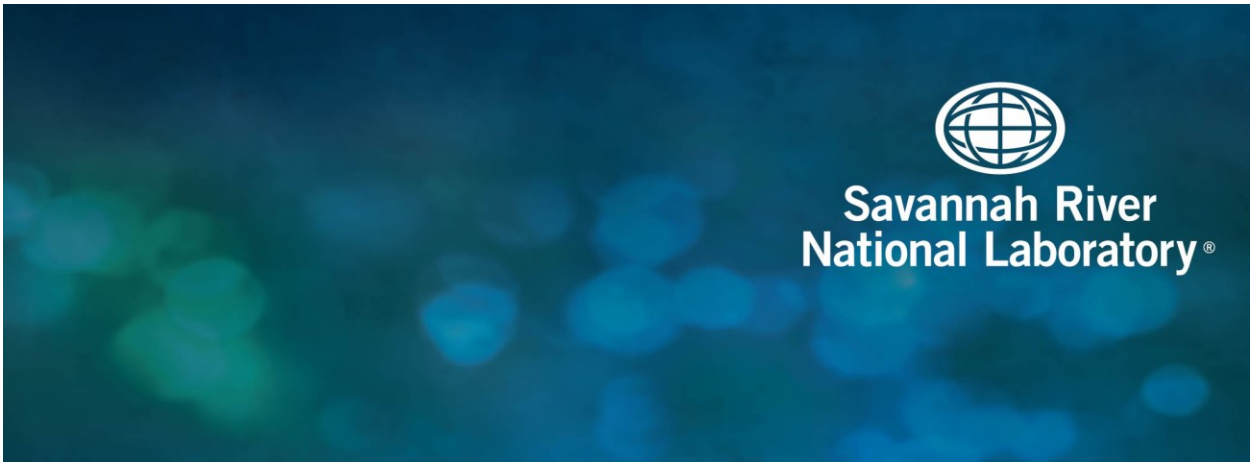
Contract No:

This document was prepared in conjunction with work accomplished under Contract No. 89303321CEM000080 with the U.S. Department of Energy (DOE) Office of Environmental Management (EM).

Disclaimer:



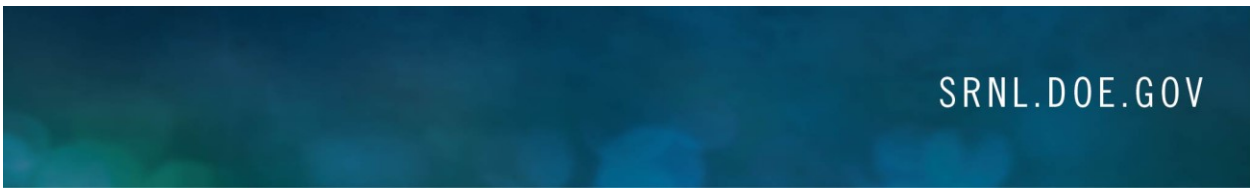
A U.S. DEPARTMENT OF ENERGY NATIONAL LAB • SAVANNAH RIVER SITE • AIKEN, SC • USA

Characterization of the Sulfur-Saturated Melt Versions of the LAW Phase 5 Glasses

M. C. Hsieh

October 2021

SRNL-STI-2021-00492, Revision 0



DISCLAIMER

Printed in the United States of America

Prepared for
U.S. Department of Energy

SRNL-STI-2021-00492
Revision 0

Keywords: *Hanford, WTP, low-activity waste, waste glass, sulfur*

Retention: *Permanent*

Characterization of the Sulfur-Saturated Melt Versions of the LAW Phase 5 Glasses

M. C. Hsieh

October 2021

Savannah River National Laboratory is operated by Battelle Savannah River Alliance for the U.S. Department of Energy under Contract No. 89303321CEM000080.

REVIEWS AND APPROVALS

AUTHORS:

_____

M. C. Hsieh, Applied Materials Research Date

TECHNICAL REVIEW:

_____

A. N. Stanfield, Applied Materials Research, Reviewed per E7 2.60 Date

APPROVAL:

_____

J. Manna, Director, Environmental and Legacy Management Date

ACKNOWLEDGEMENTS

The author would like to thank Daniel Jones, Meagan Kinard, Kandice Miles, and Whitney Riley at Savannah River National Laboratory for their skilled assistance with the sample and data analyses described in this report. The author thanks Charmayne Lonergan and Jim Neeway at Pacific Northwest National Laboratory for helpful discussions and review of these data and the report. Funding from the U.S. Department of Energy through Inter-Entity Work Order HAN-M0SRV00101 as managed by Albert A. Kruger is gratefully acknowledged.

EXECUTIVE SUMMARY

This report provides results from the chemical analyses of a series of sulfur-saturated melt versions of the LAW Phase 5 glasses, a series of simulated nuclear waste glasses designed and fabricated at Pacific Northwest National Laboratory. Results from the chemical analyses of the wash solution resulting from the preparation of these glasses are also included. These data will be used in the development of enhanced property/composition models for waste glass vitrification at Hanford.

Chemical analyses were performed on a representative sample of each of the sulfur-saturated versions of the quenched glasses to allow for comparisons with the targeted compositions, as well as the measured compositions of the quenched glasses. The measured concentrations of K_2O and V_2O_5 were below the targeted values for most of the study glasses. As expected, the measured concentrations of SO_3 in most of the glasses were higher than targeted due to the use of the sulfur saturation method in fabricating these glasses.

The wash solutions contained mainly sodium and sulfur.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF ABBREVIATIONS

BDL	below detection limit
DOE	Department of Energy
hp std	High Purity Standards ICP multi-element custom solution SM-744-063
IC	ion chromatography
ICP-OES	inductively coupled plasma – optical emission spectroscopy
ID	identifier
KH	potassium hydroxide fusion
LAW	low-activity waste
LM	lithium metaborate fusion
LP5	Low-Activity Waste Phase 5
LRM	low-activity test reference material
ORP	Office of River Protection
PF	sodium peroxide fusion
PNNL	Pacific Northwest National Laboratory
seq.	sequence
SRNL	Savannah River National Laboratory
SSM	sulfur-saturated melt
std	High Purity Standards ICP multi-element custom solution SM-744-013
TTQAP	Task Technical and Quality Assurance Plan
wt.%	weight percent
WTP	Hanford Tank Waste Treatment and Immobilization Plant

1.0 Introduction

The U.S. Department of Energy (DOE) is responsible for building the Hanford Tank Waste Treatment and Immobilization Plant (WTP) at the Hanford site in Washington to remediate 55 million gallons of radioactive waste that is temporarily stored in 177 underground tanks. The Office of River Protection (ORP) has requested that the Savannah River National Laboratory (SRNL) contribute in areas of recognized capabilities and expertise for glass waste form development to support successful startup of the WTP.

Successful efforts have allowed for demonstration of greatly enhanced treatment efficiencies of those projected from the minimum requirements set forth in the WTP Contract[a]. Additional flexibility and expansion of the qualified glass forming region are the current focus.[1] SRNL support of this work is defined in the Task Technical and Quality Assurance Plan (TTQAP).[2]

This report provides results from the chemical analyses of the sulfur-saturated melt (SSM) versions of the Low-Activity Waste Phase 5 (LP5) glasses, a series of simulated nuclear waste glasses and associated wash solutions designed and fabricated at Pacific Northwest National Laboratory (PNNL). The glasses were selected as part of a broader study of the influence of glass composition on chemical durability, sulfur retention, and other properties.[3] The resulting data will be used in the development, validation, and implementation of enhanced property/composition models for nuclear waste glasses.[1]

2.0 Experimental Procedure

2.1 Quality Assurance

Requirements for performing reviews of technical reports and the extent of review are established in manual E7 2.60. SRNL documents the extent and type of review using the SRNL Technical Report Design Checklist contained in WSRC-IM-2002-00011, Rev. 2.[4] Laboratory data for this study were recorded in the SRNL Electronic Laboratory Notebook system, experiment L6390-00441-02. The SSM glass versions and wash solutions provided by PNNL were fabricated following a Task Plan.[1]

2.2 Glasses Selected for Study

The baseline (quenched) glass compositions in this study were selected and fabricated by PNNL. Characterization of the baseline glasses was reported earlier.[5] Samples of each of the SSM versions of the study glasses, along with samples of the wash solutions resulting from the preparation of each of the SSM glasses, were received at SRNL for chemical composition analysis. PNNL identifiers (IDs) for the glass samples and the associated SRNL sample identifiers are listed in Table 2-1. The identifiers for the wash solutions are likewise listed in Table 2-2.

[a] Contract DE-AC27-01RV14136, as amended, U.S. Department of Energy, Richland, WA (2000).

Table 2-1. Identifiers for the LAW Phase 5 SSM Study Glasses

PNNL Glass ID	Lab ID
LP5-01-SSM-S	S-12344
LP5-02-SSM-S	S-12345
LP5-03-SSM-S	S-12346
LP5-04-SSM-S	S-12347
LP5-05-SSM-S	S-12348
LP5-06-MOD1-SSM-S	S-12349
LP5-07-SSM-S	S-12350
LP5-08-SSM-S	S-12351
LP5-09-SSM-S	S-12352
LP5-10-SSM-S	S-12353
LP5-11-SSM-S	S-12354
LP5-12-1-SSM-S	S-12355
LP5-13-SSM-S	S-12356
LP5-14-SSM-S	S-12357
LP5-15-SSM-S	S-12358
LP5-16-MOD1-SSM-S	S-12359
LP5-17-SSM-S	S-12360
LP5-18-SSM-S	S-12361
LP5-19-SSM-S	S-12362
LP5-20-SSM-S	S-12363
LP5-21-SSM-S	S-12364
LP5-22-SSM-S	S-12365
LP5-23-SSM-S	S-12366
LP5-24-SSM-S	S-12367
LP5-25-SSM-S	S-12368

Table 2-2. Identifiers for the LAW Phase 5 SSM Wash Solutions

PNNL Wash Solution ID	Lab ID
LP5-01-SSM-W	S-12369
LP5-02-SSM-W	S-12370
LP5-03-SSM-W	S-12371
LP5-04-SSM-W	S-12372
LP5-05-SSM-W	S-12373
LP5-06-MOD1-SSM-W	S-12374
LP5-07-SSM-W	S-12375
LP5-08-SSM-W	S-12376
LP5-09-SSM-W	S-12377
LP5-10-SSM-W	S-12378
LP5-11-SSM-W	S-12379
LP5-12-1-SSM-W	S-12380
LP5-13-SSM-W	S-12381
LP5-14-SSM-W	S-12382
LP5-15-SSM-W	S-12383
LP5-16-MOD1-SSM-W	S-12384
LP5-17-SSM-W	S-12385
LP5-18-SSM-W	S-12386
LP5-19-SSM-W	S-12387
LP5-20-SSM-W	S-12388
LP5-21-SSM-W	S-12389
LP5-22-SSM-W	S-12390
LP5-23-SSM-W	S-12391
LP5-24-SSM-W	S-12392
LP5-25-SSM-W	S-12393
LP5-SSM-W-1	S-12394
LP5-SSM-W-2	S-12395

2.3 Glass Composition Analysis

Chemical analyses were performed under the auspices of an analytical plan[6] on a representative sample of each of the glasses listed in Table 2-1 to allow for comparisons with the targeted compositions. Three dissolution techniques were used for preparing each of the glass samples, in duplicate, for analysis (potassium hydroxide fusion (KH), lithium metaborate fusion (LM), and sodium peroxide fusion (PF)).[7-9] Note that for some analytes, the analytical plan specified more than one preparation method for analysis. The results were reviewed and the method that provided better recovery of the analyte was selected for reporting.

Each of the duplicate samples was analyzed twice for each element of interest by inductively coupled plasma – optical emission spectroscopy (ICP-OES)[10] or ion chromatography (IC),[11] for a total of four measurements per element per glass. Glass standards were also intermittently measured to assess the performance of the ICP-OES and IC instruments over the course of these analyses. Specifically, several samples of the low-activity test reference material (LRM) were included as part of the analytical plans. The LRM composition reported as the "Consensus Average" is used as the reference composition of this glass.[12] The preparation and measurement methods used for each of the reported glass components are listed in Table 2-3.

Table 2-3. Preparation and Measurement Methods Used in Reporting the Analyte Concentrations of the Study Glasses

Analyte	Measurement Method	Preparation Method
Al	ICP-OES	LM
B	ICP-OES	PF
Ca	ICP-OES	LM
Cl^-	IC	KH
Cr	ICP-OES	LM
F^-	IC	KH
Fe	ICP-OES	LM
K	ICP-OES	LM
Li	ICP-OES	PF
Mg	ICP-OES	LM
Na	ICP-OES	LM
Ni	ICP-OES	LM
P	ICP-OES	LM
Pb	ICP-OES	LM
Re	ICP-OES	LM
S	ICP-OES	LM
Si	ICP-OES	PF
Sn	ICP-OES	LM
Ti	ICP-OES	LM
V	ICP-OES	LM
Zn	ICP-OES	LM
Zr	ICP-OES	LM

2.4 Wash Solution Analysis

Chemical analyses were performed under the auspices of an analytical plan[6] on a representative sample of each of the wash solutions resulting from the preparation of the SSM versions of the glasses, as listed in Table 2-2. The samples were diluted at SRNL based on the expected concentrations of the species in solution in preparation for the analysis.

Each of the samples was analyzed in triplicate for each element of interest by ICP-OES[10] and IC[11]. Solution standards[b] and blanks were also intermittently measured to assess the performance of the ICP-OES and IC instruments over the course of these analyses. The measurement methods used for each of the reported wash solution components are listed in Table 2-4.

[b] ICP multi-element custom solutions, product numbers SM-744-013 and SM-744-063, High Purity Standards, North Charleston, SC.

Table 2-4. Measurement Methods Used in Reporting the Analyte Concentrations of the Wash Solutions

Analyte	Measurement Method
Al	ICP-OES
B	ICP-OES
Ca	ICP-OES
Cl^-	IC
Cr	ICP-OES
F^-	IC
Fe	ICP-OES
K	ICP-OES
Li	ICP-OES
Mg	ICP-OES
Na	ICP-OES
Ni	ICP-OES
P	ICP-OES
PO_4^{3-}	IC
Pb	ICP-OES
Re	ICP-OES
S	ICP-OES
SO_4^{2-}	IC
Si	ICP-OES
Sn	ICP-OES
Ti	ICP-OES
V	ICP-OES
Zn	ICP-OES
Zr	ICP-OES

3.0 Results and Discussion

3.1 Review and Evaluation of the SSM Glass Composition Measurements

Table A-1, Table A-2, and Table A-3 in Appendix A provide the elemental concentration measurements in wt.% for the study glasses as prepared using KH, LM, and PF methods, respectively. Elemental measurements for samples of the LRM glass are also included in these tables of Appendix A. These unprocessed data are provided so that the values are readily available should they be of interest for future reviews.

3.1.1 Treatment of Detection Limits

The elemental concentrations in Table A-1, Table A-2, and Table A-3 in Appendix A were converted to oxide concentrations by multiplying the values of each element by the gravimetric factor for the corresponding oxide. A concentration measurement that was reported to be below the detection limit was set to the detection limit for the purposes of data review and calculating a sum of oxides for each glass. Concentration measurements that were below the detection limit (BDL) are denoted with a less than symbol (<).

3.1.2 Composition Measurements by Glass Identifier

Exhibit A-1 in Appendix A provides plots of the oxide concentration measurements by the PNNL Glass ID (including LRM glasses) by Lab ID grouped by targeted concentration. 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 instrument calibrations for each glass. Plotting the data in this format provides an opportunity to review the values for each individual glass as a function of the duplicate preparations and duplicate measurements. A review of the plots presented in these exhibits reveals the repeatability of the four individual values for each oxide for each glass. There were no indications of errors in preparation or measurement that had to be addressed in treatment of the data.

3.1.3 Results for the LRM Standard

Exhibit A-2 in Appendix A provides a comparison of the LRM results to their acceptability limits utilized by SRNL.[10] The review is in the form of plots of the measurements arranged by preparation method and element, framed by upper and lower acceptability limits for the concentration of each element of interest. The results show that all measurements of the LRM elements of interest were within the acceptability limits during the execution of these analyses.

3.1.4 Measured versus Target Compositions

All the measurements for each oxide for each glass (Table A-1, Table A-2, and Table A-3 in Appendix A) were averaged to determine a representative chemical composition for each glass. A sum of oxides was also computed for each glass based upon the averaged measured values. Exhibit A-3 in Appendix A provides plots showing the result for each glass for each oxide to allow PNNL to draw comparisons between the measured and targeted values.

Table A-4 in Appendix A provides a comparison of the average measured compositions and targeted compositions. The measured sums of oxides for all glasses fall within the interval of 95.8 to 103 wt.%, indicating acceptable recovery of the glass components.[13] Entries in Table A-4 show the relative differences between the measured values and the targeted values for the oxides with measured and targeted values above 1 wt.%. The relative differences are shaded if they are 10% or more and are summarized below.

- B_2O_3 relative differences were -10% or more for several study glasses.
  - LP5-03-SSM-S, LP5-05-SSM-S, LP5-08-SSM-S, LP5-12-1-SSM-S, LP5-13-SSM-S, LP5-19-SSM-S, and LP5-23-SSM-S.
- CaO relative differences were 10% or more for LP5-10-SSM-S and LP5-20-SSM-S.
- K_2O and V_2O_5 relative differences were -10% or more for most of the study glasses.
- The Li_2O relative difference was more than -10% for LP5-25-SSM-S.
- The ZrO_2 relative difference was more than -10% for several of the study glasses.
  - LP5-06-MOD1-SSM-S, LP5-12-1-SSM-S, LP5-13-SSM-S, LP5-17-SSM-S, LP5-22-SSM-S, and LP5-25-SSM-S.
- As expected, the measured SO_3 concentrations in most of the study glasses were higher than targeted due to the use of the sulfur saturation method in fabricating these glasses.
  - The SO_3 relative difference was -22% for LP5-12-1-SSM-S.

3.2 Comparison of Measured Compositions of Baseline and SSM Glasses

Exhibit A-4 in Appendix A provides a comparison of the measured oxide concentrations among the baseline (quenched) and SSM versions of the study glasses. A review of Exhibit A-4 led to the following observation:

- The measured SO_3 concentrations were higher for SSM versions of the study glasses, as expected, due to the use of the sulfur saturation method in fabricating these glasses.

The discussion of the analyses of the wash solutions, provided in Section 3.3, may provide further insight into the measured compositions of the SSM glasses.

3.3 Review and Evaluation of the Wash Solution Measurements

Table B-1 in Appendix B provides the elemental concentration measurements in mg/L for the wash solutions as measured by ICP-OES. Table B-2 in Appendix B provides the anion concentration measurements in mg/L for the wash solutions as measured by IC. Elemental measurements of the blanks and standard solutions are included in the tables of Appendix B. These unprocessed data are provided so that the values are readily available should they be of interest for future reviews.

3.3.1 Treatment of Detection Limits

The elemental and anion concentrations in Table B-1 and Table B-2 of Appendix B include measurements that were reported to be below the detection limit. These values were set to the detection limit for the purposes of data review and of calculating an average composition for each wash solution.

3.3.2 Composition Measurements by Wash Solution Identifier

Exhibit B-1 in Appendix B provides plots of the elemental and anion concentration measurements grouped by the wash solution identifier (including the blanks and standard solutions). Different symbols and colors are used to represent the different solutions. Plotting the data in this format provides an opportunity to review the values for each individual solution as a function of the triplicate measurements. A review of the plots presented in these exhibits reveals the repeatability of the three individual values for each analyte for each solution. These observations were not considered to indicate an error in preparation or measurement that had to be addressed in treatment of the data. Therefore, the entire set of measurement data was used in determining representative, measured compositions for the wash solutions.

3.3.3 Results for the Standard Solutions

Table B-3 in Appendix B provides comparisons of the standard solution results to their reference values. Although not a statistical comparison, the results in this table indicate no issues with the performance of the analyses.

3.3.4 Measured Compositions of the Wash Solutions

From the discussion of Section 3.3.2, all the measurements for each analyte for each wash solution (Table B-1 and Table B-2 of Appendix B) were averaged to determine a representative chemical composition for each solution. Table B-4 in Appendix B provides a summary of the average measured compositions of the wash solutions. The concentrations of PO_4^{3-} and SO_4^{2-} reported in these tables include the measured values from both ICP-OES and IC for comparison. The measured S and P concentrations from the ICP-OES analyses were converted to PO_4^{3-} and SO_4^{2-} concentrations by multiplying by the appropriate gravimetric factors to support these comparisons. A graphical representation of the average chemical composition data for each wash solution is provided in Exhibit B-2. The following observations are offered from the review of Table B-4 and Exhibit B-2:

- The wash solutions contained mainly Na (566-1300 mg/L), S (314-679 mg/L), and SO_4^{2-} (981-2000 mg/L), which could be attributed to the excess sodium sulfate added as part of the SSM preparation process.
- The measured concentrations of B, Cl^-, Ca, Cr, F^-, K, P, PO_4^{3-}, Si, and V in the wash solutions were generally below 100 mg/L.
- The measured concentrations of Al, Fe, Mg, Ni, Pb, Re, Ti, Zn, and Zr in the wash solutions were near or below the detection limits.
- The ICP-OES measured concentrations of P were converted to PO_4^{3-} for comparison and were in the range of <3.07 to 65.8 mg/L. PO_4^{3-} values as measured by IC and were in the range of <5 to 61.5 mg/L.

- The ICP-OES measured concentrations of S were converted to SO_4^{2-} for comparison with IC values and were in the range of 940 to 2030 mg/L. SO_4^{2-} values as measured by IC were in the range of 981 to 2000 mg/L.

4.0 Summary

Chemical analyses were performed on a series of SSM versions of simulated nuclear waste glasses and resulting wash solutions with ICP-OES and IC. The glasses were selected and fabricated by PNNL as part of a broader study of the influence of glass composition on chemical durability, sulfur retention, and other properties.

The measured concentrations of K_2O and V_2O_5 were below the targeted values for most of the study glasses. The measured concentrations of B_2O_3 and ZrO_2 were low in several of the glasses. As expected, the measured concentrations of SO_3 in most of the glasses were higher than targeted due to the use of the sulfur saturation method in fabricating these glasses.

The wash solutions contained mainly sodium and sulfur.

5.0 References

1. C.E. Lonergan, "Low-activity Waste (LAW) Glass Testing Phase 5: Expansion of LAW Glass Composition Boundaries," Pacific Northwest National Laboratory, Richland, WA, EWG-TP-0135, Revision 1.0, 2021.

2. K.M. Fox, "Task Technical and Quality Assurance Plan for Hanford Waste Glass Development and Characterization," Savannah River National Laboratory, Aiken, SC, SRNL-RP-2013-00692, Revision 1, 2016.

3. D.K. Peeler, D.S. Kim, J.D. Vienna, M.J. Schweiger, and G.F. Piepel, "Office of River Protection Advanced Low-Activity Waste Glass Research and Development Plan," Pacific Northwest National Laboratory, Richland, WA, PNNL-24883, EWG-RPT-008, Revision 0, 2015.

4. "Savannah River National Laboratory Technical Report Design Check Guidelines," Westinghouse Savannah River Company, Aiken, SC, WSRC-IM-2002-00011, Rev. 2, 2004.

5. M.C. Hsieh, "Composition Measurements of the LAW Phase 5 Glasses," Savannah River National Laboratory, Aiken, SC, SRNL-STI-2021-00409, Revision 0, 2021.

6. M.C. Hsieh, "An Analytical Plan for Measuring the Chemical Compositions of the Sulfur-Saturated Melt Versions of the LAW Phase 5 Study Glasses and Wash Solutions " Savannah River National Laboratory, Aiken, SC, SRNL-L3300-2021-00022, Revision 0, 2021.

7. "Sample Dissolution Using Potassium Hydroxide Fusion," Savannah River National Laboratory, Aiken, SC, Manual L29, Procedure ITS-0035, Rev. 3, 2015.

8. "Lithium Metaborate Fusion Preparation," Savannah River National Laboratory, Aiken, SC, Manual L33, Procedure 0071, Rev. 0, 2021.

9. "Dissolution of Glass, Sludge, and Slurry Samples Using Na_2O_2/NaOH/HCl," Savannah River National Laboratory, Aiken, SC, Manual L29, Procedure ITS-0040, Rev. 2, 2013.

10. "Calibration, Verification, and Operation of the Agilent 5110 ICP-OES Inductively Coupled Plasma-Optical Emission Spectrometer," Savannah River National Laboratory, Aiken, SC, Manual L33, Procedure 0242, Rev. 1, 2021.

11. "Anion Analysis Using the Dionex ICS 6000 Ion Chromatograph," Savannah River National Laboratory, Aiken, SC, Manual L33, Procedure 0244, Revision 1, 2020.

12. W.L. Ebert and S.F. Wolf, "Round-Robin Testing of a Reference Glass for Low-Activity Waste Forms," Argonne National Laboratory, Argonne, IL, ANL-99/22, Revision 0, 1999.

13. C.M. Jantzen, "Verification of Glass Composition and Strategy for SGM and DWPF Glass Composition Determination," E. I du Pont de Nemours & Co., Savannah River Laboratory, Aiken, SC, DPST-86-708, 1987.

Appendix A. Tables and Exhibits Supporting the Glass Composition Measurements

Table A-1. KH Measurements (wt.%) of the LP5 SSM Study Glasses

PNNL ID	Block	Sub – Block	Seq.	Lab ID	Cl^-	F^-
LRM	1	1	1	LRMKH111	<0.0250	0.902
LP5-20-SSM-S	1	1	2	S-12363KH11	0.204	0.175
LP5-08-SSM-S	1	1	3	S-12351KH11	0.0965	0.0861
LP5-20-SSM-S	1	1	4	S-12363KH21	0.206	0.176
LP5-10-SSM-S	1	1	5	S-12353KH21	0.0473	0.0670
LP5-21-SSM-S	1	1	6	S-12364KH21	0.144	0.159
LP5-16-MOD1-SSM-S	1	1	7	S-12359KH21	0.113	0.119
LP5-16-MOD1-SSM-S	1	1	8	S-12359KH11	0.114	0.123
LP5-03-SSM-S	1	1	9	S-12346KH21	0.149	0.181
LRM	1	1	10	LRMKH112	<0.0250	0.899
LP5-10-SSM-S	1	1	11	S-12353KH11	0.0501	0.0699
LP5-14-SSM-S	1	1	12	S-12357KH11	0.138	0.154
LP5-18-SSM-S	1	1	13	S-12361KH21	0.134	0.143
LP5-18-SSM-S	1	1	14	S-12361KH11	0.132	0.140
LP5-21-SSM-S	1	1	15	S-12364KH11	0.147	0.160
LP5-08-SSM-S	1	1	16	S-12351KH21	0.0999	0.0812
LP5-03-SSM-S	1	1	17	S-12346KH11	0.151	0.182
LP5-14-SSM-S	1	1	18	S-12357KH21	0.140	0.164
LRM	1	1	19	LRMKH113	<0.0250	0.899
LRM	1	2	1	LRMKH121	<0.0250	0.870
LP5-10-SSM-S	1	2	2	S-12353KH22	0.0497	0.0691
LP5-10-SSM-S	1	2	3	S-12353KH12	0.0506	0.0690
LP5-20-SSM-S	1	2	4	S-12363KH22	0.207	0.179
LP5-18-SSM-S	1	2	5	S-12361KH22	0.132	0.138
LP5-14-SSM-S	1	2	6	S-12357KH12	0.139	0.155
LP5-21-SSM-S	1	2	7	S-12364KH12	0.147	0.160
LP5-03-SSM-S	1	2	8	S-12346KH12	0.152	0.182
LP5-21-SSM-S	1	2	9	S-12364KH22	0.144	0.158
LRM	1	2	10	LRMKH122	<0.0250	0.898
LP5-03-SSM-S	1	2	11	S-12346KH22	0.151	0.184
LP5-14-SSM-S	1	2	12	S-12357KH22	0.141	0.165
LP5-16-MOD1-SSM-S	1	2	13	S-12359KH22	0.109	0.114
LP5-20-SSM-S	1	2	14	S-12363KH12	0.205	0.176
LP5-08-SSM-S	1	2	15	S-12351KH12	0.100	0.0883
LP5-18-SSM-S	1	2	16	S-12361KH12	0.133	0.141
LP5-16-MOD1-SSM-S	1	2	17	S-12359KH12	0.117	0.122
LP5-08-SSM-S	1	2	18	S-12351KH22	0.0993	0.0811
LRM	1	2	19	LRMKH123	<0.0250	0.902
LRM	2	1	1	LRMKH211	<0.0250	0.871
LP5-09-SSM-S	2	1	2	S-12352KH11	0.156	0.164
LP5-13-SSM-S	2	1	3	S-12356KH11	0.139	0.104
LP5-11-SSM-S	2	1	4	S-12354KH21	0.186	0.186
LP5-04-SSM-S	2	1	5	S-12347KH21	0.0967	0.107
LP5-07-SSM-S	2	1	6	S-12350KH21	0.0553	0.0401
LP5-06-MOD1-SSM-S	2	1	7	S-12349KH11	0.0822	0.147
LP5-13-SSM-S	2	1	8	S-12356KH21	0.130	0.104
LP5-23-SSM-S	2	1	9	S-12366KH11	0.0833	0.0487

Table A-1. KH Measurements (wt.%) of the LP5 SSM Study Glasses (continued)

PNNL ID	Block	Sub – Block	Seq	Lab ID	Cl^-	F^-
LRM	2	1	10	LRMKH212	<0.0250	0.883
LP5-24-SSM-S	2	1	11	S-12367KH21	0.307	0.205
LP5-04-SSM-S	2	1	12	S-12347KH11	0.0991	0.108
LP5-25-SSM-S	2	1	13	S-12368KH21	<0.0250	0.184
LP5-24-SSM-S	2	1	14	S-12367KH11	0.312	0.209
LP5-09-SSM-S	2	1	15	S-12352KH21	0.155	0.165
LP5-11-SSM-S	2	1	16	S-12354KH11	0.189	0.184
LP5-25-SSM-S	2	1	17	S-12368KH11	<0.0250	0.191
LP5-06-MOD1-SSM-S	2	1	18	S-12349KH21	0.0857	0.149
LP5-23-SSM-S	2	1	19	S-12366KH21	0.0845	0.0494
LP5-07-SSM-S	2	1	20	S-12350KH11	0.0529	0.0417
LRM	2	1	21	LRMKH213	<0.0250	0.876
LRM	2	2	1	LRMKH221	<0.0250	0.879
LP5-25-SSM-S	2	2	2	S-12368KH12	<0.0250	0.192
LP5-25-SSM-S	2	2	3	S-12368KH22	<0.0250	0.187
LP5-09-SSM-S	2	2	4	S-12352KH12	0.157	0.167
LP5-06-MOD1-SSM-S	2	2	5	S-12349KH12	0.0842	0.150
LP5-23-SSM-S	2	2	6	S-12366KH12	0.0831	0.0500
LP5-07-SSM-S	2	2	7	S-12350KH12	0.0523	0.0426
LP5-04-SSM-S	2	2	8	S-12347KH12	0.0983	0.105
LP5-11-SSM-S	2	2	9	S-12354KH22	0.188	0.189
LRM	2	2	10	LRMKH222	<0.0250	0.892
LP5-07-SSM-S	2	2	11	S-12350KH22	0.0563	0.0437
LP5-09-SSM-S	2	2	12	S-12352KH22	0.155	0.167
LP5-04-SSM-S	2	2	13	S-12347KH22	0.190	0.187
LP5-24-SSM-S	2	2	14	S-12367KH22	0.313	0.207
LP5-23-SSM-S	2	2	15	S-12366KH22	0.0847	0.0505
LP5-06-MOD1-SSM-S	2	2	16	S-12349KH22	0.0873	0.152
LP5-13-SSM-S	2	2	17	S-12356KH12	0.145	0.101
LP5-24-SSM-S	2	2	18	S-12367KH12	0.320	0.214
LP5-13-SSM-S	2	2	19	S-12356KH22	0.134	0.103
LP5-11-SSM-S	2	2	20	S-12354KH12	0.193	0.189
LRM	2	2	21	LRMKH223	<0.0250	0.891
LRM	3	1	1	LRMKH311	<0.0250	0.908
LP5-12-1-SSM-S	3	1	2	S-12355KH21	0.0416	0.182
LP5-01-SSM-S	3	1	3	S-12344KH11	0.223	0.182
LP5-15-SSM-S	3	1	4	S-12358KH21	0.315	0.0546
LP5-19-SSM-S	3	1	5	S-12362KH21	0.0769	0.0957
LP5-05-SSM-S	3	1	6	S-12348KH21	0.0914	0.0829
LP5-17-SSM-S	3	1	7	S-12360KH11	0.236	0.0669
LP5-12-1-SSM-S	3	1	8	S-12355KH11	0.0378	0.179
LP5-22-SSM-S	3	1	9	S-12365KH11	0.0642	0.0484
LRM	3	1	10	LRMKH312	<0.0250	0.912
LP5-02-SSM-S	3	1	11	S-12345KH21	0.104	0.141
LP5-15-SSM-S	3	1	12	S-12358KH11	0.313	0.0504
LP5-22-SSM-S	3	1	13	S-12365KH21	0.0611	0.0518
LP5-02-SSM-S	3	1	14	S-12345KH11	0.101	0.139

Table A-1. KH Measurements (wt.%) of the LP5 SSM Study Glasses (continued)

PNNL ID	Block	Sub – Block	Seq	Lab ID	Cl^-	F^-
LP5-17-SSM-S	3	1	15	S-12360KH21	0.236	0.0672
LP5-19-SSM-S	3	1	16	S-12362KH11	0.0728	0.0904
LP5-01-SSM-S	3	1	17	S-12344KH21	0.229	0.184
LP5-05-SSM-S	3	1	18	S-12348KH11	0.0964	0.0945
LRM	3	1	19	LRMKH313	<0.0250	0.919
LRM	3	2	1	LRMKH321	<0.0250	0.923
LP5-02-SSM-S	3	2	2	S-12345KH12	0.101	0.140
LP5-15-SSM-S	3	2	3	S-12358KH12	0.314	0.0498
LP5-19-SSM-S	3	2	4	S-12362KH22	0.0756	0.0952
LP5-22-SSM-S	3	2	5	S-12365KH22	0.0609	0.0514
LP5-02-SSM-S	3	2	6	S-12345KH22	0.104	0.140
LP5-17-SSM-S	3	2	7	S-12360KH22	0.237	0.0683
LP5-12-1-SSM-S	3	2	8	S-12355KH22	0.0409	0.183
LP5-01-SSM-S	3	2	9	S-12344KH12	0.222	0.183
LRM	3	2	10	LRMKH322	<0.0250	0.921
LP5-19-SSM-S	3	2	11	S-12362KH12	0.0770	0.0973
LP5-01-SSM-S	3	2	12	S-12344KH22	0.229	0.185
LP5-05-SSM-S	3	2	13	S-12348KH22	0.0889	0.0810
LP5-12-1-SSM-S	3	2	14	S-12355KH12	0.0388	0.189
LP5-17-SSM-S	3	2	15	S-12360KH12	0.236	0.0676
LP5-05-SSM-S	3	2	16	S-12348KH12	0.0954	0.0954
LP5-22-SSM-S	3	2	17	S-12365KH12	0.0628	0.0491
LP5-15-SSM-S	3	2	18	S-12358KH22	0.313	0.0548
LRM	3	2	19	LRMKH323	<0.0250	0.917

Table A-2. LM Measurements (wt.%) of the LP5 SSM Study Glasses

PNNL ID	Block	Sub-Block	Seq.	Lab ID	Al	Ca	Cr	Fe	K	Mg	Na	Ni	P	Pb	Re	S	Sn	Ti	V	Zn	Zr
LRM	1	1	1	LRMLM111	5.06	0.343	0.127	0.964	1.20	<0.100	15.4	0.13	0.202	<0.100	<0.0250	0.0863	<0.100	<0.100	<0.100	<0.100	0.660
LP5-17-SSM-S	1	1	2	S-12360LM21	1.81	3.40	0.0462	0.516	2.06	0.889	15.7	<0.100	<0.100	<0.100	<0.0250	0.549	3.22	0.360	2.53	4.51	3.20
LP5-13-SSM-S	1	1	3	S-12356LM11	2.23	0.177	0.107	0.564	2.71	1.48	20.00	<0.100	0.133	<0.100	<0.0250	1.10	0.604	0.596	2.12	1.30	2.70
LP5-02-SSM-S	1	1	4	S-12345LM21	1.78	7.85	0.0761	0.596	0.794	2.76	18.8	<0.100	0.173	<0.100	<0.0250	0.673	0.399	0.644	1.44	2.84	0.218
LP5-09-SSM-S	1	1	5	S-12352LM21	4.81	3.10	0.0939	0.518	1.86	0.463	19.2	<0.100	0.176	<0.100	<0.0250	0.585	1.93	0.815	0.510	4.54	0.489
LP5-06-MOD1-SSM-S	1	1	6	S-12349LM11	6.14	2.61	0.0932	0.139	2.06	1.55	17.2	<0.100	0.167	<0.100	<0.0250	0.485	2.32	0.743	2.52	0.279	1.22
LP5-14-SSM-S	1	1	7	S-12357LM21	2.34	0.393	0.297	0.107	2.56	0.889	17.9	0.737	0.201	<0.100	<0.0250	0.614	2.67	0.938	2.05	3.54	2.28
LP5-09-SSM-S	1	1	8	S-12352LM11	4.78	3.05	0.0939	0.508	1.86	0.465	19.3	<0.100	0.177	<0.100	<0.0250	0.589	1.93	0.822	0.514	4.50	0.501
LP5-03-SSM-S	1	1	9	S-12346LM21	2.43	4.52	0.130	0.243	<0.100	2.24	17.7	<0.100	0.231	<0.100	<0.0250	0.728	0.481	0.889	2.39	0.166	3.58
LRM	1	1	10	LRMLM112	4.98	0.343	0.126	0.964	1.20	<0.100	15.6	0.130	0.203	<0.100	<0.0250	0.0888	<0.100	<0.100	<0.100	<0.100	0.669
LP5-01-SSM-S	1	1	11	S-12344LM11	1.90	4.02	0.163	0.603	3.10	0.308	18.9	<0.100	0.227	<0.100	<0.0250	1.25	3.35	0.910	1.63	0.908	<0.100
LP5-17-SSM-S	1	1	12	S-12360LM11	1.85	3.51	0.0467	0.499	2.13	0.898	15.7	<0.100	<0.100	<0.100	<0.0250	0.546	3.28	0.370	2.59	4.53	3.29
LP5-03-SSM-S	1	1	13	S-12346LM11	2.51	4.57	0.181	0.238	0.108	2.25	17.6	0.252	0.227	<0.100	<0.0250	0.721	0.460	0.901	2.40	0.152	3.69
LP5-14-SSM-S	1	1	14	S-12357LM11	2.37	0.406	0.145	0.106	2.65	0.902	17.6	<0.100	0.200	<0.100	<0.0250	0.621	2.70	0.965	2.08	3.58	2.37
LP5-13-SSM-S	1	1	15	S-12356LM21	2.35	0.167	0.106	0.570	2.95	1.52	19.4	<0.100	0.135	<0.100	<0.0250	1.13	0.583	0.605	2.20	1.33	2.82
LP5-06-MOD1-SSM-S	1	1	16	S-12349LM21	6.33	2.70	0.0979	0.146	2.10	1.61	16.3	<0.100	0.167	<0.100	<0.0250	0.506	2.38	0.792	2.61	0.296	1.29
LP5-01-SSM-S	1	1	17	S-12344LM21	1.96	4.10	0.166	0.620	3.21	0.308	18.8	<0.100	0.229	<0.100	<0.0250	1.26	3.40	0.917	1.67	0.889	<0.100
LP5-02-SSM-S	1	1	18	S-12345LM11	1.83	7.97	0.0767	0.600	0.811	2.78	18.3	<0.100	0.174	<0.100	<0.0250	0.669	0.411	0.663	1.46	2.84	0.222
LRM	1	1	19	LRMLM113	5.02	0.341	0.127	0.967	1.21	<0.100	15.8	0.130	0.205	<0.100	<0.0250	0.0855	<0.100	<0.100	<0.100	<0.100	0.668
LRM	1	2	1	LRMLM121	5.21	0.377	0.129	0.972	1.27	<0.100	15.6	0.128	0.210	<0.100	<0.0250	0.0931	<0.100	<0.100	<0.100	<0.100	0.665
LP5-06-MOD1-SSM-S	1	2	2	S-12349LM12	6.34	2.72	0.0953	0.141	2.21	1.62	15.6	<0.100	0.173	<0.100	<0.0250	0.493	2.32	0.767	2.63	0.287	1.27
LP5-02-SSM-S	1	2	3	S-12345LM12	1.88	8.26	0.0783	0.602	0.843	2.90	18.2	<0.100	0.179	<0.100	<0.0250	0.684	0.416	0.672	1.52	2.86	0.228
LP5-01-SSM-S	1	2	4	S-12344LM12	1.96	4.16	0.166	0.608	3.35	0.317	18.7	<0.100	0.231	<0.100	<0.0250	1.27	3.37	0.919	1.69	0.936	<0.100
LP5-02-SSM-S	1	2	5	S-12345LM22	1.83	8.19	0.0776	0.600	0.819	2.89	18.2	<0.100	0.179	<0.100	<0.0250	0.678	0.410	0.659	1.51	2.89	0.204
LP5-17-SSM-S	1	2	6	S-12360LM12	1.88	3.60	0.0471	0.497	2.25	0.917	15.5	<0.100	<0.100	<0.100	<0.0250	0.559	3.27	0.369	2.68	4.66	3.36
LP5-13-SSM-S	1	2	7	S-12356LM22	2.32	0.181	0.108	0.569	2.96	1.53	19.1	<0.100	0.135	<0.100	<0.0250	1.07	0.595	0.607	2.20	1.30	2.79
LP5-14-SSM-S	1	2	8	S-12357LM22	2.43	0.432	0.304	0.108	2.79	0.918	17.4	0.726	0.204	<0.100	<0.0250	0.628	2.73	0.961	2.16	3.61	2.41
LP5-17-SSM-S	1	2	9	S-12360LM22	1.89	3.59	0.047	0.515	2.27	0.911	15.4	<0.100	<0.100	<0.100	<0.0250	0.556	3.30	0.366	2.67	4.65	3.38
LRM	1	2	10	LRMLM122	5.20	0.368	0.127	0.958	1.23	<0.100	15.3	0.126	0.206	<0.100	<0.0250	0.0870	<0.100	<0.100	<0.100	<0.100	0.659
LP5-03-SSM-S	1	2	11	S-12346LM22	2.51	4.68	0.133	0.244	<0.100	2.34	17.4	<0.100	0.233	<0.100	<0.0250	0.734	0.484	0.900	2.49	0.168	3.66
LP5-13-SSM-S	1	2	12	S-12356LM12	2.29	0.194	0.109	0.567	2.90	1.54	18.9	<0.100	0.140	<0.100	<0.0250	1.08	0.613	0.607	2.19	1.32	2.77
LP5-14-SSM-S	1	2	13	S-12357LM12	2.38	0.434	0.145	0.104	2.72	0.914	17.0	<0.100	0.202	<0.100	<0.0250	0.629	2.71	0.957	2.14	3.61	2.39
LP5-01-SSM-S	1	2	14	S-12344LM22	1.92	4.09	0.166	0.613	3.24	0.314	18.4	<0.100	0.231	<0.100	<0.0250	1.24	3.36	0.913	1.68	0.890	<0.100
LP5-09-SSM-S	1	2	15	S-12352LM12	4.94	3.19	0.0961	0.509	1.97	0.479	18.7	<0.100	0.179	<0.100	<0.0250	0.599	1.97	0.841	0.522	4.57	0.485
LP5-03-SSM-S	1	2	16	S-12346LM12	2.55	4.67	0.181	0.235	0.112	2.33	17.5	0.244	0.230	<0.100	<0.0250	0.734	0.458	0.898	2.48	0.152	3.68
LP5-06-MOD1-SSM-S	1	2	17	S-12349LM22	6.38	2.76	0.0982	0.144	2.20	1.65	16.3	<0.100	0.172	<0.100	<0.0250	0.506	2.38	0.790	2.66	0.296	1.30
LP5-09-SSM-S	1	2	18	S-12352LM22	4.96	3.25	0.0961	0.521	1.99	0.478	19.2	<0.100	0.178	<0.100	<0.0250	0.603	2.00	0.839	0.520	4.57	0.493
LRM	1	2	19	LRMLM123	5.16	0.372	0.128	0.959	1.24	<0.100	15.6	0.126	0.206	<0.100	<0.0250	0.0895	<0.100	<0.100	<0.100	<0.100	0.659
LRM	2	1	1	LRMLM211	5.19	0.374	0.129	0.973	1.19	<0.100	15.1	0.134	0.208	<0.100	<0.0250	0.0912	<0.100	<0.100	<0.100	<0.100	0.695
LP5-25-SSM-S	2	1	2	S-12368LM11	3.01	3.65	<0.0250	3.57	<0.100	0.832	11.3	<0.100	<0.100	<0.100	<0.0250	0.515	<0.100	0.653	<0.100	2.36	2.03
LP5-18-SSM-S	2	1	3	S-12361LM21	2.98	0.333	0.113	0.370	1.23	2.93	17.2	<0.100	0.184	<0.100	<0.0250	0.599	0.149	0.725	1.87	4.54	0.129
LP5-07-SSM-S	2	1	4	S-12350LM21	7.53	0.913	0.0356	<0.100	1.45	2.32	19.2	<0.100	<0.100	<0.100	<0.0250	0.517	0.169	0.256	0.386	0.181	0.430
LP5-18-SSM-S	2	1	5	S-12361LM11	2.99	0.334	0.126	0.370	1.24	2.94	17.1	<0.100	0.187	<0.100	<0.0250	0.606	0.150	0.728	1.88	4.57	0.126
LP5-04-SSM-S	2	1	6	S-12347LM21	2.44	8.24	0.0778	<0.100	2.21	0.119	17.3	<0.100	0.151	<0.100	<0.0250	0.781	0.810	0.572	<0.100	4.48	0.358
LP5-21-SSM-S	2	1	7	S-12364LM11	3.05	3.50	0.135	<0.100	3.00	1.77	15.9	<0.100	0.209	<0.100	<0.0250	0.761	0.904	0.828	1.77	1.21	0.500
LP5-25-SSM-S	2	1	8	S-12368LM21	3.09	3.78	<0.0250	3.63	<0.100	0.818	11.0	<0.100	<0.100	<0.100	<0.0250	0.496	<0.100	0.636	<0.100	2.41	2.06
LP5-05-SSM-S	2	1	9	S-12348LM21	2.05	5.13	0.0645	0.626	1.62	2.86	16.3	<0.100	0.106	<0.100	<0.0250	0.772	2.69	0.402	2.74	1.01	0.377

Table A-2. LM Measurements (wt.%) of the LP5 SSM Study Glasses (continued)

PNNL ID	Block	Sub-Block	Seq.	Lab ID	Al	Ca	Cr	Fe	K	Mg	Na	Ni	P	Pb	Re	S	Sn	Ti	V	Zn	Zr
LRM	2	1	10	LRMLM212	5.2	0.359	0.126	0.951	1.19	<0.100	15.0	0.131	0.204	<0.100	<0.0250	0.0886	<0.100	<0.100	<0.100	<0.100	0.678
LP5-04-SSM-S	2	1	11	S-12347LM11	2.51	8.45	0.0768	0.100	2.26	0.118	17.5	<0.100	0.148	<0.100	<0.0250	0.786	0.807	0.565	<0.100	4.58	0.352
LP5-21-SSM-S	2	1	12	S-12364LM21	3.09	3.56	0.142	0.104	3.06	1.80	15.9	<0.100	0.203	<0.100	<0.0250	0.763	0.905	0.833	1.79	1.21	0.485
LP5-11-SSM-S	2	1	13	S-12354LM21	2.89	1.76	0.138	0.475	0.295	2.19	17.8	<0.100	0.199	<0.100	<0.0250	0.678	1.24	0.902	2.86	3.48	0.801
LP5-16-MOD1-SSM-S	2	1	14	S-12359LM21	4.17	6.42	0.0574	0.435	0.305	2.68	17.2	<0.100	0.147	<0.100	<0.0250	0.483	3.21	0.594	0.412	0.273	2.17
LP5-07-SSM-S	2	1	15	S-12350LM11	7.53	0.881	0.0352	<0.100	1.44	2.32	18.4	<0.100	<0.100	<0.100	<0.0250	0.502	0.160	0.248	0.378	0.179	0.425
LP5-22-SSM-S	2	1	16	S-12365LM11	1.93	0.294	0.0547	0.467	0.282	2.67	18.5	<0.100	<0.100	<0.100	<0.0250	0.614	0.724	0.265	0.318	<0.100	1.20
LP5-16-MOD1-SSM-S	2	1	17	S-12359LM11	4.21	6.49	0.0563	0.433	0.300	2.70	17.2	<0.100	0.138	<0.100	<0.0250	0.489	3.22	0.588	0.408	0.270	2.21
LP5-11-SSM-S	2	1	18	S-12354LM11	2.94	1.78	0.131	0.475	0.291	2.22	17.8	<0.100	0.210	<0.100	<0.0250	0.684	1.24	0.905	2.89	3.52	0.850
LP5-22-SSM-S	2	1	19	S-12365LM21	1.88	0.289	0.0572	0.489	0.267	2.66	17.3	<0.100	<0.100	<0.100	<0.0250	0.629	0.766	0.273	0.326	<0.100	1.19
LP5-05-SSM-S	2	1	20	S-12348LM11	2.08	5.24	0.0645	0.625	1.65	2.89	16.3	<0.100	0.106	<0.100	<0.0250	0.778	2.70	0.405	2.77	1.02	0.374
LRM	2	1	21	LRMLM213	5.21	0.341	0.140	1.06	1.17	<0.100	14.9	0.150	0.229	0.108	<0.0250	0.0959	<0.100	<0.100	<0.100	<0.100	0.690
LRM	2	2	1	LRMLM221	5.22	0.353	0.129	0.978	1.23	<0.100	15.4	0.135	0.205	<0.100	<0.0250	0.0888	<0.100	<0.100	<0.100	<0.100	0.717
LP5-18-SSM-S	2	2	2	S-12361LM12	2.97	0.319	0.128	0.373	1.26	2.93	17.5	<0.100	0.185	<0.100	<0.0250	0.606	0.148	0.745	1.86	4.48	0.130
LP5-07-SSM-S	2	2	3	S-12350LM22	7.34	0.887	0.0363	<0.100	1.44	2.28	18.6	<0.100	<0.100	<0.100	<0.0250	0.518	0.167	0.265	0.394	0.182	0.450
LP5-25-SSM-S	2	2	4	S-12368LM22	3.03	3.57	<0.0250	3.57	<0.100	0.847	11.3	<0.100	<0.100	<0.100	<0.0250	0.509	<0.100	0.678	<0.100	2.36	2.01
LP5-11-SSM-S	2	2	5	S-12354LM12	2.88	1.67	0.137	0.499	0.308	2.18	18.3	<0.100	0.212	<0.100	<0.0250	0.701	1.23	0.978	2.82	3.39	0.918
LP5-05-SSM-S	2	2	6	S-12348LM12	2.06	5.02	0.0664	0.649	1.67	2.86	16.8	<0.100	0.108	<0.100	<0.0250	0.807	2.71	0.434	2.71	1.00	0.400
LP5-07-SSM-S	2	2	7	S-12350LM12	7.39	0.911	0.0373	<0.100	1.45	2.29	19.0	<0.100	<0.100	<0.100	<0.0250	0.535	0.172	0.272	0.402	0.187	0.459
LP5-16-MOD1-SSM-S	2	2	8	S-12359LM12	4.09	6.09	0.0593	0.455	0.320	2.64	17.7	<0.100	0.144	<0.100	<0.0250	0.511	3.19	0.637	0.429	0.277	2.12
LP5-22-SSM-S	2	2	9	S-12365LM22	1.86	0.288	0.0593	0.512	0.286	2.62	18.0	<0.100	<0.100	<0.100	<0.0250	0.653	0.804	0.292	0.341	<0.100	1.19
LRM	2	2	10	LRMLM222	5.11	0.359	0.133	0.999	1.19	<0.100	15.6	0.139	0.211	<0.100	<0.0250	0.0934	<0.100	<0.100	<0.100	<0.100	0.735
LP5-18-SSM-S	2	2	11	S-12361LM22	2.94	0.319	0.117	0.381	1.25	2.91	17.4	<0.100	0.190	<0.100	<0.0250	0.632	0.153	0.752	1.85	4.45	0.126
LP5-11-SSM-S	2	2	12	S-12354LM22	2.82	1.64	0.144	0.494	0.312	2.14	18.2	<0.100	0.197	<0.100	<0.0250	0.715	1.20	0.949	2.77	3.34	0.840
LP5-21-SSM-S	2	2	13	S-12364LM22	2.97	3.33	0.147	0.108	2.99	1.75	15.6	<0.100	0.207	<0.100	<0.0250	0.803	0.949	0.874	1.74	1.19	0.511
LP5-16-MOD1-SSM-S	2	2	14	S-12359LM22	4.06	6.10	0.0600	0.456	0.325	2.63	17.4	<0.100	0.147	<0.100	<0.0250	0.523	3.18	0.627	0.428	0.279	2.11
LP5-05-SSM-S	2	2	15	S-12348LM22	2.01	4.96	0.0678	0.650	1.63	2.83	16.6	<0.100	0.109	<0.100	<0.0250	0.831	2.67	0.422	2.68	1.00	0.400
LP5-21-SSM-S	2	2	16	S-12364LM12	3.01	3.36	0.141	<0.100	3.02	1.76	15.7	<0.100	0.213	<0.100	<0.0250	0.806	0.954	0.865	1.74	1.21	0.530
LP5-22-SSM-S	2	2	17	S-12365LM12	1.87	0.288	0.0579	0.491	0.303	2.61	18.0	<0.100	<0.100	<0.100	<0.0250	0.667	0.771	0.280	0.333	<0.100	1.15
LP5-25-SSM-S	2	2	18	S-12368LM12	2.95	3.47	<0.0250	3.51	<0.100	0.850	11.3	<0.100	<0.100	<0.100	<0.0250	0.521	<0.100	0.666	<0.100	2.32	1.99
LP5-04-SSM-S	2	2	19	S-12347LM12	2.40	7.93	0.0789	0.104	2.20	0.121	18.2	<0.100	0.151	<0.100	<0.0250	0.826	0.838	0.590	<0.100	4.37	0.383
LP5-04-SSM-S	2	2	20	S-12347LM22	2.41	7.96	0.0805	0.102	2.20	0.122	18.2	<0.100	0.152	<0.100	<0.0250	0.823	0.839	0.594	<0.100	4.44	0.375
LRM	2	2	21	LRMLM223	5.10	0.358	0.133	1.00	1.18	<0.100	15.4	0.140	0.208	0.100	<0.0250	0.0948	<0.100	<0.100	<0.100	<0.100	0.733
LRM	3	1	1	LRMLM311	5.21	0.358	0.127	0.957	1.24	<0.100	15.5	0.137	0.198	<0.100	<0.0250	0.0901	<0.100	<0.100	<0.100	<0.100	0.689
LP5-20-SSM-S	3	1	2	S-12363LM11	2.11	1.11	0.177	0.451	1.81	1.77	18.2	0.115	0.214	<0.100	<0.0250	0.715	2.94	0.910	0.112	0.381	1.12
LP5-10-SSM-S	3	1	3	S-12353LM21	2.40	1.41	0.0357	0.307	2.14	2.55	20.0	<0.100	<0.100	<0.100	<0.0250	0.625	2.80	0.333	0.671	4.33	2.82
LP5-10-SSM-S	3	1	4	S-12353LM11	2.37	1.40	0.0362	0.306	2.11	2.52	20.3	<0.100	<0.100	<0.100	<0.0250	0.623	2.76	0.328	0.669	4.25	2.71
LP5-19-SSM-S	3	1	5	S-12362LM21	2.02	4.82	0.0531	<0.100	3.66	2.78	16.8	<0.100	0.110	<0.100	<0.0250	0.610	1.22	0.451	0.667	4.25	1.16
LP5-24-SSM-S	3	1	6	S-12367LM11	5.30	3.71	0.128	0.410	0.657	0.397	16.6	<0.100	0.234	<0.100	<0.0250	0.403	1.20	<0.100	0.515	2.25	2.87
LP5-08-SSM-S	3	1	7	S-12351LM11	7.07	0.534	0.0615	0.347	3.25	<0.100	20.3	<0.100	<0.100	<0.100	<0.0250	0.625	2.94	0.450	0.159	1.44	1.12
LP5-08-SSM-S	3	1	8	S-12351LM21	7.16	0.528	0.0617	0.351	3.27	<0.100	20.4	<0.100	<0.100	<0.100	<0.0250	0.612	2.99	0.450	0.160	1.47	1.11
LP5-15-SSM-S	3	1	9	S-12358LM11	7.64	0.258	0.0170	0.640	3.09	1.29	18.7	<0.100	<0.100	<0.100	<0.0250	0.403	0.315	0.281	1.30	<0.100	4.21
LRM	3	1	10	LRMLM312	5.26	0.351	0.126	0.937	1.22	<0.100	15.6	0.134	0.196	<0.100	<0.0250	0.0885	<0.100	<0.100	<0.100	<0.100	0.698
LP5-19-SSM-S	3	1	11	S-12362LM11	2.00	4.81	0.0559	<0.100	3.58	2.73	16.7	<0.100	0.103	<0.100	<0.0250	0.608	1.18	0.436	0.648	4.200	1.07
LP5-12-1-SSM-S	3	1	12	S-12355LM11	7.43	0.873	0.137	0.396	1.38	3.05	17.1	0.214	0.177	<0.100	<0.0250	0.343	1.06	0.911	1.61	1.89	1.76
LP5-23-SSM-S	3	1	13	S-12366LM21	2.01	4.69	0.0606	0.113	1.28	1.41	17.9	<0.100	<0.100	<0.100	<0.0250	0.869	1.04	0.282	1.47	0.317	0.262
LP5-24-SSM-S	3	1	14	S-12367LM21	5.30	3.73	0.127	0.405	0.630	0.394	16.4	<0.100	0.229	<0.100	<0.0250	0.407	1.18	<0.100	0.512	2.25	2.84

Table A-2. LM Measurements (wt.%) of the LP5 SSM Study Glasses (continued)

PNNL ID	Block	Sub-Block	Seq.	Lab ID	Al	Ca	Cr	Fe	K	Mg	Na	Ni	P	Pb	Re	S	Sn	Ti	V	Zn	Zr
LP5-20-SSM-S	3	1	15	S-12363LM21	2.08	1.11	0.156	0.439	1.77	1.74	18.8	<0.100	0.205	<0.100	<0.0250	0.723	2.89	0.885	0.110	0.368	1.13
LP5-12-1-SSM-S	3	1	16	S-12355LM21	7.32	0.899	0.139	0.402	1.36	3.01	17.6	0.216	0.182	<0.100	<0.0250	0.345	1.05	0.936	1.58	1.86	1.74
LP5-15-SSM-S	3	1	17	S-12358LM21	7.23	0.264	0.0169	0.649	2.86	1.22	19.2	<0.100	<0.100	<0.100	<0.0250	0.407	0.313	0.290	1.23	<0.100	3.98
LP5-23-SSM-S	3	1	18	S-12366LM11	1.93	4.54	0.0622	0.115	1.23	1.37	18.3	<0.100	<0.100	<0.100	<0.0250	0.890	1.00	0.295	1.42	0.326	0.283
LRM	3	1	19	LRMLM313	5.29	0.367	0.127	0.953	1.22	<0.100	15.9	0.135	0.199	<0.100	<0.0250	0.0921	<0.100	<0.100	<0.100	<0.100	0.696
LRM	3	2	1	LRMLM321	5.25	0.325	0.126	0.943	1.25	<0.100	15.5	0.135	0.198	<0.100	<0.0250	0.0852	<0.100	<0.100	<0.100	<0.100	0.683
LP5-20-SSM-S	3	2	2	S-12363LM22	2.06	1.13	0.159	0.449	1.80	1.77	18.0	<0.100	0.211	<0.100	<0.0250	0.704	2.92	0.893	0.113	0.381	1.09
LP5-23-SSM-S	3	2	3	S-12366LM12	1.93	4.68	0.0628	0.117	1.26	1.40	17.7	<0.100	<0.100	<0.100	<0.0250	0.857	1.04	0.292	1.43	0.326	0.275
LP5-08-SSM-S	3	2	4	S-12351LM12	6.93	0.505	0.0623	0.352	3.25	<0.100	19.5	<0.100	<0.100	<0.100	<0.0250	0.607	2.91	0.456	0.163	1.44	1.05
LP5-20-SSM-S	3	2	5	S-12363LM12	2.08	1.15	0.181	0.459	1.82	1.79	18.6	0.117	0.213	<0.100	<0.0250	0.728	2.94	0.925	0.115	0.382	1.12
LP5-12-1-SSM-S	3	2	6	S-12355LM22	7.38	1.01	0.144	0.415	1.40	3.10	16.9	0.226	0.185	<0.100	<0.0250	0.342	1.08	0.961	1.61	1.93	1.76
LP5-19-SSM-S	3	2	7	S-12362LM12	2.03	5.08	0.0585	<0.100	3.74	2.82	16.8	<0.100	0.107	<0.100	<0.0250	0.608	1.21	0.464	0.691	4.33	1.12
LP5-08-SSM-S	3	2	8	S-12351LM22	7.09	0.512	0.0633	0.361	3.34	<0.100	19.5	<0.100	<0.100	<0.100	<0.0250	0.619	2.99	0.469	0.165	1.48	1.10
LP5-19-SSM-S	3	2	9	S-12362LM22	1.99	5.00	0.0548	<0.100	3.69	2.79	16.3	<0.100	0.112	<0.100	<0.0250	0.614	1.19	0.465	0.691	4.29	1.11
LRM	3	2	10	LRMLM322	5.29	0.340	0.129	0.972	1.27	<0.100	15.7	0.139	0.198	<0.100	<0.0250	0.0873	<0.100	<0.100	<0.100	<0.100	0.705
LP5-15-SSM-S	3	2	11	S-12358LM22	7.12	0.252	0.0177	0.678	2.93	1.24	18.8	<0.100	<0.100	<0.100	<0.0250	0.414	0.321	0.300	1.23	<0.100	3.89
LP5-10-SSM-S	3	2	12	S-12353LM22	2.35	1.43	0.0368	0.316	2.13	2.57	20.2	<0.100	<0.100	<0.100	<0.0250	0.646	2.82	0.341	0.699	4.29	2.85
LP5-24-SSM-S	3	2	13	S-12367LM22	5.20	3.77	0.134	0.432	0.666	0.416	16.2	<0.100	0.248	<0.100	<0.0250	0.422	1.21	<0.100	0.545	2.29	2.88
LP5-24-SSM-S	3	2	14	S-12367LM12	5.15	3.73	0.132	0.424	0.666	0.410	15.9	<0.100	0.244	<0.100	<0.0250	0.413	1.17	<0.100	0.539	2.26	2.82
LP5-12-1-SSM-S	3	2	15	S-12355LM12	7.30	0.866	0.145	0.421	1.39	3.09	17.0	0.229	0.191	<0.100	<0.0250	0.351	1.08	0.970	1.60	1.94	1.79
LP5-15-SSM-S	3	2	16	S-12358LM12	6.97	0.251	0.0178	0.668	2.88	1.21	18.9	<0.100	<0.100	<0.100	<0.0250	0.414	0.320	0.294	1.20	<0.100	3.88
LP5-10-SSM-S	3	2	17	S-12353LM12	2.34	1.43	0.0374	0.317	2.11	2.54	20.1	<0.100	<0.100	<0.100	<0.0250	0.640	2.76	0.338	0.699	4.30	2.73
LP5-23-SSM-S	3	2	18	S-12366LM22	1.87	4.57	0.0641	0.120	1.23	1.37	18.1	<0.100	<0.100	<0.100	<0.0250	0.895	1.04	0.301	1.40	0.335	0.298
LRM	3	2	19	LRMLM323	5.21	0.343	0.131	0.977	1.22	<0.100	15.7	0.140	0.204	<0.100	<0.0250	0.0908	<0.100	<0.100	<0.100	<0.100	0.696

Table A-3. PF Measurements (wt.%) of the LP5 SSM Study Glasses

PNNL ID	Block	Sub-Block	Seq.	Lab ID	B	Li	Si
LRM	1	1	1	LRMPF111	2.38	<0.100	26.1
LP5-14-SSM-S	1	1	2	S-12357PF21	2.00	<0.100	19.1
LP5-21-SSM-S	1	1	3	S-12364PF21	4.03	<0.100	17.6
LP5-15-SSM-S	1	1	4	S-12358PF11	2.80	<0.100	18.7
LP5-20-SSM-S	1	1	5	S-12363PF11	4.15	<0.100	19.7
LP5-07-SSM-S	1	1	6	S-12350PF11	3.19	<0.100	19.1
LP5-20-SSM-S	1	1	7	S-12363PF21	4.07	<0.100	19.7
LP5-15-SSM-S	1	1	8	S-12358PF21	2.69	<0.100	18.6
LP5-18-SSM-S	1	1	9	S-12361PF21	2.80	<0.100	20.3
LRM	1	1	10	LRMPF112	2.36	<0.100	26.2
LP5-25-SSM-S	1	1	11	S-12368PF21	2.99	0.899	23.5
LP5-07-SSM-S	1	1	12	S-12350PF21	3.11	<0.100	19.4
LP5-25-SSM-S	1	1	13	S-12368PF11	2.96	0.890	23.0
LP5-14-SSM-S	1	1	14	S-12357PF11	1.95	<0.100	19.9
LP5-21-SSM-S	1	1	15	S-12364PF11	3.89	<0.100	17.8
LP5-11-SSM-S	1	1	16	S-12354PF11	2.19	<0.100	18.7
LP5-11-SSM-S	1	1	17	S-12354PF21	2.14	<0.100	18.3
LP5-18-SSM-S	1	1	18	S-12361PF11	2.80	<0.100	19.6
LRM	1	1	19	LRMPF113	2.37	<0.100	26.3
LRM	1	2	1	LRMPF121	2.45	<0.100	26.1
LP5-18-SSM-S	1	2	2	S-12361PF12	2.94	<0.100	19.0
LP5-14-SSM-S	1	2	3	S-12357PF22	2.03	<0.100	18.8
LP5-15-SSM-S	1	2	4	S-12358PF22	2.80	<0.100	16.8
LP5-15-SSM-S	1	2	5	S-12358PF12	2.83	<0.100	16.7
LP5-25-SSM-S	1	2	6	S-12368PF22	3.07	0.931	22.0
LP5-11-SSM-S	1	2	7	S-12354PF12	2.19	<0.100	17.7
LP5-18-SSM-S	1	2	8	S-12361PF22	2.91	<0.100	19.1
LP5-25-SSM-S	1	2	9	S-12368PF12	3.06	0.927	22.3
LRM	1	2	10	LRMPF122	2.49	<0.100	26.1
LP5-07-SSM-S	1	2	11	S-12350PF22	3.17	<0.100	18.2
LP5-07-SSM-S	1	2	12	S-12350PF12	3.22	<0.100	18.5
LP5-11-SSM-S	1	2	13	S-12354PF22	2.26	<0.100	17.8
LP5-14-SSM-S	1	2	14	S-12357PF12	2.03	<0.100	18.9
LP5-20-SSM-S	1	2	15	S-12363PF12	4.13	<0.100	18.9
LP5-21-SSM-S	1	2	16	S-12364PF12	4.05	<0.100	17.0
LP5-20-SSM-S	1	2	17	S-12363PF22	4.13	<0.100	18.9
LP5-21-SSM-S	1	2	18	S-12364PF22	4.04	<0.100	17.0
LRM	1	2	19	LRMPF123	2.43	<0.100	25.8
LRM	2	1	1	LRMPF211	2.42	<0.100	25.6
LP5-04-SSM-S	2	1	2	S-12347PF11	2.97	<0.100	16.0
LP5-10-SSM-S	2	1	3	S-12353PF21	1.83	<0.100	16.8
LP5-04-SSM-S	2	1	4	S-12347PF21	2.97	<0.100	16.0
LP5-17-SSM-S	2	1	5	S-12360PF11	2.42	<0.100	16.7
LP5-01-SSM-S	2	1	6	S-12344PF11	3.22	<0.100	16.1
LP5-10-SSM-S	2	1	7	S-12353PF11	1.83	<0.100	16.8
LP5-22-SSM-S	2	1	8	S-12365PF21	3.69	<0.100	21.6
LP5-09-SSM-S	2	1	9	S-12352PF21	2.09	<0.100	16.5
LRM	2	1	10	LRMPF212	2.45	<0.100	25.7

Table A-3. PF Measurements (wt.%) of the LP5 SSM Study Glasses (continued)

PNNL ID	Block	Sub-Block	Seq.	Lab ID	B	Li	Si
LP5-01-SSM-S	2	1	11	S-12344PF21	3.10	<0.100	15.4
LP5-06-MOD1-SSM-S	2	1	12	S-12349PF11	2.44	<0.100	16.2
LP5-06-MOD1-SSM-S	2	1	13	S-12349PF21	2.49	<0.100	16.5
LP5-22-SSM-S	2	1	14	S-12365PF11	3.74	<0.100	22.0
LP5-09-SSM-S	2	1	15	S-12352PF11	2.11	<0.100	16.9
LP5-17-SSM-S	2	1	16	S-12360PF21	2.39	<0.100	16.3
LP5-02-SSM-S	2	1	17	S-12345PF21	2.07	<0.100	16.2
LP5-02-SSM-S	2	1	18	S-12345PF11	2.05	<0.100	16.1
LP5-16-MOD1-SSM-S	2	1	19	S-12359PF21	2.25	<0.100	16.3
LP5-16-MOD1-SSM-S	2	1	20	S-12359PF11	2.19	<0.100	15.8
LRM	2	1	21	LRMPF213	2.43	<0.100	25.5
LRM	2	2	1	LRMPF221	2.40	<0.100	25.9
LP5-01-SSM-S	2	2	2	S-12344PF12	3.01	<0.100	15.1
LP5-17-SSM-S	2	2	3	S-12360PF22	2.31	<0.100	16.2
LP5-06-MOD1-SSM-S	2	2	4	S-12349PF22	2.40	<0.100	16.1
LP5-09-SSM-S	2	2	5	S-12352PF12	2.01	<0.100	16.0
LP5-04-SSM-S	2	2	6	S-12347PF22	2.92	<0.100	16.0
LP5-17-SSM-S	2	2	7	S-12360PF12	2.30	<0.100	16.1
LP5-01-SSM-S	2	2	8	S-12344PF22	3.07	<0.100	15.7
LP5-16-MOD1-SSM-S	2	2	9	S-12359PF22	2.14	<0.100	15.9
LRM	2	2	10	LRMPF222	2.38	<0.100	25.6
LP5-06-MOD1-SSM-S	2	2	11	S-12349PF12	2.44	<0.100	16.3
LP5-02-SSM-S	2	2	12	S-12345PF12	2.05	<0.100	16.5
LP5-04-SSM-S	2	2	13	S-12347PF12	3.02	<0.100	16.1
LP5-10-SSM-S	2	2	14	S-12353PF22	1.81	<0.100	16.8
LP5-02-SSM-S	2	2	15	S-12345PF22	2.03	<0.100	16.3
LP5-09-SSM-S	2	2	16	S-12352PF22	2.06	<0.100	16.6
LP5-22-SSM-S	2	2	17	S-12365PF22	3.74	<0.100	21.9
LP5-16-MOD1-SSM-S	2	2	18	S-12359PF12	2.18	<0.100	16.0
LP5-10-SSM-S	2	2	19	S-12353PF12	1.81	<0.100	16.8
LP5-22-SSM-S	2	2	20	S-12365PF12	3.70	<0.100	22.1
LRM	2	2	21	LRMPF223	2.44	<0.100	26.0
LRM	3	1	1	LRMPF311	2.09	<0.100	25.2
LP5-08-SSM-S	3	1	2	S-12351PF21	2.52	<0.100	16.2
LP5-13-SSM-S	3	1	3	S-12356PF11	3.25	<0.100	15.6
LP5-23-SSM-S	3	1	4	S-12366PF11	1.54	<0.100	22.0
LP5-08-SSM-S	3	1	5	S-12351PF11	2.48	<0.100	16.2
LP5-24-SSM-S	3	1	6	S-12367PF21	2.62	<0.100	18.8
LP5-03-SSM-S	3	1	7	S-12346PF21	2.79	<0.100	15.8
LP5-19-SSM-S	3	1	8	S-12362PF11	2.81	<0.100	16.2
LP5-12-1-SSM-S	3	1	9	S-12355PF11	1.53	<0.100	16.8
LRM	3	1	10	LRMPF312	2.08	<0.100	25.5
LP5-13-SSM-S	3	1	11	S-12356PF21	3.25	<0.100	15.7
LP5-19-SSM-S	3	1	12	S-12362PF21	2.75	<0.100	16.0
LP5-03-SSM-S	3	1	13	S-12346PF11	2.77	<0.100	16.0
LP5-12-1-SSM-S	3	1	14	S-12355PF21	1.50	<0.100	16.7
LP5-05-SSM-S	3	1	15	S-12348PF11	2.32	<0.100	15.9
LP5-05-SSM-S	3	1	16	S-12348PF21	2.30	<0.100	15.9

Table A-3. PF Measurements (wt.%) of the LP5 SSM Study Glasses (continued)

PNNL ID	Block	Sub-Block	Seq.	Lab ID	B	Li	Si
LP5-23-SSM-S	3	1	17	S-12366PF21	1.49	<0.100	22.1
LP5-24-SSM-S	3	1	18	S-12367PF11	2.56	<0.100	18.7
LRM	3	1	19	LRMPF313	2.00	<0.100	25.4
LRM	3	2	1	LRMPF321	2.25	<0.100	25.0
LP5-08-SSM-S	3	2	2	S-12351PF12	2.68	<0.100	16.0
LP5-12-1-SSM-S	3	2	3	S-12355PF12	1.69	<0.100	16.3
LP5-03-SSM-S	3	2	4	S-12346PF12	2.90	<0.100	15.5
LP5-05-SSM-S	3	2	5	S-12348PF12	2.44	<0.100	15.2
LP5-19-SSM-S	3	2	6	S-12362PF12	2.93	<0.100	15.8
LP5-23-SSM-S	3	2	7	S-12366PF22	1.72	<0.100	21.5
LP5-08-SSM-S	3	2	8	S-12351PF22	2.68	<0.100	16.0
LP5-03-SSM-S	3	2	9	S-12346PF22	2.94	<0.100	15.7
LRM	3	2	10	LRMPF322	2.26	<0.100	25.1
LP5-13-SSM-S	3	2	11	S-12356PF12	3.36	<0.100	15.2
LP5-24-SSM-S	3	2	12	S-12367PF12	2.77	<0.100	18.3
LP5-19-SSM-S	3	2	13	S-12362PF22	2.97	<0.100	15.8
LP5-13-SSM-S	3	2	14	S-12356PF22	3.39	<0.100	15.3
LP5-23-SSM-S	3	2	15	S-12366PF12	1.73	<0.100	21.7
LP5-05-SSM-S	3	2	16	S-12348PF22	2.49	<0.100	15.6
LP5-24-SSM-S	3	2	17	S-12367PF22	2.78	<0.100	18.4
LP5-12-1-SSM-S	3	2	18	S-12355PF22	1.71	<0.100	16.5
LRM	3	2	19	LRMPF323	2.25	<0.100	25.0
LP5-23-SSM-S	3	1	17	S-12366PF21	1.49	<0.100	22.1
LP5-24-SSM-S	3	1	18	S-12367PF11	2.56	<0.100	18.7
LRM	3	1	19	LRMPF313	2.00	<0.100	25.4

Table A-4. Comparison of Measured and Targeted Glass Compositions

PNNL ID	Oxide	Mean Measured (wt.%)	Target (wt.%)	Difference of Measured versus Target	% Difference Measured versus Target
LRM	Al_2O_3	9.78	9.51	0.27	3%
LRM	B_2O_3	7.50	7.85	-0.349	-5%
LRM	CaO	0.495	0.54	-0.045	
LRM	Cl^-	<0.025	0	0.025	
LRM	Cr_2O_3	0.188	0.19	-0.002	
LRM	F^-	0.898	0.86	0.038	
LRM	Fe_2O_3	1.39	1.38	0.009	1%
LRM	K_2O	1.47	1.48	-0.013	-1%
LRM	Li_2O	<0.215	0.11	0.105	
LRM	MgO	<0.166	0.1	0.066	
LRM	Na_2O	20.9	20	0.864	4%
LRM	NiO	0.171	0.19	-0.019	
LRM	P_2O_5	0.470	0.54	-0.07	
LRM	PbO	<0.108	0.1	0.008	
LRM	Re_2O_7	<0.0325	0	0.033	
LRM	SiO_2	54.9	54.2	0.721	1%
LRM	SnO_2	<0.127	0	0.127	
LRM	SO_3	0.224	0.3	-0.076	
LRM	TiO_2	<0.167	0.1	0.067	
LRM	V_2O_5	<0.179	0	0.179	
LRM	ZnO	<0.124	0	0.124	
LRM	ZrO_2	0.930	0.93	0	
LRM	**Sum of Oxides**	**100**	**98.4**	**2.062**	**2%**
LP5-01-SSM-S	Al_2O_3	3.66	3.74	-0.084	-2%
LP5-01-SSM-S	B_2O_3	9.98	10.8	-0.818	-8%
LP5-01-SSM-S	CaO	5.73	5.67	0.056	1%
LP5-01-SSM-S	Cl^-	0.226	0.65	-0.424	
LP5-01-SSM-S	Cr_2O_3	0.242	0.4	-0.158	
LP5-01-SSM-S	F^-	0.184	0.26	-0.077	
LP5-01-SSM-S	Fe_2O_3	0.874	0.9	-0.026	
LP5-01-SSM-S	K_2O	3.88	4.84	-0.955	-20%
LP5-01-SSM-S	Li_2O	<0.215	0	0.215	
LP5-01-SSM-S	MgO	0.517	0.48	0.037	
LP5-01-SSM-S	Na_2O	25.2	26.3	-1.092	-4%
LP5-01-SSM-S	NiO	<0.127	0.05	0.077	
LP5-01-SSM-S	P_2O_5	0.526	0.63	-0.104	
LP5-01-SSM-S	PbO	<0.108	0.05	0.058	
LP5-01-SSM-S	Re_2O_7	<0.0325	0.05	-0.017	
LP5-01-SSM-S	SiO_2	33.3	33.6	-0.28	-1%
LP5-01-SSM-S	SnO_2	4.28	4.35	-0.071	-2%
LP5-01-SSM-S	SO_3	3.13	1.07	2.064	193%
LP5-01-SSM-S	TiO_2	1.53	1.56	-0.034	-2%
LP5-01-SSM-S	V_2O_5	2.98	3.34	-0.363	-11%
LP5-01-SSM-S	ZnO	1.13	1.16	-0.033	-3%
LP5-01-SSM-S	ZrO_2	<0.135	0.06	0.075	
LP5-01-SSM-S	**Sum of Oxides**	**98.0**	**100**	**-1.957**	**-2%**

Table A-4. Comparison of Measured and Targeted Glass Compositions (continued)

PNNL ID	Oxide	Mean Measured (wt.%)	Target (wt.%)	Difference of Measured versus Target	% Difference Measured versus Target
LP5-02-SSM-S	Al_2O_3	3.46	3.55	-0.092	-3%
LP5-02-SSM-S	B_2O_3	6.60	6.71	-0.109	-2%
LP5-02-SSM-S	CaO	11.3	11.6	-0.312	-3%
LP5-02-SSM-S	Cl^-	0.103	0.46	-0.358	
LP5-02-SSM-S	Cr_2O_3	0.113	0.28	-0.167	
LP5-02-SSM-S	F^-	0.140	0.19	-0.05	
LP5-02-SSM-S	Fe_2O_3	0.857	0.89	-0.033	
LP5-02-SSM-S	K_2O	0.984	1.27	-0.286	-23%
LP5-02-SSM-S	Li_2O	<0.215	0	0.215	
LP5-02-SSM-S	MgO	4.70	4.77	-0.073	-2%
LP5-02-SSM-S	Na_2O	24.8	25.9	-1.13	-4%
LP5-02-SSM-S	NiO	<0.127	0.04	0.087	
LP5-02-SSM-S	P_2O_5	0.404	0.45	-0.046	
LP5-02-SSM-S	PbO	<0.108	0.04	0.068	
LP5-02-SSM-S	Re_2O_7	<0.0325	0.04	-0.007	
LP5-02-SSM-S	SiO_2	34.8	34.6	0.217	1%
LP5-02-SSM-S	SnO_2	0.519	0.53	-0.011	
LP5-02-SSM-S	SO_3	1.69	0.76	0.928	122%
LP5-02-SSM-S	TiO_2	1.10	1.11	-0.01	-1%
LP5-02-SSM-S	V_2O_5	2.65	2.92	-0.273	-9%
LP5-02-SSM-S	ZnO	3.56	3.55	0.007	0%
LP5-02-SSM-S	ZrO_2	0.294	0.31	-0.016	
LP5-02-SSM-S	**Sum of Oxides**	**98.5**	**100**	**-1.451**	**-2%**
LP5-03-SSM-S	Al_2O_3	4.72	4.87	-0.146	-3%
LP5-03-SSM-S	B_2O_3	9.18	10.4	-1.223	-12%
LP5-03-SSM-S	CaO	6.45	6.49	-0.04	-1%
LP5-03-SSM-S	Cl^-	0.151	0.64	-0.489	
LP5-03-SSM-S	Cr_2O_3	0.228	0.39	-0.162	
LP5-03-SSM-S	F^-	0.182	0.26	-0.078	
LP5-03-SSM-S	Fe_2O_3	0.343	0.32	0.023	
LP5-03-SSM-S	K_2O	<0.126	0.12	0.006	
LP5-03-SSM-S	Li_2O	<0.215	0	0.215	
LP5-03-SSM-S	MgO	3.80	3.87	-0.072	-2%
LP5-03-SSM-S	Na_2O	23.7	24.4	-0.743	-3%
LP5-03-SSM-S	NiO	<0.221	0.05	0.171	
LP5-03-SSM-S	P_2O_5	0.528	0.62	-0.092	
LP5-03-SSM-S	PbO	<0.108	0.05	0.058	
LP5-03-SSM-S	Re_2O_7	<0.0325	0.05	-0.017	
LP5-03-SSM-S	SiO_2	33.7	34	-0.306	-1%
LP5-03-SSM-S	SnO_2	0.598	0.59	0.008	
LP5-03-SSM-S	SO_3	1.82	1.05	0.771	73%
LP5-03-SSM-S	TiO_2	1.50	1.53	-0.034	-2%
LP5-03-SSM-S	V_2O_5	4.36	4.84	-0.484	-10%
LP5-03-SSM-S	ZnO	0.199	0.18	0.019	
LP5-03-SSM-S	ZrO_2	4.93	5.33	-0.396	-7%
LP5-03-SSM-S	**Sum of Oxides**	**97.0**	**100**	**-3.012**	**-3%**

Table A-4. Comparison of Measured and Targeted Glass Compositions (continued)

PNNL ID	Oxide	Mean Measured (wt.%)	Target (wt.%)	Difference of Measured versus Target	% Difference Measured versus Target
LP5-04-SSM-S	Al_2O_3	4.61	4.8	-0.19	-4%
LP5-04-SSM-S	B_2O_3	9.56	10	-0.437	-4%
LP5-04-SSM-S	CaO	11.4	11.5	-0.104	-1%
LP5-04-SSM-S	Cl^-	0.121	0.42	-0.299	
LP5-04-SSM-S	Cr_2O_3	0.115	0.25	-0.135	
LP5-04-SSM-S	F^-	0.127	0.17	-0.043	
LP5-04-SSM-S	Fe_2O_3	<0.145	0.13	0.015	
LP5-04-SSM-S	K_2O	2.67	3.64	-0.969	-27%
LP5-04-SSM-S	Li_2O	<0.215	0	0.215	
LP5-04-SSM-S	MgO	0.199	0.11	0.089	
LP5-04-SSM-S	Na_2O	24.0	25	-1.006	-4%
LP5-04-SSM-S	NiO	<0.127	0.03	0.097	
LP5-04-SSM-S	P_2O_5	0.345	0.4	-0.055	
LP5-04-SSM-S	PbO	<0.108	0.03	0.078	
LP5-04-SSM-S	Re_2O_7	<0.0325	0.03	0.003	
LP5-04-SSM-S	SiO_2	34.3	34.3	-0.018	0%
LP5-04-SSM-S	SnO_2	1.05	1.1	-0.054	-5%
LP5-04-SSM-S	SO_3	2.01	0.68	1.328	195%
LP5-04-SSM-S	TiO_2	0.968	0.99	-0.022	
LP5-04-SSM-S	V_2O_5	<0.179	0.13	0.049	
LP5-04-SSM-S	ZnO	5.56	5.71	-0.149	-3%
LP5-04-SSM-S	ZrO_2	0.496	0.53	-0.034	
LP5-04-SSM-S	**Sum of Oxides**	**98.3**	**100**	**-1.642**	**-2%**
LP5-05-SSM-S	Al_2O_3	3.87	4.1	-0.227	-6%
LP5-05-SSM-S	B_2O_3	7.69	8.96	-1.272	-14%
LP5-05-SSM-S	CaO	7.12	7.12	-0.002	0%
LP5-05-SSM-S	Cl^-	0.0930	0.3	-0.207	
LP5-05-SSM-S	Cr_2O_3	0.0962	0.18	-0.084	
LP5-05-SSM-S	F^-	0.0885	0.12	-0.032	
LP5-05-SSM-S	Fe_2O_3	0.911	0.96	-0.049	
LP5-05-SSM-S	K_2O	1.98	2.54	-0.561	-22%
LP5-05-SSM-S	Li_2O	<0.215	0	0.215	
LP5-05-SSM-S	MgO	4.74	4.95	-0.207	-4%
LP5-05-SSM-S	Na_2O	22.2	23.8	-1.558	-7%
LP5-05-SSM-S	NiO	<0.127	0.02	0.107	
LP5-05-SSM-S	P_2O_5	0.246	0.29	-0.044	
LP5-05-SSM-S	PbO	<0.108	0.02	0.088	
LP5-05-SSM-S	Re_2O_7	<0.0325	0.02	0.013	
LP5-05-SSM-S	SiO_2	33.5	34.4	-0.92	-3%
LP5-05-SSM-S	SnO_2	3.42	3.61	-0.192	-5%
LP5-05-SSM-S	SO_3	1.99	0.49	1.5	306%
LP5-05-SSM-S	TiO_2	0.693	0.72	-0.027	
LP5-05-SSM-S	V_2O_5	4.86	5.49	-0.625	-11%
LP5-05-SSM-S	ZnO	1.25	1.29	-0.036	-3%
LP5-05-SSM-S	ZrO_2	0.524	0.56	-0.036	
LP5-05-SSM-S	**Sum of Oxides**	**95.8**	**99.9**	**-4.155**	**-4%**

Table A-4. Comparison of Measured and Targeted Glass Compositions (continued)

PNNL ID	Oxide	Mean Measured (wt.%)	Target (wt.%)	Difference of Measured versus Target	% Difference Measured versus Target
LP5-06-MOD1-SSM-S	Al_2O_3	11.9	11.9	-0.001	0%
LP5-06-MOD1-SSM-S	B_2O_3	7.86	7.98	-0.115	-1%
LP5-06-MOD1-SSM-S	CaO	3.77	3.71	0.064	2%
LP5-06-MOD1-SSM-S	Cl^-	0.0849	0.538	-0.453	
LP5-06-MOD1-SSM-S	Cr_2O_3	0.141	0.325	-0.184	
LP5-06-MOD1-SSM-S	F^-	0.150	0.215	-0.066	
LP5-06-MOD1-SSM-S	Fe_2O_3	0.204	0.17	0.034	
LP5-06-MOD1-SSM-S	K_2O	2.58	3.32	-0.739	-22%
LP5-06-MOD1-SSM-S	Li_2O	<0.215	0	0.215	
LP5-06-MOD1-SSM-S	MgO	2.67	2.64	0.026	1%
LP5-06-MOD1-SSM-S	Na_2O	22.0	22	0.04	0%
LP5-06-MOD1-SSM-S	NiO	<0.127	0.0416	0.086	
LP5-06-MOD1-SSM-S	P_2O_5	0.389	0.516	-0.127	
LP5-06-MOD1-SSM-S	PbO	<0.108	0.0416	0.066	
LP5-06-MOD1-SSM-S	Re_2O_7	<0.0325	0.0416	-0.009	
LP5-06-MOD1-SSM-S	SiO_2	34.8	33.6	1.217	4%
LP5-06-MOD1-SSM-S	SnO_2	2.98	2.98	0.004	0%
LP5-06-MOD1-SSM-S	SO_3	1.24	0.883	0.359	41%
LP5-06-MOD1-SSM-S	TiO_2	1.29	1.28	0.009	1%
LP5-06-MOD1-SSM-S	V_2O_5	4.65	5.49	-0.84	-15%
LP5-06-MOD1-SSM-S	ZnO	0.360	0.36	0	
LP5-06-MOD1-SSM-S	ZrO_2	1.72	1.9	-0.184	-10%
LP5-06-MOD1-SSM-S	**Sum of Oxides**	**99.3**	**99.9**	**-0.598**	**-1%**
LP5-07-SSM-S	Al_2O_3	14.1	14.5	-0.428	-3%
LP5-07-SSM-S	B_2O_3	10.2	10.4	-0.185	-2%
LP5-07-SSM-S	CaO	1.26	1.35	-0.094	-7%
LP5-07-SSM-S	Cl^-	0.0542	0.17	-0.116	
LP5-07-SSM-S	Cr_2O_3	0.0528	0.1	-0.047	
LP5-07-SSM-S	F^-	0.0420	0.07	-0.028	
LP5-07-SSM-S	Fe_2O_3	<0.143	0.05	0.093	
LP5-07-SSM-S	K_2O	1.74	2.12	-0.379	-18%
LP5-07-SSM-S	Li_2O	<0.215	0	0.215	
LP5-07-SSM-S	MgO	3.82	3.93	-0.112	-3%
LP5-07-SSM-S	Na_2O	25.3	26.5	-1.158	-4%
LP5-07-SSM-S	NiO	<0.127	0.01	0.117	
LP5-07-SSM-S	P_2O_5	<0.229	0.16	0.069	
LP5-07-SSM-S	PbO	<0.108	0.01	0.098	
LP5-07-SSM-S	Re_2O_7	<0.0325	0.01	0.023	
LP5-07-SSM-S	SiO_2	40.2	38.1	2.119	6%
LP5-07-SSM-S	SnO_2	0.212	0.21	0.002	
LP5-07-SSM-S	SO_3	1.29	0.28	1.013	362%
LP5-07-SSM-S	TiO_2	0.434	0.41	0.024	
LP5-07-SSM-S	V_2O_5	0.696	0.73	-0.034	
LP5-07-SSM-S	ZnO	0.227	0.23	-0.003	
LP5-07-SSM-S	ZrO_2	0.596	0.62	-0.024	
LP5-07-SSM-S	**Sum of Oxides**	**101**	**100**	**1.166**	**1%**

Table A-4. Comparison of Measured and Targeted Glass Compositions (continued)

PNNL ID	Oxide	Mean Measured (wt.%)	Target (wt.%)	Difference of Measured versus Target	% Difference Measured versus Target
LP5-08-SSM-S	Al_2O_3	13.3	13.4	-0.055	0%
LP5-08-SSM-S	B_2O_3	8.34	9.48	-1.14	-12%
LP5-08-SSM-S	CaO	0.727	0.71	0.017	
LP5-08-SSM-S	Cl^-	0.0989	0.32	-0.221	
LP5-08-SSM-S	Cr_2O_3	0.0909	0.19	-0.099	
LP5-08-SSM-S	F^-	0.0842	0.13	-0.046	
LP5-08-SSM-S	Fe_2O_3	0.504	0.51	-0.006	
LP5-08-SSM-S	K_2O	3.95	4.62	-0.672	-15%
LP5-08-SSM-S	Li_2O	<0.215	0	0.215	
LP5-08-SSM-S	MgO	<0.166	0.06	0.106	
LP5-08-SSM-S	Na_2O	26.9	26.9	-0.041	0%
LP5-08-SSM-S	NiO	<0.127	0.02	0.107	
LP5-08-SSM-S	P_2O_5	<0.229	0.31	-0.081	
LP5-08-SSM-S	PbO	<0.108	0.02	0.088	
LP5-08-SSM-S	Re_2O_7	<0.0325	0.02	0.013	
LP5-08-SSM-S	SiO_2	34.4	34.5	-0.057	0%
LP5-08-SSM-S	SnO_2	3.75	3.8	-0.045	-1%
LP5-08-SSM-S	SO_3	1.54	0.52	1.017	196%
LP5-08-SSM-S	TiO_2	0.761	0.76	0.001	
LP5-08-SSM-S	V_2O_5	0.289	0.31	-0.021	
LP5-08-SSM-S	ZnO	1.81	1.82	-0.006	0%
LP5-08-SSM-S	ZrO_2	1.48	1.53	-0.051	-3%
LP5-08-SSM-S	**Sum of Oxides**	**99.0**	**99.9**	**-0.977**	**-1%**
LP5-09-SSM-S	Al_2O_3	9.21	9.39	-0.183	-2%
LP5-09-SSM-S	B_2O_3	6.66	6.76	-0.103	-2%
LP5-09-SSM-S	CaO	4.40	4.33	0.074	2%
LP5-09-SSM-S	Cl^-	0.156	0.58	-0.424	
LP5-09-SSM-S	Cr_2O_3	0.139	0.35	-0.211	
LP5-09-SSM-S	F^-	0.166	0.23	-0.064	
LP5-09-SSM-S	Fe_2O_3	0.735	0.74	-0.005	
LP5-09-SSM-S	K_2O	2.31	3.07	-0.757	-25%
LP5-09-SSM-S	Li_2O	<0.215	0	0.215	
LP5-09-SSM-S	MgO	0.781	0.76	0.021	
LP5-09-SSM-S	Na_2O	25.7	26.5	-0.753	-3%
LP5-09-SSM-S	NiO	<0.127	0.05	0.077	
LP5-09-SSM-S	P_2O_5	0.407	0.56	-0.153	
LP5-09-SSM-S	PbO	<0.108	0.05	0.058	
LP5-09-SSM-S	Re_2O_7	<0.0325	0.05	-0.017	
LP5-09-SSM-S	SiO_2	35.3	34.3	0.998	3%
LP5-09-SSM-S	SnO_2	2.49	2.45	0.035	1%
LP5-09-SSM-S	SO_3	1.48	0.96	0.523	55%
LP5-09-SSM-S	TiO_2	1.38	1.39	-0.007	-1%
LP5-09-SSM-S	V_2O_5	0.922	1.03	-0.108	-11%
LP5-09-SSM-S	ZnO	5.66	5.59	0.068	1%
LP5-09-SSM-S	ZrO_2	0.665	0.77	-0.105	
LP5-09-SSM-S	**Sum of Oxides**	**99.1**	**99.9**	**-0.822**	**-1%**

Table A-4. Comparison of Measured and Targeted Glass Compositions (continued)

PNNL ID	Oxide	Mean Measured (wt.%)	Target (wt.%)	Difference of Measured versus Target	% Difference Measured versus Target
LP5-10-SSM-S	Al_2O_3	4.47	4.63	-0.161	-4%
LP5-10-SSM-S	B_2O_3	5.86	6.15	-0.29	-5%
LP5-10-SSM-S	CaO	1.98	1.71	0.273	16%
LP5-10-SSM-S	Cl^-	0.0494	0.24	-0.191	
LP5-10-SSM-S	Cr_2O_3	0.0534	0.14	-0.087	
LP5-10-SSM-S	F^-	0.0688	0.09	-0.021	
LP5-10-SSM-S	Fe_2O_3	0.445	0.45	-0.005	
LP5-10-SSM-S	K_2O	2.56	3.25	-0.693	-21%
LP5-10-SSM-S	Li_2O	<0.215	0	0.215	
LP5-10-SSM-S	MgO	4.22	4.36	-0.14	-3%
LP5-10-SSM-S	Na_2O	27.2	26.9	0.262	1%
LP5-10-SSM-S	NiO	<0.127	0.02	0.107	
LP5-10-SSM-S	P_2O_5	<0.229	0.23	-0.001	
LP5-10-SSM-S	PbO	<0.108	0.02	0.088	
LP5-10-SSM-S	Re_2O_7	<0.0325	0.02	0.013	
LP5-10-SSM-S	SiO_2	35.9	36.1	-0.16	0%
LP5-10-SSM-S	SnO_2	3.54	3.68	-0.144	-4%
LP5-10-SSM-S	SO_3	1.58	0.39	1.192	306%
LP5-10-SSM-S	TiO_2	0.559	0.56	-0.001	
LP5-10-SSM-S	V_2O_5	1.22	1.36	-0.138	-10%
LP5-10-SSM-S	ZnO	5.34	5.55	-0.207	-4%
LP5-10-SSM-S	ZrO_2	3.75	4.12	-0.368	-9%
LP5-10-SSM-S	**Sum of Oxides**	**99.5**	**100**	**-0.456**	**-1%**
LP5-11-SSM-S	Al_2O_3	5.45	5.5	-0.054	-1%
LP5-11-SSM-S	B_2O_3	7.07	7.14	-0.072	-1%
LP5-11-SSM-S	CaO	2.40	2.29	0.106	5%
LP5-11-SSM-S	Cl^-	0.189	0.66	-0.471	
LP5-11-SSM-S	Cr_2O_3	0.201	0.4	-0.199	
LP5-11-SSM-S	F^-	0.187	0.26	-0.073	
LP5-11-SSM-S	Fe_2O_3	0.694	0.69	0.004	
LP5-11-SSM-S	K_2O	0.363	0.41	-0.047	
LP5-11-SSM-S	Li_2O	<0.215	0	0.215	
LP5-11-SSM-S	MgO	3.62	3.63	-0.011	0%
LP5-11-SSM-S	Na_2O	24.3	26.5	-2.202	-8%
LP5-11-SSM-S	NiO	<0.127	0.05	0.077	
LP5-11-SSM-S	P_2O_5	0.469	0.63	-0.161	
LP5-11-SSM-S	PbO	<0.108	0.05	0.058	
LP5-11-SSM-S	Re_2O_7	<0.0325	0.05	-0.017	
LP5-11-SSM-S	SiO_2	38.8	36.3	2.475	7%
LP5-11-SSM-S	SnO_2	1.56	1.59	-0.032	-2%
LP5-11-SSM-S	SO_3	1.73	1.08	0.654	61%
LP5-11-SSM-S	TiO_2	1.56	1.57	-0.013	-1%
LP5-11-SSM-S	V_2O_5	5.06	5.67	-0.609	-11%
LP5-11-SSM-S	ZnO	4.27	4.26	0.013	0%
LP5-11-SSM-S	ZrO_2	1.15	1.26	-0.109	-9%
LP5-11-SSM-S	**Sum of Oxides**	**99.5**	**100**	**-0.467**	**-1%**

Table A-4. Comparison of Measured and Targeted Glass Compositions (continued)

PNNL ID	Oxide	Mean Measured (wt.%)	Target (wt.%)	Difference of Measured versus Target	% Difference Measured versus Target
LP5-12-1-SSM-S	Al_2O_3	13.9	13.6	0.302	2%
LP5-12-1-SSM-S	B_2O_3	5.18	6.04	-0.864	-14%
LP5-12-1-SSM-S	CaO	1.28	1.17	0.106	9%
LP5-12-1-SSM-S	Cl^-	0.0398	0.67	-0.63	
LP5-12-1-SSM-S	Cr_2O_3	0.206	0.4	-0.194	
LP5-12-1-SSM-S	F^-	0.183	0.27	-0.087	
LP5-12-1-SSM-S	Fe_2O_3	0.584	0.57	0.014	
LP5-12-1-SSM-S	K_2O	1.67	2.25	-0.585	-26%
LP5-12-1-SSM-S	Li_2O	<0.215	0	0.215	
LP5-12-1-SSM-S	MgO	5.08	4.96	0.119	2%
LP5-12-1-SSM-S	Na_2O	23.1	22.9	0.218	1%
LP5-12-1-SSM-S	NiO	0.282	0.05	0.232	
LP5-12-1-SSM-S	P_2O_5	0.421	0.64	-0.219	
LP5-12-1-SSM-S	PbO	<0.108	0.05	0.058	
LP5-12-1-SSM-S	Re_2O_7	<0.0325	0.05	-0.017	
LP5-12-1-SSM-S	SiO_2	35.5	34	1.459	4%
LP5-12-1-SSM-S	SnO_2	1.36	1.39	-0.035	-3%
LP5-12-1-SSM-S	SO_3	0.862	1.1	-0.238	-22%
LP5-12-1-SSM-S	TiO_2	1.58	1.59	-0.015	-1%
LP5-12-1-SSM-S	V_2O_5	2.86	3.15	-0.294	-9%
LP5-12-1-SSM-S	ZnO	2.37	2.31	0.061	3%
LP5-12-1-SSM-S	ZrO_2	2.38	2.77	-0.389	-14%
LP5-12-1-SSM-S	**Sum of Oxides**	**99.1**	**99.9**	**-0.782**	**-1%**
LP5-13-SSM-S	Al_2O_3	4.34	4.49	-0.149	-3%
LP5-13-SSM-S	B_2O_3	10.7	12.9	-2.234	-17%
LP5-13-SSM-S	CaO	0.252	0.06	0.192	
LP5-13-SSM-S	Cl^-	0.137	0.43	-0.293	
LP5-13-SSM-S	Cr_2O_3	0.157	0.26	-0.103	
LP5-13-SSM-S	F^-	0.103	0.17	-0.067	
LP5-13-SSM-S	Fe_2O_3	0.811	0.85	-0.039	
LP5-13-SSM-S	K_2O	3.47	4.19	-0.721	-17%
LP5-13-SSM-S	Li_2O	<0.215	0	0.215	
LP5-13-SSM-S	MgO	2.52	2.6	-0.084	-3%
LP5-13-SSM-S	Na_2O	26.1	26.5	-0.416	-2%
LP5-13-SSM-S	NiO	<0.127	0.03	0.097	
LP5-13-SSM-S	P_2O_5	0.311	0.41	-0.099	
LP5-13-SSM-S	PbO	<0.108	0.03	0.078	
LP5-13-SSM-S	Re_2O_7	<0.0325	0.03	0.003	
LP5-13-SSM-S	SiO_2	33.1	34.1	-1.048	-3%
LP5-13-SSM-S	SnO_2	0.760	0.78	-0.02	
LP5-13-SSM-S	SO_3	2.73	0.71	2.024	285%
LP5-13-SSM-S	TiO_2	1.01	1.03	-0.023	-2%
LP5-13-SSM-S	V_2O_5	3.89	4.56	-0.673	-15%
LP5-13-SSM-S	ZnO	1.63	1.65	-0.016	-1%
LP5-13-SSM-S	ZrO_2	3.74	4.18	-0.438	-11%
LP5-13-SSM-S	**Sum of Oxides**	**96.1**	**100**	**-3.813**	**-4%**

Table A-4. Comparison of Measured and Targeted Glass Compositions (continued)

PNNL ID	Oxide	Mean Measured (wt.%)	Target (wt.%)	Difference of Measured versus Target	% Difference Measured versus Target
LP5-14-SSM-S	Al_2O_3	4.50	4.51	-0.013	0%
LP5-14-SSM-S	B_2O_3	6.45	6.68	-0.232	-4%
LP5-14-SSM-S	CaO	0.582	0.44	0.142	
LP5-14-SSM-S	Cl^-	0.140	0.67	-0.531	
LP5-14-SSM-S	Cr_2O_3	0.326	0.4	-0.074	
LP5-14-SSM-S	F^-	0.160	0.27	-0.111	
LP5-14-SSM-S	Fe_2O_3	0.152	0.12	0.032	
LP5-14-SSM-S	K_2O	3.23	4.09	-0.862	-21%
LP5-14-SSM-S	Li_2O	<0.215	0	0.215	
LP5-14-SSM-S	MgO	1.50	1.55	-0.048	-3%
LP5-14-SSM-S	Na_2O	23.6	23.7	-0.144	-1%
LP5-14-SSM-S	NiO	<0.529	0.05	0.479	
LP5-14-SSM-S	P_2O_5	0.462	0.64	-0.178	
LP5-14-SSM-S	PbO	<0.108	0.05	0.058	
LP5-14-SSM-S	Re_2O_7	<0.0325	0.05	-0.017	
LP5-14-SSM-S	SiO_2	41.0	38.6	2.421	6%
LP5-14-SSM-S	SnO_2	3.43	3.43	0.001	0%
LP5-14-SSM-S	SO_3	1.56	1.1	0.456	41%
LP5-14-SSM-S	TiO_2	1.59	1.59	0.003	0%
LP5-14-SSM-S	V_2O_5	3.76	4.25	-0.488	-12%
LP5-14-SSM-S	ZnO	4.46	4.4	0.063	1%
LP5-14-SSM-S	ZrO_2	3.19	3.42	-0.229	-7%
LP5-14-SSM-S	**Sum of Oxides**	**101**	**100**	**0.945**	**1%**
LP5-15-SSM-S	Al_2O_3	13.7	13.3	0.38	3%
LP5-15-SSM-S	B_2O_3	8.95	9.06	-0.109	-1%
LP5-15-SSM-S	CaO	0.359	0.34	0.019	
LP5-15-SSM-S	Cl^-	0.314	0.19	0.124	
LP5-15-SSM-S	Cr_2O_3	0.0254	0.12	-0.095	
LP5-15-SSM-S	F^-	0.0524	0.08	-0.028	
LP5-15-SSM-S	Fe_2O_3	0.942	0.95	-0.008	
LP5-15-SSM-S	K_2O	3.54	4.82	-1.278	-27%
LP5-15-SSM-S	Li_2O	<0.215	0	0.215	
LP5-15-SSM-S	MgO	2.06	1.96	0.096	5%
LP5-15-SSM-S	Na_2O	25.5	26	-0.523	-2%
LP5-15-SSM-S	NiO	<0.127	0.01	0.117	
LP5-15-SSM-S	P_2O_5	<0.229	0.18	0.049	
LP5-15-SSM-S	PbO	<0.108	0.01	0.098	
LP5-15-SSM-S	Re_2O_7	<0.0325	0.01	0.023	
LP5-15-SSM-S	SiO_2	37.9	33.7	4.166	12%
LP5-15-SSM-S	SnO_2	0.403	0.4	0.003	
LP5-15-SSM-S	SO_3	1.02	0.31	0.712	230%
LP5-15-SSM-S	TiO_2	0.486	0.46	0.026	
LP5-15-SSM-S	V_2O_5	2.21	2.57	-0.356	-14%
LP5-15-SSM-S	ZnO	<0.124	0.02	0.104	
LP5-15-SSM-S	ZrO_2	5.39	5.51	-0.12	-2%
LP5-15-SSM-S	**Sum of Oxides**	**104**	**100**	**3.615**	**4%**

Table A-4. Comparison of Measured and Targeted Glass Compositions (continued)

PNNL ID	Oxide	Mean Measured (wt.%)	Target (wt.%)	Difference of Measured versus Target	% Difference Measured versus Target
LP5-16-MOD1-SSM-S	Al_2O_3	7.81	7.93	-0.122	-2%
LP5-16-MOD1-SSM-S	B_2O_3	7.05	7.22	-0.168	-2%
LP5-16-MOD1-SSM-S	CaO	8.78	8.76	0.02	0%
LP5-16-MOD1-SSM-S	Cl^-	0.113	0.431	-0.318	
LP5-16-MOD1-SSM-S	Cr_2O_3	0.0851	0.261	-0.176	
LP5-16-MOD1-SSM-S	F^-	0.120	0.172	-0.053	
LP5-16-MOD1-SSM-S	Fe_2O_3	0.636	0.63	0.006	
LP5-16-MOD1-SSM-S	K_2O	0.376	0.64	-0.264	
LP5-16-MOD1-SSM-S	Li_2O	<0.215	0	0.215	
LP5-16-MOD1-SSM-S	MgO	4.42	4.46	-0.045	-1%
LP5-16-MOD1-SSM-S	Na_2O	23.4	25.2	-1.778	-7%
LP5-16-MOD1-SSM-S	NiO	<0.127	0.0333	0.094	
LP5-16-MOD1-SSM-S	P_2O_5	0.330	0.413	-0.083	
LP5-16-MOD1-SSM-S	PbO	<0.108	0.0333	0.074	
LP5-16-MOD1-SSM-S	Re_2O_7	<0.0325	0.0333	-0.001	
LP5-16-MOD1-SSM-S	SiO_2	34.2	33.5	0.729	2%
LP5-16-MOD1-SSM-S	SnO_2	4.06	4.19	-0.127	-3%
LP5-16-MOD1-SSM-S	SO_3	1.25	0.708	0.544	77%
LP5-16-MOD1-SSM-S	TiO_2	1.02	1.03	-0.01	-1%
LP5-16-MOD1-SSM-S	V_2O_5	0.748	0.8	-0.052	
LP5-16-MOD1-SSM-S	ZnO	0.342	0.35	-0.008	
LP5-16-MOD1-SSM-S	ZrO_2	2.91	3.18	-0.272	-9%
LP5-16-MOD1-SSM-S	**Sum of Oxides**	**98.2**	**100**	**-1.794**	**-2%**
LP5-17-SSM-S	Al_2O_3	3.51	3.56	-0.05	-1%
LP5-17-SSM-S	B_2O_3	7.58	7.74	-0.157	-2%
LP5-17-SSM-S	CaO	4.93	4.81	0.122	3%
LP5-17-SSM-S	Cl^-	0.236	0.25	-0.014	
LP5-17-SSM-S	Cr_2O_3	0.0683	0.15	-0.082	
LP5-17-SSM-S	F^-	0.0675	0.1	-0.033	
LP5-17-SSM-S	Fe_2O_3	0.725	0.71	0.015	
LP5-17-SSM-S	K_2O	2.62	3.98	-1.357	-34%
LP5-17-SSM-S	Li_2O	<0.215	0	0.215	
LP5-17-SSM-S	MgO	1.50	1.52	-0.021	-1%
LP5-17-SSM-S	Na_2O	21.0	22	-1.005	-5%
LP5-17-SSM-S	NiO	<0.127	0.02	0.107	
LP5-17-SSM-S	P_2O_5	<0.229	0.24	-0.011	
LP5-17-SSM-S	PbO	<0.108	0.02	0.088	
LP5-17-SSM-S	Re_2O_7	<0.0325	0.02	0.013	
LP5-17-SSM-S	SiO_2	34.9	33.8	1.124	3%
LP5-17-SSM-S	SnO_2	4.15	4.21	-0.062	-2%
LP5-17-SSM-S	SO_3	1.38	0.41	0.97	237%
LP5-17-SSM-S	TiO_2	0.611	0.6	0.011	
LP5-17-SSM-S	V_2O_5	4.67	5.15	-0.477	-9%
LP5-17-SSM-S	ZnO	5.71	5.68	0.031	1%
LP5-17-SSM-S	ZrO_2	4.47	5.02	-0.552	-11%
LP5-17-SSM-S	**Sum of Oxides**	**98.9**	**100**	**-1.126**	**-1%**

Table A-4. Comparison of Measured and Targeted Glass Compositions (continued)

PNNL ID	Oxide	Mean Measured (wt.%)	Target (wt.%)	Difference of Measured versus Target	% Difference Measured versus Target
LP5-18-SSM-S	Al_2O_3	5.61	5.76	-0.148	-3%
LP5-18-SSM-S	B_2O_3	9.22	9.41	-0.193	-2%
LP5-18-SSM-S	CaO	0.456	0.42	0.036	
LP5-18-SSM-S	Cl^-	0.133	0.52	-0.387	
LP5-18-SSM-S	Cr_2O_3	0.177	0.31	-0.133	
LP5-18-SSM-S	F^-	0.141	0.21	-0.069	
LP5-18-SSM-S	Fe_2O_3	0.534	0.52	0.014	
LP5-18-SSM-S	K_2O	1.50	1.89	-0.39	-21%
LP5-18-SSM-S	Li_2O	<0.215	0	0.215	
LP5-18-SSM-S	MgO	4.85	5.01	-0.155	-3%
LP5-18-SSM-S	Na_2O	23.3	24.5	-1.18	-5%
LP5-18-SSM-S	NiO	<0.127	0.04	0.087	
LP5-18-SSM-S	P_2O_5	0.427	0.5	-0.073	
LP5-18-SSM-S	PbO	<0.108	0.04	0.068	
LP5-18-SSM-S	Re_2O_7	<0.0325	0.04	-0.007	
LP5-18-SSM-S	SiO_2	41.7	39.1	2.616	7%
LP5-18-SSM-S	SnO_2	0.190	0.19	0	
LP5-18-SSM-S	SO_3	1.52	0.85	0.675	79%
LP5-18-SSM-S	TiO_2	1.23	1.23	0	0%
LP5-18-SSM-S	V_2O_5	3.33	3.62	-0.291	-8%
LP5-18-SSM-S	ZnO	5.61	5.68	-0.066	-1%
LP5-18-SSM-S	ZrO_2	0.173	0.16	0.013	
LP5-18-SSM-S	**Sum of Oxides**	**101**	**100**	**0.632**	**1%**
LP5-19-SSM-S	Al_2O_3	3.80	3.81	-0.012	0%
LP5-19-SSM-S	B_2O_3	9.23	10.4	-1.175	-11%
LP5-19-SSM-S	CaO	6.89	6.44	0.455	7%
LP5-19-SSM-S	Cl^-	0.0756	0.33	-0.254	
LP5-19-SSM-S	Cr_2O_3	0.0812	0.2	-0.119	
LP5-19-SSM-S	F^-	0.0947	0.13	-0.035	
LP5-19-SSM-S	Fe_2O_3	<0.143	0.04	0.103	
LP5-19-SSM-S	K_2O	4.42	5.58	-1.162	-21%
LP5-19-SSM-S	Li_2O	<0.215	0	0.215	
LP5-19-SSM-S	MgO	4.61	4.62	-0.01	0%
LP5-19-SSM-S	Na_2O	22.4	22.3	0.144	1%
LP5-19-SSM-S	NiO	<0.127	0.03	0.097	
LP5-19-SSM-S	P_2O_5	0.247	0.32	-0.073	
LP5-19-SSM-S	PbO	<0.108	0.03	0.078	
LP5-19-SSM-S	Re_2O_7	<0.0325	0.03	0.003	
LP5-19-SSM-S	SiO_2	34.1	34.6	-0.478	-1%
LP5-19-SSM-S	SnO_2	1.52	1.53	-0.006	0%
LP5-19-SSM-S	SO_3	1.52	0.54	0.983	182%
LP5-19-SSM-S	TiO_2	0.757	0.79	-0.033	
LP5-19-SSM-S	V_2O_5	1.20	1.31	-0.106	-8%
LP5-19-SSM-S	ZnO	5.31	5.38	-0.068	-1%
LP5-19-SSM-S	ZrO_2	1.51	1.55	-0.044	-3%
LP5-19-SSM-S	**Sum of Oxides**	**98.5**	**100**	**-1.498**	**-2%**

Table A-4. Comparison of Measured and Targeted Glass Compositions (continued)

PNNL ID	Oxide	Mean Measured (wt.%)	Target (wt.%)	Difference of Measured versus Target	% Difference Measured versus Target
LP5-20-SSM-S	Al_2O_3	3.93	3.88	0.055	1%
LP5-20-SSM-S	B_2O_3	13.3	13.5	-0.234	-2%
LP5-20-SSM-S	CaO	1.57	1.37	0.204	15%
LP5-20-SSM-S	Cl^-	0.206	0.66	-0.455	
LP5-20-SSM-S	Cr_2O_3	0.246	0.4	-0.154	
LP5-20-SSM-S	F^-	0.177	0.26	-0.084	
LP5-20-SSM-S	Fe_2O_3	0.643	0.66	-0.017	
LP5-20-SSM-S	K_2O	2.17	2.64	-0.472	-18%
LP5-20-SSM-S	Li_2O	<0.215	0	0.215	
LP5-20-SSM-S	MgO	2.93	2.9	0.031	1%
LP5-20-SSM-S	Na_2O	24.8	25.5	-0.697	-3%
LP5-20-SSM-S	NiO	<0.137	0.05	0.087	
LP5-20-SSM-S	P_2O_5	0.483	0.63	-0.147	
LP5-20-SSM-S	PbO	<0.108	0.05	0.058	
LP5-20-SSM-S	Re_2O_7	<0.0325	0.05	-0.017	
LP5-20-SSM-S	SiO_2	41.3	38.8	2.488	6%
LP5-20-SSM-S	SnO_2	3.71	3.73	-0.02	-1%
LP5-20-SSM-S	SO_3	1.79	1.08	0.712	66%
LP5-20-SSM-S	TiO_2	1.51	1.56	-0.053	-3%
LP5-20-SSM-S	V_2O_5	0.201	0.21	-0.009	
LP5-20-SSM-S	ZnO	0.471	0.47	0.001	
LP5-20-SSM-S	ZrO_2	1.51	1.56	-0.054	-4%
LP5-20-SSM-S	**Sum of Oxides**	**101**	**100**	**1.438**	**1%**
LP5-21-SSM-S	Al_2O_3	5.73	5.86	-0.135	-2%
LP5-21-SSM-S	B_2O_3	12.9	13.2	-0.312	-2%
LP5-21-SSM-S	CaO	4.81	4.73	0.08	2%
LP5-21-SSM-S	Cl^-	0.146	0.61	-0.465	
LP5-21-SSM-S	Cr_2O_3	0.206	0.37	-0.164	
LP5-21-SSM-S	F^-	0.159	0.25	-0.091	
LP5-21-SSM-S	Fe_2O_3	<0.147	0.11	0.037	
LP5-21-SSM-S	K_2O	3.63	4.62	-0.985	-21%
LP5-21-SSM-S	Li_2O	<0.215	0	0.215	
LP5-21-SSM-S	MgO	2.94	2.97	-0.035	-1%
LP5-21-SSM-S	Na_2O	21.3	22.1	-0.835	-4%
LP5-21-SSM-S	NiO	<0.127	0.05	0.077	
LP5-21-SSM-S	P_2O_5	0.477	0.59	-0.113	
LP5-21-SSM-S	PbO	<0.108	0.05	0.058	
LP5-21-SSM-S	Re_2O_7	<0.0325	0.05	-0.017	
LP5-21-SSM-S	SiO_2	37.1	35	2.117	6%
LP5-21-SSM-S	SnO_2	1.18	1.23	-0.052	-4%
LP5-21-SSM-S	SO_3	1.96	1.01	0.946	94%
LP5-21-SSM-S	TiO_2	1.42	1.46	-0.042	-3%
LP5-21-SSM-S	V_2O_5	3.14	3.4	-0.258	-8%
LP5-21-SSM-S	ZnO	1.50	1.51	-0.01	-1%
LP5-21-SSM-S	ZrO_2	0.684	0.77	-0.086	
LP5-21-SSM-S	**Sum of Oxides**	**99.9**	**99.9**	**-0.07**	**0%**

Table A-4. Comparison of Measured and Targeted Glass Compositions (continued)

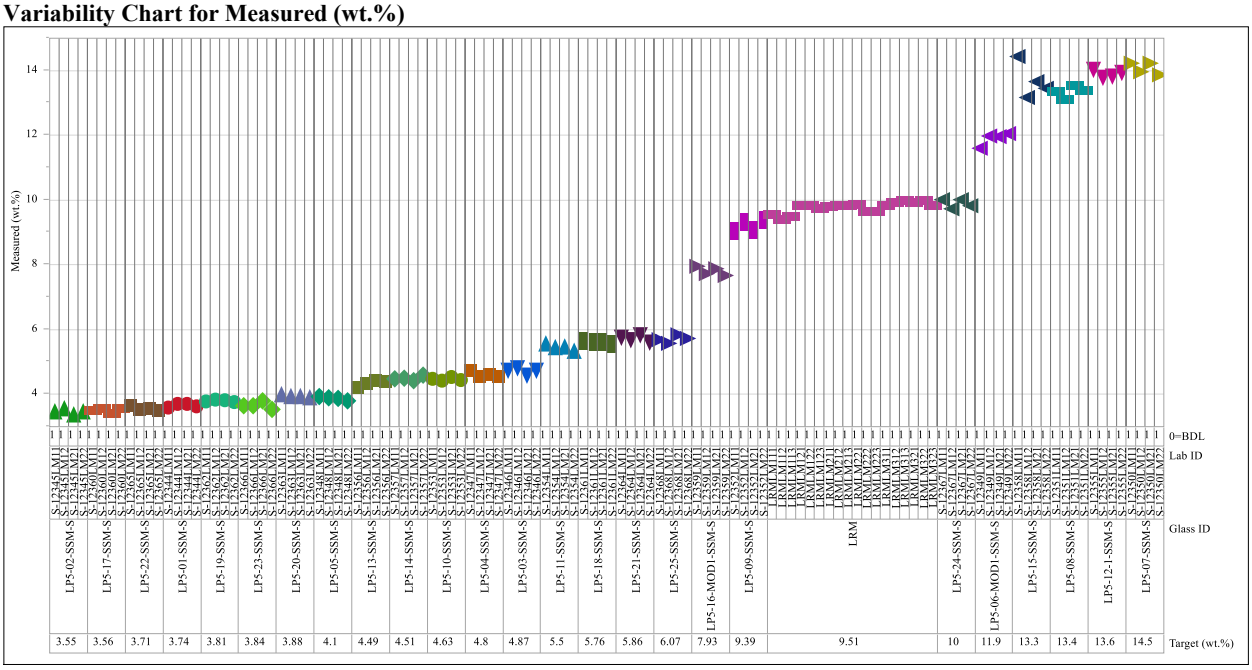
PNNL ID	Oxide	Mean Measured (wt.%)	Target (wt.%)	Difference of Measured versus Target	% Difference Measured versus Target
LP5-22-SSM-S	Al_2O_3	3.56	3.71	-0.148	-4%
LP5-22-SSM-S	B_2O_3	12.0	12.6	-0.63	-5%
LP5-22-SSM-S	CaO	0.405	0.31	0.095	
LP5-22-SSM-S	Cl^-	0.0623	0.2	-0.138	
LP5-22-SSM-S	Cr_2O_3	0.0837	0.12	-0.036	
LP5-22-SSM-S	F^-	0.0502	0.08	-0.03	
LP5-22-SSM-S	Fe_2O_3	0.700	0.74	-0.04	
LP5-22-SSM-S	K_2O	0.343	0.32	0.023	
LP5-22-SSM-S	Li_2O	<0.215	0	0.215	
LP5-22-SSM-S	MgO	4.38	4.66	-0.282	-6%
LP5-22-SSM-S	Na_2O	24.2	24.7	-0.503	-2%
LP5-22-SSM-S	NiO	<0.127	0.02	0.107	
LP5-22-SSM-S	P_2O_5	<0.229	0.19	0.039	
LP5-22-SSM-S	PbO	<0.108	0.02	0.088	
LP5-22-SSM-S	Re_2O_7	<0.0325	0.02	0.013	
LP5-22-SSM-S	SiO_2	46.9	48	-1.149	-2%
LP5-22-SSM-S	SnO_2	0.973	1.06	-0.087	-8%
LP5-22-SSM-S	SO_3	1.60	0.33	1.27	385%
LP5-22-SSM-S	TiO_2	0.463	0.48	-0.017	
LP5-22-SSM-S	V_2O_5	0.588	0.63	-0.042	
LP5-22-SSM-S	ZnO	<0.124	0.06	0.064	
LP5-22-SSM-S	ZrO_2	1.60	1.78	-0.183	-10%
LP5-22-SSM-S	**Sum of Oxides**	**98.7**	**100**	**-1.371**	**-1%**
LP5-23-SSM-S	Al_2O_3	3.66	3.84	-0.184	-5%
LP5-23-SSM-S	B_2O_3	5.22	6.37	-1.154	-18%
LP5-23-SSM-S	CaO	6.46	6.3	0.164	3%
LP5-23-SSM-S	Cl^-	0.0839	0.22	-0.136	
LP5-23-SSM-S	Cr_2O_3	0.0912	0.13	-0.039	
LP5-23-SSM-S	F^-	0.0497	0.09	-0.04	
LP5-23-SSM-S	Fe_2O_3	0.166	0.16	0.006	
LP5-23-SSM-S	K_2O	1.51	1.74	-0.234	-14%
LP5-23-SSM-S	Li_2O	<0.215	0	0.215	
LP5-23-SSM-S	MgO	2.30	2.35	-0.049	-2%
LP5-23-SSM-S	Na_2O	24.3	23.8	0.464	2%
LP5-23-SSM-S	NiO	<0.127	0.02	0.107	
LP5-23-SSM-S	P_2O_5	<0.229	0.21	0.019	
LP5-23-SSM-S	PbO	<0.108	0.02	0.088	
LP5-23-SSM-S	Re_2O_7	<0.0325	0.02	0.013	
LP5-23-SSM-S	SiO_2	46.7	49	-2.31	-5%
LP5-23-SSM-S	SnO_2	1.31	1.38	-0.072	-5%
LP5-23-SSM-S	SO_3	2.19	0.35	1.842	526%
LP5-23-SSM-S	TiO_2	0.488	0.51	-0.022	
LP5-23-SSM-S	V_2O_5	2.55	2.72	-0.167	-6%
LP5-23-SSM-S	ZnO	0.406	0.44	-0.034	
LP5-23-SSM-S	ZrO_2	0.378	0.39	-0.012	
LP5-23-SSM-S	**Sum of Oxides**	**98.5**	**100**	**-1.536**	**-2%**

Table A-4. Comparison of Measured and Targeted Glass Compositions (continued)

PNNL ID	Oxide	Mean Measured (wt.%)	Target (wt.%)	Difference of Measured versus Target	% Difference Measured versus Target
LP5-24-SSM-S	Al_2O_3	9.90	10	-0.104	-1%
LP5-24-SSM-S	B_2O_3	8.64	9.5	-0.863	-9%
LP5-24-SSM-S	CaO	5.23	5	0.226	5%
LP5-24-SSM-S	Cl^-	0.313	0.21	0.103	
LP5-24-SSM-S	Cr_2O_3	0.190	0.45	-0.26	
LP5-24-SSM-S	F^-	0.209	0.32	-0.111	
LP5-24-SSM-S	Fe_2O_3	0.597	0.6	-0.003	
LP5-24-SSM-S	K_2O	0.789	1	-0.211	-21%
LP5-24-SSM-S	Li_2O	<0.215	0	0.215	
LP5-24-SSM-S	MgO	0.670	0.65	0.02	
LP5-24-SSM-S	Na_2O	21.9	23	-1.061	-5%
LP5-24-SSM-S	NiO	<0.127	0	0.127	
LP5-24-SSM-S	P_2O_5	0.547	0.68	-0.133	
LP5-24-SSM-S	PbO	<0.108	0	0.108	
LP5-24-SSM-S	Re_2O_7	<0.0325	0	0.033	
LP5-24-SSM-S	SiO_2	39.7	38.8	0.884	2%
LP5-24-SSM-S	SnO_2	1.51	1.5	0.011	1%
LP5-24-SSM-S	SO_3	1.03	0.5	0.527	105%
LP5-24-SSM-S	TiO_2	<0.167	0	0.167	
LP5-24-SSM-S	V_2O_5	0.942	1	-0.058	-6%
LP5-24-SSM-S	ZnO	2.82	2.8	0.016	1%
LP5-24-SSM-S	ZrO_2	3.85	4	-0.147	-4%
LP5-24-SSM-S	**Sum of Oxides**	**99.5**	**100**	**-0.513**	**-1%**
LP5-25-SSM-S	Al_2O_3	5.71	6.07	-0.364	-6%
LP5-25-SSM-S	B_2O_3	9.72	10.1	-0.376	-4%
LP5-25-SSM-S	CaO	5.06	5.11	-0.048	-1%
LP5-25-SSM-S	Cl^-	<0.025	0.05	-0.025	
LP5-25-SSM-S	Cr_2O_3	<0.0365	0.01	0.027	
LP5-25-SSM-S	F^-	0.189	0.34	-0.152	
LP5-25-SSM-S	Fe_2O_3	5.10	5.42	-0.316	-6%
LP5-25-SSM-S	K_2O	<0.120	0.08	0.04	
LP5-25-SSM-S	Li_2O	1.96	2.51	-0.547	-22%
LP5-25-SSM-S	MgO	1.39	1.51	-0.122	-8%
LP5-25-SSM-S	Na_2O	15.1	14.4	0.731	5%
LP5-25-SSM-S	NiO	<0.127	0.026	0.101	
LP5-25-SSM-S	P_2O_5	<0.229	0.07	0.159	
LP5-25-SSM-S	PbO	<0.108	0.01	0.098	
LP5-25-SSM-S	Re_2O_7	<0.0325	0.1	-0.067	
LP5-25-SSM-S	SiO_2	48.6	46.6	1.962	4%
LP5-25-SSM-S	SnO_2	<0.127	0	0.127	
LP5-25-SSM-S	SO_3	1.27	0.32	0.954	298%
LP5-25-SSM-S	TiO_2	1.10	1.14	-0.042	-4%
LP5-25-SSM-S	V_2O_5	<0.179	0	0.179	
LP5-25-SSM-S	ZnO	2.94	3.07	-0.129	-4%
LP5-25-SSM-S	ZrO_2	2.73	3.03	-0.298	-10%
LP5-25-SSM-S	**Sum of Oxides**	**102**	**100**	**1.891**	**2%**

Exhibit A-1. Plots of Oxide Measurements by Glass Identifier by Target Concentrations

Oxide=Al_2O_3, Prep Method=LM
Variability Chart for Measured (wt.%)



Oxide=B_2O_3, Prep Method=PF
Variability Chart for Measured (wt.%)

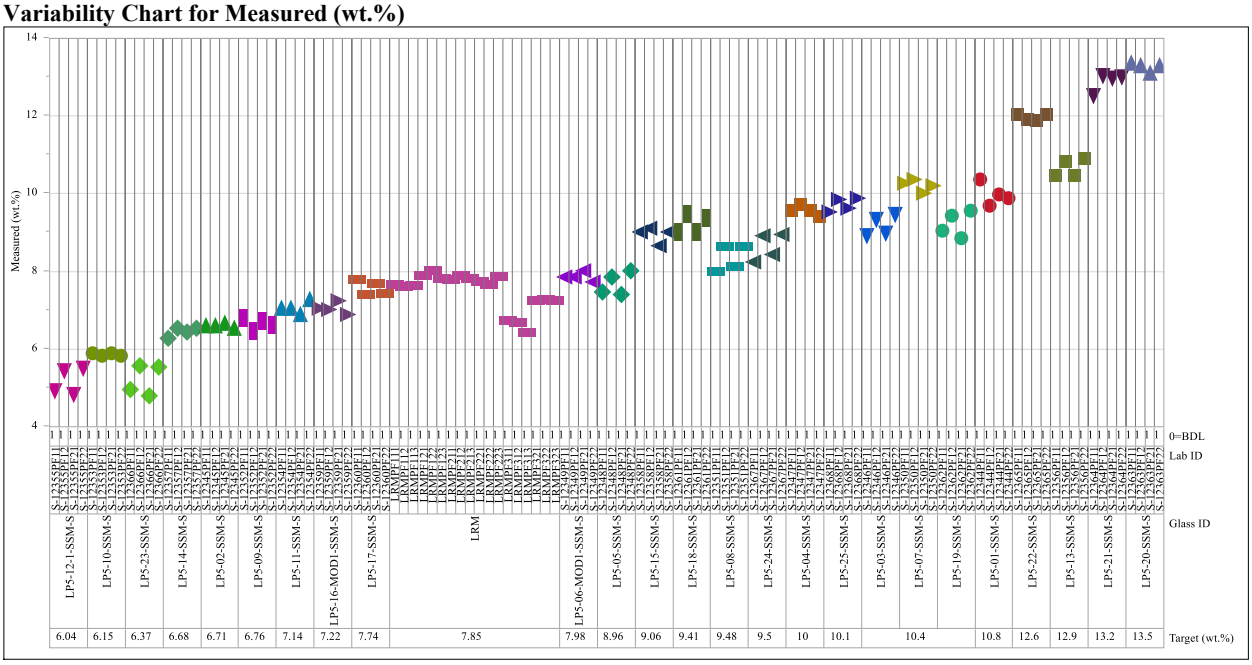
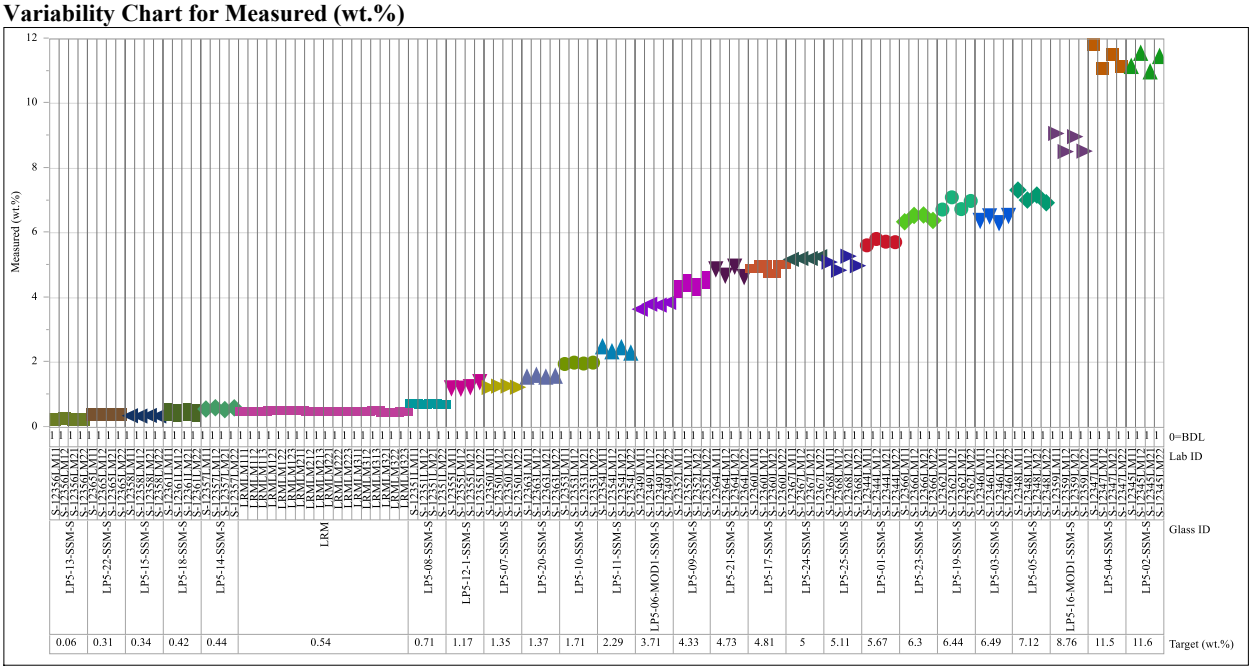


Exhibit A-1. Plots of Oxide Measurements by Glass Identifier by Target Concentrations (continued)

Oxide=CaO, Prep Method=LM
Variability Chart for Measured (wt.%)



Oxide=Cl⁻, Prep Method=KH
Variability Chart for Measured (wt.%)

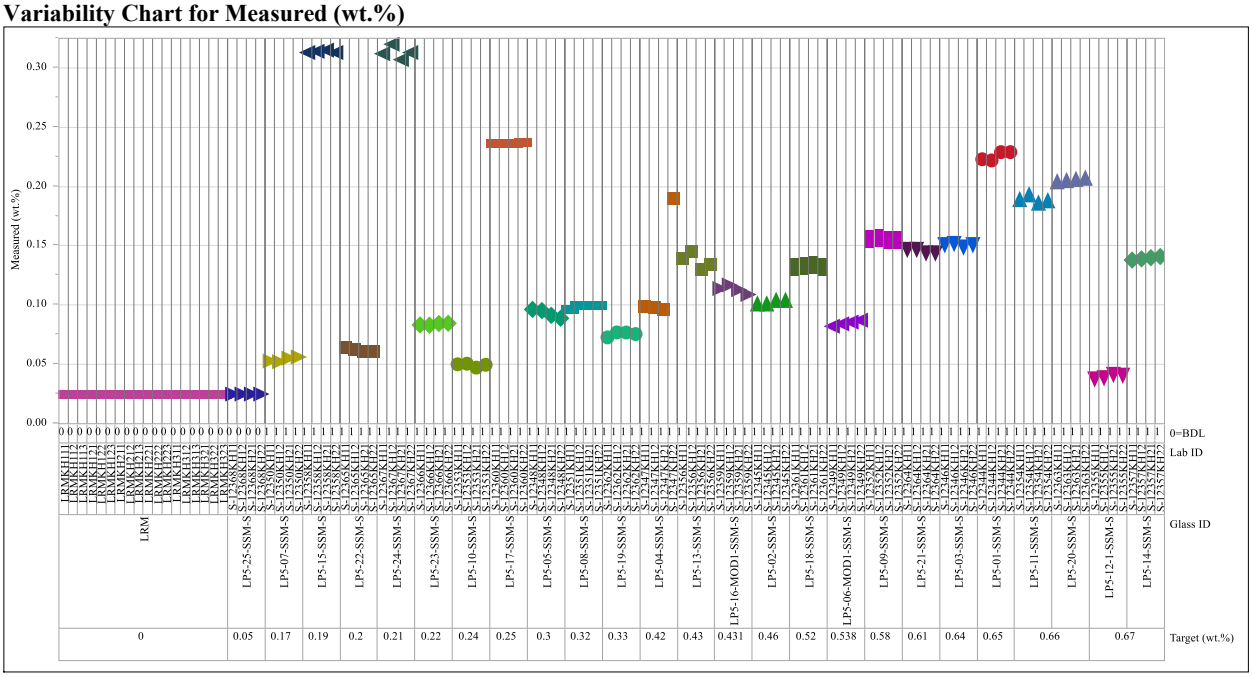
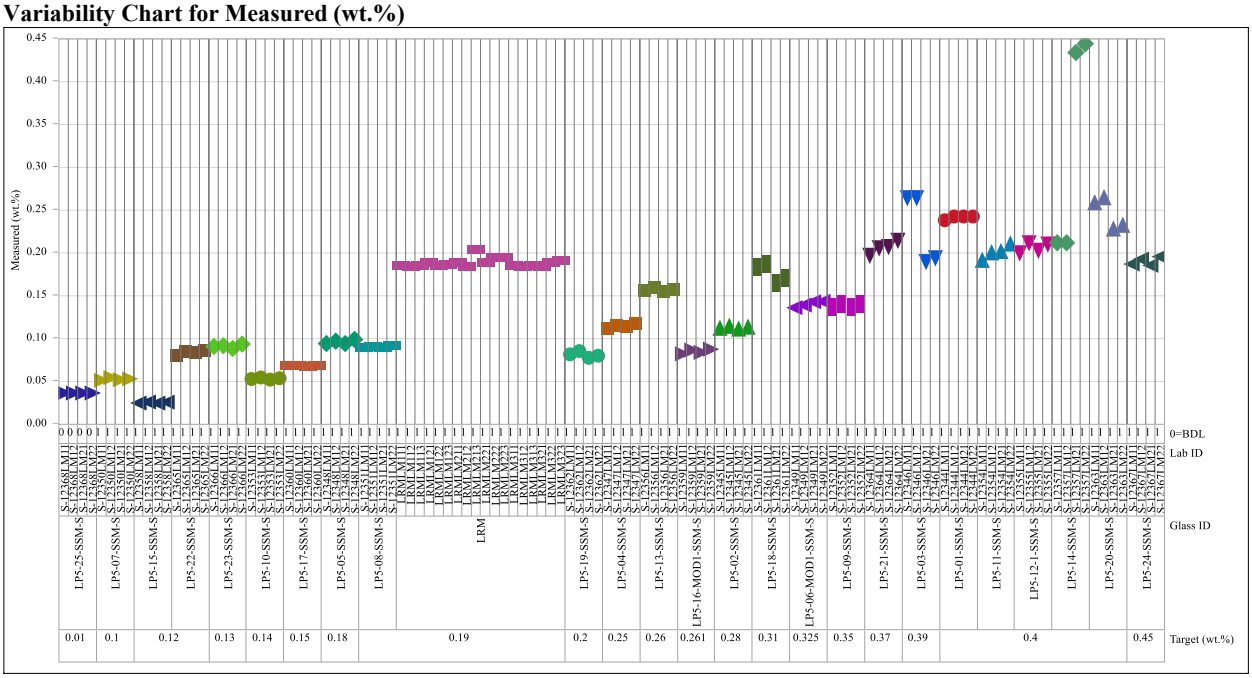


Exhibit A-1. Plots of Oxide Measurements by Glass Identifier by Target Concentrations (continued)

Oxide=Cr_2O_3, Prep Method=LM
Variability Chart for Measured (wt.%)



Oxide=F^-, Prep Method=KH
Variability Chart for Measured (wt.%)

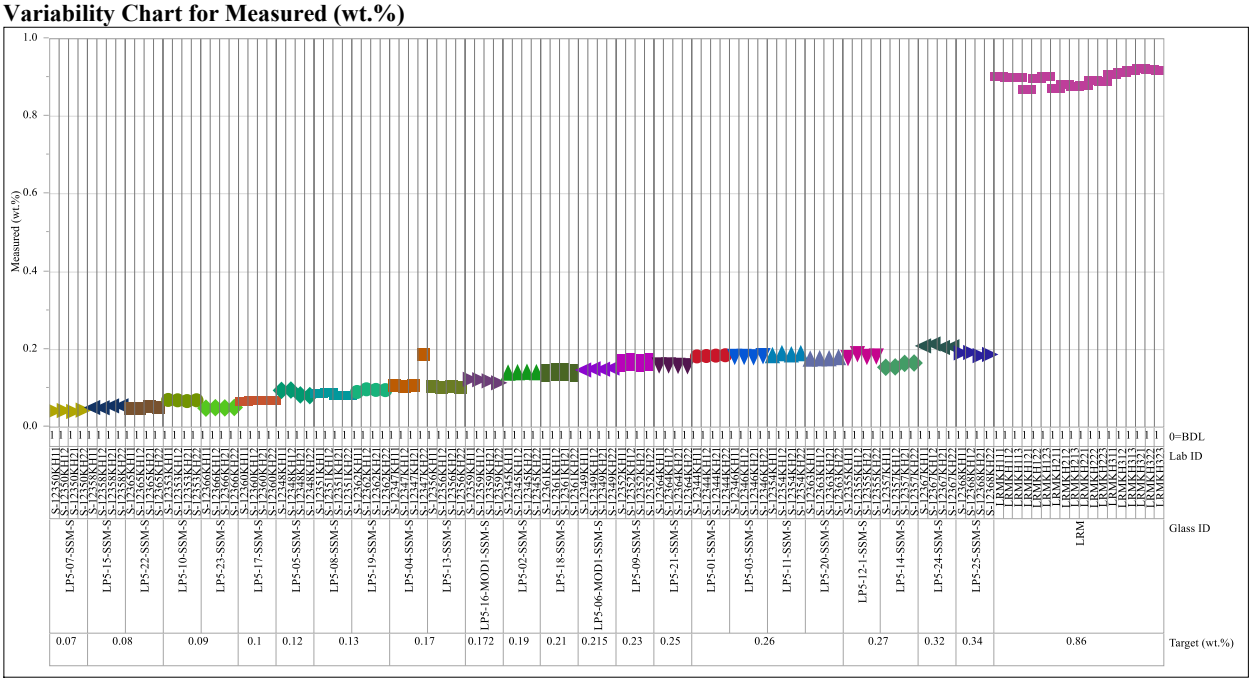
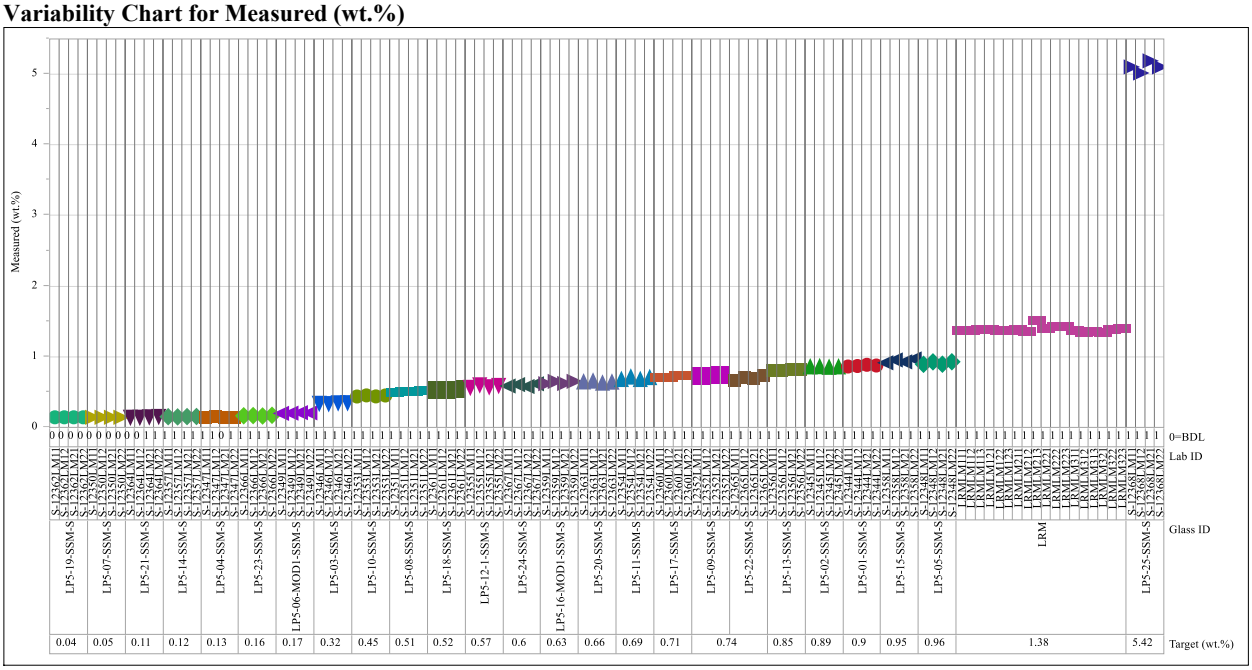


Exhibit A-1. Plots of Oxide Measurements by Glass Identifier by Target Concentrations (continued)

Oxide=Fe_2O_3, Prep Method=LM
Variability Chart for Measured (wt.%)



Oxide=K_2O, Prep Method=LM
Variability Chart for Measured (wt.%)

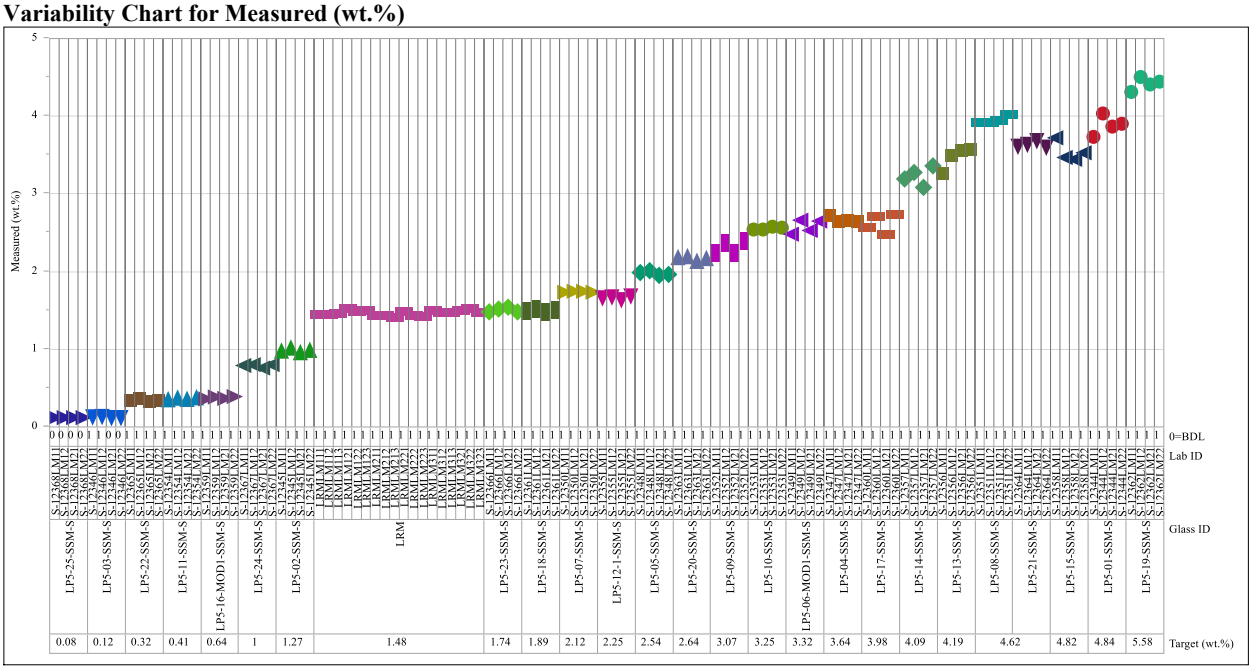
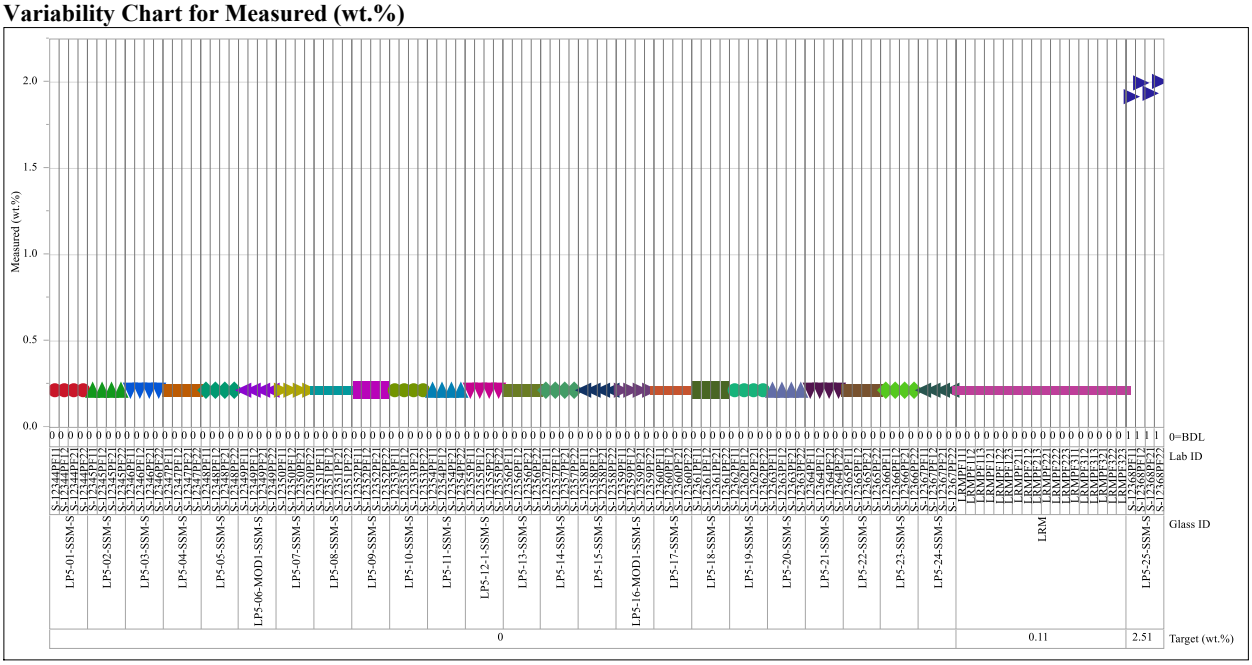


Exhibit A-1. Plots of Oxide Measurements by Glass Identifier by Target Concentrations (continued)

Oxide=Li_2O, Prep Method=PF
Variability Chart for Measured (wt.%)



Oxide=MgO, Prep Method=LM
Variability Chart for Measured (wt.%)

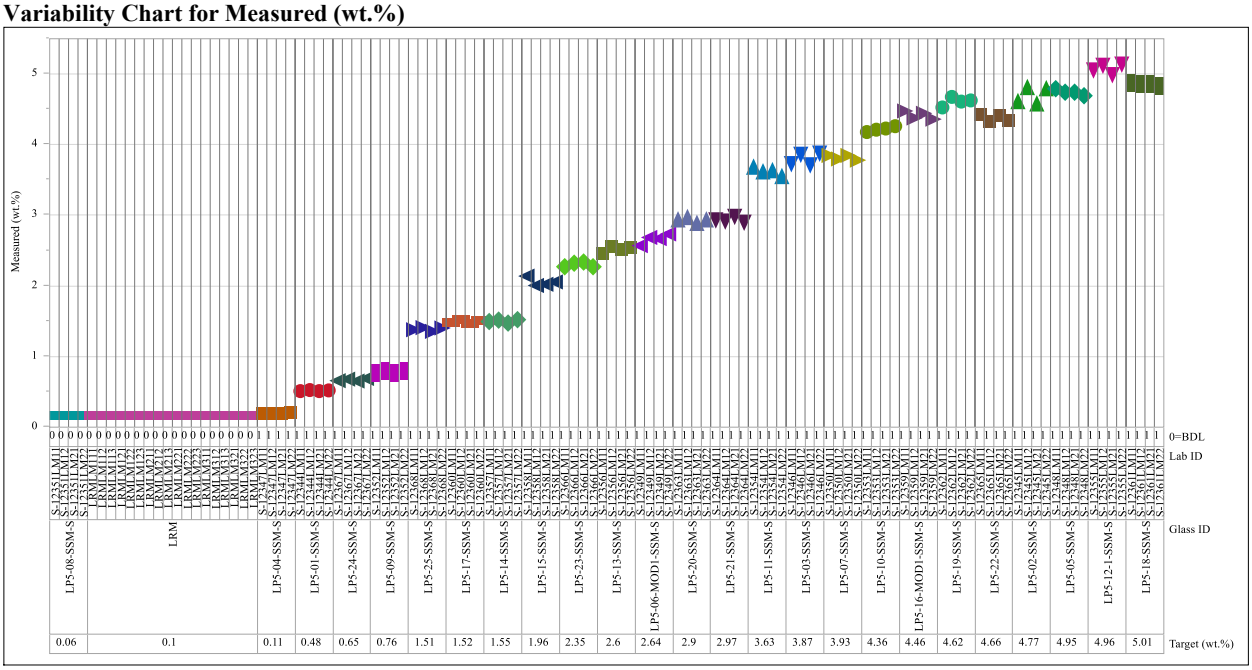
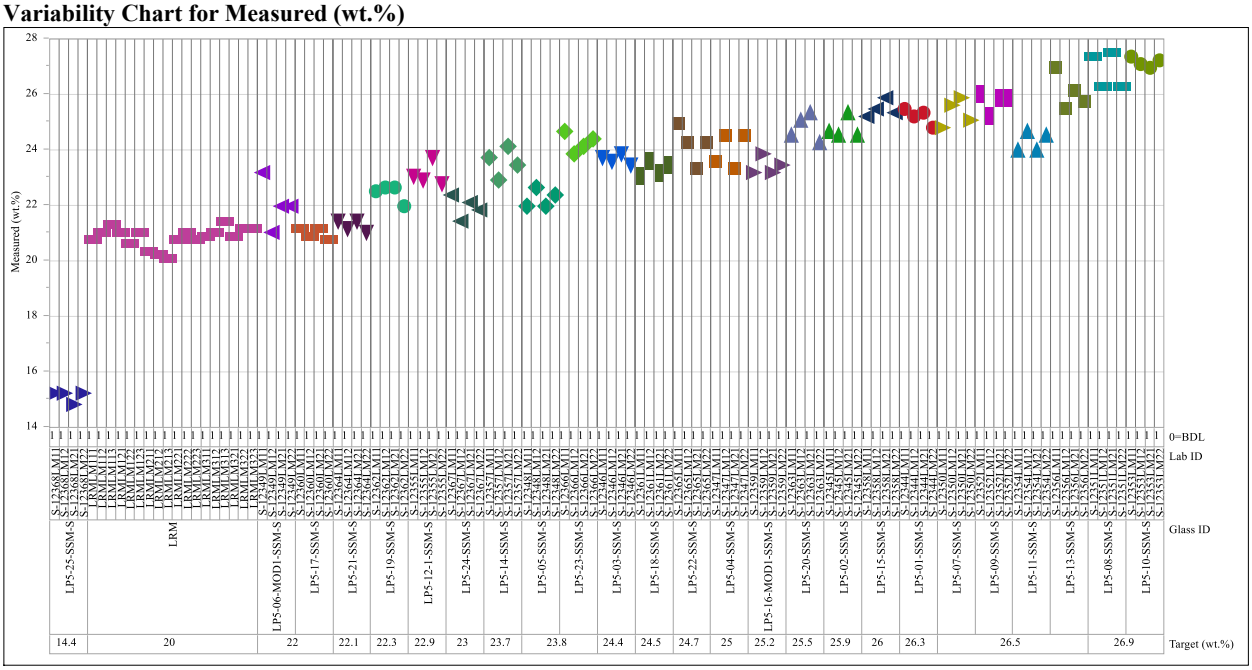


Exhibit A-1. Plots of Oxide Measurements by Glass Identifier by Target Concentrations (continued)

Oxide=Na_2O, Prep Method=LM
Variability Chart for Measured (wt.%)



Oxide=NiO, Prep Method=LM
Variability Chart for Measured (wt.%)

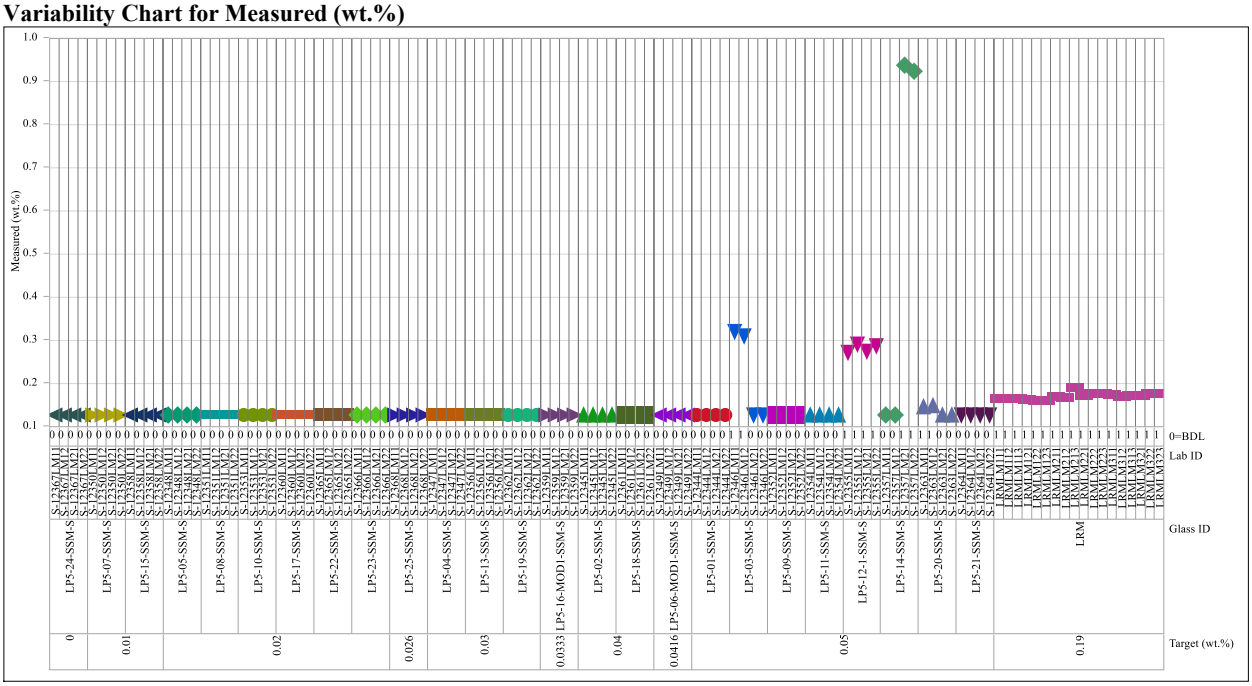
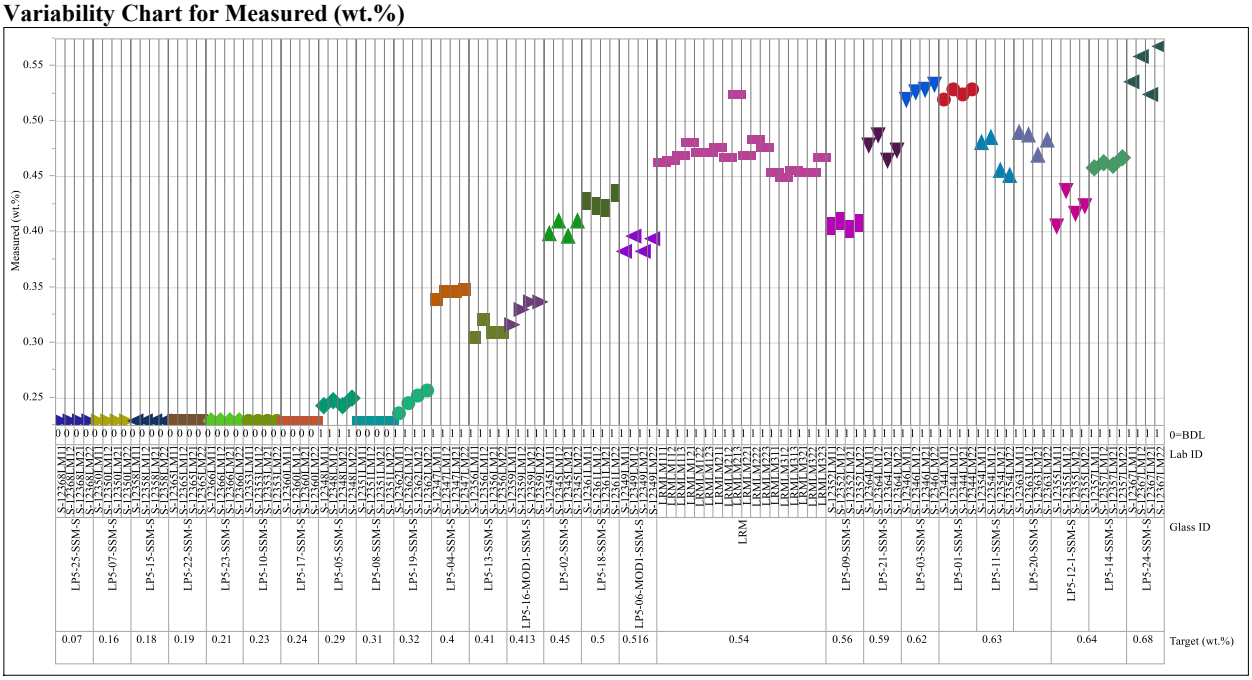


Exhibit A-1. Plots of Oxide Measurements by Glass Identifier by Target Concentrations (continued)

Oxide=P_2O_5, Prep Method=LM
Variability Chart for Measured (wt.%)



Oxide=PbO, Prep Method=LM
Variability Chart for Measured (wt.%)

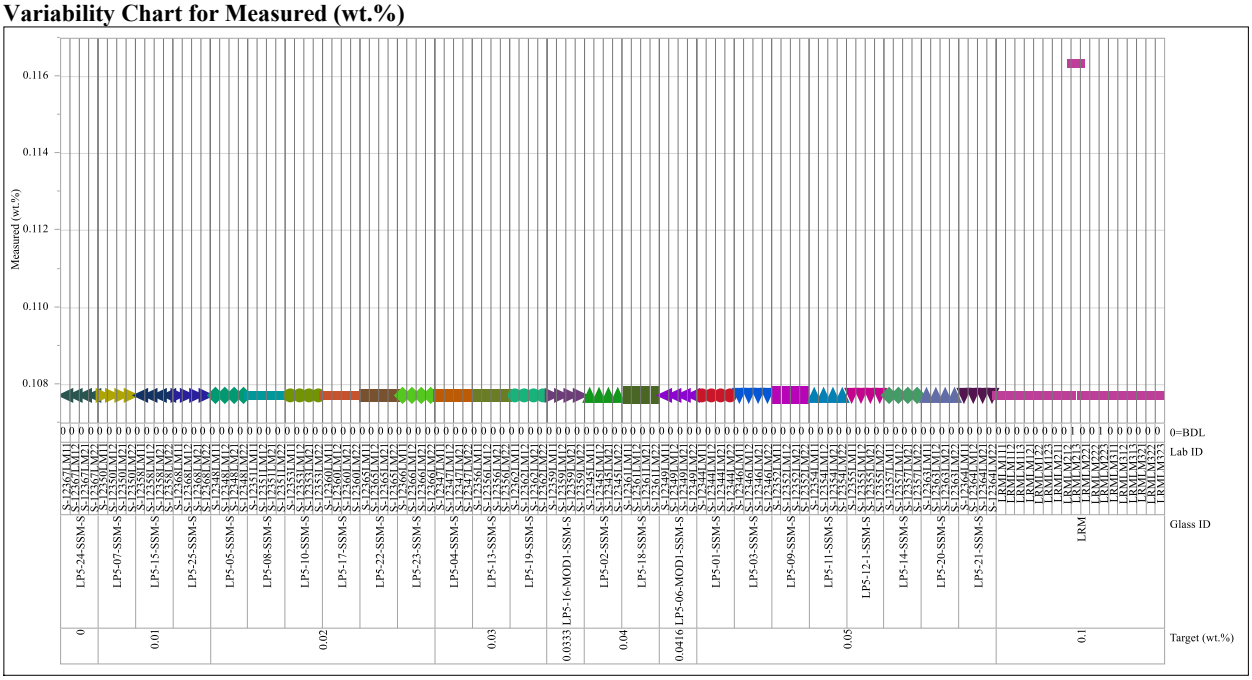
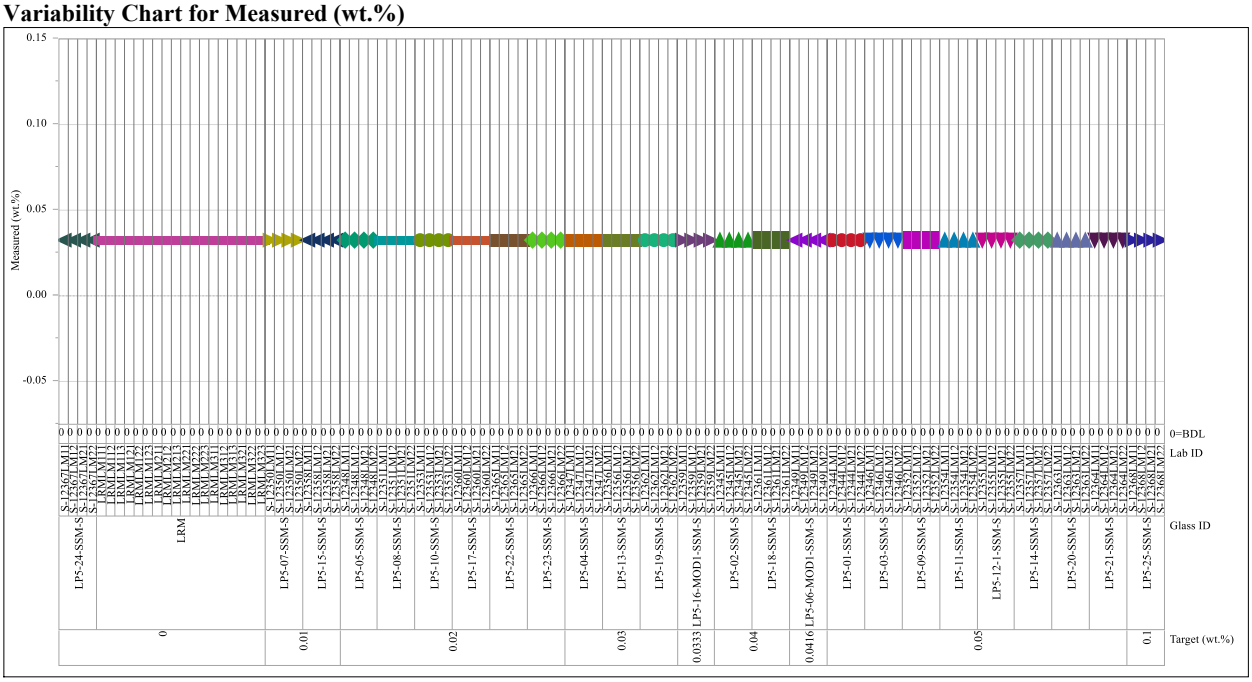


Exhibit A-1. Plots of Oxide Measurements by Glass Identifier by Target Concentrations (continued)

Oxide=Re_2O_7, Prep Method=LM
Variability Chart for Measured (wt.%)



Oxide=SiO_2, Prep Method=PF
Variability Chart for Measured (wt.%)

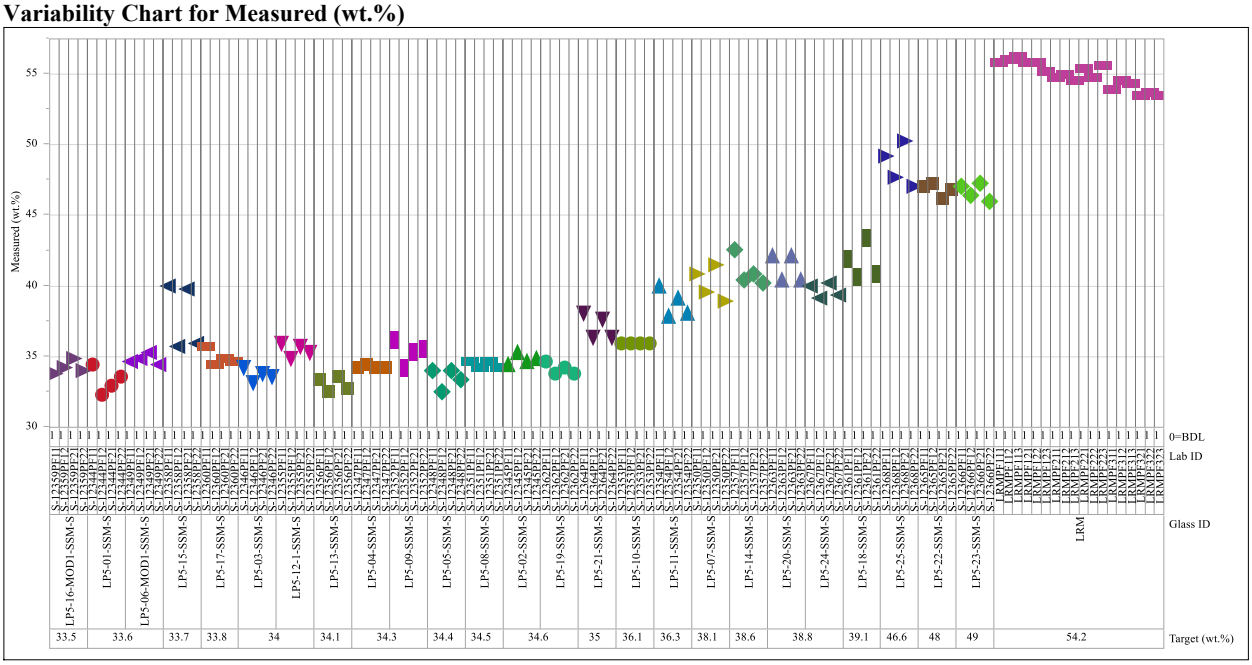
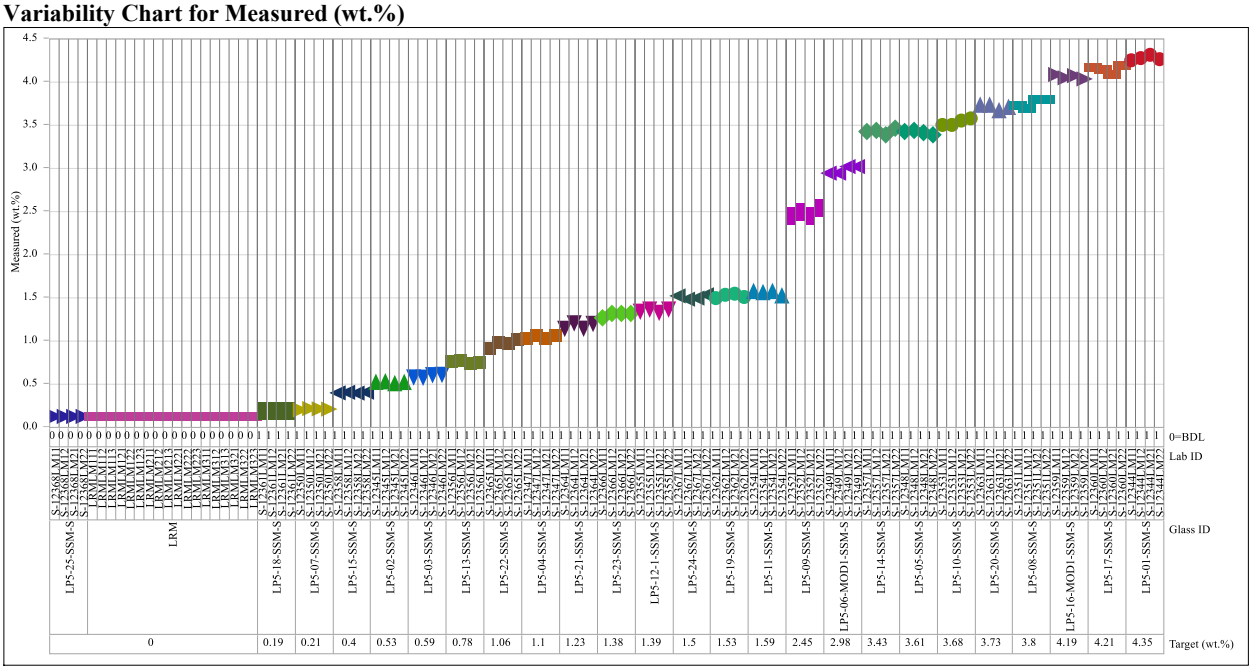


Exhibit A-1. Plots of Oxide Measurements by Glass Identifier by Target Concentrations (continued)

Oxide=SnO_2, Prep Method=LM
Variability Chart for Measured (wt.%)



Oxide=SO_3, Prep Method=LM
Variability Chart for Measured (wt.%)

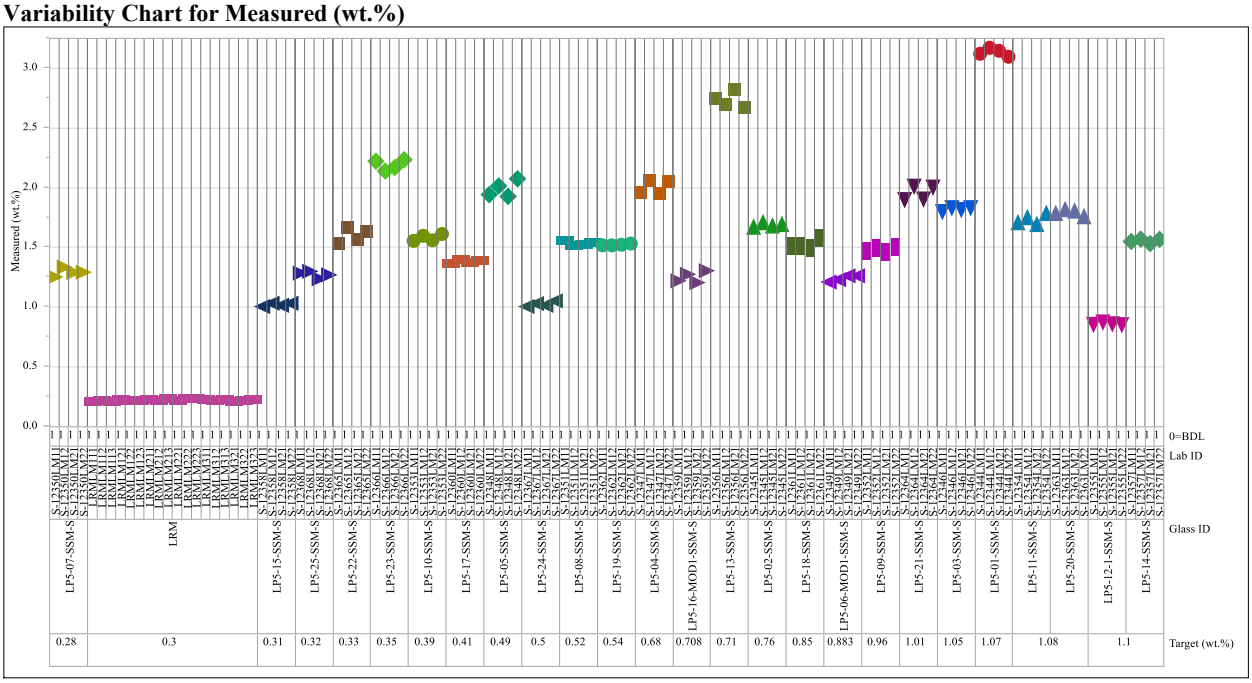
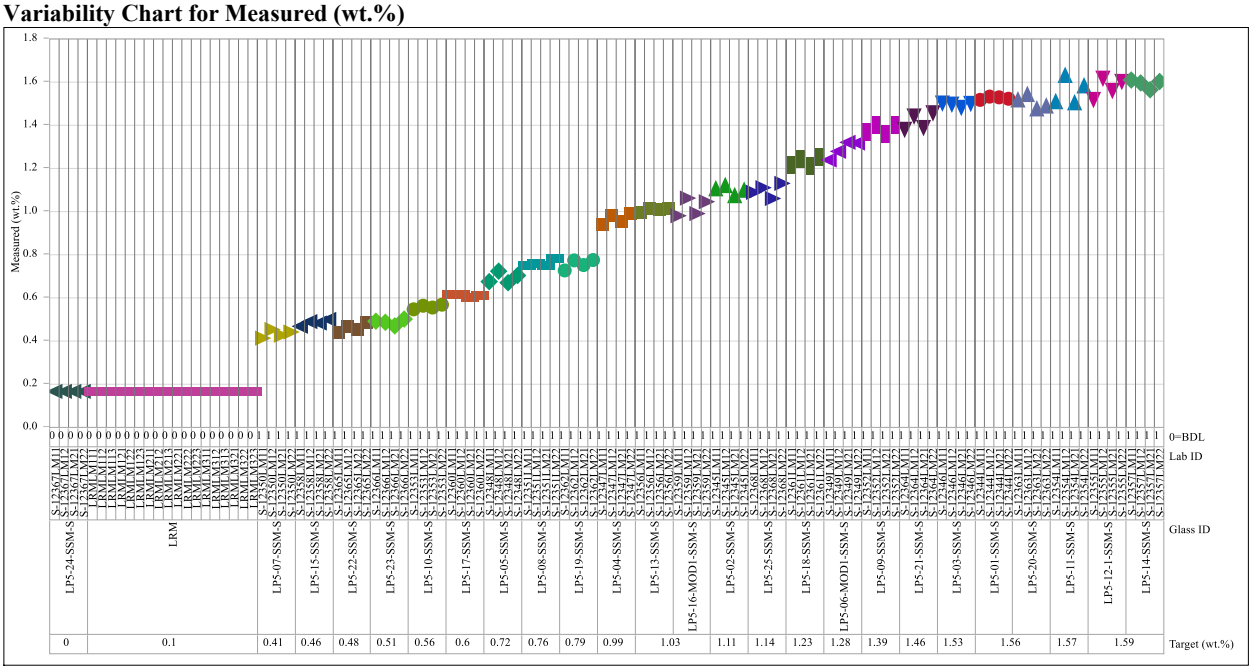


Exhibit A-1. Plots of Oxide Measurements by Glass Identifier by Target Concentrations (continued)

Oxide=TiO_2, Prep Method=LM
Variability Chart for Measured (wt.%)



Oxide=V_2O_5, Prep Method=LM
Variability Chart for Measured (wt.%)

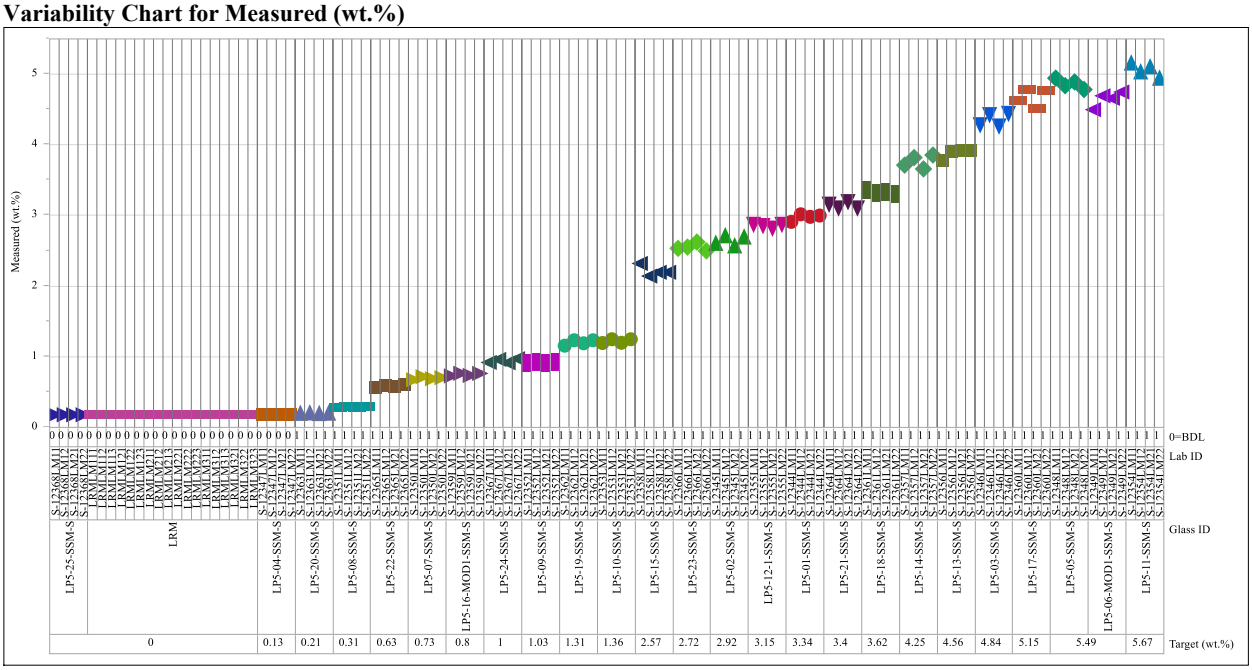
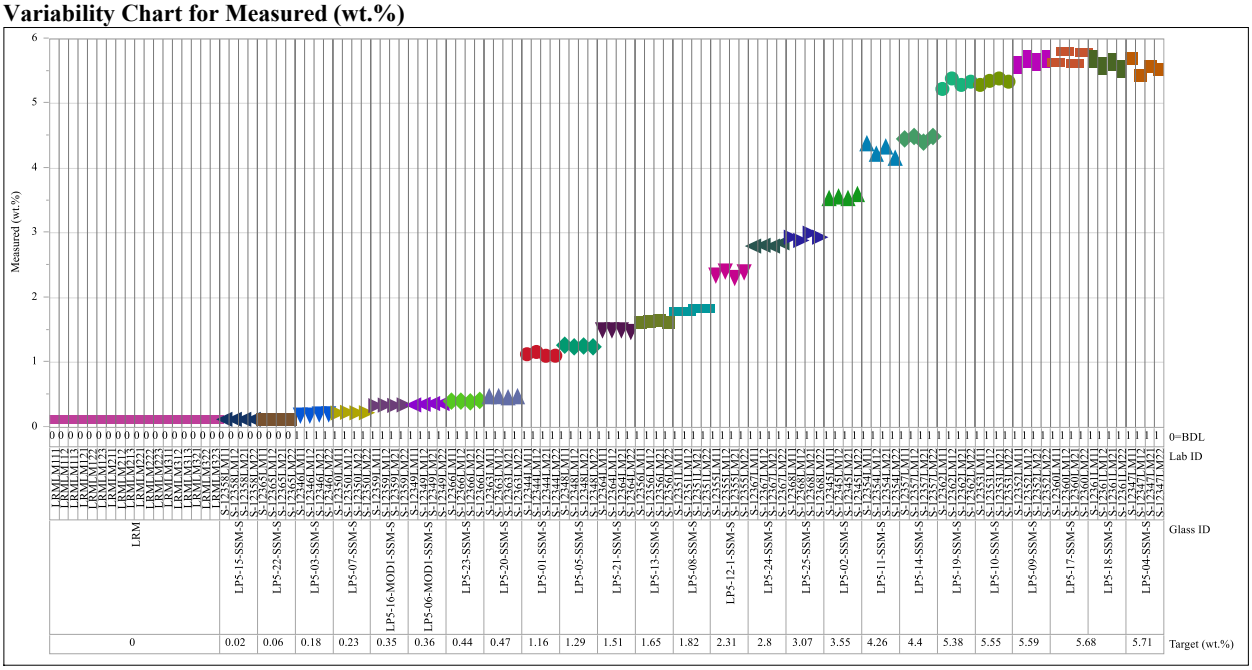


Exhibit A-1. Plots of Oxide Measurements by Glass Identifier by Target Concentrations (continued)

Oxide=ZnO, Prep Method=LM
Variability Chart for Measured (wt.%)



Oxide=ZrO_2, Prep Method=LM
Variability Chart for Measured (wt.%)

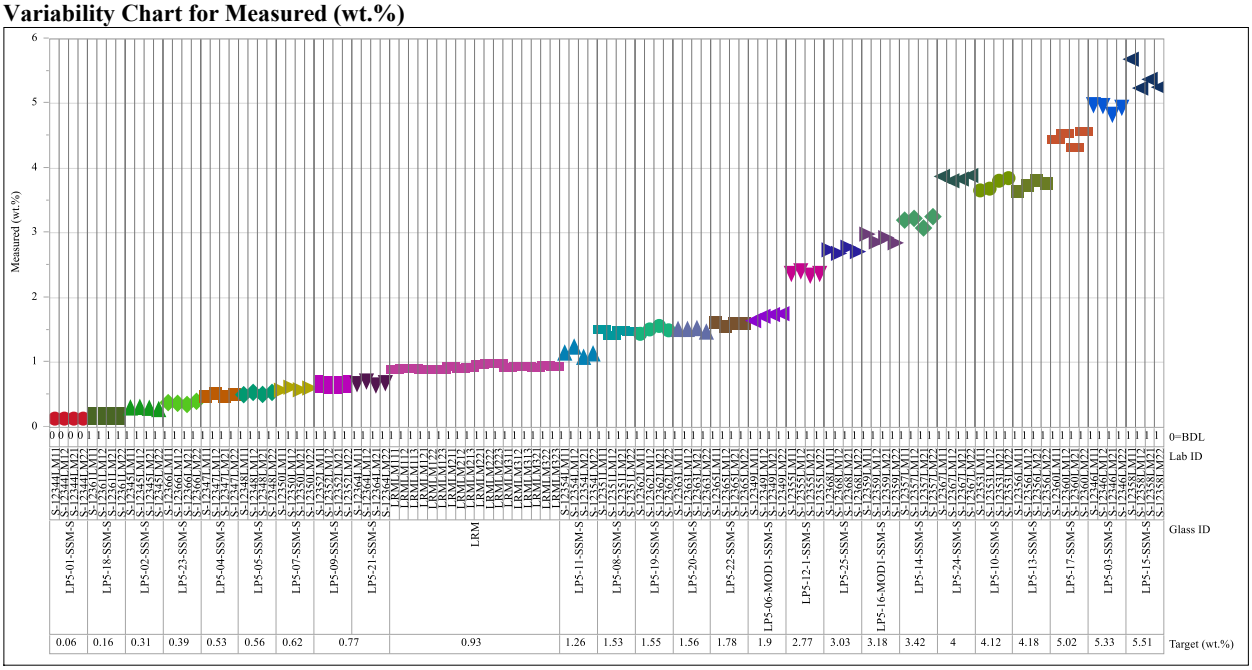
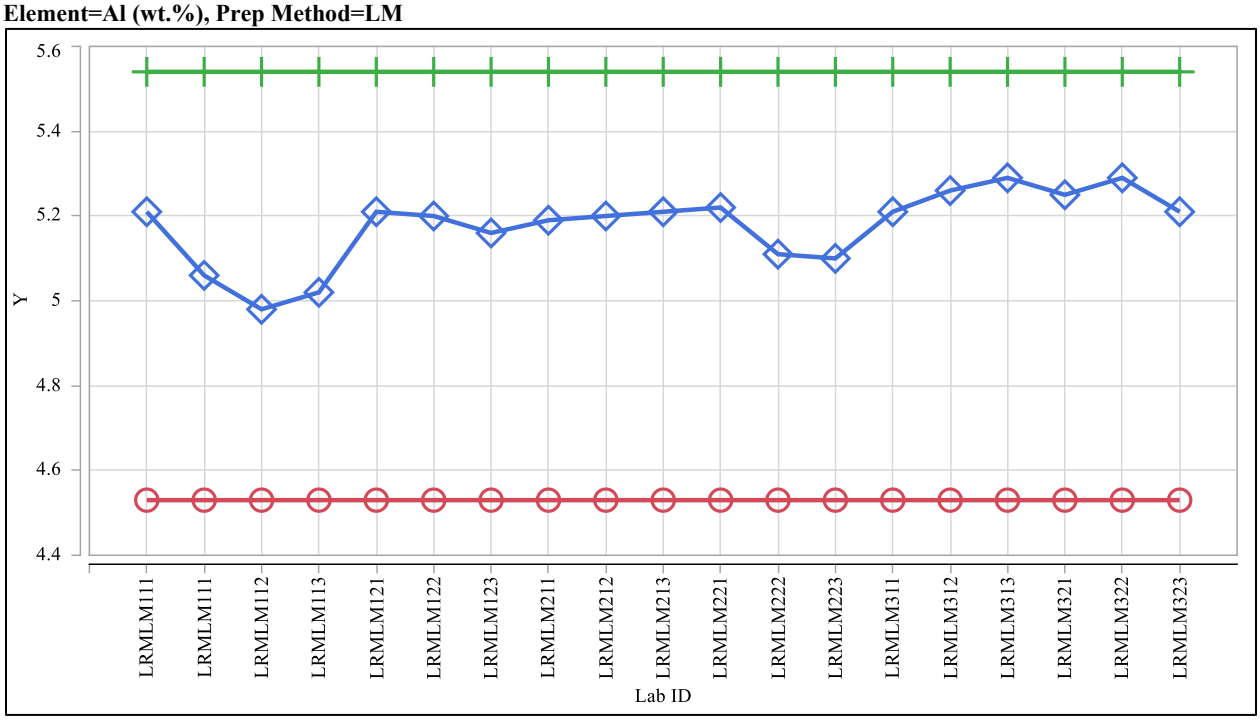
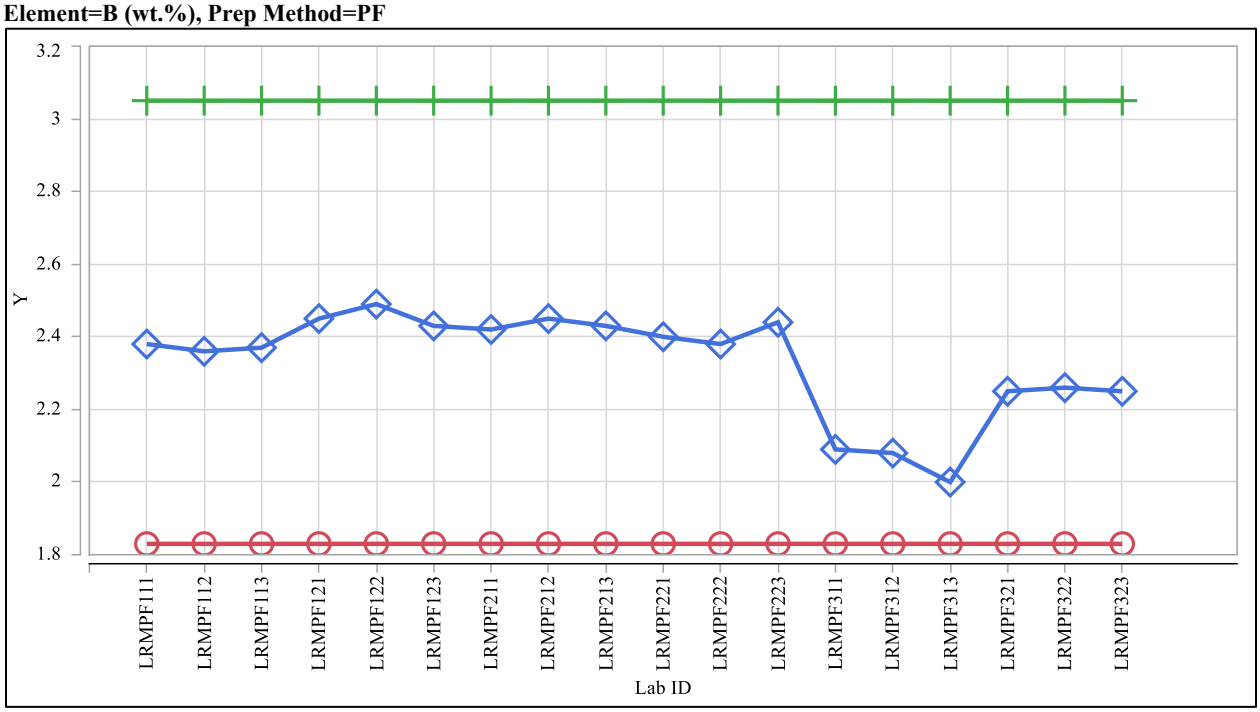


Exhibit A-2. Acceptability Evaluation for Measurements of the LRM Glass

Element=Al (wt.%), Prep Method=LM



Element=B (wt.%), Prep Method=PF



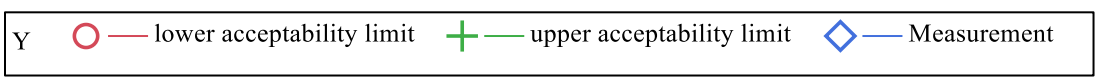
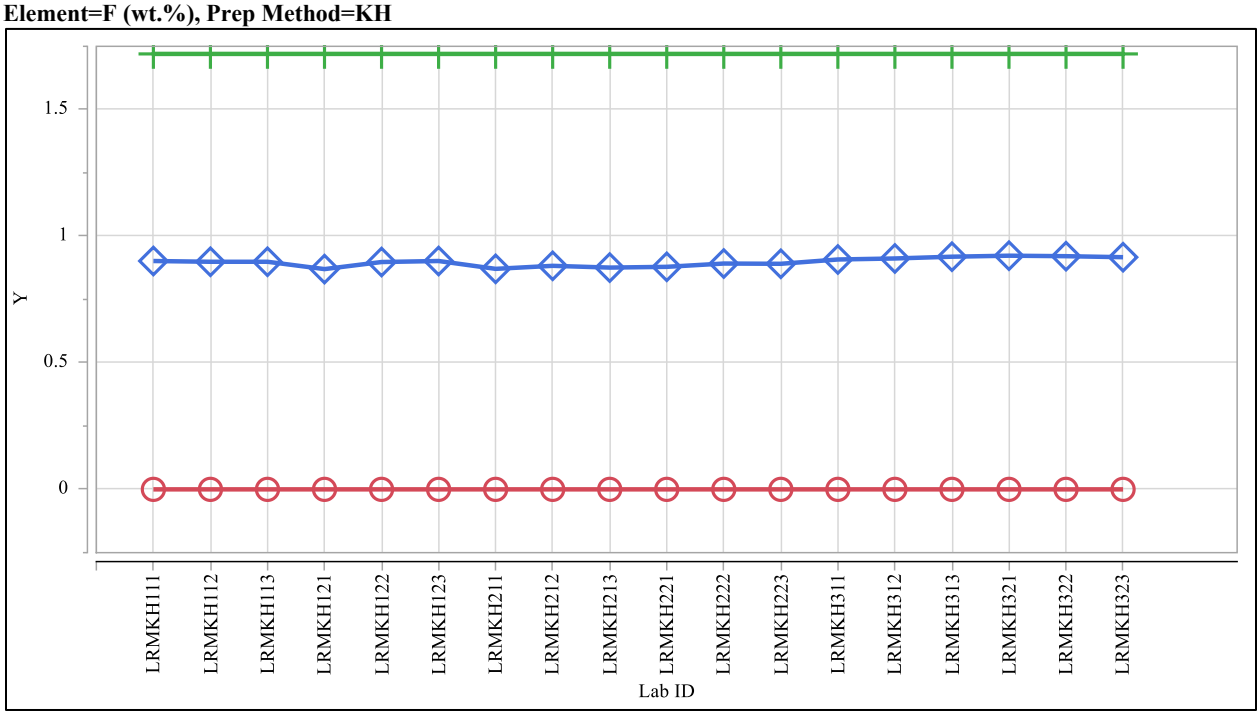
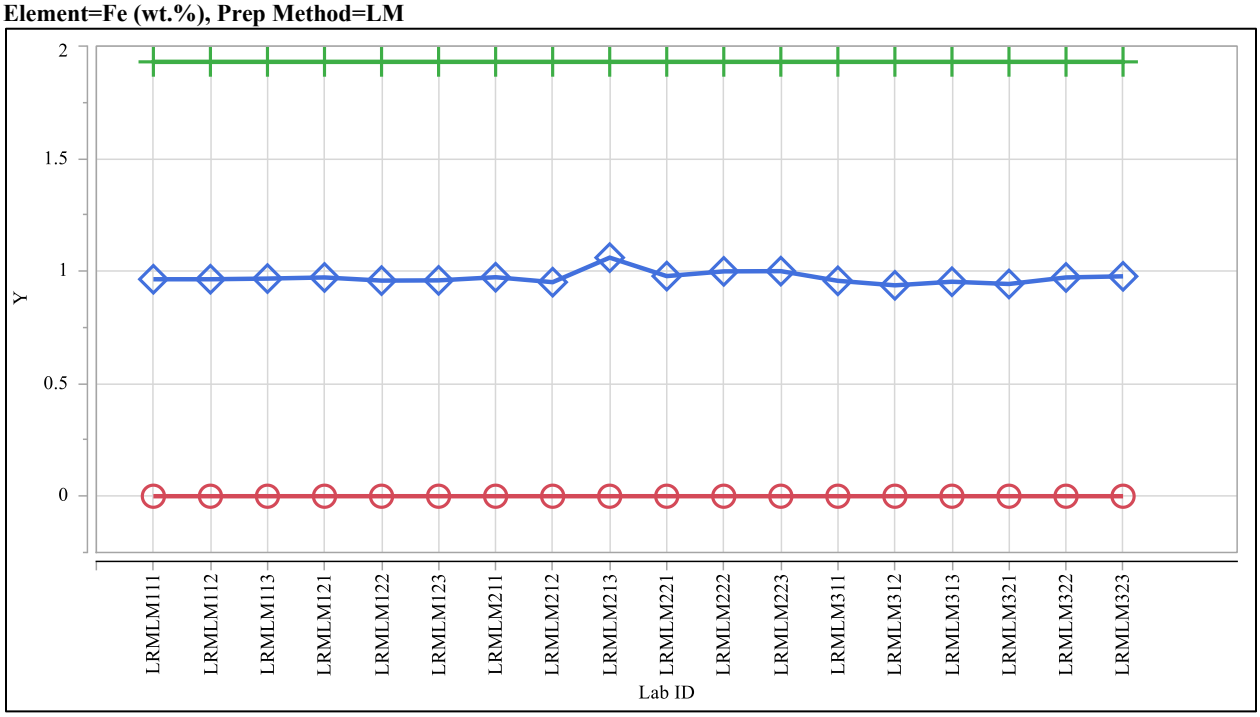


Exhibit A-2. Acceptability Evaluation for Measurements of the LRM Glass (continued)

Element=F (wt.%), Prep Method=KH



Element=Fe (wt.%), Prep Method=LM



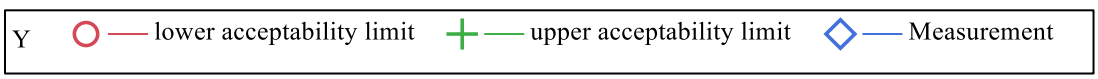
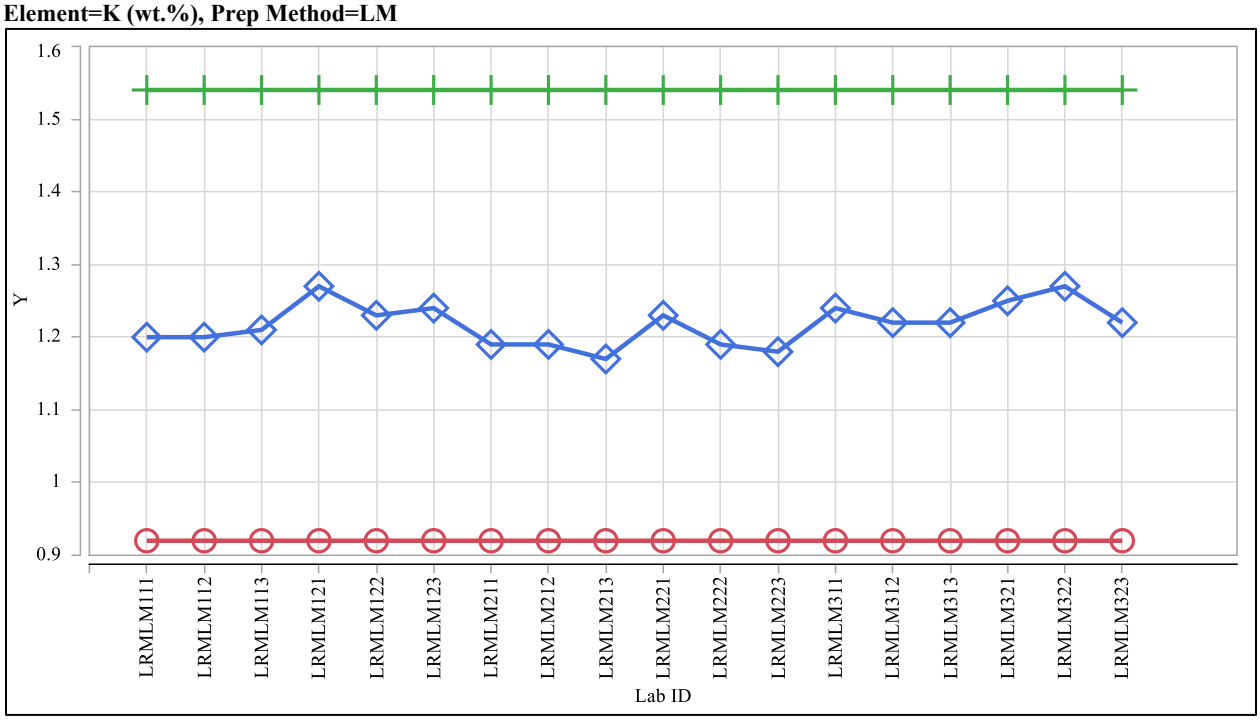
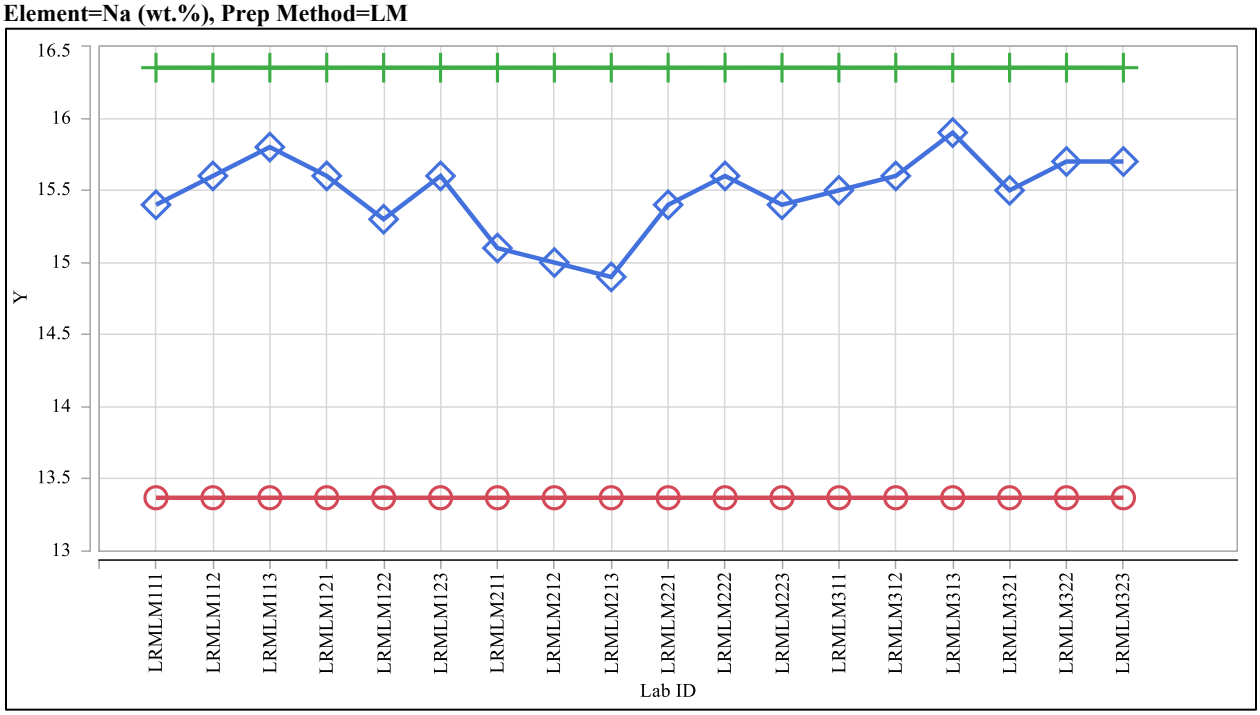


Exhibit A-2. Acceptability Evaluation for Measurements of the LRM Glass (continued)

Element=K (wt.%), Prep Method=LM



Element=Na (wt.%), Prep Method=LM



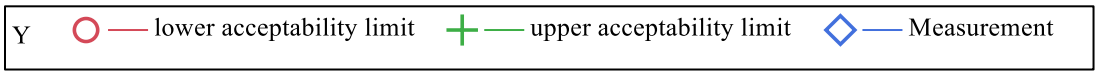
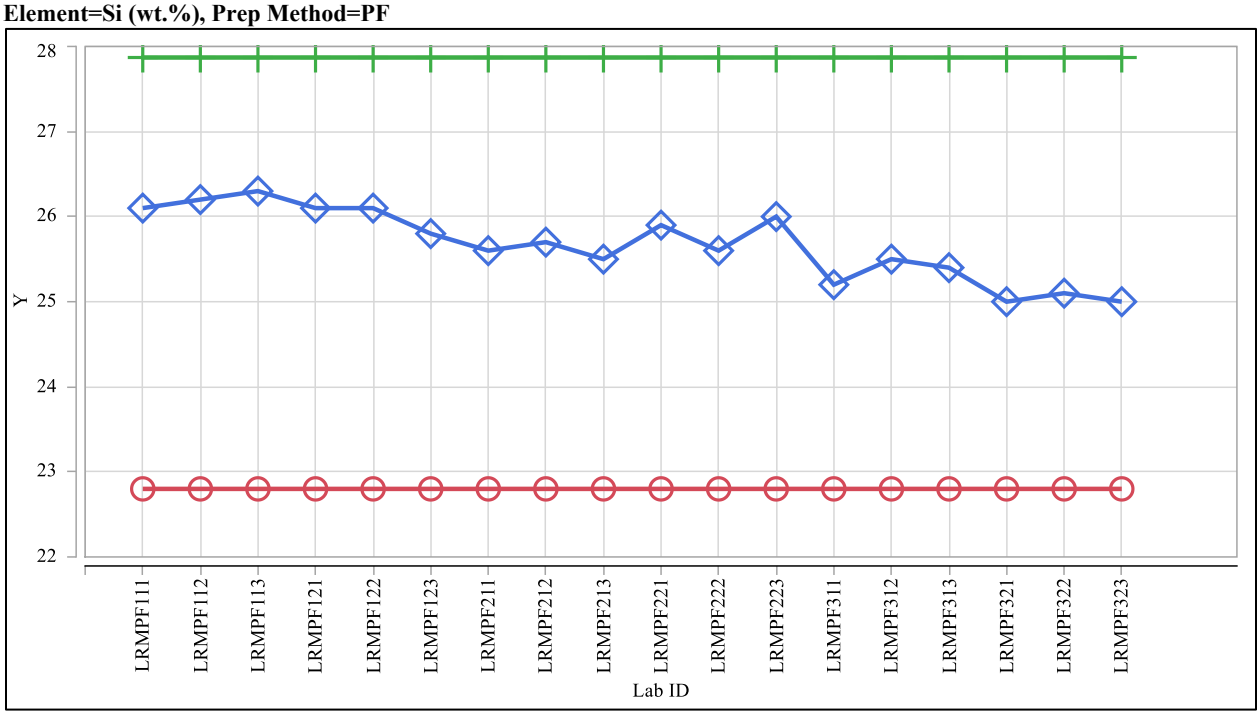
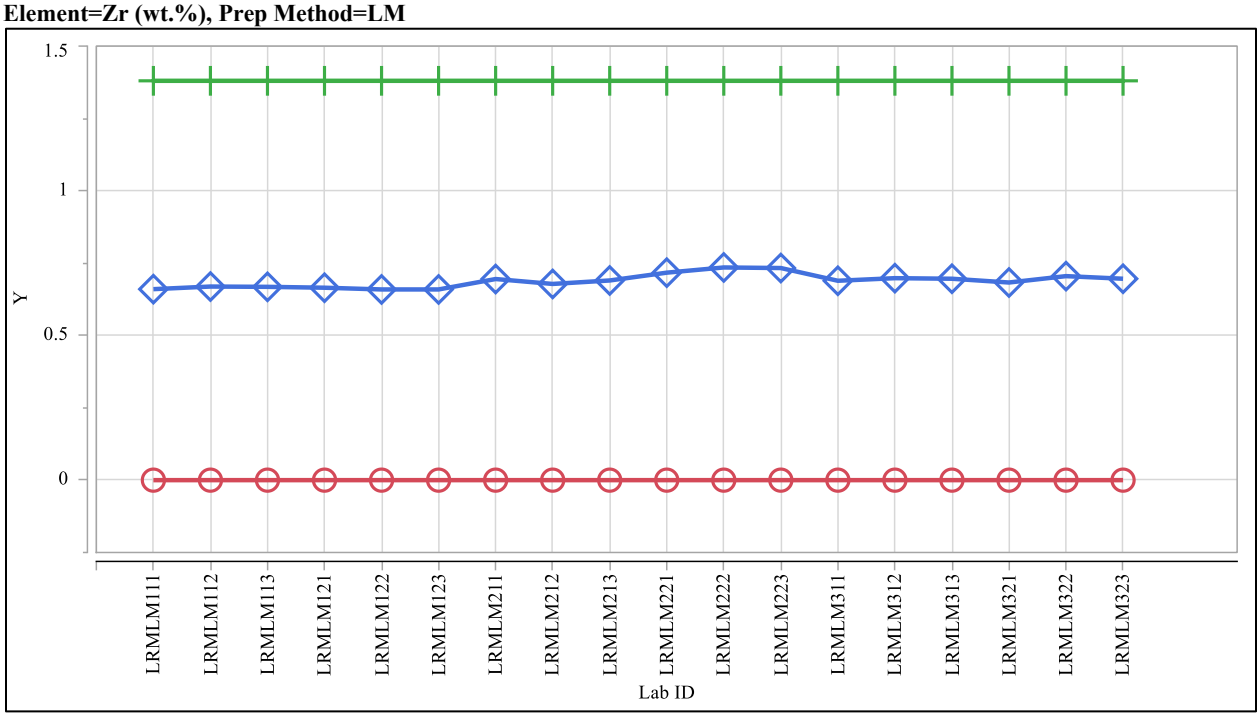


Exhibit A-2. Acceptability Evaluation for Measurements of the LRM Glass (continued)

Element=Si (wt.%), Prep Method=PF



Element=Zr (wt.%), Prep Method=LM



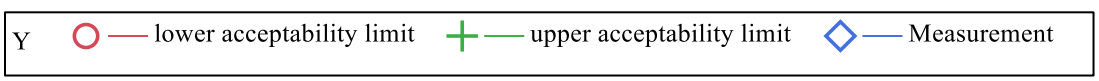
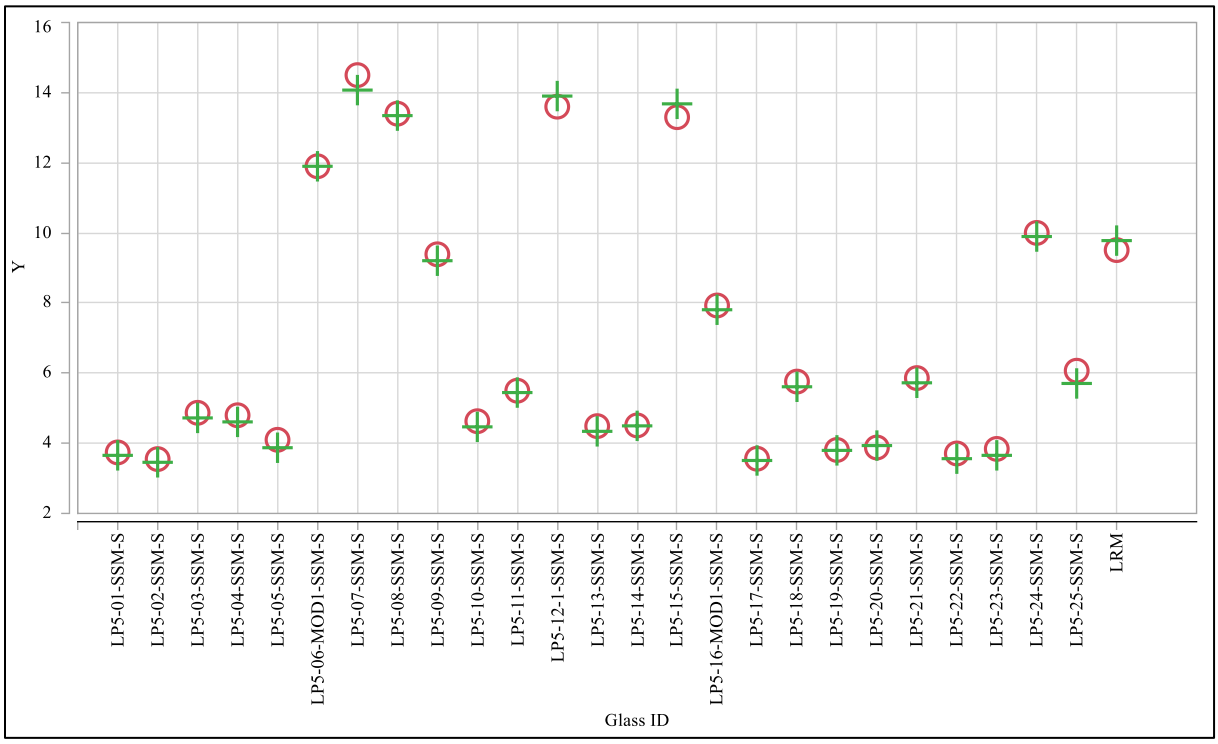
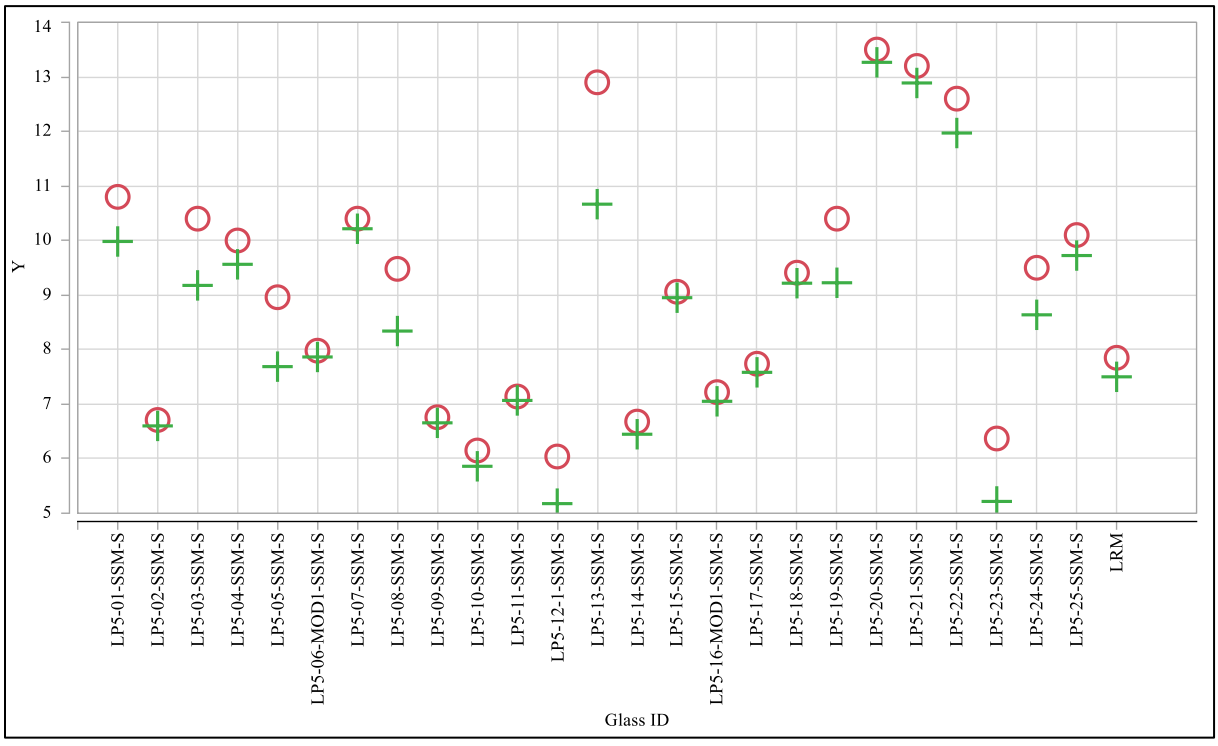


Exhibit A-3. Measured versus Target Concentrations by Glass ID by Oxide

Oxide=Al_2O_3



Oxide=B_2O_3



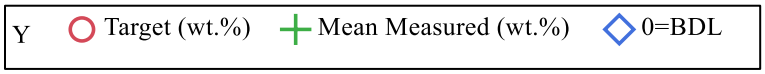
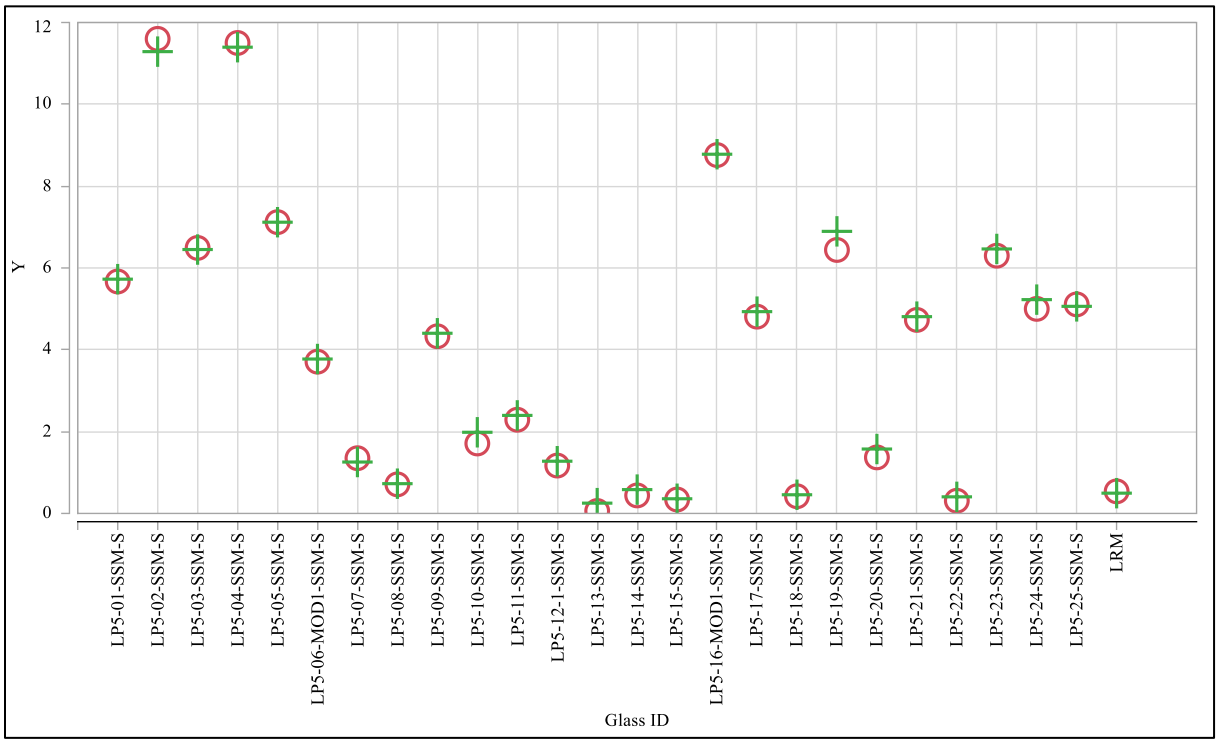
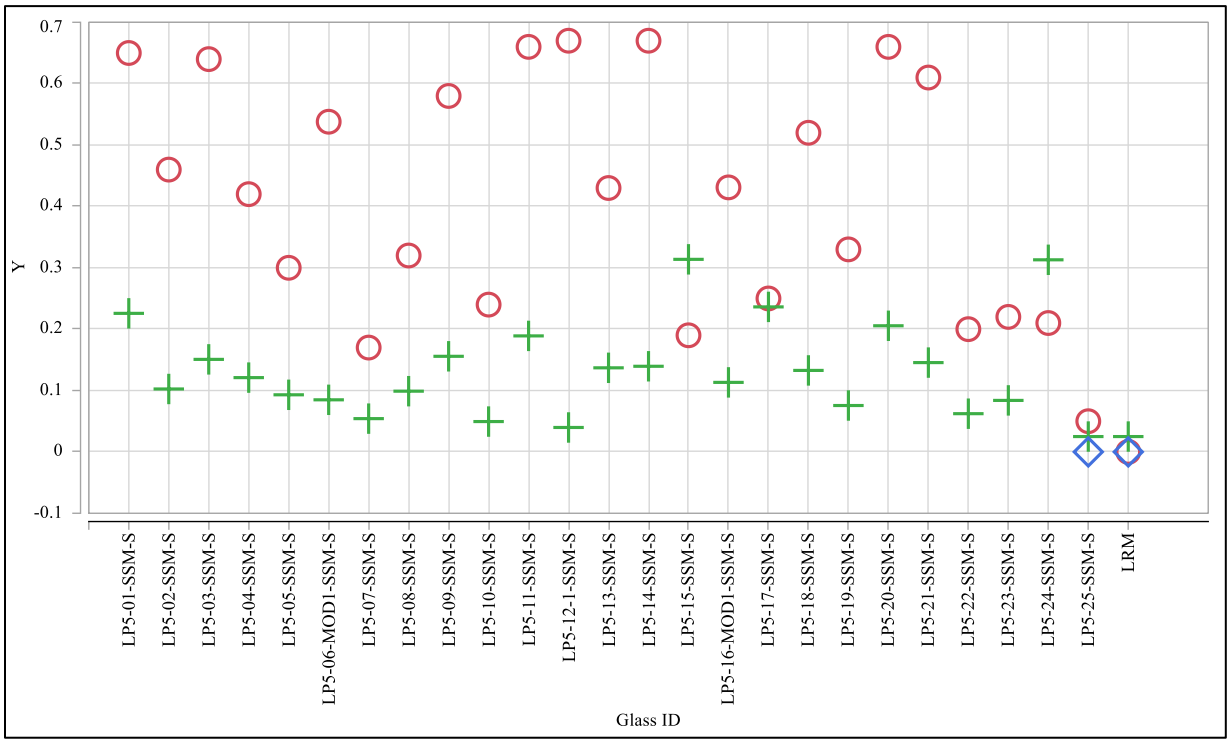


Exhibit A-3. Measured versus Target Concentrations by Glass ID by Oxide (continued)

Oxide=CaO



Oxide=Cl⁻



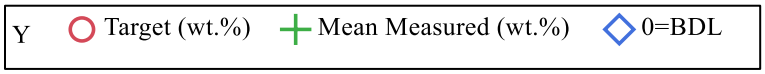
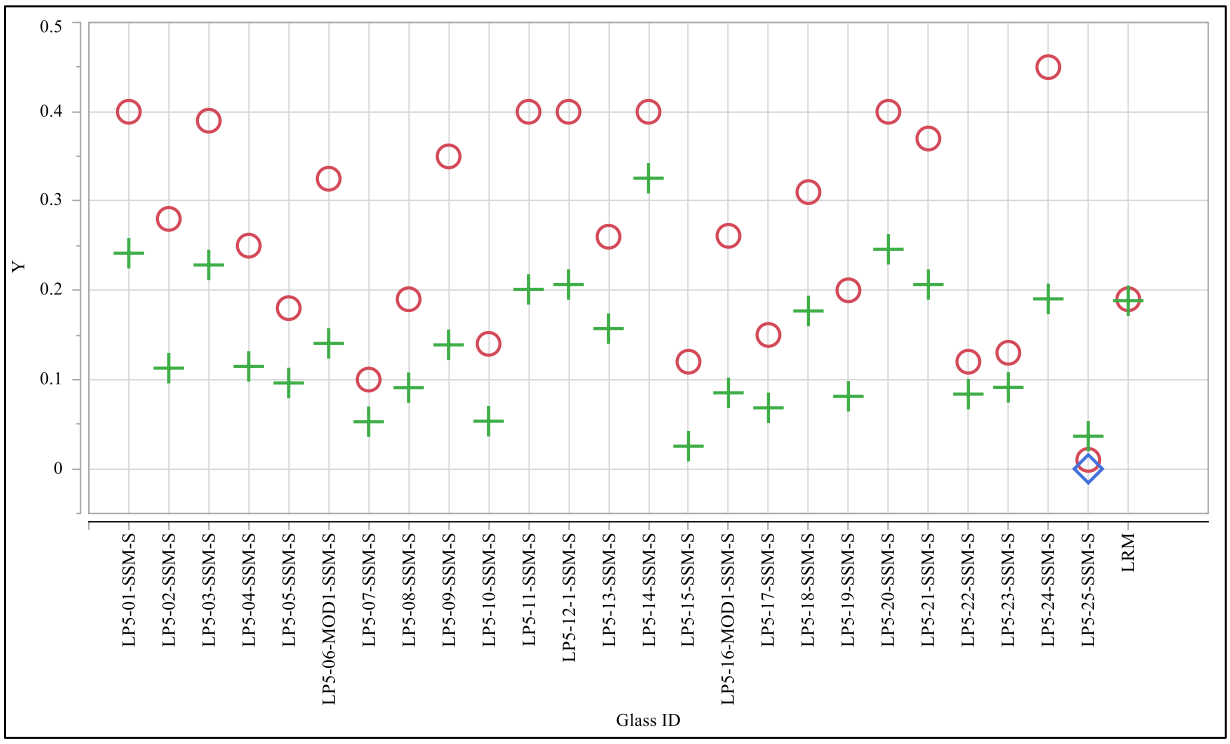
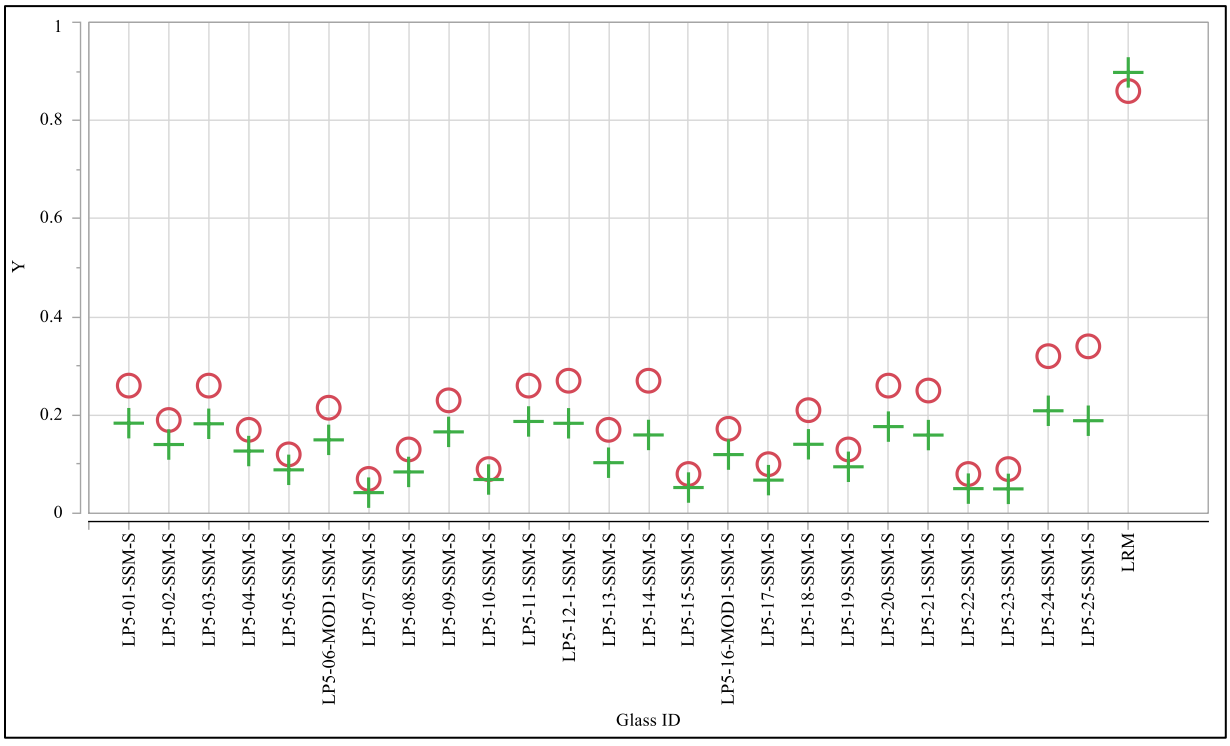


Exhibit A-3. Measured versus Target Concentrations by Glass ID by Oxide (continued)

Oxide=Cr_2O_3



Oxide=F^-



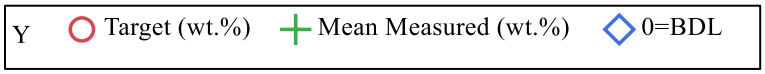
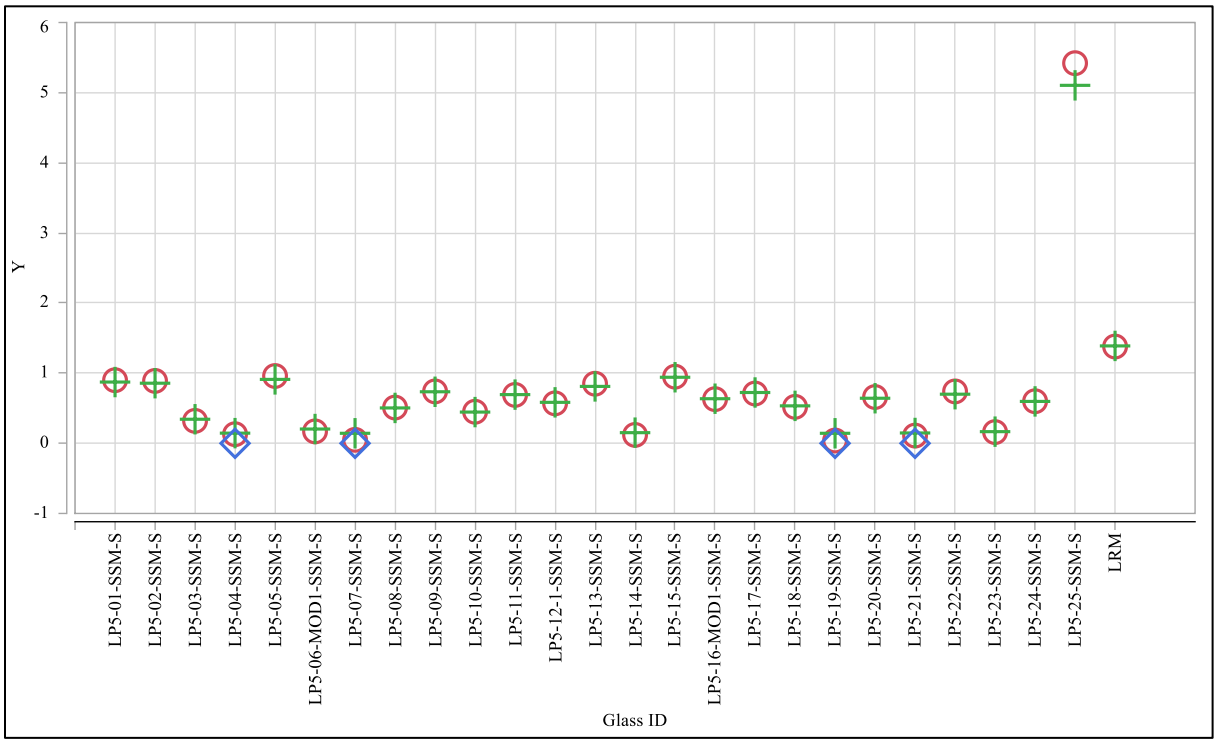
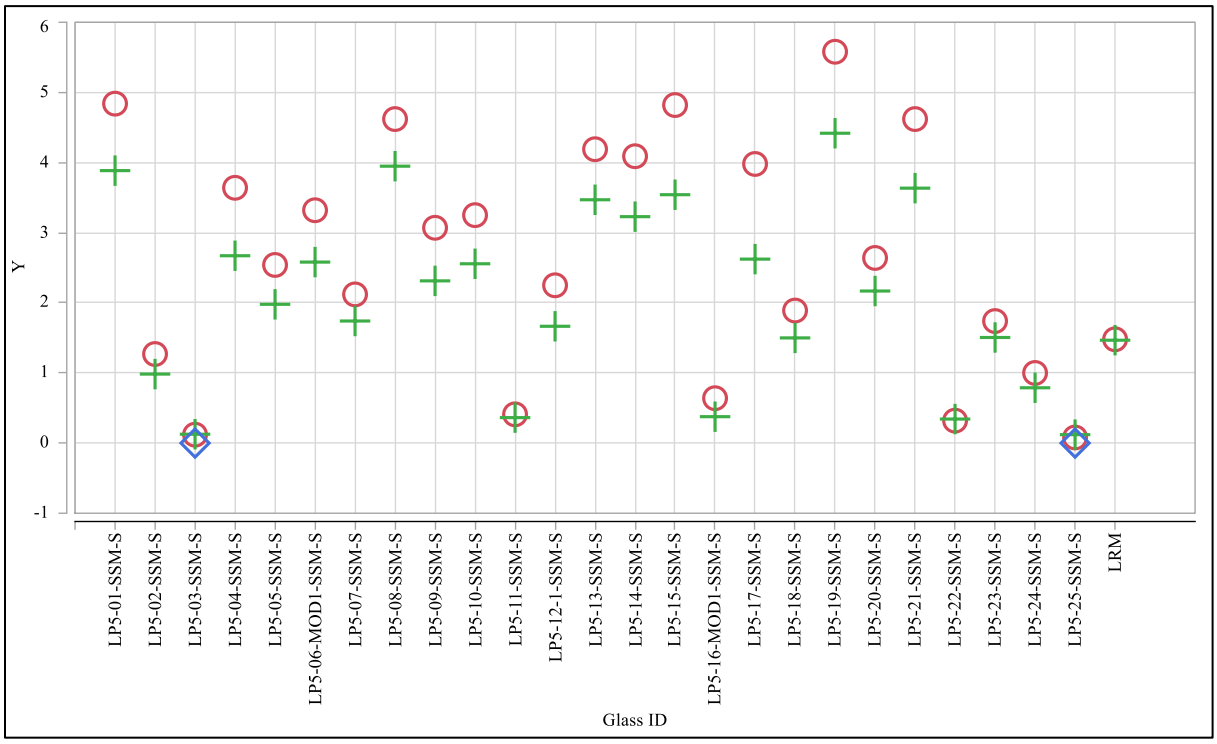


Exhibit A-3. Measured versus Target Concentrations by Glass ID by Oxide (continued)

Oxide=Fe_2O_3



Oxide=K_2O



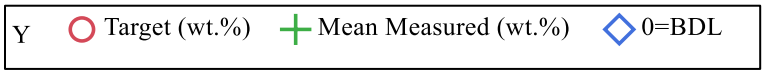
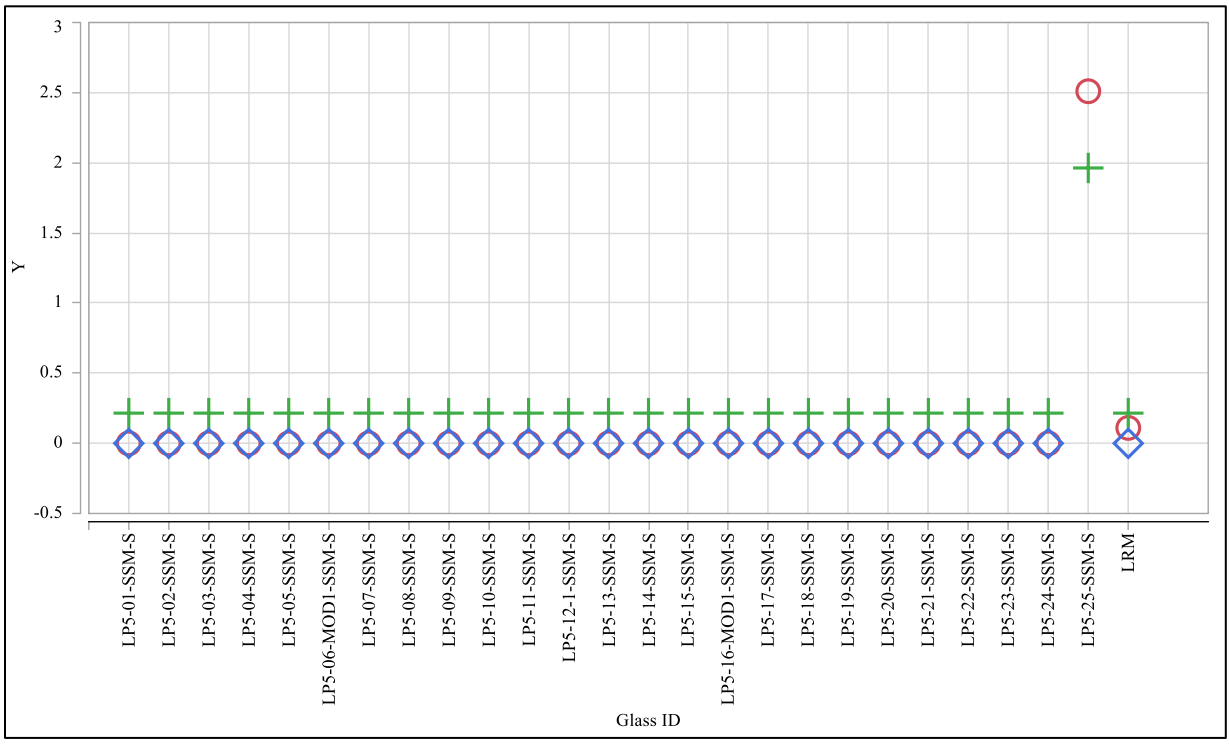
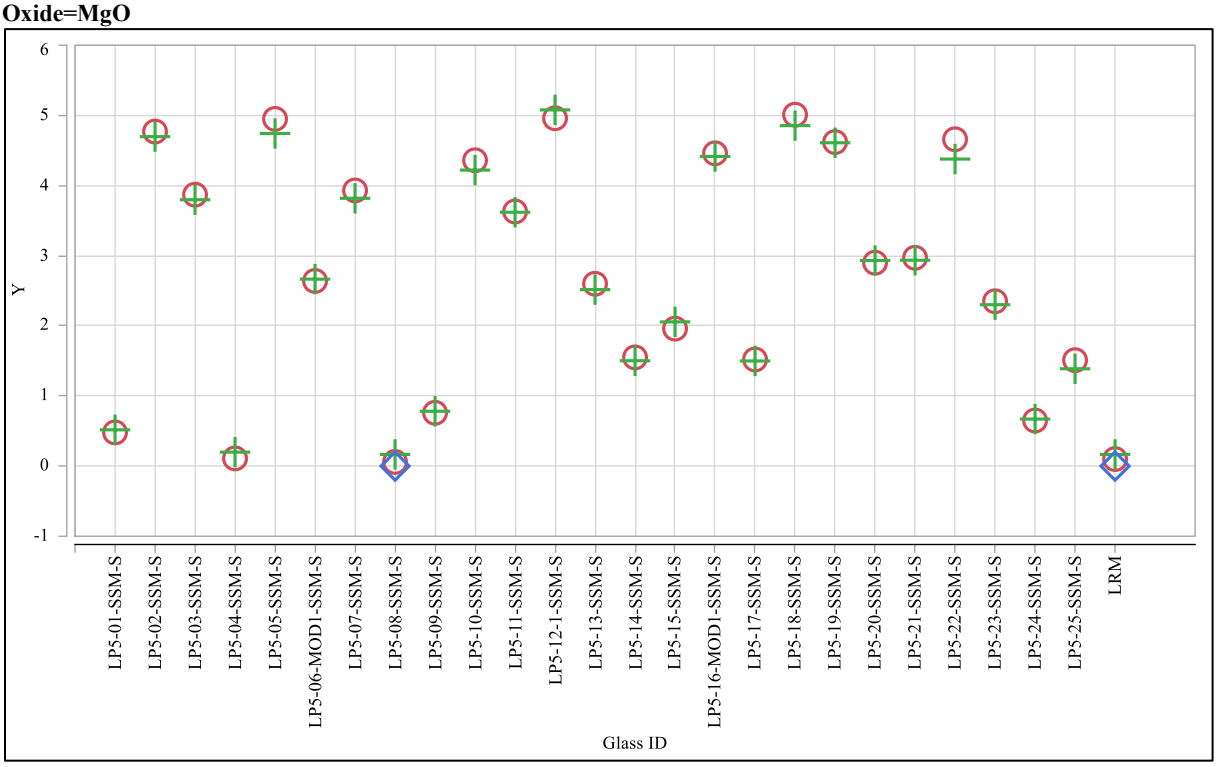


Exhibit A-3. Measured versus Target Concentrations by Glass ID by Oxide (continued)

Oxide=Li_2O



Oxide=MgO



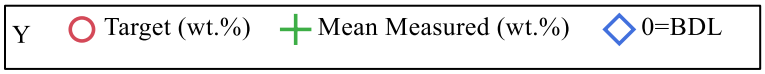
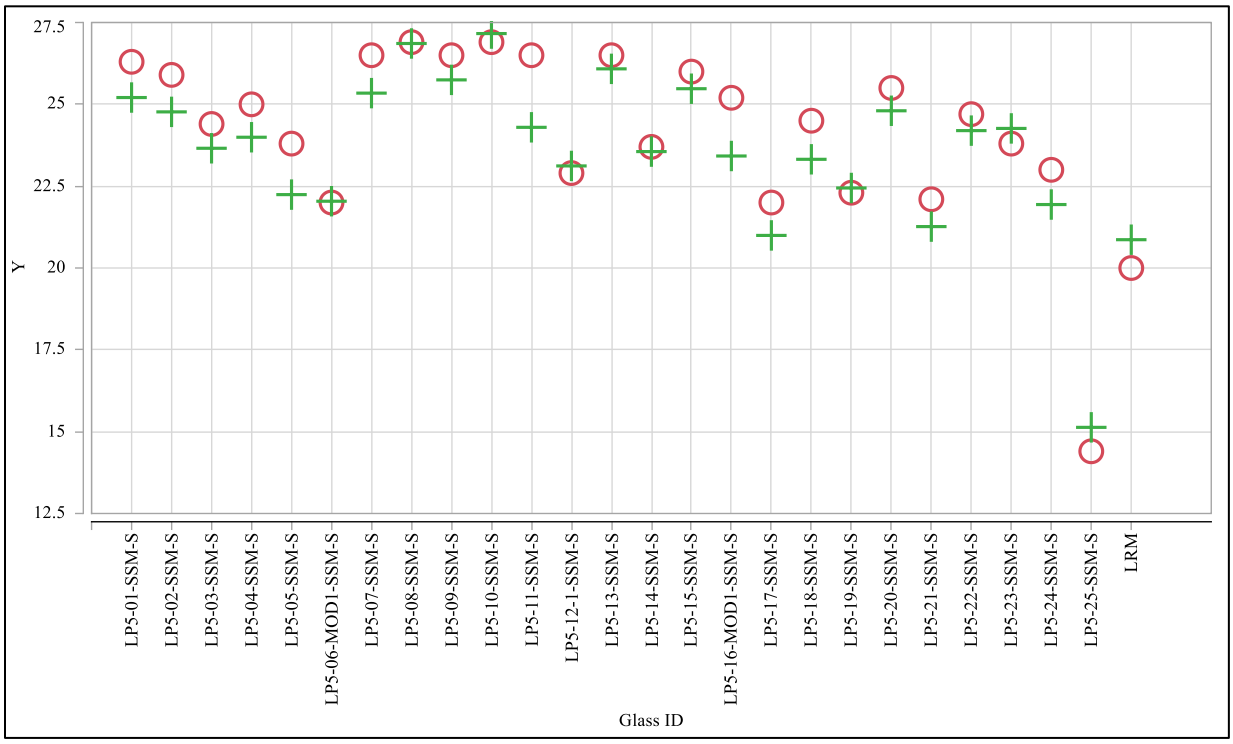
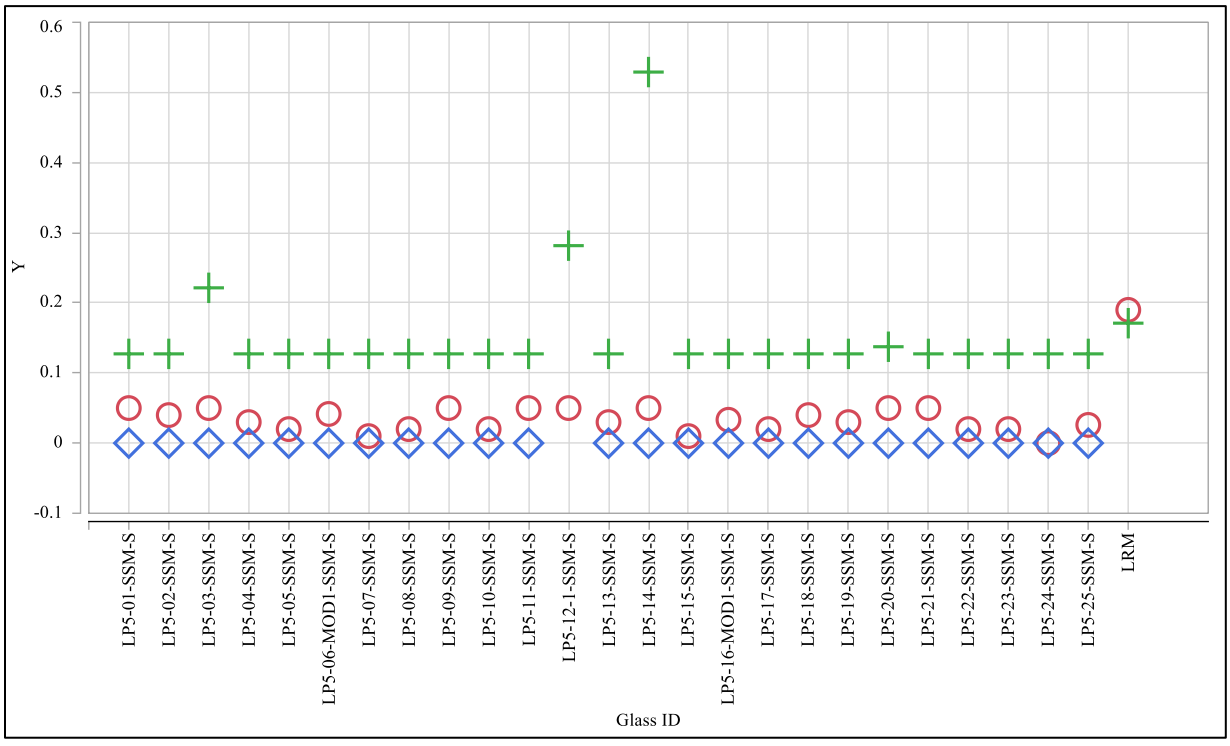


Exhibit A-3. Measured versus Target Concentrations by Glass ID by Oxide (continued)

Oxide=Na_2O



Oxide=NiO



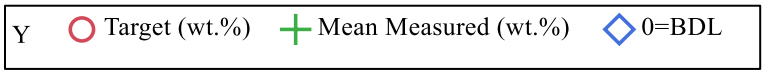
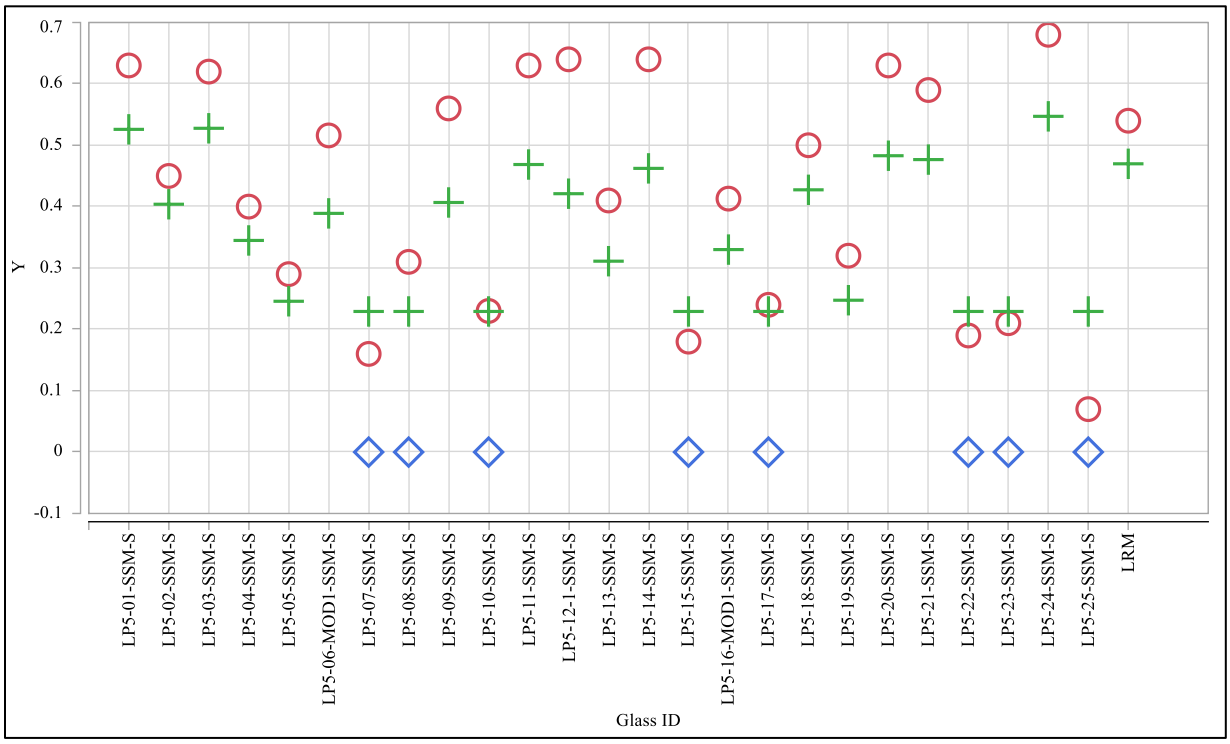
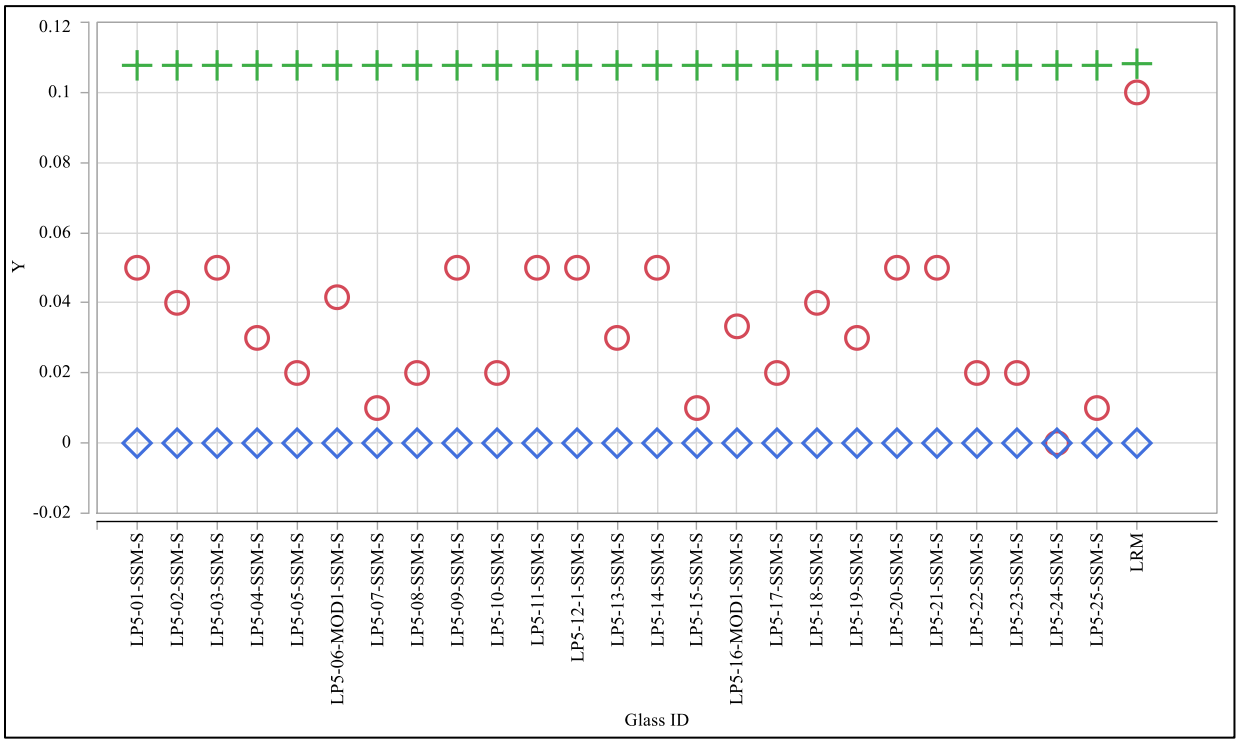


Exhibit A-3. Measured versus Target Concentrations by Glass ID by Oxide (continued)

Oxide=P_2O_5



Oxide=PbO



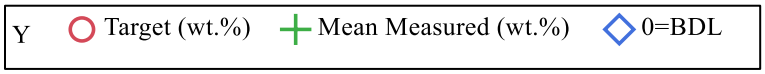
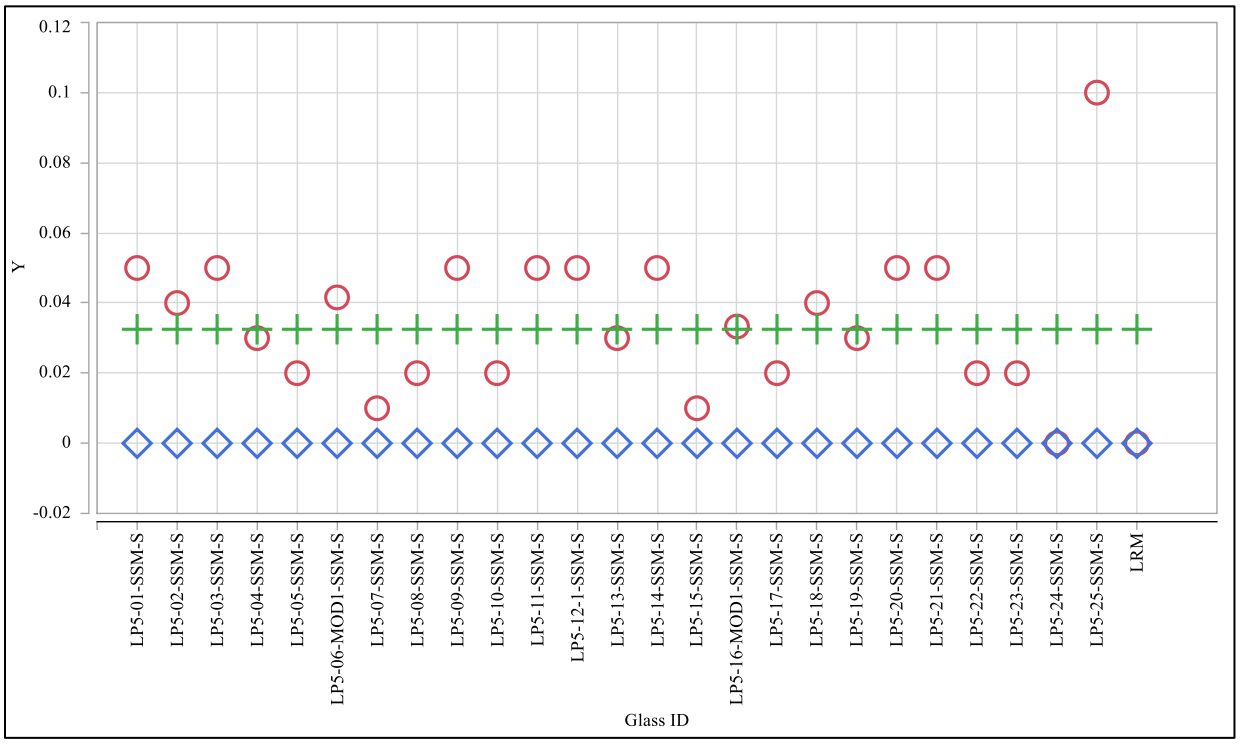
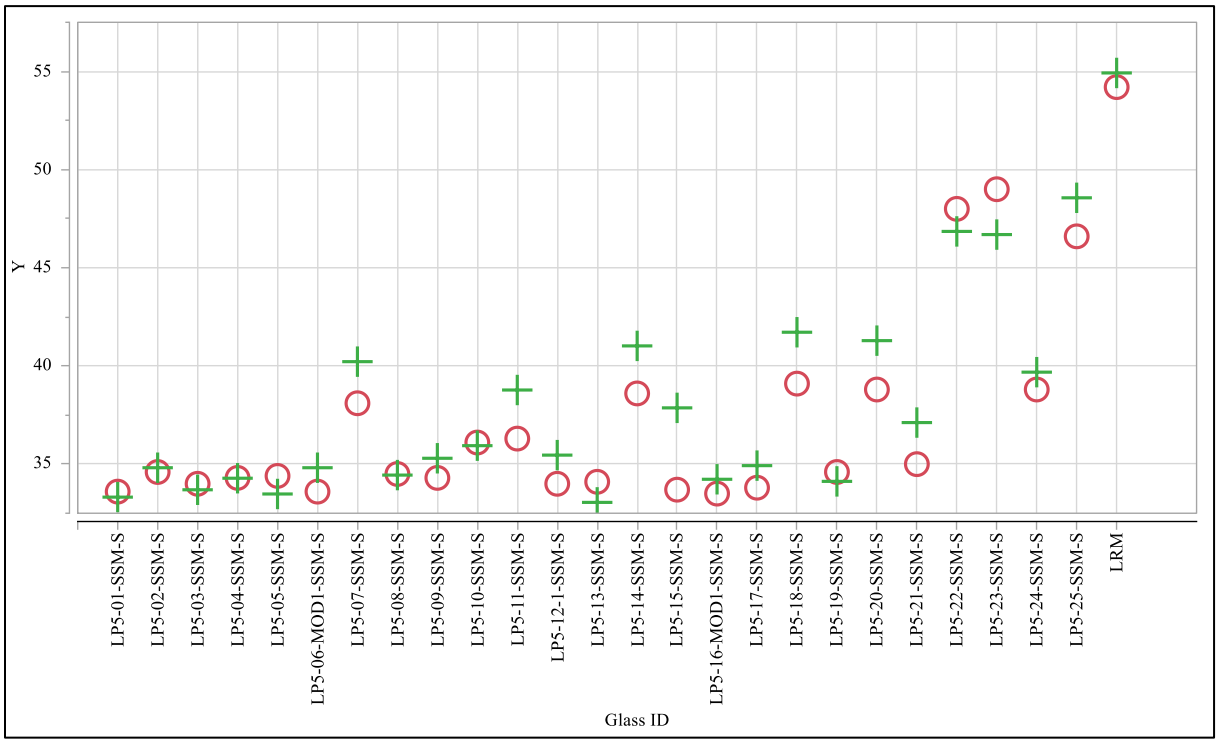


Exhibit A-3. Measured versus Target Concentrations by Glass ID by Oxide (continued)

Oxide=Re_2O_7



Oxide=SiO_2



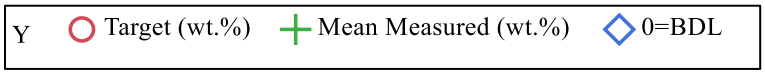
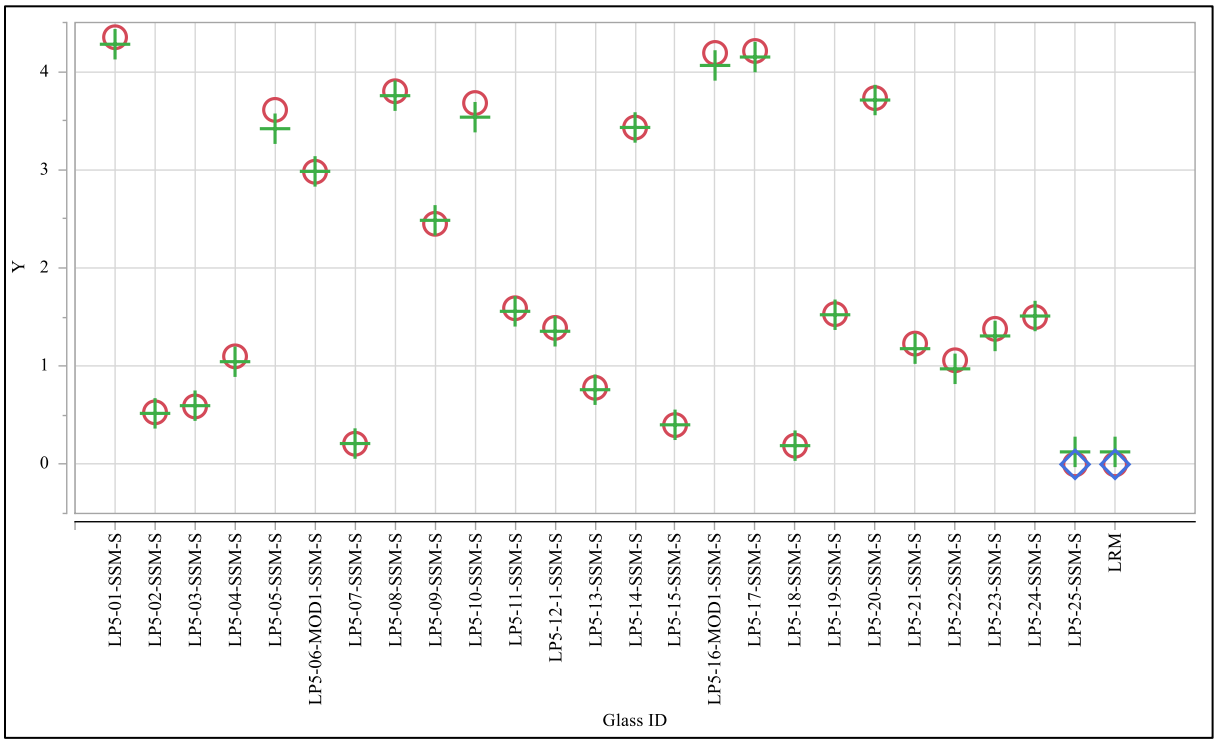
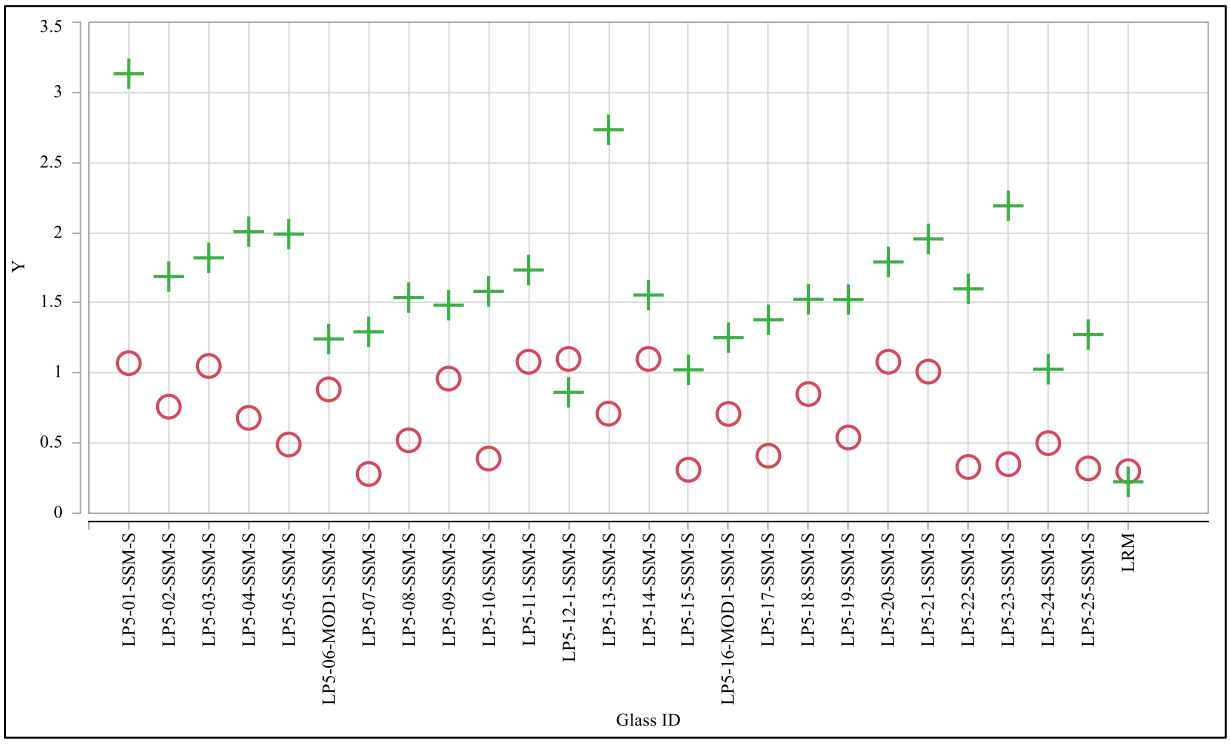


Exhibit A-3. Measured versus Target Concentrations by Glass ID by Oxide (continued)

Oxide=SnO_2



Oxide=SO_3



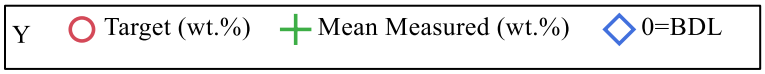
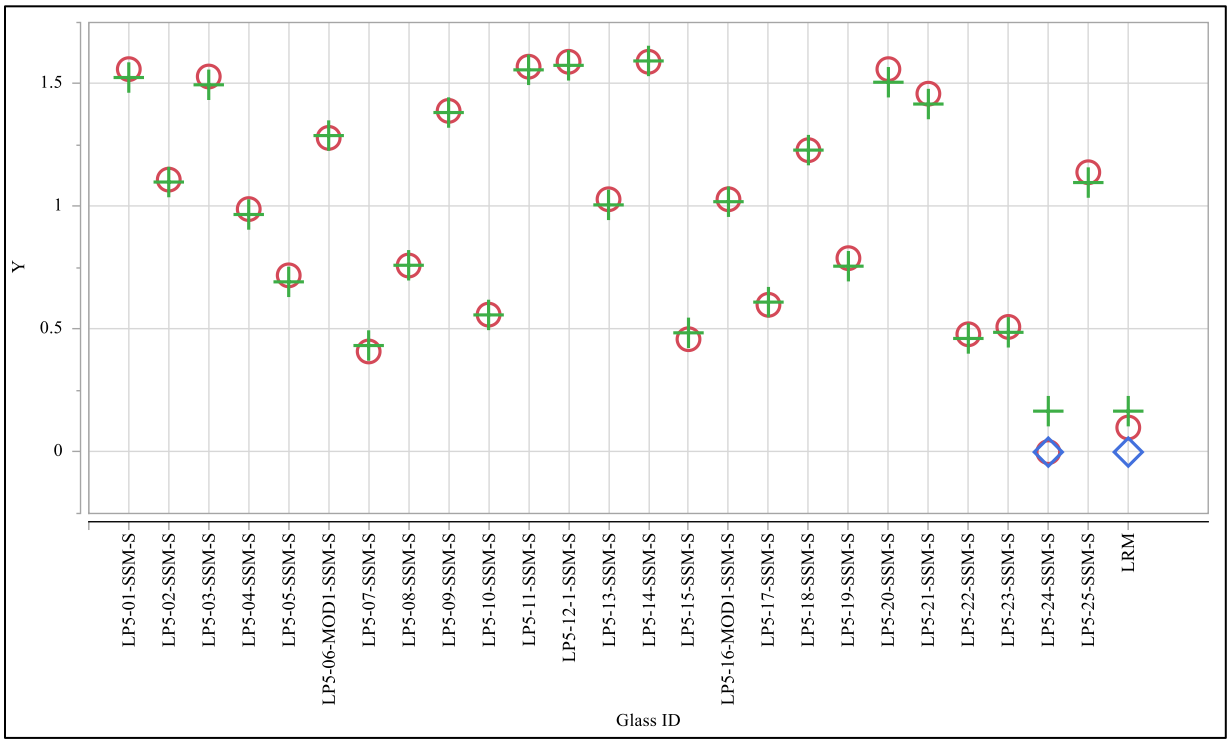
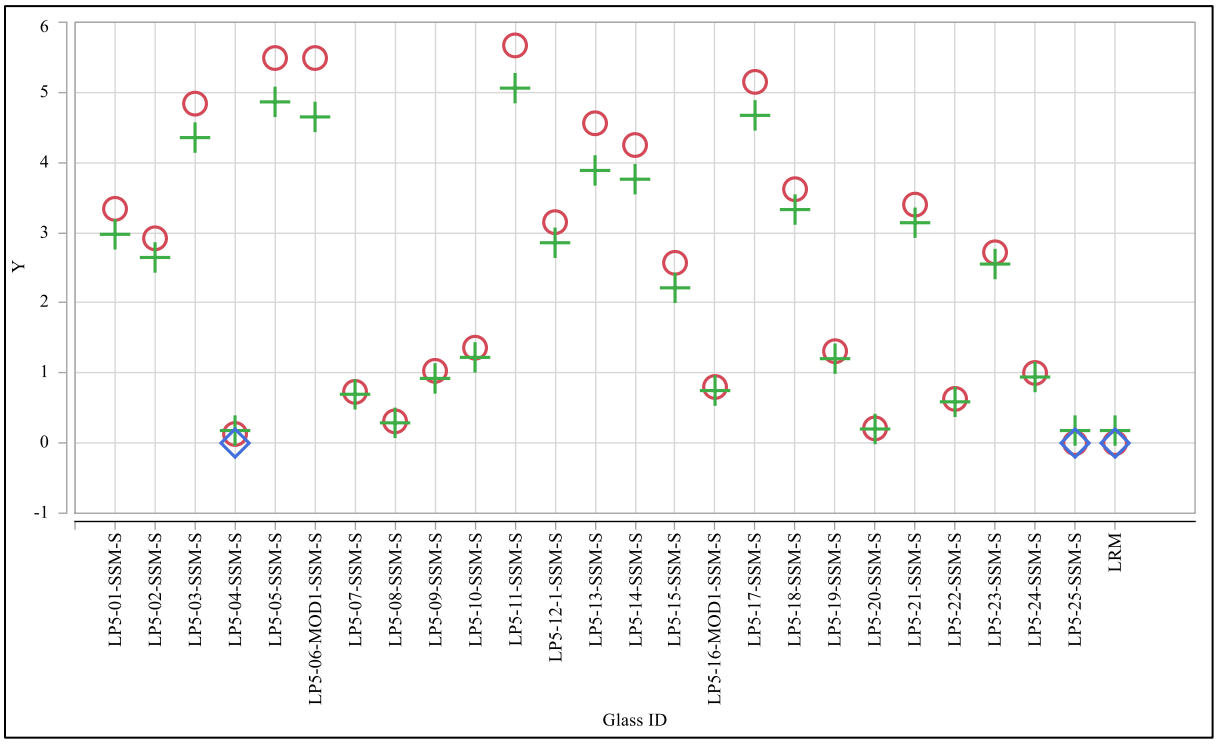


Exhibit A-3. Measured versus Target Concentrations by Glass ID by Oxide (continued)

Oxide=TiO_2



Oxide=V_2O_5



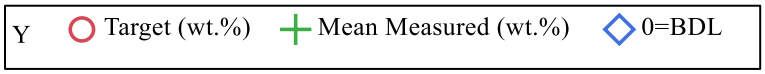
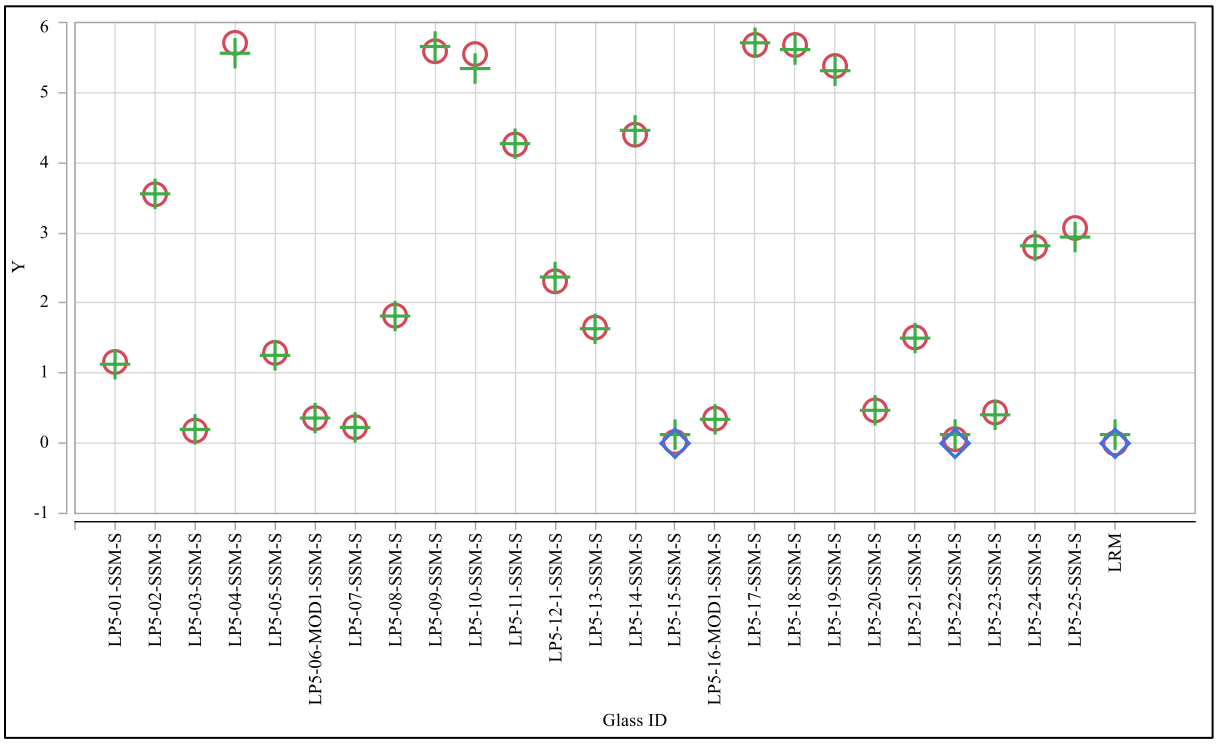
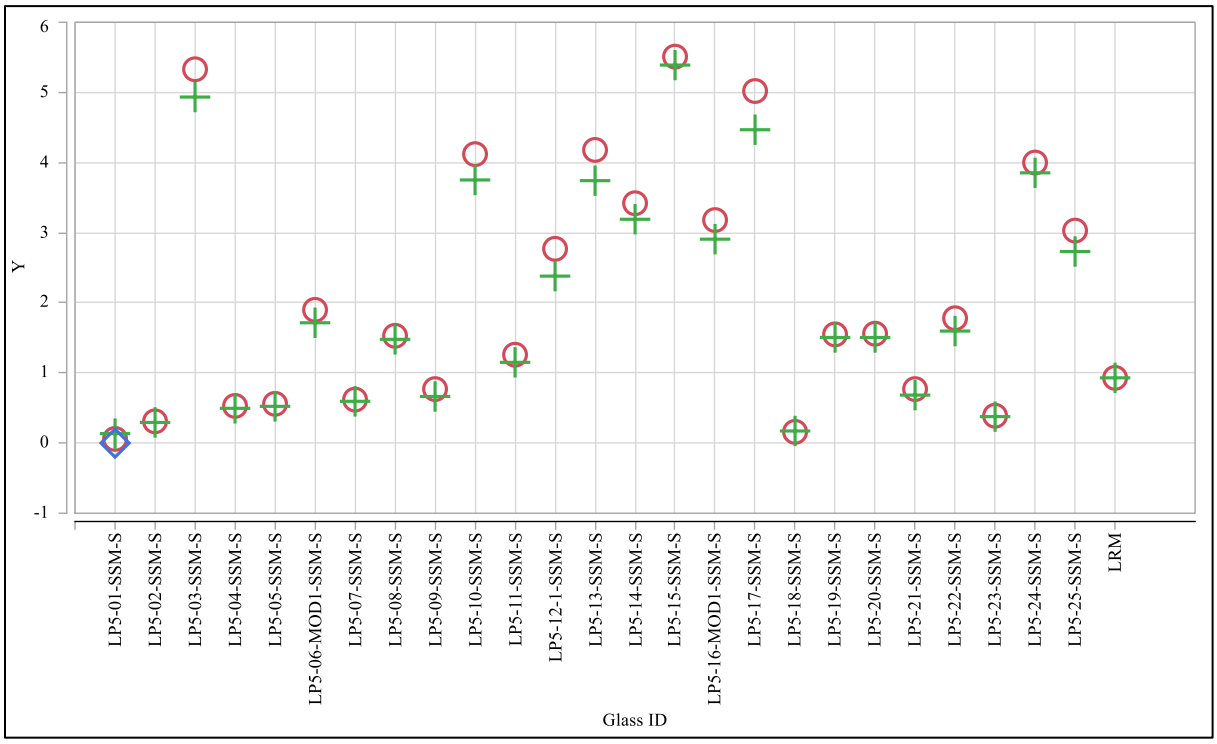


Exhibit A-3. Measured versus Target Concentrations by Glass ID by Oxide (continued)

Oxide=ZnO



Oxide=ZrO_2



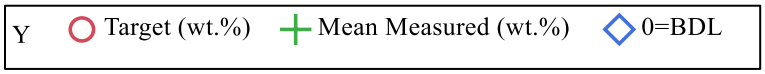


Exhibit A-3. Measured versus Target Concentrations by Glass ID by Oxide (continued)

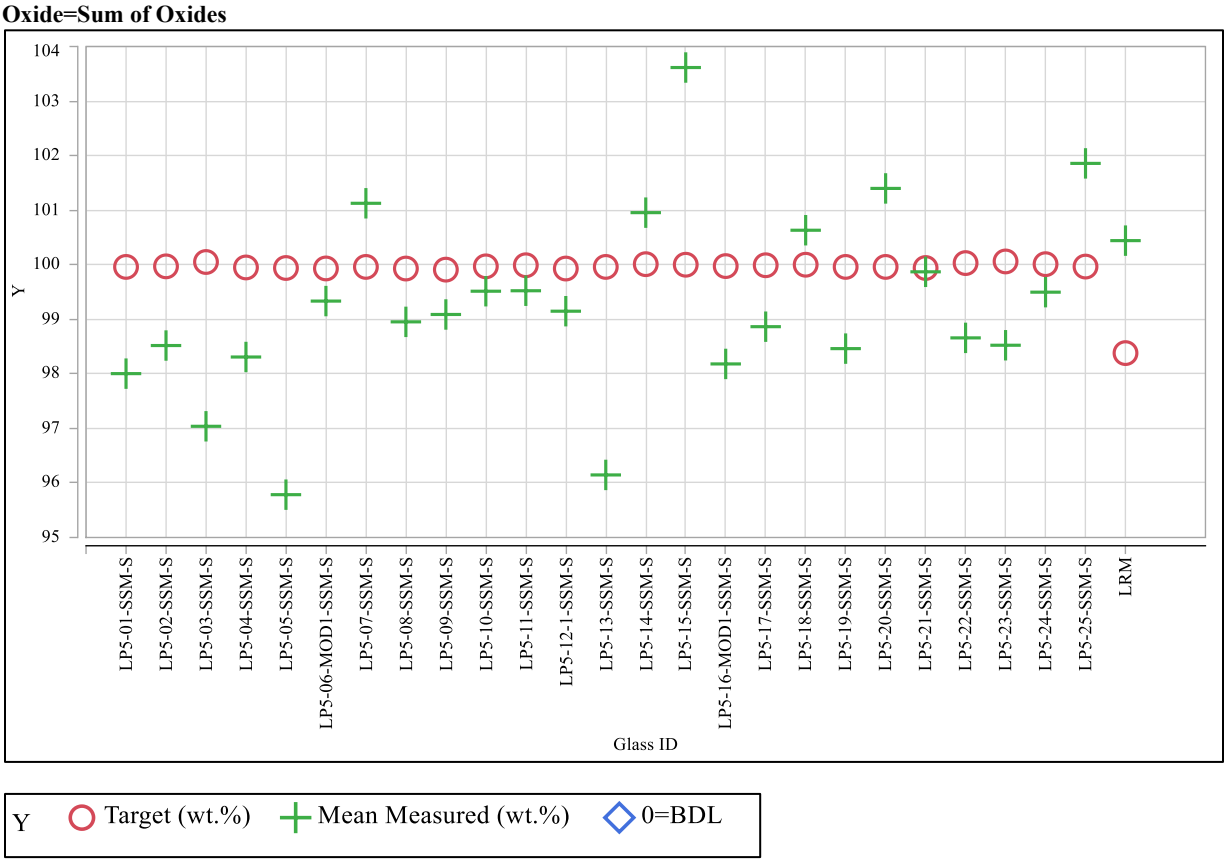
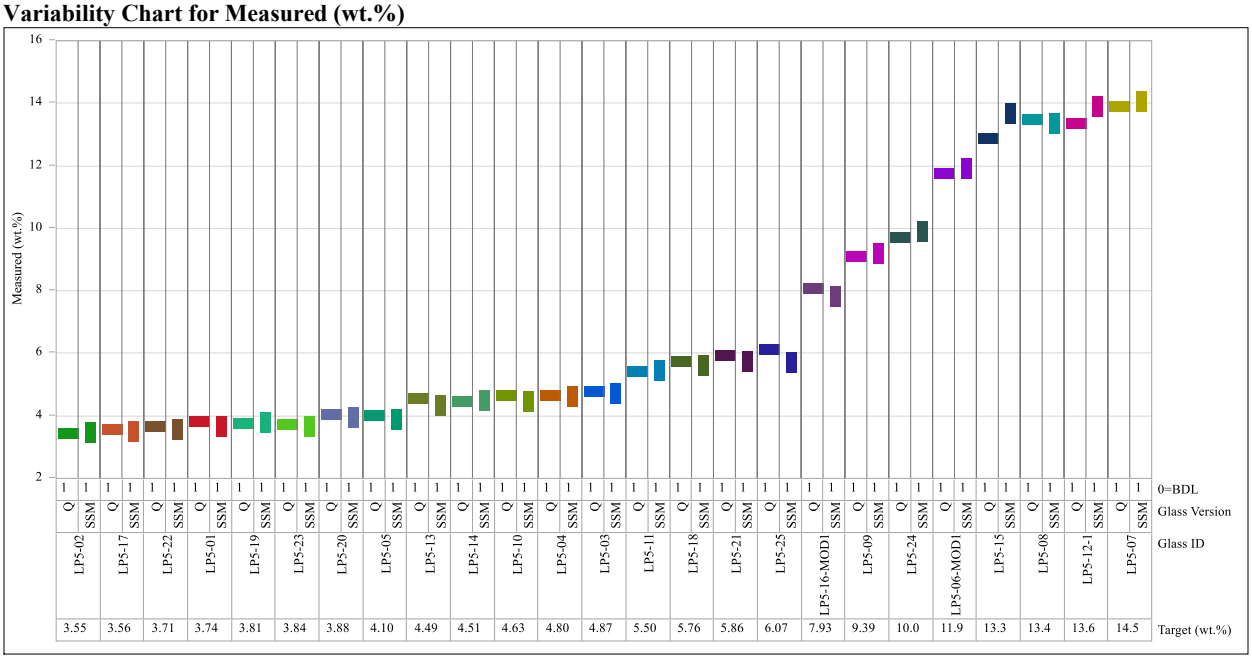


Exhibit A-4. Comparisons of the Measured Compositions of the Quenched and SSM Versions of the Study Glasses

Oxide=Al_2O_3
Variability Chart for Measured (wt.%)



Oxide=B_2O_3
Variability Chart for Measured (wt.%)

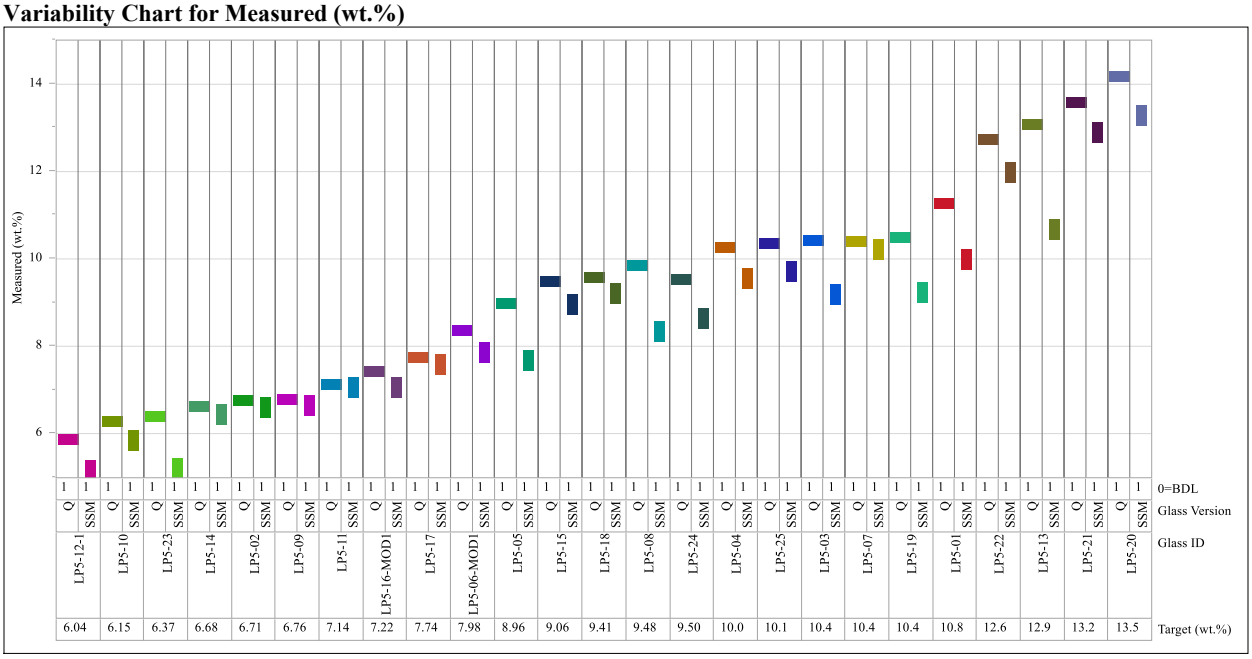
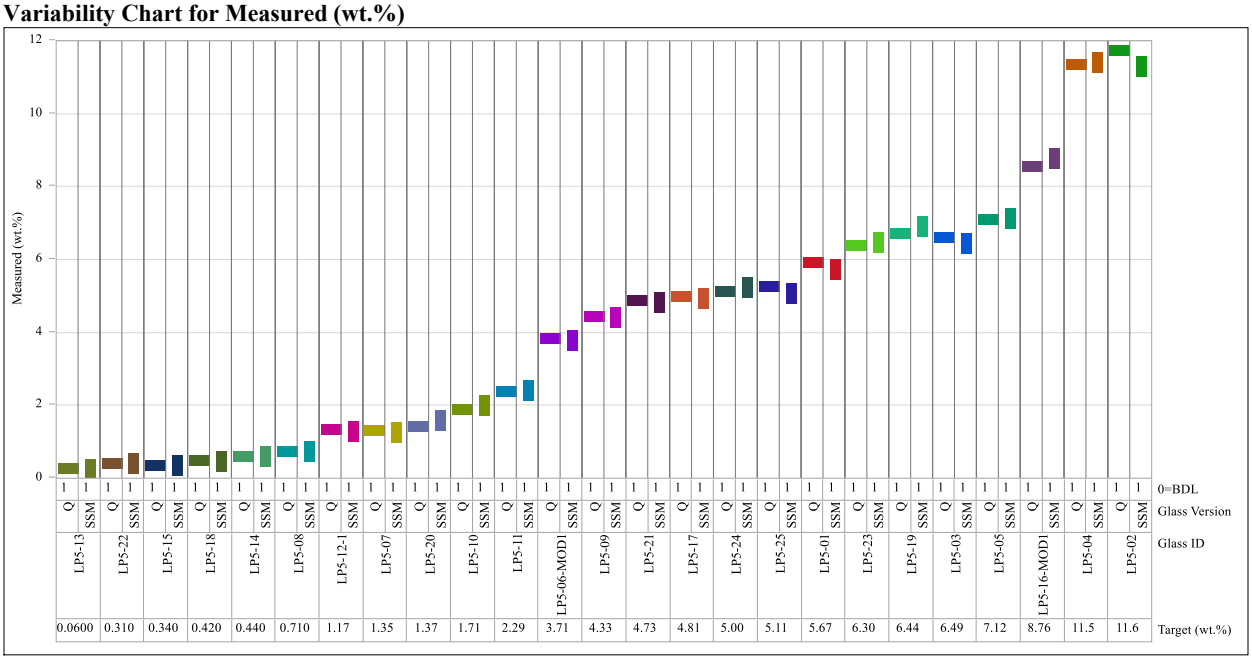


Exhibit A-4. Comparisons of the Measured Compositions of the Quenched and SSM Versions of the Study Glasses (continued)

Oxide=CaO
Variability Chart for Measured (wt.%)



Oxide=Cl^-
Variability Chart for Measured (wt.%)

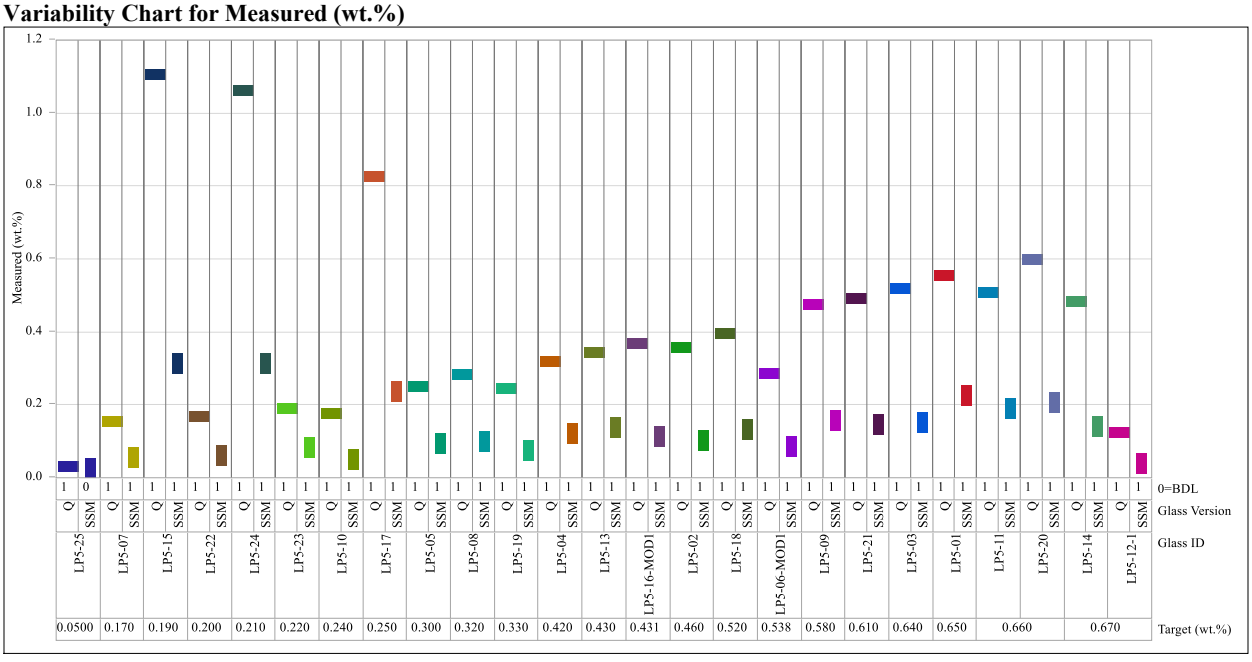
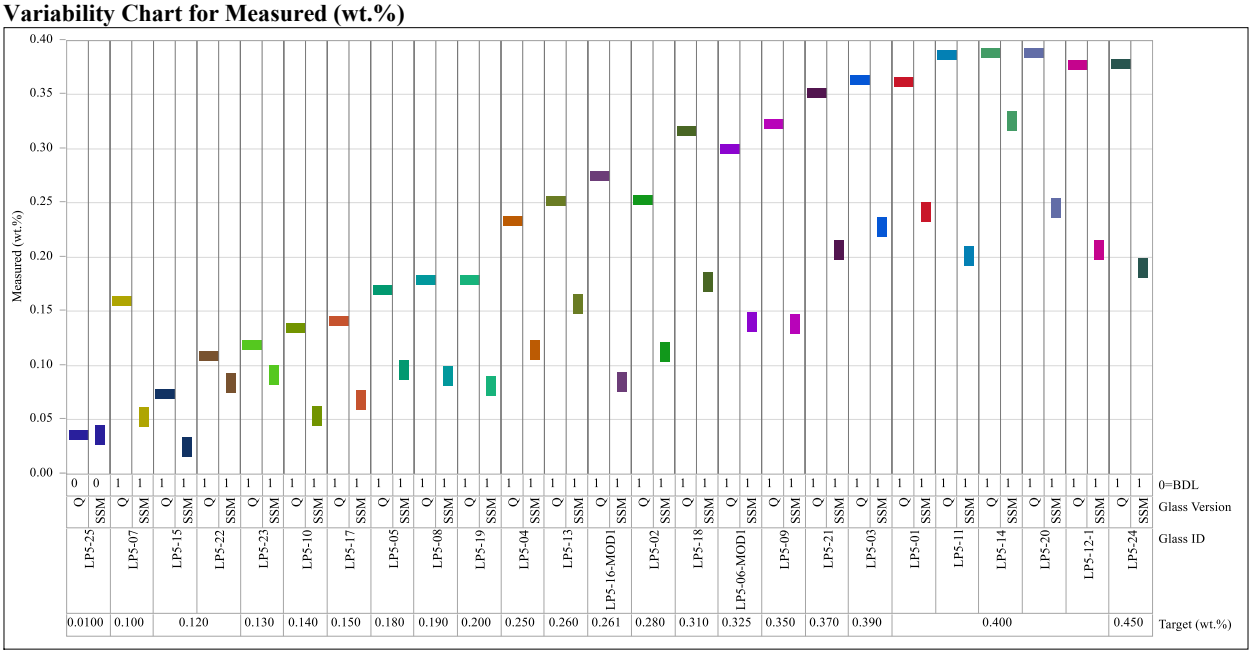


Exhibit A-4. Comparisons of the Measured Compositions of the Quenched and SSM Versions of the Study Glasses (continued)

Oxide=Cr_2O_3
Variability Chart for Measured (wt.%)



Oxide=F^-
Variability Chart for Measured (wt.%)

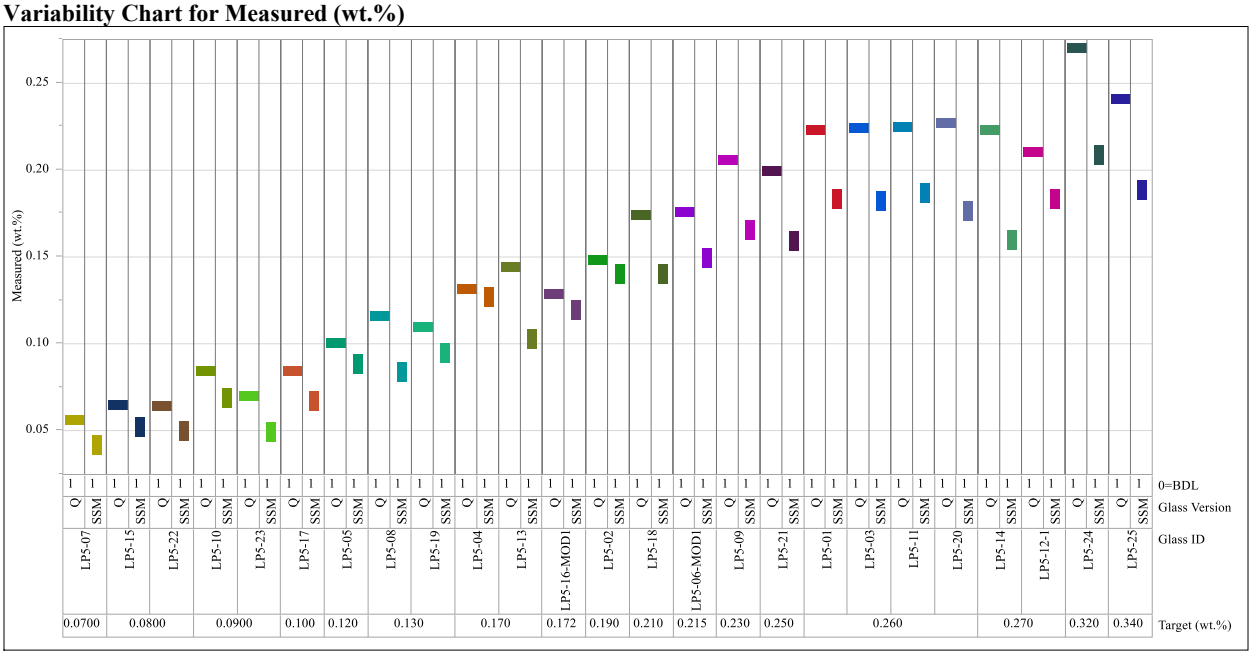
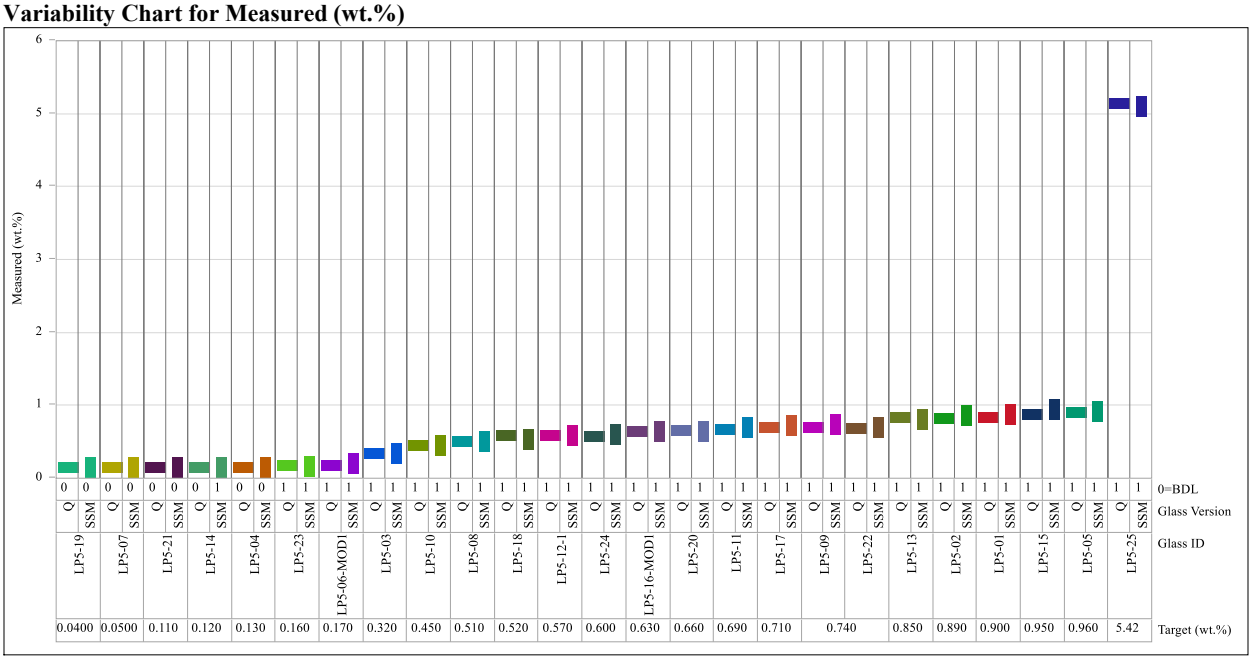


Exhibit A-4. Comparisons of the Measured Compositions of the Quenched and SSM Versions of the Study Glasses (continued)

Oxide=Fe_2O_3
Variability Chart for Measured (wt.%)



Oxide=K_2O
Variability Chart for Measured (wt.%)

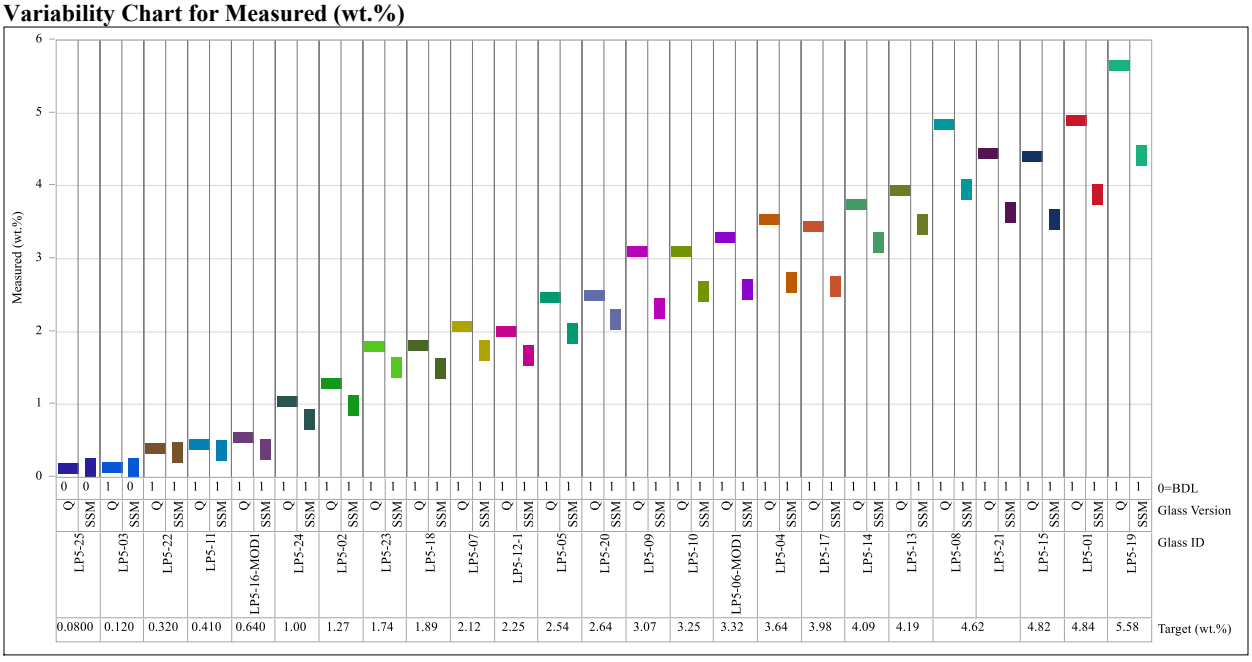
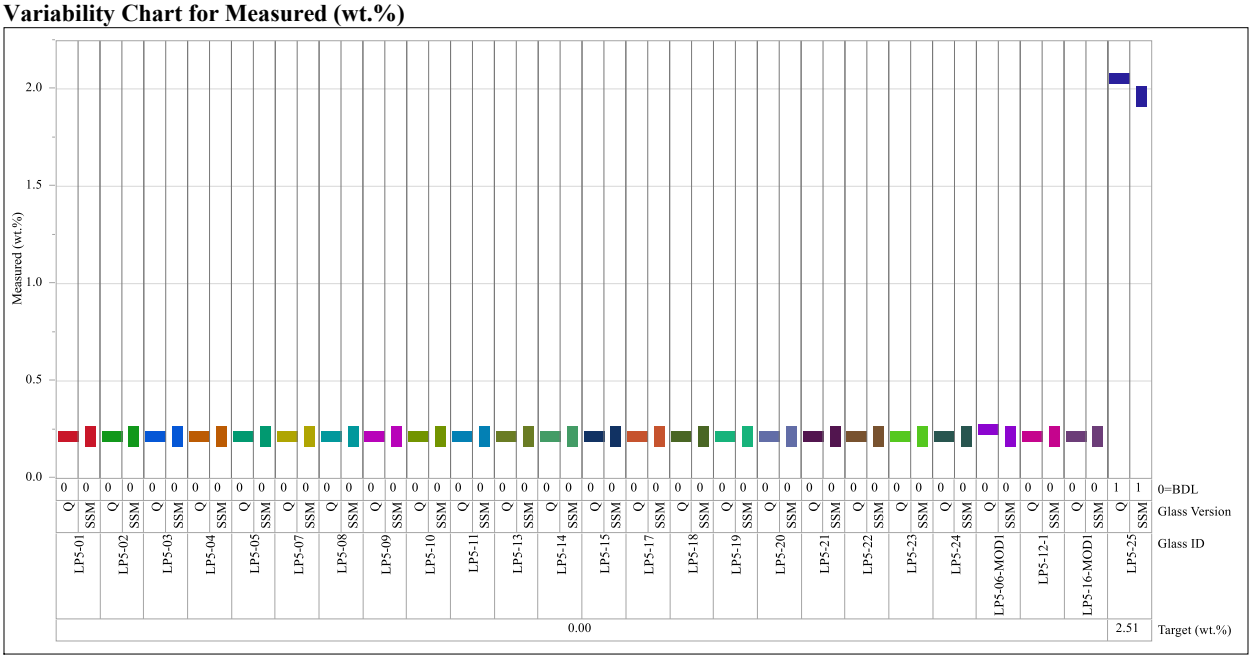


Exhibit A-4. Comparisons of the Measured Compositions of the Quenched and SSM Versions of the Study Glasses (continued)

Oxide=Li_2O
Variability Chart for Measured (wt.%)



Oxide=MgO
Variability Chart for Measured (wt.%)

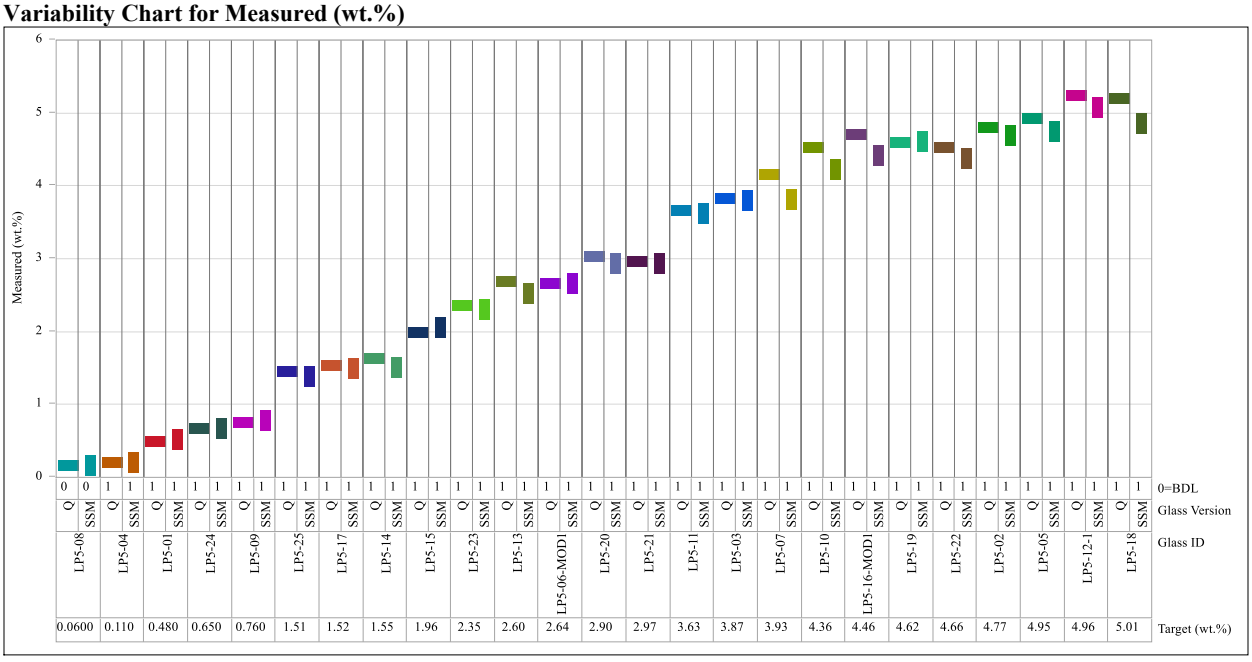
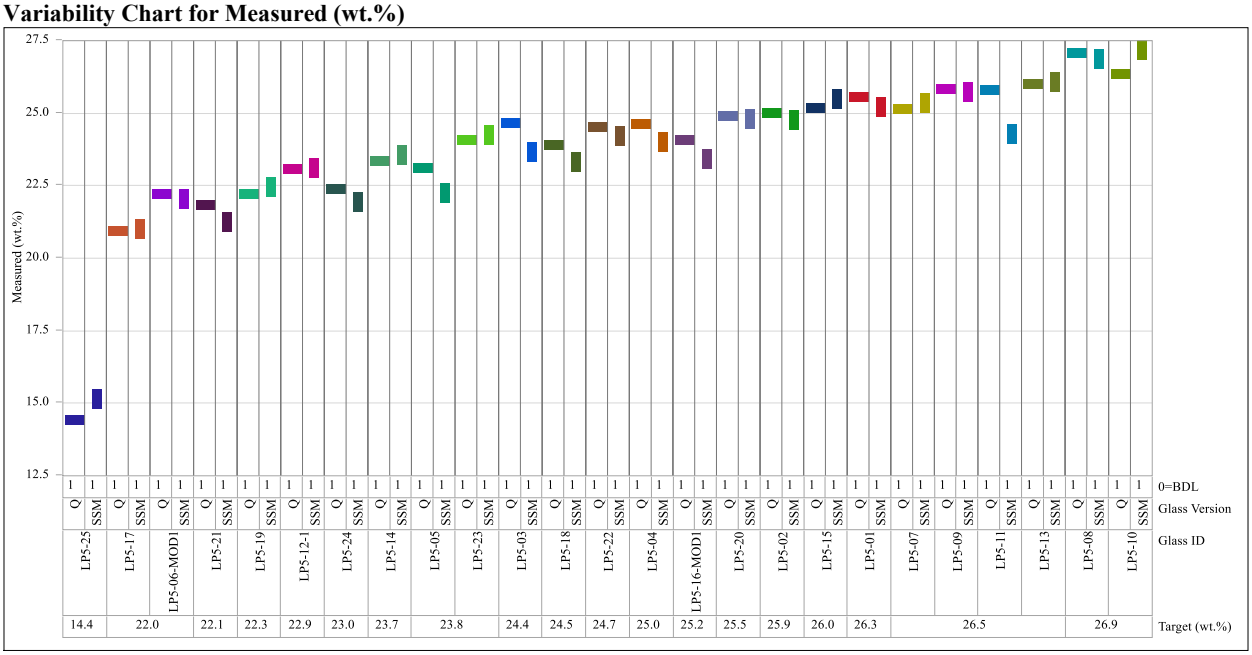


Exhibit A-4. Comparisons of the Measured Compositions of the Quenched and SSM Versions of the Study Glasses (continued)

Oxide=Na_2O
Variability Chart for Measured (wt.%)



Oxide=NiO
Variability Chart for Measured (wt.%)

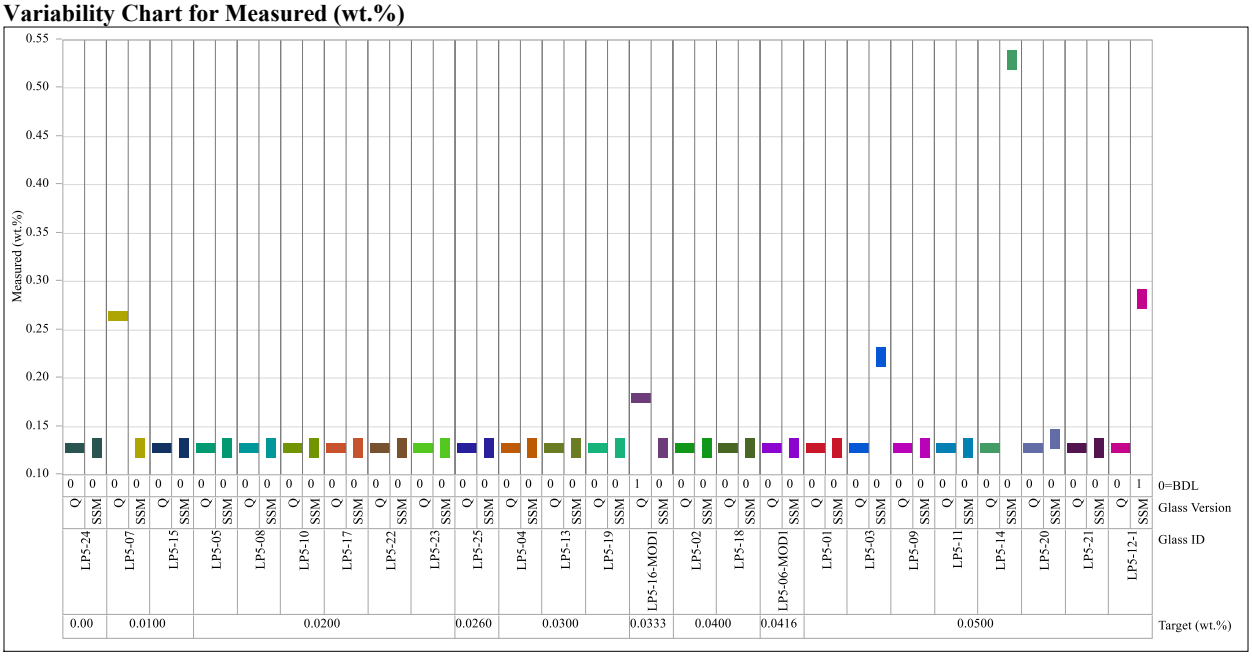
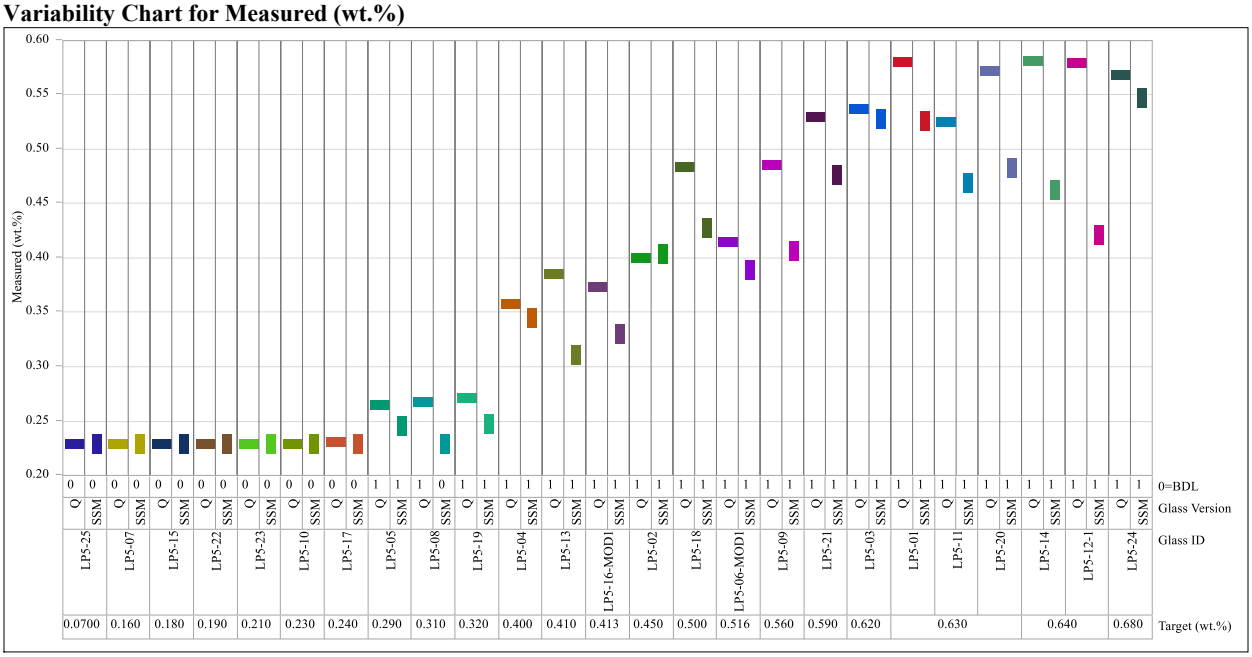


Exhibit A-4. Comparisons of the Measured Compositions of the Quenched and SSM Versions of the Study Glasses (continued)

Oxide=P_2O_5
Variability Chart for Measured (wt.%)



Oxide=PbO
Variability Chart for Measured (wt.%)

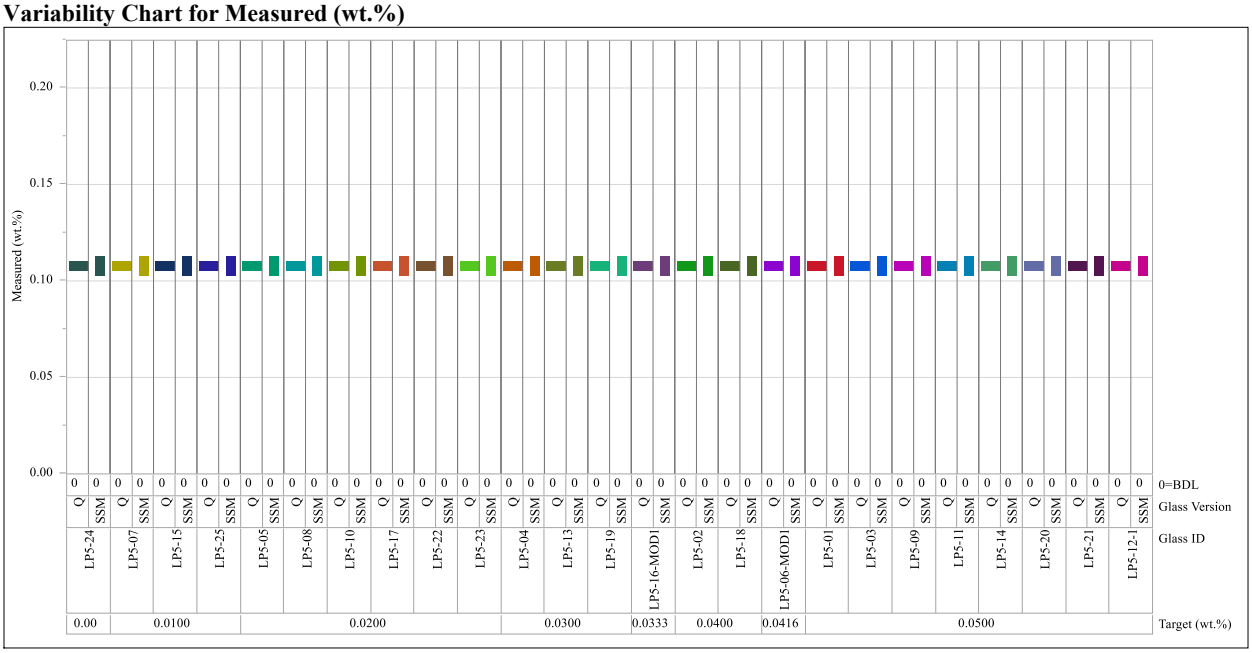
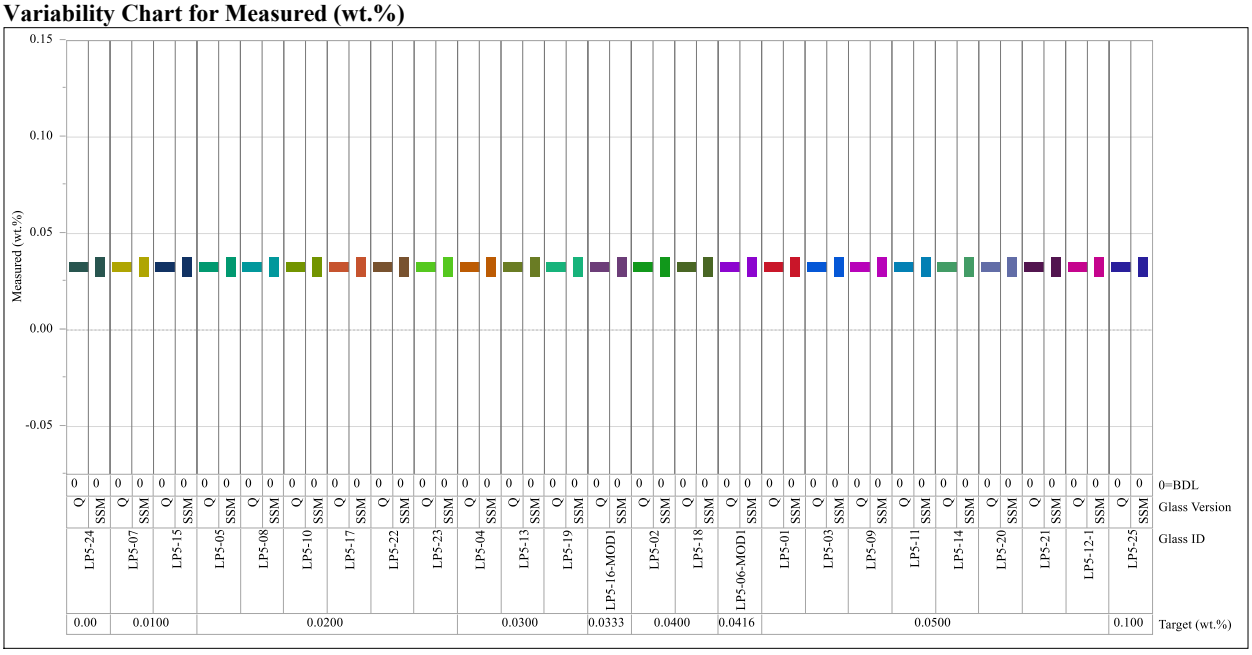


Exhibit A-4. Comparisons of the Measured Compositions of the Quenched and SSM Versions of the Study Glasses (continued)

Oxide=Re_2O_7
Variability Chart for Measured (wt.%)



Oxide=SiO_2
Variability Chart for Measured (wt.%)

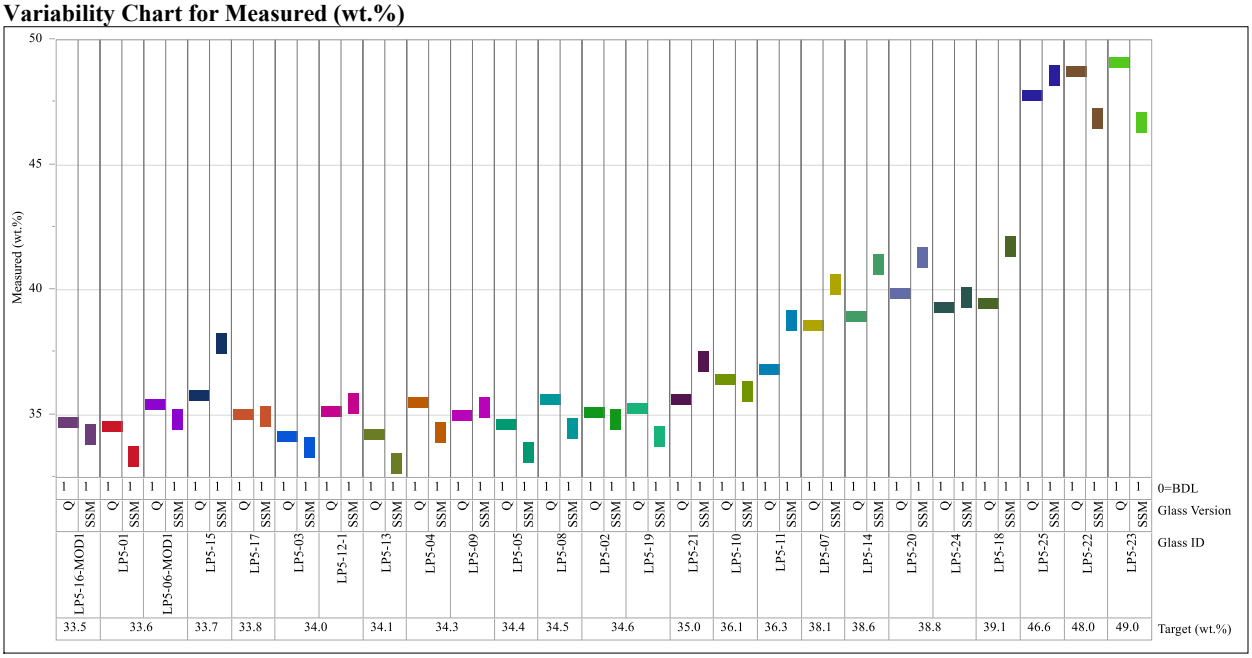
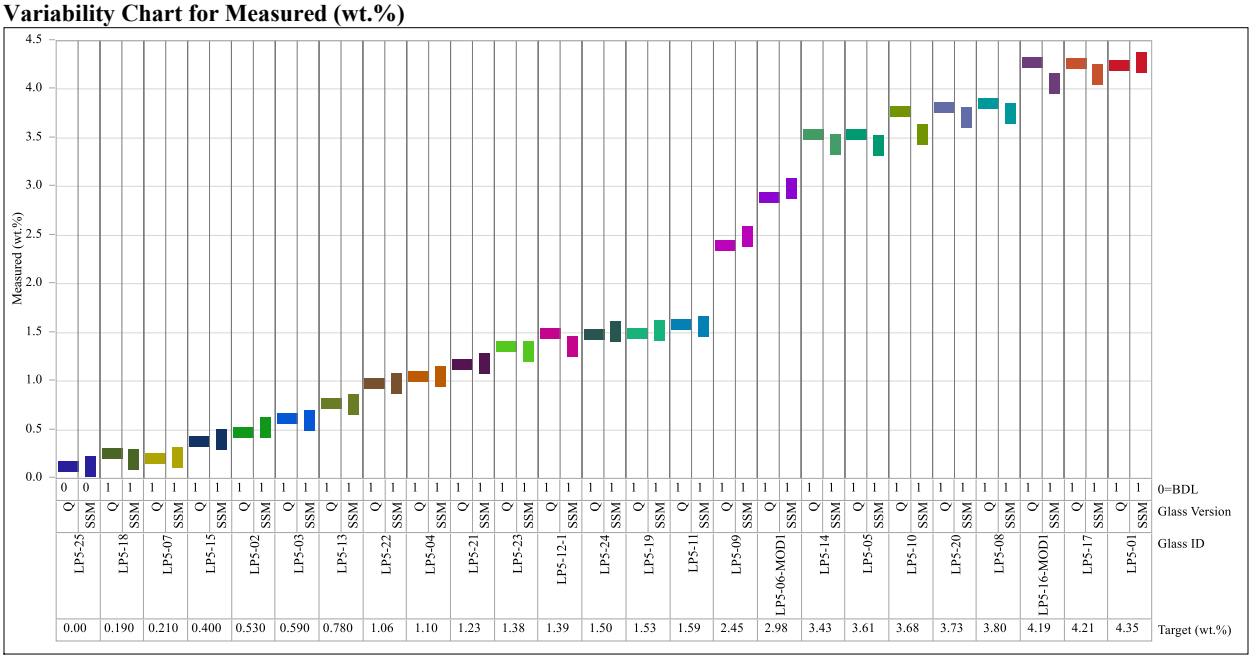


Exhibit A-4. Comparisons of the Measured Compositions of the Quenched and SSM Versions of the Study Glasses (continued)

Oxide=SnO_2
Variability Chart for Measured (wt.%)



Oxide=SO_3
Variability Chart for Measured (wt.%)

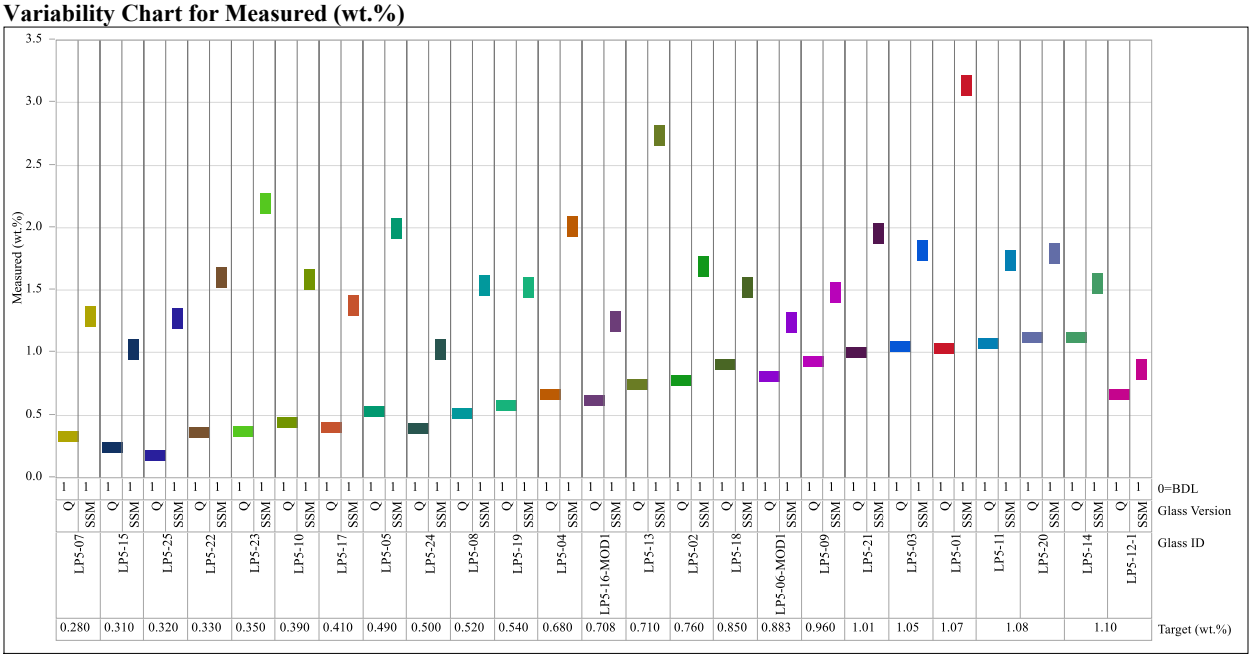
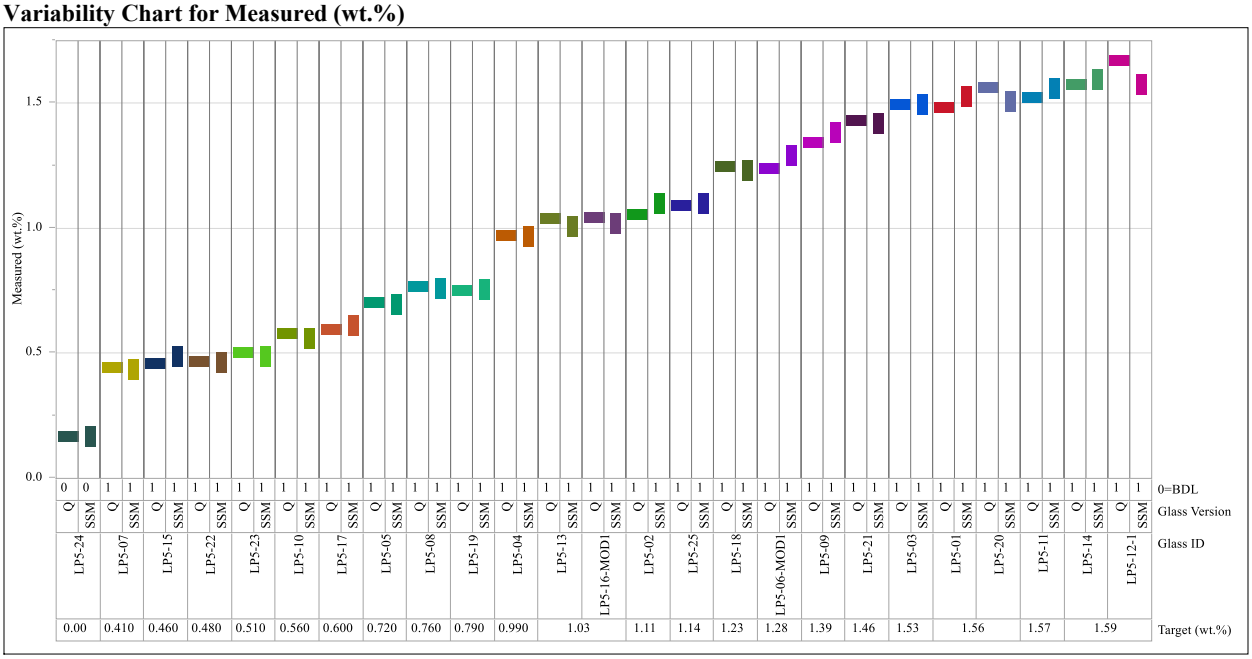


Exhibit A-4. Comparisons of the Measured Compositions of the Quenched and SSM Versions of the Study Glasses (continued)

Oxide=TiO_2
Variability Chart for Measured (wt.%)



Oxide=V_2O_5
Variability Chart for Measured (wt.%)

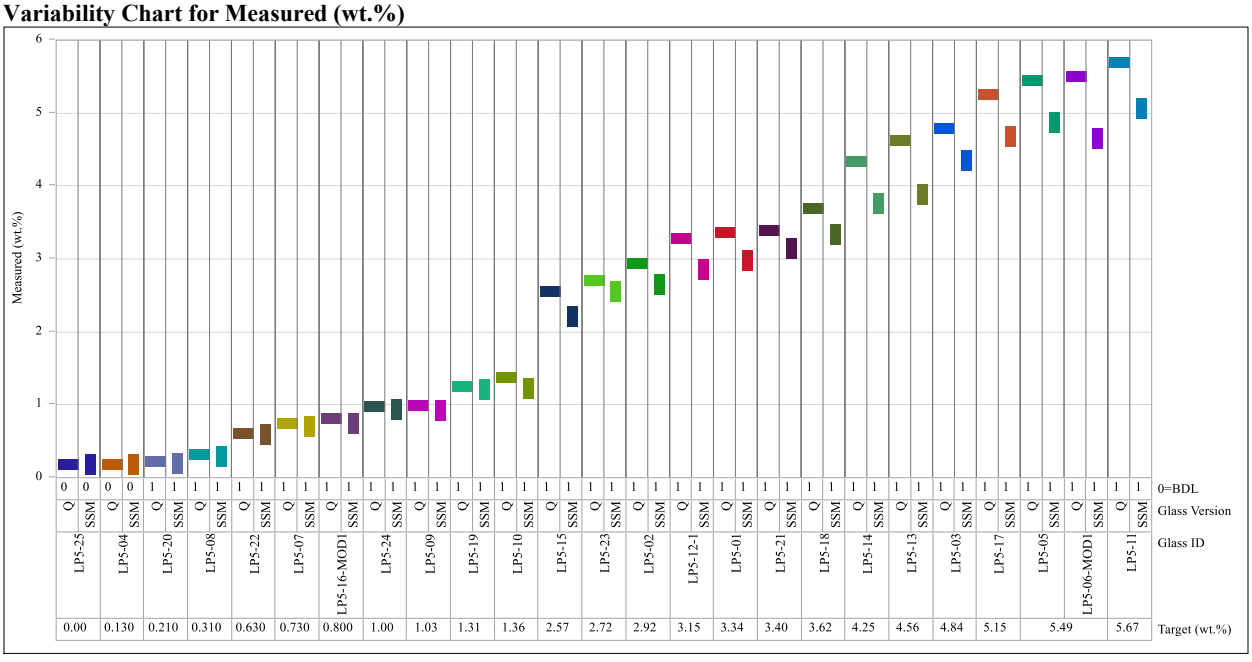
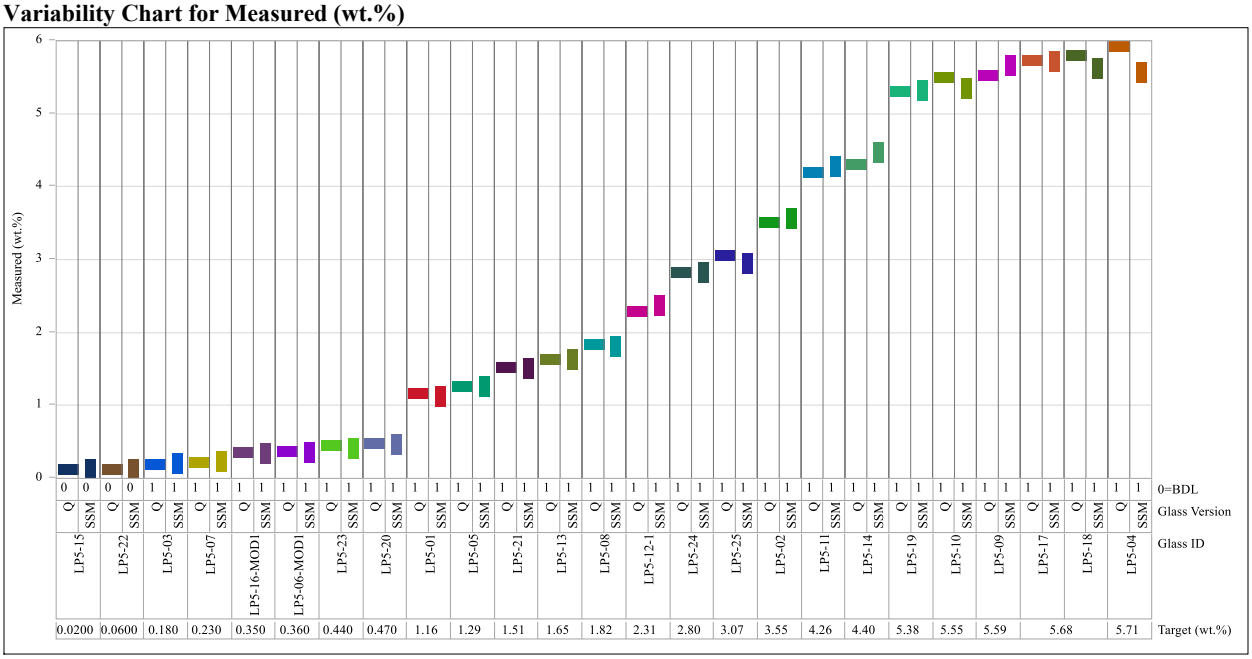


Exhibit A-4. Comparisons of the Measured Compositions of the Quenched and SSM Versions of the Study Glasses (continued)

Oxide=ZnO
Variability Chart for Measured (wt.%)



Oxide=ZrO_2
Variability Chart for Measured (wt.%)

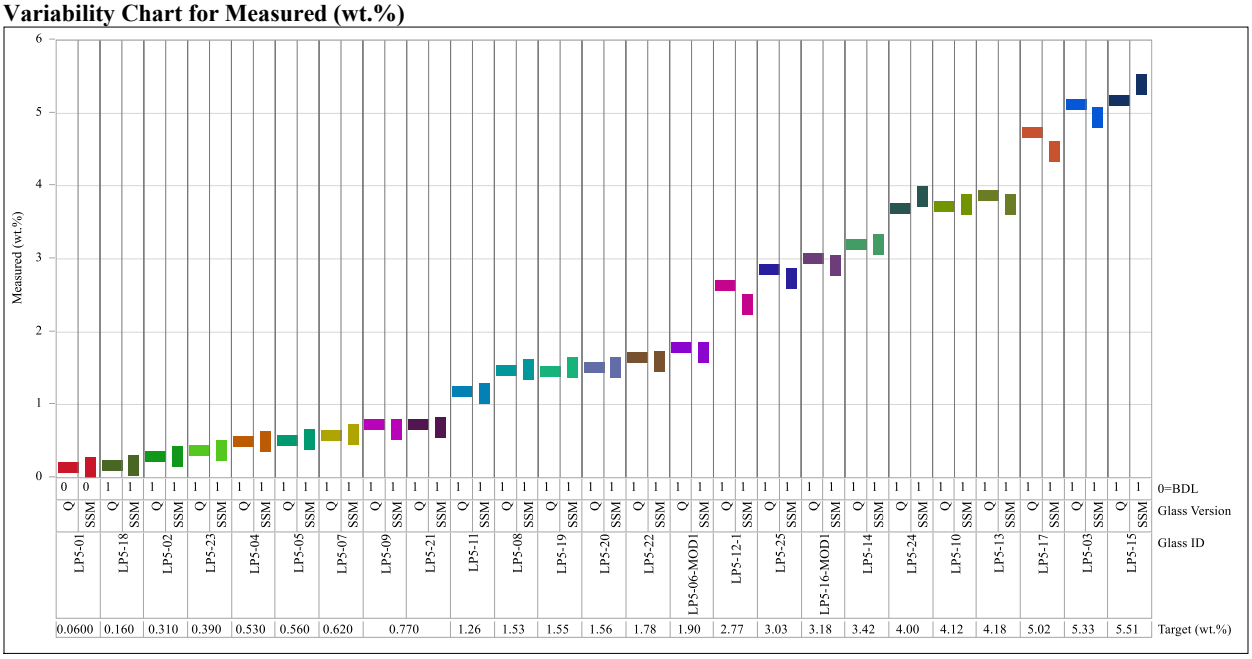
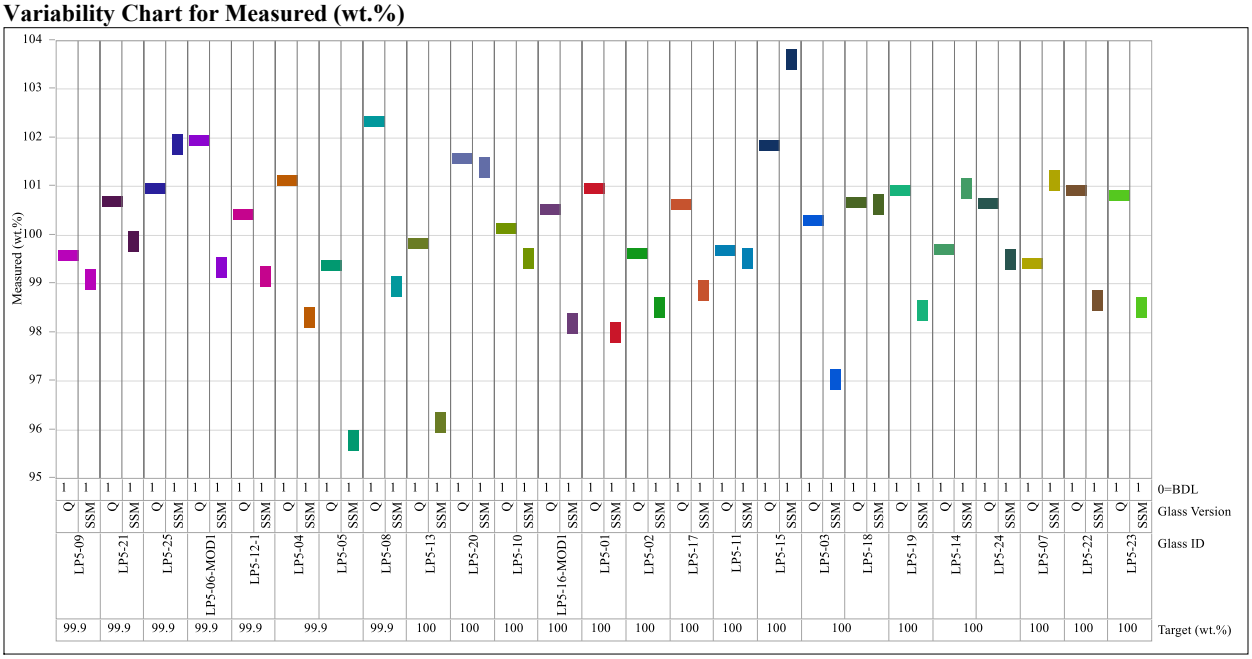


Exhibit A-4. Comparisons of the Measured Compositions of the Quenched and SSM Versions of the Study Glasses (continued)

Oxide=Sum of Oxides
Variability Chart for Measured (wt.%)



Appendix B. Tables and Exhibits Supporting the Wash Solution Composition Measurements

Table B-1. Measurements (mg/L) of the LP5 SSM Wash Solutions Measured by ICP-OES

PNNL ID	Block	Seq.	Lab ID	Al	B	Ca	Cr	Fe	K	Li	Mg	Na	Ni	P	Pb	Re	S	Si	Sn	Ti	V	Zn	Zr
std	1	1	soln std-11	4.00	19.5	<1.00	<1.00	4.16	10.7	9.38	<1.00	81.7	<1.00	<1.00	<1.00	<1.00	<1.00	49.8	<1.00	<1.00	<1.00	<1.00	<1.00
LP5-06-MOD1-SSM-W	1	2	S-12374-1	<1.00	29.6	9.09	56.4	<1.00	85.1	<1.00	3.06	1280	<1.00	10.1	<1.00	<1.00	731	13.1	<1.00	<1.00	215	<1.00	<1.00
LP5-21-SSM-W	1	3	S-12389-1	<1.00	35.5	5.92	41.3	<1.00	77.9	<1.00	2.18	759	<1.00	6.45	<1.00	<1.00	482	17.1	<1.00	<1.00	44.1	<1.00	<1.00
LP5-19-SSM-W	1	4	S-12387-1	<1.00	31.9	5.42	34.7	<1.00	157	<1.00	2.01	772	<1.00	3.33	<1.00	<1.00	593	15.4	<1.00	<1.00	16.5	<1.00	<1.00
LP5-16-MOD1-SSM-W	1	5	S-12384-1	1.13	17.0	4.30	46.4	<1.00	18.3	<1.00	1.54	1130	<1.00	5.71	<1.00	<1.00	704	10.1	<1.00	<1.00	13.3	<1.00	<1.00
LP5-04-SSM-W	1	6	S-12372-1	<1.00	32.4	1.74	39.4	<1.00	93.3	<1.00	<1.00	759	<1.00	<1.00	<1.00	<1.00	507	24.5	<1.00	<1.00	1.40	<1.00	<1.00
LP5-20-SSM-W	1	7	S-12388-1	<1.00	48.3	1.28	45.5	<1.00	57.7	<1.00	1.21	831	<1.00	11.7	<1.00	<1.00	506	19.5	<1.00	<1.00	2.33	<1.00	<1.00
LP5-13-SSM-W	1	8	S-12381-1	<1.00	90.3	<1.00	24.0	<1.00	53.1	<1.00	<1.00	891	<1.00	8.97	<1.00	<1.00	351	45.7	<1.00	<1.00	106	<1.00	<1.00
hp std	1	9	hpstd-11	50.8	<1.00	<1.00	<1.00	50.8	<1.00	<1.00	<1.00	144	10.1	<1.00	<1.00	<1.00	9.57	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
LP5-SSM-W-2	1	10	S-12395-1	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	63.4	<1.00	<1.00	<1.00	<1.00	37.5	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
LP5-10-SSM-W	1	11	S-12378-1	<1.00	18.4	<1.00	25.4	<1.00	79.1	<1.00	<1.00	914	<1.00	5.54	<1.00	<1.00	521	17.6	1.06	<1.00	25.9	<1.00	<1.00
LP5-18-SSM-W	1	12	S-12386-1	<1.00	26.7	<1.00	43.8	<1.00	41.6	<1.00	3.22	1080	<1.00	9.24	<1.00	<1.00	605	13.4	<1.00	<1.00	61.1	<1.00	<1.00
LP5-SSM-W-1	1	13	S-12394-1	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	613	<1.00	<1.00	<1.00	<1.00	417	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
LP5-15-SSM-W	1	14	S-12383-1	<1.00	36.4	<1.00	15.3	<1.00	87.7	<1.00	1.00	778	<1.00	7.05	<1.00	<1.00	405	10.4	<1.00	<1.00	90.9	<1.00	<1.00
LP5-12-1-SSM-W	1	15	S-12380-1	1.11	14.5	2.92	72.3	<1.00	56.9	<1.00	3.97	1230	<1.00	15.8	<1.00	<1.00	633	5.57	<1.00	<1.00	101	<1.00	<1.00
LP5-14-SSM-W	1	16	S-12382-1	<1.00	25.3	<1.00	55.8	<1.00	84.5	<1.00	<1.00	919	<1.00	20.6	<1.00	<1.00	519	18.5	<1.00	<1.00	101	<1.00	<1.00
Blank	1	17	Blank-1	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
std	1	18	soln std-12	4.16	19.9	<1.00	<1.00	4.18	10.5	9.74	<1.00	82.6	<1.00	<1.00	<1.00	<1.00	<1.00	50.6	<1.00	<1.00	<1.00	<1.00	<1.00
LP5-24-SSM-W	1	19	S-12392-1	<1.00	22.1	4.36	59.6	<1.00	22.3	<1.00	<1.00	934	<1.00	9.26	<1.00	<1.00	520	5.60	<1.00	<1.00	13.4	<1.00	<1.00
LP5-11-SSM-W	1	20	S-12379-1	<1.00	26.7	2.72	59.9	<1.00	10.3	<1.00	2.17	1320	<1.00	15.4	<1.00	<1.00	615	21.2	<1.00	<1.00	162	<1.00	<1.00
LP5-01-SSM-W	1	21	S-12369-1	<1.00	74.5	1.40	41.2	<1.00	88.5	<1.00	<1.00	758	<1.00	10.5	<1.00	<1.00	290	89.2	<1.00	<1.00	70.7	<1.00	<1.00
LP5-03-SSM-W	1	22	S-12371-1	<1.00	33.9	5.84	53.5	<1.00	3.87	<1.00	1.71	1000	<1.00	4.13	<1.00	<1.00	500	19.1	<1.00	<1.00	92.7	<1.00	<1.00
LP5-22-SSM-W	1	23	S-12390-1	<1.00	26.9	<1.00	8.85	<1.00	5.46	<1.00	1.76	841	<1.00	2.59	<1.00	<1.00	492	20.7	<1.00	<1.00	3.73	<1.00	<1.00
LP5-17-SSM-W	1	24	S-12385-1	<1.00	19.9	6.33	21.6	<1.00	72.1	<1.00	<1.00	790	<1.00	4.12	<1.00	<1.00	457	13.2	<1.00	<1.00	101	<1.00	<1.00
hp std	1	25	hpstd-12	50.0	<1.00	<1.00	<1.00	50.0	<1.00	<1.00	<1.00	145	9.91	<1.00	<1.00	<1.00	10.4	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
LP5-02-SSM-W	1	26	S-12370-1	<1.00	22.8	7.49	49.9	<1.00	43.8	<1.00	<1.00	1180	<1.00	<1.00	<1.00	<1.00	583	30.5	<1.00	<1.00	59.6	<1.00	<1.00
LP5-09-SSM-W	1	27	S-12377-1	1.90	24.4	1.53	63.1	<1.00	87.7	<1.00	<1.00	1140	<1.00	16.8	<1.00	<1.00	643	14.0	<1.00	<1.00	22.0	<1.00	<1.00
LP5-23-SSM-W	1	28	S-12391-1	<1.00	11.7	5.44	8.89	<1.00	24.1	<1.00	<1.00	687	<1.00	2.50	<1.00	<1.00	395	25.5	<1.00	<1.00	19.4	<1.00	<1.00
LP5-07-SSM-W	1	29	S-12375-1	1.90	29.5	1.55	14.3	<1.00	40.7	<1.00	2.09	762	<1.00	3.76	<1.00	<1.00	466	8.60	<1.00	<1.00	9.81	<1.00	<1.00
LP5-08-SSM-W	1	30	S-12376-1	1.40	37.1	<1.00	28.9	<1.00	89.7	<1.00	<1.00	835	<1.00	10.7	<1.00	<1.00	509	8.94	1.43	<1.00	5.61	<1.00	<1.00
LP5-05-SSM-W	1	31	S-12373-1	<1.00	28.5	8.13	24.2	<1.00	56.2	<1.00	1.52	906	<1.00	1.49	<1.00	<1.00	485	26.4	<1.00	<1.00	108	<1.00	<1.00
LP5-25-SSM-W	1	32	S-12393-1	<1.00	8.11	21.2	1.09	<1.00	16.4	24.3	<1.00	580	<1.00	<1.00	<1.00	<1.00	407	4.30	<1.00	<1.00	<1.00	<1.00	<1.00
std	1	33	soln std-13	4.10	19.9	<1.00	<1.00	4.16	10.4	9.62	<1.00	82.2	<1.00	<1.00	<1.00	<1.00	<1.00	50.3	<1.00	<1.00	<1.00	<1.00	<1.00
std	2	1	soln std-21	4.06	19.8	<1.00	<1.00	4.14	10.2	9.49	<1.00	81.1	<1.00	<1.00	<1.00	<1.00	<1.00	50.0	<1.00	<1.00	<1.00	<1.00	<1.00
LP5-21-SSM-W	2	2	S-12389-2	<1.00	35.1	5.98	40.4	<1.00	74.7	<1.00	2.12	779	<1.00	6.22	<1.00	<1.00	475	17.1	<1.00	<1.00	43.5	<1.00	<1.00
LP5-05-SSM-W	2	3	S-12373-2	<1.00	24.8	6.95	21.4	<1.00	49.1	<1.00	1.33	877	<1.00	1.31	<1.00	<1.00	485	22.9	<1.00	<1.00	106	<1.00	<1.00
LP5-01-SSM-W	2	4	S-12369-2	<1.00	74.4	2.10	41.6	<1.00	87.7	<1.00	<1.00	751	<1.00	10.9	<1.00	<1.00	284	88.9	1.12	<1.00	71.3	<1.00	<1.00
LP5-25-SSM-W	2	5	S-12393-2	<1.00	8.22	21.2	1.16	<1.00	16.2	24.2	<1.00	610	<1.00	<1.00	<1.00	<1.00	480	4.41	<1.00	<1.00	<1.00	<1.00	<1.00
LP5-07-SSM-W	2	6	S-12375-2	1.19	28.9	1.45	14.3	<1.00	40.2	<1.00	1.80	820	<1.00	3.65	<1.00	<1.00	525	6.96	<1.00	<1.00	9.77	<1.00	<1.00
LP5-12-1-SSM-W	2	7	S-12380-2	<1.00	13.4	2.65	67.4	<1.00	51.7	<1.00	3.50	1230	<1.00	14.6	<1.00	<1.00	646	4.67	<1.00	<1.00	94.1	<1.00	<1.00
LP5-23-SSM-W	2	8	S-12391-2	<1.00	11.5	5.50	8.88	<1.00	23.6	<1.00	<1.00	547	<1.00	2.39	<1.00	<1.00	311	24.8	<1.00	<1.00	19.2	<1.00	<1.00
hp std	2	9	hpstd-21	49.5	<1.00	<1.00	<1.00	49.3	<1.00	<1.00	<1.00	144	10.0	<1.00	<1.00	<1.00	10.7	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
LP5-18-SSM-W	2	10	S-12386-2	<1.00	25.3	<1.00	41.5	<1.00	38.4	<1.00	2.99	1080	<1.00	8.88	<1.00	<1.00	580	12.7	<1.00	<1.00	58.1	<1.00	<1.00
LP5-13-SSM-W	2	11	S-12381-2	<1.00	92.4	<1.00	24.8	<1.00	53.9	<1.00	<1.00	793	<1.00	9.32	<1.00	<1.00	287	46.8	<1.00	<1.00	110	<1.00	<1.00
LP5-04-SSM-W	2	12	S-12372-2	<1.00	32.1	1.95	39.2	<1.00	91.5	<1.00	<1.00	653	<1.00	<1.00	<1.00	<1.00	394	24.1	<1.00	<1.00	1.43	<1.00	<1.00
LP5-09-SSM-W	2	13	S-12377-2	2.14	22.2	1.82	58.4	<1.00	79.5	<1.00	<1.00	1120	<1.00	15.7	<1.00	<1.00	528	13.9	<1.00	<1.00	20.4	1.03	<1.00
LP5-14-SSM-W	2	14	S-12382-2	<1.00	26.7	<1.00	59.4	<1.00	88.3	<1.00	<1.00	958	<1.00	21.7	<1.00	<1.00	528	19.2	<1.00	<1.00	99.0	<1.00	<1.00
LP5-SSM-W-1	2	15	S-12394-2	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	586	<1.00	<1.00	<1.00	<1.00	424	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
LP5-16-MOD1-SSM-W	2	16	S-12384-2	<1.00	15.8	3.81	43.6	<1.00	16.3	<1.00	1.29	1120	<1.00	5.20	<1.00	<1.00	462	8.74	<1.00	<1.00	12.6	<1.00	<1.00
Blank	2	17	Blank-2	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00

Table B-1. Measurements (mg/L) of the LP5 SSM Wash Solutions Measured by ICP-OES (continued)

PNNL ID	Block	Seq.	Lab ID	Al	B	Ca	Cr	Fe	K	Li	Mg	Na	Ni	P	Pb	Re	S	Si	Sn	Ti	V	Zn	Zr
std	2	18	soln std-22	4.05	19.5	<1.00	<1.00	4.04	10.0	9.45	<1.00	80.9	<1.00	<1.00	<1.00	<1.00	<1.00	49.1	<1.00	<1.00	<1.00	<1.00	<1.00
LP5-17-SSM-W	2	19	S-12385-2	<1.00	20.2	6.19	22.0	<1.00	72.5	<1.00	<1.00	712	<1.00	4.20	<1.00	<1.00	432	12.6	<1.00	<1.00	103	<1.00	<1.00
LP5-08-SSM-W	2	20	S-12376-2	1.53	36.1	<1.00	28.6	<1.00	88.3	<1.00	<1.00	855	<1.00	10.6	<1.00	<1.00	550	9.02	1.56	<1.00	5.58	<1.00	<1.00
LP5-19-SSM-W	2	21	S-12387-2	<1.00	30.3	5.34	33.2	<1.00	139	<1.00	1.87	721	<1.00	3.25	<1.00	<1.00	505	14.4	<1.00	<1.00	15.9	<1.00	<1.00
LP5-10-SSM-W	2	22	S-12378-2	<1.00	18.9	<1.00	26.1	<1.00	79.9	<1.00	<1.00	722	<1.00	5.70	<1.00	<1.00	425	16.9	<1.00	<1.00	26.9	<1.00	<1.00
LP5-11-SSM-W	2	23	S-12379-2	<1.00	25.1	2.63	57.0	<1.00	9.55	<1.00	2.03	1330	<1.00	14.8	<1.00	<1.00	535	20.1	<1.00	<1.00	135	<1.00	<1.00
LP5-02-SSM-W	2	24	S-12370-2	<1.00	22.7	7.59	49.8	<1.00	43.7	<1.00	<1.00	1150	<1.00	<1.00	<1.00	<1.00	531	29.8	<1.00	<1.00	59.6	<1.00	<1.00
hp std	2	25	hpstd-22	50.4	<1.00	<1.00	<1.00	49.6	<1.00	<1.00	<1.00	141	10.0	<1.00	<1.00	<1.00	10.6	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
LP5-03-SSM-W	2	26	S-12371-2	<1.00	33.6	5.76	53.3	<1.00	3.94	<1.00	1.64	973	<1.00	4.08	<1.00	<1.00	493	18.7	<1.00	<1.00	92.3	<1.00	<1.00
LP5-22-SSM-W	2	27	S-12390-2	<1.00	26.1	<1.00	8.73	<1.00	4.99	<1.00	1.68	734	<1.00	2.53	<1.00	<1.00	433	19.9	<1.00	<1.00	3.70	<1.00	<1.00
LP5-15-SSM-W	2	28	S-12383-2	<1.00	39.6	<1.00	16.6	<1.00	94.3	<1.00	1.06	900	<1.00	7.55	<1.00	<1.00	519	11.0	<1.00	<1.00	99.0	<1.00	<1.00
LP5-SSM-W-2	2	29	S-12395-2	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	63.0	<1.00	<1.00	<1.00	<1.00	45.1	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
LP5-24-SSM-W	2	30	S-12392-2	<1.00	21.8	4.36	59.9	<1.00	21.7	<1.00	<1.00	1010	<1.00	9.39	<1.00	<1.00	579	5.31	<1.00	<1.00	13.5	<1.00	<1.00
LP5-06-MOD1-SSM-W	2	31	S-12374-2	<1.00	28.6	9.04	54.9	<1.00	81.1	<1.00	2.88	1260	<1.00	10.0	<1.00	<1.00	638	12.5	<1.00	<1.00	200	<1.00	<1.00
LP5-20-SSM-W	2	32	S-12388-2	<1.00	47.2	1.24	44.4	<1.00	55.5	<1.00	1.13	803	<1.00	11.6	<1.00	<1.00	404	18.5	<1.00	<1.00	2.31	<1.00	<1.00
std	2	33	soln std-23	4.05	19.6	<1.00	<1.00	4.08	10.1	9.41	<1.00	75.3	<1.00	<1.00	<1.00	<1.00	<1.00	49.1	<1.00	<1.00	<1.00	<1.00	<1.00
std	3	1	soln std-31	4.06	19.8	<1.00	<1.00	4.12	10.1	9.59	<1.00	81.1	<1.00	<1.00	<1.00	<1.00	<1.00	49.3	<1.00	<1.00	<1.00	<1.00	<1.00
LP5-SSM-W-1	3	2	S-12394-3	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	617	<1.00	<1.00	<1.00	<1.00	443	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
LP5-06-MOD1-SSM-W	3	3	S-12374-3	<1.00	28.1	8.60	54.5	<1.00	81.6	<1.00	2.72	1260	<1.00	9.77	<1.00	<1.00	667	10.8	<1.00	<1.00	209	<1.00	<1.00
LP5-01-SSM-W	3	4	S-12369-3	<1.00	72.5	<1.00	40.6	<1.00	86.9	<1.00	<1.00	914	<1.00	10.1	<1.00	<1.00	367	85.2	<1.00	<1.00	69.6	<1.00	<1.00
LP5-02-SSM-W	3	5	S-12370-3	<1.00	21.7	7.27	48.6	<1.00	42.6	<1.00	<1.00	1140	<1.00	<1.00	<1.00	<1.00	568	28.8	<1.00	<1.00	57.8	<1.00	<1.00
LP5-11-SSM-W	3	6	S-12379-3	<1.00	24.3	2.50	55.9	<1.00	9.26	<1.00	1.96	1240	<1.00	14.5	<1.00	<1.00	637	19.2	<1.00	<1.00	161	<1.00	<1.00
LP5-14-SSM-W	3	7	S-12382-3	<1.00	27.1	<1.00	59.9	<1.00	92.1	<1.00	<1.00	1170	<1.00	22.1	<1.00	<1.00	652	19.4	<1.00	<1.00	121	<1.00	<1.00
LP5-07-SSM-W	3	8	S-12375-3	1.19	28.3	1.45	14.0	<1.00	40.5	<1.00	1.79	702	<1.00	3.70	<1.00	<1.00	443	6.88	<1.00	<1.00	9.59	<1.00	<1.00
hp std	3	9	hpstd-31	50.2	<1.00	<1.00	<1.00	50.0	<1.00	<1.00	<1.00	143	10.1	<1.00	<1.00	<1.00	10.4	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
LP5-05-SSM-W	3	10	S-12373-3	<1.00	27.9	7.83	24.4	<1.00	57.0	<1.00	1.02	884	<1.00	1.49	<1.00	<1.00	502	24.8	<1.00	<1.00	107	<1.00	<1.00
LP5-16-MOD1-SSM-W	3	11	S-12384-3	<1.00	16.0	3.87	43.8	<1.00	17.0	<1.00	1.31	1110	<1.00	5.36	<1.00	<1.00	642	8.77	<1.00	<1.00	12.6	<1.00	<1.00
LP5-SSM-W-2	3	12	S-12395-3	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	62.5	<1.00	<1.00	<1.00	<1.00	44.6	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
LP5-04-SSM-W	3	13	S-12372-3	<1.00	30.6	1.57	37.2	<1.00	91.2	<1.00	<1.00	710	<1.00	<1.00	<1.00	<1.00	440	22.3	<1.00	<1.00	1.32	<1.00	<1.00
LP5-15-SSM-W	3	14	S-12383-3	<1.00	38.9	<1.00	16.4	<1.00	96.8	<1.00	1.07	977	<1.00	7.47	<1.00	<1.00	568	11.1	<1.00	<1.00	98.0	<1.00	<1.00
LP5-12-1-SSM-W	3	15	S-12380-3	<1.00	13.2	2.68	67.2	<1.00	53.3	<1.00	3.47	1220	<1.00	14.8	<1.00	<1.00	722	4.41	<1.00	<1.00	102	<1.00	<1.00
LP5-13-SSM-W	3	16	S-12381-3	<1.00	94.5	<1.00	25.2	<1.00	57.6	<1.00	<1.00	892	<1.00	9.54	<1.00	<1.00	344	47.1	<1.00	<1.00	112	<1.00	<1.00
Blank	3	17	Blank-3	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
std	3	18	soln std-32	4.06	19.3	<1.00	<1.00	4.06	9.99	9.52	<1.00	80.0	<1.00	<1.00	<1.00	<1.00	<1.00	48.6	<1.00	<1.00	<1.00	<1.00	<1.00
LP5-24-SSM-W	3	19	S-12392-3	<1.00	20.6	4.21	57.1	<1.00	21.0	<1.00	<1.00	1060	<1.00	9.02	<1.00	<1.00	611	5.32	<1.00	<1.00	12.9	<1.00	<1.00
LP5-23-SSM-W	3	20	S-12391-3	<1.00	10.9	5.23	8.43	<1.00	23.4	<1.00	<1.00	670	<1.00	2.32	<1.00	<1.00	405	23.4	<1.00	<1.00	18.4	<1.00	<1.00
LP5-21-SSM-W	3	21	S-12389-3	<1.00	34.0	6.20	39.5	<1.00	76.4	<1.00	2.13	768	<1.00	6.15	<1.00	<1.00	480	17.5	<1.00	<1.00	42.6	<1.00	<1.00
LP5-03-SSM-W	3	22	S-12371-3	<1.00	31.8	5.60	50.8	<1.00	3.31	<1.00	1.58	987	<1.00	3.85	<1.00	<1.00	517	17.6	<1.00	<1.00	88.5	<1.00	<1.00
LP5-10-SSM-W	3	23	S-12378-3	<1.00	18.1	<1.00	25.2	<1.00	80.4	<1.00	<1.00	777	<1.00	5.58	<1.00	<1.00	451	15.7	<1.00	<1.00	26.0	<1.00	<1.00
LP5-17-SSM-W	3	24	S-12385-3	<1.00	20.2	6.90	22.0	<1.00	76.8	<1.00	<1.00	827	<1.00	4.15	<1.00	<1.00	490	14.6	<1.00	<1.00	104	<1.00	<1.00
hp std	3	25	hpstd-32	50.7	<1.00	<1.00	<1.00	50.6	<1.00	<1.00	<1.00	140	10.1	<1.00	<1.00	<1.00	10.1	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
LP5-25-SSM-W	3	26	S-12393-3	<1.00	7.88	21.0	1.07	<1.00	15.8	23.9	<1.00	509	<1.00	<1.00	<1.00	<1.00	405	4.14	<1.00	<1.00	<1.00	<1.00	<1.00
LP5-19-SSM-W	3	27	S-12387-3	<1.00	30.7	5.45	33.8	<1.00	132	<1.00	1.91	660	<1.00	3.35	<1.00	<1.00	472	14.5	<1.00	<1.00	16.2	<1.00	<1.00
LP5-20-SSM-W	3	28	S-12388-3	<1.00	48.3	1.31	45.5	<1.00	59.0	<1.00	1.18	987	<1.00	11.9	<1.00	<1.00	605	18.9	<1.00	<1.00	2.33	<1.00	<1.00
LP5-08-SSM-W	3	29	S-12376-3	1.67	34.3	<1.00	27.2	<1.00	87.4	<1.00	<1.00	834	<1.00	10.0	<1.00	<1.00	551	9.00	1.55	<1.00	5.28	<1.00	<1.00
LP5-09-SSM-W	3	30	S-12377-3	1.70	23.1	1.35	61.3	<1.00	88.6	<1.00	<1.00	1100	<1.00	16.4	<1.00	<1.00	656	12.7	<1.00	<1.00	21.3	<1.00	<1.00
LP5-22-SSM-W	3	31	S-12390-3	<1.00	26.6	<1.00	8.94	<1.00	5.20	<1.00	1.74	652	<1.00	2.58	<1.00	<1.00	366	20.4	<1.00	<1.00	3.77	<1.00	<1.00
LP5-18-SSM-W	3	32	S-12386-3	<1.00	24.6	<1.00	41.0	<1.00	39.9	<1.00	2.94	915	<1.00	8.65	<1.00	<1.00	474	12.2	<1.00	<1.00	57.4	<1.00	<1.00
std	3	33	soln std-33	4.09	19.5	<1.00	<1.00	4.10	10.1	9.70	<1.00	80.6	<1.00	<1.00	<1.00	<1.00	<1.00	48.8	<1.00	<1.00	<1.00	<1.00	<1.00

Table B-2. Measurements (mg/L) of the LP5 SSM Wash Solutions Measured by IC

PNNL ID	Block	Seq.	Lab ID	Cl^-	F^-	PO_4^{3-}	SO_4^{2-}
1ppm std	1	1	1ppm ckstd	1.05	1.00	1.04	1.09
LP5-13-SSM-W	1	2	S-12381-1	19.2	6.06	29.4	972
LP5-SSM-W-1	1	3	S-12394-1	<5.00	<5.00	<5.00	1260
LP5-23-SSM-W	1	4	S-12391-1	9.77	<5.00	5.38	1130
LP5-25-SSM-W	1	5	S-12393-1	<5.00	6.37	<5.00	1440
LP5-21-SSM-W	1	6	S-12389-1	29.9	5.47	17.0	1360
LP5-05-SSM-W	1	7	S-12373-1	21.4	<5.00	<5.00	1410
LP5-04-SSM-W	1	8	S-12372-1	21.3	<5.00	<5.00	1440
LP5-16-MOD1-SSM-W	1	9	S-12384-1	42.5	6.21	13.7	1830
LP5-06-MOD1-SSM-W	1	10	S-12374-1	31.6	8.51	26.9	1990
LP5-20-SSM-W	1	11	S-12388-1	56.7	9.32	31.4	1670
LP5-03-SSM-W	1	12	S-12371-1	36.1	6.90	9.50	1630
LP5-14-SSM-W	1	13	S-12382-1	39.6	11.8	62.4	1850
LP5-15-SSM-W	1	14	S-12383-1	116	<5.00	19.4	1640
blank	1	15	blank-1a	<5.00	<5.00	<5.00	<10.0
1ppm std	1	16	1ppm ckstd	1.00	0.993	0.993	1.09
LP5-09-SSM-W	1	17	S-12377-1	46.4	12.9	34.7	1850
LP5-02-SSM-W	1	18	S-12370-1	30.5	6.17	<5.00	1710
LP5-08-SSM-W	1	19	S-12376-1	22.8	6.06	27.7	1570
LP5-10-SSM-W	1	20	S-12378-1	10.7	<5.00	13.5	1560
LP5-22-SSM-W	1	21	S-12390-1	10.7	<5.00	5.18	1450
LP5-18-SSM-W	1	22	S-12386-1	36.1	6.62	23.7	1820
LP5-01-SSM-W	1	23	S-12369-1	36.1	9.07	28.9	1040
LP5-11-SSM-W	1	24	S-12379-1	52.2	10.9	42.4	1790
LP5-SSM-W-2	1	25	S-12395-1	<5.00	<5.00	<5.00	116
LP5-07-SSM-W	1	26	S-12375-1	11.1	<5.00	7.76	1590
LP5-19-SSM-W	1	27	S-12387-1	20.4	<5.00	6.87	1580
LP5-12-1-SSM-W	1	28	S-12380-1	15.0	9.37	43.0	2060
LP5-24-SSM-W	1	29	S-12392-1	105	11.5	24.5	1730
LP5-17-SSM-W	1	30	S-12385-1	60.2	<5.00	9.27	1410
1ppm std	1	31	1ppm ckstd	0.994	1.01	1.10	1.09
1ppm std	2	1	1ppm ckstd	1.00	1.01	1.06	1.07
LP5-16-MOD1-SSM-W	2	2	S-12384-2	42.4	6.36	13.8	1830
LP5-07-SSM-W	2	3	S-12375-2	11.6	<5.00	8.02	1590
LP5-09-SSM-W	2	4	S-12377-2	46.4	12.9	36.3	1870
LP5-25-SSM-W	2	5	S-12393-2	<5.00	6.52	<5.00	1440
LP5-02-SSM-W	2	6	S-12370-2	30.0	6.23	<5.00	1720
LP5-04-SSM-W	2	7	S-12372-2	19.7	<5.00	<5.00	1320
LP5-15-SSM-W	2	8	S-12383-2	117	<5.00	18.1	1640
LP5-18-SSM-W	2	9	S-12386-2	36.2	6.66	23.0	1820
LP5-01-SSM-W	2	10	S-12369-2	34.0	8.54	26.3	975
LP5-10-SSM-W	2	11	S-12378-2	10.9	<5.00	12.6	1560
LP5-08-SSM-W	2	12	S-12376-2	22.5	6.09	27.0	1570
LP5-SSM-W-1	2	13	S-12394-2	<5.00	<5.00	<5.00	1260
LP5-22-SSM-W	2	14	S-12390-2	10.5	<5.00	<5.00	1450
blank	2	15	blank-2a	<5.00	<5.00	<5.00	<10.0
1ppm std	2	16	1ppm ckstd	0.963	1.02	0.988	1.09
LP5-17-SSM-W	2	17	S-12385-2	59.7	<5.00	8.93	1410

Table B-2. Measurements (mg/L) of the LP5 SSM Wash Solutions Measured by IC (continued)

PNNL ID	Block	Seq.	Lab ID	Cl^-	F^-	PO_4^{3-}	SO_4^{2-}
LP5-SSM-W-2	2	18	S-12395-2	<5.00	<5.00	<5.00	116
LP5-12-1-SSM-W	2	19	S-12380-2	13.9	8.91	39.7	1960
LP5-05-SSM-W	2	20	S-12373-2	21.6	<5.00	<5.00	1410
LP5-24-SSM-W	2	21	S-12392-2	97.3	10.6	21.4	1600
LP5-23-SSM-W	2	22	S-12391-2	9.54	<5.00	<5.00	1040
LP5-20-SSM-W	2	23	S-12388-2	56.4	9.44	29.7	1670
LP5-11-SSM-W	2	24	S-12379-2	52.4	10.9	41.6	1790
LP5-13-SSM-W	2	25	S-12381-2	19.7	6.00	23.7	974
LP5-19-SSM-W	2	26	S-12387-2	20.5	<5.00	6.45	1580
LP5-21-SSM-W	2	27	S-12389-2	28.8	5.26	14.3	1290
LP5-14-SSM-W	2	28	S-12382-2	39.8	11.9	60.7	1850
LP5-06-MOD1-SSM-W	2	29	S-12374-2	30.7	8.31	24.0	1920
LP5-03-SSM-W	2	30	S-12371-2	34.0	6.54	7.73	1530
1ppm std	2	31	1ppm ckstd	0.908	0.934	0.957	1.09
1ppm std	3	1	1ppm ckstd	1.00	1.05	1.09	0.948
LP5-20-SSM-W	3	2	S-12388-3	57.8	9.73	31.2	1710
LP5-03-SSM-W	3	3	S-12371-3	35.1	6.78	8.50	1580
LP5-04-SSM-W	3	4	S-12372-3	21.6	5.06	<5.00	1450
LP5-19-SSM-W	3	5	S-12387-3	20.7	<5.00	6.54	1580
LP5-15-SSM-W	3	6	S-12383-3	106	<5.00	16.1	1470
LP5-SSM-W-2	3	7	S-12395-3	<5.00	<5.00	<5.00	115
LP5-16-MOD1-SSM-W	3	8	S-12384-3	40.1	5.96	11.9	1730
LP5-10-SSM-W	3	9	S-12378-3	10.4	<5.00	12.1	1480
LP5-02-SSM-W	3	10	S-12370-3	30.4	6.23	<5.00	1720
LP5-05-SSM-W	3	11	S-12373-3	21.0	<5.00	<5.00	1370
LP5-14-SSM-W	3	12	S-12382-3	39.8	12.0	61.4	1860
LP5-25-SSM-W	3	13	S-12393-3	<5.00	6.52	<5.00	1440
LP5-24-SSM-W	3	14	S-12392-3	105	11.5	23.9	1730
blank	3	15	blank-3a	<5.00	<5.00	<5.00	<10.0
1ppm std	3	16	1ppm ckstd	0.979	0.991	0.961	0.949
LP5-12-1-SSM-W	3	17	S-12380-3	14.2	9.08	41.3	1980
LP5-07-SSM-W	3	18	S-12375-3	11.8	<5.00	7.96	1590
LP5-09-SSM-W	3	19	S-12377-3	47.8	13.4	37.6	1920
LP5-01-SSM-W	3	20	S-12369-3	36.3	9.10	29.0	1030
LP5-23-SSM-W	3	21	S-12391-3	10.3	<5.00	<5.00	1120
LP5-21-SSM-W	3	22	S-12389-3	29.0	5.38	14.8	1310
LP5-11-SSM-W	3	23	S-12379-3	52.6	10.9	42.0	1790
LP5-06-MOD1-SSM-W	3	24	S-12374-3	29.5	7.94	23.1	1830
LP5-18-SSM-W	3	25	S-12386-3	36.9	6.71	23.3	1830
LP5-08-SSM-W	3	26	S-12376-3	23.1	6.15	27.7	1580
LP5-13-SSM-W	3	27	S-12381-3	20.0	6.10	27.9	998
LP5-22-SSM-W	3	28	S-12390-3	10.2	<5.00	6.55	1400
LP5-SSM-W-1	3	29	S-12394-3	<5.00	<5.00	<5.00	1320
LP5-17-SSM-W	3	30	S-12385-3	64.3	<5.00	12.5	1520
1ppm std	3	31	1ppm ckstd	1.02	1.04	1.05	1.04

Table B-3. Results for Standards and Blanks Utilized During the Measurement of the Wash Solutions

Solution ID	Instrument	Analyte	Reference Value (mg/L)	Mean Measurement (mg/L)
1ppm std	IC	Cl^-	1	0.990
1ppm std	IC	F^-	1	1.01
1ppm std	IC	PO_4^{3-}	1	1.03
1ppm std	IC	SO_4^{2-}	1	1.05
hp std	ICP-OES	Al	50	50.3
hp std	ICP-OES	B	0	<1.00
hp std	ICP-OES	Ca	0	<1.00
hp std	ICP-OES	Cr	0	<1.00
hp std	ICP-OES	Fe	50	50.1
hp std	ICP-OES	K	0	<1.00
hp std	ICP-OES	Li	0	<1.00
hp std	ICP-OES	Mg	0	<1.00
hp std	ICP-OES	Na	150	143
hp std	ICP-OES	Ni	10	10.0
hp std	ICP-OES	P	0	<1.00
hp std	ICP-OES	Pb	0	<1.00
hp std	ICP-OES	Re	0	<1.00
hp std	ICP-OES	S	10	10.3
hp std	ICP-OES	Si	0	<1.00
hp std	ICP-OES	Sn	0	<1.00
hp std	ICP-OES	Ti	0	<1.00
hp std	ICP-OES	V	0	<1.00
hp std	ICP-OES	Zn	0	<1.00
hp std	ICP-OES	Zr	0	<1.00
std	ICP-OES	Al	4	4.07
std	ICP-OES	B	20	19.6
std	ICP-OES	Ca	0	<1.00
std	ICP-OES	Cr	0	<1.00
std	ICP-OES	Fe	4	4.12
std	ICP-OES	K	10	10.2
std	ICP-OES	Li	10	9.54
std	ICP-OES	Mg	0	<1.00
std	ICP-OES	Na	81	80.6
std	ICP-OES	Ni	0	<1.00
std	ICP-OES	P	0	<1.00
std	ICP-OES	Pb	0	<1.00
std	ICP-OES	Re	0	<1.00
std	ICP-OES	S	0	<1.00
std	ICP-OES	Si	50	49.5
std	ICP-OES	Sn	0	<1.00
std	ICP-OES	Ti	0	<1.00
std	ICP-OES	V	0	<1.00
std	ICP-OES	Zn	0	<1.00
std	ICP-OES	Zr	0	<1.00

*Note that all measurements of the blank samples were below the detection limits.

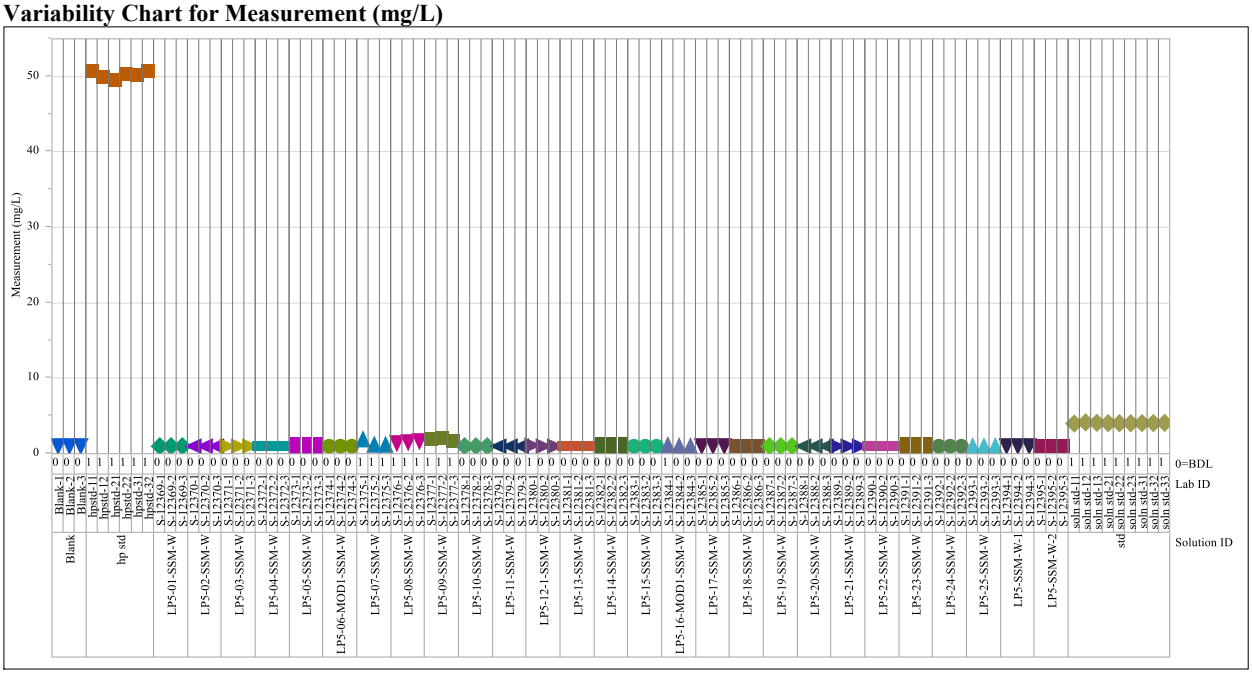
Table B-4. Average Measurements (mg/L) of Wash Solutions

		IC				ICP-OES																				
Lab ID	**PNNL ID**	**Cl^-**	**F^-**	**PO_4^{3-}**	**SO_4^{2-}**	**Al**	**B**	**Ca**	**Cr**	**Fe**	**K**	**Li**	**Mg**	**Na**	**Ni**	**P**	**PO_4^{3-*}**	**Pb**	**Re**	**S**	**SO_4^{2-*}**	**Si**	**Sn**	**Ti**	**V**	**Zn**	**Zr**
S-12369	LP5-01-SSM-W	35.5	8.90	28.1	1020	<1.00	73.8	<1.50	41.1	<1.00	87.7	<1.00	<1.00	808	<1.00	10.5	32.2	<1.00	<1.00	314	940	87.8	<1.04	<1.00	70.5	<1.00	<1.00
S-12370	LP5-02-SSM-W	30.3	6.21	<5.00	1720	<1.00	22.4	7.45	49.4	<1.00	43.4	<1.00	<1.00	1160	<1.00	<1.00	<3.07	<1.00	<1.00	561	1680	29.7	<1.00	<1.00	59.0	<1.00	<1.00
S-12371	LP5-03-SSM-W	35.1	6.74	8.58	1580	<1.00	33.1	5.73	52.5	<1.00	3.71	<1.00	1.64	987	<1.00	4.02	12.3	<1.00	<1.00	503	1510	18.5	<1.00	<1.00	91.2	<1.00	<1.00
S-12372	LP5-04-SSM-W	20.9	<5.00	<5.00	1400	<1.00	31.7	1.75	38.6	<1.00	92.0	<1.00	<1.00	707	<1.00	<1.00	<3.07	<1.00	<1.00	447	1340	23.6	<1.00	<1.00	1.38	<1.00	<1.00
S-12373	LP5-05-SSM-W	21.3	<5.00	<5.00	1400	<1.00	27.1	7.64	23.3	<1.00	54.1	<1.00	1.29	889	<1.00	1.43	4.38	<1.00	<1.00	491	1470	24.7	<1.00	<1.00	107	<1.00	<1.00
S-12374	LP5-06-MOD1-SSM-W	30.6	8.25	24.7	1910	<1.00	28.8	8.91	55.3	<1.00	82.6	<1.00	2.89	1270	<1.00	9.96	30.5	<1.00	<1.00	679	2030	12.1	<1.00	<1.00	208	<1.00	<1.00
S-12375	LP5-07-SSM-W	11.5	<5.00	7.91	1590	1.43	28.9	1.48	14.2	<1.00	40.5	<1.00	1.89	761	<1.00	3.70	11.4	<1.00	<1.00	478	1430	7.48	<1.00	<1.00	9.72	<1.00	<1.00
S-12376	LP5-08-SSM-W	22.8	6.10	27.5	1570	1.53	35.8	<1.00	28.2	<1.00	88.5	<1.00	<1.00	841	<1.00	10.4	32.0	<1.00	<1.00	537	1610	8.99	1.51	<1.00	5.49	<1.00	<1.00
S-12377	LP5-09-SSM-W	42.9	11.3	41.1	1670	1.91	23.2	1.57	60.9	<1.00	85.3	<1.00	<1.00	1120	<1.00	16.3	50.0	<1.00	<1.00	609	1820	13.5	<1.00	<1.00	21.2	<1.01	<1.00
S-12378	LP5-10-SSM-W	10.7	<5.00	12.7	1530	<1.00	18.5	<1.00	25.6	<1.00	79.8	<1.00	<1.00	804	<1.00	5.61	17.2	<1.00	<1.00	466	1400	16.7	<1.02	<1.00	26.3	<1.00	<1.00
S-12379	LP5-11-SSM-W	52.4	10.9	42.0	1790	<1.00	25.4	2.62	57.6	<1.00	9.70	<1.00	2.05	1300	<1.00	14.9	45.7	<1.00	<1.00	596	1780	20.2	<1.00	<1.00	153	<1.00	<1.00
S-12380	LP5-12-1-SSM-W	14.4	9.12	41.3	2000	<1.04	13.7	2.75	69.0	<1.00	54.0	<1.00	3.65	1230	<1.00	15.1	46.2	<1.00	<1.00	667	2000	4.88	<1.00	<1.00	99.0	<1.00	<1.00
S-12381	LP5-13-SSM-W	19.6	6.05	27.0	981	<1.00	92.4	<1.00	24.7	<1.00	54.9	<1.00	<1.00	859	<1.00	9.28	28.4	<1.00	<1.00	327	981	46.5	<1.00	<1.00	109	<1.00	<1.00
S-12382	LP5-14-SSM-W	39.7	11.9	61.5	1850	<1.00	26.4	<1.00	58.4	<1.00	88.3	<1.00	<1.00	1020	<1.00	21.5	65.8	<1.00	<1.00	566	1700	19.0	<1.00	<1.00	107	<1.00	<1.00
S-12383	LP5-15-SSM-W	113	<5.00	17.9	1580	<1.00	38.3	<1.00	16.1	<1.00	92.9	<1.00	1.04	885	<1.00	7.36	22.6	<1.00	<1.00	497	1490	10.8	<1.00	<1.00	96.0	<1.00	<1.00
S-12384	LP5-16-MOD1-SSM-W	41.7	6.18	13.1	1800	<1.04	16.3	3.99	44.6	<1.00	17.2	<1.00	1.38	1120	<1.00	5.42	16.6	<1.00	<1.00	603	1810	9.20	<1.00	<1.00	12.8	<1.00	<1.00
S-12385	LP5-17-SSM-W	61.4	<5.00	10.2	1450	<1.00	20.1	6.47	21.9	<1.00	73.8	<1.00	<1.00	776	<1.00	4.16	12.7	<1.00	<1.00	460	1380	13.5	<1.00	<1.00	103	<1.00	<1.00
S-12386	LP5-18-SSM-W	36.4	6.66	23.3	1820	<1.00	25.5	<1.00	42.1	<1.00	40.0	<1.00	3.05	1030	<1.00	8.92	27.4	<1.00	<1.00	553	1660	12.8	<1.00	<1.00	58.9	<1.00	<1.00
S-12387	LP5-19-SSM-W	20.5	<5.00	6.62	1580	<1.00	31.0	5.40	33.9	<1.00	143	<1.00	1.93	718	<1.00	3.31	10.1	<1.00	<1.00	523	1570	14.8	<1.00	<1.00	16.2	<1.00	<1.00
S-12388	LP5-20-SSM-W	57.0	9.50	30.8	1680	<1.00	47.9	1.28	45.1	<1.00	57.4	<1.00	1.17	874	<1.00	11.7	36.0	<1.00	<1.00	505	1510	19.0	<1.00	<1.00	2.32	<1.00	<1.00
S-12389	LP5-21-SSM-W	29.2	5.37	15.4	1320	<1.00	34.9	6.03	40.4	<1.00	76.3	<1.00	2.14	769	<1.00	6.27	19.2	<1.00	<1.00	479	1440	17.2	<1.00	<1.00	43.4	<1.00	<1.00
S-12390	LP5-22-SSM-W	10.5	<5.00	<5.58	1430	<1.00	26.5	<1.00	8.84	<1.00	5.22	<1.00	1.73	742	<1.00	2.57	7.87	<1.00	<1.00	430	1290	20.3	<1.00	<1.00	3.73	<1.00	<1.00
S-12391	LP5-23-SSM-W	9.87	<5.00	<5.13	1100	<1.00	11.4	5.39	8.73	<1.00	23.7	<1.00	<1.00	635	<1.00	2.40	7.37	<1.00	<1.00	370	1110	24.6	<1.00	<1.00	19.0	<1.00	<1.00
S-12392	LP5-24-SSM-W	102	11.2	23.3	1690	<1.00	21.5	4.31	58.9	<1.00	21.7	<1.00	<1.00	1000	<1.00	9.22	28.3	<1.00	<1.00	570	1710	5.41	<1.00	<1.00	13.3	<1.00	<1.00
S-12393	LP5-25-SSM-W	<5.00	6.47	<5.00	1440	<1.00	8.07	21.1	1.11	<1.00	16.1	24.1	<1.00	566	<1.00	<1.00	<3.07	<1.00	<1.00	431	1290	4.28	<1.00	<1.00	<1.00	<1.00	<1.00
S-12394	LP5-SSM-W-1	<5.00	<5.00	<5.00	1280	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	605	<1.00	<1.00	<3.07	<1.00	<1.00	428	1280	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
S-12395	LP5-SSM-W-2	<5.00	<5.00	<5.00	116	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	63.0	<1.00	<1.00	<3.07	<1.00	<1.00	42.4	127	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00

*ICP-OES PO_4^{3-} and SO_4^{2-} values were calculated from ICP-OES P and S values.

Exhibit B-1. Measurements of Wash Solutions by Analyte Grouped by Solution ID

Analyte=Al, Analysis=ICP
Variability Chart for Measurement (mg/L)



Analyte=B, Analysis=ICP
Variability Chart for Measurement (mg/L)

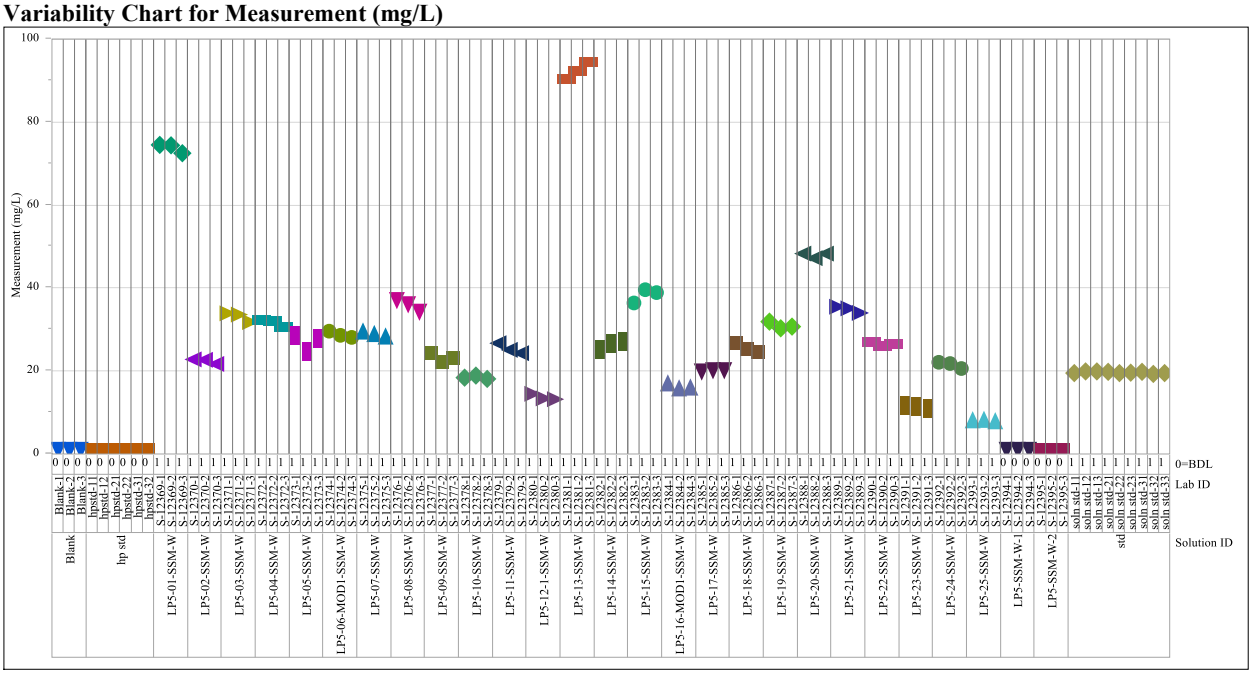
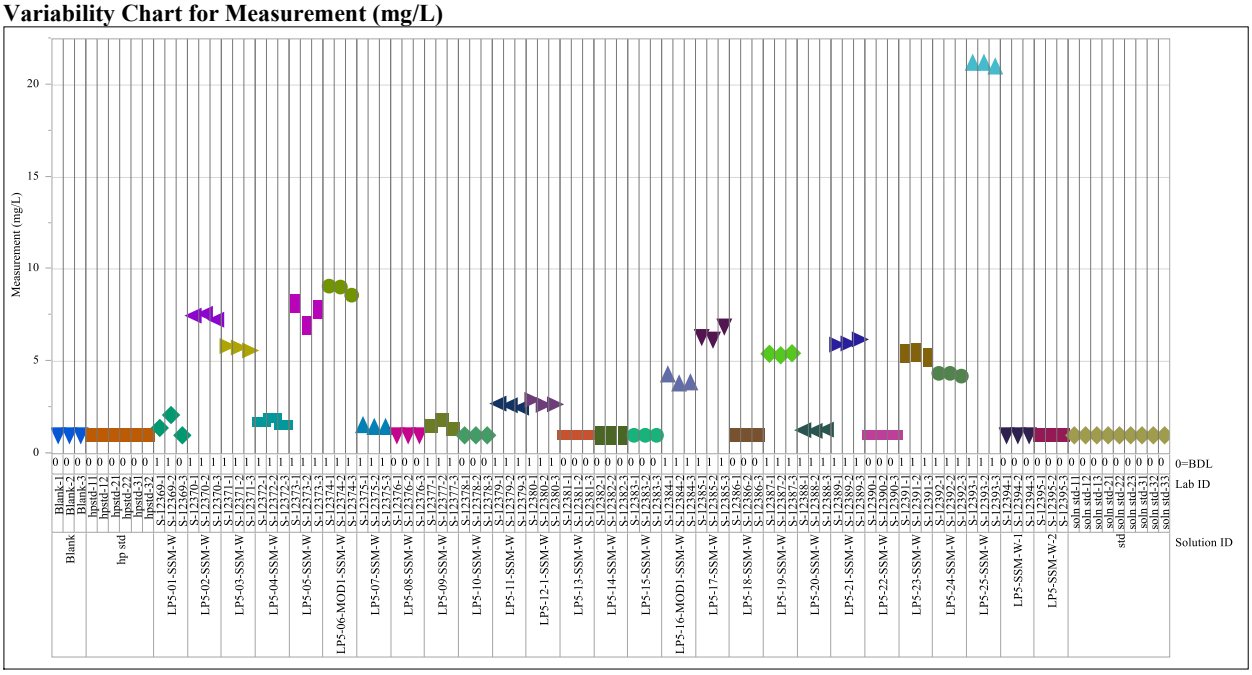


Exhibit B-1. Measurements of Wash Solutions by Analyte Grouped by Solution ID (continued)

Analyte=Ca, Analysis=ICP
Variability Chart for Measurement (mg/L)



Analyte=Cl⁻, Analysis=IC
Variability Chart for Measurement (mg/L)

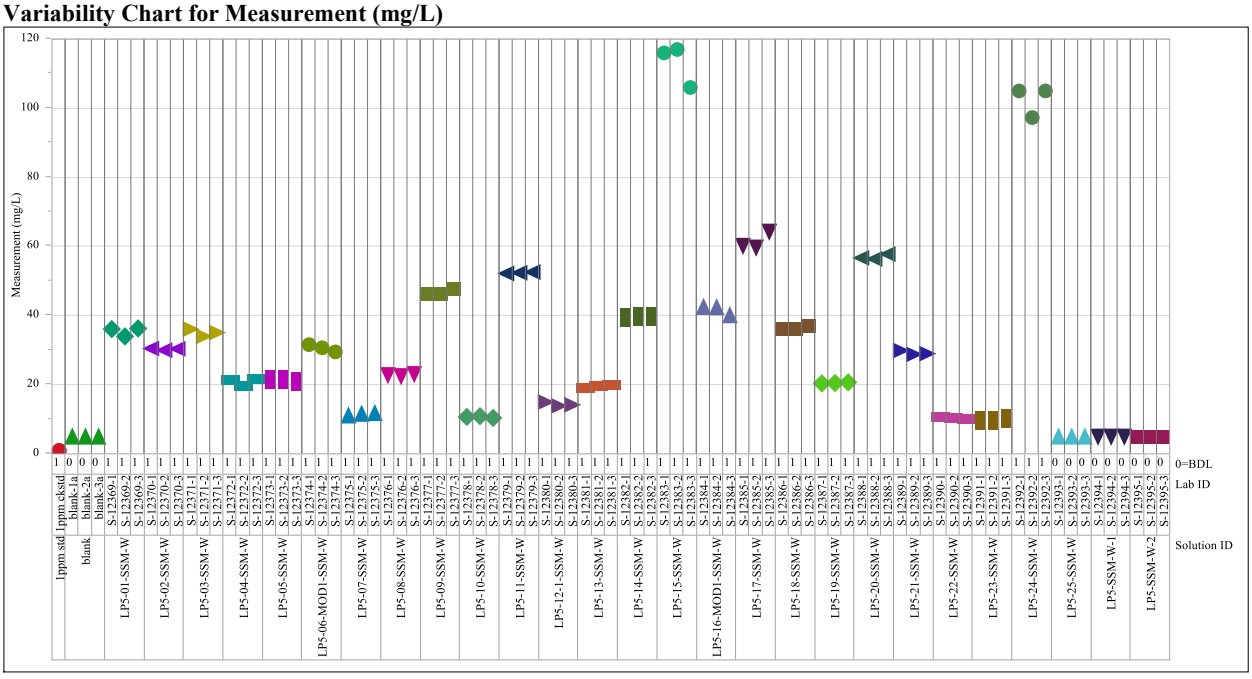
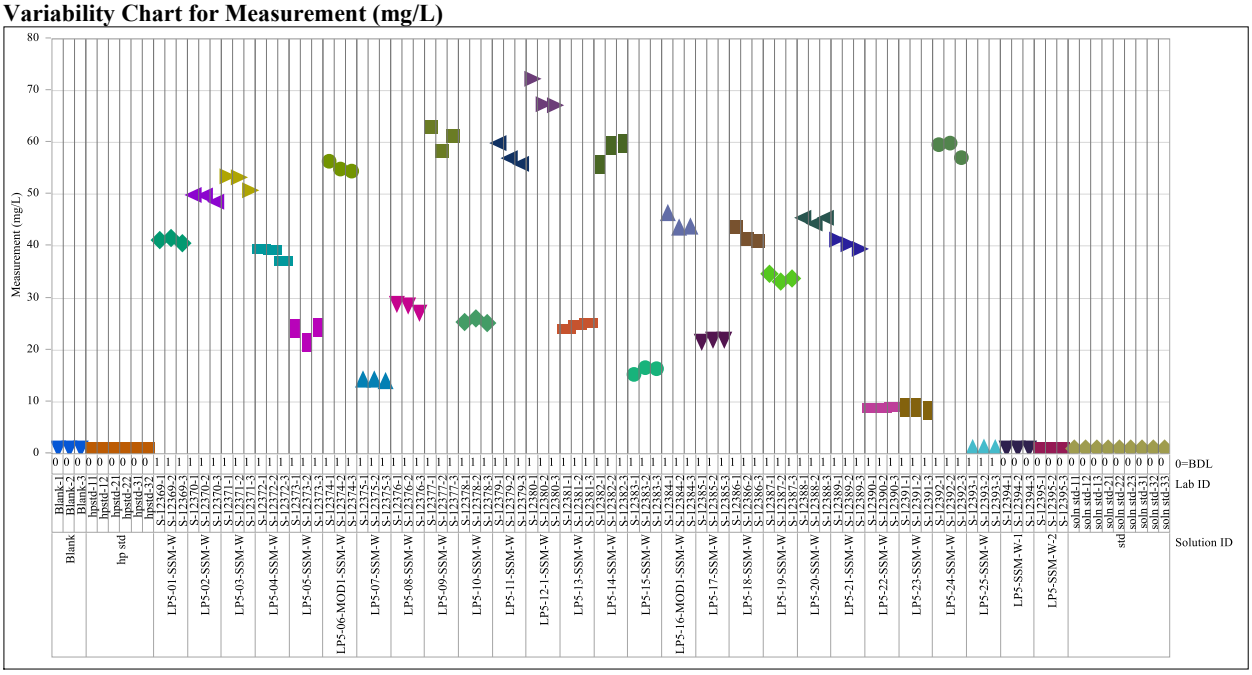


Exhibit B-1. Measurements of Wash Solutions by Analyte Grouped by Solution ID (continued)

Analyte=Cr, Analysis=ICP
Variability Chart for Measurement (mg/L)



Analyte=F, Analysis=IC
Variability Chart for Measurement (mg/L)

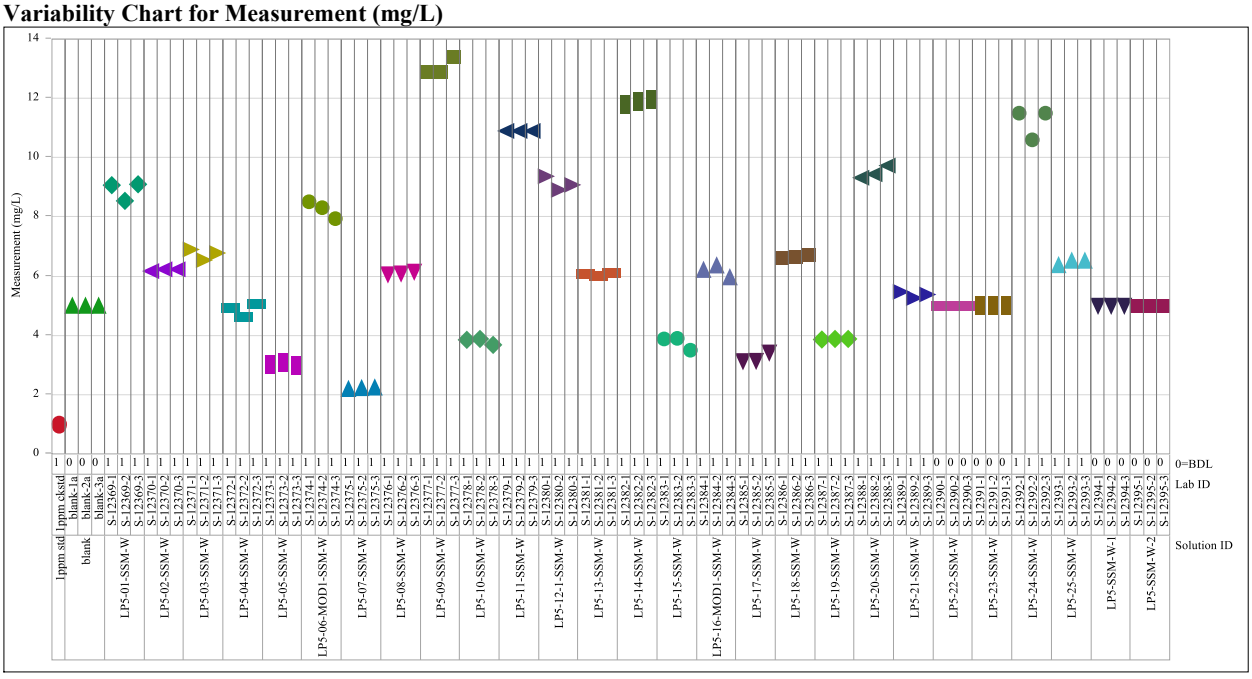
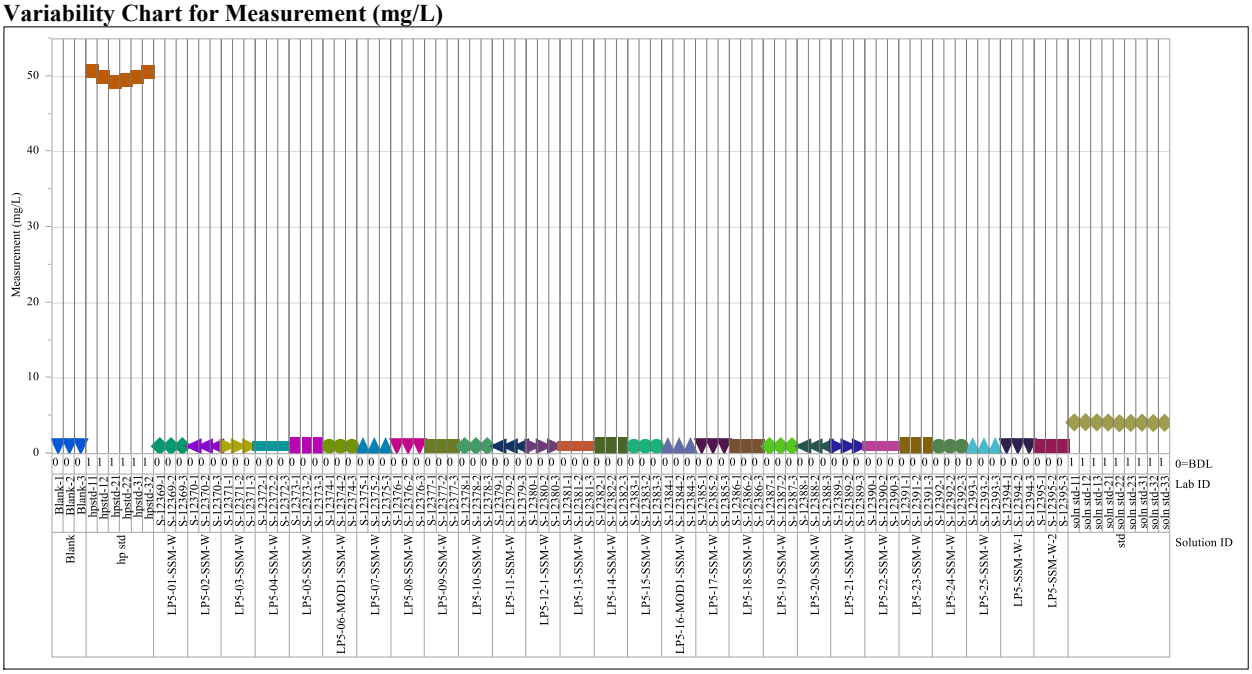


Exhibit B-1. Measurements of Wash Solutions by Analyte Grouped by Solution ID (continued)

Analyte=Fe, Analysis=ICP
Variability Chart for Measurement (mg/L)



Analyte=K, Analysis=ICP
Variability Chart for Measurement (mg/L)

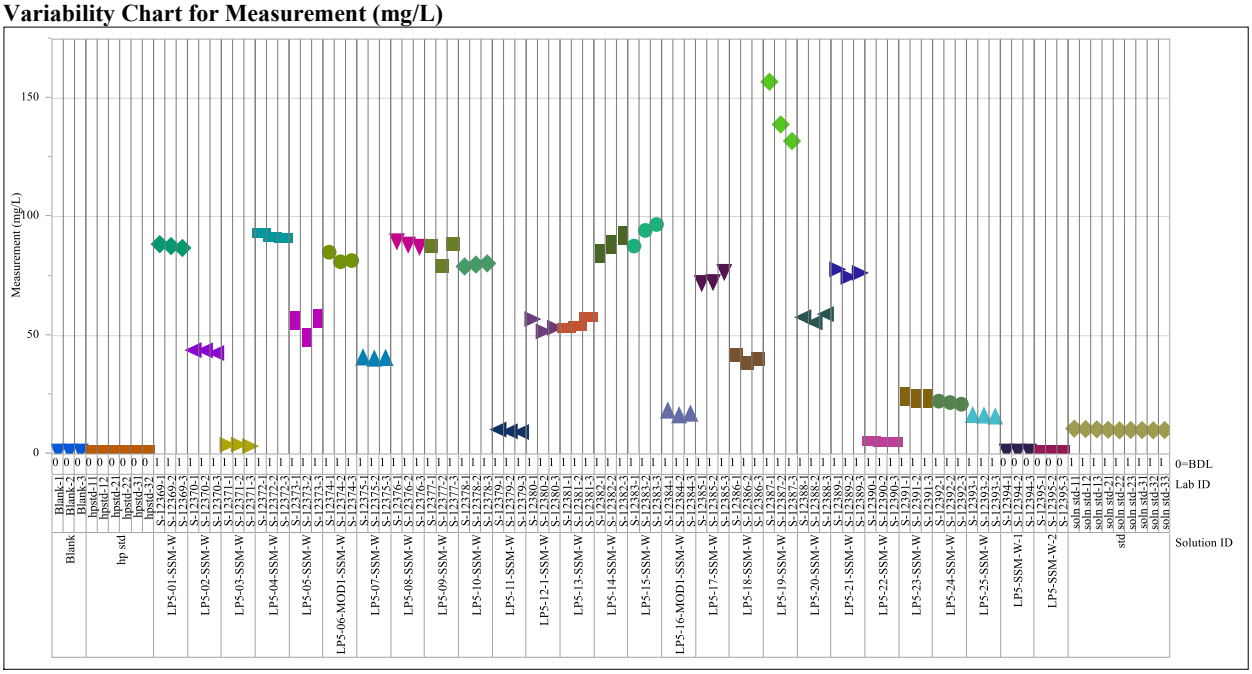
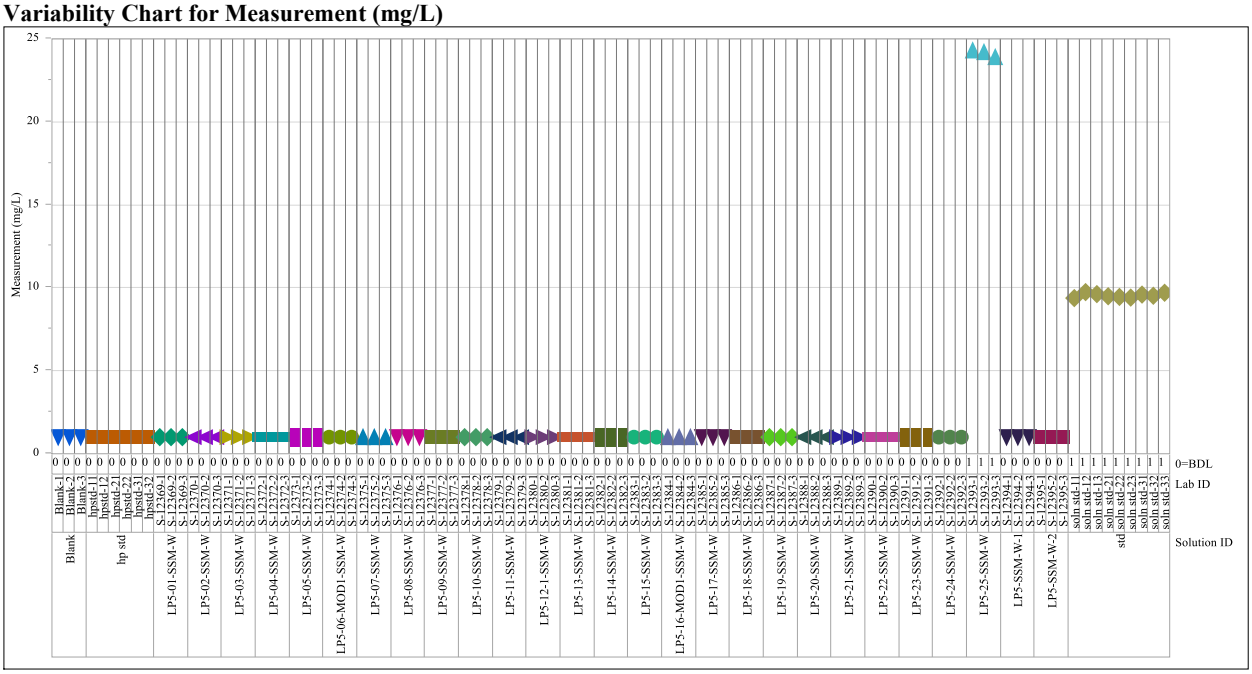


Exhibit B-1. Measurements of Wash Solutions by Analyte Grouped by Solution ID (continued)

Analyte=Li, Analysis=ICP
Variability Chart for Measurement (mg/L)



Analyte=Mg, Analysis=ICP
Variability Chart for Measurement (mg/L)

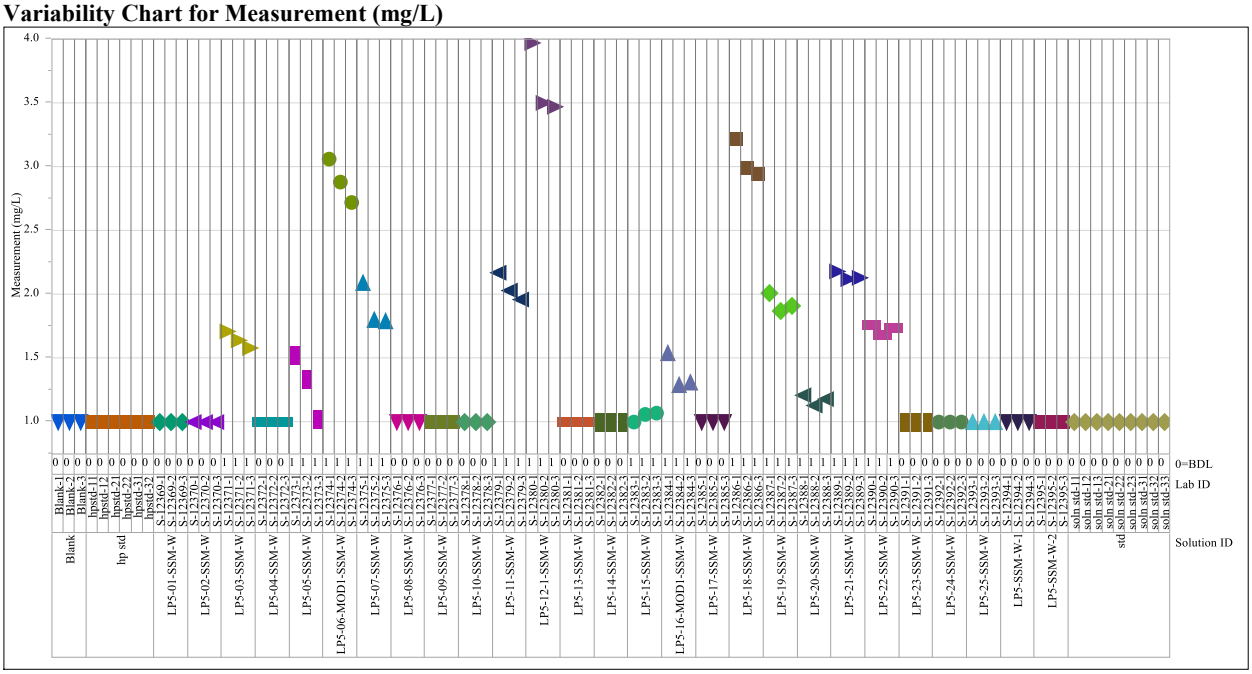
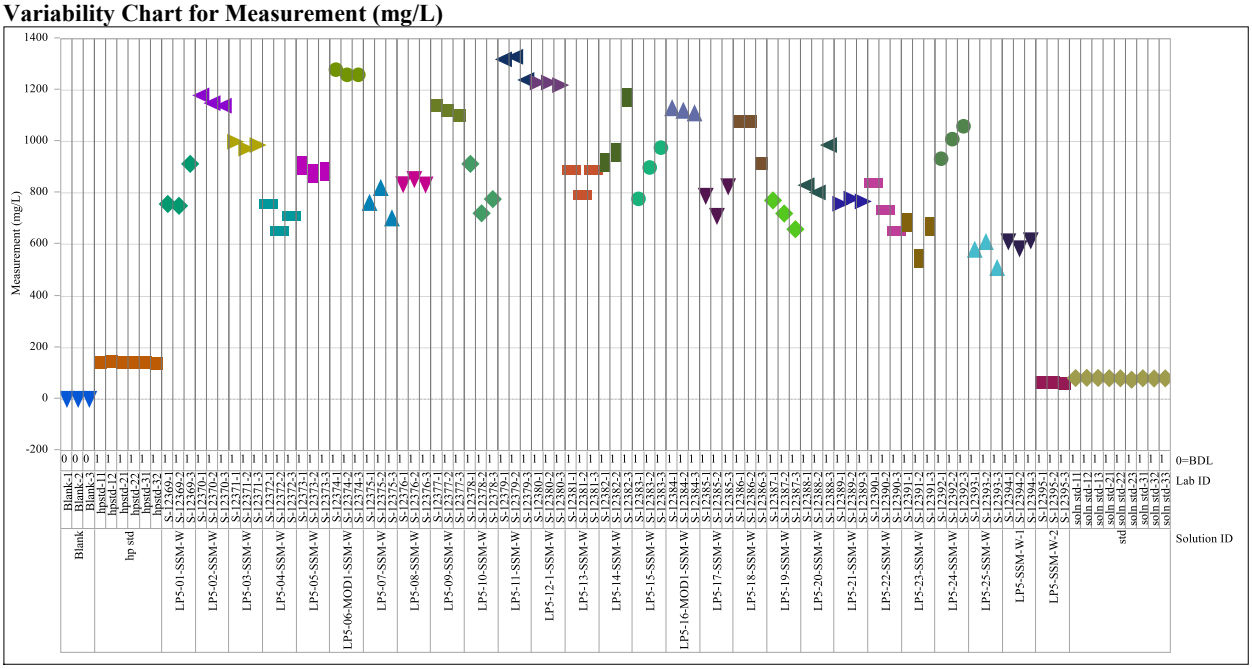


Exhibit B-1. Measurements of Wash Solutions by Analyte Grouped by Solution ID (continued)

Analyte=Na, Analysis=ICP
Variability Chart for Measurement (mg/L)



Analyte=Ni, Analysis=ICP
Variability Chart for Measurement (mg/L)

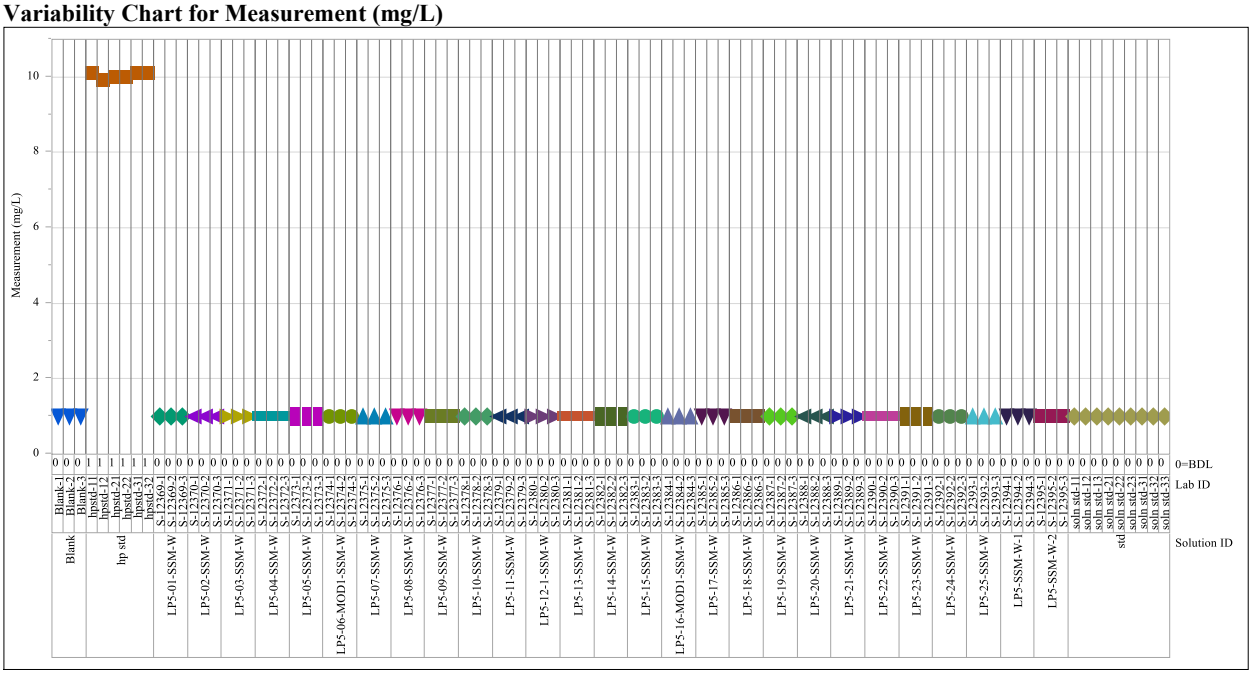
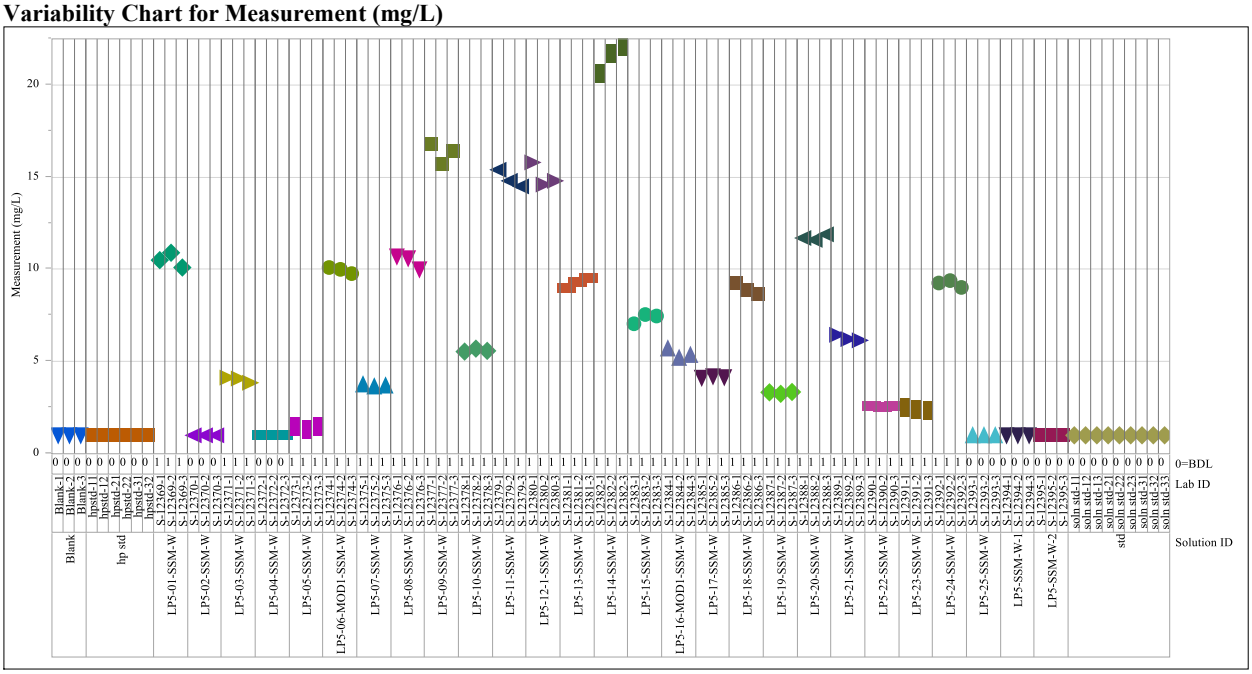


Exhibit B-1. Measurements of Wash Solutions by Analyte Grouped by Solution ID (continued)

Analyte=P, Analysis=ICP
Variability Chart for Measurement (mg/L)



Analyte=Pb, Analysis=ICP
Variability Chart for Measurement (mg/L)

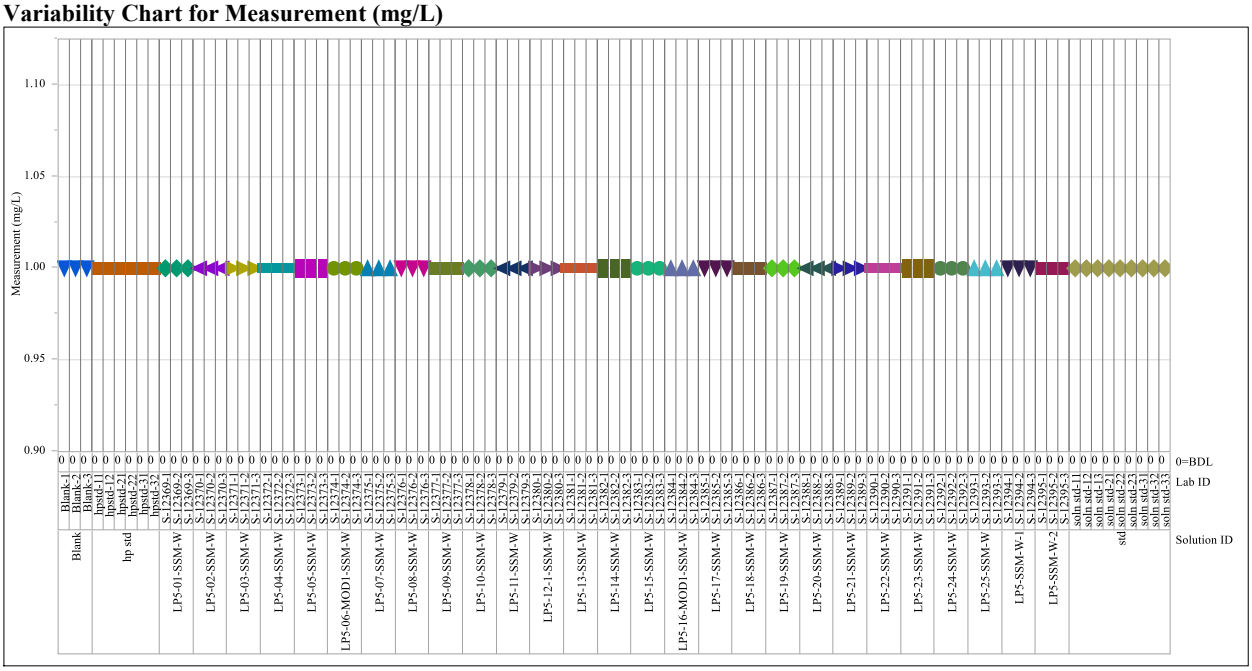
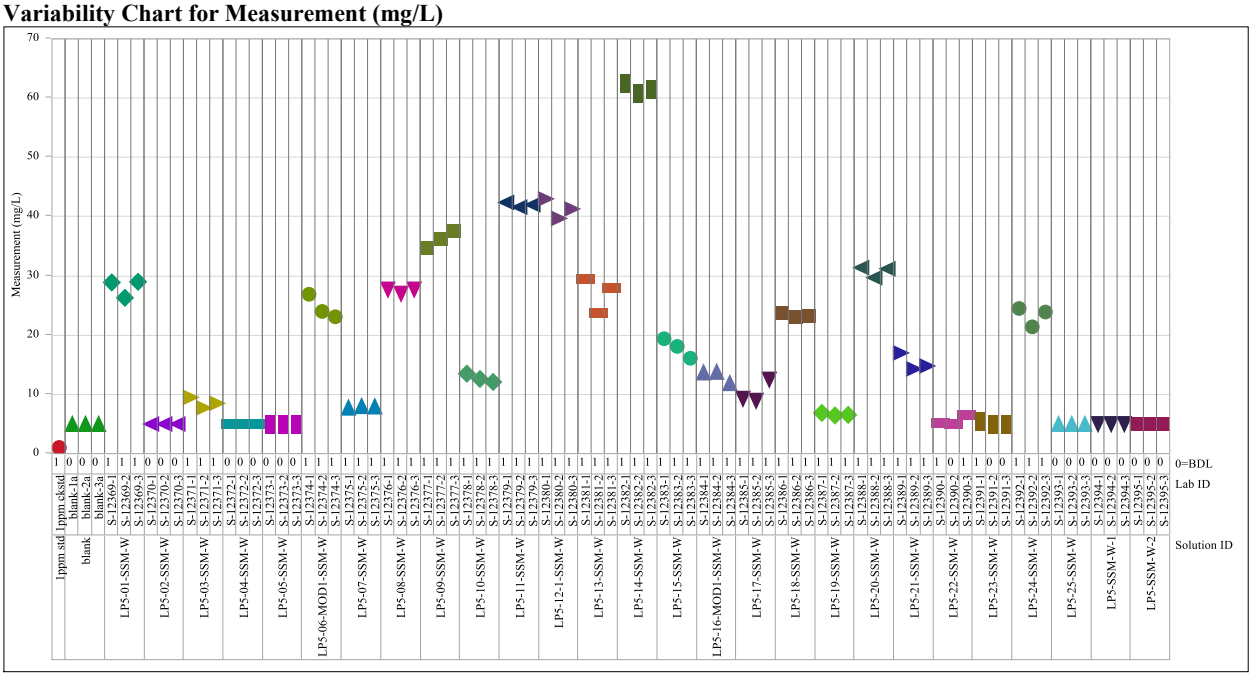


Exhibit B-1. Measurements of Wash Solutions by Analyte Grouped by Solution ID (continued)

Analyte=PO4, Analysis=IC
Variability Chart for Measurement (mg/L)



Analyte=Re, Analysis=ICP
Variability Chart for Measurement (mg/L)

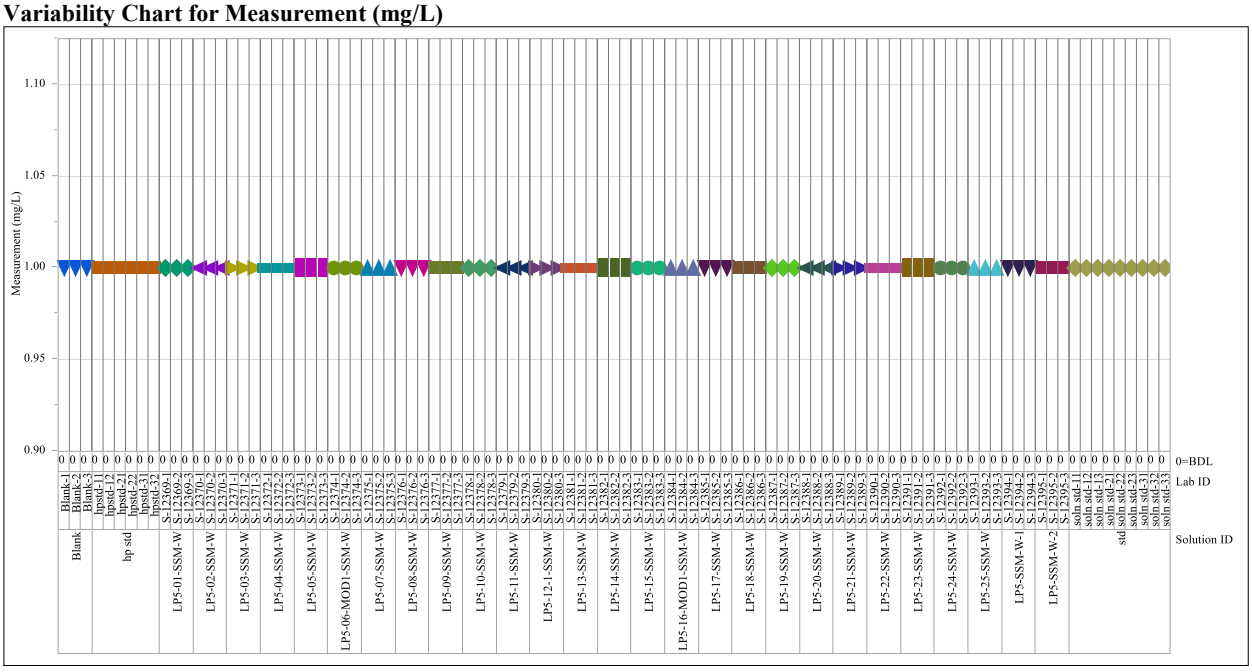
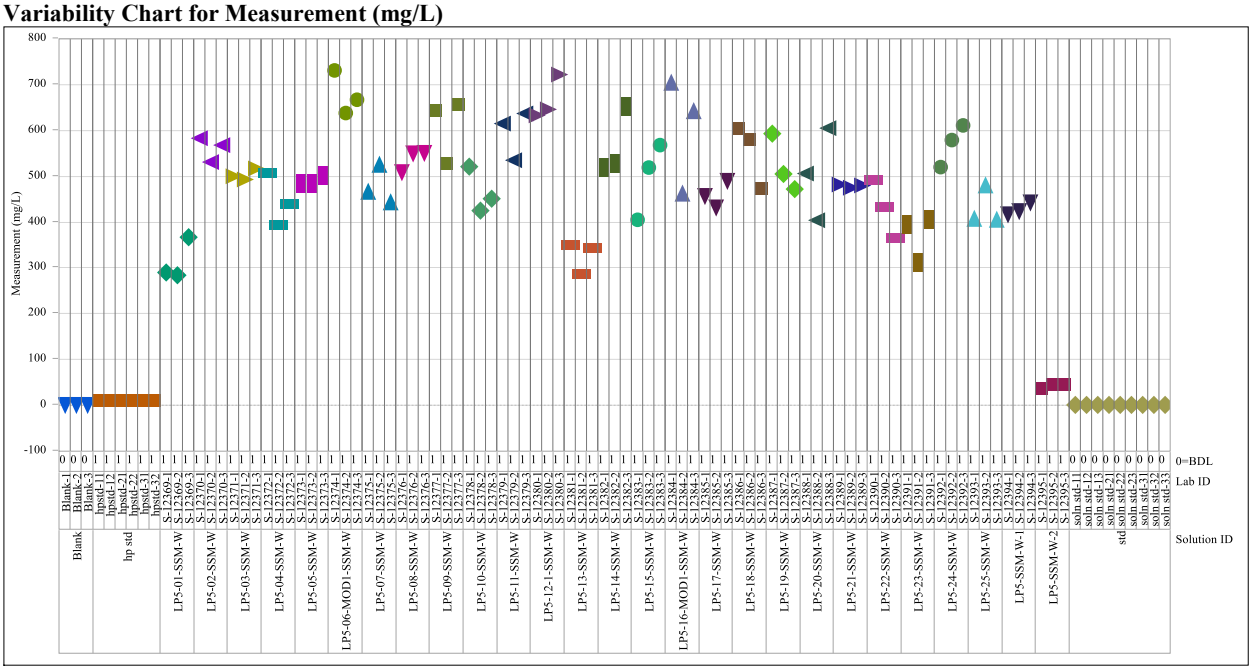


Exhibit B-1. Measurements of Wash Solutions by Analyte Grouped by Solution ID (continued)

Analyte=S, Analysis=ICP
Variability Chart for Measurement (mg/L)



Analyte=Si, Analysis=ICP
Variability Chart for Measurement (mg/L)

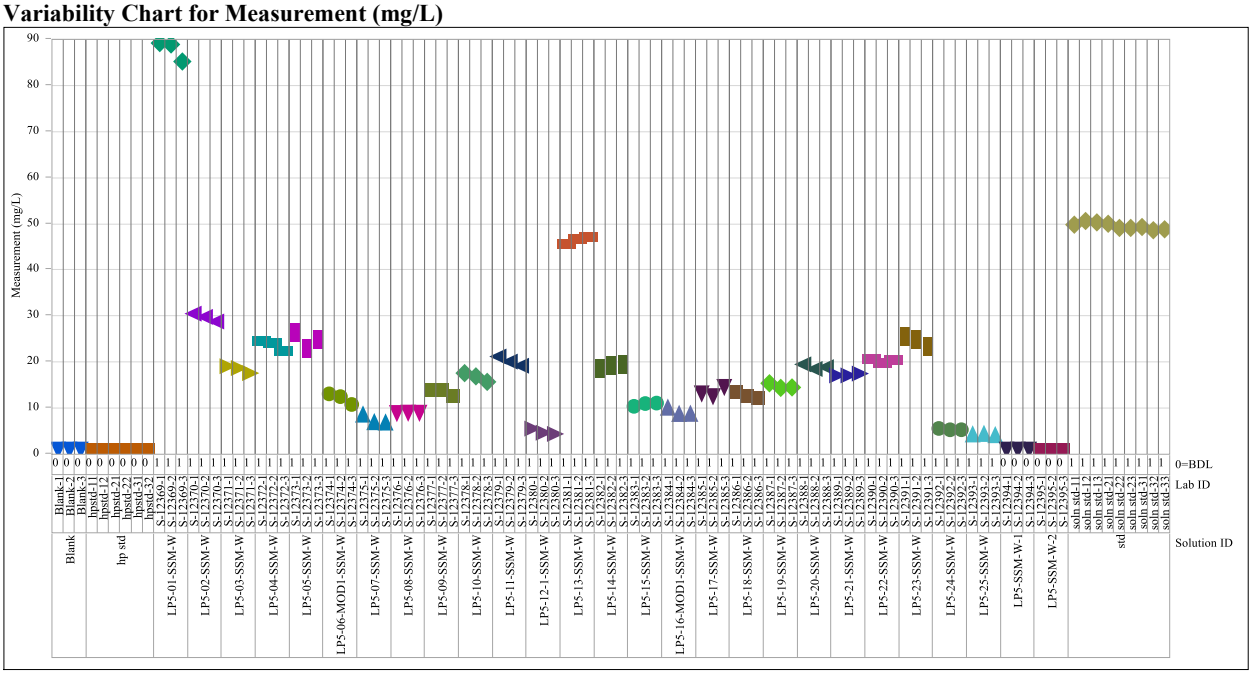
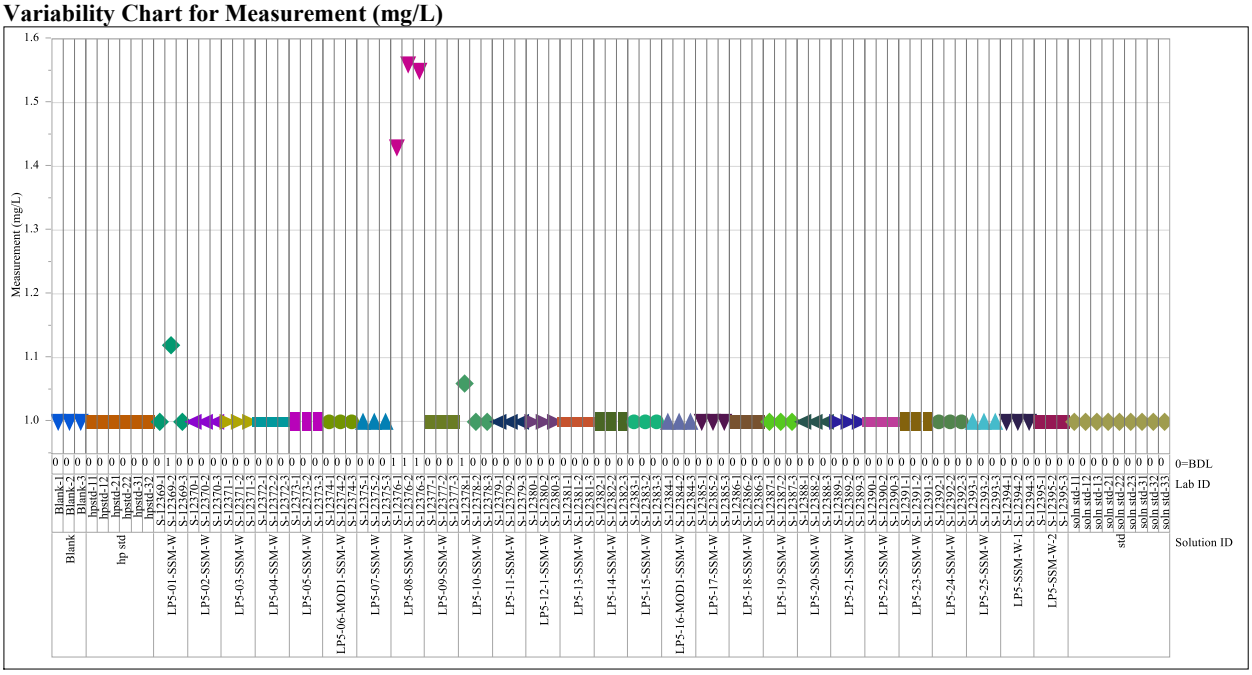


Exhibit B-1. Measurements of Wash Solutions by Analyte Grouped by Solution ID (continued)

Analyte=Sn, Analysis=ICP
Variability Chart for Measurement (mg/L)



Analyte=SO4, Analysis=IC
Variability Chart for Measurement (mg/L)

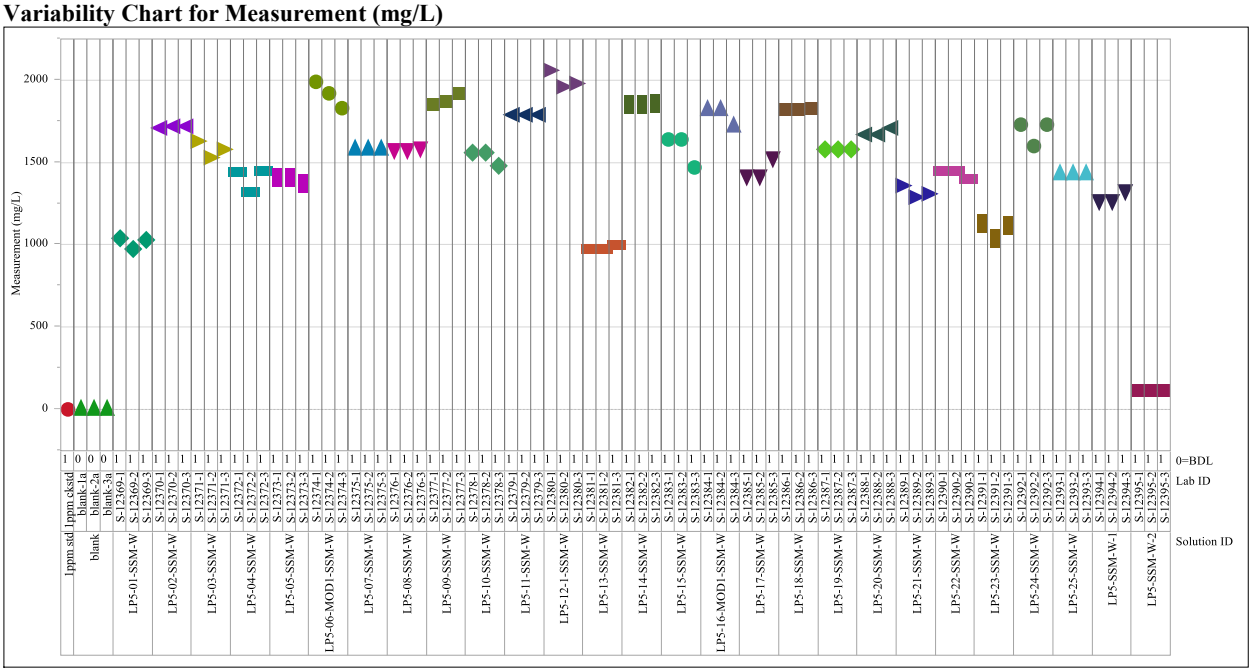
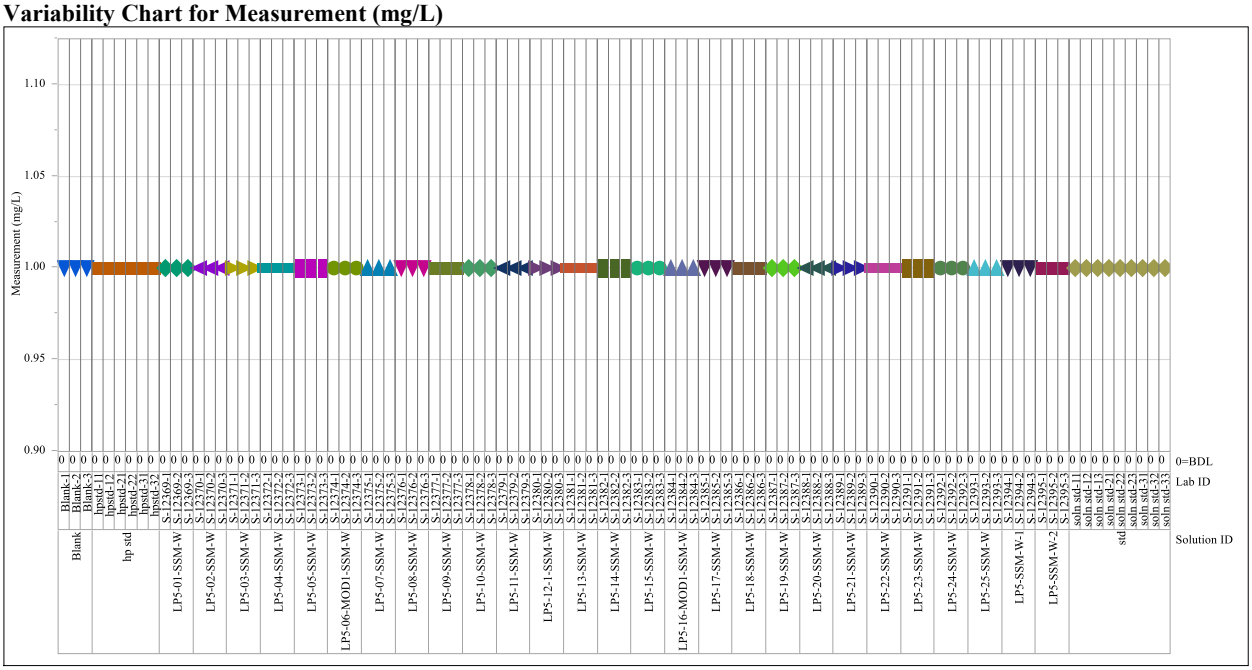


Exhibit B-1. Measurements of Wash Solutions by Analyte Grouped by Solution ID (continued)

Analyte=Ti, Analysis=ICP
Variability Chart for Measurement (mg/L)



Analyte=V, Analysis=ICP
Variability Chart for Measurement (mg/L)

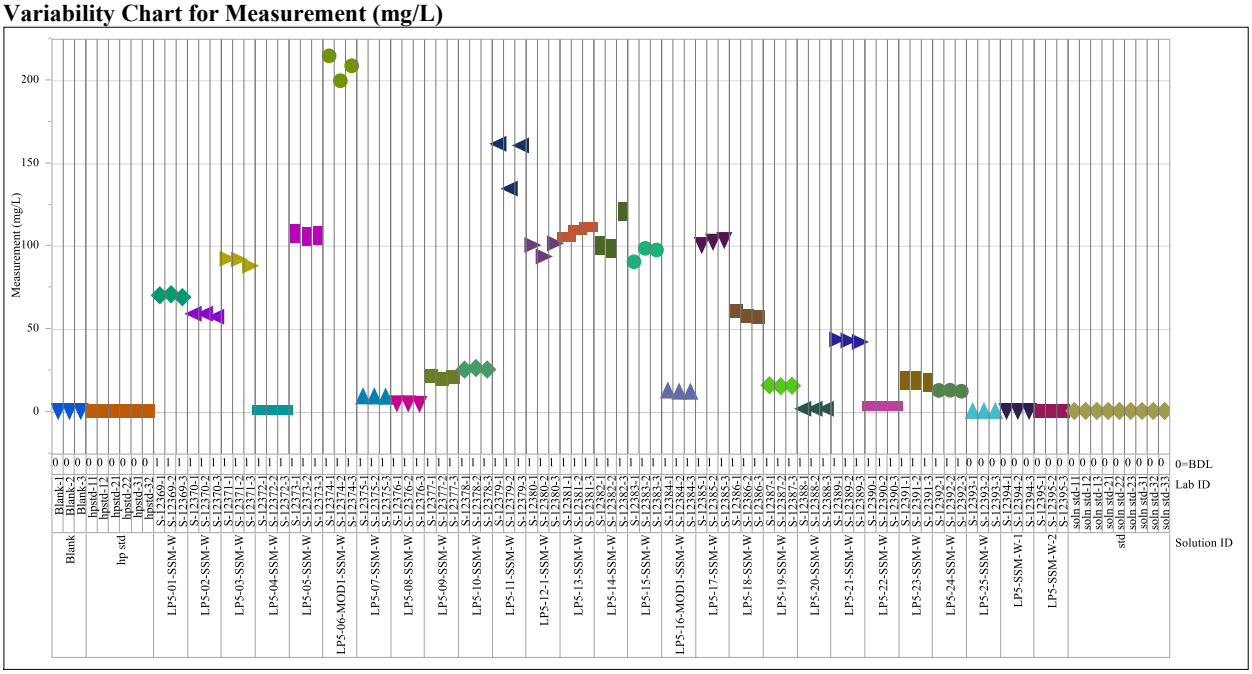
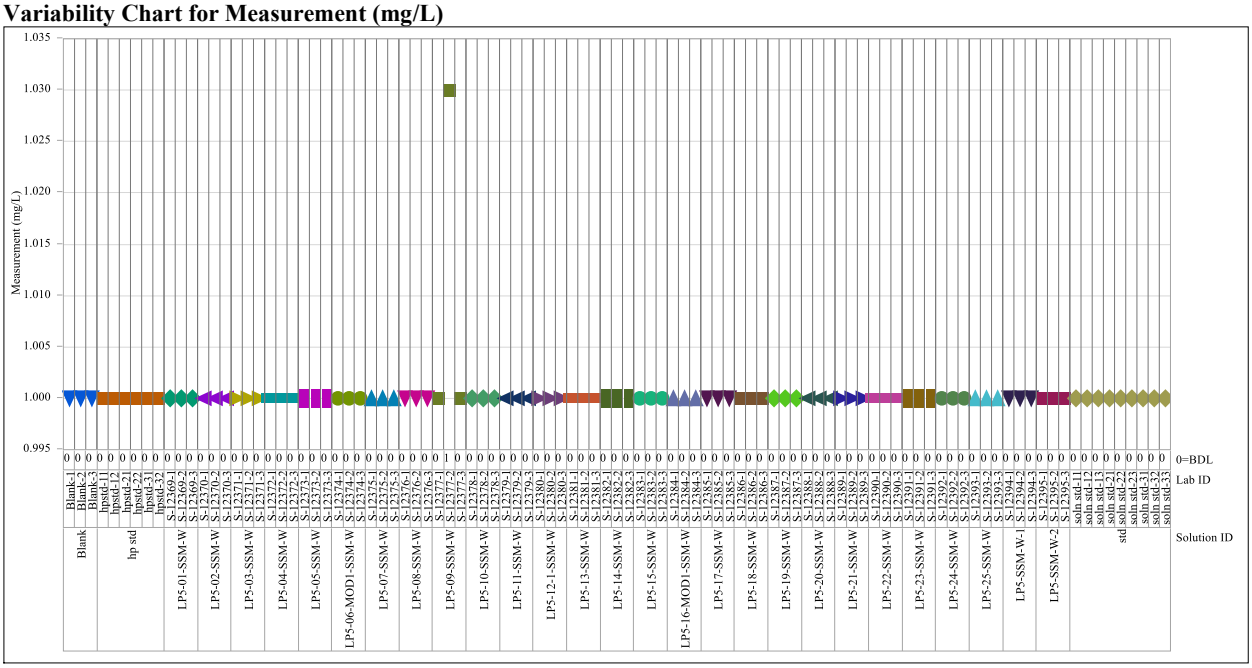


Exhibit B-1. Measurements of Wash Solutions by Analyte Grouped by Solution ID (continued)

Analyte=Zn, Analysis=ICP
Variability Chart for Measurement (mg/L)



Analyte=Zr, Analysis=ICP
Variability Chart for Measurement (mg/L)

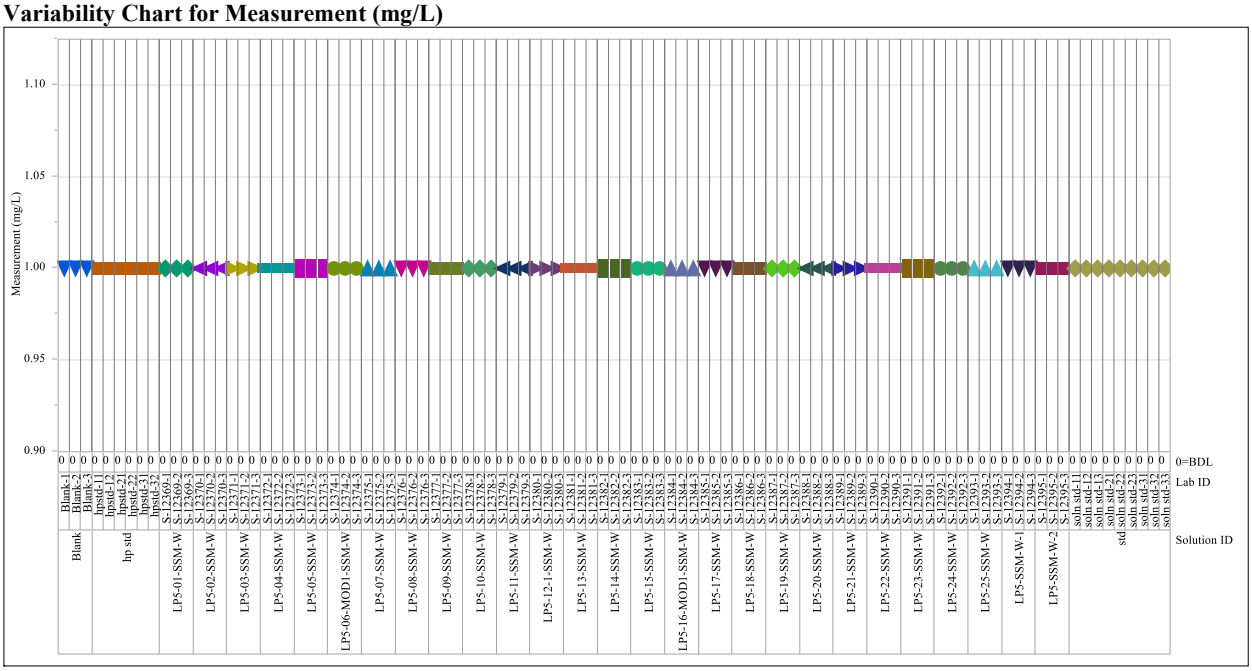
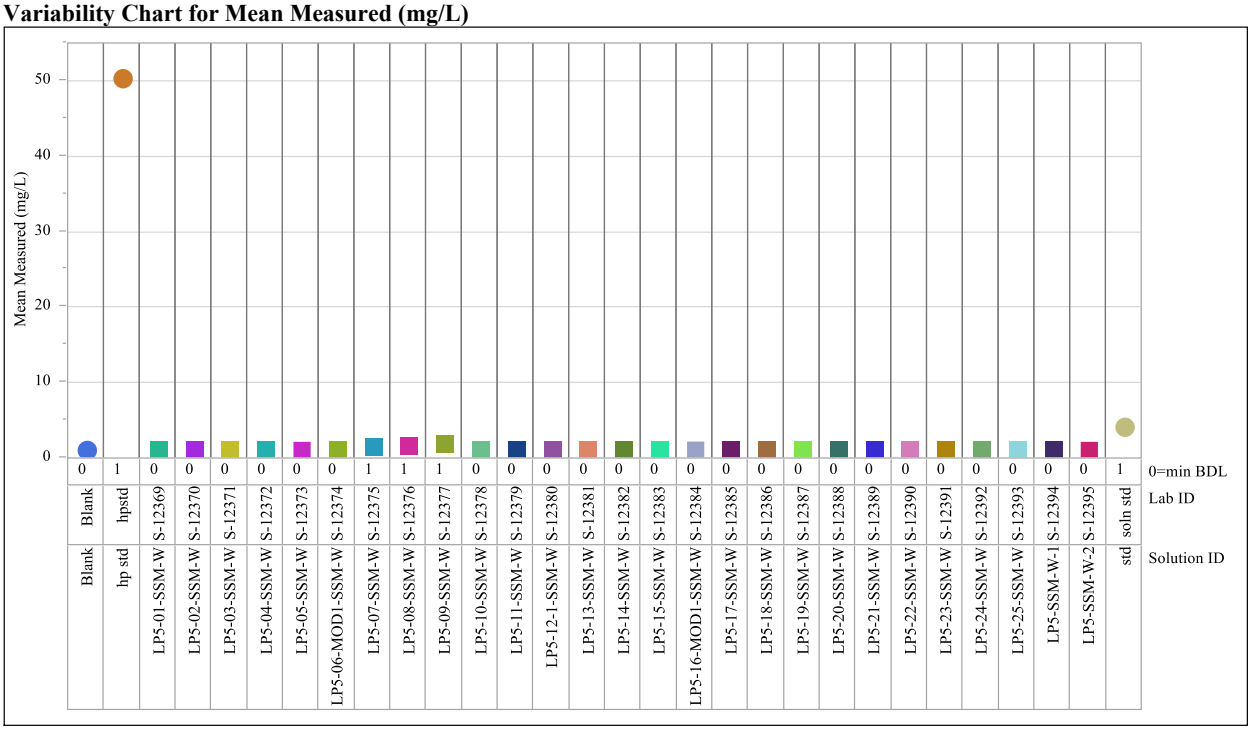


Exhibit B-2. Average Measurements of Wash Solutions by Analyte Grouped by Solution ID

Analyte=Al, Analysis=ICP
Variability Chart for Mean Measured (mg/L)



Analyte=B, Analysis=ICP
Variability Chart for Mean Measured (mg/L)

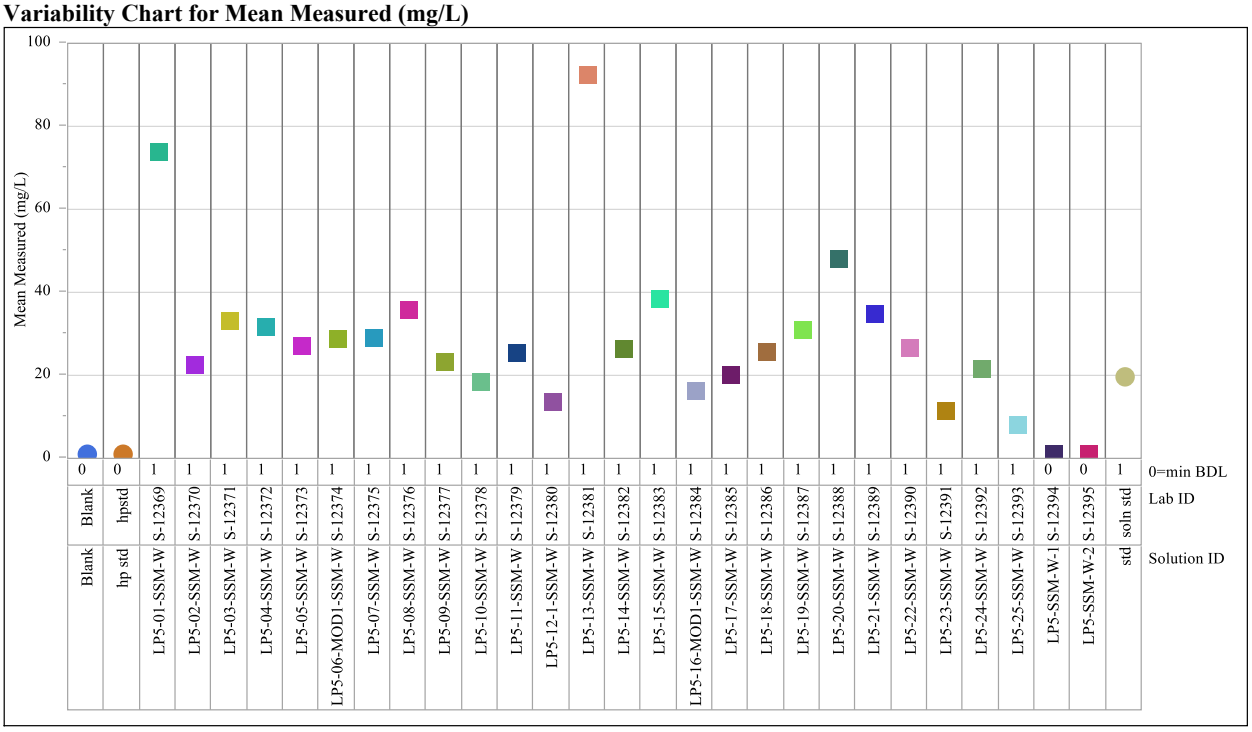
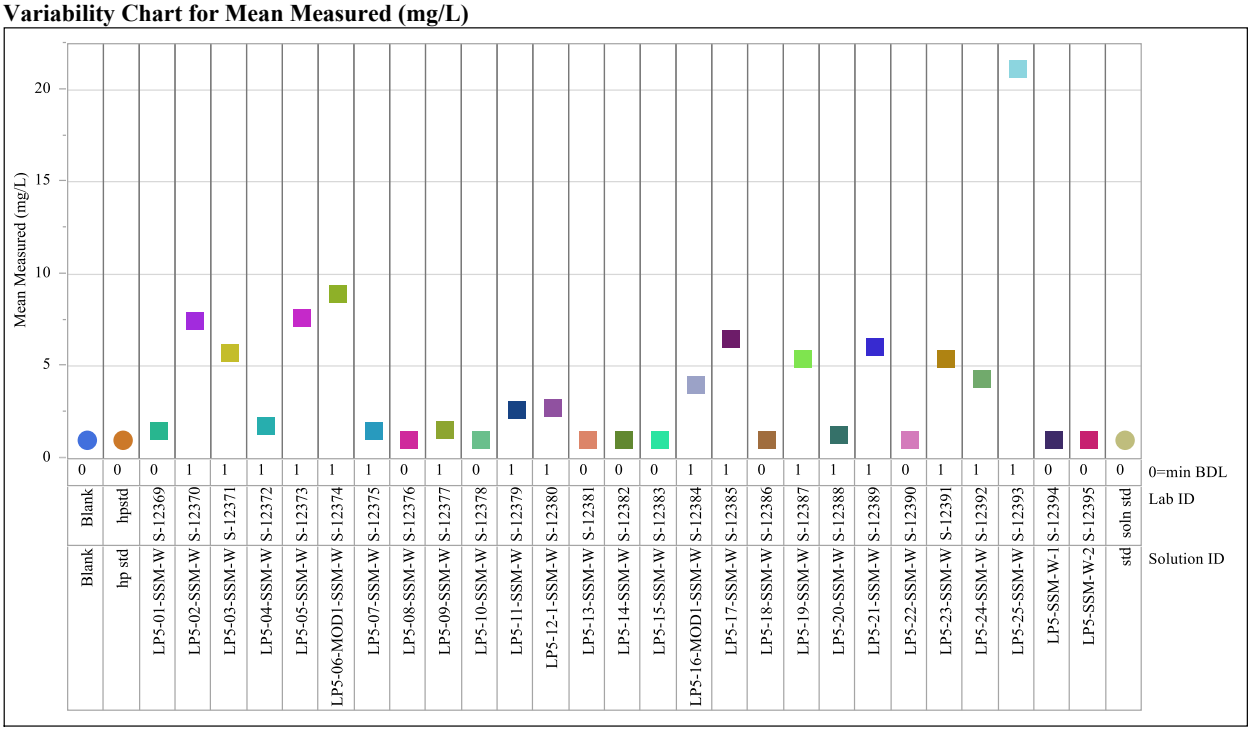


Exhibit B-2. Average Measurements of Wash Solutions by Analyte Grouped by Solution ID (continued)

Analyte=Ca, Analysis=ICP
Variability Chart for Mean Measured (mg/L)



Analyte=Cl, Analysis=IC
Variability Chart for Mean Measured (mg/L)

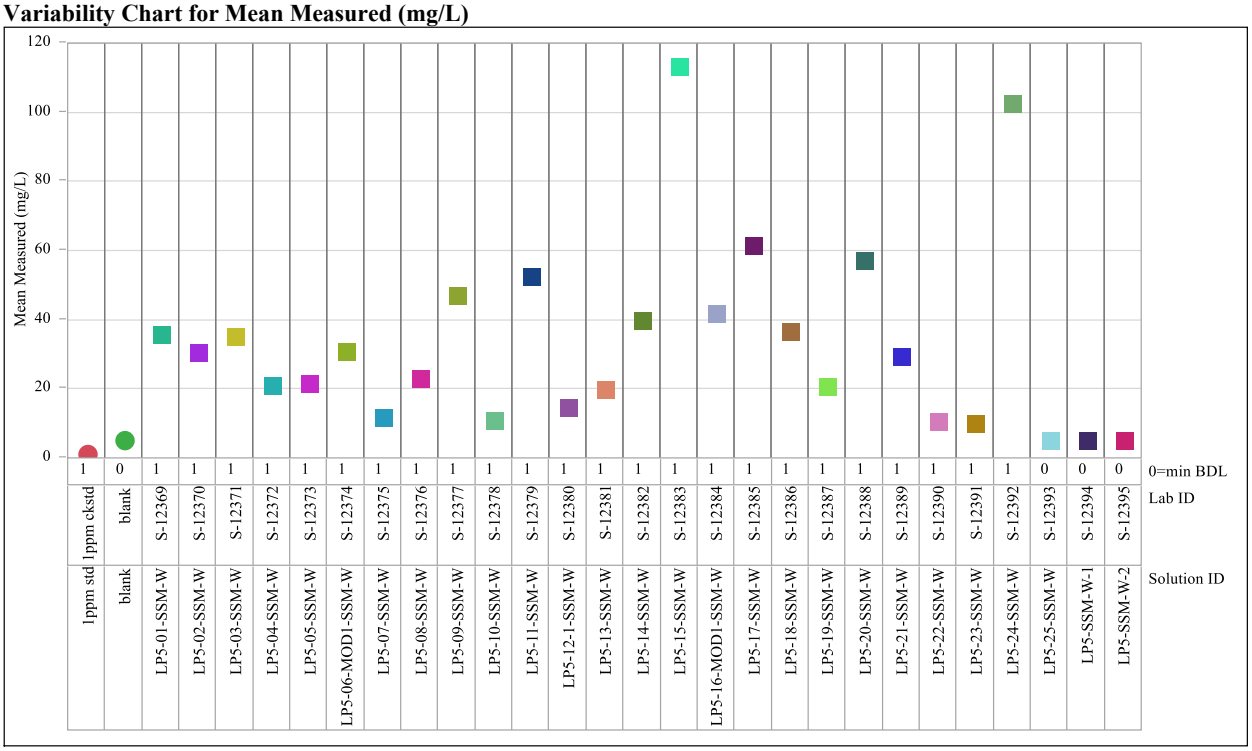
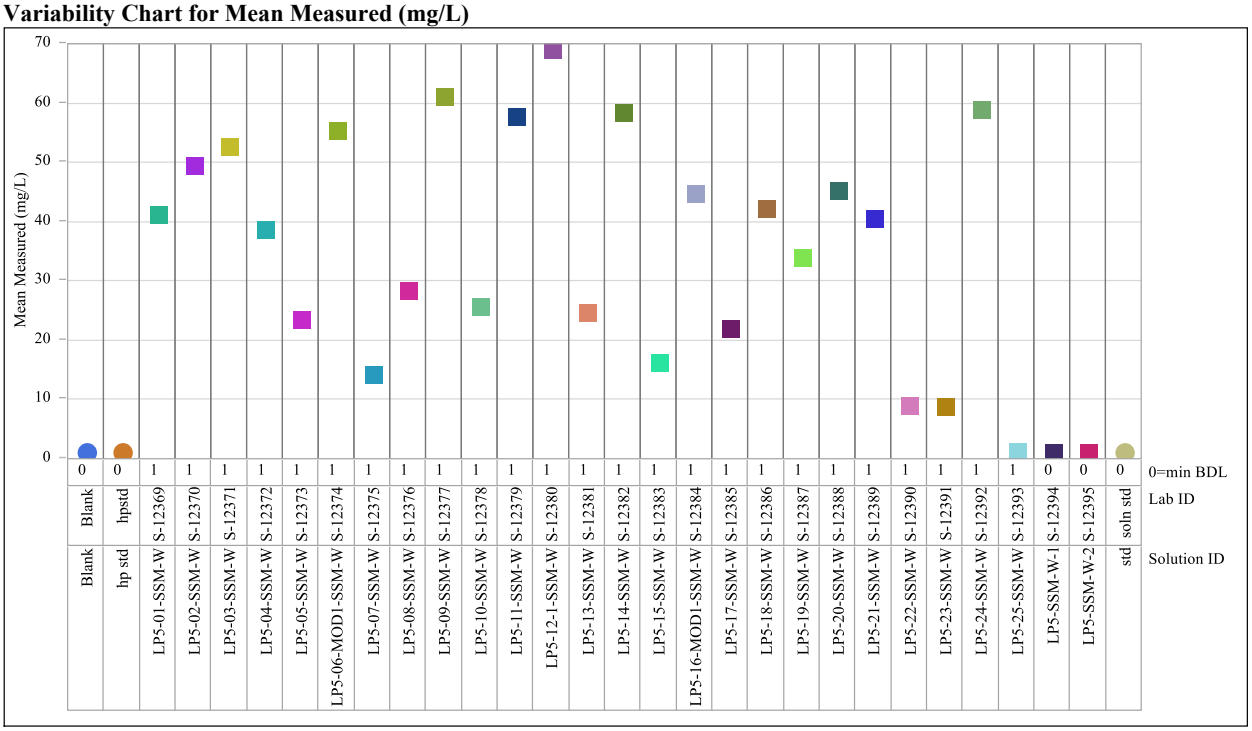


Exhibit B-2. Average Measurements of Wash Solutions by Analyte Grouped by Solution ID (continued)

Analyte=Cr, Analysis=ICP
Variability Chart for Mean Measured (mg/L)



Analyte=F, Analysis=IC
Variability Chart for Mean Measured (mg/L)

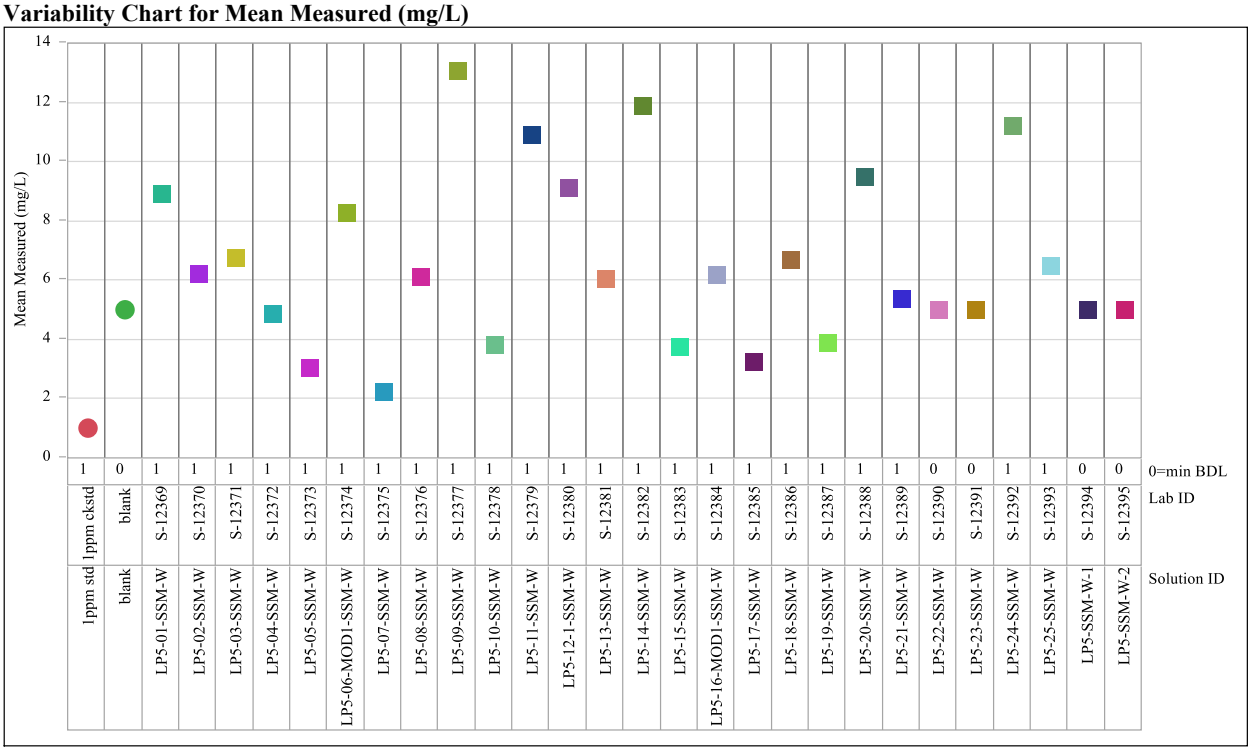
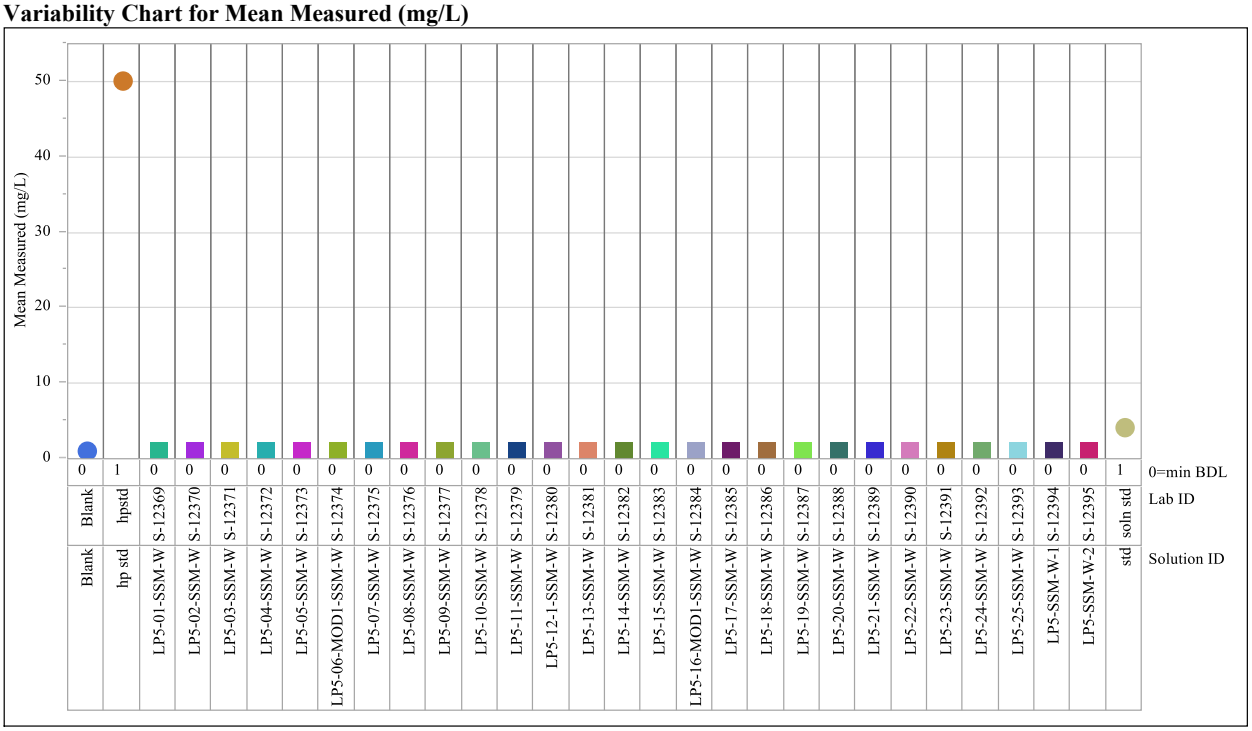


Exhibit B-2. Average Measurements of Wash Solutions by Analyte Grouped by Solution ID (continued)

Analyte=Fe, Analysis=ICP
Variability Chart for Mean Measured (mg/L)



Analyte=K, Analysis=ICP
Variability Chart for Mean Measured (mg/L)

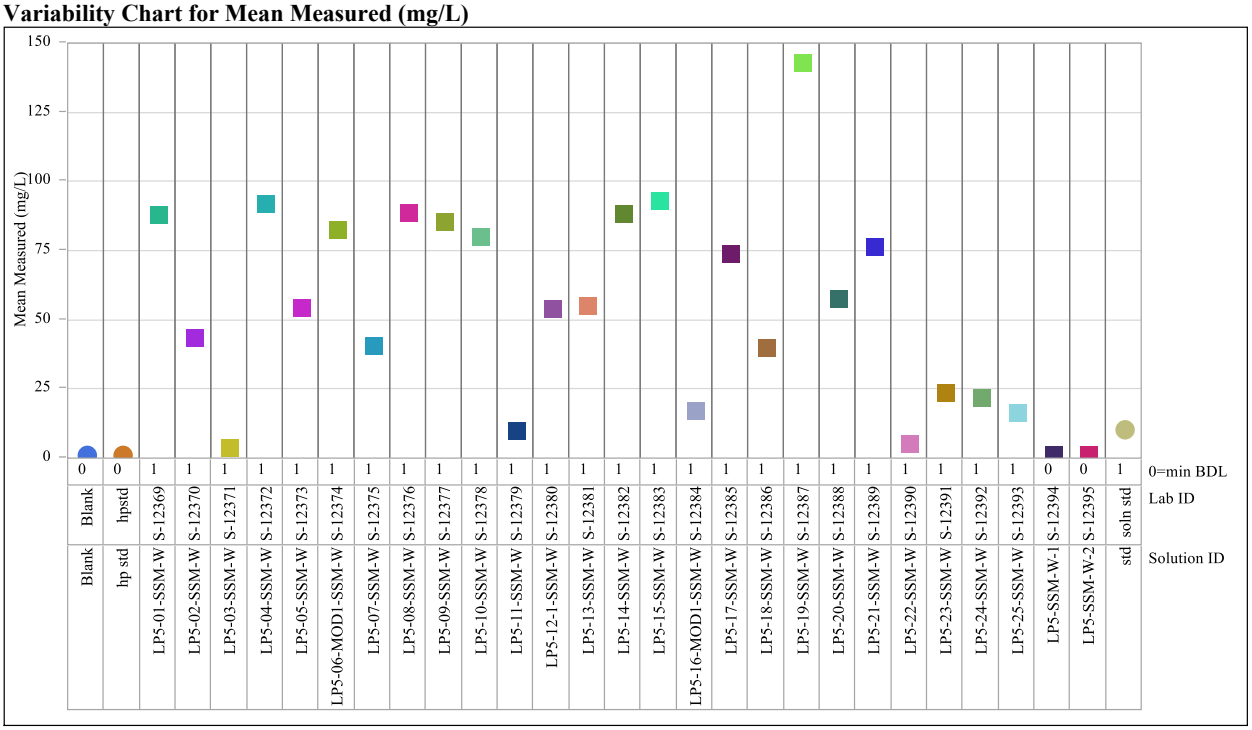
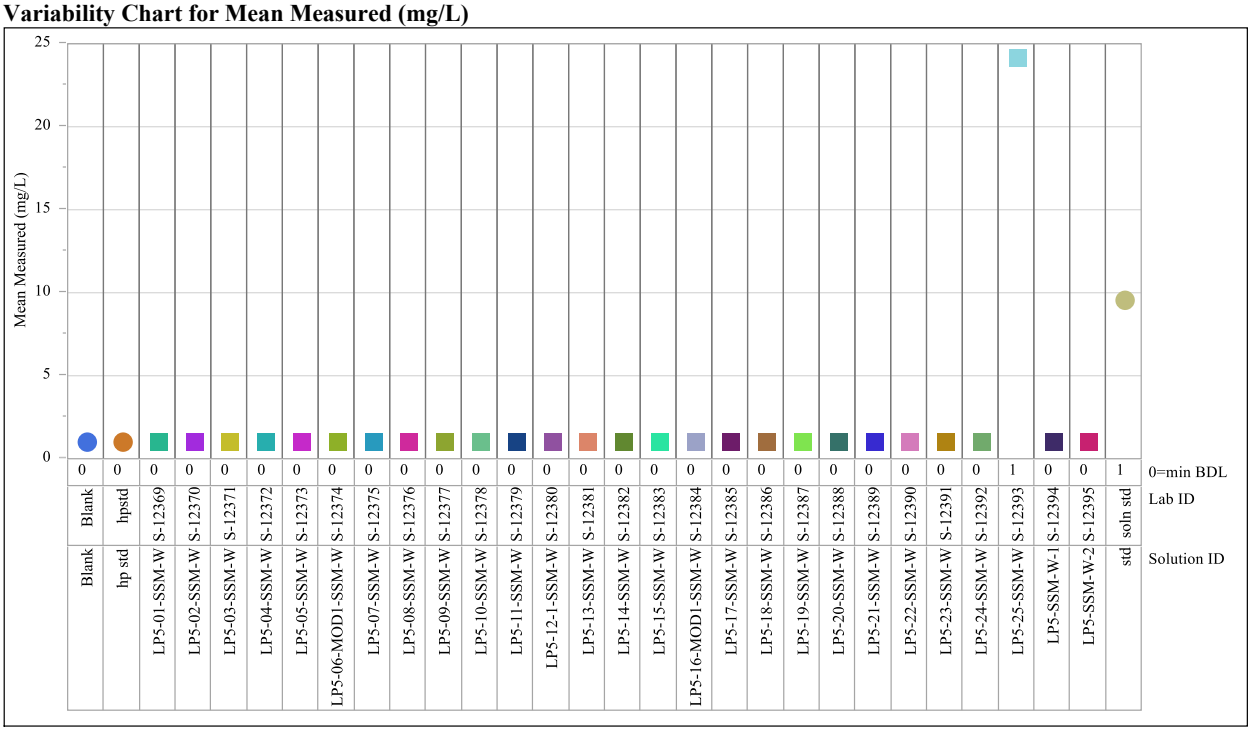


Exhibit B-2. Average Measurements of Wash Solutions by Analyte Grouped by Solution ID (continued)

Analyte=Li, Analysis=ICP
Variability Chart for Mean Measured (mg/L)



Analyte=Mg, Analysis=ICP
Variability Chart for Mean Measured (mg/L)

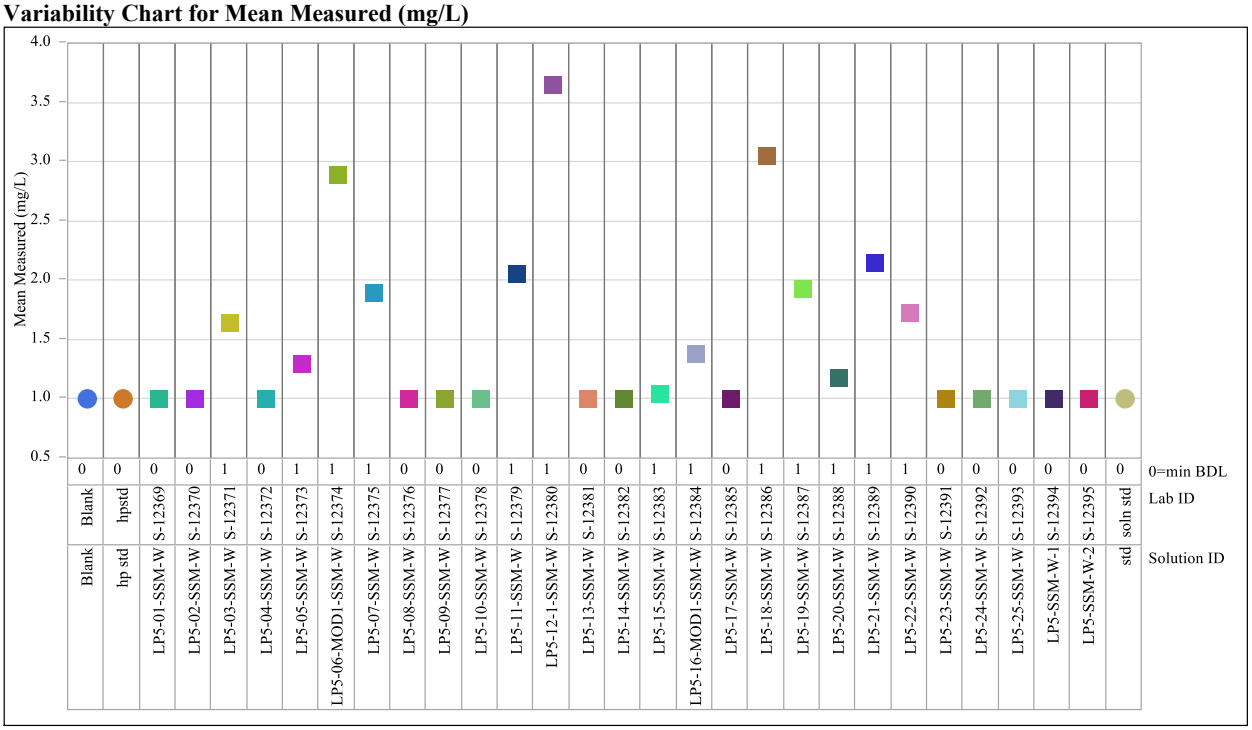
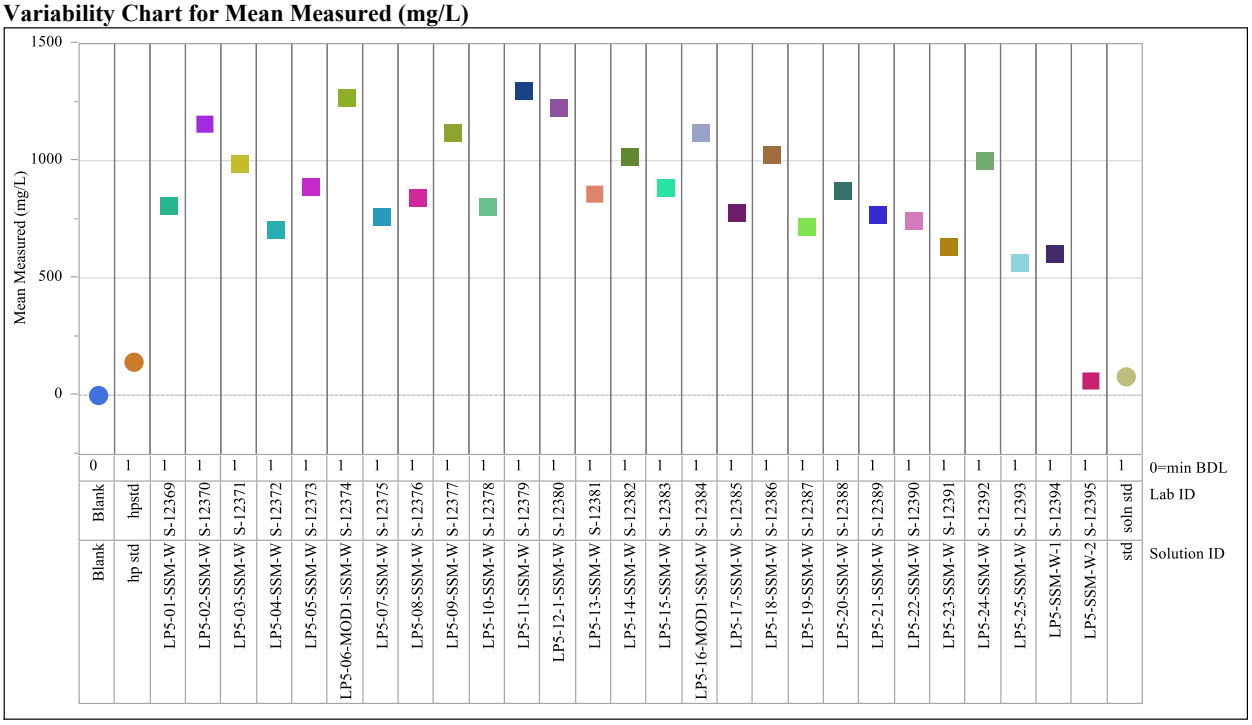


Exhibit B-2. Average Measurements of Wash Solutions by Analyte Grouped by Solution ID (continued)

Analyte=Na, Analysis=ICP
Variability Chart for Mean Measured (mg/L)



Analyte=Ni, Analysis=ICP
Variability Chart for Mean Measured (mg/L)

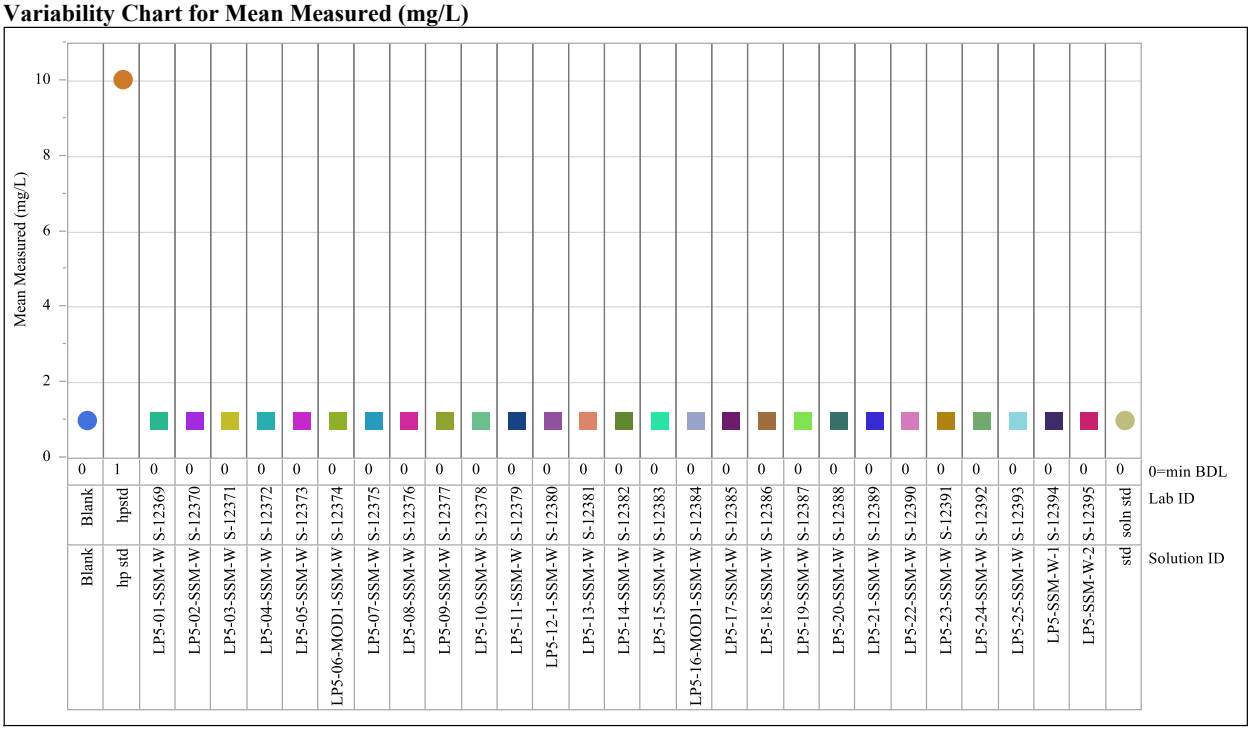
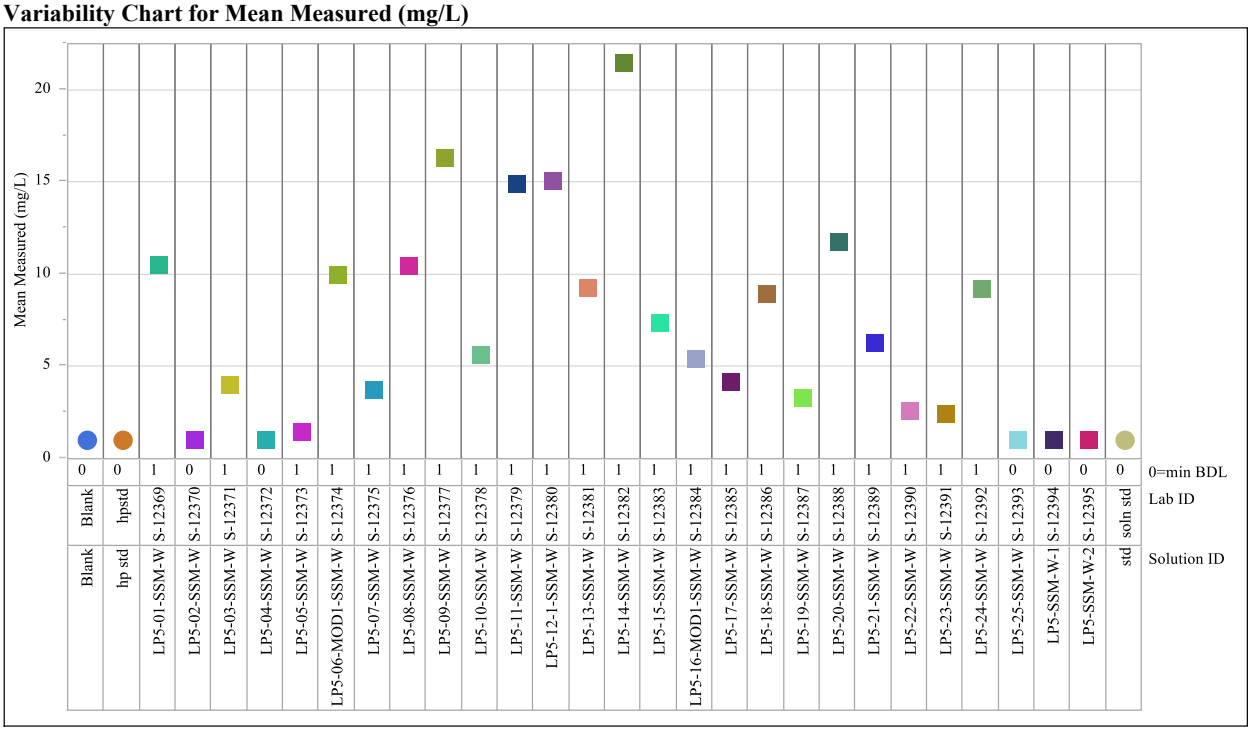


Exhibit B-2. Average Measurements of Wash Solutions by Analyte Grouped by Solution ID (continued)

Analyte=P, Analysis=ICP
Variability Chart for Mean Measured (mg/L)



Analyte=Pb, Analysis=ICP
Variability Chart for Mean Measured (mg/L)

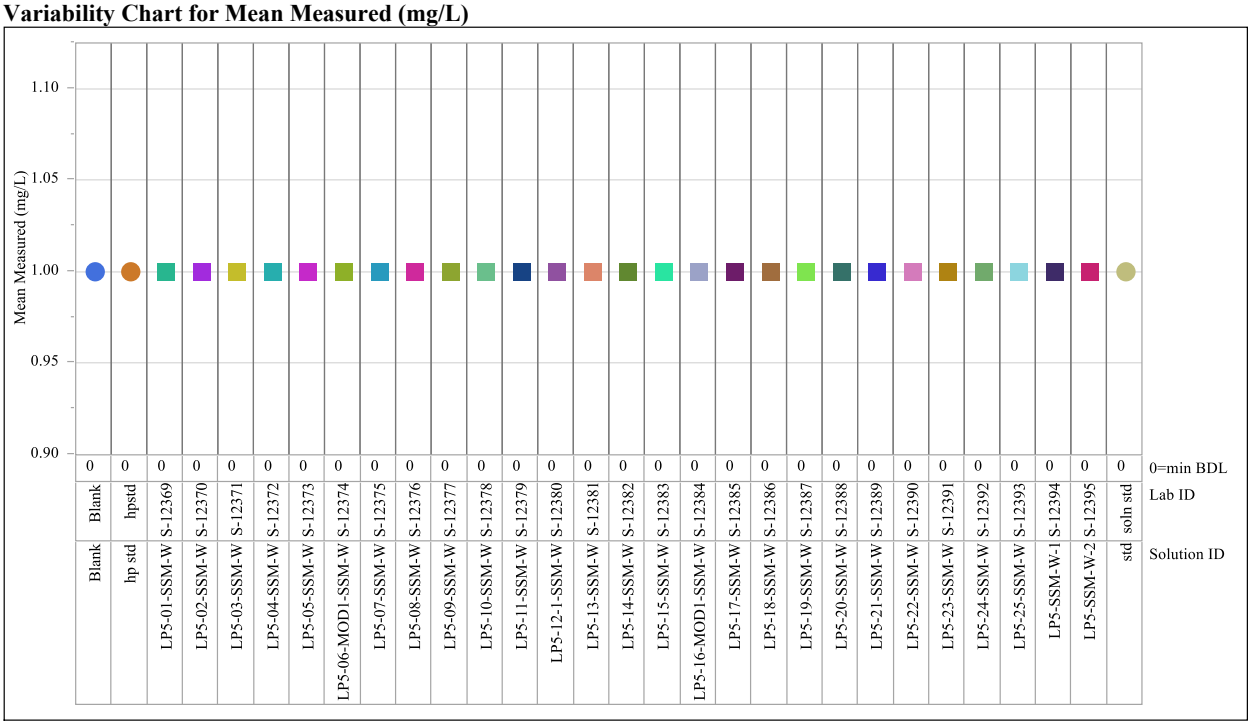
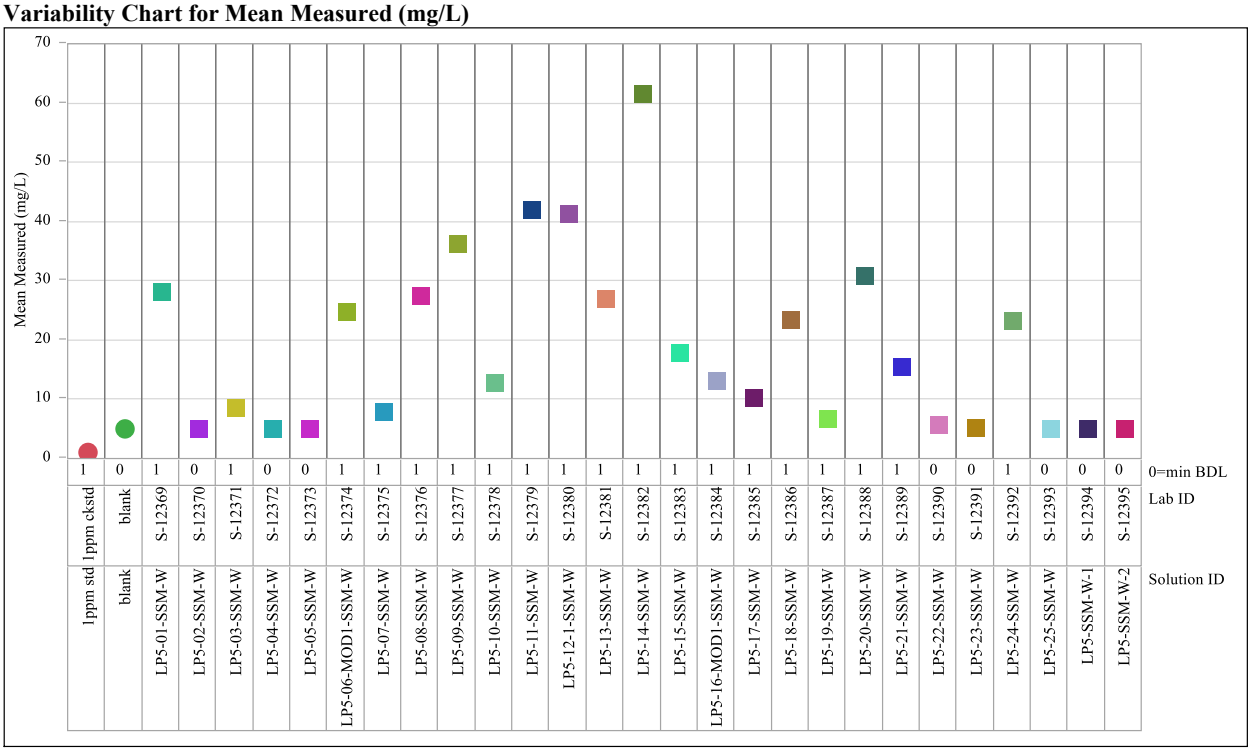


Exhibit B-2. Average Measurements of Wash Solutions by Analyte Grouped by Solution ID (continued)

Analyte=PO_4^{3-}, Analysis=IC
Variability Chart for Mean Measured (mg/L)



Analyte=Re, Analysis=ICP
Variability Chart for Mean Measured (mg/L)

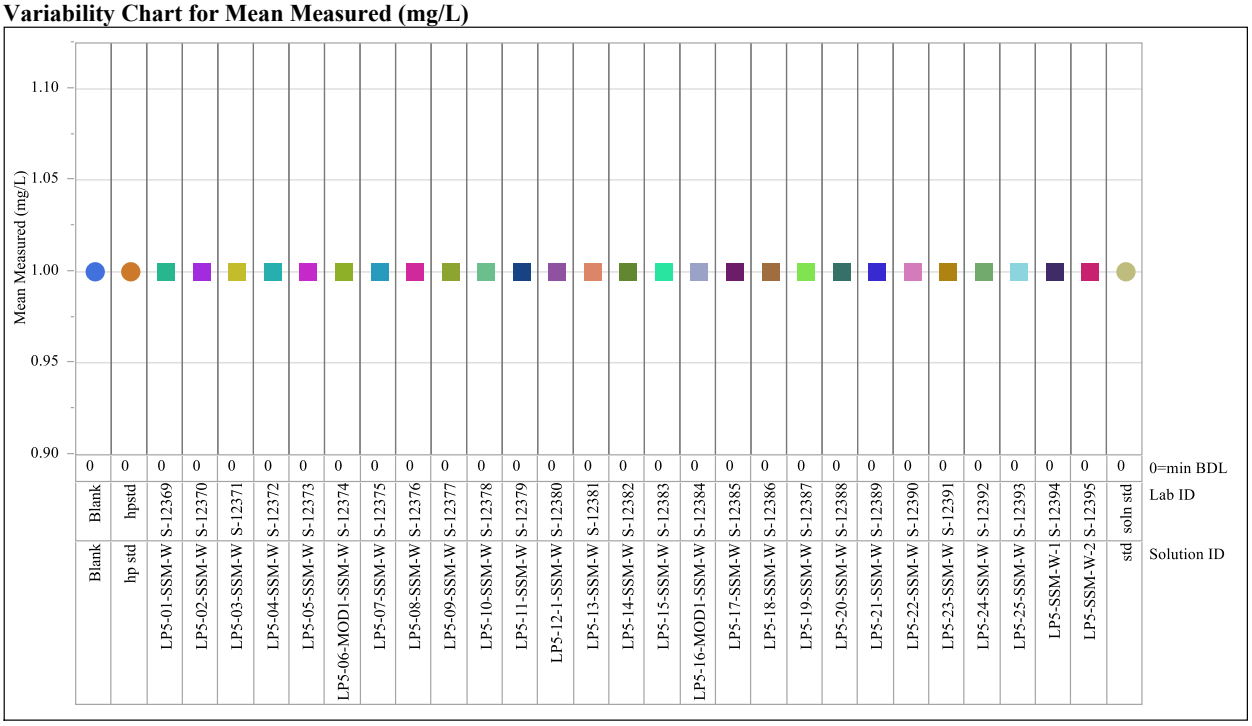
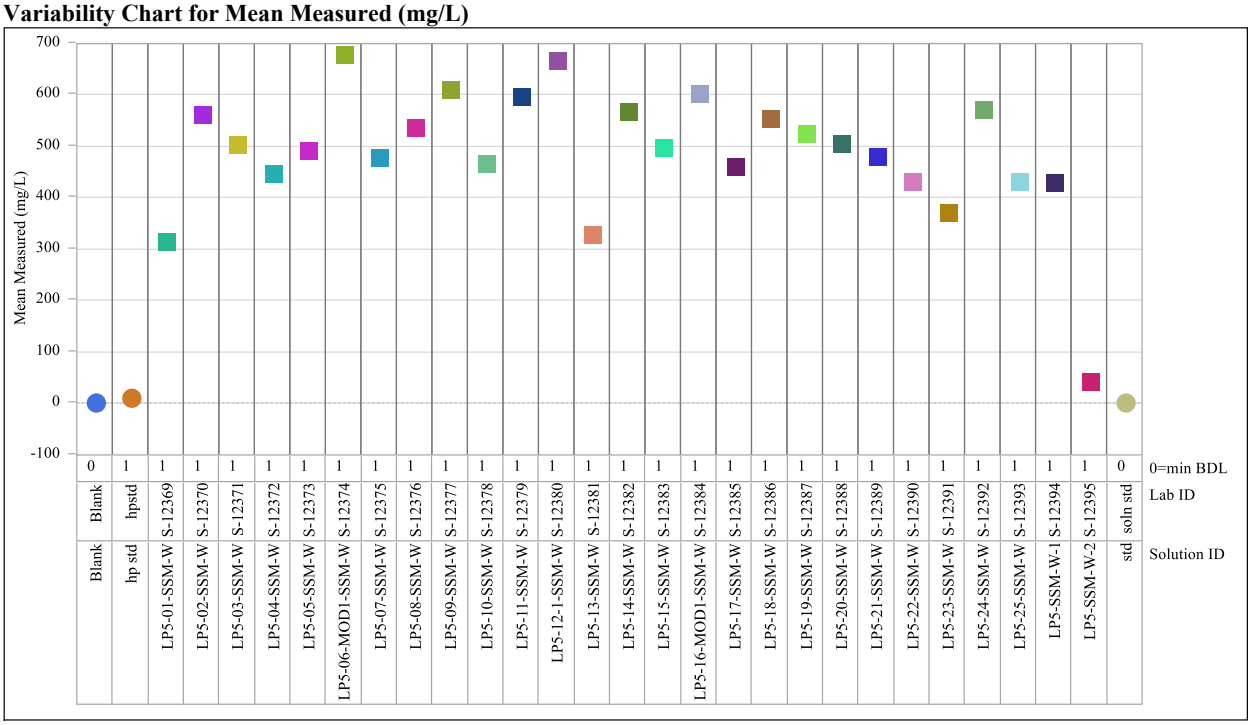


Exhibit B-2. Average Measurements of Wash Solutions by Analyte Grouped by Solution ID (continued)

Analyte=S, Analysis=ICP
Variability Chart for Mean Measured (mg/L)



Analyte=Si, Analysis=ICP
Variability Chart for Mean Measured (mg/L)

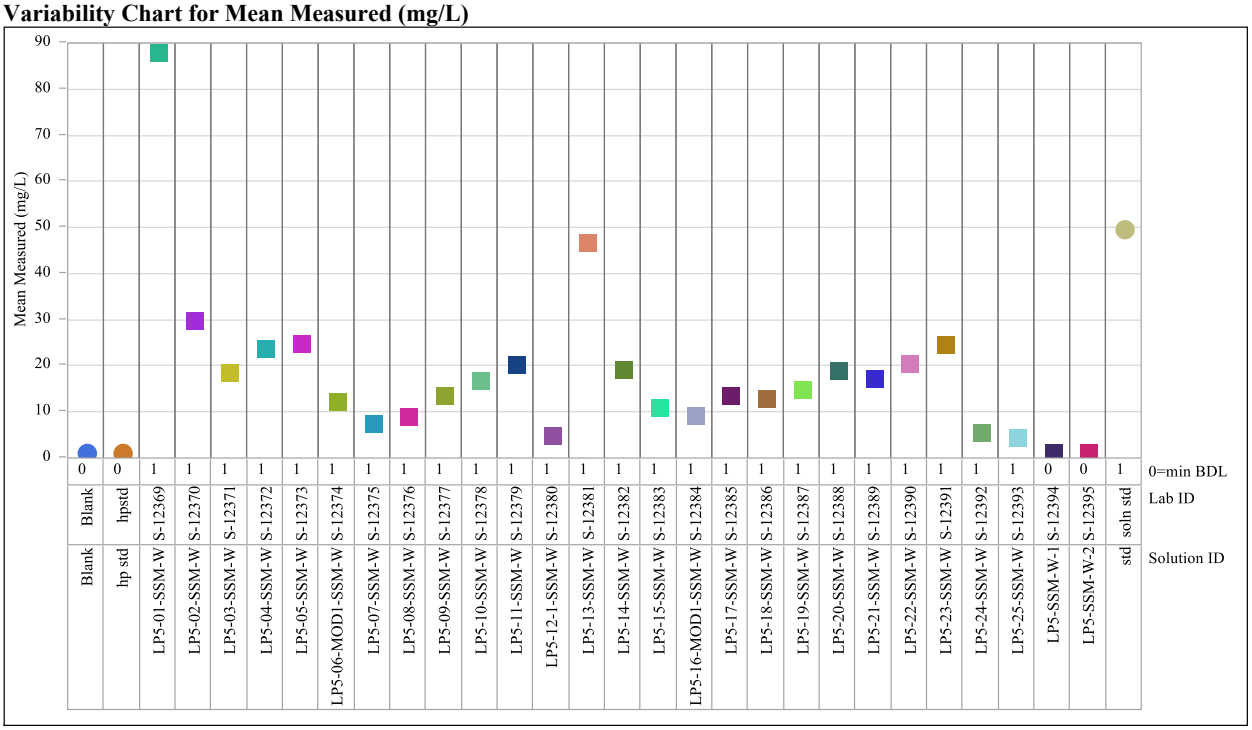
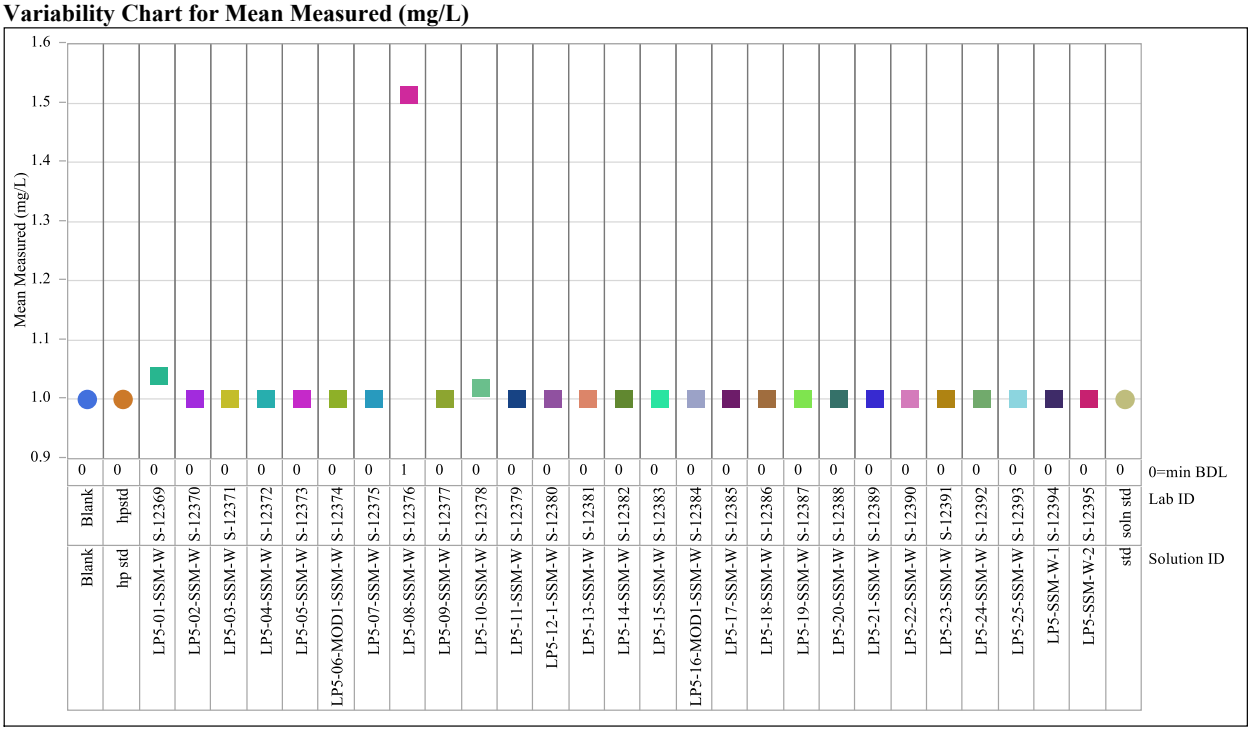


Exhibit B-2. Average Measurements of Wash Solutions by Analyte Grouped by Solution ID (continued)

Analyte=Sn, Analysis=ICP
Variability Chart for Mean Measured (mg/L)



Analyte=SO_4^{2-}, Analysis=IC
Variability Chart for Mean Measured (mg/L)

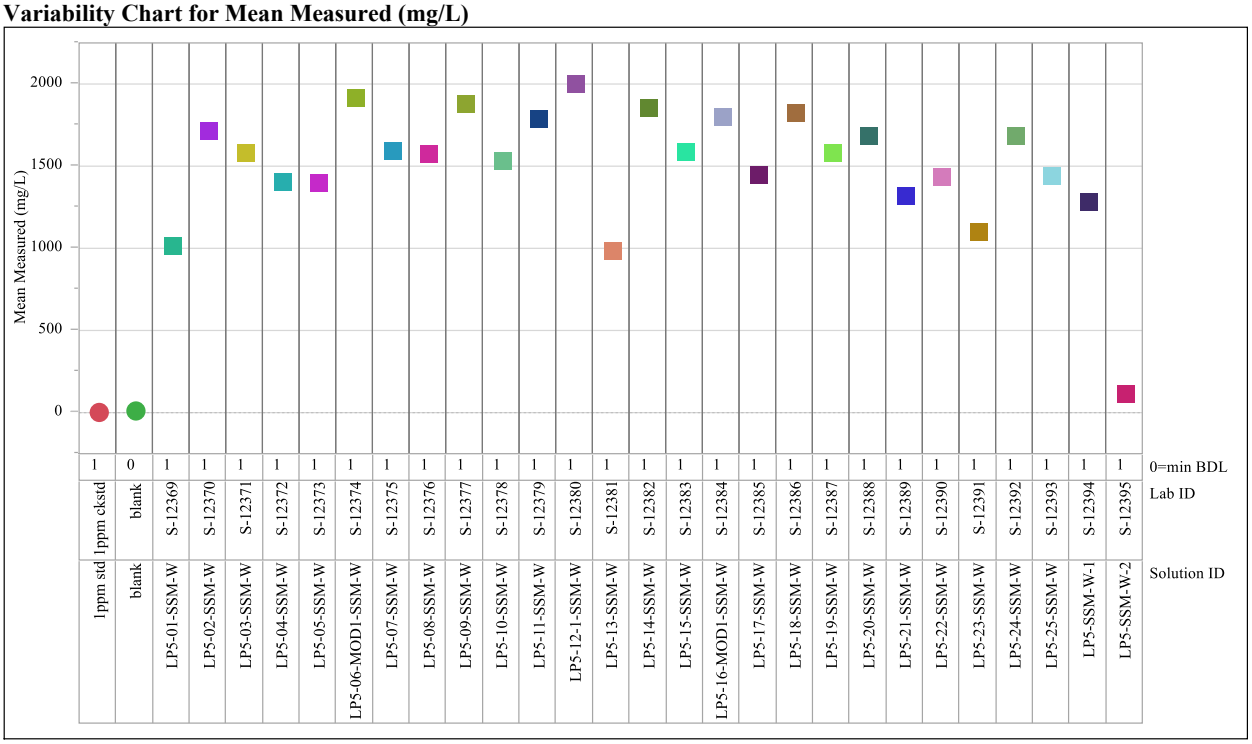
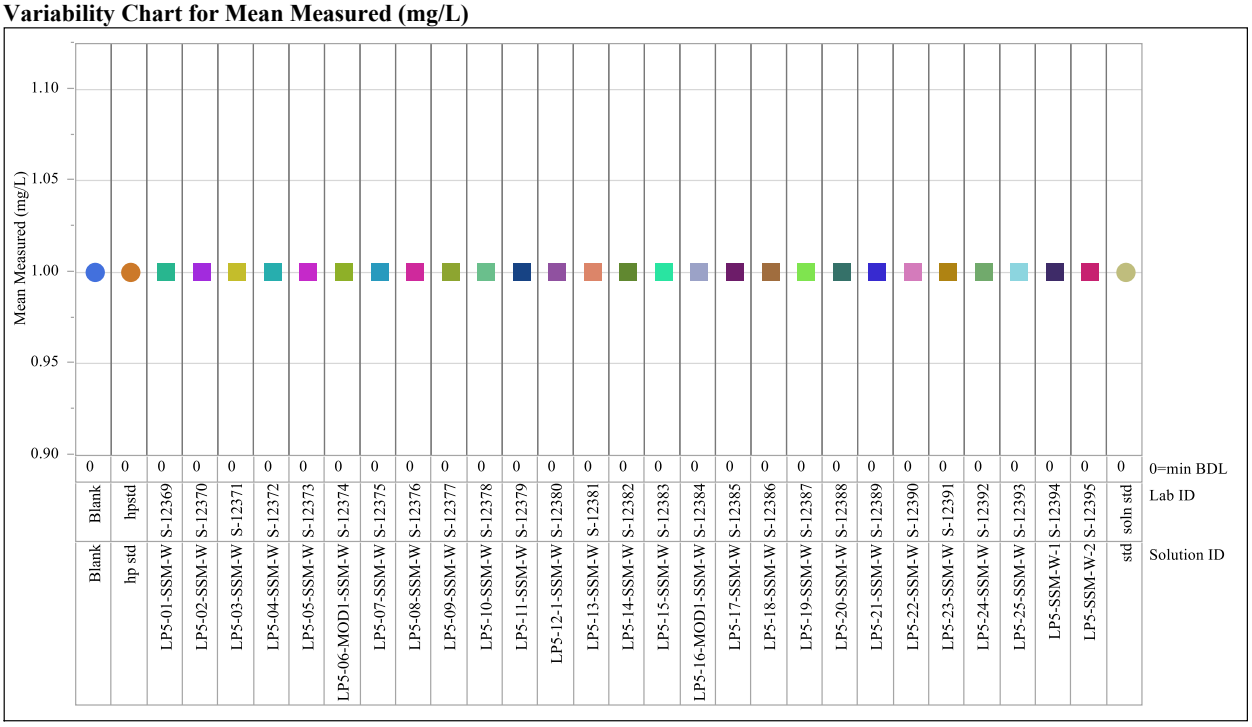


Exhibit B-2. Average Measurements of Wash Solutions by Analyte Grouped by Solution ID (continued)

Analyte=Ti, Analysis=ICP
Variability Chart for Mean Measured (mg/L)



Analyte=V, Analysis=ICP
Variability Chart for Mean Measured (mg/L)

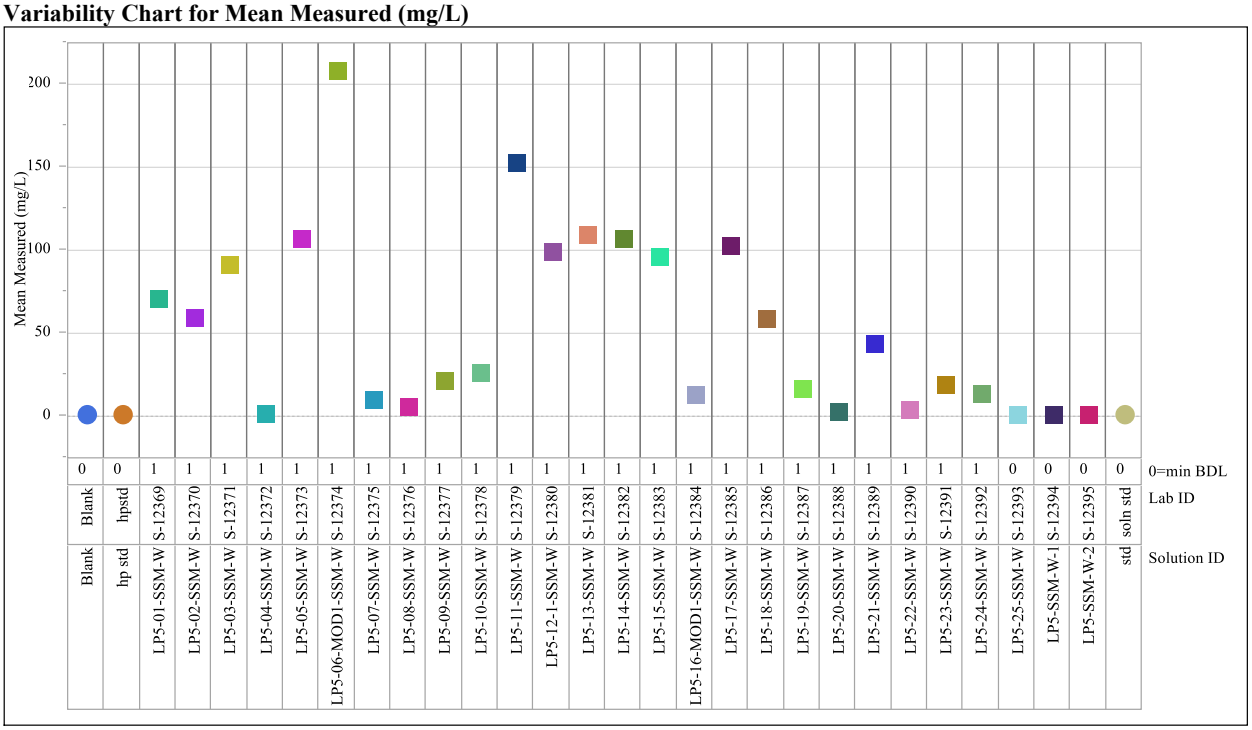
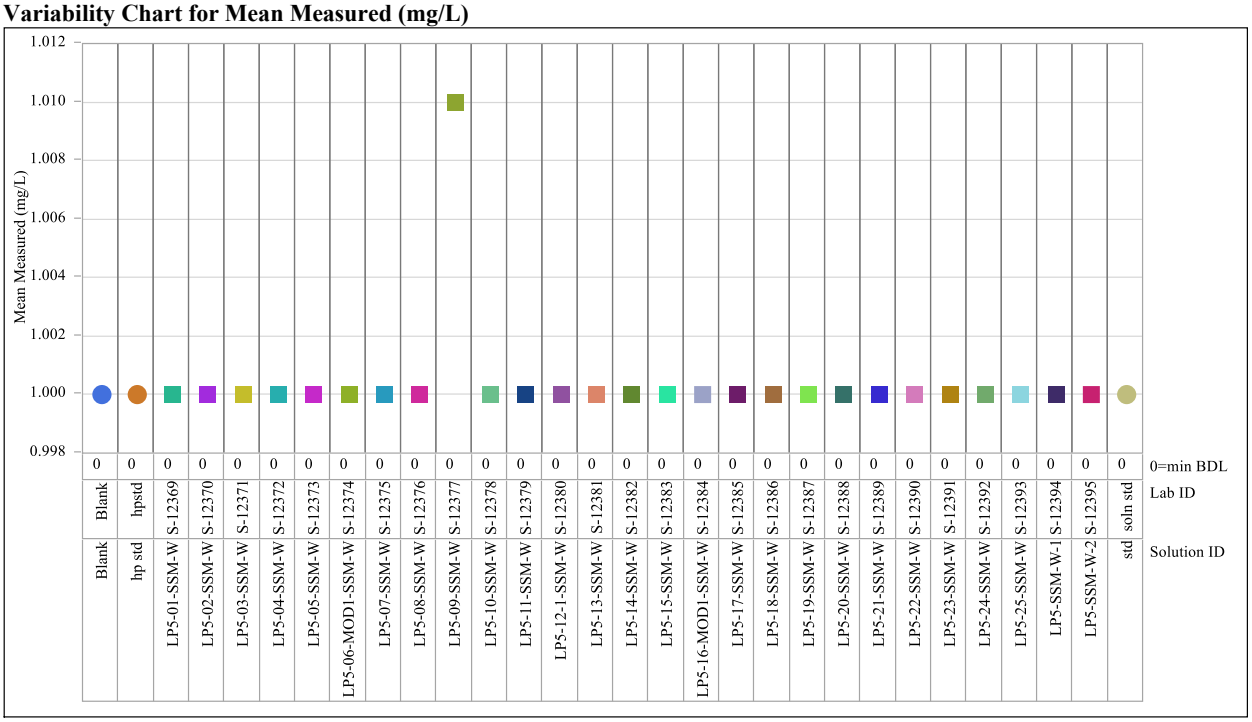
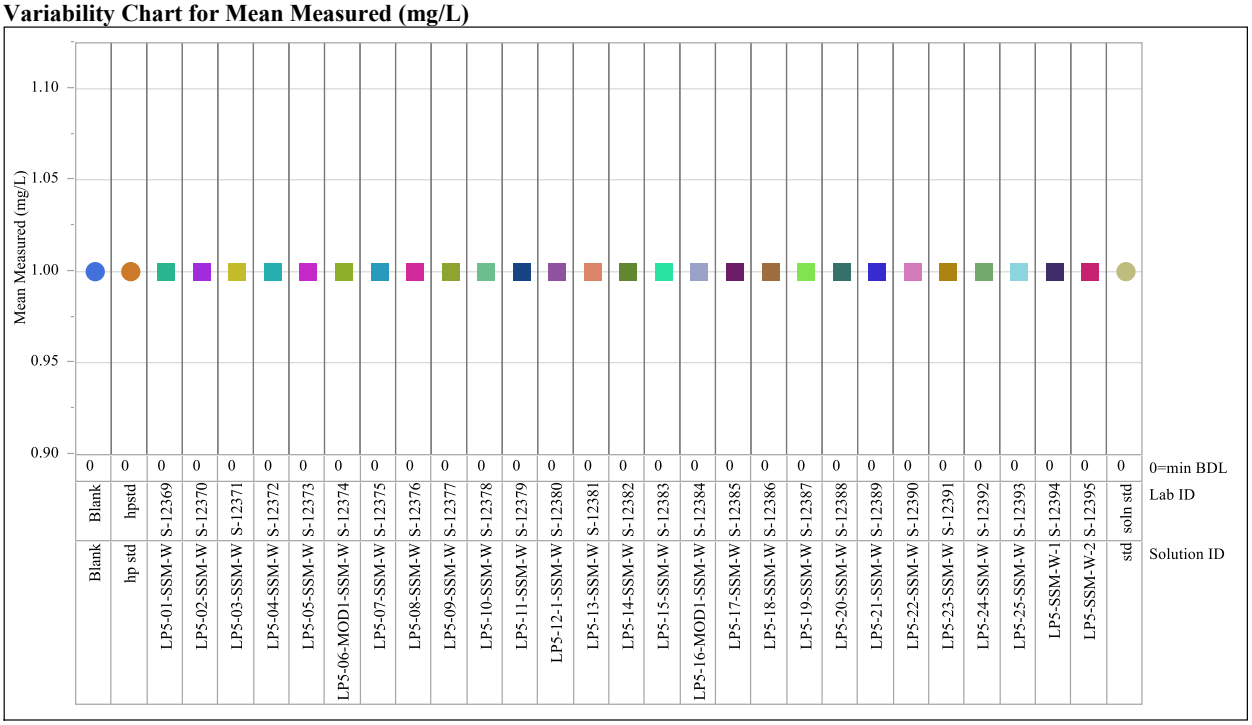


Exhibit B-2. Average Measurements of Wash Solutions by Analyte Grouped by Solution ID (continued)

Analyte=Zn, Analysis=ICP
Variability Chart for Mean Measured (mg/L)



Analyte=Zr, Analysis=ICP
Variability Chart for Mean Measured (mg/L)



Distribution:

Jake.Amoroso@srnl.doe.gov
CJ.Bannochie@srnl.doe.gov
William.Bates@srnl.doe.gov
Marion.Cofer@srnl.doe.gov
Alex.Cozzi@srnl.doe.gov
Charles.Crawford@srnl.doe.gov
William.C.Eaton@pnnl.gov
Holly.Hall@srnl.doe.gov
Erich.Hansen@srnl.doe.gov
Connie.Herman@srnl.doe.gov
Anthony.Howe@srnl.doe.gov
Madison.Hsieh@srnl.doe.gov
Fabienne.Johnson@srnl.doe.gov
Albert_A_Kruger@orp.doe.gov
Christine.Langton@srnl.doe.gov
Brady.Lee@srnl.doe.gov
Charmayne.Lonergan@pnnl.gov
Joseph.Manna@srnl.doe.gov
Daniel.McCabe@srnl.doe.gov
Kandice.Miles@srnl.doe.gov
Gregg.Morgan@srnl.doe.gov
James.Neeway@pnnl.gov
Eric_Nelson@orp.doe.gov
Ivan_G_Papp@orp.doe.gov
Frank.Pennebaker@srnl.doe.gov
Elaine_N_Porcaro@orp.doe.gov
William.Ramsey@srnl.doe.gov
Marissa.Reigel@srnl.doe.gov
Whitney.Riley@srnl.doe.gov
Renee.Russell@pnnl.gov
Eric.Skidmore@srnl.doe.gov
Anna.Stanfield@srnl.doe.gov
Austin.Stanfield@srnl.doe.gov
Michael.Stone@srnl.doe.gov
William.Swift@srnl.doe.gov
John.Vienna@pnnl.gov
Boyd.Wiedenman@srnl.doe.gov
Richard.Wyrwas@srnl.doe.gov
Records Administration (EDWS)