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Characterization of Hanford LAW Phase 3 Glasses

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EXECUTIVE SUMMARY

This report provides analyses of glass compositions, wash solution compositions, and Product Consistency Test (PCT) leachate compositions for a series of simulated low-activity waste (LAW) glasses fabricated at the Pacific Northwest National Laboratory (PNNL). These data will be used in the development of improved property/composition models for LAW glass at Hanford.

Chemical analyses were performed on a representative sample of each of the quenched and sulfur saturated glasses to allow for comparisons with the targeted compositions. For some of the quenched glasses, measured concentrations of Cr_2O_3, K_2O, Na_2O, P_2O_5, and ZrO_2 were below the targeted values. For some of the sulfur saturated glasses, the measured concentrations of Al_2O_3, Cl^-, Cr_2O_3, F^-, K_2O, Na_2O, P_2O_5, V_2O_5, and ZrO_2 were generally low relative to the targeted values.

A comparison of the measured compositions of the quenched and sulfur saturated versions of the study glasses showed that the measured concentrations of Al_2O_3, Cl^-, and F^- were lower for most of the sulfur saturated glasses. The measured Cr_2O_3 and K_2O concentrations were markedly lower for the sulfur saturated versions of the glasses as compared to the quenched versions, which may indicate that these elements partitioned to the soluble sulfur salts. A set of modified glasses was received from PNNL later in this study. Chemical analysis showed that these glasses generally met their targeted compositions. The measured SO_3 concentrations were higher for most of the sulfur saturated glasses relative to those of the quenched versions, as expected.

Chemical analysis of the wash solutions that resulted from preparation of the sulfur saturated melts identified Cr, K, Na, P, S, and V as the major elements in solution. With the exception of sulfur, this may explain why the measured concentrations of these components in the study glasses were generally below the targeted values.

PNNL performed PCTs on quenched and canister centerline cooled (CCC) versions of the study glasses, as well as the modified glasses. The leachates were sent to SRNL for chemical analysis. Minor scatter in the measured values among the triplicate samples for each glass was noted, with significant differences among the triplicate values noted for four of the CCC glasses. Normalized concentration values for some of the study glasses were greater than the 100 g/L maximum (total dissolution), which may indicate an error in the test. It is recommended that PNNL review the performance of the PCTs to determine the cause of these potential outliers and errors.

Revision 1 of this report:

- Corrects an issue with high chromium measurements for the Mod glass compositions and the second set of PCT leachates (Revised Sections 2.4, 3.6.2, and 3.7; revised Tables 3-1, G-1, and H-1; Revised Exhibit H-1)
- Adds data for the Mod glass wash solutions that were unintentionally omitted (Revised Sections 2.4 and 3.4; added Tables 3-2, D-1, and D-2)
- Corrects an issue with rounding of the targeted Al_2O_3 concentrations in the study glasses (Revised Tables A-6 and B-5; Revised Exhibits A-2 and B-2)

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LIST OF ABBREVIATIONS

BDL	Below Detection Limit
CCC	Canister Centerline Cooled
DOE	U.S. Department of Energy
EA	Environmental Assessment
IC	Ion Chromatography
ICP-AES	Inductively Coupled Plasma – Atomic Emission Spectroscopy
HLW	High Level Waste
KH	Potassium hydroxide digestion
LAW	Low Activity Waste
LM	Lithium Metaborate fusion
LRM	Low-level Reference Material
Mod	Modified
ORP	Office of River Protection
PCT	Product Consistency Test
PS	sodium Peroxide fusion with an addition of Sulfuric acid
PSH	sodium Peroxide fusion with additions of Sulfuric and Hydrofluoric acid
PNNL	Pacific Northwest National Laboratory
SRNL	Savannah River National Laboratory
SSM	Sulfur Saturated Melt
TTQAP	Task Technical and Quality Assurance Plan
wt %	Weight Percent
WTP	Hanford Tank Waste Treatment and Immobilization Plant
%RSD	Percent Relative Standard Deviation

1.0 Introduction

The U.S. Department of Energy (DOE) Office of River Protection (ORP) has requested that the Savannah River National Laboratory (SRNL) provide expert evaluation and experimental work in support of the River Protection Project vitrification technology development. DOE is 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 low-activity waste (LAW) fraction will be partitioned from the high-level waste (HLW). Both the LAW and HLW will then be vitrified into borosilicate glass using Joule-heated ceramic melters.

Efforts are being made to increase the loading of Hanford tank wastes in the glass while conforming to processing requirements and product quality regulations. DOE-ORP has requested that SRNL support the advancement of glass formulations and process control strategies in key technical areas, as defined in the Task Technical and Quality Assurance Plan (TTQAP).[1] Two of these areas are enhancing waste glass property/composition models and broadening the compositional regions over which those models are applicable.

In this report, SRNL provides chemical analysis of simulated LAW study glasses, sulfur saturation wash solutions, and Product Consistency Test (PCT) leachates. The glasses were selected as part of a broader study of the influence of glass composition on chemical durability, sulfur retention, and other properties.[2] The glasses were designated the LAW Phase 3 study. PNNL added modified glasses to the study as the analyses progressed. The resulting data will be used in the development of improved property/composition models for LAW glass.

2.0 Experimental Procedure

2.1 Quality Assurance

Requirements for performing reviews of technical reports and the extent of review are established in Savannah River Site Manual E7, Procedure 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. Laboratory data for this study were recorded in the SRNL Electronic Laboratory Notebook system, experiments C3489-00079-25 and C3489-00079-28. The glasses provided by PNNL were fabricated following a series of Test Instructions.[3-5]

2.2 Glasses Selected for Study

The baseline (quenched) glass compositions in this study were selected and fabricated at the Pacific Northwest National Laboratory (PNNL). Identifiers for the glasses are listed in Table 2-1. PNNL also provided a sulfur saturated melt (SSM) version of each of the glasses listed in Table 2-1.

In the sections that follow, the methods used for measuring the chemical compositions of the study glasses and their corresponding wash solutions are described, and reviews of the resulting data are provided. Detailed data from these analyses are included in the appendices.

Table 2-1. Identifiers for the Hanford LAW Phase 3 Glasses

LAWPh3-01
LAWPh3-02
LAWPh3-03
LAWPh3-04
LAWPh3-05
LAWPh3-06
LAWPh3-07
LAWPh3-08
LAWPh3-09
LAWPh3-10
LAWPh3-11
LAWPh3-12
LAWPh3-13
LAWPh3-14
LAWPh3-15
LAWPh3-16
LAWPh3-17
LAWPh3-18
LAWPh3-19
LAWPh3-20

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 quenched versions of the glasses listed in Table 2-1 to allow for comparisons with the targeted compositions. Three dissolution techniques, sodium peroxide fusion with an addition of sulfuric acid (PS),[7] lithium metaborate fusion (LM),[8] and potassium hydroxide fusion (KH),[9] were used for preparing each of the glass samples, in duplicate, for analysis. Note that for some analytes, the analytical plan specified more than one preparation method for analyses. The results were reviewed, and in general, the method that provided better recovery of the analyte was selected for reporting.

Chemical analyses for the SSM versions of the glasses listed in Table 2-1 were performed following a second analytical plan.[10] The PS dissolution method was modified with an addition of hydrofluoric acid for these glasses, and is abbreviated herein as PSH. Again, where more than one preparation method was specified for an analyte, the method that provided better recovery was selected for reporting.

Each of the duplicate samples was analyzed twice for each element of interest by Inductively Coupled Plasma – Atomic Emission Spectroscopy (ICP-AES)[11] or ion chromatography (IC),[12] for a total of four measurements per element per glass. Glass standards were also intermittently measured to assess the performance of the ICP-AES and IC instruments over the course of these analyses. Specifically, several samples of the low-level reference material (LRM)[13] 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 for the purposes of this study.[13] The preparation and measurement methods used for each of the reported glass components are listed in Table 2-2.

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

Analyte	Preparation Method, Quenched Glasses	Preparation Method, SSM Glasses	Measurement Method
Al	PS	PSH	ICP-AES
B	PS	PSH	ICP-AES
Ca	PS	PSH	ICP-AES
Cl	KH	KH	IC
Cr	LM	LM	ICP-AES
F	KH	KH	IC
Fe	LM, PS	LM	ICP-AES
K	LM	LM	ICP-AES
Mg	LM	LM	ICP-AES
Na	LM	LM	ICP-AES
P	PS	LM, PSH	ICP-AES
S	LM	LM	ICP-AES
Si	PS	PSH	ICP-AES
Sn	PS	LM	ICP-AES
V	LM	LM	ICP-AES
Zn	LM	LM	ICP-AES
Zr	PS	LM	ICP-AES

2.4 Mod Glass Composition and Wash Solution Analyses

During the course of the LAW Phase 3 study, PNNL sent four additional glasses for composition analysis. These glasses are modified (Mod) versions of the original Phase 3 compositions, and were analyzed separately. Identifiers for these glasses are given in Table 2-3.

Table 2-3. Identifiers for the Hanford LAW Phase 3 Mod Glasses

Receipt Date	Identifier
2/4/2019	LAWPh3-05_mod6-SSM
2/4/2019	LAWPh3-19_mod-SSM
5/9/2019	LAWPh3-05_mod6-Q
5/9/2019	LAWPh3-19_mod-Q

No analytical study plan was used for these glasses since only two glasses at a time were available for analysis. Each of the Mod glasses was prepared in duplicate via the methods shown in Table 2-4. Each of the prepared solutions was measured twice for each analyte via the methods shown in Table 2-4, for a total of four measurements per element per glass. A sample of the LRM reference glass was included in the analyses along with the study glass samples.

Samples of the wash solutions resulting from the preparation of the SSM versions of these glasses were also sent by PNNL for analysis. The solutions were diluted as appropriate, and analyzed by ICP-AES and IC for the analytes shown in Table 2-4. Each wash solution was analyzed twice for each analyte of interest.

Table 2-4. Preparation and Measurement Methods Used in Reporting the Concentrations of Each of the Analytes of the Mod Glasses

Analyte	Preparation Method, Mod Glasses	Measurement Method
Al	PSH	ICP-AES
B	PSH	ICP-AES
Ca	PSH	ICP-AES
Cl	KH	IC
Cr	LM	ICP-AES
F	KH	IC
Fe	LM	ICP-AES
K	LM	ICP-AES
Mg	LM	ICP-AES
Na	LM	ICP-AES
P	LM	ICP-AES
S	LM	ICP-AES
Si	PSH	ICP-AES
Sn	LM	ICP-AES
V	LM	ICP-AES
Zn	LM	ICP-AES
Zr	LM	ICP-AES

2.5 Wash Solution Analysis

Chemical analyses were performed under the auspices of an analytical plan[10] on a representative sample of each of the wash solutions resulting from the preparation of the SSM versions of the glasses listed in Table 2-1. The samples were diluted based on the expected concentrations of the species in solution in preparation for the analyses.

Each of the samples was analyzed in triplicate for each element of interest by ICP-AES[11] and IC.[12] Solution standards and blanks were also intermittently measured to assess the performance of the ICP-AES 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 2-5.

Table 2-5. Measurement Methods Used in Reporting the Concentrations of Each of the Analytes of the Wash Solutions

Analyte	Measurement Method
Al	ICP-AES
B	ICP-AES
Ca	ICP-AES
Cl^-	IC
Cr	ICP-AES
F^-	IC
Fe	ICP-AES
K	ICP-AES
Mg	ICP-AES
Na	ICP-AES
P	ICP-AES
PO_4^-	IC
S	ICP-AES
SO_4^{2-}	IC
Si	ICP-AES
Sn	ICP-AES
V	ICP-AES
Zn	ICP-AES
Zr	ICP-AES

2.6 PCT Leachates

PNNL supplied leachates resulting from PCTs of the quenched and canister centerline cooled (CCC) versions of the study glasses. The leachate samples were analyzed by ICP-AES under the auspices of two analytical study plans.[14,15] Samples of a multi-element, standard solution[a] were also included in the analytical plans as a check on the accuracy of the ICP-AES instrument used for these measurements. PNNL indicated that all of the leachates were diluted by a factor of ten by volume at the completion of the PCTs. Normalized release values were calculated for each glass based on the targeted and measured compositions.

3.0 Results and Discussion

3.1 Review and Evaluation of the Quenched Glass Composition Measurements

Table A-1 and Table A-2 in Appendix A provide the elemental concentration measurements in weight percent (wt %) for the study glasses as prepared by the LM method. Table A-3 and Table A-4 in Appendix A provide the elemental concentration measurements in wt % for the study glasses as prepared by the PS method. Table A-5 in Appendix A provides the elemental concentration measurements in wt % for the study glasses as prepared by the KH method. Elemental measurements for samples of the LRM standard glass are also included in the tables of Appendix A. These unprocessed data are provided so that the values are readily available should they be of interest for future reviews.

In the sections that follow, the analytical sequences of the measurements are explored, the measurements of the LRM standard glass are investigated, the measurements for each glass are reviewed, the average chemical composition for each glass is determined, and comparisons are made between the measurements and the targeted compositions of the glasses. JMP™ Pro Version 11.2.1 (SAS Institute, Inc.)[16] was used to support these analyses.

[a] ICP multi-element custom solution, product number SM-744-013, High Purity Standards, Charleston, SC.

3.1.1 Treatment of Detection Limits

The elemental concentrations in Table A-1 through Table A-5 of Appendix A were converted to oxide concentrations by multiplying the values for each element by the gravimetric factor for the corresponding oxide. Some of the elemental concentration measurements were reported as being below the detection limit of the analytical processes used. In these cases, the value of the detection limit was considered to be the measured value of the analyte during the process of converting to oxide concentrations. This approach was used for the purposes of data review and calculating a sum of oxides for each glass. Those oxides with one or more concentration measurements that were below the associated detection limit (BDL) will be denoted with a less than symbol (<) as the measured compositions are reported.

3.1.2 Measurements in Analytical Sequence

Exhibit A-1 in Appendix A provides plots of the wt % measurements generated for each sample by oxide and analytical block. The plots are in analytical sequence within each calibration block with different symbols and colors being used to represent each of the study and standard glasses. These plots include all of the measurement data from Table A-1 through Table A-5 in Appendix A, with each plotted point identified by its Lab ID (from the analytical study plan[6]). Plotting the data in this format provides an opportunity to identify gross trends in performance of the analytical instruments within and among calibration blocks. A review of these plots did not identify any gross patterns or trends in the analytical process over the course of these measurements. In all cases, the instrument check standards were within specification. Any minor calibration effects typical of ICP-AES analyses are mitigated by taking the average of the measurements for each analyte. Data for Fe concentrations were taken from the LM prepared samples for glasses with targeted Fe_2O_3 values of less than 1 wt %, and from the PS prepared samples for glasses with targeted Fe_2O_3 values of 1 wt % and above. Unusually low measured values (BDL) of P_2O_5 for the LRM reference glass were noted in Block 3, Sub Block 2 of the measurement series for the PS prepared samples. Therefore, data from Block 3, Sub Block 2 are excluded from the determination of the average P_2O_5 concentrations for the glasses that fell within this group.

3.1.3 Composition Measurements by Glass Identifier

Exhibit A-2 in Appendix A provides plots of the oxide concentration measurements by the PNNL Glass ID (including the LRM reference glass) 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. Some degree of scatter among the Al_2O_3, B_2O_3, CaO, Na_2O, SiO_2, V_2O_5, ZnO, and ZrO_2 measurements was noted for the study glasses. There were no indications of an error in preparation or measurement that had to be addressed in treatment of the data. Therefore, the entire set of measurement data shown in this exhibit was used in determining representative, measured compositions for the study glasses.

3.1.4 Results for the LRM Standard

Exhibit A-3 in Appendix A provides a comparison of the LRM results to their acceptability limits utilized by SRNL.[11] 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 the element in question. The results show that all the measurements for the elements present in the LRM standard glass were within the acceptability limits utilized by SRNL in conducting instrument and procedure assessments during the execution of these analyses.

3.1.5 Measured versus Targeted Compositions

Aside from the exceptions described in Section 3.1.2, all of the measurements for each oxide for each glass (i.e., all of the measurements in Table A-1 through Table A-5 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-4 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. The following observations are offered from a review of these plots:

- The measured concentrations of Al_2O_3 are somewhat below the targeted values for some of the study glasses.
- The measured concentrations of chlorine and fluorine are below the targeted values for most of the study glasses, likely because of volatility during melting.
- The measured concentrations of Cr_2O_3 are somewhat low relative to the targeted values for most of the glasses.
- The measured concentrations of K_2O are below the targeted values for those glasses that targeted higher concentrations of K_2O.
- The measured Na_2O, P_2O_5, and ZrO_2 concentrations are below the targeted values for the study glasses.
- There are some deviations in the measured SiO_2 concentrations, both above and below the targeted values for the study glasses.

Table A-6 in Appendix A provides a summary of the average compositions as well as the targeted compositions and some associated differences and relative differences. All the measured sums of oxides for the study glasses fall within the interval of about 95 to 100 wt %, indicating acceptable recovery of the glass components. Entries in Table A-6 show the relative differences between the measured values and the targeted values for the oxides with targeted values above 5 wt %. The relative differences are shaded if they are 10% or more.[a] The highlighted cells are consistent with the observations listed above.

3.2 Review and Evaluation of the SSM Glass Composition Measurements

Table B-1 and Table B-2 in Appendix B provide the elemental concentration measurements in wt % for the study glasses as prepared by the LM method. Table B-3 in Appendix B provide the elemental concentration measurements in wt % for the study glasses as prepared by the PSH method. Table B-4 in Appendix B provides the elemental concentration measurements in wt % for the study glasses as prepared by the KH method. Elemental measurements for samples of the LRM standard glass are also 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.

In the sections that follow, the analytical sequences of the measurements are explored, the measurements of the LRM standard glass are investigated, the measurements for each glass are reviewed, the average chemical composition for each glass is determined, and comparisons are made between the measurements and the targeted compositions of the glasses. JMP™ Pro Version 11.2.1 (SAS Institute, Inc.)[16] was used to support these analyses.

3.2.1 Treatment of Detection Limits

The elemental concentrations in Table B-1 through Table B-4 of Appendix B were converted to oxide concentrations by multiplying the values for each element by the gravimetric factor for the corresponding oxide. During the process of converting to oxide concentrations, an elemental concentration measurement that was reported to be below the detection limit of the analytical process used was set to the detection limit

[a] These criteria were selected arbitrarily for the purpose of highlighting differences from targeted concentrations that may be of practical concern.

as the oxide concentration was determined for the purposes of data review and of calculating a sum of oxides for each glass. Those oxides with one or more concentration measurements that were below the associated detection limit (BDL) will be denoted with a less than symbol (<) as the measured compositions are reported.

3.2.2 Measurements in Analytical Sequence

Exhibit B-1 in Appendix B provides plots of the wt % measurements generated for each sample by oxide and analytical block. The plots are in analytical sequence within each calibration block with different symbols and colors being used to represent each of the study and standard glasses. These plots include all of the measurement data from Table B-1 through Table B-4 in Appendix B, with each plotted point identified by its Lab ID (from the analytical study plan). Plotting the data in this format provides an opportunity to identify gross trends in performance of the analytical instruments within and among calibration blocks. A review of these plots did not identify any gross patterns or trends in the analytical process over the course of these measurements. In all cases, the instrument check standards were within specification. Any minor calibration effects typical of ICP-AES analyses are mitigated by taking the average of the measurements for each analyte.

The LM method was selected for reporting the P_2O_5 concentrations of the SSM versions of the study glasses since this method provided better recovery (higher measured concentrations) than that from the PSH method. Note however that recovery of P_2O_5 was low for two of the study glasses, LAWPh3-07-SSM-S and LAWPh3-14-SSM-S, by the LM method. The PSH method yielded average P_2O_5 concentrations of 1.09 wt % and 0.91 wt % for these glasses, respectively.

3.2.3 Composition Measurements by Glass Identifier

Exhibit B-2 in Appendix B provides plots of the oxide concentration measurements by the PNNL Glass ID (including the LRM reference glass) 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. Some degree of scatter among the Al_2O_3, B_2O_3, CaO, Na_2O, SiO_2, and ZrO_2 measurements was noted for the study glasses. There were no indications of 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 study glasses.

3.2.4 Results for the LRM Standard

Exhibit B-3 in Appendix B provides a comparison of the LRM results to their acceptability limits utilized by SRNL.[11] 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 the element in question. The results show that all the measurements for the elements present in the LRM standard glass were within the acceptability limits utilized by SRNL in conducting instrument and procedure assessments during the execution of these analyses.

3.2.5 Measured versus Targeted Compositions

From the discussion of Section 3.2.3, all of the measurements for each oxide for each glass (i.e., all of the measurements in Table B-1 through Table B-4 in Appendix B) 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 B-4 in Appendix B provides plots showing the result for each glass for each oxide to allow PNNL to draw comparisons between the measured and targeted values. The following observations are offered from a review of these plots:

- The measured concentrations of Al_2O_3 are somewhat below the targeted values for the study glasses.
- The measured concentrations of chlorine and fluorine are below the targeted values for most of the study glasses, likely because of volatility during the multiple melting steps.
- The measured concentrations of Cr_2O_3, K_2O, P_2O_5, V_2O_5, and ZrO_2 are generally low relative to the targeted values.
- The measured Na_2O concentrations are below the targeted values for several of the study glasses. This is unexpected given the additions of excess sodium sulfate. This result may indicate that significant sodium partitioned to the excess sulfate phase that was washed from the glasses prior to analyses. It may also be a reflection of the low measured Na_2O concentrations in the quenched versions of the glasses.
- There are some deviations in the measured SiO_2 concentrations, both above and below the targeted values for the study glasses.
- As expected, the measured concentrations of SO_3 in the SSM glasses are higher than targeted due to the use of the sulfur saturation method in fabricating these glasses.

Table B-5 in Appendix B provides a summary of the average compositions as well as the targeted compositions and some associated differences and relative differences. All the measured sums of oxides for the study glasses fall within the interval of about 95.8 to 100.3 wt %, indicating acceptable recovery of the glass components. Entries in Table B-5 show the relative differences between the measured values and the targeted values for the oxides with targeted values above 5 wt %. The relative differences are shaded if they are 10% or more.[a] The highlighted cells are consistent with the observations listed above.

3.3 Comparison of Measured Compositions of Baseline and SSM Glasses

Exhibit C-1 in Appendix C provides a comparison of the measured oxide concentrations among the baseline (quenched) and SSM versions of the study glasses. A review of Exhibit C-1 led to several observations:

- The measured concentrations of Al_2O_3, Cl^-, and F^- and were lower for most of the SSM glasses as compared to those of the quenched versions.
- The measured Cr_2O_3 and K_2O concentrations were markedly lower for the SSM versions of the glasses as compared to the quenched versions. This was noted in the earlier Phase 2 study as well.[17]
- The measured Na_2O concentrations were higher for most of the SSM glasses relative to those of the quenched versions, although they remain below the targeted values.
- The measured SO_3 concentrations were higher for SSM versions of the study glasses, as expected.

The discussion of the analyses of the wash solutions, provided in Section 3.5, may provide further insight into the measured compositions of the SSM glasses.

3.4 Review of Mod Glass Compositions and Wash Solution Measurements

Exhibit D-1 in Appendix D provides the elemental concentration measurements in wt % for the SSM versions of the Mod glasses. Exhibit D-2 in Appendix D provides the elemental concentration measurements in wt % for the quenched versions of the Mod glasses. Elemental measurements for samples of the LRM glass are also included in the tables of Appendix D. These unprocessed data are provided so that the values are readily available should they be of interest for future reviews.

[a] These criteria were selected arbitrarily for the purpose of highlighting differences from targeted concentrations that may be of practical concern.

All the measurements for the elements present in the LRM standard glass were within the acceptability limits utilized by SRNL[11] in conducting instrument and procedure assessments during the execution of these analyses. All of the measurements for each analyte for each glass (i.e., all of the measurements in Exhibit D-1 or Exhibit D-2 in Appendix D) 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. The resulting values are given in Table 3-1. The targeted compositions of the Mod glasses are also included in Table 3-1 to enable comparisons with the measured values.

A review of Table 3-1 shows that the measured B_2O_3 concentrations are about 15-20% above the targeted values. The measured SO_3 concentrations are higher for the SSM versions of the Mod glasses, as expected.

Table 3-1. Measured Compositions of the Mod Glasses (wt %)

Glass ID	Al_2O_3	B_2O_3	CaO	Cl	Cr_2O_3	F	Fe_2O_3	K_2O	MgO
LAWPh3-05_mod6-Tgt	6.24	8.50	2.47	0.44	0.45	0.66	1.06	2.93	1.14
LAWPh3-05_mod6-Q	5.78	10.2	2.33	0.354	0.429	0.524	1.06	2.68	1.06
LAWPh3-05_mod6-SSM	5.84	10.2	2.30	0.136	0.213	0.381	1.08	2.23	1.11
LAWPh3-19_mod-Tgt	6.72	6.91	8.51	0.08	0.37	0.12	1.06	3.08	0.21
LAWPh3-19_mod-Q	6.11	7.85	7.88	0.0838	0.354	0.0636	1.34	2.91	0.256
LAWPh3-19_mod-SSM	6.25	8.09	8.00	0.0404	0.174	0.0512	1.33	2.30	0.257
LRM – reference	9.51	7.85	0.54	-	0.19	0.86	1.38	1.48	0.10
LRM – measured	8.81	7.48	<1.40	<0.025	0.197	0.872	1.45	1.33	<1.66

Glass ID	Na_2O	P_2O_5	SO_3	SiO_2	SnO_2	V_2O_5	ZnO	ZrO_2	Sum
LAWPh3-05_mod6-Tgt	22.7	1.42	0.90	39.5	2.02	3.30	2.15	4.06	100
LAWPh3-05_mod6-Q	20.6	1.32	0.953	36.9	2.16	3.18	2.13	3.12	94.8
LAWPh3-05_mod6-SSM	20.5	1.17	1.58	37.6	2.18	2.87	2.16	3.19	94.7
LAWPh3-19_mod-Tgt	21.5	0.25	0.85	40.9	1.08	2.92	2.12	3.06	99.7
LAWPh3-19_mod-Q	19.1	0.256	1.10	38.6	1.23	2.82	2.10	2.45	94.5
LAWPh3-19_mod-SSM	19.2	0.243	1.96	39.1	1.21	2.61	2.06	2.39	95.3
LRM – reference	20.03	0.54	0.30	54.20	-	-	-	0.93	97.91
LRM – measured	19.3	0.508	0.257	54.8	<0.127	<0.179	<0.124	1.00	99.5

Table D-1 in Appendix D provides the elemental concentration measurements in mg/L for the wash solutions resulting from preparation of the SSM versions of the Mod glasses. Table D-2 in Appendix D provides the anion concentration measurements in mg/L for these wash solutions. These unprocessed data are provided so that the values are readily available should they be of interest for future reviews.

The duplicate measurements for each analyte for each of the samples were averaged to determine a representative chemical composition for each wash solution, with the results shown in Table 3-2. The concentrations of Cr, K, Na, S, and V are relatively high in the wash solutions.

Table 3-2. Measured Compositions of the Mod Glass Wash Solutions (mg/L)

Wash Solution ID	Al	B	Ca	Cl	Cr	F	Fe	K	Mg
LAWPh3-05_mod6-SSM-W	<1.00	34.4	1.54	38.8	70.8	28.5	<1.00	164	<1.00
LAWPh3-19_mod-SSM-W	<1.00	21.9	8.72	<10.0	60.1	<10.0	<1.00	201	<1.00
Wash Solution ID	**Na**	**P**	**S**	**Si**	**Sn**	**V**	**Zn**	**Zr**	
LAWPh3-05_mod6-SSM-W	1180	40.9	572	19.7	29.8	87.3	<1.00	<1.00	
LAWPh3-19_mod-SSM-W	944	2.99	629	13.5	24.9	44.5	<1.00	<1.00	

3.5 Review and Evaluation of Wash Solution Measurements

Table E-1 in Appendix E provides the elemental concentration measurements in mg/L for the wash solutions as measured by ICP-AES. Table E-2 in Appendix E 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 also included in the tables of Appendix E. These unprocessed data are provided so that the values are readily available should they be of interest for future reviews.

In the sections that follow, the analytical sequences of the measurements are explored, the measurements of the standard solutions and the wash solutions are reviewed, and the average chemical composition for each wash solution is determined. JMP™ Pro Version 11.2.1 (SAS Institute, Inc.)[16] was used to support these analyses.

3.5.1 Treatment of Detection Limits

The elemental and anion concentrations in Table E-1 and Table E-2 of Appendix E include measurements that were reported to be below the detection limit of the analytical process used. These values were set to the detection limit for the purposes of data review and of calculating an average composition for each wash solution. Those analytes with one or more concentration measurements that were below the associated detection limit (BDL) will be denoted with a less than symbol (<) as the measured compositions are reported.

3.5.2 Measurements in Analytical Sequence

Exhibit E-1 in Appendix E provides plots of the mg/L measurements generated for each wash solution sample by element or anion and analytical block. The plots are in analytical sequence within each calibration block with different symbols and colors being used to represent each of the wash solutions and standard solutions. These plots include all of the measurement data from Table E-1 and Table E-2 in Appendix E, with each plotted point identified by its Lab ID and Solution ID. Plotting the data in this format provides an opportunity to identify gross trends in performance of the analytical instruments within and among calibration blocks. A review of these plots did not identify any gross patterns or trends in the analytical process over the course of these measurements.

3.5.3 Composition Measurements by Wash Solution Identifier

Exhibit E-2 in Appendix E 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. The concentrations of PO_4^{3-} and SO_4^{2-} displayed in this exhibit include the measured values from both ICP-AES and IC for comparison. The measured S and P concentrations from the ICP-AES analyses were converted to PO_4^{3-} and SO_4^{2-} concentrations by multiplying by the appropriate gravimetric factors to support these comparisons. A review of the plots presented in these exhibits reveals the repeatability of the three individual values for each analyte for each solution. Minor scatter among the triplicate measurements of some of the analytes of the solutions was noted. 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.

3.5.4 Results for the Standard Solutions

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

3.5.5 Measured Compositions of the Wash Solutions

From the discussion of Section 3.5.3, all of the measurements for each analyte for each wash solution (i.e., all of the measurements in Table E-1 and Table E-2 of Appendix E) were averaged to determine a representative chemical composition for each solution. Table E-4 in Appendix E 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-AES and IC for comparison. The measured S and P concentrations from the ICP-AES analyses were converted to PO_4^{3-} and SO_4^{2-} concentrations by multiplying by the appropriate gravimetric factors to support these comparisons.

The following observations are offered from a review of Table E-4:

- The measured concentrations of Al, Fe, Mg, Sn, Zn, and Zr in the wash solutions were near or below the detection limits.
- The measured concentrations of B in the wash solutions were about 15-40 mg/L.
- The measured concentrations of Ca in the wash solutions were about 1-13 mg/L.
- The measured concentrations of Cr (about 40-120 mg/L), K (10-400 mg/L), and V (detection limit to about 130 mg/L) in the wash solutions may be related to the lower measured values for these components noted in the SSM versions of the study glasses.
- The measured concentrations of Na in the wash solutions were in the range of 800-1500 mg/L. This may be attributed to both the excess sodium sulfate added as part of the SSM preparation process.
- The measured concentrations of P were similar by both the ICP-AES and IC methods (ICP-AES data converted to PO_4^{3-} basis for comparison), and were in the range of about 10-175 mg/L PO_4^{3-}.
- The measured concentrations of S were similar by both the ICP-AES and IC methods (ICP-AES data converted to SO_4^{2-} basis for comparison), and were in the range of about 1500-2500 mg/L.
- The measured concentrations of Si ranged from about 6-22 mg/L.

3.6 Review and Evaluation of PCT Leachate Measurements

The PCT leachates sent by PNNL for analysis arrived in two groups. Analyses of the leachates from the quenched glasses are discussed here first, followed by a discussion of the analyses of the CCC and Mod glasses.

3.6.1 Quenched Glass PCT Leachates

Table F-1 in Appendix F provides the elemental leachate concentration measurements for the PCTs of the quenched glasses and standards. No adjustments for dilution have been made to these values. Measurable concentrations of sodium and silicon were found in about half of the blank samples. JMP Pro Version 11.2.1 (SAS Institute, Inc.)[16] was used to support the following analyses.

Table F-2 in Appendix F provides a review of the measurements of the solution standard samples that were included in the analytical blocks for the PCT leachate analyses. For each analytical block, the mean, standard deviation, and percent relative standard deviation (%RSD) are determined for each element present in the standard. Following the guidance in ASTM C 1285,[18] there were two primary evaluations conducted for these summary statistics: the mean value for each analytical block was found to be less than 10% from the reference value (i.e., a percent relative bias less than 10%) for the element in question, and the %RSD was less than 10% for the element in question. The results in Table F-2 satisfy these criteria, and thus, the results for the solution standard suggest no significant issues with the analytical outcomes for the measurements of the PCT leachates.

Exhibit F-1 in Appendix F provides plots of the leachate concentrations (mg/L) in analytical sequence by analytical block. Plotting the data in this format provides an opportunity to identify gross trends in performance of the analytical instrument within and among calibration blocks. No issues were observed in a review of these plots.

Exhibit F-2 in Appendix F provides plots of the leachate concentrations by the groupings provided by PNNL. Plotting the data in this format allows for the assessment of the repeatability of the measurements for each glass. For some of the glasses, minor scatter among the triplicate values of some analytes is observed.

3.6.2 CCC and Mod Glass PCT Leachates

Table G-1 in Appendix G provides the elemental leachate concentration measurements for the PCTs of the CCC and Mod glasses and standards. No adjustments for dilution have been made to these values. Measurable concentrations of sodium and silicon were found in about half of the blank samples.

Table G-2 in Appendix G provides a review of the measurements of the solution standard samples that were included in the analytical blocks for the PCT leachate analyses. For each analytical block, the mean, standard deviation, and percent relative standard deviation (%RSD) are determined for each element present in the standard. Following the guidance in ASTM C 1285,[18] there were two primary evaluations conducted for these summary statistics: the mean value for each analytical block was found to be less than 10% from the reference value (i.e., a percent relative bias less than 10%) for the element in question, and the %RSD was less than 10% for the element in question. The results in Table F-2 satisfy these criteria, and thus, the results for the solution standard suggest no significant issues with the analytical outcomes for the measurements of the PCT leachates.

Exhibit G-1 in Appendix G provides plots of the leachate concentrations (mg/L) in analytical sequence by analytical block. Both linear and logarithmic plots are provided due to the wide range of leachate analyte concentrations for some of the glasses. Plotting the data in this format provides an opportunity to identify gross trends in performance of the analytical instrument within and among calibration blocks. No issues with the analytical process were observed in a review of these plots. There are a few measurements for some leachate and analyte combinations that appear to have unusually high values relative to the other measurements in the triplicate sets, as discussed below.

Exhibit G-2 in Appendix G provides plots of the leachate concentrations by the groupings provided by PNNL. Both linear and logarithmic plots are provided due to the wide range of leachate analyte concentrations for some of the glasses. Plotting the data in this format allows for the assessment of the repeatability of the measurements for each glass. Minor scatter among the triplicate values of some analytes is observed for some of the glasses. For other glasses, there are more significant differences among the triplicate values. Note for example:

- The Al measurements for glasses LAWPh3-10-CCC, LAWPh3-14-CCC, and LAWPh3-17-CCC
- The B, Cr, Na, and Si measurements for glass LAWPh3-20-CCC
- The Na and Si measurements for glasses LAWPh3-10-CCC and LAWPh3-14-CCC

It is recommended that PNNL review the performance of the PCTs to determine the cause of these potential outliers.

3.7 Normalization of PCT Data

The PCT leachate data were used to determine normalized concentrations for each element of interest using both the targeted and measured (quenched) compositions of the glasses following the expression given in ASTM C1285:

$$NC_i = \frac{c_i\left(sample\right)}{f_i}$$

where NC_i is the normalized concentration in units of $g_{\text{waste form}}/L_{\text{leachant}}$, c_i is the concentration of element "i" in the leachate in units of g_i/L (corrected for the 10:1 dilution performed at PNNL), and f_i is the mass fraction of element "i" in the unleached glass in units of g_i/g_{glass}.[a]

An equation was developed to allow for calculation of the NC_i values using the units of measurement provided with the analytical results for this study, and to accommodate the triplicate leachate measurements for each of the study glasses. Note that the symbols in this second equation were kept consistent with those used in ASTM C1285, but the units of measurement differ. The common logarithm of the normalized concentration for each element "i" (NC_i) for each of the study glasses was determined using the equation:

$$\log_{10}\left(NC_i\right) = \overline{\log_{10} c_i} - \left[1 + \log_{10} f_i\right]$$

where NC_i remains in units of $g_{\text{waste form}}/L_{\text{leachant}}$, $\overline{\log_{10} c_i}$ is the average of the common logarithms of the measured concentrations of element "i" in the triplicate leachates in units of mg/L (corrected for the 10:1 dilution performed at PNNL), and $\log_{10} f_i$ is either the common logarithm of the targeted concentration of element "i" in the glass in units of wt %, or the common logarithm of the average measured concentration of element "i" in the glass in units of wt % (from Table A-6 of Appendix A).

Exhibit H-1 in Appendix H provides plots of the normalized PCT responses for the two heat treatments for each of the study glasses as well as the responses for the Environmental Assessment (EA) reference glass[19] (labeled "DWPF" in the PNNL experiments). The results are grouped by compositional view. Note that an indicator is provided as part of these plots to show results involving below detection limit (BDL) values. The plots of Exhibit H-1 provide a graphical comparison between the PCT responses for the two heat treatments of each study glass. Table H-1 in Appendix H provides a listing of the normalized PCT responses in g/L.

A review of the PCT data resulted in the following observations:

- Little difference is seen when evaluating the normalized values on the basis of targeted or measured glass composition.
- Several of the study glasses, both quenched and CCC, have NC_i values that are greater than the WTP immobilized LAW constraint[b] of 4 g/L for B, Na, and Si.

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[a] Note that the waste forms in this study were assumed to be of similar density. The PCT-A reference volume of leachant to sample mass ratio was used, and the 100 to 200 mesh reference particle size was used. Thus, no adjustment for the density of the glasses was made in normalizing the PCT results. Data provided in the appendices of this report allow for the calculation of normalized elemental mass loss (NL_i) if glass densities are measured at a later date.

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

- Normalized concentration values for the CCC version of glass LAWPh3-13 are high for most of the analytes (e.g., NC_B values of 218 and 200 g/L normalized to the measured and targeted composition, respectively).
  - An NC_i value of 100 g/L is equivalent to complete leaching of an element from the glass.
  - As described in the previous sections, no issues were identified with the chemical composition analyses of the PCT leachates.
  - Thus, these high values appear to indicate an error in performance of the PCT for this glass.
- The samples of the EA reference glass (labeled "DWPF" in the study) included with each PCT set have inconsistent NC_i values.
  - Note that some degree of variation in NC_i values for the EA glass is typical.[20]
  - However, values in this study vary over a much broader range (e.g., NC_B values of 8 to 84 g/L).
  - Glass DWPF-8 has NC_i values that are much higher than those of the other "DWPF" glasses.
- Measured concentrations for zirconium in the leachates were all below detection levels.

4.0 Summary

In this report, SRNL provides analyses of glass compositions, wash solution compositions, and PCT leachate compositions for a series of simulated LAW glasses fabricated at PNNL. The series included quenched, canister centerline cooled, and sulfur saturated melt versions of the glasses. These data will be used in the development of improved property/composition models for LAW glass at Hanford.

Chemical analyses were performed on a representative sample of each of the quenched and sulfur saturated glasses to allow for comparisons with the targeted compositions. For some of the quenched glasses, measured concentrations of Cr_2O_3, K_2O, Na_2O, P_2O_5, and ZrO_2 were below the targeted values. For some of the sulfur saturated glasses, the measured concentrations of Al_2O_3, Cr_2O_3, K_2O, Na_2O, P_2O_5, V_2O_5, and ZrO_2 were generally low relative to the targeted values. As expected, the measured SO_3 concentrations in the sulfur saturated glasses were higher than the targeted values.

A comparison of the measured compositions of the quenched and sulfur saturated versions of the study glasses showed that the measured concentrations of Al_2O_3, Cl^-, and F^- were lower for most of the sulfur saturated glasses. The measured Cr_2O_3 and K_2O concentrations were markedly lower for the sulfur saturated versions of the glasses as compared to the quenched versions, which may indicate that these elements partitioned to the soluble sulfur salts. The measured Na_2O and SO_3 concentrations were higher for most of the sulfur saturated glasses relative to those of the quenched versions, as expected.

A set of modified glasses was received from PNNL later in this study. Chemical analysis showed that these glasses generally met their targeted compositions. The measured SO_3 concentrations were higher for the sulfur saturated versions of these glasses, again as expected.

Chemical analysis of the wash solutions that resulted from preparation of the sulfur saturated melts identified Cr, K, Na, P, S, and V as the major elements in solution. With the exception of sulfur, this may explain why the measured concentrations of these components in the study glasses were generally below the targeted values.

PNNL performed PCTs on quenched and CCC versions of the study glasses, as well as the modified glasses. The leachates were sent to SRNL for chemical analysis. In general, minor scatter in the measured values among the triplicate samples was noted. Significant differences among the triplicate values were noted for four of the CCC glasses. Normalized concentration values for several of the study glasses were greater than the WTP immobilized LAW constraints. Normalized concentration values for some of the study glasses were greater than the 100 g/L maximum (total dissolution), which may indicate an error in the test. Results for multiple samples of the EA references glass may also demonstrate inconsistencies in the tests. It is recommended that PNNL review the performance of the PCTs to determine the cause of differences among some of the triplicate values, the above maximum normalized concentration values, and the inconsistencies in measurements of the reference glass.

5.0 References

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Appendix A Tables and Exhibits Supporting the Quenched Glass Composition Measurements

Table A-1. LM Measurements of the Study Glasses – Part 1

ID	Block	Sub-Blk	Sequence	Lab ID	Cr (wt%)	Fe (wt%)	K (wt%)	Mg (wt%)	Na (wt%)
LRM	1	1	1	LRMLM111	0.118	not used	1.07	<0.100	15.1
LAWPh3-17-Q	1	1	2	X13LM11	0.222	not used	0.308	0.677	17.6
LAWPh3-14-Q	1	1	3	X16LM11	0.189	<0.100	0.177	<0.100	17.8
LAWPh3-17-Q	1	1	4	X13LM21	0.215	not used	0.312	0.656	17.6
LAWPh3-03-Q	1	1	5	X07LM11	0.219	not used	3.83	0.674	14.7
LAWPh3-08-Q	1	1	6	X10LM11	0.291	<0.100	1.09	0.130	14.6
LAWPh3-01-1-Q	1	1	7	X04LM11	0.337	0.336	0.656	0.656	16.7
LAWPh3-14-Q	1	1	8	X16LM21	0.201	<0.100	0.186	<0.100	17.9
LRM	1	1	9	LRMLM112	0.114	not used	1.20	<0.100	14.5
LAWPh3-10-Q	1	1	10	X19LM11	0.213	0.490	2.15	0.207	16.1
LAWPh3-03-Q	1	1	11	X07LM21	0.217	not used	3.85	0.662	14.4
LAWPh3-06-Q	1	1	12	X01LM11	0.341	0.173	1.90	0.642	15.2
LAWPh3-10-Q	1	1	13	X19LM21	0.214	0.477	1.95	0.202	16.6
LAWPh3-08-Q	1	1	14	X10LM21	0.287	<0.100	1.14	0.128	14.9
LAWPh3-01-1-Q	1	1	15	X04LM21	0.322	0.320	0.629	0.629	16.6
LAWPh3-06-Q	1	1	16	X01LM21	0.320	0.156	1.95	0.585	14.5
LRM	1	1	17	LRMLM113	0.122	not used	1.16	<0.100	14.1
LRM	1	2	1	LRMLM121	0.128	not used	1.17	<0.100	15.8
LAWPh3-14-Q	1	2	2	X16LM22	0.216	<0.100	0.194	<0.100	18.2
LAWPh3-01-1-Q	1	2	3	X04LM12	0.366	0.367	0.692	0.705	16.9
LAWPh3-08-Q	1	2	4	X10LM22	0.305	<0.100	1.18	0.130	14.6
LAWPh3-03-Q	1	2	5	X07LM22	0.219	not used	3.91	0.682	14.3
LAWPh3-08-Q	1	2	6	X10LM12	0.292	<0.100	1.15	0.124	15.1
LAWPh3-10-Q	1	2	7	X19LM22	0.235	0.536	2.17	0.217	16.5
LAWPh3-01-1-Q	1	2	8	X04LM22	0.372	0.370	0.712	0.715	17.1
LRM	1	2	9	LRMLM122	0.125	not used	1.14	<0.100	14.6
LAWPh3-03-Q	1	2	10	X07LM12	0.221	not used	3.81	0.694	15.6
LAWPh3-06-Q	1	2	11	X01LM12	0.351	0.174	2.01	0.662	15.0
LAWPh3-06-Q	1	2	12	X01LM22	0.384	0.182	1.99	0.698	14.7
LAWPh3-17-Q	1	2	13	X13LM12	0.257	not used	0.349	0.793	17.7
LAWPh3-14-Q	1	2	14	X16LM12	0.220	<0.100	0.199	<0.100	17.9
LAWPh3-17-Q	1	2	15	X13LM22	0.248	not used	0.352	0.774	17.2
LAWPh3-10-Q	1	2	16	X19LM12	0.228	0.534	2.21	0.214	16.6
LRM	1	2	17	LRMLM113	0.121	not used	1.24	<0.100	15.2
LRM	2	1	1	LRMLM211	0.121	not used	1.09	<0.100	14.8
LAWPh3-04-Q	2	1	2	X05LM11	0.301	0.248	0.699	0.259	14.6
LAWPh3-02-Q	2	1	3	X17LM11	0.348	<0.100	2.26	0.656	15.8

Table A-1. LM Measurements of the Study Glasses – Part 1 (continued)

ID	Block	Sub-Blk	Sequence	Lab ID	Cr (wt%)	Fe (wt%)	K (wt%)	Mg (wt%)	Na (wt%)
LAWPh3-04-Q	2	1	4	X05LM21	0.326	0.268	0.765	0.283	15.6
LAWPh3-02-Q	2	1	5	X17LM21	0.333	<0.100	2.14	0.646	15.9
LAWPh3-12-Q	2	1	6	X02LM11	0.281	not used	0.209	0.730	14.8
LAWPh3-09-Q	2	1	7	X11LM11	0.194	0.574	3.98	0.150	14.5
LAWPh3-12-Q	2	1	8	X02LM21	0.272	not used	0.202	0.705	14.7
LRM	2	1	9	LRMLM212	0.131	not used	1.19	<0.100	14.7
LAWPh3-15-Q	2	1	10	X20LM11	0.282	not used	3.08	<0.100	15.1
LAWPh3-05-Q	2	1	11	X08LM11	0.360	not used	2.15	0.659	15.4
LAWPh3-15-Q	2	1	12	X20LM21	0.281	not used	3.05	<0.100	14.8
LAWPh3-09-Q	2	1	13	X11LM21	0.190	0.558	3.92	0.148	14.4
LAWPh3-20-Q	2	1	14	X14LM11	0.255	not used	0.118	<0.100	15.9
LAWPh3-05-Q	2	1	15	X08LM21	0.373	not used	2.25	0.678	16.0
LAWPh3-20-Q	2	1	16	X14LM21	0.276	not used	0.130	<0.100	15.6
LRM	2	1	17	LRMLM213	0.125	not used	1.18	<0.100	14.1
LRM	2	2	1	LRMLM221	0.117	not used	1.10	<0.100	14.6
LAWPh3-15-Q	2	2	2	X20LM22	0.255	not used	2.87	<0.100	14.7
LAWPh3-12-Q	2	2	3	X02LM12	0.247	not used	0.181	0.646	15.1
LAWPh3-09-Q	2	2	4	X11LM12	0.194	0.573	4.24	0.152	14.8
LAWPh3-02-Q	2	2	5	X17LM12	0.328	<0.100	2.19	0.629	15.9
LAWPh3-20-Q	2	2	6	X14LM12	0.256	not used	0.120	<0.100	15.5
LAWPh3-02-Q	2	2	7	X17LM22	0.319	<0.100	2.07	0.622	15.8
LAWPh3-09-Q	2	2	8	X11LM22	0.189	0.560	3.99	0.149	14.5
LRM	2	2	9	LRMLM222	0.113	not used	1.04	<0.100	14.9
LAWPh3-05-Q	2	2	10	X08LM12	0.352	not used	2.16	0.637	15.4
LAWPh3-20-Q	2	2	11	X14LM22	0.263	not used	0.124	<0.100	15.8
LAWPh3-04-Q	2	2	12	X05LM22	0.314	0.257	0.730	0.271	15.3
LAWPh3-05-Q	2	2	13	X08LM22	0.348	not used	2.03	0.626	15.2
LAWPh3-12-Q	2	2	14	X02LM22	0.260	not used	0.193	0.678	15.3
LAWPh3-15-Q	2	2	15	X20LM12	0.258	not used	2.88	<0.100	15.5
LAWPh3-04-Q	2	2	16	X05LM12	0.286	0.236	0.673	0.250	15.4
LRM	2	2	17	LRMLM213	0.120	not used	1.13	<0.100	14.6
LRM	3	1	1	LRMLM311	0.128	not used	1.16	<0.100	14.8
LAWPh3-19-Q	3	1	2	X09LM11-10x	0.230	not used	2.14	0.154	14.6
LAWPh3-13-Q	3	1	3	X12LM21	0.369	<0.100	2.58	0.731	15.5
LAWPh3-18-Q	3	1	4	X03LM21	0.311	0.280	2.27	0.754	16.0
LAWPh3-19-Q	3	1	5	X09LM21	0.220	not used	2.07	0.145	15.5
LAWPh3-11-Q	3	1	6	X15LM21	0.348	<0.100	1.05	0.469	18.2
LAWPh3-16-Q	3	1	7	X18LM11	0.254	0.220	2.93	0.449	16.5
LAWPh3-18-Q	3	1	8	X03LM11	0.312	0.280	2.30	0.767	15.8

Table A-1. LM Measurements of the Study Glasses – Part 1 (continued)

ID	Block	Sub-Blk	Sequence	Lab ID	Cr (wt%)	Fe (wt%)	K (wt%)	Mg (wt%)	Na (wt%)
LRM	3	1	9	LRMLM312	0.125	not used	1.14	<0.100	14.5
LAWPh3-07-Q	3	1	10	X06LM11	0.209	0.368	0.580	<0.100	16.8
LAWPh3-13-Q	3	1	11	X12LM11	0.375	<0.100	2.56	0.714	16.1
LAWPh3-16-Q	3	1	12	X18LM21	0.258	0.224	3.08	0.472	16.5
LAWPh3-11-Q	3	1	13	X15LM11	0.348	<0.100	1.04	0.456	17.6
LAWPh3-07-Q	3	1	14	X06LM21	0.214	0.375	0.614	<0.100	16.5
LRM	3	1	15	LRMLM213	0.126	not used	1.17	<0.100	15.0
LRM	3	2	1	LRMLM321	0.133	not used	1.16	<0.100	15.3
LAWPh3-13-Q	3	2	2	X12LM22	0.394	<0.100	2.62	0.775	16.4
LAWPh3-18-Q	3	2	3	X03LM12	0.323	0.291	2.23	0.792	16.3
LAWPh3-19-Q	3	2	4	X09LM22	0.239	not used	2.13	0.157	15.3
LAWPh3-19-Q	3	2	5	X09LM12	0.233	not used	2.03	0.153	15.2
LAWPh3-16-Q	3	2	6	X18LM22	0.272	0.237	2.95	0.488	17.0
LAWPh3-16-Q	3	2	7	X18LM12	0.270	0.235	2.97	0.473	16.0
LAWPh3-11-Q	3	2	8	X15LM22	0.391	<0.100	1.06	0.517	17.7
LRM	3	2	9	LRMLM322	0.131	not used	1.17	<0.100	14.9
LAWPh3-11-Q	3	2	10	X15LM12	0.398	<0.100	1.03	0.520	18.4
LAWPh3-18-Q	3	2	11	X03LM22	0.323	0.291	2.24	0.783	15.8
LAWPh3-07-Q	3	2	12	X06LM22	0.216	0.379	0.614	<0.100	17.3
LAWPh3-13-Q	3	2	13	X12LM12	0.389	<0.100	2.46	0.737	16.7
LAWPh3-07-Q	3	2	14	X06LM12	0.227	0.396	0.630	<0.100	17.0
LRM	3	2	15	LRMLM323	0.133	not used	1.17	<0.100	14.8

Table A-2. LM Measurements of the Initial Study Glasses – Part 2

ID	Block	Sub-Blk	Sequence	Lab ID	S (wt%)	V (wt%)	Zn (wt%)
LRM	1	1	1	LRMLM111	0.0742	<0.100	<0.100
LAWPh3-17-Q	1	1	2	X13LM11	0.239	1.28	1.85
LAWPh3-14-Q	1	1	3	X16LM11	0.307	1.17	1.95
LAWPh3-17-Q	1	1	4	X13LM21	0.232	1.29	1.87
LAWPh3-03-Q	1	1	5	X07LM11	0.208	0.141	2.42
LAWPh3-08-Q	1	1	6	X10LM11	0.142	<0.100	2.58
LAWPh3-01-1-Q	1	1	7	X04LM11	0.207	0.142	1.55
LAWPh3-14-Q	1	1	8	X16LM21	0.334	1.08	1.82
LRM	1	1	9	LRMLM112	0.0774	<0.100	<0.100
LAWPh3-10-Q	1	1	10	X19LM11	0.408	2.13	2.56
LAWPh3-03-Q	1	1	11	X07LM21	0.215	0.139	2.42
LAWPh3-06-Q	1	1	12	X01LM11	0.142	1.22	2.31
LAWPh3-10-Q	1	1	13	X19LM21	0.388	1.96	2.36
LAWPh3-08-Q	1	1	14	X10LM21	0.140	<0.100	2.67
LAWPh3-01-1-Q	1	1	15	X04LM21	0.208	0.135	1.65
LAWPh3-06-Q	1	1	16	X01LM21	0.125	1.26	2.31
LRM	1	1	17	LRMLM113	0.0942	<0.100	<0.100
LRM	1	2	1	LRMLM121	0.0955	<0.100	<0.100
LAWPh3-14-Q	1	2	2	X16LM22	0.380	1.10	1.84
LAWPh3-01-1-Q	1	2	3	X04LM12	0.241	0.150	1.52
LAWPh3-08-Q	1	2	4	X10LM22	0.150	<0.100	2.65
LAWPh3-03-Q	1	2	5	X07LM22	0.201	0.135	2.39
LAWPh3-08-Q	1	2	6	X10LM12	0.143	<0.100	2.67
LAWPh3-10-Q	1	2	7	X19LM22	0.453	2.11	2.55
LAWPh3-01-1-Q	1	2	8	X04LM22	0.228	0.151	1.61
LRM	1	2	9	LRMLM122	0.0934	<0.100	<0.100
LAWPh3-03-Q	1	2	10	X07LM12	0.217	0.137	2.41
LAWPh3-06-Q	1	2	11	X01LM12	0.152	1.27	2.37
LAWPh3-06-Q	1	2	12	X01LM22	0.149	1.27	2.30
LAWPh3-17-Q	1	2	13	X13LM12	0.309	1.28	1.83
LAWPh3-14-Q	1	2	14	X16LM12	0.394	1.16	1.93
LAWPh3-17-Q	1	2	15	X13LM22	0.302	1.22	1.76
LAWPh3-10-Q	1	2	16	X19LM12	0.471	2.14	2.57
LRM	1	2	17	LRMLM113	0.0977	<0.100	<0.100
LRM	2	1	1	LRMLM211	0.114	<0.100	<0.100
LAWPh3-04-Q	2	1	2	X05LM11	0.468	1.46	1.71
LAWPh3-02-Q	2	1	3	X17LM11	0.205	1.52	2.37
LAWPh3-04-Q	2	1	4	X05LM21	0.500	1.42	1.67

Table A-2. LM Measurements of the Initial Study Glasses – Part 2 (continued)

ID	Block	Sub-Blk	Sequence	Lab ID	S (wt%)	V (wt%)	Zn (wt%)
LAWPh3-02-Q	2	1	5	X17LM21	0.190	1.48	2.32
LAWPh3-12-Q	2	1	6	X02LM11	0.143	1.99	2.07
LAWPh3-09-Q	2	1	7	X11LM11	0.395	0.351	1.65
LAWPh3-12-Q	2	1	8	X02LM21	0.125	1.87	1.95
LRM	2	1	9	LRMLM212	0.109	<0.100	<0.100
LAWPh3-15-Q	2	1	10	X20LM11	0.178	0.894	2.24
LAWPh3-05-Q	2	1	11	X08LM11	0.360	1.71	1.62
LAWPh3-15-Q	2	1	12	X20LM21	0.171	0.892	2.19
LAWPh3-09-Q	2	1	13	X11LM21	0.374	0.344	1.67
LAWPh3-20-Q	2	1	14	X14LM11	0.275	1.99	2.70
LAWPh3-05-Q	2	1	15	X08LM21	0.378	1.77	1.67
LAWPh3-20-Q	2	1	16	X14LM21	0.315	1.95	2.63
LRM	2	1	17	LRMLM213	0.108	<0.100	<0.100
LRM	2	2	1	LRMLM221	0.0810	<0.100	<0.100
LAWPh3-15-Q	2	2	2	X20LM22	0.144	0.799	2.02
LAWPh3-12-Q	2	2	3	X02LM12	0.120	1.80	1.88
LAWPh3-09-Q	2	2	4	X11LM12	0.379	0.349	1.74
LAWPh3-02-Q	2	2	5	X17LM12	0.181	1.49	2.34
LAWPh3-20-Q	2	2	6	X14LM12	0.304	1.91	2.59
LAWPh3-02-Q	2	2	7	X17LM22	0.190	1.45	2.27
LAWPh3-09-Q	2	2	8	X11LM22	0.375	0.338	1.62
LRM	2	2	9	LRMLM222	0.0829	<0.100	<0.100
LAWPh3-05-Q	2	2	10	X08LM12	0.327	1.72	1.62
LAWPh3-20-Q	2	2	11	X14LM22	0.297	1.90	2.58
LAWPh3-04-Q	2	2	12	X05LM22	0.498	1.39	1.64
LAWPh3-05-Q	2	2	13	X08LM22	0.358	1.64	1.54
LAWPh3-12-Q	2	2	14	X02LM22	0.117	1.90	1.98
LAWPh3-15-Q	2	2	15	X20LM12	0.162	0.805	2.06
LAWPh3-04-Q	2	2	16	X05LM12	0.461	1.45	1.71
LRM	2	2	17	LRMLM213	0.0933	<0.100	<0.100
LRM	3	1	1	LRMLM311	0.0953	<0.100	<0.100
LAWPh3-19-Q	3	1	2	X09LM11-10x	0.696	1.56	1.64
LAWPh3-13-Q	3	1	3	X12LM21	0.443	0.427	2.78
LAWPh3-18-Q	3	1	4	X03LM21	0.143	0.225	2.81
LAWPh3-19-Q	3	1	5	X09LM21	0.654	1.54	1.63
LAWPh3-11-Q	3	1	6	X15LM21	0.0515	1.85	1.87
LAWPh3-16-Q	3	1	7	X18LM11	0.0780	1.91	2.63
LAWPh3-18-Q	3	1	8	X03LM11	0.146	0.229	2.84
LRM	3	1	9	LRMLM312	0.105	<0.100	<0.100

Table A-2. LM Measurements of the Initial Study Glasses – Part 2 (continued)

ID	Block	Sub-Blk	Sequence	Lab ID	S (wt%)	V (wt%)	Zn (wt%)
LAWPh3-07-Q	3	1	10	X06LM11	0.209	1.71	2.52
LAWPh3-13-Q	3	1	11	X12LM11	0.429	0.417	2.76
LAWPh3-16-Q	3	1	12	X18LM21	0.0699	1.94	2.66
LAWPh3-11-Q	3	1	13	X15LM11	0.0499	1.82	1.84
LAWPh3-07-Q	3	1	14	X06LM21	0.208	1.75	2.59
LRM	3	1	15	LRMLM213	0.0975	<0.100	<0.100
LRM	3	2	1	LRMLM321	0.101	<0.100	<0.100
LAWPh3-13-Q	3	2	2	X12LM22	0.477	0.450	2.72
LAWPh3-18-Q	3	2	3	X03LM12	0.152	0.233	2.67
LAWPh3-19-Q	3	2	4	X09LM22	0.710	1.59	1.64
LAWPh3-19-Q	3	2	5	X09LM12	0.695	1.55	1.59
LAWPh3-16-Q	3	2	6	X18LM22	0.0802	1.90	2.57
LAWPh3-16-Q	3	2	7	X18LM12	0.0795	1.89	2.56
LAWPh3-11-Q	3	2	8	X15LM22	0.0598	1.93	1.93
LRM	3	2	9	LRMLM322	0.0961	<0.100	<0.100
LAWPh3-11-Q	3	2	10	X15LM12	0.0603	1.90	1.89
LAWPh3-18-Q	3	2	11	X03LM22	0.140	0.232	2.72
LAWPh3-07-Q	3	2	12	X06LM22	0.216	1.62	2.33
LAWPh3-13-Q	3	2	13	X12LM12	0.431	0.427	2.63
LAWPh3-07-Q	3	2	14	X06LM12	0.220	1.72	2.50
LRM	3	2	15	LRMLM323	0.0880	<0.100	<0.100

Table A-3. PS Measurements of the Study Glasses – Part 1

ID	Block	Sub-Blk	Sequence	Lab ID	Al (wt%)	B (wt%)	Ca (wt%)	Fe (wt%)	P (wt%)
LRM	1	1	1	LRMPS111	5.07	2.49	0.265	0.961	0.151
LAWPh3-06-Q	1	1	2	X01PS11	4.72	2.64	7.46	not used	<0.100
LAWPh3-01-1-Q	1	1	3	X04PS11	3.40	4.89	3.46	not used	0.106
LAWPh3-17-Q	1	1	4	X13PS11	3.21	2.23	7.26	0.987	0.146
LAWPh3-03-Q	1	1	5	X07PS11	3.47	2.33	3.32	0.999	0.485
LAWPh3-06-Q	1	1	6	X01PS21	4.66	2.24	7.38	not used	0.106
LAWPh3-01-1-Q	1	1	7	X04PS21	3.41	4.42	3.50	not used	<0.100
LAWPh3-03-Q	1	1	8	X07PS21	3.32	2.13	3.14	0.953	0.485
LRM	1	1	9	LRMPS112	5.22	2.59	0.287	0.980	0.139
LAWPh3-17-Q	1	1	10	X13PS21	3.25	2.07	7.55	1.01	0.188
LAWPh3-10-Q	1	1	11	X19PS11	4.40	2.11	4.47	not used	<0.100
LAWPh3-08-Q	1	1	12	X10PS11	3.64	2.16	4.92	not used	0.568
LAWPh3-14-Q	1	1	13	X16PS11	3.46	2.68	4.14	not used	0.492
LAWPh3-08-Q	1	1	14	X10PS21	3.40	2.02	4.73	not used	0.520
LAWPh3-14-Q	1	1	15	X16PS21	3.35	2.68	4.15	not used	0.502
LAWPh3-10-Q	1	1	16	X19PS21	4.24	1.96	4.35	not used	<0.100
LRM	1	1	17	LRMPS113	5.01	2.42	0.257	0.943	0.129
LRM	1	2	1	LRMPS121	4.93	2.33	0.199	0.914	0.109
LAWPh3-10-Q	1	2	2	X19PS12	4.18	1.93	4.31	not used	<0.100
LAWPh3-06-Q	1	2	3	X01PS22	4.77	2.20	7.79	not used	<0.100
LAWPh3-08-Q	1	2	4	X10PS22	3.45	2.09	4.86	not used	0.510
LAWPh3-10-Q	1	2	5	X19PS22	4.37	2.13	4.64	not used	<0.100
LAWPh3-08-Q	1	2	6	X10PS12	3.54	2.15	4.89	not used	0.472
LAWPh3-03-Q	1	2	7	X07PS12	3.47	2.16	3.31	0.982	0.404
LAWPh3-01-1-Q	1	2	8	X04PS12	3.28	4.14	3.38	not used	<0.100
LRM	1	2	9	LRMPS122	5.00	2.45	0.223	0.946	<0.100
LAWPh3-01-1-Q	1	2	10	X04PS22	3.47	4.37	3.64	not used	<0.100
LAWPh3-14-Q	1	2	11	X16PS12	3.37	2.64	4.15	not used	0.469
LAWPh3-06-Q	1	2	12	X01PS12	4.73	2.17	7.62	not used	<0.100
LAWPh3-14-Q	1	2	13	X16PS22	3.43	2.67	4.21	not used	0.465
LAWPh3-03-Q	1	2	14	X07PS22	3.48	2.17	3.35	0.983	0.495
LAWPh3-17-Q	1	2	15	X13PS22	3.16	1.98	7.51	0.974	0.128
LAWPh3-17-Q	1	2	16	X13PS12	3.20	1.97	7.44	0.966	0.122
LRM	1	2	17	LRMPS123	5.03	2.44	0.232	0.942	0.109
LRM	2	1	1	LRMPS211	4.75	2.33	0.260	0.950	0.201
LAWPh3-09-Q	2	1	2	X11PS11	3.69	2.47	6.52	not used	0.331
LAWPh3-20-Q	2	1	3	X14PS11	2.93	2.55	3.47	0.750	0.162
LAWPh3-04-Q	2	1	4	X05PS11	3.28	4.01	7.15	not used	0.255

Table A-3. PS Measurements of the Study Glasses – Part 1 (continued)

ID	Block	Sub-Blk	Sequence	Lab ID	Al (wt%)	B (wt%)	Ca (wt%)	Fe (wt%)	P (wt%)
LAWPh3-09-Q	2	1	5	X11PS21	4.10	2.80	7.16	not used	0.351
LAWPh3-02-Q	2	1	6	X17PS11	3.58	4.14	3.61	not used	0.101
LAWPh3-20-Q	2	1	7	X14PS21	3.10	2.86	3.74	0.801	0.222
LAWPh3-15-Q	2	1	8	X20PS11	3.61	2.95	6.62	0.878	0.132
LRM	2	1	9	LRMPS212	4.73	2.27	0.258	0.938	0.209
LAWPh3-05-Q	2	1	10	X08PS11	3.29	1.90	1.98	0.791	0.580
LAWPh3-12-Q	2	1	11	X02PS11	5.59	4.18	2.15	0.761	0.483
LAWPh3-15-Q	2	1	12	X20PS21	3.70	2.93	6.55	0.892	0.141
LAWPh3-05-Q	2	1	13	X08PS21	3.25	2.00	1.94	0.758	0.593
LAWPh3-12-Q	2	1	14	X02PS21	5.45	4.08	2.11	0.758	0.412
LAWPh3-04-Q	2	1	15	X05PS21	3.14	3.78	6.99	not used	0.255
LAWPh3-02-Q	2	1	16	X17PS21	3.38	3.88	3.60	not used	<0.100
LRM	2	1	17	LRMPS213	4.66	2.13	0.268	0.915	0.195
LRM	2	2	1	LRMPS221	4.82	2.11	0.294	0.938	0.221
LAWPh3-15-Q	2	2	2	X20PS22	3.49	2.52	6.35	0.832	0.162
LAWPh3-09-Q	2	2	3	X11PS12	3.79	2.31	6.68	not used	0.355
LAWPh3-04-Q	2	2	4	X05PS22	3.39	3.85	7.23	not used	0.276
LAWPh3-12-Q	2	2	5	X02PS22	5.80	4.19	2.23	0.802	0.443
LAWPh3-04-Q	2	2	6	X05PS12	3.40	3.87	7.51	not used	0.307
LAWPh3-05-Q	2	2	7	X08PS22	3.32	1.83	1.98	0.768	0.562
LAWPh3-20-Q	2	2	8	X14PS22	3.14	2.62	3.80	0.807	0.176
LRM	2	2	9	LRMPS222	5.05	2.15	0.326	0.981	0.239
LAWPh3-02-Q	2	2	10	X17PS22	3.38	3.50	3.52	not used	0.122
LAWPh3-05-Q	2	2	11	X08PS12	3.38	1.80	2.03	0.778	0.584
LAWPh3-02-Q	2	2	12	X17PS12	3.62	3.92	3.80	not used	<0.100
LAWPh3-12-Q	2	2	13	X02PS12	5.76	3.98	2.23	0.762	0.426
LAWPh3-20-Q	2	2	14	X14PS12	3.28	2.60	3.94	0.829	0.181
LAWPh3-15-Q	2	2	15	X20PS12	3.81	2.67	6.75	0.877	0.130
LAWPh3-09-Q	2	2	16	X11PS22	4.02	2.37	7.11	not used	0.337
LRM	2	2	17	LRMPS223	4.90	2.02	0.326	0.945	0.165
LRM	3	1	1	LRMPS311	4.97	2.39	0.212	0.926	0.152
LAWPh3-13-Q	3	1	2	X12PS11	3.35	1.76	6.07	not used	0.192
LAWPh3-19-Q	3	1	3	X09PS21	3.40	2.17	6.46	0.896	<0.100
LAWPh3-07-Q	3	1	4	X06PS11	4.97	2.44	6.69	not used	0.502
LAWPh3-07-Q	3	1	5	X06PS21	4.98	2.42	6.63	not used	0.554
LAWPh3-18-Q	3	1	6	X03PS21	4.29	1.95	2.71	not used	0.368
LAWPh3-11-Q	3	1	7	X15PS11	4.68	3.02	2.88	not used	0.291
LAWPh3-18-Q	3	1	8	X03PS11	4.28	1.96	2.67	not used	0.351
LRM	3	1	9	LRMPS312	4.87	2.37	0.199	0.913	0.173

Table A-3. PS Measurements of the Study Glasses – Part 1 (continued)

ID	Block	Sub-Blk	Sequence	Lab ID	Al (wt%)	B (wt%)	Ca (wt%)	Fe (wt%)	P (wt%)
LAWPh3-11-Q	3	1	10	X15PS21	4.82	3.12	2.91	not used	0.326
LAWPh3-16-Q	3	1	11	X18PS11	3.18	2.32	5.95	not used	0.213
LAWPh3-19-Q	3	1	12	X09PS11	3.49	2.21	6.46	0.906	<0.100
LAWPh3-16-Q	3	1	13	X18PS21	3.06	2.17	5.72	not used	0.159
LAWPh3-13-Q	3	1	14	X12PS21	3.62	1.94	6.54	not used	0.164
LRM	3	1	15	LRMPS313	4.91	2.35	0.193	0.910	0.122
LRM	3	2	1	LRMPS321	4.59	2.01	0.110	0.763	<0.100
LAWPh3-11-Q	3	2	2	X15PS12	4.63	2.86	2.79	not used	0.134
LAWPh3-19-Q	3	2	3	X09PS12	3.36	2.01	6.40	0.811	<0.100
LAWPh3-18-Q	3	2	4	X03PS22	4.23	1.74	2.62	not used	0.227
LAWPh3-13-Q	3	2	5	X12PS22	3.54	1.73	6.34	not used	<0.100
LAWPh3-11-Q	3	2	6	X15PS22	4.67	2.70	2.67	not used	0.183
LAWPh3-13-Q	3	2	7	X12PS12	3.44	1.69	6.27	not used	<0.100
LAWPh3-07-Q	3	2	8	X06PS22	4.68	2.12	6.43	not used	0.373
LRM	3	2	9	LRMPS322	4.64	2.01	0.113	0.762	<0.100
LAWPh3-19-Q	3	2	10	X09PS22	3.27	1.97	6.29	0.794	<0.100
LAWPh3-16-Q	3	2	11	X18PS12	2.97	1.97	5.60	not used	<0.100
LAWPh3-16-Q	3	2	12	X18PS22	3.00	2.00	5.65	not used	<0.100
LAWPh3-07-Q	3	2	13	X06PS12	4.91	2.29	6.62	not used	0.355
LAWPh3-18-Q	3	2	14	X03PS12	4.04	1.67	2.54	not used	0.195
LRM	3	2	15	LRMPS323	4.76	2.10	0.123	0.787	<0.100

Table A-4. PS Measurements of the Study Glasses – Part 2

ID	Block	Sub-Blk	Sequence	Lab ID	Si (wt%)	Sn (wt%)	Zr (wt%)
LRM	1	1	1	LRMPS111	26.2	<0.100	0.634
LAWPh3-06-Q	1	1	2	X01PS11	16.0	2.50	1.77
LAWPh3-01-1-Q	1	1	3	X04PS11	15.4	2.39	3.50
LAWPh3-17-Q	1	1	4	X13PS11	16.3	0.564	2.33
LAWPh3-03-Q	1	1	5	X07PS11	20.1	1.19	3.32
LAWPh3-06-Q	1	1	6	X01PS21	17.3	2.49	1.82
LAWPh3-01-1-Q	1	1	7	X04PS21	17.5	2.37	3.52
LAWPh3-03-Q	1	1	8	X07PS21	19.0	1.15	3.33
LRM	1	1	9	LRMPS112	25.8	<0.100	0.774
LAWPh3-17-Q	1	1	10	X13PS21	18.9	0.597	2.27
LAWPh3-10-Q	1	1	11	X19PS11	17.5	1.40	3.99
LAWPh3-08-Q	1	1	12	X10PS11	21.3	0.407	4.10
LAWPh3-14-Q	1	1	13	X16PS11	18.8	1.63	2.41
LAWPh3-08-Q	1	1	14	X10PS21	20.6	0.396	3.89
LAWPh3-14-Q	1	1	15	X16PS21	17.8	1.67	2.42
LAWPh3-10-Q	1	1	16	X19PS21	16.7	1.26	3.86
LRM	1	1	17	LRMPS113	27.4	<0.100	0.759
LRM	1	2	1	LRMPS121	27.2	<0.100	0.597
LAWPh3-10-Q	1	2	2	X19PS12	17.6	1.22	3.78
LAWPh3-06-Q	1	2	3	X01PS22	17.5	2.50	1.88
LAWPh3-08-Q	1	2	4	X10PS22	21.3	0.414	3.97
LAWPh3-10-Q	1	2	5	X19PS22	17.2	1.36	4.05
LAWPh3-08-Q	1	2	6	X10PS12	21.9	0.409	4.08
LAWPh3-03-Q	1	2	7	X07PS12	20.4	1.14	3.25
LAWPh3-01-1-Q	1	2	8	X04PS12	17.4	2.25	3.44
LRM	1	2	9	LRMPS122	25.9	<0.100	0.755
LAWPh3-01-1-Q	1	2	10	X04PS22	17.0	2.41	3.48
LAWPh3-14-Q	1	2	11	X16PS12	18.4	1.63	2.36
LAWPh3-06-Q	1	2	12	X01PS12	17.1	2.53	1.85
LAWPh3-14-Q	1	2	13	X16PS22	18.4	1.65	2.41
LAWPh3-03-Q	1	2	14	X07PS22	20.3	1.25	3.45
LAWPh3-17-Q	1	2	15	X13PS22	19.1	0.542	2.34
LAWPh3-17-Q	1	2	16	X13PS12	19.3	0.537	2.32
LRM	1	2	17	LRMPS123	27.0	<0.100	0.734
LRM	2	1	1	LRMPS211	27.3	<0.100	0.674
LAWPh3-09-Q	2	1	2	X11PS11	17.6	0.220	2.90
LAWPh3-20-Q	2	1	3	X14PS11	20.3	2.03	2.14
LAWPh3-04-Q	2	1	4	X05PS11	17.3	0.394	2.17

Table A-4. PS Measurements of the Study Glasses – Part 2 (continued)

ID	Block	Sub-Blk	Sequence	Lab ID	Si (wt%)	Sn (wt%)	Zr (wt%)
LAWPh3-09-Q	2	1	5	X11PS21	16.9	0.309	3.36
LAWPh3-02-Q	2	1	6	X17PS11	16.2	1.31	3.06
LAWPh3-20-Q	2	1	7	X14PS21	18.5	2.21	2.23
LAWPh3-15-Q	2	1	8	X20PS11	15.4	1.39	2.79
LRM	2	1	9	LRMPS212	27.5	<0.100	0.772
LAWPh3-05-Q	2	1	10	X08PS11	19.2	2.42	3.73
LAWPh3-12-Q	2	1	11	X02PS11	16.4	0.846	2.13
LAWPh3-15-Q	2	1	12	X20PS21	16.7	1.36	2.77
LAWPh3-05-Q	2	1	13	X08PS21	18.3	2.43	3.87
LAWPh3-12-Q	2	1	14	X02PS21	15.5	0.734	2.08
LAWPh3-04-Q	2	1	15	X05PS21	15.7	0.353	2.11
LAWPh3-02-Q	2	1	16	X17PS21	15.2	1.22	2.98
LRM	2	1	17	LRMPS213	27.4	<0.100	0.751
LRM	2	2	1	LRMPS221	25.5	<0.100	0.672
LAWPh3-15-Q	2	2	2	X20PS22	15.4	1.29	2.56
LAWPh3-09-Q	2	2	3	X11PS12	17.1	0.290	3.09
LAWPh3-04-Q	2	2	4	X05PS22	16.6	0.411	2.21
LAWPh3-12-Q	2	2	5	X02PS22	16.2	0.778	2.18
LAWPh3-04-Q	2	2	6	X05PS12	16.9	0.406	2.26
LAWPh3-05-Q	2	2	7	X08PS22	18.7	2.46	3.92
LAWPh3-20-Q	2	2	8	X14PS22	19.6	2.33	2.28
LRM	2	2	9	LRMPS222	25.7	<0.100	0.803
LAWPh3-02-Q	2	2	10	X17PS22	14.8	1.19	2.81
LAWPh3-05-Q	2	2	11	X08PS12	18.2	2.38	3.87
LAWPh3-02-Q	2	2	12	X17PS12	16.1	1.33	3.15
LAWPh3-12-Q	2	2	13	X02PS12	16.1	0.854	2.20
LAWPh3-20-Q	2	2	14	X14PS12	19.7	2.34	2.40
LAWPh3-15-Q	2	2	15	X20PS12	15.5	1.43	2.86
LAWPh3-09-Q	2	2	16	X11PS22	15.7	0.282	3.32
LRM	2	2	17	LRMPS223	24.3	<0.100	0.785
LRM	3	1	1	LRMPS311	27.3	<0.100	0.652
LAWPh3-13-Q	3	1	2	X12PS11	19.5	0.151	1.80
LAWPh3-19-Q	3	1	3	X09PS21	19.4	0.778	1.86
LAWPh3-07-Q	3	1	4	X06PS11	16.1	0.522	2.04
LAWPh3-07-Q	3	1	5	X06PS21	16.8	0.531	2.02
LAWPh3-18-Q	3	1	6	X03PS21	19.4	2.60	2.86
LAWPh3-11-Q	3	1	7	X15PS11	16.1	0.558	4.08
LAWPh3-18-Q	3	1	8	X03PS11	18.5	2.54	2.86
LRM	3	1	9	LRMPS312	25.0	<0.100	0.721

Table A-4. PS Measurements of the Study Glasses – Part 2 (continued)

ID	Block	Sub-Blk	Sequence	Lab ID	Si (wt%)	Sn (wt%)	Zr (wt%)
LAWPh3-11-Q	3	1	10	X15PS21	17.0	0.590	4.05
LAWPh3-16-Q	3	1	11	X18PS11	17.7	<0.100	3.66
LAWPh3-19-Q	3	1	12	X09PS11	19.1	0.808	1.91
LAWPh3-16-Q	3	1	13	X18PS21	17.1	<0.100	3.55
LAWPh3-13-Q	3	1	14	X12PS21	18.5	0.213	2.04
LRM	3	1	15	LRMPS313	26.1	<0.100	0.721
LRM	3	2	1	LRMPS321	26.2	<0.100	0.530
LAWPh3-11-Q	3	2	2	X15PS12	16.9	0.358	3.94
LAWPh3-19-Q	3	2	3	X09PS12	18.6	0.647	1.82
LAWPh3-18-Q	3	2	4	X03PS22	18.9	2.41	2.75
LAWPh3-13-Q	3	2	5	X12PS22	18.1	<0.100	1.93
LAWPh3-11-Q	3	2	6	X15PS22	15.3	0.375	3.89
LAWPh3-13-Q	3	2	7	X12PS12	16.6	<0.100	1.90
LAWPh3-07-Q	3	2	8	X06PS22	15.9	0.355	1.87
LRM	3	2	9	LRMPS322	25.4	<0.100	0.609
LAWPh3-19-Q	3	2	10	X09PS22	18.2	0.653	1.72
LAWPh3-16-Q	3	2	11	X18PS12	15.9	<0.100	3.40
LAWPh3-16-Q	3	2	12	X18PS22	16.1	<0.100	3.49
LAWPh3-07-Q	3	2	13	X06PS12	14.8	0.356	2.00
LAWPh3-18-Q	3	2	14	X03PS12	17.4	2.32	2.67
LRM	3	2	15	LRMPS323	22.9	<0.100	0.637

Table A-5. KH Measurements of the Study Glasses

ID	Block	Sub-Blk	Sequence	Lab ID	Cl (wt%)	F (wt%)
LRM	1	1	1	LRMKH111	<0.0500	0.868
LAWPh3-10-Q	1	1	2	X19KH11	0.0677	0.119
LAWPh3-08-Q	1	1	3	X10KH11	0.342	0.569
LAWPh3-03-Q	1	1	4	X07KH11	0.351	0.583
LAWPh3-14-Q	1	1	5	X16KH11	0.375	0.558
LAWPh3-17-Q	1	1	6	X13KH11	0.171	0.246
LAWPh3-03-Q	1	1	7	X07KH21	0.357	0.585
LAWPh3-10-Q	1	1	8	X19KH21	0.0811	0.108
LRM	1	1	9	LRMKH112	<0.0500	0.872
LAWPh3-01-1-Q	1	1	10	X04KH11	0.132	0.160
LAWPh3-17-Q	1	1	11	X13KH21	0.152	0.239
LAWPh3-06-Q	1	1	12	X01KH11	0.0829	0.128
LAWPh3-08-Q	1	1	13	X10KH21	0.356	0.582
LAWPh3-01-1-Q	1	1	14	X04KH21	0.116	0.184
LAWPh3-06-Q	1	1	15	X01KH21	0.0842	0.121
LAWPh3-14-Q	1	1	16	X16KH21	0.385	0.562
LRM	1	1	17	LRMKH113	<0.0500	0.859
LRM	1	2	1	LRMKH121	<0.0500	0.892
LAWPh3-08-Q	1	2	2	X10KH12	0.379	0.577
LAWPh3-14-Q	1	2	3	X16KH22	0.361	0.624
LAWPh3-10-Q	1	2	4	X19KH22	0.0533	0.156
LAWPh3-01-1-Q	1	2	5	X04KH22	0.0986	0.191
LAWPh3-17-Q	1	2	6	X13KH12	0.133	0.266
LAWPh3-06-Q	1	2	7	X01KH12	0.0620	0.129
LAWPh3-14-Q	1	2	8	X16KH12	0.370	0.591
LRM	1	2	9	LRMKH122	<0.0500	0.885
LAWPh3-10-Q	1	2	10	X19KH12	0.0730	0.104
LAWPh3-03-Q	1	2	11	X07KH12	0.381	0.583
LAWPh3-06-Q	1	2	12	X01KH22	0.0944	0.121
LAWPh3-08-Q	1	2	13	X10KH22	0.374	0.578
LAWPh3-03-Q	1	2	14	X07KH22	0.382	0.593
LAWPh3-17-Q	1	2	15	X13KH22	0.172	0.220
LAWPh3-01-1-Q	1	2	16	X04KH12	0.125	0.157
LRM	1	2	17	LRMKH123	<0.0500	0.872
LRM	2	1	1	LRMKH211	<0.0500	0.894
LAWPh3-20-Q	2	1	2	X14KH11	0.128	0.149
LAWPh3-04-Q	2	1	3	X05KH11	0.188	0.246
LAWPh3-02-Q	2	1	4	X17KH11	0.0728	0.0681
LAWPh3-05-Q	2	1	5	X08KH11	0.327	0.546
LAWPh3-15-Q	2	1	6	X20KH11	0.0855	0.143
LAWPh3-09-Q	2	1	7	X11KH11	0.196	0.350
LAWPh3-04-Q	2	1	8	X05KH21	0.188	0.249
LRM	2	1	9	LRMKH212	<0.0500	0.959
LAWPh3-02-Q	2	1	10	X17KH21	0.0824	0.0744
LAWPh3-12-Q	2	1	11	X02KH11	0.258	0.400
LAWPh3-20-Q	2	1	12	X14KH21	0.132	0.157
LAWPh3-05-Q	2	1	13	X08KH21	0.330	0.579
LAWPh3-12-Q	2	1	14	X02KH21	0.259	0.394
LAWPh3-15-Q	2	1	15	X20KH21	0.0865	0.133
LAWPh3-09-Q	2	1	16	X11KH21	0.187	0.308
LRM	2	1	17	LRMKH213	<0.0500	0.892
LRM	2	2	1	LRMKH221	<0.0500	0.930
LAWPh3-15-Q	2	2	2	X20KH12	0.0906	0.125
LAWPh3-15-Q	2	2	3	X20KH22	0.0948	0.118
LAWPh3-04-Q	2	2	4	X05KH22	0.186	0.257
LAWPh3-05-Q	2	2	5	X08KH22	0.328	0.558
LAWPh3-02-Q	2	2	6	X17KH22	0.0579	0.0933
LAWPh3-05-Q	2	2	7	X08KH12	0.312	0.605
LAWPh3-20-Q	2	2	8	X14KH12	0.122	0.145

Table A-5. KH Measurements of the Study Glasses (continued)

ID	Block	Sub-Blk	Sequence	Lab ID	Cl (wt%)	F (wt%)
LRM	2	2	9	LRMKH222	<0.0500	0.943
LAWPh3-04-Q	2	2	10	X05KH12	0.186	0.245
LAWPh3-12-Q	2	2	11	X02KH12	0.263	0.378
LAWPh3-09-Q	2	2	12	X11KH12	0.198	0.339
LAWPh3-09-Q	2	2	13	X11KH22	0.181	0.343
LAWPh3-12-Q	2	2	14	X02KH22	0.272	0.391
LAWPh3-02-Q	2	2	15	X17KH12	0.0869	0.0699
LAWPh3-20-Q	2	2	16	X14KH22	0.141	0.142
LRM	2	2	17	LRMKH223	<0.0500	0.901
LRM	3	1	1	LRMKH311	<0.0500	0.895
LAWPh3-19-Q	3	1	2	X09KH11	0.0714	0.104
LAWPh3-13-Q	3	1	3	X12KH11	0.131	0.224
LAWPh3-11-Q	3	1	4	X15KH11	0.228	0.336
LAWPh3-18-Q	3	1	5	X03KH11	0.256	0.419
LAWPh3-11-Q	3	1	6	X15KH21	0.232	0.355
LAWPh3-19-Q	3	1	7	X09KH21	0.0762	0.092
LAWPh3-07-Q	3	1	8	X06KH11	0.339	0.503
LRM	3	1	9	LRMKH312	<0.0500	0.876
LAWPh3-16-Q	3	1	10	X18KH11	0.156	0.246
LAWPh3-13-Q	3	1	11	X12KH21	0.134	0.216
LAWPh3-07-Q	3	1	12	X06KH21	0.348	0.515
LAWPh3-18-Q	3	1	13	X03KH21	0.263	0.400
LAWPh3-16-Q	3	1	14	X18KH21	0.156	0.255
LRM	3	1	15	LRMKH313	<0.0500	0.885
LRM	3	2	1	LRMKH321	<0.0500	0.896
LAWPh3-11-Q	3	2	2	X15KH22	0.229	0.350
LAWPh3-19-Q	3	2	3	X09KH12	0.0748	0.105
LAWPh3-13-Q	3	2	4	X12KH12	0.135	0.229
LAWPh3-13-Q	3	2	5	X12KH22	0.138	0.228
LAWPh3-07-Q	3	2	6	X06KH22	0.350	0.551
LAWPh3-18-Q	3	2	7	X03KH12	0.264	0.419
LAWPh3-16-Q	3	2	8	X18KH12	0.163	0.261
LRM	3	2	9	LRMKH322	<0.0500	0.901
LAWPh3-07-Q	3	2	10	X06KH12	0.343	0.540
LAWPh3-16-Q	3	2	11	X18KH22	0.163	0.265
LAWPh3-19-Q	3	2	12	X09KH22	0.0779	0.104
LAWPh3-18-Q	3	2	13	X03KH22	0.262	0.421
LAWPh3-11-Q	3	2	14	X15KH12	0.252	0.355
LRM	3	2	15	LRMKH323	<0.0500	0.904

Table A-6. Comparison of Measured and Targeted Compositions of the Study Glasses

Glass ID	Oxide	BDL (<)	Measured (wt %)	Targeted (wt %)	Difference of Measured versus Targeted	% Difference of Measured versus Targeted
LAWPh3-01-1-Q	Al_2O_3		6.405	6.576	-0.171	-2.6%
LAWPh3-01-1-Q	B_2O_3		14.345	13.506	0.839	6.2%
LAWPh3-01-1-Q	CaO		4.890	4.456	0.434	
LAWPh3-01-1-Q	Cl		0.118	0.137	-0.019	
LAWPh3-01-1-Q	Cr_2O_3		0.510	0.574	-0.064	
LAWPh3-01-1-Q	F		0.173	0.208	-0.035	
LAWPh3-01-1-Q	Fe_2O_3		0.498	0.537	-0.039	
LAWPh3-01-1-Q	K_2O		0.810	0.676	0.134	
LAWPh3-01-1-Q	MgO		1.121	1.235	-0.114	
LAWPh3-01-1-Q	Na_2O		22.680	24.131	-1.451	-6.0%
LAWPh3-01-1-Q	P_2O_5	<	0.233	0.446	-0.213	
LAWPh3-01-1-Q	SiO_2		35.994	35.582	0.412	1.2%
LAWPh3-01-1-Q	SnO_2		2.990	3.076	-0.086	
LAWPh3-01-1-Q	SO_3		0.552	0.528	0.024	
LAWPh3-01-1-Q	V_2O_5		0.258	0.281	-0.023	
LAWPh3-01-1-Q	ZnO		1.970	2.070	-0.100	
LAWPh3-01-1-Q	ZrO_2		4.708	5.981	-1.273	-21.3%
LAWPh3-01-1-Q	sum		98.254	100.000	-1.746	-1.7%
LAWPh3-02-Q	Al_2O_3		6.594	6.869	-0.275	-4.0%
LAWPh3-02-Q	B_2O_3		12.429	13.158	-0.729	-5.5%
LAWPh3-02-Q	CaO		5.083	4.673	0.410	
LAWPh3-02-Q	Cl		0.075	0.074	0.001	
LAWPh3-02-Q	Cr_2O_3		0.485	0.520	-0.035	
LAWPh3-02-Q	F		0.076	0.112	-0.036	
LAWPh3-02-Q	Fe_2O_3	<	0.143	0.045	0.098	
LAWPh3-02-Q	K_2O		2.608	2.886	-0.278	
LAWPh3-02-Q	MgO		1.058	1.084	-0.026	
LAWPh3-02-Q	Na_2O		21.366	22.707	-1.341	-5.9%
LAWPh3-02-Q	P_2O_5	<	0.242	0.240	0.002	
LAWPh3-02-Q	SiO_2		33.320	34.922	-1.602	-4.6%
LAWPh3-02-Q	SnO_2		1.603	1.553	0.050	
LAWPh3-02-Q	SO_3		0.478	0.447	0.031	
LAWPh3-02-Q	V_2O_5		2.651	2.854	-0.203	
LAWPh3-02-Q	ZnO		2.894	3.091	-0.197	
LAWPh3-02-Q	ZrO_2		4.052	4.765	-0.713	
LAWPh3-02-Q	sum		95.158	100.000	-4.842	-4.8%
LAWPh3-03-Q	Al_2O_3		6.490	6.500	-0.010	-0.1%
LAWPh3-03-Q	B_2O_3		7.076	6.620	0.456	6.9%
LAWPh3-03-Q	CaO		4.589	4.093	0.496	
LAWPh3-03-Q	Cl		0.368	0.443	-0.075	
LAWPh3-03-Q	Cr_2O_3		0.320	0.344	-0.024	
LAWPh3-03-Q	F		0.586	0.672	-0.086	
LAWPh3-03-Q	Fe_2O_3		1.400	1.403	-0.003	
LAWPh3-03-Q	K_2O		4.638	5.005	-0.367	-7.3%
LAWPh3-03-Q	MgO		1.124	1.176	-0.052	
LAWPh3-03-Q	Na_2O		19.883	21.585	-1.702	-7.9%
LAWPh3-03-Q	P_2O_5		1.071	1.438	-0.367	
LAWPh3-03-Q	SiO_2		42.679	39.958	2.721	6.8%
LAWPh3-03-Q	SnO_2		1.501	1.578	-0.077	
LAWPh3-03-Q	SO_3		0.525	0.538	-0.013	
LAWPh3-03-Q	V_2O_5		0.246	0.254	-0.008	
LAWPh3-03-Q	ZnO		3.000	3.033	-0.033	
LAWPh3-03-Q	ZrO_2		4.508	5.358	-0.850	-15.9%
LAWPh3-03-Q	sum		100.005	99.998	0.007	0.0%
LAWPh3-04-Q	Al_2O_3		6.240	6.363	-0.123	-1.9%
LAWPh3-04-Q	B_2O_3		12.485	12.757	-0.272	-2.1%
LAWPh3-04-Q	CaO		10.102	9.524	0.578	6.1%

Table A-6. Comparison of Measured and Targeted Compositions of the Study Glasses (continued)

Glass ID	Oxide	BDL (<)	Measured (wt %)	Targeted (wt %)	Difference of Measured versus Targeted	% Difference of Measured versus Targeted
LAWPh3-04-Q	Cl		0.187	0.201	-0.014	
LAWPh3-04-Q	Cr_2O_3		0.448	0.494	-0.046	
LAWPh3-04-Q	F		0.249	0.305	-0.056	
LAWPh3-04-Q	Fe_2O_3		0.361	0.367	-0.006	
LAWPh3-04-Q	K_2O		0.863	0.895	-0.032	
LAWPh3-04-Q	MgO		0.441	0.415	0.026	
LAWPh3-04-Q	Na_2O		20.523	22.210	-1.687	-7.6%
LAWPh3-04-Q	P_2O_5		0.626	0.652	-0.026	
LAWPh3-04-Q	SiO_2		35.566	35.803	-0.237	-0.7%
LAWPh3-04-Q	SnO_2		0.496	0.349	0.147	
LAWPh3-04-Q	SO_3		1.203	1.274	-0.071	
LAWPh3-04-Q	V_2O_5		2.553	2.756	-0.203	
LAWPh3-04-Q	ZnO		2.094	2.243	-0.149	
LAWPh3-04-Q	ZrO_2		2.955	3.392	-0.437	
LAWPh3-04-Q	sum		97.393	100.000	-2.607	-2.6%
LAWPh3-05-Q	Al_2O_3		6.254	6.186	0.068	1.1%
LAWPh3-05-Q	B_2O_3		6.061	6.195	-0.134	-2.2%
LAWPh3-05-Q	CaO		2.774	2.442	0.332	
LAWPh3-05-Q	Cl		0.324	0.432	-0.108	
LAWPh3-05-Q	Cr_2O_3		0.524	0.557	-0.033	
LAWPh3-05-Q	F		0.572	0.656	-0.084	
LAWPh3-05-Q	Fe_2O_3		1.106	1.051	0.055	
LAWPh3-05-Q	K_2O		2.587	2.903	-0.316	
LAWPh3-05-Q	MgO		1.078	1.126	-0.048	
LAWPh3-05-Q	Na_2O		20.894	22.524	-1.630	-7.2%
LAWPh3-05-Q	P_2O_5		1.328	1.404	-0.076	
LAWPh3-05-Q	SiO_2		39.791	39.153	0.638	1.6%
LAWPh3-05-Q	SnO_2		3.076	3.024	0.052	
LAWPh3-05-Q	SO_3		0.888	0.895	-0.007	
LAWPh3-05-Q	V_2O_5		3.053	3.267	-0.214	
LAWPh3-05-Q	ZnO		2.007	2.126	-0.119	
LAWPh3-05-Q	ZrO_2		5.197	6.059	-0.862	-14.2%
LAWPh3-05-Q	sum		97.515	100.000	-2.485	-2.5%
LAWPh3-06-Q	Al_2O_3		8.918	9.019	-0.101	-1.1%
LAWPh3-06-Q	B_2O_3		7.446	6.727	0.719	10.7%
LAWPh3-06-Q	CaO		10.581	10.161	0.420	4.1%
LAWPh3-06-Q	Cl		0.081	0.100	-0.019	
LAWPh3-06-Q	Cr_2O_3		0.510	0.583	-0.073	
LAWPh3-06-Q	F		0.125	0.151	-0.026	
LAWPh3-06-Q	Fe_2O_3		0.245	0.239	0.006	
LAWPh3-06-Q	K_2O		2.364	2.394	-0.030	
LAWPh3-06-Q	MgO		1.073	1.138	-0.065	
LAWPh3-06-Q	Na_2O		20.018	21.267	-1.249	-5.9%
LAWPh3-06-Q	P_2O_5	<	0.233	0.324	-0.091	
LAWPh3-06-Q	SiO_2		36.315	35.777	0.538	1.5%
LAWPh3-06-Q	SnO_2		3.180	3.253	-0.073	
LAWPh3-06-Q	SO_3		0.355	0.341	0.014	
LAWPh3-06-Q	V_2O_5		2.240	2.304	-0.064	
LAWPh3-06-Q	ZnO		2.891	2.895	-0.004	
LAWPh3-06-Q	ZrO_2		2.472	3.327	-0.855	
LAWPh3-06-Q	sum		99.046	100.000	-0.954	-1.0%
LAWPh3-07-Q	Al_2O_3		9.230	9.804	-0.574	-5.9%
LAWPh3-07-Q	B_2O_3		7.462	7.610	-0.148	-1.9%
LAWPh3-07-Q	CaO		9.224	8.843	0.381	4.3%
LAWPh3-07-Q	Cl		0.345	0.415	-0.070	
LAWPh3-07-Q	Cr_2O_3		0.316	0.329	-0.013	

Table A-6. Comparison of Measured and Targeted Compositions of the Study Glasses (continued)

Glass ID	Oxide	BDL (<)	Measured (wt %)	Targeted (wt %)	Difference of Measured versus Targeted	% Difference of Measured versus Targeted
LAWPh3-07-Q	F		0.527	0.631	-0.104	
LAWPh3-07-Q	Fe_2O_3		0.543	0.525	0.018	
LAWPh3-07-Q	K_2O		0.734	0.782	-0.048	
LAWPh3-07-Q	MgO	<	0.166	0.070	0.096	
LAWPh3-07-Q	Na_2O		22.781	23.886	-1.105	-4.6%
LAWPh3-07-Q	P_2O_5		1.210	1.350	-0.140	
LAWPh3-07-Q	SiO_2		34.015	35.064	-1.049	-3.0%
LAWPh3-07-Q	SnO_2		0.560	0.733	-0.173	
LAWPh3-07-Q	SO_3		0.532	0.557	-0.025	
LAWPh3-07-Q	V_2O_5		3.035	3.050	-0.015	
LAWPh3-07-Q	ZnO		3.093	3.095	-0.002	
LAWPh3-07-Q	ZrO_2		2.678	3.256	-0.578	
LAWPh3-07-Q	sum		96.452	100.000	-3.548	-3.5%
LAWPh3-08-Q	Al_2O_3		6.627	6.672	-0.045	-0.7%
LAWPh3-08-Q	B_2O_3		6.778	6.482	0.296	4.6%
LAWPh3-08-Q	CaO		6.786	6.142	0.644	10.5%
LAWPh3-08-Q	Cl		0.363	0.456	-0.093	
LAWPh3-08-Q	Cr_2O_3		0.429	0.468	-0.039	
LAWPh3-08-Q	F		0.577	0.693	-0.117	
LAWPh3-08-Q	Fe_2O_3	<	0.143	0.106	0.037	
LAWPh3-08-Q	K_2O		1.373	1.515	-0.142	
LAWPh3-08-Q	MgO		0.212	0.185	0.027	
LAWPh3-08-Q	Na_2O		19.950	21.243	-1.293	-6.1%
LAWPh3-08-Q	P_2O_5		1.186	1.482	-0.296	
LAWPh3-08-Q	SiO_2		45.514	43.987	1.527	3.5%
LAWPh3-08-Q	SnO_2		0.516	0.569	-0.053	
LAWPh3-08-Q	SO_3		0.359	0.371	-0.012	
LAWPh3-08-Q	V_2O_5	<	0.179	0.050	0.129	
LAWPh3-08-Q	ZnO		3.289	3.291	-0.002	
LAWPh3-08-Q	ZrO_2		5.417	6.288	-0.871	-13.9%
LAWPh3-08-Q	sum		99.698	100.000	-0.302	-0.3%
LAWPh3-09-Q	Al_2O_3		7.369	7.822	-0.453	-5.8%
LAWPh3-09-Q	B_2O_3		8.010	8.597	-0.587	-6.8%
LAWPh3-09-Q	CaO		9.609	9.226	0.383	4.2%
LAWPh3-09-Q	Cl		0.191	0.257	-0.067	
LAWPh3-09-Q	Cr_2O_3		0.280	0.305	-0.025	
LAWPh3-09-Q	F		0.335	0.391	-0.056	
LAWPh3-09-Q	Fe_2O_3		0.810	0.842	-0.032	
LAWPh3-09-Q	K_2O		4.858	5.498	-0.640	-11.6%
LAWPh3-09-Q	MgO		0.248	0.205	0.043	
LAWPh3-09-Q	Na_2O		19.613	21.285	-1.672	-7.9%
LAWPh3-09-Q	P_2O_5		0.787	0.836	-0.049	
LAWPh3-09-Q	SiO_2		35.994	35.513	0.481	1.4%
LAWPh3-09-Q	SnO_2		0.349	0.236	0.113	
LAWPh3-09-Q	SO_3		0.951	0.964	-0.013	
LAWPh3-09-Q	V_2O_5		0.617	0.644	-0.027	
LAWPh3-09-Q	ZnO		2.079	2.289	-0.210	
LAWPh3-09-Q	ZrO_2		4.279	5.090	-0.811	-15.9%
LAWPh3-09-Q	sum		96.377	100.000	-3.623	-3.6%
LAWPh3-10-Q	Al_2O_3		8.120	8.251	-0.131	-1.6%
LAWPh3-10-Q	B_2O_3		6.544	6.361	0.183	2.9%
LAWPh3-10-Q	CaO		6.216	5.579	0.637	11.4%
LAWPh3-10-Q	Cl		0.069	0.095	-0.026	
LAWPh3-10-Q	Cr_2O_3		0.325	0.361	-0.036	
LAWPh3-10-Q	F		0.122	0.144	-0.022	
LAWPh3-10-Q	Fe_2O_3		0.728	0.789	-0.061	

Table A-6. Comparison of Measured and Targeted Compositions of the Study Glasses (continued)

Glass ID	Oxide	BDL (<)	Measured (wt %)	Targeted (wt %)	Difference of Measured versus Targeted	% Difference of Measured versus Targeted
LAWPh3-10-Q	K_2O		2.554	2.626	-0.072	
LAWPh3-10-Q	MgO		0.348	0.338	0.010	
LAWPh3-10-Q	Na_2O		22.175	23.593	-1.418	-6.0%
LAWPh3-10-Q	P_2O_5	<	0.229	0.308	-0.079	
LAWPh3-10-Q	SiO_2		36.903	35.502	1.401	3.9%
LAWPh3-10-Q	SnO_2		1.663	1.719	-0.056	
LAWPh3-10-Q	SO_3		1.074	1.103	-0.029	
LAWPh3-10-Q	V_2O_5		3.722	3.836	-0.114	
LAWPh3-10-Q	ZnO		3.124	3.187	-0.063	
LAWPh3-10-Q	ZrO_2		5.295	6.208	-0.913	-14.7%
LAWPh3-10-Q	sum		99.212	100.000	-0.788	-0.8%
LAWPh3-11-Q	Al_2O_3		8.881	9.337	-0.456	-4.9%
LAWPh3-11-Q	B_2O_3		9.418	9.333	0.085	0.9%
LAWPh3-11-Q	CaO		3.935	3.773	0.162	
LAWPh3-11-Q	Cl		0.235	0.272	-0.037	
LAWPh3-11-Q	Cr_2O_3		0.543	0.565	-0.022	
LAWPh3-11-Q	F		0.349	0.412	-0.063	
LAWPh3-11-Q	Fe_2O_3	<	0.143	0.052	0.091	
LAWPh3-11-Q	K_2O		1.259	1.372	-0.113	
LAWPh3-11-Q	MgO		0.813	0.817	-0.004	
LAWPh3-11-Q	Na_2O		24.230	24.759	-0.529	-2.1%
LAWPh3-11-Q	P_2O_5		0.707	0.882	-0.175	
LAWPh3-11-Q	SiO_2		34.924	35.499	-0.575	-1.6%
LAWPh3-11-Q	SnO_2		0.597	0.746	-0.149	
LAWPh3-11-Q	SO_3		0.138	0.108	0.030	
LAWPh3-11-Q	V_2O_5		3.347	3.457	-0.110	
LAWPh3-11-Q	ZnO		2.343	2.187	0.156	
LAWPh3-11-Q	ZrO_2		5.390	6.429	-1.039	-16.2%
LAWPh3-11-Q	sum		97.253	100.000	-2.747	-2.7%
LAWPh3-12-Q	Al_2O_3		10.676	11.122	-0.446	-4.0%
LAWPh3-12-Q	B_2O_3		13.226	13.512	-0.286	-2.1%
LAWPh3-12-Q	CaO		3.050	2.761	0.289	
LAWPh3-12-Q	Cl		0.263	0.320	-0.057	
LAWPh3-12-Q	Cr_2O_3		0.387	0.427	-0.040	
LAWPh3-12-Q	F		0.391	0.486	-0.095	
LAWPh3-12-Q	Fe_2O_3		1.102	1.071	0.031	
LAWPh3-12-Q	K_2O		0.236	0.229	0.007	
LAWPh3-12-Q	MgO		1.144	1.259	-0.115	
LAWPh3-12-Q	Na_2O		20.186	21.432	-1.246	-5.8%
LAWPh3-12-Q	P_2O_5		1.011	1.039	-0.028	
LAWPh3-12-Q	SiO_2		34.336	35.137	-0.801	-2.3%
LAWPh3-12-Q	SnO_2		1.019	0.934	0.085	
LAWPh3-12-Q	SO_3		0.315	0.295	0.020	
LAWPh3-12-Q	V_2O_5		3.374	3.846	-0.472	
LAWPh3-12-Q	ZnO		2.452	2.791	-0.339	
LAWPh3-12-Q	ZrO_2		2.901	3.339	-0.438	
LAWPh3-12-Q	sum		96.069	100.000	-3.931	-3.9%
LAWPh3-13-Q	Al_2O_3		6.590	7.122	-0.532	-7.5%
LAWPh3-13-Q	B_2O_3		5.731	6.245	-0.514	-8.2%
LAWPh3-13-Q	CaO		8.822	8.596	0.226	2.6%
LAWPh3-13-Q	Cl		0.135	0.169	-0.035	
LAWPh3-13-Q	Cr_2O_3		0.558	0.580	-0.022	
LAWPh3-13-Q	F		0.224	0.257	-0.033	
LAWPh3-13-Q	Fe_2O_3	<	0.143	0.069	0.074	
LAWPh3-13-Q	K_2O		3.078	3.403	-0.325	
LAWPh3-13-Q	MgO		1.226	1.251	-0.025	

Table A-6. Comparison of Measured and Targeted Compositions of the Study Glasses (continued)

Glass ID	Oxide	BDL (<)	Measured (wt %)	Targeted (wt %)	Difference of Measured versus Targeted	% Difference of Measured versus Targeted
LAWPh3-13-Q	Na_2O		21.804	23.038	-1.234	-5.4%
LAWPh3-13-Q	P_2O_5		0.408	0.549	-0.141	
LAWPh3-13-Q	SiO_2		38.882	39.839	-0.957	-2.4%
LAWPh3-13-Q	SnO_2	<	0.179	0.272	-0.093	
LAWPh3-13-Q	SO_3		1.111	1.109	0.002	
LAWPh3-13-Q	V_2O_5		0.768	0.786	-0.018	
LAWPh3-13-Q	ZnO		3.389	3.501	-0.112	
LAWPh3-13-Q	ZrO_2		2.590	3.214	-0.624	
LAWPh3-13-Q	sum		95.637	100.000	-4.363	-4.4%
LAWPh3-14-Q	Al_2O_3		6.429	6.633	-0.204	-3.1%
LAWPh3-14-Q	B_2O_3		8.589	8.264	0.325	3.9%
LAWPh3-14-Q	CaO		5.824	5.296	0.528	10.0%
LAWPh3-14-Q	Cl		0.373	0.430	-0.057	
LAWPh3-14-Q	Cr_2O_3		0.302	0.318	-0.016	
LAWPh3-14-Q	F		0.584	0.654	-0.070	
LAWPh3-14-Q	Fe_2O_3	<	0.143	0.033	0.110	
LAWPh3-14-Q	K_2O		0.228	0.209	0.019	
LAWPh3-14-Q	MgO	<	0.166	0.087	0.079	
LAWPh3-14-Q	Na_2O		24.197	25.643	-1.446	-5.6%
LAWPh3-14-Q	P_2O_5		1.104	1.399	-0.295	
LAWPh3-14-Q	SiO_2		39.256	39.559	-0.303	-0.8%
LAWPh3-14-Q	SnO_2		2.088	2.168	-0.080	
LAWPh3-14-Q	SO_3		0.883	0.917	-0.034	
LAWPh3-14-Q	V_2O_5		2.013	2.139	-0.126	
LAWPh3-14-Q	ZnO		2.346	2.480	-0.134	
LAWPh3-14-Q	ZrO_2		3.242	3.771	-0.529	
LAWPh3-14-Q	sum		97.767	100.000	-2.233	-2.2%
LAWPh3-15-Q	Al_2O_3		6.901	7.298	-0.397	-5.4%
LAWPh3-15-Q	B_2O_3		8.911	9.432	-0.521	-5.5%
LAWPh3-15-Q	CaO		9.189	8.668	0.521	6.0%
LAWPh3-15-Q	Cl		0.089	0.105	-0.016	
LAWPh3-15-Q	Cr_2O_3		0.393	0.430	-0.037	
LAWPh3-15-Q	F		0.130	0.160	-0.030	
LAWPh3-15-Q	Fe_2O_3		1.243	1.246	-0.003	
LAWPh3-15-Q	K_2O		3.578	4.136	-0.558	
LAWPh3-15-Q	MgO	<	0.166	0.008	0.158	
LAWPh3-15-Q	Na_2O		20.254	21.708	-1.454	-6.7%
LAWPh3-15-Q	P_2O_5		0.324	0.342	-0.018	
LAWPh3-15-Q	SiO_2		33.694	35.343	-1.649	-4.7%
LAWPh3-15-Q	SnO_2		1.736	1.692	0.044	
LAWPh3-15-Q	SO_3		0.409	0.387	0.022	
LAWPh3-15-Q	V_2O_5		1.513	1.604	-0.091	
LAWPh3-15-Q	ZnO		2.648	2.942	-0.294	
LAWPh3-15-Q	ZrO_2		3.708	4.499	-0.791	
LAWPh3-15-Q	sum		94.887	100.000	-5.113	-5.1%
LAWPh3-16-Q	Al_2O_3		5.768	6.112	-0.344	-5.6%
LAWPh3-16-Q	B_2O_3		6.810	6.919	-0.109	-1.6%
LAWPh3-16-Q	CaO		8.017	7.417	0.600	8.1%
LAWPh3-16-Q	Cl		0.160	0.193	-0.034	
LAWPh3-16-Q	Cr_2O_3		0.385	0.425	-0.040	
LAWPh3-16-Q	F		0.257	0.294	-0.037	
LAWPh3-16-Q	Fe_2O_3		0.327	0.333	-0.006	
LAWPh3-16-Q	K_2O		3.593	4.082	-0.489	
LAWPh3-16-Q	MgO		0.780	0.792	-0.012	
LAWPh3-16-Q	Na_2O		22.242	23.202	-0.960	-4.1%
LAWPh3-16-Q	P_2O_5		0.426	0.629	-0.203	

Table A-6. Comparison of Measured and Targeted Compositions of the Study Glasses (continued)

Glass ID	Oxide	BDL (<)	Measured (wt %)	Targeted (wt %)	Difference of Measured versus Targeted	% Difference of Measured versus Targeted
LAWPh3-16-Q	SiO_2		35.726	36.558	-0.832	-2.3%
LAWPh3-16-Q	SnO_2	<	0.127	0.115	0.012	
LAWPh3-16-Q	SO_3		0.192	0.165	0.027	
LAWPh3-16-Q	V_2O_5		3.410	3.623	-0.213	
LAWPh3-16-Q	ZnO		3.243	3.433	-0.190	
LAWPh3-16-Q	ZrO_2		4.762	5.708	-0.946	-16.6%
LAWPh3-16-Q	sum		96.224	100.000	-3.776	-3.8%
LAWPh3-17-Q	Al_2O_3		6.056	6.166	-0.110	-1.8%
LAWPh3-17-Q	B_2O_3		6.641	6.124	0.517	8.4%
LAWPh3-17-Q	CaO		10.410	9.859	0.551	5.6%
LAWPh3-17-Q	Cl		0.157	0.191	-0.034	
LAWPh3-17-Q	Cr_2O_3		0.344	0.392	-0.048	
LAWPh3-17-Q	F		0.243	0.290	-0.047	
LAWPh3-17-Q	Fe_2O_3		1.407	1.395	0.012	
LAWPh3-17-Q	K_2O		0.398	0.328	0.070	
LAWPh3-17-Q	MgO		1.202	1.327	-0.125	
LAWPh3-17-Q	Na_2O		23.624	25.366	-1.742	-6.9%
LAWPh3-17-Q	P_2O_5		0.335	0.620	-0.285	
LAWPh3-17-Q	SiO_2		39.363	38.076	1.287	3.4%
LAWPh3-17-Q	SnO_2		0.711	0.753	-0.042	
LAWPh3-17-Q	SO_3		0.675	0.699	-0.024	
LAWPh3-17-Q	V_2O_5		2.263	2.388	-0.125	
LAWPh3-17-Q	ZnO		2.275	2.374	-0.099	
LAWPh3-17-Q	ZrO_2		3.127	3.652	-0.525	
LAWPh3-17-Q	sum		99.231	100.000	-0.769	-0.8%
LAWPh3-18-Q	Al_2O_3		7.955	8.374	-0.419	-5.0%
LAWPh3-18-Q	B_2O_3		5.892	6.075	-0.183	-3.0%
LAWPh3-18-Q	CaO		3.687	3.578	0.109	
LAWPh3-18-Q	Cl		0.261	0.309	-0.048	
LAWPh3-18-Q	Cr_2O_3		0.464	0.478	-0.014	
LAWPh3-18-Q	F		0.415	0.470	-0.055	
LAWPh3-18-Q	Fe_2O_3		0.408	0.394	0.014	
LAWPh3-18-Q	K_2O		2.722	2.946	-0.224	
LAWPh3-18-Q	MgO		1.284	1.303	-0.019	
LAWPh3-18-Q	Na_2O		21.534	22.246	-0.712	-3.2%
LAWPh3-18-Q	P_2O_5		0.824	1.005	-0.181	
LAWPh3-18-Q	SiO_2		39.684	40.785	-1.101	-2.7%
LAWPh3-18-Q	SnO_2		3.133	3.302	-0.169	
LAWPh3-18-Q	SO_3		0.363	0.324	0.039	
LAWPh3-18-Q	V_2O_5		0.410	0.403	0.007	
LAWPh3-18-Q	ZnO		3.436	3.460	-0.024	
LAWPh3-18-Q	ZrO_2		3.762	4.548	-0.786	
LAWPh3-18-Q	sum		96.233	100.000	-3.767	-3.8%
LAWPh3-19-Q	Al_2O_3		6.387	6.703	-0.316	-4.7%
LAWPh3-19-Q	B_2O_3		6.730	6.893	-0.163	-2.4%
LAWPh3-19-Q	CaO		8.958	8.490	0.468	5.5%
LAWPh3-19-Q	Cl		0.075	0.077	-0.002	
LAWPh3-19-Q	Cr_2O_3		0.337	0.373	-0.036	
LAWPh3-19-Q	F		0.101	0.116	-0.015	
LAWPh3-19-Q	Fe_2O_3		1.218	1.361	-0.143	
LAWPh3-19-Q	K_2O		2.521	3.078	-0.557	
LAWPh3-19-Q	MgO		0.252	0.211	0.041	
LAWPh3-19-Q	Na_2O		20.422	21.427	-1.005	-4.7%
LAWPh3-19-Q	P_2O_5	<	0.229	0.249	-0.020	
LAWPh3-19-Q	SiO_2		40.272	40.815	-0.543	-1.3%
LAWPh3-19-Q	SnO_2		0.916	1.079	-0.163	

Table A-6. Comparison of Measured and Targeted Compositions of the Study Glasses (continued)

Glass ID	Oxide	BDL (<)	Measured (wt %)	Targeted (wt %)	Difference of Measured versus Targeted	% Difference of Measured versus Targeted
LAWPh3-19-Q	SO_3		1.720	1.048	0.672	
LAWPh3-19-Q	V_2O_5		2.785	2.912	-0.127	
LAWPh3-19-Q	ZnO		2.023	2.112	-0.089	
LAWPh3-19-Q	ZrO_2		2.469	3.056	-0.587	
LAWPh3-19-Q	sum		97.414	100.000	-2.586	-2.6%
LAWPh3-20-Q	Al_2O_3		5.881	6.035	-0.154	-2.6%
LAWPh3-20-Q	B_2O_3		8.557	8.934	-0.377	-4.2%
LAWPh3-20-Q	CaO		5.230	4.758	0.472	
LAWPh3-20-Q	Cl		0.131	0.132	-0.001	
LAWPh3-20-Q	Cr_2O_3		0.384	0.409	-0.025	
LAWPh3-20-Q	F		0.148	0.200	-0.052	
LAWPh3-20-Q	Fe_2O_3		1.139	1.122	0.017	
LAWPh3-20-Q	K_2O		0.148	0.127	0.021	
LAWPh3-20-Q	MgO	<	0.166	0.074	0.092	
LAWPh3-20-Q	Na_2O		21.164	22.432	-1.268	-5.7%
LAWPh3-20-Q	P_2O_5		0.424	0.429	-0.005	
LAWPh3-20-Q	SiO_2		41.770	41.198	0.572	1.4%
LAWPh3-20-Q	SnO_2		2.828	2.863	-0.035	
LAWPh3-20-Q	SO_3		0.743	0.730	0.013	
LAWPh3-20-Q	V_2O_5		3.459	3.639	-0.180	
LAWPh3-20-Q	ZnO		3.268	3.388	-0.120	
LAWPh3-20-Q	ZrO_2		3.056	3.530	-0.474	
LAWPh3-20-Q	sum		98.495	100.000	-1.505	-1.5%
LRM	Al_2O_3		9.228	9.510	-0.282	-3.0%
LRM	B_2O_3		7.327	7.850	-0.523	-6.7%
LRM	CaO		0.322	0.540	-0.218	
LRM	Cl	<	0.050	0.000	0.050	
LRM	Cr_2O_3		0.181	0.190	-0.009	
LRM	F		0.896	0.860	0.036	
LRM	Fe_2O_3		1.304	1.380	-0.076	
LRM	K_2O		1.384	1.480	-0.096	
LRM	MgO	<	0.166	0.100	0.066	
LRM	Na_2O		19.943	20.030	-0.087	-0.4%
LRM	P_2O_5	<	0.369	0.540	-0.171	
LRM	SiO_2		55.871	54.200	1.671	3.1%
LRM	SnO_2	<	0.127	0.000	0.127	
LRM	SO_3		0.236	0.300	-0.064	
LRM	V_2O_5	<	0.179	0.000	0.179	
LRM	ZnO	<	0.124	0.000	0.124	
LRM	ZrO_2		0.944	0.930	0.014	
LRM	sum		98.651	97.910	0.741	0.8%

Exhibit A-1. Plots of Oxide Measurements in Analytical Sequence

Analyte=Al2O3, Prep Method=PS

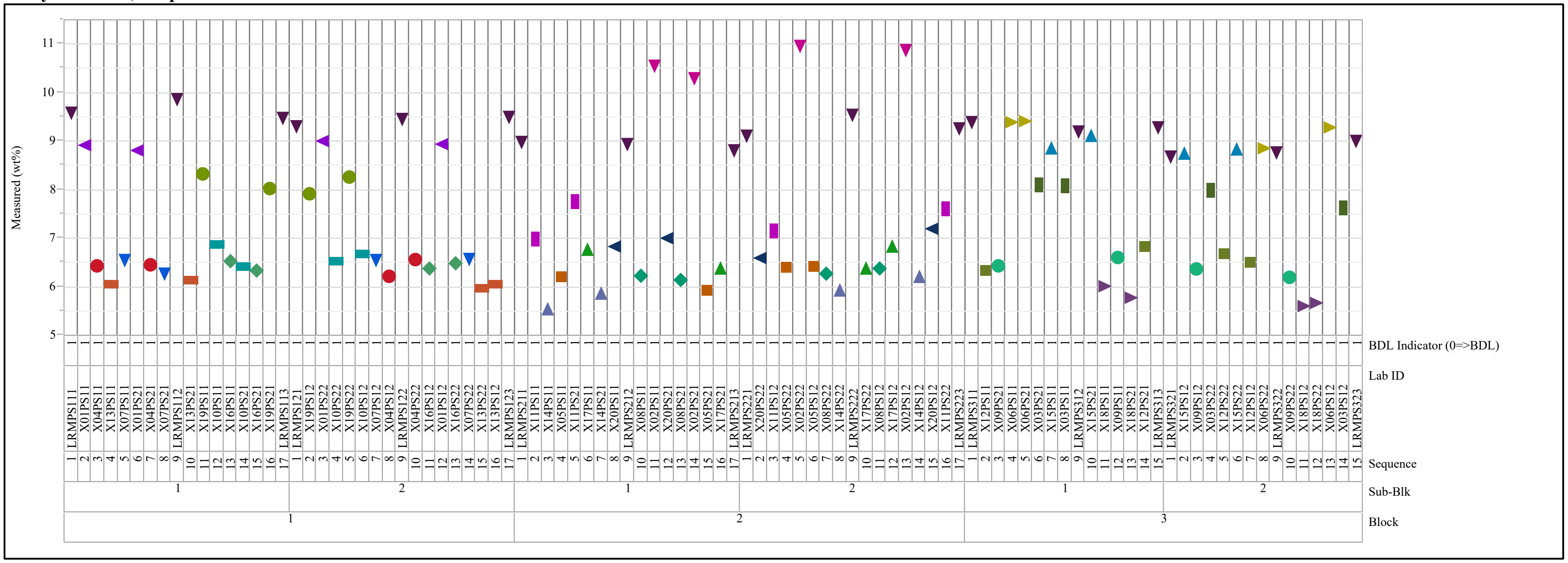


Exhibit A-1. Plots of Oxide Measurements in Analytical Sequence (continued)

Analyte=B2O3, Prep Method=PS

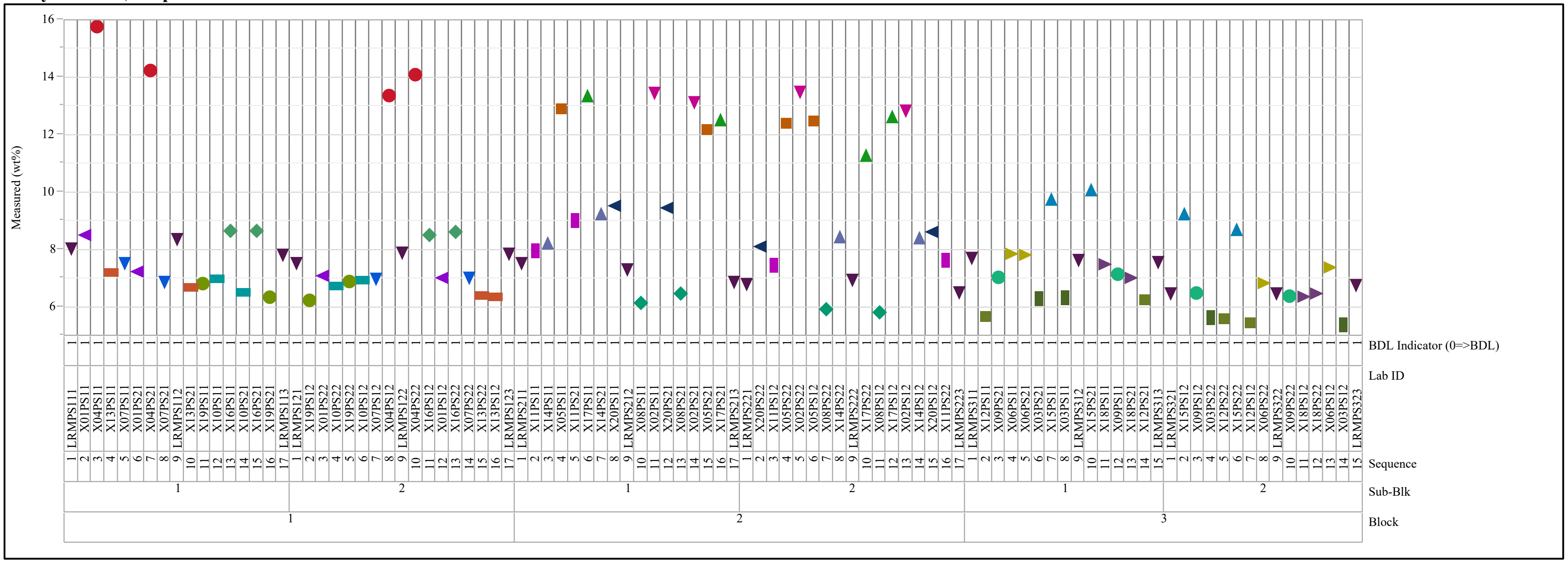


Exhibit A-1. Plots of Oxide Measurements in Analytical Sequence (continued)

Analyte=CaO, Prep Method=PS

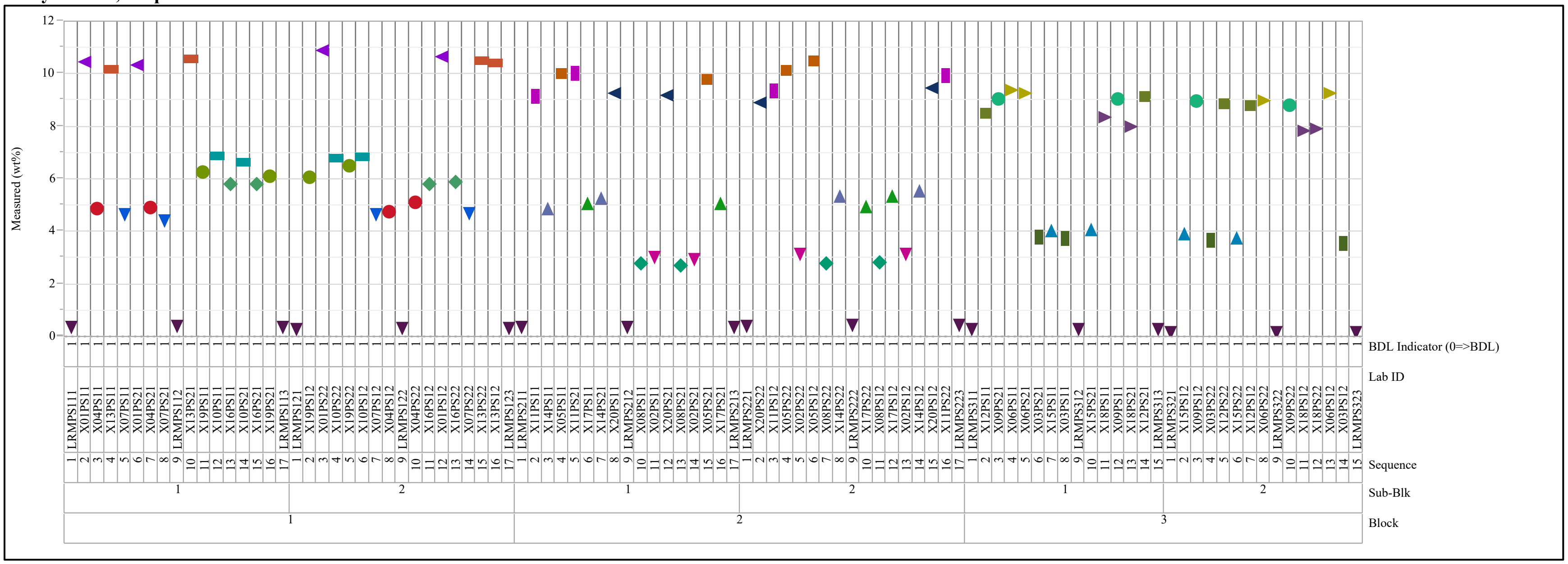


Exhibit A-1. Plots of Oxide Measurements in Analytical Sequence (continued)

Analyte=Cl, Prep Method=KH

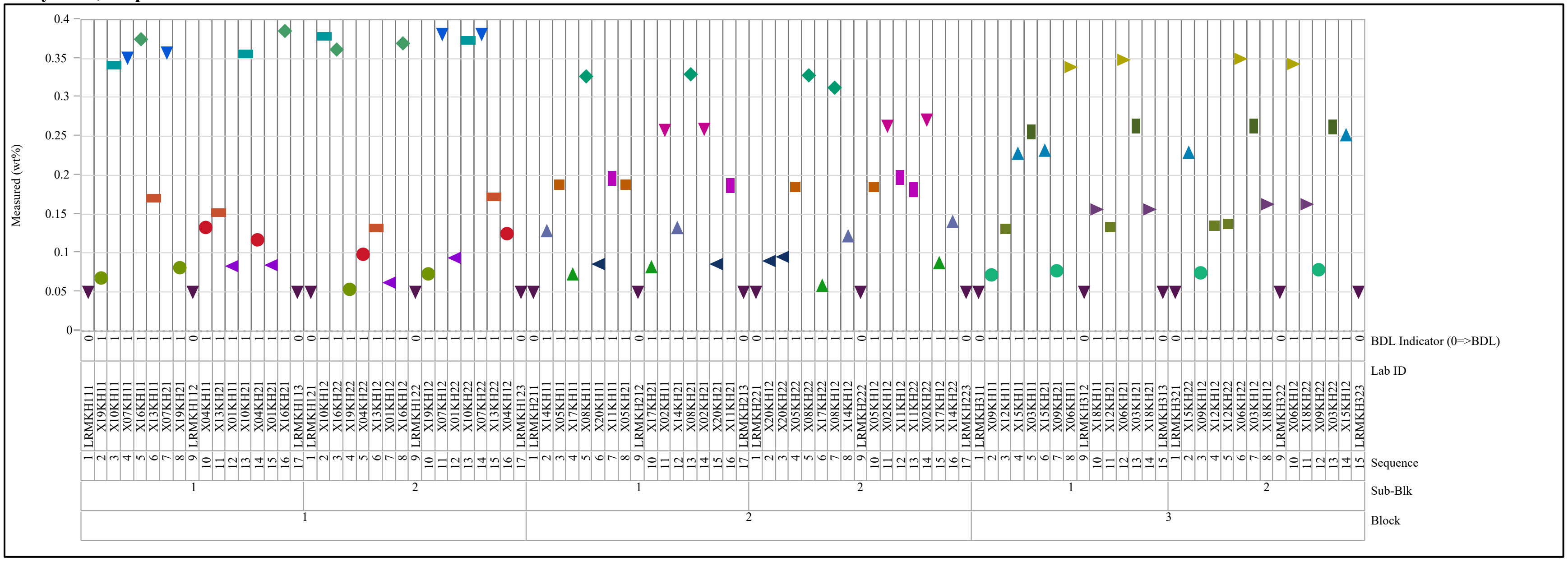


Exhibit A-1. Plots of Oxide Measurements in Analytical Sequence (continued)

Analyte=Cr2O3, Prep Method=LM

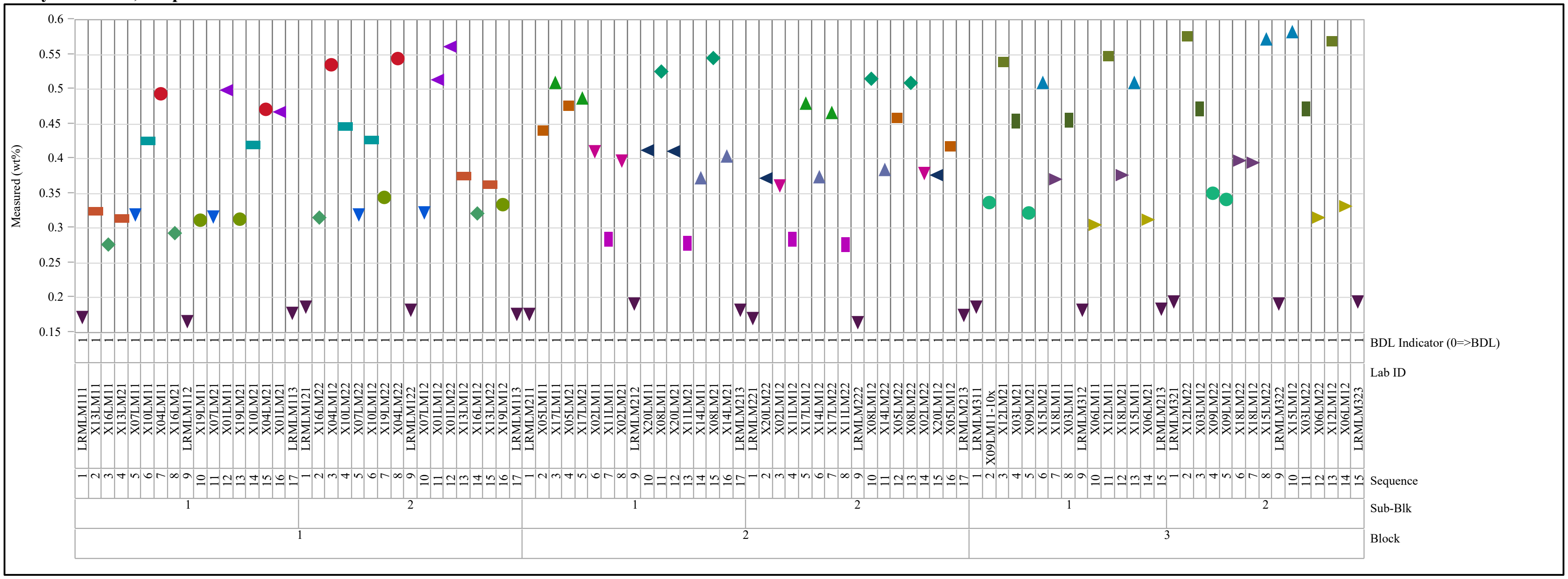


Exhibit A-1. Plots of Oxide Measurements in Analytical Sequence (continued)

Analyte=F, Prep Method=KH

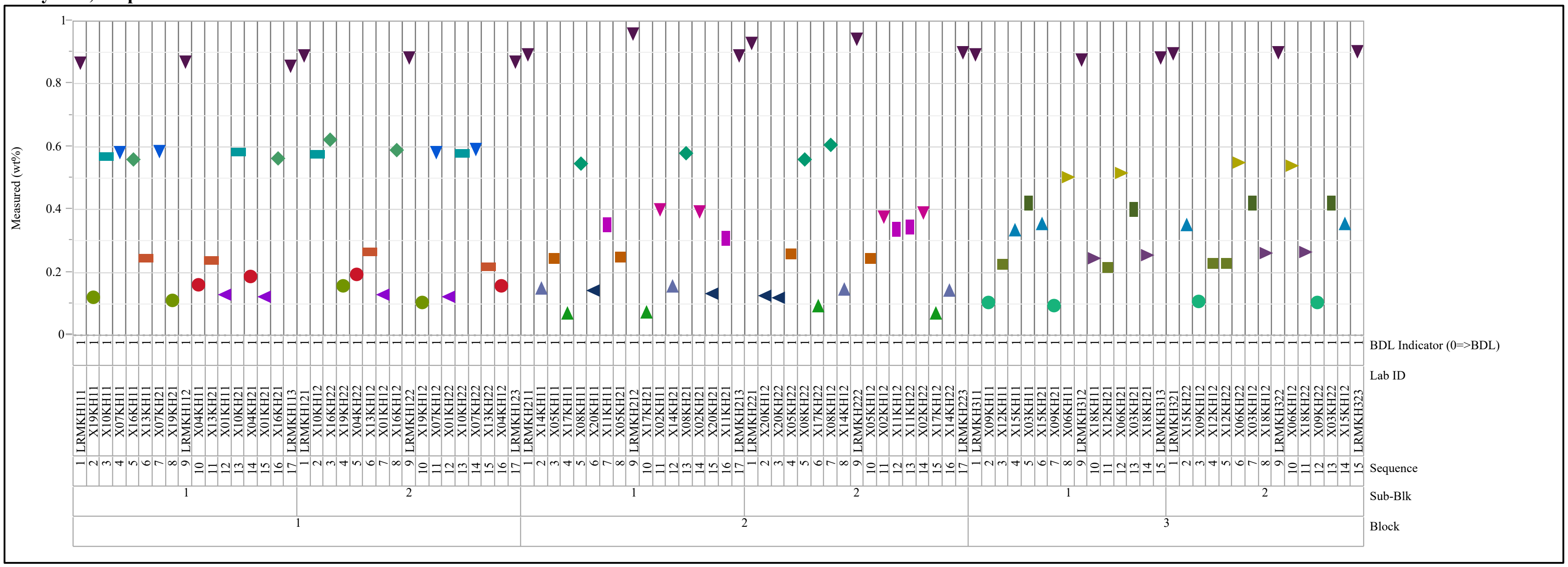


Exhibit A-1. Plots of Oxide Measurements in Analytical Sequence (continued)

Analyte=Fe2O3, Prep Method=LM

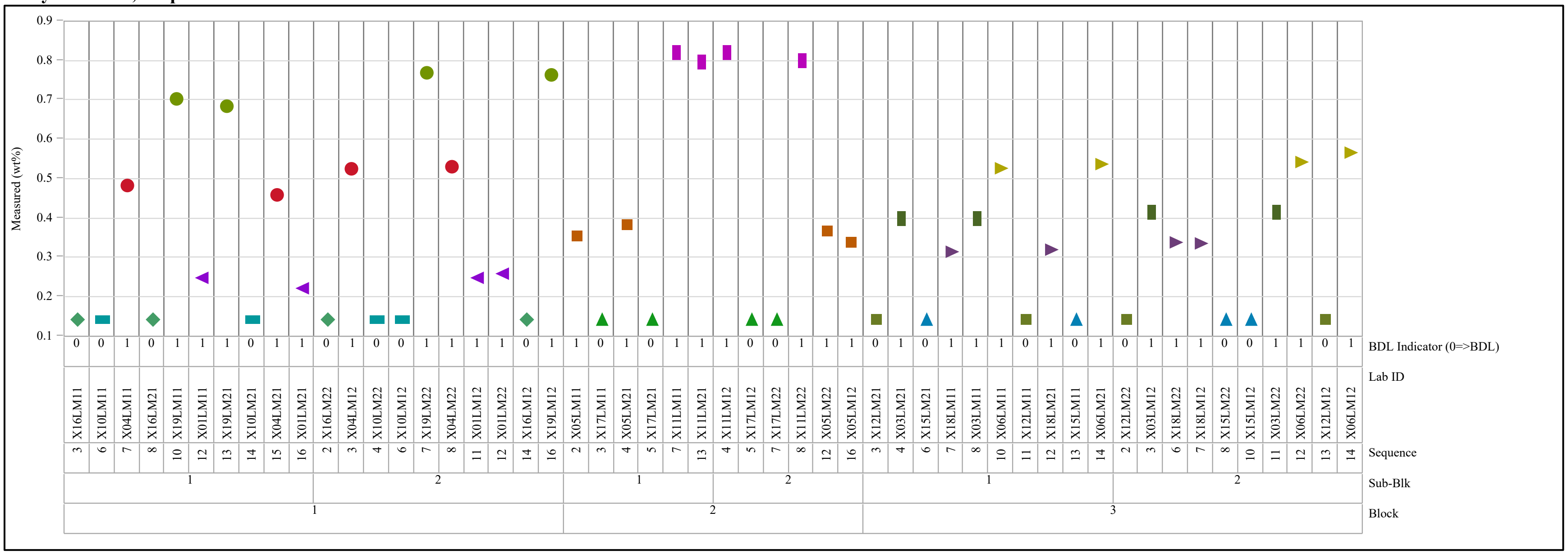


Exhibit A-1. Plots of Oxide Measurements in Analytical Sequence (continued)

Analyte=Fe2O3, Prep Method=PS

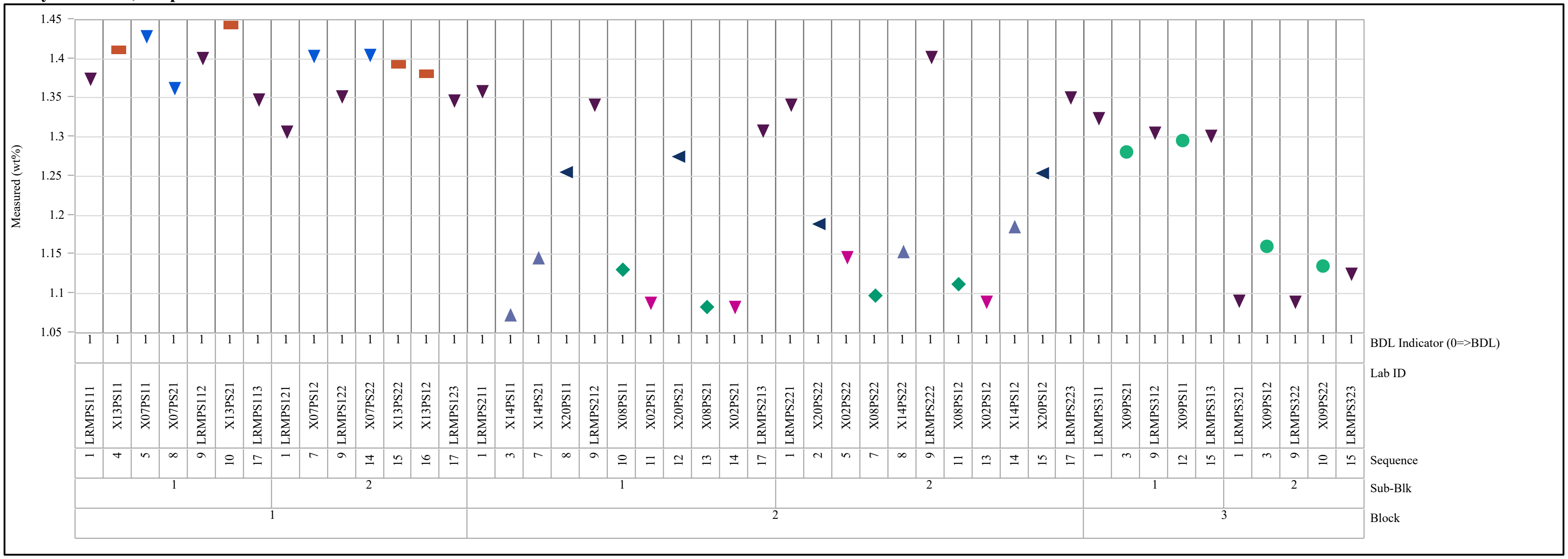


Exhibit A-1. Plots of Oxide Measurements in Analytical Sequence (continued)

Analyte=K2O, Prep Method=LM

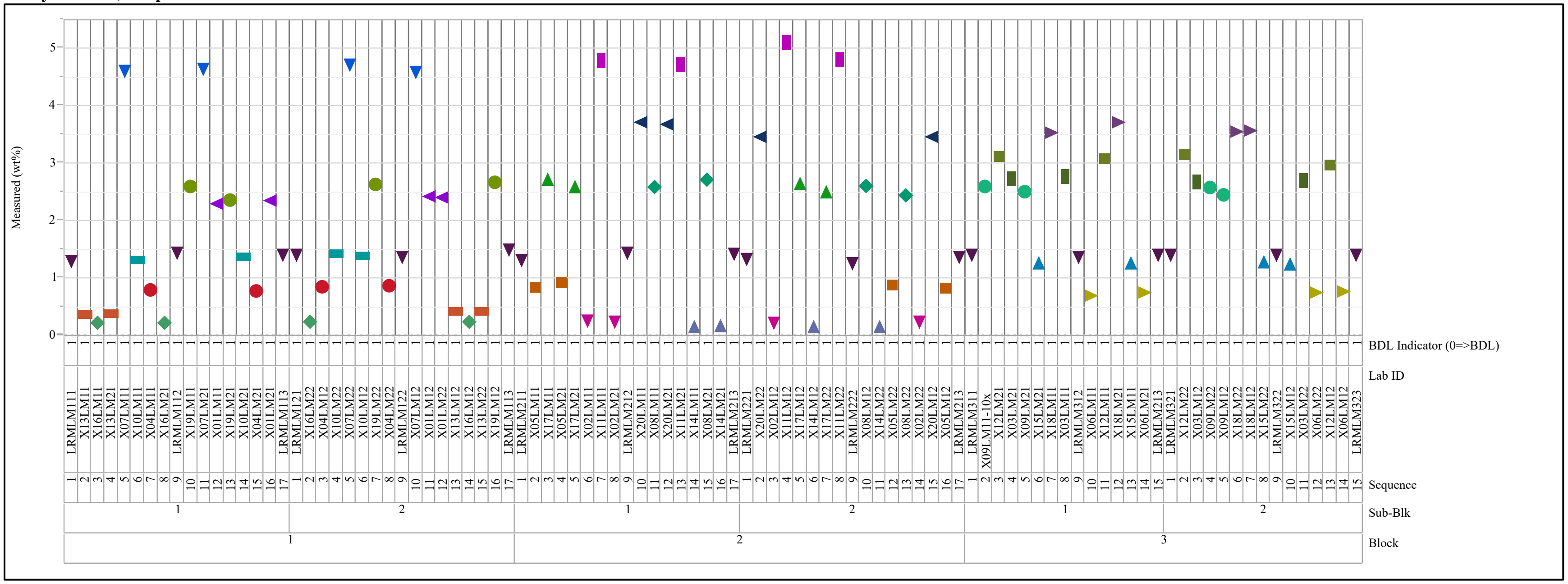


Exhibit A-1. Plots of Oxide Measurements in Analytical Sequence (continued)

Analyte=MgO, Prep Method=LM

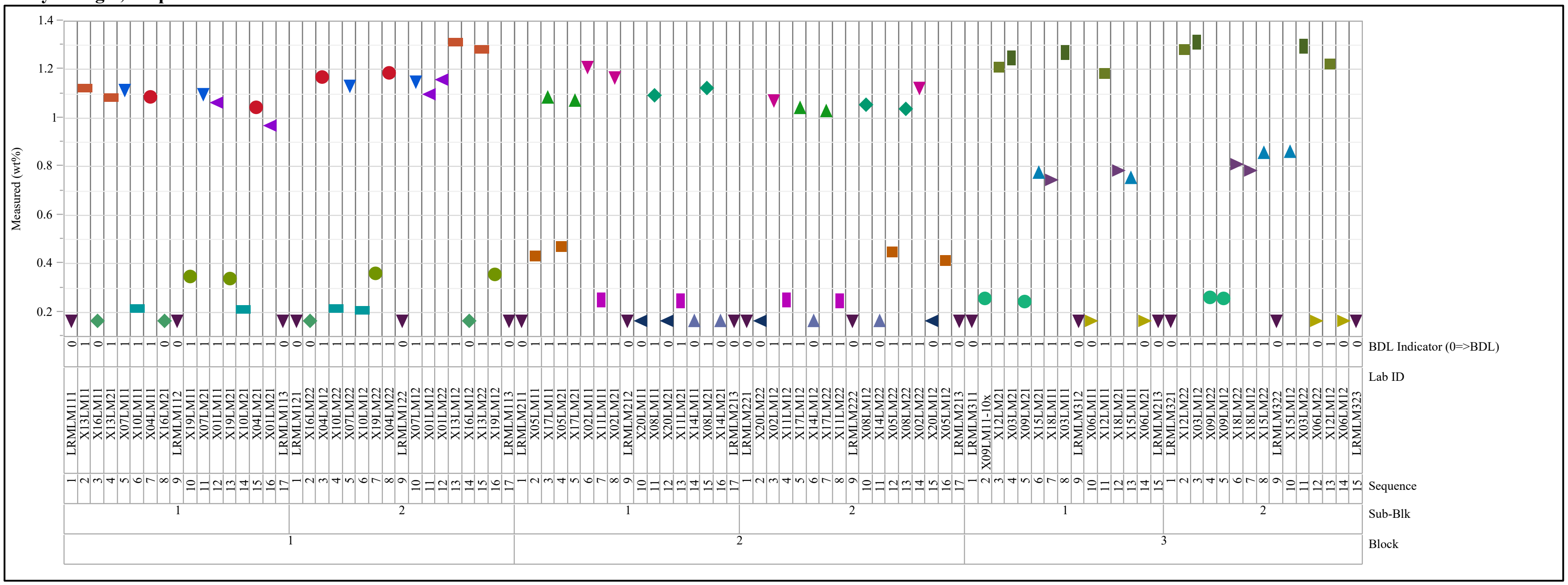


Exhibit A-1. Plots of Oxide Measurements in Analytical Sequence (continued)

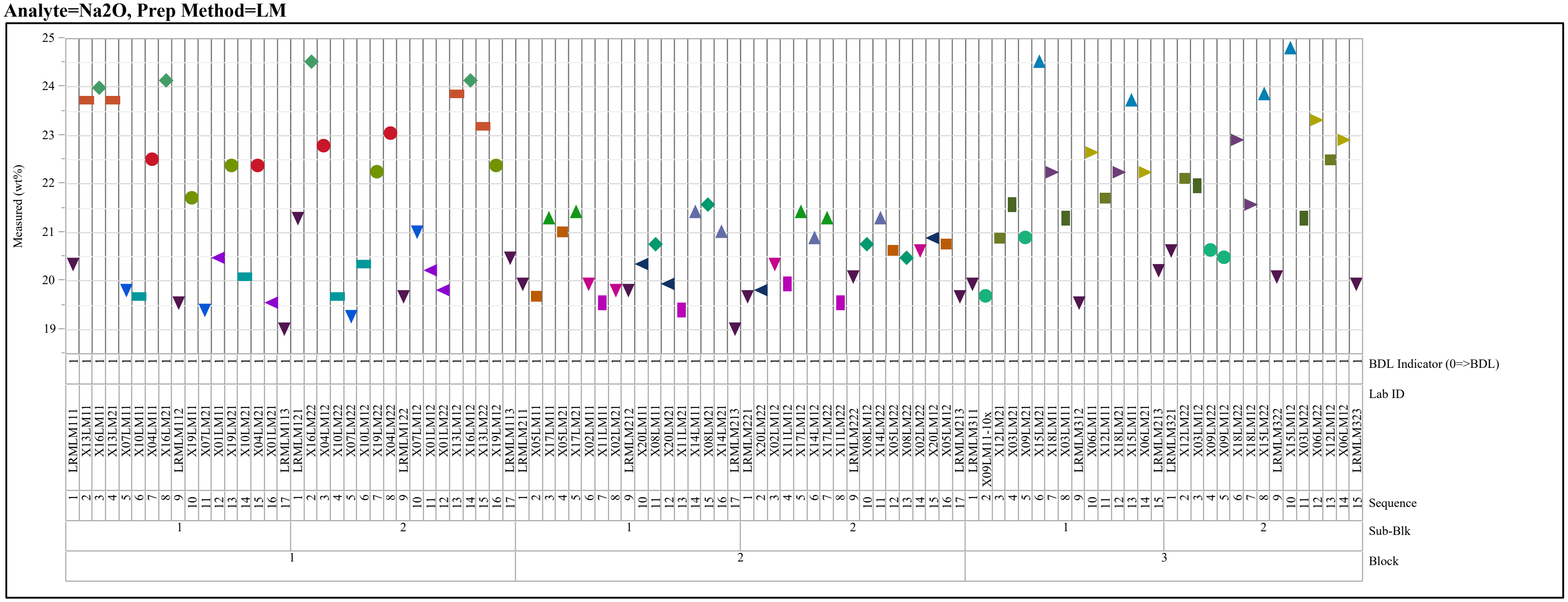


Exhibit A-1. Plots of Oxide Measurements in Analytical Sequence (continued)

Analyte=P2O5, Prep Method=PS

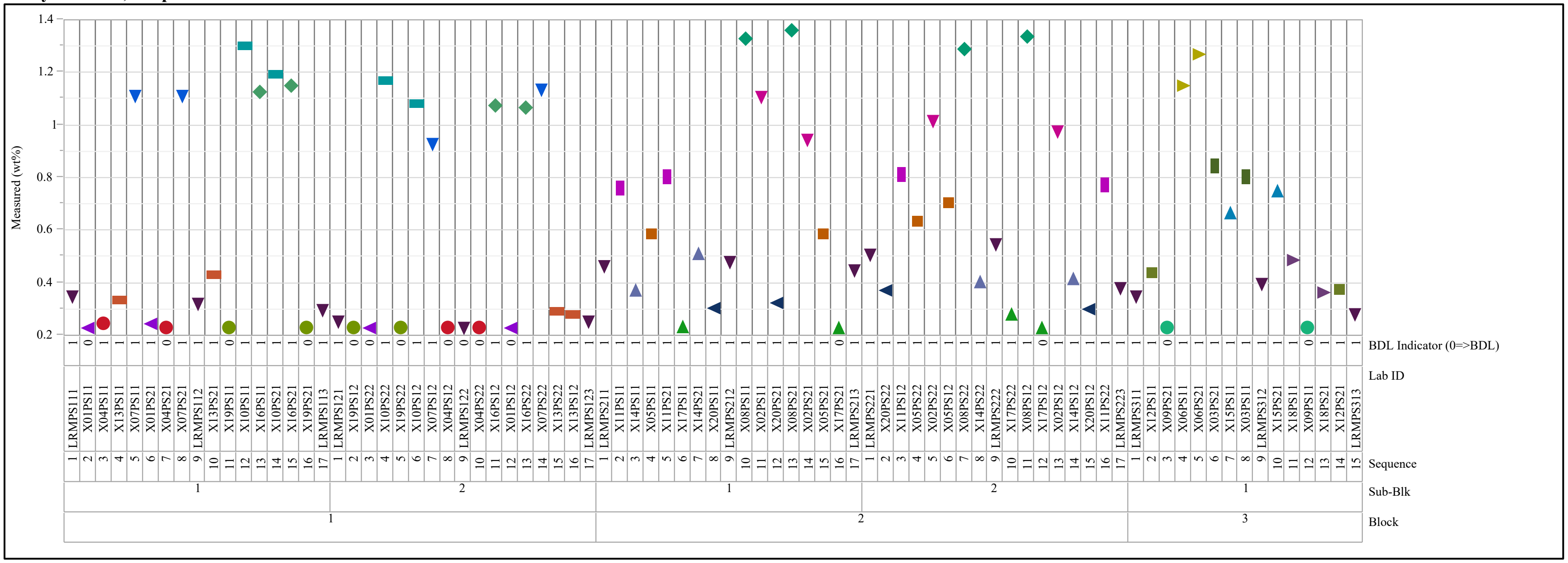


Exhibit A-1. Plots of Oxide Measurements in Analytical Sequence (continued)

Analyte=SiO2, Prep Method=PS

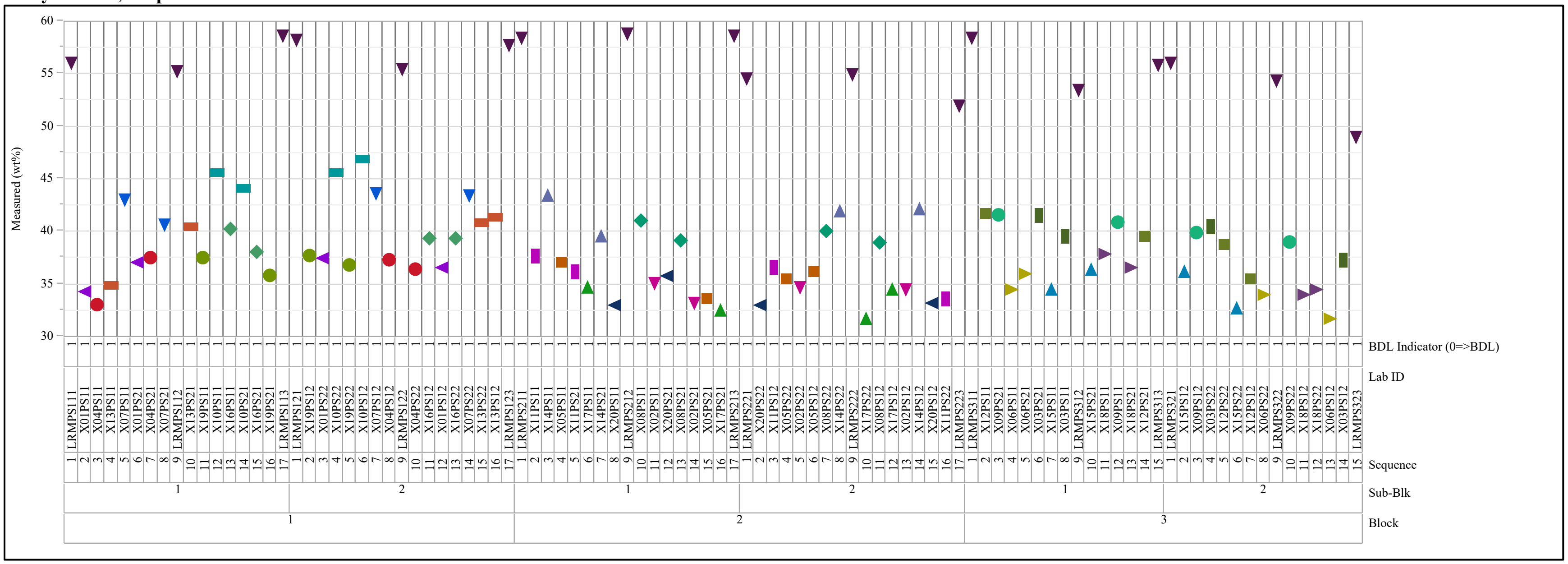


Exhibit A-1. Plots of Oxide Measurements in Analytical Sequence (continued)

Analyte=SnO2, Prep Method=PS

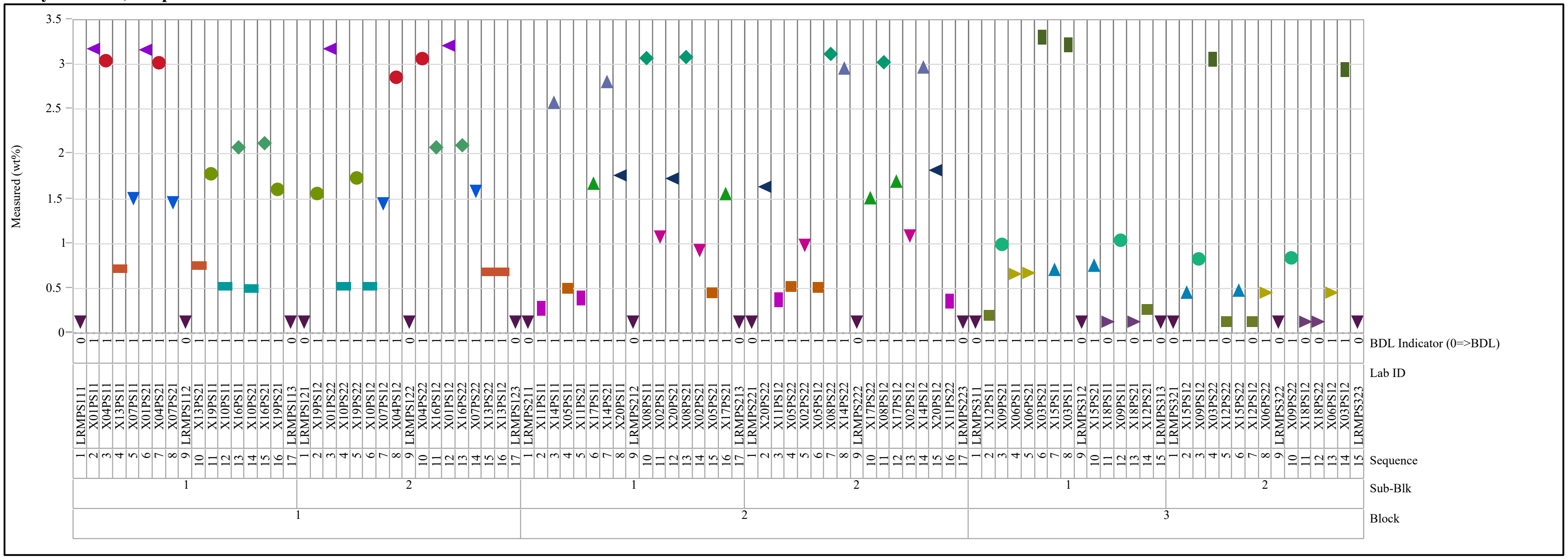


Exhibit A-1. Plots of Oxide Measurements in Analytical Sequence (continued)

Analyte=SO3, Prep Method=LM

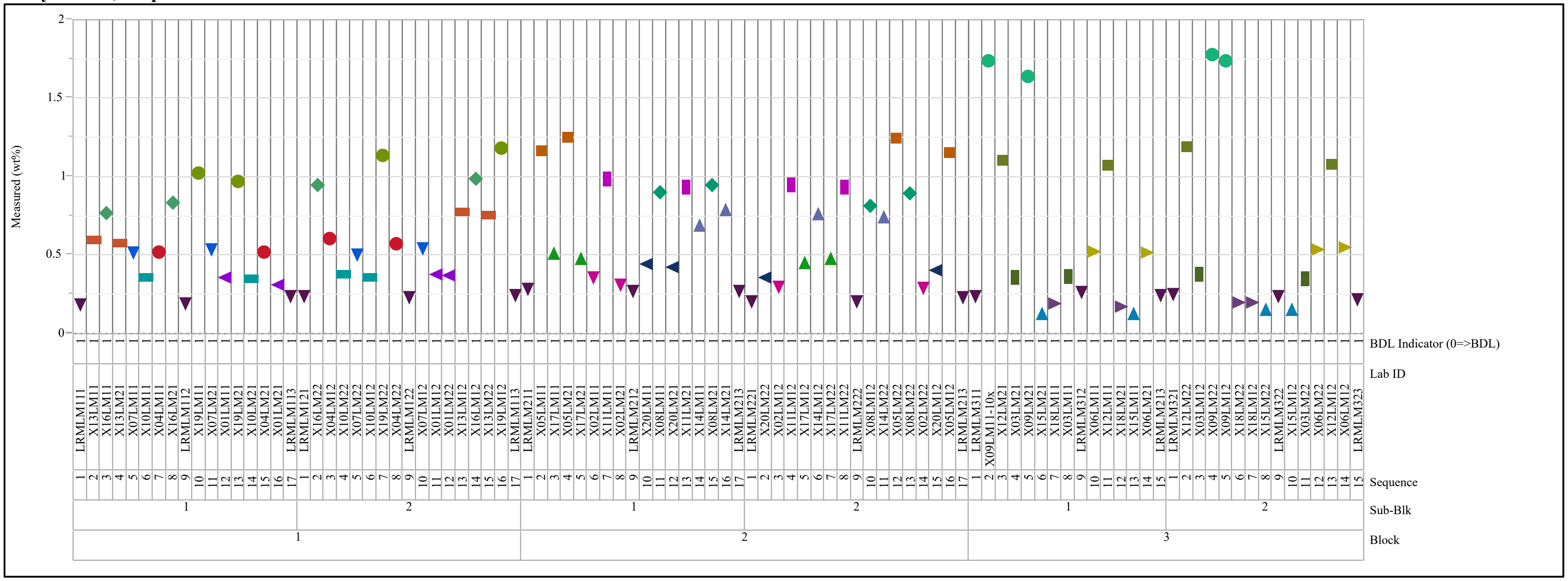


Exhibit A-1. Plots of Oxide Measurements in Analytical Sequence (continued)

Analyte=V2O5, Prep Method=LM

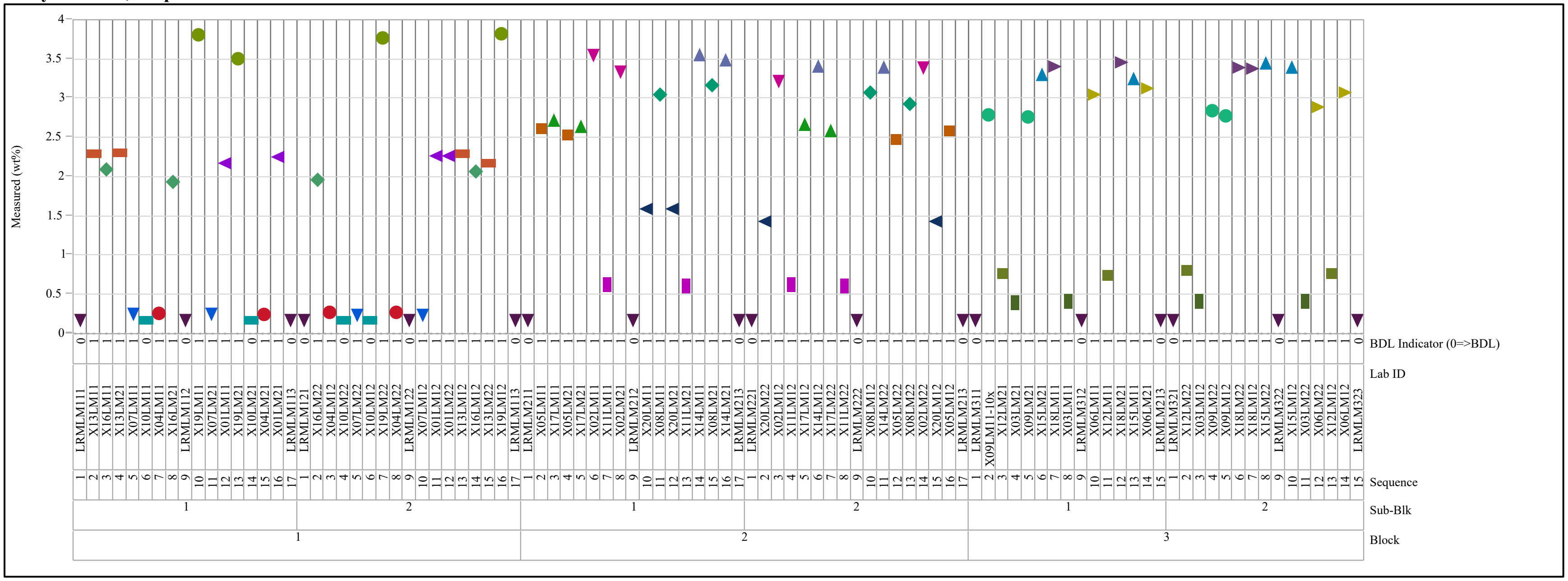


Exhibit A-1. Plots of Oxide Measurements in Analytical Sequence (continued)

Analyte=ZnO, Prep Method=LM

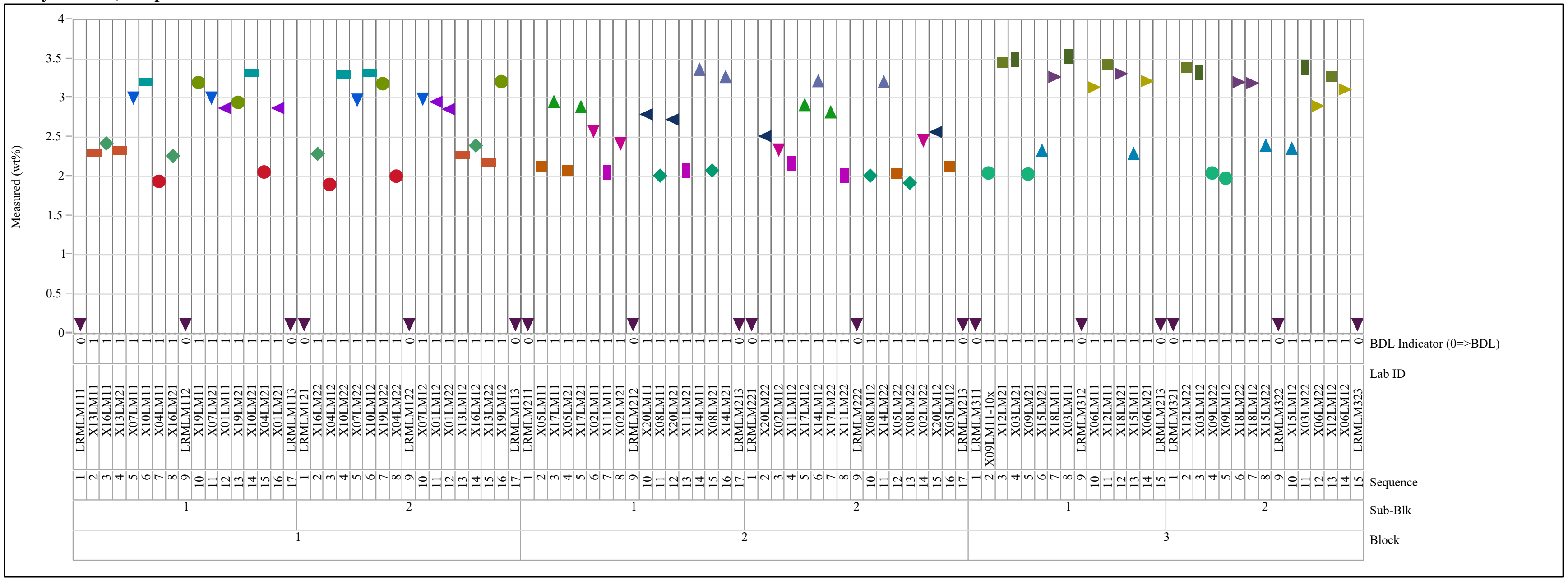


Exhibit A-1. Plots of Oxide Measurements in Analytical Sequence (continued)

Analyte=ZrO2, Prep Method=PS

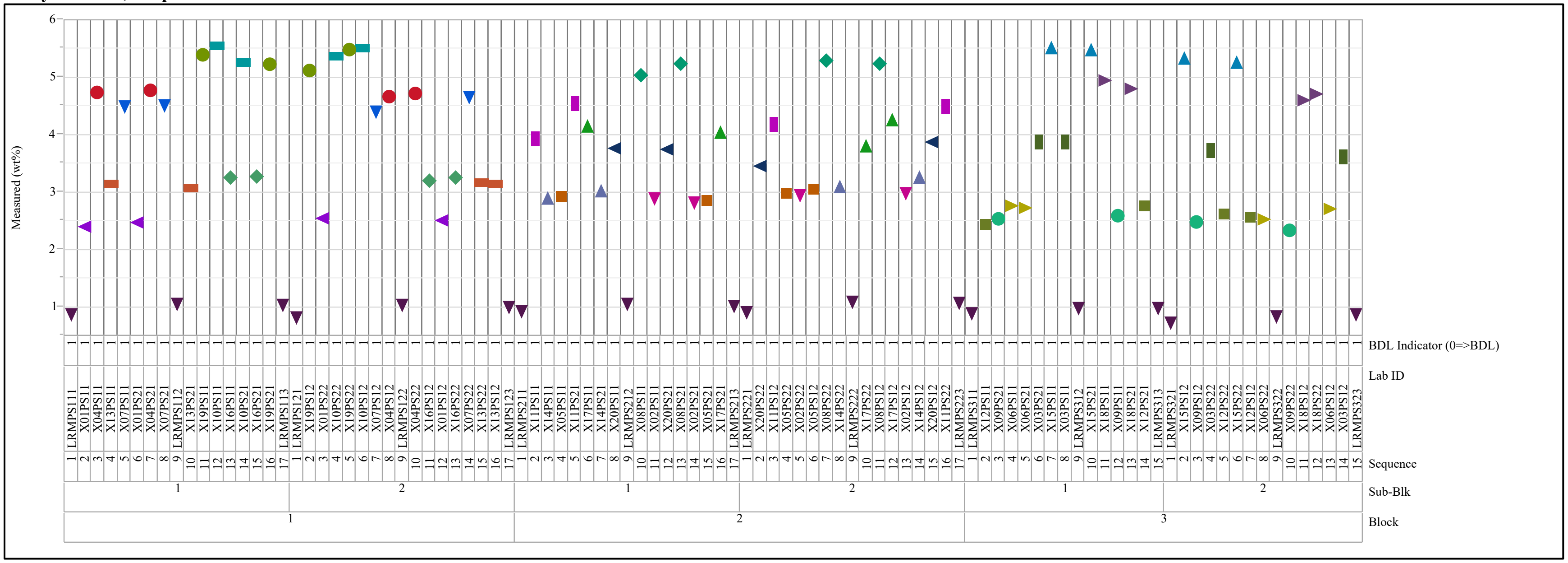


Exhibit A-2. Plots of Oxide Measurements by Set by Glass Identifier Grouped by Targeted Concentrations

Analyte=Al2O3, Prep Method=PS

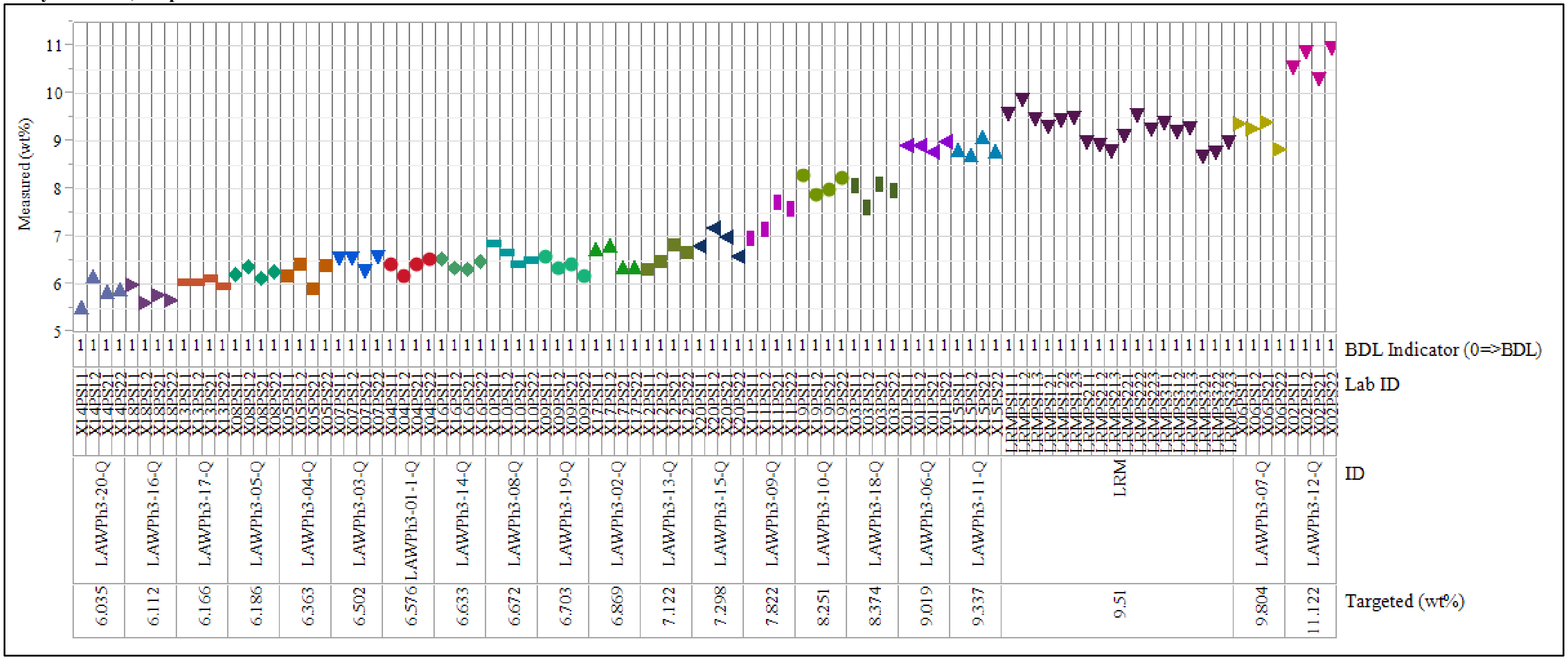


Exhibit A-2. Plots of Oxide Measurements by Set by Glass Identifier Grouped by Targeted Concentrations (continued)

Analyte=B2O3, Prep Method=PS

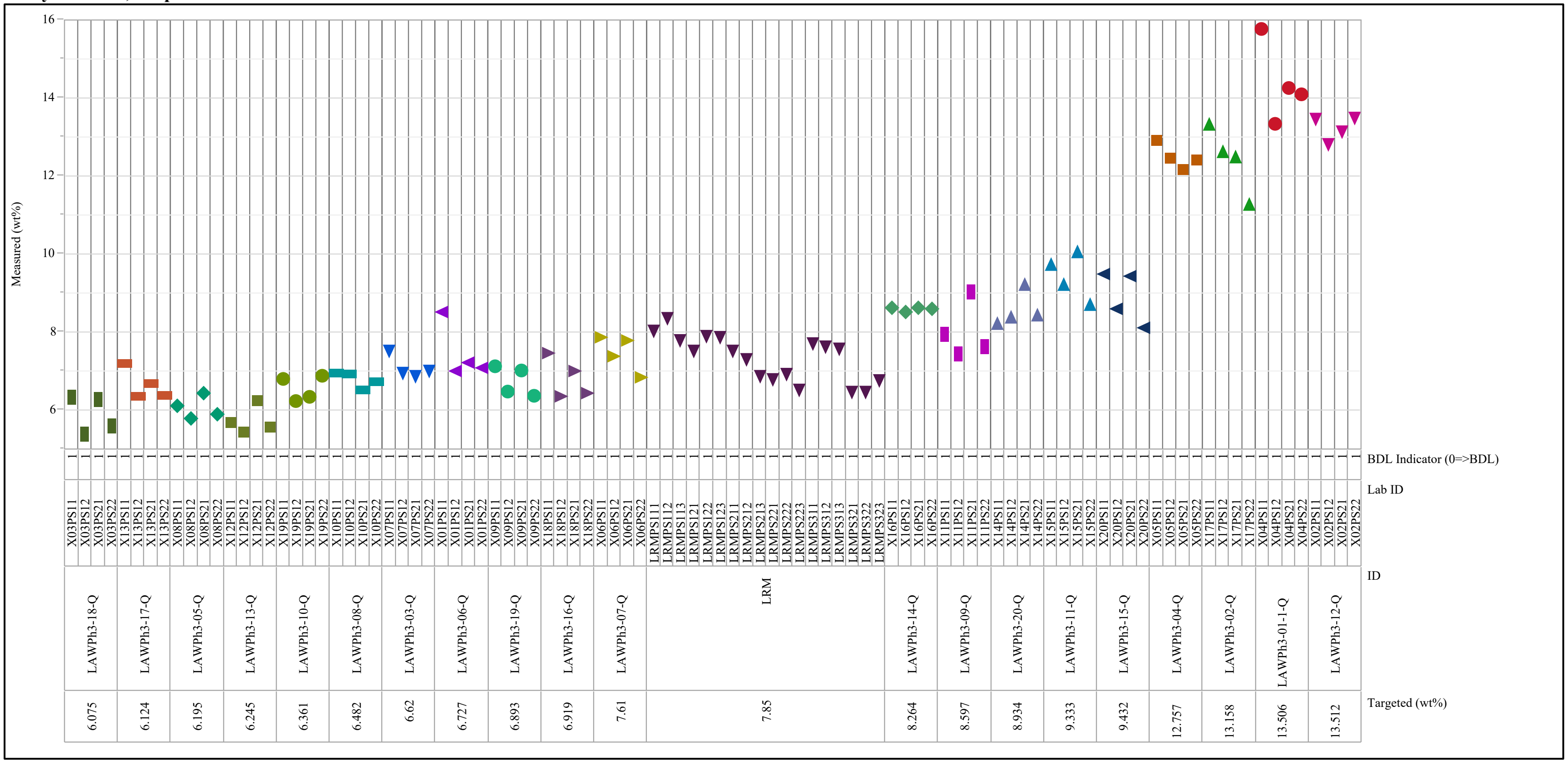


Exhibit A-2. Plots of Oxide Measurements by Set by Glass Identifier Grouped by Targeted Concentrations (continued)

Analyte=CaO, Prep Method=PS

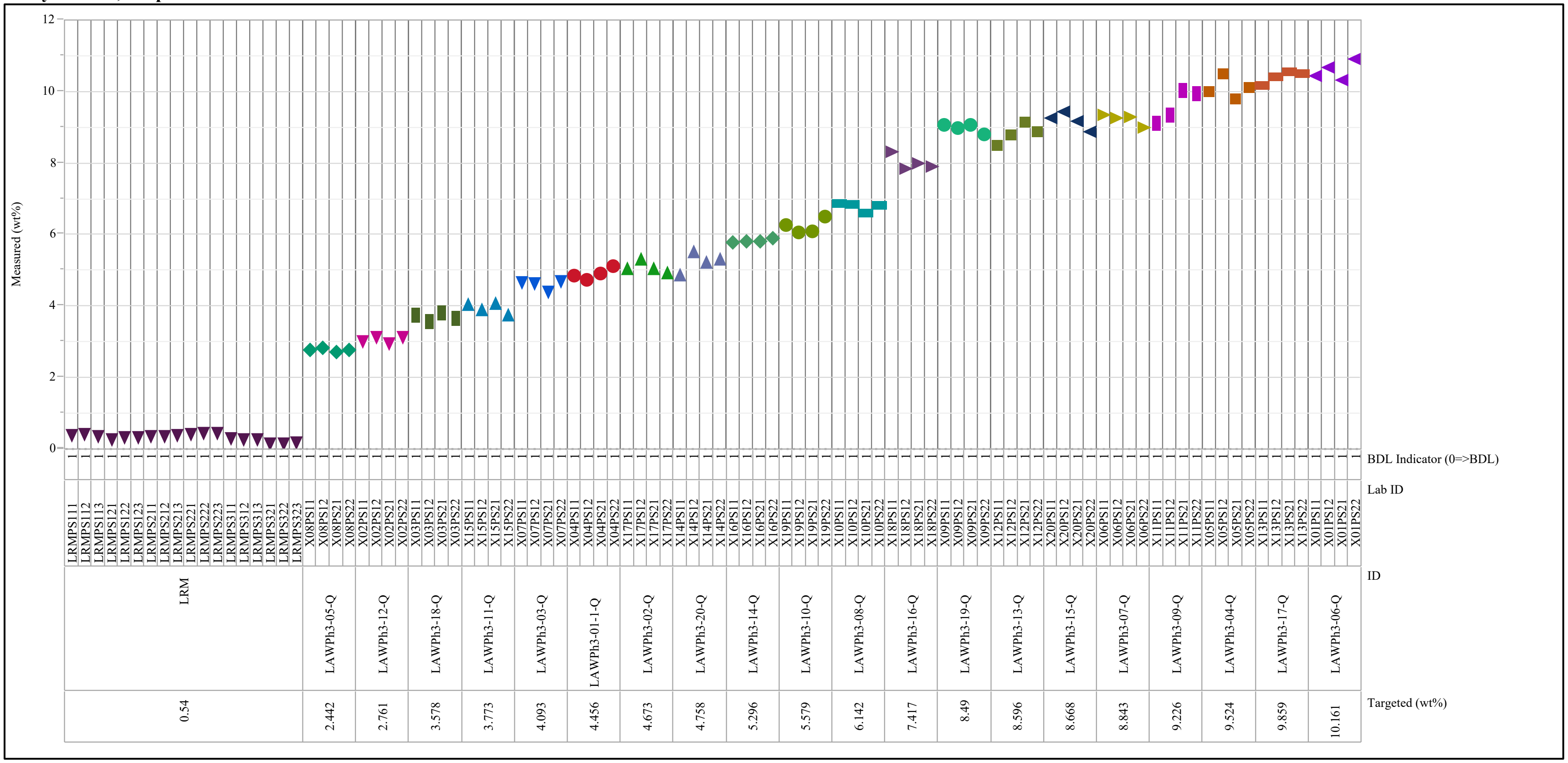


Exhibit A-2. Plots of Oxide Measurements by Set by Glass Identifier Grouped by Targeted Concentrations (continued)

Analyte=Cl, Prep Method=KH

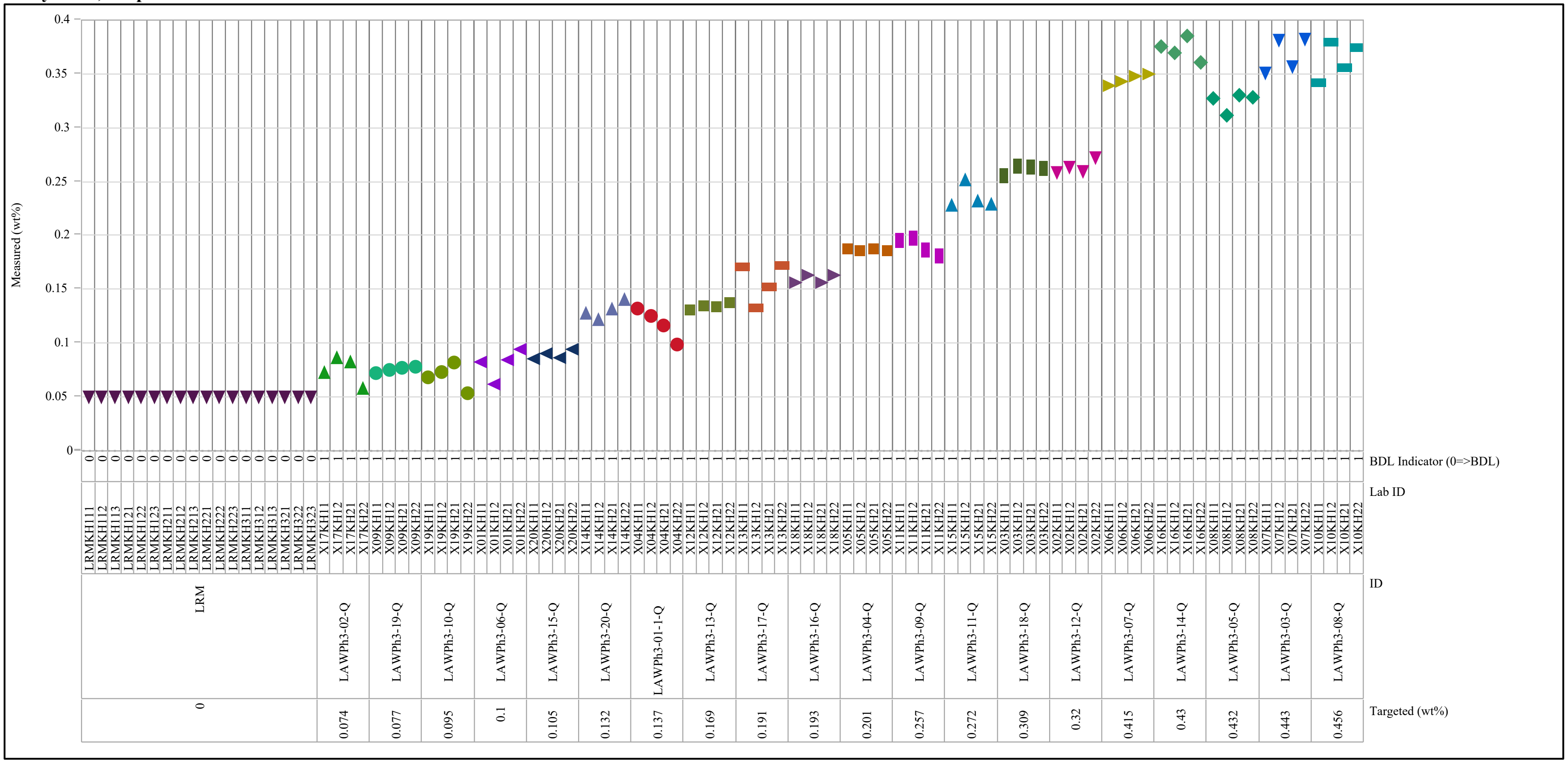


Exhibit A-2. Plots of Oxide Measurements by Set by Glass Identifier Grouped by Targeted Concentrations (continued)

Analyte=Cr2O3, Prep Method=LM

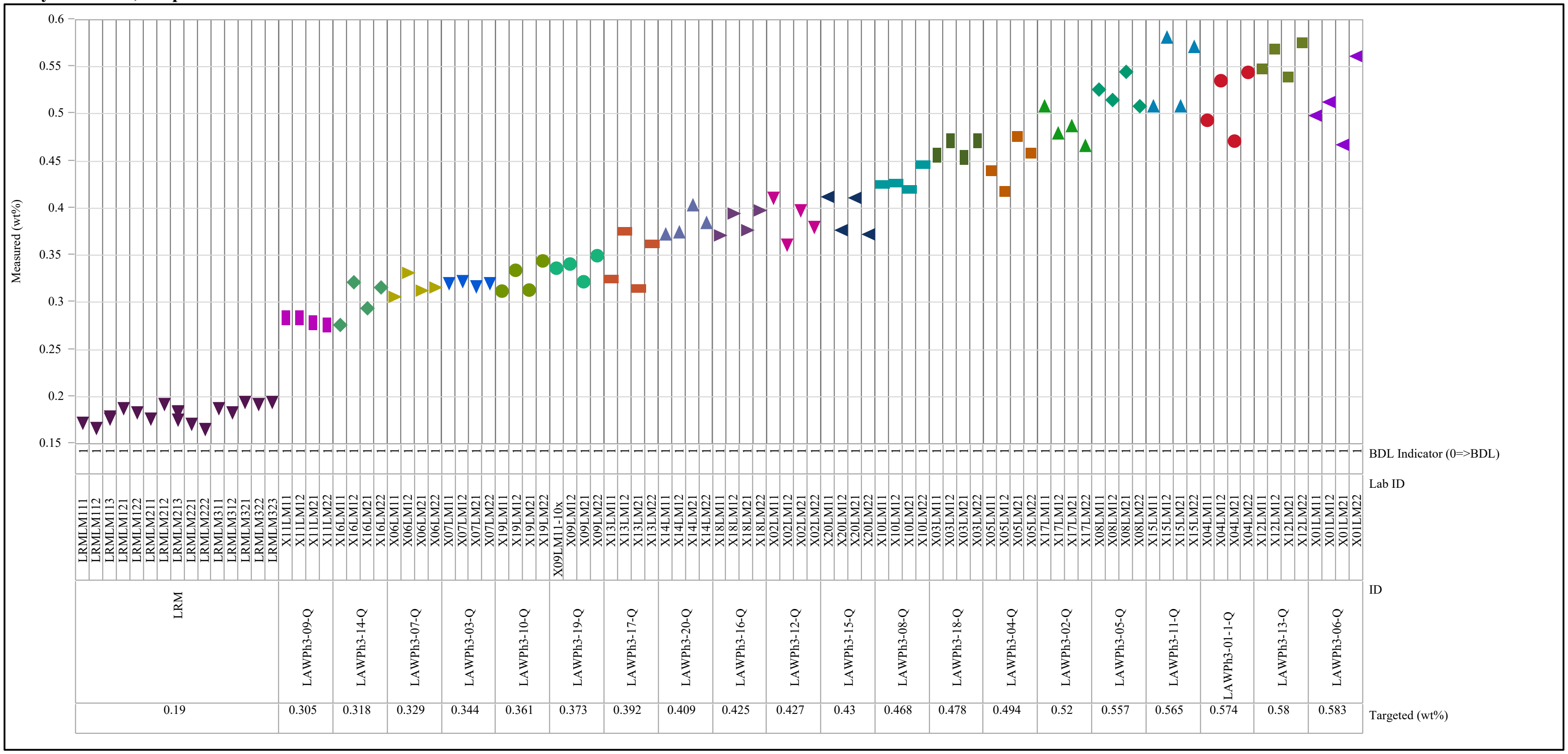


Exhibit A-2. Plots of Oxide Measurements by Set by Glass Identifier Grouped by Targeted Concentrations (continued)

Analyte=F, Prep Method=KH

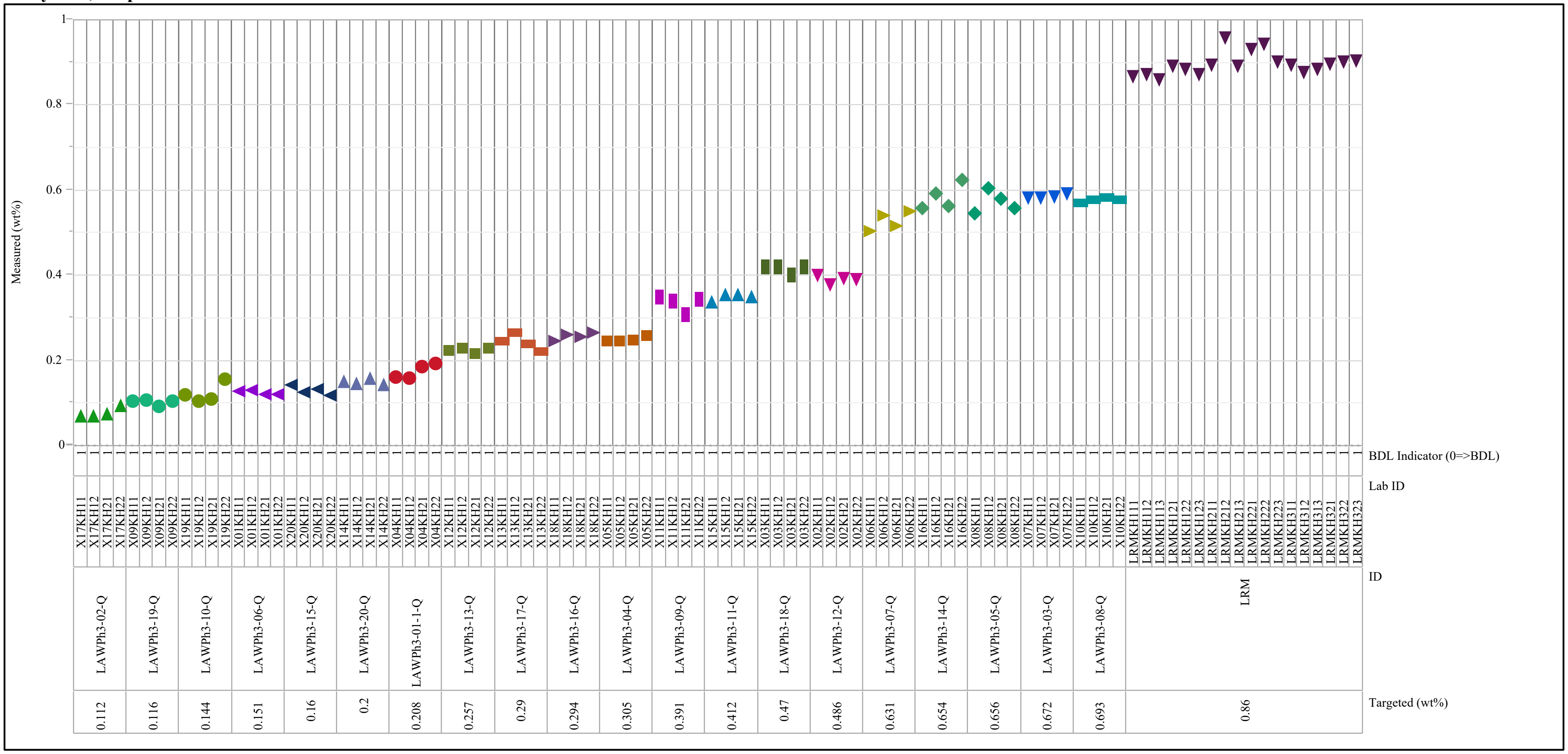


Exhibit A-2. Plots of Oxide Measurements by Set by Glass Identifier Grouped by Targeted Concentrations (continued)

Analyte=Fe2O3, Prep Method=LM

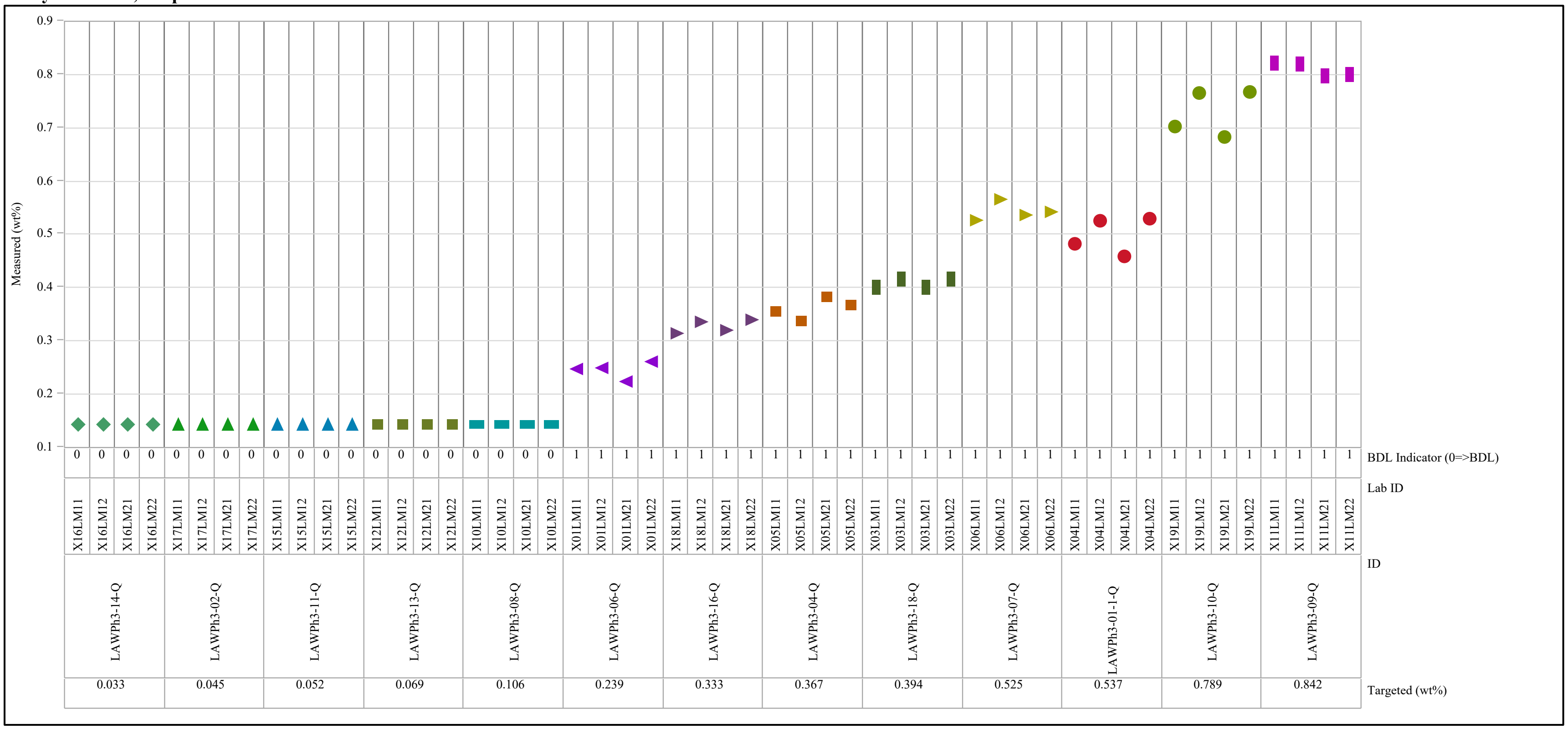


Exhibit A-2. Plots of Oxide Measurements by Set by Glass Identifier Grouped by Targeted Concentrations (continued)

Analyte=Fe2O3, Prep Method=PS

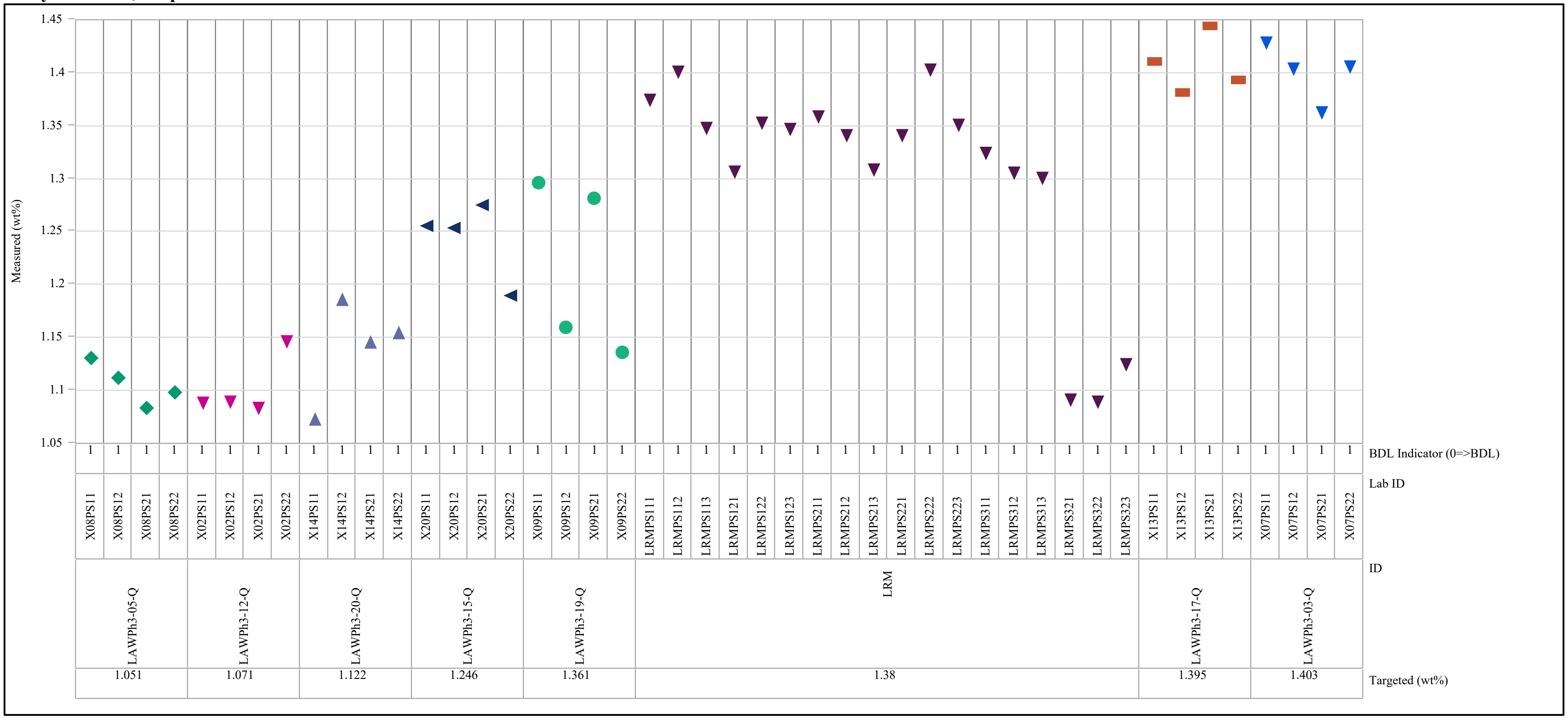


Exhibit A-2. Plots of Oxide Measurements by Set by Glass Identifier Grouped by Targeted Concentrations (continued)

Analyte=K2O, Prep Method=LM

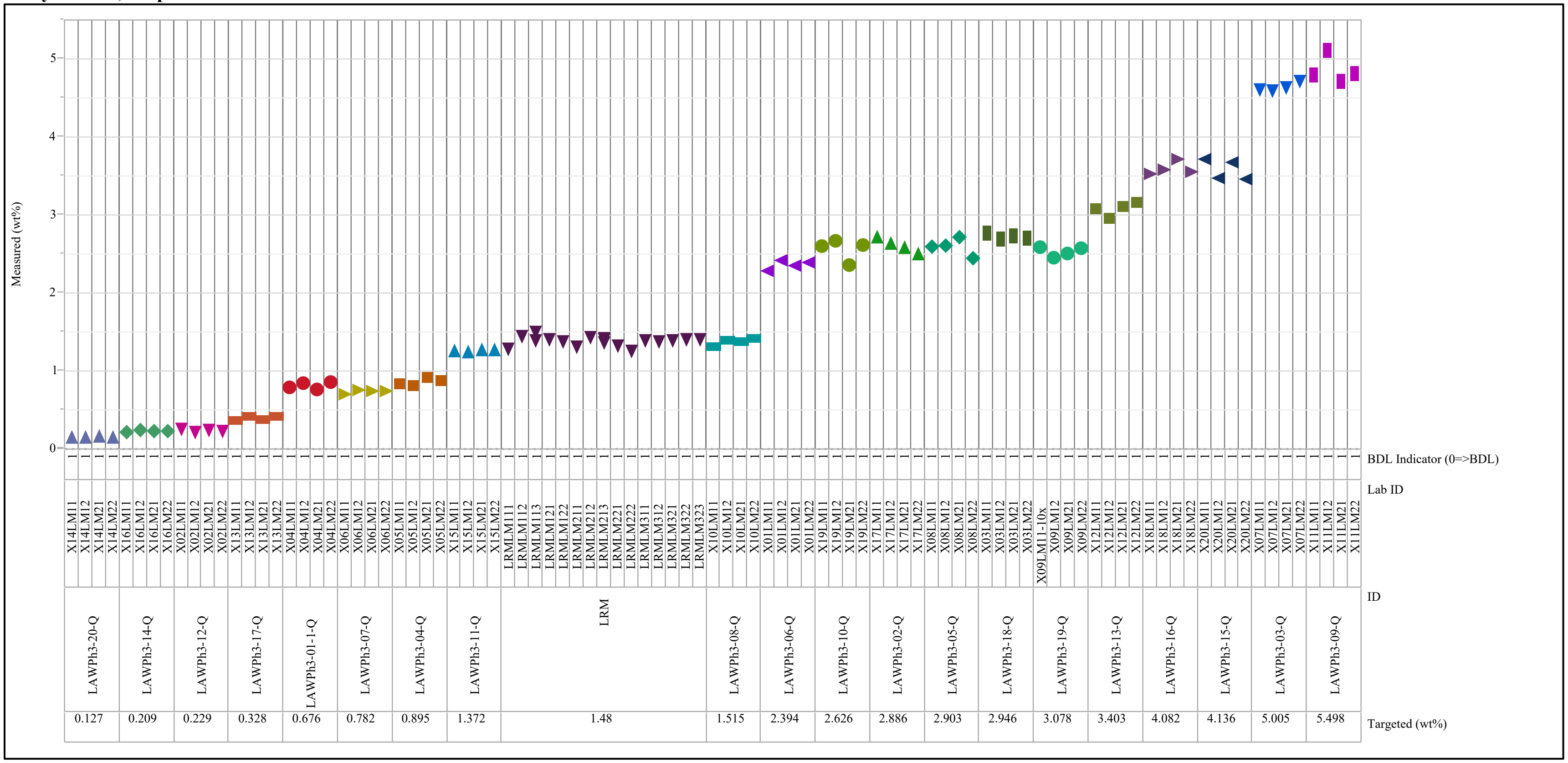


Exhibit A-2. Plots of Oxide Measurements by Set by Glass Identifier Grouped by Targeted Concentrations (continued)

Analyte=MgO, Prep Method=LM

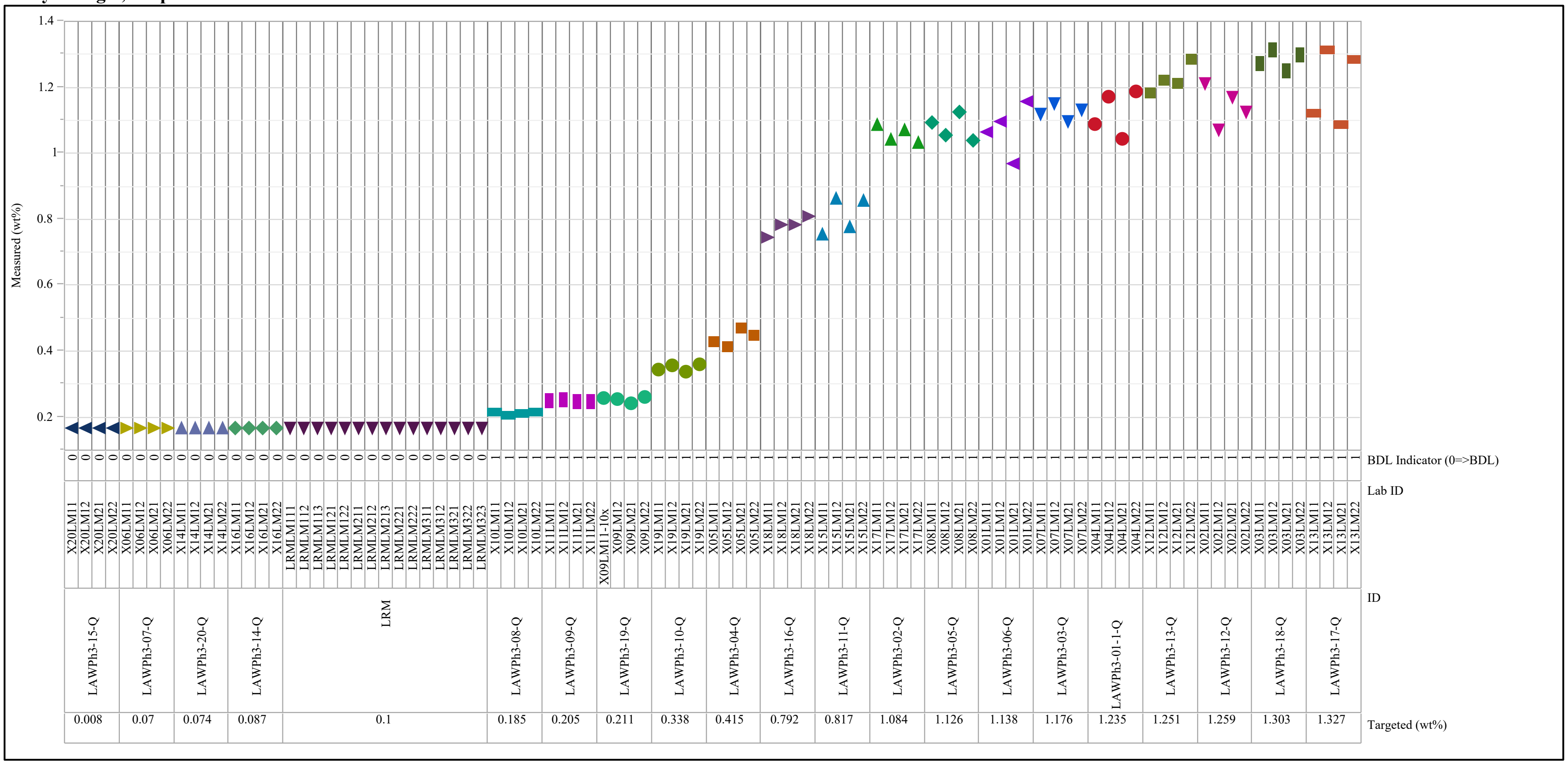


Exhibit A-2. Plots of Oxide Measurements by Set by Glass Identifier Grouped by Targeted Concentrations (continued)

Analyte=Na2O, Prep Method=LM

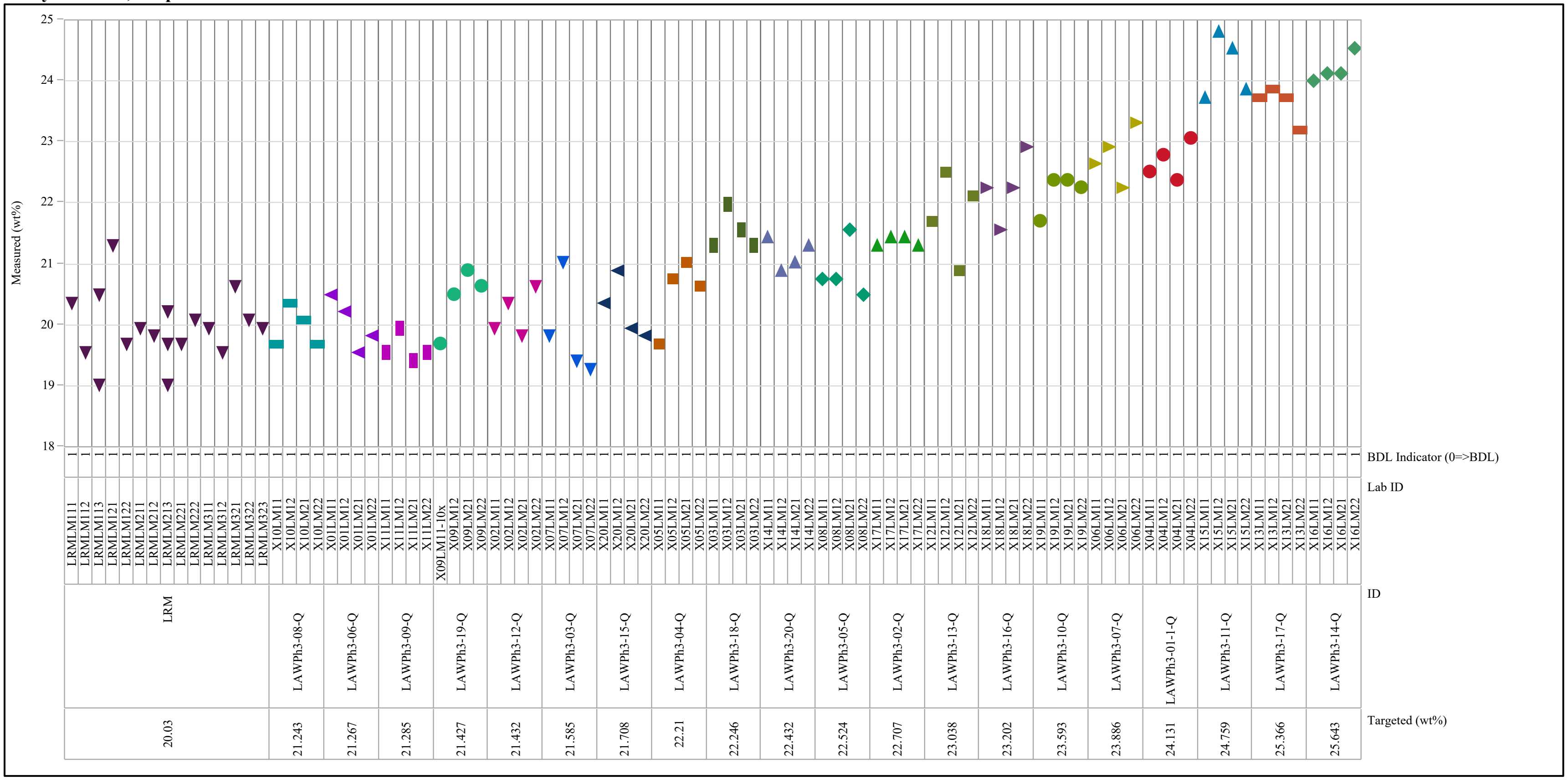


Exhibit A-2. Plots of Oxide Measurements by Set by Glass Identifier Grouped by Targeted Concentrations (continued)

Analyte=P2O5, Prep Method=PS

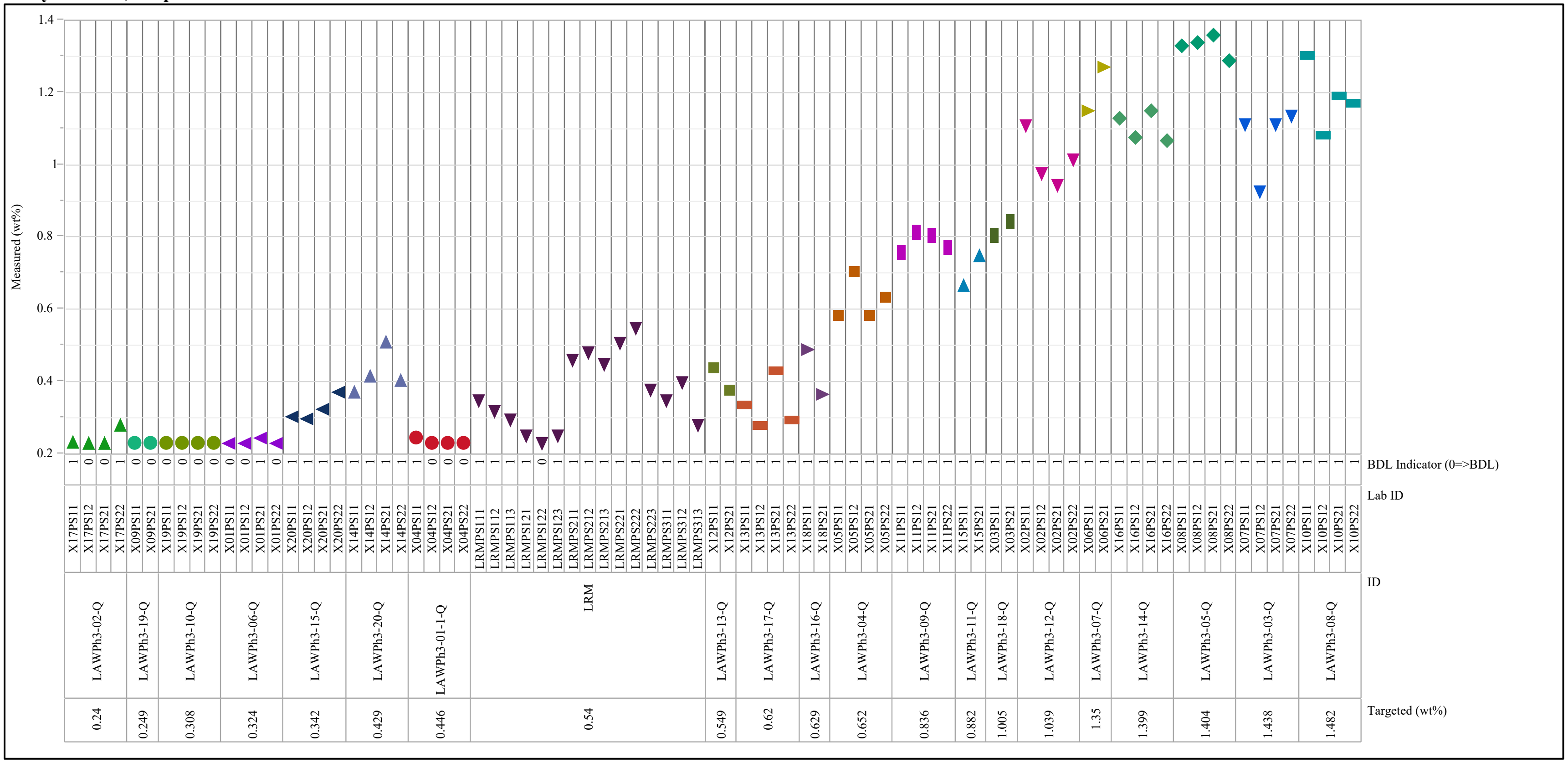


Exhibit A-2. Plots of Oxide Measurements by Set by Glass Identifier Grouped by Targeted Concentrations (continued)

Analyte=SiO2, Prep Method=PS

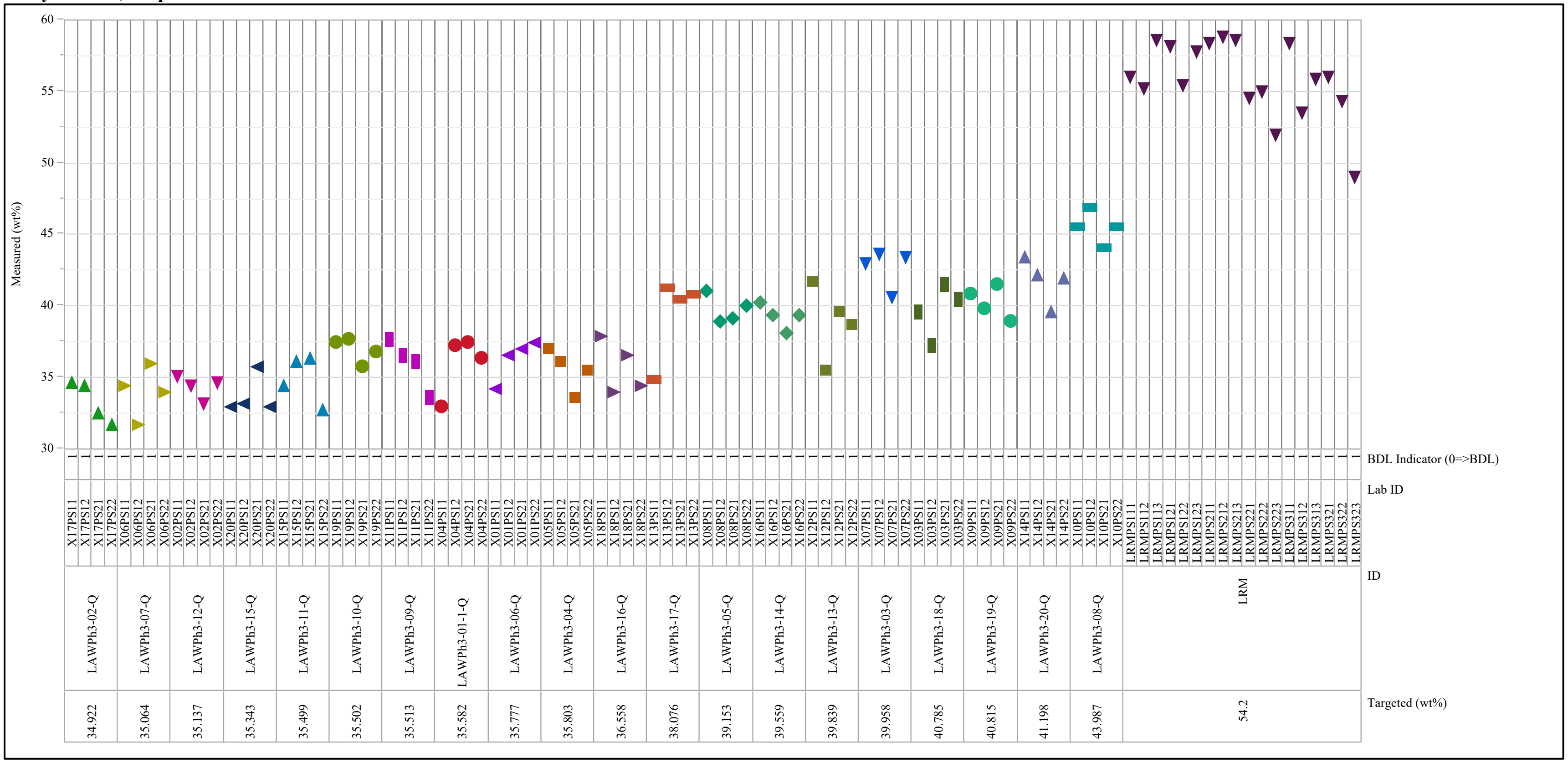


Exhibit A-2. Plots of Oxide Measurements by Set by Glass Identifier Grouped by Targeted Concentrations (continued)

Analyte=SnO2, Prep Method=PS

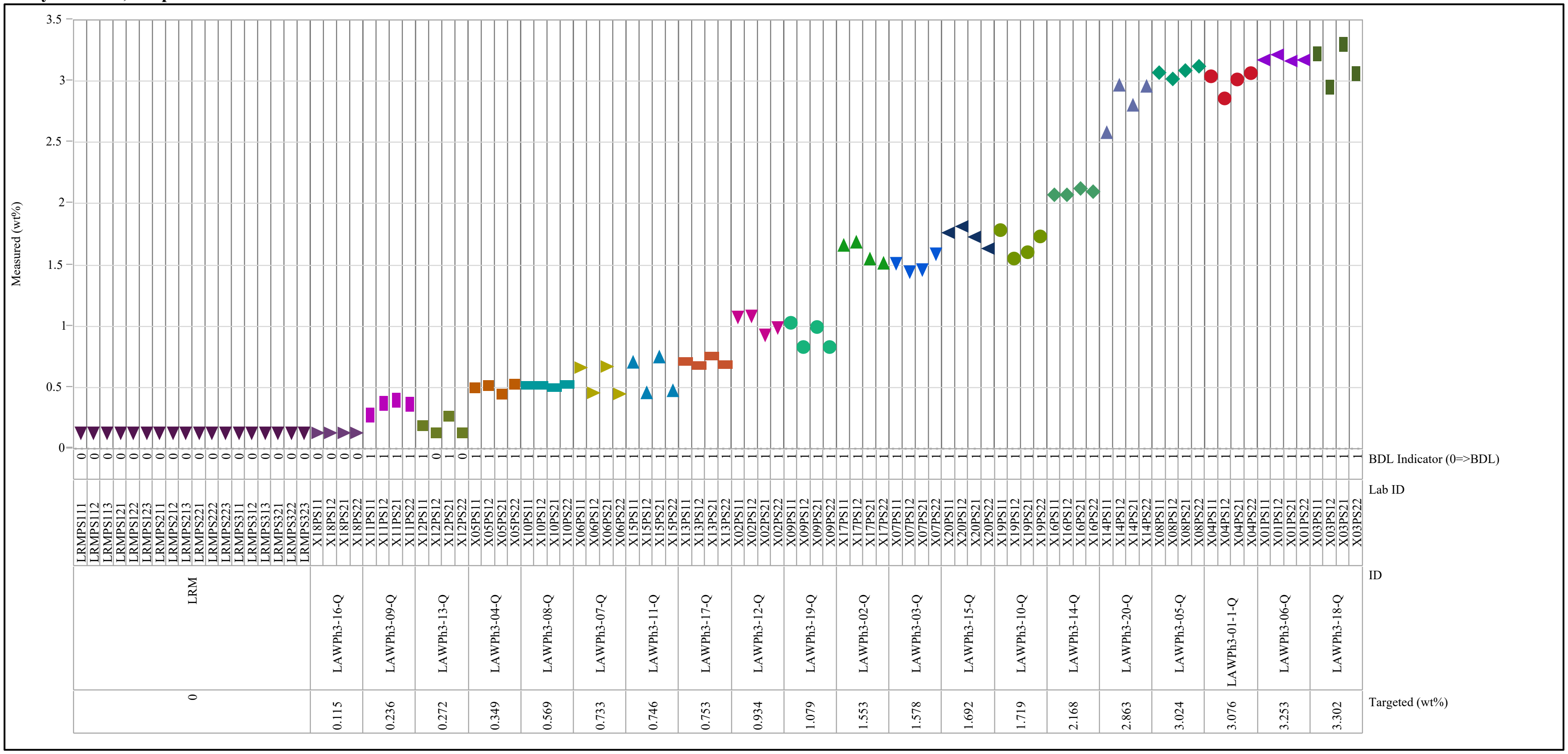


Exhibit A-2. Plots of Oxide Measurements by Set by Glass Identifier Grouped by Targeted Concentrations (continued)

Analyte=SO3, Prep Method=LM

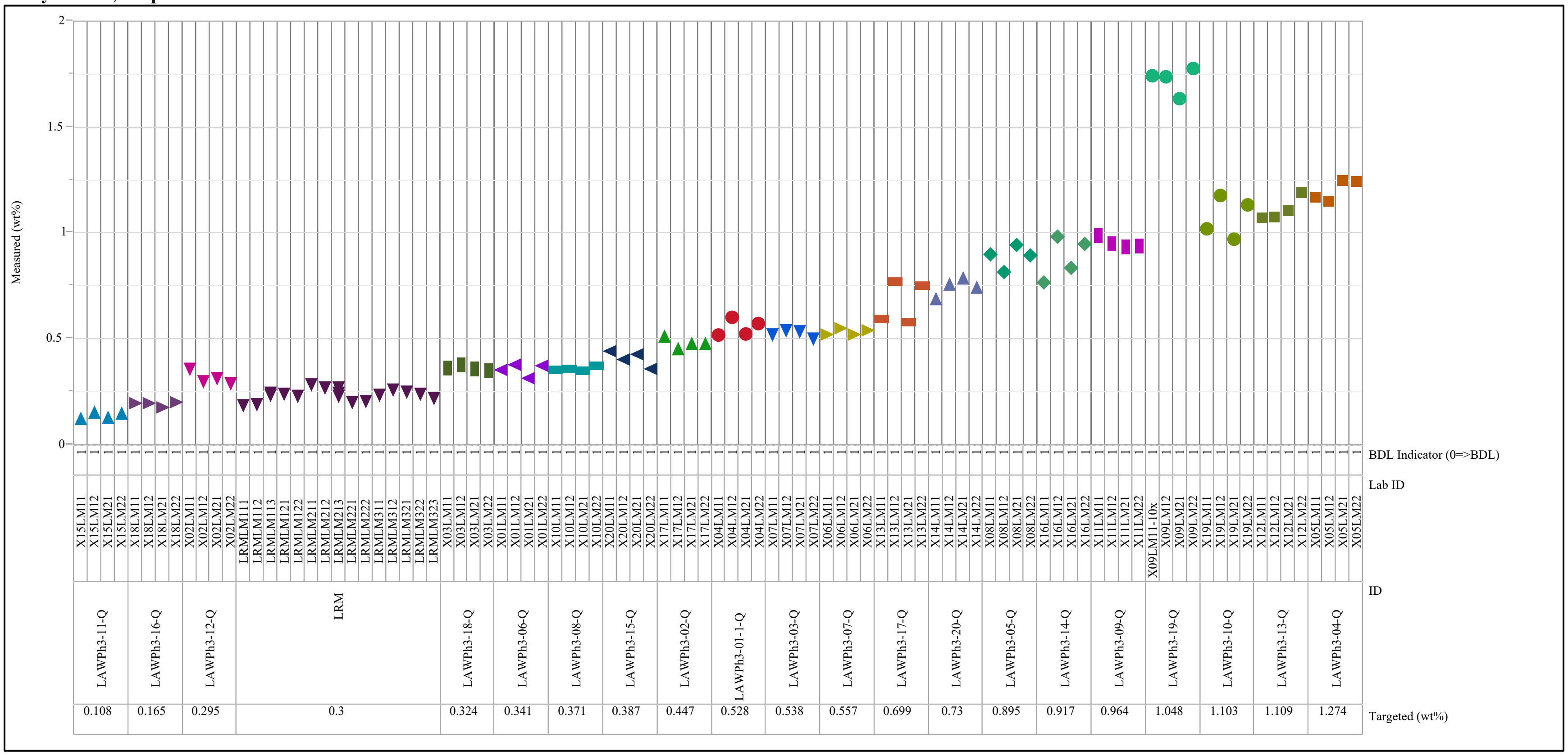


Exhibit A-2. Plots of Oxide Measurements by Set by Glass Identifier Grouped by Targeted Concentrations (continued)

Analyte=V2O5, Prep Method=LM

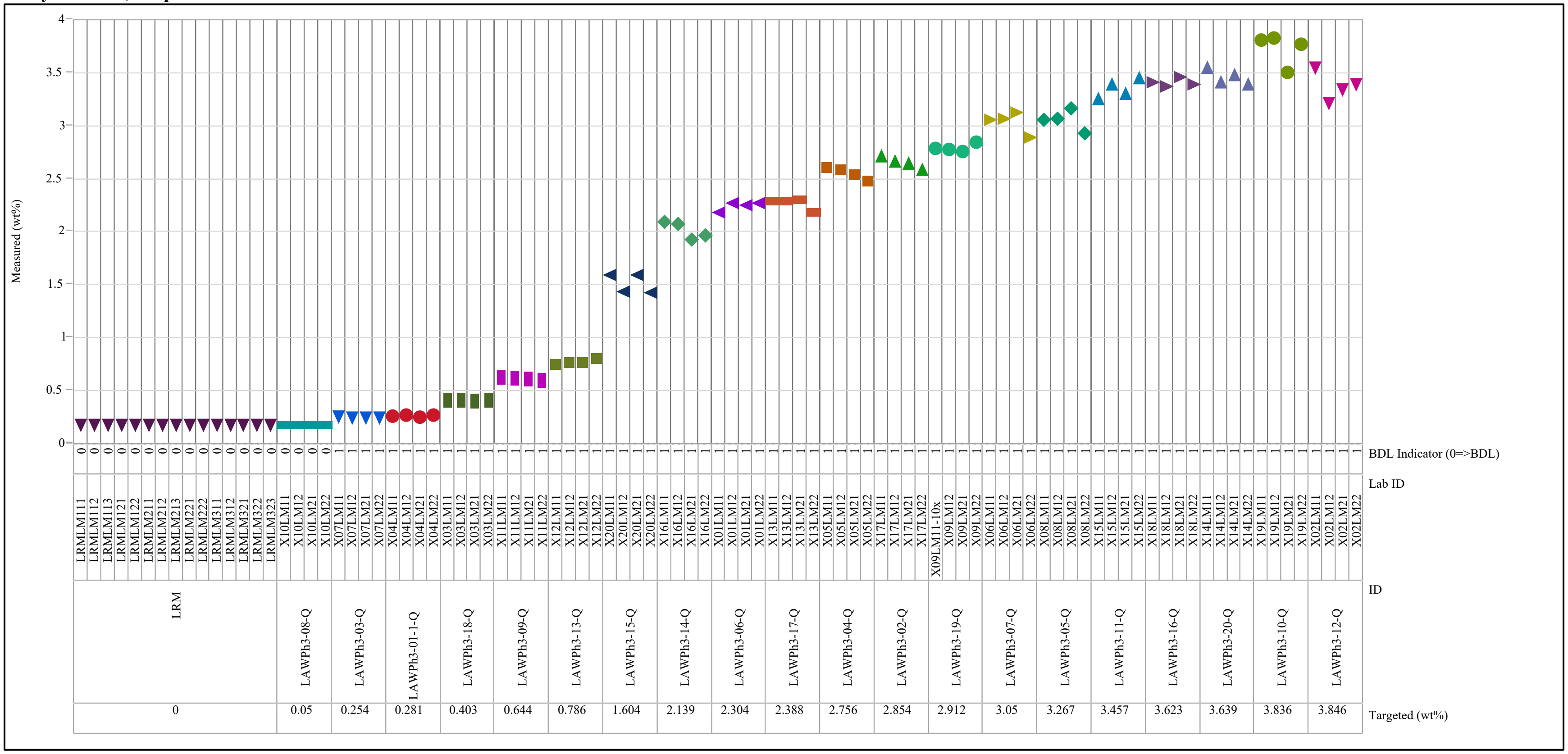


Exhibit A-2. Plots of Oxide Measurements by Set by Glass Identifier Grouped by Targeted Concentrations (continued)

Analyte=ZnO, Prep Method=LM

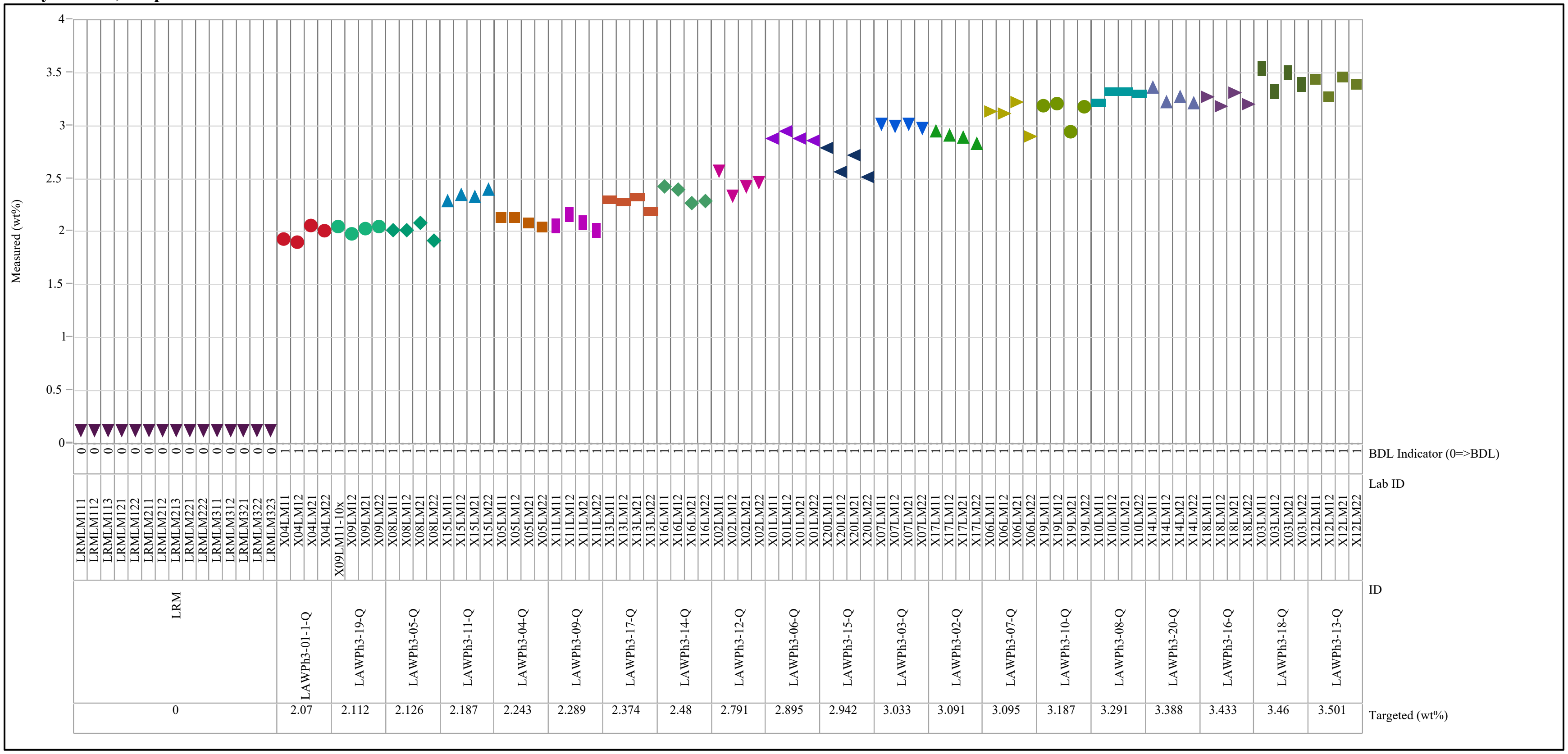


Exhibit A-2. Plots of Oxide Measurements by Set by Glass Identifier Grouped by Targeted Concentrations (continued)

Analyte=ZrO2, Prep Method=PS

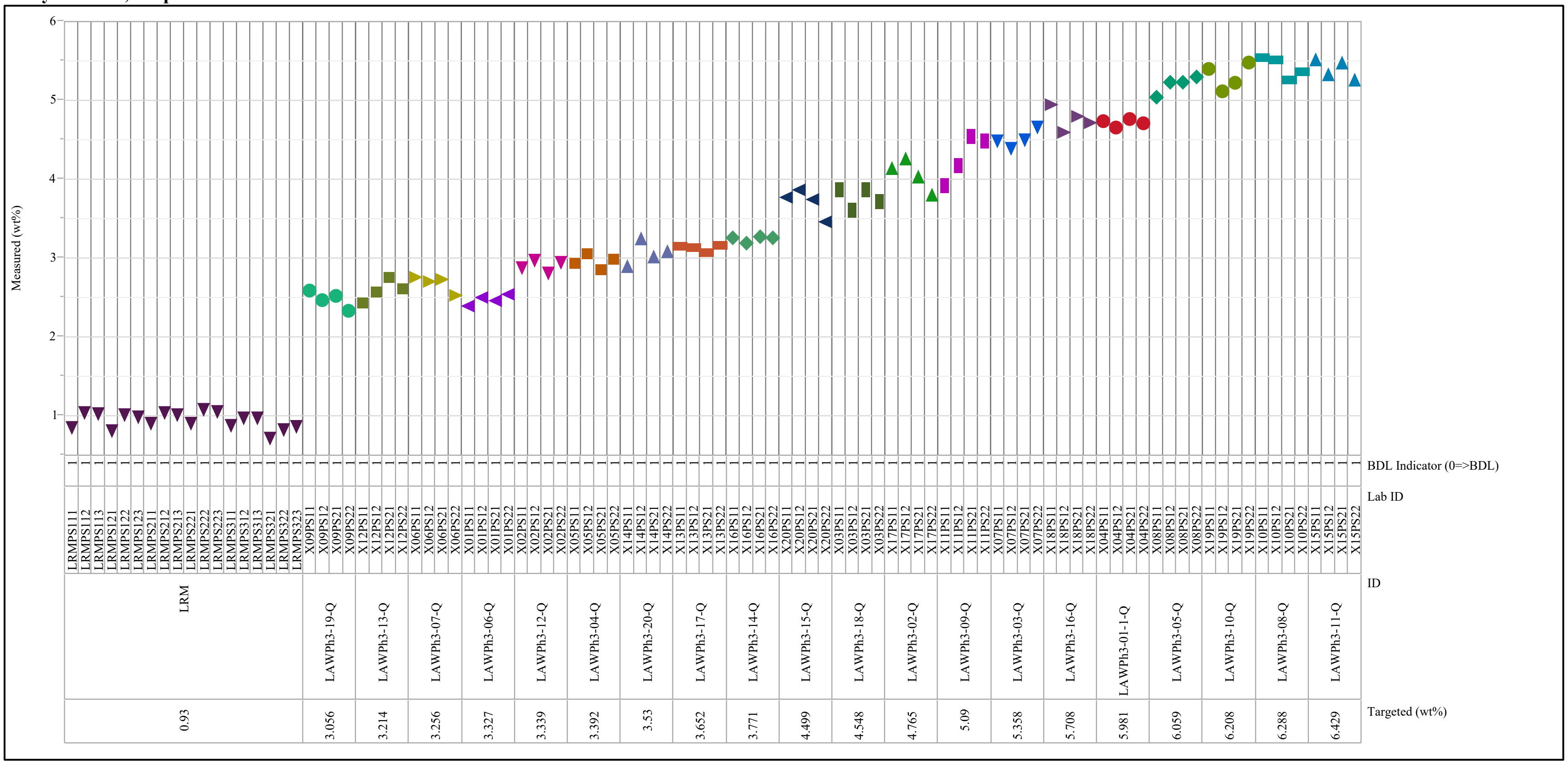
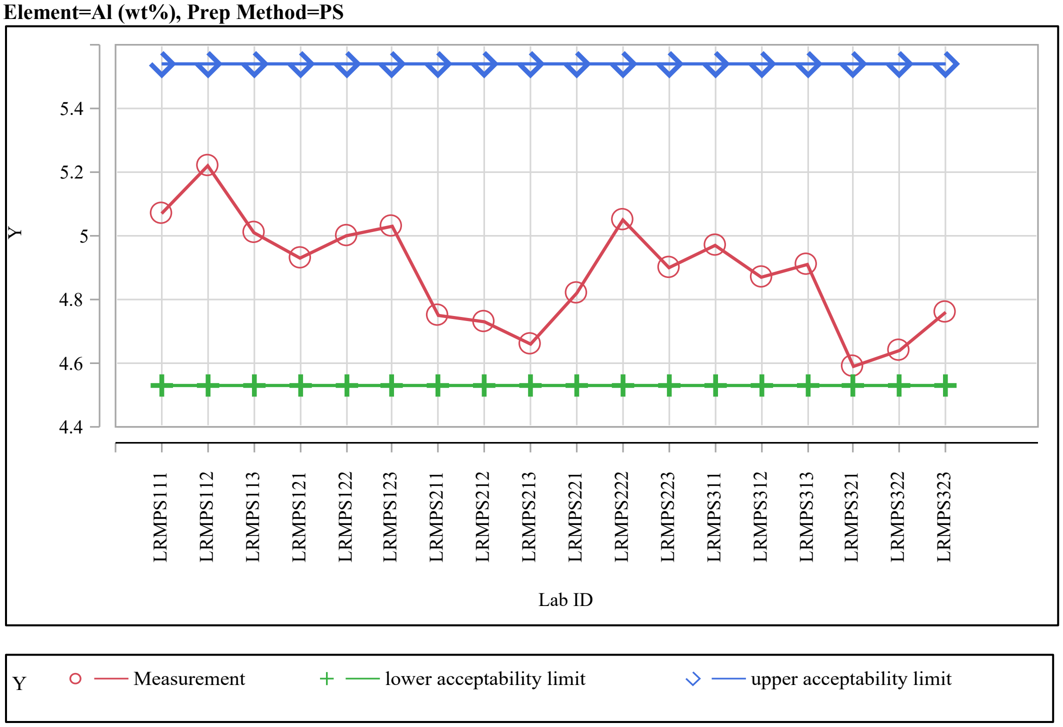


Exhibit A-3. Acceptability Evaluation for Measurements of the LRM Standard Glass

Element=Al (wt%), Prep Method=PS



Element=B (wt%), Prep Method=PS

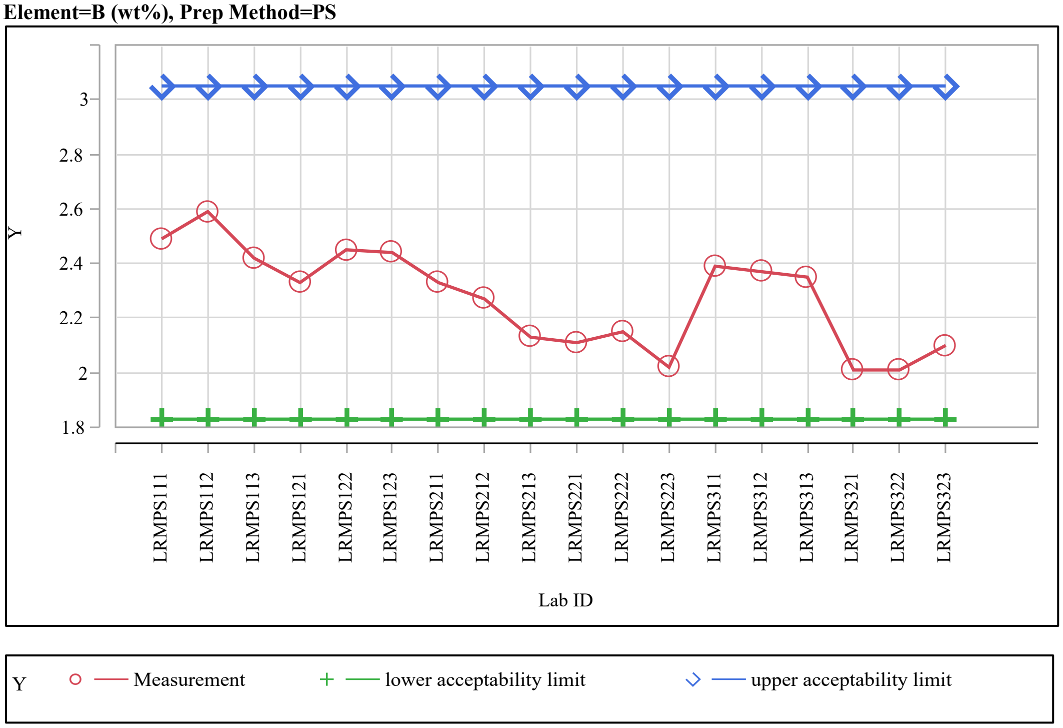
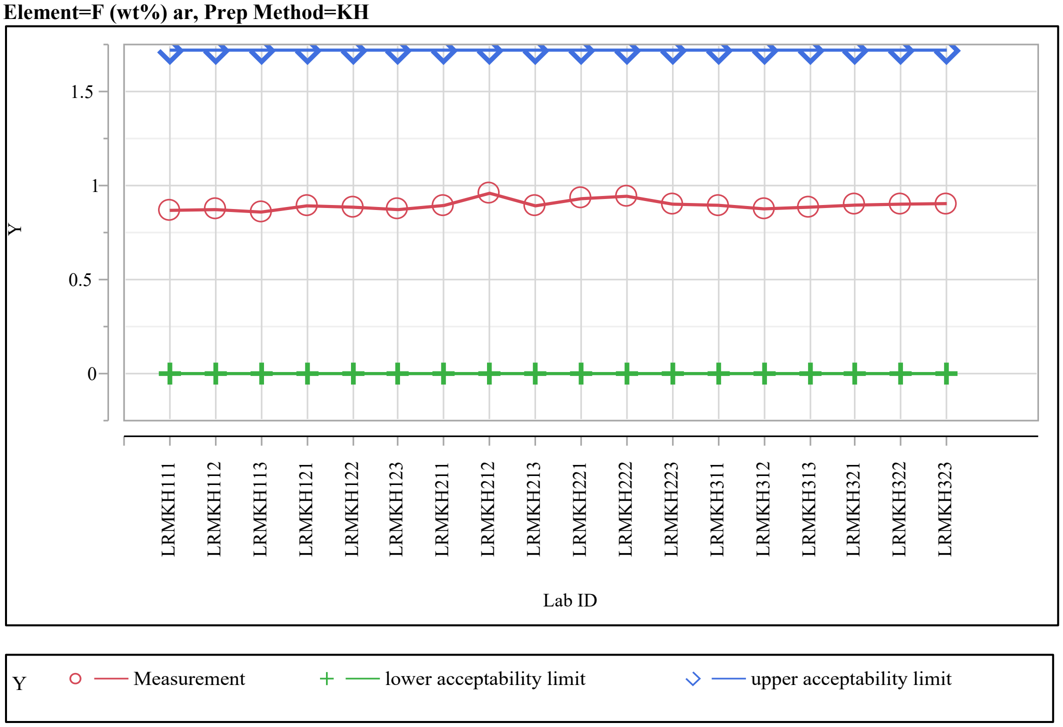


Exhibit A-3. Acceptability Evaluation for Measurements of the LRM Standard Glass (continued)

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



Element=Fe (wt%), Prep Method=PS

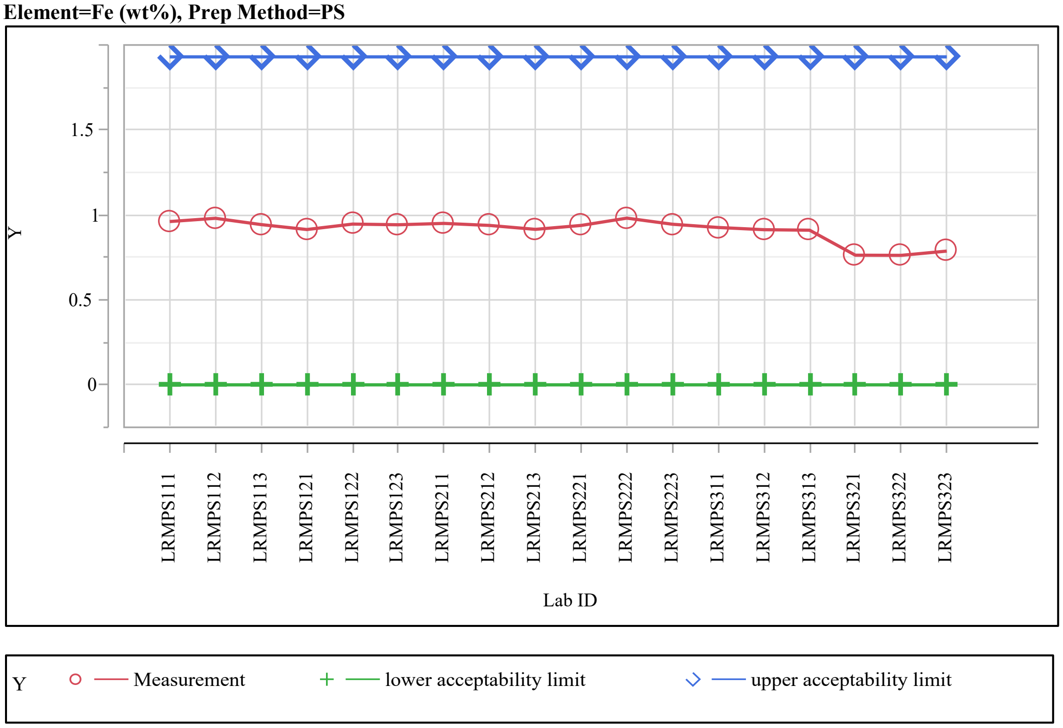
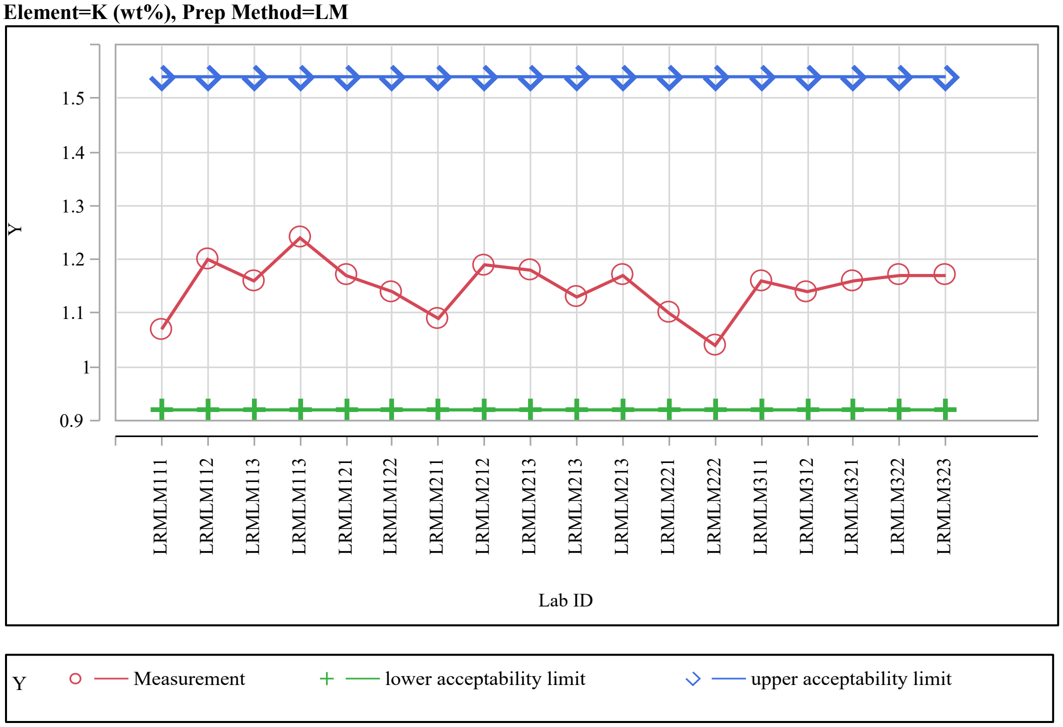


Exhibit A-3. Acceptability Evaluation for Measurements of the LRM Standard Glass (continued)

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



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

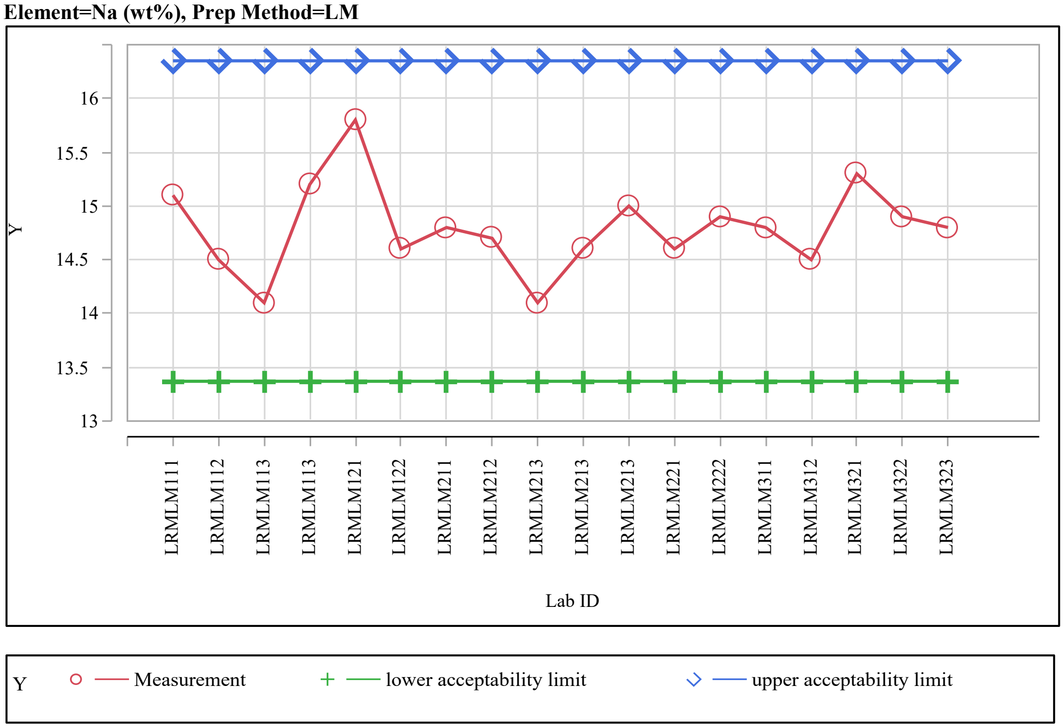
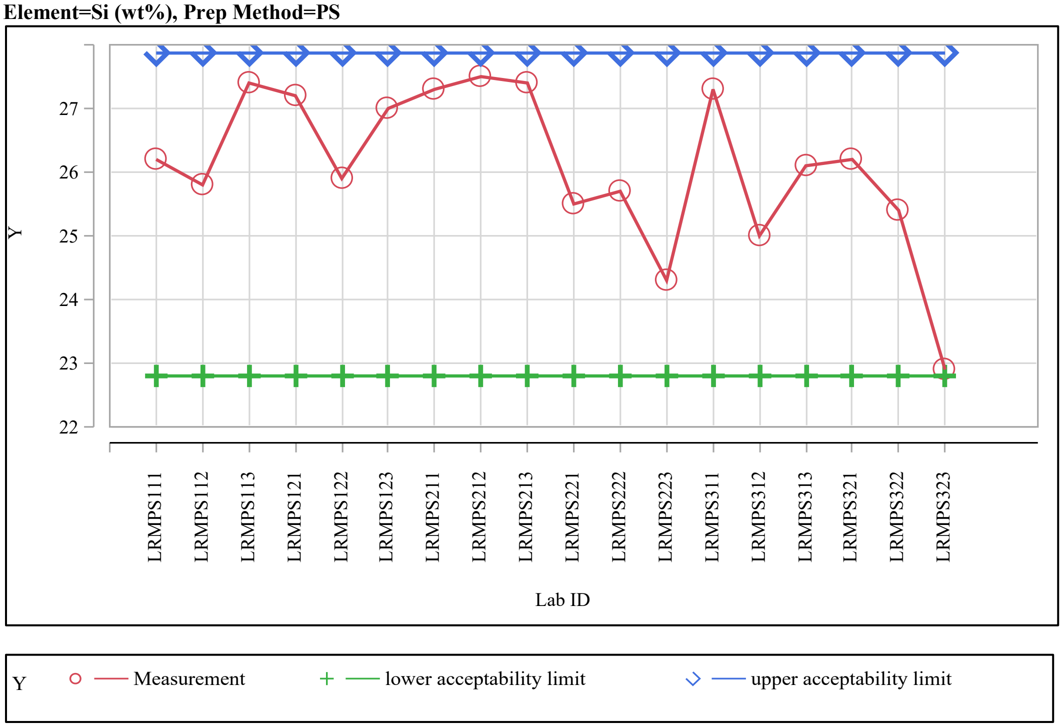


Exhibit A-3. Acceptability Evaluation for Measurements of the LRM Standard Glass (continued)

Element=Si (wt%), Prep Method=PS



Element=Zr (wt%), Prep Method=PS

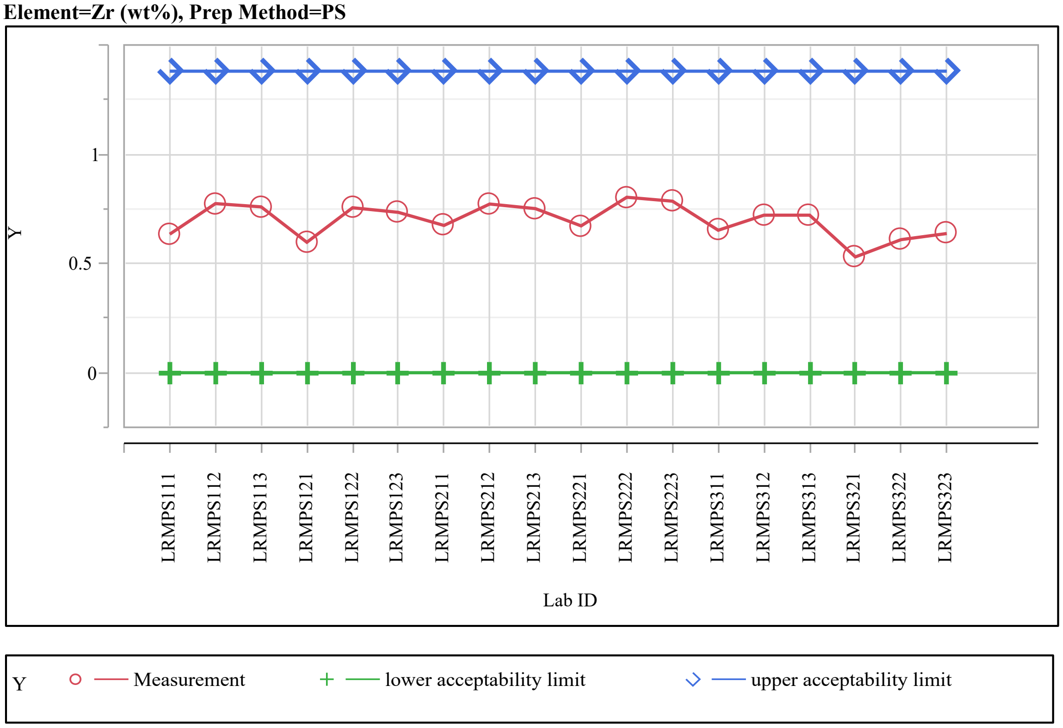


Exhibit A-4. Measured versus Targeted Concentrations by Glass ID by Oxide

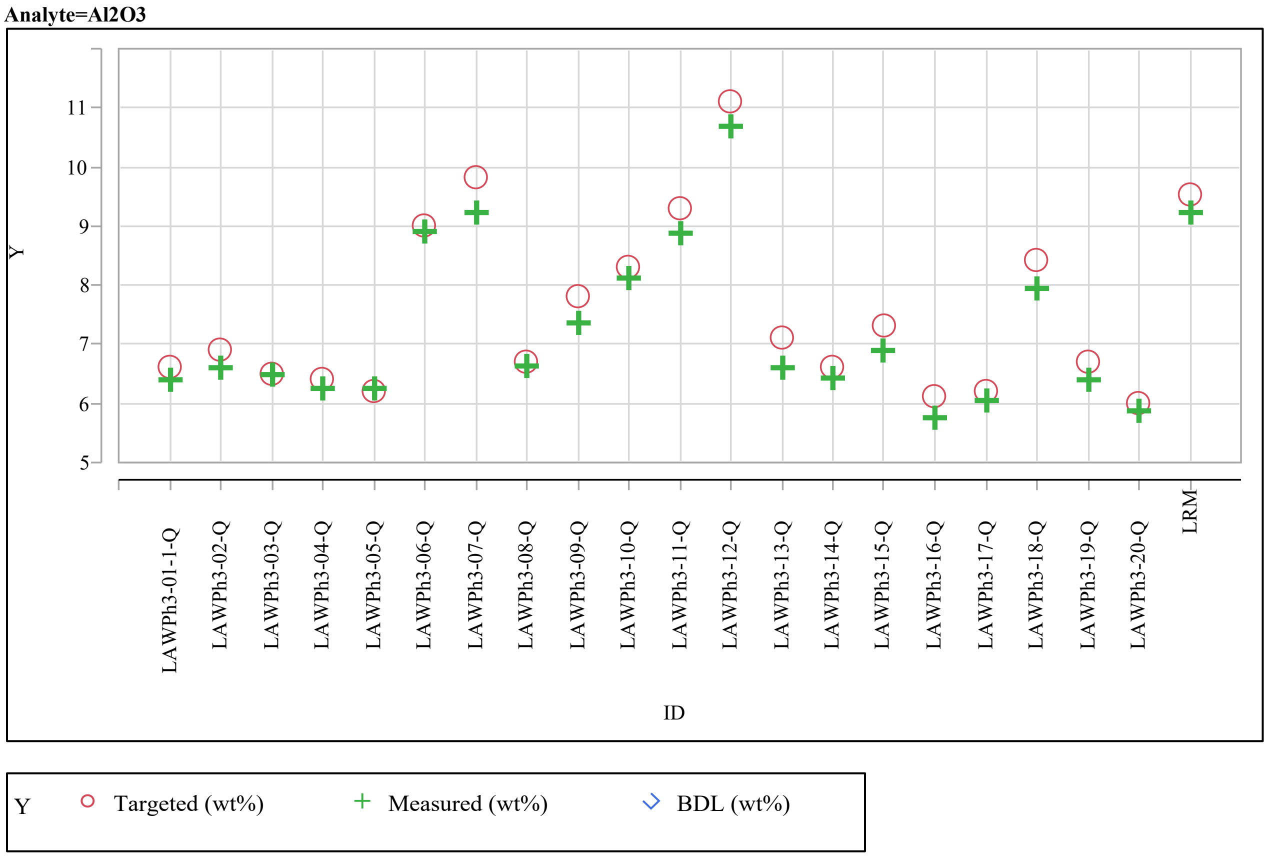


Exhibit A-4. Measured versus Targeted Concentrations by Glass ID by Oxide (continued)

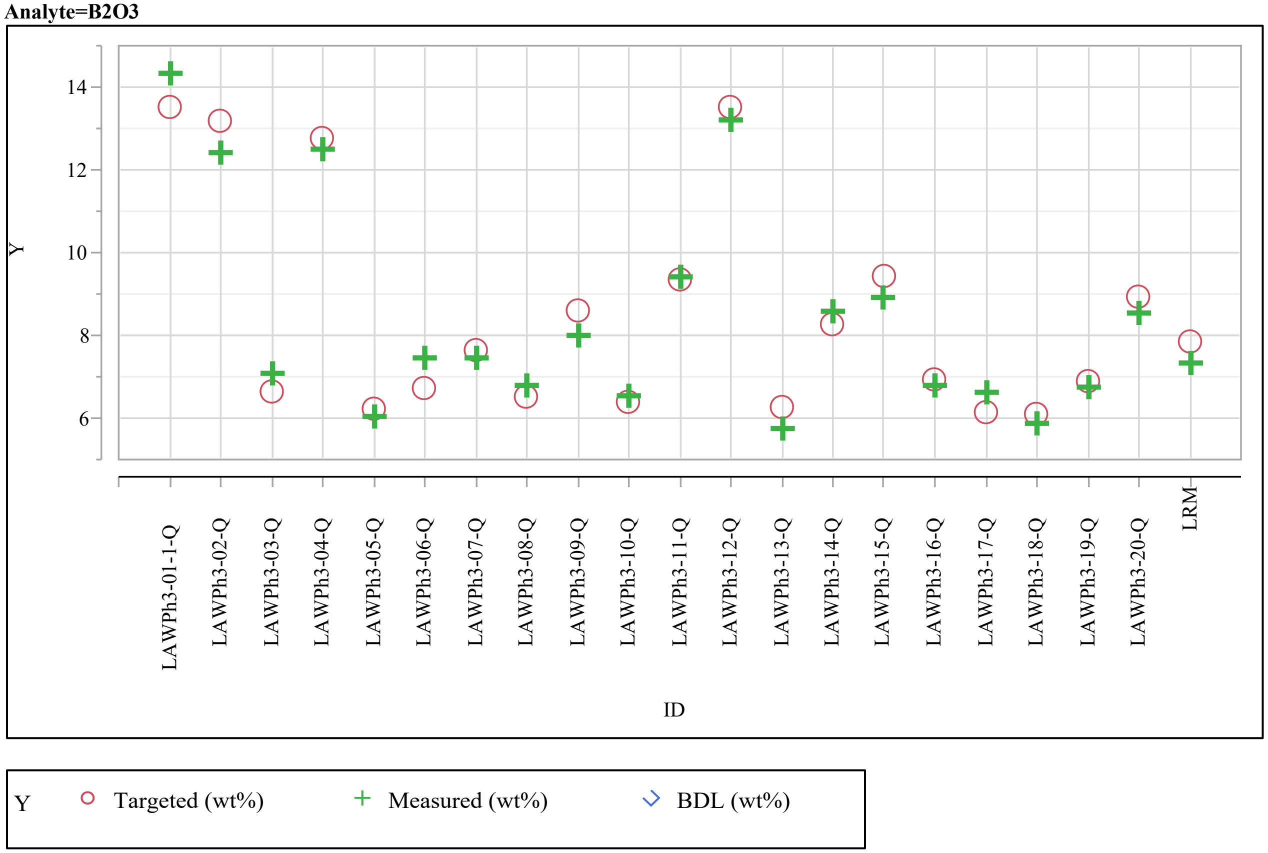


Exhibit A-4. Measured versus Targeted Concentrations by Glass ID by Oxide (continued)

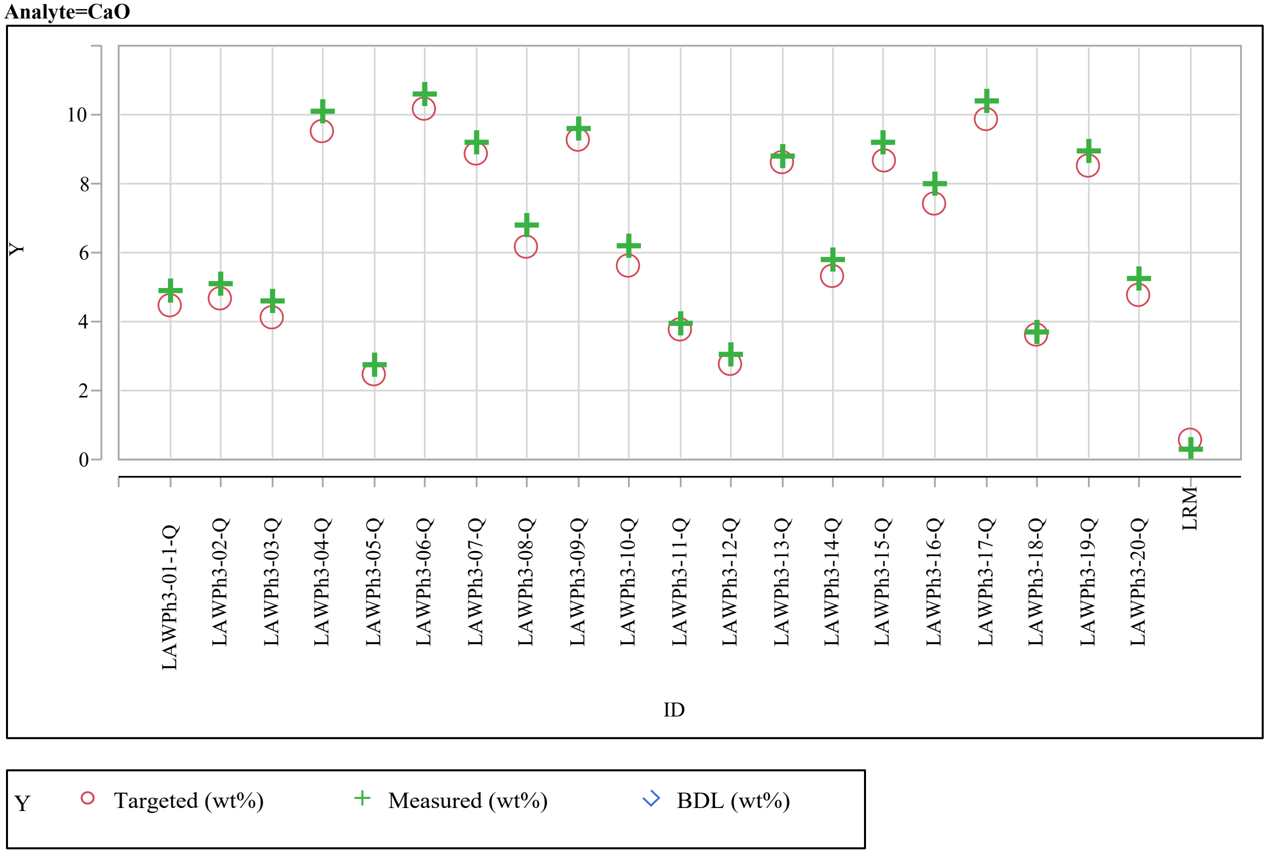


Exhibit A-4. Measured versus Targeted Concentrations by Glass ID by Oxide (continued)

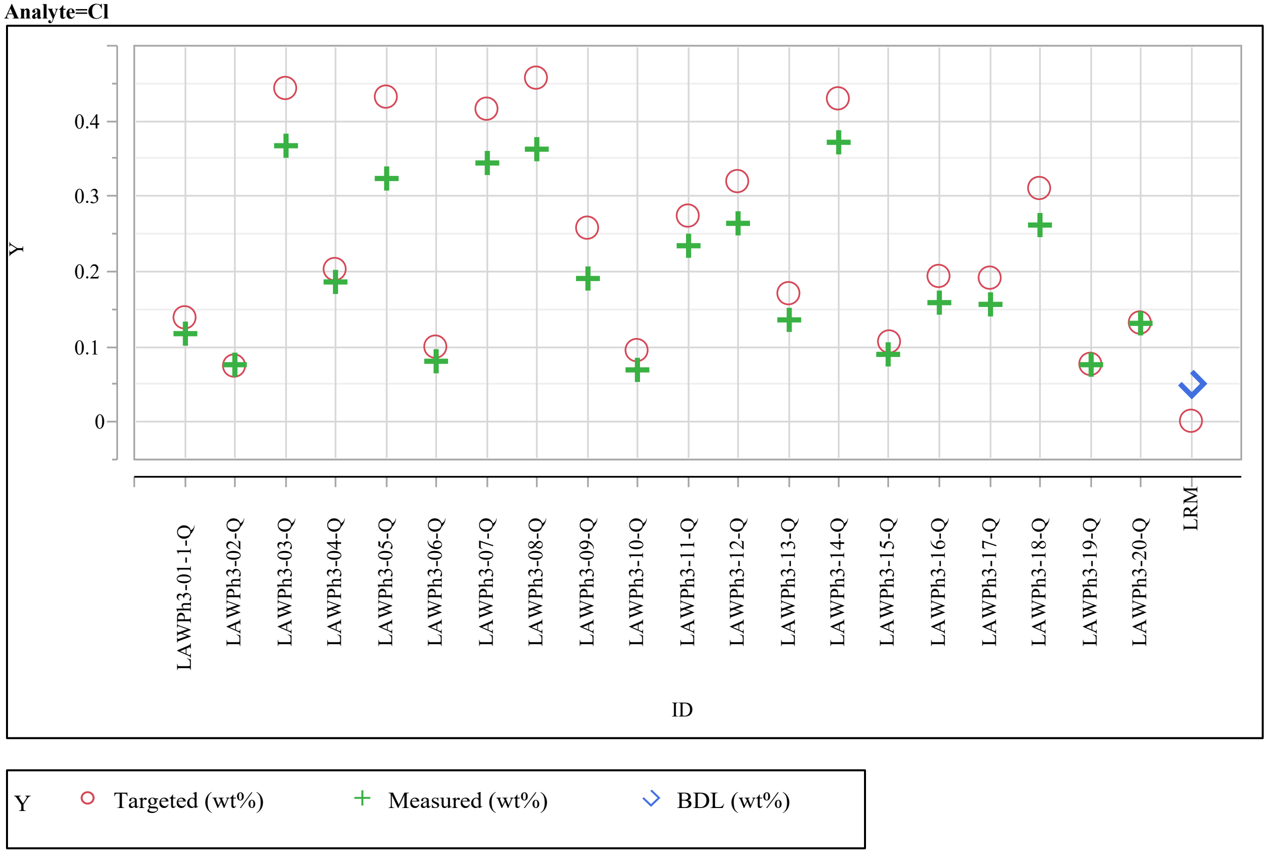


Exhibit A-4. Measured versus Targeted Concentrations by Glass ID by Oxide (continued)

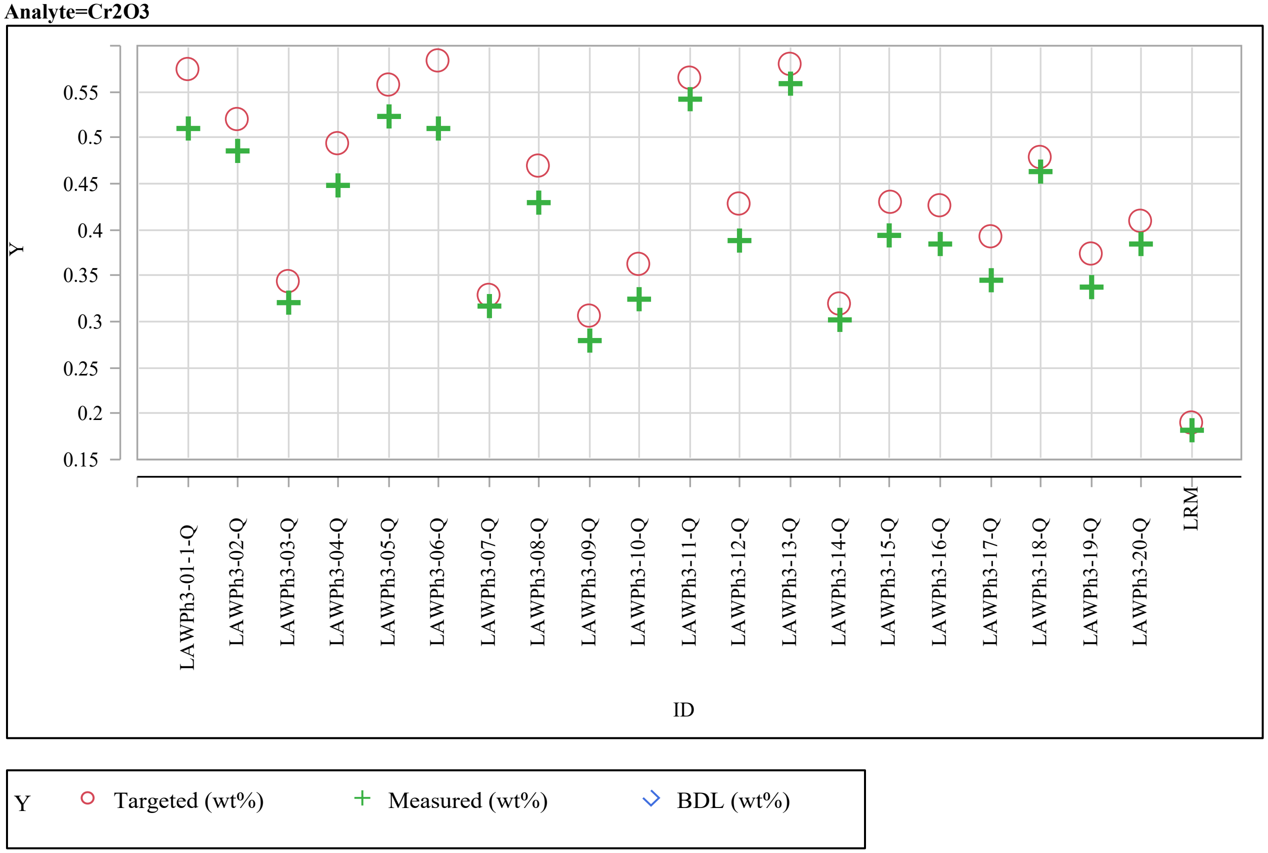


Exhibit A-4. Measured versus Targeted Concentrations by Glass ID by Oxide (continued)

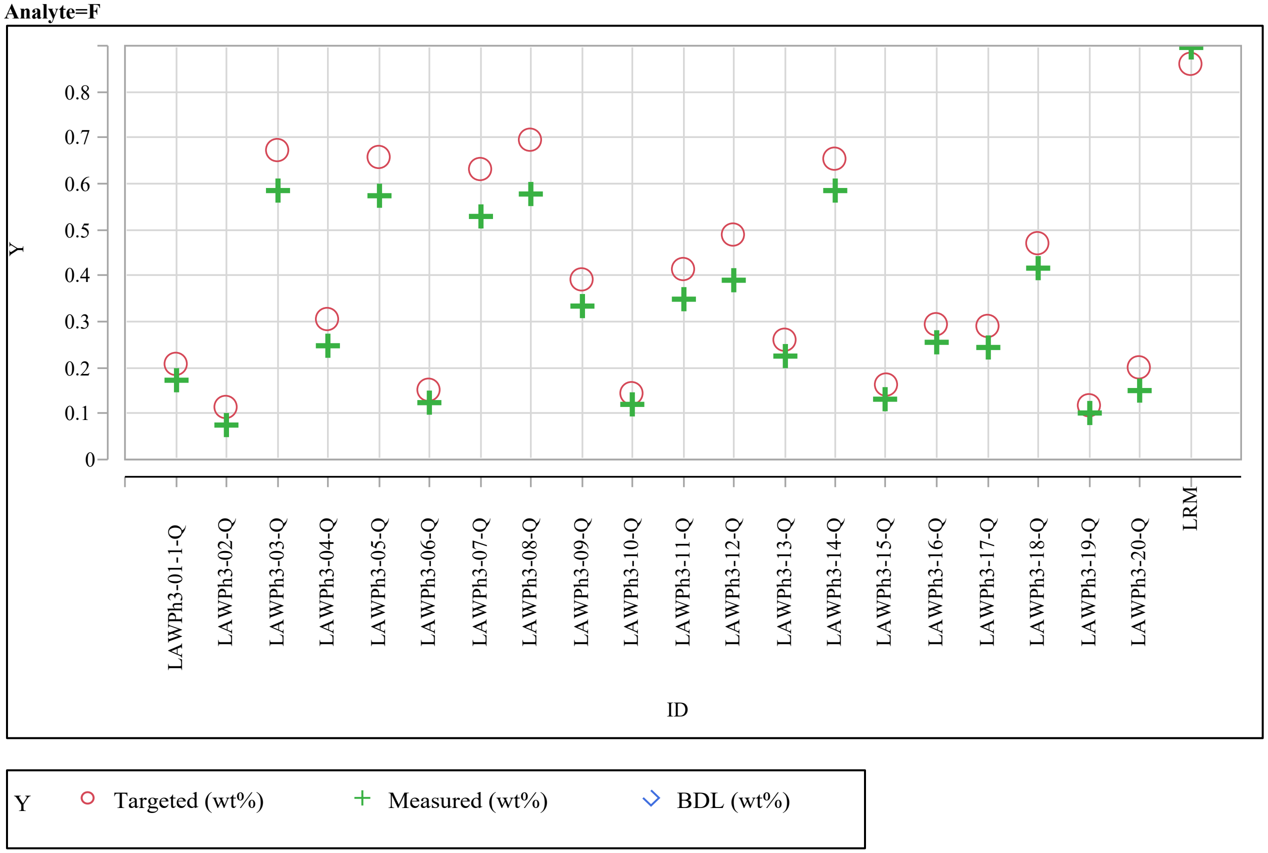


Exhibit A-4. Measured versus Targeted Concentrations by Glass ID by Oxide (continued)

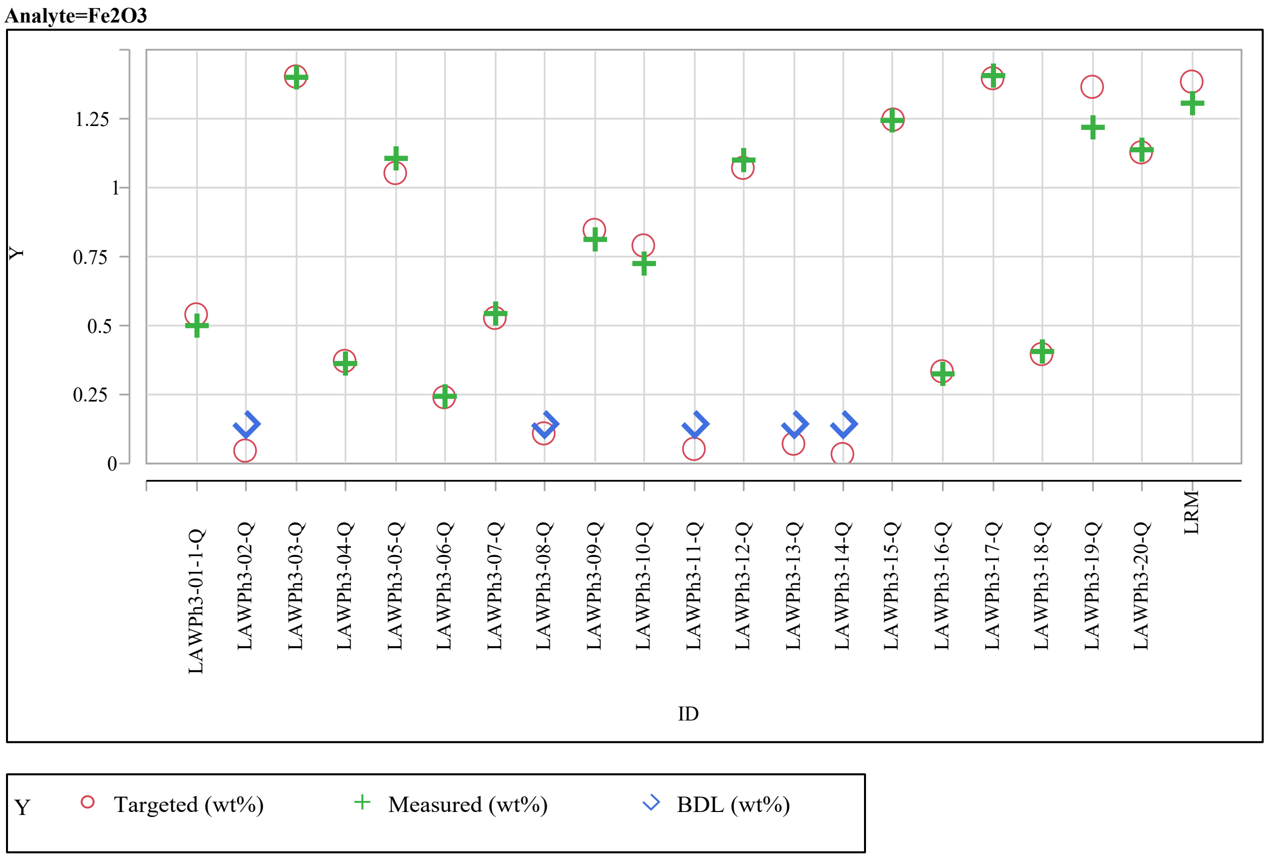


Exhibit A-4. Measured versus Targeted Concentrations by Glass ID by Oxide (continued)

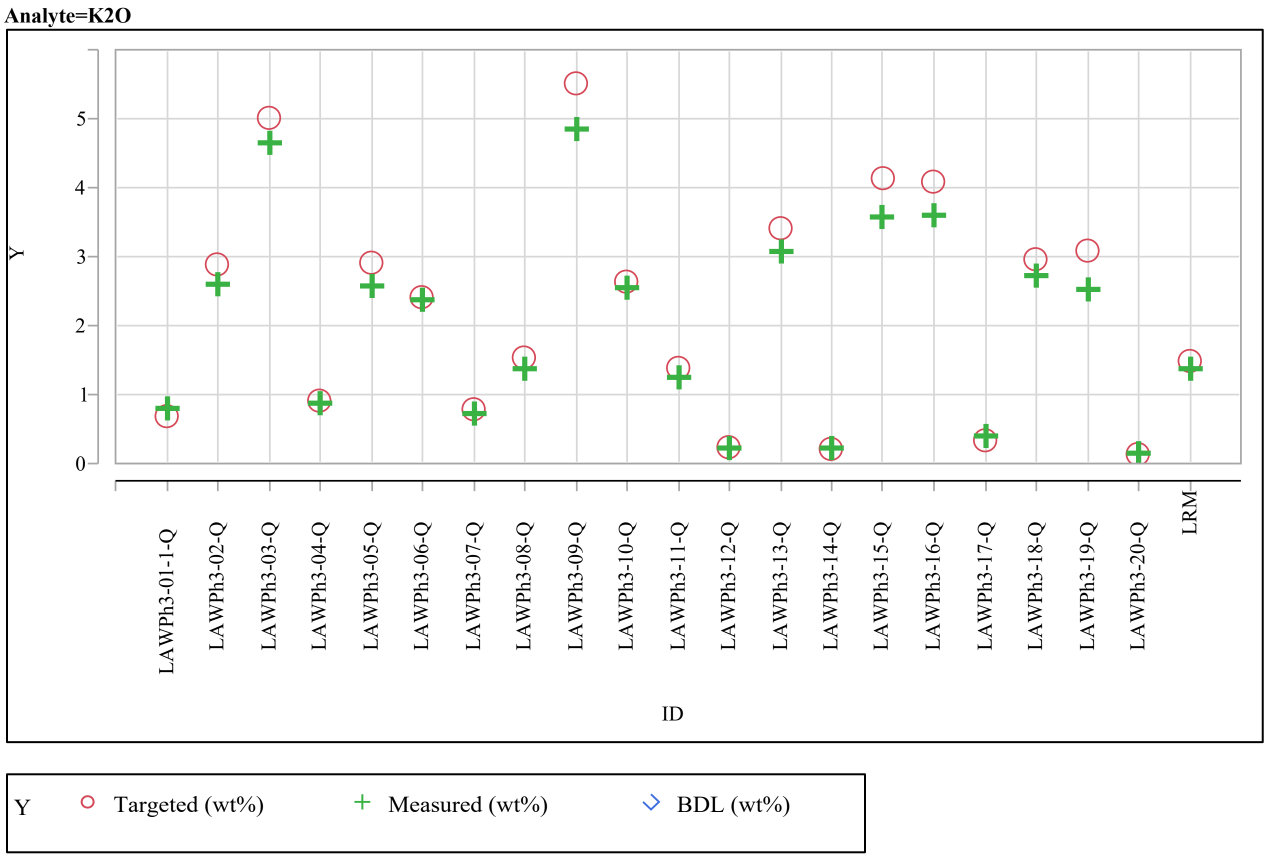


Exhibit A-4. Measured versus Targeted Concentrations by Glass ID by Oxide (continued)

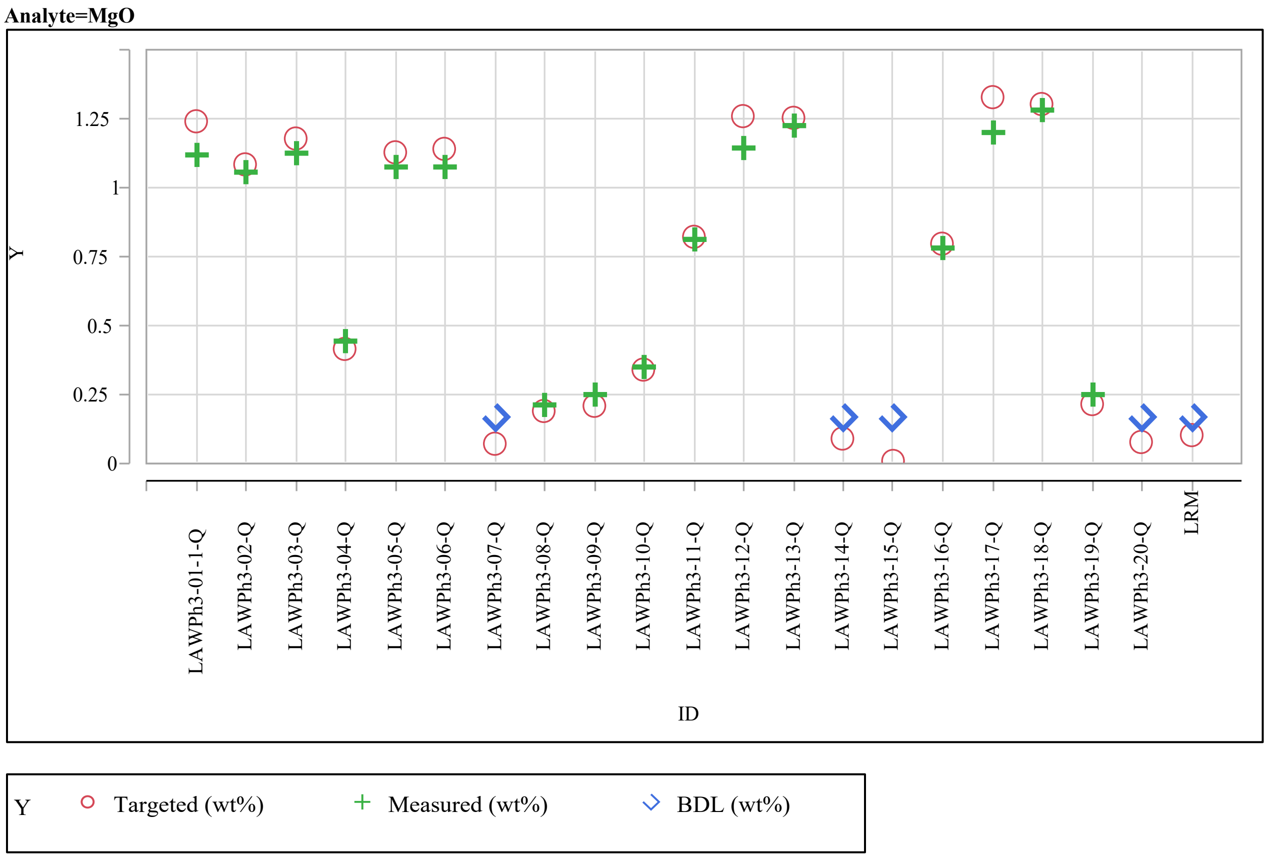


Exhibit A-4. Measured versus Targeted Concentrations by Glass ID by Oxide (continued)

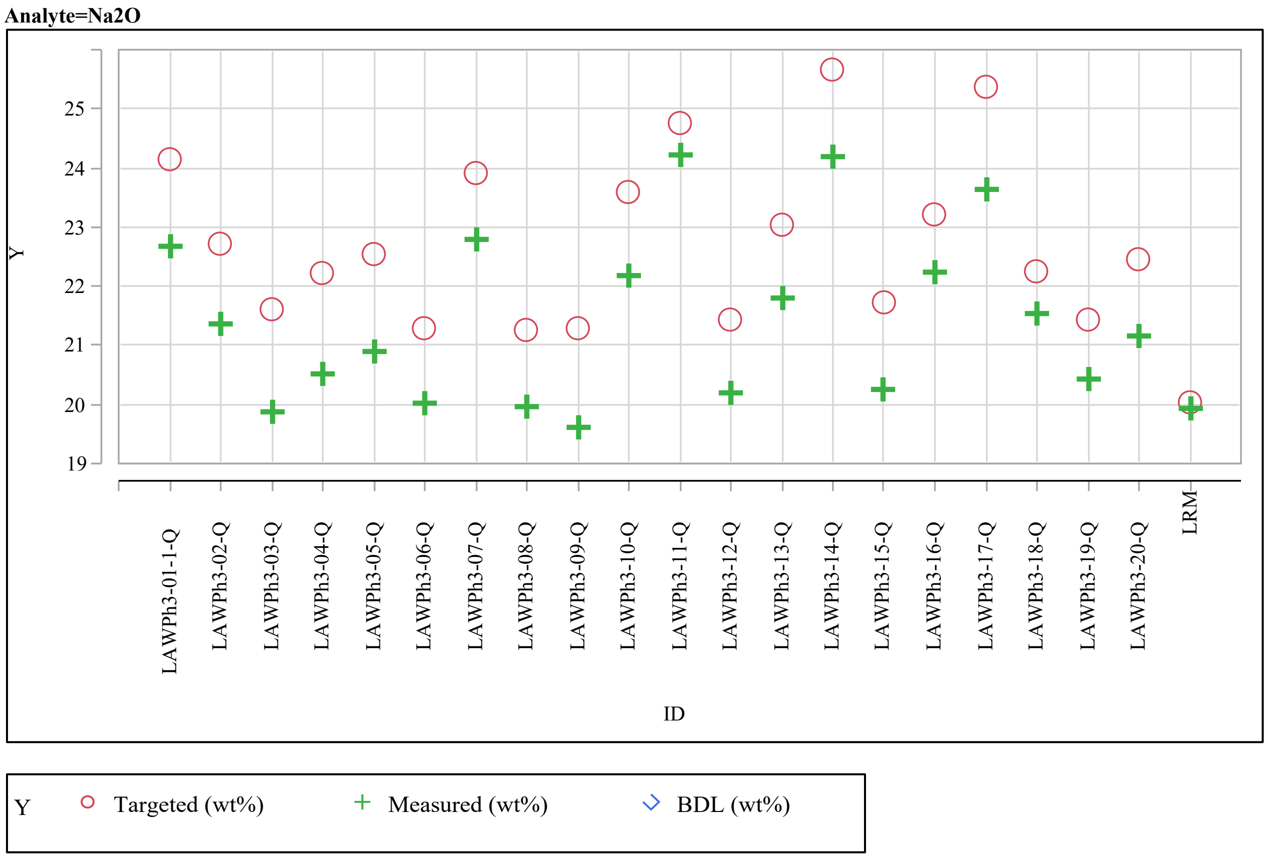


Exhibit A-4. Measured versus Targeted Concentrations by Glass ID by Oxide (continued)

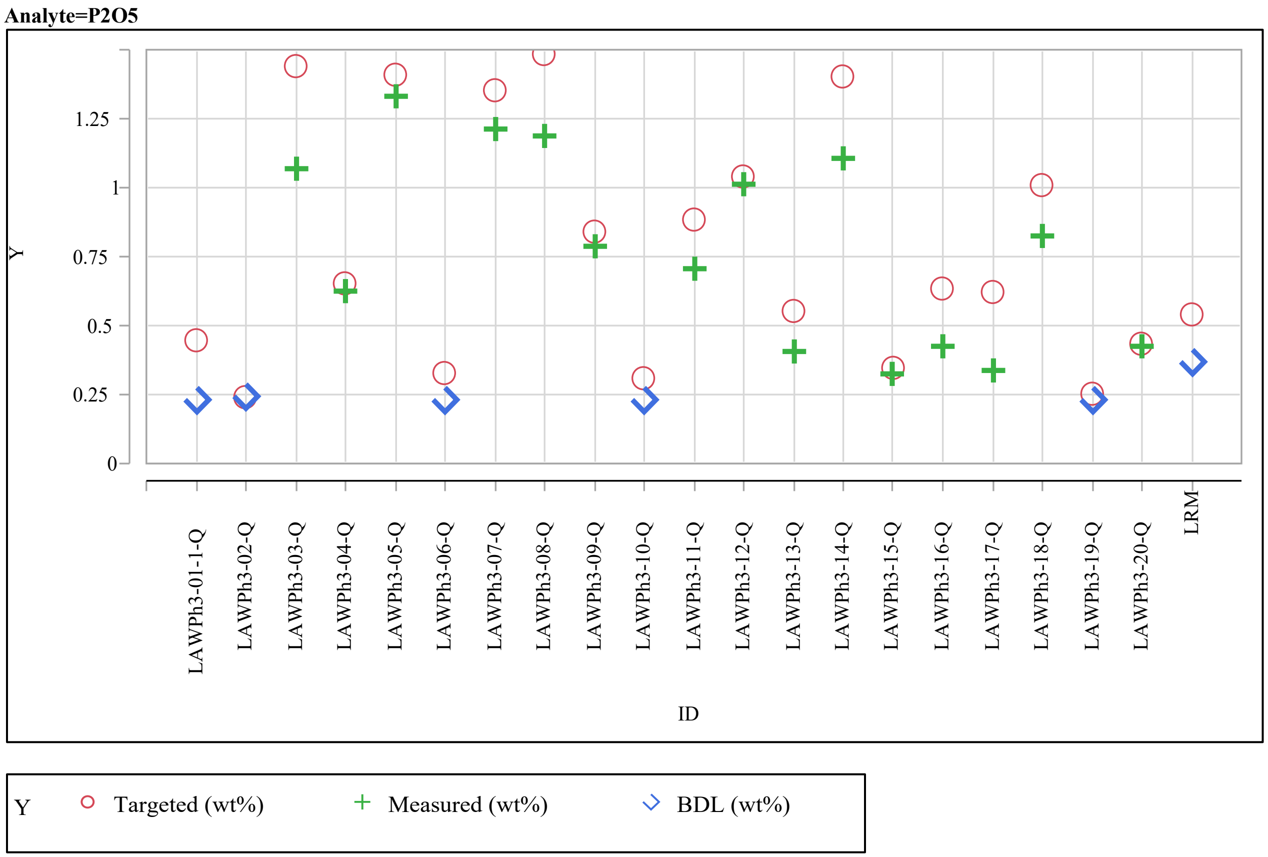


Exhibit A-4. Measured versus Targeted Concentrations by Glass ID by Oxide (continued)

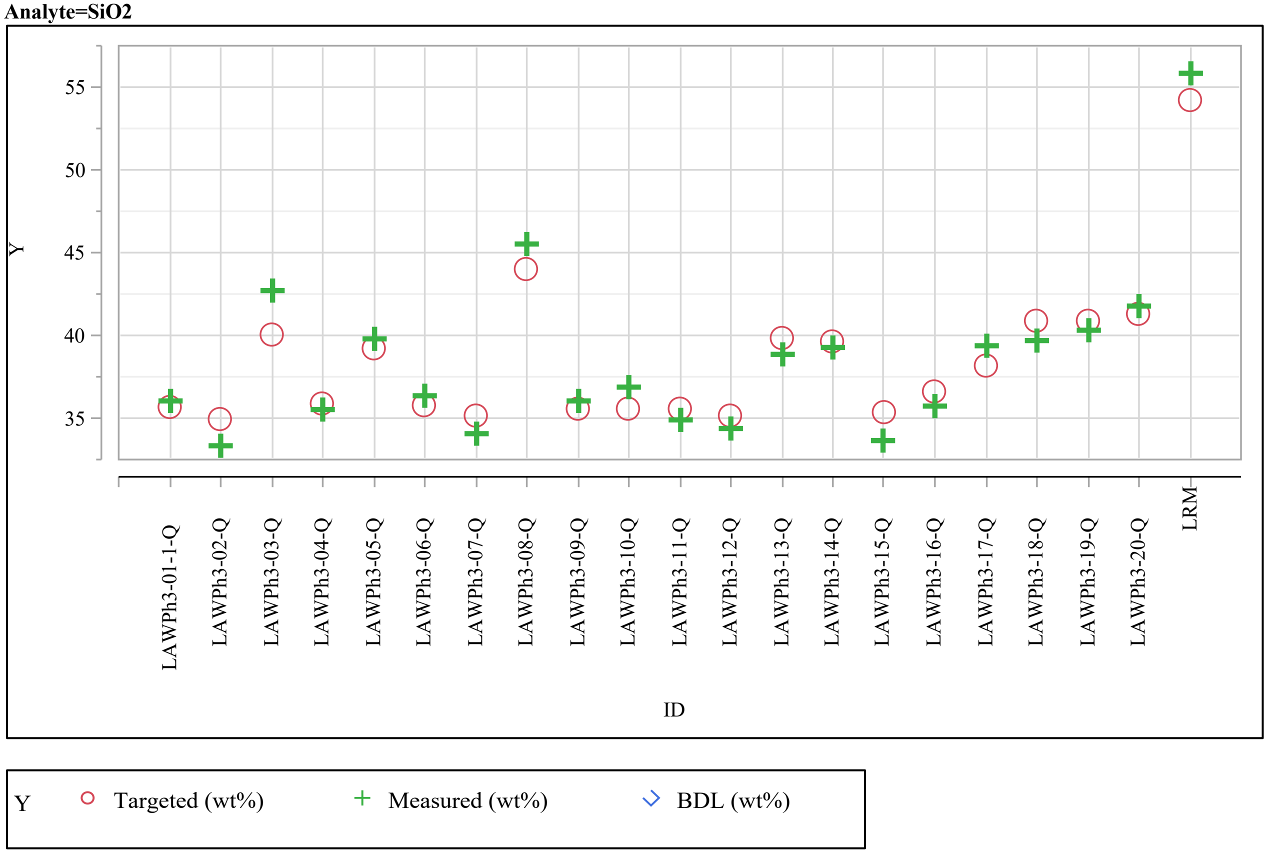


Exhibit A-4. Measured versus Targeted Concentrations by Glass ID by Oxide (continued)

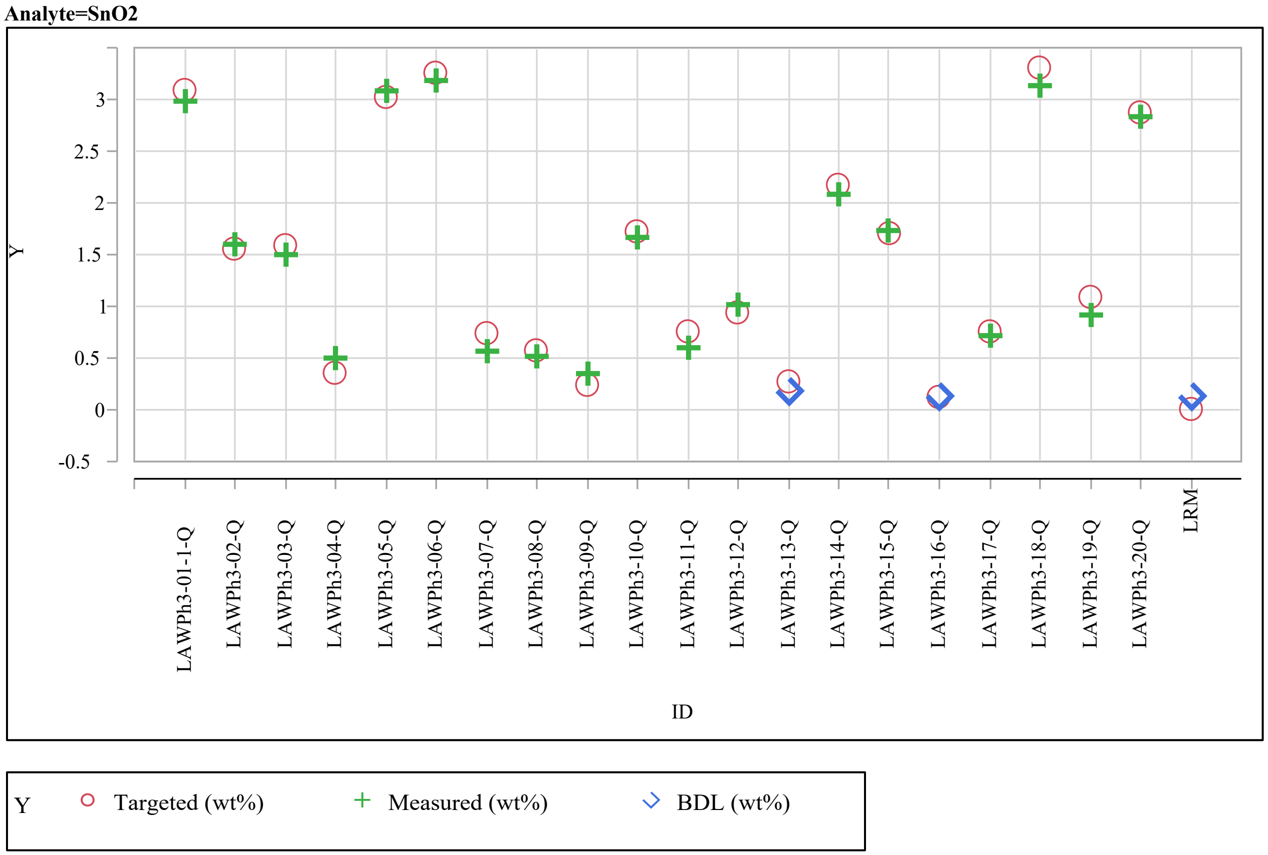


Exhibit A-4. Measured versus Targeted Concentrations by Glass ID by Oxide (continued)

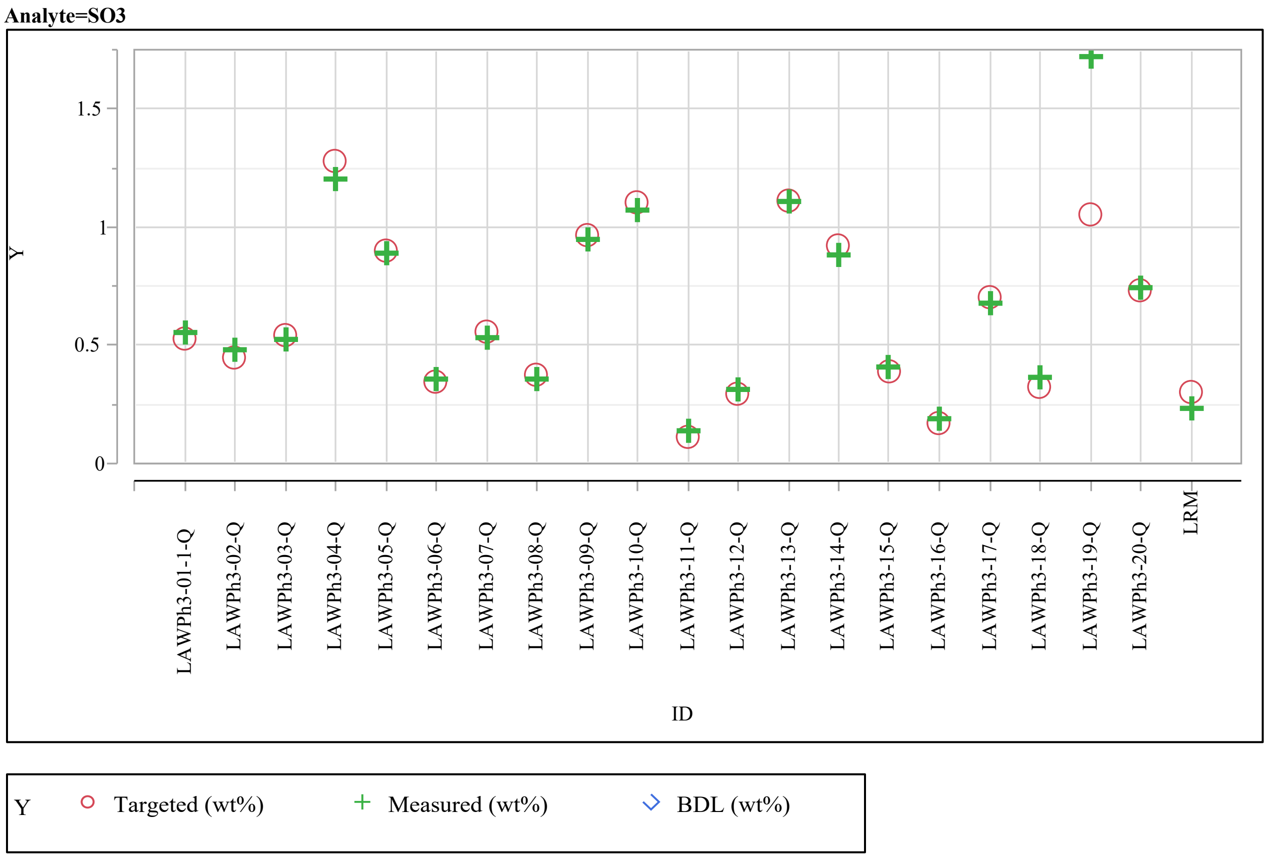


Exhibit A-4. Measured versus Targeted Concentrations by Glass ID by Oxide (continued)

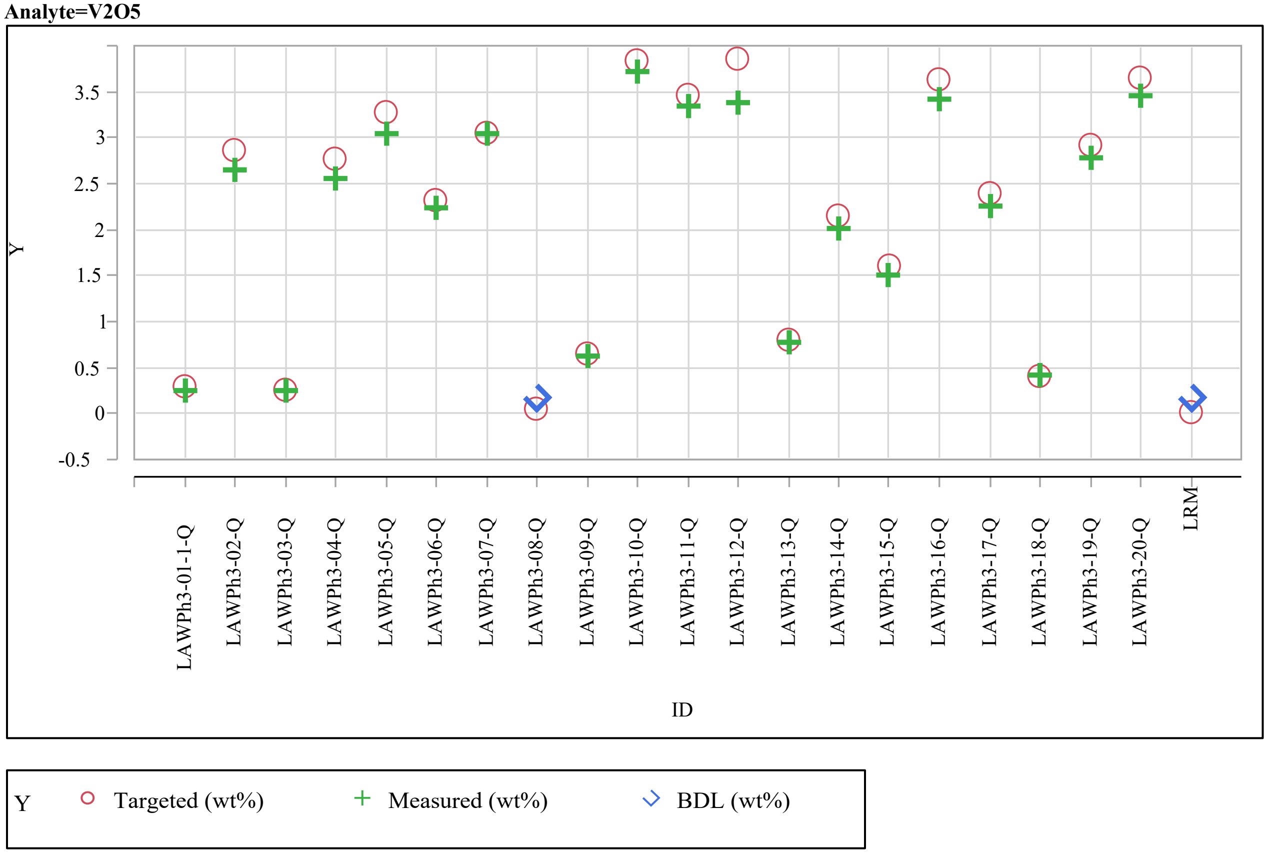


Exhibit A-4. Measured versus Targeted Concentrations by Glass ID by Oxide (continued)

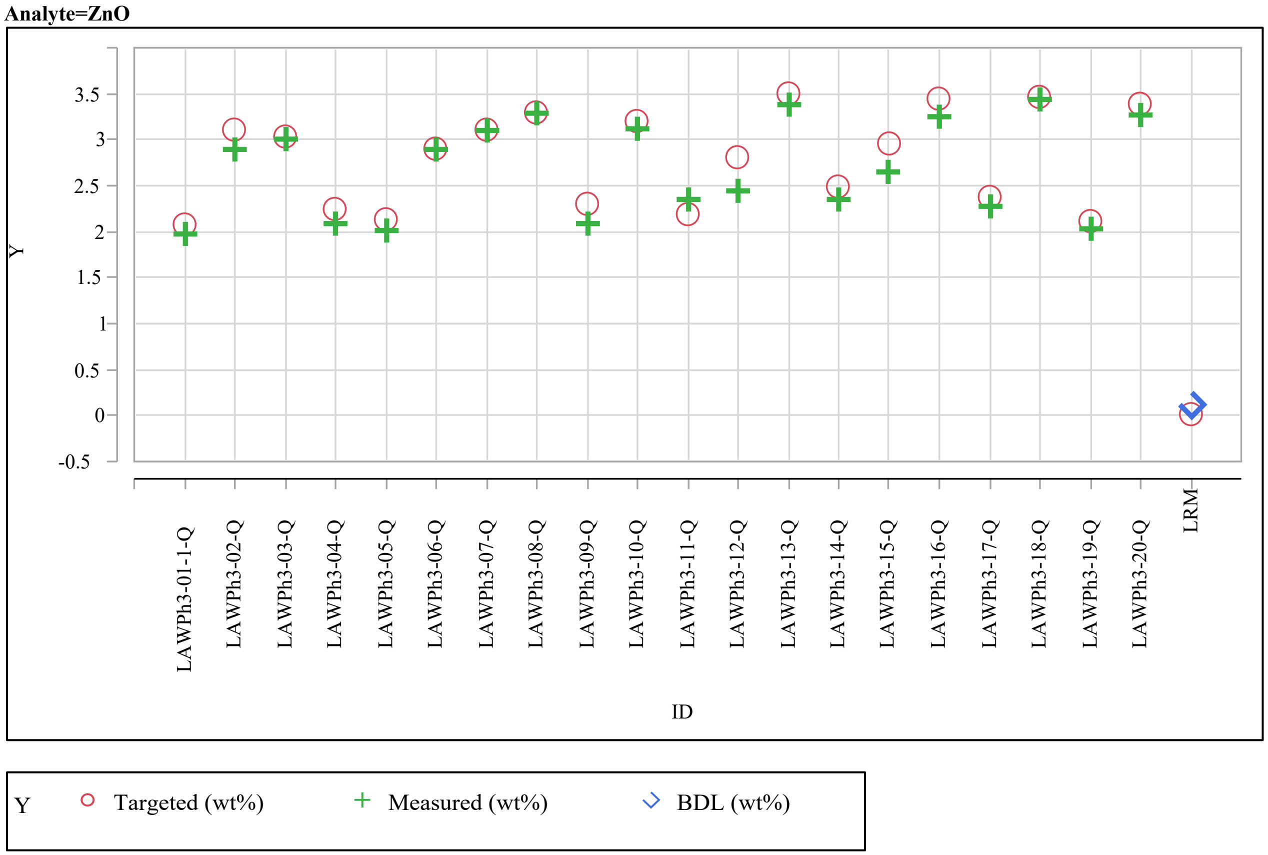


Exhibit A-4. Measured versus Targeted Concentrations by Glass ID by Oxide (continued)

Analyte=ZrO2

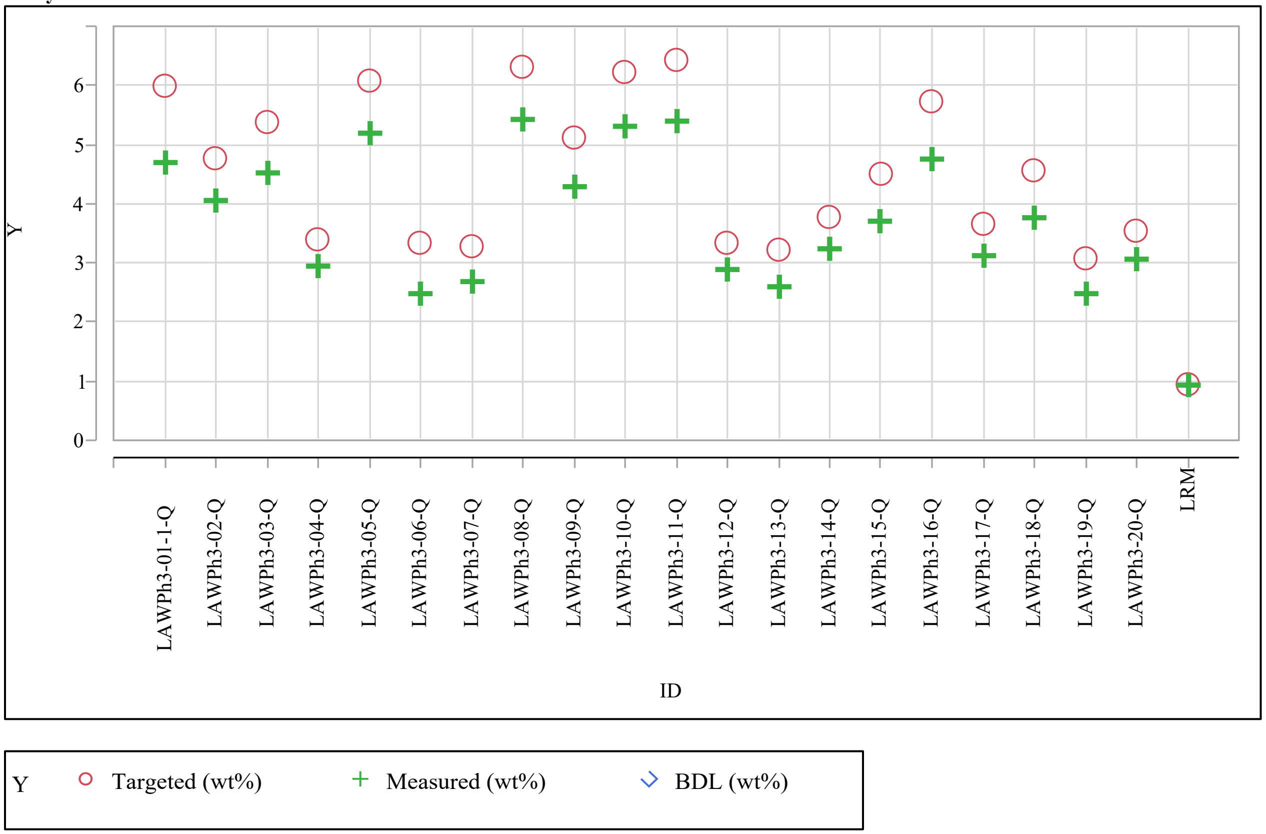
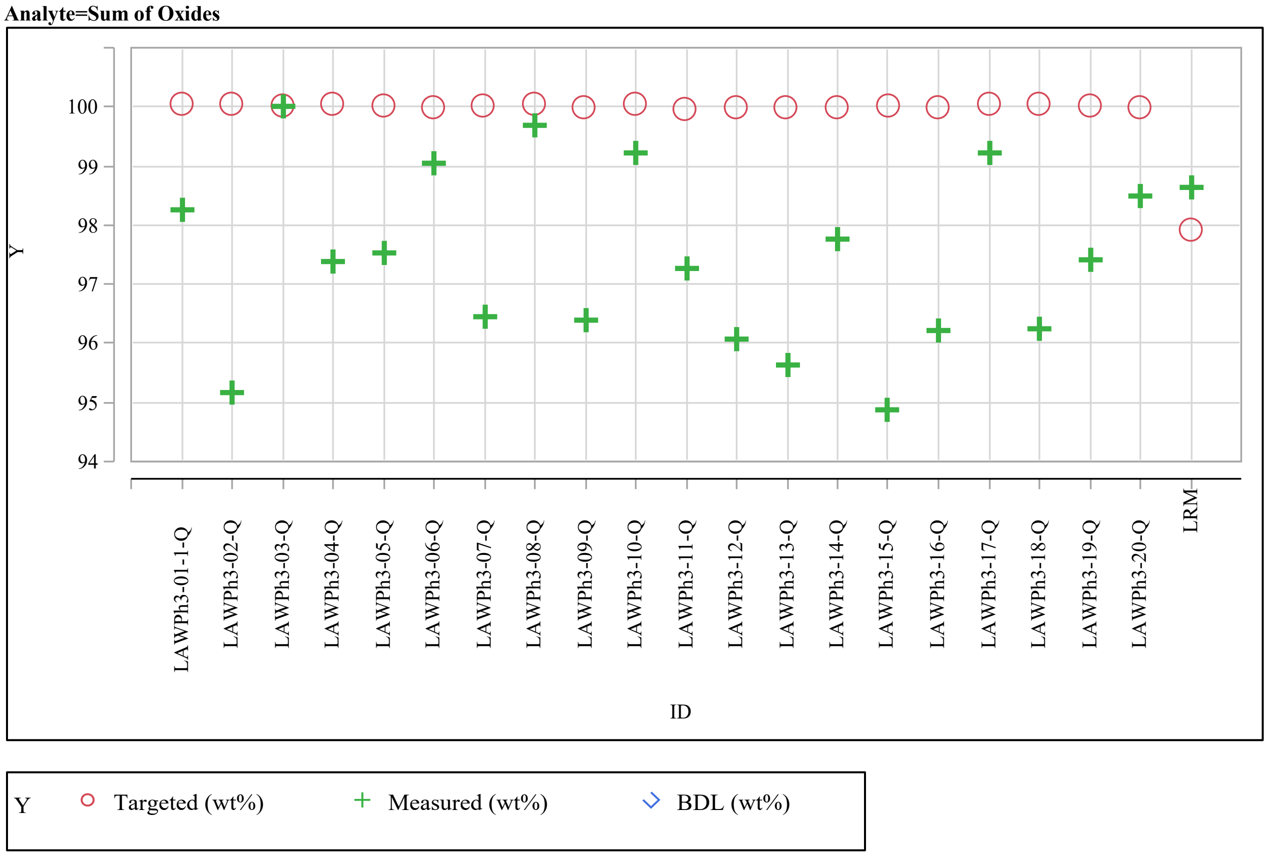


Exhibit A-4. Measured versus Targeted Concentrations by Glass ID by Oxide (continued)



Appendix B Tables and Exhibits Supporting the SSM Glass Composition Measurements

Table B-1. LM Measurements of the SSM Study Glasses – Part 1

ID	Block	Sub-Blk	Sequence	Lab ID	Cr (wt%)	Fe (wt%)	K (wt%)	Mg (wt%)	Na (wt%)	P (wt%)
LRM	1	1	1	LRMLM111	0.129	0.982	1.22	<0.100	15.8	0.210
LAWPh3-16-SSM-S	1	1	2	C13LM11	0.137	0.240	2.61	0.487	16.9	0.245
LAWPh3-12-SSM-S	1	1	3	C16LM11	0.176	0.731	0.179	0.717	15.3	0.349
LAWPh3-16-SSM-S	1	1	4	C13LM21	0.130	0.239	2.65	0.472	17.6	0.238
LAWPh3-07-SSM-S	1	1	5	C07LM11	0.104	0.376	0.524	<0.100	17.3	0.125
LAWPh3-01-SSM-S	1	1	6	C10LM11	0.192	0.386	0.462	0.722	18.1	0.174
LAWPh3-08-SSM-S	1	1	7	C04LM11	0.145	<0.100	0.997	0.133	15.6	0.557
LAWPh3-12-SSM-S	1	1	8	C16LM21	0.172	0.736	0.183	0.726	15.5	0.294
LRM	1	1	9	LRMLM112	0.129	0.981	1.21	<0.100	15.6	0.204
LAWPh3-18-SSM-S	1	1	10	C19LM11	0.124	0.290	1.87	0.756	16.4	0.356
LAWPh3-07-SSM-S	1	1	11	C07LM21	0.104	0.374	0.532	<0.100	17.5	0.118
LAWPh3-09-SSM-S	1	1	12	C01LM11	<0.100	0.592	3.41	0.158	16.0	0.308
LAWPh3-18-SSM-S	1	1	13	C19LM21	0.121	0.285	1.86	0.759	16.3	0.363
LAWPh3-01-SSM-S	1	1	14	C10LM21	0.190	0.377	0.471	0.725	17.5	0.176
LAWPh3-08-SSM-S	1	1	15	C04LM21	0.149	<0.100	1.01	0.133	15.2	0.557
LAWPh3-09-SSM-S	1	1	16	C01LM21	<0.100	0.599	3.38	0.171	15.5	0.299
LRM	1	1	17	LRMLM113	0.132	0.992	1.24	<0.100	15.7	0.214
LRM	1	2	1	LRMLM121	0.130	0.975	1.22	<0.100	15.5	0.206
LAWPh3-12-SSM-S	1	2	2	C16LM22	0.169	0.718	0.178	0.702	15.6	0.283
LAWPh3-08-SSM-S	1	2	3	C04LM12	0.145	<0.100	0.972	0.131	15.5	0.545
LAWPh3-01-SSM-S	1	2	4	C10LM22	0.187	0.369	0.457	0.694	17.7	0.167
LAWPh3-07-SSM-S	1	2	5	C07LM22	0.103	0.367	0.516	<0.100	17.4	0.117
LAWPh3-01-SSM-S	1	2	6	C10LM12	0.189	0.377	0.448	0.702	17.8	0.169
LAWPh3-18-SSM-S	1	2	7	C19LM22	0.121	0.283	1.87	0.742	16.6	0.353
LAWPh3-08-SSM-S	1	2	8	C04LM22	0.148	<0.100	0.961	0.129	15.5	0.542
LRM	1	2	9	LRMLM122	0.132	0.977	1.23	<0.100	15.5	0.209
LAWPh3-07-SSM-S	1	2	10	C07LM12	0.104	0.368	0.515	<0.100	17.3	0.118
LAWPh3-09-SSM-S	1	2	11	C01LM12	<0.100	0.585	3.31	0.154	15.6	0.309
LAWPh3-09-SSM-S	1	2	12	C01LM22	<0.100	0.589	3.32	0.167	15.4	0.290
LAWPh3-16-SSM-S	1	2	13	C13LM12	0.136	0.236	2.64	0.476	16.8	0.231
LAWPh3-12-SSM-S	1	2	14	C16LM12	0.175	0.724	0.175	0.711	15.1	0.350
LAWPh3-16-SSM-S	1	2	15	C13LM22	0.130	0.236	2.68	0.472	17.2	0.233
LAWPh3-18-SSM-S	1	2	16	C19LM12	0.123	0.287	1.90	0.741	16.3	0.352
LRM	1	2	17	LRMLM123	0.131	0.974	1.22	<0.100	15.4	0.210
LRM	2	1	1	LRMLM211	0.125	0.952	1.18	<0.100	15.1	0.195
LAWPh3-13-SSM-S	2	1	2	C05LM11	0.136	<0.100	1.97	0.707	16.4	0.194
LAWPh3-15-SSM-S	2	1	3	C17LM11	0.119	0.848	2.57	<0.100	15.7	0.131
LAWPh3-13-SSM-S	2	1	4	C05LM21	0.141	<0.100	1.95	0.731	16.5	0.208

Table B-1. LM Measurements of the SSM Study Glasses – Part 1 (continued)

ID	Block	Sub-Blk	Sequence	Lab ID	Cr (wt%)	Fe (wt%)	K (wt%)	Mg (wt%)	Na (wt%)	P (wt%)
LAWPh3-15-SSM-S	2	1	5	C17LM21	0.120	0.856	2.60	<0.100	15.5	0.134
LAWPh3-06-SSM-S	2	1	6	C02LM11	0.167	0.189	1.50	0.681	14.8	0.131
LAWPh3-03-SSM-S	2	1	7	C11LM11	<0.100	0.999	3.25	0.694	15.3	0.512
LAWPh3-06-SSM-S	2	1	8	C02LM21	0.165	0.184	1.52	0.676	14.8	0.130
LRM	2	1	9	LRMLM212	0.127	0.970	1.18	<0.100	15.3	0.197
LAWPh3-04-SSM-S	2	1	10	C20LM11	0.187	0.266	0.608	0.276	15.8	0.266
LAWPh3-02-SSM-S	2	1	11	C08LM11	0.179	<0.100	2.01	0.613	16.1	<0.100
LAWPh3-04-SSM-S	2	1	12	C20LM21	0.196	0.267	0.607	0.276	15.6	0.261
LAWPh3-03-SSM-S	2	1	13	C11LM21	0.120	0.976	3.35	0.683	15.8	0.498
LAWPh3-14-SSM-S	2	1	14	C14LM11	0.112	<0.100	0.155	<0.100	18.0	0.179
LAWPh3-02-SSM-S	2	1	15	C08LM21	0.173	<0.100	2.02	0.619	16.8	<0.100
LAWPh3-14-SSM-S	2	1	16	C14LM21	0.108	<0.100	0.150	<0.100	18.1	0.181
LRM	2	1	17	LRMLM213	0.127	0.968	1.18	<0.100	15.1	0.204
LRM	2	2	1	LRMLM221	0.124	0.954	1.22	<0.100	15.2	0.191
LAWPh3-04-SSM-S	2	2	2	C20LM22	0.191	0.261	0.622	0.270	15.4	0.246
LAWPh3-06-SSM-S	2	2	3	C02LM12	0.163	0.184	1.42	0.667	15.0	0.124
LAWPh3-03-SSM-S	2	2	4	C11LM12	<0.100	0.967	3.14	0.687	15.4	0.486
LAWPh3-15-SSM-S	2	2	5	C17LM12	0.114	0.823	2.58	<0.100	15.9	0.124
LAWPh3-14-SSM-S	2	2	6	C14LM12	0.108	<0.100	0.157	<0.100	17.9	0.160
LAWPh3-15-SSM-S	2	2	7	C17LM22	0.115	0.825	2.55	<0.100	15.8	0.125
LAWPh3-03-SSM-S	2	2	8	C11LM22	0.117	0.963	3.15	0.683	15.6	0.473
LRM	2	2	9	LRMLM222	0.128	0.988	1.27	<0.100	15.2	0.206
LAWPh3-02-SSM-S	2	2	10	C08LM12	0.180	<0.100	1.84	0.632	16.2	<0.100
LAWPh3-14-SSM-S	2	2	11	C14LM22	0.111	<0.100	0.164	<0.100	17.7	0.180
LAWPh3-13-SSM-S	2	2	12	C05LM22	0.140	<0.100	1.95	0.743	15.9	0.212
LAWPh3-02-SSM-S	2	2	13	C08LM22	0.183	<0.100	1.86	0.635	15.9	<0.100
LAWPh3-06-SSM-S	2	2	14	C02LM22	0.165	0.185	1.46	0.691	14.6	0.131
LAWPh3-04-SSM-S	2	2	15	C20LM12	0.194	0.276	0.651	0.285	14.8	0.271
LAWPh3-13-SSM-S	2	2	16	C05LM12	0.145	<0.100	1.94	0.761	16.3	0.207
LRM	2	2	17	LRMLM223	0.128	0.984	1.25	<0.100	15.5	0.203
LRM	3	1	1	LRMLM311	0.124	0.951	1.21	<0.100	15.0	0.214
LAWPh3-10-SSM-S	3	1	2	C09LM11	<0.100	0.538	1.51	0.221	17.1	0.112
LAWPh3-20-SSM-S	3	1	3	C12LM21	0.153	0.742	0.102	<0.100	16.1	0.156
LAWPh3-05-SSM-S	3	1	4	C03LM21	0.134	0.710	1.87	0.643	16.1	0.445
LAWPh3-10-SSM-S	3	1	5	C09LM21	<0.100	0.520	1.56	0.210	17.1	0.109
LAWPh3-11-SSM-S	3	1	6	C15LM21	0.169	<0.100	0.897	0.486	18.0	0.316
LAWPh3-19-SSM-S	3	1	7	C18LM11	0.100	0.933	1.85	0.156	15.4	<0.100
LAWPh3-05-SSM-S	3	1	8	C03LM11	0.139	0.738	1.81	0.676	15.8	0.490

Table B-1. LM Measurements of the SSM Study Glasses – Part 1 (continued)

ID	Block	Sub-Blk	Sequence	Lab ID	Cr (wt%)	Fe (wt%)	K (wt%)	Mg (wt%)	Na (wt%)	P (wt%)
LRM	3	1	9	LRMLM312	0.126	0.968	1.21	<0.100	15.7	0.223
LAWPh3-17-SSM-S	3	1	10	C06LM11	0.115	0.915	0.214	0.764	18.6	0.233
LAWPh3-20-SSM-S	3	1	11	C12LM11	0.154	0.735	<0.100	<0.100	16.1	0.151
LAWPh3-19-SSM-S	3	1	12	C18LM21	<0.100	0.923	1.88	0.155	15.4	<0.100
LAWPh3-11-SSM-S	3	1	13	C15LM11	0.168	<0.100	0.886	0.487	17.9	0.304
LAWPh3-17-SSM-S	3	1	14	C06LM21	0.117	0.913	0.219	0.760	18.2	0.224
LRM	3	1	15	LRMLM313	0.122	0.947	1.18	<0.100	15.8	0.224
LRM	3	2	1	LRMLM321	0.129	0.952	1.16	<0.100	15.6	0.217
LAWPh3-20-SSM-S	3	2	2	C12LM22	0.160	0.756	0.112	<0.100	16.2	0.163
LAWPh3-05-SSM-S	3	2	3	C03LM12	0.143	0.732	1.80	0.661	16.3	0.484
LAWPh3-10-SSM-S	3	2	4	C09LM22	<0.100	0.545	1.56	0.224	16.9	0.117
LAWPh3-10-SSM-S	3	2	5	C09LM12	<0.100	0.544	1.57	0.225	17.4	0.114
LAWPh3-19-SSM-S	3	2	6	C18LM22	0.103	0.921	1.83	0.160	16.1	<0.100
LAWPh3-19-SSM-S	3	2	7	C18LM12	0.102	0.903	1.84	0.161	16.1	<0.100
LAWPh3-11-SSM-S	3	2	8	C15LM22	0.172	<0.100	0.898	0.481	18.7	0.314
LRM	3	2	9	LRMLM322	0.125	0.928	1.12	<0.100	16.1	0.205
LAWPh3-11-SSM-S	3	2	10	C15LM12	0.167	<0.100	0.876	0.471	18.0	0.297
LAWPh3-05-SSM-S	3	2	11	C03LM22	0.140	0.710	1.75	0.645	16.0	0.445
LAWPh3-17-SSM-S	3	2	12	C06LM22	0.125	0.931	0.234	0.769	18.4	0.231
LAWPh3-20-SSM-S	3	2	13	C12LM12	0.165	0.768	0.113	<0.100	16.2	0.167
LAWPh3-17-SSM-S	3	2	14	C06LM12	0.124	0.941	0.234	0.772	18.3	0.243
LRM	3	2	15	LRMLM323	0.129	0.958	1.18	<0.100	15.5	0.216

Table B-2. LM Measurements of the SSM Study Glasses – Part 2

ID	Block	Sub-Blk	Sequence	Lab ID	S (wt%)	Sn (wt%)	V (wt%)	Zn (wt%)	Zr (wt%)
LRM	1	1	1	LRMLM111	0.0811	<0.100	<0.100	<0.100	0.698
LAWPh3-16-SSM-S	1	1	2	C13LM11	0.786	<0.100	1.91	2.82	3.64
LAWPh3-12-SSM-S	1	1	3	C16LM11	0.536	0.722	2.07	2.29	2.07
LAWPh3-16-SSM-S	1	1	4	C13LM21	0.798	<0.100	1.93	2.86	3.67
LAWPh3-07-SSM-S	1	1	5	C07LM11	0.765	0.550	1.61	2.58	1.94
LAWPh3-01-SSM-S	1	1	6	C10LM11	0.690	2.48	0.152	1.71	3.67
LAWPh3-08-SSM-S	1	1	7	C04LM11	0.520	0.440	<0.100	2.81	4.21
LAWPh3-12-SSM-S	1	1	8	C16LM21	0.570	0.718	2.12	2.37	2.20
LRM	1	1	9	LRMLM112	0.0980	<0.100	<0.100	<0.100	0.716
LAWPh3-18-SSM-S	1	1	10	C19LM11	0.469	2.68	0.225	2.94	2.99
LAWPh3-07-SSM-S	1	1	11	C07LM21	0.768	0.561	1.61	2.59	1.39
LAWPh3-09-SSM-S	1	1	12	C01LM11	0.645	0.182	0.332	1.95	3.37
LAWPh3-18-SSM-S	1	1	13	C19LM21	0.463	2.66	0.213	2.90	2.95
LAWPh3-01-SSM-S	1	1	14	C10LM21	0.714	2.46	0.151	1.72	3.70
LAWPh3-08-SSM-S	1	1	15	C04LM21	0.558	0.447	<0.100	2.70	4.04
LAWPh3-09-SSM-S	1	1	16	C01LM21	0.681	0.178	0.334	1.94	3.25
LRM	1	1	17	LRMLM113	0.0851	<0.100	<0.100	<0.100	0.727
LRM	1	2	1	LRMLM121	0.0987	<0.100	<0.100	<0.100	0.723
LAWPh3-12-SSM-S	1	2	2	C16LM22	0.528	0.697	2.058	2.25	2.15
LAWPh3-08-SSM-S	1	2	3	C04LM12	0.516	0.437	<0.100	2.73	4.14
LAWPh3-01-SSM-S	1	2	4	C10LM22	0.677	2.47	0.149	1.67	3.66
LAWPh3-07-SSM-S	1	2	5	C07LM22	0.781	0.553	1.60	2.52	1.36
LAWPh3-01-SSM-S	1	2	6	C10LM12	0.665	2.49	0.151	1.68	3.66
LAWPh3-18-SSM-S	1	2	7	C19LM22	0.458	2.64	0.211	2.81	2.96
LAWPh3-08-SSM-S	1	2	8	C04LM22	0.515	0.433	<0.100	2.62	4.00
LRM	1	2	9	LRMLM122	0.0906	<0.100	<0.100	<0.100	0.726
LAWPh3-07-SSM-S	1	2	10	C07LM12	0.737	0.530	1.61	2.55	1.79
LAWPh3-09-SSM-S	1	2	11	C01LM12	0.657	0.187	0.328	1.90	3.37
LAWPh3-09-SSM-S	1	2	12	C01LM22	0.645	0.182	0.330	1.88	3.18
LAWPh3-16-SSM-S	1	2	13	C13LM12	0.749	<0.100	1.88	2.77	3.64
LAWPh3-12-SSM-S	1	2	14	C16LM12	0.533	0.709	2.07	2.26	2.08
LAWPh3-16-SSM-S	1	2	15	C13LM22	0.790	<0.100	1.89	2.78	3.66
LAWPh3-18-SSM-S	1	2	16	C19LM12	0.441	2.70	0.212	2.85	2.99
LRM	1	2	17	LRMLM123	0.0964	<0.100	<0.100	<0.100	0.711
LRM	2	1	1	LRMLM211	0.101	<0.100	<0.100	<0.100	0.680
LAWPh3-13-SSM-S	2	1	2	C05LM11	0.624	0.212	0.387	2.73	2.05
LAWPh3-15-SSM-S	2	1	3	C17LM11	0.722	1.26	0.818	2.25	2.87

Table B-2. LM Measurements of the SSM Study Glasses – Part 2 (continued)

ID	Block	Sub-Blk	Sequence	Lab ID	S (wt%)	Sn (wt%)	V (wt%)	Zn (wt%)	Zr (wt%)
LAWPh3-13-SSM-S	2	1	4	C05LM21	0.651	0.219	0.401	2.74	2.05
LAWPh3-15-SSM-S	2	1	5	C17LM21	0.725	1.34	0.823	2.32	2.92
LAWPh3-06-SSM-S	2	1	6	C02LM11	0.636	2.70	1.20	2.34	1.92
LAWPh3-03-SSM-S	2	1	7	C11LM11	0.547	1.29	0.136	2.47	3.49
LAWPh3-06-SSM-S	2	1	8	C02LM21	0.651	2.75	1.22	2.37	1.95
LRM	2	1	9	LRMLM212	0.0959	<0.100	<0.100	<0.100	0.719
LAWPh3-04-SSM-S	2	1	10	C20LM11	0.945	0.286	1.51	1.85	2.24
LAWPh3-02-SSM-S	2	1	11	C08LM11	0.780	1.26	1.52	2.51	3.17
LAWPh3-04-SSM-S	2	1	12	C20LM21	0.988	0.292	1.49	1.85	2.24
LAWPh3-03-SSM-S	2	1	13	C11LM21	0.526	1.32	0.134	2.54	3.54
LAWPh3-14-SSM-S	2	1	14	C14LM11	0.841	1.77	1.15	2.07	1.88
LAWPh3-02-SSM-S	2	1	15	C08LM21	0.769	1.30	1.53	2.53	3.22
LAWPh3-14-SSM-S	2	1	16	C14LM21	0.790	1.81	1.15	2.06	2.25
LRM	2	1	17	LRMLM213	0.104	<0.100	<0.100	<0.100	0.742
LRM	2	2	1	LRMLM221	0.0933	<0.100	<0.100	<0.100	0.693
LAWPh3-04-SSM-S	2	2	2	C20LM22	0.927	0.269	1.45	1.79	2.14
LAWPh3-06-SSM-S	2	2	3	C02LM12	0.618	2.66	1.17	2.29	1.87
LAWPh3-03-SSM-S	2	2	4	C11LM12	0.499	1.28	0.131	2.38	3.37
LAWPh3-15-SSM-S	2	2	5	C17LM12	0.675	1.30	0.796	2.27	2.85
LAWPh3-14-SSM-S	2	2	6	C14LM12	0.760	1.66	1.08	1.94	1.73
LAWPh3-15-SSM-S	2	2	7	C17LM22	0.680	1.34	0.802	2.31	2.89
LAWPh3-03-SSM-S	2	2	8	C11LM22	0.495	1.29	0.129	2.44	3.37
LRM	2	2	9	LRMLM222	0.0843	<0.100	<0.100	<0.100	0.693
LAWPh3-02-SSM-S	2	2	10	C08LM12	0.764	1.17	1.43	2.36	2.99
LAWPh3-14-SSM-S	2	2	11	C14LM22	0.829	1.68	1.08	1.95	1.97
LAWPh3-13-SSM-S	2	2	12	C05LM22	0.634	0.217	0.404	2.75	2.04
LAWPh3-02-SSM-S	2	2	13	C08LM22	0.811	1.19	1.44	2.38	3.03
LAWPh3-06-SSM-S	2	2	14	C02LM22	0.646	2.65	1.16	2.29	1.87
LAWPh3-04-SSM-S	2	2	15	C20LM12	1.01	0.295	1.44	1.78	2.16
LAWPh3-13-SSM-S	2	2	16	C05LM12	0.699	0.225	0.417	2.77	2.05
LRM	2	2	17	LRMLM223	0.0987	<0.100	<0.100	<0.100	0.674
LRM	3	1	1	LRMLM311	0.0872	<0.100	<0.100	<0.100	0.691
LAWPh3-10-SSM-S	3	1	2	C09LM11	0.635	1.28	1.80	2.46	3.96
LAWPh3-20-SSM-S	3	1	3	C12LM21	0.681	2.22	1.84	2.62	2.22
LAWPh3-05-SSM-S	3	1	4	C03LM21	0.497	2.44	1.57	1.72	3.96
LAWPh3-10-SSM-S	3	1	5	C09LM21	0.597	1.30	1.84	2.52	4.05
LAWPh3-11-SSM-S	3	1	6	C15LM21	0.629	0.597	1.65	1.83	4.04
LAWPh3-19-SSM-S	3	1	7	C18LM11	0.749	0.884	1.46	1.65	1.92
LAWPh3-05-SSM-S	3	1	8	C03LM11	0.516	2.46	1.58	1.72	4.02

Table B-2. LM Measurements of the SSM Study Glasses – Part 2 (continued)

ID	Block	Sub-Blk	Sequence	Lab ID	S (wt%)	Sn (wt%)	V (wt%)	Zn (wt%)	Zr (wt%)
LRM	3	1	9	LRMLM312	0.0994	<0.100	<0.100	<0.100	0.712
LAWPh3-17-SSM-S	3	1	10	C06LM11	0.836	0.592	1.19	1.81	2.24
LAWPh3-20-SSM-S	3	1	11	C12LM11	0.681	2.23	1.86	2.64	2.22
LAWPh3-19-SSM-S	3	1	12	C18LM21	0.755	0.874	1.45	1.63	1.91
LAWPh3-11-SSM-S	3	1	13	C15LM11	0.630	0.593	1.67	1.86	4.08
LAWPh3-17-SSM-S	3	1	14	C06LM21	0.818	0.589	1.20	1.85	2.28
LRM	3	1	15	LRMLM313	0.0871	<0.100	<0.100	<0.100	0.726
LRM	3	2	1	LRMLM321	0.0943	<0.100	<0.100	<0.100	0.681
LAWPh3-20-SSM-S	3	2	2	C12LM22	0.693	2.12	1.84	2.59	2.17
LAWPh3-05-SSM-S	3	2	3	C03LM12	0.495	2.35	1.55	1.69	3.87
LAWPh3-10-SSM-S	3	2	4	C09LM22	0.635	1.33	1.86	2.53	4.01
LAWPh3-10-SSM-S	3	2	5	C09LM12	0.627	1.33	1.84	2.50	3.97
LAWPh3-19-SSM-S	3	2	6	C18LM22	0.762	0.901	1.48	1.67	1.93
LAWPh3-19-SSM-S	3	2	7	C18LM12	0.734	0.883	1.46	1.65	1.90
LAWPh3-11-SSM-S	3	2	8	C15LM22	0.626	0.606	1.68	1.86	4.00
LRM	3	2	9	LRMLM322	0.0844	<0.100	<0.100	<0.100	0.701
LAWPh3-11-SSM-S	3	2	10	C15LM12	0.612	0.584	1.67	1.84	3.97
LAWPh3-05-SSM-S	3	2	11	C03LM22	0.492	2.35	1.56	1.68	3.83
LAWPh3-17-SSM-S	3	2	12	C06LM22	0.841	0.623	1.20	1.80	2.21
LAWPh3-20-SSM-S	3	2	13	C12LM12	0.712	2.13	1.85	2.58	2.18
LAWPh3-17-SSM-S	3	2	14	C06LM12	0.830	0.632	1.19	1.79	2.22
LRM	3	2	15	LRMLM323	0.0894	<0.100	<0.100	<0.100	0.697

Table B-3. PSH Measurements of the SSM Study Glasses

ID	Block	Sub-Blk	Sequence	Lab ID	Al (wt%)	B (wt%)	Ca (wt%)	Si (wt%)
LRM	1	1	1	LRMPSH111	4.74	2.45	0.395	26.4
LAWPh3-09-SSM-S	1	1	2	C01PSH11	4.10	2.79	7.19	18.1
LAWPh3-08-SSM-S	1	1	3	C04PSH11	3.47	2.10	4.83	22.4
LAWPh3-16-SSM-S	1	1	4	C13PSH11	3.05	2.15	5.71	17.6
LAWPh3-07-SSM-S	1	1	5	C07PSH11	4.98	2.42	6.74	16.9
LAWPh3-09-SSM-S	1	1	6	C01PSH21	4.04	2.72	7.03	17.8
LAWPh3-08-SSM-S	1	1	7	C04PSH21	3.44	2.03	4.73	21.6
LAWPh3-07-SSM-S	1	1	8	C07PSH21	4.93	2.38	6.74	16.7
LRM	1	1	9	LRMPSH112	5.04	2.34	0.402	26.3
LAWPh3-16-SSM-S	1	1	10	C13PSH21	3.04	2.19	5.70	17.7
LAWPh3-18-SSM-S	1	1	11	C19PSH11	4.23	1.89	2.82	19.3
LAWPh3-01-SSM-S	1	1	12	C10PSH11	3.36	4.23	3.49	17.9
LAWPh3-12-SSM-S	1	1	13	C16PSH11	5.64	4.14	2.17	17.0
LAWPh3-01-SSM-S	1	1	14	C10PSH21	3.40	4.23	3.57	17.5
LAWPh3-12-SSM-S	1	1	15	C16PSH21	5.70	4.19	2.23	16.6
LAWPh3-18-SSM-S	1	1	16	C19PSH21	4.35	1.93	2.87	19.5
LRM	1	1	17	LRMPSH113	5.05	2.33	0.407	27.3
LRM	1	2	1	LRMPSH121	4.74	2.41	0.279	26.7
LAWPh3-18-SSM-S	1	2	2	C19PSH12	4.11	1.91	2.68	18.8
LAWPh3-09-SSM-S	1	2	3	C01PSH22	3.88	2.69	6.92	15.8
LAWPh3-01-SSM-S	1	2	4	C10PSH22	3.27	4.19	3.38	16.3
LAWPh3-18-SSM-S	1	2	5	C19PSH22	4.24	1.92	2.76	19.1
LAWPh3-01-SSM-S	1	2	6	C10PSH12	3.23	4.15	3.33	16.3
LAWPh3-07-SSM-S	1	2	7	C07PSH12	4.81	2.35	6.70	15.9
LAWPh3-08-SSM-S	1	2	8	C04PSH12	3.32	2.01	4.65	20.2
LRM	1	2	9	LRMPSH122	4.83	2.24	0.271	26.1
LAWPh3-08-SSM-S	1	2	10	C04PSH22	3.30	2.04	4.58	19.4
LAWPh3-12-SSM-S	1	2	11	C16PSH12	5.52	4.14	2.05	16.2
LAWPh3-09-SSM-S	1	2	12	C01PSH12	3.97	2.68	6.98	16.6
LAWPh3-12-SSM-S	1	2	13	C16PSH22	5.53	4.12	2.09	16.0
LAWPh3-07-SSM-S	1	2	14	C07PSH22	4.91	2.40	6.70	16.2
LAWPh3-16-SSM-S	1	2	15	C13PSH22	2.98	2.12	5.63	16.9
LAWPh3-16-SSM-S	1	2	16	C13PSH12	2.97	2.10	5.54	16.9
LRM	1	2	17	LRMPSH123	4.85	2.26	0.269	25.9
LRM	2	1	1	LRMPSH211	4.95	2.40	0.322	25.1
LAWPh3-03-SSM-S	2	1	2	C11PSH11	3.32	2.16	3.21	18.6
LAWPh3-14-SSM-S	2	1	3	C14PSH11	3.32	2.62	4.06	18.2
LAWPh3-13-SSM-S	2	1	4	C05PSH11	3.58	1.95	6.58	18.2
LAWPh3-03-SSM-S	2	1	5	C11PSH21	3.38	2.15	3.25	18.4
LAWPh3-15-SSM-S	2	1	6	C17PSH11	3.56	2.87	6.48	16.5
LAWPh3-14-SSM-S	2	1	7	C14PSH21	3.28	2.53	4.01	17.4
LAWPh3-04-SSM-S	2	1	8	C20PSH11	3.08	3.86	6.98	16.5
LRM	2	1	9	LRMPSH212	4.94	2.31	0.253	26.3
LAWPh3-02-SSM-S	2	1	10	C08PSH11	3.34	4.10	3.54	16.2
LAWPh3-06-SSM-S	2	1	11	C02PSH11	4.62	2.19	7.74	17.3
LAWPh3-04-SSM-S	2	1	12	C20PSH21	3.15	3.97	7.20	17.1
LAWPh3-02-SSM-S	2	1	13	C08PSH21	3.33	4.03	3.46	16.5
LAWPh3-06-SSM-S	2	1	14	C02PSH21	4.49	2.09	7.64	16.8
LAWPh3-13-SSM-S	2	1	15	C05PSH21	3.56	1.92	6.71	18.0
LAWPh3-15-SSM-S	2	1	16	C17PSH21	3.66	2.92	6.69	16.8
LRM	2	1	17	LRMPSH213	5.07	2.38	0.269	27.5
LRM	2	2	1	LRMPSH221	4.64	2.25	0.311	22.9
LAWPh3-04-SSM-S	2	2	2	C20PSH22	3.01	3.82	6.69	16.1
LAWPh3-03-SSM-S	2	2	3	C11PSH12	3.20	2.04	3.03	20.0
LAWPh3-13-SSM-S	2	2	4	C05PSH22	3.45	1.84	6.26	19.2
LAWPh3-06-SSM-S	2	2	5	C02PSH22	4.37	2.02	7.21	16.0
LAWPh3-13-SSM-S	2	2	6	C05PSH12	3.52	1.87	6.42	19.2
LAWPh3-02-SSM-S	2	2	7	C08PSH22	3.31	3.91	3.35	15.5
LAWPh3-14-SSM-S	2	2	8	C14PSH22	3.21	2.46	3.90	18.8

Table B-3. PSH Measurements of the SSM Study Glasses (continued)

ID	Block	Sub-Blk	Sequence	Lab ID	Al (wt%)	B (wt%)	Ca (wt%)	Si (wt%)
LRM	2	2	9	LRMPSH222	4.74	2.19	0.291	24.7
LAWPh3-15-SSM-S	2	2	10	C17PSH22	3.55	2.86	6.40	16.0
LAWPh3-02-SSM-S	2	2	11	C08PSH12	3.29	3.94	3.47	15.5
LAWPh3-15-SSM-S	2	2	12	C17PSH12	3.54	2.84	6.42	16.4
LAWPh3-06-SSM-S	2	2	13	C02PSH12	4.40	2.01	7.30	16.3
LAWPh3-14-SSM-S	2	2	14	C14PSH12	3.25	2.47	3.92	19.1
LAWPh3-04-SSM-S	2	2	15	C20PSH12	3.08	3.84	7.02	16.5
LAWPh3-03-SSM-S	2	2	16	C11PSH22	3.21	1.97	3.04	19.4
LRM	2	2	17	LRMPSH223	4.87	2.24	0.313	24.7
LRM	3	1	1	LRMPSH311	5.06	2.47	0.367	27.1
LAWPh3-20-SSM-S	3	1	2	C12PSH11	3.01	2.84	3.60	18.0
LAWPh3-10-SSM-S	3	1	3	C09PSH21	4.11	1.98	4.25	16.6
LAWPh3-17-SSM-S	3	1	4	C06PSH11	2.96	1.91	7.15	17.3
LAWPh3-17-SSM-S	3	1	5	C06PSH21	3.01	1.93	7.20	17.7
LAWPh3-05-SSM-S	3	1	6	C03PSH21	3.23	2.00	1.95	17.7
LAWPh3-11-SSM-S	3	1	7	C15PSH11	4.68	2.94	2.93	16.8
LAWPh3-05-SSM-S	3	1	8	C03PSH11	3.22	1.98	1.95	18.0
LRM	3	1	9	LRMPSH312	4.99	2.37	0.373	27.6
LAWPh3-11-SSM-S	3	1	10	C15PSH21	4.60	2.94	2.87	17.1
LAWPh3-19-SSM-S	3	1	11	C18PSH11	3.38	2.18	6.55	18.1
LAWPh3-10-SSM-S	3	1	12	C09PSH11	4.15	1.98	4.35	16.6
LAWPh3-19-SSM-S	3	1	13	C18PSH21	3.38	2.16	6.84	17.6
LAWPh3-20-SSM-S	3	1	14	C12PSH21	3.08	2.87	3.72	17.2
LRM	3	1	15	LRMPSH313	5.12	2.44	0.391	27.5
LRM	3	2	1	LRMPSH321	4.79	2.34	0.265	25.3
LAWPh3-11-SSM-S	3	2	2	C15PSH12	4.55	2.93	2.78	16.6
LAWPh3-10-SSM-S	3	2	3	C09PSH12	4.11	1.99	4.20	16.6
LAWPh3-05-SSM-S	3	2	4	C03PSH22	3.18	2.00	1.87	18.6
LAWPh3-20-SSM-S	3	2	5	C12PSH22	2.97	2.78	3.48	18.2
LAWPh3-11-SSM-S	3	2	6	C15PSH22	4.58	2.89	2.79	16.7
LAWPh3-20-SSM-S	3	2	7	C12PSH12	3.04	2.84	3.60	18.8
LAWPh3-17-SSM-S	3	2	8	C06PSH22	3.02	1.92	7.08	17.7
LRM	3	2	9	LRMPSH322	4.99	2.38	0.299	26.5
LAWPh3-10-SSM-S	3	2	10	C09PSH22	4.21	2.08	4.33	17.2
LAWPh3-19-SSM-S	3	2	11	C18PSH12	3.32	2.15	6.35	18.6
LAWPh3-19-SSM-S	3	2	12	C18PSH22	3.29	2.12	6.53	18.5
LAWPh3-17-SSM-S	3	2	13	C06PSH12	2.93	1.87	7.08	17.2
LAWPh3-05-SSM-S	3	2	14	C03PSH12	3.15	1.95	1.84	17.7
LRM	3	2	15	LRMPSH323	5.01	2.40	0.299	26.4

Table B-4. KH Measurements of the SSM Study Glasses

ID	Block	Sub-Blk	Sequence	Lab ID	Cl (wt%) ar	F (wt%) ar
LRM	1	1	1	LRMKH111	<0.0500	0.897
LAWPh3-18-SSM-S	1	1	2	C19KH11	0.0558	0.288
LAWPh3-01-SSM-S	1	1	3	C10KH11	<0.0500	0.122
LAWPh3-07-SSM-S	1	1	4	C07KH11	0.145	0.424
LAWPh3-12-SSM-S	1	1	5	C16KH11	0.0769	0.269
LAWPh3-16-SSM-S	1	1	6	C13KH11	<0.0500	0.158
LAWPh3-07-SSM-S	1	1	7	C07KH21	0.118	0.424
LAWPh3-18-SSM-S	1	1	8	C19KH21	0.0556	0.31
LRM	1	1	9	LRMKH112	<0.0500	0.875
LAWPh3-08-SSM-S	1	1	10	C04KH11	0.129	0.436
LAWPh3-16-SSM-S	1	1	11	C13KH21	0.0569	0.202
LAWPh3-09-SSM-S	1	1	12	C01KH11	0.0539	0.268
LAWPh3-01-SSM-S	1	1	13	C10KH21	0.059	0.181
LAWPh3-08-SSM-S	1	1	14	C04KH21	0.106	0.448
LAWPh3-09-SSM-S	1	1	15	C01KH21	0.0599	0.279
LAWPh3-12-SSM-S	1	1	16	C16KH21	0.0732	0.296
LRM	1	1	17	LRMKH113	<0.0500	0.846
LRM	1	2	1	LRMKH121	<0.0500	0.891
LAWPh3-01-SSM-S	1	2	2	C10KH12	0.0566	0.154
LAWPh3-12-SSM-S	1	2	3	C16KH22	0.0730	0.286
LAWPh3-18-SSM-S	1	2	4	C19KH22	0.0578	0.312
LAWPh3-08-SSM-S	1	2	5	C04KH22	0.113	0.458
LAWPh3-16-SSM-S	1	2	6	C13KH12	0.0590	0.179
LAWPh3-09-SSM-S	1	2	7	C01KH12	0.0579	0.273
LAWPh3-12-SSM-S	1	2	8	C16KH12	0.087	0.286
LRM	1	2	9	LRMKH122	<0.0500	0.917
LAWPh3-18-SSM-S	1	2	10	C19KH12	0.067	0.317
LAWPh3-07-SSM-S	1	2	11	C07KH12	0.106	0.441
LAWPh3-09-SSM-S	1	2	12	C01KH22	0.0746	0.286
LAWPh3-01-SSM-S	1	2	13	C10KH22	<0.0500	0.148
LAWPh3-07-SSM-S	1	2	14	C07KH22	0.107	0.418
LAWPh3-16-SSM-S	1	2	15	C13KH22	0.0671	0.203
LAWPh3-08-SSM-S	1	2	16	C04KH12	0.114	0.442
LRM	1	2	17	LRMKH123	<0.0500	0.855
LRM	2	1	1	LRMKH211	<0.0500	0.976
LAWPh3-14-SSM-S	2	1	2	C14KH11	0.135	0.507
LAWPh3-13-SSM-S	2	1	3	C05KH11	<0.0500	0.245
LAWPh3-15-SSM-S	2	1	4	C17KH11	<0.0500	0.18
LAWPh3-02-SSM-S	2	1	5	C08KH11	<0.0500	0.137
LAWPh3-04-SSM-S	2	1	6	C20KH11	0.0675	0.254
LAWPh3-03-SSM-S	2	1	7	C11KH11	0.0990	0.521
LAWPh3-13-SSM-S	2	1	8	C05KH21	0.0510	0.285
LRM	2	1	9	LRMKH212	<0.0500	0.956
LAWPh3-15-SSM-S	2	1	10	C17KH21	0.0507	0.218
LAWPh3-06-SSM-S	2	1	11	C02KH11	<0.0500	0.166
LAWPh3-14-SSM-S	2	1	12	C14KH21	0.128	0.539
LAWPh3-02-SSM-S	2	1	13	C08KH21	<0.0500	0.147
LAWPh3-06-SSM-S	2	1	14	C02KH21	<0.0500	0.185
LAWPh3-04-SSM-S	2	1	15	C20KH21	0.0691	0.305
LAWPh3-03-SSM-S	2	1	16	C11KH21	0.0963	0.561
LRM	2	1	17	LRMKH213	<0.0500	0.993
LRM	2	2	1	LRMKH221	<0.0500	0.961
LAWPh3-04-SSM-S	2	2	2	C20KH12	0.0790	0.301
LAWPh3-04-SSM-S	2	2	3	C20KH22	0.0724	0.272
LAWPh3-13-SSM-S	2	2	4	C05KH22	<0.0500	0.246
LAWPh3-02-SSM-S	2	2	5	C08KH22	<0.0500	0.218
LAWPh3-15-SSM-S	2	2	6	C17KH22	<0.0500	0.186
LAWPh3-02-SSM-S	2	2	7	C08KH12	<0.0500	0.15
LAWPh3-14-SSM-S	2	2	8	C14KH12	0.122	0.486

Table B-4. KH Measurements of the SSM Study Glasses (continued)

ID	Block	Sub-Blk	Sequence	Lab ID	Cl (wt%) ar	F (wt%) ar
LRM	2	2	9	LRMKH222	<0.0500	0.943
LAWPh3-13-SSM-S	2	2	10	C05KH12	<0.0500	0.262
LAWPh3-06-SSM-S	2	2	11	C02KH12	<0.0500	0.136
LAWPh3-03-SSM-S	2	2	12	C11KH12	0.0922	0.553
LAWPh3-03-SSM-S	2	2	13	C11KH22	0.0938	0.586
LAWPh3-06-SSM-S	2	2	14	C02KH22	<0.0500	0.132
LAWPh3-15-SSM-S	2	2	15	C17KH12	<0.0500	0.183
LAWPh3-14-SSM-S	2	2	16	C14KH22	0.134	0.467
LRM	2	2	17	LRMKH223	<0.0500	0.988
LRM	3	1	1	LRMKH311	<0.0500	0.983
LAWPh3-10-SSM-S	3	1	2	C09KH11	<0.0500	0.166
LAWPh3-20-SSM-S	3	1	3	C12KH11	<0.0500	0.135
LAWPh3-11-SSM-S	3	1	4	C15KH11	0.0777	0.354
LAWPh3-05-SSM-S	3	1	5	C03KH11	0.0898	0.423
LAWPh3-11-SSM-S	3	1	6	C15KH21	0.0807	0.323
LAWPh3-10-SSM-S	3	1	7	C09KH21	<0.0500	0.111
LAWPh3-17-SSM-S	3	1	8	C06KH11	0.0596	0.252
LRM	3	1	9	LRMKH312	<0.0500	0.907
LAWPh3-19-SSM-S	3	1	10	C18KH11	<0.0500	0.124
LAWPh3-20-SSM-S	3	1	11	C12KH21	0.0617	0.205
LAWPh3-17-SSM-S	3	1	12	C06KH21	0.0773	0.249
LAWPh3-05-SSM-S	3	1	13	C03KH21	0.0792	0.465
LAWPh3-19-SSM-S	3	1	14	C18KH21	<0.0500	0.132
LRM	3	1	15	LRMKH313	<0.0500	0.927
LRM	3	2	1	LRMKH321	<0.0500	0.92
LAWPh3-11-SSM-S	3	2	2	C15KH22	0.101	0.331
LAWPh3-10-SSM-S	3	2	3	C09KH12	<0.0500	0.0978
LAWPh3-20-SSM-S	3	2	4	C12KH12	<0.0500	0.141
LAWPh3-20-SSM-S	3	2	5	C12KH22	<0.0500	0.153
LAWPh3-17-SSM-S	3	2	6	C06KH22	0.0671	0.22
LAWPh3-05-SSM-S	3	2	7	C03KH12	0.103	0.45
LAWPh3-19-SSM-S	3	2	8	C18KH12	<0.0500	0.0774
LRM	3	2	9	LRMKH322	<0.0500	0.984
LAWPh3-17-SSM-S	3	2	10	C06KH12	0.0683	0.292
LAWPh3-19-SSM-S	3	2	11	C18KH22	<0.0500	0.105
LAWPh3-10-SSM-S	3	2	12	C09KH22	<0.0500	0.188
LAWPh3-05-SSM-S	3	2	13	C03KH22	0.0887	0.453
LAWPh3-11-SSM-S	3	2	14	C15KH12	0.0824	0.286
LRM	3	2	15	LRMKH323	<0.0500	0.971

Table B-5. Comparison of Measured and Targeted Compositions of the SSM Study Glasses

Glass ID	Oxide	BDL (<)	Measured (wt %)	Targeted (wt %)	Difference of Measured versus Targeted	% Difference of Measured versus Targeted
LAWPh3-01-SSM-S	Al_2O_3		6.264	6.576	-0.312	-4.7%
LAWPh3-01-SSM-S	B_2O_3		13.524	13.506	0.018	0.1%
LAWPh3-01-SSM-S	CaO		4.817	4.456	0.361	
LAWPh3-01-SSM-S	Cl	<	0.054	0.137	-0.083	
LAWPh3-01-SSM-S	Cr_2O_3		0.277	0.574	-0.297	
LAWPh3-01-SSM-S	F		0.151	0.208	-0.057	
LAWPh3-01-SSM-S	Fe_2O_3		0.539	0.537	0.002	
LAWPh3-01-SSM-S	K_2O		0.554	0.676	-0.123	
LAWPh3-01-SSM-S	MgO		1.179	1.235	-0.056	
LAWPh3-01-SSM-S	Na_2O		23.961	24.131	-0.170	-0.7%
LAWPh3-01-SSM-S	P_2O_5		0.393	0.446	-0.053	
LAWPh3-01-SSM-S	SiO_2		36.368	35.582	0.786	2.2%
LAWPh3-01-SSM-S	SnO_2		3.142	3.076	0.066	
LAWPh3-01-SSM-S	SO_3		1.714	0.528	1.186	
LAWPh3-01-SSM-S	V_2O_5		0.269	0.281	-0.012	
LAWPh3-01-SSM-S	ZnO		2.110	2.070	0.040	
LAWPh3-01-SSM-S	ZrO_2		4.961	5.981	-1.020	-17.1%
LAWPh3-01-SSM-S	Sum		100.276	100.000	0.276	0.3%
LAWPh3-02-SSM-S	Al_2O_3		6.268	6.869	-0.601	-8.7%
LAWPh3-02-SSM-S	B_2O_3		12.864	13.158	-0.294	-2.2%
LAWPh3-02-SSM-S	CaO		4.834	4.673	0.161	
LAWPh3-02-SSM-S	Cl	<	0.050	0.074	-0.024	
LAWPh3-02-SSM-S	Cr_2O_3		0.261	0.520	-0.259	
LAWPh3-02-SSM-S	F		0.163	0.112	0.051	
LAWPh3-02-SSM-S	Fe_2O_3	<	0.143	0.045	0.098	
LAWPh3-02-SSM-S	K_2O		2.328	2.886	-0.558	
LAWPh3-02-SSM-S	MgO		1.036	1.084	-0.048	
LAWPh3-02-SSM-S	Na_2O		21.905	22.707	-0.802	-3.5%
LAWPh3-02-SSM-S	P_2O_5	<	0.229	0.240	-0.011	
LAWPh3-02-SSM-S	SiO_2		34.068	34.922	-0.854	-2.4%
LAWPh3-02-SSM-S	SnO_2		1.562	1.553	0.009	
LAWPh3-02-SSM-S	SO_3		1.950	0.447	1.503	
LAWPh3-02-SSM-S	V_2O_5		2.642	2.854	-0.212	
LAWPh3-02-SSM-S	ZnO		3.044	3.091	-0.048	
LAWPh3-02-SSM-S	ZrO_2		4.191	4.765	-0.574	
LAWPh3-02-SSM-S	Sum		97.538	100.000	-2.462	-2.5%
LAWPh3-03-SSM-S	Al_2O_3		6.193	6.500	-0.307	-4.7%
LAWPh3-03-SSM-S	B_2O_3		6.697	6.620	0.077	1.2%
LAWPh3-03-SSM-S	CaO		4.383	4.093	0.290	
LAWPh3-03-SSM-S	Cl		0.095	0.443	-0.348	
LAWPh3-03-SSM-S	Cr_2O_3	<	0.160	0.344	-0.184	
LAWPh3-03-SSM-S	F		0.555	0.672	-0.117	
LAWPh3-03-SSM-S	Fe_2O_3		1.396	1.403	-0.007	
LAWPh3-03-SSM-S	K_2O		3.882	5.005	-1.123	-22.4%
LAWPh3-03-SSM-S	MgO		1.139	1.176	-0.037	
LAWPh3-03-SSM-S	Na_2O		20.928	21.585	-0.657	-3.0%
LAWPh3-03-SSM-S	P_2O_5		1.128	1.438	-0.310	
LAWPh3-03-SSM-S	SiO_2		40.861	39.958	0.903	2.3%
LAWPh3-03-SSM-S	SnO_2		1.644	1.578	0.066	
LAWPh3-03-SSM-S	SO_3		1.290	0.538	0.752	
LAWPh3-03-SSM-S	V_2O_5		0.237	0.254	-0.018	
LAWPh3-03-SSM-S	ZnO		3.059	3.033	0.026	
LAWPh3-03-SSM-S	ZrO_2		4.650	5.358	-0.708	-13.2%
LAWPh3-03-SSM-S	Sum		98.296	99.998	-1.702	-1.7%
LAWPh3-04-SSM-S	Al_2O_3		5.820	6.363	-0.543	-8.5%
LAWPh3-04-SSM-S	B_2O_3		12.469	12.757	-0.288	-2.3%
LAWPh3-04-SSM-S	CaO		9.756	9.524	0.232	2.4%

Table B-5. Comparison of Measured and Targeted Compositions of the SSM Study Glasses (continued)

Glass ID	Oxide	BDL (<)	Measured (wt %)	Targeted (wt %)	Difference of Measured versus Targeted	% Difference of Measured versus Targeted
LAWPh3-04-SSM-S	Cl		0.072	0.201	-0.129	
LAWPh3-04-SSM-S	Cr_2O_3		0.281	0.494	-0.213	
LAWPh3-04-SSM-S	F		0.283	0.305	-0.022	
LAWPh3-04-SSM-S	Fe_2O_3		0.382	0.367	0.015	
LAWPh3-04-SSM-S	K_2O		0.749	0.895	-0.146	
LAWPh3-04-SSM-S	MgO		0.459	0.415	0.044	
LAWPh3-04-SSM-S	Na_2O		20.759	22.210	-1.451	-6.5%
LAWPh3-04-SSM-S	P_2O_5		0.598	0.652	-0.054	
LAWPh3-04-SSM-S	SiO_2		35.405	35.803	-0.398	-1.1%
LAWPh3-04-SSM-S	SnO_2		0.363	0.349	0.014	
LAWPh3-04-SSM-S	SO_3		2.416	1.274	1.142	
LAWPh3-04-SSM-S	V_2O_5		2.629	2.756	-0.127	
LAWPh3-04-SSM-S	ZnO		2.262	2.243	0.019	
LAWPh3-04-SSM-S	ZrO_2		2.965	3.392	-0.427	
LAWPh3-04-SSM-S	Sum		97.668	100.000	-2.332	-2.3%
LAWPh3-05-SSM-S	Al_2O_3		6.037	6.186	-0.149	-2.4%
LAWPh3-05-SSM-S	B_2O_3		6.384	6.195	0.188	3.0%
LAWPh3-05-SSM-S	CaO		2.662	2.442	0.220	
LAWPh3-05-SSM-S	Cl		0.090	0.432	-0.342	
LAWPh3-05-SSM-S	Cr_2O_3		0.203	0.557	-0.354	
LAWPh3-05-SSM-S	F		0.448	0.656	-0.208	
LAWPh3-05-SSM-S	Fe_2O_3		1.033	1.051	-0.018	
LAWPh3-05-SSM-S	K_2O		2.177	2.903	-0.726	
LAWPh3-05-SSM-S	MgO		1.088	1.126	-0.038	
LAWPh3-05-SSM-S	Na_2O		21.635	22.524	-0.889	-3.9%
LAWPh3-05-SSM-S	P_2O_5		1.068	1.404	-0.336	
LAWPh3-05-SSM-S	SiO_2		38.507	39.153	-0.646	-1.6%
LAWPh3-05-SSM-S	SnO_2		3.047	3.024	0.023	
LAWPh3-05-SSM-S	SO_3		1.249	0.895	0.354	
LAWPh3-05-SSM-S	V_2O_5		2.794	3.267	-0.473	
LAWPh3-05-SSM-S	ZnO		2.119	2.126	-0.007	
LAWPh3-05-SSM-S	ZrO_2		5.295	6.059	-0.764	-12.6%
LAWPh3-05-SSM-S	Sum		95.836	100.000	-4.164	-4.2%
LAWPh3-06-SSM-S	Al_2O_3		8.446	9.019	-0.573	-6.4%
LAWPh3-06-SSM-S	B_2O_3		6.689	6.727	-0.038	-0.6%
LAWPh3-06-SSM-S	CaO		10.456	10.161	0.295	2.9%
LAWPh3-06-SSM-S	Cl	<	0.050	0.100	-0.050	
LAWPh3-06-SSM-S	Cr_2O_3		0.241	0.583	-0.342	
LAWPh3-06-SSM-S	F		0.155	0.151	0.004	
LAWPh3-06-SSM-S	Fe_2O_3		0.265	0.239	0.026	
LAWPh3-06-SSM-S	K_2O		1.777	2.394	-0.617	
LAWPh3-06-SSM-S	MgO		1.126	1.138	-0.012	
LAWPh3-06-SSM-S	Na_2O		19.950	21.267	-1.317	-6.2%
LAWPh3-06-SSM-S	P_2O_5		0.296	0.324	-0.028	
LAWPh3-06-SSM-S	SiO_2		35.512	35.777	-0.265	-0.7%
LAWPh3-06-SSM-S	SnO_2		3.415	3.253	0.162	
LAWPh3-06-SSM-S	SO_3		1.592	0.341	1.251	
LAWPh3-06-SSM-S	V_2O_5		2.120	2.304	-0.184	
LAWPh3-06-SSM-S	ZnO		2.891	2.895	-0.004	
LAWPh3-06-SSM-S	ZrO_2		2.570	3.327	-0.757	
LAWPh3-06-SSM-S	Sum		97.551	100.000	-2.449	-2.4%
LAWPh3-07-SSM-S	Al_2O_3		9.273	9.804	-0.531	-5.4%
LAWPh3-07-SSM-S	B_2O_3		7.688	7.610	0.077	1.0%
LAWPh3-07-SSM-S	CaO		9.403	8.843	0.560	6.3%
LAWPh3-07-SSM-S	Cl		0.119	0.415	-0.296	
LAWPh3-07-SSM-S	Cr_2O_3		0.152	0.329	-0.177	

Table B-5. Comparison of Measured and Targeted Compositions of the SSM Study Glasses (continued)

Glass ID	Oxide	BDL (<)	Measured (wt %)	Targeted (wt %)	Difference of Measured versus Targeted	% Difference of Measured versus Targeted
LAWPh3-07-SSM-S	F		0.427	0.631	-0.204	
LAWPh3-07-SSM-S	Fe_2O_3		0.531	0.525	0.006	
LAWPh3-07-SSM-S	K_2O		0.629	0.782	-0.154	
LAWPh3-07-SSM-S	MgO	<	0.166	0.070	0.096	
LAWPh3-07-SSM-S	Na_2O		23.422	23.886	-0.464	-1.9%
LAWPh3-07-SSM-S	P_2O_5		0.274	1.350	-1.076	
LAWPh3-07-SSM-S	SiO_2		35.138	35.064	0.074	0.2%
LAWPh3-07-SSM-S	SnO_2		0.696	0.733	-0.037	
LAWPh3-07-SSM-S	SO_3		1.905	0.557	1.348	
LAWPh3-07-SSM-S	V_2O_5		2.870	3.050	-0.180	
LAWPh3-07-SSM-S	ZnO		3.187	3.095	0.092	
LAWPh3-07-SSM-S	ZrO_2		2.188	3.256	-1.068	
LAWPh3-07-SSM-S	Sum		98.064	100.000	-1.936	-1.9%
LAWPh3-08-SSM-S	Al_2O_3		6.391	6.672	-0.281	-4.2%
LAWPh3-08-SSM-S	B_2O_3		6.585	6.482	0.103	1.6%
LAWPh3-08-SSM-S	CaO		6.573	6.142	0.431	7.0%
LAWPh3-08-SSM-S	Cl		0.116	0.456	-0.341	
LAWPh3-08-SSM-S	Cr_2O_3		0.215	0.468	-0.254	
LAWPh3-08-SSM-S	F		0.446	0.693	-0.247	
LAWPh3-08-SSM-S	Fe_2O_3	<	0.143	0.106	0.037	
LAWPh3-08-SSM-S	K_2O		1.187	1.515	-0.329	
LAWPh3-08-SSM-S	MgO		0.218	0.185	0.033	
LAWPh3-08-SSM-S	Na_2O		20.827	21.243	-0.416	-2.0%
LAWPh3-08-SSM-S	P_2O_5		1.261	1.482	-0.221	
LAWPh3-08-SSM-S	SiO_2		44.711	43.987	0.724	1.6%
LAWPh3-08-SSM-S	SnO_2		0.558	0.569	-0.011	
LAWPh3-08-SSM-S	SO_3		1.317	0.371	0.946	
LAWPh3-08-SSM-S	V_2O_5	<	0.179	0.050	0.129	
LAWPh3-08-SSM-S	ZnO		3.380	3.291	0.089	
LAWPh3-08-SSM-S	ZrO_2		5.535	6.288	-0.753	-12.0%
LAWPh3-08-SSM-S	Sum		99.638	100.000	-0.362	-0.4%
LAWPh3-09-SSM-S	Al_2O_3		7.553	7.822	-0.269	-3.4%
LAWPh3-09-SSM-S	B_2O_3		8.758	8.597	0.161	1.9%
LAWPh3-09-SSM-S	CaO		9.836	9.226	0.610	6.6%
LAWPh3-09-SSM-S	Cl		0.062	0.257	-0.195	
LAWPh3-09-SSM-S	Cr_2O_3	<	0.146	0.305	-0.159	
LAWPh3-09-SSM-S	F		0.277	0.391	-0.115	
LAWPh3-09-SSM-S	Fe_2O_3		0.845	0.842	0.003	
LAWPh3-09-SSM-S	K_2O		4.041	5.498	-1.457	-26.5%
LAWPh3-09-SSM-S	MgO		0.270	0.205	0.065	
LAWPh3-09-SSM-S	Na_2O		21.063	21.285	-0.223	-1.0%
LAWPh3-09-SSM-S	P_2O_5		0.691	0.836	-0.145	
LAWPh3-09-SSM-S	SiO_2		36.529	35.513	1.016	2.9%
LAWPh3-09-SSM-S	SnO_2		0.231	0.236	-0.005	
LAWPh3-09-SSM-S	SO_3		1.641	0.964	0.677	
LAWPh3-09-SSM-S	V_2O_5		0.591	0.644	-0.053	
LAWPh3-09-SSM-S	ZnO		2.387	2.289	0.098	
LAWPh3-09-SSM-S	ZrO_2		4.448	5.090	-0.643	-12.6%
LAWPh3-09-SSM-S	Sum		99.367	100.000	-0.633	-0.6%
LAWPh3-10-SSM-S	Al_2O_3		7.832	8.251	-0.419	-5.1%
LAWPh3-10-SSM-S	B_2O_3		6.464	6.361	0.103	1.6%
LAWPh3-10-SSM-S	CaO		5.992	5.579	0.413	7.4%
LAWPh3-10-SSM-S	Cl	<	0.050	0.095	-0.045	
LAWPh3-10-SSM-S	Cr_2O_3	<	0.146	0.361	-0.215	
LAWPh3-10-SSM-S	F		0.141	0.144	-0.003	
LAWPh3-10-SSM-S	Fe_2O_3		0.767	0.789	-0.022	

Table B-5. Comparison of Measured and Targeted Compositions of the SSM Study Glasses (continued)

Glass ID	Oxide	BDL (<)	Measured (wt %)	Targeted (wt %)	Difference of Measured versus Targeted	% Difference of Measured versus Targeted
LAWPh3-10-SSM-S	K_2O		1.867	2.626	-0.759	
LAWPh3-10-SSM-S	MgO		0.365	0.338	0.027	
LAWPh3-10-SSM-S	Na_2O		23.085	23.593	-0.509	-2.2%
LAWPh3-10-SSM-S	P_2O_5		0.259	0.308	-0.049	
LAWPh3-10-SSM-S	SiO_2		35.833	35.502	0.331	0.9%
LAWPh3-10-SSM-S	SnO_2		1.663	1.719	-0.056	
LAWPh3-10-SSM-S	SO_3		1.557	1.103	0.454	
LAWPh3-10-SSM-S	V_2O_5		3.276	3.836	-0.560	
LAWPh3-10-SSM-S	ZnO		3.115	3.187	-0.072	
LAWPh3-10-SSM-S	ZrO_2		5.400	6.208	-0.808	-13.0%
LAWPh3-10-SSM-S	Sum		97.812	100.000	-2.188	-2.2%
LAWPh3-11-SSM-S	Al_2O_3		8.696	9.337	-0.641	-6.9%
LAWPh3-11-SSM-S	B_2O_3		9.418	9.333	0.085	0.9%
LAWPh3-11-SSM-S	CaO		3.977	3.773	0.204	
LAWPh3-11-SSM-S	Cl		0.086	0.272	-0.187	
LAWPh3-11-SSM-S	Cr_2O_3		0.247	0.565	-0.318	
LAWPh3-11-SSM-S	F		0.324	0.412	-0.089	
LAWPh3-11-SSM-S	Fe_2O_3	<	0.143	0.052	0.091	
LAWPh3-11-SSM-S	K_2O		1.071	1.372	-0.301	
LAWPh3-11-SSM-S	MgO		0.798	0.817	-0.019	
LAWPh3-11-SSM-S	Na_2O		24.466	24.759	-0.293	-1.2%
LAWPh3-11-SSM-S	P_2O_5		0.705	0.882	-0.177	
LAWPh3-11-SSM-S	SiO_2		35.940	35.499	0.441	1.2%
LAWPh3-11-SSM-S	SnO_2		0.755	0.746	0.009	
LAWPh3-11-SSM-S	SO_3		1.559	0.108	1.451	
LAWPh3-11-SSM-S	V_2O_5		2.977	3.457	-0.480	
LAWPh3-11-SSM-S	ZnO		2.300	2.187	0.113	
LAWPh3-11-SSM-S	ZrO_2		5.434	6.429	-0.995	-15.5%
LAWPh3-11-SSM-S	Sum		98.896	100.000	-1.104	-1.1%
LAWPh3-12-SSM-S	Al_2O_3		10.577	11.122	-0.546	-4.9%
LAWPh3-12-SSM-S	B_2O_3		13.355	13.512	-0.158	-1.2%
LAWPh3-12-SSM-S	CaO		2.987	2.761	0.226	
LAWPh3-12-SSM-S	Cl		0.078	0.320	-0.243	
LAWPh3-12-SSM-S	Cr_2O_3		0.253	0.427	-0.174	
LAWPh3-12-SSM-S	F		0.284	0.486	-0.202	
LAWPh3-12-SSM-S	Fe_2O_3		1.040	1.071	-0.031	
LAWPh3-12-SSM-S	K_2O		0.215	0.229	-0.014	
LAWPh3-12-SSM-S	MgO		1.184	1.259	-0.075	
LAWPh3-12-SSM-S	Na_2O		20.726	21.432	-0.706	-3.3%
LAWPh3-12-SSM-S	P_2O_5		0.731	1.039	-0.308	
LAWPh3-12-SSM-S	SiO_2		35.192	35.137	0.054	0.2%
LAWPh3-12-SSM-S	SnO_2		0.903	0.934	-0.031	
LAWPh3-12-SSM-S	SO_3		1.353	0.295	1.058	
LAWPh3-12-SSM-S	V_2O_5		3.712	3.846	-0.134	
LAWPh3-12-SSM-S	ZnO		2.854	2.791	0.063	
LAWPh3-12-SSM-S	ZrO_2		2.871	3.339	-0.469	
LAWPh3-12-SSM-S	Sum		98.313	100.000	-1.688	-1.7%
LAWPh3-13-SSM-S	Al_2O_3		6.665	7.122	-0.457	-6.4%
LAWPh3-13-SSM-S	B_2O_3		6.102	6.245	-0.143	-2.3%
LAWPh3-13-SSM-S	CaO		9.084	8.596	0.488	5.7%
LAWPh3-13-SSM-S	Cl	<	0.050	0.169	-0.119	
LAWPh3-13-SSM-S	Cr_2O_3		0.205	0.580	-0.375	
LAWPh3-13-SSM-S	F		0.260	0.257	0.003	
LAWPh3-13-SSM-S	Fe_2O_3	<	0.143	0.069	0.074	
LAWPh3-13-SSM-S	K_2O		2.352	3.403	-1.051	
LAWPh3-13-SSM-S	MgO		1.220	1.251	-0.031	

Table B-5. Comparison of Measured and Targeted Compositions of the SSM Study Glasses (continued)

Glass ID	Oxide	BDL (<)	Measured (wt %)	Targeted (wt %)	Difference of Measured versus Targeted	% Difference of Measured versus Targeted
LAWPh3-13-SSM-S	Na_2O		21.939	23.038	-1.099	-4.8%
LAWPh3-13-SSM-S	P_2O_5		0.470	0.549	-0.079	
LAWPh3-13-SSM-S	SiO_2		39.898	39.839	0.059	0.1%
LAWPh3-13-SSM-S	SnO_2		0.277	0.272	0.005	
LAWPh3-13-SSM-S	SO_3		1.628	1.109	0.519	
LAWPh3-13-SSM-S	V_2O_5		0.718	0.786	-0.068	
LAWPh3-13-SSM-S	ZnO		3.420	3.501	-0.081	
LAWPh3-13-SSM-S	ZrO_2		2.766	3.214	-0.448	
LAWPh3-13-SSM-S	Sum		97.197	100.000	-2.803	-2.8%
LAWPh3-14-SSM-S	Al_2O_3		6.169	6.633	-0.464	-7.0%
LAWPh3-14-SSM-S	B_2O_3		8.114	8.264	-0.150	-1.8%
LAWPh3-14-SSM-S	CaO		5.558	5.296	0.262	5.0%
LAWPh3-14-SSM-S	Cl		0.130	0.430	-0.300	
LAWPh3-14-SSM-S	Cr_2O_3		0.160	0.318	-0.158	
LAWPh3-14-SSM-S	F		0.500	0.654	-0.154	
LAWPh3-14-SSM-S	Fe_2O_3	<	0.143	0.033	0.110	
LAWPh3-14-SSM-S	K_2O		0.189	0.209	-0.021	
LAWPh3-14-SSM-S	MgO	<	0.166	0.087	0.079	
LAWPh3-14-SSM-S	Na_2O		24.163	25.643	-1.480	-5.8%
LAWPh3-14-SSM-S	P_2O_5		0.401	1.399	-0.998	
LAWPh3-14-SSM-S	SiO_2		39.310	39.559	-0.249	-0.6%
LAWPh3-14-SSM-S	SnO_2		2.196	2.168	0.028	
LAWPh3-14-SSM-S	SO_3		2.010	0.917	1.093	
LAWPh3-14-SSM-S	V_2O_5		1.991	2.139	-0.149	
LAWPh3-14-SSM-S	ZnO		2.496	2.480	0.016	
LAWPh3-14-SSM-S	ZrO_2		2.644	3.771	-1.127	
LAWPh3-14-SSM-S	Sum		96.339	100.000	-3.661	-3.7%
LAWPh3-15-SSM-S	Al_2O_3		6.760	7.298	-0.538	-7.4%
LAWPh3-15-SSM-S	B_2O_3		9.249	9.432	-0.183	-1.9%
LAWPh3-15-SSM-S	CaO		9.091	8.668	0.423	4.9%
LAWPh3-15-SSM-S	Cl	<	0.050	0.105	-0.055	
LAWPh3-15-SSM-S	Cr_2O_3		0.171	0.430	-0.259	
LAWPh3-15-SSM-S	F		0.192	0.160	0.032	
LAWPh3-15-SSM-S	Fe_2O_3		1.198	1.246	-0.048	
LAWPh3-15-SSM-S	K_2O		3.102	4.136	-1.034	
LAWPh3-15-SSM-S	MgO	<	0.166	0.008	0.158	
LAWPh3-15-SSM-S	Na_2O		21.197	21.708	-0.511	-2.4%
LAWPh3-15-SSM-S	P_2O_5		0.294	0.342	-0.048	
LAWPh3-15-SSM-S	SiO_2		35.138	35.343	-0.205	-0.6%
LAWPh3-15-SSM-S	SnO_2		1.663	1.692	-0.029	
LAWPh3-15-SSM-S	SO_3		1.749	0.387	1.362	
LAWPh3-15-SSM-S	V_2O_5		1.446	1.604	-0.158	
LAWPh3-15-SSM-S	ZnO		2.848	2.942	-0.095	
LAWPh3-15-SSM-S	ZrO_2		3.894	4.499	-0.605	
LAWPh3-15-SSM-S	Sum		98.208	100.000	-1.792	-1.8%
LAWPh3-16-SSM-S	Al_2O_3		5.687	6.112	-0.425	-6.9%
LAWPh3-16-SSM-S	B_2O_3		6.891	6.919	-0.028	-0.4%
LAWPh3-16-SSM-S	CaO		7.899	7.417	0.482	6.5%
LAWPh3-16-SSM-S	Cl	<	0.058	0.193	-0.135	
LAWPh3-16-SSM-S	Cr_2O_3		0.195	0.425	-0.230	
LAWPh3-16-SSM-S	F		0.186	0.294	-0.109	
LAWPh3-16-SSM-S	Fe_2O_3		0.340	0.333	0.007	
LAWPh3-16-SSM-S	K_2O		3.186	4.082	-0.896	
LAWPh3-16-SSM-S	MgO		0.791	0.792	-0.001	
LAWPh3-16-SSM-S	Na_2O		23.085	23.202	-0.118	-0.5%
LAWPh3-16-SSM-S	P_2O_5		0.543	0.629	-0.087	

Table B-5. Comparison of Measured and Targeted Compositions of the SSM Study Glasses (continued)

Glass ID	Oxide	BDL (<)	Measured (wt %)	Targeted (wt %)	Difference of Measured versus Targeted	% Difference of Measured versus Targeted
LAWPh3-16-SSM-S	SiO_2		36.956	36.558	0.398	1.1%
LAWPh3-16-SSM-S	SnO_2	<	0.127	0.115	0.012	
LAWPh3-16-SSM-S	SO_3		1.950	0.165	1.785	
LAWPh3-16-SSM-S	V_2O_5		3.396	3.623	-0.227	
LAWPh3-16-SSM-S	ZnO		3.495	3.433	0.062	
LAWPh3-16-SSM-S	ZrO_2		4.934	5.708	-0.774	-13.6%
LAWPh3-16-SSM-S	Sum		99.716	100.000	-0.284	-0.3%
LAWPh3-17-SSM-S	Al_2O_3		5.631	6.166	-0.535	-8.7%
LAWPh3-17-SSM-S	B_2O_3		6.142	6.124	0.018	0.3%
LAWPh3-17-SSM-S	CaO		9.973	9.859	0.114	1.2%
LAWPh3-17-SSM-S	Cl		0.068	0.191	-0.123	
LAWPh3-17-SSM-S	Cr_2O_3		0.176	0.392	-0.216	
LAWPh3-17-SSM-S	F		0.253	0.290	-0.037	
LAWPh3-17-SSM-S	Fe_2O_3		1.323	1.395	-0.073	
LAWPh3-17-SSM-S	K_2O		0.271	0.328	-0.057	
LAWPh3-17-SSM-S	MgO		1.271	1.327	-0.056	
LAWPh3-17-SSM-S	Na_2O		24.770	25.366	-0.596	-2.4%
LAWPh3-17-SSM-S	P_2O_5		0.533	0.620	-0.087	
LAWPh3-17-SSM-S	SiO_2		37.384	38.076	-0.692	-1.8%
LAWPh3-17-SSM-S	SnO_2		0.773	0.753	0.020	
LAWPh3-17-SSM-S	SO_3		2.076	0.699	1.377	
LAWPh3-17-SSM-S	V_2O_5		2.133	2.388	-0.255	
LAWPh3-17-SSM-S	ZnO		2.256	2.374	-0.118	
LAWPh3-17-SSM-S	ZrO_2		3.022	3.652	-0.630	
LAWPh3-17-SSM-S	Sum		98.055	100.000	-1.945	-1.9%
LAWPh3-18-SSM-S	Al_2O_3		7.997	8.374	-0.377	-4.5%
LAWPh3-18-SSM-S	B_2O_3		6.158	6.075	0.083	1.4%
LAWPh3-18-SSM-S	CaO		3.893	3.578	0.315	
LAWPh3-18-SSM-S	Cl		0.059	0.309	-0.250	
LAWPh3-18-SSM-S	Cr_2O_3		0.179	0.478	-0.299	
LAWPh3-18-SSM-S	F		0.307	0.470	-0.163	
LAWPh3-18-SSM-S	Fe_2O_3		0.409	0.394	0.015	
LAWPh3-18-SSM-S	K_2O		2.259	2.946	-0.687	
LAWPh3-18-SSM-S	MgO		1.243	1.303	-0.060	
LAWPh3-18-SSM-S	Na_2O		22.107	22.246	-0.139	-0.6%
LAWPh3-18-SSM-S	P_2O_5		0.816	1.005	-0.189	
LAWPh3-18-SSM-S	SiO_2		41.021	40.785	0.236	0.6%
LAWPh3-18-SSM-S	SnO_2		3.390	3.302	0.088	
LAWPh3-18-SSM-S	SO_3		1.143	0.324	0.819	
LAWPh3-18-SSM-S	V_2O_5		0.384	0.403	-0.019	
LAWPh3-18-SSM-S	ZnO		3.579	3.460	0.119	
LAWPh3-18-SSM-S	ZrO_2		4.015	4.548	-0.533	
LAWPh3-18-SSM-S	Sum		98.959	100.000	-1.041	-1.0%
LAWPh3-19-SSM-S	Al_2O_3		6.316	6.703	-0.387	-5.8%
LAWPh3-19-SSM-S	B_2O_3		6.931	6.893	0.038	0.5%
LAWPh3-19-SSM-S	CaO		9.189	8.490	0.699	8.2%
LAWPh3-19-SSM-S	Cl	<	0.050	0.077	-0.027	
LAWPh3-19-SSM-S	Cr_2O_3	<	0.148	0.373	-0.225	
LAWPh3-19-SSM-S	F		0.110	0.116	-0.006	
LAWPh3-19-SSM-S	Fe_2O_3		1.315	1.361	-0.046	
LAWPh3-19-SSM-S	K_2O		2.229	3.078	-0.850	
LAWPh3-19-SSM-S	MgO		0.262	0.211	0.051	
LAWPh3-19-SSM-S	Na_2O		21.231	21.427	-0.196	-0.9%
LAWPh3-19-SSM-S	P_2O_5	<	0.229	0.249	-0.020	
LAWPh3-19-SSM-S	SiO_2		38.935	40.815	-1.880	-4.6%
LAWPh3-19-SSM-S	SnO_2		1.124	1.079	0.045	

Table B-5. Comparison of Measured and Targeted Compositions of the SSM Study Glasses (continued)

Glass ID	Oxide	BDL (<)	Measured (wt %)	Targeted (wt %)	Difference of Measured versus Targeted	% Difference of Measured versus Targeted
LAWPh3-19-SSM-S	SO_3		1.873	1.048	0.825	
LAWPh3-19-SSM-S	V_2O_5		2.611	2.912	-0.301	
LAWPh3-19-SSM-S	ZnO		2.054	2.112	-0.058	
LAWPh3-19-SSM-S	ZrO_2		2.587	3.056	-0.469	
LAWPh3-19-SSM-S	Sum		97.193	100.000	-2.807	-2.8%
LAWPh3-20-SSM-S	Al_2O_3		5.716	6.035	-0.319	-5.3%
LAWPh3-20-SSM-S	B_2O_3		9.120	8.934	0.186	2.1%
LAWPh3-20-SSM-S	CaO		5.037	4.758	0.279	
LAWPh3-20-SSM-S	Cl	<	0.053	0.132	-0.079	
LAWPh3-20-SSM-S	Cr_2O_3		0.231	0.409	-0.178	
LAWPh3-20-SSM-S	F		0.159	0.200	-0.042	
LAWPh3-20-SSM-S	Fe_2O_3		1.073	1.122	-0.049	
LAWPh3-20-SSM-S	K_2O	<	0.129	0.127	0.002	
LAWPh3-20-SSM-S	MgO	<	0.166	0.074	0.092	
LAWPh3-20-SSM-S	Na_2O		21.770	22.432	-0.662	-3.0%
LAWPh3-20-SSM-S	P_2O_5		0.365	0.429	-0.064	
LAWPh3-20-SSM-S	SiO_2		38.614	41.198	-2.584	-6.3%
LAWPh3-20-SSM-S	SnO_2		2.761	2.863	-0.102	
LAWPh3-20-SSM-S	SO_3		1.727	0.730	0.997	
LAWPh3-20-SSM-S	V_2O_5		3.298	3.639	-0.341	
LAWPh3-20-SSM-S	ZnO		3.246	3.388	-0.142	
LAWPh3-20-SSM-S	ZrO_2		2.968	3.530	-0.562	
LAWPh3-20-SSM-S	Sum		96.433	100.000	-3.567	-3.6%
LRM	Al_2O_3		9.282	9.510	-0.228	-2.4%
LRM	B_2O_3		7.549	7.850	-0.301	-3.8%
LRM	CaO		0.449	0.540	-0.091	
LRM	Cl	<	0.050	0.000	0.050	
LRM	Cr_2O_3		0.187	0.190	-0.004	
LRM	F		0.933	0.860	0.073	
LRM	Fe_2O_3		1.382	1.380	0.002	
LRM	K_2O		1.451	1.480	-0.029	
LRM	MgO	<	0.166	0.100	0.066	
LRM	Na_2O		20.864	20.030	0.834	4.2%
LRM	P_2O_5		0.477	0.540	-0.063	
LRM	SiO_2		55.895	54.200	1.695	3.1%
LRM	SnO_2	<	0.127	0.000	0.127	
LRM	SO_3		0.232	0.300	-0.069	
LRM	V_2O_5	<	0.179	0.000	0.179	
LRM	ZnO	<	0.125	0.000	0.125	
LRM	ZrO_2		0.954	0.930	0.024	
LRM	Sum		100.299	97.910	2.389	2.4%

Exhibit B-1. Plots of Oxide Measurements in Analytical Sequence

Analyte=Al2O3 (wt%), Prep Method=PS
Variability Chart for Measured (wt%)

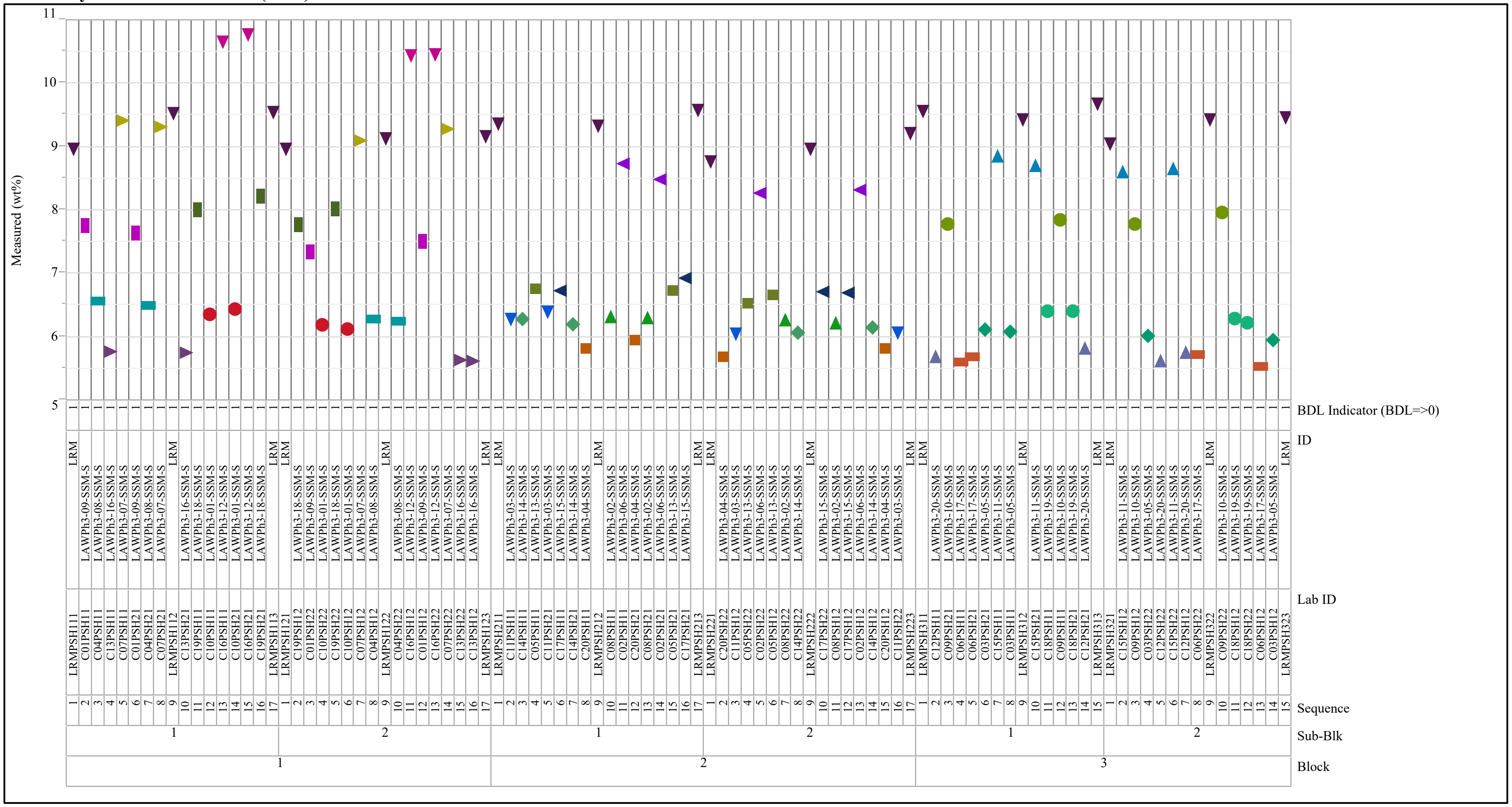


Exhibit B-1. Plots of Oxide Measurements in Analytical Sequence (continued)

Analyte=B2O3 (wt%), Prep Method=PS
Variability Chart for Measured (wt%)

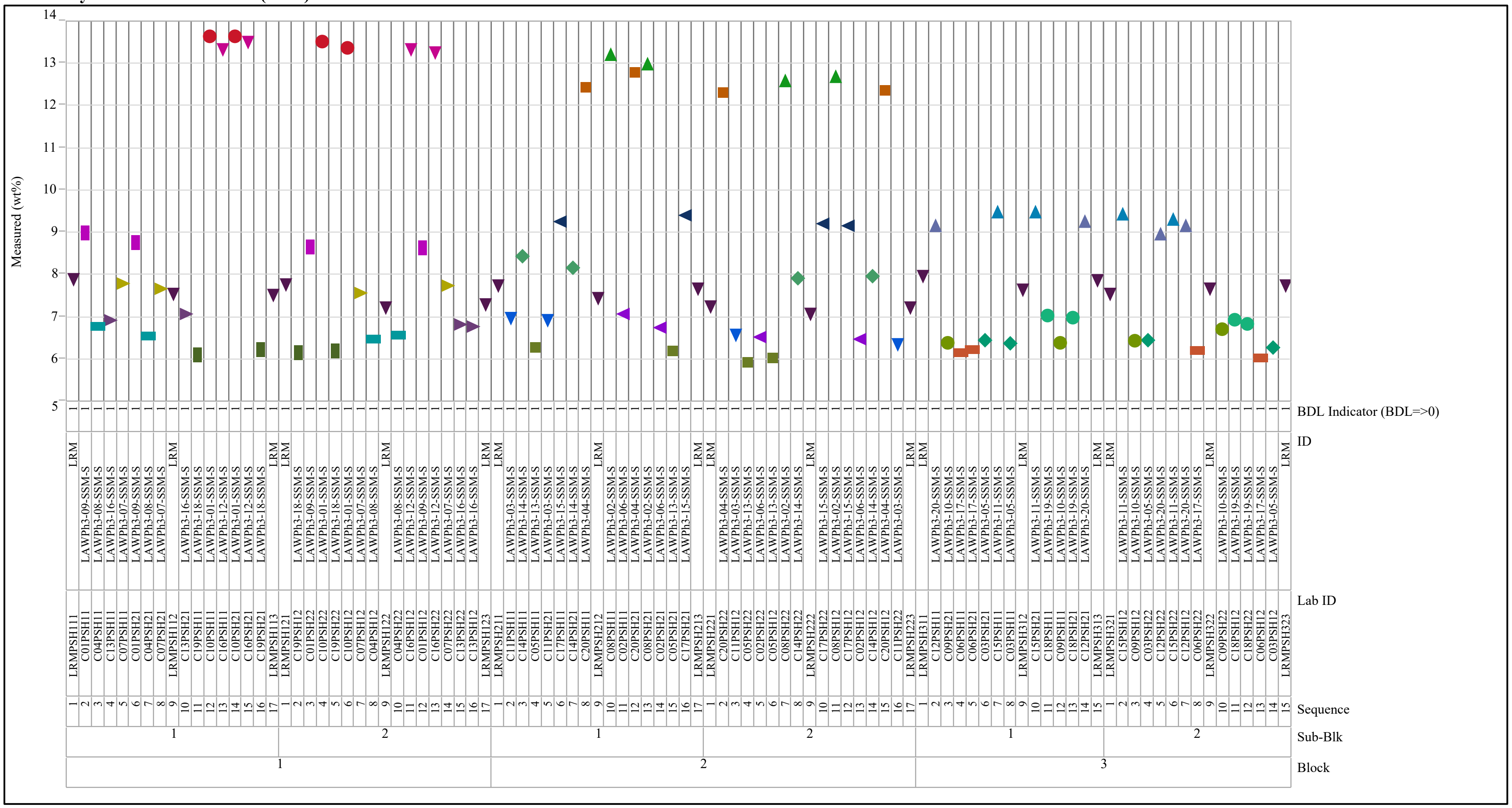


Exhibit B-1. Plots of Oxide Measurements in Analytical Sequence (continued)

Analyte=CaO (wt%), Prep Method=PS
Variability Chart for Measured (wt%)

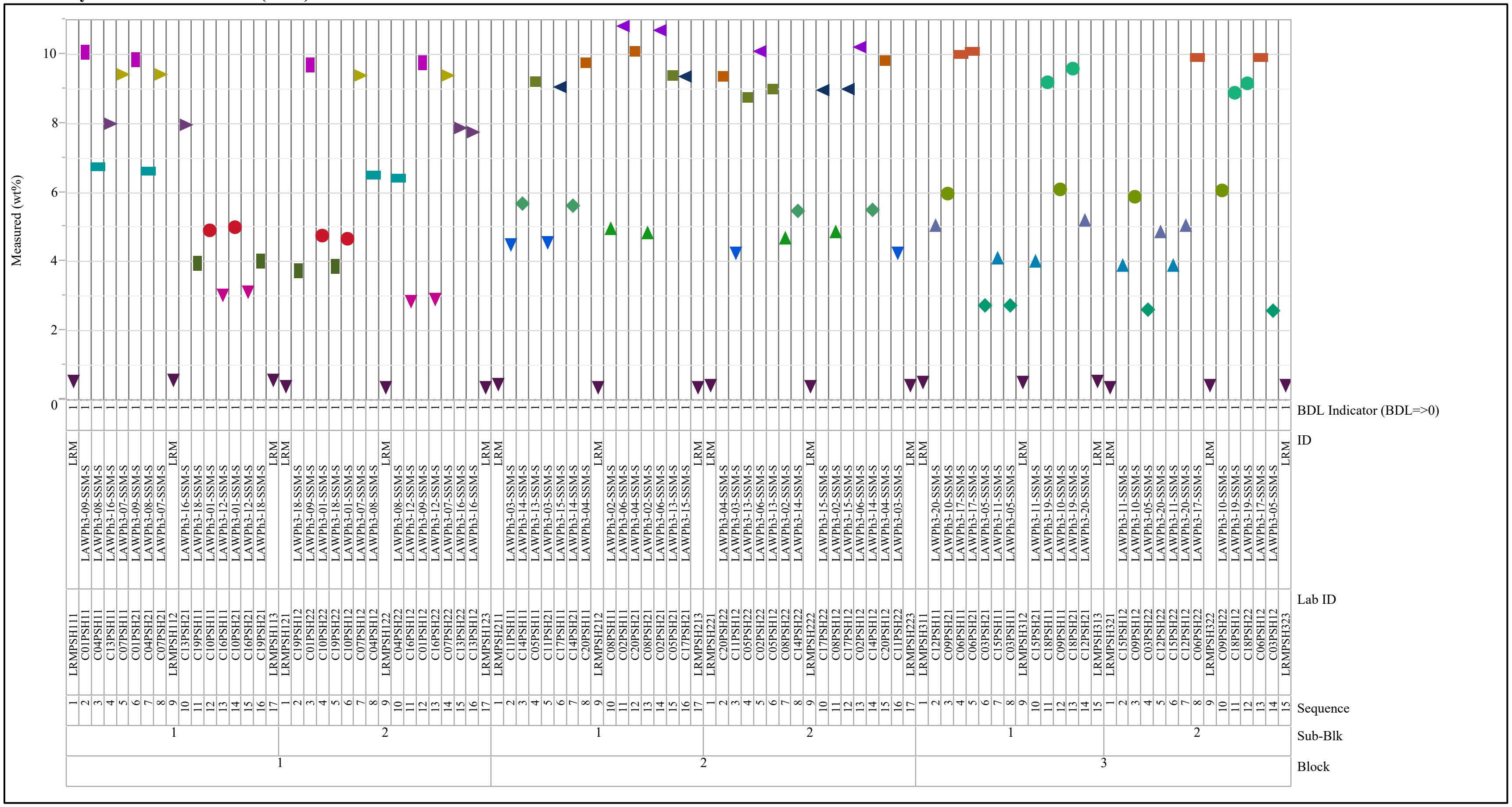


Exhibit B-1. Plots of Oxide Measurements in Analytical Sequence (continued)

Analyte=Cl (wt%), Prep Method=KH
Variability Chart for Measured (wt%)

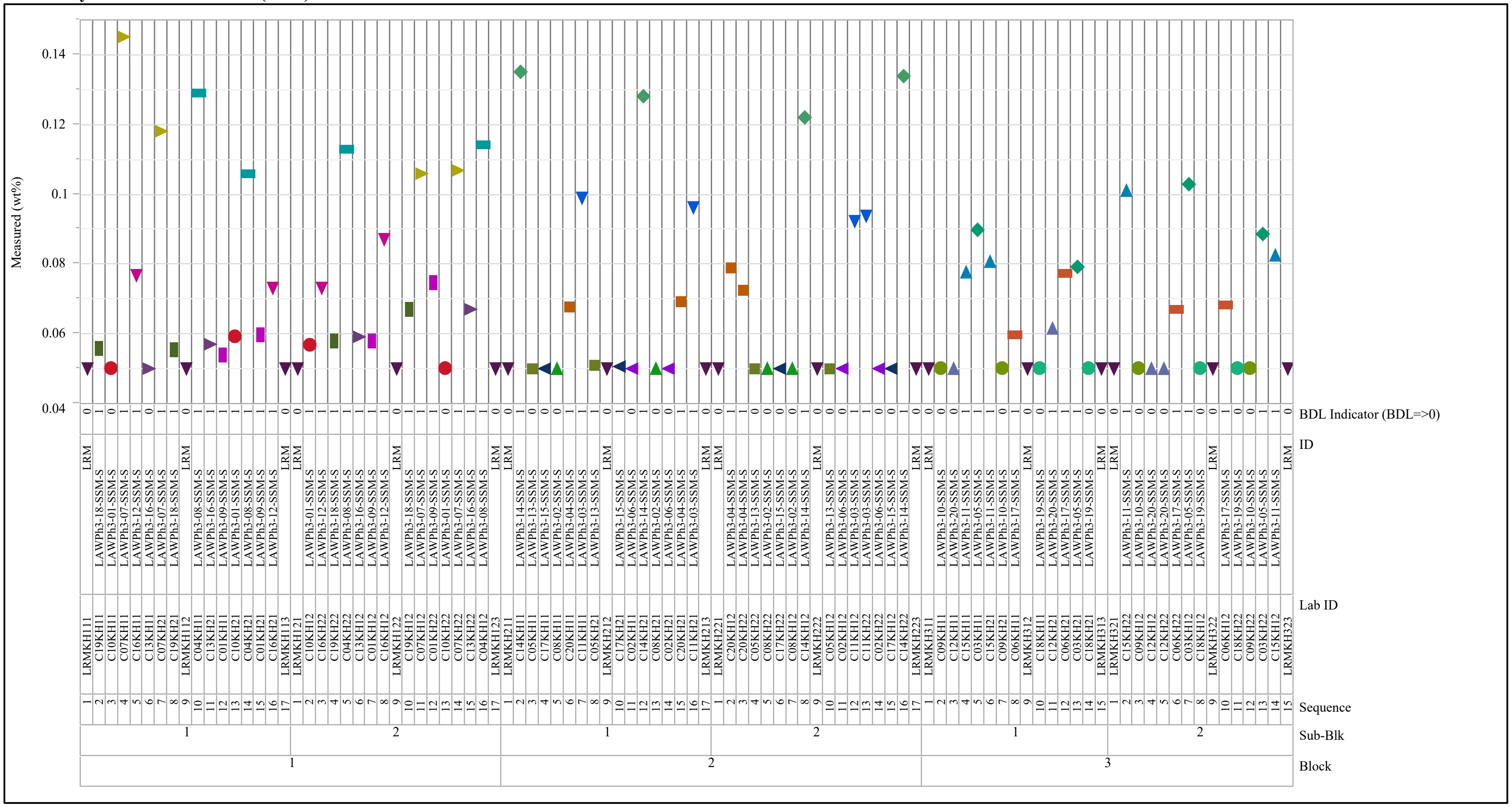


Exhibit B-1. Plots of Oxide Measurements in Analytical Sequence (continued)

Analyte=Cr2O3 (wt%), Prep Method=LM
Variability Chart for Measured (wt%)

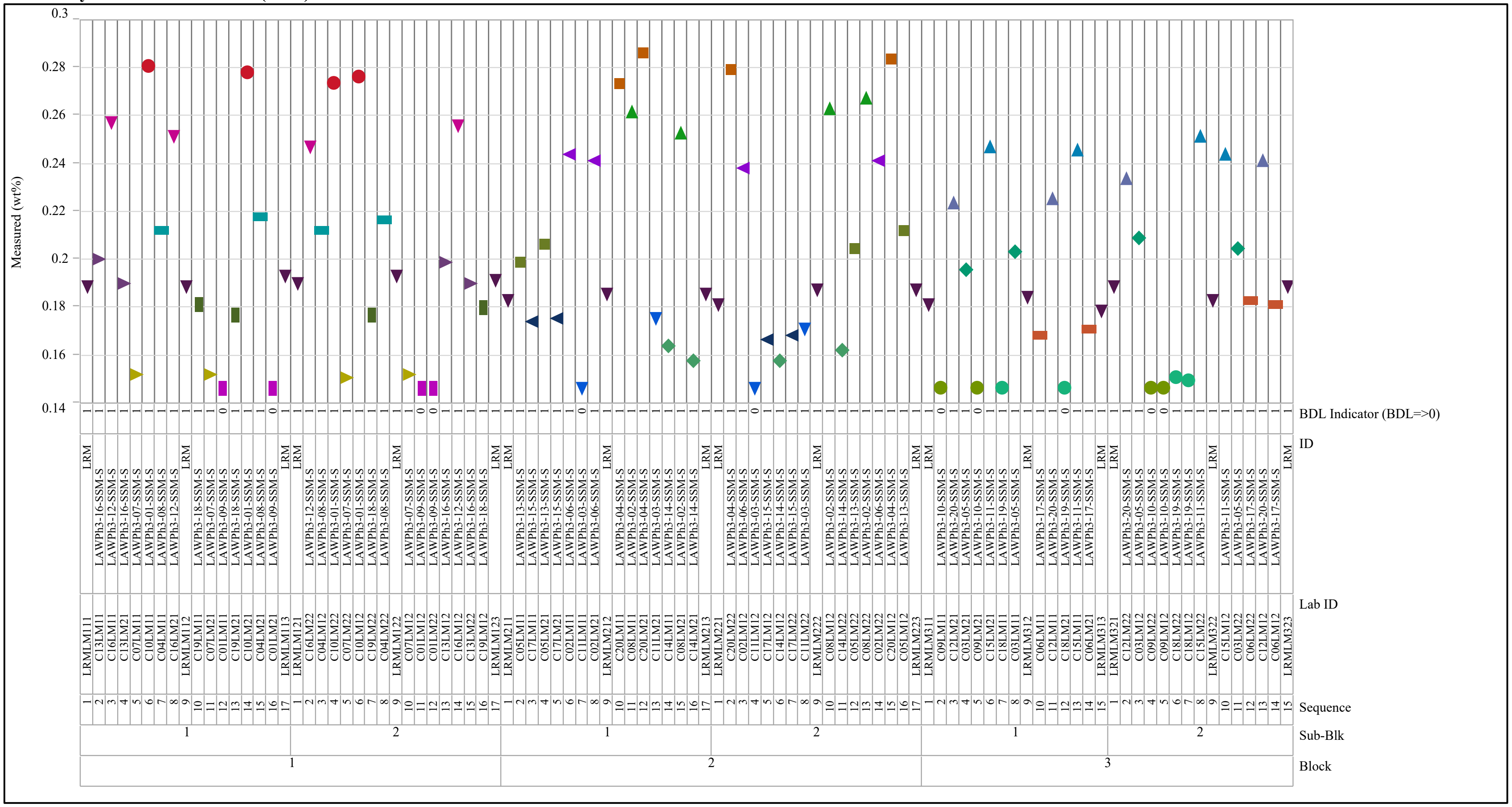


Exhibit B-1. Plots of Oxide Measurements in Analytical Sequence (continued)

Analyte=F (wt%), Prep Method=KH
Variability Chart for Measured (wt%)

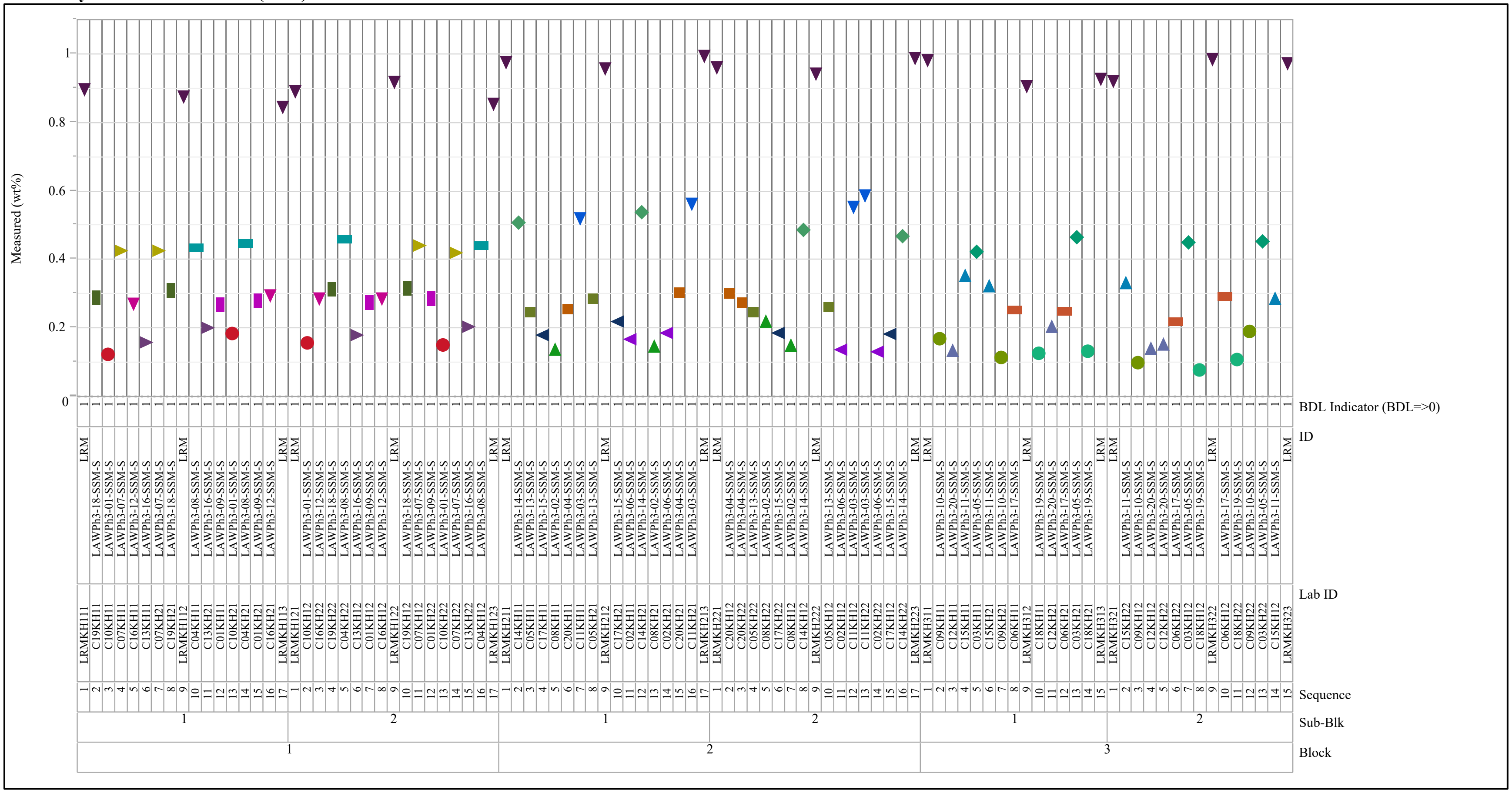


Exhibit B-1. Plots of Oxide Measurements in Analytical Sequence (continued)

Analyte=Fe2O3 (wt%), Prep Method=LM
Variability Chart for Measured (wt%)

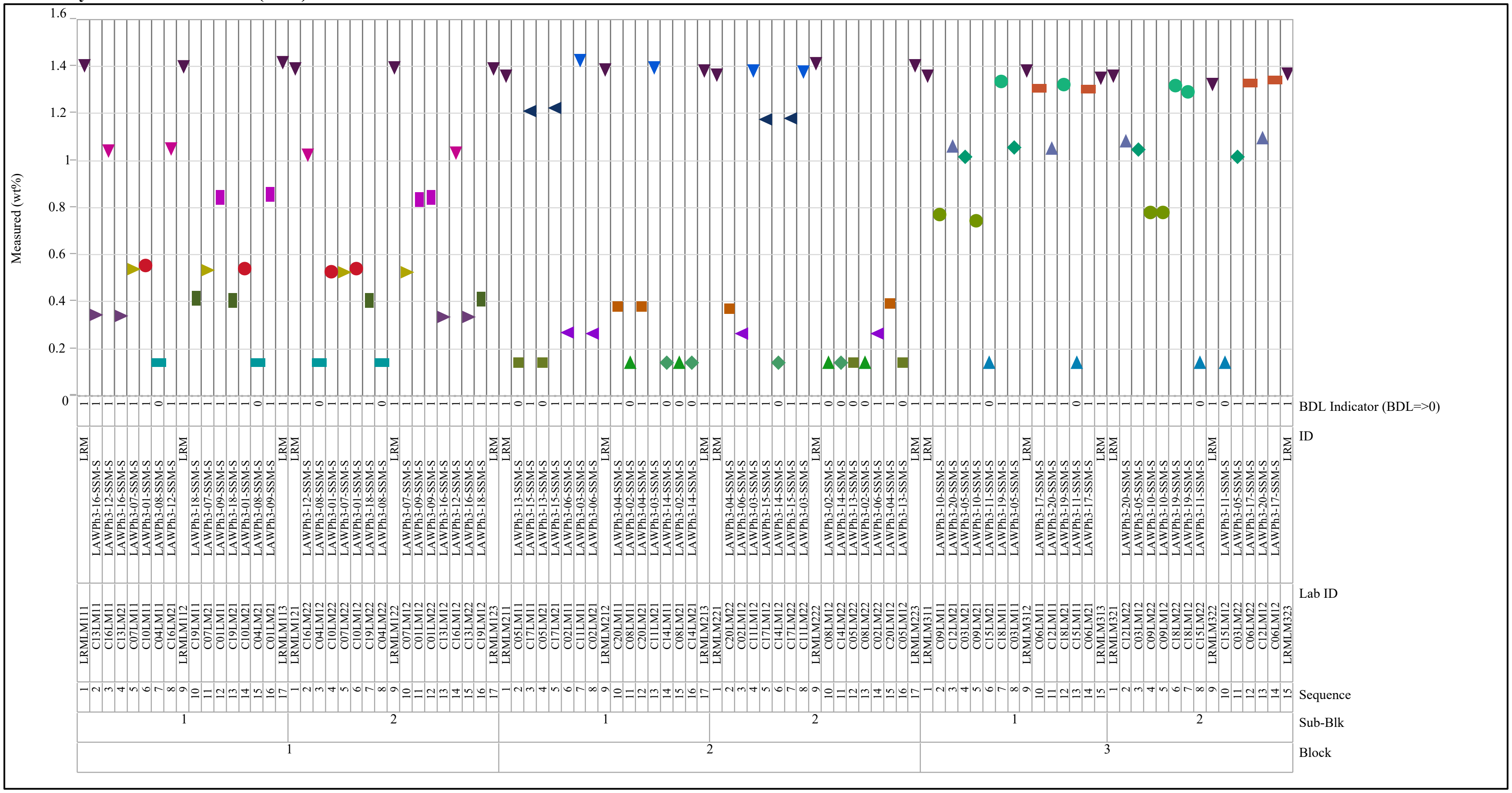


Exhibit B-1. Plots of Oxide Measurements in Analytical Sequence (continued)

Analyte=K2O (wt%), Prep Method=LM
Variability Chart for Measured (wt%)

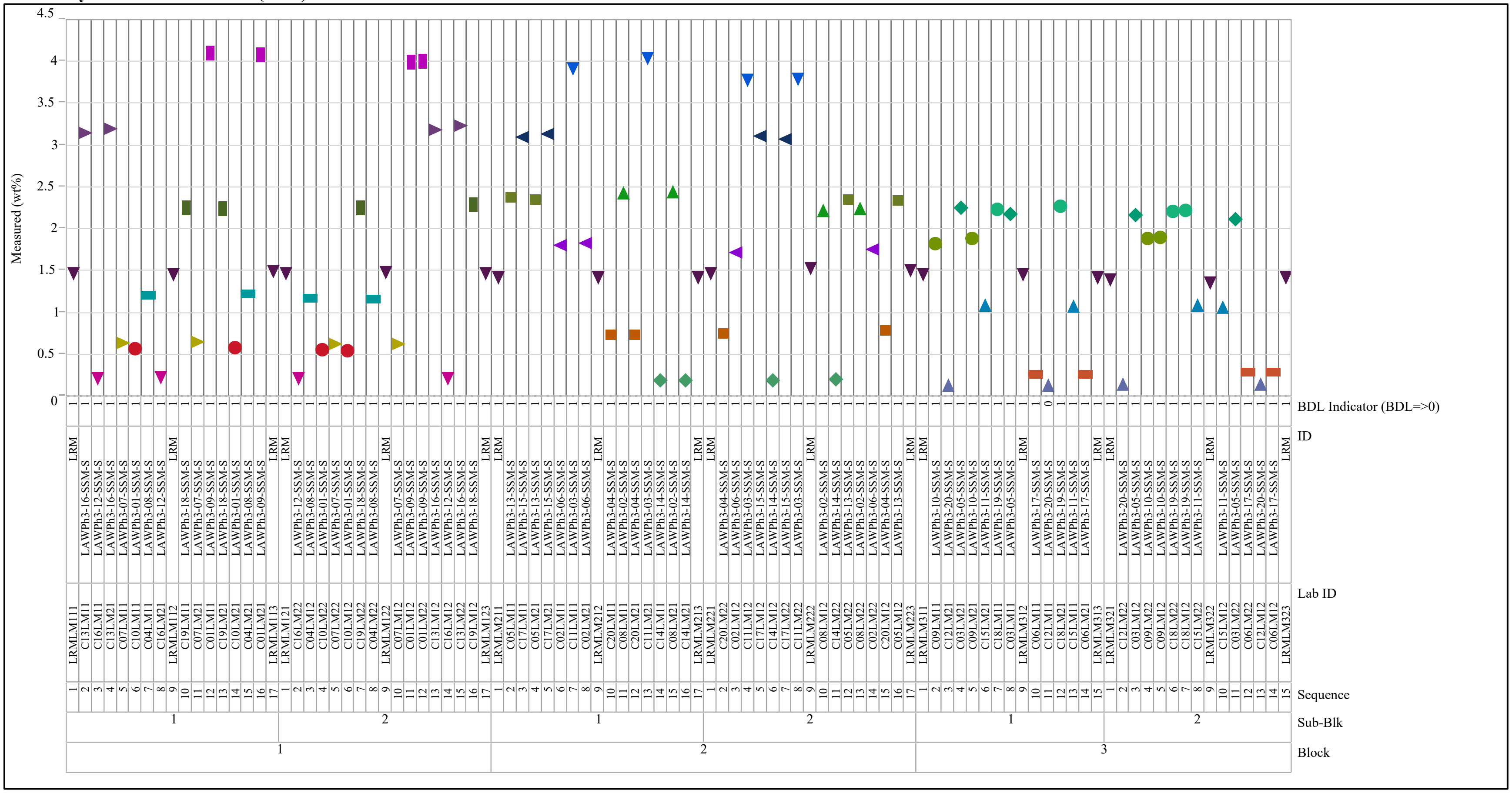


Exhibit B-1. Plots of Oxide Measurements in Analytical Sequence (continued)

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

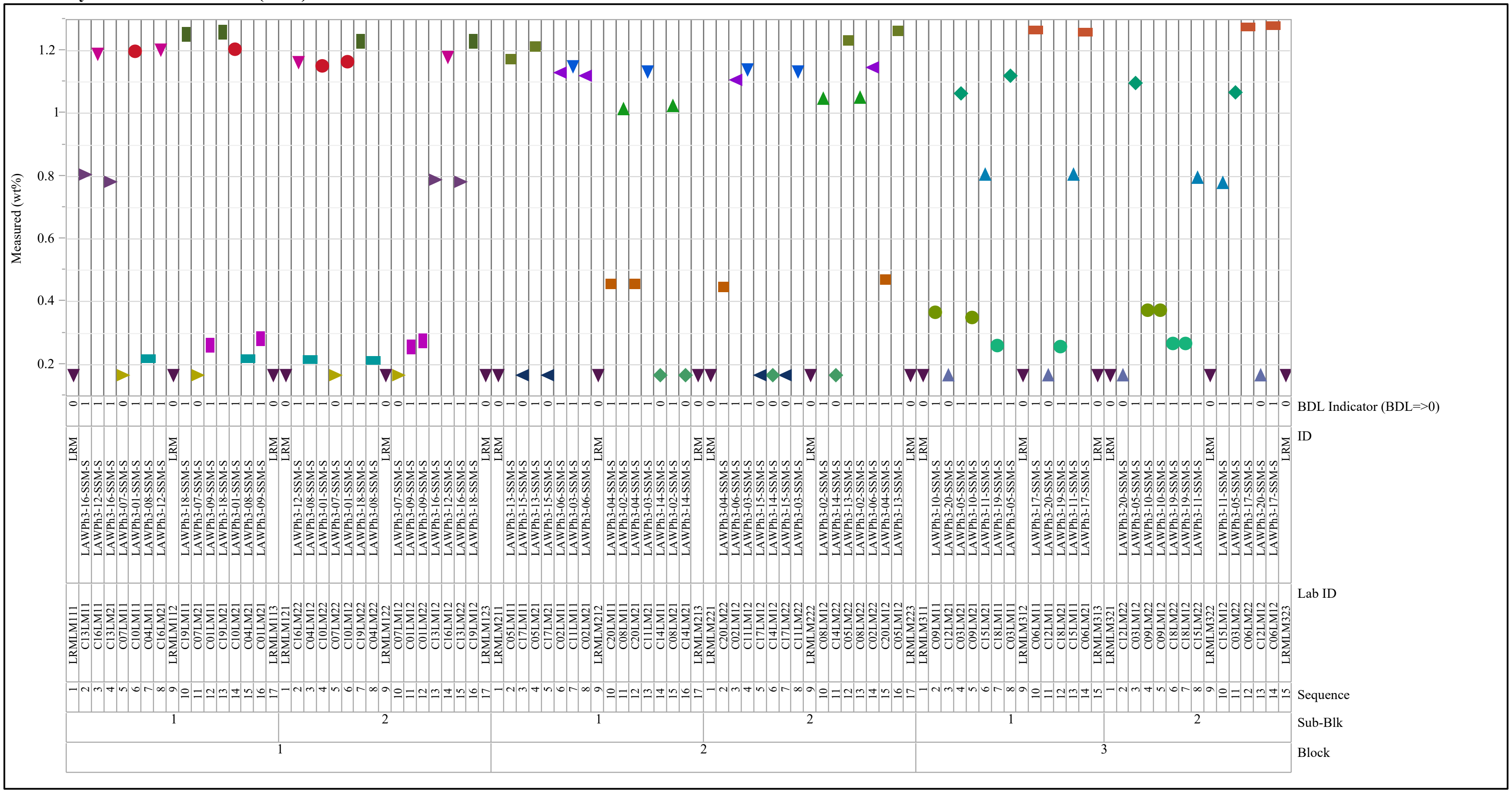


Exhibit B-1. Plots of Oxide Measurements in Analytical Sequence (continued)

Analyte=Na2O (wt%), Prep Method=LM
Variability Chart for Measured (wt%)

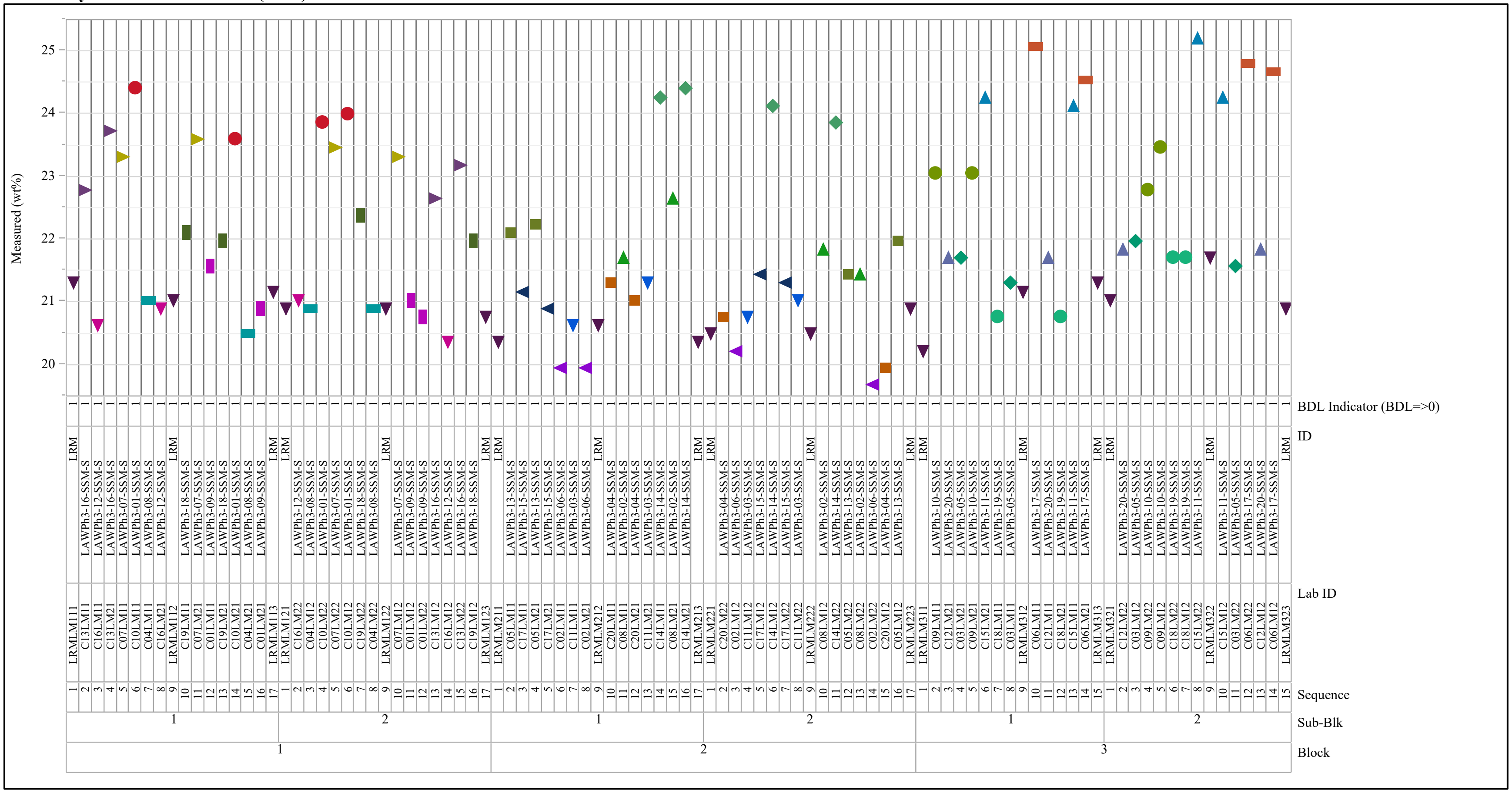


Exhibit B-1. Plots of Oxide Measurements in Analytical Sequence (continued)

Analyte=P2O5 (wt%), Prep Method=LM
Variability Chart for Measured (wt%)

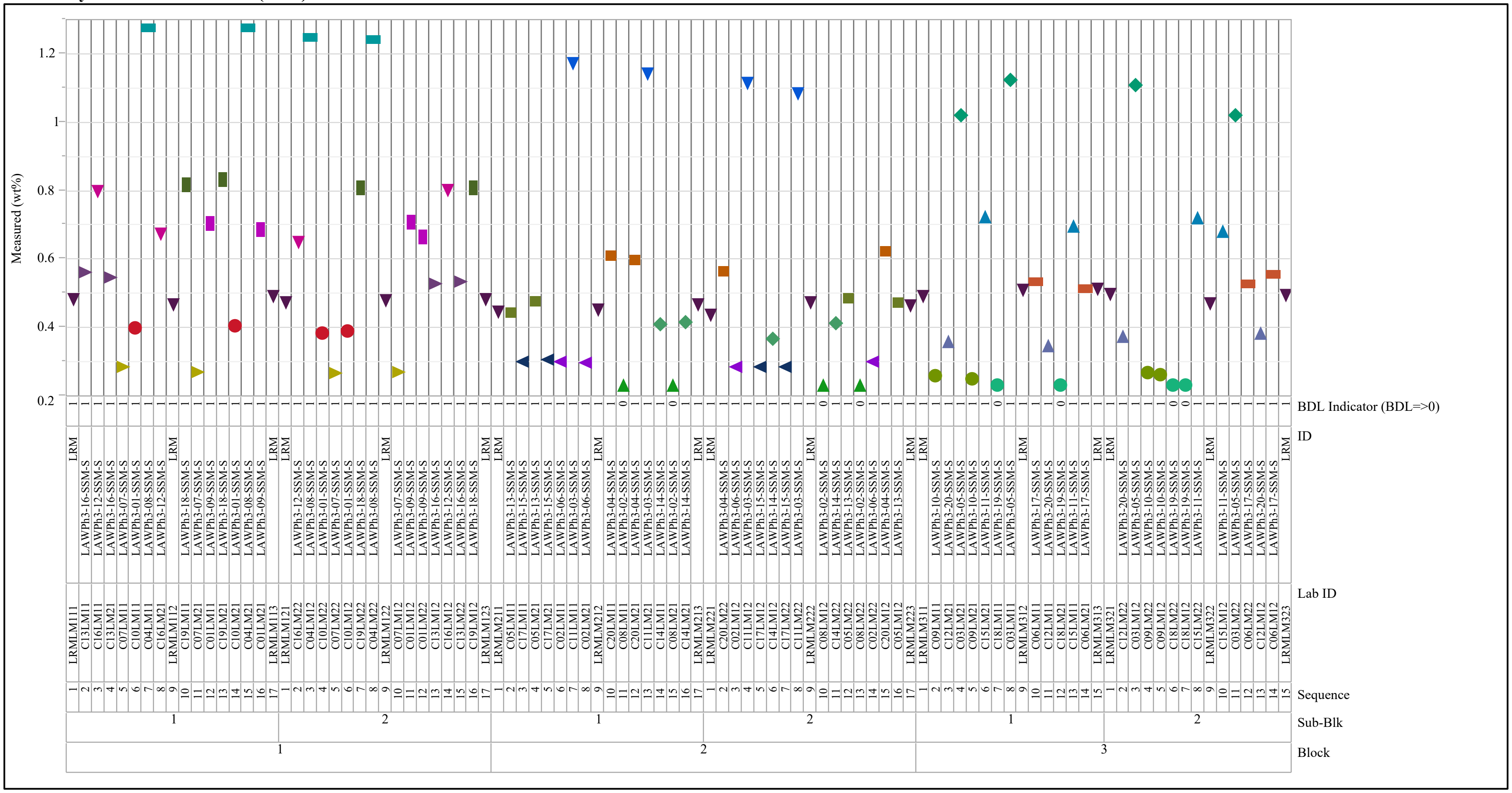


Exhibit B-1. Plots of Oxide Measurements in Analytical Sequence (continued)

Analyte=SiO2 (wt%), Prep Method=PS
Variability Chart for Measured (wt%)

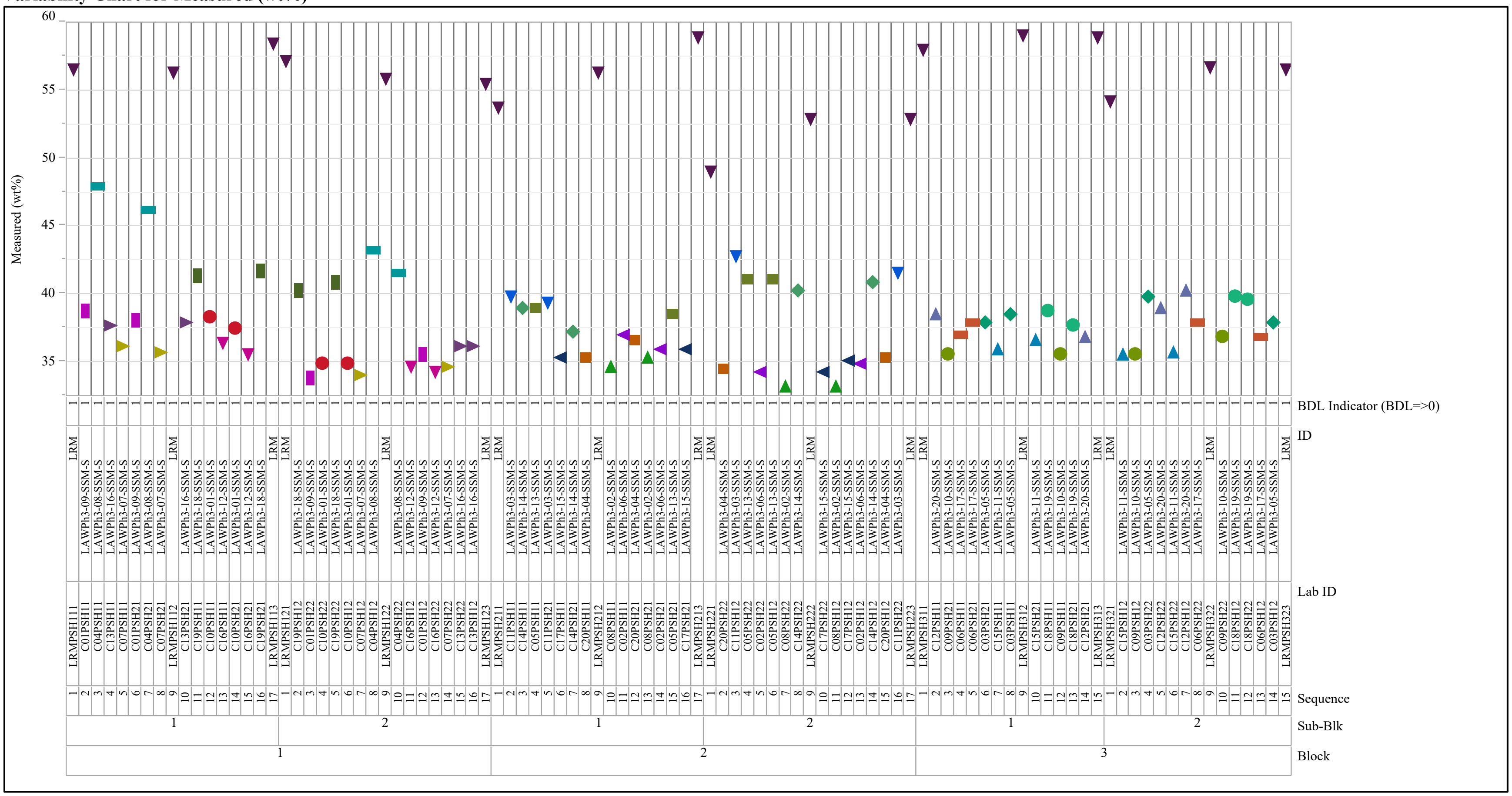


Exhibit B-1. Plots of Oxide Measurements in Analytical Sequence (continued)

Analyte=SnO2 (wt%), Prep Method=LM
Variability Chart for Measured (wt%)

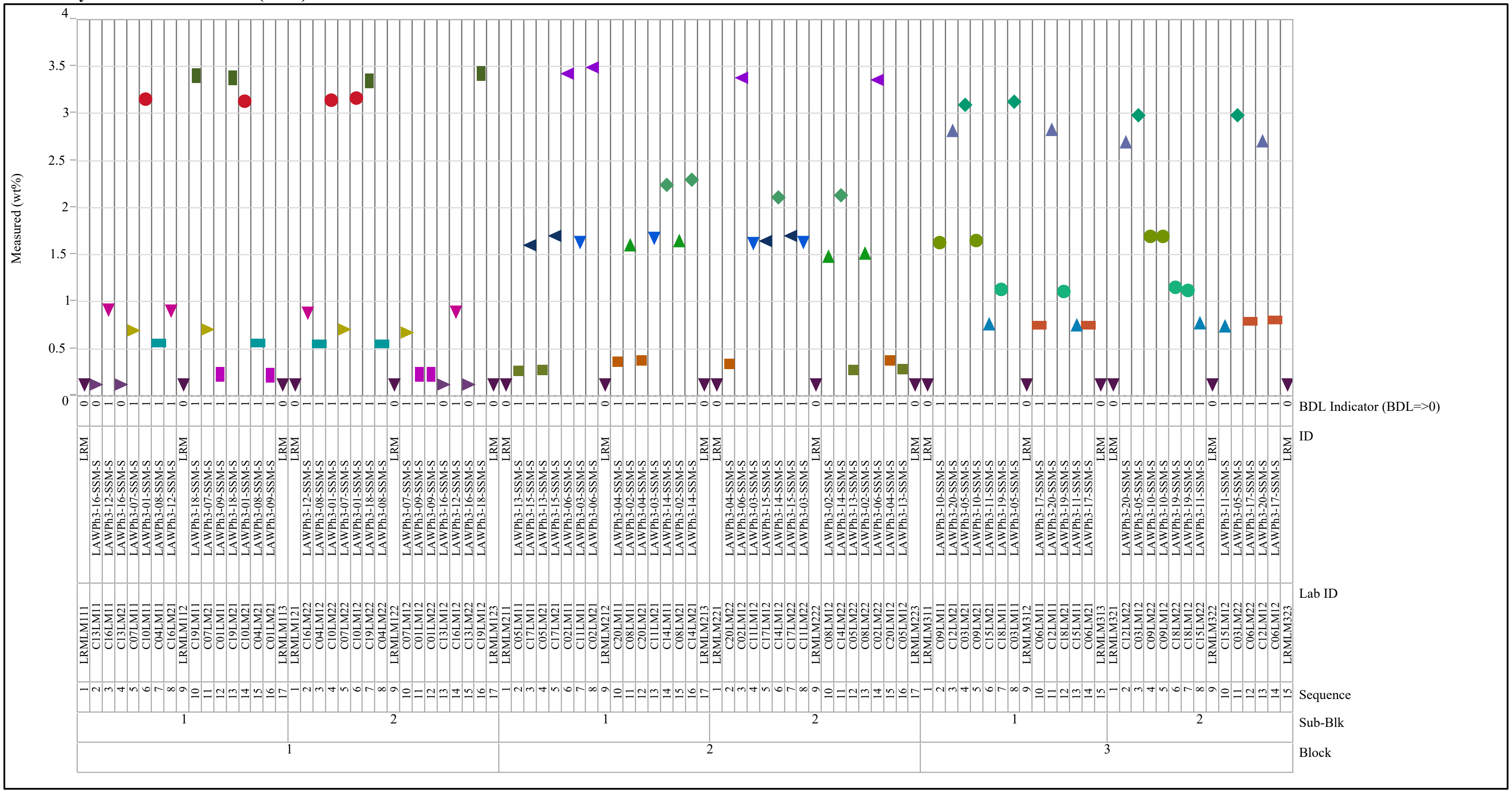


Exhibit B-1. Plots of Oxide Measurements in Analytical Sequence (continued)

Analyte=SO3 (wt%), Prep Method=LM
Variability Chart for Measured (wt%)

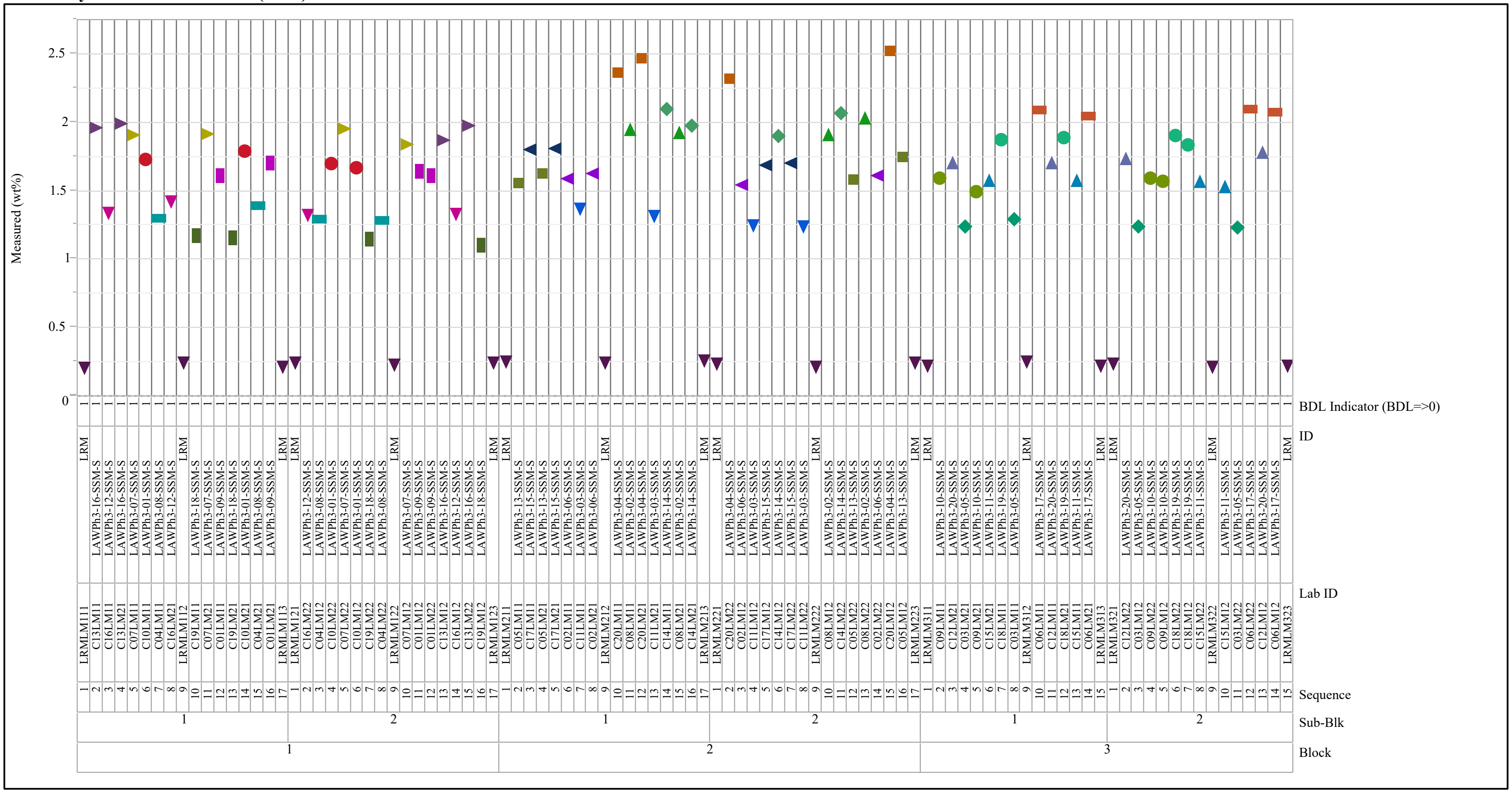


Exhibit B-1. Plots of Oxide Measurements in Analytical Sequence (continued)

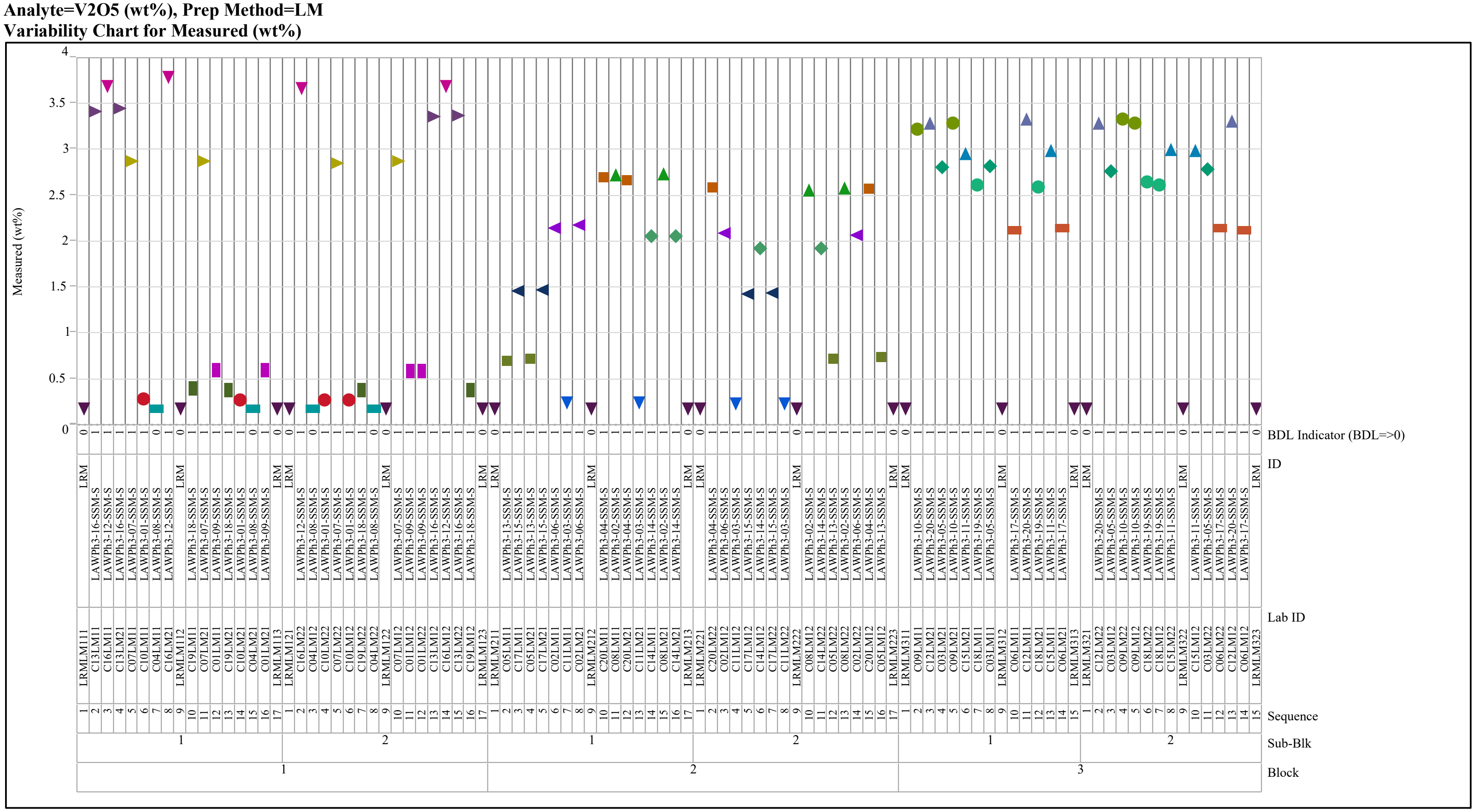


Exhibit B-1. Plots of Oxide Measurements in Analytical Sequence (continued)

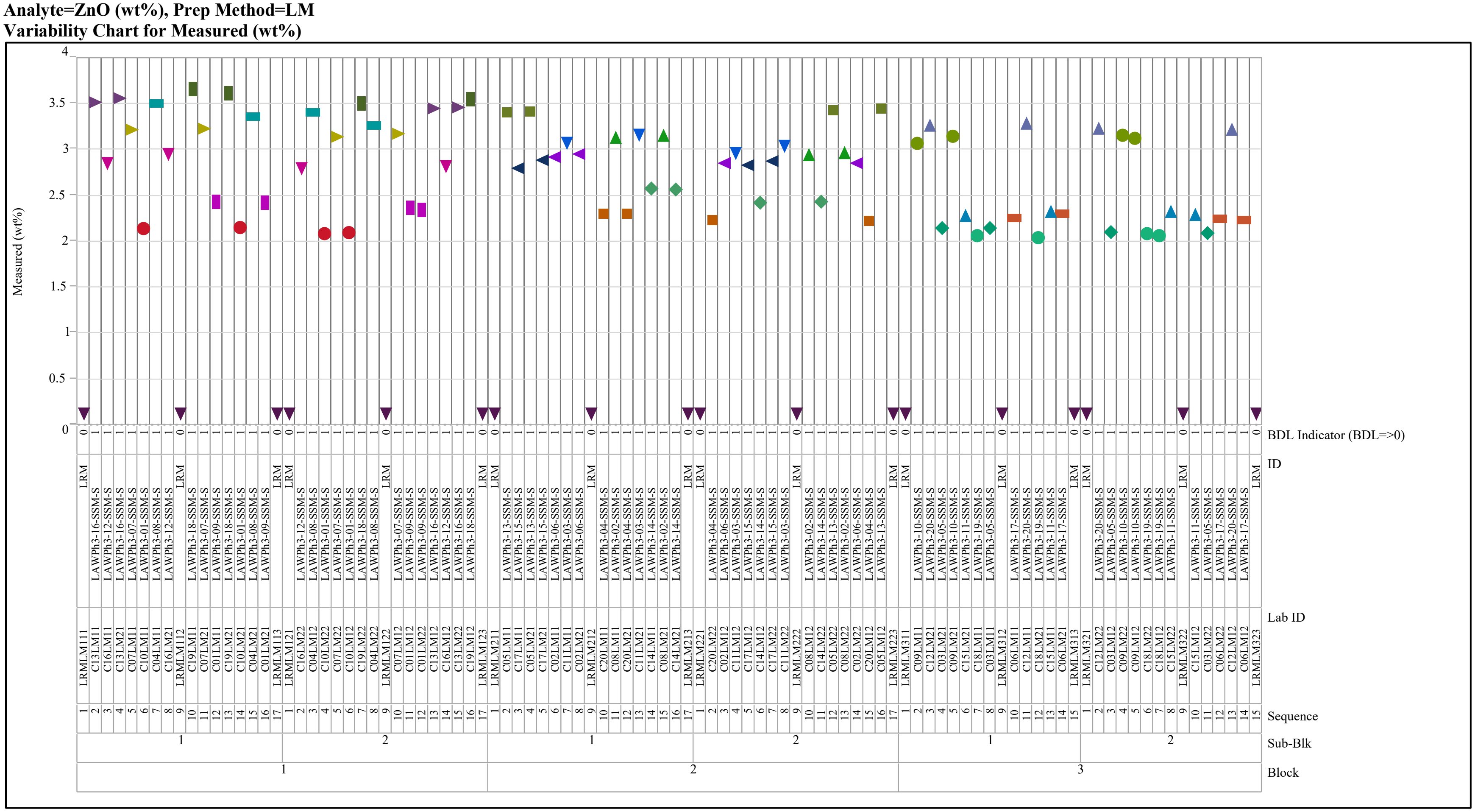


Exhibit B-1. Plots of Oxide Measurements in Analytical Sequence (continued)

Analyte=ZrO2 (wt%), Prep Method=LM
Variability Chart for Measured (wt%)

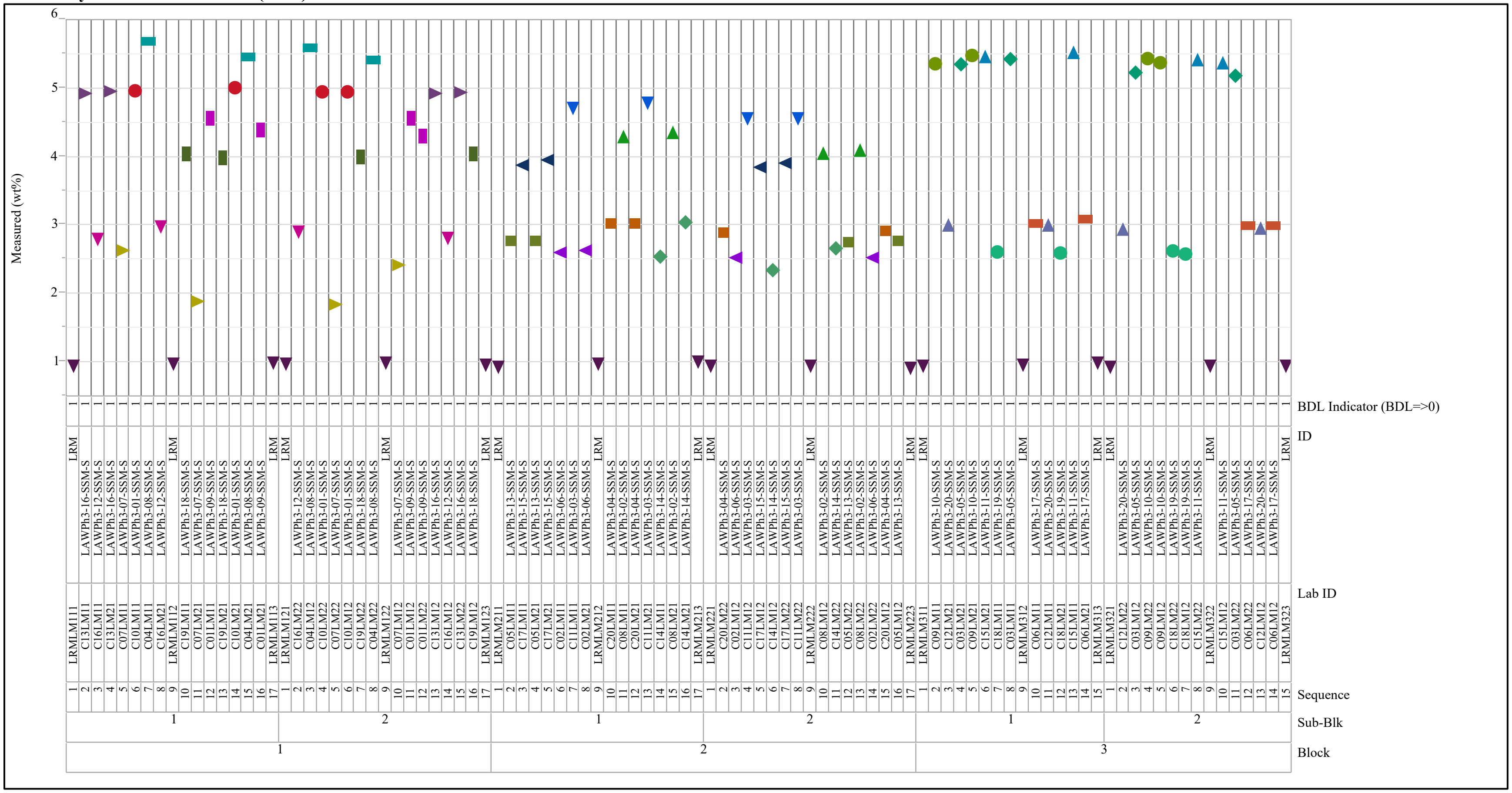


Exhibit B-2. Plots of Oxide Measurements by Glass Identifier Grouped by Targeted Concentrations

Analyte=Al2O3 (wt%), Prep Method=PS
Variability Chart for Measured (wt%)

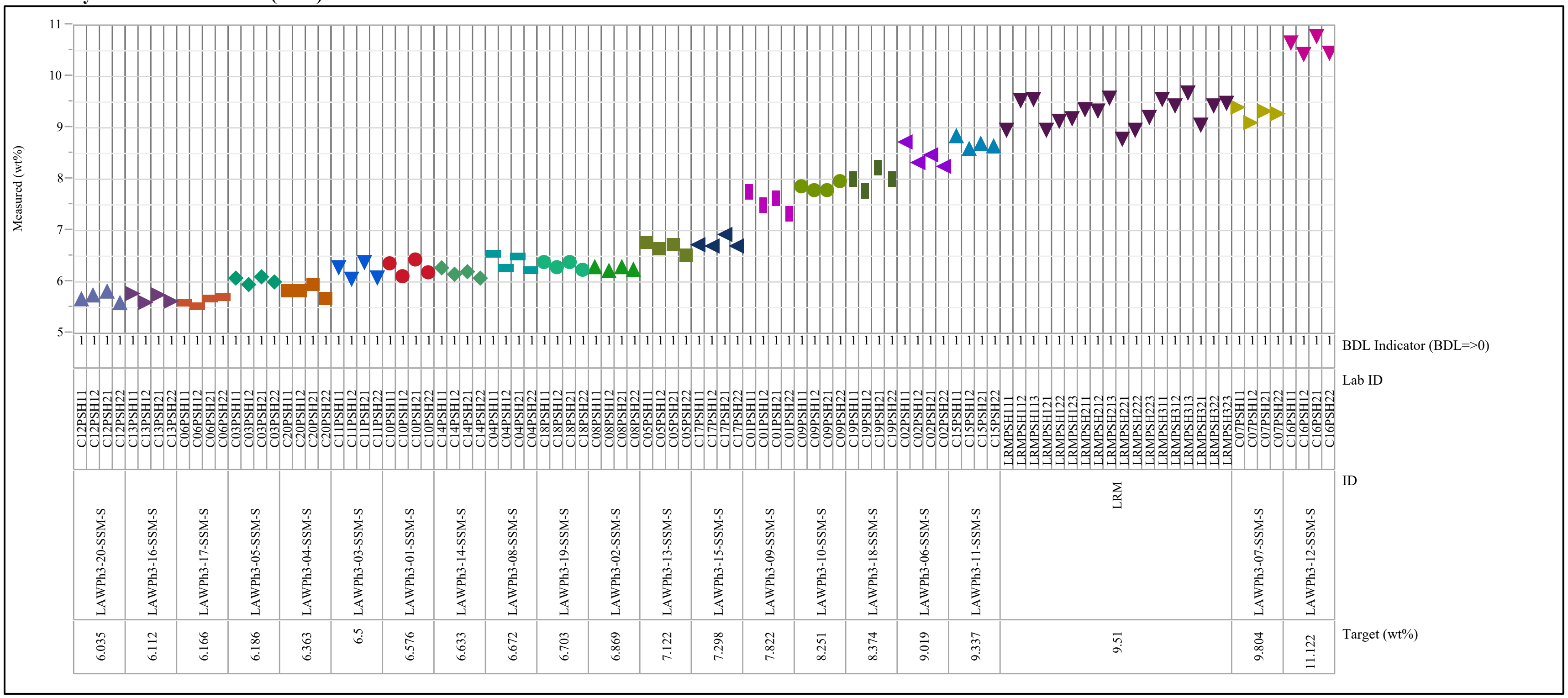


Exhibit B-2. Plots of Oxide Measurements by Glass Identifier Grouped by Targeted Concentrations (continued)

Analyte=B2O3 (wt%), Prep Method=PS
Variability Chart for Measured (wt%)

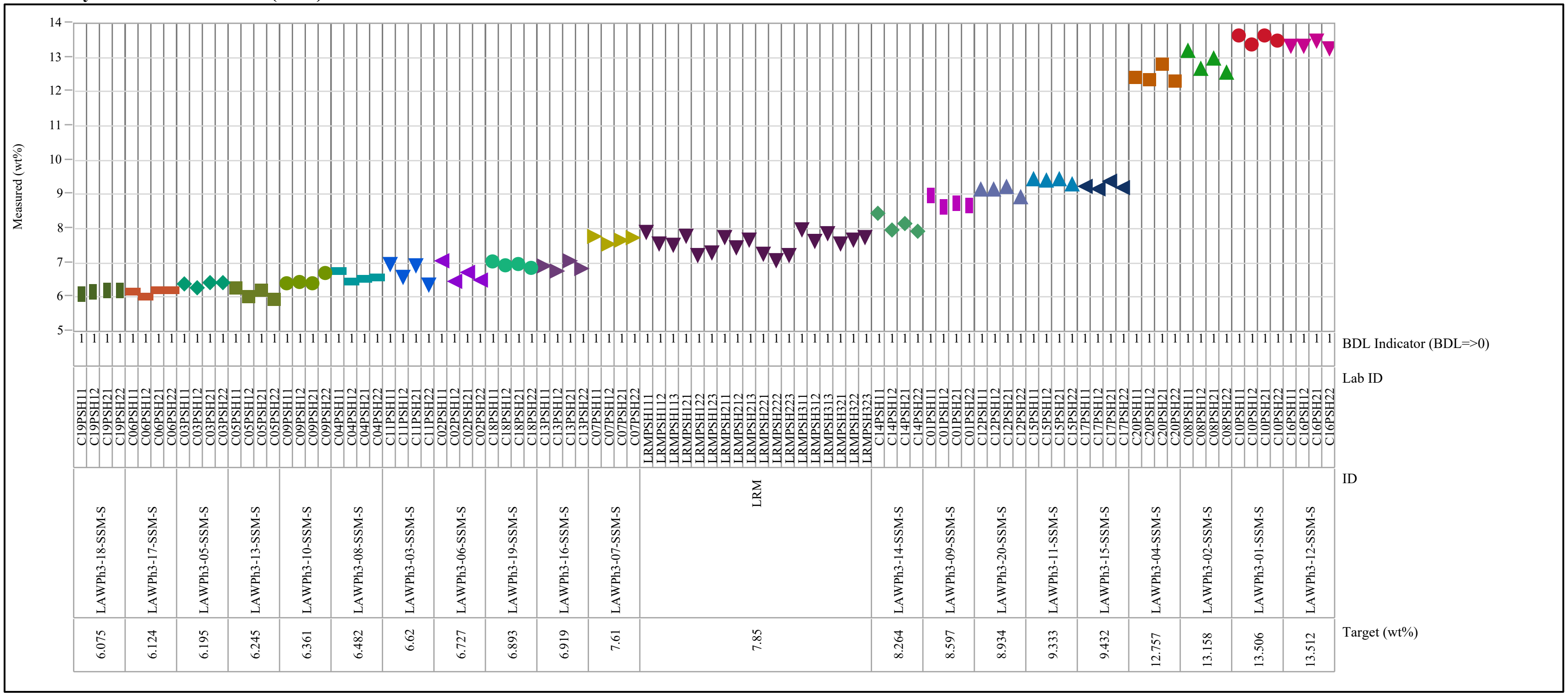


Exhibit B-2. Plots of Oxide Measurements by Glass Identifier Grouped by Targeted Concentrations (continued)

Analyte=CaO (wt%), Prep Method=PS
Variability Chart for Measured (wt%)

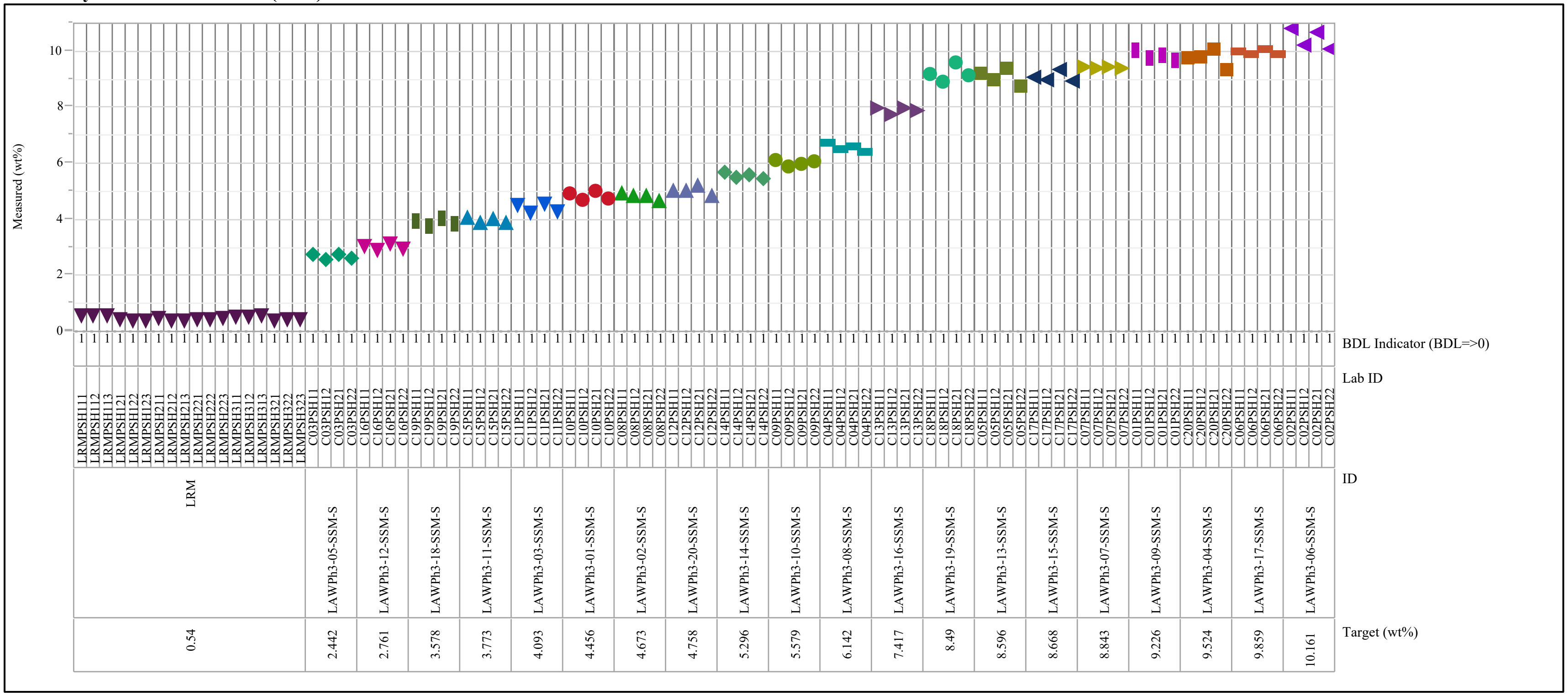


Exhibit B-2. Plots of Oxide Measurements by Glass Identifier Grouped by Targeted Concentrations (continued)

Analyte=Cl (wt%), Prep Method=KH
Variability Chart for Measured (wt%)

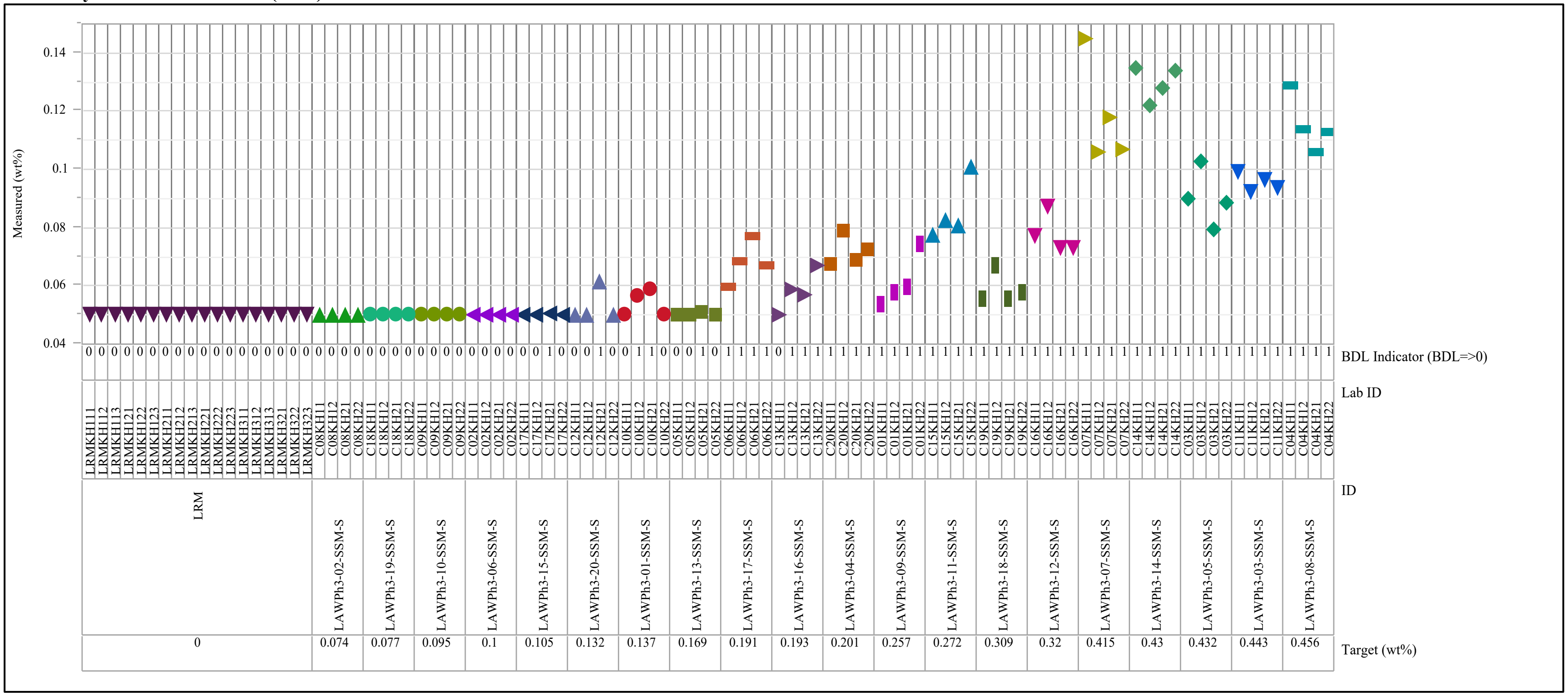


Exhibit B-2. Plots of Oxide Measurements by Glass Identifier Grouped by Targeted Concentrations (continued)

Analyte=Cr2O3 (wt%), Prep Method=LM
Variability Chart for Measured (wt%)

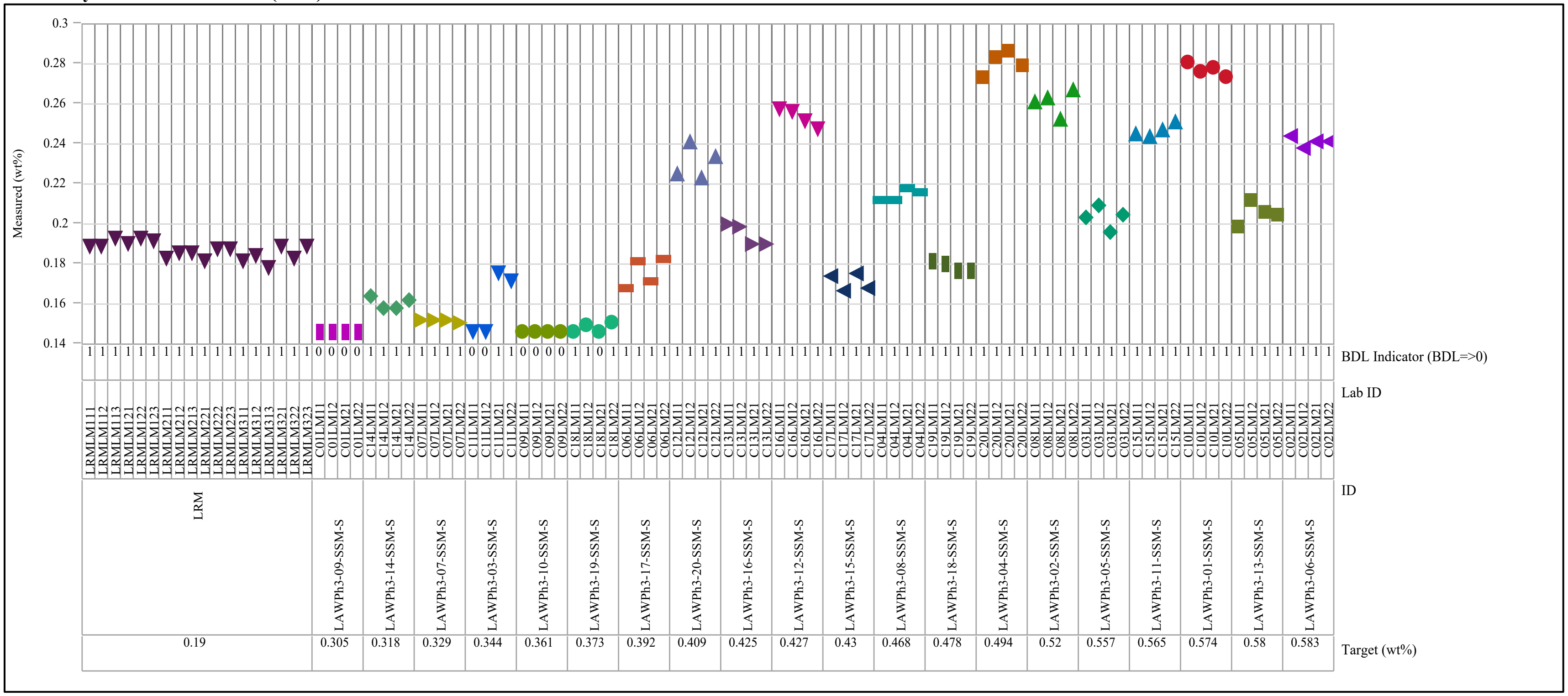


Exhibit B-2. Plots of Oxide Measurements by Glass Identifier Grouped by Targeted Concentrations (continued)

Analyte=F (wt%), Prep Method=KH
Variability Chart for Measured (wt%)

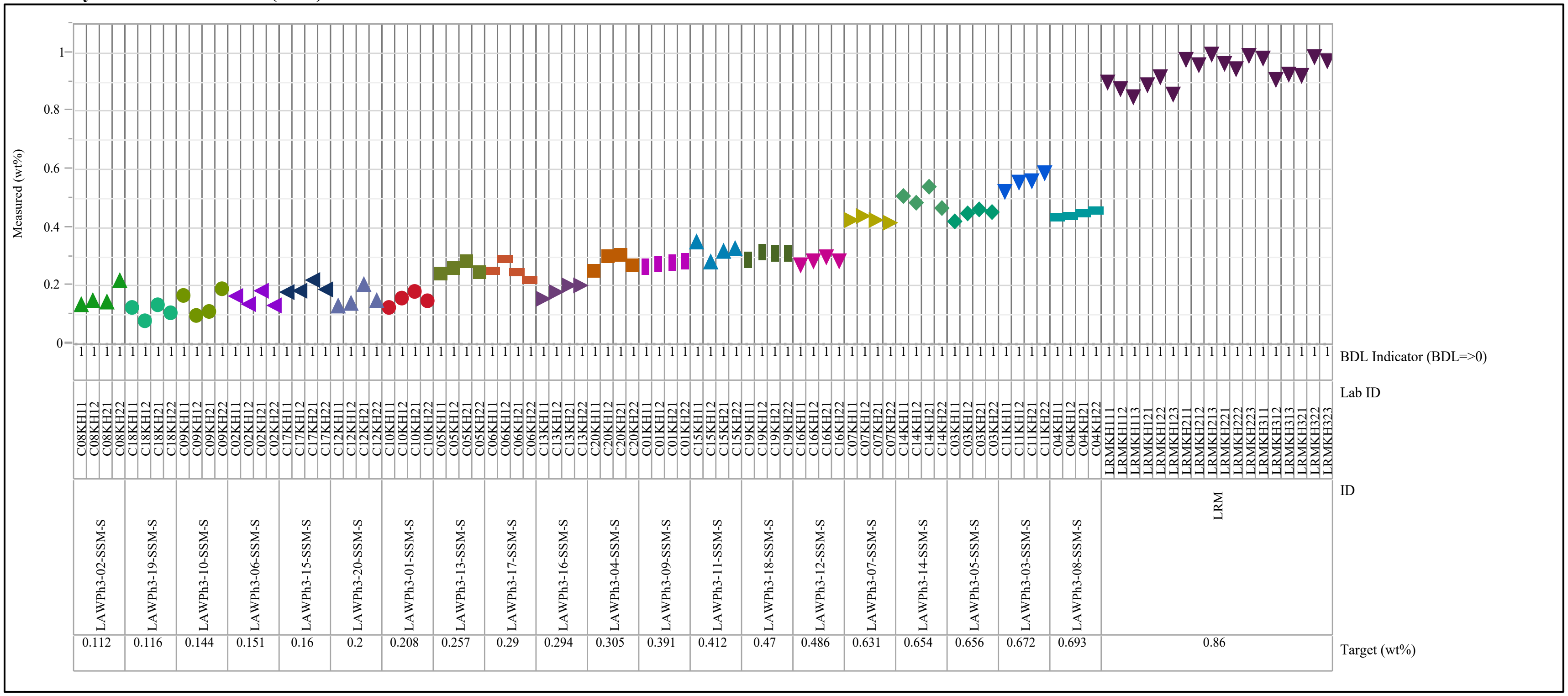


Exhibit B-2. Plots of Oxide Measurements by Glass Identifier Grouped by Targeted Concentrations (continued)

Analyte=Fe2O3 (wt%), Prep Method=LM
Variability Chart for Measured (wt%)

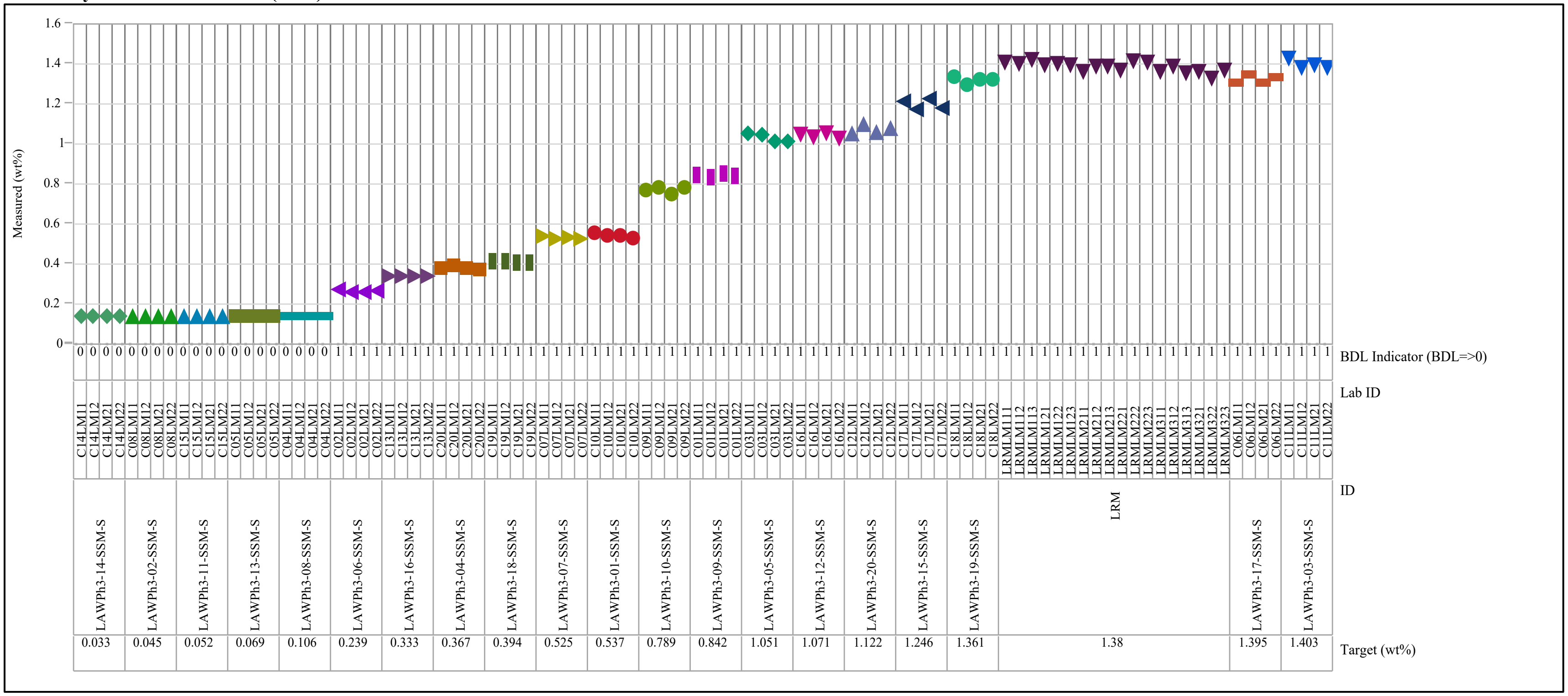


Exhibit B-2. Plots of Oxide Measurements by Glass Identifier Grouped by Targeted Concentrations (continued)

Analyte=K2O (wt%), Prep Method=LM
Variability Chart for Measured (wt%)

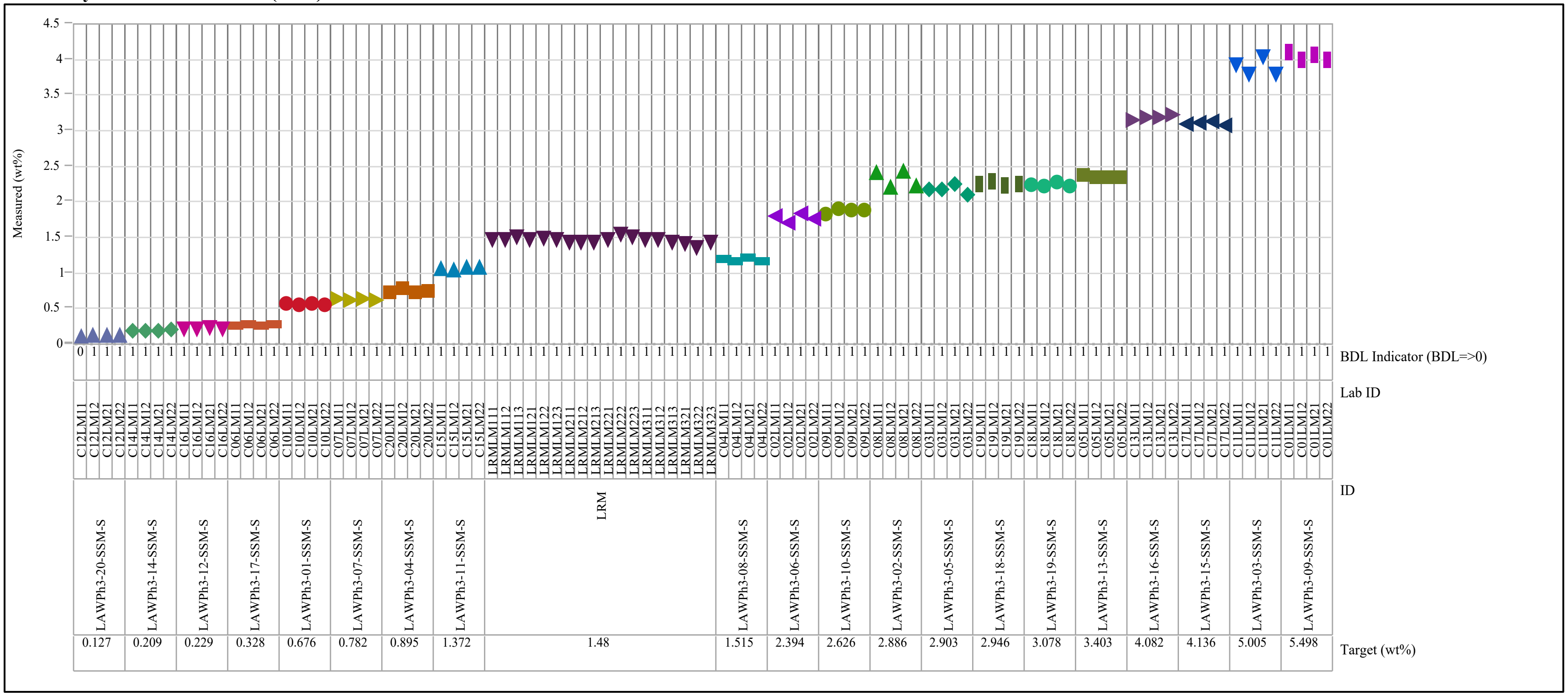


Exhibit B-2. Plots of Oxide Measurements by Glass Identifier Grouped by Targeted Concentrations (continued)

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

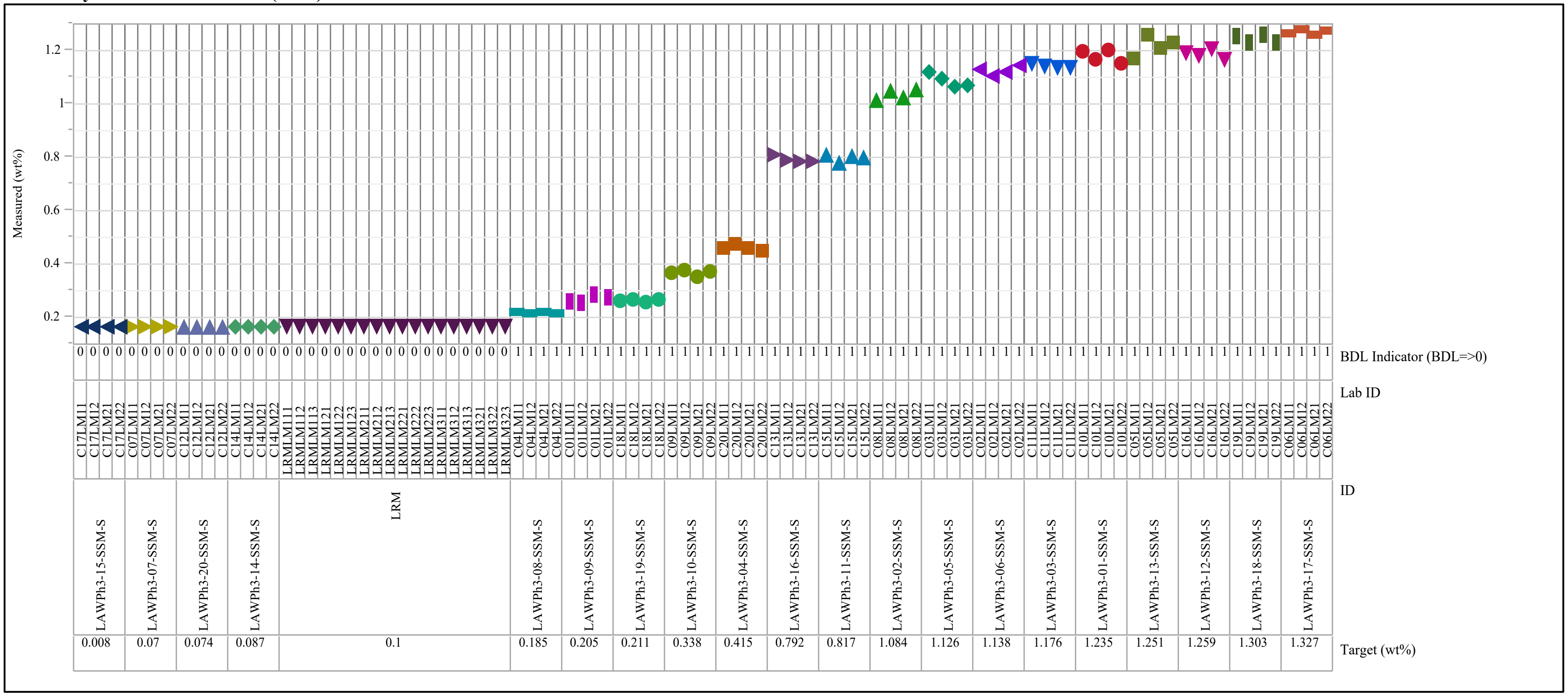


Exhibit B-2. Plots of Oxide Measurements by Glass Identifier Grouped by Targeted Concentrations (continued)

Analyte=Na2O (wt%), Prep Method=LM
Variability Chart for Measured (wt%)

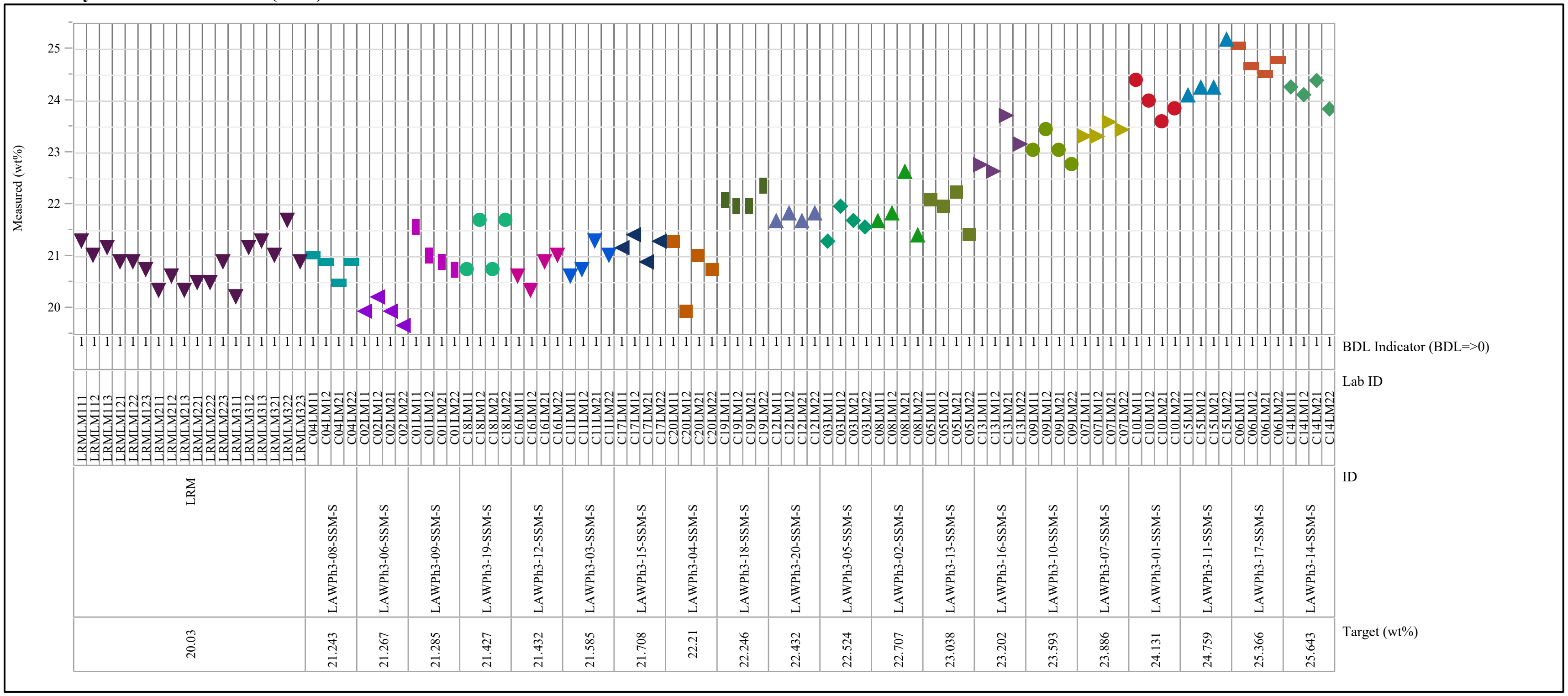


Exhibit B-2. Plots of Oxide Measurements by Glass Identifier Grouped by Targeted Concentrations (continued)

Analyte=P2O5 (wt%), Prep Method=LM
Variability Chart for Measured (wt%)

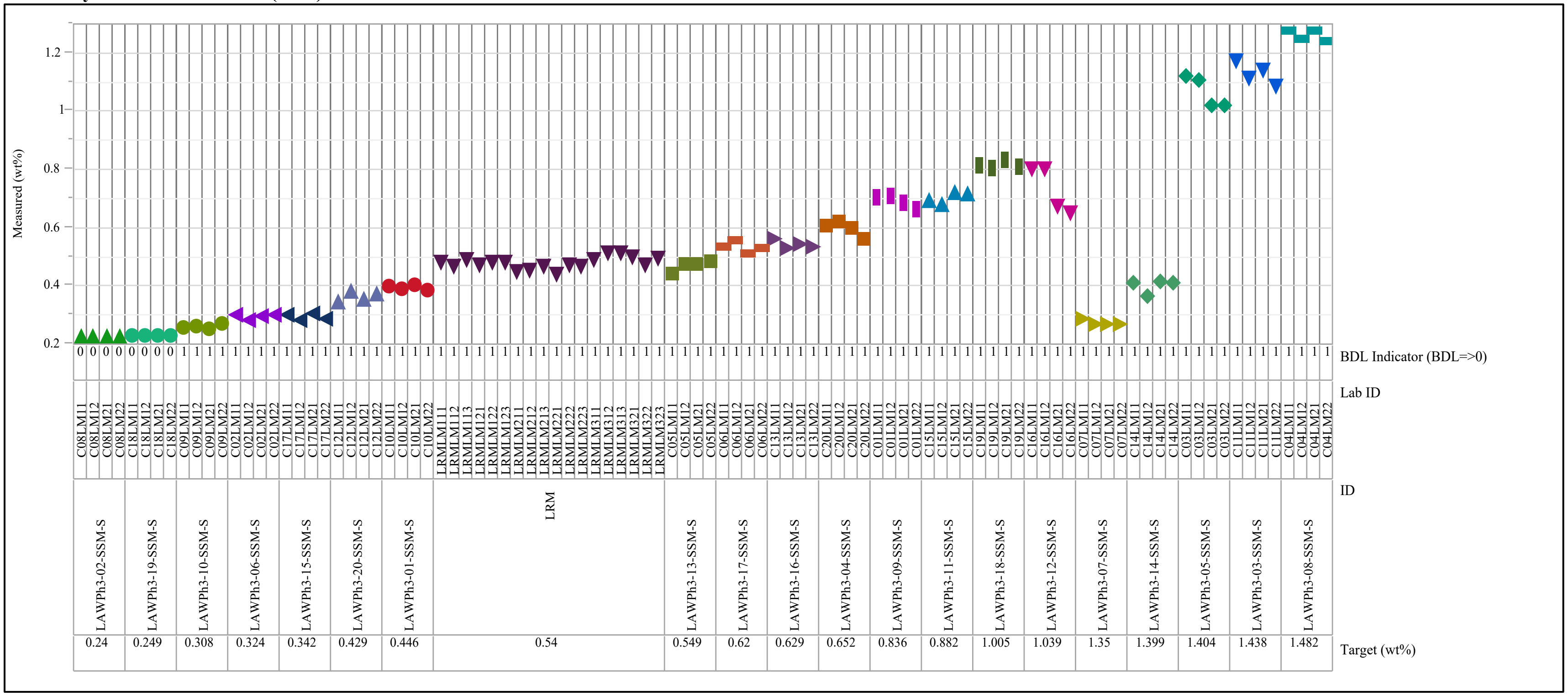


Exhibit B-2. Plots of Oxide Measurements by Glass Identifier Grouped by Targeted Concentrations (continued)

Analyte=SiO2 (wt%), Prep Method=PS
Variability Chart for Measured (wt%)

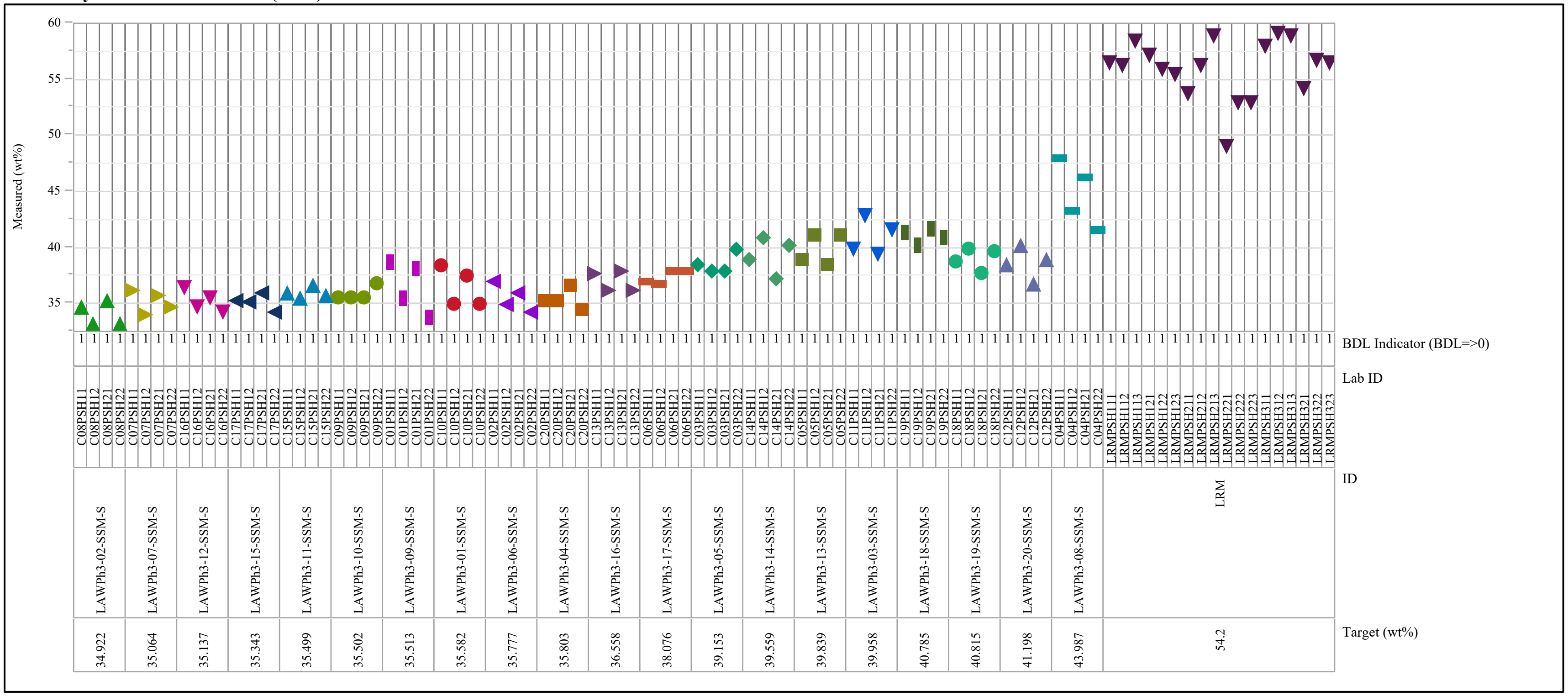


Exhibit B-2. Plots of Oxide Measurements by Glass Identifier Grouped by Targeted Concentrations (continued)

Analyte=SnO2 (wt%), Prep Method=LM
Variability Chart for Measured (wt%)

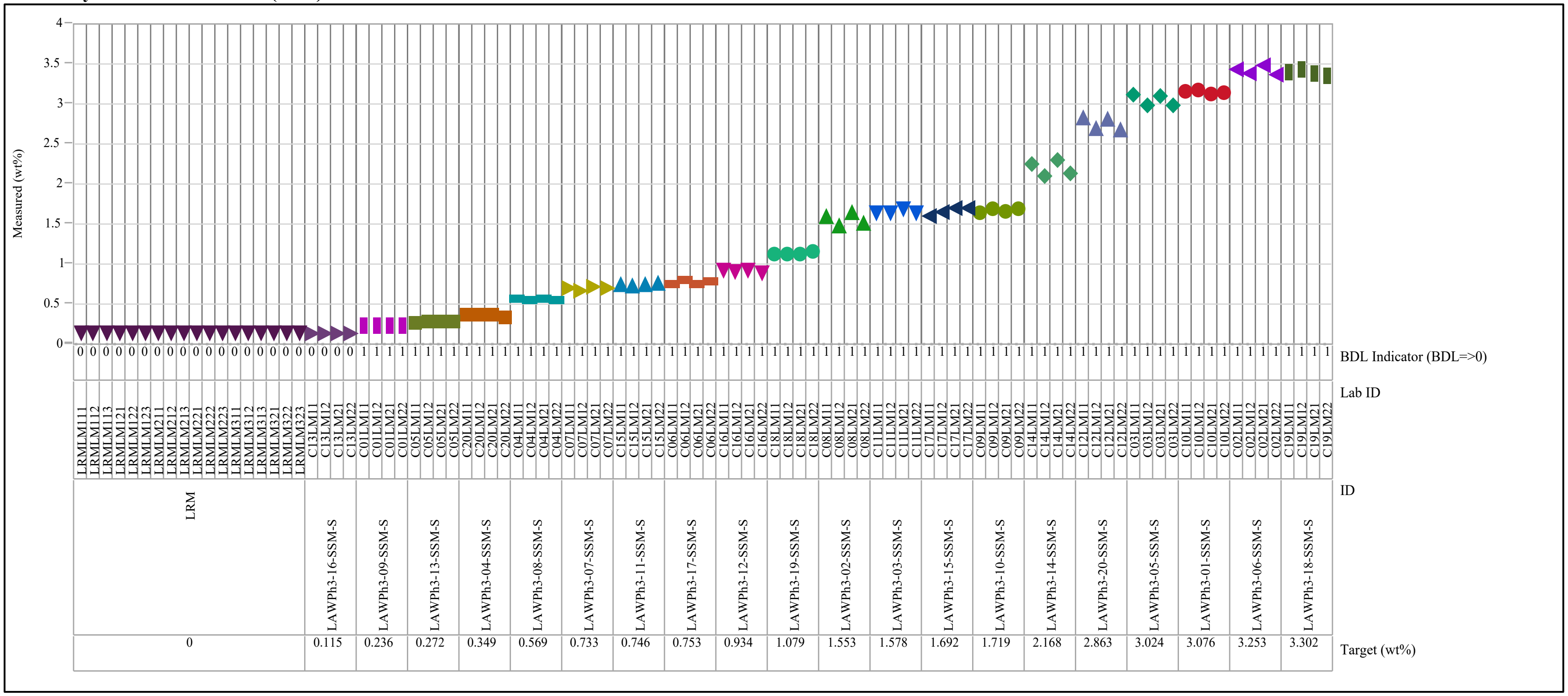


Exhibit B-2. Plots of Oxide Measurements by Glass Identifier Grouped by Targeted Concentrations (continued)

Analyte=SO3 (wt%), Prep Method=LM
Variability Chart for Measured (wt%)

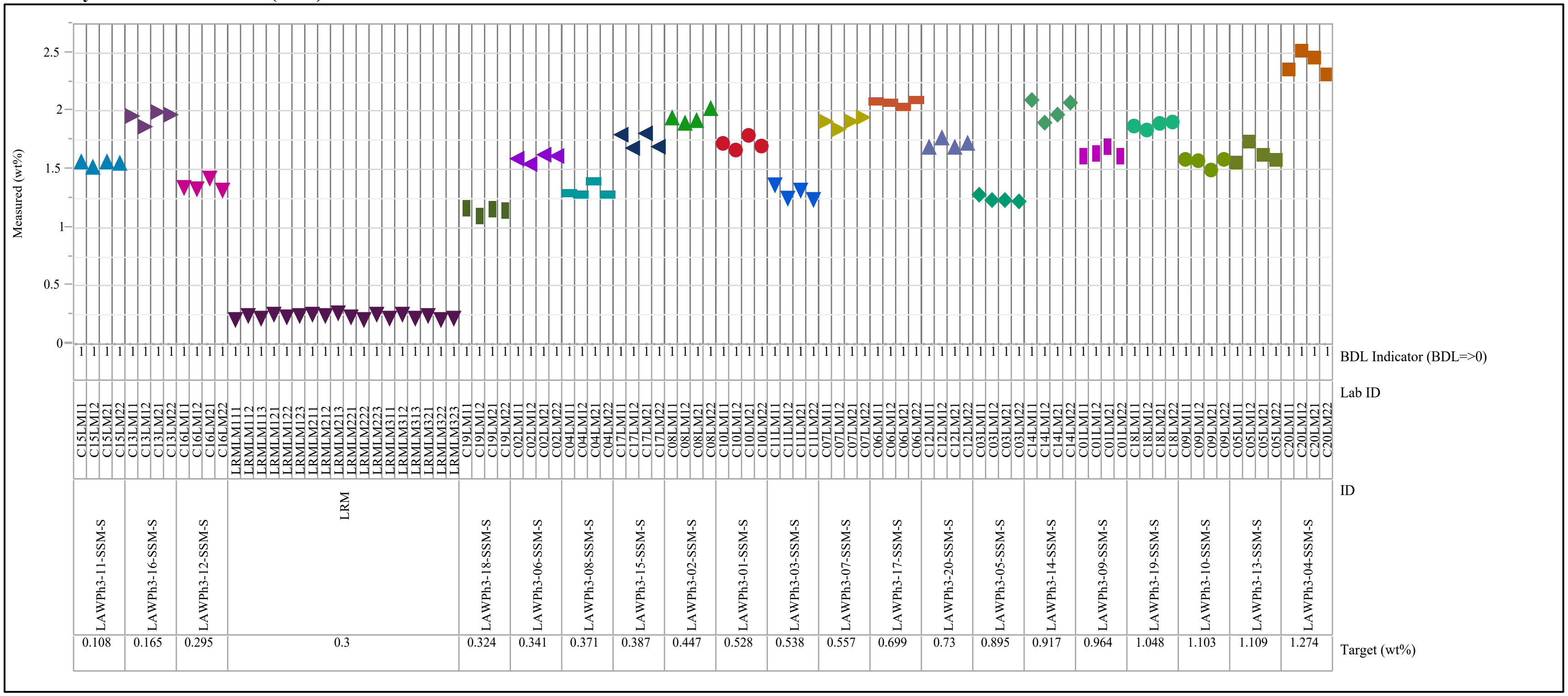


Exhibit B-2. Plots of Oxide Measurements by Glass Identifier Grouped by Targeted Concentrations (continued)

Analyte=V2O5 (wt%), Prep Method=LM
Variability Chart for Measured (wt%)

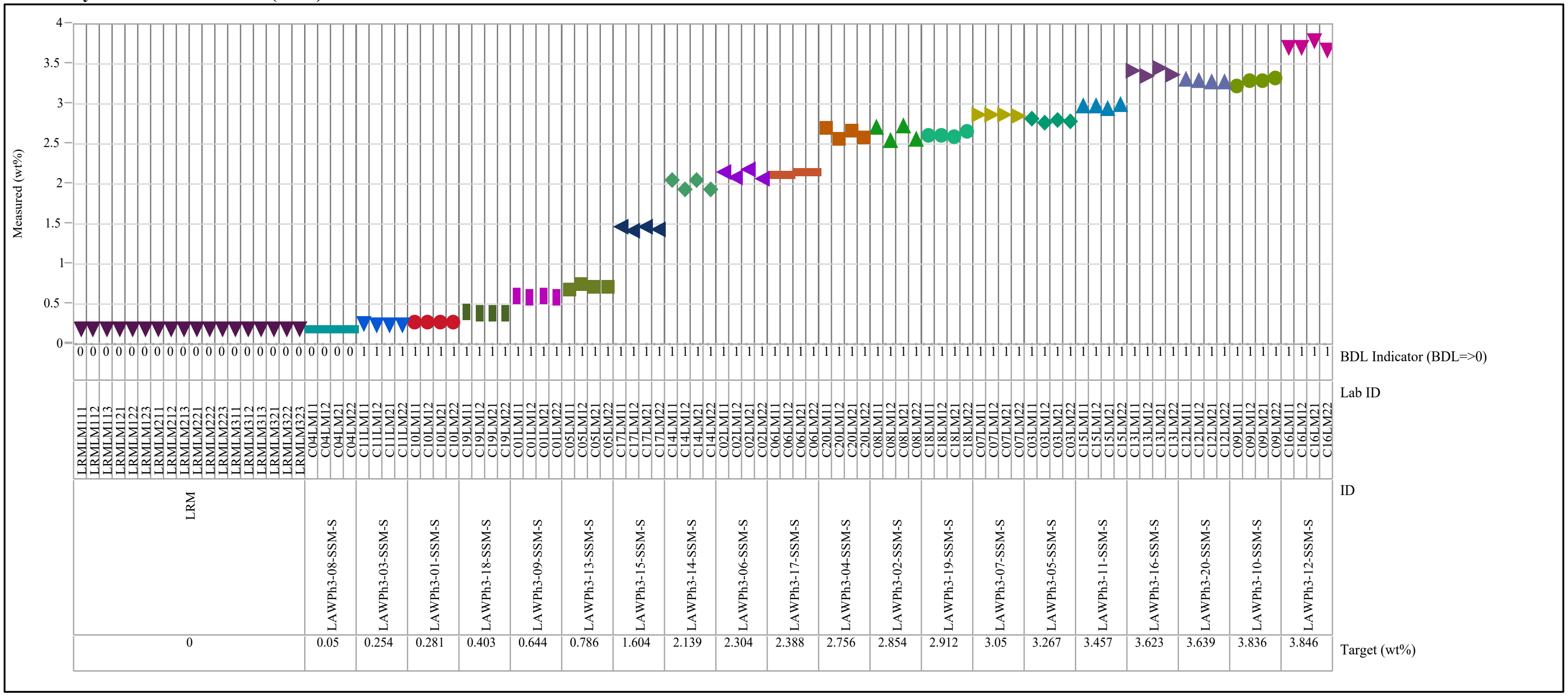


Exhibit B-2. Plots of Oxide Measurements by Glass Identifier Grouped by Targeted Concentrations (continued)

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

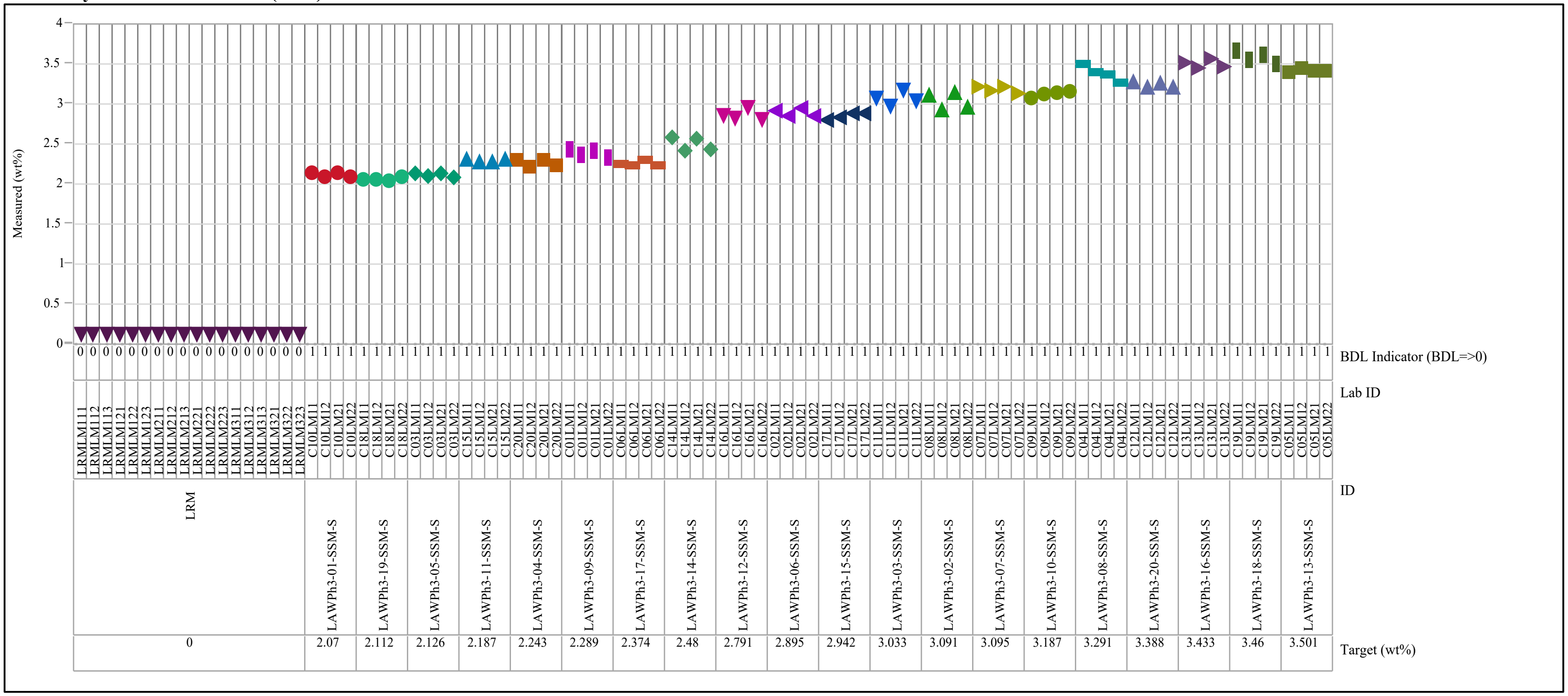


Exhibit B-2. Plots of Oxide Measurements by Glass Identifier Grouped by Targeted Concentrations (continued)

Analyte=ZrO2 (wt%), Prep Method=LM
Variability Chart for Measured (wt%)

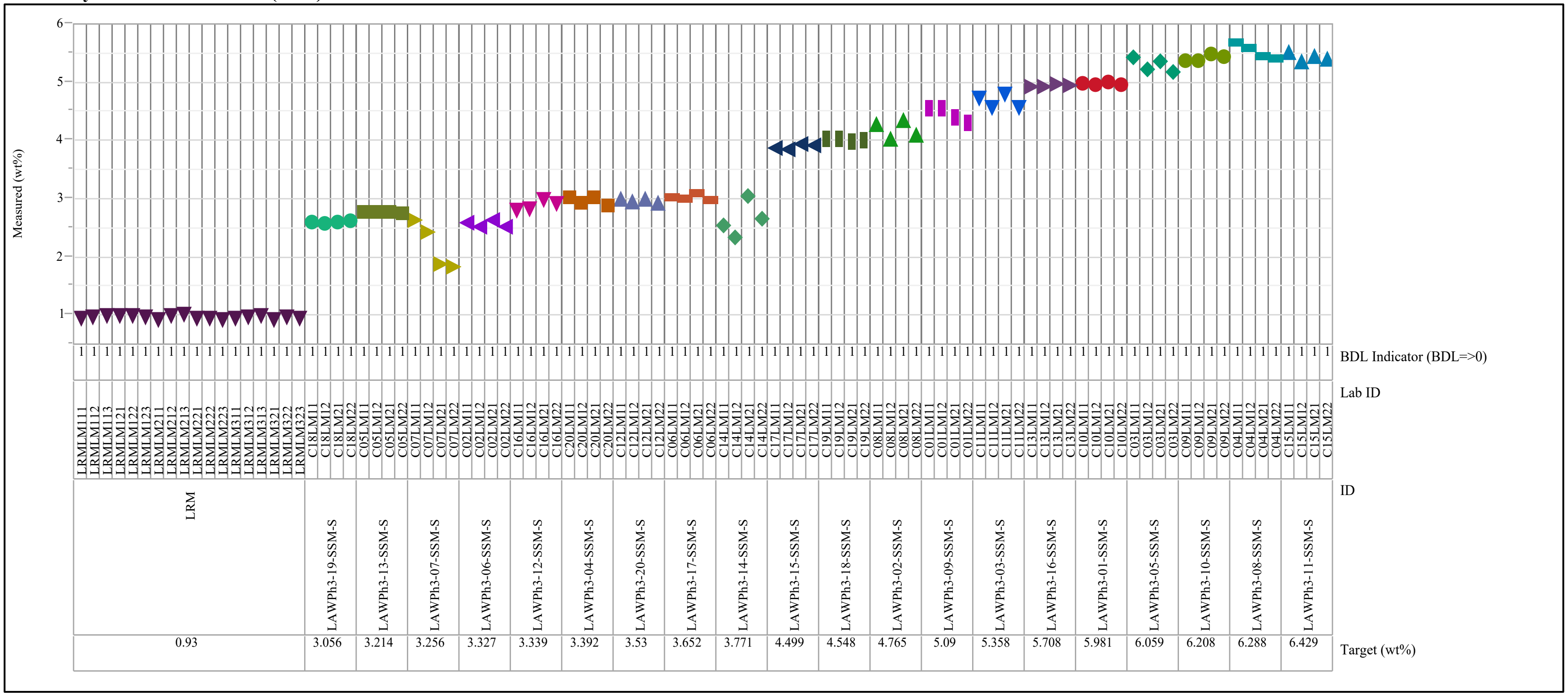
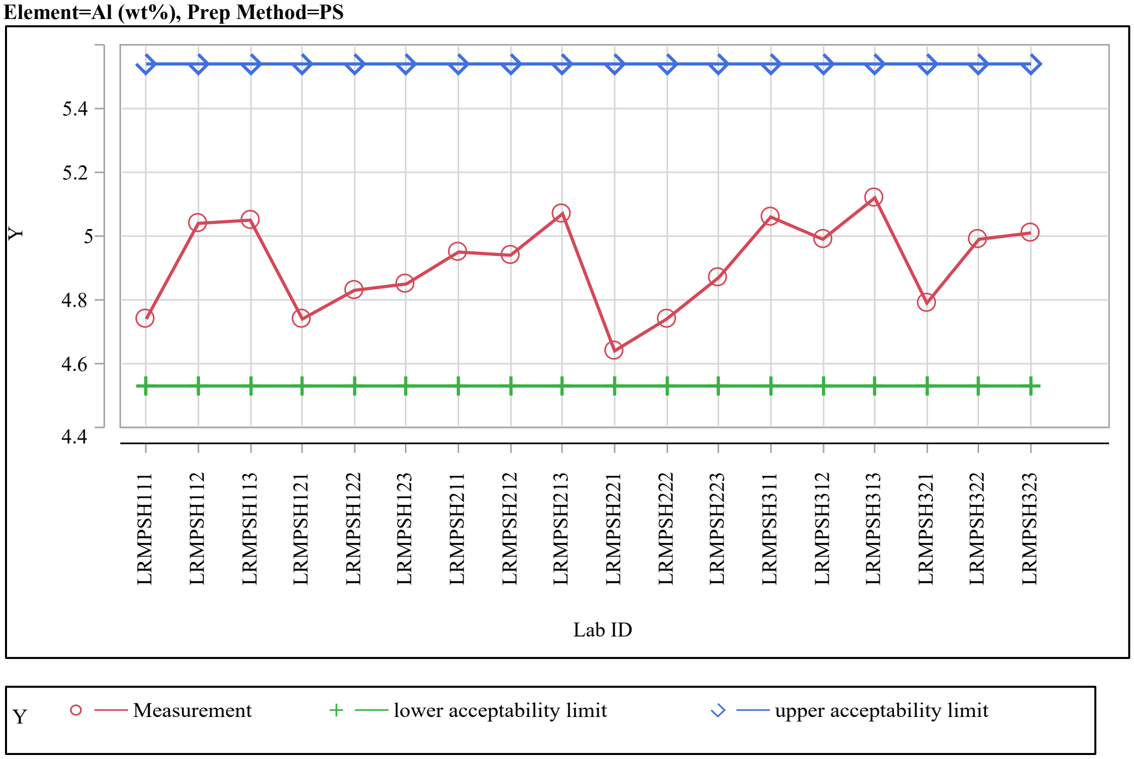


Exhibit B-3. Acceptability Evaluation for Measurements of the LRM Standard Glass

Element=Al (wt%), Prep Method=PS



Element=B (wt%), Prep Method=PS

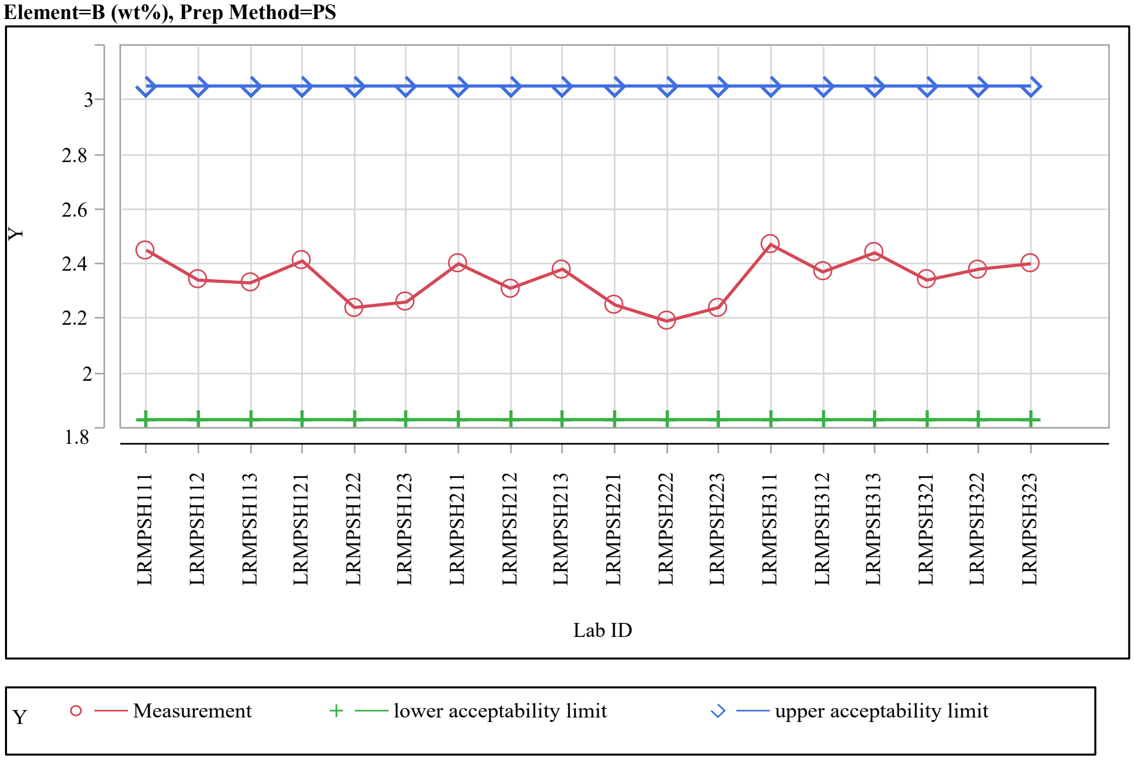
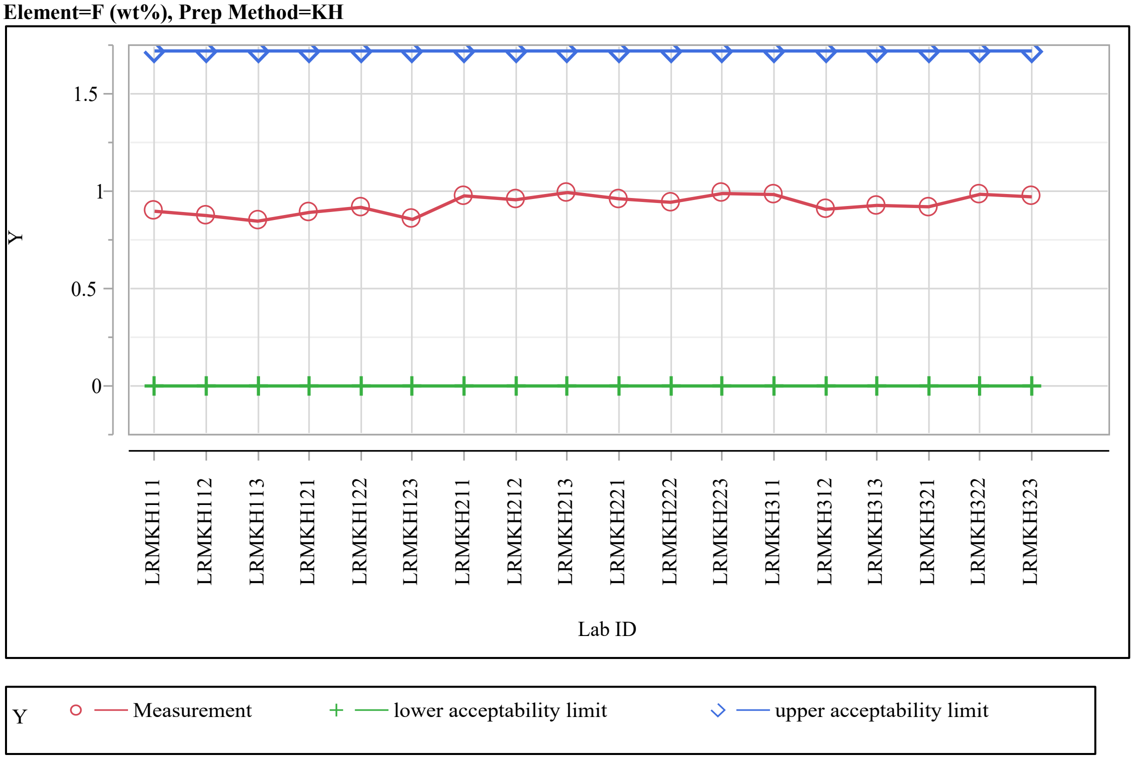


Exhibit B-3. Acceptability Evaluation for Measurements of the LRM Standard Glass (continued)

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



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

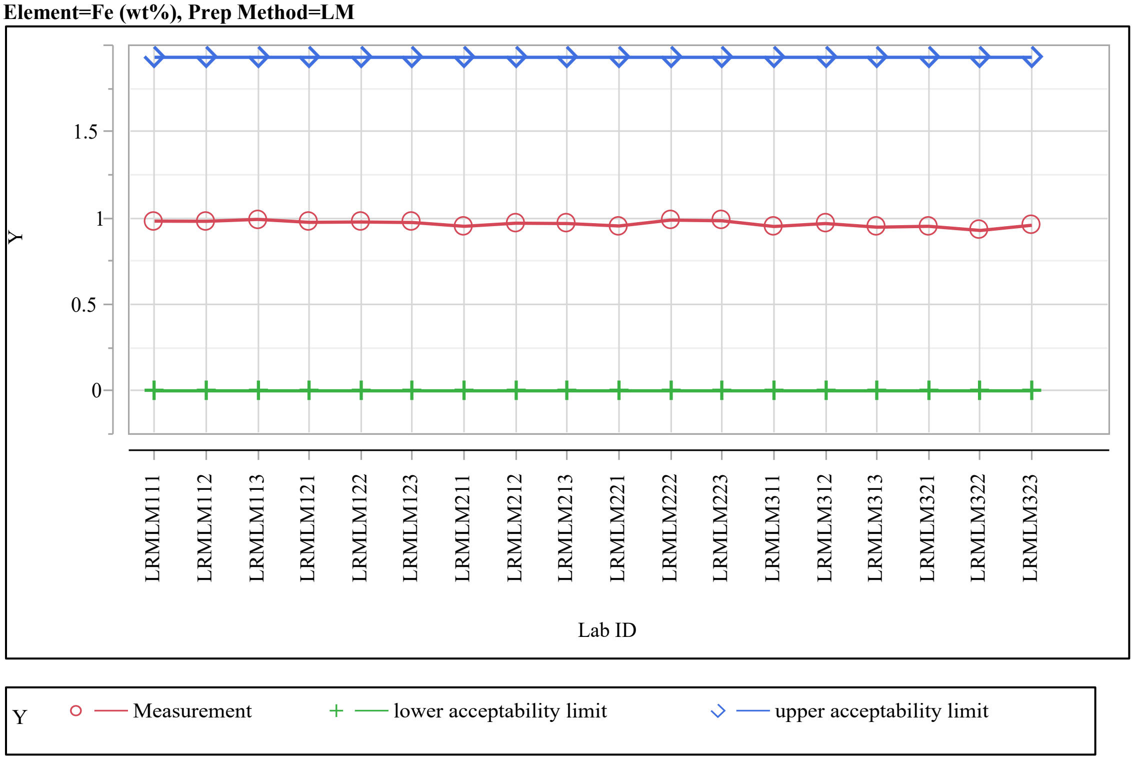
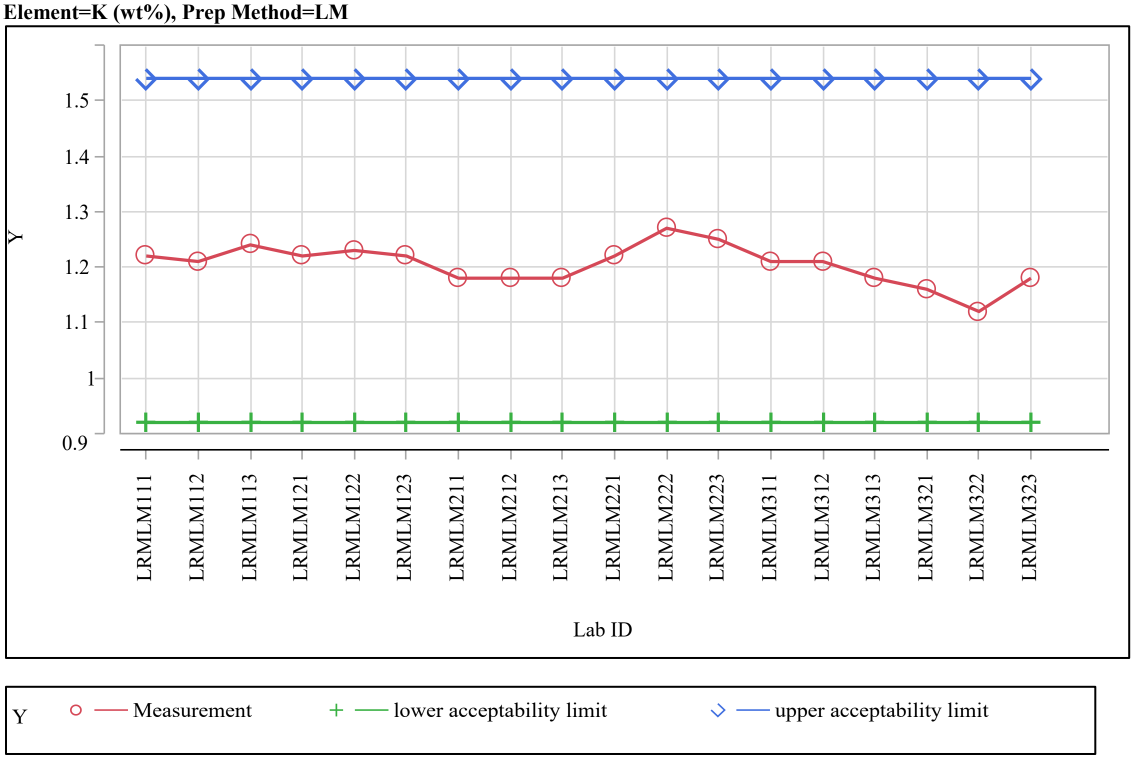


Exhibit B-3. Acceptability Evaluation for Measurements of the LRM Standard Glass (continued)

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



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

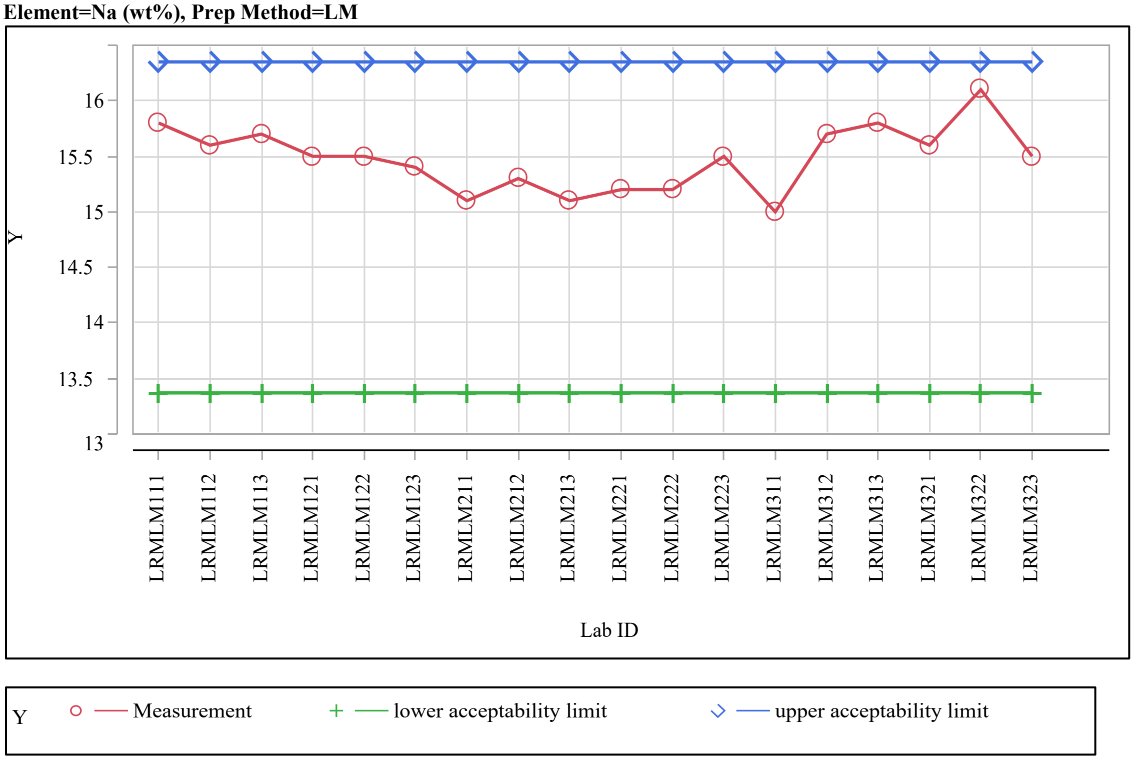
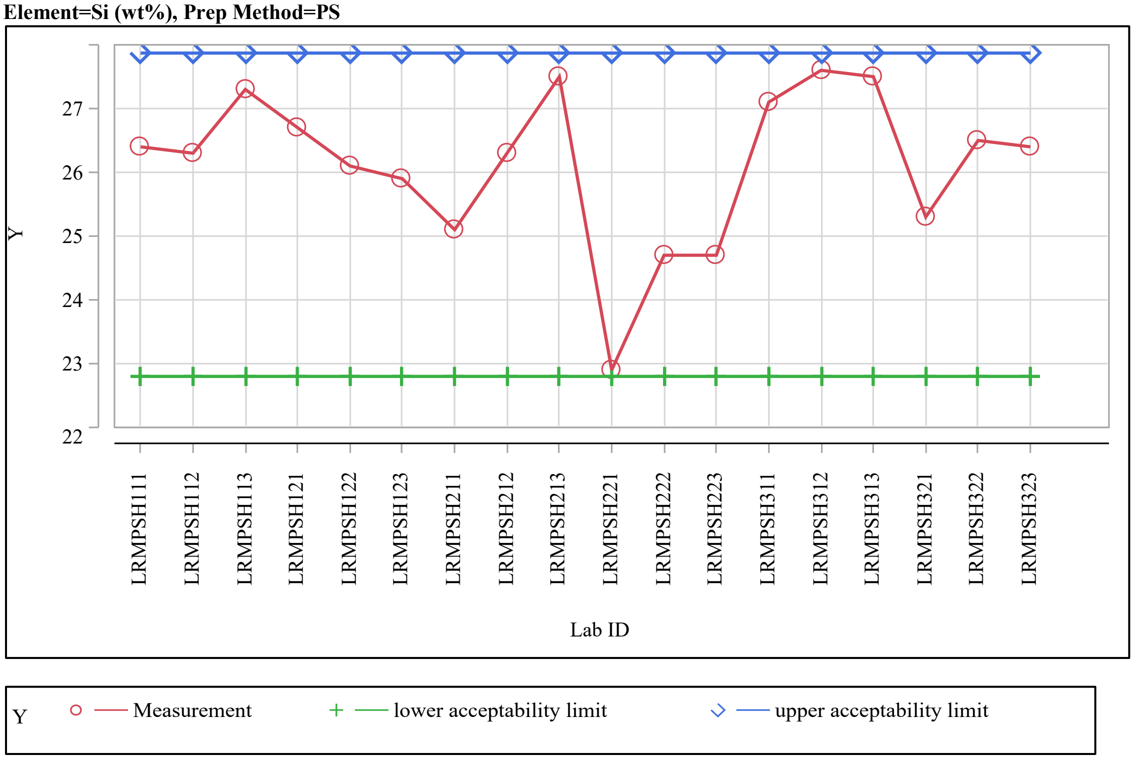


Exhibit B-3. Acceptability Evaluation for Measurements of the LRM Standard Glass (continued)

Element=Si (wt%), Prep Method=PS



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

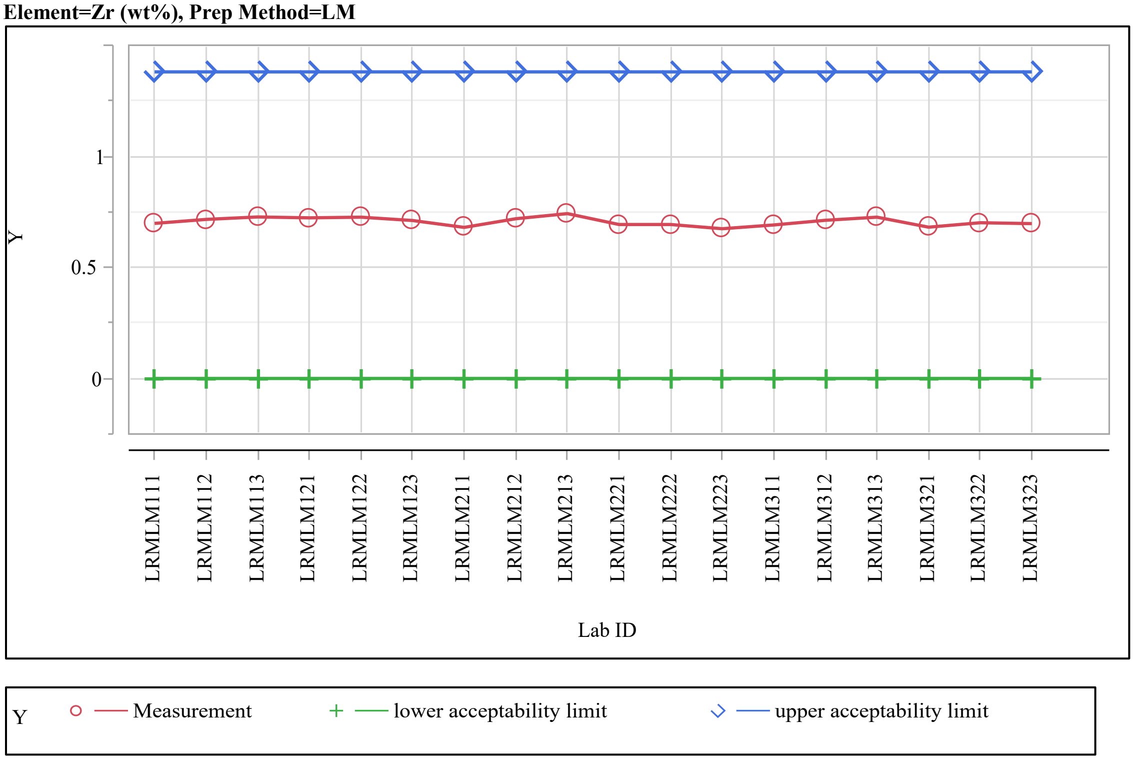


Exhibit B-4. Measured versus Targeted Concentrations by Glass ID by Oxide

Analyte=Al2O3 (wt%)

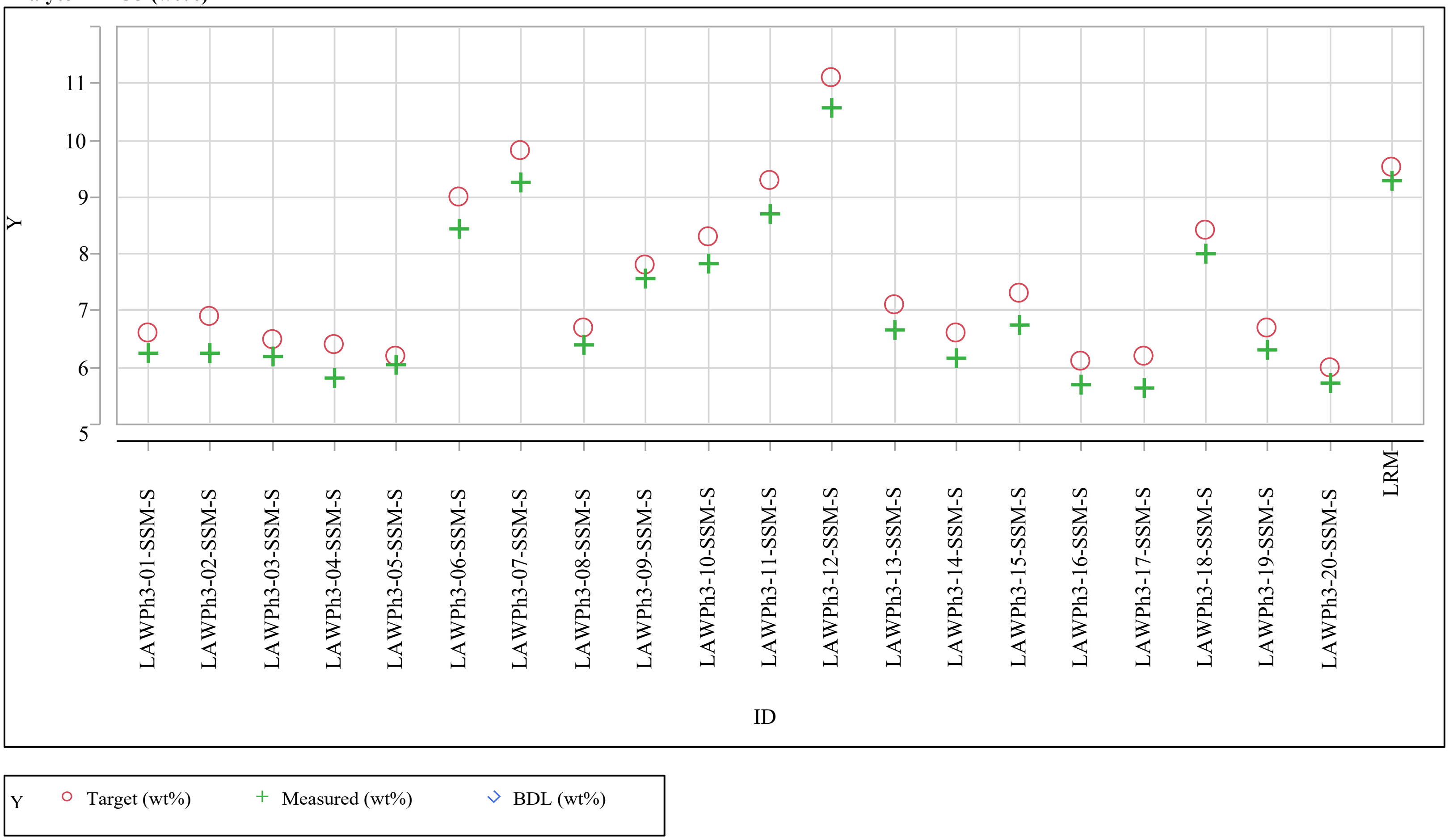


Exhibit B-4. Measured versus Targeted Concentrations by Glass ID by Oxide (continued)

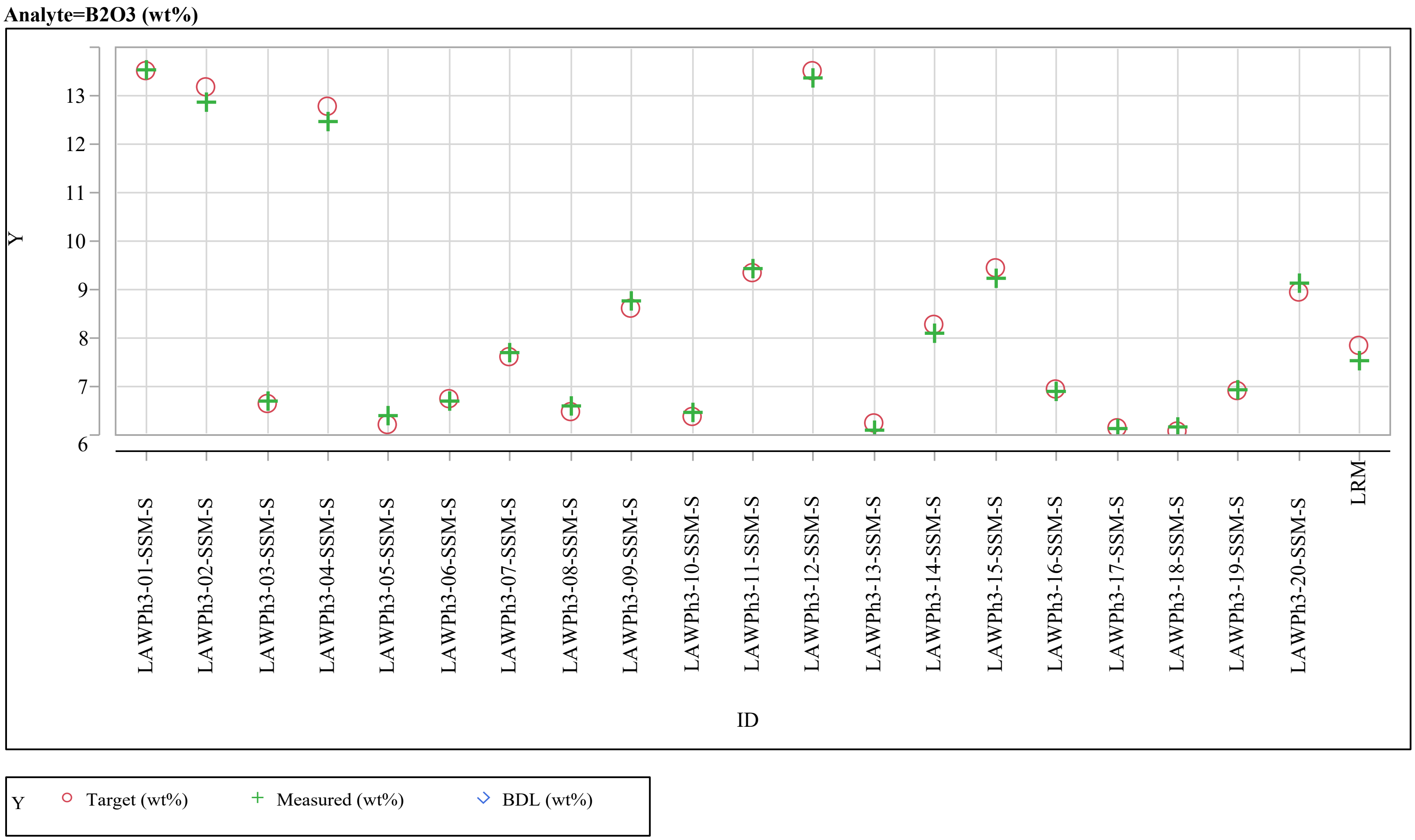


Exhibit B-4. Measured versus Targeted Concentrations by Glass ID by Oxide (continued)

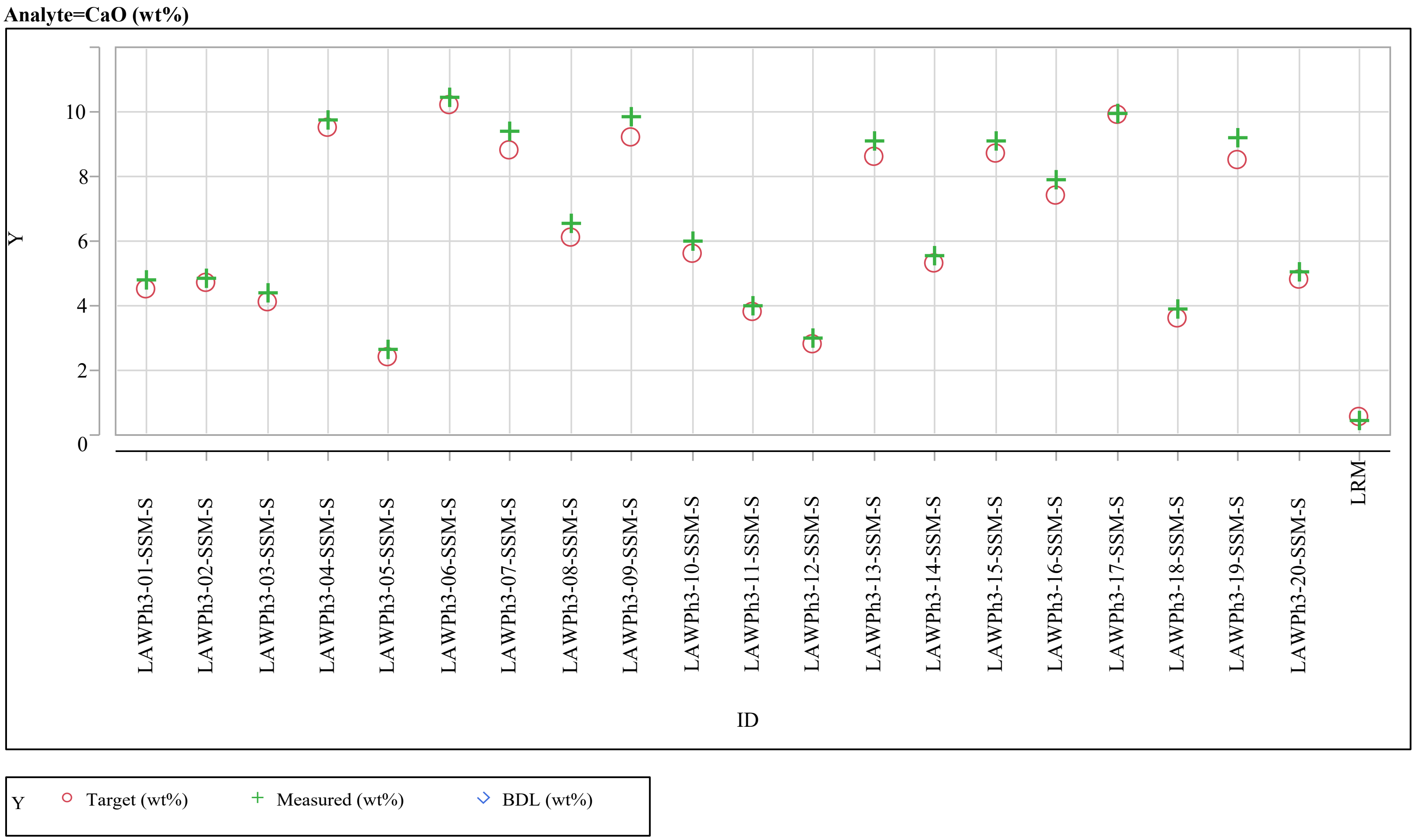


Exhibit B-4. Measured versus Targeted Concentrations by Glass ID by Oxide (continued)

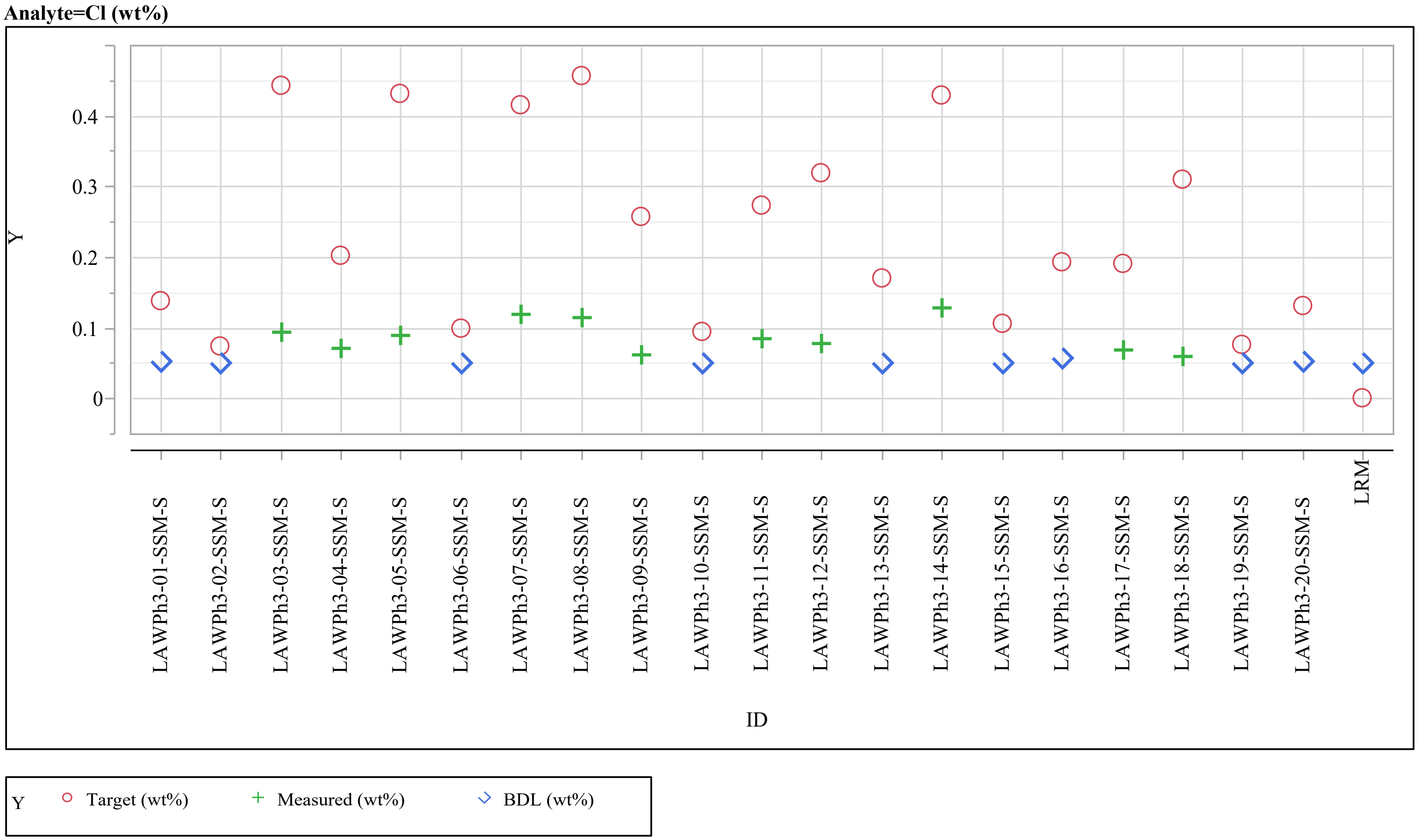


Exhibit B-4. Measured versus Targeted Concentrations by Glass ID by Oxide (continued)

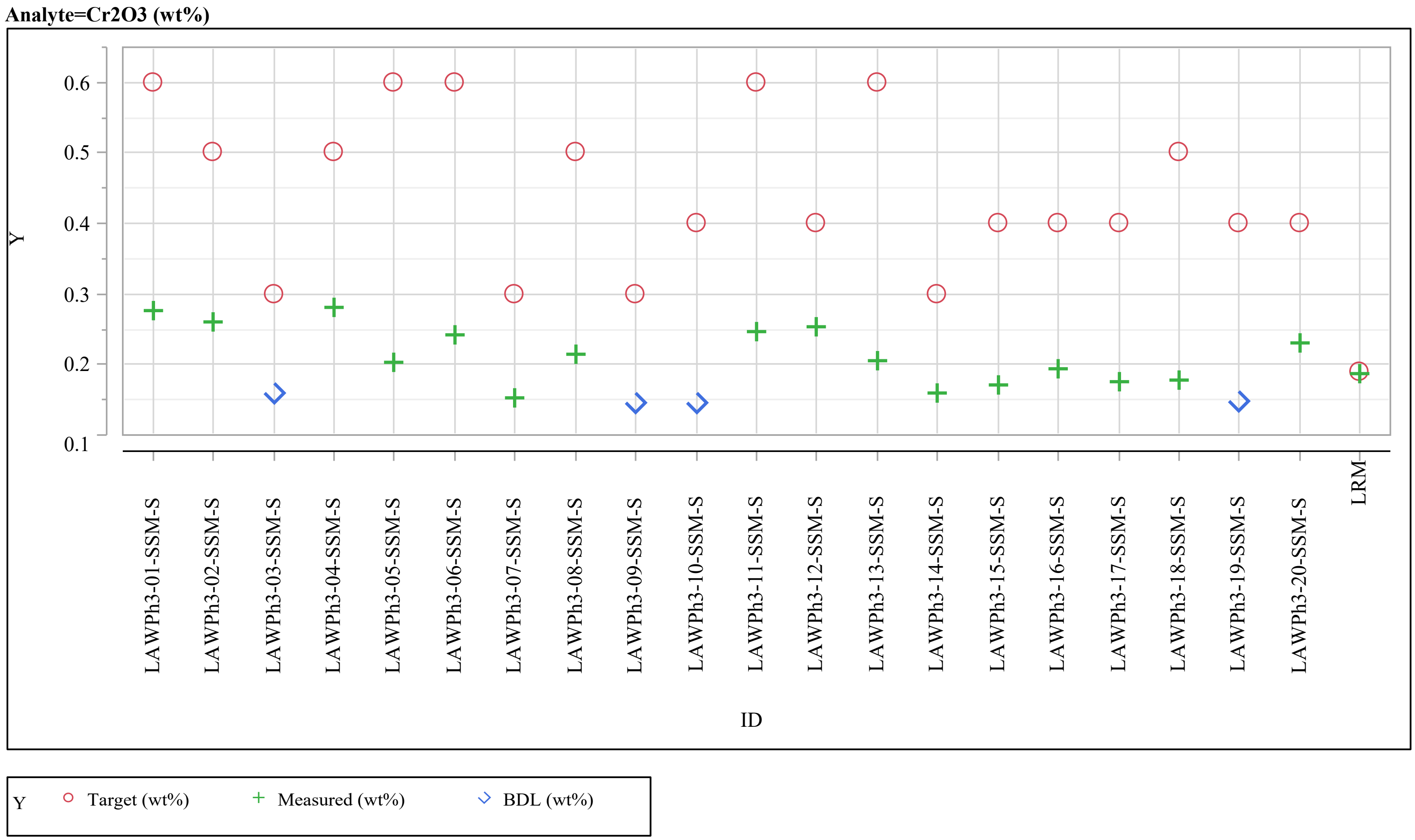


Exhibit B-4. Measured versus Targeted Concentrations by Glass ID by Oxide (continued)

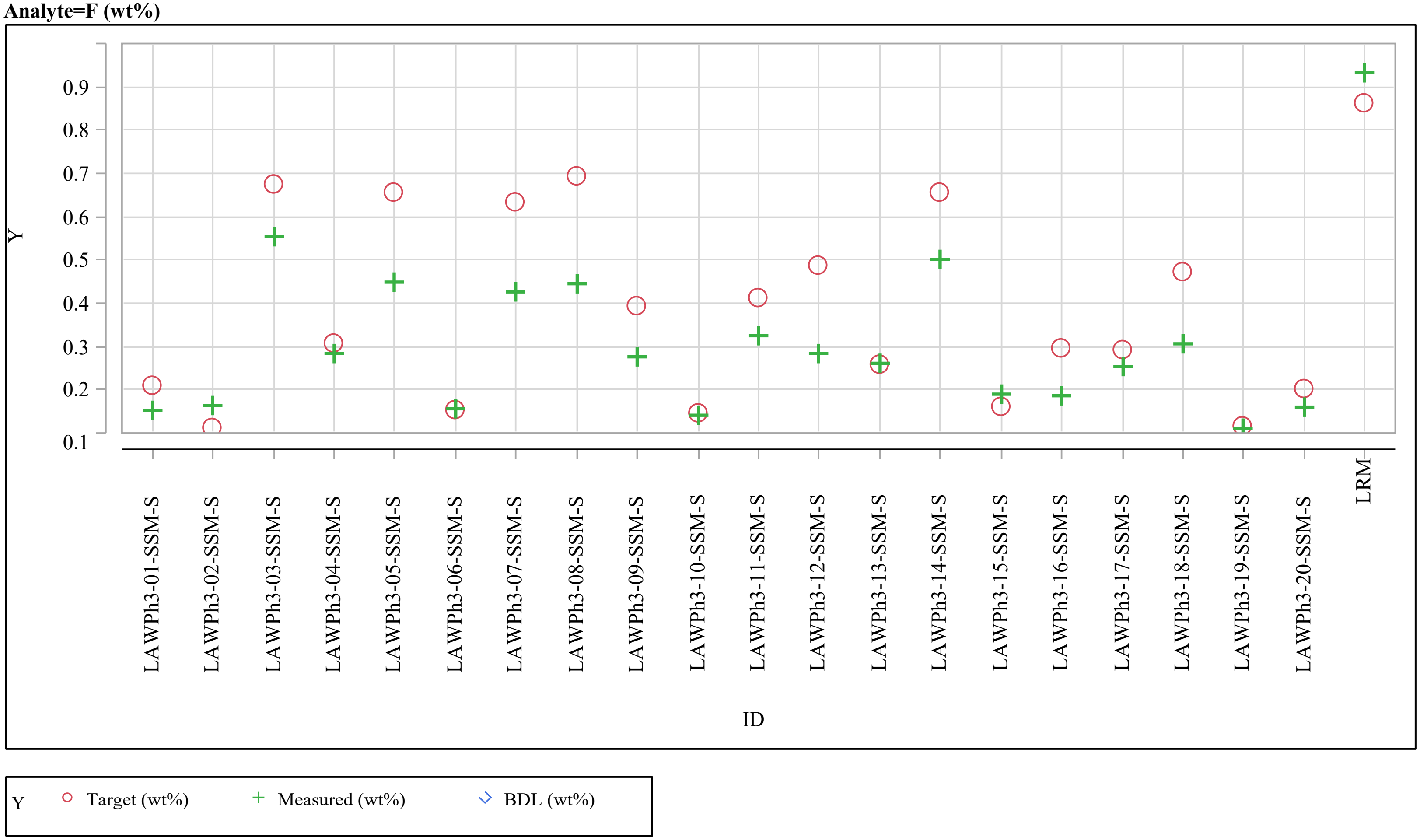


Exhibit B-4. Measured versus Targeted Concentrations by Glass ID by Oxide (continued)

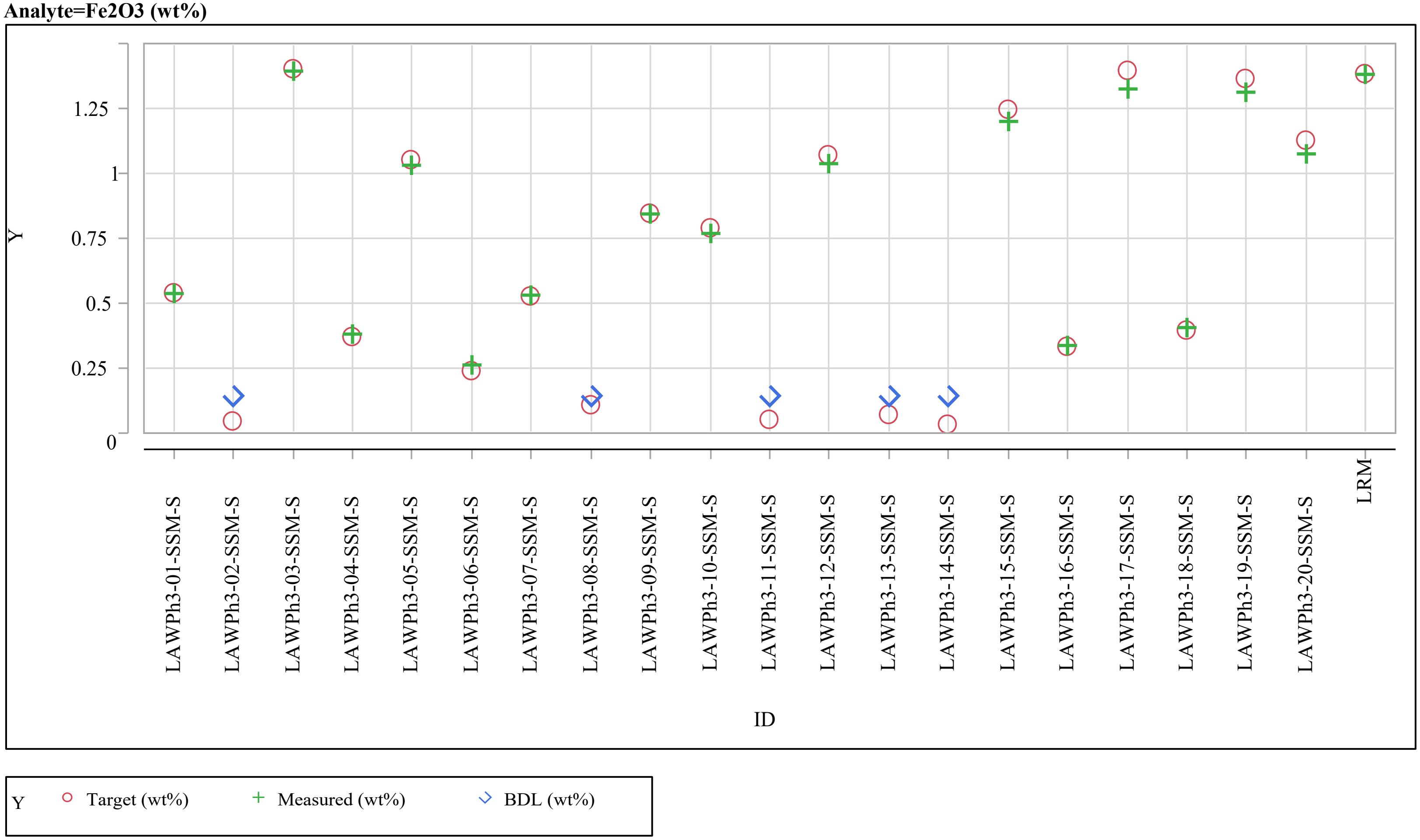


Exhibit B-4. Measured versus Targeted Concentrations by Glass ID by Oxide (continued)

Analyte=K2O (wt%)

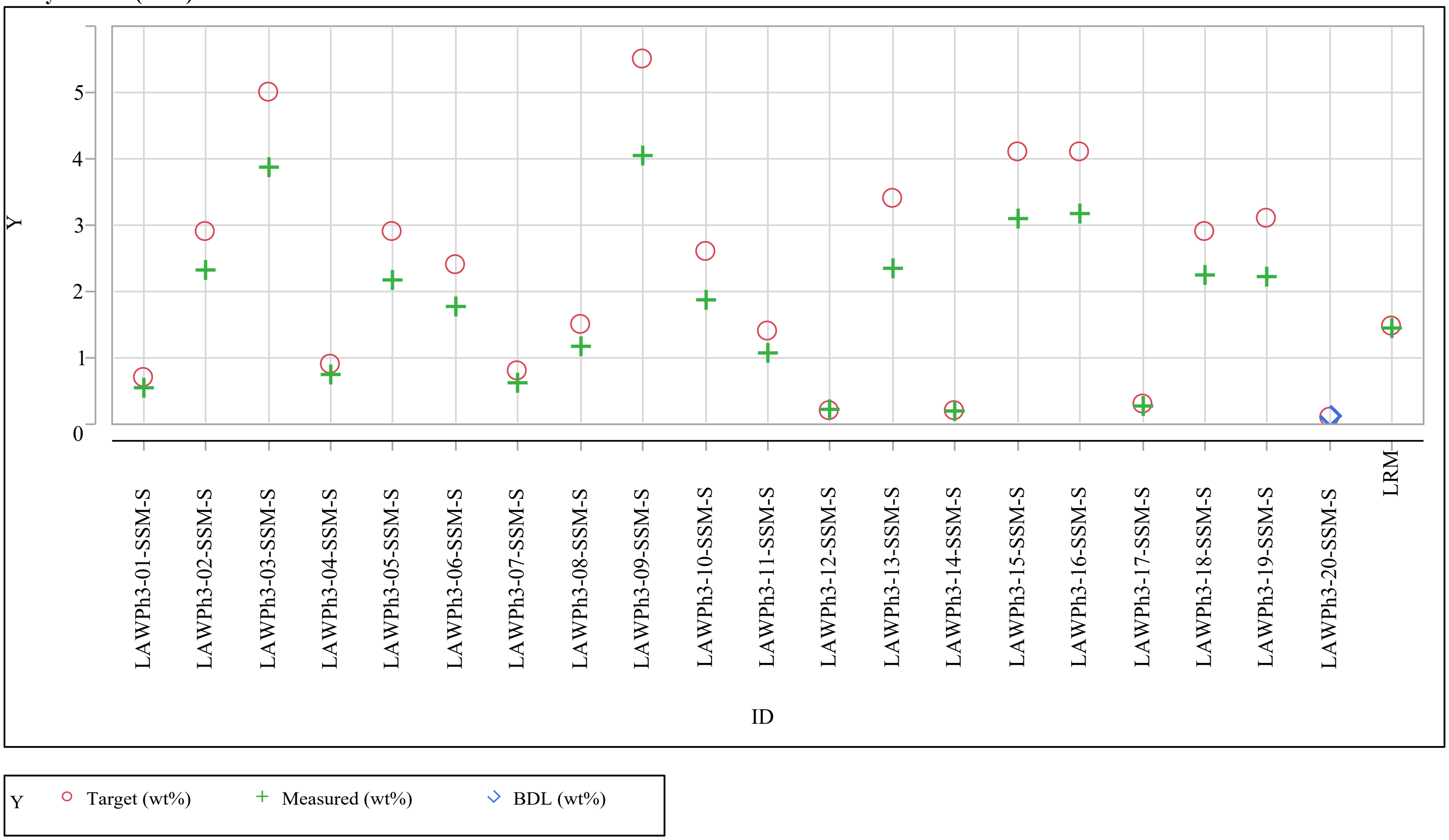


Exhibit B-4. Measured versus Targeted Concentrations by Glass ID by Oxide (continued)

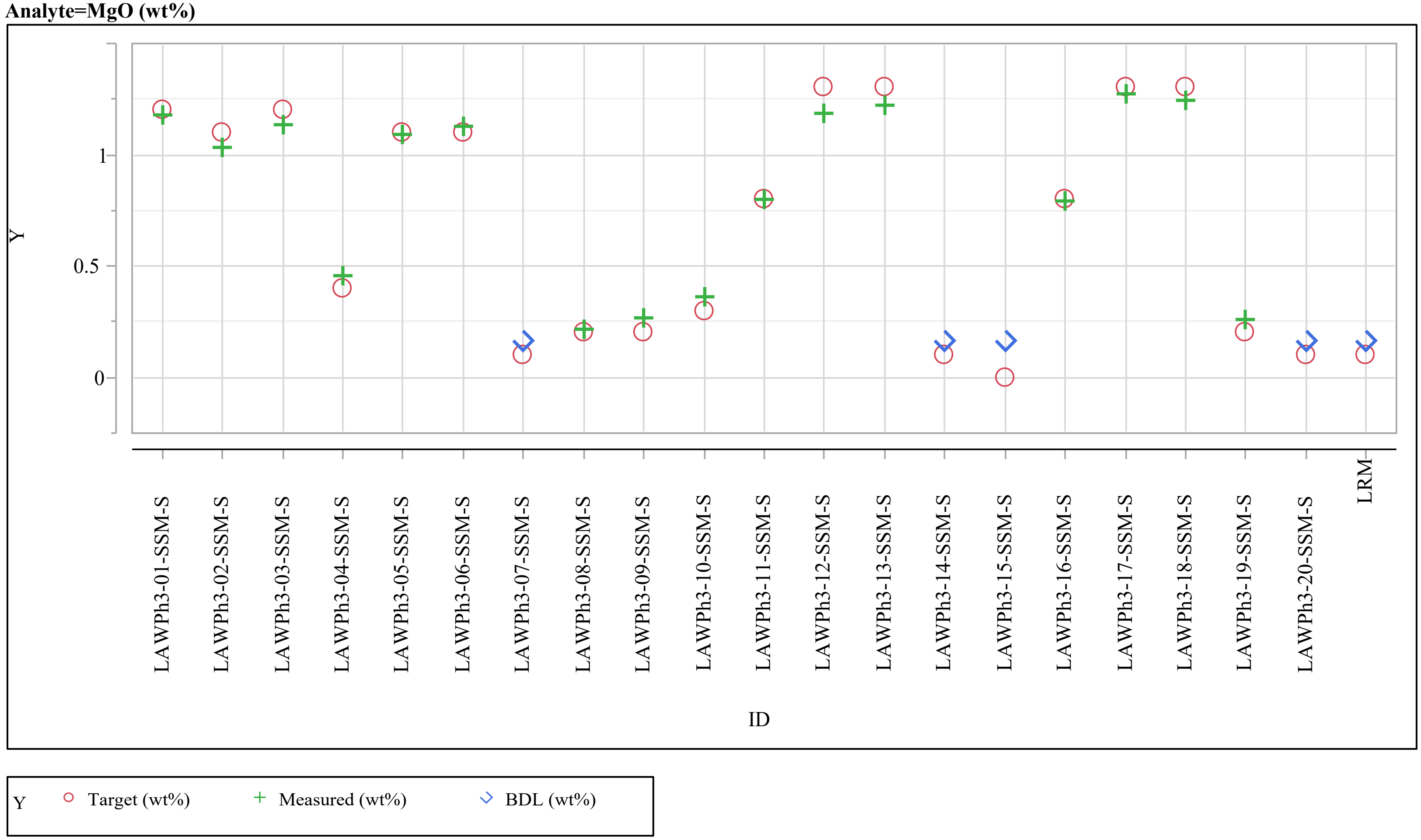


Exhibit B-4. Measured versus Targeted Concentrations by Glass ID by Oxide (continued)

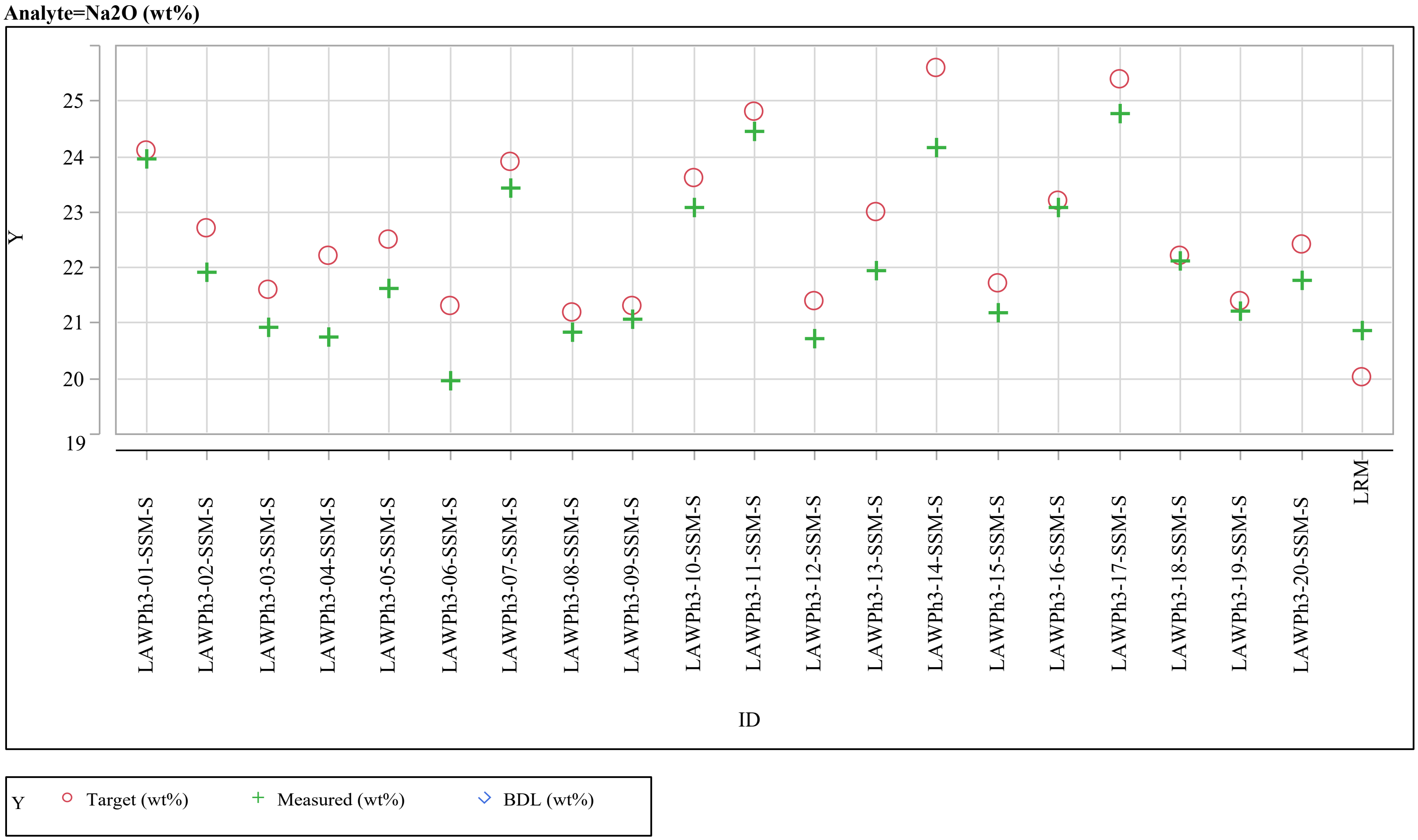


Exhibit B-4. Measured versus Targeted Concentrations by Glass ID by Oxide (continued)

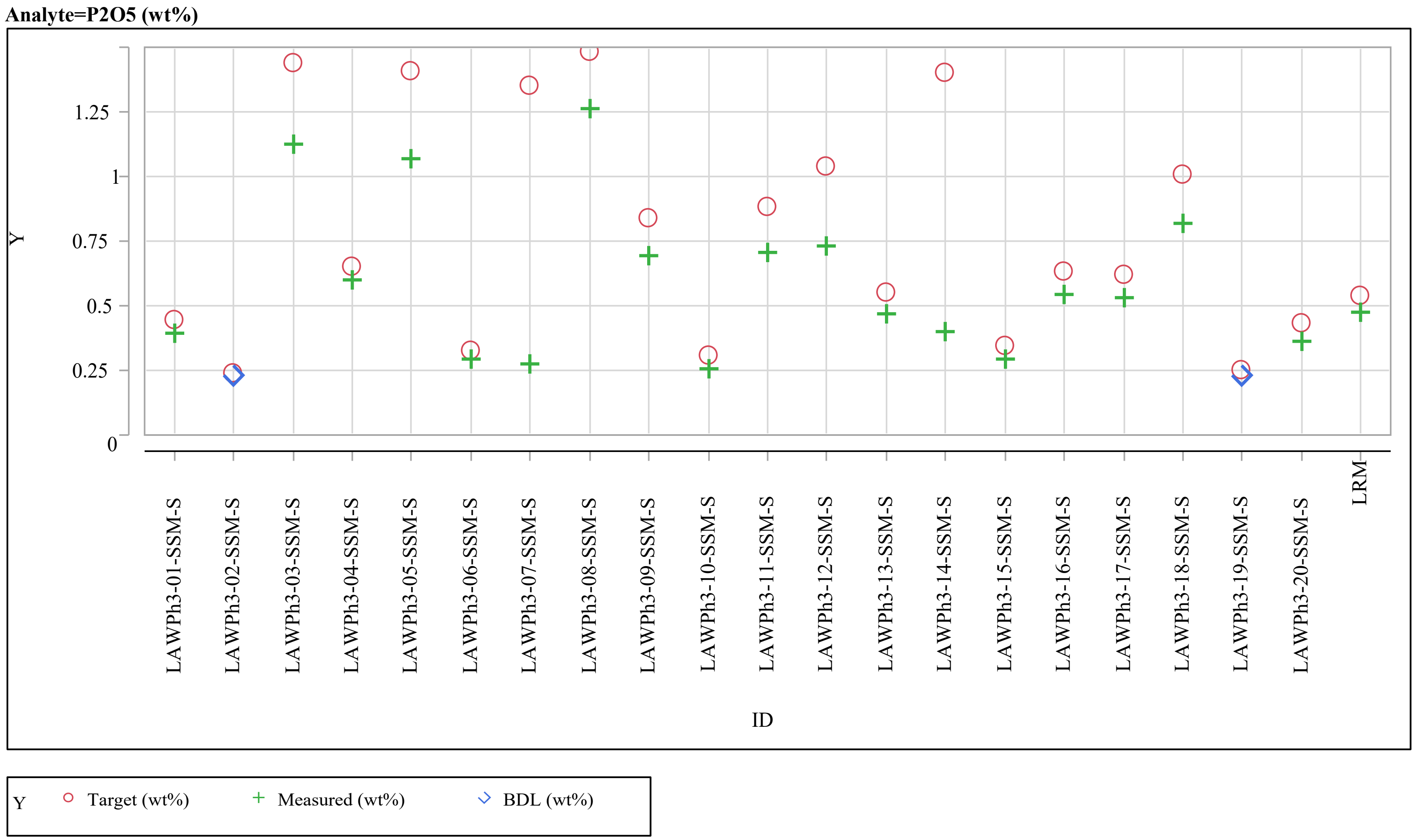


Exhibit B-4. Measured versus Targeted Concentrations by Glass ID by Oxide (continued)

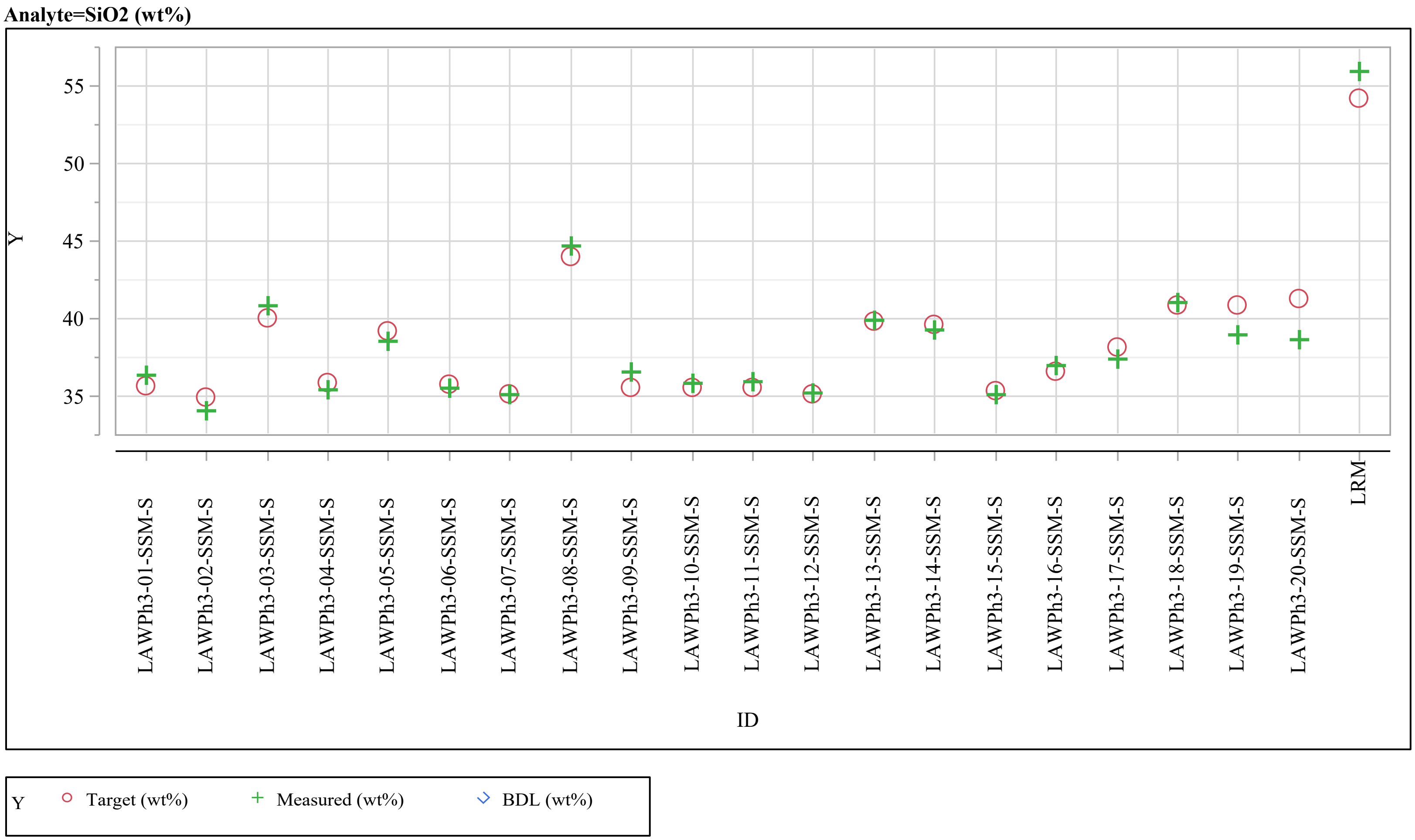


Exhibit B-4. Measured versus Targeted Concentrations by Glass ID by Oxide (continued)

Analyte=SnO2 (wt%)

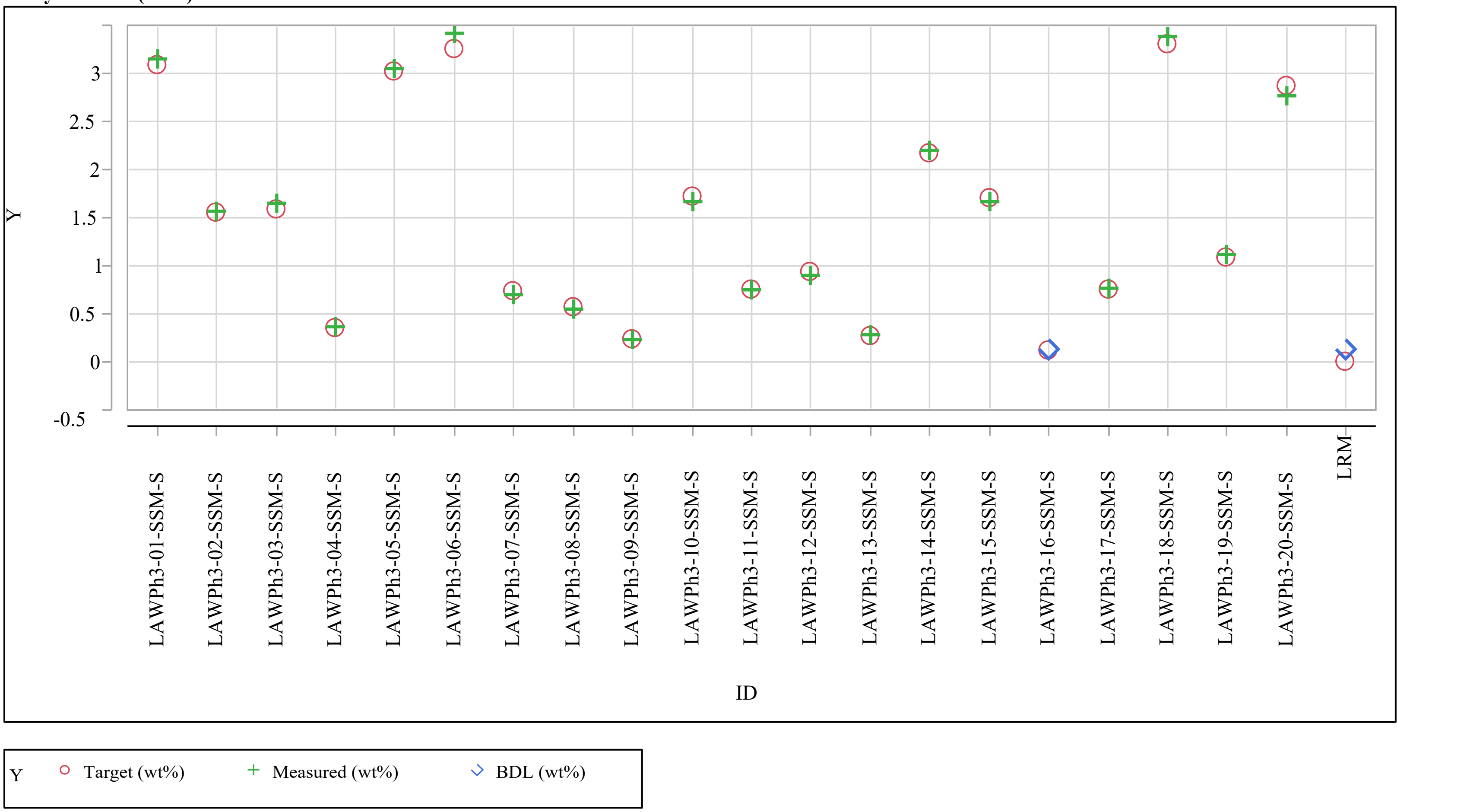


Exhibit B-4. Measured versus Targeted Concentrations by Glass ID by Oxide (continued)

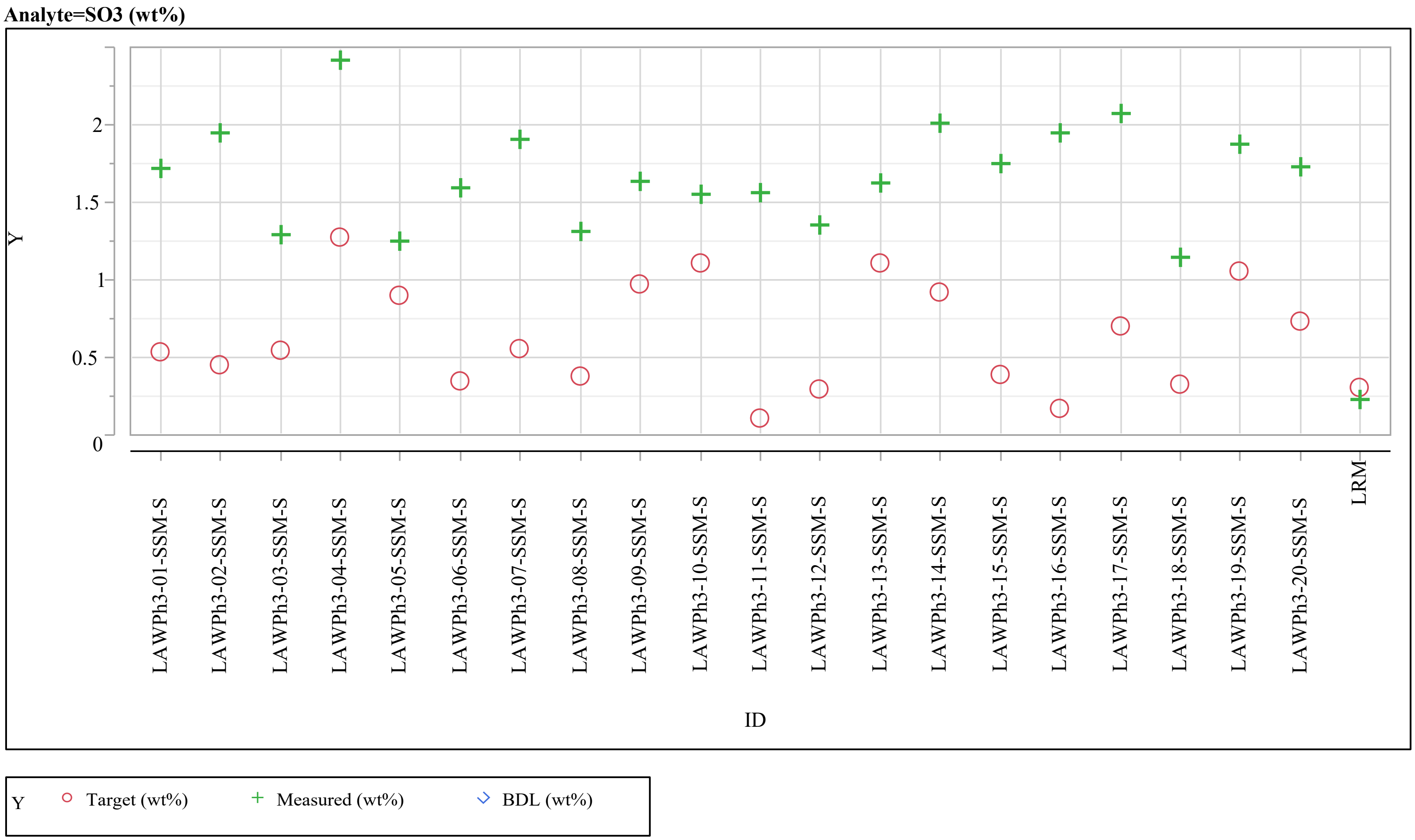


Exhibit B-4. Measured versus Targeted Concentrations by Glass ID by Oxide (continued)

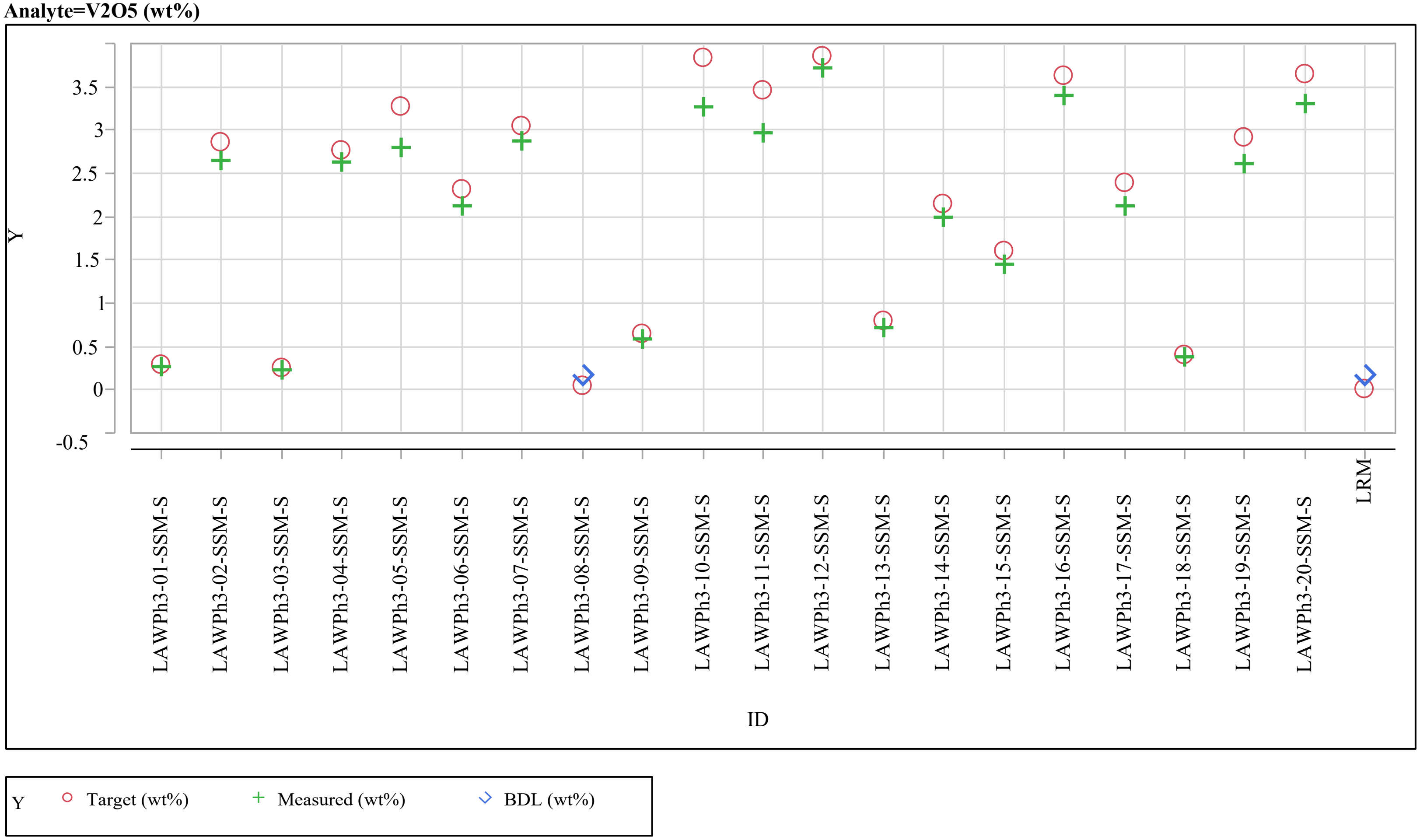


Exhibit B-4. Measured versus Targeted Concentrations by Glass ID by Oxide (continued)

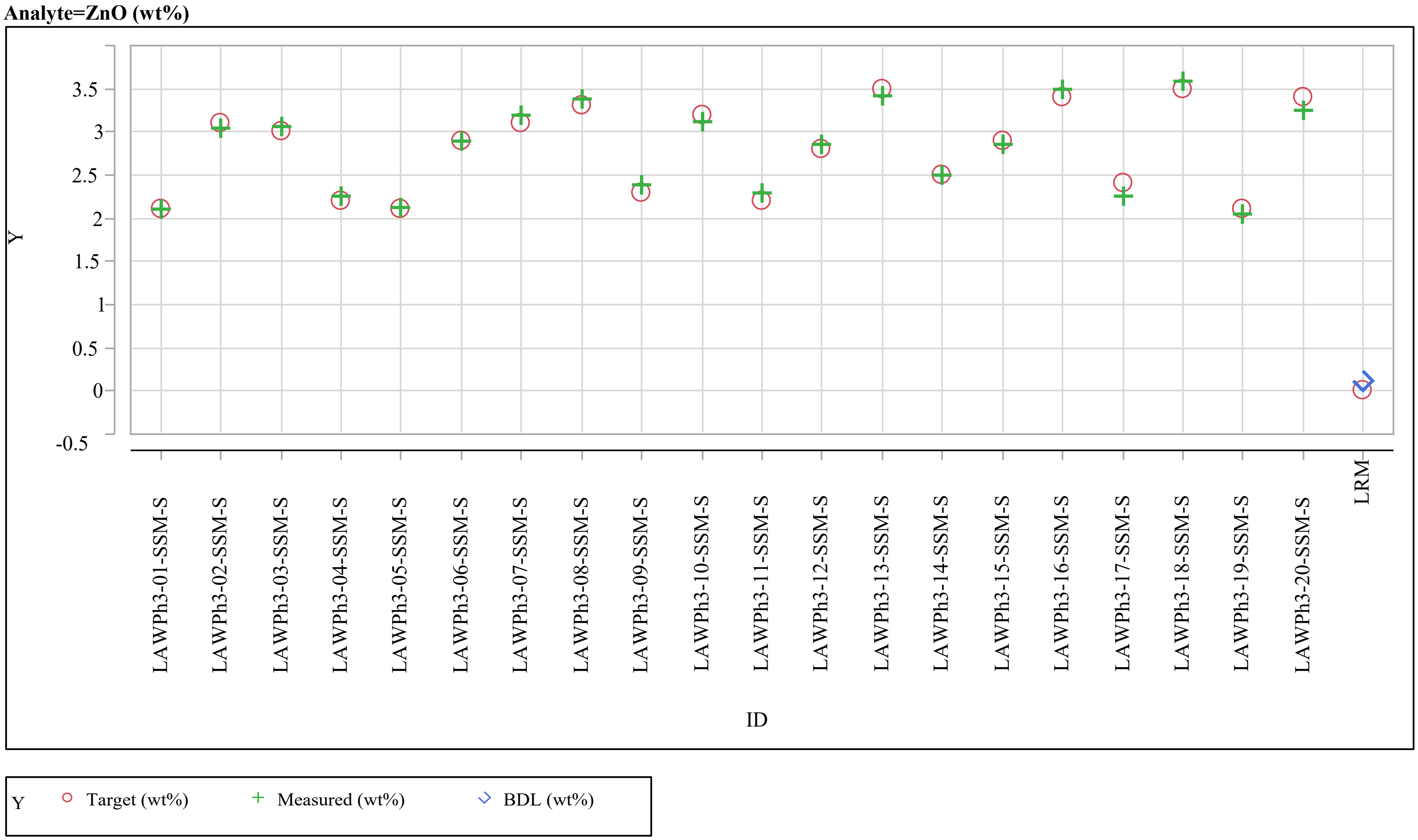


Exhibit B-4. Measured versus Targeted Concentrations by Glass ID by Oxide (continued)

Analyte=ZrO2 (wt%)

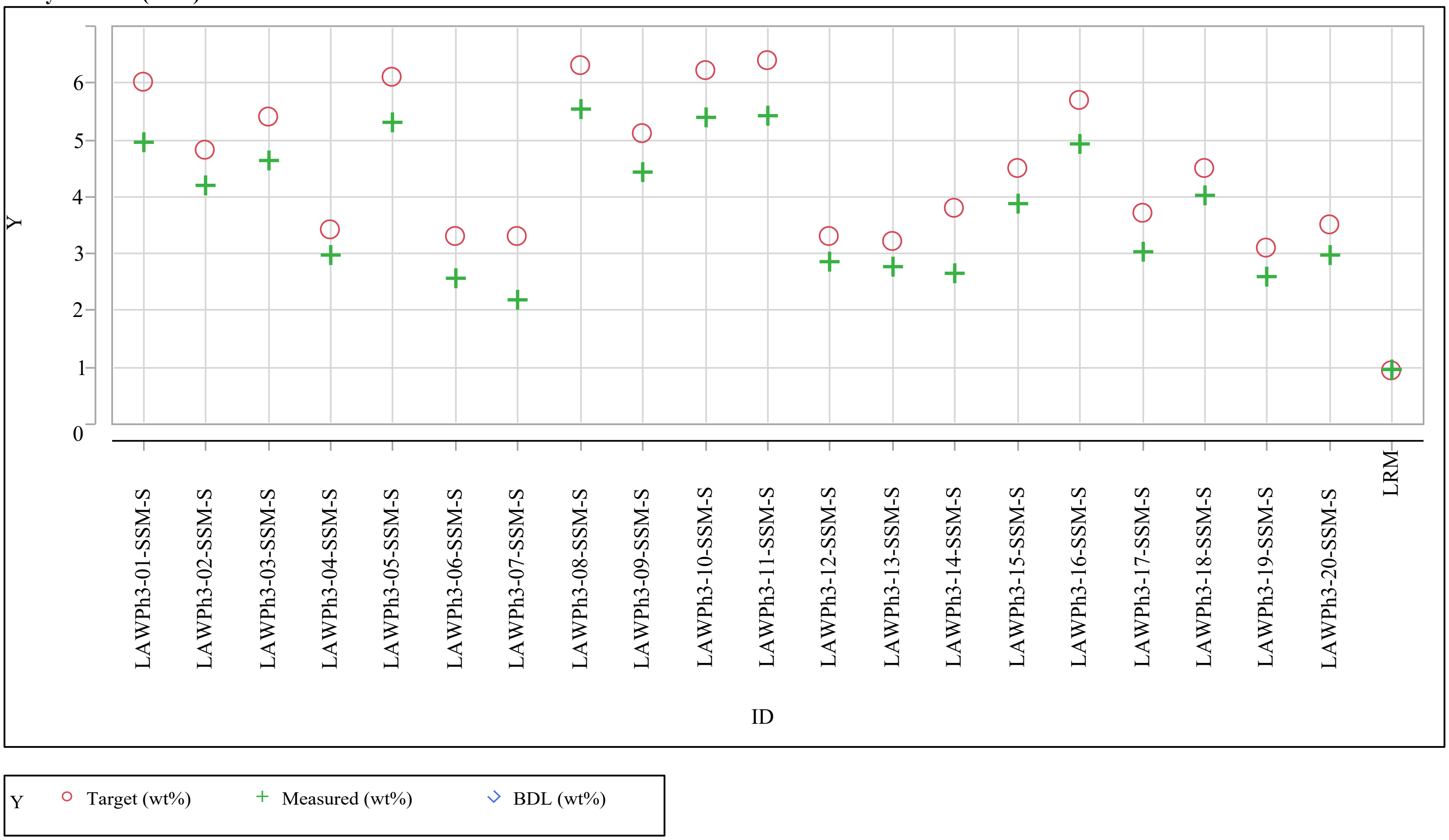
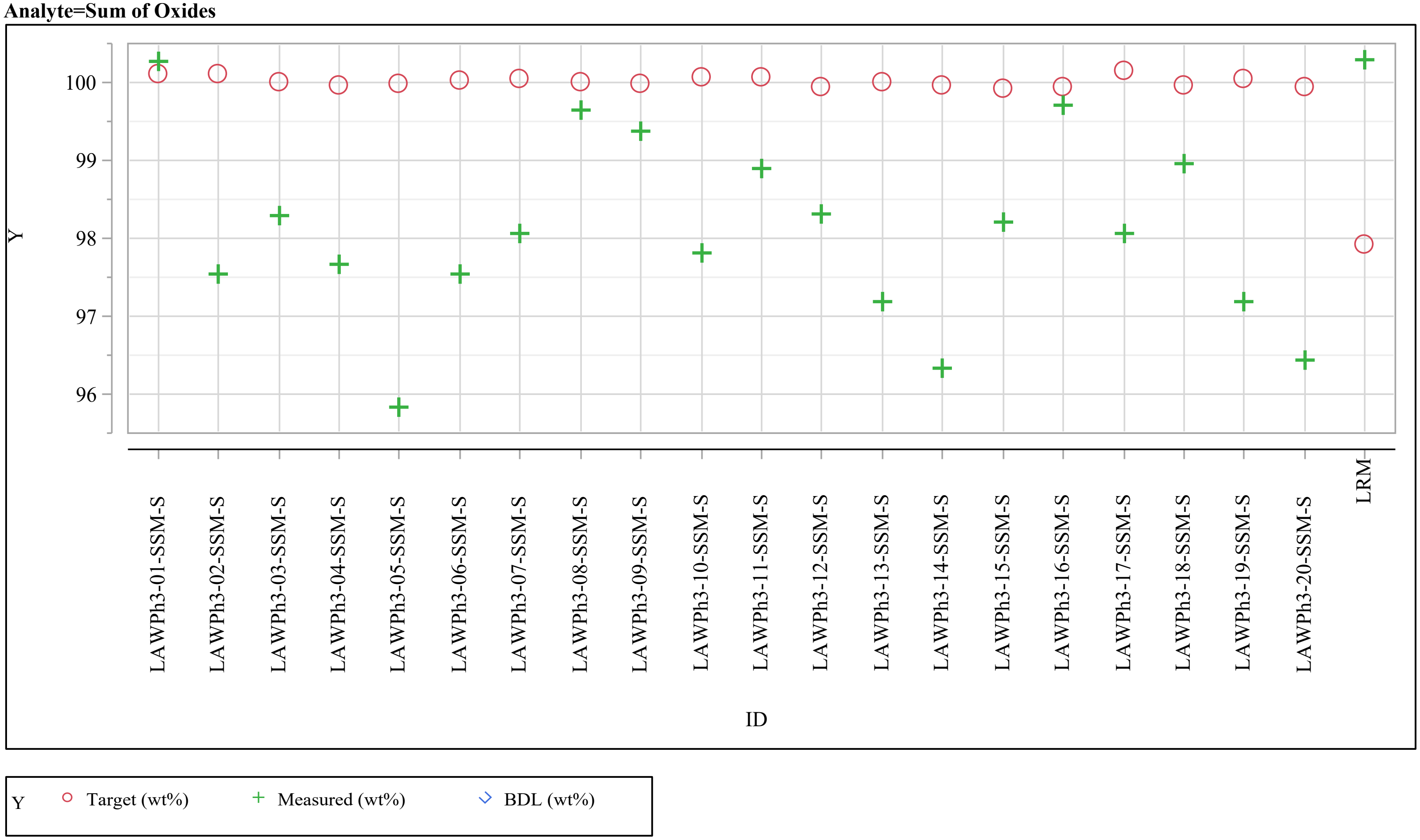


Exhibit B-4. Measured versus Targeted Concentrations by Glass ID by Oxide (continued)



Appendix C Comparisons of the Q and SSM Versions of the Study Glasses

Exhibit C-1. Comparisons of the Measured Compositions of the Quenched and Sulfur Saturated Versions of the Study Glasses

Analyte=Al2O3
Variability Chart for Measured (wt%)

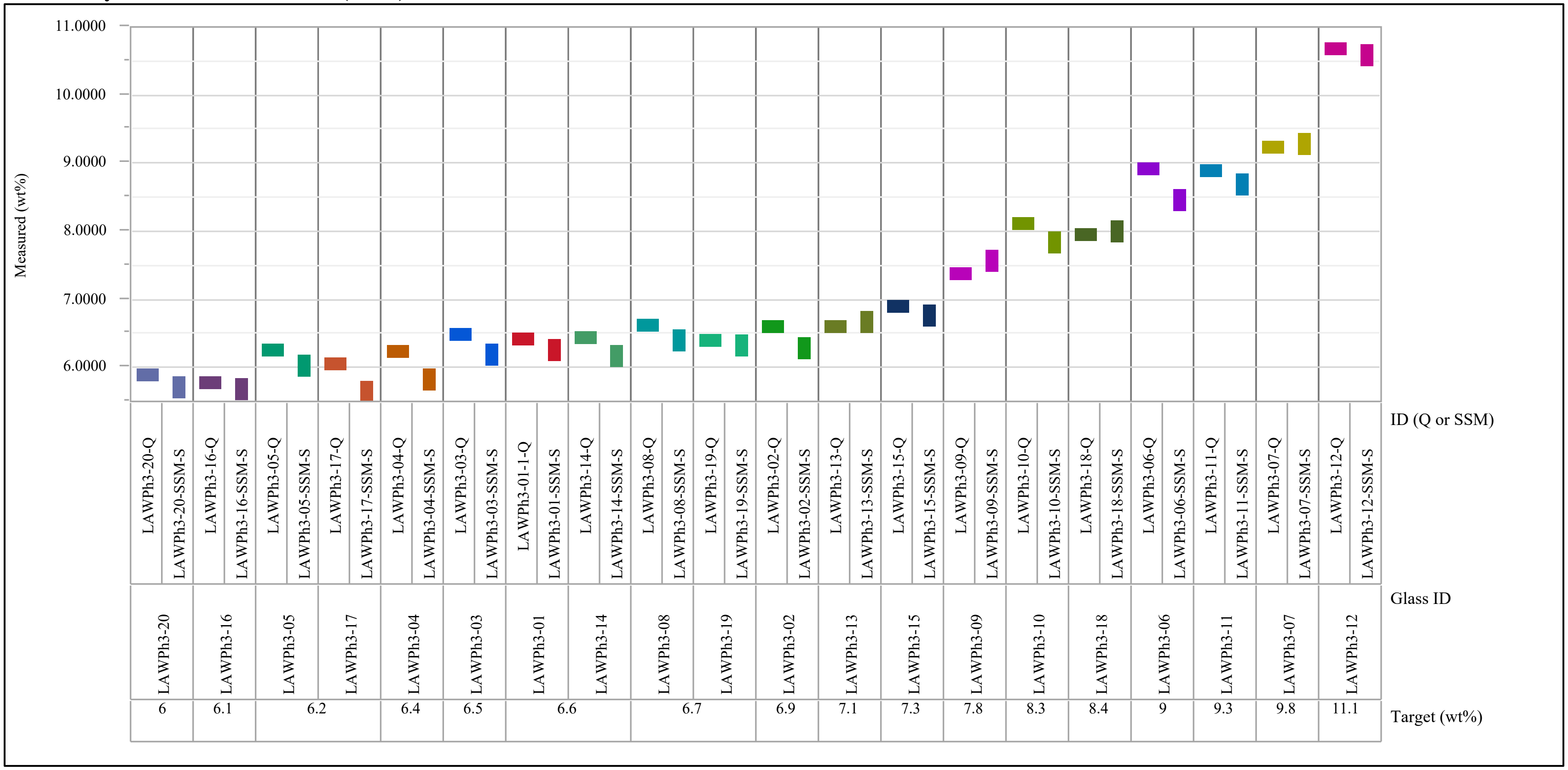


Exhibit C-1. Comparisons of the Measured Compositions of the Quenched and Sulfur Saturated Versions of the Study Glasses (continued)

Analyte=B2O3
Variability Chart for Measured (wt%)

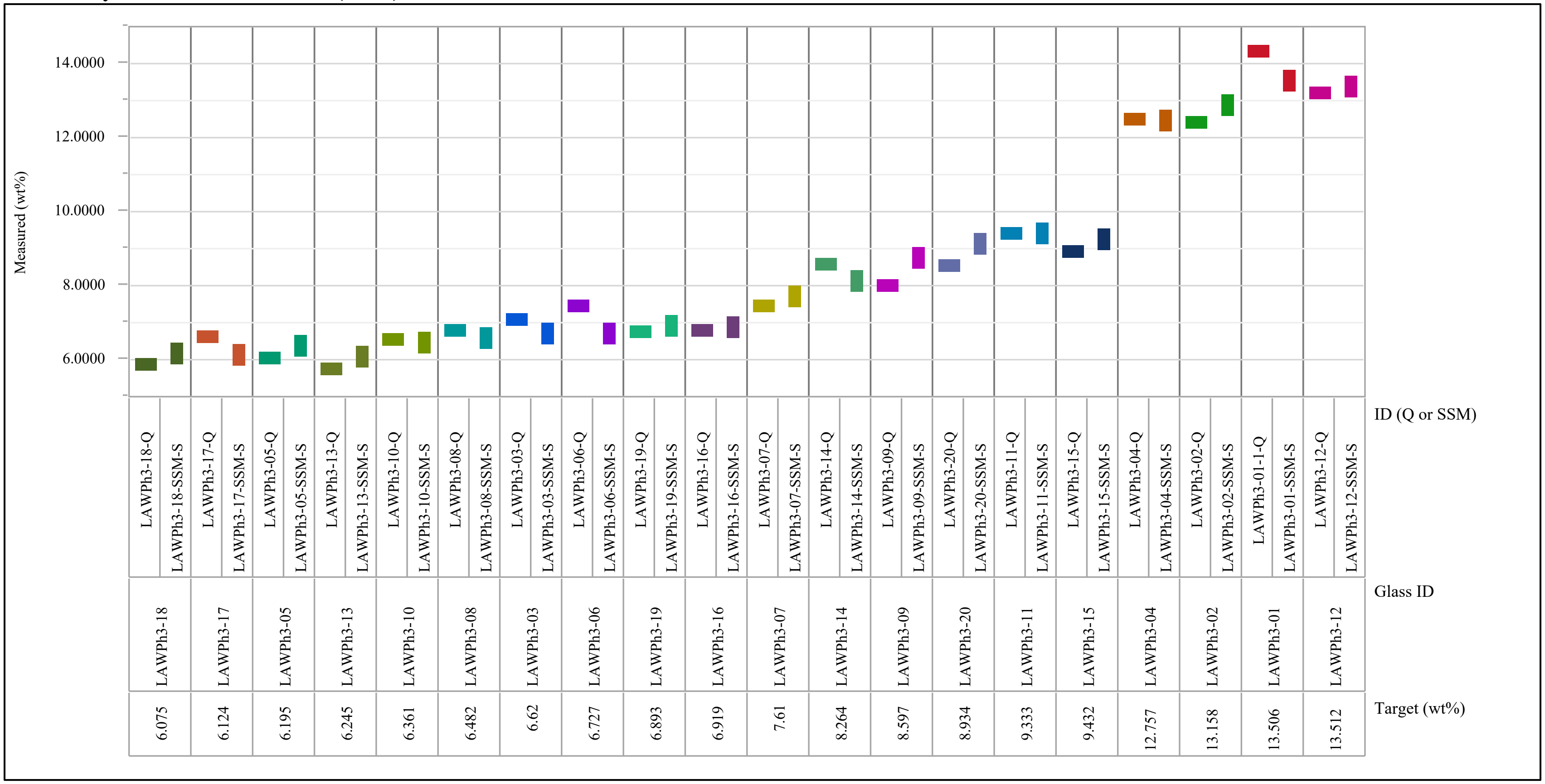


Exhibit C-1. Comparisons of the Measured Compositions of the Quenched and Sulfur Saturated Versions of the Study Glasses (continued)

Analyte=CaO
Variability Chart for Measured (wt%)

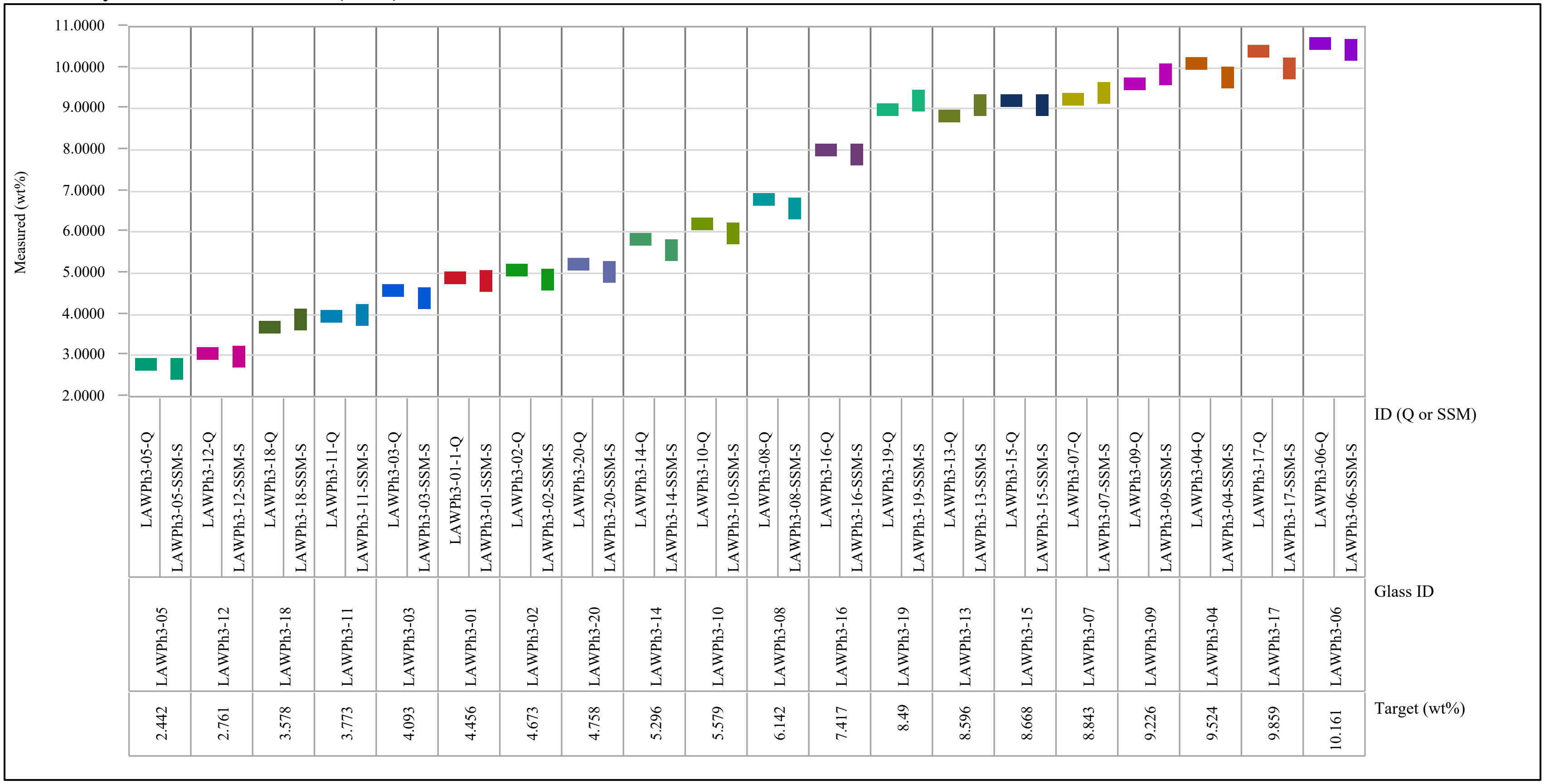


Exhibit C-1. Comparisons of the Measured Compositions of the Quenched and Sulfur Saturated Versions of the Study Glasses (continued)

Analyte=Cl
Variability Chart for Measured (wt%)

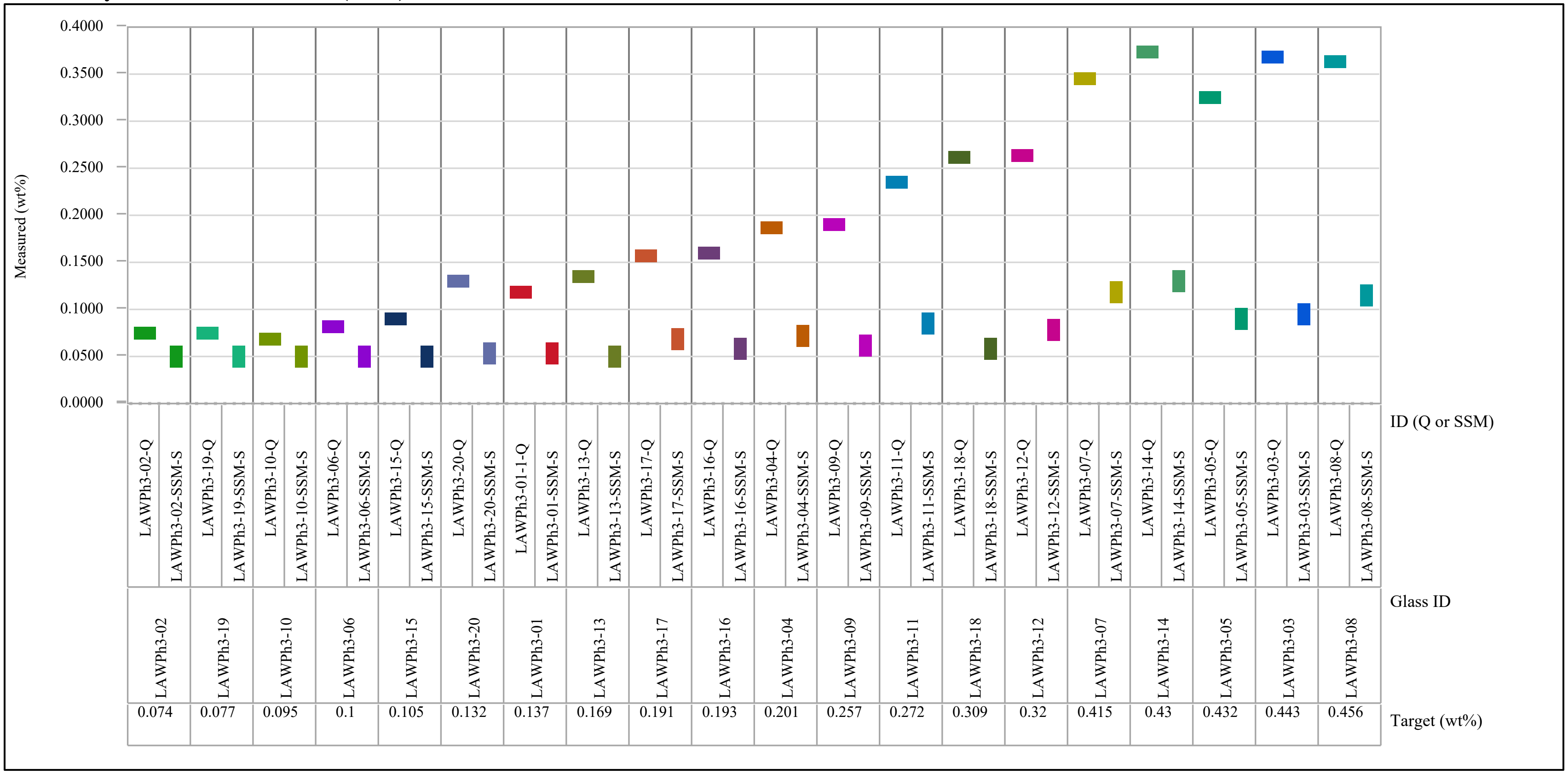


Exhibit C-1. Comparisons of the Measured Compositions of the Quenched and Sulfur Saturated Versions of the Study Glasses (continued)

Analyte=Cr2O3
Variability Chart for Measured (wt%)

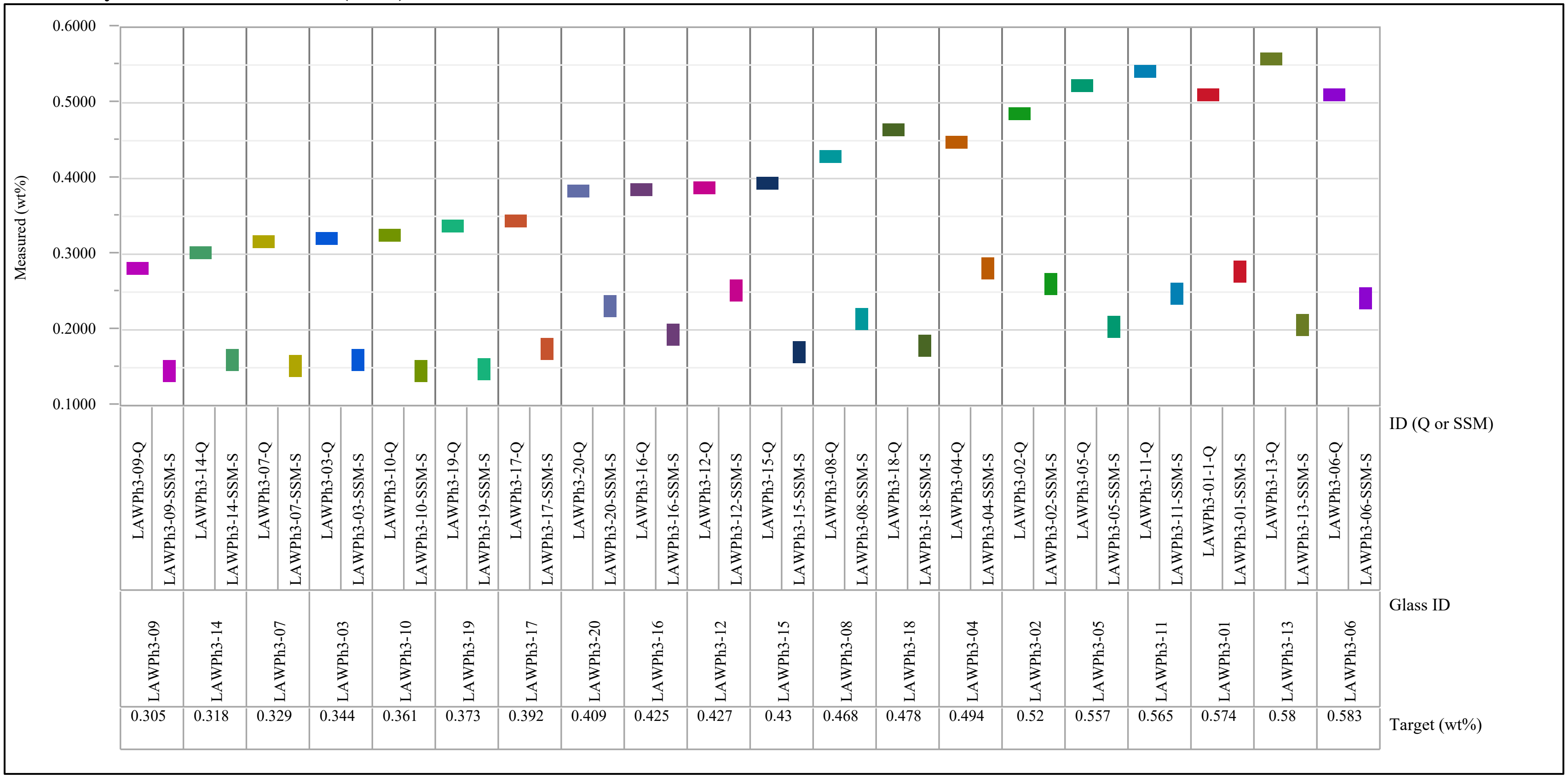


Exhibit C-1. Comparisons of the Measured Compositions of the Quenched and Sulfur Saturated Versions of the Study Glasses (continued)

Analyte=F
Variability Chart for Measured (wt%)

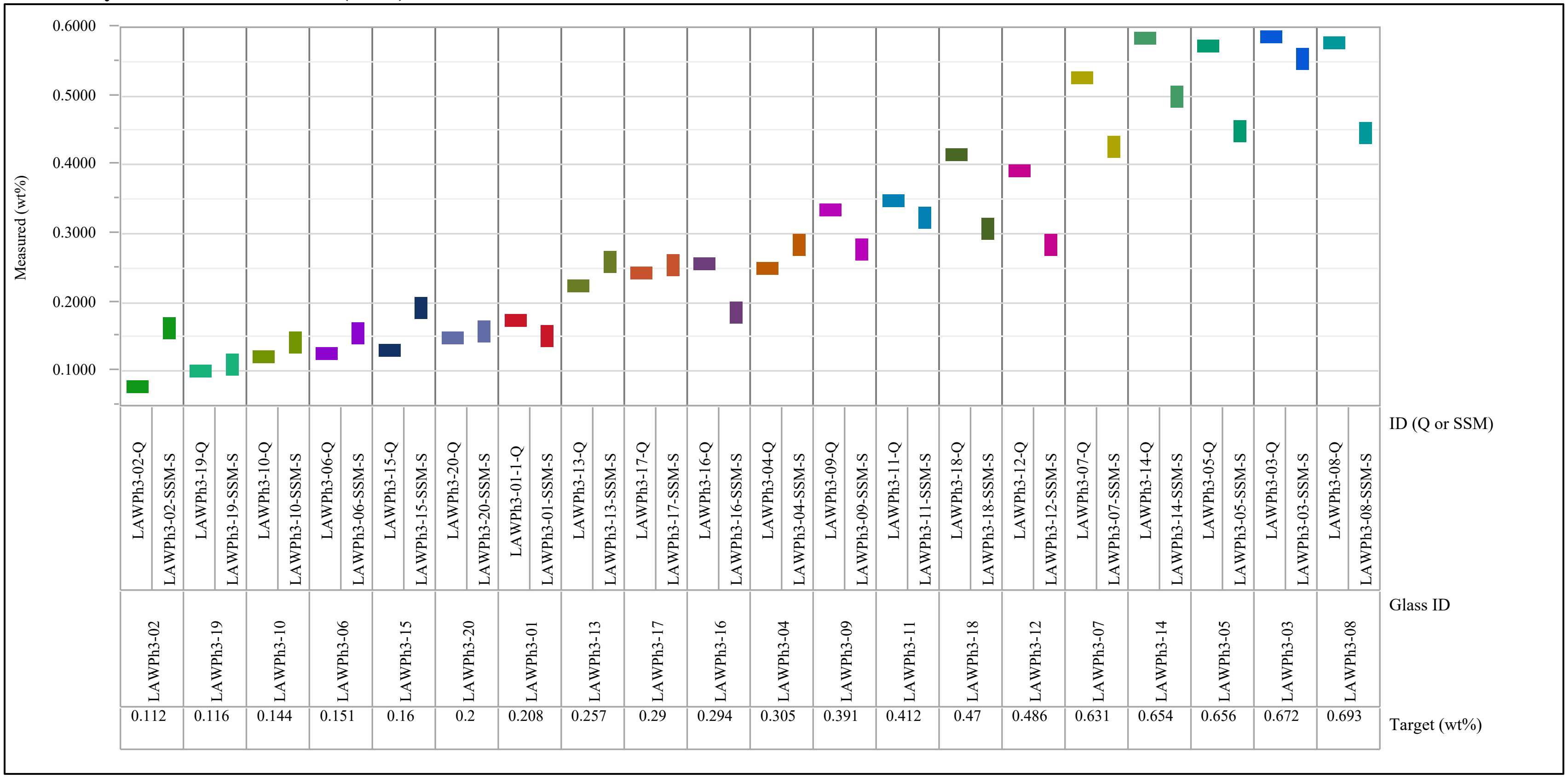


Exhibit C-1. Comparisons of the Measured Compositions of the Quenched and Sulfur Saturated Versions of the Study Glasses (continued)

Analyte=Fe2O3
Variability Chart for Measured (wt%)

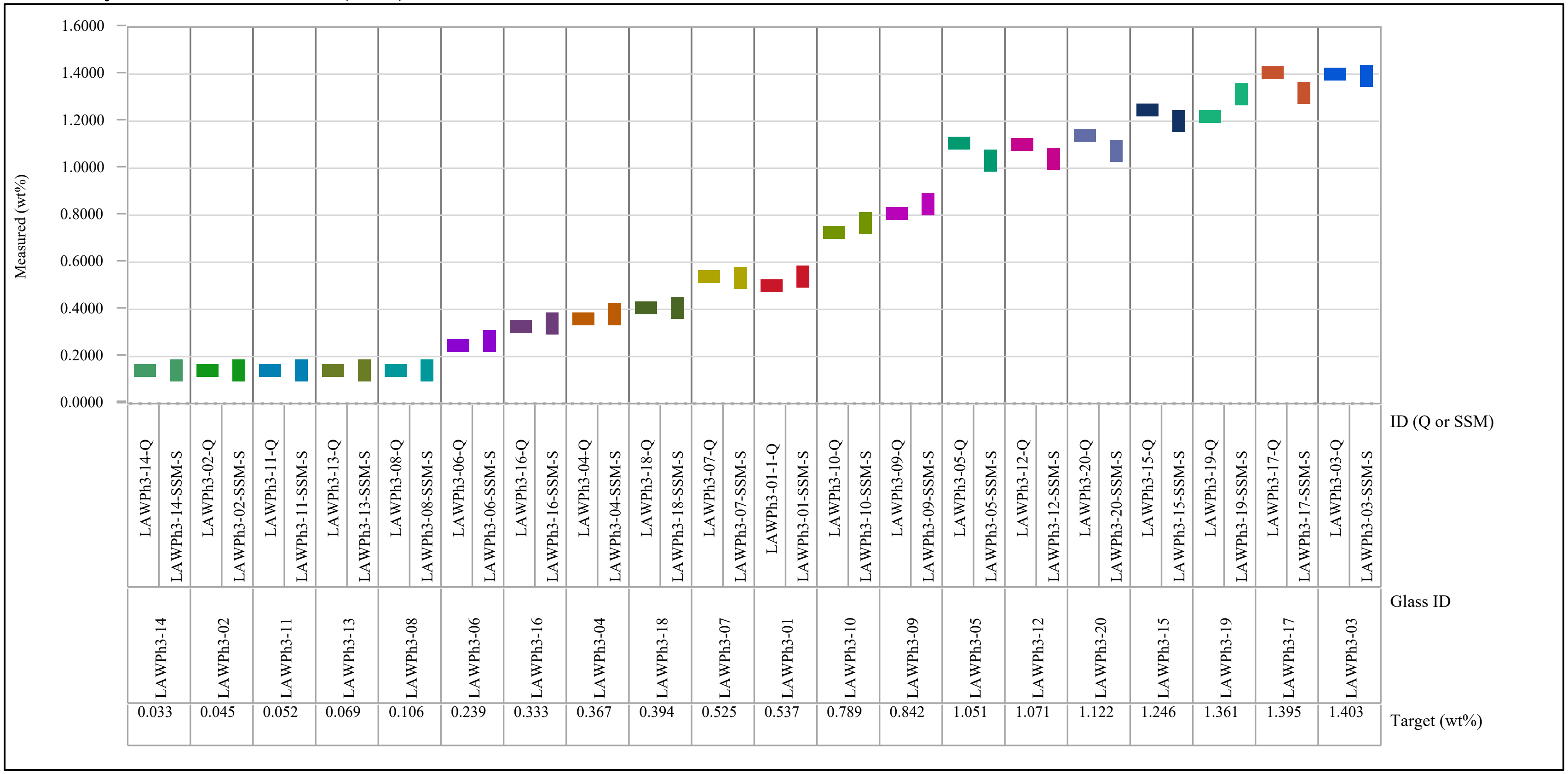


Exhibit C-1. Comparisons of the Measured Compositions of the Quenched and Sulfur Saturated Versions of the Study Glasses (continued)

Analyte=K2O
Variability Chart for Measured (wt%)

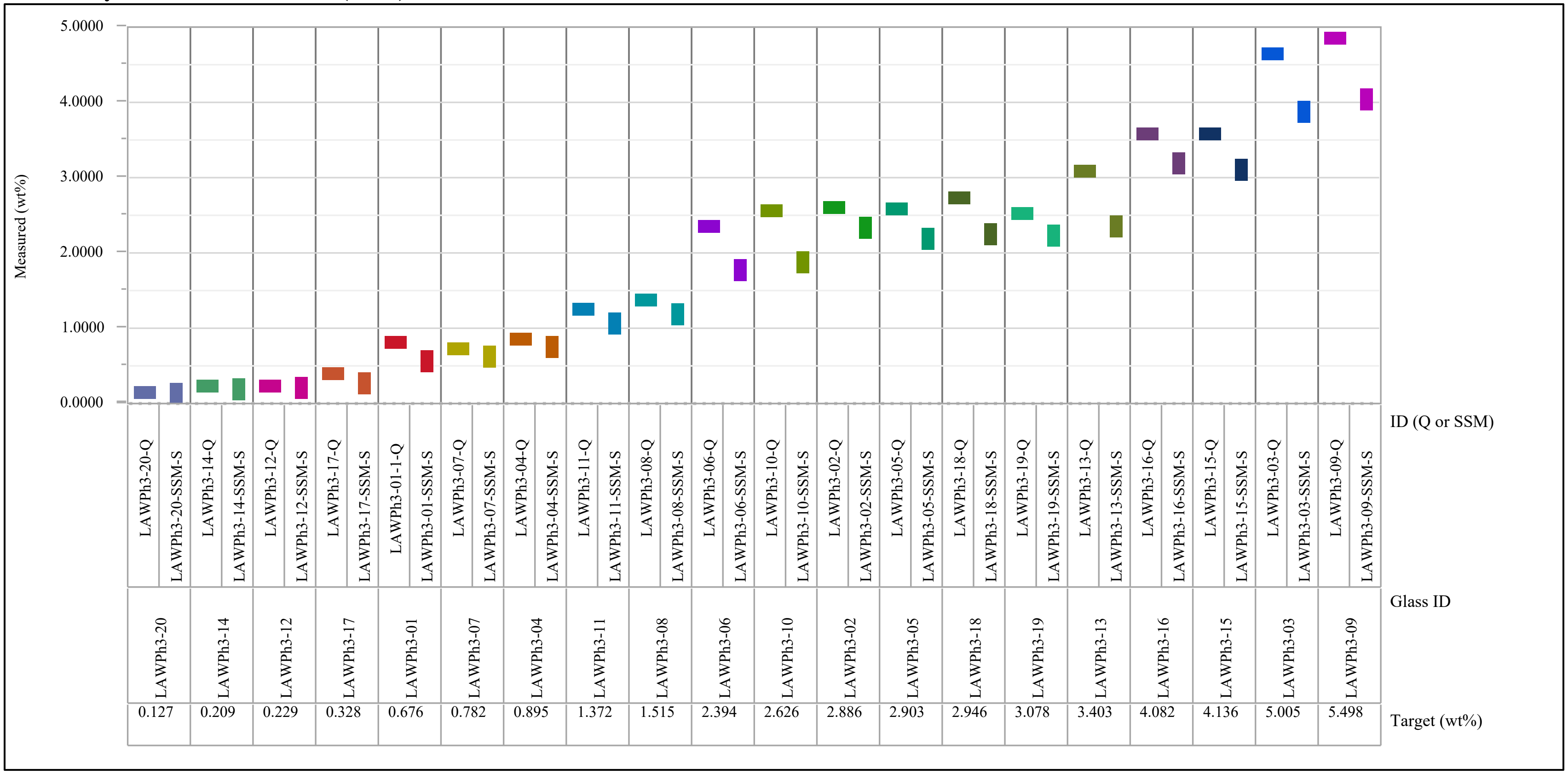


Exhibit C-1. Comparisons of the Measured Compositions of the Quenched and Sulfur Saturated Versions of the Study Glasses (continued)

Analyte=MgO
Variability Chart for Measured (wt%)

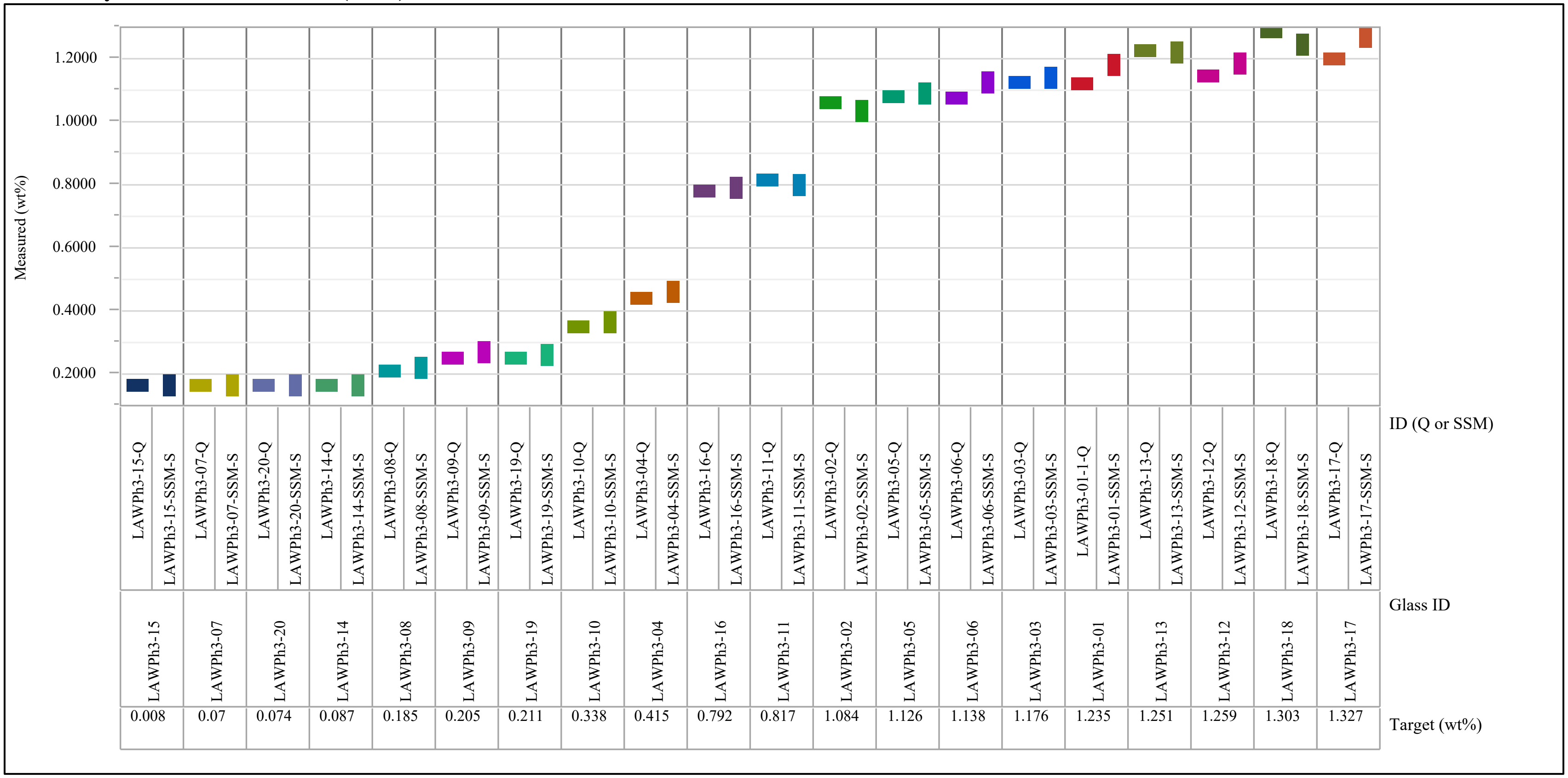


Exhibit C-1. Comparisons of the Measured Compositions of the Quenched and Sulfur Saturated Versions of the Study Glasses (continued)

Analyte=Na2O
Variability Chart for Measured (wt%)

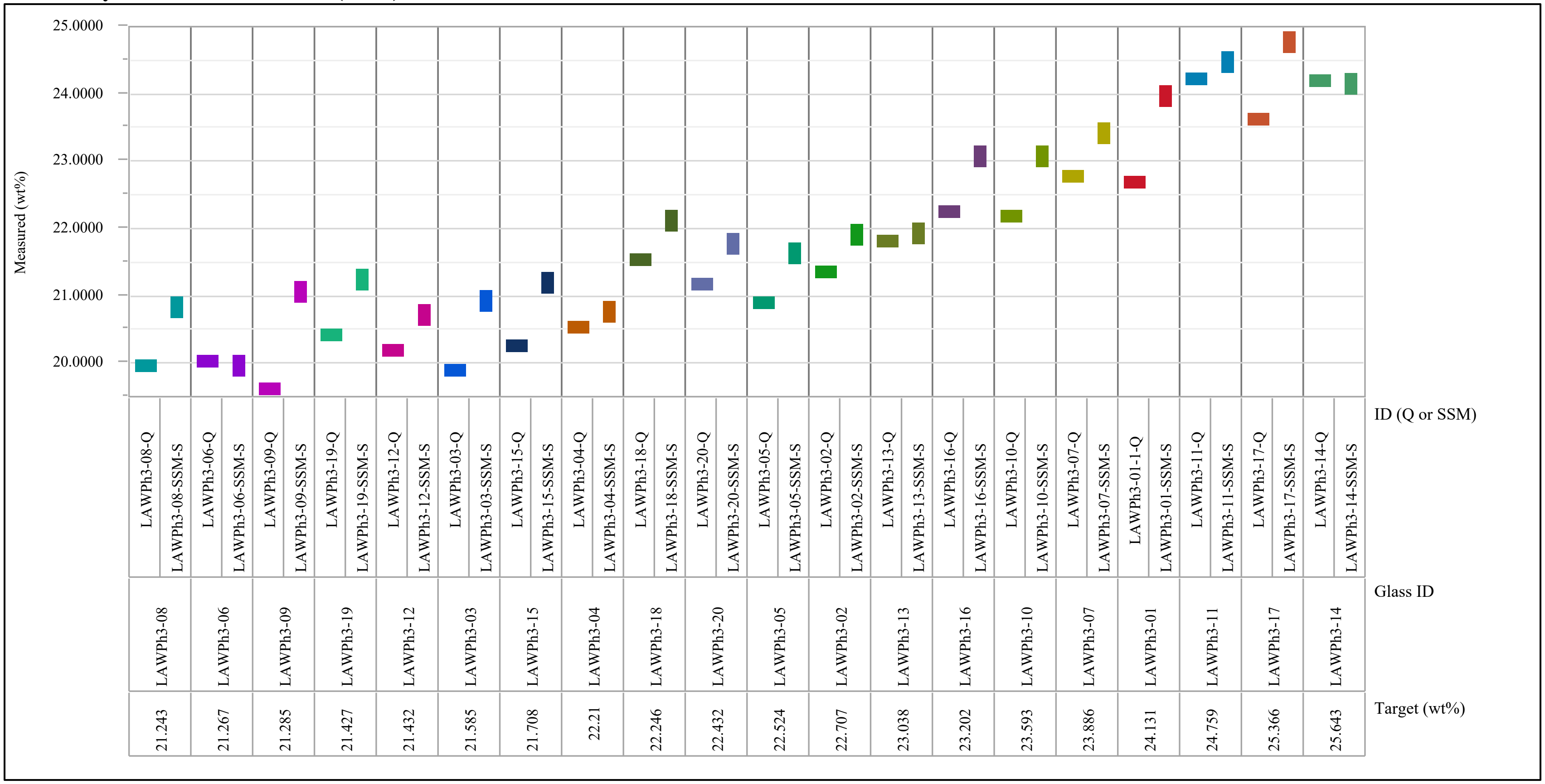


Exhibit C-1. Comparisons of the Measured Compositions of the Quenched and Sulfur Saturated Versions of the Study Glasses (continued)

Analyte=P2O5
Variability Chart for Measured (wt%)

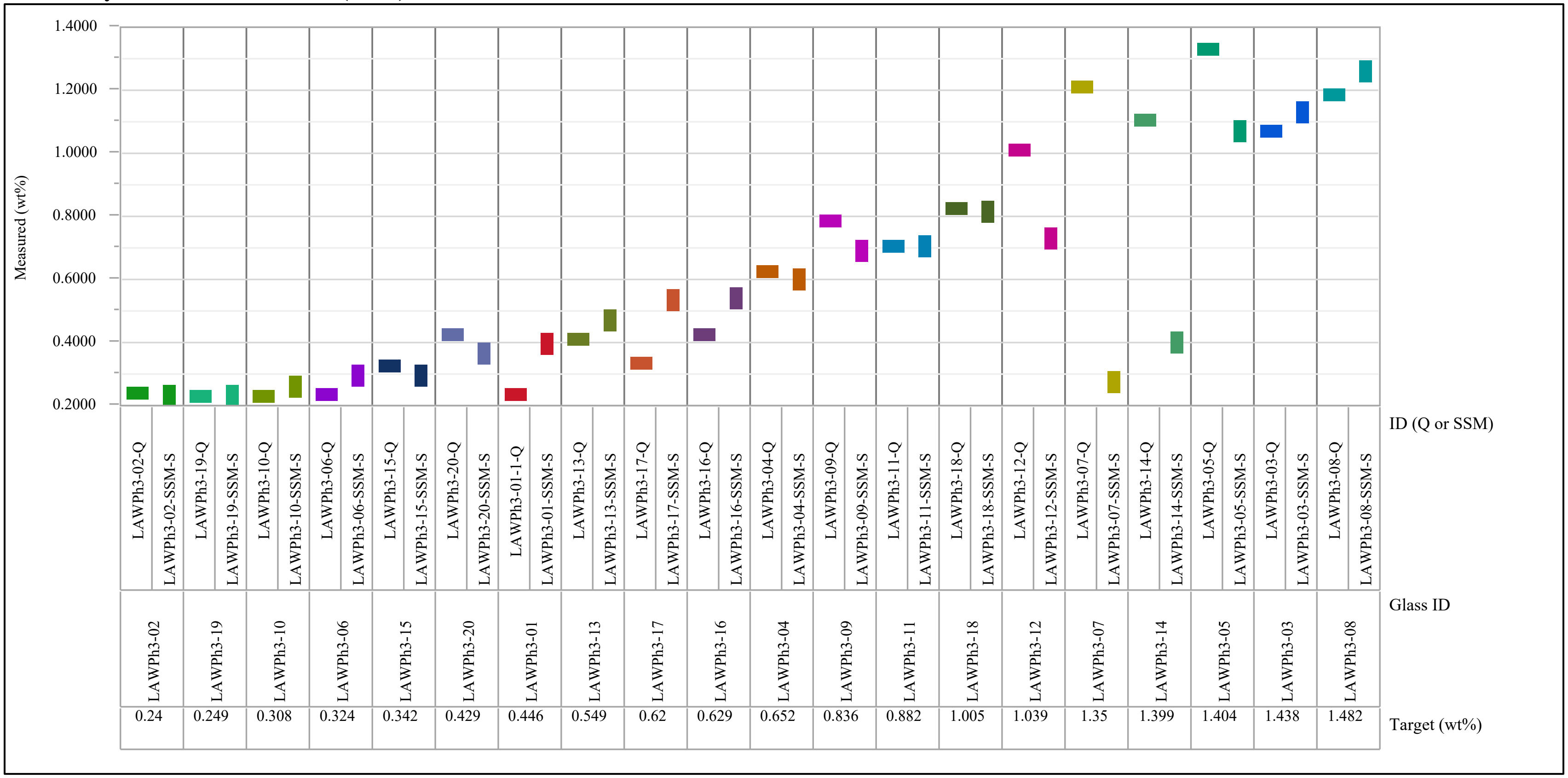


Exhibit C-1. Comparisons of the Measured Compositions of the Quenched and Sulfur Saturated Versions of the Study Glasses (continued)

Analyte=SiO2
Variability Chart for Measured (wt%)

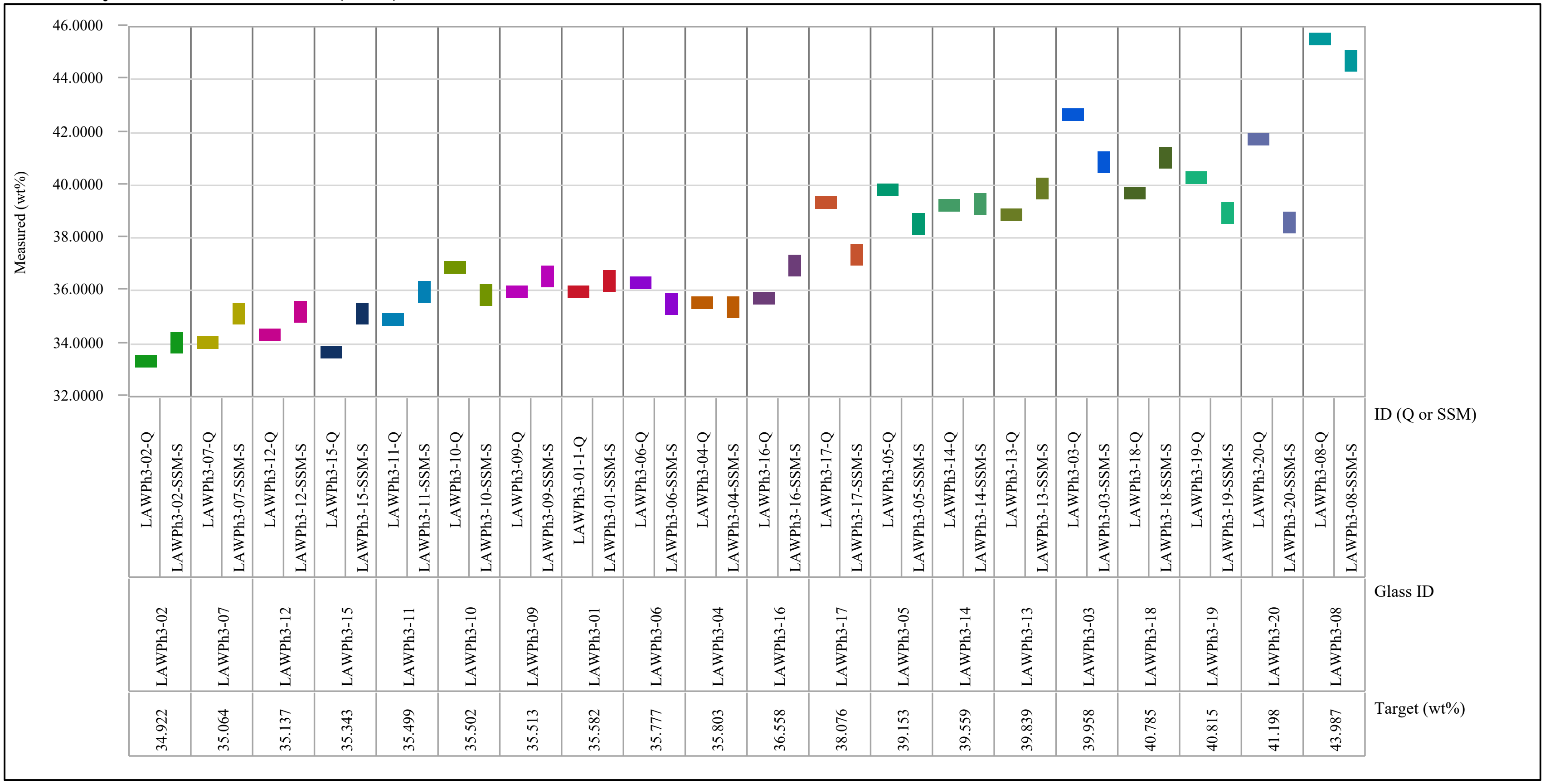


Exhibit C-1. Comparisons of the Measured Compositions of the Quenched and Sulfur Saturated Versions of the Study Glasses (continued)

Analyte=SnO2
Variability Chart for Measured (wt%)

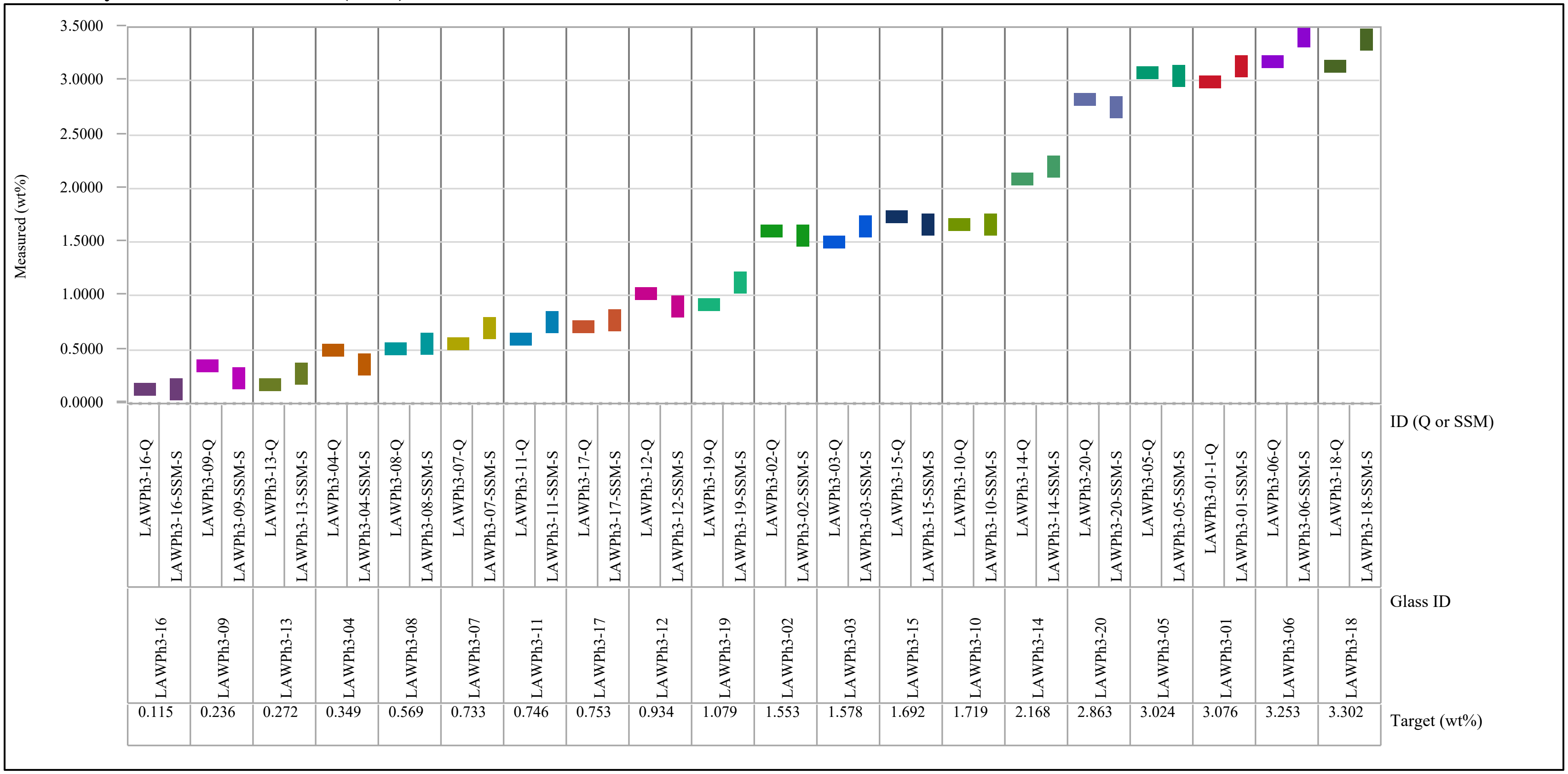


Exhibit C-1. Comparisons of the Measured Compositions of the Quenched and Sulfur Saturated Versions of the Study Glasses (continued)

Analyte=SO3
Variability Chart for Measured (wt%)

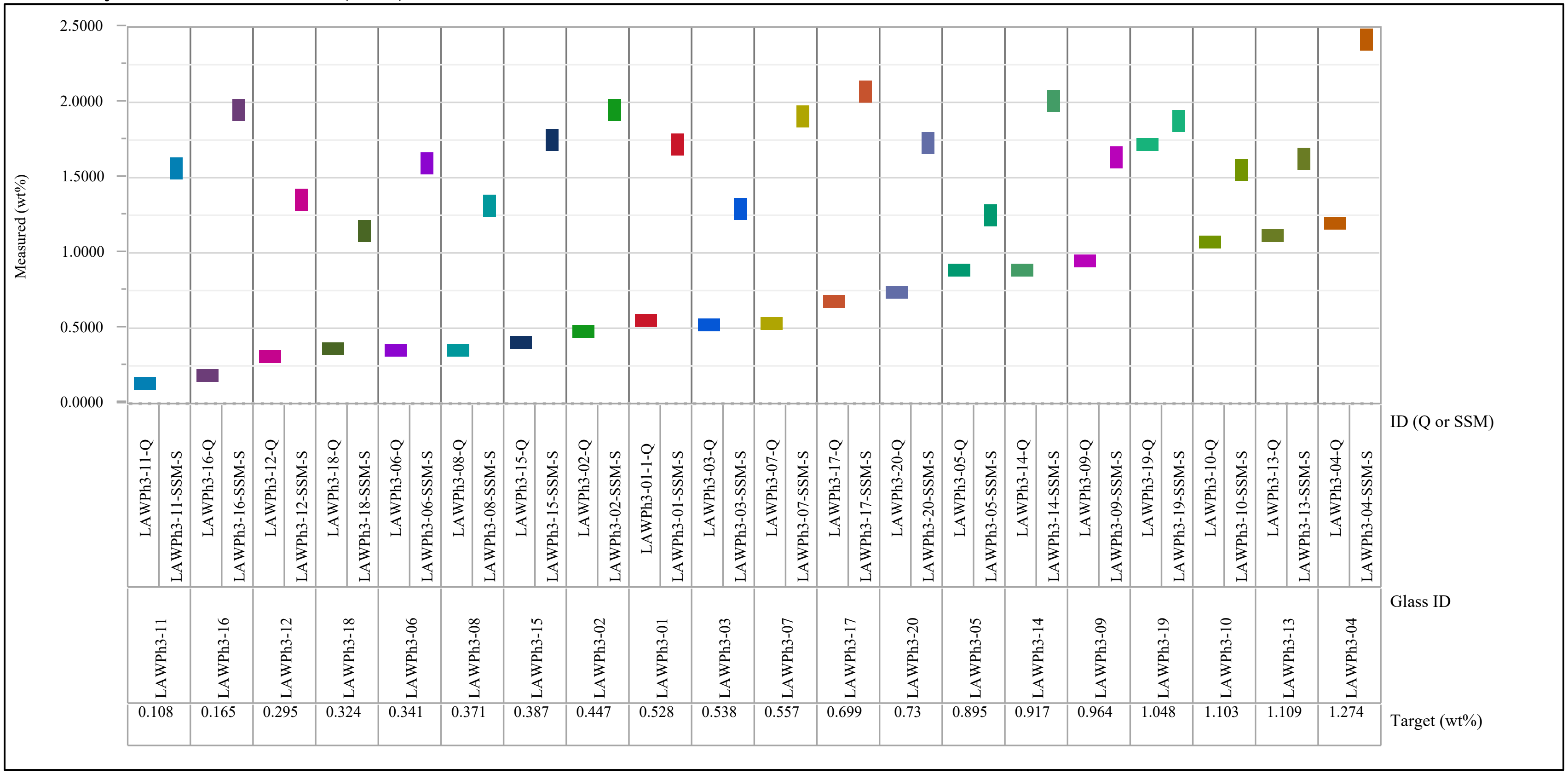


Exhibit C-1. Comparisons of the Measured Compositions of the Quenched and Sulfur Saturated Versions of the Study Glasses (continued)

Analyte=V2O5
Variability Chart for Measured (wt%)

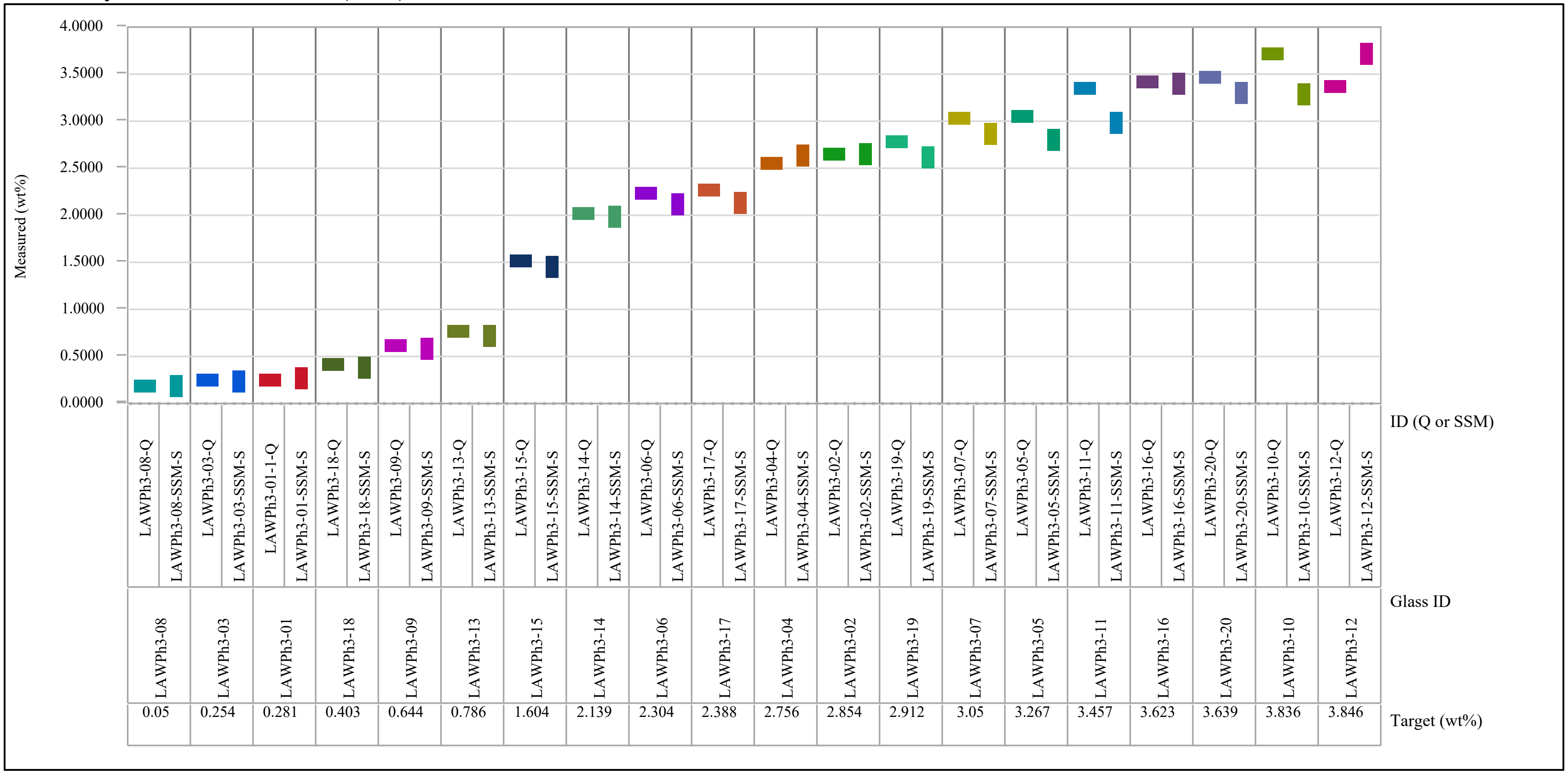


Exhibit C-1. Comparisons of the Measured Compositions of the Quenched and Sulfur Saturated Versions of the Study Glasses (continued)

Analyte=ZnO
Variability Chart for Measured (wt%)

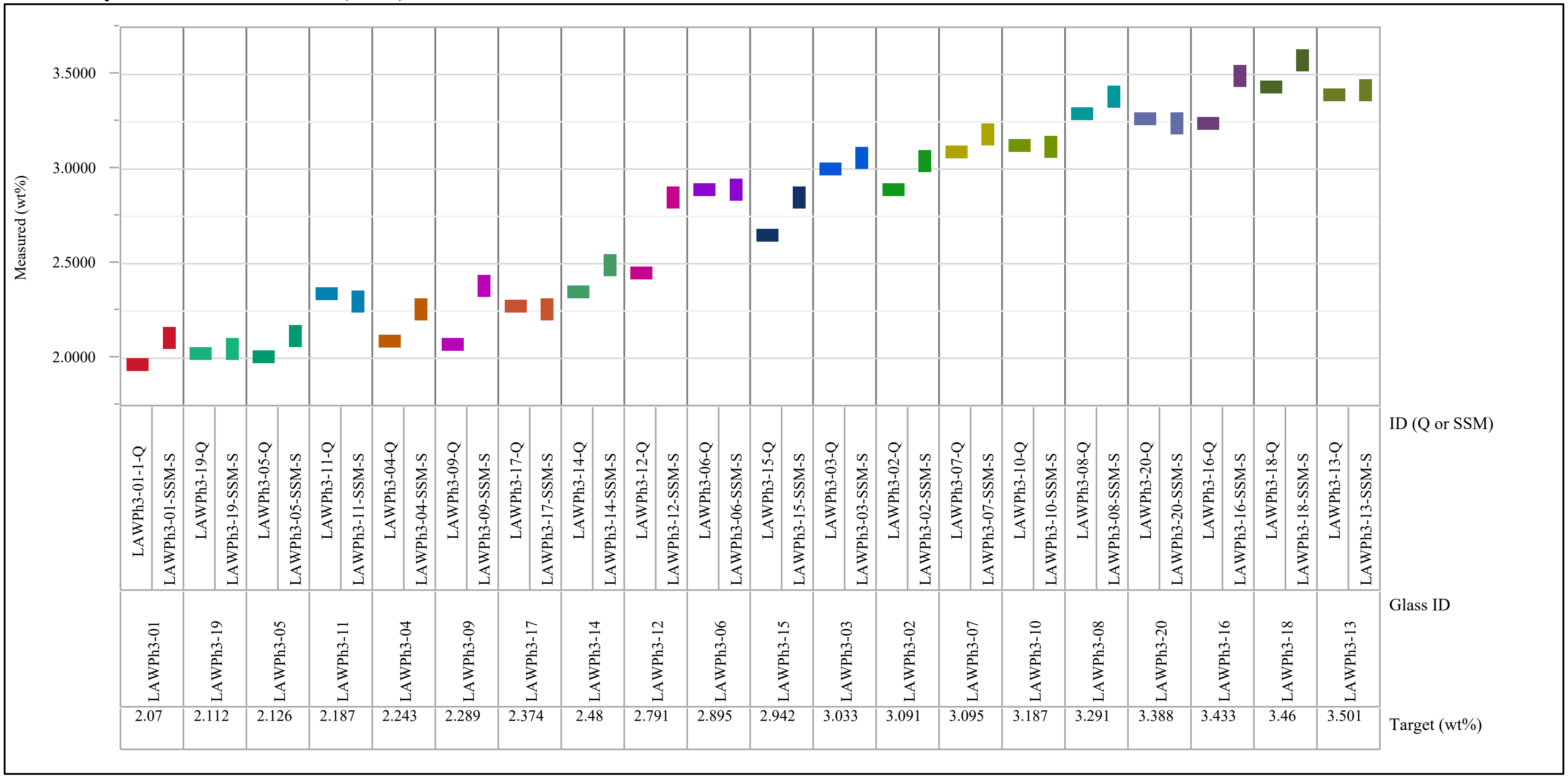


Exhibit C-1. Comparisons of the Measured Compositions of the Quenched and Sulfur Saturated Versions of the Study Glasses (continued)

Analyte=ZrO2
Variability Chart for Measured (wt%)

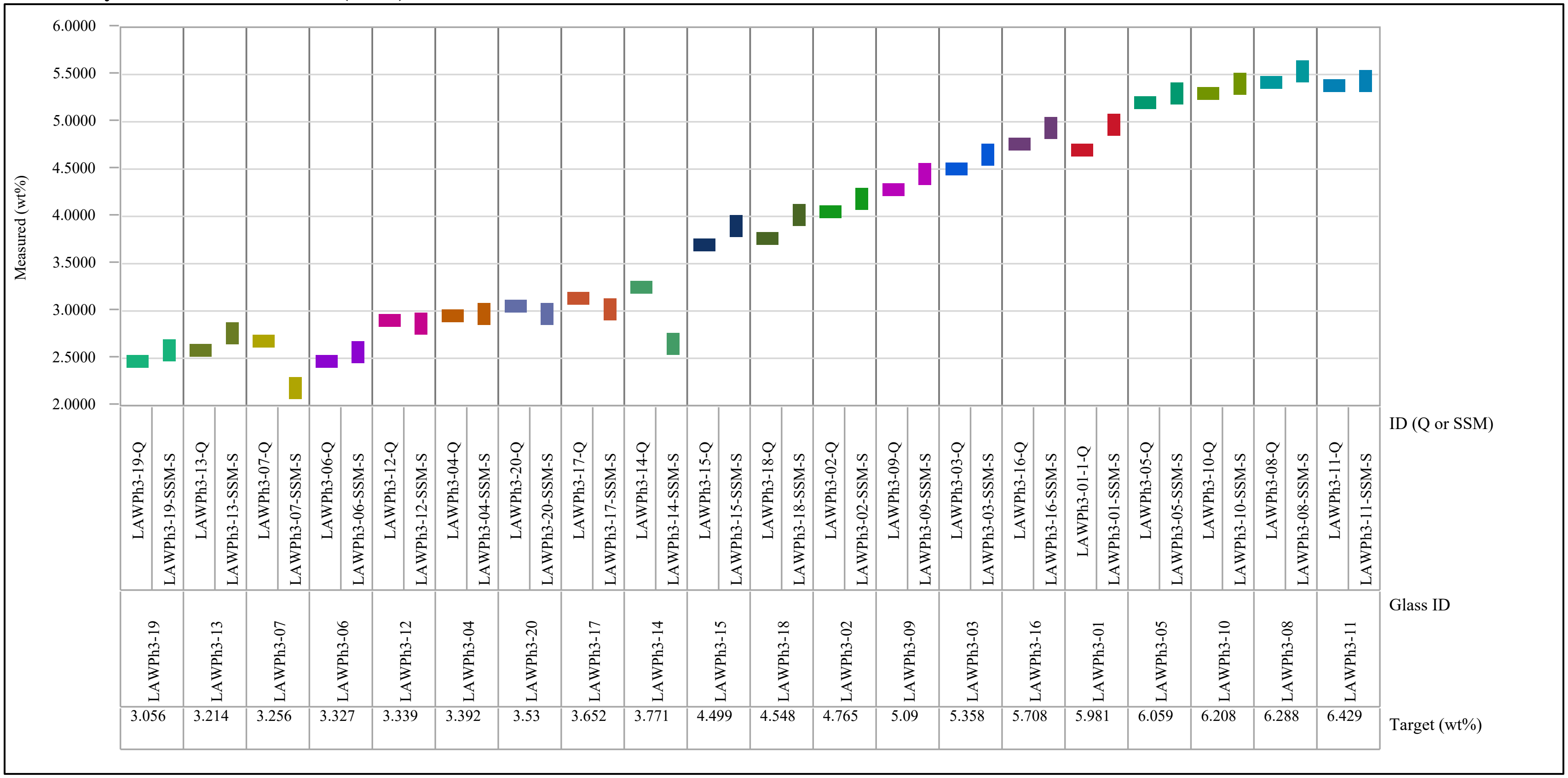
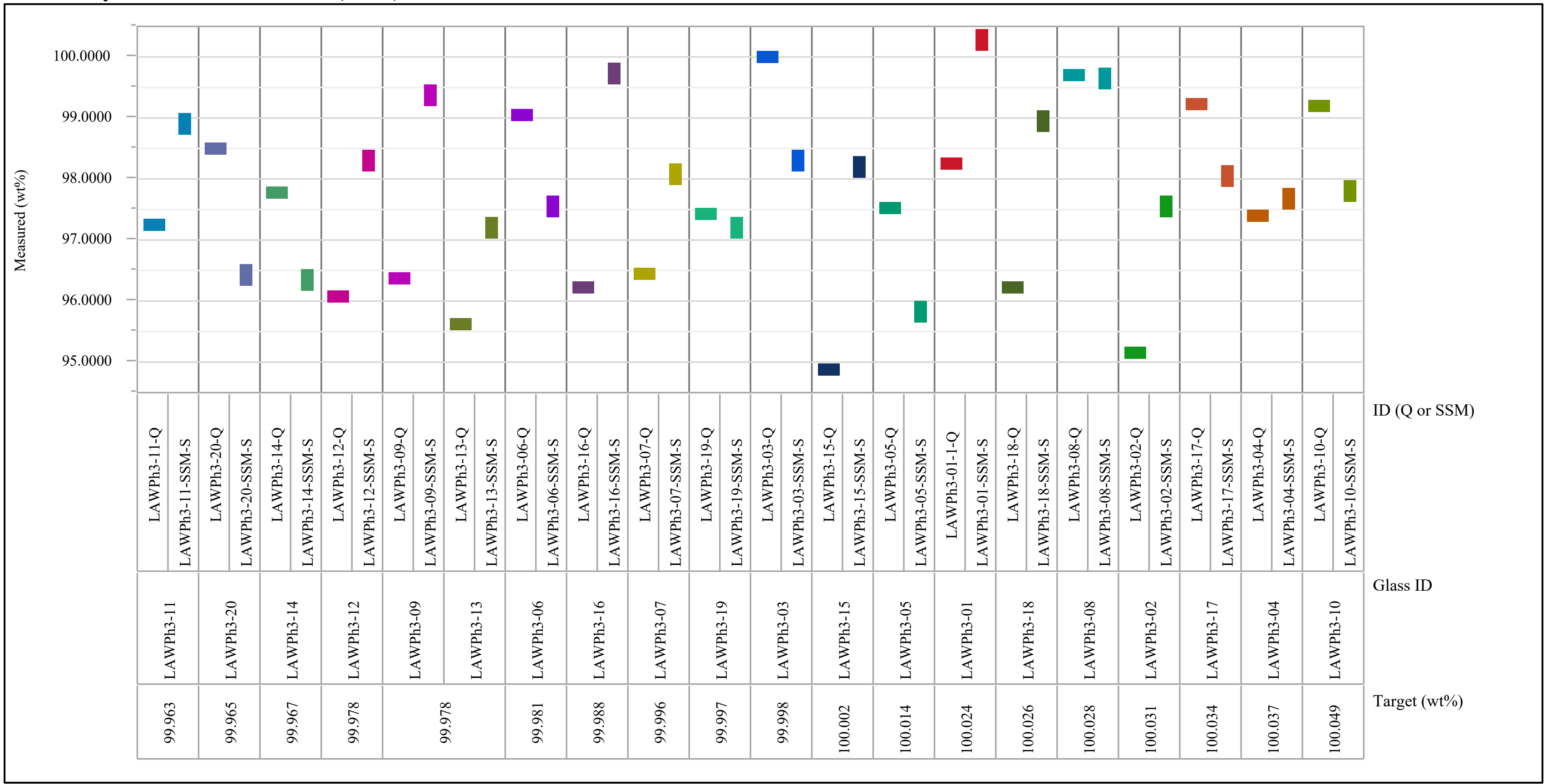


Exhibit C-1. Comparisons of the Measured Compositions of the Quenched and Sulfur Saturated Versions of the Study Glasses (continued)

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



Appendix D Tables Supporting the Mod Glass Composition Measurements

Table D-1. ICP-AES Measurements of the SSM Mod Glass Wash Solutions (mg/L)

Sample ID	Lab ID	Al	B	Ca	Cr	Fe	K	Mg	Na
Custom standard, Lot 1811411	-	3.98	21.7	<1.00	<1.00	4.14	10.1	<1.00	81.9
LAWPh3-05_mod6-SSM-W	S-8892	<1.00	35.0	1.56	71.6	<1.00	164	<1.00	1170
LAWPh3-05_mod6-SSM-W	S-8892	<1.00	33.9	1.53	70.0	<1.00	164	<1.00	1190
LAWPh3-19_mod-SSM-W	S-8893	<1.00	21.9	8.75	60.4	<1.00	204	<1.00	958
LAWPh3-19_mod-SSM-W	S-8893	<1.00	22.0	8.68	59.8	<1.00	198	<1.00	929
Sample ID	**Lab ID**	**P**	**S**	**Si**	**Sn**	**V**	**Zn**	**Zr**	
Custom standard Lot 1811411	-	<1.00	<1.00	51.0	<1.00	<1.00	<1.00	<1.00	
LAWPh3-05_mod6-SSM-W	S-8892	41.2	611	19.9	29.9	87.6	<1.00	<1.00	
LAWPh3-05_mod6-SSM-W	S-8892	40.5	534	19.5	29.6	87.1	<1.00	<1.00	
LAWPh3-19_mod-SSM-W	S-8893	3.23	637	13.4	25.1	44.5	<1.00	<1.00	
LAWPh3-19_mod-SSM-W	S-8893	2.75	621	13.7	24.7	44.5	<1.00	<1.00	

Table D-2. IC Measurements of the SSM Mod Glass Wash Solutions (mg/L)

Sample ID	Lab ID	Cl	F
LAWPh3-05_mod6-SSM-W	S-8892	38.7	28.4
LAWPh3-05_mod6-SSM-W	S-8892	38.9	28.6
LAWPh3-19_mod-SSM-W	S-8893	<10.0	<10.0
LAWPh3-19_mod-SSM-W	S-8893	<10.0	<10.0

Exhibit D-1. Measurements of the SSM Mod Glasses (wt %)

PSH Prepared Samples, ICP-AES Measurements

Sample ID	Al	B	Ca	Si
LRM	4.75	2.37	<1.00	25.6
S-8894	3.23	3.09	1.75	17.0
S-8894	3.19	3.07	1.73	17.4
S-8895	3.42	2.47	5.96	17.7
S-8895	3.38	2.43	5.84	17.7

Sample ID	Al	B	Ca	Si
LRM	4.57	2.28	<1.00	25.6
S-8894	2.93	3.23	1.53	17.9
S-8894	3.01	3.24	1.56	18.0
S-8895	3.24	2.62	5.59	19.1
S-8895	3.19	2.53	5.49	18.7

KH Prepared Samples, IC Measurements

Sample ID	Cl	F
LRM	<0.0250	0.855
S-8894	0.131	0.369
S-8894	0.129	0.364
S-8895	0.0417	0.0480
S-8895	0.0389	0.0521

Sample ID	Cl	F
LRM	<0.0250	0.889
S-8894	0.142	0.396
S-8894	0.142	0.396
S-8895	0.0401	0.0511
S-8895	0.0407	0.0537

LM Prepared Samples, ICP-AES Measurements

Sample ID	Cr	Fe	K	Mg	Na	P	S	Sn	V	Zn	Zr
LRM	0.136	1.02	1.03	<1.00	13.5	0.229	0.101	<0.100	<0.100	<0.100	0.747
S-8894	0.145	0.735	1.86	0.665	15.2	0.495	0.587	1.60	1.59	1.71	2.32
S-8894	0.143	0.729	1.86	0.657	14.9	0.488	0.616	1.70	1.58	1.69	2.32
S-8895	0.117	0.898	1.88	0.148	14.1	0.106	0.748	0.918	1.42	1.60	1.73
S-8895	0.115	0.900	1.87	0.150	13.9	0.103	0.742	0.901	1.42	1.59	1.72

Sample ID	Cr	Fe	K	Mg	Na	P	S	Sn	V	Zn	Zr
LRM	0.133	1.01	1.18	<1.00	15.1	0.214	0.105	<0.100	<0.100	<0.100	0.741
S-8894	0.148	0.775	1.85	0.676	15.6	0.529	0.661	1.81	1.65	1.79	2.42
S-8894	0.146	0.785	1.85	0.683	15.0	0.530	0.674	1.77	1.62	1.75	2.39
S-8895	0.122	0.955	1.94	0.159	14.8	0.108	0.816	1.00	1.51	1.71	1.83
S-8895	0.122	0.955	1.93	0.162	14.2	0.108	0.831	0.985	1.50	1.71	1.81

S-8894 = LAWPh3-05_mod6-SSM; S-8895 = LAWPh3-19_mod-SSM

Exhibit D-2. Measurements of the Q Mod Glasses (wt %)

PSH Prepared Samples, ICP-AES Measurements

Sample ID	Al	B	Ca	Si
LRM	4.75	2.37	<1.00	25.6
S-9447	3.08	3.14	1.73	16.4
S-9447	3.13	3.12	1.74	16.3
S-9448	3.34	2.48	5.90	17.1
S-9448	3.25	2.40	5.71	17.1
Sample ID	**Al**	**B**	**Ca**	**Si**
LRM	4.57	2.28	<1.00	25.6
S-9447	3.04	3.24	1.59	18.4
S-9447	2.98	3.19	1.59	18.0
S-9448	3.24	2.50	5.56	19.2
S-9448	3.11	2.36	5.36	18.8

KH Prepared Samples, IC Measurements

Sample ID	Cl	F
LRM	<0.0250	0.855
S-9447	0.343	0.513
S-9447	0.329	0.512
S-9448	0.0863	0.0620
S-9448	0.0815	0.0583
Sample ID	**Cl**	**F**
LRM	<0.0250	0.889
S-9447	0.371	0.539
S-9447	0.373	0.531
S-9448	0.0869	0.0685
S-9448	0.0805	0.0656

LM Prepared Samples, ICP-AES Measurements

Sample ID	Cr	Fe	K	Mg	Na	P	S	Sn	V	Zn	Zr
LRM	0.136	1.02	1.03	<1.00	13.5	0.229	0.101	<0.100	<0.100	<0.100	0.747
S-9447	0.282	0.720	2.16	0.635	15.2	0.562	0.378	1.64	1.71	1.64	2.24
S-9447	0.293	0.712	2.30	0.626	15.0	0.550	0.357	1.64	1.77	1.70	2.27
S-9448	0.241	0.924	2.46	0.152	14.2	0.113	0.406	0.948	1.58	1.68	1.80
S-9448	0.242	0.935	2.43	0.154	13.9	0.115	0.433	0.935	1.57	1.67	1.81
Sample ID	**Cr**	**Fe**	**K**	**Mg**	**Na**	**P**	**S**	**Sn**	**V**	**Zn**	**Zr**
LRM	0.133	1.01	1.18	<1.00	15.1	0.214	0.105	<0.100	<0.100	<0.100	0.741
S-9447	0.300	0.763	2.21	0.654	15.4	0.603	0.397	1.78	1.82	1.75	2.38
S-9447	0.300	0.764	2.24	0.654	15.3	0.588	0.395	1.73	1.81	1.74	2.34
S-9448	0.247	0.944	2.40	0.158	14.5	0.109	0.463	1.00	1.61	1.73	1.84
S-9448	0.239	0.937	2.36	0.154	14.0	0.111	0.454	0.990	1.56	1.68	1.79

S-9447 = LAWPh3-05_mod6-Q; S-9448 = LAWPh3-19_mod-Q

Appendix E Tables and Exhibits Supporting the Wash Solution Composition Measurements

Table E-1. Measurements (mg/L) of Wash Solutions by ICP-AES

Soln ID	Blk	Seq	Lab ID	Al	B	Ca	Cr	Fe	K	Mg	Na	P	S	Si	Sn	V	Zn	Zr
soln std	1	1	soln std 1-1	3.66	21.3	<1.00	<1.00	3.97	9.40	<1.00	78.2	<1.00	<1.00	51.4	<1.00	<1.00	<1.00	<1.00
LAWPh3-17-SSM-W	1	2	F02-1	1.29	17.6	2.81	61.8	<1.00	23.8	<1.00	985	6.19	575	19.1	<1.00	36.2	<1.00	<1.00
LAWPh3-16-SSM-W	1	3	F05-1	1.65	24.2	3.24	71.5	<1.00	229	<1.00	806	7.79	509	22.4	<1.00	76.0	<1.00	<1.00
LAWPh3-15-SSM-W	1	4	F19-1	<1.00	34.3	7.11	97.4	<1.00	340	<1.00	1050	4.36	739	12.3	<1.00	27.2	<1.00	<1.00
hpstd	1	5	hpstd-11	49.2	<1.00	<1.00	<1.00	50.1	<1.00	<1.00	140	<1.00	10.7	<1.00	<1.00	<1.00	<1.00	<1.00
LAWPh3-04-SSM-W	1	6	F09-1	<1.00	37.3	13.4	64.5	<1.00	55.6	<1.00	1010	1.79	660	17.1	<1.00	31.8	<1.00	<1.00
LAWPh3-06-SSM-W	1	7	F10-1	1.30	19.4	8.18	117	<1.00	208	<1.00	1090	2.49	716	10.4	<1.00	46.8	<1.00	<1.00
LAWPh3-19-SSM-W	1	8	F18-1	<1.00	23.9	10.6	61.8	<1.00	224	<1.00	1180	2.51	789	14.2	<1.00	50.5	<1.00	<1.00
LAWPh3-18-SSM-W	1	9	F01-1	1.03	15.2	1.34	80.6	<1.00	166	<1.00	938	21.5	557	6.18	<1.00	6.35	<1.00	<1.00
LAWPh3-11-SSM-W	1	10	F14-1	2.14	36.9	1.58	106	<1.00	79.6	<1.00	1180	23.0	593	17.5	<1.00	97.7	<1.00	<1.00
LAWPh3-05-SSM-W	1	11	F16-1	2.11	32.1	1.68	123	<1.00	237	<1.00	1560	58.2	840	21.2	<1.00	132	<1.00	<1.00
soln std	1	12	soln std 1-2	3.68	20.7	<1.00	<1.00	3.98	9.58	<1.00	78.1	<1.00	<1.00	50.4	<1.00	<1.00	<1.00	<1.00
LAWPh3-13-SSM-W	1	13	F17-1	<1.00	22.0	3.08	105	<1.00	271	<1.00	1050	7.69	723	11.7	<1.00	11.2	<1.00	<1.00
LAWPh3-08-SSM-W	1	14	F20-1	<1.00	14.8	2.98	71.0	<1.00	79.0	<1.00	1000	19.2	599	7.23	<1.00	<1.00	<1.00	<1.00
LAWPh3-02-SSM-W	1	15	F11-1	<1.00	41.6	6.34	70.7	<1.00	138	<1.00	810	3.74	510	14.2	<1.00	36.3	<1.00	<1.00
LAWPh3-14-SSM-W	1	16	F13-1	1.30	24.6	<1.00	37.9	<1.00	9.66	<1.00	917	25.6	482	20.2	<1.00	33.0	<1.00	<1.00
LAWPh3-01-SSM-W	1	17	F08-1	<1.00	42.6	3.25	89.7	<1.00	42.0	<1.00	1040	7.74	613	8.63	<1.00	2.66	<1.00	<1.00
LAWPh3-20-SSM-W	1	18	F07-1	<1.00	24.8	7.14	57.6	<1.00	8.44	<1.00	1200	6.48	699	12.1	<1.00	55.6	<1.00	<1.00
blank	1	19	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
LAWPh3-12-SSM-W	1	20	F06-1	1.27	25.9	6.09	44.7	<1.00	8.75	<1.00	867	11.8	526	5.81	<1.00	53.7	<1.00	<1.00
LAWPh3-07-SSM-W	1	21	F03-1	2.46	26.4	1.46	57.4	<1.00	52.3	<1.00	1220	16.9	619	16.0	<1.00	68.7	<1.00	<1.00
LAWPh3-10-SSM-W	1	22	F15-1	2.74	29.9	5.21	77.9	<1.00	227	<1.00	1370	6.87	821	19.3	<1.00	131	<1.00	<1.00
hpstd	1	23	hpstd-12	49.4	<1.00	<1.00	<1.00	50.5	<1.00	<1.00	141	<1.00	10.6	<1.00	<1.00	<1.00	<1.00	<1.00
LAWPh3-09-SSM-W	1	24	F12-1	<1.00	30.8	3.05	56.6	<1.00	378	<1.00	848	10.5	652	9.93	<1.00	9.31	<1.00	<1.00
LAWPh3-03-SSM-W	1	25	F04-1	<1.00	28.8	1.74	86.0	<1.00	404	<1.00	1280	40.6	836	9.06	<1.00	5.43	<1.00	<1.00
soln std	1	26	soln std 1-3 .	3.61	20.7	<1.00	<1.00	3.95	9.58	<1.00	77.1	<1.00	<1.00	50.7	<1.00	<1.00	<1.00	<1.00
soln std	2	1	soln std 2-1	3.61	20.9	<1.00	<1.00	3.94	9.45	<1.00	79.3	<1.00	<1.00	48.8	<1.00	<1.00	<1.00	<1.00
LAWPh3-13-SSM-W	2	2	F17-2	1.02	22.8	3.27	105	<1.00	254	<1.00	990	8.10	715	11.5	<1.00	11.1	<1.00	<1.00
LAWPh3-02-SSM-W	2	3	F11-2	<1.00	42.2	6.55	71.5	<1.00	137	<1.00	798	4.05	517	13.5	<1.00	37.4	<1.00	<1.00
LAWPh3-14-SSM-W	2	4	F13-2	1.19	24.9	1.14	38.0	<1.00	9.61	<1.00	902	25.6	482	19.2	<1.00	33.4	<1.00	<1.00
hpstd	2	5	hpstd-21	49.0	<1.00	<1.00	<1.00	50.0	<1.00	<1.00	151	<1.00	10.1	<1.00	<1.00	<1.00	<1.00	<1.00
LAWPh3-04-SSM-W	2	6	F09-2	<1.00	37.7	13.6	63.9	<1.00	57.9	<1.00	1000	2.22	641	16.2	<1.00	32.2	<1.00	<1.00
LAWPh3-01-SSM-W	2	7	F08-2	<1.00	42.5	3.42	89.8	<1.00	42.1	<1.00	1050	8.05	609	7.63	<1.00	2.60	<1.00	<1.00
LAWPh3-17-SSM-W	2	8	F02-2	1.33	18.8	3.06	62.6	<1.00	24.4	<1.00	952	6.29	576	17.3	<1.00	38.5	<1.00	<1.00
LAWPh3-20-SSM-W	2	9	F07-2	<1.00	24.9	7.28	57.8	<1.00	8.78	<1.00	1180	6.64	702	11.2	<1.00	56.4	<1.00	<1.00
LAWPh3-12-SSM-W	2	10	F06-2	1.20	26.4	6.32	44.8	<1.00	9.57	<1.00	896	11.7	522	5.20	<1.00	54.8	<1.00	<1.00
soln std	2	11	soln std 2-2	3.62	20.3	<1.00	<1.00	3.89	9.77	<1.00	82.2	<1.00	<1.00	49.6	<1.00	<1.00	<1.00	<1.00
LAWPh3-06-SSM-W	2	12	F10-2	1.22	20.6	8.46	117	<1.00	202	<1.00	1090	2.58	729	9.37	<1.00	46.4	<1.00	<1.00
LAWPh3-08-SSM-W	2	13	F20-2	<1.00	15.4	3.16	70.8	<1.00	83.2	<1.00	965	19.8	605	6.37	<1.00	<1.00	<1.00	<1.00
LAWPh3-16-SSM-W	2	14	F05-2	1.65	25.8	3.45	71.9	<1.00	232	<1.00	803	8.12	499	21.3	<1.00	77.8	<1.00	<1.00
LAWPh3-19-SSM-W	2	15	F18-2	<1.00	24.8	10.7	61.7	<1.00	230	<1.00	1180	2.90	798	13.2	<1.00	51.4	<1.00	<1.00
LAWPh3-15-SSM-W	2	16	F19-2	<1.00	35.9	7.28	96.4	<1.00	327	<1.00	1010	4.92	730	10.9	<1.00	27.3	<1.00	<1.00
LAWPh3-07-SSM-W	2	17	F03-2	2.42	26.7	1.65	57.6	<1.00	56.7	<1.00	1200	17.1	630	15.5	<1.00	69.9	<1.00	<1.00

Table E-1. Measurements (mg/L) of Wash Solutions by ICP-AES (continued)

Soln ID	Blk	Seq	Lab ID	Al	B	Ca	Cr	Fe	K	Mg	Na	P	S	Si	Sn	V	Zn	Zr
blank	2	18	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
LAWPh3-18-SSM-W	2	19	F01-2	<1.00	15.9	1.53	80.4	<1.00	165	<1.00	909	22.1	574	5.28	<1.00	6.23	<1.00	<1.00
LAWPh3-03-SSM-W	2	20	F04-2	<1.00	29.2	1.93	86.3	<1.00	415	<1.00	1290	40.8	853	7.90	<1.00	5.44	<1.00	<1.00
LAWPh3-09-SSM-W	2	21	F12-2	<1.00	31.2	3.22	56.3	<1.00	409	<1.00	906	10.6	650	8.86	<1.00	9.05	<1.00	<1.00
LAWPh3-10-SSM-W	2	22	F15-2	2.69	30.7	5.45	78.7	<1.00	212	<1.00	1360	7.30	826	18.6	<1.00	130	<1.00	<1.00
hpstd	2	23	hpstd-22	49.2	1.06	<1.00	<1.00	50.6	<1.00	<1.00	151	<1.00	10.2	<1.00	<1.00	<1.00	<1.00	<1.00
LAWPh3-05-SSM-W	2	24	F16-2	2.01	32.4	1.86	123	<1.00	222	<1.00	1550	58.5	838	20.6	<1.00	130	<1.00	<1.00
LAWPh3-11-SSM-W	2	25	F14-2	2.10	37.5	1.74	105	<1.00	80.7	<1.00	1190	23.1	576	16.5	<1.00	98.9	<1.00	<1.00
soln std	2	26	soln std 2-3	3.63	20.6	<1.00	<1.00	3.94	9.53	<1.00	79.8	<1.00	<1.00	48.3	<1.00	<1.00	<1.00	<1.00
soln std	3	1	soln std 3-1	3.62	20.5	<1.00	<1.00	3.88	9.14	<1.00	78.2	<1.00	<1.00	50.2	<1.00	<1.00	<1.00	<1.00
LAWPh3-20-SSM-W	3	2	F07-3	<1.00	24.6	7.03	57.3	<1.00	8.46	<1.00	1190	6.48	702	12.3	<1.00	54.4	<1.00	<1.00
LAWPh3-13-SSM-W	3	3	F17-3	1.23	21.5	3.06	104	<1.00	266	<1.00	1020	7.55	696	12.2	<1.00	12.0	<1.00	<1.00
LAWPh3-11-SSM-W	3	4	F14-3	2.24	36.6	1.58	105	<1.00	80.1	<1.00	1160	22.7	606	18.2	<1.00	98.4	<1.00	<1.00
LAWPh3-03-SSM-W	3	5	F04-3	<1.00	28.4	1.75	85.4	<1.00	399	<1.00	1280	39.9	863	9.78	<1.00	6.13	<1.00	<1.00
hpstd	3	6	hpstd-31	48.9	<1.00	<1.00	<1.00	49.5	<1.00	<1.00	142	<1.00	10.1	<1.00	<1.00	<1.00	<1.00	<1.00
LAWPh3-19-SSM-W	3	7	F18-3	<1.00	24.2	10.6	61.4	<1.00	232	<1.00	1170	2.78	801	15.2	<1.00	50.3	<1.00	<1.00
LAWPh3-12-SSM-W	3	8	F06-3	1.26	25.8	6.17	44.6	<1.00	8.59	<1.00	860	11.4	511	6.88	<1.00	54.5	<1.00	<1.00
LAWPh3-04-SSM-W	3	9	F09-3	<1.00	37.4	13.4	63.6	<1.00	55.8	<1.00	1020	2.23	632	18.1	<1.00	33.0	<1.00	<1.00
LAWPh3-01-SSM-W	3	10	F08-3	<1.00	41.7	3.23	88.6	<1.00	42.4	<1.00	1050	8.14	617	9.83	<1.00	2.75	<1.00	<1.00
LAWPh3-06-SSM-W	3	11	F10-3	1.36	19.5	8.22	115	<1.00	203	<1.00	1130	2.46	697	11.2	<1.00	47.0	<1.00	<1.00
soln std	3	12	soln std 3-2 .	3.61	20.0	<1.00	<1.00	3.88	9.35	<1.00	74.7	<1.00	<1.00	51.3	<1.00	<1.00	<1.00	<1.00
LAWPh3-16-SSM-W	3	13	F05-3	1.73	25.3	3.26	71.1	<1.00	241	<1.00	823	8.16	494	23.8	<1.00	76.5	<1.00	<1.00
LAWPh3-07-SSM-W	3	14	F03-3	2.45	26.4	1.47	57.0	<1.00	52.2	<1.00	1240	16.9	644	17.4	<1.00	69.1	<1.00	<1.00
LAWPh3-18-SSM-W	3	15	F01-3	1.07	15.5	1.35	80.0	<1.00	169	<1.00	913	21.6	590	7.18	<1.00	6.52	<1.00	<1.00
blank	3	16	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
LAWPh3-02-SSM-W	3	17	F11-3	<1.00	40.9	6.34	70.4	<1.00	142	<1.00	808	3.65	520	15.4	<1.00	37.9	<1.00	<1.00
LAWPh3-15-SSM-W	3	18	F19-3	<1.00	34.9	7.14	96.0	<1.00	350	<1.00	1050	4.65	741	12.7	<1.00	27.2	<1.00	<1.00
LAWPh3-08-SSM-W	3	19	F20-3	<1.00	14.6	3.00	70.5	<1.00	79.2	<1.00	978	18.8	600	8.19	<1.00	<1.00	<1.00	<1.00
LAWPh3-14-SSM-W	3	20	F13-3	1.38	24.5	<1.00	37.5	<1.00	9.30	<1.00	897	25.0	491	21.1	<1.00	33.1	<1.00	<1.00
hpstd	3	21	hpstd-32	49.3	<1.00	<1.00	<1.00	49.9	<1.00	<1.00	140	<1.00	9.92	<1.00	<1.00	<1.00	<1.00	<1.00
LAWPh3-17-SSM-W	3	22	F02-3	1.39	18.5	2.90	62.0	<1.00	23.6	<1.00	1010	6.03	582	19.2	<1.00	38.4	<1.00	<1.00
LAWPh3-10-SSM-W	3	23	F15-3	2.82	29.9	5.25	77.8	<1.00	222	<1.00	1390	6.91	817	20.5	<1.00	130	<1.00	<1.00
LAWPh3-09-SSM-W	3	24	F12-3	1.00	30.4	3.02	56.3	<1.00	384	<1.00	865	10.5	652	10.9	<1.00	9.93	<1.00	<1.00
LAWPh3-05-SSM-W	3	25	F16-3	2.19	32.1	1.68	123	<1.00	227	<1.00	1600	57.3	851	22.5	<1.00	132	<1.00	<1.00
soln std	3	26	soln std 3-3	3.61	20.0	<1.00	<1.00	3.87	9.31	<1.00	72.9	<1.00	<1.00	50.2	<1.00	<1.00	<1.00	<1.00

Table E-2. Measurements (mg/L) of Wash Solutions by IC

Soln ID	Blk	Seq	Lab ID	Cl	F	PO4	SO4
10 ppm check std	1	1	10 ppm check std	10.0	10.1	9.98	9.12
IV-STOCK-59	1	2	IV-STOCK-59 1000mg/L	997	1000	973	910
LAWPh3-16-SSM-W	1	3	F05-1	14.9	10.5	22.5	1270
LAWPh3-09-SSM-W	1	4	F12-1	19.5	15.5	35.8	1640
LAWPh3-08-SSM-W	1	5	F20-1	44.8	24.2	53.0	1550
LAWPh3-15-SSM-W	1	6	F19-1	11.1	<10.0	<10.0	1840
LAWPh3-10-SSM-W	1	7	F15-1	10.1	<10.0	20.5	2040
LAWPh3-02-SSM-W	1	8	F11-1	<10.0	<10.0	13.0	1300
LAWPh3-06-SSM-W	1	9	F10-1	<10.0	<10.0	<10.0	1760
LAWPh3-12-SSM-W	1	10	F06-1	19.9	<10.0	30.0	1260
LAWPh3-17-SSM-W	1	11	F02-1	14.2	<10.0	20.5	1480
LAWPh3-05-SSM-W	1	12	F16-1	48.2	38.0	166	2110
blank	1	13	blank-1	<10.0	<10.0	<10.0	<10.0
LAWPh3-13-SSM-W	1	14	F17-1	13.7	10.8	25.0	1760
LAWPh3-04-SSM-W	1	15	F09-1	17.5	<10.0	<10.0	1590
LAWPh3-19-SSM-W	1	16	F18-1	<10.0	<10.0	<10.0	1710
LAWPh3-03-SSM-W	1	17	F04-1	51.4	37.0	124	2070
LAWPh3-18-SSM-W	1	18	F01-1	20.5	17.3	64.1	1530
LAWPh3-01-SSM-W	1	19	F08-1	12.1	<10.0	28.8	1540
LAWPh3-20-SSM-W	1	20	F07-1	10.2	<10.0	21.6	1760
LAWPh3-11-SSM-W	1	21	F14-1	23.7	18.1	69.7	1500
LAWPh3-07-SSM-W	1	22	F03-1	36.4	25.7	52.7	1600
LAWPh3-14-SSM-W	1	23	F13-1	26.4	22.1	73.3	1270
10 ppm check std	1	24	10 ppm check std	10.1	10.1	10.0	9.38
10 ppm check std	2	1	10 ppm check std	10.2	10.1	9.91	9.27
IV-STOCK-59	2	2	IV-STOCK-59 1000mg/L	978	963	968	902
LAWPh3-06-SSM-W	2	3	F10-2	<10.0	<10.0	<10.0	1460
LAWPh3-10-SSM-W	2	4	F15-2	10.4	<10.0	24.1	2030
LAWPh3-04-SSM-W	2	5	F09-2	17.6	<10.0	<10.0	1580
LAWPh3-02-SSM-W	2	6	F11-2	<10.0	<10.0	10.1	1320
LAWPh3-11-SSM-W	2	7	F14-2	23.7	18.0	67.0	1520
LAWPh3-15-SSM-W	2	8	F19-2	11.2	<10.0	15.2	1860
LAWPh3-12-SSM-W	2	9	F06-2	21.2	10.0	36.1	1300
LAWPh3-14-SSM-W	2	10	F13-2	25.7	21.5	75.6	1200
LAWPh3-16-SSM-W	2	11	F05-2	15.1	10.2	24.8	1260
LAWPh3-03-SSM-W	2	12	F04-2	50.3	36.8	115	2080
LAWPh3-20-SSM-W	2	13	F07-2	10.1	<10.0	21.6	1760
blank	2	14	blank-2	<10.0	<10.0	<10.0	<10.0
LAWPh3-05-SSM-W	2	15	F16-2	48.6	40.3	167	2100
LAWPh3-07-SSM-W	2	16	F03-2	36.1	25.4	53.5	1580
LAWPh3-13-SSM-W	2	17	F17-2	13.6	10.8	27.0	1770
LAWPh3-18-SSM-W	2	18	F01-2	15.9	14.1	52.8	1220
LAWPh3-17-SSM-W	2	19	F02-2	14.0	<10.0	19.9	1410
LAWPh3-08-SSM-W	2	20	F20-2	41.4	22.8	53.7	1460
LAWPh3-19-SSM-W	2	21	F18-2	<10.0	<10.0	10.1	1990
LAWPh3-01-SSM-W	2	22	F08-2	11.8	<10.0	23.3	1560
LAWPh3-09-SSM-W	2	23	F12-2	20.0	15.5	29.2	1640
10 ppm check std	2	24	10 ppm check std	10.0	10.0	9.80	9.63
10 ppm check std	3	1	10 ppm check std	10.1	10.3	9.84	9.15
IV-STOCK-59	3	2	IV-STOCK-59 1000mg/L	973	957	958	904
LAWPh3-18-SSM-W	3	3	F01-3	19.8	17.4	63.6	1470
LAWPh3-11-SSM-W	3	4	F14-3	23.7	18.0	67.2	1500
LAWPh3-07-SSM-W	3	5	F03-3	35.8	25.4	51.3	1580
LAWPh3-09-SSM-W	3	6	F12-3	19.8	15.8	33.5	1630
LAWPh3-16-SSM-W	3	7	F05-3	14.4	10.1	24.5	1250
LAWPh3-12-SSM-W	3	8	F06-3	20.6	10.0	31.0	1330
LAWPh3-03-SSM-W	3	9	F04-3	48.5	35.8	113	1970
LAWPh3-19-SSM-W	3	10	F18-3	<10.0	<10.0	10.5	1960
LAWPh3-17-SSM-W	3	11	F02-3	13.8	<10.0	20.5	1390

Table E-2. Measurements (mg/L) of Wash Solutions by IC (continued)

Soln ID	Blk	Seq	Lab ID	Cl	F	PO4	SO4
Blank	3	12	blank-3	<10.0	<10.0	<10.0	<10.0
LAWPh3-04-SSM-W	3	13	F09-3	20.7	10.2	10.3	1810
LAWPh3-14-SSM-W	3	14	F13-3	30.8	25.5	91.3	1420
LAWPh3-01-SSM-W	3	15	F08-3	14.3	<10.0	25.0	1840
LAWPh3-06-SSM-W	3	16	F10-3	<10.0	<10.0	<10.0	1950
LAWPh3-13-SSM-W	3	17	F17-3	16.0	12.8	30.2	2070
LAWPh3-05-SSM-W	3	18	F16-3	56.5	42.6	195	2450
LAWPh3-15-SSM-W	3	19	F19-3	13.2	<10.0	16.0	2160
LAWPh3-02-SSM-W	3	20	F11-3	<10.0	<10.0	14.7	1500
LAWPh3-08-SSM-W	3	21	F20-3	50.1	28.5	68.1	1760
LAWPh3-10-SSM-W	3	22	F15-3	12.2	<10.0	30.4	2330
LAWPh3-20-SSM-W	3	23	F07-3	11.6	<10.0	28.7	2020
10 ppm check std	3	24	10 ppm check std	10.9	10.9	10.9	10.8

Table E-3. Results for Standards Utilized During the Measurement of the Wash Solutions

Solution Identifier	Analyte	Instrument	Reference Value (mg/L)	Mean Measurement (mg/L)
10 ppm check std	Cl	IC	10	10.2
10 ppm check std	F	IC	10	10.3
10 ppm check std	PO4	IC	10	10.1
10 ppm check std	SO4	IC	10	9.6
IV-STOCK-59 1000 mg/L	Cl	IC	1000	982.7
IV-STOCK-59 1000 mg/L	F	IC	1000	973.3
IV-STOCK-59 1000 mg/L	PO4	IC	1000	966.3
IV-STOCK-59 1000 mg/L	SO4	IC	1000	905.3
hpstd	Al	ICP-AES	50	49.2
hpstd	B	ICP-AES	0	<1.0
hpstd	Ca	ICP-AES	0	<1.0
hpstd	Cr	ICP-AES	0	<1.0
hpstd	Fe	ICP-AES	50	50.1
hpstd	K	ICP-AES	0	<1.0
hpstd	Mg	ICP-AES	0	<1.0
hpstd	Na	ICP-AES	150	144.2
hpstd	P	ICP-AES	0	<1.0
hpstd	S	ICP-AES	10	10.3
hpstd	Si	ICP-AES	0	<1.0
hpstd	Sn	ICP-AES	0	<1.0
hpstd	V	ICP-AES	0	<1.0
hpstd	Zn	ICP-AES	0	<1.0
hpstd	Zr	ICP-AES	0	<1.0
soln std	Al	ICP-AES	4	3.6
soln std	B	ICP-AES	20	20.6
soln std	Ca	ICP-AES	0	<1.0
soln std	Cr	ICP-AES	0	<1.0
soln std	Fe	ICP-AES	4	3.9
soln std	K	ICP-AES	10	9.5
soln std	Mg	ICP-AES	0	<1.0
soln std	Na	ICP-AES	81	77.8
soln std	P	ICP-AES	0	<1.0
soln std	S	ICP-AES	0	<1.0
soln std	Si	ICP-AES	50	50.1
soln std	Sn	ICP-AES	0	<1.0
soln std	V	ICP-AES	0	<1.0
soln std	Zn	ICP-AES	0	<1.0
soln std	Zr	ICP-AES	0	<1.0

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

Table E-4. Average Measurements of the Wash Solutions

Solution Identifier	Analyte	Analysis	Average Measured Concentration (mg/L)
LAWPh3-01-SSM-W	Al	ICP-AES	<1
LAWPh3-01-SSM-W	B	ICP-AES	42.3
LAWPh3-01-SSM-W	Ca	ICP-AES	3.3
LAWPh3-01-SSM-W	Cl	IC	12.7
LAWPh3-01-SSM-W	Cr	ICP-AES	89.4
LAWPh3-01-SSM-W	F	IC	<10
LAWPh3-01-SSM-W	Fe	ICP-AES	<1
LAWPh3-01-SSM-W	K	ICP-AES	42.2
LAWPh3-01-SSM-W	Mg	ICP-AES	<1
LAWPh3-01-SSM-W	Na	ICP-AES	1046.7
LAWPh3-01-SSM-W	P	ICP-AES	8.0
LAWPh3-01-SSM-W	PO4	IC	25.7
LAWPh3-01-SSM-W	PO4	ICP-AES	24.5
LAWPh3-01-SSM-W	S	ICP-AES	613.0
LAWPh3-01-SSM-W	Si	ICP-AES	8.7
LAWPh3-01-SSM-W	Sn	ICP-AES	<1
LAWPh3-01-SSM-W	SO4	IC	1646.7
LAWPh3-01-SSM-W	SO4	ICP-AES	1836.5
LAWPh3-01-SSM-W	V	ICP-AES	2.7
LAWPh3-01-SSM-W	Zn	ICP-AES	<1
LAWPh3-01-SSM-W	Zr	ICP-AES	<1
LAWPh3-02-SSM-W	Al	ICP-AES	<1
LAWPh3-02-SSM-W	B	ICP-AES	41.6
LAWPh3-02-SSM-W	Ca	ICP-AES	6.4
LAWPh3-02-SSM-W	Cl	IC	<10
LAWPh3-02-SSM-W	Cr	ICP-AES	70.9
LAWPh3-02-SSM-W	F	IC	<10
LAWPh3-02-SSM-W	Fe	ICP-AES	<1
LAWPh3-02-SSM-W	K	ICP-AES	139.0
LAWPh3-02-SSM-W	Mg	ICP-AES	<1
LAWPh3-02-SSM-W	Na	ICP-AES	805.3
LAWPh3-02-SSM-W	P	ICP-AES	3.8
LAWPh3-02-SSM-W	PO4	IC	12.6
LAWPh3-02-SSM-W	PO4	ICP-AES	11.7
LAWPh3-02-SSM-W	S	ICP-AES	515.7
LAWPh3-02-SSM-W	Si	ICP-AES	14.4
LAWPh3-02-SSM-W	Sn	ICP-AES	<1
LAWPh3-02-SSM-W	SO4	IC	1373.3
LAWPh3-02-SSM-W	SO4	ICP-AES	1544.9
LAWPh3-02-SSM-W	V	ICP-AES	37.2
LAWPh3-02-SSM-W	Zn	ICP-AES	<1
LAWPh3-02-SSM-W	Zr	ICP-AES	<1
LAWPh3-03-SSM-W	Al	ICP-AES	<1
LAWPh3-03-SSM-W	B	ICP-AES	28.8
LAWPh3-03-SSM-W	Ca	ICP-AES	1.8
LAWPh3-03-SSM-W	Cl	IC	50.1
LAWPh3-03-SSM-W	Cr	ICP-AES	85.9
LAWPh3-03-SSM-W	F	IC	36.5
LAWPh3-03-SSM-W	Fe	ICP-AES	<1
LAWPh3-03-SSM-W	K	ICP-AES	406.0
LAWPh3-03-SSM-W	Mg	ICP-AES	<1
LAWPh3-03-SSM-W	Na	ICP-AES	1283.3
LAWPh3-03-SSM-W	P	ICP-AES	40.4
LAWPh3-03-SSM-W	PO4	IC	117.3
LAWPh3-03-SSM-W	PO4	ICP-AES	124.0

Table E-4. Average Measurements of the Wash Solutions (continued)

Solution Identifier	Analyte	Analysis	Average Measured Concentration (mg/L)
LAWPh3-03-SSM-W	S	ICP-AES	850.7
LAWPh3-03-SSM-W	Si	ICP-AES	8.9
LAWPh3-03-SSM-W	Sn	ICP-AES	<1
LAWPh3-03-SSM-W	SO4	IC	2040.0
LAWPh3-03-SSM-W	SO4	ICP-AES	2548.5
LAWPh3-03-SSM-W	V	ICP-AES	5.7
LAWPh3-03-SSM-W	Zn	ICP-AES	<1
LAWPh3-03-SSM-W	Zr	ICP-AES	<1
LAWPh3-04-SSM-W	Al	ICP-AES	<1
LAWPh3-04-SSM-W	B	ICP-AES	37.5
LAWPh3-04-SSM-W	Ca	ICP-AES	13.5
LAWPh3-04-SSM-W	Cl	IC	18.6
LAWPh3-04-SSM-W	Cr	ICP-AES	64.0
LAWPh3-04-SSM-W	F	IC	<10.1
LAWPh3-04-SSM-W	Fe	ICP-AES	<1
LAWPh3-04-SSM-W	K	ICP-AES	56.4
LAWPh3-04-SSM-W	Mg	ICP-AES	<1
LAWPh3-04-SSM-W	Na	ICP-AES	1010.0
LAWPh3-04-SSM-W	P	ICP-AES	2.1
LAWPh3-04-SSM-W	PO4	IC	<10.1
LAWPh3-04-SSM-W	PO4	ICP-AES	6.4
LAWPh3-04-SSM-W	S	ICP-AES	644.3
LAWPh3-04-SSM-W	Si	ICP-AES	17.1
LAWPh3-04-SSM-W	Sn	ICP-AES	<1
LAWPh3-04-SSM-W	SO4	IC	1660.0
LAWPh3-04-SSM-W	SO4	ICP-AES	1930.4
LAWPh3-04-SSM-W	V	ICP-AES	32.3
LAWPh3-04-SSM-W	Zn	ICP-AES	<1
LAWPh3-04-SSM-W	Zr	ICP-AES	<1
LAWPh3-05-SSM-W	Al	ICP-AES	2.1
LAWPh3-05-SSM-W	B	ICP-AES	32.2
LAWPh3-05-SSM-W	Ca	ICP-AES	1.7
LAWPh3-05-SSM-W	Cl	IC	51.1
LAWPh3-05-SSM-W	Cr	ICP-AES	123.0
LAWPh3-05-SSM-W	F	IC	40.3
LAWPh3-05-SSM-W	Fe	ICP-AES	<1
LAWPh3-05-SSM-W	K	ICP-AES	228.7
LAWPh3-05-SSM-W	Mg	ICP-AES	<1
LAWPh3-05-SSM-W	Na	ICP-AES	1570.0
LAWPh3-05-SSM-W	P	ICP-AES	58.0
LAWPh3-05-SSM-W	PO4	IC	176.0
LAWPh3-05-SSM-W	PO4	ICP-AES	177.8
LAWPh3-05-SSM-W	S	ICP-AES	843.0
LAWPh3-05-SSM-W	Si	ICP-AES	21.4
LAWPh3-05-SSM-W	Sn	ICP-AES	<1
LAWPh3-05-SSM-W	SO4	IC	2220.0
LAWPh3-05-SSM-W	SO4	ICP-AES	2525.5
LAWPh3-05-SSM-W	V	ICP-AES	131.3
LAWPh3-05-SSM-W	Zn	ICP-AES	<1
LAWPh3-05-SSM-W	Zr	ICP-AES	<1
LAWPh3-06-SSM-W	Al	ICP-AES	1.3
LAWPh3-06-SSM-W	B	ICP-AES	19.8
LAWPh3-06-SSM-W	Ca	ICP-AES	8.3
LAWPh3-06-SSM-W	Cl	IC	<10
LAWPh3-06-SSM-W	Cr	ICP-AES	116.3
LAWPh3-06-SSM-W	F	IC	<10

Table E-4. Average Measurements of the Wash Solutions (continued)

Solution Identifier	Analyte	Analysis	Average Measured Concentration (mg/L)
LAWPh3-06-SSM-W	Fe	ICP-AES	<1
LAWPh3-06-SSM-W	K	ICP-AES	204.3
LAWPh3-06-SSM-W	Mg	ICP-AES	<1
LAWPh3-06-SSM-W	Na	ICP-AES	1103.3
LAWPh3-06-SSM-W	P	ICP-AES	2.5
LAWPh3-06-SSM-W	PO4	IC	<10
LAWPh3-06-SSM-W	PO4	ICP-AES	7.7
LAWPh3-06-SSM-W	S	ICP-AES	714.0
LAWPh3-06-SSM-W	Si	ICP-AES	10.3
LAWPh3-06-SSM-W	Sn	ICP-AES	<1
LAWPh3-06-SSM-W	SO4	IC	1723.3
LAWPh3-06-SSM-W	SO4	ICP-AES	2139.1
LAWPh3-06-SSM-W	V	ICP-AES	46.7
LAWPh3-06-SSM-W	Zn	ICP-AES	<1
LAWPh3-06-SSM-W	Zr	ICP-AES	<1
LAWPh3-07-SSM-W	Al	ICP-AES	2.4
LAWPh3-07-SSM-W	B	ICP-AES	26.5
LAWPh3-07-SSM-W	Ca	ICP-AES	1.5
LAWPh3-07-SSM-W	Cl	IC	36.1
LAWPh3-07-SSM-W	Cr	ICP-AES	57.3
LAWPh3-07-SSM-W	F	IC	25.5
LAWPh3-07-SSM-W	Fe	ICP-AES	<1
LAWPh3-07-SSM-W	K	ICP-AES	53.7
LAWPh3-07-SSM-W	Mg	ICP-AES	<1
LAWPh3-07-SSM-W	Na	ICP-AES	1220.0
LAWPh3-07-SSM-W	P	ICP-AES	17.0
LAWPh3-07-SSM-W	PO4	IC	52.5
LAWPh3-07-SSM-W	PO4	ICP-AES	52.0
LAWPh3-07-SSM-W	S	ICP-AES	631.0
LAWPh3-07-SSM-W	Si	ICP-AES	16.3
LAWPh3-07-SSM-W	Sn	ICP-AES	<1
LAWPh3-07-SSM-W	SO4	IC	1586.7
LAWPh3-07-SSM-W	SO4	ICP-AES	1890.4
LAWPh3-07-SSM-W	V	ICP-AES	69.2
LAWPh3-07-SSM-W	Zn	ICP-AES	<1
LAWPh3-07-SSM-W	Zr	ICP-AES	<1
LAWPh3-08-SSM-W	Al	ICP-AES	<1
LAWPh3-08-SSM-W	B	ICP-AES	14.9
LAWPh3-08-SSM-W	Ca	ICP-AES	3.0
LAWPh3-08-SSM-W	Cl	IC	45.4
LAWPh3-08-SSM-W	Cr	ICP-AES	70.8
LAWPh3-08-SSM-W	F	IC	25.2
LAWPh3-08-SSM-W	Fe	ICP-AES	<1
LAWPh3-08-SSM-W	K	ICP-AES	80.5
LAWPh3-08-SSM-W	Mg	ICP-AES	<1
LAWPh3-08-SSM-W	Na	ICP-AES	981.0
LAWPh3-08-SSM-W	P	ICP-AES	19.3
LAWPh3-08-SSM-W	PO4	IC	58.3
LAWPh3-08-SSM-W	PO4	ICP-AES	59.1
LAWPh3-08-SSM-W	S	ICP-AES	601.3
LAWPh3-08-SSM-W	Si	ICP-AES	7.3
LAWPh3-08-SSM-W	Sn	ICP-AES	<1
LAWPh3-08-SSM-W	SO4	IC	1590.0
LAWPh3-08-SSM-W	SO4	ICP-AES	1801.5
LAWPh3-08-SSM-W	V	ICP-AES	<1
LAWPh3-08-SSM-W	Zn	ICP-AES	<1
LAWPh3-08-SSM-W	Zr	ICP-AES	<1

Table E-4. Average Measurements of the Wash Solutions (continued)

Solution Identifier	Analyte	Analysis	Average Measured Concentration (mg/L)
LAWPh3-09-SSM-W	Al	ICP-AES	<1
LAWPh3-09-SSM-W	B	ICP-AES	30.8
LAWPh3-09-SSM-W	Ca	ICP-AES	3.1
LAWPh3-09-SSM-W	Cl	IC	19.8
LAWPh3-09-SSM-W	Cr	ICP-AES	56.4
LAWPh3-09-SSM-W	F	IC	15.6
LAWPh3-09-SSM-W	Fe	ICP-AES	<1
LAWPh3-09-SSM-W	K	ICP-AES	390.3
LAWPh3-09-SSM-W	Mg	ICP-AES	<1
LAWPh3-09-SSM-W	Na	ICP-AES	873.0
LAWPh3-09-SSM-W	P	ICP-AES	10.5
LAWPh3-09-SSM-W	PO4	IC	32.8
LAWPh3-09-SSM-W	PO4	ICP-AES	32.3
LAWPh3-09-SSM-W	S	ICP-AES	651.3
LAWPh3-09-SSM-W	Si	ICP-AES	9.9
LAWPh3-09-SSM-W	Sn	ICP-AES	<1
LAWPh3-09-SSM-W	SO4	IC	1636.7
LAWPh3-09-SSM-W	SO4	ICP-AES	1951.3
LAWPh3-09-SSM-W	V	ICP-AES	9.4
LAWPh3-09-SSM-W	Zn	ICP-AES	<1
LAWPh3-09-SSM-W	Zr	ICP-AES	<1
LAWPh3-10-SSM-W	Al	ICP-AES	2.8
LAWPh3-10-SSM-W	B	ICP-AES	30.2
LAWPh3-10-SSM-W	Ca	ICP-AES	5.3
LAWPh3-10-SSM-W	Cl	IC	10.9
LAWPh3-10-SSM-W	Cr	ICP-AES	78.1
LAWPh3-10-SSM-W	F	IC	<10
LAWPh3-10-SSM-W	Fe	ICP-AES	<1
LAWPh3-10-SSM-W	K	ICP-AES	220.3
LAWPh3-10-SSM-W	Mg	ICP-AES	<1
LAWPh3-10-SSM-W	Na	ICP-AES	1373.3
LAWPh3-10-SSM-W	P	ICP-AES	7.0
LAWPh3-10-SSM-W	PO4	IC	25.0
LAWPh3-10-SSM-W	PO4	ICP-AES	21.5
LAWPh3-10-SSM-W	S	ICP-AES	821.3
LAWPh3-10-SSM-W	Si	ICP-AES	19.5
LAWPh3-10-SSM-W	Sn	ICP-AES	<1
LAWPh3-10-SSM-W	SO4	IC	2133.3
LAWPh3-10-SSM-W	SO4	ICP-AES	2460.6
LAWPh3-10-SSM-W	V	ICP-AES	130.3
LAWPh3-10-SSM-W	Zn	ICP-AES	<1
LAWPh3-10-SSM-W	Zr	ICP-AES	<1
LAWPh3-11-SSM-W	Al	ICP-AES	2.2
LAWPh3-11-SSM-W	B	ICP-AES	37.0
LAWPh3-11-SSM-W	Ca	ICP-AES	1.6
LAWPh3-11-SSM-W	Cl	IC	23.7
LAWPh3-11-SSM-W	Cr	ICP-AES	105.3
LAWPh3-11-SSM-W	F	IC	18.0
LAWPh3-11-SSM-W	Fe	ICP-AES	<1
LAWPh3-11-SSM-W	K	ICP-AES	80.1
LAWPh3-11-SSM-W	Mg	ICP-AES	<1
LAWPh3-11-SSM-W	Na	ICP-AES	1176.7
LAWPh3-11-SSM-W	P	ICP-AES	22.9
LAWPh3-11-SSM-W	PO4	IC	68.0
LAWPh3-11-SSM-W	PO4	ICP-AES	70.3
LAWPh3-11-SSM-W	S	ICP-AES	591.7

Table E-4. Average Measurements of the Wash Solutions (continued)

Solution Identifier	Analyte	Analysis	Average Measured Concentration (mg/L)
LAWPh3-11-SSM-W	Si	ICP-AES	17.4
LAWPh3-11-SSM-W	Sn	ICP-AES	<1
LAWPh3-11-SSM-W	SO4	IC	1506.7
LAWPh3-11-SSM-W	SO4	ICP-AES	1772.6
LAWPh3-11-SSM-W	V	ICP-AES	98.3
LAWPh3-11-SSM-W	Zn	ICP-AES	<1
LAWPh3-11-SSM-W	Zr	ICP-AES	<1
LAWPh3-12-SSM-W	Al	ICP-AES	1.2
LAWPh3-12-SSM-W	B	ICP-AES	26.0
LAWPh3-12-SSM-W	Ca	ICP-AES	6.2
LAWPh3-12-SSM-W	Cl	IC	20.6
LAWPh3-12-SSM-W	Cr	ICP-AES	44.7
LAWPh3-12-SSM-W	F	IC	<10
LAWPh3-12-SSM-W	Fe	ICP-AES	<1
LAWPh3-12-SSM-W	K	ICP-AES	9.0
LAWPh3-12-SSM-W	Mg	ICP-AES	<1
LAWPh3-12-SSM-W	Na	ICP-AES	874.3
LAWPh3-12-SSM-W	P	ICP-AES	11.6
LAWPh3-12-SSM-W	PO4	IC	32.4
LAWPh3-12-SSM-W	PO4	ICP-AES	35.7
LAWPh3-12-SSM-W	S	ICP-AES	519.7
LAWPh3-12-SSM-W	Si	ICP-AES	6.0
LAWPh3-12-SSM-W	Sn	ICP-AES	<1
LAWPh3-12-SSM-W	SO4	IC	1296.7
LAWPh3-12-SSM-W	SO4	ICP-AES	1556.9
LAWPh3-12-SSM-W	V	ICP-AES	54.3
LAWPh3-12-SSM-W	Zn	ICP-AES	<1
LAWPh3-12-SSM-W	Zr	ICP-AES	<1
LAWPh3-13-SSM-W	Al	ICP-AES	<1.1
LAWPh3-13-SSM-W	B	ICP-AES	22.1
LAWPh3-13-SSM-W	Ca	ICP-AES	3.1
LAWPh3-13-SSM-W	Cl	IC	14.4
LAWPh3-13-SSM-W	Cr	ICP-AES	104.7
LAWPh3-13-SSM-W	F	IC	11.5
LAWPh3-13-SSM-W	Fe	ICP-AES	<1
LAWPh3-13-SSM-W	K	ICP-AES	263.7
LAWPh3-13-SSM-W	Mg	ICP-AES	<1
LAWPh3-13-SSM-W	Na	ICP-AES	1020.0
LAWPh3-13-SSM-W	P	ICP-AES	7.8
LAWPh3-13-SSM-W	PO4	IC	27.4
LAWPh3-13-SSM-W	PO4	ICP-AES	23.9
LAWPh3-13-SSM-W	S	ICP-AES	711.3
LAWPh3-13-SSM-W	Si	ICP-AES	11.8
LAWPh3-13-SSM-W	Sn	ICP-AES	<1
LAWPh3-13-SSM-W	SO4	IC	1866.7
LAWPh3-13-SSM-W	SO4	ICP-AES	2131.1
LAWPh3-13-SSM-W	V	ICP-AES	11.4
LAWPh3-13-SSM-W	Zn	ICP-AES	<1
LAWPh3-13-SSM-W	Zr	ICP-AES	<1
LAWPh3-14-SSM-W	Al	ICP-AES	1.3
LAWPh3-14-SSM-W	B	ICP-AES	24.7
LAWPh3-14-SSM-W	Ca	ICP-AES	<1
LAWPh3-14-SSM-W	Cl	IC	27.6
LAWPh3-14-SSM-W	Cr	ICP-AES	37.8
LAWPh3-14-SSM-W	F	IC	23.0
LAWPh3-14-SSM-W	Fe	ICP-AES	<1

Table E-4. Average Measurements of the Wash Solutions (continued)

Solution Identifier	Analyte	Analysis	Average Measured Concentration (mg/L)
LAWPh3-14-SSM-W	K	ICP-AES	9.5
LAWPh3-14-SSM-W	Mg	ICP-AES	<1
LAWPh3-14-SSM-W	Na	ICP-AES	905.3
LAWPh3-14-SSM-W	P	ICP-AES	25.4
LAWPh3-14-SSM-W	PO4	IC	80.1
LAWPh3-14-SSM-W	PO4	ICP-AES	77.9
LAWPh3-14-SSM-W	S	ICP-AES	485.0
LAWPh3-14-SSM-W	Si	ICP-AES	20.2
LAWPh3-14-SSM-W	Sn	ICP-AES	<1
LAWPh3-14-SSM-W	SO4	IC	1296.7
LAWPh3-14-SSM-W	SO4	ICP-AES	1453.0
LAWPh3-14-SSM-W	V	ICP-AES	33.2
LAWPh3-14-SSM-W	Zn	ICP-AES	<1
LAWPh3-14-SSM-W	Zr	ICP-AES	<1
LAWPh3-15-SSM-W	Al	ICP-AES	<1
LAWPh3-15-SSM-W	B	ICP-AES	35.0
LAWPh3-15-SSM-W	Ca	ICP-AES	7.2
LAWPh3-15-SSM-W	Cl	IC	11.8
LAWPh3-15-SSM-W	Cr	ICP-AES	96.6
LAWPh3-15-SSM-W	F	IC	<10
LAWPh3-15-SSM-W	Fe	ICP-AES	<1
LAWPh3-15-SSM-W	K	ICP-AES	339.0
LAWPh3-15-SSM-W	Mg	ICP-AES	<1
LAWPh3-15-SSM-W	Na	ICP-AES	1036.7
LAWPh3-15-SSM-W	P	ICP-AES	4.6
LAWPh3-15-SSM-W	PO4	IC	<13.7
LAWPh3-15-SSM-W	PO4	ICP-AES	14.2
LAWPh3-15-SSM-W	S	ICP-AES	736.7
LAWPh3-15-SSM-W	Si	ICP-AES	12.0
LAWPh3-15-SSM-W	Sn	ICP-AES	<1
LAWPh3-15-SSM-W	SO4	IC	1953.3
LAWPh3-15-SSM-W	SO4	ICP-AES	2207.0
LAWPh3-15-SSM-W	V	ICP-AES	27.2
LAWPh3-15-SSM-W	Zn	ICP-AES	<1
LAWPh3-15-SSM-W	Zr	ICP-AES	<1
LAWPh3-16-SSM-W	Al	ICP-AES	1.7
LAWPh3-16-SSM-W	B	ICP-AES	25.1
LAWPh3-16-SSM-W	Ca	ICP-AES	3.3
LAWPh3-16-SSM-W	Cl	IC	14.8
LAWPh3-16-SSM-W	Cr	ICP-AES	71.5
LAWPh3-16-SSM-W	F	IC	10.3
LAWPh3-16-SSM-W	Fe	ICP-AES	<1
LAWPh3-16-SSM-W	K	ICP-AES	234.0
LAWPh3-16-SSM-W	Mg	ICP-AES	<1
LAWPh3-16-SSM-W	Na	ICP-AES	810.7
LAWPh3-16-SSM-W	P	ICP-AES	8.0
LAWPh3-16-SSM-W	PO4	IC	23.9
LAWPh3-16-SSM-W	PO4	ICP-AES	24.6
LAWPh3-16-SSM-W	S	ICP-AES	500.7
LAWPh3-16-SSM-W	Si	ICP-AES	22.5
LAWPh3-16-SSM-W	Sn	ICP-AES	<1
LAWPh3-16-SSM-W	SO4	IC	1260.0
LAWPh3-16-SSM-W	SO4	ICP-AES	1499.9
LAWPh3-16-SSM-W	V	ICP-AES	76.8
LAWPh3-16-SSM-W	Zn	ICP-AES	<1
LAWPh3-16-SSM-W	Zr	ICP-AES	<1
LAWPh3-17-SSM-W	Al	ICP-AES	1.3

Table E-4. Average Measurements of the Wash Solutions (continued)

Solution Identifier	Analyte	Analysis	Average Measured Concentration (mg/L)
LAWPh3-17-SSM-W	B	ICP-AES	18.3
LAWPh3-17-SSM-W	Ca	ICP-AES	2.9
LAWPh3-17-SSM-W	Cl	IC	14.0
LAWPh3-17-SSM-W	Cr	ICP-AES	62.1
LAWPh3-17-SSM-W	F	IC	<10
LAWPh3-17-SSM-W	Fe	ICP-AES	<1
LAWPh3-17-SSM-W	K	ICP-AES	23.9
LAWPh3-17-SSM-W	Mg	ICP-AES	<1
LAWPh3-17-SSM-W	Na	ICP-AES	982.3
LAWPh3-17-SSM-W	P	ICP-AES	6.2
LAWPh3-17-SSM-W	PO4	IC	20.3
LAWPh3-17-SSM-W	PO4	ICP-AES	18.9
LAWPh3-17-SSM-W	S	ICP-AES	577.7
LAWPh3-17-SSM-W	Si	ICP-AES	18.5
LAWPh3-17-SSM-W	Sn	ICP-AES	<1
LAWPh3-17-SSM-W	SO4	IC	1426.7
LAWPh3-17-SSM-W	SO4	ICP-AES	1730.6
LAWPh3-17-SSM-W	V	ICP-AES	37.7
LAWPh3-17-SSM-W	Zn	ICP-AES	<1
LAWPh3-17-SSM-W	Zr	ICP-AES	<1
LAWPh3-18-SSM-W	Al	ICP-AES	<1
LAWPh3-18-SSM-W	B	ICP-AES	15.5
LAWPh3-18-SSM-W	Ca	ICP-AES	1.4
LAWPh3-18-SSM-W	Cl	IC	18.7
LAWPh3-18-SSM-W	Cr	ICP-AES	80.3
LAWPh3-18-SSM-W	F	IC	16.3
LAWPh3-18-SSM-W	Fe	ICP-AES	<1
LAWPh3-18-SSM-W	K	ICP-AES	166.7
LAWPh3-18-SSM-W	Mg	ICP-AES	<1
LAWPh3-18-SSM-W	Na	ICP-AES	920.0
LAWPh3-18-SSM-W	P	ICP-AES	21.7
LAWPh3-18-SSM-W	PO4	IC	60.2
LAWPh3-18-SSM-W	PO4	ICP-AES	66.6
LAWPh3-18-SSM-W	S	ICP-AES	573.7
LAWPh3-18-SSM-W	Si	ICP-AES	6.2
LAWPh3-18-SSM-W	Sn	ICP-AES	<1
LAWPh3-18-SSM-W	SO4	IC	1406.7
LAWPh3-18-SSM-W	SO4	ICP-AES	1718.6
LAWPh3-18-SSM-W	V	ICP-AES	6.4
LAWPh3-18-SSM-W	Zn	ICP-AES	<1
LAWPh3-18-SSM-W	Zr	ICP-AES	<1
LAWPh3-19-SSM-W	Al	ICP-AES	<1
LAWPh3-19-SSM-W	B	ICP-AES	24.3
LAWPh3-19-SSM-W	Ca	ICP-AES	10.6
LAWPh3-19-SSM-W	Cl	IC	<10
LAWPh3-19-SSM-W	Cr	ICP-AES	61.6
LAWPh3-19-SSM-W	F	IC	<10
LAWPh3-19-SSM-W	Fe	ICP-AES	<1
LAWPh3-19-SSM-W	K	ICP-AES	228.7
LAWPh3-19-SSM-W	Mg	ICP-AES	<1
LAWPh3-19-SSM-W	Na	ICP-AES	1176.7
LAWPh3-19-SSM-W	P	ICP-AES	2.7
LAWPh3-19-SSM-W	PO4	IC	<10.2
LAWPh3-19-SSM-W	PO4	ICP-AES	8.4
LAWPh3-19-SSM-W	S	ICP-AES	796.0
LAWPh3-19-SSM-W	Si	ICP-AES	14.2

Table E-4. Average Measurements of the Wash Solutions (continued)

Solution Identifier	Analyte	Analysis	Average Measured Concentration (mg/L)
LAWPh3-19-SSM-W	Sn	ICP-AES	<1
LAWPh3-19-SSM-W	SO4	IC	1886.7
LAWPh3-19-SSM-W	SO4	ICP-AES	2384.7
LAWPh3-19-SSM-W	V	ICP-AES	50.7
LAWPh3-19-SSM-W	Zn	ICP-AES	<1
LAWPh3-19-SSM-W	Zr	ICP-AES	<1
LAWPh3-20-SSM-W	Al	ICP-AES	<1
LAWPh3-20-SSM-W	B	ICP-AES	24.8
LAWPh3-20-SSM-W	Ca	ICP-AES	7.2
LAWPh3-20-SSM-W	Cl	IC	10.6
LAWPh3-20-SSM-W	Cr	ICP-AES	57.6
LAWPh3-20-SSM-W	F	IC	<10
LAWPh3-20-SSM-W	Fe	ICP-AES	<1
LAWPh3-20-SSM-W	K	ICP-AES	8.6
LAWPh3-20-SSM-W	Mg	ICP-AES	<1
LAWPh3-20-SSM-W	Na	ICP-AES	1190.0
LAWPh3-20-SSM-W	P	ICP-AES	6.5
LAWPh3-20-SSM-W	PO4	IC	24.0
LAWPh3-20-SSM-W	PO4	ICP-AES	20.0
LAWPh3-20-SSM-W	S	ICP-AES	701.0
LAWPh3-20-SSM-W	Si	ICP-AES	11.9
LAWPh3-20-SSM-W	Sn	ICP-AES	<1
LAWPh3-20-SSM-W	SO4	IC	1846.7
LAWPh3-20-SSM-W	SO4	ICP-AES	2100.1
LAWPh3-20-SSM-W	V	ICP-AES	55.5
LAWPh3-20-SSM-W	Zn	ICP-AES	<1
LAWPh3-20-SSM-W	Zr	ICP-AES	<1

Exhibit E-1. Measurements of Wash Solutions by Analyte Grouped by Block in Analytical Sequence

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

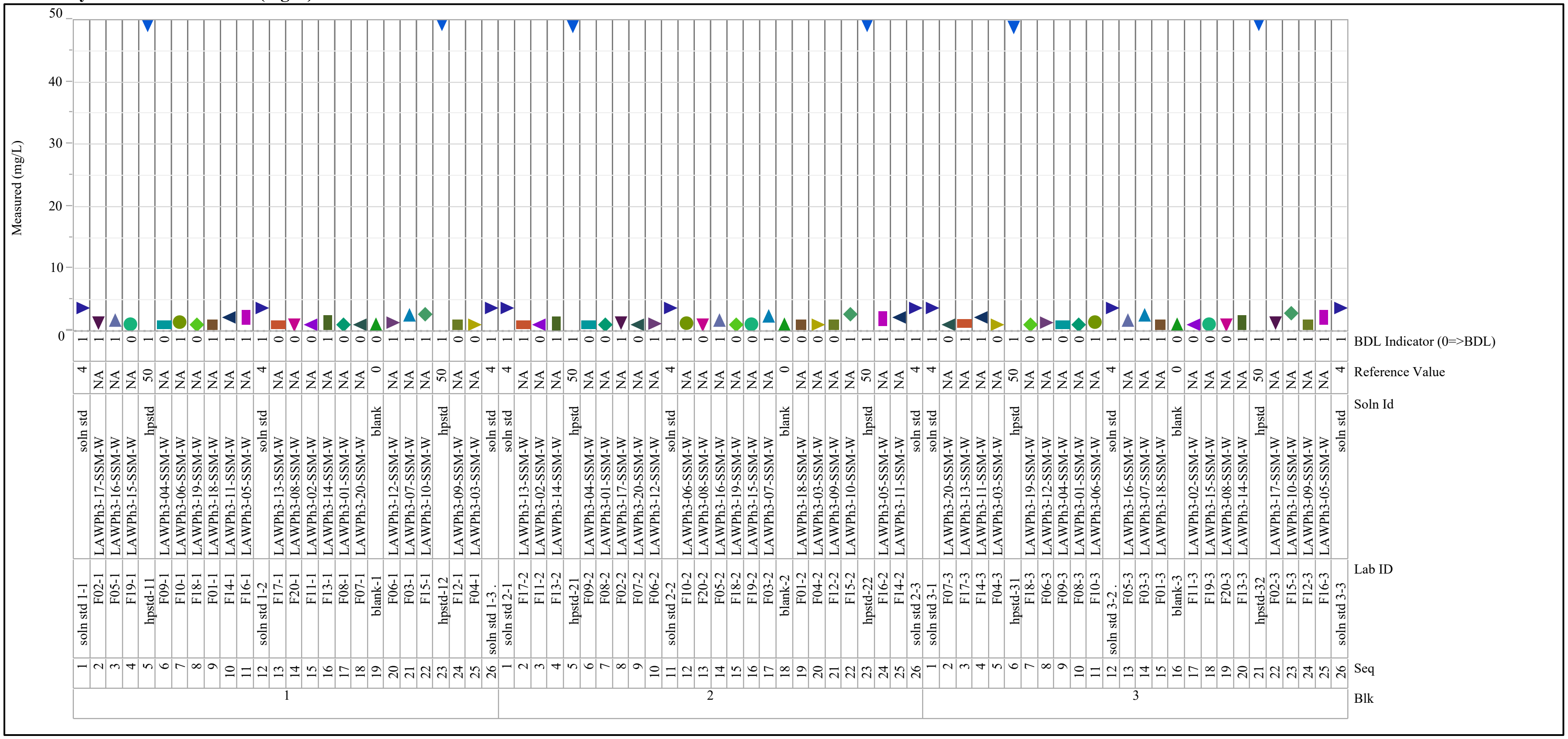


Exhibit E-1. Measurements of Wash Solutions by Analyte Grouped by Block in Analytical Sequence (continued)

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

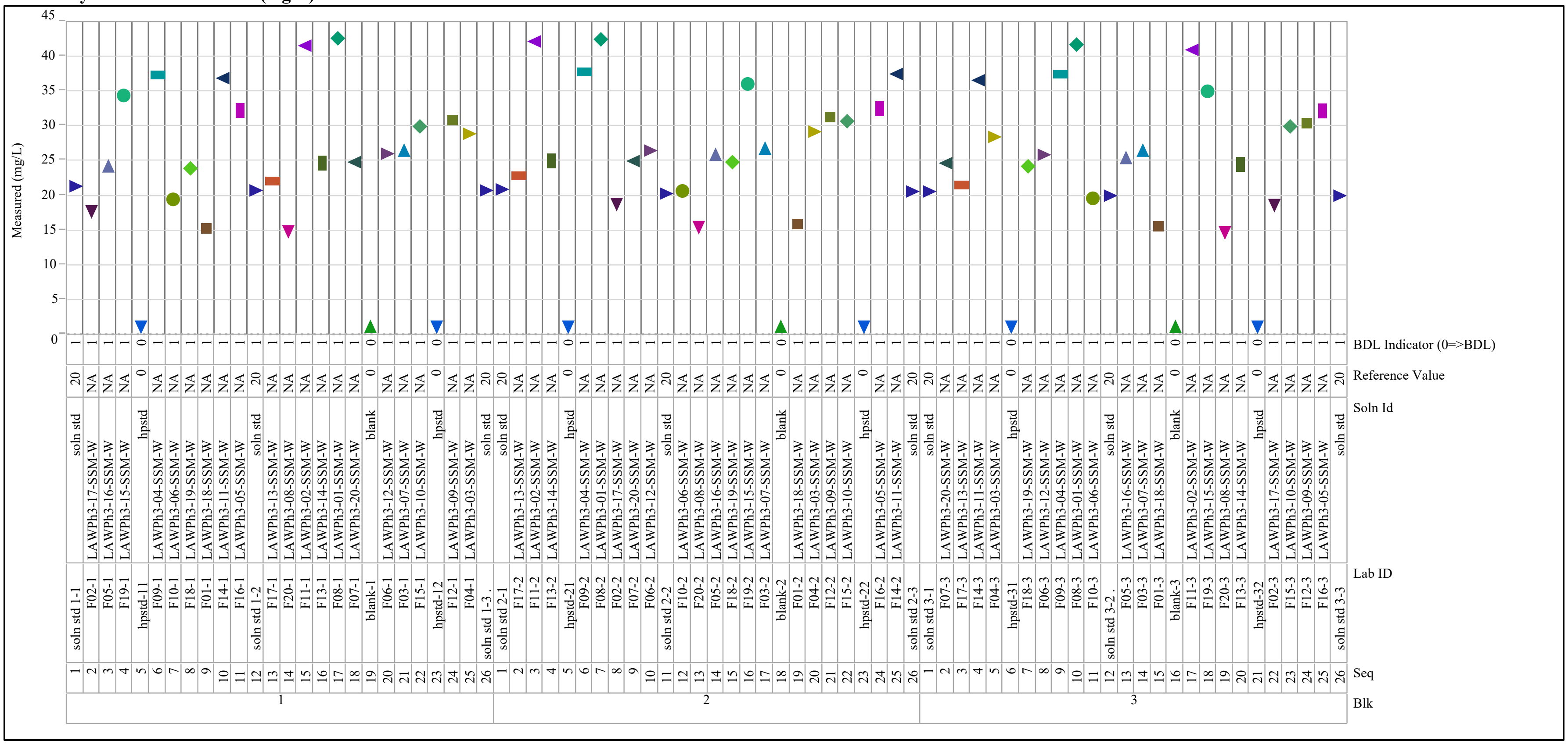


Exhibit E-1. Measurements of Wash Solutions by Analyte Grouped by Block in Analytical Sequence (continued)

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

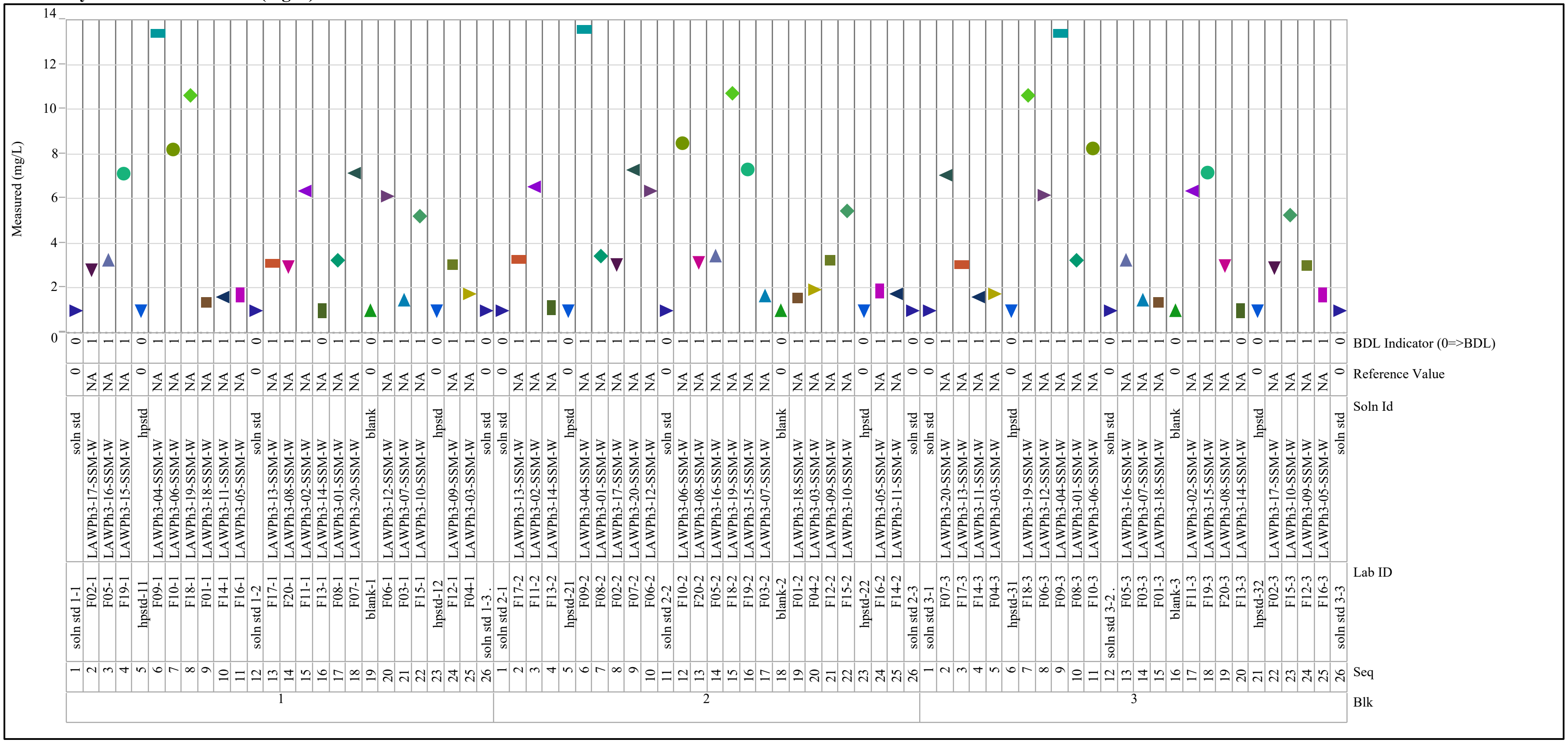


Exhibit E-1. Measurements of Wash Solutions by Analyte Grouped by Block in Analytical Sequence (continued)

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

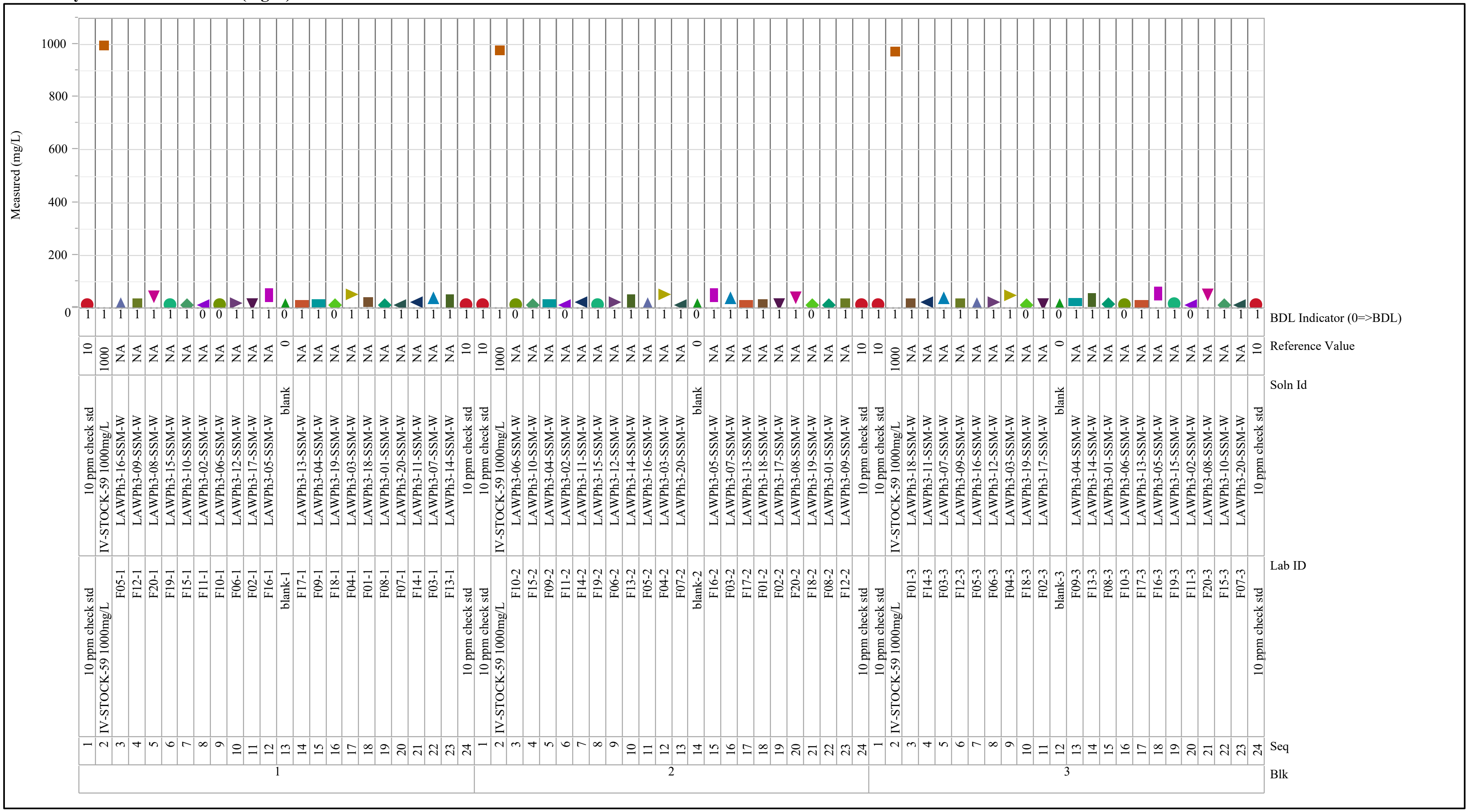


Exhibit E-1. Measurements of Wash Solutions by Analyte Grouped by Block in Analytical Sequence (continued)

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

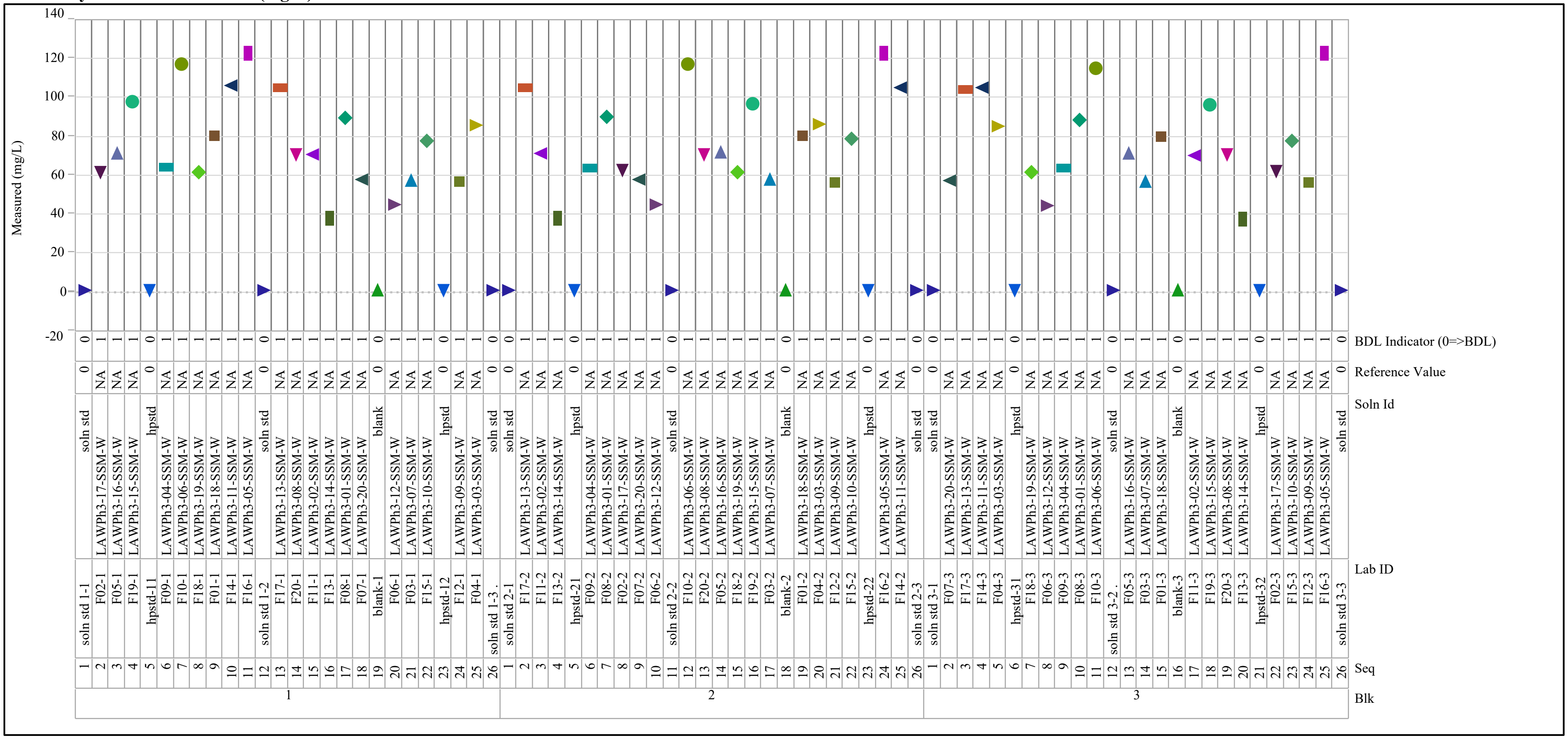


Exhibit E-1. Measurements of Wash Solutions by Analyte Grouped by Block in Analytical Sequence (continued)

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

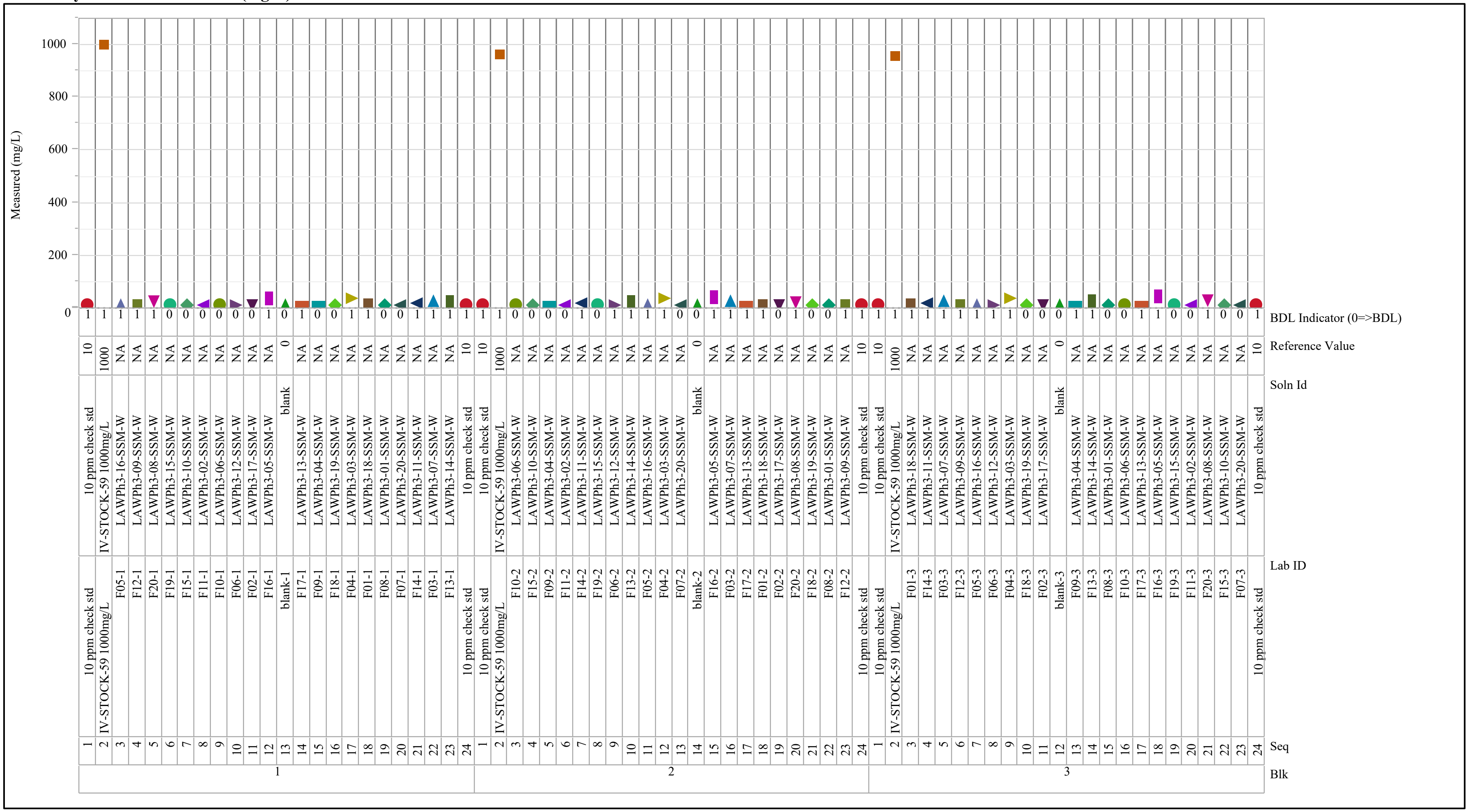


Exhibit E-1. Measurements of Wash Solutions by Analyte Grouped by Block in Analytical Sequence (continued)

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

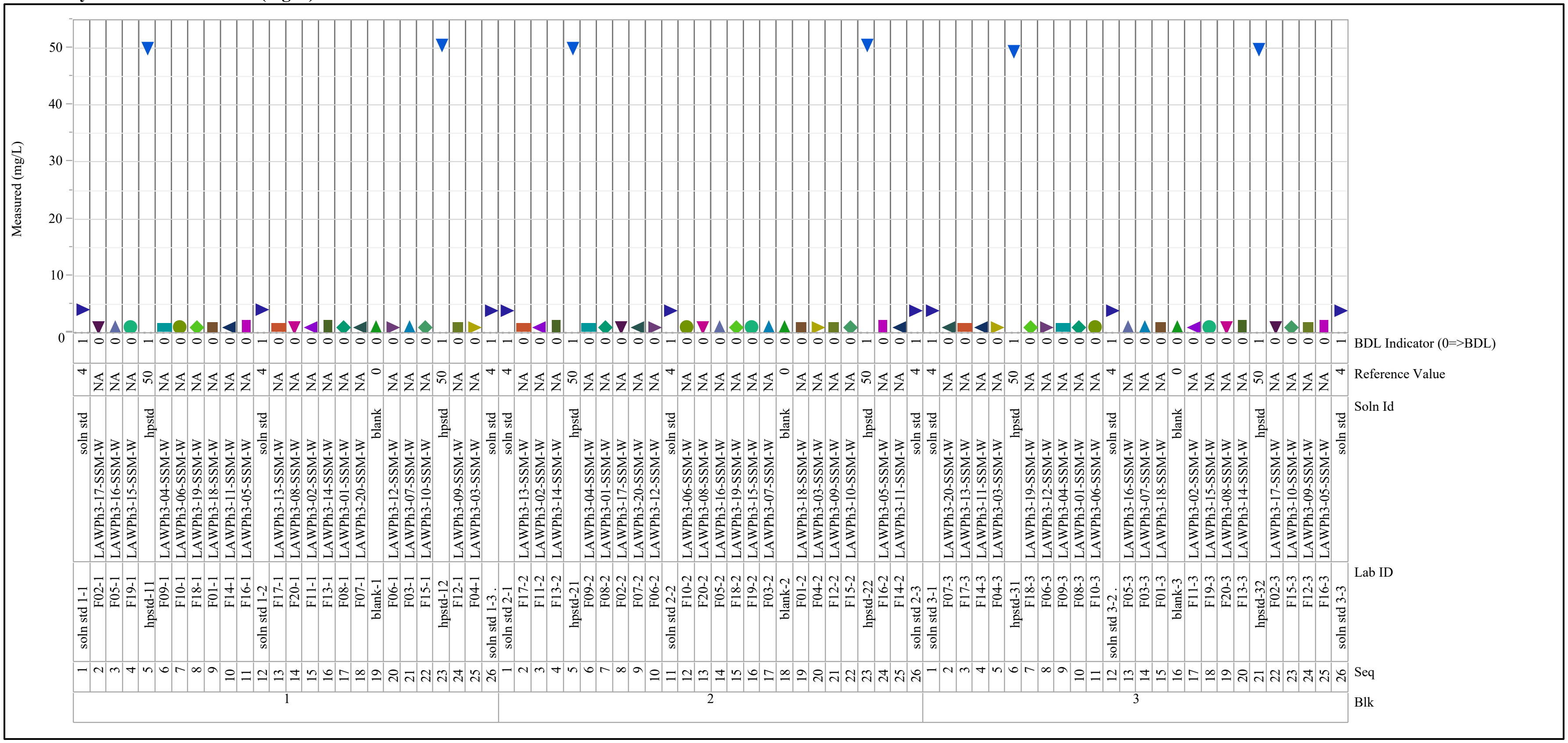


Exhibit E-1. Measurements of Wash Solutions by Analyte Grouped by Block in Analytical Sequence (continued)

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

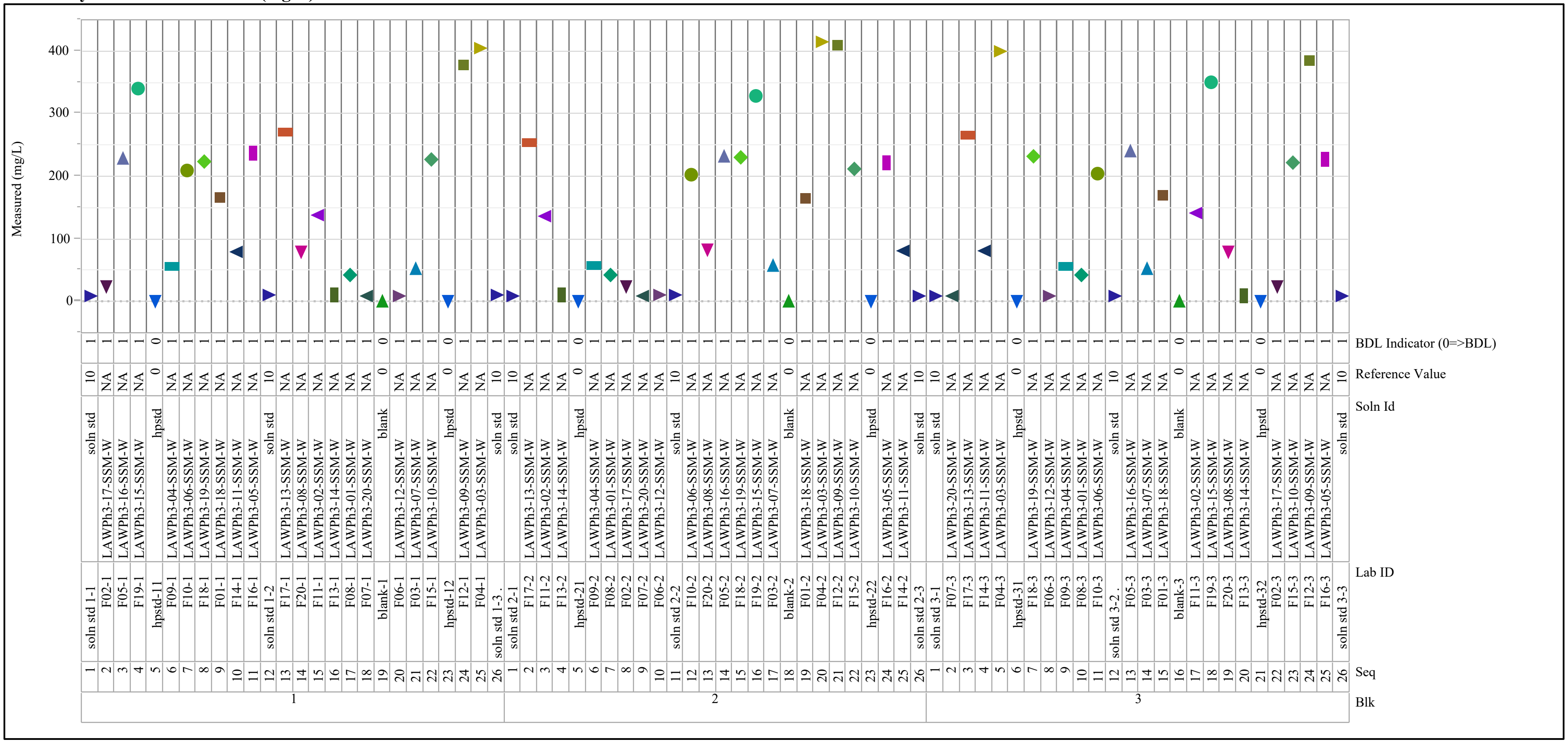


Exhibit E-1. Measurements of Wash Solutions by Analyte Grouped by Block in Analytical Sequence (continued)

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

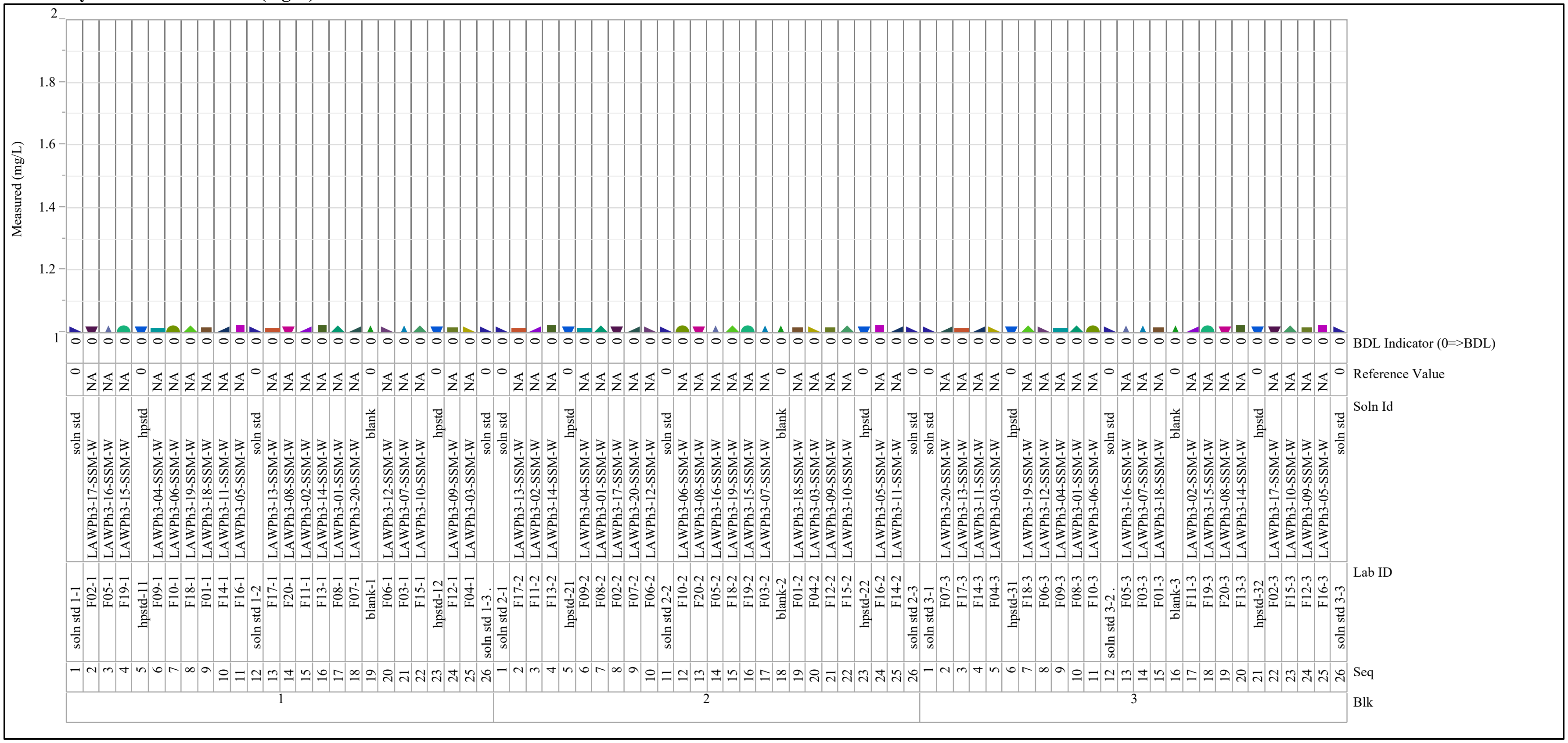


Exhibit E-1. Measurements of Wash Solutions by Analyte Grouped by Block in Analytical Sequence (continued)

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

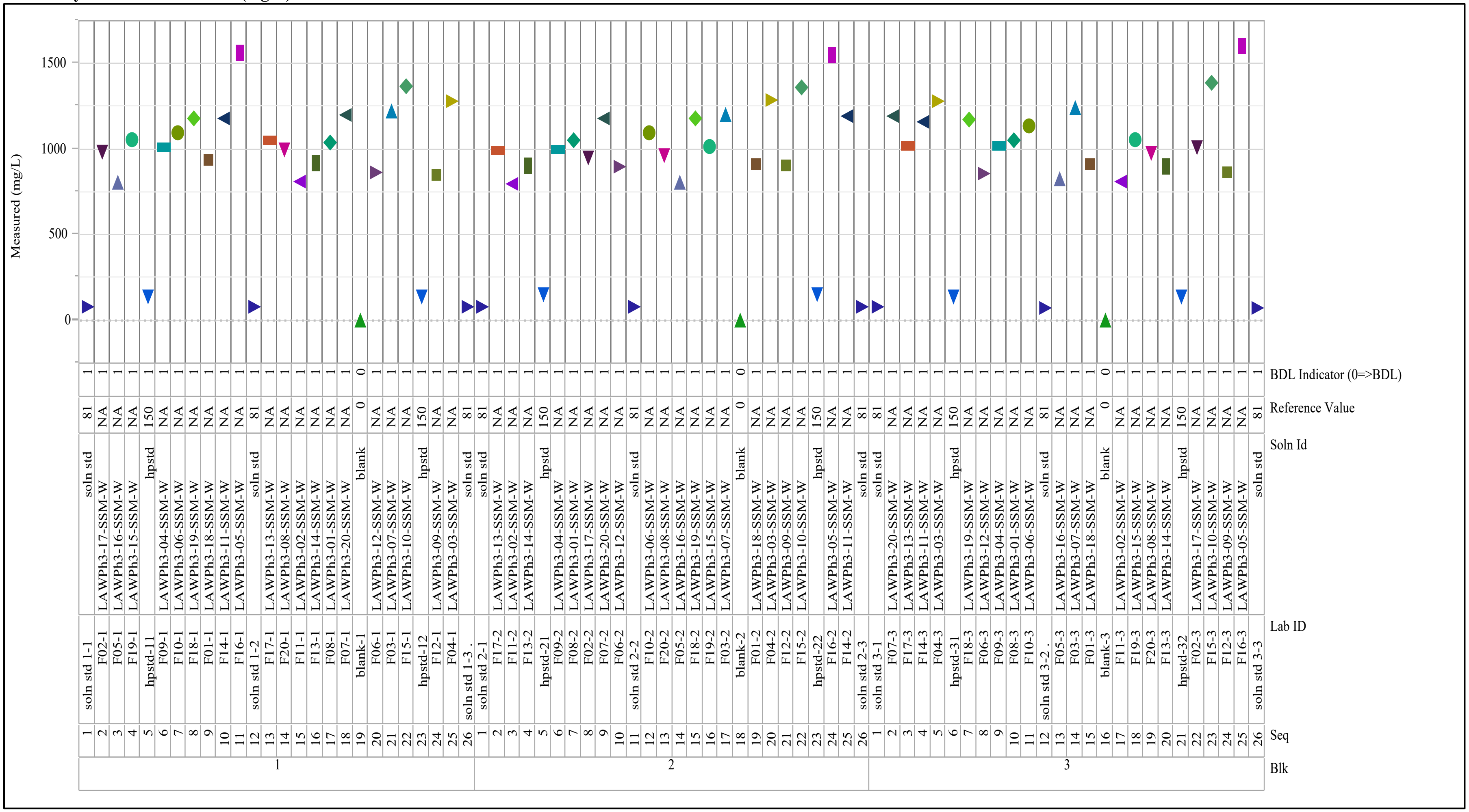


Exhibit E-1. Measurements of Wash Solutions by Analyte Grouped by Block in Analytical Sequence (continued)

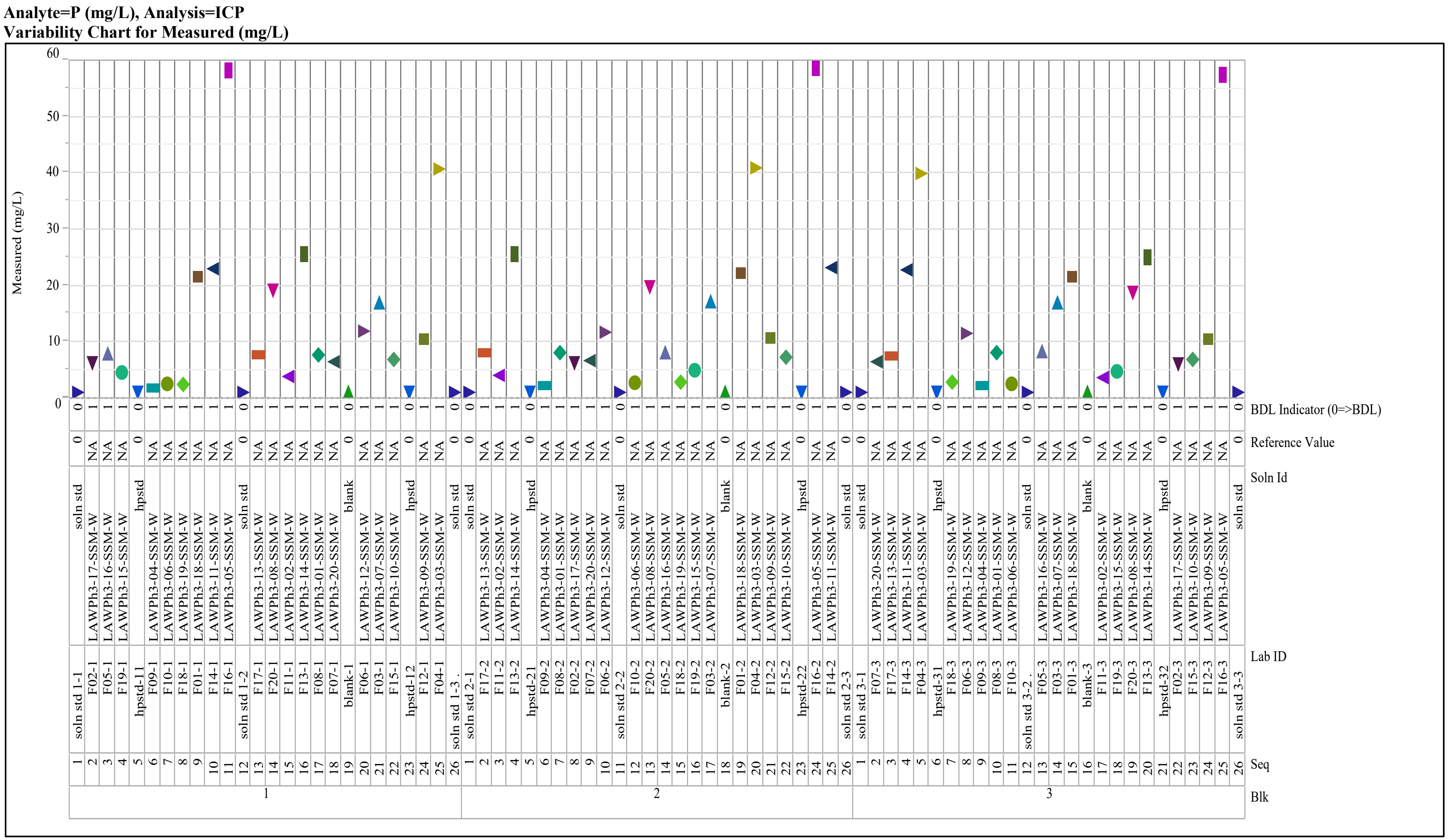


Exhibit E-1. Measurements of Wash Solutions by Analyte Grouped by Block in Analytical Sequence (continued)

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

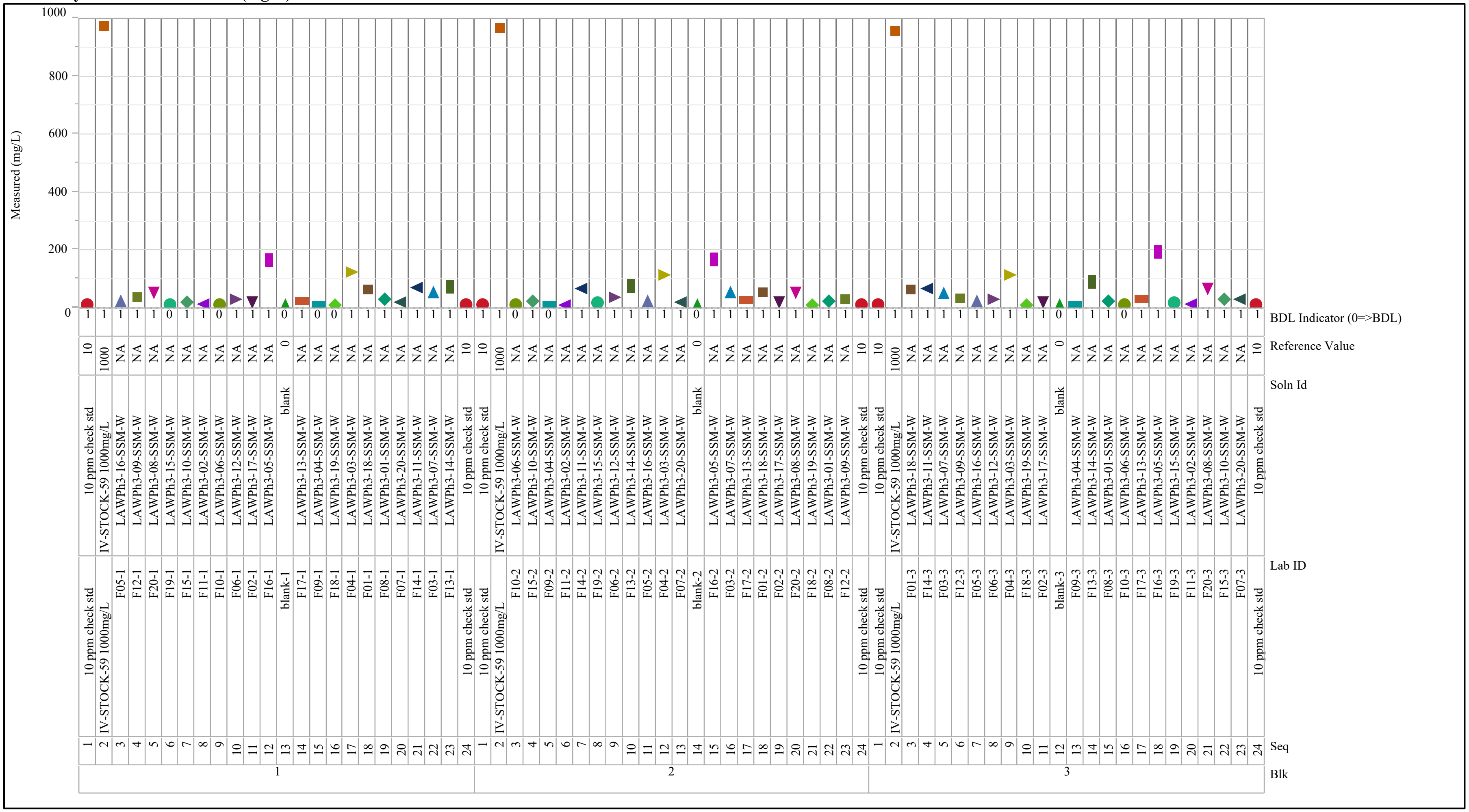


Exhibit E-1. Measurements of Wash Solutions by Analyte Grouped by Block in Analytical Sequence (continued)

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

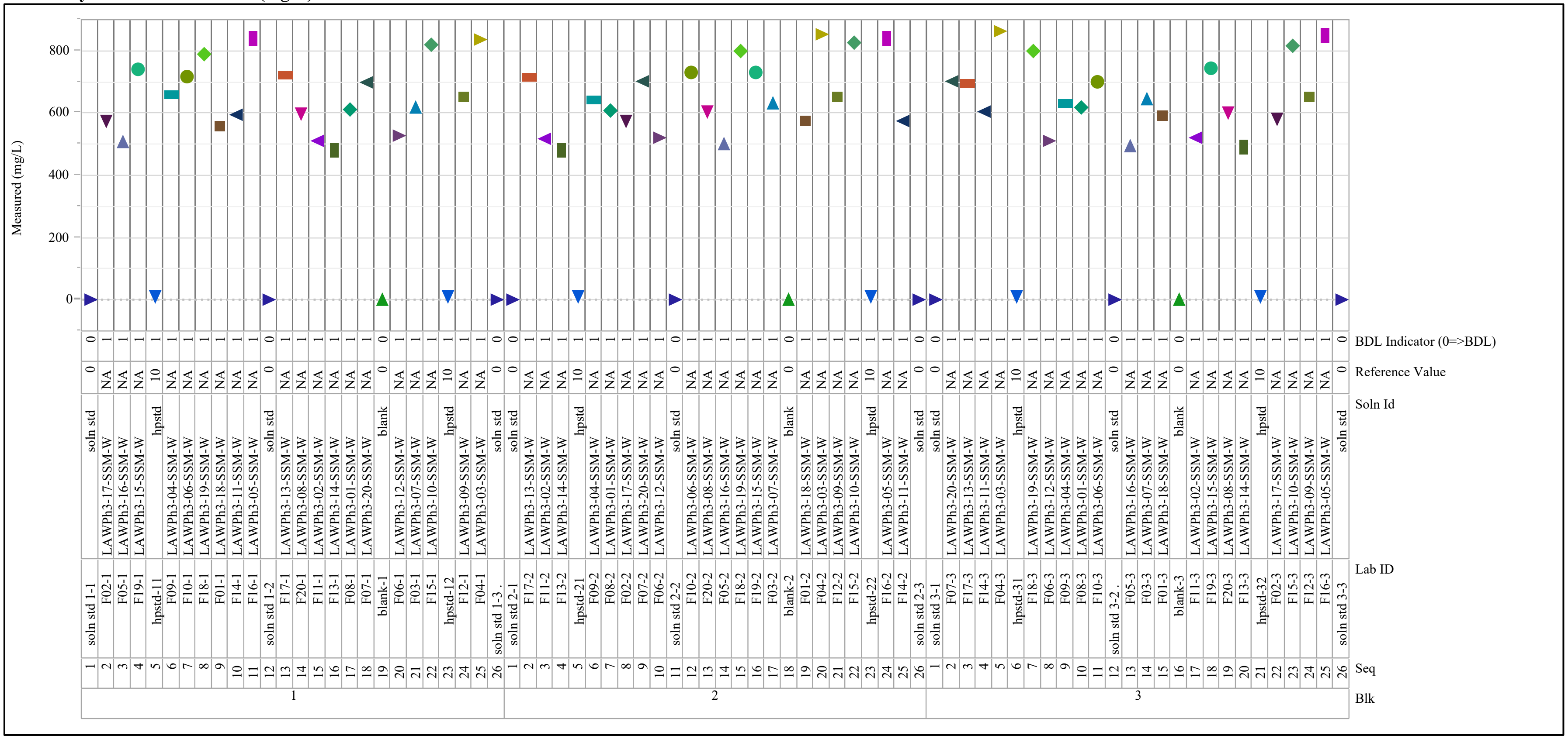


Exhibit E-1. Measurements of Wash Solutions by Analyte Grouped by Block in Analytical Sequence (continued)

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

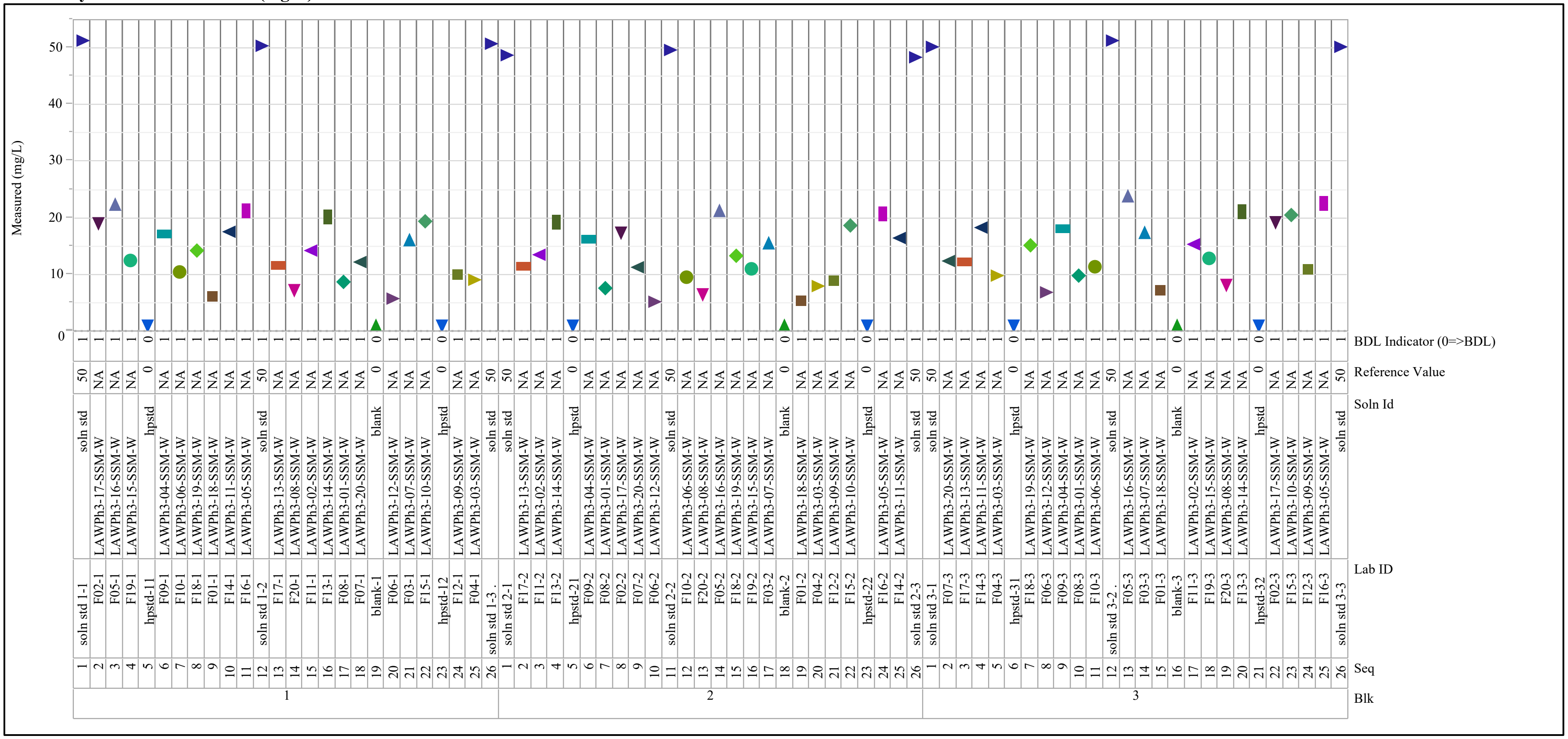


Exhibit E-1. Measurements of Wash Solutions by Analyte Grouped by Block in Analytical Sequence (continued)

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

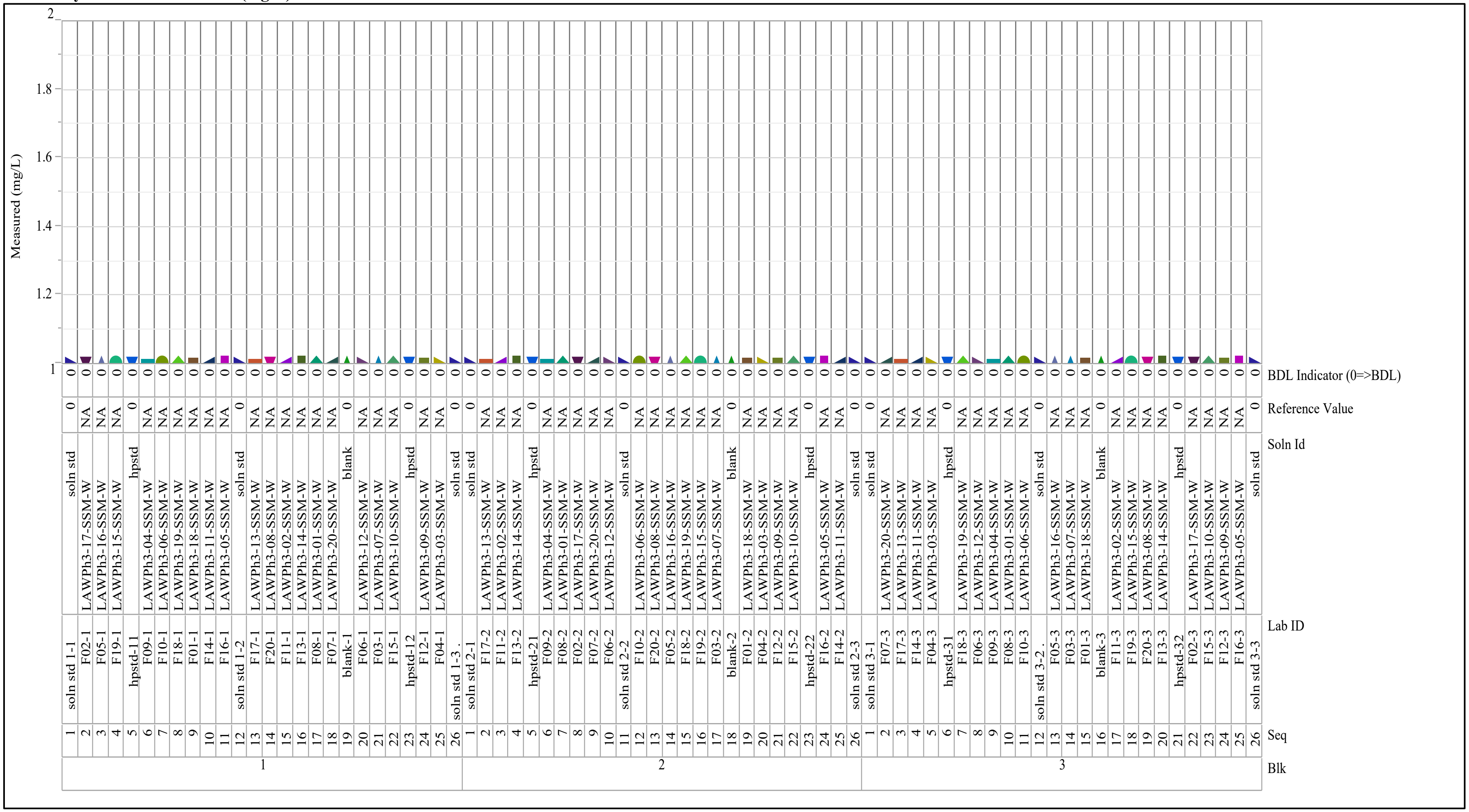


Exhibit E-1. Measurements of Wash Solutions by Analyte Grouped by Block in Analytical Sequence (continued)

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

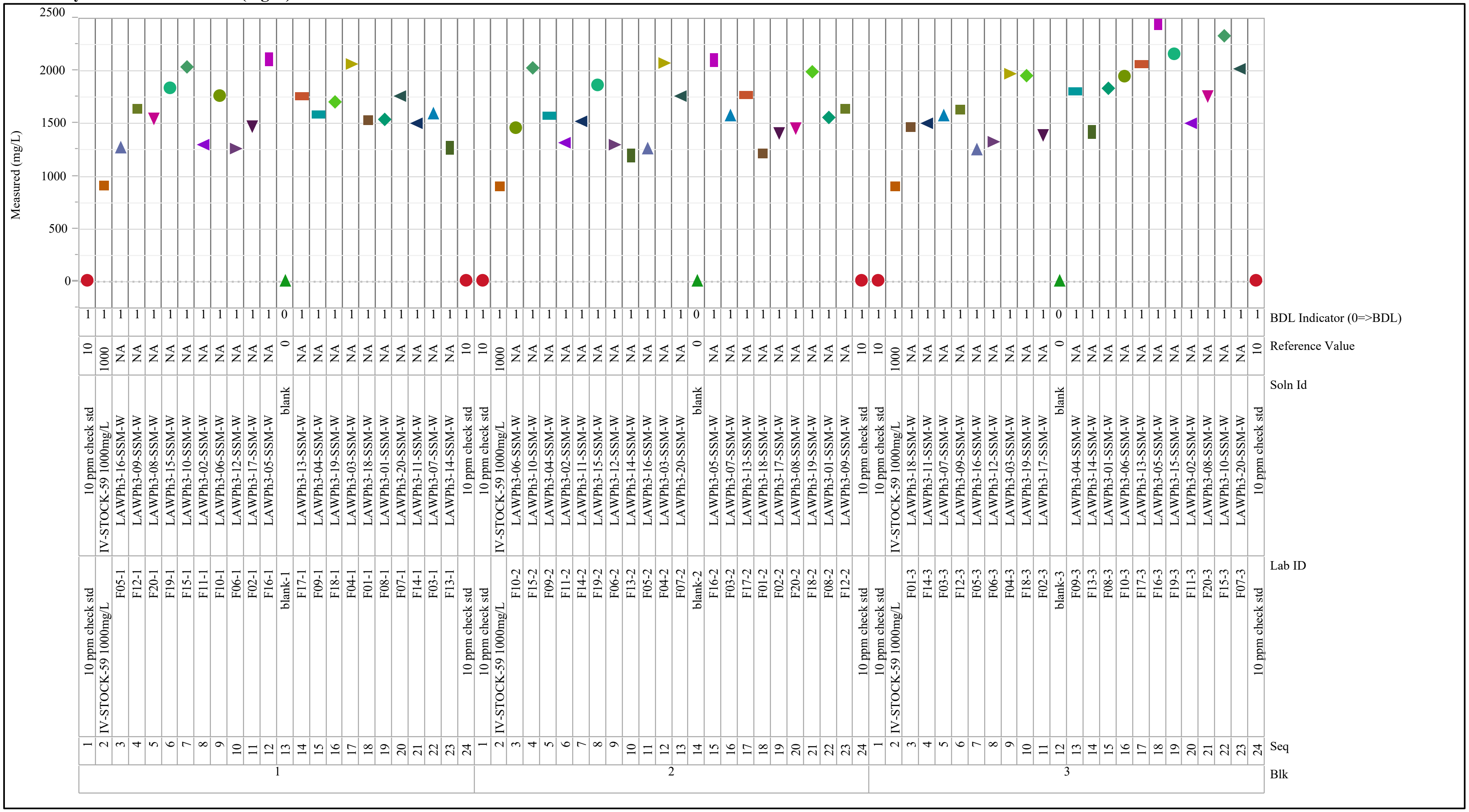


Exhibit E-1. Measurements of Wash Solutions by Analyte Grouped by Block in Analytical Sequence (continued)

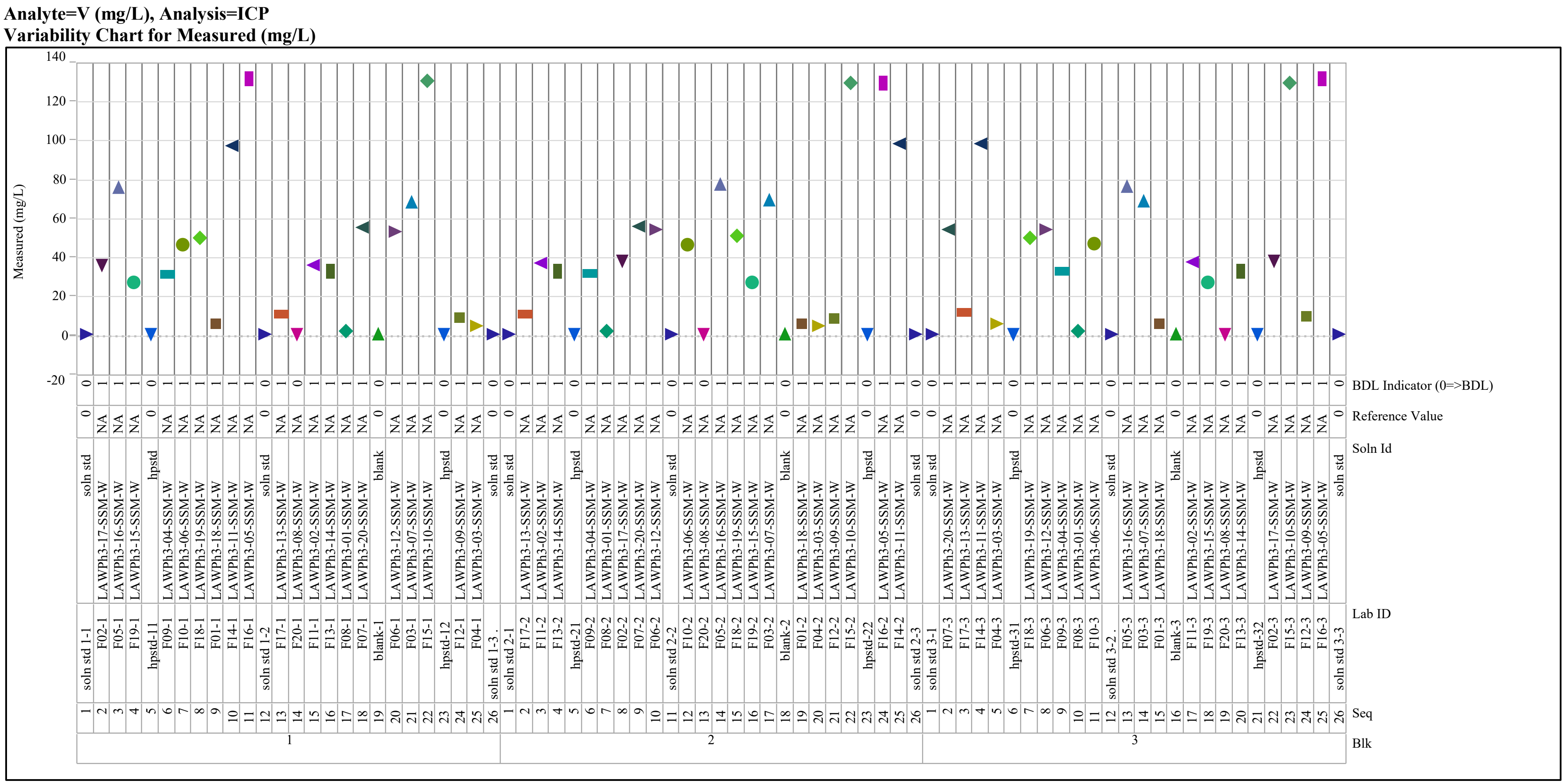


Exhibit E-1. Measurements of Wash Solutions by Analyte Grouped by Block in Analytical Sequence (continued)

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

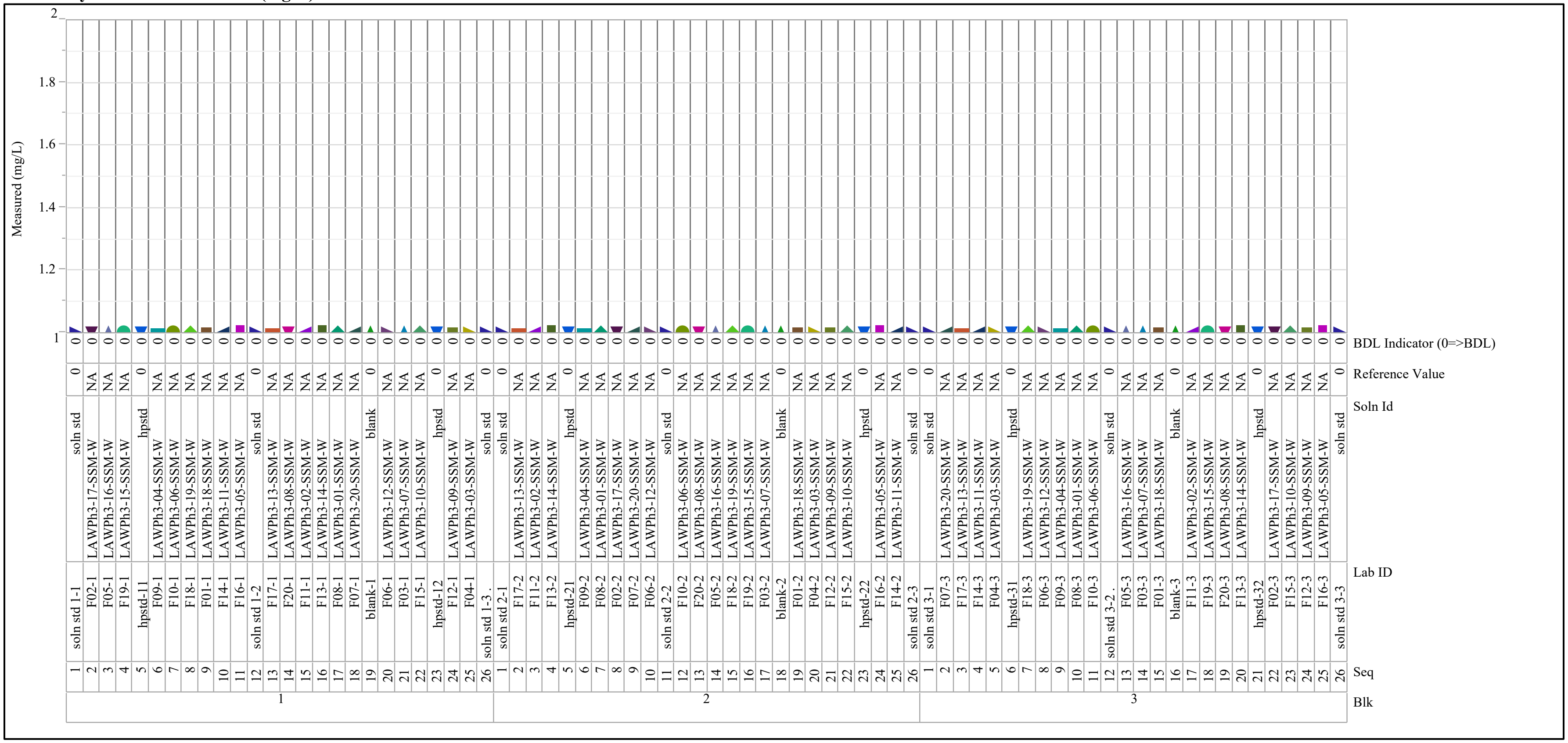


Exhibit E-1. Measurements of Wash Solutions by Analyte Grouped by Block in Analytical Sequence (continued)

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

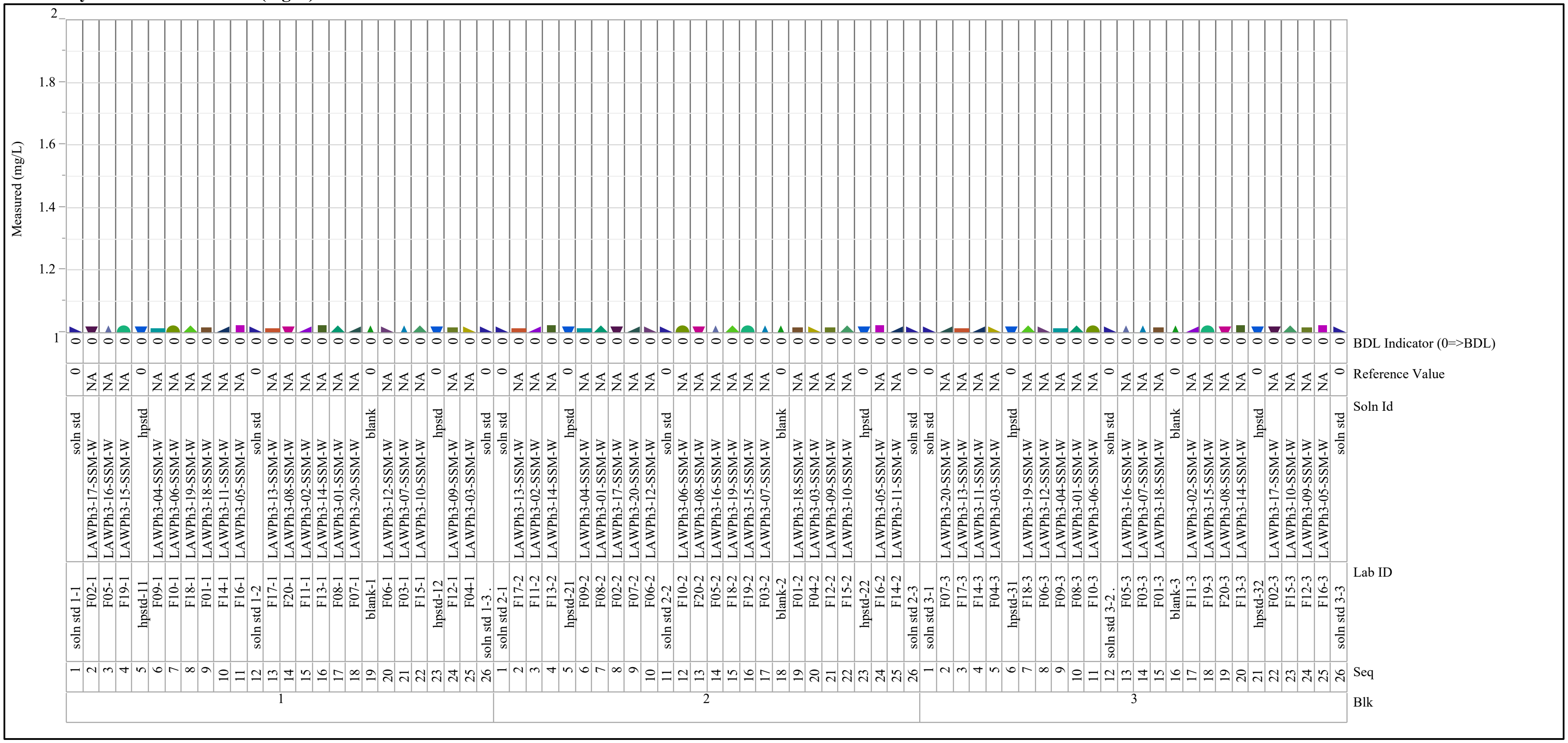


Exhibit E-2. Analysis of Wash Solutions by Solution Identifier

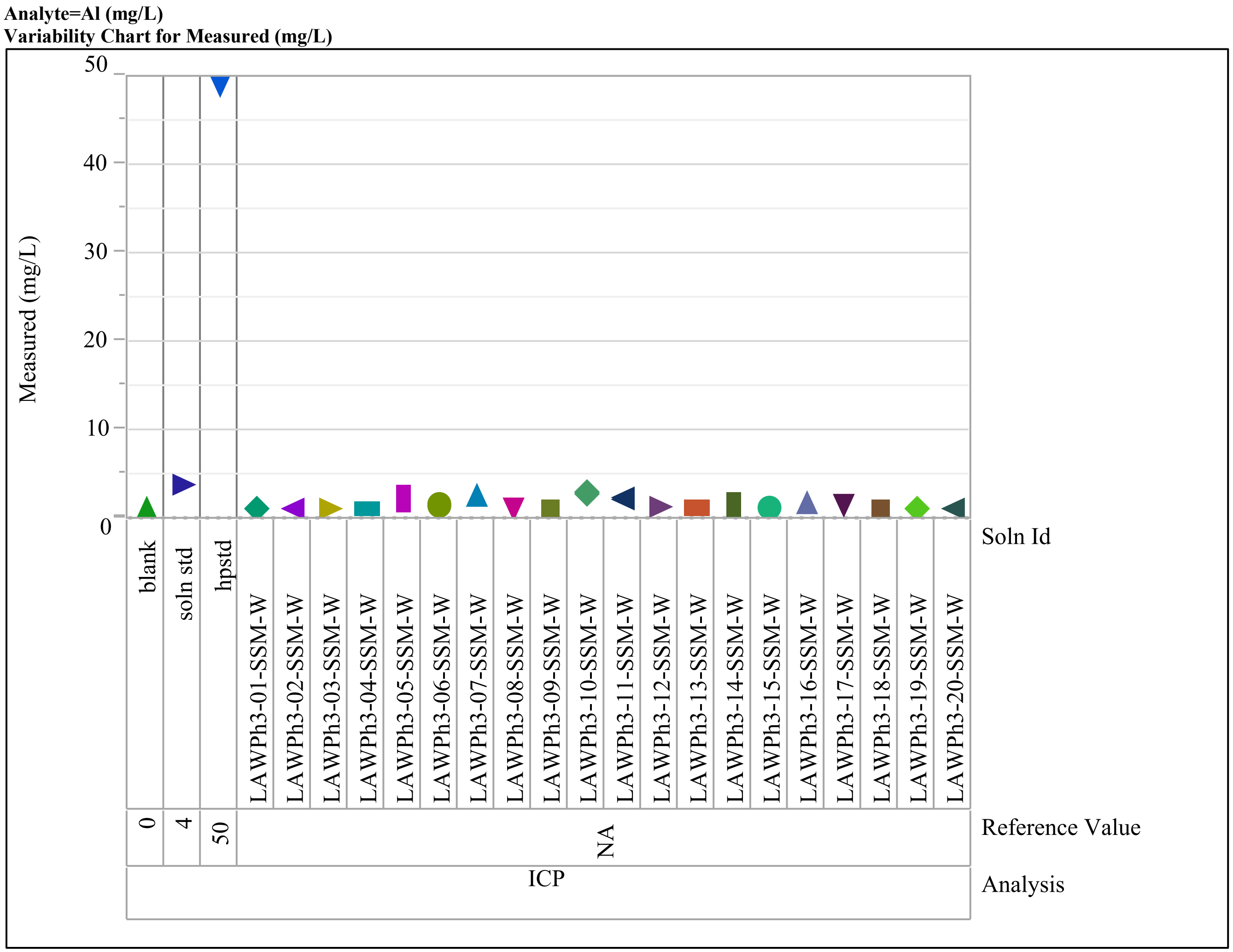


Exhibit E-2. Analysis of Wash Solutions by Solution Identifier (continued)

Analyte=B (mg/L)
Variability Chart for Measured (mg/L)

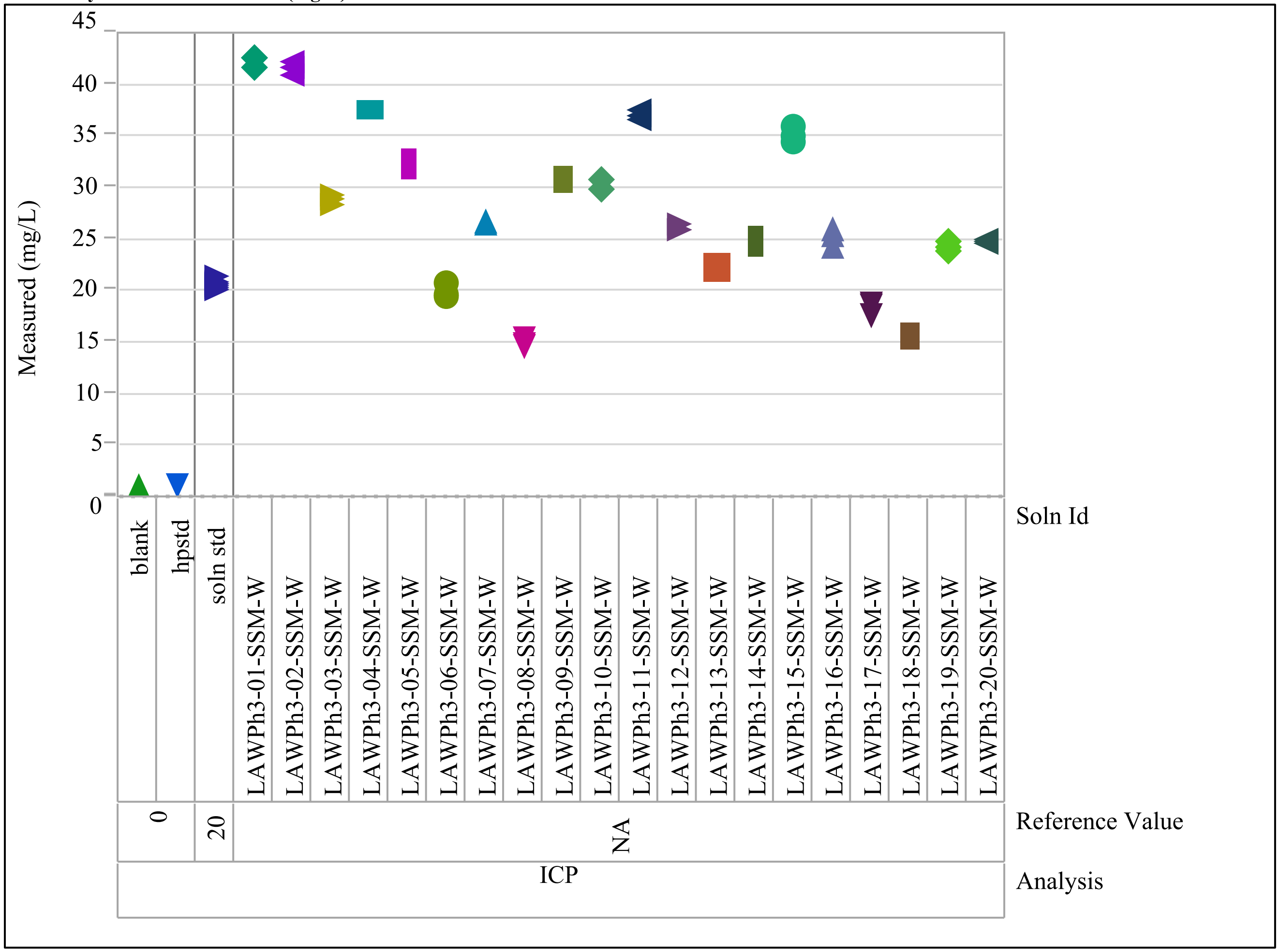


Exhibit E-2. Analysis of Wash Solutions by Solution Identifier (continued)

Analyte=Ca (mg/L)
Variability Chart for Measured (mg/L)

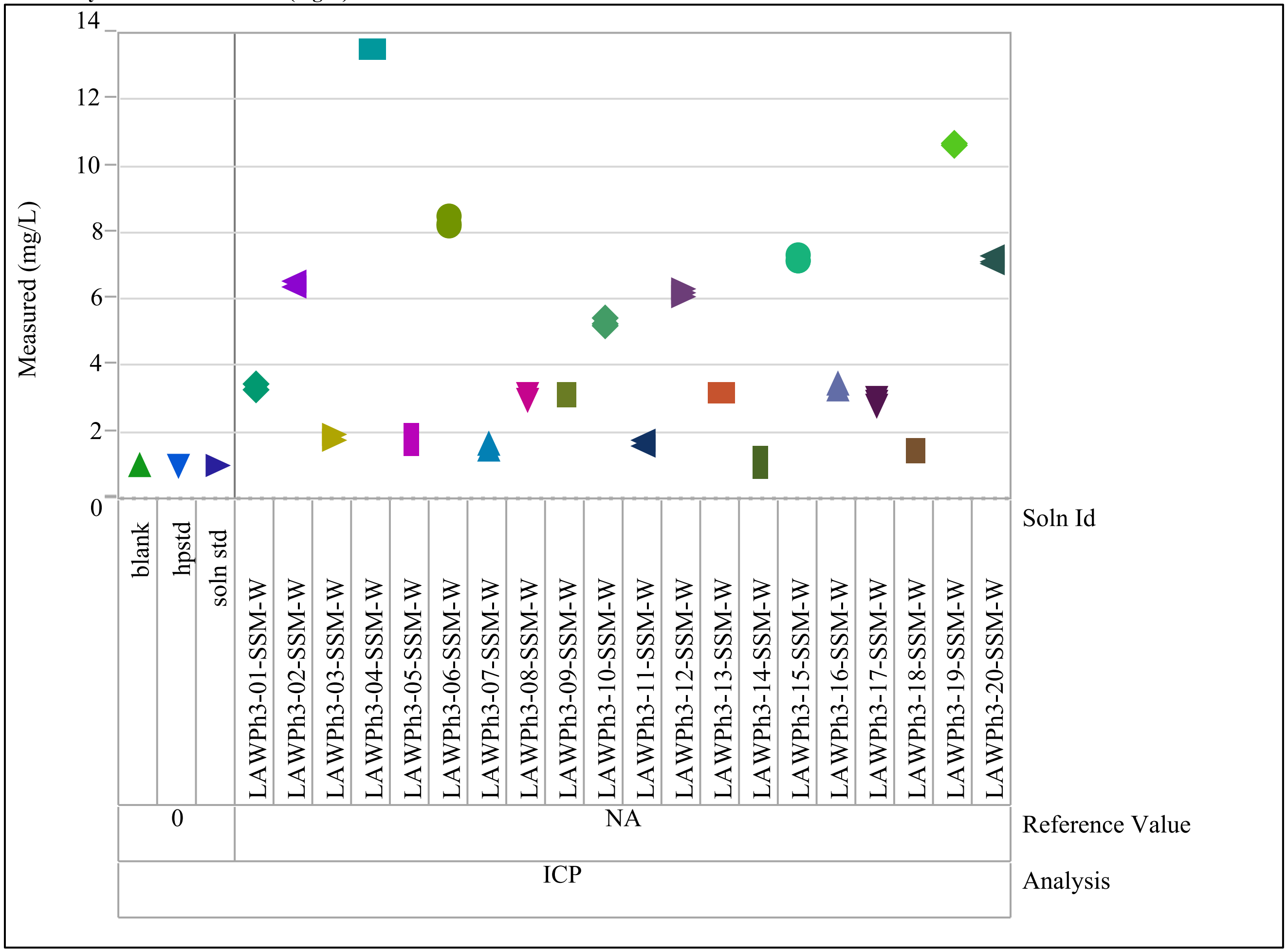


Exhibit E-2. Analysis of Wash Solutions by Solution Identifier (continued)

Analyte=Cl (mg/L)
Variability Chart for Measured (mg/L)

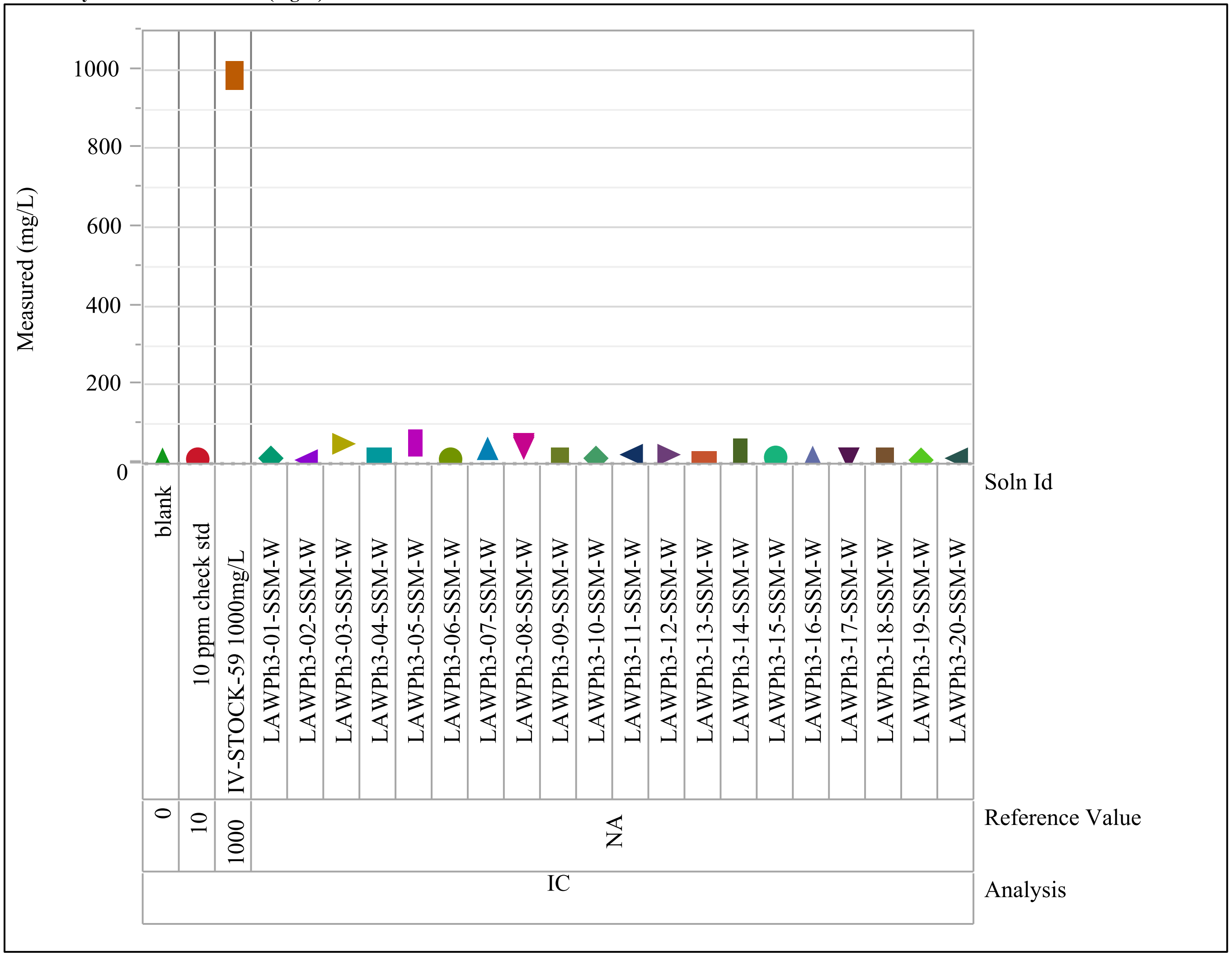


Exhibit E-2. Analysis of Wash Solutions by Solution Identifier (continued)

Analyte=Cr (mg/L)
Variability Chart for Measured (mg/L)

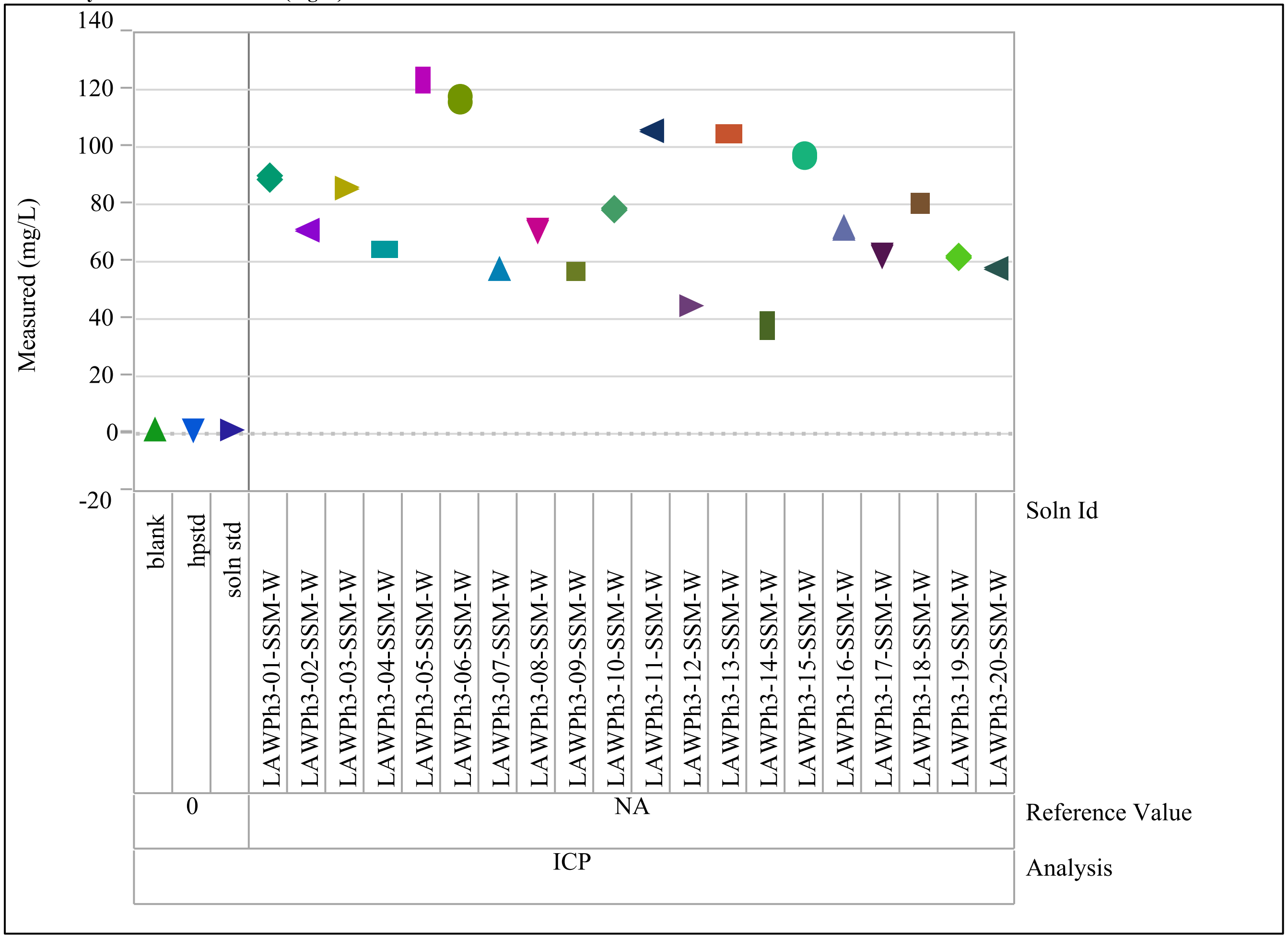


Exhibit E-2. Analysis of Wash Solutions by Solution Identifier (continued)

Analyte=F (mg/L)
Variability Chart for Measured (mg/L)

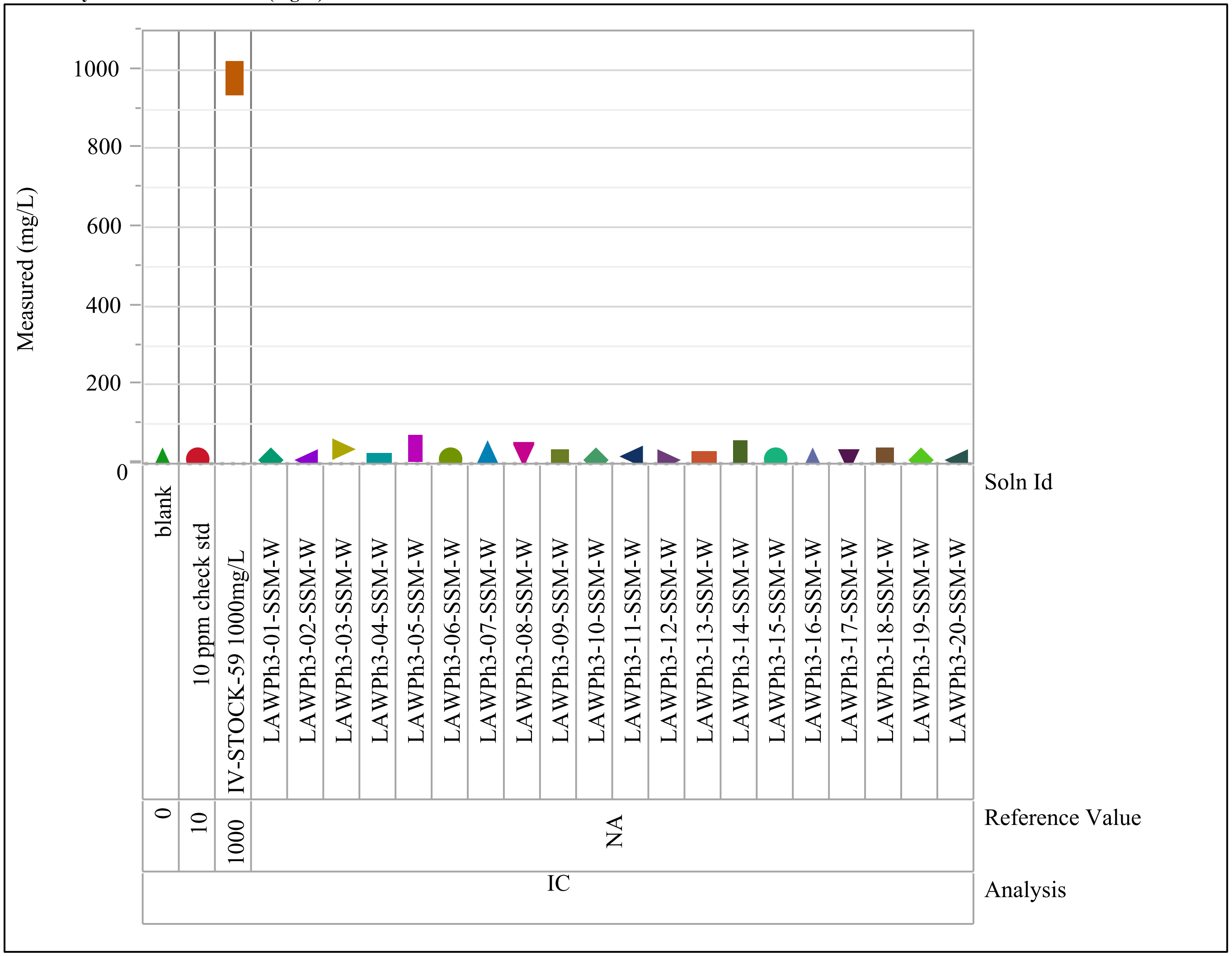


Exhibit E-2. Analysis of Wash Solutions by Solution Identifier (continued)

Analyte=Fe (mg/L)
Variability Chart for Measured (mg/L)

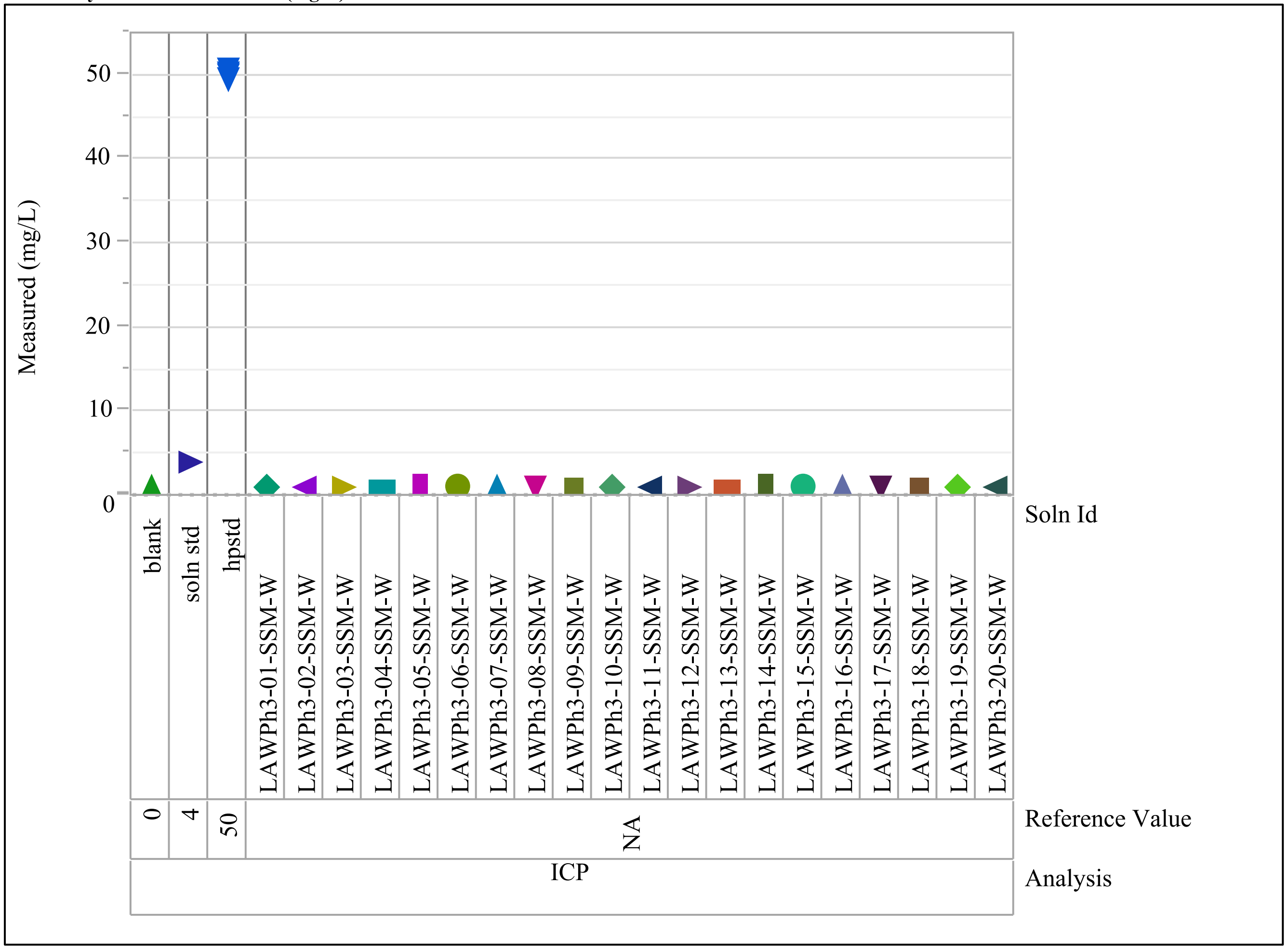


Exhibit E-2. Analysis of Wash Solutions by Solution Identifier (continued)

Analyte=K (mg/L)
Variability Chart for Measured (mg/L)

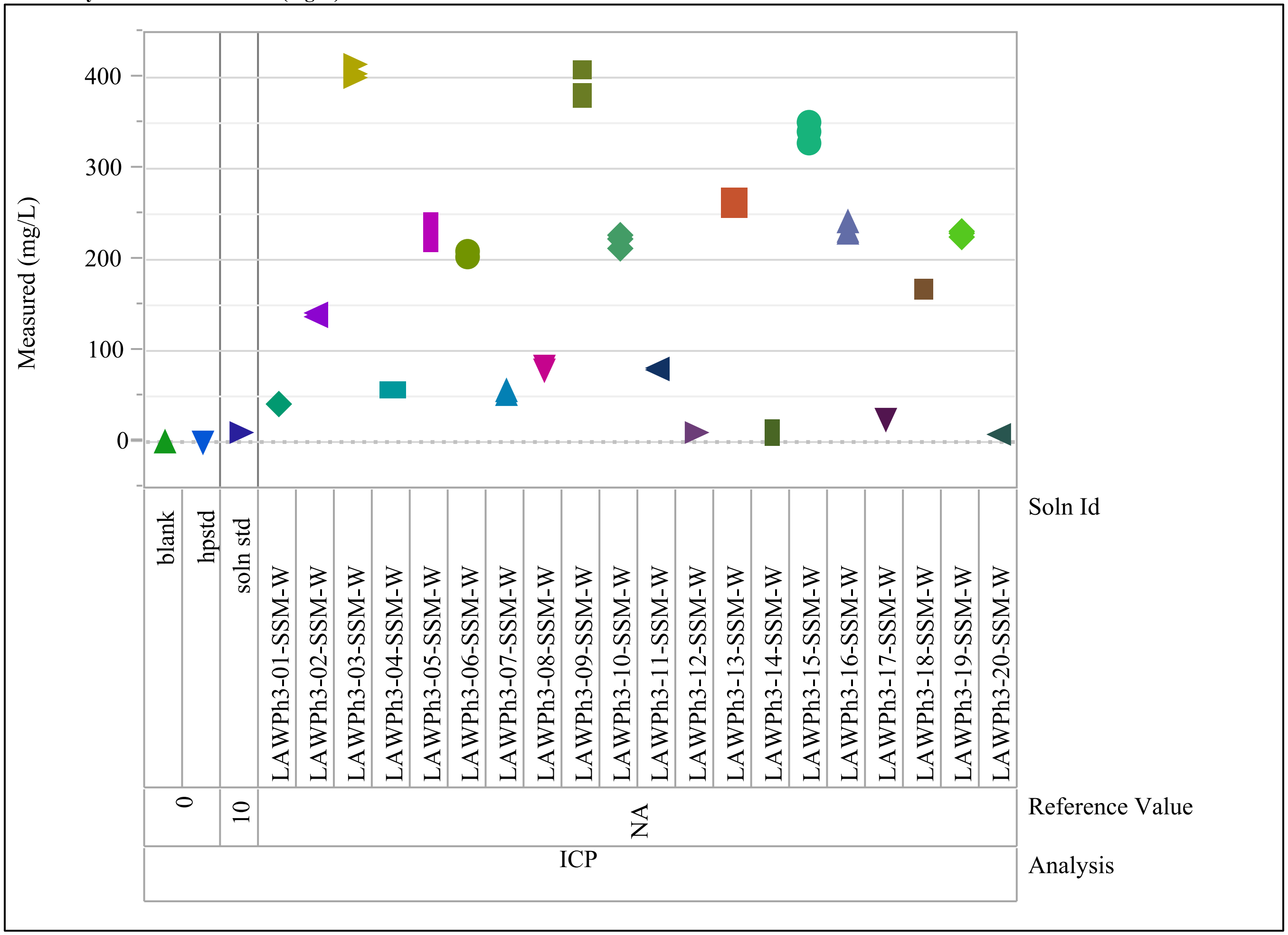


Exhibit E-2. Analysis of Wash Solutions by Solution Identifier (continued)

Analyte=Mg (mg/L)
Variability Chart for Measured (mg/L)

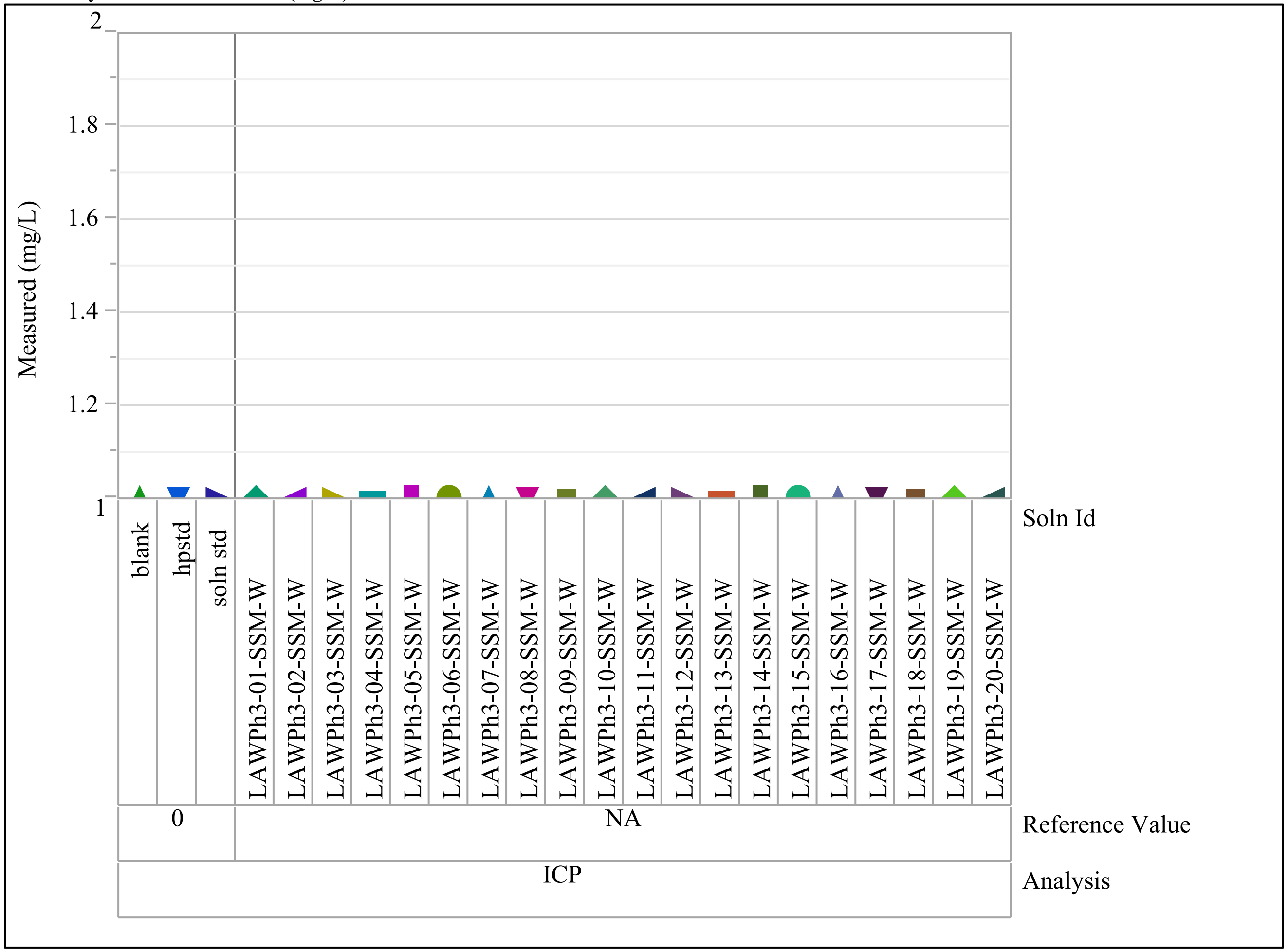


Exhibit E-2. Analysis of Wash Solutions by Solution Identifier (continued)

Analyte=Na (mg/L)
Variability Chart for Measured (mg/L)

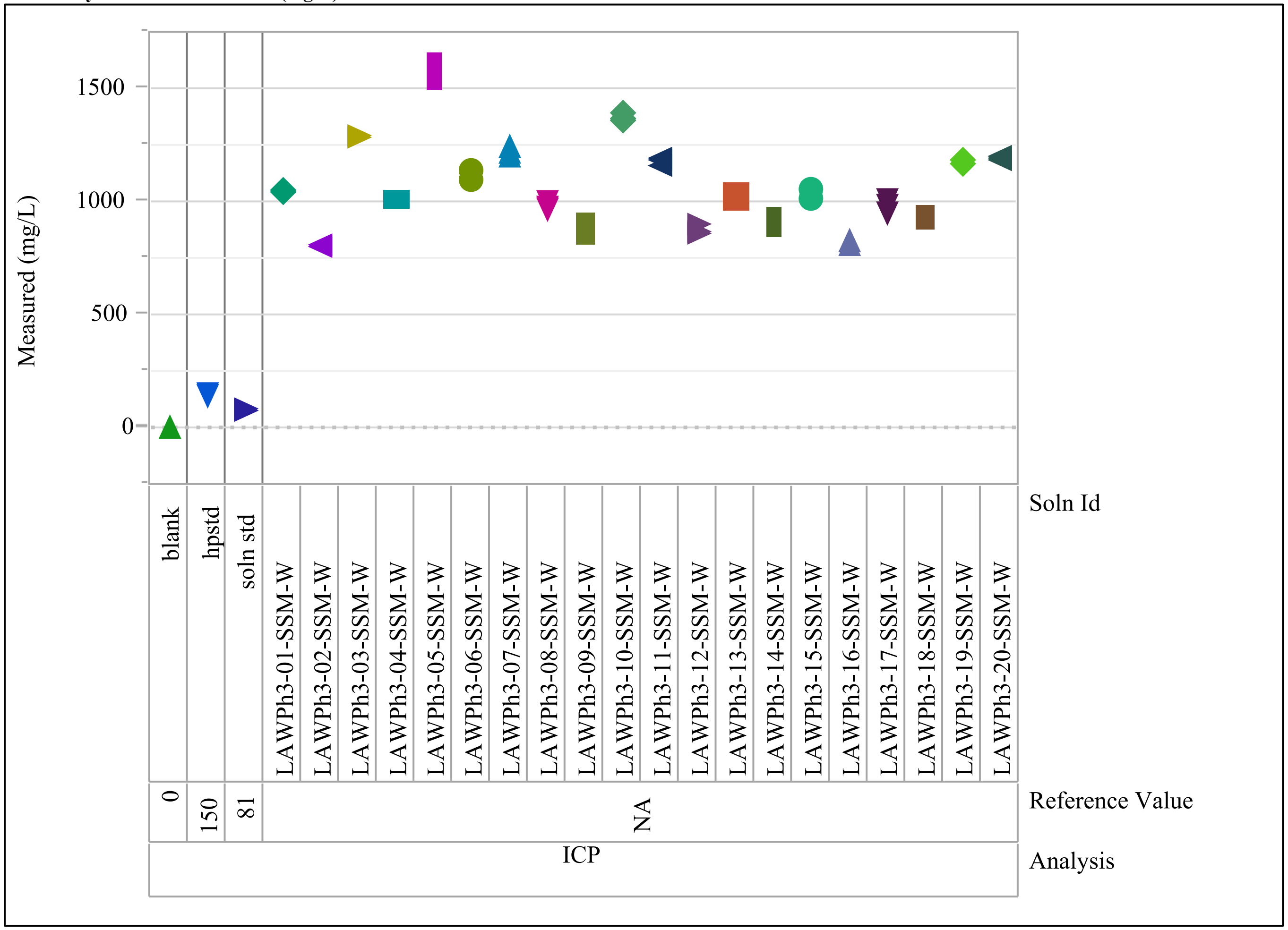


Exhibit E-2. Analysis of Wash Solutions by Solution Identifier (continued)

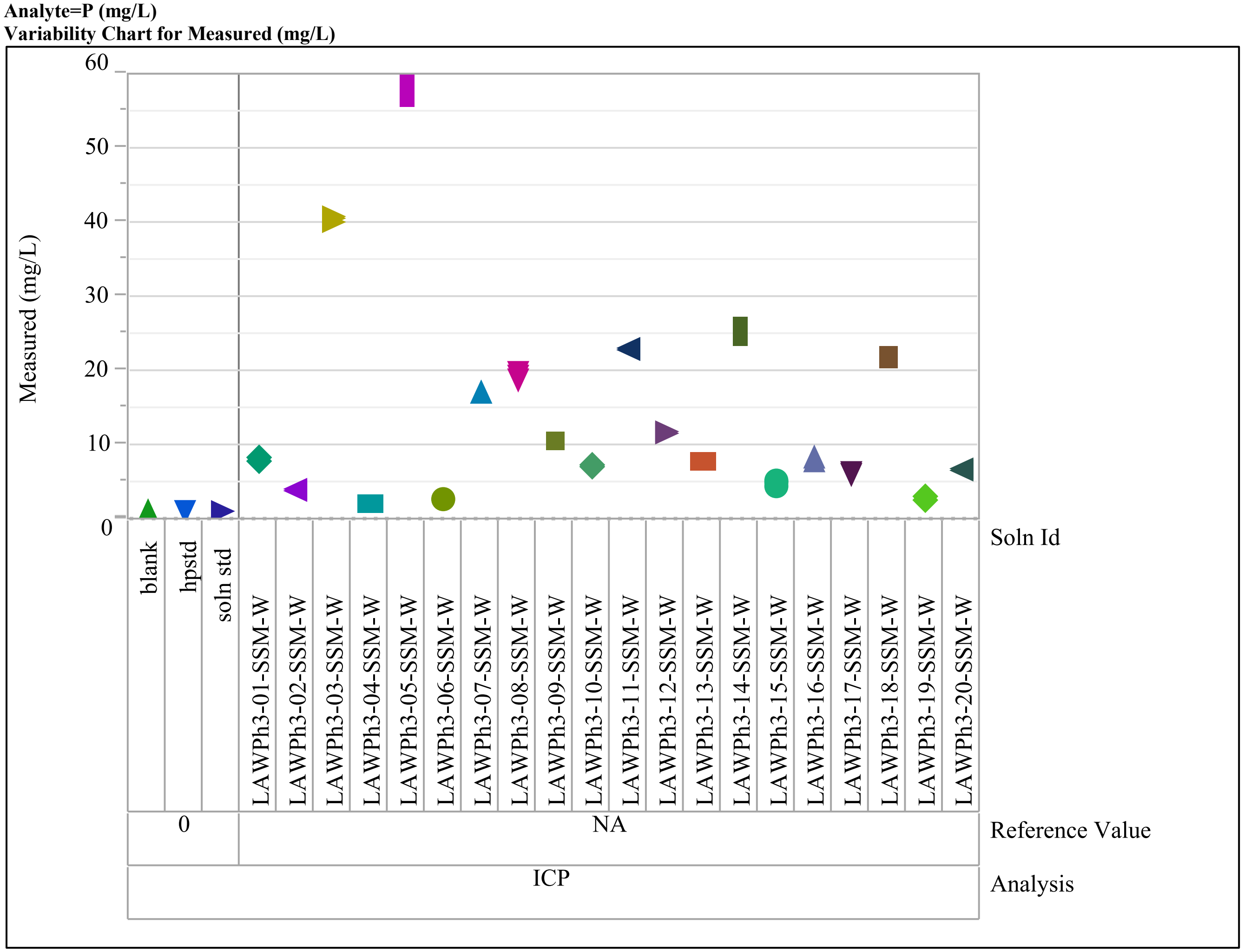


Exhibit E-2. Analysis of Wash Solutions by Solution Identifier (continued)

Analyte=PO4 (mg/L)
Variability Chart for Measured (mg/L)

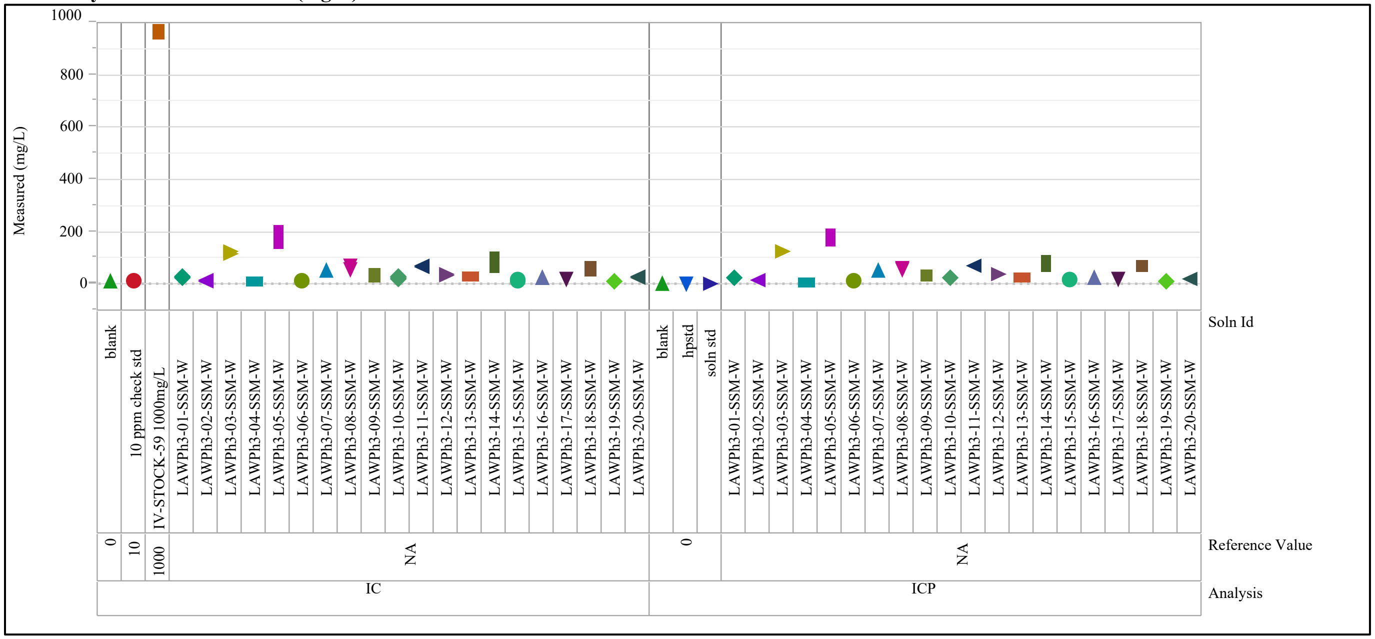


Exhibit E-2. Analysis of Wash Solutions by Solution Identifier (continued)

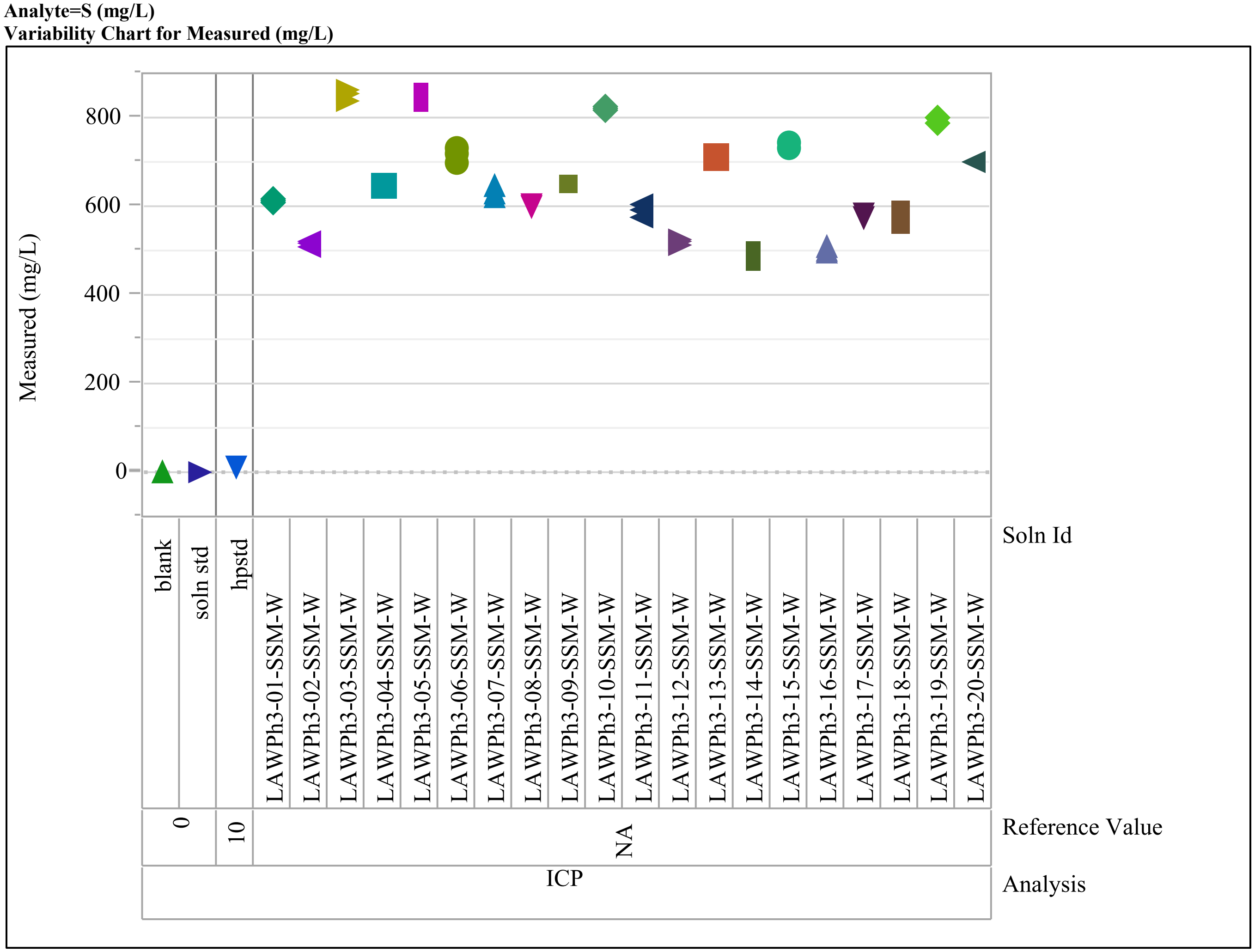


Exhibit E-2. Analysis of Wash Solutions by Solution Identifier (continued)

Analyte=Si (mg/L)
Variability Chart for Measured (mg/L)

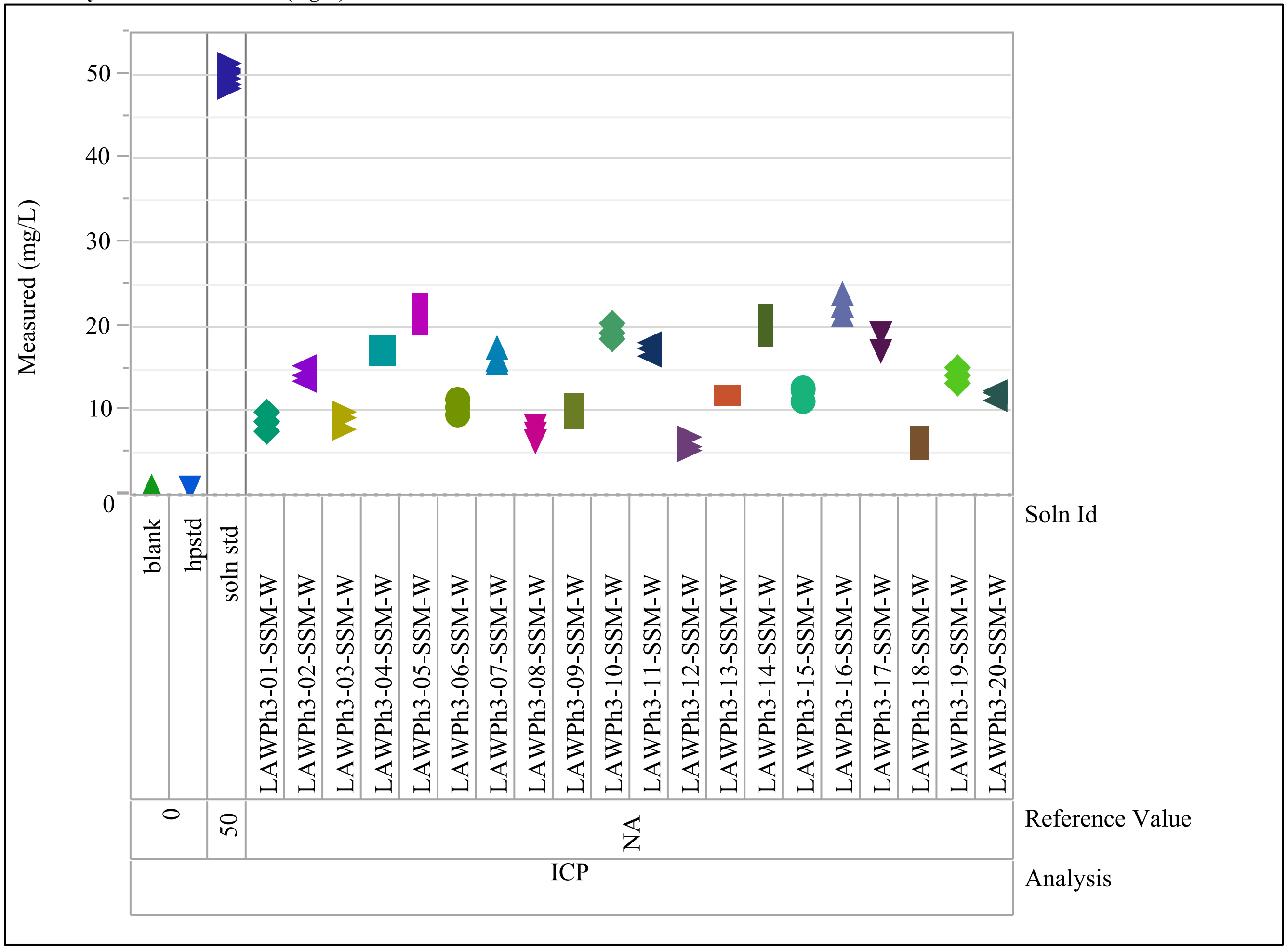


Exhibit E-2. Analysis of Wash Solutions by Solution Identifier (continued)

Analyte=Sn (mg/L)
Variability Chart for Measured (mg/L)

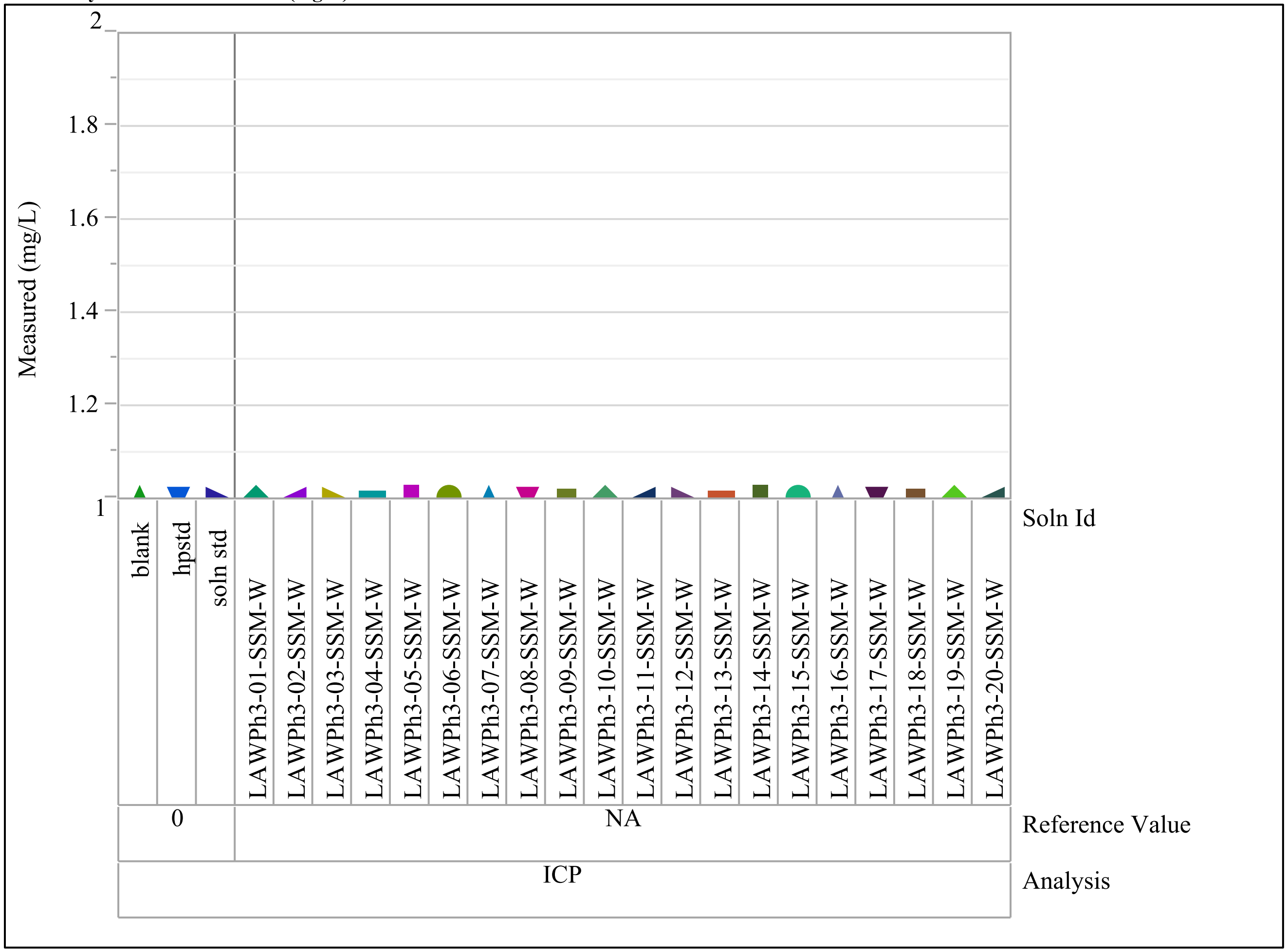


Exhibit E-2. Analysis of Wash Solutions by Solution Identifier (continued)

Analyte=SO4 (mg/L)
Variability Chart for Measured (mg/L)

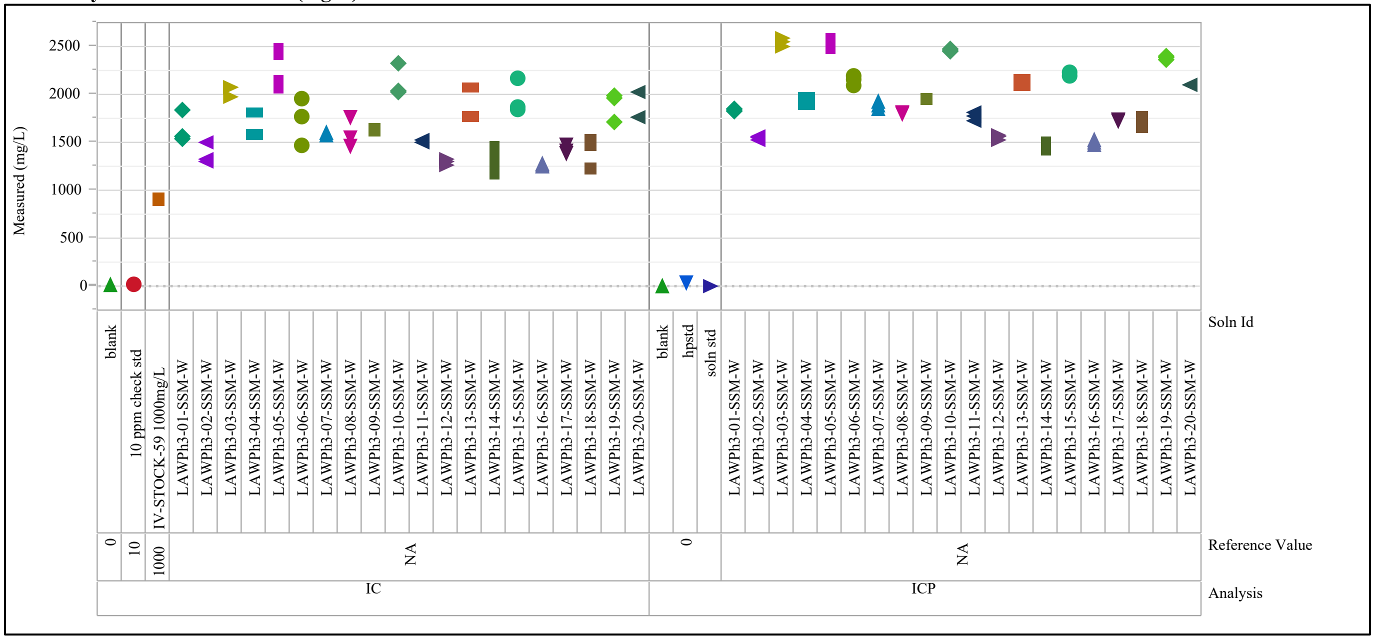


Exhibit E-2. Analysis of Wash Solutions by Solution Identifier (continued)

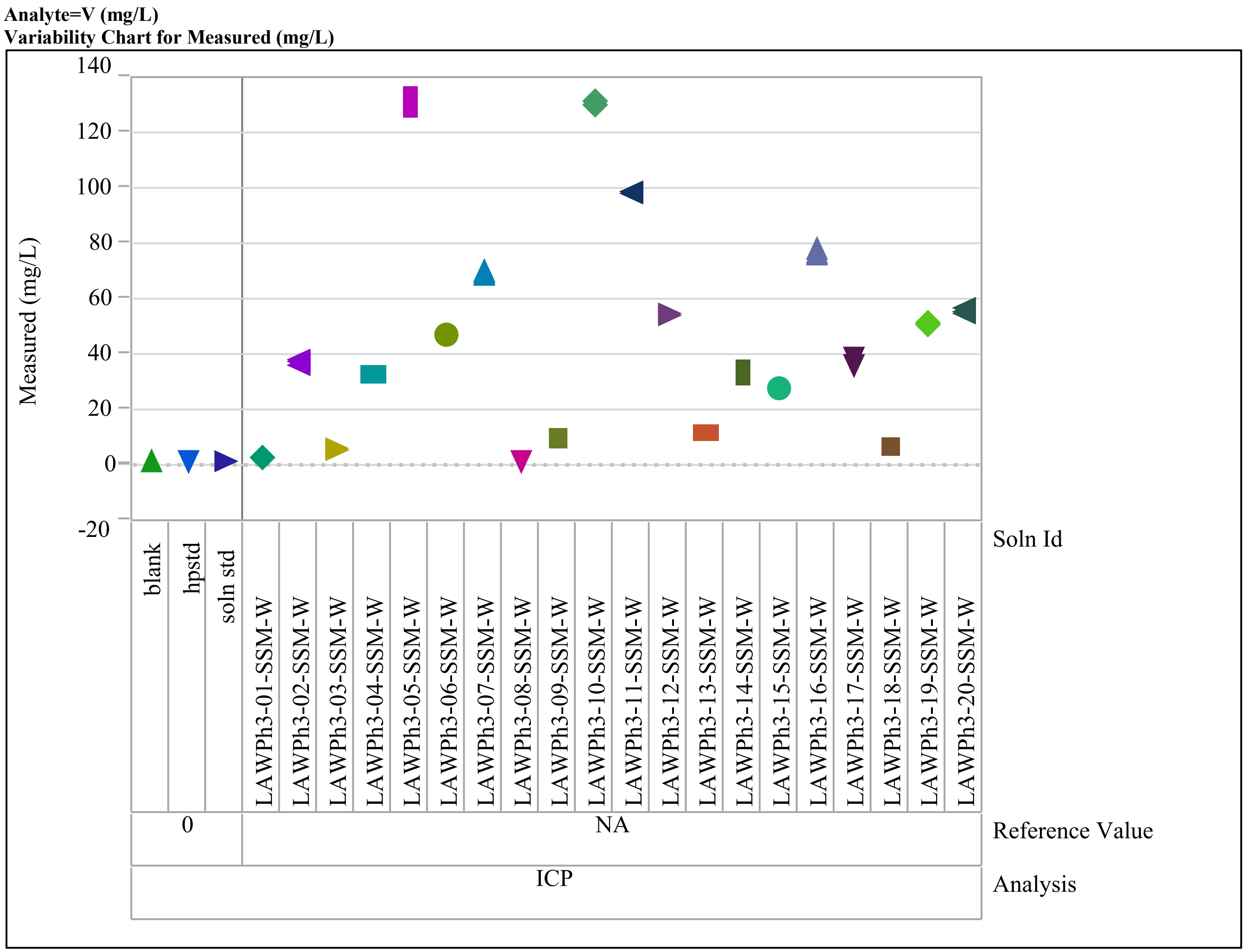


Exhibit E-2. Analysis of Wash Solutions by Solution Identifier (continued)

Analyte=Zn (mg/L)
Variability Chart for Measured (mg/L)

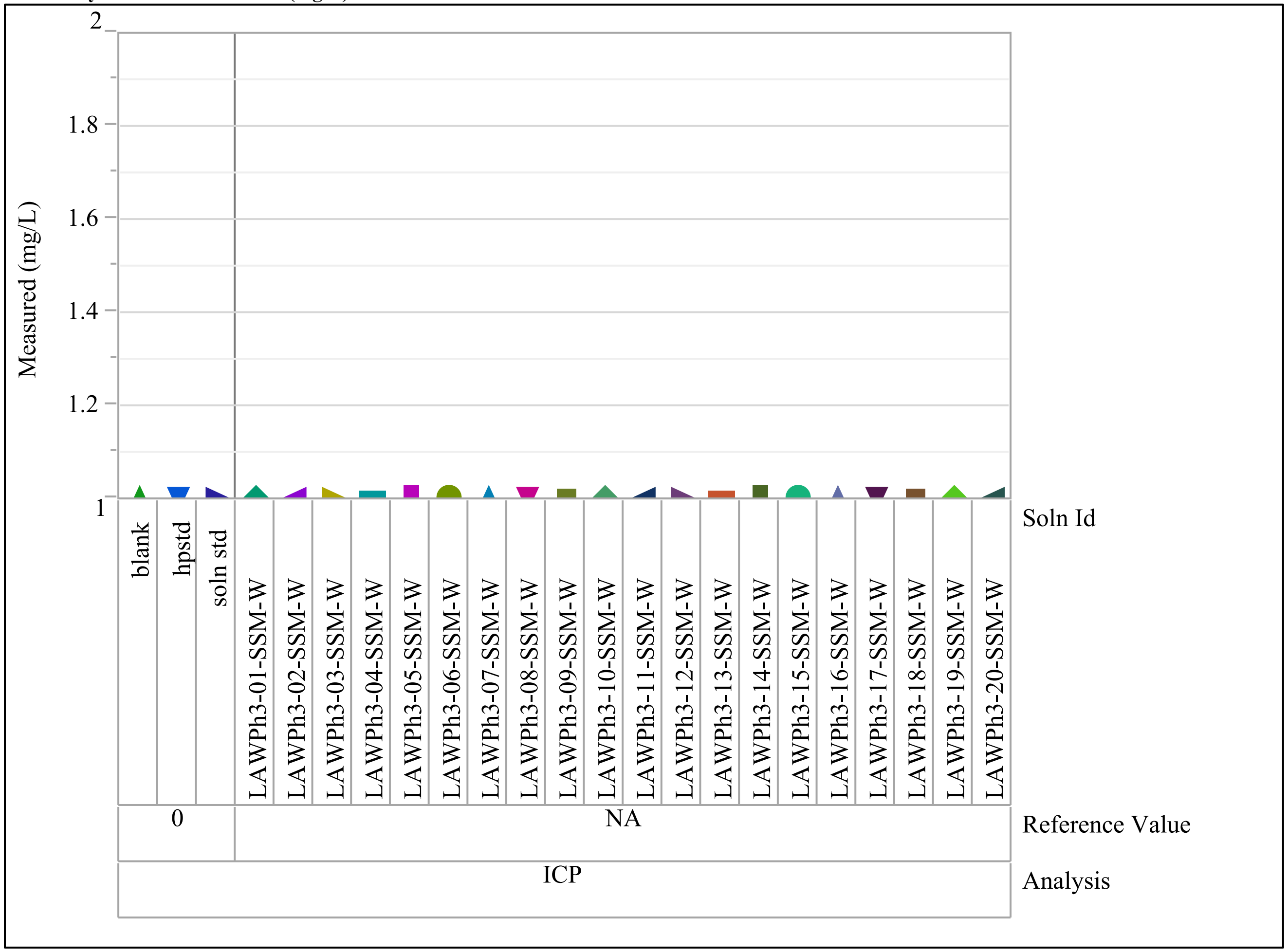
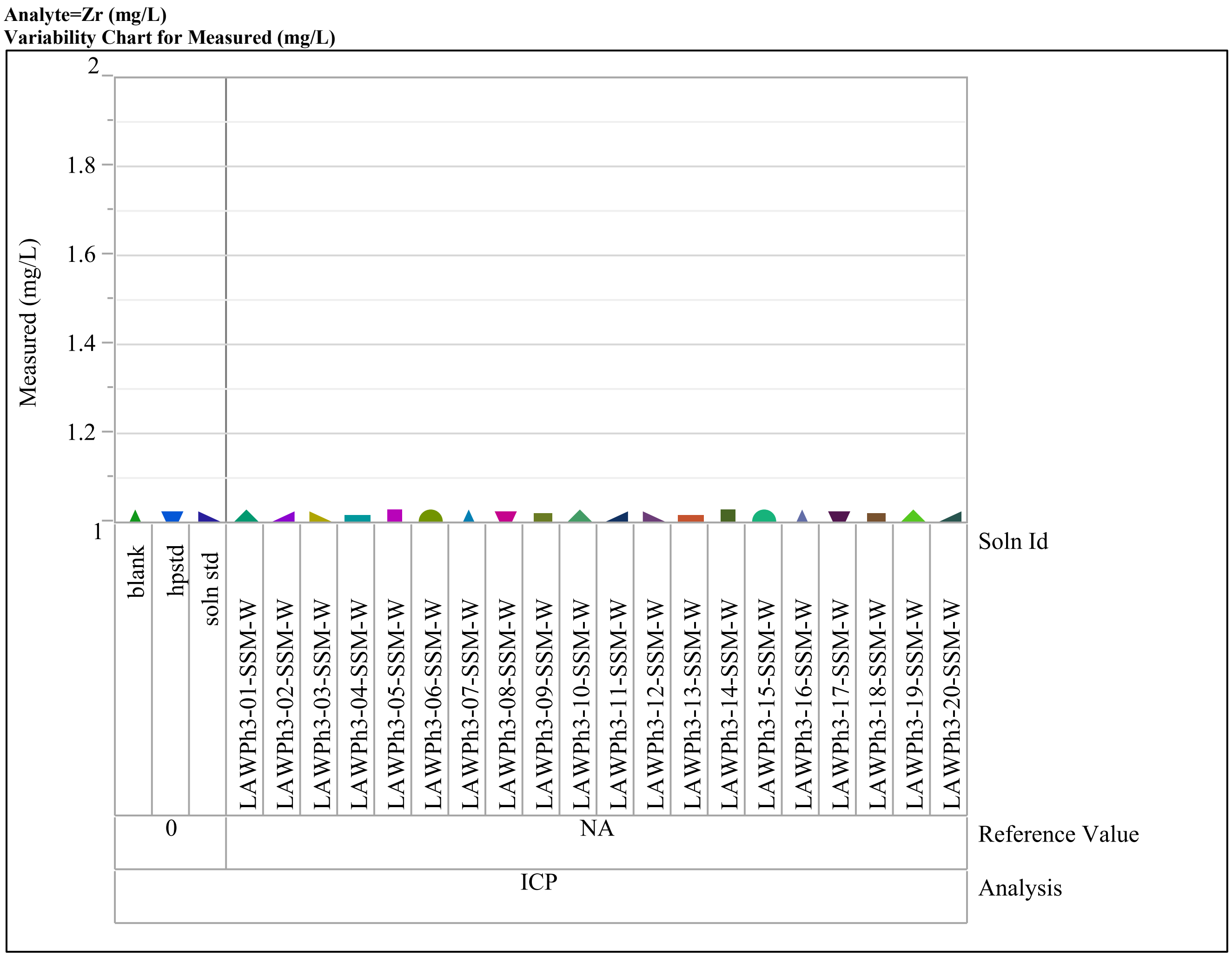


Exhibit E-2. Analysis of Wash Solutions by Solution Identifier (continued)



Appendix F Tables and Exhibits Supporting the Quenched Glass PCT Leachate Measurements

Table F-1. PCT Leachate Measurements for the Quenched Glasses

PNNL Groupings	Glass ID	Glass ID (extended)	Block	Seq	Lab ID	Al (mg/L)	B (mg/L)	Cr (mg/L)	Li (mg/L)	Na (mg/L)	Si (mg/L)	Zr (mg/L)
soln std	soln std	soln std	1	1	std-11	3.740	19.700	<1.000	9.820	80.700	47.300	<1.000
1	BLANK #1	BLANK #1-01	1	2	S-8994	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
1	DWPF-PCT-01	DWPF-PCT-A-01	1	3	S-8991	5.880	73.900	<1.000	20.600	192.000	84.200	<1.000
1	LAWPh3-01-1-Q	LAWPh3-01-1-Q-PCT-A	1	4	S-8982	6.190	40.200	3.520	<1.000	135.000	13.400	<1.000
2	DWPF-PCT-02	DWPF-PCT-A-02	1	5	S-9008	5.790	70.700	<1.000	20.200	191.000	89.400	<1.000
2	LAWPh3-05-Q	LAWPh3-05-Q-PCT-A	1	6	S-8999	6.050	6.310	1.890	<1.000	58.100	12.200	<1.000
2	LAWPh3-07-Q	LAWPh3-07-Q-PCT-A	1	7	S-9005	8.170	1.540	1.130	<1.000	41.300	7.560	<1.000
1	LAWPh3-03-Q	LAWPh3-03-Q-PCT-A	1	8	S-8988	5.860	14.600	2.470	<1.000	100.000	25.900	<1.000
2	LAWPh3-04-Q	LAWPh3-04-Q-PCT-A	1	9	S-8996	6.230	9.080	1.590	<1.000	52.400	11.400	<1.000
soln std	soln std	soln std	1	10	std-12	3.720	18.300	<1.000	9.760	79.500	45.600	<1.000
4	DWPF-PCT-04	DWPF-PCT-A-04	1	11	S-9048	<1.000	28.400	<1.000	10.300	84.600	51.000	<1.000
4	LAWPh3-15-Q	LAWPh3-15-Q-PCT-A	1	12	S-9039	1.070	4.000	<1.000	<1.000	46.200	9.000	<1.000
2	LAWPh3-06-Q	LAWPh3-06-Q-PCT-A	1	13	S-9002	6.920	<1.000	1.070	<1.000	29.900	5.070	<1.000
4	LAWPh3-14-Q	LAWPh3-14-Q-PCT-A	1	14	S-9036	1.000	3.200	<1.000	<1.000	49.500	12.100	<1.000
1	LAWPh3-02-Q	LAWPh3-02-Q-PCT-A	1	15	S-8985	5.820	60.700	5.750	<1.000	220.000	26.200	<1.000
4	BLANK #1	BLANK #1-04	1	16	S-9051	<1.000	<1.000	<1.000	<1.000	2.700	10.500	<1.000
4	LAWPh3-16-Q	LAWPh3-16-Q-PCT-A	1	17	S-9042	<1.000	10.700	1.070	<1.000	115.000	21.100	<1.000
4	LAWPh3-17-Q	LAWPh3-17-Q-PCT-A	1	18	S-9045	1.300	1.050	<1.000	<1.000	62.000	10.200	<1.000
soln std	soln std	soln std	1	19	std-13	3.670	21.300	<1.000	9.390	74.500	48.800	<1.000
soln std	soln std	soln std	2	1	std-21	3.800	19.800	<1.000	9.750	80.400	45.400	<1.000
2	LAWPh3-05-Q	LAWPh3-05-Q-PCT-B	2	2	S-9000	5.970	7.990	1.990	<1.000	60.800	17.300	<1.000
4	LAWPh3-17-Q	LAWPh3-17-Q-PCT-B	2	3	S-9046	1.320	2.900	<1.000	<1.000	63.800	13.300	<1.000
4	LAWPh3-16-Q	LAWPh3-16-Q-PCT-B	2	4	S-9043	<1.000	12.100	1.080	<1.000	117.000	24.200	<1.000
2	LAWPh3-04-Q	LAWPh3-04-Q-PCT-B	2	5	S-8997	5.840	11.100	1.630	<1.000	54.800	13.900	<1.000
4	BLANK #2	BLANK #2-04	2	6	S-9052	<1.000	<1.000	<1.000	<1.000	1.610	6.100	<1.000
2	LAWPh3-06-Q	LAWPh3-06-Q-PCT-B	2	7	S-9003	6.940	1.530	1.120	<1.000	31.500	6.200	<1.000
1	LAWPh3-02-Q	LAWPh3-02-Q-PCT-B	2	8	S-8986	5.790	62.400	5.700	<1.000	227.000	25.200	<1.000
2	DWPF-PCT-02	DWPF-PCT-B-02	2	9	S-9009	5.480	64.800	<1.000	19.100	194.000	89.200	<1.000
soln std	soln std	soln std	2	10	std-22	3.630	18.200	<1.000	9.270	76.500	50.200	<1.000
2	LAWPh3-07-Q	LAWPh3-07-Q-PCT-B	2	11	S-9006	8.000	3.050	1.140	<1.000	40.800	9.170	<1.000
2	BLANK #1	BLANK #1-02	2	12	S-9011	<1.000	<1.000	<1.000	<1.000	8.800	27.000	<1.000
4	LAWPh3-15-Q	LAWPh3-15-Q-PCT-B	2	13	S-9040	1.280	5.650	<1.000	<1.000	47.000	8.390	<1.000
4	LAWPh3-14-Q	LAWPh3-14-Q-PCT-B	2	14	S-9037	<1.000	4.620	<1.000	<1.000	49.900	12.900	<1.000
1	LAWPh3-03-Q	LAWPh3-03-Q-PCT-B	2	15	S-8989	5.710	15.700	2.480	<1.000	106.000	25.600	<1.000
1	DWPF-PCT-01	DWPF-PCT-B-01	2	16	S-8992	5.630	62.400	<1.000	17.900	182.000	82.400	<1.000
4	DWPF-PCT-04	DWPF-PCT-B-04	2	17	S-9049	<1.000	28.200	<1.000	9.770	82.300	47.900	<1.000

Table F-1. PCT Leachate Measurements for the Quenched Glasses (continued)

PNNL Groupings	Glass ID	Glass ID (extended)	Block	Seq	Lab ID	Al (mg/L)	B (mg/L)	Cr (mg/L)	Li (mg/L)	Na (mg/L)	Si (mg/L)	Zr (mg/L)
1	LAWPh3-01-1-Q	LAWPh3-01-1-Q-PCT-B	2	18	S-8983	5.860	35.800	3.240	<1.000	133.000	17.100	<1.000
soln std	soln std	soln std	2	19	std-23	3.720	19.600	<1.000	9.660	78.500	51.800	<1.000
soln std	soln std	soln std	3	1	std-31	4.100	19.900	<1.000	10.100	81.800	47.800	<1.000
4	LAWPh3-16-Q	LAWPh3-16-Q-PCT-C	3	2	S-9044	<1.000	12.700	1.430	<1.000	120.000	25.900	<1.000
4	LAWPh3-17-Q	LAWPh3-17-Q-PCT-C	3	3	S-9047	1.720	2.720	<1.000	<1.000	67.700	14.600	<1.000
2	LAWPh3-05-Q	LAWPh3-05-Q-PCT-C	3	4	S-9001	6.220	7.470	2.250	<1.000	60.800	18.000	<1.000
4	LAWPh3-14-Q	LAWPh3-14-Q-PCT-C	3	5	S-9038	1.380	4.630	<1.000	<1.000	51.200	15.000	<1.000
2	BLANK #2	BLANK #2-02	3	6	S-9012	<1.000	<1.000	<1.000	<1.000	3.510	12.100	<1.000
1	DWPF-PCT-01	DWPF-PCT-C-01	3	7	S-8993	5.970	66.200	1.230	19.000	191.000	92.500	<1.000
1	LAWPh3-03-Q	LAWPh3-03-Q-PCT-C	3	8	S-8990	6.040	16.000	2.760	<1.000	107.000	29.000	<1.000
2	LAWPh3-04-Q	LAWPh3-04-Q-PCT-C	3	9	S-8998	6.240	10.400	1.880	<1.000	53.700	12.700	<1.000
soln std	soln std	soln std	3	10	std-32	4.080	19.400	<1.000	10.100	81.700	47.300	<1.000
1	LAWPh3-02-Q	LAWPh3-02-Q-PCT-C	3	11	S-8987	6.320	61.500	5.980	<1.000	216.000	27.700	<1.000
2	DWPF-PCT-02	DWPF-PCT-C-02	3	12	S-9010	5.970	67.700	1.220	19.300	186.000	93.000	<1.000
1	LAWPh3-01-1-Q	LAWPh3-01-1-Q-PCT-C	3	13	S-8984	6.350	37.500	3.770	<1.000	133.000	20.400	<1.000
1	BLANK #2	BLANK #2-01	3	14	S-8995	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
4	DWPF-PCT-04	DWPF-PCT-C-04	3	15	S-9050	<1.000	33.100	<1.000	11.700	96.900	56.200	<1.000
4	LAWPh3-15-Q	LAWPh3-15-Q-PCT-C	3	16	S-9041	1.680	5.910	<1.000	<1.000	49.400	9.030	<1.000
2	LAWPh3-06-Q	LAWPh3-06-Q-PCT-C	3	17	S-9004	7.370	1.570	1.430	<1.000	32.600	6.040	<1.000
2	LAWPh3-07-Q	LAWPh3-07-Q-PCT-C	3	18	S-9007	8.310	2.830	1.430	<1.000	42.100	8.850	<1.000
soln std	soln std	soln std	3	19	std-33	4.100	19.500	<1.000	10.100	81.900	46.000	<1.000
soln std	soln std	soln std	4	1	std-41	3.950	20.100	<1.000	10.000	80.900	48.200	<1.000
3	LAWPh3-08-Q	LAWPh3-08-Q-PCT-A	4	2	S-9013	<1.000	1.440	<1.000	<1.000	20.800	8.110	<1.000
3	LAWPh3-11-Q	LAWPh3-11-Q-PCT-A	4	3	S-9022	1.860	9.570	<1.000	<1.000	56.000	9.290	<1.000
5	LAWPh3-20-Q	LAWPh3-20-Q-PCT-A	4	4	S-9059	<1.000	2.560	<1.000	<1.000	23.700	8.850	<1.000
Others	DWPF-05	DWPF A-05-(1)	4	5	S-9068	<1.000	36.200	<1.000	12.600	106.000	62.800	<1.000
Others	2% Vol. HNO3	2% Vol. HNO3	4	6	S-9067	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
3	LAWPh3-12-Q	LAWPh3-12-Q-PCT-A	4	7	S-9025	1.300	13.400	<1.000	<1.000	36.100	4.230	<1.000
3	LAWPh3-10-Q	LAWPh3-10-Q-PCT-A	4	8	S-9019	1.690	3.660	<1.000	<1.000	46.500	9.520	<1.000
soln std	soln std	soln std	4	9	std-42	3.970	19.200	<1.000	10.000	81.400	48.800	<1.000
5	DWPF-PCT-05	DWPF-PCT-A-05	4	10	S-9062	<1.000	37.300	<1.000	12.900	108.000	63.800	<1.000
5	LAWPh3-19-Q	LAWPh3-19-Q-PCT-A	4	11	S-9056	<1.000	<1.000	<1.000	<1.000	10.300	1.610	<1.000
3	LAWPh3-13-Q	LAWPh3-13-Q-PCT-A	4	12	S-9028	1.490	1.500	<1.000	<1.000	44.600	9.770	<1.000
3	LAWPh3-09-Q	LAWPh3-09-Q-PCT-A	4	13	S-9016	1.520	5.790	<1.000	<1.000	52.000	10.700	<1.000
3	DWPF-PCT-03	DWPF-PCT-A-03	4	14	S-9031	<1.000	64.000	<1.000	18.500	181.000	88.000	<1.000
5	LAWPh3-18-Q	LAWPh3-18-Q-PCT-A	4	15	S-9053	1.750	1.930	<1.000	<1.000	29.000	9.320	<1.000
3	BLANK #1	BLANK #1-03	4	16	S-9034	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000

Table F-1. PCT Leachate Measurements for the Quenched Glasses (continued)

PNNL Groupings	Glass ID	Glass ID (extended)	Block	Seq	Lab ID	Al (mg/L)	B (mg/L)	Cr (mg/L)	Li (mg/L)	Na (mg/L)	Si (mg/L)	Zr (mg/L)
soln std	soln std	soln std	4	17	std-43	3.960	19.300	<1.000	9.950	81.000	48.100	<1.000
soln std	soln std	soln std	5	1	std-51	3.850	19.700	<1.000	9.830	79.800	49.200	<1.000
5	BLANK #1	BLANK #1-05	5	2	S-9065	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Others	DWPF-05	DWPF B-05-(1)	5	3	S-9069	<1.000	42.700	<1.000	13.800	127.000	66.300	<1.000
3	LAWPh3-09-Q	LAWPh3-09-Q-PCT-B	5	4	S-9017	1.350	6.280	<1.000	<1.000	50.700	10.800	<1.000
3	LAWPh3-08-Q	LAWPh3-08-Q-PCT-B	5	5	S-9014	<1.000	1.560	<1.000	<1.000	20.600	7.140	<1.000
5	LAWPh3-19-Q	LAWPh3-19-Q-PCT-B	5	6	S-9057	1.340	2.010	<1.000	<1.000	37.700	9.560	<1.000
5	LAWPh3-18-Q	LAWPh3-18-Q-PCT-B	5	7	S-9054	1.650	1.880	<1.000	<1.000	28.400	9.400	<1.000
3	LAWPh3-10-Q	LAWPh3-10-Q-PCT-B	5	8	S-9020	1.480	2.730	<1.000	<1.000	37.000	6.960	<1.000
soln std	soln std	soln std	5	9	std-52	3.860	19.700	<1.000	9.840	80.000	48.000	<1.000
3	DWPF-PCT-03	DWPF-PCT-B-03	5	10	S-9032	<1.000	64.100	<1.000	18.600	180.000	87.500	<1.000
3	LAWPh3-12-Q	LAWPh3-12-Q-PCT-B	5	11	S-9026	1.030	11.100	<1.000	<1.000	29.200	2.440	<1.000
3	LAWPh3-13-Q	LAWPh3-13-Q-PCT-B	5	12	S-9029	1.400	1.590	<1.000	<1.000	41.600	8.120	<1.000
5	LAWPh3-20-Q	LAWPh3-20-Q-PCT-B	5	13	S-9060	<1.000	2.740	<1.000	<1.000	24.600	7.610	<1.000
5	DWPF-PCT-05	DWPF-PCT-B-05	5	14	S-9063	<1.000	40.800	<1.000	13.200	122.000	62.200	<1.000
3	LAWPh3-11-Q	LAWPh3-11-Q-PCT-B	5	15	S-9023	1.780	9.360	<1.000	<1.000	51.900	7.180	<1.000
soln std	soln std	soln std	5	16	std-53	3.780	19.000	<1.000	9.570	78.000	47.000	<1.000
soln std	soln std	soln std	6	1	std-61	3.770	19.400	<1.000	9.700	80.400	47.500	<1.000
5	LAWPh3-19-Q	LAWPh3-19-Q-PCT-C	6	2	S-9058	1.320	1.870	<1.000	<1.000	38.500	9.470	<1.000
5	LAWPh3-20-Q	LAWPh3-20-Q-PCT-C	6	3	S-9061	<1.000	2.710	<1.000	<1.000	25.700	8.410	<1.000
3	LAWPh3-10-Q	LAWPh3-10-Q-PCT-C	6	4	S-9021	1.600	3.590	<1.000	<1.000	46.800	8.510	<1.000
3	LAWPh3-08-Q	LAWPh3-08-Q-PCT-C	6	5	S-9015	<1.000	1.180	<1.000	<1.000	20.400	6.790	<1.000
5	DWPF-PCT-05	DWPF-PCT-C-05	6	6	S-9064	<1.000	49.400	<1.000	15.200	143.000	71.900	<1.000
3	LAWPh3-12-Q	LAWPh3-12-Q-PCT-C	6	7	S-9027	<1.000	10.000	<1.000	<1.000	27.000	2.060	<1.000
3	LAWPh3-11-Q	LAWPh3-11-Q-PCT-C	6	8	S-9024	1.610	9.290	<1.000	<1.000	54.300	7.530	<1.000
soln std	soln std	soln std	6	9	std-62	3.820	19.900	<1.000	9.850	81.100	49.400	<1.000
5	LAWPh3-18-Q	LAWPh3-18-Q-PCT-C	6	10	S-9055	1.430	1.360	<1.000	<1.000	25.900	6.820	<1.000
5	BLANK #2	BLANK #2-05	6	11	S-9066	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
3	LAWPh3-09-Q	LAWPh3-09-Q-PCT-C	6	12	S-9018	1.340	6.170	<1.000	<1.000	53.900	9.250	<1.000
3	LAWPh3-13-Q	LAWPh3-13-Q-PCT-C	6	13	S-9030	1.420	1.620	<1.000	<1.000	45.900	8.580	<1.000
3	BLANK #2	BLANK #2-03	6	14	S-9035	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Others	DWPF-05	DWPF C-05-(1)	6	15	S-9070	<1.000	51.700	<1.000	15.900	145.000	74.800	<1.000
3	DWPF-PCT-03	DWPF-PCT-C-03	6	16	S-9033	<1.000	61.700	<1.000	17.800	170.000	85.700	<1.000
soln std	soln std	soln std	6	17	std-63	3.820	19.500	<1.000	9.870	81.100	50.800	<1.000

Table F-2. Results from Samples of the Multi-Element Solution Standard Included with the Quenched Glass PCT Leachates

PCT Set	1	1	1	1	1	1	Reference Values (mg/L)
Block	1	2	3	4	5	6	
Mean (Al (mg/L))	3.71	3.72	4.09	3.96	3.83	3.80	4
Mean (B (mg/L))	19.77	19.20	19.60	19.53	19.47	19.60	20
Mean (Li (mg/L))	9.66	9.56	10.10	9.98	9.75	9.81	10
Mean (Na (mg/L))	78.23	78.47	81.80	81.10	79.27	80.87	81
Mean (Si (mg/L))	47.23	49.13	47.03	48.37	48.07	49.23	50
% relative bias, Al	-7.3%	-7.1%	2.3%	-1.0%	-4.3%	-4.9%	<10% per ASTM C 1285
% relative bias, B	-1.2%	-4.0%	-2.0%	-2.3%	-2.7%	-2.0%	
% relative bias, Li	-3.4%	-4.4%	1.0%	-0.2%	-2.5%	-1.9%	
% relative bias, Na	-3.4%	-3.1%	1.0%	0.1%	-2.1%	-0.2%	
% relative bias, Si	-5.5%	-1.7%	-5.9%	-3.3%	-3.9%	-1.5%	
Std Dev (Al (mg/L))	0.036	0.085	0.012	0.010	0.044	0.029	
Std Dev (B (mg/L))	1.501	0.872	0.265	0.493	0.404	0.265	
Std Dev (Li (mg/L))	0.233	0.255	0.000	0.029	0.153	0.093	
Std Dev (Na (mg/L))	3.288	1.950	0.100	0.265	1.102	0.404	
Std Dev (Si (mg/L))	1.601	3.331	0.929	0.379	1.102	1.656	
%RSD (Al (mg/L))	1.0%	2.3%	0.3%	0.3%	1.1%	0.8%	<10% per ASTM C 1285
%RSD (B (mg/L))	7.6%	4.5%	1.3%	2.5%	2.1%	1.3%	
%RSD (Li (mg/L))	2.4%	2.7%	0.0%	0.3%	1.6%	0.9%	
%RSD (Na (mg/L))	4.2%	2.5%	0.1%	0.3%	1.4%	0.5%	
%RSD (Si (mg/L))	3.4%	6.8%	2.0%	0.8%	2.3%	3.4%	

Exhibit F-1. PCT Leachate Measurements in Analytical Sequence

Analyte=Al (mg/L)
Variability Chart for Conc (mg/L)

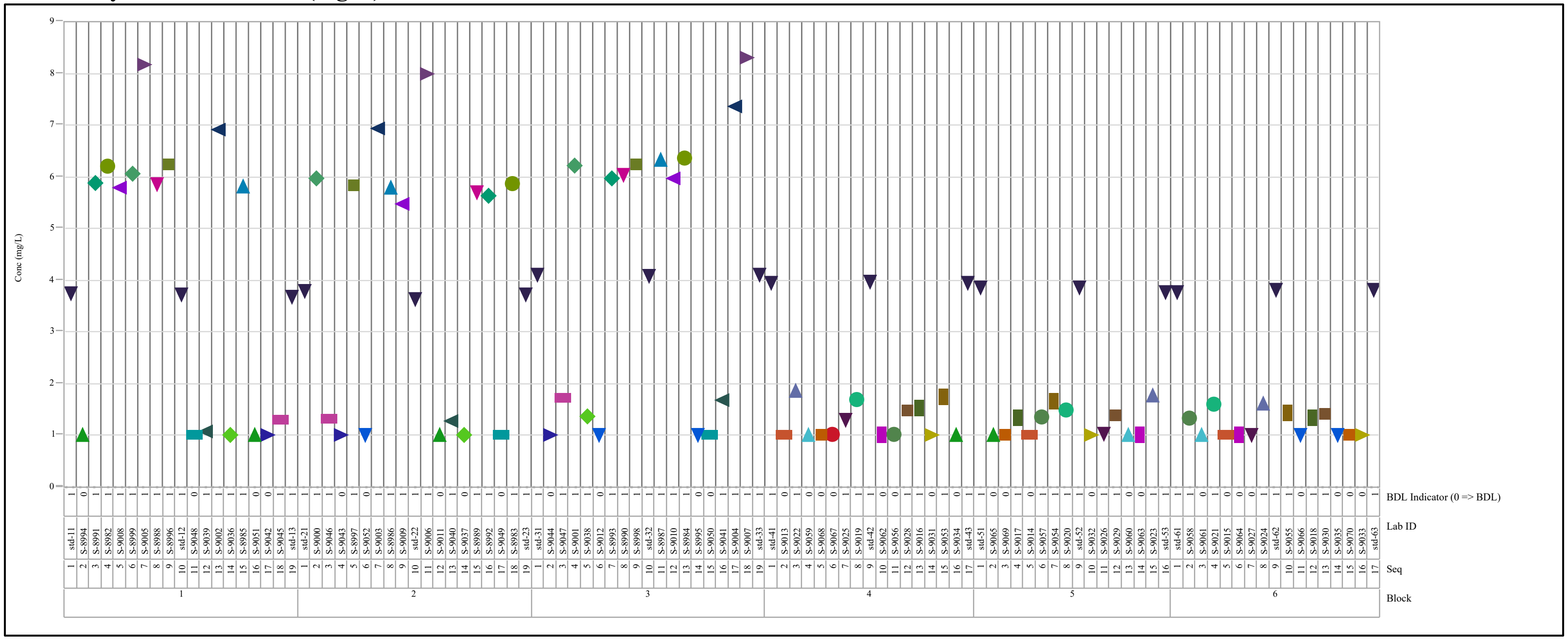


Exhibit F-1. PCT Leachate Measurements in Analytical Sequence (continued)

Analyte=B (mg/L)
Variability Chart for Conc (mg/L)

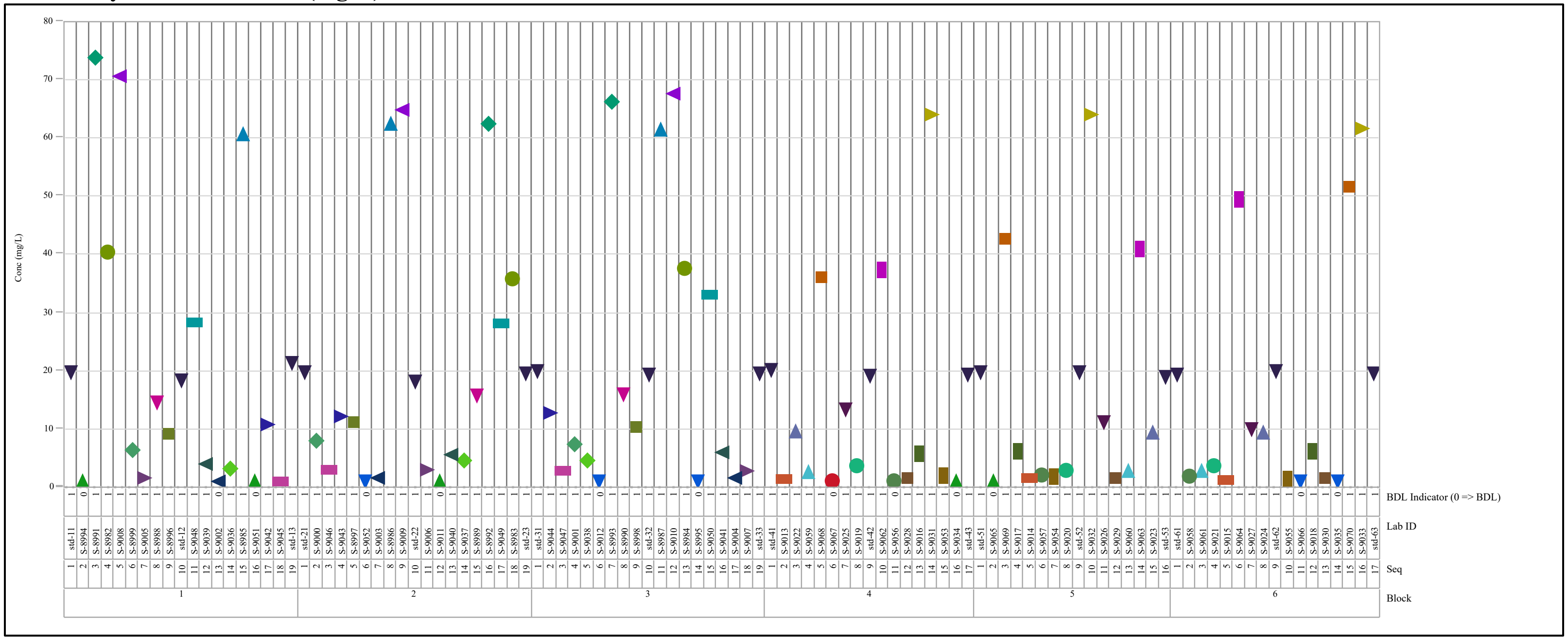


Exhibit F-1. PCT Leachate Measurements in Analytical Sequence (continued)

Analyte=Cr (mg/L)
Variability Chart for Conc (mg/L)

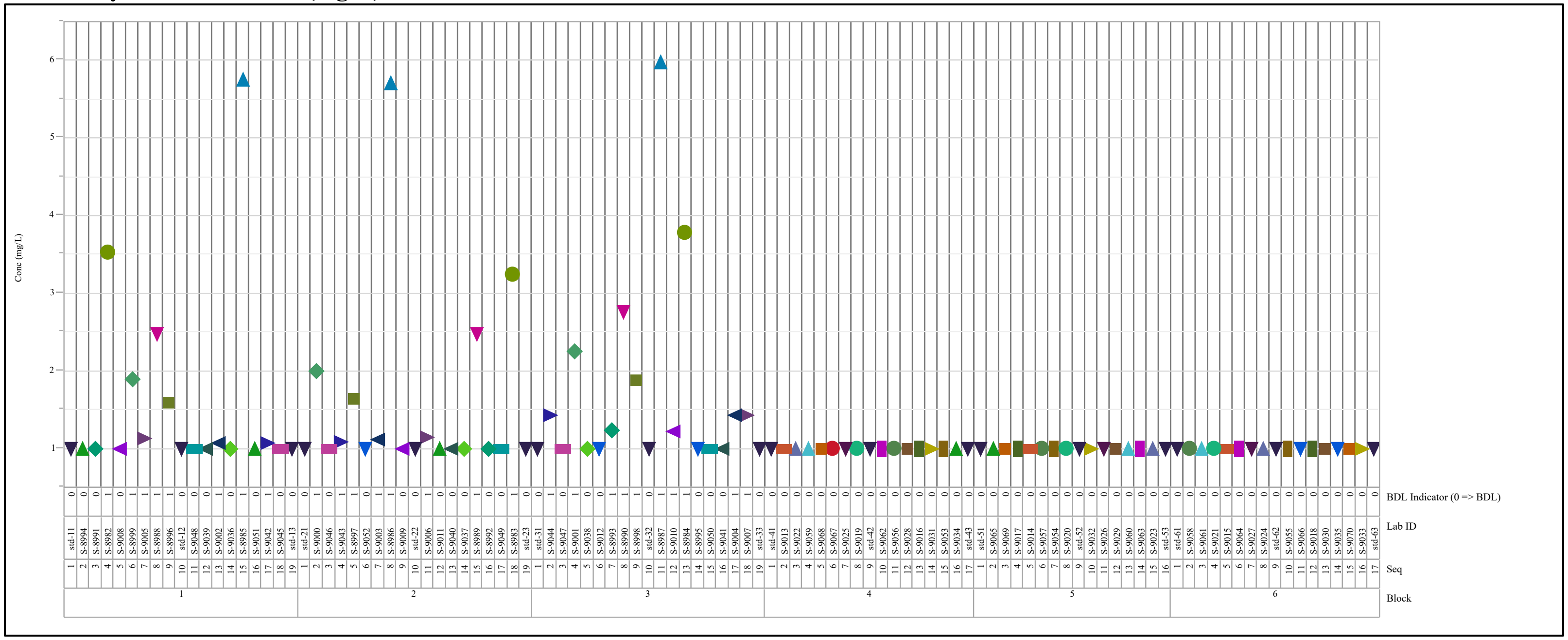


Exhibit F-1. PCT Leachate Measurements in Analytical Sequence (continued)

Analyte=Li (mg/L)
Variability Chart for Conc (mg/L)

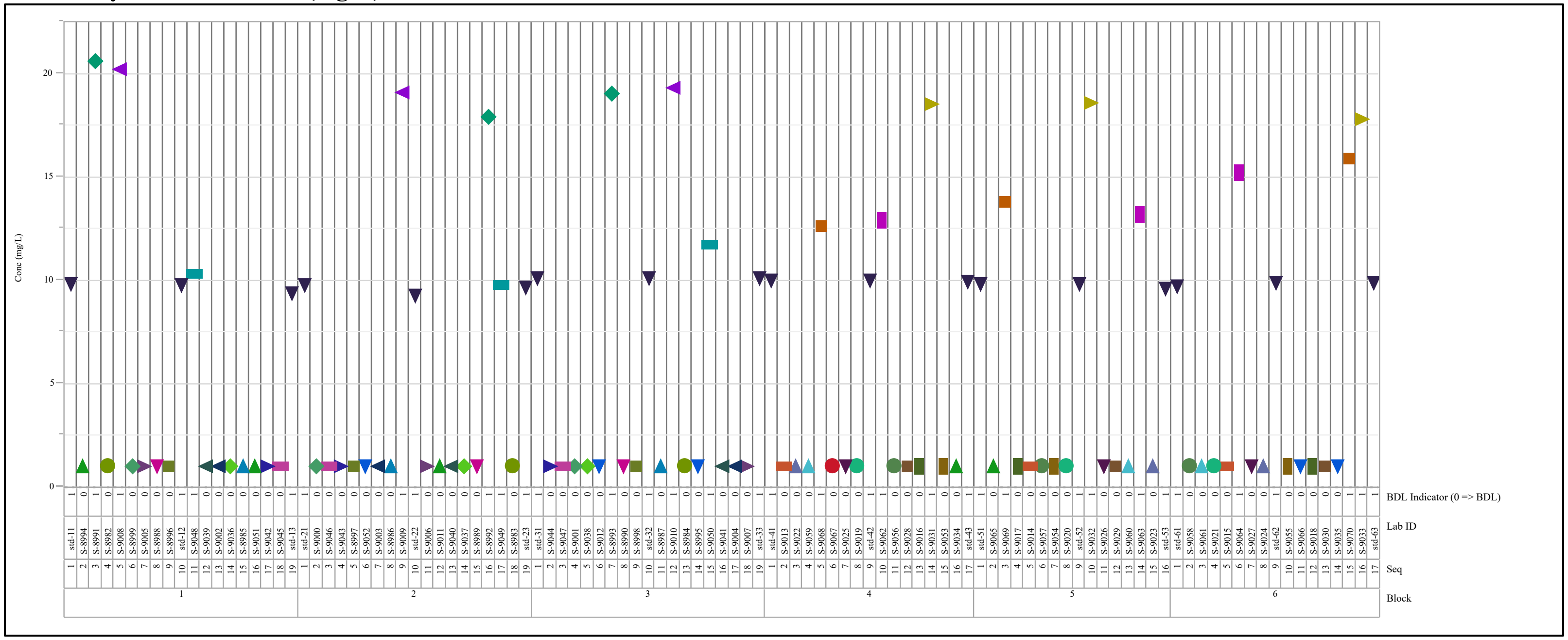


Exhibit F-1. PCT Leachate Measurements in Analytical Sequence (continued)

Analyte=Na (mg/L)
Variability Chart for Conc (mg/L)

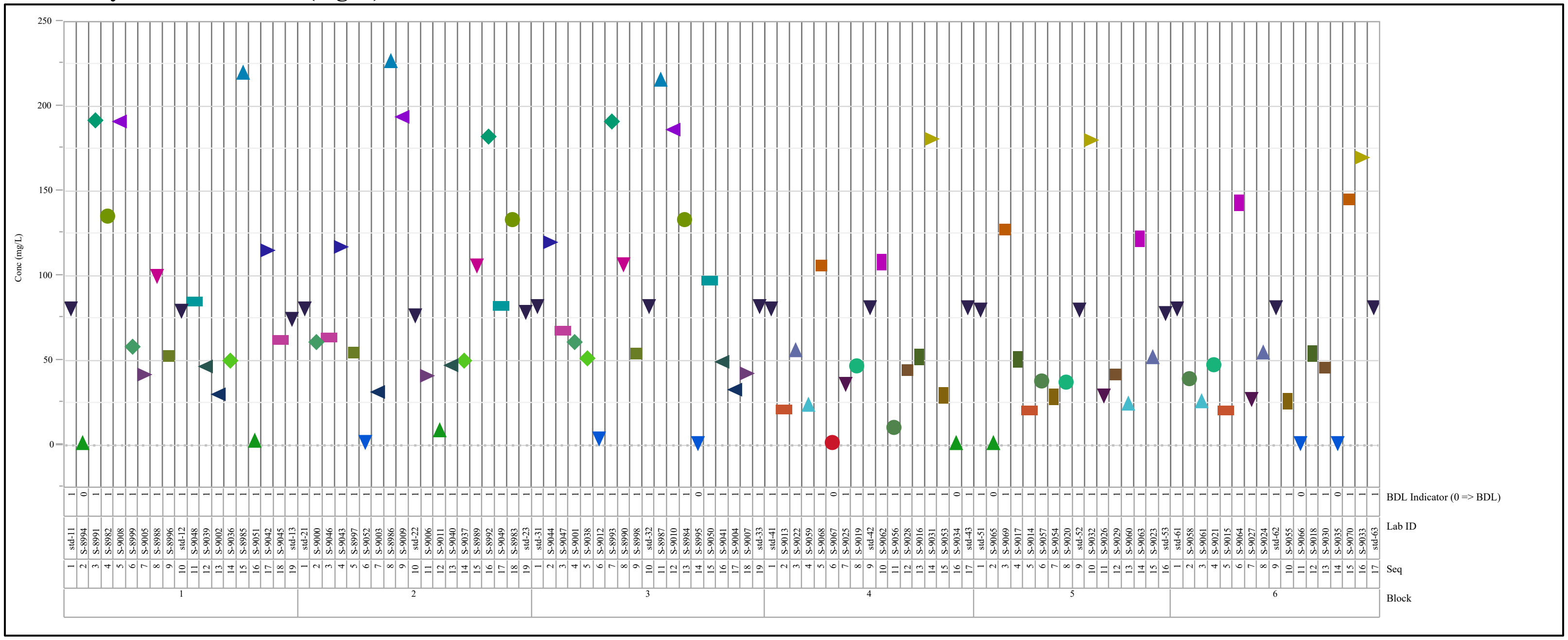


Exhibit F-1. PCT Leachate Measurements in Analytical Sequence (continued)

Analyte=Si (mg/L)
Variability Chart for Conc (mg/L)

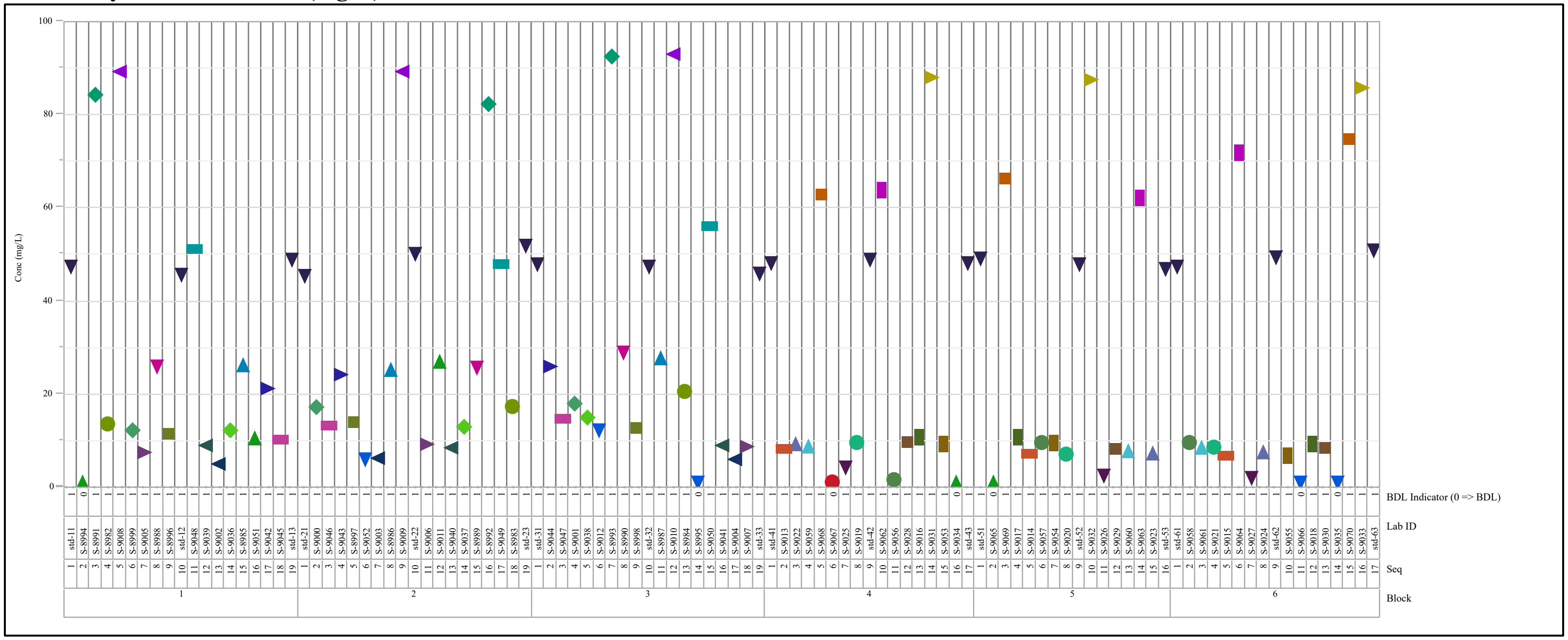


Exhibit F-1. PCT Leachate Measurements in Analytical Sequence (continued)

Analyte=Zr (mg/L)
Variability Chart for Conc (mg/L)

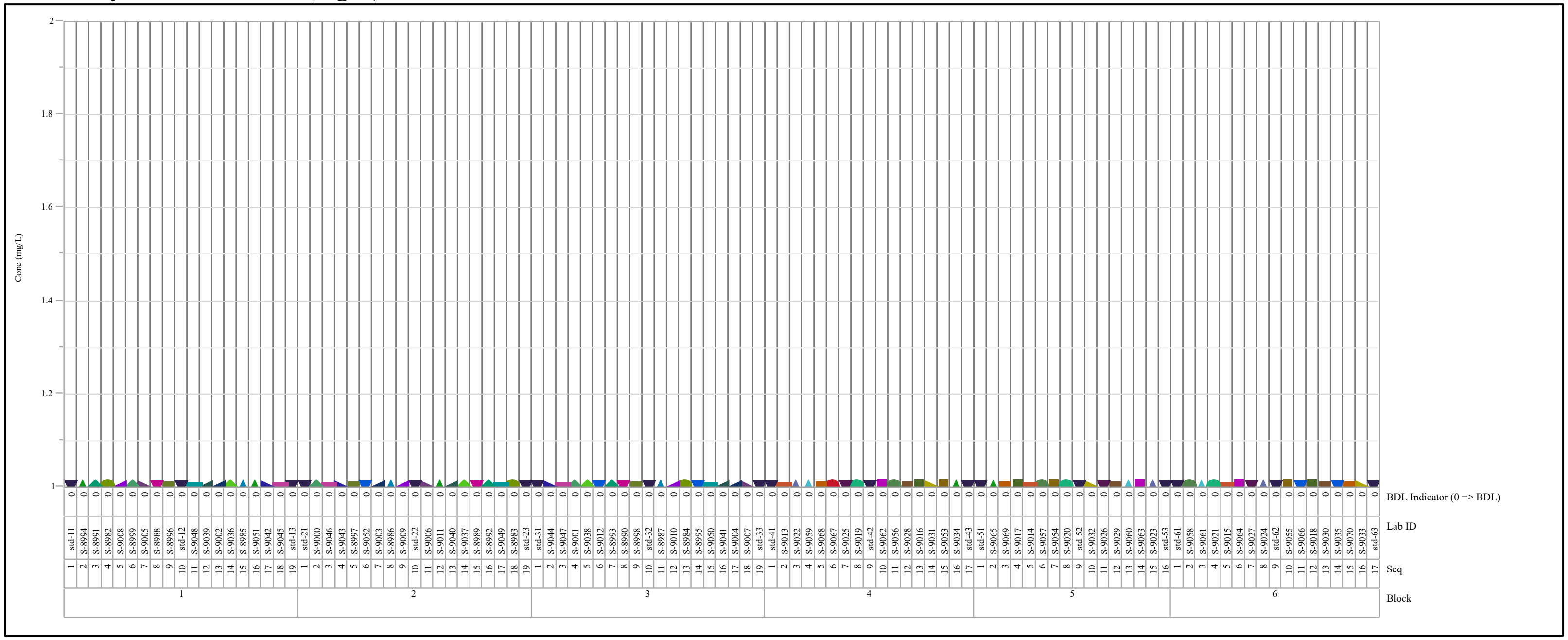


Exhibit F-2. PCT Leachate Measurements by PNNL Grouping

Analyte=Al (mg/L)
Variability Chart for Conc (mg/L)

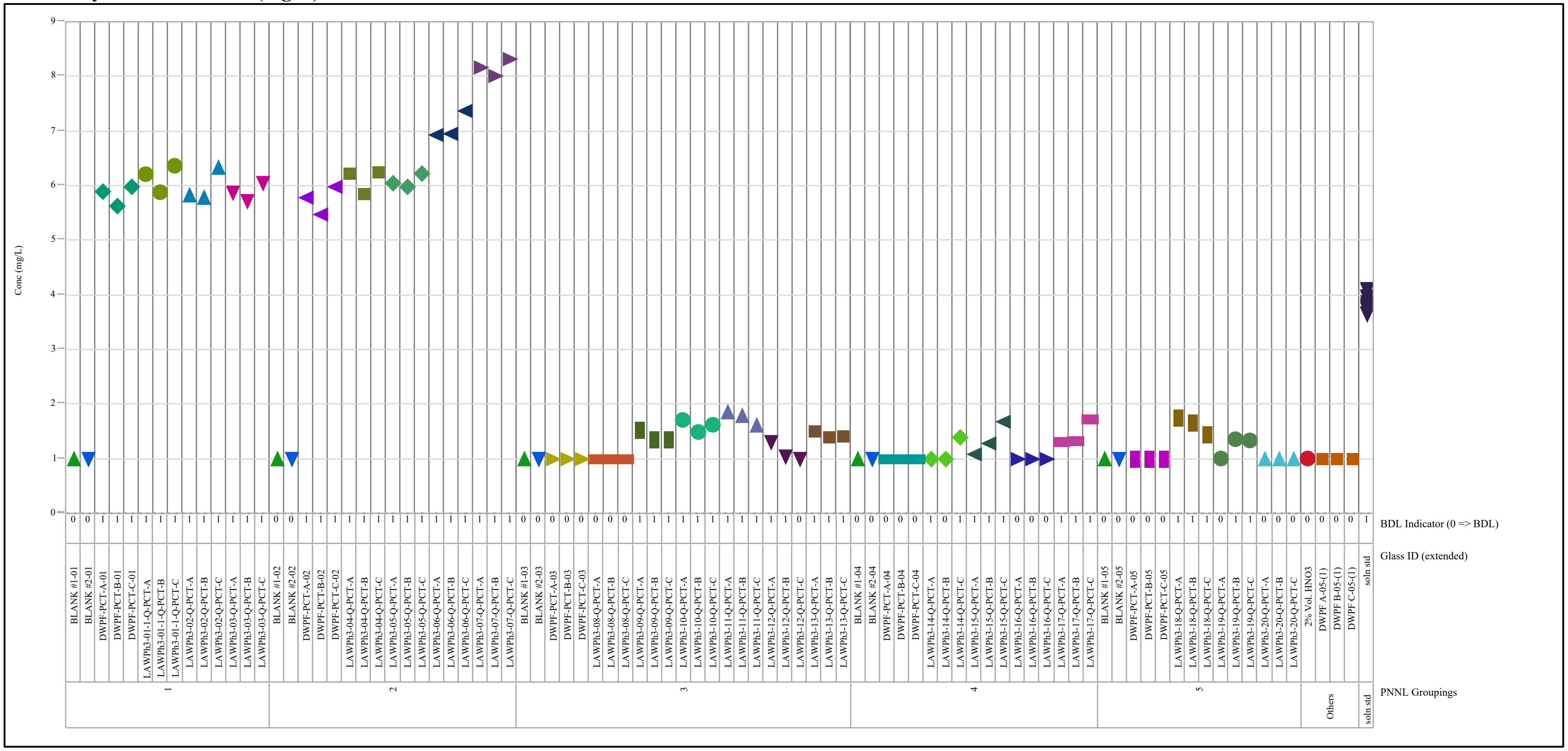


Exhibit F-2. PCT Leachate Measurements by PNNL Grouping (continued)

Analyte=B (mg/L)
Variability Chart for Conc (mg/L)

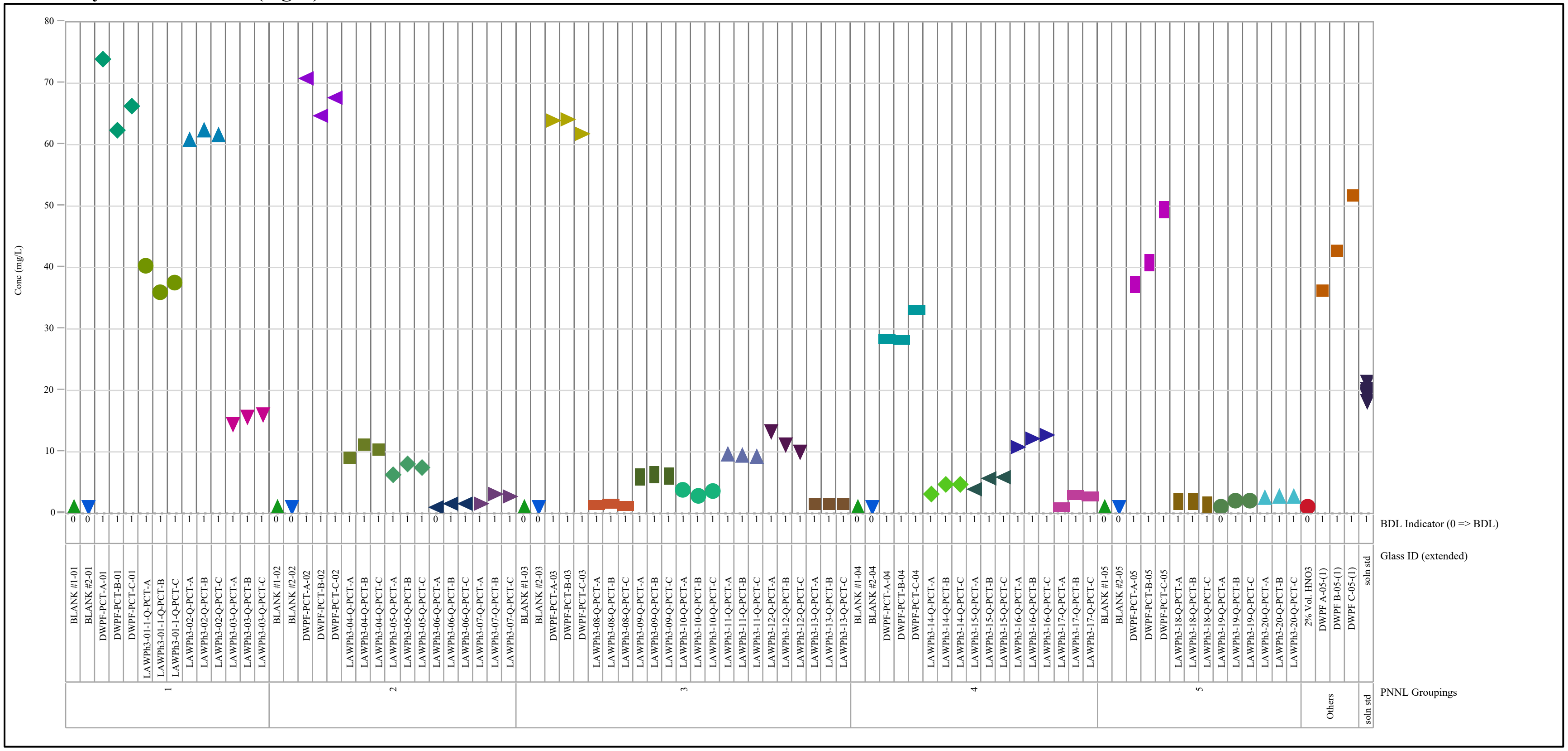


Exhibit F-2. PCT Leachate Measurements by PNNL Grouping (continued)

Analyte=Cr (mg/L)
Variability Chart for Conc (mg/L)

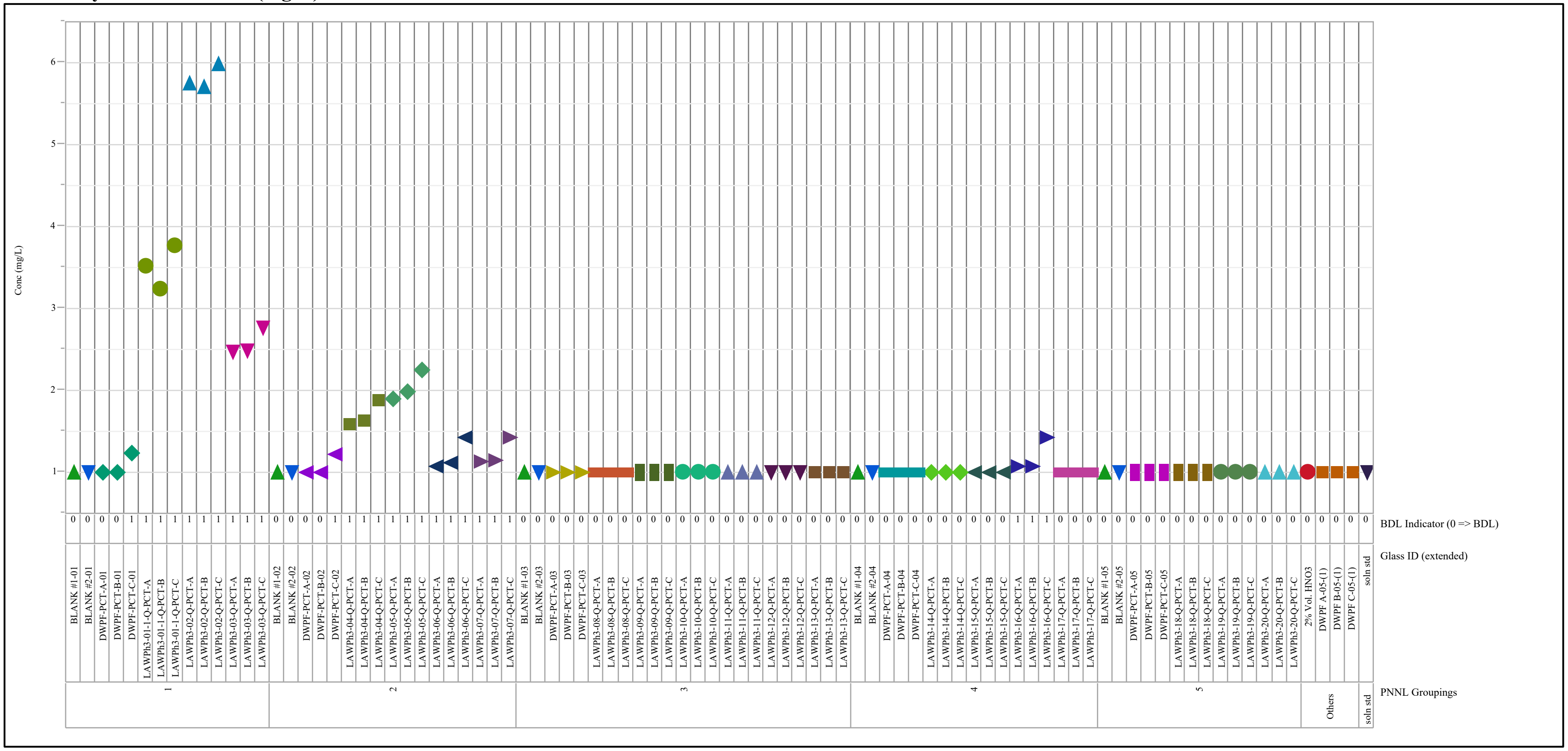


Exhibit F-2. PCT Leachate Measurements by PNNL Grouping (continued)

Analyte=Li (mg/L)
Variability Chart for Conc (mg/L)

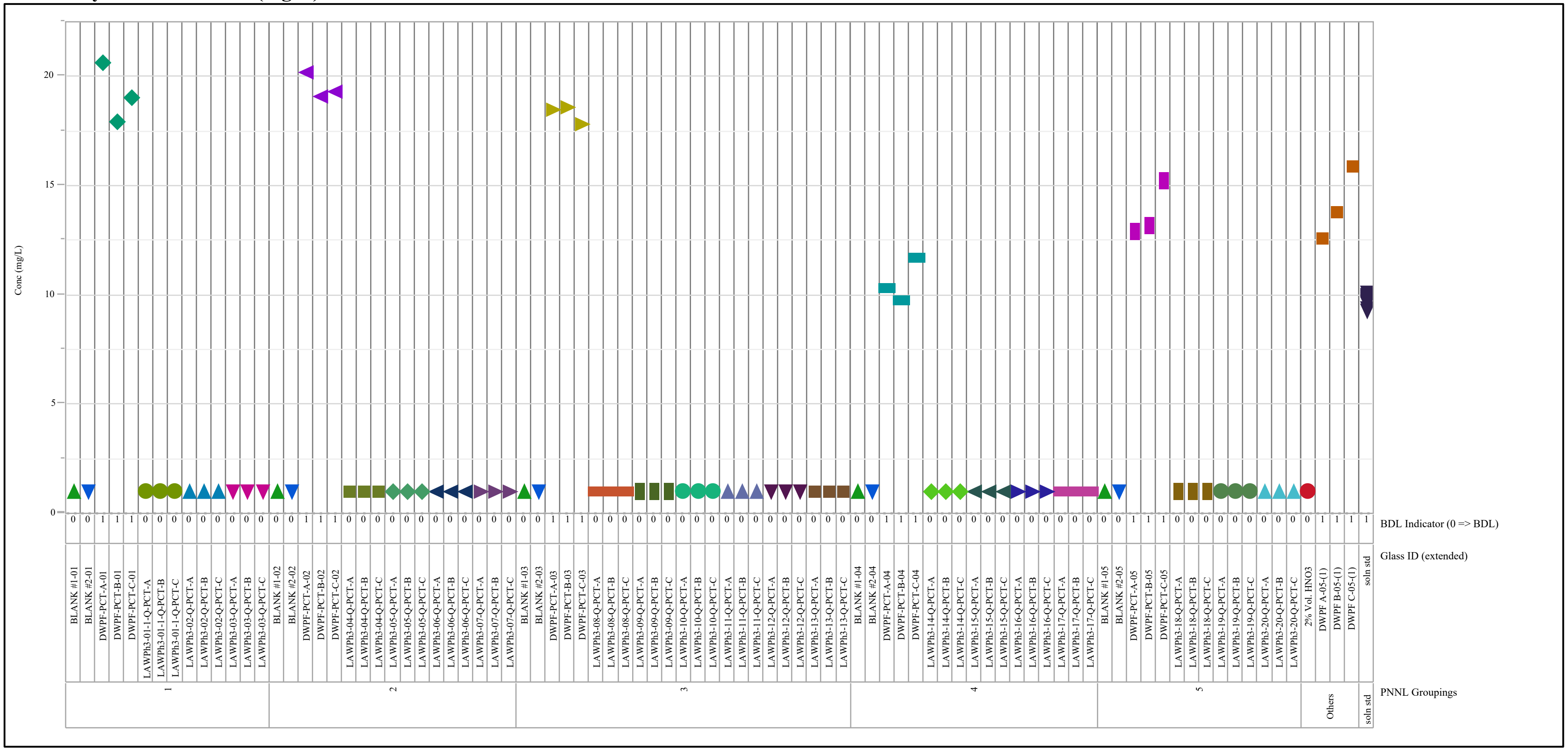


Exhibit F-2. PCT Leachate Measurements by PNNL Grouping (continued)

Analyte=Na (mg/L)
Variability Chart for Conc (mg/L)

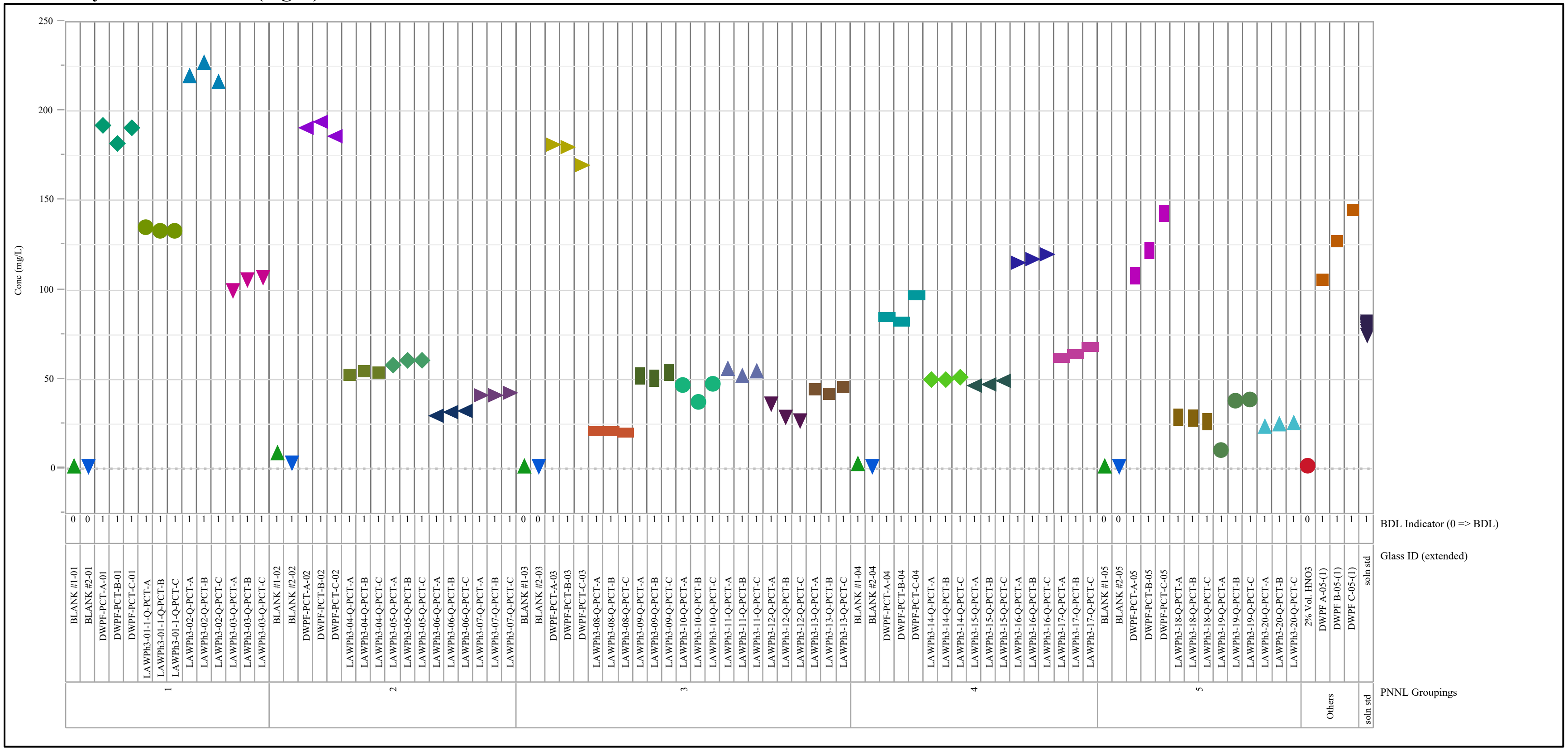


Exhibit F-2. PCT Leachate Measurements by PNNL Grouping (continued)

Analyte=Si (mg/L)
Variability Chart for Conc (mg/L)

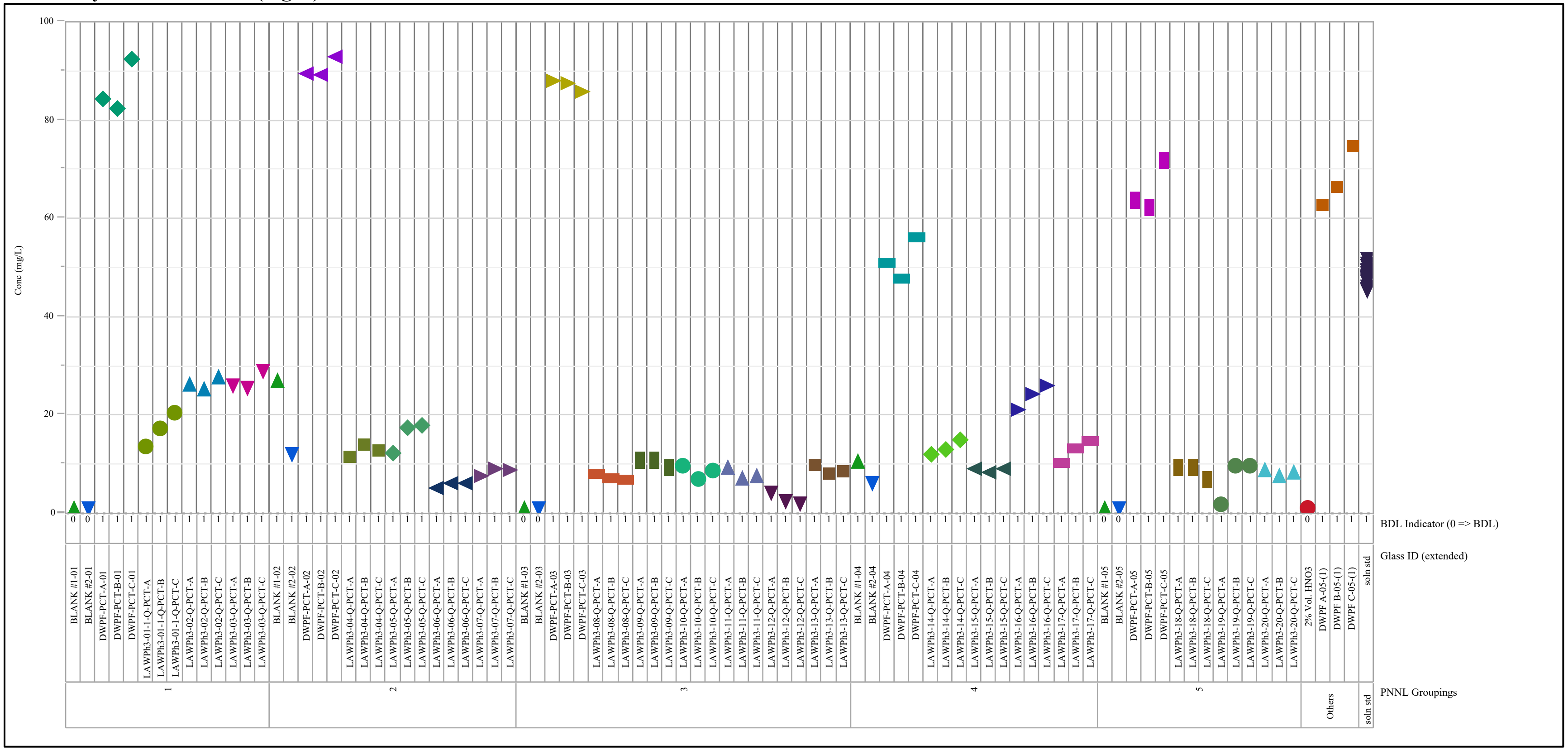
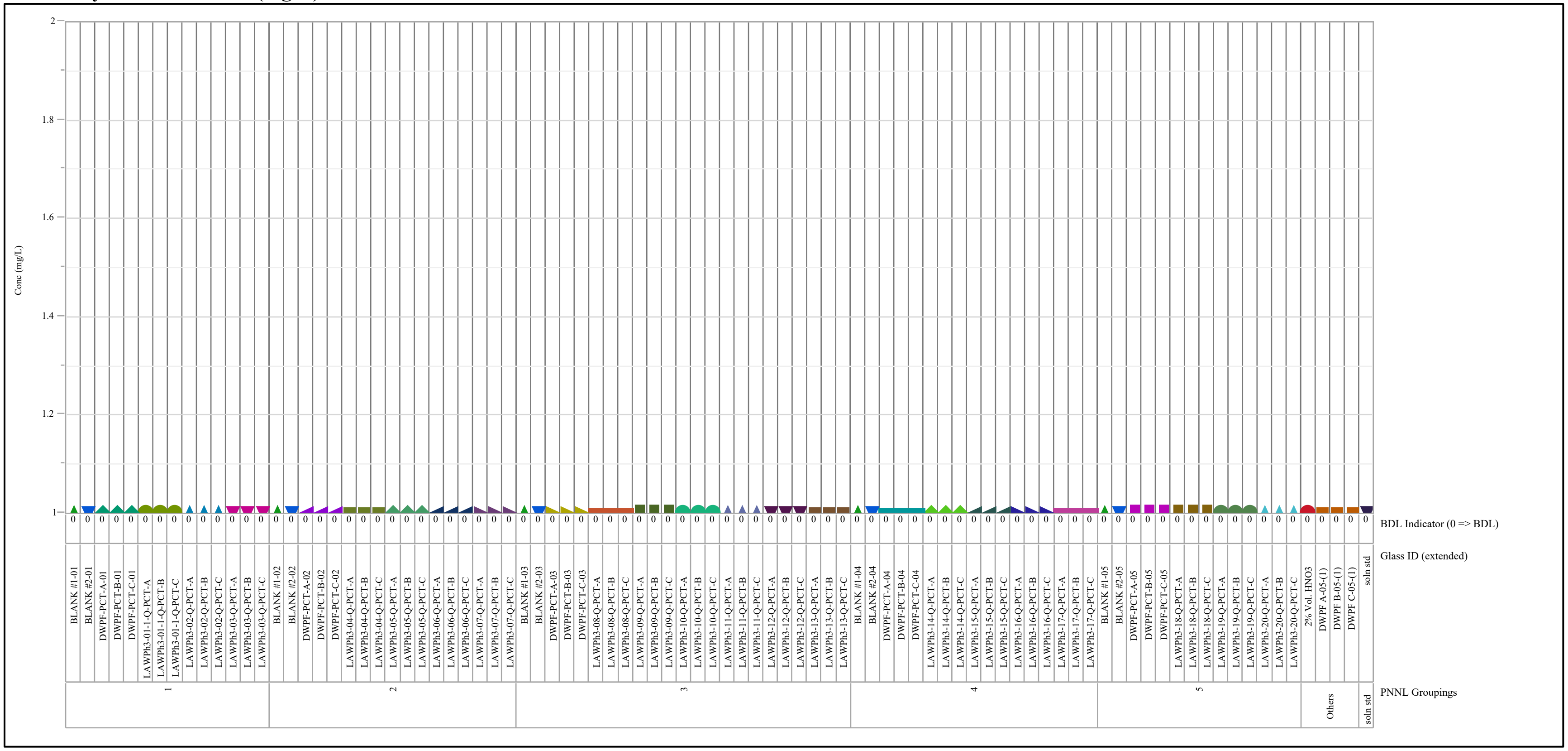


Exhibit F-2. PCT Leachate Measurements by PNNL Grouping (continued)

Analyte=Zr (mg/L)
Variability Chart for Conc (mg/L)



Appendix G Tables and Exhibits for the CCC and Mod Glass PCT Leachate Measurements

Table G-1. PCT Leachate Measurements for the CCC and Mod Glasses

PNNL Groupings	Glass ID with Heat Treatment	Glass ID (extended)	Block	Seq	Lab ID	Al (mg/L)	B (mg/L)	Cr (mg/L)	Li (mg/L)	Na (mg/L)	Si (mg/L)	Zr (mg/L)
0	std soln	std soln	1	1	std-11	3.62	19.3	<1.00	9.17	78.2	47.9	<1.00
8	DWPF-8	DWPF-8-PCT-A	1	2	S-9337	1.19	301	<1.00	109	875	548	<1.00
7	LAWPh3-06-CCC	LAWPh3-06-CCC-PCT-A	1	3	S-9313	5.12	2.79	<1.00	<1.00	56.9	6.75	<1.00
10	LAWPh3-20-CCC	LAWPh3-20-CCC-PCT-A	1	4	S-9374	<1.00	49.3	<1.00	<1.00	234	35.7	<1.00
10	LAWPh3-19-CCC	LAWPh3-19-CCC-PCT-A	1	5	S-9371	<1.00	2.87	<1.00	<1.00	22.4	3.86	<1.00
8	LAWPh3-10-CCC	LAWPh3-10-CCC-PCT-A	1	6	S-9334	16.6	43.4	3.27	<1.00	509	107	<1.00
8	LAWPh3-07-CCC	LAWPh3-07-CCC-PCT-A	1	7	S-9325	1.22	1.73	<1.00	<1.00	23.0	<1.00	<1.00
10	LAWPh3-18-CCC	LAWPh3-18-CCC-PCT-A	1	8	S-9368	1.02	1.57	<1.00	<1.00	23.3	2.96	<1.00
10	LAWPh3-16-CCC	LAWPh3-16-CCC-PCT-A	1	9	S-9362	1.35	9.49	1.13	<1.00	93.7	12.0	<1.00
8	LAWPh3-08-CCC	LAWPh3-08-CCC-PCT-A	1	10	S-9328	<1.00	1.04	<1.00	<1.00	17.7	2.08	<1.00
0	std soln	std soln	1	11	std-12	3.65	19.8	<1.00	9.36	81.0	46.7	<1.00
10	DWPF-10	DWPF-10-PCT-A	1	12	S-9377	<1.00	48.2	<1.00	15.3	134	75.3	<1.00
8	LAWPh3-19-mod-Q	LAWPh3-19-mod-Q-PCT-A	1	13	S-9322	<1.00	1.96	<1.00	<1.00	35.1	5.67	<1.00
7	LAWPh3-05-CCC	LAWPh3-05-CCC-PCT-A	1	14	S-9310	<1.00	3.46	<1.00	<1.00	33.1	5.95	<1.00
7	DWPF-7	DWPF-7-PCT-A	1	15	S-9316	<1.00	35.4	<1.00	11.7	102	60.0	<1.00
10	LAWPh3-17-CCC	LAWPh3-17-CCC-PCT-A	1	16	S-9365	4.34	32.5	<1.00	<1.00	232	15.3	<1.00
8	LAWPh3-09-CCC	LAWPh3-09-CCC-PCT-A	1	17	S-9331	1.70	102	5.96	<1.00	347	17.2	<1.00
8	LAWPh3-05_mod6-Q	LAWPh3-05_mod6-Q-PCT-A	1	18	S-9319	<1.00	33.5	2.73	<1.00	166	34.8	<1.00
10	Blank-10	Blank-10-PCT-#1	1	19	S-9380	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
0	std soln	std soln	1	20	std-13	3.73	20.2	<1.00	9.54	82.9	47.3	<1.00
0	std soln	std soln	2	1	std-21	4.10	20.5	<1.00	9.72	81.3	50.0	<1.00
8	Blank-8	Blank-8-PCT-#1	2	2	S-9340	1.19	<1.00	<1.00	<1.00	1.69	7.44	<1.00
8	LAWPh3-09-CCC	LAWPh3-09-CCC-PCT-B	2	3	S-9332	5.12	82.9	4.91	<1.00	306	19.1	<1.00
10	LAWPh3-20-CCC	LAWPh3-20-CCC-PCT-B	2	4	S-9375	<1.00	549	7.41	<1.00	2630	432	<1.00
8	LAWPh3-07-CCC	LAWPh3-07-CCC-PCT-B	2	5	S-9326	<1.00	4.90	<1.00	<1.00	38.2	8.80	<1.00
10	LAWPh3-17-CCC	LAWPh3-17-CCC-PCT-B	2	6	S-9366	16.6	35.5	1.03	<1.00	237	20.4	<1.00
7	LAWPh3-05-CCC	LAWPh3-05-CCC-PCT-B	2	7	S-9311	1.22	4.82	<1.00	<1.00	32.8	10.4	<1.00
10	LAWPh3-19-CCC	LAWPh3-19-CCC-PCT-B	2	8	S-9372	1.02	3.55	<1.00	<1.00	23.8	8.37	<1.00
7	LAWPh3-06-CCC	LAWPh3-06-CCC-PCT-B	2	9	S-9314	1.35	2.33	<1.00	<1.00	56.0	10.4	<1.00
8	LAWPh3-08-CCC	LAWPh3-08-CCC-PCT-B	2	10	S-9329	<1.00	1.84	<1.00	<1.00	18.6	6.36	<1.00
0	std soln	std soln	2	11	std-22	3.65	20.4	<1.00	9.75	81.5	49.3	<1.00
7	DWPF-7	DWPF-7-PCT-B	2	12	S-9317	<1.00	45.6	<1.00	14.4	121	70.9	<1.00
8	LAWPh3-10-CCC	LAWPh3-10-CCC-PCT-B	2	13	S-9335	<1.00	4.61	<1.00	<1.00	46.3	9.47	<1.00
10	Blank-10	Blank-10-PCT-#2	2	14	S-9381	<1.00	<1.00	<1.00	<1.00	2.04	<1.00	<1.00
10	DWPF-10	DWPF-10-PCT-B	2	15	S-9378	<1.00	38.2	<1.00	13.1	108	64.9	<1.00
8	DWPF-8	DWPF-8-PCT-B	2	16	S-9338	4.34	275	<1.00	105	800	528	<1.00

Table G-1. PCT Leachate Measurements for the CCC and Mod Glasses (continued)

PNNL Groupings	Glass ID with Heat Treatment	Glass ID (extended)	Block	Seq	Lab ID	Al (mg/L)	B (mg/L)	Cr (mg/L)	Li (mg/L)	Na (mg/L)	Si (mg/L)	Zr (mg/L)
8	LAWPh3-05_mod6-Q	LAWPh3-05_mod6-Q-PCT-B	2	17	S-9320	1.70	37.5	2.88	<1.00	201	39.6	<1.00
10	LAWPh3-16-CCC	LAWPh3-16-CCC-PCT-B	2	18	S-9363	<1.00	9.45	1.06	<1.00	83.5	14.1	<1.00
8	LAWPh3-19-mod-Q	LAWPh3-19-mod-Q-PCT-B	2	19	S-9323	<1.00	2.59	<1.00	<1.00	34.8	9.22	<1.00
10	LAWPh3-18-CCC	LAWPh3-18-CCC-PCT-B	2	20	S-9369	1.65	2.52	<1.00	<1.00	27.0	8.17	<1.00
0	std soln	std soln	2	21	std-23	4.14	20.7	<1.00	9.87	82.9	49.6	<1.00
0	std soln	std soln	3	1	std-31	4.13	20.3	<1.00	9.78	81.6	50.2	<1.00
10	LAWPh3-17-CCC	LAWPh3-17-CCC-PCT-C	3	2	S-9367	5.04	33.1	1.00	<1.00	230	20.2	<1.00
8	LAWPh3-05_mod6-Q	LAWPh3-05_mod6-Q-PCT-C	3	3	S-9321	<1.00	34.3	2.71	<1.00	160	38.2	<1.00
8	LAWPh3-19-mod-Q	LAWPh3-19-mod-Q-PCT-C	3	4	S-9324	1.40	1.95	<1.00	<1.00	34.6	9.74	<1.00
8	LAWPh3-09-CCC	LAWPh3-09-CCC-PCT-C	3	5	S-9333	2.01	95.6	5.71	<1.00	328	20.4	<1.00
8	LAWPh3-07-CCC	LAWPh3-07-CCC-PCT-C	3	6	S-9327	2.89	3.18	<1.00	<1.00	40.5	9.17	<1.00
8	LAWPh3-08-CCC	LAWPh3-08-CCC-PCT-C	3	7	S-9330	1.51	1.51	<1.00	<1.00	21.2	7.30	<1.00
10	LAWPh3-18-CCC	LAWPh3-18-CCC-PCT-C	3	8	S-9370	1.73	1.92	<1.00	<1.00	27.0	8.46	<1.00
7	DWPF-7	DWPF-7-PCT-C	3	9	S-9318	<1.00	47.7	<1.00	14.7	126	75.6	<1.00
8	LAWPh3-10-CCC	LAWPh3-10-CCC-PCT-C	3	10	S-9336	1.89	4.42	<1.00	<1.00	48.4	10.3	<1.00
0	std soln	std soln	3	11	std-32	4.22	20.2	<1.00	9.91	82.9	51.2	<1.00
10	DWPF-10	DWPF-10-PCT-C	3	12	S-9379	<1.00	29.2	<1.00	10.1	84.8	52.4	<1.00
7	LAWPh3-06-CCC	LAWPh3-06-CCC-PCT-C	3	13	S-9315	5.41	1.71	<1.00	<1.00	56.1	10.0	<1.00
10	LAWPh3-19-CCC	LAWPh3-19-CCC-PCT-C	3	14	S-9373	1.09	2.56	<1.00	<1.00	23.4	7.97	<1.00
7	LAWPh3-05-CCC	LAWPh3-05-CCC-PCT-C	3	15	S-9312	<1.00	3.59	<1.00	<1.00	32.5	10.2	<1.00
8	Blank-8	Blank-8-PCT-#2	3	16	S-9341	<1.00	<1.00	<1.00	<1.00	2.01	4.34	<1.00
8	DWPF-8	DWPF-8-PCT-C	3	17	S-9339	1.74	304	<1.00	116	880	572	<1.00
10	LAWPh3-20-CCC	LAWPh3-20-CCC-PCT-C	3	18	S-9376	1.60	53.1	<1.00	<1.00	259	42.0	<1.00
10	LAWPh3-16-CCC	LAWPh3-16-CCC-PCT-C	3	19	S-9364	1.79	10.3	1.24	<1.00	97.8	16.7	<1.00
0	std soln	std soln	3	20	std-33	4.23	18.9	<1.00	9.89	82.5	52.5	<1.00
0	std soln	std soln	4	1	std-41	3.91	19.4	<1.00	9.40	79.0	48.9	<1.00
6	DWPF-6	DWPF-6-PCT-B	4	2	S-9306	<1.00	32.4	<1.00	10.9	93.5	61.5	<1.00
11	LAWPh3-12-Q-2	LAWPh3-12-Q-PCT-A-2	4	3	S-9382	1.57	16.5	<1.00	<1.00	41.8	4.92	<1.00
9	LAWPh3-14-CCC	LAWPh3-14-CCC-PCT-A	4	4	S-9351	12.8	46.4	3.07	<1.00	491	119	<1.00
9	LAWPh3-11-CCC	LAWPh3-11-CCC-PCT-A	4	5	S-9342	1.87	8.08	<1.00	<1.00	44.2	8.49	<1.00
6	LAWPh3-02-CCC	LAWPh3-02-CCC-PCT-A	4	6	S-9296	<1.00	50.8	3.77	<1.00	190	24.1	<1.00
9	LAWPh3-15-CCC	LAWPh3-15-CCC-PCT-A	4	7	S-9354	1.31	6.39	<1.00	<1.00	44.3	9.95	<1.00
9	LAWPh3-12-CCC	LAWPh3-12-CCC-PCT-A	4	8	S-9345	<1.00	5.77	<1.00	<1.00	15.6	2.25	<1.00
9	DWPF-9	DWPF-9-PCT-A	4	9	S-9357	<1.00	35.5	<1.00	11.3	98.0	61.4	<1.00
9	Blank-9	Blank-9-PCT-#1	4	10	S-9360	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
0	std soln	std soln	4	11	std-42	3.79	19.4	<1.00	9.17	75.2	49.1	<1.00
6	LAWPh3-03-CCC	LAWPh3-03-CCC-PCT-A	4	12	S-9299	<1.00	8.72	<1.00	<1.00	55.5	19.7	<1.00

Table G-1. PCT Leachate Measurements for the CCC and Mod Glasses (continued)

PNNL Groupings	Glass ID with Heat Treatment	Glass ID (extended)	Block	Seq	Lab ID	Al (mg/L)	B (mg/L)	Cr (mg/L)	Li (mg/L)	Na (mg/L)	Si (mg/L)	Zr (mg/L)
11	LAWPh3-05_mod6-CCC	LAWPh3-05_mod6-CCC-PCT-A	4	13	S-9388	<1.00	30.8	1.83	<1.00	156	37.3	<1.00
9	LAWPh3-13-CCC	LAWPh3-13-CCC-PCT-A	4	14	S-9348	61.6	403	26.6	<1.00	3130	359	<1.00
11	LAWPh3-19-mod-CCC	LAWPh3-19-mod-CCC-PCT-A	4	15	S-9391	4.33	3.44	<1.00	<1.00	47.4	10.5	<1.00
6	LAWPh3-01-1-CCC	LAWPh3-01-1-CCC-PCT-A	4	16	S-9293	<1.00	26.3	1.72	<1.00	89.9	16.5	<1.00
11	LAWPh3-17-Q-2	LAWPh3-17-Q-PCT-A-2	4	17	S-9385	1.26	2.93	<1.00	<1.00	54.0	12.1	<1.00
11	DWPF-11	DWPF-11-PCT-A	4	18	S-9394	<1.00	50.7	<1.00	15.2	141	79.3	<1.00
6	LAWPh3-04-CCC	LAWPh3-04-CCC-PCT-A	4	19	S-9302	<1.00	4.49	<1.00	<1.00	22.0	6.23	<1.00
0	std soln	std soln	4	20	std-43	3.69	18.9	<1.00	9.87	74.4	48.3	<1.00
0	std soln	std soln	5	1	std-51	3.91	20.0	<1.00	9.60	80.9	49.2	<1.00
11	LAWPh3-12-Q-2	LAWPh3-12-Q-PCT-B-2	5	2	S-9383	<1.00	8.68	<1.00	<1.00	23.2	2.34	<1.00
11	LAWPh3-05_mod6-CCC	LAWPh3-05_mod6-CCC-PCT-B	5	3	S-9389	<1.00	32.0	1.86	<1.00	156	37.5	<1.00
6	LAWPh3-03-CCC	LAWPh3-03-CCC-PCT-B	5	4	S-9300	<1.00	9.17	<1.00	<1.00	61.6	19.9	<1.00
11	LAWPh3-17-Q-2	LAWPh3-17-Q-PCT-B-2	5	5	S-9386	<1.00	1.71	<1.00	<1.00	41.5	8.34	<1.00
9	LAWPh3-14-CCC	LAWPh3-14-CCC-PCT-B	5	6	S-9352	1.16	4.31	<1.00	<1.00	44.0	12.9	<1.00
11	DWPF-11	DWPF-11-PCT-B	5	7	S-9395	<1.00	47.3	<1.00	13.9	125	69.0	<1.00
9	LAWPh3-13-CCC	LAWPh3-13-CCC-PCT-B	5	8	S-9349	65.0	383	25.8	<1.00	3140	355	<1.00
6	Blank-6	Blank-6-PCT-#1	5	9	S-9308	<1.00	1.66	<1.00	<1.00	1.39	1.29	<1.00
11	LAWPh3-19-mod-CCC	LAWPh3-19-mod-CCC-PCT-B	5	10	S-9392	3.59	3.08	<1.00	<1.00	43.8	6.88	<1.00
0	std soln	std soln	5	11	std-52	4.15	20.3	<1.00	10.0	87.3	50.6	<1.00
9	Blank-9	Blank-9-PCT-#2	5	12	S-9361	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
9	LAWPh3-15-CCC	LAWPh3-15-CCC-PCT-B	5	13	S-9355	1.53	6.91	<1.00	<1.00	52.8	9.49	<1.00
9	DWPF-9	DWPF-9-PCT-B	5	14	S-9358	<1.00	51.7	<1.00	16.4	130	77.7	<1.00
6	LAWPh3-02-CCC	LAWPh3-02-CCC-PCT-B	5	15	S-9297	<1.00	58.2	4.30	<1.00	177	26.1	<1.00
9	LAWPh3-12-CCC	LAWPh3-12-CCC-PCT-B	5	16	S-9346	<1.00	7.60	<1.00	<1.00	21.1	2.25	<1.00
6	DWPF-6	DWPF-6-PCT-C	5	17	S-9307	<1.00	33.2	<1.00	11.2	97.1	58.4	<1.00
9	LAWPh3-11-CCC	LAWPh3-11-CCC-PCT-B	5	18	S-9343	1.93	8.95	<1.00	<1.00	49.9	8.33	<1.00
6	LAWPh3-04-CCC	LAWPh3-04-CCC-PCT-B	5	19	S-9303	<1.00	8.31	<1.00	<1.00	44.5	10.4	<1.00
6	LAWPh3-01-1-CCC	LAWPh3-01-1-CCC-PCT-B	5	20	S-9294	<1.00	29.8	1.94	<1.00	110	17.6	<1.00
0	std soln	std soln	5	21	std-53	4.20	20.6	<1.00	10.1	86.3	50.9	<1.00
0	std soln	std soln	6	1	std-61	3.95	19.5	<1.00	9.32	81.1	49.9	<1.00
9	LAWPh3-12-CCC	LAWPh3-12-CCC-PCT-C	6	2	S-9347	<1.00	6.39	<1.00	<1.00	18.5	1.94	<1.00
6	DWPF-6	DWPF-6-PCT-A	6	3	S-9305	<1.00	5.19	<1.00	<1.00	30.3	7.59	<1.00
6	LAWPh3-03-CCC	LAWPh3-03-CCC-PCT-C	6	4	S-9301	<1.00	8.02	<1.00	<1.00	56.7	18.3	<1.00
11	DWPF-11	DWPF-11-PCT-C	6	5	S-9396	<1.00	55.4	<1.00	16.6	137	83.5	<1.00
6	Blank-6	Blank-6-PCT-#2	6	6	S-9309	<1.00	<1.00	<1.00	<1.00	<1.00	2.62	<1.00
9	DWPF-9	DWPF-9-PCT-C	6	7	S-9359	<1.00	29.7	<1.00	9.80	87.7	54.2	<1.00
9	LAWPh3-14-CCC	LAWPh3-14-CCC-PCT-C	6	8	S-9353	<1.00	3.94	<1.00	<1.00	42.8	12.6	<1.00

Table G-1. PCT Leachate Measurements for the CCC and Mod Glasses (continued)

PNNL Groupings	Glass ID with Heat Treatment	Glass ID (extended)	Block	Seq	Lab ID	Al (mg/L)	B (mg/L)	Cr (mg/L)	Li (mg/L)	Na (mg/L)	Si (mg/L)	Zr (mg/L)
9	LAWPh3-15-CCC	LAWPh3-15-CCC-PCT-C	6	9	S-9356	<1.00	5.56	<1.00	<1.00	43.7	8.52	<1.00
9	LAWPh3-13-CCC	LAWPh3-13-CCC-PCT-C	6	10	S-9350	64.7	378	25.8	<1.00	3040	360	<1.00
0	std soln	std soln	6	11	std-62	3.61	20.5	<1.00	9.34	81.5	50.3	<1.00
11	LAWPh3-17-Q-2	LAWPh3-17-Q-PCT-C-2	6	12	S-9387	1.03	2.27	<1.00	<1.00	55.2	11.2	<1.00
6	LAWPh3-02-CCC	LAWPh3-02-CCC-PCT-C	6	13	S-9298	<1.00	51.9	3.93	<1.00	166.1	24.6	<1.00
6	LAWPh3-01-1-CCC	LAWPh3-01-1-CCC-PCT-C	6	14	S-9295	<1.00	26.8	1.79	<1.00	98.9	16.4	<1.00
11	LAWPh3-12-Q-2	LAWPh3-12-Q-PCT-C-2	6	15	S-9384	1.20	15.6	<1.00	<1.00	41.2	4.12	<1.00
11	LAWPh3-05_mod6-CCC	LAWPh3-05_mod6-CCC-PCT-C	6	16	S-9390	<1.00	25.7	1.48	<1.00	110	29.8	<1.00
9	LAWPh3-11-CCC	LAWPh3-11-CCC-PCT-C	6	17	S-9344	1.36	8.24	<1.00	<1.00	46.7	7.66	<1.00
11	LAWPh3-19-mod-CCC	LAWPh3-19-mod-CCC-PCT-C	6	18	S-9393	4.40	2.70	<1.00	<1.00	55.4	10.9	<1.00
6	LAWPh3-04-CCC	LAWPh3-04-CCC-PCT-C	6	19	S-9304	<1.00	30.7	<1.00	10.2	89.1	57.2	<1.00
0	std soln	std soln	6	20	std-63	3.97	19.5	<1.00	9.31	81.1	49.8	<1.00

Table G-2. Results from Samples of the Multi-Element Solution Standard Included with the CCC and Mod Glass PCT Leachates

PCT Set	2	2	2	2	2	2	Reference Values (mg/L)
Block	1	2	3	4	5	6	
Mean (Al (mg/L))	3.67	3.96	4.19	3.80	4.09	3.84	4
Mean (B (mg/L))	19.77	20.53	19.80	19.23	20.30	19.83	20
Mean (Li (mg/L))	9.36	9.78	9.86	9.48	9.90	9.32	10
Mean (Na (mg/L))	80.70	81.90	82.33	76.20	84.83	81.23	81
Mean (Si (mg/L))	47.30	49.63	51.30	48.77	50.23	50.00	50
% relative bias, Al	-8.3%	-0.9%	4.8%	-5.1%	2.2%	-3.9%	<10% per ASTM C 1285
% relative bias, B	-1.2%	2.7%	-1.0%	-3.8%	1.5%	-0.8%	
% relative bias, Li	-6.4%	-2.2%	-1.4%	-5.2%	-1.0%	-6.8%	
% relative bias, Na	-0.4%	1.1%	1.6%	-5.9%	4.7%	0.3%	
% relative bias, Si	-5.4%	-0.7%	2.6%	-2.5%	0.5%	0.0%	
Std Dev (Al (mg/L))	0.057	0.272	0.055	0.110	0.155	0.202	
Std Dev (B (mg/L))	0.451	0.153	0.781	0.289	0.300	0.577	
Std Dev (Li (mg/L))	0.185	0.079	0.070	0.357	0.265	0.015	
Std Dev (Na (mg/L))	2.364	0.872	0.666	2.458	3.443	0.231	
Std Dev (Si (mg/L))	0.600	0.351	1.153	0.416	0.907	0.265	
%RSD (Al (mg/L))	1.6%	6.9%	1.3%	2.9%	3.8%	5.3%	<10% per ASTM C 1285
%RSD (B (mg/L))	2.3%	0.7%	3.9%	1.5%	1.5%	2.9%	
%RSD (Li (mg/L))	2.0%	0.8%	0.7%	3.8%	2.7%	0.2%	
%RSD (Na (mg/L))	2.9%	1.1%	0.8%	3.2%	4.1%	0.3%	
%RSD (Si (mg/L))	1.3%	0.7%	2.2%	0.9%	1.8%	0.5%	

Exhibit G-1. PCT Leachate Measurements in Analytical Sequence

Analyte=Al
Variability Chart for Conc (mg/L)

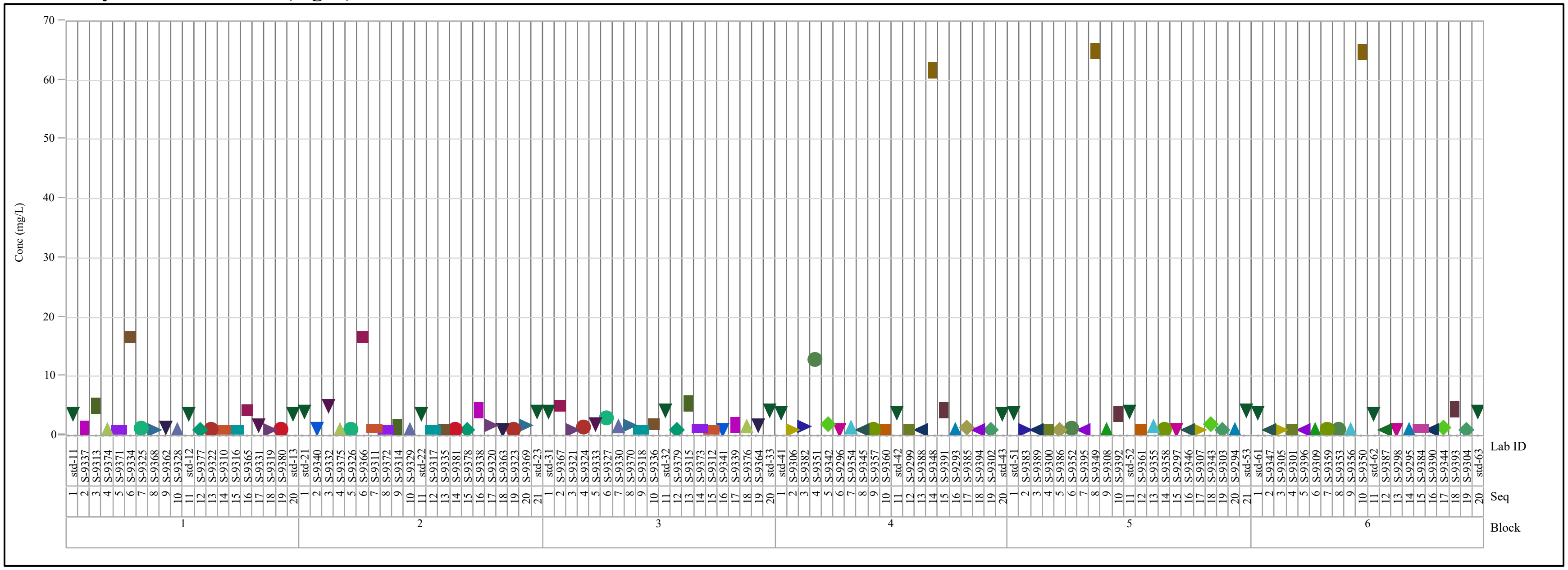


Exhibit G-1. PCT Leachate Measurements in Analytical Sequence (continued)

Analyte=Al
Variability Chart for log[Conc (mg/L)]

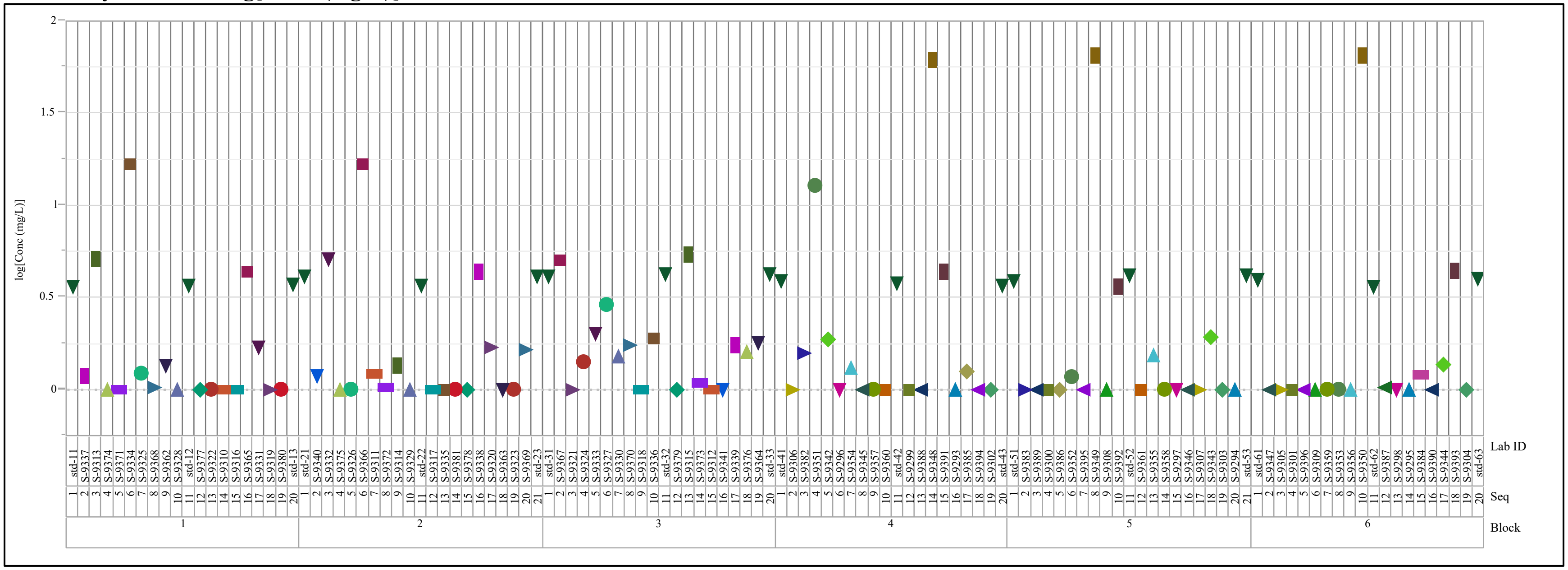


Exhibit G-1. PCT Leachate Measurements in Analytical Sequence (continued)

Analyte=B
Variability Chart for Conc (mg/L)

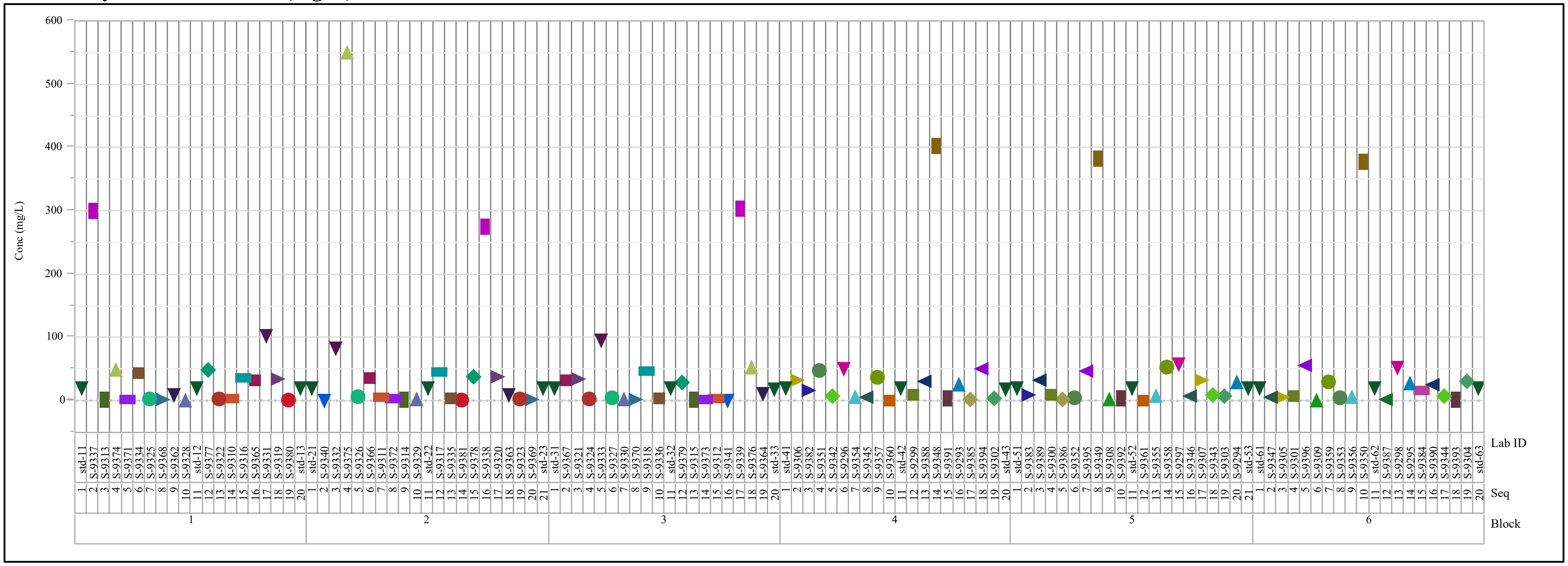


Exhibit G-1. PCT Leachate Measurements in Analytical Sequence (continued)

Analyte=B
Variability Chart for log[Conc (mg/L)]

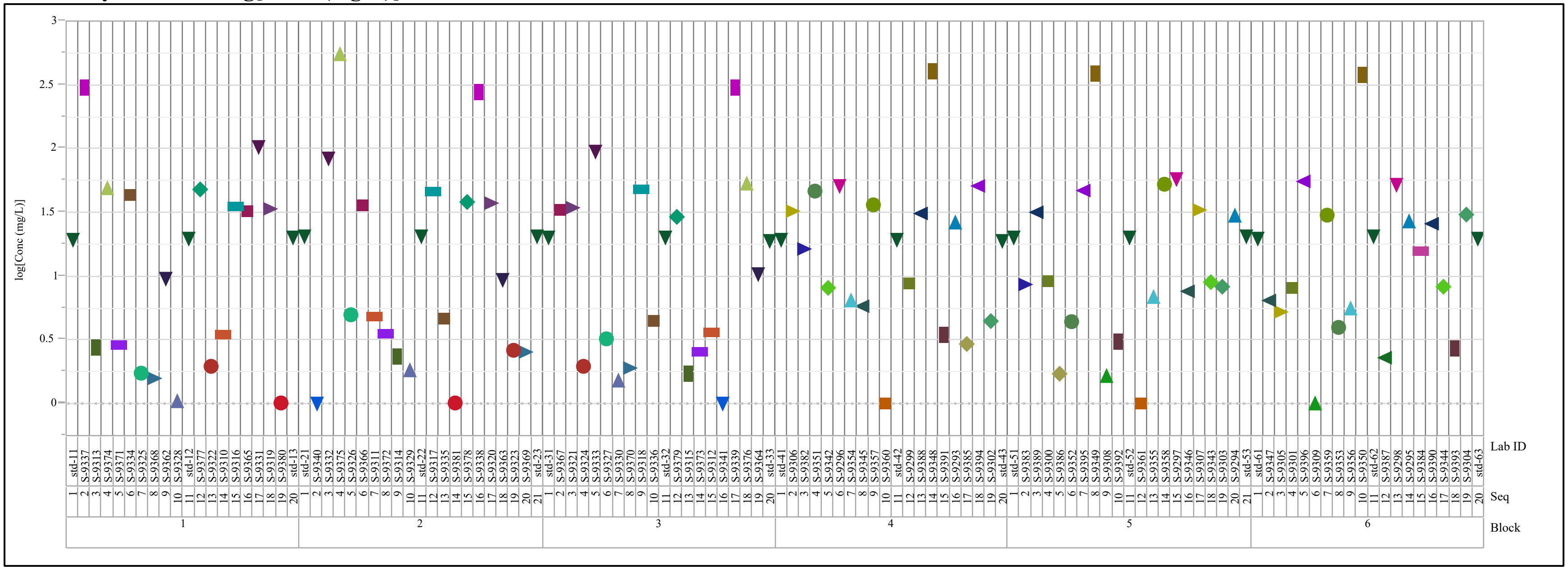


Exhibit G-1. PCT Leachate Measurements in Analytical Sequence (continued)

Analyte=Cr
Variability Chart for Conc (mg/L)

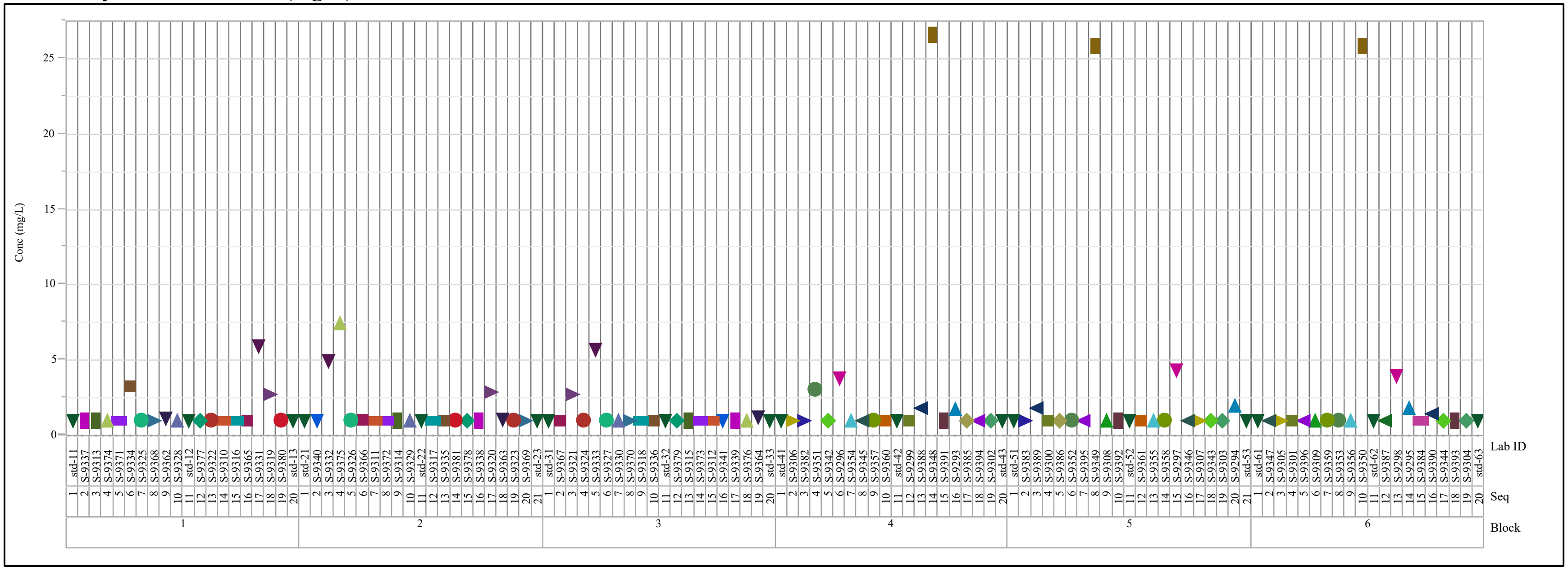


Exhibit G-1. PCT Leachate Measurements in Analytical Sequence (continued)

Analyte=Cr
Variability Chart for log[Conc (mg/L)]

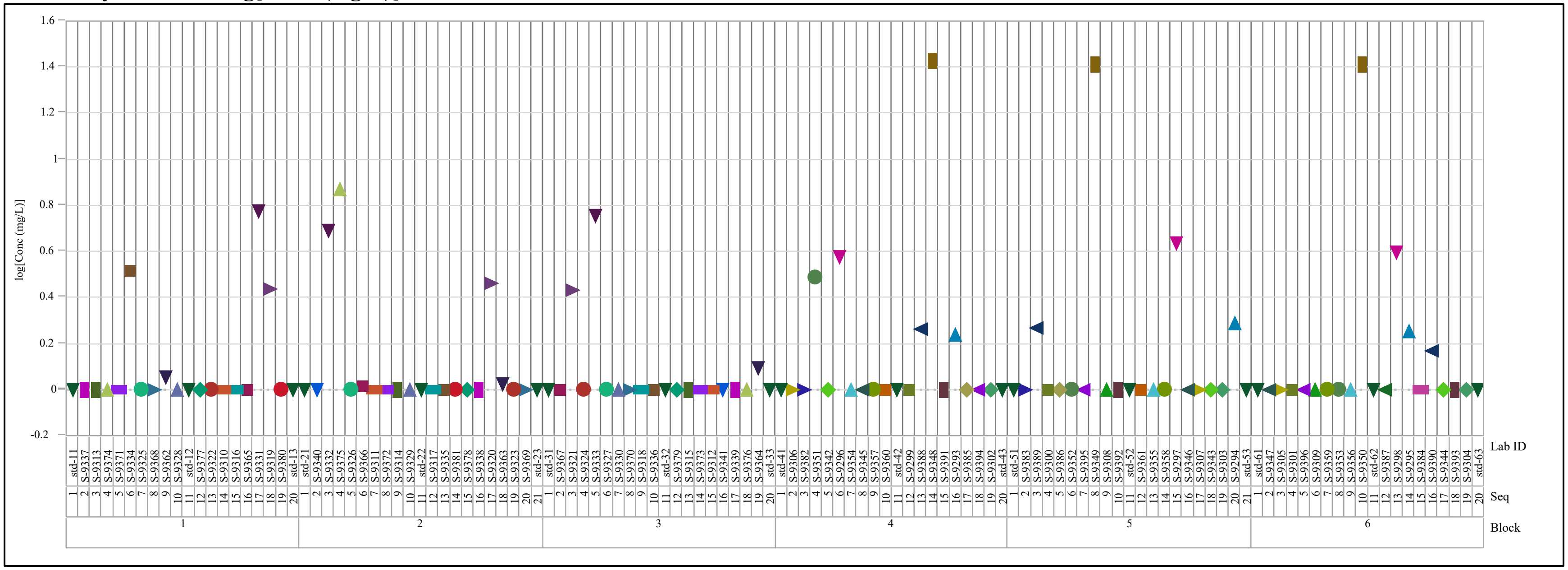


Exhibit G-1. PCT Leachate Measurements in Analytical Sequence (continued)

Analyte=Li
Variability Chart for Conc (mg/L)

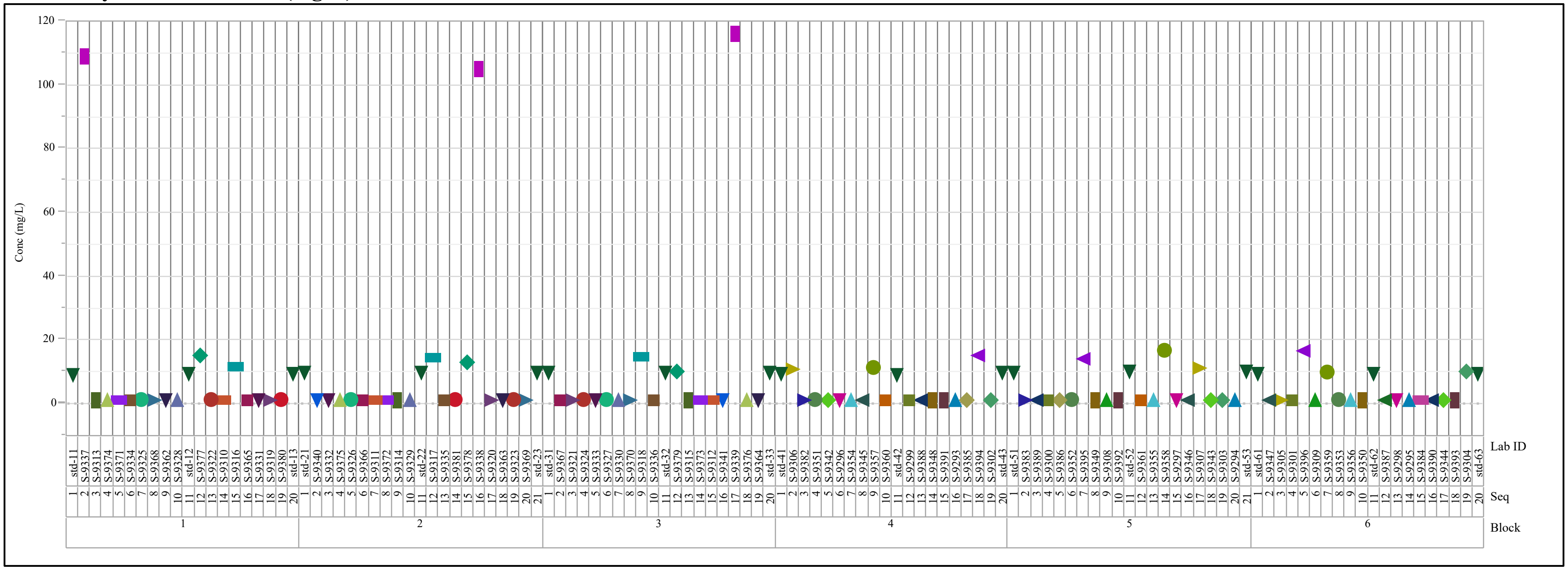


Exhibit G-1. PCT Leachate Measurements in Analytical Sequence (continued)

Analyte=Li
Variability Chart for log[Conc (mg/L)]

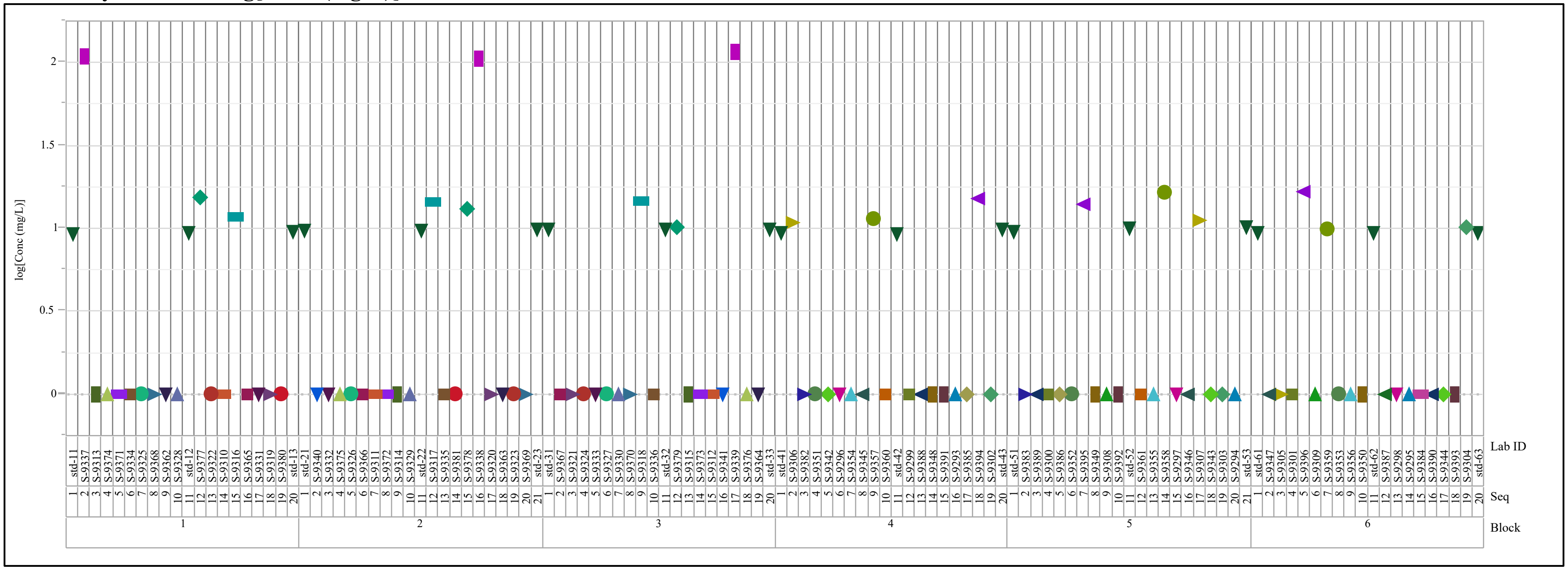


Exhibit G-1. PCT Leachate Measurements in Analytical Sequence (continued)

Analyte=Na
Variability Chart for Conc (mg/L)

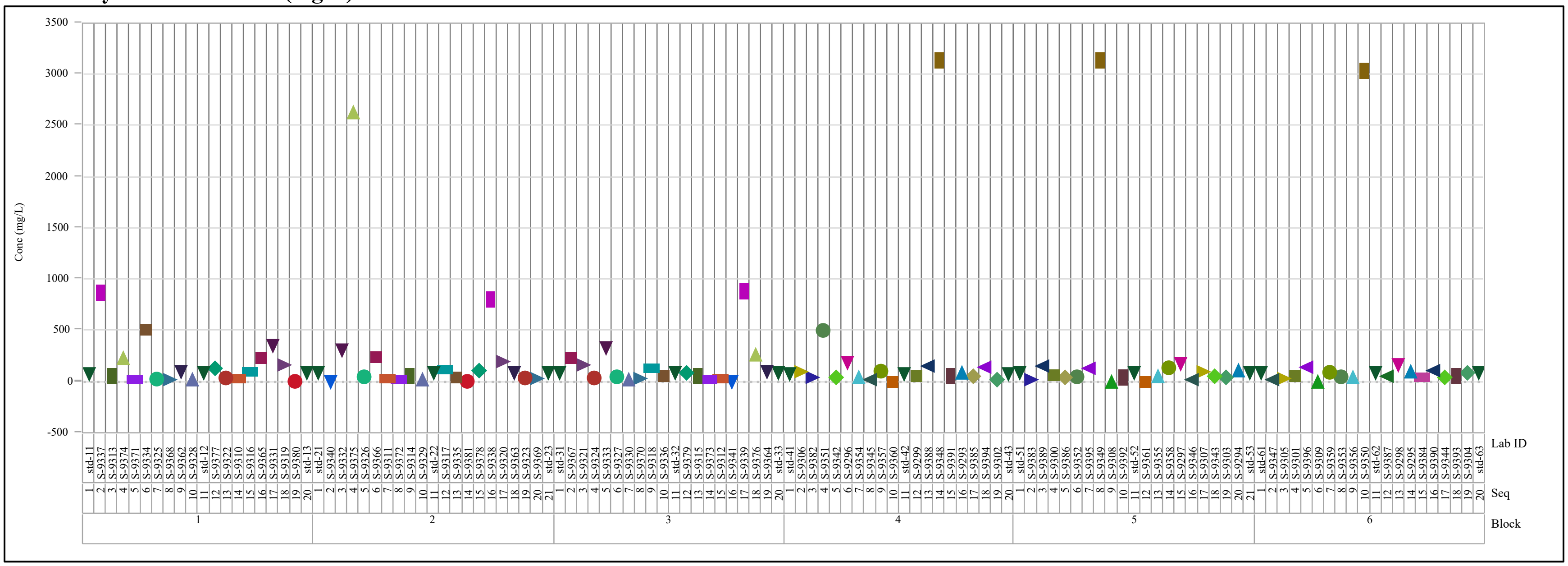


Exhibit G-1. PCT Leachate Measurements in Analytical Sequence (continued)

Analyte=Na
Variability Chart for log[Conc (mg/L)]

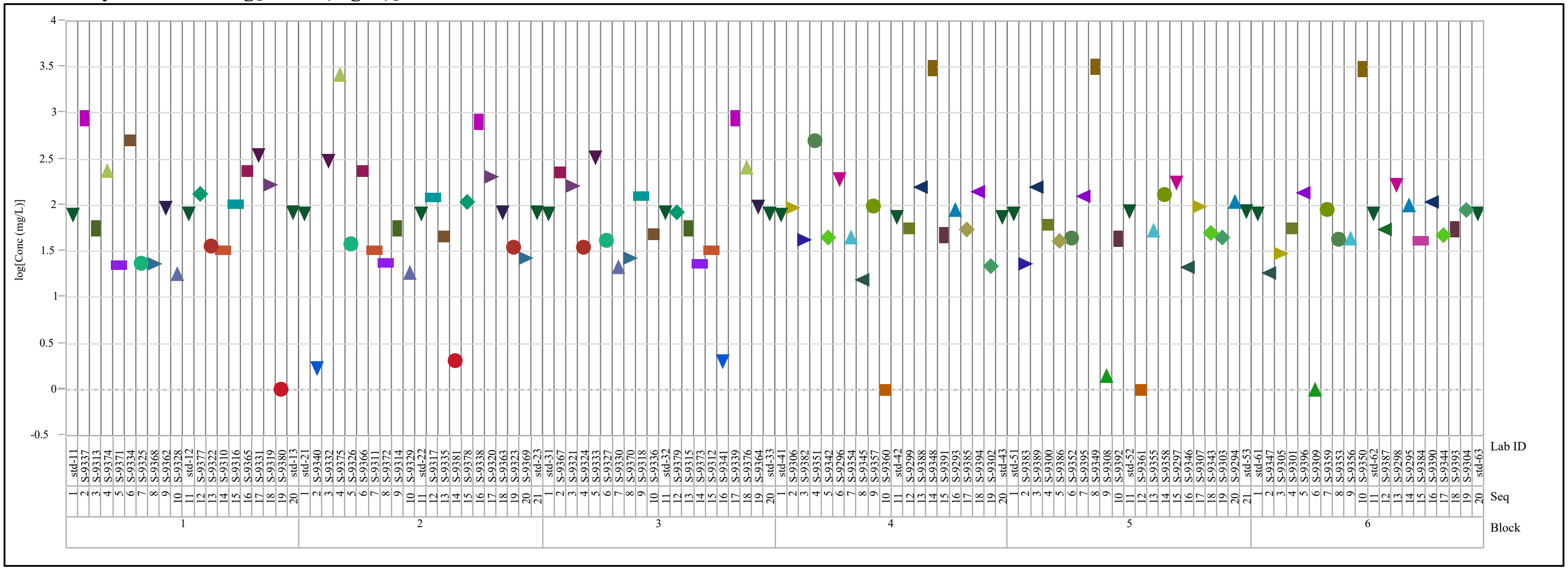


Exhibit G-1. PCT Leachate Measurements in Analytical Sequence (continued)

Analyte=Si
Variability Chart for Conc (mg/L)

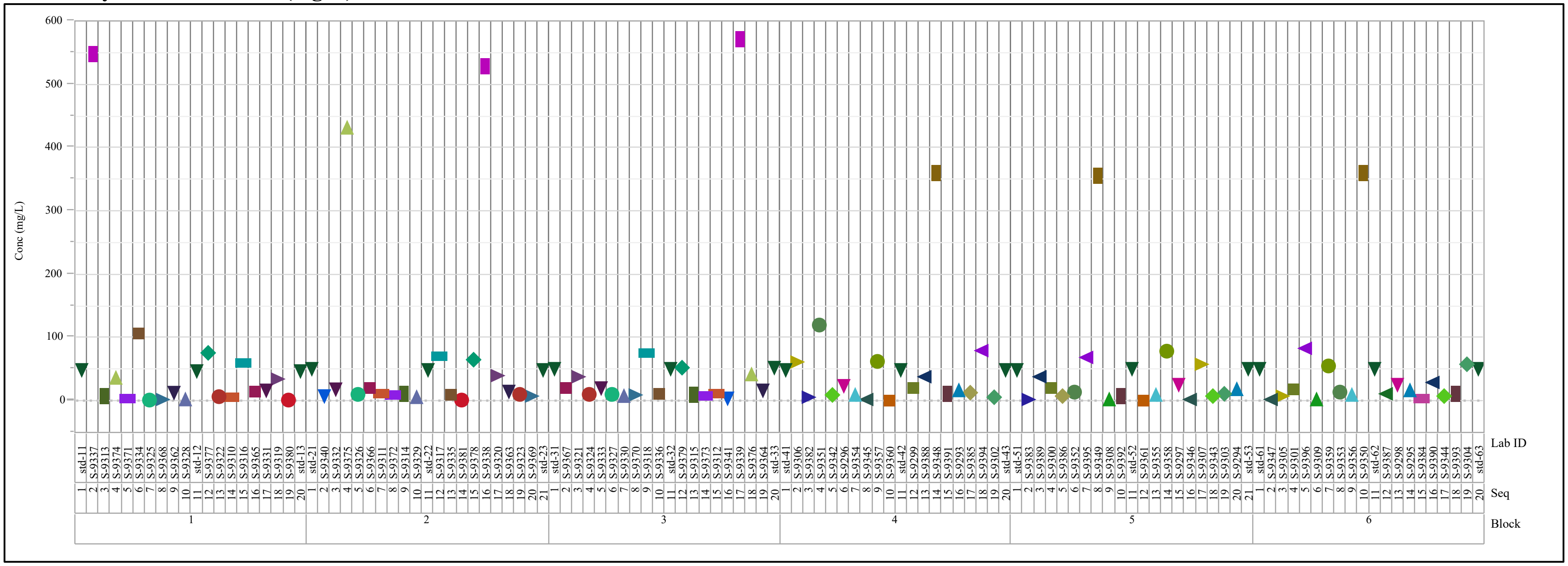


Exhibit G-1. PCT Leachate Measurements in Analytical Sequence (continued)

Analyte=Si
Variability Chart for log[Conc (mg/L)]

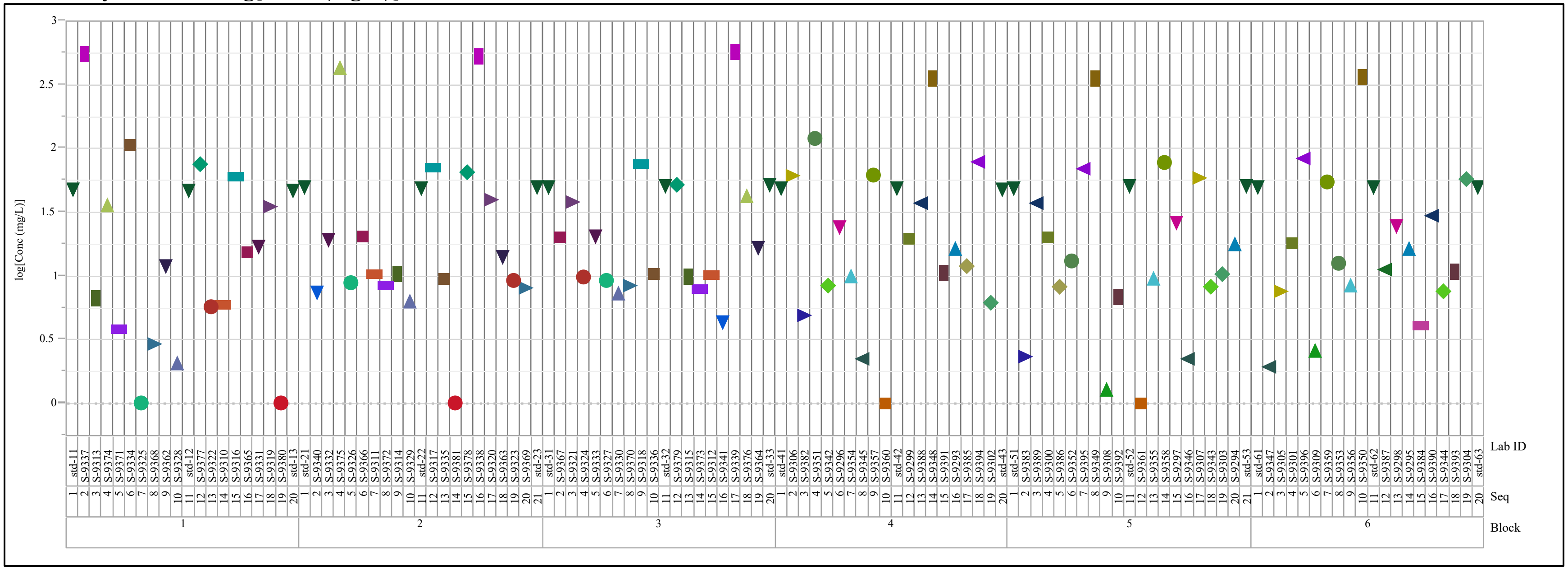


Exhibit G-1. PCT Leachate Measurements in Analytical Sequence (continued)

Analyte=Zr
Variability Chart for Conc (mg/L)

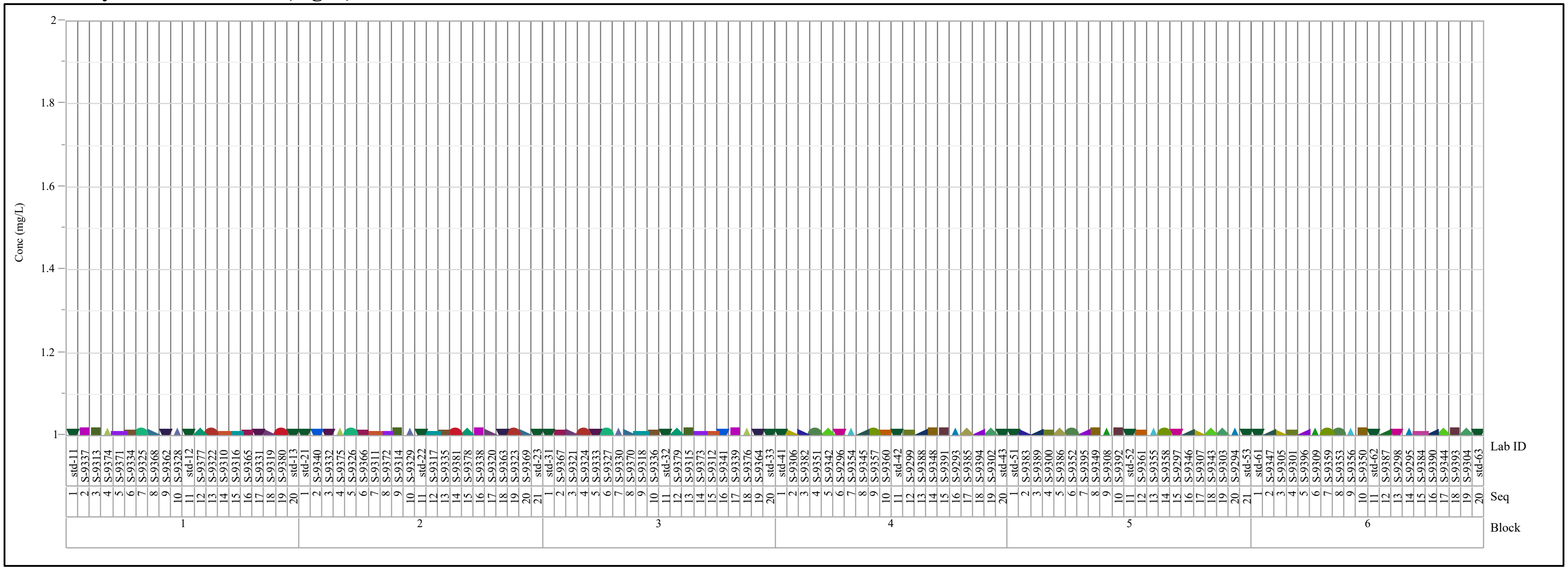


Exhibit G-1. PCT Leachate Measurements in Analytical Sequence (continued)

Analyte=Zr

Variability Chart for log[Conc (mg/L)]

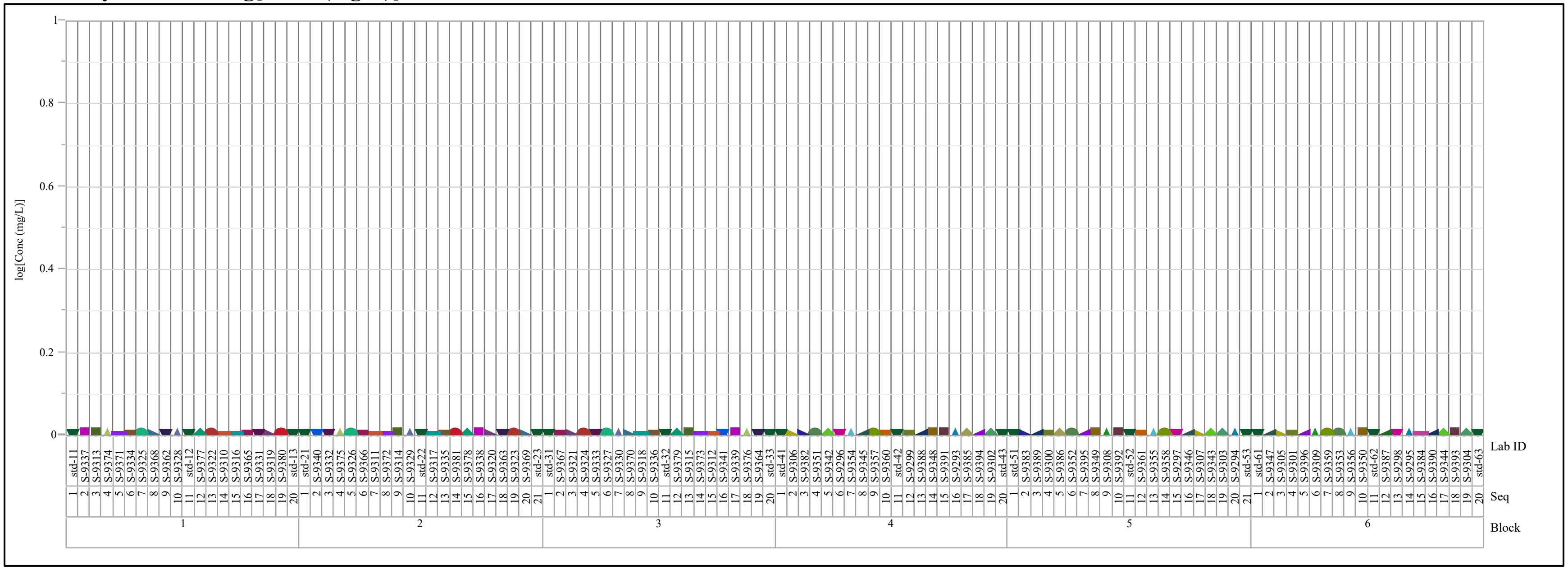


Exhibit G-2. PCT Leachate Measurements by PNNL Grouping

Analyte=Al
Variability Chart for Conc (mg/L)

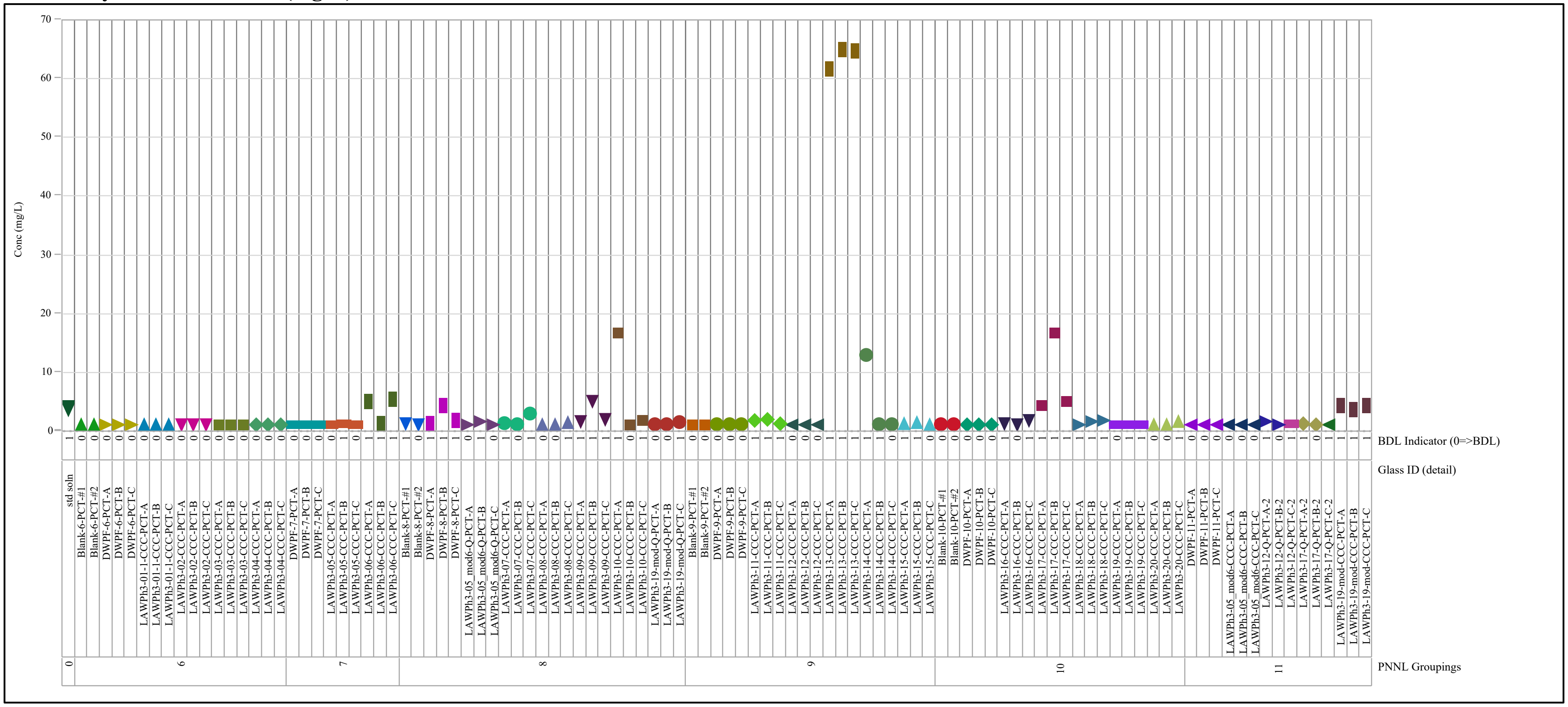


Exhibit G-2. PCT Leachate Measurements by PNNL Grouping (continued)

Analyte=Al
Variability Chart for log[Conc (mg/L)]

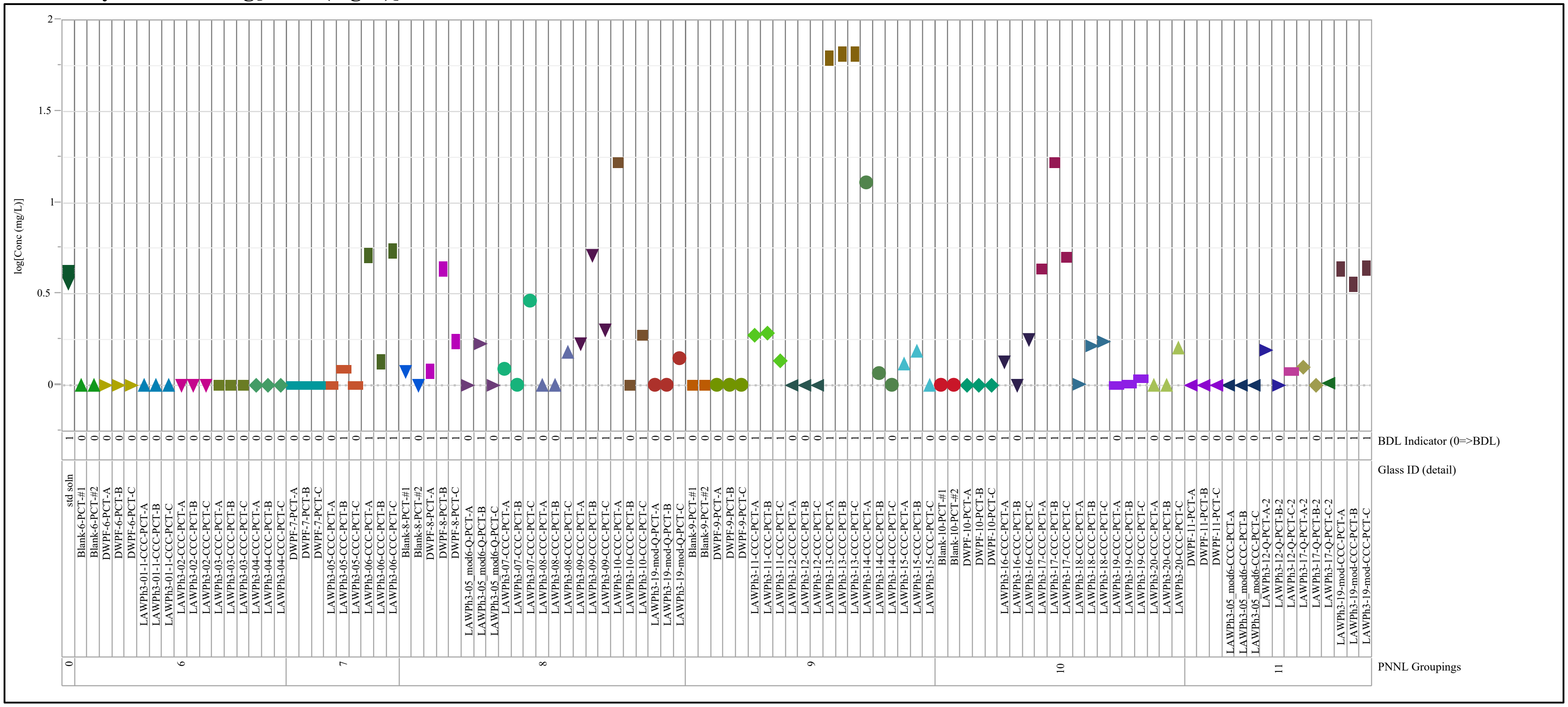


Exhibit G-2. PCT Leachate Measurements by PNNL Grouping (continued)

Analyte=B
Variability Chart for Conc (mg/L)

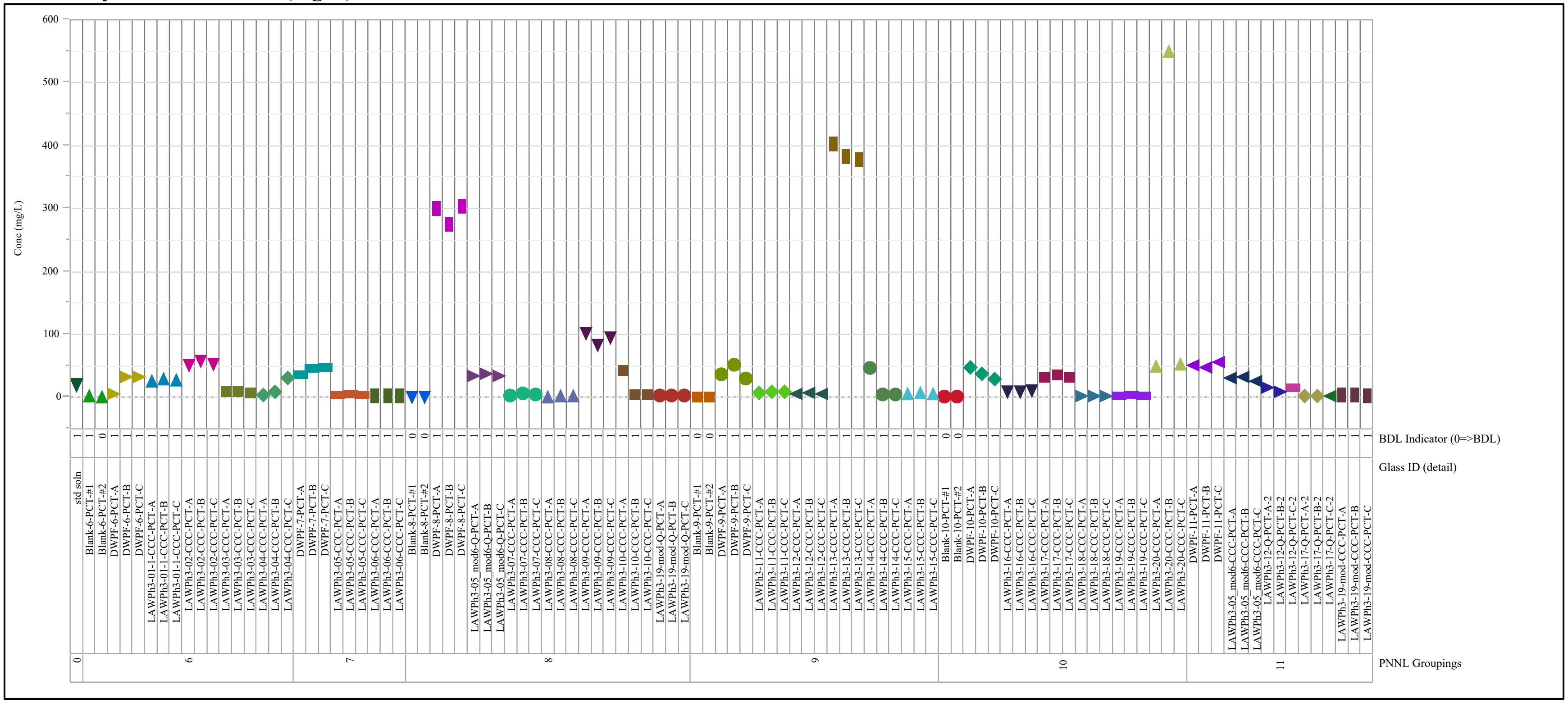


Exhibit G-2. PCT Leachate Measurements by PNNL Grouping (continued)

Analyte=B
Variability Chart for log[Conc (mg/L)]

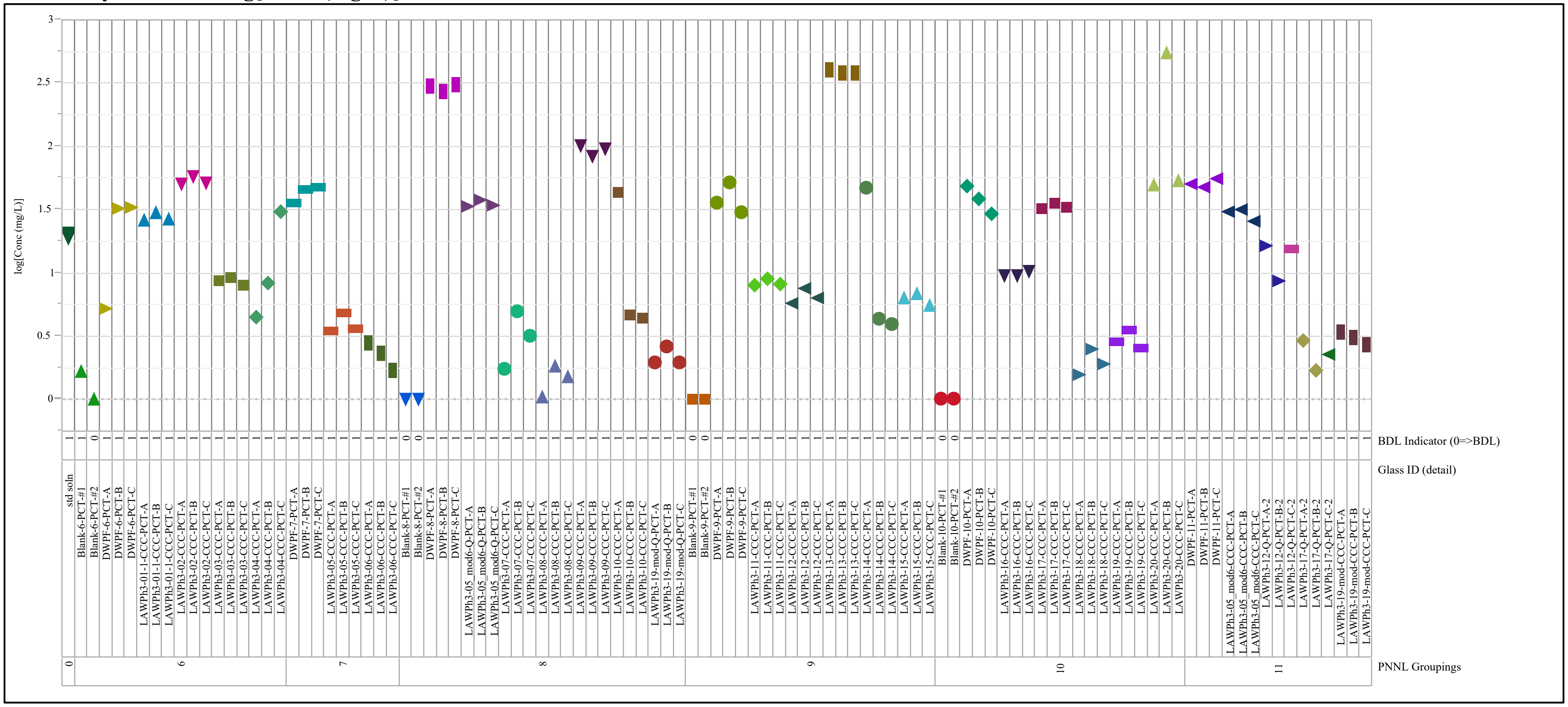


Exhibit G-2. PCT Leachate Measurements by PNNL Grouping (continued)

Analyte=Cr
Variability Chart for Conc (mg/L)

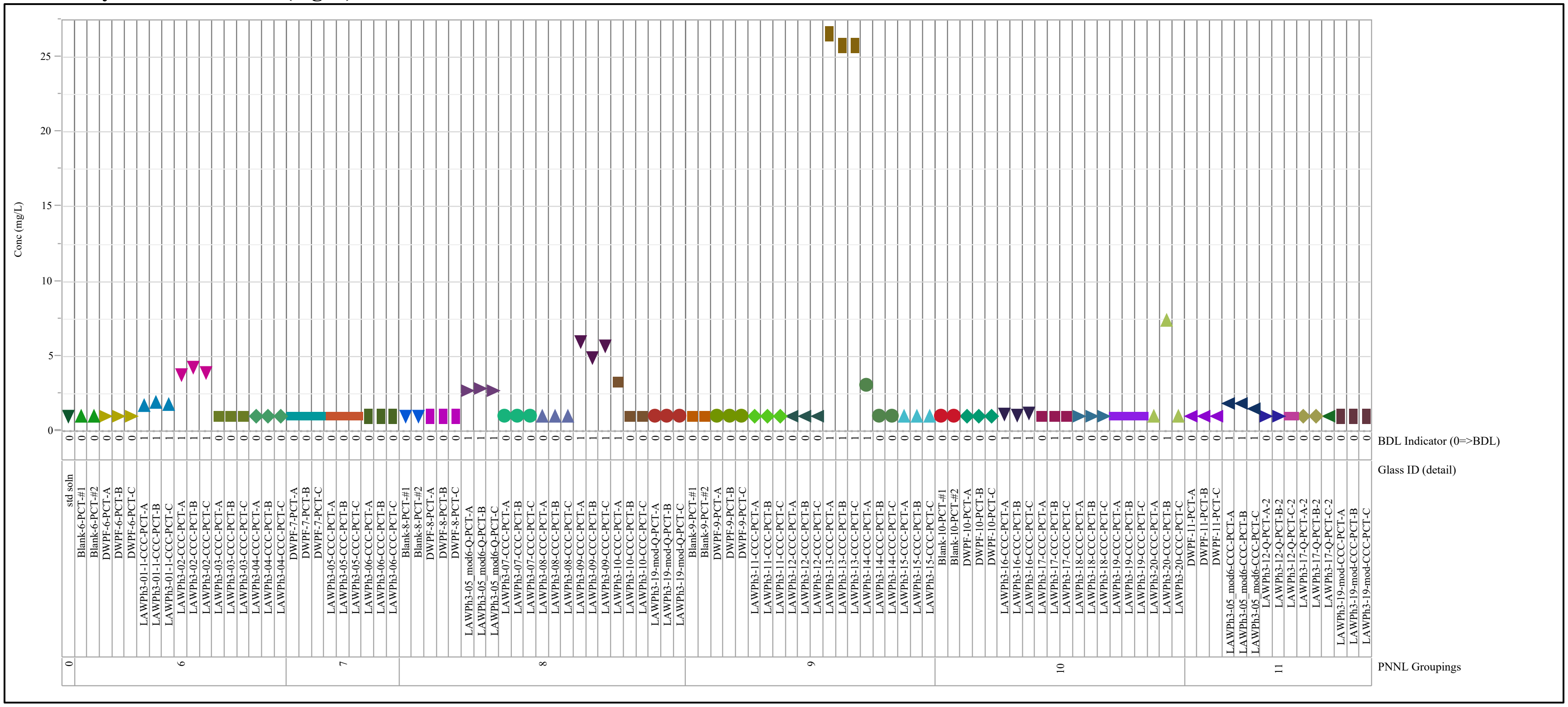


Exhibit G-2. PCT Leachate Measurements by PNNL Grouping (continued)

Analyte=Cr
Variability Chart for log[Conc (mg/L)]

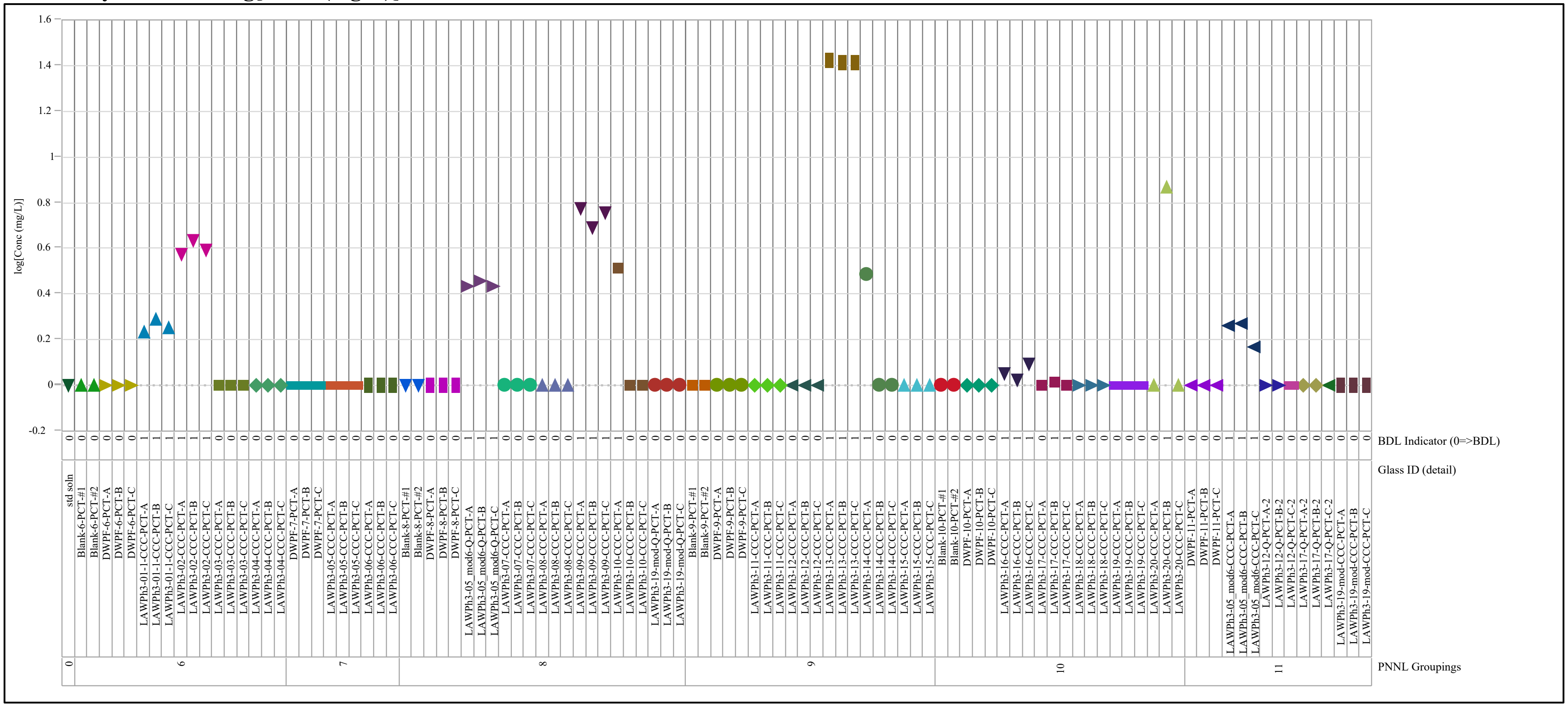


Exhibit G-2. PCT Leachate Measurements by PNNL Grouping (continued)

Analyte=Li
Variability Chart for Conc (mg/L)

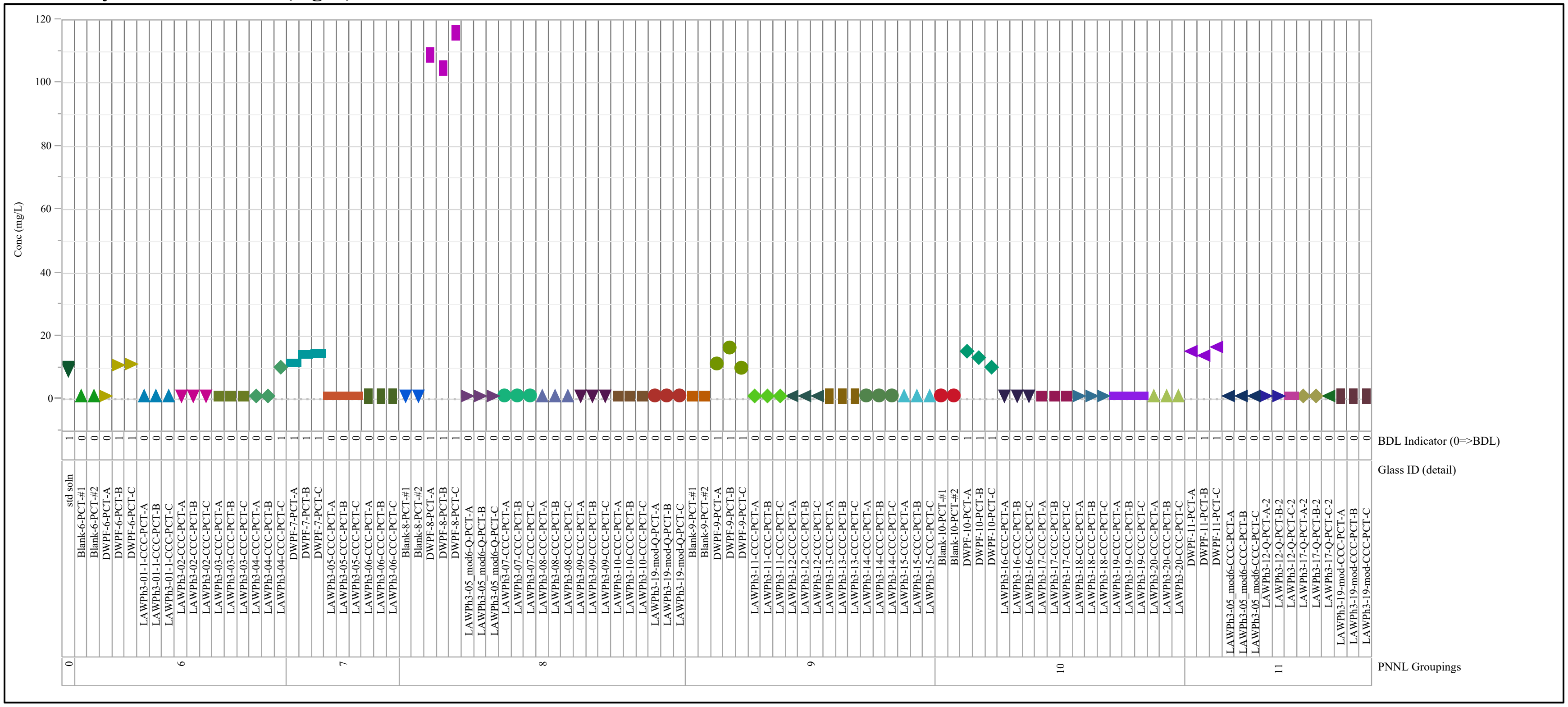


Exhibit G-2. PCT Leachate Measurements by PNNL Grouping (continued)

Analyte=Li
Variability Chart for log[Conc (mg/L)]

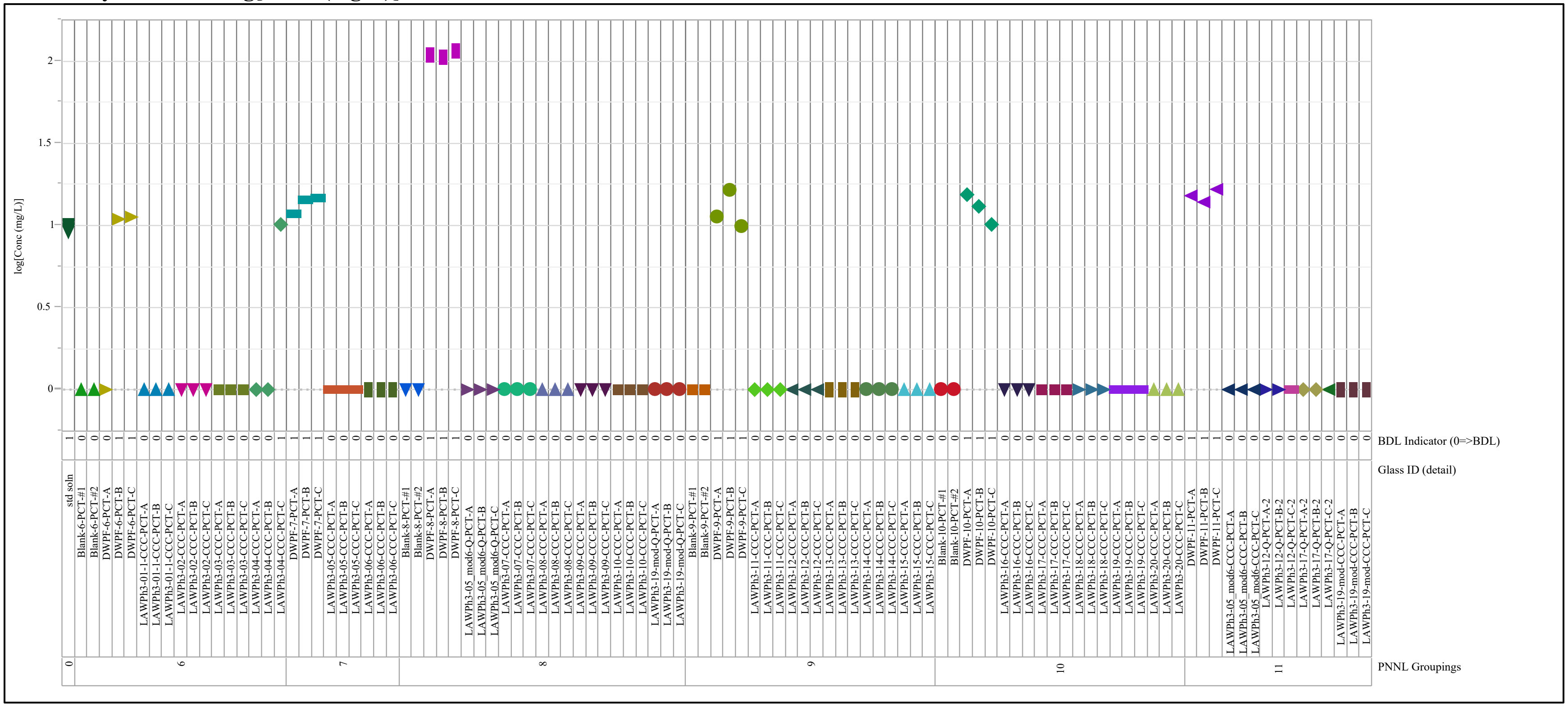


Exhibit G-2. PCT Leachate Measurements by PNNL Grouping (continued)

Analyte=Na
Variability Chart for Conc (mg/L)

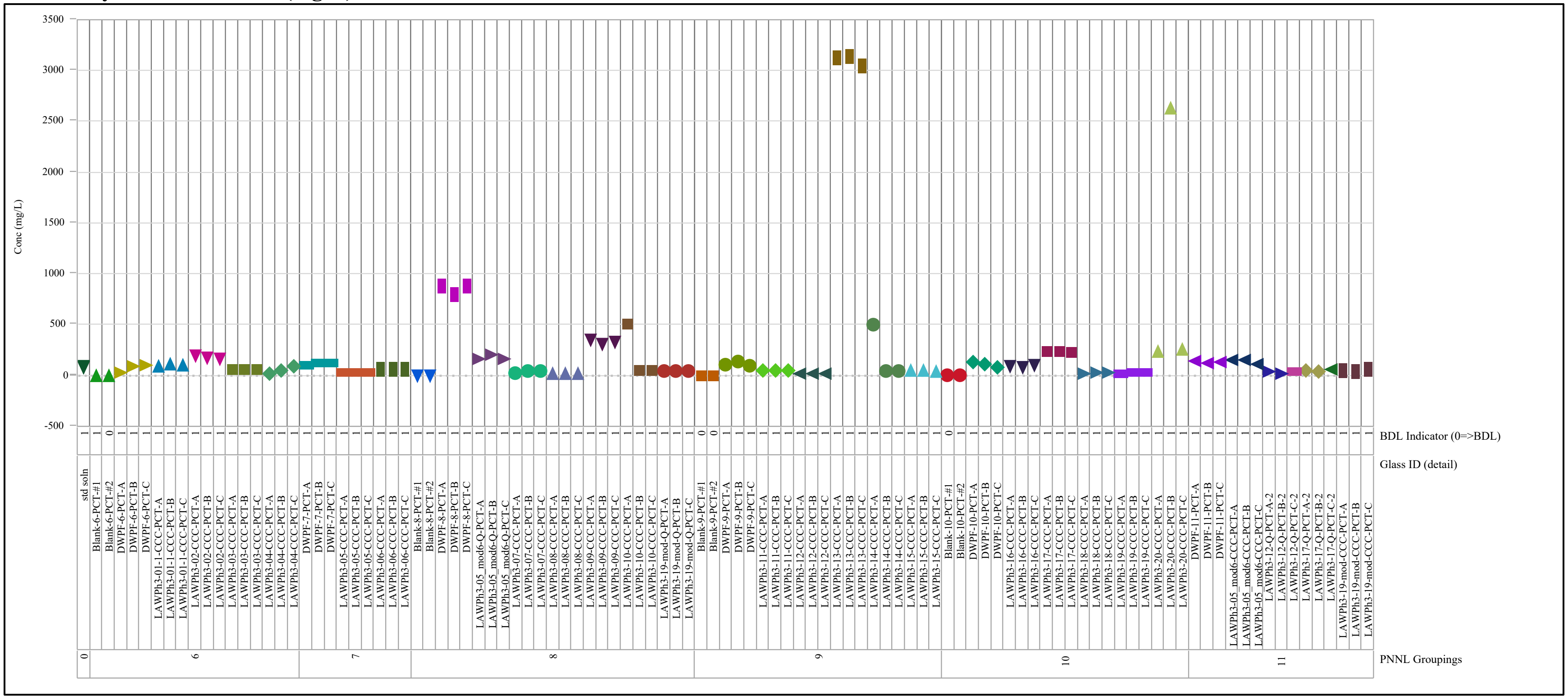


Exhibit G-2. PCT Leachate Measurements by PNNL Grouping (continued)

Analyte=Na
Variability Chart for log[Conc (mg/L)]

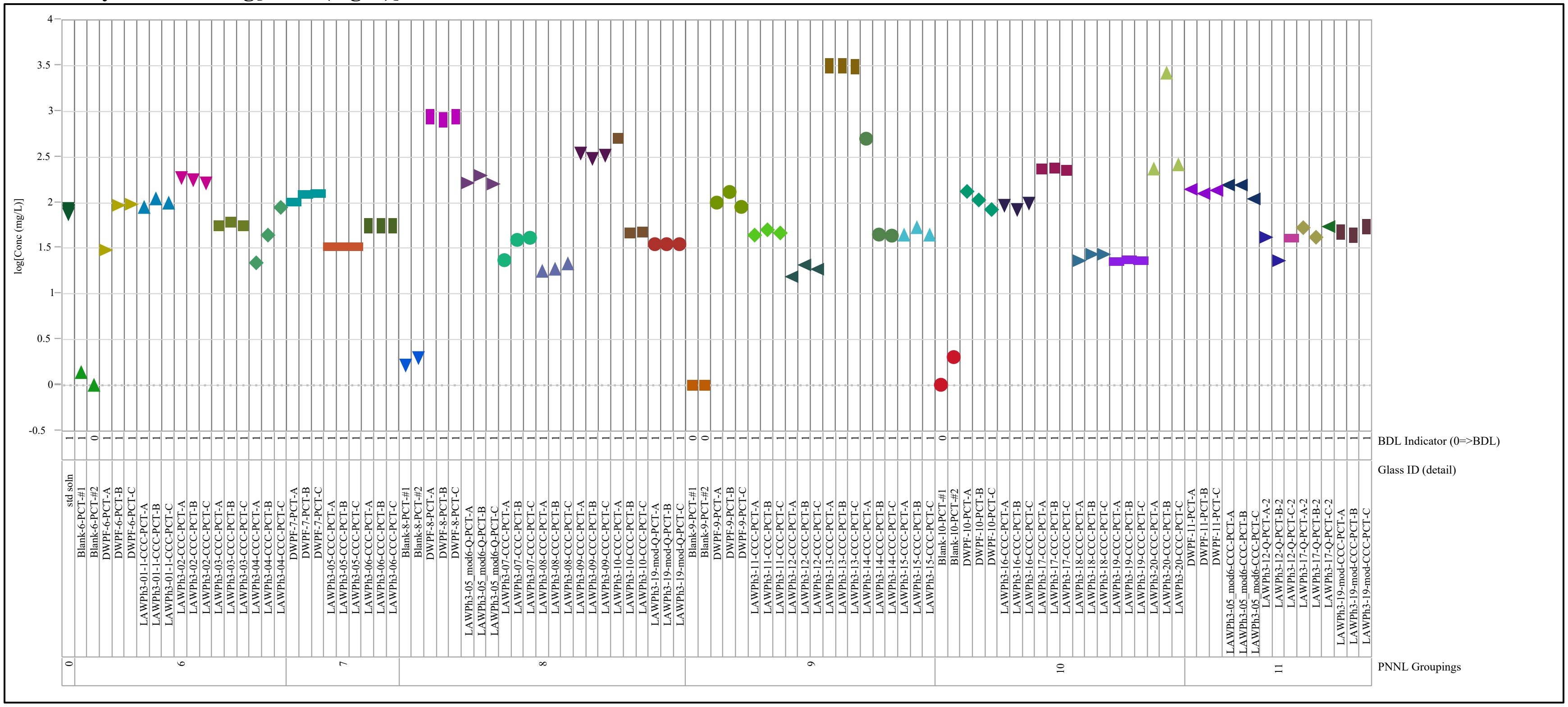


Exhibit G-2. PCT Leachate Measurements by PNNL Grouping (continued)

Analyte=Si
Variability Chart for Conc (mg/L)

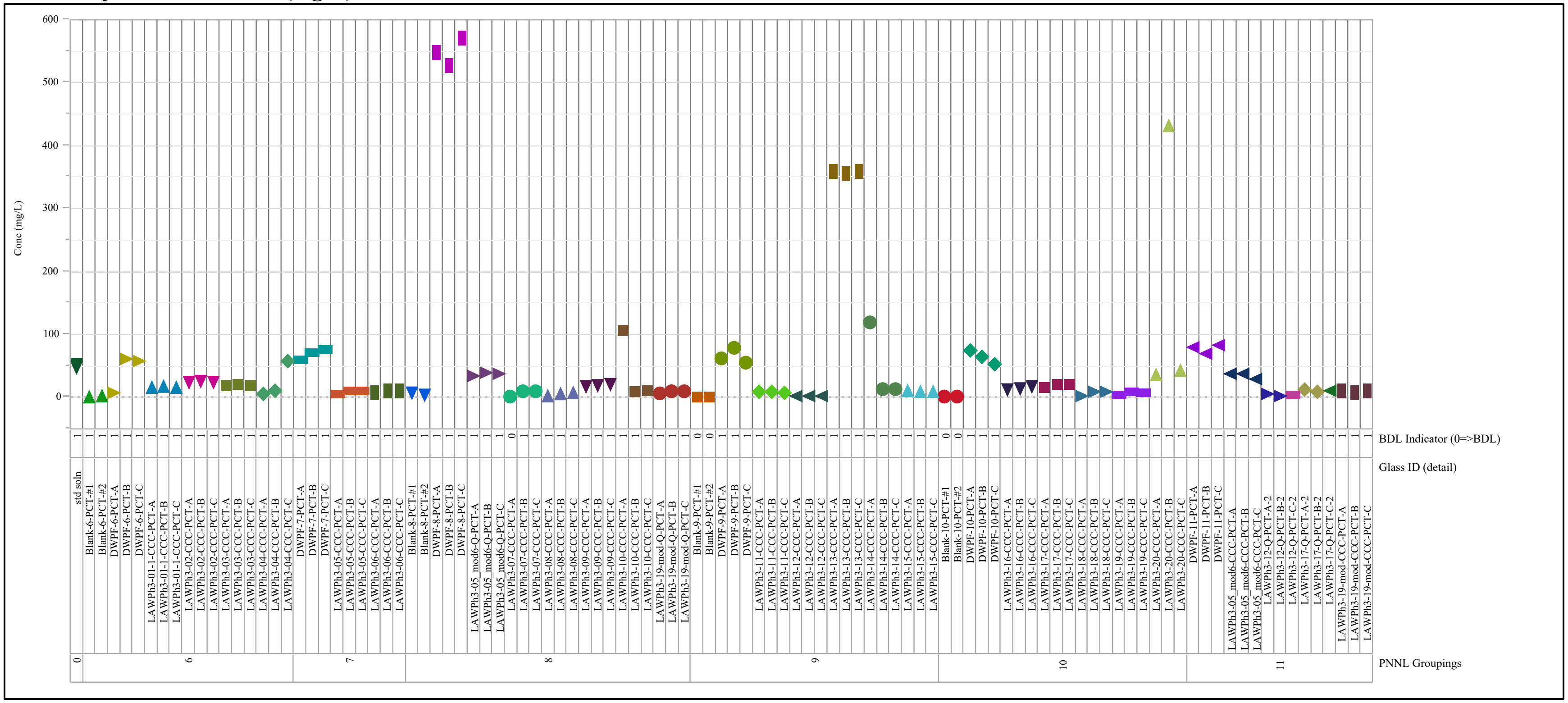


Exhibit G-2. PCT Leachate Measurements by PNNL Grouping (continued)

Analyte=Si
Variability Chart for log[Conc (mg/L)]

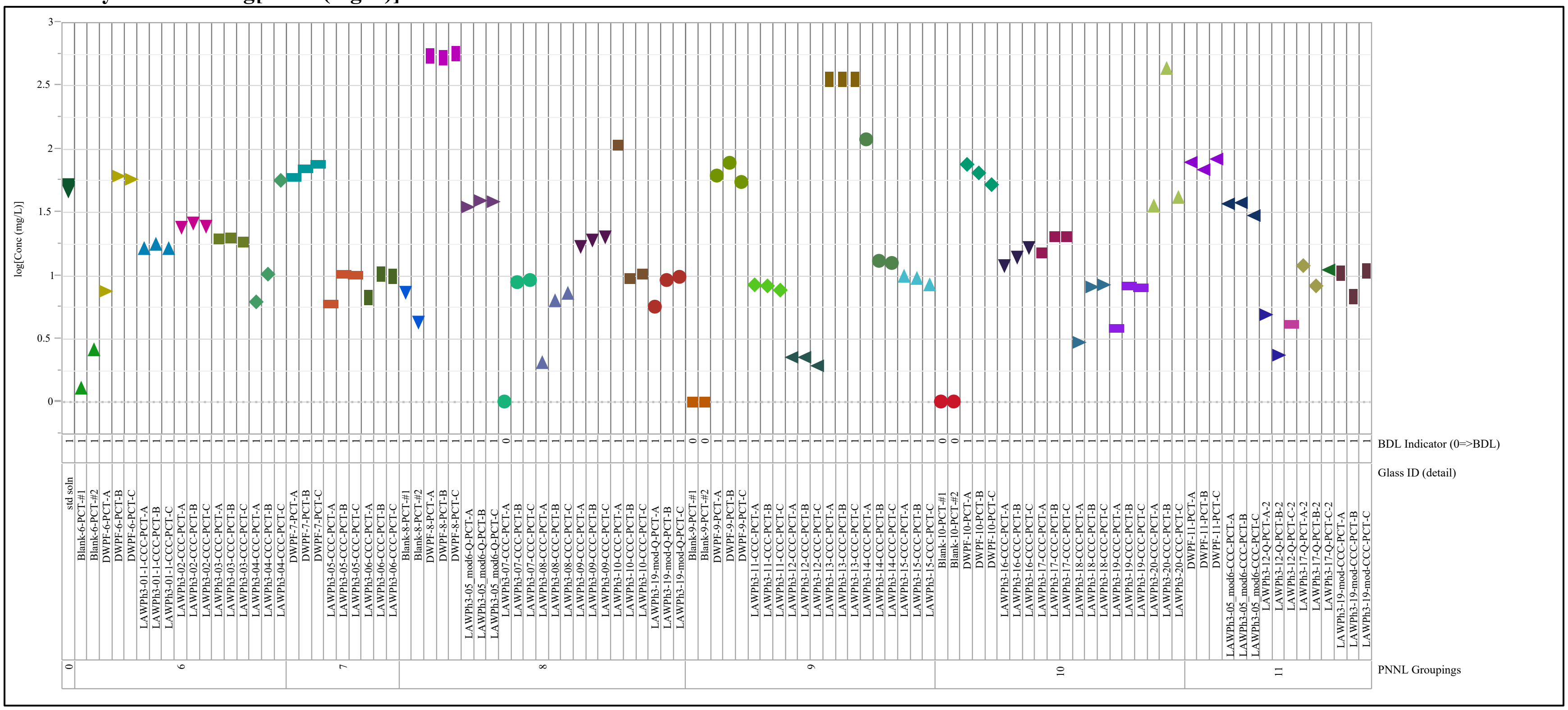


Exhibit G-2. PCT Leachate Measurements by PNNL Grouping (continued)

Analyte=Zr
Variability Chart for Conc (mg/L)

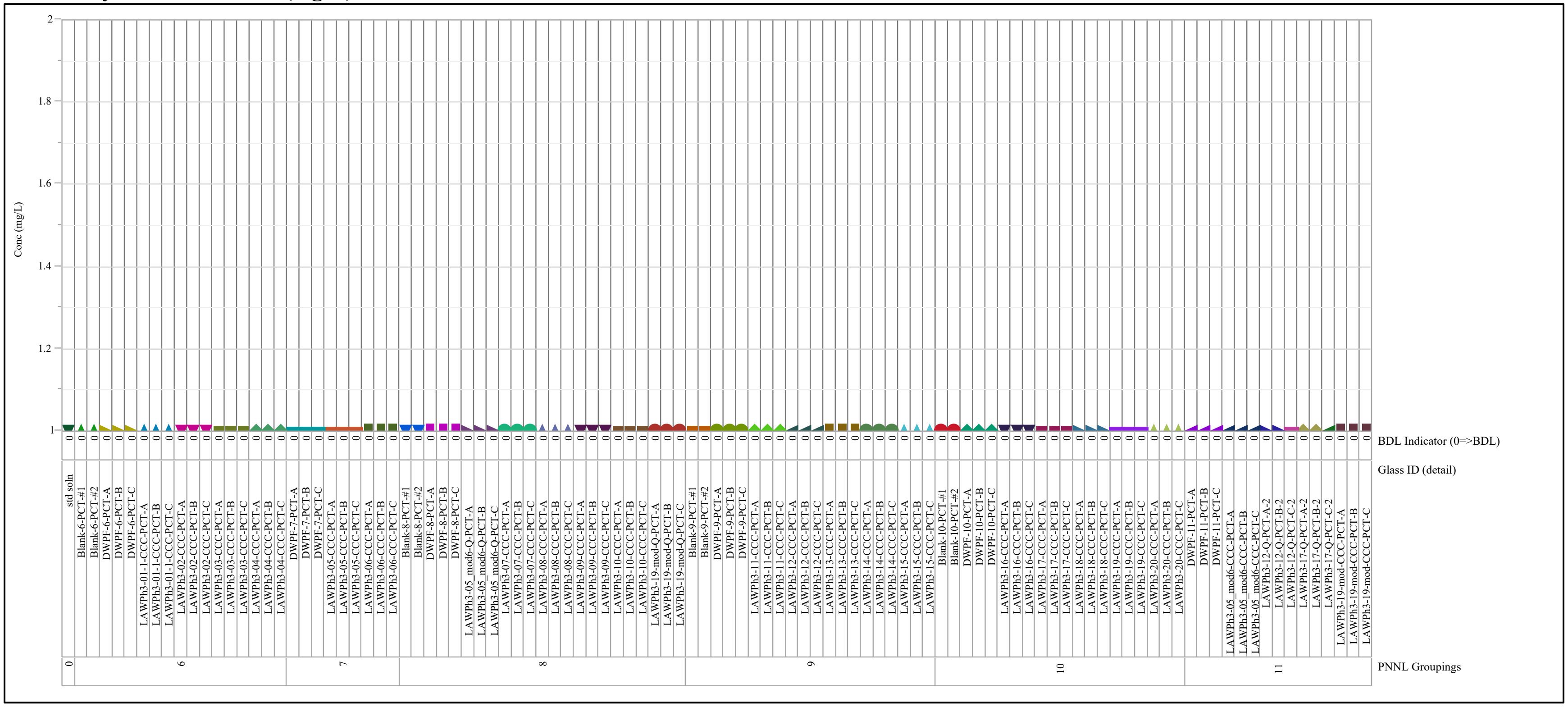
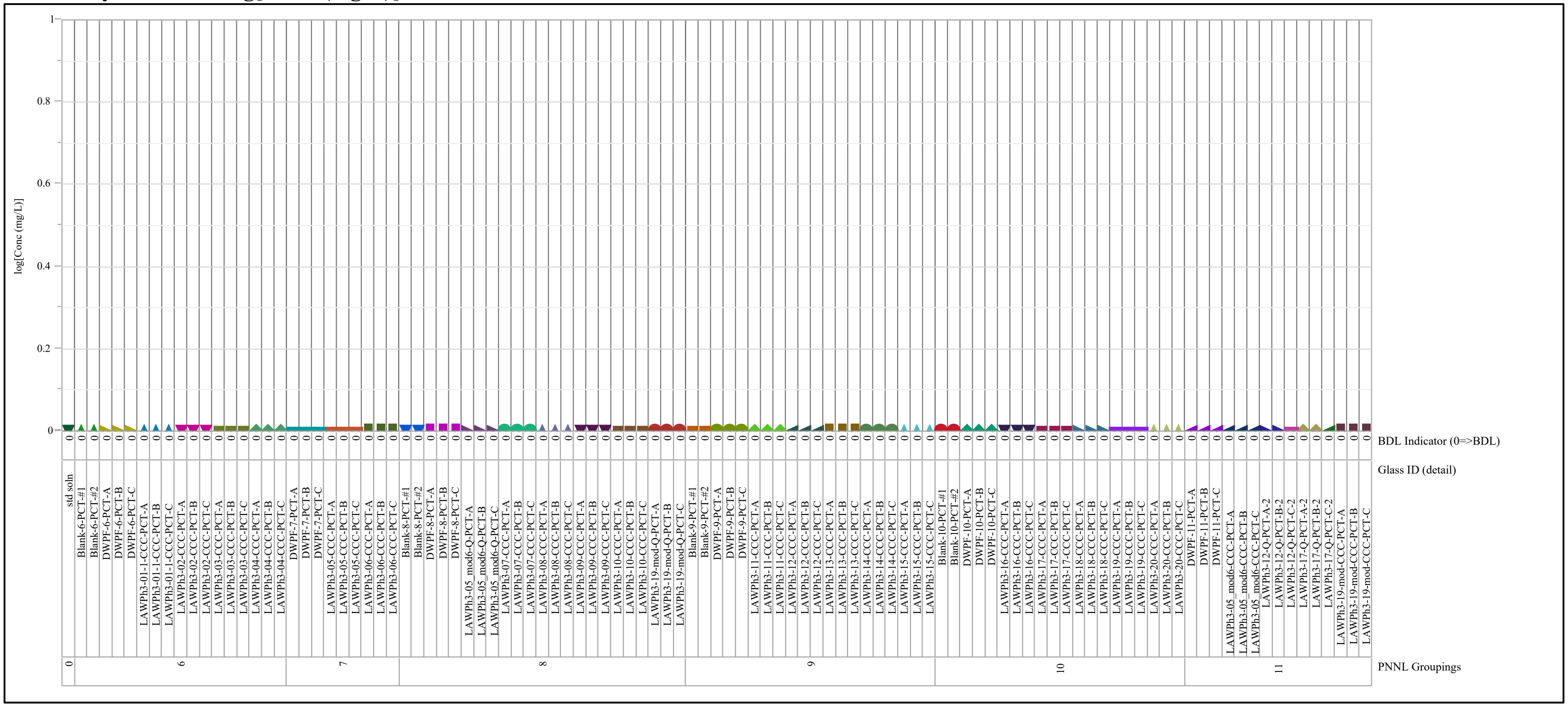


Exhibit G-2. PCT Leachate Measurements by PNNL Grouping (continued)

Analyte=Zr
Variability Chart for log[Conc (mg/L)]



Appendix H Normalized PCT Results for the LAW Phase 3 Glasses

Exhibit H-1. Normalized PCT Results by Compositional View by Heat Treatment for Each Glass

Analyte=Al, Comp View=measured
Variability Chart for log NC[] (g/L)

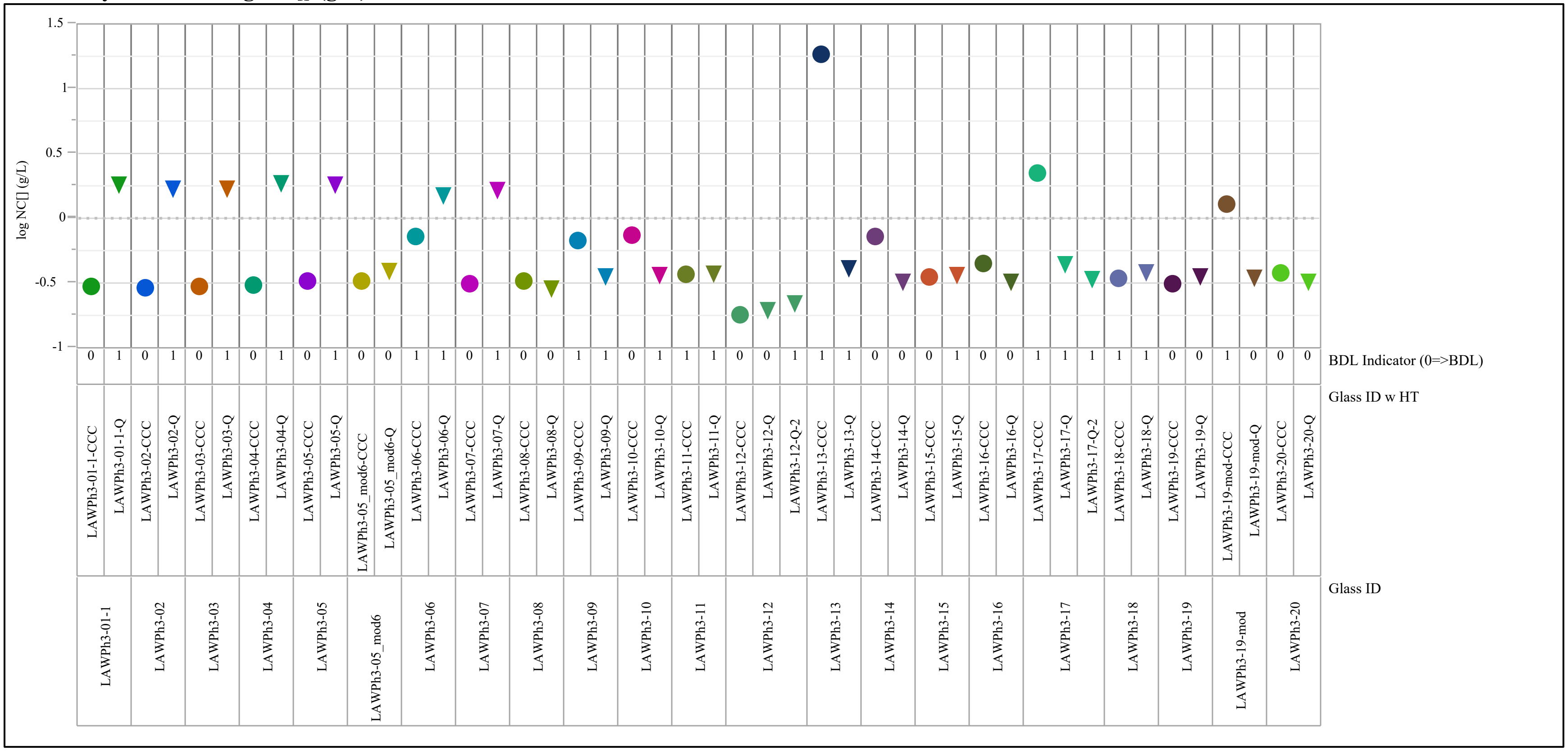


Exhibit H-1. Normalized PCT Results by Compositional View by Heat Treatment for Each Glass (continued)

Analyte=Al, Comp View=Ref
Variability Chart for log NC[] (g/L)

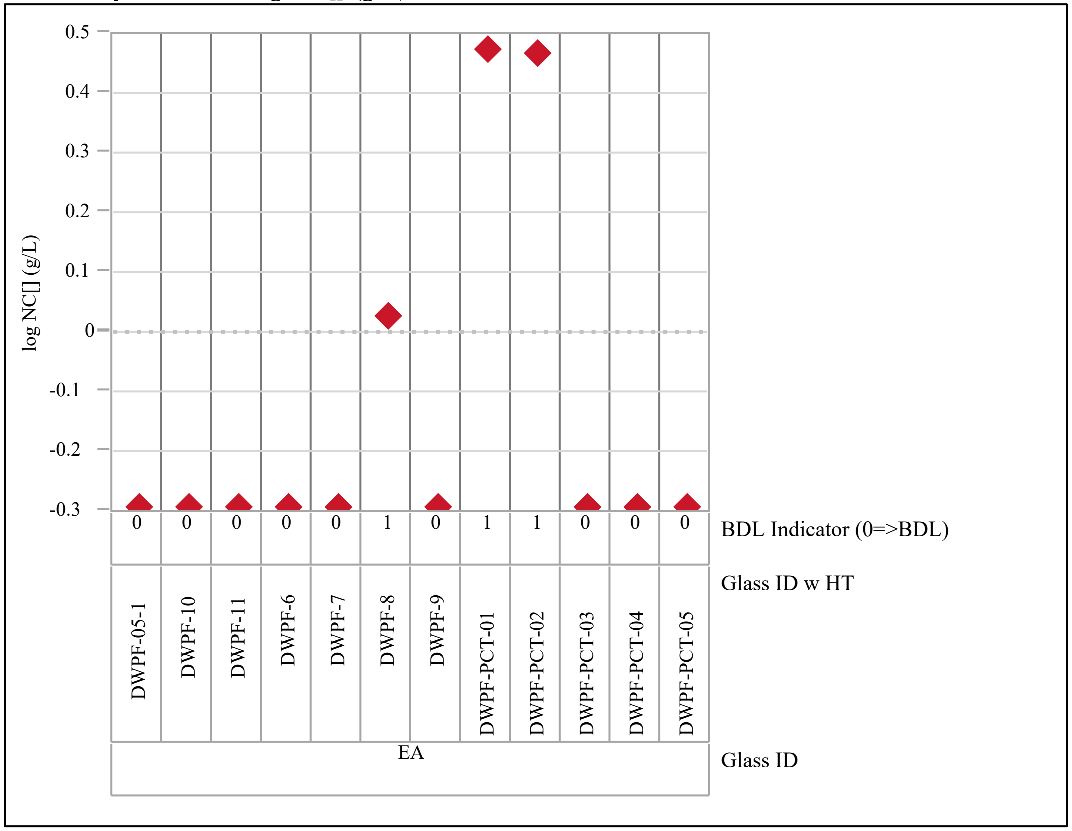


Exhibit H-1. Normalized PCT Results by Compositional View by Heat Treatment for Each Glass (continued)

Analyte=Al, Comp View=targeted
Variability Chart for log NC[] (g/L)

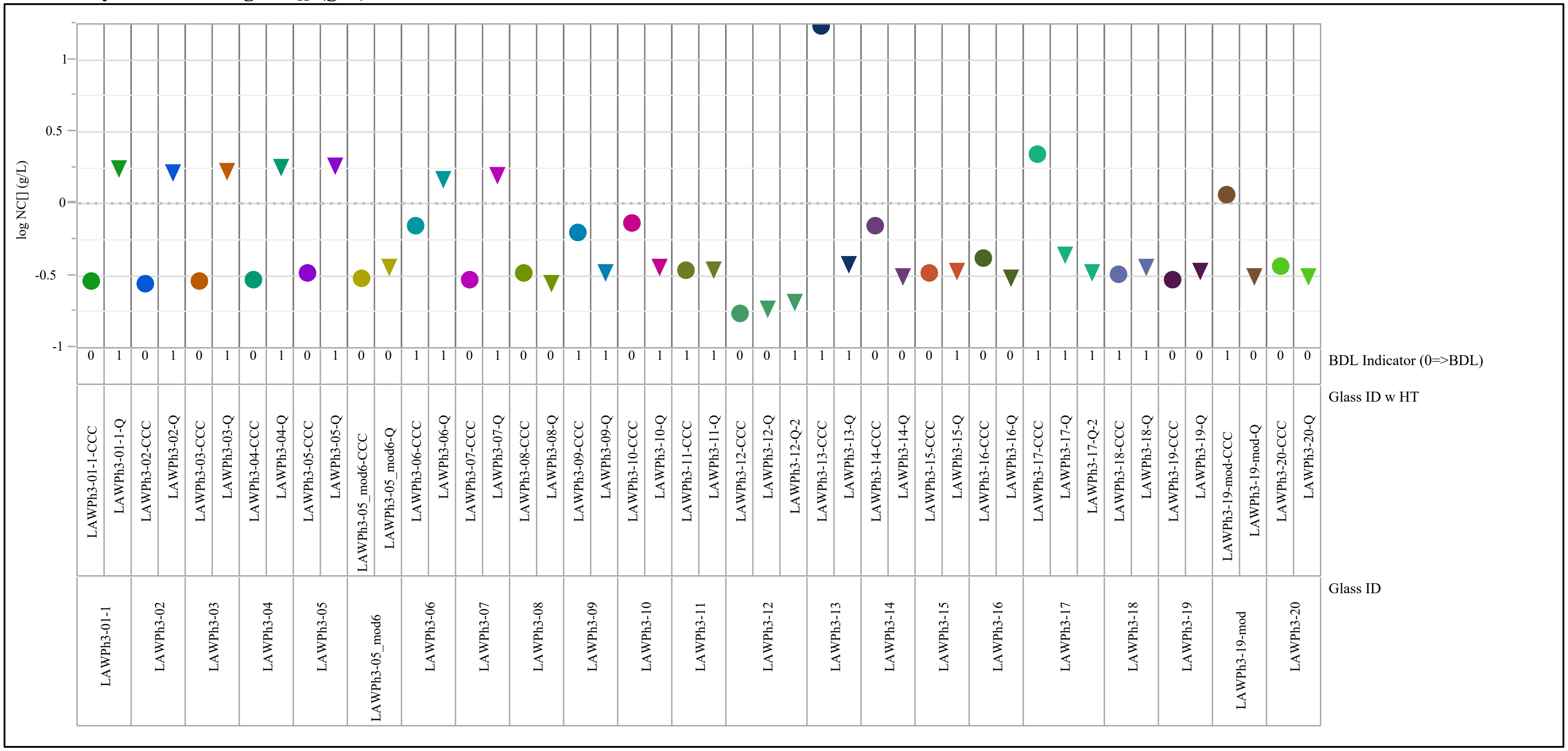


Exhibit H-1. Normalized PCT Results by Compositional View by Heat Treatment for Each Glass (continued)

Analyte=B, Comp View=measured
Variability Chart for log NC[] (g/L)

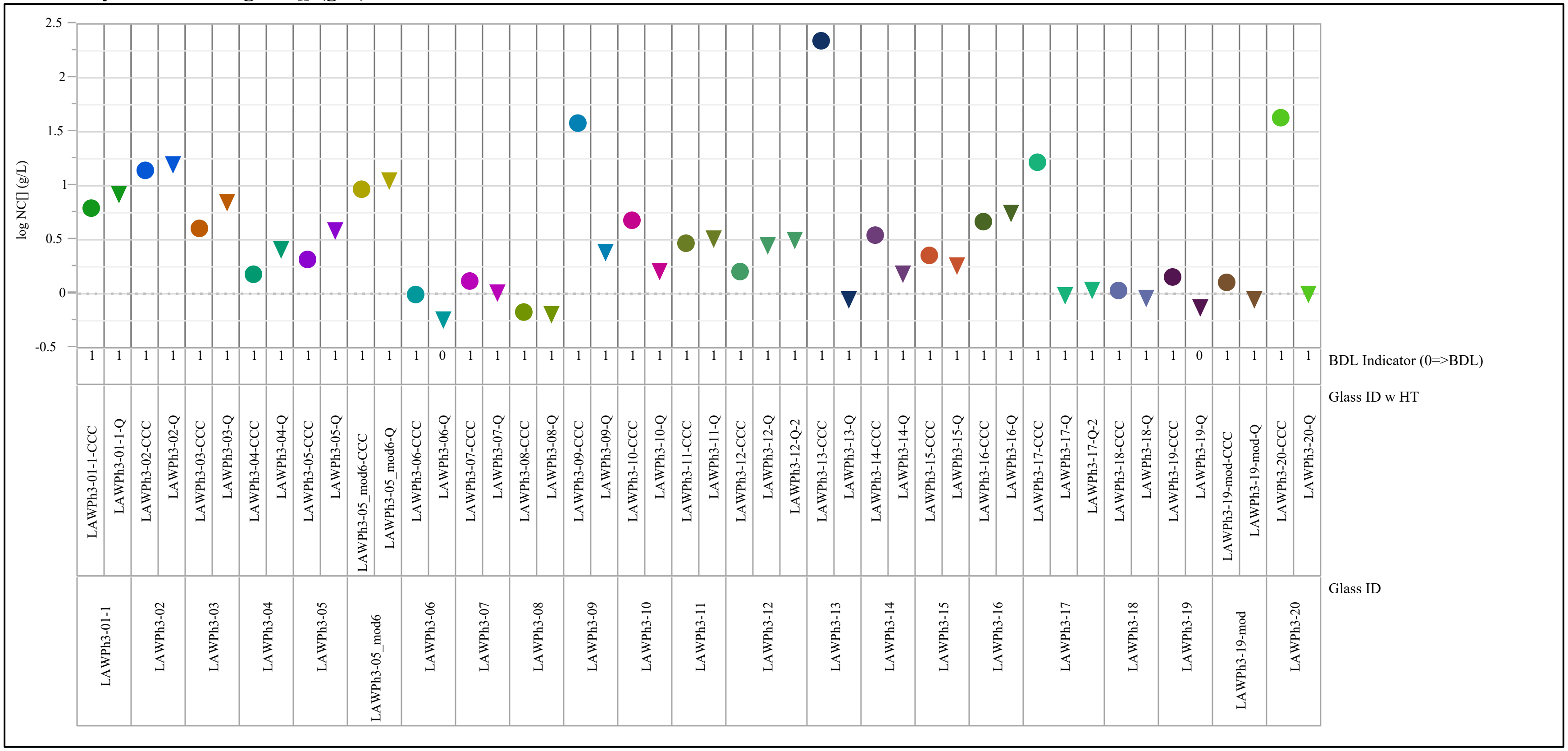


Exhibit H-1. Normalized PCT Results by Compositional View by Heat Treatment for Each Glass (continued)

Analyte=B, Comp View=Ref
Variability Chart for log NC[] (g/L)

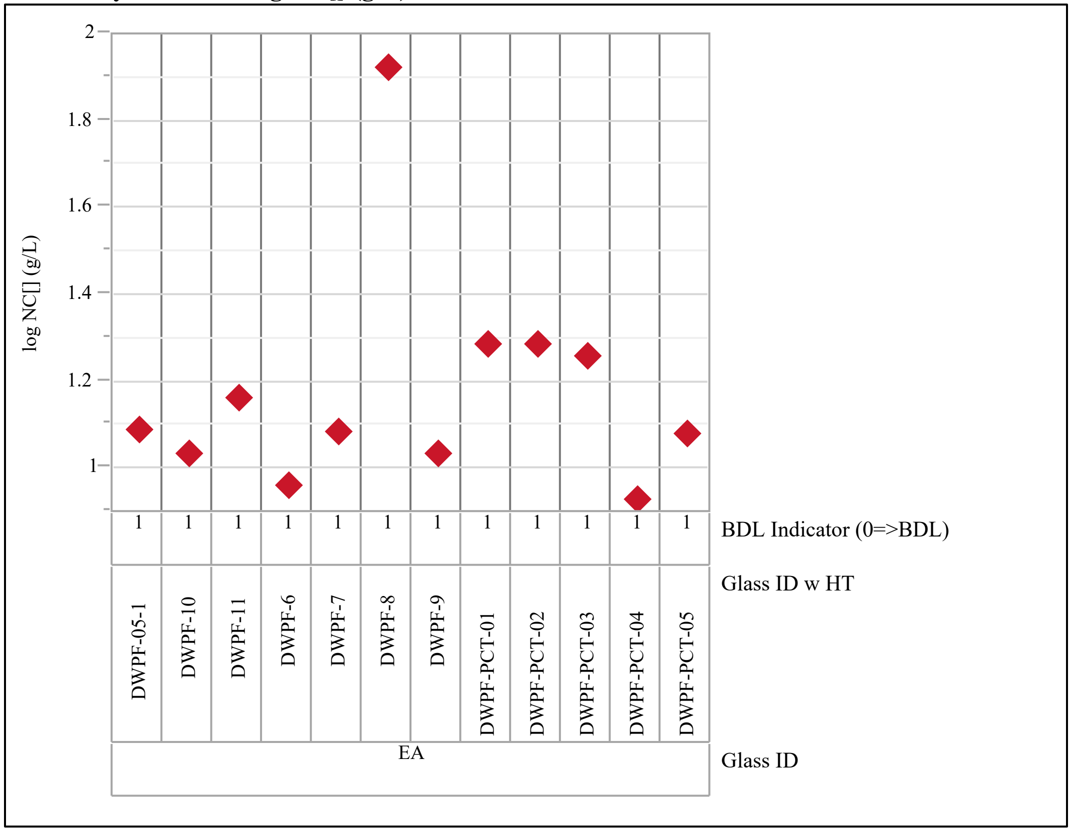


Exhibit H-1. Normalized PCT Results by Compositional View by Heat Treatment for Each Glass (continued)

Analyte=B, Comp View=targeted
Variability Chart for log NC[] (g/L)

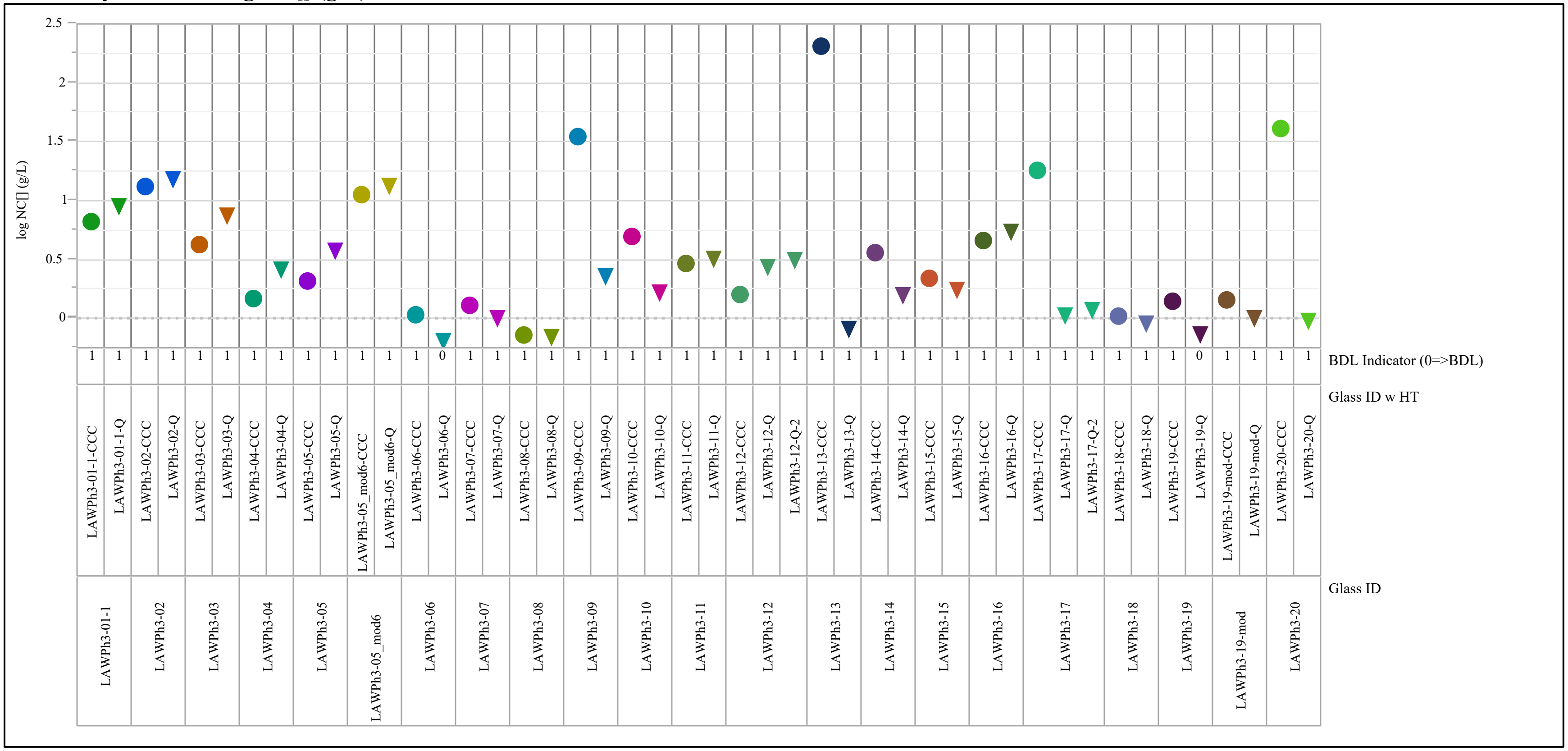


Exhibit H-1. Normalized PCT Results by Compositional View by Heat Treatment for Each Glass (continued)

Analyte=Cr, Comp View=measured
Variability Chart for log NC[] (g/L)

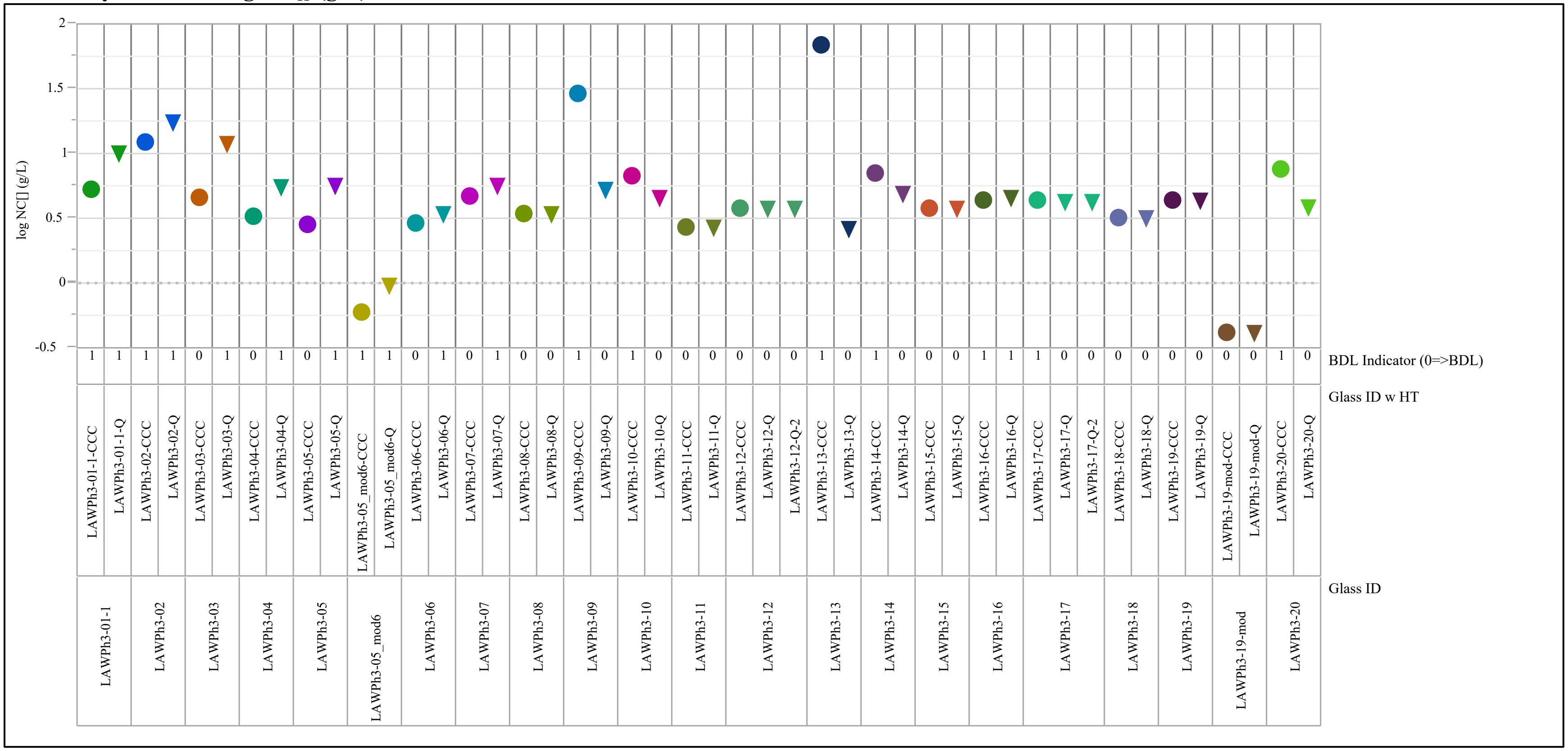


Exhibit H-1. Normalized PCT Results by Compositional View by Heat Treatment for Each Glass (continued)

Analyte=Cr, Comp View=targeted
Variability Chart for log NC[] (g/L)

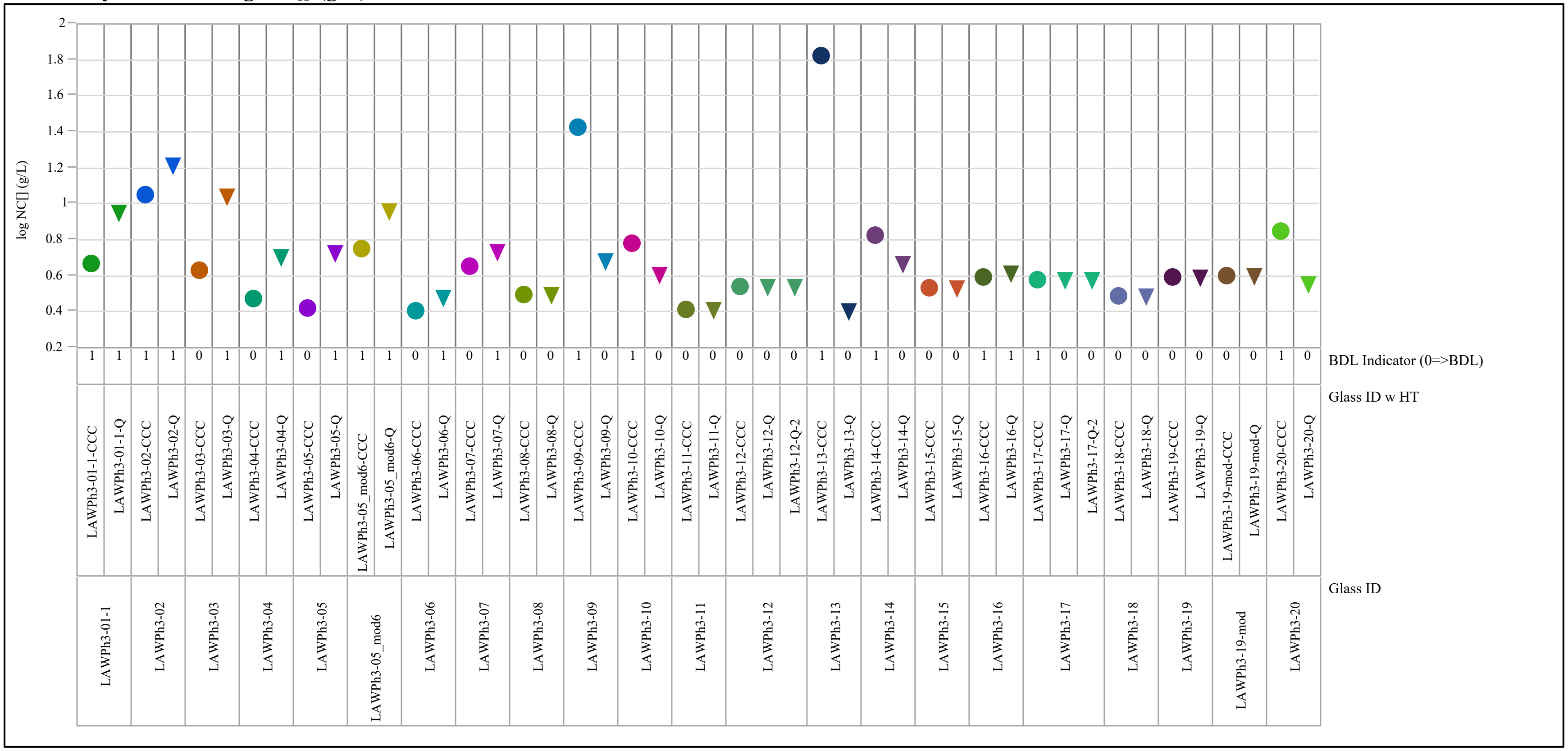


Exhibit H-1. Normalized PCT Results by Compositional View by Heat Treatment for Each Glass (continued)

Analyte=Li, Comp View=Ref
Variability Chart for log NC[] (g/L)

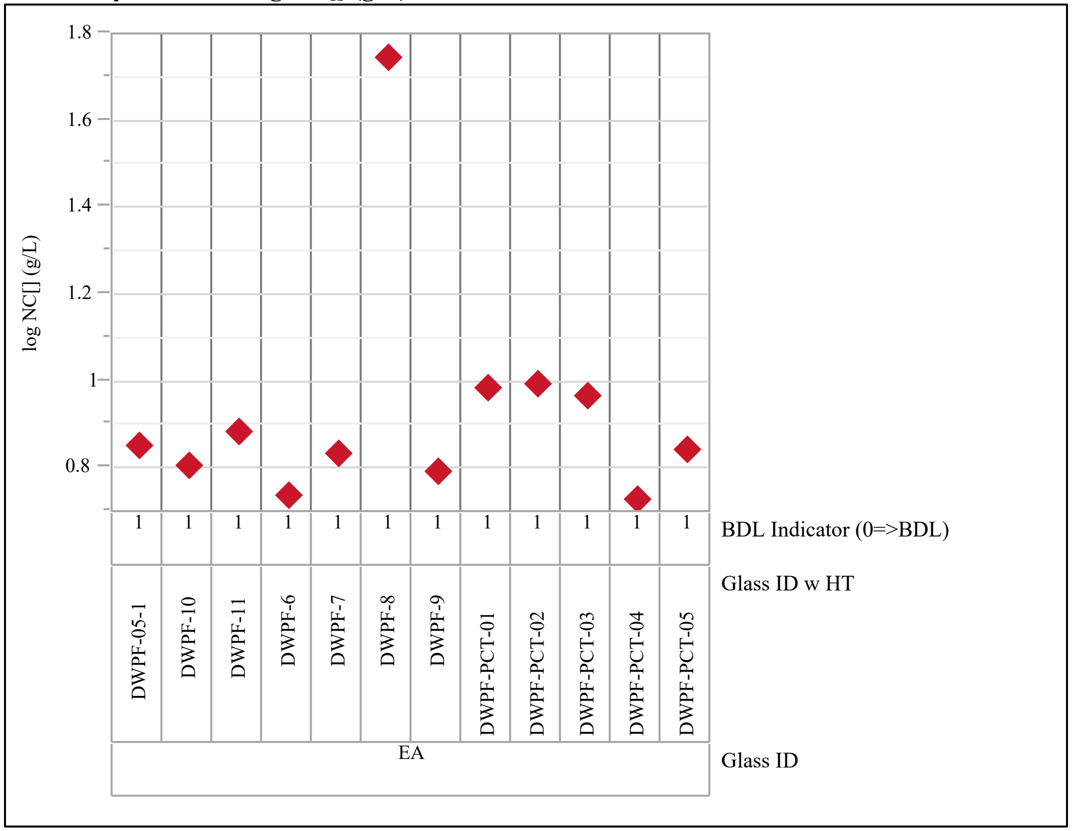


Exhibit H-1. Normalized PCT Results by Compositional View by Heat Treatment for Each Glass (continued)

Analyte=Na, Comp View=measured
Variability Chart for log NC[] (g/L)

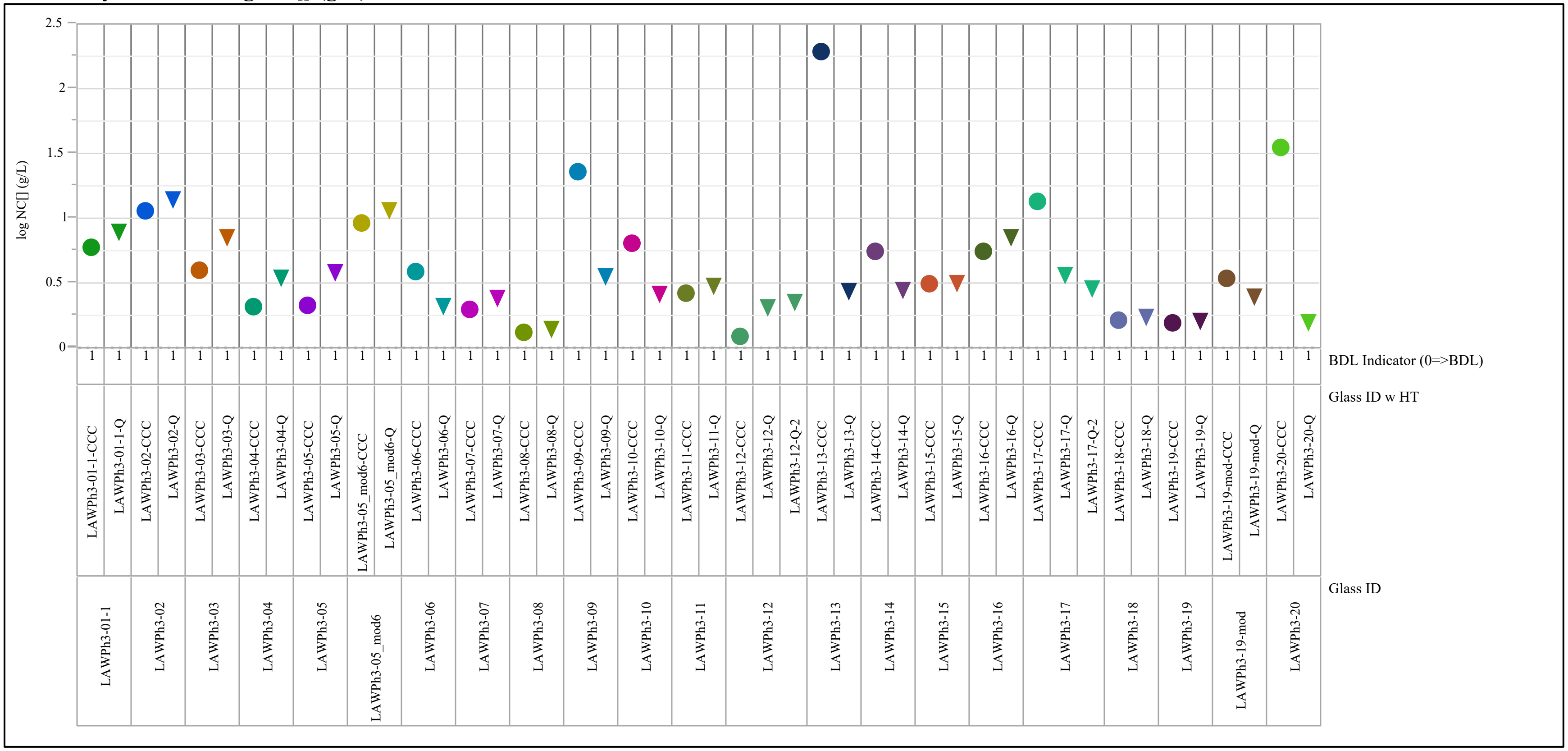


Exhibit H-1. Normalized PCT Results by Compositional View by Heat Treatment for Each Glass (continued)

Analyte=Na, Comp View=Ref
Variability Chart for log NC[] (g/L)

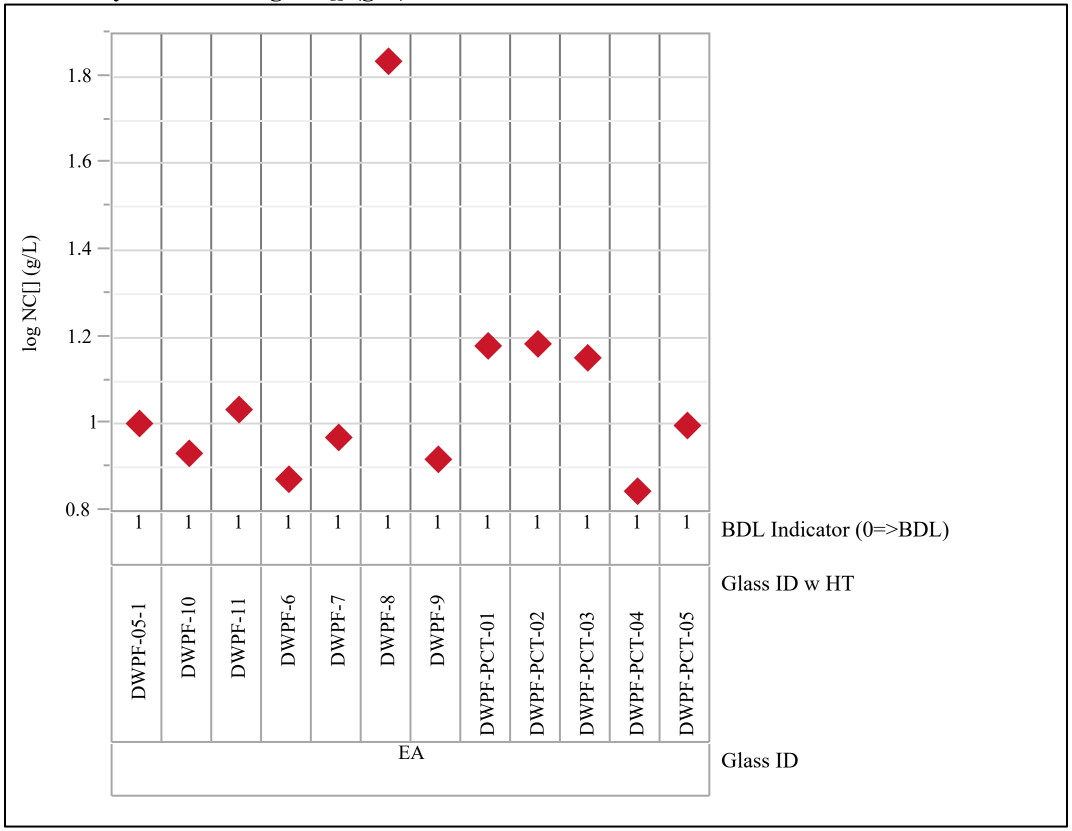


Exhibit H-1. Normalized PCT Results by Compositional View by Heat Treatment for Each Glass (continued)

Analyte=Na, Comp View=targeted
Variability Chart for log NC[] (g/L)

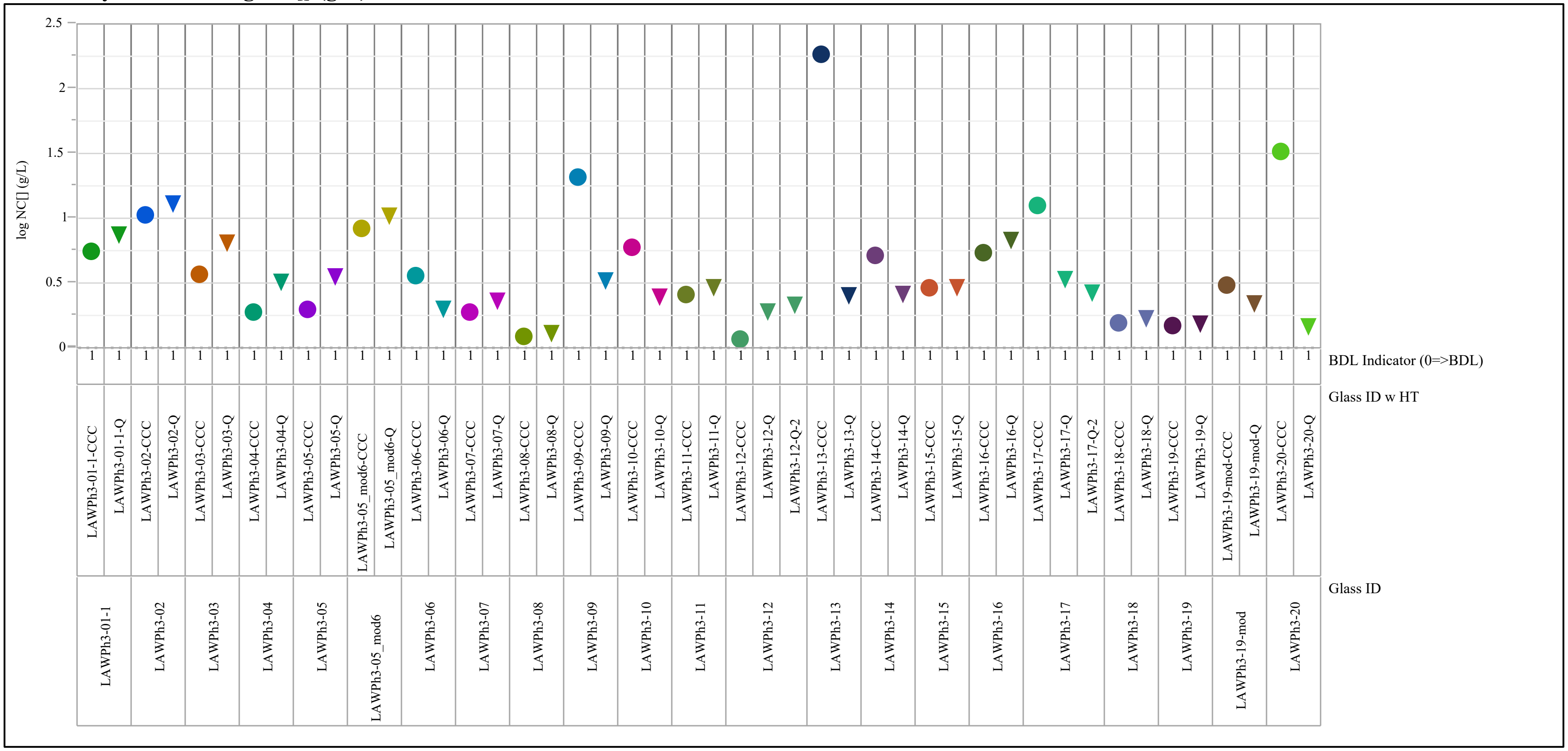


Exhibit H-1. Normalized PCT Results by Compositional View by Heat Treatment for Each Glass (continued)

Analyte=Si, Comp View=measured
Variability Chart for log NC[] (g/L)

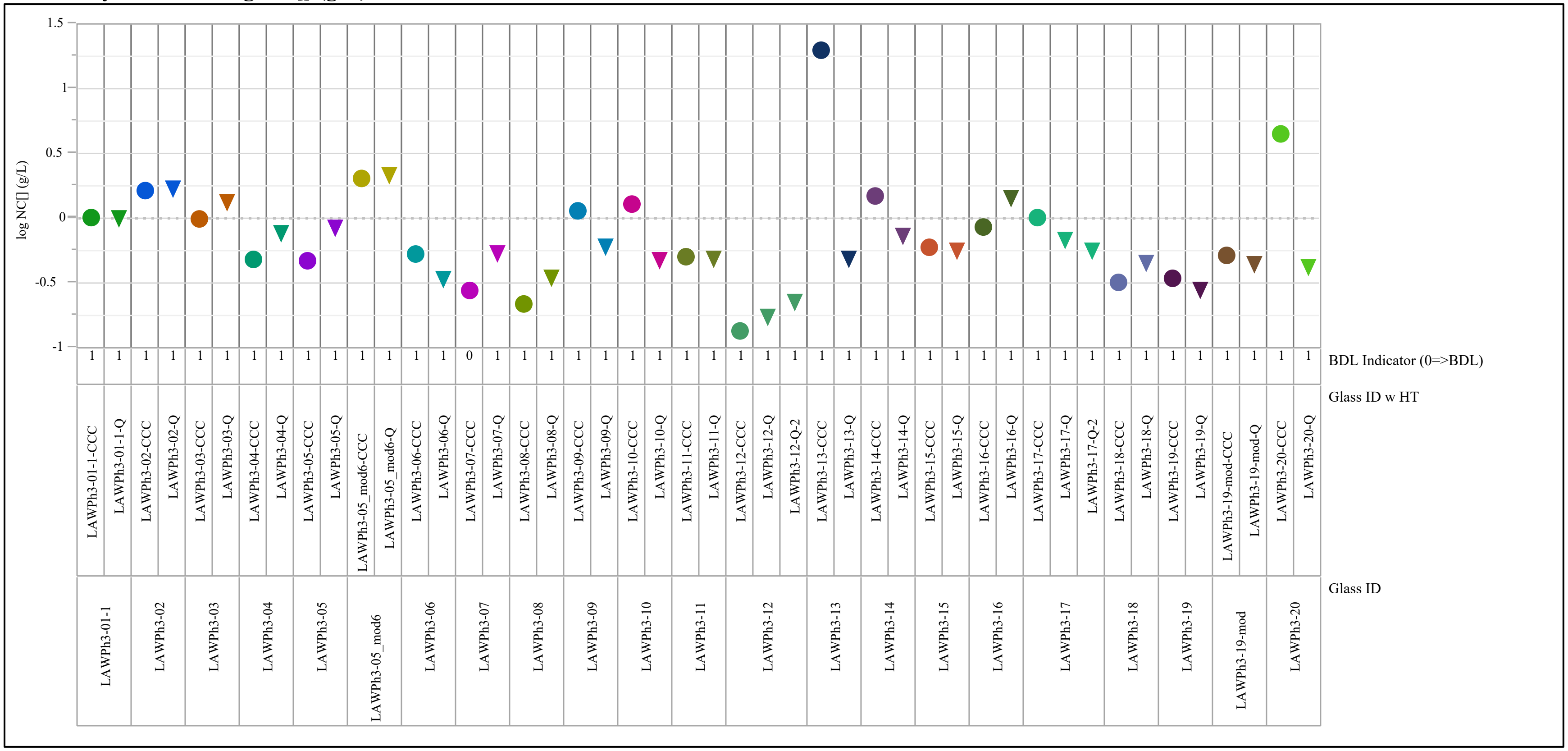


Exhibit H-1. Normalized PCT Results by Compositional View by Heat Treatment for Each Glass (continued)

Analyte=Si, Comp View=Ref
Variability Chart for log NC[] (g/L)

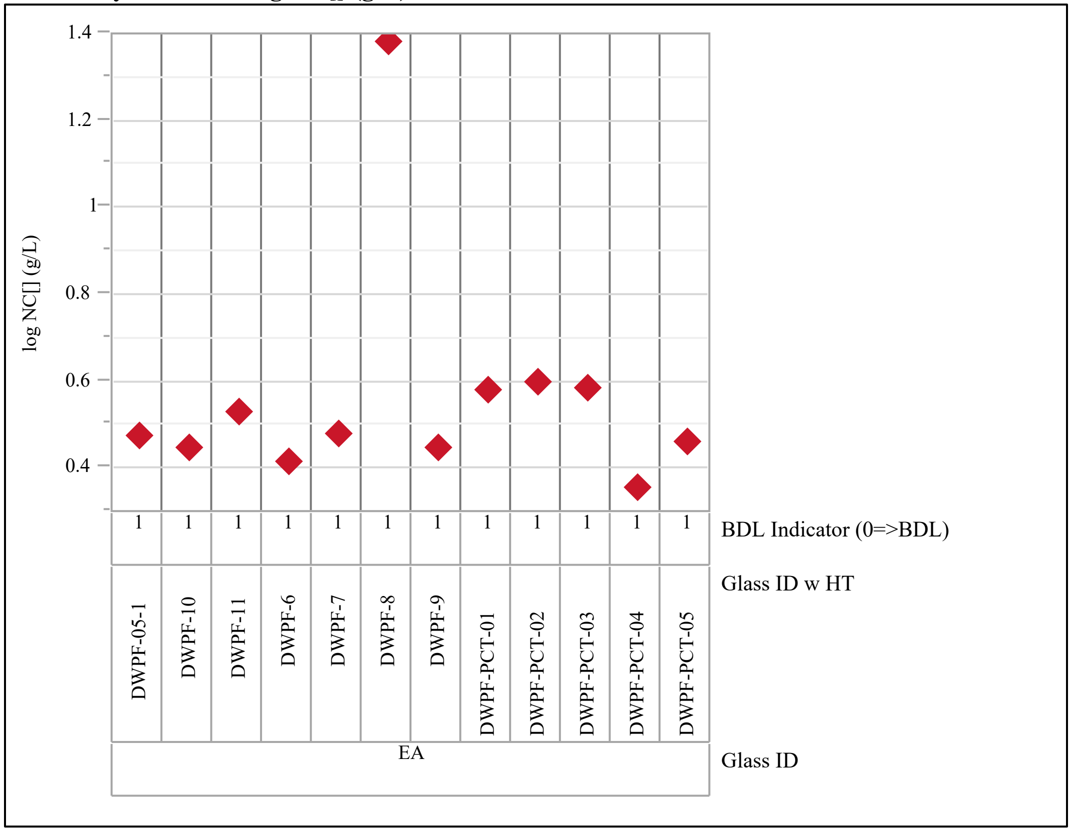


Exhibit H-1. Normalized PCT Results by Compositional View by Heat Treatment for Each Glass (continued)

Analyte=Si, Comp View=targeted
Variability Chart for log NC[] (g/L)

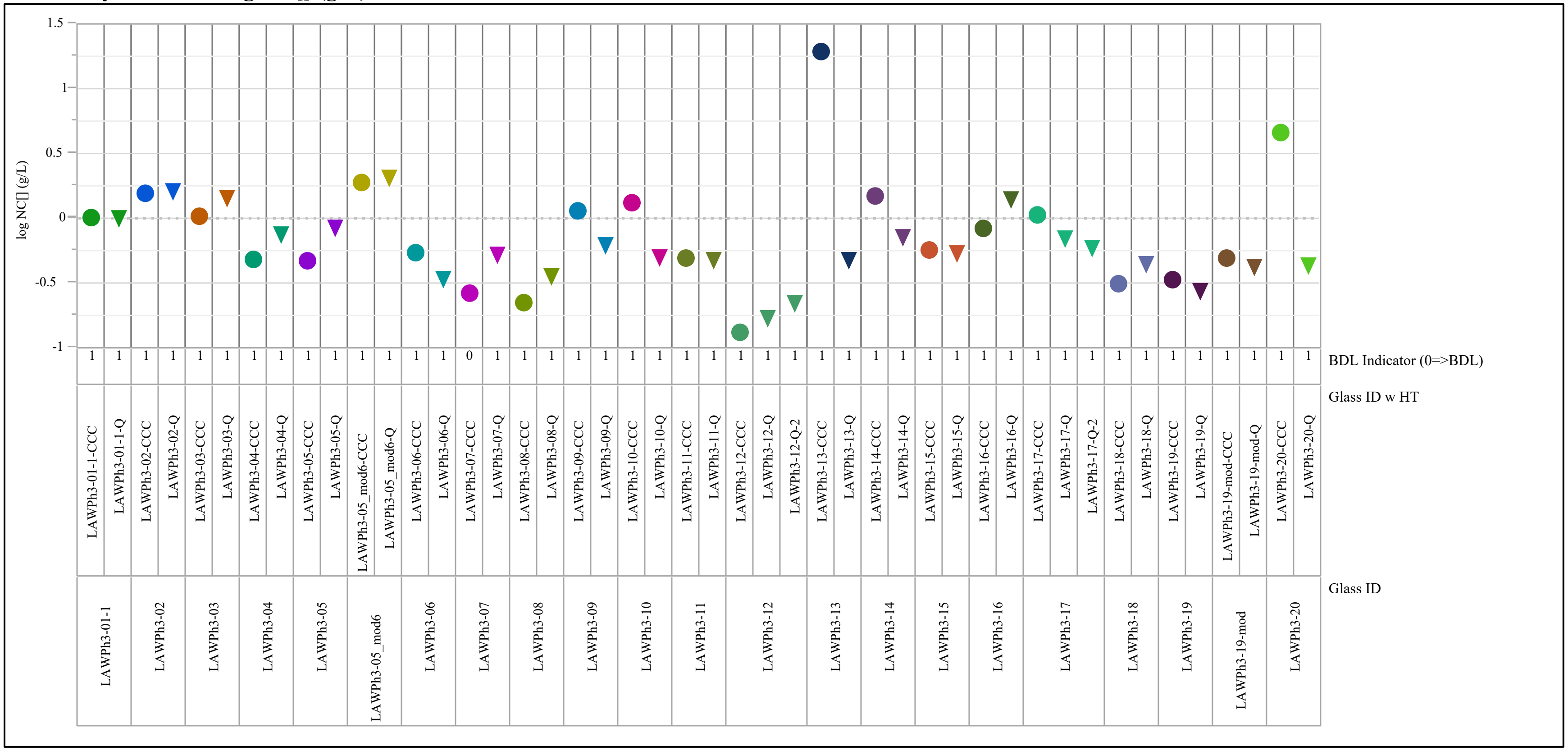


Exhibit H-1. Normalized PCT Results by Compositional View by Heat Treatment for Each Glass (continued)

Analyte=Zr, Comp View=measured
Variability Chart for log NC[] (g/L)

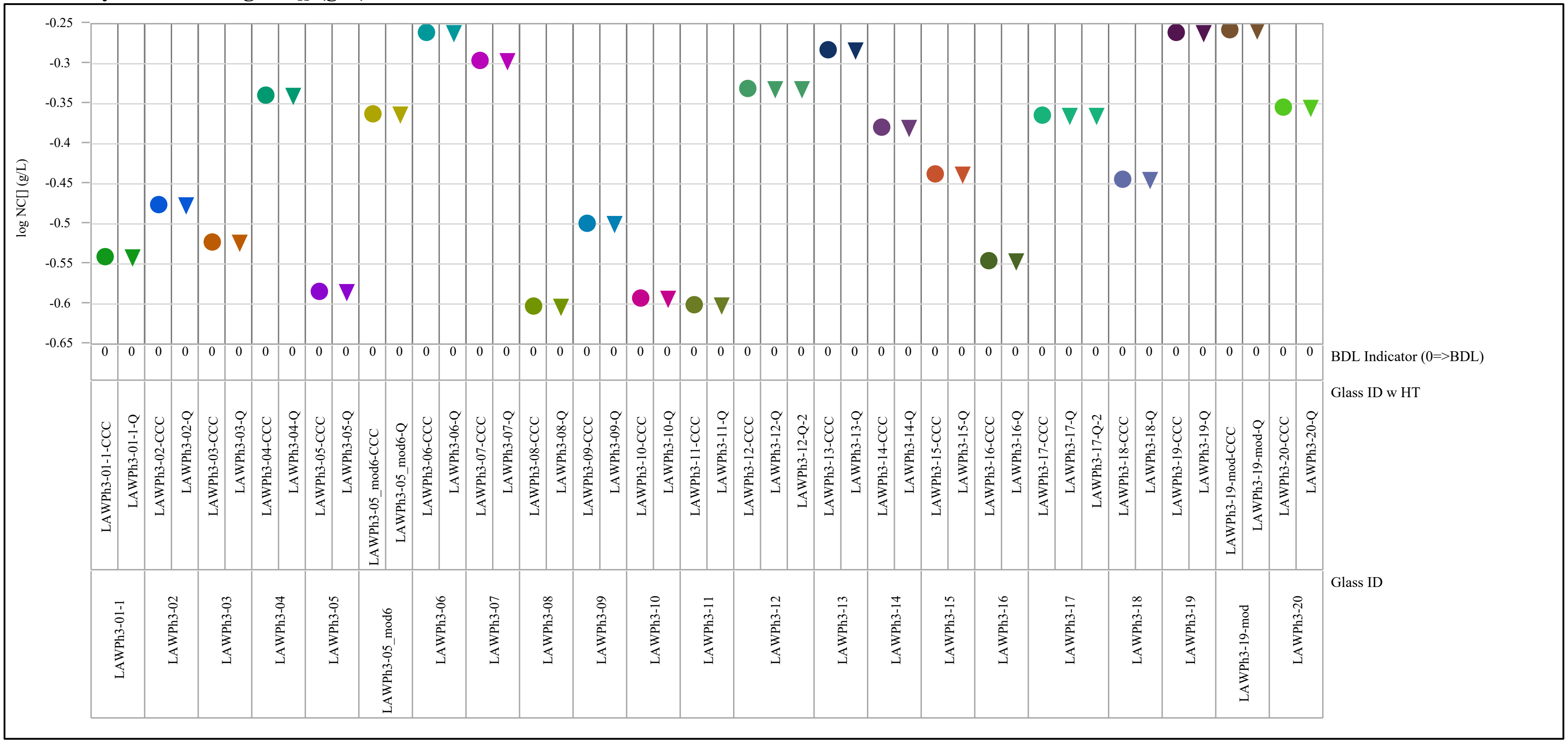


Exhibit H-1. Normalized PCT Results by Compositional View by Heat Treatment for Each Glass (continued)

Analyte=Zr, Comp View=Ref
Variability Chart for log NC[] (g/L)

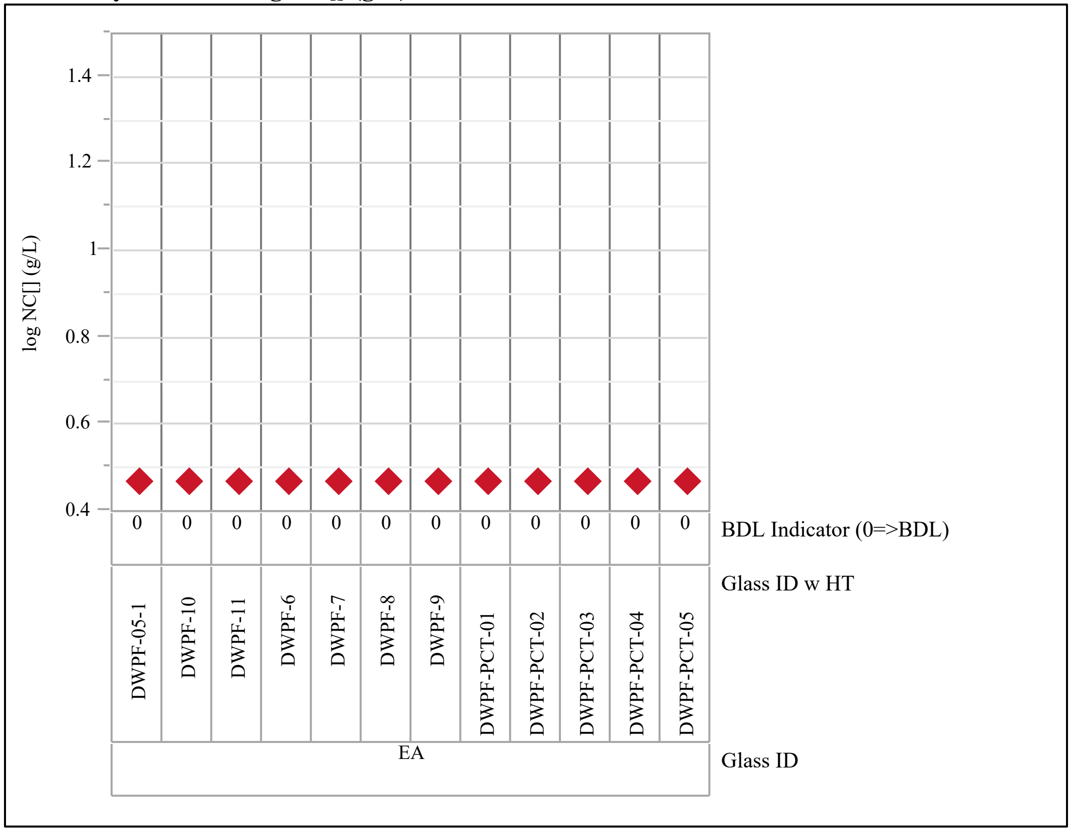


Exhibit H-1. Normalized PCT Results by Compositional View by Heat Treatment for Each Glass (continued)

Analyte=Zr, Comp View=targeted
Variability Chart for log NC[] (g/L)

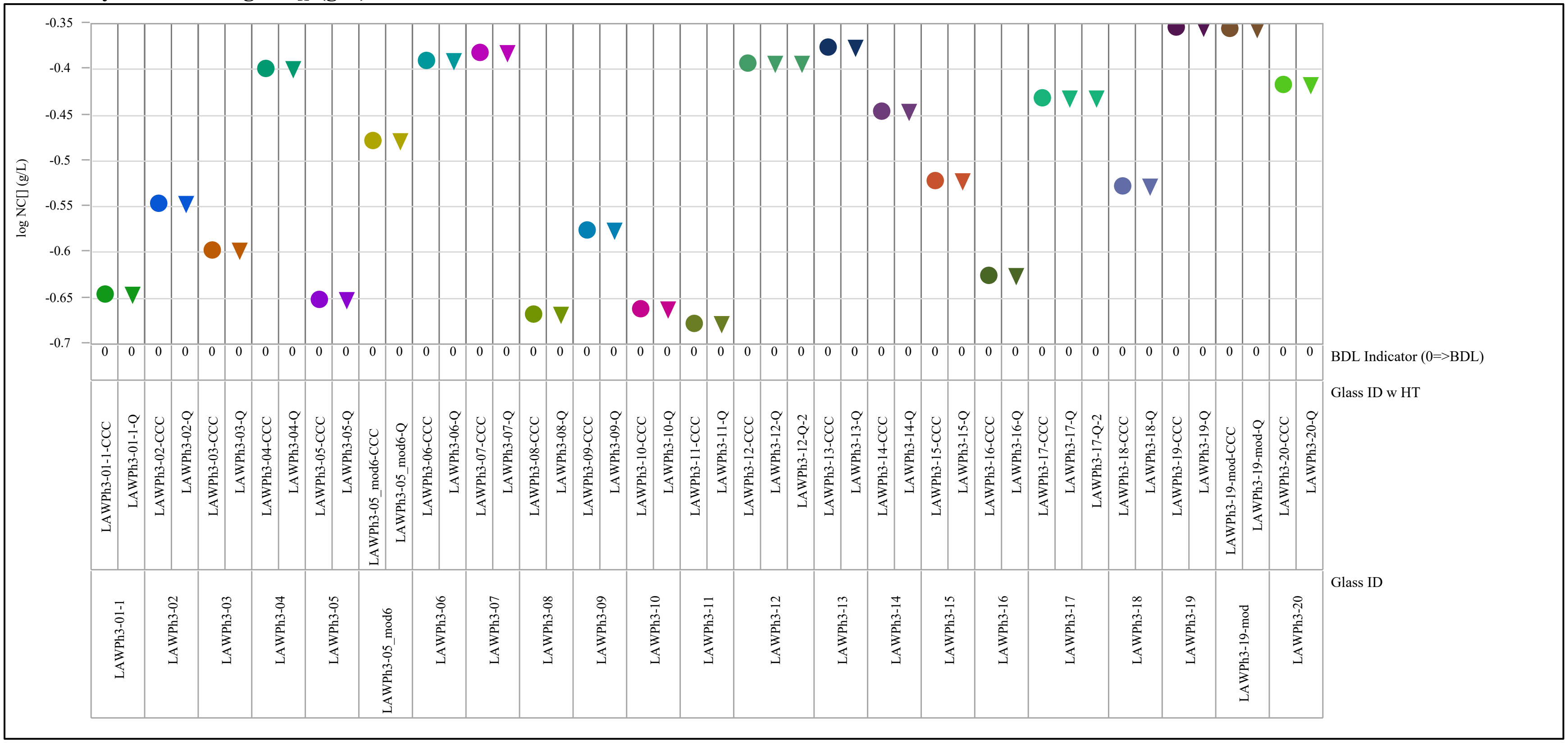


Table H-1. Normalized PCT Results

Set	PNNL Group	Glass Description	Comp. View	NC_{Al} (g/L)	NC_{B} (g/L)	NC_{Cr} (g/L)	NC_{Li} (g/L)	NC_{Na} (g/L)	NC_{Si} (g/L)	NC_{Zr} (g/L)
First	Others	DWPF-05-1	Ref	< 0.511	12.274	NA	7.093	10.028	2.976	< 2.937
First	1	DWPF-PCT-01	Ref	2.975	19.186	NA	9.670	15.107	3.787	< 2.937
First	2	DWPF-PCT-02	Ref	2.933	19.288	NA	9.869	15.270	3.974	< 2.937
First	3	DWPF-PCT-03	Ref	< 0.511	18.025	NA	9.247	14.196	3.822	< 2.937
First	4	DWPF-PCT-04	Ref	< 0.511	8.496	NA	5.336	7.037	2.265	< 2.937
First	5	DWPF-PCT-05	Ref	< 0.511	12.026	NA	6.939	9.910	2.890	< 2.937
Second	6	DWPF-6	Ref	< 0.511	9.142	NA	5.437	7.476	2.590	< 2.937
Second	7	DWPF-7	Ref	< 0.511	12.123	NA	6.838	9.296	3.008	< 2.937
Second	8	DWPF-8	Ref	1.062	83.500	NA	55.544	68.272	24.103	< 2.937
Second	9	DWPF-9	Ref	< 0.511	10.804	NA	6.166	8.326	2.797	< 2.937
Second	10	DWPF-10	Ref	< 0.511	10.755	NA	6.393	8.591	2.788	< 2.937
Second	11	DWPF-11	Ref	< 0.511	14.540	NA	7.678	10.765	3.381	< 2.937
Second	6	LAWPh3-01-1-CCC	measured	< 0.295	6.193	5.195	NA	5.900	1.000	< 0.287
Second	6	LAWPh3-01-1-CCC	targeted	< 0.287	6.578	4.620	NA	5.545	1.012	< 0.226
First	1	LAWPh3-01-1-Q	measured	1.808	8.483	10.031	NA	7.944	0.994	< 0.287
First	1	LAWPh3-01-1-Q	targeted	1.761	9.009	8.921	NA	7.467	1.005	< 0.226
Second	6	LAWPh3-02-CCC	measured	< 0.287	13.870	12.030	NA	11.194	1.600	< 0.333
Second	6	LAWPh3-02-CCC	targeted	< 0.275	13.101	11.226	NA	10.533	1.527	< 0.283
First	1	LAWPh3-02-Q	measured	1.711	15.940	17.496	NA	13.940	1.692	< 0.333
First	1	LAWPh3-02-Q	targeted	1.643	15.057	16.327	NA	13.117	1.614	< 0.283
Second	6	LAWPh3-03-CCC	measured	< 0.291	3.924	< 4.566	NA	3.924	0.967	< 0.300
Second	6	LAWPh3-03-CCC	targeted	< 0.291	4.194	< 4.249	NA	3.614	1.033	< 0.252
First	1	LAWPh3-03-Q	measured	1.708	7.018	11.719	NA	7.070	1.343	< 0.300
First	1	LAWPh3-03-Q	targeted	1.705	7.501	10.905	NA	6.513	1.434	< 0.252
Second	6	LAWPh3-04-CCC	measured	< 0.303	1.492	< 3.260	NA	2.033	0.475	< 0.457
Second	6	LAWPh3-04-CCC	targeted	< 0.297	1.460	< 2.959	NA	1.879	0.472	< 0.398
First	2	LAWPh3-04-Q	measured	1.847	2.620	5.527	NA	3.522	0.759	< 0.457
First	2	LAWPh3-04-Q	targeted	1.812	2.564	5.016	NA	3.255	0.754	< 0.398
First	2	LAWPh3-05-Q	measured	1.837	3.836	5.688	NA	3.864	0.839	< 0.260
First	2	LAWPh3-05-Q	targeted	1.857	3.753	5.347	NA	3.584	0.853	< 0.223
Second	8	LAWPh3-05-CCC	measured	< 0.323	2.078	< 2.791	NA	2.116	0.461	< 0.260
Second	8	LAWPh3-05-CCC	targeted	< 0.326	2.033	< 2.624	NA	1.963	0.469	< 0.223
Second	7	LAWPh3-05_mod6-CCC	measured	< 0.327	9.271	0.584	NA	9.086	2.010	< 0.433
Second	7	LAWPh3-05_mod6-CCC	targeted	< 0.303	11.125	5.568	NA	8.245	1.878	< 0.333
Second	11	LAWPh3-05_mod6-Q	measured	< 0.390	11.067	0.945	NA	11.437	2.173	< 0.433
Second	11	LAWPh3-05_mod6-Q	targeted	< 0.361	13.280	9.004	NA	10.379	2.030	< 0.333
Second	7	LAWPh3-06-CCC	measured	0.708	0.965	< 2.865	NA	3.793	0.524	< 0.546
Second	7	LAWPh3-06-CCC	targeted	0.701	1.068	< 2.507	NA	3.571	0.531	< 0.406
First	2	LAWPh3-06-Q	measured	1.499	< 0.579	3.429	NA	2.109	0.339	< 0.546
First	2	LAWPh3-06-Q	targeted	1.482	< 0.641	3.000	NA	1.985	0.344	< 0.406

Table H-1. Normalized PCT Results (continued)

Set	PNNL Group	Glass Description	Comp. View		NC_{Al} (g/L)		NC_B (g/L)		NC_{Cr} (g/L)		NC_{Li} (g/L)		NC_{Na} (g/L)		NC_{Si} (g/L)		NC_{Zr} (g/L)
Second	8	LAWPh3-07-CCC	measured	<	0.312		1.294	<	4.619		NA		1.946	<	0.272	<	0.504
Second	8	LAWPh3-07-CCC	targeted	<	0.293		1.269	<	4.443		NA		1.856	<	0.264	<	0.415
First	2	LAWPh3-07-Q	measured		1.670		1.022		5.662		NA		2.450		0.534	<	0.504
First	2	LAWPh3-07-Q	targeted		1.572		1.002		5.446		NA		2.336		0.518	<	0.415
Second	8	LAWPh3-08-CCC	measured	<	0.327		0.677	<	3.404		NA		1.291		0.216	<	0.249
Second	8	LAWPh3-08-CCC	targeted	<	0.325		0.708	<	3.123		NA		1.213		0.223	<	0.215
First	3	LAWPh3-08-Q	measured	<	0.285		0.657	<	3.404		NA		1.392		0.344	<	0.249
First	3	LAWPh3-08-Q	targeted	<	0.283		0.687	<	3.123		NA		1.307		0.356	<	0.215
Second	8	LAWPh3-09-CCC	measured		0.666		37.449		28.725		NA		22.445		1.121	<	0.316
Second	8	LAWPh3-09-CCC	targeted		0.627		34.890		26.395		NA		20.682		1.136	<	0.265
First	3	LAWPh3-09-Q	measured		0.359		2.443	<	5.215		NA		3.586		0.608	<	0.316
First	3	LAWPh3-09-Q	targeted		0.338		2.276	<	4.792		NA		3.305		0.616	<	0.265
Second	8	LAWPh3-10-CCC	measured	<	0.734		4.723		6.671		NA		6.352		1.267	<	0.255
Second	8	LAWPh3-10-CCC	targeted	<	0.722		4.859		6.009		NA		5.970		1.317	<	0.218
First	3	LAWPh3-10-Q	measured		0.369		1.623	<	4.494		NA		2.625		0.479	<	0.255
First	3	LAWPh3-10-Q	targeted		0.364		1.669	<	4.049		NA		2.467		0.498	<	0.218
Second	9	LAWPh3-11-CCC	measured		0.362		2.877	<	2.694		NA		2.608		0.499	<	0.251
Second	9	LAWPh3-11-CCC	targeted		0.344		2.903	<	2.587		NA		2.552		0.491	<	0.210
First	3	LAWPh3-11-Q	measured		0.372		3.216	<	2.694		NA		3.006		0.487	<	0.251
First	3	LAWPh3-11-Q	targeted		0.354		3.245	<	2.587		NA		2.942		0.479	<	0.210
Second	9	LAWPh3-12-CCC	measured	<	0.177		1.593	<	3.774		NA		1.219		0.133	<	0.466
Second	9	LAWPh3-12-CCC	targeted	<	0.170		1.559	<	3.423		NA		1.149		0.130	<	0.405
First	3	LAWPh3-12-Q	measured	<	0.195		2.779	<	3.774		NA		2.039		0.173	<	0.466
First	3	LAWPh3-12-Q	targeted	<	0.187		2.720	<	3.423		NA		1.920		0.169	<	0.405
Second	11	LAWPh3-12-Q-2	measured		0.219		3.183	<	3.774		NA		2.283		0.226	<	0.466
Second	11	LAWPh3-12-Q-2	targeted		0.210		3.115	<	3.423		NA		2.150		0.220	<	0.405
Second	9	LAWPh3-13-CCC	measured		18.279		217.894		68.275		NA		191.840		19.697	<	0.522
Second	9	LAWPh3-13-CCC	targeted		16.913		199.975		65.681		NA		181.563		19.224	<	0.420
First	3	LAWPh3-13-Q	measured		0.412		0.882	<	2.620		NA		2.720		0.484	<	0.522
First	3	LAWPh3-13-Q	targeted		0.381		0.809	<	2.520		NA		2.574		0.472	<	0.420
Second	9	LAWPh3-14-CCC	measured	<	0.722		3.463		7.038		NA		5.427		1.463	<	0.417
Second	9	LAWPh3-14-CCC	targeted	<	0.700		3.599		6.680		NA		5.121		1.452	<	0.358
First	4	LAWPh3-14-Q	measured	<	0.327		1.534	<	4.843		NA		2.796		0.724	<	0.417
First	4	LAWPh3-14-Q	targeted	<	0.317		1.594	<	4.596		NA		2.639		0.718	<	0.358
Second	9	LAWPh3-15-CCC	measured	<	0.345		2.263	<	3.717		NA		3.112		0.591	<	0.364
Second	9	LAWPh3-15-CCC	targeted	<	0.326		2.138	<	3.399		NA		2.903		0.563	<	0.300
First	4	LAWPh3-15-Q	measured		0.361		1.847	<	3.717		NA		3.162		0.559	<	0.364
First	4	LAWPh3-15-Q	targeted		0.342		1.745	<	3.399		NA		2.950		0.533	<	0.300

Table H-1. Normalized PCT Results (continued)

Set	PNNL Group	Glass Description	Comp. View	NC_{Al} (g/L)	NC_{B} (g/L)	NC_{Cr} (g/L)	NC_{Li} (g/L)	NC_{Na} (g/L)	NC_{Si} (g/L)	NC_{Zr} (g/L)
Second	10	LAWPh3-16-CCC	measured	< 0.440	4.605	4.330	NA	5.543	0.847	< 0.284
Second	10	LAWPh3-16-CCC	targeted	< 0.415	4.532	3.924	NA	5.314	0.827	< 0.237
First	4	LAWPh3-16-Q	measured	< 0.328	5.581	4.487	NA	7.110	1.416	< 0.284
First	4	LAWPh3-16-Q	targeted	< 0.309	5.493	4.066	NA	6.816	1.384	< 0.237
Second	10	LAWPh3-17-CCC	measured	2.226	16.327	4.288	NA	13.294	1.004	< 0.432
Second	10	LAWPh3-17-CCC	targeted	2.186	17.706	3.765	NA	12.381	1.038	< 0.370
First	4	LAWPh3-17-Q	measured	0.448	0.981	< 4.246	NA	3.678	0.683	< 0.432
First	4	LAWPh3-17-Q	targeted	0.440	1.064	< 3.729	NA	3.425	0.706	< 0.370
Second	11	LAWPh3-17-Q-2	measured	0.340	1.090	< 4.246	NA	2.843	0.566	< 0.432
Second	11	LAWPh3-17-Q-2	targeted	0.334	1.182	< 3.729	NA	2.648	0.585	< 0.370
Second	10	LAWPh3-18-CCC	measured	0.339	1.074	< 3.152	NA	1.609	0.318	< 0.359
Second	10	LAWPh3-18-CCC	targeted	0.322	1.042	< 3.058	NA	1.558	0.309	< 0.297
First	5	LAWPh3-18-Q	measured	0.381	0.930	< 3.152	NA	1.736	0.454	< 0.359
First	5	LAWPh3-18-Q	targeted	0.362	0.902	< 3.058	NA	1.681	0.442	< 0.297
Second	10	LAWPh3-19-CCC	measured	< 0.306	1.419	< 4.338	NA	1.531	0.338	< 0.547
Second	10	LAWPh3-19-CCC	targeted	< 0.292	1.385	< 3.918	NA	1.459	0.333	< 0.442
First	5	LAWPh3-19-Q	measured	< 0.358	< 0.744	< 4.338	NA	1.626	0.280	< 0.547
First	5	LAWPh3-19-Q	targeted	< 0.341	< 0.726	< 3.918	NA	1.550	0.276	< 0.442
Second	11	LAWPh3-19-mod-CCC	measured	1.265	1.254	< 0.413	NA	3.432	0.512	< 0.551
Second	11	LAWPh3-19-mod-CCC	targeted	1.150	1.425	< 3.950	NA	3.049	0.483	< 0.441
Second	8	LAWPh3-19-mod-Q	measured	< 0.346	0.881	< 0.413	NA	2.458	0.443	< 0.551
Second	8	LAWPh3-19-mod-Q	targeted	< 0.315	1.001	< 3.950	NA	2.184	0.418	< 0.441
Second	10	LAWPh3-20-CCC	measured	< 0.376	42.465	7.427	NA	34.535	4.431	< 0.442
Second	10	LAWPh3-20-CCC	targeted	< 0.366	40.673	6.967	NA	32.582	4.493	< 0.383
First	5	LAWPh3-20-Q	measured	< 0.321	1.004	< 3.810	NA	1.570	0.424	< 0.442
First	5	LAWPh3-20-Q	targeted	< 0.313	0.962	< 3.574	NA	1.481	0.430	< 0.383

Distribution:

J. W. Amoroso, 999-W
T. B. Brown, 773-A
A. D. Cozzi, 999-W
C. L. Crawford, 773-42A
W. C. Eaton, PNNL
T. B. Edwards, 999-W
A. P. Fellinger, 773-42A
S. D. Fink, 773-A
K. M. Fox, 999-W
H. K. Hall, 999-1W
C. C. Herman, 773-A
A. M. Howe, 999-W
M. C. Hsieh, 999-W
T. Jin, PNNL
F. C. Johnson, 999-W
D. S. Kim, PNNL
A. A. Kruger, DOE-ORP
C. E. Lonergan, PNNL
J. Manna, 999-W
D. J. McCabe, 773-42A
D. L. McClane, 999-W
G. A. Morgan, 999-W
F. M. Pennebaker, 773-42A
W. T. Riley, 999-1W
R. L. Russell, PNNL
M. J. Schweiger, PNNL
C. L. Trivelpiece, 999-W
J. D. Vienna, PNNL
B. J. Wiedenman, 773-42A
W. R. Wilmarth, 773-A
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