.8	<0.010	0.02
2	SB5-01	1	2	7	N02LM12	10.1	<0.010	0.69	<0.100	<0.020	<0.100	20.9	0.095	<0.100	<0.010	2.29	<0.010	0.063
2	SB5-04	1	2	8	N03LM12	10.8	<0.010	0.721	<0.100	<0.020	<0.100	20.4	0.088	<0.100	<0.010	2.33	<0.010	0.067
2	SB5-01	1	2	9	N02LM22	10.1	<0.010	0.727	<0.100	<0.020	<0.100	21	0.096	<0.100	<0.010	2.3	<0.010	0.061
2	SB5-07	1	2	10	N15LM12	9.75	<0.010	0.8	<0.100	<0.020	<0.100	20.4	0.105	<0.100	<0.010	2.52	<0.010	0.07
2	Batch 1	1	2	11	BCHLM2-122	6.42	0.027	0.545	<0.100	<0.020	<0.100	23.2	<0.010	<0.100	0.384	<0.100	<0.010	0.062
2	U std	1	2	12	UstdLM2-122	8.56	0.045	0.078	<0.100	<0.020	<0.100	21.5	<0.010	<0.100	0.552	1.98	<0.010	<0.010
2	SB5-04	1	2	13	N03LM22	10.6	<0.010	0.705	<0.100	<0.020	<0.100	20.5	0.089	<0.100	<0.010	2.33	<0.010	0.065
2	SB5-11	1	2	14	N14LM22	9.81	<0.010	0.871	<0.100	<0.020	<0.100	20.7	0.112	<0.100	0.01	2.73	<0.010	0.081
2	SB5-05	1	2	15	N07LM12	9.97	<0.010	0.811	<0.100	<0.020	<0.100	20.8	0.106	<0.100	<0.010	2.56	<0.010	0.073
2	SB5-02	1	2	16	N12LM12	9.8	<0.010	0.738	<0.100	<0.020	<0.100	21.2	0.089	<0.100	<0.010	2.28	<0.010	0.066
2	SB5-11	1	2	17	N14LM12	9.69	<0.010	0.886	<0.100	<0.020	0.1	20.8	0.111	<0.100	<0.010	2.66	<0.010	0.082
2	SB5-02	1	2	18	N12LM22	9.77	<0.010	0.735	<0.100	<0.020	<0.100	20.8	0.09	<0.100	<0.010	2.24	<0.010	0.067
2	SB5-12	1	2	19	N13LM12	9.96	<0.010	0.89	<0.100	<0.020	<0.100	21.1	0.109	<0.100	<0.010	2.72	<0.010	0.079
2	SB5-07	1	2	20	N15LM22	9.83	<0.010	0.782	<0.100	<0.020	<0.100	21.4	0.106	<0.100	<0.010	2.57	<0.010	0.071
2	Batch 1	1	2	21	BCHLM2-123	6.62	0.028	0.557	<0.100	<0.020	<0.100	24.5	<0.010	<0.100	0.387	<0.100	<0.010	0.063
2	U std	1	2	22	UstdLM2-123	8.42	0.047	0.804	<0.100	<0.020	<0.100	21.5	<0.010	<0.100	0.562	1.95	<0.010	<0.010
2	Batch 1	2	1	1	BCHLM2-211	6.62	0.032	0.557	<0.100	<0.020	<0.100	23.5	<0.010	<0.100	0.397	<0.100	<0.010	0.065
2	U std	2	1	2	UstdLM2-211	8.55	0.051	0.799	<0.100	<0.020	<0.100	21.2	<0.010	<0.100	0.575	1.94	<0.010	<0.010
2	SB4VAR32	2	1	3	N11LM21	8.97	<0.010	0.399	<0.100	<0.020	0.116	21	<0.010	<0.100	0.013	2.51	<0.010	0.019
2	SB4VAR31	2	1	4	N06LM11	8.56	<0.010	0.38	<0.100	<0.020	0.104	22	<0.010	<0.100	0.015	2.21	<0.010	0.018
2	SB5-03	2	1	5	N09LM11	9.9	<0.010	0.726	<0.100	<0.020	<0.100	20.8	0.099	<0.100	0.01	2.29	<0.010	0.069
2	SB5-09	2	1	6	N04LM11	9.82	<0.010	0.836	<0.100	<0.020	0.104	21	0.123	<0.100	0.012	2.69	<0.010	0.085
2	SB5-03	2	1	7	N09LM21	9.93	<0.010	0.753	<0.100	<0.020	<0.100	21.3	0.097	<0.100	0.011	2.34	<0.010	0.071
2	SB4VAR32	2	1	8	N11LM11	8.93	<0.010	0.408	<0.100	<0.020	0.117	21.9	<0.010	<0.100	0.013	2.57	<0.010	0.019
2	SB5-10	2	1	9	N08lLM11	9.87	<0.010	0.849	<0.100	<0.020	0.11	22.2	0.122	<0.100	0.013	2.75	<0.010	0.08
2	Batch 1	2	1	10	BCHLM2-212	6.59	0.031	0.553	<0.100	<0.020	<0.100	24.1	<0.010	<0.100	0.393	<0.100	<0.010	0.065
2	U std	2	1	11	UstdLM2-212	8.58	0.051	0.812	<0.100	<0.020	<0.100	21.1	<0.010	<0.100	0.585	1.94	<0.010	<0.010
2	SB5-08	2	1	12	N10LM21	9.96	<0.010	0.808	<0.100	<0.020	<0.100	21.2	0.104	<0.100	0.012	2.49	<0.010	0.072
2	SB5-06	2	1	13	N01LM11	9.91	<0.010	0.819	<0.100	<0.020	0.102	21.2	0.111	<0.100	0.011	2.55	<0.010	0.076

Table A2. Measured Elemental Concentrations (wt%) for Samples Prepared Using Lithium Metaborate (part 2)

Set	Glass ID	Block	Sub-Block	Sequence	Lab ID	Na (wt%)	Nb (wt%)	Ni (wt%)	P (wt%)	Pb (wt%)	S (wt%)	Si (wt%)	Sr (wt%)	Th (wt%)	Ti (wt%)	U (wt%)	Zn (wt%)	Zr (wt%)
2	SB4VAR31	2	1	14	N06LM21	8.69	<0.010	0.362	<0.100	<0.020	0.103	22.8	<0.010	<0.100	0.015	2.26	<0.010	0.017
2	SB5-10	2	1	15	N08LM21	9.8	<0.010	0.86	<0.100	<0.020	0.107	21.4	0.121	<0.100	0.012	2.69	<0.010	0.081
2	SB5-08	2	1	16	N10LM11	10.4	<0.010	0.877	<0.100	<0.020	0.105	20.7	0.11	<0.100	0.012	2.56	<0.010	0.075
2	SB5-09	2	1	17	N04LM21	9.8	<0.010	0.89	<0.100	<0.020	0.107	20.7	0.118	<0.100	0.012	2.68	<0.010	0.089
2	SB5-06	2	1	18	N01LM21	10.2	<0.010	0.74	<0.100	<0.020	<0.100	21.7	0.106	<0.100	0.01	2.65	<0.010	0.071
2	Batch 1	2	1	19	BCHLM2-213	6.66	0.031	0.558	<0.100	<0.020	<0.100	24.2	<0.010	<0.100	0.399	<0.100	<0.010	0.066
2	U std	2	1	20	UstdLM2-213	8.49	0.051	0.81	<0.100	<0.020	<0.100	21.7	<0.010	<0.100	0.578	1.96	<0.010	<0.010
2	Batch 1	2	2	1	BCHLM2-221	6.91	0.028	0.557	<0.100	<0.020	<0.100	23.7	<0.010	<0.100	0.394	<0.100	<0.010	0.062
2	U std	2	2	2	UstdLM2-221	9.13	0.047	0.805	<0.100	<0.020	<0.100	22	<0.010	<0.100	0.575	2.11	<0.010	<0.010
2	SB4VAR31	2	2	3	N06LM22	9.02	<0.010	0.357	<0.100	<0.020	0.104	22.9	<0.010	<0.100	0.012	2.41	<0.010	0.014
2	SB4VAR32	2	2	4	N11LM22	9.24	<0.010	0.405	<0.100	<0.020	0.115	21.9	<0.010	<0.100	0.01	2.71	<0.010	0.016
2	SB5-10	2	2	5	N08LM12	10.1	<0.010	0.839	<0.100	<0.020	0.107	22.1	0.118	<0.100	<0.010	2.88	<0.010	0.077
2	SB5-06	2	2	6	N01LM22	10.2	<0.010	0.789	<0.100	<0.020	<0.100	21.7	0.107	<0.100	<0.010	2.69	<0.010	0.072
2	SB4VAR31	2	2	7	N06LM12	8.97	<0.010	0.38	<0.100	<0.020	0.104	22.9	<0.010	<0.100	0.012	2.38	<0.010	0.016
2	SB5-09	2	2	8	N04LM12	10.4	<0.010	0.843	<0.100	<0.020	0.107	21.6	0.12	<0.100	<0.010	2.87	<0.010	0.083
2	SB5-08	2	2	9	N10LM12	10.9	<0.010	0.881	<0.100	<0.020	0.101	21.3	0.105	<0.100	<0.010	2.71	<0.010	0.073
2	Batch 1	2	2	10	BCHLM2-222	7.1	0.027	0.562	<0.100	<0.020	<0.100	24.2	<0.010	<0.100	0.396	<0.100	<0.010	0.063
2	U std	2	2	11	UstdLM2-222	9.17	0.047	0.812	<0.100	<0.020	<0.100	22.1	<0.010	<0.100	0.579	2.08	<0.010	<0.010
2	SB5-03	2	2	12	N09LM12	10.7	<0.010	0.747	<0.100	<0.020	<0.100	21.5	0.093	<0.100	<0.010	2.46	<0.010	0.068
2	SB5-10	2	2	13	N08LM22	10.4	<0.010	0.877	<0.100	<0.020	0.104	22.1	0.111	<0.100	<0.010	2.86	<0.010	0.078
2	SB5-09	2	2	14	N04LM22	10.3	<0.010	0.926	<0.100	<0.020	0.108	20.7	0.112	<0.100	<0.010	2.82	<0.010	0.088
2	SB5-03	2	2	15	N09LM22	10.4	<0.010	0.796	<0.100	<0.020	<0.100	20.8	0.092	<0.100	<0.010	2.42	<0.010	0.071
2	SB5-08	2	2	16	N10LM22	10.4	<0.010	0.838	<0.100	<0.020	<0.100	21.3	0.098	<0.100	<0.010	2.57	<0.010	0.071
2	SB5-06	2	2	17	N01LM12	10.4	<0.010	0.84	<0.100	<0.020	0.103	21.4	0.106	<0.100	<0.010	2.65	<0.010	0.075
2	SB4VAR32	2	2	18	N11LM12	9.61	<0.010	0.419	<0.100	<0.020	0.118	21.4	<0.010	<0.100	0.01	2.66	<0.010	0.017
2	Batch 1	2	2	19	BCHLM2-223	6.93	0.028	0.586	<0.100	<0.020	<0.100	24.1	<0.010	<0.100	0.407	<0.100	<0.010	0.064
2	U std	2	2	20	UstdLM2-223	9.21	0.048	0.851	<0.100	<0.020	<0.100	22	<0.010	<0.100	0.592	2.09	<0.010	<0.010

Table A3. Measured Elemental Concentrations (wt%) for Samples Prepared Using Peroxide Fusion

Set	Glass ID	Block	Sub-Block	Sequence	Lab ID	B (wt%)	Li (wt%)	Si (wt%)
1	Batch 1	1	1	1	BCHPF1-111	2.57	2.03	24.1
1	U std	1	1	2	UstdPF1-111	2.86	1.37	21.3
1	SB4VAR54	1	1	3	M03PF11	2.55	2.17	19.6
1	SB4VAR41	1	1	4	M01PF21	2.84	2.51	22.9
1	SB4VAR21	1	1	5	M13PF11	2.95	2.52	22.9
1	SB4VAR54	1	1	6	M03PF21	2.5	2.12	20
1	SB4VAR53	1	1	7	M11PF21	2.69	2.26	20.8
1	SB4VAR22	1	1	8	M12PF21	2.75	2.35	21.7
1	SB4VAR42	1	1	9	M05PF21	2.83	2.4	22.3
1	SB4VAR23	1	1	10	M10PF21	2.65	2.23	20.8
1	Batch 1	1	1	11	BCHPF1-112	2.33	1.97	23.1
1	U std	1	1	12	UstdPF1-112	2.73	1.36	20.5
1	SB4VAR13	1	1	13	M14PF21	2.54	2.14	19.9
1	SB4VAR13	1	1	14	M14PF11	2.55	2.11	20.3
1	SB4VAR42	1	1	15	M05PF11	2.7	2.28	21.1
1	SB4VAR23	1	1	16	M10PF11	2.58	2.19	20.5
1	SB4VAR53	1	1	17	M11PF11	2.7	2.29	21.2
1	SB4VAR22	1	1	18	M12PF11	2.9	2.41	22.7
1	SB4VAR21	1	1	19	M13PF21	3.08	2.55	23.8
1	SB4VAR41	1	1	20	M01PF11	3.14	2.55	24.2
1	Batch 1	1	1	21	BCHPF1-113	2.52	2.04	24.6
1	U std	1	1	22	UstdPF1-113	2.96	1.41	22.3
1	Batch 1	1	2	1	BCHPF1-121	2.53	2.02	23.9
1	U std	1	2	2	UstdPF1-121	2.86	1.37	20.8
1	SB4VAR54	1	2	3	M03PF22	2.58	2.13	20.1
1	SB4VAR42	1	2	4	M05PF12	2.9	2.35	22.2
1	SB4VAR41	1	2	5	M01PF12	3.05	2.5	23.4
1	SB4VAR54	1	2	6	M03PF12	2.62	2.17	20.2
1	SB4VAR21	1	2	7	M13PF22	3.01	2.52	23.5
1	SB4VAR23	1	2	8	M10PF12	2.74	2.25	21.4
1	SB4VAR21	1	2	9	M13PF12	3.06	2.54	23.5
1	SB4VAR42	1	2	10	M05PF22	2.94	2.42	23
1	Batch 1	1	2	11	BCHPF1-122	2.48	2	23.9
1	U std	1	2	12	UstdPF1-122	2.86	1.38	21.3
1	SB4VAR23	1	2	13	M10PF22	2.86	2.27	21.8
1	SB4VAR53	1	2	14	M11PF12	2.9	2.33	22.3
1	SB4VAR41	1	2	15	M01PF22	3.09	2.57	24
1	SB4VAR13	1	2	16	M14PF22	2.63	2.17	20.8
1	SB4VAR53	1	2	17	M11PF22	2.89	2.31	21.6
1	SB4VAR22	1	2	18	M12PF12	3.06	2.44	23.5
1	SB4VAR13	1	2	19	M14PF12	2.71	2.18	21.1
1	SB4VAR22	1	2	20	M12PF22	2.96	2.41	22.5
1	Batch 1	1	2	21	BCHPF1-123	2.52	2.04	24.7
1	U std	1	2	22	UstdPF1-123	2.95	1.4	21.8
1	Batch 1	2	1	1	BCHPF1-211	2.43	1.97	23.3
1	U std	2	1	2	UstdPF1-211	2.75	1.35	20.9
1	SB4VAR12	2	1	3	M15PF21	2.7	2.26	21.4
1	SB4VAR52	2	1	4	M09PF11	2.79	2.34	22
1	SB4VAR43	2	1	5	M06PF21	2.69	2.25	21.4
1	SB4VAR51	2	1	6	M04PF11	2.89	2.45	23
1	SB4VAR52	2	1	7	M09PF21	2.8	2.35	21.9
1	SB4VAR44	2	1	8	M08PF21	2.56	2.14	20.4
1	SB4VAR24	2	1	9	M07PF21	2.58	2.14	20.5
1	Batch 1	2	1	10	BCHPF1-212	2.31	1.96	23.2
1	U std	2	1	11	UstdPF1-212	2.75	1.36	20.8
1	SB4VAR44	2	1	12	M08PF11	2.54	2.11	19.9
1	SB4VAR24	2	1	13	M07PF11	2.54	2.14	20.3
1	SB4VAR11	2	1	14	M02PF11	2.81	2.34	22
1	SB4VAR11	2	1	15	M02PF21	2.81	2.4	22.4
1	SB4VAR51	2	1	16	M04PF21	2.92	2.47	22.5
1	SB4VAR12	2	1	17	M15PF11	2.71	2.26	21.6
1	SB4VAR43	2	1	18	M06PF11	2.63	2.25	21.3
1	Batch 1	2	1	19	BCHPF1-213	2.35	1.97	23.6
1	U std	2	1	20	UstdPF1-213	2.73	1.35	21
1	Batch 1	2	2	1	BCHPF1-221	2.46	1.97	23.3
1	U std	2	2	2	UstdPF1-221	2.79	1.35	20.4
1	SB4VAR43	2	2	3	M06PF22	2.69	2.26	21
1	SB4VAR43	2	2	4	M06PF12	2.71	2.26	21.4

Table A3. Measured Elemental Concentrations (wt%) for Samples Prepared Using Peroxide Fusion

Set	Glass ID	Block	Sub-Block	Sequence	Lab ID	B (wt%)	Li (wt%)	Si (wt%)
1	SB4VAR52	2	2	5	M09PF12	2.82	2.34	21.9
1	SB4VAR51	2	2	6	M04PF22	2.95	2.46	22.3
1	SB4VAR44	2	2	7	M08PF22	2.59	2.14	20.4
1	SB4VAR52	2	2	8	M09PF22	2.79	2.35	21.6
1	SB4VAR24	2	2	9	M07PF22	2.52	2.14	20
1	Batch 1	2	2	10	BCHPF1-222	2.29	1.94	22.7
1	U std	2	2	11	UstdPF1-222	2.74	1.35	20.5
1	SB4VAR11	2	2	12	M02PF12	2.87	2.34	22
1	SB4VAR44	2	2	13	M08PF12	2.57	2.12	20.2
1	SB4VAR12	2	2	14	M15PF12	2.67	2.27	21.1
1	SB4VAR24	2	2	15	M07PF12	2.48	2.11	19.8
1	SB4VAR12	2	2	16	M15PF22	2.61	2.24	20.6
1	SB4VAR11	2	2	17	M02PF22	2.79	2.37	21.8
1	SB4VAR51	2	2	18	M04PF12	2.9	2.44	22.5
1	Batch 1	2	2	19	BCHPF1-223	2.34	1.95	23.1
1	U std	2	2	20	UstdPF1-223	2.7	1.35	20.3
2	Batch 1	1	1	1	BCHPF2-111	2.45	1.97	
2	U std	1	1	2	UstdPF2-111	2.8	1.35	
2	SB5-04	1	1	3	N03PF11	3.13	1.46	
2	SB5-09	1	1	4	N04PF21	2.02	1.98	
2	SB5-08	1	1	5	N10PF21	3.12	1.42	
2	SB5-09	1	1	6	N04PF11	1.99	1.98	
2	SB5-04	1	1	7	N03PF21	3.26	1.43	
2	SB5-08	1	1	8	N10PF11	3.14	1.42	
2	SB5-03	1	1	9	N09PF11	2.56	1.6	
2	Batch 1	1	1	10	BCHPF2-112	2.3	1.91	
2	U std	1	1	11	UstdPF2-112	2.78	1.35	
2	SB4VAR32	1	1	12	N11PF11	2.86	2.32	
2	SB5-12	1	1	13	N13PF21	3.15	1.45	
2	SB5-11	1	1	14	N14PF11	2.68	1.68	
2	SB5-12	1	1	15	N13PF11	3.11	1.43	
2	SB5-03	1	1	16	N09PF21	2.65	1.68	
2	SB4VAR32	1	1	17	N11PF21	2.7	2.32	
2	SB5-11	1	1	18	N14PF21	2.62	1.69	
2	Batch 1	1	1	19	BCHPF2-113	2.36	1.95	
2	U std	1	1	20	UstdPF2-113	2.71	1.34	
2	Batch 1	1	2	1	BCHPF1-121	2.5	1.98	
2	U std	1	2	2	UstdPF1-121	2.85	1.36	
2	SB5-12	1	2	3	N13PF22	3.16	1.45	
2	SB5-11	1	2	4	N14PF12	2.72	1.7	
2	SB5-03	1	2	5	N09PF22	2.76	1.72	
2	SB5-11	1	2	6	N14PF22	2.74	1.7	
2	SB5-03	1	2	7	N09PF12	2.6	1.62	
2	SB5-08	1	2	8	N10PF12	3.18	1.45	
2	SB4VAR32	1	2	9	N11PF12	2.84	2.32	
2	Batch 1	1	2	10	BCHPF1-122	2.44	1.97	
2	U std	1	2	11	UstdPF1-122	2.83	1.36	
2	SB5-08	1	2	12	N10PF22	3.17	1.44	
2	SB4VAR32	1	2	13	N11PF22	2.79	2.36	
2	SB5-04	1	2	14	N03PF12	3.19	1.45	
2	SB5-04	1	2	15	N03PF22	3.22	1.45	
2	SB5-09	1	2	16	N04PF22	1.98	2	
2	SB5-12	1	2	17	N13PF12	3.06	1.45	
2	SB5-09	1	2	18	N04PF12	2	2	
2	Batch 1	1	2	19	BCHPF2-123	2.37	1.94	
2	U std	1	2	20	UstdPF1-123	2.79	1.36	
2	Batch 1	2	1	1	BCHPF2-211	2.5	1.98	
2	U std	2	1	2	UstdPF2-211	2.84	1.37	
2	SB5-06	2	1	3	N01PF21	2.19	2	
2	SB5-05	2	1	4	N07PF11	2.01	2.02	
2	SB4VAR33	2	1	5	N05PF11	2.67	2.23	
2	SB5-10	2	1	6	N08PF21	2.17	2	
2	SB5-02	2	1	7	N12PF11	2.15	2.01	
2	SB5-07	2	1	8	N15PF21	2.62	1.7	
2	SB5-01	2	1	9	N02PF11	1.89	1.96	
2	SB5-02	2	1	10	N12PF21	2.12	2	
2	Batch 1	2	1	11	BCHPF2-212	2.35	1.97	
2	U std	2	1	12	UstdPF2-212	2.77	1.37	
2	SB4VAR31	2	1	13	N06PF21	2.96	2.48	

Table A3. Measured Elemental Concentrations (wt%) for Samples Prepared Using Peroxide Fusion

Set	Glass ID	Block	Sub-Block	Sequence	Lab ID	B (wt%)	Li (wt%)	Si (wt%)
2	SB5-05	2	1	14	N07PF21	1.97	1.99	
2	SB4VAR33	2	1	15	N05PF21	2.57	2.2	
2	SB5-01	2	1	16	N02PF21	1.9	1.96	
2	SB5-10	2	1	17	N08PF11	2.05	2	
2	SB4VAR31	2	1	18	N06PF11	2.91	2.5	
2	SB5-06	2	1	19	N01PF11	2.16	1.97	
2	SB5-07	2	1	20	N15PF11	2.68	1.71	
2	Batch 1	2	1	21	BCHPF2-213	2.37	1.99	
2	U std	2	1	22	UstdPF2-213	2.72	1.36	
2	Batch 1	2	2	1	BCHPF2-221	2.5	1.98	
2	U std	2	2	2	UstdPF2-221	2.83	1.38	
2	SB5-06	2	2	3	N01PF12	2.27	2.01	
2	SB4VAR33	2	2	4	N05PF22	2.66	2.23	
2	SB5-01	2	2	5	N02PF22	1.93	1.95	
2	SB5-10	2	2	6	N08PF22	2.19	2.02	
2	SB5-05	2	2	7	N07PF22	2	2.02	
2	SB4VAR31	2	2	8	N06PF22	3.03	2.48	
2	SB5-07	2	2	9	N15PF12	2.78	1.73	
2	SB4VAR33	2	2	10	N05PF12	2.64	2.23	
2	Batch 1	2	2	11	BCHPF2-222	2.43	1.98	
2	U std	2	2	12	UstdPF2-222	2.79	1.38	
2	SB5-05	2	2	13	N07PF12	2.09	2.04	
2	SB5-01	2	2	14	N02PF12	1.99	1.98	
2	SB5-06	2	2	15	N01PF22	2.18	2.01	
2	SB5-10	2	2	16	N08PF12	2.14	2.03	
2	SB5-02	2	2	17	N12PF22	2.18	2.03	
2	SB5-07	2	2	18	N15PF22	2.65	1.72	
2	SB5-02	2	2	19	N12PF12	2.26	2.06	
2	SB4VAR31	2	2	20	N06PF12	3.08	2.58	
2	Batch 1	2	2	21	BCHPF2-223	2.52	2.02	
2	U std	2	2	22	UstdPF2-223	2.88	1.4	

Table A4. Average Measured and Bias-Corrected Chemical Compositions Versus Targeted Compositions by Oxide by SB4-Decant Variability Study Glass

Set	Glass ID	Oxide	Measured (wt%)	Measured Bias-Corrected (BC) (wt%)	Targeted (wt%)	Diff of Measured	Diff of Meas BC	% Diff of Measured	% Diff of Meas. BC
1	Batch 1	Al_2O_3	4.7820	4.8770	4.8770	-0.0950	0.0000	-1.9%	0.0%
1	Batch 1	B_2O_3	7.8163	7.7770	7.7770	0.0393	0.0000	0.5%	0.0%
1	Batch 1	BaO	0.1411	0.1510	0.1510	-0.0099	0.0000	-6.5%	0.0%
1	Batch 1	CaO	1.1838	1.2200	1.2200	-0.0362	0.0000	-3.0%	0.0%
1	Batch 1	Ce_2O_3	0.0224	0.0224	0.0000	0.0224	0.0224		
1	Batch 1	Cr_2O_3	0.1056	0.1070	0.1070	-0.0014	0.0000	-1.3%	0.0%
1	Batch 1	CuO	0.3755	0.3990	0.3990	-0.0235	0.0000	-5.9%	0.0%
1	Batch 1	Fe_2O_3	12.6636	12.8390	12.8390	-0.1754	0.0000	-1.4%	0.0%
1	Batch 1	K_2O	3.5967	3.3270	3.3270	0.2697	0.0000	8.1%	0.0%
1	Batch 1	La_2O_3	0.0586	0.0586	0.0000	0.0586	0.0586		
1	Batch 1	Li_2O	4.2807	4.4290	4.4290	-0.1483	0.0000	-3.3%	0.0%
1	Batch 1	MgO	1.3649	1.4190	1.4190	-0.0541	0.0000	-3.8%	0.0%
1	Batch 1	MnO	1.7173	1.7260	1.7260	-0.0087	0.0000	-0.5%	0.0%
1	Batch 1	Na_2O	8.9788	9.0030	9.0030	-0.0242	0.0000	-0.3%	0.0%
1	Batch 1	NiO	0.7007	0.7510	0.7510	-0.0503	0.0000	-6.7%	0.0%
1	Batch 1	PbO	0.0108	0.0108	0.0000	0.0108	0.0108		
1	Batch 1	SiO_2	50.5410	50.2200	50.2200	0.3210	0.0000	0.6%	0.0%
1	Batch 1	SO_4	0.1498	0.1498	0.0000	0.1498	0.1498		
1	Batch 1	TiO_2	0.6465	0.6770	0.6770	-0.0305	0.0000	-4.5%	0.0%
1	Batch 1	U_3O_8	0.0590	0.0615	0.0000	0.0590	0.0615		
1	Batch 1	ZnO	0.0062	0.0062	0.0000	0.0062	0.0062		
1	Batch 1	ZrO_2	0.0858	0.0858	0.0980	-0.0122	-0.0122	-12.5%	-12.5%
1	Batch 1	Sum	99.2872	99.3172	99.0200	0.2672	0.2972	0.3%	0.3%
1	SB4VAR11	Al_2O_3	8.5358	8.6855	8.4639	0.0719	0.2216	0.8%	2.6%
1	SB4VAR11	B_2O_3	9.0801	9.2797	9.2400	-0.1599	0.0397	-1.7%	0.4%
1	SB4VAR11	BaO	0.0229	0.0244	0.0252	-0.0023	-0.0008	-9.2%	-3.1%
1	SB4VAR11	CaO	0.8825	0.9058	0.9283	-0.0458	-0.0225	-4.9%	-2.4%
1	SB4VAR11	Ce_2O_3	0.0190	0.0190	0.0221	-0.0031	-0.0031	-13.9%	-13.9%
1	SB4VAR11	Cr_2O_3	0.0570	0.0577	0.0527	0.0043	0.0050	8.2%	9.5%
1	SB4VAR11	CuO	0.0244	0.0259	0.0195	0.0049	0.0064	25.2%	32.8%
1	SB4VAR11	Fe_2O_3	9.0214	9.4768	9.6198	-0.5984	-0.1430	-6.2%	-1.5%
1	SB4VAR11	K_2O	0.1262	0.1171	0.1190	0.0071	-0.0020	6.0%	-1.6%
1	SB4VAR11	La_2O_3	0.0586	0.0586	0.0166	0.0420	0.0420	253.3%	253.3%
1	SB4VAR11	Li_2O	5.0862	5.3385	5.2800	-0.1938	0.0585	-3.7%	1.1%
1	SB4VAR11	MgO	0.8777	0.9221	0.9129	-0.0352	0.0092	-3.9%	1.0%
1	SB4VAR11	MnO	1.8722	1.9275	1.9320	-0.0598	-0.0045	-3.1%	-0.2%
1	SB4VAR11	Na_2O	12.2668	12.2547	12.2570	0.0098	-0.0023	0.1%	0.0%
1	SB4VAR11	NiO	0.4826	0.5220	0.5353	-0.0527	-0.0133	-9.8%	-2.5%
1	SB4VAR11	PbO	0.0232	0.0232	0.0211	0.0021	0.0021	9.8%	9.8%
1	SB4VAR11	SiO_2	47.1716	47.7308	47.1049	0.0667	0.6259	0.1%	1.3%
1	SB4VAR11	SO_4	0.4127	0.4127	0.4483	-0.0356	-0.0356	-7.9%	-7.9%
1	SB4VAR11	TiO_2	0.0171	0.0180	0.0130	0.0041	0.0050	31.5%	38.6%
1	SB4VAR11	U_3O_8	2.8271	2.9482	2.9352	-0.1081	0.0130	-3.7%	0.4%
1	SB4VAR11	ZnO	0.0218	0.0218	0.0263	-0.0045	-0.0045	-17.2%	-17.2%
1	SB4VAR11	ZrO_2	0.0257	0.0257	0.0268	-0.0011	-0.0011	-4.2%	-4.2%
1	SB4VAR11	Sum	98.9126	100.7958	100.0000	-1.0873	0.7958	-1.1%	0.8%
1	SB4VAR12	Al_2O_3	9.4853	9.6987	9.4596	0.0257	0.2391	0.3%	2.5%
1	SB4VAR12	B_2O_3	8.6052	8.7944	8.6800	-0.0748	0.1144	-0.9%	1.3%
1	SB4VAR12	BaO	0.0232	0.0248	0.0281	-0.0049	-0.0033	-17.6%	-11.6%
1	SB4VAR12	CaO	0.9798	1.0138	1.0375	-0.0577	-0.0237	-5.6%	-2.3%
1	SB4VAR12	Ce_2O_3	0.0193	0.0193	0.0247	-0.0054	-0.0054	-21.8%	-21.8%
1	SB4VAR12	Cr_2O_3	0.0607	0.0615	0.0589	0.0018	0.0026	3.0%	4.5%
1	SB4VAR12	CuO	0.0275	0.0293	0.0218	0.0057	0.0075	26.3%	34.4%
1	SB4VAR12	Fe_2O_3	10.8800	10.6604	10.7516	0.1284	-0.0912	1.2%	-0.8%
1	SB4VAR12	K_2O	0.1430	0.1319	0.1330	0.0100	-0.0011	7.5%	-0.8%
1	SB4VAR12	La_2O_3	0.0586	0.0586	0.0185	0.0401	0.0401	217.0%	217.0%
1	SB4VAR12	Li_2O	4.8602	5.1013	4.9600	-0.0998	0.1413	-2.0%	2.8%
1	SB4VAR12	MgO	0.9950	1.0236	1.0203	-0.0253	0.0033	-2.5%	0.3%

Table A4. Average Measured and Bias-Corrected Chemical Compositions Versus Targeted Compositions by Oxide by SB4-Decant Variability Study Glass

Set	Glass ID	Oxide	Measured (wt%)	Measured Bias-Corrected (BC) (wt%)	Targeted (wt%)	Diff of Measured	Diff of Meas BC	% Diff of Measured	% Diff of Meas. BC
1	SB4VAR12	MnO	2.2305	2.1919	2.1593	0.0712	0.0326	3.3%	1.5%
1	SB4VAR12	Na_2O	12.5128	12.5957	12.7578	-0.2450	-0.1621	-1.9%	-1.3%
1	SB4VAR12	NiO	0.5402	0.5737	0.5983	-0.0581	-0.0246	-9.7%	-4.1%
1	SB4VAR12	PbO	0.0191	0.0191	0.0236	-0.0045	-0.0045	-19.0%	-19.0%
1	SB4VAR12	SiO_2	45.2997	45.8339	44.4114	0.8883	1.4225	2.0%	3.2%
1	SB4VAR12	SO_4	0.4441	0.4441	0.5011	-0.0569	-0.0569	-11.4%	-11.4%
1	SB4VAR12	TiO_2	0.0229	0.0239	0.0146	0.0083	0.0093	57.1%	63.6%
1	SB4VAR12	U_3O_8	3.1573	3.2923	3.2805	-0.1232	0.0118	-3.8%	0.4%
1	SB4VAR12	ZnO	0.0215	0.0215	0.0294	-0.0079	-0.0079	-27.0%	-27.0%
1	SB4VAR12	ZrO_2	0.0277	0.0277	0.0300	-0.0023	-0.0023	-7.7%	-7.7%
1	SB4VAR12	Sum	100.4137	101.6415	100.0000	0.4137	1.6415	0.4%	1.6%
1	SB4VAR13	Al_2O_3	10.3923	10.5745	10.4554	-0.0631	0.1191	-0.6%	1.1%
1	SB4VAR13	B_2O_3	8.3959	8.1375	8.1200	0.2759	0.0175	3.4%	0.2%
1	SB4VAR13	BaO	0.0299	0.0319	0.0311	-0.0012	0.0008	-4.0%	2.5%
1	SB4VAR13	CaO	1.0861	1.1148	1.1467	-0.0606	-0.0319	-5.3%	-2.8%
1	SB4VAR13	Ce_2O_3	0.0237	0.0237	0.0273	-0.0036	-0.0036	-13.1%	-13.1%
1	SB4VAR13	Cr_2O_3	0.0614	0.0621	0.0651	-0.0037	-0.0030	-5.7%	-4.6%
1	SB4VAR13	CuO	0.0304	0.0322	0.0241	0.0063	0.0081	26.0%	33.6%
1	SB4VAR13	Fe_2O_3	11.0980	11.6585	11.8833	-0.7853	-0.2248	-6.6%	-1.9%
1	SB4VAR13	K_2O	0.1391	0.1291	0.1470	-0.0079	-0.0179	-5.4%	-12.2%
1	SB4VAR13	La_2O_3	0.0586	0.0586	0.0205	0.0381	0.0381	186.0%	186.0%
1	SB4VAR13	Li_2O	4.6287	4.7217	4.6400	-0.0113	0.0817	-0.2%	1.8%
1	SB4VAR13	MgO	1.1111	1.1673	1.1277	-0.0166	0.0396	-1.5%	3.5%
1	SB4VAR13	MnO	2.3209	2.3896	2.3866	-0.0657	0.0030	-2.8%	0.1%
1	SB4VAR13	Na_2O	13.1059	13.0917	13.2587	-0.1528	-0.1670	-1.2%	-1.3%
1	SB4VAR13	NiO	0.5917	0.6400	0.6612	-0.0695	-0.0212	-10.5%	-3.2%
1	SB4VAR13	PbO	0.0304	0.0304	0.0261	0.0043	0.0043	16.6%	16.6%
1	SB4VAR13	SiO_2	43.9091	42.8560	41.7179	2.1912	1.1381	5.3%	2.7%
1	SB4VAR13	SO_4	0.5048	0.5048	0.5538	-0.0490	-0.0490	-8.8%	-8.8%
1	SB4VAR13	TiO_2	0.0229	0.0242	0.0161	0.0068	0.0081	42.5%	50.2%
1	SB4VAR13	U_3O_8	3.4875	3.6368	3.6258	-0.1383	0.0110	-3.8%	0.3%
1	SB4VAR13	ZnO	0.0274	0.0274	0.0325	-0.0051	-0.0051	-15.7%	-15.7%
1	SB4VAR13	ZrO_2	0.0317	0.0317	0.0331	-0.0014	-0.0014	-4.1%	-4.1%
1	SB4VAR13	Sum	101.0877	100.9447	100.0001	1.0877	0.9447	1.1%	0.9%
1	SB4VAR21	Al_2O_3	8.3658	8.5123	8.3067	0.0591	0.2056	0.7%	2.5%
1	SB4VAR21	B_2O_3	9.7402	9.4419	9.5200	0.2202	-0.0781	2.3%	-0.8%
1	SB4VAR21	BaO	0.0246	0.0262	0.0248	-0.0002	0.0014	-1.0%	5.7%
1	SB4VAR21	CaO	0.8755	0.8987	0.9141	-0.0386	-0.0154	-4.2%	-1.7%
1	SB4VAR21	Ce_2O_3	0.0170	0.0170	0.0218	-0.0048	-0.0048	-21.9%	-21.9%
1	SB4VAR21	Cr_2O_3	0.0555	0.0562	0.0519	0.0036	0.0043	7.0%	8.3%
1	SB4VAR21	CuO	0.0250	0.0266	0.0192	0.0058	0.0074	30.4%	38.3%
1	SB4VAR21	Fe_2O_3	8.7712	9.2133	9.4727	-0.7015	-0.2594	-7.4%	-2.7%
1	SB4VAR21	K_2O	0.1168	0.1084	0.1172	-0.0004	-0.0088	-0.3%	-7.5%
1	SB4VAR21	La_2O_3	0.0586	0.0586	0.0163	0.0423	0.0423	259.8%	259.8%
1	SB4VAR21	Li_2O	5.4522	5.5619	5.4400	0.0122	0.1219	0.2%	2.2%
1	SB4VAR21	MgO	0.8735	0.9177	0.8989	-0.0254	0.0188	-2.8%	2.1%
1	SB4VAR21	MnO	1.8335	1.8875	1.9024	-0.0689	-0.0149	-3.6%	-0.8%
1	SB4VAR21	Na_2O	10.8042	10.7917	10.9820	-0.1778	-0.1903	-1.6%	-1.7%
1	SB4VAR21	NiO	0.4801	0.5192	0.5271	-0.0470	-0.0079	-8.9%	-1.5%
1	SB4VAR21	PbO	0.0232	0.0232	0.0208	0.0024	0.0024	11.3%	11.3%
1	SB4VAR21	SiO_2	50.1131	48.9153	48.4911	1.6220	0.4242	3.3%	0.9%
1	SB4VAR21	SO_4	0.1498	0.1498	0.3175	-0.1677	-0.1677	-52.8%	-52.8%
1	SB4VAR21	TiO_2	0.0200	0.0211	0.0128	0.0072	0.0083	56.4%	64.9%
1	SB4VAR21	U_3O_8	2.7652	2.8834	2.8902	-0.1250	-0.0068	-4.3%	-0.2%
1	SB4VAR21	ZnO	0.0205	0.0205	0.0259	-0.0054	-0.0054	-20.7%	-20.7%
1	SB4VAR21	ZrO_2	0.0253	0.0253	0.0264	-0.0011	-0.0011	-4.1%	-4.1%
1	SB4VAR21	Sum	100.6110	100.0758	99.9998	0.6112	0.0760	0.6%	0.1%
1	SB4VAR22	Al_2O_3	9.0507	9.2565	9.0855	-0.0348	0.1710	-0.4%	1.9%

Table A4. Average Measured and Bias-Corrected Chemical Compositions Versus Targeted Compositions by Oxide by SB4-Decant Variability Study Glass

Set	Glass ID	Oxide	Measured (wt%)	Measured Bias-Corrected (BC) (wt%)	Targeted (wt%)	Diff of Measured	Diff of Meas BC	% Diff of Measured	% Diff of Meas. BC
1	SB4VAR22	B_2O_3	9.3941	9.1045	9.1000	0.2941	0.0045	3.2%	0.0%
1	SB4VAR22	BaO	0.0257	0.0275	0.0271	-0.0014	0.0004	-5.2%	1.6%
1	SB4VAR22	CaO	0.9466	0.9794	0.9998	-0.0532	-0.0204	-5.3%	-2.0%
1	SB4VAR22	Ce_2O_3	0.0179	0.0179	0.0238	-0.0059	-0.0059	-24.9%	-24.9%
1	SB4VAR22	Cr_2O_3	0.0643	0.0652	0.0568	0.0075	0.0084	13.2%	14.9%
1	SB4VAR22	CuO	0.0269	0.0286	0.0210	0.0059	0.0076	28.2%	36.4%
1	SB4VAR22	Fe_2O_3	10.1973	9.9915	10.3607	-0.1634	-0.3692	-1.6%	-3.6%
1	SB4VAR22	K_2O	0.1283	0.1183	0.1282	0.0001	-0.0099	0.1%	-7.7%
1	SB4VAR22	La_2O_3	0.0586	0.0586	0.0178	0.0408	0.0408	229.4%	229.4%
1	SB4VAR22	Li_2O	5.1723	5.2763	5.2000	-0.0277	0.0763	-0.5%	1.5%
1	SB4VAR22	MgO	0.9888	1.0172	0.9832	0.0056	0.0340	0.6%	3.5%
1	SB4VAR22	MnO	2.1047	2.0681	2.0808	0.0239	-0.0127	1.1%	-0.6%
1	SB4VAR22	Na_2O	11.0772	11.1544	11.2616	-0.1844	-0.1072	-1.6%	-1.0%
1	SB4VAR22	NiO	0.5386	0.5720	0.5765	-0.0379	-0.0045	-6.6%	-0.8%
1	SB4VAR22	PbO	0.0240	0.0240	0.0228	0.0012	0.0012	5.1%	5.1%
1	SB4VAR22	SiO_2	48.3482	47.1892	46.4746	1.8736	0.7146	4.0%	1.5%
1	SB4VAR22	SO_4	0.3438	0.3438	0.3473	-0.0035	-0.0035	-1.0%	-1.0%
1	SB4VAR22	TiO_2	0.0267	0.0278	0.0140	0.0127	0.0138	90.6%	98.5%
1	SB4VAR22	U_3O_8	3.0423	3.1734	3.1612	-0.1189	0.0122	-3.8%	0.4%
1	SB4VAR22	ZnO	0.0212	0.0212	0.0283	-0.0071	-0.0071	-25.2%	-25.2%
1	SB4VAR22	ZrO_2	0.0216	0.0216	0.0289	-0.0073	-0.0073	-25.2%	-25.2%
1	SB4VAR22	Sum	101.6196	100.5370	99.9999	1.6197	0.5371	1.6%	0.5%
1	SB4VAR23	Al_2O_3	10.2931	10.4731	9.8642	0.4289	0.6089	4.3%	6.2%
1	SB4VAR23	B_2O_3	8.7179	8.4490	8.6800	0.0379	-0.2310	0.4%	-2.7%
1	SB4VAR23	BaO	0.0268	0.0286	0.0294	-0.0026	-0.0008	-8.9%	-2.7%
1	SB4VAR23	CaO	1.0323	1.0595	1.0855	-0.0532	-0.0260	-4.9%	-2.4%
1	SB4VAR23	Ce_2O_3	0.0199	0.0199	0.0258	-0.0059	-0.0059	-22.9%	-22.9%
1	SB4VAR23	Cr_2O_3	0.0552	0.0558	0.0617	-0.0065	-0.0059	-10.6%	-9.5%
1	SB4VAR23	CuO	0.0300	0.0319	0.0228	0.0072	0.0091	31.8%	39.8%
1	SB4VAR23	Fe_2O_3	10.4404	10.9679	11.2488	-0.8084	-0.2809	-7.2%	-2.5%
1	SB4VAR23	K_2O	0.1436	0.1333	0.1392	0.0045	-0.0059	3.2%	-4.2%
1	SB4VAR23	La_2O_3	0.0586	0.0586	0.0193	0.0393	0.0393	203.8%	203.8%
1	SB4VAR23	Li_2O	4.8117	4.9084	4.9600	-0.1483	-0.0516	-3.0%	-1.0%
1	SB4VAR23	MgO	1.0215	1.0732	1.0675	-0.0460	0.0057	-4.3%	0.5%
1	SB4VAR23	MnO	2.2047	2.2700	2.2591	-0.0544	0.0109	-2.4%	0.5%
1	SB4VAR23	Na_2O	11.3603	11.3469	11.5412	-0.1809	-0.1943	-1.6%	-1.7%
1	SB4VAR23	NiO	0.5437	0.5880	0.6259	-0.0822	-0.0379	-13.1%	-6.1%
1	SB4VAR23	PbO	0.0259	0.0259	0.0247	0.0012	0.0012	4.7%	4.7%
1	SB4VAR23	SiO_2	45.1927	44.1084	44.4582	0.7345	-0.3498	1.7%	-0.8%
1	SB4VAR23	SO_4	0.3505	0.3505	0.3770	-0.0265	-0.0265	-7.0%	-7.0%
1	SB4VAR23	TiO_2	0.0229	0.0242	0.0152	0.0077	0.0090	50.9%	59.1%
1	SB4VAR23	U_3O_8	3.2575	3.3968	3.4322	-0.1747	-0.0354	-5.1%	-1.0%
1	SB4VAR23	ZnO	0.0255	0.0255	0.0307	-0.0052	-0.0052	-16.9%	-16.9%
1	SB4VAR23	ZrO_2	0.0277	0.0277	0.0314	-0.0037	-0.0037	-11.8%	-11.8%
1	SB4VAR23	Sum	99.6625	99.4231	99.9999	-0.3374	-0.5767	-0.3%	-0.6%
1	SB4VAR24	Al_2O_3	10.6284	10.8147	10.6430	-0.0146	0.1717	-0.1%	1.6%
1	SB4VAR24	B_2O_3	8.1463	8.3254	8.2600	-0.1137	0.0654	-1.4%	0.8%
1	SB4VAR24	BaO	0.0287	0.0307	0.0317	-0.0030	-0.0010	-9.3%	-3.2%
1	SB4VAR24	CaO	1.1362	1.1661	1.1712	-0.0350	-0.0051	-3.0%	-0.4%
1	SB4VAR24	Ce_2O_3	0.0246	0.0246	0.0279	-0.0033	-0.0033	-11.8%	-11.8%
1	SB4VAR24	Cr_2O_3	0.0607	0.0614	0.0665	-0.0058	-0.0051	-8.8%	-7.7%
1	SB4VAR24	CuO	0.0310	0.0329	0.0246	0.0064	0.0083	25.9%	33.6%
1	SB4VAR24	Fe_2O_3	11.1409	11.7035	12.1369	-0.9960	-0.4334	-8.2%	-3.6%
1	SB4VAR24	K_2O	0.1991	0.1847	0.1502	0.0489	0.0345	32.5%	23.0%
1	SB4VAR24	La_2O_3	0.0586	0.0586	0.0209	0.0377	0.0377	180.6%	180.6%
1	SB4VAR24	Li_2O	4.5911	4.8188	4.7200	-0.1289	0.0988	-2.7%	2.1%
1	SB4VAR24	MgO	1.0820	1.1368	1.1518	-0.0698	-0.0150	-6.1%	-1.3%
1	SB4VAR24	MnO	2.4016	2.4726	2.4375	-0.0359	0.0351	-1.5%	1.4%

Table A4. Average Measured and Bias-Corrected Chemical Compositions Versus Targeted Compositions by Oxide by SB4-Decant Variability Study Glass

Set	Glass ID	Oxide	Measured (wt%)	Measured Bias-Corrected (BC) (wt%)	Targeted (wt%)	Diff of Measured	Diff of Meas BC	% Diff of Measured	% Diff of Meas. BC
1	SB4VAR24	Na_2O	11.6669	11.6534	11.8207	-0.1538	-0.1673	-1.3%	-1.4%
1	SB4VAR24	NiO	0.5500	0.5949	0.6754	-0.1254	-0.0805	-18.6%	-11.9%
1	SB4VAR24	PbO	0.0302	0.0302	0.0267	0.0035	0.0035	13.0%	13.0%
1	SB4VAR24	SiO_2	43.1069	43.6162	42.4417	0.6652	1.1745	1.6%	2.8%
1	SB4VAR24	SO_4	0.3790	0.3790	0.4068	-0.0278	-0.0278	-6.8%	-6.8%
1	SB4VAR24	TiO_2	0.0225	0.0237	0.0164	0.0061	0.0073	37.3%	44.7%
1	SB4VAR24	U_3O_8	3.5405	3.6919	3.7031	-0.1626	-0.0112	-4.4%	-0.3%
1	SB4VAR24	ZnO	0.0268	0.0268	0.0332	-0.0064	-0.0064	-19.4%	-19.4%
1	SB4VAR24	ZrO_2	0.0317	0.0317	0.0338	-0.0021	-0.0021	-6.1%	-6.1%
1	SB4VAR24	Sum	98.8839	100.8786	100.0000	-1.1161	0.8786	-1.1%	0.9%
1	SB4VAR41	Al_2O_3	8.1390	8.3219	7.9963	0.1427	0.3256	1.8%	4.1%
1	SB4VAR41	B_2O_3	9.7563	9.4568	9.5200	0.2363	-0.0632	2.5%	-0.7%
1	SB4VAR41	BaO	0.0212	0.0227	0.0249	-0.0037	-0.0022	-14.8%	-8.7%
1	SB4VAR41	CaO	0.8546	0.8842	0.8848	-0.0302	-0.0006	-3.4%	-0.1%
1	SB4VAR41	Ce_2O_3	0.0214	0.0214	0.0233	-0.0019	-0.0019	-8.2%	-8.2%
1	SB4VAR41	Cr_2O_3	0.0548	0.0556	0.0510	0.0038	0.0046	7.5%	9.0%
1	SB4VAR41	CuO	0.0238	0.0253	0.0190	0.0048	0.0063	25.2%	33.2%
1	SB4VAR41	Fe_2O_3	9.2502	9.0625	9.1990	0.0512	-0.1365	0.6%	-1.5%
1	SB4VAR41	K_2O	0.1274	0.1175	0.1133	0.0141	0.0042	12.5%	3.7%
1	SB4VAR41	La_2O_3	0.0586	0.0586	0.0165	0.0421	0.0421	255.4%	255.4%
1	SB4VAR41	Li_2O	5.4522	5.5619	5.4400	0.0122	0.1219	0.2%	2.2%
1	SB4VAR41	MgO	0.8354	0.8595	0.8564	-0.0210	0.0031	-2.5%	0.4%
1	SB4VAR41	MnO	1.9626	1.9275	1.8810	0.0816	0.0465	4.3%	2.5%
1	SB4VAR41	Na_2O	11.3839	11.4605	11.3434	0.0405	0.1171	0.4%	1.0%
1	SB4VAR41	NiO	0.4629	0.4916	0.5227	-0.0598	-0.0311	-11.4%	-6.0%
1	SB4VAR41	PbO	0.0218	0.0218	0.0217	0.0001	0.0001	0.5%	0.5%
1	SB4VAR41	SiO_2	50.5410	49.3329	48.4580	2.0830	0.8749	4.3%	1.8%
1	SB4VAR41	SO_4	0.3303	0.3303	0.3475	-0.0172	-0.0172	-5.0%	-5.0%
1	SB4VAR41	TiO_2	0.3962	0.4121	0.4279	-0.0318	-0.0158	-7.4%	-3.7%
1	SB4VAR41	U_3O_8	2.7416	2.8590	2.7991	-0.0575	0.0599	-2.1%	2.1%
1	SB4VAR41	ZnO	0.0180	0.0180	0.0258	-0.0078	-0.0078	-30.0%	-30.0%
1	SB4VAR41	ZrO_2	0.0257	0.0257	0.0283	-0.0026	-0.0026	-9.3%	-9.3%
1	SB4VAR41	Sum	102.4788	101.3274	99.9999	2.4789	1.3275	2.5%	1.3%
1	SB4VAR42	Al_2O_3	8.6775	8.8748	8.7460	-0.0685	0.1288	-0.8%	1.5%
1	SB4VAR42	B_2O_3	9.1526	8.8707	9.1000	0.0526	-0.2293	0.6%	-2.5%
1	SB4VAR42	BaO	0.0232	0.0248	0.0273	-0.0041	-0.0025	-15.1%	-9.0%
1	SB4VAR42	CaO	0.9193	0.9512	0.9678	-0.0485	-0.0166	-5.0%	-1.7%
1	SB4VAR42	Ce_2O_3	0.0228	0.0228	0.0255	-0.0026	-0.0026	-10.4%	-10.4%
1	SB4VAR42	Cr_2O_3	0.0555	0.0563	0.0558	-0.0003	0.0005	-0.5%	1.0%
1	SB4VAR42	CuO	0.0272	0.0290	0.0208	0.0064	0.0082	30.9%	39.3%
1	SB4VAR42	Fe_2O_3	10.1080	9.9032	10.0615	0.0465	-0.1583	0.5%	-1.6%
1	SB4VAR42	K_2O	0.1310	0.1208	0.1239	0.0071	-0.0031	5.7%	-2.5%
1	SB4VAR42	La_2O_3	0.0586	0.0586	0.0181	0.0405	0.0405	224.0%	224.0%
1	SB4VAR42	Li_2O	5.0862	5.1885	5.2000	-0.1138	-0.0115	-2.2%	-0.2%
1	SB4VAR42	MgO	0.9270	0.9538	0.9367	-0.0097	0.0171	-1.0%	1.8%
1	SB4VAR42	MnO	2.1240	2.0863	2.0573	0.0667	0.0290	3.2%	1.4%
1	SB4VAR42	Na_2O	11.3738	11.4551	11.6568	-0.2831	-0.2017	-2.4%	-1.7%
1	SB4VAR42	NiO	0.5192	0.5514	0.5717	-0.0525	-0.0203	-9.2%	-3.6%
1	SB4VAR42	PbO	0.0248	0.0248	0.0237	0.0011	0.0011	4.5%	4.5%
1	SB4VAR42	SiO_2	47.3855	46.2490	46.4385	0.9470	-0.1895	2.0%	-0.4%
1	SB4VAR42	SO_4	0.3505	0.3505	0.3801	-0.0296	-0.0296	-7.8%	-7.8%
1	SB4VAR42	TiO_2	0.4474	0.4655	0.4680	-0.0206	-0.0025	-4.4%	-0.5%
1	SB4VAR42	U_3O_8	2.9244	3.0501	3.0615	-0.1371	-0.0114	-4.5%	-0.4%
1	SB4VAR42	ZnO	0.0224	0.0224	0.0282	-0.0058	-0.0058	-20.5%	-20.5%
1	SB4VAR42	ZrO_2	0.0263	0.0263	0.0309	-0.0046	-0.0046	-14.8%	-14.8%
1	SB4VAR42	Sum	100.3873	99.3361	100.0001	0.3872	-0.6640	0.4%	-0.7%
1	SB4VAR43	Al_2O_3	9.4144	9.6252	9.4956	-0.0812	0.1296	-0.9%	1.4%
1	SB4VAR43	B_2O_3	8.6293	8.8191	8.6800	-0.0507	0.1391	-0.6%	1.6%

Table A4. Average Measured and Bias-Corrected Chemical Compositions Versus Targeted Compositions by Oxide by SB4-Decant Variability Study Glass

Set	Glass ID	Oxide	Measured (wt%)	Measured Bias-Corrected (BC) (wt%)	Targeted (wt%)	Diff of Measured	Diff of Meas BC	% Diff of Measured	% Diff of Meas. BC
1	SB4VAR43	BaO	0.0290	0.0311	0.0296	-0.0006	0.0015	-1.9%	5.1%
1	SB4VAR43	CaO	0.9903	1.0246	1.0507	-0.0604	-0.0261	-5.8%	-2.5%
1	SB4VAR43	Ce_2O_3	0.0252	0.0252	0.0277	-0.0025	-0.0025	-9.0%	-9.0%
1	SB4VAR43	Cr_2O_3	0.0515	0.0523	0.0606	-0.0091	-0.0083	-15.0%	-13.8%
1	SB4VAR43	CuO	0.0300	0.0320	0.0225	0.0075	0.0095	33.5%	42.1%
1	SB4VAR43	Fe_2O_3	11.2339	11.0068	10.9239	0.3100	0.0829	2.8%	0.8%
1	SB4VAR43	K_2O	0.1705	0.1572	0.1345	0.0359	0.0227	26.7%	16.8%
1	SB4VAR43	La_2O_3	0.0586	0.0586	0.0196	0.0390	0.0390	199.2%	199.2%
1	SB4VAR43	Li_2O	4.8548	5.0957	4.9600	-0.1052	0.1357	-2.1%	2.7%
1	SB4VAR43	MgO	1.0070	1.0361	1.0170	-0.0100	0.0191	-1.0%	1.9%
1	SB4VAR43	MnO	2.3758	2.3344	2.2337	0.1421	0.1007	6.4%	4.5%
1	SB4VAR43	Na_2O	11.6198	11.6971	11.9703	-0.3505	-0.2732	-2.9%	-2.3%
1	SB4VAR43	NiO	0.5685	0.6038	0.6207	-0.0522	-0.0169	-8.4%	-2.7%
1	SB4VAR43	PbO	0.0264	0.0264	0.0258	0.0006	0.0006	2.3%	2.3%
1	SB4VAR43	SiO_2	45.5136	46.0542	44.4189	1.0947	1.6353	2.5%	3.7%
1	SB4VAR43	SO_4	0.4000	0.4000	0.4127	-0.0127	-0.0127	-3.1%	-3.1%
1	SB4VAR43	TiO_2	0.5158	0.5366	0.5081	0.0077	0.0285	1.5%	5.6%
1	SB4VAR43	U_3O_8	3.2074	3.3446	3.3239	-0.1165	0.0207	-3.5%	0.6%
1	SB4VAR43	ZnO	0.0249	0.0249	0.0307	-0.0058	-0.0058	-18.9%	-18.9%
1	SB4VAR43	ZrO_2	0.0277	0.0277	0.0336	-0.0059	-0.0059	-17.6%	-17.6%
1	SB4VAR43	Sum	100.7744	102.0135	100.0001	0.7744	2.0134	0.8%	2.0%
1	SB4VAR44	Al_2O_3	10.2553	10.4345	10.2453	0.0100	0.1892	0.1%	1.8%
1	SB4VAR44	B_2O_3	8.2590	8.4406	8.2600	-0.0010	0.1806	0.0%	2.2%
1	SB4VAR44	BaO	0.0299	0.0319	0.0319	-0.0020	0.0000	-6.4%	-0.1%
1	SB4VAR44	CaO	1.0756	1.1040	1.1337	-0.0581	-0.0297	-5.1%	-2.6%
1	SB4VAR44	Ce_2O_3	0.0258	0.0258	0.0298	-0.0041	-0.0041	-13.7%	-13.7%
1	SB4VAR44	Cr_2O_3	0.0661	0.0669	0.0654	0.0007	0.0015	1.1%	2.3%
1	SB4VAR44	CuO	0.0307	0.0325	0.0243	0.0064	0.0082	26.2%	33.9%
1	SB4VAR44	Fe_2O_3	10.5691	11.1031	11.7863	-1.2172	-0.6832	-10.3%	-5.8%
1	SB4VAR44	K_2O	0.1482	0.1375	0.1451	0.0030	-0.0077	2.1%	-5.3%
1	SB4VAR44	La_2O_3	0.0586	0.0586	0.0212	0.0374	0.0374	176.6%	176.6%
1	SB4VAR44	Li_2O	4.5803	4.8076	4.7200	-0.1397	0.0876	-3.0%	1.9%
1	SB4VAR44	MgO	1.0601	1.1137	1.0972	-0.0371	0.0165	-3.4%	1.5%
1	SB4VAR44	MnO	2.3112	2.3796	2.4100	-0.0988	-0.0304	-4.1%	-1.3%
1	SB4VAR44	Na_2O	12.1758	12.1614	12.2837	-0.1079	-0.1223	-0.9%	-1.0%
1	SB4VAR44	NiO	0.5704	0.6169	0.6697	-0.0993	-0.0528	-14.8%	-7.9%
1	SB4VAR44	PbO	0.0307	0.0307	0.0278	0.0029	0.0029	10.4%	10.4%
1	SB4VAR44	SiO_2	43.2673	43.7836	42.3993	0.8680	1.3843	2.0%	3.3%
1	SB4VAR44	SO_4	0.4104	0.4104	0.4453	-0.0348	-0.0348	-7.8%	-7.8%
1	SB4VAR44	TiO_2	0.5029	0.5302	0.5482	-0.0453	-0.0180	-8.3%	-3.3%
1	SB4VAR44	U_3O_8	3.4079	3.5535	3.5863	-0.1784	-0.0328	-5.0%	-0.9%
1	SB4VAR44	ZnO	0.0296	0.0296	0.0331	-0.0035	-0.0035	-10.7%	-10.7%
1	SB4VAR44	ZrO_2	0.0317	0.0317	0.0362	-0.0045	-0.0045	-12.3%	-12.3%
1	SB4VAR44	Sum	98.8966	100.8844	99.9998	-1.1032	0.8846	-1.1%	0.9%
1	SB4VAR51	Al_2O_3	7.7847	7.9605	7.7091	0.0756	0.2514	1.0%	3.3%
1	SB4VAR51	B_2O_3	9.3860	9.5924	9.5200	-0.1340	0.0724	-1.4%	0.8%
1	SB4VAR51	BaO	0.0207	0.0221	0.0241	-0.0034	-0.0020	-14.3%	-8.1%
1	SB4VAR51	CaO	0.8101	0.8383	0.8532	-0.0431	-0.0149	-5.0%	-1.7%
1	SB4VAR51	Ce_2O_3	0.0202	0.0202	0.0225	-0.0023	-0.0023	-10.3%	-10.3%
1	SB4VAR51	Cr_2O_3	0.0512	0.0519	0.0492	0.0020	0.0027	4.0%	5.5%
1	SB4VAR51	CuO	0.0272	0.0290	0.0183	0.0089	0.0107	48.8%	58.3%
1	SB4VAR51	Fe_2O_3	8.7140	8.5366	8.8716	-0.1576	-0.3350	-1.8%	-3.8%
1	SB4VAR51	K_2O	0.1177	0.1086	0.1092	0.0085	-0.0006	7.8%	-0.6%
1	SB4VAR51	La_2O_3	0.0586	0.0586	0.0160	0.0426	0.0426	266.5%	266.5%
1	SB4VAR51	Li_2O	5.2854	5.5476	5.4400	-0.1546	0.1076	-2.8%	2.0%
1	SB4VAR51	MgO	0.7964	0.8194	0.8253	-0.0289	-0.0059	-3.5%	-0.7%
1	SB4VAR51	MnO	1.8432	1.8094	1.8152	0.0280	-0.0058	1.5%	-0.3%
1	SB4VAR51	Na_2O	12.1657	12.2525	12.2471	-0.0814	0.0054	-0.7%	0.0%

Table A4. Average Measured and Bias-Corrected Chemical Compositions Versus Targeted Compositions by Oxide by SB4-Decant Variability Study Glass

Set	Glass ID	Oxide	Measured (wt%)	Measured Bias-Corrected (BC) (wt%)	Targeted (wt%)	Diff of Measured	Diff of Meas BC	% Diff of Measured	% Diff of Meas. BC
1	SB4VAR51	NiO	0.4441	0.4717	0.5045	-0.0604	-0.0328	-12.0%	-6.5%
1	SB4VAR51	PbO	0.0189	0.0189	0.0210	-0.0021	-0.0021	-10.2%	-10.2%
1	SB4VAR51	SiO_2	48.2947	48.8669	48.4272	-0.1325	0.4397	-0.3%	0.9%
1	SB4VAR51	SO_4	0.3295	0.3295	0.3475	-0.0180	-0.0180	-5.2%	-5.2%
1	SB4VAR51	TiO_2	0.3953	0.4112	0.4275	-0.0322	-0.0163	-7.5%	-3.8%
1	SB4VAR51	U_3O_8	2.6001	2.7113	2.6992	-0.0991	0.0121	-3.7%	0.4%
1	SB4VAR51	ZnO	0.0168	0.0168	0.0249	-0.0081	-0.0081	-32.5%	-32.5%
1	SB4VAR51	ZrO_2	0.0240	0.0240	0.0274	-0.0034	-0.0034	-12.5%	-12.5%
1	SB4VAR51	Sum	99.2046	100.4973	100.0001	-0.7954	0.4972	-0.8%	0.5%
1	SB4VAR52	Al_2O_3	8.5783	8.7287	8.4319	0.1464	0.2968	1.7%	3.5%
1	SB4VAR52	B_2O_3	9.0157	9.2139	9.1000	-0.0843	0.1139	-0.9%	1.3%
1	SB4VAR52	BaO	0.0246	0.0262	0.0263	-0.0017	-0.0001	-6.6%	-0.3%
1	SB4VAR52	CaO	0.8951	0.9188	0.9332	-0.0381	-0.0144	-4.1%	-1.5%
1	SB4VAR52	Ce_2O_3	0.0223	0.0223	0.0246	-0.0024	-0.0024	-9.7%	-9.7%
1	SB4VAR52	Cr_2O_3	0.0574	0.0581	0.0539	0.0035	0.0042	6.4%	7.7%
1	SB4VAR52	CuO	0.0250	0.0266	0.0200	0.0050	0.0066	25.2%	32.8%
1	SB4VAR52	Fe_2O_3	9.2394	9.7063	9.7033	-0.4639	0.0030	-4.8%	0.0%
1	SB4VAR52	K_2O	0.1150	0.1067	0.1195	-0.0044	-0.0127	-3.7%	-10.6%
1	SB4VAR52	La_2O_3	0.0586	0.0586	0.0175	0.0411	0.0411	235.1%	235.1%
1	SB4VAR52	Li_2O	5.0486	5.2990	5.2000	-0.1514	0.0990	-2.9%	1.9%
1	SB4VAR52	MgO	0.9013	0.9469	0.9027	-0.0014	0.0442	-0.2%	4.9%
1	SB4VAR52	MnO	1.9755	2.0341	1.9854	-0.0099	0.0487	-0.5%	2.5%
1	SB4VAR52	Na_2O	12.5735	12.5600	12.6453	-0.0718	-0.0853	-0.6%	-0.7%
1	SB4VAR52	NiO	0.5100	0.5515	0.5518	-0.0418	-0.0003	-7.6%	0.0%
1	SB4VAR52	PbO	0.0245	0.0245	0.0230	0.0015	0.0015	6.5%	6.5%
1	SB4VAR52	SiO_2	46.7437	47.2986	46.4048	0.3389	0.8938	0.7%	1.9%
1	SB4VAR52	SO_4	0.3550	0.3550	0.3801	-0.0251	-0.0251	-6.6%	-6.6%
1	SB4VAR52	TiO_2	0.4595	0.4844	0.4675	-0.0080	0.0169	-1.7%	3.6%
1	SB4VAR52	U_3O_8	2.8684	2.9913	2.9522	-0.0838	0.0391	-2.8%	1.3%
1	SB4VAR52	ZnO	0.0227	0.0227	0.0273	-0.0046	-0.0046	-16.8%	-16.8%
1	SB4VAR52	ZrO_2	0.0277	0.0277	0.0300	-0.0023	-0.0023	-7.7%	-7.7%
1	SB4VAR52	Sum	99.5419	101.4620	100.0003	-0.4584	1.4617	-0.5%	1.5%
1	SB4VAR53	Al_2O_3	9.1688	9.3294	9.1546	0.0142	0.1748	0.2%	1.9%
1	SB4VAR53	B_2O_3	8.9996	8.7219	8.6800	0.3196	0.0419	3.7%	0.5%
1	SB4VAR53	BaO	0.0265	0.0283	0.0286	-0.0021	-0.0003	-7.3%	-1.0%
1	SB4VAR53	CaO	0.9913	1.0175	1.0132	-0.0219	0.0043	-2.2%	0.4%
1	SB4VAR53	Ce_2O_3	0.0231	0.0231	0.0268	-0.0036	-0.0036	-13.5%	-13.5%
1	SB4VAR53	Cr_2O_3	0.0592	0.0599	0.0585	0.0007	0.0014	1.2%	2.4%
1	SB4VAR53	CuO	0.0285	0.0302	0.0217	0.0068	0.0085	31.2%	39.2%
1	SB4VAR53	Fe_2O_3	9.7255	10.2172	10.5350	-0.8095	-0.3178	-7.7%	-3.0%
1	SB4VAR53	K_2O	0.1647	0.1529	0.1297	0.0350	0.0232	27.0%	17.9%
1	SB4VAR53	La_2O_3	0.0586	0.0586	0.0190	0.0396	0.0396	208.6%	208.6%
1	SB4VAR53	Li_2O	4.9463	5.0457	4.9600	-0.0137	0.0857	-0.3%	1.7%
1	SB4VAR53	MgO	0.9411	0.9887	0.9801	-0.0390	0.0086	-4.0%	0.9%
1	SB4VAR53	MnO	2.0917	2.1538	2.1556	-0.0639	-0.0018	-3.0%	-0.1%
1	SB4VAR53	Na_2O	13.0655	13.0507	13.0435	0.0220	0.0072	0.2%	0.1%
1	SB4VAR53	NiO	0.5376	0.5815	0.5991	-0.0615	-0.0176	-10.3%	-2.9%
1	SB4VAR53	PbO	0.0272	0.0272	0.0249	0.0023	0.0023	9.2%	9.2%
1	SB4VAR53	SiO_2	45.9415	44.8393	44.3823	1.5592	0.4570	3.5%	1.0%
1	SB4VAR53	SO_4	0.3827	0.3827	0.4127	-0.0300	-0.0300	-7.3%	-7.3%
1	SB4VAR53	TiO_2	0.4750	0.5007	0.5076	-0.0326	-0.0069	-6.4%	-1.4%
1	SB4VAR53	U_3O_8	3.0600	3.1909	3.2053	-0.1453	-0.0144	-4.5%	-0.4%
1	SB4VAR53	ZnO	0.0243	0.0243	0.0296	-0.0053	-0.0053	-18.0%	-18.0%
1	SB4VAR53	ZrO_2	0.0290	0.0290	0.0325	-0.0035	-0.0035	-10.6%	-10.6%
1	SB4VAR53	Sum	100.7679	100.4536	100.0002	0.7677	0.4534	0.8%	0.5%
1	SB4VAR54	Al_2O_3	9.8632	10.0854	9.8773	-0.0141	0.2081	-0.1%	2.1%
1	SB4VAR54	B_2O_3	8.2510	7.9977	8.2600	-0.0090	-0.2623	-0.1%	-3.2%
1	SB4VAR54	BaO	0.0257	0.0275	0.0308	-0.0051	-0.0033	-16.6%	-10.6%

Table A4. Average Measured and Bias-Corrected Chemical Compositions Versus Targeted Compositions by Oxide by SB4-Decant Variability Study Glass

Set	Glass ID	Oxide	Measured (wt%)	Measured Bias-Corrected (BC) (wt%)	Targeted (wt%)	Diff of Measured	Diff of Meas BC	% Diff of Measured	% Diff of Meas. BC
1	SB4VAR54	CaO	1.0291	1.0649	1.0931	-0.0640	-0.0282	-5.9%	-2.6%
1	SB4VAR54	Ce_2O_3	0.0246	0.0246	0.0289	-0.0043	-0.0043	-14.8%	-14.8%
1	SB4VAR54	Cr_2O_3	0.0599	0.0608	0.0631	-0.0032	-0.0023	-5.0%	-3.7%
1	SB4VAR54	CuO	0.0300	0.0320	0.0235	0.0065	0.0085	27.8%	36.0%
1	SB4VAR54	Fe_2O_3	11.2911	11.0614	11.3667	-0.0756	-0.3053	-0.7%	-2.7%
1	SB4VAR54	K_2O	0.1433	0.1322	0.1399	0.0034	-0.0077	2.4%	-5.5%
1	SB4VAR54	La_2O_3	0.0586	0.0586	0.0205	0.0381	0.0381	186.0%	186.0%
1	SB4VAR54	Li_2O	4.6234	4.7163	4.7200	-0.0966	-0.0037	-2.0%	-0.1%
1	SB4VAR54	MgO	1.0348	1.0646	1.0574	-0.0226	0.0072	-2.1%	0.7%
1	SB4VAR54	MnO	2.3661	2.3230	2.3258	0.0403	-0.0028	1.7%	-0.1%
1	SB4VAR54	Na_2O	13.2845	13.3779	13.4416	-0.1571	-0.0637	-1.2%	-0.5%
1	SB4VAR54	NiO	0.5780	0.6139	0.6464	-0.0684	-0.0325	-10.6%	-5.0%
1	SB4VAR54	PbO	0.0269	0.0269	0.0269	0.0000	0.0000	0.1%	0.1%
1	SB4VAR54	SiO_2	42.7325	41.7100	42.3599	0.3726	-0.6499	0.9%	-1.5%
1	SB4VAR54	SO_4	0.4299	0.4299	0.4453	-0.0153	-0.0153	-3.4%	-3.4%
1	SB4VAR54	TiO_2	0.5267	0.5479	0.5477	-0.0210	0.0002	-3.8%	0.0%
1	SB4VAR54	U_3O_8	3.3489	3.4923	3.4583	-0.1094	0.0340	-3.2%	1.0%
1	SB4VAR54	ZnO	0.0277	0.0277	0.0319	-0.0042	-0.0042	-13.2%	-13.2%
1	SB4VAR54	ZrO_2	0.0324	0.0324	0.0351	-0.0027	-0.0027	-7.6%	-7.6%
1	SB4VAR54	Sum	99.7885	98.9079	100.0001	-0.2116	-1.0921	-0.2%	-1.1%
1	U std	Al_2O_3	3.9191	3.9973	4.1000	-0.1809	-0.1027	-4.4%	-2.5%
1	U std	B_2O_3	9.0372	8.9927	9.2090	-0.1718	-0.2163	-1.9%	-2.3%
1	U std	BaO	0.0056	0.0060	0.0000	0.0056	0.0060		
1	U std	CaO	1.2587	1.2971	1.3010	-0.0423	-0.0039	-3.3%	-0.3%
1	U std	Ce_2O_3	0.0059	0.0059	0.0000	0.0059	0.0059		
1	U std	Cr_2O_3	0.2329	0.2360	0.0000	0.2329	0.2360		
1	U std	CuO	0.0063	0.0067	0.0000	0.0063	0.0067		
1	U std	Fe_2O_3	13.0722	13.2536	13.1960	-0.1238	0.0576	-0.9%	0.4%
1	U std	K_2O	3.4512	3.1926	2.9990	0.4522	0.1936	15.1%	6.5%
1	U std	La_2O_3	0.0586	0.0586	0.0000	0.0586	0.0586		
1	U std	Li_2O	2.9423	3.0444	3.0570	-0.1147	-0.0126	-3.8%	-0.4%
1	U std	MgO	1.1685	1.2148	1.2100	-0.0415	0.0048	-3.4%	0.4%
1	U std	MnO	2.8073	2.8218	2.8920	-0.0847	-0.0702	-2.9%	-2.4%
1	U std	Na_2O	11.6029	11.6360	11.7950	-0.1921	-0.1590	-1.6%	-1.3%
1	U std	NiO	1.0050	1.0771	1.1200	-0.1150	-0.0429	-10.3%	-3.8%
1	U std	PbO	0.0108	0.0108	0.0000	0.0108	0.0108		
1	U std	SiO_2	44.9075	44.6236	45.3530	-0.4455	-0.7294	-1.0%	-1.6%
1	U std	SO_4	0.1498	0.1498	0.0000	0.1498	0.1498		
1	U std	TiO_2	0.9337	0.9777	1.0490	-0.1153	-0.0713	-11.0%	-6.8%
1	U std	U_3O_8	2.3073	2.4060	2.4060	-0.0987	0.0000	-4.1%	0.0%
1	U std	ZnO	0.0062	0.0062	0.0000	0.0062	0.0062		
1	U std	ZrO_2	0.0068	0.0068	0.0000	0.0068	0.0068		
1	U std	Sum	98.8956	99.0212	99.6870	-0.7914	-0.6658	-0.8%	-0.7%
2	Batch 1	Al_2O_3	4.7820	4.8770	4.8770	-0.0950	0.0000	-1.9%	0.0%
2	Batch 1	B_2O_3	7.8056	7.7770	7.7770	0.0286	0.0000	0.4%	0.0%
2	Batch 1	BaO	0.1421	0.1510	0.1510	-0.0089	0.0000	-5.9%	0.0%
2	Batch 1	CaO	1.1885	1.2200	1.2200	-0.0315	0.0000	-2.6%	0.0%
2	Batch 1	Ce_2O_3	0.0130	0.0130	0.0000	0.0130	0.0130		
2	Batch 1	Cr_2O_3	0.1077	0.1070	0.1070	0.0007	0.0000	0.6%	0.0%
2	Batch 1	CuO	0.3781	0.3990	0.3990	-0.0209	0.0000	-5.2%	0.0%
2	Batch 1	Fe_2O_3	13.0341	12.8393	12.8390	0.1951	0.0003	1.5%	0.0%
2	Batch 1	K_2O	3.0406	3.3270	3.3270	-0.2864	0.0000	-8.6%	0.0%
2	Batch 1	La_2O_3	0.0586	0.0586	0.0000	0.0586	0.0586		
2	Batch 1	Li_2O	4.2412	4.4290	4.4290	-0.1878	0.0000	-4.2%	0.0%
2	Batch 1	MgO	1.3794	1.4190	1.4190	-0.0396	0.0000	-2.8%	0.0%
2	Batch 1	MnO	1.7700	1.7260	1.7260	0.0440	0.0000	2.6%	0.0%
2	Batch 1	Na_2O	8.9979	9.0030	9.0030	-0.0051	0.0000	-0.1%	0.0%
2	Batch 1	NiO	0.7085	0.7510	0.7510	-0.0425	0.0000	-5.7%	0.0%

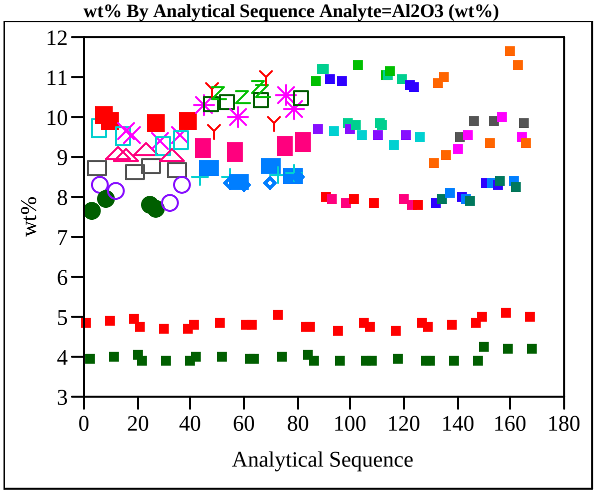
Table A4. Average Measured and Bias-Corrected Chemical Compositions Versus Targeted Compositions by Oxide by SB4-Decant Variability Study Glass

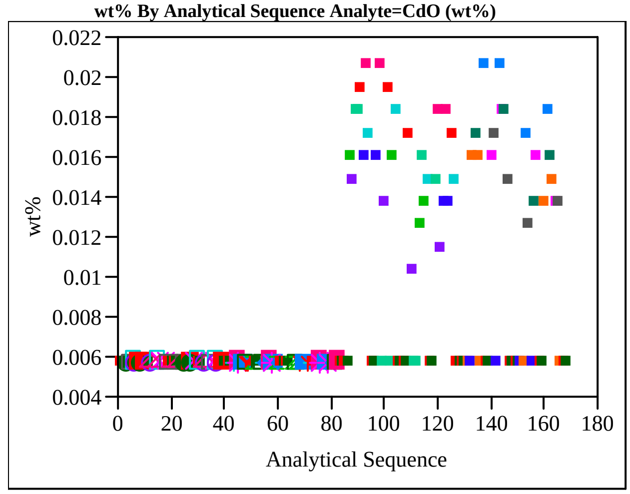
Set	Glass ID	Oxide	Measured (wt%)	Measured Bias-Corrected (BC) (wt%)	Targeted (wt%)	Diff of Measured	Diff of Meas BC	% Diff of Measured	% Diff of Meas. BC
2	Batch 1	PbO	0.0108	0.0108	0.0000	0.0108	0.0108		
2	Batch 1	SiO_2	51.0401	50.2200	50.2200	0.8201	0.0000	1.6%	0.0%
2	Batch 1	SO_4	0.1498	0.1498	0.0000	0.1498	0.1498		
2	Batch 1	TiO_2	0.6543	0.6770	0.6770	-0.0227	0.0000	-3.4%	0.0%
2	Batch 1	U_3O_8	0.0590	0.0607	0.0000	0.0590	0.0607		
2	Batch 1	ZnO	0.0062	0.0062	0.0000	0.0062	0.0062		
2	Batch 1	ZrO_2	0.0857	0.0857	0.0980	-0.0123	-0.0123	-12.6%	-12.6%
2	Batch 1	Sum	99.6532	99.3071	99.0200	0.6332	0.2871	0.6%	0.3%
2	SB4VAR31	Al_2O_3	8.0918	8.1107	8.0047	0.0871	0.1060	1.1%	1.3%
2	SB4VAR31	B_2O_3	9.6436	9.5258	9.5200	0.1236	0.0058	1.3%	0.1%
2	SB4VAR31	BaO	0.0223	0.0234	0.0239	-0.0016	-0.0005	-6.6%	-2.0%
2	SB4VAR31	CaO	0.8728	0.8838	0.8809	-0.0081	0.0029	-0.9%	0.3%
2	SB4VAR31	Ce_2O_3	0.0196	0.0196	0.0210	-0.0013	-0.0013	-6.4%	-6.4%
2	SB4VAR31	Cr_2O_3	0.0537	0.0528	0.0500	0.0037	0.0028	7.4%	5.6%
2	SB4VAR31	CuO	0.0225	0.0234	0.0185	0.0040	0.0049	21.8%	26.5%
2	SB4VAR31	Fe_2O_3	8.8248	8.7410	9.1282	-0.3034	-0.3872	-3.3%	-4.2%
2	SB4VAR31	K_2O	0.1168	0.1260	0.1130	0.0039	0.0130	3.4%	11.5%
2	SB4VAR31	La_2O_3	0.0586	0.0586	0.0157	0.0429	0.0429	273.5%	273.5%
2	SB4VAR31	Li_2O	5.4038	5.5956	5.4400	-0.0362	0.1556	-0.7%	2.9%
2	SB4VAR31	MgO	0.8702	0.8876	0.8663	0.0039	0.0213	0.4%	2.5%
2	SB4VAR31	MnO	1.8400	1.8137	1.8333	0.0067	-0.0196	0.4%	-1.1%
2	SB4VAR31	Na_2O	11.8759	11.6629	11.9326	-0.0567	-0.2697	-0.5%	-2.3%
2	SB4VAR31	NiO	0.4705	0.4940	0.5079	-0.0374	-0.0139	-7.4%	-2.7%
2	SB4VAR31	PbO	0.0108	0.0108	0.0201	-0.0093	-0.0093	-46.4%	-46.4%
2	SB4VAR31	SiO_2	48.4551	47.4604	48.4587	-0.0036	-0.9983	0.0%	-2.1%
2	SB4VAR31	SO_4	0.3108	0.3108	0.3175	-0.0067	-0.0067	-2.1%	-2.1%
2	SB4VAR31	TiO_2	0.0225	0.0230	0.0124	0.0101	0.0106	81.6%	85.4%
2	SB4VAR31	U_3O_8	2.7298	2.7575	2.7852	-0.0554	-0.0277	-2.0%	-1.0%
2	SB4VAR31	ZnO	0.0062	0.0062	0.0250	-0.0188	-0.0188	-75.1%	-75.1%
2	SB4VAR31	ZrO_2	0.0220	0.0220	0.0254	-0.0034	-0.0034	-13.6%	-13.6%
2	SB4VAR31	Sum	99.7442	98.6098	100.0002	-0.2560	-1.3904	-0.3%	-1.4%
2	SB4VAR32	Al_2O_3	9.0885	9.1102	9.0053	0.0832	0.1049	0.9%	1.2%
2	SB4VAR32	B_2O_3	9.0077	9.0534	8.9600	0.0477	0.0934	0.5%	1.0%
2	SB4VAR32	BaO	0.0237	0.0249	0.0269	-0.0032	-0.0020	-11.8%	-7.5%
2	SB4VAR32	CaO	0.9801	0.9925	0.9910	-0.0109	0.0015	-1.1%	0.1%
2	SB4VAR32	Ce_2O_3	0.0199	0.0199	0.0236	-0.0037	-0.0037	-15.6%	-15.6%
2	SB4VAR32	Cr_2O_3	0.0632	0.0621	0.0563	0.0069	0.0058	12.3%	10.3%
2	SB4VAR32	CuO	0.0253	0.0263	0.0208	0.0045	0.0055	21.9%	26.6%
2	SB4VAR32	Fe_2O_3	10.1223	10.0235	10.2693	-0.1470	-0.2458	-1.4%	-2.4%
2	SB4VAR32	K_2O	0.1358	0.1464	0.1271	0.0087	0.0193	6.9%	15.2%
2	SB4VAR32	La_2O_3	0.0586	0.0586	0.0177	0.0409	0.0409	231.3%	231.3%
2	SB4VAR32	Li_2O	5.0163	5.2831	5.1200	-0.1037	0.1631	-2.0%	3.2%
2	SB4VAR32	MgO	0.9577	0.9765	0.9746	-0.0169	0.0019	-1.7%	0.2%
2	SB4VAR32	MnO	2.1014	2.0710	2.0624	0.0390	0.0086	1.9%	0.4%
2	SB4VAR32	Na_2O	12.3848	12.1611	12.4241	-0.0393	-0.2630	-0.3%	-2.1%
2	SB4VAR32	NiO	0.5189	0.5447	0.5714	-0.0525	-0.0267	-9.2%	-4.7%
2	SB4VAR32	PbO	0.0108	0.0108	0.0226	-0.0118	-0.0118	-52.3%	-52.3%
2	SB4VAR32	SiO_2	46.1019	45.1559	45.7660	0.3359	-0.6101	0.7%	-1.3%
2	SB4VAR32	SO_4	0.3490	0.3490	0.3572	-0.0082	-0.0082	-2.3%	-2.3%
2	SB4VAR32	TiO_2	0.0192	0.0196	0.0139	0.0053	0.0057	38.0%	40.9%
2	SB4VAR32	U_3O_8	3.0807	3.1127	3.1333	-0.0526	-0.0206	-1.7%	-0.7%
2	SB4VAR32	ZnO	0.0062	0.0062	0.0281	-0.0219	-0.0219	-77.9%	-77.9%
2	SB4VAR32	ZrO_2	0.0240	0.0240	0.0286	-0.0046	-0.0046	-16.2%	-16.2%
2	SB4VAR32	Sum	100.0960	99.2324	100.0002	0.0958	-0.7677	0.1%	-0.8%
2	SB4VAR33	Al_2O_3	9.7829	10.1544	10.0058	-0.2229	0.1486	-2.2%	1.5%
2	SB4VAR33	B_2O_3	8.4844	8.3827	8.4000	0.0844	-0.0173	1.0%	-0.2%
2	SB4VAR33	BaO	0.0248	0.0268	0.0298	-0.0050	-0.0030	-16.6%	-10.2%
2	SB4VAR33	CaO	1.0400	1.0823	1.1011	-0.0611	-0.0188	-5.6%	-1.7%

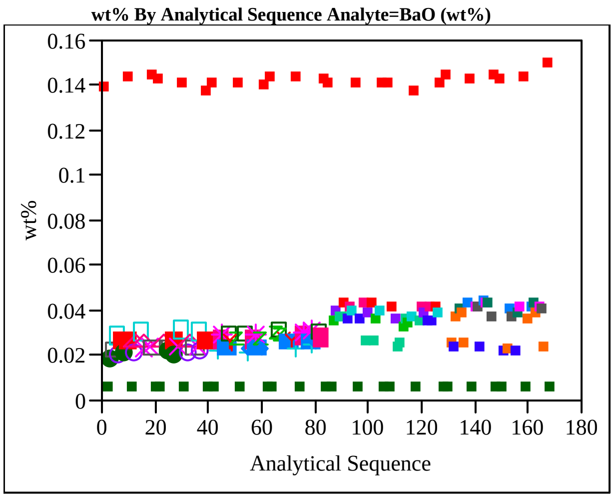
Table A4. Average Measured and Bias-Corrected Chemical Compositions Versus Targeted Compositions by Oxide by SB4-Decant Variability Study Glass

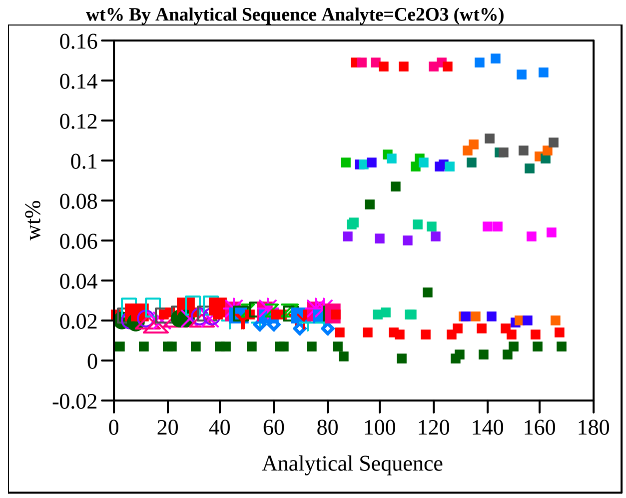
Set	Glass ID	Oxide	Measured (wt%)	Measured Bias-Corrected (BC) (wt%)	Targeted (wt%)	Diff of Measured	Diff of Meas BC	% Diff of Measured	% Diff of Meas. BC
2	SB4VAR33	Ce_2O_3	0.0225	0.0225	0.0262	-0.0037	-0.0037	-13.9%	-13.9%
2	SB4VAR33	Cr_2O_3	0.0552	0.0555	0.0626	-0.0074	-0.0071	-11.9%	-11.4%
2	SB4VAR33	CuO	0.0288	0.0308	0.0231	0.0057	0.0077	24.6%	33.5%
2	SB4VAR33	Fe_2O_3	10.7299	10.5166	11.4103	-0.6804	-0.8937	-6.0%	-7.8%
2	SB4VAR33	K_2O	0.1458	0.1619	0.1412	0.0046	0.0207	3.2%	14.7%
2	SB4VAR33	La_2O_3	0.0586	0.0586	0.0196	0.0390	0.0390	199.2%	199.2%
2	SB4VAR33	Li_2O	4.7848	4.9548	4.8000	-0.0152	0.1548	-0.3%	3.2%
2	SB4VAR33	MgO	1.0377	1.0769	1.0828	-0.0451	-0.0059	-4.2%	-0.5%
2	SB4VAR33	MnO	2.2757	2.1969	2.2916	-0.0159	-0.0947	-0.7%	-4.1%
2	SB4VAR33	Na_2O	12.4926	12.7415	12.9157	-0.4231	-0.1742	-3.3%	-1.3%
2	SB4VAR33	NiO	0.5574	0.5966	0.6349	-0.0775	-0.0383	-12.2%	-6.0%
2	SB4VAR33	PbO	0.0272	0.0272	0.0251	0.0021	0.0021	8.4%	8.4%
2	SB4VAR33	SiO_2	42.2512	41.7624	43.0734	-0.8222	-1.3110	-1.9%	-3.0%
2	SB4VAR33	SO_4	0.3715	0.3715	0.3969	-0.0254	-0.0254	-6.4%	-6.4%
2	SB4VAR33	TiO_2	0.0217	0.0228	0.0154	0.0063	0.0074	40.8%	47.7%
2	SB4VAR33	U_3O_8	3.3018	3.4637	3.4814	-0.1796	-0.0177	-5.2%	-0.5%
2	SB4VAR33	ZnO	0.0062	0.0062	0.0312	-0.0250	-0.0250	-80.1%	-80.1%
2	SB4VAR33	ZrO_2	0.0270	0.0270	0.0318	-0.0048	-0.0048	-15.0%	-15.0%
2	SB4VAR33	Sum	97.5277	97.7396	99.9999	-2.4722	-2.2603	-2.5%	-2.3%
2	U std	Al_2O_3	3.9365	4.0138	4.1000	-0.1635	-0.0862	-4.0%	-2.1%
2	U std	B_2O_3	9.0130	8.9811	9.2090	-0.1960	-0.2279	-2.1%	-2.5%
2	U std	BaO	0.0056	0.0059	0.0000	0.0056	0.0059		
2	U std	CaO	1.2649	1.2983	1.3010	-0.0361	-0.0027	-2.8%	-0.2%
2	U std	Ce_2O_3	0.0184	0.0184	0.0000	0.0184	0.0184		
2	U std	Cr_2O_3	0.2388	0.2374	0.0000	0.2388	0.2374		
2	U std	CuO	0.0063	0.0066	0.0000	0.0063	0.0066		
2	U std	Fe_2O_3	13.4511	13.2525	13.1960	0.2551	0.0565	1.9%	0.4%
2	U std	K_2O	2.6973	2.9511	2.9990	-0.3017	-0.0479	-10.1%	-1.6%
2	U std	La_2O_3	0.0586	0.0586	0.0000	0.0586	0.0586		
2	U std	Li_2O	2.9387	3.0688	3.0570	-0.1183	0.0118	-3.9%	0.4%
2	U std	MgO	1.1868	1.2208	1.2100	-0.0232	0.0108	-1.9%	0.9%
2	U std	MnO	2.8858	2.8149	2.8920	-0.0062	-0.0771	-0.2%	-2.7%
2	U std	Na_2O	11.6624	11.6666	11.7950	-0.1326	-0.1284	-1.1%	-1.1%
2	U std	NiO	0.9483	1.0044	1.1200	-0.1717	-0.1156	-15.3%	-10.3%
2	U std	PbO	0.0108	0.0108	0.0000	0.0108	0.0108		
2	U std	SiO_2	46.0841	45.3438	45.3530	0.7311	-0.0092	1.6%	0.0%
2	U std	SO_4	0.1498	0.1498	0.0000	0.1498	0.1498		
2	U std	TiO_2	0.9517	0.9847	1.0490	-0.0973	-0.0643	-9.3%	-6.1%
2	U std	U_3O_8	2.3378	2.4060	2.4060	-0.0682	0.0000	-2.8%	0.0%
2	U std	ZnO	0.0062	0.0062	0.0000	0.0062	0.0062		
2	U std	ZrO_2	0.0068	0.0068	0.0000	0.0068	0.0068		
2	U std	Sum	99.8598	99.5075	99.6870	0.1728	-0.1795	0.2%	-0.2%

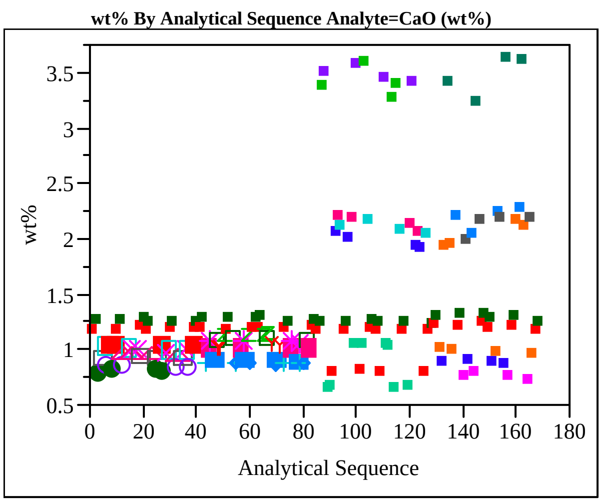
Exhibit A1. Oxide Measurements in Analytical Sequence for Samples Prepared Using the LM Method











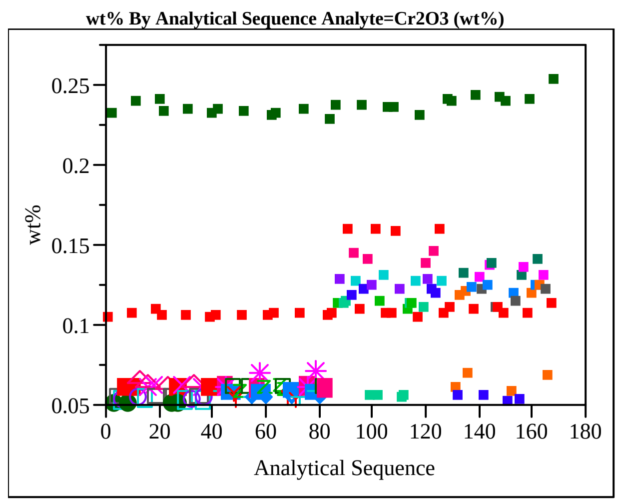
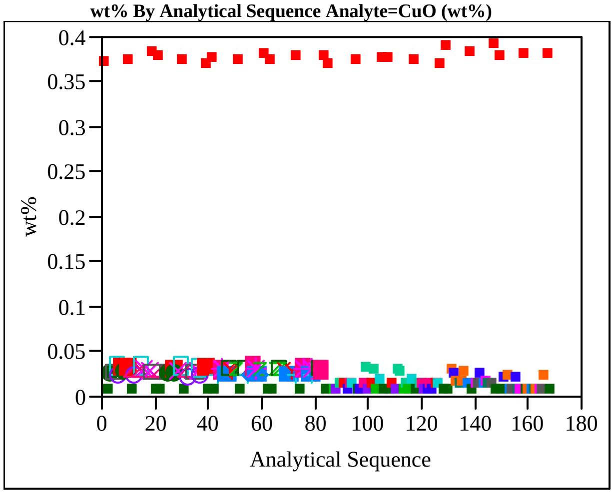
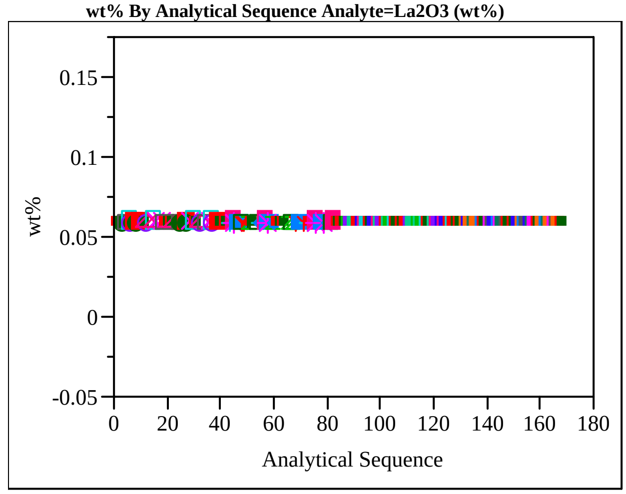


Exhibit A1. Oxide Measurements in Analytical Sequence for Samples Prepared Using the LM Method

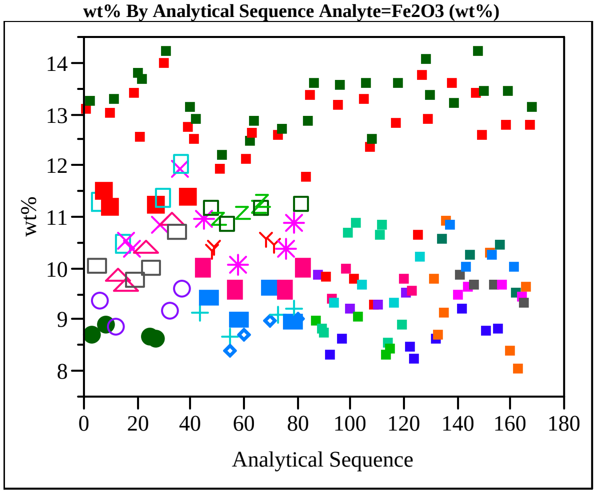
wt% By Analytical Sequence Analyte=CuO (wt%)



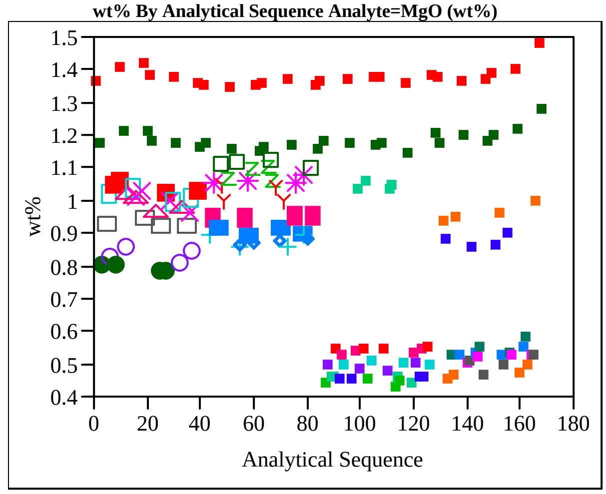
wt% By Analytical Sequence Analyte=La2O3 (wt%)



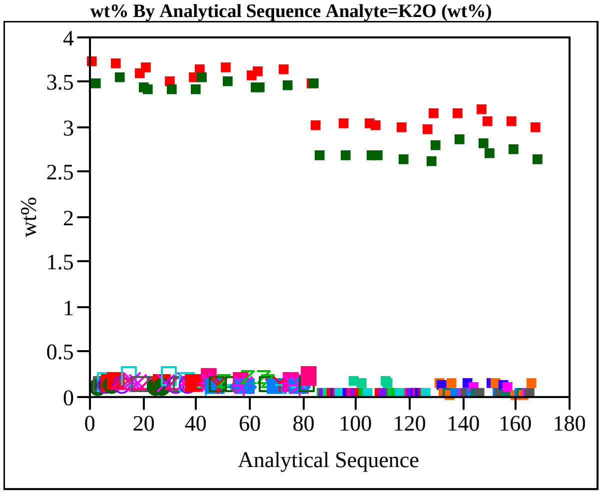
wt% By Analytical Sequence Analyte=Fe2O3 (wt%)



wt% By Analytical Sequence Analyte=MgO (wt%)



wt% By Analytical Sequence Analyte=K2O (wt%)



wt% By Analytical Sequence Analyte=MnO (wt%)

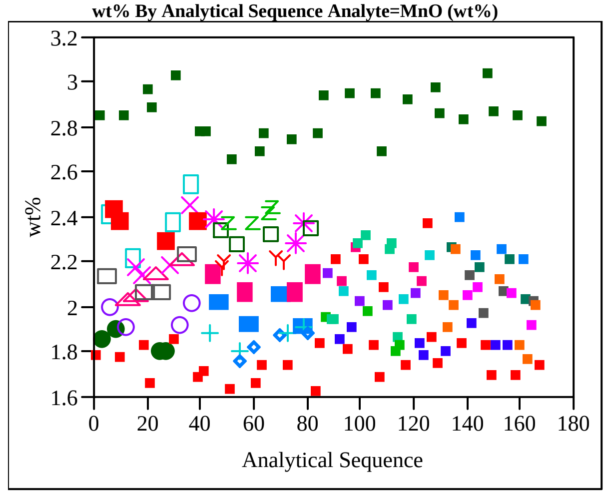
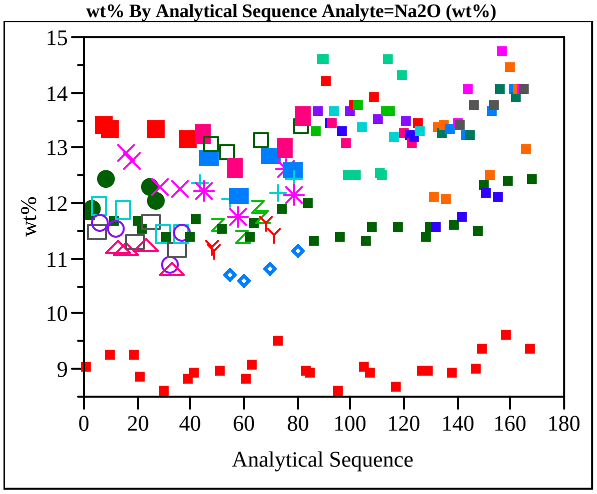
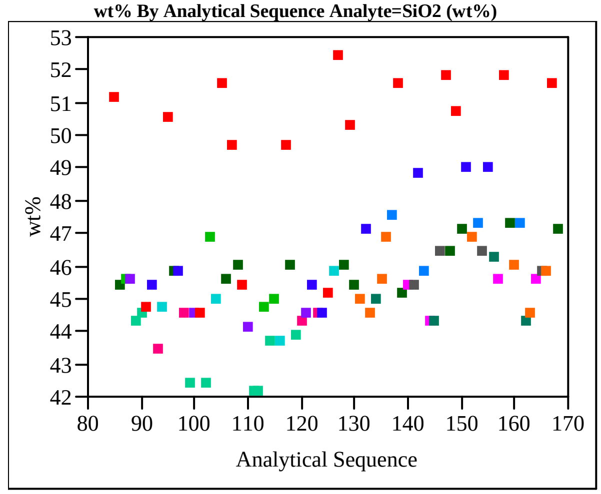


Exhibit A1. Oxide Measurements in Analytical Sequence for Samples Prepared Using the LM Method

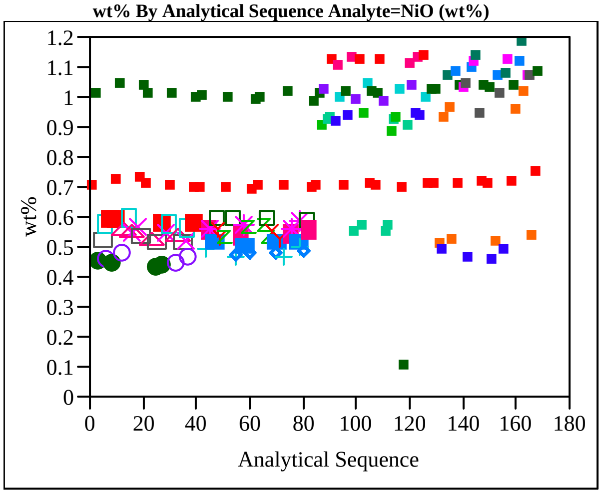
wt% By Analytical Sequence Analyte=Na2O (wt%)



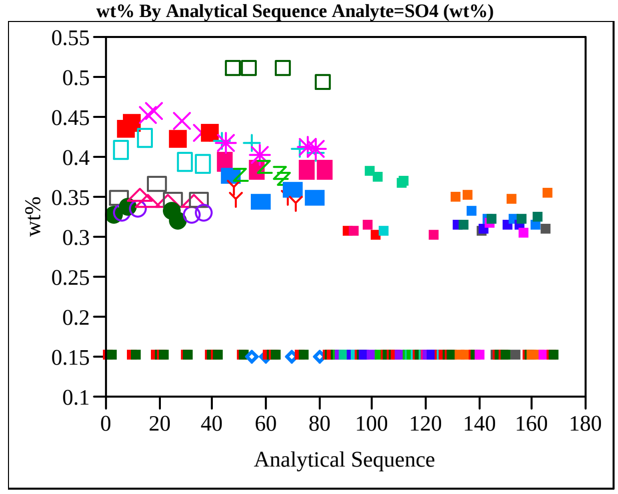
wt% By Analytical Sequence Analyte=SiO2 (wt%)



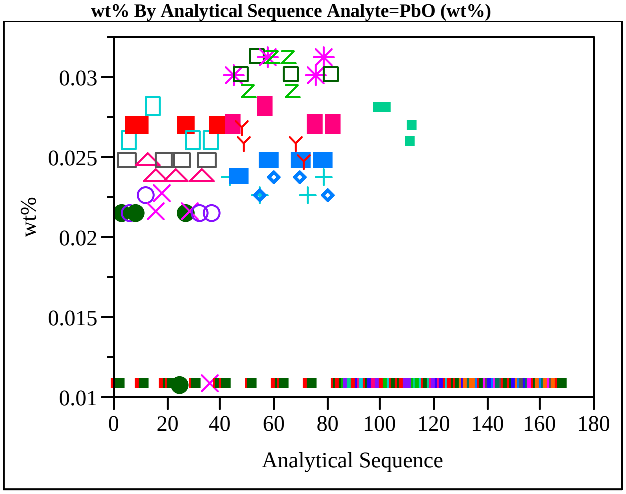
wt% By Analytical Sequence Analyte=NiO (wt%)



wt% By Analytical Sequence Analyte=SO4 (wt%)



wt% By Analytical Sequence Analyte=PbO (wt%)



wt% By Analytical Sequence Analyte=TiO2 (wt%)

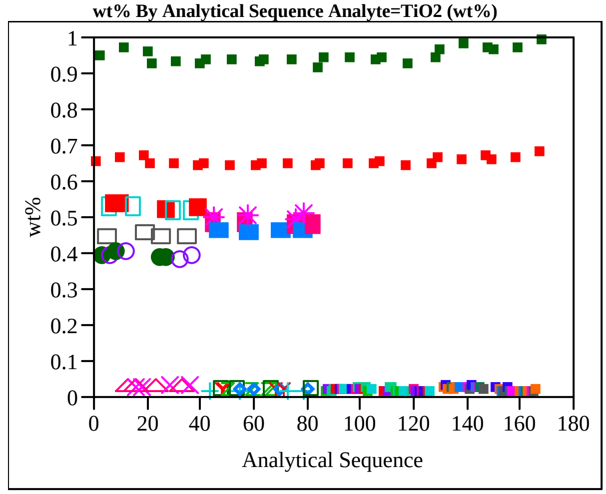
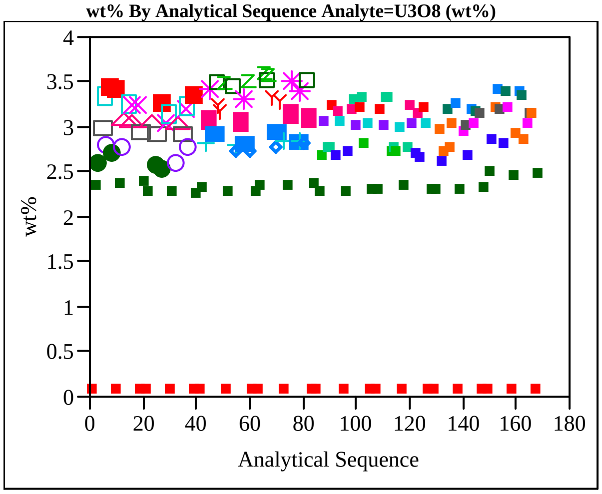
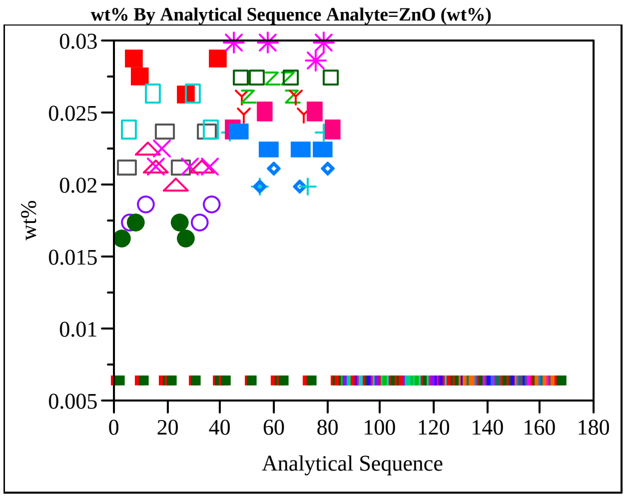


Exhibit A1. Oxide Measurements in Analytical Sequence for Samples Prepared Using the LM Method





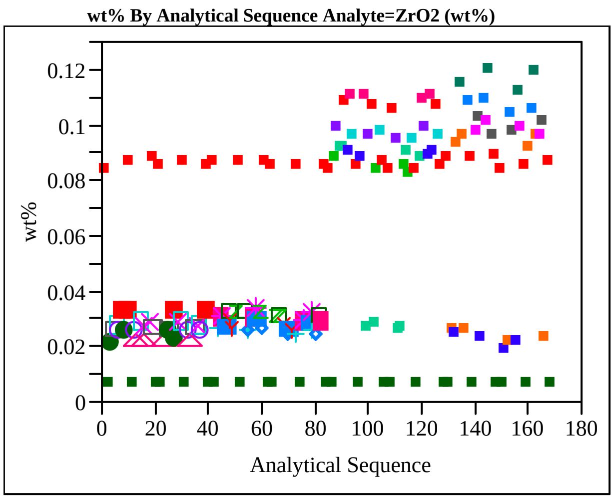
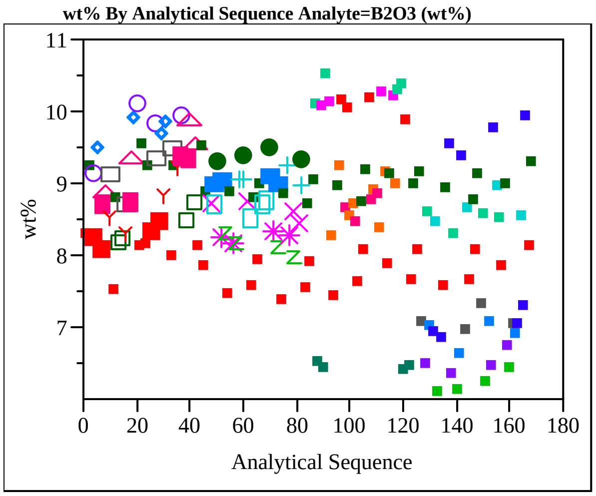
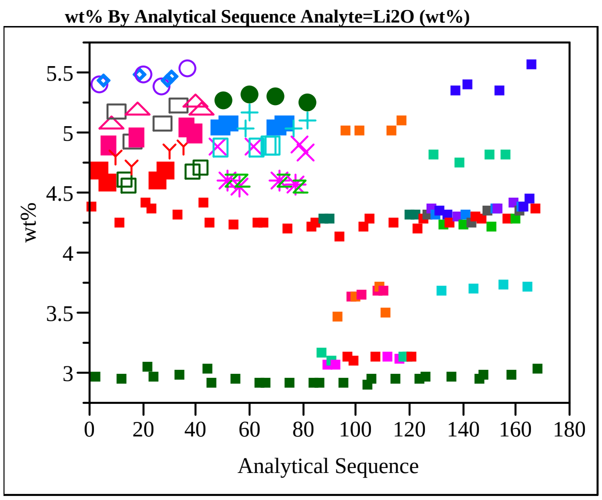


Exhibit A2. Oxide Measurements in Analytical Sequence for Samples Prepared Using the PF Method





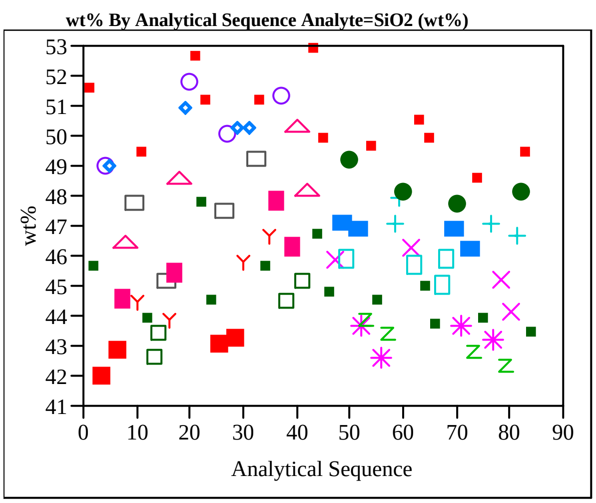
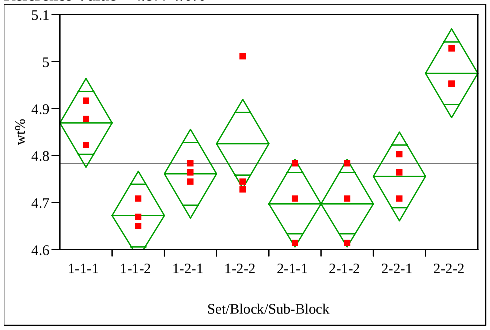


Exhibit A3. PSAL Measurements by Analytical Block for Samples of the Standard Glasses Prepared Using the LM Method

Oneway Analysis of wt% By Set/Block/Sub-Block Glass ID=Batch 1, Analyte=Al2O3 (wt%)
Reference Value = 4.877 wt%



Oneway Anova
Summary of Fit

Rsquare	0.700547
Adj Rsquare	0.569536
Root Mean Square Error	0.076849
Mean of Response	4.78201
Observations (or Sum Wgts)	24

Analysis of Variance

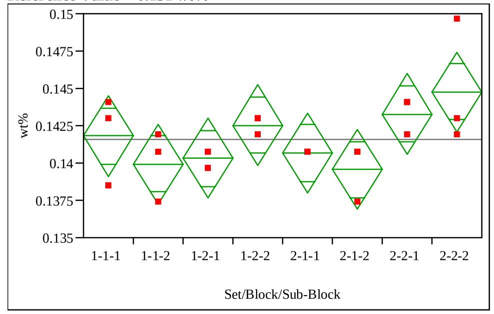
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Block	7	0.22105552	0.031579	5.3472	0.0027
Error	16	0.09449156	0.005906		
C. Total	23	0.31554708			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1-1-1	3	4.86861	0.04437	4.7746	4.9627
1-1-2	3	4.67336	0.04437	4.5793	4.7674
1-2-1	3	4.76154	0.04437	4.6675	4.8556
1-2-2	3	4.82452	0.04437	4.7305	4.9186
2-1-1	3	4.69856	0.04437	4.6045	4.7926
2-1-2	3	4.69856	0.04437	4.6045	4.7926
2-2-1	3	4.75524	0.04437	4.6612	4.8493
2-2-2	3	4.97568	0.04437	4.8816	5.0697

Std Error uses a pooled estimate of error variance

Oneway Analysis of wt% By Set/Block/Sub-Block Glass ID=Batch 1, Analyte=BaO (wt%)
Reference Value = 0.151 wt%



Oneway Anova
Summary of Fit

Rsquare	0.477273
Adj Rsquare	0.24858
Root Mean Square Error	0.002186
Mean of Response	0.141609
Observations (or Sum Wgts)	24

Analysis of Variance

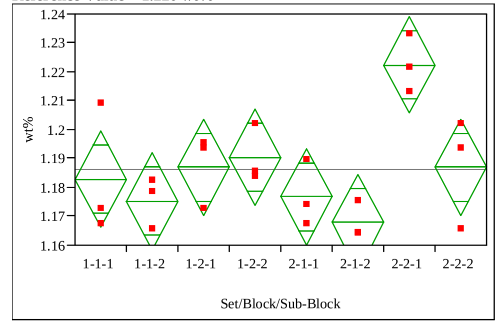
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Block	7	0.00006981	9.9726e-6	2.0870	0.1057
Error	16	0.00007646	4.7785e-6		
C. Total	23	0.00014626			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1-1-1	3	0.141796	0.00126	0.13912	0.14447
1-1-2	3	0.139935	0.00126	0.13726	0.14261
1-2-1	3	0.140307	0.00126	0.13763	0.14298
1-2-2	3	0.142540	0.00126	0.13986	0.14522
2-1-1	3	0.140679	0.00126	0.13800	0.14335
2-1-2	3	0.139563	0.00126	0.13689	0.14224
2-2-1	3	0.143284	0.00126	0.14061	0.14596
2-2-2	3	0.144773	0.00126	0.14210	0.14745

Std Error uses a pooled estimate of error variance

Oneway Analysis of wt% By Set/Block/Sub-Block Glass ID=Batch 1, Analyte=CaO (wt%)
Reference Value = 1.220 wt%



Oneway Anova
Summary of Fit

Rsquare	0.655368
Adj Rsquare	0.504591
Root Mean Square Error	0.013638
Mean of Response	1.186172
Observations (or Sum Wgts)	24

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Block	7	0.00565891	0.000808	4.3466	0.0071
Error	16	0.00297580	0.000186		
C. Total	23	0.00863470			

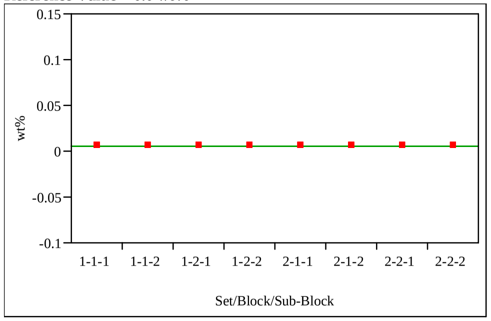
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1-1-1	3	1.18279	0.00787	1.1661	1.1995
1-1-2	3	1.17533	0.00787	1.1586	1.1920
1-2-1	3	1.18699	0.00787	1.1703	1.2037
1-2-2	3	1.19025	0.00787	1.1736	1.2069
2-1-1	3	1.17673	0.00787	1.1600	1.1934
2-1-2	3	1.16787	0.00787	1.1512	1.1846
2-2-1	3	1.22243	0.00787	1.2057	1.2391
2-2-2	3	1.18699	0.00787	1.1703	1.2037

Std Error uses a pooled estimate of error variance

Exhibit A3. PSAL Measurements by Analytical Block for Samples of the Standard Glasses Prepared Using the LM Method

Oneway Analysis of wt% By Set/Block/Sub-Block Glass ID=Batch 1, Analyte=CdO (wt%)
Reference Value = 0.0 wt%



Oneway Anova
Summary of Fit

Rsquare	.
Adj Rsquare	.
Root Mean Square Error	0
Mean of Response	0.005712
Observations (or Sum Wgts)	24

Analysis of Variance

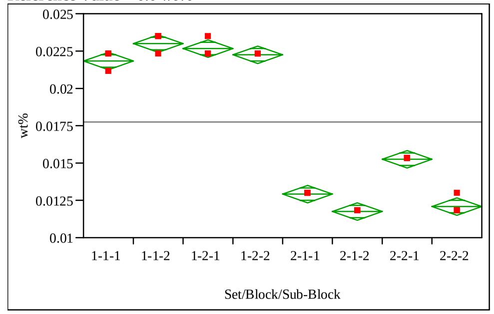
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Block	7	0	0	.	.
Error	16	0	0		
C. Total	23	0			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1-1-1	3	0.005712	0	0.00571	0.00571
1-1-2	3	0.005712	0	0.00571	0.00571
1-2-1	3	0.005712	0	0.00571	0.00571
1-2-2	3	0.005712	0	0.00571	0.00571
2-1-1	3	0.005712	0	0.00571	0.00571
2-1-2	3	0.005712	0	0.00571	0.00571
2-2-1	3	0.005712	0	0.00571	0.00571
2-2-2	3	0.005712	0	0.00571	0.00571

Std Error uses a pooled estimate of error variance

Oneway Analysis of wt% By Set/Block/Sub-Block Glass ID=Batch 1, Analyte=Ce2O3 (wt%)
Reference Value = 0.0 wt%



Oneway Anova
Summary of Fit

Rsquare	0.993537
Adj Rsquare	0.99071
Root Mean Square Error	0.000478
Mean of Response	0.017716
Observations (or Sum Wgts)	24

Analysis of Variance

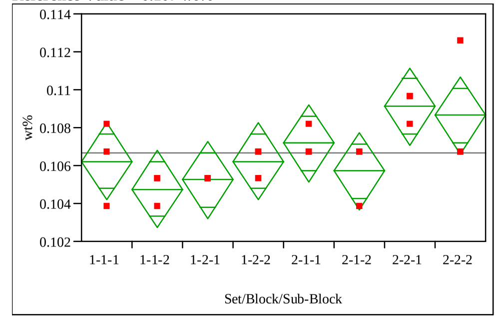
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Block	7	0.00056244	0.000080	351.3929	<.0001
Error	16	0.00000366	2.287e-7		
C. Total	23	0.00056610			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1-1-1	3	0.021864	0.00028	0.02128	0.02245
1-1-2	3	0.023036	0.00028	0.02245	0.02362
1-2-1	3	0.022645	0.00028	0.02206	0.02323
1-2-2	3	0.022255	0.00028	0.02167	0.02284
2-1-1	3	0.012884	0.00028	0.01230	0.01347
2-1-2	3	0.011713	0.00028	0.01113	0.01230
2-2-1	3	0.015227	0.00028	0.01464	0.01581
2-2-2	3	0.012103	0.00028	0.01152	0.01269

Std Error uses a pooled estimate of error variance

Oneway Analysis of wt% By Set/Block/Sub-Block Glass ID=Batch 1, Analyte=Cr2O3 (wt%)
Reference Value = 0.107 wt%



Oneway Anova
Summary of Fit

Rsquare	0.540315
Adj Rsquare	0.339203
Root Mean Square Error	0.001661
Mean of Response	0.106636
Observations (or Sum Wgts)	24

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Block	7	0.00005189	7.4134e-6	2.6866	0.0482
Error	16	0.00004415	2.7594e-6		
C. Total	23	0.00009604			

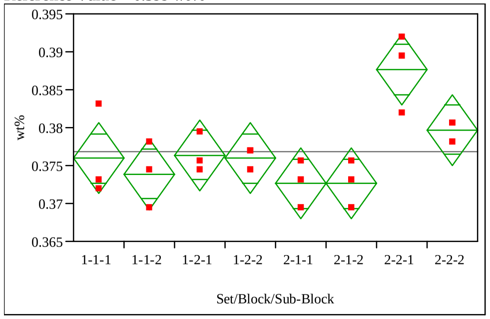
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1-1-1	3	0.106210	0.00096	0.10418	0.10824
1-1-2	3	0.104748	0.00096	0.10271	0.10678
1-2-1	3	0.105235	0.00096	0.10320	0.10727
1-2-2	3	0.106210	0.00096	0.10418	0.10824
2-1-1	3	0.107184	0.00096	0.10515	0.10922
2-1-2	3	0.105722	0.00096	0.10369	0.10776
2-2-1	3	0.109133	0.00096	0.10710	0.11117
2-2-2	3	0.108646	0.00096	0.10661	0.11068

Std Error uses a pooled estimate of error variance

Exhibit A3. PSAL Measurements by Analytical Block for Samples of the Standard Glasses Prepared Using the LM Method

Oneway Analysis of wt% By Set/Block/Sub-Block Glass ID=Batch 1, Analyte=CuO (wt%)
Reference Value = 0.399 wt%



Oneway Anova
Summary of Fit

Rsquare	0.689797
Adj Rsquare	0.554084
Root Mean Square Error	0.003799
Mean of Response	0.376844
Observations (or Sum Wgts)	24

Analysis of Variance

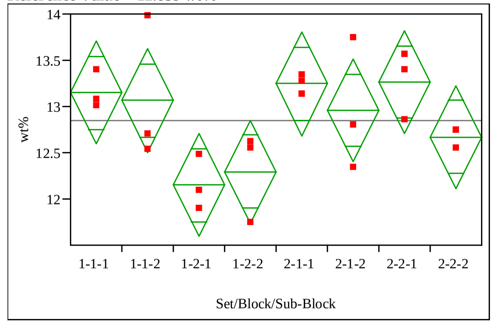
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Block	7	0.00051339	0.000073	5.0827	0.0034
Error	16	0.00023087	0.000014		
C. Total	23	0.00074426			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1-1-1	3	0.375957	0.00219	0.37131	0.38061
1-1-2	3	0.373871	0.00219	0.36922	0.37852
1-2-1	3	0.376375	0.00219	0.37173	0.38102
1-2-2	3	0.375957	0.00219	0.37131	0.38061
2-1-1	3	0.372619	0.00219	0.36797	0.37727
2-1-2	3	0.372619	0.00219	0.36797	0.37727
2-2-1	3	0.387641	0.00219	0.38299	0.39229
2-2-2	3	0.379713	0.00219	0.37506	0.38436

Std Error uses a pooled estimate of error variance

Oneway Analysis of wt% By Set/Block/Sub-Block Glass ID=Batch 1, Analyte=Fe2O3 (wt%)
Reference Value = 12.839 wt%



Oneway Anova
Summary of Fit

Rsquare	0.541962
Adj Rsquare	0.341571
Root Mean Square Error	0.454572
Mean of Response	12.84883
Observations (or Sum Wgts)	24

Analysis of Variance

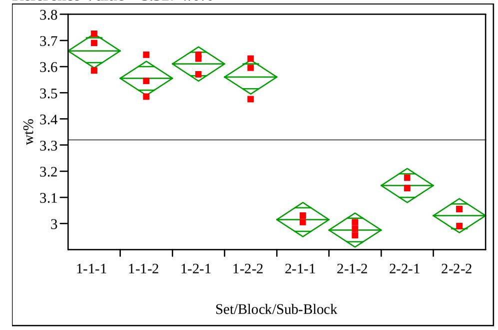
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Block	7	3.9119474	0.558850	2.7045	0.0471
Error	16	3.3061699	0.206636		
C. Total	23	7.2181173			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1-1-1	3	13.1485	0.26245	12.592	13.705
1-1-2	3	13.0627	0.26245	12.506	13.619
1-2-1	3	12.1477	0.26245	11.591	12.704
1-2-2	3	12.2954	0.26245	11.739	12.852
2-1-1	3	13.2438	0.26245	12.687	13.800
2-1-2	3	12.9578	0.26245	12.401	13.514
2-2-1	3	13.2629	0.26245	12.706	13.819
2-2-2	3	12.6719	0.26245	12.116	13.228

Std Error uses a pooled estimate of error variance

Oneway Analysis of wt% By Set/Block/Sub-Block Glass ID=Batch 1, Analyte=K2O (wt%)
Reference Value = 3.327 wt%



Oneway Anova
Summary of Fit

Rsquare	0.977123
Adj Rsquare	0.967115
Root Mean Square Error	0.05308
Mean of Response	3.318673
Observations (or Sum Wgts)	24

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Block	7	1.9254614	0.275066	97.6284	<.0001
Error	16	0.0450796	0.002817		
C. Total	23	1.9705411			

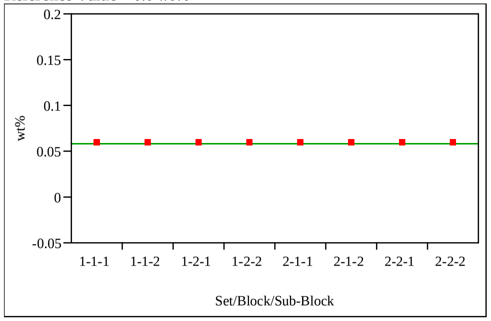
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1-1-1	3	3.66198	0.03065	3.5970	3.7269
1-1-2	3	3.55357	0.03065	3.4886	3.6185
1-2-1	3	3.60978	0.03065	3.5448	3.6748
1-2-2	3	3.56160	0.03065	3.4966	3.6266
2-1-1	3	3.01552	0.03065	2.9505	3.0805
2-1-2	3	2.97536	0.03065	2.9104	3.0403
2-2-1	3	3.14401	0.03065	3.0790	3.2090
2-2-2	3	3.02756	0.03065	2.9626	3.0925

Std Error uses a pooled estimate of error variance

Exhibit A3. PSAL Measurements by Analytical Block for Samples of the Standard Glasses Prepared Using the LM Method

Oneway Analysis of wt% By Set/Block/Sub-Block Glass ID=Batch 1, Analyte=La2O3 (wt%)
Reference Value = 0.0 wt%



Oneway Anova
Summary of Fit

Rsquare	1
Adj Rsquare	1
Root Mean Square Error	0
Mean of Response	0.05864
Observations (or Sum Wgts)	24

Analysis of Variance

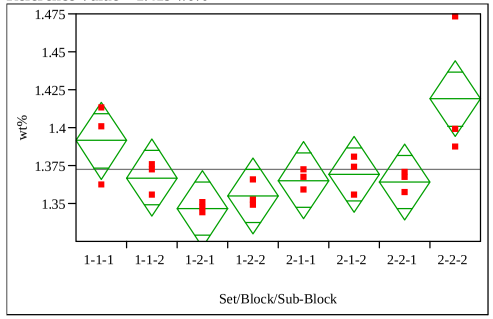
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Block	7	4.6222e-33	6.603e-34	.	.
Error	16	0	0		
C. Total	23	4.6222e-33			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1-1-1	3	0.058640	0	0.05864	0.05864
1-1-2	3	0.058640	0	0.05864	0.05864
1-2-1	3	0.058640	0	0.05864	0.05864
1-2-2	3	0.058640	0	0.05864	0.05864
2-1-1	3	0.058640	0	0.05864	0.05864
2-1-2	3	0.058640	0	0.05864	0.05864
2-2-1	3	0.058640	0	0.05864	0.05864
2-2-2	3	0.058640	0	0.05864	0.05864

Std Error uses a pooled estimate of error variance

Oneway Analysis of wt% By Set/Block/Sub-Block Glass ID=Batch 1, Analyte=MgO (wt%)
Reference Value = 1.419 wt%



Oneway Anova
Summary of Fit

Rsquare	0.620051
Adj Rsquare	0.453824
Root Mean Square Error	0.020501
Mean of Response	1.372174
Observations (or Sum Wgts)	24

Analysis of Variance

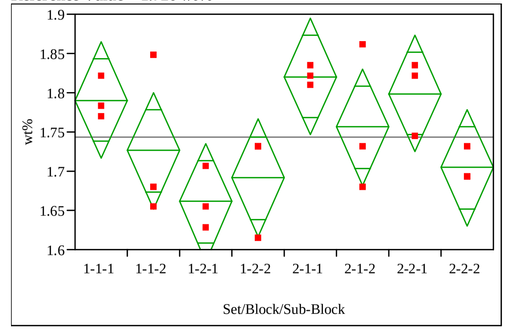
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Block	7	0.01097405	0.001568	3.7301	0.0139
Error	16	0.00672457	0.000420		
C. Total	23	0.01769862			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1-1-1	3	1.39131	0.01184	1.3662	1.4164
1-1-2	3	1.36699	0.01184	1.3419	1.3921
1-2-1	3	1.34654	0.01184	1.3214	1.3716
1-2-2	3	1.35483	0.01184	1.3297	1.3799
2-1-1	3	1.36533	0.01184	1.3402	1.3904
2-1-2	3	1.36920	0.01184	1.3441	1.3943
2-2-1	3	1.36423	0.01184	1.3391	1.3893
2-2-2	3	1.41895	0.01184	1.3939	1.4440

Std Error uses a pooled estimate of error variance

Oneway Analysis of wt% By Set/Block/Sub-Block Glass ID=Batch 1, Analyte=MnO (wt%)
Reference Value = 1.726 wt%



Oneway Anova
Summary of Fit

Rsquare	0.535143
Adj Rsquare	0.331768
Root Mean Square Error	0.060792
Mean of Response	1.743658
Observations (or Sum Wgts)	24

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Block	7	0.06807028	0.009724	2.6313	0.0517
Error	16	0.05912994	0.003696		
C. Total	23	0.12720022			

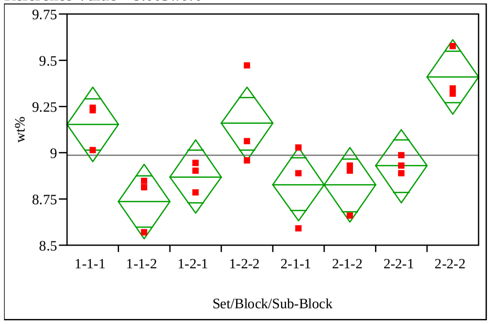
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1-1-1	3	1.79046	0.03510	1.7161	1.8649
1-1-2	3	1.72590	0.03510	1.6515	1.8003
1-2-1	3	1.66134	0.03510	1.5869	1.7357
1-2-2	3	1.69147	0.03510	1.6171	1.7659
2-1-1	3	1.82059	0.03510	1.7462	1.8950
2-1-2	3	1.75603	0.03510	1.6816	1.8304
2-2-1	3	1.79907	0.03510	1.7247	1.8735
2-2-2	3	1.70438	0.03510	1.6300	1.7788

Std Error uses a pooled estimate of error variance

Exhibit A3. PSAL Measurements by Analytical Block for Samples of the Standard Glasses Prepared Using the LM Method

Oneway Analysis of wt% By Set/Block/Sub-Block Glass ID=Batch 1, Analyte=Na2O (wt%)
Reference Value = 9.003wt%



Oneway Anova
Summary of Fit

Rsquare	0.720923
Adj Rsquare	0.598827
Root Mean Square Error	0.163089
Mean of Response	8.988352
Observations (or Sum Wgts)	24

Analysis of Variance

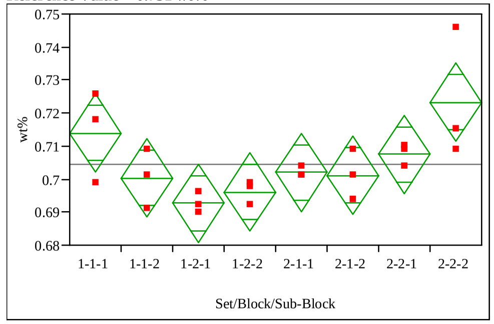
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Block	7	1.0993403	0.157049	5.9046	0.0016
Error	16	0.4255658	0.026598		
C. Total	23	1.5249061			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1-1-1	3	9.15292	0.09416	8.9533	9.3525
1-1-2	3	8.73504	0.09416	8.5354	8.9346
1-2-1	3	8.86984	0.09416	8.6702	9.0694
1-2-2	3	9.15741	0.09416	8.9578	9.3570
2-1-1	3	8.82940	0.09416	8.6298	9.0290
2-1-2	3	8.82491	0.09416	8.6253	9.0245
2-2-1	3	8.92825	0.09416	8.7286	9.1279
2-2-2	3	9.40904	0.09416	9.2094	9.6086

Std Error uses a pooled estimate of error variance

Oneway Analysis of wt% By Set/Block/Sub-Block Glass ID=Batch 1, Analyte=NiO (wt%)
Reference Value = 0.751 wt%



Oneway Anova
Summary of Fit

Rsquare	0.580351
Adj Rsquare	0.396754
Root Mean Square Error	0.009695
Mean of Response	0.704594
Observations (or Sum Wgts)	24

Analysis of Variance

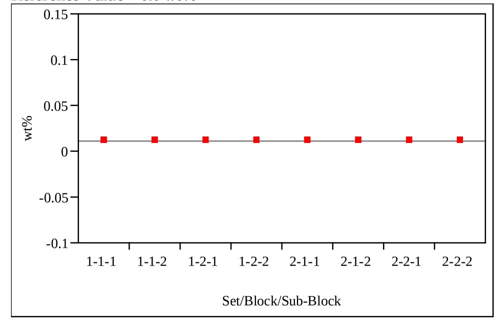
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Block	7	0.00207960	0.000297	3.1610	0.0268
Error	16	0.00150375	0.000094		
C. Total	23	0.00358335			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1-1-1	3	0.713873	0.00560	0.70201	0.72574
1-1-2	3	0.700299	0.00560	0.68843	0.71216
1-2-1	3	0.692664	0.00560	0.68080	0.70453
1-2-2	3	0.696058	0.00560	0.68419	0.70792
2-1-1	3	0.701996	0.00560	0.69013	0.71386
2-1-2	3	0.701148	0.00560	0.68928	0.71301
2-2-1	3	0.707510	0.00560	0.69564	0.71938
2-2-2	3	0.723204	0.00560	0.71134	0.73507

Std Error uses a pooled estimate of error variance

Oneway Analysis of wt% By Set/Block/Sub-Block Glass ID=Batch 1, Analyte=PbO (wt%)
Reference Value = 0.0 wt%



Oneway Anova
Summary of Fit

Rsquare	4
Adj Rsquare	5.3125
Root Mean Square Error	.
Mean of Response	0.010772
Observations (or Sum Wgts)	24

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Block	7	2.8889e-34	4.127e-35	-3.0476	0.0000
Error	16	-2.167e-34	-1.35e-35		
C. Total	23	7.2222e-35			

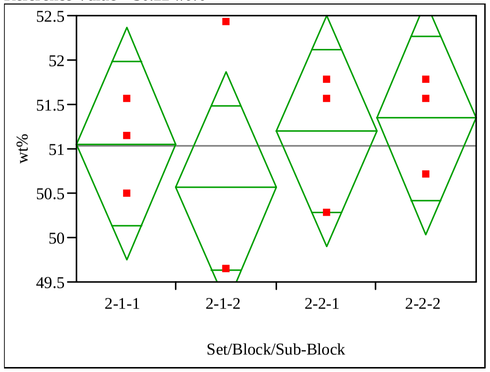
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1-1-1	3	0.010772	.	.	.
1-1-2	3	0.010772	.	.	.
1-2-1	3	0.010772	.	.	.
1-2-2	3	0.010772	.	.	.
2-1-1	3	0.010772	.	.	.
2-1-2	3	0.010772	.	.	.
2-2-1	3	0.010772	.	.	.
2-2-2	3	0.010772	.	.	.

Std Error uses a pooled estimate of error variance

Exhibit A3. PSAL Measurements by Analytical Block for Samples of the Standard Glasses Prepared Using the LM Method

Oneway Analysis of wt% By Set/Block/Sub-Block Glass ID=Batch 1, Analyte=SiO2 (wt%)
Reference Value = 50.22 wt%



Missing Rows
12

Oneway Anova
Summary of Fit

Rsquare	0.120035
Adj Rsquare	-0.20995
Root Mean Square Error	0.98035
Mean of Response	51.04013
Observations (or Sum Wgts)	12

Analysis of Variance

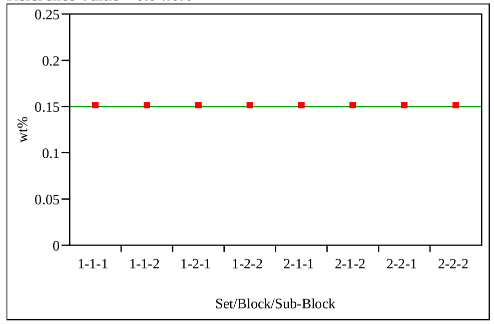
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Block	3	1.0488052	0.349602	0.3638	0.7812
Error	8	7.6886955	0.961087		
C. Total	11	8.7375007			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
2-1-1	3	51.0580	0.56601	49.753	52.363
2-1-2	3	50.5588	0.56601	49.254	51.864
2-2-1	3	51.2006	0.56601	49.895	52.506
2-2-2	3	51.3432	0.56601	50.038	52.648

Std Error uses a pooled estimate of error variance

Oneway Analysis of wt% By Set/Block/Sub-Block Glass ID=Batch 1, Analyte=SO4 (wt%)
Reference Value = 0.0 wt%



Oneway Anova
Summary of Fit

Rsquare	.
Adj Rsquare	.
Root Mean Square Error	0
Mean of Response	0.149795
Observations (or Sum Wgts)	24

Analysis of Variance

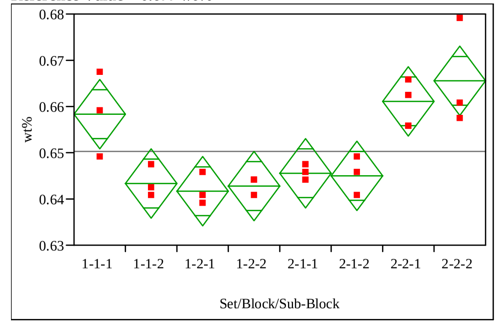
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Block	7	0	0	.	.
Error	16	0	0		
C. Total	23	0			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1-1-1	3	0.149795	0	0.14980	0.14980
1-1-2	3	0.149795	0	0.14980	0.14980
1-2-1	3	0.149795	0	0.14980	0.14980
1-2-2	3	0.149795	0	0.14980	0.14980
2-1-1	3	0.149795	0	0.14980	0.14980
2-1-2	3	0.149795	0	0.14980	0.14980
2-2-1	3	0.149795	0	0.14980	0.14980
2-2-2	3	0.149795	0	0.14980	0.14980

Std Error uses a pooled estimate of error variance

Oneway Analysis of wt% By Set/Block/Sub-Block Glass ID=Batch 1, Analyte=TiO2 (wt%)
Reference Value = 0.677 wt%



Oneway Anova
Summary of Fit

Rsquare	0.766477
Adj Rsquare	0.664311
Root Mean Square Error	0.006072
Mean of Response	0.650381
Observations (or Sum Wgts)	24

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Block	7	0.00193596	0.000277	7.5022	0.0004
Error	16	0.00058983	0.000037		
C. Total	23	0.00252580			

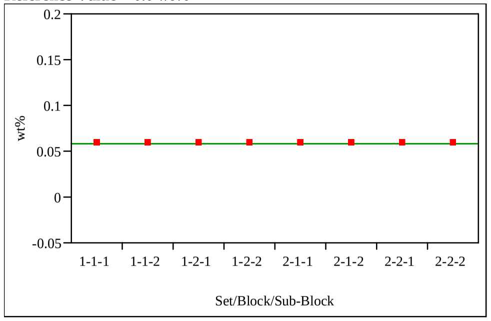
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1-1-1	3	0.658304	0.00351	0.65087	0.66574
1-1-2	3	0.643292	0.00351	0.63586	0.65072
1-2-1	3	0.641624	0.00351	0.63419	0.64906
1-2-2	3	0.642736	0.00351	0.63530	0.65017
2-1-1	3	0.645516	0.00351	0.63808	0.65295
2-1-2	3	0.644960	0.00351	0.63753	0.65239
2-2-1	3	0.661084	0.00351	0.65365	0.66852
2-2-2	3	0.665532	0.00351	0.65810	0.67296

Std Error uses a pooled estimate of error variance

Exhibit A3. PSAL Measurements by Analytical Block for Samples of the Standard Glasses Prepared Using the LM Method

Oneway Analysis of wt% By Set/Block/Sub-Block Glass ID=Batch 1, Analyte=U3O8 (wt%)
Reference Value = 0.0 wt%



Oneway Anova
Summary of Fit

Rsquare	1
Adj Rsquare	1
Root Mean Square Error	0
Mean of Response	0.05896
Observations (or Sum Wgts)	24

Analysis of Variance

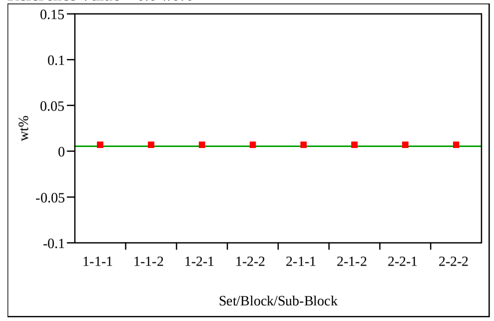
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Block	7	4.6222e-33	6.603e-34	.	.
Error	16	0	0		
C. Total	23	4.6222e-33			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1-1-1	3	0.058960	0	0.05896	0.05896
1-1-2	3	0.058960	0	0.05896	0.05896
1-2-1	3	0.058960	0	0.05896	0.05896
1-2-2	3	0.058960	0	0.05896	0.05896
2-1-1	3	0.058960	0	0.05896	0.05896
2-1-2	3	0.058960	0	0.05896	0.05896
2-2-1	3	0.058960	0	0.05896	0.05896
2-2-2	3	0.058960	0	0.05896	0.05896

Std Error uses a pooled estimate of error variance

Oneway Analysis of wt% By Set/Block/Sub-Block Glass ID=Batch 1, Analyte=ZnO (wt%)
Reference Value = 0.0 wt%



Oneway Anova
Summary of Fit

Rsquare	.
Adj Rsquare	.
Root Mean Square Error	0
Mean of Response	0.006224
Observations (or Sum Wgts)	24

Analysis of Variance

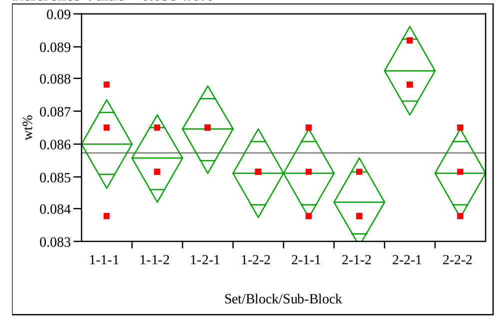
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Block	7	0	0	.	.
Error	16	0	0		
C. Total	23	0			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1-1-1	3	0.006224	0	0.00622	0.00622
1-1-2	3	0.006224	0	0.00622	0.00622
1-2-1	3	0.006224	0	0.00622	0.00622
1-2-2	3	0.006224	0	0.00622	0.00622
2-1-1	3	0.006224	0	0.00622	0.00622
2-1-2	3	0.006224	0	0.00622	0.00622
2-2-1	3	0.006224	0	0.00622	0.00622
2-2-2	3	0.006224	0	0.00622	0.00622

Std Error uses a pooled estimate of error variance

Oneway Analysis of wt% By Set/Block/Sub-Block Glass ID=Batch 1, Analyte=ZrO2 (wt%)
Reference Value = 0.098 wt%



Oneway Anova
Summary of Fit

Rsquare	0.61848
Adj Rsquare	0.451565
Root Mean Square Error	0.001103
Mean of Response	0.08572
Observations (or Sum Wgts)	24

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Block	7	0.00003155	4.5073e-6	3.7054	0.0142
Error	16	0.00001946	1.2164e-6		
C. Total	23	0.00005101			

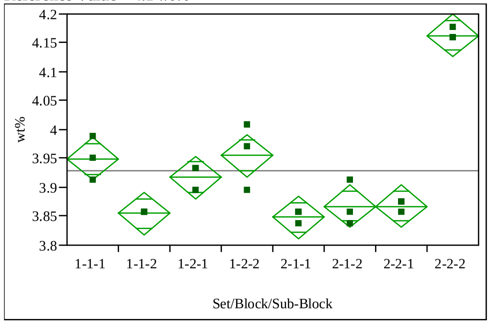
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1-1-1	3	0.086001	0.00064	0.08465	0.08735
1-1-2	3	0.085551	0.00064	0.08420	0.08690
1-2-1	3	0.086451	0.00064	0.08510	0.08780
1-2-2	3	0.085100	0.00064	0.08375	0.08645
2-1-1	3	0.085100	0.00064	0.08375	0.08645
2-1-2	3	0.084200	0.00064	0.08285	0.08555
2-2-1	3	0.088252	0.00064	0.08690	0.08960
2-2-2	3	0.085100	0.00064	0.08375	0.08645

Std Error uses a pooled estimate of error variance

Exhibit A3. PSAL Measurements by Analytical Block for Samples of the Standard Glasses Prepared Using the LM Method

Oneway Analysis of wt% By Set/Block/Sub-Block Glass ID=U std, Analyte=Al2O3 (wt%)
Reference Value = 4.1 wt%



Oneway Anova
Summary of Fit

Rsquare	0.940883
Adj Rsquare	0.915019
Root Mean Square Error	0.029876
Mean of Response	3.927798
Observations (or Sum Wgts)	24

Analysis of Variance

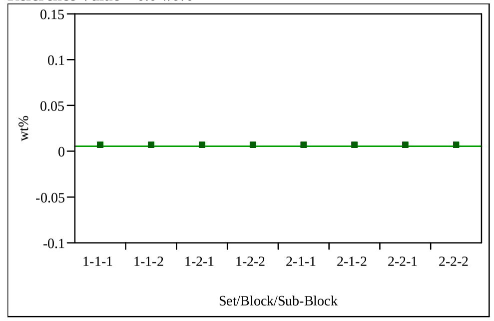
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Block	7	0.22728851	0.032470	36.3786	<.0001
Error	16	0.01428084	0.000893		
C. Total	23	0.24156935			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1-1-1	3	3.94906	0.01725	3.9125	3.9856
1-1-2	3	3.85458	0.01725	3.8180	3.8911
1-2-1	3	3.91756	0.01725	3.8810	3.9541
1-2-2	3	3.95535	0.01725	3.9188	3.9919
2-1-1	3	3.84828	0.01725	3.8117	3.8848
2-1-2	3	3.86718	0.01725	3.8306	3.9037
2-2-1	3	3.86718	0.01725	3.8306	3.9037
2-2-2	3	4.16320	0.01725	4.1266	4.1998

Std Error uses a pooled estimate of error variance

Oneway Analysis of wt% By Set/Block/Sub-Block Glass ID=U std, Analyte=BaO (wt%)
Reference Value = 0.0 wt%



Oneway Anova
Summary of Fit

Rsquare	.
Adj Rsquare	.
Root Mean Square Error	0
Mean of Response	0.005583
Observations (or Sum Wgts)	24

Analysis of Variance

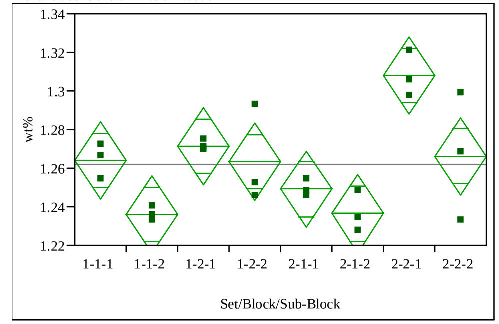
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Block	7	0	0	.	.
Error	16	0	0		
C. Total	23	0			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1-1-1	3	0.005583	0	0.00558	0.00558
1-1-2	3	0.005583	0	0.00558	0.00558
1-2-1	3	0.005583	0	0.00558	0.00558
1-2-2	3	0.005583	0	0.00558	0.00558
2-1-1	3	0.005583	0	0.00558	0.00558
2-1-2	3	0.005583	0	0.00558	0.00558
2-2-1	3	0.005583	0	0.00558	0.00558
2-2-2	3	0.005583	0	0.00558	0.00558

Std Error uses a pooled estimate of error variance

Oneway Analysis of wt% By Set/Block/Sub-Block Glass ID=U std, Analyte=CaO (wt%)
Reference Value = 1.301 wt%



Oneway Anova
Summary of Fit

Rsquare	0.723338
Adj Rsquare	0.602298
Root Mean Square Error	0.01631
Mean of Response	1.261787
Observations (or Sum Wgts)	24

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Block	7	0.01112783	0.001590	5.9760	0.0015
Error	16	0.00425617	0.000266		
C. Total	23	0.01538400			

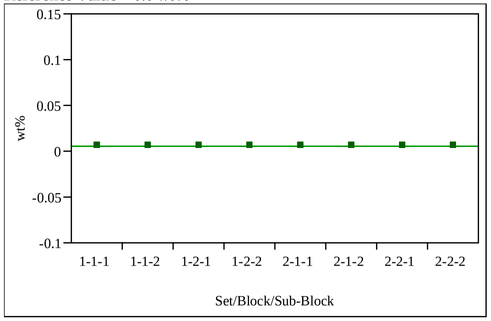
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1-1-1	3	1.26394	0.00942	1.2440	1.2839
1-1-2	3	1.23596	0.00942	1.2160	1.2559
1-2-1	3	1.27141	0.00942	1.2514	1.2914
1-2-2	3	1.26348	0.00942	1.2435	1.2834
2-1-1	3	1.24902	0.00942	1.2291	1.2690
2-1-2	3	1.23643	0.00942	1.2165	1.2564
2-2-1	3	1.30779	0.00942	1.2878	1.3277
2-2-2	3	1.26628	0.00942	1.2463	1.2862

Std Error uses a pooled estimate of error variance

Exhibit A3. PSAL Measurements by Analytical Block for Samples of the Standard Glasses Prepared Using the LM Method

Oneway Analysis of wt% By Set/Block/Sub-Block Glass ID=U std, Analyte=CdO (wt%)
Reference Value = 0.0 wt%



Oneway Anova
Summary of Fit

Rsquare	.
Adj Rsquare	.
Root Mean Square Error	0
Mean of Response	0.005712
Observations (or Sum Wgts)	24

Analysis of Variance

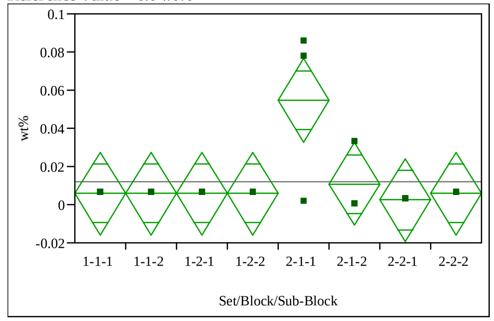
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Block	7	0	0	.	.
Error	16	0	0		
C. Total	23	0			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1-1-1	3	0.005712	0	0.00571	0.00571
1-1-2	3	0.005712	0	0.00571	0.00571
1-2-1	3	0.005712	0	0.00571	0.00571
1-2-2	3	0.005712	0	0.00571	0.00571
2-1-1	3	0.005712	0	0.00571	0.00571
2-1-2	3	0.005712	0	0.00571	0.00571
2-2-1	3	0.005712	0	0.00571	0.00571
2-2-2	3	0.005712	0	0.00571	0.00571

Std Error uses a pooled estimate of error variance

Oneway Analysis of wt% By Set/Block/Sub-Block Glass ID=U std, Analyte=Ce2O3 (wt%)
Reference Value = 0.0 wt%



Oneway Anova
Summary of Fit

Rsquare	0.555777
Adj Rsquare	0.36143
Root Mean Square Error	0.017752
Mean of Response	0.012152
Observations (or Sum Wgts)	24

Analysis of Variance

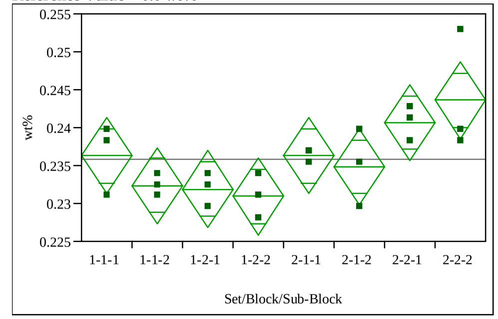
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Block	7	0.00630860	0.000901	2.8597	0.0387
Error	16	0.00504235	0.000315		
C. Total	23	0.01135095			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1-1-1	3	0.005857	0.01025	-0.0159	0.02758
1-1-2	3	0.005857	0.01025	-0.0159	0.02758
1-2-1	3	0.005857	0.01025	-0.0159	0.02758
1-2-2	3	0.005857	0.01025	-0.0159	0.02758
2-1-1	3	0.054661	0.01025	0.0329	0.07639
2-1-2	3	0.010932	0.01025	-0.0108	0.03266
2-2-1	3	0.002343	0.01025	-0.0194	0.02407
2-2-2	3	0.005857	0.01025	-0.0159	0.02758

Std Error uses a pooled estimate of error variance

Oneway Analysis of wt% By Set/Block/Sub-Block Glass ID=U std, Analyte=Cr2O3 (wt%)
Reference Value = 0.0 wt%



Oneway Anova
Summary of Fit

Rsquare	0.603306
Adj Rsquare	0.429752
Root Mean Square Error	0.004102
Mean of Response	0.235866
Observations (or Sum Wgts)	24

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Block	7	0.00040936	0.000058	3.4762	0.0185
Error	16	0.00026917	0.000017		
C. Total	23	0.00067853			

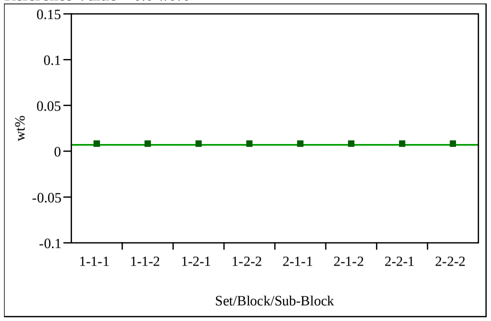
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1-1-1	3	0.236292	0.00237	0.23127	0.24131
1-1-2	3	0.232394	0.00237	0.22737	0.23741
1-2-1	3	0.231907	0.00237	0.22689	0.23693
1-2-2	3	0.230933	0.00237	0.22591	0.23595
2-1-1	3	0.236292	0.00237	0.23127	0.24131
2-1-2	3	0.234830	0.00237	0.22981	0.23985
2-2-1	3	0.240677	0.00237	0.23566	0.24570
2-2-2	3	0.243600	0.00237	0.23858	0.24862

Std Error uses a pooled estimate of error variance

Exhibit A3. PSAL Measurements by Analytical Block for Samples of the Standard Glasses Prepared Using the LM Method

Oneway Analysis of wt% By Set/Block/Sub-Block Glass ID=U std, Analyte=CuO (wt%)
Reference Value = 0.0 wt%



Oneway Anova
Summary of Fit

Rsquare	.
Adj Rsquare	.
Root Mean Square Error	0
Mean of Response	0.006259
Observations (or Sum Wgts)	24

Analysis of Variance

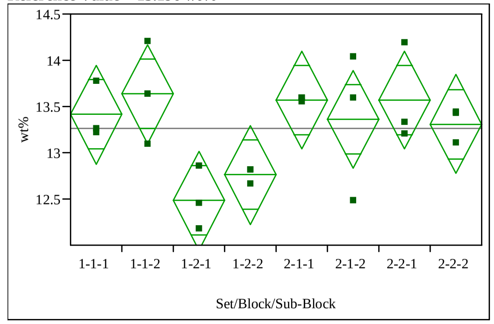
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Block	7	0	0	.	.
Error	16	0	0		
C. Total	23	0			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1-1-1	3	0.006259	0	0.00626	0.00626
1-1-2	3	0.006259	0	0.00626	0.00626
1-2-1	3	0.006259	0	0.00626	0.00626
1-2-2	3	0.006259	0	0.00626	0.00626
2-1-1	3	0.006259	0	0.00626	0.00626
2-1-2	3	0.006259	0	0.00626	0.00626
2-2-1	3	0.006259	0	0.00626	0.00626
2-2-2	3	0.006259	0	0.00626	0.00626

Std Error uses a pooled estimate of error variance

Oneway Analysis of wt% By Set/Block/Sub-Block Glass ID=U std, Analyte=Fe2O3 (wt%)
Reference Value = 13.196 wt%



Oneway Anova
Summary of Fit

Rsquare	0.548337
Adj Rsquare	0.350734
Root Mean Square Error	0.433365
Mean of Response	13.26166
Observations (or Sum Wgts)	24

Analysis of Variance

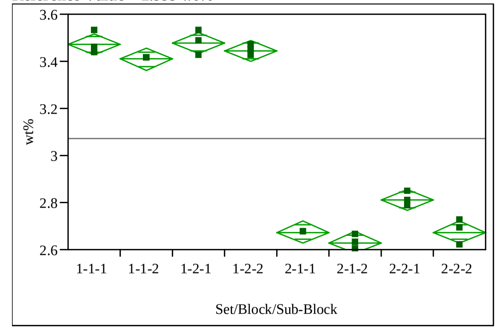
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Block	7	3.6480360	0.521148	2.7749	0.0431
Error	16	3.0048781	0.187805		
C. Total	23	6.6529141			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1-1-1	3	13.4106	0.25020	12.880	13.941
1-1-2	3	13.6346	0.25020	13.104	14.165
1-2-1	3	12.4860	0.25020	11.956	13.016
1-2-2	3	12.7577	0.25020	12.227	13.288
2-1-1	3	13.5679	0.25020	13.037	14.098
2-1-2	3	13.3582	0.25020	12.828	13.889
2-2-1	3	13.5679	0.25020	13.037	14.098
2-2-2	3	13.3105	0.25020	12.780	13.841

Std Error uses a pooled estimate of error variance

Oneway Analysis of wt% By Set/Block/Sub-Block Glass ID=U std, Analyte=K2O (wt%)
Reference Value = 2.999 wt%



Oneway Anova
Summary of Fit

Rsquare	0.993747
Adj Rsquare	0.991011
Root Mean Square Error	0.036965
Mean of Response	3.07424
Observations (or Sum Wgts)	24

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Block	7	3.4743181	0.496331	363.2358	<.0001
Error	16	0.0218627	0.001366		
C. Total	23	3.4961807			

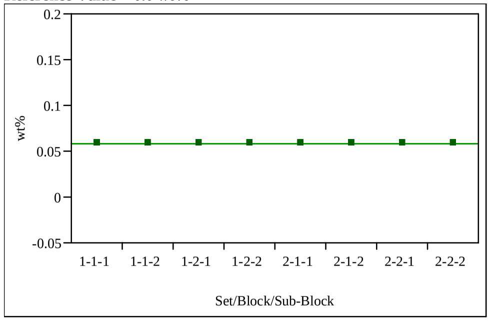
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1-1-1	3	3.47326	0.02134	3.4280	3.5185
1-1-2	3	3.40902	0.02134	3.3638	3.4543
1-2-1	3	3.47728	0.02134	3.4320	3.5225
1-2-2	3	3.44516	0.02134	3.3999	3.4904
2-1-1	3	2.67421	0.02134	2.6290	2.7195
2-1-2	3	2.63004	0.02134	2.5848	2.6753
2-2-1	3	2.81073	0.02134	2.7655	2.8560
2-2-2	3	2.67421	0.02134	2.6290	2.7195

Std Error uses a pooled estimate of error variance

Exhibit A3. PSAL Measurements by Analytical Block for Samples of the Standard Glasses Prepared Using the LM Method

Oneway Analysis of wt% By Set/Block/Sub-Block Glass ID=U std, Analyte=La2O3 (wt%)
Reference Value = 0.0 wt%



Oneway Anova
Summary of Fit

Rsquare	1
Adj Rsquare	1
Root Mean Square Error	0
Mean of Response	0.05864
Observations (or Sum Wgts)	24

Analysis of Variance

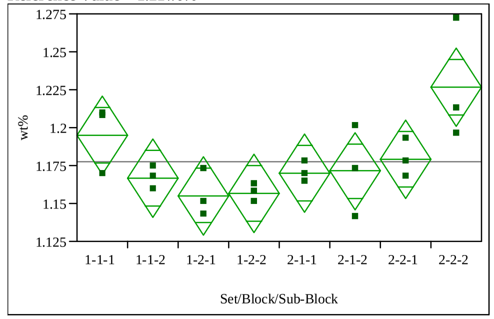
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Block	7	4.6222e-33	6.603e-34	.	.
Error	16	0	0		
C. Total	23	4.6222e-33			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1-1-1	3	0.058640	0	0.05864	0.05864
1-1-2	3	0.058640	0	0.05864	0.05864
1-2-1	3	0.058640	0	0.05864	0.05864
1-2-2	3	0.058640	0	0.05864	0.05864
2-1-1	3	0.058640	0	0.05864	0.05864
2-1-2	3	0.058640	0	0.05864	0.05864
2-2-1	3	0.058640	0	0.05864	0.05864
2-2-2	3	0.058640	0	0.05864	0.05864

Std Error uses a pooled estimate of error variance

Oneway Analysis of wt% By Set/Block/Sub-Block Glass ID=U std, Analyte=MgO (wt%)
Reference Value = 1.21wt%



Oneway Anova
Summary of Fit

Rsquare	0.619616
Adj Rsquare	0.453197
Root Mean Square Error	0.021028
Mean of Response	1.177669
Observations (or Sum Wgts)	24

Analysis of Variance

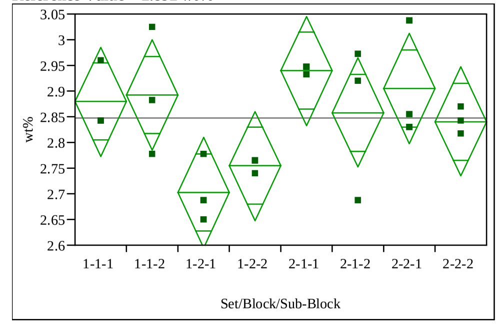
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Block	7	0.01152416	0.001646	3.7232	0.0140
Error	16	0.00707473	0.000442		
C. Total	23	0.01859889			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1-1-1	3	1.19508	0.01214	1.1693	1.2208
1-1-2	3	1.16689	0.01214	1.1412	1.1926
1-2-1	3	1.15528	0.01214	1.1295	1.1810
1-2-2	3	1.15694	0.01214	1.1312	1.1827
2-1-1	3	1.17021	0.01214	1.1445	1.1959
2-1-2	3	1.17131	0.01214	1.1456	1.1970
2-2-1	3	1.17905	0.01214	1.1533	1.2048
2-2-2	3	1.22659	0.01214	1.2009	1.2523

Std Error uses a pooled estimate of error variance

Oneway Analysis of wt% By Set/Block/Sub-Block Glass ID=U std, Analyte=MnO (wt%)
Reference Value = 2.892 wt%



Oneway Anova
Summary of Fit

Rsquare	0.52442
Adj Rsquare	0.316354
Root Mean Square Error	0.087016
Mean of Response	2.846558
Observations (or Sum Wgts)	24

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Block	7	0.13359114	0.019084	2.5204	0.0596
Error	16	0.12114968	0.007572		
C. Total	23	0.25474082			

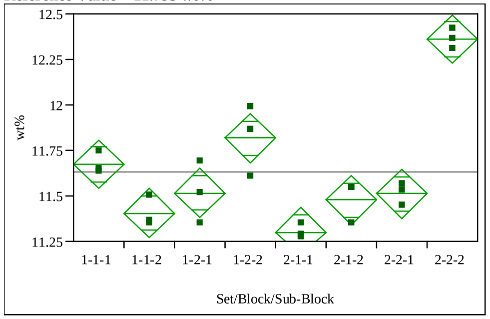
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1-1-1	3	2.87938	0.05024	2.7729	2.9859
1-1-2	3	2.89229	0.05024	2.7858	2.9988
1-2-1	3	2.70291	0.05024	2.5964	2.8094
1-2-2	3	2.75456	0.05024	2.6481	2.8611
2-1-1	3	2.93963	0.05024	2.8331	3.0461
2-1-2	3	2.85786	0.05024	2.7514	2.9644
2-2-1	3	2.90520	0.05024	2.7987	3.0117
2-2-2	3	2.84064	0.05024	2.7341	2.9471

Std Error uses a pooled estimate of error variance

Exhibit A3. PSAL Measurements by Analytical Block for Samples of the Standard Glasses Prepared Using the LM Method

Oneway Analysis of wt% By Set/Block/Sub-Block Glass ID=U std, Analyte=Na2O (wt%)
Reference Value = 11.795 wt%



Oneway Anova
Summary of Fit

Rsquare	0.92418
Adj Rsquare	0.891009
Root Mean Square Error	0.10965
Mean of Response	11.63268
Observations (or Sum Wgts)	24

Analysis of Variance

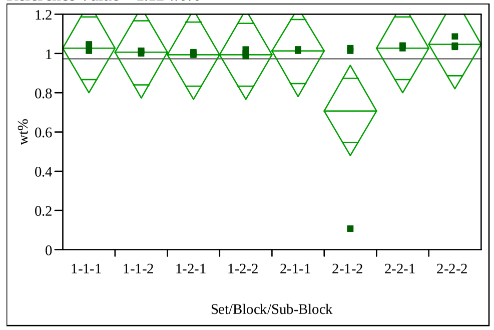
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Block	7	2.3448440	0.334978	27.8610	<.0001
Error	16	0.1923707	0.012023		
C. Total	23	2.5372147			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1-1-1	3	11.6737	0.06331	11.539	11.808
1-1-2	3	11.4041	0.06331	11.270	11.538
1-2-1	3	11.5164	0.06331	11.382	11.651
1-2-2	3	11.8175	0.06331	11.683	11.952
2-1-1	3	11.3007	0.06331	11.167	11.435
2-1-2	3	11.4760	0.06331	11.342	11.610
2-2-1	3	11.5119	0.06331	11.378	11.646
2-2-2	3	12.3612	0.06331	12.227	12.495

Std Error uses a pooled estimate of error variance

Oneway Analysis of wt% By Set/Block/Sub-Block Glass ID=U std, Analyte=NiO (wt%)
Reference Value = 1.12 wt%



Oneway Anova
Summary of Fit

Rsquare	0.309587
Adj Rsquare	0.007532
Root Mean Square Error	0.187382
Mean of Response	0.976644
Observations (or Sum Wgts)	24

Analysis of Variance

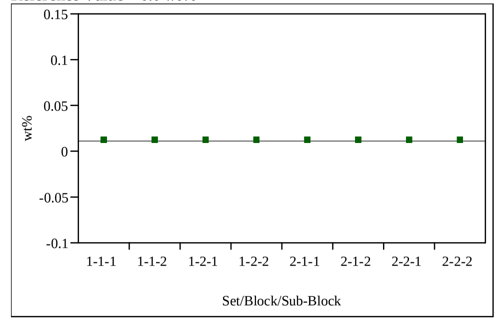
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Block	7	0.25191201	0.035987	1.0249	0.4514
Error	16	0.56179016	0.035112		
C. Total	23	0.81370217			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1-1-1	3	1.02606	0.10818	0.79672	1.2554
1-1-2	3	1.00400	0.10818	0.77466	1.2333
1-2-1	3	0.99552	0.10818	0.76618	1.2249
1-2-2	3	0.99425	0.10818	0.76491	1.2236
2-1-1	3	1.01037	0.10818	0.78102	1.2397
2-1-2	3	0.70921	0.10818	0.47987	0.9385
2-2-1	3	1.02691	0.10818	0.79757	1.2562
2-2-2	3	1.04684	0.10818	0.81750	1.2762

Std Error uses a pooled estimate of error variance

Oneway Analysis of wt% By Set/Block/Sub-Block Glass ID=U std, Analyte=PbO (wt%)
Reference Value = 0.0 wt%



Oneway Anova
Summary of Fit

Rsquare	4
Adj Rsquare	5.3125
Root Mean Square Error	.
Mean of Response	0.010772
Observations (or Sum Wgts)	24

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Block	7	2.8889e-34	4.127e-35	-3.0476	0.0000
Error	16	-2.167e-34	-1.35e-35		
C. Total	23	7.2222e-35			

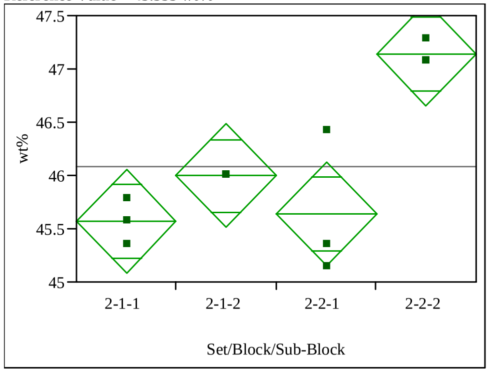
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1-1-1	3	0.010772	.	.	.
1-1-2	3	0.010772	.	.	.
1-2-1	3	0.010772	.	.	.
1-2-2	3	0.010772	.	.	.
2-1-1	3	0.010772	.	.	.
2-1-2	3	0.010772	.	.	.
2-2-1	3	0.010772	.	.	.
2-2-2	3	0.010772	.	.	.

Std Error uses a pooled estimate of error variance

Exhibit A3. PSAL Measurements by Analytical Block for Samples of the Standard Glasses Prepared Using the LM Method

Oneway Analysis of wt% By Set/Block/Sub-Block Glass ID=U std, Analyte=SiO2 (wt%)
Reference Value = 45.353 wt%



Missing Rows
12

Oneway Anova
Summary of Fit

Rsquare	0.816152
Adj Rsquare	0.747209
Root Mean Square Error	0.365355
Mean of Response	46.08409
Observations (or Sum Wgts)	12

Analysis of Variance

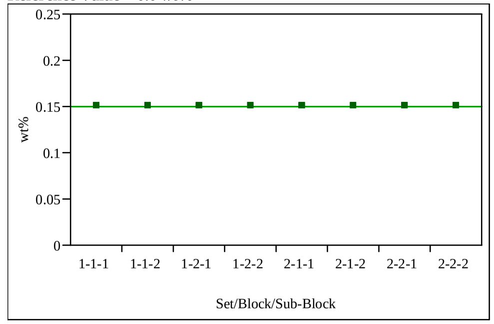
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Block	3	4.7405995	1.58020	11.8381	0.0026
Error	8	1.0678744	0.13348		
C. Total	11	5.8084739			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
2-1-1	3	45.5671	0.21094	45.081	46.054
2-1-2	3	45.9950	0.21094	45.509	46.481
2-2-1	3	45.6384	0.21094	45.152	46.125
2-2-2	3	47.1359	0.21094	46.649	47.622

Std Error uses a pooled estimate of error variance

Oneway Analysis of wt% By Set/Block/Sub-Block Glass ID=U std, Analyte=SO4 (wt%)
Reference Value = 0.0 wt%



Oneway Anova
Summary of Fit

Rsquare	.
Adj Rsquare	.
Root Mean Square Error	0
Mean of Response	0.149795
Observations (or Sum Wgts)	24

Analysis of Variance

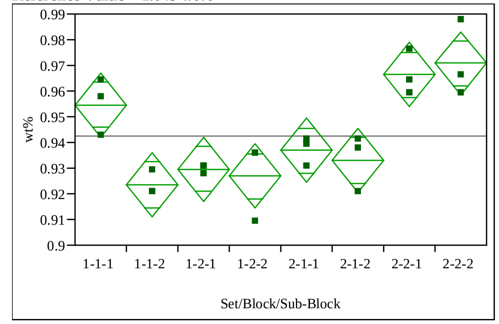
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Block	7	0	0	.	.
Error	16	0	0		
C. Total	23	0			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1-1-1	3	0.149795	0	0.14980	0.14980
1-1-2	3	0.149795	0	0.14980	0.14980
1-2-1	3	0.149795	0	0.14980	0.14980
1-2-2	3	0.149795	0	0.14980	0.14980
2-1-1	3	0.149795	0	0.14980	0.14980
2-1-2	3	0.149795	0	0.14980	0.14980
2-2-1	3	0.149795	0	0.14980	0.14980
2-2-2	3	0.149795	0	0.14980	0.14980

Std Error uses a pooled estimate of error variance

Oneway Analysis of wt% By Set/Block/Sub-Block Glass ID=U std, Analyte=TiO2 (wt%)
Reference Value = 1.049 wt%



Oneway Anova
Summary of Fit

Rsquare	0.814172
Adj Rsquare	0.732873
Root Mean Square Error	0.010152
Mean of Response	0.942698
Observations (or Sum Wgts)	24

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Block	7	0.00722451	0.001032	10.0145	<.0001
Error	16	0.00164893	0.000103		
C. Total	23	0.00887344			

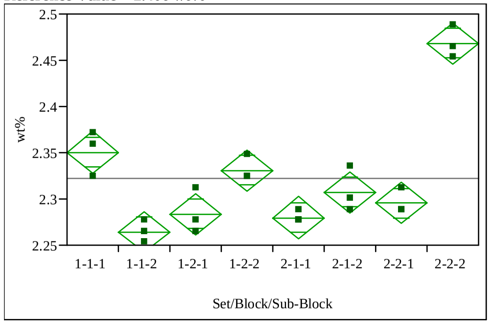
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1-1-1	3	0.954652	0.00586	0.94223	0.96708
1-1-2	3	0.923516	0.00586	0.91109	0.93594
1-2-1	3	0.929632	0.00586	0.91721	0.94206
1-2-2	3	0.926852	0.00586	0.91443	0.93928
2-1-1	3	0.936860	0.00586	0.92443	0.94929
2-1-2	3	0.932968	0.00586	0.92054	0.94539
2-2-1	3	0.966328	0.00586	0.95390	0.97875
2-2-2	3	0.970776	0.00586	0.95835	0.98320

Std Error uses a pooled estimate of error variance

Exhibit A3. PSAL Measurements by Analytical Block for Samples of the Standard Glasses Prepared Using the LM Method

Oneway Analysis of wt% By Set/Block/Sub-Block Glass ID=U std, Analyte=U3O8 (wt%)
Reference Value = 2.406 wt%



Oneway Anova
Summary of Fit

Rsquare	0.943384
Adj Rsquare	0.918614
Root Mean Square Error	0.018331
Mean of Response	2.322533
Observations (or Sum Wgts)	24

Analysis of Variance

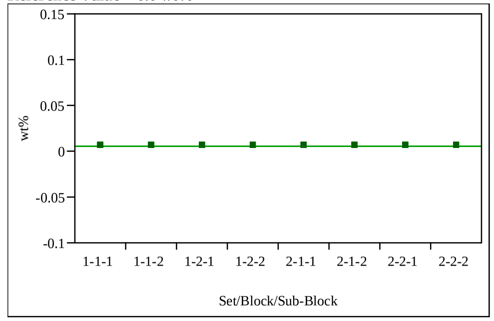
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Block	7	0.08958957	0.012799	38.0862	<.0001
Error	16	0.00537665	0.000336		
C. Total	23	0.09496622			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1-1-1	3	2.35054	0.01058	2.3281	2.3730
1-1-2	3	2.26406	0.01058	2.2416	2.2865
1-2-1	3	2.28372	0.01058	2.2613	2.3062
1-2-2	3	2.33089	0.01058	2.3084	2.3533
2-1-1	3	2.27979	0.01058	2.2574	2.3022
2-1-2	3	2.30730	0.01058	2.2849	2.3297
2-2-1	3	2.29551	0.01058	2.2731	2.3179
2-2-2	3	2.46846	0.01058	2.4460	2.4909

Std Error uses a pooled estimate of error variance

Oneway Analysis of wt% By Set/Block/Sub-Block Glass ID=U std, Analyte=ZnO (wt%)
Reference Value = 0.0 wt%



Oneway Anova
Summary of Fit

Rsquare	.
Adj Rsquare	.
Root Mean Square Error	0
Mean of Response	0.006224
Observations (or Sum Wgts)	24

Analysis of Variance

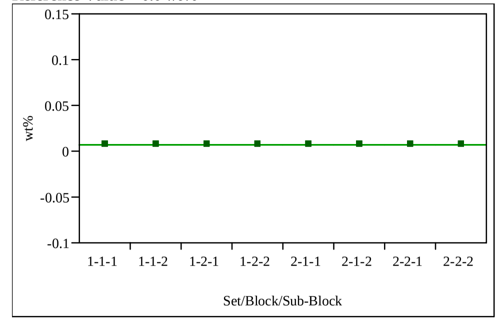
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Block	7	0	0	.	.
Error	16	0	0		
C. Total	23	0			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1-1-1	3	0.006224	0	0.00622	0.00622
1-1-2	3	0.006224	0	0.00622	0.00622
1-2-1	3	0.006224	0	0.00622	0.00622
1-2-2	3	0.006224	0	0.00622	0.00622
2-1-1	3	0.006224	0	0.00622	0.00622
2-1-2	3	0.006224	0	0.00622	0.00622
2-2-1	3	0.006224	0	0.00622	0.00622
2-2-2	3	0.006224	0	0.00622	0.00622

Std Error uses a pooled estimate of error variance

Oneway Analysis of wt% By Set/Block/Sub-Block Glass ID=U std, Analyte=ZrO2 (wt%)
Reference Value = 0.0 wt%



Oneway Anova
Summary of Fit

Rsquare	.
Adj Rsquare	.
Root Mean Square Error	0
Mean of Response	0.006754
Observations (or Sum Wgts)	24

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Block	7	0	0	.	.
Error	16	0	0		
C. Total	23	0			

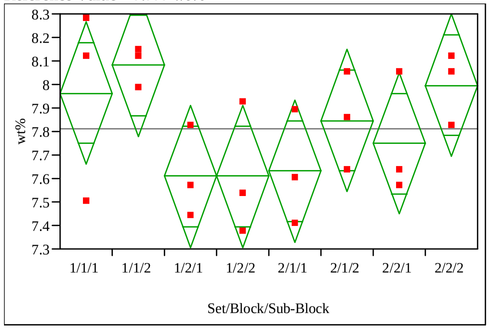
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1-1-1	3	0.006754	0	0.00675	0.00675
1-1-2	3	0.006754	0	0.00675	0.00675
1-2-1	3	0.006754	0	0.00675	0.00675
1-2-2	3	0.006754	0	0.00675	0.00675
2-1-1	3	0.006754	0	0.00675	0.00675
2-1-2	3	0.006754	0	0.00675	0.00675
2-2-1	3	0.006754	0	0.00675	0.00675
2-2-2	3	0.006754	0	0.00675	0.00675

Std Error uses a pooled estimate of error variance

Exhibit A4: PSAL Measurements by Analytical Block for Samples of the Standard Glasses Prepared Using the PF Method

Oneway Analysis of wt% By Set/Block/Sub-Block Glass ID=Batch 1, Analyte=B2O3 (wt%)
Reference Value = 7.777 wt%



Oneway Anova
Summary of Fit

Rsquare	0.434883
Adj Rsquare	0.187644
Root Mean Square Error	0.246538
Mean of Response	7.810941
Observations (or Sum Wgts)	24

Analysis of Variance

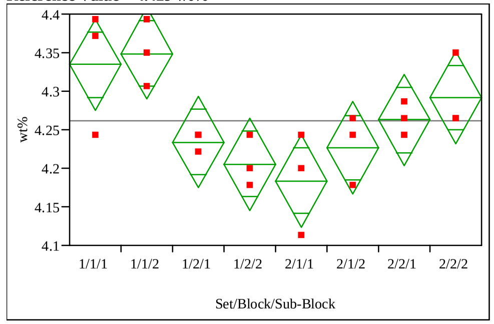
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Block	7	0.7483792	0.106911	1.7590	0.1653
Error	16	0.9724955	0.060781		
C. Total	23	1.7208747			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1/1/1	3	7.96389	0.14234	7.6621	8.2656
1/1/2	3	8.08195	0.14234	7.7802	8.3837
1/2/1	3	7.60970	0.14234	7.3080	7.9114
1/2/2	3	7.60970	0.14234	7.3080	7.9114
2/1/1	3	7.63116	0.14234	7.3294	7.9329
2/1/2	3	7.84582	0.14234	7.5441	8.1476
2/2/1	3	7.74923	0.14234	7.4475	8.0510
2/2/2	3	7.99609	0.14234	7.6943	8.2978

Std Error uses a pooled estimate of error variance

Oneway Analysis of wt% By Set/Block/Sub-Block Glass ID=Batch 1, Analyte=Li2O (wt%)
Reference Value = 4.429 wt%



Oneway Anova
Summary of Fit

Rsquare	0.663705
Adj Rsquare	0.516576
Root Mean Square Error	0.048738
Mean of Response	4.260948
Observations (or Sum Wgts)	24

Analysis of Variance

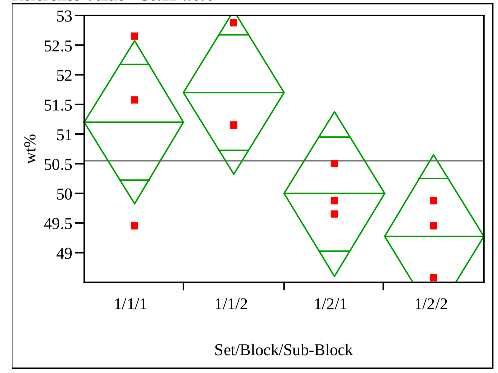
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Block	7	0.07500940	0.010716	4.5110	0.0060
Error	16	0.03800682	0.002375		
C. Total	23	0.11301622			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1/1/1	3	4.33451	0.02814	4.2749	4.3942
1/1/2	3	4.34886	0.02814	4.2892	4.4085
1/2/1	3	4.23404	0.02814	4.1744	4.2937
1/2/2	3	4.20533	0.02814	4.1457	4.2650
2/1/1	3	4.18380	0.02814	4.1242	4.2435
2/1/2	3	4.22686	0.02814	4.1672	4.2865
2/2/1	3	4.26274	0.02814	4.2031	4.3224
2/2/2	3	4.29145	0.02814	4.2318	4.3511

Std Error uses a pooled estimate of error variance

Oneway Analysis of wt% By Set/Block/Sub-Block Glass ID=Batch 1, Analyte=SiO2 (wt%)
Reference Value = 50.22 wt%



Oneway Anova
Summary of Fit

Rsquare	0.564118
Adj Rsquare	0.400662
Root Mean Square Error	1.03338
Mean of Response	50.54096
Observations (or Sum Wgts)	12

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Block	3	11.056314	3.68544	3.4512	0.0716
Error	8	8.542995	1.06787		
C. Total	11	19.599309			

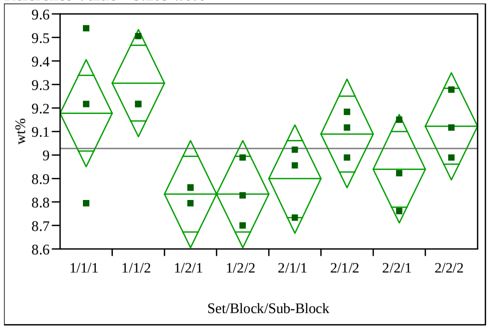
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1/1/1	3	51.2006	0.59662	49.825	52.576
1/1/2	3	51.6998	0.59662	50.324	53.076
1/2/1	3	49.9883	0.59662	48.612	51.364
1/2/2	3	49.2752	0.59662	47.899	50.651

Std Error uses a pooled estimate of error variance

Exhibit A4: PSAL Measurements by Analytical Block for Samples of the Standard Glasses Prepared Using the PF Method

Oneway Analysis of wt% By Set/Block/Sub-Block Glass ID=U std, Analyte=B2O3 (wt%)
Reference Value = 9.209 wt%



Oneway Anova
Summary of Fit

Rsquare	0.532451
Adj Rsquare	0.327898
Root Mean Square Error	0.187059
Mean of Response	9.025111
Observations (or Sum Wgts)	24

Analysis of Variance

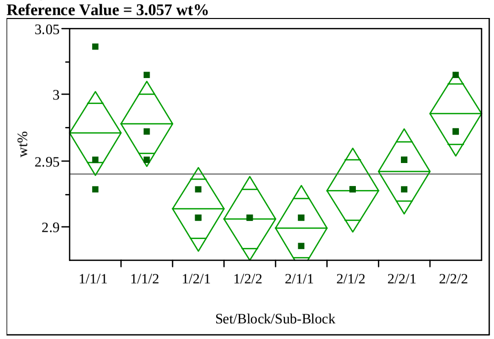
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Block	7	0.6375738	0.091082	2.6030	0.0536
Error	16	0.5598588	0.034991		
C. Total	23	1.1974326			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1/1/1	3	9.17672	0.10800	8.9478	9.4057
1/1/2	3	9.30551	0.10800	9.0766	9.5345
1/2/1	3	8.83326	0.10800	8.6043	9.0622
1/2/2	3	8.83326	0.10800	8.6043	9.0622
2/1/1	3	8.89766	0.10800	8.6687	9.1266
2/1/2	3	9.09085	0.10800	8.8619	9.3198
2/2/1	3	8.94059	0.10800	8.7116	9.1695
2/2/2	3	9.12305	0.10800	8.8941	9.3520

Std Error uses a pooled estimate of error variance

Oneway Analysis of wt% By Set/Block/Sub-Block Glass ID=U std, Analyte=Li2O (wt%)
Reference Value = 3.057 wt%



Oneway Anova
Summary of Fit

Rsquare	0.692308
Adj Rsquare	0.557692
Root Mean Square Error	0.025999
Mean of Response	2.940503
Observations (or Sum Wgts)	24

Analysis of Variance

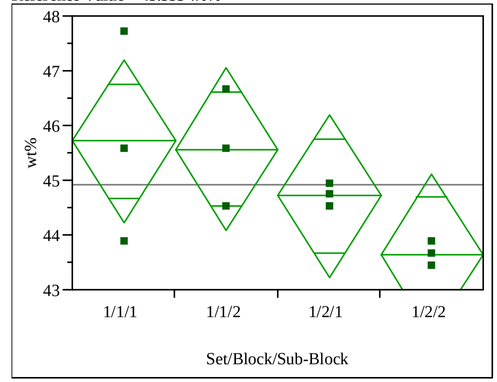
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Block	7	0.02433364	0.003476	5.1429	0.0032
Error	16	0.01081495	0.000676		
C. Total	23	0.03514859			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1/1/1	3	2.97100	0.01501	2.9392	3.0028
1/1/2	3	2.97818	0.01501	2.9464	3.0100
1/2/1	3	2.91359	0.01501	2.8818	2.9454
1/2/2	3	2.90642	0.01501	2.8746	2.9382
2/1/1	3	2.89924	0.01501	2.8674	2.9311
2/1/2	3	2.92794	0.01501	2.8961	2.9598
2/2/1	3	2.94230	0.01501	2.9105	2.9741
2/2/2	3	2.98535	0.01501	2.9535	3.0172

Std Error uses a pooled estimate of error variance

Oneway Analysis of wt% By Set/Block/Sub-Block Glass ID=U std, Analyte=SiO2 (wt%)
Reference Value = 45.353 wt%



Oneway Anova
Summary of Fit

Rsquare	0.451361
Adj Rsquare	0.245621
Root Mean Square Error	1.113327
Mean of Response	44.90747
Observations (or Sum Wgts)	12

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block/Sub-Block	3	8.157798	2.71927	2.1938	0.1665
Error	8	9.915976	1.23950		
C. Total	11	18.073774			

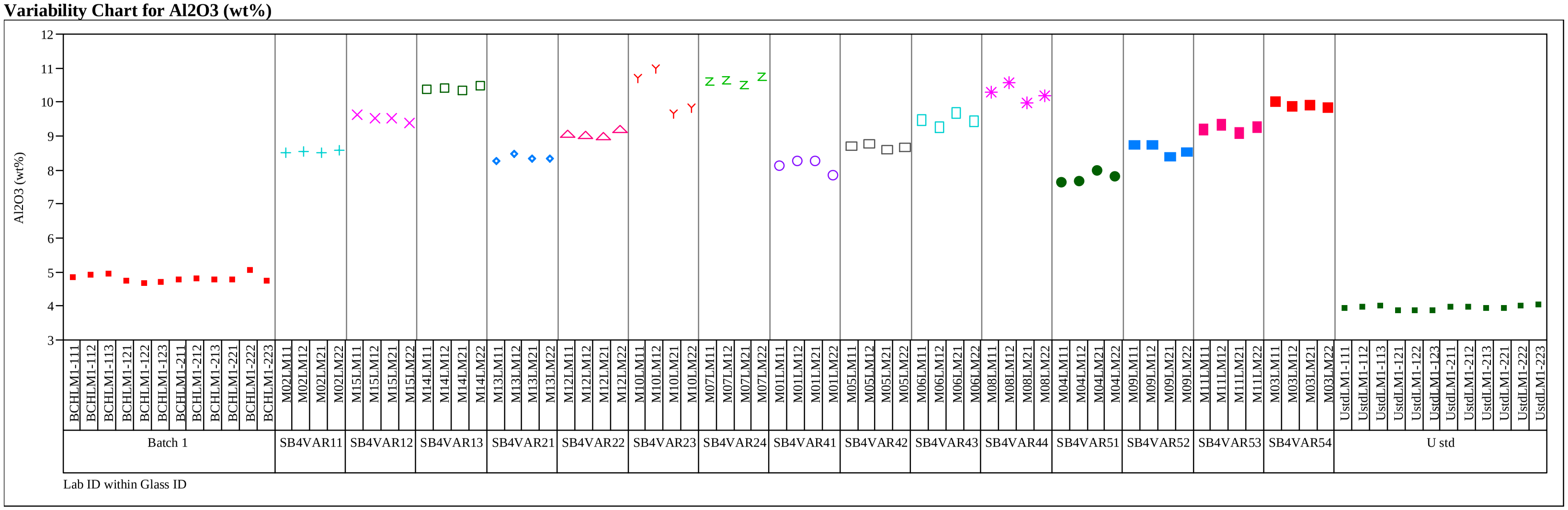
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1/1/1	3	45.7097	0.64278	44.227	47.192
1/1/2	3	45.5671	0.64278	44.085	47.049
1/2/1	3	44.7114	0.64278	43.229	46.194
1/2/2	3	43.6417	0.64278	42.159	45.124

Std Error uses a pooled estimate of error variance

Exhibit A5. Oxide Measurements by Solution ID for Samples Prepared Using the LM Method

Set=1
Variability Chart for Al2O3 (wt%)



Set=1
Variability Chart for BaO (wt%)

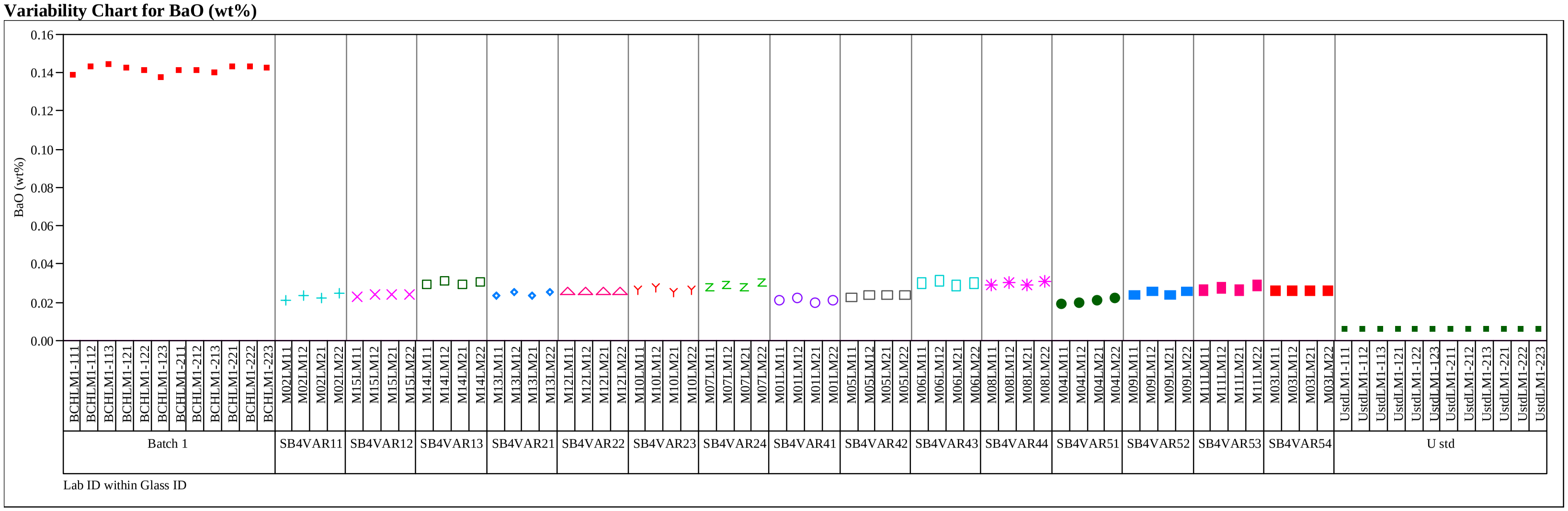
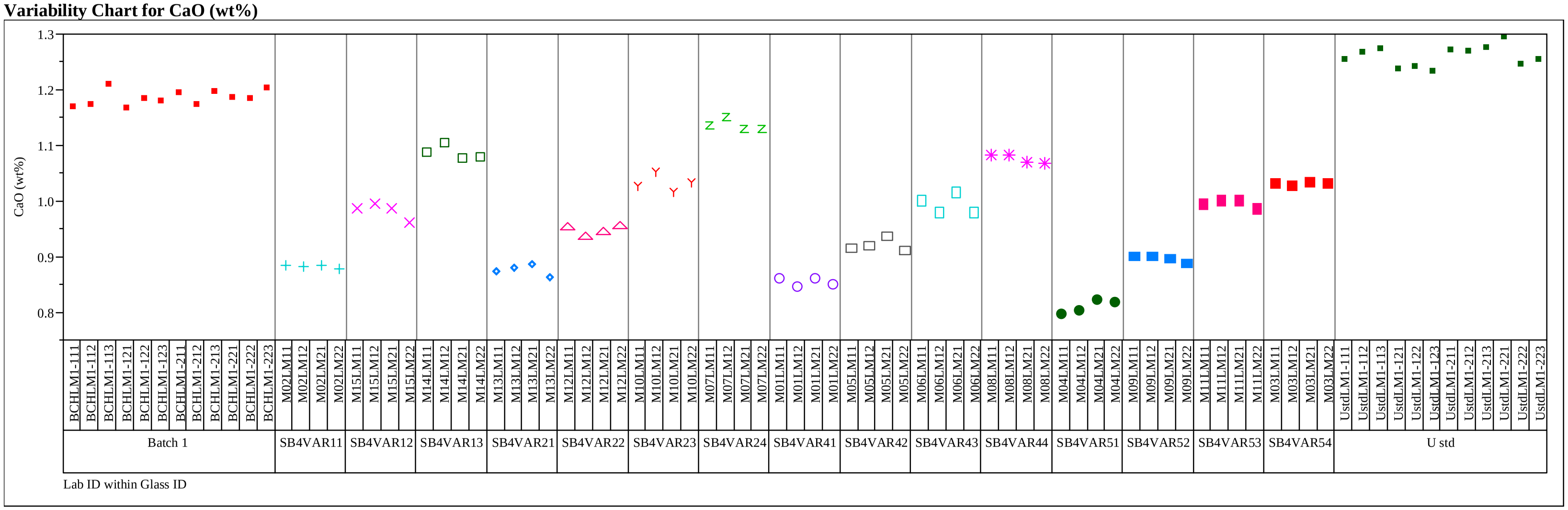


Exhibit A5. Oxide Measurements by Solution ID for Samples Prepared Using the LM Method

Set=1
Variability Chart for CaO (wt%)



Set=1
Variability Chart for CdO (wt%)

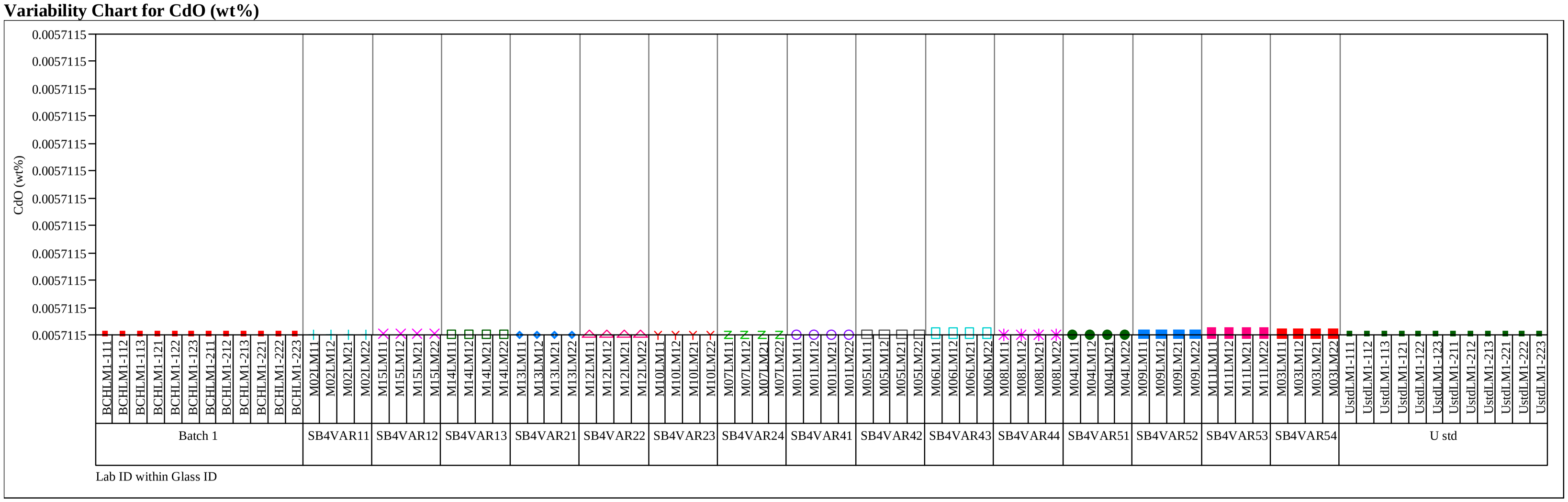
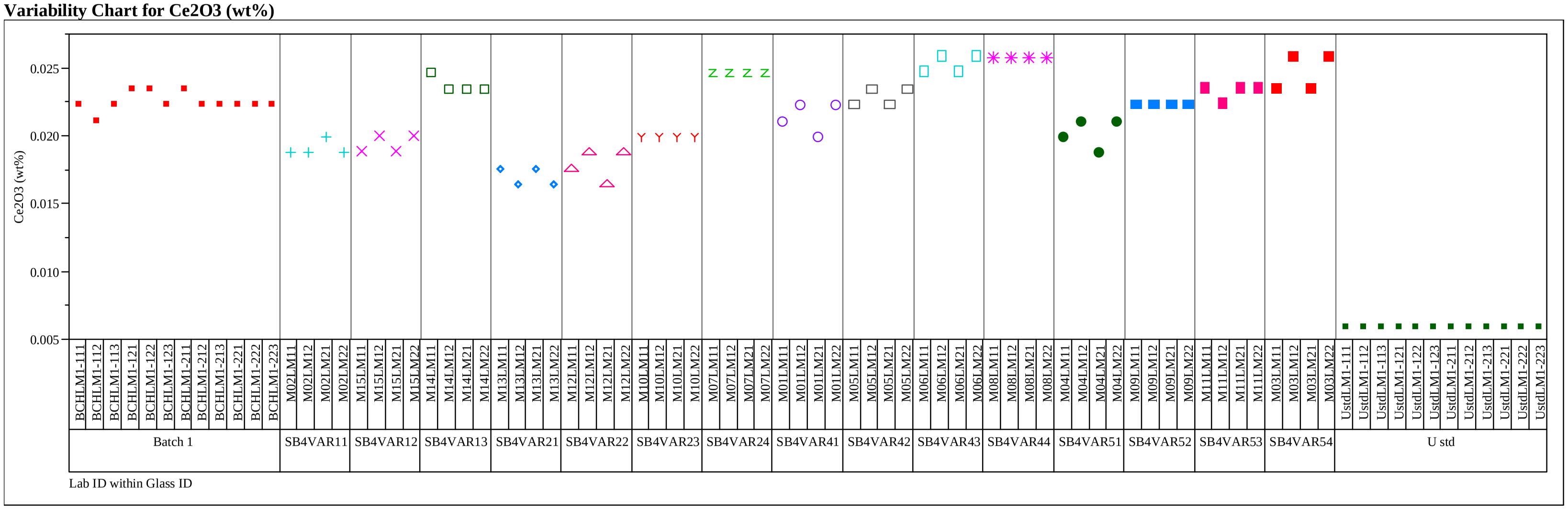


Exhibit A5. Oxide Measurements by Solution ID for Samples Prepared Using the LM Method

Set=1
Variability Chart for Ce2O3 (wt%)



Set=1
Variability Chart for Cr2O3 (wt%)

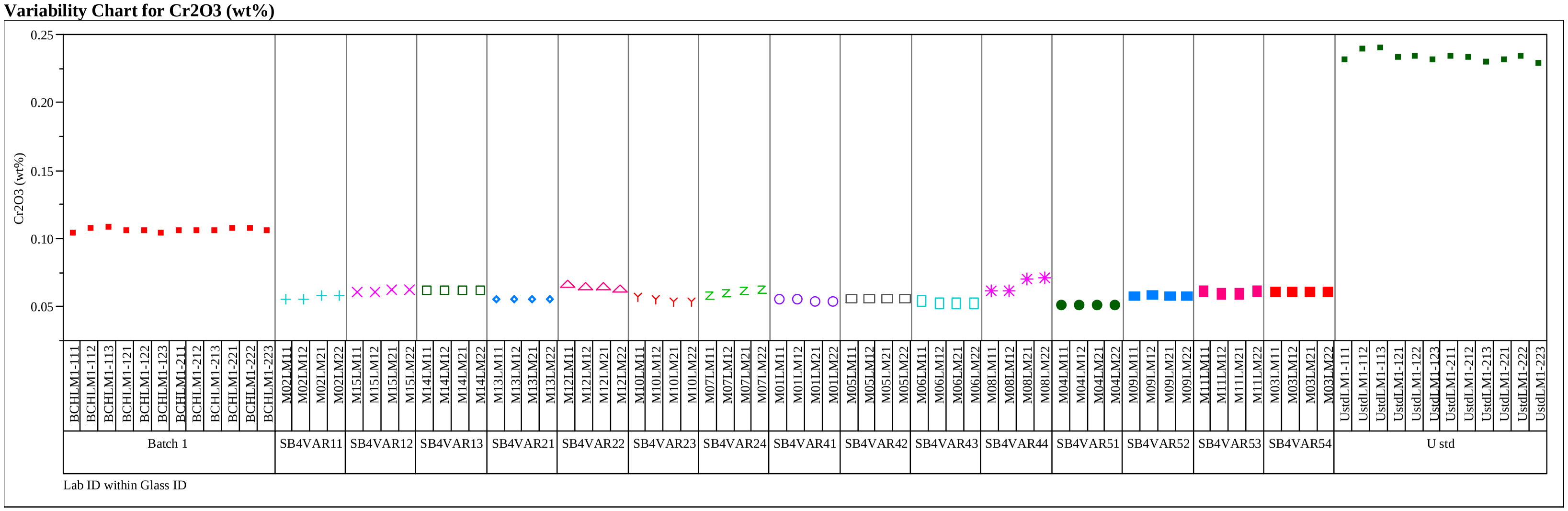
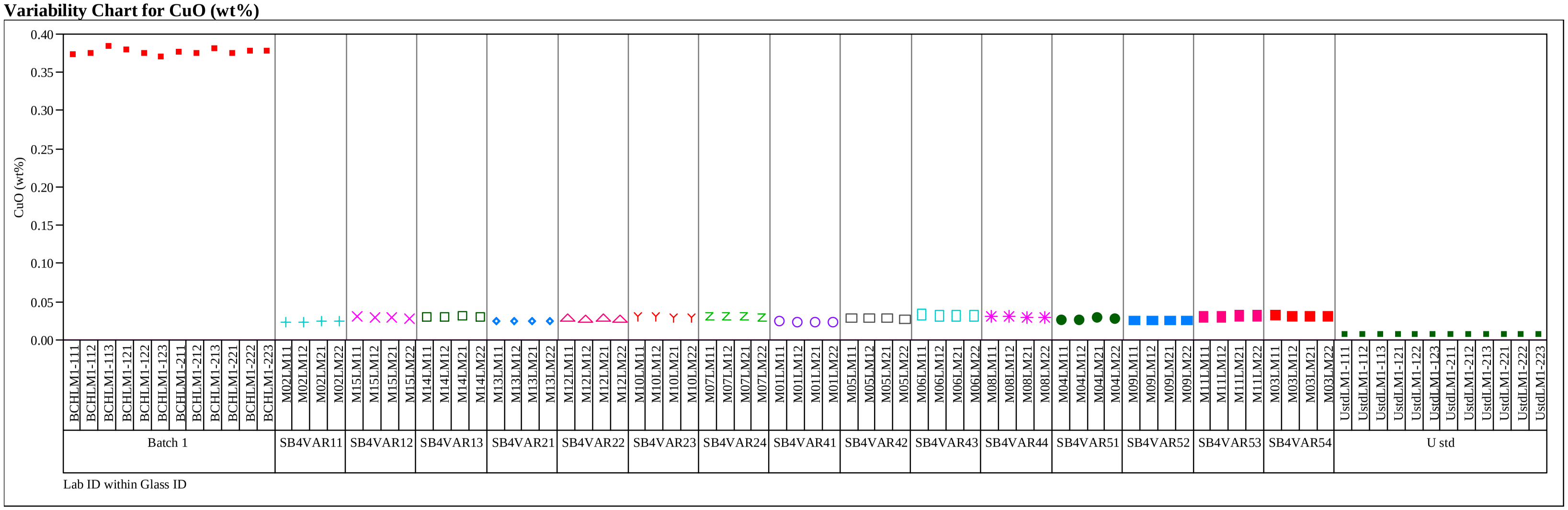


Exhibit A5. Oxide Measurements by Solution ID for Samples Prepared Using the LM Method

Set=1
Variability Chart for CuO (wt%)



Set=1
Variability Chart for Fe2O3 (wt%)

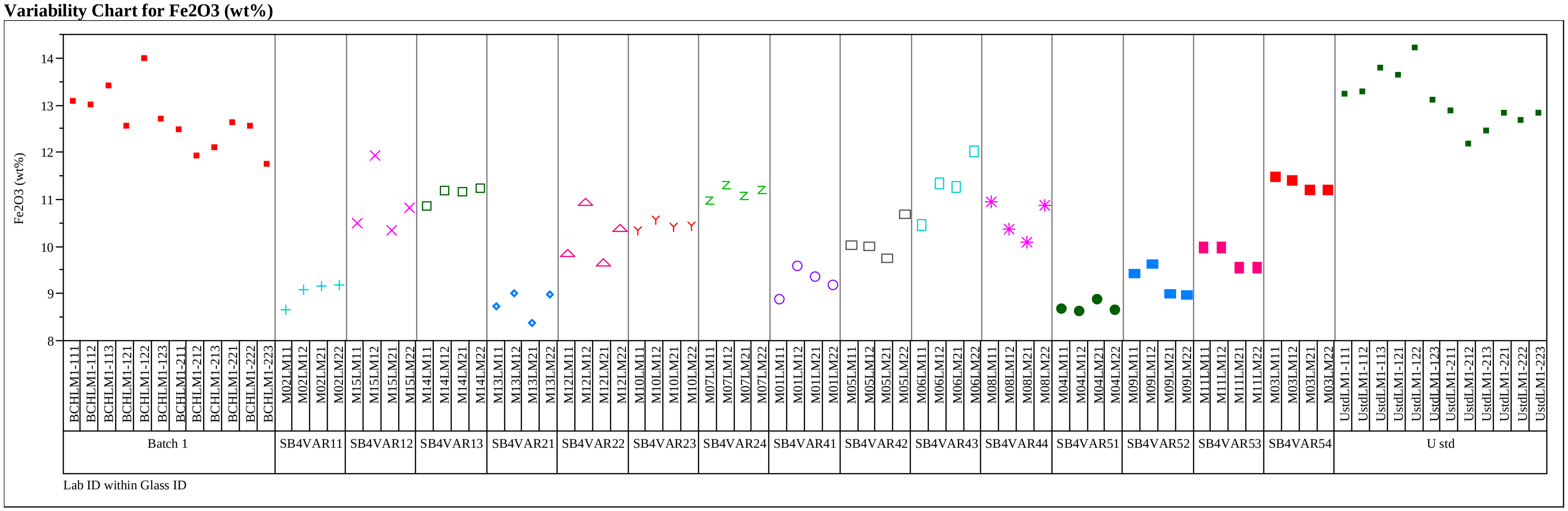
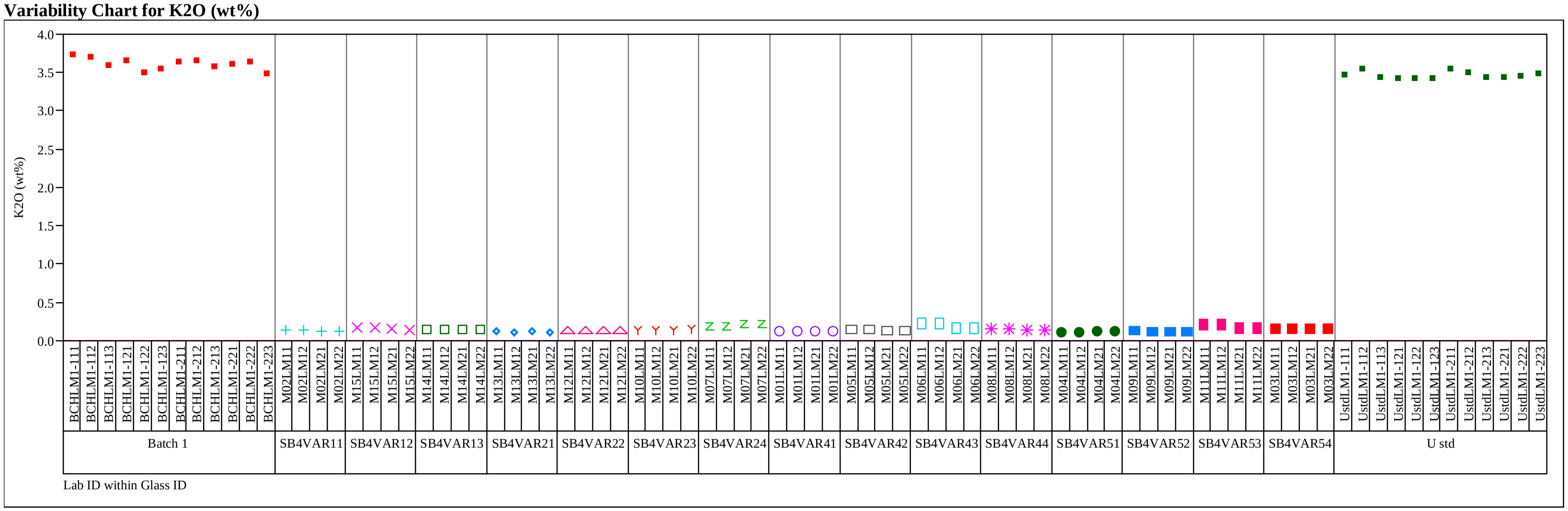


Exhibit A5. Oxide Measurements by Solution ID for Samples Prepared Using the LM Method

Set=1
Variability Chart for K2O (wt%)



Set=1
Variability Chart for La2O3 (wt%)

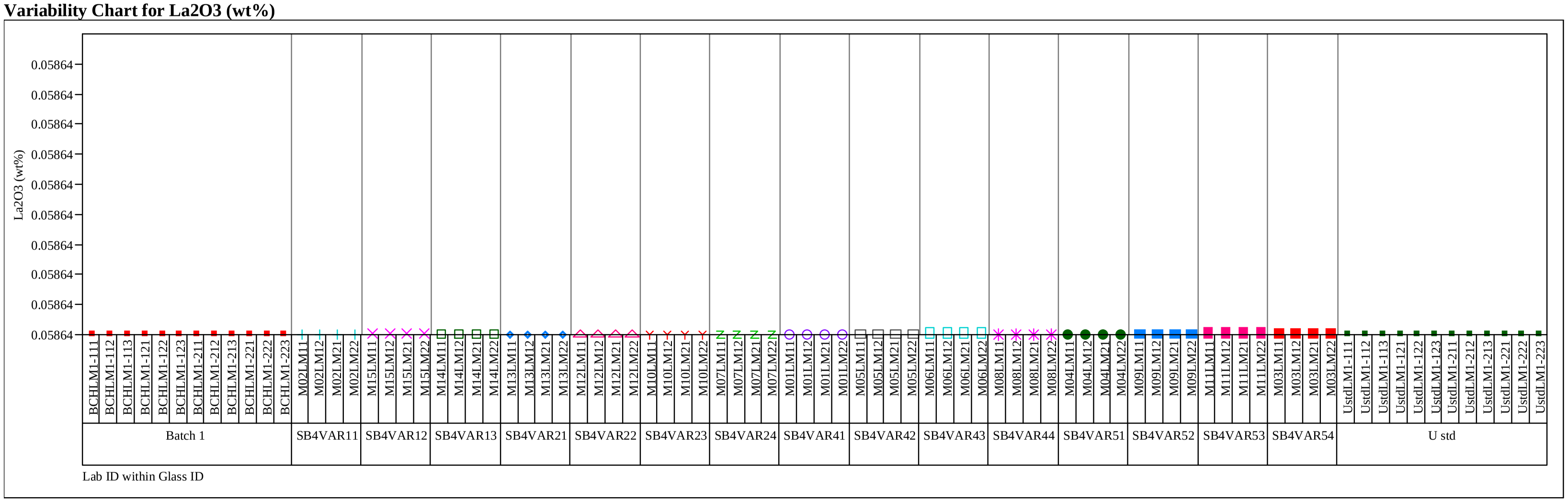
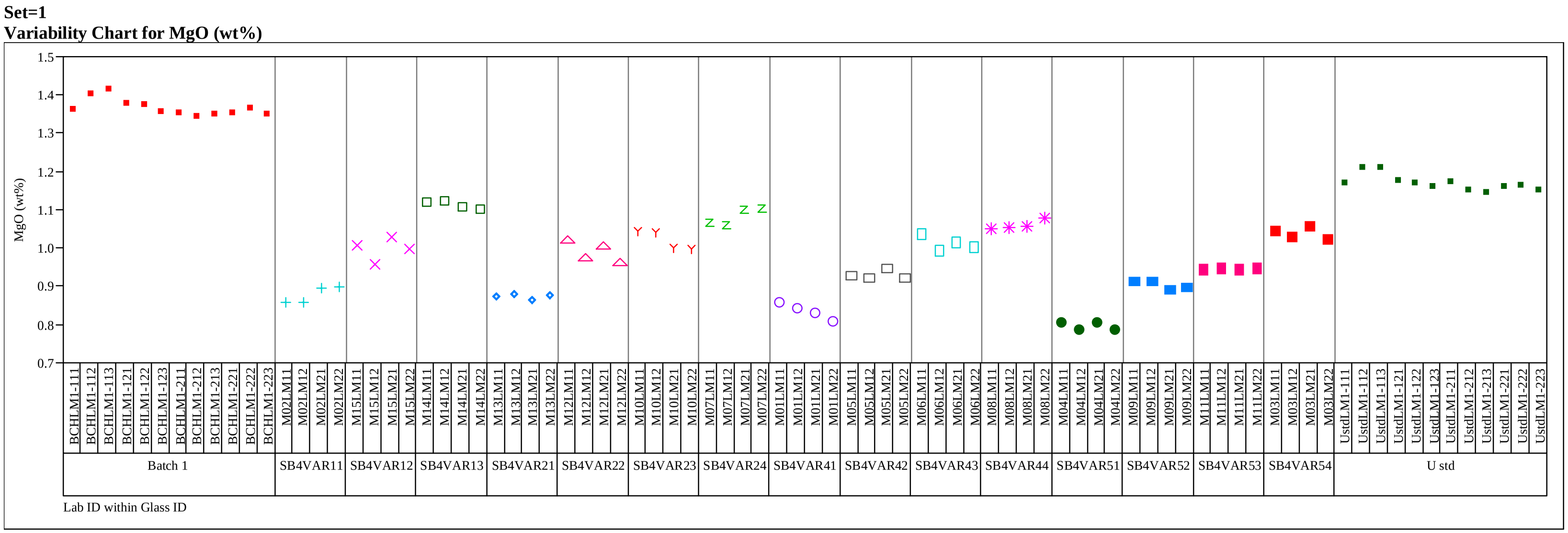


Exhibit A5. Oxide Measurements by Solution ID for Samples Prepared Using the LM Method



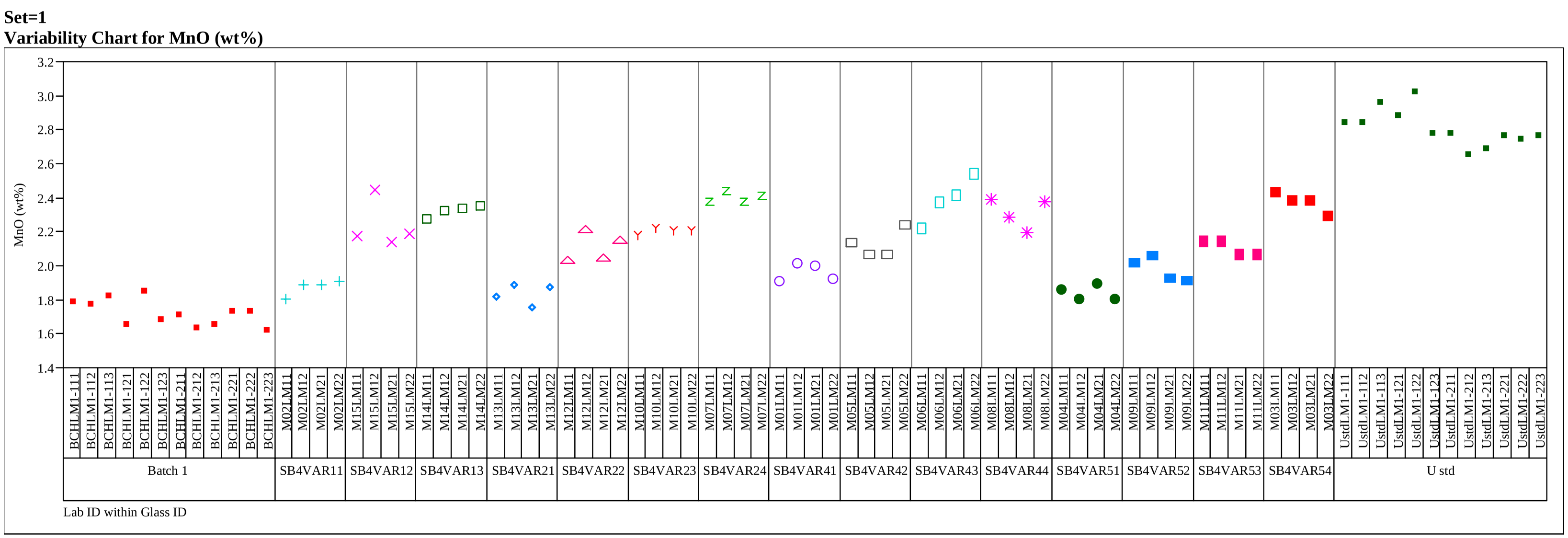
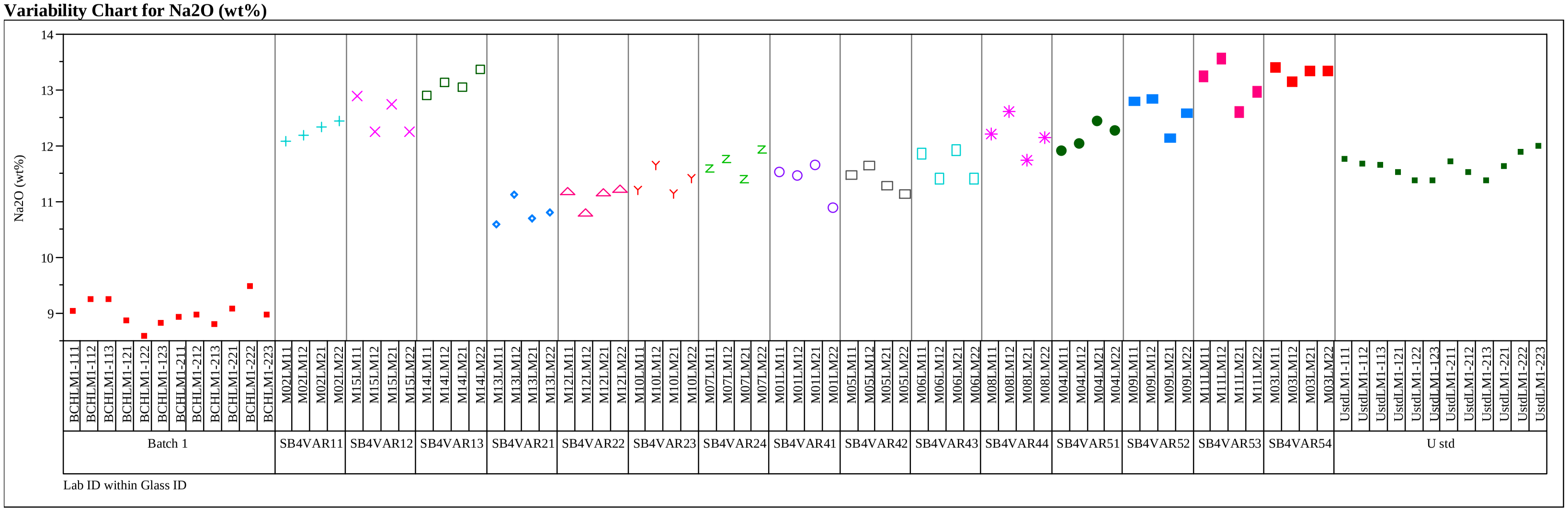


Exhibit A5. Oxide Measurements by Solution ID for Samples Prepared Using the LM Method

Set=1
Variability Chart for Na2O (wt%)



Set=1
Variability Chart for NiO (wt%)

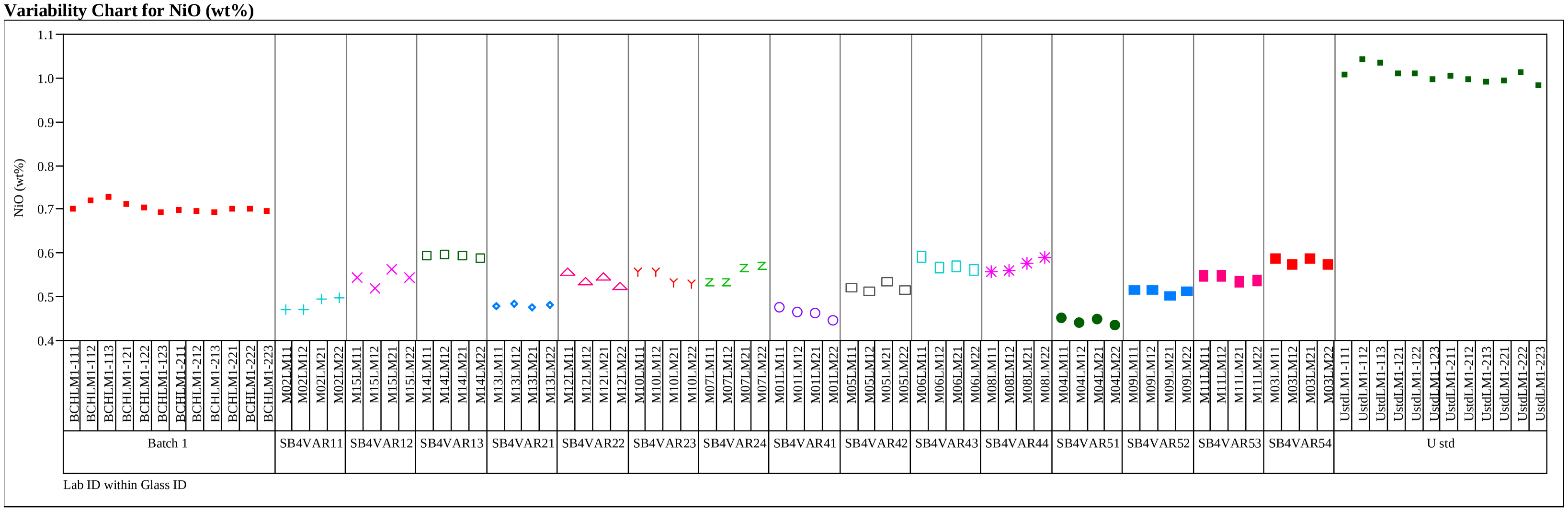
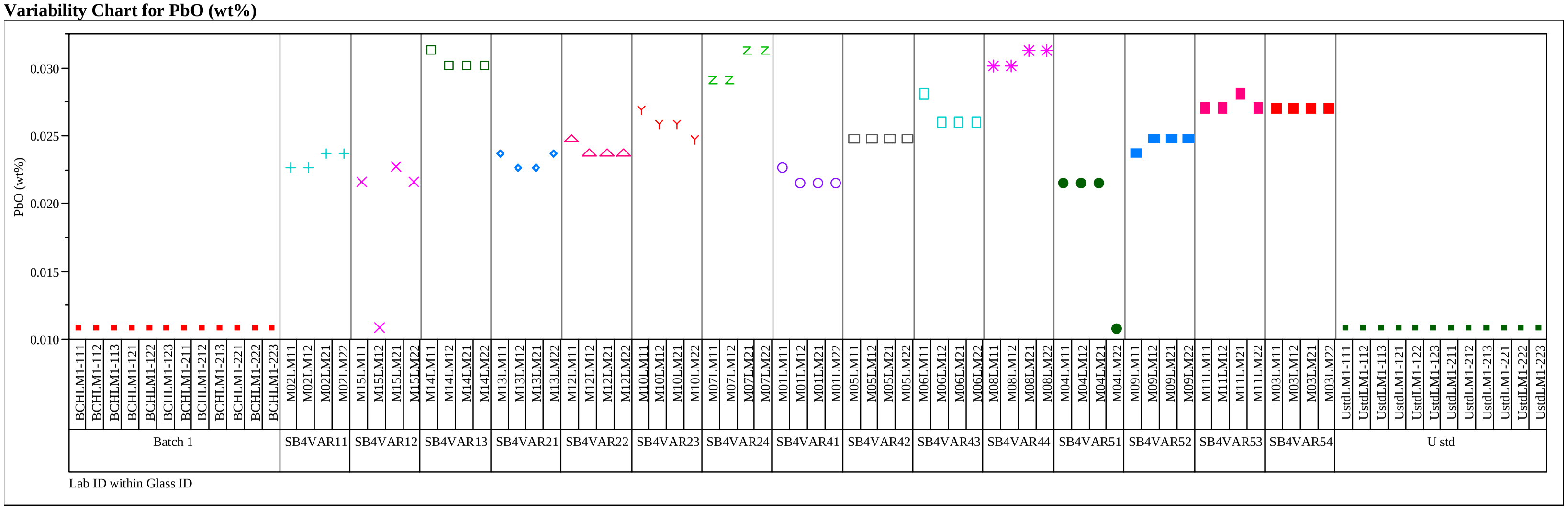


Exhibit A5. Oxide Measurements by Solution ID for Samples Prepared Using the LM Method

Set=1
Variability Chart for PbO (wt%)



Set=1
Variability Chart for SO4 (wt%)

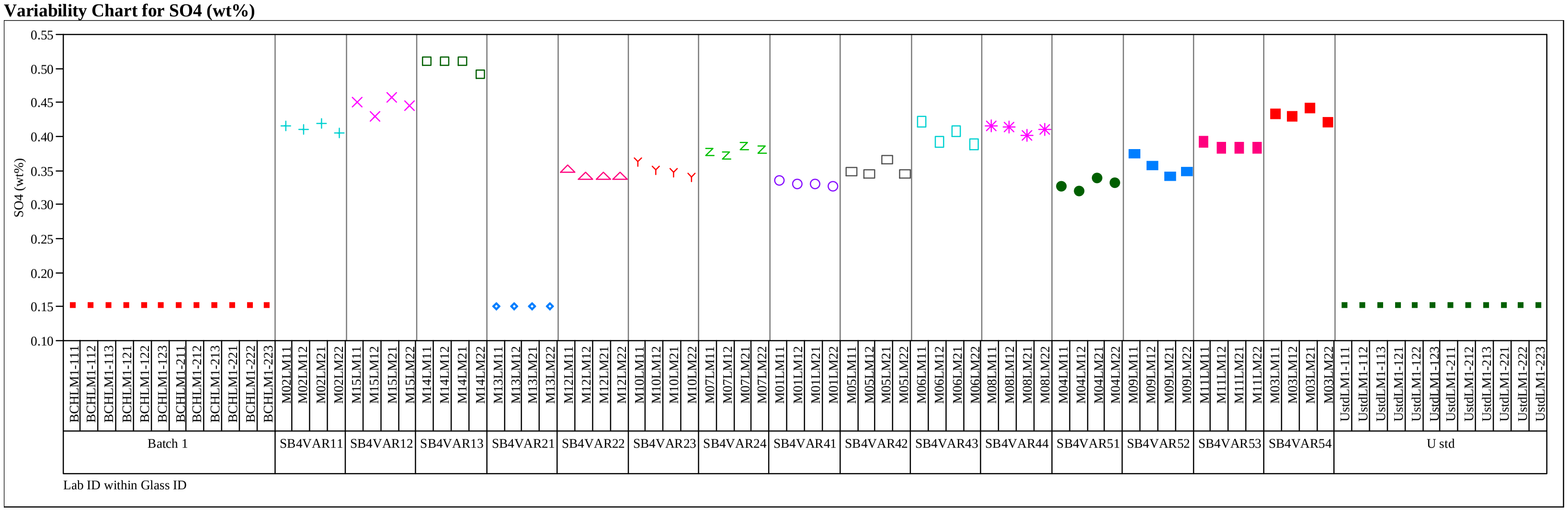
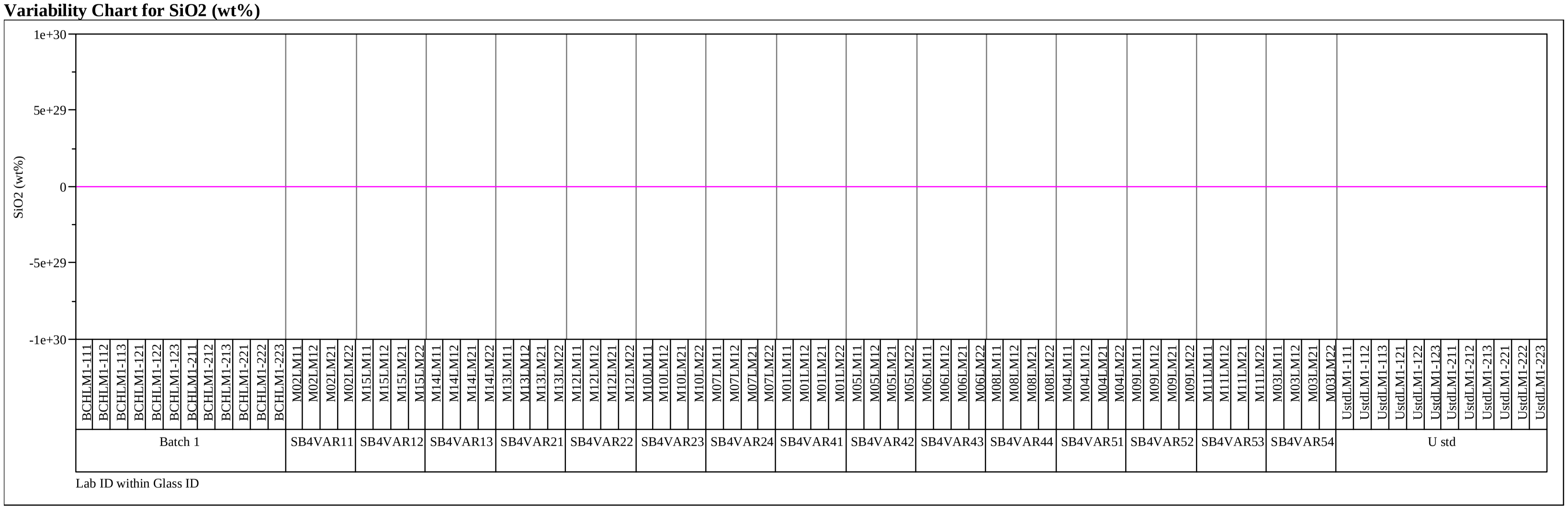


Exhibit A5. Oxide Measurements by Solution ID for Samples Prepared Using the LM Method

Set=1
Variability Chart for SiO2 (wt%)



Set=1
Variability Chart for TiO2 (wt%)

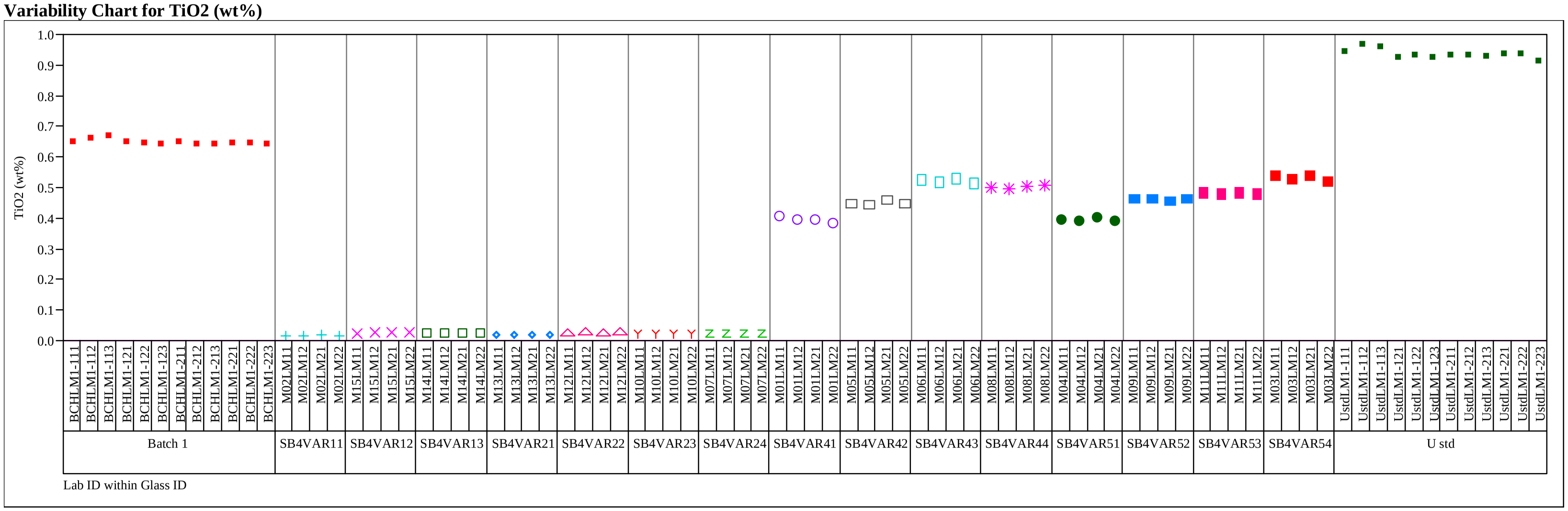
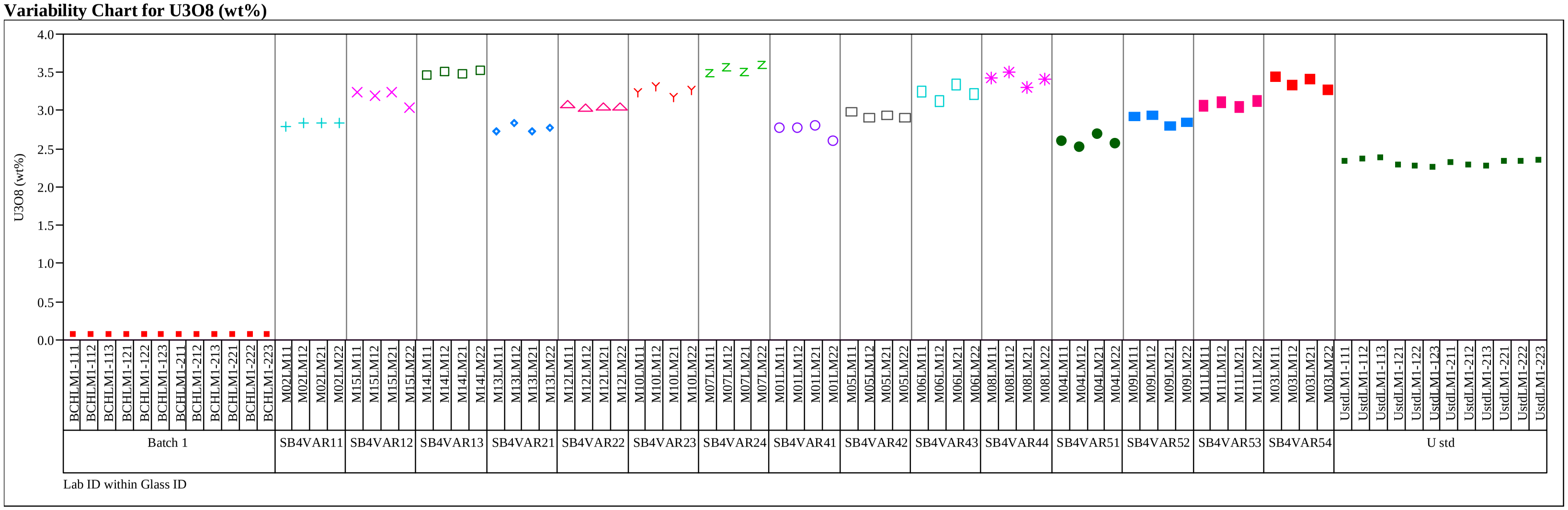


Exhibit A5. Oxide Measurements by Solution ID for Samples Prepared Using the LM Method

Set=1
Variability Chart for U3O8 (wt%)



Set=1
Variability Chart for ZnO (wt%)

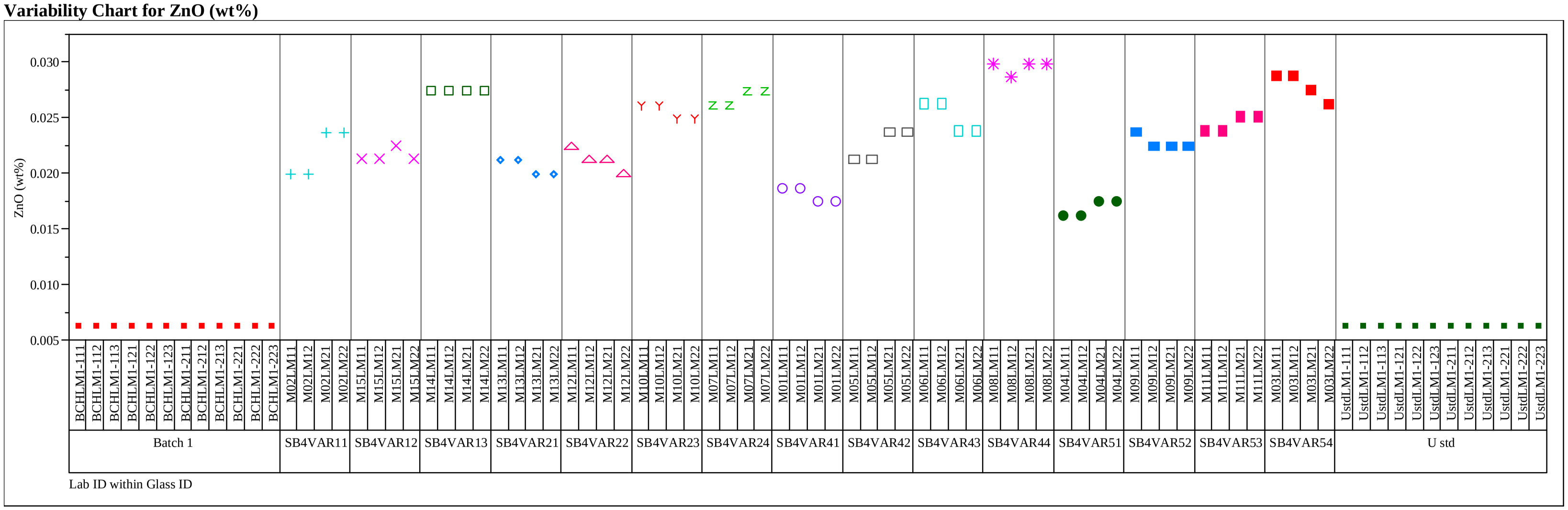
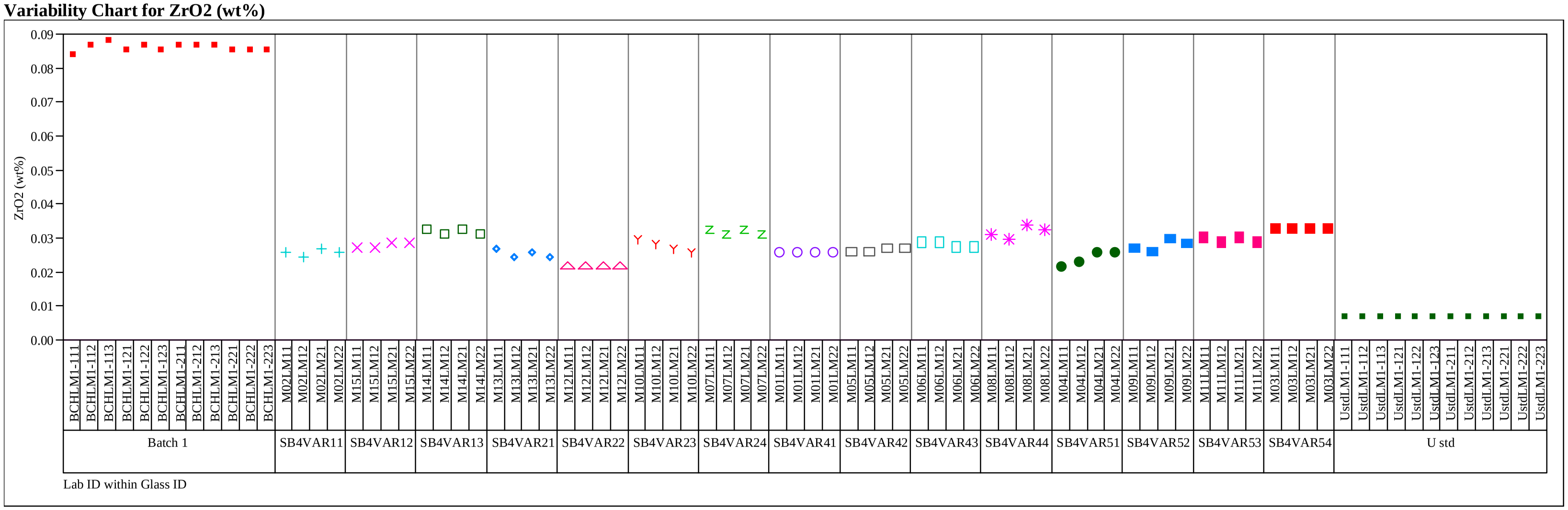


Exhibit A5. Oxide Measurements by Solution ID for Samples Prepared Using the LM Method

Set=1
Variability Chart for ZrO2 (wt%)



Set=1
Variability Chart for Al2O3 bc (wt%)

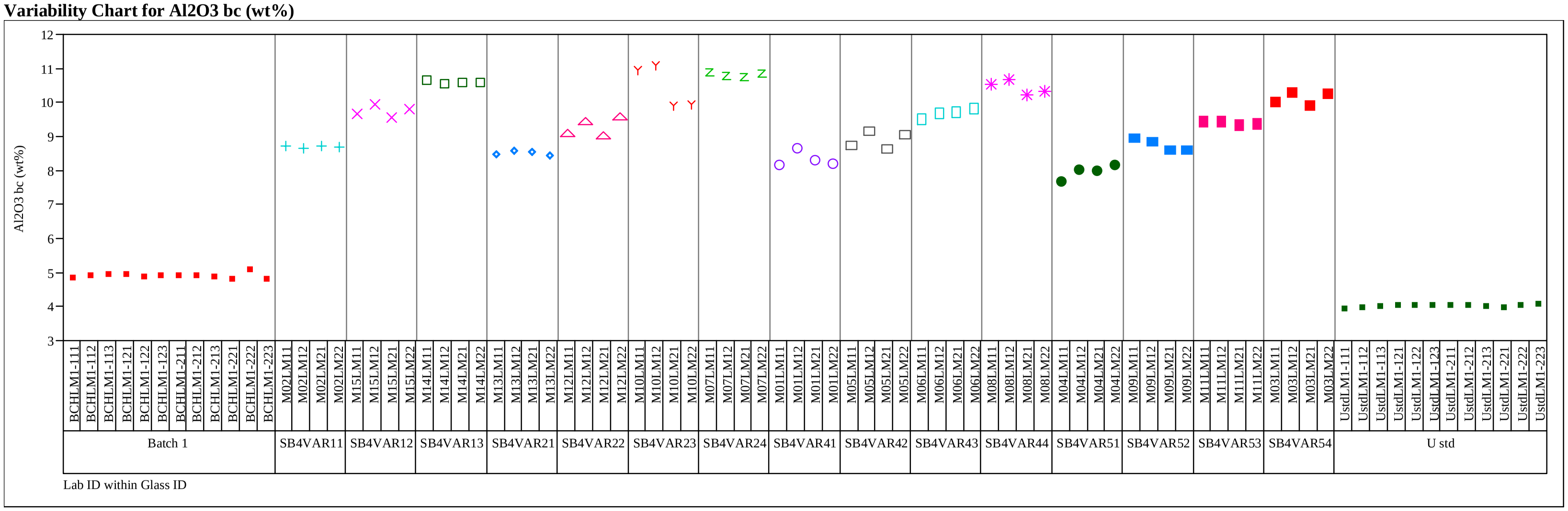
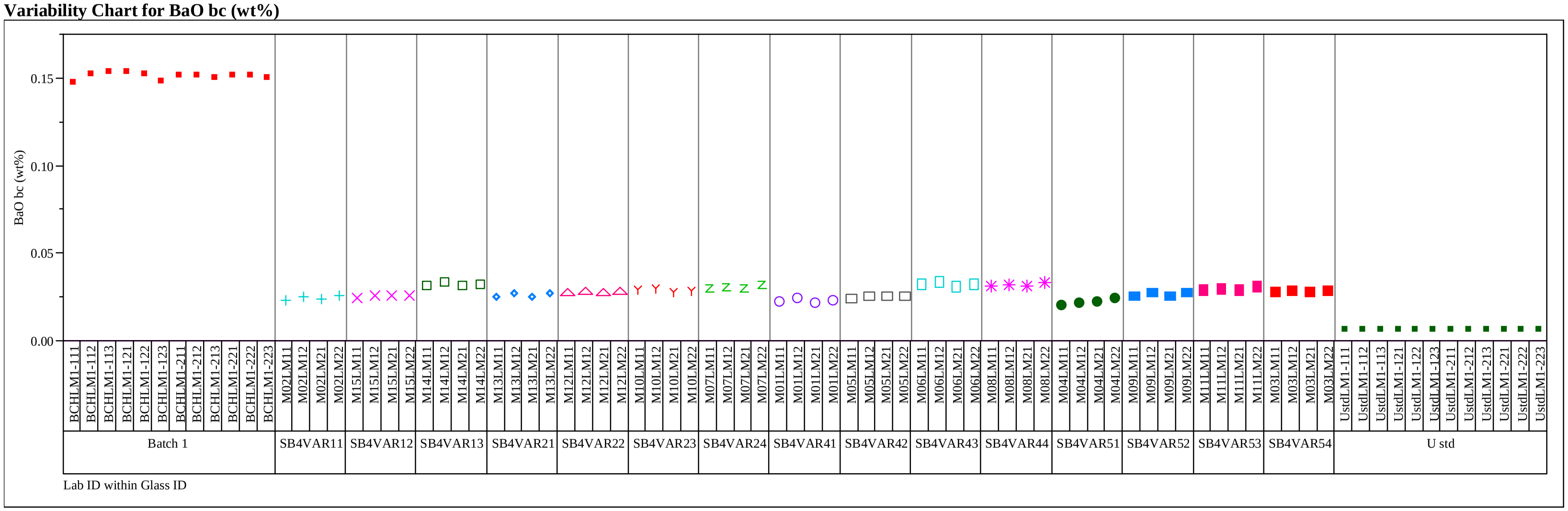


Exhibit A5. Oxide Measurements by Solution ID for Samples Prepared Using the LM Method

Set=1
Variability Chart for BaO bc (wt%)



Set=1
Variability Chart for CaO bc (wt%)

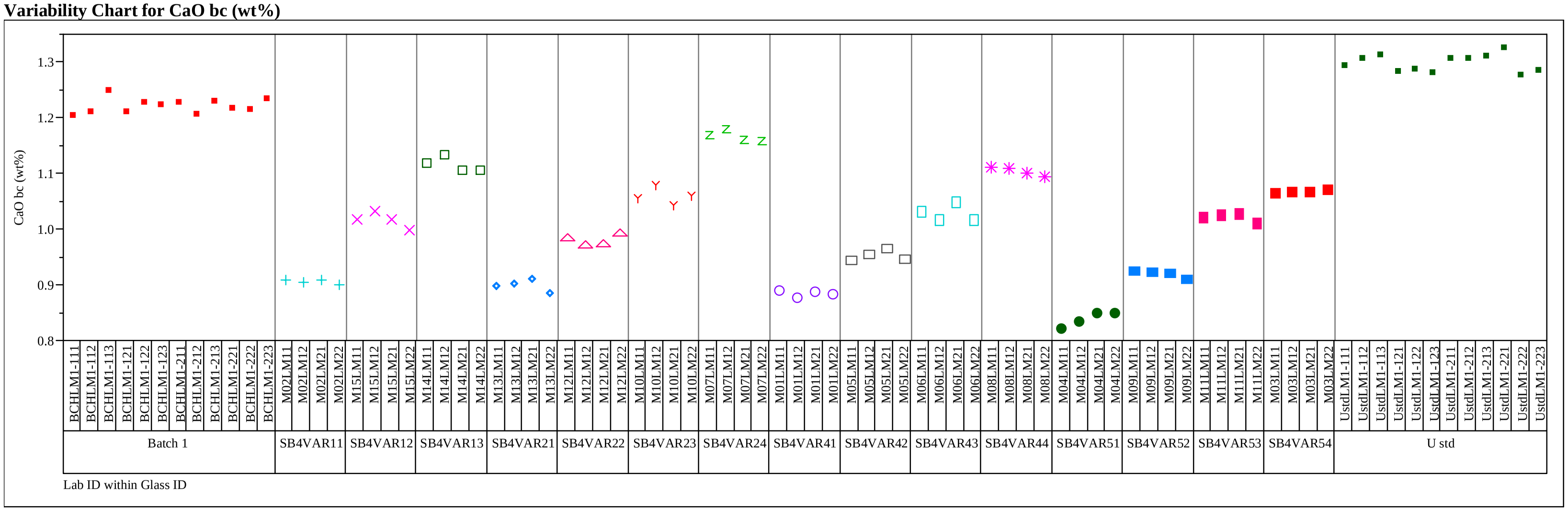
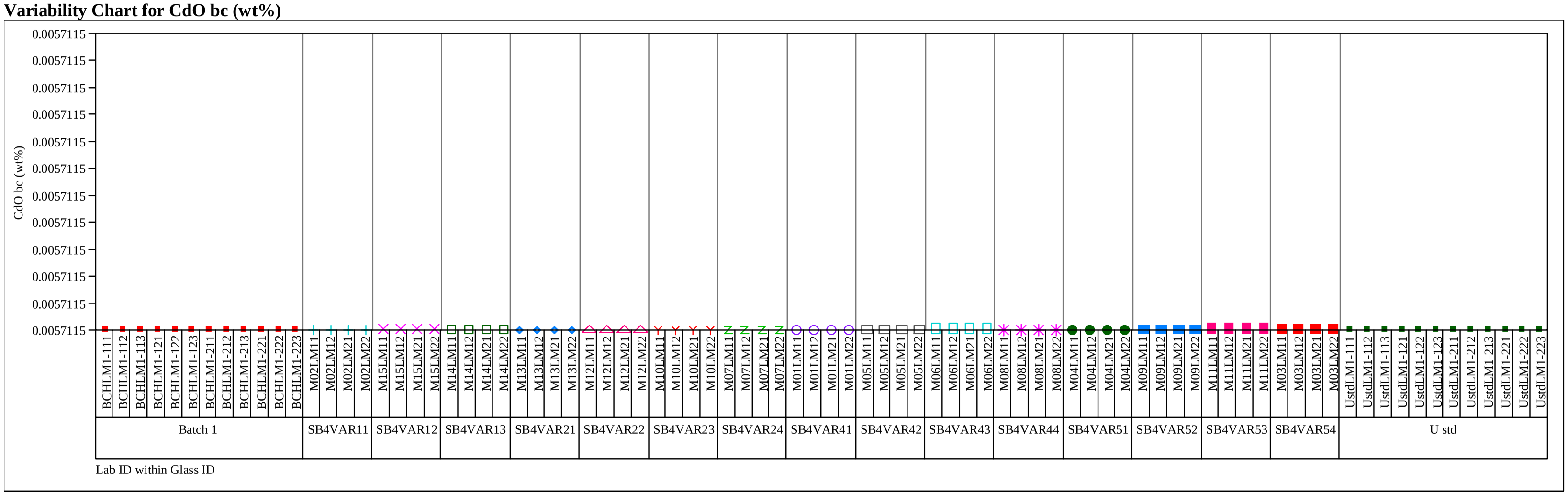


Exhibit A5. Oxide Measurements by Solution ID for Samples Prepared Using the LM Method

Set=1
Variability Chart for CdO bc (wt%)



Set=1
Variability Chart for Ce2O3 bc (wt%)

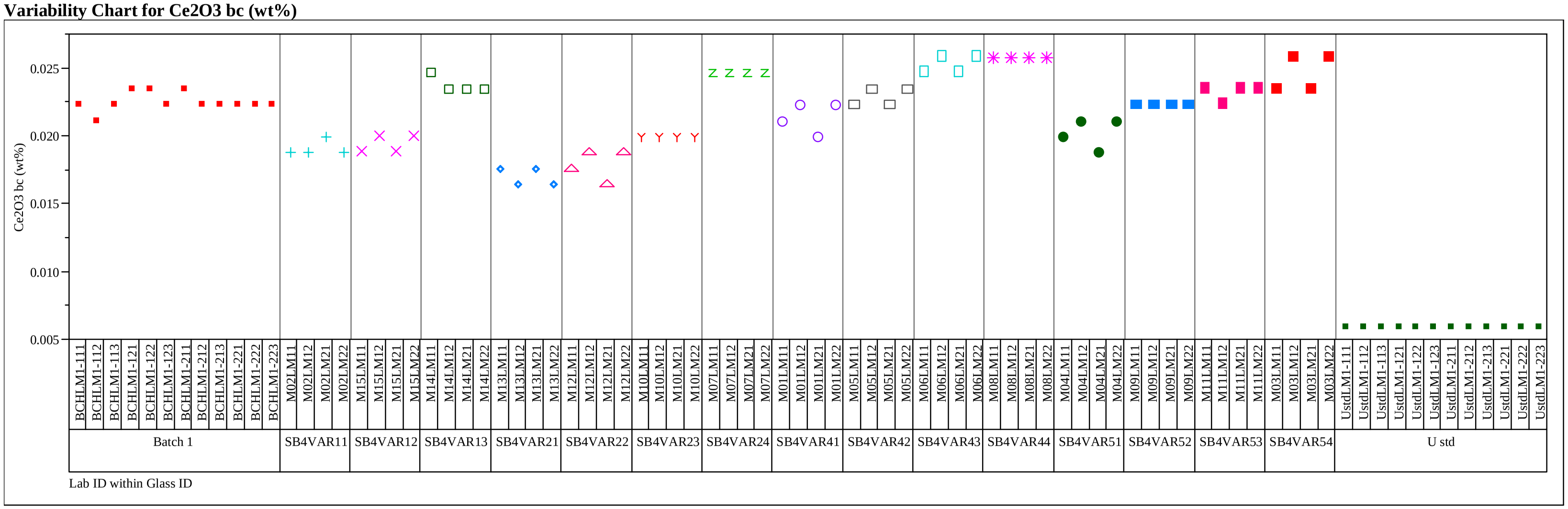
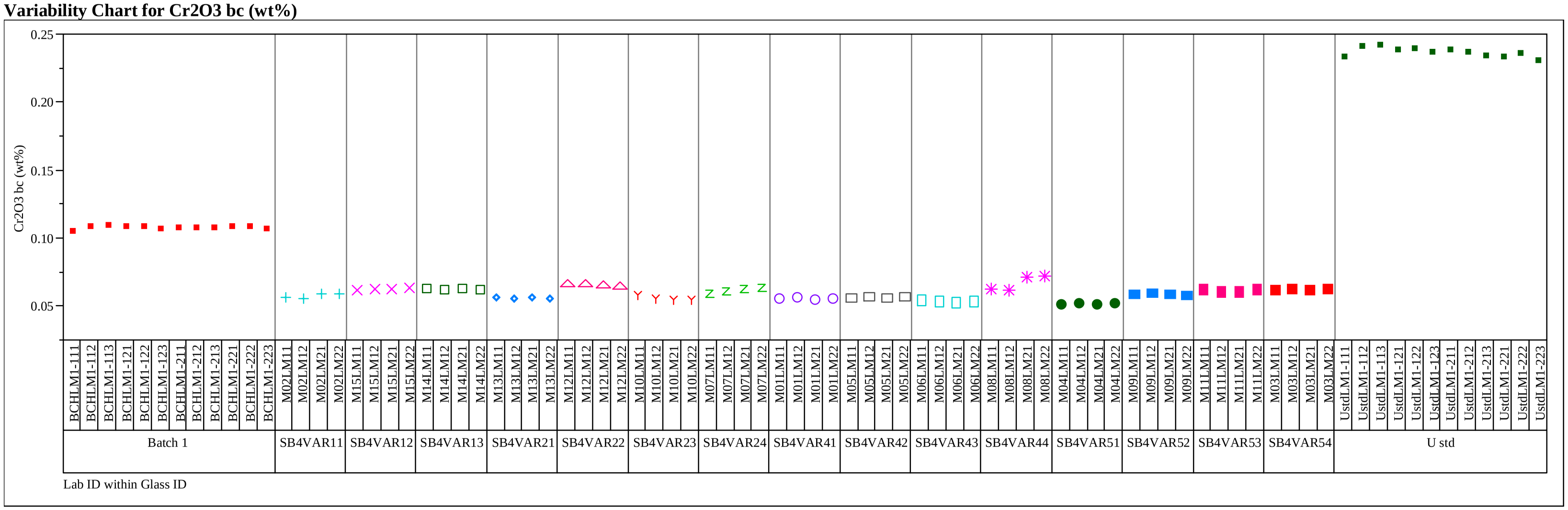


Exhibit A5. Oxide Measurements by Solution ID for Samples Prepared Using the LM Method

Set=1
Variability Chart for Cr2O3 bc (wt%)



Set=1
Variability Chart for CuO bc (wt%)

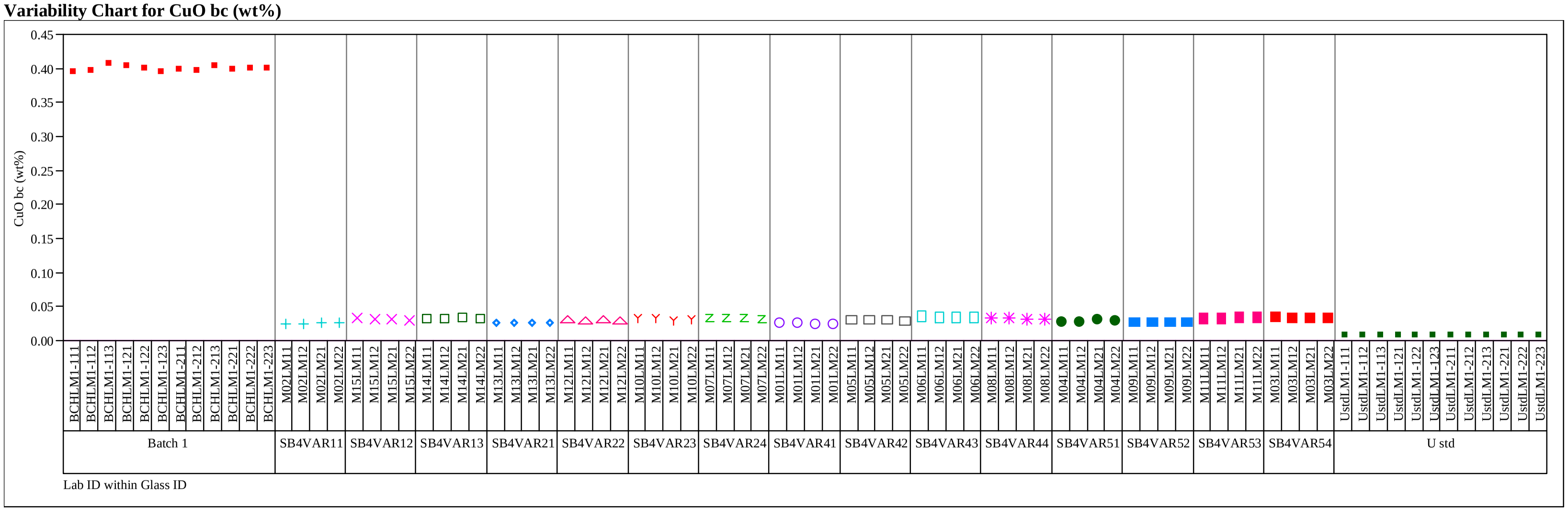
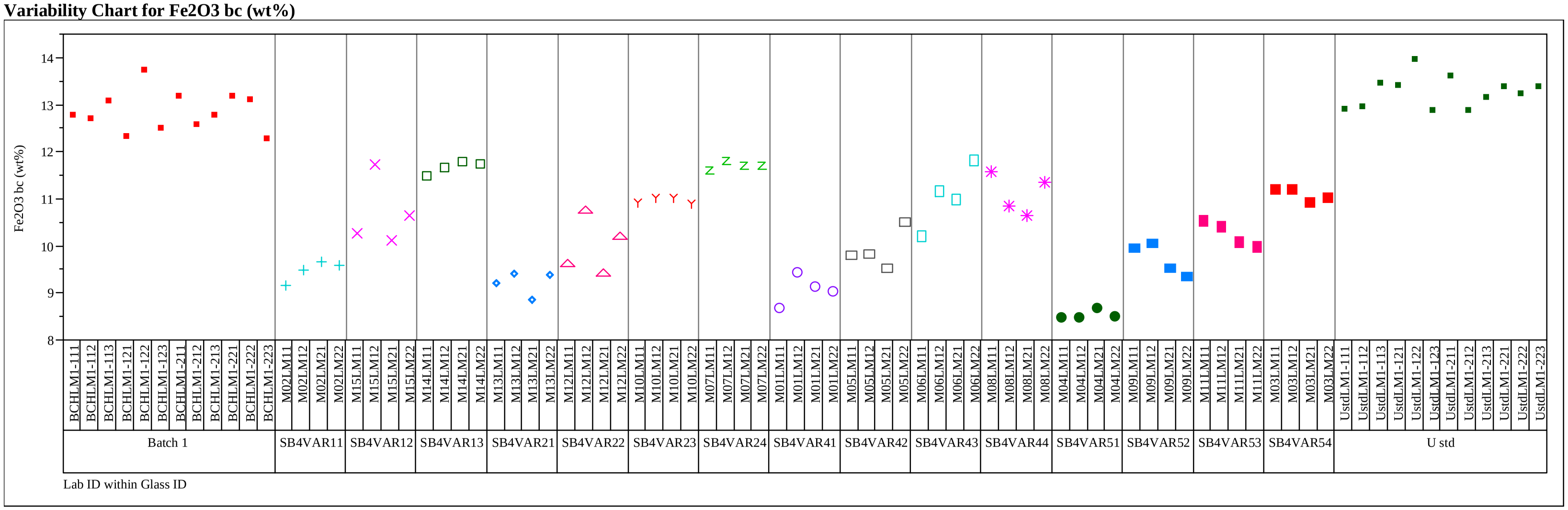


Exhibit A5. Oxide Measurements by Solution ID for Samples Prepared Using the LM Method

Set=1
Variability Chart for Fe2O3 bc (wt%)



Set=1
Variability Chart for K2O bc (wt%)

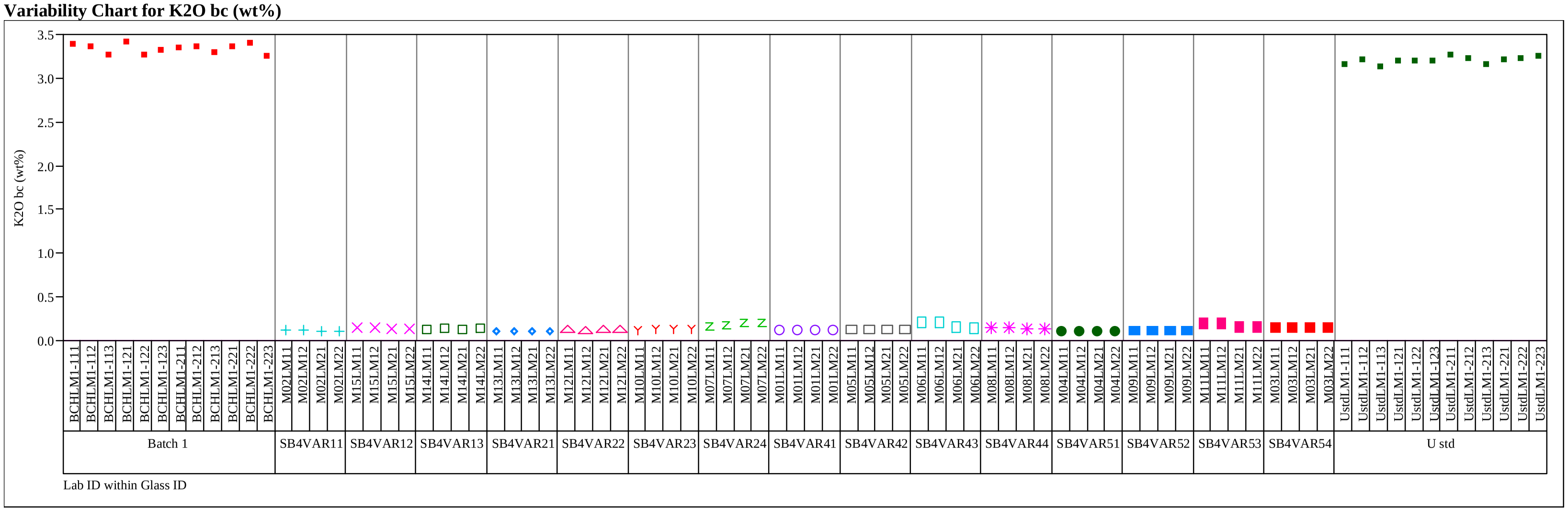
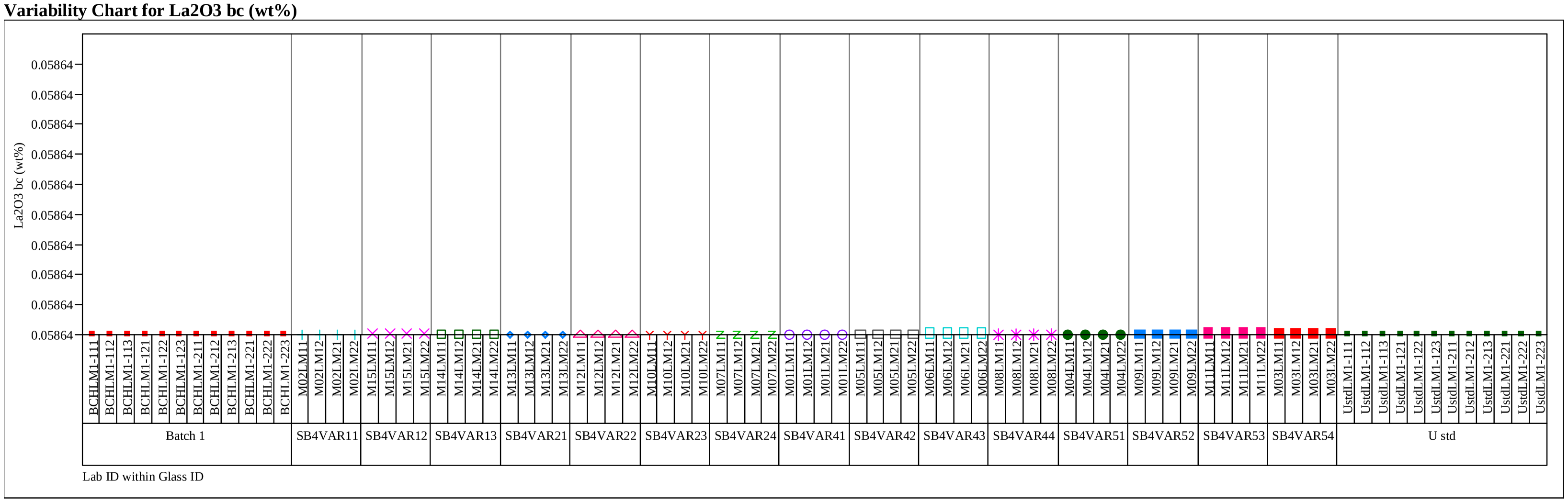


Exhibit A5. Oxide Measurements by Solution ID for Samples Prepared Using the LM Method

Set=1
Variability Chart for La2O3 bc (wt%)



Set=1
Variability Chart for MgO bc (wt%)

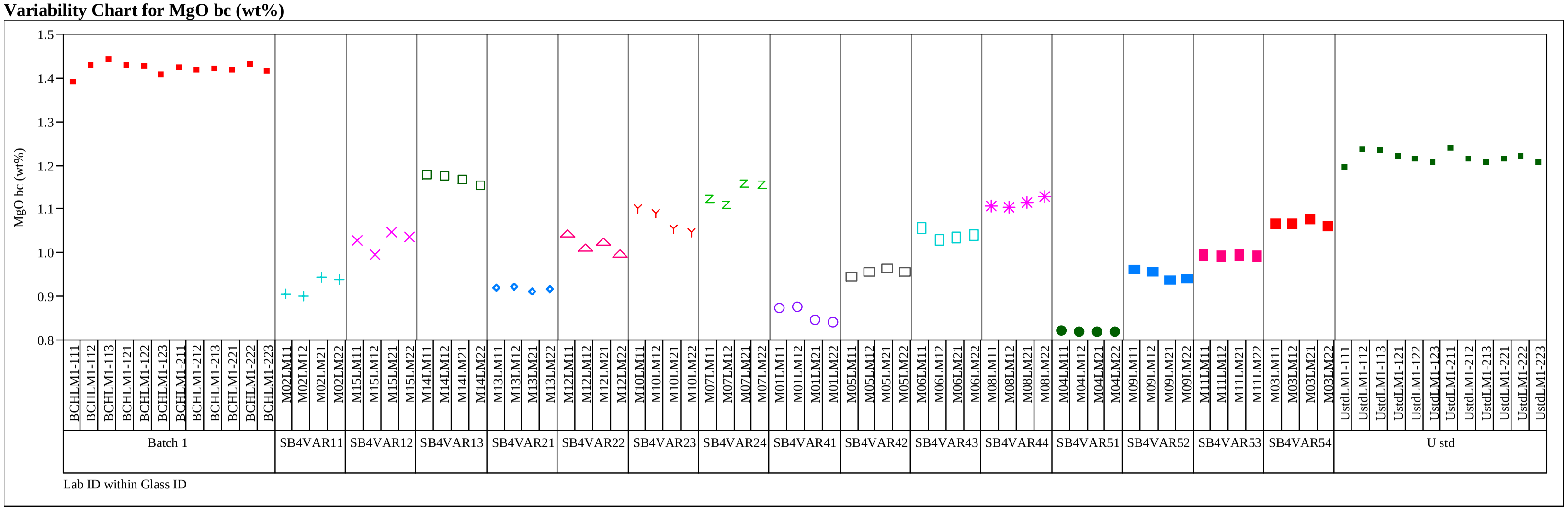
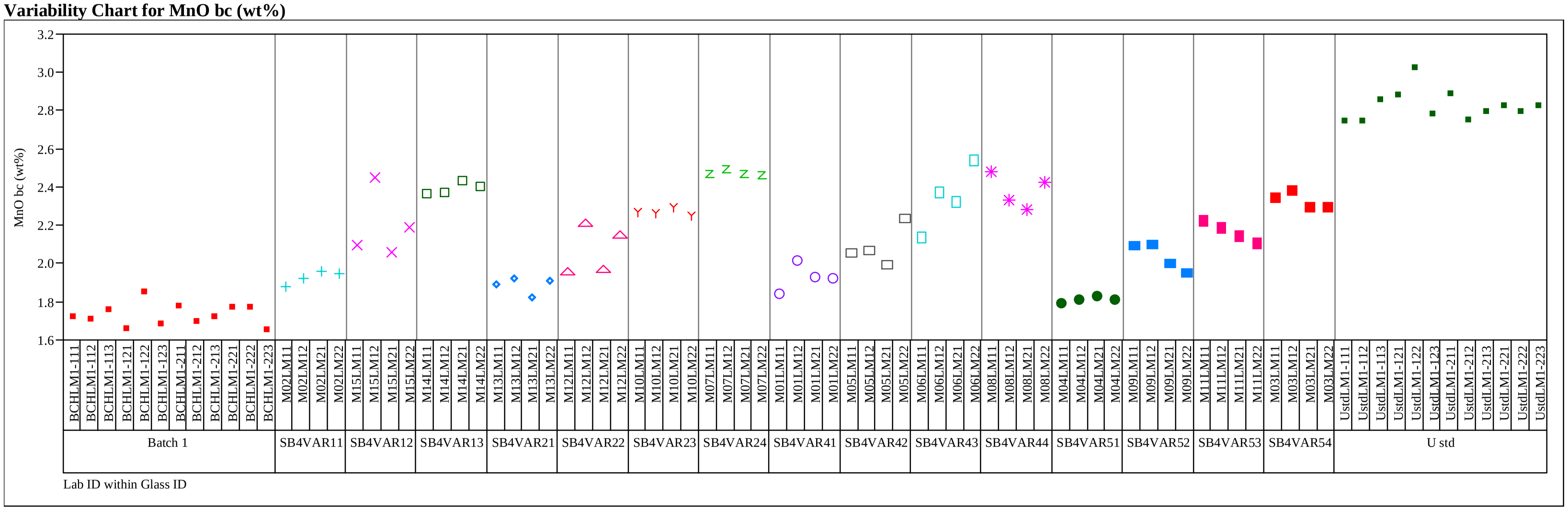


Exhibit A5. Oxide Measurements by Solution ID for Samples Prepared Using the LM Method

Set=1
Variability Chart for MnO bc (wt%)



Set=1
Variability Chart for Na2O bc (wt%)

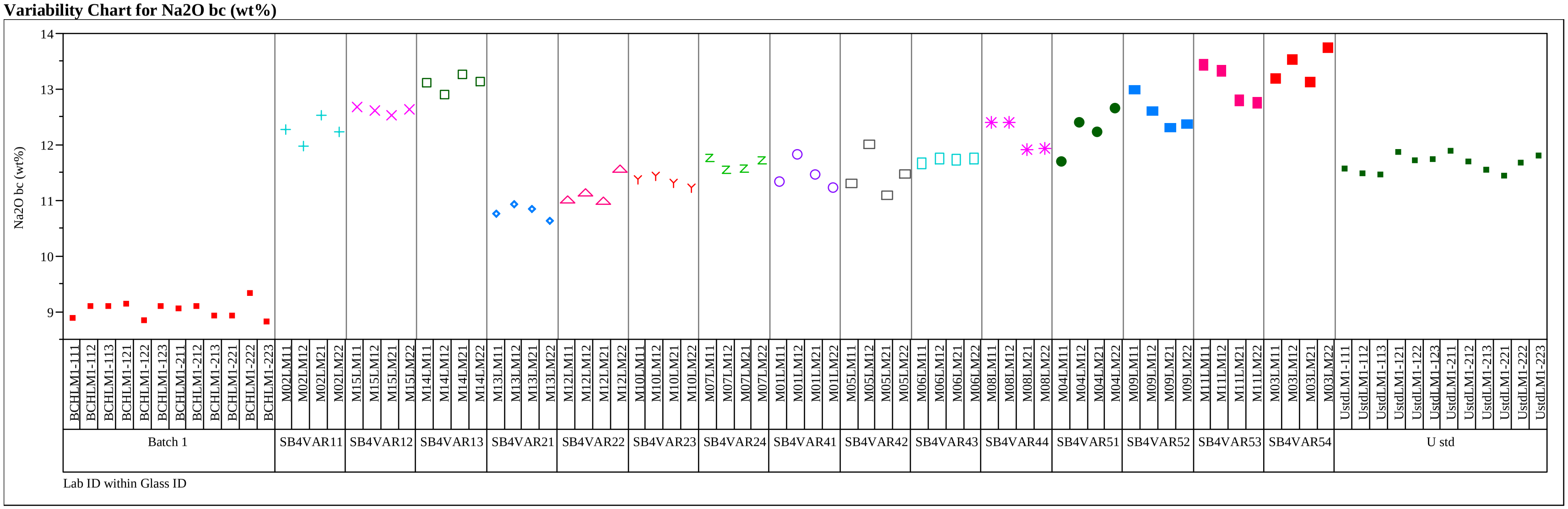
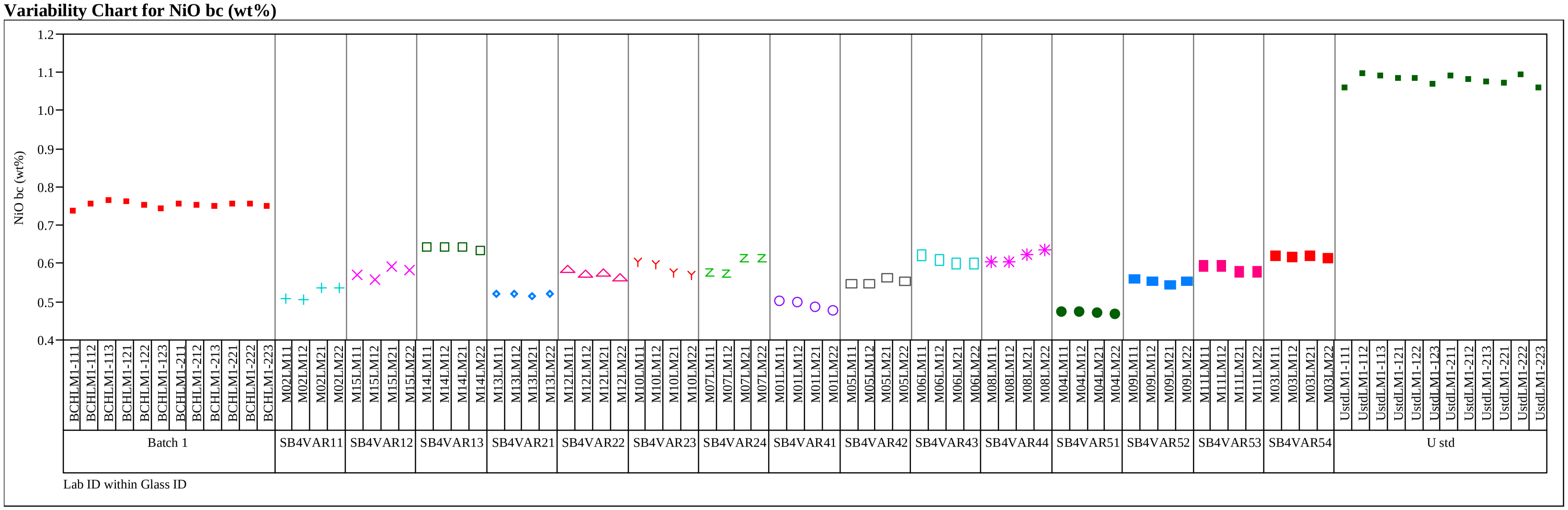


Exhibit A5. Oxide Measurements by Solution ID for Samples Prepared Using the LM Method

Set=1
Variability Chart for NiO bc (wt%)



Set=1
Variability Chart for PbO bc (wt%)

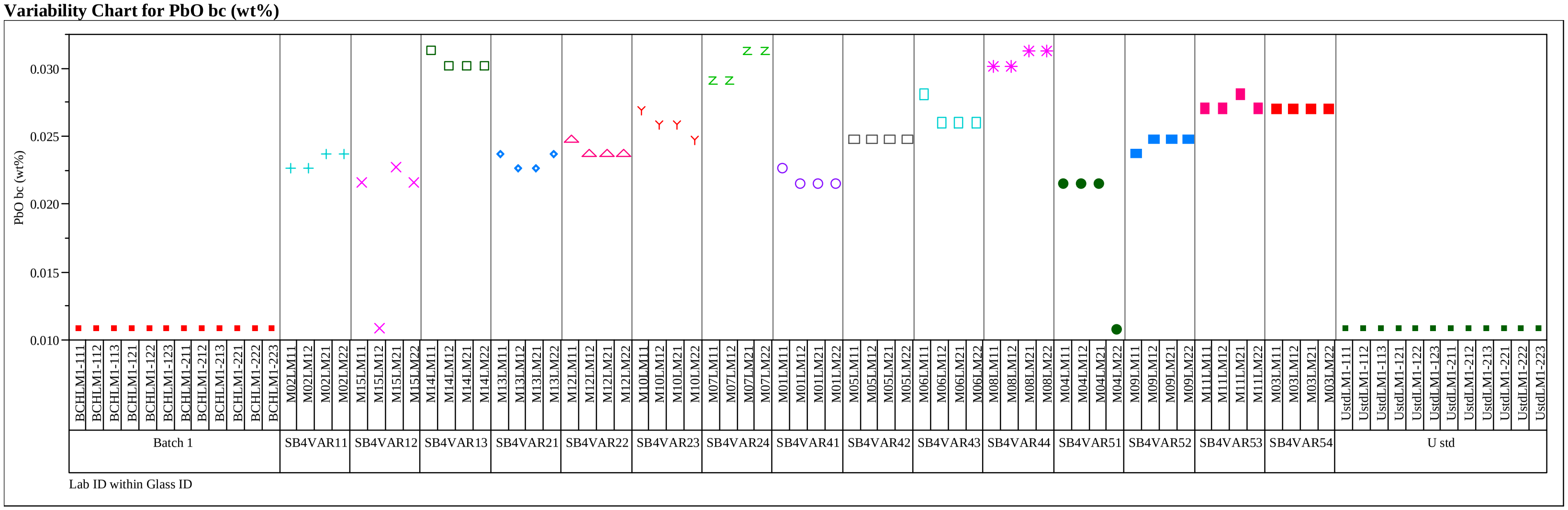
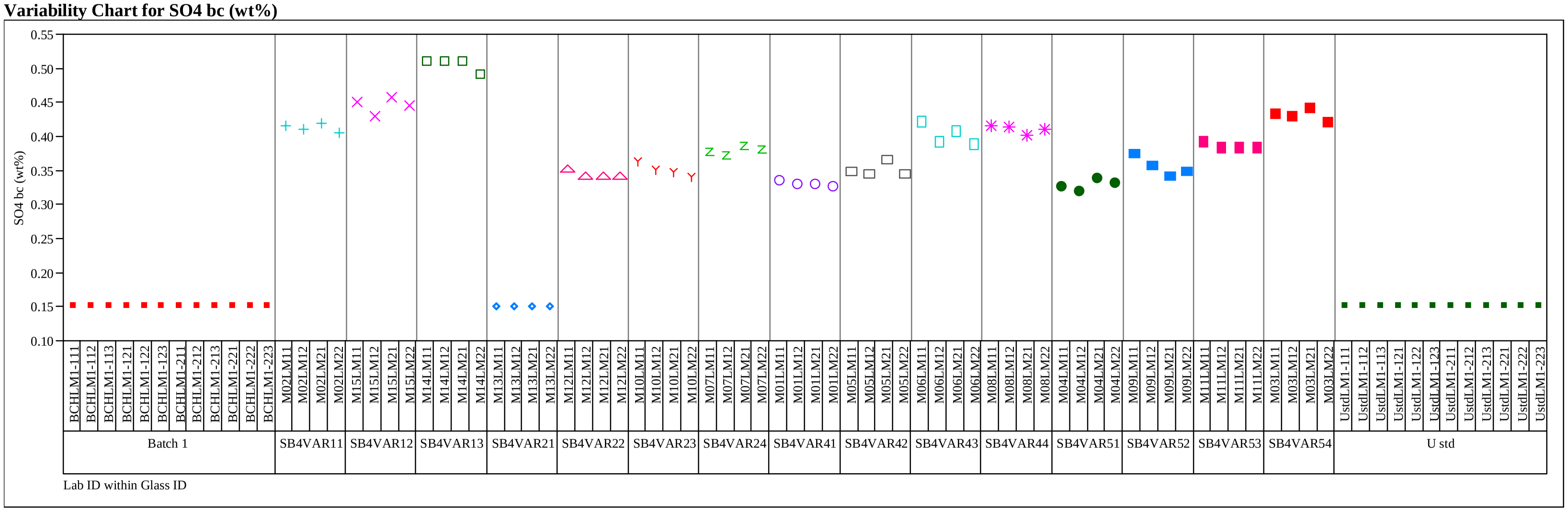


Exhibit A5. Oxide Measurements by Solution ID for Samples Prepared Using the LM Method

Set=1
Variability Chart for SO4 bc (wt%)



Set=1
Variability Chart for SiO2 bc (wt%)

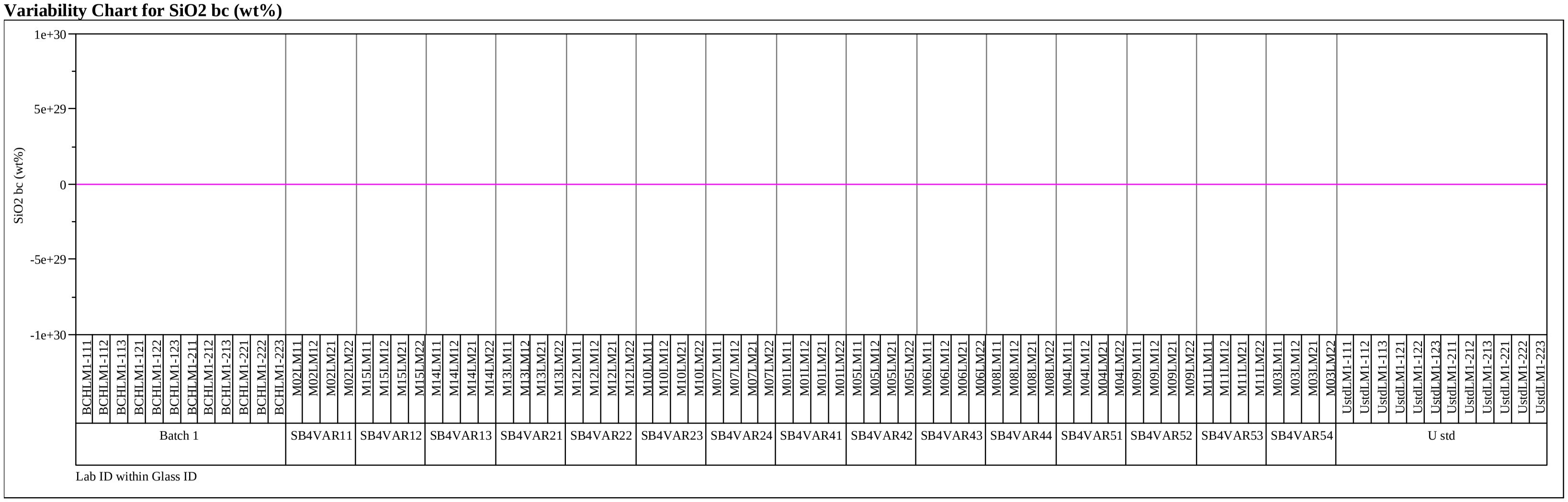
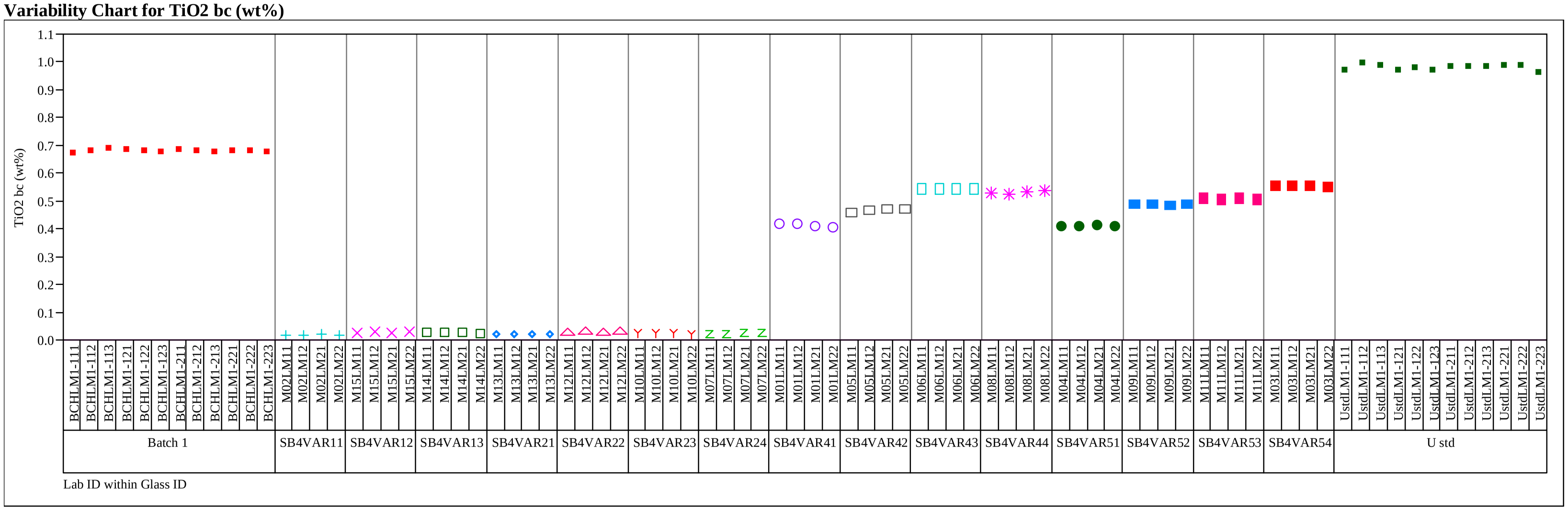


Exhibit A5. Oxide Measurements by Solution ID for Samples Prepared Using the LM Method

Set=1
Variability Chart for TiO2 bc (wt%)



Set=1
Variability Chart for U3O8 bc (wt%)

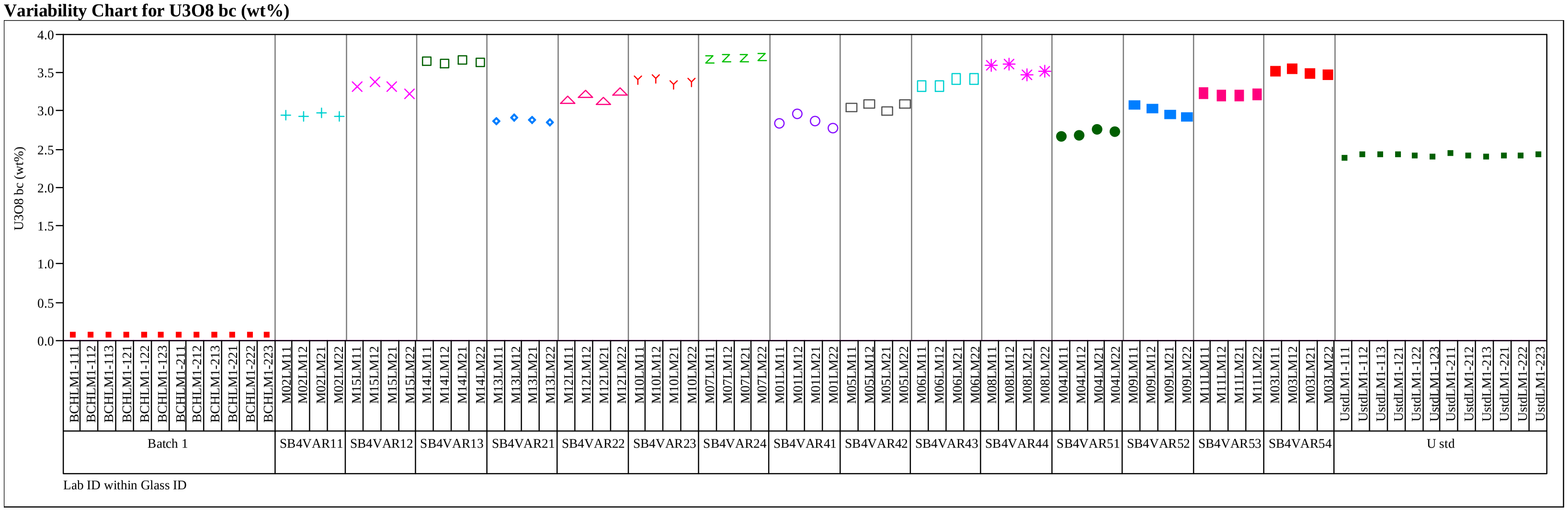
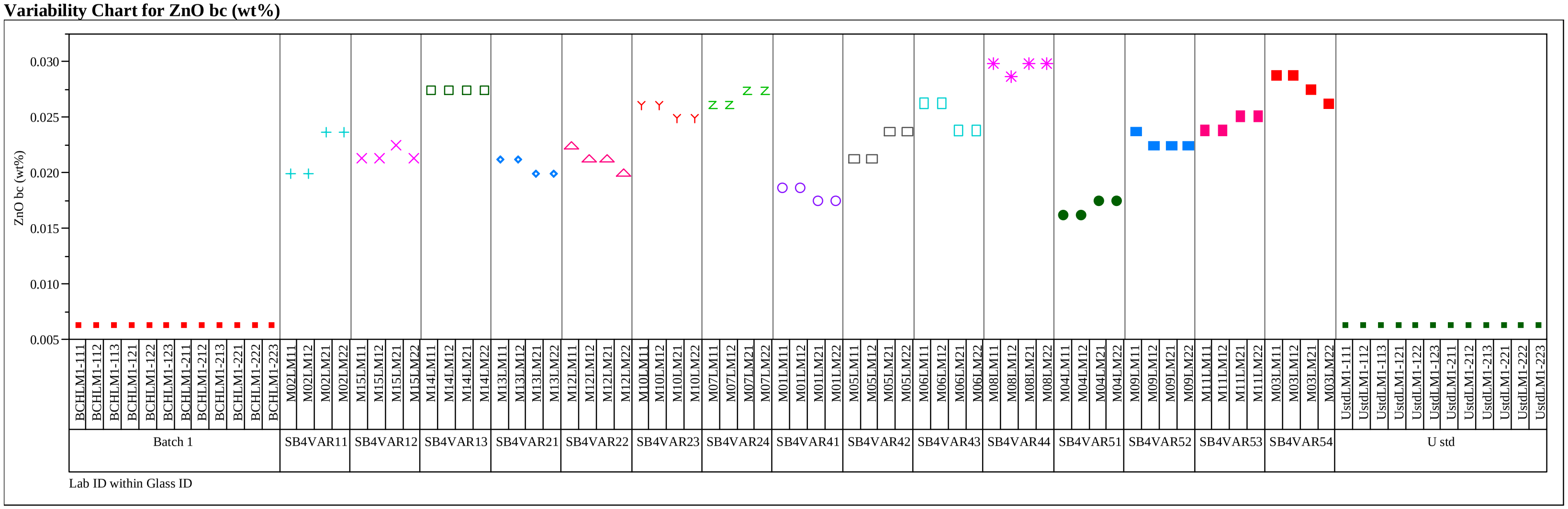


Exhibit A5. Oxide Measurements by Solution ID for Samples Prepared Using the LM Method

Set=1
Variability Chart for ZnO bc (wt%)



Set=1
Variability Chart for ZrO2 bc (wt%)

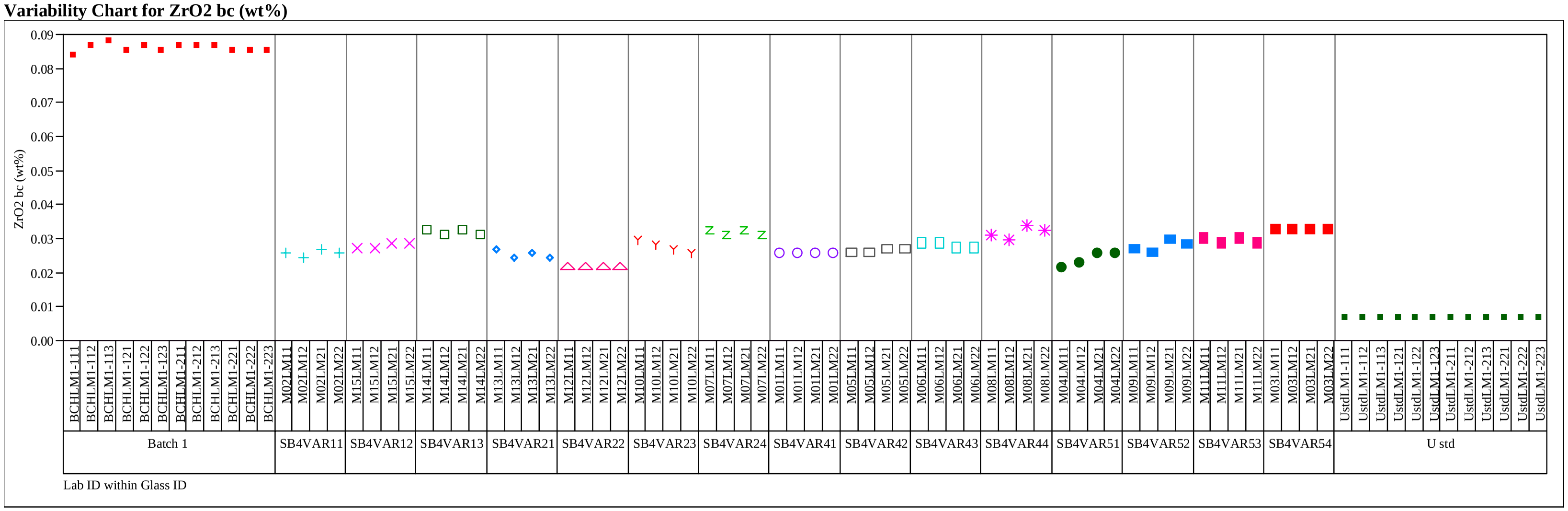
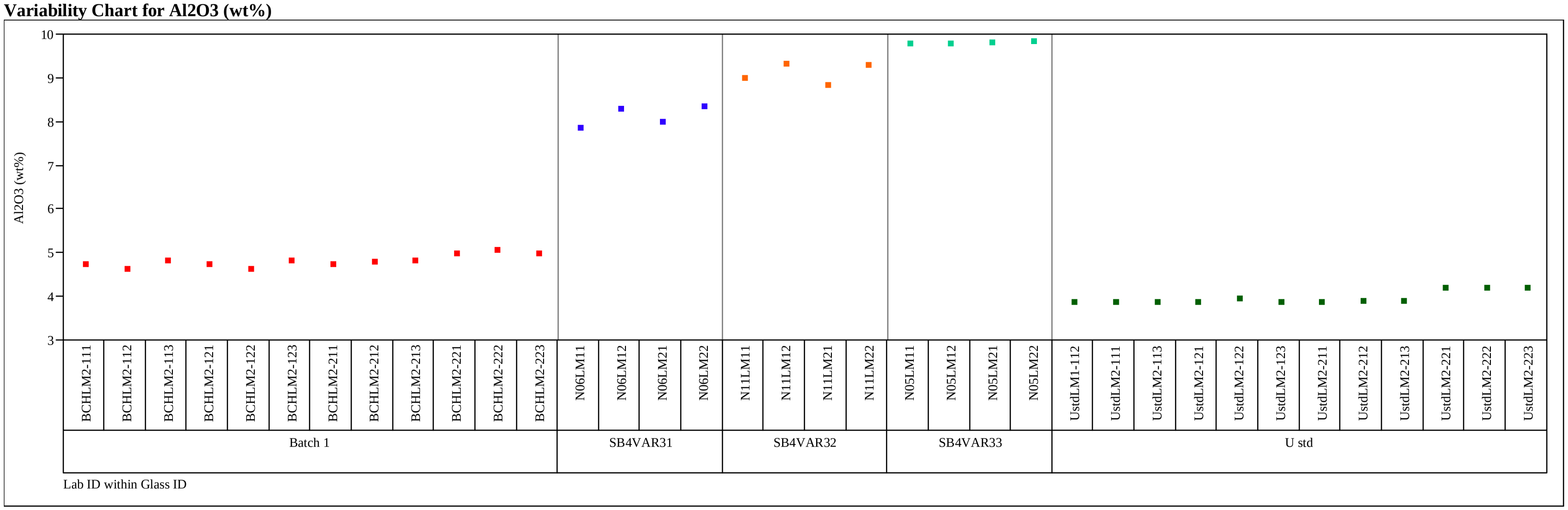


Exhibit A5. Oxide Measurements by Solution ID for Samples Prepared Using the LM Method

Set=2
Variability Chart for Al2O3 (wt%)



Set=2
Variability Chart for BaO (wt%)

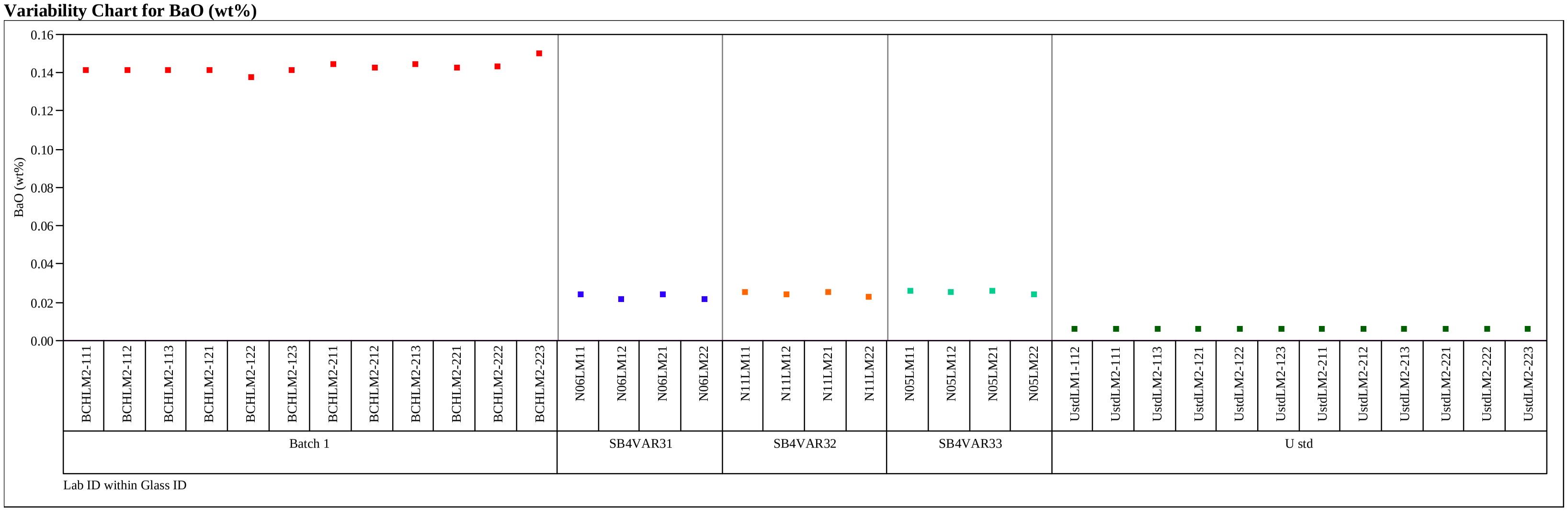
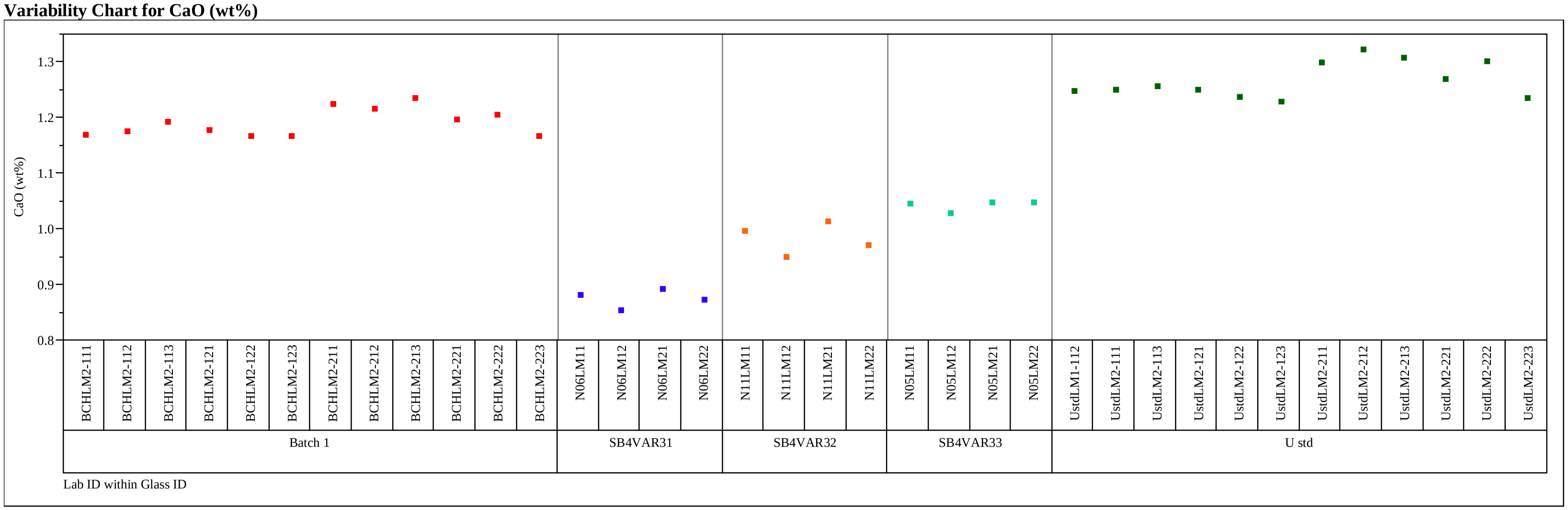


Exhibit A5. Oxide Measurements by Solution ID for Samples Prepared Using the LM Method

Set=2
Variability Chart for CaO (wt%)



Set=2
Variability Chart for CdO (wt%)

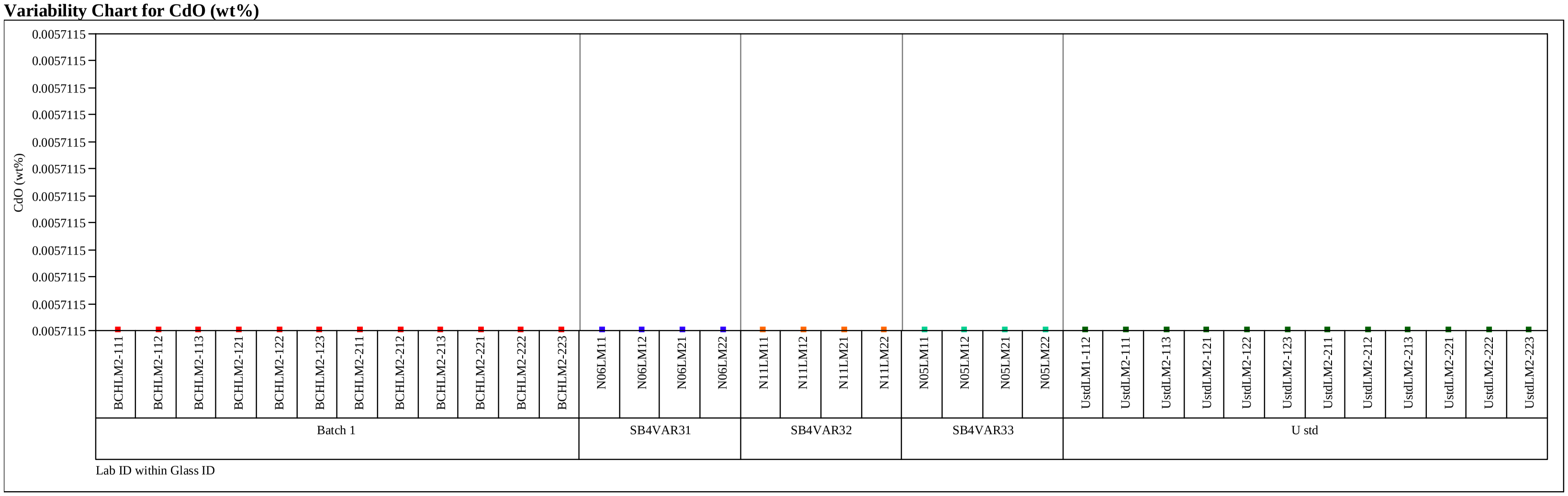
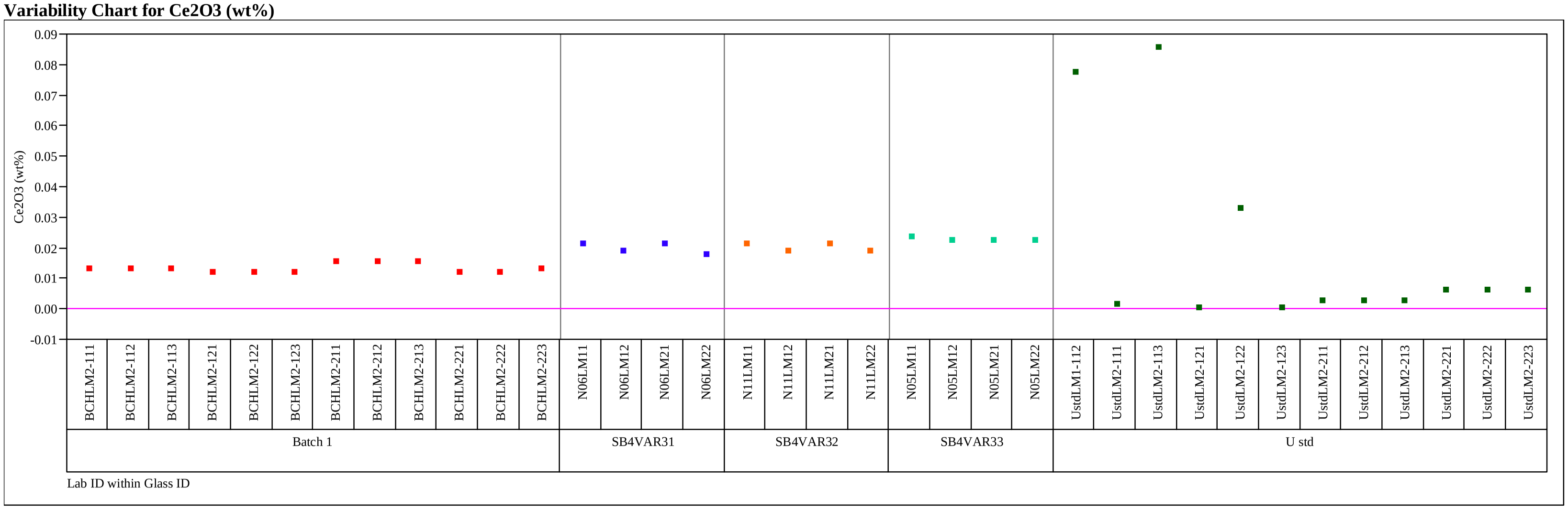


Exhibit A5. Oxide Measurements by Solution ID for Samples Prepared Using the LM Method

Set=2
Variability Chart for Ce2O3 (wt%)



Set=2
Variability Chart for Cr2O3 (wt%)

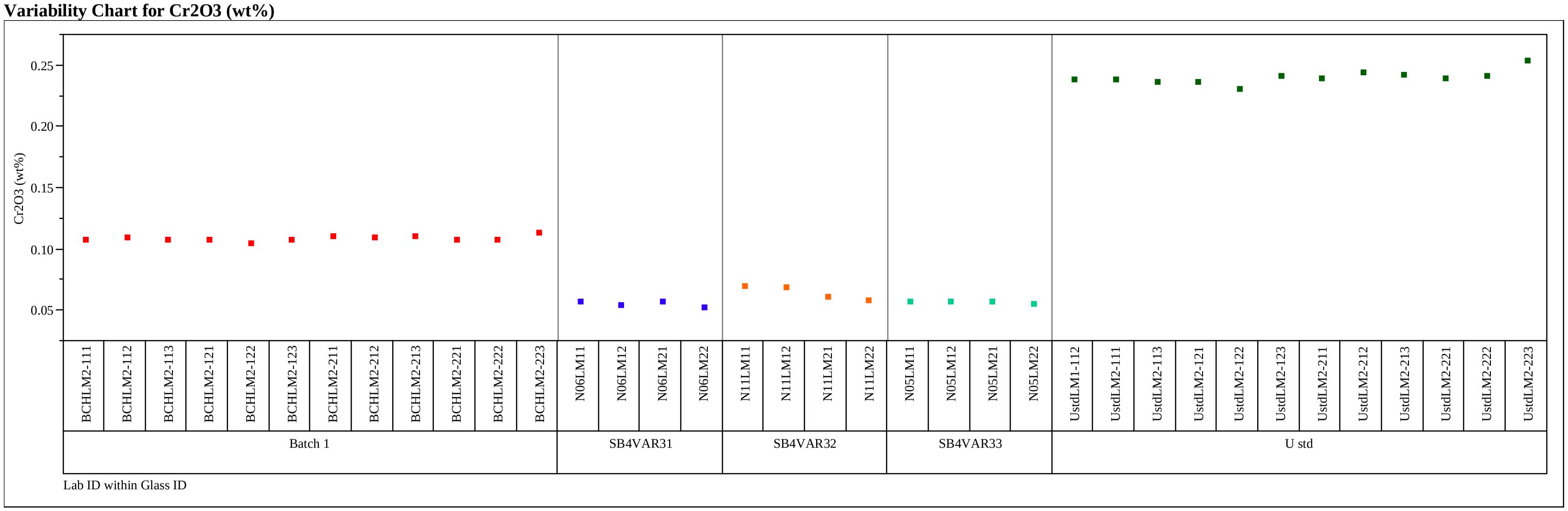
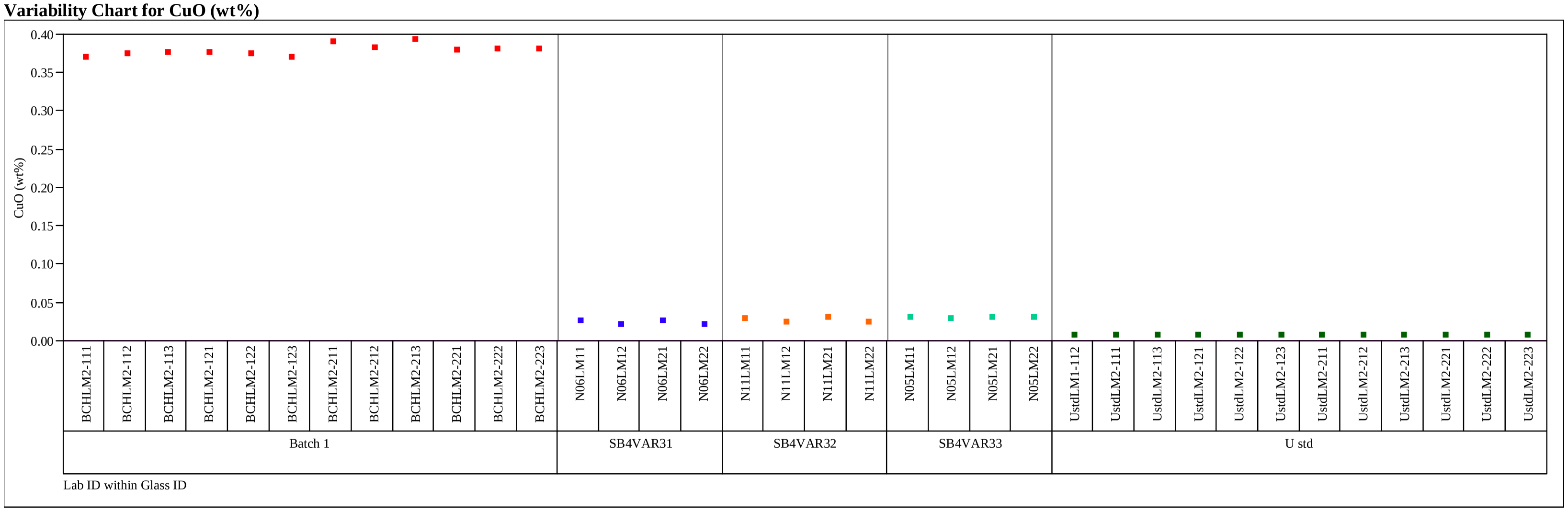


Exhibit A5. Oxide Measurements by Solution ID for Samples Prepared Using the LM Method

Set=2
Variability Chart for CuO (wt%)



Set=2
Variability Chart for Fe2O3 (wt%)

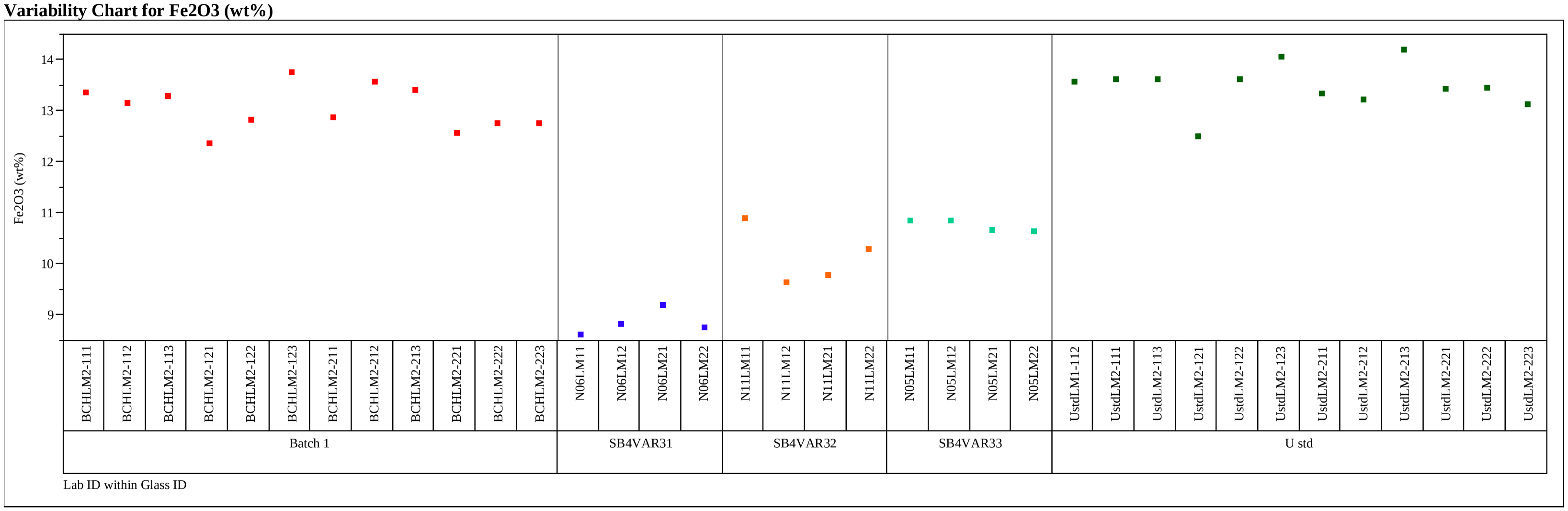
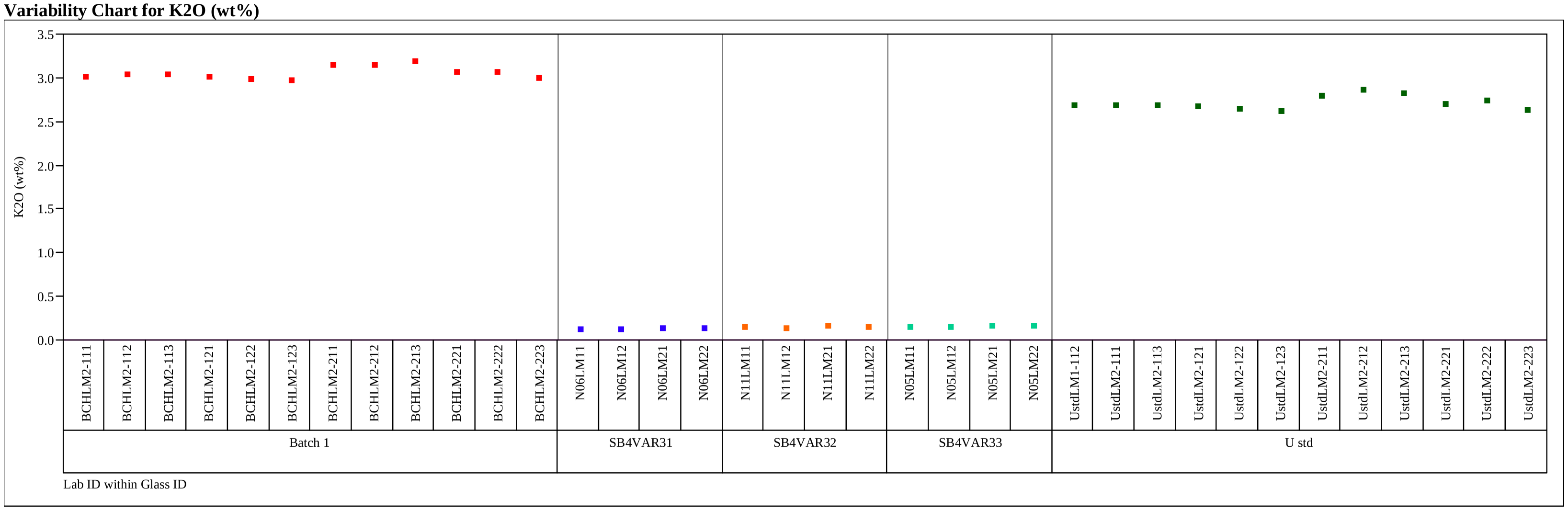


Exhibit A5. Oxide Measurements by Solution ID for Samples Prepared Using the LM Method

Set=2
Variability Chart for K2O (wt%)



Set=2
Variability Chart for La2O3 (wt%)

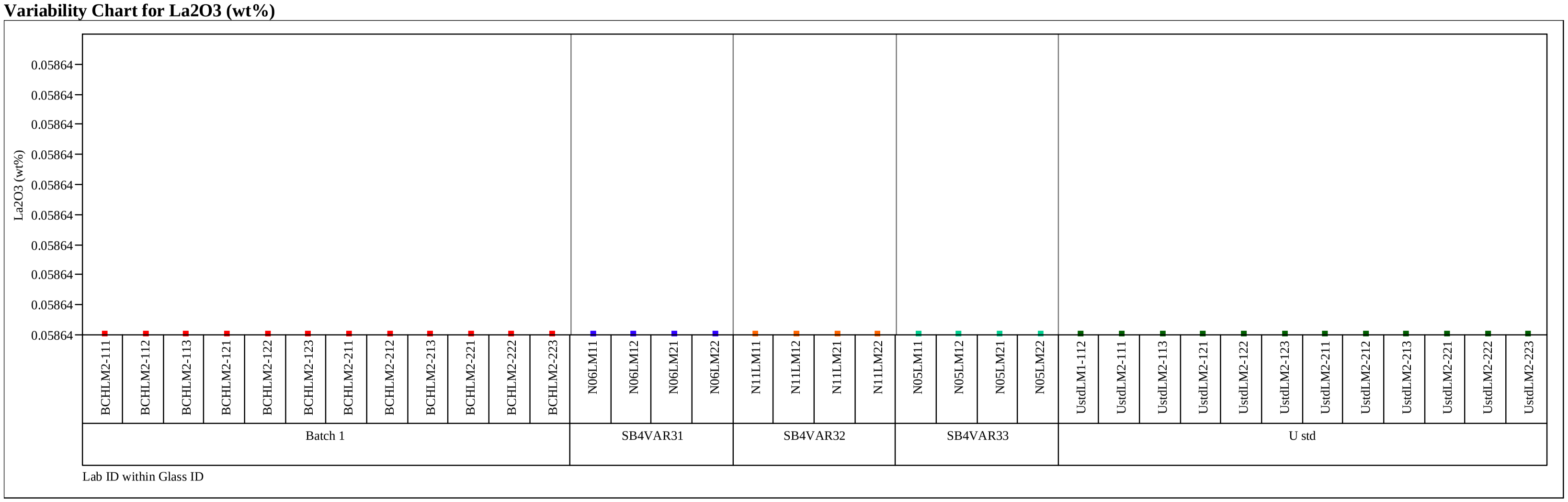
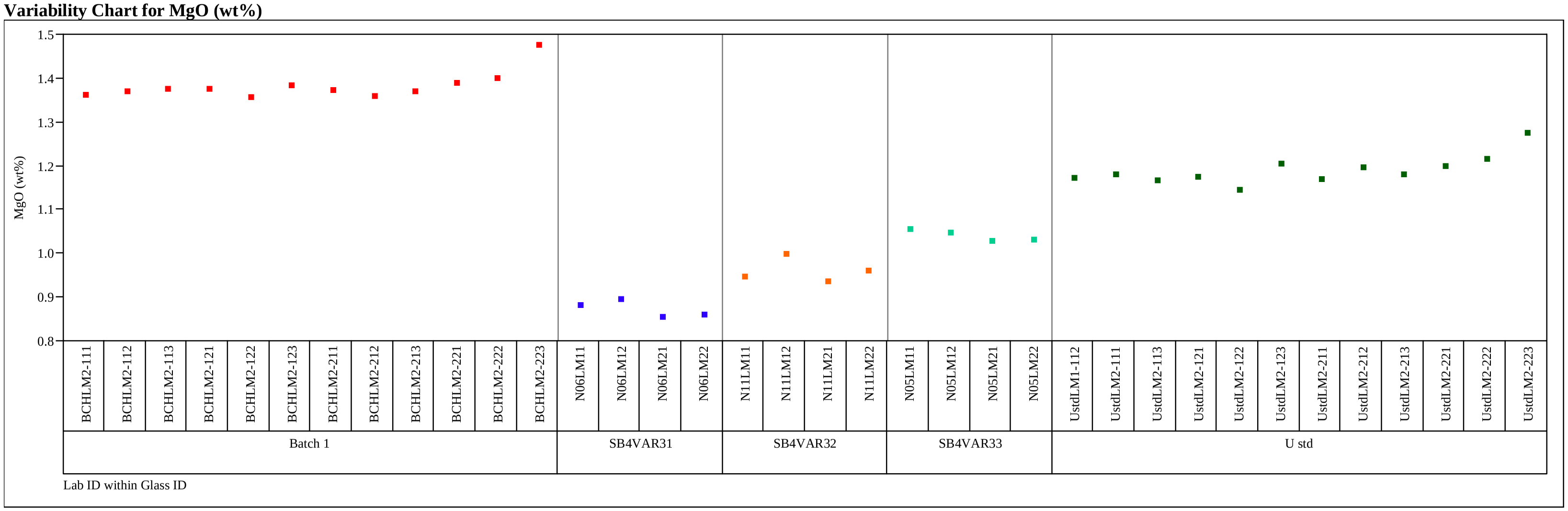


Exhibit A5. Oxide Measurements by Solution ID for Samples Prepared Using the LM Method

Set=2
Variability Chart for MgO (wt%)



Set=2
Variability Chart for MnO (wt%)

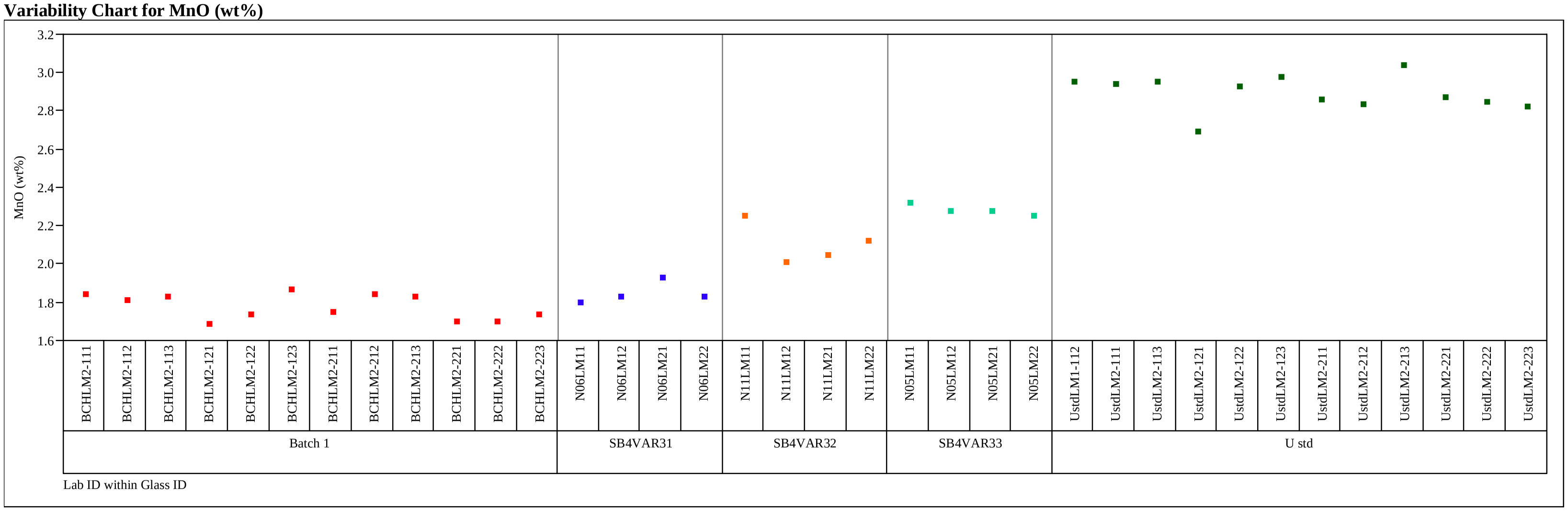
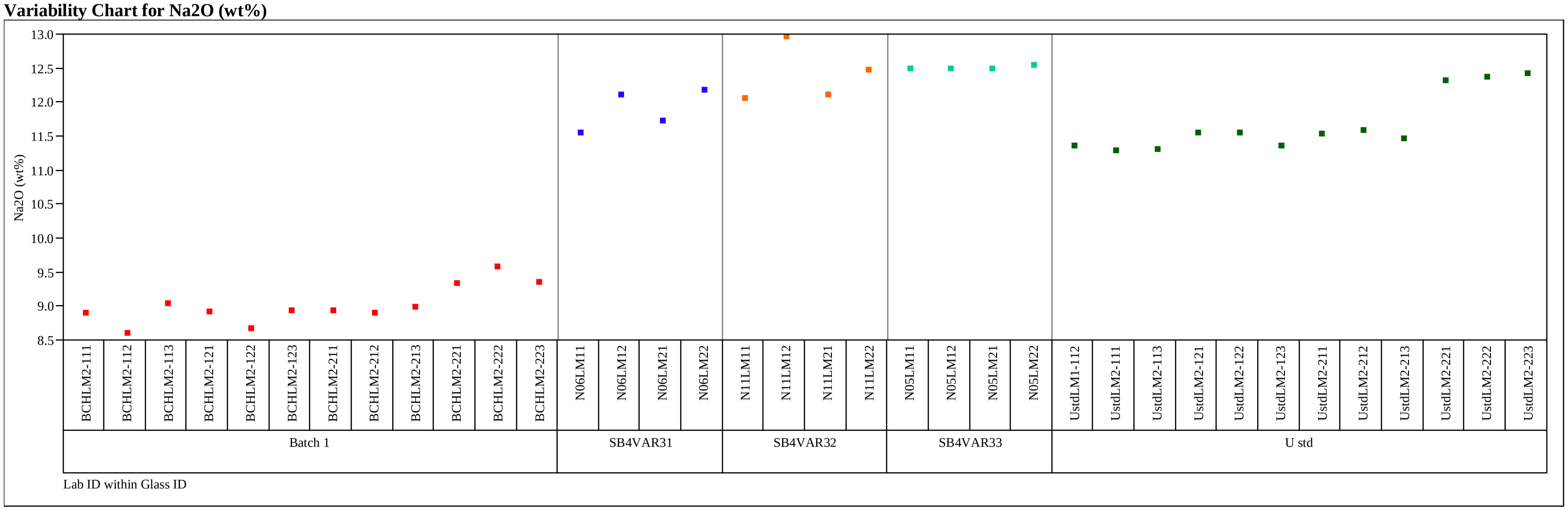


Exhibit A5. Oxide Measurements by Solution ID for Samples Prepared Using the LM Method

Set=2
Variability Chart for Na2O (wt%)



Set=2
Variability Chart for NiO (wt%)

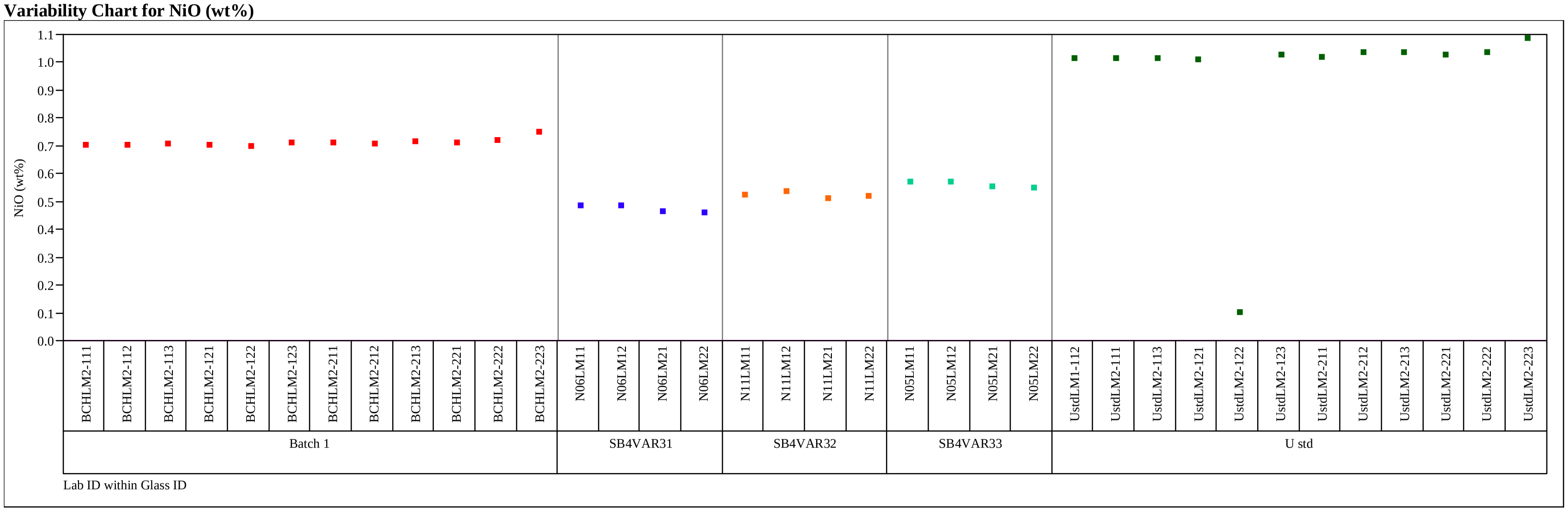
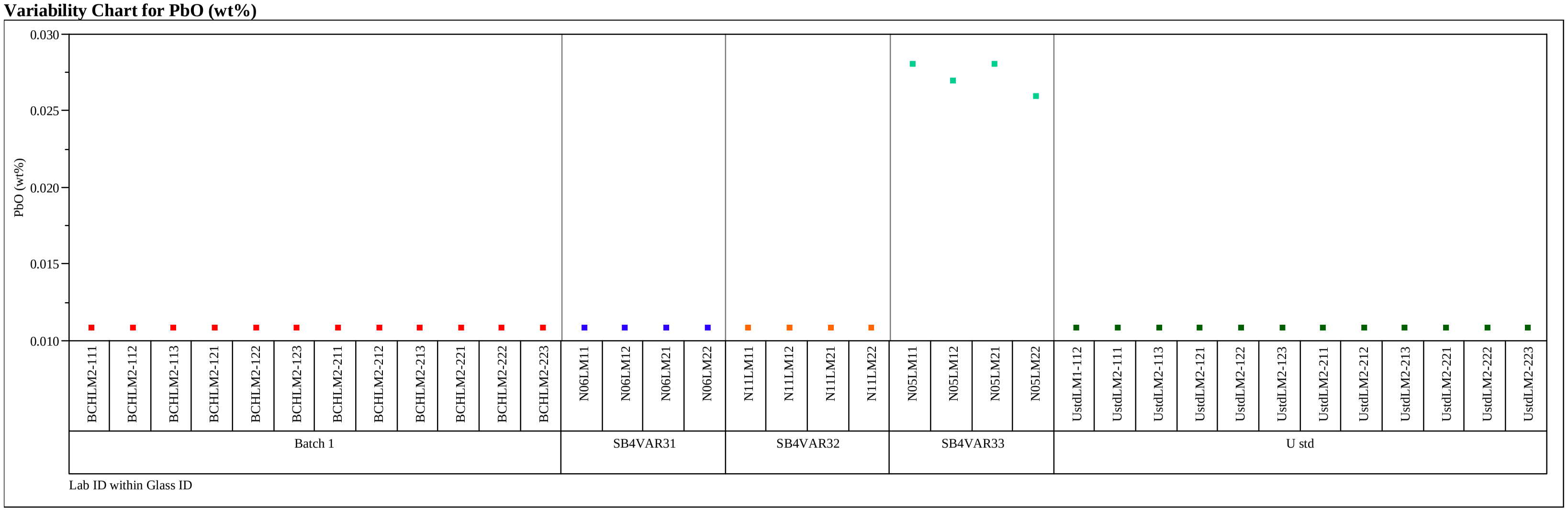


Exhibit A5. Oxide Measurements by Solution ID for Samples Prepared Using the LM Method

Set=2
Variability Chart for PbO (wt%)



Set=2
Variability Chart for SO4 (wt%)

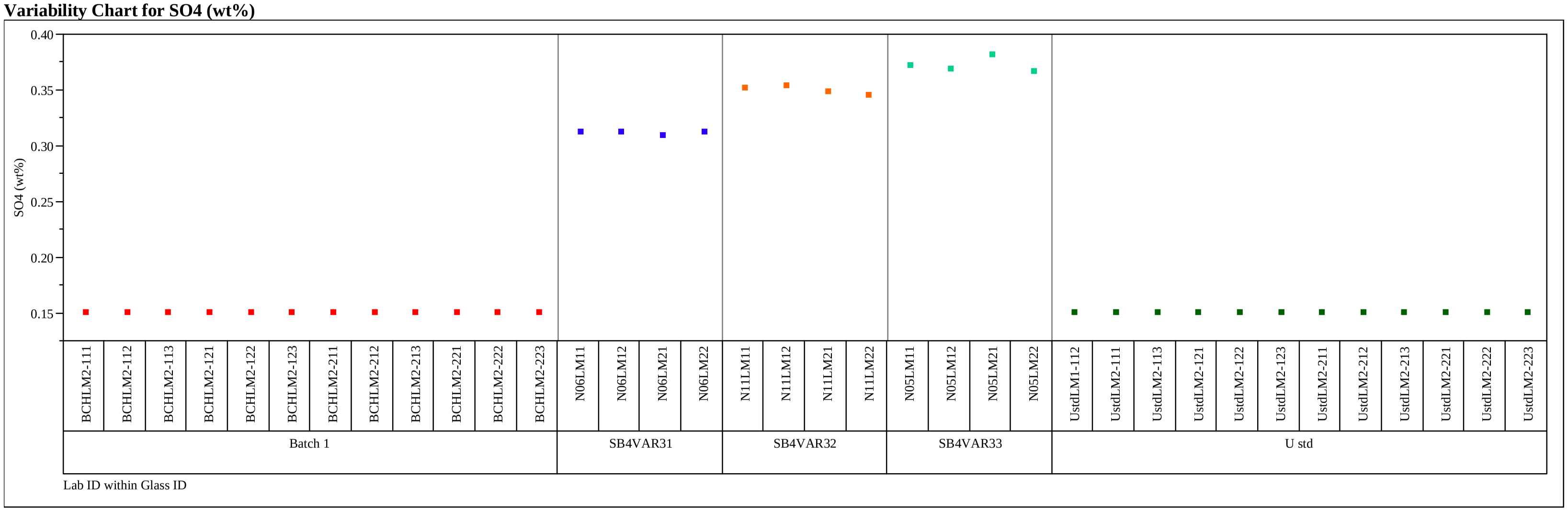
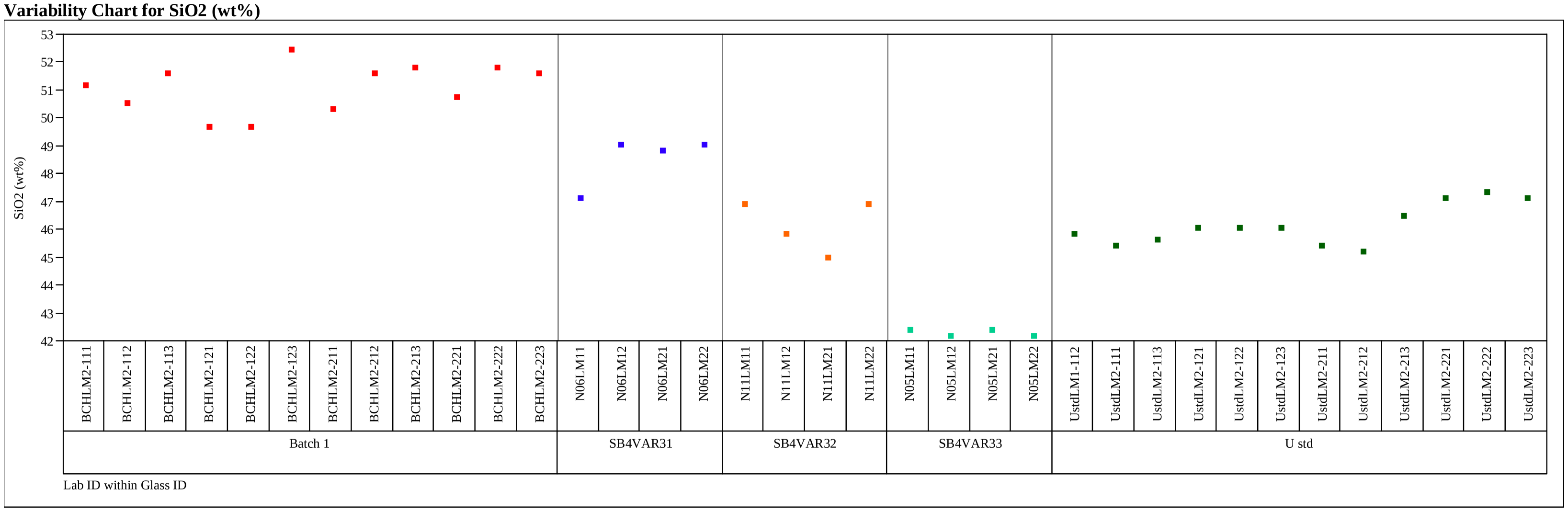


Exhibit A5. Oxide Measurements by Solution ID for Samples Prepared Using the LM Method

Set=2
Variability Chart for SiO2 (wt%)



Set=2
Variability Chart for TiO2 (wt%)

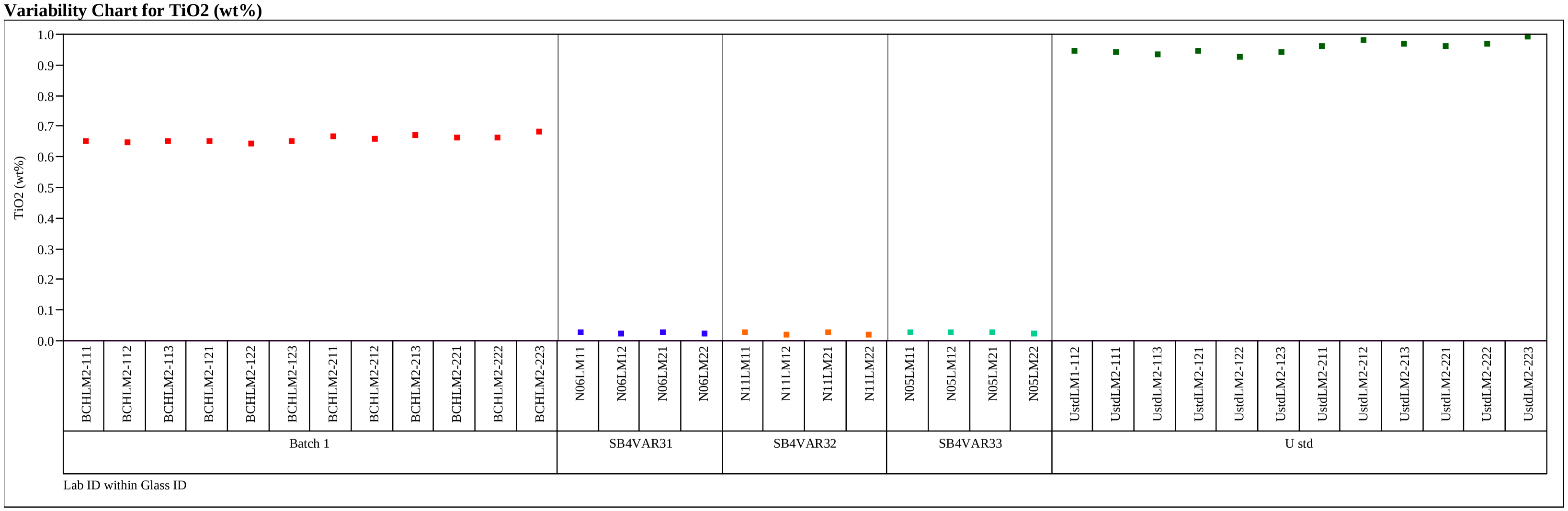
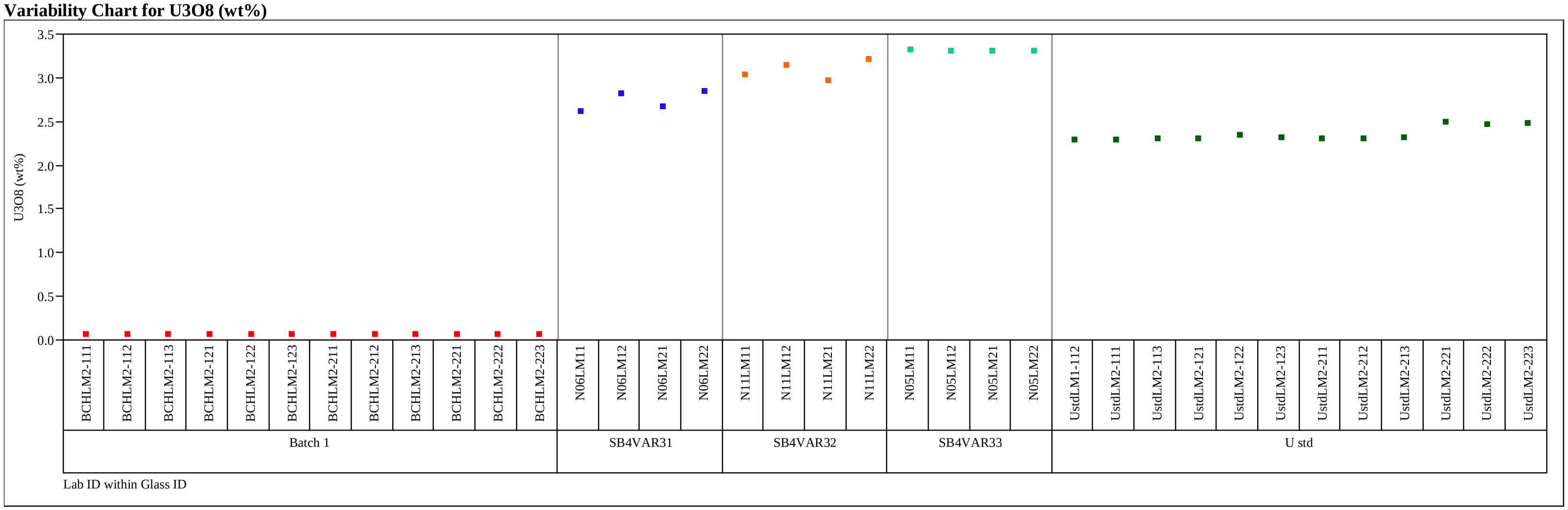


Exhibit A5. Oxide Measurements by Solution ID for Samples Prepared Using the LM Method

Set=2
Variability Chart for U3O8 (wt%)



Set=2
Variability Chart for ZnO (wt%)

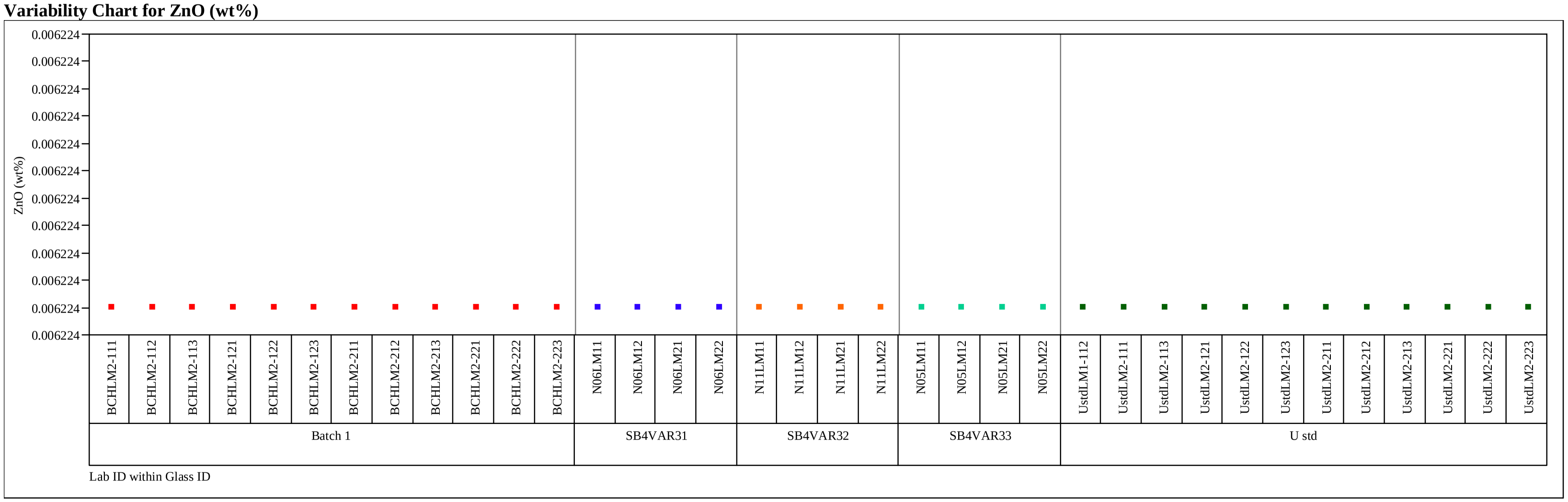
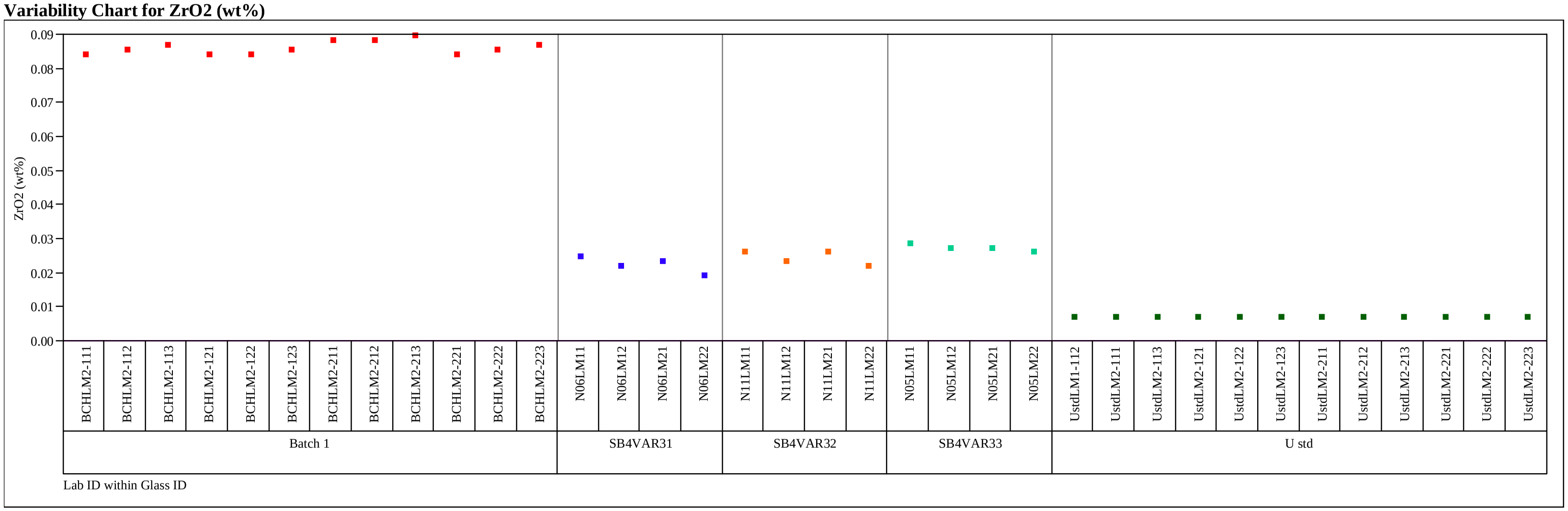


Exhibit A5. Oxide Measurements by Solution ID for Samples Prepared Using the LM Method

Set=2
Variability Chart for ZrO2 (wt%)



Set=2
Variability Chart for Al2O3 bc (wt%)

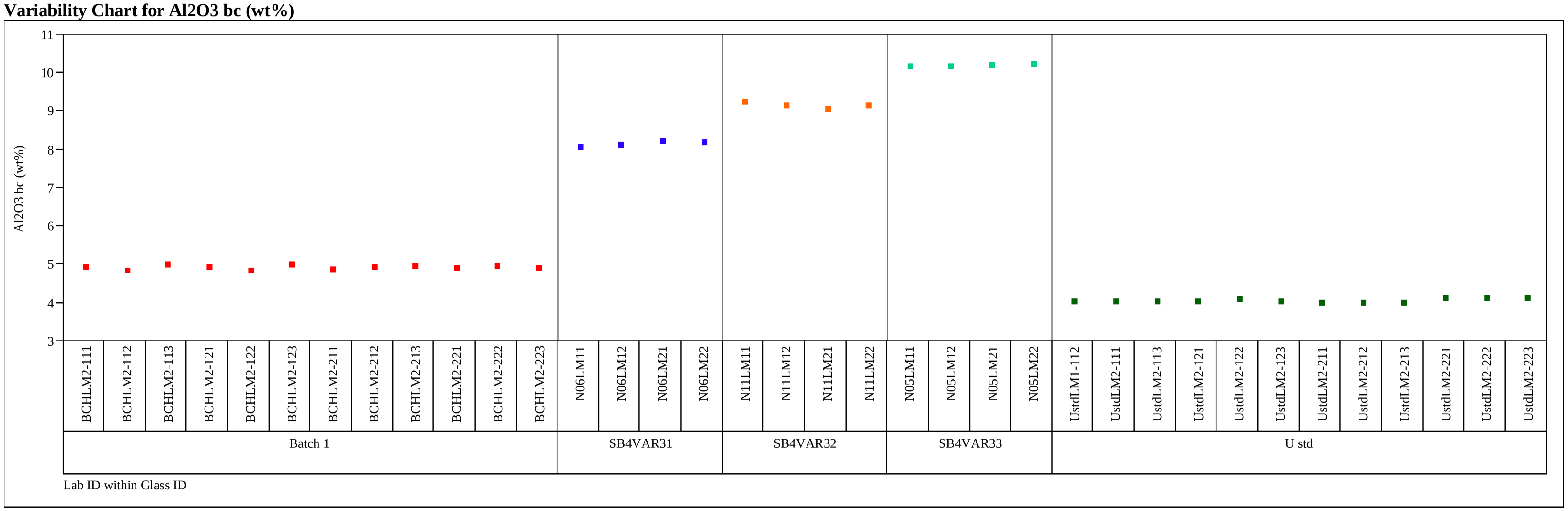
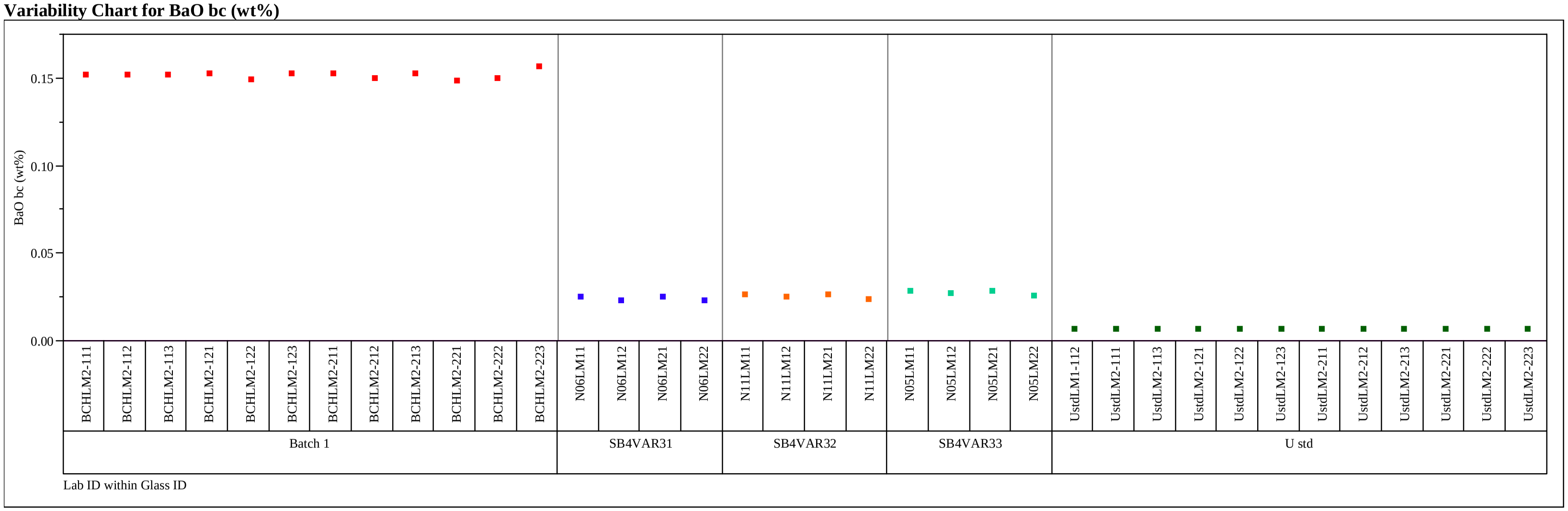


Exhibit A5. Oxide Measurements by Solution ID for Samples Prepared Using the LM Method

Set=2
Variability Chart for BaO bc (wt%)



Set=2
Variability Chart for CaO bc (wt%)

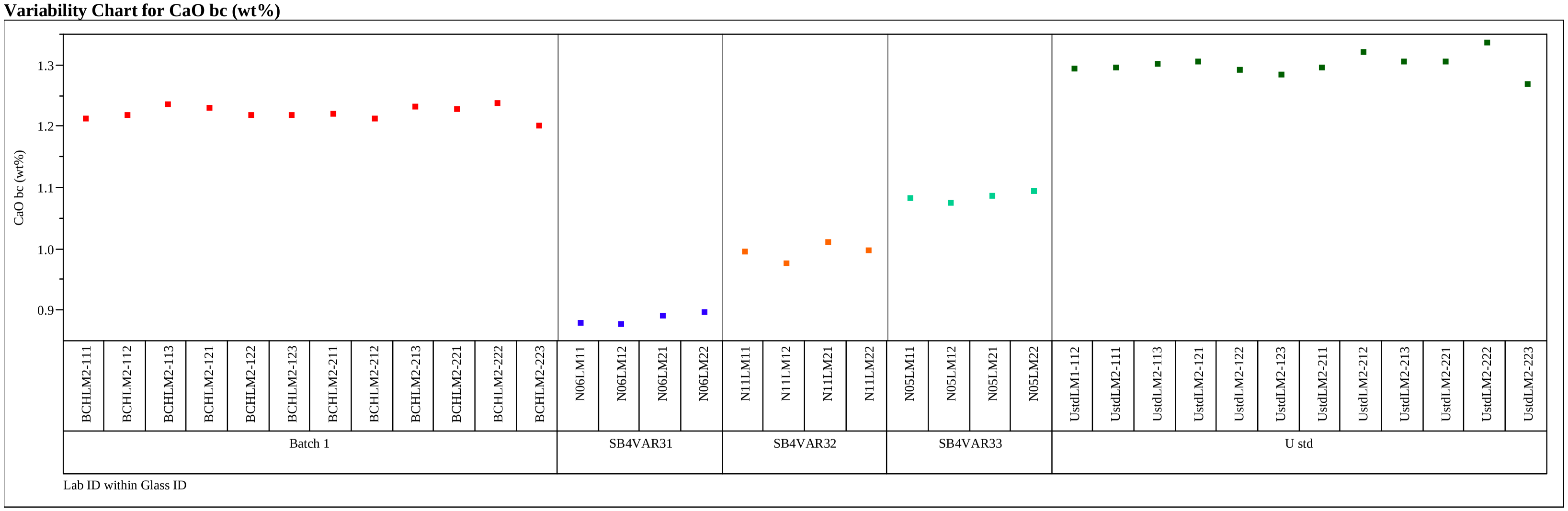
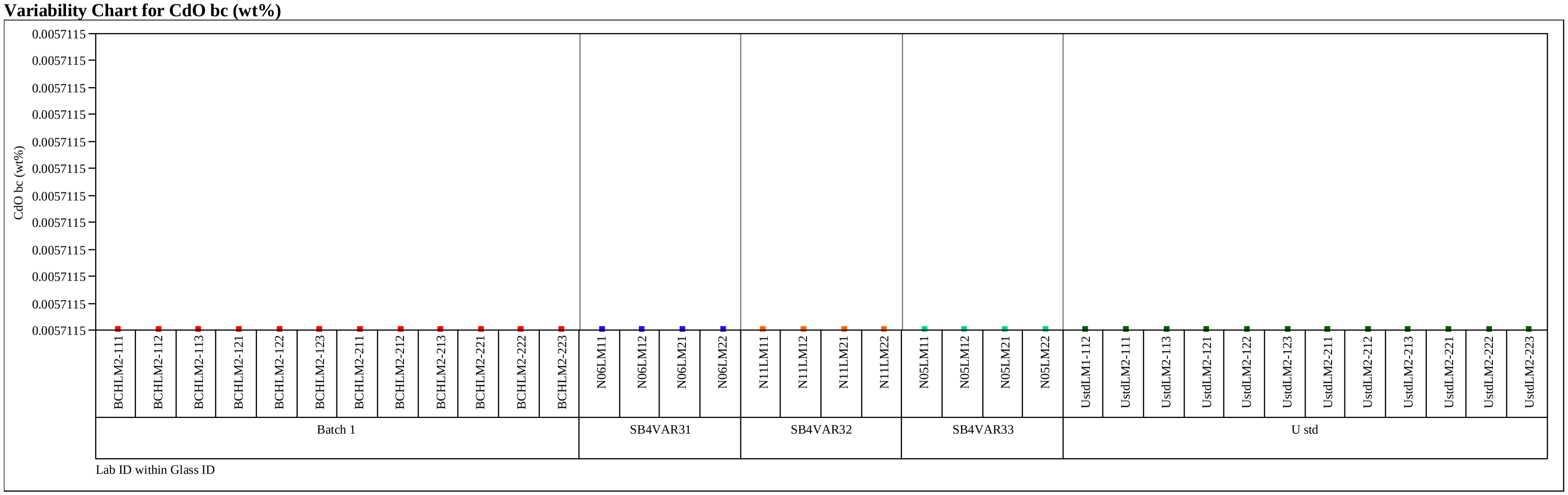


Exhibit A5. Oxide Measurements by Solution ID for Samples Prepared Using the LM Method

Set=2
Variability Chart for CdO bc (wt%)



Set=2
Variability Chart for Ce2O3 bc (wt%)

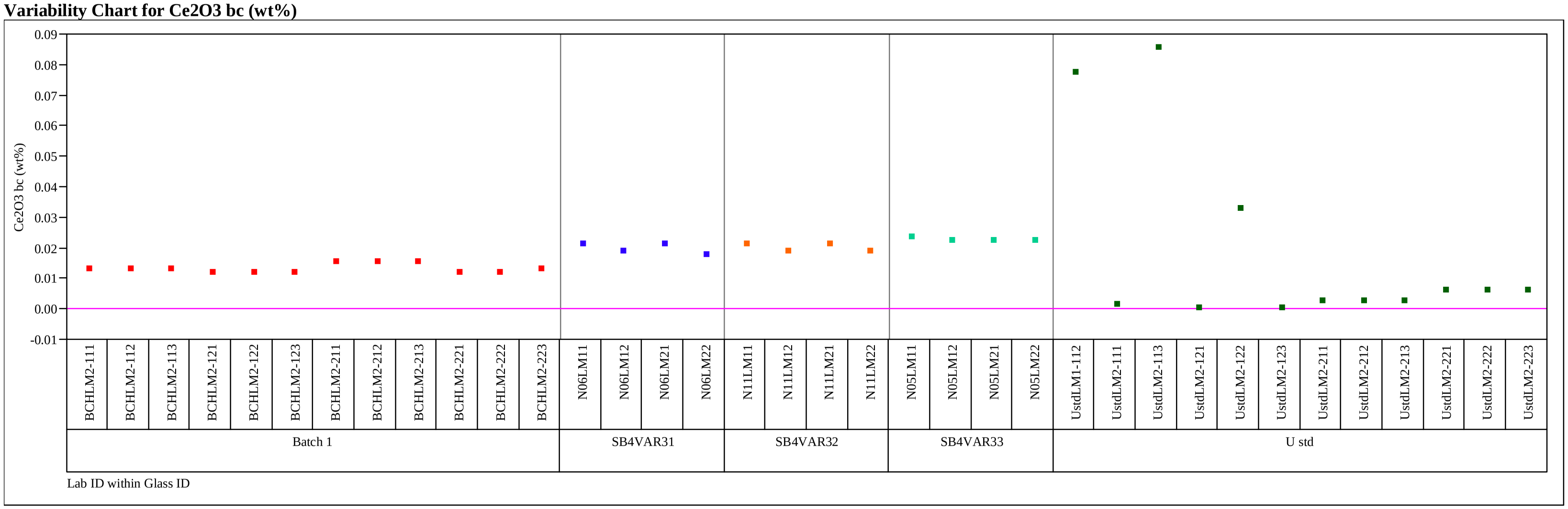
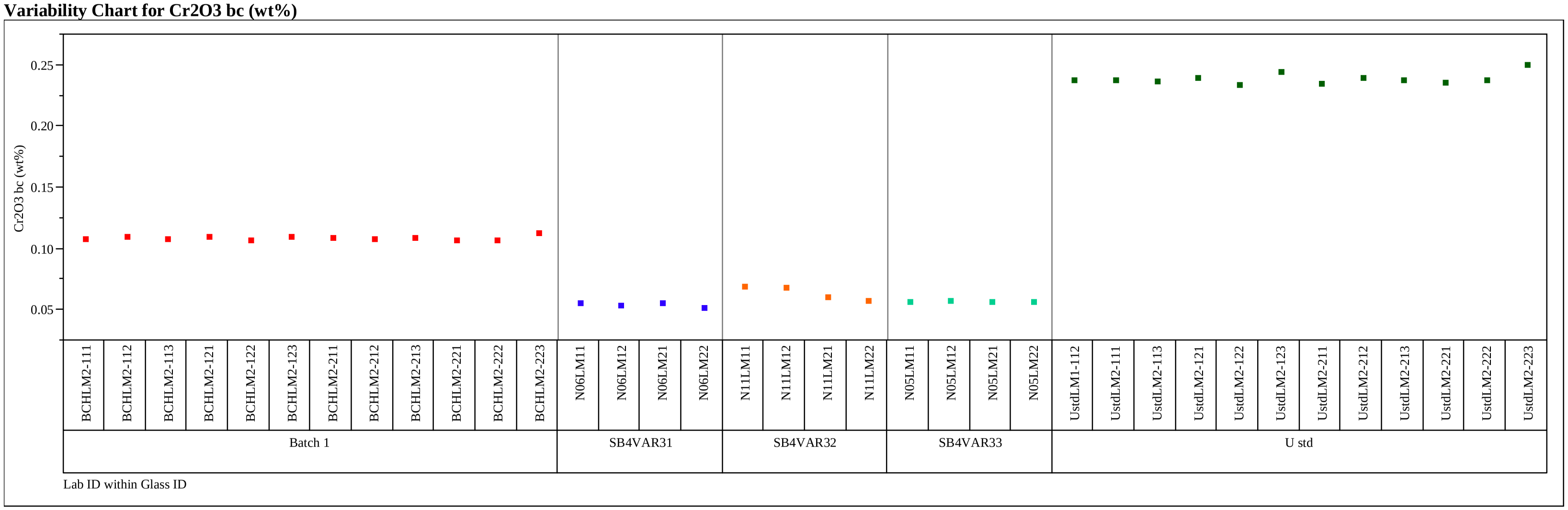


Exhibit A5. Oxide Measurements by Solution ID for Samples Prepared Using the LM Method

Set=2
Variability Chart for Cr2O3 bc (wt%)



Set=2
Variability Chart for CuO bc (wt%)

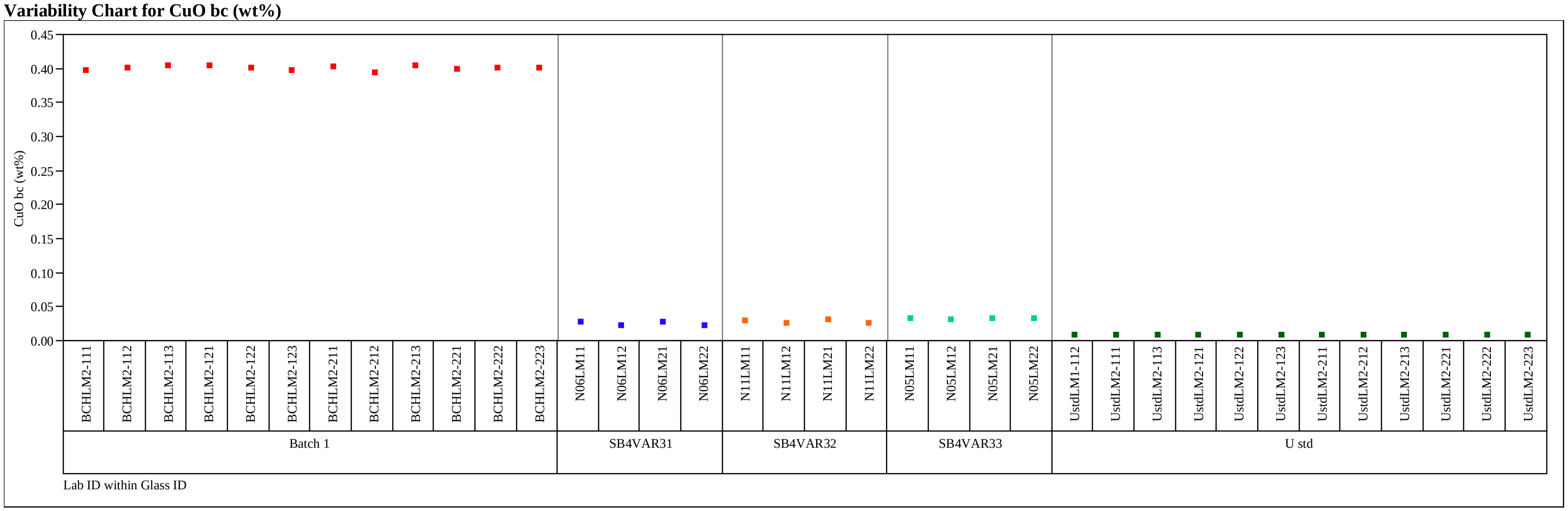
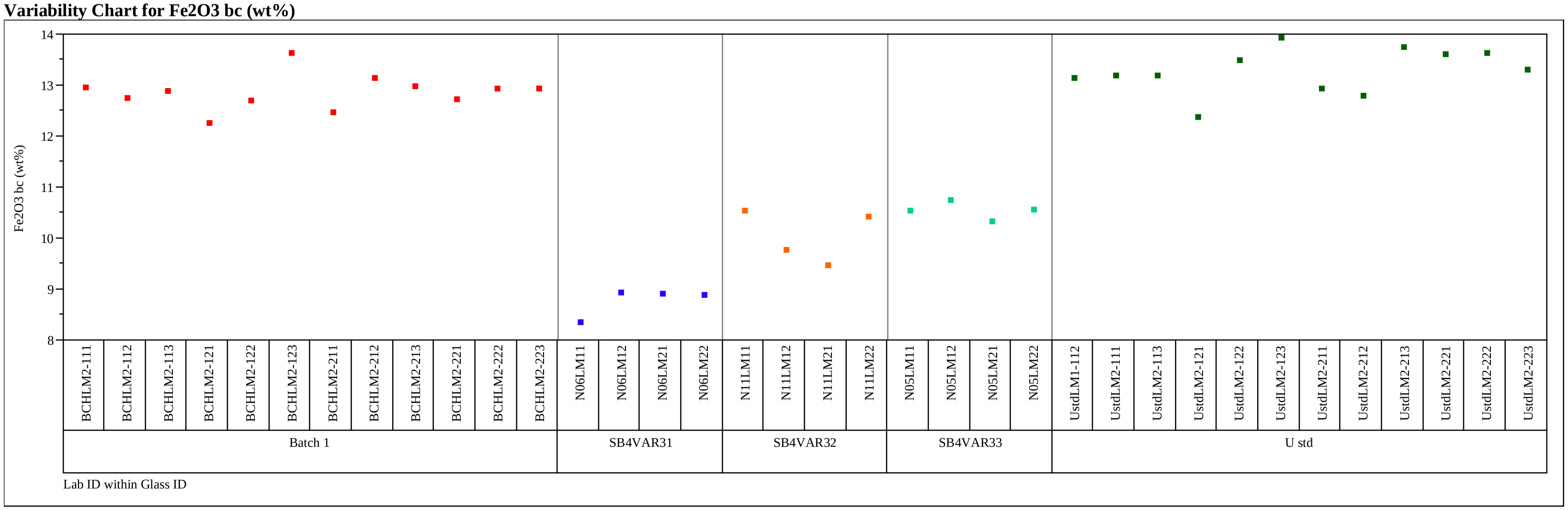


Exhibit A5. Oxide Measurements by Solution ID for Samples Prepared Using the LM Method

Set=2
Variability Chart for Fe2O3 bc (wt%)



Set=2
Variability Chart for K2O bc (wt%)

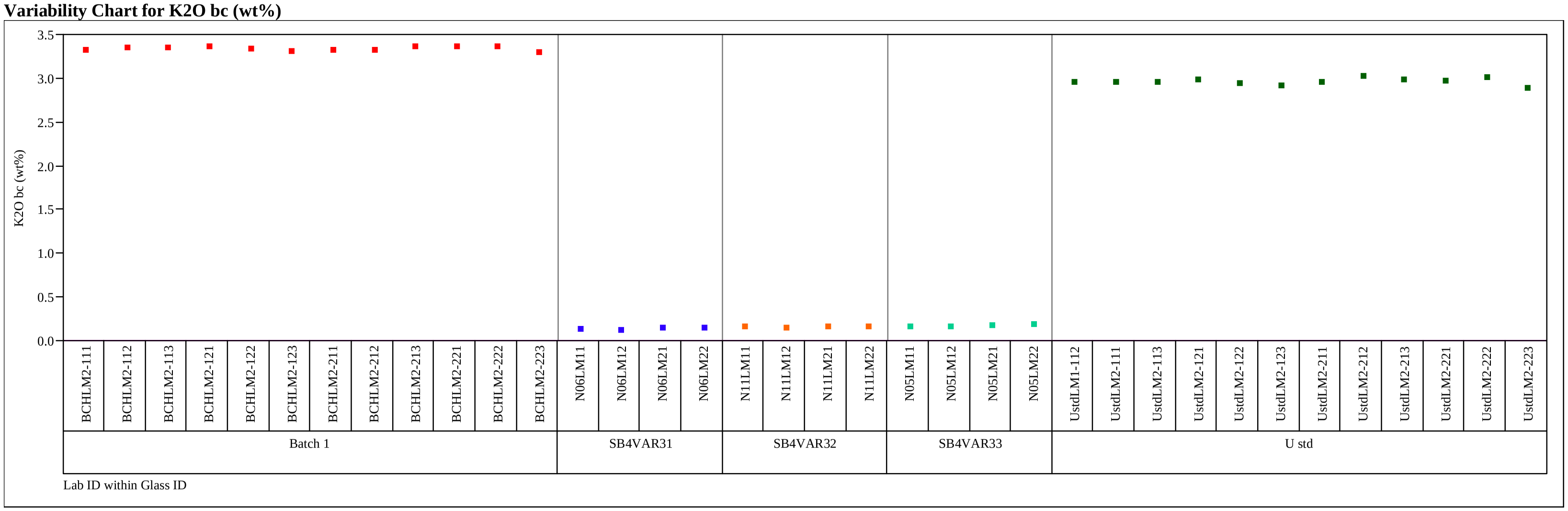
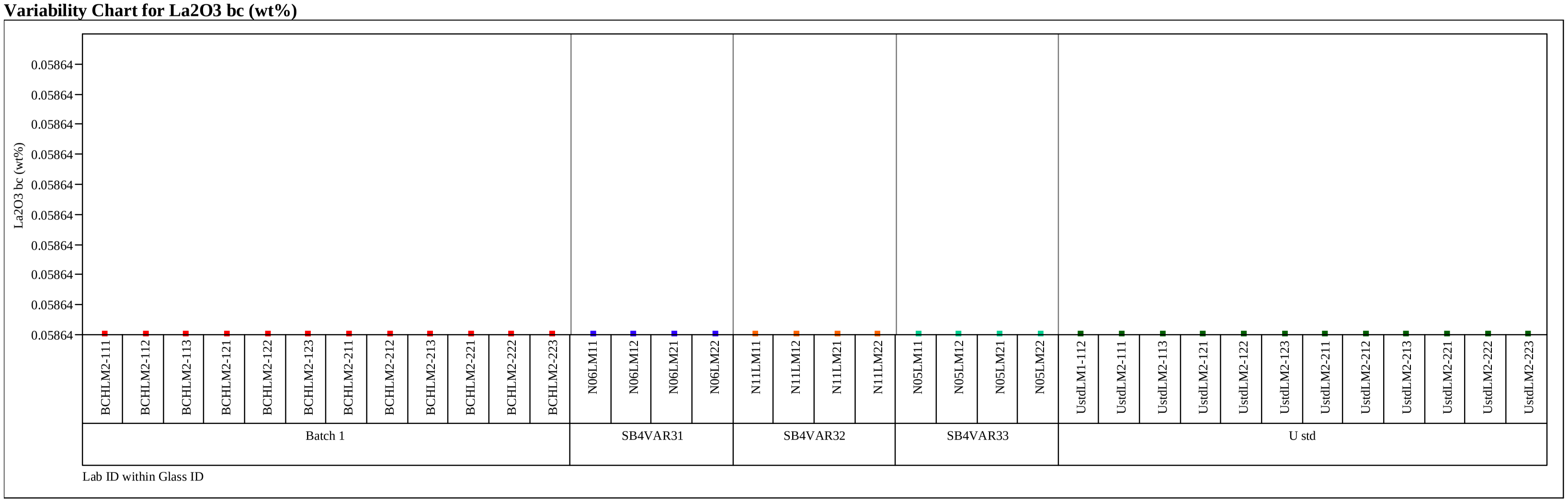


Exhibit A5. Oxide Measurements by Solution ID for Samples Prepared Using the LM Method

Set=2
Variability Chart for La2O3 bc (wt%)



Set=2
Variability Chart for MgO bc (wt%)

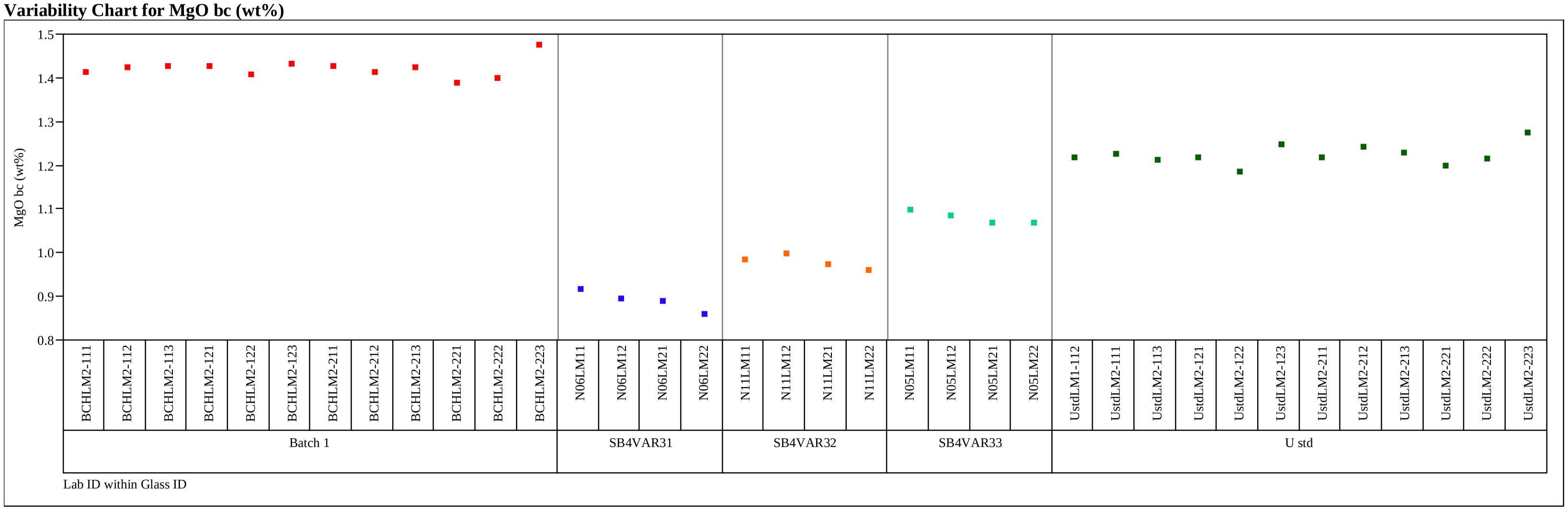
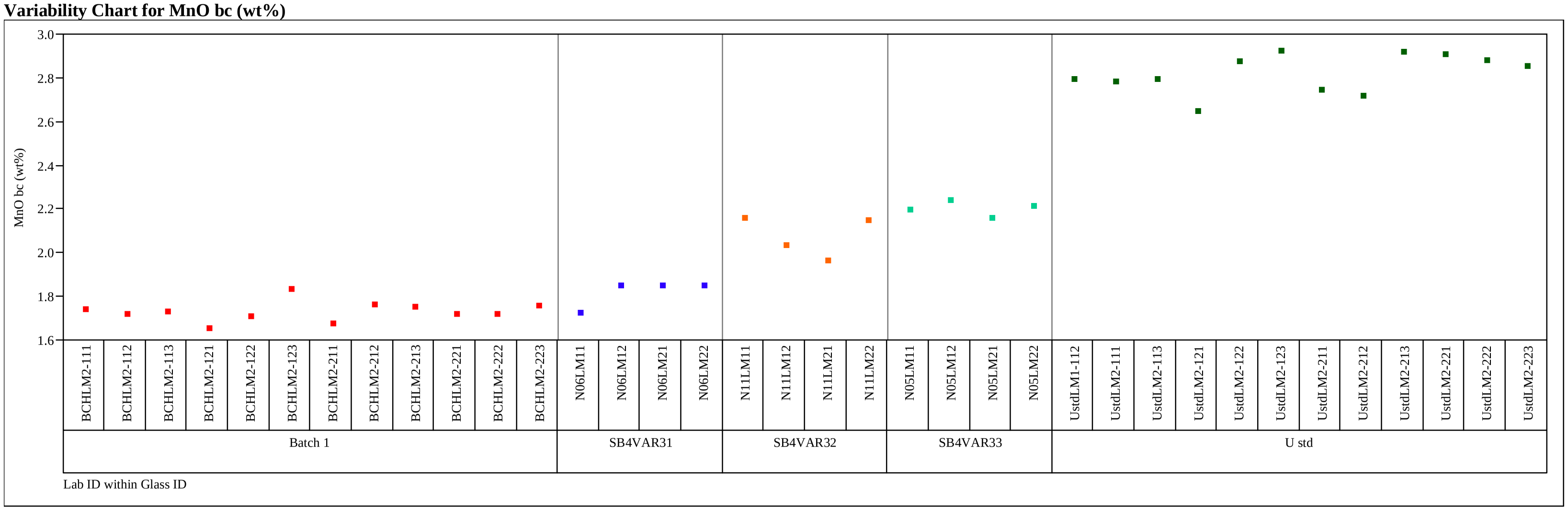


Exhibit A5. Oxide Measurements by Solution ID for Samples Prepared Using the LM Method

Set=2
Variability Chart for MnO bc (wt%)



Set=2
Variability Chart for Na2O bc (wt%)

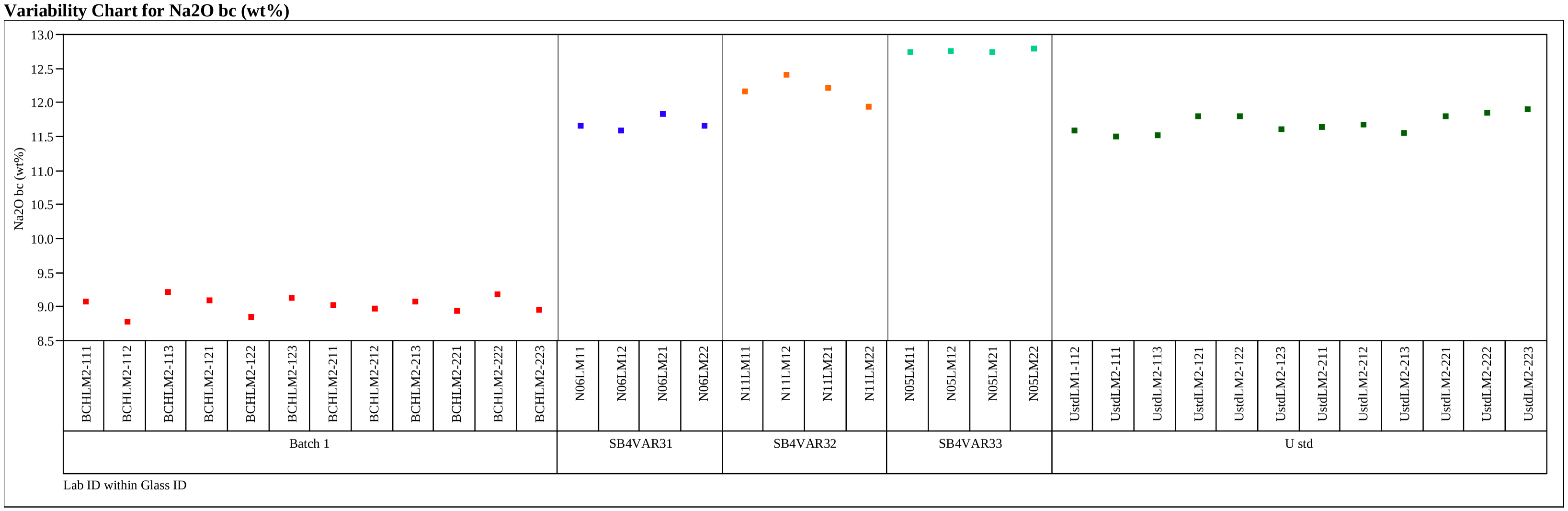
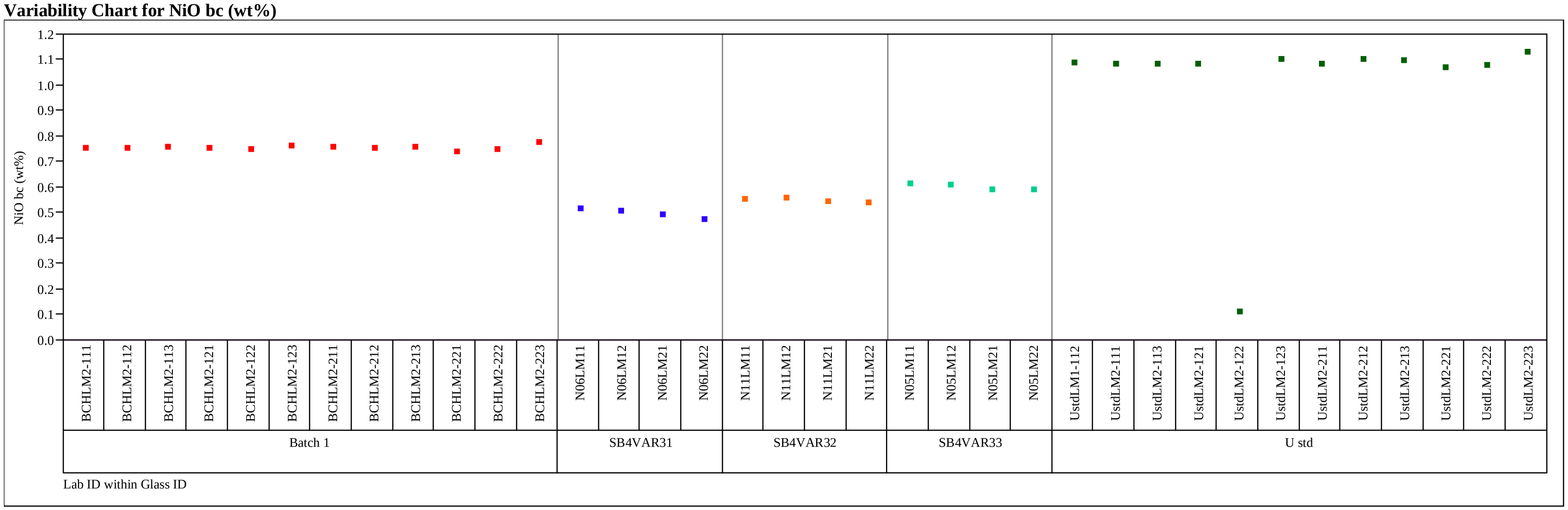


Exhibit A5. Oxide Measurements by Solution ID for Samples Prepared Using the LM Method

Set=2
Variability Chart for NiO bc (wt%)



Set=2
Variability Chart for PbO bc (wt%)

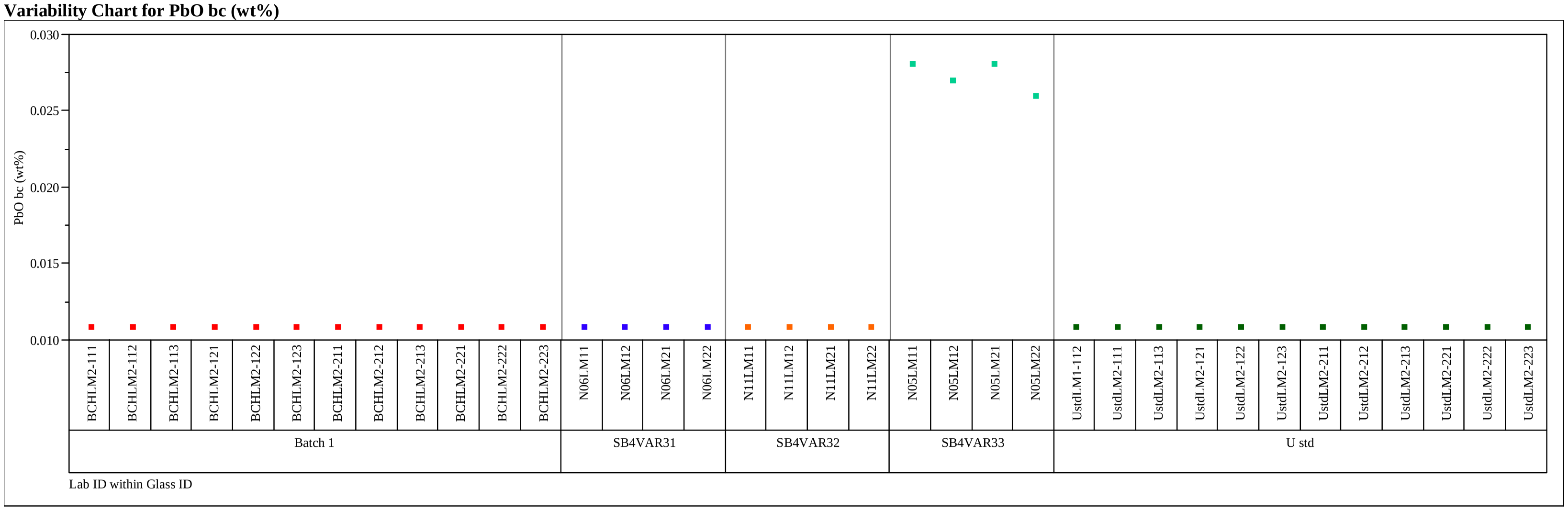
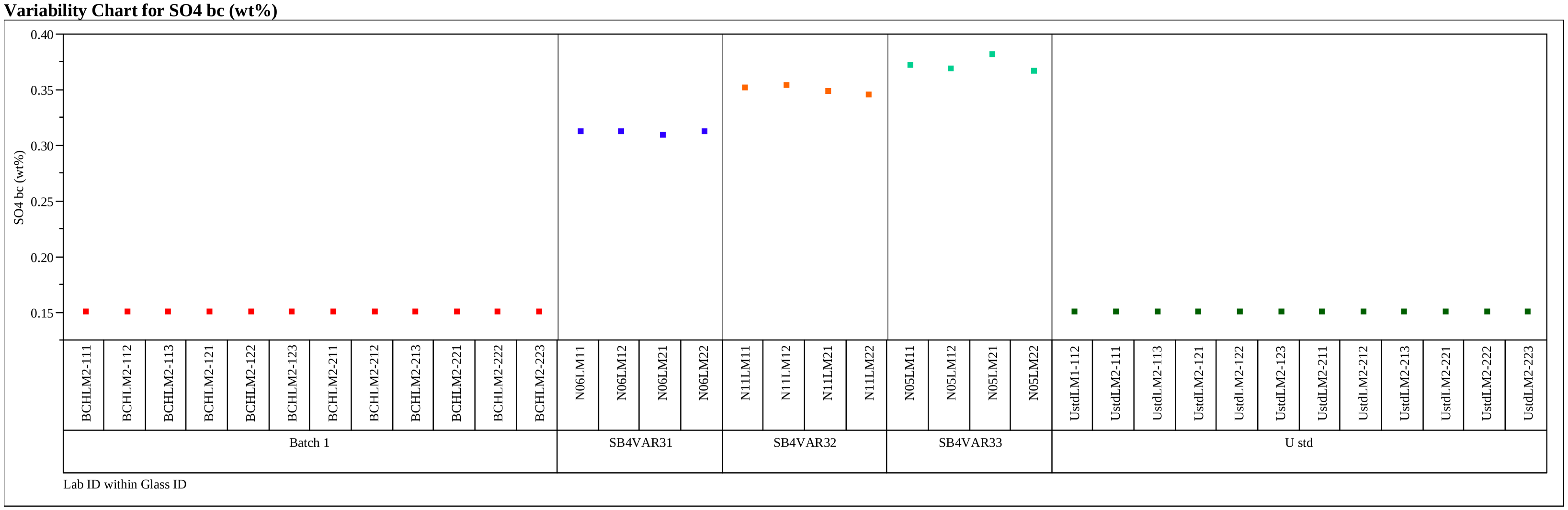


Exhibit A5. Oxide Measurements by Solution ID for Samples Prepared Using the LM Method

Set=2
Variability Chart for SO4 bc (wt%)



Set=2
Variability Chart for SiO2 bc (wt%)

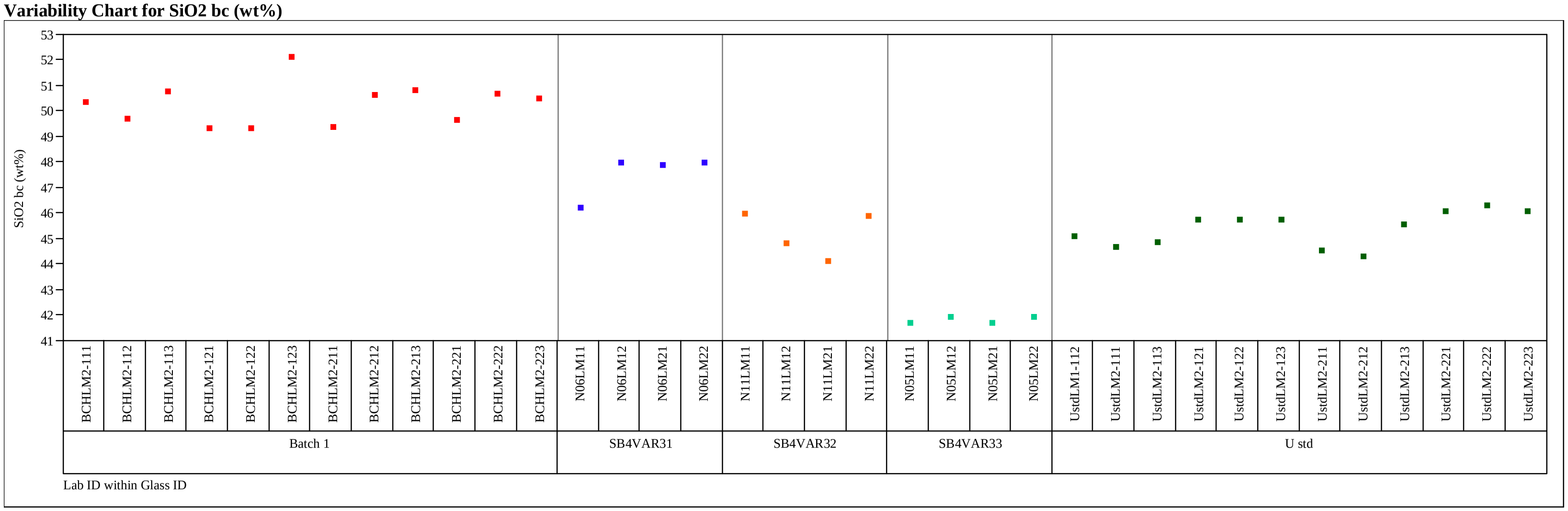
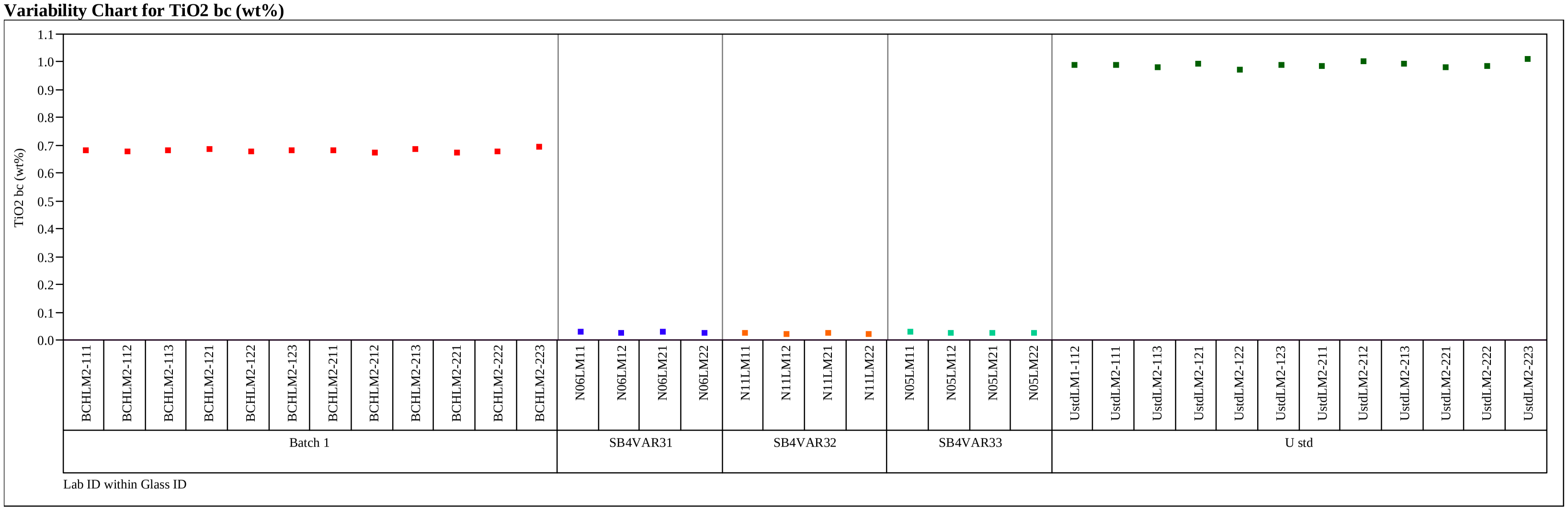


Exhibit A5. Oxide Measurements by Solution ID for Samples Prepared Using the LM Method

Set=2
Variability Chart for TiO2 bc (wt%)



Set=2
Variability Chart for U3O8 bc (wt%)

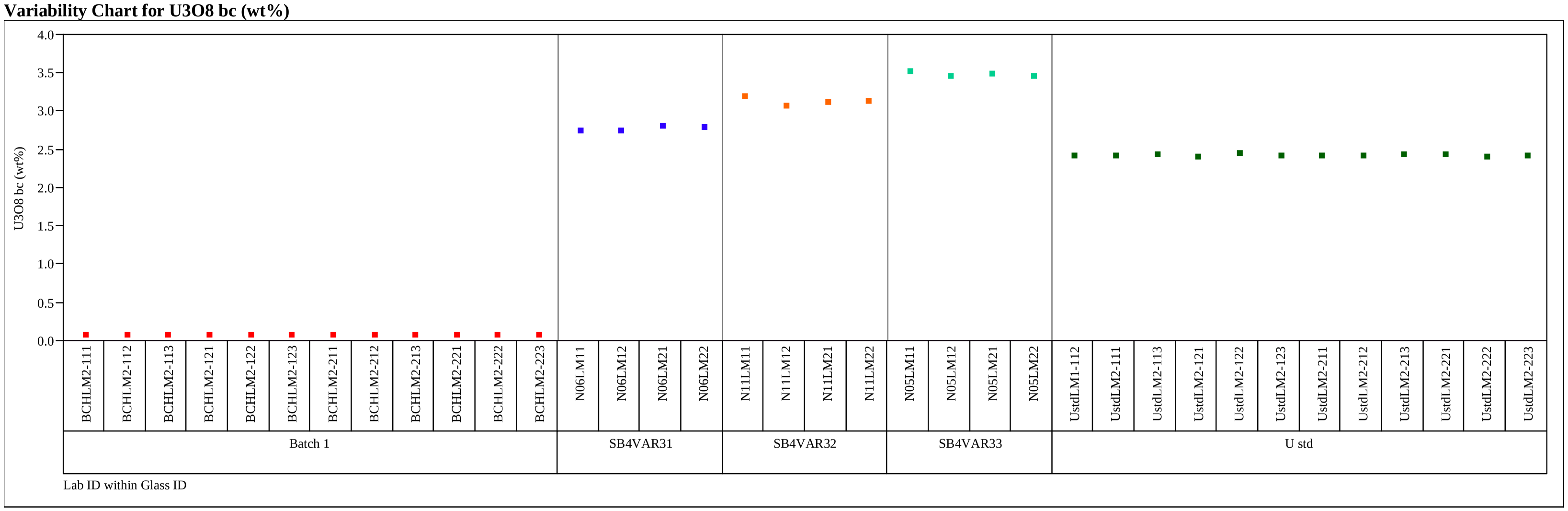
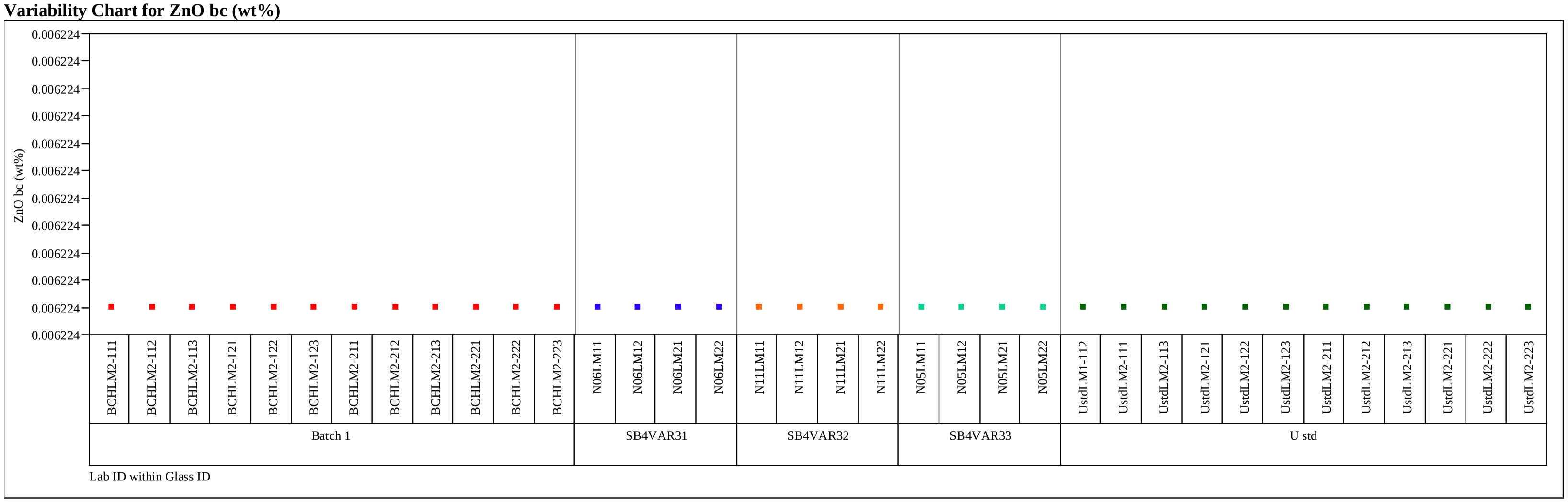


Exhibit A5. Oxide Measurements by Solution ID for Samples Prepared Using the LM Method

Set=2
Variability Chart for ZnO bc (wt%)



Set=2
Variability Chart for ZrO2 bc (wt%)

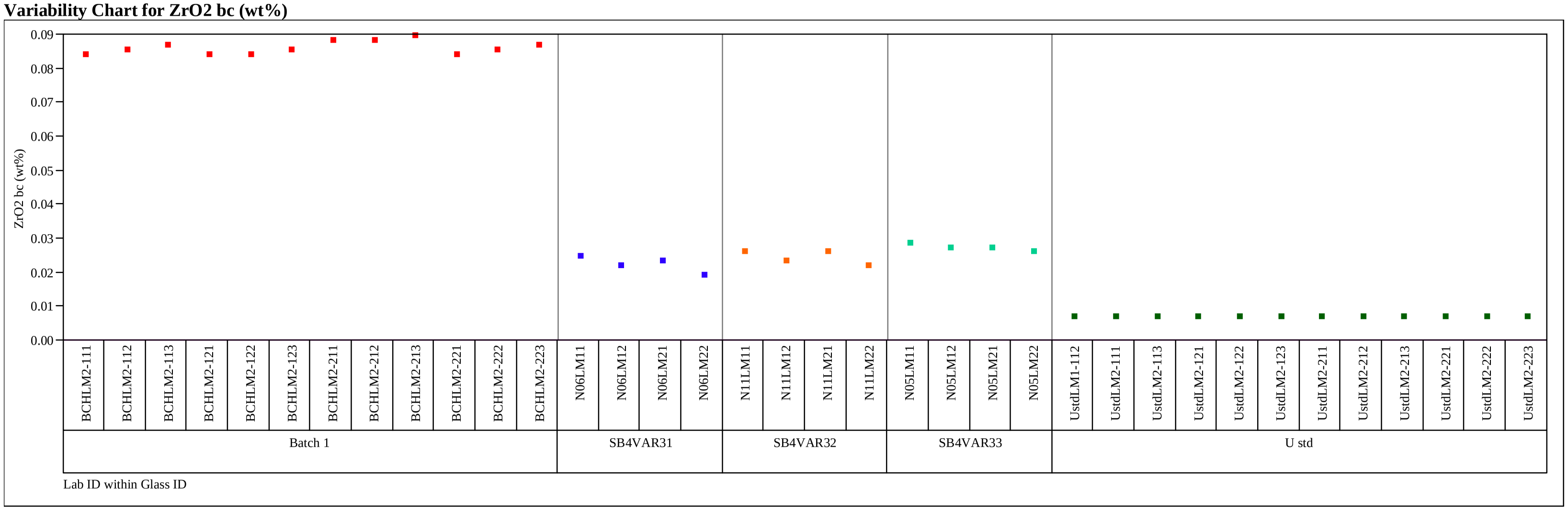
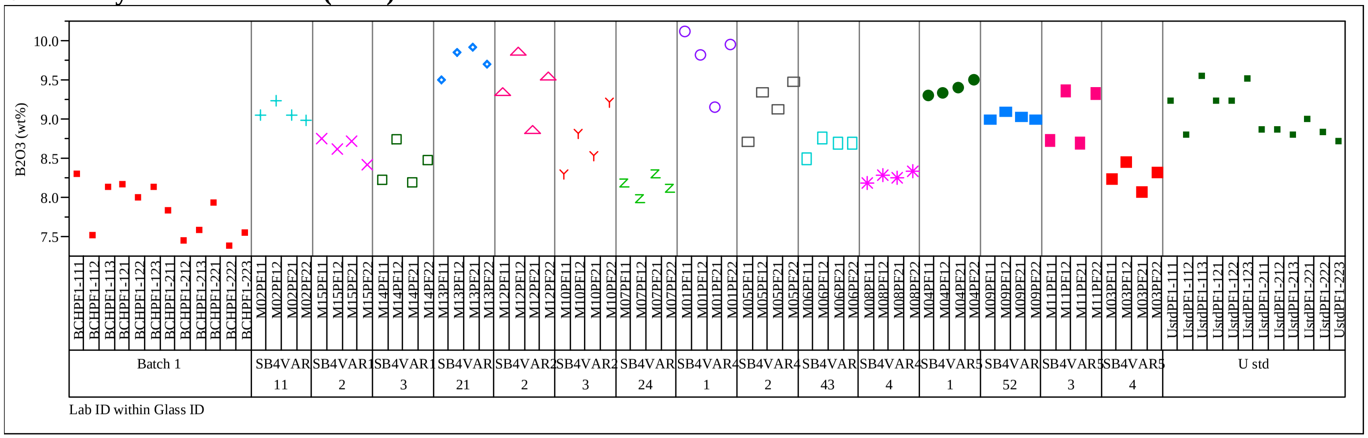


Exhibit A6. Average Oxide Measurements by Solution ID for Samples Prepared Using the PF Method

Set=1
Variability Chart for B2O3 (wt%)



Set=1
Variability Chart for Li2O (wt%)

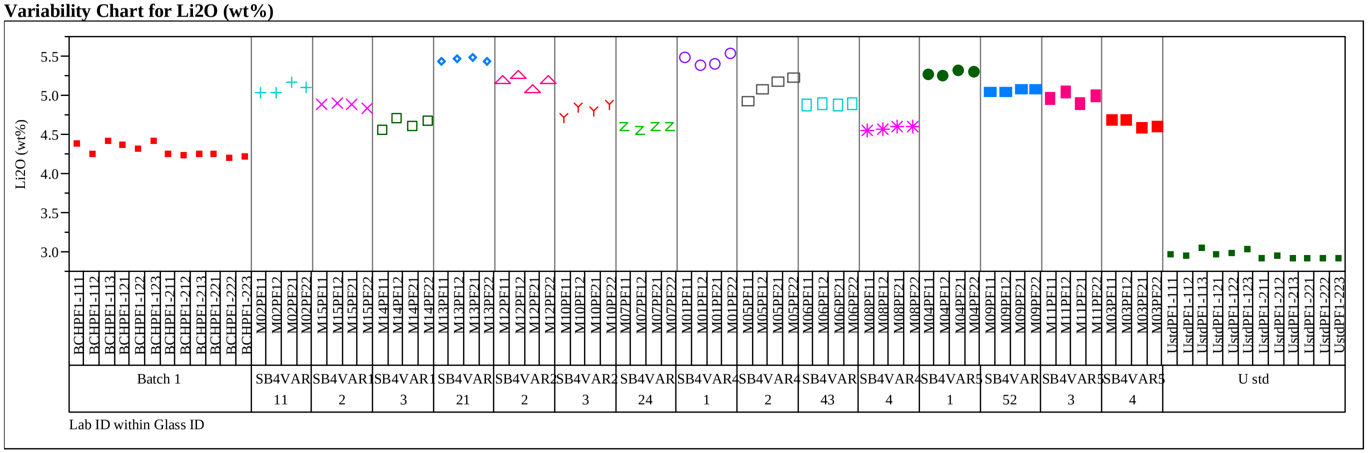
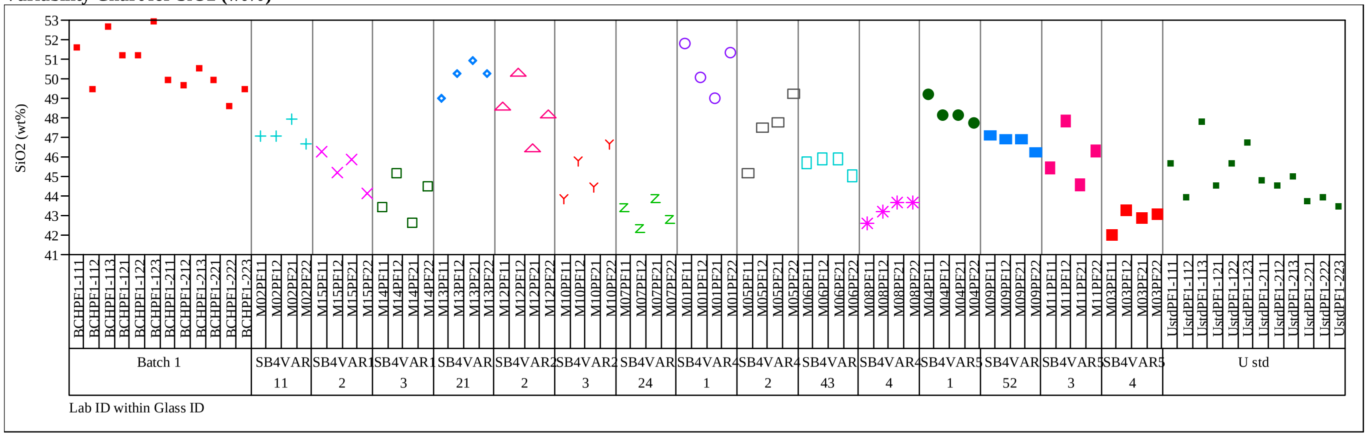


Exhibit A6. Average Oxide Measurements by Solution ID for Samples Prepared Using the PF Method

Set=1
Variability Chart for SiO2 (wt%)



Set=1
Variability Chart for B2O3 bc (wt%)

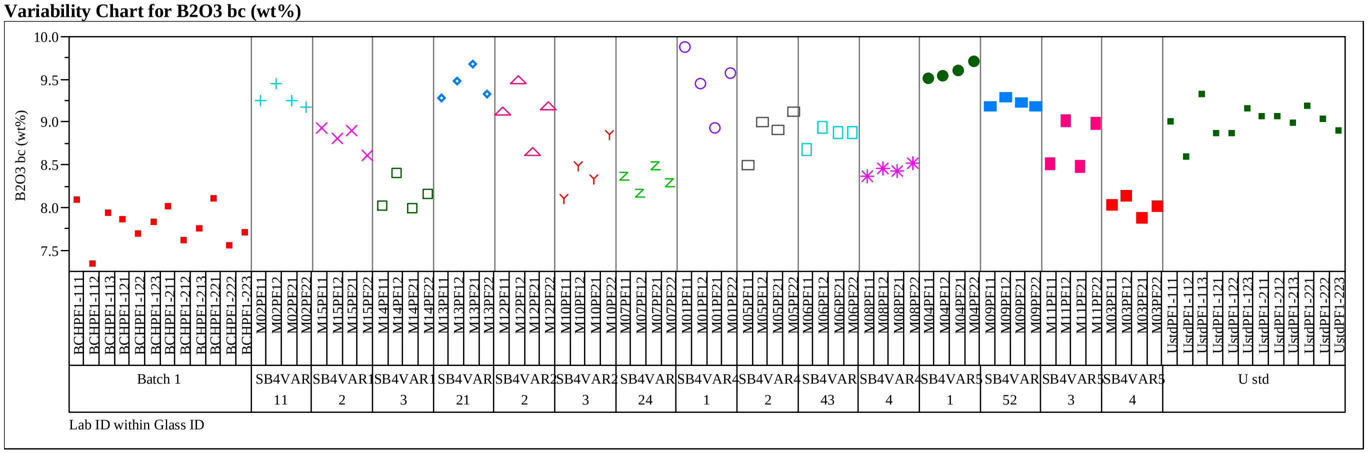
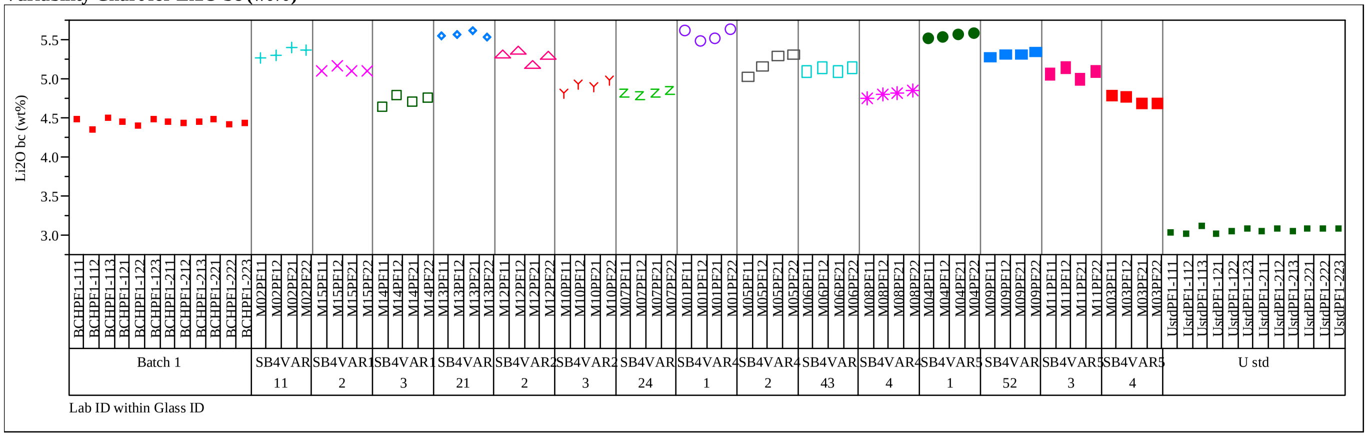


Exhibit A6. Average Oxide Measurements by Solution ID for Samples Prepared Using the PF Method

Set=1
Variability Chart for Li2O bc (wt%)



Set=1
Variability Chart for SiO2 bc (wt%)

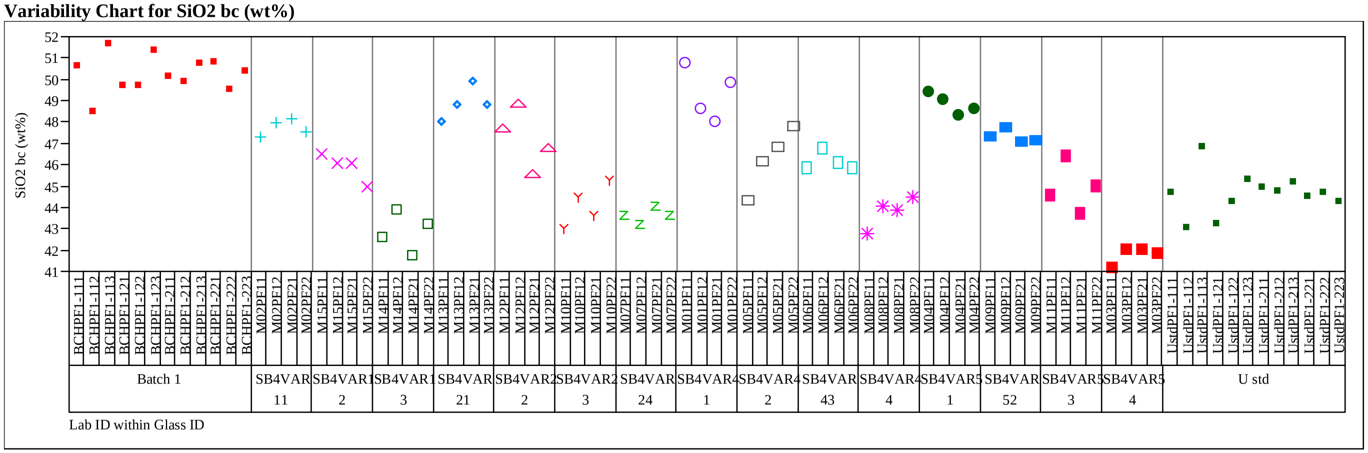
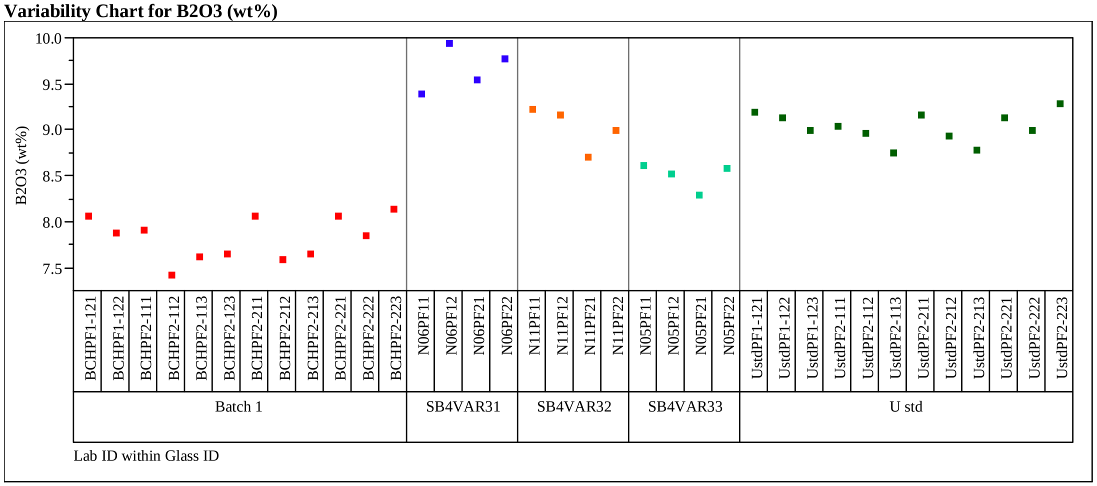


Exhibit A6. Average Oxide Measurements by Solution ID for Samples Prepared Using the PF Method

Set=2
Variability Chart for B2O3 (wt%)



Set=2
Variability Chart for Li2O (wt%)

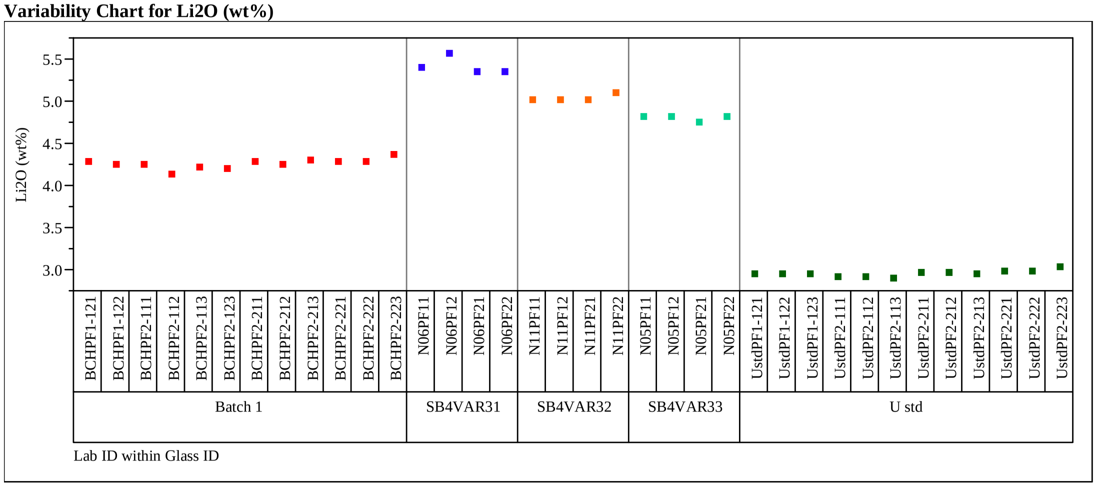
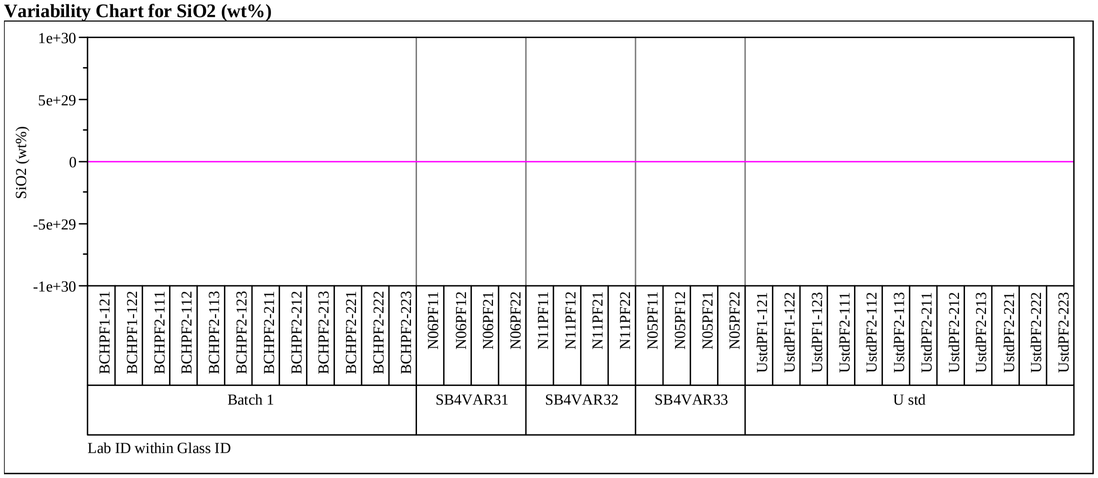


Exhibit A6. Average Oxide Measurements by Solution ID for Samples Prepared Using the PF Method

Set=2
Variability Chart for SiO2 (wt%)



Set=2
Variability Chart for B2O3 bc (wt%)

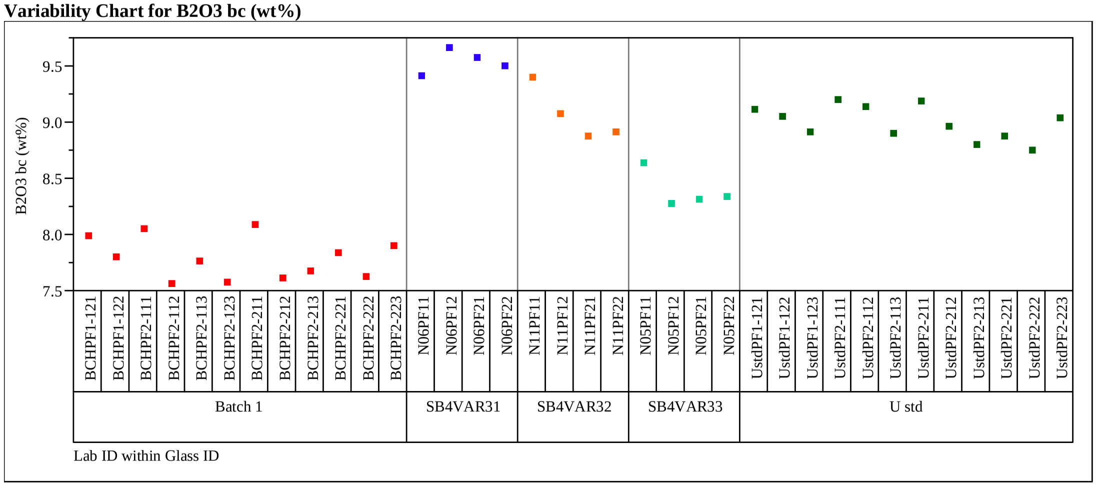
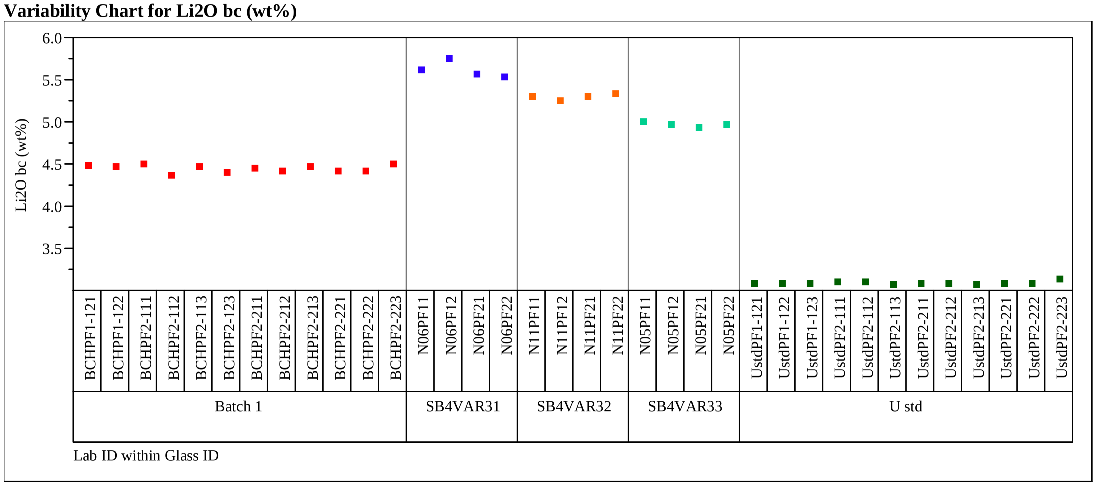


Exhibit A6. Average Oxide Measurements by Solution ID for Samples Prepared Using the PF Method

Set=2
Variability Chart for Li2O bc (wt%)



Set=2
Variability Chart for SiO2 bc (wt%)

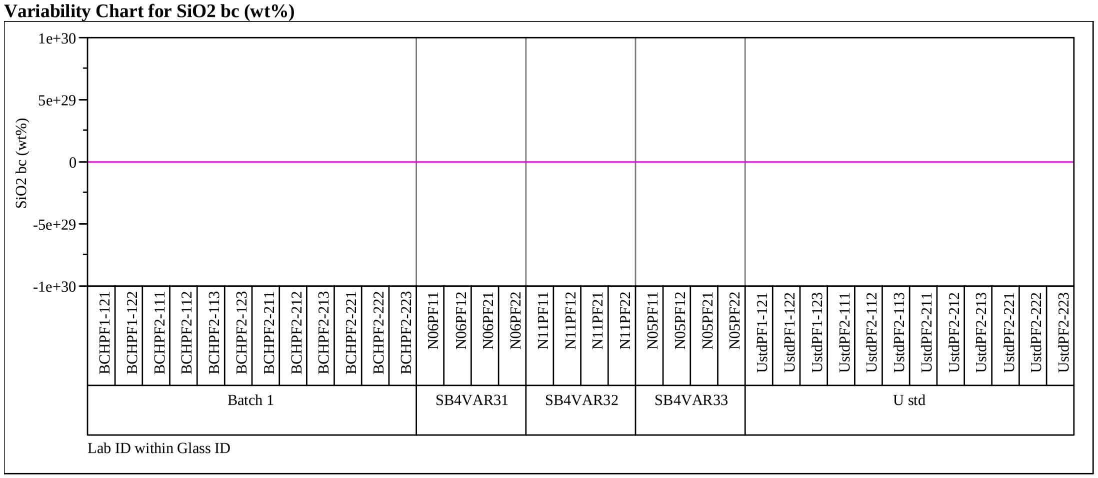
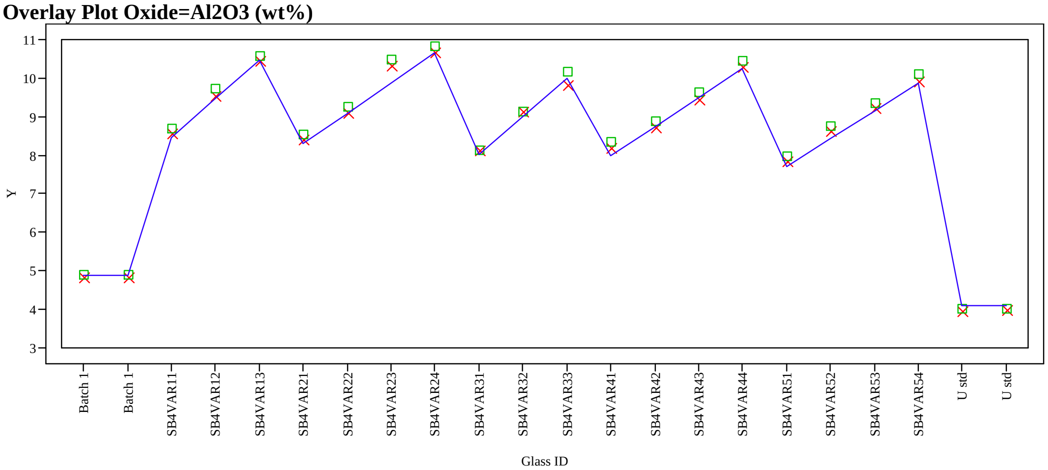
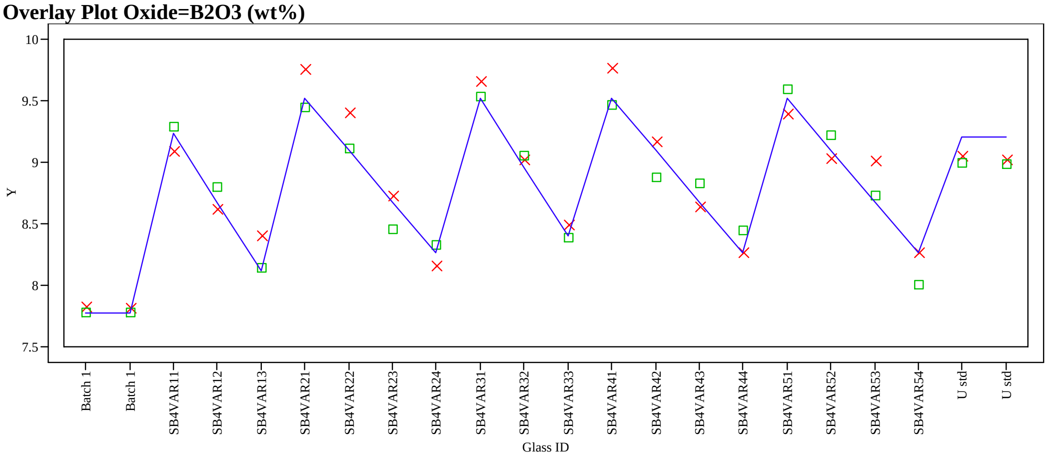


Exhibit A7. Average Measured and Bias-Corrected (bc) Versus Targeted Compositions by Glass # by Oxide

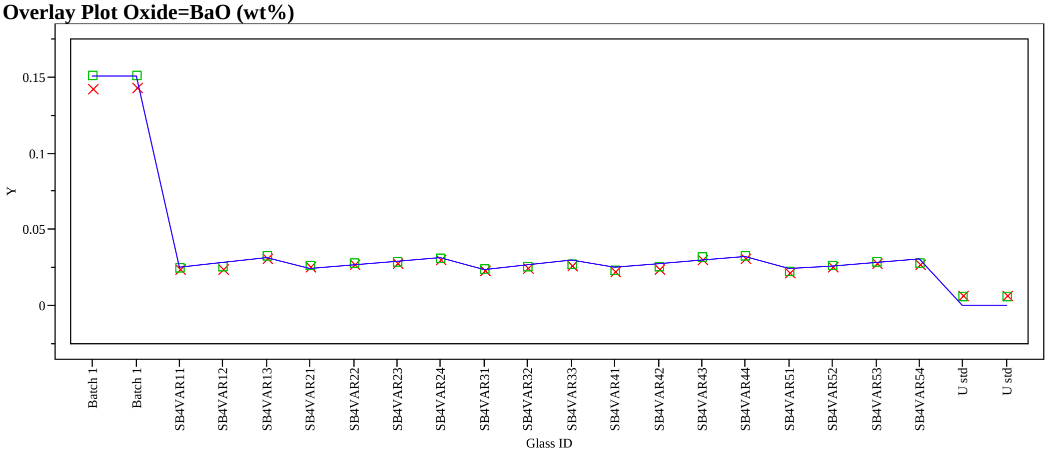
Overlay Plot Oxide=Al2O3 (wt%)



Overlay Plot Oxide=B2O3 (wt%)



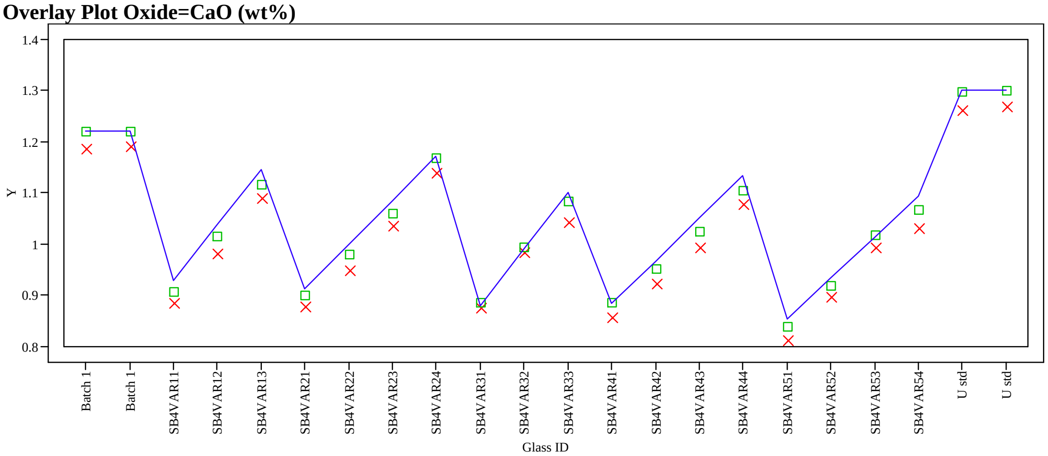
Overlay Plot Oxide=BaO (wt%)



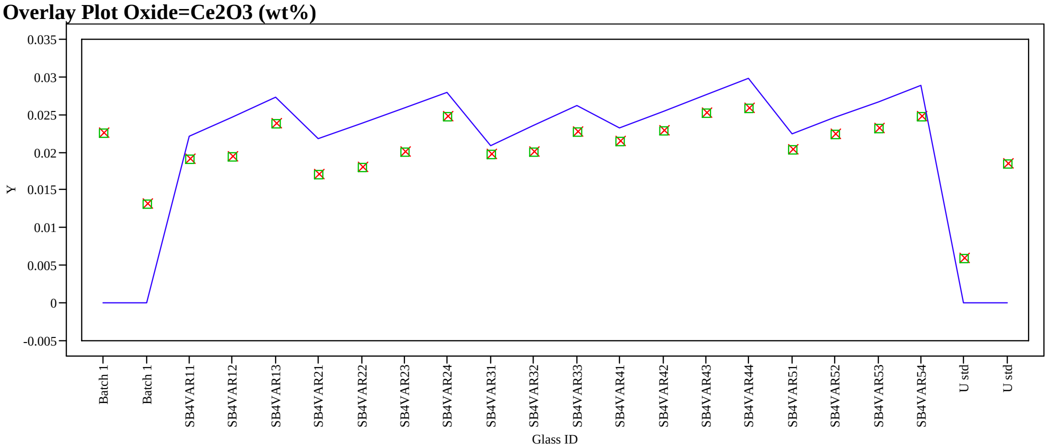
Y × Measured ▫ Measured bc — Targeted

Exhibit A7. Average Measured and Bias-Corrected (bc) Versus Targeted Compositions by Glass # by Oxide

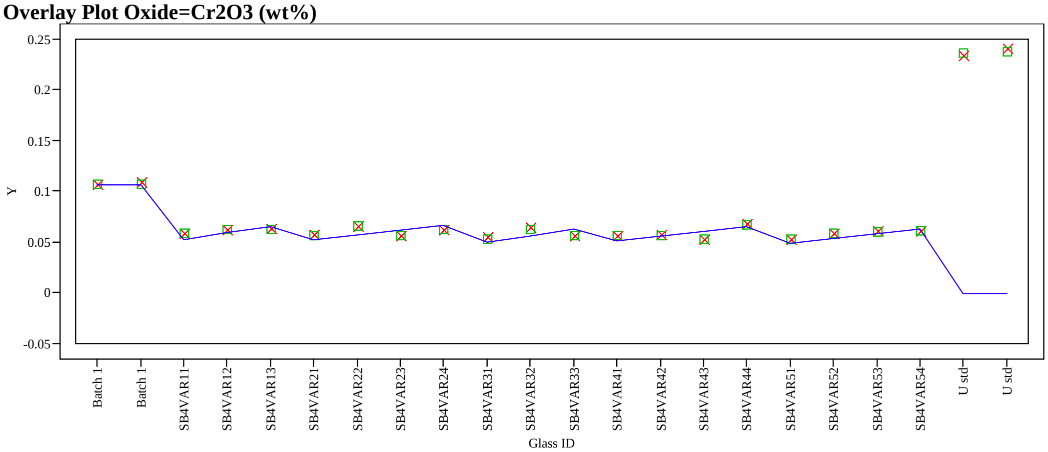
Overlay Plot Oxide=CaO (wt%)



Overlay Plot Oxide=Ce2O3 (wt%)



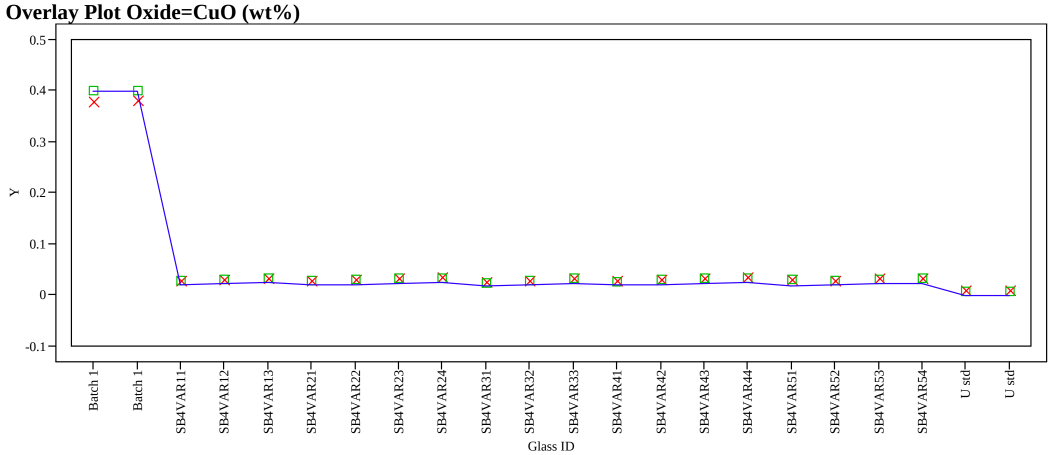
Overlay Plot Oxide=Cr2O3 (wt%)



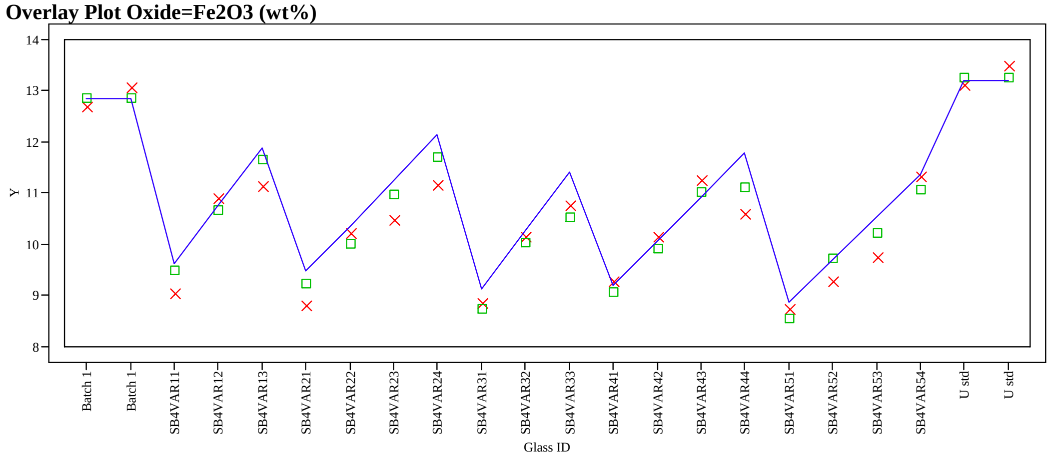
Y ✕ Measured ▪ Measured bc — Targeted

Exhibit A7. Average Measured and Bias-Corrected (bc) Versus Targeted Compositions by Glass # by Oxide

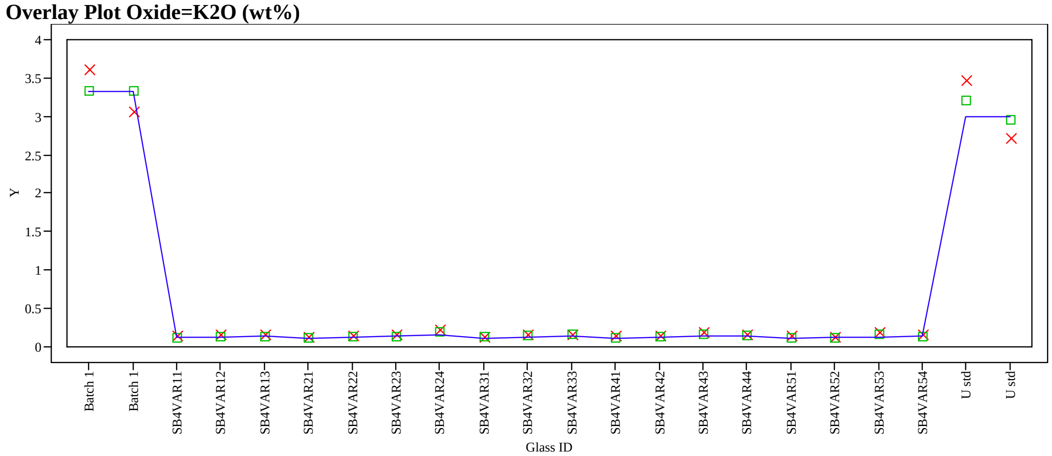
Overlay Plot Oxide=CuO (wt%)



Overlay Plot Oxide=Fe2O3 (wt%)



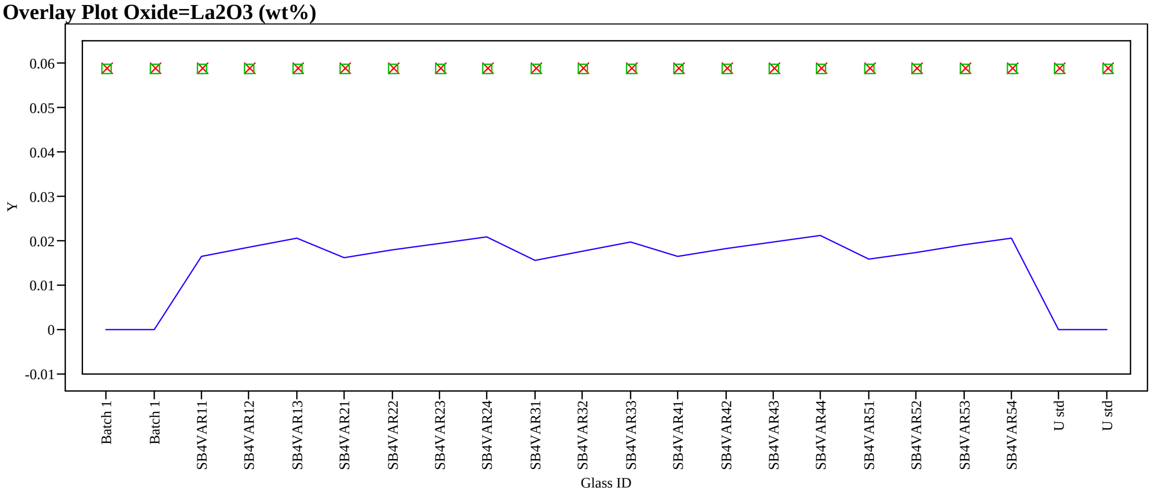
Overlay Plot Oxide=K2O (wt%)



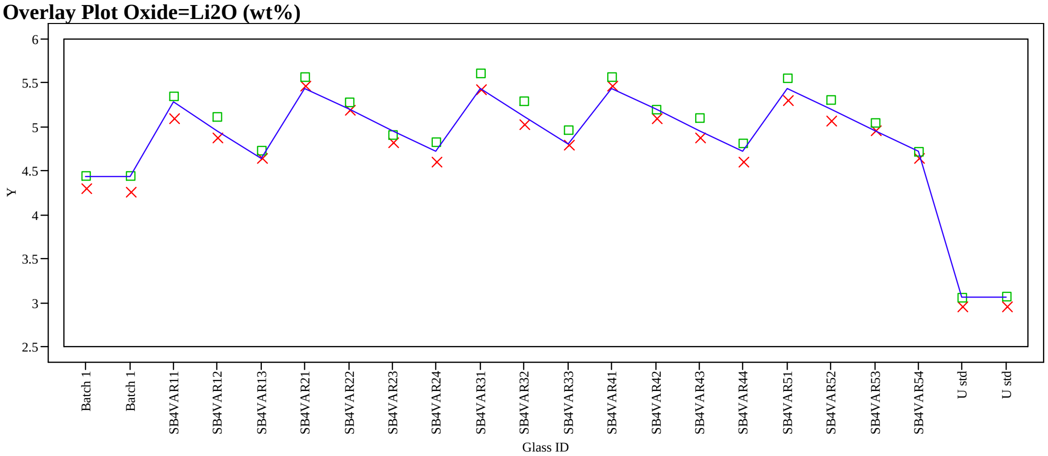
Y ✕ Measured   ▫ Measured bc   — Targeted

Exhibit A7. Average Measured and Bias-Corrected (bc) Versus Targeted Compositions by Glass # by Oxide

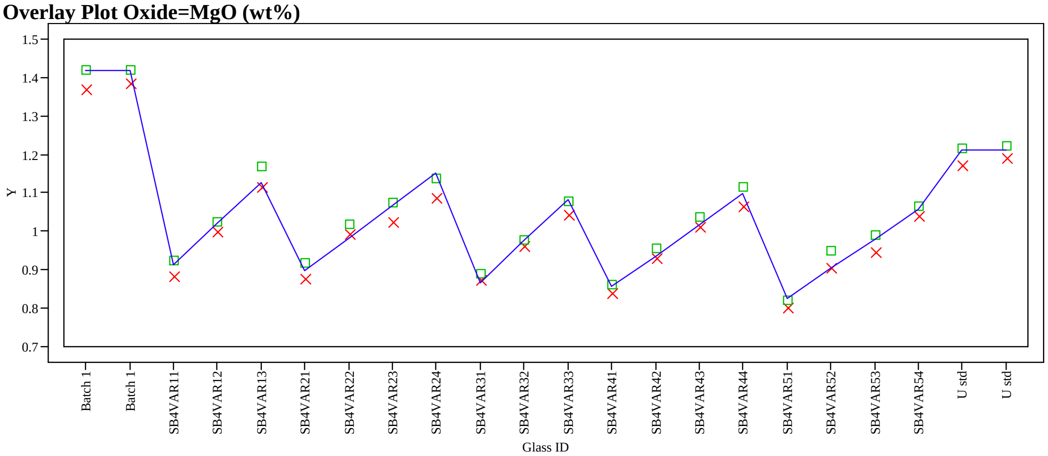
Overlay Plot Oxide=La2O3 (wt%)



Overlay Plot Oxide=Li2O (wt%)



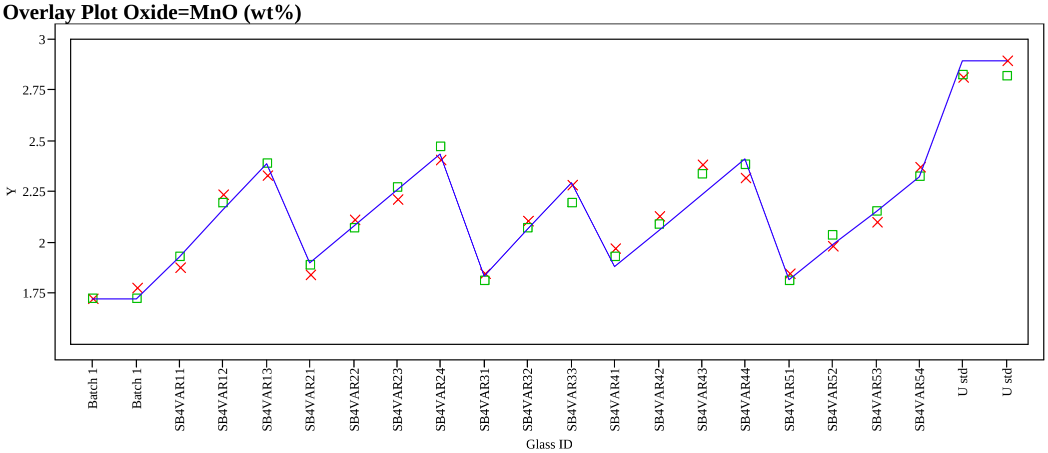
Overlay Plot Oxide=MgO (wt%)



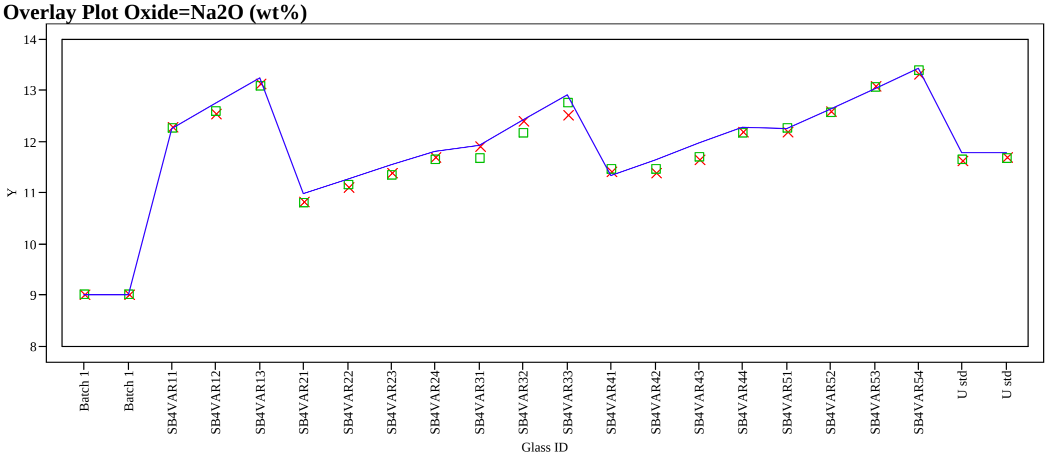
Y × Measured ▫ Measured bc — Targeted

Exhibit A7. Average Measured and Bias-Corrected (bc) Versus Targeted Compositions by Glass # by Oxide

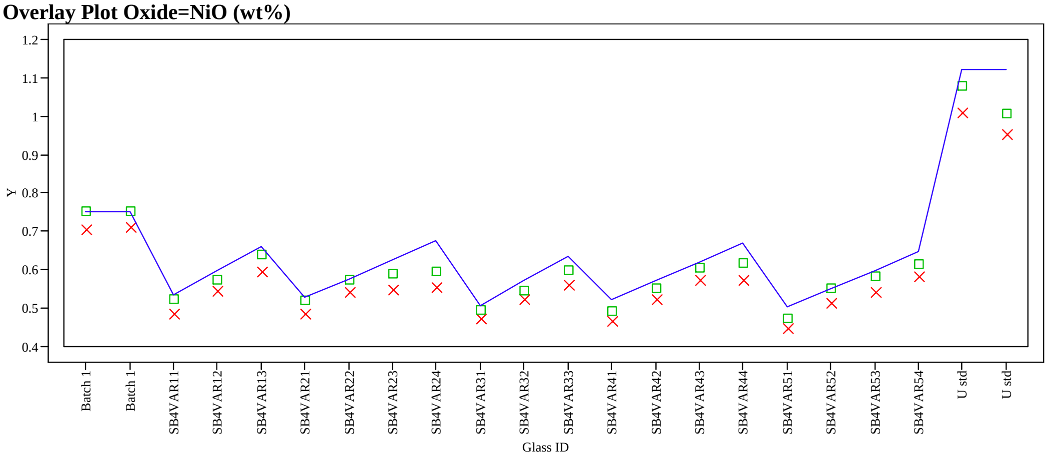
Overlay Plot Oxide=MnO (wt%)



Overlay Plot Oxide=Na2O (wt%)



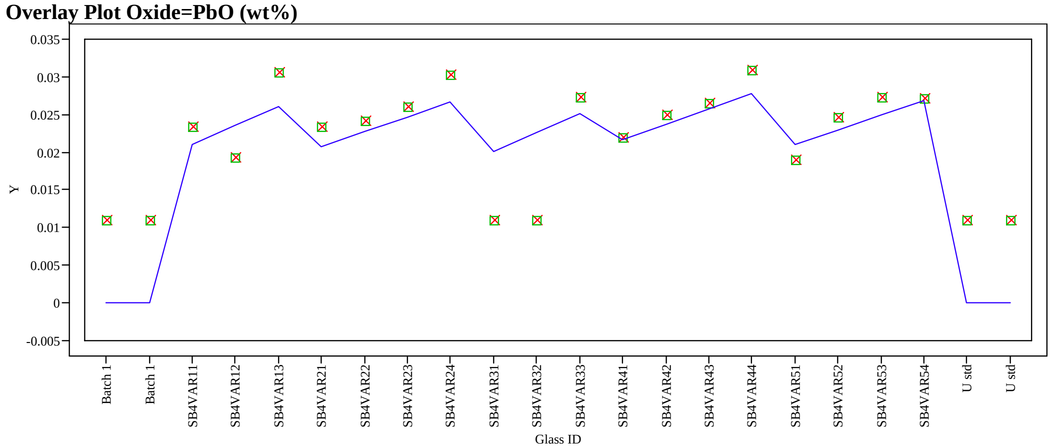
Overlay Plot Oxide=NiO (wt%)



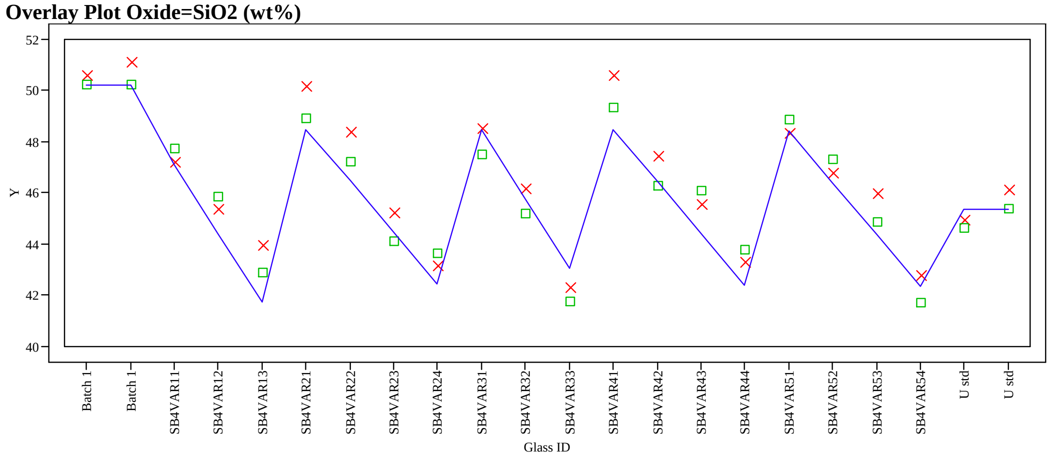
Y × Measured ▫ Measured bc — Targeted

Exhibit A7. Average Measured and Bias-Corrected (bc) Versus Targeted Compositions by Glass # by Oxide

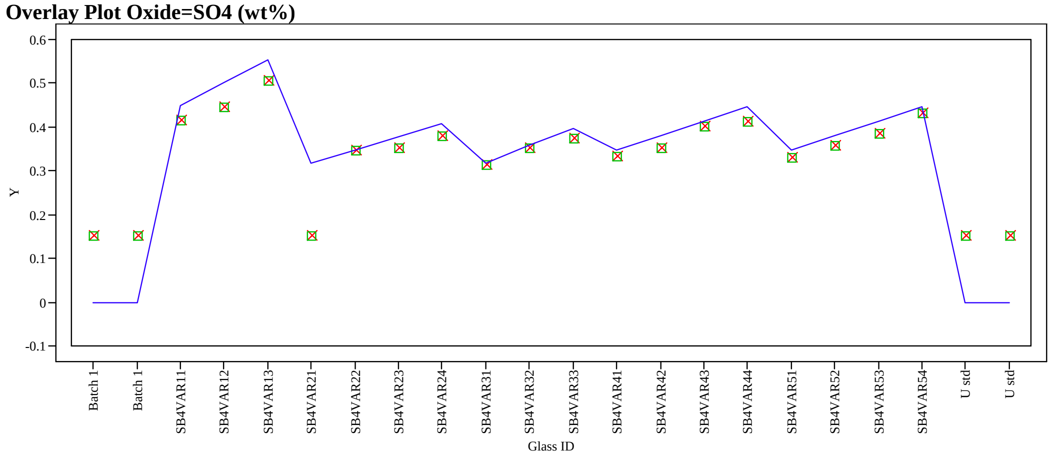
Overlay Plot Oxide=PbO (wt%)



Overlay Plot Oxide=SiO2 (wt%)



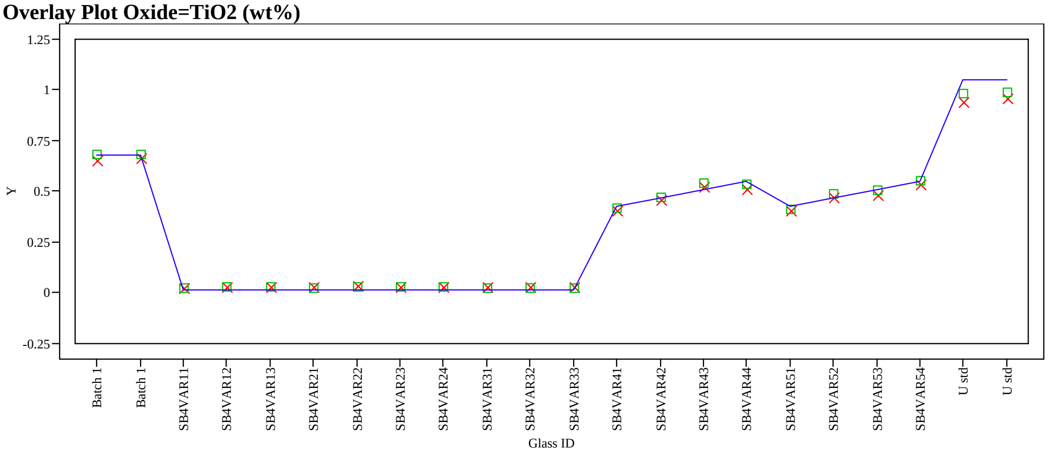
Overlay Plot Oxide=SO4 (wt%)



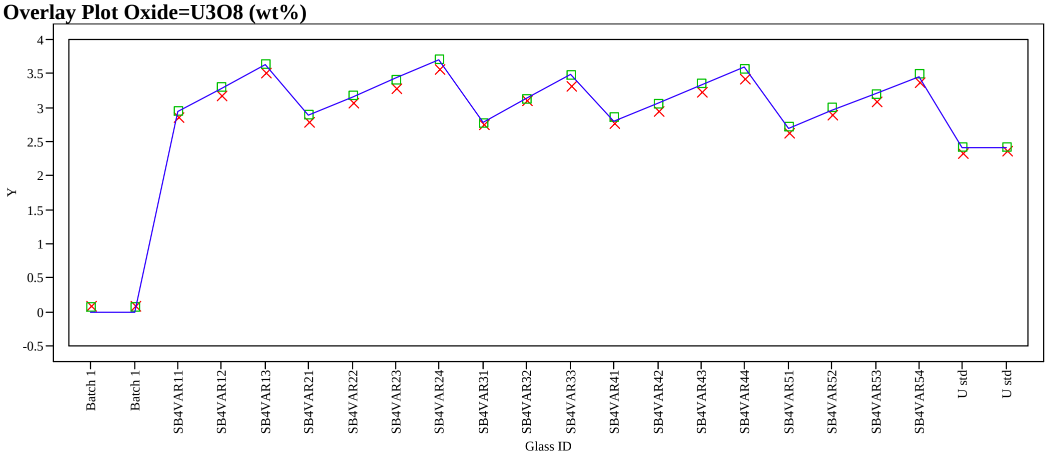
Y × Measured ▪ Measured bc — Targeted

Exhibit A7. Average Measured and Bias-Corrected (bc) Versus Targeted Compositions by Glass # by Oxide

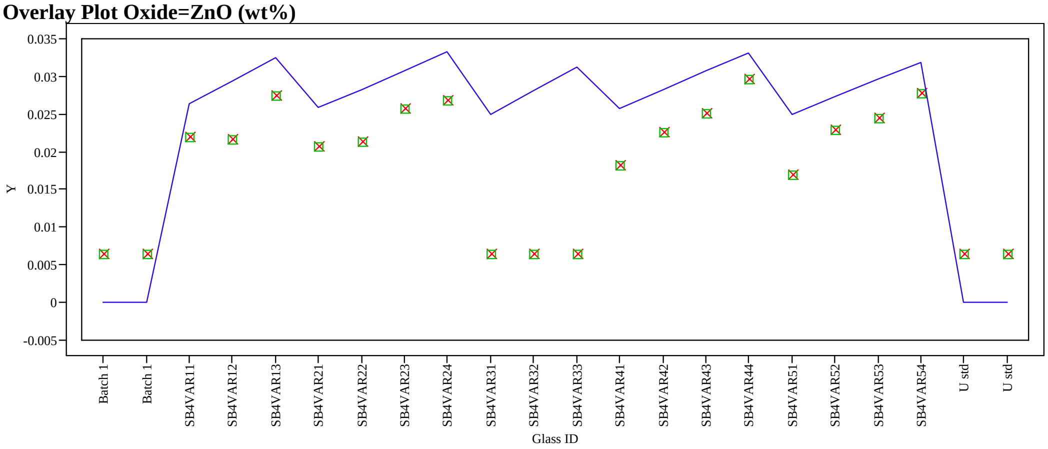
Overlay Plot Oxide=TiO2 (wt%)



Overlay Plot Oxide=U3O8 (wt%)



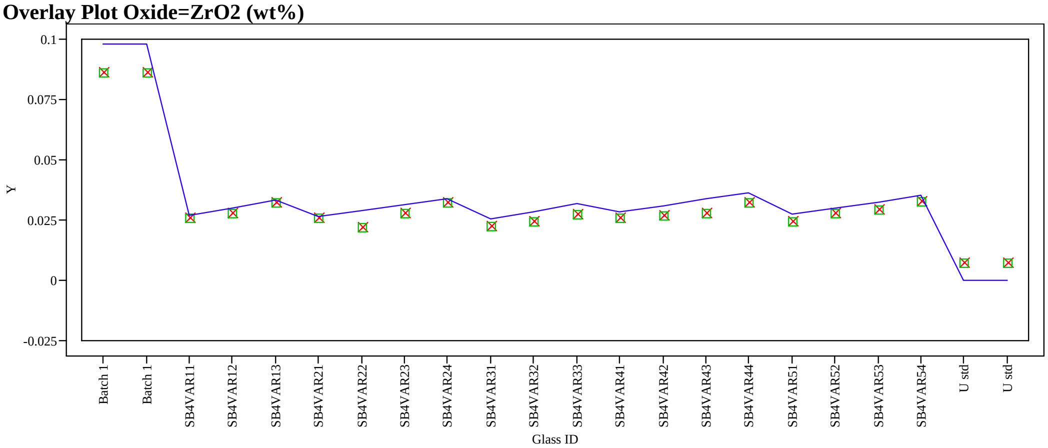
Overlay Plot Oxide=ZnO (wt%)



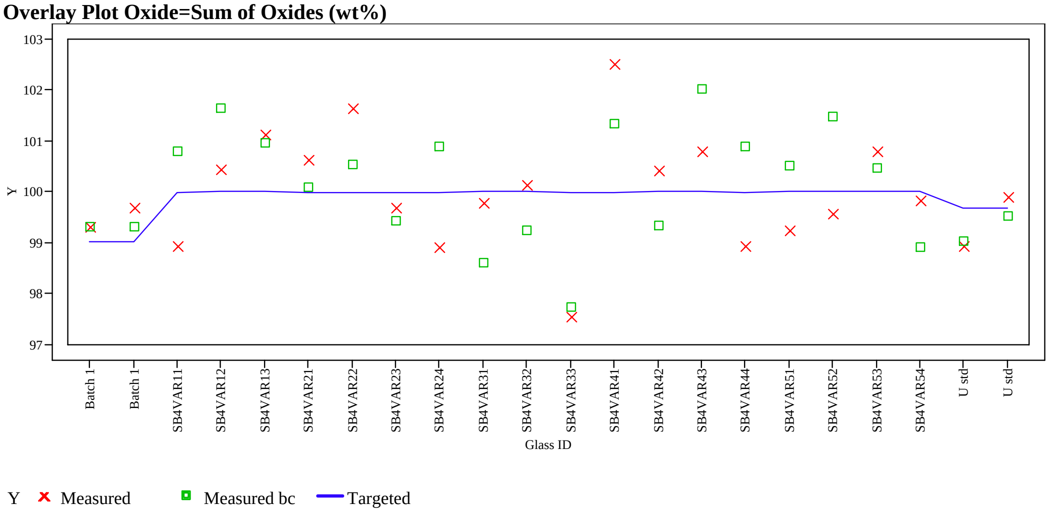
Y Measured Measured bc Targeted

Exhibit A7. Average Measured and Bias-Corrected (bc) Versus Targeted Compositions by Glass # by Oxide

Overlay Plot Oxide=ZrO2 (wt%)



Overlay Plot Oxide=Sum of Oxides (wt%)



APPENDIX B

TABLES AND EXHIBITS SUPPORTING THE ANALYSIS OF THE PCT RESULTS FOR THE SB4-DECANT VARIABILITY STUDY GLASSES

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Table B1. PSAL Measurements of the PCT Solutions for the Study Glasses As-Received (ar) and After Appropriate Adjustments (in ppm)

Set	Glass ID (w HT)	Block	Seq	Lab ID	B ar	Li ar	Na ar	Si ar	B (ppm)	Li (ppm)	Na (ppm)	Si (ppm)
q	Soln Std	1	1	STD-11-1	20.6	9.81	79.9	49.1	20.600	9.810	79.900	49.100
q	SB4VAR21ccc	1	2	Q49	12.1	11	29.1	61.3	20.167	18.334	48.501	102.169
q	SB4VAR54ccc	1	3	Q47	16.1	13.1	54.2	61.6	26.834	21.834	90.335	102.669
q	EA	1	4	Q67	34.3	10.6	91.8	50.4	571.668	176.667	1530.003	840.002
q	SB4VAR22	1	5	Q30	12.3	10.8	31.8	58.2	20.500	18.000	53.001	97.002
q	SB4VAR44	1	6	Q25	12.1	10.2	40.2	55.2	20.167	17.000	67.001	92.002
q	SB4VAR21	1	7	Q69	11.9	10.9	30.2	59.4	19.834	18.167	50.334	99.002
q	SB4VAR42ccc	1	8	Q45	11.9	10.8	34.3	58.6	19.834	18.000	57.168	97.669
q	SB4VAR23	1	9	Q14	11.8	10.5	35.2	54.7	19.667	17.500	58.668	91.168
q	SB4VAR41	1	10	Q59	12.3	11.2	33.9	61	20.500	18.667	56.501	101.669
q	SB4VAR51	1	11	Q53	11.9	10.6	36.7	58.8	19.834	17.667	61.168	98.002
q	ARM-1	1	12	Q24	12.3	9.44	25.3	39.3	20.500	15.734	42.168	65.501
q	SB4VAR22ccc	1	13	Q79	11.6	10.6	32.9	57.8	19.334	17.667	54.834	96.335
q	blank	1	14	Q23	<1.00	<1.00	<1.00	<0.100	0.833	0.833	0.833	0.083
q	Soln Std	1	15	STD-11-2	19.7	9.94	81.5	48.8	19.700	9.940	81.500	48.800
q	SB4VAR42	1	16	Q42	12.2	10.8	35.7	59	20.334	18.000	59.501	98.335
q	SB4VAR24	1	17	Q52	12.5	10.7	39.3	55.3	20.834	17.834	65.501	92.169
q	SB4VAR52	1	18	Q19	12.6	10.9	41.2	60.3	21.000	18.167	68.668	100.502
q	SB4VAR44ccc	1	19	Q01	13.7	11.8	43.1	56.7	22.834	19.667	71.835	94.502
q	SB4VAR24ccc	1	20	Q71	28.2	22.3	60.6	72.4	47.001	37.167	101.002	120.669
q	SB4VAR41ccc	1	21	Q48	13.1	12	34.3	65.4	21.834	20.000	57.168	109.002
q	SB4VAR53ccc	1	22	Q61	12.3	10.8	43.9	58.1	20.500	18.000	73.168	96.835
q	SB4VAR53	1	23	Q51	12.6	10.8	46.8	59.1	21.000	18.000	78.002	98.502
q	SB4VAR52ccc	1	24	Q13	12.4	11	41	60.9	20.667	18.334	68.335	101.502
q	SB4VAR43	1	25	Q80	11.8	10.6	38.3	57.1	19.667	17.667	63.835	95.169
q	SB4VAR43ccc	1	26	Q77	11.5	10.4	36.8	55.4	19.167	17.334	61.335	92.335
q	SB4VAR51ccc	1	27	Q60	12.6	11.5	37.4	63.5	21.000	19.167	62.335	105.835
q	SB4VAR54	1	28	Q76	12.3	10.3	49.2	55.8	20.500	17.167	82.002	93.002
q	SB4VAR23ccc	1	29	Q18	12.3	10.9	36.6	57	20.500	18.167	61.001	95.002
q	Soln Std	1	30	STD-11-3	20.3	10.1	82.2	50.2	20.300	10.100	82.200	50.200
q	Soln Std	2	1	STD-12-1	20.7	9.74	78.2	50.3	20.700	9.740	78.200	50.300
q	ARM-1	2	2	Q28	11.9	8.7	23.1	38.2	19.834	14.500	38.501	63.668
q	SB4VAR23ccc	2	3	Q12	12.3	10.5	34	57.7	20.500	17.500	56.668	96.169
q	SB4VAR52	2	4	Q03	12.5	10.7	40.8	61	20.834	17.834	68.001	101.669
q	SB4VAR21ccc	2	5	Q75	11.7	10.7	30.7	61.1	19.500	17.834	51.168	101.835
q	SB4VAR54	2	6	Q08	12.6	10.4	49	58.5	21.000	17.334	81.668	97.502
q	SB4VAR24	2	7	Q09	12.1	10.4	38	56.1	20.167	17.334	63.335	93.502
q	SB4VAR23	2	8	Q74	11.8	10.6	35.4	57.3	19.667	17.667	59.001	95.502
q	SB4VAR44ccc	2	9	Q63	13.4	11.9	43	58.1	22.334	19.834	71.668	96.835
q	SB4VAR53	2	10	Q07	12.1	10.5	45.8	59.9	20.167	17.500	76.335	99.835
q	SB4VAR44	2	11	Q29	11	9.64	38.4	53.8	18.334	16.067	64.001	89.668
q	SB4VAR24ccc	2	12	Q55	27.6	21.8	59.1	73.2	46.001	36.334	98.502	122.002
q	SB4VAR43ccc	2	13	Q41	11.2	10	35.5	56.8	18.667	16.667	59.168	94.669
q	SB4VAR21	2	14	Q32	12	11.3	31.2	62.6	20.000	18.834	52.001	104.335
q	Soln Std	2	15	STD-12-2	20	9.9	81.5	50.8	20.000	9.900	81.500	50.800
q	SB4VAR52ccc	2	16	Q02	12.7	11	39.6	63.7	21.167	18.334	66.001	106.169
q	SB4VAR42ccc	2	17	Q26	12.4	11.2	35.5	63.1	20.667	18.667	59.168	105.169
q	SB4VAR54ccc	2	18	Q64	16.1	13.2	53.9	63.6	26.834	22.000	89.835	106.002
q	SB4VAR22	2	19	Q10	12.1	11	32.3	61.2	20.167	18.334	53.834	102.002
q	SB4VAR41	2	20	Q44	12.4	11.4	32.5	64.1	20.667	19.000	54.168	106.835
q	SB4VAR42	2	21	Q34	11.9	10.8	33.8	61.1	19.834	18.000	56.334	101.835
q	EA	2	22	Q31	39	11.4	99.3	56.6	650.001	190.000	1655.003	943.335
q	SB4VAR51	2	23	Q06	12.9	11.2	36.1	65.3	21.500	18.667	60.168	108.836
q	SB4VAR43	2	24	Q70	12.5	10.8	37.1	61.4	20.834	18.000	61.835	102.335
q	SB4VAR41ccc	2	25	Q65	13	11.8	32.5	67.9	21.667	19.667	54.168	113.169
q	SB4VAR53ccc	2	26	Q38	12.2	10.7	42.7	60.6	20.334	17.834	71.168	101.002
q	SB4VAR22ccc	2	27	Q15	11.5	10.6	32.7	59.7	19.167	17.667	54.501	99.502
q	SB4VAR51ccc	2	28	Q16	12.3	11.4	36.9	64.6	20.500	19.000	61.501	107.669
q	Soln Std	2	29	STD-12-3	20.1	9.9	80.7	50.8	20.100	9.900	80.700	50.800
q	Soln Std	3	1	STD-13-1	20	9.75	79.3	50.5	20.000	9.750	79.300	50.500

Table B1. PSAL Measurements of the PCT Solutions for the Study Glasses As-Received (ar) and After Appropriate Adjustments (in ppm)

Set	Glass ID (w HT)	Block	Seq	Lab ID	B ar	Li ar	Na ar	Si ar	B (ppm)	Li (ppm)	Na (ppm)	Si (ppm)
q	SB4VAR53	3	2	Q04	11.2	10.1	44.8	56.6	18.667	16.834	74.668	94.335
q	SB4VAR52ccc	3	3	Q68	11.2	10.4	38.9	59.1	18.667	17.334	64.835	98.502
q	SB4VAR22ccc	3	4	Q78	11.1	10.4	31.3	58.2	18.500	17.334	52.168	97.002
q	EA	3	5	Q62	37.5	11.5	102	55.4	625.001	191.667	1700.003	923.335
q	SB4VAR42	3	6	Q58	11.2	10.5	34.2	59	18.667	17.500	57.001	98.335
q	SB4VAR53ccc	3	7	Q57	11	10	41.4	57.6	18.334	16.667	69.001	96.002
q	SB4VAR22	3	8	Q43	11.1	10.6	30.9	58.1	18.500	17.667	51.501	96.835
q	SB4VAR23ccc	3	9	Q73	10.8	10.3	33.7	56.3	18.000	17.167	56.168	93.835
q	SB4VAR42ccc	3	10	Q17	11	10.7	33.6	59.6	18.334	17.834	56.001	99.335
q	SB4VAR54	3	11	Q39	11.3	9.85	47.2	56.5	18.834	16.417	78.668	94.169
q	SB4VAR51ccc	3	12	Q33	11.2	11	35.1	62.3	18.667	18.334	58.501	103.835
q	SB4VAR43	3	13	Q27	10.4	9.92	37.3	56.6	17.334	16.534	62.168	94.335
q	SB4VAR51	3	14	Q72	11.4	10.9	37.3	61.8	19.000	18.167	62.168	103.002
q	Soln Std	3	15	STD-13-2	19.1	9.8	78.9	50.4	19.100	9.800	78.900	50.400
q	SB4VAR43ccc	3	16	Q36	10.7	10.1	33.8	56.6	17.834	16.834	56.334	94.335
q	SB4VAR44ccc	3	17	Q37	12.9	11.5	40.6	57.6	21.500	19.167	67.668	96.002
q	SB4VAR24ccc	3	18	Q66	26.5	21.1	56.9	71.3	44.168	35.167	94.835	118.836
q	SB4VAR54ccc	3	19	Q56	14.9	12.6	50.4	61.1	24.834	21.000	84.002	101.835
q	blank	3	20	Q20	<1.00	<1.00	<1.00	0.142	0.833	0.833	0.833	0.237
q	SB4VAR24	3	21	Q40	10.9	10.1	35.6	53.9	18.167	16.834	59.335	89.835
q	SB4VAR21ccc	3	22	Q35	10.6	10.4	27.7	59.4	17.667	17.334	46.168	99.002
q	SB4VAR52	3	23	Q22	11.1	10.5	38.5	59.9	18.500	17.500	64.168	99.835
q	SB4VAR44	3	24	Q50	10.4	9.85	38.3	53.1	17.334	16.417	63.835	88.502
q	SB4VAR41	3	25	Q54	10.5	10.5	30.2	58.9	17.500	17.500	50.334	98.169
q	ARM-1	3	26	Q46	9.5	8.24	21.2	36.1	15.834	13.734	35.334	60.168
q	SB4VAR21	3	27	Q05	10.7	10.7	28.1	59.7	17.834	17.834	46.834	99.502
q	SB4VAR23	3	28	Q11	10.5	10	32.4	54	17.500	16.667	54.001	90.002
q	SB4VAR41ccc	3	29	Q21	10.9	10.9	30.1	62	18.167	18.167	50.168	103.335
q	Soln Std	3	30	STD-13-3	19.1	10.1	83.1	50.3	19.100	10.100	83.100	50.300
r	Soln Std	1	1	STD-21-1	20.5	9.89	79.3	50.7	20.500	9.890	79.300	50.700
r	EA	1	2	R62	36.5	11	98.2	53.3	608.335	183.334	1636.670	888.335
r	SB5-17	1	3	R55	11.9	11.3	34.1	59.4	19.834	18.834	56.834	99.002
r	SB4VAR13ccc	1	4	R09	23.8	17.9	65.9	71.6	39.667	29.834	109.836	119.336
r	SB5-18ccc	1	5	R38	11.7	8.53	45.8	58	19.500	14.217	76.335	96.669
r	SB4VAR33	1	6	R77	12.5	10.3	44.9	57.5	20.834	17.167	74.835	95.835
r	SB4VAR11ccc	1	7	R06	12.2	10.6	35.2	61.1	20.334	17.667	58.668	101.835
r	SB5-14ccc	1	8	R49	11.1	10.5	60.5	68.5	18.500	17.500	100.835	114.169
r	SB5-17ccc	1	9	R45	11.3	10.5	32	58.4	18.834	17.500	53.334	97.335
r	SB4VAR33ccc	1	10	R84	13.1	10.7	43.6	59.1	21.834	17.834	72.668	98.502
r	SB5-20ccc	1	11	R26	11.7	4.55	39	49.9	19.500	7.583	65.001	83.168
r	SB4VAR32	1	12	R52	12.3	10.4	37.7	59.9	20.500	17.334	62.835	99.835
r	SB5-16	1	13	R68	15	6.42	55.3	56.2	25.001	10.700	92.169	93.669
r	ARM-1	1	14	R17	10.2	8.03	21.1	36	17.000	13.384	35.167	60.001
r	SB5-15	1	15	R69	13.3	8.12	58.9	59.2	22.167	13.534	98.169	98.669
r	Soln Std	1	16	STD-21-2	19.8	9.69	79.1	49.4	19.800	9.690	79.100	49.400
r	SB5-16ccc	1	17	R61	13.8	5.94	48.2	54.4	23.000	9.900	80.335	90.668
r	SB4VAR12	1	18	R85	12.9	10.5	41.5	59.1	21.500	17.500	69.168	98.502
r	SB5-15ccc	1	19	R78	12.8	7.93	51.6	57.3	21.334	13.217	86.002	95.502
r	SB4VAR13	1	20	R57	13.3	10.5	48.7	56.6	22.167	17.500	81.168	94.335
r	SB5-20	1	21	R31	11.8	4.44	41.1	48.3	19.667	7.400	68.501	80.502
r	SB4VAR31	1	22	R30	12.4	10.9	34.3	61.2	20.667	18.167	57.168	102.002
r	blank	1	23	R08	<1.00	<1.00	<1.00	0.116	0.833	0.833	0.833	0.193
r	SB4VAR12ccc	1	24	R46	12.2	10.3	46.2	57.7	20.334	17.167	77.002	96.169
r	SB5-18	1	25	R48	11.7	8.35	46.7	57.4	19.500	13.917	77.835	95.669
r	SB4VAR11	1	26	R01	12.7	10.7	36.9	62	21.167	17.834	61.501	103.335
r	SB4VAR31ccc	1	27	R59	12.4	11.1	34.3	62.2	20.667	18.500	57.168	103.669
r	SB5-19	1	28	R65	12.3	5.63	51.5	52.8	20.500	9.384	85.835	88.002
r	SB4VAR32ccc	1	29	R02	12	10.4	38.4	58.4	20.000	17.334	64.001	97.335
r	SB5-19ccc	1	30	R37	11.9	5.66	49.7	51.8	19.834	9.434	82.835	86.335
r	SB5-14	1	31	R53	11.1	10.2	64.4	67.8	18.500	17.000	107.335	113.002

Table B1. PSAL Measurements of the PCT Solutions for the Study Glasses As-Received (ar) and After Appropriate Adjustments (in ppm)

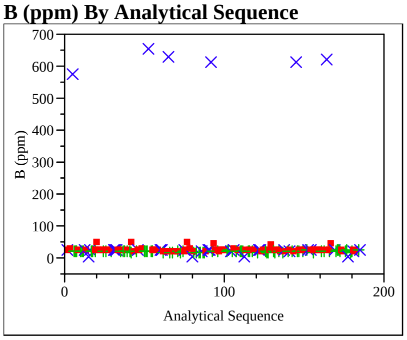
Set	Glass ID (w HT)	Block	Seq	Lab ID	B ar	Li ar	Na ar	Si ar	B (ppm)	Li (ppm)	Na (ppm)	Si (ppm)
r	Soln Std	1	32	STD-21-3	20.1	9.82	79.4	49.9	20.100	9.820	79.400	49.900
r	Soln Std	2	1	STD-22-1	20.1	9.63	78.7	50.8	20.100	9.630	78.700	50.800
r	SB5-17ccc	2	2	R83	10.8	10.4	31.5	58.1	18.000	17.334	52.501	96.835
r	SB4VAR11ccc	2	3	R03	11.4	10	34.1	59.3	19.000	16.667	56.834	98.835
r	SB5-15	2	4	R20	12.3	7.6	56.8	56.8	20.500	12.667	94.669	94.669
r	SB5-14	2	5	R54	10.1	9.53	61.3	65	16.834	15.884	102.169	108.336
r	SB4VAR11	2	6	R13	11	9.73	35.4	57.9	18.334	16.217	59.001	96.502
r	SB5-15ccc	2	7	R80	11.4	7.42	52.8	55.1	19.000	12.367	88.002	91.835
r	SB4VAR13ccc	2	8	R47	21.5	16.5	62.3	65.8	35.834	27.501	103.835	109.669
r	SB4VAR12	2	9	R82	11.7	10	41.3	58.1	19.500	16.667	68.835	96.835
r	SB5-18	2	10	R66	10.4	7.51	44.6	54.6	17.334	12.517	74.335	91.002
r	SB4VAR12ccc	2	11	R32	11.7	10.1	39.7	59	19.500	16.834	66.168	98.335
r	SB4VAR13	2	12	R40	12.2	10	48.9	56.2	20.334	16.667	81.502	93.669
r	SB4VAR33ccc	2	13	R74	12	10.2	53.4	56.9	20.000	17.000	89.002	94.835
r	SB5-19ccc	2	14	R50	11.2	5.38	48.9	52.3	18.667	8.967	81.502	87.168
r	SB5-17	2	15	R27	11.1	11	34.3	60.2	18.500	18.334	57.168	100.335
r	Soln Std	2	16	STD-22-2	19.6	9.64	80.1	50.9	19.600	9.640	80.100	50.900
r	SB5-14ccc	2	17	R81	10.4	10.1	60.5	68.1	17.334	16.834	100.835	113.502
r	SB4VAR33	2	18	R42	12.2	10.1	44.7	58.1	20.334	16.834	74.501	96.835
r	ARM-1	2	19	R25	9.64	7.65	20.5	35.6	16.067	12.750	34.167	59.335
r	SB5-16ccc	2	20	R35	12.4	5.52	47.9	52.6	20.667	9.200	79.835	87.668
r	SB5-19	2	21	R41	12.2	5.6	52.9	53.6	20.334	9.334	88.168	89.335
r	SB5-20ccc	2	22	R19	11.1	4.34	40.6	49.6	18.500	7.233	67.668	82.668
r	EA	2	23	R51	36.6	10.7	98.6	53.8	610.001	178.334	1643.337	896.668
r	SB4VAR32	2	24	R36	11.9	10.2	38.8	60.9	19.834	17.000	64.668	101.502
r	SB5-20	2	25	R11	11.7	4.3	41.1	51.1	19.500	7.167	68.501	85.168
r	SB4VAR32ccc	2	26	R34	12.5	10.5	37.8	62.7	20.834	17.500	63.001	104.502
r	SB4VAR31	2	27	R24	12.3	10.8	34.1	63.4	20.500	18.000	56.834	105.669
r	SB5-18ccc	2	28	R12	11.5	8.4	46.1	59.9	19.167	14.000	76.835	99.835
r	SB4VAR31ccc	2	29	R72	11.7	10.4	34.1	62.4	19.500	17.334	56.834	104.002
r	SB5-16	2	30	R70	14.8	6.11	55.1	57.2	24.667	10.184	91.835	95.335
r	Soln Std	2	31	STD-22-3	21.5	10.1	81.5	54.3	21.500	10.100	81.500	54.300
r	Soln Std	3	1	STD-23-1	20.8	9.7	79.1	49.9	20.800	9.700	79.100	49.900
r	SB4VAR32ccc	3	2	R73	12.5	10.7	40.2	60.4	20.834	17.834	67.001	100.669
r	SB5-17	3	3	R60	11.1	10.1	31.8	54.8	18.500	16.834	53.001	91.335
r	SB4VAR12ccc	3	4	R23	11.9	10	40.1	56.6	19.834	16.667	66.835	94.335
r	SB4VAR11ccc	3	5	R15	11.8	10	34.2	59.2	19.667	16.667	57.001	98.669
r	SB4VAR31ccc	3	6	R58	11.9	10.3	32.7	60.5	19.834	17.167	54.501	100.835
r	SB5-19ccc	3	7	R76	12.5	5.46	48.4	54.5	20.834	9.100	80.668	90.835
r	SB5-14	3	8	R79	11.5	10	63.7	70.2	19.167	16.667	106.169	117.002
r	SB4VAR33ccc	3	9	R63	13.7	10.8	45.1	60.6	22.834	18.000	75.168	101.002
r	SB4VAR32	3	10	R67	12.5	10.1	37.5	59.4	20.834	16.834	62.501	99.002
r	EA	3	11	R64	36.9	10.7	91.3	55	615.001	178.334	1521.670	916.669
r	SB5-20ccc	3	12	R22	12.6	4.39	40.2	51.4	21.000	7.317	67.001	85.668
r	SB4VAR12	3	13	R44	13.6	10.6	43.9	63.3	22.667	17.667	73.168	105.502
r	SB5-17ccc	3	14	R07	12.6	11.2	33	64.2	21.000	18.667	55.001	107.002
r	SB4VAR13ccc	3	15	R28	25	18.1	64.6	73.7	41.668	30.167	107.669	122.836
r	Soln Std	3	16	STD-23-2	22	10.1	80	54.6	22.000	10.100	80.000	54.600
r	SB4VAR11	3	17	R33	12.8	10.4	37.1	58.9	21.334	17.334	61.835	98.169
r	SB4VAR31	3	18	R04	14.2	11.2	36.4	67.2	23.667	18.667	60.668	112.002
r	SB5-19	3	19	R86	14	6	56	57.2	23.334	10.000	93.335	95.335
r	SB4VAR13	3	20	R10	12.3	10.4	50.9	52.6	20.500	17.334	84.835	87.668
r	SB5-15ccc	3	21	R16	11.4	7.68	55.1	51.2	19.000	12.800	91.835	85.335
r	SB5-14ccc	3	22	R71	9.94	10.2	62.5	60.3	16.567	17.000	104.169	100.502
r	SB5-20	3	23	R56	11.3	4.29	42.3	46.7	18.834	7.150	70.501	77.835
r	SB5-16	3	24	R75	13.8	6.17	58	53.3	23.000	10.284	96.669	88.835
r	blank	3	25	R39	<1.00	<1.00	<1.00	0.456	0.833	0.833	0.833	0.760
r	SB5-18	3	26	R21	10.9	8.22	49.7	53.5	18.167	13.700	82.835	89.168
r	SB4VAR33	3	27	R18	12.3	10.7	48.4	57	20.500	17.834	80.668	95.002
r	ARM-1	3	28	R29	10.1	8.25	23.2	35	16.834	13.750	38.667	58.335

Table B1. PSAL Measurements of the PCT Solutions for the Study Glasses As-Received (ar) and After Appropriate Adjustments (in ppm)

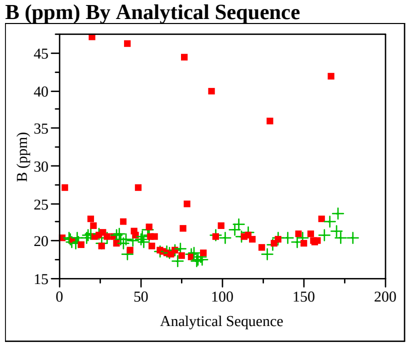
Set	Glass ID (w HT)	Block	Seq	Lab ID	B ar	Li ar	Na ar	Si ar	B (ppm)	Li (ppm)	Na (ppm)	Si (ppm)
r	SB5-16ccc	3	29	R14	13.7	6.3	55.1	53.2	22.834	10.500	91.835	88.668
r	SB5-18ccc	3	30	R43	10.8	8.28	48.5	54.2	18.000	13.800	80.835	90.335
r	SB5-15	3	31	R05	14.4	8.23	58.7	61.6	24.000	13.717	97.835	102.669
r	Soln Std	3	32	STD-23-3	19.7	10.2	83.1	50	19.700	10.200	83.100	50.000

Exhibit B1. Laboratory PCT Measurements in Analytical Sequence for Study Glasses with and without Other Results from the Analytical Plans

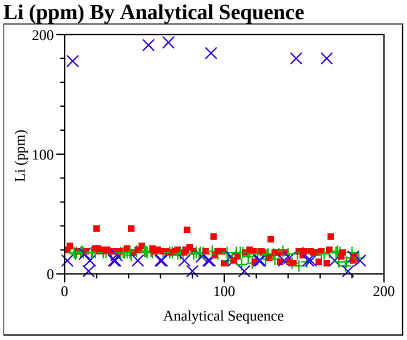
B (ppm) By Analytical Sequence



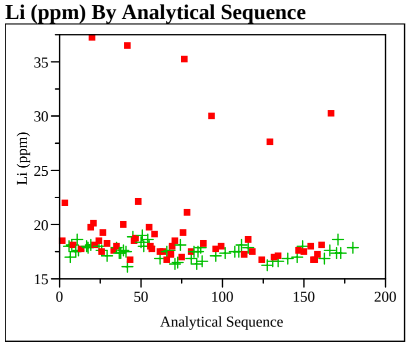
B (ppm) By Analytical Sequence



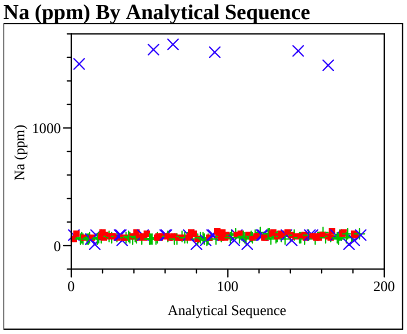
Li (ppm) By Analytical Sequence



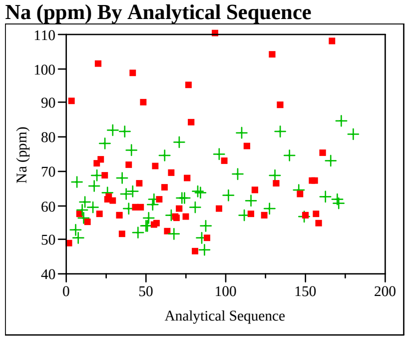
Li (ppm) By Analytical Sequence



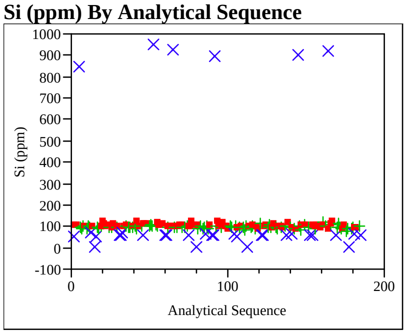
Na (ppm) By Analytical Sequence



Na (ppm) By Analytical Sequence



Si (ppm) By Analytical Sequence



Si (ppm) By Analytical Sequence

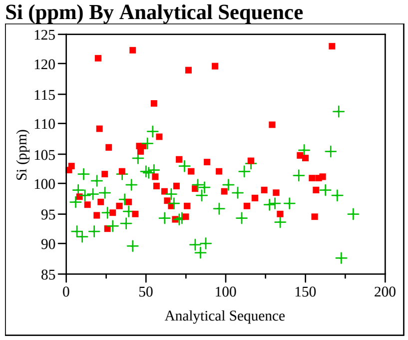
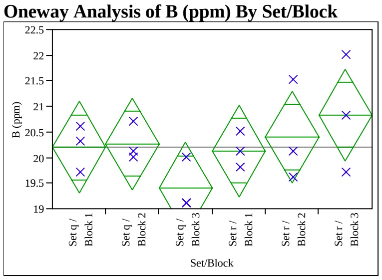


Exhibit B2. Measurements of the Multi-Element Solution Standard by ICP Block

Oneway Analysis of B (ppm) By Set/Block



Oneway Anova
Summary of Fit

Rsquare	0.349694
Adj Rsquare	0.078733
Root Mean Square Error	0.711805
Mean of Response	20.20556
Observations (or Sum Wgts)	18

Analysis of Variance

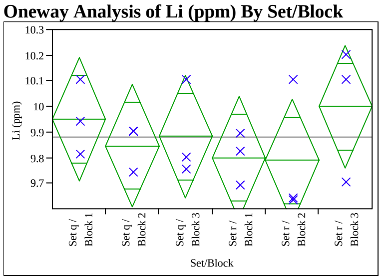
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block	5	3.2694444	0.653889	1.2906	0.3305
Error	12	6.0800000	0.506667		
C. Total	17	9.3494444			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
Set q /Block 1	3	20.2000	0.41096	19.305	21.095
Set q /Block 2	3	20.2667	0.41096	19.371	21.162
Set q /Block 3	3	19.4000	0.41096	18.505	20.295
Set r /Block 1	3	20.1333	0.41096	19.238	21.029
Set r /Block 2	3	20.4000	0.41096	19.505	21.295
Set r /Block 3	3	20.8333	0.41096	19.938	21.729

Std Error uses a pooled estimate of error variance

Oneway Analysis of Li (ppm) By Set/Block



Oneway Anova
Summary of Fit

Rsquare	0.193758
Adj Rsquare	-0.14218
Root Mean Square Error	0.190555
Mean of Response	9.878333
Observations (or Sum Wgts)	18

Analysis of Variance

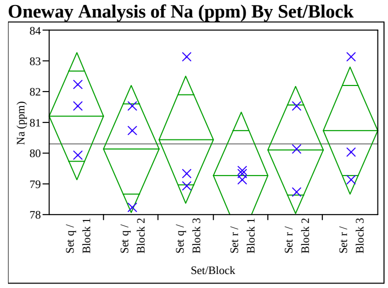
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block	5	0.10471667	0.020943	0.5768	0.7173
Error	12	0.43573333	0.036311		
C. Total	17	0.54045000			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
Set q /Block 1	3	9.9500	0.11002	9.7103	10.190
Set q /Block 2	3	9.8467	0.11002	9.6070	10.086
Set q /Block 3	3	9.8833	0.11002	9.6436	10.123
Set r /Block 1	3	9.8000	0.11002	9.5603	10.040
Set r /Block 2	3	9.7900	0.11002	9.5503	10.030
Set r /Block 3	3	10.0000	0.11002	9.7603	10.240

Std Error uses a pooled estimate of error variance

Oneway Analysis of Na (ppm) By Set/Block



Oneway Anova
Summary of Fit

Rsquare	0.166791
Adj Rsquare	-0.18038
Root Mean Square Error	1.638766
Mean of Response	80.31111
Observations (or Sum Wgts)	18

Analysis of Variance

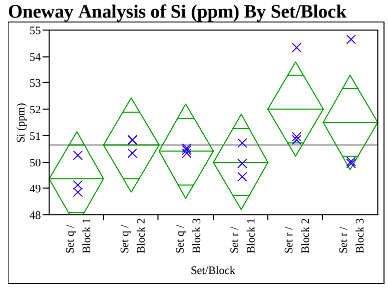
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block	5	6.451111	1.29022	0.4804	0.7844
Error	12	32.226667	2.68556		
C. Total	17	38.677778			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
Set q /Block 1	3	81.2000	0.94614	79.139	83.261
Set q /Block 2	3	80.1333	0.94614	78.072	82.195
Set q /Block 3	3	80.4333	0.94614	78.372	82.495
Set r /Block 1	3	79.2667	0.94614	77.205	81.328
Set r /Block 2	3	80.1000	0.94614	78.039	82.161
Set r /Block 3	3	80.7333	0.94614	78.672	82.795

Std Error uses a pooled estimate of error variance

Oneway Analysis of Si (ppm) By Set/Block



Oneway Anova
Summary of Fit

Rsquare	0.364222
Adj Rsquare	0.099315
Root Mean Square Error	1.428675
Mean of Response	50.65
Observations (or Sum Wgts)	18

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block	5	14.031667	2.80633	1.3749	0.3005
Error	12	24.493333	2.04111		
C. Total	17	38.525000			

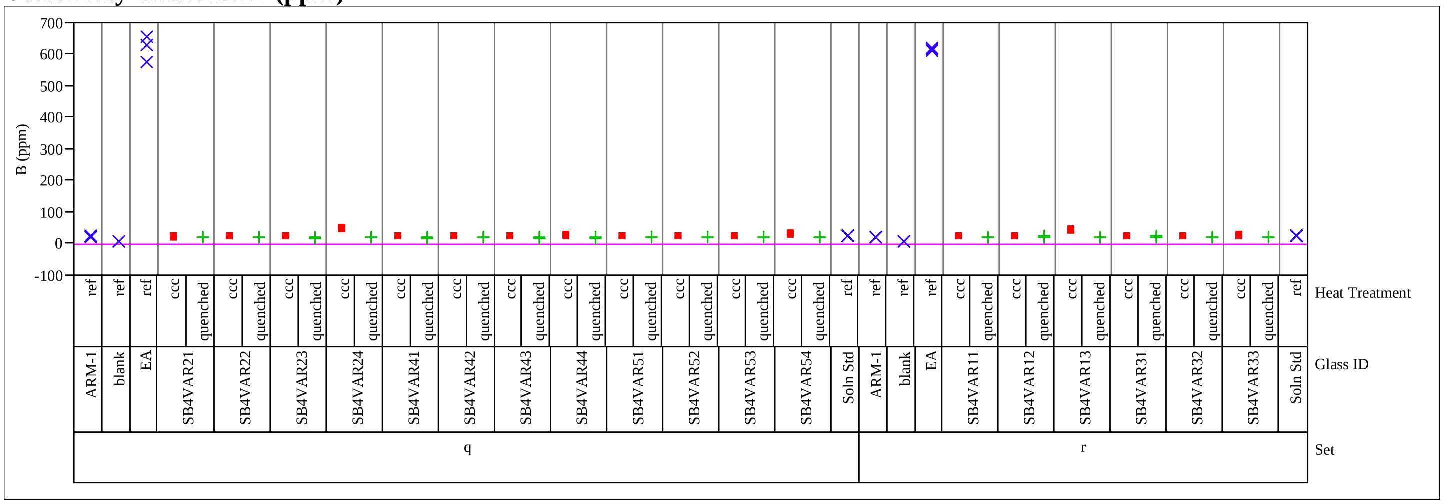
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
Set q /Block 1	3	49.3667	0.82485	47.569	51.164
Set q /Block 2	3	50.6333	0.82485	48.836	52.431
Set q /Block 3	3	50.4000	0.82485	48.603	52.197
Set r /Block 1	3	50.0000	0.82485	48.203	51.797
Set r /Block 2	3	52.0000	0.82485	50.203	53.797
Set r /Block 3	3	51.5000	0.82485	49.703	53.297

Std Error uses a pooled estimate of error variance

Exhibit B3. Laboratory PCT Measurements by Glass Identifier for Study Glasses and Standards

Variability Chart for B (ppm)



Variability Chart for Li (ppm)

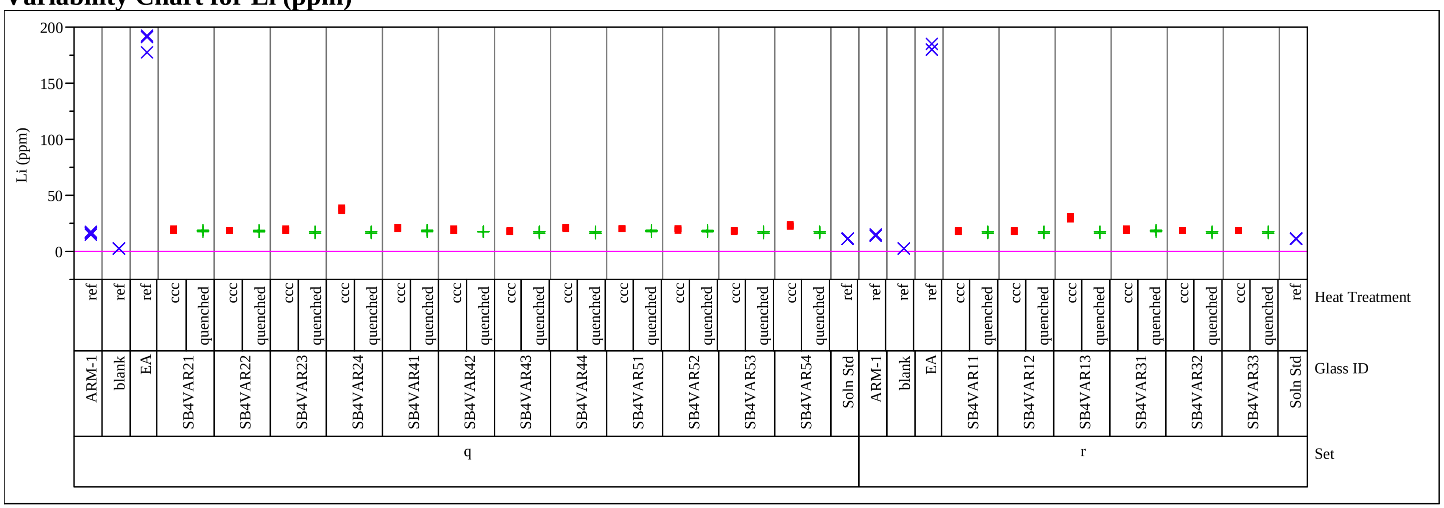
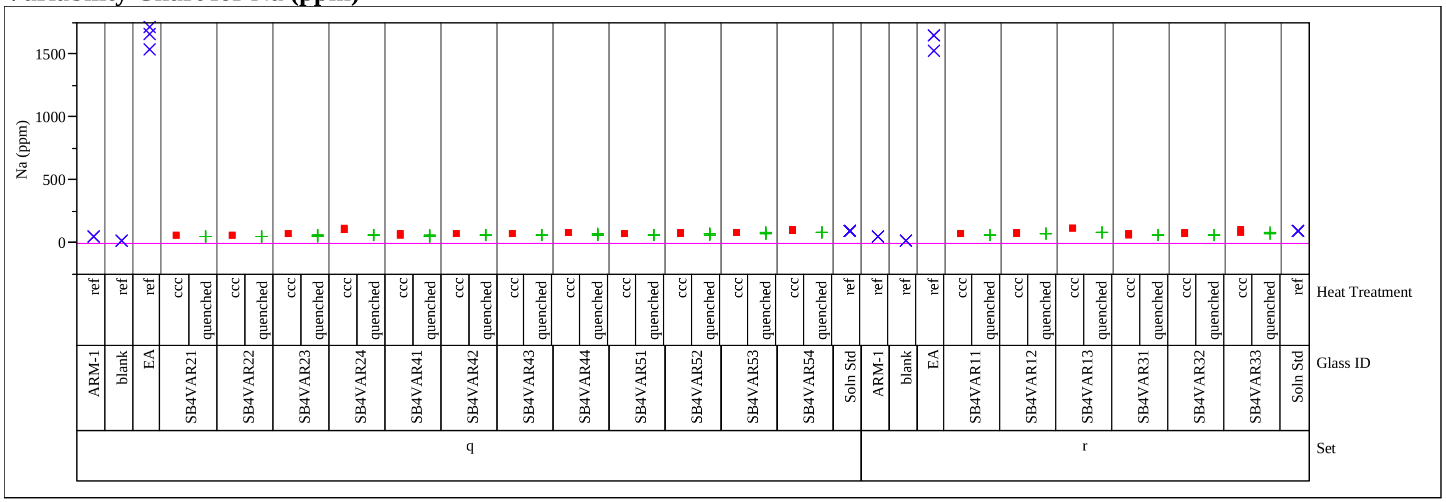


Exhibit B3. Laboratory PCT Measurements by Glass Identifier for Study Glasses and Standards

Variability Chart for Na (ppm)



Variability Chart for Si (ppm)

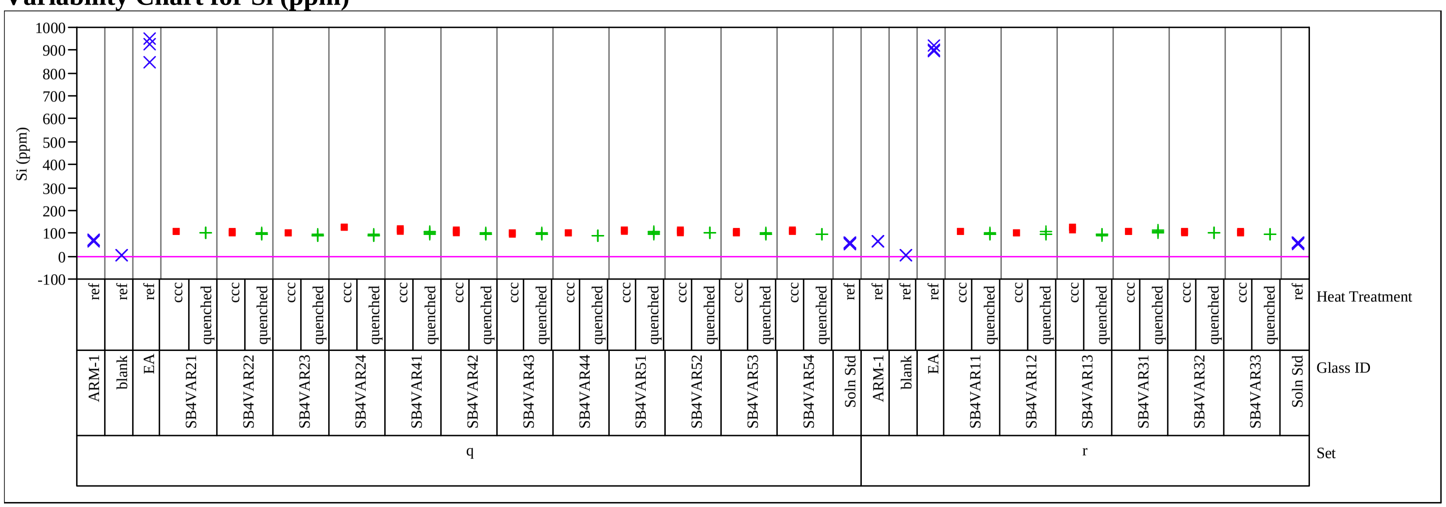


Exhibit B4. Laboratory PCT Measurements by Glass Identifier for Study Glasses

Variability Chart for B (ppm)

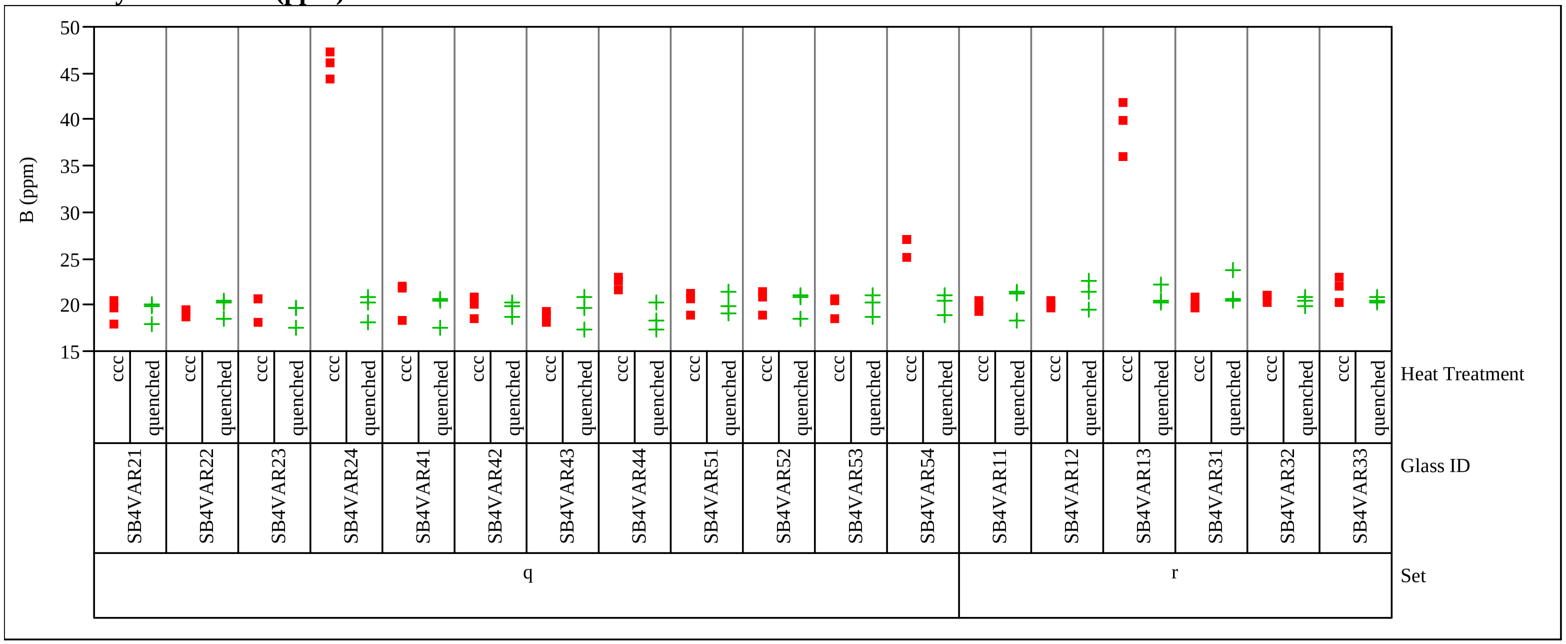


Exhibit B4. Laboratory PCT Measurements by Glass Identifier for Study Glasses

Variability Chart for Li (ppm)

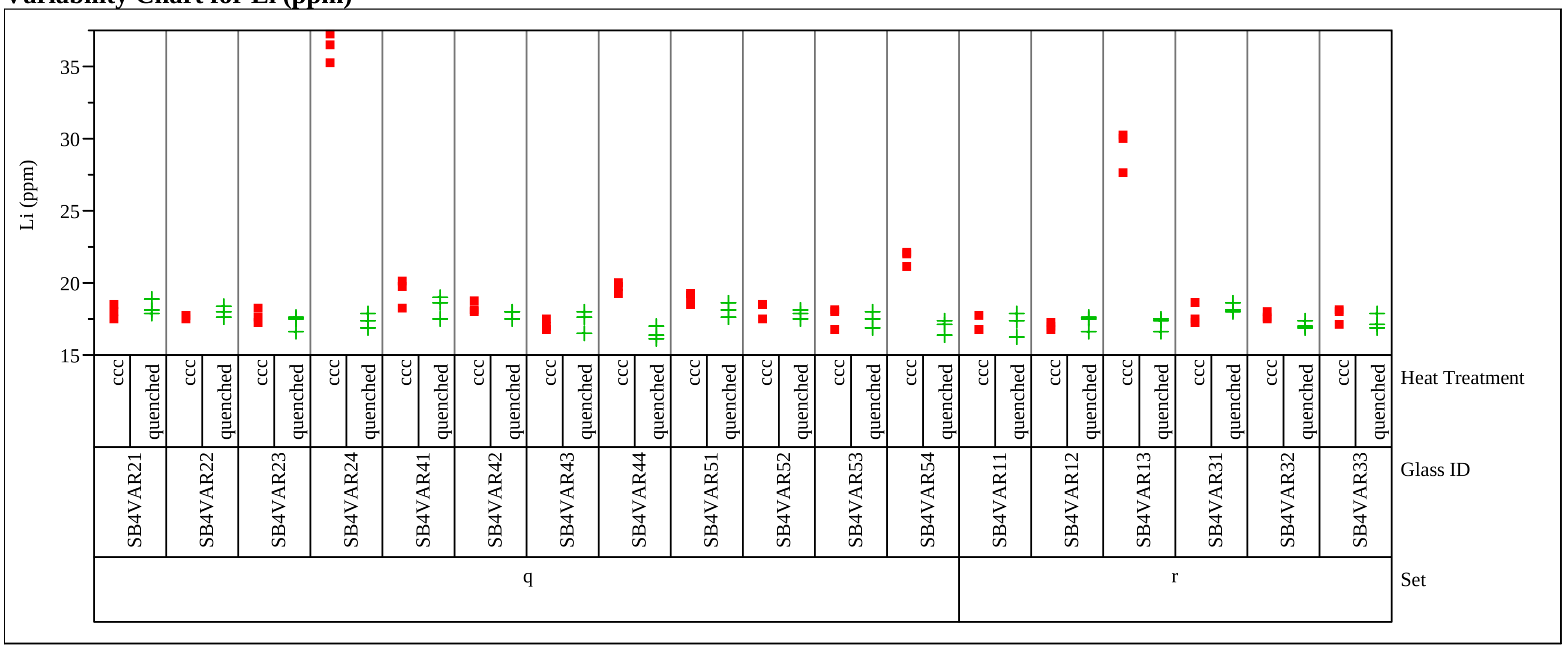


Exhibit B4. Laboratory PCT Measurements by Glass Identifier for Study Glasses

Variability Chart for Na (ppm)

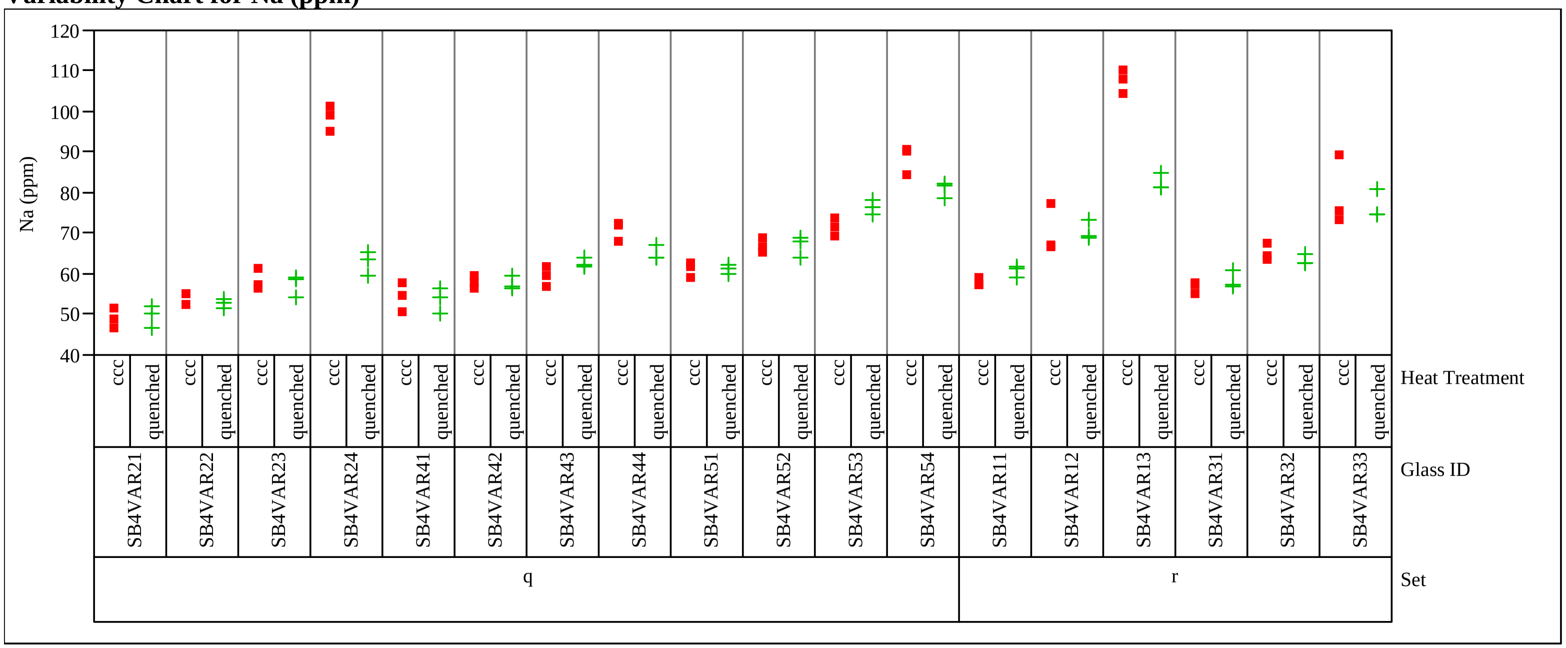


Exhibit B4. Laboratory PCT Measurements by Glass Identifier for Study Glasses

Variability Chart for Si (ppm)

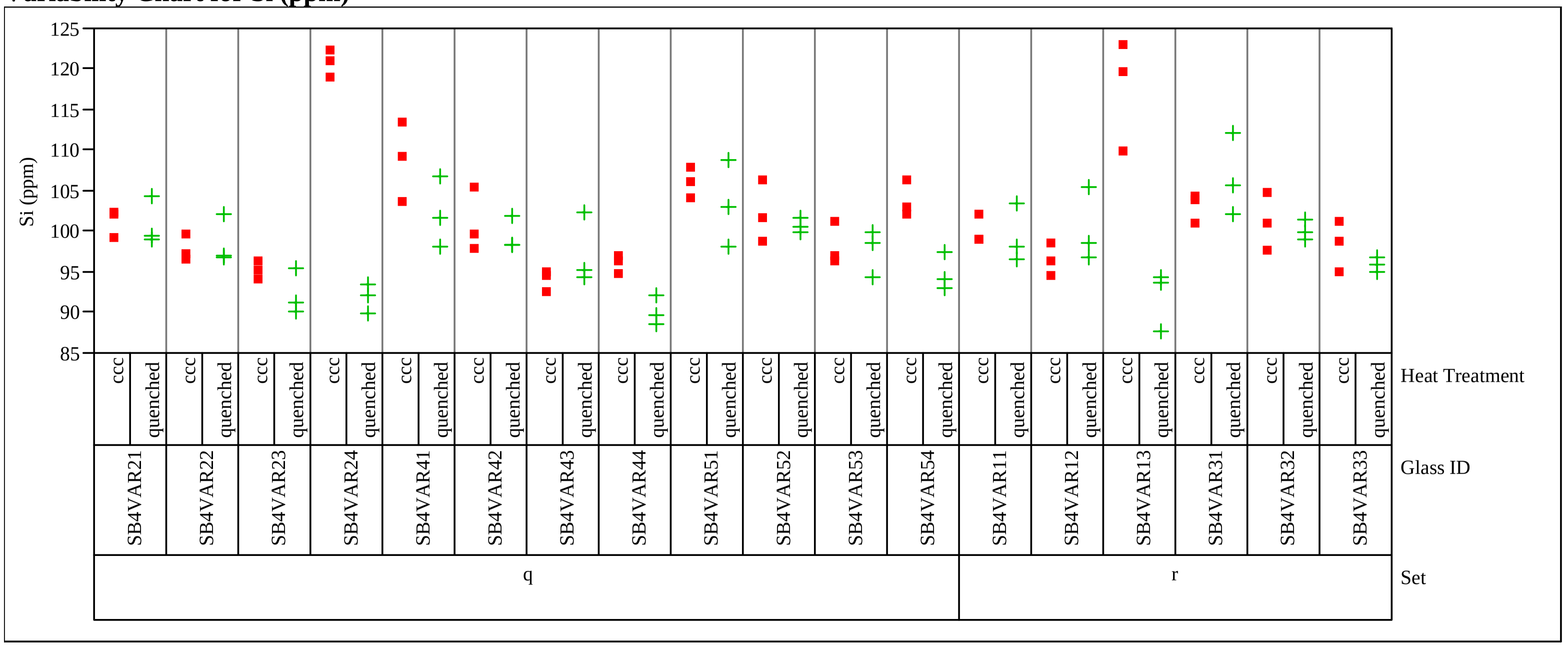


Exhibit B5. Correlations and Scatter Plots of Normalized PCTs Over All Compositional Views and Heat Treatments

Correlations

	log NL[B (g/L)]	log NL[Li(g/L)]	log NL[Na (g/L)]	log NL[Si (g/L)]
log NL[B (g/L)]	1.0000	0.9942	0.9820	0.9641
log NL[Li(g/L)]	0.9942	1.0000	0.9702	0.9529
log NL[Na (g/L)]	0.9820	0.9702	1.0000	0.9776
log NL[Si (g/L)]	0.9641	0.9529	0.9776	1.0000

Scatterplot Matrix

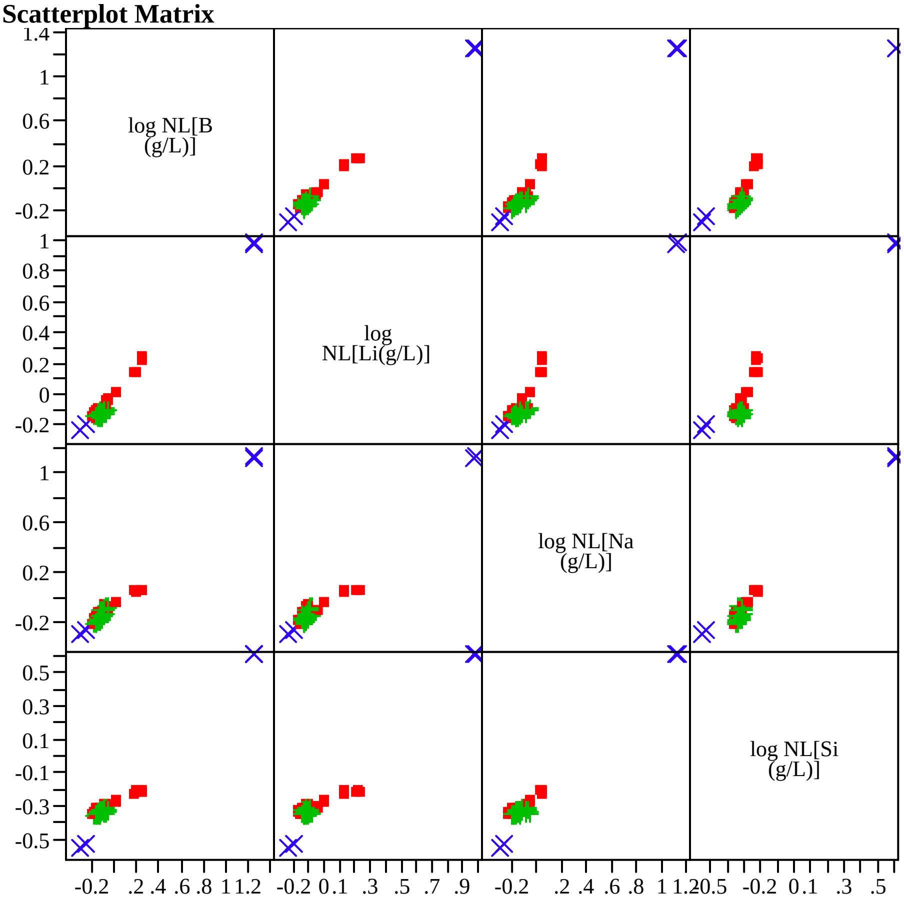
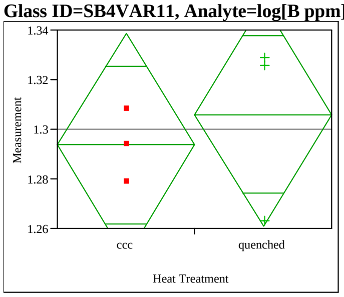


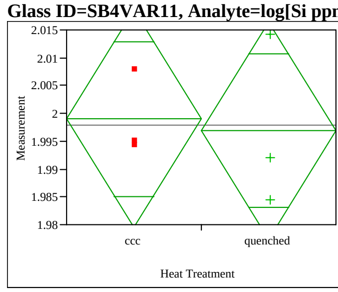
Exhibit B6. Effects of Heat Treatment on PCT log(ppm)-Response of Study Glasses

Glass ID=SB4VAR11, Analyte=log[B ppm]



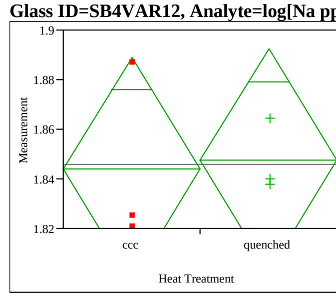
Difference	0.01242	t Ratio	0.539481
Std Err Dif	0.02302	DF	4
Upper CL Dif	0.07634	Prob > |t|	0.6182
Lower CL Dif	-0.05150	Prob > t	0.3091
Confidence	0.95	Prob < t	0.6909

Glass ID=SB4VAR11, Analyte=log[Si ppm]



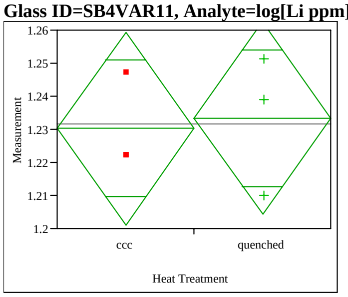
Difference	-0.00208	t Ratio	-0.20821
Std Err Dif	0.00998	DF	4
Upper CL Dif	0.02562	Prob > |t|	0.8452
Lower CL Dif	-0.02978	Prob > t	0.5774
Confidence	0.95	Prob < t	0.4226

Glass ID=SB4VAR12, Analyte=log[Na ppm]



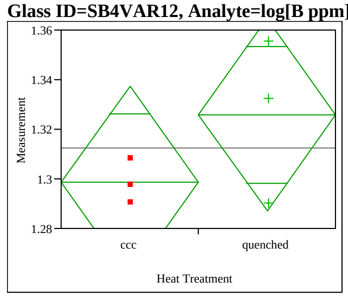
Difference	0.00330	t Ratio	0.143887
Std Err Dif	0.02290	DF	4
Upper CL Dif	0.06688	Prob > |t|	0.8925
Lower CL Dif	-0.06029	Prob > t	0.4463
Confidence	0.95	Prob < t	0.5537

Glass ID=SB4VAR11, Analyte=log[Li ppm]



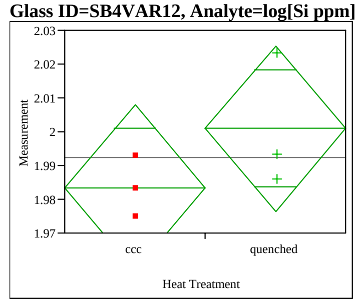
Difference	0.00307	t Ratio	0.206957
Std Err Dif	0.01486	DF	4
Upper CL Dif	0.04432	Prob > |t|	0.8462
Lower CL Dif	-0.03817	Prob > t	0.4231
Confidence	0.95	Prob < t	0.5769

Glass ID=SB4VAR12, Analyte=log[B ppm]



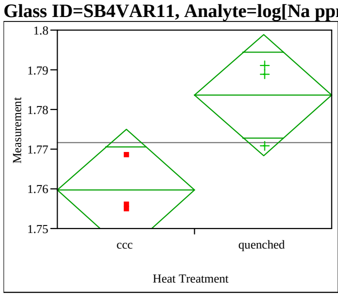
Difference	0.02741	t Ratio	1.380256
Std Err Dif	0.01986	DF	4
Upper CL Dif	0.08254	Prob > |t|	0.2396
Lower CL Dif	-0.02772	Prob > t	0.1198
Confidence	0.95	Prob < t	0.8802

Glass ID=SB4VAR12, Analyte=log[Si ppm]



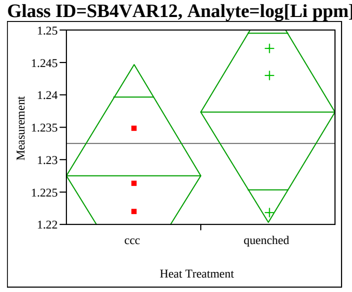
Difference	0.01744	t Ratio	1.393767
Std Err Dif	0.01251	DF	4
Upper CL Dif	0.05218	Prob > |t|	0.2358
Lower CL Dif	-0.01730	Prob > t	0.1179
Confidence	0.95	Prob < t	0.8821

Glass ID=SB4VAR11, Analyte=log[Na ppm]



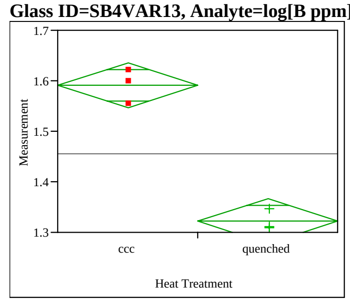
Difference	0.024027	t Ratio	3.082351
Std Err Dif	0.007795	DF	4
Upper CL Dif	0.045669	Prob > |t|	0.0368
Lower CL Dif	0.002385	Prob > t	0.0184
Confidence	0.95	Prob < t	0.9816

Glass ID=SB4VAR12, Analyte=log[Li ppm]



Difference	0.00978	t Ratio	1.124053
Std Err Dif	0.00870	DF	4
Upper CL Dif	0.03393	Prob > |t|	0.3239
Lower CL Dif	-0.01438	Prob > t	0.1619
Confidence	0.95	Prob < t	0.8381

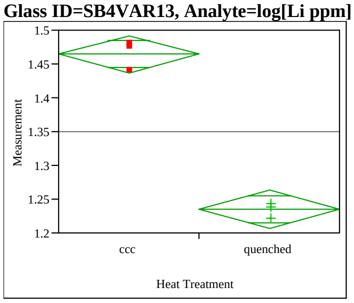
Glass ID=SB4VAR13, Analyte=log[B ppm]



Difference	-0.26895	t Ratio	-11.854
Std Err Dif	0.02269	DF	4
Upper CL Dif	-0.20595	Prob > |t|	0.0003
Lower CL Dif	-0.33194	Prob > t	0.9999
Confidence	0.95	Prob < t	0.0001

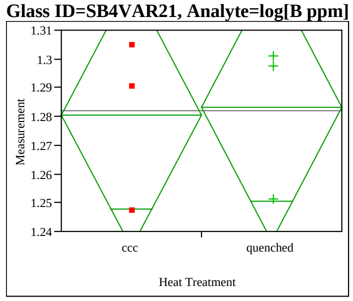
Exhibit B6. Effects of Heat Treatment on PCT log(ppm)-Response of Study Glasses

Glass ID=SB4VAR13, Analyte=log[Li ppm]



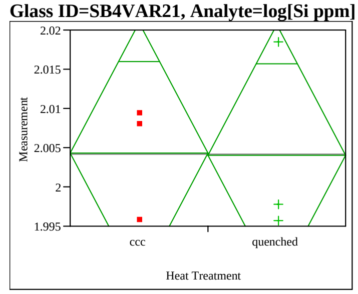
Difference	-0.22993	t Ratio	-16.1551
Std Err Dif	0.01423	DF	4
Upper CL Dif	-0.19041	Prob > |t|	<.0001
Lower CL Dif	-0.26945	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001

Glass ID=SB4VAR21, Analyte=log[B ppm]



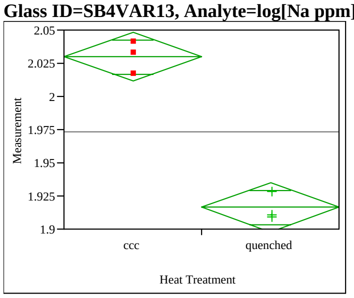
Difference	0.00261	t Ratio	0.110914
Std Err Dif	0.02355	DF	4
Upper CL Dif	0.06799	Prob > |t|	0.9170
Lower CL Dif	-0.06276	Prob > t	0.4585
Confidence	0.95	Prob < t	0.5415

Glass ID=SB4VAR21, Analyte=log[Si ppm]



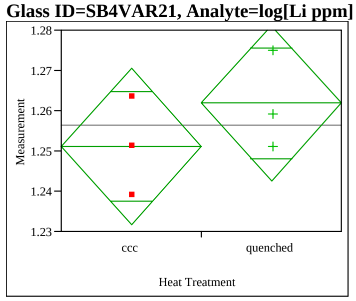
Difference	-0.00032	t Ratio	-0.03756
Std Err Dif	0.00846	DF	4
Upper CL Dif	0.02316	Prob > |t|	0.9718
Lower CL Dif	-0.02380	Prob > t	0.5141
Confidence	0.95	Prob < t	0.4859

Glass ID=SB4VAR13, Analyte=log[Na ppm]



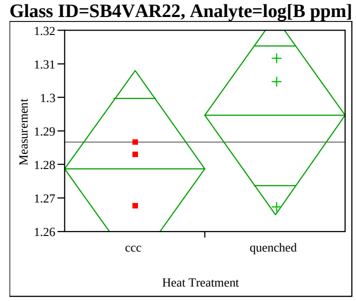
Difference	-0.11335	t Ratio	-12.0511
Std Err Dif	0.00941	DF	4
Upper CL Dif	-0.08724	Prob > |t|	0.0003
Lower CL Dif	-0.13946	Prob > t	0.9999
Confidence	0.95	Prob < t	0.0001

Glass ID=SB4VAR21, Analyte=log[Li ppm]



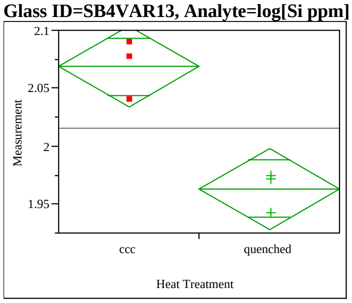
Difference	0.01069	t Ratio	1.081002
Std Err Dif	0.00989	DF	4
Upper CL Dif	0.03816	Prob > |t|	0.3405
Lower CL Dif	-0.01677	Prob > t	0.1703
Confidence	0.95	Prob < t	0.8297

Glass ID=SB4VAR22, Analyte=log[B ppm]



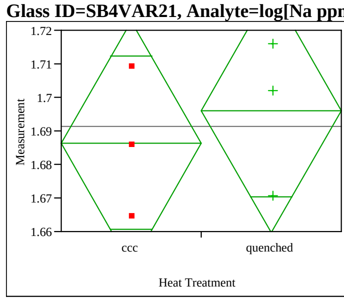
Difference	0.01584	t Ratio	1.055237
Std Err Dif	0.01502	DF	4
Upper CL Dif	0.05753	Prob > |t|	0.3508
Lower CL Dif	-0.02584	Prob > t	0.1754
Confidence	0.95	Prob < t	0.8246

Glass ID=SB4VAR13, Analyte=log[Si ppm]



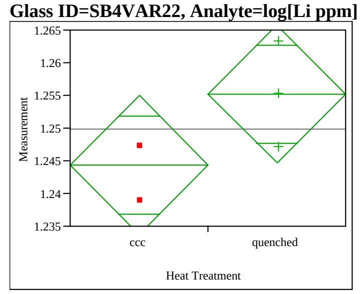
Difference	-0.10569	t Ratio	-5.89922
Std Err Dif	0.01792	DF	4
Upper CL Dif	-0.05595	Prob > |t|	0.0041
Lower CL Dif	-0.15543	Prob > t	0.9979
Confidence	0.95	Prob < t	0.0021

Glass ID=SB4VAR21, Analyte=log[Na ppm]



Difference	0.00979	t Ratio	0.525625
Std Err Dif	0.01862	DF	4
Upper CL Dif	0.06147	Prob > |t|	0.6269
Lower CL Dif	-0.04190	Prob > t	0.3135
Confidence	0.95	Prob < t	0.6865

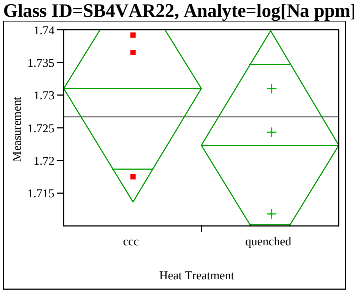
Glass ID=SB4VAR22, Analyte=log[Li ppm]



Difference	0.01083	t Ratio	2.004426
Std Err Dif	0.00540	DF	4
Upper CL Dif	0.02582	Prob > |t|	0.1155
Lower CL Dif	-0.00417	Prob > t	0.0578
Confidence	0.95	Prob < t	0.9422

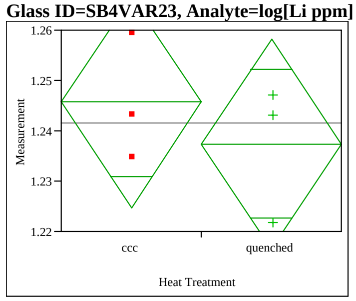
Exhibit B6. Effects of Heat Treatment on PCT log(ppm)-Response of Study Glasses

Glass ID=SB4VAR22, Analyte=log[Na ppm]



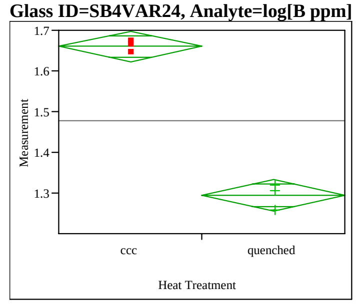
Difference	-0.00857	t Ratio	-0.96838
Std Err Dif	0.00885	DF	4
Upper CL Dif	0.01599	Prob > |t|	0.3877
Lower CL Dif	-0.03313	Prob > t	0.8062
Confidence	0.95	Prob < t	0.1938

Glass ID=SB4VAR23, Analyte=log[Li ppm]



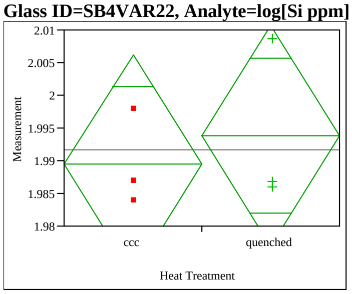
Difference	-0.00832	t Ratio	-0.78063
Std Err Dif	0.01066	DF	4
Upper CL Dif	0.02127	Prob > |t|	0.4786
Lower CL Dif	-0.03791	Prob > t	0.7607
Confidence	0.95	Prob < t	0.2393

Glass ID=SB4VAR24, Analyte=log[B ppm]



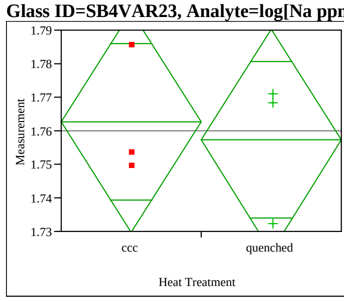
Difference	-0.36576	t Ratio	-18.6495
Std Err Dif	0.01961	DF	4
Upper CL Dif	-0.31131	Prob > |t|	<.0001
Lower CL Dif	-0.42021	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001

Glass ID=SB4VAR22, Analyte=log[Si ppm]



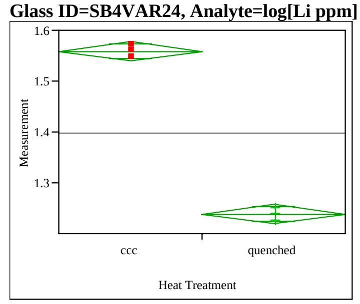
Difference	0.00434	t Ratio	0.507958
Std Err Dif	0.00855	DF	4
Upper CL Dif	0.02807	Prob > |t|	0.6382
Lower CL Dif	-0.01939	Prob > t	0.3191
Confidence	0.95	Prob < t	0.6809

Glass ID=SB4VAR23, Analyte=log[Na ppm]



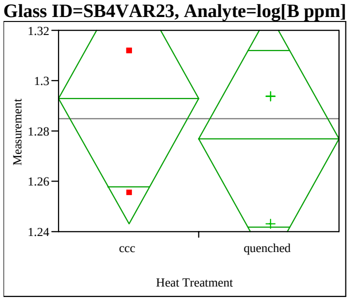
Difference	-0.00550	t Ratio	-0.32656
Std Err Dif	0.01684	DF	4
Upper CL Dif	0.04126	Prob > |t|	0.7604
Lower CL Dif	-0.05226	Prob > t	0.6198
Confidence	0.95	Prob < t	0.3802

Glass ID=SB4VAR24, Analyte=log[Li ppm]



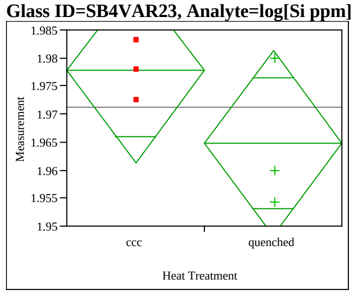
Difference	-0.32010	t Ratio	-31.8581
Std Err Dif	0.01005	DF	4
Upper CL Dif	-0.29220	Prob > |t|	<.0001
Lower CL Dif	-0.34800	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001

Glass ID=SB4VAR23, Analyte=log[B ppm]



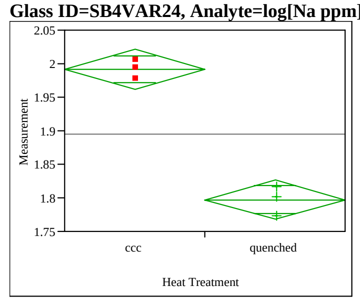
Difference	-0.01609	t Ratio	-0.63616
Std Err Dif	0.02530	DF	4
Upper CL Dif	0.05414	Prob > |t|	0.5593
Lower CL Dif	-0.08633	Prob > t	0.7204
Confidence	0.95	Prob < t	0.2796

Glass ID=SB4VAR23, Analyte=log[Si ppm]



Difference	-0.01301	t Ratio	-1.54718
Std Err Dif	0.00841	DF	4
Upper CL Dif	0.01033	Prob > |t|	0.1967
Lower CL Dif	-0.03635	Prob > t	0.9016
Confidence	0.95	Prob < t	0.0984

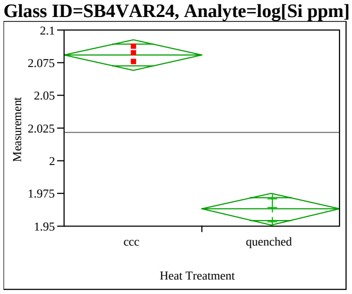
Glass ID=SB4VAR24, Analyte=log[Na ppm]



Difference	-0.19452	t Ratio	-13.0505
Std Err Dif	0.01490	DF	4
Upper CL Dif	-0.15313	Prob > |t|	0.0002
Lower CL Dif	-0.23590	Prob > t	0.9999
Confidence	0.95	Prob < t	<.0001

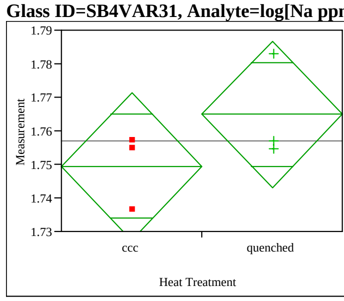
Exhibit B6. Effects of Heat Treatment on PCT log(ppm)-Response of Study Glasses

Glass ID=SB4VAR24, Analyte=log[Si ppm]



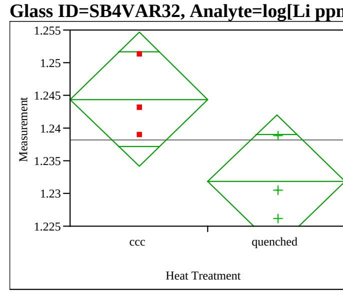
Difference	-0.11802	t Ratio	-19.4577
Std Err Dif	0.00607	DF	4
Upper CL Dif	-0.10118	Prob > |t|	<.0001
Lower CL Dif	-0.13486	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001

Glass ID=SB4VAR31, Analyte=log[Na ppm]



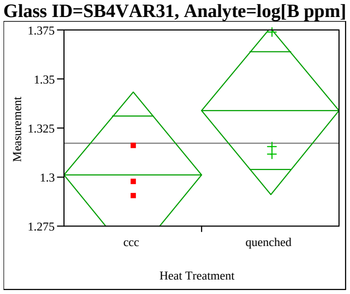
Difference	0.01552	t Ratio	1.389704
Std Err Dif	0.01117	DF	4
Upper CL Dif	0.04652	Prob > |t|	0.2370
Lower CL Dif	-0.01548	Prob > t	0.1185
Confidence	0.95	Prob < t	0.8815

Glass ID=SB4VAR32, Analyte=log[Li ppm]



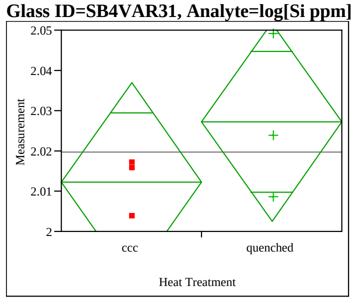
Difference	-0.01255	t Ratio	-2.41045
Std Err Dif	0.00521	DF	4
Upper CL Dif	0.00191	Prob > |t|	0.0735
Lower CL Dif	-0.02701	Prob > t	0.9632
Confidence	0.95	Prob < t	0.0368

Glass ID=SB4VAR31, Analyte=log[B ppm]



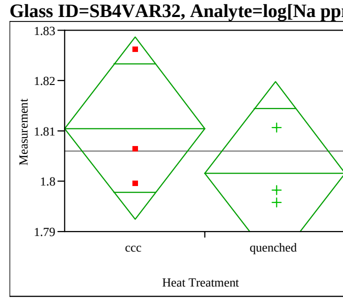
Difference	0.03282	t Ratio	1.521106
Std Err Dif	0.02158	DF	4
Upper CL Dif	0.09273	Prob > |t|	0.2029
Lower CL Dif	-0.02709	Prob > t	0.1014
Confidence	0.95	Prob < t	0.8986

Glass ID=SB4VAR31, Analyte=log[Si ppm]



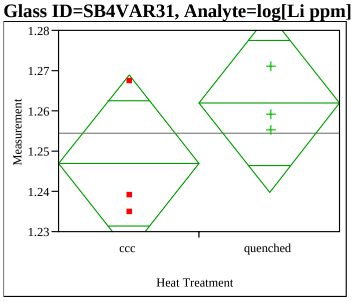
Difference	0.01516	t Ratio	1.204516
Std Err Dif	0.01259	DF	4
Upper CL Dif	0.05010	Prob > |t|	0.2948
Lower CL Dif	-0.01978	Prob > t	0.1474
Confidence	0.95	Prob < t	0.8526

Glass ID=SB4VAR32, Analyte=log[Na ppm]



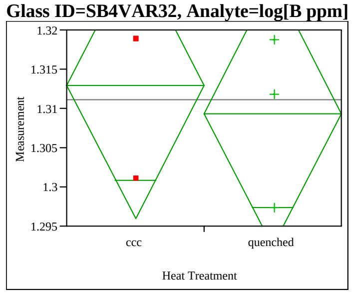
Difference	-0.00895	t Ratio	-0.96814
Std Err Dif	0.00924	DF	4
Upper CL Dif	0.01671	Prob > |t|	0.3878
Lower CL Dif	-0.03461	Prob > t	0.8061
Confidence	0.95	Prob < t	0.1939

Glass ID=SB4VAR31, Analyte=log[Li ppm]



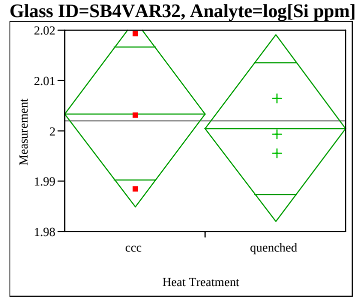
Difference	0.01496	t Ratio	1.329729
Std Err Dif	0.01125	DF	4
Upper CL Dif	0.04619	Prob > |t|	0.2544
Lower CL Dif	-0.01627	Prob > t	0.1272
Confidence	0.95	Prob < t	0.8728

Glass ID=SB4VAR32, Analyte=log[B ppm]



Difference	-0.00355	t Ratio	-0.41099
Std Err Dif	0.00863	DF	4
Upper CL Dif	0.02041	Prob > |t|	0.7021
Lower CL Dif	-0.02750	Prob > t	0.6489
Confidence	0.95	Prob < t	0.3511

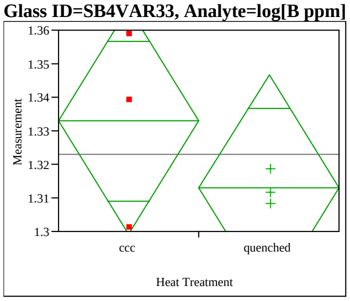
Glass ID=SB4VAR32, Analyte=log[Si ppm]



Difference	-0.00296	t Ratio	-0.31306
Std Err Dif	0.00946	DF	4
Upper CL Dif	0.02331	Prob > |t|	0.7699
Lower CL Dif	-0.02923	Prob > t	0.6151
Confidence	0.95	Prob < t	0.3849

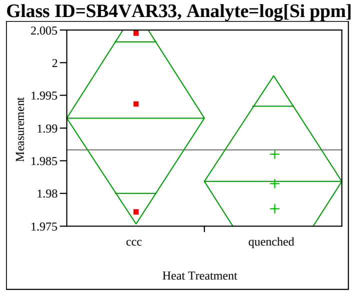
Exhibit B6. Effects of Heat Treatment on PCT log(ppm)-Response of Study Glasses

Glass ID=SB4VAR33, Analyte=log[B ppm]



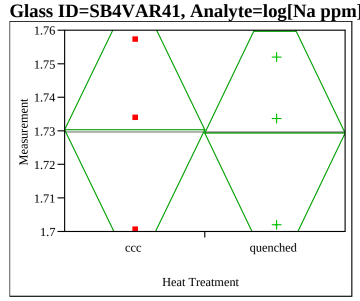
Difference	-0.02000	t Ratio	-1.1641
Std Err Dif	0.01718	DF	4
Upper CL Dif	0.02770	Prob > |t|	0.3091
Lower CL Dif	-0.06770	Prob > t	0.8455
Confidence	0.95	Prob < t	0.1545

Glass ID=SB4VAR33, Analyte=log[Si ppm]



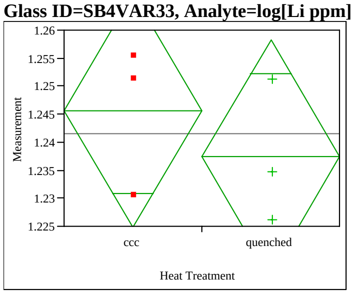
Difference	-0.00982	t Ratio	-1.18187
Std Err Dif	0.00831	DF	4
Upper CL Dif	0.01325	Prob > |t|	0.3027
Lower CL Dif	-0.03288	Prob > t	0.8486
Confidence	0.95	Prob < t	0.1514

Glass ID=SB4VAR41, Analyte=log[Na ppm]



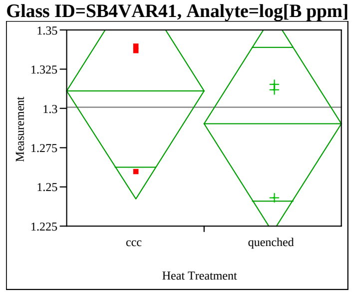
Difference	-0.00122	t Ratio	-0.05525
Std Err Dif	0.02204	DF	4
Upper CL Dif	0.05999	Prob > |t|	0.9586
Lower CL Dif	-0.06242	Prob > t	0.5207
Confidence	0.95	Prob < t	0.4793

Glass ID=SB4VAR33, Analyte=log[Li ppm]



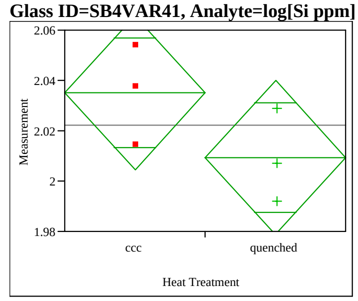
Difference	-0.00829	t Ratio	-0.77877
Std Err Dif	0.01064	DF	4
Upper CL Dif	0.02126	Prob > |t|	0.4796
Lower CL Dif	-0.03784	Prob > t	0.7602
Confidence	0.95	Prob < t	0.2398

Glass ID=SB4VAR41, Analyte=log[B ppm]



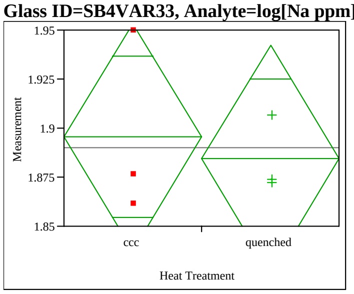
Difference	-0.02138	t Ratio	-0.60875
Std Err Dif	0.03511	DF	4
Upper CL Dif	0.07611	Prob > |t|	0.5756
Lower CL Dif	-0.11886	Prob > t	0.7122
Confidence	0.95	Prob < t	0.2878

Glass ID=SB4VAR41, Analyte=log[Si ppm]



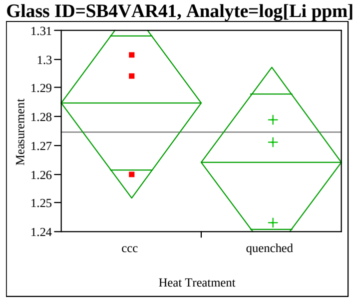
Difference	-0.02585	t Ratio	-1.65185
Std Err Dif	0.01565	DF	4
Upper CL Dif	0.01760	Prob > |t|	0.1739
Lower CL Dif	-0.06929	Prob > t	0.9130
Confidence	0.95	Prob < t	0.0870

Glass ID=SB4VAR33, Analyte=log[Na ppm]



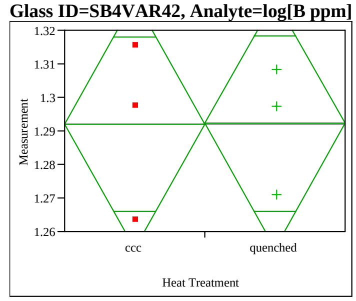
Difference	-0.01127	t Ratio	-0.38263
Std Err Dif	0.02945	DF	4
Upper CL Dif	0.07050	Prob > |t|	0.7215
Lower CL Dif	-0.09303	Prob > t	0.6393
Confidence	0.95	Prob < t	0.3607

Glass ID=SB4VAR41, Analyte=log[Li ppm]



Difference	-0.02039	t Ratio	-1.211
Std Err Dif	0.01684	DF	4
Upper CL Dif	0.02636	Prob > |t|	0.2926
Lower CL Dif	-0.06715	Prob > t	0.8537
Confidence	0.95	Prob < t	0.1463

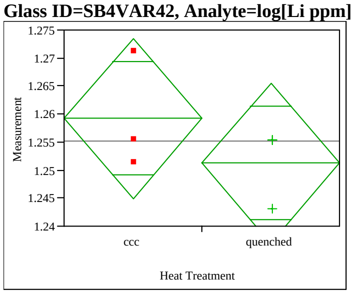
Glass ID=SB4VAR42, Analyte=log[B ppm]



Difference	0.00025	t Ratio	0.013515
Std Err Dif	0.01883	DF	4
Upper CL Dif	0.05254	Prob > |t|	0.9899
Lower CL Dif	-0.05203	Prob > t	0.4949
Confidence	0.95	Prob < t	0.5051

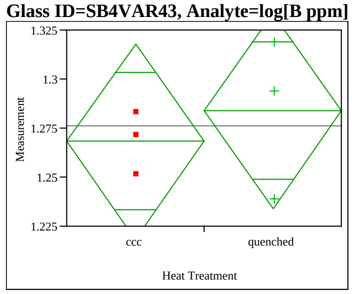
Exhibit B6. Effects of Heat Treatment on PCT log(ppm)-Response of Study Glasses

Glass ID=SB4VAR42, Analyte=log[Li ppm]



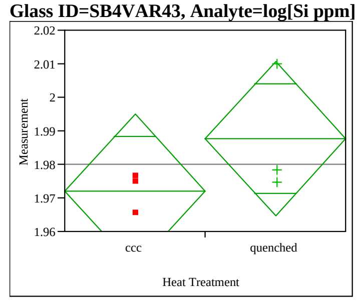
Difference	-0.00800	t Ratio	-1.09576
Std Err Dif	0.00730	DF	4
Upper CL Dif	0.01226	Prob > |t|	0.3347
Lower CL Dif	-0.02826	Prob > t	0.8326
Confidence	0.95	Prob < t	0.1674

Glass ID=SB4VAR43, Analyte=log[B ppm]



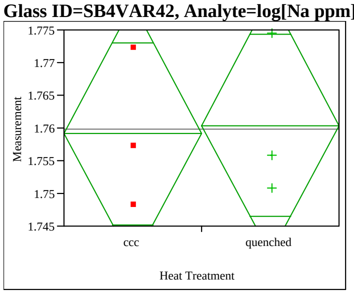
Difference	0.01551	t Ratio	0.613009
Std Err Dif	0.02530	DF	4
Upper CL Dif	0.08575	Prob > |t|	0.5730
Lower CL Dif	-0.05473	Prob > t	0.2865
Confidence	0.95	Prob < t	0.7135

Glass ID=SB4VAR43, Analyte=log[Si ppm]



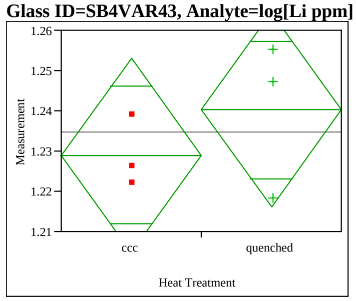
Difference	0.01565	t Ratio	1.337219
Std Err Dif	0.01170	DF	4
Upper CL Dif	0.04814	Prob > |t|	0.2521
Lower CL Dif	-0.01684	Prob > t	0.1261
Confidence	0.95	Prob < t	0.8739

Glass ID=SB4VAR42, Analyte=log[Na ppm]



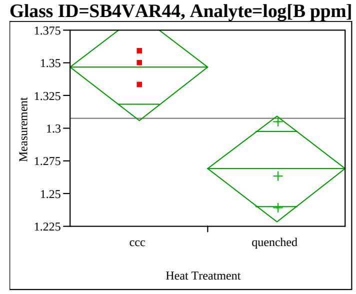
Difference	0.00125	t Ratio	0.124572
Std Err Dif	0.01003	DF	4
Upper CL Dif	0.02910	Prob > |t|	0.9069
Lower CL Dif	-0.02660	Prob > t	0.4534
Confidence	0.95	Prob < t	0.5466

Glass ID=SB4VAR43, Analyte=log[Li ppm]



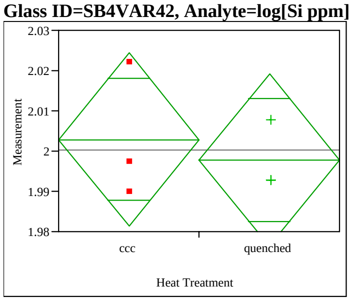
Difference	0.01130	t Ratio	0.917546
Std Err Dif	0.01231	DF	4
Upper CL Dif	0.04548	Prob > |t|	0.4108
Lower CL Dif	-0.02288	Prob > t	0.2054
Confidence	0.95	Prob < t	0.7946

Glass ID=SB4VAR44, Analyte=log[B ppm]



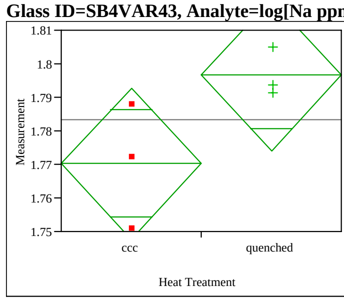
Difference	-0.07773	t Ratio	-3.76378
Std Err Dif	0.02065	DF	4
Upper CL Dif	-0.02039	Prob > |t|	0.0197
Lower CL Dif	-0.13508	Prob > t	0.9901
Confidence	0.95	Prob < t	0.0099

Glass ID=SB4VAR42, Analyte=log[Si ppm]



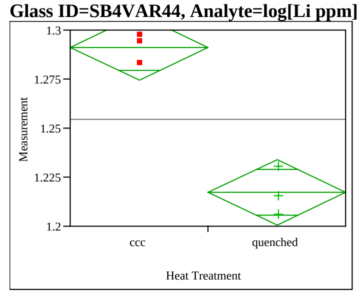
Difference	-0.00514	t Ratio	-0.46923
Std Err Dif	0.01096	DF	4
Upper CL Dif	0.02529	Prob > |t|	0.6633
Lower CL Dif	-0.03557	Prob > t	0.6683
Confidence	0.95	Prob < t	0.3317

Glass ID=SB4VAR43, Analyte=log[Na ppm]



Difference	0.02643	t Ratio	2.293333
Std Err Dif	0.01152	DF	4
Upper CL Dif	0.05843	Prob > |t|	0.0835
Lower CL Dif	-0.00557	Prob > t	0.0418
Confidence	0.95	Prob < t	0.9582

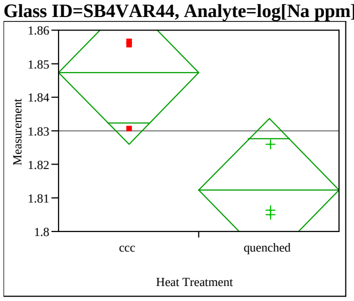
Glass ID=SB4VAR44, Analyte=log[Li ppm]



Difference	-0.07400	t Ratio	-8.78293
Std Err Dif	0.00843	DF	4
Upper CL Dif	-0.05061	Prob > |t|	0.0009
Lower CL Dif	-0.09740	Prob > t	0.9995
Confidence	0.95	Prob < t	0.0005

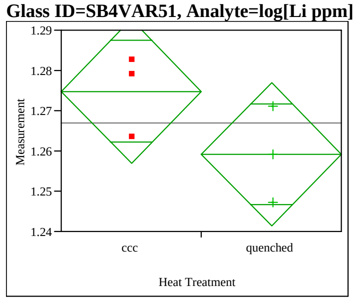
Exhibit B6. Effects of Heat Treatment on PCT log(ppm)-Response of Study Glasses

Glass ID=SB4VAR44, Analyte=log[Na ppm]



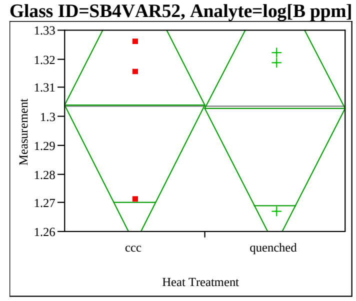
Difference	-0.03491	t Ratio	-3.20437
Std Err Dif	0.01089	DF	4
Upper CL Dif	-0.00466	Prob > |t|	0.0328
Lower CL Dif	-0.06515	Prob > t	0.9836
Confidence	0.95	Prob < t	0.0164

Glass ID=SB4VAR51, Analyte=log[Li ppm]



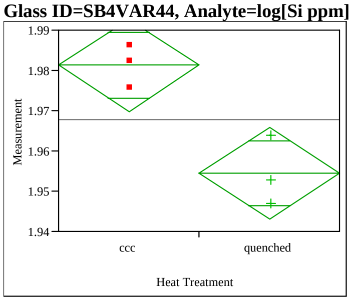
Difference	-0.01568	t Ratio	-1.72624
Std Err Dif	0.00908	DF	4
Upper CL Dif	0.00954	Prob > |t|	0.1594
Lower CL Dif	-0.04090	Prob > t	0.9203
Confidence	0.95	Prob < t	0.0797

Glass ID=SB4VAR52, Analyte=log[B ppm]



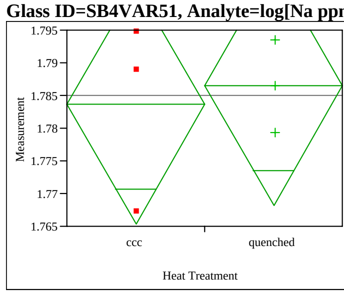
Difference	-0.00128	t Ratio	-0.05239
Std Err Dif	0.02443	DF	4
Upper CL Dif	0.06655	Prob > |t|	0.9607
Lower CL Dif	-0.06911	Prob > t	0.5196
Confidence	0.95	Prob < t	0.4804

Glass ID=SB4VAR44, Analyte=log[Si ppm]



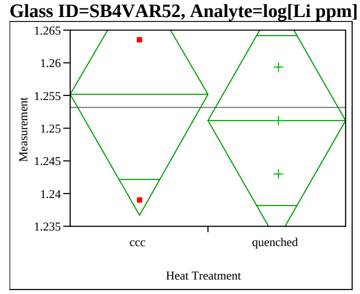
Difference	-0.02679	t Ratio	-4.58805
Std Err Dif	0.00584	DF	4
Upper CL Dif	-0.01058	Prob > |t|	0.0101
Lower CL Dif	-0.04300	Prob > t	0.9949
Confidence	0.95	Prob < t	0.0051

Glass ID=SB4VAR51, Analyte=log[Na ppm]



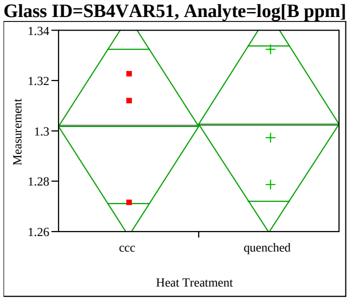
Difference	0.00289	t Ratio	0.309871
Std Err Dif	0.00933	DF	4
Upper CL Dif	0.02881	Prob > |t|	0.7721
Lower CL Dif	-0.02302	Prob > t	0.3861
Confidence	0.95	Prob < t	0.6139

Glass ID=SB4VAR52, Analyte=log[Li ppm]



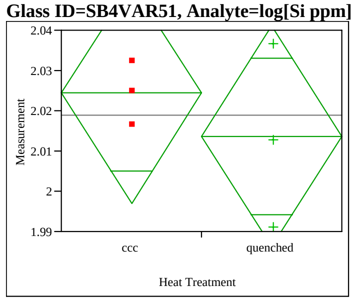
Difference	-0.00394	t Ratio	-0.42021
Std Err Dif	0.00938	DF	4
Upper CL Dif	0.02209	Prob > |t|	0.6959
Lower CL Dif	-0.02997	Prob > t	0.6520
Confidence	0.95	Prob < t	0.3480

Glass ID=SB4VAR51, Analyte=log[B ppm]



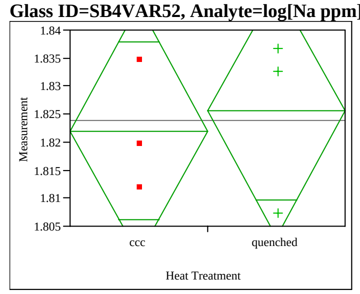
Difference	0.00118	t Ratio	0.053367
Std Err Dif	0.02216	DF	4
Upper CL Dif	0.06271	Prob > |t|	0.9600
Lower CL Dif	-0.06034	Prob > t	0.4800
Confidence	0.95	Prob < t	0.5200

Glass ID=SB4VAR51, Analyte=log[Si ppm]



Difference	-0.01074	t Ratio	-0.77174
Std Err Dif	0.01391	DF	4
Upper CL Dif	0.02789	Prob > |t|	0.4833
Lower CL Dif	-0.04937	Prob > t	0.7583
Confidence	0.95	Prob < t	0.2417

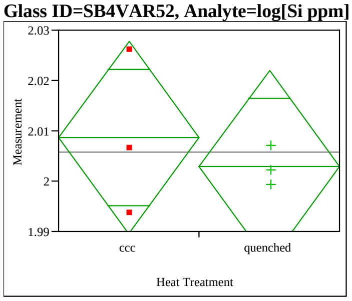
Glass ID=SB4VAR52, Analyte=log[Na ppm]



Difference	0.00353	t Ratio	0.310347
Std Err Dif	0.01137	DF	4
Upper CL Dif	0.03511	Prob > |t|	0.7718
Lower CL Dif	-0.02805	Prob > t	0.3859
Confidence	0.95	Prob < t	0.6141

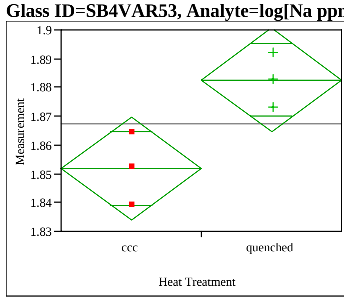
Exhibit B6. Effects of Heat Treatment on PCT log(ppm)-Response of Study Glasses

Glass ID=SB4VAR52, Analyte=log[Si ppm]



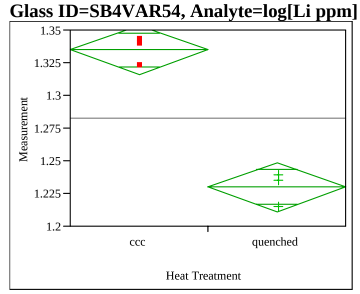
Difference	-0.00576	t Ratio	-0.59124
Std Err Dif	0.00974	DF	4
Upper CL Dif	0.02128	Prob > |t|	0.5862
Lower CL Dif	-0.03279	Prob > t	0.7069
Confidence	0.95	Prob < t	0.2931

Glass ID=SB4VAR53, Analyte=log[Na ppm]



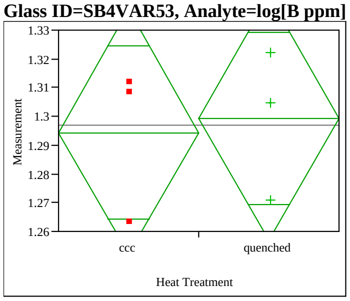
Difference	0.030832	t Ratio	3.362631
Std Err Dif	0.009169	DF	4
Upper CL Dif	0.056290	Prob > |t|	0.0282
Lower CL Dif	0.005375	Prob > t	0.0141
Confidence	0.95	Prob < t	0.9859

Glass ID=SB4VAR54, Analyte=log[Li ppm]



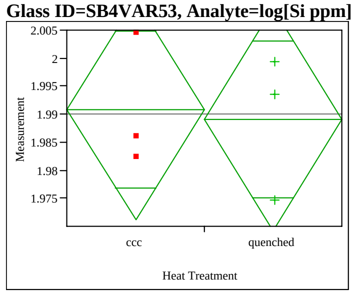
Difference	-0.10497	t Ratio	-10.9453
Std Err Dif	0.00959	DF	4
Upper CL Dif	-0.07834	Prob > |t|	0.0004
Lower CL Dif	-0.13160	Prob > t	0.9998
Confidence	0.95	Prob < t	0.0002

Glass ID=SB4VAR53, Analyte=log[B ppm]



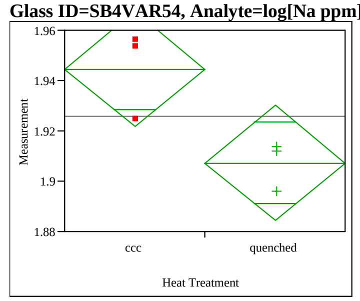
Difference	0.00491	t Ratio	0.22653
Std Err Dif	0.02165	DF	4
Upper CL Dif	0.06503	Prob > |t|	0.8319
Lower CL Dif	-0.05522	Prob > t	0.4159
Confidence	0.95	Prob < t	0.5841

Glass ID=SB4VAR53, Analyte=log[Si ppm]



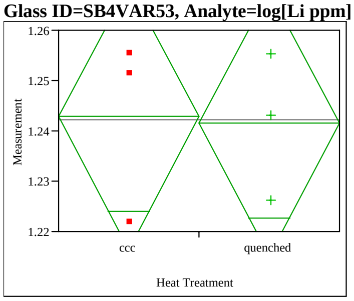
Difference	-0.00175	t Ratio	-0.17338
Std Err Dif	0.01008	DF	4
Upper CL Dif	0.02623	Prob > |t|	0.8708
Lower CL Dif	-0.02972	Prob > t	0.5646
Confidence	0.95	Prob < t	0.4354

Glass ID=SB4VAR54, Analyte=log[Na ppm]



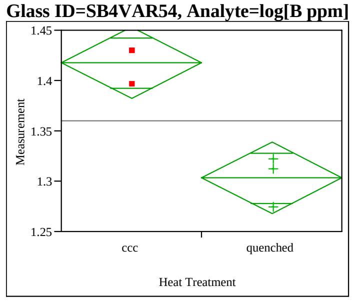
Difference	-0.03731	t Ratio	-3.20101
Std Err Dif	0.01165	DF	4
Upper CL Dif	-0.00495	Prob > |t|	0.0329
Lower CL Dif	-0.06966	Prob > t	0.9836
Confidence	0.95	Prob < t	0.0164

Glass ID=SB4VAR53, Analyte=log[Li ppm]



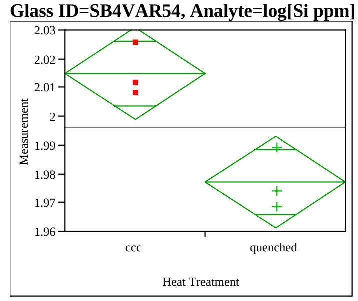
Difference	-0.00129	t Ratio	-0.09567
Std Err Dif	0.01349	DF	4
Upper CL Dif	0.03618	Prob > |t|	0.9284
Lower CL Dif	-0.03876	Prob > t	0.5358
Confidence	0.95	Prob < t	0.4642

Glass ID=SB4VAR54, Analyte=log[B ppm]



Difference	-0.11449	t Ratio	-6.28923
Std Err Dif	0.01820	DF	4
Upper CL Dif	-0.06395	Prob > |t|	0.0033
Lower CL Dif	-0.16504	Prob > t	0.9984
Confidence	0.95	Prob < t	0.0016

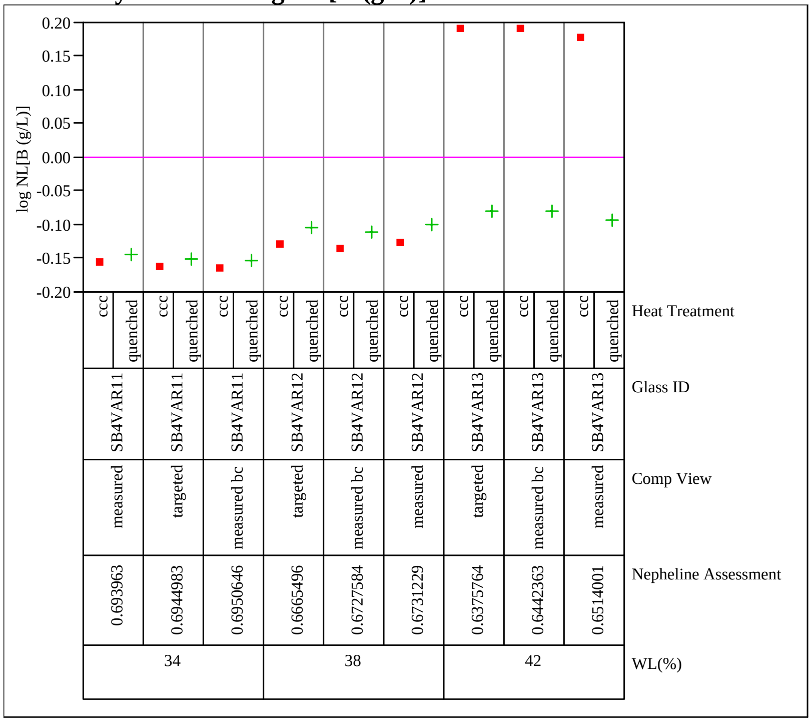
Glass ID=SB4VAR54, Analyte=log[Si ppm]



Difference	-0.03775	t Ratio	-4.64811
Std Err Dif	0.00812	DF	4
Upper CL Dif	-0.01520	Prob > |t|	0.0097
Lower CL Dif	-0.06029	Prob > t	0.9952
Confidence	0.95	Prob < t	0.0048

Exhibit B7. Effects of Heat Treatment for Study Glasses by Compositional View

Sludge Case=Case 1
Variability Chart for log NL[B (g/L)]



Sludge Case=Case 1
Variability Chart for log NL[Li(g/L)]

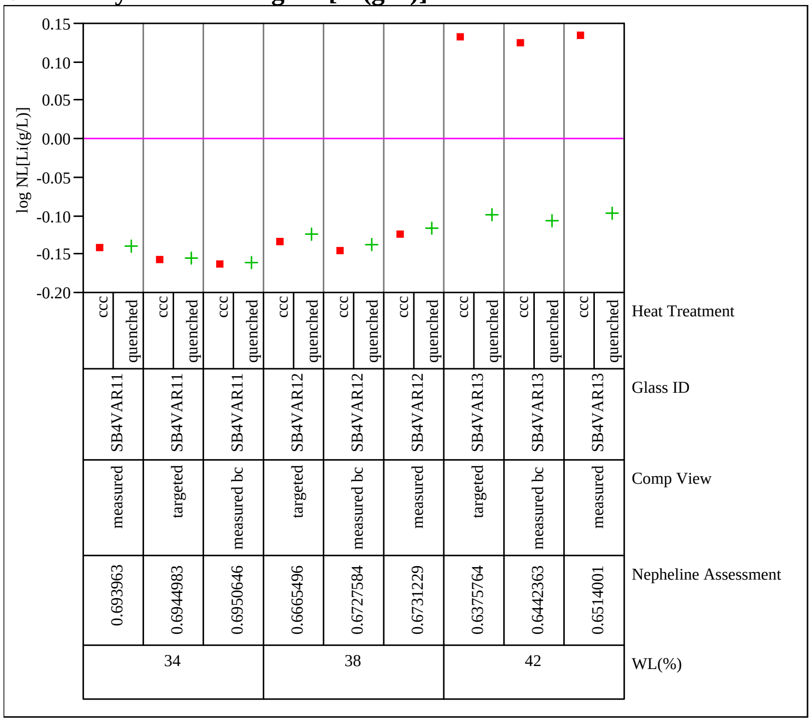
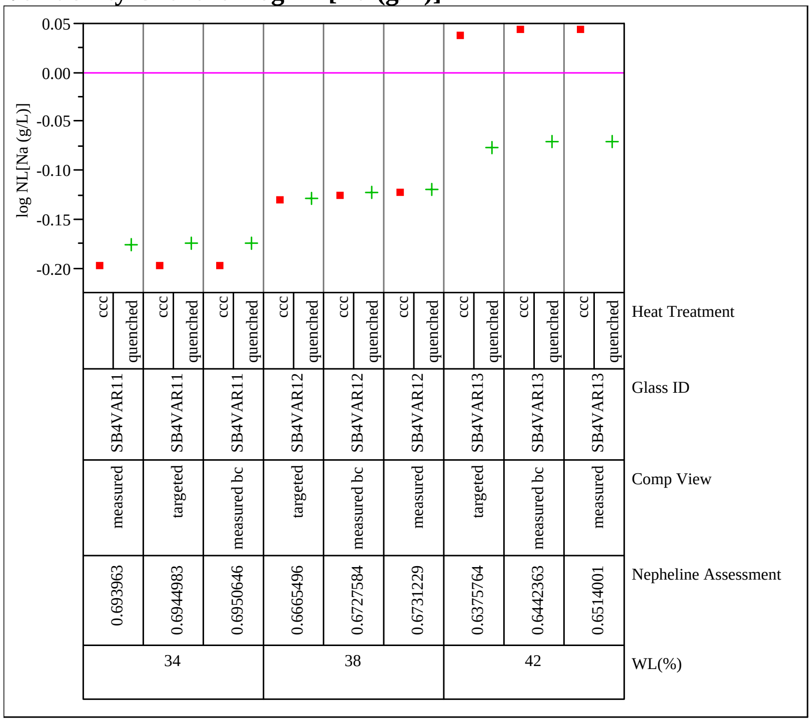


Exhibit B7. Effects of Heat Treatment for Study Glasses by Compositional View

Sludge Case=Case 1
Variability Chart for log NL[Na (g/L)]



Sludge Case=Case 1
Variability Chart for log NL[Si (g/L)]

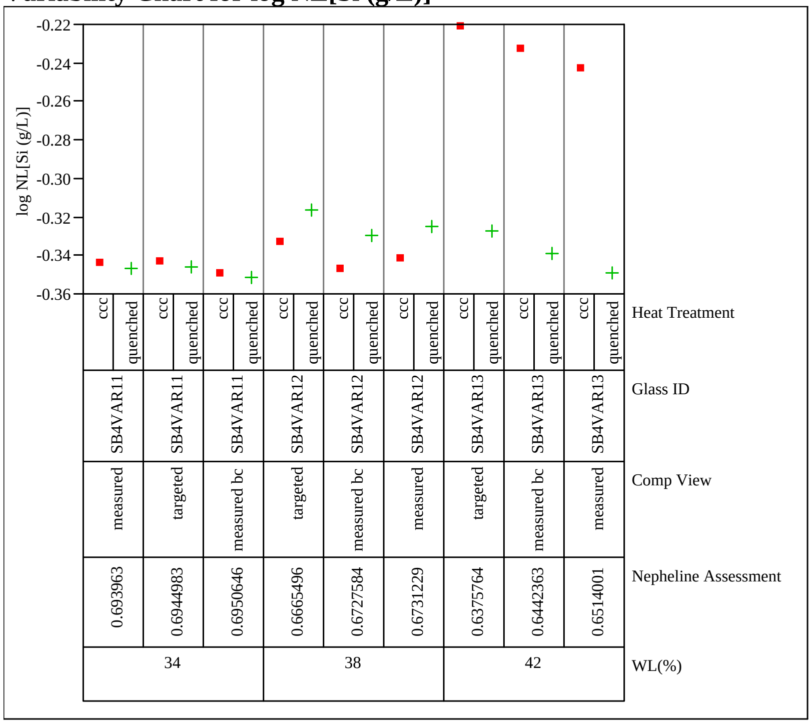
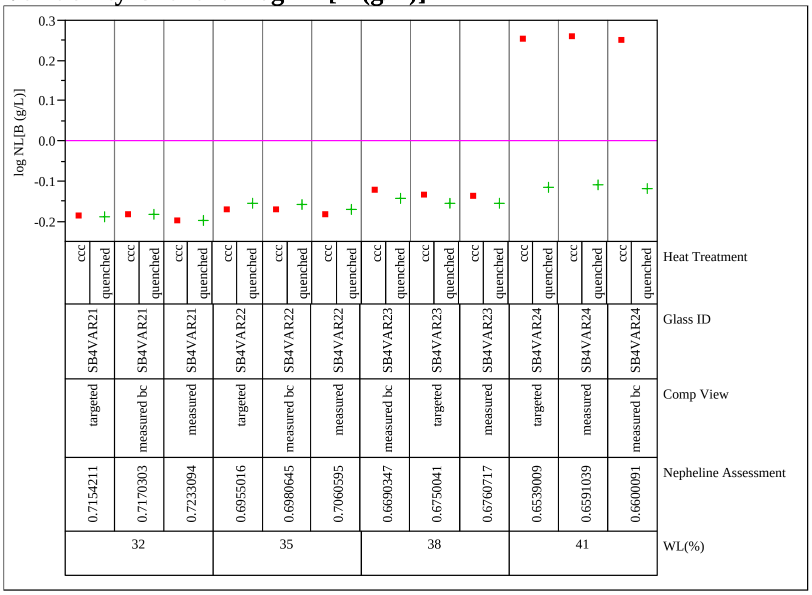


Exhibit B7. Effects of Heat Treatment for Study Glasses by Compositional View

Sludge Case=Case 2
Variability Chart for log NL[B (g/L)]



Sludge Case=Case 2
Variability Chart for log NL[Li(g/L)]

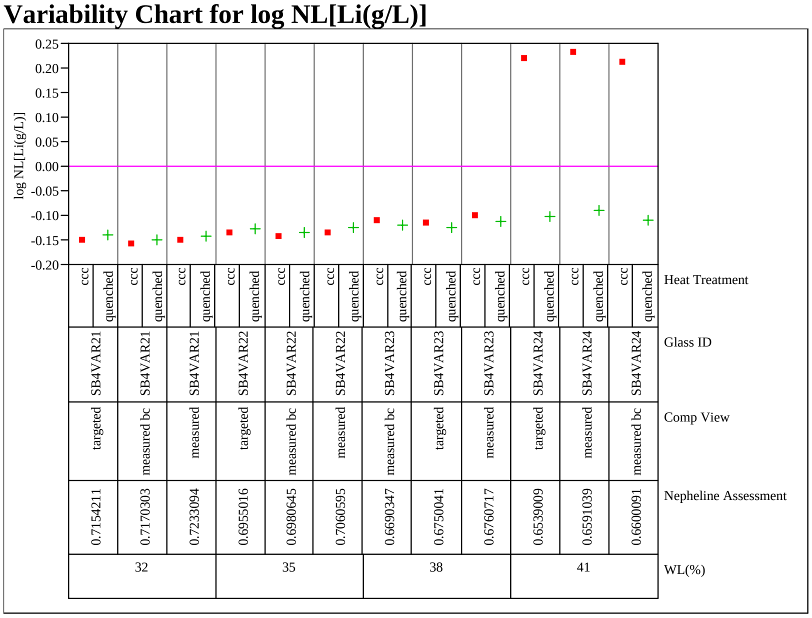
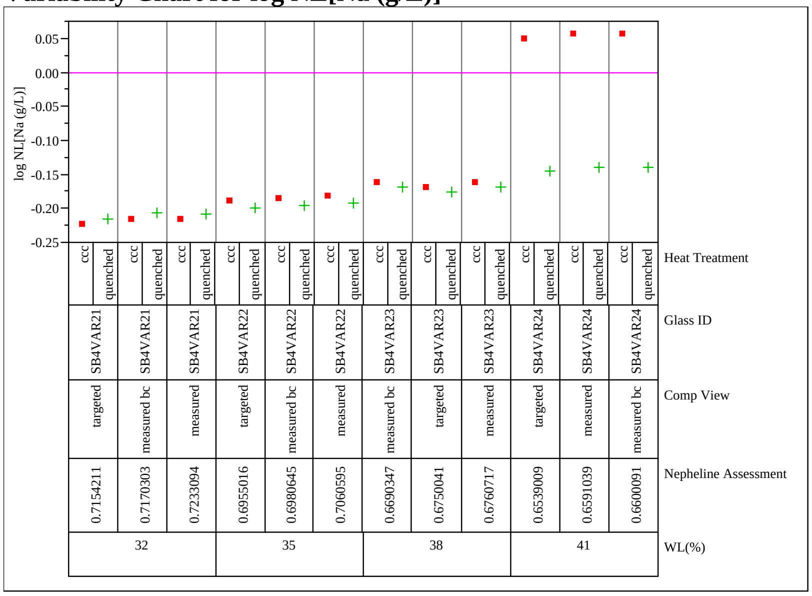


Exhibit B7. Effects of Heat Treatment for Study Glasses by Compositional View

Sludge Case=Case 2
Variability Chart for log NL[Na (g/L)]



Sludge Case=Case 2
Variability Chart for log NL[Si (g/L)]

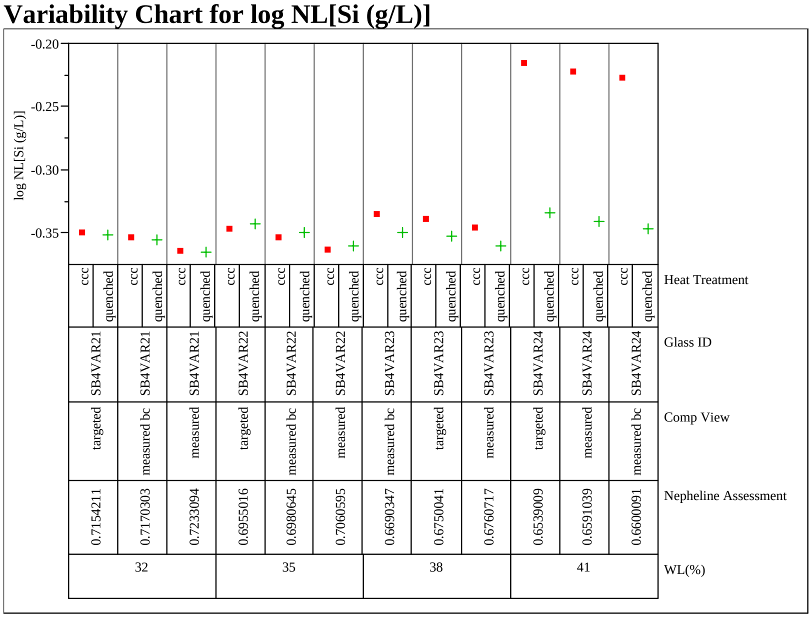
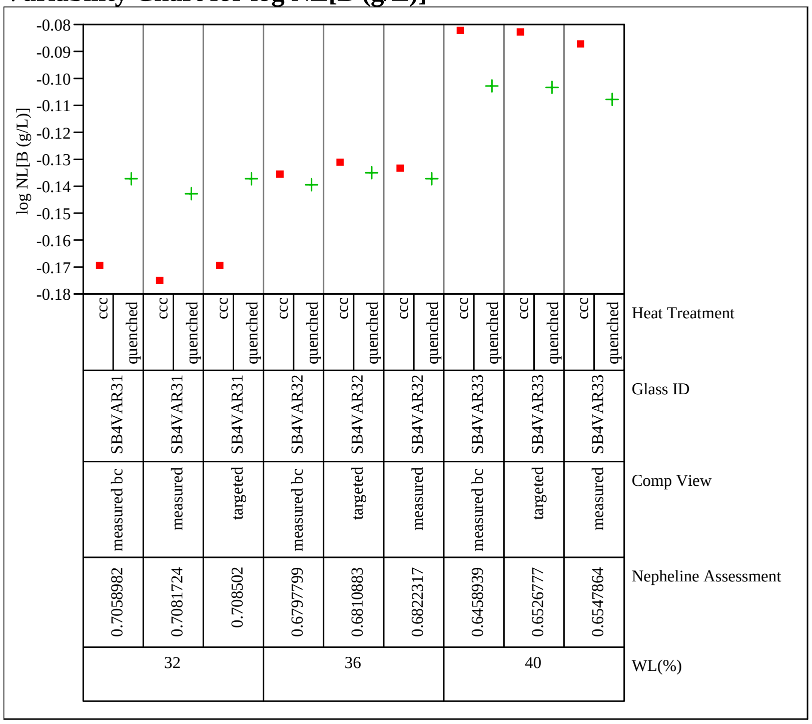


Exhibit B7. Effects of Heat Treatment for Study Glasses by Compositional View

Sludge Case=Case 3
Variability Chart for log NL[B (g/L)]



Sludge Case=Case 3
Variability Chart for log NL[Li(g/L)]

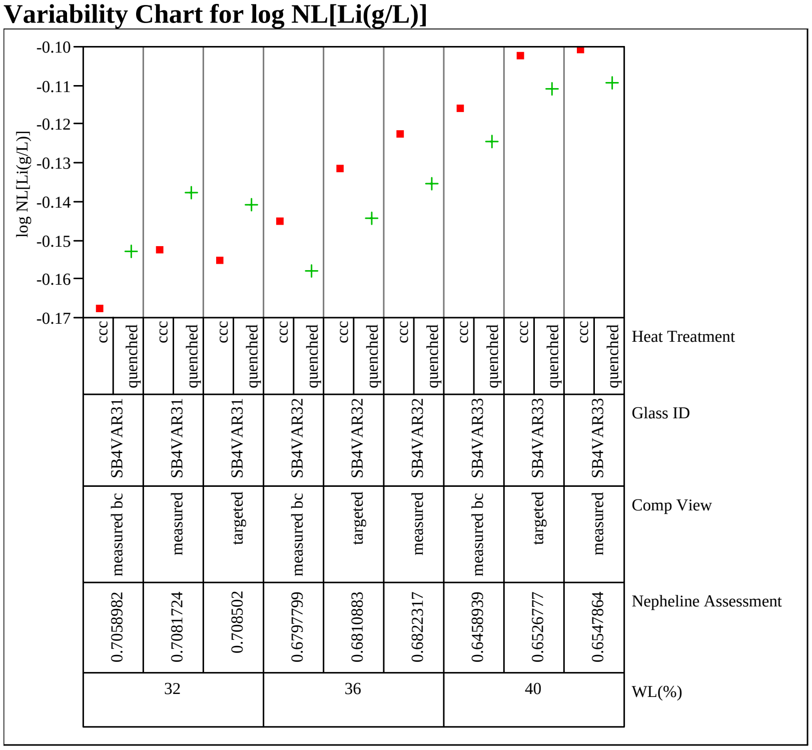
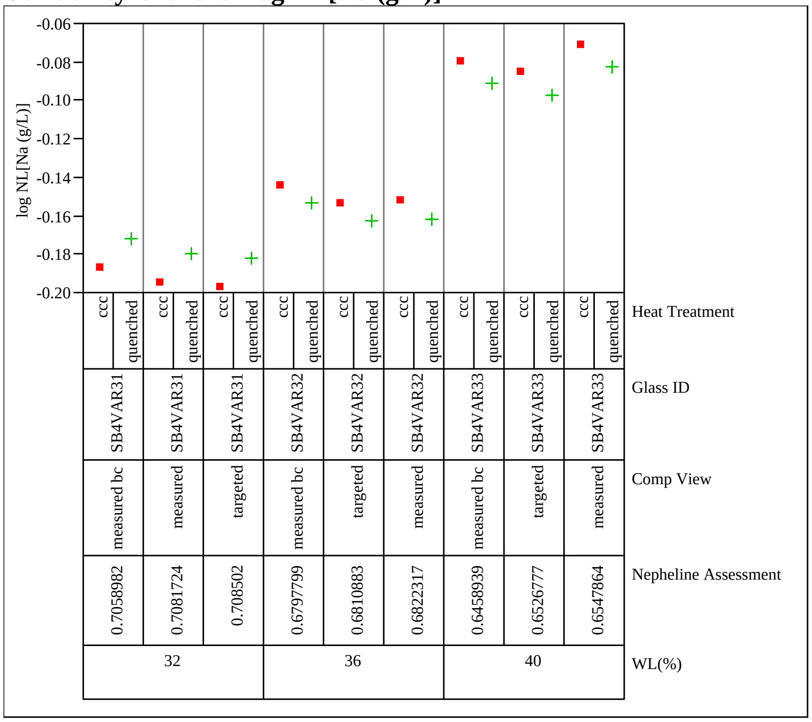


Exhibit B7. Effects of Heat Treatment for Study Glasses by Compositional View

Sludge Case=Case 3
Variability Chart for log NL[Na (g/L)]



Sludge Case=Case 3
Variability Chart for log NL[Si (g/L)]

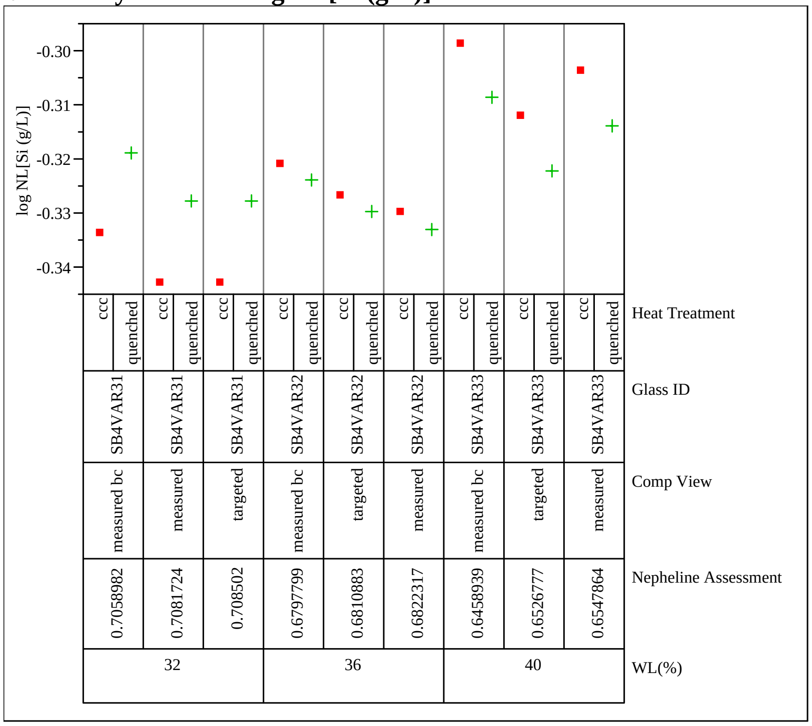
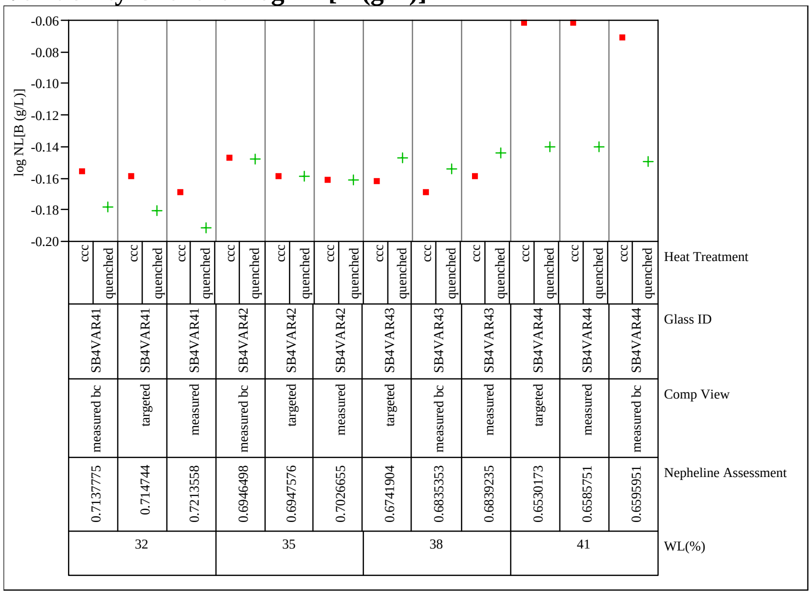


Exhibit B7. Effects of Heat Treatment for Study Glasses by Compositional View

Sludge Case=Case 4
Variability Chart for log NL[B (g/L)]



Sludge Case=Case 4
Variability Chart for log NL[Li(g/L)]

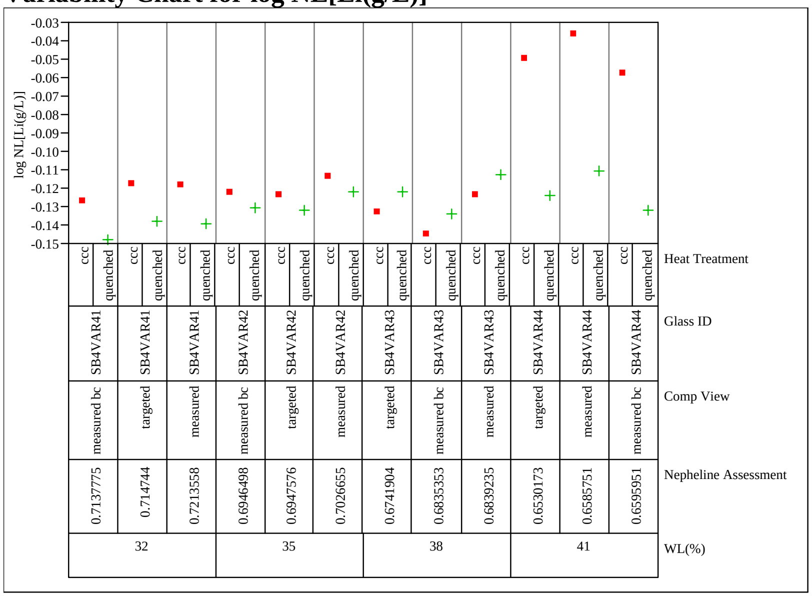
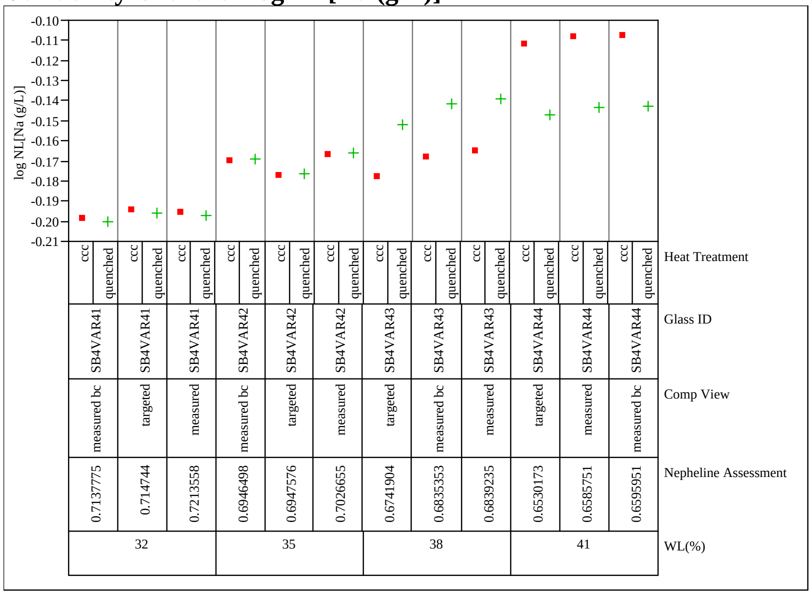


Exhibit B7. Effects of Heat Treatment for Study Glasses by Compositional View

Sludge Case=Case 4
Variability Chart for log NL[Na (g/L)]



Sludge Case=Case 4
Variability Chart for log NL[Si (g/L)]

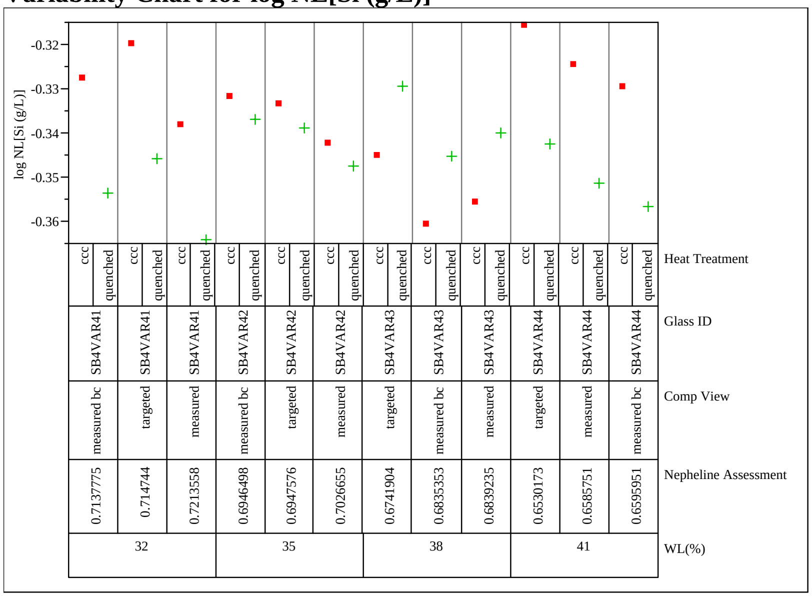
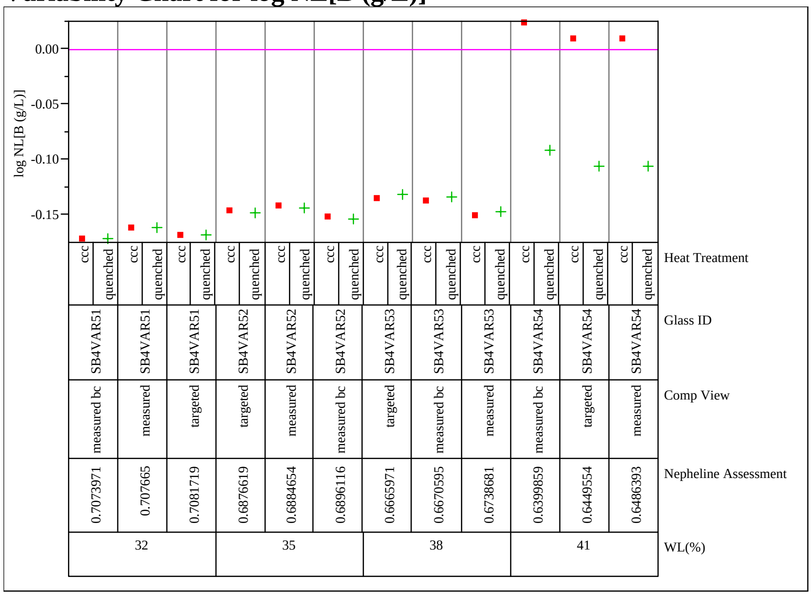


Exhibit B7. Effects of Heat Treatment for Study Glasses by Compositional View

Sludge Case=Case 5
Variability Chart for log NL[B (g/L)]



Sludge Case=Case 5
Variability Chart for log NL[Li(g/L)]

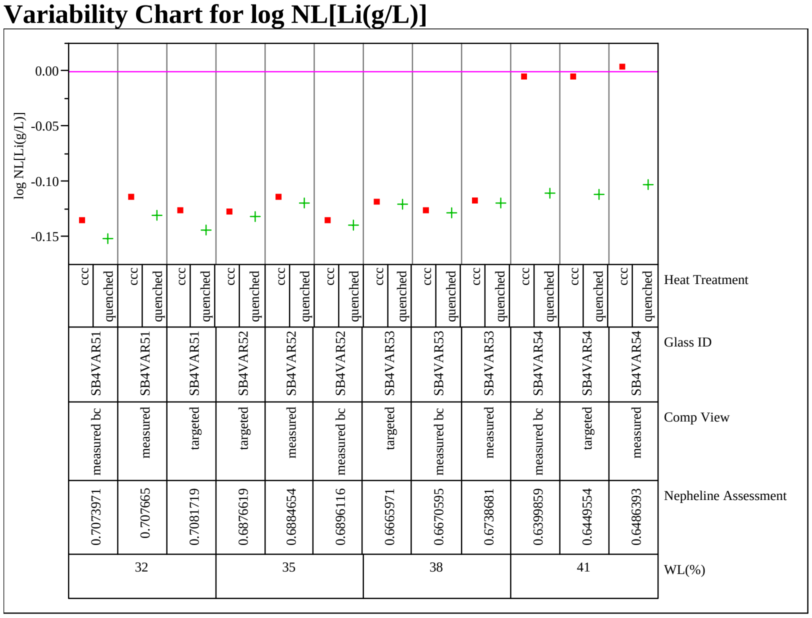
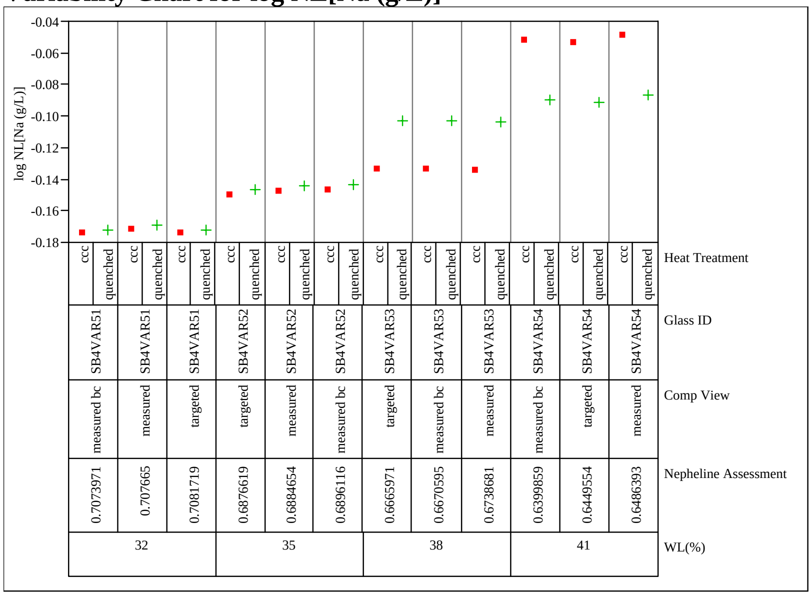


Exhibit B7. Effects of Heat Treatment for Study Glasses by Compositional View

Sludge Case=Case 5
Variability Chart for log NL[Na (g/L)]



Sludge Case=Case 5
Variability Chart for log NL[Si (g/L)]

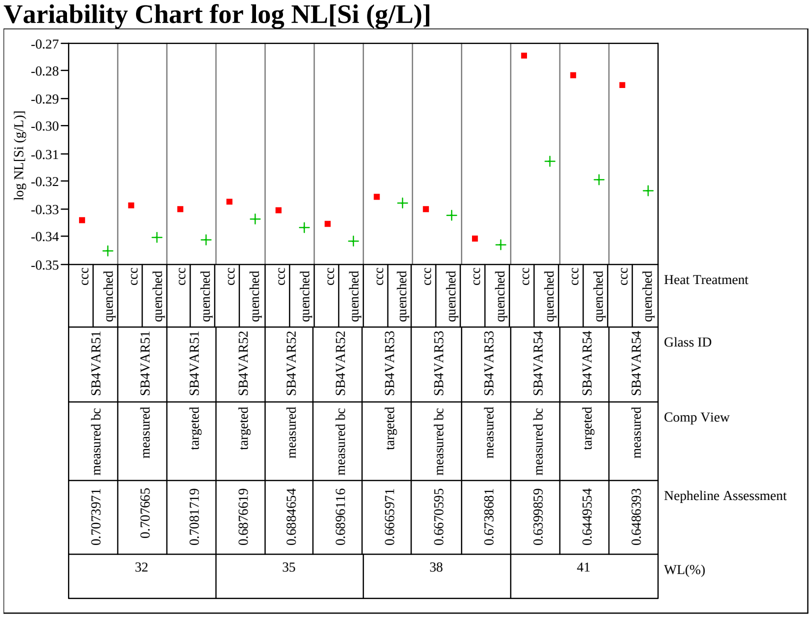
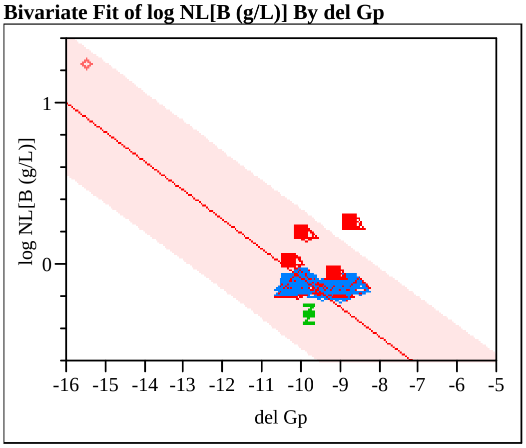


Exhibit B8. del Gp (ΔG_p) Predictions versus Common Logarithm Normalized Leachate (log NL[.]) for B, Li, Na, and Si Over All Compositional Views and Heat Treatments

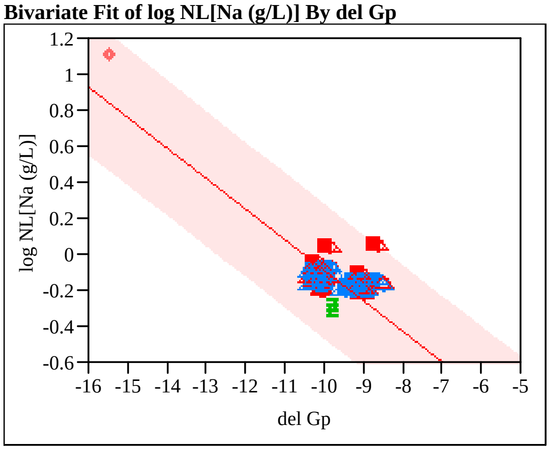
Legend

		Heat Treatment	Composition
z	1	ARM	ARM
○	2	ccc	measured
△	3	ccc	measured bc
■	4	ccc	targeted
◇	5	EA	EA
○	6	quenched	measured
△	7	quenched	measured bc
■	8	quenched	targeted

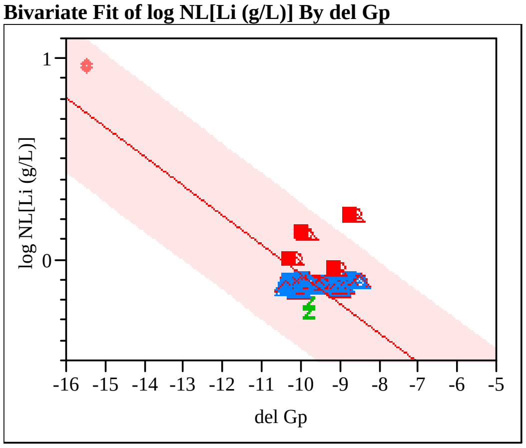
Bivariate Fit of log NL[B (g/L)] By del Gp



Bivariate Fit of log NL[Na (g/L)] By del Gp



Bivariate Fit of log NL[Li (g/L)] By del Gp



Bivariate Fit of log NL[Si (g/L)] By del Gp

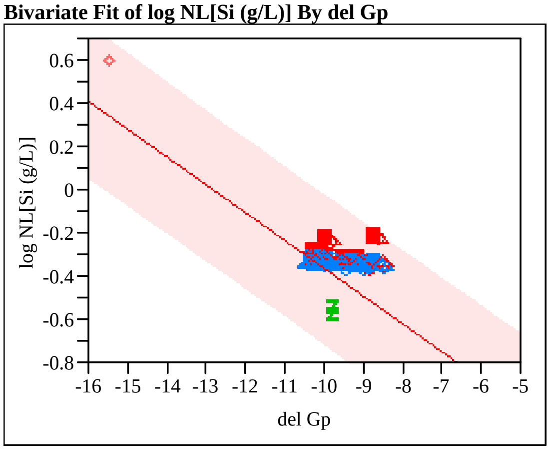
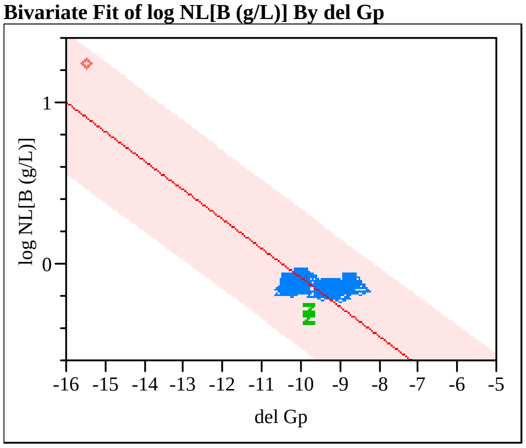


Exhibit B9. del Gp (ΔG_p) Predictions versus Common Logarithm Normalized Leachate (log NL[.]) for B, Li, Na, and Si Over All Compositional Views for Quenched Glasses

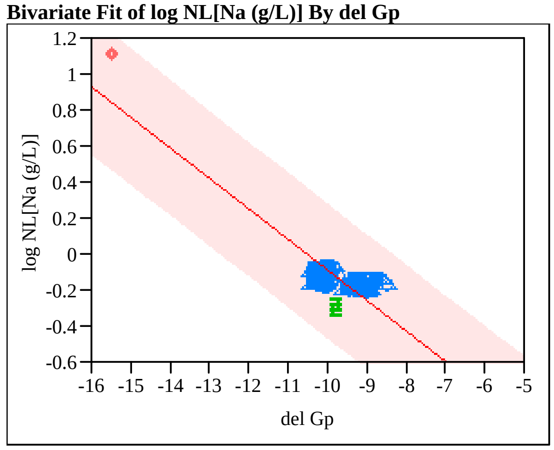
Legend

		Heat Treatment	Composition
	1	ARM	ARM
	2	ccc	measured
	3	ccc	measured bc
	4	ccc	targeted
	5	EA	EA
	6	quenched	measured
	7	quenched	measured bc
	8	quenched	targeted

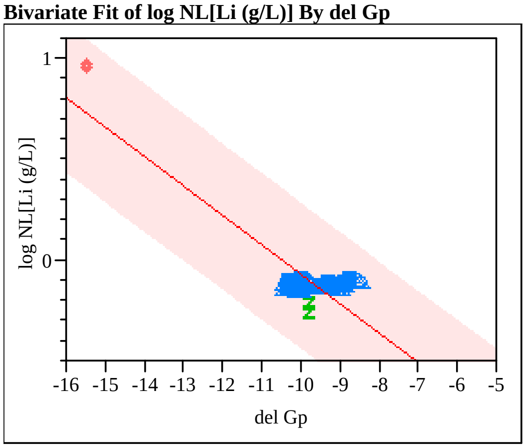
Bivariate Fit of log NL[B (g/L)] By del Gp



Bivariate Fit of log NL[Na (g/L)] By del Gp



Bivariate Fit of log NL[Li (g/L)] By del Gp



Bivariate Fit of log NL[Si (g/L)] By del Gp

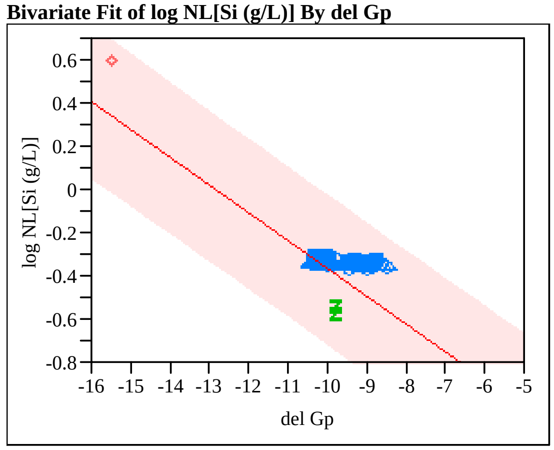
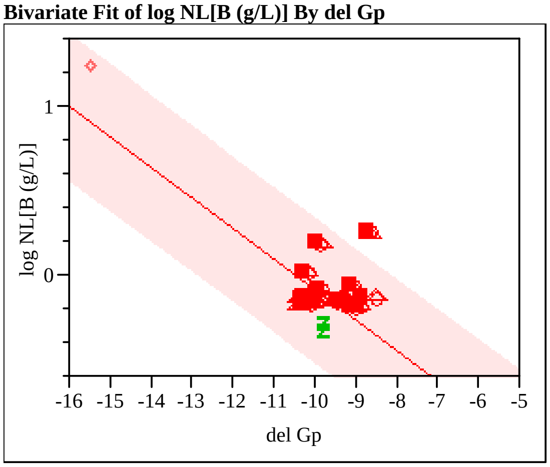


Exhibit B10. del Gp (ΔG_p) Predictions versus Common Logarithm Normalized Leachate (log NL[.]) for B, Li, Na, and Si Over All Compositional Views for ccc Glasses

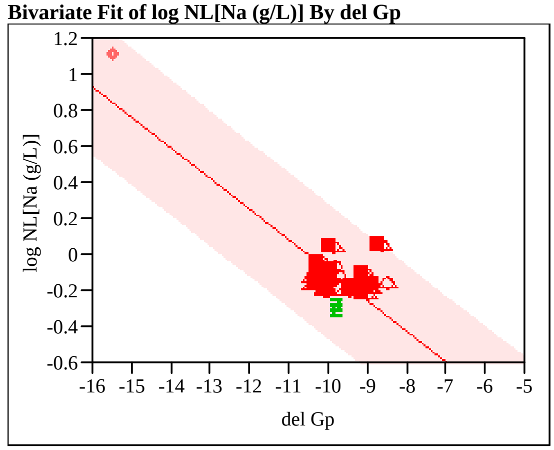
Legend

	Heat Treatment	Composition
1	ARM	ARM
2	ccc	measured
3	ccc	measured bc
4	ccc	targeted
5	EA	EA
6	quenched	measured
7	quenched	measured bc
8	quenched	targeted

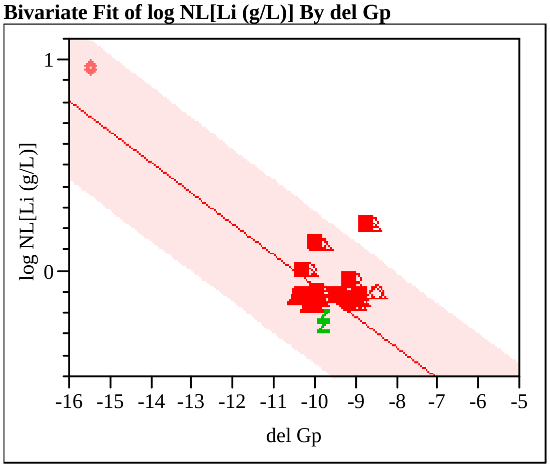
Bivariate Fit of log NL[B (g/L)] By del Gp



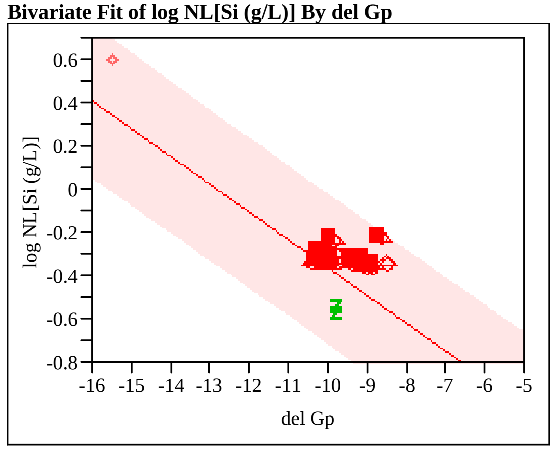
Bivariate Fit of log NL[Na (g/L)] By del Gp



Bivariate Fit of log NL[Li (g/L)] By del Gp



Bivariate Fit of log NL[Si (g/L)] By del Gp



APPENDIX C

COMPARISON OF SME BATCH COMPOSITIONS TO VARIABILITY STUDY GLASS COMPOSITIONS

SME Batch	Al_2O_3	Fe_2O_3	Na_2O	U_3O_8
	wt%			
402	6.61	12.50	12.72	3.31
403	7.11	9.74	11.22	2.43
404	7.90	9.33	11.56	2.42
405	8.06	8.64	10.54	2.42
406	8.35	9.26	11.44	2.35
407	7.79	8.79	11.18	2.19
408	7.86	8.63	11.60	2.81
409	8.33	9.24	11.26	2.43
410	7.80	8.93	11.80	2.35
411	8.76	9.75	10.69	2.46
412	8.22	9.40	11.39	2.41
413	7.80	8.83	11.09	2.28
414	7.97	9.09	10.86	2.34
415	8.12	9.38	9.47	2.30
416	8.45	9.33	10.47	2.26
417	8.32	9.46	10.35	2.15
418	8.47	9.64	10.43	2.08
419	8.14	8.98	11.04	2.51
420	7.88	9.02	11.76	2.16
421	8.21	9.27	10.36	2.63
422	7.52	8.73	10.97	2.15
423	7.72	8.76	10.81	2.21
424	7.87	8.80	11.39	2.15
425	8.18	9.44	12.39	2.36
426	7.74	8.56	11.34	2.04
427	8.43	8.57	11.56	1.95
428	8.46	8.98	12.29	2.20
429	8.33	8.83	11.23	2.15
430	8.29	9.07	11.00	3.02
431	8.54	9.46	11.68	3.14
432	7.88	8.63	11.66	2.96
433	8.13	9.12	11.47	2.94
434	7.65	8.12	12.19	2.75
435	7.29	7.94	11.86	2.66
436	8.03	8.73	11.63	2.46
MINIMUM	6.61	7.94	9.47	1.95
MAXIMUM	8.76	12.50	12.72	3.31

Glass ID	WL (%)	Al_2O_3	Fe_2O_3	Na_2O	U_3O_8
		wt%			
SB4VAR11	34	8.46	9.62	12.26	2.94
SB4VAR12	38	9.46	10.75	12.76	3.28
SB4VAR13	42	10.46	11.88	13.26	3.63
SB4VAR21	32	8.31	9.47	10.98	2.89
SB4VAR22	35	9.09	10.36	11.26	3.16
SB4VAR23	38	9.86	11.25	11.54	3.43
SB4VAR24	41	10.64	12.14	11.82	3.70
SB4VAR31	32	8.00	9.13	11.93	2.79
SB4VAR32	36	9.01	10.27	12.42	3.13
SB4VAR33	40	10.01	11.41	12.92	3.48
SB4VAR41	32	8.00	9.20	11.34	2.80
SB4VAR42	35	8.75	10.06	11.66	3.06
SB4VAR43	38	9.50	10.92	11.97	3.32
SB4VAR44	41	10.25	11.79	12.28	3.59
SB4VAR51	32	7.71	8.87	12.25	2.70
SB4VAR52	35	8.43	9.70	12.65	2.95
SB4VAR53	38	9.15	10.53	13.04	3.21
SB4VAR54	41	9.88	11.37	13.44	3.46
MINIMUM		7.71	8.87	10.98	2.70
MAXIMUM		**10.64**	12.14	**13.44**	**3.70**
SB4PS1		7.61	8.07	12.12	2.73
SB4PS2		7.37	8.03	11.98	2.68
SB4PS3		7.92	9.00	11.99	2.75
SB4PS4		8.29	9.42	12.18	2.88
SB4PS5		8.49	9.65	12.28	2.94
MINIMUM		7.37	8.03	11.98	2.68
MAXIMUM		8.49	9.65	12.28	2.94

Table C1. Comparison of SME batch compositions and variability study glass compositions. Note – the variability study glass compositions (SB4VAR11 – SB4VAR54 and SB4PS1 – SB4PS5) are target compositions. The maximum contents of the variability study glasses in bold indicate that these are outside the range of the SME batch compositions.

Distribution:

C.J. Bannochie, 773-42A
A.B. Barnes, 999-W
D.R. Best, 786-1A
D.B. Burns, 786-5A
D.A. Crowley, 999-W
B.A. Davis, 704-27S
T.B. Edwards, 999-W
H.H. Elder, 766-H
T.L. Fellinger, 704-26S
K.M. Fox, 999-W
J.M. Gillam, 766-H
J.C. Griffin, 773-A
B.A. Hamm, 766-H
C.C. Herman, 999-W
J.F. Iaukea, 704-30S
J.E. Marra, 773-A
R.T. McNew, 704-27S
T.A. Nance, 773-42A
J.D. Newell, 999-W
J.E. Occhipinti, 704-S
D.K. Peeler, 999-W
F.C. Raszewski, 999-W
J.W. Ray, 704-S
I.A. Reamer, 999-1W
H.B. Shah, 766-H
M.E. Smith, 999-W
M.E. Stone, 999-W
J. Stuberfield, 766-H
M.F. Williams, 999-1W
R.J. Workman, 999-1W
A.L. Youchak, 999-W