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Sulfur Solubility Testing and Characterization of Hanford LAW Phase 2, Outer Layer Matrix Glasses

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EXECUTIVE SUMMARY

In this report, the Savannah River National Laboratory (SRNL) provides chemical analyses and Product Consistency Test (PCT) results for a series of simulated Low-Activity Waste (LAW) glass compositions. A procedure developed at the Pacific Northwest National Laboratory (PNNL) for producing sulfur saturated melts (SSMs) was carried out at both SRNL and PNNL to fabricate the glasses characterized in this report. This method includes triplicate melting steps with excess sodium sulfate, followed by grinding and washing to remove unincorporated sulfur salts. The wash solutions were also analyzed as part of this study. These data will be used in the development of improved property/composition models for LAW glass.

Chemical analyses were performed on a representative sample of each of the baseline and sulfur saturated glasses to allow for comparisons with the targeted compositions. An additional dissolution technique, sodium peroxide fusion with the addition of sulfuric acid, was used to obtain improved measurements of the P and Zr concentrations of the study glasses. Minor differences between the targeted and measured concentrations of some of the baseline (quenched) glass components were noted. The measured concentrations of several components of the SSM glasses were low as compared to those of the quenched versions. The measured SO_3 concentrations were higher for SSM versions of the study glasses, as expected.

The PCT Method-A was performed in triplicate on each of the quenched and canister centerline cooled (CCC) versions of the baseline glasses to assess chemical durability. It was noted that some of the leachates had a yellow color after the PCT. For some of the study glasses, the CCC heat treatment resulted in increased normalized release values as compared to those of the quenched versions. Several of the study glasses have normalized concentration (NC_i) values that are higher than those of the Hanford Waste Treatment and Immobilization Plant (WTP) contract limit of 2.0 g/m^2 (~4 g/L) for B, Na, and Si.

Chemical analyses were also performed on a representative sample of each of the wash solutions resulting from the preparation of the SSM versions of the study glasses. The measured concentrations of B, Ca, Cr, K, and V 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 S were in the range of about 325-1775 mg/L. Glass LP2-OL-13 stood out as generating the highest concentrations of several species in its wash solution, although there didn’t appear to be any obvious link to composition or PCT performance. It is recommended that PNNL examine this result further as part of its broader review of these data.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF ABBREVIATIONS

ARM-1	Approved Reference Material
BDL	Below Detection Limit
CCC	Canister Centerline Cooled
DI	De-ionized
DOE	U.S. Department of Energy
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
OM	Optical Microscopy
ORP	Office of River Protection
PCT	Product Consistency Test
PF	Peroxide Fusion
PFSA	Peroxide Fusion with Sulfuric Acid addition
PNNL	Pacific Northwest National Laboratory
ppm	Parts Per Million
Q	Quenched
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, sulfur saturation data, and Product Consistency Test (PCT) results for several simulated LAW glasses. These 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 resulting data will be used in the development of improved property/composition models for LAW glass.

2.0 Experimental Procedure

2.1 <u>Quality Assurance</u>

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 C3489-00079-19 and C3489-00079-22. The glasses provided by PNNL were fabricated following Test Instructions EWG-TI-0056, EWG-TI-0057, and EWG-TI-0060.

2.2 <u>Glasses Selected for Study</u>

The baseline (quenched) glass compositions were selected and fabricated at the Pacific Northwest National Laboratory (PNNL). Identifiers for each of the glasses are listed in Table 2-1. The procedure for producing sulfur saturated melts (SSMs) of these glasses was carried out at both SRNL and PNNL, as shown in Table 2-1. PNNL also provided canister centerline cooled versions of each of the glasses listed in Table 2-1, which, along with the quenched versions, were included in the PCTs.

In the sections that follow, the procedure used for producing the SSMs and removing excess sulfur is briefly described, the methods used for measuring chemical compositions of the glasses and performing the PCTs are described, and reviews of the resulting data are provided. Detailed data from these analyses are included in the appendices.

Table 2-1. Identifier and Lab Responsible for Preparing Each Sulfur Saturated Melt (SSM)

Glass Identifier	SSM Preparation	SSM Glass Identifier
LP2-OL-01-3Q	SRNL	LP2-OL-01-3SSM
LP2-OL-02-1Q	PNNL	LP2-OL-02-1SSM
LP2-OL-03-MOD2Q	PNNL	LP2-OL-03-MOD2SSM
LP2-OL-04-1Q	SRNL	LP2-OL-04-1SSM
LP2-OL-05Q	SRNL	LP2-OL-05SSM
LP2-OL-07-1Q	SRNL	LP2-OL-07-1SSM
LP2-OL-08-MODQ	PNNL	LP2-OL-08-MODSSM
LP2-OL-09-1Q	SRNL	LP2-OL-09-1SSM
LP2-OL-10-MODQ	PNNL	LP2-OL-10-MODSSM
LP2-OL-11Q	SRNL	LP2-OL-11SSM
LP2-OL-12Q	SRNL	LP2-OL-12SSM
LP2-OL-13Q	SRNL	LP2-OL-13SSM
LP2-OL-14Q	SRNL	LP2-OL-14SSM
LP2-OL-15Q	SRNL	LP2-OL-15SSM
LP2-OL-16-MODQ	PNNL	LP2-OL-16-MODSSM
LP2-OL-17Q	SRNL	LP2-OL-17SSM
LP2-OL-18Q	PNNL	LP2-OL-18SSM
LP2-OL-19Q	SRNL	LP2-OL-19SSM
LP2-OL-20Q	SRNL	LP2-OL-20SSM
LP2-OL-21Q	SRNL	LP2-OL-21SSM
LP2-OL-22Q	SRNL	LP2-OL-22SSM
LP2-OL-23Q	PNNL	LP2-OL-23SSM
LP2-OL-24Q	PNNL	LP2-OL-24SSM
LP2-OL-25Q	SRNL	LP2-OL-25SSM

2.3 Preparation of Sulfur Saturated Melts

A methodology for the preparation of the SSMs and for the removal (washing) of excess sulfur was developed at PNNL and is outlined in a test instruction.[3] Implementation of the methodology at SRNL is described in detail in a previous report on the Phase 1 glasses of this study.[4]

Briefly, the as-received, baseline glasses were first ground in an Angstrom, Inc., TE250 Laboratory Ring Pulverizer until all the glass powder passed through a 100 mesh sieve. Next, 50 g of ground baseline glass and 3.82 g of Na_2SO_4 were combined by blending in the ring pulverizer for about 30 seconds. The mixture was melted at 1150 °C for approximately 1 hour in a platinum/gold alloy crucible. The glass was then quenched on a steel plate. The grinding and melting process was repeated two more times to maximize sulfur incorporation in the glass, with the resulting glasses being described as SSMs.

The identifiers given in Table 2-1 were modified by replacing the suffix "Q" with the suffix "SSM" to designate the sulfur saturated melts as indicated. Complete details of the grinding and melting process were recorded on log sheets for each of the study glasses. These log sheets are included as Exhibit A-1 of Appendix A. Masses recorded during the process are tabulated in Table A-1 of Appendix A.

Photographs of the SSMs taken after the first and third re-melting steps are included as Exhibit B-1 in Appendix B. Each of the SSMs was examined using optical microscopy (OM) to identify whether the glass was homogeneous and whether visible crystals were present after the third re-melting step. Optical micrographs of each of the SSMs, at two levels of magnification, are included as Exhibit B-2 in Appendix B. Fracture surfaces resulting from pouring and quenching the glasses were imaged. In general, inclusions that appear to be sulfur salts are visible in all the glasses, along with varying amounts of small bubbles.

2.4 Removal of Excess Sulfur

Each of the SSMs was ground, washed, and filtered to remove excess sulfur prior to further analysis. This methodology was developed at PNNL and is outlined in a test instruction.[3] Implementation of the methodology at SRNL is described in detail in a previous report on the Phase 1 glasses of this study.[4]

Briefly, about 4 g of each of the SSM glasses was ground in the ring pulverizer such that the resulting powder passed through a 120 mesh (125 µm) sieve. The powders were washed with about 100 mL of de-ionized (DI) water in a beaker immersed in an ultrasonic bath followed by vacuum assisted filtering with a 0.2 µm polyvinylidene difluoride membrane disc filter. The filter with glass powder was placed in a 90 °C oven overnight to dry. The dried glass powder sample was placed into a labeled vial for further analysis. The washing and filtering steps were repeated for some of the study glasses with a second ~4 g sample to obtain a sufficient mass of washed glass to support composition analyses. Samples of the wash solutions were also collected for analysis. The suffix "-W" was appended to the SSM glass identifiers to indicate the wash solutions resulting from the preparation of each glass.

Complete details of the grinding, washing, and filtering process to remove excess sulfur were recorded on log sheets for each of the study glasses. These log sheets are included as Exhibit A-2 of Appendix A. Masses recorded during the process are tabulated in Table A-2 of Appendix A.

2.5 Glass Composition Analysis

Chemical analyses were performed under the auspices of an analytical plan[5] on a representative sample of each of the glasses listed in Table 2-1 to allow for comparisons with the targeted compositions. Three dissolution techniques, sodium peroxide fusion (PF),[6] lithium metaborate fusion (LM),[7] and potassium hydroxide fusion (KH),[8] were used for preparing each of the glass samples, in duplicate, for analysis. A fourth dissolution technique, PF with the addition of sulfuric acid (PFSA), was added later in the analyses due to difficulties in getting complete dissolution of P and Zr. These additional dissolutions are further described in Section 3.1.

Each of the duplicate samples was analyzed twice for each element of interest by Inductively Coupled Plasma – Atomic Emission Spectroscopy (ICP-AES)[9] or ion chromatography (IC),[10] 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)[11] were included as part of the analytical plan. The LRM composition reported as the "Consensus Average" is used as the reference composition of this glass for the purposes of this study.[11] 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	Measurement Method
Al	PF	ICP-AES
B	PF	ICP-AES
Ca	LM	ICP-AES
Cl	KH	IC
Cr	LM	ICP-AES
F	KH	IC
Fe	PF	ICP-AES
K	LM	ICP-AES
Li	PF	ICP-AES
Mg	LM	ICP-AES
Na	LM	ICP-AES
Ni	LM	ICP-AES
P	LM, PF, and PFSA	ICP-AES
S	LM	ICP-AES
Si	PF	ICP-AES
Sn	PF	ICP-AES
V	LM	ICP-AES
Zn	LM	ICP-AES
Zr	PF and PFSA	ICP-AES

2.6 Product Consistency Test

The PCT Method-A[12] was performed using three replicate samples of each of the quenched and WTP canister centerline cooled (CCC)[13] versions of the study glasses to assess chemical durability. Also included in the experimental test matrix were the Approved Reference Material (ARM-1) glass[14] and blanks from each vessel cleaning batch. Samples were ground, washed, and prepared according to the standard procedure.[12] Fifteen milliliters of Type-I ASTM water were added to 1.5 g of glass in stainless steel vessels.[a] The vessels were closed, sealed, and placed in an oven at 90 ± 2 °C where the samples were maintained at temperature for 7 days (+/-2%). The vessels were then removed from the oven and cooled to ambient temperature. Once cooled, an aliquot was drawn from each vessel and used to determine the ambient temperature pH of the leachate. The remaining solution from each vessel was sampled (filtered and acidified), then labeled and analyzed by ICP-AES under the auspices of a series of analytical plans.[15-17] Samples of a multi-element, standard solution[b] were also included in the analytical plan as a check on the accuracy of the ICP-AES instrument used for these measurements. Normalized concentrations were calculated based on the targeted (provided by PNNL) and measured (quenched) compositions using the average of the common logarithms of the leachate concentrations.

2.7 Wash Solution Analysis

Chemical analyses were performed under the auspices of an analytical plan[17] on a representative sample of each of the wash solutions from the glasses listed in Table 2-1 that resulted from the

[a] During the preparation two of the study glasses, LP2-OL-03-MOD2CCC and LP2-OL-08-MODCCC, were observed to dissolve somewhat in the washing process. After several alcohol rinses, the rinsates still were not clear. As a result, there was a smaller amount of these two glasses remaining after preparation. For these two glasses, 1.2 g of glass and 12.0 ml of leachant were used in each of the triplicate PCTs.

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

preparation steps described in Section 2.4. The samples were diluted based on the expected concentrations of the species in solution and acidified as appropriate (only when visible solids were present) in preparation for the analyses.

Each of the samples was analyzed in triplicate for each element of interest by ICP-AES[9] and IC.[10] 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 2-3.

Table 2-3. 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
Li	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

3.0 Results and Discussion

3.1 Review and Evaluation of the Glass Composition Measurements

During preliminary reviews of the chemical composition data, it was noted that the measured concentrations of P and Zr were lower than anticipated based on the targeted compositions of the glasses. Additional preparation methods were explored to determine whether better results could be obtained for these two analytes. An Aqua Regia preparation method was tested and was found to produce results that were poor relative to the those of the LM method. Measurements of the solutions prepared using Aqua Regia showed that P concentrations were not measurable when Zr was present in the glass, suggesting an interaction between these analytes during the preparation. A lithium tetraborate/nitrate preparation method was also tested, which again produced results that were poor relative to those of the LM method. Finally, a modified PF preparation was tested with an addition of sulfuric acid after the fused samples were removed from the furnace. This preparation method (referred to as PFSA) provided improved measurements for P and Zr concentrations, although the reported values remain somewhat below targeted values.

The study glasses were all prepared using the PFSA method and measured for P and Zr concentrations, although an analytical study plan was not used for these measurements due to time and budget constraints. Each sample was prepared a single time, with the resulting solutions measured twice by ICP-AES.

Further review showed that the preparation method that led to better results for P measurements appeared to be linked to the targeted concentration of P in each glass. Therefore, data from two of the preparation methods are used in reporting the measured values of P. For those glasses that targeted P_2O_5 concentrations of less than 1 weight percent (wt %), data from the LM preparation are used in reporting the measured concentrations of P. For those glasses that targeted P_2O_5 concentrations of 1 wt % or more, data from the PFSA preparation are used in reporting the measured concentrations of P.

Note that there was insufficient sample remaining for the PFSA preparation of glasses LP2-OL-02-1SSM and LP2-OL-10-MODSSM. Measurements of the Zr concentrations from the PF preparations of these glasses were therefore used in reporting their measured compositions. Measured P concentrations are reported from the LM preparation of glass LP2-OL-02-1SSM (targeted P_2O_5 concentration of 0.68 wt %), and from the PF preparation of glass LP2-OL-10-MODSSM (targeted P_2O_5 concentration of 1.52 wt %).

Note also that there was insufficient sample for the duplicate KH preparation of glass LP2-OL-18SSM. The duplicate measured values for the single preparation of this glass will be used in reporting its measured Cl and F concentrations.

Table C-1 and Table C-2 in Appendix C provide the elemental concentration measurements in wt % for the study glasses as prepared by the LM method. Table C-3 and Table C-4 in Appendix C provide the elemental concentration measurements in wt % for the study glasses as prepared by the PF method. Table C-5 in Appendix C provides the elemental concentration measurements in wt % for the study glasses as prepared by the KH method. Table C-6 in Appendix C provides the elemental concentration measurements in wt % for the study glasses as prepared by the PFSA method. Elemental measurements for samples of the LRM standard glass are also included in the tables of Appendix C. 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.)[18] was used to support these analyses.

3.1.1 Treatment of Detection Limits

The elemental concentrations in Table C-1 through Table C-6 of Appendix C 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 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.

3.1.2 Measurements in Analytical Sequence

Exhibit C-1 in Appendix C 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 C-1 through Table C-6 in Appendix C, 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. Only minor, block-to-block calibration shifts are seen. For example, minor calibration effects are visible between calibration blocks 2 and 3 of the second set of SiO_2 measurements. In all cases, the instrument check standards were within specification. These calibration effects are typical of ICP-AES analyses and are mitigated by taking the average of the measurements for each analyte.

3.1.3 Composition Measurements by Glass Identifier

Exhibit C-2 in Appendix C 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, K_2O, Na_2O, SiO_2, SO_3, 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 was used in determining representative, measured compositions for the study glasses.

3.1.4 Results for the LRM Standard

Exhibit C-3 in Appendix C provides a comparison of the LRM results to their acceptability limits utilized by SRNL.[9] 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

From the discussion of Section 3.1.3, all of the measurements for each oxide for each glass (i.e., all of the measurements in Table C-1 through Table C-6 in Appendix C) 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 C-4 in Appendix C 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 B_2O_3 and CaO are below the targeted values for some of the SSM versions of the study glasses.
- The measured concentrations of chlorine and fluorine are below the targeted values for most of the study glasses, and in particular for the SSM versions, likely because of volatility during melting.

- The measured concentrations of Cr_2O_3 are somewhat high relative to the targeted values for the quenched versions of the glasses and low for the SSM versions.
- The measured concentrations of Fe_2O_3 are above the targeted values for the quenched versions of the glasses and closer to the targeted values for the SSM versions.
- The measured concentrations of K_2O are below the targeted values for the SSM versions of the study glasses.
- The measured Na_2O concentrations are below the targeted values for several of the quenched versions of the study glasses. Also, the measured Na_2O concentrations are below the targeted values for some of the SSM versions 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.
- 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.
- The measured ZrO_2 concentrations are below the targeted values for several of the study glasses. As described in Section 3.1, this appears to be related to the dissolution method used in the analysis.

Table C-7 in Appendix C 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 94.7 to 101.9 wt %, indicating acceptable recovery of the glass components. Entries in Table C-7 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 Comparison of Measured Compositions of Baseline and SSM Glasses

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

- The measured concentrations of Al_2O_3, B_2O_3, CaO, Cl^-, Cr, F^-, SiO_2, and SnO_2 were lower for most of the SSM glasses as compared to those of the quenched versions.
- The measured Cr_2O_3, Fe_2O_3, and K_2O concentrations were markedly lower for the SSM versions of the glasses as compared to the quenched versions.
- The measured Na_2O concentrations were lower for some of the SSM glasses relative to those of the quenched versions, but higher for others.
- The measured P_2O_5 concentrations were lower relative to those of the quenched versions for the SSM glasses that targeted more than 1 wt % P_2O_5.
- The measured SO_3 concentrations were higher for SSM versions of the study glasses, as expected.
- The measured V_2O_5 concentrations were lower than those of the quenched versions for the SSM glasses that targeted more than 3 wt % V_2O_5.
- Differences in the measured ZnO and ZrO_2 concentrations between the quenched and SSM versions varied depending on the glass composition.

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

The discussion of the analyses of the wash solutions, provided in Section 3.4, may provide further insight into the measured compositions of the SSM glasses.

3.3 Review and Evaluation of PCT Measurements

At the completion of each set of PCTs, yellow or yellowish leachates were observed for several of the study glasses. A summary of these observations and example photos are provided in Table 3-1. These leachates were characterized in the same fashion as the other, clear leachates.

Table 3-1. Observations of Discolored PCT Leachates

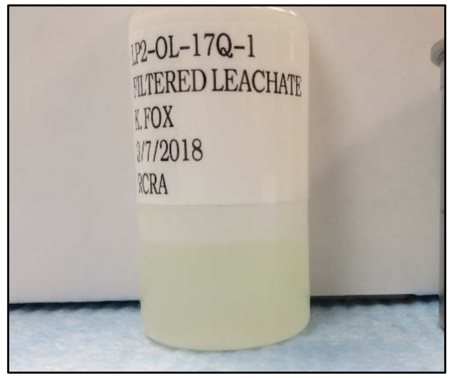
PCT Set	Glass ID	Observation	Example Photo
1	LP2-OL-04-1CCC LP2-OL-11Q LP2-OL-17Q	Faint yellow leachate	 (LP2-OL-17Q)
	LP2-OL-12Q LP2-OL-14Q	Yellow leachate	 (LP2-OL-12Q)
2	LP2-OL-11CCC LP2-OL-12CCC LP2-OL-13CCC LP2-OL-14CCC	Yellow leachate	 (LP2-OL-12CCC)

Table 3-1. Observations of Discolored PCT Leachates (continued)

<table>
<tr><th>PCT Set</th><th>Glass ID</th><th>Observation</th><th>Example Photo</th></tr>
<tr><td rowspan="2">3</td><td>LP2-OL-08-MODQ
LP2-OL-10-MODCCC
LP2-OL-16-MODCCC
LP2-OL-18CCC
LP2-OL-18Q
LP2-OL-24CCC</td><td>Faint
yellow leachate</td><td>(No photos taken)</td></tr>
<tr><td>LP2-OL-03-MOD2CCC
LP2-OL-08-MODCCC
LP2-OL-17CCC</td><td>Yellow leachate</td><td>

(LP2-OL-17CCC)</td></tr>
</table>

Table E-1 in Appendix E provides the elemental leachate concentration measurements for the solution samples generated by the PCTs for the study glasses and standards. The values for these measurements are given in the table as-received (“ar”) from the laboratory analyses and after adjustments for the dilution factors. The measurements for the study glasses, blanks, and the ARM-1 glass were multiplied by 1.6667 to determine the values in mg/L.

Based on the masses of the PCT vessels before and after the 7-day procedures, there were no water-loss issues. The ratio of leachant volume to the mass of ground glass was confirmed to be correct for each vessel. The measured concentrations of B, Li, Na, and Si in the leachates from the ARM-1 glasses fell within the control charts for these results, demonstrating proper performance of the PCTs.[14] The measured, ambient temperature pH values for each of the PCT leachates are provided in Table E-2, Table E-3, and Table E-4 of Appendix E for reference.

In the sections that follow, the analytical sequences of the measurements are explored, the measurements for each glass are reviewed, the measurements of the multi-element solution standard are investigated, the normalized PCT results for each glass are determined, and comparisons are made between the PCT results for the two heat treatments of each glass. JMP Pro Version 11.2.1 (SAS Institute, Inc.)[18] was used to support these analyses.

3.3.1 Treatment of Detection Limits

Some of the “ar” measurements (Table E-1 in Appendix E) were below the analytical detection limits. These measurements (indicated by a “<” symbol in Table E-1) were replaced by their detection limits in subsequent analyses for the purposes of data review and of calculating normalized leachate values. Those elements with measured concentrations that were below the associated detection limit will be denoted with a less than symbol (<) as the normalized leachate values are reported.

3.3.2 Results for the Samples of the Multi-Element Solution Standard

Table 3-2 provides a review of the measurements of the solution standard samples that were included in the analytical blocks for the PCT 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, 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 3-2 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 solutions.

Table 3-2. Results from Samples of the Multi-Element Solution Standard

Oven Run	1			2			3			Reference Values (mg/L)
Block	1	2	3	1	2	3	1	2	3	
Mean (B (mg/L))	20.60	18.67	20.07	19.67	20.47	20.77	20.70	19.37	20.03	20
Mean (Li (mg/L))	9.38	9.34	9.17	9.41	9.53	9.57	9.24	9.37	9.78	10
Mean (Na (mg/L))	83.03	77.70	79.57	77.33	78.33	77.40	83.73	78.13	77.60	81
Mean (Si (mg/L))	52.67	50.03	50.03	46.80	47.63	48.33	50.33	47.07	50.33	50
% relative bias B	3.0%	-6.7%	0.3%	-1.7%	2.3%	3.8%	3.5%	-3.2%	0.2%	<10% per ASTM C 1285
% relative bias Li	-6.2%	-6.6%	-8.3%	-5.9%	-4.7%	-4.3%	-7.6%	-6.3%	-2.2%	
% relative bias Na	2.5%	-4.1%	-1.8%	-4.5%	-3.3%	-4.4%	3.4%	-3.5%	-4.2%	
% relative bias Si	5.3%	0.1%	0.1%	-6.4%	-4.7%	-3.3%	0.7%	-5.9%	0.7%	
Std Dev (B (mg/L))	1.562	0.416	0.643	1.150	0.306	0.289	0.173	0.513	0.058	
Std Dev (Li (mg/L))	0.180	0.218	0.032	0.123	0.038	0.131	0.278	0.146	0.225	
Std Dev (Na (mg/L))	0.666	2.750	0.850	1.589	0.252	1.253	0.929	1.069	0.954	
Std Dev (Si (mg/L))	2.060	1.079	0.503	0.361	0.231	0.611	1.790	1.021	0.950	
%RSD (B (mg/L))	7.6%	2.2%	3.2%	5.8%	1.5%	1.4%	0.8%	2.6%	0.3%	<10% per ASTM C 1285
%RSD (Li (mg/L))	1.9%	2.3%	0.4%	1.3%	0.4%	1.4%	3.0%	1.6%	2.3%	
%RSD (Na (mg/L))	0.8%	3.5%	1.1%	2.1%	0.3%	1.6%	1.1%	1.4%	1.2%	
%RSD (Si (mg/L))	3.9%	2.2%	1.0%	0.8%	0.5%	1.3%	3.6%	2.2%	1.9%	

3.3.3 Measurements in Analytical Sequence

Exhibit E-1 in Appendix E provides plots of the common logarithms of the leachate concentrations (mg/L) in analytical sequence by analytical block by analytical set. Each of the analytical sets corresponds to an oven run that was used to conduct the PCT measurements needed to support the analyses of the study 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 were observed in a review of these plots.

3.3.4 Measurements by Glass Identifier

Exhibit E-2 in Appendix E provides plots of the leachate concentrations for both the quenched and CCC versions of each of the study glasses and for the standards for each analytical set. These plots are in common logarithms of the mg/L values and allow 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. It is noted that one of the measurements for boron for the quenched version of glass LP2-OL-20 in oven run 1 is somewhat higher (Lab ID J29) than the other two. However, all three values were used in calculating the normalized release for this glass. A closer look at the quenched and CCC outcomes is provided in the following sections.

3.3.5 Normalization of the PCT Results

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, 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, 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 C-7 of Appendix C). The calculated NC_i values are discussed further in the following sections.

[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.

3.3.6 Effects of Heat Treatments

Exhibit E-3 in Appendix E provides plots of the normalized PCT responses for the two heat treatments for each of the study glasses as well as the responses for ARM-1. 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 E-3 provide a graphical comparison between the PCT responses for the two heat treatments of each study glass. Table 3-3 provides a listing of the normalized PCT responses in g/L.

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

- The use of either the targeted or measured compositions in calculating the normalized concentration values has little if any practical effect.
- For some of the study glasses, the CCC heat treatment resulted in increased normalized release values as compared to those of the quenched versions.
  - Glass LP2-OL-18 was the most obvious exception, where the CCC heat treatment reduced the normalized release values for B, Na, and Si for this glass.
- Several of the study glasses have NC_i values that are higher than those of the WTP contract limit of 2.0 g/m^2 (~4 g/L) for B, Na, and Si.
- The CCC version of glass LP2-OL-12 had the highest NC_B value, about 35.8 g/L based on normalization to the measured composition.

PNNL may wish to perform a more complete review of the influence of composition and heat treatment on the PCT responses of the glasses described in this report to draw further conclusions, including any potential correlations with the methods used in selecting these glass compositions for study.

Table 3-3. Normalized PCT Results

Oven Run	Glass ID with Heat Treatment	Compositional View	NC_B (g/L)	NC_{Li} (g/L)	NC_{Na} (g/L)	NC_{Si} (g/L)
1	ARM	Ref	0.493	0.532	0.477	0.290
2	ARM	Ref	0.518	0.565	0.486	0.275
3	ARM	Ref	0.497	0.558	0.479	0.280
1	LP2-OL-01-3CCC	Measured	0.622	n/a	1.024	0.286
1	LP2-OL-01-3CCC	Targeted	0.625	n/a	0.955	0.292
1	LP2-OL-01-3Q	Measured	0.661	n/a	1.223	0.330
1	LP2-OL-01-3Q	Targeted	0.665	n/a	1.140	0.337
2	LP2-OL-02-1CCC	Measured	0.987	n/a	0.994	0.296
2	LP2-OL-02-1CCC	Targeted	0.959	n/a	0.983	0.314
1	LP2-OL-02-1Q	Measured	0.965	n/a	1.056	0.315
1	LP2-OL-02-1Q	Targeted	0.937	n/a	1.045	0.334
3	LP2-OL-03-MOD2CCC	Measured	1.762	n/a	14.666	1.762
3	LP2-OL-03-MOD2CCC	Targeted	1.642	n/a	14.511	1.693
3	LP2-OL-03-MOD2Q	Measured	0.795	n/a	2.580	0.414
3	LP2-OL-03-MOD2Q	Targeted	0.741	n/a	2.552	0.398
1	LP2-OL-04-1CCC	Measured	9.052	n/a	21.877	2.231
1	LP2-OL-04-1CCC	Targeted	9.449	n/a	20.573	2.304
1	LP2-OL-04-1Q	Measured	1.466	n/a	2.249	0.430
1	LP2-OL-04-1Q	Targeted	1.531	n/a	2.115	0.444
2	LP2-OL-05CCC	Measured	0.864	n/a	1.094	0.182
2	LP2-OL-05CCC	Targeted	0.862	n/a	0.990	0.190
1	LP2-OL-05Q	Measured	0.320	n/a	0.801	0.177
1	LP2-OL-05Q	Targeted	0.319	n/a	0.725	0.184
2	LP2-OL-07-1CCC	Measured	0.793	n/a	0.916	0.222
2	LP2-OL-07-1CCC	Targeted	0.813	n/a	0.845	0.224
1	LP2-OL-07-1Q	Measured	0.854	n/a	1.086	0.269
1	LP2-OL-07-1Q	Targeted	0.874	n/a	1.001	0.271
3	LP2-OL-08-MODCCC	Measured	18.783	n/a	23.842	1.985
3	LP2-OL-08-MODCCC	Targeted	18.526	n/a	22.386	1.979
3	LP2-OL-08-MODQ	Measured	2.570	n/a	4.816	0.875
3	LP2-OL-08-MODQ	Targeted	2.535	n/a	4.522	0.872
2	LP2-OL-09-1CCC	Measured	2.300	n/a	1.592	0.241
2	LP2-OL-09-1CCC	Targeted	2.309	n/a	1.453	0.246
1	LP2-OL-09-1Q	Measured	3.104	n/a	2.018	0.245
1	LP2-OL-09-1Q	Targeted	3.117	n/a	1.843	0.250
3	LP2-OL-10-MODCCC	Measured	10.236	n/a	5.133	0.415
3	LP2-OL-10-MODCCC	Targeted	9.581	n/a	5.007	0.408
3	LP2-OL-10-MODQ	Measured	0.362	n/a	0.829	0.191
3	LP2-OL-10-MODQ	Targeted	0.339	n/a	0.809	0.187
2	LP2-OL-11CCC	Measured	7.403	n/a	6.955	1.177
2	LP2-OL-11CCC	Targeted	7.129	n/a	6.675	1.235
1	LP2-OL-11Q	Measured	8.034	n/a	7.513	1.156
1	LP2-OL-11Q	Targeted	7.737	n/a	7.210	1.214
2	LP2-OL-12CCC	Measured	35.763	n/a	30.478	4.340
2	LP2-OL-12CCC	Targeted	35.740	n/a	28.587	4.489
1	LP2-OL-12Q	Measured	34.245	n/a	28.587	3.932
1	LP2-OL-12Q	Targeted	34.223	n/a	26.813	4.068

Table 3-3. Normalized PCT Results (continued)

Oven Run	Glass ID with Heat Treatment	Compositional View	NC_B (g/L)	NC_{Li} (g/L)	NC_{Na} (g/L)	NC_{Si} (g/L)
2	LP2-OL-13CCC	Measured	11.775	n/a	15.398	1.568
2	LP2-OL-13CCC	Targeted	11.643	n/a	14.231	1.560
1	LP2-OL-13Q	Measured	1.043	n/a	4.203	0.644
1	LP2-OL-13Q	Targeted	1.031	n/a	3.885	0.640
2	LP2-OL-14CCC	Measured	9.945	n/a	10.304	1.849
2	LP2-OL-14CCC	Targeted	9.921	n/a	9.293	1.788
1	LP2-OL-14Q	Measured	14.501	n/a	14.148	2.147
1	LP2-OL-14Q	Targeted	14.466	n/a	12.760	2.076
3	LP2-OL-15CCC	Measured	0.472	n/a	0.922	0.216
3	LP2-OL-15CCC	Targeted	0.477	n/a	0.840	0.221
1	LP2-OL-15Q	Measured	0.546	n/a	0.960	0.238
1	LP2-OL-15Q	Targeted	0.552	n/a	0.875	0.243
3	LP2-OL-16-MODCCC	Measured	2.231	n/a	2.210	0.710
3	LP2-OL-16-MODCCC	Targeted	2.179	n/a	2.153	0.753
3	LP2-OL-16-MODQ	Measured	2.670	n/a	2.681	0.852
3	LP2-OL-16-MODQ	Targeted	2.608	n/a	2.612	0.904
3	LP2-OL-17CCC	Measured	12.260	n/a	11.712	2.518
3	LP2-OL-17CCC	Targeted	12.632	n/a	10.825	2.582
1	LP2-OL-17Q	Measured	10.902	n/a	10.265	2.249
1	LP2-OL-17Q	Targeted	11.233	n/a	9.488	2.306
3	LP2-OL-18CCC	Measured	0.354	n/a	1.002	0.265
3	LP2-OL-18CCC	Targeted	0.350	n/a	0.968	0.259
3	LP2-OL-18Q	Measured	2.397	n/a	2.454	0.594
3	LP2-OL-18Q	Targeted	2.366	n/a	2.371	0.581
3	LP2-OL-19CCC	Measured	0.734	n/a	1.909	0.521
3	LP2-OL-19CCC	Targeted	0.739	n/a	1.743	0.483
1	LP2-OL-19Q	Measured	0.772	n/a	1.999	0.574
1	LP2-OL-19Q	Targeted	0.777	n/a	1.825	0.533
3	LP2-OL-20CCC	Measured	1.913	n/a	4.641	0.928
3	LP2-OL-20CCC	Targeted	1.848	n/a	4.560	0.886
1	LP2-OL-20Q	Measured	0.559	n/a	2.221	0.346
1	LP2-OL-20Q	Targeted	0.540	n/a	2.182	0.331
3	LP2-OL-21CCC	Measured	0.901	n/a	1.050	0.302
3	LP2-OL-21CCC	Targeted	0.895	n/a	1.003	0.328
1	LP2-OL-21Q	Measured	0.907	n/a	1.090	0.327
1	LP2-OL-21Q	Targeted	0.901	n/a	1.041	0.354
3	LP2-OL-22CCC	Measured	0.468	n/a	1.147	0.217
3	LP2-OL-22CCC	Targeted	0.459	n/a	1.051	0.215
1	LP2-OL-22Q	Measured	0.402	n/a	1.176	0.224
1	LP2-OL-22Q	Targeted	0.395	n/a	1.078	0.222
2	LP2-OL-23CCC	Measured	0.779	n/a	1.105	0.255
2	LP2-OL-23CCC	Targeted	0.753	n/a	1.077	0.266
1	LP2-OL-23Q	Measured	0.994	n/a	1.226	0.310
1	LP2-OL-23Q	Targeted	0.961	n/a	1.194	0.323
3	LP2-OL-24CCC	Measured	3.351	n/a	4.023	0.738
3	LP2-OL-24CCC	Targeted	3.242	n/a	4.030	0.718
1	LP2-OL-24Q	Measured	0.945	n/a	1.743	0.460
1	LP2-OL-24Q	Targeted	0.914	n/a	1.746	0.448

Table 3-3. Normalized PCT Results (continued)

Oven Run	Glass ID with Heat Treatment	Compositional View	NC_B (g/L)	NC_{Li} (g/L)	NC_{Na} (g/L)	NC_{Si} (g/L)
2	LP2-OL-25CCC	Measured	5.837	n/a	4.509	0.625
2	LP2-OL-25CCC	Targeted	5.697	n/a	4.138	0.642
1	LP2-OL-25Q	Measured	5.275	n/a	4.210	0.608
1	LP2-OL-25Q	Targeted	5.148	n/a	3.864	0.624

3.4 Review and Evaluation of Wash Solution Measurements

Table F-1 and Table F-2 in Appendix F provide the elemental concentration measurements in mg/L for the wash solutions as measured by ICP-AES. Table F-3 in Appendix F 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 F. 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.)[18] was used to support these analyses.

3.4.1 Treatment of Detection Limits

The elemental and anion concentrations in Table F-1 through Table F-3 of Appendix F 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.

3.4.2 Measurements in Analytical Sequence

Exhibit F-1 in Appendix F 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 F-1 through Table F-3 in Appendix F, 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.

3.4.3 Composition Measurements by Wash Solution Identifier

Exhibit F-2 in Appendix F provides plots of the elemental and anion concentration measurements grouped by the wash solution identifier (including the blanks and standard solutions). Different symbols and colors are used to represent the different solutions. Plotting the data in this format provides an opportunity to review the values for each individual solution as a function of the triplicate measurements. A review of the plots presented in these exhibits reveals the repeatability of the three individual values for each analyte for each solution. Minor scatter among the triplicate measurements of some of the analytes of the study glasses 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.

3.4.4 Results for the Standard Solutions

Table F-4 in Appendix F 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.

3.4.5 Measured Compositions of the Wash Solutions

From the discussion of Section 3.4.3, all of the measurements for each analyte for each wash solution (i.e., all of the measurements in Table F-1 through Table F-3 of Appendix F) were averaged to determine a representative chemical composition for each solution. Table F-5 and Table F-6 in Appendix F provide 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 F-5 and Table F-6:

- The measured concentrations of Al, Fe, Li, Mg, Sn, Zn, and Zr in the wash solutions were at or below the detection limits.
- The measured concentrations of Cl^- ranged from below detection limits to about 50 mg/L. The measured concentrations of F^- were below detection limits for most of the solutions, although LP2-OL-13W contained about 100 mg/L of F^-.
- The measured concentrations of B (about 10-75 mg/L), Ca (about 5-25 mg/L), Cr (about 30-200 mg/L), K (detection limit to about 1400 mg/L), and V (detection limit to about 90 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 625-1325 mg/L. This may be attributed to both the excess sodium sulfate added as part of the SSM preparation process, as well as to the lower measured concentrations of Na_2O in some of the SSM versions of the study glasses.
- The concentrations of P were measurable for most of the solutions by ICP-AES but several were below the detection limit of the IC method. The measured P concentrations ranged from the detection limit to about 25 mg/L.
- 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 325-1775 mg/L.
- The measured concentrations of Si ranged from about 5-150 mg/L.
- Glass LP2-OL-13 stands out as generating the highest concentrations of several species in its wash solution, although there doesn’t appear to be any obvious link to composition or PCT performance.

4.0 Summary

In this report, SRNL provides chemical analyses and PCT results for a series of simulated LAW glass compositions. A procedure developed at PNNL for producing sulfur saturated melts (SSMs) was carried out at both SRNL and PNNL to fabricate the glasses characterized in this report. This method includes triplicate melting steps with excess sodium sulfate, followed by grinding and washing to remove unincorporated sulfur salts. The wash solutions were also analyzed as part of this study. These data will be used in the development of improved property/composition models for LAW glass.

Chemical analyses were performed on a representative sample of each of the baseline and sulfur saturated glasses to allow for comparisons with the targeted compositions. Three dissolution techniques, sodium peroxide fusion, lithium metaborate fusion, and potassium hydroxide fusion, were used for preparing each of the glass samples, in duplicate, for analysis. Each of the duplicate samples was analyzed twice for each element of interest by ICP-AES or IC, for a total of four measurements per element per glass. Glass standards were intermittently measured to assess the performance of the analytical instruments over the course of these analyses. There were no issues with measurements of the glass standards. An additional dissolution technique, sodium peroxide fusion with the addition of sulfuric acid, was used to obtain improved measurements of the P and Zr concentrations of the study glasses.

A review of the individual glass composition measurements identified no analytical issues of concern. Some degree of scatter among the Al_2O_3, B_2O_3, CaO, K_2O, Na_2O, SiO_2, SO_3, V_2O_5, ZnO, and ZrO_2 measurements was noted. There were no indications of an error in preparation or measurement that had to be addressed in treatment of the data. Minor differences between the targeted and measured concentrations of some of the baseline (quenched) glass components were noted, including some low values for Al_2O_3, and Na_2O. The measured concentrations of Al_2O_3, B_2O_3, CaO, Cl^-, Cr, F^-, SiO_2, and SnO_2 were lower for most of the SSM glasses as compared to those of the quenched versions. The measured Cr_2O_3, Fe_2O_3, and K_2O concentrations were markedly lower for the SSM versions of the glasses as compared to the quenched versions. The measured SO_3 concentrations were higher for SSM versions of the study glasses, as expected.

The PCT Method-A was performed in triplicate on each of the quenched and CCC versions of the baseline glasses to assess chemical durability. A review of the leachate analyses and standard solution data identified no issues with the analytical methods. It was noted that some of the leachates had a yellow color after the PCT. Normalized concentrations were calculated based on the targeted (provided by PNNL) and measured (quenched, baseline) compositions using the average of the common logarithms of the leachate concentrations. The choice of compositional view (targeted or measured) had no practical impact on the PCT result for each of the study glasses. For some of the study glasses, the CCC heat treatment resulted in increased normalized release values as compared to those of the quenched versions. Glass LP2-OL-18 was the most obvious exception, where the CCC heat treatment reduced the normalized release values for B, Na, and Si for this glass. Several of the study glasses have NC_i values that are higher than those of the WTP contract limit of 2.0 g/m^2 (~4 g/L) for B, Na, and Si. The CCC version of glass LP2-OL-12 had the highest NC_B value, about 35.8 g/L based on normalization to the measured composition.

Chemical analyses were also performed on a representative sample of each of the wash solutions resulting from the preparation of the SSM versions of the study glasses. The samples were analyzed in triplicate for each element of interest by ICP-AES or IC. No issues were noted for the measurements of the solution standards. Minor scatter among the triplicate measurements of some of the analytes of the study glasses was noted. The measured concentrations of B, Ca, Cr, K, and V 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 625-1325 mg/L. This may be attributed to both the excess sodium sulfate added as part of the SSM preparation process, as well as to the lower measured concentrations of Na_2O in some of the SSM versions of the study glasses. 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 325-1775 mg/L. Glass LP2-OL-13 stands out as generating the highest concentrations of several species in its wash solution, although there doesn't appear to be any obvious link to composition or PCT performance. It is recommended that PNNL examine this result further as part of its broader review of these data.

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Appendix A Observations and Log Sheets for Sulfur Saturated Glass Fabrication

Exhibit A-1. Glass Melting History and Observations Log Sheets

First Re-Melt: History and Observations	
Glass ID:	LP2-OL-01-3Q
Person performing work:	M. Caldwell
Batch Preparation Details	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	12/14/2017
Number of additional 30 second milling intervals used:	Ø
Sieve size:	100
Mass of ground baseline glass (Target ~~100~~ 50 g): MC 12/14/17	50.009
Mass of Na_2SO_4 added (Target ~~7.64~~ 3.82 g): MC 12/14/17	3.822
Mix in Angstrom Mill (puck only + bag) for 30 sec., record date mixed:	12/14/2017
Glass Melt Details	
Crucible ID:	911-1
Mass of empty crucible (g):	88.427
Mass of crucible with glass and Na_2SO_4 (g):	MC 12/16/17 ~~53.277~~ 141.704
Balance ID:	AD-0044-1
Furnace ID:	MSE-006-16
Temperature and date/time into the furnace:	1150°C 12/16/2017 1:11
Temperature and date/time out of the furnace:	1150°C 12/16/2017 2:11
Quench Details	
Viscosity notes (describe consistency):	Thick
Observations (examples below): *Undissolved particles* *Crystallization/phase separation* *Color* *Residue on the pour plate* *Bubbles* *Surface appearance*	Glass is between lime and true green. All particles seem to be dissolved. There are quite a few sulfate bubbles. Sulfate is bright yellow. Glass is translucent.
Crucible and glass mass after cooling (g):	141.500

Exhibit A-1. Glass Melting History and Observations Log Sheets (continued)

Second Re-Melt: History and Observations	
Glass ID:	LP2-OL-Ø1-3Q
Person performing work:	M. Caldwell
Glass Preparation Details	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	12/18/17
Number of additional 30 second milling intervals used:	1
Sieve size:	100
Glass Melt Details	
Crucible ID:	911-1
Empty crucible mass (g):	98.441
Crucible with glass mass (g):	140.788
Balance ID:	AD-0044-1
Furnace ID:	MSE-006-16
Temperature and date/time into the furnace:	1150°C 12/19/17 9:35
Temperature and date/time out of the furnace:	1150°C 12/19/17 10:37
Quench Details	
Viscosity notes (describe consistency):	Thick
Observations (examples below): *Undissolved particles* *Crystallization/phase separation* *Color* *Residue on the pour plate* *Bubbles* *Surface appearance*	Same as first remelt. ~~Seems~~ Seems mc 12/19/17 to be a few more smaller sulfate inclusions.
Crucible and glass mass after cooling (g):	140.187

Exhibit A-1. Glass Melting History and Observations Log Sheets (continued)

Third Re-Melt: History and Observations	
Glass ID:	LP2-OL-Ø1-3Q
Person performing work:	M. Caldwell
Glass Preparation Details	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	12/21/17
Number of additional 30 second milling intervals used:	1
Sieve size:	100
Glass Melt Details	
Crucible ID:	911-1
Empty crucible mass (g):	88.432
Crucible with glass mass (g):	139.660
Balance ID:	AD-0044-1
Furnace ID:	MSE-006-16
Temperature and date/time into the furnace:	1150°C 12/27/17 9:49
Temperature and date/time out of the furnace:	1150°C 12/27/17 10:58
Quench Details	
Viscosity notes (describe consistency):	Very thick
Observations (examples below): *Undissolved particles* *Crystallization/phase separation* *Color* *Residue on the pour plate* *Bubbles* *Surface appearance*	Glass is between lime and true green. Glass is completely opaque. Just a few sulfate bubbles Sulfate is bright yellow.
Crucible and glass mass after cooling (g):	139.058

Exhibit A-1. Glass Melting History and Observations Log Sheets (continued)

First Re-Melt: History and Observations	
Glass ID:	LP2-OL-Ø4-1Q
Person performing work:	M. Caldwell
Batch Preparation Details	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	12/15/2017
Number of additional 30 second milling intervals used:	Ø
Sieve size:	100
Mass of ground baseline glass (Target ~~100~~ 50 g): MC 12/14/17	50.026
Mass of Na_2SO_4 added (Target ~~7.64~~ 3.82 g): MC 12/14/17	3.826
Mix in Angstrom Mill (puck only + bag) for 30 sec., record date mixed:	12/15/2017
Glass Melt Details	
Crucible ID:	911-2
Mass of empty crucible (g):	87.529
Mass of crucible with glass and Na_2SO_4 (g):	140.500
Balance ID:	AD-0044-1
Furnace ID:	MSE-006-16
Temperature and date/time into the furnace:	1150°C 12/16/2017 1:11
Temperature and date/time out of the furnace:	1150°C 12/16/2017 2:11
Quench Details	
Viscosity notes (describe consistency):	Poured easily
Observations (examples below): *Undissolved particles* *Crystallization/phase separation* *Color* *Residue on the pour plate* *Bubbles* *Surface appearance*	Glass is an olive green. All particles seem to be dissolved. Sulfate bubbles present. Sulfate is bright yellow w/green tint. Glass is translucent.
Crucible and glass mass after cooling (g):	140.105

Exhibit A-1. Glass Melting History and Observations Log Sheets (continued)

Second Re-Melt: History and Observations	
Glass ID:	LP2-OL-Ø4-1Q
Person performing work:	M.Caldwell
Glass Preparation Details	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	12/18/17
Number of additional 30 second milling intervals used:	Ø
Sieve size:	100
Glass Melt Details	
Crucible ID:	911-2
Empty crucible mass (g):	87.646
Crucible with glass mass (g):	139.594
Balance ID:	AD-0044-1
Furnace ID:	MSE-006-16
Temperature and date/time into the furnace:	1150°C 12/19/17 9:35
Temperature and date/time out of the furnace:	1150°C 12/19/17 10:37
Quench Details	
Viscosity notes (describe consistency):	Thin
Observations (examples below): *Undissolved particles* *Crystallization/phase separation* *Color* *Residue on the pour plate* *Bubbles* *Surface appearance*	Glass is same olive color. There is sulfate swirling in the glass, making it slightly opaque.
Crucible and glass mass after cooling (g):	139.360

Exhibit A-1. Glass Melting History and Observations Log Sheets (continued)

Third Re-Melt: History and Observations	
Glass ID:	LP2-OL-Ø4-1Q
Person performing work:	M. Caldwell
Glass Preparation Details	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	12/21/17
Number of additional 30 second milling intervals used:	Ø
Sieve size:	100
Glass Melt Details	
Crucible ID:	911-2
Empty crucible mass (g):	87.634
Crucible with glass mass (g):	138.592
Balance ID:	AD-0044-1
Furnace ID:	MSE-006-16
Temperature and date/time into the furnace:	1150°C 12/27/17 9:49
Temperature and date/time out of the furnace:	1150°C 12/27/17 10:58
Quench Details	
Viscosity notes (describe consistency):	Medium-thin
Observations (examples below): *Undissolved particles* *Crystallization/phase separation* *Color* *Residue on the pour plate* *Bubbles* *Surface appearance*	Glass is almost a brown. Glass is very slightly opaque with bubbles and swirls of sulfate. Sulfate is bright yellow.
Crucible and glass mass after cooling (g):	138.249

Exhibit A-1. Glass Melting History and Observations Log Sheets (continued)

First Re-Melt: History and Observations	
Glass ID:	LP2-OL-Ø5Q
Person performing work:	M. Caldwell
Batch Preparation Details	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	12/15/2017
Number of additional 30 second milling intervals used:	Ø
Sieve size:	100
Mass of ground baseline glass (Target ~~100~~ 50 g): MC 12/14/17	50.015
Mass of Na_2SO_4 added (Target ~~7.64~~ 3.82 g): MC 12/14/17	3.823
Mix in Angstrom Mill (puck only + bag) for 30 sec., record date mixed:	12/15/2017
Glass Melt Details	
Crucible ID:	911-3
Mass of empty crucible (g):	90.105
Mass of crucible with glass and Na_2SO_4 (g):	143.233
Balance ID:	AD-0044-1
Furnace ID:	MSE-0010-16
Temperature and date/time into the furnace:	1150°C 12/16/2017 1:11
Temperature and date/time out of the furnace:	1150°C 12/16/2017 2:11
Quench Details	
Viscosity notes (describe consistency):	Thick
Observations (examples below): *Undissolved particles* *Crystallization/phase separation* *Color* *Residue on the pour plate* *Bubbles* *Surface appearance*	Glass is a lighter olive green. Glass is relatively opaque. Sulfate bubbles present. Sulfate is a pale yellow.
Crucible and glass mass after cooling (g):	142.294

Exhibit A-1. Glass Melting History and Observations Log Sheets (continued)

Second Re-Melt: History and Observations	
Glass ID:	LP2-OL-05Q
Person performing work:	M.Caldwell
Glass Preparation Details	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	12/18/17
Number of additional 30 second milling intervals used:	1
Sieve size:	100
Glass Melt Details	
Crucible ID:	911-3
Empty crucible mass (g):	90.132
Crucible with glass mass (g):	141.754
Balance ID:	AD-0044-1
Furnace ID:	MSE-0016-16
Temperature and date/time into the furnace:	1150°C 12/19/17 9:35
Temperature and date/time out of the furnace:	1150°C 12/19/17 10:37
Quench Details	
Viscosity notes (describe consistency):	Thick consistency
Observations (examples below): *Undissolved particles* *Crystallization/phase separation* *Color* *Residue on the pour plate* *Bubbles* *Surface appearance*	Glass is more of ~~an~~ a jade green. It is still opaque with a few large sulfate bubbles.
Crucible and glass mass after cooling (g):	141.231

Exhibit A-1. Glass Melting History and Observations Log Sheets (continued)

Third Re-Melt: History and Observations	
Glass ID:	LP2-OL-Ø5Q
Person performing work:	M.Caldwell
Glass Preparation Details	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	12/21/17
Number of additional 30 second milling intervals used:	1
Sieve size:	100
Glass Melt Details	
Crucible ID:	911-3
Empty crucible mass (g):	90.117
Crucible with glass mass (g):	140.530
Balance ID:	AD-0044-1
Furnace ID:	MSE-006-16
Temperature and date/time into the furnace:	1150°C 12/27/17 9:49
Temperature and date/time out of the furnace:	1150°C 12/27/17 10:52
Quench Details	
Viscosity notes (describe consistency):	Medium thick
Observations (examples below): *Undissolved particles* *Crystallization/phase separation* *Color* *Residue on the pour plate* *Bubbles* *Surface appearance*	Glass is an opaque jade green. There are a few sulfate bubbles. Sulfate is pale yellow.
Crucible and glass mass after cooling (g):	139.970

Exhibit A-1. Glass Melting History and Observations Log Sheets (continued)

First Re-Melt: History and Observations	
Glass ID:	LP2-OL-Ø7-1Q
Person performing work:	M.Caldwell
Batch Preparation Details	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	12/15/17
Number of additional 30 second milling intervals used:	Ø
Sieve size:	100
Mass of ground baseline glass (Target ~~100~~ 50 g): MC 12/14/17	50.035
Mass of Na_2SO_4 added (Target ~~7.64~~ 3.82 g): MC 12/14/17	3.8260
Mix in Angstrom Mill (puck only + bag) for 30 sec., record date mixed:	12/15/17
Glass Melt Details	
Crucible ID:	911-4
Mass of empty crucible (g):	87.111
Mass of crucible with glass and Na_2SO_4 (g):	140.175
Balance ID:	AD-0044-1
Furnace ID:	MSE-0060-16
Temperature and date/time into the furnace:	1150°C 12/18/17 8:43
Temperature and date/time out of the furnace:	1150°C 12/18/17 9:43
Quench Details	
Viscosity notes (describe consistency):	Medium-thick
Observations (examples below): *Undissolved particles* *Crystallization/phase separation* *Color* *Residue on the pour plate* *Bubbles* *Surface appearance*	Glass is a translucent true-green. Only a few sulfate bubbles. Sulfate is bright yellow.
Crucible and glass mass after cooling (g):	139.793

Exhibit A-1. Glass Melting History and Observations Log Sheets (continued)

Second Re-Melt: History and Observations	
Glass ID:	LP2-OL-Ø7-1Q
Person performing work:	M.Caldwell
Glass Preparation Details	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	12/18/17
Number of additional 30 second milling intervals used:	1
Sieve size:	100
Glass Melt Details	
Crucible ID:	911-4
Empty crucible mass (g):	87.117
Crucible with glass mass (g):	139.211
Balance ID:	AD-0044-1
Furnace ID:	MSE-006-16
Temperature and date/time into the furnace:	1150°C ~~12/19/18~~ 12/19/17 MC 2:34
Temperature and date/time out of the furnace:	1150°C 12/19/17 12/19/17 3:42
Quench Details	
Viscosity notes (describe consistency):	Medium-thick
Observations (examples below): *Undissolved particles* *Crystallization/phase separation* *Color* *Residue on the pour plate* *Bubbles* *Surface appearance*	Glass is a true green. It is opaque. Sulfate is bright yellow. Very few sulfate bubbles
Crucible and glass mass after cooling (g):	138.925

Exhibit A-1. Glass Melting History and Observations Log Sheets (continued)

Third Re-Melt: History and Observations	
Glass ID:	LP2-OL-07-1Q
Person performing work:	M. Caldwell
Glass Preparation Details	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	12/21/17
Number of additional 30 second milling intervals used:	1
Sieve size:	100
Glass Melt Details	
Crucible ID:	911-4
Empty crucible mass (g):	87.117
Crucible with glass mass (g):	138.012
Balance ID:	AD-0044-1
Furnace ID:	MSE-006-16
Temperature and date/time into the furnace:	1150°C 12/27/17 11:59
Temperature and date/time out of the furnace:	1150°C 12/27/17 1:00
Quench Details	
Viscosity notes (describe consistency):	Medium-thin
Observations (examples below): *Undissolved particles* *Crystallization/phase separation* *Color* *Residue on the pour plate* *Bubbles* *Surface appearance*	Glass is opaque true/olive green. Only a couple sulfate bubbles. Sulfate is yellow.
Crucible and glass mass after cooling (g):	137.902

Exhibit A-1. Glass Melting History and Observations Log Sheets (continued)

First Re-Melt: History and Observations	
Glass ID:	LP2-OL-Ø9-1Q
Person performing work:	M.Caldwell
Batch Preparation Details	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	12/15/17
Number of additional 30 second milling intervals used:	Ø
Sieve size:	100
Mass of ground baseline glass (Target ~~100~~ 50 g): MC 12/14/17	50.022
Mass of Na_2SO_4 added (Target ~~7.64~~ 3.82 g): MC 12/14/17	3.823
Mix in Angstrom Mill (puck only + bag) for 30 sec., record date mixed:	12/15/17
Glass Melt Details	
Crucible ID:	911-5
Mass of empty crucible (g):	88.113
Mass of crucible with glass and Na_2SO_4 (g):	140.923
Balance ID:	AD-0044-1
Furnace ID:	MSE-0066-166
Temperature and date/time into the furnace:	1150°C 12/18/17 8:43
Temperature and date/time out of the furnace:	1150°C 12/18/17 9:43
Quench Details	
Viscosity notes (describe consistency):	Medium thick
Observations (examples below): *Undissolved particles* *Crystallization/phase separation* *Color* *Residue on the pour plate* *Bubbles* *Surface appearance*	Glass is a translucent true green. There are many sulfate bubbles. Sulfate is bright yellow
Crucible and glass mass after cooling (g):	140.744

Exhibit A-1. Glass Melting History and Observations Log Sheets (continued)

Second Re-Melt: History and Observations	
Glass ID:	LP2-OL-Ø9-1Q
Person performing work:	M. Caldwell
Glass Preparation Details	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	12/19/17
Number of additional 30 second milling intervals used:	1
Sieve size:	100
Glass Melt Details	
Crucible ID:	911-5
Empty crucible mass (g):	88.157
Crucible with glass mass (g):	140.1101
Balance ID:	AD-0044-1
Furnace ID:	MSE-006-16
Temperature and date/time into the furnace:	1150°C 12/19/17 2:34
Temperature and date/time out of the furnace:	1150°C 12/19/17 3:42
Quench Details	
Viscosity notes (describe consistency):	Thick
Observations (examples below): *Undissolved particles* *Crystallization/phase separation* *Color* *Residue on the pour plate* *Bubbles* *Surface appearance*	Glass is a relatively translucent green. There is sulfate swirling and a few sulfate bubbles. Sulfate is bright yellow.
Crucible and glass mass after cooling (g):	139.936

Exhibit A-1. Glass Melting History and Observations Log Sheets (continued)

Third Re-Melt: History and Observations	
Glass ID:	LP2-OL-Ø9-1Q
Person performing work:	M.Caldwell
Glass Preparation Details	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	12/21/17
Number of additional 30 second milling intervals used:	0
Sieve size:	100
Glass Melt Details	
Crucible ID:	911-5
Empty crucible mass (g):	88.204
Crucible with glass mass (g):	138.259
Balance ID:	AD-0044-1
Furnace ID:	MSE-006-16
Temperature and date/time into the furnace:	1150°C 12/27/17 11:59
Temperature and date/time out of the furnace:	1150°C 12/27/17 1:00
Quench Details	
Viscosity notes (describe consistency):	Thick
Observations (examples below): *Undissolved particles* *Crystallization/phase separation* *Color* *Residue on the pour plate* *Bubbles* *Surface appearance*	Glass is opaque lime/true green. There are a few sulfate bubbles Sulfate is bright yellow.
Crucible and glass mass after cooling (g):	137.869

Exhibit A-1. Glass Melting History and Observations Log Sheets (continued)

First Re-Melt: History and Observations	
Glass ID:	LP2-OL-11Q
Person performing work:	M.Caldwell
Batch Preparation Details	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	12/15/17
Number of additional 30 second milling intervals used:	Ø
Sieve size:	100
Mass of ground baseline glass (Target ~~100~~ 50 g): MC 12/14/17	50.034
Mass of Na_2SO_4 added (Target ~~7.64~~ 3.82 g): MC 12/14/17	3.826
Mix in Angstrom Mill (puck only + bag) for 30 sec., record date mixed:	12/15/17
Glass Melt Details	
Crucible ID:	911-6
Mass of empty crucible (g):	89.127
Mass of crucible with glass and Na_2SO_4 (g):	142.105
Balance ID:	AD-0044-1
Furnace ID:	MSE-006-16
Temperature and date/time into the furnace:	1150°C 12/18/17 8:43
Temperature and date/time out of the furnace:	1150°C 12/18/17 9:43
Quench Details	
Viscosity notes (describe consistency):	Very thin
Observations (examples below): *Undissolved particles* *Crystallization/phase separation* *Color* *Residue on the pour plate* *Bubbles* *Surface appearance*	MC 12/18/17 ~~Glass is a translucent lime green. There are quite a few sulfate bubbles.~~ Sulfate is bright yellow. Glass is translucent lime green. There are no sulfate bubbles
Crucible and glass mass after cooling (g):	141.958

Exhibit A-1. Glass Melting History and Observations Log Sheets (continued)

Second Re-Melt: History and Observations	
Glass ID:	LP2-OL-11Q
Person performing work:	M. Caldwell
Glass Preparation Details	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	12/19/2017
Number of additional 30 second milling intervals used:	1
Sieve size:	100
Glass Melt Details	
Crucible ID:	911-6
Empty crucible mass (g):	89.258
Crucible with glass mass (g):	140.862
Balance ID:	AD-0044-1
Furnace ID:	MSE-0000-16
Temperature and date/time into the furnace:	1150°C 12/19/17 2:34
Temperature and date/time out of the furnace:	1150°C 12/19/17 3:42
Quench Details	
Viscosity notes (describe consistency):	Thin
Observations (examples below): *Undissolved particles* *Crystallization/phase separation* *Color* *Residue on the pour plate* *Bubbles* *Surface appearance*	Same as first remelt
Crucible and glass mass after cooling (g):	140.732

Exhibit A-1. Glass Melting History and Observations Log Sheets (continued)

Third Re-Melt: History and Observations	
Glass ID:	LP2-OL-11Q
Person performing work:	M. Caldwell
Glass Preparation Details	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	12/21/17
Number of additional 30 second milling intervals used:	1
Sieve size:	100
Glass Melt Details	
Crucible ID:	911-6
Empty crucible mass (g):	89.242
Crucible with glass mass (g):	138.858
Balance ID:	AD-0044-1
Furnace ID:	MSE-006-16
Temperature and date/time into the furnace:	1150°C 12/27/17 11:59
Temperature and date/time out of the furnace:	1150°C 12/27/17 1:02
Quench Details	
Viscosity notes (describe consistency):	Very thin
Observations (examples below): *Undissolved particles* *Crystallization/phase separation* *Color* *Residue on the pour plate* *Bubbles* *Surface appearance*	Glass is slighty opaque and a light lime green. There are only a couple of sulfate bubbles. Sulfate is bright yellow.
Crucible and glass mass after cooling (g):	136.652

Exhibit A-1. Glass Melting History and Observations Log Sheets (continued)

First Re-Melt: History and Observations	
Glass ID:	LP2-OL-12Q
Person performing work:	M.Caldwell
Batch Preparation Details	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	12/18/17
Number of additional 30 second milling intervals used:	Ø
Sieve size:	100
Mass of ground baseline glass (Target ~~100 g~~ 50 MC 12/14/17):	50.331
Mass of Na_2SO_4 added (Target ~~7.64 g~~ 3.82 12/14/17):	3.835
Mix in Angstrom Mill (puck only + bag) for 30 sec., record date mixed:	12/18/17
Glass Melt Details	
Crucible ID:	911-7
Mass of empty crucible (g):	89.138
Mass of crucible with glass and Na_2SO_4 (g):	142.719
Balance ID:	AD-0044-1
Furnace ID:	MSE-006-16
Temperature and date/time into the furnace:	1150°C 12/18/17 11:27
Temperature and date/time out of the furnace:	1150°C 12/18/17 12:36
Quench Details	
Viscosity notes (describe consistency):	Medium-thick
Observations (examples below): *Undissolved particles* *Crystallization/phase separation* *Color* *Residue on the pour plate* *Bubbles* *Surface appearance*	Translucent true green glass. no sulfate bubbles. Sulfate is bright yellow
Crucible and glass mass after cooling (g):	142.324

Exhibit A-1. Glass Melting History and Observations Log Sheets (continued)

Second Re-Melt: History and Observations	
Glass ID:	LP2-OL-12Q
Person performing work:	M. Caldwell
Glass Preparation Details	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	12/19/17
Number of additional 30 second milling intervals used:	1
Sieve size:	100
Glass Melt Details	
Crucible ID:	911-7
Empty crucible mass (g):	89.226
Crucible with glass mass (g):	141.571
Balance ID:	AD-0044-1
Furnace ID:	MSE-000-16
Temperature and date/time into the furnace:	1150°C 12/21/17 9:00
Temperature and date/time out of the furnace:	1150°C 12/21/17 10:00
Quench Details	
Viscosity notes (describe consistency):	Medium thin
Observations (examples below): *Undissolved particles* *Crystallization/phase separation* *Color* *Residue on the pour plate* *Bubbles* *Surface appearance*	Glass is a slightly opaque darker lime green. Only a couple sulfate bubbles. Sulfate is bright yellow
Crucible and glass mass after cooling (g):	141.428

Exhibit A-1. Glass Melting History and Observations Log Sheets (continued)

Third Re-Melt: History and Observations	
Glass ID:	LP2-OL-12Q
Person performing work:	M.Caldwell
Glass Preparation Details	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	12/27/17
Number of additional 30 second milling intervals used:	1
Sieve size:	100
Glass Melt Details	
Crucible ID:	911-7
Empty crucible mass (g):	89.190
Crucible with glass mass (g):	141.013
Balance ID:	AD-0044-1
Furnace ID:	MSE-0060-16
Temperature and date/time into the furnace:	1150°C 12/27/17 1:55
Temperature and date/time out of the furnace:	1150°C 12/27/17 2:55
Quench Details	
Viscosity notes (describe consistency):	Very thin
Observations (examples below): *Undissolved particles* *Crystallization/phase separation* *Color* *Residue on the pour plate* *Bubbles* *Surface appearance*	Glass is an opaque jade green. Very few sulfate bubbles. Sulfate is yellow.
Crucible and glass mass after cooling (g):	140.515

Exhibit A-1. Glass Melting History and Observations Log Sheets (continued)

First Re-Melt: History and Observations	
Glass ID:	LP2-OL-13Q
Person performing work:	M.Caldwell
Batch Preparation Details	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	12/18/17
Number of additional 30 second milling intervals used:	Ø
Sieve size:	100 mesh
Mass of ground baseline glass (Target ~~100~~ 50 g): MC 12/14/17	50.239
Mass of Na_2SO_4 added (Target ~~7.64~~ 3.82 g): MC 12/14/17	3.834
Mix in Angstrom Mill (puck only + bag) for 30 sec., record date mixed:	12/18/17
Glass Melt Details	
Crucible ID:	911-8
Mass of empty crucible (g):	89.823
Mass of crucible with glass and Na_2SO_4 (g):	143.515
Balance ID:	AD-00414-1
Furnace ID:	MSE-006-16
Temperature and date/time into the furnace:	1150°C 12/18/17 11:27
Temperature and date/time out of the furnace:	1150°C 12/18/17 12:36
Quench Details	
Viscosity notes (describe consistency):	Medium-thick
Observations (examples below): *Undissolved particles* *Crystallization/phase separation* *Color* *Residue on the pour plate* *Bubbles* *Surface appearance*	Translucent light lime green glass. No sulfate bubbles. Sulfate is yellow
Crucible and glass mass after cooling (g):	143.227

Exhibit A-1. Glass Melting History and Observations Log Sheets (continued)

Second Re-Melt: History and Observations	
Glass ID:	LP2-OL-13Q
Person performing work:	M.Caldwell
Glass Preparation Details	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	12/19/17
Number of additional 30 second milling intervals used:	1
Sieve size:	100
Glass Melt Details	
Crucible ID:	911-8
Empty crucible mass (g):	89.999
Crucible with glass mass (g):	142.113
Balance ID:	AD-0044-1
Furnace ID:	MSE-006-16
Temperature and date/time into the furnace:	1150°C 12/21/2017 9:00
Temperature and date/time out of the furnace:	1150°C 12/21/2017 10:00
Quench Details	
Viscosity notes (describe consistency):	Medium-thin
Observations (examples below): *Undissolved particles* *Crystallization/phase separation* *Color* *Residue on the pour plate* *Bubbles* *Surface appearance*	Glass is completely opaque light lime green. No sulfate bubbles. Sulfate is yellow.
Crucible and glass mass after cooling (g):	141.865

Exhibit A-1. Glass Melting History and Observations Log Sheets (continued)

Third Re-Melt: History and Observations	
Glass ID:	LP2-OL-13Q
Person performing work:	M. Caldwell
Glass Preparation Details	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	12/27/17
Number of additional 30 second milling intervals used:	0
Sieve size:	100
Glass Melt Details	
Crucible ID:	911-8
Empty crucible mass (g):	90.059
Crucible with glass mass (g):	140.787
Balance ID:	AD-0044-1
Furnace ID:	MSE-006-16
Temperature and date/time into the furnace:	1150°C 12/27/17 1:55
Temperature and date/time out of the furnace:	1150°C 12/27/17 2:55
Quench Details	
Viscosity notes (describe consistency):	Very thin
Observations (examples below): *Undissolved particles* *Crystallization/phase separation* *Color* *Residue on the pour plate* *Bubbles* *Surface appearance*	Very light, ~~opaque~~ opaque lime green. There is very little visible excess sulfate. No sulfate bubbles. Sulfate is yellow.
Crucible and glass mass after cooling (g):	140.451

Exhibit A-1. Glass Melting History and Observations Log Sheets (continued)

First Re-Melt: History and Observations	
Glass ID:	LP2-OL-14Q
Person performing work:	M.Caldwell
Batch Preparation Details	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	12/18/17
Number of additional 30 second milling intervals used:	Ø
Sieve size:	100
Mass of ground baseline glass (Target ~~100~~ 50 g): MC 12/18/17	50.379
Mass of Na_2SO_4 added (Target ~~7.64~~ 3.82 g): MC 12/18/17	3.828
Mix in Angstrom Mill (puck only + bag) for 30 sec., record date mixed:	12/18/17
Glass Melt Details	
Crucible ID:	911-9
Mass of empty crucible (g):	91.112
Mass of crucible with glass and Na_2SO_4 (g):	145.128
Balance ID:	AD-0044-1
Furnace ID:	MSE-0060-116
Temperature and date/time into the furnace:	1150°C 12/18/17 11:27
Temperature and date/time out of the furnace:	1150°C 12/18/17 12:36
Quench Details	
Viscosity notes (describe consistency):	Medium thin
Observations (examples below): *Undissolved particles* *Crystallization/phase separation* *Color* *Residue on the pour plate* *Bubbles* *Surface appearance*	Glass is opaque light green. No sulfate bubbles but swirls are present. Sulfate is bright yellow.
Crucible and glass mass after cooling (g):	144.923

Exhibit A-1. Glass Melting History and Observations Log Sheets (continued)

Second Re-Melt: History and Observations	
Glass ID:	LP2-OL-14Q
Person performing work:	M.Caldwell
Glass Preparation Details	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	12/19/17
Number of additional 30 second milling intervals used:	1
Sieve size:	100
Glass Melt Details	
Crucible ID:	911-9
Empty crucible mass (g):	91.326
Crucible with glass mass (g):	144.080
Balance ID:	AD-0044-1
Furnace ID:	MSE-006-16
Temperature and date/time into the furnace:	1150°C 12/21/17 9:00
Temperature and date/time out of the furnace:	1150°C 12/21/17 10:00
Quench Details	
Viscosity notes (describe consistency):	Thin
Observations (examples below): *Undissolved particles* *Crystallization/phase separation* *Color* *Residue on the pour plate* *Bubbles* *Surface appearance*	Glass is completly opaque lime green. There are no Sulfate bubbles. Sulfate is bright yellow.
Crucible and glass mass after cooling (g):	143.827

Exhibit A-1. Glass Melting History and Observations Log Sheets (continued)

Third Re-Melt: History and Observations	
Glass ID:	LP2-OL-14Q
Person performing work:	M. Caldwell
Glass Preparation Details	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	12/27/17
Number of additional 30 second milling intervals used:	1
Sieve size:	100
Glass Melt Details	
Crucible ID:	911-9
Empty crucible mass (g):	91.486
Crucible with glass mass (g):	143.123
Balance ID:	AD-0044-1
Furnace ID:	MSE-006-16
Temperature and date/time into the furnace:	1150°C 12/27/17 1:55
Temperature and date/time out of the furnace:	1150°C 12/27/17 2:58
Quench Details	
Viscosity notes (describe consistency):	Very thin
Observations (examples below): *Undissolved particles* *Crystallization/phase separation* *Color* *Residue on the pour plate* *Bubbles* *Surface appearance*	Glass is opaque lime green. There are a couple of large sulfate bubbles. Sulfate is bright yellow.
Crucible and glass mass after cooling (g):	142.702

Exhibit A-1. Glass Melting History and Observations Log Sheets (continued)

First Re-Melt: History and Observations	
Glass ID:	LP2-OL-15-Q
Person performing work:	M. Caldwell
Batch Preparation Details	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	1/17/2018
Number of additional 30 second milling intervals used:	1
Sieve size:	100
Mass of ground baseline glass (Target 50 g):	50.878
Mass of Na_2SO_4 added (Target 3.82 g):	3.821
Mix in Angstrom Mill (puck only + bag) for 30 sec., record date mixed:	1/17/2018
Glass Melt Details	
Crucible ID:	911-1
Mass of empty crucible (g):	88.419
Mass of crucible with glass and Na_2SO_4 (g):	142.276
Balance ID:	AD-0044-1
Furnace ID:	MSE-006-16
Temperature and date/time into the furnace:	1150°C 1/22/18 8:00
Temperature and date/time out of the furnace:	1150°C 1/22/18 9:00
Quench Details	
Viscosity notes (describe consistency):	Thin
Observations (examples below): *Undissolved particles* *Crystallization/phase separation* *Color* *Residue on the pour plate* *Bubbles* *Surface appearance*	Glass is translucent and is a true green color. Very few, small sulfate bubbles. Sulfate is a bright yellow.
Crucible and glass mass after cooling (g):	142.165

Exhibit A-1. Glass Melting History and Observations Log Sheets (continued)

Second Re-Melt: History and Observations	
Glass ID:	LP2-OL-15-Q
Person performing work:	M. Caldwell
Glass Preparation Details	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	1/22/18
Number of additional 30 second milling intervals used:	1
Sieve size:	100
Glass Melt Details	
Crucible ID:	911-1
Empty crucible mass (g):	88.425
Crucible with glass mass (g):	141.708
Balance ID:	AD-0044-1
Furnace ID:	MSE-006-16
Temperature and date/time into the furnace:	1150°C 1/22/18 12:45
Temperature and date/time out of the furnace:	1150°C 1/22/18 1:45
Quench Details	
Viscosity notes (describe consistency):	Thin
Observations (examples below): *Undissolved particles* *Crystallization/phase separation* *Color* *Residue on the pour plate* *Bubbles* *Surface appearance*	Glass is still a translucent true green. Not very many sulfate bubbles. Sulfate is bright yellow.
Crucible and glass mass after cooling (g):	141.577

Exhibit A-1. Glass Melting History and Observations Log Sheets (continued)

Third Re-Melt: History and Observations	
Glass ID:	LP2-OL-15-Q
Person performing work:	M. Caldwell
Glass Preparation Details	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	~~1/23/18~~ MC 1/22/18 1/22/18
Number of additional 30 second milling intervals used:	1
Sieve size:	100
Glass Melt Details	
Crucible ID:	911-1
Empty crucible mass (g):	88.426
Crucible with glass mass (g):	141.212
Balance ID:	AD-0044-1
Furnace ID:	MSE-006-16
Temperature and date/time into the furnace:	1150°C 1/23/18 9:20
Temperature and date/time out of the furnace:	1150°C 1/23/18 10:21
Quench Details	
Viscosity notes (describe consistency):	Very thin
Observations (examples below): *Undissolved particles* *Crystallization/phase separation* *Color* *Residue on the pour plate* *Bubbles* *Surface appearance*	Glass is translucent and is a true-green. No sulfate bubbles. Sulfate is bright green.
Crucible and glass mass after cooling (g):	141.057

Exhibit A-1. Glass Melting History and Observations Log Sheets (continued)

First Re-Melt: History and Observations	
Glass ID:	LP2-OL-17-Q
Person performing work:	M. Caldwell
Batch Preparation Details	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	1/17/2018
Number of additional 30 second milling intervals used:	0
Sieve size:	100
Mass of ground baseline glass (Target 50 g):	50.566
Mass of Na_2SO_4 added (Target 3.82 g):	3.828
Mix in Angstrom Mill (puck only + bag) for 30 sec., record date mixed:	1/17/2018
Glass Melt Details	
Crucible ID:	911-2
Mass of empty crucible (g):	87.524
Mass of crucible with glass and Na_2SO_4 (g):	140.909
Balance ID:	AD-0044-1
Furnace ID:	MSE-006-16
Temperature and date/time into the furnace:	1150°C 1/22/18 8:00
Temperature and date/time out of the furnace:	1150°C 1/22/18 9:00
Quench Details	
Viscosity notes (describe consistency):	Thin
Observations (examples below): *Undissolved particles* *Crystallization/phase separation* *Color* *Residue on the pour plate* *Bubbles* *Surface appearance*	Glass is a translucent, light olive green. There are clusters of sulfate bubbles. Sulfate is slightly pale yellow.
Crucible and glass mass after cooling (g):	140.622

Exhibit A-1. Glass Melting History and Observations Log Sheets (continued)

Second Re-Melt: History and Observations	
Glass ID:	LP2-OL-17-Q
Person performing work:	M. Caldwell
Glass Preparation Details	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	1/22/18
Number of additional 30 second milling intervals used:	1
Sieve size:	100
Glass Melt Details	
Crucible ID:	911-2
Empty crucible mass (g):	87.680
Crucible with glass mass (g):	140.099
Balance ID:	AD-0044-1
Furnace ID:	MSE-006-110
Temperature and date/time into the furnace:	1150°C 1/22/18 12:45
Temperature and date/time out of the furnace:	1150°C 1/22/18 1:45
Quench Details	
Viscosity notes (describe consistency):	Medium-thin
Observations (examples below): *Undissolved particles* *Crystallization/phase separation* *Color* *Residue on the pour plate* *Bubbles* *Surface appearance*	Glass is comletely opaque. It is a very muted lime green. There was not much excess sulfate. Sulfate is yellow.
Crucible and glass mass after cooling (g):	139.768

Exhibit A-1. Glass Melting History and Observations Log Sheets (continued)

Third Re-Melt: History and Observations	
Glass ID:	LP2-OL-17-Q
Person performing work:	M. Caldwell
Glass Preparation Details	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	1/23/18
Number of additional 30 second milling intervals used:	0
Sieve size:	100
Glass Melt Details	
Crucible ID:	911-2
Empty crucible mass (g):	87.679
Crucible with glass mass (g):	139.358
Balance ID:	AD-0044-1
Furnace ID:	MSE-006-16
Temperature and date/time into the furnace:	1150°C 1/23/18 ~~12~~ MC 1/23/18 9:20
Temperature and date/time out of the furnace:	1150°C 1/23/18 10:21
Quench Details	
Viscosity notes (describe consistency):	Thin
Observations (examples below): *Undissolved particles* *Crystallization/phase separation* *Color* *Residue on the pour plate* *Bubbles* *Surface appearance*	Glass is comlotely opaque. It is still a muted lime green. Mostly sulfate swirling and only a couple sulfate bubbles. Sulfate is yellow.
Crucible and glass mass after cooling (g):	138.912

Exhibit A-1. Glass Melting History and Observations Log Sheets (continued)

First Re-Melt: History and Observations	
Glass ID:	LP2-OL-19-Q
Person performing work:	M. Caldwell
Batch Preparation Details	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	1/17/2018
Number of additional 30 second milling intervals used:	0
Sieve size:	100
Mass of ground baseline glass (Target 50 g):	50.785
Mass of Na_2SO_4 added (Target 3.82 g):	3.826
Mix in Angstrom Mill (puck only + bag) for 30 sec., record date mixed:	1/17/2018
Glass Melt Details	
Crucible ID:	911-3
Mass of empty crucible (g):	90.098
Mass of crucible with glass and Na_2SO_4 (g):	143.993
Balance ID:	AD-0044-1
Furnace ID:	MSE-006-16
Temperature and date/time into the furnace:	1150°C 1/22/18 8:00
Temperature and date/time out of the furnace:	1150°C 1/22/18 9:00
Quench Details	
Viscosity notes (describe consistency):	Medium-thin
Observations (examples below): *Undissolved particles* *Crystallization/phase separation* *Color* *Residue on the pour plate* *Bubbles* *Surface appearance*	Glass is a lighter green and is translucent. There are a few sulfate bubbles. Sulfate is bright yellow.
Crucible and glass mass after cooling (g):	143.861

Exhibit A-1. Glass Melting History and Observations Log Sheets (continued)

Second Re-Melt: History and Observations	
Glass ID:	LP2-OL-19-Q
Person performing work:	M.Caldwell
Glass Preparation Details	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	1/22/18
Number of additional 30 second milling intervals used:	1
Sieve size:	100
Glass Melt Details	
Crucible ID:	911-3
Empty crucible mass (g):	90.120
Crucible with glass mass (g):	143.350
Balance ID:	AD-0044-1
Furnace ID:	MSE-006-16
Temperature and date/time into the furnace:	1150°C 1/22/18 12:45
Temperature and date/time out of the furnace:	1150°C 1/22/18 1:46
Quench Details	
Viscosity notes (describe consistency):	Thick
Observations (examples below): *Undissolved particles* *Crystallization/phase separation* *Color* *Residue on the pour plate* *Bubbles* *Surface appearance*	Glass is an opaque lime green. Sulfate is swirled through out the glass. Sulfate is bright yellow.
Crucible and glass mass after cooling (g):	142.865

Exhibit A-1. Glass Melting History and Observations Log Sheets (continued)

Third Re-Melt: History and Observations	
Glass ID:	LP2-OL-19-Q
Person performing work:	M. Caldwell
Glass Preparation Details	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	1/23/18
Number of additional 30 second milling intervals used:	1
Sieve size:	100
Glass Melt Details	
Crucible ID:	911-3
Empty crucible mass (g):	90.120
Crucible with glass mass (g):	142.549
Balance ID:	AD-0044-1
Furnace ID:	MSE-006-16
Temperature and date/time into the furnace:	1150°C 1/23/18 9:20
Temperature and date/time out of the furnace:	1150°C 1/23/18 10:22
Quench Details	
Viscosity notes (describe consistency):	Very thick
Observations (examples below): *Undissolved particles* *Crystallization/phase separation* *Color* *Residue on the pour plate* *Bubbles* *Surface appearance*	Glass is a completely opaque lime green. Quite a few sulfate bubbles and visible swirling. Sulfate is bright yellow.
Crucible and glass mass after cooling (g):	142.165

Exhibit A-1. Glass Melting History and Observations Log Sheets (continued)

First Re-Melt: History and Observations	
Glass ID:	LP2-OL-20-Q
Person performing work:	M.Caldwell
Batch Preparation Details	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	1/18/2018
Number of additional 30 second milling intervals used:	1
Sieve size:	100
Mass of ground baseline glass (Target 50 g):	50.1004
Mass of Na_2SO_4 added (Target 3.82 g):	3.822
Mix in Angstrom Mill (puck only + bag) for 30 sec., record date mixed:	1/18/2018
Glass Melt Details	
Crucible ID:	911-4
Mass of empty crucible (g):	87.105
Mass of crucible with glass and Na_2SO_4 (g):	140.851
Balance ID:	AD-0044-1
Furnace ID:	MSE-006-16
Temperature and date/time into the furnace:	1150°C 1/22/18 9:15
Temperature and date/time out of the furnace:	1160°C 1/22/18 10:15
Quench Details	
Viscosity notes (describe consistency):	Medium-thick
Observations (examples below): *Undissolved particles* *Crystallization/phase separation* *Color* *Residue on the pour plate* *Bubbles* *Surface appearance*	Glass is a translucent light green with many sulfate bubbles. Sulfate is pale yellow.
Crucible and glass mass after cooling (g):	140.639

Exhibit A-1. Glass Melting History and Observations Log Sheets (continued)

Second Re-Melt: History and Observations	
Glass ID:	LP2-OL-20-Q
Person performing work:	M. Caldwell
Glass Preparation Details	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	1/22/18
Number of additional 30 second milling intervals used:	1
Sieve size:	100
Glass Melt Details	
Crucible ID:	911-4
Empty crucible mass (g):	87.130
Crucible with glass mass (g):	140.366
Balance ID:	AD-0044-1
Furnace ID:	MSE-006-16
Temperature and date/time into the furnace:	1150°C 1/22/18 2:09
Temperature and date/time out of the furnace:	1150°C 1/22/18 3:10
Quench Details	
Viscosity notes (describe consistency):	~~Thin~~ MC 1/22/18 Medium-thin
Observations (examples below): *Undissolved particles* *Crystallization/phase separation* *Color* *Residue on the pour plate* *Bubbles* *Surface appearance*	Glass is translucent lime/light green with distinct sulfate swirling and a few sulfate bubbles. Sulfate is bright yellow.
Crucible and glass mass after cooling (g):	140.133

Exhibit A-1. Glass Melting History and Observations Log Sheets (continued)

Third Re-Melt: History and Observations	
Glass ID:	LP2-OL-20-Q
Person performing work:	M. Caldwell
Glass Preparation Details	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	1/23/18
Number of additional 30 second milling intervals used:	0
Sieve size:	100
Glass Melt Details	
Crucible ID:	911-4
Empty crucible mass (g):	87.119
Crucible with glass mass (g):	139.838
Balance ID:	AD-0044-1
Furnace ID:	MSE-000-16
Temperature and date/time into the furnace:	1150°C 1/23/18 MC 1/23/18 ~~10:32~~ 10:31
Temperature and date/time out of the furnace:	1150°C 1/23/18 11:31
Quench Details	
Viscosity notes (describe consistency):	Medium-thin
Observations (examples below): *Undissolved particles* *Crystallization/phase separation* *Color* *Residue on the pour plate* *Bubbles* *Surface appearance*	Glass is slighty opaque. It is lime green with sulfate swirling. Very few sulfate bubbles. Sulfate is bright yellow.
Crucible and glass mass after cooling (g):	139.688

Exhibit A-1. Glass Melting History and Observations Log Sheets (continued)

First Re-Melt: History and Observations	
Glass ID:	LP2-OL-21-Q
Person performing work:	M.Caldwell
Batch Preparation Details	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	1/18/2018
Number of additional 30 second milling intervals used:	1
Sieve size:	100
Mass of ground baseline glass (Target 50 g):	50.685
Mass of Na_2SO_4 added (Target 3.82 g):	3.822
Mix in Angstrom Mill (puck only + bag) for 30 sec., record date mixed:	1/18/2018
Glass Melt Details	
Crucible ID:	911-5
Mass of empty crucible (g):	88.105
Mass of crucible with glass and Na_2SO_4 (g):	141.079
Balance ID:	AD-0044-1
Furnace ID:	MSE-006-16
Temperature and date/time into the furnace:	1150°C 1/22/18 9:15
Temperature and date/time out of the furnace:	1150°C 1/22/18 10:15
Quench Details	
Viscosity notes (describe consistency):	Medium-thin
Observations (examples below): *Undissolved particles* *Crystallization/phase separation* *Color* *Residue on the pour plate* *Bubbles* *Surface appearance*	Glass is a darker, translucent lime green. Very, very few sulfate bubbles. Sulfate is bright yellow.
Crucible and glass mass after cooling (g):	140.961

Exhibit A-1. Glass Melting History and Observations Log Sheets (continued)

Second Re-Melt: History and Observations	
Glass ID:	LP2-OL-21-Q
Person performing work:	M.Caldwell
Glass Preparation Details	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	1/22/18
Number of additional 30 second milling intervals used:	1
Sieve size:	100
Glass Melt Details	
Crucible ID:	911-5
Empty crucible mass (g):	86.108
Crucible with glass mass (g):	140.513
Balance ID:	AD-0044-1
Furnace ID:	MSE-006-16
Temperature and date/time into the furnace:	1150°C 1/22/18 2:09
Temperature and date/time out of the furnace:	1150°C 1/22/18 3:10
Quench Details	
Viscosity notes (describe consistency):	Medium-~~thin~~ thick. MC 1/22/18
Observations (examples below): *Undissolved particles* *Crystallization/phase separation* *Color* *Residue on the pour plate* *Bubbles* *Surface appearance*	Glass is a slightly opaque darker lime green. Glass has sulfate swirls and a few sulfate bubbles. Sulfate is bright yellow.
Crucible and glass mass after cooling (g):	140.380

Exhibit A-1. Glass Melting History and Observations Log Sheets (continued)

Third Re-Melt: History and Observations	
Glass ID:	LP2-OL-21-Q
Person performing work:	M. Caldwell
Glass Preparation Details	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	~~1/23/18~~ MC 1/23/18 1/23/18
Number of additional 30 second milling intervals used:	0
Sieve size:	100
Glass Melt Details	
Crucible ID:	911-5
Empty crucible mass (g):	48.121
Crucible with glass mass (g):	140.075
Balance ID:	AD-0044-1
Furnace ID:	MSE-006-116
Temperature and date/time into the furnace:	1150°C 1/23/18 10:31
Temperature and date/time out of the furnace:	1150°C 1/23/18 11:33
Quench Details	
Viscosity notes (describe consistency):	Very thick
Observations (examples below): *Undissolved particles* *Crystallization/phase separation* *Color* *Residue on the pour plate* *Bubbles* *Surface appearance*	Glass is a slightly opaque darker lime green. Visible sulfate swirling with a few sulfate bubbles. Sulfate is bright yellow.
Crucible and glass mass after cooling (g):	140.277

Exhibit A-1. Glass Melting History and Observations Log Sheets (continued)

First Re-Melt: History and Observations	
Glass ID:	LP2-OL-22-Q
Person performing work:	M.Caldwell
Batch Preparation Details	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	1/18/2018
Number of additional 30 second milling intervals used:	1
Sieve size:	100
Mass of ground baseline glass (Target 100 g):	50.456
Mass of Na_2SO_4 added (Target 7.64 g):	3.821
Mix in Angstrom Mill (puck only + bag) for 30 sec., record date mixed:	1/18/2018
Glass Melt Details	
Crucible ID:	911-6
Mass of empty crucible (g):	89.121
Mass of crucible with glass and Na_2SO_4 (g):	142.018
Balance ID:	AD-0044-1
Furnace ID:	MSE-006-16
Temperature and date/time into the furnace:	1150°C 1/22/2018 9:15
Temperature and date/time out of the furnace:	1150°C 1/22/2018 10:17
Quench Details	
Viscosity notes (describe consistency):	Medium-thick
Observations (examples below): *Undissolved particles* *Crystallization/phase separation* *Color* *Residue on the pour plate* *Bubbles* *Surface appearance*	Translucent olivegreen. Some sulfate bubbles. Sulfate is bright yellow.
Crucible and glass mass after cooling (g):	139.613

Exhibit A-1. Glass Melting History and Observations Log Sheets (continued)

Second Re-Melt: History and Observations	
Glass ID:	LP2-OL-22-Q
Person performing work:	M. Caldwell
Glass Preparation Details	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	1/22/18
Number of additional 30 second milling intervals used:	1
Sieve size:	100
Glass Melt Details	
Crucible ID:	911-6
Empty crucible mass (g):	89.193
Crucible with glass mass (g):	141.492
Balance ID:	AD-0044-1
Furnace ID:	MSE-006-16
Temperature and date/time into the furnace:	1150°C 1/22/18 2:09
Temperature and date/time out of the furnace:	1150°C 1/22/18 3:10
Quench Details	
Viscosity notes (describe consistency):	Thin
Observations (examples below): *Undissolved particles* *Crystallization/phase separation* *Color* *Residue on the pour plate* *Bubbles* *Surface appearance*	Glass is a completly opaque olive green. Only a few sulfate bubbles. Sulfate is bright light yellow.
Crucible and glass mass after cooling (g):	141.244

Exhibit A-1. Glass Melting History and Observations Log Sheets (continued)

Third Re-Melt: History and Observations	
Glass ID:	LP2-OL-22-Q
Person performing work:	M. Caldwell
Glass Preparation Details	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	1/23/18
Number of additional 30 second milling intervals used:	0
Sieve size:	100
Glass Melt Details	
Crucible ID:	911-6
Empty crucible mass (g):	~~89.~~ MC 1/22/18 89.221
Crucible with glass mass (g):	140.482
Balance ID:	AD-0044-1
Furnace ID:	MSE-006-16
Temperature and date/time into the furnace:	1150°C 1/23/18 10:31
Temperature and date/time out of the furnace:	1150°C 1/23/18 11:35
Quench Details	
Viscosity notes (describe consistency):	Medium-thick
Observations (examples below): *Undissolved particles* *Crystallization/phase separation* *Color* *Residue on the pour plate* *Bubbles* *Surface appearance*	Glass is a completely opaque olive green. There are a few sulfate bubbles. Sulfate is yellow.
Crucible and glass mass after cooling (g):	140.277

Exhibit A-1. Glass Melting History and Observations Log Sheets (continued)

First Re-Melt: History and Observations	
Glass ID:	LP2-OL-25Q
Person performing work:	M. Caldwell
Batch Preparation Details	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	1/18/2018
Number of additional 30 second milling intervals used:	0
Sieve size:	100
Mass of ground baseline glass (Target 50 g):	50.389
Mass of Na_2SO_4 added (Target 3.82 g):	3.820
Mix in Angstrom Mill (puck only + bag) for 30 sec., record date mixed:	1/18/2018
Glass Melt Details	
Crucible ID:	911-7
Mass of empty crucible (g):	49.132
Mass of crucible with glass and Na_2SO_4 (g):	142.030
Balance ID:	AD-0044-1
Furnace ID:	MSE-006-16
Temperature and date/time into the furnace:	1150°C 1/22/18 10:20
Temperature and date/time out of the furnace:	1150°C 1/22/18 11:20
Quench Details	
Viscosity notes (describe consistency):	Very thin
Observations (examples below): *Undissolved particles* *Crystallization/phase separation* *Color* *Residue on the pour plate* *Bubbles* *Surface appearance*	Glass is a transparent, light olive green. Only a few sulfate bubbles. Sulfate is a light, bright yellow.
Crucible and glass mass after cooling (g):	141.925

Exhibit A-1. Glass Melting History and Observations Log Sheets (continued)

Second Re-Melt: History and Observations	
Glass ID:	LP2-OL-25-Q
Person performing work:	M. Caldwell
Glass Preparation Details	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	1/22/18
Number of additional 30 second milling intervals used:	1
Sieve size:	100
Glass Melt Details	
Crucible ID:	911-7
Empty crucible mass (g):	89.154
Crucible with glass mass (g):	141.747
Balance ID:	AD-0044-1
Furnace ID:	MSE-006-16
Temperature and date/time into the furnace:	1150°C 1/23/18 8:12
Temperature and date/time out of the furnace:	1150°C 1/23/18 9:13
Quench Details	
Viscosity notes (describe consistency):	Medium-thin
Observations (examples below): *Undissolved particles* *Crystallization/phase separation* *Color* *Residue on the pour plate* *Bubbles* *Surface appearance*	Glass is translucent olive green with very faint sulfate swirling and only a few sulfate bubbles. Sulfate is bright yellow.
Crucible and glass mass after cooling (g):	141.426

Exhibit A-1. Glass Melting History and Observations Log Sheets (continued)

Third Re-Melt: History and Observations	
Glass ID:	LP2-OL-25-Q
Person performing work:	M.Caldwell
Glass Preparation Details	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	1/23/18
Number of additional 30 second milling intervals used:	1
Sieve size:	100
Glass Melt Details	
Crucible ID:	911-7
Empty crucible mass (g):	89.197
Crucible with glass mass (g):	140.808
Balance ID:	AD-0044-1
Furnace ID:	MSE-000-16
Temperature and date/time into the furnace:	1150°C 1/23/2018 11:37
Temperature and date/time out of the furnace:	1150°C 1/23/2018 12:37
Quench Details	
Viscosity notes (describe consistency):	Thin
Observations (examples below): *Undissolved particles* *Crystallization/phase separation* *Color* *Residue on the pour plate* *Bubbles* *Surface appearance*	Glass is slightly transparent olive green. There is sulfate swirling and a few sulfate bubbles. Sulfate is yellow.
Crucible and glass mass after cooling (g):	140.439

Exhibit A-2. Glass Grinding, Washing, and Filtering Log Sheets

Glass Grinding, Washing, and Filtering	
Glass ID:	LP2-OL-01-3Q
First or second batch of this Glass ID (circle):	First 4 g Second 4 g
Person performing work:	M.Caldwell
Glass Grinding and Sieving	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	12/28/17
Number of additional 30 second milling intervals used:	1
Sieve size:	120
Glass Washing and Filtering	
Date of wash and filter steps:	1/2/2018
Balance ID:	AD-0044-1 / ITS-BL001
Tare mass of new filter plus petri dish (g):	97.736
Mass of super-saturated glass (target 4 g):	4.000
Mass of DI water added to 250 mL beaker, 1st (target 50 g):	50.~~0040~~ 125 MEC 1/2/18
Tare mass of solution flask (g):	524.37
Mass of DI water added to 250 mL beaker, 2nd (target 50 g):	50.150
Mass of wet sample plus filter and petri dish (g):	102.334
Mass of recovered solution and flask (g):	620.96
Mass of dry sample plus filter and petri dish (g):	101.433

Exhibit A-2. Glass Grinding, Washing, and Filtering Log Sheets (continued)

Glass Grinding, Washing, and Filtering	
Glass ID:	LP2-OL-Ø1-3Q
First or second batch of this Glass ID (circle):	First 4 g Second 4 g
Person performing work:	M.Caldwell
Glass Grinding and Sieving	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	12/28/17
Number of additional 30 second milling intervals used:	1
Sieve size:	120
Glass Washing and Filtering	
Date of wash and filter steps:	1/2/2018
Balance ID:	AD-0044-1 / ITS-BL001
Tare mass of new filter plus petri dish (g):	99.443
Mass of super-saturated glass (target 4 g):	4.002
Mass of DI water added to 250 mL beaker, 1st (target 50 g):	51.150
Tare mass of solution flask (g):	526.75
Mass of DI water added to 250 mL beaker, 2nd (target 50 g):	50.520
Mass of wet sample plus filter and petri dish (g):	104.095
Mass of recovered solution and flask (g):	625.05
Mass of dry sample plus filter and petri dish (g):	103.124

Exhibit A-2. Glass Grinding, Washing, and Filtering Log Sheets (continued)

Glass Grinding, Washing, and Filtering	
Glass ID:	LP2-OL-Ø4-1Q
First or second batch of this Glass ID (circle):	First 4 g Second 4 g
Person performing work:	M. Caldwell
Glass Grinding and Sieving	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	12/28/17
Number of additional 30 second milling intervals used:	1
Sieve size:	120
Glass Washing and Filtering	
Date of wash and filter steps:	1/2/18
Balance ID:	AD-0044-1 / ITS-BL001
Tare mass of new filter plus petri dish (g):	97.668
Mass of super-saturated glass (target 4 g):	4.007
Mass of DI water added to 250 mL beaker, 1st (target 50 g):	50.237
Tare mass of solution flask (g):	526.04
Mass of DI water added to 250 mL beaker, 2nd (target 50 g):	50.132
Mass of wet sample plus filter and petri dish (g):	102.085
Mass of recovered solution and flask (g):	617.58
Mass of dry sample plus filter and petri dish (g):	101.241

Exhibit A-2. Glass Grinding, Washing, and Filtering Log Sheets (continued)

Glass Grinding, Washing, and Filtering	
Glass ID:	LP2-OL-Ø4-1Q
First or second batch of this Glass ID (circle):	First 4 g Second 4 g
Person performing work:	M. Caldwell
Glass Grinding and Sieving	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	12/28/17
Number of additional 30 second milling intervals used:	1
Sieve size:	120
Glass Washing and Filtering	
Date of wash and filter steps:	1/2/2018
Balance ID:	AD-0044-1 / ITS-B1001
Tare mass of new filter plus petri dish (g):	101.342
Mass of super-saturated glass (target 4 g):	4.003
Mass of DI water added to 250 mL beaker, 1st (target 50 g):	50.101
Tare mass of solution flask (g):	525.65
Mass of DI water added to 250 mL beaker, 2nd (target 50 g):	50.340
Mass of wet sample plus filter and petri dish (g):	105.813
Mass of recovered solution and flask (g):	619.27
Mass of dry sample plus filter and petri dish (g):	105.027

Exhibit A-2. Glass Grinding, Washing, and Filtering Log Sheets (continued)

Glass Grinding, Washing, and Filtering	
Glass ID:	LP2-OL-05Q
First or second batch of this Glass ID (circle):	First 4 g Second 4 g
Person performing work:	M. Caldwell
Glass Grinding and Sieving	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	12/29/17
Number of additional 30 second milling intervals used:	1
Sieve size:	120
Glass Washing and Filtering	
Date of wash and filter steps:	1/3/2018
Balance ID:	AD-0044-1/TTS-BL001
Tare mass of new filter plus petri dish (g):	100.483
Mass of super-saturated glass (target 4 g):	4.029
Mass of DI water added to 250 mL beaker, 1st (target 50 g):	50.152
Tare mass of solution flask (g):	524.31
Mass of DI water added to 250 mL beaker, 2nd (target 50 g):	50.440
Mass of wet sample plus filter and petri dish (g):	105.037
Mass of recovered solution and flask (g):	606.04
Mass of dry sample plus filter and petri dish (g):	104.149

Exhibit A-2. Glass Grinding, Washing, and Filtering Log Sheets (continued)

Glass Grinding, Washing, and Filtering		
Glass ID:	LP2-OL-Ø5Q	
First or second batch of this Glass ID (circle):	First 4 g	Second 4 g
Person performing work:	M. Caldwell	
Glass Grinding and Sieving		
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	12/29/17	
Number of additional 30 second milling intervals used:	1	
Sieve size:	120	
Glass Washing and Filtering		
Date of wash and filter steps:	1/9/2018	
Balance ID:	AD-0044-1 / ITS-BL001	
Tare mass of new filter plus petri dish (g):	100.927	
Mass of super-saturated glass (target 4 g):	4.004	
Mass of DI water added to 250 mL beaker, 1st (target 50 g):	50.310	
Tare mass of solution flask (g):	526.35	
Mass of DI water added to 250 mL beaker, 2nd (target 50 g):	50.747	
Mass of wet sample plus filter and petri dish (g):	105.401	
Mass of recovered solution and flask (g):	592.93	
Mass of dry sample plus filter and petri dish (g):	104.660	

Exhibit A-2. Glass Grinding, Washing, and Filtering Log Sheets (continued)

Glass Grinding, Washing, and Filtering	
Glass ID:	LP2-OL-Ø7-1Q
First or second batch of this Glass ID (circle):	First 4 g Second 4 g
Person performing work:	M. Caldwell
Glass Grinding and Sieving	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	12/29/17
Number of additional 30 second milling intervals used:	1
Sieve size:	120
Glass Washing and Filtering	
Date of wash and filter steps:	1/4/2018
Balance ID:	AD-0044-1 / TTS-B1001
Tare mass of new filter plus petri dish (g):	99.314
Mass of super-saturated glass (target 4 g):	4.004
Mass of DI water added to 250 mL beaker, 1st (target 50 g):	50.590
Tare mass of solution flask (g):	524.96
Mass of DI water added to 250 mL beaker, 2nd (target 50 g):	50.435
Mass of wet sample plus filter and petri dish (g):	103.705
Mass of recovered solution and flask (g):	611.59
Mass of dry sample plus filter and petri dish (g):	102.995

Exhibit A-2. Glass Grinding, Washing, and Filtering Log Sheets (continued)

Glass Grinding, Washing, and Filtering	
Glass ID:	LP2-OL-Ø7-1Q
First or second batch of this Glass ID (circle):	First 4 g Second 4 g
Person performing work:	M.Caldwell
Glass Grinding and Sieving	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	12/29/17
Number of additional 30 second milling intervals used:	1
Sieve size:	120
Glass Washing and Filtering	
Date of wash and filter steps:	1/8/18
Balance ID:	AD-0044-1 /ITS-BLØØ1
Tare mass of new filter plus petri dish (g):	103.127
Mass of super-saturated glass (target 4 g):	4.008
Mass of DI water added to 250 mL beaker, 1st (target 50 g):	50.208
Tare mass of solution flask (g):	524.27
Mass of DI water added to 250 mL beaker, 2nd (target 50 g):	50.403
Mass of wet sample plus filter and petri dish (g):	107.765
Mass of recovered solution and flask (g):	572.29
Mass of dry sample plus filter and petri dish (g):	106.794

Exhibit A-2. Glass Grinding, Washing, and Filtering Log Sheets (continued)

Glass Grinding, Washing, and Filtering	
Glass ID:	LP2-OL-Ø9-1Q
First or second batch of this Glass ID (circle):	First 4 g Second 4 g
Person performing work:	M. Caldwell
Glass Grinding and Sieving	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	12/29/17
Number of additional 30 second milling intervals used:	Ø
Sieve size:	120
Glass Washing and Filtering	
Date of wash and filter steps:	1/8/18
Balance ID:	AD-0044-1 / ITS-BL001
Tare mass of new filter plus petri dish (g):	98.443
Mass of super-saturated glass (target 4 g):	4.012
Mass of DI water added to 250 mL beaker, 1st (target 50 g):	50.757
Tare mass of solution flask (g):	526.27
Mass of DI water added to 250 mL beaker, 2nd (target 50 g):	50.223
Mass of wet sample plus filter and petri dish (g):	103.233
Mass of recovered solution and flask (g):	603.62
Mass of dry sample plus filter and petri dish (g):	102.108

Exhibit A-2. Glass Grinding, Washing, and Filtering Log Sheets (continued)

Glass Grinding, Washing, and Filtering	
Glass ID:	LP2-OL-Ø9-1Q
First or second batch of this Glass ID (circle):	First 4 g Second 4 g
Person performing work:	M. Caldwell
Glass Grinding and Sieving	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	12/29/17
Number of additional 30 second milling intervals used:	Ø
Sieve size:	120
Glass Washing and Filtering	
Date of wash and filter steps:	1/9/2018
Balance ID:	AD-0044-1 / ITS-BL001
Tare mass of new filter plus petri dish (g):	98.983
Mass of super-saturated glass (target 4 g):	4.006
Mass of DI water added to 250 mL beaker, 1st (target 50 g):	50.928
Tare mass of solution flask (g):	526.32
Mass of DI water added to 250 mL beaker, 2nd (target 50 g):	50.361
Mass of wet sample plus filter and petri dish (g):	103.478
Mass of recovered solution and flask (g):	616.31
Mass of dry sample plus filter and petri dish (g):	102.723

Exhibit A-2. Glass Grinding, Washing, and Filtering Log Sheets (continued)

Glass Grinding, Washing, and Filtering	
Glass ID:	LP2-OL-11Q
First or second batch of this Glass ID (circle):	First 4 g Second 4 g
Person performing work:	M. Caldwell
Glass Grinding and Sieving	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	12/29/17
Number of additional 30 second milling intervals used:	1
Sieve size:	120
Glass Washing and Filtering	
Date of wash and filter steps:	1/9/2018
Balance ID:	AD-0044-1 / ITS-BL001
Tare mass of new filter plus petri dish (g):	100.704
Mass of super-saturated glass (target 4 g):	4.004
Mass of DI water added to 250 mL beaker, 1st (target 50 g):	50.390
Tare mass of solution flask (g):	524.35
Mass of DI water added to 250 mL beaker, 2nd (target 50 g):	50.532
Mass of wet sample plus filter and petri dish (g):	105.437
Mass of recovered solution and flask (g):	572.04
Mass of dry sample plus filter and petri dish (g):	104.466

Exhibit A-2. Glass Grinding, Washing, and Filtering Log Sheets (continued)

Glass Grinding, Washing, and Filtering	
Glass ID:	LP2-OL-11Q
First or second batch of this Glass ID (circle):	First 4 g Second 4 g
Person performing work:	M. Hsieh
Glass Grinding and Sieving	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	12/29/2017
Number of additional 30 second milling intervals used:	1
Sieve size:	120
Glass Washing and Filtering	
Date of wash and filter steps:	3/20/2018
Balance ID:	AD-0044-1 / ITS-BL001
Tare mass of new filter plus petri dish (g):	99.520
Mass of super-saturated glass (target 4 g):	4.019
Mass of DI water added to 250 mL beaker, 1st (target 50 g):	50.394
Tare mass of solution flask (g):	524.38
Mass of DI water added to 250 mL beaker, 2nd (target 50 g):	50.096
Mass of wet sample plus filter and petri dish (g):	104.526
Mass of recovered solution and flask (g):	605.65
Mass of dry sample plus filter and petri dish (g):	103.265

Exhibit A-2. Glass Grinding, Washing, and Filtering Log Sheets (continued)

Glass Grinding, Washing, and Filtering	
Glass ID:	LP2-OL-12Q
First or second batch of this Glass ID (circle):	First 4 g Second 4 g
Person performing work:	M. Caldwell
Glass Grinding and Sieving	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	12/29/17
Number of additional 30 second milling intervals used:	1
Sieve size:	120
Glass Washing and Filtering	
Date of wash and filter steps:	1/9/18
Balance ID:	AD-0044-1 / ITS-B4001
Tare mass of new filter plus petri dish (g):	97.144
Mass of super-saturated glass (target 4 g):	4.008
Mass of DI water added to 250 mL beaker, 1st (target 50 g):	51.330
Tare mass of solution flask (g):	526.28
Mass of DI water added to 250 mL beaker, 2nd (target 50 g):	50.238
Mass of wet sample plus filter and petri dish (g):	101.379
Mass of recovered solution and flask (g):	608.95
Mass of dry sample plus filter and petri dish (g):	100.940

Exhibit A-2. Glass Grinding, Washing, and Filtering Log Sheets (continued)

Glass Grinding, Washing, and Filtering	
Glass ID:	LP2-OL-12Q
First or second batch of this Glass ID (circle):	First 4 g Second 4 g
Person performing work:	M.Caldwell
Glass Grinding and Sieving	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	12/29/17
Number of additional 30 second milling intervals used:	1
Sieve size:	120
Glass Washing and Filtering	
Date of wash and filter steps:	1/10/2018
Balance ID:	AD-0044-1 / ITS-BL001
Tare mass of new filter plus petri dish (g):	97.395
Mass of super-saturated glass (target 4 g):	4.002
Mass of DI water added to 250 mL beaker, 1st (target 50 g):	50.651
Tare mass of solution flask (g):	524.33
Mass of DI water added to 250 mL beaker, 2nd (target 50 g):	51.026
Mass of wet sample plus filter and petri dish (g):	102.236
Mass of recovered solution and flask (g):	587.09
Mass of dry sample plus filter and petri dish (g):	101.181

Exhibit A-2. Glass Grinding, Washing, and Filtering Log Sheets (continued)

Glass Grinding, Washing, and Filtering	
Glass ID:	LP2-OL-13Q
First or second batch of this Glass ID (circle):	First 4 g Second 4 g
Person performing work:	M. Caldwell
Glass Grinding and Sieving	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	12/29/17
Number of additional 30 second milling intervals used:	1
Sieve size:	120
Glass Washing and Filtering	
Date of wash and filter steps:	1/9/18
Balance ID:	AD-0044-1 / ITS-BL001
Tare mass of new filter plus petri dish (g):	99.671
Mass of super-saturated glass (target 4 g):	4.010
Mass of DI water added to 250 mL beaker, 1st (target 50 g):	50.184
Tare mass of solution flask (g):	524.33
Mass of DI water added to 250 mL beaker, 2nd (target 50 g):	50.924
Mass of wet sample plus filter and petri dish (g):	103.373
Mass of recovered solution and flask (g):	540.59
Mass of dry sample plus filter and petri dish (g):	103.371

Exhibit A-2. Glass Grinding, Washing, and Filtering Log Sheets (continued)

Glass Grinding, Washing, and Filtering	
Glass ID:	LP2-OL-14Q
First or second batch of this Glass ID (circle):	First 4 g Second 4 g
Person performing work:	M.Caldwell
Glass Grinding and Sieving	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	12/29/17
Number of additional 30 second milling intervals used:	1
Sieve size:	120
Glass Washing and Filtering	
Date of wash and filter steps:	1/8/18
Balance ID:	AD-00444/ITS-B4001
Tare mass of new filter plus petri dish (g):	101.431
Mass of super-saturated glass (target 4 g):	4.035
Mass of DI water added to 250 mL beaker, 1st (target 50 g):	50.568
Tare mass of solution flask (g):	526.43
Mass of DI water added to 250 mL beaker, 2nd (target 50 g):	50.595
Mass of wet sample plus filter and petri dish (g):	106.340
Mass of recovered solution and flask (g):	621.10
Mass of dry sample plus filter and petri dish (g):	105.174

Exhibit A-2. Glass Grinding, Washing, and Filtering Log Sheets (continued)

Glass Grinding, Washing, and Filtering	
Glass ID:	LP2-OL-14Q
First or second batch of this Glass ID (circle):	First 4 g Second 4 g
Person performing work:	M. Caldwell
Glass Grinding and Sieving	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	12/29/17
Number of additional 30 second milling intervals used:	1
Sieve size:	120
Glass Washing and Filtering	
Date of wash and filter steps:	1/8/18
Balance ID:	AD-0044-1/ITS-B1001
Tare mass of new filter plus petri dish (g):	97.468
Mass of super-saturated glass (target 4 g):	4.004
Mass of DI water added to 250 mL beaker, 1st (target 50 g):	50.353
Tare mass of solution flask (g):	528.26
Mass of DI water added to 250 mL beaker, 2nd (target 50 g):	50.922
Mass of wet sample plus filter and petri dish (g):	101.973
Mass of recovered solution and flask (g):	615.57
Mass of dry sample plus filter and petri dish (g):	101.178

Exhibit A-2. Glass Grinding, Washing, and Filtering Log Sheets (continued)

Glass Grinding, Washing, and Filtering	
Glass ID:	LP2-OL-15Q
First or second batch of this Glass ID (circle):	First 4 g Second 4 g
Person performing work:	M.Caldwell
Glass Grinding and Sieving	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	1/29/2018
Number of additional 30 second milling intervals used:	1
Sieve size:	120
Glass Washing and Filtering	
Date of wash and filter steps:	2/13/2018
Balance ID:	AD-0044-1 / ITS-BL001
Tare mass of new filter plus petri dish (g):	98.242
Mass of super-saturated glass (target 4 g):	4.008
Mass of DI water added to 250 mL beaker, 1st (target 50 g):	50.508
Tare mass of solution flask (g):	524.30
Mass of DI water added to 250 mL beaker, 2nd (target 50 g):	50.444
Mass of wet sample plus filter and petri dish (g):	102.450
Mass of recovered solution and flask (g):	611.42
Mass of dry sample plus filter and petri dish (g):	101.997

Exhibit A-2. Glass Grinding, Washing, and Filtering Log Sheets (continued)

Glass Grinding, Washing, and Filtering	
Glass ID:	LP2-OL-15Q
First or second batch of this Glass ID (circle):	First 4 g Second 4 g
Person performing work:	M.Caldwell
Glass Grinding and Sieving	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	1/29/2018
Number of additional 30 second milling intervals used:	1
Sieve size:	120
Glass Washing and Filtering	
Date of wash and filter steps:	2/13/2018
Balance ID:	AD-0044-1 / ITS-BL001
Tare mass of new filter plus petri dish (g):	101.080
Mass of super-saturated glass (target 4 g):	4.006
Mass of DI water added to 250 mL beaker, 1st (target 50 g):	50.133
Tare mass of solution flask (g):	526.42
Mass of DI water added to 250 mL beaker, 2nd (target 50 g):	50.008
Mass of wet sample plus filter and petri dish (g):	105.668
Mass of recovered solution and flask (g):	603.98
Mass of dry sample plus filter and petri dish (g):	104.840

Exhibit A-2. Glass Grinding, Washing, and Filtering Log Sheets (continued)

Glass Grinding, Washing, and Filtering	
Glass ID:	LP2-OL-17-Q
First or second batch of this Glass ID (circle):	First 4 g Second 4 g
Person performing work:	M. Caldwell
Glass Grinding and Sieving	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	1/29/2018
Number of additional 30 second milling intervals used:	0
Sieve size:	120
Glass Washing and Filtering	
Date of wash and filter steps:	2/13/2018
Balance ID:	AD-0044-1 / ITS-BL001
Tare mass of new filter plus petri dish (g):	98.984
Mass of super-saturated glass (target 4 g):	4.004
Mass of DI water added to 250 mL beaker, 1st (target 50 g):	50.349
Tare mass of solution flask (g):	526.30
Mass of DI water added to 250 mL beaker, 2nd (target 50 g):	50.008
Mass of wet sample plus filter and petri dish (g):	103.756
Mass of recovered solution and flask (g):	618.14
Mass of dry sample plus filter and petri dish (g):	102.716

Exhibit A-2. Glass Grinding, Washing, and Filtering Log Sheets (continued)

Glass Grinding, Washing, and Filtering	
Glass ID:	LP2-OL-17-Q
First or second batch of this Glass ID (circle):	First 4 g Second 4 g
Person performing work:	M. Caldwell
Glass Grinding and Sieving	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	1/29/2018
Number of additional 30 second milling intervals used:	0
Sieve size:	120
Glass Washing and Filtering	
Date of wash and filter steps:	2/13/2018
Balance ID:	AD-0044-1 / ITS-BL001
Tare mass of new filter plus petri dish (g):	99.345
Mass of super-saturated glass (target 4 g):	4.009
Mass of DI water added to 250 mL beaker, 1st (target 50 g):	50.957
Tare mass of solution flask (g):	526.30
Mass of DI water added to 250 mL beaker, 2nd (target 50 g):	50.478
Mass of wet sample plus filter and petri dish (g):	103.908
Mass of recovered solution and flask (g):	605.92
Mass of dry sample plus filter and petri dish (g):	103.063

Exhibit A-2. Glass Grinding, Washing, and Filtering Log Sheets (continued)

Glass Grinding, Washing, and Filtering	
Glass ID:	LP2-OL-19Q
First or second batch of this Glass ID (circle):	First 4 g Second 4 g
Person performing work:	M. Hsieh
Glass Grinding and Sieving	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	1/29/2018
Number of additional 30 second milling intervals used:	1
Sieve size:	120
Glass Washing and Filtering	
Date of wash and filter steps:	3/22/2018
Balance ID:	AD-0044-1/ITS-BL001
Tare mass of new filter plus petri dish (g):	100.264
Mass of super-saturated glass (target 4 g):	4.007
Mass of DI water added to 250 mL beaker, 1st (target 50 g):	51.023
Tare mass of solution flask (g):	524.25
Mass of DI water added to 250 mL beaker, 2nd (target 50 g):	50.056
Mass of wet sample plus filter and petri dish (g):	104.791
Mass of recovered solution and flask (g):	607.34
Mass of dry sample plus filter and petri dish (g):	103.933

Exhibit A-2. Glass Grinding, Washing, and Filtering Log Sheets (continued)

Glass Grinding, Washing, and Filtering	
Glass ID:	LP2-OL-20Q
First or second batch of this Glass ID (circle):	First 4 g Second 4 g
Person performing work:	M. Hsieh
Glass Grinding and Sieving	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	1/29/2018
Number of additional 30 second milling intervals used:	1
Sieve size:	120
Glass Washing and Filtering	
Date of wash and filter steps:	3/22/2018
Balance ID:	AD-0044-1 / ITS-BL001
Tare mass of new filter plus petri dish (g):	97.728
Mass of super-saturated glass (target 4 g):	4.004
Mass of DI water added to 250 mL beaker, 1st (target 50 g):	51.349
Tare mass of solution flask (g):	524.37
Mass of DI water added to 250 mL beaker, 2nd (target 50 g):	50.429
Mass of wet sample plus filter and petri dish (g):	102.529
Mass of recovered solution and flask (g):	619.31
Mass of dry sample plus filter and petri dish (g):	101.513

Exhibit A-2. Glass Grinding, Washing, and Filtering Log Sheets (continued)

Glass Grinding, Washing, and Filtering	
Glass ID:	LP2-OL-21-Q
First or second batch of this Glass ID (circle):	First 4 g Second 4 g
Person performing work:	M.Caldwell
Glass Grinding and Sieving	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	1/29/2018
Number of additional 30 second milling intervals used:	1
Sieve size:	120
Glass Washing and Filtering	
Date of wash and filter steps:	2/14/2018
Balance ID:	AD-0044-1 / ITS-BL001
Tare mass of new filter plus petri dish (g):	102.432
Mass of super-saturated glass (target 4 g):	4.015
Mass of DI water added to 250 mL beaker, 1st (target 50 g):	50.439
Tare mass of solution flask (g):	526.44
Mass of DI water added to 250 mL beaker, 2nd (target 50 g):	50.362
Mass of wet sample plus filter and petri dish (g):	107.128
Mass of recovered solution and flask (g):	613.12
Mass of dry sample plus filter and petri dish (g):	106.173

Exhibit A-2. Glass Grinding, Washing, and Filtering Log Sheets (continued)

Glass Grinding, Washing, and Filtering	
Glass ID:	LP2-OL-21Q
First or second batch of this Glass ID (circle):	First 4 g Second 4 g
Person performing work:	M. Hsieh
Glass Grinding and Sieving	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	1/29/2018
Number of additional 30 second milling intervals used:	1
Sieve size:	120
Glass Washing and Filtering	
Date of wash and filter steps:	3/20/2018
Balance ID:	AD-0044-1 / ITS-BL001
Tare mass of new filter plus petri dish (g):	100.404
Mass of super-saturated glass (target 4 g):	4.014
Mass of DI water added to 250 mL beaker, 1st (target 50 g):	50.261
Tare mass of solution flask (g):	526.32
Mass of DI water added to 250 mL beaker, 2nd. (target 50 g):	50.221
Mass of wet sample plus filter and petri dish (g):	105.051
Mass of recovered solution and flask (g):	570.35
Mass of dry sample plus filter and petri dish (g):	104.129

Exhibit A-2. Glass Grinding, Washing, and Filtering Log Sheets (continued)

Glass Grinding, Washing, and Filtering	
Glass ID:	LP2-OL-22Q
First or second batch of this Glass ID (circle):	First 4 g Second 4 g
Person performing work:	M. Hsieh
Glass Grinding and Sieving	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	1/29/2018
Number of additional 30 second milling intervals used:	1
Sieve size:	120
Glass Washing and Filtering	
Date of wash and filter steps:	3/21/2018
Balance ID:	AD-0044-1 /ITS-BL001
Tare mass of new filter plus petri dish (g):	98.048
Mass of super-saturated glass (target 4 g):	4.004
Mass of DI water added to 250 mL beaker, 1st (target 50 g):	50.245
Tare mass of solution flask (g):	524.38
Mass of DI water added to 250 mL beaker, 2nd (target 50 g):	51.033
Mass of wet sample plus filter and petri dish (g):	102.633
Mass of recovered solution and flask (g):	582.73
Mass of dry sample plus filter and petri dish (g):	101.800

Exhibit A-2. Glass Grinding, Washing, and Filtering Log Sheets (continued)

Glass Grinding, Washing, and Filtering	
Glass ID:	LP2-OL-25Q
First or second batch of this Glass ID (circle):	First 4 g Second 4 g
Person performing work:	M. Hsieh
Glass Grinding and Sieving	
Grind glass in Angstrom Mill with ring & puck for 2 minutes, record date milled:	1/29/2018
Number of additional 30 second milling intervals used:	1
Sieve size:	120
Glass Washing and Filtering	
Date of wash and filter steps:	3/22/2018
Balance ID:	AD-0044-1 /ITS-BL001
Tare mass of new filter plus petri dish (g):	100.346
Mass of super-saturated glass (target 4 g):	4.007
Mass of DI water added to 250 mL beaker, 1st (target 50 g):	50.111
Tare mass of solution flask (g):	526.42
Mass of DI water added to 250 mL beaker, 2nd (target 50 g):	51.573
Mass of wet sample plus filter and petri dish (g):	105.110
Mass of recovered solution and flask (g):	587.01
Mass of dry sample plus filter and petri dish (g):	104.092

Table A-1. Summary of Data Recorded During Re-Melting of Sulfur Saturated Glasses

Glass Identifier	First Re-Melt			Second Re-Melt			Third Re-Melt		
	Mass of Empty Crucible (g)	Mass of Crucible with Glass (g)	Mass of Crucible with Glass After Cooling (g)	Mass of Empty Crucible (g)	Mass of Crucible with Glass (g)	Mass of Crucible with Glass After Cooling (g)	Mass of Empty Crucible (g)	Mass of Crucible with Glass (g)	Mass of Crucible with Glass After Cooling (g)
LP2-OL-01-3	88.427	141.704	141.506	88.441	140.788	140.187	88.432	139.660	139.058
LP2-OL-04-1	87.529	140.500	140.105	87.646	139.594	139.360	87.634	138.592	138.249
LP2-OL-05	90.105	143.233	142.294	90.132	141.754	141.231	90.117	140.530	139.970
LP2-OL-07-1	87.111	140.175	139.793	87.117	139.211	138.925	87.117	138.012	137.802
LP2-OL-09-1	88.113	140.923	140.744	88.157	140.161	139.936	88.204	138.259	137.869
LP2-OL-11	89.127	142.105	141.958	89.258	140.862	140.732	89.242	138.858	138.652
LP2-OL-12	89.138	142.719	142.324	89.226	141.571	141.428	89.190	141.013	140.515
LP2-OL-13	89.823	143.515	143.227	89.999	142.113	141.865	90.059	140.787	140.451
LP2-OL-14	91.112	145.128	144.923	91.326	144.080	143.827	91.486	143.123	142.702
LP2-OL-15	88.419	142.276	142.165	88.425	141.708	141.577	88.426	141.212	141.057
LP2-OL-17	87.524	140.909	140.622	87.680	140.099	139.768	87.679	139.358	138.912
LP2-OL-19	90.098	143.993	143.861	90.120	143.350	142.865	90.120	142.549	142.165
LP2-OL-20	87.105	140.851	140.639	87.130	140.366	140.133	87.119	139.838	139.688
LP2-OL-21	88.105	141.079	140.961	88.108	140.513	140.380	88.121	140.075	140.277
LP2-OL-22	89.121	142.018	139.613	89.193	141.492	141.244	89.221	140.482	140.277
LP2-OL-25	89.132	142.030	141.925	89.154	141.787	141.426	89.197	140.808	140.439

Table A-2. Summary of Data Recorded During Washing of Sulfur Saturated Melts

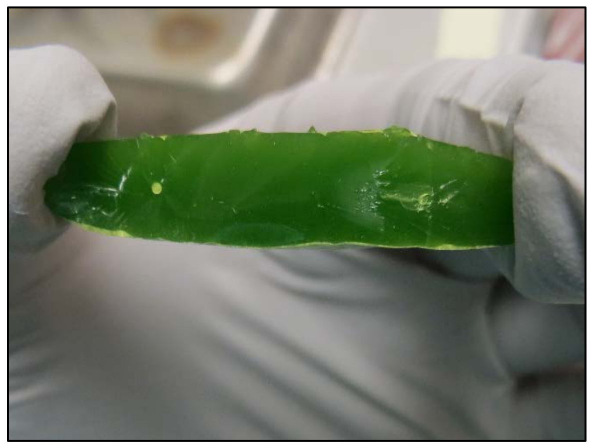
Glass Identifier	First Wash Sample								Second Wash Sample							
	Tare Mass of New Filter Plus Petri Dish (g)	Mass of Glass Sample (g)	Mass of Water Added First (g)	Mass of Water Added Second (g)	Mass of Wet Glass, Filter, and Petri Dish (g)	Mass of Dry Glass, Filter, and Petri Dish (g)	Tare Mass of Flask (g)	Mass of Recovered Solution and Flask (g)	Tare Mass of New Filter Plus Petri Dish (g)	Mass of Glass Sample (g)	Mass of Water Added First (g)	Mass of Water Added Second (g)	Mass of Wet Glass, Filter, and Petri Dish (g)	Mass of Dry Glass, Filter, and Petri Dish (g)	Tare Mass of Flask (g)	Mass of Recovered Solution and Flask (g)
LP2-OL-01-3	97.736	4.000	50.125	50.150	102.334	101.433	524.37	620.96	99.443	4.002	51.150	50.520	104.095	103.124	526.75	625.05
LP2-OL-04-1	97.668	4.007	50.237	50.132	102.085	101.241	526.04	617.58	101.342	4.003	50.101	50.340	105.813	105.027	525.65	619.27
LP2-OL-05	100.483	4.029	50.152	50.440	105.037	104.149	524.31	606.04	100.927	4.004	50.310	50.747	105.401	104.660	526.35	592.93
LP2-OL-07-1	99.314	4.004	50.590	50.435	103.705	102.995	524.96	611.59	103.127	4.008	50.208	50.403	107.765	106.794	524.27	572.29
LP2-OL-09-1	98.443	4.012	50.757	50.223	103.233	102.108	526.27	603.62	98.983	4.006	50.928	50.361	103.478	102.723	526.32	616.31
LP2-OL-11	100.704	4.004	50.390	50.532	105.437	104.466	524.35	572.04	99.520	4.019	50.394	50.096	104.526	103.265	524.38	605.65
LP2-OL-12	97.144	4.008	51.330	50.238	101.379	100.940	526.28	608.95	97.395	4.002	50.651	51.026	102.236	101.181	524.33	587.09
LP2-OL-13	99.671	4.010	50.184	50.924	103.373	103.371	524.33	540.59	n/a, only one wash and filter cycle was needed							
LP2-OL-14	101.431	4.035	50.568	50.595	106.340	105.174	526.43	621.10	97.468	4.004	50.353	50.922	101.973	101.178	528.26	615.57
LP2-OL-15	98.242	4.008	50.508	50.444	102.850	101.997	524.30	611.42	101.080	4.006	50.133	50.008	105.668	104.840	526.42	603.98
LP2-OL-17	98.984	4.004	50.349	50.008	103.756	102.716	526.30	618.14	99.345	4.009	50.957	50.478	103.908	103.063	526.30	605.92
LP2-OL-19	100.264	4.007	51.023	50.056	104.791	103.933	524.25	607.34	n/a, only one wash and filter cycle was needed							
LP2-OL-20	97.728	4.004	51.349	50.429	102.529	101.513	524.37	619.31	n/a, only one wash and filter cycle was needed							
LP2-OL-21	102.432	4.015	50.439	50.362	107.128	106.173	526.44	613.12	100.404	4.014	50.261	50.221	105.051	104.129	526.32	570.35
LP2-OL-22	98.048	4.004	50.245	51.033	102.633	101.800	524.38	582.73	n/a, only one wash and filter cycle was needed							
LP2-OL-25	100.386	4.007	50.111	51.573	105.110	104.092	526.42	587.01	n/a, only one wash and filter cycle was needed							

nm – not measured

Appendix B Photographs and Micrographs of the LP2-OL Sulfur Saturated Melts

Exhibit B-1. Photographs of the Sulfur Saturated Melts

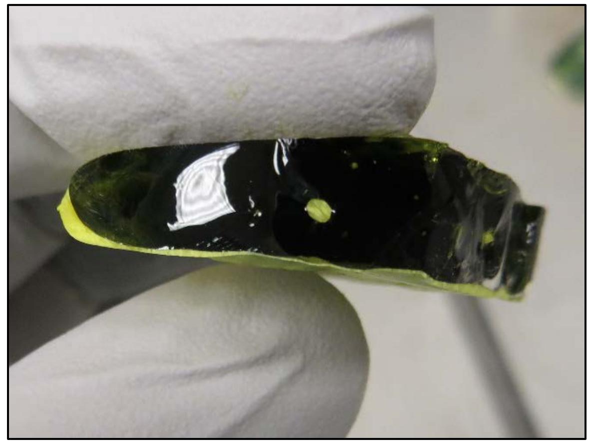

First re-melt

Third re-melt

LP2-OL-01-3

Exhibit B-1. Photographs of the Sulfur Saturated Melts (continued)

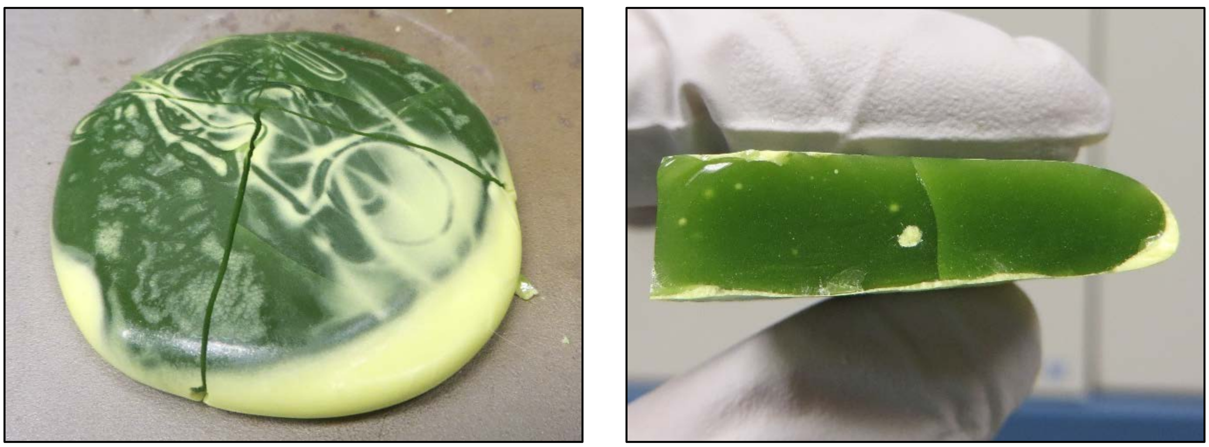
First re-melt


Third re-melt

LP2-OL-04-1

Exhibit B-1. Photographs of the Sulfur Saturated Melts (continued)

First re-melt

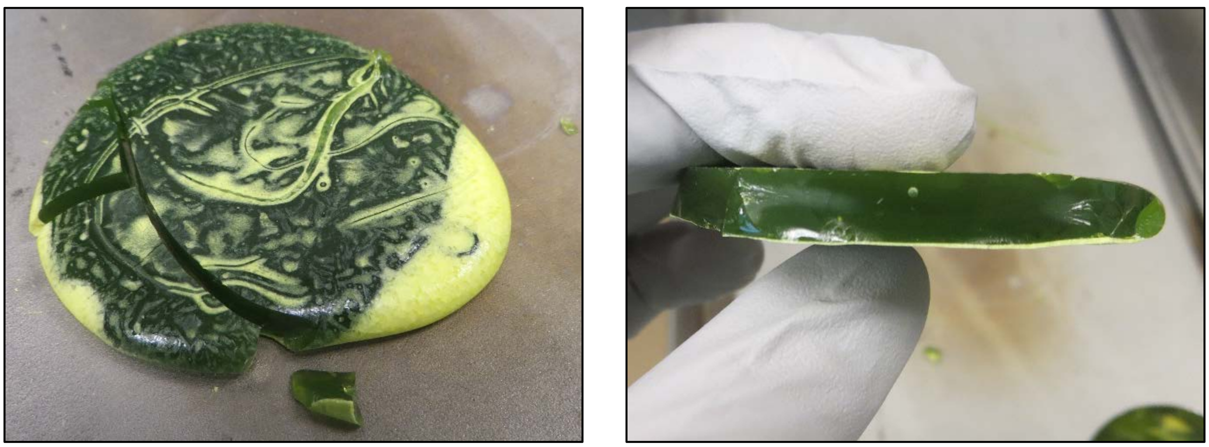


Third re-melt

LP2-OL-05

Exhibit B-1. Photographs of the Sulfur Saturated Melts (continued)

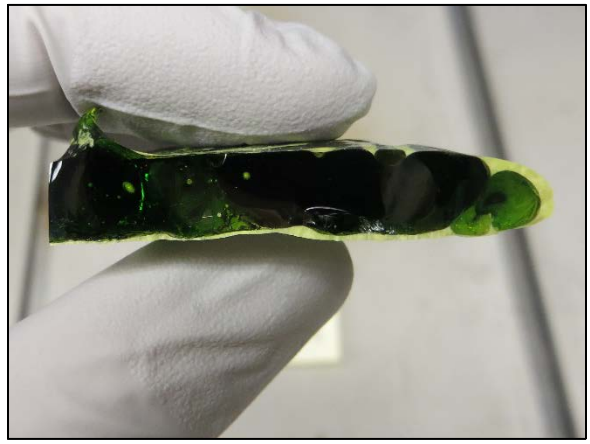
First re-melt



Third re-melt

LP2-OL-07-1

Exhibit B-1. Photographs of the Sulfur Saturated Melts (continued)

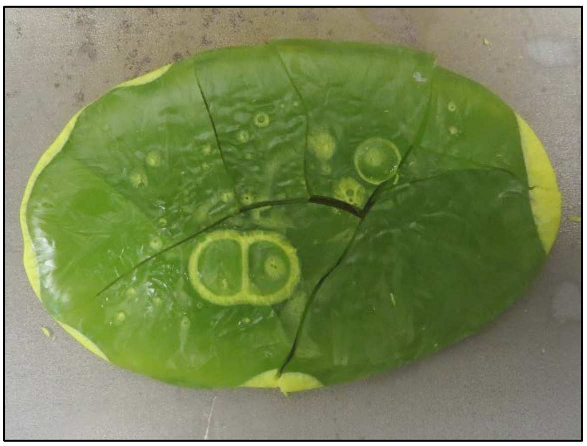
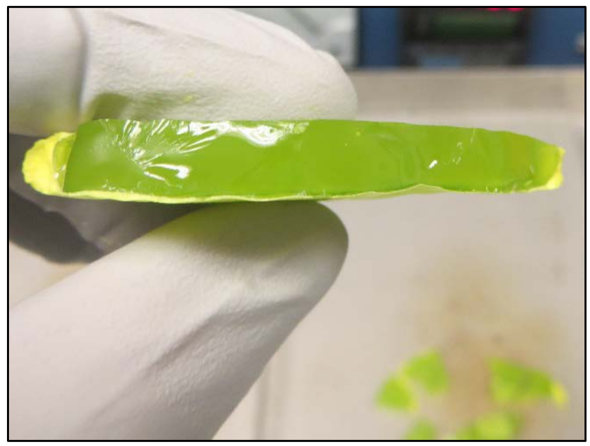
First re-melt


Third re-melt

LP2-OL-09-1

Exhibit B-1. Photographs of the Sulfur Saturated Melts (continued)

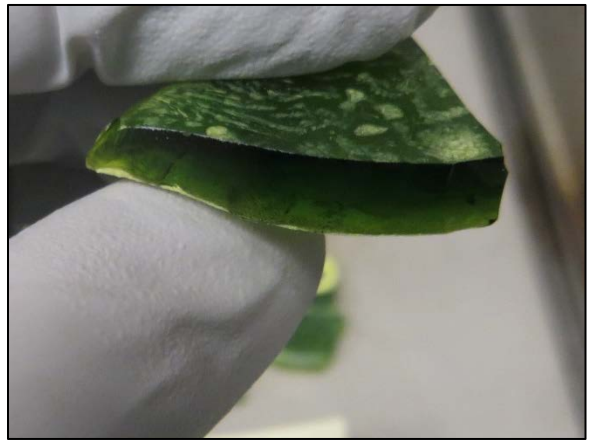

First re-melt

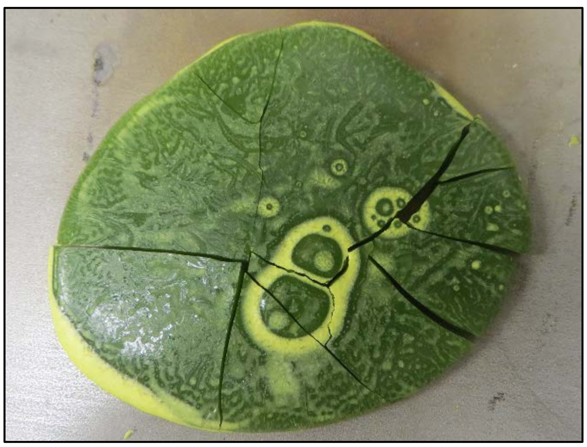
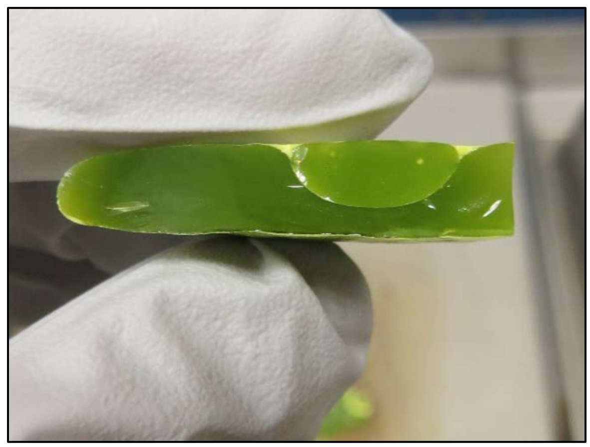
Third re-melt

LP2-OL-11

Exhibit B-1. Photographs of the Sulfur Saturated Melts (continued)

First re-melt

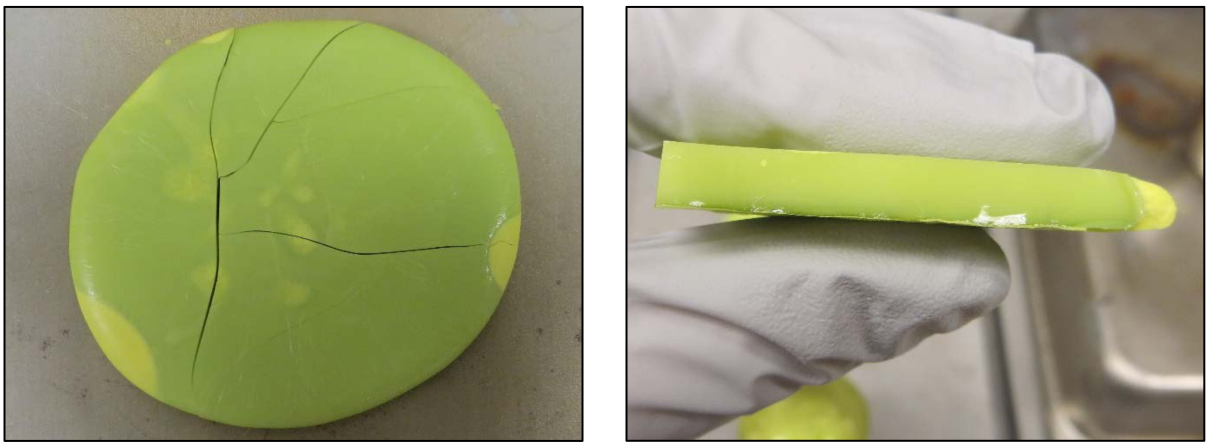



Third re-melt

LP2-OL-12

Exhibit B-1. Photographs of the Sulfur Saturated Melts (continued)

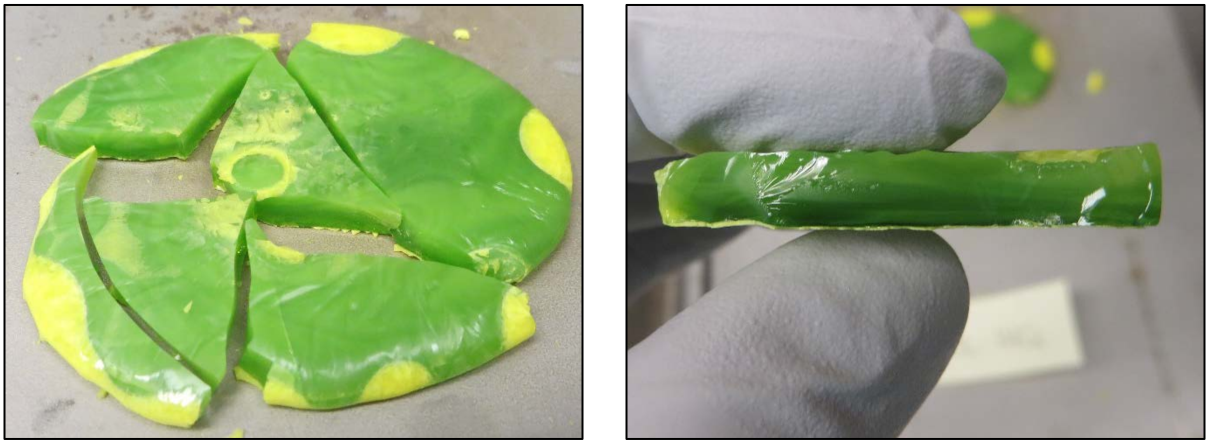
First re-melt



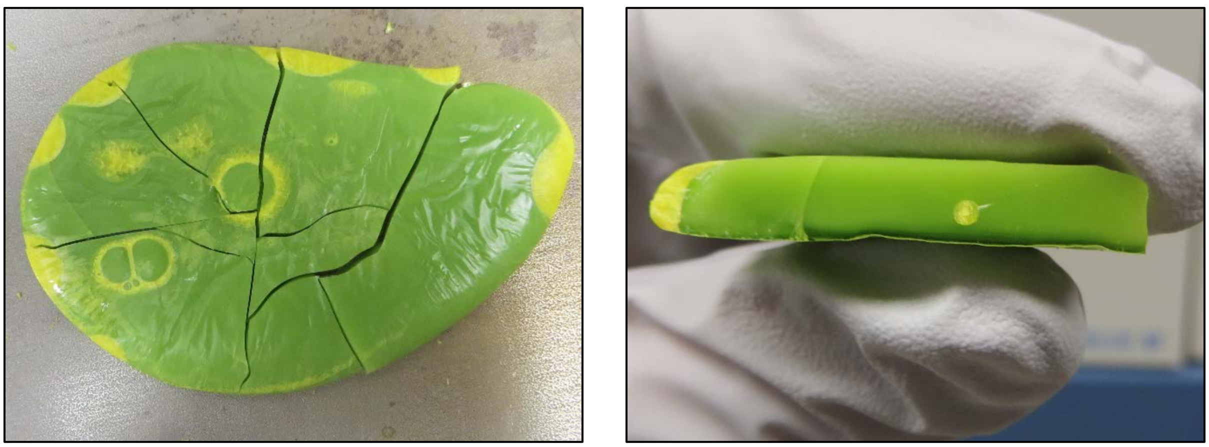
Third re-melt

LP2-OL-13

Exhibit B-1. Photographs of the Sulfur Saturated Melts (continued)



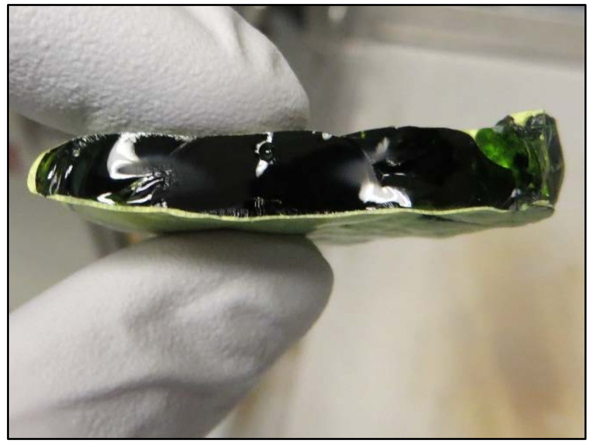
First re-melt



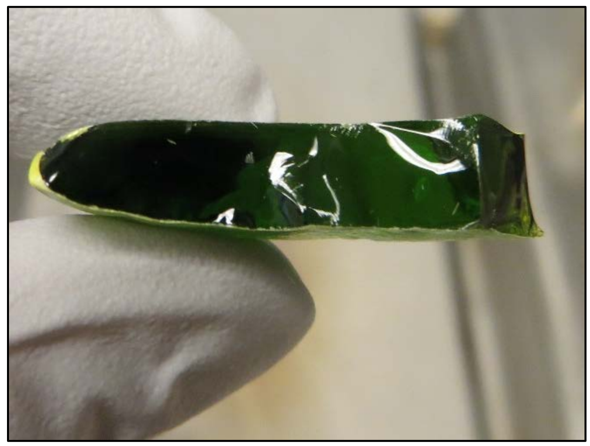
Third re-melt

LP2-OL-14

Exhibit B-1. Photographs of the Sulfur Saturated Melts (continued)

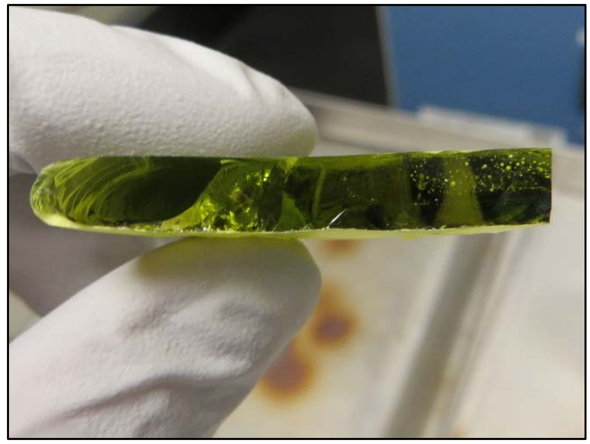
First re-melt

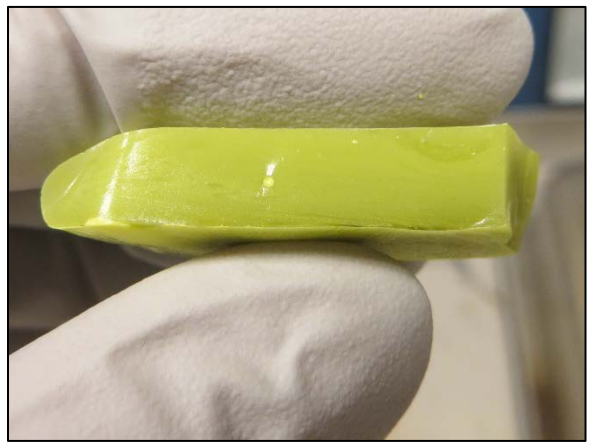
Third re-melt

LP2-OL-15

Exhibit B-1. Photographs of the Sulfur Saturated Melts (continued)

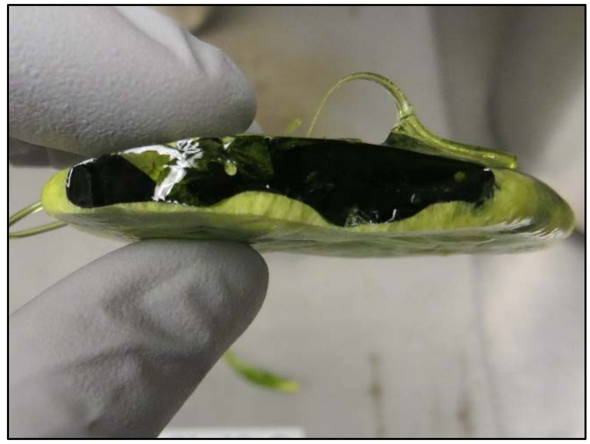
First re-melt

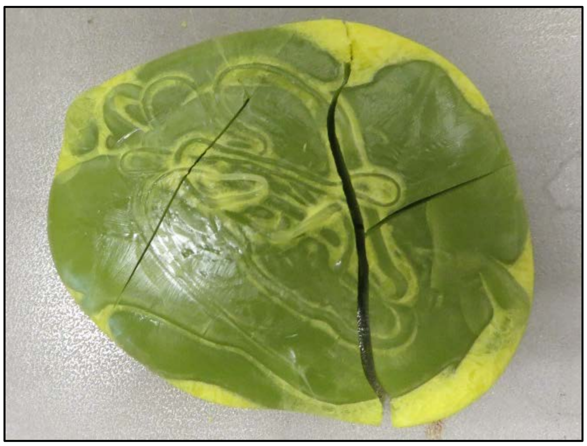
Third re-melt

LP2-OL-17

Exhibit B-1. Photographs of the Sulfur Saturated Melts (continued)



First re-melt

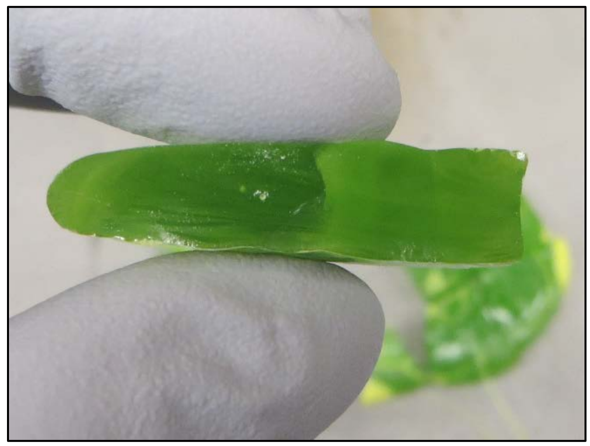


Third re-melt

LP2-OL-19

Exhibit B-1. Photographs of the Sulfur Saturated Melts (continued)

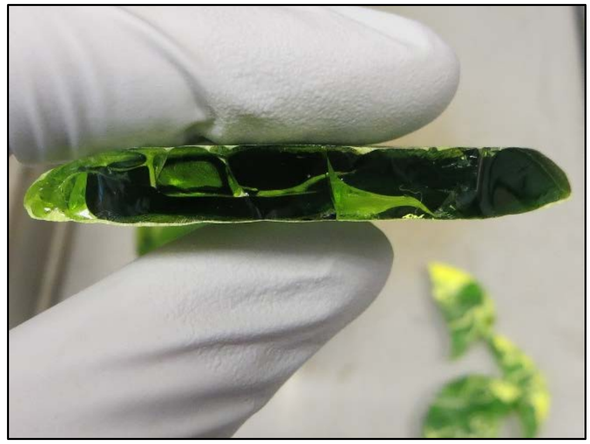

First re-melt

Third re-melt

LP2-OL-20

Exhibit B-1. Photographs of the Sulfur Saturated Melts (continued)

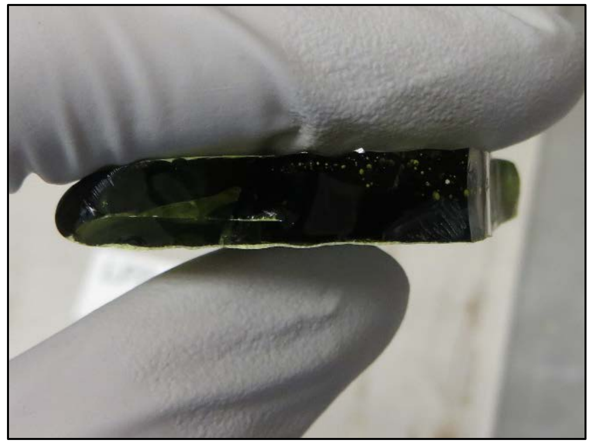



First re-melt

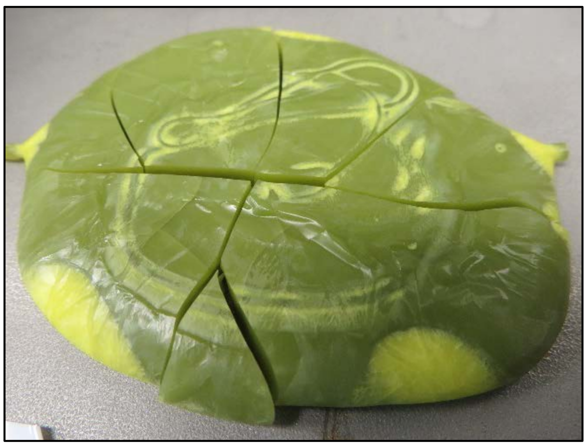

Third re-melt

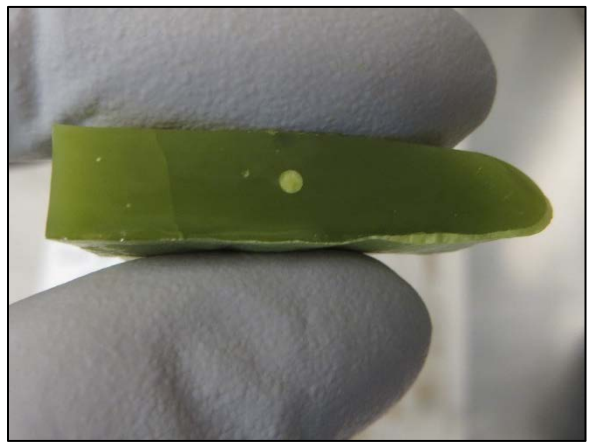
LP2-OL-21

Exhibit B-1. Photographs of the Sulfur Saturated Melts (continued)



First re-melt

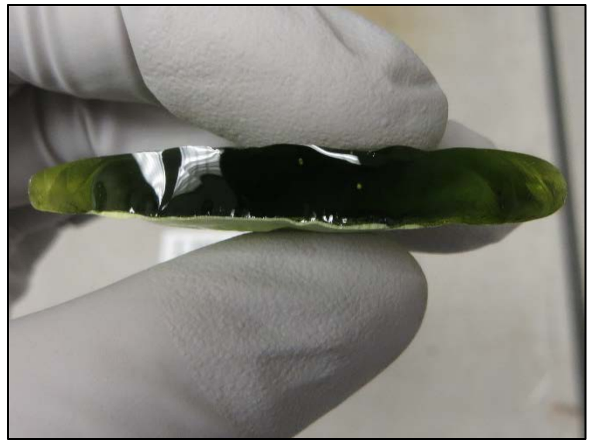




Third re-melt

LP2-OL-22

Exhibit B-1. Photographs of the Sulfur Saturated Melts (continued)

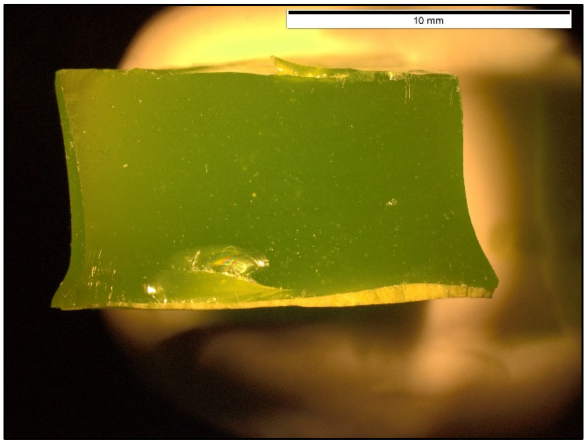



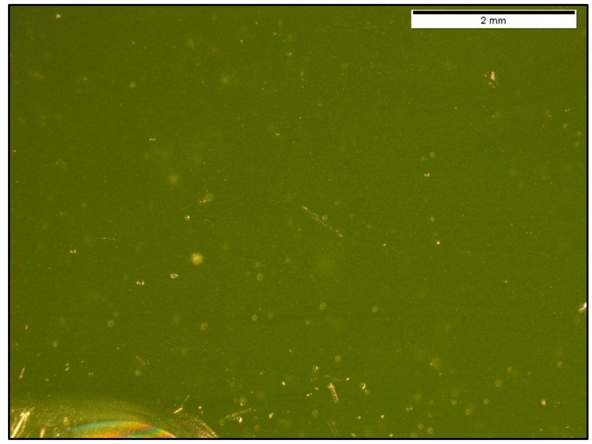
First re-melt


Third re-melt

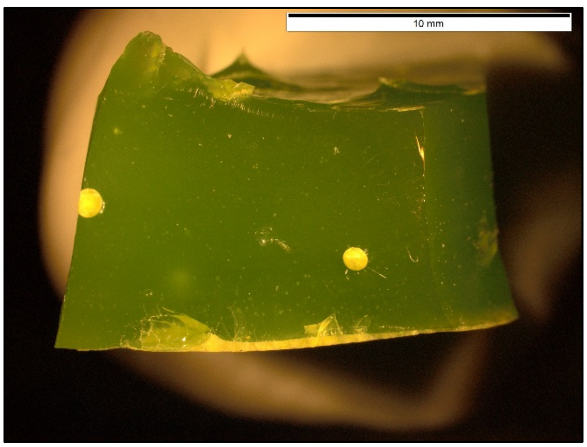
LP2-OL-25

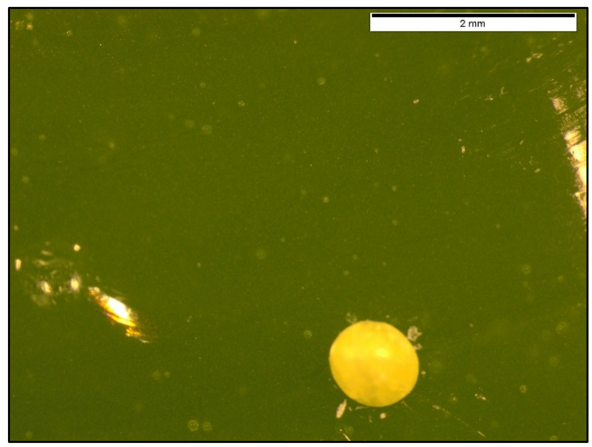
Exhibit B-2. Optical Micrographs of the Sulfur Saturated Melts





Section A

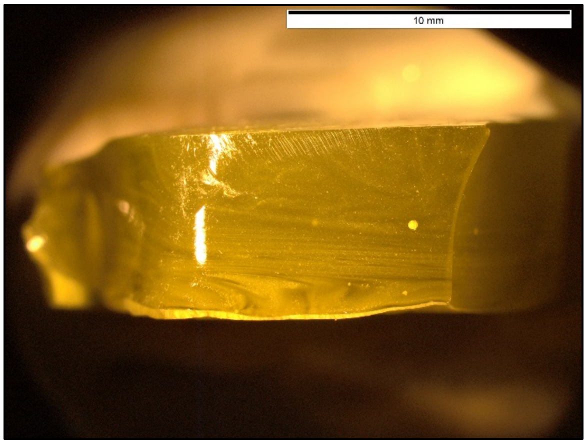


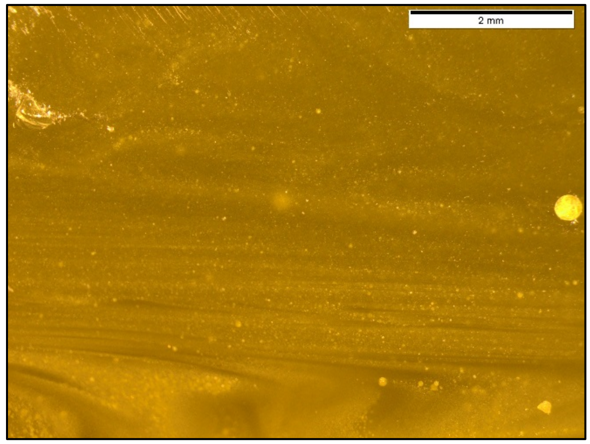


Section B

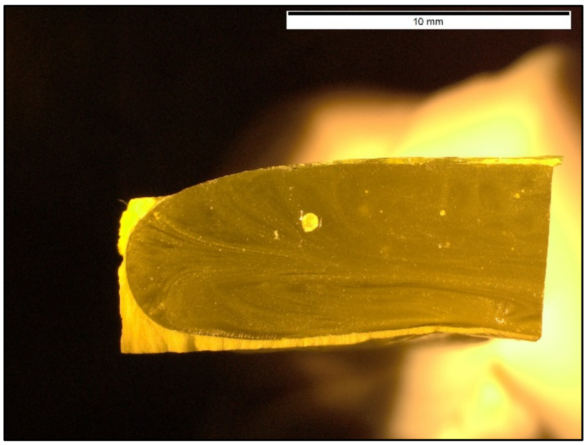
LP2-OL-01-3

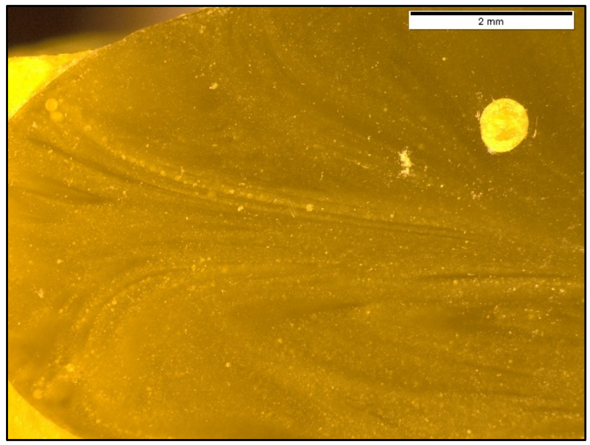
Exhibit B-2. Optical Micrographs of the Sulfur Saturated Melts (continued)





Section A

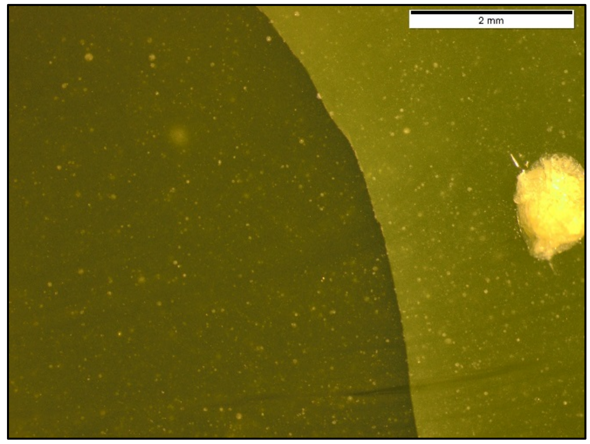




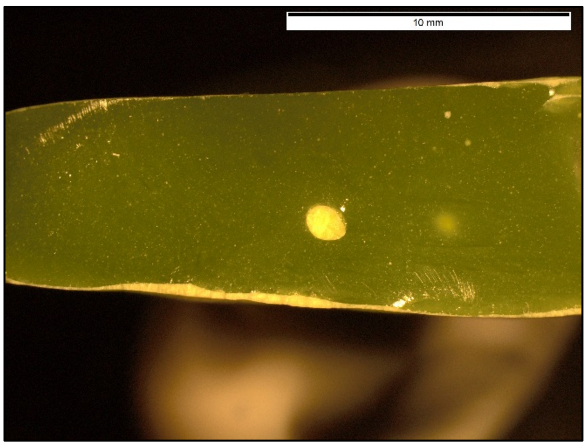
Section B

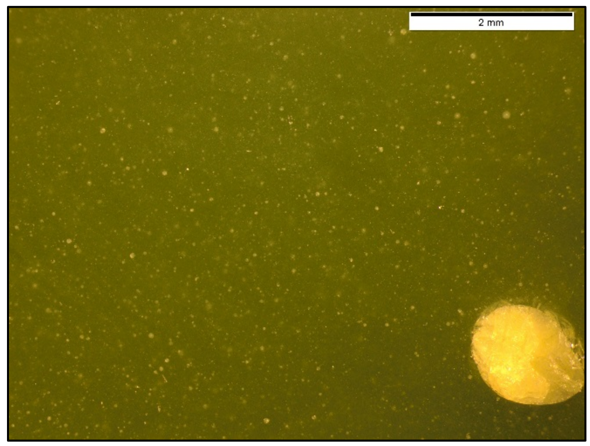
LP2-OL-04-1

Exhibit B-2. Optical Micrographs of the Sulfur Saturated Melts (continued)



Section A

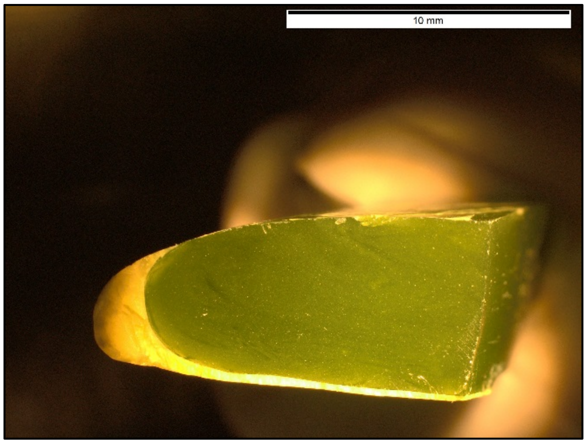


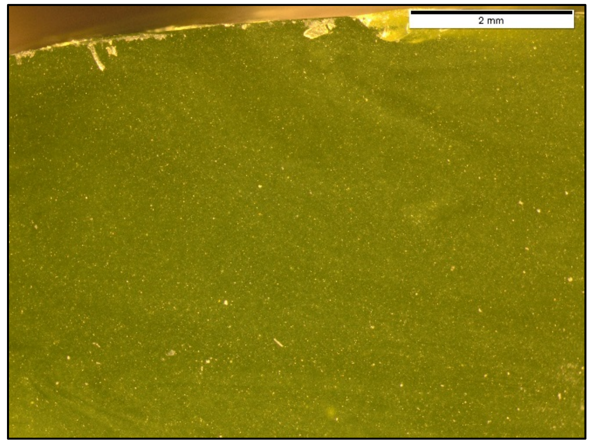


Section B

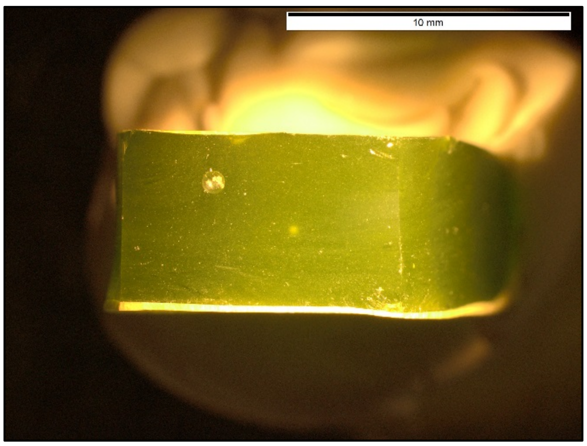
LP2-OL-05

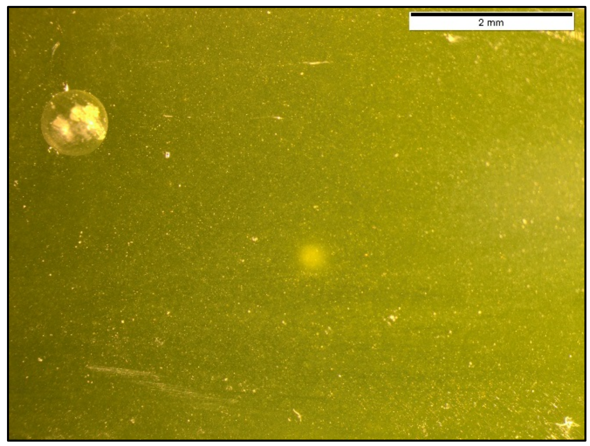
Exhibit B-2. Optical Micrographs of the Sulfur Saturated Melts (continued)





Section A

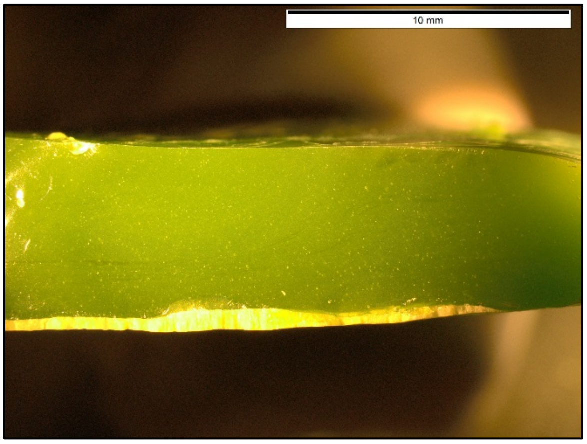


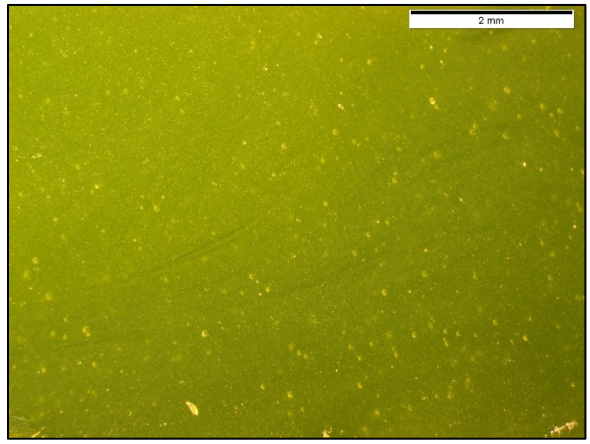


Section B

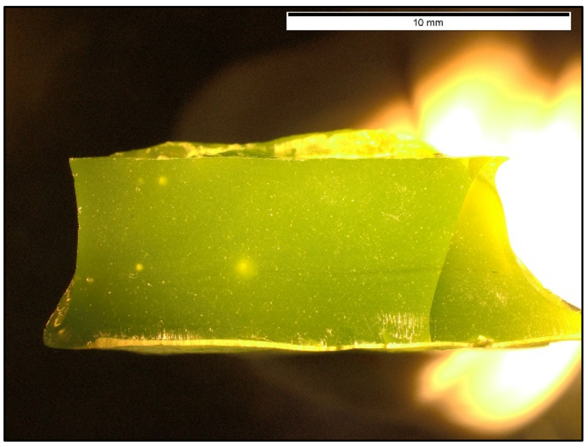
LP2-OL-07-1

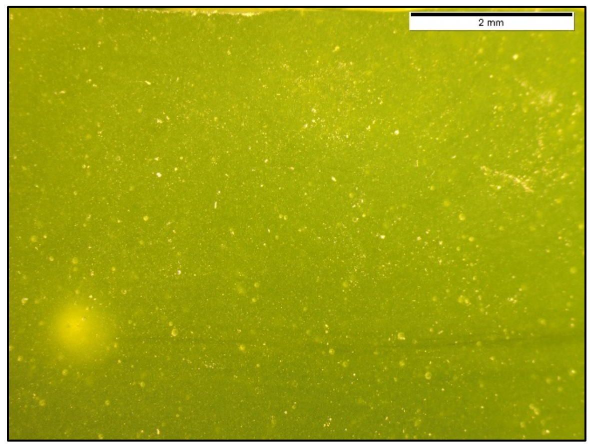
Exhibit B-2. Optical Micrographs of the Sulfur Saturated Melts (continued)





Section A

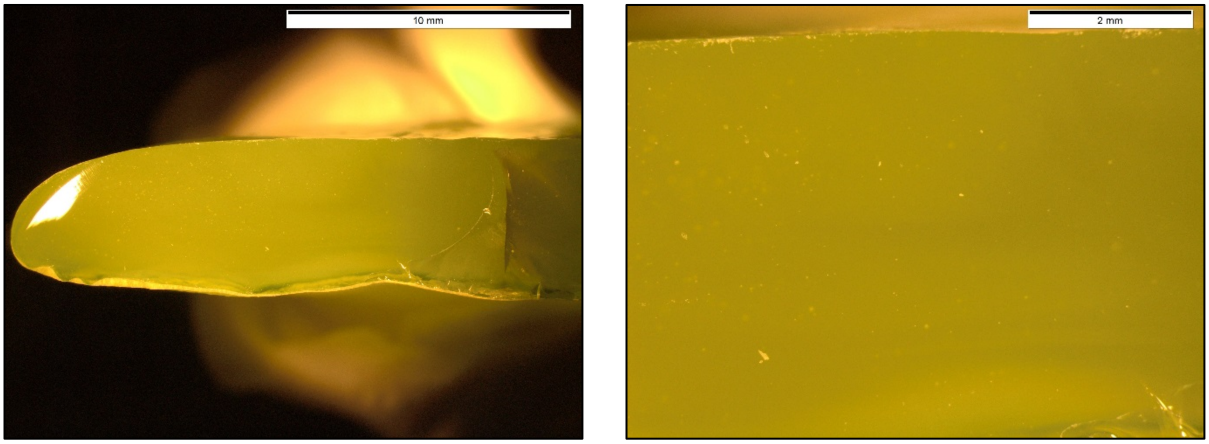




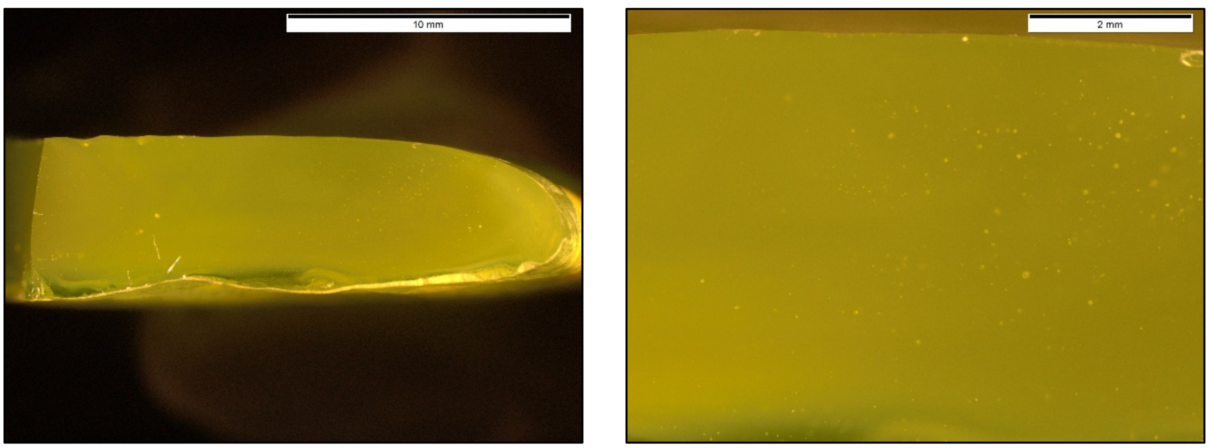
Section B

LP2-OL-09-1

Exhibit B-2. Optical Micrographs of the Sulfur Saturated Melts (continued)



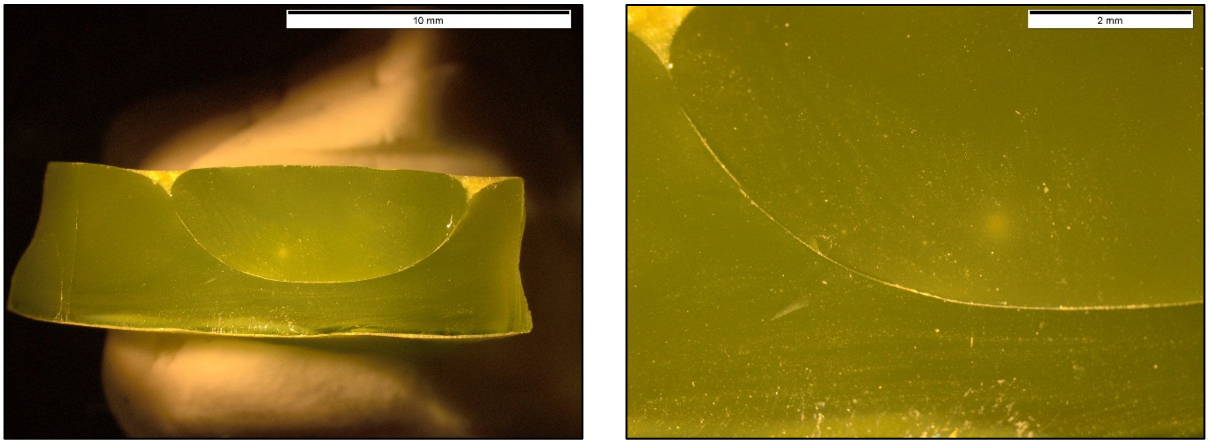
Section A



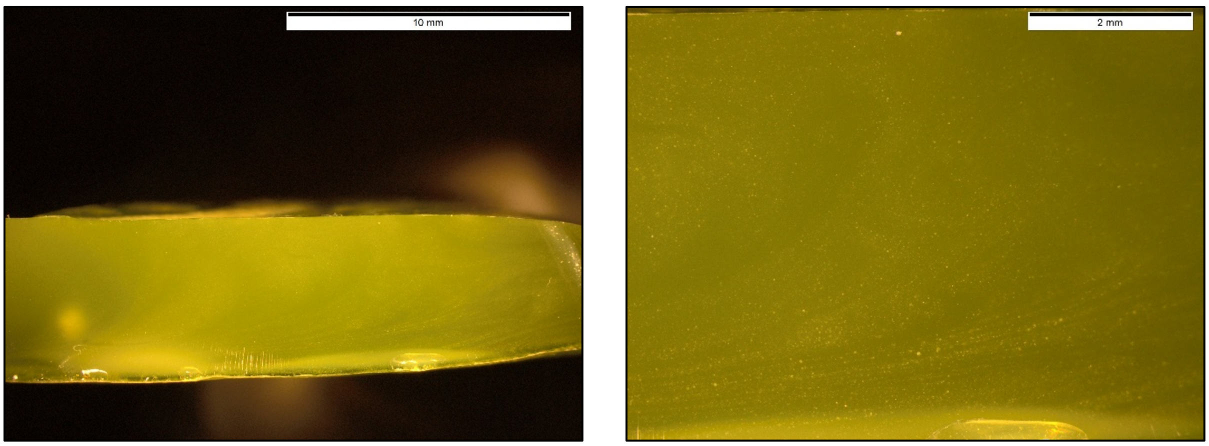
Section B

LP2-OL-11

Exhibit B-2. Optical Micrographs of the Sulfur Saturated Melts (continued)



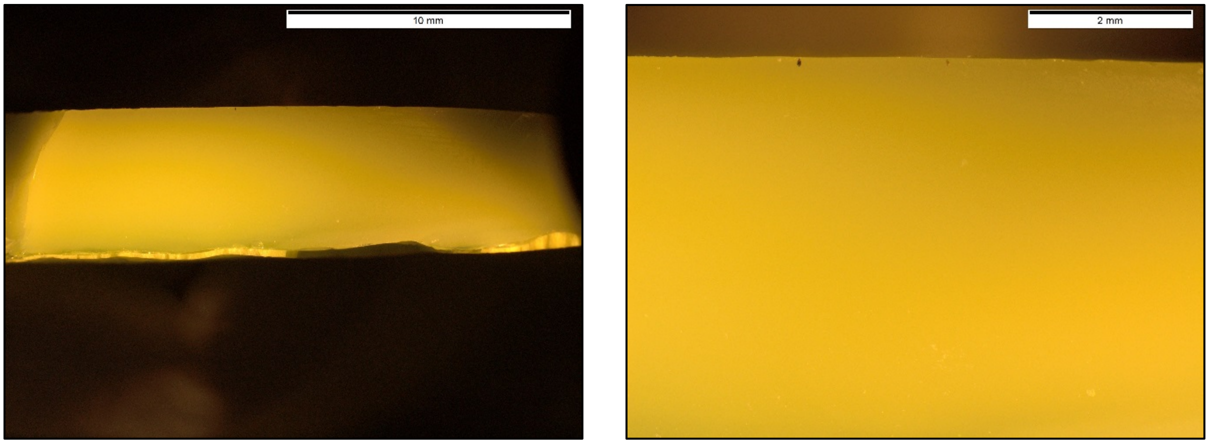
Section A



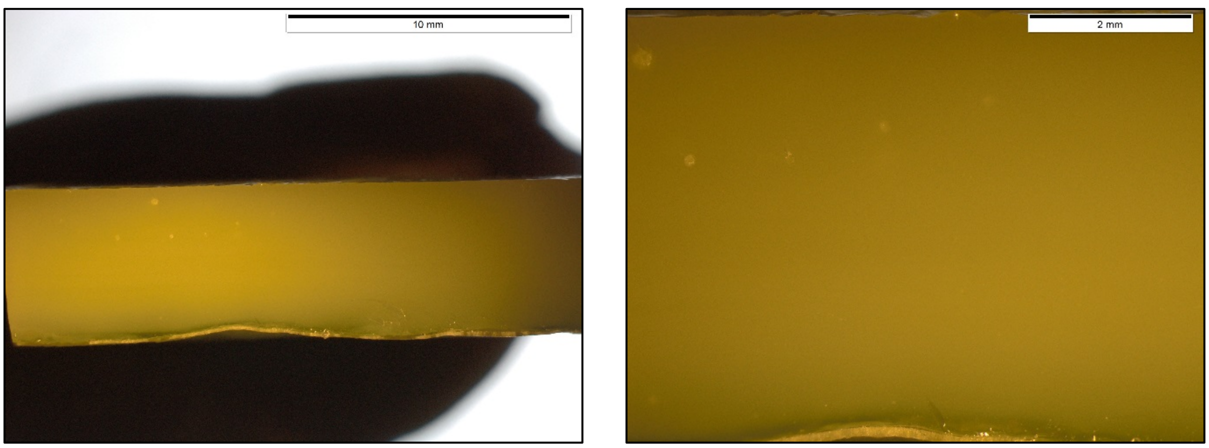
Section B

LP2-OL-12

Exhibit B-2. Optical Micrographs of the Sulfur Saturated Melts (continued)



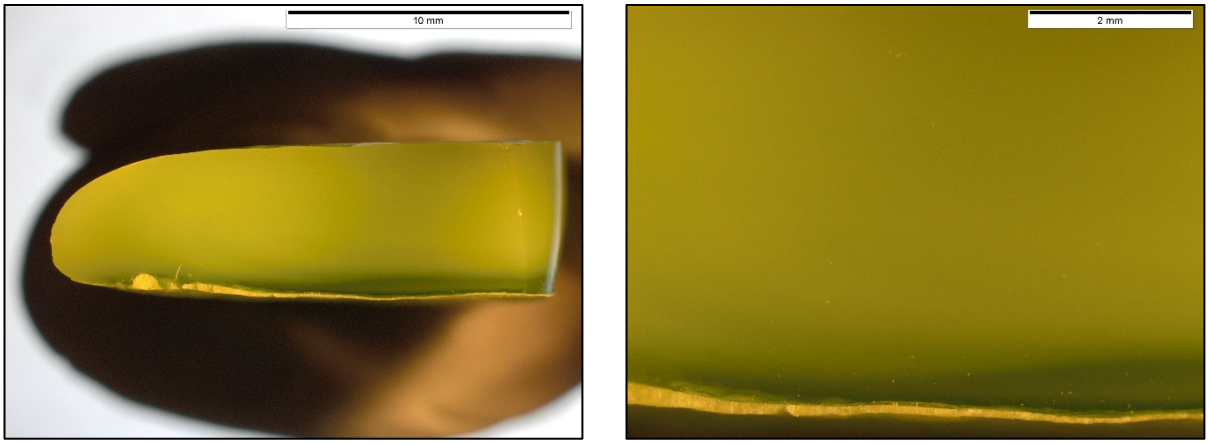
Section A



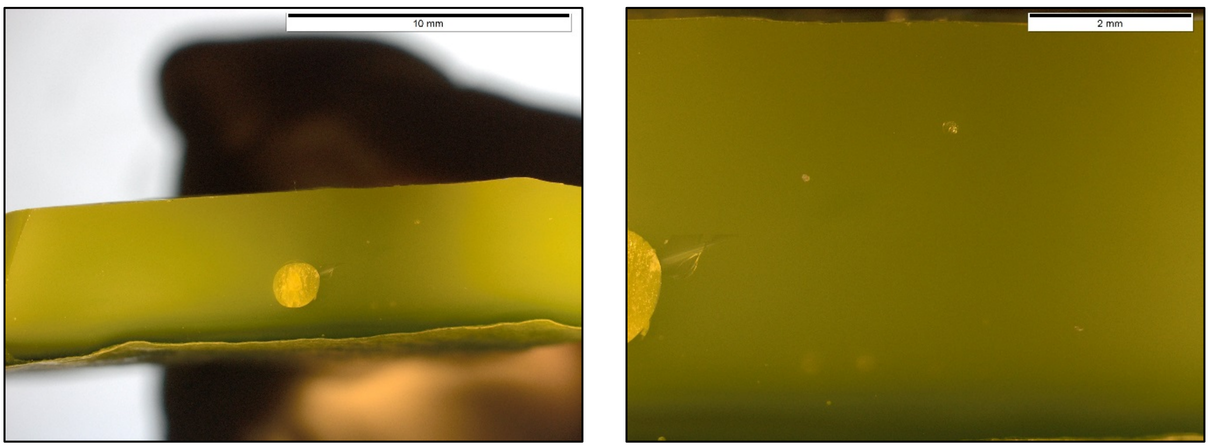
Section B

LP2-OL-13

Exhibit B-2. Optical Micrographs of the Sulfur Saturated Melts (continued)



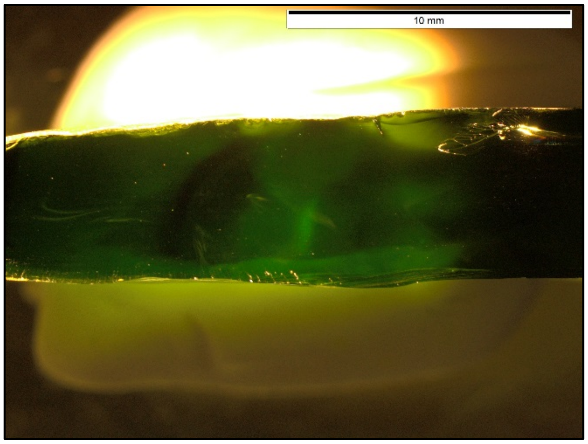
Section A

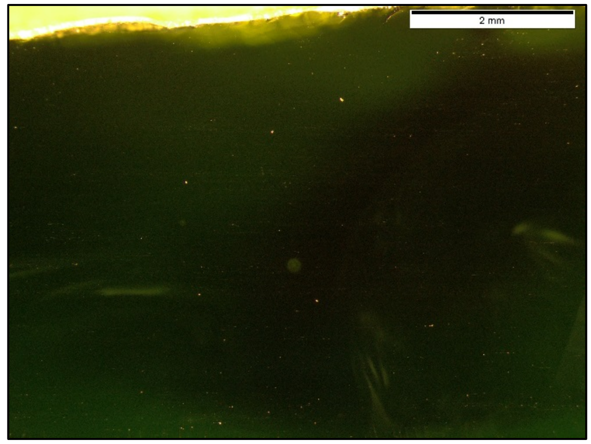


Section B

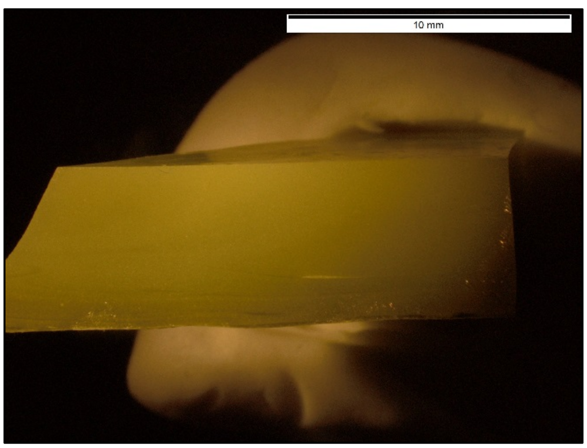
LP2-OL-14

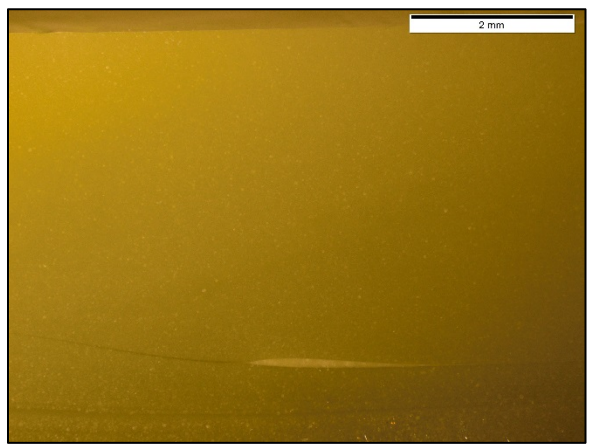
Exhibit B-2. Optical Micrographs of the Sulfur Saturated Melts (continued)





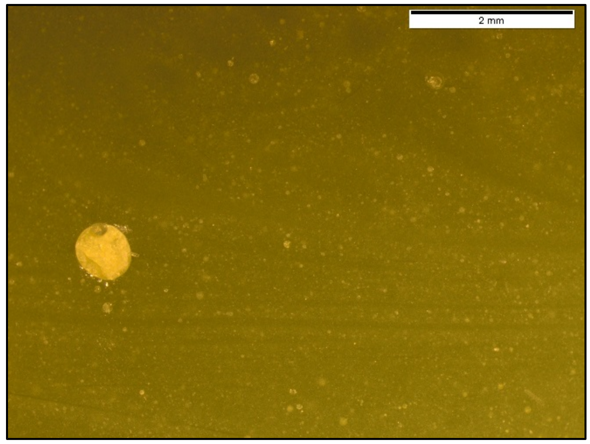
LP2-OL-15



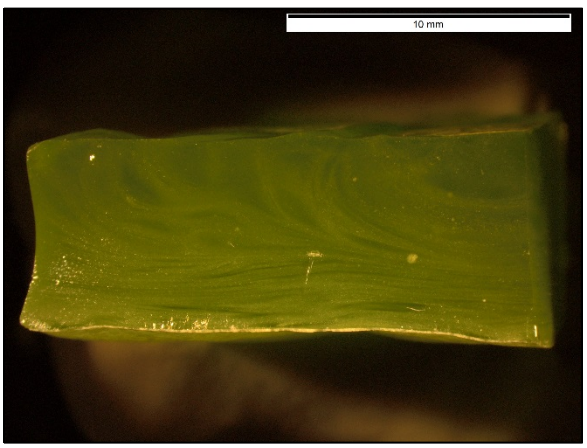


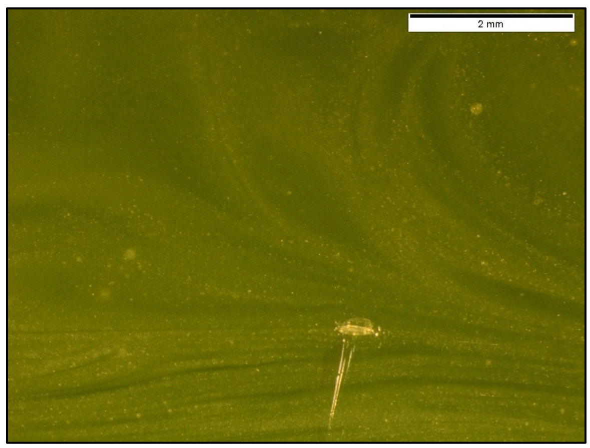
LP2-OL-17

Exhibit B-2. Optical Micrographs of the Sulfur Saturated Melts (continued)



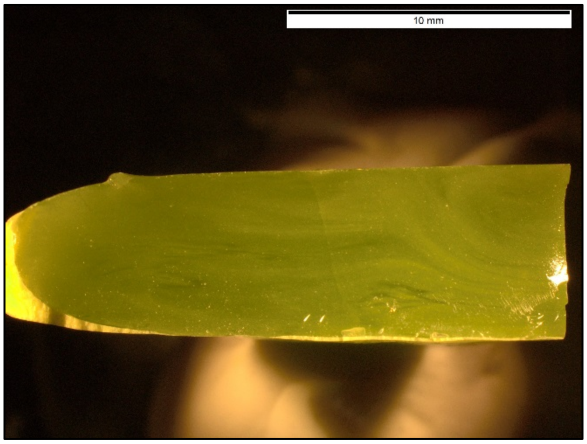
LP2-OL-19

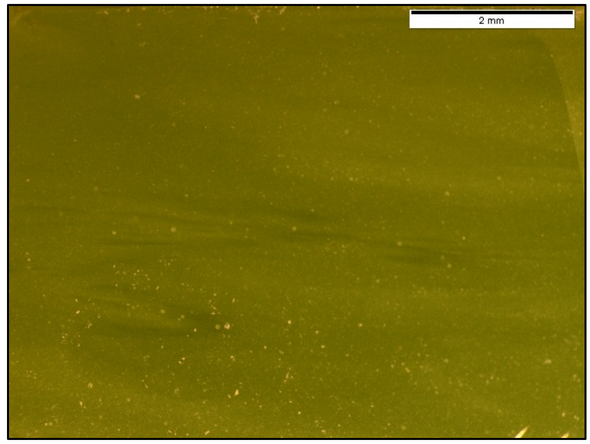




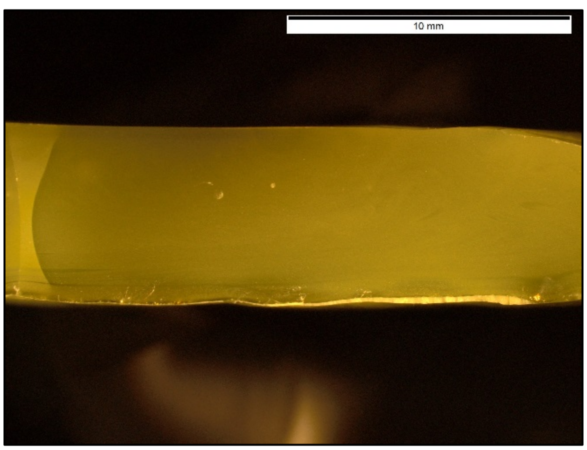
LP2-OL-20

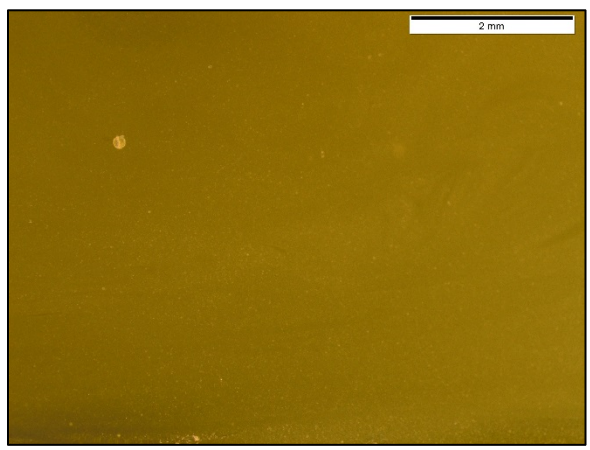
Exhibit B-2. Optical Micrographs of the Sulfur Saturated Melts (continued)





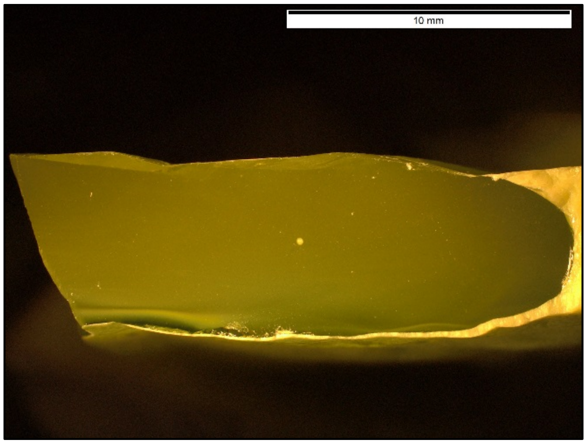
LP2-OL-21

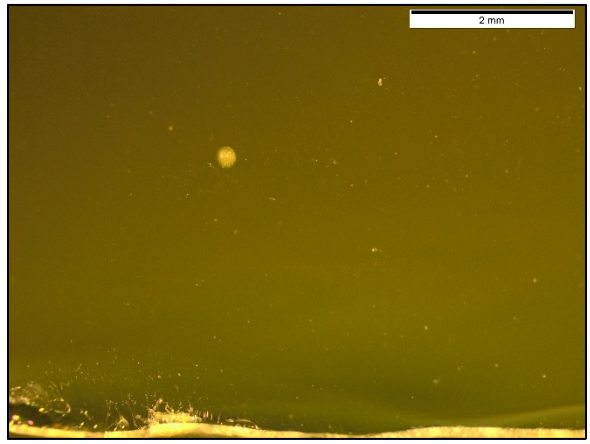




LP2-OL-22

Exhibit B-2. Optical Micrographs of the Sulfur Saturated Melts (continued)





LP2-OL-25

Appendix C Tables and Exhibits Supporting the Chemical Analysis of the Study Glasses

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

Set	Block	Sub-Blk	Sequence	ID	Lab ID	Ca (wt%)	Cr (wt%)	K (wt%)	Mg (wt%)	Na (wt%)
1	1	1	1	LRM	LRMLM111	0.375	0.128	1.15	<0.100	14.1
1	1	1	2	LP2-OL-07-1SSM	C05LM21	5.29	0.292	0.125	0.551	15.4
1	1	1	3	LP2-OL-05Q	C04LM11	7.73	0.277	<0.100	<0.100	14.2
1	1	1	4	LP2-OL-14SSM	C02LM11	4.80	0.353	4.37	<0.100	15.4
1	1	1	5	LP2-OL-12Q	C07LM21	5.64	0.498	<0.100	0.808	18.0
1	1	1	6	LP2-OL-15SSM	C09LM11	7.26	0.381	<0.100	<0.100	15.4
1	1	1	7	LP2-OL-15Q	C10LM11	7.70	0.490	<0.100	<0.100	14.0
1	1	1	8	LP2-OL-12SSM	C08LM11	5.43	0.363	<0.100	0.755	17.9
1	1	1	9	LP2-OL-05Q	C04LM21	7.65	0.263	<0.100	<0.100	13.7
1	1	1	10	LP2-OL-07-1Q	C06LM21	5.72	0.402	0.144	0.583	14.4
1	1	1	11	LP2-OL-15SSM	C09LM21	7.31	0.353	<0.100	<0.100	15.4
1	1	1	12	LRM	LRMLM112	0.398	0.137	1.19	<0.100	14.9
1	1	1	13	LP2-OL-15Q	C10LM21	7.63	0.485	<0.100	<0.100	14.0
1	1	1	14	LP2-OL-12SSM	C08LM21	5.56	0.368	<0.100	0.770	17.9
1	1	1	15	LP2-OL-07-1Q	C06LM11	5.95	0.407	0.203	0.594	14.0
1	1	1	16	LP2-OL-14Q	C01LM11	5.08	0.467	4.78	<0.100	14.5
1	1	1	17	LP2-OL-12Q	C07LM11	5.65	0.463	<0.100	0.789	18.1
1	1	1	18	LP2-OL-05SSM	C03LM21	7.47	0.207	<0.100	<0.100	15.9
1	1	1	19	LP2-OL-14SSM	C02LM21	4.83	0.370	4.26	<0.100	15.6
1	1	1	20	LP2-OL-07-1SSM	C05LM11	5.41	0.327	0.161	0.586	15.7
1	1	1	21	LP2-OL-05SSM	C03LM11	7.60	0.188	<0.100	<0.100	15.2
1	1	1	22	LP2-OL-14Q	C01LM21	5.27	0.480	4.98	<0.100	13.7
1	1	1	23	LRM	LRMLM113	0.399	0.139	1.19	<0.100	13.7
1	1	2	1	LRM	LRMLM121	0.337	0.124	1.18	<0.100	13.9
1	1	2	2	LP2-OL-15Q	C10LM12	7.66	0.453	<0.100	<0.100	14.8
1	1	2	3	LP2-OL-07-1SSM	C05LM22	5.27	0.285	0.125	0.556	15.9
1	1	2	4	LP2-OL-07-1SSM	C05LM12	4.98	0.280	0.149	0.531	15.7
1	1	2	5	LP2-OL-12SSM	C08LM12	5.26	0.353	<0.100	0.759	18.8
1	1	2	6	LP2-OL-05Q	C04LM12	7.73	0.261	<0.100	<0.100	14.3
1	1	2	7	LP2-OL-14Q	C01LM22	5.06	0.450	4.49	<0.100	13.7
1	1	2	8	LP2-OL-14SSM	C02LM12	4.78	0.329	4.06	<0.100	15.7
1	1	2	9	LP2-OL-05SSM	C03LM12	7.30	0.174	<0.100	<0.100	15.6
1	1	2	10	LP2-OL-15SSM	C09LM12	7.07	0.365	<0.100	<0.100	15.6

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

Set	Block	Sub-Blk	Sequence	ID	Lab ID	Ca (wt%)	Cr (wt%)	K (wt%)	Mg (wt%)	Na (wt%)
1	1	2	11	LP2-OL-12SSM	C08LM22	5.50	0.345	<0.100	0.757	17.8
1	1	2	12	LRM	LRMLM122	0.350	0.130	1.26	<0.100	13.5
1	1	2	13	LP2-OL-15Q	C10LM22	7.49	0.465	<0.100	<0.100	14.0
1	1	2	14	LP2-OL-15SSM	C09LM22	7.12	0.358	<0.100	<0.100	15.0
1	1	2	15	LP2-OL-14SSM	C02LM22	4.82	0.339	4.16	<0.100	15.2
1	1	2	16	LP2-OL-05Q	C04LM22	7.76	0.254	<0.100	<0.100	14.2
1	1	2	17	LP2-OL-14Q	C01LM12	4.96	0.438	4.28	<0.100	14.3
1	1	2	18	LP2-OL-07-1Q	C06LM12	5.75	0.382	0.200	0.581	14.4
1	1	2	19	LP2-OL-05SSM	C03LM22	7.47	0.192	<0.100	<0.100	15.8
1	1	2	20	LP2-OL-12Q	C07LM22	5.68	0.475	<0.100	0.796	18.2
1	1	2	21	LP2-OL-07-1Q	C06LM22	5.63	0.408	0.154	0.612	14.6
1	1	2	22	LP2-OL-12Q	C07LM12	5.70	0.446	<0.100	0.800	17.9
1	1	2	23	LRM	LRMLM123	0.341	0.127	1.23	<0.100	14.8
1	2	1	1	LRM	LRMLM211	0.364	0.134	1.10	<0.100	15.0
1	2	1	2	LP2-OL-04-1Q	C18LM11	5.25	0.421	4.30	0.743	14.9
1	2	1	3	LP2-OL-17Q	C16LM21	2.94	0.246	4.24	0.739	15.6
1	2	1	4	LP2-OL-01-3Q	C12LM21	5.83	0.497	<0.100	0.741	14.9
1	2	1	5	LP2-OL-01-3SSM	C11LM21	5.74	0.397	<0.100	0.765	17.3
1	2	1	6	LP2-OL-01-3Q	C12LM11	6.23	0.497	<0.100	0.810	14.5
1	2	1	7	LP2-OL-17Q	C16LM11	3.11	0.272	4.51	0.802	15.1
1	2	1	8	LP2-OL-09-1SSM	C14LM11	1.33	0.367	<0.100	<0.100	15.2
1	2	1	9	LP2-OL-09-1Q	C13LM21	1.39	0.486	<0.100	<0.100	14.0
1	2	1	10	LP2-OL-04-1Q	C18LM21	5.25	0.457	4.47	0.780	15.1
1	2	1	11	LP2-OL-17SSM	C15LM11	2.81	0.177	3.79	0.712	16.3
1	2	1	12	LRM	LRMLM212	0.339	0.134	1.10	<0.100	14.9
1	2	1	13	LP2-OL-04-1SSM	C17LM21	5.01	0.350	4.07	0.760	16.0
1	2	1	14	LP2-OL-09-1SSM	C14LM21	1.31	0.377	<0.100	<0.100	15.5
1	2	1	15	LP2-OL-17SSM	C15LM21	2.86	0.183	3.99	0.733	15.9
1	2	1	16	LP2-OL-09-1Q	C13LM11	1.40	0.490	<0.100	<0.100	13.8
1	2	1	17	LP2-OL-04-1SSM	C17LM11	4.77	0.336	3.91	0.721	15.9
1	2	1	18	LP2-OL-01-3SSM	C11LM11	5.64	0.397	<0.100	0.719	15.9
1	2	1	19	LRM	LRMLM213	0.347	0.134	1.11	<0.100	14.8
1	2	2	1	LRM	LRMLM221	0.358	0.123	1.12	<0.100	13.9
1	2	2	2	LP2-OL-04-1SSM	C17LM12	4.81	0.329	3.87	0.740	15.5

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

Set	Block	Sub-Blk	Sequence	ID	Lab ID	Ca (wt%)	Cr (wt%)	K (wt%)	Mg (wt%)	Na (wt%)
1	2	2	3	LP2-OL-04-1SSM	C17LM22	4.90	0.328	3.90	0.746	16.2
1	2	2	4	LP2-OL-17Q	C16LM22	3.21	0.254	4.57	0.773	15.4
1	2	2	5	LP2-OL-01-3SSM	C11LM12	5.78	0.382	<0.100	0.731	15.9
1	2	2	6	LP2-OL-17SSM	C15LM22	2.93	0.174	4.08	0.734	16.2
1	2	2	7	LP2-OL-01-3Q	C12LM22	6.15	0.516	<0.100	0.781	14.1
1	2	2	8	LP2-OL-04-1Q	C18LM22	5.27	0.428	4.47	0.759	14.4
1	2	2	9	LP2-OL-09-1SSM	C14LM22	1.28	0.340	<0.100	<0.100	15.1
1	2	2	10	LP2-OL-09-1SSM	C14LM12	1.29	0.325	<0.100	<0.100	14.8
1	2	2	11	LP2-OL-01-3SSM	C11LM22	5.53	0.380	<0.100	0.750	14.9
1	2	2	12	LRM	LRMLM222	0.375	0.123	1.11	<0.100	15.0
1	2	2	13	LP2-OL-09-1Q	C13LM22	1.41	0.464	<0.100	<0.100	14.6
1	2	2	14	LP2-OL-17SSM	C15LM12	2.91	0.172	3.96	0.722	16.1
1	2	2	15	LP2-OL-01-3Q	C12LM12	6.09	0.452	<0.100	0.761	14.6
1	2	2	16	LP2-OL-09-1Q	C13LM12	1.37	0.451	<0.100	<0.100	14.5
1	2	2	17	LP2-OL-04-1Q	C18LM12	5.05	0.413	4.25	0.735	14.2
1	2	2	18	LP2-OL-17Q	C16LM12	3.16	0.263	4.57	0.793	14.8
1	2	2	19	LRM	LRMLM123	0.363	0.120	1.07	<0.100	14.1
2	1	1	1	LRM	LRMLM111	0.382	0.133	1.11	<0.100	14.6
2	1	1	2	LP2-OL-08-MODQ	U25LM11	7.25	0.461	<0.100	<0.100	18.2
2	1	1	3	LP2-OL-25SSM	U27LM11	1.89	0.0960	<0.100	<0.100	19.0
2	1	1	4	LP2-OL-19Q	U18LM21	2.42	0.282	4.42	<0.100	14.0
2	1	1	5	LP2-OL-13Q	U17LM21	7.49	0.247	4.39	<0.100	14.8
2	1	1	6	LP2-OL-19SSM	U26LM21	2.44	0.0805	3.72	<0.100	14.8
2	1	1	7	LP2-OL-13Q	U17LM11	7.56	0.250	4.39	<0.100	14.9
2	1	1	8	LP2-OL-08-MODQ	U25LM21	7.32	0.476	<0.100	<0.100	18.2
2	1	1	9	LP2-OL-22Q	U19LM11	7.43	0.254	<0.100	<0.100	14.4
2	1	1	10	LP2-OL-13SSM	U04LM21	7.49	0.0967	3.52	<0.100	16.0
2	1	1	11	LP2-OL-08-MODSSM	U20LM11	7.30	0.230	<0.100	<0.100	18.7
2	1	1	12	LRM	LRMLM112	0.374	0.135	1.117	<0.100	14.7
2	1	1	13	LP2-OL-25Q	U05LM11	1.83	0.273	<0.100	<0.100	17.3
2	1	1	14	LP2-OL-19Q	U18LM11	2.44	0.287	4.57	<0.100	13.8
2	1	1	15	LP2-OL-25Q	U05LM21	1.85	0.269	<0.100	<0.100	17.3
2	1	1	16	LP2-OL-25SSM	U27LM21	1.87	0.0967	<0.100	<0.100	17.0
2	1	1	17	LP2-OL-22SSM	U02LM11	7.30	0.0923	<0.100	<0.100	14.3

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

Set	Block	Sub-Blk	Sequence	ID	Lab ID	Ca (wt%)	Cr (wt%)	K (wt%)	Mg (wt%)	Na (wt%)
2	1	1	18	LP2-OL-22SSM	U02LM21	7.29	0.0929	<0.100	<0.100	14.6
2	1	1	19	LP2-OL-19SSM	U26LM11	2.38	0.0793	3.54	<0.100	14.3
2	1	1	20	LP2-OL-22Q	U19LM21	7.25	0.250	<0.100	<0.100	13.6
2	1	1	21	LP2-OL-08-MODSSM	U20LM21	7.01	0.231	<0.100	<0.100	17.9
2	1	1	22	LP2-OL-13SSM	U04LM11	7.36	0.0972	3.48	<0.100	15.4
2	1	1	23	LRM	LRMLM113	0.372	0.134	1.10	<0.100	14.7
2	1	2	1	LRM	LRMLM121	0.399	0.139	1.11	<0.100	15.1
2	1	2	2	LP2-OL-13SSM	U04LM22	7.86	0.100	3.84	<0.100	16.4
2	1	2	3	LP2-OL-22Q	U19LM22	7.89	0.258	<0.100	<0.100	14.5
2	1	2	4	LP2-OL-19Q	U18LM22	2.56	0.289	4.85	<0.100	14.7
2	1	2	5	LP2-OL-19SSM	U26LM22	2.58	0.0854	4.08	<0.100	15.1
2	1	2	6	LP2-OL-13Q	U17LM12	8.02	0.259	4.81	<0.100	15.6
2	1	2	7	LP2-OL-25Q	U05LM12	1.93	0.278	<0.100	<0.100	17.9
2	1	2	8	LP2-OL-25SSM	U27LM12	1.96	0.101	<0.100	<0.100	17.2
2	1	2	9	LP2-OL-08-MODQ	U25LM12	7.72	0.475	<0.100	<0.100	18.5
2	1	2	10	LP2-OL-08-MODSSM	U20LM22	7.65	0.236	<0.100	<0.100	18.6
2	1	2	11	LP2-OL-25SSM	U27LM22	1.96	0.103	<0.100	<0.100	18.2
2	1	2	12	LRM	LRMLM122	0.399	0.141	1.14	<0.100	15.2
2	1	2	13	LP2-OL-25Q	U05LM22	1.89	0.281	<0.100	<0.100	18.3
2	1	2	14	LP2-OL-08-MODQ	U25LM22	7.82	0.486	<0.100	<0.100	19.0
2	1	2	15	LP2-OL-22SSM	U02LM22	7.81	0.0998	<0.100	<0.100	15.3
2	1	2	16	LP2-OL-13SSM	U04LM12	8.10	0.103	3.96	<0.100	16.0
2	1	2	17	LP2-OL-13Q	U17LM22	8.05	0.267	4.88	<0.100	15.6
2	1	2	18	LP2-OL-08-MODSSM	U20LM12	7.84	0.246	<0.100	<0.100	18.6
2	1	2	19	LP2-OL-22SSM	U02LM12	7.86	0.103	<0.100	<0.100	15.1
2	1	2	20	LP2-OL-19Q	U18LM12	2.60	0.303	4.89	<0.100	14.4
2	1	2	21	LP2-OL-22Q	U19LM12	8.06	0.268	<0.100	<0.100	14.6
2	1	2	22	LP2-OL-19SSM	U26LM12	2.60	0.0864	3.99	<0.100	15.2
2	1	2	23	LRM	LRMLM123	0.405	0.146	1.18	<0.100	15.1
2	2	1	1	LRM	LRMLM211	0.370	0.131	0.970	<0.100	14.9
2	2	1	2	LP2-OL-10-MODSSM	U28LM11	7.72	0.0778	<0.100	<0.100	14.7
2	2	1	3	LP2-OL-10-MODQ	U15LM21	7.58	0.268	<0.100	<0.100	14.6
2	2	1	4	LP2-OL-03-MOD2Q	U09LM11	7.41	0.454	<0.100	0.787	19.0
2	2	1	5	LP2-OL-03-MOD2SSM	U22LM11	7.51	0.145	<0.100	0.802	19.3

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

Set	Block	Sub-Blk	Sequence	ID	Lab ID	Ca (wt%)	Cr (wt%)	K (wt%)	Mg (wt%)	Na (wt%)
2	2	1	6	LP2-OL-24SSM	U29LM21	5.11	0.0930	<0.100	0.769	18.1
2	2	1	7	LP2-OL-18Q	U30LM21	6.03	0.446	<0.100	0.766	14.8
2	2	1	8	LP2-OL-03-MOD2Q	U09LM21	7.71	0.465	<0.100	0.802	19.8
2	2	1	9	LP2-OL-18SSM	U11LM11	6.30	0.169	<0.100	0.768	14.5
2	2	1	10	LP2-OL-24Q	U08LM11	5.24	0.284	<0.100	0.803	18.7
2	2	1	11	LP2-OL-20SSM	U16LM21	5.62	0.126	<0.100	<0.100	19.6
2	2	1	12	LRM	LRMLM212	0.363	0.135	0.986	<0.100	15.4
2	2	1	13	LP2-OL-03-MOD2SSM	U22LM21	7.59	0.150	<0.100	0.825	20.4
2	2	1	14	LP2-OL-18Q	U30LM11	6.10	0.449	<0.100	0.767	15.3
2	2	1	15	LP2-OL-18SSM	U11LM21	6.16	0.167	<0.100	0.757	14.8
2	2	1	16	LP2-OL-20Q	U03LM11	5.50	0.295	<0.100	<0.100	19.0
2	2	1	17	LP2-OL-24Q	U08LM21	5.14	0.290	<0.100	0.815	18.9
2	2	1	18	LP2-OL-20Q	U03LM21	5.75	0.292	<0.100	<0.100	18.0
2	2	1	19	LP2-OL-10-MODSSM	U28LM21	7.87	0.0809	<0.100	<0.100	14.8
2	2	1	20	LP2-OL-24SSM	U29LM11	5.18	0.0976	<0.100	0.805	18.8
2	2	1	21	LP2-OL-10-MODQ	U15LM11	7.63	0.285	<0.100	<0.100	16.0
2	2	1	22	LP2-OL-20SSM	U16LM11	5.51	0.131	<0.100	<0.100	19.8
2	2	1	23	LRM	LRMLM213	0.369	0.139	0.990	<0.100	16.0
2	2	2	1	LRM	LRMLM221	0.386	0.135	0.983	<0.100	14.9
2	2	2	2	LP2-OL-24Q	U08LM12	5.45	0.287	<0.100	0.817	18.7
2	2	2	3	LP2-OL-24Q	U08LM22	5.39	0.291	<0.100	0.824	18.6
2	2	2	4	LP2-OL-20SSM	U16LM22	5.84	0.125	<0.100	<0.100	19.2
2	2	2	5	LP2-OL-18Q	U30LM12	6.39	0.457	<0.100	0.783	15.0
2	2	2	6	LP2-OL-18SSM	U11LM12	6.56	0.170	<0.100	0.775	14.7
2	2	2	7	LP2-OL-03-MOD2Q	U09LM22	8.23	0.491	<0.100	0.853	19.7
2	2	2	8	LP2-OL-24SSM	U29LM12	5.41	0.100	<0.100	0.844	18.2
2	2	2	9	LP2-OL-10-MODSSM	U28LM22	8.40	0.0829	<0.100	<0.100	15.4
2	2	2	10	LP2-OL-20Q	U03LM22	6.07	0.302	<0.100	<0.100	19.4
2	2	2	11	LP2-OL-03-MOD2SSM	U22LM22	8.06	0.156	<0.100	0.868	19.6
2	2	2	12	LRM	LRMLM222	0.369	0.139	0.974	<0.100	15.4
2	2	2	13	LP2-OL-20Q	U03LM12	5.73	0.295	<0.100	<0.100	19.4
2	2	2	14	LP2-OL-18Q	U30LM22	6.14	0.447	<0.100	0.774	15.1
2	2	2	15	LP2-OL-03-MOD2Q	U09LM12	7.53	0.464	<0.100	0.806	19.2
2	2	2	16	LP2-OL-10-MODQ	U15LM12	7.81	0.274	<0.100	<0.100	15.3

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

Set	Block	Sub-Blk	Sequence	ID	Lab ID	Ca (wt%)	Cr (wt%)	K (wt%)	Mg (wt%)	Na (wt%)
2	2	2	17	LP2-OL-10-MODQ	U15LM22	7.63	0.280	<0.100	<0.100	15.0
2	2	2	18	LP2-OL-20SSM	U16LM12	5.59	0.127	<0.100	<0.100	19.7
2	2	2	19	LP2-OL-03-MOD2SSM	U22LM12	7.41	0.157	<0.100	0.872	21.0
2	2	2	20	LP2-OL-10-MODSSM	U28LM12	7.80	0.0833	<0.100	<0.100	15.1
2	2	2	21	LP2-OL-18SSM	U11LM22	6.20	0.173	<0.100	0.790	14.6
2	2	2	22	LP2-OL-24SSM	U29LM22	5.07	0.0978	<0.100	0.819	18.6
2	2	2	23	LRM	LRMLM223	0.366	0.140	0.971	<0.100	15.1
2	3	1	1	LRM	LRMLM311	0.385	0.129	1.07	<0.100	14.7
2	3	1	2	LP2-OL-16-MODSSM	U12LM11	2.30	0.229	<0.100	0.771	14.4
2	3	1	3	LP2-OL-16-MODQ	U13LM21	2.19	0.475	<0.100	0.772	15.0
2	3	1	4	LP2-OL-02-1SSM	U21LM21	3.66	0.160	0.542	0.374	16.6
2	3	1	5	LP2-OL-21Q	U06LM11	3.66	0.380	0.827	0.381	16.6
2	3	1	6	LP2-OL-11SSM	U01LM11	5.54	0.0951	3.73	0.798	15.9
2	3	1	7	LP2-OL-11Q	U14LM11	5.73	0.272	4.42	0.801	15.7
2	3	1	8	LP2-OL-23Q	U07LM21	7.49	0.308	<0.100	0.813	15.4
2	3	1	9	LP2-OL-21Q	U06LM21	3.67	0.377	0.879	0.393	16.8
2	3	1	10	LP2-OL-02-1Q	U24LM11	3.72	0.370	0.736	0.382	17.3
2	3	1	11	LP2-OL-02-1SSM	U21LM11	3.69	0.167	0.594	0.390	17.1
2	3	1	12	LRM	LRMLM312	0.384	0.131	1.12	<0.100	16.0
2	3	1	13	LP2-OL-11SSM	U01LM21	5.40	0.0961	3.62	0.751	16.9
2	3	1	14	LP2-OL-16-MODSSM	U12LM21	2.13	0.229	<0.100	0.754	15.5
2	3	1	15	LP2-OL-21SSM	U10LM21	3.60	0.147	0.608	0.392	17.0
2	3	1	16	LP2-OL-23Q	U07LM11	7.39	0.270	<0.100	0.778	15.8
2	3	1	17	LP2-OL-23SSM	U23LM21	7.39	0.131	<0.100	0.785	15.7
2	3	1	18	LP2-OL-16-MODQ	U13LM11	2.19	0.489	<0.100	0.777	16.2
2	3	1	19	LP2-OL-02-1Q	U24LM21	3.52	0.399	0.880	0.403	17.5
2	3	1	20	LP2-OL-21SSM	U10LM21	3.74	0.148	0.779	0.420	17.4
2	3	1	21	LP2-OL-11Q	U14LM21	5.57	0.279	4.37	0.799	15.5
2	3	1	22	LP2-OL-23SSM	U23LM11	7.52	0.168	<0.100	0.817	15.5
2	3	1	23	LRM	LRMLM313	0.383	0.133	1.17	<0.100	16.0
2	3	2	1	LRM	LRMLM321	0.378	0.130	1.17	<0.100	15.2
2	3	2	2	LP2-OL-21Q	U06LM12	3.66	0.380	0.899	0.385	16.2
2	3	2	3	LP2-OL-16-MODQ	U13LM22	2.23	0.491	<0.100	0.793	14.7
2	3	2	4	LP2-OL-21SSM	U10LM12	3.46	0.137	0.542	0.357	16.0

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

Set	Block	Sub-Blk	Sequence	ID	Lab ID	Ca (wt%)	Cr (wt%)	K (wt%)	Mg (wt%)	Na (wt%)
2	3	2	5	LP2-OL-02-1SSM	U21LM12	3.63	0.165	0.594	0.396	16.4
2	3	2	6	LP2-OL-23Q	U07LM22	7.56	0.311	<0.100	0.805	14.4
2	3	2	7	LP2-OL-16-MODSSM	U12LM12	2.30	0.230	<0.100	0.781	14.4
2	3	2	8	LP2-OL-02-1Q	U24LM22	3.59	0.401	0.888	0.409	16.0
2	3	2	9	LP2-OL-16-MODQ	U13LM12	2.15	0.489	<0.100	0.795	14.9
2	3	2	10	LP2-OL-23Q	U07LM12	7.40	0.269	<0.100	0.754	15.1
2	3	2	11	LP2-OL-11SSM	U01LM12	5.66	0.0958	3.73	0.814	14.7
2	3	2	12	LRM	LRMLM322	0.380	0.130	1.16	<0.100	15.3
2	3	2	13	LP2-OL-21SSM	U10LM22	3.67	0.150	0.760	0.426	16.2
2	3	2	14	LP2-OL-16-MODSSM	U12LM22	2.18	0.226	<0.100	0.764	14.5
2	3	2	15	LP2-OL-02-1SSM	U21LM22	3.60	0.157	0.534	0.368	16.3
2	3	2	16	LP2-OL-02-1Q	U24LM12	3.66	0.360	0.740	0.383	16.7
2	3	2	17	LP2-OL-11SSM	U01LM22	5.45	0.0962	3.51	0.763	15.0
2	3	2	18	LP2-OL-11Q	U14LM22	5.42	0.275	4.40	0.809	14.6
2	3	2	19	LP2-OL-23SSM	U23LM22	7.35	0.131	<0.100	0.814	15.0
2	3	2	20	LP2-OL-11Q	U14LM12	5.67	0.274	4.53	0.805	14.0
2	3	2	21	LP2-OL-21Q	U06LM22	3.67	0.376	0.900	0.391	15.6
2	3	2	22	LP2-OL-23SSM	U23LM12	7.49	0.162	<0.100	0.815	14.7
2	3	2	23	LRM	LRMLM323	0.387	0.130	1.15	<0.100	14.6

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

Set	Block	Sub-Blk	Sequence	ID	Lab ID	Ni (wt%)	P (wt%)	S (wt%)	V (wt%)	Zn (wt%)
1	1	1	1	LRM	LRMLM111	0.140	0.204	0.0867	<0.100	<0.100
1	1	1	2	LP2-OL-07-1SSM	C05LM21	<0.100	0.106	1.92	0.468	2.29
1	1	1	3	LP2-OL-05Q	C04LM11	<0.100	na	0.392	<0.100	1.66
1	1	1	4	LP2-OL-14SSM	C02LM11	<0.100	<0.100	1.87	2.09	1.59
1	1	1	5	LP2-OL-12Q	C07LM21	0.146	na	0.0624	<0.100	1.65
1	1	1	6	LP2-OL-15SSM	C09LM11	<0.100	<0.100	1.63	<0.100	2.76
1	1	1	7	LP2-OL-15Q	C10LM11	<0.100	<0.100	0.0519	<0.100	2.92
1	1	1	8	LP2-OL-12SSM	C08LM11	<0.100	na	1.68	<0.100	1.60
1	1	1	9	LP2-OL-05Q	C04LM21	<0.100	na	0.373	<0.100	1.63
1	1	1	10	LP2-OL-07-1Q	C06LM21	<0.100	0.106	0.409	0.508	2.52
1	1	1	11	LP2-OL-15SSM	C09LM21	<0.100	<0.100	1.66	<0.100	2.82
1	1	1	12	LRM	LRMLM112	0.152	0.222	0.0911	<0.100	<0.100
1	1	1	13	LP2-OL-15Q	C10LM21	<0.100	0.105	0.0526	<0.100	2.93
1	1	1	14	LP2-OL-12SSM	C08LM21	<0.100	na	1.69	<0.100	1.64
1	1	1	15	LP2-OL-07-1Q	C06LM11	<0.100	0.123	0.423	0.518	2.59
1	1	1	16	LP2-OL-14Q	C01LM11	<0.100	0.106	0.621	2.28	1.67
1	1	1	17	LP2-OL-12Q	C07LM11	<0.100	na	0.0532	<0.100	1.68
1	1	1	18	LP2-OL-05SSM	C03LM21	0.123	na	1.93	<0.100	1.62
1	1	1	19	LP2-OL-14SSM	C02LM21	<0.100	<0.100	1.91	2.11	1.61
1	1	1	20	LP2-OL-07-1SSM	C05LM11	<0.100	0.122	2.15	0.511	2.38
1	1	1	21	LP2-OL-05SSM	C03LM11	<0.100	na	2.02	<0.100	1.63
1	1	1	22	LP2-OL-14Q	C01LM21	<0.100	<0.100	0.641	2.33	1.75
1	1	1	23	LRM	LRMLM113	0.152	0.225	0.103	<0.100	<0.100
1	1	2	1	LRM	LRMLM121	0.136	0.202	0.0709	<0.100	<0.100
1	1	2	2	LP2-OL-15Q	C10LM12	<0.100	<0.100	0.0405	<0.100	2.77
1	1	2	3	LP2-OL-07-1SSM	C05LM22	<0.100	0.105	1.73	0.476	2.17
1	1	2	4	LP2-OL-07-1SSM	C05LM12	<0.100	0.104	1.74	0.468	2.05
1	1	2	5	LP2-OL-12SSM	C08LM12	<0.100	na	1.44	<0.100	1.47
1	1	2	6	LP2-OL-05Q	C04LM12	<0.100	na	0.368	<0.100	1.57
1	1	2	7	LP2-OL-14Q	C01LM22	<0.100	<0.100	0.577	2.144	1.55
1	1	2	8	LP2-OL-14SSM	C02LM12	<0.100	<0.100	1.79	2.029	1.51
1	1	2	9	LP2-OL-05SSM	C03LM12	<0.100	na	1.73	<0.100	1.47
1	1	2	10	LP2-OL-15SSM	C09LM12	<0.100	<0.100	1.46	<0.100	2.61

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

Set	Block	Sub-Blk	Sequence	ID	Lab ID	Ni (wt%)	P (wt%)	S (wt%)	V (wt%)	Zn (wt%)
1	1	2	11	LP2-OL-12SSM	C08LM22	<0.100	na	1.34	<0.100	1.51
1	1	2	12	LRM	LRMLM122	0.143	0.215	0.0880	<0.100	<0.100
1	1	2	13	LP2-OL-15Q	C10LM22	<0.100	<0.100	0.0459	<0.100	2.79
1	1	2	14	LP2-OL-15SSM	C09LM22	<0.100	<0.100	1.46	<0.100	2.66
1	1	2	15	LP2-OL-14SSM	C02LM22	<0.100	<0.100	1.77	2.04	1.49
1	1	2	16	LP2-OL-05Q	C04LM22	<0.100	na	0.356	<0.100	1.56
1	1	2	17	LP2-OL-14Q	C01LM12	<0.100	<0.100	0.568	2.15	1.51
1	1	2	18	LP2-OL-07-1Q	C06LM12	<0.100	0.118	0.381	0.514	2.33
1	1	2	19	LP2-OL-05SSM	C03LM22	0.112	na	1.71	<0.100	1.49
1	1	2	20	LP2-OL-12Q	C07LM22	0.135	na	0.0481	<0.100	1.57
1	1	2	21	LP2-OL-07-1Q	C06LM22	<0.100	0.109	0.407	0.542	2.37
1	1	2	22	LP2-OL-12Q	C07LM12	<0.100	na	0.0555	<0.100	1.57
1	1	2	23	LRM	LRMLM123	0.138	0.210	0.0853	<0.100	<0.100
1	2	1	1	LRM	LRMLM211	0.147	0.229	0.0910	<0.100	<0.100
1	2	1	2	LP2-OL-04-1Q	C18LM11	<0.100	<0.100	0.0555	<0.100	2.82
1	2	1	3	LP2-OL-17Q	C16LM21	<0.100	na	0.0458	2.03	1.51
1	2	1	4	LP2-OL-01-3Q	C12LM21	0.254	0.108	0.0482	<0.100	1.51
1	2	1	5	LP2-OL-01-3SSM	C11LM21	<0.100	0.101	1.69	<0.100	1.52
1	2	1	6	LP2-OL-01-3Q	C12LM11	<0.100	0.107	0.0717	<0.100	1.65
1	2	1	7	LP2-OL-17Q	C16LM11	<0.100	na	0.0592	2.17	1.64
1	2	1	8	LP2-OL-09-1SSM	C14LM11	<0.100	<0.100	1.58	2.04	1.55
1	2	1	9	LP2-OL-09-1Q	C13LM21	<0.100	0.103	0.0414	2.14	1.61
1	2	1	10	LP2-OL-04-1Q	C18LM21	<0.100	0.117	0.0553	<0.100	2.93
1	2	1	11	LP2-OL-17SSM	C15LM11	<0.100	na	1.53	1.92	1.46
1	2	1	12	LRM	LRMLM212	0.146	0.224	0.0850	<0.100	<0.100
1	2	1	13	LP2-OL-04-1SSM	C17LM21	<0.100	0.101	1.68	<0.100	2.82
1	2	1	14	LP2-OL-09-1SSM	C14LM21	<0.100	0.101	1.53	2.00	1.54
1	2	1	15	LP2-OL-17SSM	C15LM21	<0.100	na	1.63	2.01	1.56
1	2	1	16	LP2-OL-09-1Q	C13LM11	<0.100	0.117	0.0426	2.15	1.65
1	2	1	17	LP2-OL-04-1SSM	C17LM11	<0.100	<0.100	1.52	<0.100	2.71
1	2	1	18	LP2-OL-01-3SSM	C11LM11	0.153	<0.100	1.62	<0.100	1.53
1	2	1	19	LRM	LRMLM213	0.147	0.230	0.0939	<0.100	<0.100
1	2	2	1	LRM	LRMLM221	0.134	0.202	0.0855	<0.100	<0.100
1	2	2	2	LP2-OL-04-1SSM	C17LM12	<0.100	<0.100	1.33	<0.100	2.45

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

Set	Block	Sub-Blk	Sequence	ID	Lab ID	Ni (wt%)	P (wt%)	S (wt%)	V (wt%)	Zn (wt%)
1	2	2	3	LP2-OL-04-1SSM	C17LM22	<0.100	<0.100	1.38	<0.100	2.55
1	2	2	4	LP2-OL-17Q	C16LM22	<0.100	na	0.0584	2.20	1.59
1	2	2	5	LP2-OL-01-3SSM	C11LM12	0.147	<0.100	1.57	<0.100	1.45
1	2	2	6	LP2-OL-17SSM	C15LM22	<0.100	na	1.49	2.01	1.45
1	2	2	7	LP2-OL-01-3Q	C12LM22	0.262	0.109	0.0613	<0.100	1.52
1	2	2	8	LP2-OL-04-1Q	C18LM22	<0.100	0.103	0.0670	<0.100	2.75
1	2	2	9	LP2-OL-09-1SSM	C14LM22	<0.100	<0.100	1.39	1.93	1.39
1	2	2	10	LP2-OL-09-1SSM	C14LM12	<0.100	<0.100	1.38	1.93	1.39
1	2	2	11	LP2-OL-01-3SSM	C11LM22	<0.100	<0.100	1.38	<0.100	1.36
1	2	2	12	LRM	LRMLM222	0.134	0.197	0.0855	<0.100	<0.100
1	2	2	13	LP2-OL-09-1Q	C13LM22	<0.100	<0.100	0.0480	2.13	1.52
1	2	2	14	LP2-OL-17SSM	C15LM12	<0.100	na	1.49	1.97	1.42
1	2	2	15	LP2-OL-01-3Q	C12LM12	<0.100	<0.100	0.0648	<0.100	1.50
1	2	2	16	LP2-OL-09-1Q	C13LM12	<0.100	<0.100	0.0410	2.04	1.47
1	2	2	17	LP2-OL-04-1Q	C18LM12	<0.100	<0.100	0.0693	<0.100	2.61
1	2	2	18	LP2-OL-17Q	C16LM12	<0.100	na	0.0583	2.19	1.58
1	2	2	19	LRM	LRMLM123	0.132	0.195	0.0861	<0.100	<0.100
2	1	1	1	LRM	LRMLM111	0.153	0.222	0.0727	<0.100	<0.100
2	1	1	2	LP2-OL-08-MODQ	U25LM11	<0.100	0.100	0.251	2.13	1.56
2	1	1	3	LP2-OL-25SSM	U27LM11	<0.100	0.105	0.480	<0.100	2.84
2	1	1	4	LP2-OL-19Q	U18LM21	<0.100	0.109	0.244	<0.100	1.58
2	1	1	5	LP2-OL-13Q	U17LM21	<0.100	na	0.0337	2.15	2.85
2	1	1	6	LP2-OL-19SSM	U26LM21	<0.100	0.0812	0.375	<0.100	1.58
2	1	1	7	LP2-OL-13Q	U17LM11	<0.100	na	0.0435	2.15	2.83
2	1	1	8	LP2-OL-08-MODQ	U25LM21	<0.100	0.0986	0.254	2.17	1.59
2	1	1	9	LP2-OL-22Q	U19LM11	<0.100	0.121	0.0397	2.12	1.55
2	1	1	10	LP2-OL-13SSM	U04LM21	<0.100	na	0.596	1.98	2.83
2	1	1	11	LP2-OL-08-MODSSM	U20LM11	<0.100	0.0885	0.705	2.01	1.58
2	1	1	12	LRM	LRMLM112	0.155	0.227	0.0749	<0.100	<0.100
2	1	1	13	LP2-OL-25Q	U05LM11	<0.100	0.124	0.316	<0.100	2.75
2	1	1	14	LP2-OL-19Q	U18LM11	<0.100	0.102	0.242	<0.100	1.55
2	1	1	15	LP2-OL-25Q	U05LM21	<0.100	0.118	0.309	<0.100	2.75
2	1	1	16	LP2-OL-25SSM	U27LM21	<0.100	0.115	0.493	<0.100	2.80
2	1	1	17	LP2-OL-22SSM	U02LM11	<0.100	0.100	0.432	1.96	1.54

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

Set	Block	Sub-Blk	Sequence	ID	Lab ID	Ni (wt%)	P (wt%)	S (wt%)	V (wt%)	Zn (wt%)
2	1	1	18	LP2-OL-22SSM	U02LM21	<0.100	0.104	0.432	1.98	1.55
2	1	1	19	LP2-OL-19SSM	U26LM11	<0.100	0.0860	0.370	<0.100	1.56
2	1	1	20	LP2-OL-22Q	U19LM21	<0.100	0.119	0.0320	2.08	1.54
2	1	1	21	LP2-OL-08-MODSSM	U20LM21	<0.100	0.0887	0.717	1.93	1.54
2	1	1	22	LP2-OL-13SSM	U04LM11	<0.100	na	0.592	1.93	2.76
2	1	1	23	LRM	LRMLM113	0.154	0.224	0.0750	<0.100	<0.100
2	1	2	1	LRM	LRMLM121	0.152	0.223	0.0772	<0.100	<0.100
2	1	2	2	LP2-OL-13SSM	U04LM22	<0.100	na	0.592	2.07	3.02
2	1	2	3	LP2-OL-22Q	U19LM22	<0.100	0.118	0.0439	2.25	1.65
2	1	2	4	LP2-OL-19Q	U18LM22	<0.100	0.105	0.250	<0.100	1.66
2	1	2	5	LP2-OL-19SSM	U26LM22	<0.100	0.0857	0.392	<0.100	1.67
2	1	2	6	LP2-OL-13Q	U17LM12	<0.100	na	0.0441	2.27	3.03
2	1	2	7	LP2-OL-25Q	U05LM12	<0.100	0.120	0.320	<0.100	2.97
2	1	2	8	LP2-OL-25SSM	U27LM12	<0.100	0.106	0.510	<0.100	3.01
2	1	2	9	LP2-OL-08-MODQ	U25LM12	<0.100	0.0984	0.252	2.26	1.66
2	1	2	10	LP2-OL-08-MODSSM	U20LM22	<0.100	0.0836	0.726	2.09	1.66
2	1	2	11	LP2-OL-25SSM	U27LM22	<0.100	0.114	0.517	<0.100	3.06
2	1	2	12	LRM	LRMLM122	0.155	0.230	0.0744	<0.100	<0.100
2	1	2	13	LP2-OL-25Q	U05LM22	<0.100	0.125	0.320	<0.100	2.89
2	1	2	14	LP2-OL-08-MODQ	U25LM22	<0.100	0.0987	0.257	2.28	1.68
2	1	2	15	LP2-OL-22SSM	U02LM22	<0.100	0.110	0.469	2.08	1.62
2	1	2	16	LP2-OL-13SSM	U04LM12	<0.100	na	0.623	2.14	3.12
2	1	2	17	LP2-OL-13Q	U17LM22	<0.100	na	0.0419	2.31	3.10
2	1	2	18	LP2-OL-08-MODSSM	U20LM12	<0.100	0.0955	0.762	2.14	1.68
2	1	2	19	LP2-OL-22SSM	U02LM12	<0.100	0.111	0.491	2.09	1.63
2	1	2	20	LP2-OL-19Q	U18LM12	<0.100	0.106	0.258	<0.100	1.67
2	1	2	21	LP2-OL-22Q	U19LM12	<0.100	0.122	0.0518	2.299	1.69
2	1	2	22	LP2-OL-19SSM	U26LM12	<0.100	0.0943	0.395	<0.100	1.71
2	1	2	23	LRM	LRMLM123	0.160	0.237	0.0847	<0.100	<0.100
2	2	1	1	LRM	LRMLM211	0.141	0.190	0.0852	<0.100	<0.100
2	2	1	2	LP2-OL-10-MODSSM	U28LM11	<0.100	na	0.423	<0.100	1.65
2	2	1	3	LP2-OL-10-MODQ	U15LM21	<0.100	na	0.284	<0.100	1.61
2	2	1	4	LP2-OL-03-MOD2Q	U09LM11	<0.100	0.0744	0.291	<0.100	1.62
2	2	1	5	LP2-OL-03-MOD2SSM	U22LM11	<0.100	0.0702	0.580	<0.100	1.62

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

Set	Block	Sub-Blk	Sequence	ID	Lab ID	Ni (wt%)	P (wt%)	S (wt%)	V (wt%)	Zn (wt%)
2	2	1	6	LP2-OL-24SSM	U29LM21	<0.100	0.0831	0.558	2.02	2.95
2	2	1	7	LP2-OL-18Q	U30LM21	<0.100	na	0.407	2.18	2.92
2	2	1	8	LP2-OL-03-MOD2Q	U09LM21	<0.100	0.0813	0.297	<0.100	1.66
2	2	1	9	LP2-OL-18SSM	U11LM11	<0.100	na	0.484	2.07	3.04
2	2	1	10	LP2-OL-24Q	U08LM11	<0.100	0.0833	0.0524	2.27	3.03
2	2	1	11	LP2-OL-20SSM	U16LM21	<0.100	0.0769	0.776	<0.100	2.90
2	2	1	12	LRM	LRMLM212	0.147	0.198	0.0880	<0.100	<0.100
2	2	1	13	LP2-OL-03-MOD2SSM	U22LM21	<0.100	0.0696	0.583	<0.100	1.63
2	2	1	14	LP2-OL-18Q	U30LM11	<0.100	na	0.416	2.18	2.89
2	2	1	15	LP2-OL-18SSM	U11LM21	<0.100	na	0.491	2.02	2.96
2	2	1	16	LP2-OL-20Q	U03LM11	<0.100	0.0908	0.0508	<0.100	2.82
2	2	1	17	LP2-OL-24Q	U08LM21	<0.100	0.0804	0.0552	2.20	2.91
2	2	1	18	LP2-OL-20Q	U03LM21	<0.100	0.0980	0.0474	<0.100	2.96
2	2	1	19	LP2-OL-10-MODSSM	U28LM21	<0.100	na	0.447	<0.100	1.63
2	2	1	20	LP2-OL-24SSM	U29LM11	<0.100	0.0825	0.558	2.07	3.00
2	2	1	21	LP2-OL-10-MODQ	U15LM11	<0.100	na	0.298	<0.100	1.61
2	2	1	22	LP2-OL-20SSM	U16LM11	<0.100	0.0830	0.757	<0.100	2.82
2	2	1	23	LRM	LRMLM213	0.151	0.195	0.0843	<0.100	<0.100
2	2	2	1	LRM	LRMLM221	0.145	0.191	0.0832	<0.100	<0.100
2	2	2	2	LP2-OL-24Q	U08LM12	<0.100	0.0903	0.0490	2.34	3.15
2	2	2	3	LP2-OL-24Q	U08LM22	<0.100	0.0813	0.0492	2.34	3.15
2	2	2	4	LP2-OL-20SSM	U16LM22	<0.100	0.0730	0.739	<0.100	3.08
2	2	2	5	LP2-OL-18Q	U30LM12	<0.100	na	0.396	2.34	3.17
2	2	2	6	LP2-OL-18SSM	U11LM12	<0.100	na	0.473	2.177	3.25
2	2	2	7	LP2-OL-03-MOD2Q	U09LM22	<0.100	0.0841	0.296	<0.100	1.81
2	2	2	8	LP2-OL-24SSM	U29LM12	<0.100	0.0797	0.557	2.16	3.19
2	2	2	9	LP2-OL-10-MODSSM	U28LM22	<0.100	na	0.440	<0.100	1.82
2	2	2	10	LP2-OL-20Q	U03LM22	<0.100	0.0972	0.0449	<0.100	3.21
2	2	2	11	LP2-OL-03-MOD2SSM	U22LM22	<0.100	0.0718	0.578	<0.100	1.75
2	2	2	12	LRM	LRMLM222	0.149	0.192	0.0840	<0.100	<0.100
2	2	2	13	LP2-OL-20Q	U03LM12	<0.100	0.0877	0.0489	<0.100	2.95
2	2	2	14	LP2-OL-18Q	U30LM22	<0.100	na	0.388	2.20	2.93
2	2	2	15	LP2-OL-03-MOD2Q	U09LM12	<0.100	0.0738	0.278	<0.100	1.62
2	2	2	16	LP2-OL-10-MODQ	U15LM12	<0.100	na	0.287	<0.100	1.64

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

Set	Block	Sub-Blk	Sequence	ID	Lab ID	Ni (wt%)	P (wt%)	S (wt%)	V (wt%)	Zn (wt%)
2	2	2	17	LP2-OL-10-MODQ	U15LM22	<0.100	na	0.281	<0.100	1.61
2	2	2	18	LP2-OL-20SSM	U16LM12	<0.100	0.0767	0.724	<0.100	2.91
2	2	2	19	LP2-OL-03-MOD2SSM	U22LM12	<0.100	0.0724	0.574	<0.100	1.62
2	2	2	20	LP2-OL-10-MODSSM	U28LM12	<0.100	na	0.423	<0.100	1.63
2	2	2	21	LP2-OL-18SSM	U11LM22	<0.100	na	0.467	2.01	2.97
2	2	2	22	LP2-OL-24SSM	U29LM22	<0.100	0.0861	0.546	1.99	2.88
2	2	2	23	LRM	LRMLM223	0.150	0.187	0.0788	<0.100	<0.100
2	3	1	1	LRM	LRMLM311	0.138	0.186	0.0899	<0.100	<0.100
2	3	1	2	LP2-OL-16-MODSSM	U12LM11	<0.100	0.0776	0.509	2.05	2.89
2	3	1	3	LP2-OL-16-MODQ	U13LM21	<0.100	0.0873	0.352	2.10	2.76
2	3	1	4	LP2-OL-02-1SSM	U21LM21	<0.100	0.218	0.421	0.491	2.21
2	3	1	5	LP2-OL-21Q	U06LM11	<0.100	0.275	0.200	0.528	2.22
2	3	1	6	LP2-OL-11SSM	U01LM11	<0.100	0.0908	0.628	<0.100	1.57
2	3	1	7	LP2-OL-11Q	U14LM11	<0.100	0.0977	0.0592	<0.100	1.59
2	3	1	8	LP2-OL-23Q	U07LM21	<0.100	0.0875	0.497	<0.100	2.84
2	3	1	9	LP2-OL-21Q	U06LM21	<0.100	0.278	0.204	0.533	2.21
2	3	1	10	LP2-OL-02-1Q	U24LM11	<0.100	0.240	0.184	0.524	2.22
2	3	1	11	LP2-OL-02-1SSM	U21LM11	<0.100	0.232	0.466	0.504	2.21
2	3	1	12	LRM	LRMLM312	0.141	0.191	0.0969	<0.100	<0.100
2	3	1	13	LP2-OL-11SSM	U01LM21	<0.100	0.0849	0.546	<0.100	1.48
2	3	1	14	LP2-OL-16-MODSSM	U12LM21	<0.100	0.0716	0.442	1.99	2.71
2	3	1	15	LP2-OL-21SSM	U10LM21	<0.100	0.234	0.428	0.505	2.18
2	3	1	16	LP2-OL-23Q	U07LM11	<0.100	0.0819	0.434	<0.100	2.69
2	3	1	17	LP2-OL-23SSM	U23LM21	<0.100	0.0823	0.627	<0.100	2.74
2	3	1	18	LP2-OL-16-MODQ	U13LM11	<0.100	0.0875	0.367	2.12	2.77
2	3	1	19	LP2-OL-02-1Q	U24LM21	<0.100	0.268	0.205	0.546	2.13
2	3	1	20	LP2-OL-21SSM	U10LM21	<0.100	0.251	0.491	0.511	2.29
2	3	1	21	LP2-OL-11Q	U14LM21	<0.100	0.103	0.0639	<0.100	1.57
2	3	1	22	LP2-OL-23SSM	U23LM11	<0.100	0.0831	0.748	<0.100	2.84
2	3	1	23	LRM	LRMLM313	0.143	0.193	0.0929	<0.100	<0.100
2	3	2	1	LRM	LRMLM321	0.139	0.189	0.0885	<0.100	<0.100
2	3	2	2	LP2-OL-21Q	U06LM12	<0.100	0.276	0.196	0.533	2.19
2	3	2	3	LP2-OL-16-MODQ	U13LM22	<0.100	0.0891	0.360	2.15	2.80
2	3	2	4	LP2-OL-21SSM	U10LM12	<0.100	0.219	0.394	0.470	2.05

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

Set	Block	Sub-Blk	Sequence	ID	Lab ID	Ni (wt%)	P (wt%)	S (wt%)	V (wt%)	Zn (wt%)
2	3	2	5	LP2-OL-02-1SSM	U21LM12	<0.100	0.231	0.458	0.506	2.15
2	3	2	6	LP2-OL-23Q	U07LM22	<0.100	0.0918	0.506	<0.100	2.78
2	3	2	7	LP2-OL-16-MODSSM	U12LM12	<0.100	0.0812	0.505	2.03	2.85
2	3	2	8	LP2-OL-02-1Q	U24LM22	<0.100	0.267	0.202	0.551	2.15
2	3	2	9	LP2-OL-16-MODQ	U13LM12	<0.100	0.0918	0.357	2.08	2.72
2	3	2	10	LP2-OL-23Q	U07LM12	<0.100	0.0799	0.422	<0.100	2.67
2	3	2	11	LP2-OL-11SSM	U01LM12	<0.100	0.0974	0.640	<0.100	1.60
2	3	2	12	LRM	LRMLM322	0.140	0.187	0.0937	<0.100	<0.100
2	3	2	13	LP2-OL-21SSM	U10LM22	<0.100	0.254	0.492	0.519	2.25
2	3	2	14	LP2-OL-16-MODSSM	U12LM22	<0.100	0.0723	0.451	2.04	2.76
2	3	2	15	LP2-OL-02-1SSM	U21LM22	<0.100	0.218	0.414	0.484	2.16
2	3	2	16	LP2-OL-02-1Q	U24LM12	<0.100	0.233	0.177	0.512	2.15
2	3	2	17	LP2-OL-11SSM	U01LM22	<0.100	0.0875	0.541	<0.100	1.52
2	3	2	18	LP2-OL-11Q	U14LM22	<0.100	0.104	0.0538	<0.100	1.54
2	3	2	19	LP2-OL-23SSM	U23LM22	<0.100	0.0799	0.642	<0.100	2.69
2	3	2	20	LP2-OL-11Q	U14LM12	<0.100	0.103	0.058	<0.100	1.59
2	3	2	21	LP2-OL-21Q	U06LM22	<0.100	0.274	0.204	0.536	2.19
2	3	2	22	LP2-OL-23SSM	U23LM12	<0.100	0.0906	0.717	<0.100	2.82
2	3	2	23	LRM	LRMLM323	0.140	0.191	0.0866	<0.100	<0.100

Table C-3. PF Measurements of the Study Glasses – Part 1

Set	Block	Sub-Blk	Sequence	ID	Lab ID	Al (wt%)	B (wt%)	Fe (wt%)	Li (wt%)
1	1	1	1	LRM	LRMPF111	5.07	2.46	1.00	<0.100
1	1	1	2	LP2-OL-12SSM	C08PF21	2.81	3.80	0.978	<0.100
1	1	1	3	LP2-OL-04-1SSM	C17PF21	5.00	1.69	0.978	<0.100
1	1	1	4	LP2-OL-12Q	C07PF11	3.06	4.22	1.28	<0.100
1	1	1	5	LP2-OL-15SSM	C09PF11	2.81	3.88	0.982	<0.100
1	1	1	6	LP2-OL-05Q	C04PF11	6.37	1.87	1.36	<0.100
1	1	1	7	LP2-OL-05Q	C04PF21	6.28	1.83	1.34	<0.100
1	1	1	8	LP2-OL-09-1Q	C13PF11	6.38	4.36	0.427	<0.100
1	1	1	9	LP2-OL-09-1Q	C13PF21	6.32	4.31	0.374	<0.100
1	1	1	10	LP2-OL-04-1Q	C18PF11	5.45	1.96	1.31	<0.100
1	1	1	11	LP2-OL-15SSM	C09PF21	2.84	4.04	1.00	<0.100
1	1	1	12	LRM	LRMPF112	5.21	2.44	1.03	<0.100
1	1	1	13	LP2-OL-09-1SSM	C14PF21	5.81	3.99	<0.100	<0.100
1	1	1	14	LP2-OL-05SSM	C03PF21	6.07	1.78	1.02	<0.100
1	1	1	15	LP2-OL-12Q	C07PF21	3.05	4.22	1.32	<0.100
1	1	1	16	LP2-OL-05SSM	C03PF11	5.98	1.76	0.993	<0.100
1	1	1	17	LP2-OL-15Q	C10PF21	3.11	4.41	1.45	<0.100
1	1	1	18	LP2-OL-04-1SSM	C17PF11	5.32	1.87	1.05	<0.100
1	1	1	19	LP2-OL-09-1SSM	C14PF11	6.04	4.17	<0.100	<0.100
1	1	1	20	LP2-OL-04-1Q	C18PF21	5.53	1.98	1.34	<0.100
1	1	1	21	LP2-OL-15Q	C10PF11	3.13	4.46	1.43	<0.100
1	1	1	22	LP2-OL-12SSM	C08PF11	2.94	4.12	1.02	<0.100
1	1	1	23	LRM	LRMPF113	5.16	2.44	1.03	<0.100
1	1	2	1	LRM	LRMPF121	4.97	2.42	1.00	<0.100
1	1	2	2	LP2-OL-15Q	C10PF22	2.97	4.10	1.36	<0.100
1	1	2	3	LP2-OL-12Q	C07PF12	3.03	4.33	1.29	<0.100
1	1	2	4	LP2-OL-12SSM	C08PF12	2.97	4.20	1.02	<0.100
1	1	2	5	LP2-OL-04-1Q	C18PF22	5.26	1.94	1.28	<0.100
1	1	2	6	LP2-OL-09-1SSM	C14PF22	5.76	3.98	<0.100	<0.100
1	1	2	7	LP2-OL-05Q	C04PF22	6.23	1.89	1.33	<0.100
1	1	2	8	LP2-OL-04-1SSM	C17PF22	5.01	1.74	0.981	<0.100
1	1	2	9	LP2-OL-12SSM	C08PF22	2.79	3.89	0.983	<0.100
1	1	2	10	LP2-OL-04-1Q	C18PF12	5.24	1.90	1.26	<0.100

Table C-3. PF Measurements of the Study Glasses – Part 1 (continued)

Set	Block	Sub-Blk	Sequence	ID	Lab ID	Al (wt%)	B (wt%)	Fe (wt%)	Li (wt%)
1	1	2	11	LP2-OL-12Q	C07PF22	3.07	4.30	1.32	<0.100
1	1	2	12	LRM	LRMPF122	5.05	2.46	1.01	<0.100
1	1	2	13	LP2-OL-04-1SSM	C17PF12	4.94	1.82	0.987	<0.100
1	1	2	14	LP2-OL-05SSM	C03PF22	5.76	1.76	0.990	<0.100
1	1	2	15	LP2-OL-15SSM	C09PF22	2.71	3.85	0.965	<0.100
1	1	2	16	LP2-OL-05Q	C04PF12	6.13	1.85	1.33	<0.100
1	1	2	17	LP2-OL-05SSM	C03PF12	5.81	1.76	0.973	<0.100
1	1	2	18	LP2-OL-09-1Q	C13PF12	6.15	4.16	0.415	<0.100
1	1	2	19	LP2-OL-09-1SSM	C14PF12	5.99	4.09	<0.100	<0.100
1	1	2	20	LP2-OL-15SSM	C09PF12	2.75	3.84	0.961	<0.100
1	1	2	21	LP2-OL-09-1Q	C13PF22	6.29	4.32	0.378	<0.100
1	1	2	22	LP2-OL-15Q	C10PF12	3.06	4.29	1.38	<0.100
1	1	2	23	LRM	LRMPF123	5.14	2.54	1.03	<0.100
1	2	1	1	LRM	LRMPF211	5.05	2.40	0.890	<0.100
1	2	1	2	LP2-OL-01-3Q	C12PF11	2.93	1.86	0.243	<0.100
1	2	1	3	LP2-OL-17SSM	C15PF21	2.77	1.78	0.881	<0.100
1	2	1	4	LP2-OL-14Q	C01PF11	2.92	4.19	0.157	<0.100
1	2	1	5	LP2-OL-14SSM	C02PF21	2.83	4.06	<0.100	<0.100
1	2	1	6	LP2-OL-17SSM	C15PF11	2.83	1.76	0.888	<0.100
1	2	1	7	LP2-OL-14Q	C01PF21	2.88	4.25	0.155	<0.100
1	2	1	8	LP2-OL-07-1Q	C06PF11	5.03	3.88	0.901	<0.100
1	2	1	9	LP2-OL-01-3SSM	C11PF21	2.76	1.75	<0.100	<0.100
1	2	1	10	LP2-OL-01-3SSM	C11PF11	2.71	1.71	<0.100	<0.100
1	2	1	11	LP2-OL-07-1SSM	C05PF11	4.64	3.53	0.549	<0.100
1	2	1	12	LRM	LRMPF212	4.86	2.23	0.856	<0.100
1	2	1	13	LP2-OL-07-1SSM	C05PF21	4.63	3.53	0.556	<0.100
1	2	1	14	LP2-OL-07-1Q	C06PF21	4.97	3.74	0.887	<0.100
1	2	1	15	LP2-OL-01-3Q	C12PF21	3.06	1.92	0.264	<0.100
1	2	1	16	LP2-OL-17Q	C16PF11	2.95	1.84	1.17	<0.100
1	2	1	17	LP2-OL-14SSM	C02PF11	2.77	4.04	<0.100	<0.100
1	2	1	18	LP2-OL-17Q	C16PF21	3.02	1.94	1.21	<0.100
1	2	1	19	LRM	LRMPF213	5.07	2.43	0.912	<0.100
1	2	2	1	LRM	LRMPF221	5.10	2.46	0.981	<0.100
1	2	2	2	LP2-OL-17SSM	C15PF22	2.78	1.77	0.939	<0.100

Table C-3. PF Measurements of the Study Glasses – Part 1 (continued)

Set	Block	Sub-Blk	Sequence	ID	Lab ID	Al (wt%)	B (wt%)	Fe (wt%)	Li (wt%)
1	2	2	3	LP2-OL-07-1Q	C06PF12	5.14	3.94	0.991	<0.100
1	2	2	4	LP2-OL-17Q	C16PF12	3.07	1.95	1.29	<0.100
1	2	2	5	LP2-OL-01-3Q	C12PF12	3.02	1.87	0.325	<0.100
1	2	2	6	LP2-OL-14Q	C01PF22	2.98	4.39	0.244	<0.100
1	2	2	7	LP2-OL-07-1SSM	C05PF22	4.80	3.58	0.637	<0.100
1	2	2	8	LP2-OL-01-3Q	C12PF22	3.05	1.85	0.338	<0.100
1	2	2	9	LP2-OL-01-3SSM	C11PF22	2.78	1.74	<0.100	<0.100
1	2	2	10	LP2-OL-07-1Q	C06PF22	5.02	3.76	0.967	<0.100
1	2	2	11	LP2-OL-14SSM	C02PF22	2.79	4.01	<0.100	<0.100
1	2	2	12	LRM	LRMPF222	5.15	2.44	0.994	<0.100
1	2	2	13	LP2-OL-17SSM	C15PF12	2.85	1.79	0.958	<0.100
1	2	2	14	LP2-OL-14SSM	C02PF12	2.86	4.06	<0.100	<0.100
1	2	2	15	LP2-OL-17Q	C16PF22	3.07	1.95	1.28	<0.100
1	2	2	16	LP2-OL-07-1SSM	C05PF12	4.85	3.70	0.651	<0.100
1	2	2	17	LP2-OL-01-3SSM	C11PF12	2.81	1.78	<0.100	<0.100
1	2	2	18	LP2-OL-14Q	C01PF12	2.95	4.21	0.243	<0.100
1	2	2	19	LRM	LRMPF223	5.18	2.43	0.992	<0.100
2	1	1	1	LRM	LRMPF111	4.99	2.36	0.982	<0.100
2	1	1	2	LP2-OL-08-MODQ	U25PF21	3.05	1.89	1.28	<0.100
2	1	1	3	LP2-OL-25SSM	U27PF11	2.97	3.99	1.01	<0.100
2	1	1	4	LP2-OL-22Q	U19PF11	3.48	1.81	1.28	<0.100
2	1	1	5	LP2-OL-19Q	U18PF11	3.02	1.90	1.36	<0.100
2	1	1	6	LP2-OL-25Q	U05PF11	3.06	4.20	1.36	<0.100
2	1	1	7	LP2-OL-22SSM	U02PF11	3.40	1.79	1.00	<0.100
2	1	1	8	LP2-OL-19Q	U18PF21	3.02	1.86	1.34	<0.100
2	1	1	9	LP2-OL-25SSM	U27PF21	3.02	4.12	1.03	<0.100
2	1	1	10	LP2-OL-19SSM	U26PF11	3.05	1.81	1.03	<0.100
2	1	1	11	LP2-OL-25Q	U05PF21	3.09	4.25	1.37	<0.100
2	1	1	12	LRM	LRMPF112	5.16	2.52	1.02	<0.100
2	1	1	13	LP2-OL-19SSM	U26PF21	3.06	1.83	1.03	<0.100
2	1	1	14	LP2-OL-08-MODSSM	U20PF21	3.01	1.76	1.03	<0.100
2	1	1	15	LP2-OL-08-MODSSM	U20PF11	3.00	1.75	1.03	<0.100
2	1	1	16	LP2-OL-22Q	U19PF21	3.45	1.78	1.29	<0.100
2	1	1	17	LP2-OL-13Q	U17PF21	3.00	1.83	0.196	<0.100

Table C-3. PF Measurements of the Study Glasses – Part 1 (continued)

Set	Block	Sub-Blk	Sequence	ID	Lab ID	Al (wt%)	B (wt%)	Fe (wt%)	Li (wt%)
2	1	1	18	LP2-OL-22SSM	U02PF21	3.50	1.79	1.01	<0.100
2	1	1	19	LP2-OL-13Q	U17PF11	3.00	1.85	0.197	<0.100
2	1	1	20	LP2-OL-08-MODQ	U25PF11	3.11	1.86	1.30	<0.100
2	1	1	21	LP2-OL-13SSM	U04PF11	2.90	1.71	<0.100	<0.100
2	1	1	22	LP2-OL-13SSM	U04PF21	3.01	1.79	<0.100	<0.100
2	1	1	23	LRM	LRMPF113	4.86	2.28	0.945	<0.100
2	1	2	1	LRM	LRMPF121	4.68	2.27	1.02	<0.100
2	1	2	2	LP2-OL-13Q	U17PF22	2.93	1.85	0.314	<0.100
2	1	2	3	LP2-OL-08-MODSSM	U20PF12	2.91	1.76	1.09	<0.100
2	1	2	4	LP2-OL-19Q	U18PF12	3.02	1.86	1.40	<0.100
2	1	2	5	LP2-OL-08-MODQ	U25PF22	2.97	1.84	1.33	<0.100
2	1	2	6	LP2-OL-13SSM	U04PF12	2.92	1.77	0.146	<0.100
2	1	2	7	LP2-OL-08-MODQ	U25PF12	3.07	1.91	1.38	<0.100
2	1	2	8	LP2-OL-25Q	U05PF12	3.03	4.12	1.42	<0.100
2	1	2	9	LP2-OL-19Q	U18PF22	2.99	1.88	1.41	<0.100
2	1	2	10	LP2-OL-13Q	U17PF12	2.97	1.84	0.313	<0.100
2	1	2	11	LP2-OL-19SSM	U26PF12	2.96	1.78	1.08	<0.100
2	1	2	12	LRM	LRMPF122	4.87	2.36	1.05	<0.100
2	1	2	13	LP2-OL-22Q	U19PF12	3.39	1.85	1.35	<0.100
2	1	2	14	LP2-OL-25Q	U05PF22	3.06	4.10	1.42	<0.100
2	1	2	15	LP2-OL-13SSM	U04PF22	2.91	1.78	0.143	<0.100
2	1	2	16	LP2-OL-22SSM	U02PF22	3.44	1.79	1.08	<0.100
2	1	2	17	LP2-OL-19SSM	U26PF22	2.97	1.77	1.09	<0.100
2	1	2	18	LP2-OL-22Q	U19PF22	3.47	1.87	1.39	<0.100
2	1	2	19	LP2-OL-08-MODSSM	U20PF22	2.99	1.76	1.11	<0.100
2	1	2	20	LP2-OL-22SSM	U02PF12	3.45	1.81	1.10	<0.100
2	1	2	21	LP2-OL-25SSM	U27PF12	3.01	3.96	1.11	<0.100
2	1	2	22	LP2-OL-25SSM	U27PF22	3.02	3.97	1.10	<0.100
2	1	2	23	LRM	LRMPF123	4.88	2.39	1.06	<0.100
2	2	1	1	LRM	LRMPF211	4.93	2.37	0.955	<0.100
2	2	1	2	LP2-OL-18Q	U30PF11	3.13	1.86	0.289	<0.100
2	2	1	3	LP2-OL-20Q	U03PF11	3.04	1.81	0.344	<0.100
2	2	1	4	LP2-OL-10-MODSSM	U28PF11	6.22	1.78	1.01	<0.100
2	2	1	5	LP2-OL-10-MODSSM	U28PF21	6.26	1.81	1.02	<0.100

Table C-3. PF Measurements of the Study Glasses – Part 1 (continued)

Set	Block	Sub-Blk	Sequence	ID	Lab ID	Al (wt%)	B (wt%)	Fe (wt%)	Li (wt%)
2	2	1	6	LP2-OL-20Q	U03PF21	3.02	1.78	0.348	<0.100
2	2	1	7	LP2-OL-03-MOD2SSM	U22PF21	5.35	1.74	<0.100	<0.100
2	2	1	8	LP2-OL-10-MODQ	U15PF21	6.14	1.74	1.33	<0.100
2	2	1	9	LP2-OL-03-MOD2Q	U09PF21	5.37	1.82	0.298	<0.100
2	2	1	10	LP2-OL-20SSM	U16PF21	3.01	1.74	<0.100	<0.100
2	2	1	11	LP2-OL-18Q	U30PF21	3.12	1.86	0.288	<0.100
2	2	1	12	LRM	LRMPF212	5.02	2.32	0.964	<0.100
2	2	1	13	LP2-OL-03-MOD2Q	U09PF11	5.42	1.88	0.313	<0.100
2	2	1	14	LP2-OL-18SSM	U11PF21	3.23	1.92	<0.100	<0.100
2	2	1	15	LP2-OL-24SSM	U29PF21	6.37	1.78	1.04	<0.100
2	2	1	16	LP2-OL-20SSM	U16PF11	2.97	1.71	<0.100	<0.100
2	2	1	17	LP2-OL-24Q	U08PF11	6.22	1.82	1.37	<0.100
2	2	1	18	LP2-OL-10-MODQ	U15PF11	6.20	1.76	1.37	<0.100
2	2	1	19	LP2-OL-18SSM	U11PF11	3.06	1.79	<0.100	<0.100
2	2	1	20	LP2-OL-24SSM	U29PF11	5.98	1.61	0.969	<0.100
2	2	1	21	LP2-OL-24Q	U08PF21	6.24	1.79	1.36	<0.100
2	2	1	22	LP2-OL-03-MOD2SSM	U22PF11	5.39	1.75	<0.100	<0.100
2	2	1	23	LRM	LRMPF213	4.93	2.30	0.959	<0.100
2	2	2	1	LRM	LRMPF221	4.81	2.35	1.00	<0.100
2	2	2	2	LP2-OL-18SSM	U11PF12	3.09	1.90	<0.100	<0.100
2	2	2	3	LP2-OL-10-MODSSM	U28PF12	5.97	1.79	1.04	<0.100
2	2	2	4	LP2-OL-20SSM	U16PF12	2.88	1.76	<0.100	<0.100
2	2	2	5	LP2-OL-18Q	U30PF22	3.03	1.84	0.361	<0.100
2	2	2	6	LP2-OL-18SSM	U11PF22	3.02	1.80	<0.100	<0.100
2	2	2	7	LP2-OL-24Q	U08PF12	5.87	1.78	1.34	<0.100
2	2	2	8	LP2-OL-24SSM	U29PF12	5.87	1.69	1.02	<0.100
2	2	2	9	LP2-OL-10-MODQ	U15PF22	5.89	1.75	1.34	<0.100
2	2	2	10	LP2-OL-18Q	U30PF12	2.94	1.80	0.354	<0.100
2	2	2	11	LP2-OL-20SSM	U16PF22	2.85	1.70	<0.100	<0.100
2	2	2	12	LRM	LRMPF222	4.70	2.22	0.970	<0.100
2	2	2	13	LP2-OL-20Q	U03PF12	2.83	1.87	0.395	<0.100
2	2	2	14	LP2-OL-03-MOD2SSM	U22PF12	4.98	1.77	<0.100	<0.100
2	2	2	15	LP2-OL-24Q	U08PF22	5.81	1.82	1.29	<0.100
2	2	2	16	LP2-OL-03-MOD2Q	U09PF12	4.82	1.60	0.343	<0.100

Table C-3. PF Measurements of the Study Glasses – Part 1 (continued)

Set	Block	Sub-Blk	Sequence	ID	Lab ID	Al (wt%)	B (wt%)	Fe (wt%)	Li (wt%)
2	2	2	17	LP2-OL-10-MODQ	U15PF12	5.99	1.74	1.33	<0.100
2	2	2	18	LP2-OL-20Q	U03PF22	2.88	1.74	0.409	<0.100
2	2	2	19	LP2-OL-24SSM	U29PF22	5.93	1.66	1.00	<0.100
2	2	2	20	LP2-OL-03-MOD2Q	U09PF22	5.08	1.77	0.365	<0.100
2	2	2	21	LP2-OL-10-MODSSM	U28PF22	5.95	1.73	1.02	<0.100
2	2	2	22	LP2-OL-03-MOD2SSM	U22PF22	4.93	1.63	<0.100	<0.100
2	2	2	23	LRM	LRMPF223	4.68	2.20	0.966	<0.100
2	3	1	1	LRM	LRMPF311	4.85	2.31	0.959	<0.100
2	3	1	2	LP2-OL-21Q	U06PF21	5.01	2.98	0.680	<0.100
2	3	1	3	LP2-OL-23SSM	U23PF21	2.88	3.99	<0.100	<0.100
2	3	1	4	LP2-OL-21Q	U06PF11	4.95	2.91	0.685	<0.100
2	3	1	5	LP2-OL-11SSM	U01PF21	3.01	4.15	<0.100	<0.100
2	3	1	6	LP2-OL-21SSM	U10PF11	4.96	2.88	0.434	<0.100
2	3	1	7	LP2-OL-02-1Q	U24PF11	4.91	2.93	0.730	<0.100
2	3	1	8	LP2-OL-02-1SSM	U21PF21	4.80	2.73	0.441	<0.100
2	3	1	9	LP2-OL-02-1Q	U24PF21	4.82	2.81	0.705	<0.100
2	3	1	10	LP2-OL-16-MODQ	U13PF21	2.91	2.28	1.32	<0.100
2	3	1	11	LP2-OL-11Q	U14PF21	2.91	4.22	0.236	<0.100
2	3	1	12	LRM	LRMPF312	4.95	2.39	0.980	<0.100
2	3	1	13	LP2-OL-23Q	U07PF21	2.86	4.13	0.391	<0.100
2	3	1	14	LP2-OL-16-MODSSM	U12PF11	2.88	2.20	1.00	<0.100
2	3	1	15	LP2-OL-23Q	U07PF11	2.97	4.10	0.468	<0.100
2	3	1	16	LP2-OL-11Q	U14PF11	2.92	4.02	0.249	<0.100
2	3	1	17	LP2-OL-16-MODSSM	U12PF21	2.97	2.24	1.04	<0.100
2	3	1	18	LP2-OL-11SSM	U01PF11	2.93	3.87	<0.100	<0.100
2	3	1	19	LP2-OL-23SSM	U23PF11	2.86	3.93	<0.100	<0.100
2	3	1	20	LP2-OL-21SSM	U10PF21	4.84	2.80	0.425	<0.100
2	3	1	21	LP2-OL-02-1SSM	U21PF11	4.89	2.80	0.446	<0.100
2	3	1	22	LP2-OL-16-MODQ	U13PF11	2.89	2.24	1.31	<0.100
2	3	1	23	LRM	LRMPF313	4.97	2.36	0.982	<0.100
2	3	2	1	LRM	LRMPF321	4.87	2.39	0.958	<0.100
2	3	2	2	LP2-OL-11SSM	U01PF22	2.93	4.02	<0.100	<0.100
2	3	2	3	LP2-OL-23Q	U07PF12	2.99	4.19	0.459	<0.100
2	3	2	4	LP2-OL-23Q	U07PF22	2.85	4.06	0.358	<0.100

Table C-3. PF Measurements of the Study Glasses – Part 1 (continued)

Set	Block	Sub-Blk	Sequence	ID	Lab ID	Al (wt%)	B (wt%)	Fe (wt%)	Li (wt%)
2	3	2	5	LP2-OL-21Q	U06PF22	4.98	2.97	0.660	<0.100
2	3	2	6	LP2-OL-11Q	U14PF12	2.99	4.11	0.231	<0.100
2	3	2	7	LP2-OL-16-MODSSM	U12PF12	2.88	2.25	1.00	<0.100
2	3	2	8	LP2-OL-02-1SSM	U21PF12	4.85	2.74	0.421	<0.100
2	3	2	9	LP2-OL-16-MODSSM	U12PF22	2.94	2.25	1.02	<0.100
2	3	2	10	LP2-OL-21Q	U06PF12	4.87	2.86	0.641	<0.100
2	3	2	11	LP2-OL-23SSM	U23PF22	2.72	3.67	<0.100	<0.100
2	3	2	12	LRM	LRMPF322	4.71	2.24	0.917	<0.100
2	3	2	13	LP2-OL-21SSM	U10PF12	4.84	2.83	0.413	<0.100
2	3	2	14	LP2-OL-02-1Q	U24PF12	4.83	2.85	0.698	<0.100
2	3	2	15	LP2-OL-02-1Q	U24PF22	4.75	2.87	0.696	<0.100
2	3	2	16	LP2-OL-16-MODQ	U13PF12	2.93	2.29	1.33	<0.100
2	3	2	17	LP2-OL-23SSM	U23PF12	2.84	3.91	<0.100	<0.100
2	3	2	18	LP2-OL-02-1SSM	U21PF22	4.83	2.81	0.428	<0.100
2	3	2	19	LP2-OL-21SSM	U10PF22	5.01	2.87	0.415	<0.100
2	3	2	20	LP2-OL-11Q	U14PF22	2.84	4.10	0.207	<0.100
2	3	2	21	LP2-OL-11SSM	U01PF12	2.99	4.12	<0.100	<0.100
2	3	2	22	LP2-OL-16-MODQ	U13PF22	2.86	2.27	1.30	<0.100
2	3	2	23	LRM	LRMPF323	4.88	2.37	0.961	<0.100

Table C-4. PF Measurements of the Study Glasses – Part 2

Set	Block	Sub-Blk	Sequence	ID	Lab ID	P (wt%)	Si (wt%)	Sn (wt%)	Zr (wt%)
1	1	1	1	LRM	LRMPF111	na	25.42	<0.100	na
1	1	1	2	LP2-OL-12SSM	C08PF21	na	16.11	<0.100	na
1	1	1	3	LP2-OL-04-1SSM	C17PF21	na	15.45	<0.100	na
1	1	1	4	LP2-OL-12Q	C07PF11	na	17.23	<0.100	na
1	1	1	5	LP2-OL-15SSM	C09PF11	na	16.35	2.44	na
1	1	1	6	LP2-OL-05Q	C04PF11	na	19.16	<0.100	na
1	1	1	7	LP2-OL-05Q	C04PF21	na	19.21	<0.100	na
1	1	1	8	LP2-OL-09-1Q	C13PF11	na	19.05	1.21	na
1	1	1	9	LP2-OL-09-1Q	C13PF21	na	18.79	1.23	na
1	1	1	10	LP2-OL-04-1Q	C18PF11	na	16.74	<0.100	na
1	1	1	11	LP2-OL-15SSM	C09PF21	na	15.04	2.51	na
1	1	1	12	LRM	LRMPF112	na	26.51	<0.100	na
1	1	1	13	LP2-OL-09-1SSM	C14PF21	na	18.05	1.12	na
1	1	1	14	LP2-OL-05SSM	C03PF21	na	18.31	<0.100	na
1	1	1	15	LP2-OL-12Q	C07PF21	na	17.36	<0.100	na
1	1	1	16	LP2-OL-05SSM	C03PF11	na	17.65	<0.100	na
1	1	1	17	LP2-OL-15Q	C10PF21	na	16.99	2.81	na
1	1	1	18	LP2-OL-04-1SSM	C17PF11	na	15.43	<0.100	na
1	1	1	19	LP2-OL-09-1SSM	C14PF11	na	17.47	1.16	na
1	1	1	20	LP2-OL-04-1Q	C18PF21	na	16.16	<0.100	na
1	1	1	21	LP2-OL-15Q	C10PF11	na	16.62	2.81	na
1	1	1	22	LP2-OL-12SSM	C08PF11	na	16.01	<0.100	na
1	1	1	23	LRM	LRMPF113	na	27.49	<0.100	na
1	1	2	1	LRM	LRMPF121	na	24.67	<0.100	na
1	1	2	2	LP2-OL-15Q	C10PF22	na	17.57	2.63	na
1	1	2	3	LP2-OL-12Q	C07PF12	na	16.44	<0.100	na
1	1	2	4	LP2-OL-12SSM	C08PF12	na	15.21	<0.100	na
1	1	2	5	LP2-OL-04-1Q	C18PF22	na	17.00	<0.100	na
1	1	2	6	LP2-OL-09-1SSM	C14PF22	na	17.63	1.10	na
1	1	2	7	LP2-OL-05Q	C04PF22	na	18.98	<0.100	na
1	1	2	8	LP2-OL-04-1SSM	C17PF22	na	15.45	<0.100	na
1	1	2	9	LP2-OL-12SSM	C08PF22	na	16.08	<0.100	na
1	1	2	10	LP2-OL-04-1Q	C18PF12	na	17.48	<0.100	na

Table C-4. PF Measurements of the Study Glasses – Part 2 (continued)

Set	Block	Sub-Blk	Sequence	ID	Lab ID	P (wt%)	Si (wt%)	Sn (wt%)	Zr (wt%)
1	1	2	11	LP2-OL-12Q	C07PF22	na	16.91	<0.100	na
1	1	2	12	LRM	LRMPF122	na	26.48	<0.100	na
1	1	2	13	LP2-OL-04-1SSM	C17PF12	na	15.66	0.114	na
1	1	2	14	LP2-OL-05SSM	C03PF22	na	17.35	<0.100	na
1	1	2	15	LP2-OL-15SSM	C09PF22	na	15.53	2.41	na
1	1	2	16	LP2-OL-05Q	C04PF12	na	18.64	<0.100	na
1	1	2	17	LP2-OL-05SSM	C03PF12	na	16.73	<0.100	na
1	1	2	18	LP2-OL-09-1Q	C13PF12	na	18.64	1.20	na
1	1	2	19	LP2-OL-09-1SSM	C14PF12	na	17.33	1.13	na
1	1	2	20	LP2-OL-15SSM	C09PF12	na	15.30	2.43	na
1	1	2	21	LP2-OL-09-1Q	C13PF22	na	18.27	1.20	na
1	1	2	22	LP2-OL-15Q	C10PF12	na	16.99	2.66	na
1	1	2	23	LRM	LRMPF123	na	26.60	<0.100	na
1	2	1	1	LRM	LRMPF211	na	27.42	<0.100	na
1	2	1	2	LP2-OL-01-3Q	C12PF11	na	22.38	<0.100	na
1	2	1	3	LP2-OL-17SSM	C15PF21	na	16.57	2.47	na
1	2	1	4	LP2-OL-14Q	C01PF11	na	16.36	<0.100	na
1	2	1	5	LP2-OL-14SSM	C02PF21	na	15.89	<0.100	na
1	2	1	6	LP2-OL-17SSM	C15PF11	na	15.92	2.47	na
1	2	1	7	LP2-OL-14Q	C01PF21	na	15.39	<0.100	na
1	2	1	8	LP2-OL-07-1Q	C06PF11	na	17.29	<0.100	na
1	2	1	9	LP2-OL-01-3SSM	C11PF21	na	21.08	<0.100	na
1	2	1	10	LP2-OL-01-3SSM	C11PF11	na	20.54	<0.100	na
1	2	1	11	LP2-OL-07-1SSM	C05PF11	na	15.90	<0.100	na
1	2	1	12	LRM	LRMPF212	na	27.06	<0.100	na
1	2	1	13	LP2-OL-07-1SSM	C05PF21	na	15.52	<0.100	na
1	2	1	14	LP2-OL-07-1Q	C06PF21	na	17.53	<0.100	na
1	2	1	15	LP2-OL-01-3Q	C12PF21	na	22.34	<0.100	na
1	2	1	16	LP2-OL-17Q	C16PF11	na	17.94	2.60	na
1	2	1	17	LP2-OL-14SSM	C02PF11	na	14.88	<0.100	na
1	2	1	18	LP2-OL-17Q	C16PF21	na	17.34	2.66	na
1	2	1	19	LRM	LRMPF213	na	27.00	<0.100	na
1	2	2	1	LRM	LRMPF221	na	26.39	<0.100	na
1	2	2	2	LP2-OL-17SSM	C15PF22	na	17.35	2.43	na

Table C-4. PF Measurements of the Study Glasses – Part 2 (continued)

Set	Block	Sub-Blk	Sequence	ID	Lab ID	P (wt%)	Si (wt%)	Sn (wt%)	Zr (wt%)
1	2	2	3	LP2-OL-07-1Q	C06PF12	na	17.81	<0.100	na
1	2	2	4	LP2-OL-17Q	C16PF12	na	18.15	2.74	na
1	2	2	5	LP2-OL-01-3Q	C12PF12	na	22.51	<0.100	na
1	2	2	6	LP2-OL-14Q	C01PF22	na	15.87	<0.100	na
1	2	2	7	LP2-OL-07-1SSM	C05PF22	na	15.93	<0.100	na
1	2	2	8	LP2-OL-01-3Q	C12PF22	na	22.42	<0.100	na
1	2	2	9	LP2-OL-01-3SSM	C11PF22	na	21.71	<0.100	na
1	2	2	10	LP2-OL-07-1Q	C06PF22	na	17.49	<0.100	na
1	2	2	11	LP2-OL-14SSM	C02PF22	na	14.96	<0.100	na
1	2	2	12	LRM	LRMPF222	na	27.23	<0.100	na
1	2	2	13	LP2-OL-17SSM	C15PF12	na	16.50	2.50	na
1	2	2	14	LP2-OL-14SSM	C02PF12	na	15.34	<0.100	na
1	2	2	15	LP2-OL-17Q	C16PF22	na	17.69	2.71	na
1	2	2	16	LP2-OL-07-1SSM	C05PF12	na	16.22	<0.100	na
1	2	2	17	LP2-OL-01-3SSM	C11PF12	na	20.44	<0.100	na
1	2	2	18	LP2-OL-14Q	C01PF12	na	15.46	<0.100	na
1	2	2	19	LRM	LRMPF223	na	25.32	<0.100	na
2	1	1	1	LRM	LRMPF111	na	23.48	0.147	na
2	1	1	2	LP2-OL-08-MODQ	U25PF21	na	16.91	0.345	na
2	1	1	3	LP2-OL-25SSM	U27PF11	na	16.64	2.63	na
2	1	1	4	LP2-OL-22Q	U19PF11	na	17.29	2.80	na
2	1	1	5	LP2-OL-19Q	U18PF11	na	20.76	2.89	na
2	1	1	6	LP2-OL-25Q	U05PF11	na	17.10	2.93	na
2	1	1	7	LP2-OL-22SSM	U02PF11	na	17.28	2.66	na
2	1	1	8	LP2-OL-19Q	U18PF21	na	20.42	2.86	na
2	1	1	9	LP2-OL-25SSM	U27PF21	na	16.98	2.81	na
2	1	1	10	LP2-OL-19SSM	U26PF11	na	20.24	2.79	na
2	1	1	11	LP2-OL-25Q	U05PF21	na	17.27	2.96	na
2	1	1	12	LRM	LRMPF112	na	25.72	0.161	na
2	1	1	13	LP2-OL-19SSM	U26PF21	na	20.30	2.73	na
2	1	1	14	LP2-OL-08-MODSSM	U20PF21	na	16.76	0.174	na
2	1	1	15	LP2-OL-08-MODSSM	U20PF11	na	16.70	0.150	na
2	1	1	16	LP2-OL-22Q	U19PF21	na	17.33	2.78	na
2	1	1	17	LP2-OL-13Q	U17PF21	na	16.97	0.196	na

Table C-4. PF Measurements of the Study Glasses – Part 2 (continued)

Set	Block	Sub-Blk	Sequence	ID	Lab ID	P (wt%)	Si (wt%)	Sn (wt%)	Zr (wt%)
2	1	1	18	LP2-OL-22SSM	U02PF21	na	17.45	2.72	na
2	1	1	19	LP2-OL-13Q	U17PF11	na	17.07	0.185	na
2	1	1	20	LP2-OL-08-MODQ	U25PF11	na	17.17	0.319	na
2	1	1	21	LP2-OL-13SSM	U04PF11	na	16.32	<0.100	na
2	1	1	22	LP2-OL-13SSM	U04PF21	na	16.96	<0.100	na
2	1	1	23	LRM	LRMPF113	na	24.74	<0.100	na
2	1	2	1	LRM	LRMPF121	na	26.37	0.184	na
2	1	2	2	LP2-OL-13Q	U17PF22	na	15.93	0.262	na
2	1	2	3	LP2-OL-08-MODSSM	U20PF12	na	15.70	0.276	na
2	1	2	4	LP2-OL-19Q	U18PF12	na	19.46	2.83	na
2	1	2	5	LP2-OL-08-MODQ	U25PF22	na	15.84	0.406	na
2	1	2	6	LP2-OL-13SSM	U04PF12	na	15.78	0.165	na
2	1	2	7	LP2-OL-08-MODQ	U25PF12	na	16.43	0.417	na
2	1	2	8	LP2-OL-25Q	U05PF12	na	16.36	2.91	na
2	1	2	9	LP2-OL-19Q	U18PF22	na	20.04	2.84	na
2	1	2	10	LP2-OL-13Q	U17PF12	na	15.86	0.230	na
2	1	2	11	LP2-OL-19SSM	U26PF12	na	20.11	2.67	na
2	1	2	12	LRM	LRMPF122	na	25.81	0.180	na
2	1	2	13	LP2-OL-22Q	U19PF12	na	16.39	2.81	na
2	1	2	14	LP2-OL-25Q	U05PF22	na	16.25	2.89	na
2	1	2	15	LP2-OL-13SSM	U04PF22	na	15.82	0.242	na
2	1	2	16	LP2-OL-22SSM	U02PF22	na	16.51	2.74	na
2	1	2	17	LP2-OL-19SSM	U26PF22	na	20.68	2.70	na
2	1	2	18	LP2-OL-22Q	U19PF22	na	16.90	2.86	na
2	1	2	19	LP2-OL-08-MODSSM	U20PF22	na	15.82	0.261	na
2	1	2	20	LP2-OL-22SSM	U02PF12	na	16.62	2.68	na
2	1	2	21	LP2-OL-25SSM	U27PF12	na	15.95	2.76	na
2	1	2	22	LP2-OL-25SSM	U27PF22	na	16.35	2.81	na
2	1	2	23	LRM	LRMPF123	na	26.17	0.182	na
2	2	1	1	LRM	LRMPF211	na	25.61	<0.100	na
2	2	1	2	LP2-OL-18Q	U30PF11	na	15.60	3.05	na
2	2	1	3	LP2-OL-20Q	U03PF11	na	20.88	0.143	na
2	2	1	4	LP2-OL-10-MODSSM	U28PF11	0.535	18.04	<0.100	1.92
2	2	1	5	LP2-OL-10-MODSSM	U28PF21	0.559	18.28	<0.100	2.00

Table C-4. PF Measurements of the Study Glasses – Part 2 (continued)

Set	Block	Sub-Blk	Sequence	ID	Lab ID	P (wt%)	Si (wt%)	Sn (wt%)	Zr (wt%)
2	2	1	6	LP2-OL-20Q	U03PF21	na	21.07	0.148	na
2	2	1	7	LP2-OL-03-MOD2SSM	U22PF21	na	15.43	2.18	na
2	2	1	8	LP2-OL-10-MODQ	U15PF21	na	18.07	0.172	na
2	2	1	9	LP2-OL-03-MOD2Q	U09PF21	na	15.82	2.47	na
2	2	1	10	LP2-OL-20SSM	U16PF21	na	20.55	<0.100	na
2	2	1	11	LP2-OL-18Q	U30PF21	na	15.42	3.15	na
2	2	1	12	LRM	LRMPF212	na	24.70	<0.100	na
2	2	1	13	LP2-OL-03-MOD2Q	U09PF11	na	15.68	2.47	na
2	2	1	14	LP2-OL-18SSM	U11PF21	na	16.19	2.98	na
2	2	1	15	LP2-OL-24SSM	U29PF21	na	15.52	<0.100	na
2	2	1	16	LP2-OL-20SSM	U16PF11	na	19.50	<0.100	na
2	2	1	17	LP2-OL-24Q	U08PF11	na	15.07	0.130	na
2	2	1	18	LP2-OL-10-MODQ	U15PF11	na	17.47	0.179	na
2	2	1	19	LP2-OL-18SSM	U11PF11	na	15.77	2.80	na
2	2	1	20	LP2-OL-24SSM	U29PF11	na	15.30	<0.100	na
2	2	1	21	LP2-OL-24Q	U08PF21	na	15.18	0.127	na
2	2	1	22	LP2-OL-03-MOD2SSM	U22PF11	na	16.12	2.19	na
2	2	1	23	LRM	LRMPF213	na	25.34	<0.100	na
2	2	2	1	LRM	LRMPF221	na	25.06	0.175	na
2	2	2	2	LP2-OL-18SSM	U11PF12	na	16.95	2.85	na
2	2	2	3	LP2-OL-10-MODSSM	U28PF12	0.557	18.63	0.132	1.86
2	2	2	4	LP2-OL-20SSM	U16PF12	na	21.06	0.179	na
2	2	2	5	LP2-OL-18Q	U30PF22	na	16.52	2.99	na
2	2	2	6	LP2-OL-18SSM	U11PF22	na	16.81	2.81	na
2	2	2	7	LP2-OL-24Q	U08PF12	na	16.65	0.274	na
2	2	2	8	LP2-OL-24SSM	U29PF12	na	16.36	0.189	na
2	2	2	9	LP2-OL-10-MODQ	U15PF22	na	18.05	0.216	na
2	2	2	10	LP2-OL-18Q	U30PF12	na	16.24	2.93	na
2	2	2	11	LP2-OL-20SSM	U16PF22	na	20.79	0.171	na
2	2	2	12	LRM	LRMPF222	na	25.69	0.143	na
2	2	2	13	LP2-OL-20Q	U03PF12	na	20.52	0.225	na
2	2	2	14	LP2-OL-03-MOD2SSM	U22PF12	na	16.24	2.08	na
2	2	2	15	LP2-OL-24Q	U08PF22	na	16.59	0.258	na
2	2	2	16	LP2-OL-03-MOD2Q	U09PF12	na	16.13	2.09	na

Table C-4. PF Measurements of the Study Glasses – Part 2 (continued)

Set	Block	Sub-Blk	Sequence	ID	Lab ID	P (wt%)	Si (wt%)	Sn (wt%)	Zr (wt%)
2	2	2	17	LP2-OL-10-MODQ	U15PF12	na	18.31	0.260	na
2	2	2	18	LP2-OL-20Q	U03PF22	na	20.81	0.296	na
2	2	2	19	LP2-OL-24SSM	U29PF22	na	16.14	0.115	na
2	2	2	20	LP2-OL-03-MOD2Q	U09PF22	na	16.17	2.31	na
2	2	2	21	LP2-OL-10-MODSSM	U28PF22	0.594	18.21	<0.100	1.89
2	2	2	22	LP2-OL-03-MOD2SSM	U22PF22	na	16.22	2.04	na
2	2	2	23	LRM	LRMPF223	na	25.67	0.193	na
2	3	1	1	LRM	LRMPF311	na	27.59	0.108	na
2	3	1	2	LP2-OL-21Q	U06PF21	na	19.70	1.42	na
2	3	1	3	LP2-OL-23SSM	U23PF21	na	17.26	2.73	na
2	3	1	4	LP2-OL-21Q	U06PF11	na	21.02	1.45	na
2	3	1	5	LP2-OL-11SSM	U01PF21	na	17.18	<0.100	na
2	3	1	6	LP2-OL-21SSM	U10PF11	na	19.08	1.28	na
2	3	1	7	LP2-OL-02-1Q	U24PF11	na	18.94	1.40	na
2	3	1	8	LP2-OL-02-1SSM	U21PF21	na	20.18	1.28	2.51
2	3	1	9	LP2-OL-02-1Q	U24PF21	na	20.69	1.33	na
2	3	1	10	LP2-OL-16-MODQ	U13PF21	na	24.43	0.313	na
2	3	1	11	LP2-OL-11Q	U14PF21	na	17.21	0.146	na
2	3	1	12	LRM	LRMPF312	na	26.47	<0.100	na
2	3	1	13	LP2-OL-23Q	U07PF21	na	17.18	2.83	na
2	3	1	14	LP2-OL-16-MODSSM	U12PF11	na	22.50	0.177	na
2	3	1	15	LP2-OL-23Q	U07PF11	na	17.40	2.75	na
2	3	1	16	LP2-OL-11Q	U14PF11	na	18.11	0.232	na
2	3	1	17	LP2-OL-16-MODSSM	U12PF21	na	24.26	0.229	na
2	3	1	18	LP2-OL-11SSM	U01PF11	na	18.01	<0.100	na
2	3	1	19	LP2-OL-23SSM	U23PF11	na	18.06	2.60	na
2	3	1	20	LP2-OL-21SSM	U10PF21	na	19.27	1.23	na
2	3	1	21	LP2-OL-02-1SSM	U21PF11	na	18.42	1.29	2.53
2	3	1	22	LP2-OL-16-MODQ	U13PF11	na	22.59	0.338	na
2	3	1	23	LRM	LRMPF313	na	27.25	<0.100	na
2	3	2	1	LRM	LRMPF321	na	27.16	<0.100	na
2	3	2	2	LP2-OL-11SSM	U01PF22	na	16.37	<0.100	na
2	3	2	3	LP2-OL-23Q	U07PF12	na	17.06	2.82	na
2	3	2	4	LP2-OL-23Q	U07PF22	na	16.44	2.77	na

Table C-4. PF Measurements of the Study Glasses – Part 2 (continued)

Set	Block	Sub-Blk	Sequence	ID	Lab ID	P (wt%)	Si (wt%)	Sn (wt%)	Zr (wt%)
2	3	2	5	LP2-OL-21Q	U06PF22	na	19.26	1.41	na
2	3	2	6	LP2-OL-11Q	U14PF12	na	16.27	0.332	na
2	3	2	7	LP2-OL-16-MODSSM	U12PF12	na	22.76	0.205	na
2	3	2	8	LP2-OL-02-1SSM	U21PF12	na	18.68	1.31	2.53
2	3	2	9	LP2-OL-16-MODSSM	U12PF22	na	23.14	0.240	na
2	3	2	10	LP2-OL-21Q	U06PF12	na	18.73	1.38	na
2	3	2	11	LP2-OL-23SSM	U23PF22	na	15.72	2.56	na
2	3	2	12	LRM	LRMPF322	na	27.02	<0.100	na
2	3	2	13	LP2-OL-21SSM	U10PF12	na	19.10	1.29	na
2	3	2	14	LP2-OL-02-1Q	U24PF12	na	18.77	1.36	na
2	3	2	15	LP2-OL-02-1Q	U24PF22	na	18.48	1.32	na
2	3	2	16	LP2-OL-16-MODQ	U13PF12	na	23.42	0.405	na
2	3	2	17	LP2-OL-23SSM	U23PF12	na	17.46	2.61	na
2	3	2	18	LP2-OL-02-1SSM	U21PF22	na	18.82	1.32	2.54
2	3	2	19	LP2-OL-21SSM	U10PF22	na	19.67	1.26	na
2	3	2	20	LP2-OL-11Q	U14PF22	na	16.93	0.125	na
2	3	2	21	LP2-OL-11SSM	U01PF12	na	17.16	<0.100	na
2	3	2	22	LP2-OL-16-MODQ	U13PF22	na	22.85	0.329	na
2	3	2	23	LRM	LRMPF323	na	27.86	<0.100	na

Table C-5. KH Measurements of the Study Glasses

Set	Block	Sub-Blk	Sequence	ID	Lab ID	Cl (wt%)	F (wt%)
1	1	1	1	LRM	LRMKH111	<0.05	0.867
1	1	1	2	LP2-OL-15Q	C10KH11	0.052	0.072
1	1	1	3	LP2-OL-01-3Q	C12KH11	<0.05	0.069
1	1	1	4	LP2-OL-12SSM	C08KH21	0.227	0.51
1	1	1	5	LP2-OL-15SSM	C09KH11	<0.05	0.059
1	1	1	6	LP2-OL-15SSM	C09KH21	<0.05	0.061
1	1	1	7	LP2-OL-04-1Q	C18KH11	<0.05	0.077
1	1	1	8	LP2-OL-01-3Q	C12KH21	<0.05	0.071
1	1	1	9	LP2-OL-01-3SSM	C11KH11	<0.05	0.06
1	1	1	10	LP2-OL-14Q	C01KH21	<0.05	0.065
1	1	1	11	LP2-OL-01-3SSM	C11KH21	<0.05	0.061
1	1	1	12	LRM	LRMKH112	<0.05	0.899
1	1	1	13	LP2-OL-04-1SSM	C17KH11	<0.05	0.069
1	1	1	14	LP2-OL-04-1Q	C18KH21	<0.05	0.079
1	1	1	15	LP2-OL-15Q	C10KH21	<0.05	0.068
1	1	1	16	LP2-OL-14SSM	C02KH21	<0.05	0.059
1	1	1	17	LP2-OL-12Q	C07KH11	0.339	0.573
1	1	1	18	LP2-OL-14SSM	C02KH11	<0.05	0.055
1	1	1	19	LP2-OL-12Q	C07KH21	0.338	0.574
1	1	1	20	LP2-OL-14Q	C01KH11	0.054	0.07
1	1	1	21	LP2-OL-12SSM	C08KH11	0.22	0.503
1	1	1	22	LP2-OL-04-1SSM	C17KH21	<0.05	0.073
1	1	1	23	LRM	LRMKH213	<0.05	0.857
1	1	2	1	LRM	LRMKH121	<0.05	0.846
1	1	2	2	LP2-OL-01-3SSM	C11KH12	<0.05	0.063
1	1	2	3	LP2-OL-12SSM	C08KH12	0.233	0.518
1	1	2	4	LP2-OL-14SSM	C02KH12	<0.05	0.056
1	1	2	5	LP2-OL-14Q	C01KH12	0.054	0.071
1	1	2	6	LP2-OL-12Q	C07KH12	0.349	0.592
1	1	2	7	LP2-OL-15SSM	C09KH22	<0.05	0.062
1	1	2	8	LP2-OL-14SSM	C02KH22	<0.05	0.056
1	1	2	9	LP2-OL-15SSM	C09KH12	<0.05	0.064
1	1	2	10	LP2-OL-01-3Q	C12KH12	<0.05	0.076
1	1	2	11	LP2-OL-14Q	C01KH22	0.054	0.075
1	1	2	12	LRM	LRMKH122	<0.05	0.865
1	1	2	13	LP2-OL-01-3SSM	C11KH22	<0.05	0.062
1	1	2	14	LP2-OL-15Q	C10KH22	0.058	0.072
1	1	2	15	LP2-OL-04-1Q	C18KH22	<0.05	0.079
1	1	2	16	LP2-OL-01-3Q	C12KH22	<0.05	0.073
1	1	2	17	LP2-OL-12SSM	C08KH22	0.227	0.496
1	1	2	18	LP2-OL-15Q	C10KH12	0.055	0.066
1	1	2	19	LP2-OL-12Q	C07KH22	0.367	0.604
1	1	2	20	LP2-OL-04-1SSM	C17KH12	<0.05	0.07
1	1	2	21	LP2-OL-04-1Q	C18KH12	<0.05	0.08
1	1	2	22	LP2-OL-04-1SSM	C17KH22	<0.05	0.073
1	1	2	23	LRM	LRMKH123	<0.05	0.863
1	2	1	1	LRM	LRMKH211	<0.05	0.863
1	2	1	2	LP2-OL-05Q	C04KH21	0.281	0.558
1	2	1	3	LP2-OL-09-1SSM	C14KH21	<0.05	<0.05
1	2	1	4	LP2-OL-17SSM	C15KH21	0.195	0.532
1	2	1	5	LP2-OL-07-1Q	C06KH21	0.21	0.107
1	2	1	6	LP2-OL-05SSM	C03KH11	0.188	0.522

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

Set	Block	Sub-Blk	Sequence	ID	Lab ID	Cl (wt%)	F (wt%)
1	2	1	7	LP2-OL-09-1Q	C13KH11	<0.05	0.074
1	2	1	8	LP2-OL-07-1SSM	C05KH11	0.137	0.1
1	2	1	9	LP2-OL-05Q	C04KH11	0.296	0.639
1	2	1	10	LP2-OL-17Q	C16KH11	0.348	0.626
1	2	1	11	LP2-OL-07-1Q	C06KH11	0.196	0.124
1	2	1	12	LRM	LRMKH212	<0.05	0.878
1	2	1	13	LP2-OL-09-1Q	C13KH21	<0.05	0.057
1	2	1	14	LP2-OL-07-1SSM	C05KH21	0.131	0.111
1	2	1	15	LP2-OL-17Q	C16KH21	0.308	0.563
1	2	1	16	LP2-OL-05SSM	C03KH21	0.188	0.466
1	2	1	17	LP2-OL-09-1SSM	C14KH11	<0.05	<0.05
1	2	1	18	LP2-OL-17SSM	C15KH11	0.183	0.485
1	2	1	19	LRM	LRMKH213	<0.05	0.875
1	2	2	1	LRM	LRMKH221	<0.05	0.869
1	2	2	2	LP2-OL-09-1Q	C13KH12	<0.05	0.078
1	2	2	3	LP2-OL-05SSM	C03KH22	0.187	0.515
1	2	2	4	LP2-OL-05Q	C04KH12	0.289	0.601
1	2	2	5	LP2-OL-07-1Q	C06KH22	0.203	0.13
1	2	2	6	LP2-OL-17SSM	C15KH22	0.198	0.532
1	2	2	7	LP2-OL-05SSM	C03KH12	0.21	0.496
1	2	2	8	LP2-OL-17SSM	C15KH12	0.184	0.51
1	2	2	9	LP2-OL-09-1Q	C13KH22	<0.05	0.059
1	2	2	10	LP2-OL-07-1Q	C06KH12	0.208	0.126
1	2	2	11	LP2-OL-09-1SSM	C14KH12	<0.05	0.067
1	2	2	12	LRM	LRMK222	<0.05	0.867
1	2	2	13	LP2-OL-17Q	C16KH22	0.336	0.596
1	2	2	14	LP2-OL-07-1SSM	C05KH22	0.132	0.109
1	2	2	15	LP2-OL-17Q	C16KH12	0.324	0.628
1	2	2	16	LP2-OL-05Q	C04KH22	0.302	0.582
1	2	2	17	LP2-OL-07-1SSM	C05KH12	0.136	0.114
1	2	2	18	LP2-OL-09-1SSM	C14KH22	<0.05	0.054
1	2	2	19	LRM	LRMKH223	<0.05	0.894
2	1	1	1	LRM	LRMKH111	<0.05	0.902
2	1	1	2	LP2-OL-08-MODSSM	U20KH11	<0.05	0.071
2	1	1	3	LP2-OL-13Q	U17KH11	0.291	0.57
2	1	1	4	LP2-OL-25SSM	U27KH11	<0.05	0.061
2	1	1	5	LP2-OL-22SSM	U02KH21	<0.05	0.06
2	1	1	6	LP2-OL-19SSM	U26KH11	<0.05	0.058
2	1	1	7	LP2-OL-13SSM	U04KH21	0.133	0.495
2	1	1	8	LP2-OL-13SSM	U04KH11	0.129	0.49
2	1	1	9	LP2-OL-08-MODQ	U25KH11	0.06	0.074
2	1	1	10	LP2-OL-13Q	U17KH21	0.309	0.625
2	1	1	11	LP2-OL-25Q	U05KH21	0.059	0.079
2	1	1	12	LRM	LRMKH112	<0.05	0.882
2	1	1	13	LP2-OL-19Q	U18KH11	0.055	0.072
2	1	1	14	LP2-OL-22Q	U19KH21	<0.05	0.067
2	1	1	15	LP2-OL-25SSM	U27KH21	<0.05	0.079
2	1	1	16	LP2-OL-19Q	U18KH21	0.053	0.075
2	1	1	17	LP2-OL-08-MODQ	U25KH21	0.058	0.074
2	1	1	18	LP2-OL-25Q	U05KH11	0.058	0.073
2	1	1	19	LP2-OL-08-MODSSM	U20KH21	<0.05	0.06
2	1	1	20	LP2-OL-22Q	U19KH11	<0.05	0.069
2	1	1	21	LP2-OL-19SSM	U26KH21	<0.05	0.077

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

Set	Block	Sub-Blk	Sequence	ID	Lab ID	Cl (wt%)	F (wt%)
2	1	1	22	LP2-OL-22SSM	U02KH11	<0.05	0.062
2	1	1	23	LRM	LRMKH113	<0.05	0.883
2	1	2	1	LRM	LRMKH121	<0.05	0.895
2	1	2	2	LP2-OL-19Q	U18KH12	0.057	0.096
2	1	2	3	LP2-OL-13SSM	U04KH22	0.143	0.484
2	1	2	4	LP2-OL-13Q	U17KH22	0.3	0.611
2	1	2	5	LP2-OL-08-MODQ	U25KH22	0.063	0.079
2	1	2	6	LP2-OL-08-MODQ	U25KH12	0.057	0.08
2	1	2	7	LP2-OL-22Q	U19KH12	<0.05	0.084
2	1	2	8	LP2-OL-22Q	U19KH22	<0.05	0.079
2	1	2	9	LP2-OL-25SSM	U27KH12	<0.05	0.074
2	1	2	10	LP2-OL-25Q	U05KH22	0.056	0.076
2	1	2	11	LP2-OL-19SSM	U26KH22	<0.05	0.071
2	1	2	12	LRM	LRMKH122	<0.05	0.845
2	1	2	13	LP2-OL-13SSM	U04KH12	0.137	0.492
2	1	2	14	LP2-OL-08-MODSSM	U20KH22	<0.05	0.067
2	1	2	15	LP2-OL-19Q	U18KH22	0.057	0.08
2	1	2	16	LP2-OL-25Q	U05KH12	0.058	0.074
2	1	2	17	LP2-OL-13Q	U17KH12	0.294	0.575
2	1	2	18	LP2-OL-08-MODSSM	U20KH12	<0.05	0.061
2	1	2	19	LP2-OL-22SSM	U02KH12	<0.05	0.063
2	1	2	20	LP2-OL-19SSM	U26KH12	<0.05	0.067
2	1	2	21	LP2-OL-22SSM	U02KH22	<0.05	0.075
2	1	2	22	LP2-OL-25SSM	U27KH22	<0.05	0.068
2	1	2	23	LRM	LRMKH123	<0.05	0.884
2	2	1	1	LRM	LRMKH211	<0.05	0.917
2	2	1	2	LP2-OL-24SSM	U29KH21	<0.05	0.056
2	2	1	3	LP2-OL-24Q	U08KH11	0.062	0.101
2	2	1	4	LP2-OL-20Q	U03KH21	0.068	0.077
2	2	1	5	LP2-OL-10-MODSSM	U28KH11	0.116	0.483
2	2	1	6	LP2-OL-03-MOD2SSM	U22KH11	<0.05	<0.05
2	2	1	7	LP2-OL-18Q	U30KH21	0.332	0.613
2	2	1	8	LP2-OL-24SSM	U29KH11	<0.05	0.067
2	2	1	9	LP2-OL-24Q	U08KH21	0.064	0.117
2	2	1	10	LP2-OL-18SSM	U11KH11	0.099	0.54
2	2	1	11	LP2-OL-03-MOD2Q	U09KH21	0.069	0.101
2	2	1	12	LRM	LRMKH212	<0.05	0.941
2	2	1	13	LP2-OL-20SSM	U16KH21	<0.05	0.081
2	2	1	14	LP2-OL-18Q	U30KH11	0.314	0.637
2	2	1	15	LP2-OL-10-MODQ	U15KH21	0.396	0.644
2	2	1	16	LP2-OL-10-MODSSM	U28KH21	0.115	0.499
2	2	1	17	LP2-OL-03-MOD2Q	U09KH11	0.067	0.1
2	2	1	18	LP2-OL-20Q	U03KH11	0.065	0.079
2	2	1	19	LP2-OL-03-MOD2SSM	U22KH21	<0.05	<0.05
2	2	1	20	LP2-OL-20SSM	U16KH11	<0.05	0.09
2	2	1	21	LP2-OL-10-MODQ	U15KH11	0.377	0.659
2	2	1	22	LRM	LRMKH213	<0.05	0.911
2	2	2	1	LRM	LRMKH221	<0.05	0.929
2	2	2	2	LP2-OL-18Q	U30KH12	0.303	0.642
2	2	2	3	LP2-OL-03-MOD2SSM	U22KH12	<0.05	0.061
2	2	2	4	LP2-OL-20SSM	U16KH22	<0.05	0.07
2	2	2	5	LP2-OL-24Q	U08KH22	0.057	0.079
2	2	2	6	LP2-OL-20SSM	U16KH12	<0.05	0.069

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

Set	Block	Sub-Blk	Sequence	ID	Lab ID	Cl (wt%)	F (wt%)
2	2	2	7	LP2-OL-18SSM	U11KH12	0.093	0.497
2	2	2	8	LP2-OL-24SSM	U29KH22	<0.05	0.096
2	2	2	9	LP2-OL-18Q	U30KH22	0.322	0.628
2	2	2	10	LP2-OL-03-MOD2Q	U09KH22	0.067	0.11
2	2	2	11	LRM	LRMKH222	<0.05	0.905
2	2	2	12	LP2-OL-10-MODSSM	U28KH22	0.108	0.525
2	2	2	13	LP2-OL-24SSM	U29KH12	<0.05	0.06
2	2	2	14	LP2-OL-20Q	U03KH12	0.061	0.077
2	2	2	15	LP2-OL-03-MOD2SSM	U22KH22	<0.05	0.065
2	2	2	16	LP2-OL-10-MODQ	U15KH12	0.373	0.644
2	2	2	17	LP2-OL-10-MODSSM	U28KH12	0.103	0.478
2	2	2	18	LP2-OL-20Q	U03KH22	0.064	0.091
2	2	2	19	LP2-OL-24Q	U08KH12	0.061	0.083
2	2	2	20	LP2-OL-10-MODQ	U15KH22	0.366	0.646
2	2	2	21	LP2-OL-03-MOD2Q	U09KH12	0.066	0.099
2	2	2	22	LRM	LRMKH223	<0.05	0.911
2	3	1	1	LRM	LRMKH311	<0.05	0.905
2	3	1	2	LP2-OL-21SSM	U10KH11	0.074	0.219
2	3	1	3	LP2-OL-11SSM	U01KH21	<0.05	0.066
2	3	1	4	LP2-OL-21Q	U06KH21	0.157	0.265
2	3	1	5	LP2-OL-21SSM	U10KH21	0.073	0.231
2	3	1	6	LP2-OL-23SSM	U23KH11	<0.05	0.051
2	3	1	7	LP2-OL-11Q	U14KH11	0.05	0.076
2	3	1	8	LP2-OL-23SSM	U23KH21	<0.05	0.054
2	3	1	9	LP2-OL-02-1Q	U24KH21	0.145	0.257
2	3	1	10	LP2-OL-11Q	U14KH21	0.051	0.073
2	3	1	11	LP2-OL-16-MODQ	U13KH11	0.051	0.073
2	3	1	12	LRM	LRMKH312	<0.05	0.938
2	3	1	13	LP2-OL-11SSM	U01KH11	<0.05	0.068
2	3	1	14	LP2-OL-16-MODSSM	U12KH11	<0.05	0.051
2	3	1	15	LP2-OL-23Q	U07KH21	0.055	0.071
2	3	1	16	LP2-OL-16-MODSSM	U12KH21	<0.05	0.058
2	3	1	17	LP2-OL-02-1SSM	U21KH21	<0.05	0.181
2	3	1	18	LP2-OL-23Q	U07KH11	0.055	0.071
2	3	1	19	LP2-OL-16-MODQ	U13KH21	0.053	0.074
2	3	1	20	LP2-OL-21Q	U06KH11	0.162	0.266
2	3	1	21	LP2-OL-02-1SSM	U21KH11	<0.05	0.182
2	3	1	22	LP2-OL-02-1Q	U24KH11	0.149	0.259
2	3	1	23	LRM	LRMKH313	<0.05	0.938
2	3	2	1	LRM	LRMKH321	<0.05	0.919
2	3	2	2	LP2-OL-23Q	U07KH12	0.058	0.073
2	3	2	3	LP2-OL-11Q	U14KH22	0.052	0.079
2	3	2	4	LP2-OL-02-1Q	U24KH12	0.145	0.261
2	3	2	5	LP2-OL-23SSM	U23KH22	<0.05	0.055
2	3	2	6	LP2-OL-21Q	U06KH12	0.165	0.288
2	3	2	7	LP2-OL-21Q	U06KH22	0.163	0.291
2	3	2	8	LP2-OL-23Q	U07KH22	0.057	0.072
2	3	2	9	LP2-OL-02-1Q	U24KH22	0.146	0.262
2	3	2	10	LP2-OL-11Q	U14KH12	0.051	0.079
2	3	2	11	LP2-OL-11SSM	U01KH12	<0.05	0.073
2	3	2	12	LRM	LRMKH322	<0.05	0.924
2	3	2	13	LP2-OL-23SSM	U23KH12	<0.05	0.054
2	3	2	14	LP2-OL-21SSM	U10KH12	0.069	0.226

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

Set	Block	Sub-Blk	Sequence	ID	Lab ID	Cl (wt%)	F (wt%)
2	3	2	15	LP2-OL-16-MODSSM	U12KH12	<0.05	0.056
2	3	2	16	LP2-OL-11SSM	U01KH22	<0.05	0.074
2	3	2	17	LP2-OL-16-MODQ	U13KH22	0.052	0.076
2	3	2	18	LP2-OL-21SSM	U10KH22	0.07	0.253
2	3	2	19	LP2-OL-02-1SSM	U21KH12	<0.05	0.2
2	3	2	20	LP2-OL-16-MODQ	U13KH12	0.054	0.078
2	3	2	21	LP2-OL-16-MODSSM	U12KH22	<0.05	0.055
2	3	2	22	LP2-OL-02-1SSM	U21KH22	<0.05	0.186
2	3	2	23	LRM	LRMKH323	<0.05	0.91

Table C-6. PFSA Measurements of the Study Glasses

Set	ID	Block	Sub-Blk	Sequence	Lab ID	P (wt%)	Zr (wt%)
1	LRM	1	1	1	LRMPF	na	0.667
1	LRM	1	1	2	LRMPF	na	0.628
1	LP2-OL-01-3Q	1	1	3	S-7897	na	3.89
1	LP2-OL-01-3SSM	1	1	4	S-7898	na	3.81
1	LP2-OL-04-1Q	1	1	5	S-7899	na	4.10
1	LP2-OL-04-1SSM	1	1	6	S-7900	na	3.90
1	LP2-OL-05Q	1	1	7	S-7901	0.710	1.67
1	LP2-OL-05SSM	1	1	8	S-7902	0.655	1.85
1	LP2-OL-07-1Q	1	1	9	S-7903	na	1.81
1	LP2-OL-07-1SSM	1	1	10	S-7904	na	1.77
1	LP2-OL-09-1Q	1	1	11	S-7905	na	1.47
1	LP2-OL-09-1SSM	1	1	12	S-7906	na	1.58
1	LP2-OL-12Q	1	1	13	S-7907	0.670	1.57
1	LP2-OL-12SSM	1	1	14	S-7908	0.650	1.47
1	LP2-OL-14Q	1	1	15	S-7909	na	1.40
1	LP2-OL-14SSM	1	1	16	S-7910	na	1.46
1	LP2-OL-15Q	1	1	17	S-7911	na	1.53
1	LP2-OL-15SSM	1	1	18	S-7912	na	1.49
1	LP2-OL-17Q	1	1	19	S-7913	0.653	1.66
1	LP2-OL-17SSM	1	1	20	S-7914	0.638	1.56
1	LRM	1	2	1	LRMPF	na	0.649
1	LRM	1	2	2	LRMPF	na	0.671
1	LP2-OL-01-3Q	1	2	3	S-7897	na	3.80
1	LP2-OL-01-3SSM	1	2	4	S-7898	na	3.97
1	LP2-OL-04-1Q	1	2	5	S-7899	na	4.11
1	LP2-OL-04-1SSM	1	2	6	S-7900	na	3.85
1	LP2-OL-05Q	1	2	7	S-7901	0.565	1.53
1	LP2-OL-05SSM	1	2	8	S-7902	0.587	1.82
1	LP2-OL-07-1Q	1	2	9	S-7903	na	1.82
1	LP2-OL-07-1SSM	1	2	10	S-7904	na	1.72
1	LP2-OL-09-1Q	1	2	11	S-7905	na	1.58
1	LP2-OL-09-1SSM	1	2	12	S-7906	na	1.63
1	LP2-OL-12Q	1	2	13	S-7907	0.579	1.61
1	LP2-OL-12SSM	1	2	14	S-7908	0.564	1.54
1	LP2-OL-14Q	1	2	15	S-7909	na	1.41
1	LP2-OL-14SSM	1	2	16	S-7910	na	1.48
1	LP2-OL-15Q	1	2	17	S-7911	na	1.55
1	LP2-OL-15SSM	1	2	18	S-7912	na	1.48
1	LP2-OL-17Q	1	2	19	S-7913	0.624	1.66
1	LP2-OL-17SSM	1	2	20	S-7914	0.598	1.52
2	LRM	1	1	1	LRMPF	na	na
2	LRM	1	1	2	LRMPF	na	0.849
2	LP2-OL-02-1Q	1	1	3	S-7658	na	2.53
2	LP2-OL-13Q	1	1	4	S-7659	0.771	1.91
2	LP2-OL-21Q	1	1	5	S-7660	na	2.45
2	LP2-OL-10-MODQ	1	1	6	S-7661	0.750	2.27
2	LP2-OL-03-MOD2Q	1	1	7	S-7783	na	1.82
2	LP2-OL-03-MOD2SSM	1	1	8	S-7784	na	1.86
2	LP2-OL-08-MODQ	1	1	9	S-7785	na	3.95
2	LP2-OL-08-MODSSM	1	1	10	S-7786	na	3.82
2	LP2-OL-11Q	1	1	11	S-7788	na	3.88
2	LP2-OL-11SSM	1	1	12	S-7789	na	4.02

Table C-6. PFSA Measurements of the Study Glasses (continued)

Set	ID	Block	Sub-Blk	Sequence	Lab ID	P (wt%)	Zr (wt%)
2	LP2-OL-13SSM	1	1	13	S-7790	0.732	1.91
2	LP2-OL-16-MODQ	1	1	14	S-7791	na	1.84
2	LP2-OL-16-MODSSM	1	1	15	S-7792	na	1.83
2	LP2-OL-18Q	1	1	16	S-7793	0.578	3.69
2	LP2-OL-18SSM	1	1	17	S-7794	0.457	3.47
2	LP2-OL-19Q	1	1	18	S-7795	na	1.99
2	LP2-OL-19SSM	1	1	19	S-7796	na	1.85
2	LP2-OL-20Q	1	1	20	S-7797	na	1.89
2	LP2-OL-20SSM	1	1	21	S-7798	na	1.85
2	LP2-OL-21SSM	1	1	22	S-7799	na	2.43
2	LP2-OL-22Q	1	1	23	S-7800	na	3.87
2	LP2-OL-22SSM	1	1	24	S-7801	na	3.91
2	LP2-OL-23Q	1	1	25	S-7802	na	1.93
2	LP2-OL-23SSM	1	1	26	S-7803	na	1.94
2	LP2-OL-24Q	1	1	27	S-7804	na	1.98
2	LP2-OL-24SSM	1	1	28	S-7805	na	1.98
2	LP2-OL-25Q	1	1	29	S-7806	na	4.05
2	LP2-OL-25SSM	1	1	30	S-7807	na	4.13
2	LRM	1	2	1	LRMPF	na	na
2	LRM	1	2	2	LRMPF	na	0.868
2	LP2-OL-02-1Q	1	2	3	S-7658	na	2.58
2	LP2-OL-13Q	1	2	4	S-7659	0.765	1.79
2	LP2-OL-21Q	1	2	5	S-7660	na	2.33
2	LP2-OL-10-MODQ	1	2	6	S-7661	0.754	2.22
2	LP2-OL-03-MOD2Q	1	2	7	S-7783	na	1.78
2	LP2-OL-03-MOD2SSM	1	2	8	S-7784	na	1.84
2	LP2-OL-08-MODQ	1	2	9	S-7785	na	3.85
2	LP2-OL-08-MODSSM	1	2	10	S-7786	na	3.78
2	LP2-OL-11Q	1	2	11	S-7788	na	3.80
2	LP2-OL-11SSM	1	2	12	S-7789	na	3.93
2	LP2-OL-13SSM	1	2	13	S-7790	0.745	1.88
2	LP2-OL-16-MODQ	1	2	14	S-7791	na	1.81
2	LP2-OL-16-MODSSM	1	2	15	S-7792	na	1.93
2	LP2-OL-18Q	1	2	16	S-7793	0.537	3.57
2	LP2-OL-18SSM	1	2	17	S-7794	0.405	3.41
2	LP2-OL-19Q	1	2	18	S-7795	na	1.96
2	LP2-OL-19SSM	1	2	19	S-7796	na	1.83
2	LP2-OL-20Q	1	2	20	S-7797	na	1.86
2	LP2-OL-20SSM	1	2	21	S-7798	na	1.78
2	LP2-OL-21SSM	1	2	22	S-7799	na	2.39
2	LP2-OL-22Q	1	2	23	S-7800	na	3.85
2	LP2-OL-22SSM	1	2	24	S-7801	na	3.88
2	LP2-OL-23Q	1	2	25	S-7802	na	1.88
2	LP2-OL-23SSM	1	2	26	S-7803	na	1.88
2	LP2-OL-24Q	1	2	27	S-7804	na	1.91
2	LP2-OL-24SSM	1	2	28	S-7805	na	1.95
2	LP2-OL-25Q	1	2	29	S-7806	na	3.88
2	LP2-OL-25SSM	1	2	30	S-7807	na	4.07

Table C-7. 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
LP2-OL-01-3Q	Al_2O_3		5.697	6.000	-0.303	-5.1%
LP2-OL-01-3Q	B_2O_3		6.037	6.000	0.037	0.6%
LP2-OL-01-3Q	CaO		8.500	9.090	-0.590	-6.5%
LP2-OL-01-3Q	Cl	<	0.050	0.062	-0.012	
LP2-OL-01-3Q	Cr_2O_3		0.717	0.600	0.117	
LP2-OL-01-3Q	F		0.072	0.095	-0.023	
LP2-OL-01-3Q	Fe_2O_3		0.418	0.000	0.418	
LP2-OL-01-3Q	K_2O	<	0.120	0.000	0.120	
LP2-OL-01-3Q	Li_2O	<	0.215	0.000	0.215	
LP2-OL-01-3Q	MgO		1.282	1.350	-0.068	
LP2-OL-01-3Q	Na_2O		19.580	21.000	-1.420	-6.8%
LP2-OL-01-3Q	NiO	<	0.228	0.000	0.228	
LP2-OL-01-3Q	P_2O_5	<	0.243	0.203	0.040	
LP2-OL-01-3Q	SiO_2		47.947	47.000	0.947	2.0%
LP2-OL-01-3Q	SnO_2	<	0.127	0.000	0.127	
LP2-OL-01-3Q	SO_3		0.154	0.100	0.054	
LP2-OL-01-3Q	V_2O_5	<	0.179	0.000	0.179	
LP2-OL-01-3Q	ZnO		1.923	2.000	-0.077	
LP2-OL-01-3Q	ZrO_2		5.194	6.500	-1.306	-20.1%
LP2-OL-01-3Q	Sum		98.683	100.000	-1.317	-1.3%
LP2-OL-01-3SSM	Al_2O_3		5.224	6.000	-0.776	-12.9%
LP2-OL-01-3SSM	B_2O_3		5.619	6.000	-0.381	-6.4%
LP2-OL-01-3SSM	CaO		7.937	9.090	-1.153	-12.7%
LP2-OL-01-3SSM	Cl	<	0.050	0.062	-0.012	
LP2-OL-01-3SSM	Cr_2O_3		0.569	0.600	-0.031	
LP2-OL-01-3SSM	F		0.061	0.095	-0.034	
LP2-OL-01-3SSM	Fe_2O_3	<	0.143	0.000	0.143	
LP2-OL-01-3SSM	K_2O	<	0.120	0.000	0.120	
LP2-OL-01-3SSM	Li_2O	<	0.215	0.000	0.215	
LP2-OL-01-3SSM	MgO		1.229	1.350	-0.121	
LP2-OL-01-3SSM	Na_2O		21.568	21.000	0.568	2.7%
LP2-OL-01-3SSM	NiO	<	0.159	0.000	0.159	
LP2-OL-01-3SSM	P_2O_5	<	0.230	0.203	0.027	
LP2-OL-01-3SSM	SiO_2		44.802	47.000	-2.198	-4.7%
LP2-OL-01-3SSM	SnO_2	<	0.127	0.000	0.127	
LP2-OL-01-3SSM	SO_3		3.908	0.100	3.808	
LP2-OL-01-3SSM	V_2O_5	<	0.179	0.000	0.179	
LP2-OL-01-3SSM	ZnO		1.824	2.000	-0.176	
LP2-OL-01-3SSM	ZrO_2		5.255	6.500	-1.245	-19.2%
LP2-OL-01-3SSM	Sum		99.219	100.000	-0.781	-0.8%
LP2-OL-02-1Q	Al_2O_3		9.122	10.000	-0.878	-8.8%
LP2-OL-02-1Q	B_2O_3		9.225	9.500	-0.275	-2.9%
LP2-OL-02-1Q	CaO		5.069	5.000	0.069	1.4%
LP2-OL-02-1Q	Cl		0.146	0.208	-0.062	
LP2-OL-02-1Q	Cr_2O_3		0.559	0.450	0.109	
LP2-OL-02-1Q	F		0.260	0.316	-0.056	
LP2-OL-02-1Q	Fe_2O_3		1.011	0.600	0.411	
LP2-OL-02-1Q	K_2O		0.977	1.000	-0.023	
LP2-OL-02-1Q	Li_2O	<	0.215	0.000	0.215	
LP2-OL-02-1Q	MgO		0.654	0.650	0.004	

Table C-7. 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
LP2-OL-02-1Q	Na_2O		22.748	23.000	-0.253	-1.1%
LP2-OL-02-1Q	NiO	<	0.127	0.000	0.127	
LP2-OL-02-1Q	P_2O_5		0.577	0.676	-0.099	
LP2-OL-02-1Q	SiO_2		41.117	38.800	2.317	6.0%
LP2-OL-02-1Q	SnO_2		1.717	1.500	0.217	
LP2-OL-02-1Q	SO_3		0.479	0.500	-0.021	
LP2-OL-02-1Q	V_2O_5		0.952	1.000	-0.048	
LP2-OL-02-1Q	ZnO		2.692	2.800	-0.108	
LP2-OL-02-1Q	ZrO_2		3.451	4.000	-0.549	
LP2-OL-02-1Q	Sum		101.099	100.000	1.099	1.1%
LP2-OL-02-1SSM	Al_2O_3		9.150	10.000	-0.850	-8.5%
LP2-OL-02-1SSM	B_2O_3		8.919	9.500	-0.581	-6.1%
LP2-OL-02-1SSM	CaO		5.100	5.000	0.100	2.0%
LP2-OL-02-1SSM	Cl	<	0.050	0.208	-0.158	
LP2-OL-02-1SSM	Cr_2O_3		0.237	0.450	-0.213	
LP2-OL-02-1SSM	F		0.187	0.316	-0.129	
LP2-OL-02-1SSM	Fe_2O_3		0.620	0.600	0.020	
LP2-OL-02-1SSM	K_2O		0.682	1.000	-0.318	
LP2-OL-02-1SSM	Li_2O	<	0.215	0.000	0.215	
LP2-OL-02-1SSM	MgO		0.633	0.650	-0.017	
LP2-OL-02-1SSM	Na_2O		22.377	23.000	-0.623	-2.7%
LP2-OL-02-1SSM	NiO	<	0.127	0.000	0.127	
LP2-OL-02-1SSM	P_2O_5		0.515	0.676	-0.161	
LP2-OL-02-1SSM	SiO_2		40.700	38.800	1.900	4.9%
LP2-OL-02-1SSM	SnO_2		1.650	1.500	0.150	
LP2-OL-02-1SSM	SO_3		1.098	0.500	0.598	
LP2-OL-02-1SSM	V_2O_5		0.886	1.000	-0.114	
LP2-OL-02-1SSM	ZnO		2.717	2.800	-0.083	
LP2-OL-02-1SSM	ZrO_2		3.414	4.000	-0.586	
LP2-OL-02-1SSM	Sum		99.279	100.000	-0.721	-0.7%
LP2-OL-03-MOD2Q	Al_2O_3		9.773	10.738	-0.965	-9.0%
LP2-OL-03-MOD2Q	B_2O_3		5.691	6.107	-0.416	-6.8%
LP2-OL-03-MOD2Q	CaO		10.802	10.905	-0.103	-0.9%
LP2-OL-03-MOD2Q	Cl		0.067	0.063	0.004	
LP2-OL-03-MOD2Q	Cr_2O_3		0.685	0.611	0.074	
LP2-OL-03-MOD2Q	F		0.102	0.097	0.005	
LP2-OL-03-MOD2Q	Fe_2O_3		0.471	0.000	0.471	
LP2-OL-03-MOD2Q	K_2O	<	0.120	0.000	0.120	
LP2-OL-03-MOD2Q	Li_2O	<	0.215	0.000	0.215	
LP2-OL-03-MOD2Q	MgO		1.347	1.374	-0.027	
LP2-OL-03-MOD2Q	Na_2O		26.185	26.464	-0.279	-1.1%
LP2-OL-03-MOD2Q	NiO	<	0.127	0.000	0.127	
LP2-OL-03-MOD2Q	P_2O_5		0.180	0.207	-0.027	
LP2-OL-03-MOD2Q	SiO_2		34.122	35.523	-1.401	-3.9%
LP2-OL-03-MOD2Q	SnO_2		2.965	2.779	0.186	
LP2-OL-03-MOD2Q	SO_3		0.725	0.754	-0.029	
LP2-OL-03-MOD2Q	V_2O_5	<	0.179	0.000	0.179	
LP2-OL-03-MOD2Q	ZnO		2.088	2.036	0.052	
LP2-OL-03-MOD2Q	ZrO_2		2.431	2.342	0.089	

Table C-7. 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
LP2-OL-03-MOD2Q	Sum		98.276	100.000	-1.724	-1.7%
LP2-OL-03-MOD2SSM	Al_2O_3		9.755	10.738	-0.983	-9.2%
LP2-OL-03-MOD2SSM	B_2O_3		5.546	6.107	-0.561	-9.2%
LP2-OL-03-MOD2SSM	CaO		10.693	10.905	-0.212	-1.9%
LP2-OL-03-MOD2SSM	Cl	<	0.050	0.063	-0.013	
LP2-OL-03-MOD2SSM	Cr_2O_3		0.222	0.611	-0.389	
LP2-OL-03-MOD2SSM	F	<	0.056	0.097	-0.041	
LP2-OL-03-MOD2SSM	Fe_2O_3	<	0.143	0.000	0.143	
LP2-OL-03-MOD2SSM	K_2O	<	0.120	0.000	0.120	
LP2-OL-03-MOD2SSM	Li_2O	<	0.215	0.000	0.215	
LP2-OL-03-MOD2SSM	MgO		1.396	1.374	0.022	
LP2-OL-03-MOD2SSM	Na_2O		27.061	26.464	0.597	2.3%
LP2-OL-03-MOD2SSM	NiO	<	0.127	0.000	0.127	
LP2-OL-03-MOD2SSM	P_2O_5		0.163	0.207	-0.044	
LP2-OL-03-MOD2SSM	SiO_2		34.234	35.523	-1.289	-3.6%
LP2-OL-03-MOD2SSM	SnO_2		2.695	2.779	-0.084	
LP2-OL-03-MOD2SSM	SO_3		1.445	0.754	0.691	
LP2-OL-03-MOD2SSM	V_2O_5	<	0.179	0.000	0.179	
LP2-OL-03-MOD2SSM	ZnO		2.060	2.036	0.024	
LP2-OL-03-MOD2SSM	ZrO_2		2.499	2.342	0.157	
LP2-OL-03-MOD2SSM	Sum		98.660	100.000	-1.340	-1.3%
LP2-OL-04-1Q	Al_2O_3		10.147	10.500	-0.353	-3.4%
LP2-OL-04-1Q	B_2O_3		6.263	6.000	0.263	4.4%
LP2-OL-04-1Q	CaO		7.283	7.840	-0.557	-7.1%
LP2-OL-04-1Q	Cl	<	0.050	0.062	-0.012	
LP2-OL-04-1Q	Cr_2O_3		0.628	0.600	0.028	
LP2-OL-04-1Q	F		0.079	0.095	-0.016	
LP2-OL-04-1Q	Fe_2O_3		1.855	1.500	0.355	
LP2-OL-04-1Q	K_2O		5.267	5.750	-0.483	-8.4%
LP2-OL-04-1Q	Li_2O	<	0.215	0.000	0.215	
LP2-OL-04-1Q	MgO		1.251	1.350	-0.099	
LP2-OL-04-1Q	Na_2O		19.748	21.000	-1.252	-6.0%
LP2-OL-04-1Q	NiO	<	0.127	0.000	0.127	
LP2-OL-04-1Q	P_2O_5	<	0.241	0.203	0.038	
LP2-OL-04-1Q	SiO_2		36.037	34.900	1.137	3.3%
LP2-OL-04-1Q	SnO_2	<	0.127	0.000	0.127	
LP2-OL-04-1Q	SO_3		0.154	0.100	0.054	
LP2-OL-04-1Q	V_2O_5	<	0.179	0.000	0.179	
LP2-OL-04-1Q	ZnO		3.457	3.600	-0.143	
LP2-OL-04-1Q	ZrO_2		5.545	6.500	-0.955	-14.7%
LP2-OL-04-1Q	Sum		98.652	100.000	-1.348	-1.3%
LP2-OL-04-1SSM	Al_2O_3		9.575	10.500	-0.925	-8.8%
LP2-OL-04-1SSM	B_2O_3		5.731	6.000	-0.269	-4.5%
LP2-OL-04-1SSM	CaO		6.818	7.840	-1.022	-13.0%
LP2-OL-04-1SSM	Cl	<	0.050	0.062	-0.012	
LP2-OL-04-1SSM	Cr_2O_3		0.491	0.600	-0.109	
LP2-OL-04-1SSM	F		0.071	0.095	-0.024	
LP2-OL-04-1SSM	Fe_2O_3		1.428	1.500	-0.072	
LP2-OL-04-1SSM	K_2O		4.743	5.750	-1.007	-17.5%

Table C-7. 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
LP2-OL-04-1SSM	Li_2O	<	0.215	0.000	0.215	
LP2-OL-04-1SSM	MgO		1.230	1.350	-0.120	
LP2-OL-04-1SSM	Na_2O		21.433	21.000	0.433	2.1%
LP2-OL-04-1SSM	NiO	<	0.127	0.000	0.127	
LP2-OL-04-1SSM	P_2O_5	<	0.230	0.203	0.027	
LP2-OL-04-1SSM	SiO_2		33.154	34.900	-1.746	-5.0%
LP2-OL-04-1SSM	SnO_2	<	0.131	0.000	0.131	
LP2-OL-04-1SSM	SO_3		3.689	0.100	3.589	
LP2-OL-04-1SSM	V_2O_5	<	0.179	0.000	0.179	
LP2-OL-04-1SSM	ZnO		3.277	3.600	-0.323	
LP2-OL-04-1SSM	ZrO_2		5.234	6.500	-1.266	-19.5%
LP2-OL-04-1SSM	Sum		97.807	100.000	-2.193	-2.2%
LP2-OL-05Q	Al_2O_3		11.814	12.500	-0.686	-5.5%
LP2-OL-05Q	B_2O_3		5.989	6.000	-0.011	-0.2%
LP2-OL-05Q	CaO		10.798	11.000	-0.202	-1.8%
LP2-OL-05Q	Cl		0.292	0.467	-0.175	
LP2-OL-05Q	Cr_2O_3		0.385	0.300	0.085	
LP2-OL-05Q	F		0.595	0.708	-0.113	
LP2-OL-05Q	Fe_2O_3		1.916	1.500	0.416	
LP2-OL-05Q	K_2O	<	0.120	0.000	0.120	
LP2-OL-05Q	Li_2O	<	0.215	0.000	0.215	
LP2-OL-05Q	MgO	<	0.166	0.000	0.166	
LP2-OL-05Q	Na_2O		19.007	21.000	-1.993	-9.5%
LP2-OL-05Q	NiO	<	0.127	0.000	0.127	
LP2-OL-05Q	P_2O_5		1.461	1.515	-0.054	
LP2-OL-05Q	SiO_2		40.641	39.080	1.561	4.0%
LP2-OL-05Q	SnO_2	<	0.127	0.000	0.127	
LP2-OL-05Q	SO_3		0.929	0.980	-0.051	
LP2-OL-05Q	V_2O_5	<	0.179	0.000	0.179	
LP2-OL-05Q	ZnO		1.998	2.000	-0.002	
LP2-OL-05Q	ZrO_2		2.161	2.950	-0.789	
LP2-OL-05Q	Sum		98.922	100.000	-1.078	-1.1%
LP2-OL-05SSM	Al_2O_3		11.157	12.500	-1.343	-10.7%
LP2-OL-05SSM	B_2O_3		5.683	6.000	-0.317	-5.3%
LP2-OL-05SSM	CaO		10.438	11.000	-0.562	-5.1%
LP2-OL-05SSM	Cl		0.193	0.467	-0.274	
LP2-OL-05SSM	Cr_2O_3		0.278	0.300	-0.022	
LP2-OL-05SSM	F		0.500	0.708	-0.208	
LP2-OL-05SSM	Fe_2O_3		1.421	1.500	-0.079	
LP2-OL-05SSM	K_2O	<	0.120	0.000	0.120	
LP2-OL-05SSM	Li_2O	<	0.215	0.000	0.215	
LP2-OL-05SSM	MgO	<	0.166	0.000	0.166	
LP2-OL-05SSM	Na_2O		21.063	21.000	0.063	0.3%
LP2-OL-05SSM	NiO	<	0.138	0.000	0.138	
LP2-OL-05SSM	P_2O_5		1.423	1.515	-0.092	
LP2-OL-05SSM	SiO_2		37.459	39.080	-1.621	-4.1%
LP2-OL-05SSM	SnO_2	<	0.127	0.000	0.127	
LP2-OL-05SSM	SO_3		4.613	0.980	3.633	
LP2-OL-05SSM	V_2O_5	<	0.179	0.000	0.179	

Table C-7. 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
LP2-OL-05SSM	ZnO		1.933	2.000	-0.067	
LP2-OL-05SSM	ZrO_2		2.479	2.950	-0.471	
LP2-OL-05SSM	Sum		99.585	100.000	-0.415	-0.4%
LP2-OL-07-1Q	Al_2O_3		9.523	10.150	-0.627	-6.2%
LP2-OL-07-1Q	B_2O_3		12.332	12.040	0.292	2.4%
LP2-OL-07-1Q	CaO		8.063	8.010	0.053	0.7%
LP2-OL-07-1Q	Cl		0.204	0.330	-0.126	
LP2-OL-07-1Q	Cr_2O_3		0.584	0.500	0.084	
LP2-OL-07-1Q	F		0.122	0.170	-0.048	
LP2-OL-07-1Q	Fe_2O_3		1.339	1.000	0.339	
LP2-OL-07-1Q	K_2O		0.211	0.160	0.051	
LP2-OL-07-1Q	Li_2O	<	0.215	0.000	0.215	
LP2-OL-07-1Q	MgO		0.983	1.000	-0.017	
LP2-OL-07-1Q	Na_2O		19.344	20.980	-1.636	-7.8%
LP2-OL-07-1Q	NiO	<	0.127	0.040	0.087	
LP2-OL-07-1Q	P_2O_5		0.261	0.290	-0.029	
LP2-OL-07-1Q	SiO_2		37.502	37.140	0.362	1.0%
LP2-OL-07-1Q	SnO_2	<	0.127	0.000	0.127	
LP2-OL-07-1Q	SO_3		1.011	1.060	-0.049	
LP2-OL-07-1Q	V_2O_5		0.929	1.000	-0.071	
LP2-OL-07-1Q	ZnO		3.053	3.000	0.053	
LP2-OL-07-1Q	ZrO_2		2.452	3.000	-0.548	
LP2-OL-07-1Q	Sum		98.382	99.870	-1.488	-1.5%
LP2-OL-07-1SSM	Al_2O_3		8.937	10.150	-1.213	-11.9%
LP2-OL-07-1SSM	B_2O_3		11.543	12.040	-0.497	-4.1%
LP2-OL-07-1SSM	CaO		7.328	8.010	-0.682	-8.5%
LP2-OL-07-1SSM	Cl		0.134	0.330	-0.196	
LP2-OL-07-1SSM	Cr_2O_3		0.433	0.500	-0.067	
LP2-OL-07-1SSM	F		0.109	0.170	-0.062	
LP2-OL-07-1SSM	Fe_2O_3		0.855	1.000	-0.145	
LP2-OL-07-1SSM	K_2O		0.169	0.160	0.009	
LP2-OL-07-1SSM	Li_2O	<	0.215	0.000	0.215	
LP2-OL-07-1SSM	MgO		0.922	1.000	-0.078	
LP2-OL-07-1SSM	Na_2O		21.130	20.980	0.150	0.7%
LP2-OL-07-1SSM	NiO	<	0.127	0.040	0.087	
LP2-OL-07-1SSM	P_2O_5		0.250	0.290	-0.040	
LP2-OL-07-1SSM	SiO_2		33.999	37.140	-3.141	-8.5%
LP2-OL-07-1SSM	SnO_2	<	0.127	0.000	0.127	
LP2-OL-07-1SSM	SO_3		4.707	1.060	3.647	
LP2-OL-07-1SSM	V_2O_5		0.858	1.000	-0.142	
LP2-OL-07-1SSM	ZnO		2.767	3.000	-0.233	
LP2-OL-07-1SSM	ZrO_2		2.357	3.000	-0.643	
LP2-OL-07-1SSM	Sum		96.967	99.870	-2.903	-2.9%
LP2-OL-08-MODQ	Al_2O_3		5.763	6.121	-0.358	-5.8%
LP2-OL-08-MODQ	B_2O_3		6.037	6.121	-0.084	-1.4%
LP2-OL-08-MODQ	CaO		10.532	10.879	-0.347	-3.2%
LP2-OL-08-MODQ	Cl		0.060	0.063	-0.003	
LP2-OL-08-MODQ	Cr_2O_3		0.694	0.612	0.082	
LP2-OL-08-MODQ	F		0.077	0.097	-0.020	

Table C-7. 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
LP2-OL-08-MODQ	Fe_2O_3		1.891	1.530	0.361	
LP2-OL-08-MODQ	K_2O	<	0.120	0.000	0.120	
LP2-OL-08-MODQ	Li_2O	<	0.215	0.000	0.215	
LP2-OL-08-MODQ	MgO	<	0.166	0.000	0.166	
LP2-OL-08-MODQ	Na_2O		24.904	26.524	-1.620	-6.1%
LP2-OL-08-MODQ	NiO	<	0.127	0.000	0.127	
LP2-OL-08-MODQ	P_2O_5		0.227	0.207	0.020	
LP2-OL-08-MODQ	SiO_2		35.486	35.604	-0.118	-0.3%
LP2-OL-08-MODQ	SnO_2		0.472	0.000	0.472	
LP2-OL-08-MODQ	SO_3		0.633	0.816	-0.183	
LP2-OL-08-MODQ	V_2O_5		3.945	4.081	-0.136	
LP2-OL-08-MODQ	ZnO		2.020	2.040	-0.020	
LP2-OL-08-MODQ	ZrO_2		5.268	5.305	-0.037	-0.7%
LP2-OL-08-MODQ	Sum		98.637	100.000	-1.363	-1.4%
LP2-OL-08-MODSSM	Al_2O_3		5.626	6.121	-0.495	-8.1%
LP2-OL-08-MODSSM	B_2O_3		5.659	6.121	-0.462	-7.5%
LP2-OL-08-MODSSM	CaO		10.424	10.879	-0.455	-4.2%
LP2-OL-08-MODSSM	Cl	<	0.050	0.063	-0.013	
LP2-OL-08-MODSSM	Cr_2O_3		0.345	0.612	-0.267	
LP2-OL-08-MODSSM	F		0.065	0.097	-0.033	
LP2-OL-08-MODSSM	Fe_2O_3		1.523	1.530	-0.007	
LP2-OL-08-MODSSM	K_2O	<	0.120	0.000	0.120	
LP2-OL-08-MODSSM	Li_2O	<	0.215	0.000	0.215	
LP2-OL-08-MODSSM	MgO	<	0.166	0.000	0.166	
LP2-OL-08-MODSSM	Na_2O		24.871	26.524	-1.653	-6.2%
LP2-OL-08-MODSSM	NiO	<	0.127	0.000	0.127	
LP2-OL-08-MODSSM	P_2O_5		0.204	0.207	-0.003	
LP2-OL-08-MODSSM	SiO_2		34.753	35.604	-0.851	-2.4%
LP2-OL-08-MODSSM	SnO_2		0.273	0.000	0.273	
LP2-OL-08-MODSSM	SO_3		1.816	0.816	1.000	
LP2-OL-08-MODSSM	V_2O_5		3.646	4.081	-0.435	
LP2-OL-08-MODSSM	ZnO		2.010	2.040	-0.030	
LP2-OL-08-MODSSM	ZrO_2		5.133	5.305	-0.172	-3.2%
LP2-OL-08-MODSSM	Sum		97.027	100.000	-2.973	-3.0%
LP2-OL-09-1Q	Al_2O_3		11.876	12.500	-0.624	-5.0%
LP2-OL-09-1Q	B_2O_3		13.805	13.750	0.055	0.4%
LP2-OL-09-1Q	CaO		1.948	2.000	-0.052	
LP2-OL-09-1Q	Cl	<	0.050	0.062	-0.012	
LP2-OL-09-1Q	Cr_2O_3		0.691	0.600	0.091	
LP2-OL-09-1Q	F		0.067	0.095	-0.028	
LP2-OL-09-1Q	Fe_2O_3		0.570	0.000	0.570	
LP2-OL-09-1Q	K_2O	<	0.120	0.000	0.120	
LP2-OL-09-1Q	Li_2O	<	0.215	0.000	0.215	
LP2-OL-09-1Q	MgO	<	0.166	0.000	0.166	
LP2-OL-09-1Q	Na_2O		19.175	21.000	-1.825	-8.7%
LP2-OL-09-1Q	NiO	<	0.127	0.000	0.127	
LP2-OL-09-1Q	P_2O_5	<	0.241	0.203	0.038	
LP2-OL-09-1Q	SiO_2		39.978	39.190	0.788	2.0%
LP2-OL-09-1Q	SnO_2		1.536	1.550	-0.014	

Table C-7. 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
LP2-OL-09-1Q	SO_3		0.108	0.100	0.008	
LP2-OL-09-1Q	V_2O_5		3.776	4.000	-0.224	
LP2-OL-09-1Q	ZnO		1.945	2.000	-0.055	
LP2-OL-09-1Q	ZrO_2		2.060	2.950	-0.890	
LP2-OL-09-1Q	Sum		98.455	100.000	-1.545	-1.5%
LP2-OL-09-1SSM	Al_2O_3		11.148	12.500	-1.352	-10.8%
LP2-OL-09-1SSM	B_2O_3		13.065	13.750	-0.685	-5.0%
LP2-OL-09-1SSM	CaO		1.822	2.000	-0.178	
LP2-OL-09-1SSM	Cl	<	0.050	0.062	-0.012	
LP2-OL-09-1SSM	Cr_2O_3		0.515	0.600	-0.085	
LP2-OL-09-1SSM	F	<	0.055	0.095	-0.040	
LP2-OL-09-1SSM	Fe_2O_3	<	0.143	0.000	0.143	
LP2-OL-09-1SSM	K_2O	<	0.120	0.000	0.120	
LP2-OL-09-1SSM	Li_2O	<	0.215	0.000	0.215	
LP2-OL-09-1SSM	MgO	<	0.166	0.000	0.166	
LP2-OL-09-1SSM	Na_2O		20.422	21.000	-0.578	-2.8%
LP2-OL-09-1SSM	NiO	<	0.127	0.000	0.127	
LP2-OL-09-1SSM	P_2O_5	<	0.230	0.203	0.027	
LP2-OL-09-1SSM	SiO_2		37.694	39.190	-1.496	-3.8%
LP2-OL-09-1SSM	SnO_2		1.431	1.550	-0.119	
LP2-OL-09-1SSM	SO_3		3.670	0.100	3.570	
LP2-OL-09-1SSM	V_2O_5		3.526	4.000	-0.474	
LP2-OL-09-1SSM	ZnO		1.827	2.000	-0.173	
LP2-OL-09-1SSM	ZrO_2		2.168	2.950	-0.782	
LP2-OL-09-1SSM	Sum		98.396	100.000	-1.604	-1.6%
LP2-OL-10-MODQ	Al_2O_3		11.441	12.523	-1.082	-8.6%
LP2-OL-10-MODQ	B_2O_3		5.627	6.011	-0.384	-6.4%
LP2-OL-10-MODQ	CaO		10.721	11.020	-0.299	-2.7%
LP2-OL-10-MODQ	Cl		0.378	0.468	-0.090	
LP2-OL-10-MODQ	Cr_2O_3		0.404	0.301	0.103	
LP2-OL-10-MODQ	F		0.648	0.709	-0.061	
LP2-OL-10-MODQ	Fe_2O_3		1.919	1.503	0.416	
LP2-OL-10-MODQ	K_2O	<	0.120	0.000	0.120	
LP2-OL-10-MODQ	Li_2O	<	0.215	0.000	0.215	
LP2-OL-10-MODQ	MgO	<	0.166	0.000	0.166	
LP2-OL-10-MODQ	Na_2O		20.523	21.038	-0.515	-2.4%
LP2-OL-10-MODQ	NiO	<	0.127	0.000	0.127	
LP2-OL-10-MODQ	P_2O_5		1.723	1.518	0.205	
LP2-OL-10-MODQ	SiO_2		38.454	39.151	-0.697	-1.8%
LP2-OL-10-MODQ	SnO_2		0.262	0.000	0.262	
LP2-OL-10-MODQ	SO_3		0.718	0.800	-0.082	
LP2-OL-10-MODQ	V_2O_5	<	0.179	0.000	0.179	
LP2-OL-10-MODQ	ZnO		2.013	2.004	0.009	
LP2-OL-10-MODQ	ZrO_2		3.033	2.955	0.078	
LP2-OL-10-MODQ	Sum		98.673	100.001	-1.328	-1.3%
LP2-OL-10-MODSSM	Al_2O_3		11.526	12.523	-0.997	-8.0%
LP2-OL-10-MODSSM	B_2O_3		5.723	6.011	-0.288	-4.8%
LP2-OL-10-MODSSM	CaO		11.120	11.020	0.100	0.9%
LP2-OL-10-MODSSM	Cl		0.111	0.468	-0.358	

Table C-7. 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
LP2-OL-10-MODSSM	Cr_2O_3		0.119	0.301	-0.182	
LP2-OL-10-MODSSM	F		0.496	0.709	-0.213	
LP2-OL-10-MODSSM	Fe_2O_3		1.462	1.503	-0.041	
LP2-OL-10-MODSSM	K_2O	<	0.120	0.000	0.120	
LP2-OL-10-MODSSM	Li_2O	<	0.215	0.000	0.215	
LP2-OL-10-MODSSM	MgO	<	0.166	0.000	0.166	
LP2-OL-10-MODSSM	Na_2O		20.220	21.038	-0.818	-3.9%
LP2-OL-10-MODSSM	NiO	<	0.127	0.000	0.127	
LP2-OL-10-MODSSM	P_2O_5		1.286	1.518	-0.232	
LP2-OL-10-MODSSM	SiO_2		39.128	39.151	-0.023	-0.1%
LP2-OL-10-MODSSM	SnO_2	<	0.137	0.000	0.137	
LP2-OL-10-MODSSM	SO_3		1.082	0.800	0.282	
LP2-OL-10-MODSSM	V_2O_5	<	0.179	0.000	0.179	
LP2-OL-10-MODSSM	ZnO		2.094	2.004	0.090	
LP2-OL-10-MODSSM	ZrO_2		2.590	2.955	-0.365	
LP2-OL-10-MODSSM	Sum		97.901	100.001	-2.100	-2.1%
LP2-OL-11Q	Al_2O_3		5.508	6.000	-0.492	-8.2%
LP2-OL-11Q	B_2O_3		13.242	13.750	-0.508	-3.7%
LP2-OL-11Q	CaO		7.832	7.990	-0.158	-2.0%
LP2-OL-11Q	Cl		0.051	0.062	-0.011	
LP2-OL-11Q	Cr_2O_3		0.402	0.300	0.102	
LP2-OL-11Q	F		0.077	0.095	-0.018	
LP2-OL-11Q	Fe_2O_3		0.330	0.000	0.330	
LP2-OL-11Q	K_2O		5.336	5.750	-0.414	-7.2%
LP2-OL-11Q	Li_2O	<	0.215	0.000	0.215	
LP2-OL-11Q	MgO		1.332	1.350	-0.018	
LP2-OL-11Q	Na_2O		20.153	21.000	-0.847	-4.0%
LP2-OL-11Q	NiO	<	0.127	0.000	0.127	
LP2-OL-11Q	P_2O_5		0.234	0.203	0.031	
LP2-OL-11Q	SiO_2		36.646	34.900	1.746	5.0%
LP2-OL-11Q	SnO_2		0.265	0.000	0.265	
LP2-OL-11Q	SO_3		0.147	0.100	0.047	
LP2-OL-11Q	V_2O_5	<	0.179	0.000	0.179	
LP2-OL-11Q	ZnO		1.957	2.000	-0.043	
LP2-OL-11Q	ZrO_2		5.187	6.500	-1.313	-20.2%
LP2-OL-11Q	Sum		99.220	100.000	-0.780	-0.8%
LP2-OL-11SSM	Al_2O_3		5.602	6.000	-0.398	-6.6%
LP2-OL-11SSM	B_2O_3		13.008	13.750	-0.742	-5.4%
LP2-OL-11SSM	CaO		7.713	7.990	-0.277	-3.5%
LP2-OL-11SSM	Cl	<	0.050	0.062	-0.012	
LP2-OL-11SSM	Cr_2O_3		0.140	0.300	-0.160	
LP2-OL-11SSM	F		0.070	0.095	-0.025	
LP2-OL-11SSM	Fe_2O_3	<	0.143	0.000	0.143	
LP2-OL-11SSM	K_2O		4.394	5.750	-1.356	-23.6%
LP2-OL-11SSM	Li_2O	<	0.215	0.000	0.215	
LP2-OL-11SSM	MgO		1.296	1.350	-0.054	
LP2-OL-11SSM	Na_2O		21.063	21.000	0.063	0.3%
LP2-OL-11SSM	NiO	<	0.127	0.000	0.127	
LP2-OL-11SSM	P_2O_5		0.207	0.203	0.004	

Table C-7. 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
LP2-OL-11SSM	SiO_2		36.753	34.900	1.853	5.3%
LP2-OL-11SSM	SnO_2	<	0.127	0.000	0.127	
LP2-OL-11SSM	SO_3		1.470	0.100	1.370	
LP2-OL-11SSM	V_2O_5	<	0.179	0.000	0.179	
LP2-OL-11SSM	ZnO		1.920	2.000	-0.080	
LP2-OL-11SSM	ZrO_2		5.369	6.500	-1.131	-17.4%
LP2-OL-11SSM	Sum		99.847	100.000	-0.153	-0.2%
LP2-OL-12Q	Al_2O_3		5.768	6.000	-0.232	-3.9%
LP2-OL-12Q	B_2O_3		13.741	13.750	-0.009	-0.1%
LP2-OL-12Q	CaO		7.930	7.991	-0.061	-0.8%
LP2-OL-12Q	Cl		0.348	0.467	-0.119	
LP2-OL-12Q	Cr_2O_3		0.688	0.600	0.088	
LP2-OL-12Q	F		0.586	0.708	-0.122	
LP2-OL-12Q	Fe_2O_3		1.862	1.500	0.362	
LP2-OL-12Q	K_2O	<	0.120	0.000	0.120	
LP2-OL-12Q	Li_2O	<	0.215	0.000	0.215	
LP2-OL-12Q	MgO		1.324	1.350	-0.026	
LP2-OL-12Q	Na_2O		24.331	25.941	-1.610	-6.2%
LP2-OL-12Q	NiO	<	0.153	0.000	0.153	
LP2-OL-12Q	P_2O_5		1.431	1.515	-0.084	
LP2-OL-12Q	SiO_2		36.336	35.128	1.208	3.4%
LP2-OL-12Q	SnO_2	<	0.127	0.000	0.127	
LP2-OL-12Q	SO_3		0.137	0.100	0.037	
LP2-OL-12Q	V_2O_5	<	0.179	0.000	0.179	
LP2-OL-12Q	ZnO		2.013	2.000	0.013	
LP2-OL-12Q	ZrO_2		2.148	2.950	-0.802	
LP2-OL-12Q	Sum		99.437	100.000	-0.563	-0.6%
LP2-OL-12SSM	Al_2O_3		5.437	6.000	-0.563	-9.4%
LP2-OL-12SSM	B_2O_3		12.888	13.750	-0.862	-6.3%
LP2-OL-12SSM	CaO		7.608	7.991	-0.383	-4.8%
LP2-OL-12SSM	Cl		0.227	0.467	-0.240	
LP2-OL-12SSM	Cr_2O_3		0.522	0.600	-0.078	
LP2-OL-12SSM	F		0.507	0.708	-0.201	
LP2-OL-12SSM	Fe_2O_3		1.430	1.500	-0.070	
LP2-OL-12SSM	K_2O	<	0.120	0.000	0.120	
LP2-OL-12SSM	Li_2O	<	0.215	0.000	0.215	
LP2-OL-12SSM	MgO		1.261	1.350	-0.089	
LP2-OL-12SSM	Na_2O		24.399	25.941	-1.542	-5.9%
LP2-OL-12SSM	NiO	<	0.127	0.000	0.127	
LP2-OL-12SSM	P_2O_5		1.391	1.515	-0.124	
LP2-OL-12SSM	SiO_2		33.913	35.128	-1.215	-3.5%
LP2-OL-12SSM	SnO_2	<	0.127	0.000	0.127	
LP2-OL-12SSM	SO_3		3.839	0.100	3.739	
LP2-OL-12SSM	V_2O_5	<	0.179	0.000	0.179	
LP2-OL-12SSM	ZnO		1.936	2.000	-0.064	
LP2-OL-12SSM	ZrO_2		2.033	2.950	-0.917	
LP2-OL-12SSM	Sum		98.158	100.000	-1.842	-1.8%
LP2-OL-13Q	Al_2O_3		5.621	6.000	-0.379	-6.3%
LP2-OL-13Q	B_2O_3		5.933	6.000	-0.067	-1.1%

Table C-7. 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
LP2-OL-13Q	CaO		10.886	11.000	-0.114	-1.0%
LP2-OL-13Q	Cl		0.299	0.467	-0.169	
LP2-OL-13Q	Cr_2O_3		0.374	0.300	0.074	
LP2-OL-13Q	F		0.595	0.708	-0.113	
LP2-OL-13Q	Fe_2O_3		0.365	0.000	0.365	
LP2-OL-13Q	K_2O		5.562	5.750	-0.188	-3.3%
LP2-OL-13Q	Li_2O	<	0.215	0.000	0.215	
LP2-OL-13Q	MgO	<	0.166	0.000	0.166	
LP2-OL-13Q	Na_2O		20.523	22.205	-1.682	-7.6%
LP2-OL-13Q	NiO	<	0.127	0.000	0.127	
LP2-OL-13Q	P_2O_5		1.760	1.515	0.245	
LP2-OL-13Q	SiO_2		35.208	35.405	-0.197	-0.6%
LP2-OL-13Q	SnO_2		0.277	0.000	0.277	
LP2-OL-13Q	SO_3		0.102	0.100	0.002	
LP2-OL-13Q	V_2O_5		3.963	4.000	-0.037	
LP2-OL-13Q	ZnO		3.675	3.600	0.075	
LP2-OL-13Q	ZrO_2		2.499	2.950	-0.451	
LP2-OL-13Q	Sum		98.149	100.000	-1.851	-1.9%
LP2-OL-13SSM	Al_2O_3		5.546	6.000	-0.454	-7.6%
LP2-OL-13SSM	B_2O_3		5.675	6.000	-0.325	-5.4%
LP2-OL-13SSM	CaO		10.777	11.000	-0.223	-2.0%
LP2-OL-13SSM	Cl		0.136	0.467	-0.332	
LP2-OL-13SSM	Cr_2O_3		0.145	0.300	-0.155	
LP2-OL-13SSM	F		0.490	0.708	-0.218	
LP2-OL-13SSM	Fe_2O_3	<	0.175	0.000	0.175	
LP2-OL-13SSM	K_2O		4.457	5.750	-1.293	-22.5%
LP2-OL-13SSM	Li_2O	<	0.215	0.000	0.215	
LP2-OL-13SSM	MgO	<	0.166	0.000	0.166	
LP2-OL-13SSM	Na_2O		21.501	22.205	-0.704	-3.2%
LP2-OL-13SSM	NiO	<	0.127	0.000	0.127	
LP2-OL-13SSM	P_2O_5		1.692	1.515	0.177	
LP2-OL-13SSM	SiO_2		34.699	35.405	-0.706	-2.0%
LP2-OL-13SSM	SnO_2	<	0.193	0.000	0.193	
LP2-OL-13SSM	SO_3		1.500	0.100	1.400	
LP2-OL-13SSM	V_2O_5		3.624	4.000	-0.376	
LP2-OL-13SSM	ZnO		3.650	3.600	0.050	
LP2-OL-13SSM	ZrO_2		2.560	2.950	-0.390	
LP2-OL-13SSM	Sum		97.328	100.000	-2.672	-2.7%
LP2-OL-14Q	Al_2O_3		5.541	6.000	-0.459	-7.7%
LP2-OL-14Q	B_2O_3		13.717	13.750	-0.033	-0.2%
LP2-OL-14Q	CaO		7.125	7.171	-0.046	-0.6%
LP2-OL-14Q	Cl	<	0.053	0.062	-0.009	
LP2-OL-14Q	Cr_2O_3		0.671	0.600	0.071	
LP2-OL-14Q	F		0.070	0.095	-0.025	
LP2-OL-14Q	Fe_2O_3		0.286	0.000	0.286	
LP2-OL-14Q	K_2O		5.580	5.750	-0.170	-3.0%
LP2-OL-14Q	Li_2O	<	0.215	0.000	0.215	
LP2-OL-14Q	MgO	<	0.166	0.000	0.166	
LP2-OL-14Q	Na_2O		18.939	21.000	-2.061	-9.8%

Table C-7. 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
LP2-OL-14Q	NiO	<	0.127	0.000	0.127	
LP2-OL-14Q	P_2O_5	<	0.233	0.203	0.030	
LP2-OL-14Q	SiO_2		33.737	34.900	-1.163	-3.3%
LP2-OL-14Q	SnO_2	<	0.127	0.000	0.127	
LP2-OL-14Q	SO_3		1.503	1.519	-0.016	
LP2-OL-14Q	V_2O_5		3.974	4.000	-0.026	
LP2-OL-14Q	ZnO		2.017	2.000	0.017	
LP2-OL-14Q	ZrO_2		1.898	2.950	-1.052	
LP2-OL-14Q	Sum		95.977	100.000	-4.023	-4.0%
LP2-OL-14SSM	Al_2O_3		5.314	6.000	-0.686	-11.4%
LP2-OL-14SSM	B_2O_3		13.016	13.750	-0.734	-5.3%
LP2-OL-14SSM	CaO		6.727	7.171	-0.444	-6.2%
LP2-OL-14SSM	Cl	<	0.050	0.062	-0.012	
LP2-OL-14SSM	Cr_2O_3		0.508	0.600	-0.092	
LP2-OL-14SSM	F		0.056	0.095	-0.039	
LP2-OL-14SSM	Fe_2O_3	<	0.143	0.000	0.143	
LP2-OL-14SSM	K_2O		5.074	5.750	-0.676	-11.7%
LP2-OL-14SSM	Li_2O	<	0.215	0.000	0.215	
LP2-OL-14SSM	MgO	<	0.166	0.000	0.166	
LP2-OL-14SSM	Na_2O		20.860	21.000	-0.140	-0.7%
LP2-OL-14SSM	NiO	<	0.127	0.000	0.127	
LP2-OL-14SSM	P_2O_5	<	0.229	0.203	0.026	
LP2-OL-14SSM	SiO_2		32.662	34.900	-2.238	-6.4%
LP2-OL-14SSM	SnO_2	<	0.127	0.000	0.127	
LP2-OL-14SSM	SO_3		4.582	1.519	3.063	
LP2-OL-14SSM	V_2O_5		3.690	4.000	-0.310	
LP2-OL-14SSM	ZnO		1.929	2.000	-0.071	
LP2-OL-14SSM	ZrO_2		1.986	2.950	-0.964	
LP2-OL-14SSM	Sum		97.463	100.000	-2.537	-2.5%
LP2-OL-15Q	Al_2O_3		5.796	6.000	-0.204	-3.4%
LP2-OL-15Q	B_2O_3		13.894	13.750	0.144	1.0%
LP2-OL-15Q	CaO		10.662	11.000	-0.338	-3.1%
LP2-OL-15Q	Cl	<	0.054	0.062	-0.008	
LP2-OL-15Q	Cr_2O_3		0.692	0.600	0.092	
LP2-OL-15Q	F		0.070	0.095	-0.025	
LP2-OL-15Q	Fe_2O_3		2.009	1.500	0.509	
LP2-OL-15Q	K_2O	<	0.120	0.000	0.120	
LP2-OL-15Q	Li_2O	<	0.215	0.000	0.215	
LP2-OL-15Q	MgO	<	0.166	0.000	0.166	
LP2-OL-15Q	Na_2O		19.142	21.000	-1.858	-8.8%
LP2-OL-15Q	NiO	<	0.127	0.000	0.127	
LP2-OL-15Q	P_2O_5	<	0.232	0.203	0.029	
LP2-OL-15Q	SiO_2		36.459	35.640	0.819	2.3%
LP2-OL-15Q	SnO_2		3.463	3.500	-0.037	
LP2-OL-15Q	SO_3		0.119	0.100	0.019	
LP2-OL-15Q	V_2O_5	<	0.179	0.000	0.179	
LP2-OL-15Q	ZnO		3.551	3.600	-0.049	
LP2-OL-15Q	ZrO_2		2.080	2.950	-0.870	
LP2-OL-15Q	Sum		99.028	100.000	-0.972	-1.0%

Table C-7. 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
LP2-OL-15SSM	Al_2O_3		5.248	6.000	-0.752	-12.5%
LP2-OL-15SSM	B_2O_3		12.566	13.750	-1.184	-8.6%
LP2-OL-15SSM	CaO		10.060	11.000	-0.940	-8.5%
LP2-OL-15SSM	Cl	<	0.050	0.062	-0.012	
LP2-OL-15SSM	Cr_2O_3		0.532	0.600	-0.068	
LP2-OL-15SSM	F		0.062	0.095	-0.033	
LP2-OL-15SSM	Fe_2O_3		1.397	1.500	-0.103	
LP2-OL-15SSM	K_2O	<	0.120	0.000	0.120	
LP2-OL-15SSM	Li_2O	<	0.215	0.000	0.215	
LP2-OL-15SSM	MgO	<	0.166	0.000	0.166	
LP2-OL-15SSM	Na_2O		20.692	21.000	-0.308	-1.5%
LP2-OL-15SSM	NiO	<	0.127	0.000	0.127	
LP2-OL-15SSM	P_2O_5	<	0.229	0.203	0.026	
LP2-OL-15SSM	SiO_2		33.277	35.640	-2.363	-6.6%
LP2-OL-15SSM	SnO_2		3.107	3.500	-0.393	
LP2-OL-15SSM	SO_3		3.876	0.100	3.776	
LP2-OL-15SSM	V_2O_5	<	0.179	0.000	0.179	
LP2-OL-15SSM	ZnO		3.377	3.600	-0.223	
LP2-OL-15SSM	ZrO_2		2.006	2.950	-0.944	
LP2-OL-15SSM	Sum		97.286	100.000	-2.714	-2.7%
LP2-OL-16-MODQ	Al_2O_3		5.475	6.008	-0.533	-8.9%
LP2-OL-16-MODQ	B_2O_3		7.309	7.483	-0.174	-2.3%
LP2-OL-16-MODQ	CaO		3.064	3.054	0.010	
LP2-OL-16-MODQ	Cl		0.052	0.062	-0.010	
LP2-OL-16-MODQ	Cr_2O_3		0.710	0.601	0.109	
LP2-OL-16-MODQ	F		0.075	0.095	-0.020	
LP2-OL-16-MODQ	Fe_2O_3		1.880	1.502	0.378	
LP2-OL-16-MODQ	K_2O	<	0.120	0.000	0.120	
LP2-OL-16-MODQ	Li_2O	<	0.215	0.000	0.215	
LP2-OL-16-MODQ	MgO		1.301	1.352	-0.051	
LP2-OL-16-MODQ	Na_2O		20.490	21.026	-0.536	-2.6%
LP2-OL-16-MODQ	NiO	<	0.127	0.000	0.127	
LP2-OL-16-MODQ	P_2O_5		0.204	0.203	0.001	
LP2-OL-16-MODQ	SiO_2		49.894	47.059	2.835	6.0%
LP2-OL-16-MODQ	SnO_2		0.440	0.000	0.440	
LP2-OL-16-MODQ	SO_3		0.896	0.992	-0.096	
LP2-OL-16-MODQ	V_2O_5		3.771	4.005	-0.234	
LP2-OL-16-MODQ	ZnO		3.439	3.605	-0.166	
LP2-OL-16-MODQ	ZrO_2		2.465	2.954	-0.489	
LP2-OL-16-MODQ	Sum		101.928	100.001	1.927	1.9%
LP2-OL-16-MODSSM	Al_2O_3		5.513	6.008	-0.495	-8.2%
LP2-OL-16-MODSSM	B_2O_3		7.196	7.483	-0.287	-3.8%
LP2-OL-16-MODSSM	CaO		3.117	3.054	0.063	
LP2-OL-16-MODSSM	Cl	<	0.050	0.062	-0.012	
LP2-OL-16-MODSSM	Cr_2O_3		0.334	0.601	-0.267	
LP2-OL-16-MODSSM	F		0.055	0.095	-0.040	
LP2-OL-16-MODSSM	Fe_2O_3		1.451	1.502	-0.051	
LP2-OL-16-MODSSM	K_2O	<	0.120	0.000	0.120	
LP2-OL-16-MODSSM	Li_2O	<	0.215	0.000	0.215	

Table C-7. 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
LP2-OL-16-MODSSM	MgO		1.273	1.352	-0.079	
LP2-OL-16-MODSSM	Na_2O		19.816	21.026	-1.210	-5.8%
LP2-OL-16-MODSSM	NiO	<	0.127	0.000	0.127	
LP2-OL-16-MODSSM	P_2O_5		0.173	0.203	-0.030	
LP2-OL-16-MODSSM	SiO_2		49.557	47.059	2.498	5.3%
LP2-OL-16-MODSSM	SnO_2		0.270	0.000	0.270	
LP2-OL-16-MODSSM	SO_3		1.190	0.992	0.198	
LP2-OL-16-MODSSM	V_2O_5		3.619	4.005	-0.386	
LP2-OL-16-MODSSM	ZnO		3.489	3.605	-0.116	
LP2-OL-16-MODSSM	ZrO_2		2.540	2.954	-0.414	
LP2-OL-16-MODSSM	Sum		100.105	100.001	0.104	0.1%
LP2-OL-17Q	Al_2O_3		5.720	6.000	-0.280	-4.7%
LP2-OL-17Q	B_2O_3		6.182	6.000	0.182	3.0%
LP2-OL-17Q	CaO		4.345	4.550	-0.205	
LP2-OL-17Q	Cl		0.329	0.467	-0.138	
LP2-OL-17Q	Cr_2O_3		0.378	0.300	0.078	
LP2-OL-17Q	F		0.603	0.708	-0.105	
LP2-OL-17Q	Fe_2O_3		1.769	1.500	0.269	
LP2-OL-17Q	K_2O		5.388	5.750	-0.362	-6.3%
LP2-OL-17Q	Li_2O	<	0.215	0.000	0.215	
LP2-OL-17Q	MgO		1.288	1.350	-0.062	
LP2-OL-17Q	Na_2O		20.523	22.205	-1.682	-7.6%
LP2-OL-17Q	NiO	<	0.127	0.000	0.127	
LP2-OL-17Q	P_2O_5		1.463	1.515	-0.052	
LP2-OL-17Q	SiO_2		38.037	37.105	0.932	2.5%
LP2-OL-17Q	SnO_2		3.399	3.500	-0.101	
LP2-OL-17Q	SO_3		0.138	0.100	0.038	
LP2-OL-17Q	V_2O_5		3.834	4.000	-0.166	
LP2-OL-17Q	ZnO		1.967	2.000	-0.033	
LP2-OL-17Q	ZrO_2		2.242	2.950	-0.708	
LP2-OL-17Q	Sum		97.949	100.000	-2.051	-2.1%
LP2-OL-17SSM	Al_2O_3		5.305	6.000	-0.695	-11.6%
LP2-OL-17SSM	B_2O_3		5.715	6.000	-0.285	-4.7%
LP2-OL-17SSM	CaO		4.026	4.550	-0.524	
LP2-OL-17SSM	Cl		0.190	0.467	-0.277	
LP2-OL-17SSM	Cr_2O_3		0.258	0.300	-0.042	
LP2-OL-17SSM	F		0.515	0.708	-0.193	
LP2-OL-17SSM	Fe_2O_3		1.310	1.500	-0.190	
LP2-OL-17SSM	K_2O		4.764	5.750	-0.986	-17.1%
LP2-OL-17SSM	Li_2O	<	0.215	0.000	0.215	
LP2-OL-17SSM	MgO		1.203	1.350	-0.147	
LP2-OL-17SSM	Na_2O		21.737	22.205	-0.468	-2.1%
LP2-OL-17SSM	NiO	<	0.127	0.000	0.127	
LP2-OL-17SSM	P_2O_5		1.416	1.515	-0.099	
LP2-OL-17SSM	SiO_2		35.480	37.105	-1.625	-4.4%
LP2-OL-17SSM	SnO_2		3.133	3.500	-0.367	
LP2-OL-17SSM	SO_3		3.833	0.100	3.733	
LP2-OL-17SSM	V_2O_5		3.530	4.000	-0.470	
LP2-OL-17SSM	ZnO		1.833	2.000	-0.167	

Table C-7. 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
LP2-OL-17SSM	ZrO_2		2.080	2.950	-0.870	
LP2-OL-17SSM	Sum		96.671	100.000	-3.329	-3.3%
LP2-OL-18Q	Al_2O_3		5.772	6.000	-0.228	-3.8%
LP2-OL-18Q	B_2O_3		5.925	6.000	-0.075	-1.3%
LP2-OL-18Q	CaO		8.626	8.720	-0.094	-1.1%
LP2-OL-18Q	Cl		0.318	0.470	-0.152	
LP2-OL-18Q	Cr_2O_3		0.657	0.600	0.057	
LP2-OL-18Q	F		0.630	0.710	-0.080	
LP2-OL-18Q	Fe_2O_3		0.462	0.000	0.462	
LP2-OL-18Q	K_2O	<	0.120	0.000	0.120	
LP2-OL-18Q	Li_2O	<	0.215	0.000	0.215	
LP2-OL-18Q	MgO		1.281	1.350	-0.069	
LP2-OL-18Q	Na_2O		20.287	21.000	-0.713	-3.4%
LP2-OL-18Q	NiO	<	0.127	0.000	0.127	
LP2-OL-18Q	P_2O_5		1.277	1.520	-0.243	
LP2-OL-18Q	SiO_2		34.111	34.900	-0.789	-2.3%
LP2-OL-18Q	SnO_2		3.847	3.500	0.347	
LP2-OL-18Q	SO_3		1.003	1.140	-0.137	
LP2-OL-18Q	V_2O_5		3.972	4.000	-0.028	
LP2-OL-18Q	ZnO		3.706	3.600	0.106	
LP2-OL-18Q	ZrO_2		4.903	6.500	-1.597	-24.6%
LP2-OL-18Q	Sum		97.242	100.010	-2.768	-2.8%
LP2-OL-18SSM	Al_2O_3		5.857	6.000	-0.143	-2.4%
LP2-OL-18SSM	B_2O_3		5.965	6.000	-0.035	-0.6%
LP2-OL-18SSM	CaO		8.822	8.720	0.102	1.2%
LP2-OL-18SSM	Cl		0.096	0.470	-0.374	
LP2-OL-18SSM	Cr_2O_3		0.248	0.600	-0.352	
LP2-OL-18SSM	F		0.519	0.710	-0.192	
LP2-OL-18SSM	Fe_2O_3	<	0.143	0.000	0.143	
LP2-OL-18SSM	K_2O	<	0.120	0.000	0.120	
LP2-OL-18SSM	Li_2O	<	0.215	0.000	0.215	
LP2-OL-18SSM	MgO		1.281	1.350	-0.069	
LP2-OL-18SSM	Na_2O		19.748	21.000	-1.252	-6.0%
LP2-OL-18SSM	NiO	<	0.127	0.000	0.127	
LP2-OL-18SSM	P_2O_5		0.988	1.520	-0.532	
LP2-OL-18SSM	SiO_2		35.149	34.900	0.249	0.7%
LP2-OL-18SSM	SnO_2		3.631	3.500	0.131	
LP2-OL-18SSM	SO_3		1.195	1.140	0.055	
LP2-OL-18SSM	V_2O_5		3.694	4.000	-0.306	
LP2-OL-18SSM	ZnO		3.803	3.600	0.203	
LP2-OL-18SSM	ZrO_2		4.647	6.500	-1.853	-28.5%
LP2-OL-18SSM	Sum		96.249	100.010	-3.761	-3.8%
LP2-OL-19Q	Al_2O_3		5.692	6.000	-0.308	-5.1%
LP2-OL-19Q	B_2O_3		6.037	6.000	0.037	0.6%
LP2-OL-19Q	CaO		3.505	3.345	0.160	
LP2-OL-19Q	Cl		0.055	0.062	-0.007	
LP2-OL-19Q	Cr_2O_3		0.424	0.300	0.124	
LP2-OL-19Q	F		0.081	0.095	-0.014	
LP2-OL-19Q	Fe_2O_3		1.969	1.500	0.469	

Table C-7. 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
LP2-OL-19Q	K_2O		5.641	5.750	-0.109	-1.9%
LP2-OL-19Q	Li_2O	<	0.215	0.000	0.215	
LP2-OL-19Q	MgO	<	0.166	0.000	0.166	
LP2-OL-19Q	Na_2O		19.175	21.000	-1.825	-8.7%
LP2-OL-19Q	NiO	<	0.127	0.000	0.127	
LP2-OL-19Q	P_2O_5		0.242	0.203	0.039	
LP2-OL-19Q	SiO_2		43.150	46.499	-3.349	-7.2%
LP2-OL-19Q	SnO_2		3.625	3.500	0.125	
LP2-OL-19Q	SO_3		0.620	0.796	-0.176	
LP2-OL-19Q	V_2O_5	<	0.179	0.000	0.179	
LP2-OL-19Q	ZnO		2.010	2.000	0.010	
LP2-OL-19Q	ZrO_2		2.668	2.950	-0.282	
LP2-OL-19Q	Sum		95.582	100.000	-4.418	-4.4%
LP2-OL-19SSM	Al_2O_3		5.687	6.000	-0.313	-5.2%
LP2-OL-19SSM	B_2O_3		5.788	6.000	-0.212	-3.5%
LP2-OL-19SSM	CaO		3.498	3.345	0.153	
LP2-OL-19SSM	Cl	<	0.050	0.062	-0.012	
LP2-OL-19SSM	Cr_2O_3		0.121	0.300	-0.179	
LP2-OL-19SSM	F		0.068	0.095	-0.027	
LP2-OL-19SSM	Fe_2O_3		1.512	1.500	0.012	
LP2-OL-19SSM	K_2O		4.617	5.750	-1.133	-19.7%
LP2-OL-19SSM	Li_2O	<	0.215	0.000	0.215	
LP2-OL-19SSM	MgO	<	0.166	0.000	0.166	
LP2-OL-19SSM	Na_2O		20.018	21.000	-0.982	-4.7%
LP2-OL-19SSM	NiO	<	0.127	0.000	0.127	
LP2-OL-19SSM	P_2O_5		0.199	0.203	-0.004	
LP2-OL-19SSM	SiO_2		43.497	46.499	-3.002	-6.5%
LP2-OL-19SSM	SnO_2		3.456	3.500	-0.044	
LP2-OL-19SSM	SO_3		0.956	0.796	0.160	
LP2-OL-19SSM	V_2O_5	<	0.179	0.000	0.179	
LP2-OL-19SSM	ZnO		2.029	2.000	0.029	
LP2-OL-19SSM	ZrO_2		2.485	2.950	-0.465	
LP2-OL-19SSM	Sum		94.669	100.000	-5.331	-5.3%
LP2-OL-20Q	Al_2O_3		5.560	6.000	-0.440	-7.3%
LP2-OL-20Q	B_2O_3		5.796	6.000	-0.204	-3.4%
LP2-OL-20Q	CaO		8.063	8.050	0.013	0.2%
LP2-OL-20Q	Cl		0.064	0.062	0.002	
LP2-OL-20Q	Cr_2O_3		0.433	0.300	0.133	
LP2-OL-20Q	F		0.081	0.095	-0.014	
LP2-OL-20Q	Fe_2O_3		0.535	0.000	0.535	
LP2-OL-20Q	K_2O	<	0.120	0.000	0.120	
LP2-OL-20Q	Li_2O	<	0.215	0.000	0.215	
LP2-OL-20Q	MgO	<	0.166	0.000	0.166	
LP2-OL-20Q	Na_2O		25.545	26.000	-0.455	-1.8%
LP2-OL-20Q	NiO	<	0.127	0.000	0.127	
LP2-OL-20Q	P_2O_5		0.214	0.203	0.011	
LP2-OL-20Q	SiO_2		44.540	46.640	-2.100	-4.5%
LP2-OL-20Q	SnO_2		0.258	0.000	0.258	
LP2-OL-20Q	SO_3		0.120	0.100	0.020	

Table C-7. 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
LP2-OL-20Q	V_2O_5	<	0.179	0.000	0.179	
LP2-OL-20Q	ZnO		3.716	3.600	0.116	
LP2-OL-20Q	ZrO_2		2.533	2.950	-0.417	
LP2-OL-20Q	Sum		98.263	100.000	-1.737	-1.7%
LP2-OL-20SSM	Al_2O_3		5.532	6.000	-0.468	-7.8%
LP2-OL-20SSM	B_2O_3		5.562	6.000	-0.438	-7.3%
LP2-OL-20SSM	CaO		7.891	8.050	-0.159	-2.0%
LP2-OL-20SSM	Cl	<	0.050	0.062	-0.012	
LP2-OL-20SSM	Cr_2O_3		0.186	0.300	-0.114	
LP2-OL-20SSM	F		0.078	0.095	-0.017	
LP2-OL-20SSM	Fe_2O_3	<	0.143	0.000	0.143	
LP2-OL-20SSM	K_2O	<	0.120	0.000	0.120	
LP2-OL-20SSM	Li_2O	<	0.215	0.000	0.215	
LP2-OL-20SSM	MgO	<	0.166	0.000	0.166	
LP2-OL-20SSM	Na_2O		26.387	26.000	0.387	1.5%
LP2-OL-20SSM	NiO	<	0.127	0.000	0.127	
LP2-OL-20SSM	P_2O_5		0.177	0.203	-0.026	
LP2-OL-20SSM	SiO_2		43.802	46.640	-2.838	-6.1%
LP2-OL-20SSM	SnO_2	<	0.175	0.000	0.175	
LP2-OL-20SSM	SO_3		1.870	0.100	1.770	
LP2-OL-20SSM	V_2O_5	<	0.179	0.000	0.179	
LP2-OL-20SSM	ZnO		3.644	3.600	0.044	
LP2-OL-20SSM	ZrO_2		2.452	2.950	-0.498	
LP2-OL-20SSM	Sum		98.756	100.000	-1.244	-1.2%
LP2-OL-21Q	Al_2O_3		9.358	10.000	-0.642	-6.4%
LP2-OL-21Q	B_2O_3		9.434	9.500	-0.066	-0.7%
LP2-OL-21Q	CaO		5.128	5.000	0.128	2.6%
LP2-OL-21Q	Cl		0.162	0.208	-0.046	
LP2-OL-21Q	Cr_2O_3		0.553	0.450	0.103	
LP2-OL-21Q	F		0.278	0.316	-0.039	
LP2-OL-21Q	Fe_2O_3		0.953	0.600	0.353	
LP2-OL-21Q	K_2O		1.056	1.000	0.056	
LP2-OL-21Q	Li_2O	<	0.215	0.000	0.215	
LP2-OL-21Q	MgO		0.643	0.650	-0.007	
LP2-OL-21Q	Na_2O		21.972	23.000	-1.028	-4.5%
LP2-OL-21Q	NiO	<	0.127	0.000	0.127	
LP2-OL-21Q	P_2O_5		0.632	0.676	-0.044	
LP2-OL-21Q	SiO_2		42.096	38.800	3.296	8.5%
LP2-OL-21Q	SnO_2		1.796	1.500	0.296	
LP2-OL-21Q	SO_3		0.502	0.500	0.002	
LP2-OL-21Q	V_2O_5		0.951	1.000	-0.049	
LP2-OL-21Q	ZnO		2.742	2.800	-0.058	
LP2-OL-21Q	ZrO_2		3.228	4.000	-0.772	
LP2-OL-21Q	Sum		101.825	100.000	1.825	1.8%
LP2-OL-21SSM	Al_2O_3		9.282	10.000	-0.718	-7.2%
LP2-OL-21SSM	B_2O_3		9.161	9.500	-0.339	-3.6%
LP2-OL-21SSM	CaO		5.062	5.000	0.062	1.2%
LP2-OL-21SSM	Cl		0.072	0.208	-0.136	
LP2-OL-21SSM	Cr_2O_3		0.213	0.450	-0.237	

Table C-7. 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
LP2-OL-21SSM	F		0.232	0.316	-0.084	
LP2-OL-21SSM	Fe_2O_3		0.603	0.600	0.003	
LP2-OL-21SSM	K_2O		0.810	1.000	-0.190	
LP2-OL-21SSM	Li_2O	<	0.215	0.000	0.215	
LP2-OL-21SSM	MgO		0.661	0.650	0.011	
LP2-OL-21SSM	Na_2O		22.444	23.000	-0.556	-2.4%
LP2-OL-21SSM	NiO	<	0.127	0.000	0.127	
LP2-OL-21SSM	P_2O_5		0.549	0.676	-0.127	
LP2-OL-21SSM	SiO_2		41.246	38.800	2.446	6.3%
LP2-OL-21SSM	SnO_2		1.606	1.500	0.106	
LP2-OL-21SSM	SO_3		1.127	0.500	0.627	
LP2-OL-21SSM	V_2O_5		0.895	1.000	-0.105	
LP2-OL-21SSM	ZnO		2.729	2.800	-0.071	
LP2-OL-21SSM	ZrO_2		3.255	4.000	-0.745	
LP2-OL-21SSM	Sum		100.288	100.000	0.288	0.3%
LP2-OL-22Q	Al_2O_3		6.514	7.000	-0.486	-6.9%
LP2-OL-22Q	B_2O_3		5.884	6.000	-0.116	-1.9%
LP2-OL-22Q	CaO		10.714	11.000	-0.286	-2.6%
LP2-OL-22Q	Cl	<	0.050	0.062	-0.012	
LP2-OL-22Q	Cr_2O_3		0.376	0.300	0.076	
LP2-OL-22Q	F		0.075	0.095	-0.020	
LP2-OL-22Q	Fe_2O_3		1.898	1.500	0.398	
LP2-OL-22Q	K_2O	<	0.120	0.000	0.120	
LP2-OL-22Q	Li_2O	<	0.215	0.000	0.215	
LP2-OL-22Q	MgO	<	0.166	0.000	0.166	
LP2-OL-22Q	Na_2O		19.243	21.000	-1.757	-8.4%
LP2-OL-22Q	NiO	<	0.127	0.000	0.127	
LP2-OL-22Q	P_2O_5		0.275	0.203	0.072	
LP2-OL-22Q	SiO_2		36.320	36.740	-0.420	-1.1%
LP2-OL-22Q	SnO_2		3.571	3.500	0.071	
LP2-OL-22Q	SO_3		0.104	0.100	0.004	
LP2-OL-22Q	V_2O_5		3.905	4.000	-0.095	
LP2-OL-22Q	ZnO		2.001	2.000	0.001	
LP2-OL-22Q	ZrO_2		5.214	6.500	-1.286	-19.8%
LP2-OL-22Q	Sum		96.773	100.000	-3.227	-3.2%
LP2-OL-22SSM	Al_2O_3		6.514	7.000	-0.486	-6.9%
LP2-OL-22SSM	B_2O_3		5.780	6.000	-0.220	-3.7%
LP2-OL-22SSM	CaO		10.585	11.000	-0.415	-3.8%
LP2-OL-22SSM	Cl	<	0.050	0.062	-0.012	
LP2-OL-22SSM	Cr_2O_3		0.142	0.300	-0.158	
LP2-OL-22SSM	F		0.065	0.095	-0.030	
LP2-OL-22SSM	Fe_2O_3		1.498	1.500	-0.002	
LP2-OL-22SSM	K_2O	<	0.120	0.000	0.120	
LP2-OL-22SSM	Li_2O	<	0.215	0.000	0.215	
LP2-OL-22SSM	MgO	<	0.166	0.000	0.166	
LP2-OL-22SSM	Na_2O		19.984	21.000	-1.016	-4.8%
LP2-OL-22SSM	NiO	<	0.127	0.000	0.127	
LP2-OL-22SSM	P_2O_5		0.243	0.203	0.040	
LP2-OL-22SSM	SiO_2		36.293	36.740	-0.447	-1.2%

Table C-7. 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
LP2-OL-22SSM	SnO_2		3.428	3.500	-0.072	
LP2-OL-22SSM	SO_3		1.139	0.100	1.039	
LP2-OL-22SSM	V_2O_5		3.619	4.000	-0.381	
LP2-OL-22SSM	ZnO		1.973	2.000	-0.027	
LP2-OL-22SSM	ZrO_2		5.261	6.500	-1.239	-19.1%
LP2-OL-22SSM	Sum		97.203	100.000	-2.797	-2.8%
LP2-OL-23Q	Al_2O_3		5.513	6.000	-0.487	-8.1%
LP2-OL-23Q	B_2O_3		13.266	13.725	-0.459	-3.3%
LP2-OL-23Q	CaO		10.438	11.000	-0.562	-5.1%
LP2-OL-23Q	Cl		0.056	0.062	-0.006	
LP2-OL-23Q	Cr_2O_3		0.423	0.300	0.123	
LP2-OL-23Q	F		0.072	0.095	-0.023	
LP2-OL-23Q	Fe_2O_3		0.599	0.000	0.599	
LP2-OL-23Q	K_2O	<	0.120	0.000	0.120	
LP2-OL-23Q	Li_2O	<	0.215	0.000	0.215	
LP2-OL-23Q	MgO		1.306	1.350	-0.044	
LP2-OL-23Q	Na_2O		20.456	21.000	-0.544	-2.6%
LP2-OL-23Q	NiO	<	0.127	0.000	0.127	
LP2-OL-23Q	P_2O_5		0.195	0.203	-0.008	
LP2-OL-23Q	SiO_2		36.411	34.900	1.511	4.3%
LP2-OL-23Q	SnO_2		3.545	3.500	0.045	
LP2-OL-23Q	SO_3		1.160	1.315	-0.155	
LP2-OL-23Q	V_2O_5	<	0.179	0.000	0.179	
LP2-OL-23Q	ZnO		3.417	3.600	-0.183	
LP2-OL-23Q	ZrO_2		2.573	2.950	-0.377	
LP2-OL-23Q	Sum		100.072	100.000	0.072	0.1%
LP2-OL-23SSM	Al_2O_3		5.338	6.000	-0.662	-11.0%
LP2-OL-23SSM	B_2O_3		12.477	13.725	-1.248	-9.1%
LP2-OL-23SSM	CaO		10.407	11.000	-0.593	-5.4%
LP2-OL-23SSM	Cl	<	0.050	0.062	-0.012	
LP2-OL-23SSM	Cr_2O_3		0.216	0.300	-0.084	
LP2-OL-23SSM	F		0.054	0.095	-0.042	
LP2-OL-23SSM	Fe_2O_3	<	0.143	0.000	0.143	
LP2-OL-23SSM	K_2O	<	0.120	0.000	0.120	
LP2-OL-23SSM	Li_2O	<	0.215	0.000	0.215	
LP2-OL-23SSM	MgO		1.339	1.350	-0.011	
LP2-OL-23SSM	Na_2O		20.523	21.000	-0.477	-2.3%
LP2-OL-23SSM	NiO	<	0.127	0.000	0.127	
LP2-OL-23SSM	P_2O_5		0.192	0.203	-0.011	
LP2-OL-23SSM	SiO_2		36.636	34.900	1.736	5.0%
LP2-OL-23SSM	SnO_2		3.333	3.500	-0.167	
LP2-OL-23SSM	SO_3		1.707	1.315	0.392	
LP2-OL-23SSM	V_2O_5	<	0.179	0.000	0.179	
LP2-OL-23SSM	ZnO		3.451	3.600	-0.149	
LP2-OL-23SSM	ZrO_2		2.580	2.950	-0.370	
LP2-OL-23SSM	Sum		99.087	100.000	-0.913	-0.9%
LP2-OL-24Q	Al_2O_3		11.403	12.500	-1.097	-8.8%
LP2-OL-24Q	B_2O_3		5.804	6.000	-0.196	-3.3%
LP2-OL-24Q	CaO		7.423	7.245	0.178	2.5%

Table C-7. 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
LP2-OL-24Q	Cl		0.061	0.062	-0.001	
LP2-OL-24Q	Cr_2O_3		0.421	0.300	0.121	
LP2-OL-24Q	F		0.095	0.095	0.000	
LP2-OL-24Q	Fe_2O_3		1.916	1.500	0.416	
LP2-OL-24Q	K_2O	<	0.120	0.000	0.120	
LP2-OL-24Q	Li_2O	<	0.215	0.000	0.215	
LP2-OL-24Q	MgO		1.351	1.350	0.001	
LP2-OL-24Q	Na_2O		25.241	25.195	0.046	0.2%
LP2-OL-24Q	NiO	<	0.127	0.000	0.127	
LP2-OL-24Q	P_2O_5		0.192	0.203	-0.011	
LP2-OL-24Q	SiO_2		33.956	34.900	-0.944	-2.7%
LP2-OL-24Q	SnO_2		0.250	0.000	0.250	
LP2-OL-24Q	SO_3		0.128	0.100	0.028	
LP2-OL-24Q	V_2O_5		4.084	4.000	0.084	
LP2-OL-24Q	ZnO		3.809	3.600	0.209	
LP2-OL-24Q	ZrO_2		2.627	2.950	-0.323	
LP2-OL-24Q	Sum		99.225	100.000	-0.775	-0.8%
LP2-OL-24SSM	Al_2O_3		11.408	12.500	-1.092	-8.7%
LP2-OL-24SSM	B_2O_3		5.426	6.000	-0.574	-9.6%
LP2-OL-24SSM	CaO		7.265	7.245	0.020	0.3%
LP2-OL-24SSM	Cl	<	0.050	0.062	-0.012	
LP2-OL-24SSM	Cr_2O_3		0.142	0.300	-0.158	
LP2-OL-24SSM	F		0.070	0.095	-0.025	
LP2-OL-24SSM	Fe_2O_3		1.440	1.500	-0.060	
LP2-OL-24SSM	K_2O	<	0.120	0.000	0.120	
LP2-OL-24SSM	Li_2O	<	0.215	0.000	0.215	
LP2-OL-24SSM	MgO		1.342	1.350	-0.008	
LP2-OL-24SSM	Na_2O		24.837	25.195	-0.358	-1.4%
LP2-OL-24SSM	NiO	<	0.127	0.000	0.127	
LP2-OL-24SSM	P_2O_5		0.190	0.203	-0.013	
LP2-OL-24SSM	SiO_2		33.865	34.900	-1.035	-3.0%
LP2-OL-24SSM	SnO_2	<	0.160	0.000	0.160	
LP2-OL-24SSM	SO_3		1.385	0.100	1.285	
LP2-OL-24SSM	V_2O_5		3.678	4.000	-0.322	
LP2-OL-24SSM	ZnO		3.741	3.600	0.141	
LP2-OL-24SSM	ZrO_2		2.654	2.950	-0.296	
LP2-OL-24SSM	Sum		98.115	100.000	-1.885	-1.9%
LP2-OL-25Q	Al_2O_3		5.782	6.000	-0.218	-3.6%
LP2-OL-25Q	B_2O_3		13.419	13.750	-0.331	-2.4%
LP2-OL-25Q	CaO		2.624	2.578	0.046	
LP2-OL-25Q	Cl		0.058	0.062	-0.004	
LP2-OL-25Q	Cr_2O_3		0.402	0.300	0.102	
LP2-OL-25Q	F		0.076	0.095	-0.020	
LP2-OL-25Q	Fe_2O_3		1.991	1.500	0.491	
LP2-OL-25Q	K_2O	<	0.120	0.000	0.120	
LP2-OL-25Q	Li_2O	<	0.215	0.000	0.215	
LP2-OL-25Q	MgO	<	0.166	0.000	0.166	
LP2-OL-25Q	Na_2O		23.860	26.000	-2.140	-8.2%
LP2-OL-25Q	NiO	<	0.127	0.000	0.127	

Table C-7. 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
LP2-OL-25Q	P_2O_5		0.279	0.203	0.076	
LP2-OL-25Q	SiO_2		35.823	34.900	0.923	2.6%
LP2-OL-25Q	SnO_2		3.710	3.500	0.210	
LP2-OL-25Q	SO_3		0.790	1.012	-0.222	
LP2-OL-25Q	V_2O_5	<	0.179	0.000	0.179	
LP2-OL-25Q	ZnO		3.535	3.600	-0.065	
LP2-OL-25Q	ZrO_2		5.356	6.500	-1.144	-17.6%
LP2-OL-25Q	Sum		98.511	100.000	-1.489	-1.5%
LP2-OL-25SSM	Al_2O_3		5.678	6.000	-0.322	-5.4%
LP2-OL-25SSM	B_2O_3		12.912	13.750	-0.838	-6.1%
LP2-OL-25SSM	CaO		2.686	2.578	0.108	
LP2-OL-25SSM	Cl	<	0.050	0.062	-0.012	
LP2-OL-25SSM	Cr_2O_3		0.145	0.300	-0.155	
LP2-OL-25SSM	F		0.070	0.095	-0.025	
LP2-OL-25SSM	Fe_2O_3		1.519	1.500	0.019	
LP2-OL-25SSM	K_2O	<	0.120	0.000	0.120	
LP2-OL-25SSM	Li_2O	<	0.215	0.000	0.215	
LP2-OL-25SSM	MgO	<	0.166	0.000	0.166	
LP2-OL-25SSM	Na_2O		24.062	26.000	-1.938	-7.5%
LP2-OL-25SSM	NiO	<	0.127	0.000	0.127	
LP2-OL-25SSM	P_2O_5		0.252	0.203	0.049	
LP2-OL-25SSM	SiO_2		35.256	34.900	0.356	1.0%
LP2-OL-25SSM	SnO_2		3.495	3.500	-0.005	
LP2-OL-25SSM	SO_3		1.248	1.012	0.236	
LP2-OL-25SSM	V_2O_5	<	0.179	0.000	0.179	
LP2-OL-25SSM	ZnO		3.644	3.600	0.044	
LP2-OL-25SSM	ZrO_2		5.538	6.500	-0.962	-14.8%
LP2-OL-25SSM	Sum		97.363	100.000	-2.637	-2.6%
LRM (Set 1)	Al_2O_3		9.607	9.510	0.097	1.0%
LRM (Set 1)	B_2O_3		7.822	7.850	-0.028	-0.4%
LRM (Set 1)	CaO		0.507	0.540	-0.033	
LRM (Set 1)	Cl	<	0.050	0.000	0.050	
LRM (Set 1)	Cr_2O_3		0.189	0.190	-0.001	
LRM (Set 1)	F		0.870	0.860	0.010	
LRM (Set 1)	Fe_2O_3		1.397	1.380	0.017	
LRM (Set 1)	K_2O		1.386	1.480	-0.094	
LRM (Set 1)	Li_2O	<	0.215	0.110	0.105	
LRM (Set 1)	MgO	<	0.166	0.100	0.066	
LRM (Set 1)	Na_2O		19.389	20.030	-0.641	-3.2%
LRM (Set 1)	NiO		0.180	0.190	-0.010	
LRM (Set 1)	P_2O_5		0.488	0.540	-0.052	
LRM (Set 1)	SiO_2		56.618	54.200	2.418	4.5%
LRM (Set 1)	SnO_2	<	0.127	0.000	0.127	
LRM (Set 1)	SO_3		0.219	0.300	-0.081	
LRM (Set 1)	V_2O_5	<	0.179	0.000	0.179	
LRM (Set 1)	ZnO	<	0.124	0.000	0.124	
LRM (Set 1)	ZrO_2		0.883	0.930	-0.047	
LRM (Set 1)	Sum		100.416	98.210	2.206	2.2%
LRM (Set 2)	Al_2O_3		9.210	9.510	-0.300	-3.2%

Table C-7. 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
LRM (Set 2)	B_2O_3		7.513	7.850	-0.337	-4.3%
LRM (Set 2)	CaO		0.533	0.540	-0.007	
LRM (Set 2)	Cl	<	0.050	0.000	0.050	
LRM (Set 2)	Cr_2O_3		0.197	0.190	0.007	
LRM (Set 2)	F		0.908	0.860	0.048	
LRM (Set 2)	Fe_2O_3		1.402	1.380	0.022	
LRM (Set 2)	K_2O		1.303	1.480	-0.177	
LRM (Set 2)	Li_2O	<	0.215	0.110	0.105	
LRM (Set 2)	MgO	<	0.166	0.100	0.066	
LRM (Set 2)	Na_2O		20.437	20.030	0.407	2.0%
LRM (Set 2)	NiO		0.188	0.190	-0.002	
LRM (Set 2)	P_2O_5		0.465	0.540	-0.075	
LRM (Set 2)	SiO_2		55.587	54.200	1.387	2.6%
LRM (Set 2)	SnO_2	<	0.167	0.000	0.167	
LRM (Set 2)	SO_3		0.210	0.300	-0.090	
LRM (Set 2)	V_2O_5	<	0.179	0.000	0.179	
LRM (Set 2)	ZnO	<	0.124	0.000	0.124	
LRM (Set 2)	ZrO_2		1.160	0.930	0.230	
LRM (Set 2)	Sum		100.014	98.210	1.804	1.8%

Exhibit C-1. Plots of Oxide Measurements by Set in Analytical Sequence

Set=1, Analyte=Al2O3 (wt%), Prep Method=PF
Variability Chart for Measured

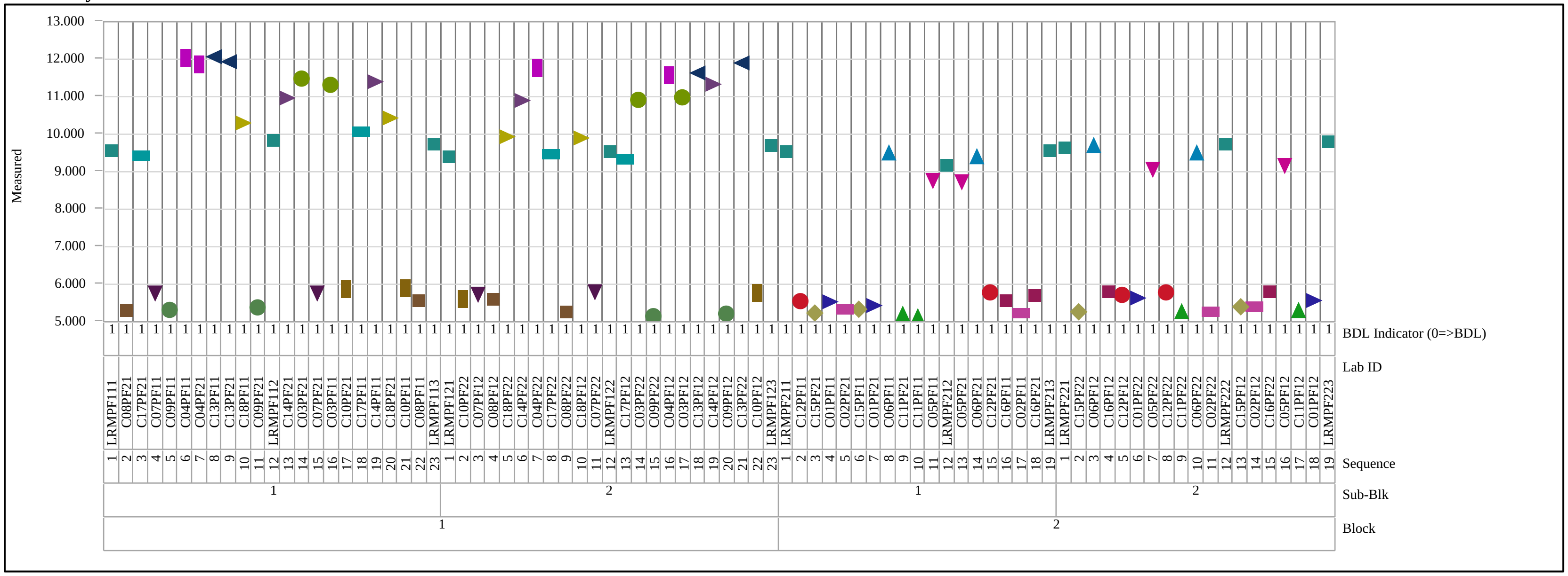


Exhibit C-1. Plots of Oxide Measurements by Set in Analytical Sequence (continued)

Set=2, Analyte=Al2O3 (wt%), Prep Method=PF
Variability Chart for Measured

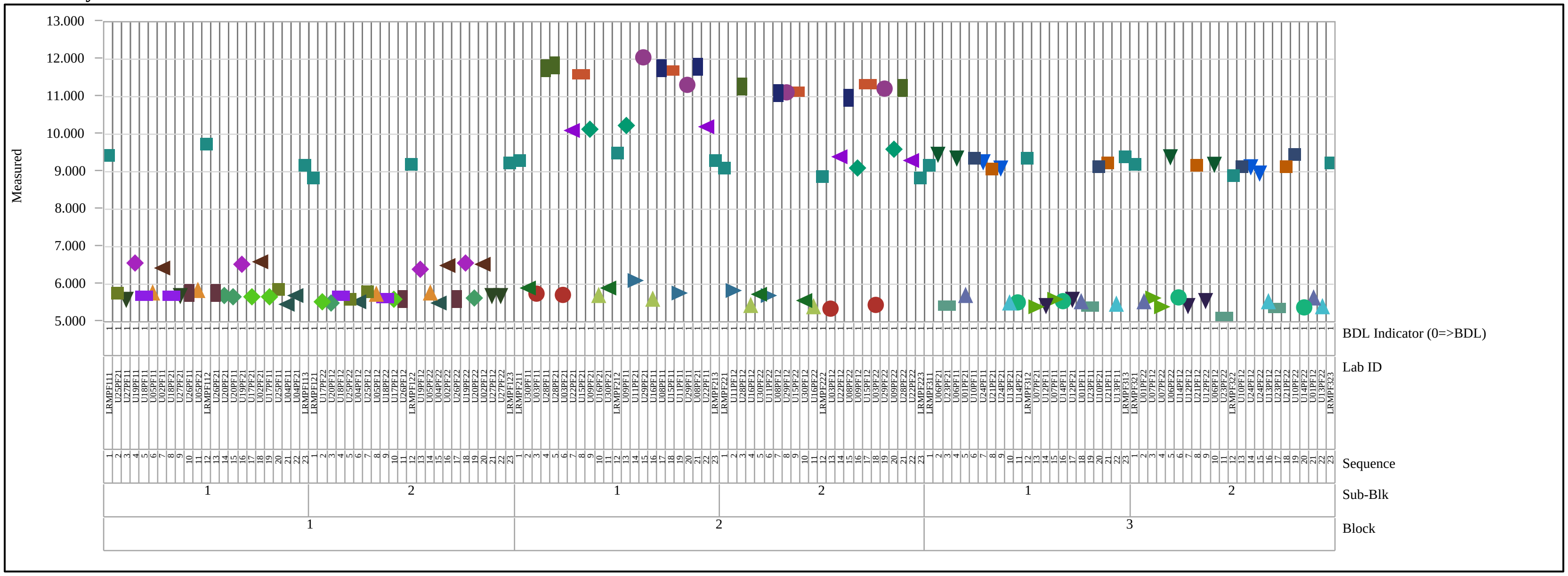


Exhibit C-1. Plots of Oxide Measurements by Set in Analytical Sequence (continued)

Set=1, Analyte=B2O3 (wt%), Prep Method=PF
Variability Chart for Measured

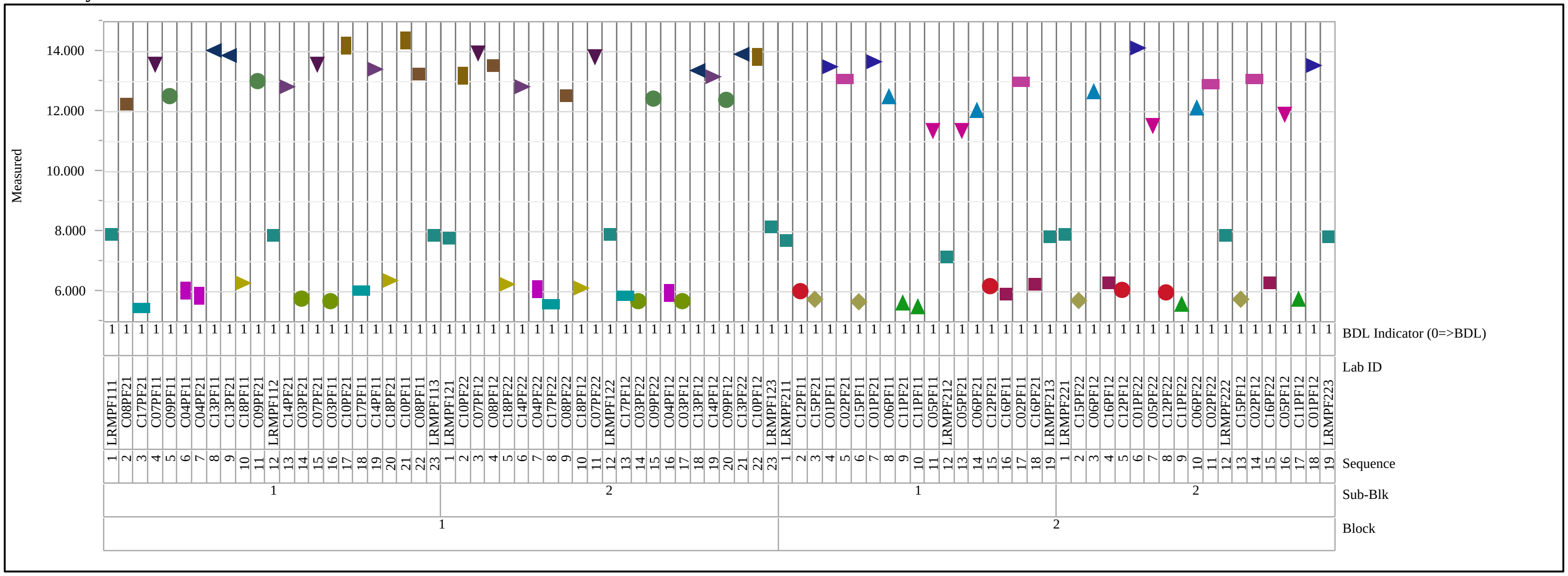


Exhibit C-1. Plots of Oxide Measurements by Set in Analytical Sequence (continued)

Set=2, Analyte=B2O3 (wt%), Prep Method=PF
Variability Chart for Measured

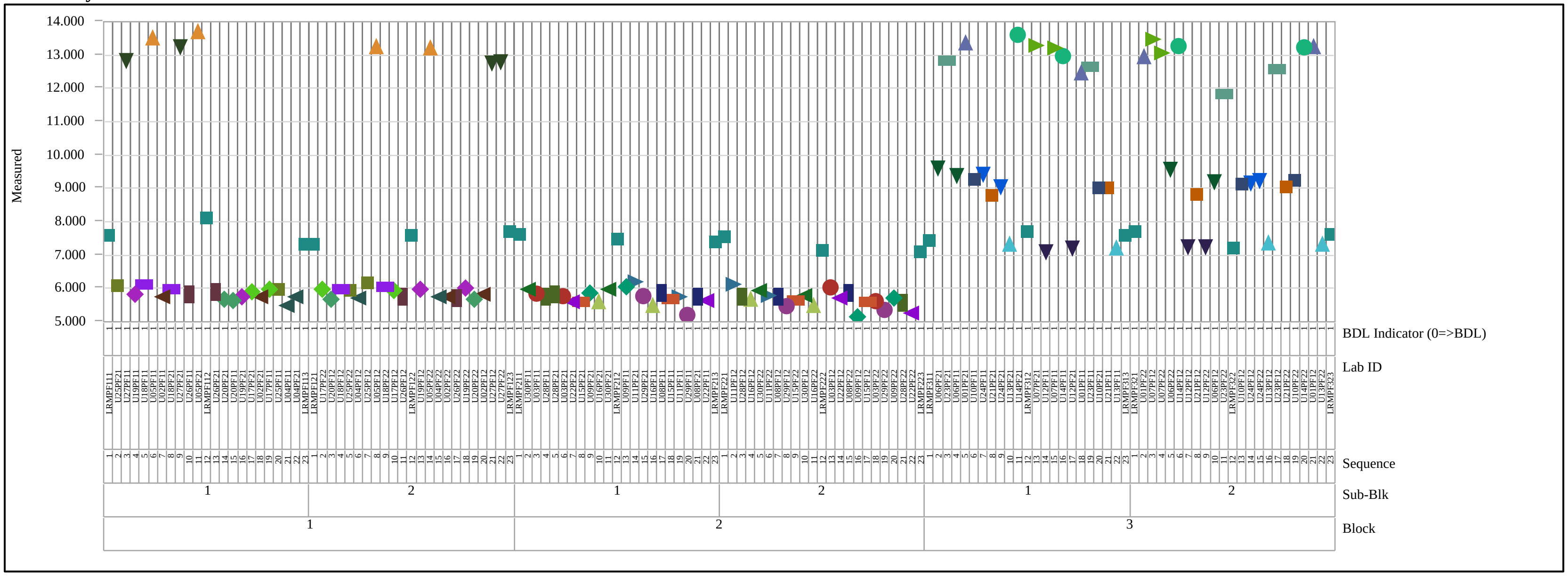


Exhibit C-1. Plots of Oxide Measurements by Set in Analytical Sequence (continued)

Set=1, Analyte=CaO (wt%), Prep Method=LM
Variability Chart for Measured

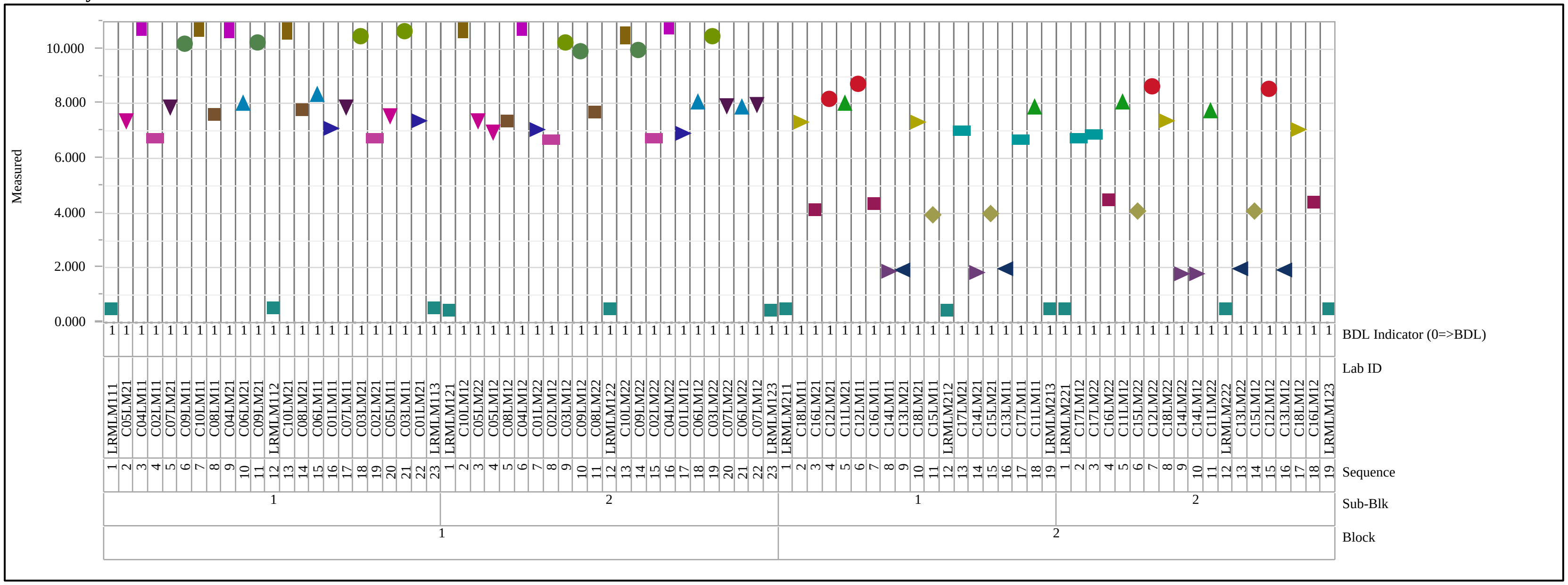


Exhibit C-1. Plots of Oxide Measurements by Set in Analytical Sequence (continued)

Set=2, Analyte=CaO (wt%), Prep Method=LM
Variability Chart for Measured

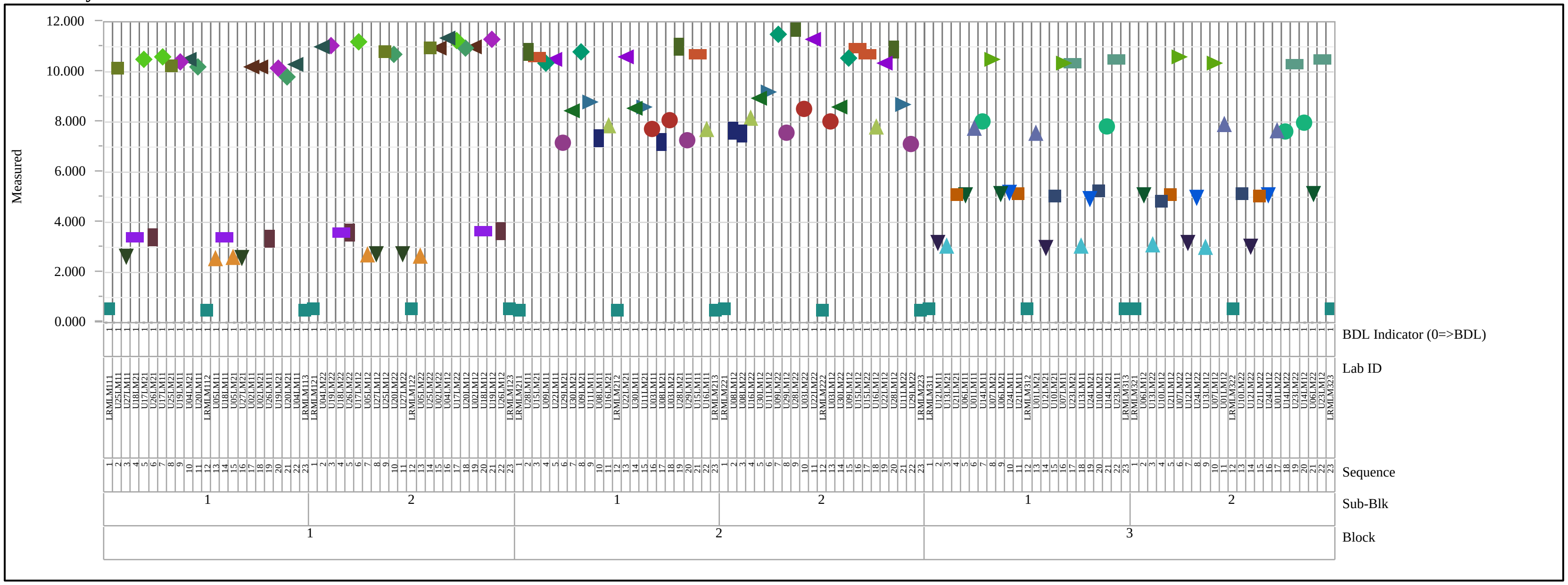


Exhibit C-1. Plots of Oxide Measurements by Set in Analytical Sequence (continued)

Set=1, Analyte=Cl (wt%), Prep Method=KH
Variability Chart for Measured

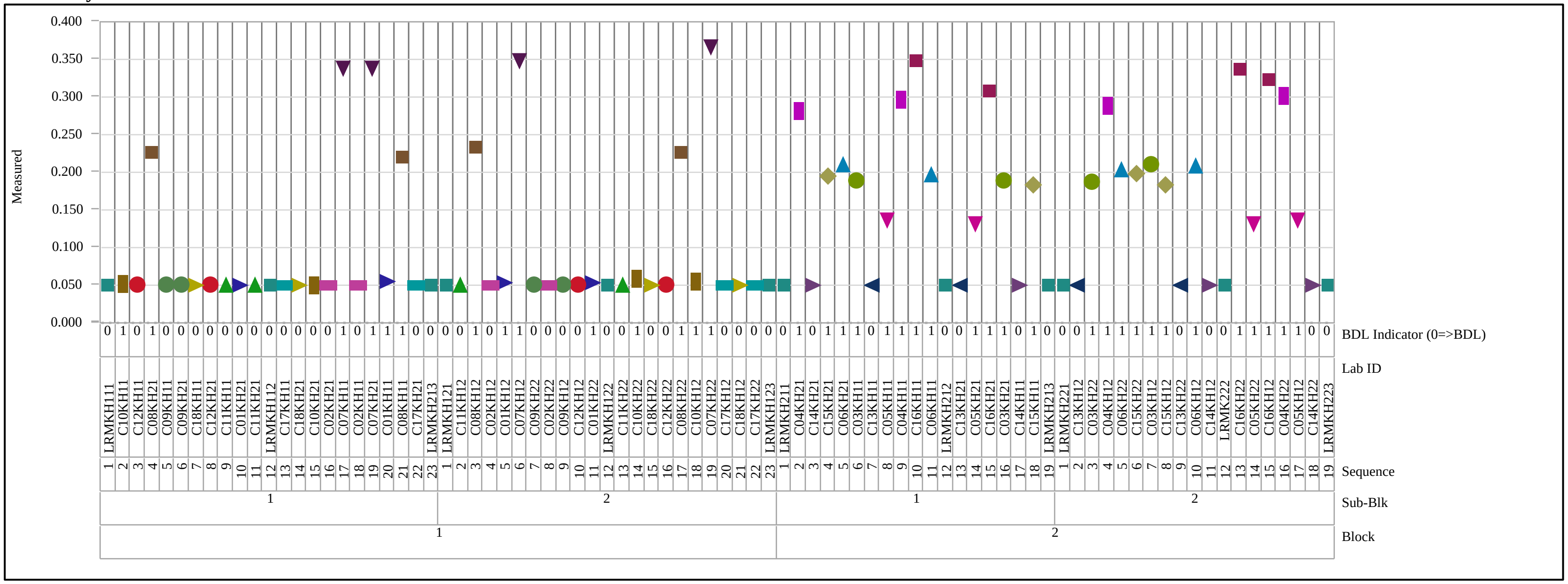


Exhibit C-1. Plots of Oxide Measurements by Set in Analytical Sequence (continued)

Set=2, Analyte=Cl (wt%), Prep Method=KH
Variability Chart for Measured

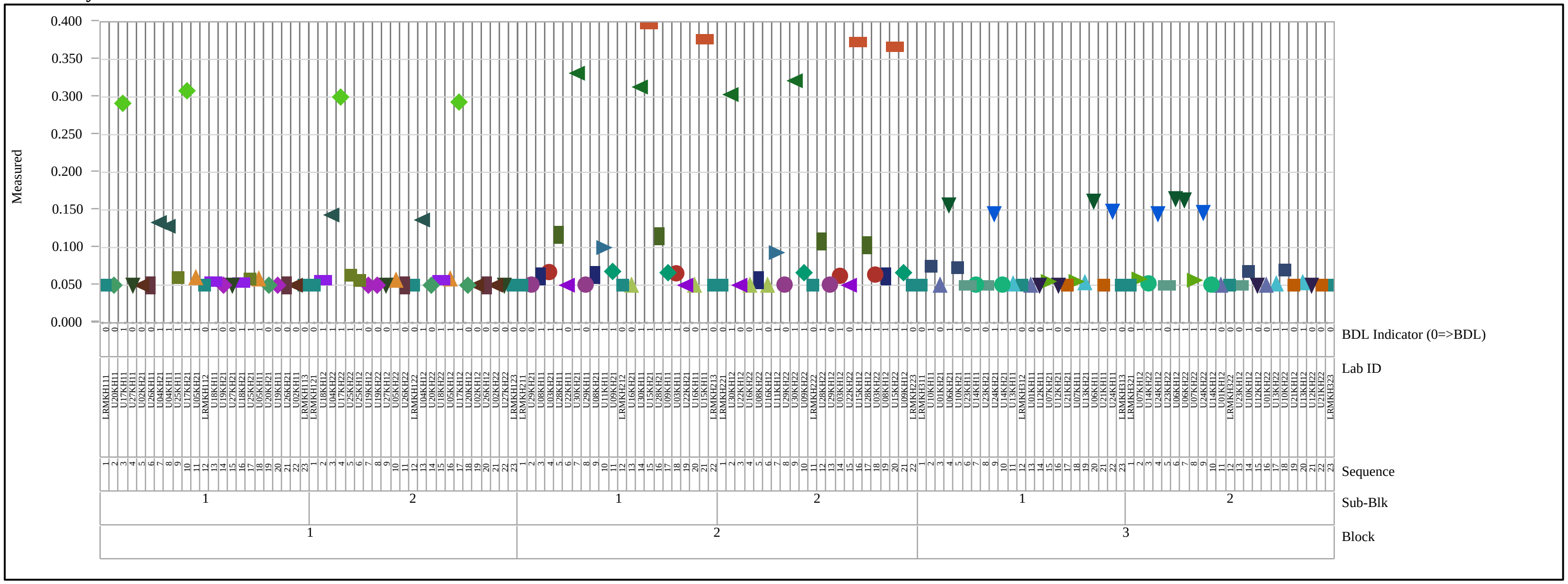


Exhibit C-1. Plots of Oxide Measurements by Set in Analytical Sequence (continued)

Set=1, Analyte=Cr2O3 (wt%), Prep Method=LM
Variability Chart for Measured

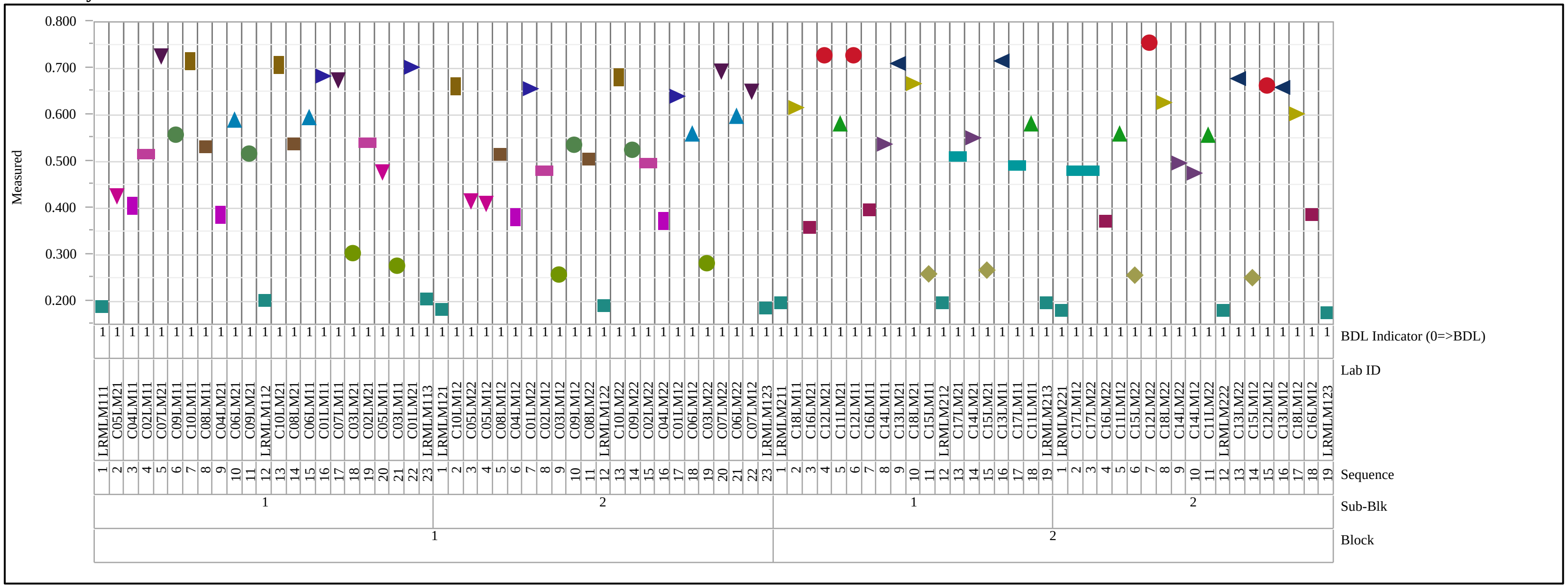


Exhibit C-1. Plots of Oxide Measurements by Set in Analytical Sequence (continued)

Set=2, Analyte=Cr2O3 (wt%), Prep Method=LM
Variability Chart for Measured

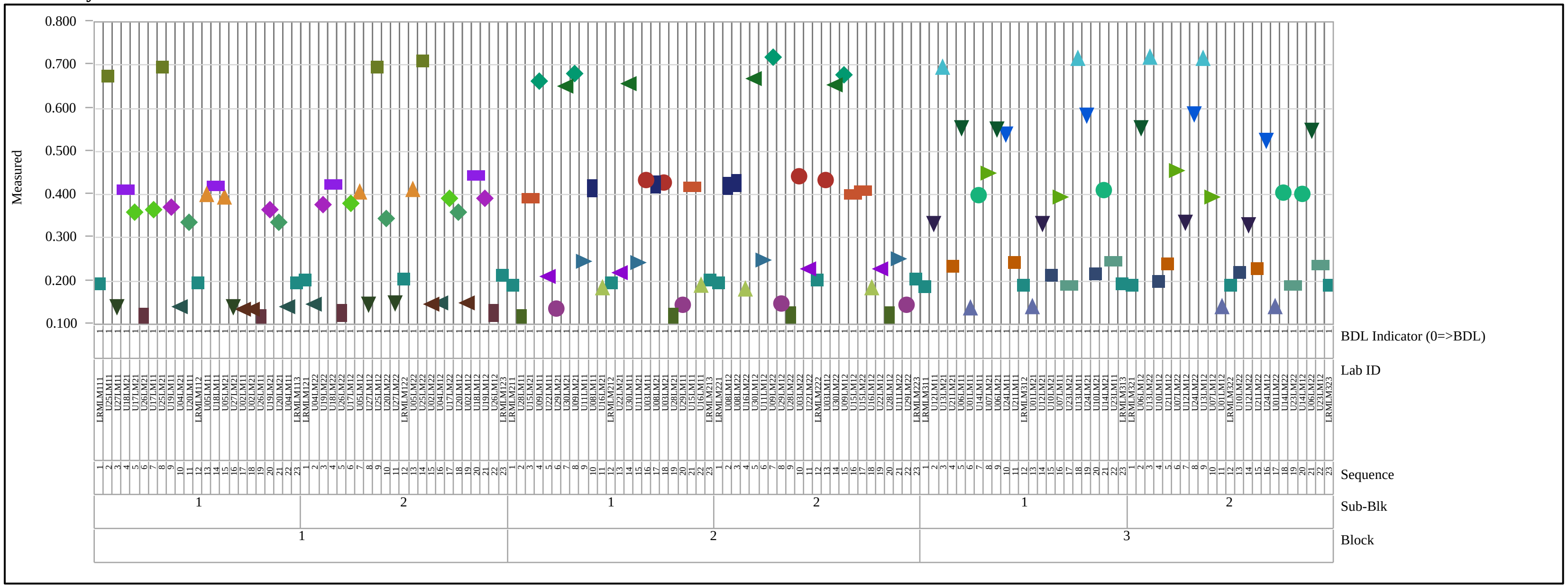


Exhibit C-1. Plots of Oxide Measurements by Set in Analytical Sequence (continued)

Set=1, Analyte=F (wt%), Prep Method=KH
Variability Chart for Measured

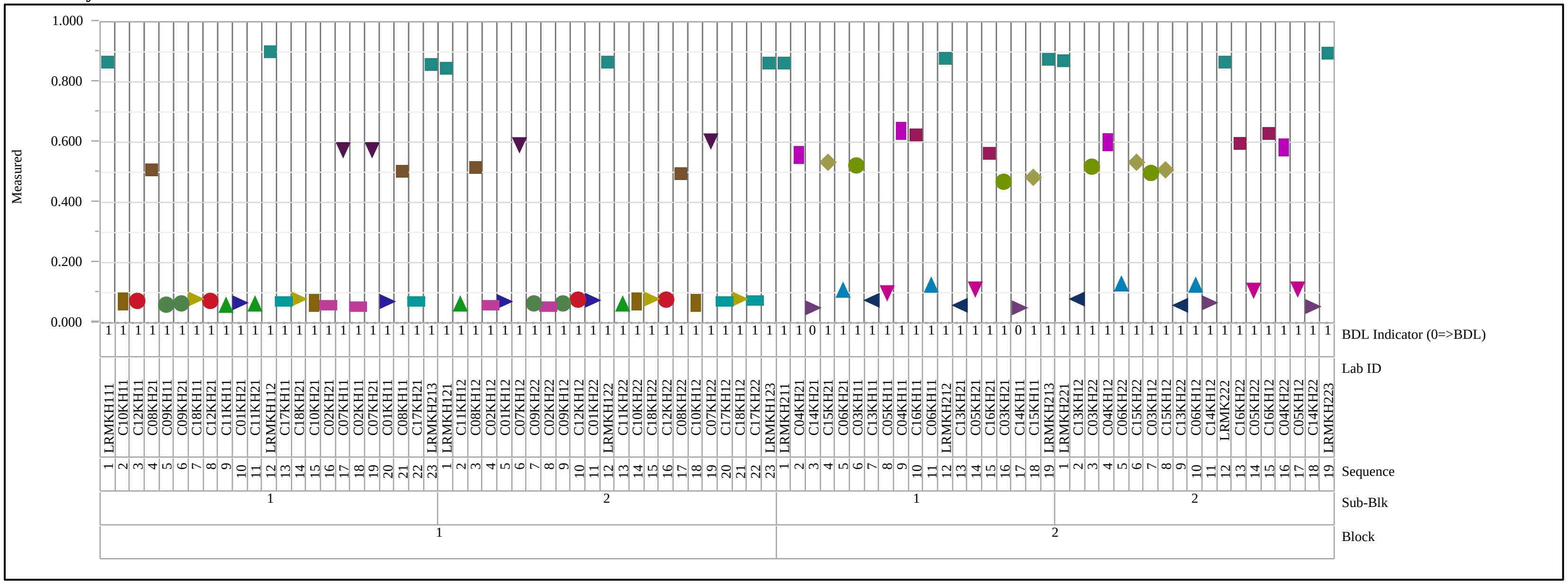


Exhibit C-1. Plots of Oxide Measurements by Set in Analytical Sequence (continued)

Set=2, Analyte=F (wt%), Prep Method=KH
Variability Chart for Measured

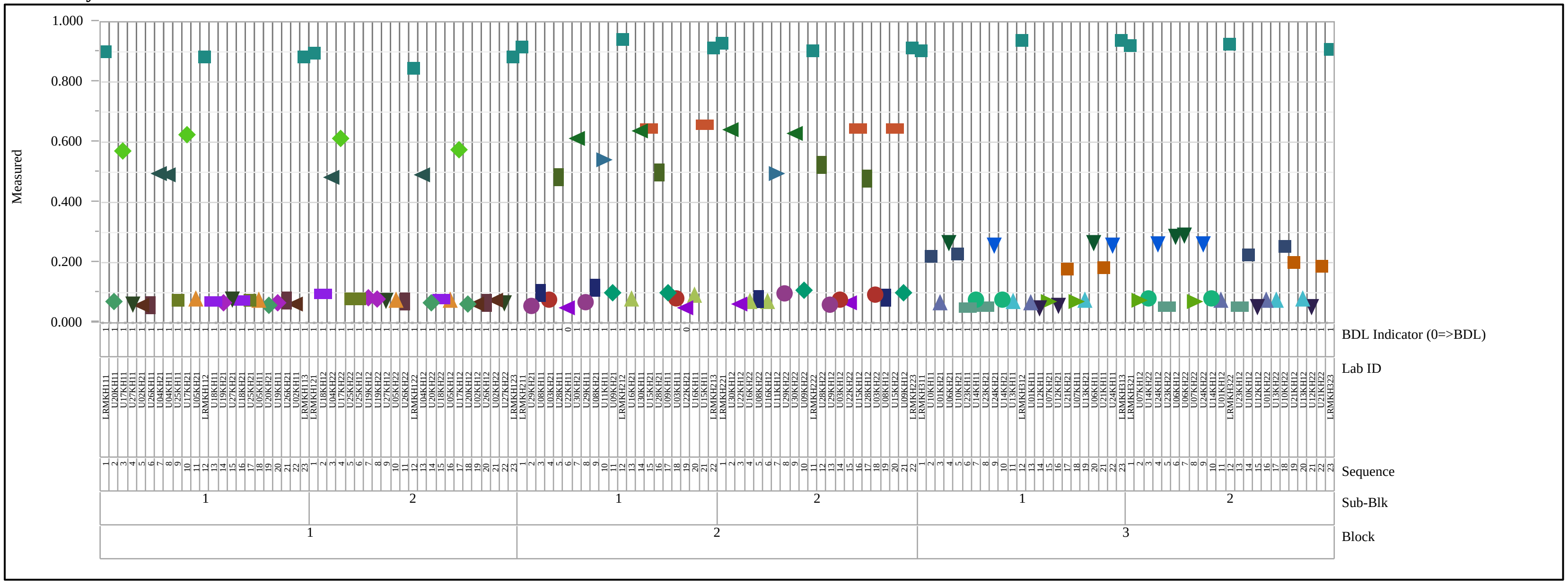


Exhibit C-1. Plots of Oxide Measurements by Set in Analytical Sequence (continued)

Set=1, Analyte=Fe2O3 (wt%), Prep Method=PF
Variability Chart for Measured

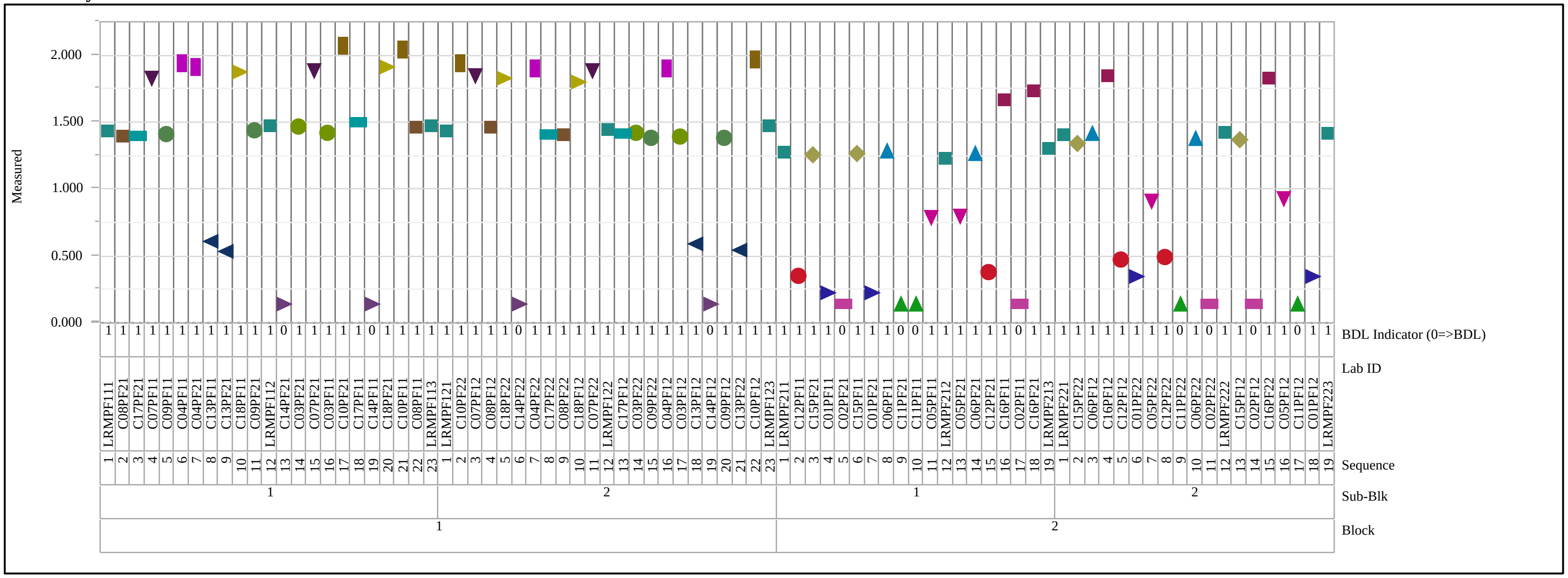


Exhibit C-1. Plots of Oxide Measurements by Set in Analytical Sequence (continued)

Set=2, Analyte=Fe2O3 (wt%), Prep Method=PF
Variability Chart for Measured

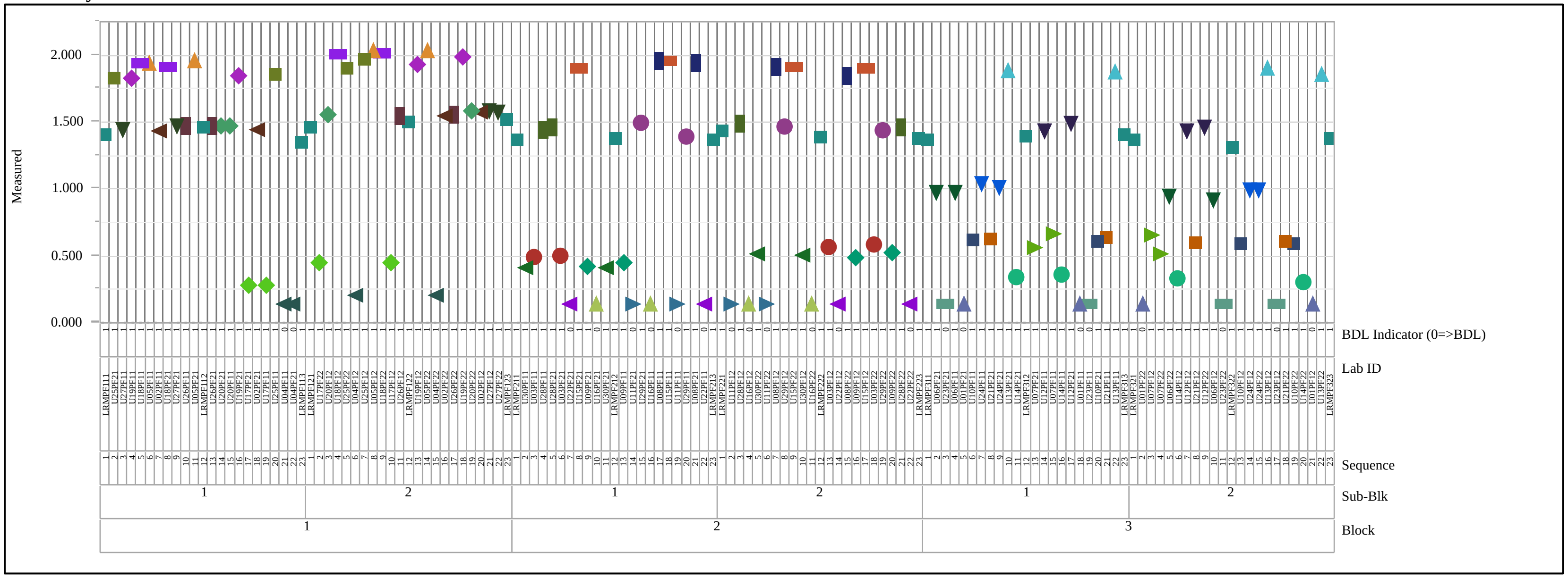


Exhibit C-1. Plots of Oxide Measurements by Set in Analytical Sequence (continued)

Set=1, Analyte=K2O (wt%), Prep Method=LM
Variability Chart for Measured

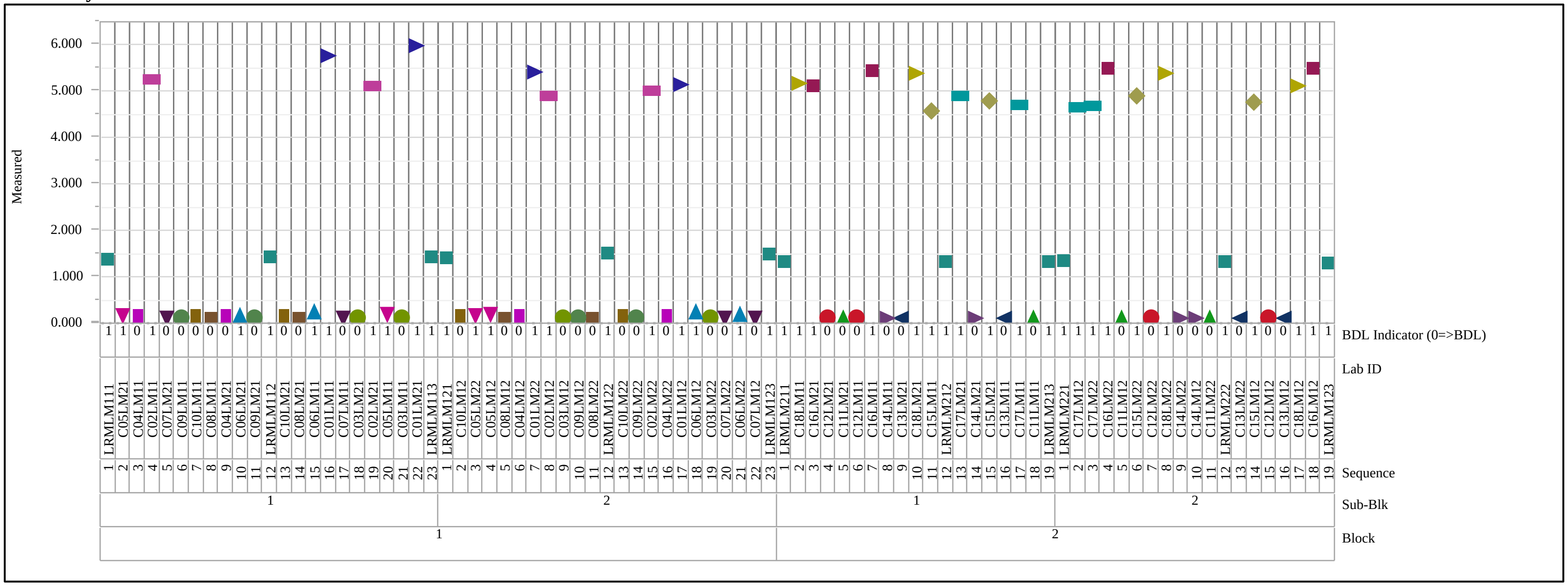


Exhibit C-1. Plots of Oxide Measurements by Set in Analytical Sequence (continued)

Set=2, Analyte=K2O (wt%), Prep Method=LM
Variability Chart for Measured

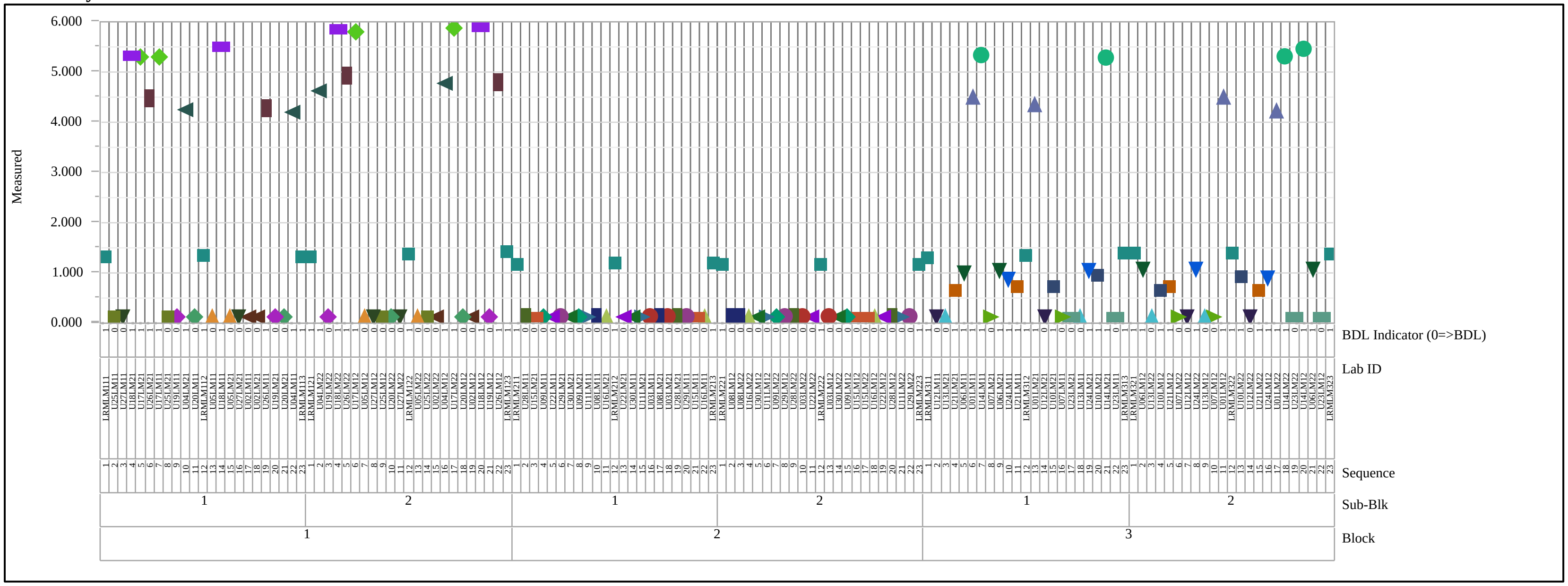


Exhibit C-1. Plots of Oxide Measurements by Set in Analytical Sequence (continued)

Set=1, Analyte=Li2O (wt%), Prep Method=PF
Variability Chart for Measured

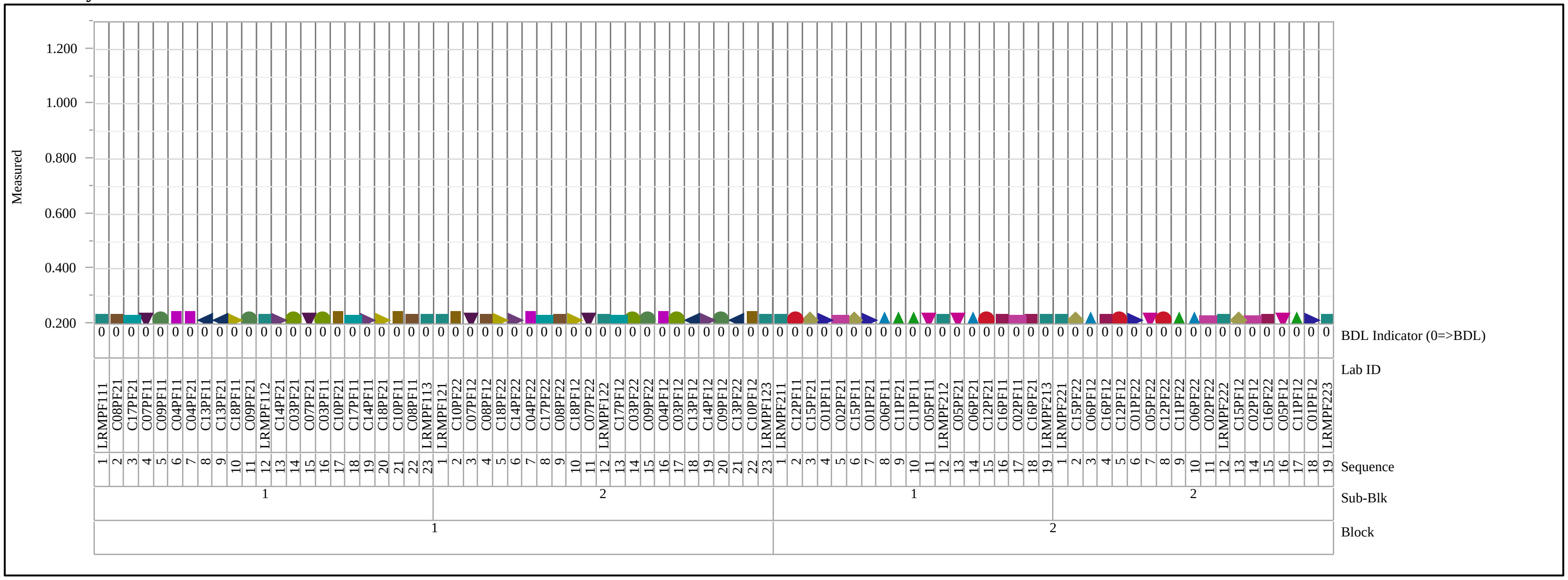


Exhibit C-1. Plots of Oxide Measurements by Set in Analytical Sequence (continued)

Set=2, Analyte=Li2O (wt%), Prep Method=PF
Variability Chart for Measured

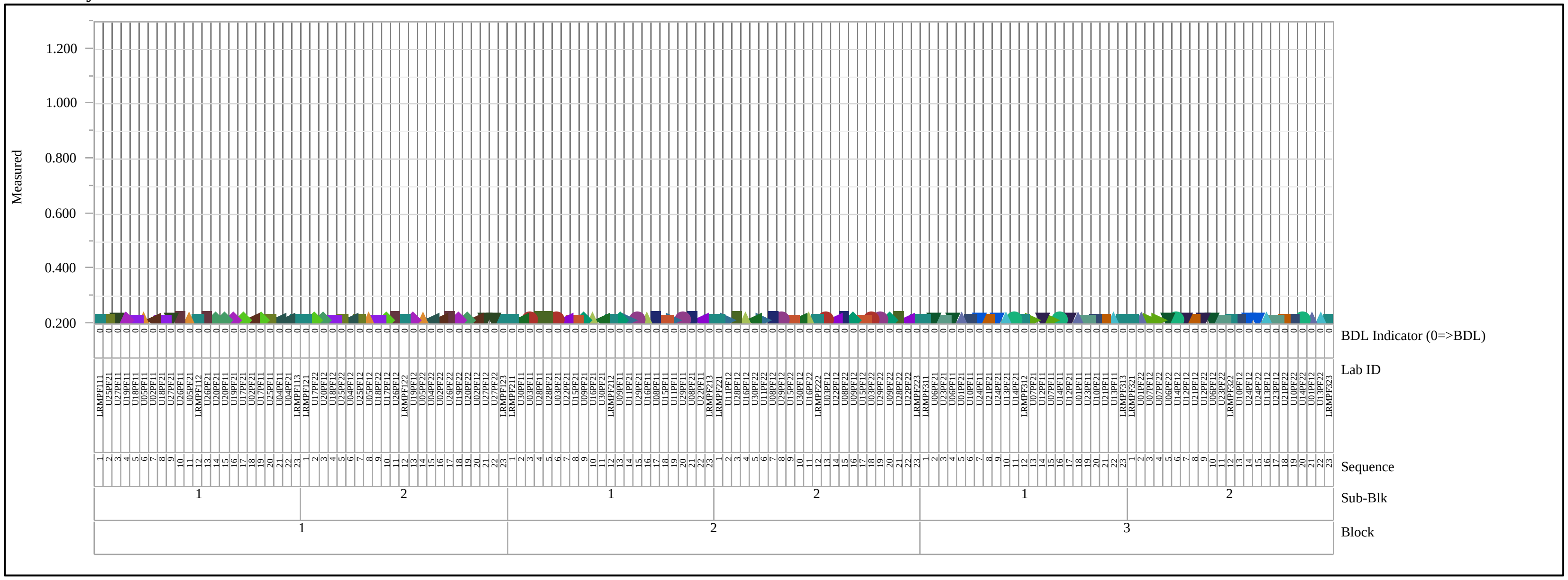


Exhibit C-1. Plots of Oxide Measurements by Set in Analytical Sequence (continued)

Set=1, Analyte=MgO (wt%), Prep Method=LM
Variability Chart for Measured

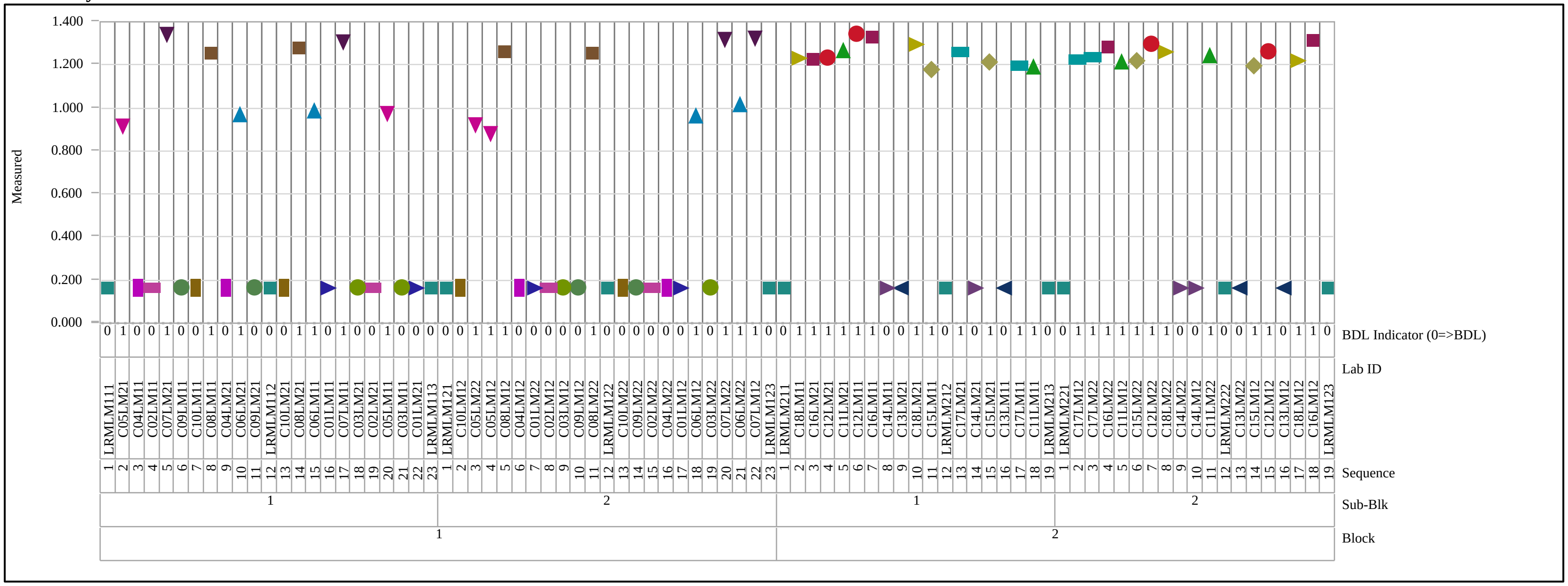


Exhibit C-1. Plots of Oxide Measurements by Set in Analytical Sequence (continued)

Set=2, Analyte=MgO (wt%), Prep Method=LM
Variability Chart for Measured

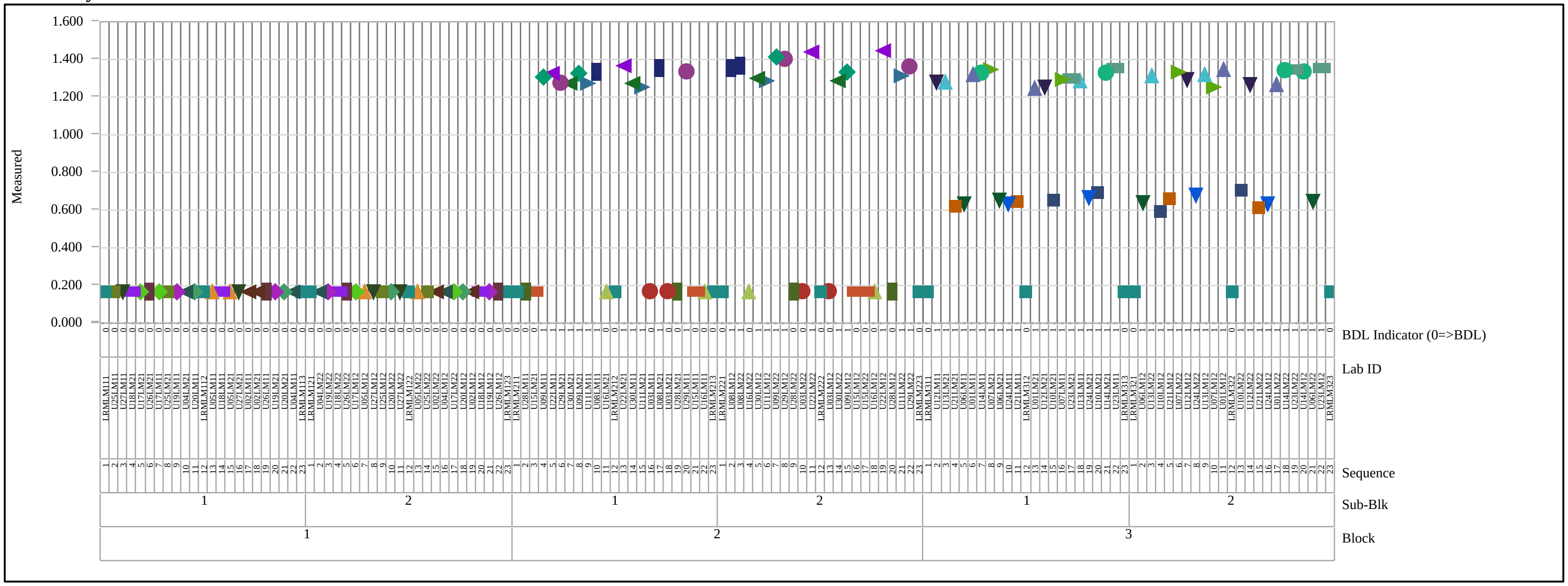


Exhibit C-1. Plots of Oxide Measurements by Set in Analytical Sequence (continued)

Set=1, Analyte=Na2O (wt%), Prep Method=LM
Variability Chart for Measured

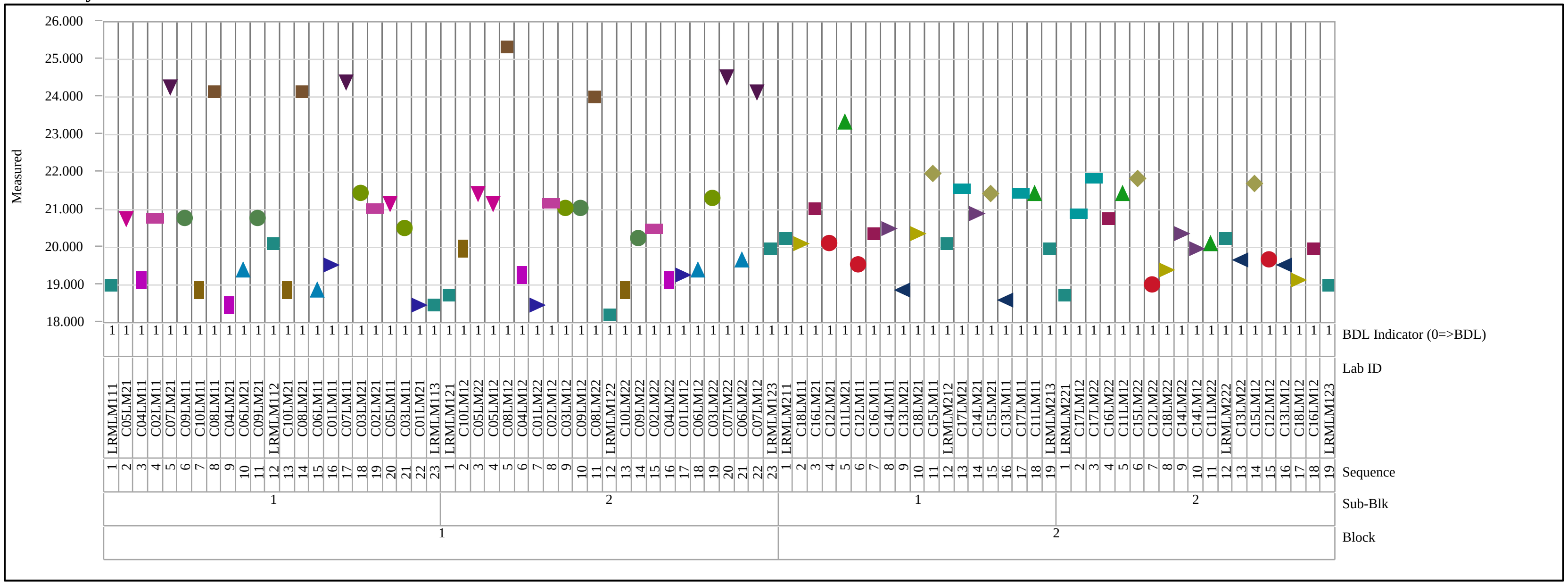


Exhibit C-1. Plots of Oxide Measurements by Set in Analytical Sequence (continued)

Set=2, Analyte=Na2O (wt%), Prep Method=LM
Variability Chart for Measured

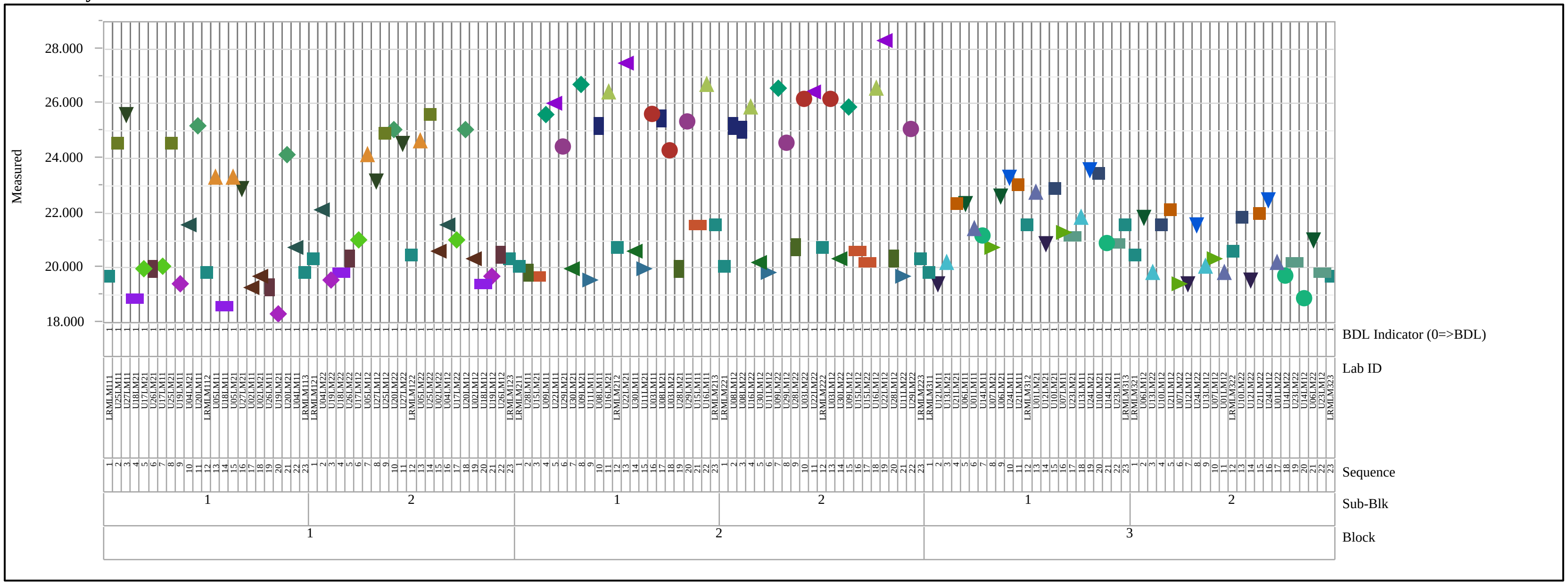


Exhibit C-1. Plots of Oxide Measurements by Set in Analytical Sequence (continued)

Set=1, Analyte=NiO (wt%), Prep Method=LM
Variability Chart for Measured

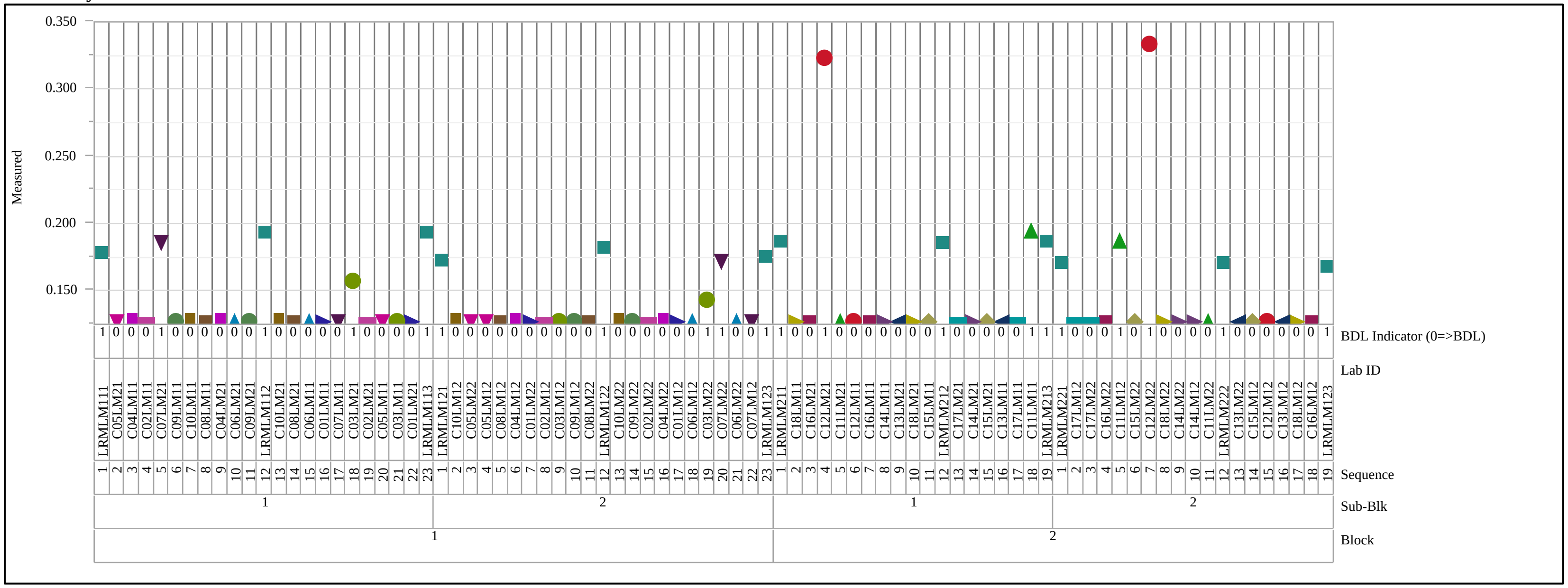


Exhibit C-1. Plots of Oxide Measurements by Set in Analytical Sequence (continued)

Set=2, Analyte=NiO (wt%), Prep Method=LM
Variability Chart for Measured

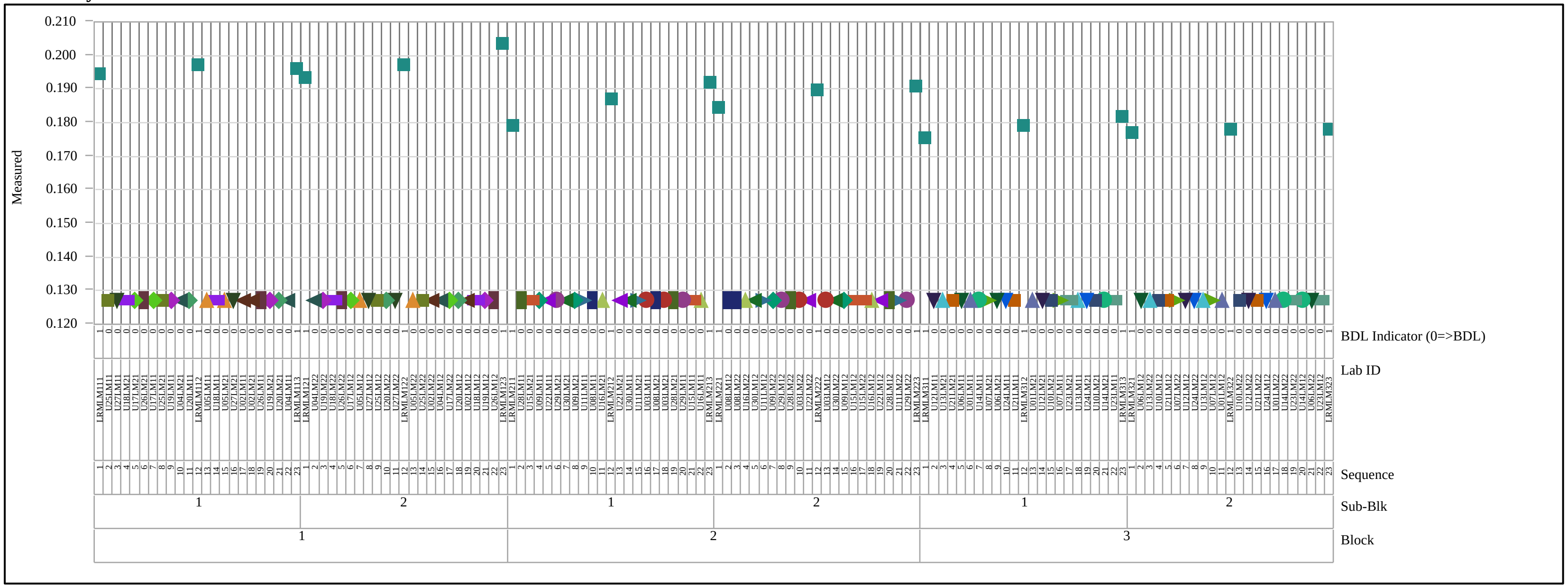


Exhibit C-1. Plots of Oxide Measurements by Set in Analytical Sequence (continued)

Set=1, Analyte=P2O5 (wt%), Prep Method=LM
Variability Chart for Measured

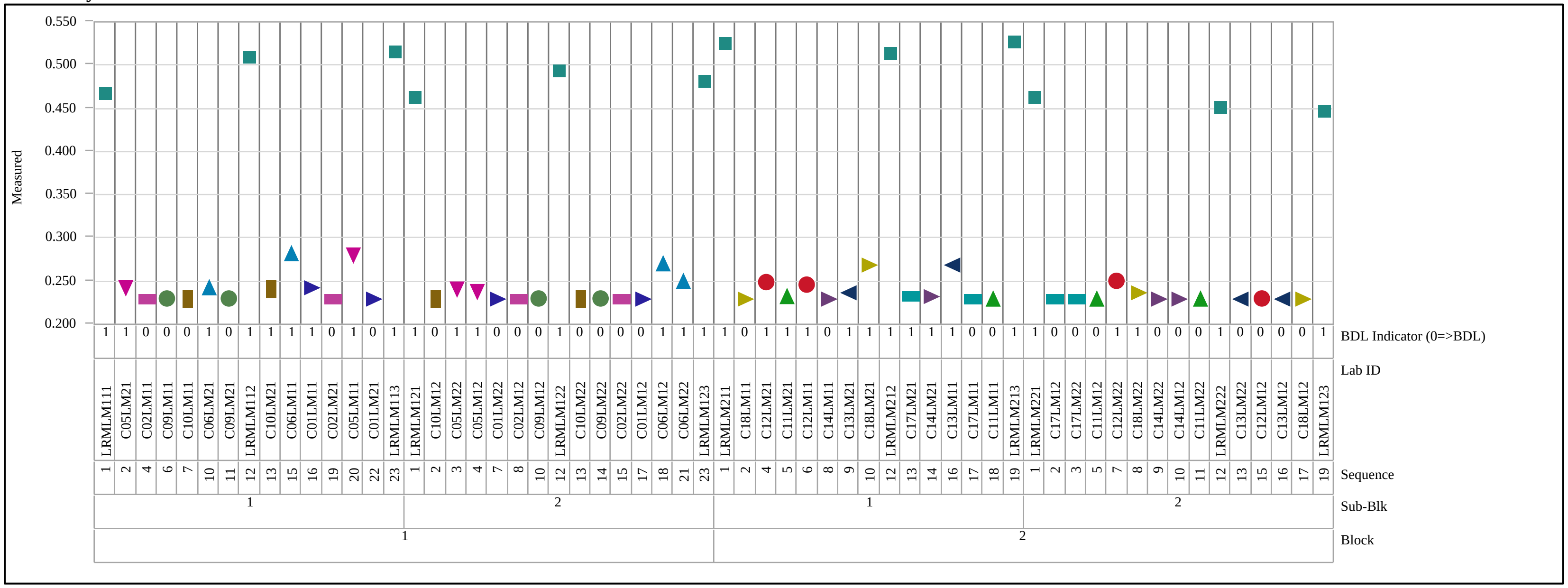


Exhibit C-1. Plots of Oxide Measurements by Set in Analytical Sequence (continued)

Set=1, Analyte=P2O5 (wt%), Prep Method=PFSA
Variability Chart for Measured

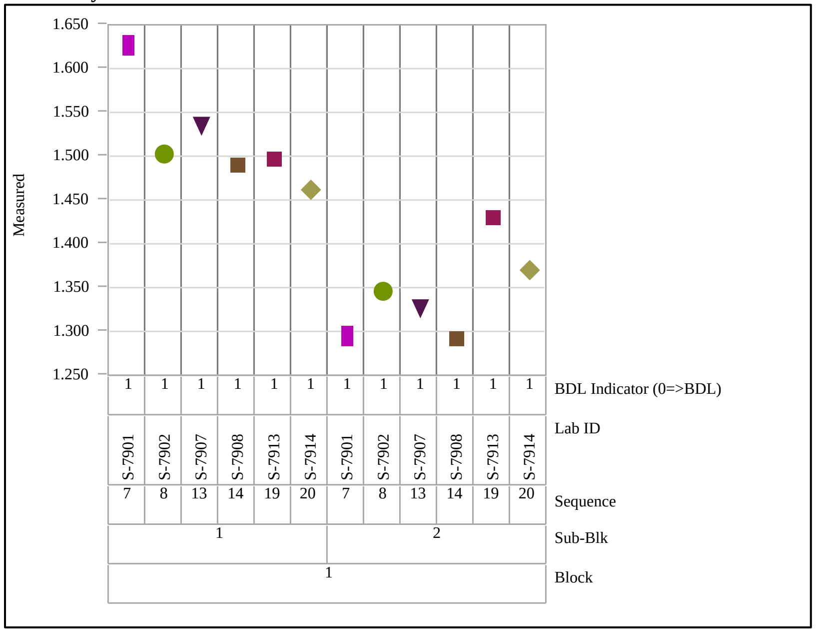


Exhibit C-1. Plots of Oxide Measurements by Set in Analytical Sequence (continued)

Set=2, Analyte=P2O5 (wt%), Prep Method=LM
Variability Chart for Measured

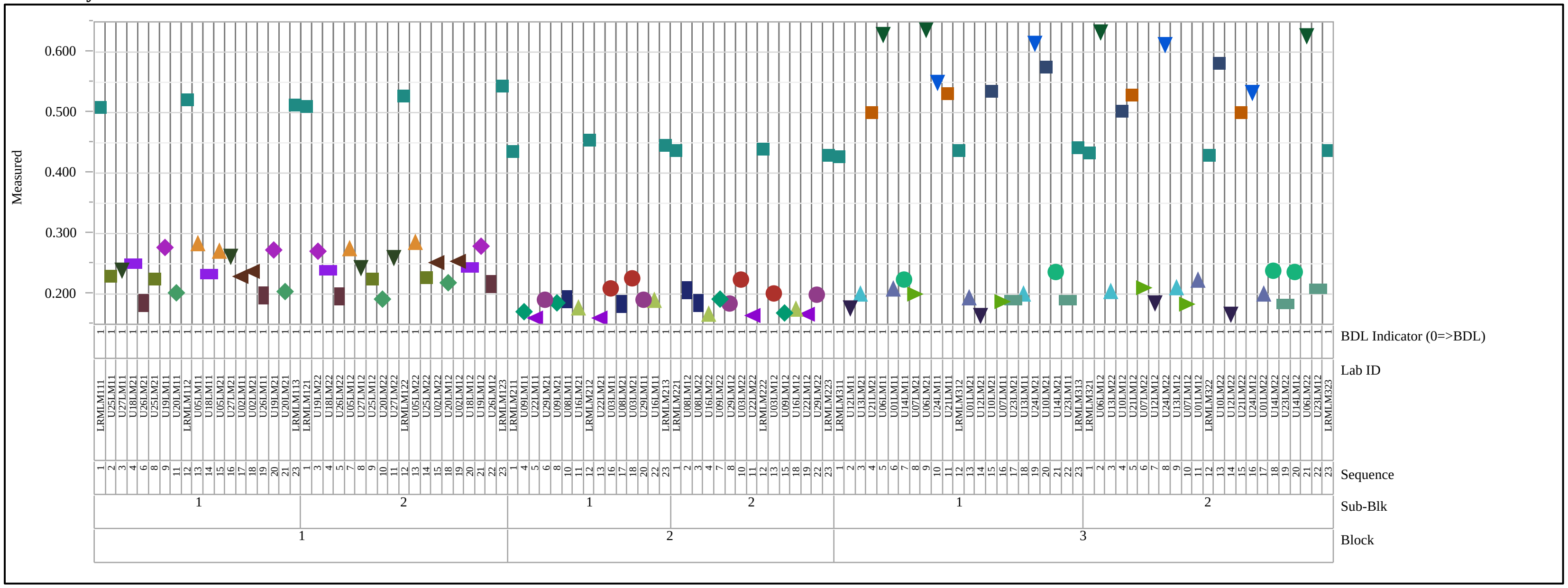


Exhibit C-1. Plots of Oxide Measurements by Set in Analytical Sequence (continued)

Set=2, Analyte=P2O5 (wt%), Prep Method=PF
Variability Chart for Measured

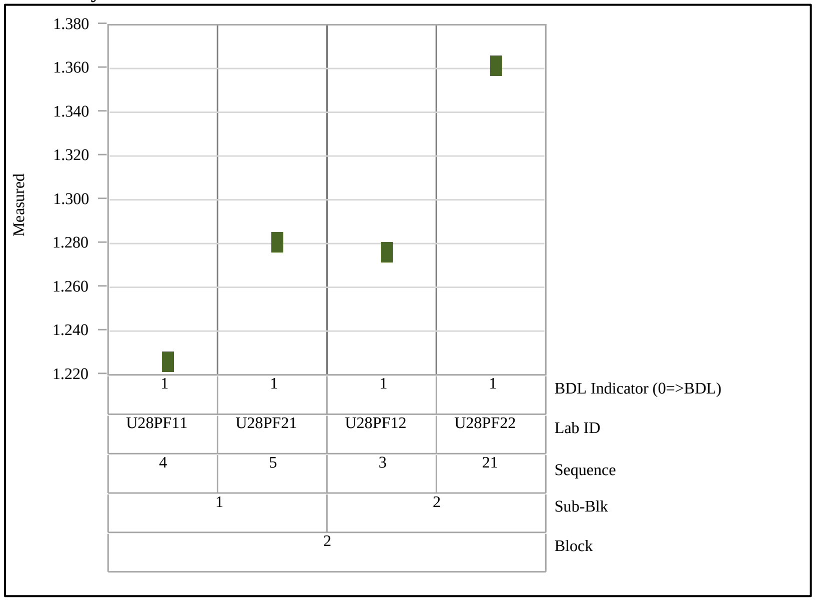


Exhibit C-1. Plots of Oxide Measurements by Set in Analytical Sequence (continued)

Set=2, Analyte=P2O5 (wt%), Prep Method=PFSA
Variability Chart for Measured

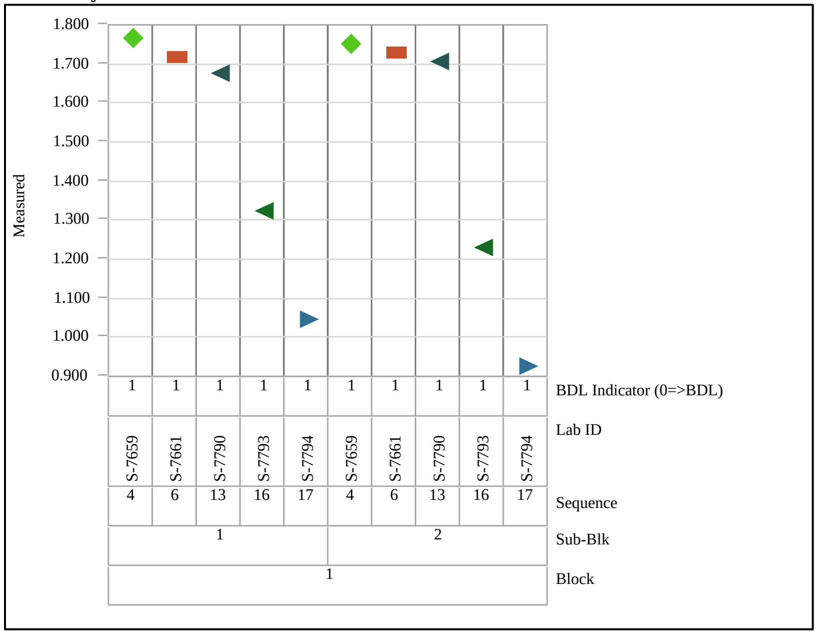


Exhibit C-1. Plots of Oxide Measurements by Set in Analytical Sequence (continued)

Set=1, Analyte=SiO2 (wt%), Prep Method=PF
Variability Chart for Measured

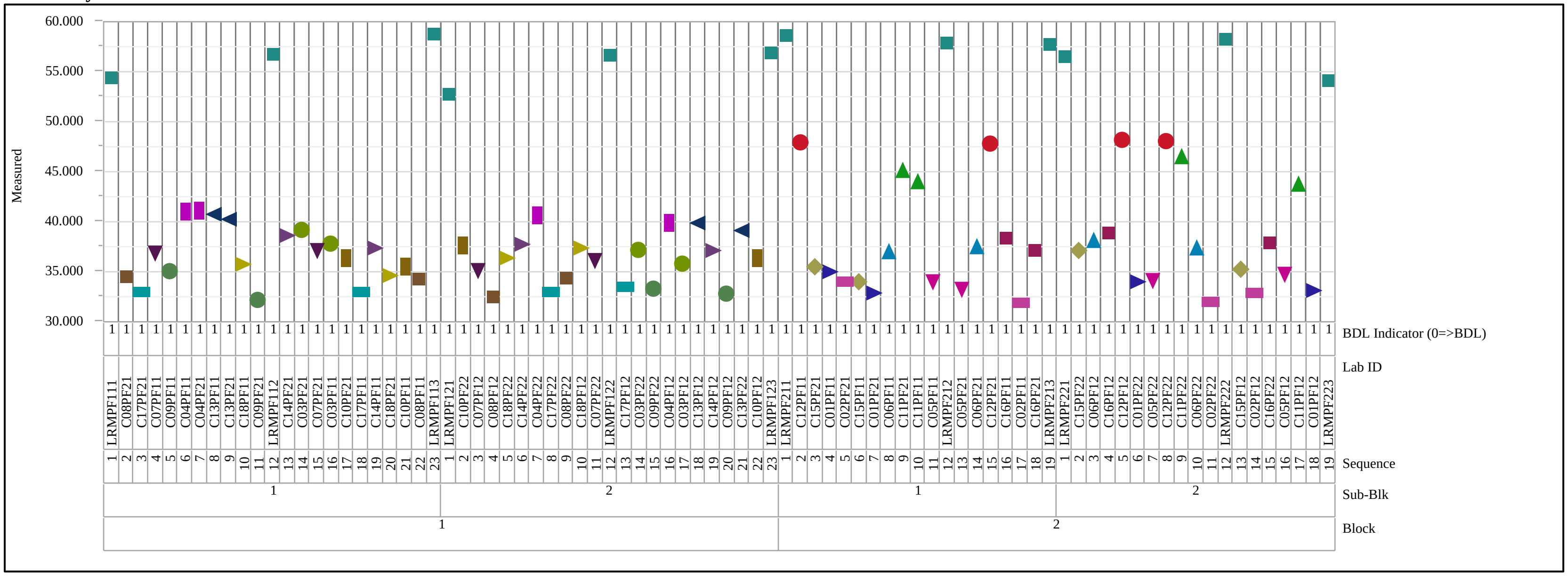


Exhibit C-1. Plots of Oxide Measurements by Set in Analytical Sequence (continued)

Set=2, Analyte=SiO2 (wt%), Prep Method=PF
Variability Chart for Measured

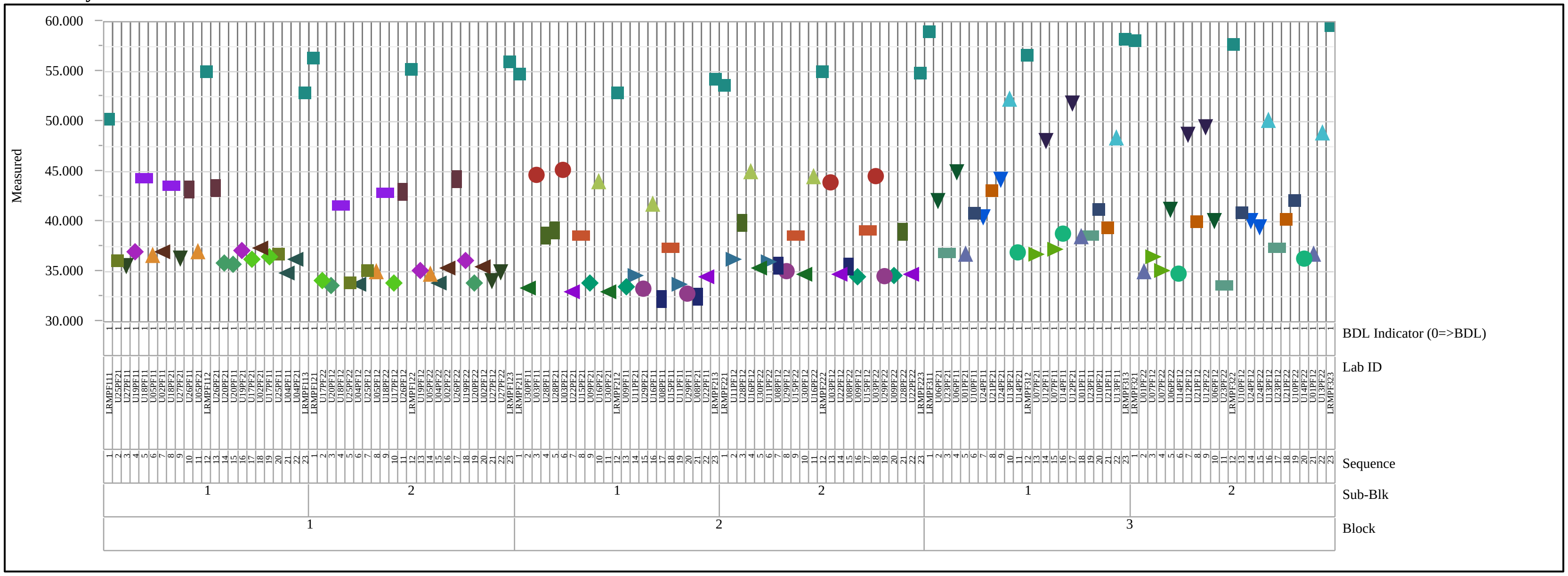


Exhibit C-1. Plots of Oxide Measurements by Set in Analytical Sequence (continued)

Set=1, Analyte=SnO2 (wt%), Prep Method=PF
Variability Chart for Measured

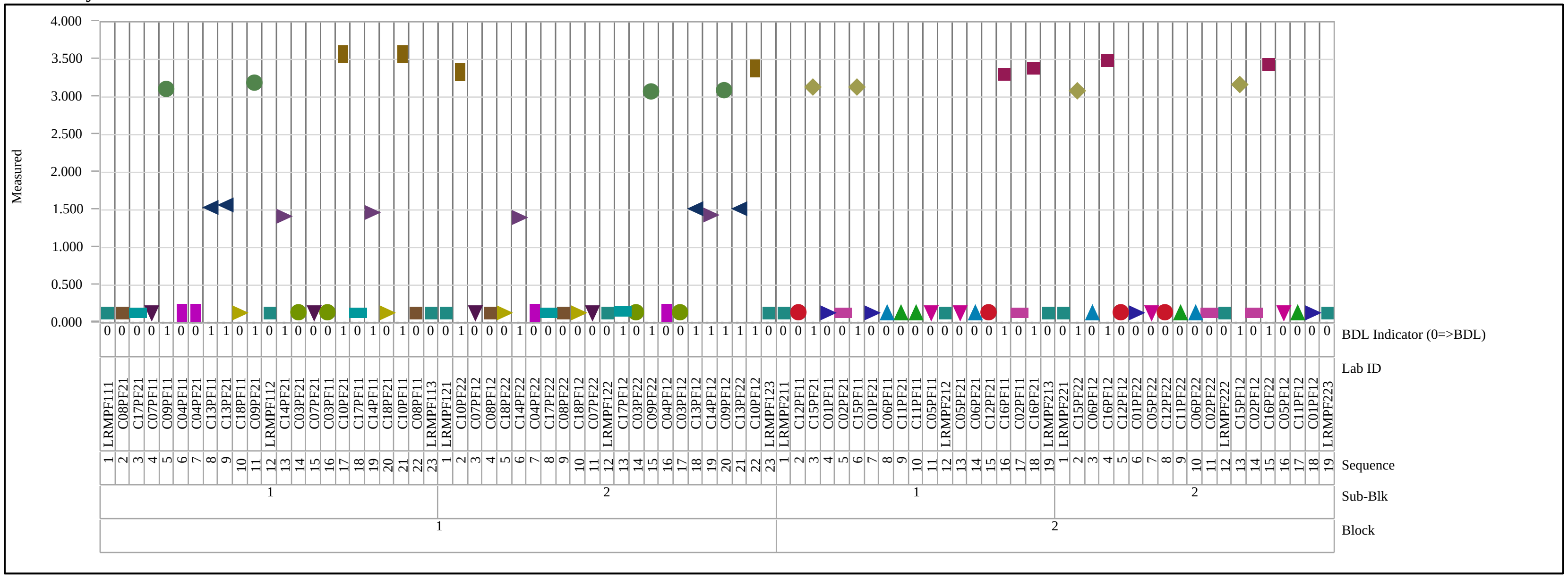


Exhibit C-1. Plots of Oxide Measurements by Set in Analytical Sequence (continued)

Set=2, Analyte=SnO2 (wt%), Prep Method=PF
Variability Chart for Measured

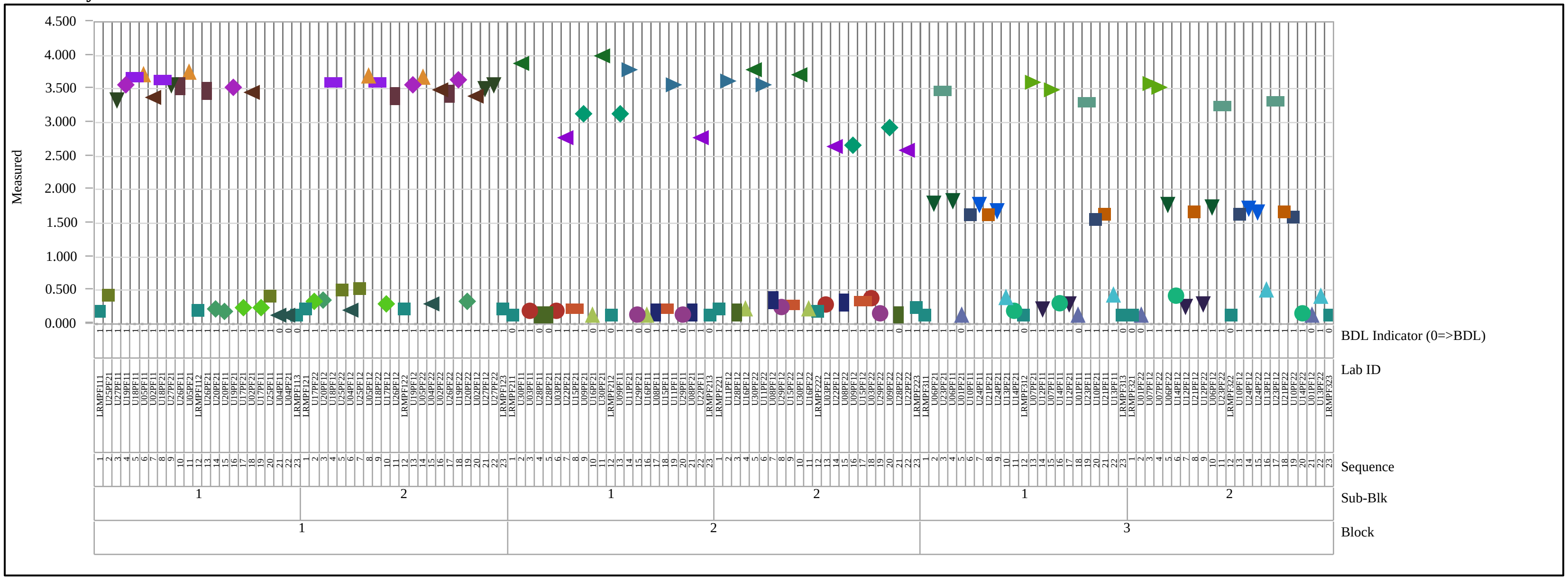


Exhibit C-1. Plots of Oxide Measurements by Set in Analytical Sequence (continued)

Set=1, Analyte=SO3 (wt%), Prep Method=LM
Variability Chart for Measured

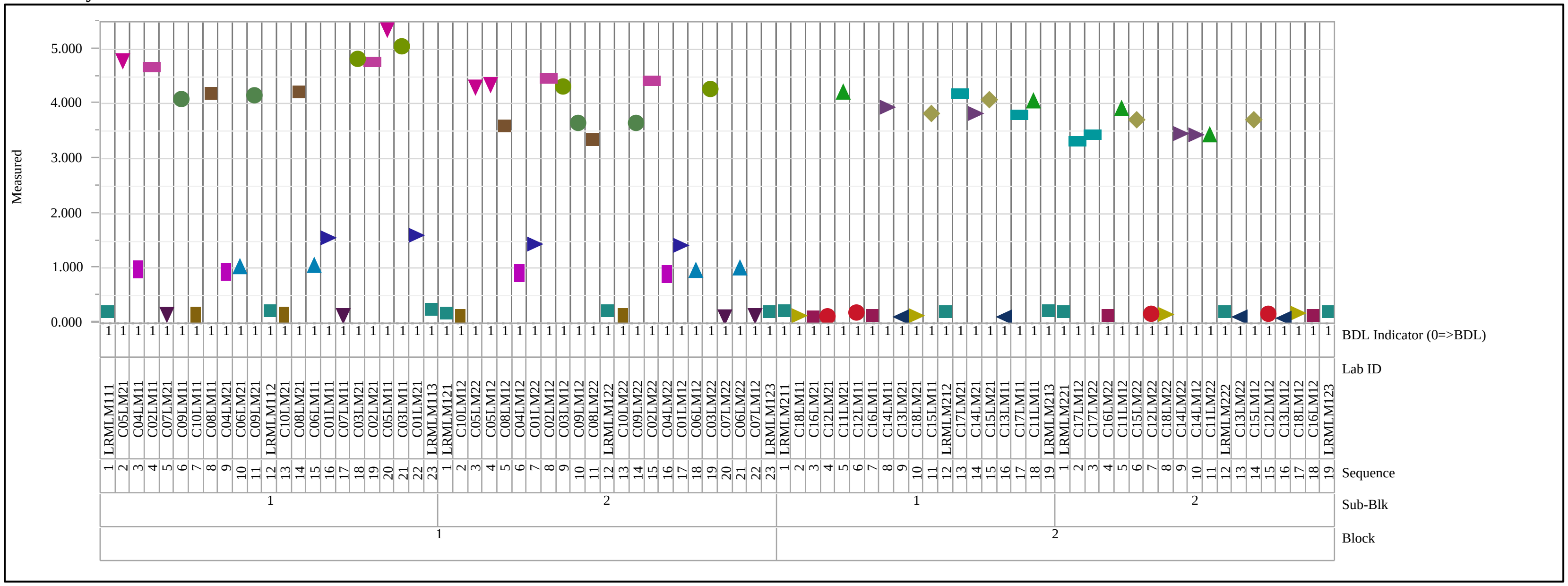


Exhibit C-1. Plots of Oxide Measurements by Set in Analytical Sequence (continued)

Set=2, Analyte=SO3 (wt%), Prep Method=LM
Variability Chart for Measured

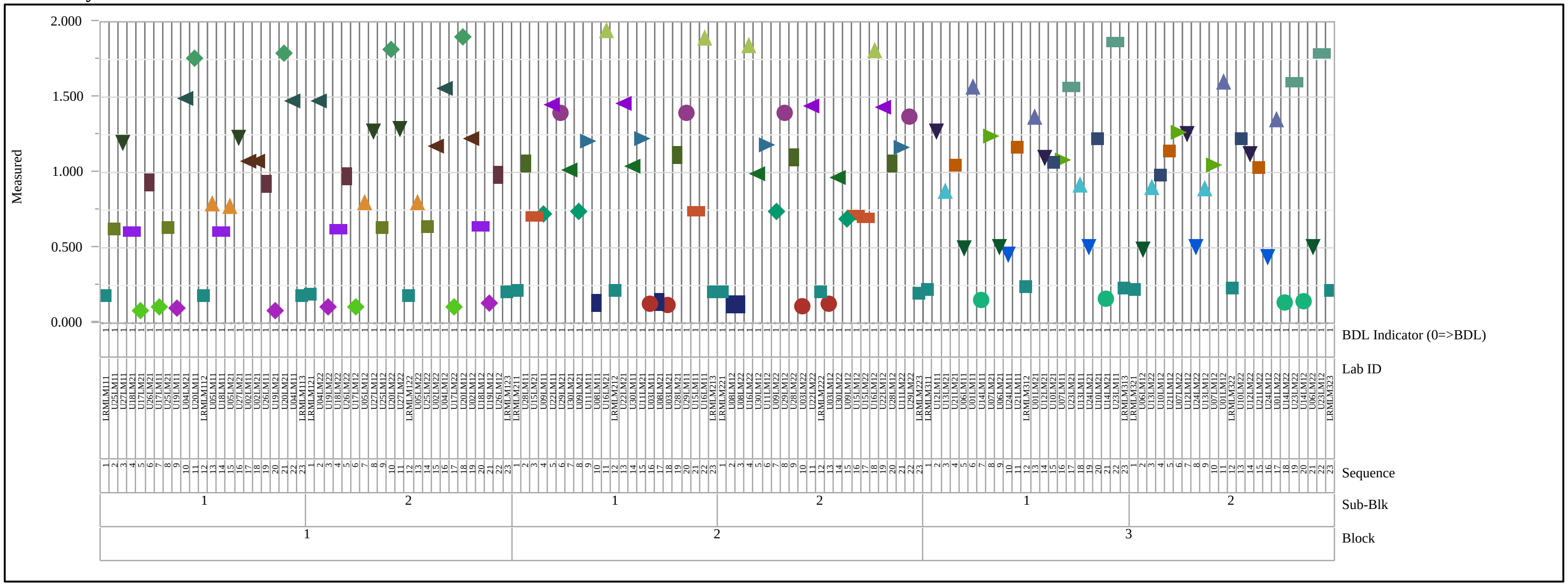


Exhibit C-1. Plots of Oxide Measurements by Set in Analytical Sequence (continued)

Set=1, Analyte=V2O5 (wt%), Prep Method=LM
Variability Chart for Measured

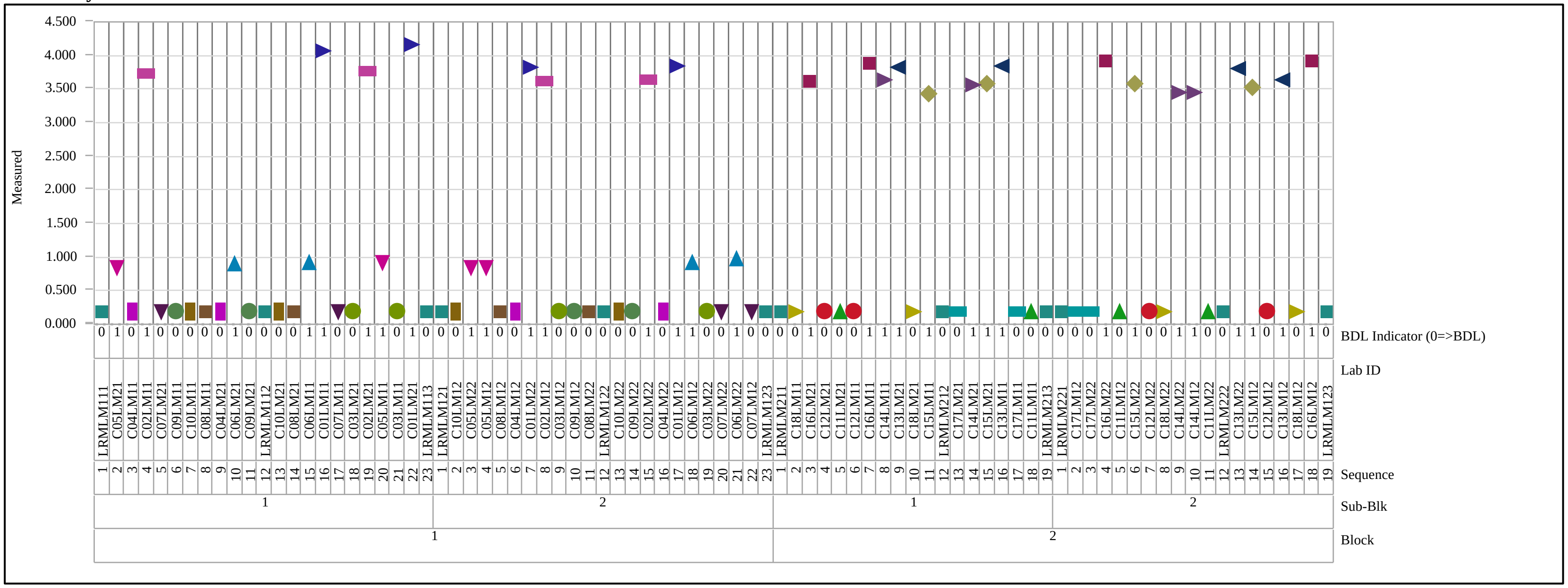


Exhibit C-1. Plots of Oxide Measurements by Set in Analytical Sequence (continued)

Set=2, Analyte=V2O5 (wt%), Prep Method=LM
Variability Chart for Measured

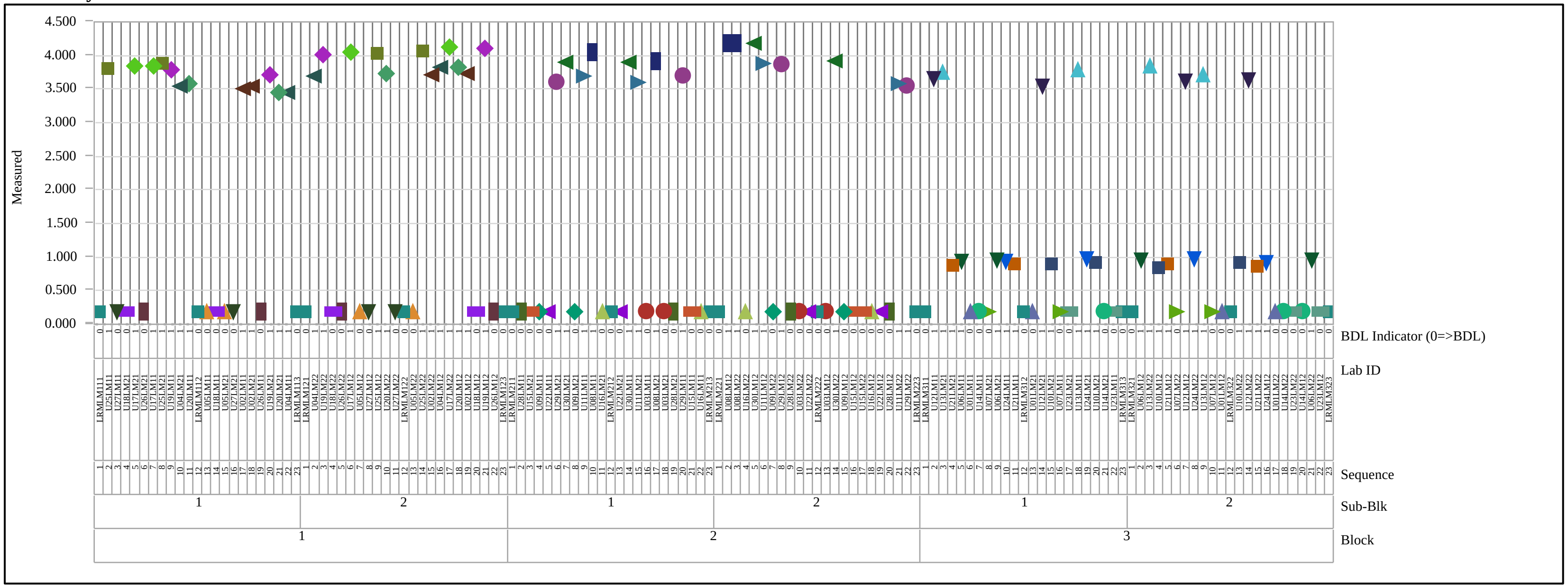


Exhibit C-1. Plots of Oxide Measurements by Set in Analytical Sequence (continued)

Set=1, Analyte=ZnO (wt%), Prep Method=LM
Variability Chart for Measured

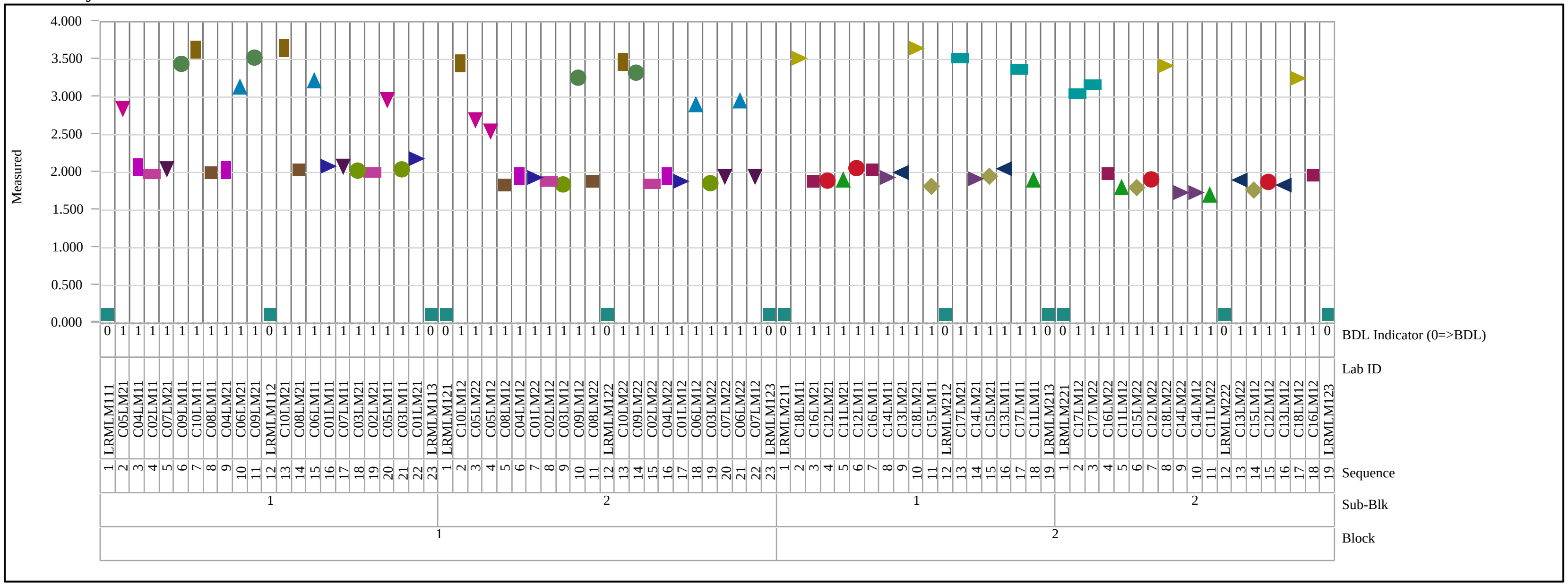


Exhibit C-1. Plots of Oxide Measurements by Set in Analytical Sequence (continued)

Set=2, Analyte=ZnO (wt%), Prep Method=LM
Variability Chart for Measured

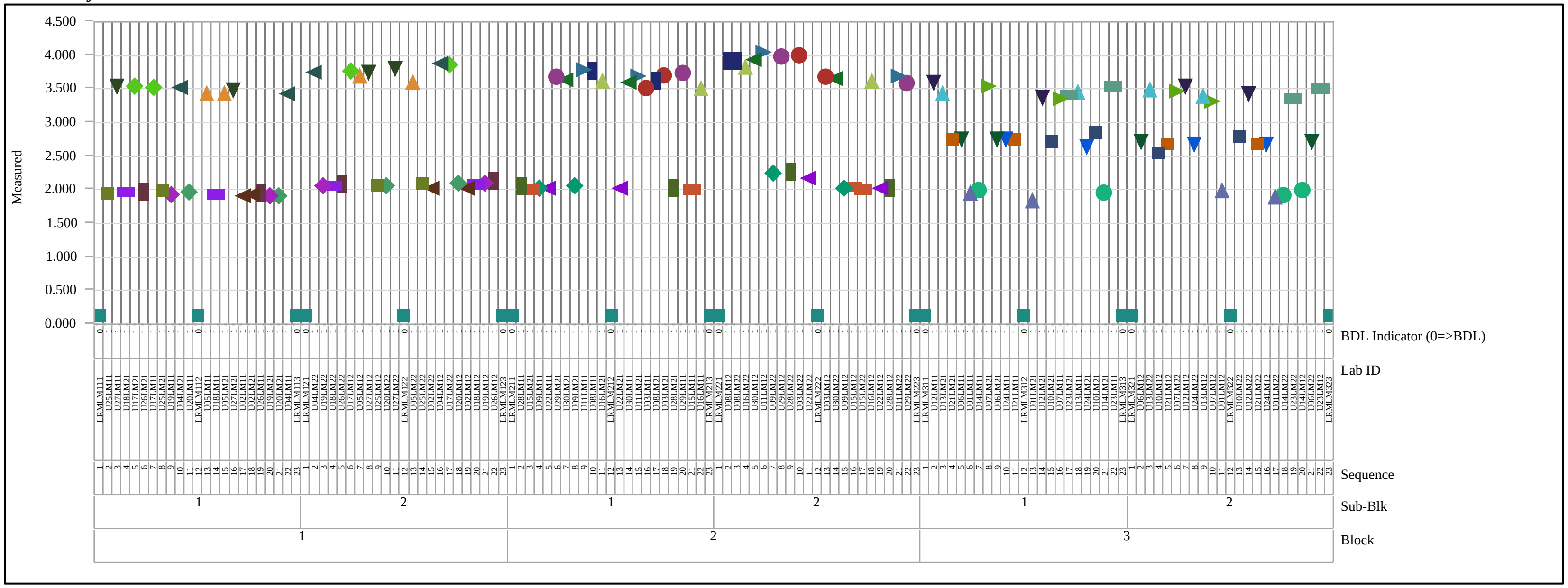


Exhibit C-1. Plots of Oxide Measurements by Set in Analytical Sequence (continued)

Set=1, Analyte=ZrO2 (wt%), Prep Method=PFSA
Variability Chart for Measured

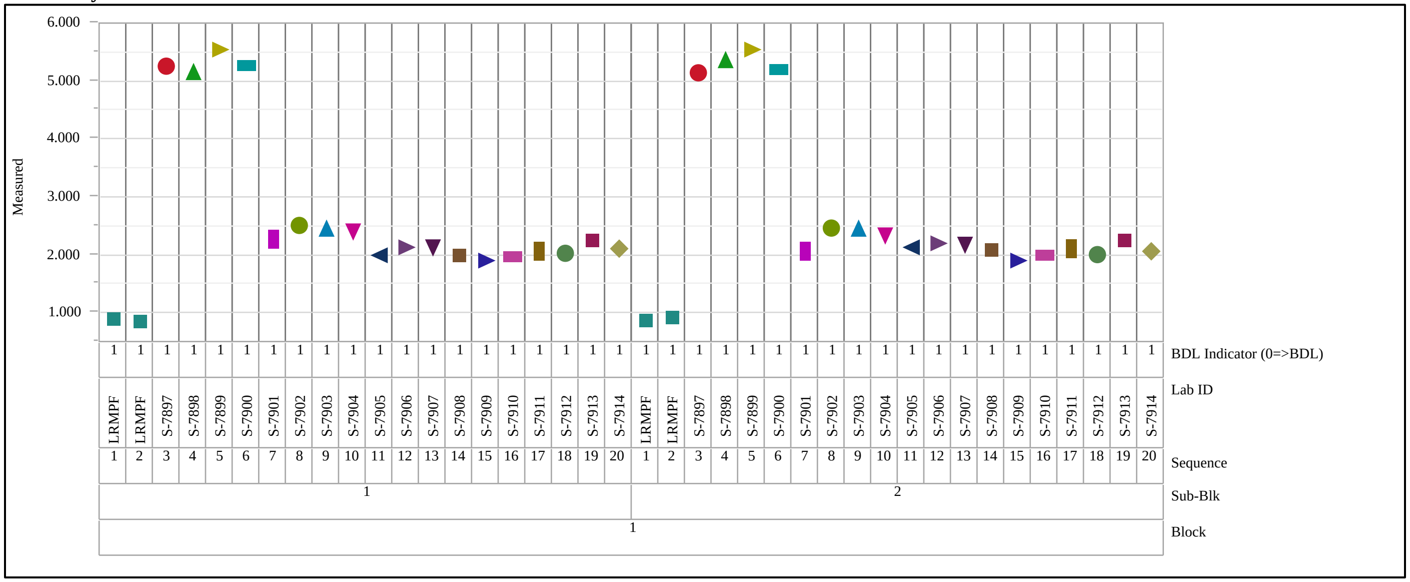


Exhibit C-1. Plots of Oxide Measurements by Set in Analytical Sequence (continued)

Set=2, Analyte=ZrO2 (wt%), Prep Method=PF
Variability Chart for Measured

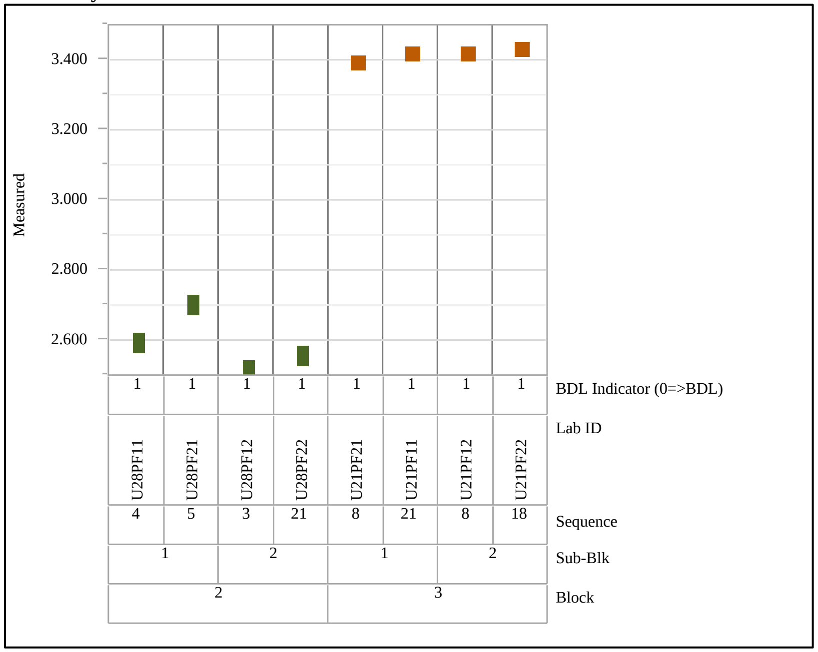


Exhibit C-1. Plots of Oxide Measurements by Set in Analytical Sequence (continued)

Set=2, Analyte=ZrO2 (wt%), Prep Method=PFSA
Variability Chart for Measured

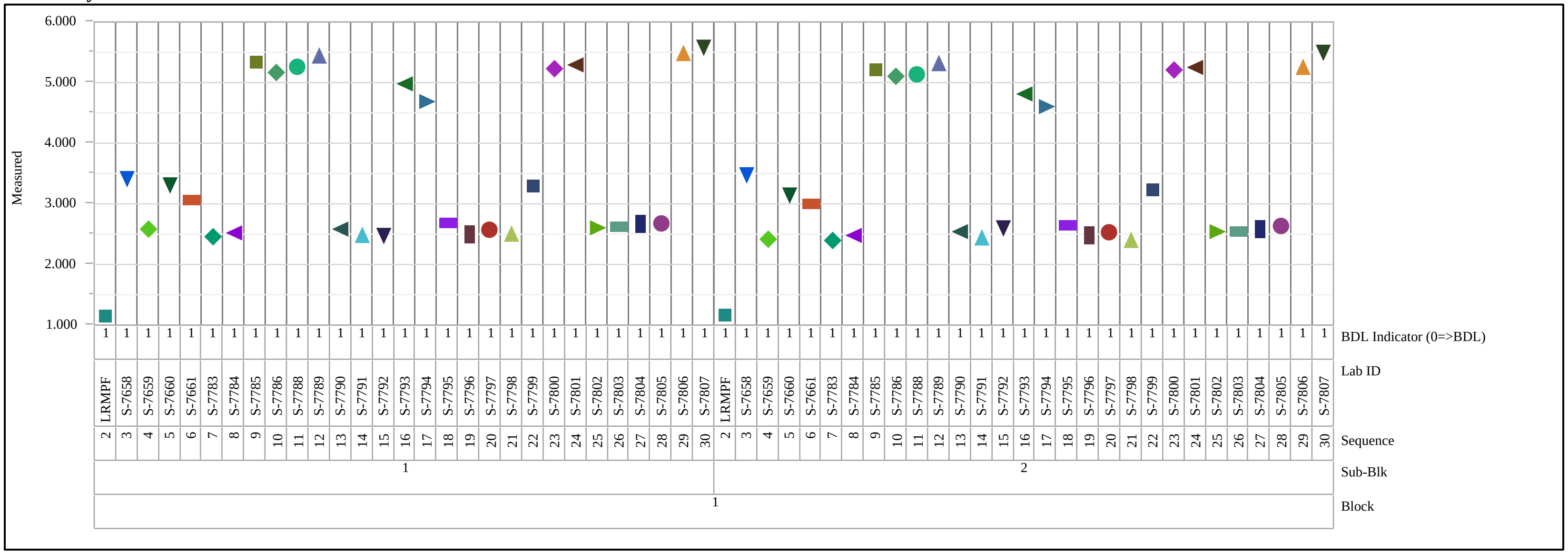


Exhibit C-2. Plots of Oxide Measurements by Set by Glass Identifier Grouped by Targeted Concentrations

Set=1, Analyte=Al2O3 (wt%)
Variability Chart for Measured

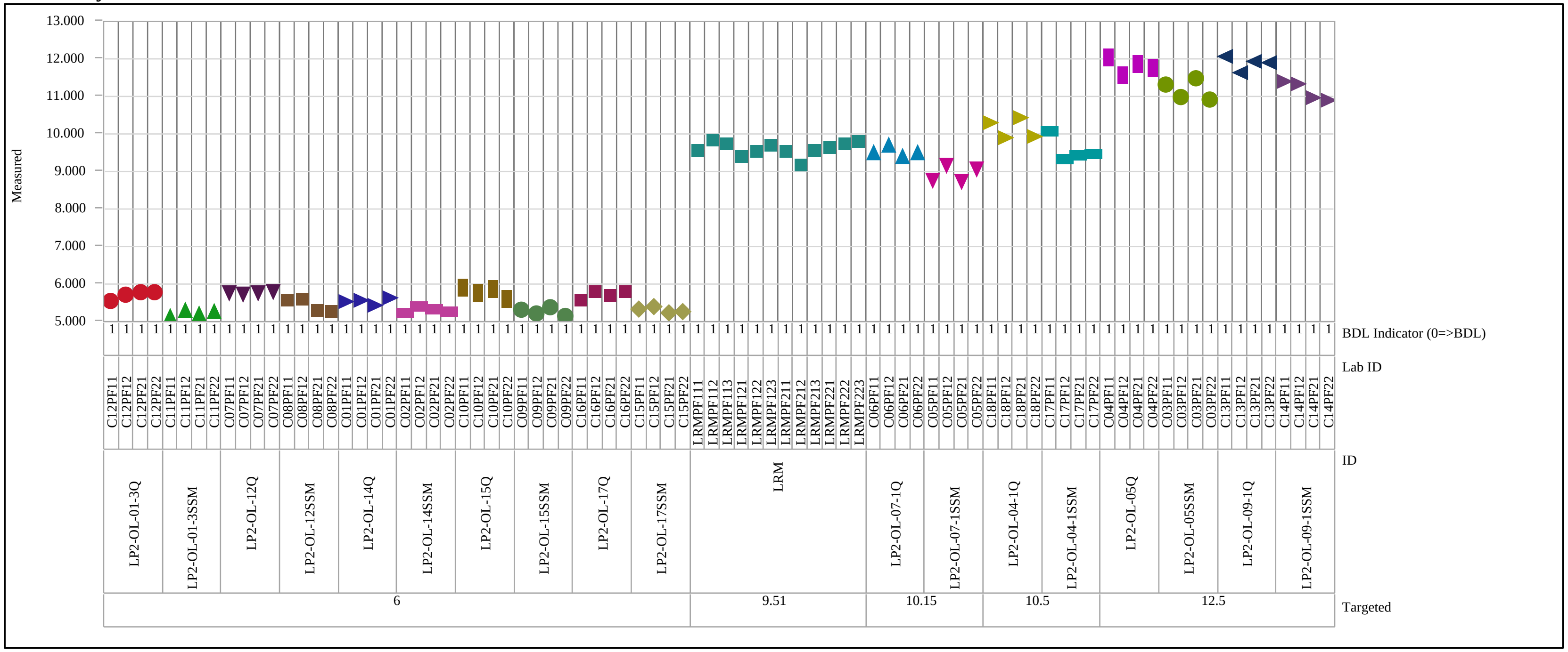


Exhibit C-2. Plots of Oxide Measurements by Set by Glass Identifier Grouped by Targeted Concentrations (continued)

Set=2, Analyte=Al2O3 (wt%)
Variability Chart for Measured

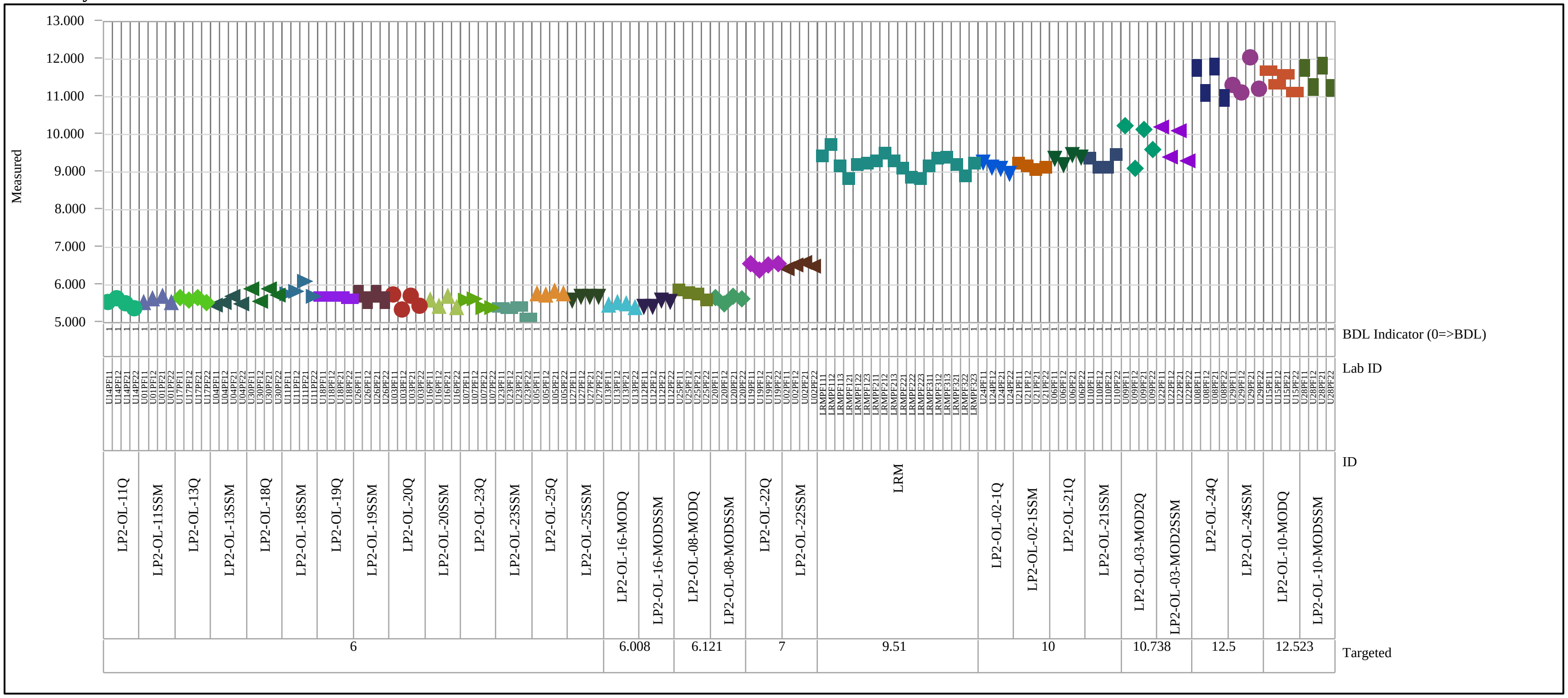


Exhibit C-2. Plots of Oxide Measurements by Set by Glass Identifier Grouped by Targeted Concentrations (continued)

Set=1, Analyte=B2O3 (wt%)
Variability Chart for Measured

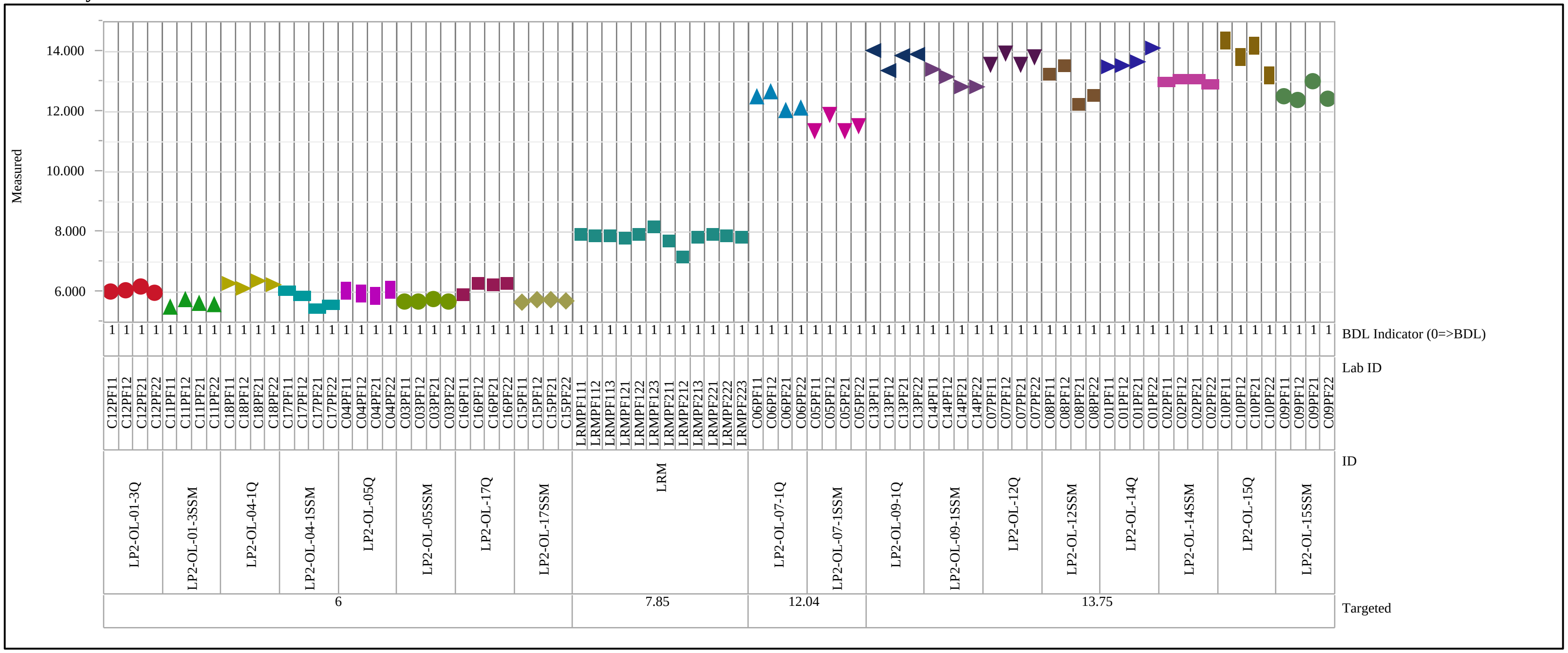


Exhibit C-2. Plots of Oxide Measurements by Set by Glass Identifier Grouped by Targeted Concentrations (continued)

Set=2, Analyte=B2O3 (wt%)
Variability Chart for Measured

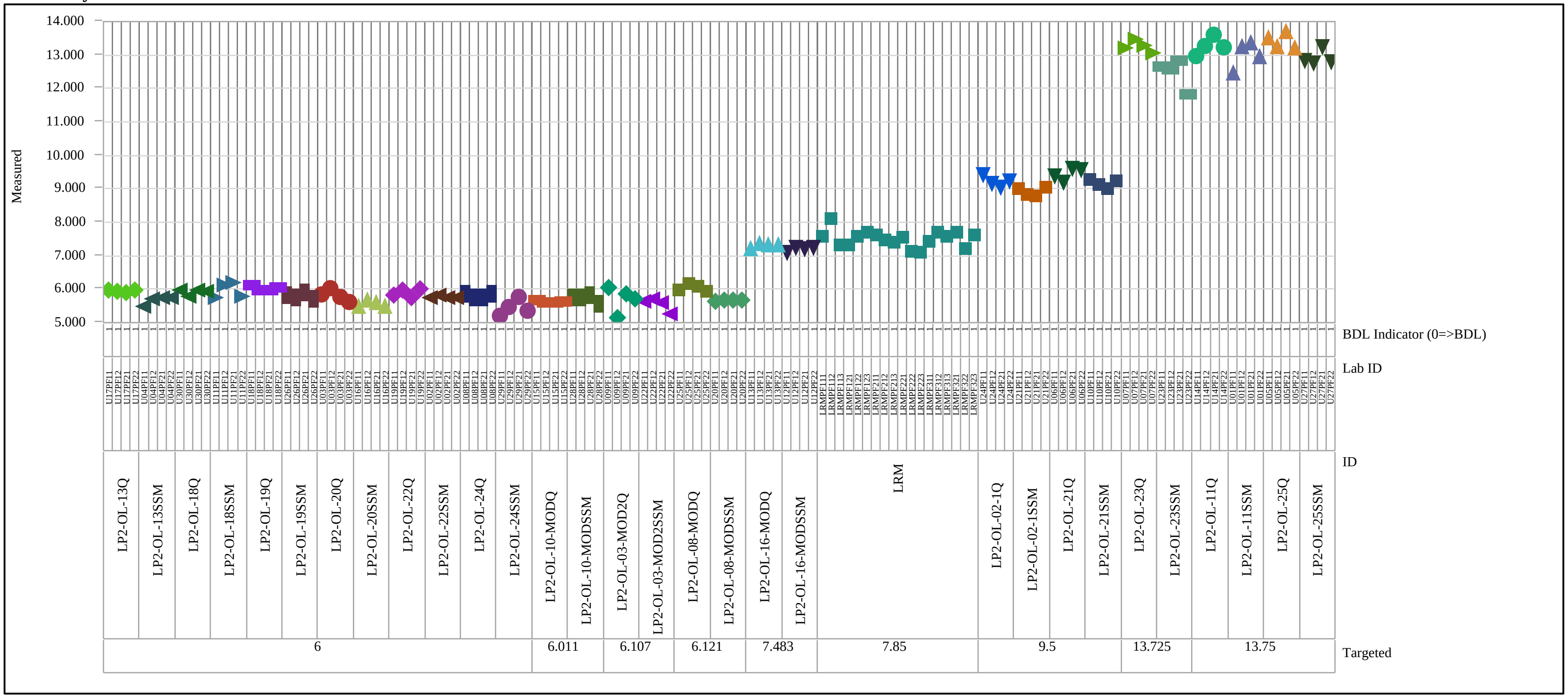


Exhibit C-2. Plots of Oxide Measurements by Set by Glass Identifier Grouped by Targeted Concentrations (continued)

Set=1, Analyte=CaO (wt%)
Variability Chart for Measured

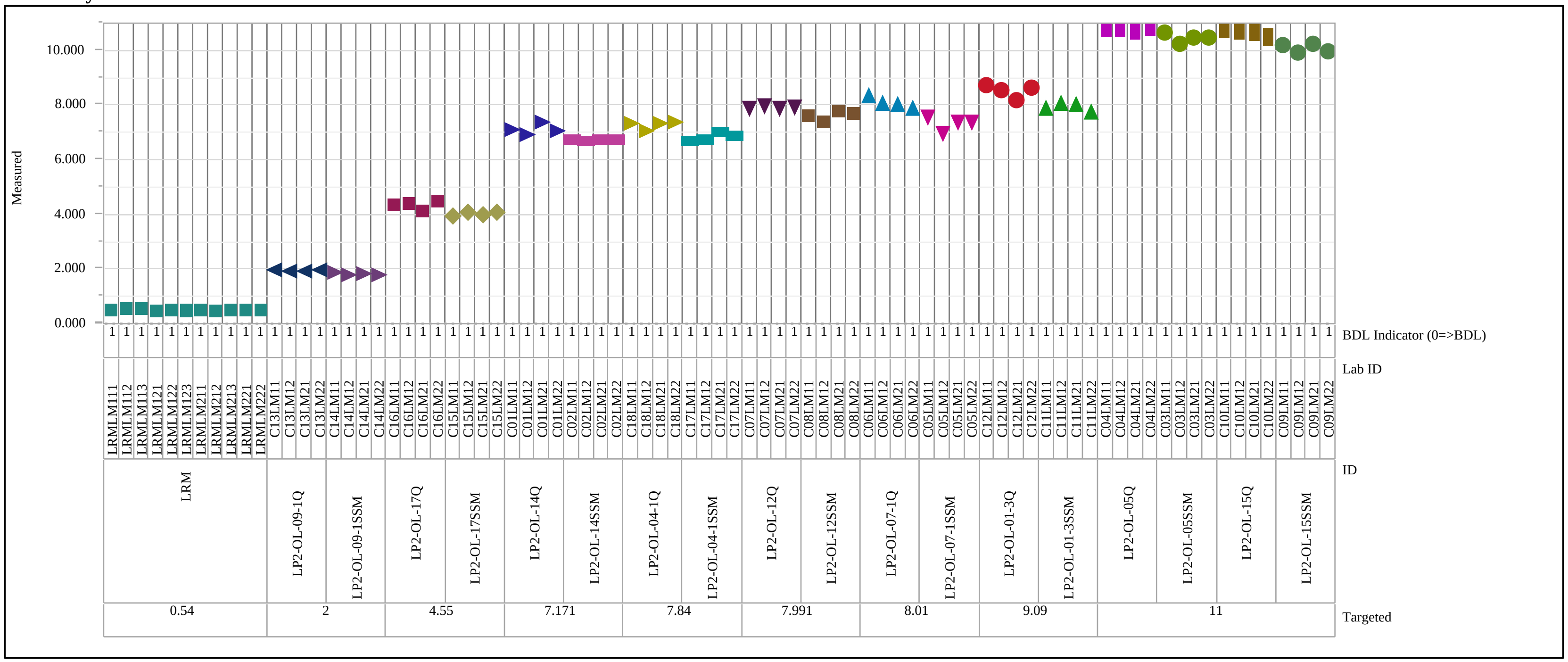


Exhibit C-2. Plots of Oxide Measurements by Set by Glass Identifier Grouped by Targeted Concentrations (continued)

Set=2, Analyte=CaO (wt%)
Variability Chart for Measured

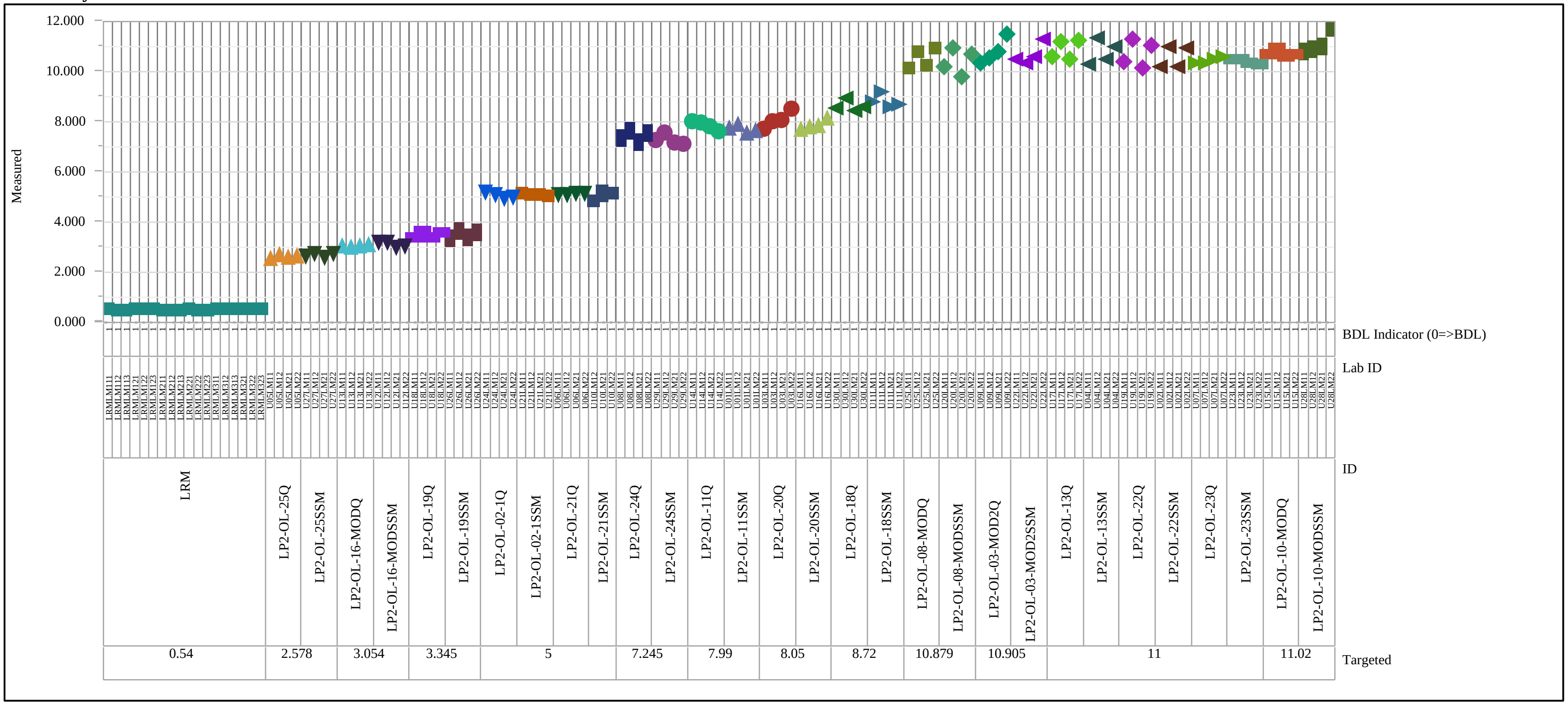


Exhibit C-2. Plots of Oxide Measurements by Set by Glass Identifier Grouped by Targeted Concentrations (continued)

Set=1, Analyte=Cl (wt%)
Variability Chart for Measured

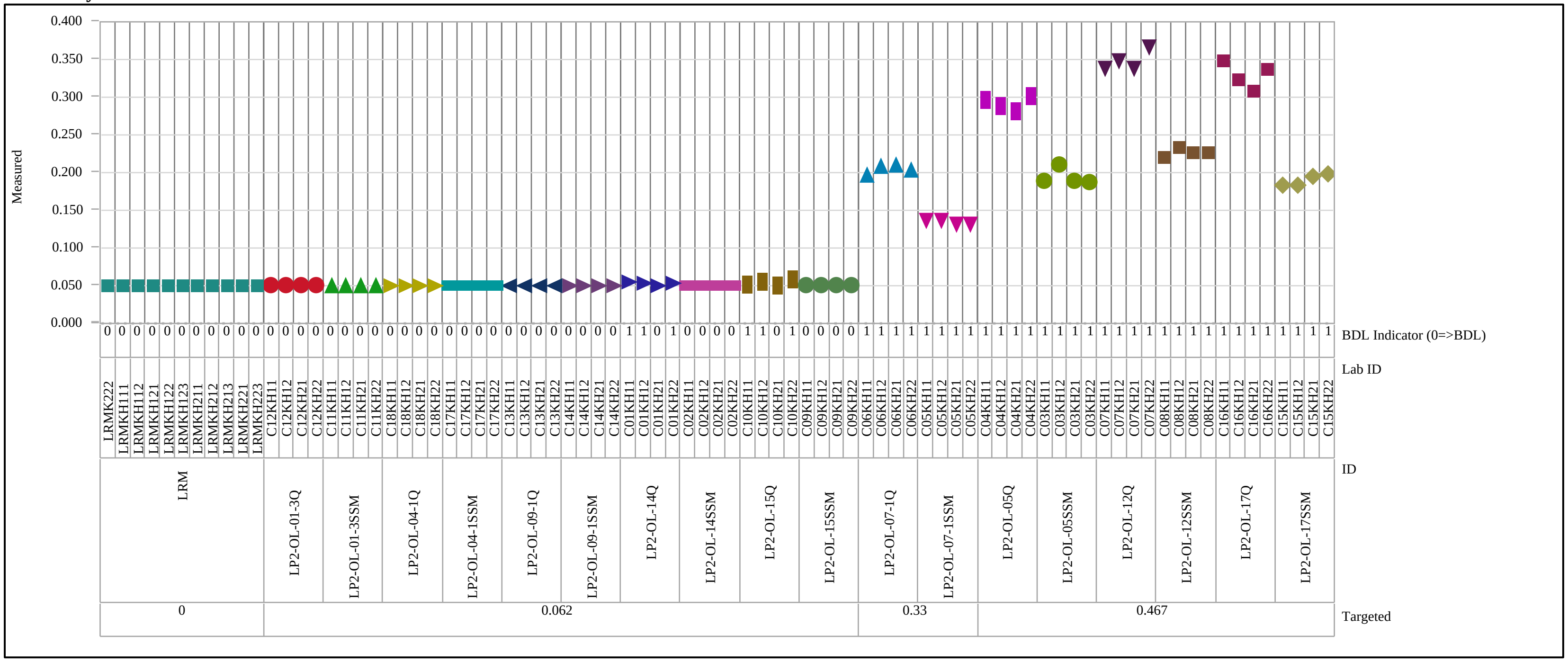


Exhibit C-2. Plots of Oxide Measurements by Set by Glass Identifier Grouped by Targeted Concentrations (continued)

Set=2, Analyte=Cl (wt%)
Variability Chart for Measured

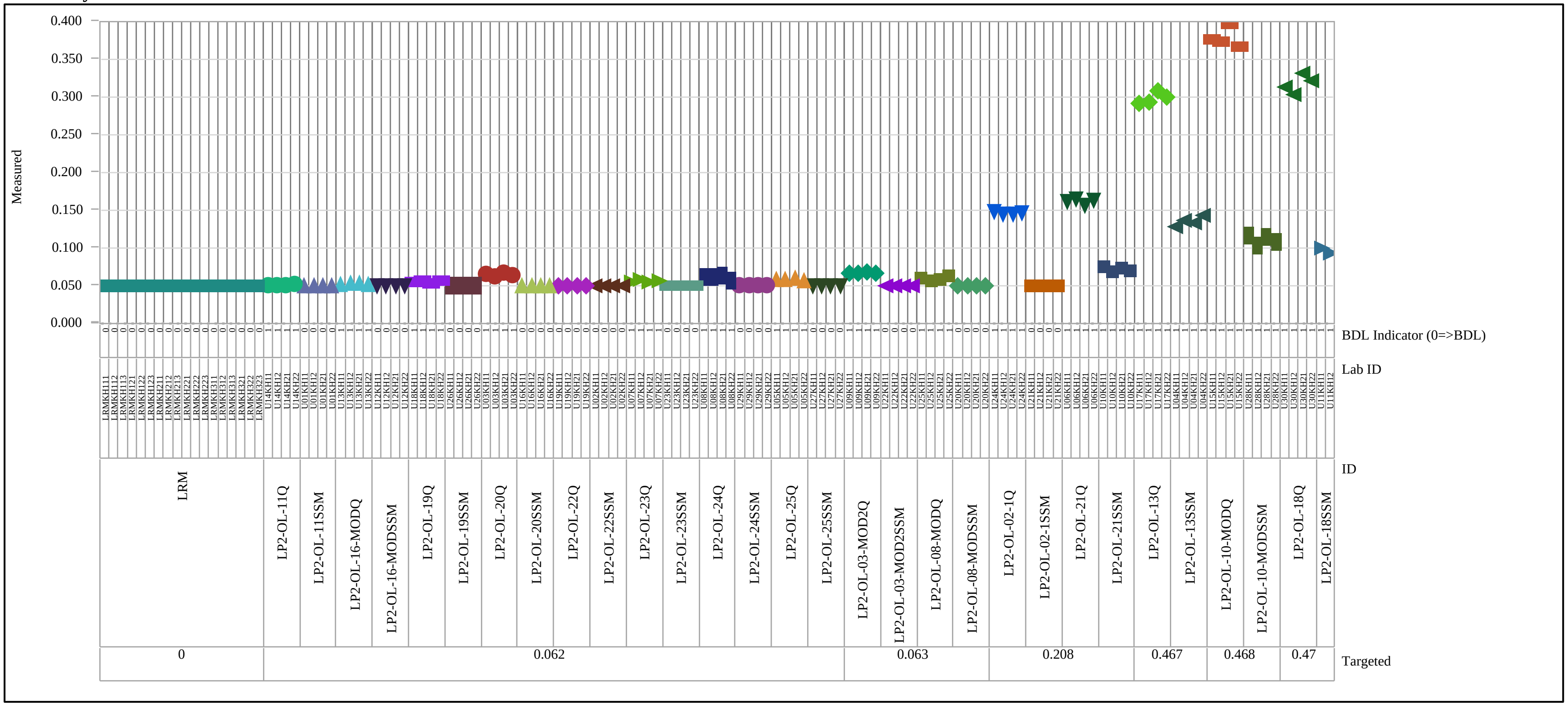


Exhibit C-2. Plots of Oxide Measurements by Set by Glass Identifier Grouped by Targeted Concentrations (continued)

Set=1, Analyte=Cr2O3 (wt%)
Variability Chart for Measured

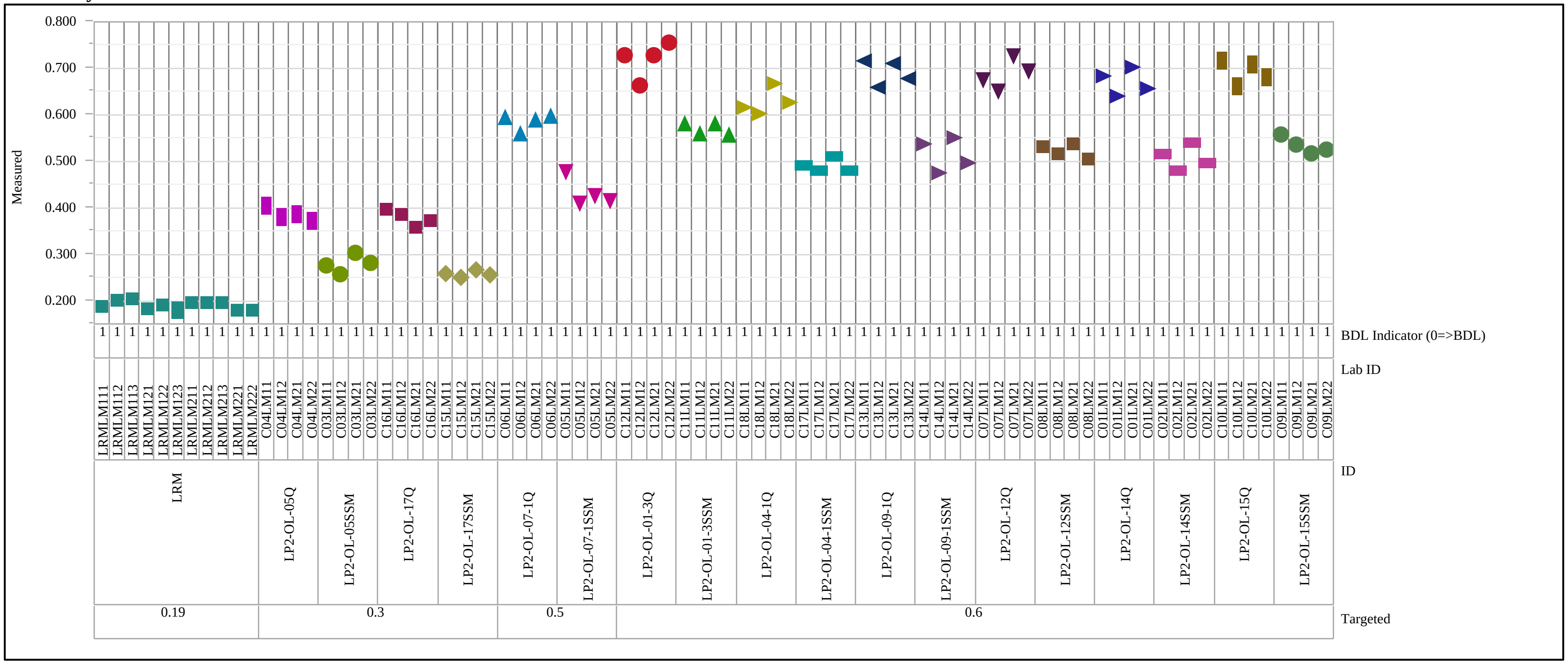


Exhibit C-2. Plots of Oxide Measurements by Set by Glass Identifier Grouped by Targeted Concentrations (continued)

Set=2, Analyte=Cr2O3 (wt%)
Variability Chart for Measured

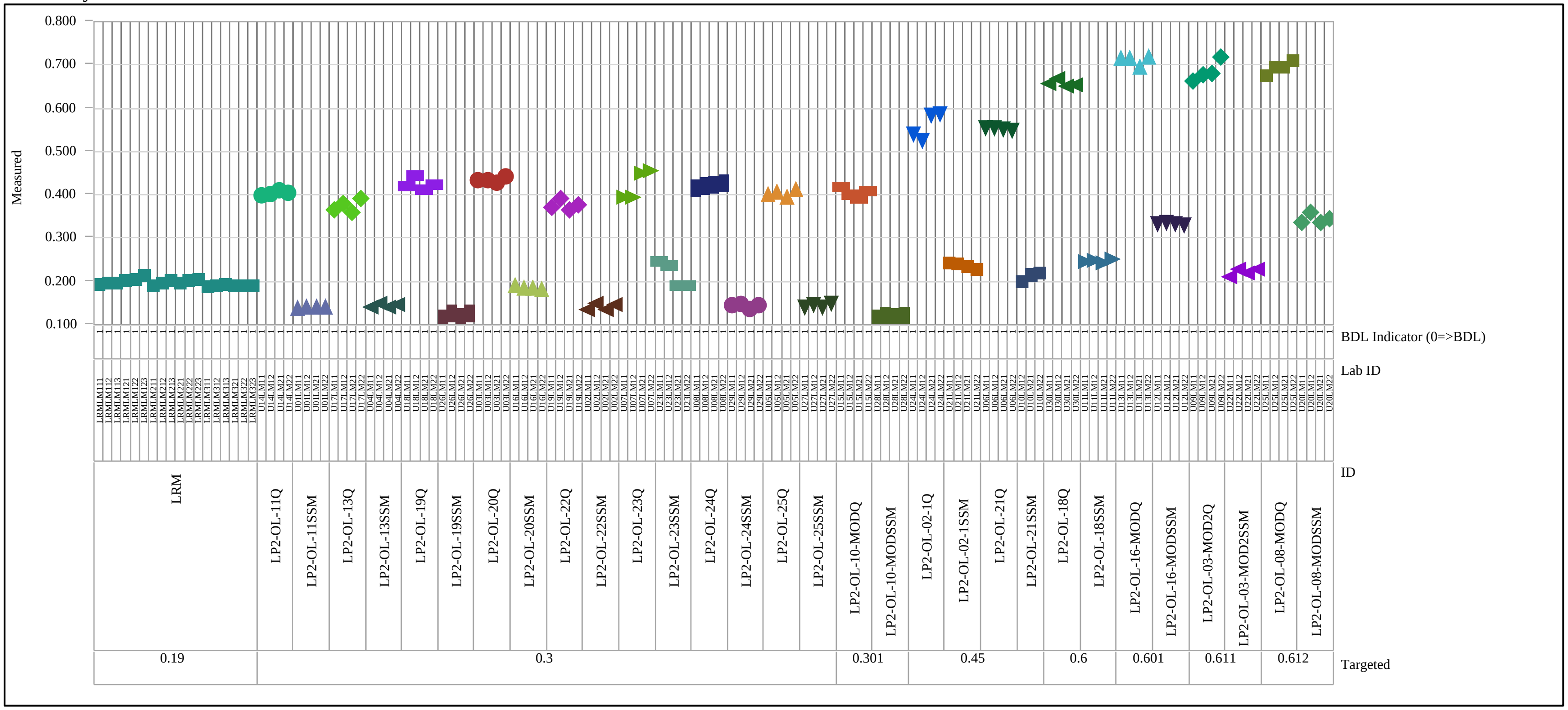


Exhibit C-2. Plots of Oxide Measurements by Set by Glass Identifier Grouped by Targeted Concentrations (continued)

Set=1, Analyte=F (wt%)
Variability Chart for Measured

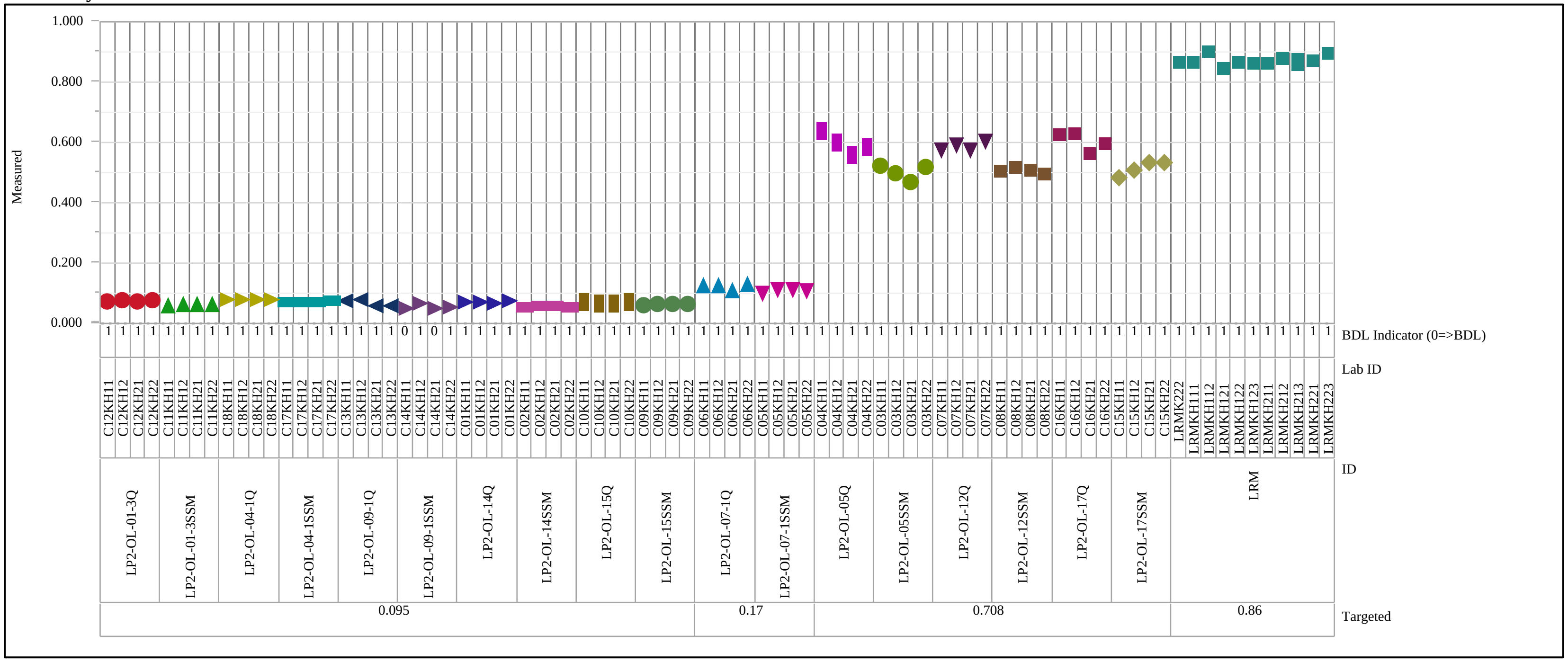


Exhibit C-2. Plots of Oxide Measurements by Set by Glass Identifier Grouped by Targeted Concentrations (continued)

Set=2, Analyte=F (wt%)
Variability Chart for Measured

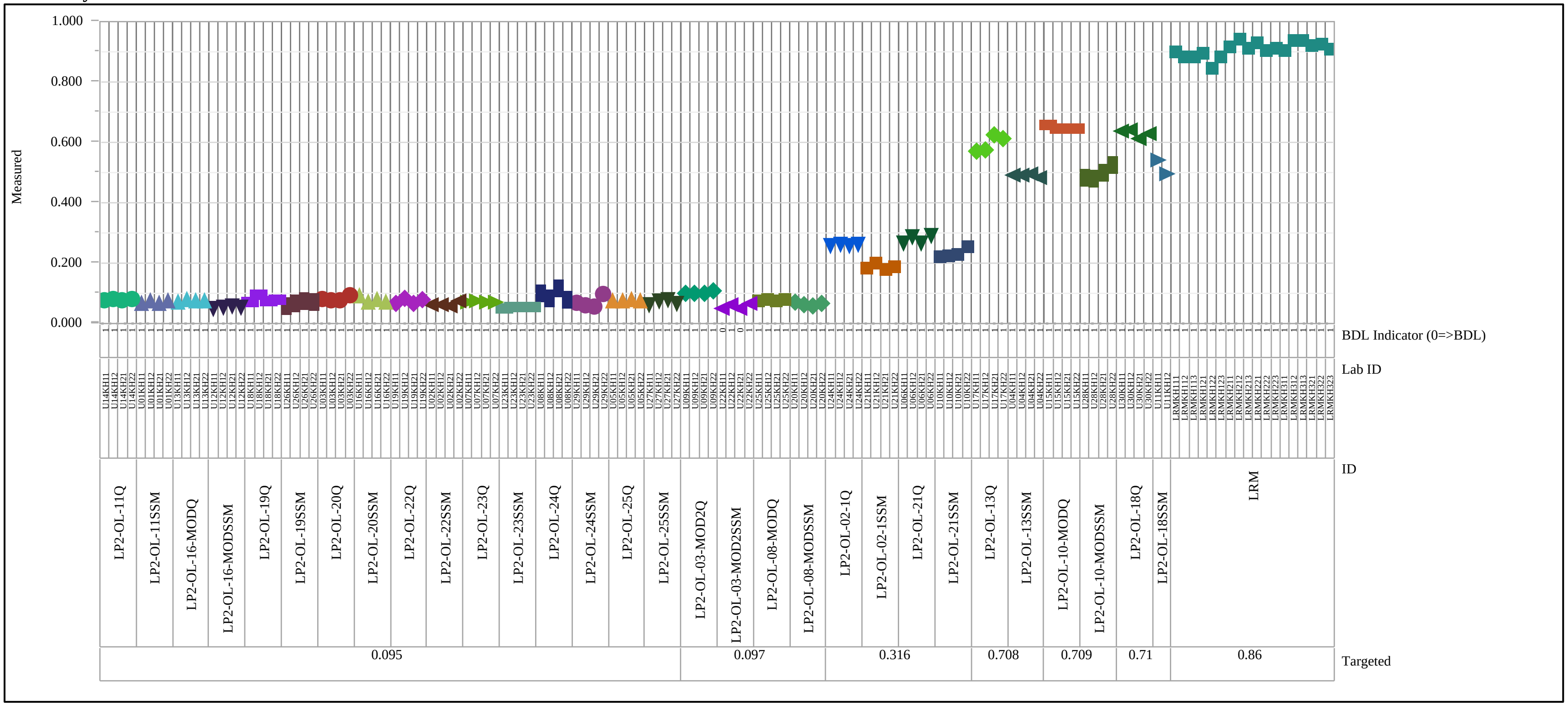


Exhibit C-2. Plots of Oxide Measurements by Set by Glass Identifier Grouped by Targeted Concentrations (continued)

Set=1, Analyte=Fe2O3 (wt%)
Variability Chart for Measured

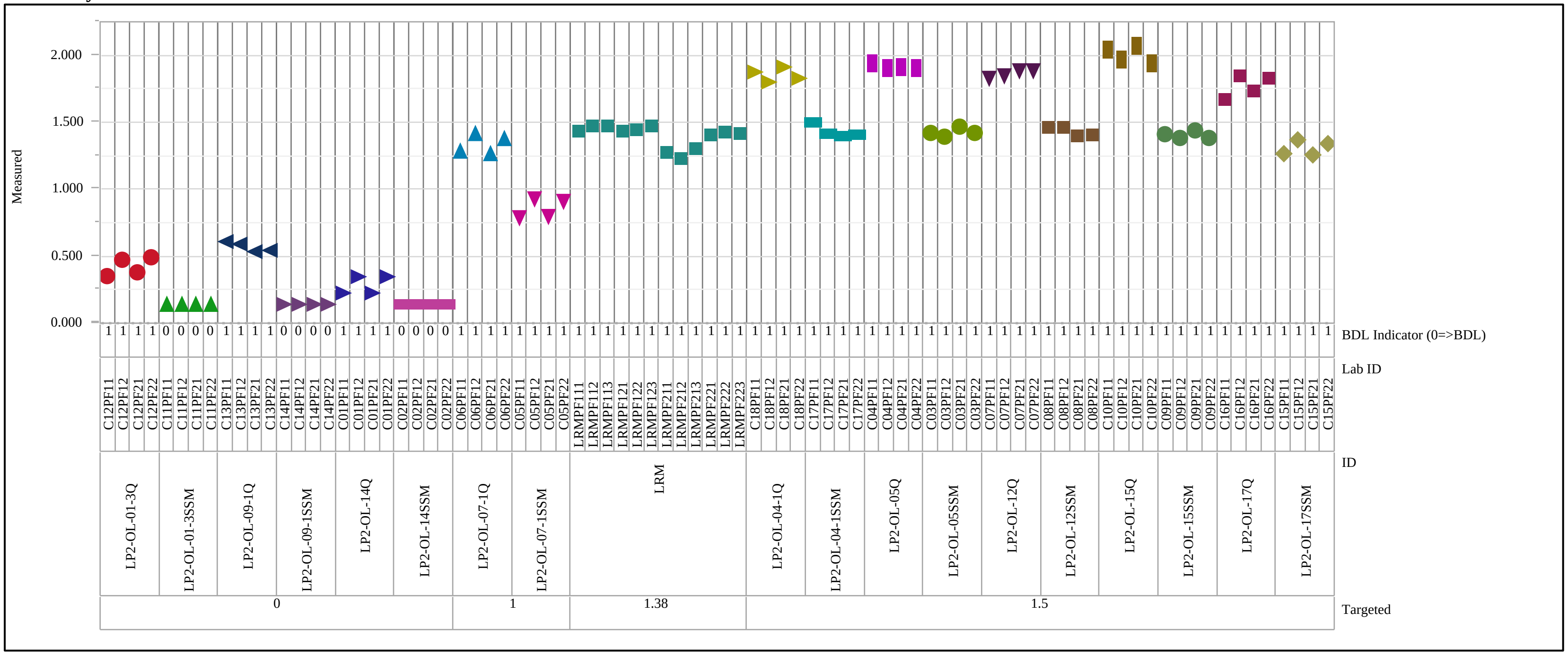


Exhibit C-2. Plots of Oxide Measurements by Set by Glass Identifier Grouped by Targeted Concentrations (continued)

Set=2, Analyte=Fe2O3 (wt%)
Variability Chart for Measured

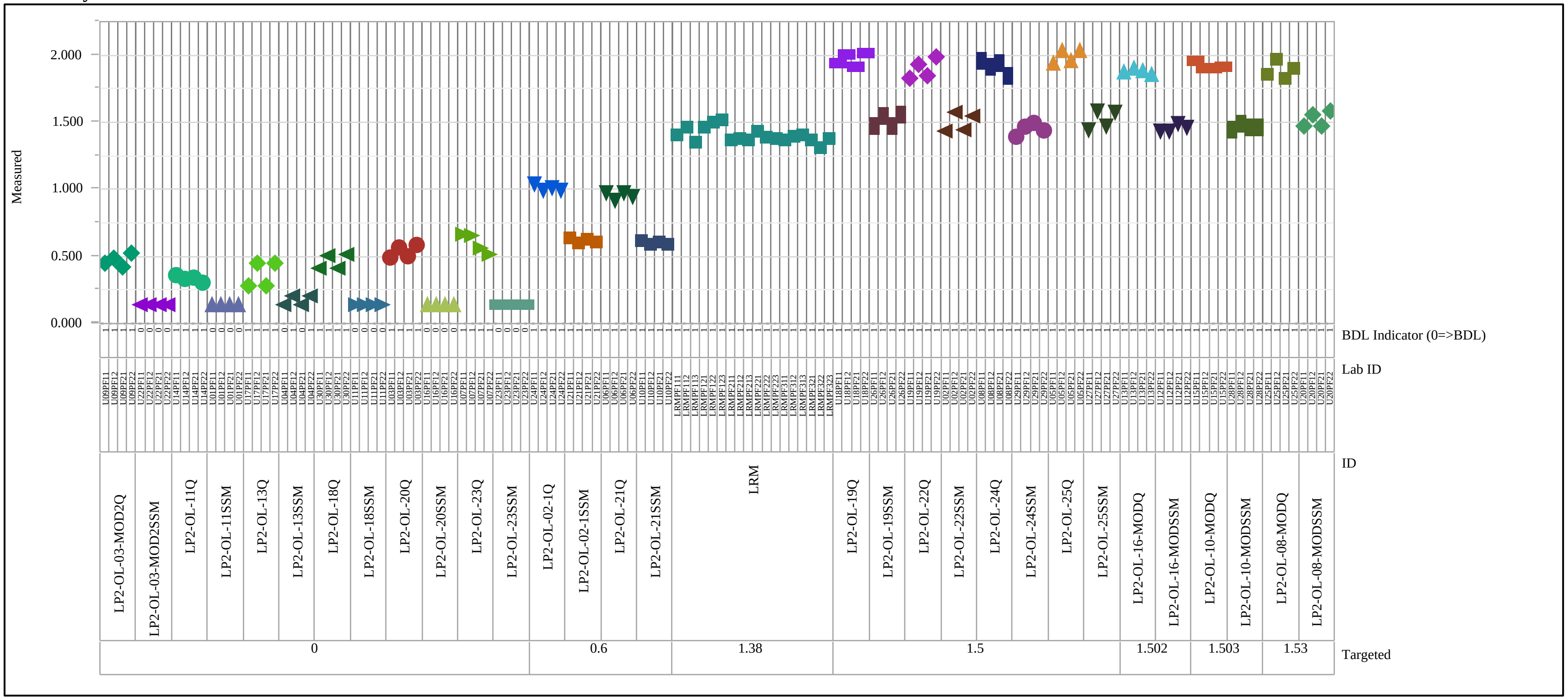


Exhibit C-2. Plots of Oxide Measurements by Set by Glass Identifier Grouped by Targeted Concentrations (continued)

Set=1, Analyte=K2O (wt%)
Variability Chart for Measured

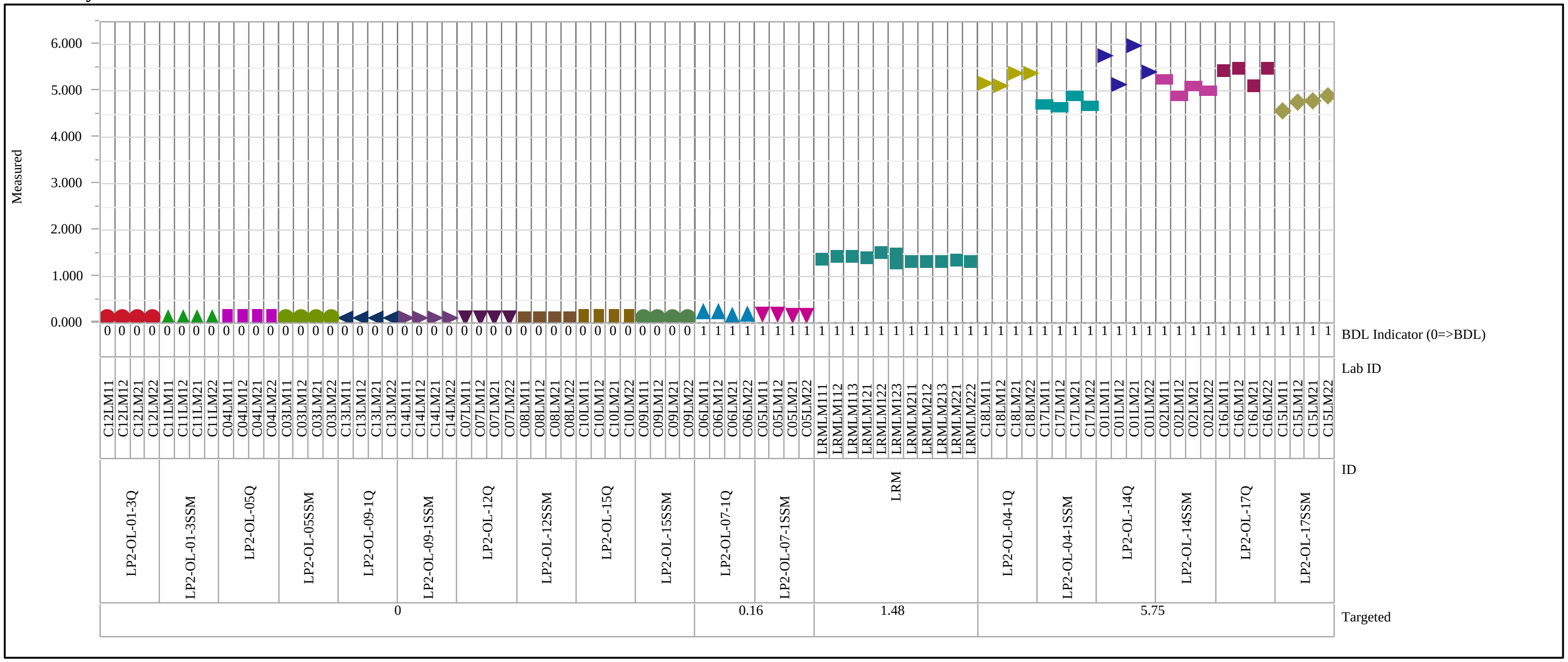


Exhibit C-2. Plots of Oxide Measurements by Set by Glass Identifier Grouped by Targeted Concentrations (continued)

Set=2, Analyte=K2O (wt%)
Variability Chart for Measured

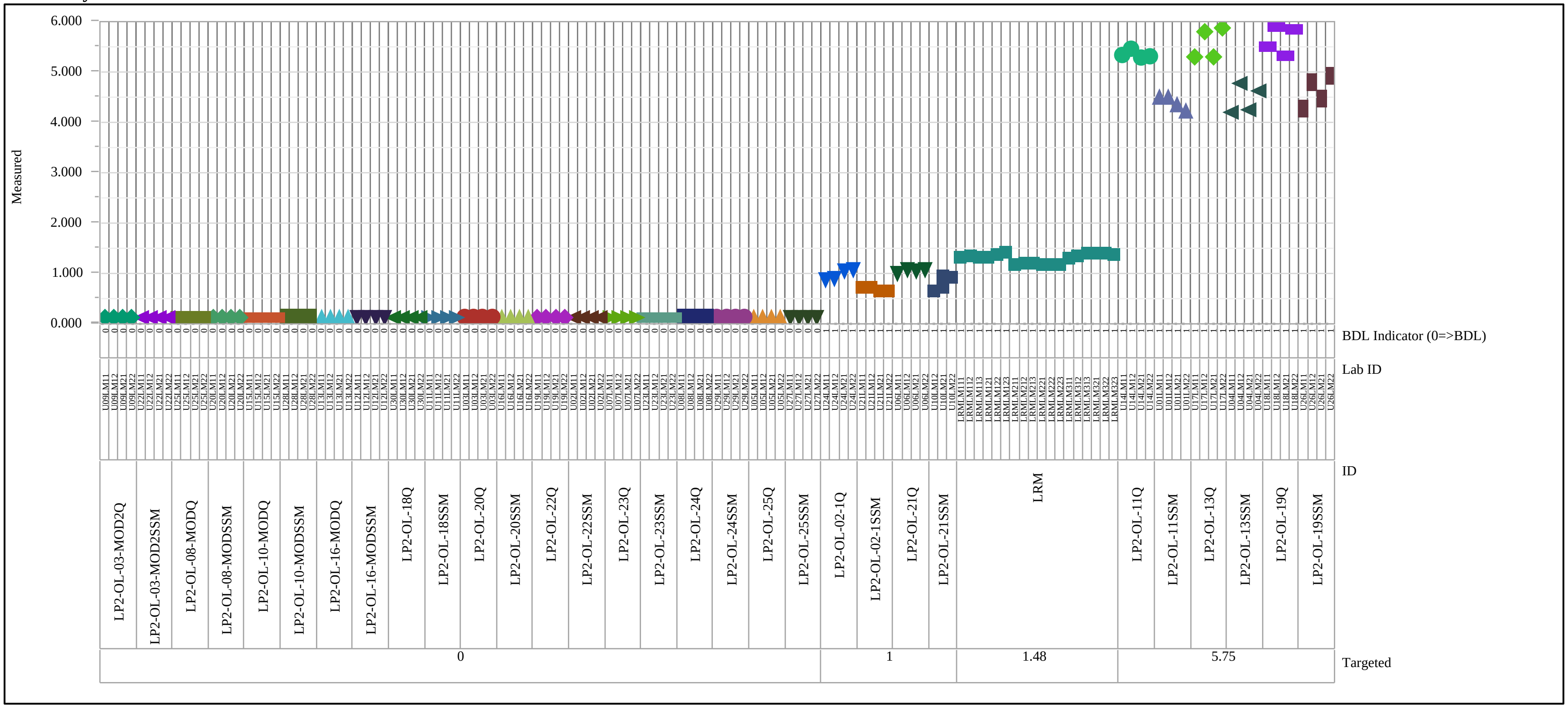


Exhibit C-2. Plots of Oxide Measurements by Set by Glass Identifier Grouped by Targeted Concentrations (continued)

Set=1, Analyte=Li2O (wt%)
Variability Chart for Measured

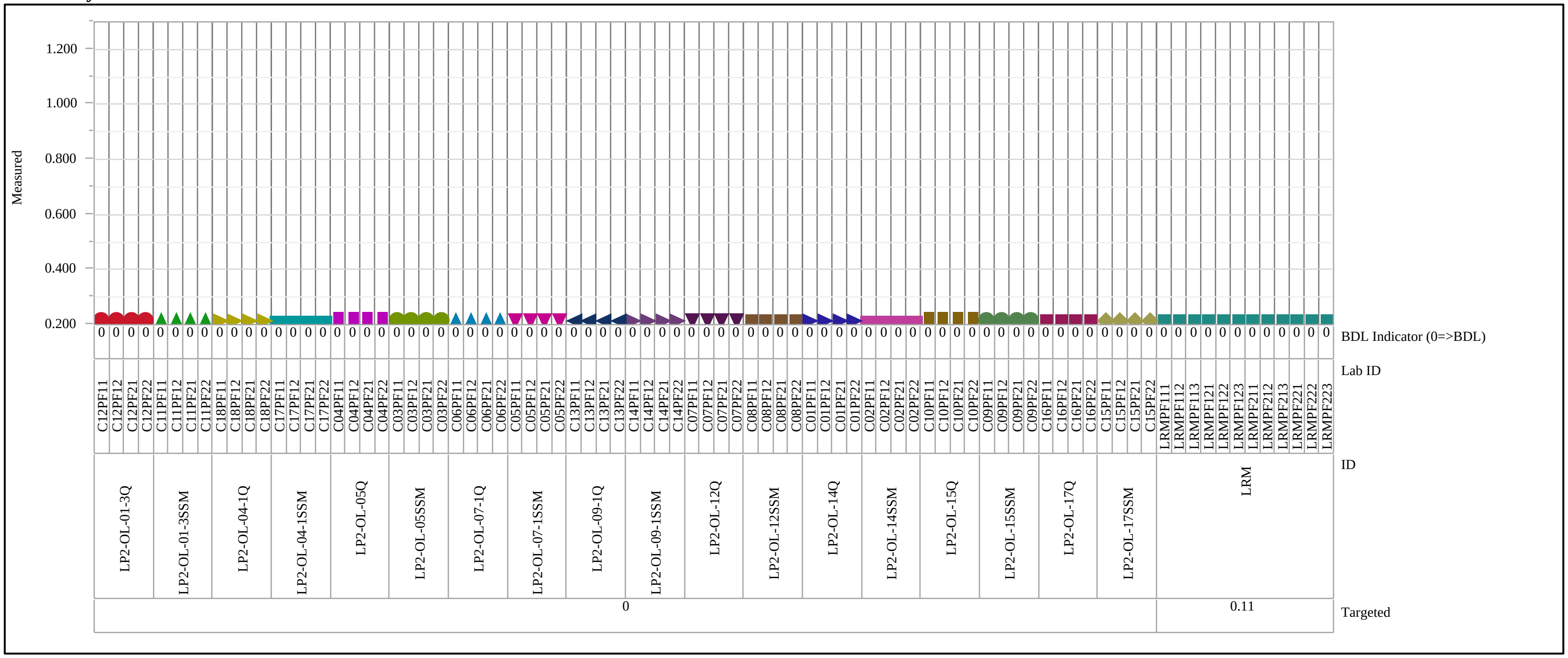


Exhibit C-2. Plots of Oxide Measurements by Set by Glass Identifier Grouped by Targeted Concentrations (continued)

Set=2, Analyte=Li2O (wt%)
Variability Chart for Measured

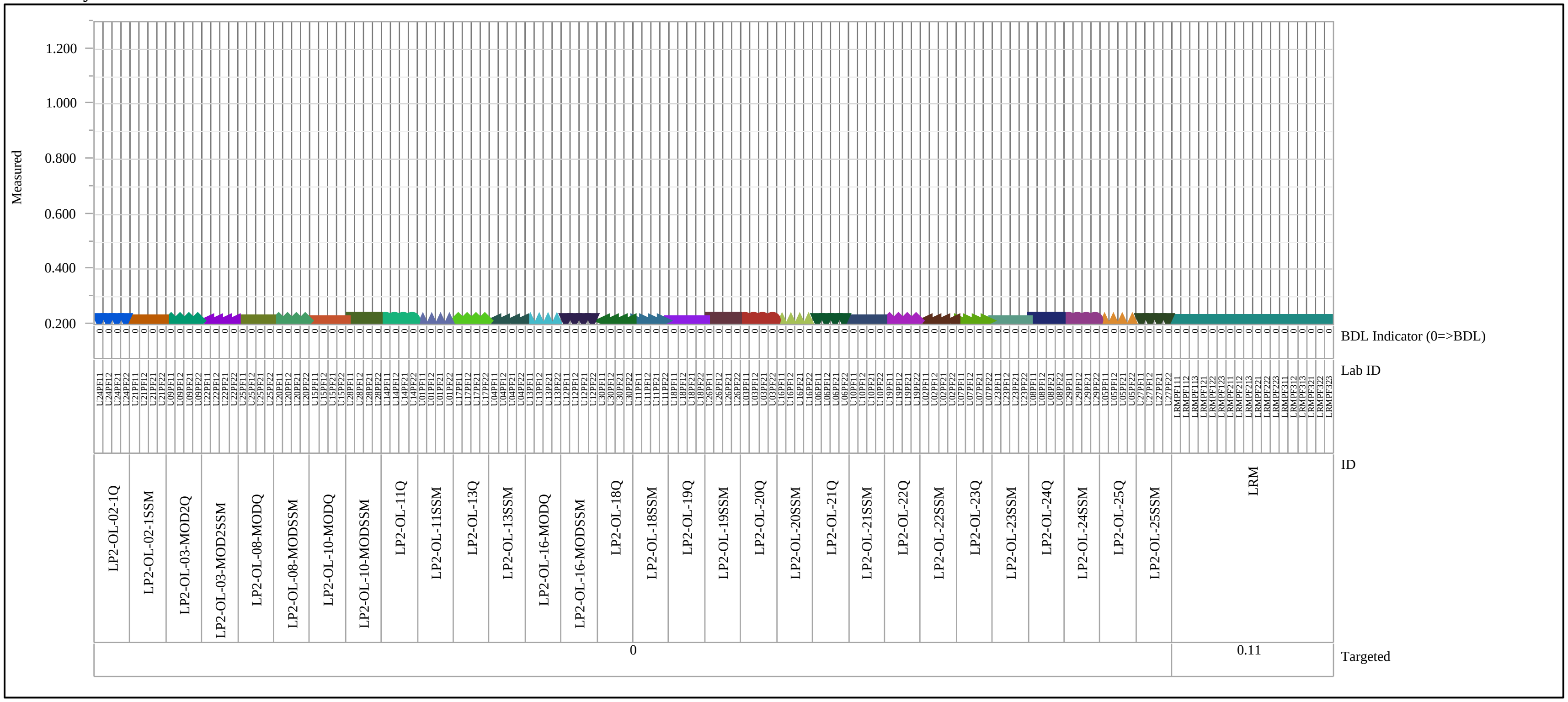


Exhibit C-2. Plots of Oxide Measurements by Set by Glass Identifier Grouped by Targeted Concentrations (continued)

Set=1, Analyte=MgO (wt%)
Variability Chart for Measured

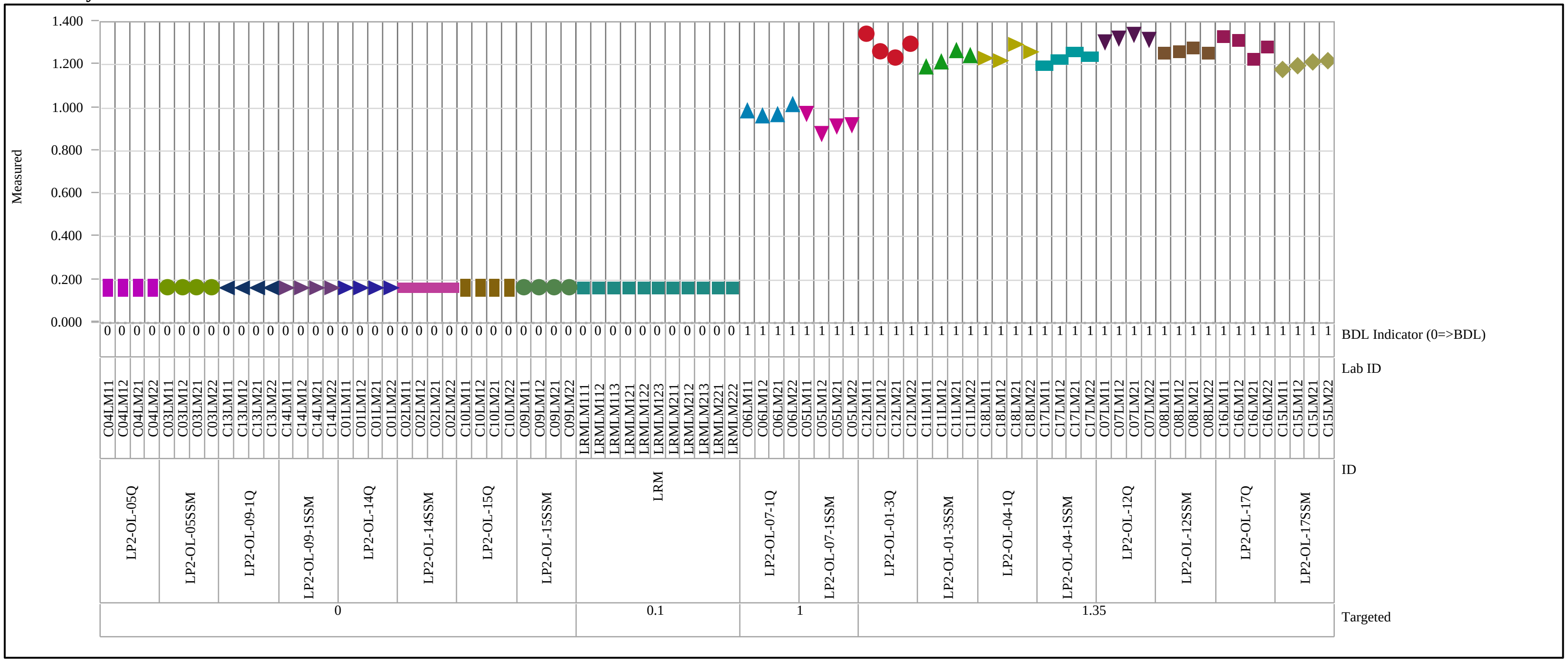


Exhibit C-2. Plots of Oxide Measurements by Set by Glass Identifier Grouped by Targeted Concentrations (continued)

Set=2, Analyte=MgO (wt%)
Variability Chart for Measured

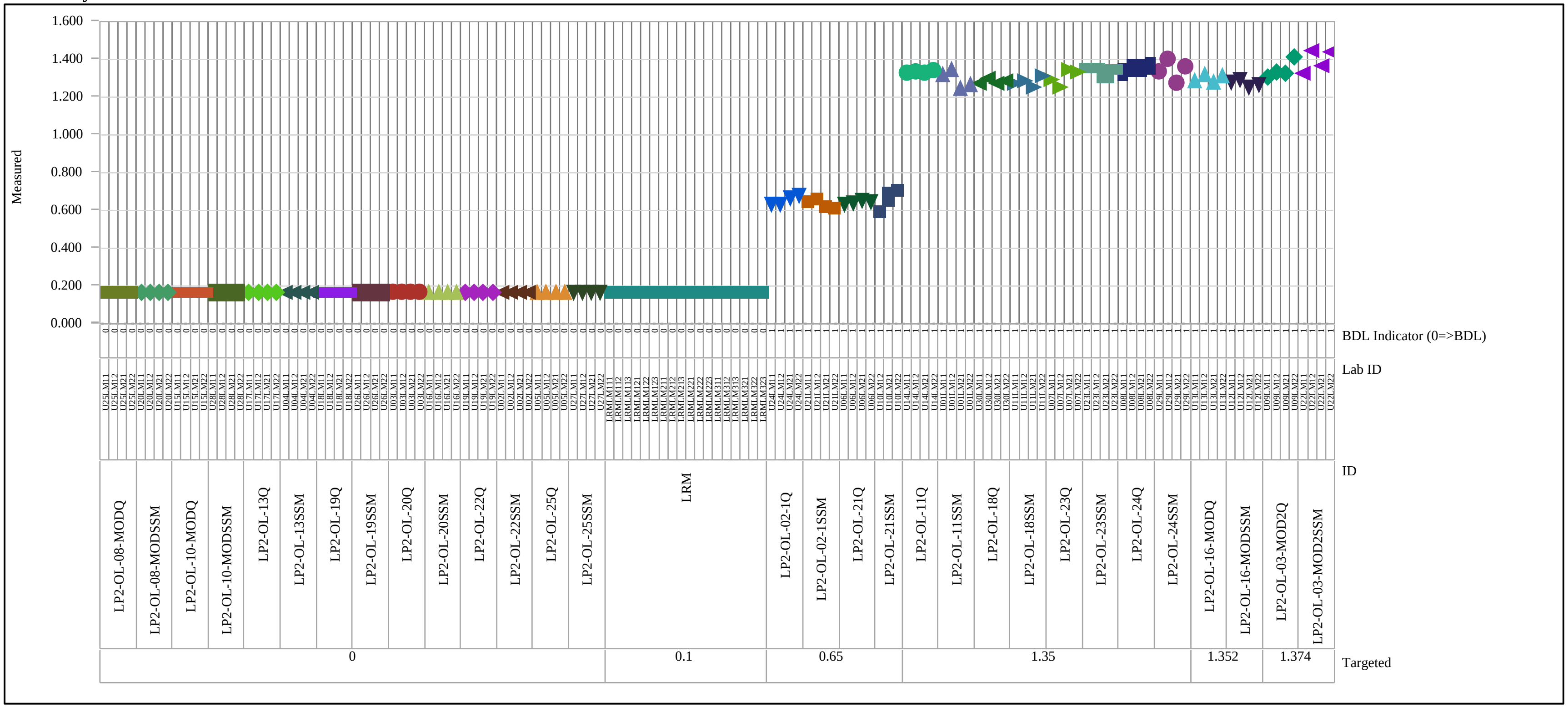


Exhibit C-2. Plots of Oxide Measurements by Set by Glass Identifier Grouped by Targeted Concentrations (continued)

Set=1, Analyte=Na2O (wt%)
Variability Chart for Measured

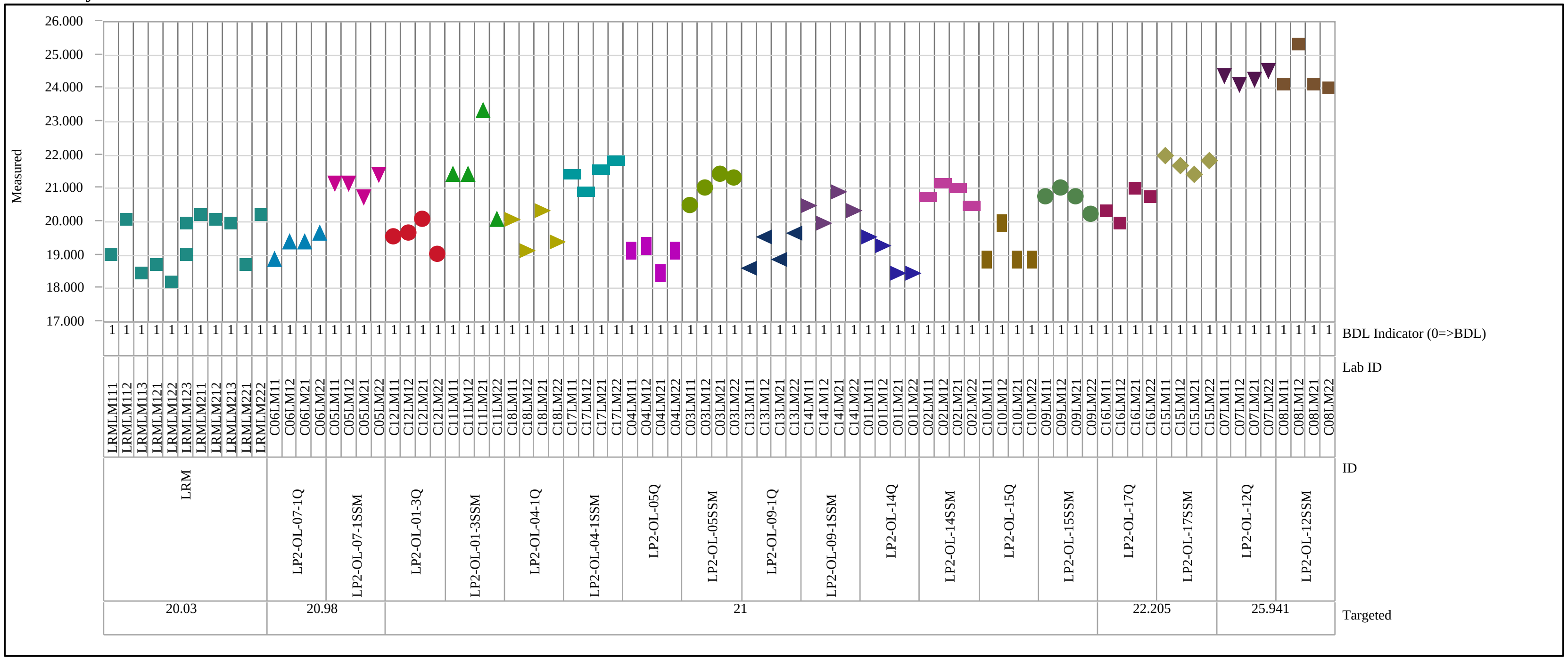


Exhibit C-2. Plots of Oxide Measurements by Set by Glass Identifier Grouped by Targeted Concentrations (continued)

Set=2, Analyte=Na2O (wt%)
Variability Chart for Measured

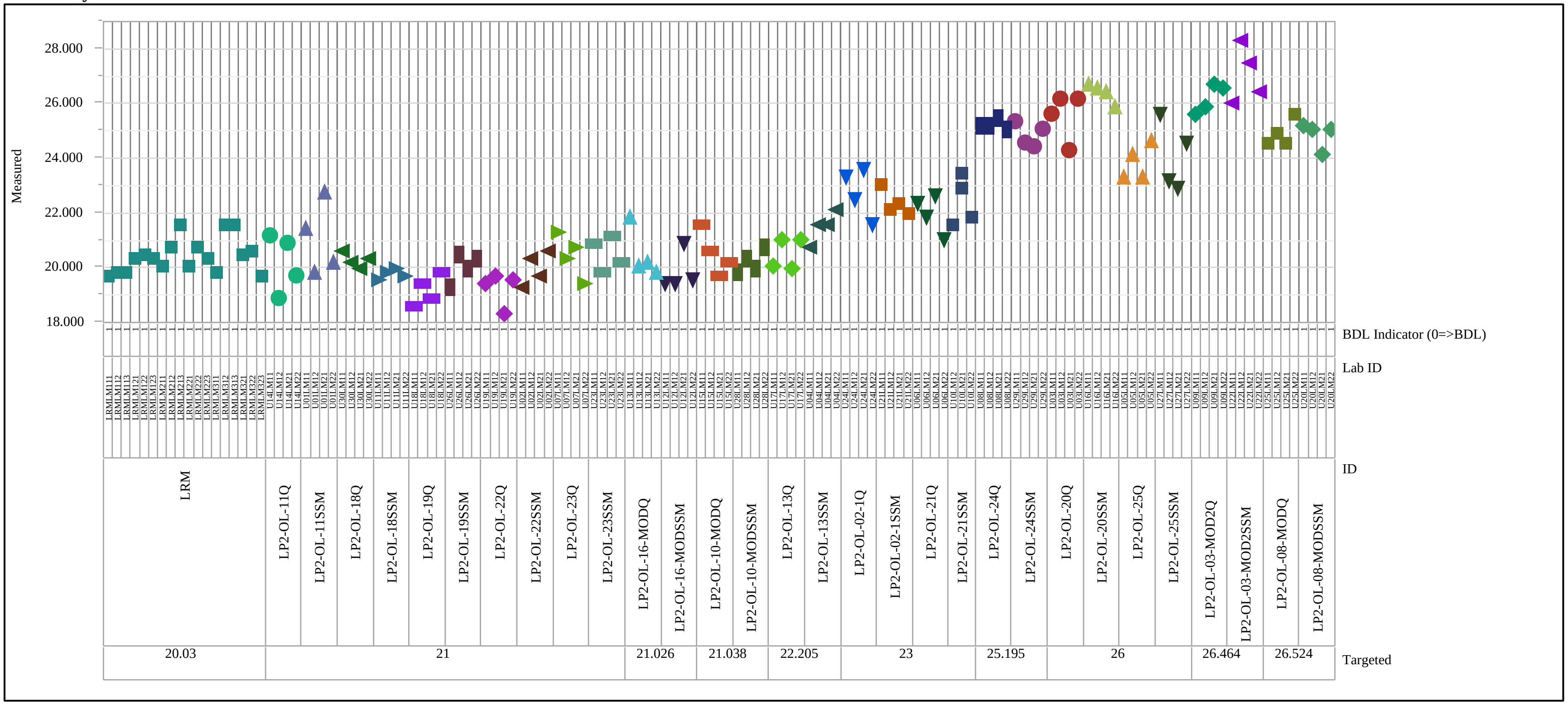


Exhibit C-2. Plots of Oxide Measurements by Set by Glass Identifier Grouped by Targeted Concentrations (continued)

Set=1, Analyte=NiO (wt%)
Variability Chart for Measured

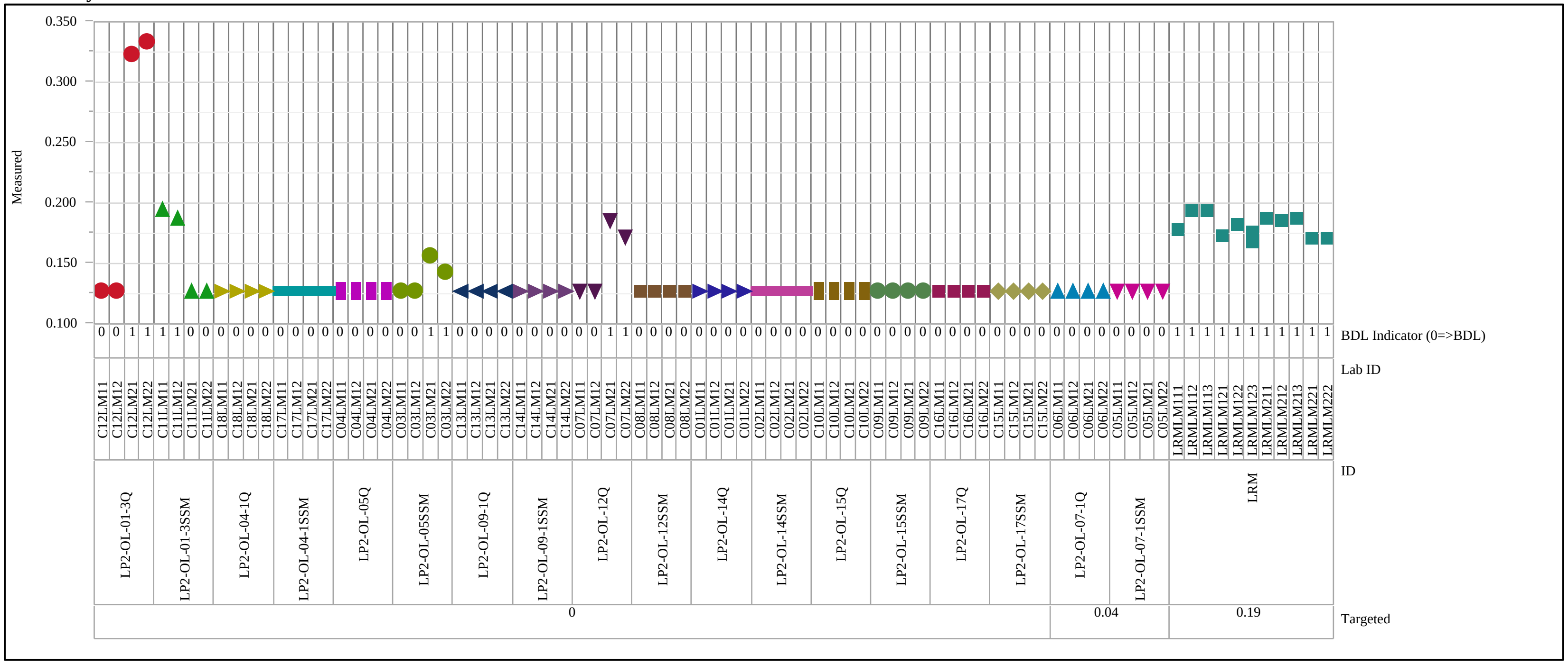


Exhibit C-2. Plots of Oxide Measurements by Set by Glass Identifier Grouped by Targeted Concentrations (continued)

Set=2, Analyte=NiO (wt%)
Variability Chart for Measured

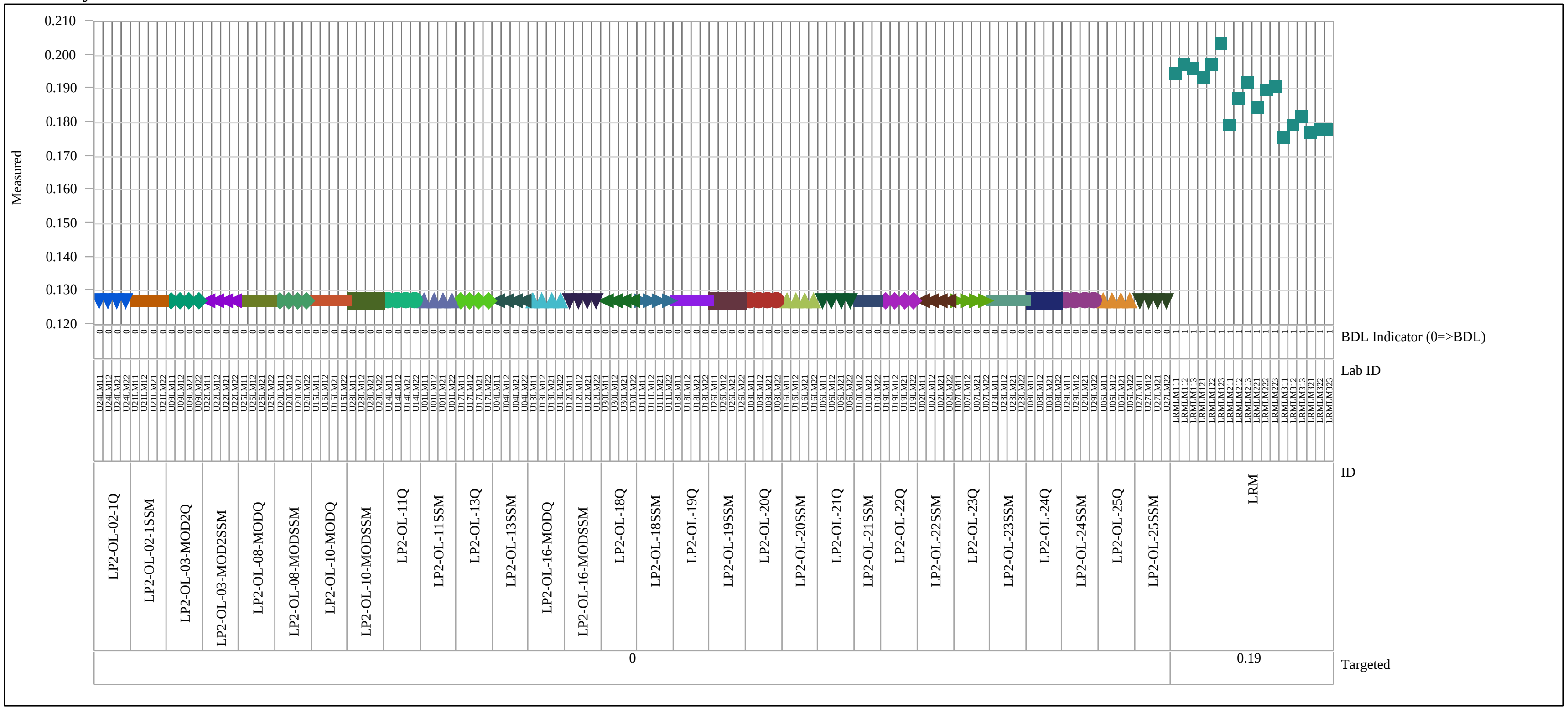


Exhibit C-2. Plots of Oxide Measurements by Set by Glass Identifier Grouped by Targeted Concentrations (continued)

Set=1, Analyte=P2O5 (wt%)
Variability Chart for Measured

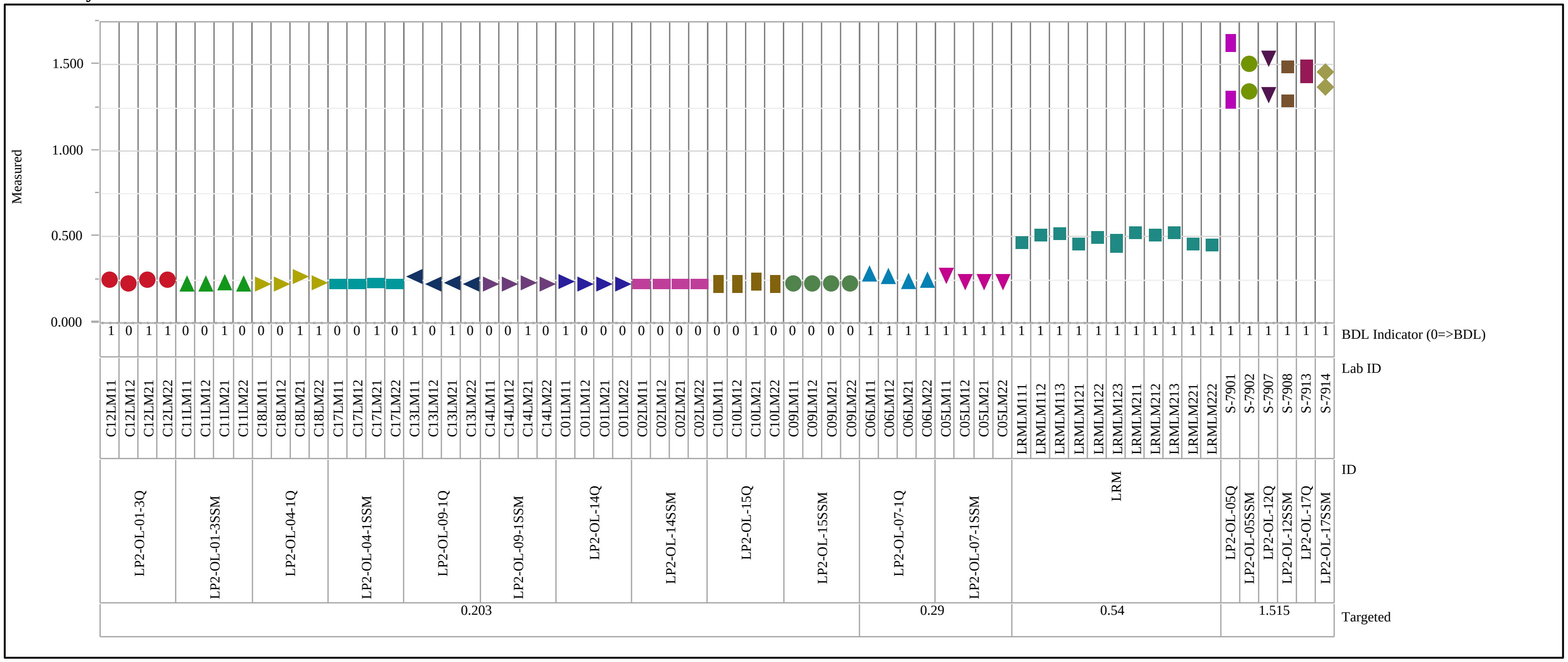


Exhibit C-2. Plots of Oxide Measurements by Set by Glass Identifier Grouped by Targeted Concentrations (continued)

Set=2, Analyte=P2O5 (wt%)
Variability Chart for Measured

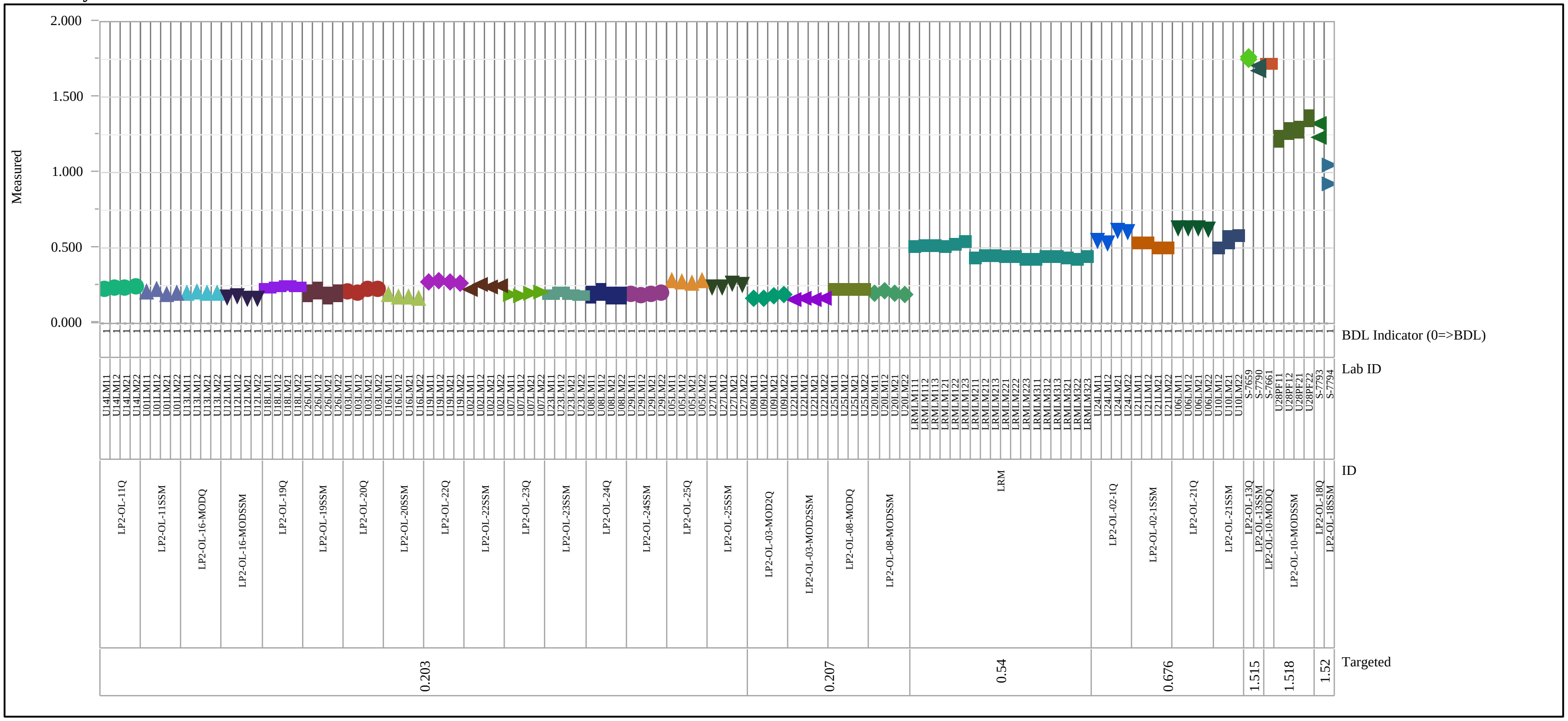


Exhibit C-2. Plots of Oxide Measurements by Set by Glass Identifier Grouped by Targeted Concentrations (continued)

Set=1, Analyte=SiO2 (wt%)
Variability Chart for Measured

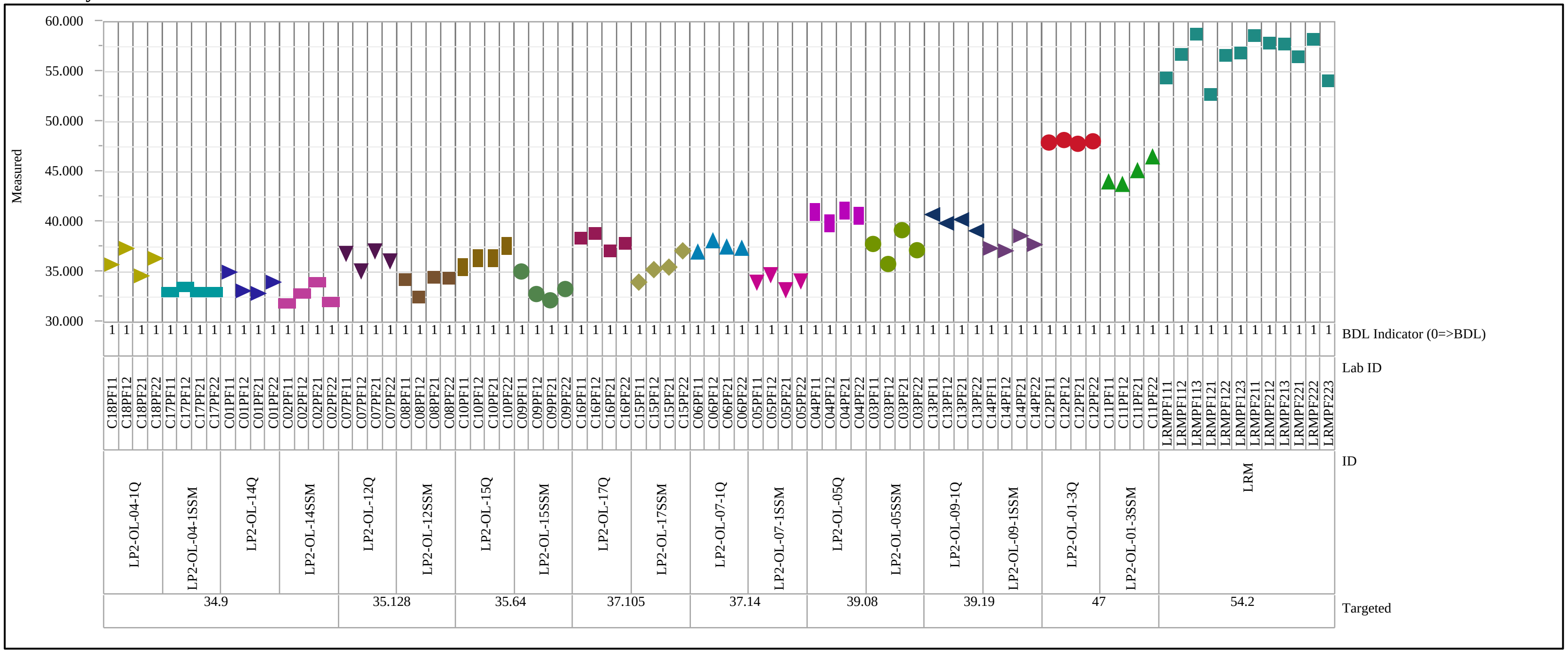


Exhibit C-2. Plots of Oxide Measurements by Set by Glass Identifier Grouped by Targeted Concentrations (continued)

Set=2, Analyte=SiO2 (wt%)
Variability Chart for Measured

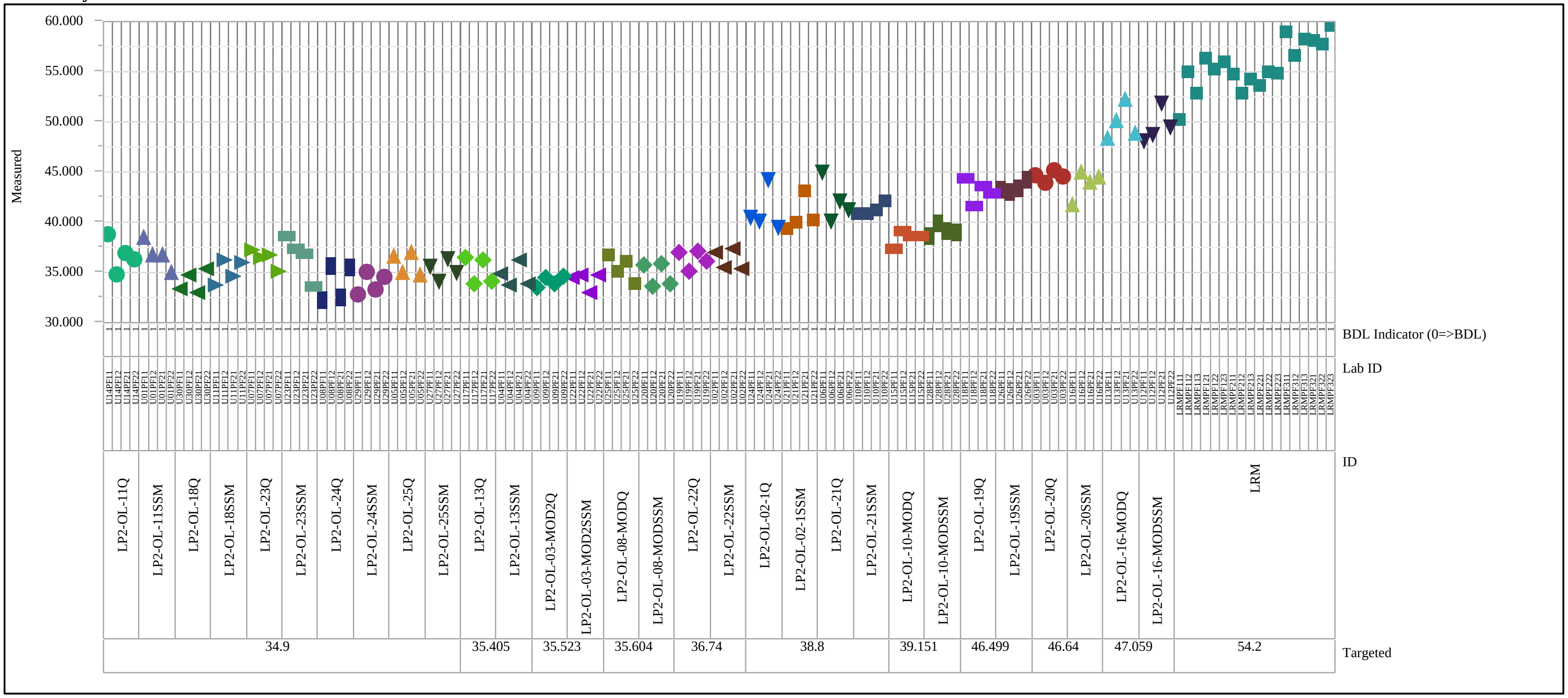


Exhibit C-2. Plots of Oxide Measurements by Set by Glass Identifier Grouped by Targeted Concentrations (continued)

Set=1, Analyte=SnO2 (wt%)
Variability Chart for Measured

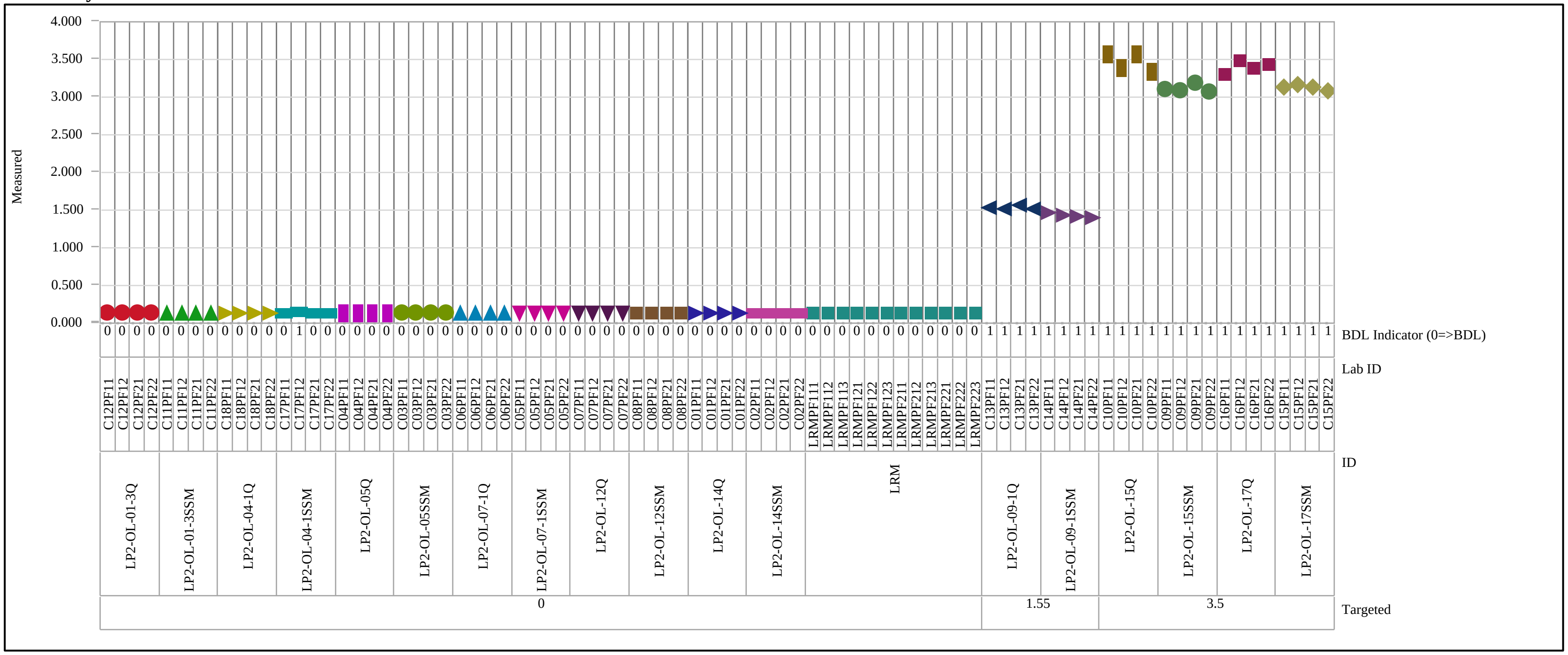


Exhibit C-2. Plots of Oxide Measurements by Set by Glass Identifier Grouped by Targeted Concentrations (continued)

Set=2, Analyte=SnO2 (wt%)
Variability Chart for Measured

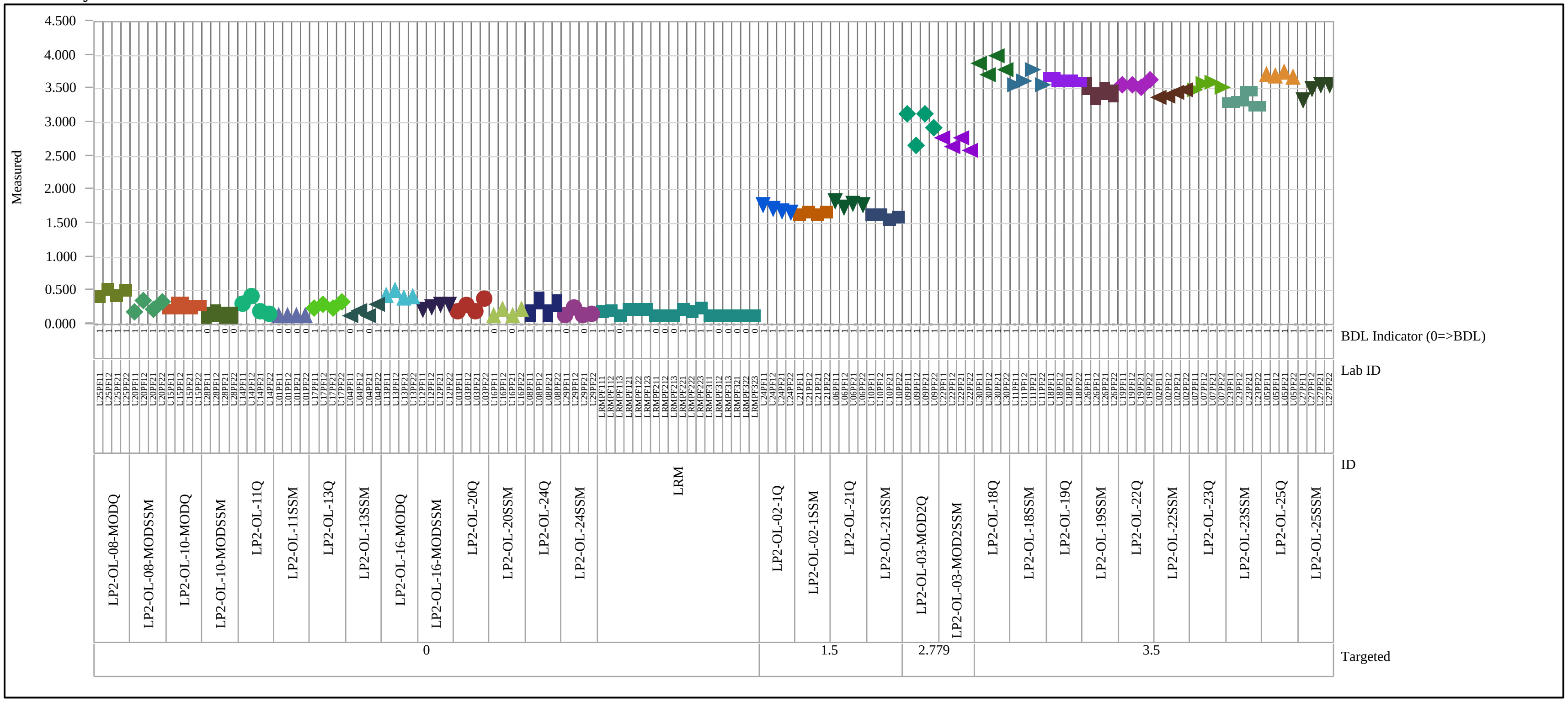


Exhibit C-2. Plots of Oxide Measurements by Set by Glass Identifier Grouped by Targeted Concentrations (continued)

Set=1, Analyte=SO3 (wt%)
Variability Chart for Measured

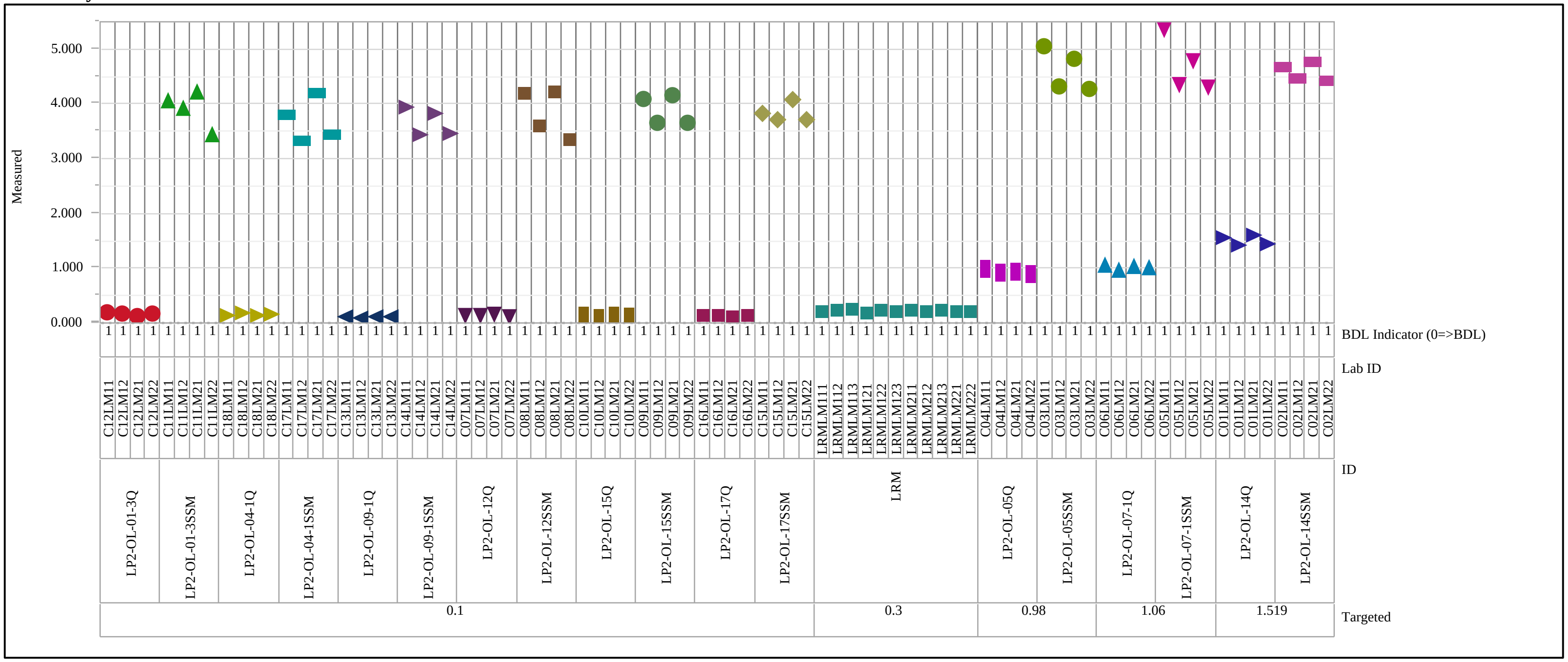


Exhibit C-2. Plots of Oxide Measurements by Set by Glass Identifier Grouped by Targeted Concentrations (continued)

Set=2, Analyte=SO3 (wt%)
Variability Chart for Measured

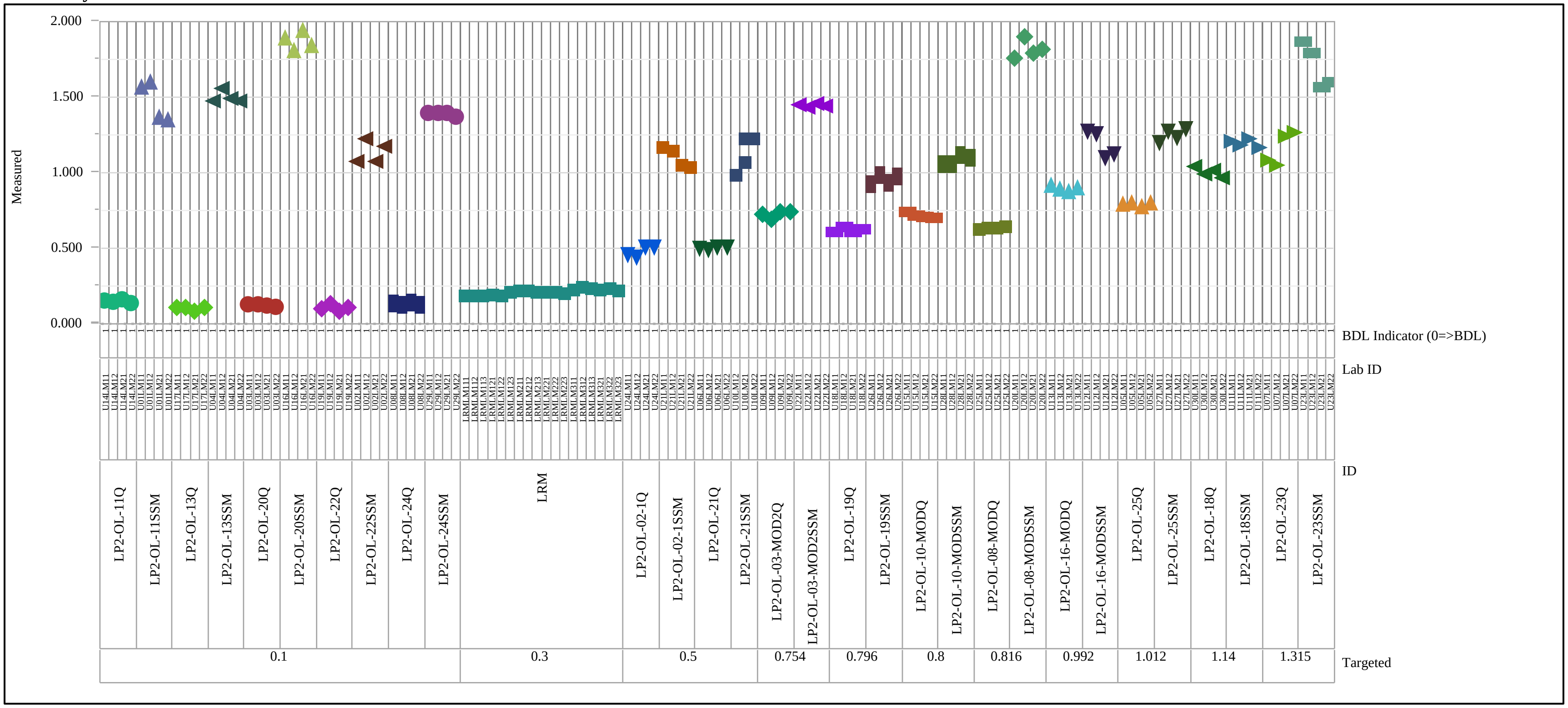


Exhibit C-2. Plots of Oxide Measurements by Set by Glass Identifier Grouped by Targeted Concentrations (continued)

Set=1, Analyte=V2O5 (wt%)
Variability Chart for Measured

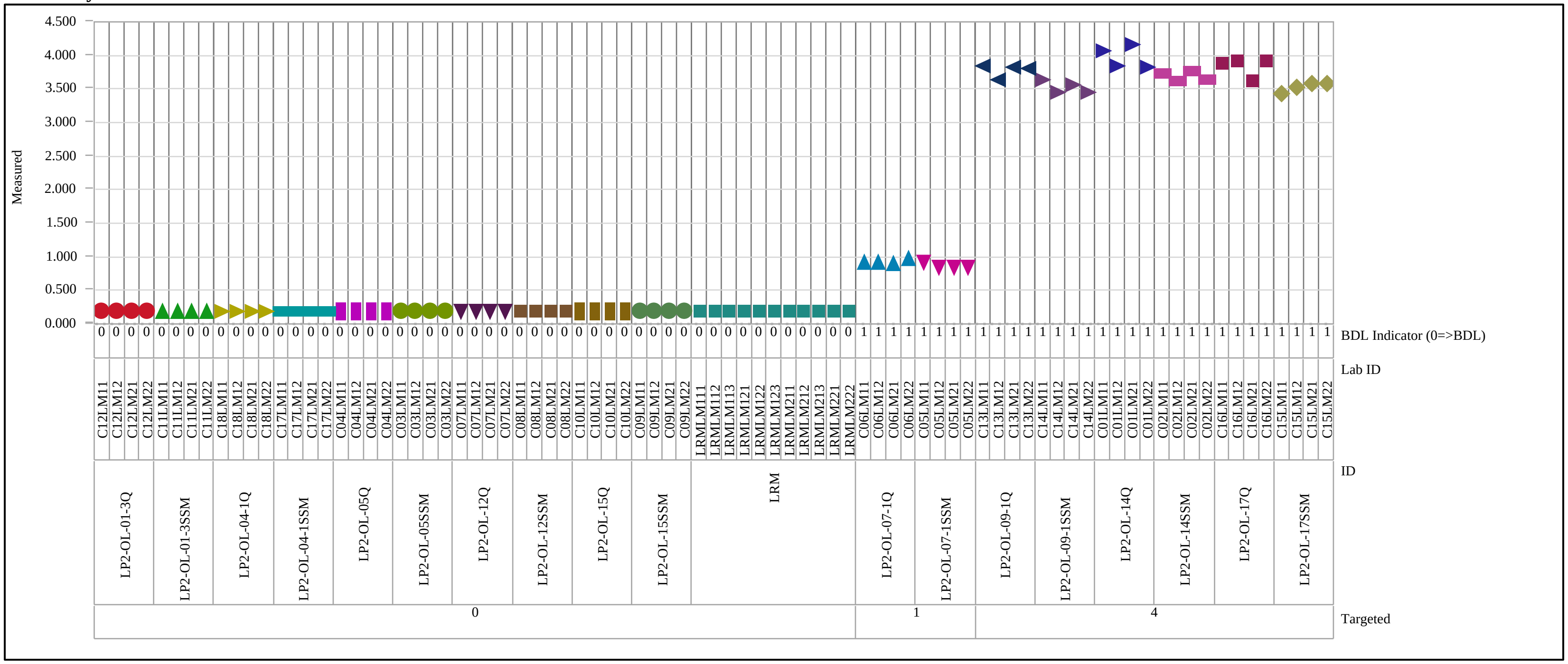


Exhibit C-2. Plots of Oxide Measurements by Set by Glass Identifier Grouped by Targeted Concentrations (continued)

Set=2, Analyte=V2O5 (wt%)
Variability Chart for Measured

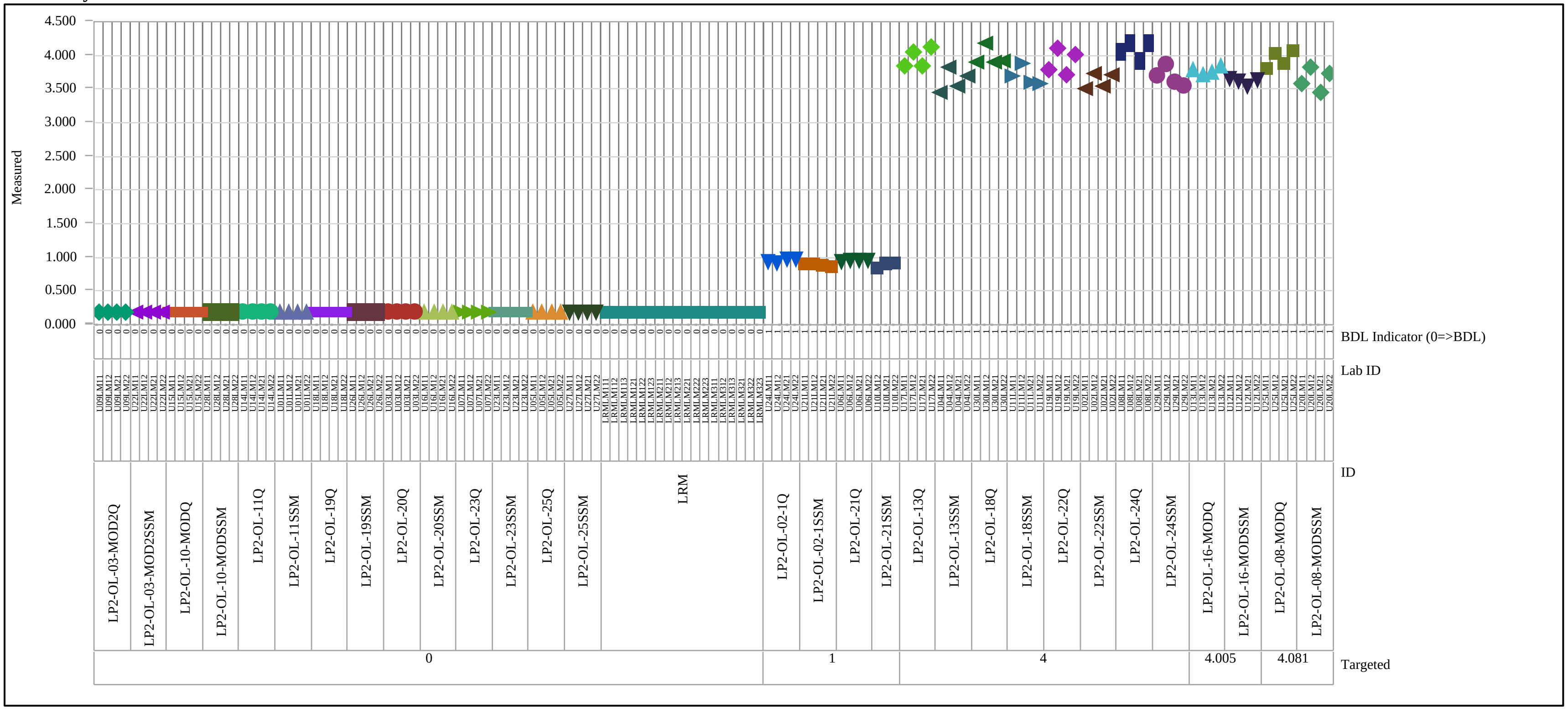


Exhibit C-2. Plots of Oxide Measurements by Set by Glass Identifier Grouped by Targeted Concentrations (continued)

Set=1, Analyte=ZnO (wt%)
Variability Chart for Measured

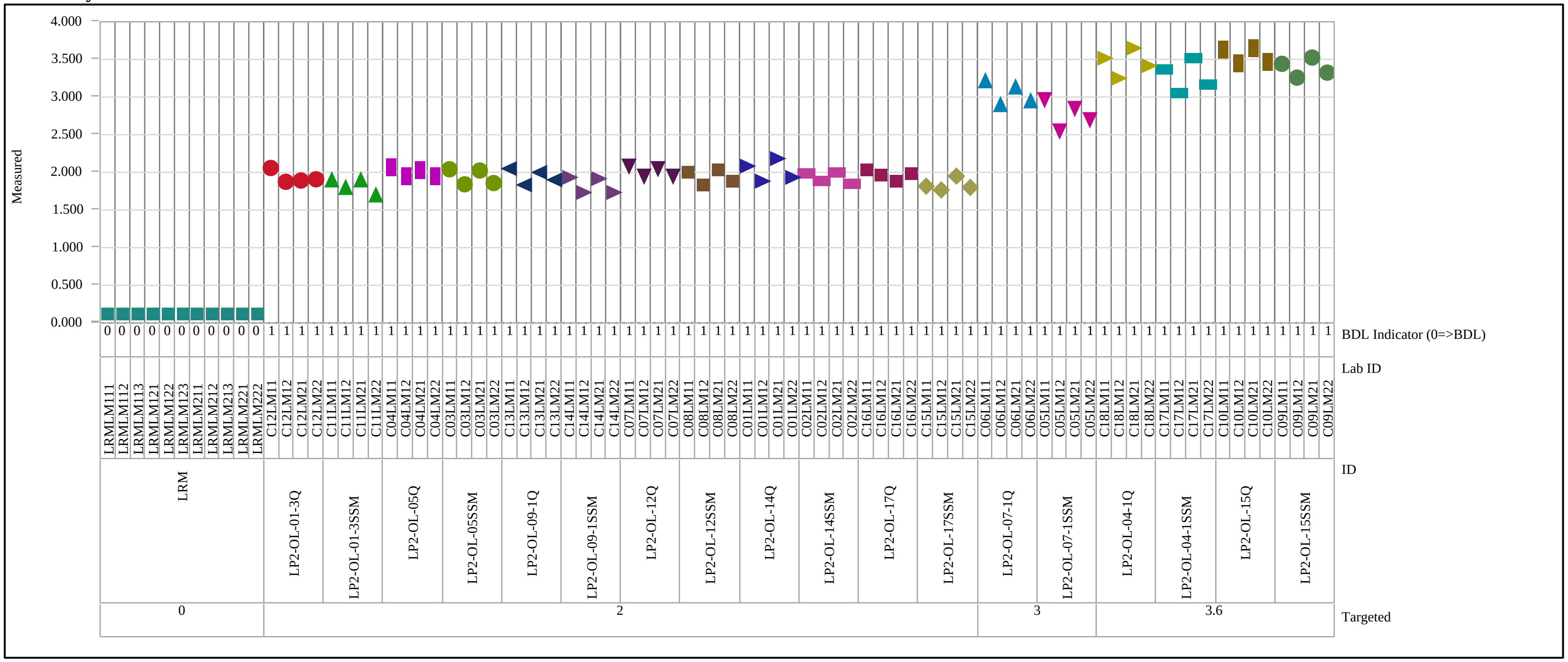


Exhibit C-2. Plots of Oxide Measurements by Set by Glass Identifier Grouped by Targeted Concentrations (continued)

Set=2, Analyte=ZnO (wt%)
Variability Chart for Measured

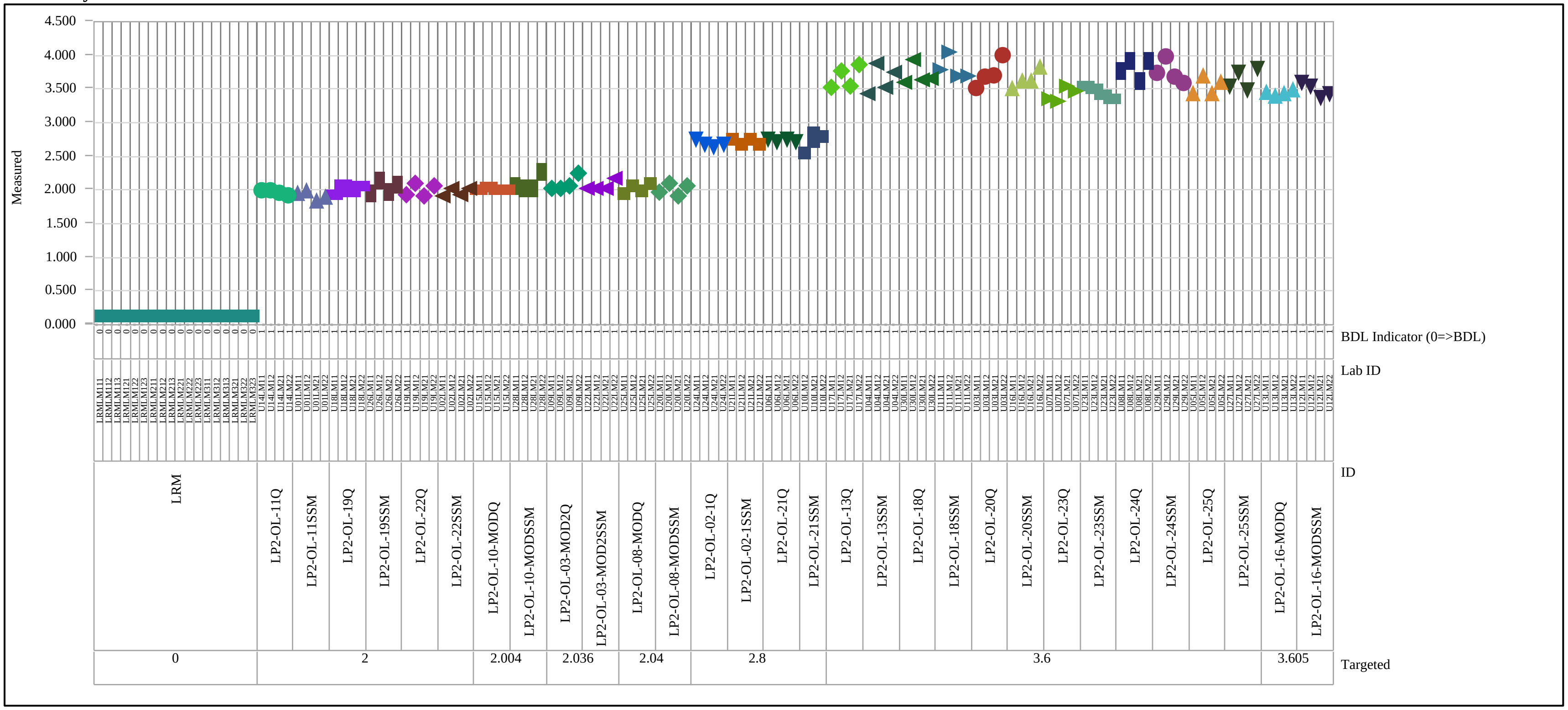


Exhibit C-2. Plots of Oxide Measurements by Set by Glass Identifier Grouped by Targeted Concentrations (continued)

Set=1, Analyte=ZrO2 (wt%)
Variability Chart for Measured

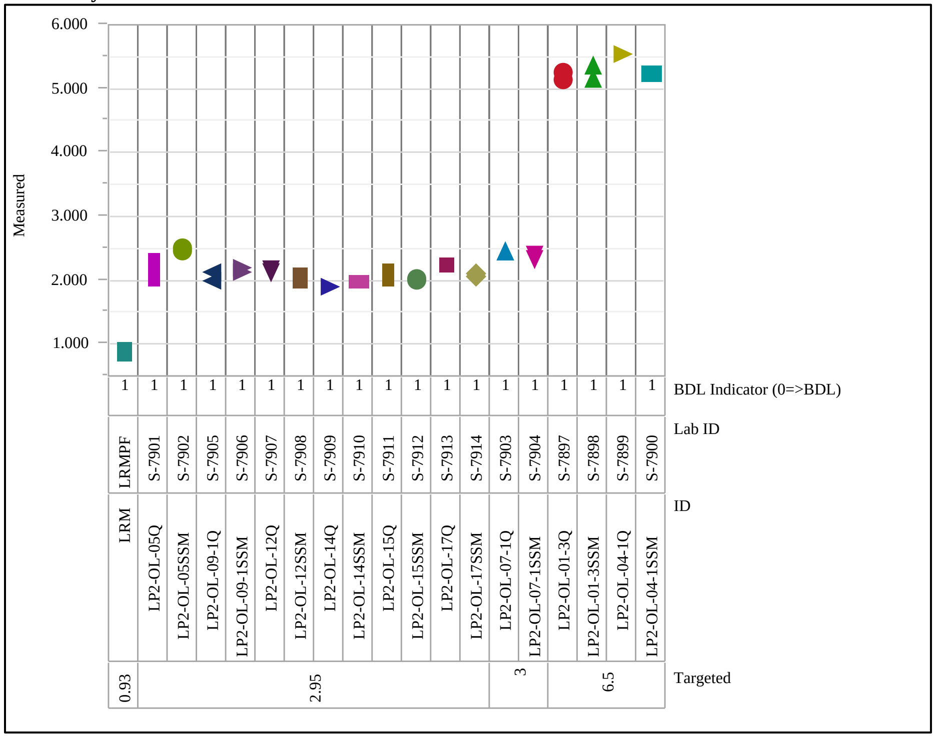


Exhibit C-2. Plots of Oxide Measurements by Set by Glass Identifier Grouped by Targeted Concentrations (continued)

Set=2, Analyte=ZrO2 (wt%)
Variability Chart for Measured

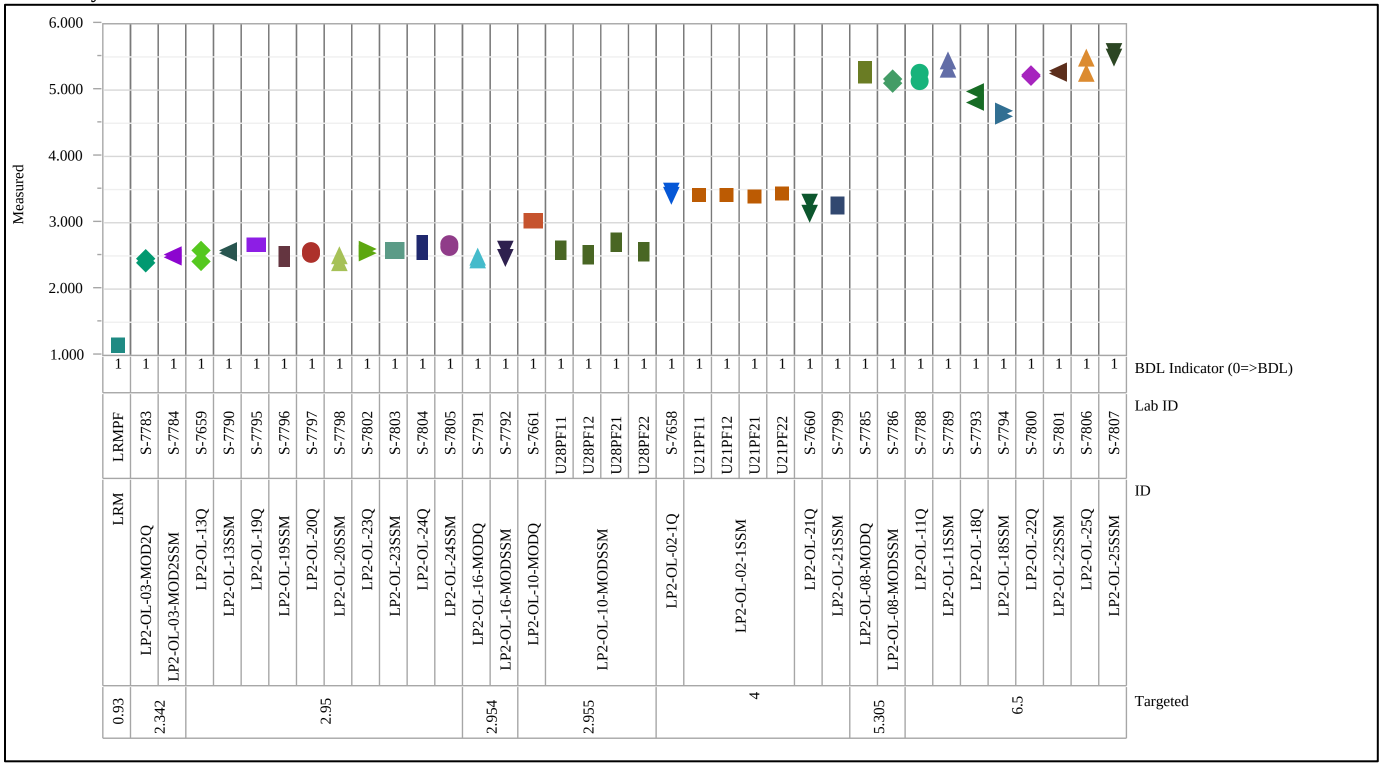
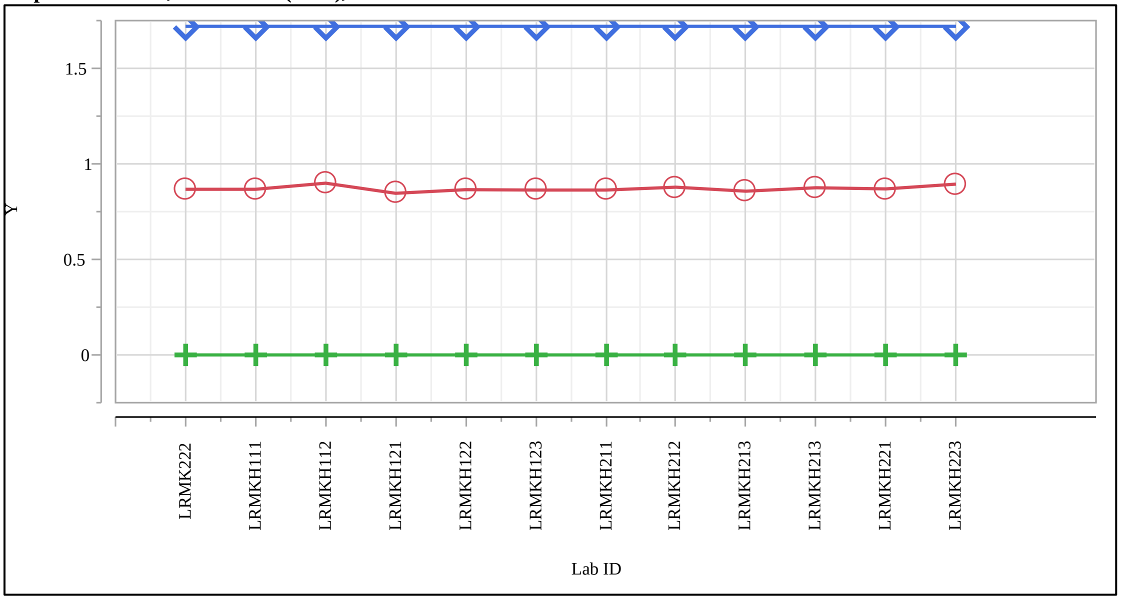
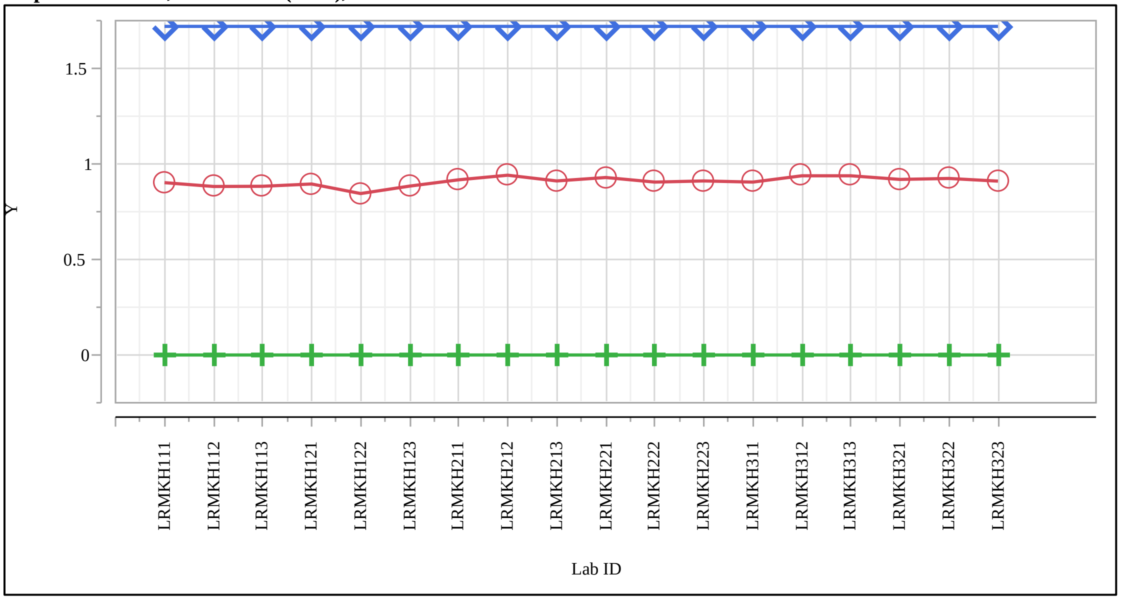


Exhibit C-3. Acceptability Evaluation for Measurements of the LRM Standard Glass

Prep Method=KH, Element=F (wt%), Set=1



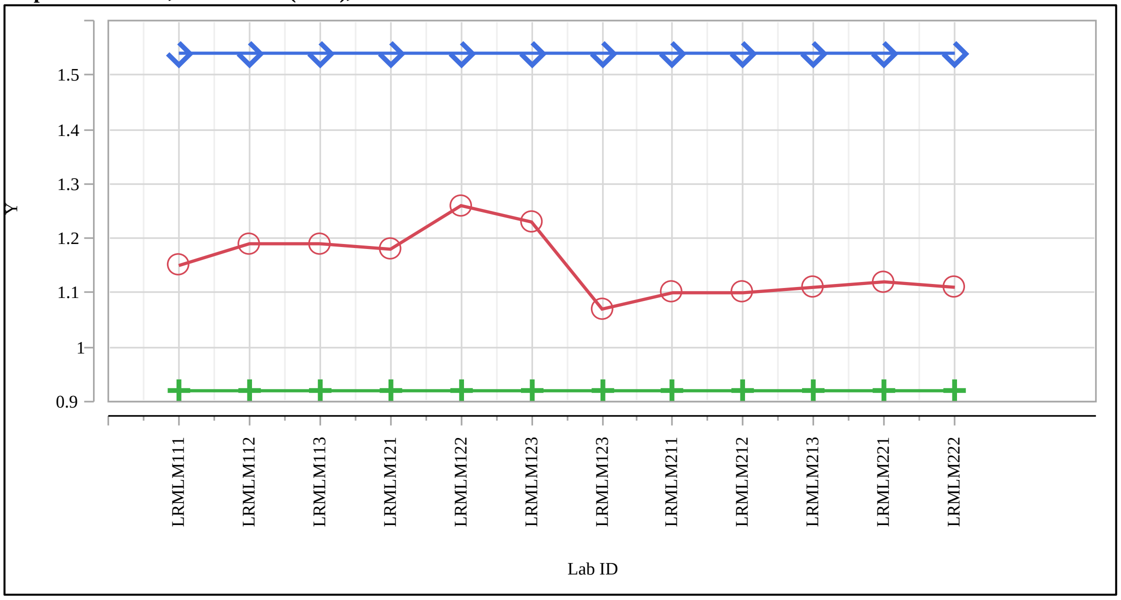
Prep Method=KH, Element=F (wt%), Set=2



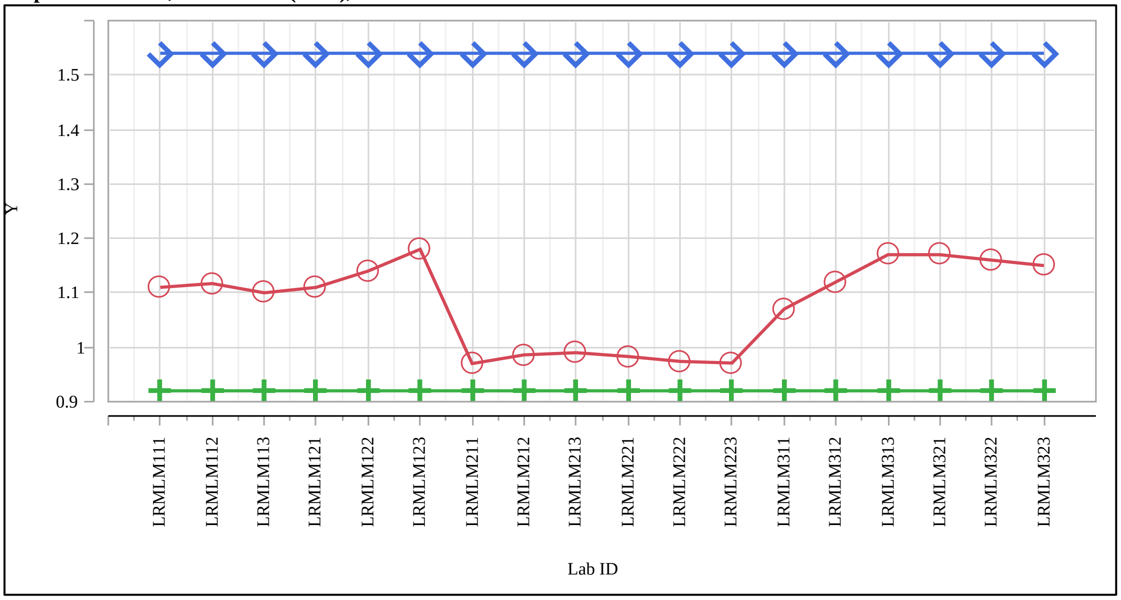
Y ○ —— Measurement + —— lower acceptability limit ◇ —— upper acceptability limit

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

Prep Method=LM, Element=K (wt%), Set=1



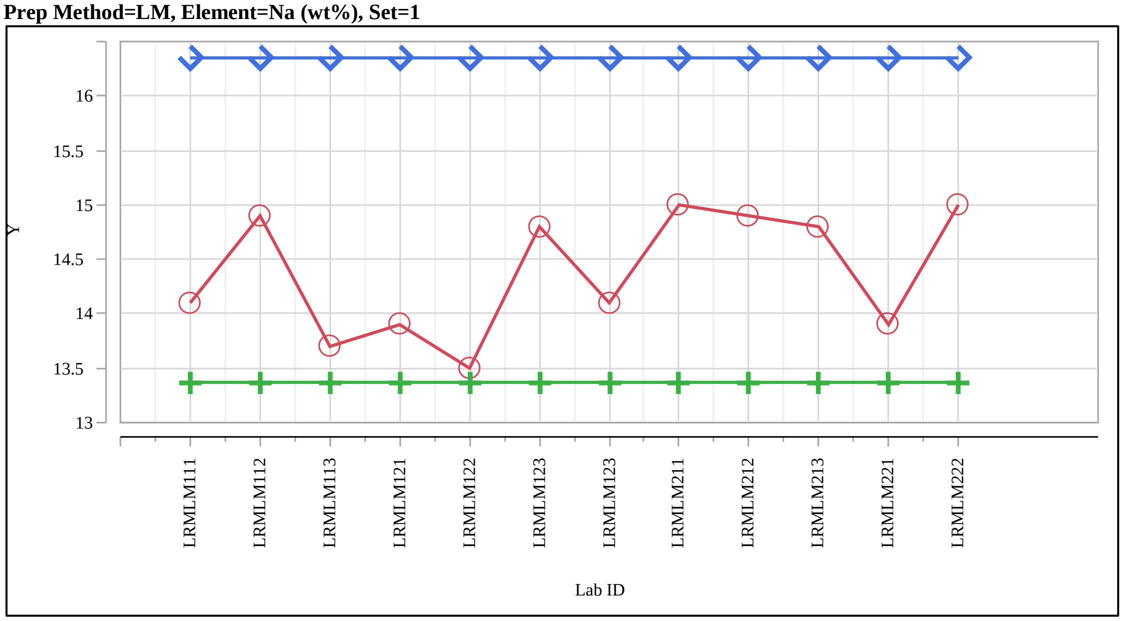
Prep Method=LM, Element=K (wt%), Set=2



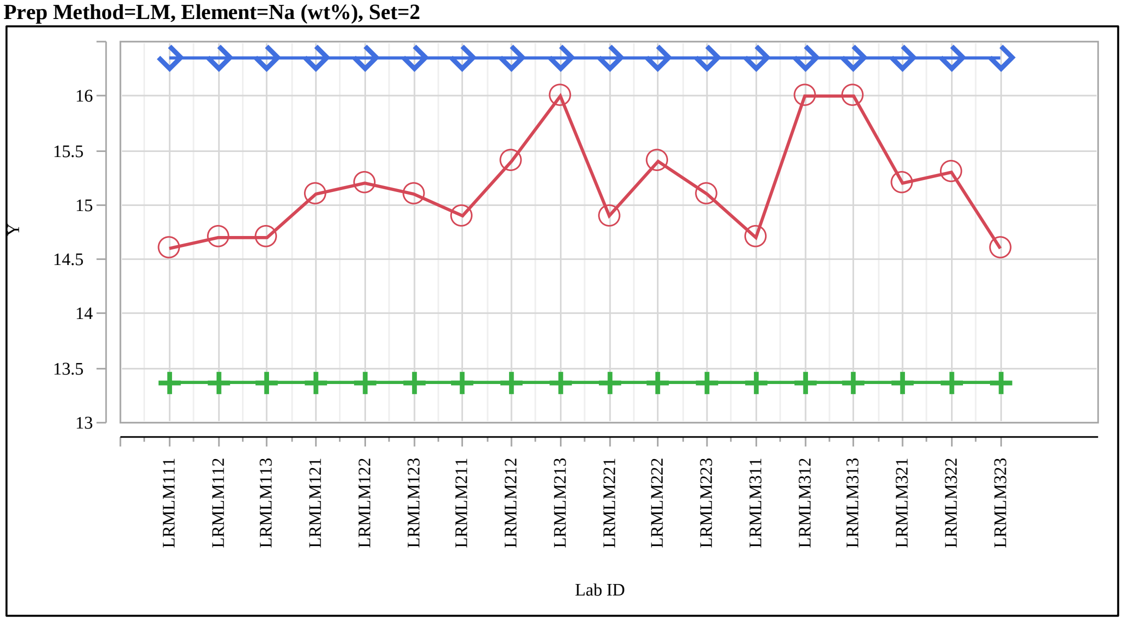
Y Measurement lower acceptability limit upper acceptability limit

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

Prep Method=LM, Element=Na (wt%), Set=1



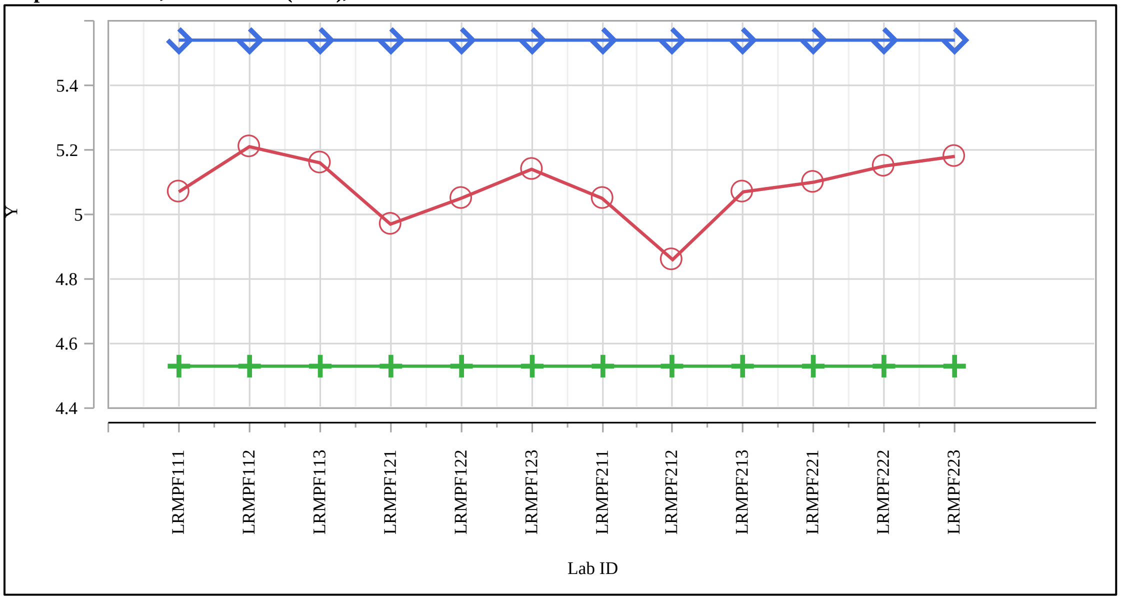
Prep Method=LM, Element=Na (wt%), Set=2



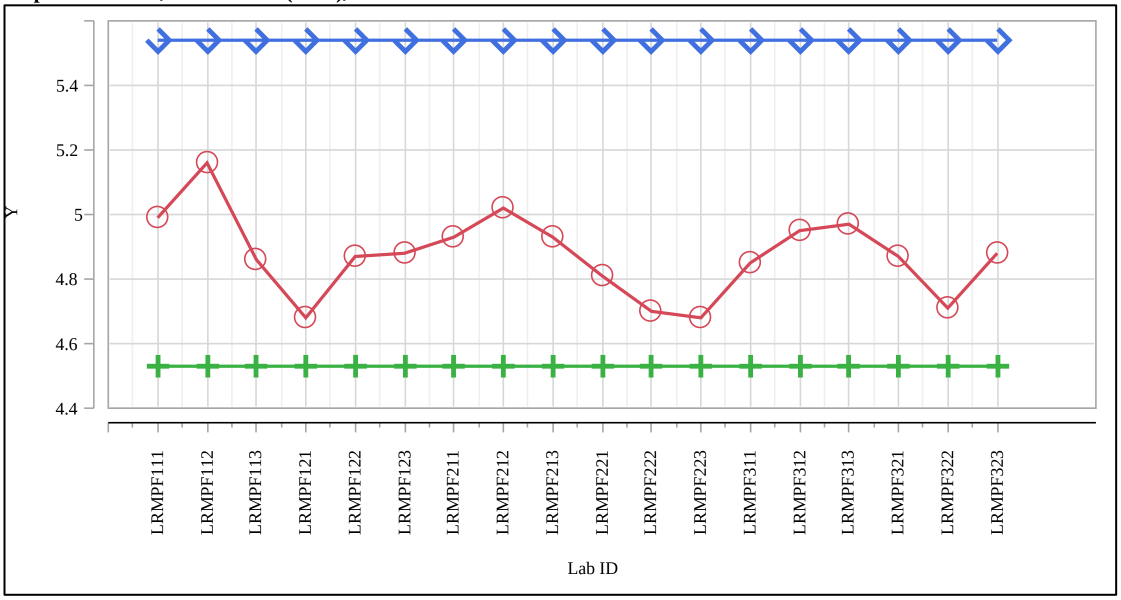
Y ○ —— Measurement + —— lower acceptability limit ◇ —— upper acceptability limit

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

Prep Method=PF, Element=Al (wt%), Set=1



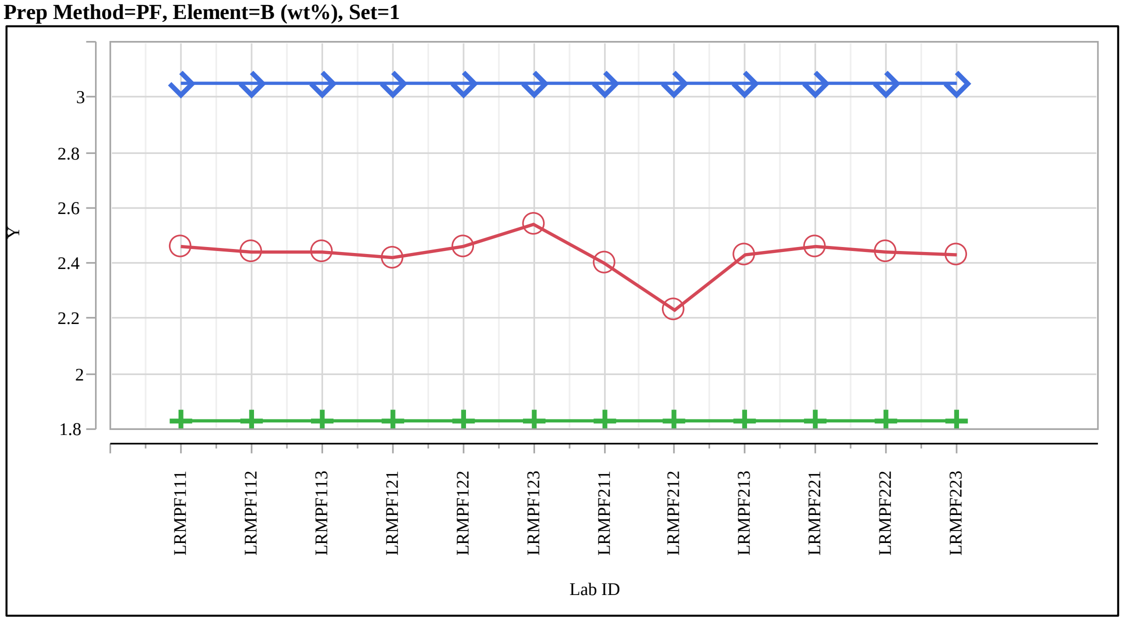
Prep Method=PF, Element=Al (wt%), Set=2



Y Measurement lower acceptability limit upper acceptability limit

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

Prep Method=PF, Element=B (wt%), Set=1



Prep Method=PF, Element=B (wt%), Set=2

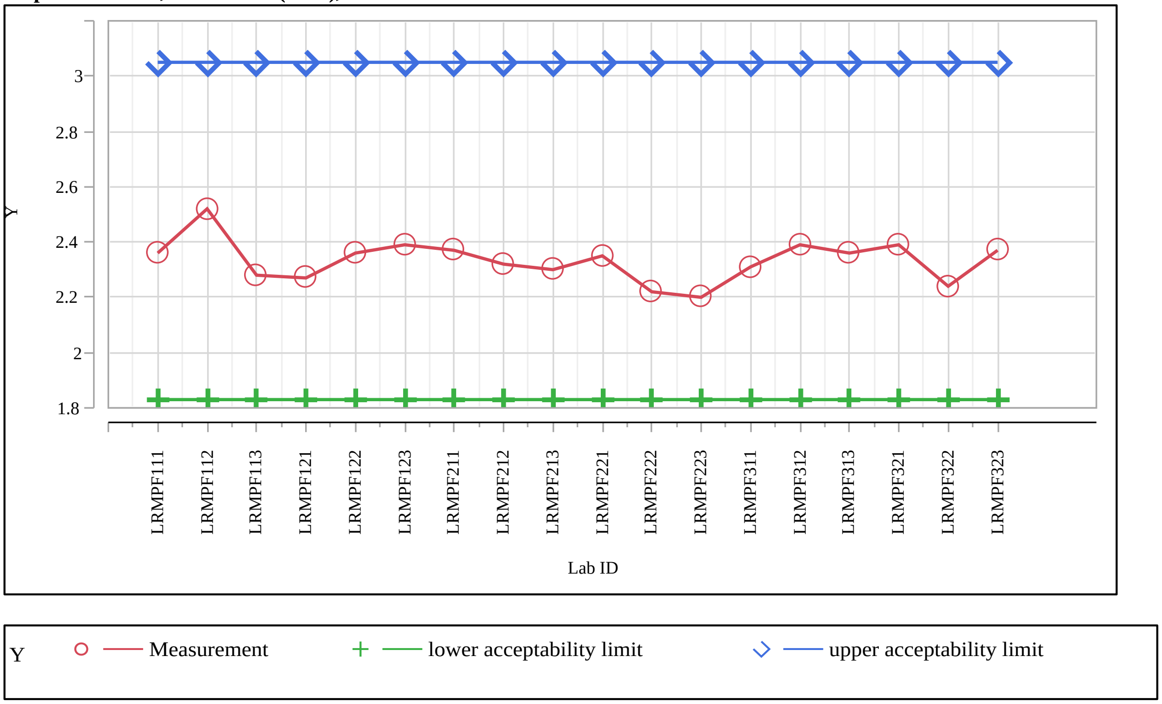
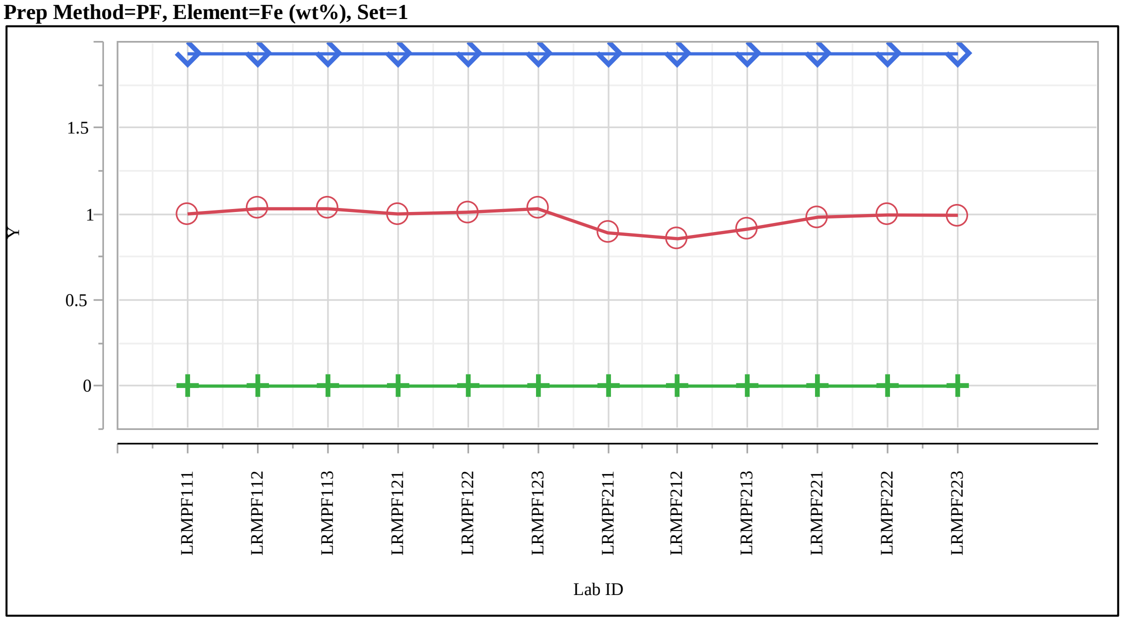
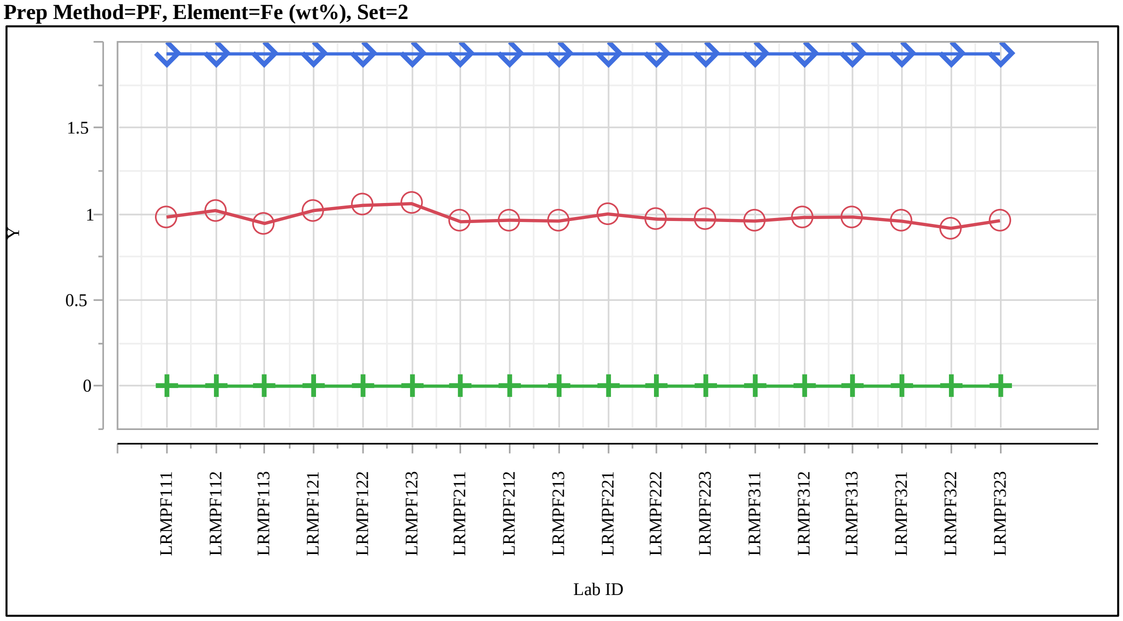


Exhibit C-3. Acceptability Evaluation for Measurements of the LRM Standard Glass (continued)

Prep Method=PF, Element=Fe (wt%), Set=1



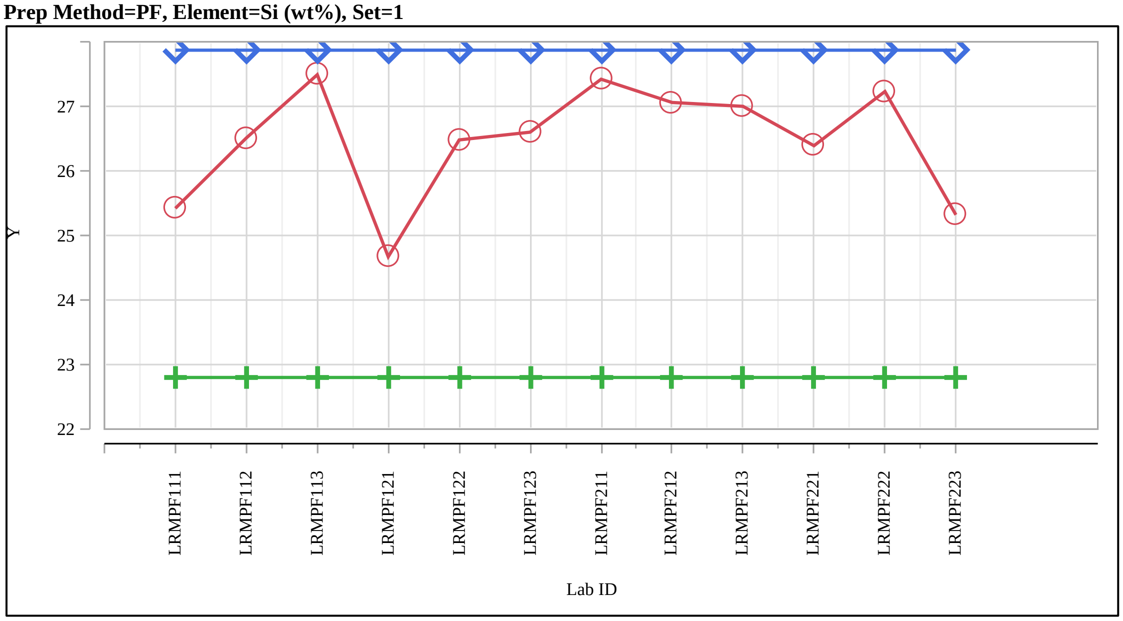
Prep Method=PF, Element=Fe (wt%), Set=2



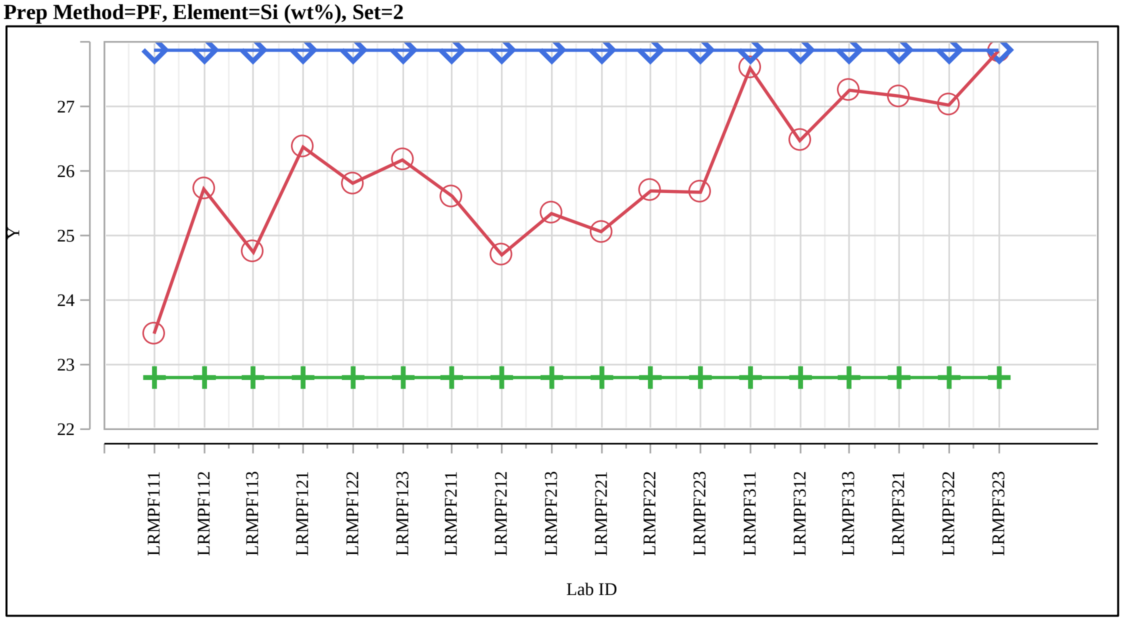
Y Measurement lower acceptability limit upper acceptability limit

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

Prep Method=PF, Element=Si (wt%), Set=1



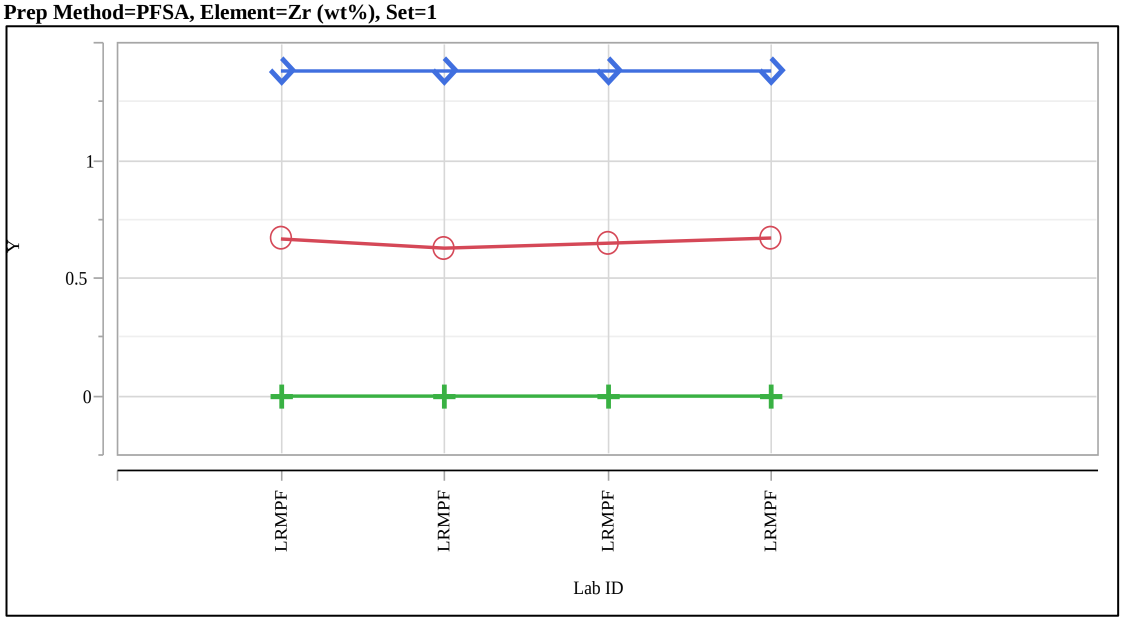
Prep Method=PF, Element=Si (wt%), Set=2



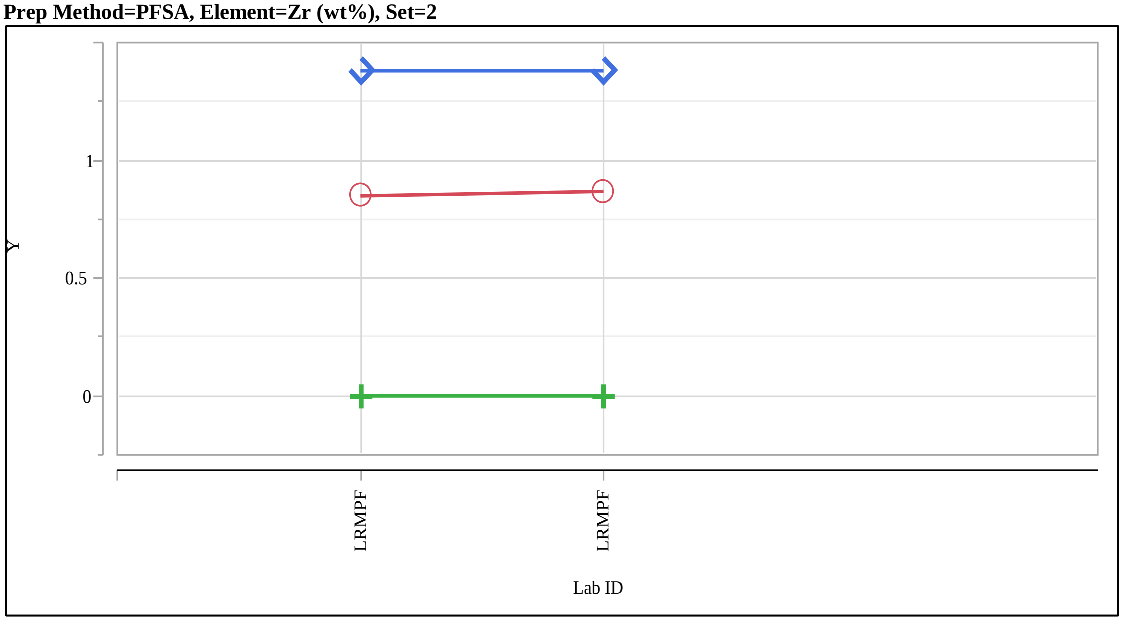
Y Measurement lower acceptability limit upper acceptability limit

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

Prep Method=PFSA, Element=Zr (wt%), Set=1



Prep Method=PFSA, Element=Zr (wt%), Set=2



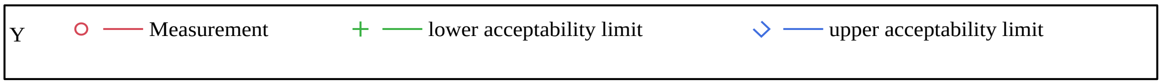


Exhibit C-4. Measured versus Targeted Concentrations by Glass ID by Oxide

Analyte=Al2O3 (wt%)

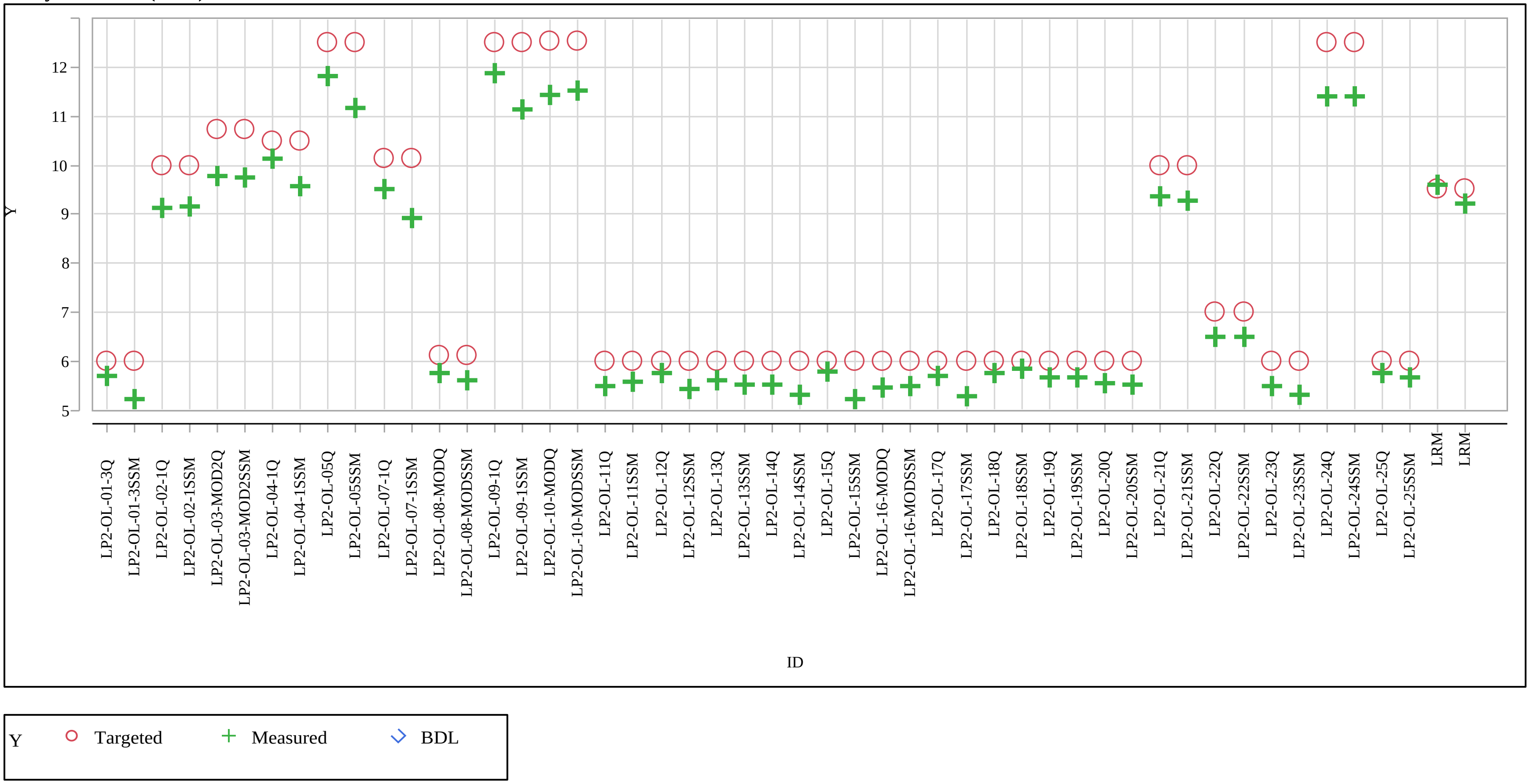


Exhibit C-4. Measured versus Targeted Concentrations by Glass ID by Oxide (continued)

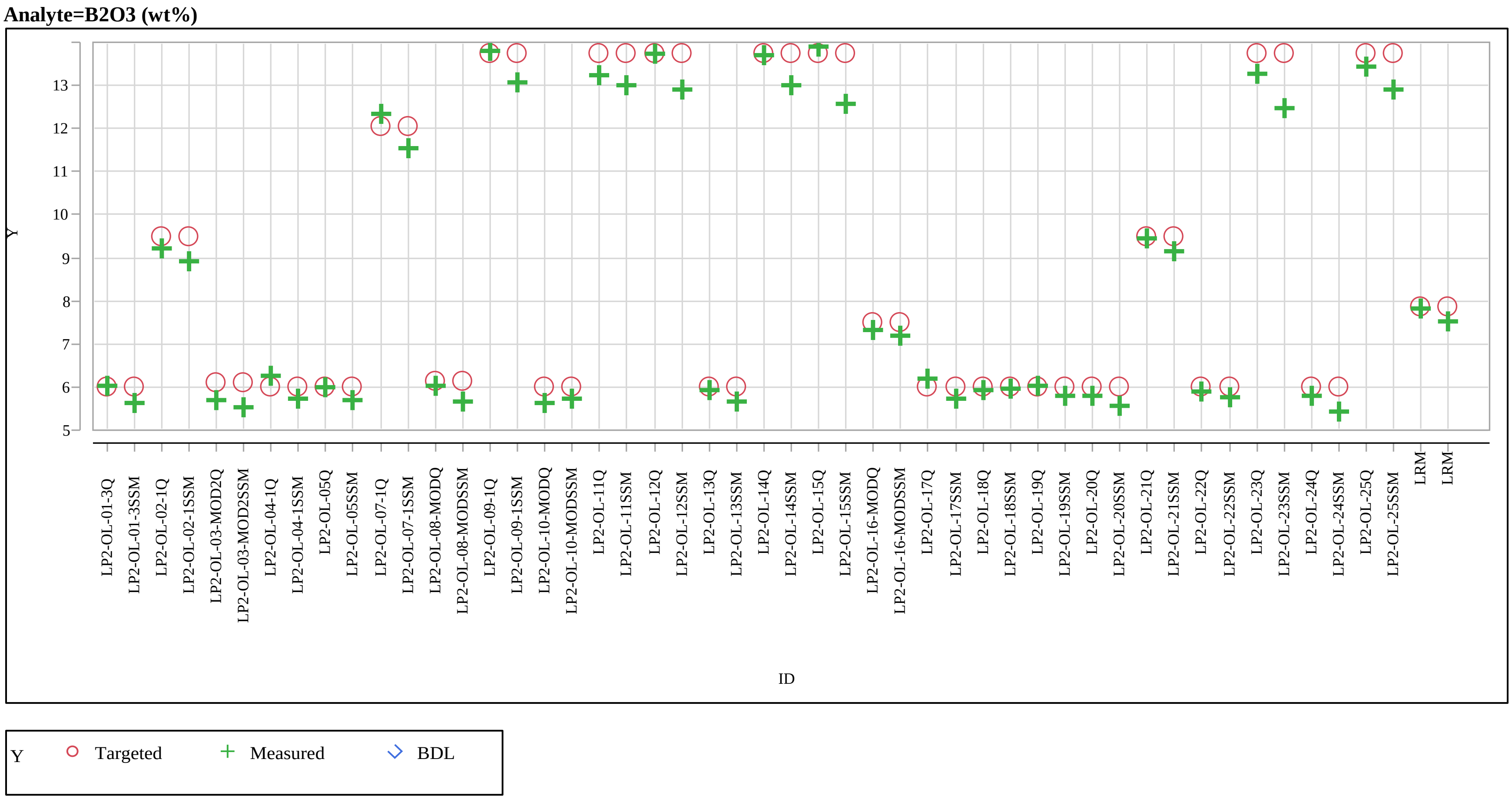


Exhibit C-4. Measured versus Targeted Concentrations by Glass ID by Oxide (continued)

Analyte=CaO (wt%)

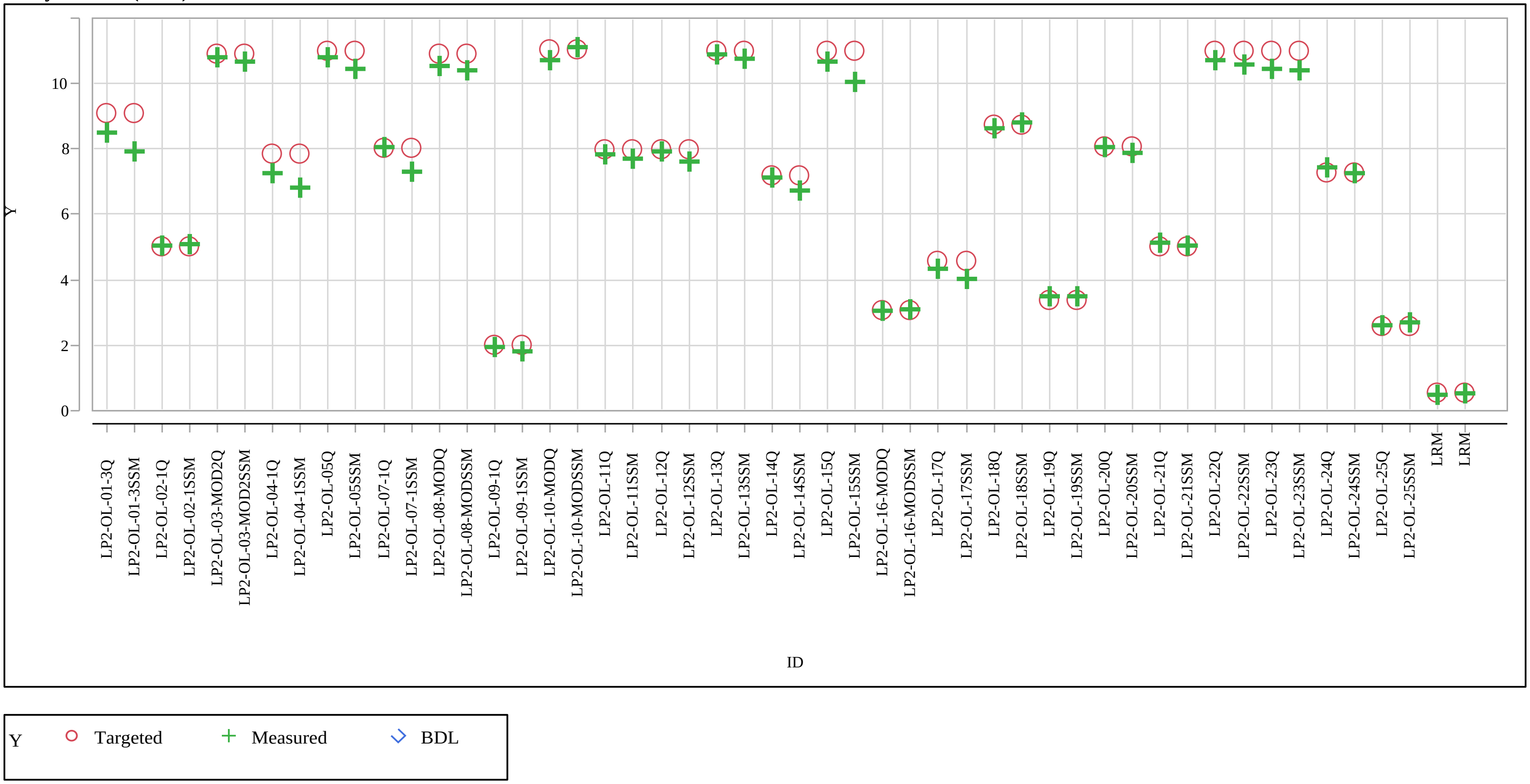


Exhibit C-4. Measured versus Targeted Concentrations by Glass ID by Oxide (continued)

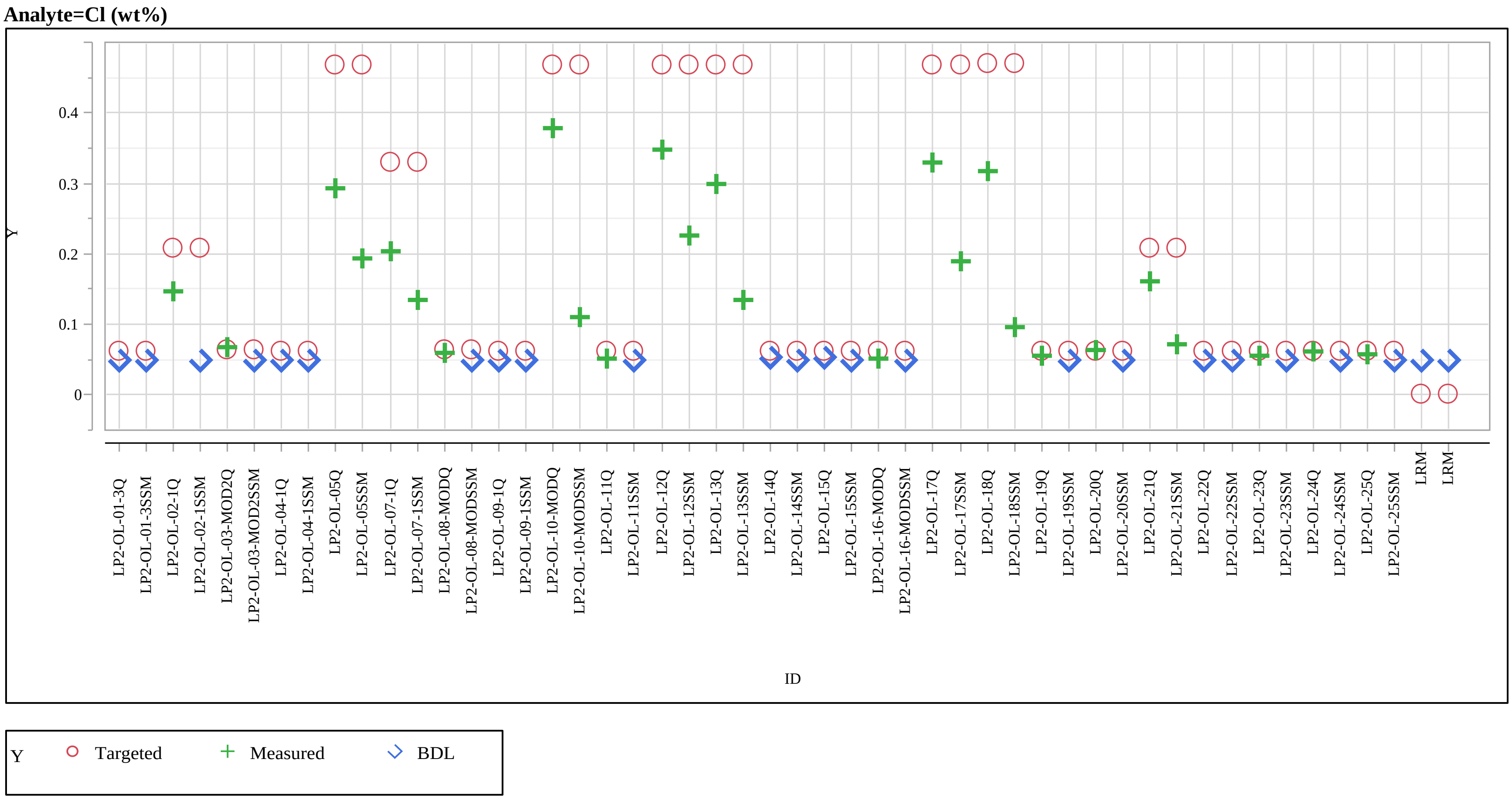


Exhibit C-4. Measured versus Targeted Concentrations by Glass ID by Oxide (continued)

Analyte=Cr2O3 (wt%)

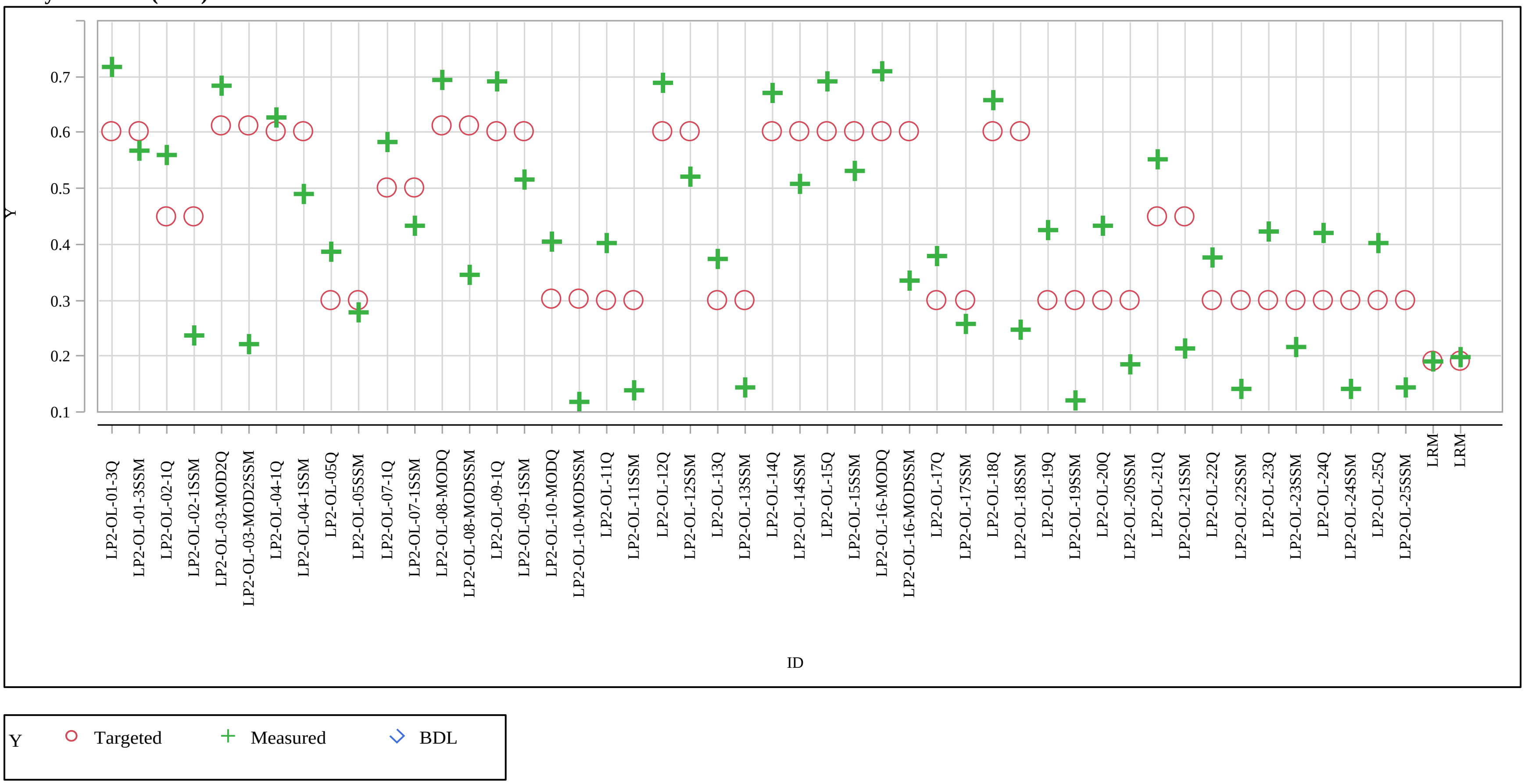


Exhibit C-4. Measured versus Targeted Concentrations by Glass ID by Oxide (continued)

Analyte=F (wt%)

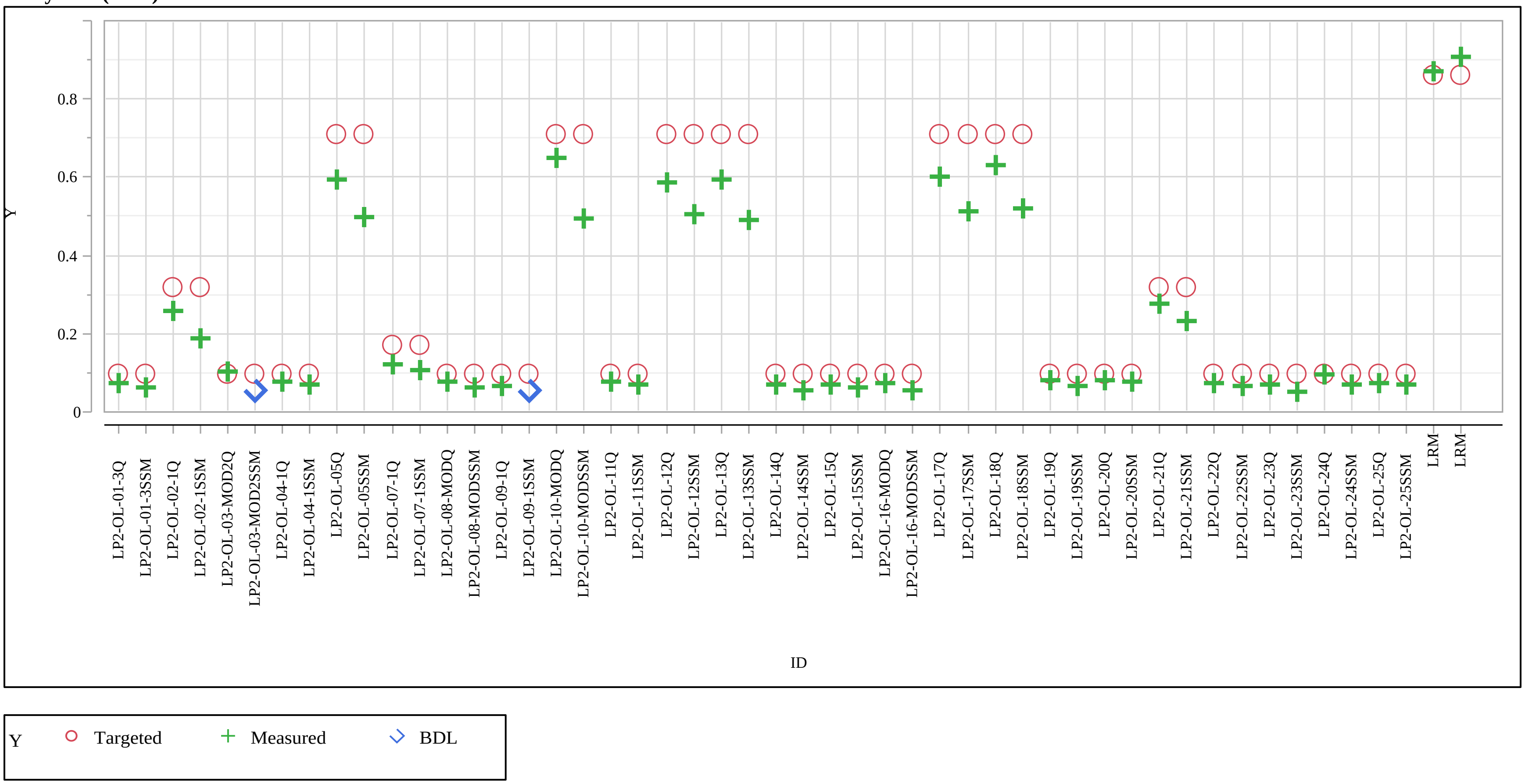


Exhibit C-4. Measured versus Targeted Concentrations by Glass ID by Oxide (continued)

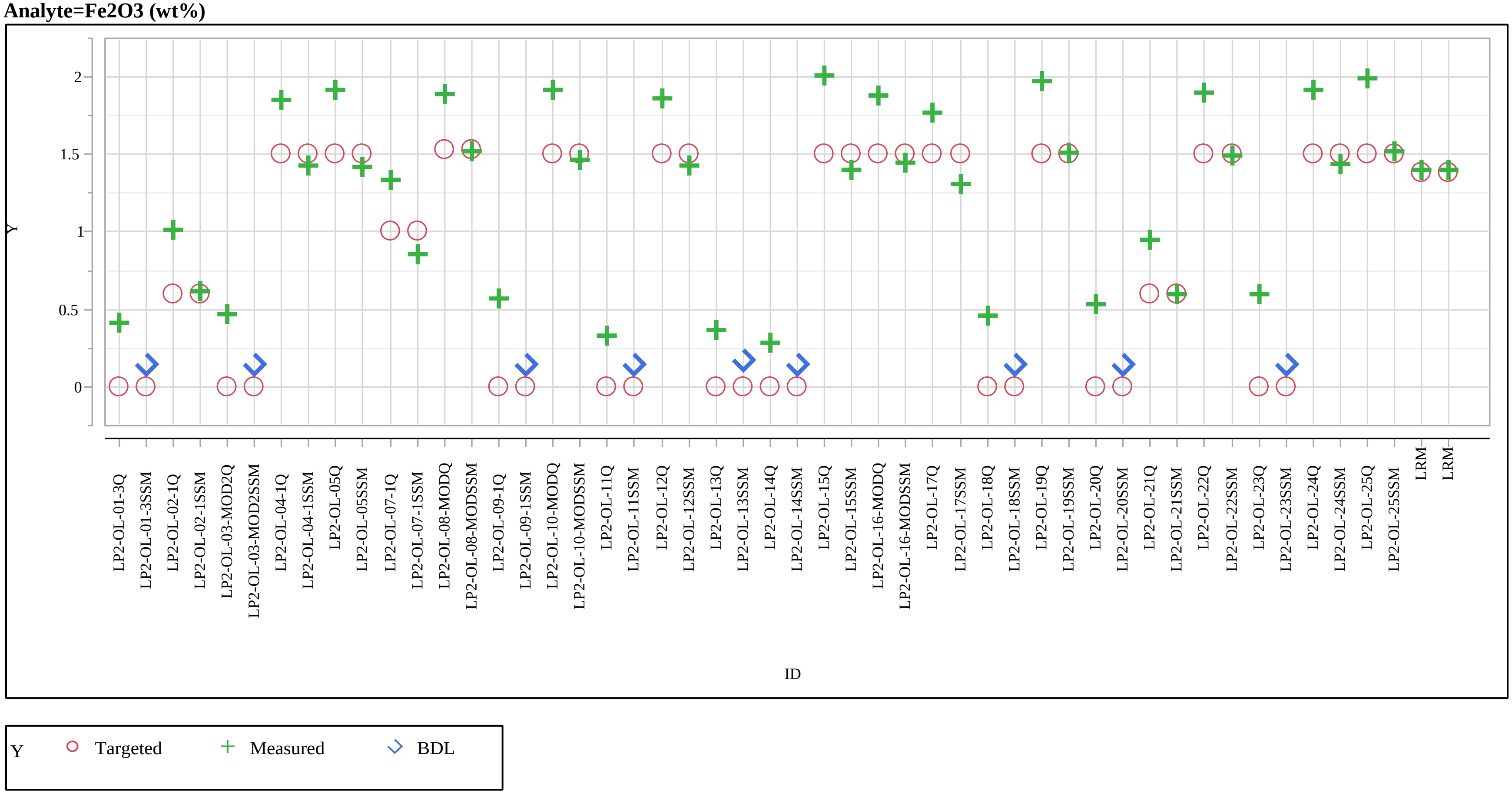


Exhibit C-4. Measured versus Targeted Concentrations by Glass ID by Oxide (continued)

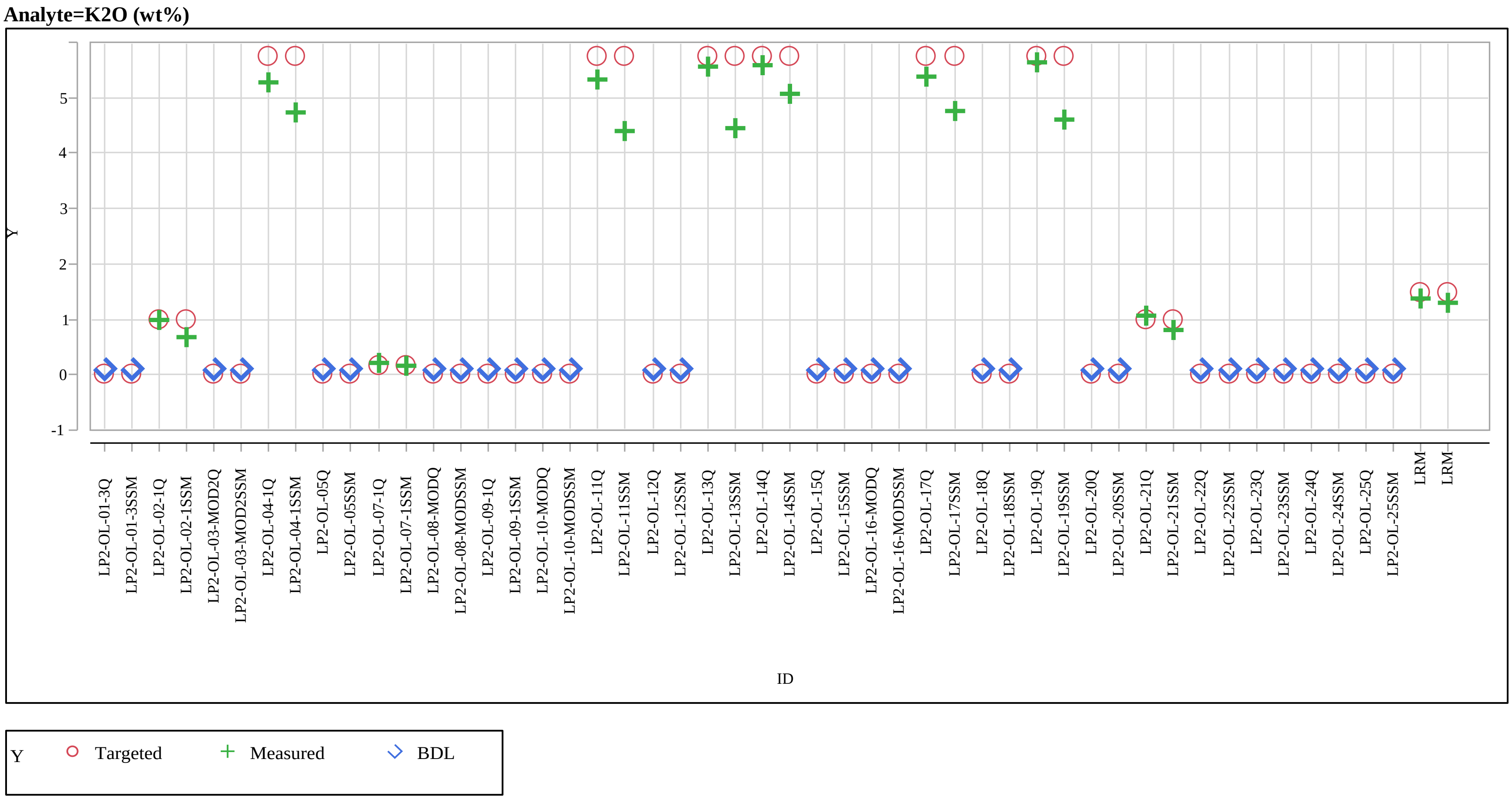


Exhibit C-4. Measured versus Targeted Concentrations by Glass ID by Oxide (continued)

Analyte=Li2O (wt%)

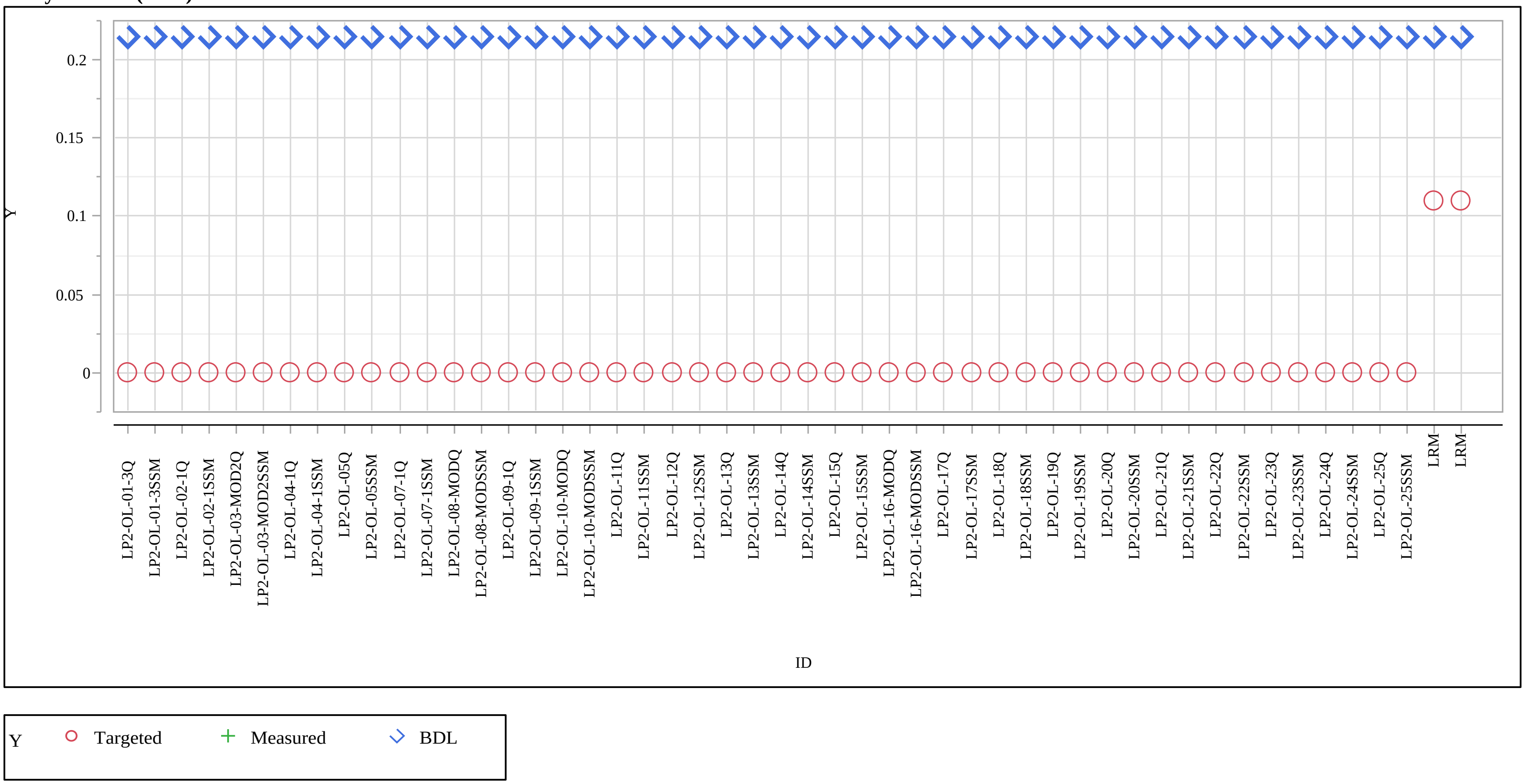


Exhibit C-4. Measured versus Targeted Concentrations by Glass ID by Oxide (continued)

Analyte=MgO (wt%)

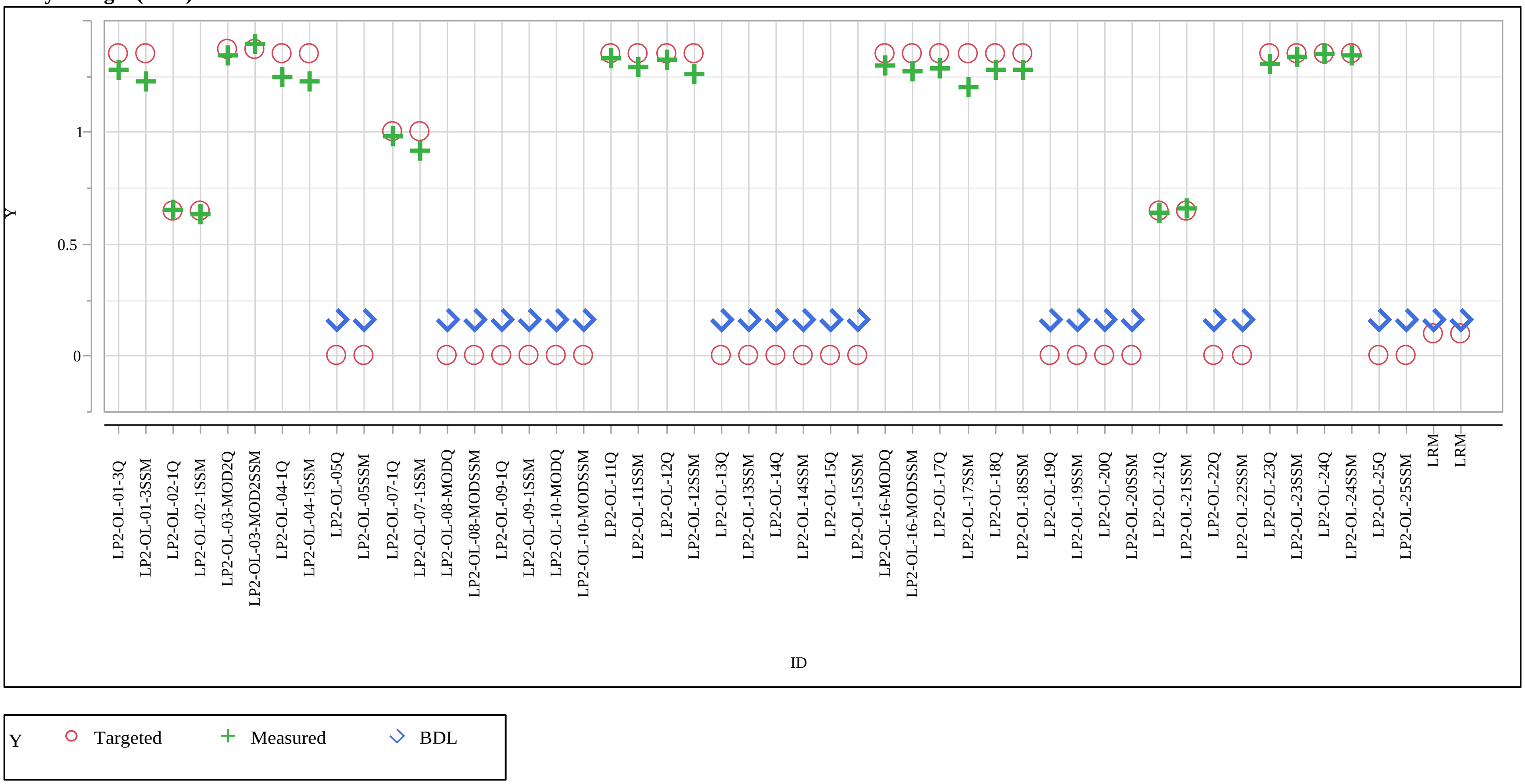


Exhibit C-4. Measured versus Targeted Concentrations by Glass ID by Oxide (continued)

Analyte=Na2O (wt%)

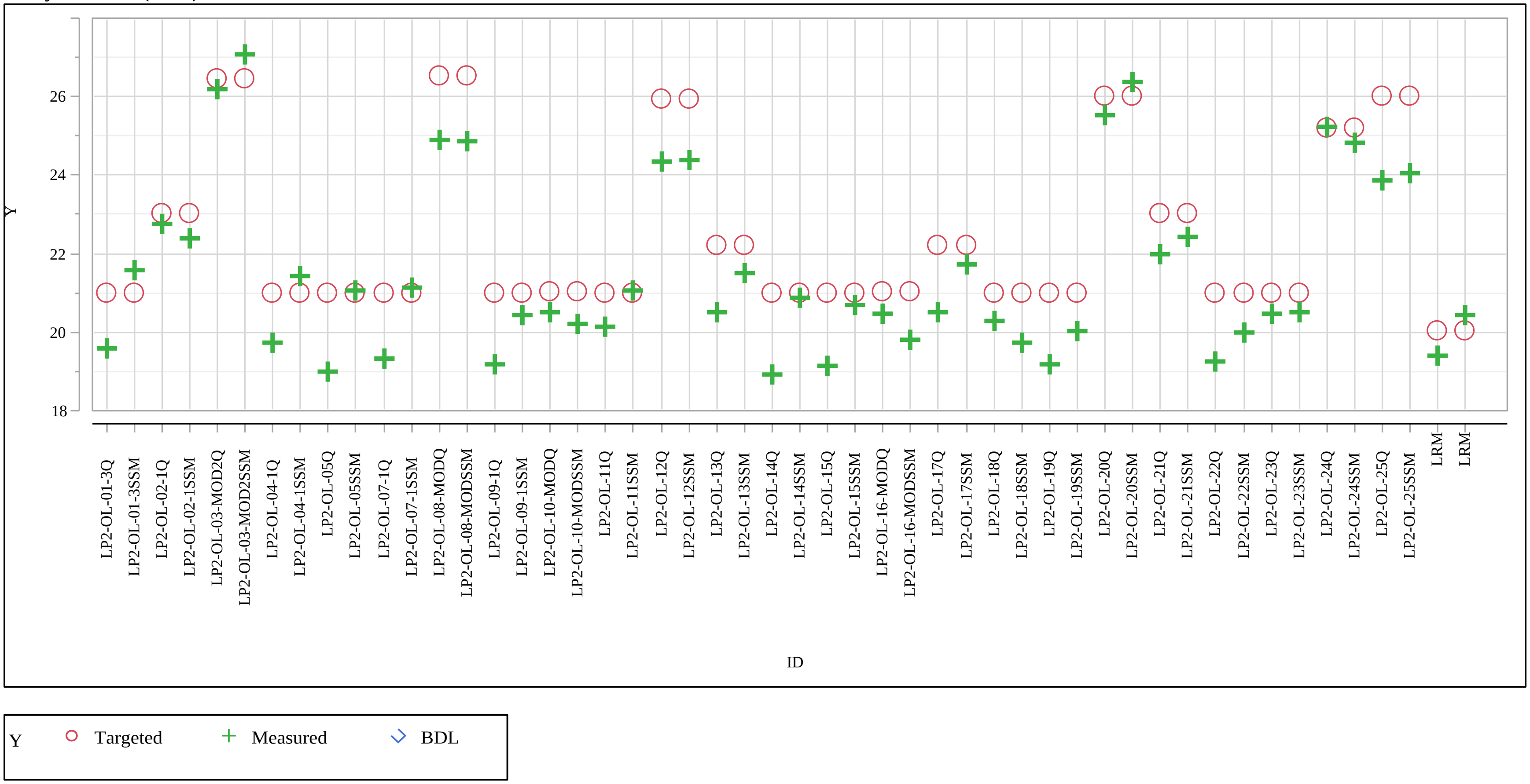


Exhibit C-4. Measured versus Targeted Concentrations by Glass ID by Oxide (continued)

Analyte=NiO (wt%)

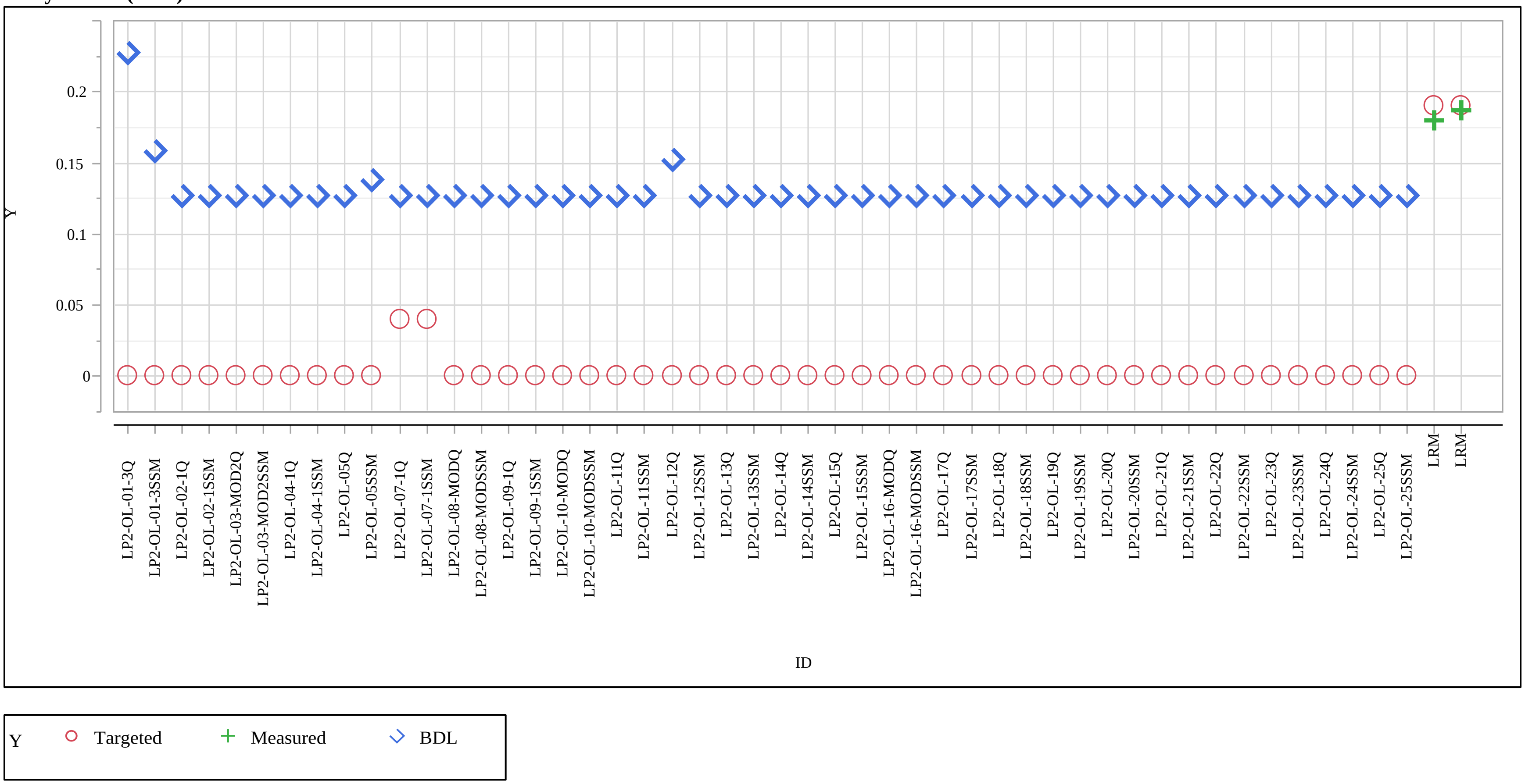


Exhibit C-4. Measured versus Targeted Concentrations by Glass ID by Oxide (continued)

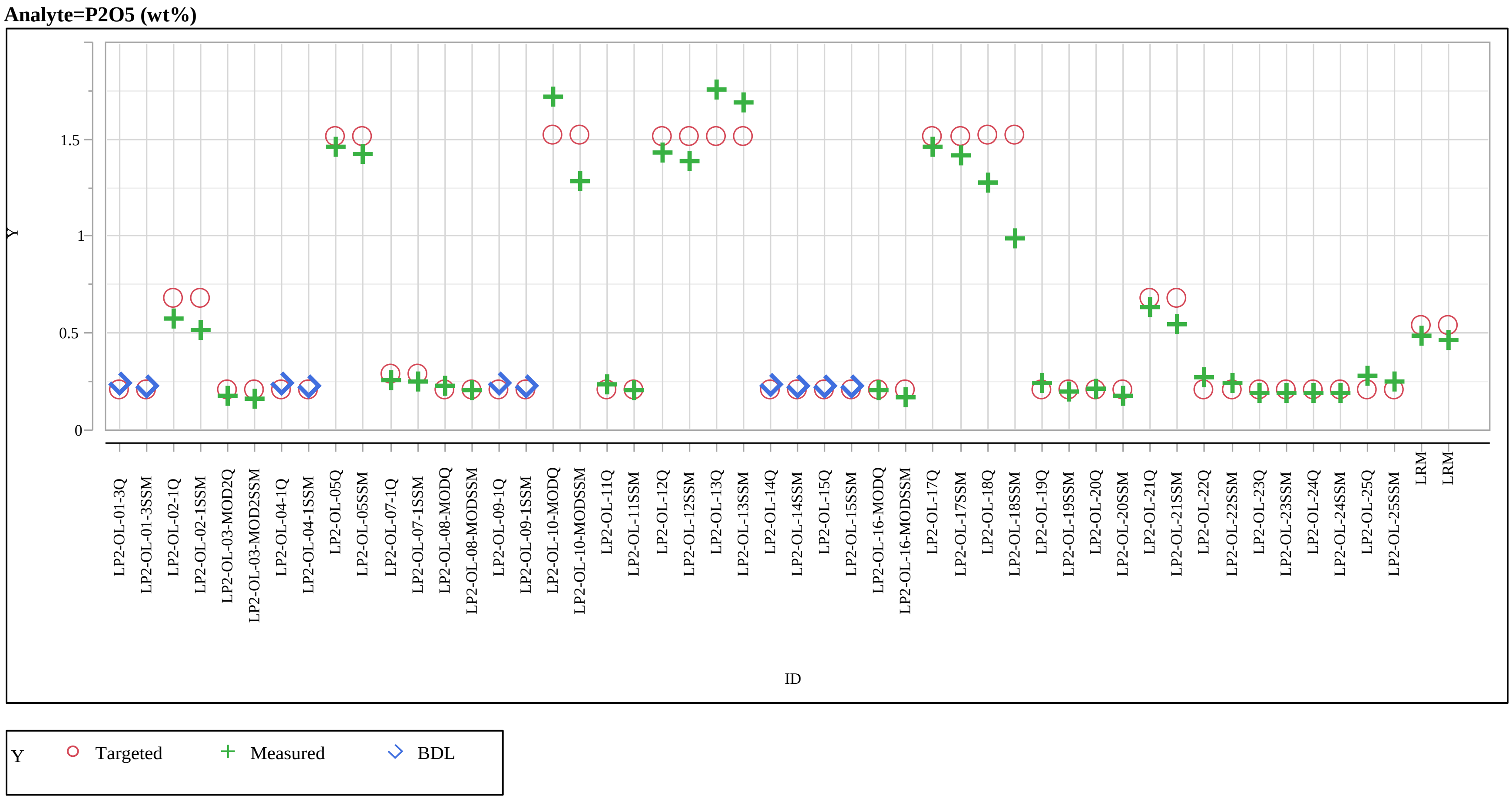


Exhibit C-4. Measured versus Targeted Concentrations by Glass ID by Oxide (continued)

Analyte=SiO2 (wt%)

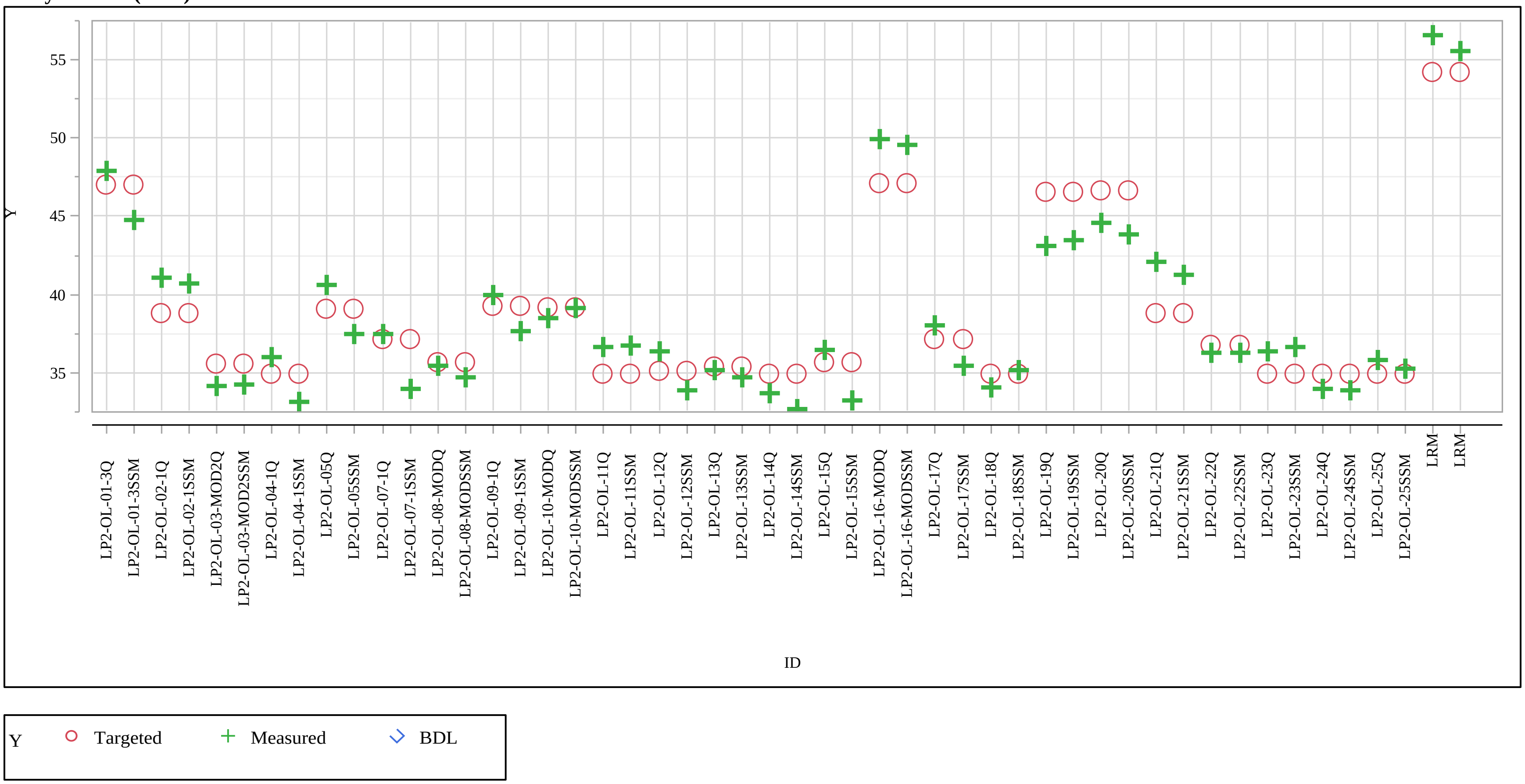


Exhibit C-4. Measured versus Targeted Concentrations by Glass ID by Oxide (continued)

Analyte=SnO2 (wt%)

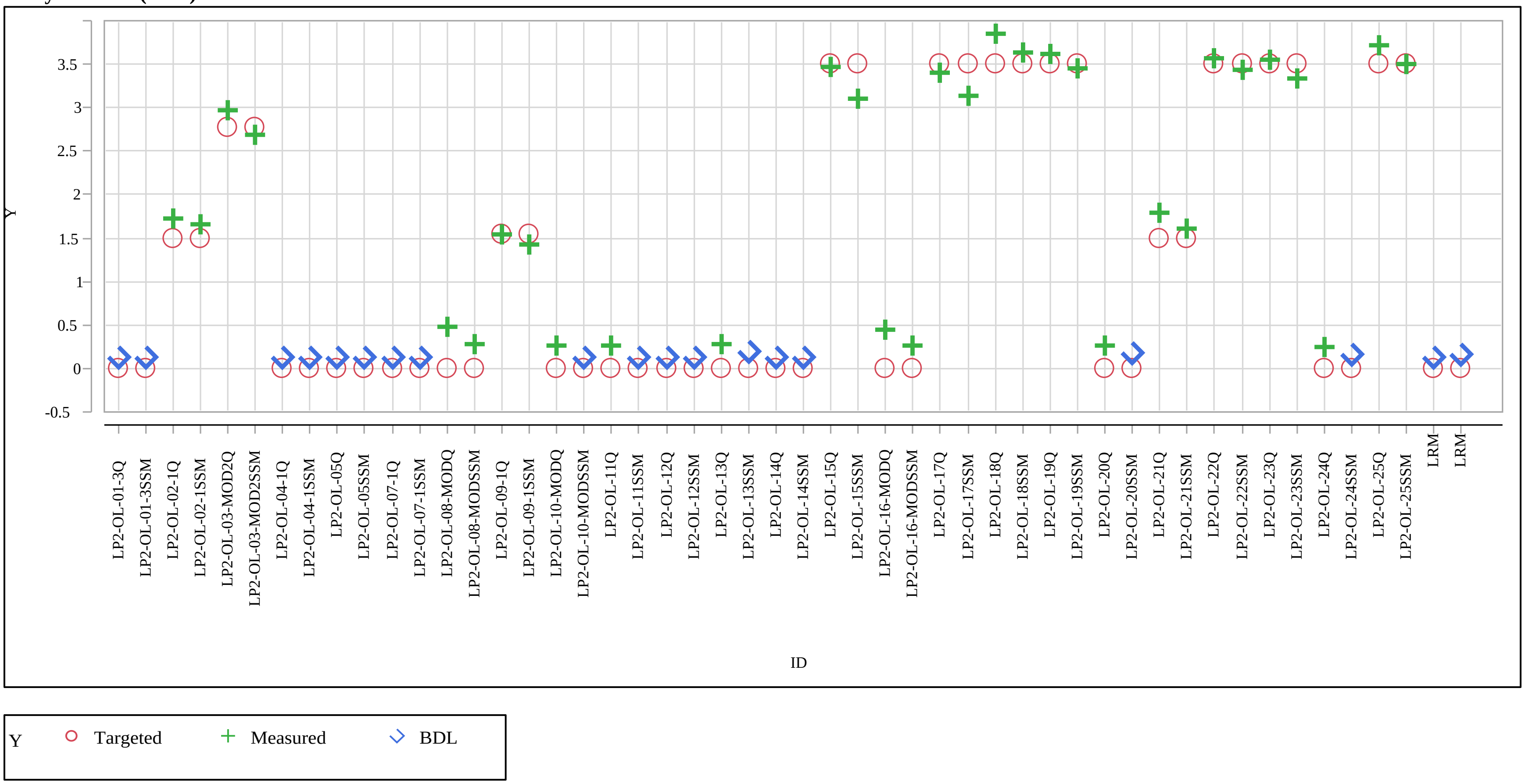


Exhibit C-4. Measured versus Targeted Concentrations by Glass ID by Oxide (continued)

Analyte=SO3 (wt%)

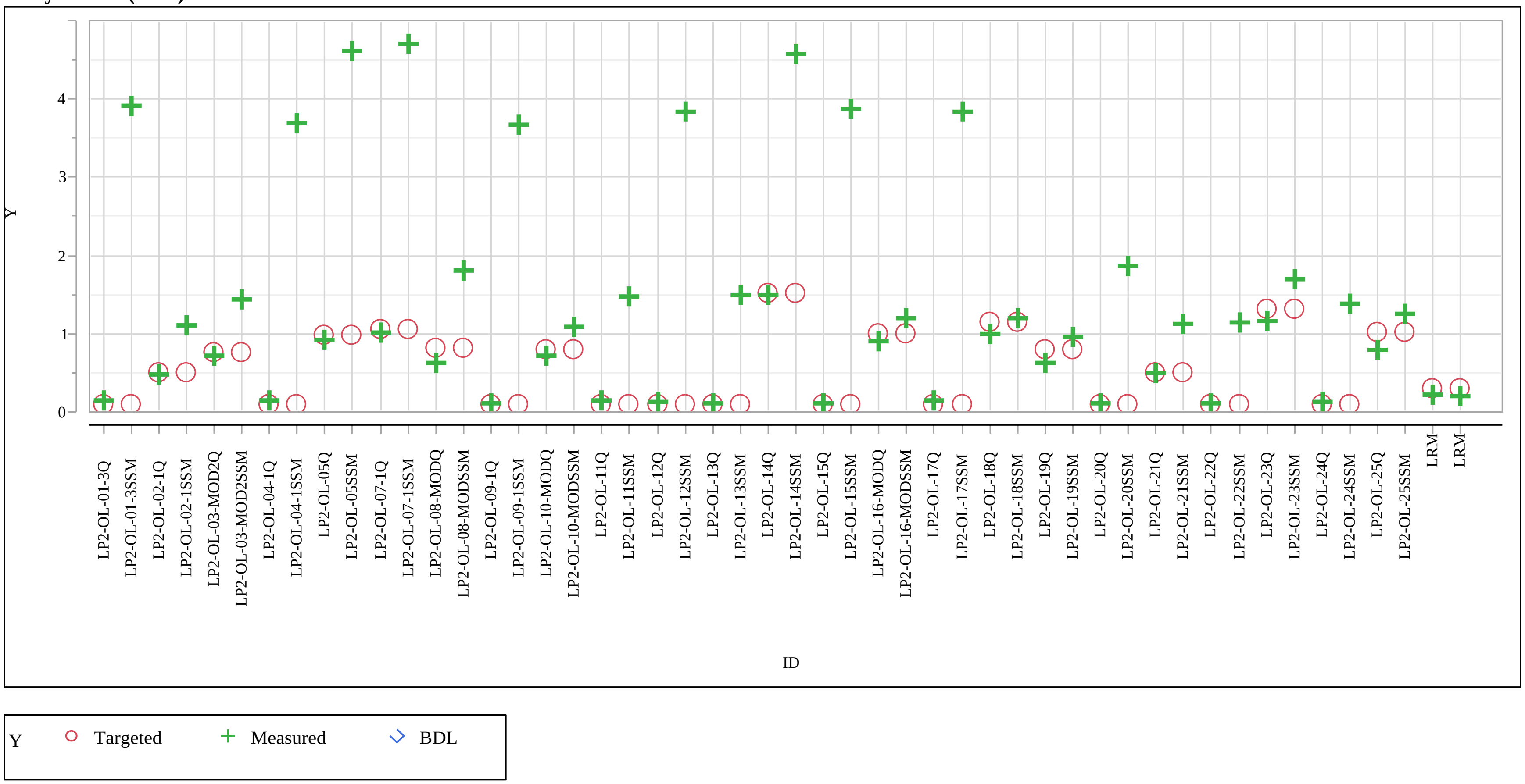


Exhibit C-4. Measured versus Targeted Concentrations by Glass ID by Oxide (continued)

Analyte=V2O5 (wt%)

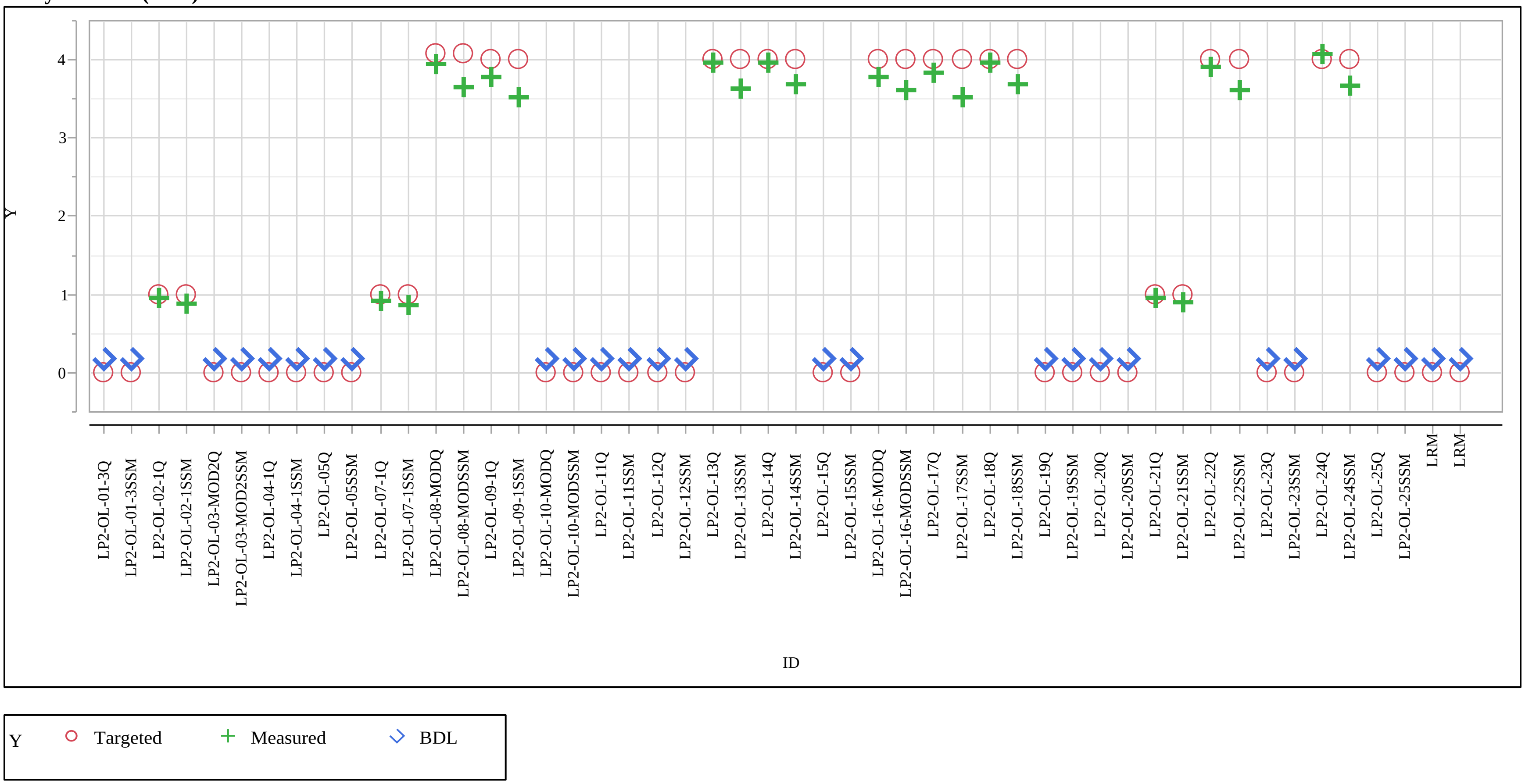


Exhibit C-4. Measured versus Targeted Concentrations by Glass ID by Oxide (continued)

Analyte=ZnO (wt%)

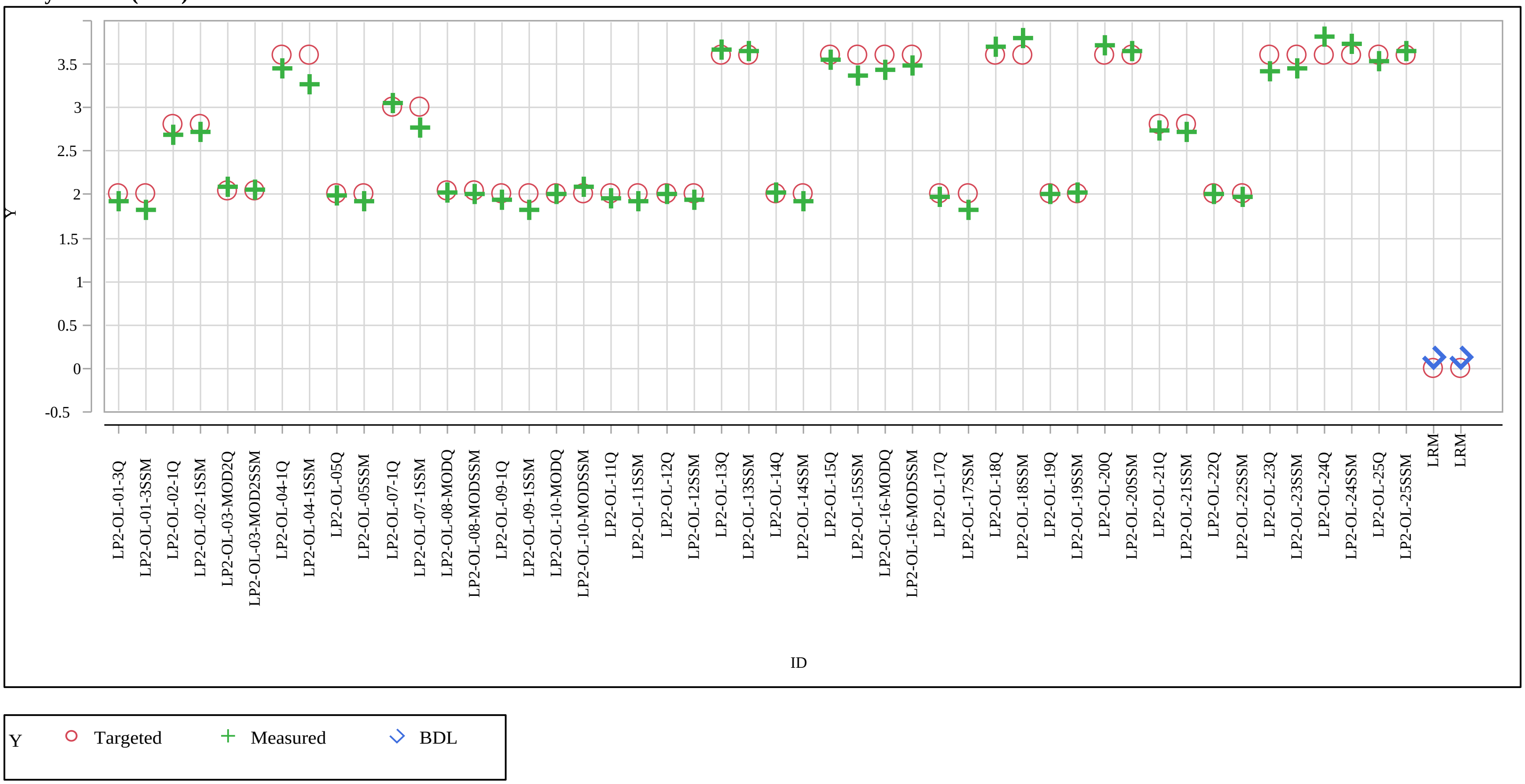


Exhibit C-4. Measured versus Targeted Concentrations by Glass ID by Oxide (continued)

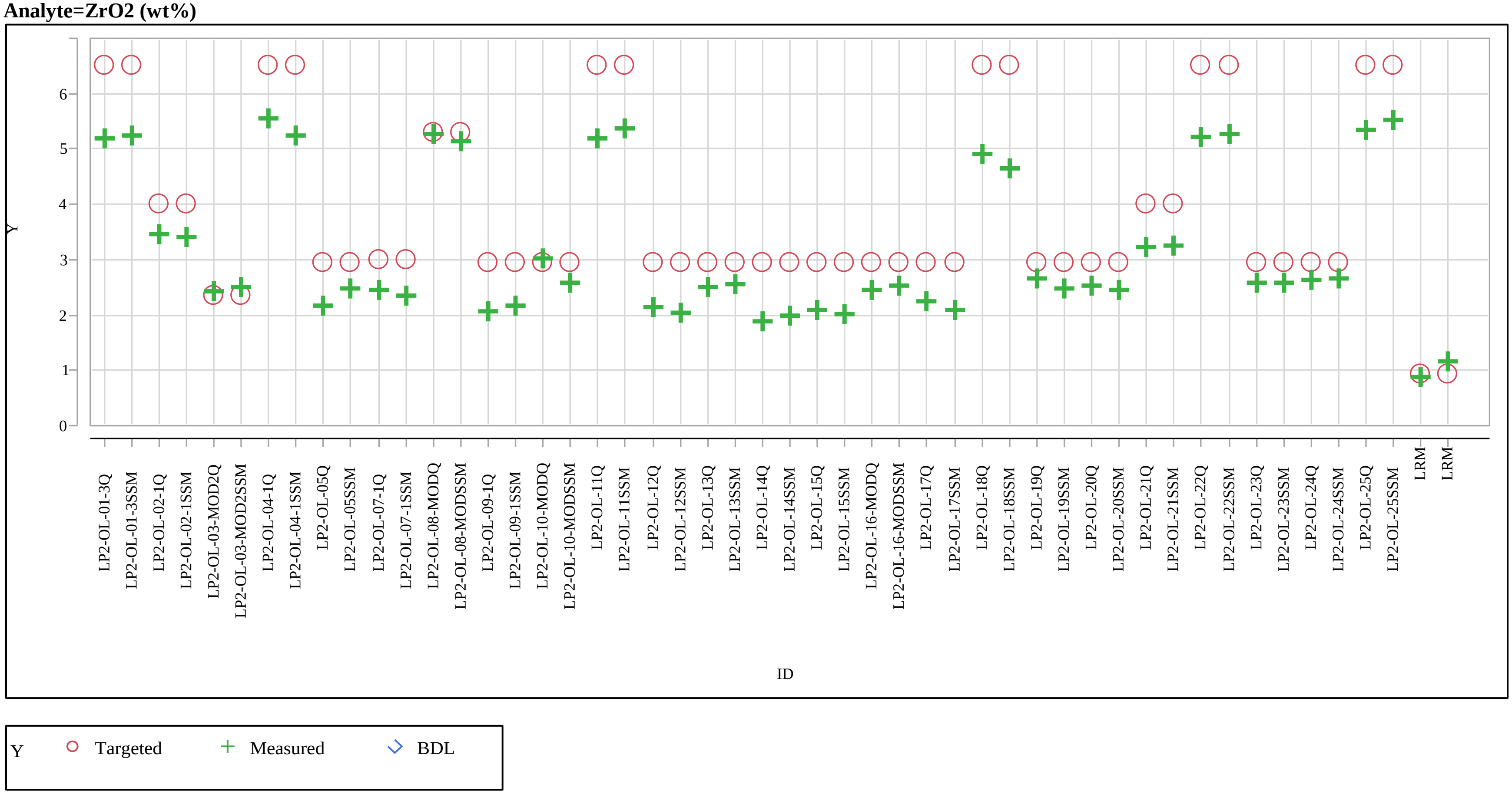
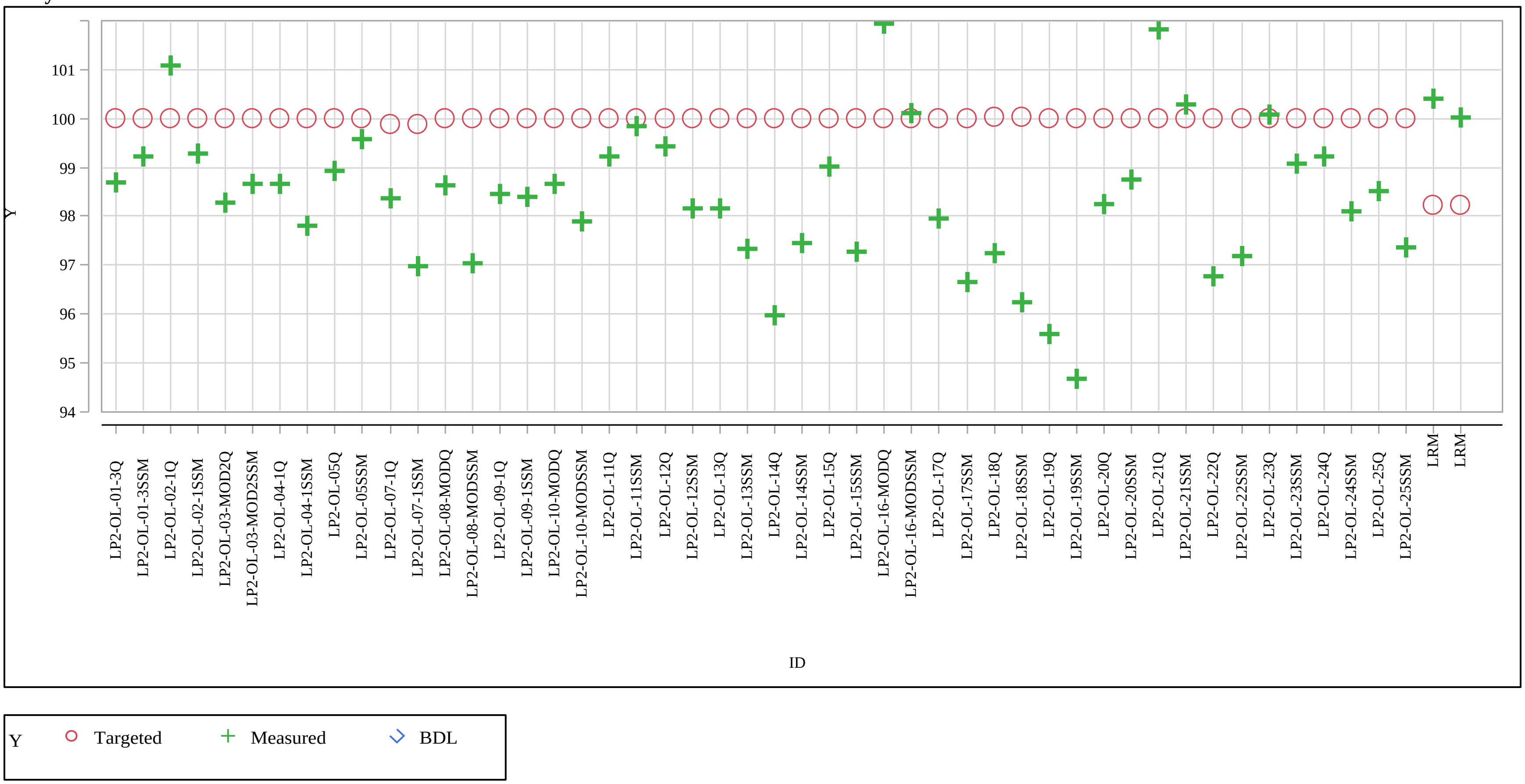


Exhibit C-4. Measured versus Targeted Concentrations by Glass ID by Oxide (continued)

Analyte=Sum of Oxides



Appendix D Comparisons of the Baseline and SSM Versions of the Study Glasses

Exhibit D-1. Comparisons of the Measured Compositions of the Baseline and Sulfur Saturated Versions of the Study Glasses

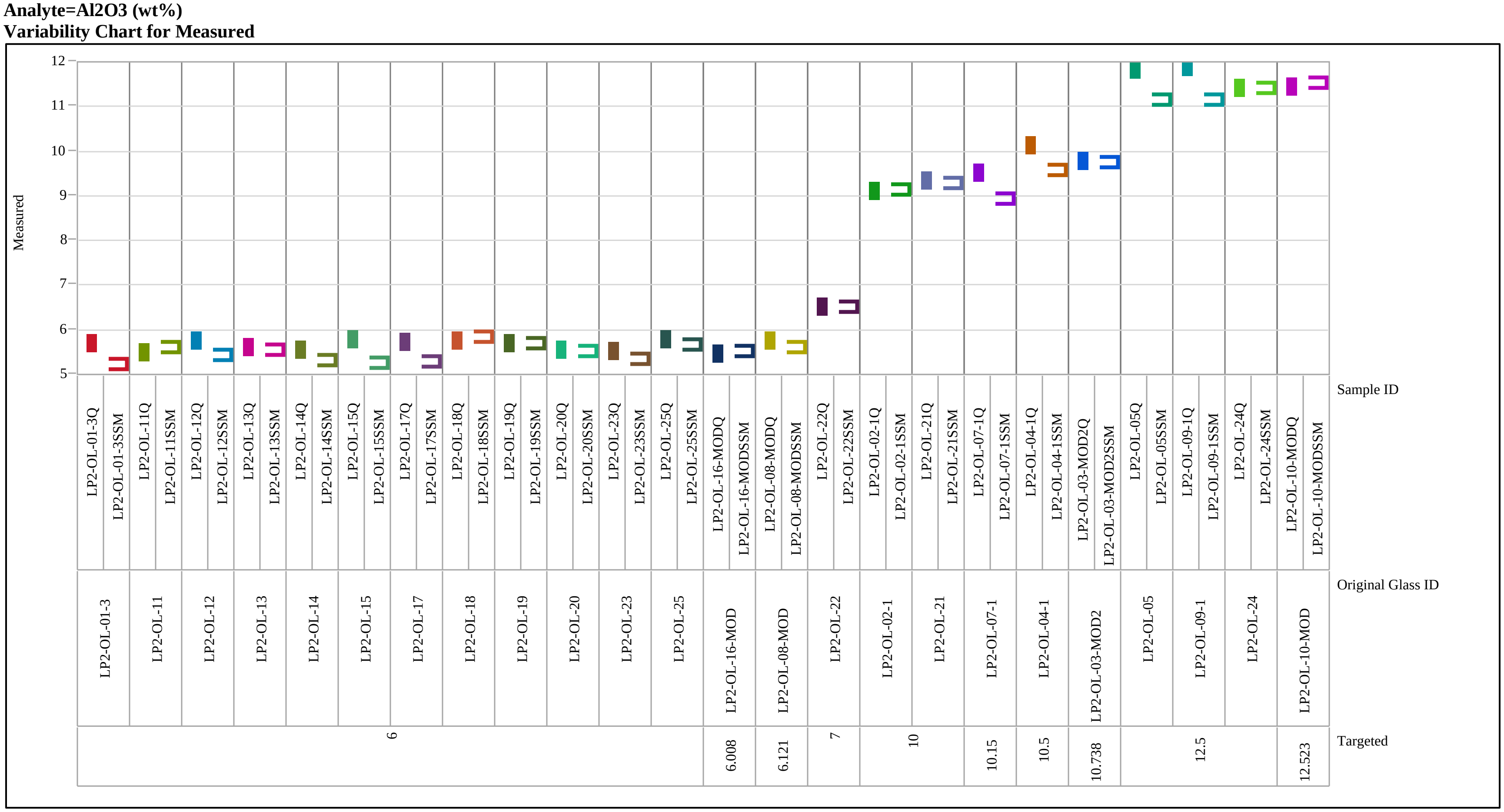


Exhibit D-1. Comparisons of the Measured Compositions of the Baseline and Sulfur Saturated Versions of the Study Glasses (continued)

Analyte=B2O3 (wt%)
Variability Chart for Measured

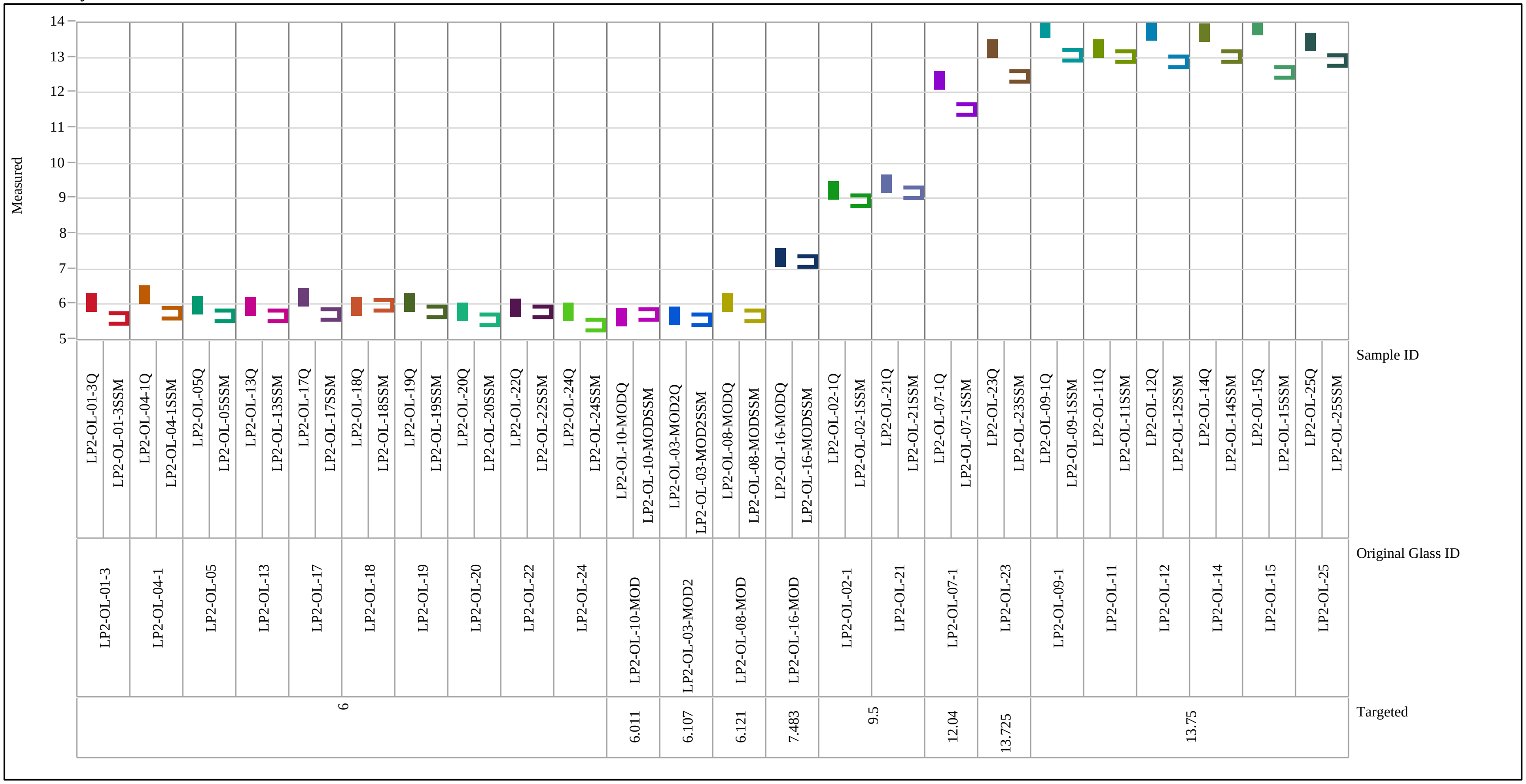


Exhibit D-1. Comparisons of the Measured Compositions of the Baseline and Sulfur Saturated Versions of the Study Glasses (continued)

Analyte=CaO (wt%)
Variability Chart for Measured

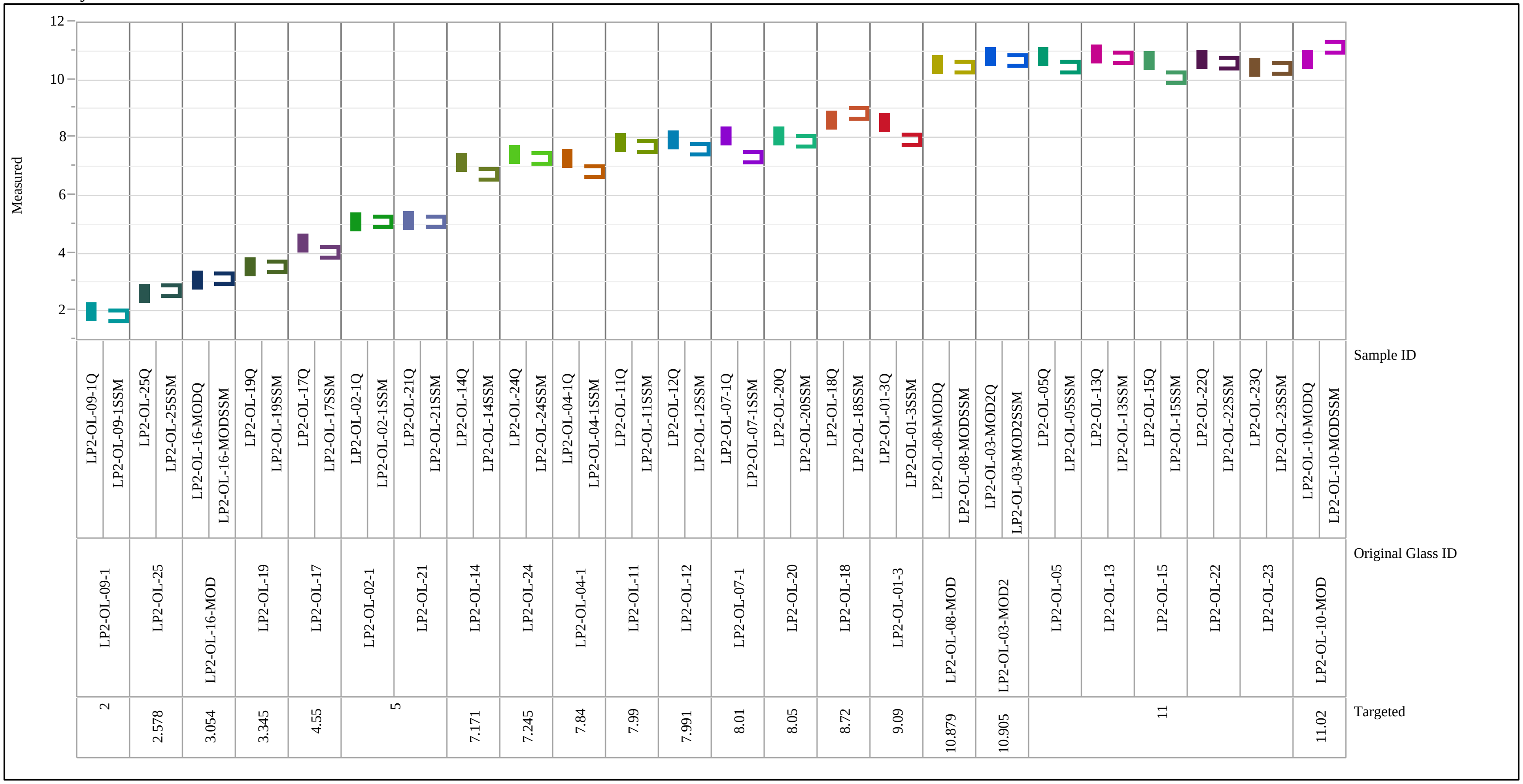


Exhibit D-1. Comparisons of the Measured Compositions of the Baseline and Sulfur Saturated Versions of the Study Glasses (continued)

Analyte=Cl (wt%)
Variability Chart for Measured

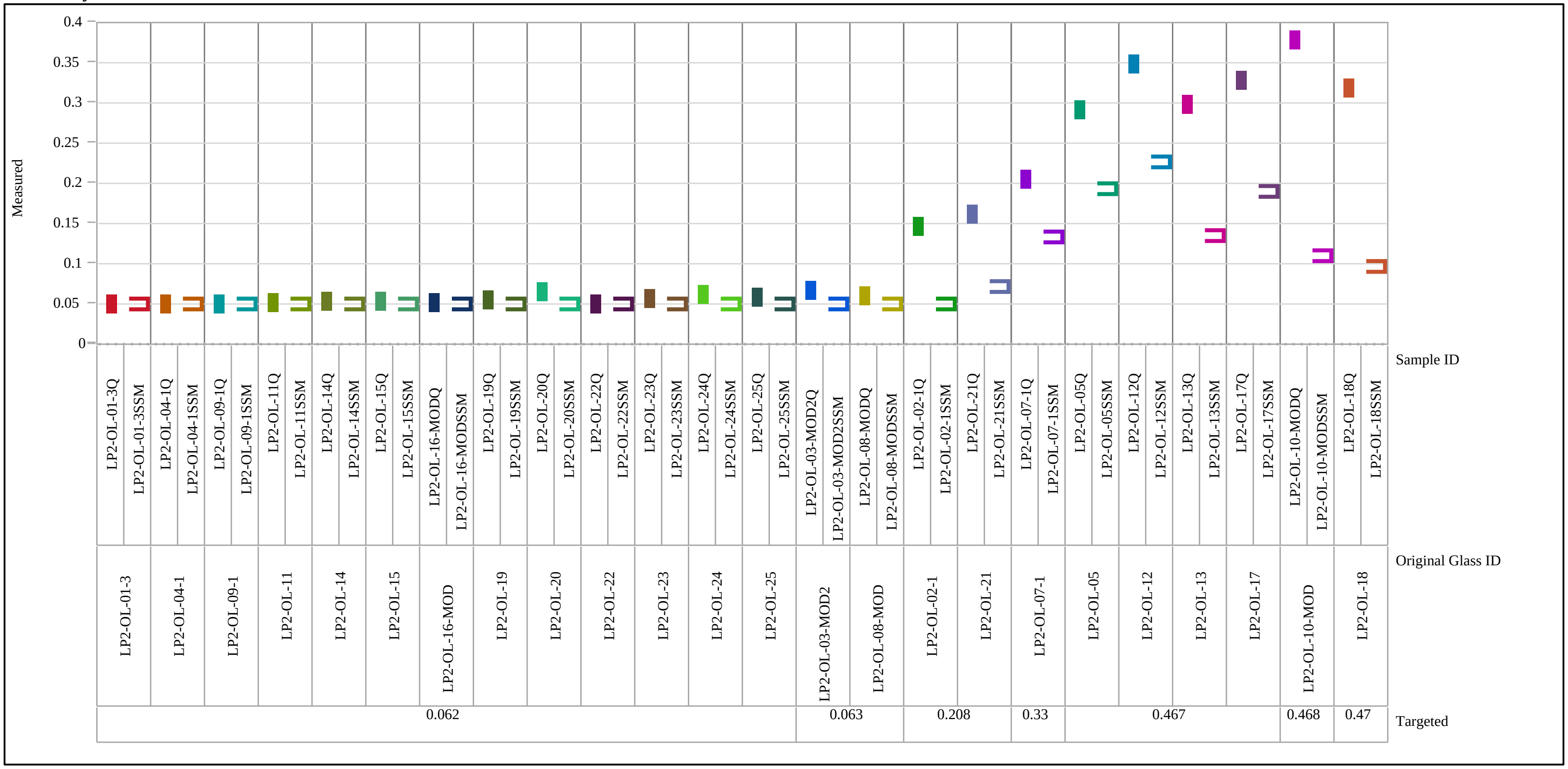


Exhibit D-1. Comparisons of the Measured Compositions of the Baseline and Sulfur Saturated Versions of the Study Glasses (continued)

Analyte=Cr2O3 (wt%)
Variability Chart for Measured

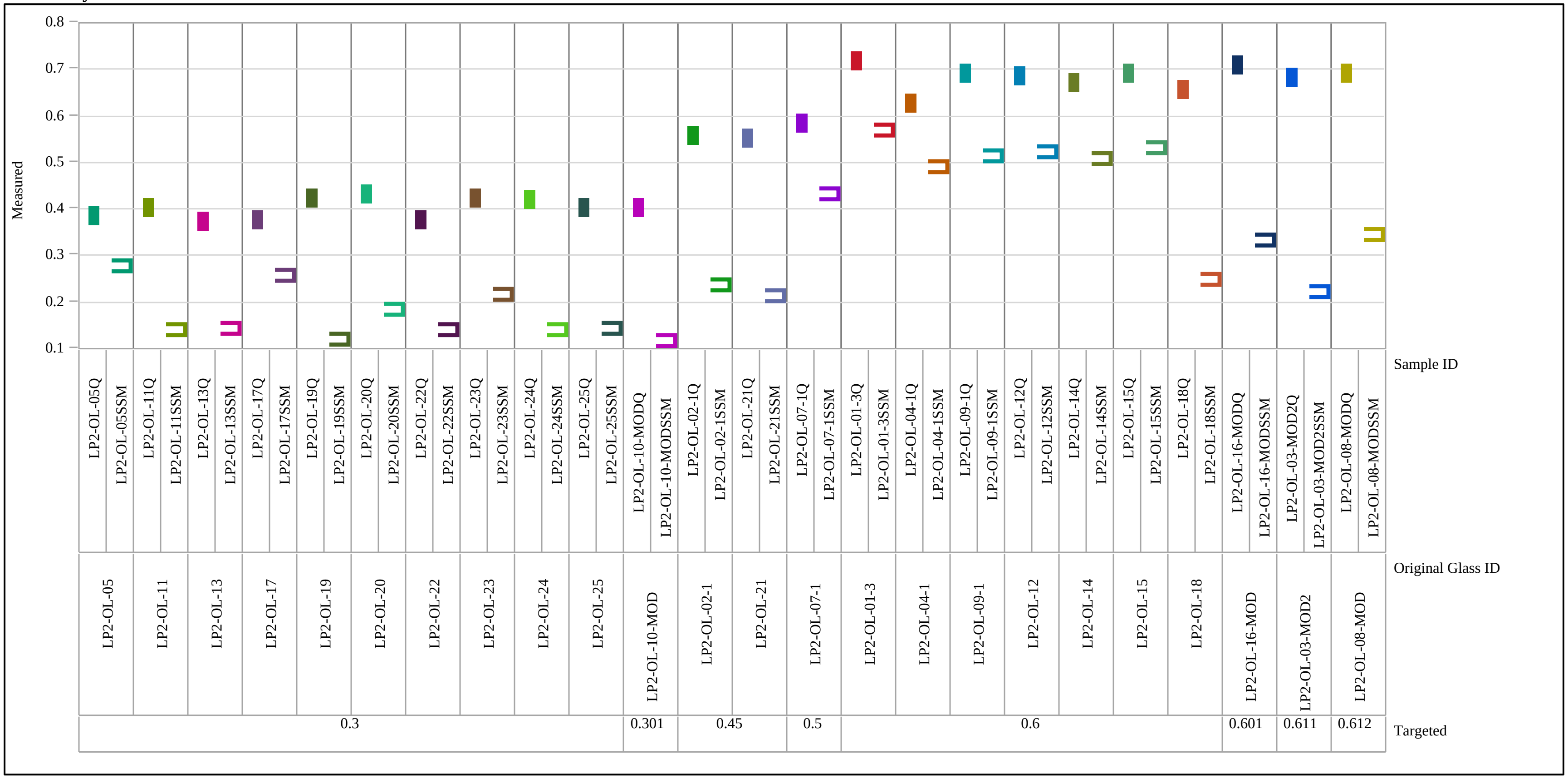


Exhibit D-1. Comparisons of the Measured Compositions of the Baseline and Sulfur Saturated Versions of the Study Glasses (continued)

Analyte=F (wt%)
Variability Chart for Measured

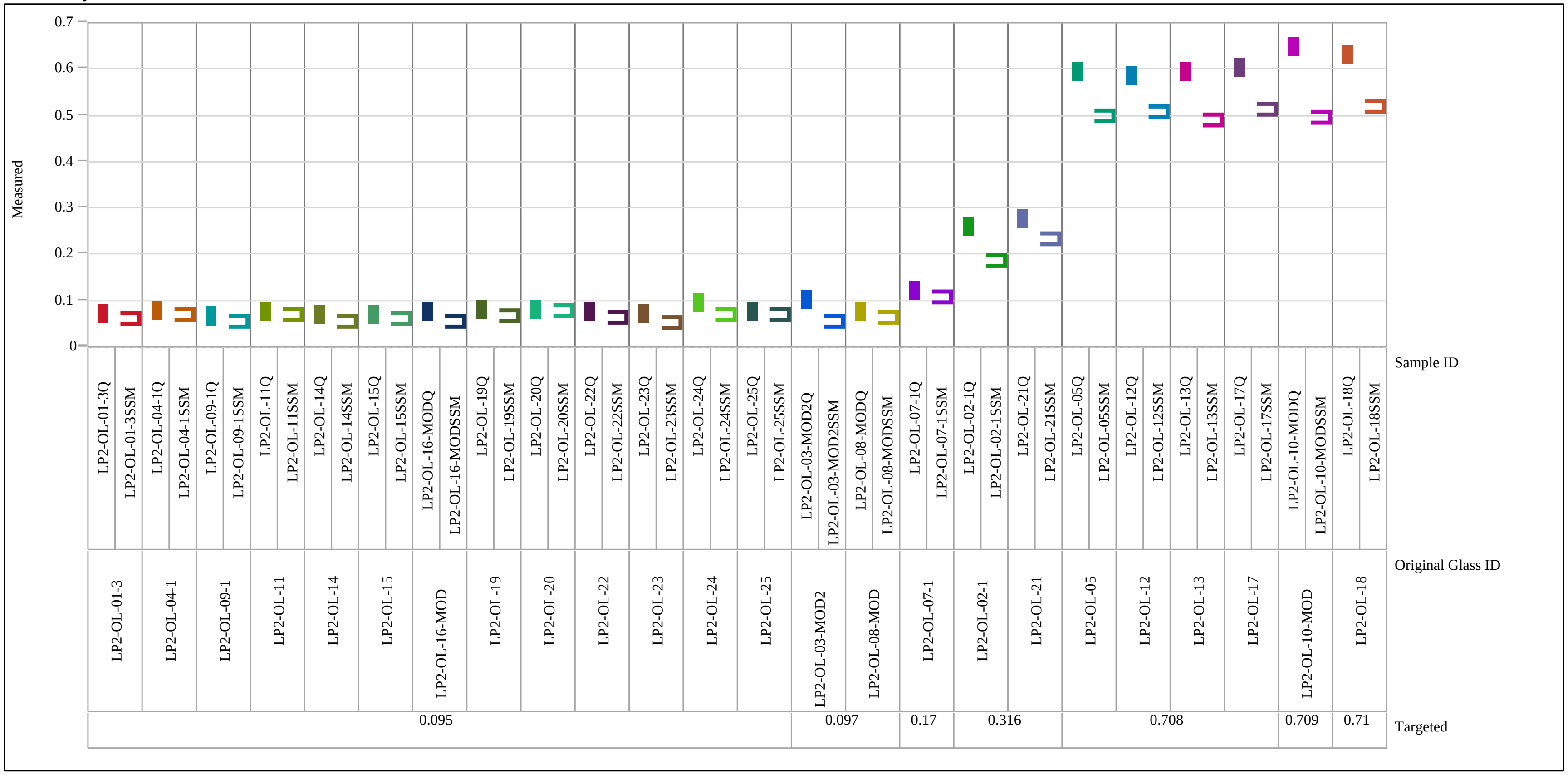


Exhibit D-1. Comparisons of the Measured Compositions of the Baseline and Sulfur Saturated Versions of the Study Glasses (continued)

Analyte=Fe2O3 (wt%)
Variability Chart for Measured

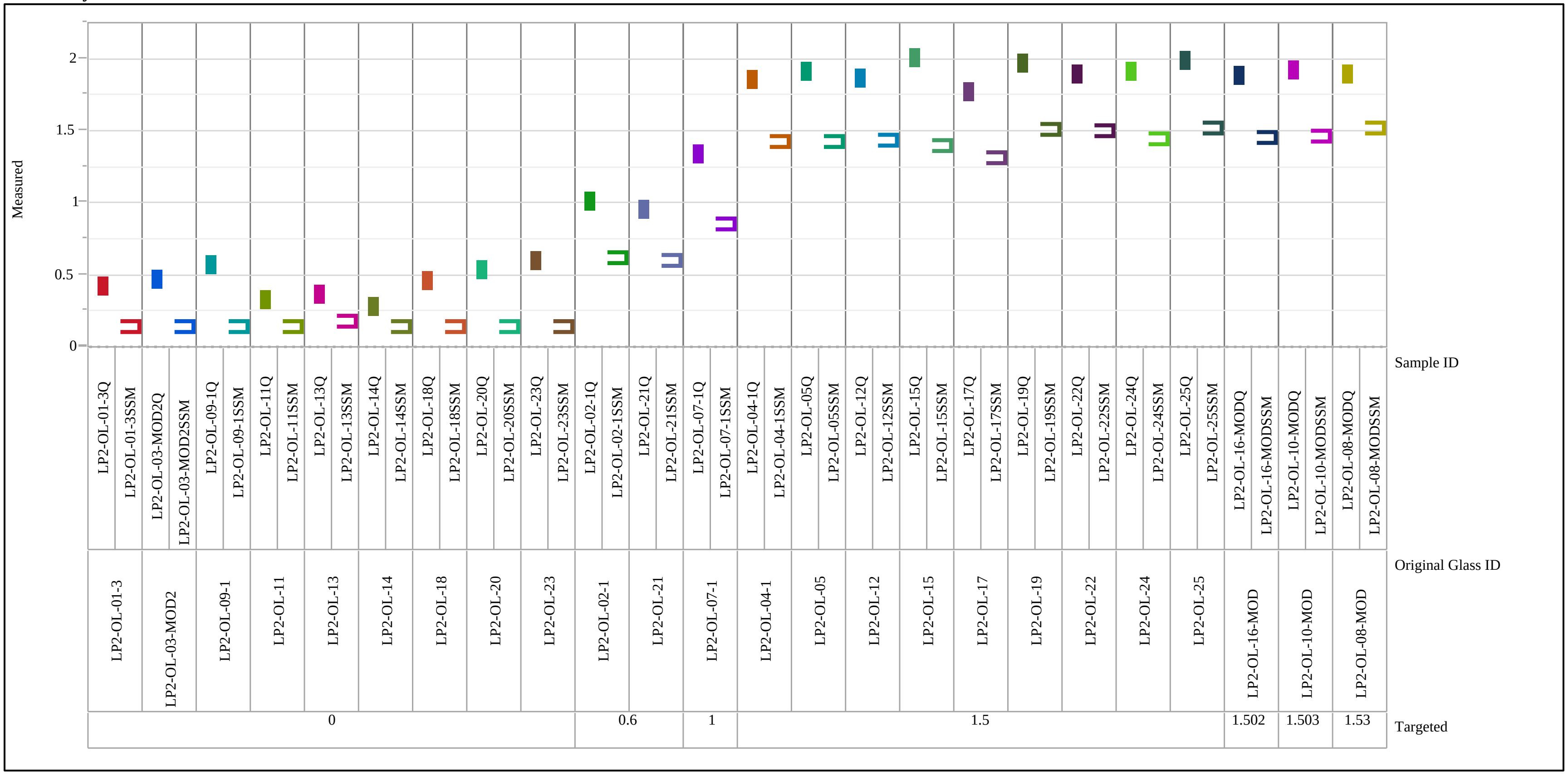


Exhibit D-1. Comparisons of the Measured Compositions of the Baseline and Sulfur Saturated Versions of the Study Glasses (continued)

Analyte=K2O (wt%)
Variability Chart for Measured

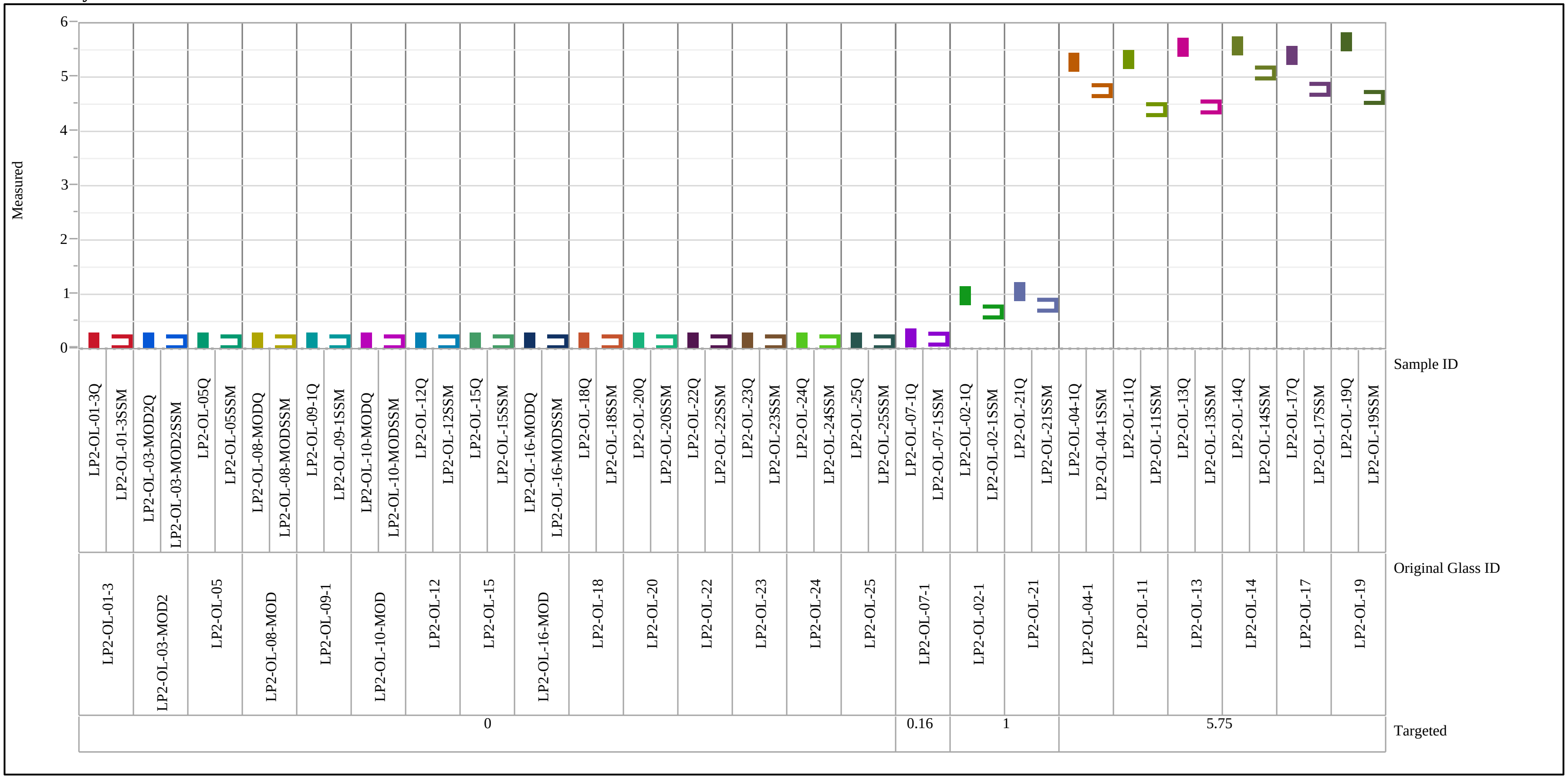


Exhibit D-1. Comparisons of the Measured Compositions of the Baseline and Sulfur Saturated Versions of the Study Glasses (continued)

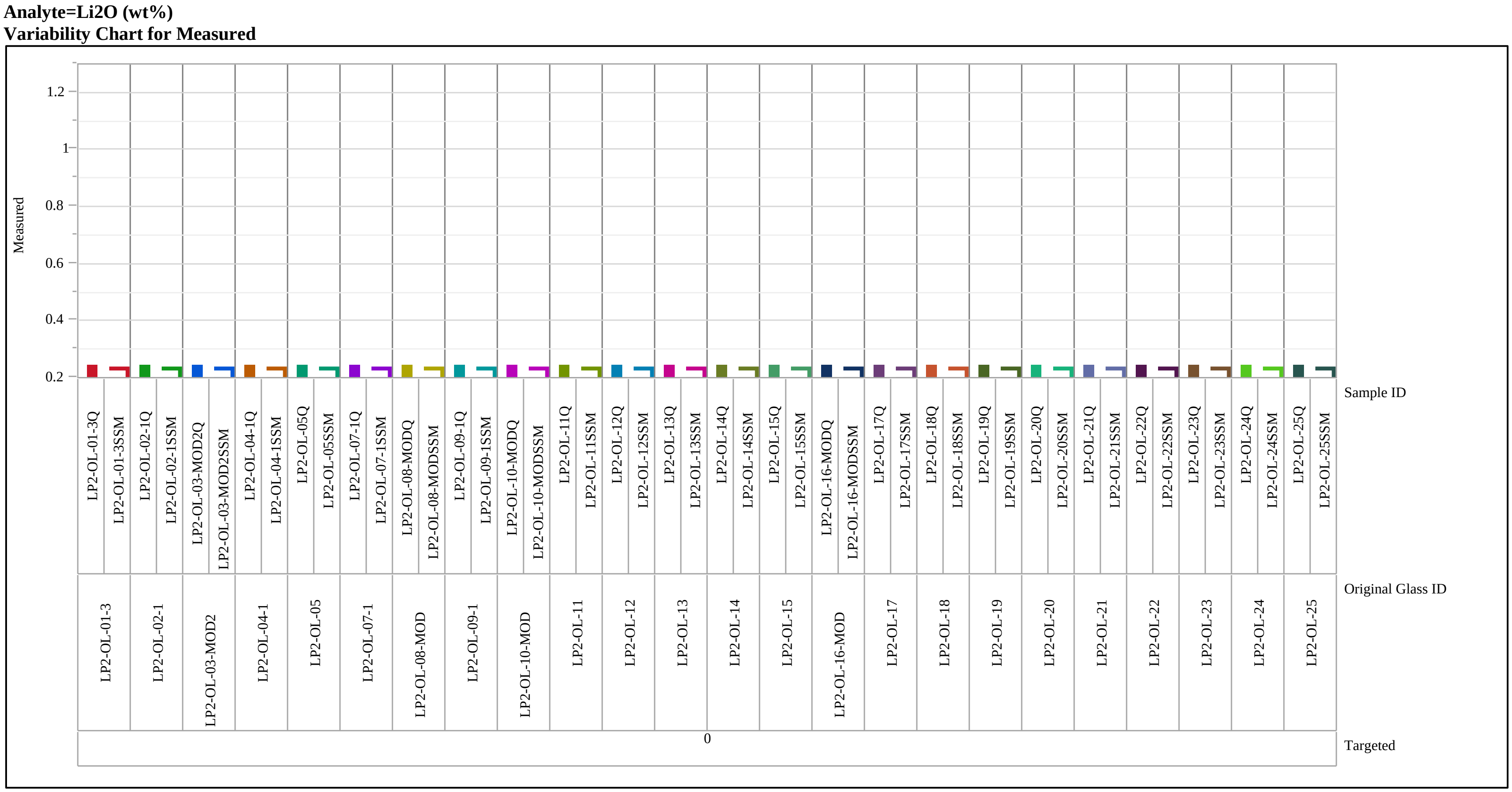


Exhibit D-1. Comparisons of the Measured Compositions of the Baseline and Sulfur Saturated Versions of the Study Glasses (continued)

Analyte=MgO (wt%)
Variability Chart for Measured

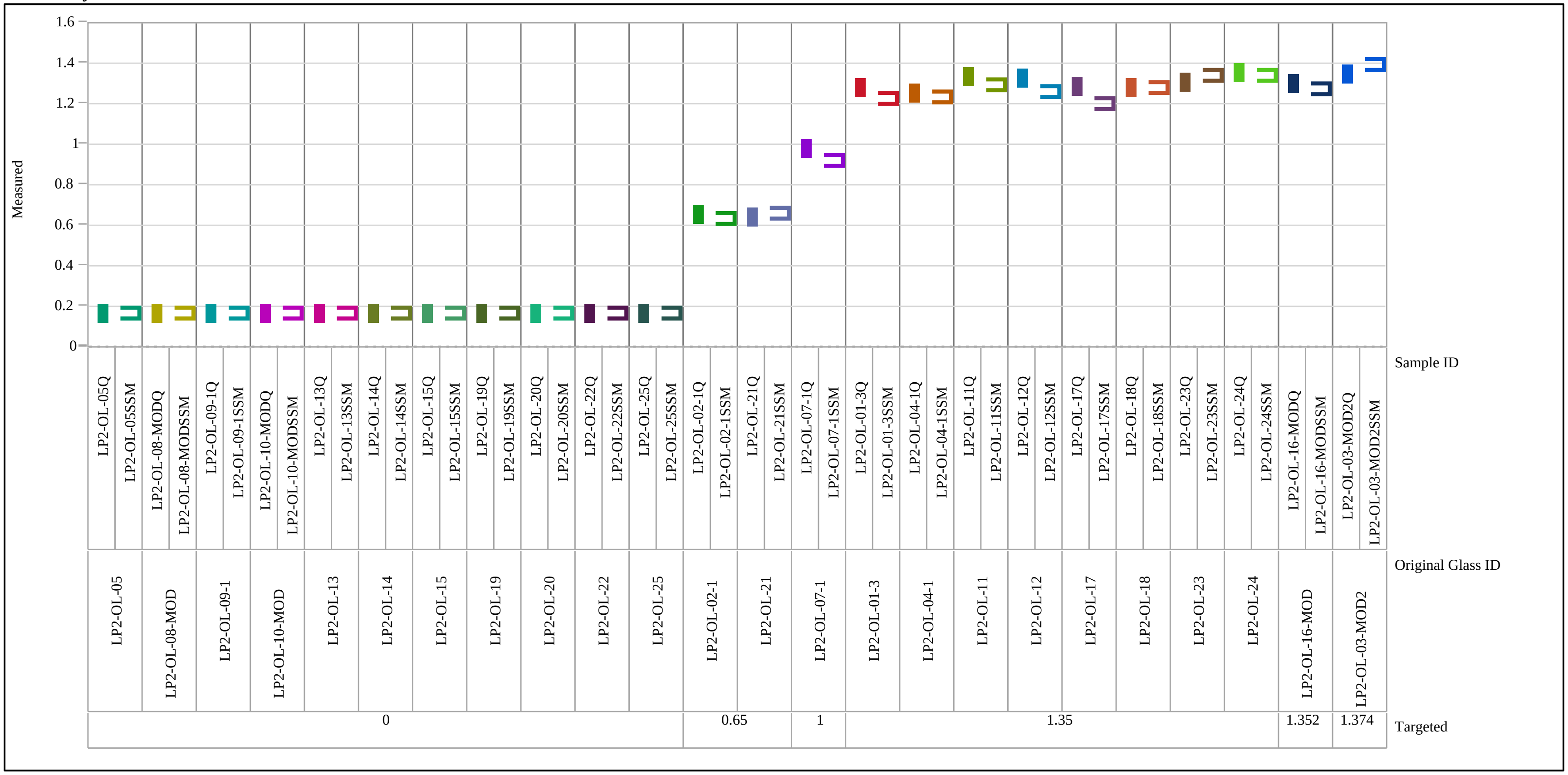


Exhibit D-1. Comparisons of the Measured Compositions of the Baseline and Sulfur Saturated Versions of the Study Glasses (continued)

Analyte=Na2O (wt%)
Variability Chart for Measured

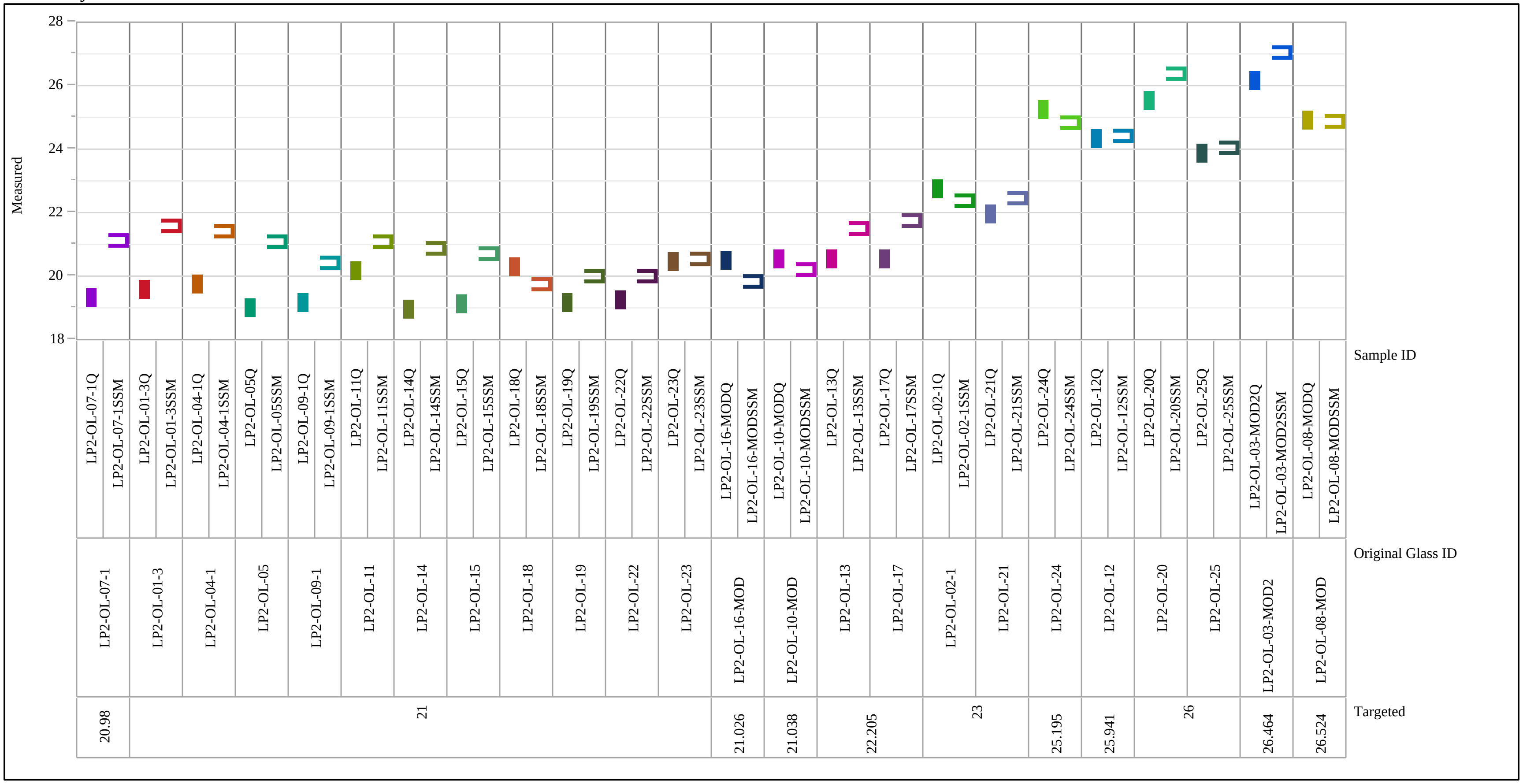


Exhibit D-1. Comparisons of the Measured Compositions of the Baseline and Sulfur Saturated Versions of the Study Glasses (continued)

Analyte=NiO (wt%)
Variability Chart for Measured

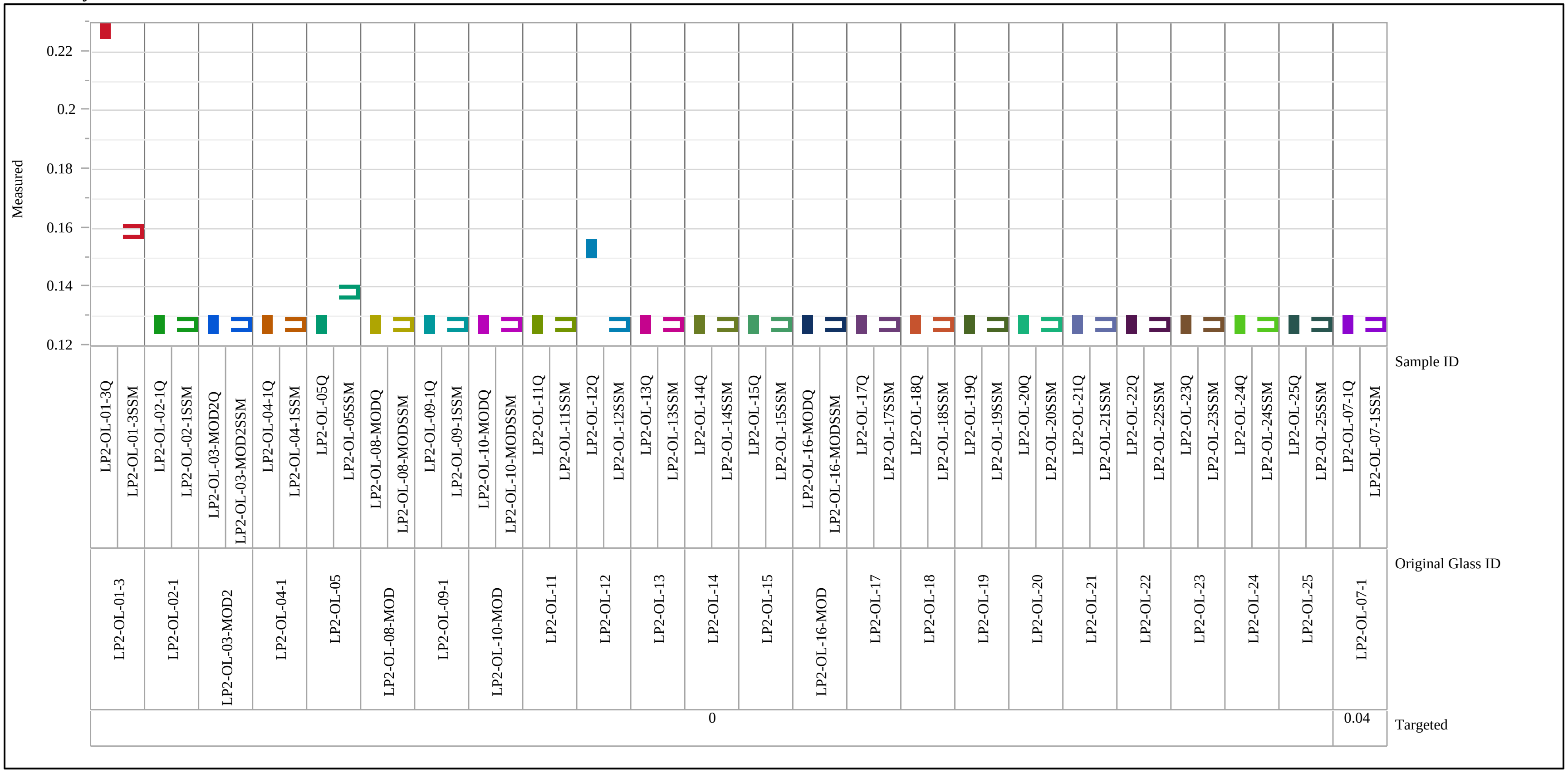


Exhibit D-1. Comparisons of the Measured Compositions of the Baseline and Sulfur Saturated Versions of the Study Glasses (continued)

Analyte=P2O5 (wt%)
Variability Chart for Measured

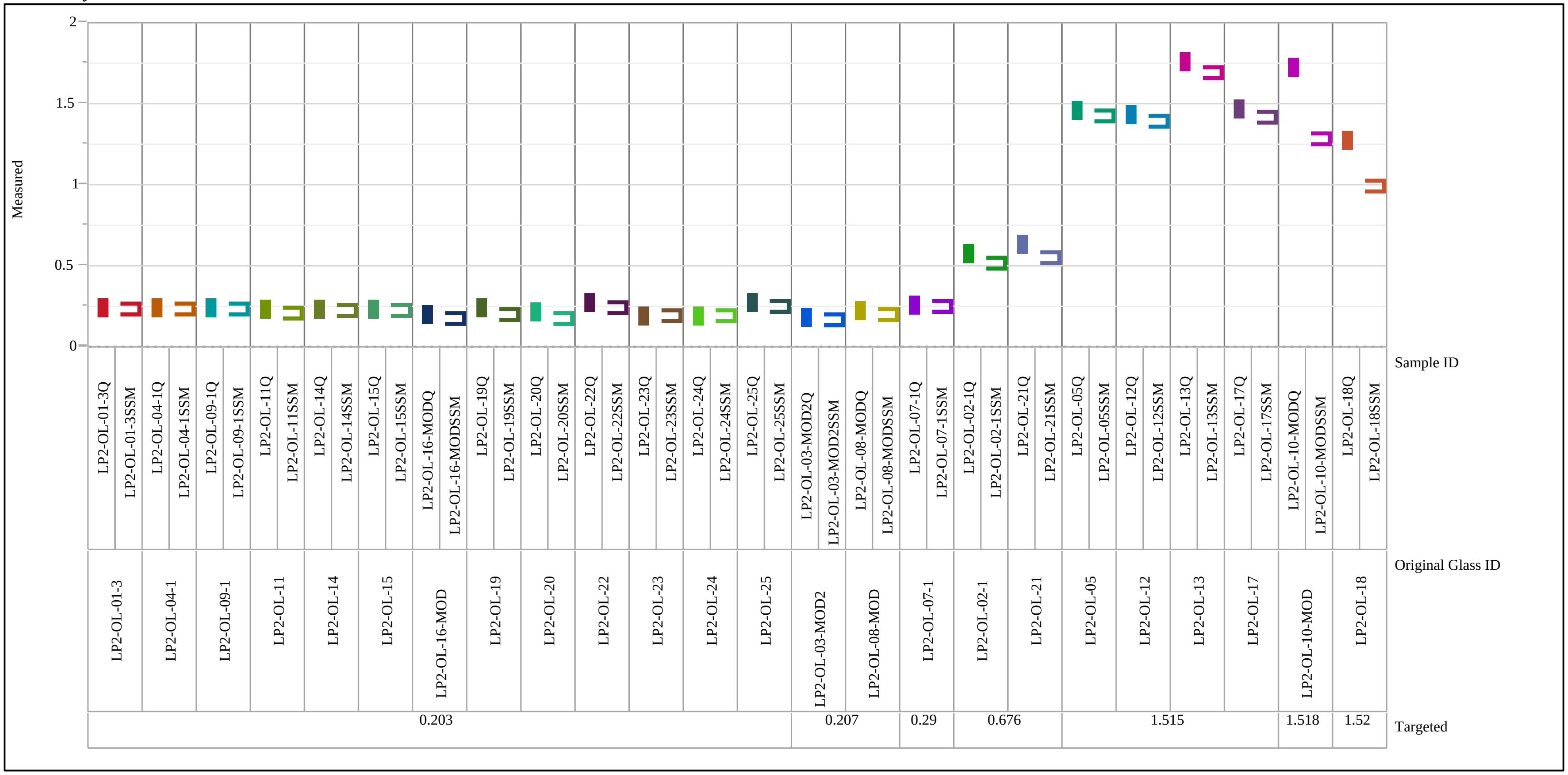


Exhibit D-1. Comparisons of the Measured Compositions of the Baseline and Sulfur Saturated Versions of the Study Glasses (continued)

Analyte=SiO2 (wt%)
Variability Chart for Measured

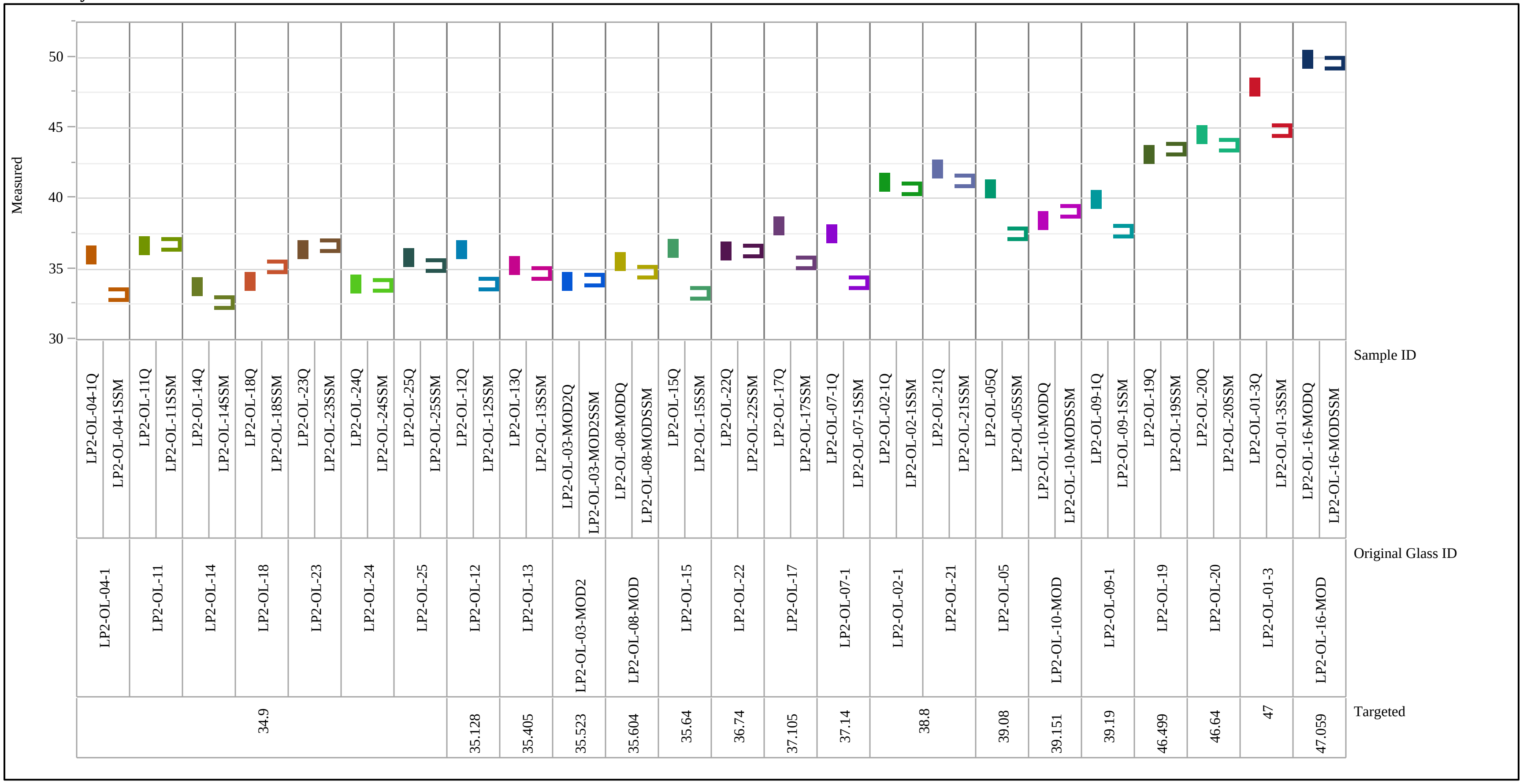


Exhibit D-1. Comparisons of the Measured Compositions of the Baseline and Sulfur Saturated Versions of the Study Glasses (continued)

Analyte=SnO2 (wt%)
Variability Chart for Measured

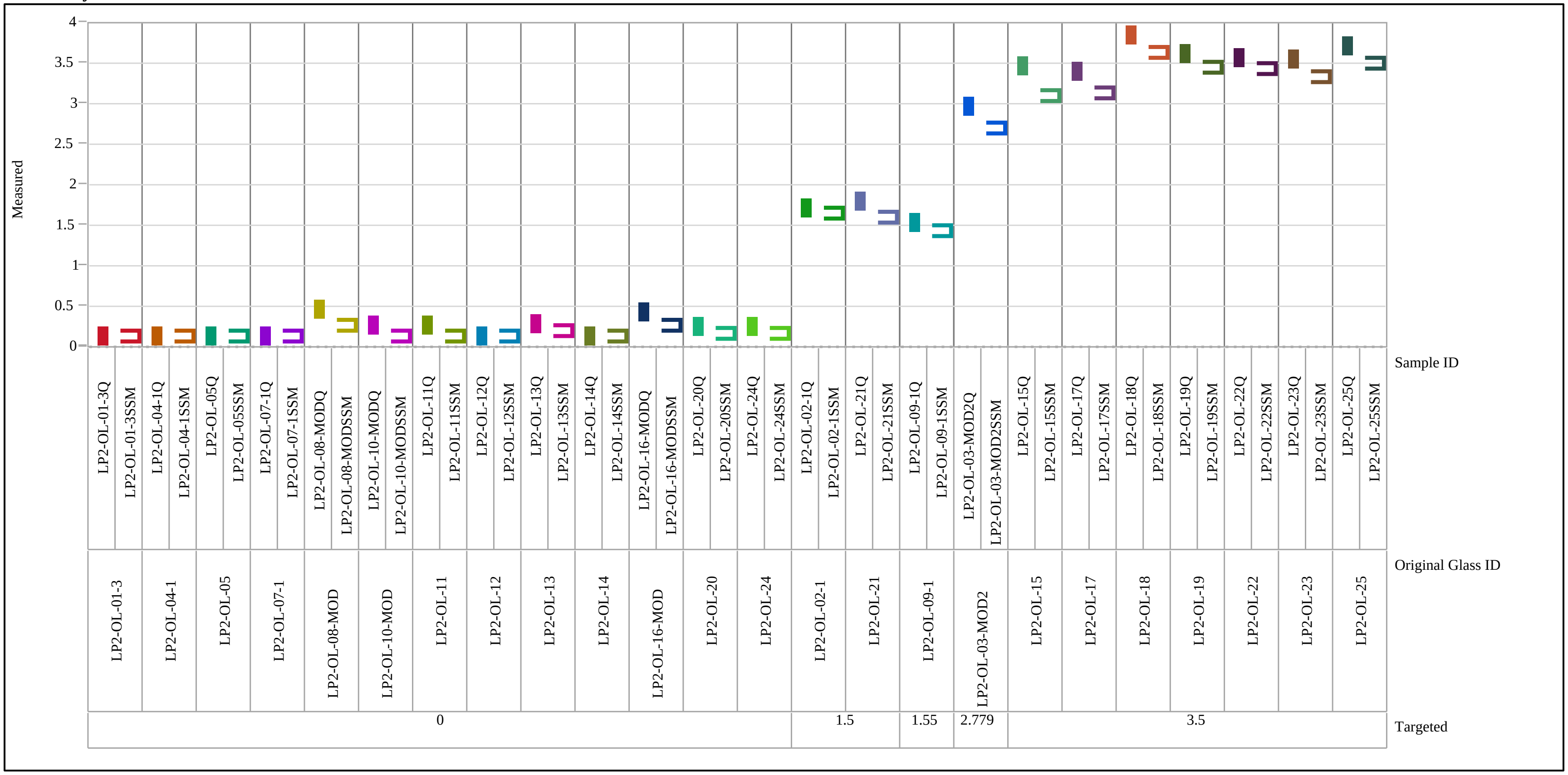


Exhibit D-1. Comparisons of the Measured Compositions of the Baseline and Sulfur Saturated Versions of the Study Glasses (continued)

Analyte=SO3 (wt%)
Variability Chart for Measured

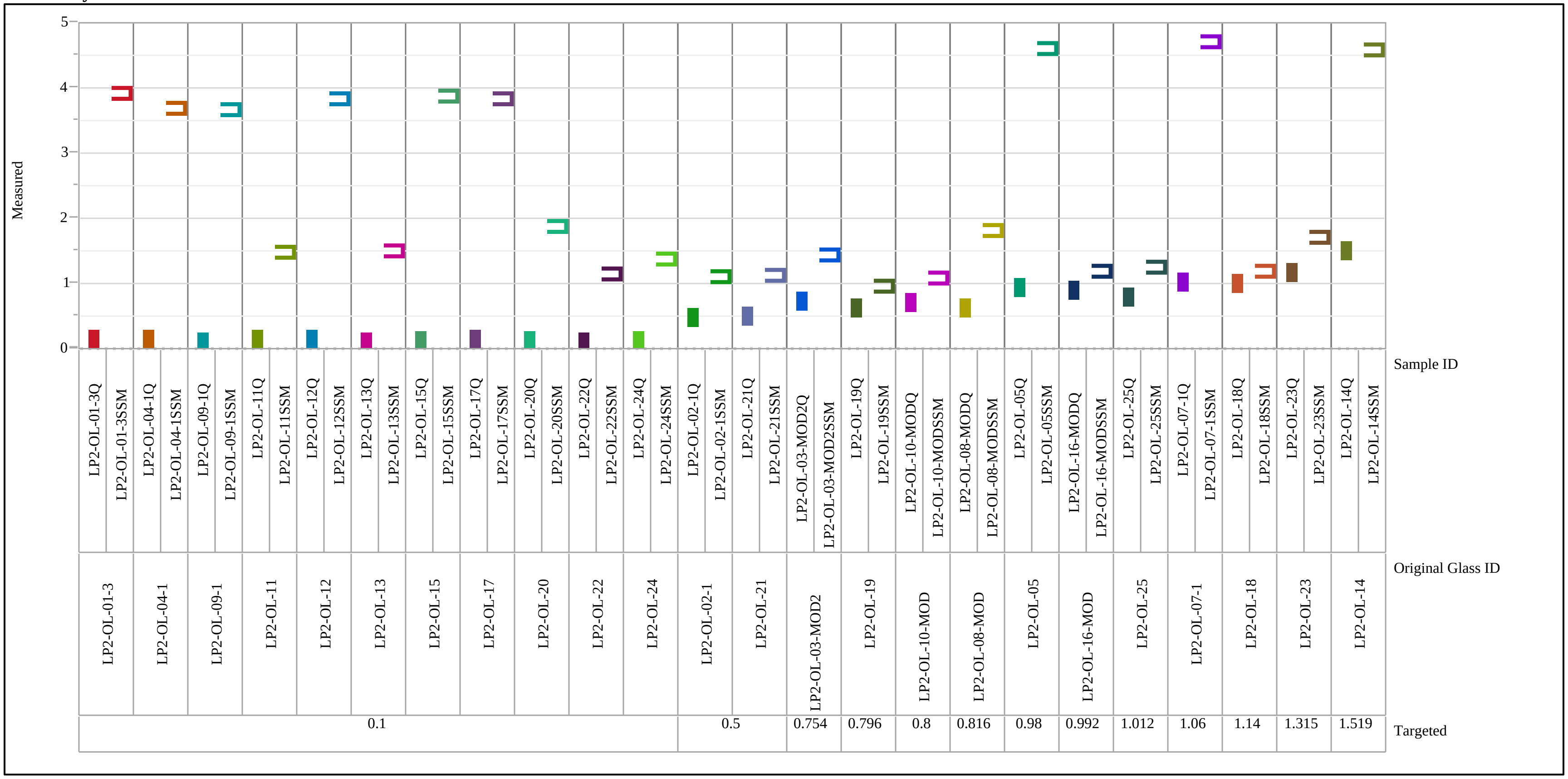


Exhibit D-1. Comparisons of the Measured Compositions of the Baseline and Sulfur Saturated Versions of the Study Glasses (continued)

Analyte=V2O5 (wt%)
Variability Chart for Measured

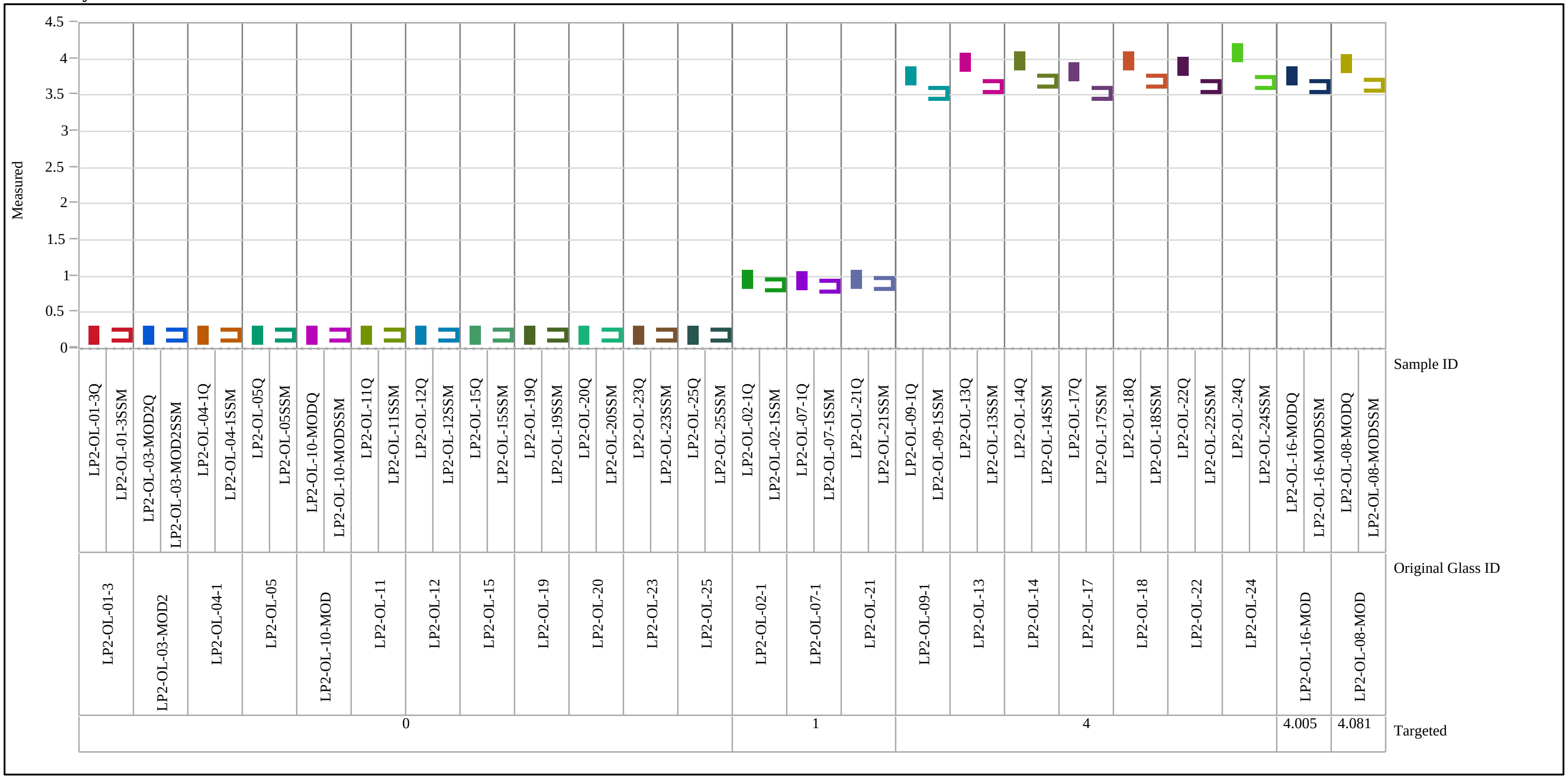


Exhibit D-1. Comparisons of the Measured Compositions of the Baseline and Sulfur Saturated Versions of the Study Glasses (continued)

Analyte=ZnO (wt%)
Variability Chart for Measured

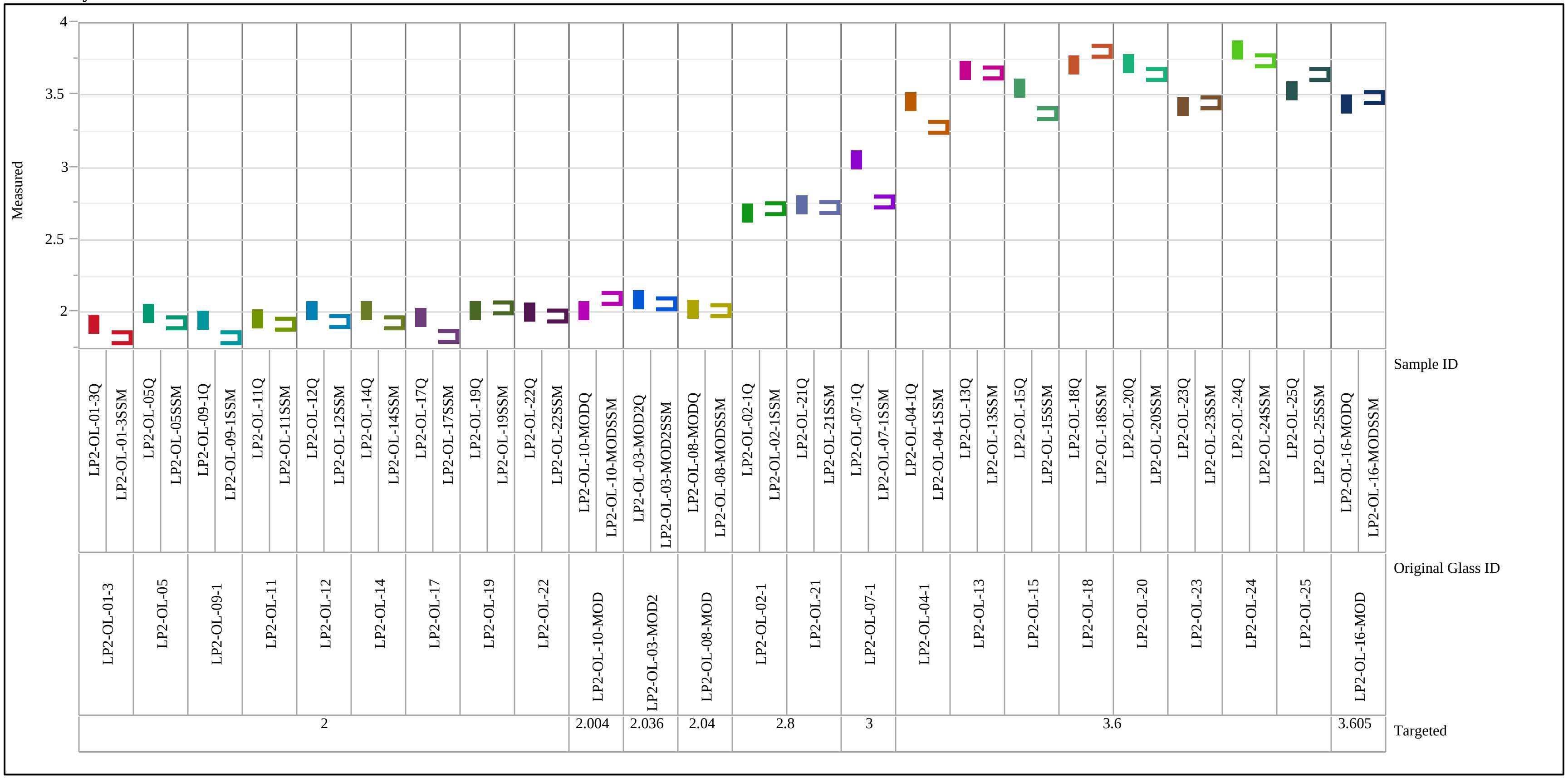


Exhibit D-1. Comparisons of the Measured Compositions of the Baseline and Sulfur Saturated Versions of the Study Glasses (continued)

Analyte=ZrO2 (wt%)
Variability Chart for Measured

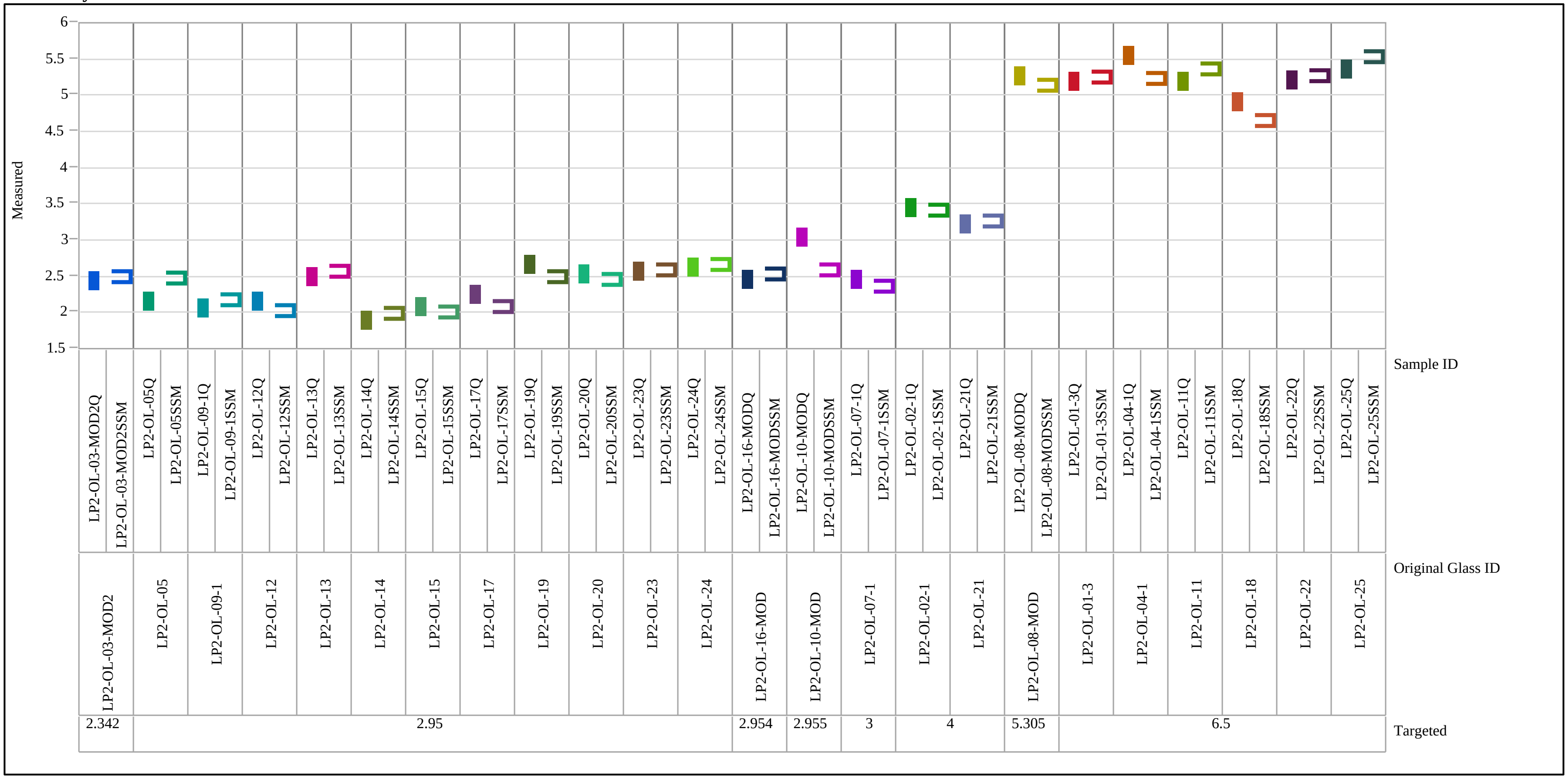
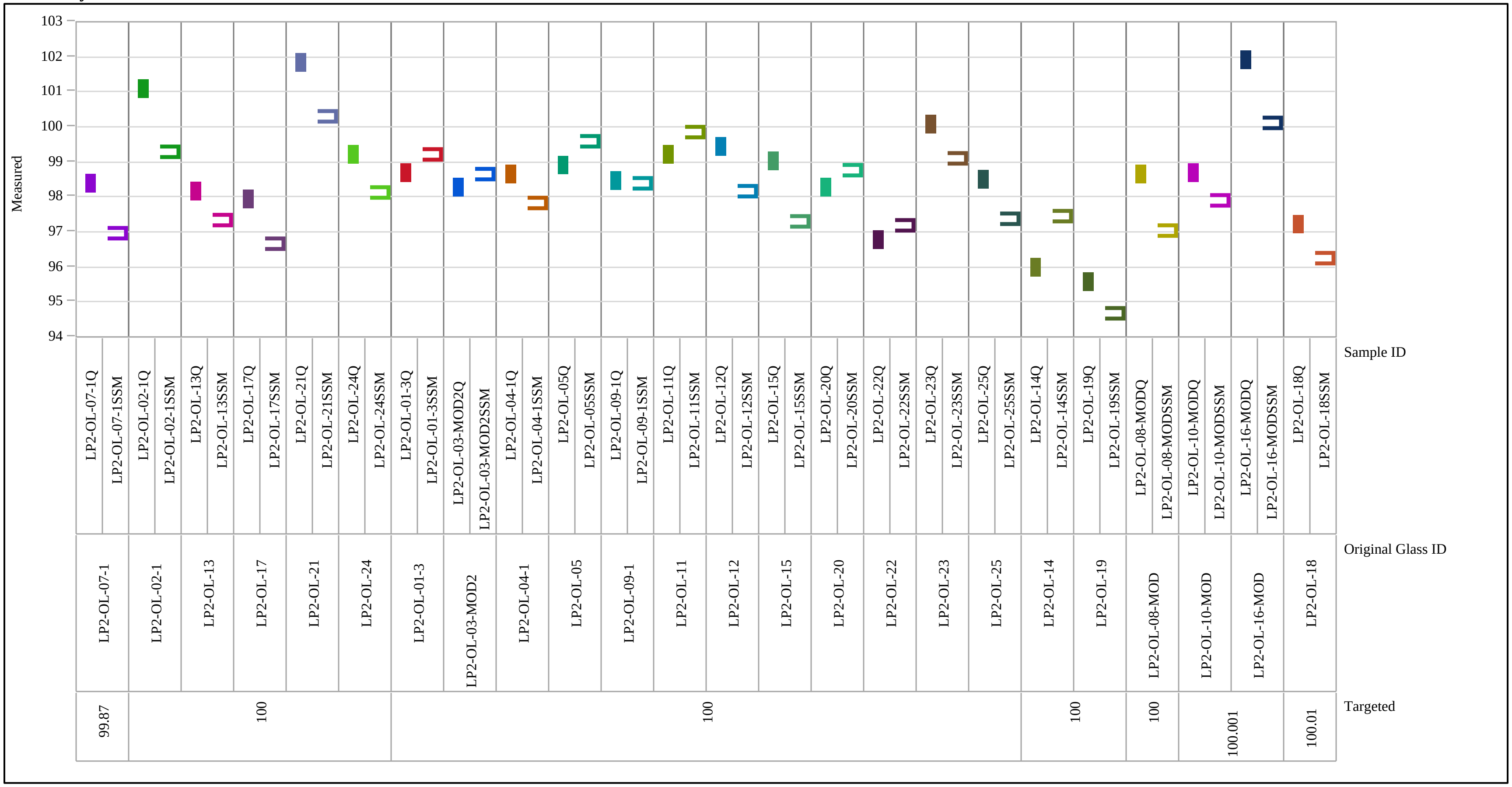


Exhibit D-1. Comparisons of the Measured Compositions of the Baseline and Sulfur Saturated Versions of the Study Glasses (continued)

Analyte=Sum of Oxides
Variability Chart for Measured



Appendix E Tables and Exhibits Supporting the PCT Results

Table E-1. PCT Measurements for the LAW Phase 2 OL Glasses (ar – as received)

Oven Run	Glass ID (with Heat Treatment)	Block	Sequence	Lab ID	B (ar)	Li (ar)	Na (ar)	Si (ar)	B (mg/L)	Li (mg/L)	Na (mg/L)	Si (mg/L)
1	Soln Std	1	1	std-1-1	18.8	9.43	82.3	51.1	18.800	9.430	82.300	51.100
1	LP2-OL-14Q	1	2	J53	397	<1.00	1250	209	661.680	<1.667	2083.375	348.340
1	LP2-OL-02-1Q	1	3	J45	16.9	<1.00	111	37.0	28.167	<1.667	185.004	61.668
1	LP2-OL-04-1CCC	1	4	J49	105	<1.00	1980	221	175.004	<1.667	3300.066	368.341
1	LP2-OL-20Q	1	5	J66	4.90	<1.00	262	45.1	8.167	<1.667	436.675	75.168
1	LP2-OL-15Q	1	6	J08	14.2	<1.00	87.4	26.3	23.667	<1.667	145.670	43.834
1	LP2-OL-07-1Q	1	7	J41	20.6	<1.00	99.1	30.3	34.334	<1.667	165.170	50.501
1	LP2-OL-25Q	1	8	J57	139	<1.00	478	62.5	231.671	<1.667	796.683	104.169
1	blank	1	9	J26	<1.00	<1.00	<1.00	<1.00	<1.667	<1.667	<1.667	<1.667
1	LP2-OL-24Q	1	10	J05	10.5	<1.00	204	47.3	17.500	<1.667	340.007	78.835
1	ARM-1	1	11	J48	10.4	7.71	20.8	39.8	17.334	12.850	34.667	66.335
1	LP2-OL-22Q	1	12	J65	4.30	<1.00	105	23.8	7.167	<1.667	175.004	39.667
1	LP2-OL-17Q	1	13	J58	123	<1.00	961	234	205.004	<1.667	1601.699	390.008
1	Soln Std	1	14	std-1-2	21.4	9.53	83.6	55.0	21.400	9.530	83.600	55.000
1	LP2-OL-04-1Q	1	15	J40	16.7	<1.00	210	44.9	27.834	<1.667	350.007	74.835
1	LP2-OL-21Q	1	16	J16	17.0	<1.00	108	41.0	28.334	<1.667	180.004	68.335
1	LP2-OL-09-1Q	1	17	J51	85.4	<1.00	179	29.3	142.336	<1.667	298.339	48.834
1	LP2-OL-01-3CCC	1	18	J37	6.44	<1.00	90.1	40.0	10.734	<1.667	150.170	66.668
1	LP2-OL-19Q	1	19	J38	8.23	<1.00	178	70.5	13.717	<1.667	296.673	117.502
1	LP2-OL-01-3Q	1	20	J24	7.58	<1.00	107	47.2	12.634	<1.667	178.337	78.668
1	LP2-OL-05Q	1	21	J25	2.81	<1.00	70.0	21.2	4.683	<1.667	116.669	35.334
1	LP2-OL-13Q	1	22	J60	9.79	<1.00	391	66.6	16.317	<1.667	651.680	111.002
1	LP2-OL-12Q	1	23	J50	855	<1.00	3190	388	1425.029	<1.667	5316.773	646.680
1	LP2-OL-23Q	1	24	J68	27.6	<1.00	110	33.2	46.001	<1.667	183.337	55.334
1	LP2-OL-11Q	1	25	J19	190	<1.00	671	111	316.673	<1.667	1118.356	185.004
1	Soln Std	1	26	std-1-3	21.6	9.18	83.2	51.9	21.600	9.180	83.200	51.900
1	Soln Std	2	1	std-2-1	18.8	9.41	80.1	50.8	18.800	9.410	80.100	50.800
1	LP2-OL-14Q	2	2	J17	375	<1.00	1170	209	625.013	<1.667	1950.039	348.340
1	LP2-OL-13Q	2	3	J13	10.8	<1.00	377	59.5	18.000	<1.667	628.346	99.169
1	LP2-OL-02-1Q	2	4	J47	15.1	<1.00	106	36.2	25.167	<1.667	176.670	60.335
1	LP2-OL-12Q	2	5	J21	897	<1.00	3030	421	1495.030	<1.667	5050.101	701.681
1	LP2-OL-20Q	2	6	J29	9.57	<1.00	243	42.5	15.950	<1.667	405.008	70.835
1	LP2-OL-15Q	2	7	J59	14.2	<1.00	76.5	24.3	23.667	<1.667	127.503	40.501
1	LP2-OL-05Q	2	8	J09	4.25	<1.00	63.0	20.2	7.083	<1.667	105.002	33.667
1	LP2-OL-11Q	2	9	J36	201	<1.00	661	125	335.007	<1.667	1101.689	208.338
1	LP2-OL-17Q	2	10	J28	122	<1.00	890	244	203.337	<1.667	1483.363	406.675

Table E-1. PCT Measurements for the LAW Phase 2 OL Glasses (ar – as received) (continued)

Oven Run	Glass ID (with Heat Treatment)	Block	Sequence	Lab ID	B (ar)	Li (ar)	Na (ar)	Si (ar)	B (mg/L)	Li (mg/L)	Na (mg/L)	Si (mg/L)
1	LP2-OL-24Q	2	11	J56	9.76	<1.00	185	41.5	16.267	<1.667	308.340	69.168
1	LP2-OL-07-1Q	2	12	J43	18.5	<1.00	88.0	28.0	30.834	<1.667	146.670	46.668
1	LP2-OL-21Q	2	13	J22	14.9	<1.00	101	37.6	24.834	<1.667	168.337	62.668
1	Soln Std	2	14	std-2-2	18.2	9.10	78.3	48.8	18.200	9.100	78.300	48.800
1	LP2-OL-22Q	2	15	J14	4.79	<1.00	97.3	22.5	7.983	<1.667	162.170	37.501
1	ARM-1	2	16	J15	9.46	7.37	19.9	36.5	15.767	12.284	33.167	60.835
1	LP2-OL-09-1Q	2	17	J11	75.0	<1.00	168	26.9	125.003	<1.667	280.006	44.834
1	LP2-OL-19Q	2	18	J42	8.51	<1.00	165	67.2	14.184	<1.667	275.006	112.002
1	LP2-OL-04-1CCC	2	19	J62	109	<1.00	1890	238	181.670	<1.667	3150.063	396.675
1	LP2-OL-23Q	2	20	J46	23.1	<1.00	109	30.9	38.501	<1.667	181.670	51.501
1	LP2-OL-25Q	2	21	J03	128	<1.00	425	59.3	213.338	<1.667	708.348	98.835
1	LP2-OL-04-1Q	2	22	J20	16.4	<1.00	182	42.0	27.334	<1.667	303.339	70.001
1	LP2-OL-01-3CCC	2	23	J01	6.46	<1.00	86.9	37.1	10.767	<1.667	144.836	61.835
1	LP2-OL-01-3Q	2	24	J23	6.85	<1.00	101	40.9	11.417	<1.667	168.337	68.168
1	Soln Std	2	25	std-2-3	19.0	9.52	74.7	50.5	19.000	9.520	74.700	50.500
1	Soln Std	3	1	std-3-1	19.8	9.15	79.9	50.1	19.800	9.150	79.900	50.100
1	LP2-OL-07-1Q	3	2	J44	19.8	<1.00	93.7	26.6	33.001	<1.667	156.170	44.334
1	LP2-OL-01-3Q	3	3	J33	7.92	<1.00	112	45.4	13.200	<1.667	186.670	75.668
1	blank	3	4	J02	<1.00	<1.00	<1.00	<1.00	<1.667	<1.667	<1.667	<1.667
1	LP2-OL-22Q	3	5	J64	4.17	<1.00	100	22.3	6.950	<1.667	166.670	37.167
1	LP2-OL-23Q	3	6	J63	23.3	<1.00	116	30.9	38.834	<1.667	193.337	51.501
1	LP2-OL-21Q	3	7	J31	16.0	<1.00	111	37.2	26.667	<1.667	185.004	62.001
1	LP2-OL-12Q	3	8	J34	879	<1.00	3070	394	1465.029	<1.667	5116.769	656.680
1	LP2-OL-13Q	3	9	J12	14.5	<1.00	384	64.8	24.167	<1.667	640.013	108.002
1	LP2-OL-01-3CCC	3	10	J06	8.22	<1.00	90.8	38.5	13.700	<1.667	151.336	64.168
1	LP2-OL-17Q	3	11	J10	132	<1.00	964	242	220.004	<1.667	1606.699	403.341
1	LP2-OL-11Q	3	12	J61	204	<1.00	690	121	340.007	<1.667	1150.023	201.671
1	LP2-OL-04-1Q	3	13	J55	18.3	<1.00	202	43.4	30.501	<1.667	336.673	72.335
1	Soln Std	3	14	std-3-2	20.8	9.21	80.2	50.5	20.800	9.210	80.200	50.500
1	LP2-OL-05Q	3	15	J30	3.80	<1.00	70.5	19.3	6.333	<1.667	117.502	32.167
1	LP2-OL-09-1Q	3	16	J07	79.5	<1.00	170	26.4	132.503	<1.667	283.339	44.001
1	LP2-OL-14Q	3	17	J67	342	<1.00	1160	192	570.011	<1.667	1933.372	320.006
1	LP2-OL-02-1Q	3	18	J54	17.9	<1.00	104	35.8	29.834	<1.667	173.337	59.668
1	LP2-OL-15Q	3	19	J39	14.0	<1.00	81.8	22.5	23.334	<1.667	136.336	37.501
1	LP2-OL-24Q	3	20	J18	10.4	<1.00	199	42.9	17.334	<1.667	331.673	71.501
1	LP2-OL-20Q	3	21	J04	4.68	<1.00	253	42.3	7.800	<1.667	421.675	70.501
1	LP2-OL-25Q	3	22	J32	129	<1.00	440	61.5	215.004	<1.667	733.348	102.502

Table E-1. PCT Measurements for the LAW Phase 2 OL Glasses (ar – as received) (continued)

Oven Run	Glass ID (with Heat Treatment)	Block	Sequence	Lab ID	B (ar)	Li (ar)	Na (ar)	Si (ar)	B (mg/L)	Li (mg/L)	Na (mg/L)	Si (mg/L)
1	LP2-OL-04-1CCC	3	23	J35	103	<1.00	1900	218	171.670	<1.667	3166.730	363.341
1	ARM-1	3	24	J27	11.4	7.52	20.9	37.2	19.000	12.534	34.834	62.001
1	LP2-OL-19Q	3	25	J52	9.36	<1.00	169	70.8	15.600	<1.667	281.672	118.002
1	Soln Std	3	26	std-3-3	19.6	9.16	78.6	49.5	19.600	9.160	78.600	49.500
2	Soln Std	1	1	std-1-1	18.5	9.27	75.5	46.7	18.500	9.270	75.500	46.700
2	ARM-1	1	2	Y20	9.30	7.81	20.4	34.3	15.500	13.017	34.001	57.168
2	LP2-OL-25CCC	1	3	Y25	148	<1.00	494	62.7	246.672	<1.667	823.350	104.502
2	LP2-OL-12CCC	1	4	Y21	920	<1.00	3420	445	1533.364	<1.667	5700.114	741.682
2	LP2-OL-14CCC	1	5	Y31	239	<1.00	831	172	398.341	<1.667	1385.028	286.672
2	LP2-OL-11CCC	1	6	Y09	196	<1.00	651	125	326.673	<1.667	1085.022	208.338
2	LP2-OL-02-1CCC	1	7	Y27	16.4	<1.00	101	33.0	27.334	<1.667	168.337	55.001
2	Soln Std	1	8	std-1-2	20.8	9.51	78.3	47.2	20.800	9.510	78.300	47.200
2	blank	1	9	Y15	<1.00	<1.00	<1.00	<1.00	<1.667	<1.667	<1.667	<1.667
2	LP2-OL-13CCC	1	10	Y37	123	<1.00	1420	150	205.004	<1.667	2366.714	250.005
2	LP2-OL-07-1CCC	1	11	Y03	16.3	<1.00	78.9	21.8	27.167	<1.667	131.503	36.334
2	LP2-OL-23CCC	1	12	Y01	18.3	<1.00	98.9	24.1	30.501	<1.667	164.837	40.167
2	LP2-OL-09-1CCC	1	13	Y05	64.4	<1.00	145	26.7	107.335	<1.667	241.672	44.501
2	LP2-OL-05CCC	1	14	Y26	8.58	<1.00	95.7	19.3	14.300	<1.667	159.503	32.167
2	Soln Std	1	15	std-1-3	19.7	9.44	78.2	46.5	19.700	9.440	78.200	46.500
2	Soln Std	2	1	std-2-1	20.2	9.57	78.6	47.9	20.200	9.570	78.600	47.900
2	blank	2	2	Y14	<1.00	<1.00	<1.00	<1.00	<1.667	<1.667	<1.667	<1.667
2	LP2-OL-23CCC	2	3	Y34	18.3	<1.00	101	26.7	30.501	<1.667	168.337	44.501
2	LP2-OL-09-1CCC	2	4	Y10	55.8	<1.00	133	26.6	93.002	<1.667	221.671	44.334
2	blank	2	5	Y19	<1.00	<1.00	<1.00	<1.00	<1.667	<1.667	<1.667	<1.667
2	LP2-OL-11CCC	2	6	Y17	184	<1.00	628	123	306.673	<1.667	1046.688	205.004
2	LP2-OL-13CCC	2	7	Y32	129	<1.00	1380	164	215.004	<1.667	2300.046	273.339
2	Soln Std	2	8	std-2-2	20.4	9.51	78.1	47.5	20.400	9.510	78.100	47.500
2	LP2-OL-12CCC	2	9	Y02	956	<1.00	3370	452	1593.365	<1.667	5616.779	753.348
2	LP2-OL-07-1CCC	2	10	Y24	20.1	<1.00	77.7	24.2	33.501	<1.667	129.503	40.334
2	ARM-1	2	11	Y06	12.1	7.94	21.0	35.8	20.167	13.234	35.001	59.668
2	LP2-OL-25CCC	2	12	Y18	141	<1.00	481	62.3	235.005	<1.667	801.683	103.835
2	LP2-OL-14CCC	2	13	Y30	242	<1.00	862	175	403.341	<1.667	1436.695	291.673
2	LP2-OL-05CCC	2	14	Y07	10.6	<1.00	90.8	21.3	17.667	<1.667	151.336	35.501
2	LP2-OL-02-1CCC	2	15	Y22	15.6	<1.00	100	33.9	26.001	<1.667	166.670	56.501
2	Soln Std	2	16	std-2-3	20.8	9.50	78.3	47.5	20.800	9.500	78.300	47.500
2	Soln Std	3	1	std-3-1	20.6	9.72	78.7	49.0	20.600	9.720	78.700	49.000
2	blank	3	2	Y29	<1.00	<1.00	<1.00	<1.00	<1.667	<1.667	<1.667	<1.667

Table E-1. PCT Measurements for the LAW Phase 2 OL Glasses (ar – as received) (continued)

Oven Run	Glass ID (with Heat Treatment)	Block	Sequence	Lab ID	B (ar)	Li (ar)	Na (ar)	Si (ar)	B (mg/L)	Li (mg/L)	Na (mg/L)	Si (mg/L)
2	LP2-OL-11CCC	3	3	Y08	169	<1.00	594	115	281.672	<1.667	990.020	191.671
2	LP2-OL-09-1CCC	3	4	Y35	57.6	<1.00	130	27.9	96.002	<1.667	216.671	46.501
2	LP2-OL-12CCC	3	5	Y12	873	<1.00	3120	430	1455.029	<1.667	5200.104	716.681
2	LP2-OL-02-1CCC	3	6	Y16	19.1	<1.00	101	35.6	31.834	<1.667	168.337	59.335
2	LP2-OL-23CCC	3	7	Y23	21.3	<1.00	102	27.5	35.501	<1.667	170.003	45.834
2	Soln Std	3	8	std-3-2	20.6	9.47	76.2	47.8	20.600	9.470	76.200	47.800
2	LP2-OL-05CCC	3	9	Y33	9.84	<1.00	91.3	21.8	16.400	<1.667	152.170	36.334
2	ARM-1	3	10	Y13	11.5	8.24	21.3	37.5	19.167	13.734	35.501	62.501
2	LP2-OL-14CCC	3	11	Y11	284	<1.00	915	178	473.343	<1.667	1525.031	296.673
2	LP2-OL-25CCC	3	12	Y04	149	<1.00	462	63.4	248.338	<1.667	770.015	105.669
2	LP2-OL-07-1CCC	3	13	Y28	18.5	<1.00	80.0	24.2	30.834	<1.667	133.336	40.334
2	LP2-OL-13CCC	3	14	Y36	139	<1.00	1420	151	231.671	<1.667	2366.714	251.672
2	Soln Std	3	15	std-3-3	21.1	9.53	77.3	48.2	21.100	9.530	77.300	48.200
3	Soln Std	1	1	std-1-1	20.9	9.56	82.7	52.4	20.900	9.560	82.700	52.400
3	LP2-OL-10-MODCCC	1	2	K30	109	<1.00	453	44.3	181.670	<1.667	755.015	73.835
3	LP2-OL-03-MOD2Q	1	3	K01	8.64	<1.00	300	40.2	14.400	<1.667	500.010	67.001
3	LP2-OL-19CCC	1	4	K19	8.73	<1.00	169	66.4	14.550	<1.667	281.672	110.669
3	LP2-OL-21CCC	1	5	K22	15.6	<1.00	104	36.3	26.001	<1.667	173.337	60.501
3	LP2-OL-18Q	1	6	K43	26.8	<1.00	227	57.5	44.668	<1.667	378.341	95.835
3	blank	1	7	K25	<1.00	<1.00	<1.00	<1.00	<1.667	<1.667	<1.667	<1.667
3	LP2-OL-16-MODCCC	1	8	K03	31.2	<1.00	210	103	52.001	<1.667	350.007	171.670
3	LP2-OL-17CCC	1	9	K10	134	<1.00	1090	266	223.338	<1.667	1816.703	443.342
3	LP2-OL-08-MODQ	1	10	K54	31.9	<1.00	566	91.4	53.168	<1.667	943.352	152.336
3	LP2-OL-03-MOD2CCC	1	11	K45	19.5	<1.00	1650	172	32.501	<1.667	2750.055	286.672
3	Soln Std	1	12	std-1-2	20.6	9.13	84.0	49.3	20.600	9.130	84.000	49.300
3	LP2-OL-10-MODQ	1	13	K38	3.86	<1.00	75.7	20.5	6.433	<1.667	126.169	34.167
3	LP2-OL-16-MODQ	1	14	K04	37.3	<1.00	268	122	62.168	<1.667	446.676	203.337
3	LP2-OL-15CCC	1	15	K44	13.0	<1.00	80.9	22.5	21.667	<1.667	134.836	37.501
3	LP2-OL-08-MODCCC	1	16	K50	208	<1.00	2610	203	346.674	<1.667	4350.087	338.340
3	ARM-1	1	17	K16	11.7	8.12	20.5	37.7	19.500	13.534	34.167	62.835
3	LP2-OL-20CCC	1	18	K13	21.3	<1.00	595	120	35.501	<1.667	991.687	200.004
3	LP2-OL-22CCC	1	19	K36	5.27	<1.00	98.1	22.4	8.784	<1.667	163.503	37.334
3	LP2-OL-18CCC	1	20	K24	4.02	<1.00	92.2	26.1	6.700	<1.667	153.670	43.501
3	LP2-OL-24CCC	1	21	K48	38.1	<1.00	503	72.8	63.501	<1.667	838.350	121.336
3	Soln Std	1	22	std-1-3	20.6	9.04	84.5	49.3	20.600	9.040	84.500	49.300
3	Soln Std	2	1	std-2-1	19.5	9.42	76.9	47.5	19.500	9.420	76.900	47.500
3	LP2-OL-16-MODQ	2	2	K21	34.1	<1.00	230	114	56.834	<1.667	383.341	190.004

Table E-1. PCT Measurements for the LAW Phase 2 OL Glasses (ar – as received) (continued)

Oven Run	Glass ID (with Heat Treatment)	Block	Sequence	Lab ID	B (ar)	Li (ar)	Na (ar)	Si (ar)	B (mg/L)	Li (mg/L)	Na (mg/L)	Si (mg/L)
3	LP2-OL-08-MODQ	2	3	K17	29.6	<1.00	523	84.6	49.334	<1.667	871.684	141.003
3	LP2-OL-10-MODCCC	2	4	K47	105	<1.00	476	44.3	175.004	<1.667	793.349	73.835
3	LP2-OL-03-MOD2CCC	2	5	K51	18.0	<1.00	1710	164	30.001	<1.667	2850.057	273.339
3	LP2-OL-21CCC	2	6	K07	14.9	<1.00	100	33.7	24.834	<1.667	166.670	56.168
3	LP2-OL-15CCC	2	7	K14	11.7	<1.00	77.7	21.3	19.500	<1.667	129.503	35.501
3	LP2-OL-08-MODCCC	2	8	K18	210	<1.00	2720	189	350.007	<1.667	4533.424	315.006
3	LP2-OL-20CCC	2	9	K05	20.6	<1.00	491	109	34.334	<1.667	818.350	181.670
3	LP2-OL-16-MODCCC	2	10	K09	29.3	<1.00	192	93.3	48.834	<1.667	320.006	155.503
3	LP2-OL-10-MODQ	2	11	K56	3.95	<1.00	77.0	20.5	6.583	<1.667	128.336	34.167
3	Soln Std	2	12	std-2-2	18.8	9.21	78.8	45.9	18.800	9.210	78.800	45.900
3	LP2-OL-18Q	2	13	K27	25.5	<1.00	213	53.2	42.501	<1.667	355.007	88.668
3	LP2-OL-18CCC	2	14	K08	3.99	<1.00	93.2	25.2	6.650	<1.667	155.336	42.001
3	LP2-OL-22CCC	2	15	K34	4.76	<1.00	97.6	21.1	7.933	<1.667	162.670	35.167
3	LP2-OL-03-MOD2Q	2	16	K55	7.83	<1.00	304	38.4	13.050	<1.667	506.677	64.001
3	LP2-OL-24CCC	2	17	K52	35.3	<1.00	418	67.6	58.835	<1.667	696.681	112.669
3	LP2-OL-19CCC	2	18	K02	8.09	<1.00	163	59.8	13.484	<1.667	271.672	99.669
3	ARM-1	2	19	K37	9.81	7.72	20.7	34.8	16.350	12.867	34.501	58.001
3	LP2-OL-17CCC	2	20	K23	143	<1.00	1050	267	238.338	<1.667	1750.035	445.009
3	Soln Std	2	21	std-2-3	19.8	9.49	78.7	47.8	19.800	9.490	78.700	47.800
3	Soln Std	3	1	std-3-1	20.0	9.79	77.0	49.4	20.000	9.790	77.000	49.400
3	ARM-1	3	2	K46	9.98	7.88	20.6	37.2	16.634	13.134	34.334	62.001
3	LP2-OL-19CCC	3	3	K32	7.97	<1.00	157	63.0	13.284	<1.667	261.672	105.002
3	LP2-OL-24CCC	3	4	K33	35.4	<1.00	439	70.4	59.001	<1.667	731.681	117.336
3	LP2-OL-10-MODQ	3	5	K39	3.59	<1.00	74.5	20.7	5.983	<1.667	124.169	34.501
3	LP2-OL-17CCC	3	6	K41	147	<1.00	1070	273	245.005	<1.667	1783.369	455.009
3	LP2-OL-22CCC	3	7	K12	5.40	<1.00	99.1	23.0	9.000	<1.667	165.170	38.334
3	LP2-OL-08-MODQ	3	8	K15	25.6	<1.00	514	85.3	42.668	<1.667	856.684	142.170
3	LP2-OL-15CCC	3	9	K28	12.0	<1.00	77.1	22.4	20.000	<1.667	128.503	37.334
3	LP2-OL-16-MODCCC	3	10	K26	30.7	<1.00	203	102	51.168	<1.667	338.340	170.003
3	blank	3	11	K11	<1.00	<1.00	<1.00	<1.00	<1.667	<1.667	<1.667	<1.667
3	Soln Std	3	12	std-3-2	20.0	9.55	78.7	51.3	20.000	9.550	78.700	51.300
3	LP2-OL-20CCC	3	13	K53	20.1	<1.00	503	119	33.501	<1.667	838.350	198.337
3	LP2-OL-18CCC	3	14	K42	3.72	<1.00	86.1	24.9	6.200	<1.667	143.503	41.501
3	LP2-OL-18Q	3	15	K29	27.1	<1.00	225	60.0	45.168	<1.667	375.008	100.002
3	LP2-OL-03-MOD2CCC	3	16	K40	18.6	<1.00	1770	170	31.001	<1.667	2950.059	283.339
3	LP2-OL-10-MODCCC	3	17	K49	108	<1.00	478	45.7	180.004	<1.667	796.683	76.168
3	LP2-OL-16-MODQ	3	18	K31	37.8	<1.00	237	122	63.001	<1.667	395.008	203.337

Table E-1. PCT Measurements for the LAW Phase 2 OL Glasses (ar – as received) (continued)

Oven Run	Glass ID (with Heat Treatment)	Block	Sequence	Lab ID	B (ar)	Li (ar)	Na (ar)	Si (ar)	B (mg/L)	Li (mg/L)	Na (mg/L)	Si (mg/L)
3	LP2-OL-08-MODCCC	3	19	K06	216	<1.00	2600	201	360.007	<1.667	4333.420	335.007
3	LP2-OL-21CCC	3	20	K20	17.1	<1.00	104	37.2	28.501	<1.667	173.337	62.001
3	LP2-OL-03-MOD2Q	3	21	K35	8.85	<1.00	298	40.3	14.750	<1.667	496.677	67.168
3	Soln Std	3	22	std-3-3	20.1	10.0	77.1	50.3	20.100	10.000	77.100	50.300

Table E-2. PCT Leachate pH Values for the First Oven Run of LAW Phase 2 Outer Layer Glasses

Identifier	pH		Identifier	pH		Identifier	pH
ARM-1-1	10.11		LP2-OL-07-1Q-1	11.62		LP2-OL-17Q-3	12.08
ARM-1-2	10.08		LP2-OL-07-1Q-2	11.1		LP2-OL-19Q-1	11.55
ARM-1-3	10.1		LP2-OL-07-1Q-3	10.84		LP2-OL-19Q-2	11.78
BLANK-1	8.75		LP2-OL-09-1Q-1	10.23		LP2-OL-19Q-3	11.56
BLANK-2	8.14		LP2-OL-09-1Q-2	10.42		LP2-OL-20Q-1	11.77
LP2-OL-01-3CCC-1	11.32		LP2-OL-09-1Q-3	10.39		LP2-OL-20Q-2	11.75
LP2-OL-01-3CCC-2	11.35		LP2-OL-11Q-1	11.76		LP2-OL-20Q-3	11.83
LP2-OL-01-3CCC-3	11.2		LP2-OL-11Q-2	11.74		LP2-OL-21Q-1	11.1
LP2-OL-01-3Q-1	11.39		LP2-OL-11Q-3	11.73		LP2-OL-21Q-2	11.31
LP2-OL-01-3Q-2	11.28		LP2-OL-12Q-1	12.18		LP2-OL-21Q-3	11.27
LP2-OL-01-3Q-3	11.52		LP2-OL-12Q-2	12.27		LP2-OL-22Q-1	11.01
LP2-OL-02-1Q-1	11.39		LP2-OL-12Q-3	12.25		LP2-OL-22Q-2	11.09
LP2-OL-02-1Q-2	11.24		LP2-OL-13Q-1	12.22		LP2-OL-22Q-3	11.74
LP2-OL-02-1Q-3	11.42		LP2-OL-13Q-2	12.14		LP2-OL-23Q-1	11.3
LP2-OL-04-1CCC-1	12.71		LP2-OL-13Q-3	12.03		LP2-OL-23Q-2	11.52
LP2-OL-04-1CCC-2	12.9		LP2-OL-14Q-1	11.75		LP2-OL-23Q-3	11.55
LP2-OL-04-1CCC-3	12.88		LP2-OL-14Q-2	11.66		LP2-OL-24Q-1	12.23
LP2-OL-04-1Q-1	11.7		LP2-OL-14Q-3	11.67		LP2-OL-24Q-2	11.73
LP2-OL-04-1Q-2	11.61		LP2-OL-15Q-1	11.19		LP2-OL-24Q-3	11.81
LP2-OL-04-1Q-3	11.14		LP2-OL-15Q-2	11.46		LP2-OL-25Q-1	11.95
LP2-OL-05Q-1	10.96		LP2-OL-15Q-3	11.11		LP2-OL-25Q-2	11.52
LP2-OL-05Q-2	11.34		LP2-OL-17Q-1	12.29		LP2-OL-25Q-3	11.57
LP2-OL-05Q-3	11.3		LP2-OL-17Q-2	12.06			

Table E-3. PCT Leachate pH Values for the Second Oven Run of LAW Phase 2 Outer Layer Glasses

Identifier	pH		Identifier	pH		Identifier	pH
ARM-1-1	10.16		LP2-OL-07-1CCC-1	10.91		LP2-OL-13CCC-1	12.361
ARM-1-2	10.2		LP2-OL-07-1CCC-2	11.3		LP2-OL-13CCC-2	12.58
ARM-1-3	10.04		LP2-OL-07-1CCC-3	11.05		LP2-OL-13CCC-3	12.35
BLANK-1	7.78		LP2-OL-09-1CCC-1	10.1		LP2-OL-14CCC-1	11.62
BLANK-2	6.83		LP2-OL-09-1CCC-2	10.14		LP2-OL-14CCC-2	11.76
BLANK-3	5.69		LP2-OL-09-1CCC-3	10.05		LP2-OL-14CCC-3	11.71
BLANK-4	5.77		LP2-OL-11CCC-1	11.85		LP2-OL-23CCC-1	11.22
LP2-OL-02-1CCC-1	11.27		LP2-OL-11CCC-2	11.85		LP2-OL-23CCC-2	11.25
LP2-OL-02-1CCC-2	10.98		LP2-OL-11CCC-3	11.86		LP2-OL-23CCC-3	11.28
LP2-OL-02-1CCC-3	11.19		LP2-OL-12CCC-1	12.22		LP2-OL-25CCC-1	11.7
LP2-OL-05CCC-1	11.22		LP2-OL-12CCC-2	12.18		LP2-OL-25CCC-2	11.82
LP2-OL-05CCC-2	11.21		LP2-OL-12CCC-3	12.23		LP2-OL-25CCC-3	11.79
LP2-OL-05CCC-3	11.16						

Table E-4. PCT Leachate pH Values for the Third Oven Run of LAW Phase 2 Outer Layer Glasses

Identifier	pH
ARM-1-1	9.94
ARM-1-2	9.93
ARM-1-3	9.98
blank-1	8.33
blank-2	8.04
LP2-OL-03-MOD2CCC-1	12.73
LP2-OL-03-MOD2CCC-2	12.85
LP2-OL-03-MOD2CCC-3	12.85
LP2-OL-03-MOD2Q-1	12.19
LP2-OL-03-MOD2Q-2	11.94
LP2-OL-03-MOD2Q-3	12.13
LP2-OL-08-MODCCC-1	12.66
LP2-OL-08-MODCCC-2	12.48
LP2-OL-08-MODCCC-3	12.59
LP2-OL-08-MODQ-1	12.07
LP2-OL-08-MODQ-2	12.14
LP2-OL-08-MODQ-3	12.01
LP2-OL-10-MODCCC-1	11.62
LP2-OL-10-MODCCC-2	11.74
LP2-OL-10-MODCCC-3	11.66
LP2-OL-10-MODQ-1	11.26
LP2-OL-10-MODQ-2	11.33
LP2-OL-10-MODQ-3	11.38
LP2-OL-15CCC-1	11.12
LP2-OL-15CCC-2	11.26
LP2-OL-15CCC-3	11.15
LP2-OL-16-MODCCC-1	10.86
LP2-OL-16-MODCCC-2	11.01
LP2-OL-16-MODCCC-3	10.93
LP2-OL-16-MODQ-1	10.93
LP2-OL-16-MODQ-2	10.99
LP2-OL-16-MODQ-3	11.07
LP2-OL-17CCC-1	12.05
LP2-OL-17CCC-2	12.02
LP2-OL-17CCC-3	12.17
LP2-OL-18CCC-1	11.26
LP2-OL-18CCC-2	11.28
LP2-OL-18CCC-3	11.3
LP2-OL-18Q-1	11.32
LP2-OL-18Q-2	11.35
LP2-OL-18Q-3	11.71
LP2-OL-19CCC-1	11.58
LP2-OL-19CCC-2	11.57
LP2-OL-19CCC-3	11.62
LP2-OL-20CCC-1	12.14
LP2-OL-20CCC-2	12.18
LP2-OL-20CCC-3	12.13
LP2-OL-21CCC-1	11.14
LP2-OL-21CCC-2	11.23
LP2-OL-21CCC-3	11.31
LP2-OL-22CCC-1	11.35
LP2-OL-22CCC-2	11.44
LP2-OL-22CCC-3	11.47
LP2-OL-24CCC-1	11.82
LP2-OL-24CCC-2	11.87
LP2-OL-24CCC-3	11.93

Exhibit E-1. PCT Measurements in Analytical Sequence by Oven Run

Oven Run=1, Element=B
Variability Chart for log[(mg/L)]

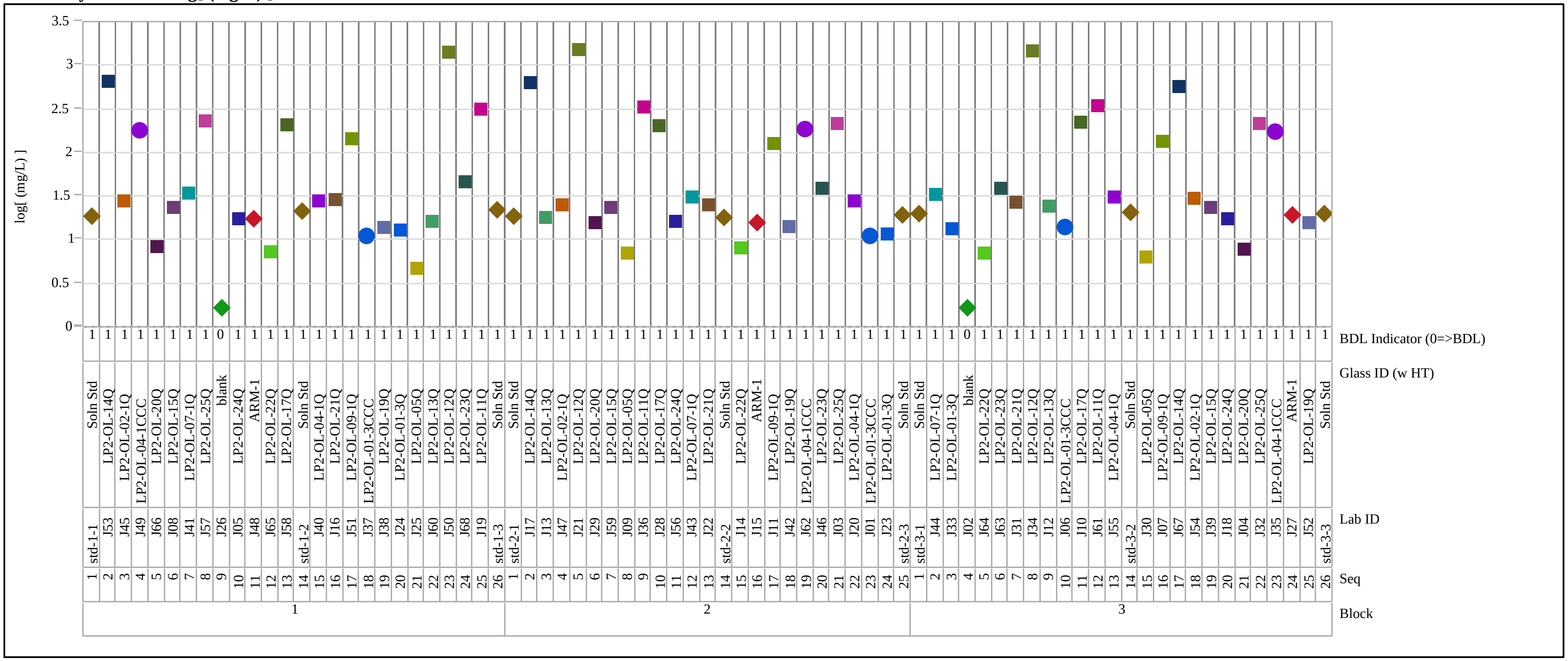


Exhibit E-1. PCT Measurements in Analytical Sequence by Oven Run (continued)

Oven Run=1, Element=Li
Variability Chart for log[(mg/L)]

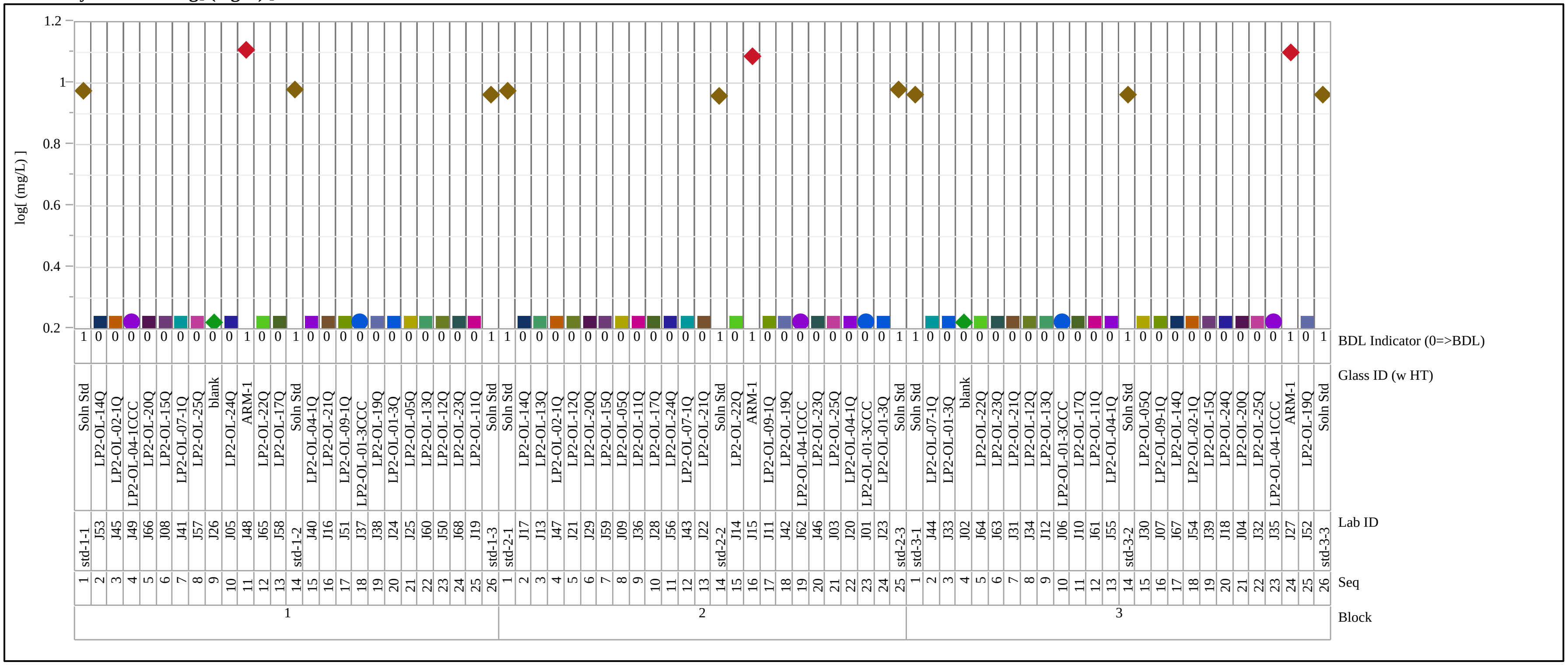


Exhibit E-1. PCT Measurements in Analytical Sequence by Oven Run (continued)

Oven Run=1, Element=Na
Variability Chart for log[(mg/L)]

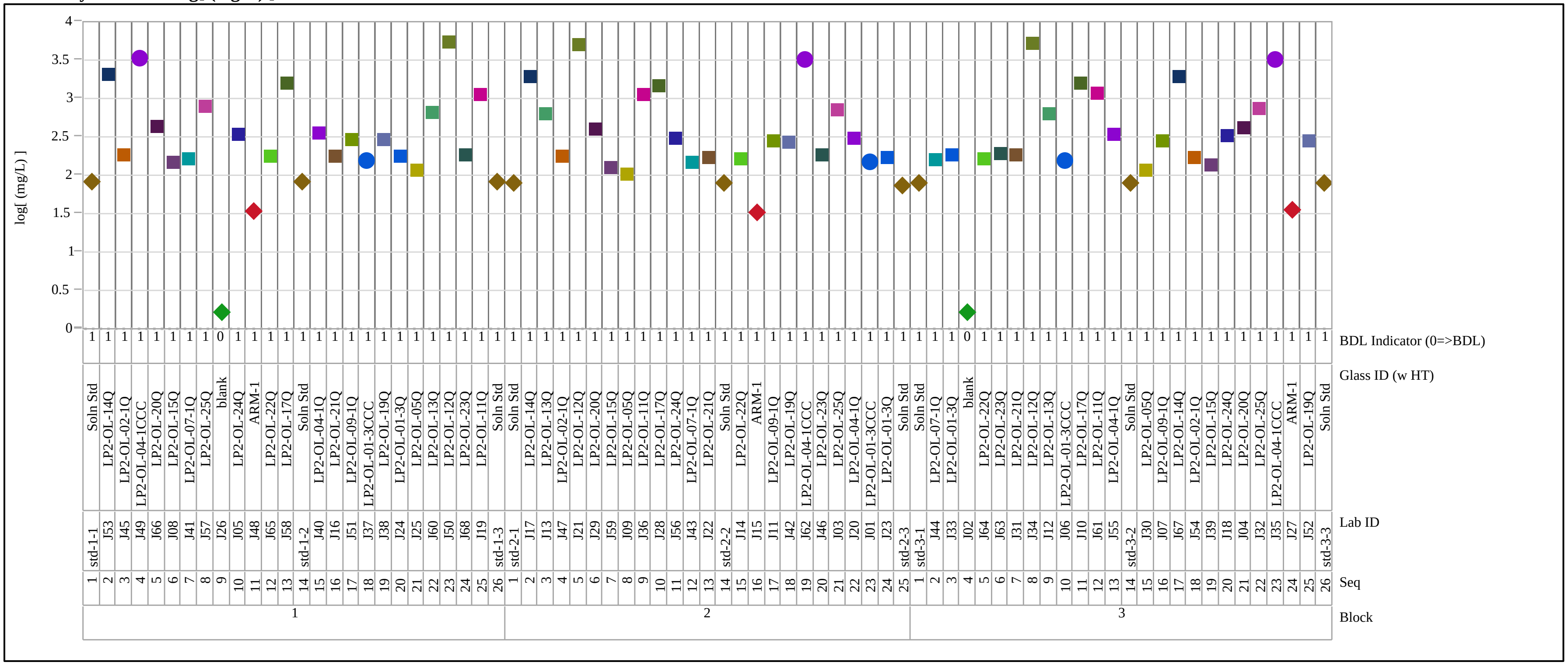


Exhibit E-1. PCT Measurements in Analytical Sequence by Oven Run (continued)

Oven Run=1, Element=Si
Variability Chart for log[(mg/L)]

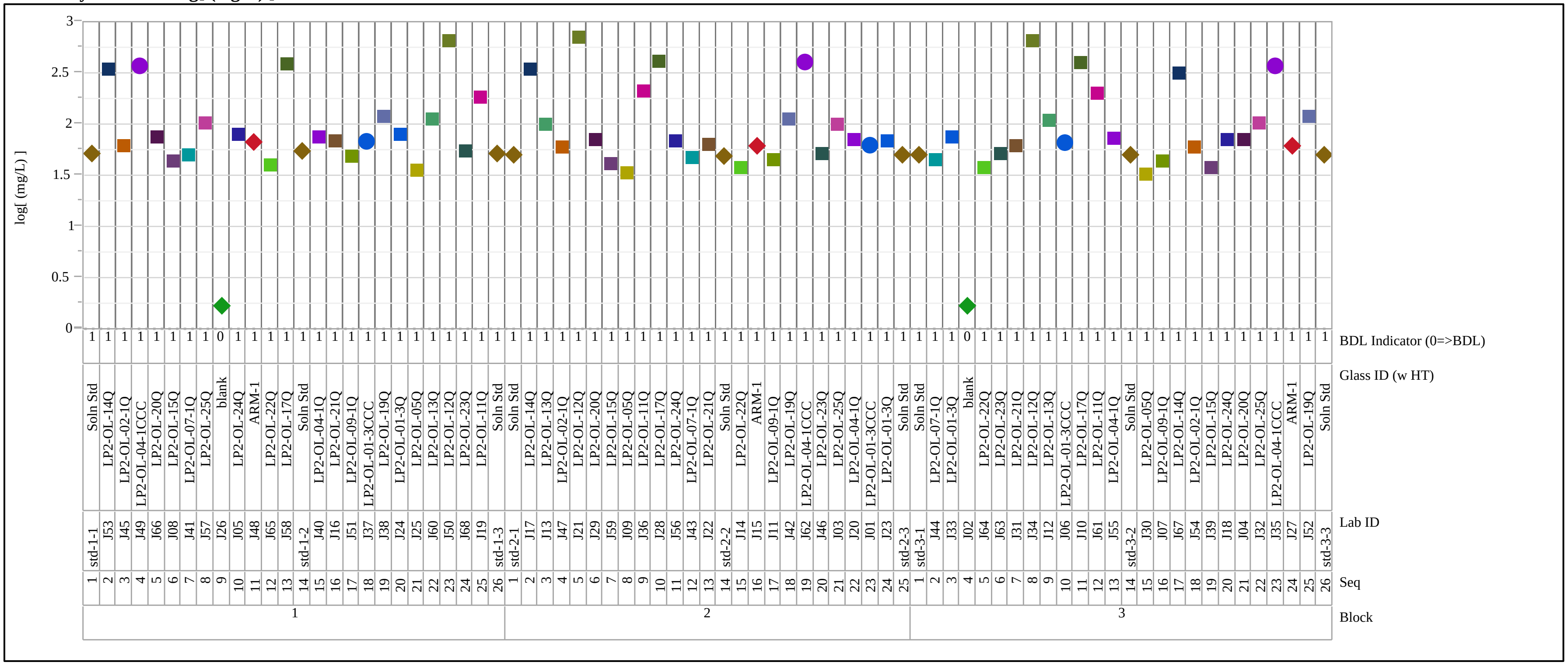


Exhibit E-1. PCT Measurements in Analytical Sequence by Oven Run (continued)

Oven Run=2, Element=B
Variability Chart for log[(mg/L)]

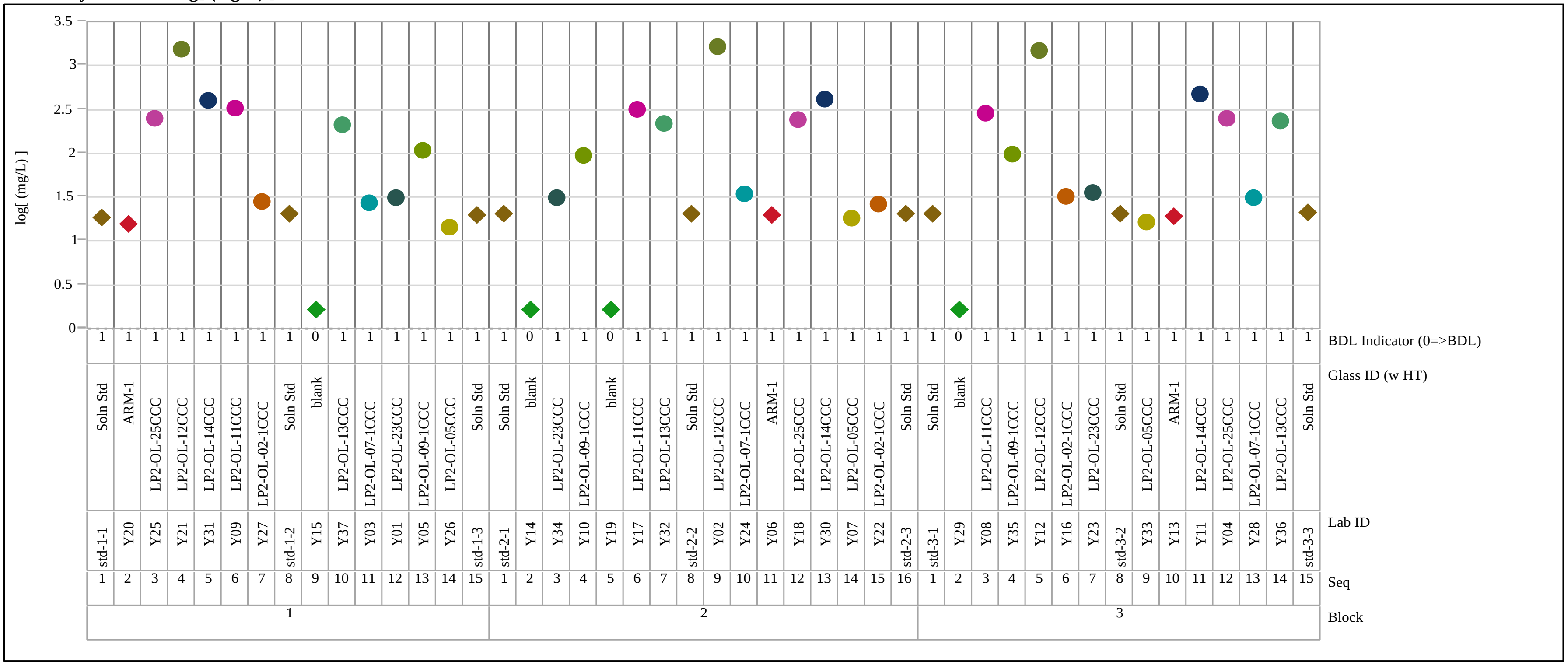


Exhibit E-1. PCT Measurements in Analytical Sequence by Oven Run (continued)

Oven Run=2, Element=Li
Variability Chart for log[(mg/L)]

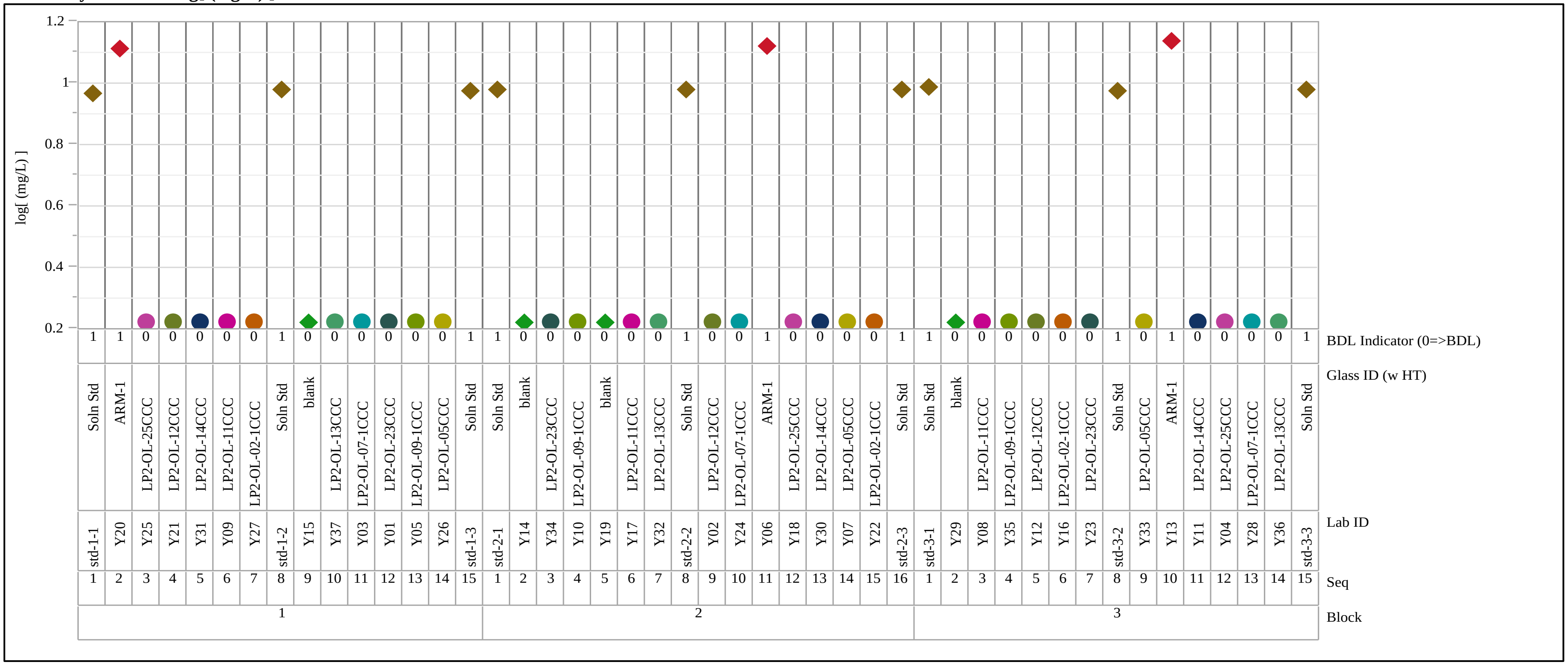


Exhibit E-1. PCT Measurements in Analytical Sequence by Oven Run (continued)

Oven Run=2, Element=Na
Variability Chart for log[(mg/L)]

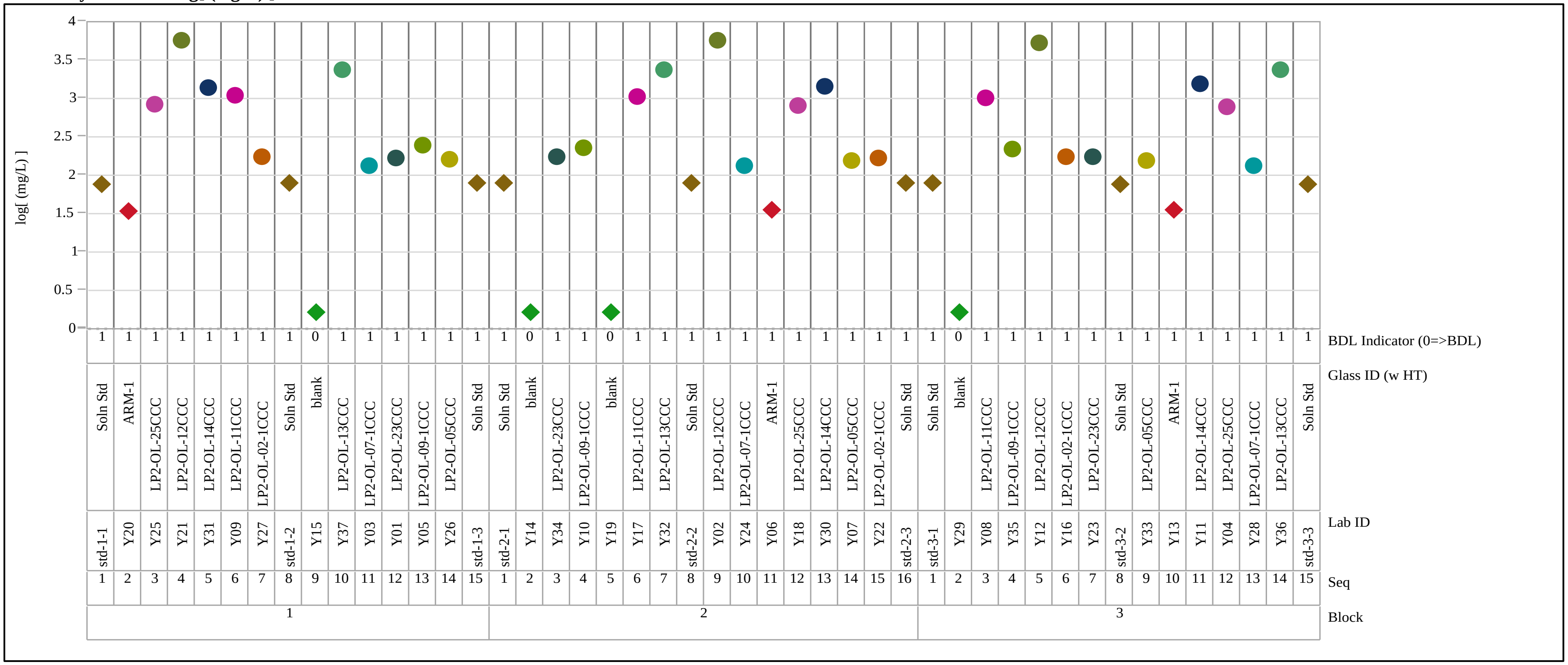


Exhibit E-1. PCT Measurements in Analytical Sequence by Oven Run (continued)

Oven Run=2, Element=Si
Variability Chart for log[(mg/L)]

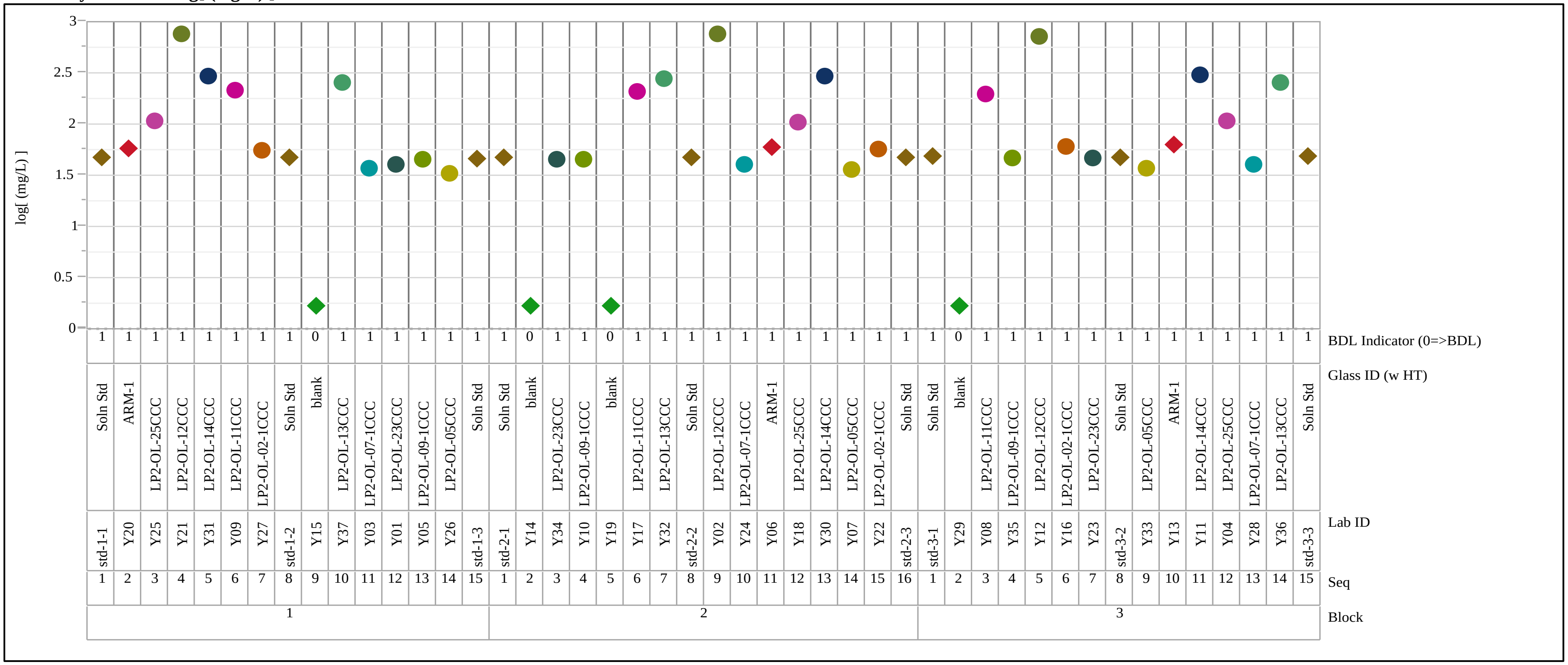


Exhibit E-1. PCT Measurements in Analytical Sequence by Oven Run (continued)

Oven Run=3, Element=B
Variability Chart for log[(mg/L)]

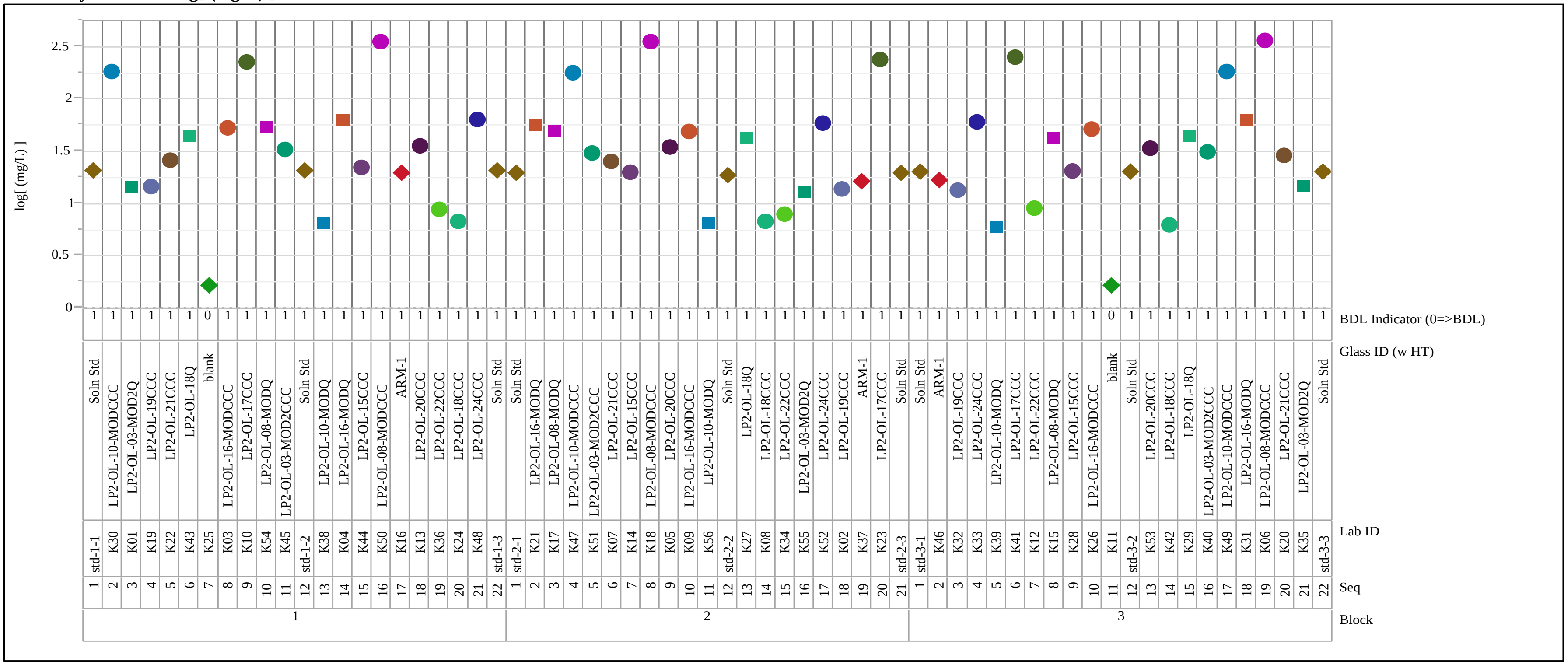


Exhibit E-1. PCT Measurements in Analytical Sequence by Oven Run (continued)

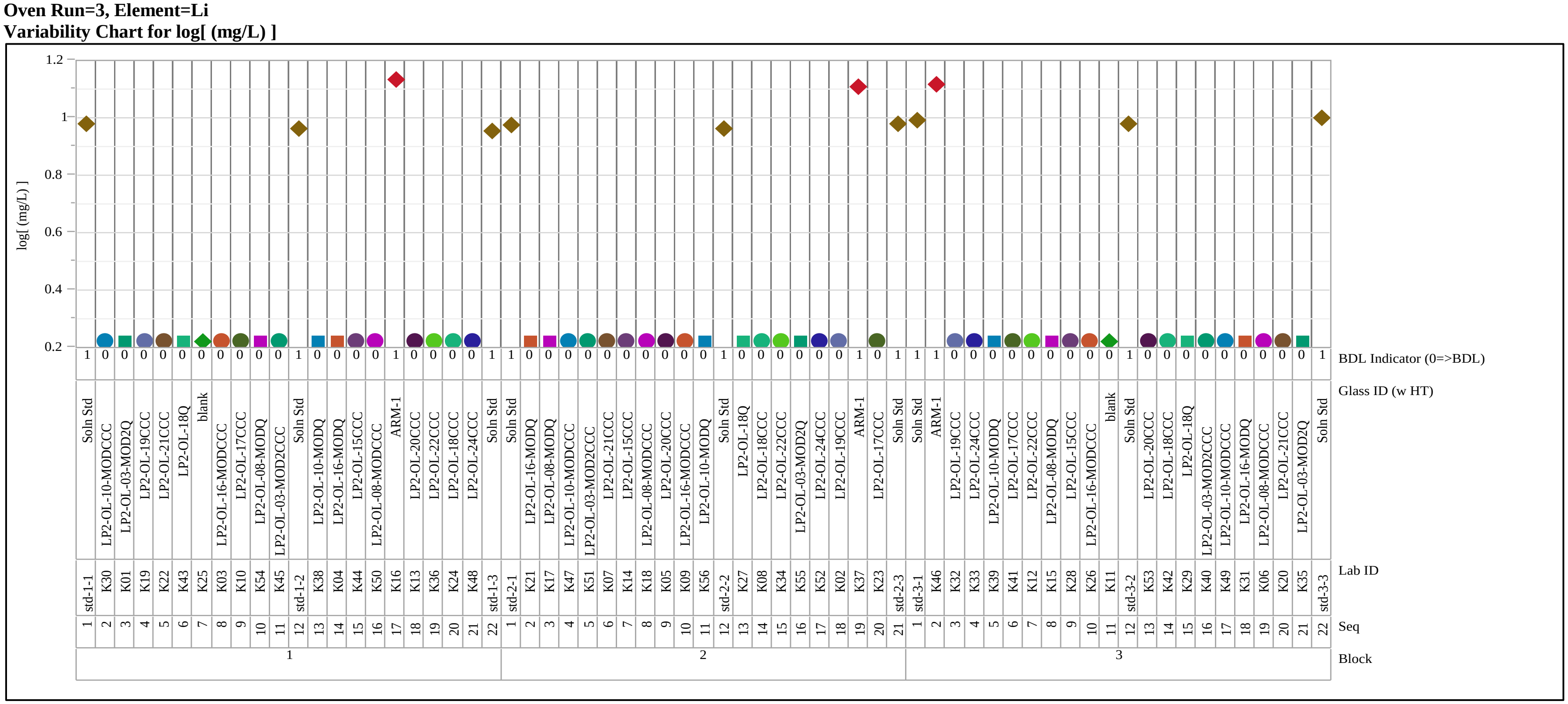


Exhibit E-1. PCT Measurements in Analytical Sequence by Oven Run (continued)

Oven Run=3, Element=Na
Variability Chart for log[(mg/L)]

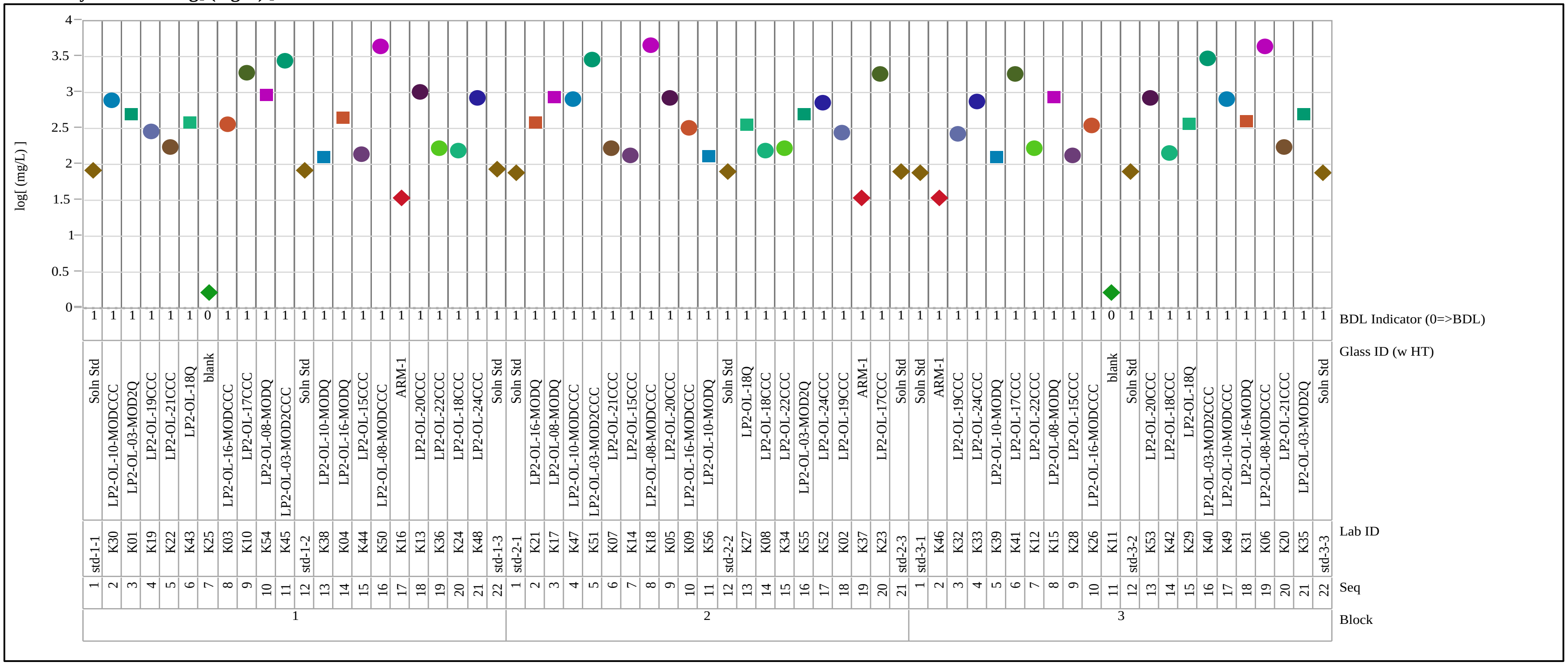


Exhibit E-1. PCT Measurements in Analytical Sequence by Oven Run (continued)

Oven Run=3, Element=Si
Variability Chart for log[(mg/L)]

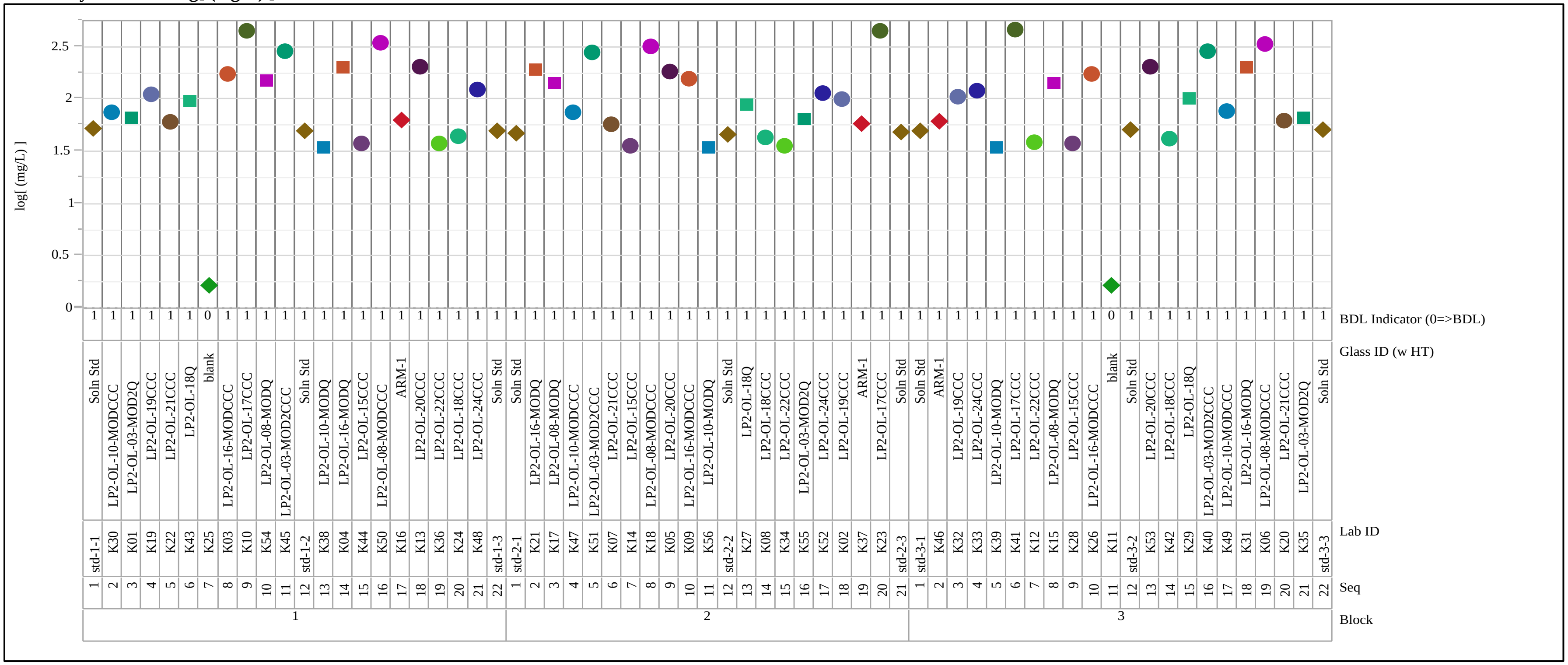


Exhibit E-2. PCT Measurements by Glass Identifier by Oven Run

Oven Run=1, Element=B
Variability Chart for log[(mg/L)]

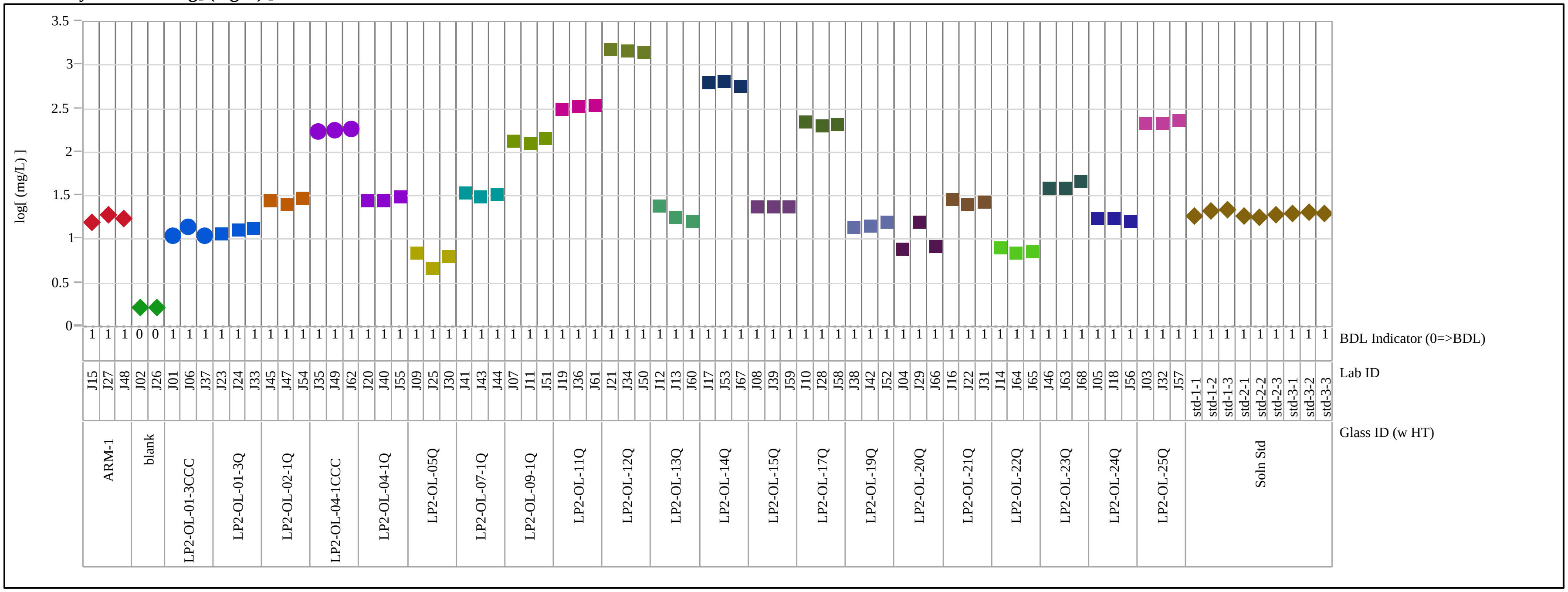


Exhibit E-2. PCT Measurements by Glass Identifier by Oven Run (continued)

Oven Run=1, Element=Li
Variability Chart for log[(mg/L)]

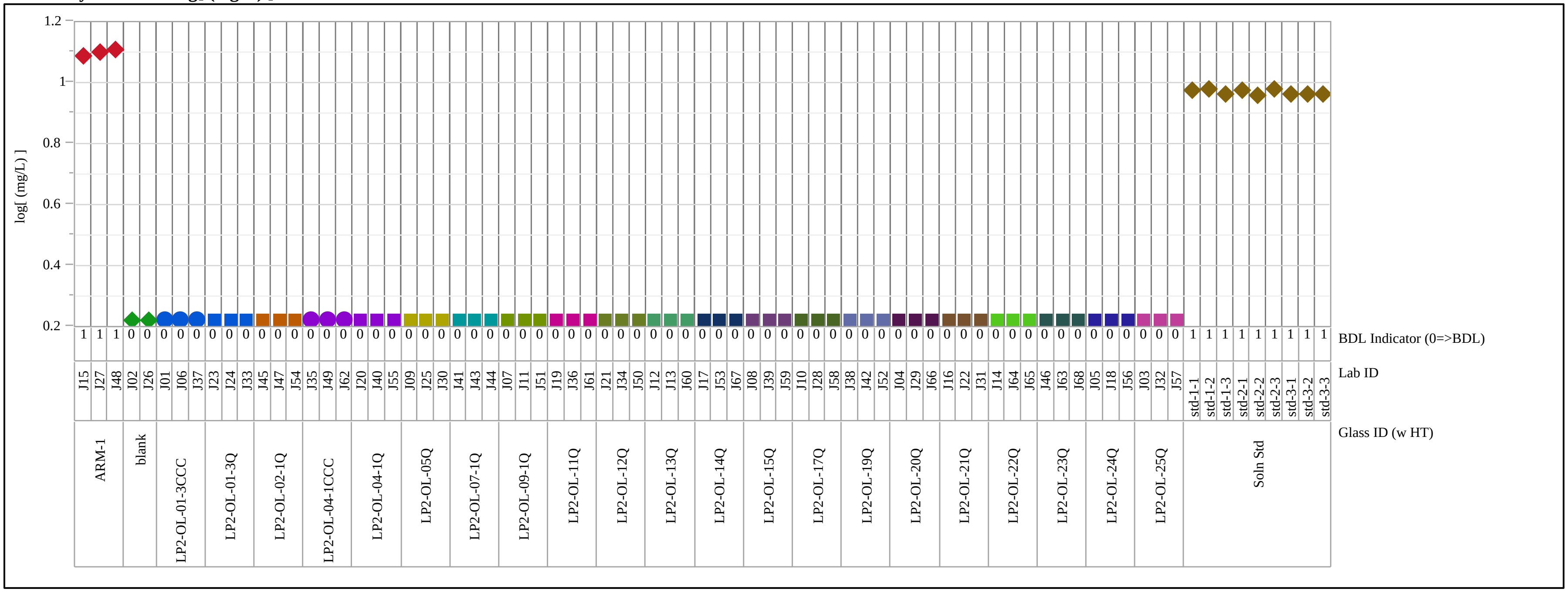


Exhibit E-2. PCT Measurements by Glass Identifier by Oven Run (continued)

Oven Run=1, Element=Na
Variability Chart for log[(mg/L)]

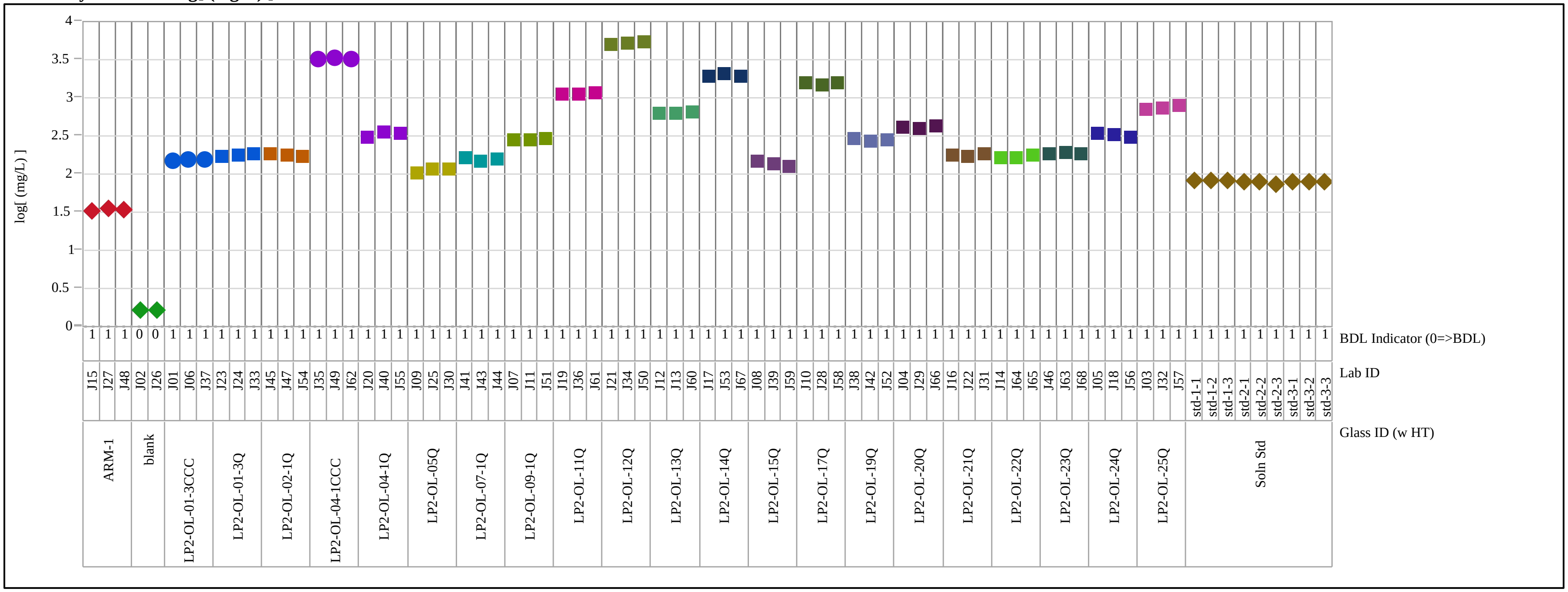


Exhibit E-2. PCT Measurements by Glass Identifier by Oven Run (continued)

Oven Run=1, Element=Si
Variability Chart for log[(mg/L)]

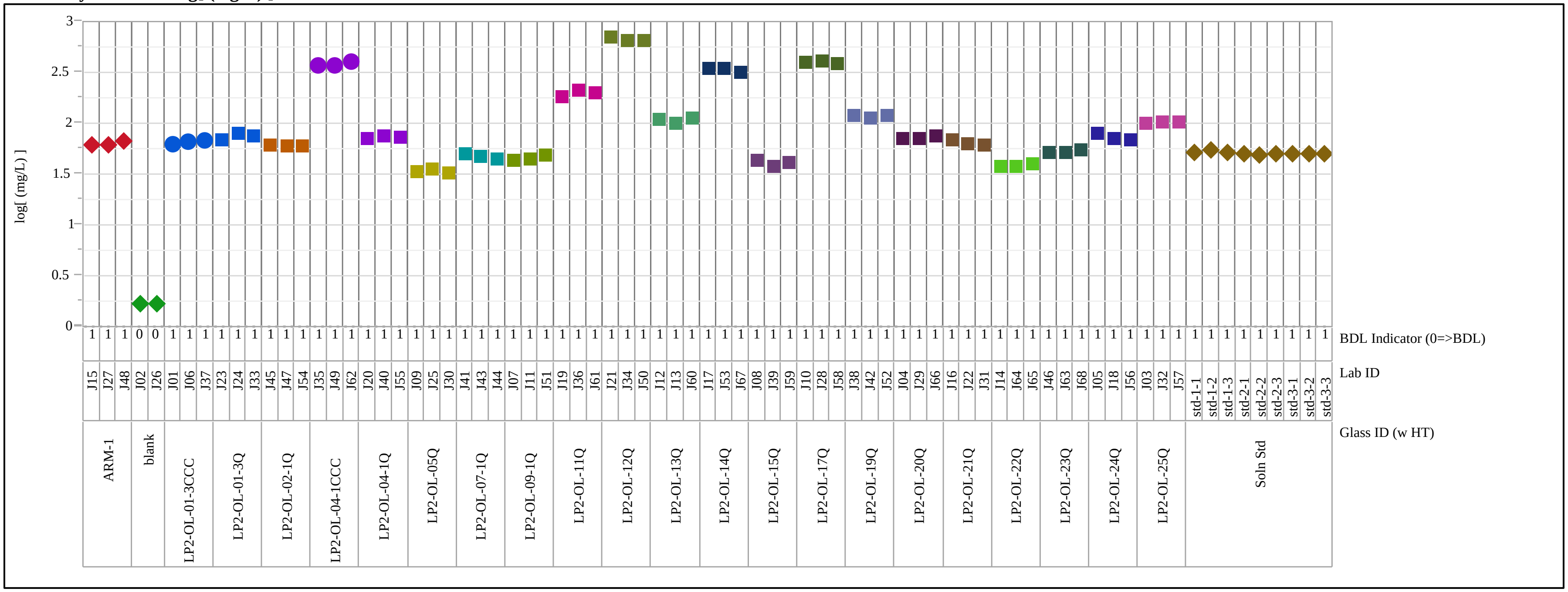


Exhibit E-2. PCT Measurements by Glass Identifier by Oven Run (continued)

Oven Run=2, Element=B
Variability Chart for log[(mg/L)]

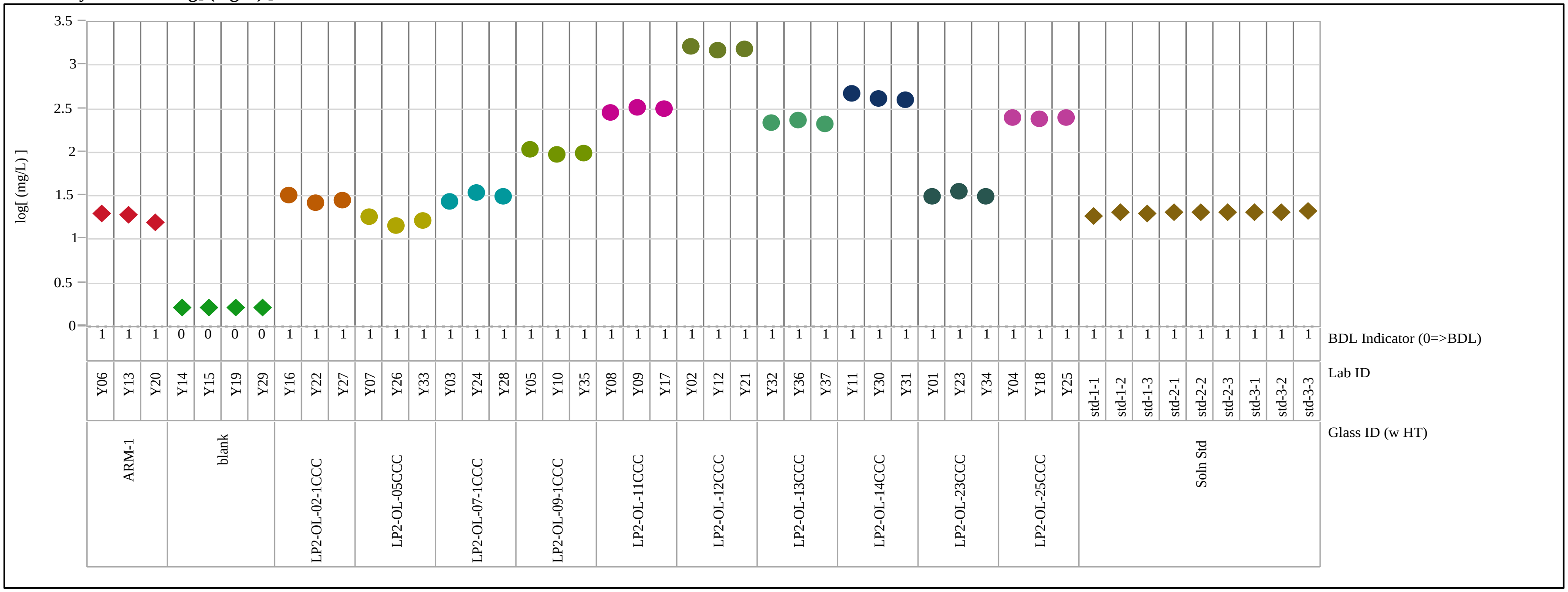


Exhibit E-2. PCT Measurements by Glass Identifier by Oven Run (continued)

Oven Run=2, Element=Li
Variability Chart for log[(mg/L)]

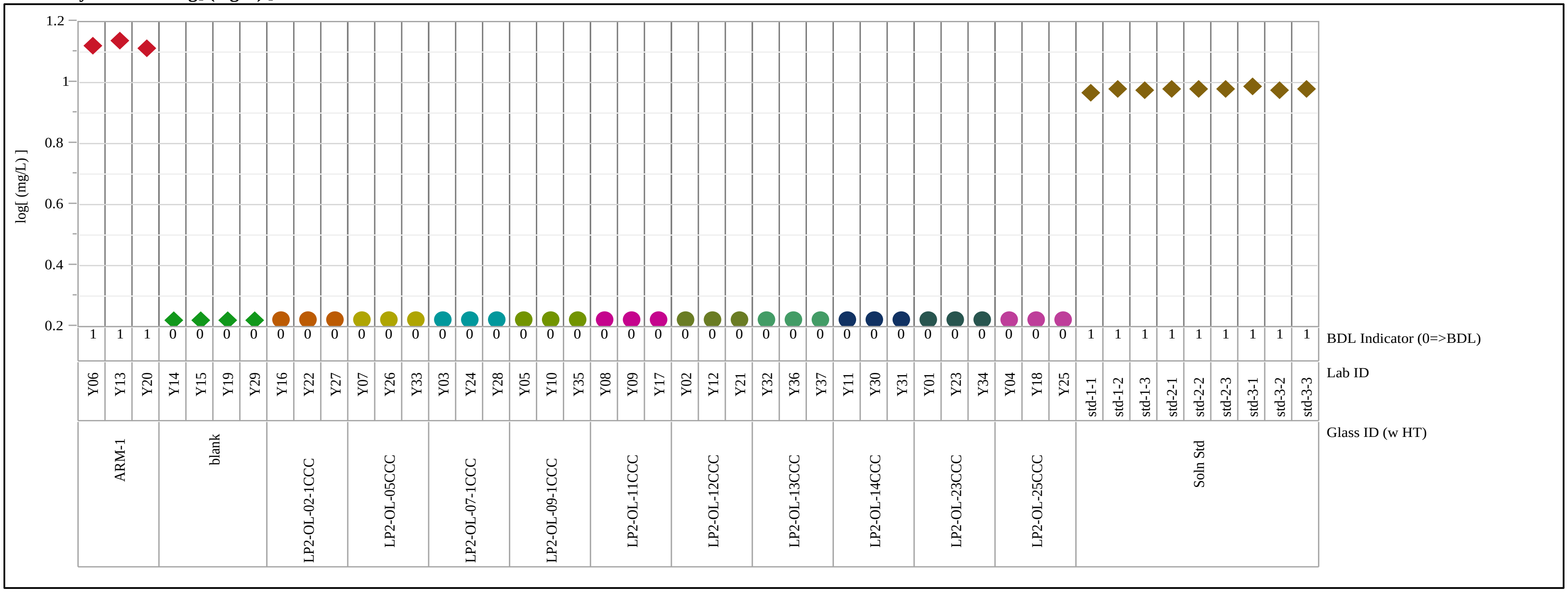


Exhibit E-2. PCT Measurements by Glass Identifier by Oven Run (continued)

Oven Run=2, Element=Na
Variability Chart for log[(mg/L)]

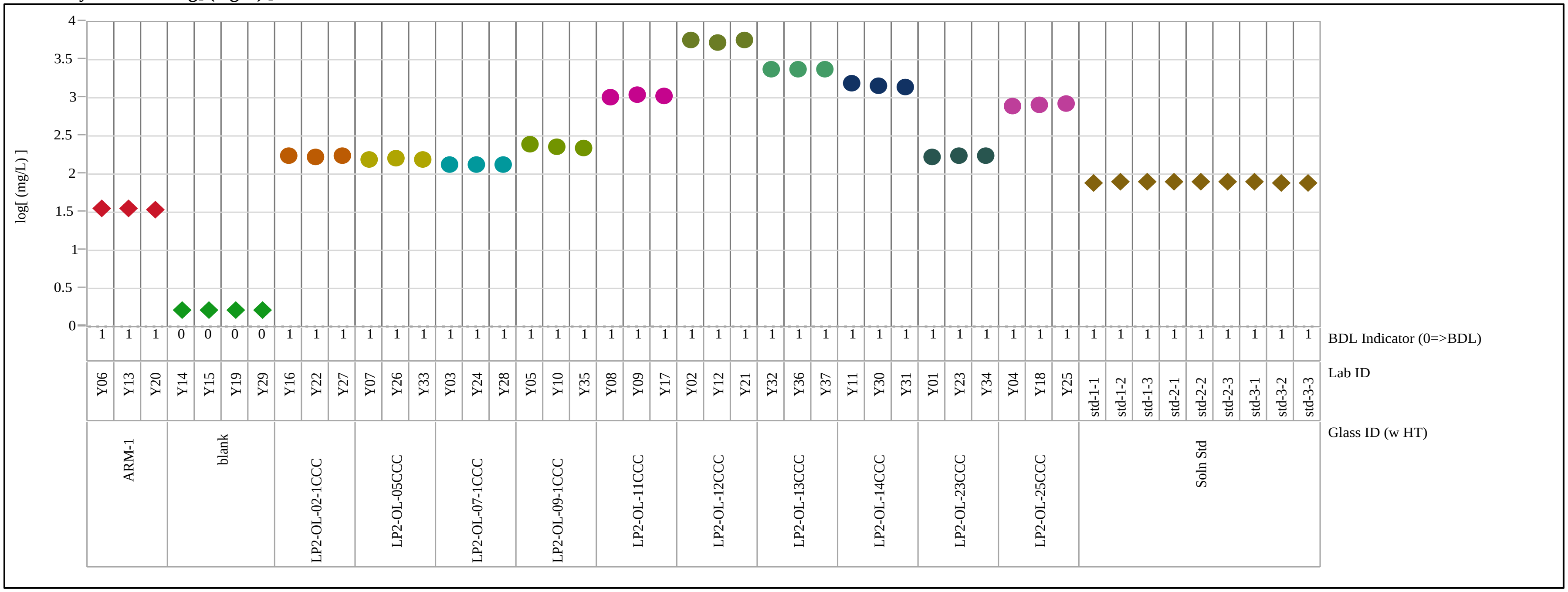


Exhibit E-2. PCT Measurements by Glass Identifier by Oven Run (continued)

Oven Run=2, Element=Si
Variability Chart for log[(mg/L)]

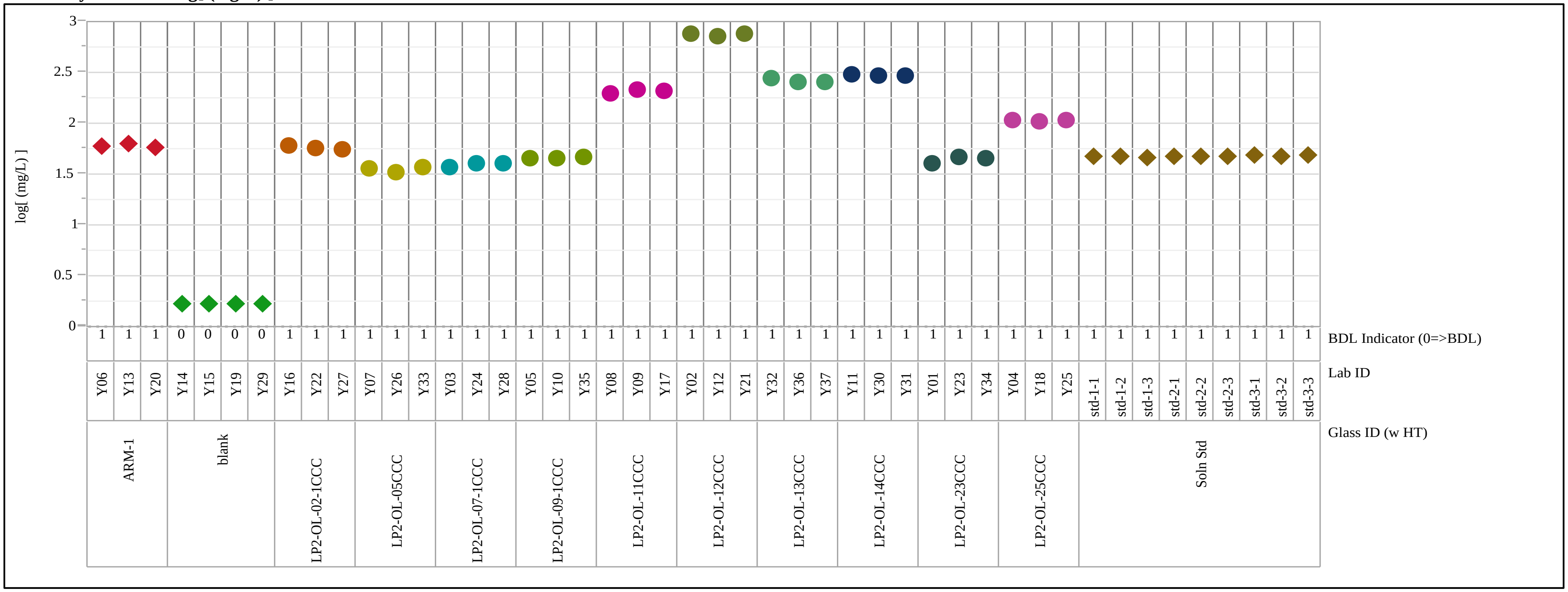


Exhibit E-2. PCT Measurements by Glass Identifier by Oven Run (continued)

Oven Run=3, Element=B
Variability Chart for log[(mg/L)]

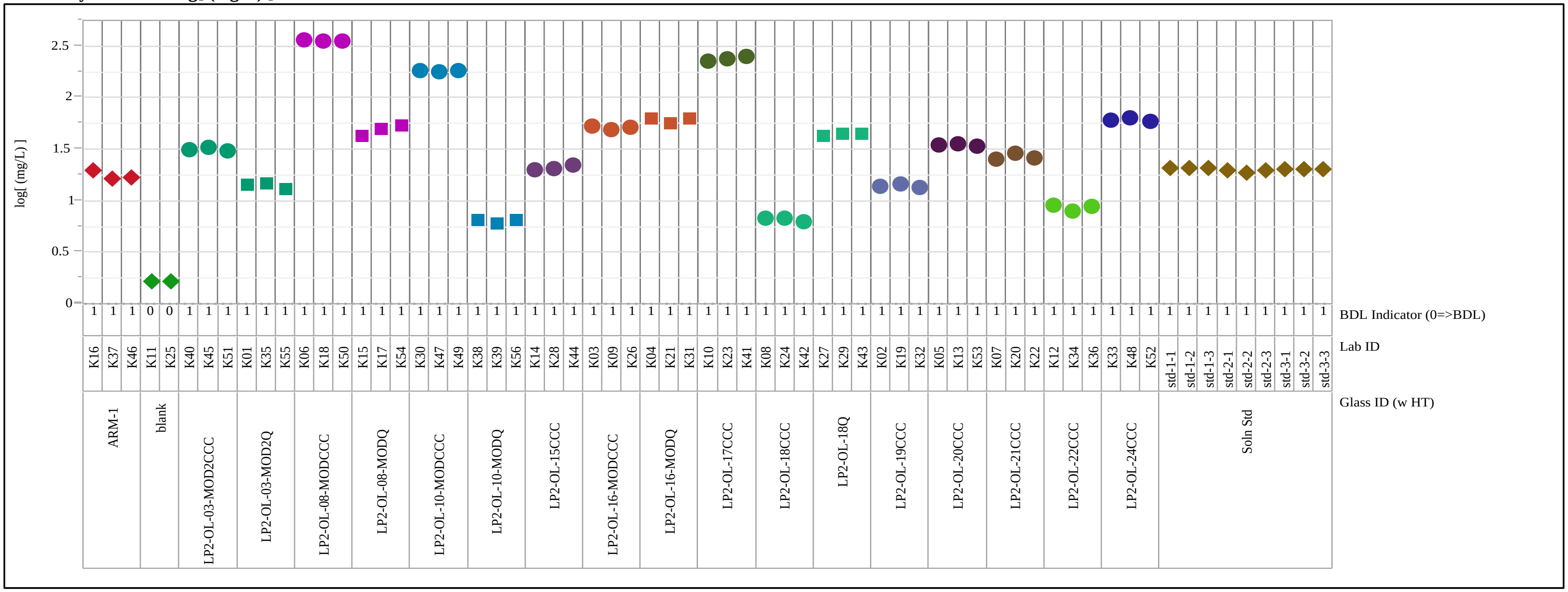


Exhibit E-2. PCT Measurements by Glass Identifier by Oven Run (continued)

Oven Run=3, Element=Li
Variability Chart for log[(mg/L)]

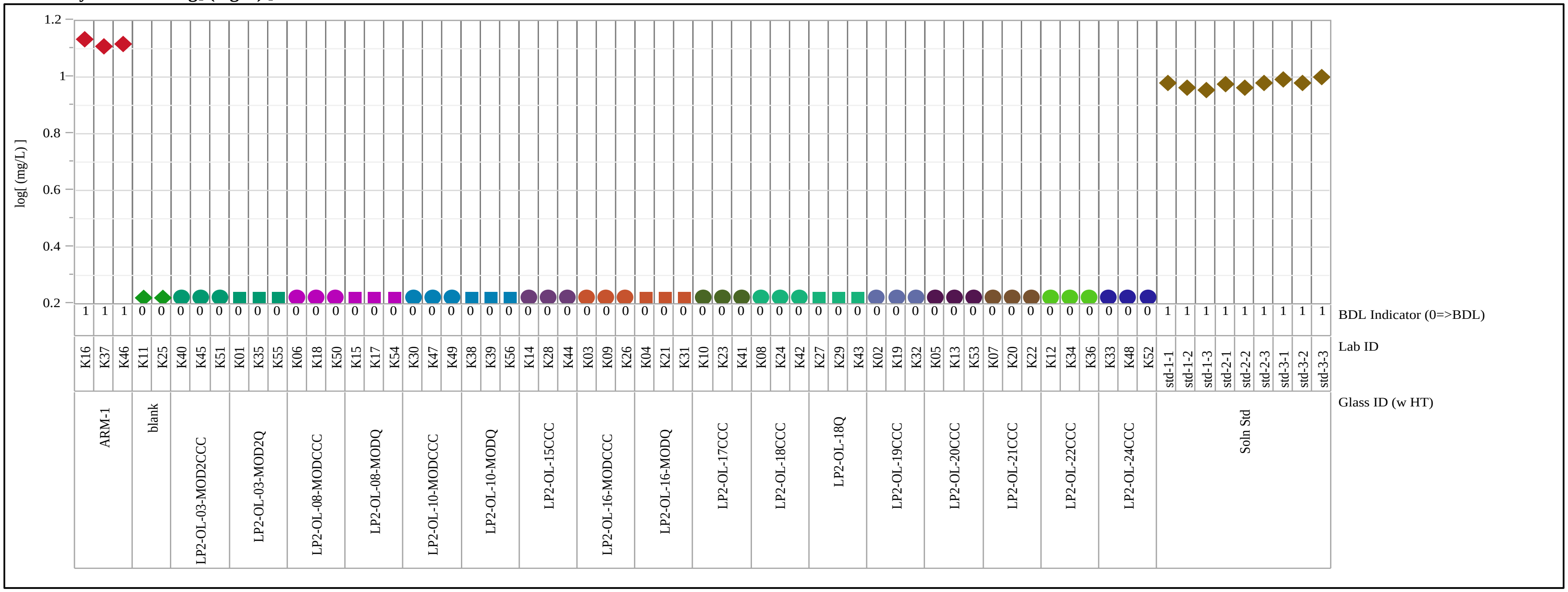


Exhibit E-2. PCT Measurements by Glass Identifier by Oven Run (continued)

Oven Run=3, Element=Na
Variability Chart for log[(mg/L)]

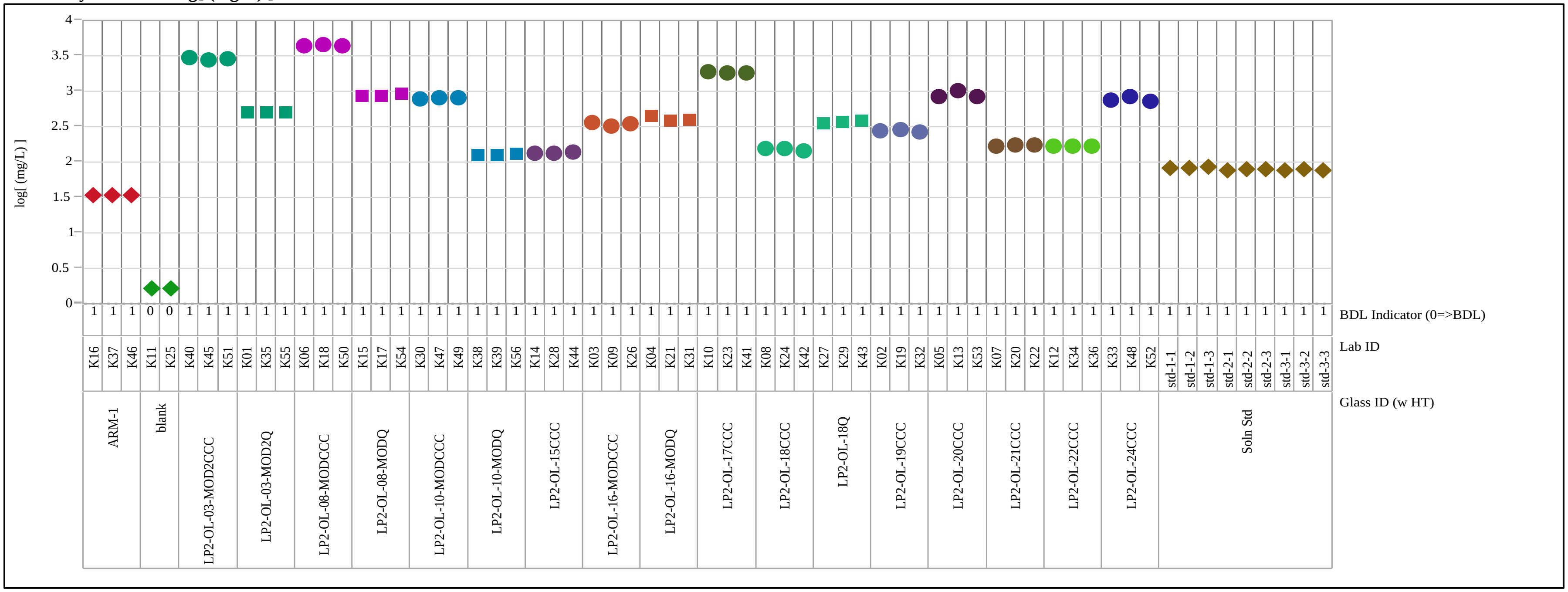


Exhibit E-2. PCT Measurements by Glass Identifier by Oven Run (continued)

Oven Run=3, Element=Si
Variability Chart for log[(mg/L)]

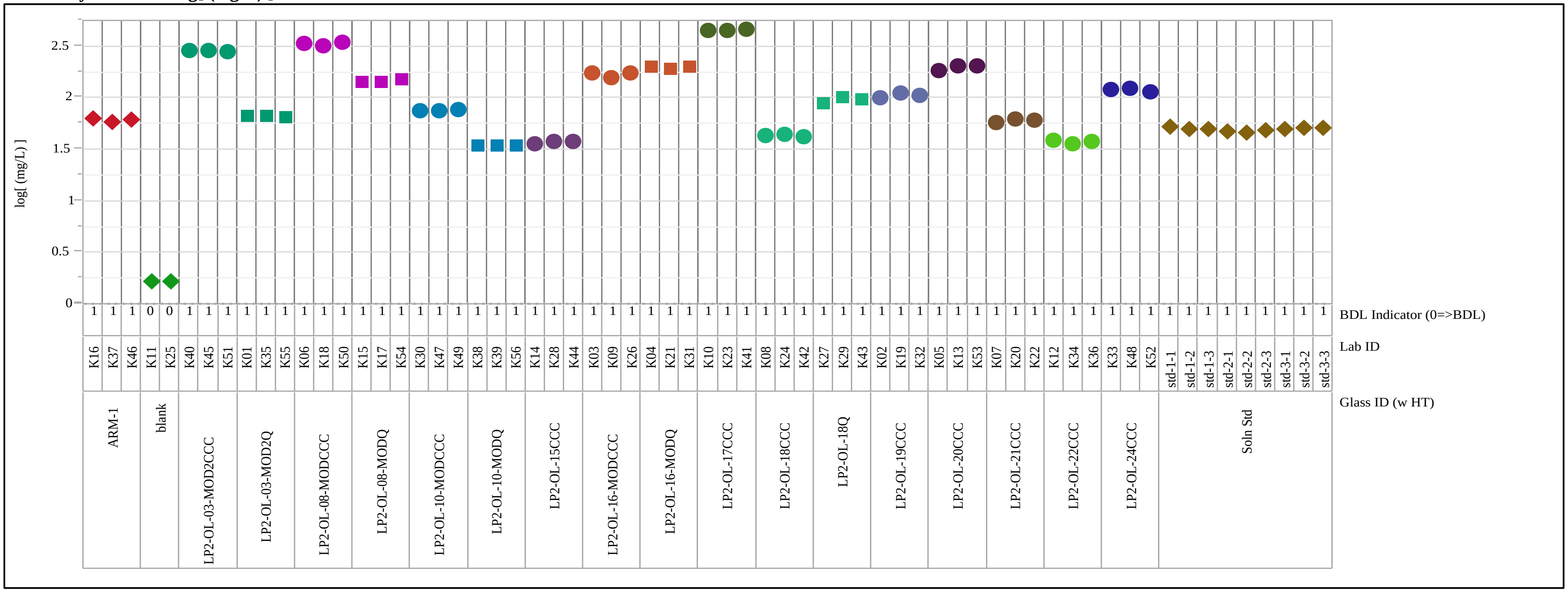


Exhibit E-3. Normalized PCT Results by Compositional View by Heat Treatment for Each Glass

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

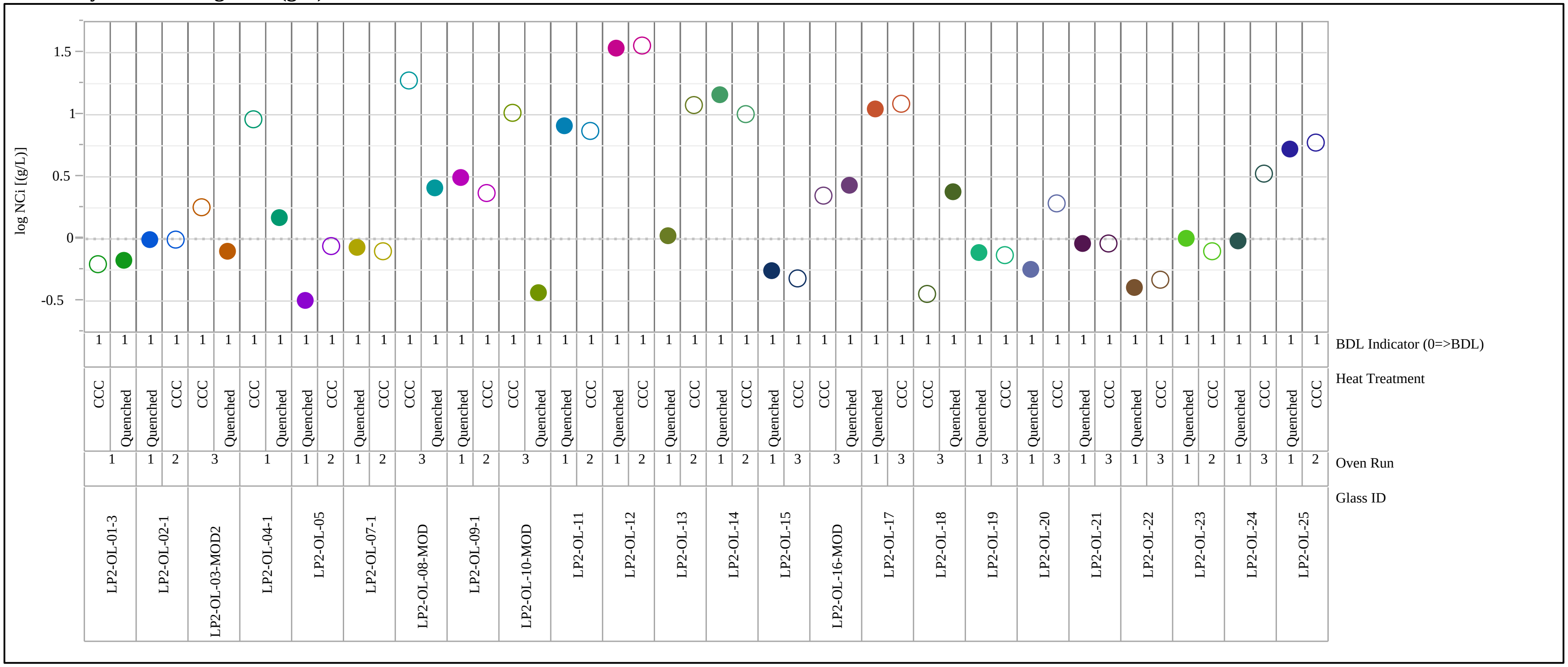


Exhibit E-3. Normalized PCT Results by Compositional View by Heat Treatment for Each Glass (continued)

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

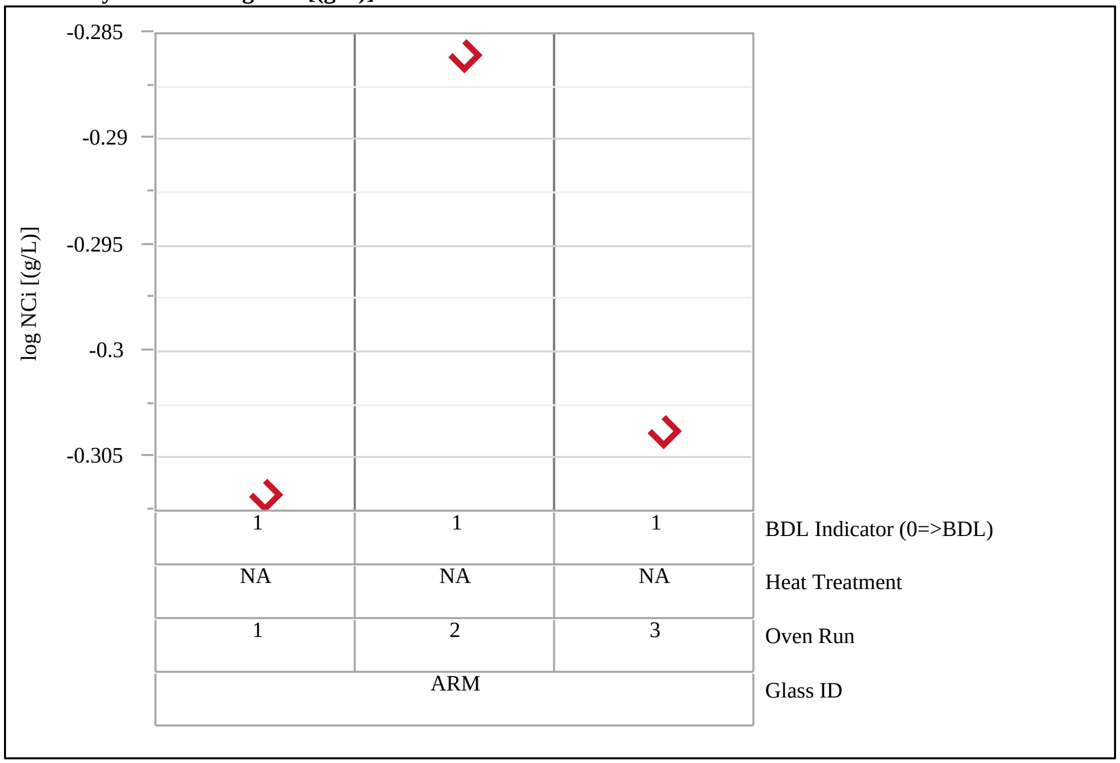


Exhibit E-3. Normalized PCT Results by Compositional View by Heat Treatment for Each Glass (continued)

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

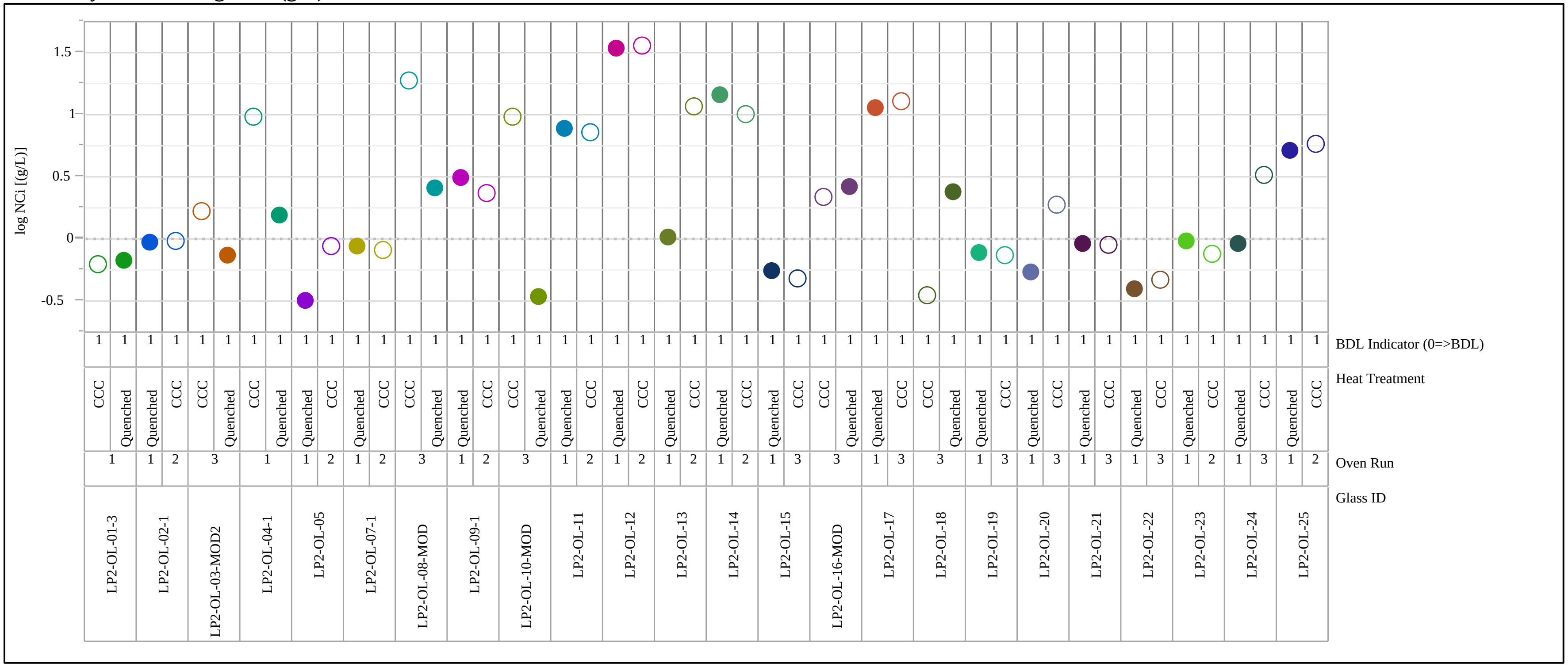


Exhibit E-3. Normalized PCT Results by Compositional View by Heat Treatment for Each Glass (continued)

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

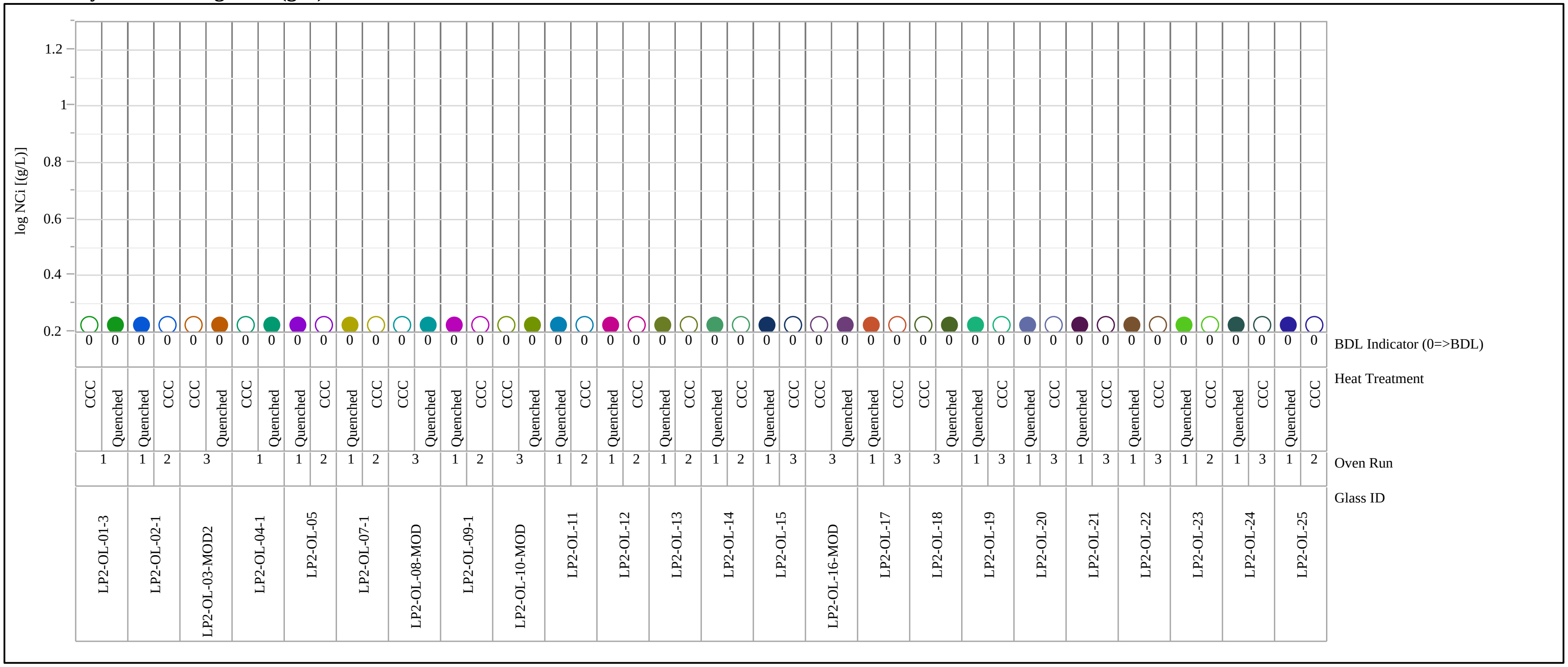


Exhibit E-3. Normalized PCT Results by Compositional View by Heat Treatment for Each Glass (continued)

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

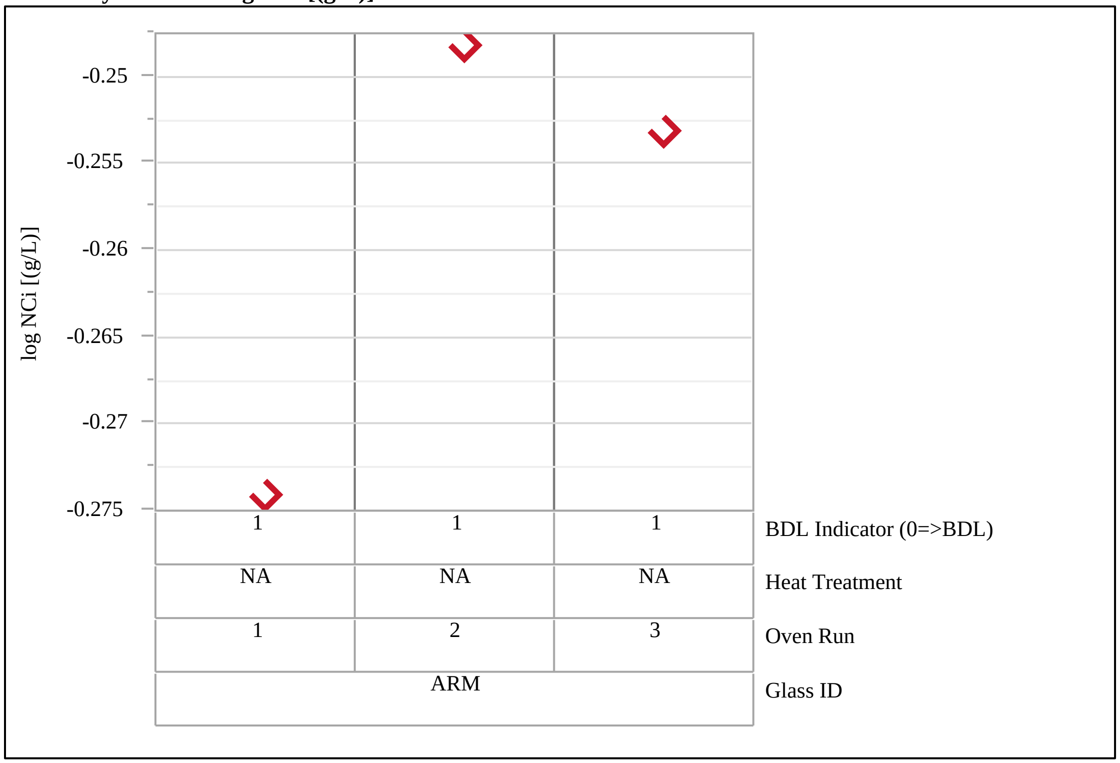


Exhibit E-3. Normalized PCT Results by Compositional View by Heat Treatment for Each Glass (continued)

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

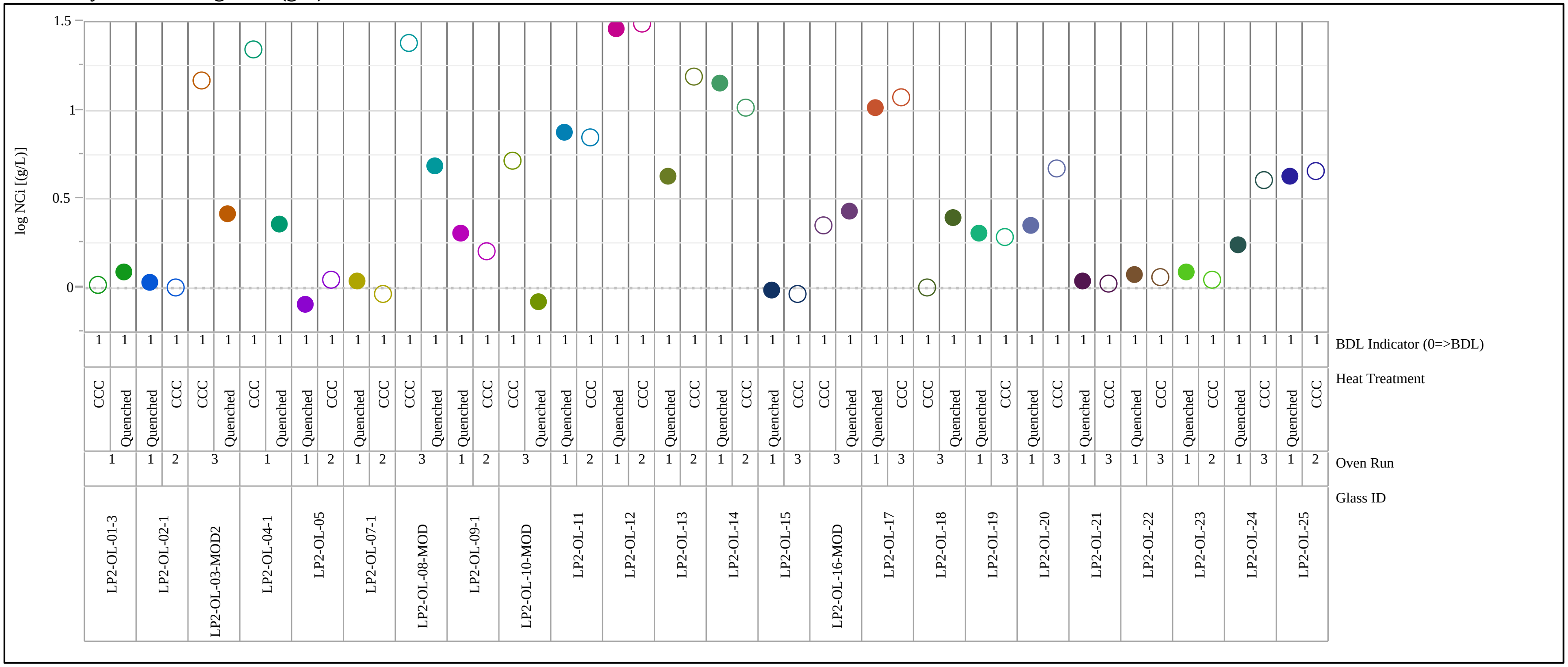


Exhibit E-3. Normalized PCT Results by Compositional View by Heat Treatment for Each Glass (continued)

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

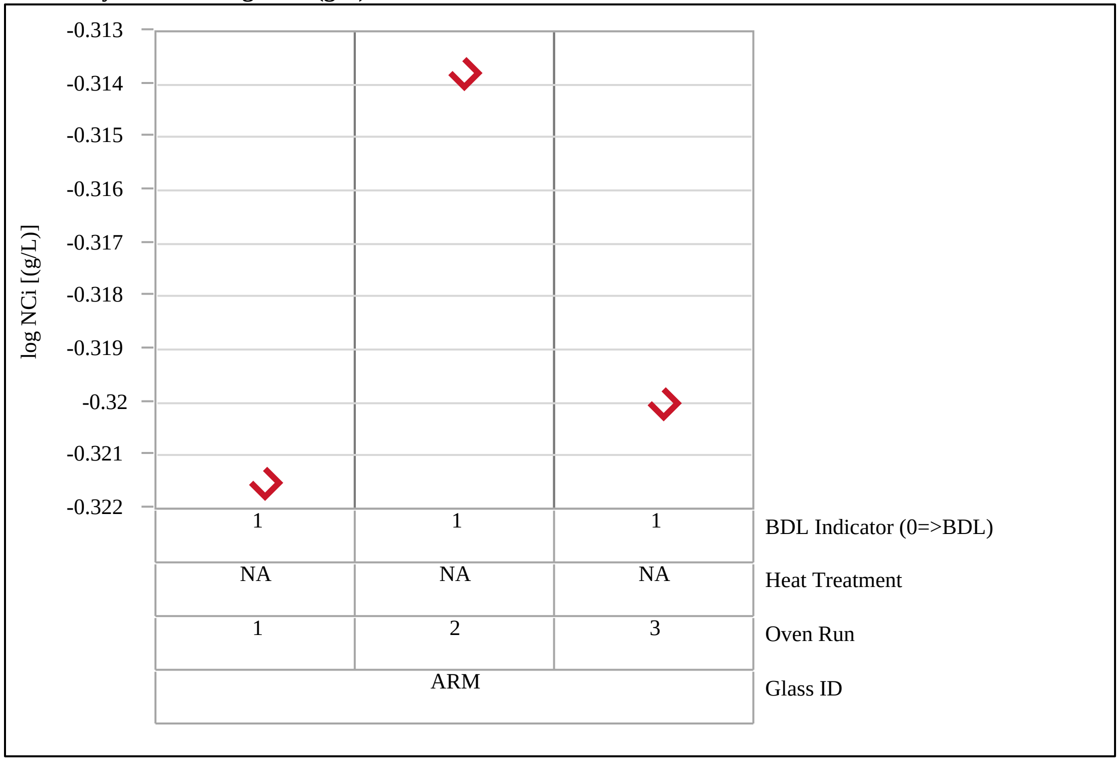


Exhibit E-3. Normalized PCT Results by Compositional View by Heat Treatment for Each Glass (continued)

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

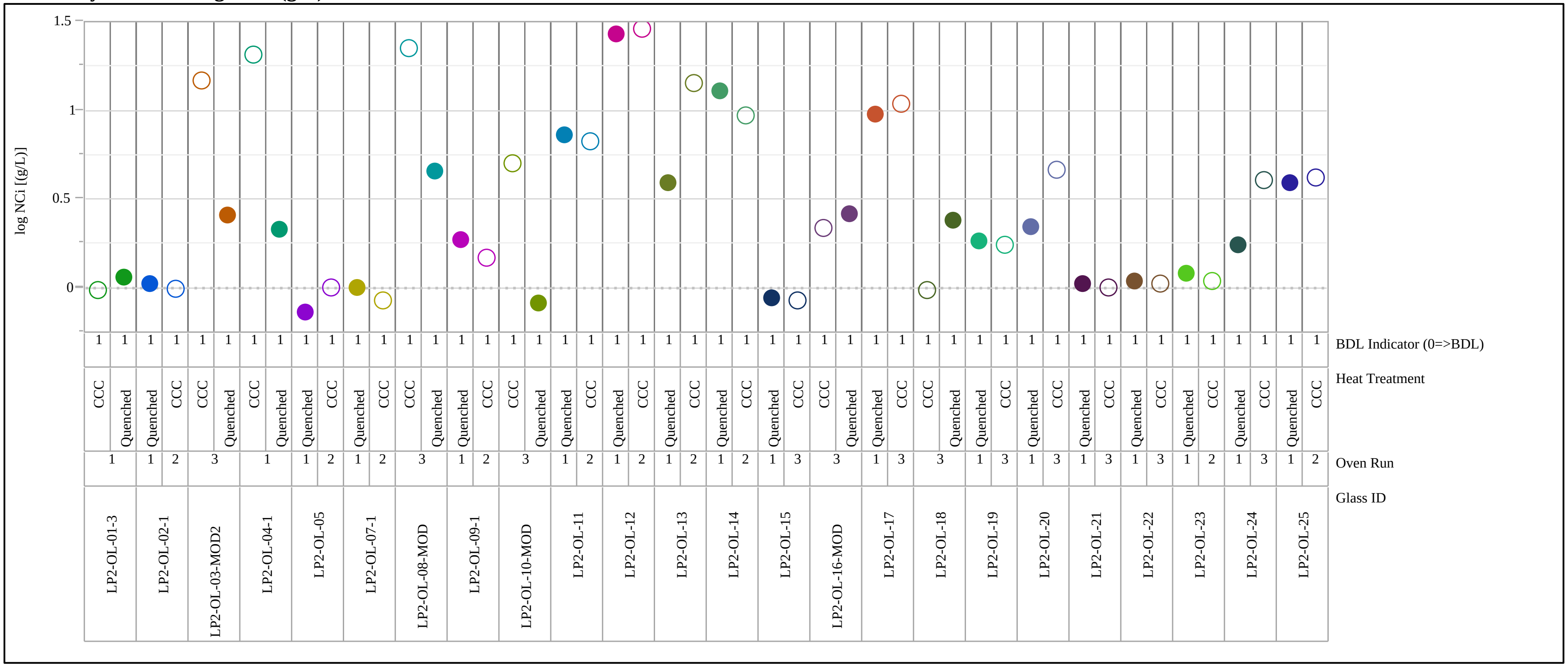


Exhibit E-3. Normalized PCT Results by Compositional View by Heat Treatment for Each Glass (continued)

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

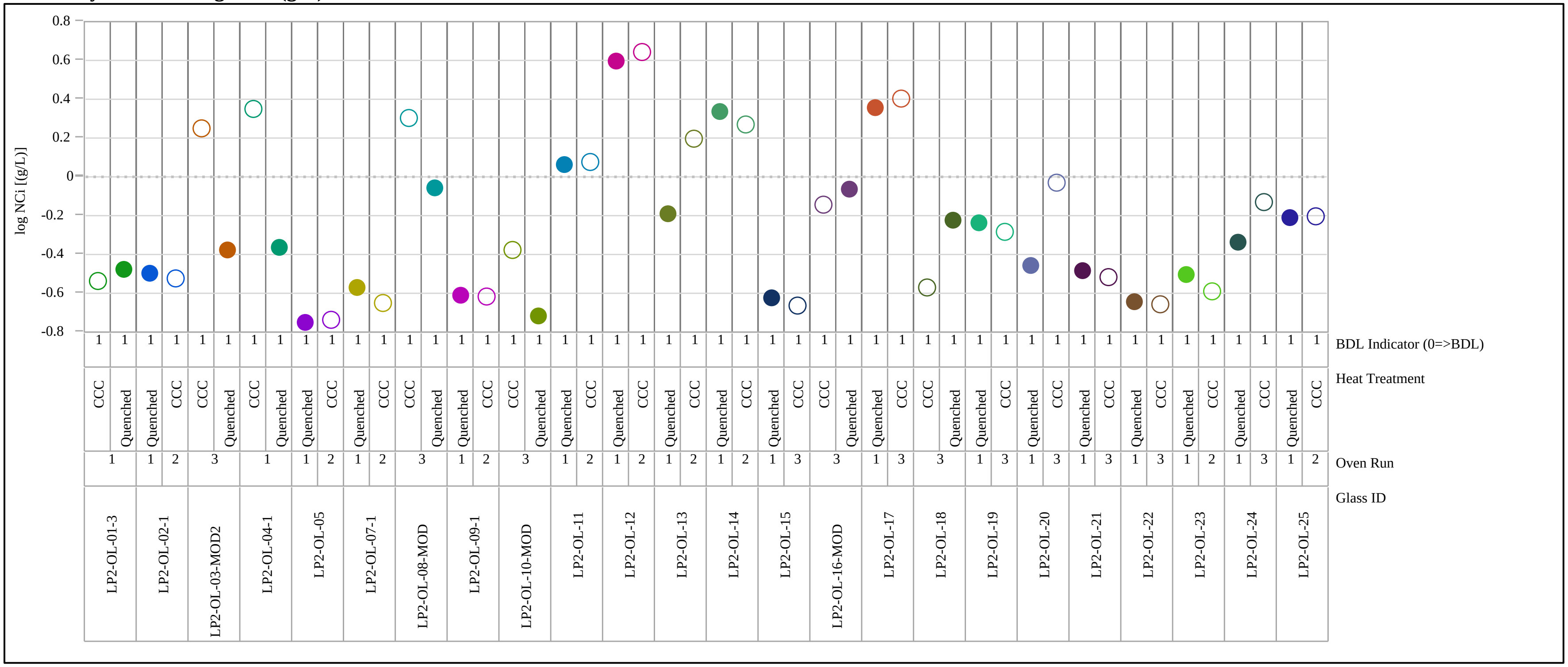


Exhibit E-3. Normalized PCT Results by Compositional View by Heat Treatment for Each Glass (continued)

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

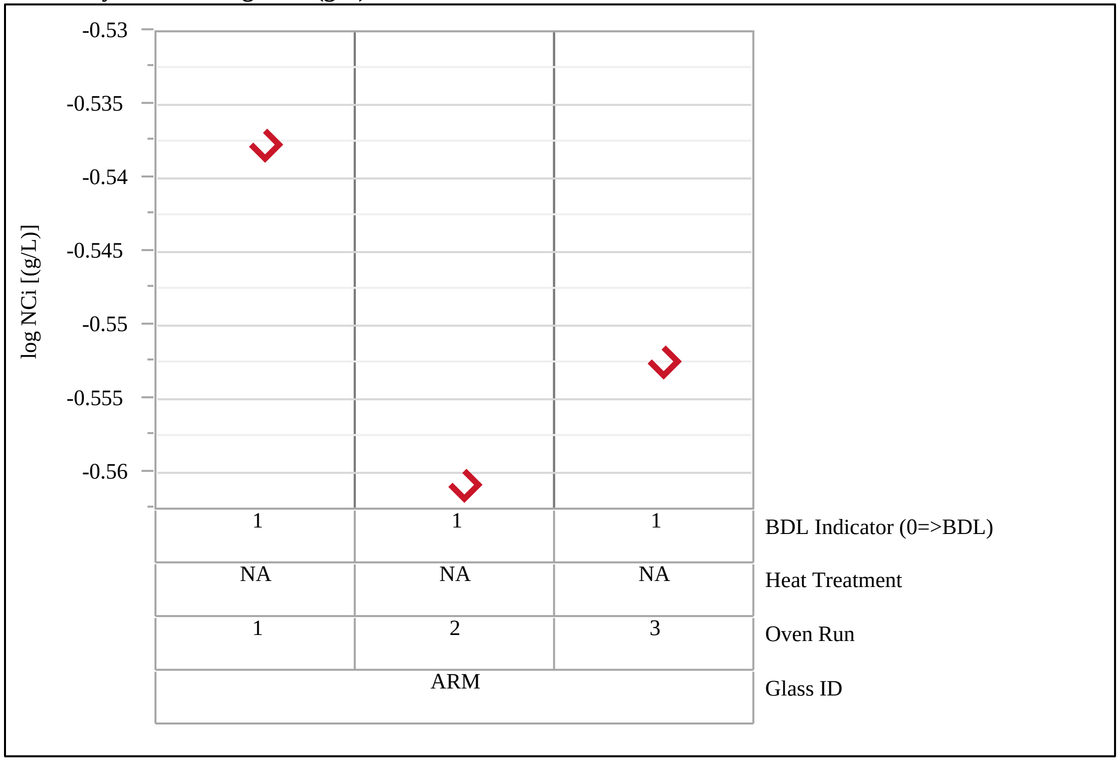
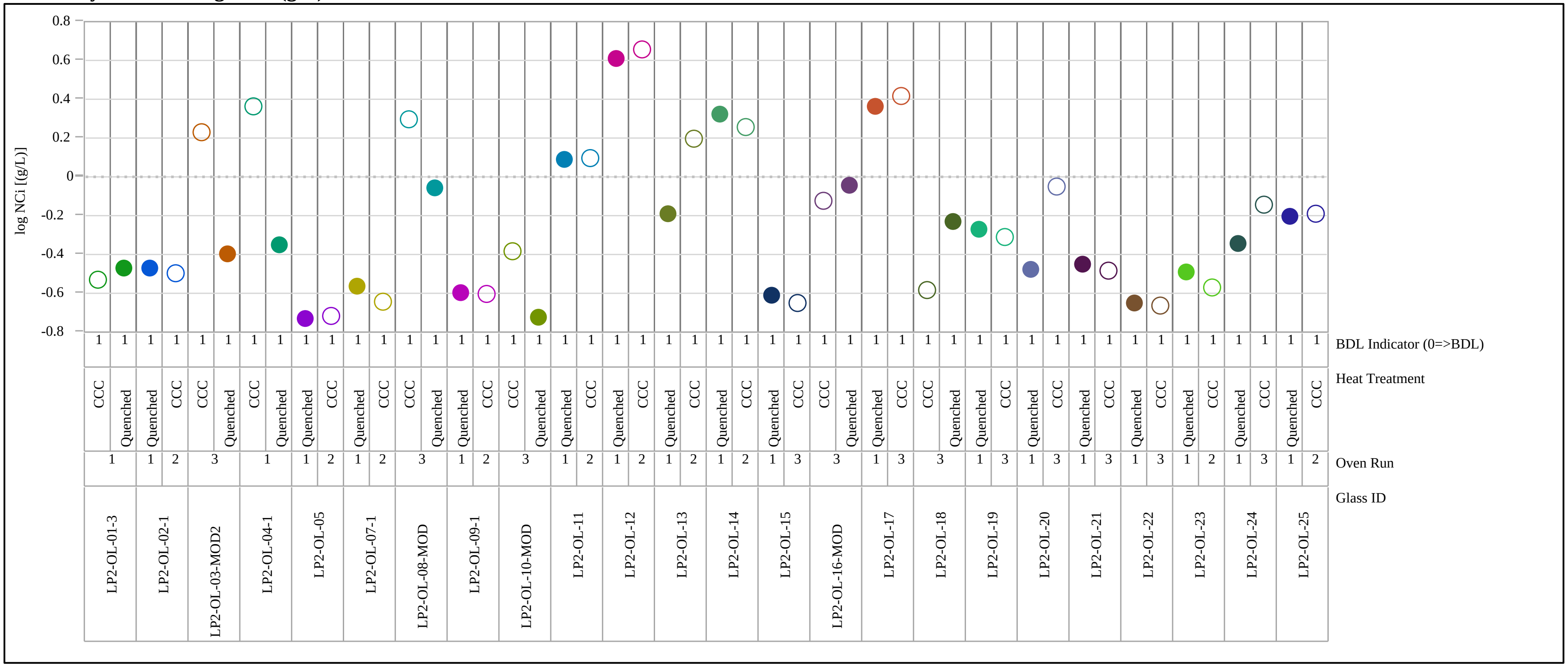


Exhibit E-3. Normalized PCT Results by Compositional View by Heat Treatment for Each Glass (continued)

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



Appendix F Tables and Exhibits Supporting the Wash Solution Chemical Composition Analysis

Table F-1. Measurements (mg/L) of Wash Solutions by ICP-AES (Part 1 of 2)

Solution Identifier	Block	Sequence	Lab ID	Al	B	Ca	Cr	Fe	K	Li	Mg
Soln Std	1	1	soln std 1-1	4.12	20.6	<1.00	<1.00	4.21	9.13	9.93	<1.00
LP2-OL-07-1W	1	2	W02-1	1.01	24.8	19.5	61.1	<1.00	10.8	<1.00	<1.00
LP2-OL-17W	1	3	W05-1	<1.00	19.5	<1.00	39.5	<1.00	264	<1.00	<1.00
LP2-OL-21W	1	4	W19-1	1.37	22.7	<1.00	53.4	<1.00	46.0	<1.00	<1.00
LP2-OL-11W	1	5	W24-1	<1.00	75.3	10.6	73.5	<1.00	523	<1.00	<1.00
HPstd	1	6	hpstd-11	48.7	2.15	<1.00	<1.00	49.4	<1.00	<1.00	<1.00
LP2-OL-25W	1	7	W09-1	<1.00	67.9	1.91	54.4	<1.00	<1.00	<1.00	<1.00
LP2-OL-05W	1	8	W10-1	1.48	14.1	<1.00	32.0	<1.00	<1.00	<1.00	<1.00
LP2-OL-09-1W	1	9	W18-1	<1.00	33.1	10.2	56.0	<1.00	<1.00	<1.00	<1.00
LP2-OL-18W	1	10	W01-1	<1.00	13.8	8.14	83.2	<1.00	<1.00	<1.00	<1.00
LP2-OL-10-MODW	1	11	W14-1	<1.00	9.91	4.78	42.1	<1.00	<1.00	<1.00	<1.00
LP2-OL-01-3W	1	12	W16-1	<1.00	10.8	7.54	63.9	<1.00	<1.00	<1.00	<1.00
Soln Std	1	13	soln std 1-2	4.03	19.9	<1.00	<1.00	4.17	9.43	9.77	<1.00
LP2-OL-16-MODW	1	14	W17-1	<1.00	11.8	10.4	59.5	<1.00	<1.00	<1.00	<1.00
LP2-OL-02-1W	1	15	W20-1	5.51	23.6	5.19	50.8	<1.00	44.3	<1.00	<1.00
LP2-OL-03-MOD2W	1	16	W11-1	1.42	14.0	4.39	88.3	<1.00	<1.00	<1.00	<1.00
LP2-OL-19W	1	17	W13-1	<1.00	20.5	2.34	52.6	<1.00	362	<1.00	<1.00
LP2-OL-13W	1	18	W08-1	<1.00	103	<1.00	204	<1.00	1430	<1.00	<1.00
LP2-OL-20W	1	19	W07-1	1.19	11.5	<1.00	28.0	<1.00	<1.00	<1.00	<1.00
blank	1	20	blank-1	<1.00	1.47	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
LP2-OL-15W	1	21	W23-1	<1.00	23.5	13.0	46.3	<1.00	<1.00	<1.00	<1.00
LP2-OL-12W	1	22	W06-1	1.19	40.9	<1.00	57.4	<1.00	<1.00	<1.00	<1.00
LP2-OL-24W	1	23	W03-1	1.66	13.0	8.24	36.5	<1.00	<1.00	<1.00	<1.00
LP2-OL-23W	1	24	W15-1	<1.00	29.3	20.6	27.4	<1.00	<1.00	<1.00	<1.00
HPstd	1	25	hpstd-12	45.7	1.82	<1.00	<1.00	49.1	<1.00	<1.00	<1.00
LP2-OL-08-MODW	1	26	W22-1	<1.00	17.0	11.9	68.7	<1.00	<1.00	<1.00	<1.00
LP2-OL-14W	1	27	W12-1	<1.00	44.6	9.26	57.6	<1.00	255	<1.00	<1.00
LP2-OL-22W	1	28	W21-1	1.03	18.8	23.9	52.1	<1.00	1.74	<1.00	<1.00
LP2-OL-04-1W	1	29	W04-1	1.95	15.1	<1.00	108	<1.00	397	<1.00	<1.00
Soln Std	1	30	soln std 1-3	3.92	19.8	<1.00	<1.00	4.16	9.12	9.70	<1.00
Soln Std	2	1	soln std 2-1	4.07	19.8	<1.00	<1.00	3.89	10.1	9.67	<1.00
LP2-OL-16-MODW	2	2	W17-2	<1.00	10.8	10.0	59.0	<1.00	1.14	<1.00	<1.00
LP2-OL-03-MOD2W	2	3	W11-2	1.29	13.1	4.05	88.1	<1.00	1.67	<1.00	<1.00
LP2-OL-19W	2	4	W13-2	<1.00	19.6	1.96	52.6	<1.00	362	<1.00	<1.00
LP2-OL-15W	2	5	W23-2	<1.00	23.4	13.0	46.4	<1.00	<1.00	<1.00	<1.00
HPstd	2	6	hpstd-21	51.3	<1.00	<1.00	<1.00	49.3	<1.00	<1.00	<1.00
LP2-OL-25W	2	7	W09-2	<1.00	71.4	1.52	54.4	<1.00	1.15	<1.00	<1.00
LP2-OL-13W	2	8	W08-2	<1.00	105	<1.00	201	<1.00	1340	<1.00	<1.00
LP2-OL-08-MODW	2	9	W22-2	<1.00	15.9	11.5	67.3	<1.00	1.52	<1.00	<1.00
LP2-OL-07-1W	2	10	W02-2	<1.00	24.5	19.4	61.0	<1.00	11.7	<1.00	<1.00
LP2-OL-20W	2	11	W07-2	1.04	10.6	<1.00	27.8	<1.00	1.08	<1.00	<1.00
LP2-OL-12W	2	12	W06-2	1.02	40.3	<1.00	57.1	<1.00	<1.00	<1.00	<1.00
Soln Std	2	13	soln std 2-2	4.17	19.1	<1.00	<1.00	3.88	10.4	9.60	<1.00
LP2-OL-05W	2	14	W10-2	1.36	13.0	<1.00	31.9	<1.00	1.89	<1.00	<1.00
LP2-OL-02-1W	2	15	W20-2	11.7	23.0	5.29	50.4	<1.00	49.2	<1.00	<1.00
LP2-OL-17W	2	16	W05-2	<1.00	18.8	<1.00	39.1	<1.00	251	<1.00	<1.00
LP2-OL-09-1W	2	17	W18-2	<1.00	31.6	9.77	55.1	<1.00	<1.00	<1.00	<1.00
LP2-OL-21W	2	18	W19-2	1.23	21.8	<1.00	52.7	<1.00	47.3	<1.00	<1.00
LP2-OL-24W	2	19	W03-2	1.55	12.1	7.96	36.1	<1.00	<1.00	<1.00	<1.00
blank	2	20	blank-2	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
LP2-OL-18W	2	21	W01-2	<1.00	12.3	7.85	82.7	<1.00	1.64	<1.00	<1.00
LP2-OL-04-1W	2	22	W04-2	1.77	14.1	<1.00	107	<1.00	367	<1.00	<1.00
LP2-OL-14W	2	23	W12-2	<1.00	45.3	8.87	57.3	<1.00	228	<1.00	<1.00
LP2-OL-23W	2	24	W15-2	<1.00	28.5	20.4	27.1	<1.00	1.15	<1.00	<1.00
HPstd	2	25	hpstd-22	52.7	<1.00	<1.00	<1.00	48.8	<1.00	<1.00	<1.00
LP2-OL-01-3W	2	26	W16-2	<1.00	9.68	7.14	63.4	<1.00	1.62	<1.00	<1.00
LP2-OL-11W	2	27	W24-2	<1.00	76.8	10.5	73.6	<1.00	516	<1.00	<1.00
LP2-OL-10-MODW	2	28	W14-2	<1.00	9.10	4.38	41.8	<1.00	1.59	<1.00	<1.00
LP2-OL-22W	2	29	W21-2	<1.00	17.8	23.6	51.4	<1.00	2.66	<1.00	<1.00
Soln Std	2	30	soln std 2-3	4.09	19.2	<1.00	<1.00	3.87	10.0	9.61	<1.00

Table F-1. Measurements (mg/L) of Wash Solutions by ICP-AES (Part 1 of 2) (continued)

Solution Identifier	Block	Sequence	Lab ID	Al	B	Ca	Cr	Fe	K	Li	Mg
Soln Std	3	1	soln std 3-1	3.78	18.6	<1.00	<1.00	4.25	9.42	9.85	<1.00
LP2-OL-20W	3	2	W07-3	<1.00	10.3	<1.00	27.9	<1.00	<1.00	<1.00	<1.00
LP2-OL-16-MODW	3	3	W17-3	<1.00	10.4	10.4	59.0	<1.00	<1.00	<1.00	<1.00
LP2-OL-10-MODW	3	4	W14-3	<1.00	8.54	4.84	41.8	<1.00	1.23	<1.00	<1.00
LP2-OL-04-1W	3	5	W04-3	1.65	13.9	<1.00	108	<1.00	362	<1.00	<1.00
HPstd	3	6	hpstd-31	48.7	<1.00	<1.00	<1.00	49.3	<1.00	<1.00	<1.00
LP2-OL-09-1W	3	7	W18-3	<1.00	30.4	10.1	55.0	<1.00	<1.00	<1.00	<1.00
LP2-OL-20W	3	2	W07-3	<1.00	10.3	<1.00	27.9	<1.00	<1.00	<1.00	<1.00
LP2-OL-16-MODW	3	3	W17-3	<1.00	10.4	10.4	59.0	<1.00	<1.00	<1.00	<1.00
LP2-OL-10-MODW	3	4	W14-3	<1.00	8.54	4.84	41.8	<1.00	1.23	<1.00	<1.00
LP2-OL-04-1W	3	5	W04-3	1.65	13.9	<1.00	108	<1.00	362	<1.00	<1.00
HPstd	3	6	hpstd-31	48.7	<1.00	<1.00	<1.00	49.3	<1.00	<1.00	<1.00
LP2-OL-09-1W	3	7	W18-3	<1.00	30.4	10.1	55.0	<1.00	<1.00	<1.00	<1.00
LP2-OL-12W	3	8	W06-3	<1.00	39.4	<1.00	56.6	<1.00	<1.00	<1.00	<1.00
LP2-OL-25W	3	9	W09-3	<1.00	68.4	2.04	54.0	<1.00	<1.00	<1.00	<1.00
LP2-OL-13W	3	10	W08-3	<1.00	107	<1.00	202	<1.00	1420	<1.00	<1.00
LP2-OL-15W	3	11	W23-3	<1.00	23.1	13.0	45.9	<1.00	<1.00	<1.00	<1.00
LP2-OL-05W	3	12	W10-3	1.10	12.8	<1.00	31.5	<1.00	1.52	<1.00	<1.00
Soln Std	3	13	soln std 3-2	4.00	18.9	<1.00	<1.00	4.15	10.1	9.76	<1.00
LP2-OL-08-MODW	3	14	W22-3	<1.00	16.4	12.3	68.3	<1.00	1.27	<1.00	<1.00
LP2-OL-17W	3	15	W05-3	<1.00	18.6	1.06	39.0	<1.00	254	<1.00	<1.00
LP2-OL-24W	3	16	W03-3	1.33	12.1	8.38	36.3	<1.00	<1.00	<1.00	<1.00
LP2-OL-11W	3	17	W24-3	<1.00	72.0	10.2	70.7	<1.00	508	<1.00	<1.00
LP2-OL-18W	3	18	W01-3	<1.00	12.8	8.16	81.4	<1.00	1.40	<1.00	<1.00
LP2-OL-22W	3	19	W21-3	<1.00	17.9	23.5	51.3	<1.00	2.23	<1.00	<1.00
blank	3	20	blank-3	<1.00	1.02	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
LP2-OL-03-MOD2W	3	21	W11-3	<1.00	13.0	4.54	87.7	<1.00	1.17	<1.00	<1.00
LP2-OL-21W	3	22	W19-3	<1.00	21.3	<1.00	52.8	<1.00	44.7	<1.00	<1.00
LP2-OL-02-1W	3	23	W20-3	11.2	23.5	6.70	49.9	<1.00	46.5	<1.00	<1.00
LP2-OL-19W	3	24	W13-3	<1.00	19.8	2.47	52.2	<1.00	349	<1.00	<1.00
HPstd	3	25	hpstd-32	50.7	1.03	<1.00	<1.00	48.7	<1.00	<1.00	<1.00
LP2-OL-07-1W	3	26	W02-3	<1.00	24.3	19.7	61.3	<1.00	11.0	<1.00	<1.00
LP2-OL-23W	3	27	W15-3	<1.00	28.1	20.7	27.3	<1.00	<1.00	<1.00	<1.00
LP2-OL-14W	3	28	W12-3	<1.00	44.3	9.26	57.1	<1.00	245	<1.00	<1.00
LP2-OL-01-3W	3	29	W16-3	<1.00	10.3	7.59	63.5	<1.00	1.25	<1.00	<1.00
Soln Std	3	30	soln std 3-3	3.95	19.0	<1.00	<1.00	4.17	9.95	9.83	<1.00

Table F-2. Measurements (mg/L) of Wash Solutions by ICP-AES (Part 2 of 2)

Solution Identifier	Block	Sequence	Lab ID	Na	P	S	Si	Sn	V	Zn	Zr
Soln Std	1	1	soln std 1-1	85.4	<1.00	<1.00	45.2	<1.00	<1.00	<1.00	<1.00
LP2-OL-07-1W	1	2	W02-1	1040	<1.00	608	5.79	<1.00	8.35	<1.00	<1.00
LP2-OL-17W	1	3	W05-1	755	28.3	386	23.3	<1.00	90.3	<1.00	<1.00
LP2-OL-21W	1	4	W19-1	838	8.68	451	9.31	<1.00	11.1	<1.00	<1.00
LP2-OL-11W	1	5	W24-1	1010	2.26	698	25.7	<1.00	<1.00	<1.00	<1.00
HPstd	1	6	hpstd-11	144	<1.00	9.14	<1.00	<1.00	<1.00	<1.00	<1.00
LP2-OL-25W	1	7	W09-1	1322	8.36	747	15.3	<1.00	<1.00	<1.00	<1.00
LP2-OL-05W	1	8	W10-1	1050	3.07	660	5.83	<1.00	<1.00	<1.00	<1.00
LP2-OL-09-1W	1	9	W18-1	946	5.58	491	5.93	<1.00	56.9	<1.00	<1.00
LP2-OL-18W	1	10	W01-1	1030	9.21	513	6.93	<1.00	80.0	<1.00	<1.00
LP2-OL-10-MODW	1	11	W14-1	924	9.38	517	2.02	<1.00	<1.00	<1.00	<1.00
LP2-OL-01-3W	1	12	W16-1	837	<1.00	468	5.08	<1.00	<1.00	<1.00	<1.00
Soln Std	1	13	soln std 1-2	88.3	<1.00	<1.00	45.9	<1.00	<1.00	<1.00	<1.00
LP2-OL-16-MODW	1	14	W17-1	951	4.76	523	5.04	<1.00	42.6	<1.00	<1.00
LP2-OL-02-1W	1	15	W20-1	798	8.23	421	21.6	<1.00	10.2	<1.00	<1.00
LP2-OL-03-MOD2W	1	16	W11-1	919	3.79	419	5.27	<1.00	<1.00	<1.00	<1.00
LP2-OL-19W	1	17	W13-1	904	6.39	637	10.9	<1.00	<1.00	<1.00	<1.00
LP2-OL-13W	1	18	W08-1	3370	25.3	1840	162	<1.00	390	<1.00	<1.00
LP2-OL-20W	1	19	W07-1	631	2.10	374	15.4	<1.00	<1.00	<1.00	<1.00
blank	1	20	blank-1	<1.00	<1.00	1.08	<1.00	<1.00	<1.00	<1.00	<1.00
LP2-OL-15W	1	21	W23-1	658	<1.00	374	10.3	<1.00	<1.00	<1.00	<1.00
LP2-OL-12W	1	22	W06-1	725	9.05	322	27.4	<1.00	<1.00	<1.00	<1.00
LP2-OL-24W	1	23	W03-1	691	2.98	376	7.94	<1.00	67.6	<1.00	<1.00
LP2-OL-23W	1	24	W15-1	772	2.22	439	11.2	<1.00	<1.00	<1.00	<1.00
HPstd	1	25	hpstd-12	152	<1.00	10.8	<1.00	<1.00	<1.00	<1.00	<1.00
LP2-OL-08-MODW	1	26	W22-1	867	2.28	388	16.0	<1.00	64.0	<1.00	<1.00
LP2-OL-14W	1	27	W12-1	707	<1.00	387	25.4	<1.00	50.1	<1.00	<1.00
LP2-OL-22W	1	28	W21-1	1160	1.56	665	16.7	<1.00	79.5	<1.00	<1.00
LP2-OL-04-1W	1	29	W04-1	682	2.61	475	4.99	<1.00	<1.00	<1.00	<1.00
Soln Std	1	30	soln std 1-3	81.5	<1.00	<1.00	46.0	<1.00	<1.00	<1.00	<1.00
Soln Std	2	1	soln std 2-1	80.5	<1.00	<1.00	46.9	<1.00	<1.00	<1.00	<1.00
LP2-OL-16-MODW	2	2	W17-2	895	4.35	513	6.08	<1.00	42.2	<1.00	<1.00
LP2-OL-03-MOD2W	2	3	W11-2	810	3.38	413	6.85	<1.00	<1.00	<1.00	<1.00
LP2-OL-19W	2	4	W13-2	882	5.91	623	12.5	<1.00	<1.00	<1.00	<1.00
LP2-OL-15W	2	5	W23-2	668	<1.00	360	11.7	<1.00	<1.00	<1.00	<1.00
HPstd	2	6	hpstd-21	150	<1.00	9.60	<1.00	<1.00	<1.00	<1.00	<1.00
LP2-OL-25W	2	7	W09-2	1330	7.78	726	16.3	<1.00	<1.00	<1.00	<1.00
LP2-OL-13W	2	8	W08-2	3090	25.2	1690	151	<1.00	384	<1.00	<1.00
LP2-OL-08-MODW	2	9	W22-2	786	2.09	370	20.5	<1.00	62.9	<1.00	<1.00
LP2-OL-07-1W	2	10	W02-2	1010	<1.00	600	7.12	<1.00	8.53	<1.00	<1.00
LP2-OL-20W	2	11	W07-2	640	1.66	334	17.1	<1.00	<1.00	<1.00	<1.00
LP2-OL-12W	2	12	W06-2	767	8.75	323	30.3	<1.00	<1.00	<1.00	<1.00
Soln Std	2	13	soln std 2-2	79.9	<1.00	<1.00	48.9	<1.00	<1.00	<1.00	<1.00
LP2-OL-05W	2	14	W10-2	1100	2.63	649	6.69	<1.00	<1.00	<1.00	<1.00
LP2-OL-02-1W	2	15	W20-2	785	8.19	427	45.2	<1.00	9.79	<1.00	<1.00
LP2-OL-17W	2	16	W05-2	704	27.9	375	27.0	<1.00	90.0	<1.00	<1.00
LP2-OL-09-1W	2	17	W18-2	894	5.02	517	7.85	<1.00	56.3	<1.00	<1.00
LP2-OL-21W	2	18	W19-2	820	8.04	448	11.0	<1.00	10.9	<1.00	<1.00
LP2-OL-24W	2	19	W03-2	716	2.96	370	9.25	<1.00	67.4	<1.00	<1.00
blank	2	20	blank-2	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
LP2-OL-18W	2	21	W01-2	956	8.92	511	8.37	<1.00	79.8	<1.00	<1.00
LP2-OL-04-1W	2	22	W04-2	627	2.42	459	6.16	<1.00	<1.00	<1.00	<1.00
LP2-OL-14W	2	23	W12-2	624	<1.00	382	28.2	<1.00	49.8	<1.00	<1.00
LP2-OL-23W	2	24	W15-2	761	1.72	450	14.3	<1.00	<1.00	<1.00	<1.00
HPstd	2	25	hpstd-22	142	<1.00	9.23	<1.00	<1.00	<1.00	<1.00	<1.00
LP2-OL-01-3W	2	26	W16-2	754	<1.00	464	5.63	<1.00	<1.00	<1.00	<1.00
LP2-OL-11W	2	27	W24-2	1100	1.78	706	27.9	<1.00	<1.00	<1.00	<1.00
LP2-OL-10-MODW	2	28	W14-2	888	9.14	503	2.85	<1.00	<1.00	<1.00	<1.00
LP2-OL-22W	2	29	W21-2	1150	1.11	622	17.7	<1.00	78.2	<1.00	<1.00
Soln Std	2	30	soln std 2-3	77.3	<1.00	<1.00	48.1	<1.00	<1.00	<1.00	<1.00

Table F-2. Measurements (mg/L) of Wash Solutions by ICP-AES (Part 2 of 2) (continued)

Solution Identifier	Block	Sequence	Lab ID	Na	P	S	Si	Sn	V	Zn	Zr
Soln Std	3	1	soln std 3-1	79.8	<1.00	<1.00	45.5	<1.00	<1.00	<1.00	<1.00
LP2-OL-20W	3	2	W07-3	599	2.22	340	16.5	<1.00	<1.00	<1.00	<1.00
LP2-OL-16-MODW	3	3	W17-3	959	4.84	507	6.40	<1.00	42.3	<1.00	<1.00
LP2-OL-10-MODW	3	4	W14-3	919	9.19	520	3.34	<1.00	<1.00	<1.00	<1.00
LP2-OL-04-1W	3	5	W04-3	617	2.76	475	6.88	<1.00	<1.00	<1.00	<1.00
HPstd	3	6	hpstd-31	146	<1.00	10.0	<1.00	<1.00	<1.00	<1.00	<1.00
LP2-OL-09-1W	3	7	W18-3	898	5.38	484	7.60	<1.00	55.9	<1.00	<1.00
LP2-OL-12W	3	8	W06-3	740	8.99	328	29.5	<1.00	<1.00	<1.00	<1.00
LP2-OL-25W	3	9	W09-3	1330	8.23	737	16.7	<1.00	<1.00	<1.00	<1.00
LP2-OL-13W	3	10	W08-3	3260	25.5	1790	148	<1.00	387	<1.00	<1.00
LP2-OL-15W	3	11	W23-3	694	<1.00	373	12.2	<1.00	<1.00	<1.00	<1.00
LP2-OL-05W	3	12	W10-3	1120	3.38	659	6.87	<1.00	<1.00	<1.00	<1.00
Soln Std	3	13	soln std 3-2	81.8	<1.00	1.35	47.8	<1.00	<1.00	<1.00	<1.00
LP2-OL-08-MODW	3	14	W22-3	837	2.45	387	20.4	<1.00	63.7	<1.00	<1.00
LP2-OL-17W	3	15	W05-3	719	27.9	371	25.3	<1.00	90.1	<1.00	<1.00
LP2-OL-24W	3	16	W03-3	746	3.21	369	9.35	<1.00	67.6	<1.00	<1.00
LP2-OL-11W	3	17	W24-3	1070	2.11	693	28.1	<1.00	<1.00	<1.00	<1.00
LP2-OL-18W	3	18	W01-3	1080	9.22	506	9.04	<1.00	78.9	<1.00	<1.00
LP2-OL-22W	3	19	W21-3	1160	1.65	651	17.6	<1.00	78.2	<1.00	<1.00
blank	3	20	blank-3	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
LP2-OL-03-MOD2W	3	21	W11-3	826	3.90	422	6.14	<1.00	<1.00	<1.00	<1.00
LP2-OL-21W	3	22	W19-3	764	8.06	447	10.3	<1.00	10.9	<1.00	<1.00
LP2-OL-02-1W	3	23	W20-3	740	8.21	419	42.2	<1.00	10.1	<1.00	<1.00
LP2-OL-19W	3	24	W13-3	853	6.43	621	12.6	<1.00	<1.00	<1.00	<1.00
HPstd	3	25	hpstd-32	147	<1.00	10.0	<1.00	<1.00	<1.00	<1.00	<1.00
LP2-OL-07-1W	3	26	W02-3	1030	1.13	618	7.25	<1.00	8.50	<1.00	<1.00
LP2-OL-23W	3	27	W15-3	797	2.35	453	12.5	<1.00	<1.00	<1.00	<1.00
LP2-OL-14W	3	28	W12-3	677	<1.00	392	27.1	<1.00	49.7	<1.00	<1.00
LP2-OL-01-3W	3	29	W16-3	711	1.12	438	5.80	<1.00	<1.00	<1.00	<1.00
Soln Std	3	30	soln std 3-3	80.9	1.05	<1.00	47.3	<1.00	<1.00	<1.00	<1.00

Table F-3. Measurements (mg/L) of Wash Solutions by IC

Solution Identifier	Block	Sequence	Lab ID	Cl	F	PO4	SO4
10 ppm check std	1	1	10 ppm check std	9.63	9.86	9.78	10.6
LP2-OL-17W	1	2	W05-1	30.1	24.9	68.6	1170
LP2-OL-14W	1	3	W12-1	<10.0	<10.0	<10.0	1290
LP2-OL-02-1W	1	4	W20-1	<10.0	<10.0	19.3	1370
LP2-OL-08-MODW	1	5	W22-1	<10.0	<10.0	<10.0	1190
LP2-OL-21W	1	6	W19-1	13.5	<10.0	16.0	1370
LP2-OL-23W	1	7	W15-1	<10.0	<10.0	<10.0	1310
LP2-OL-03-MOD2W	1	8	W11-1	<10.0	<10.0	<10.0	1390
LP2-OL-05W	1	9	W10-1	46.0	23.0	<10.0	2040
LP2-OL-12W	1	10	W06-1	23.8	16.6	18.3	1060
LP2-OL-15W	1	11	W23-1	<10.0	<10.0	<10.0	1200
LP2-OL-07-1W	1	12	W02-1	21.7	<10.0	<10.0	1800
LP2-OL-01-3W	1	13	W16-1	<10.0	<10.0	<10.0	1470
blank	1	14	BLANK-1	<10.0	<10.0	<10.0	<100
10 ppm check std	1	15	10 ppm check std	9.58	10.1	9.43	10.0
LP2-OL-16-MODW	1	16	W17-1	<10.0	<10.0	<10.0	1640
LP2-OL-25W	1	17	W09-1	<10.0	<10.0	18.3	2300
LP2-OL-09-1W	1	18	W18-1	<10.0	<10.0	<10.0	1650
LP2-OL-04-1W	1	19	W04-1	<10.0	<10.0	<10.0	1430
LP2-OL-18W	1	20	W01-1	21.6	17.5	18.8	1710
LP2-OL-13W	1	21	W08-1	117	104	61.3	5570
LP2-OL-20W	1	22	W07-1	<10.0	<10.0	<10.0	1130
LP2-OL-22W	1	23	W21-1	<10.0	<10.0	<10.0	2010
LP2-OL-10-MODW	1	24	W14-1	21.4	17.9	17.8	1580
LP2-OL-24W	1	25	W03-1	<10.0	<10.0	<10.0	1200
LP2-OL-11W	1	26	W24-1	<10.0	<10.0	<10.0	2120
LP2-OL-19W	1	27	W13-1	<10.0	<10.0	12.3	1970
10 ppm check std	1	28	10 ppm check std	9.55	10.2	10.3	10.8
10 ppm check std	2	1	10 ppm check std	9.54	10.1	9.57	10.3
LP2-OL-05W	2	2	W10-2	49.7	27.0	<10.0	2030
LP2-OL-23W	2	3	W15-2	<10.0	<10.0	<10.0	1390
LP2-OL-25W	2	4	W09-2	<10.0	<10.0	16.0	2260
LP2-OL-03-MOD2W	2	5	W11-2	<10.0	<10.0	<10.0	1460
LP2-OL-10-MODW	2	6	W14-2	21.3	19.8	19.2	1650
LP2-OL-21W	2	7	W19-2	13.8	<10.0	15.1	1360
LP2-OL-08-MODW	2	8	W22-2	<10.0	<10.0	<10.0	1210
LP2-OL-12W	2	9	W06-2	24.5	16.9	16.3	1050
LP2-OL-19W	2	10	W13-2	<10.0	<10.0	12.6	1880
LP2-OL-17W	2	11	W05-2	26.6	23.8	60.8	1170
LP2-OL-04-1W	2	12	W04-2	<10.0	<10.0	<10.0	1440
LP2-OL-20W	2	13	W07-2	<10.0	<10.0	<10.0	1110
blank	2	14	BLANK-2	<10.0	<10.0	<10.0	<100
10 ppm check std	2	15	10 ppm check std	9.63	10.6	9.39	9.88
LP2-OL-01-3W	2	16	W16-2	<10.0	<10.0	<10.0	1440
LP2-OL-24W	2	17	W03-2	<10.0	<10.0	<10.0	1150
LP2-OL-16-MODW	2	18	W17-2	<10.0	<10.0	<10.0	1620
LP2-OL-18W	2	19	W01-2	21.6	18.5	19.0	1680
LP2-OL-07-1W	2	20	W02-2	21.6	<10.0	<10.0	1860
LP2-OL-15W	2	21	W23-2	<10.0	<10.0	<10.0	1200
LP2-OL-02-1W	2	22	W20-2	<10.0	<10.0	15.0	1320
LP2-OL-22W	2	23	W21-2	<10.0	<10.0	<10.0	2090
LP2-OL-09-1W	2	24	W18-2	<10.0	<10.0	<10.0	1570
LP2-OL-13W	2	25	W08-2	120	107	54.8	5440
LP2-OL-11W	2	26	W24-2	<10.0	<10.0	<10.0	2180
LP2-OL-14W	2	27	W12-2	<10.0	<10.0	<10.0	1190
10 ppm check std	2	28	10 ppm check std	9.44	10.1	9.72	10.3
10 ppm check std	3	1	10 ppm check std	10.0	10.4	9.63	10.2
LP2-OL-18W	3	2	W01-3	26.0	21.5	22.9	1690
LP2-OL-22W	3	3	W21-3	<10.0	<10.0	<10.0	1960
LP2-OL-15W	3	4	W23-3	<10.0	<10.0	<10.0	1200

Table F-3. Measurements (mg/L) of Wash Solutions by IC (continued)

Solution Identifier	Block	Sequence	Lab ID	Cl	F	PO4	SO4
LP2-OL-10-MODW	3	5	W14-3	22.8	24.1	18.3	1630
LP2-OL-24W	3	6	W03-3	<10.0	<10.0	<10.0	1130
LP2-OL-14W	3	7	W12-3	<10.0	<10.0	<10.0	1220
LP2-OL-17W	3	8	W05-3	26.0	26.0	63.3	1150
LP2-OL-12W	3	9	W06-3	23.3	19.8	19.6	998
LP2-OL-08-MODW	3	10	W22-3	<10.0	<10.0	<10.0	1220
LP2-OL-04-1W	3	11	W04-3	<10.0	<10.0	<10.0	1450
LP2-OL-09-1W	3	12	W18-3	<10.0	<10.0	<10.0	1570
LP2-OL-07-1W	3	13	W02-3	22.2	<10.0	<10.0	1840
blank	3	14	BLANK-3	<10.0	<10.0	<10.0	<100
10 ppm check std	3	15	10 ppm check std	9.69	10.2	9.50	9.88
LP2-OL-25W	3	16	W09-3	<10.0	<10.0	19.4	2260
LP2-OL-19W	3	17	W13-3	<10.0	<10.0	15.8	1950
LP2-OL-13W	3	18	W08-3	114	109	53.7	5420
LP2-OL-05W	3	19	W10-3	44.8	29.1	<10.0	2210
LP2-OL-16-MODW	3	20	W17-3	<10.0	<10.0	<10.0	1590
LP2-OL-01-3W	3	21	W16-3	<10.0	<10.0	<10.0	1440
LP2-OL-21W	3	22	W19-3	14.0	<10.0	15.9	1360
LP2-OL-03-MOD2W	3	23	W11-3	<10.0	<10.0	<10.0	1430
LP2-OL-02-1W	3	24	W20-3	<10.0	<10.0	16.9	1380
LP2-OL-23W	3	25	W15-3	<10.0	<10.0	<10.0	1440
LP2-OL-11W	3	26	W24-3	<10.0	<10.0	<10.0	2180
LP2-OL-20W	3	27	W07-3	<10.0	<10.0	<10.0	1140
10 ppm check std	3	28	10 ppm check std	9.79	10.2	9.91	9.87

Table F-4. Results for Standards Utilized During the Measurement of the Wash Solutions

Solution Identifier	Analyte	Instrument	Reference Value (mg/)	Mean Measurement (mg/L)
10 ppm check std	Cl	IC	10	9.65
10 ppm check std	F	IC	10	10.2
10 ppm check std	PO4	IC	10	9.69
10 ppm check std	SO4	IC	10	10.2
HPstd	Al	ICP-AES	50	49.63
HPstd	Fe	ICP-AES	50	49.1
HPstd	Na	ICP-AES	150	146.83
HPstd	S	ICP-AES	10	9.8
Soln Std	Al	ICP-AES	4	4.01
Soln Std	B	ICP-AES	20	19.43
Soln Std	Fe	ICP-AES	4	4.08
Soln Std	K	ICP-AES	10	9.74
Soln Std	Li	ICP-AES	10	9.75
Soln Std	Na	ICP-AES	81	81.71
Soln Std	Si	ICP-AES	50	46.84

Table F-5. Average Measurements (mg/L) of Wash Solutions (Part 1 of 2)

Solution Identifier	Al [ICP]	B [ICP]	Ca [ICP]	Cl [IC]	Cr [ICP]	F [IC]	Fe [ICP]	K [ICP]	Li [ICP]	Mg [ICP]	Na [ICP]	P [ICP]
blank	<1	<1.16	<1	<10	<1	<10	<1	<1	<1	<1	<1	<1
LP2-OL-01-3W	<1	10.26	7.42	<10	63.6	<10	<1	<1.29	<1	<1	767.33	<1.04
LP2-OL-02-1W	9.47	23.37	5.73	<10	50.37	<10	<1	46.67	<1	<1	774.33	8.21
LP2-OL-03-MOD2W	<1.24	13.37	4.33	<10	88.03	<10	<1	<1.28	<1	<1	851.67	3.69
LP2-OL-04-1W	1.79	14.37	<1	<10	107.67	<10	<1	375.33	<1	<1	642	2.6
LP2-OL-05W	1.31	13.3	<1	46.83	31.8	26.37	<1	<1.47	<1	<1	1090	3.03
LP2-OL-07-1W	<1	24.53	19.53	21.83	61.13	<10	<1	11.17	<1	<1	1026.67	<1.04
LP2-OL-08-MODW	<1	16.43	11.9	<10	68.1	<10	<1	<1.26	<1	<1	830	2.27
LP2-OL-09-1W	<1	31.7	10.02	<10	55.37	<10	<1	<1	<1	<1	912.67	5.33
LP2-OL-10-MODW	<1	9.18	4.67	21.83	41.9	20.6	<1	<1.27	<1	<1	910.33	9.24
LP2-OL-11W	<1	74.7	10.43	<10	72.6	<10	<1	515.67	<1	<1	1060	2.05
LP2-OL-12W	<1.07	40.2	<1	23.87	57.03	17.77	<1	<1	<1	<1	744	8.93
LP2-OL-13W	<1	105	<1	117	202.33	106.67	<1	1396.67	<1	<1	3240	25.33
LP2-OL-14W	<1	44.73	9.13	<10	57.33	<10	<1	242.67	<1	<1	669.33	<1
LP2-OL-15W	<1	23.33	13	<10	46.2	<10	<1	<1	<1	<1	673.33	<1
LP2-OL-16-MODW	<1	11	10.27	<10	59.17	<10	<1	<1.05	<1	<1	935	4.65
LP2-OL-17W	<1	18.97	<1.02	27.57	39.2	24.9	<1	256.33	<1	<1	726	28.03
LP2-OL-18W	<1	12.97	8.05	23.07	82.43	19.17	<1	<1.35	<1	<1	1022	9.12
LP2-OL-19W	<1	19.97	2.26	<10	52.47	<10	<1	357.67	<1	<1	879.67	6.24
LP2-OL-20W	<1.08	10.8	<1	<10	27.9	<10	<1	<1.03	<1	<1	623.33	1.99
LP2-OL-21W	<1.2	21.93	<1	13.77	52.97	<10	<1	46	<1	<1	807.33	8.26
LP2-OL-22W	<1.01	18.17	23.67	<10	51.6	<10	<1	2.21	<1	<1	1156.67	1.44
LP2-OL-23W	<1	28.63	20.57	<10	27.27	<10	<1	<1.05	<1	<1	776.67	2.1
LP2-OL-24W	1.51	12.4	8.19	<10	36.3	<10	<1	<1	<1	<1	717.67	3.05
LP2-OL-25W	<1	69.23	1.82	<10	54.27	<10	<1	<1.05	<1	<1	1327.33	8.12

Table F-6. Average Measurements (mg/L) of Wash Solutions (Part 2 of 2)

Solution Identifier	PO4 [IC]	PO4 [ICP]	S [ICP]	Si [ICP]	Sn [ICP]	SO4 [IC]	SO4 [ICP]	V [ICP]	Zn [ICP]	Zr [ICP]
blank	<10	<3.07	<1.03	<1	<1	<100	<3.08	<1	<1	<1
LP2-OL-01-3W	<10	<3.19	456.67	5.5	<1	1450	1368.13	<1	<1	<1
LP2-OL-02-1W	17.07	25.17	422.33	36.33	<1	1356.67	1265.27	10.03	<1	<1
LP2-OL-03-MOD2W	<10	11.31	418	6.09	<1	1426.67	1252.29	<1	<1	<1
LP2-OL-04-1W	<10	7.96	469.67	6.01	<1	1440	1407.07	<1	<1	<1
LP2-OL-05W	<10	9.28	656	6.46	<1	2093.33	1965.31	<1	<1	<1
LP2-OL-07-1W	<10	<3.2	608.67	6.72	<1	1833.33	1823.5	8.46	<1	<1
LP2-OL-08-MODW	<10	6.97	381.67	18.97	<1	1206.67	1143.44	63.53	<1	<1
LP2-OL-09-1W	<10	16.33	497.33	7.13	<1	1596.67	1489.96	56.37	<1	<1
LP2-OL-10-MODW	18.43	28.32	513.33	2.74	<1	1620	1537.9	<1	<1	<1
LP2-OL-11W	<10	6.29	699	27.23	<1	2160	2094.13	<1	<1	<1
LP2-OL-12W	18.07	27.38	324.33	29.07	<1	1036	971.67	<1	<1	<1
LP2-OL-13W	56.6	77.68	1773.33	153.67	<1	5476.67	5312.73	387	<1	<1
LP2-OL-14W	<10	<3.07	387	26.9	<1	1233.33	1159.41	49.87	<1	<1
LP2-OL-15W	<10	<3.07	369	11.4	<1	1200	1105.49	<1	<1	<1
LP2-OL-16-MODW	<10	14.26	514.33	5.84	<1	1616.67	1540.89	42.37	<1	<1
LP2-OL-17W	64.23	85.96	377.33	25.2	<1	1163.33	1130.45	90.13	<1	<1
LP2-OL-18W	20.23	27.95	510	8.11	<1	1693.33	1527.91	79.57	<1	<1
LP2-OL-19W	13.57	19.14	627	12	<1	1933.33	1878.43	<1	<1	<1
LP2-OL-20W	<10	6.11	349.33	16.33	<1	1126.67	1046.57	<1	<1	<1
LP2-OL-21W	15.67	25.33	448.67	10.2	<1	1363.33	1344.16	10.97	<1	<1
LP2-OL-22W	<10	4.42	646	17.33	<1	2020	1935.35	78.63	<1	<1
LP2-OL-23W	<10	6.43	447.33	12.67	<1	1380	1340.17	<1	<1	<1
LP2-OL-24W	<10	9.35	371.67	8.85	<1	1160	1113.48	67.53	<1	<1
LP2-OL-25W	17.9	24.91	736.67	16.1	<1	2273.33	2206.98	<1	<1	<1

Exhibit F-1. Measurements by Analyte, Instrument, and Block in Analytical Sequence

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

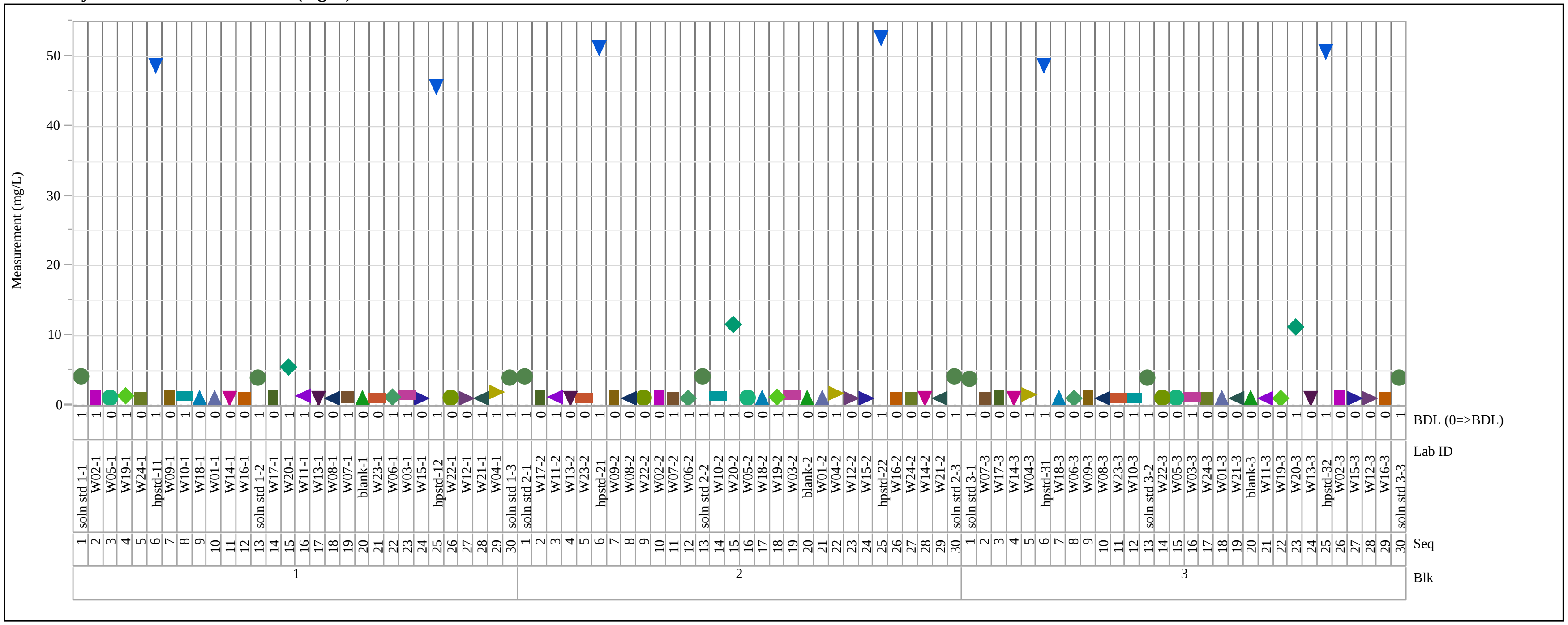


Exhibit F-1. Measurements by Analyte, Instrument, and Block in Analytical Sequence (continued)

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

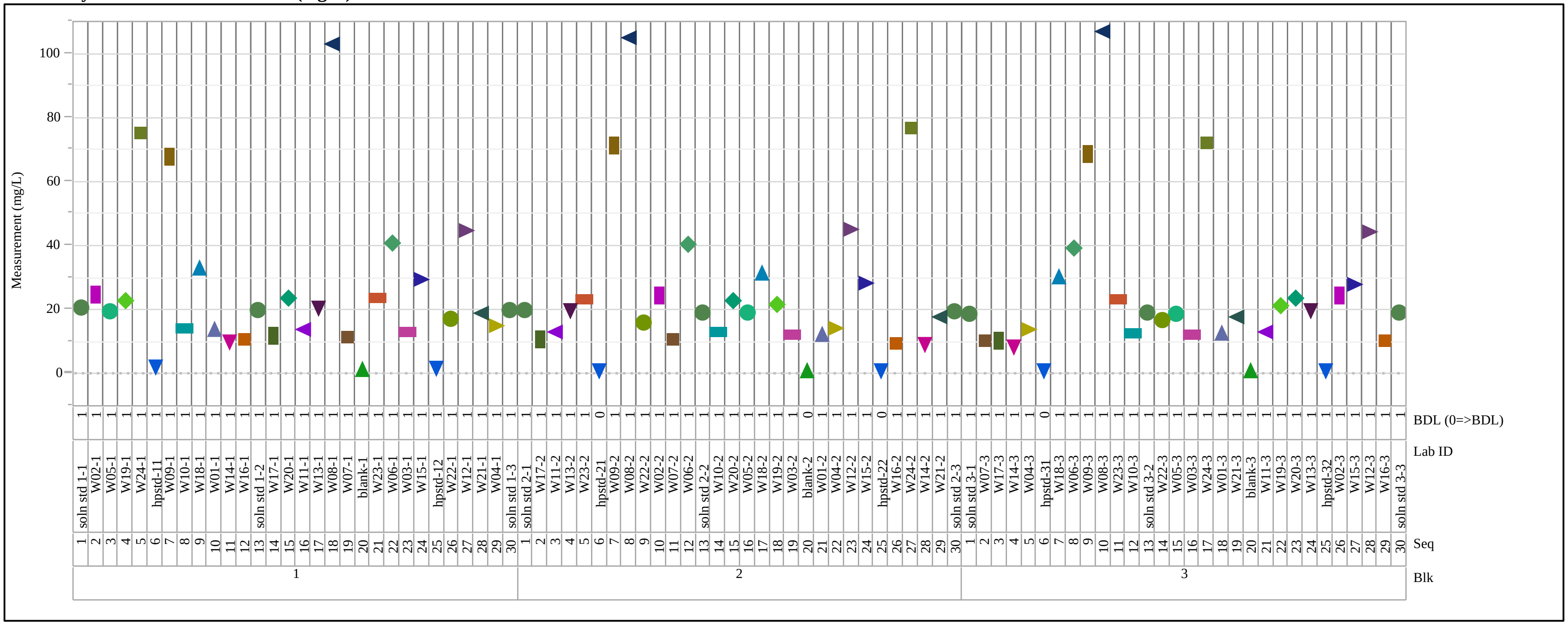


Exhibit F-1. Measurements by Analyte, Instrument, and Block in Analytical Sequence (continued)

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

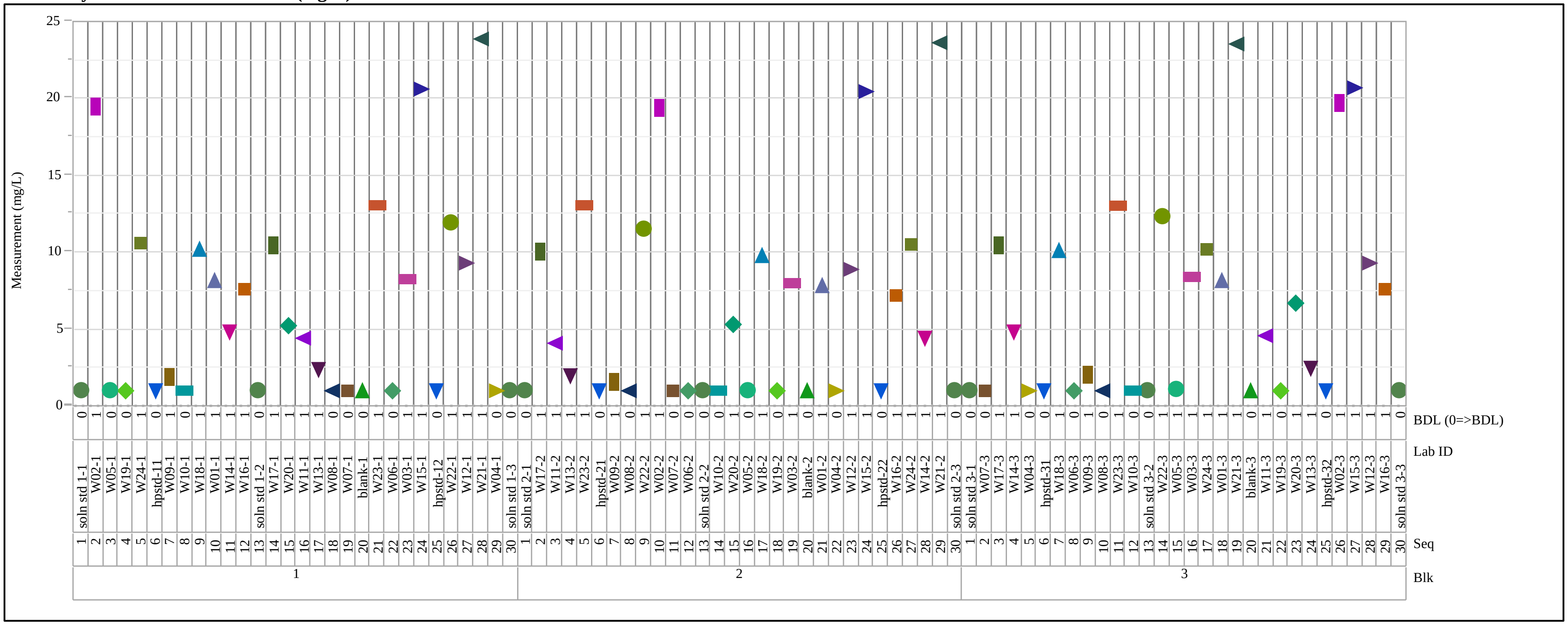


Exhibit F-1. Measurements by Analyte, Instrument, and Block in Analytical Sequence (continued)

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

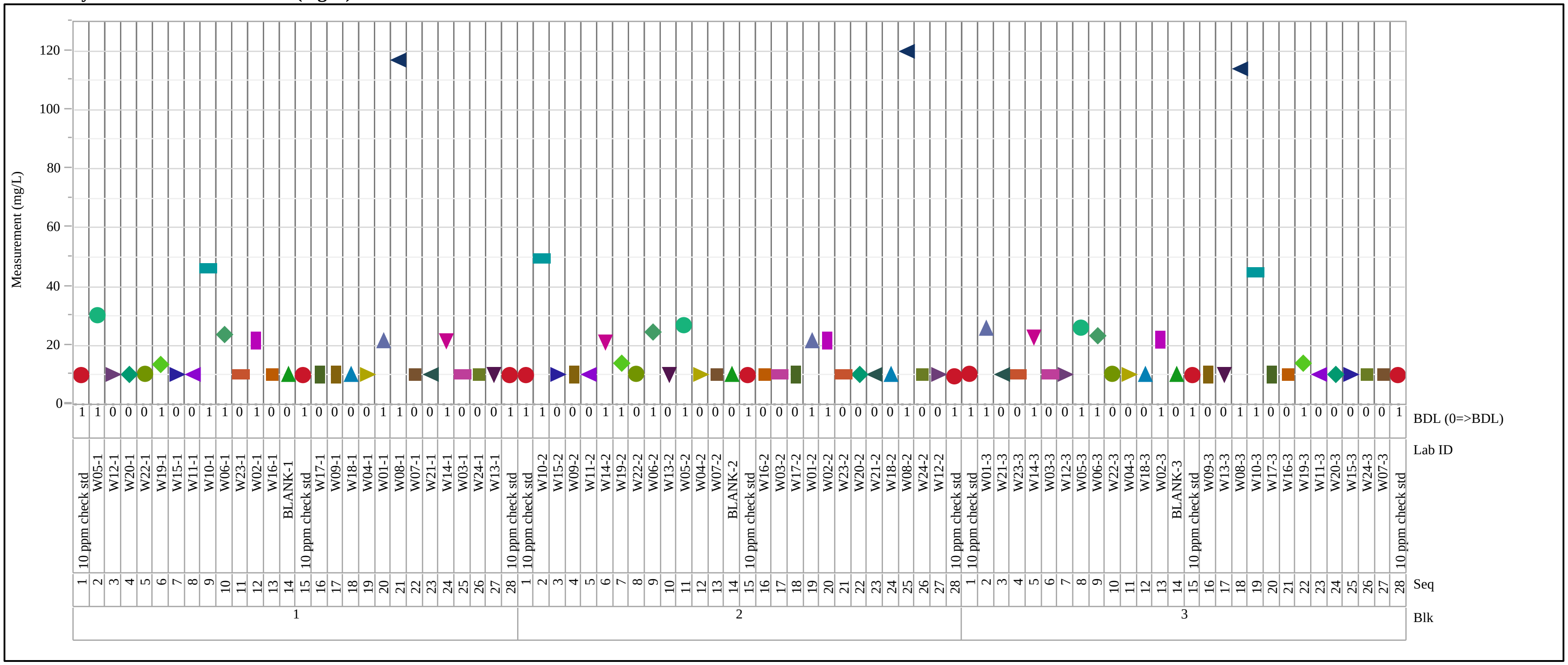


Exhibit F-1. Measurements by Analyte, Instrument, and Block in Analytical Sequence (continued)

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

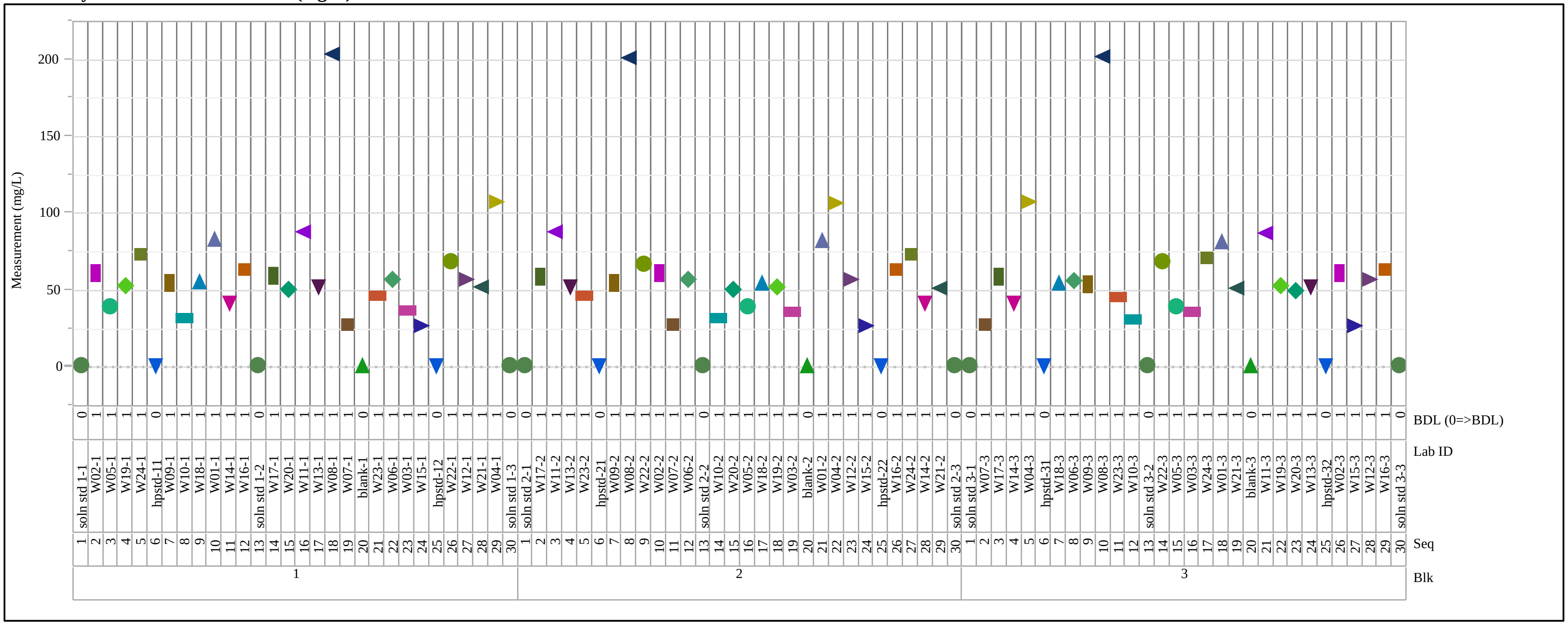


Exhibit F-1. Measurements by Analyte, Instrument, and Block in Analytical Sequence (continued)

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

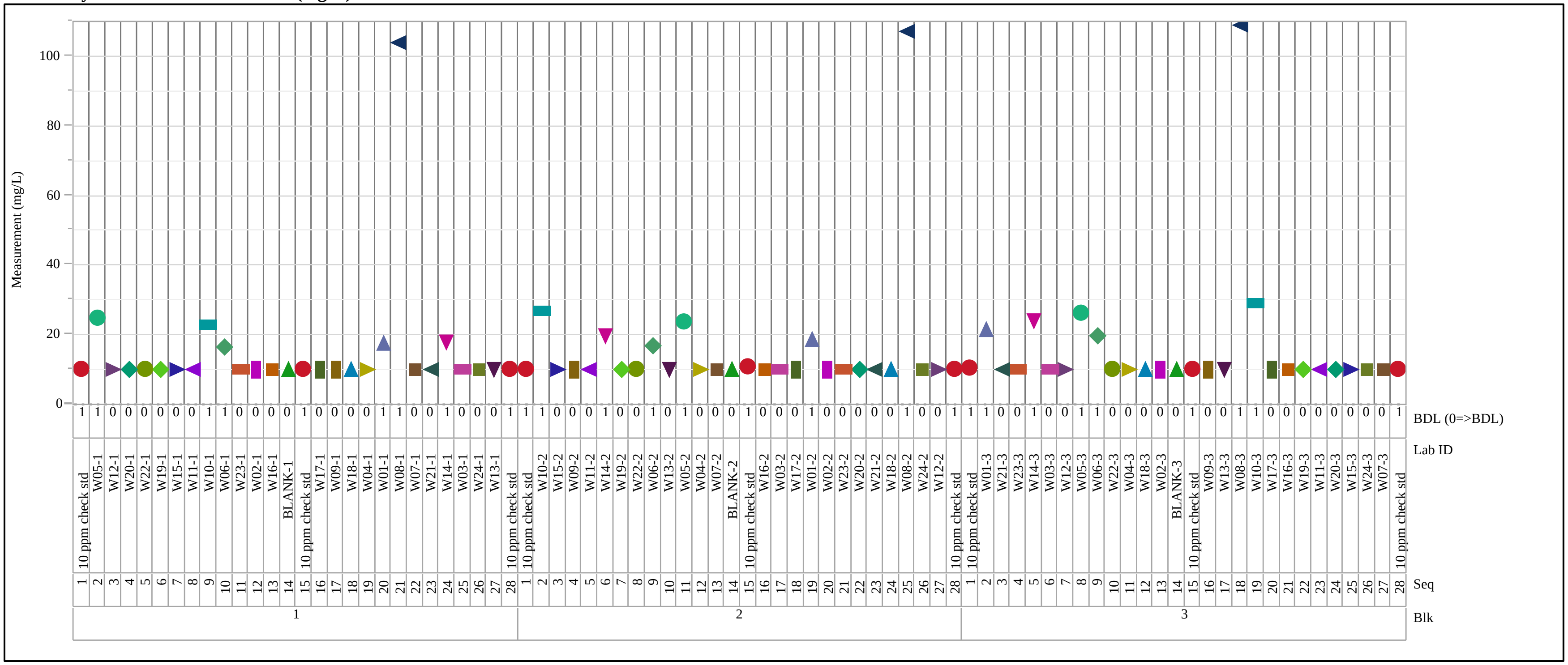


Exhibit F-1. Measurements by Analyte, Instrument, and Block in Analytical Sequence (continued)

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

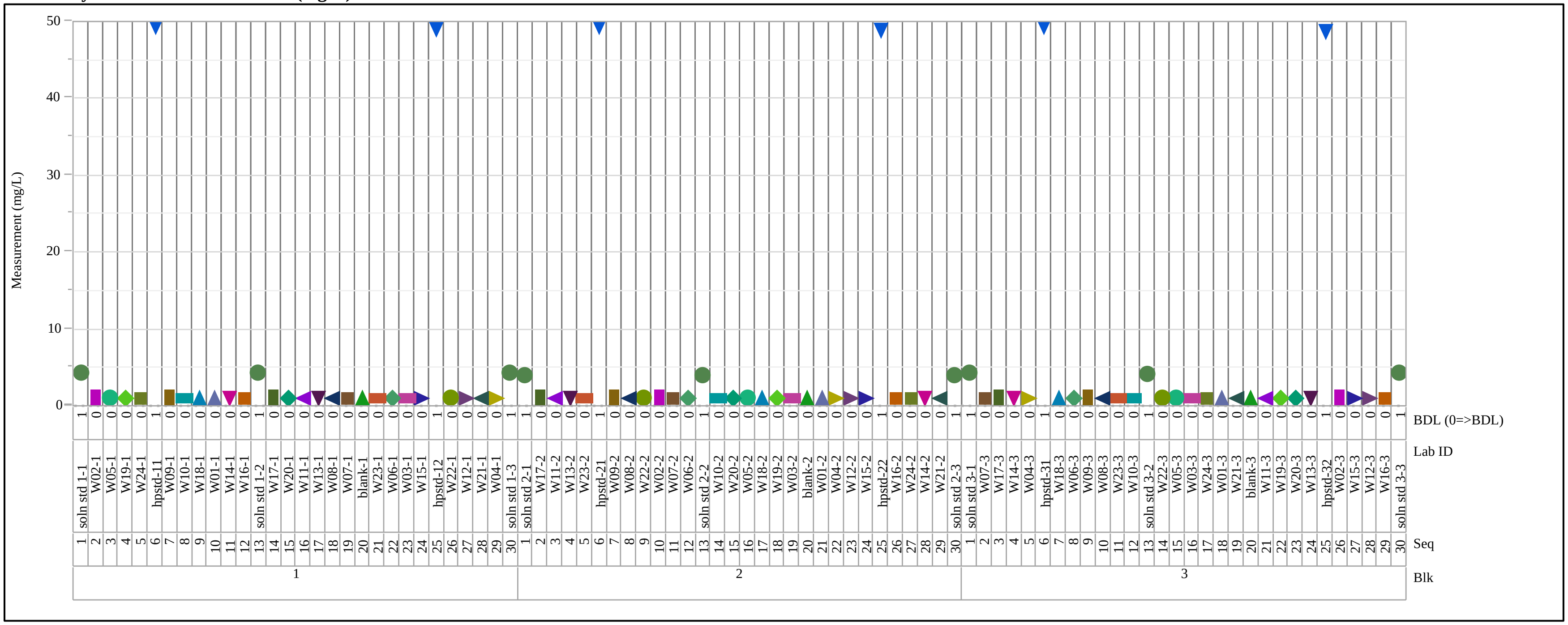


Exhibit F-1. Measurements by Analyte, Instrument, and Block in Analytical Sequence (continued)

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

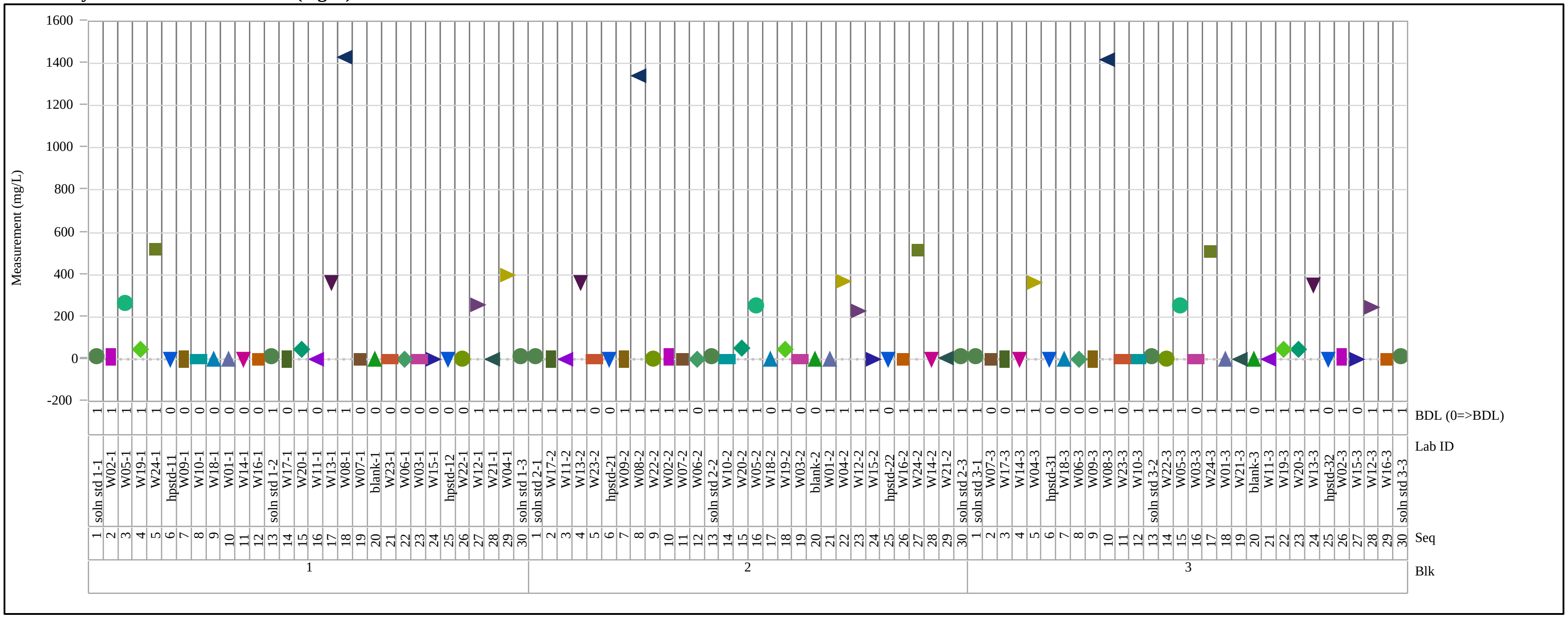


Exhibit F-1. Measurements by Analyte, Instrument, and Block in Analytical Sequence (continued)

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

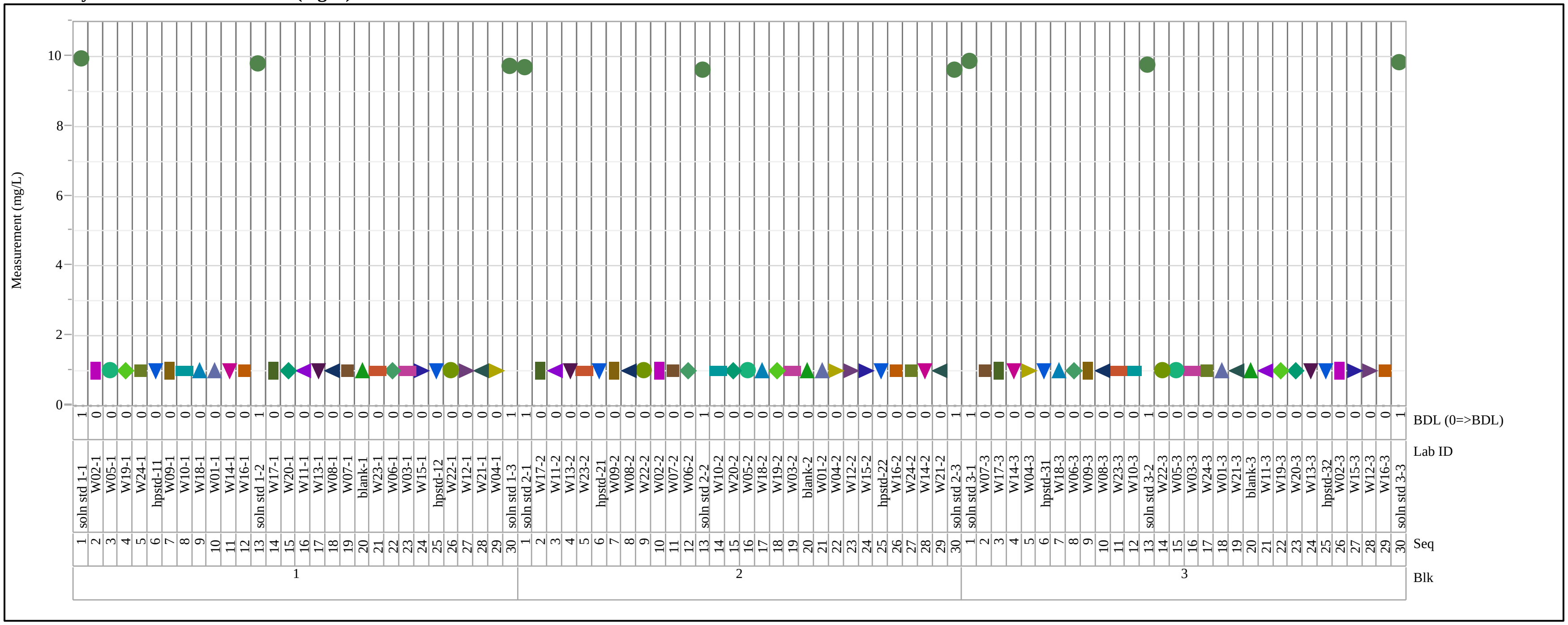


Exhibit F-1. Measurements by Analyte, Instrument, and Block in Analytical Sequence (continued)

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

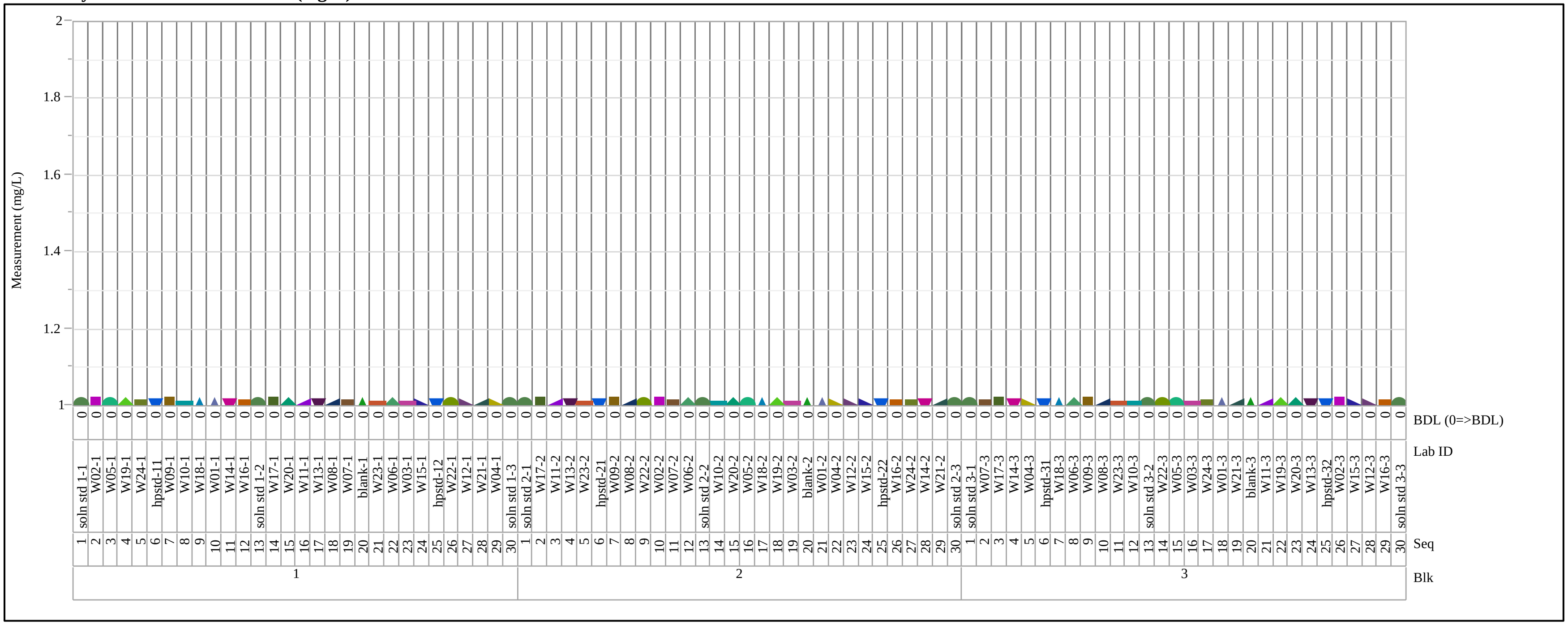


Exhibit F-1. Measurements by Analyte, Instrument, and Block in Analytical Sequence (continued)

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

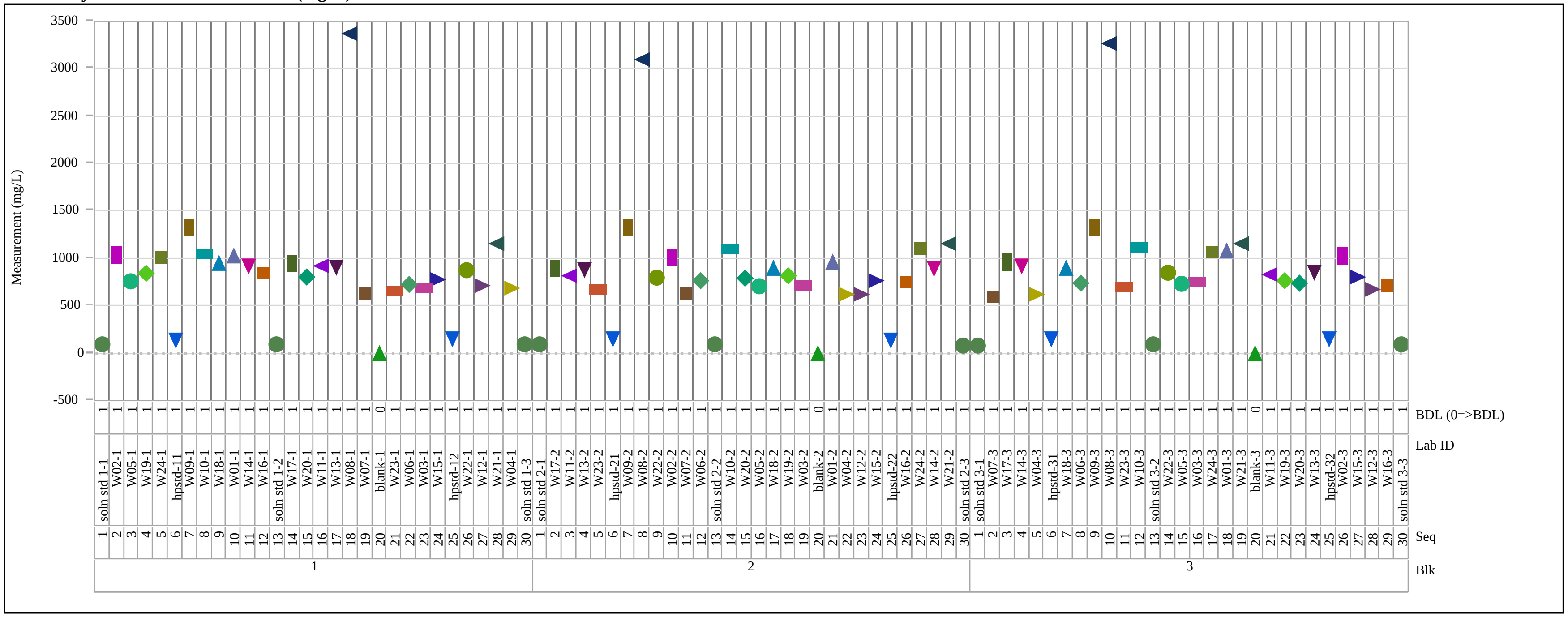


Exhibit F-1. Measurements by Analyte, Instrument, and Block in Analytical Sequence (continued)

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

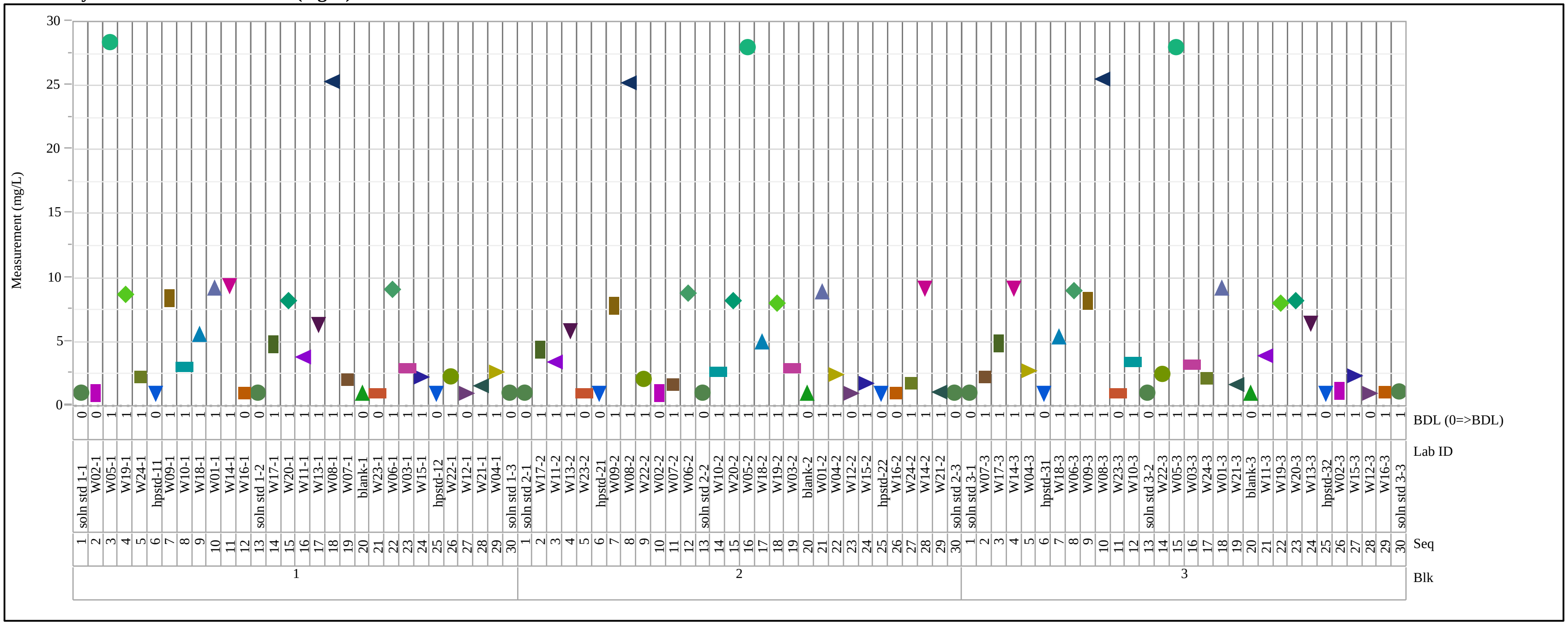


Exhibit F-1. Measurements by Analyte, Instrument, and Block in Analytical Sequence (continued)

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

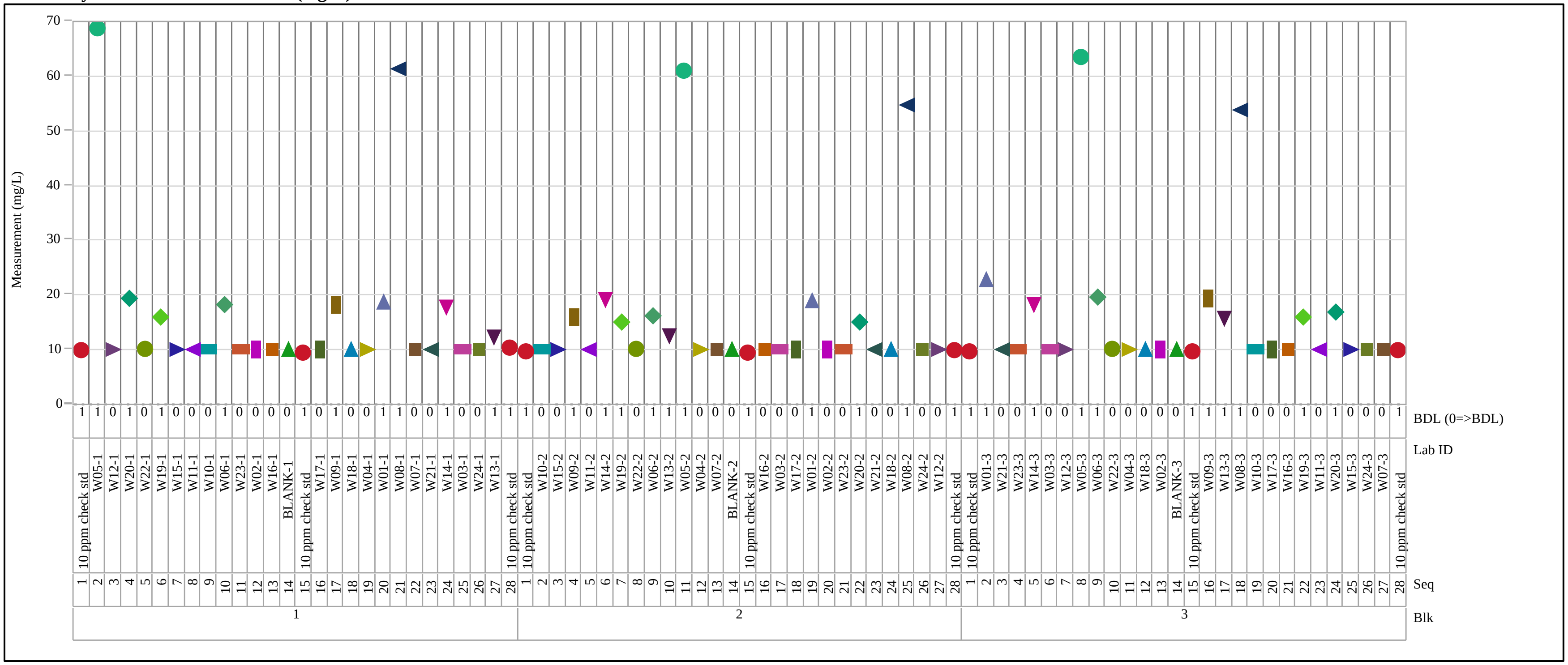


Exhibit F-1. Measurements by Analyte, Instrument, and Block in Analytical Sequence (continued)

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

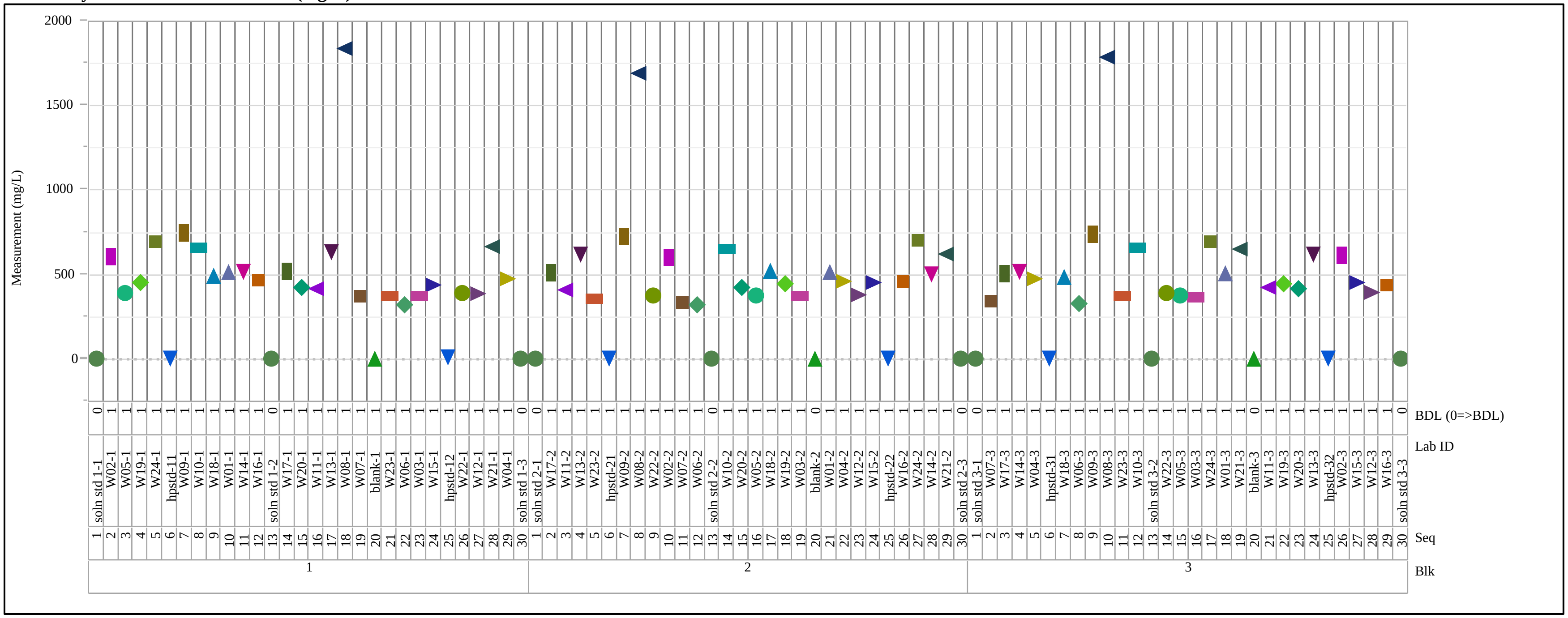


Exhibit F-1. Measurements by Analyte, Instrument, and Block in Analytical Sequence (continued)

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

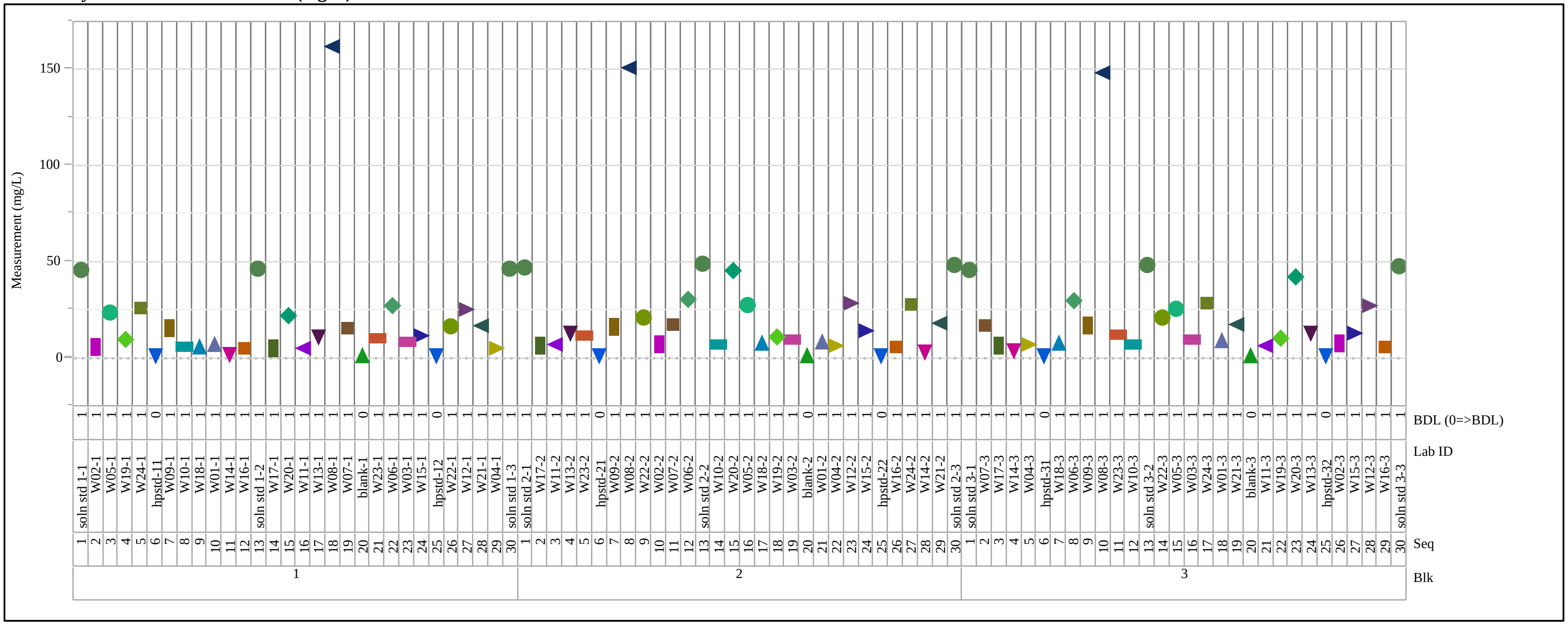


Exhibit F-1. Measurements by Analyte, Instrument, and Block in Analytical Sequence (continued)

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

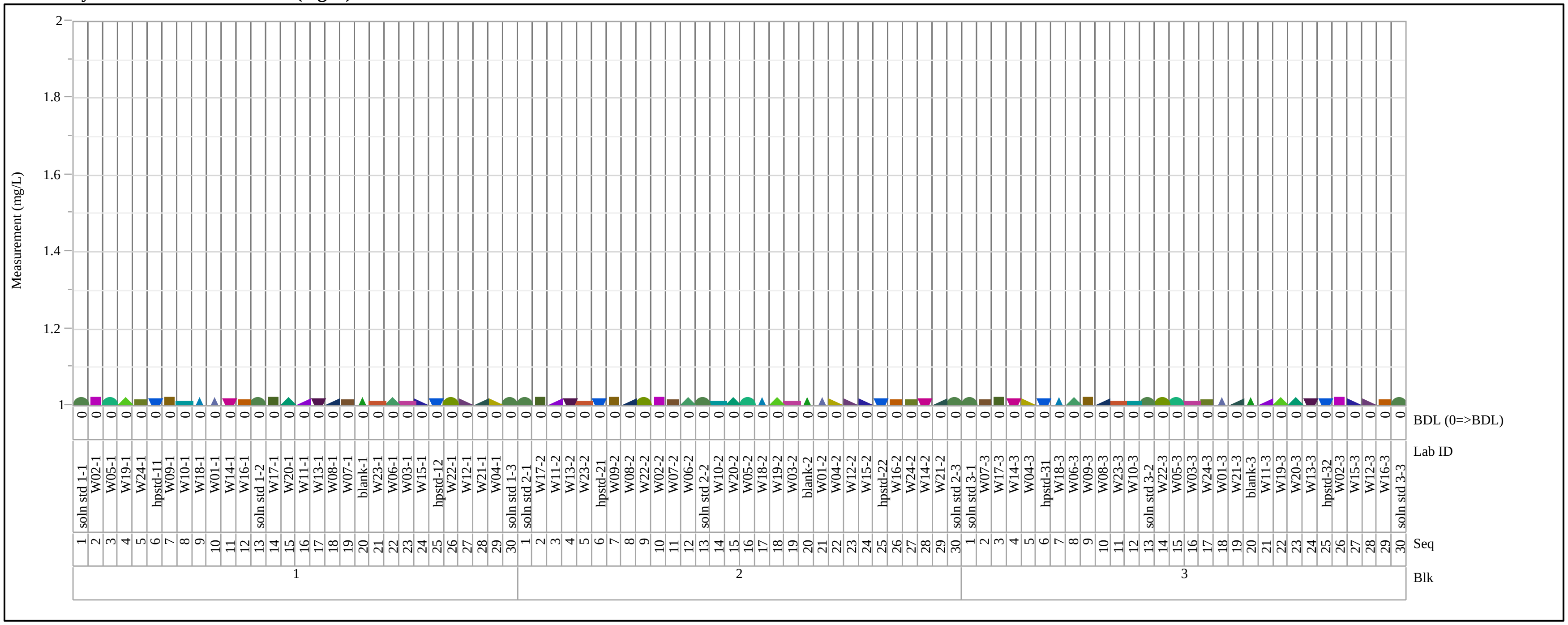


Exhibit F-1. Measurements by Analyte, Instrument, and Block in Analytical Sequence (continued)

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

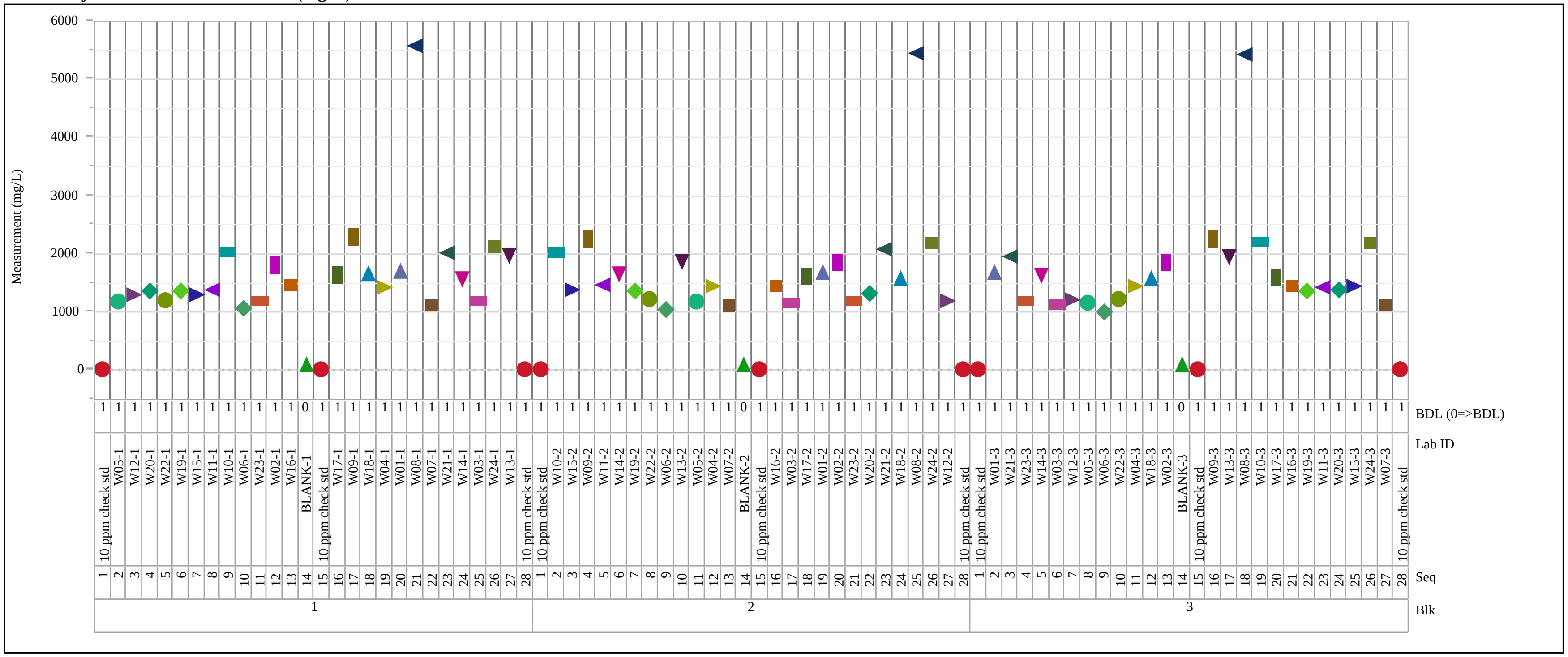


Exhibit F-1. Measurements by Analyte, Instrument, and Block in Analytical Sequence (continued)

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

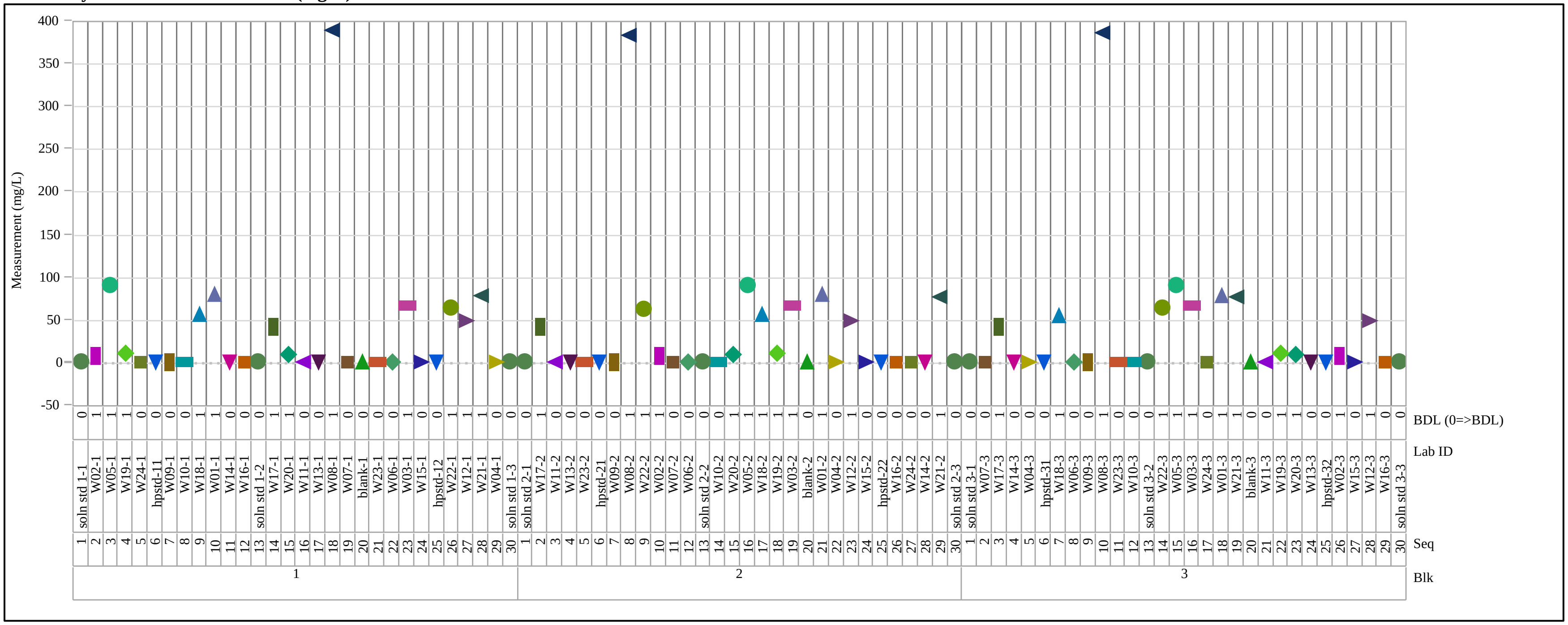


Exhibit F-1. Measurements by Analyte, Instrument, and Block in Analytical Sequence (continued)

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

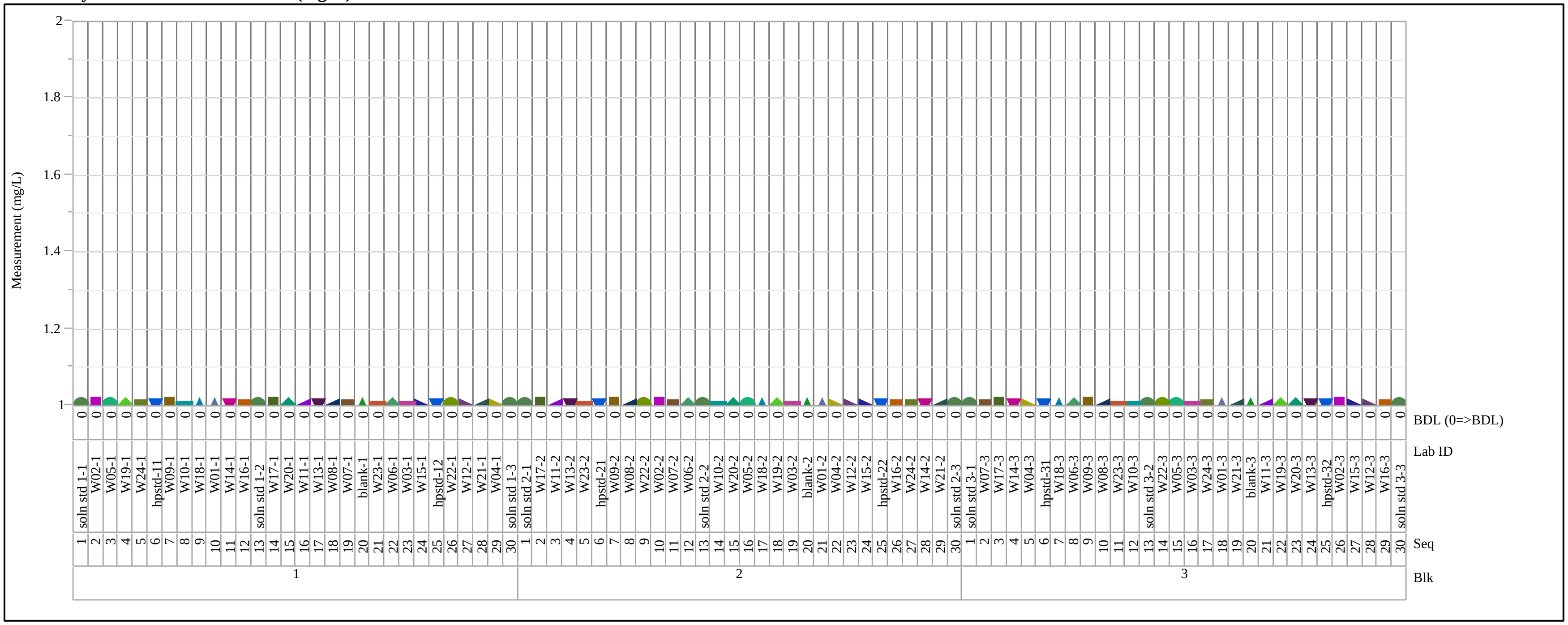


Exhibit F-1. Measurements by Analyte, Instrument, and Block in Analytical Sequence (continued)

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

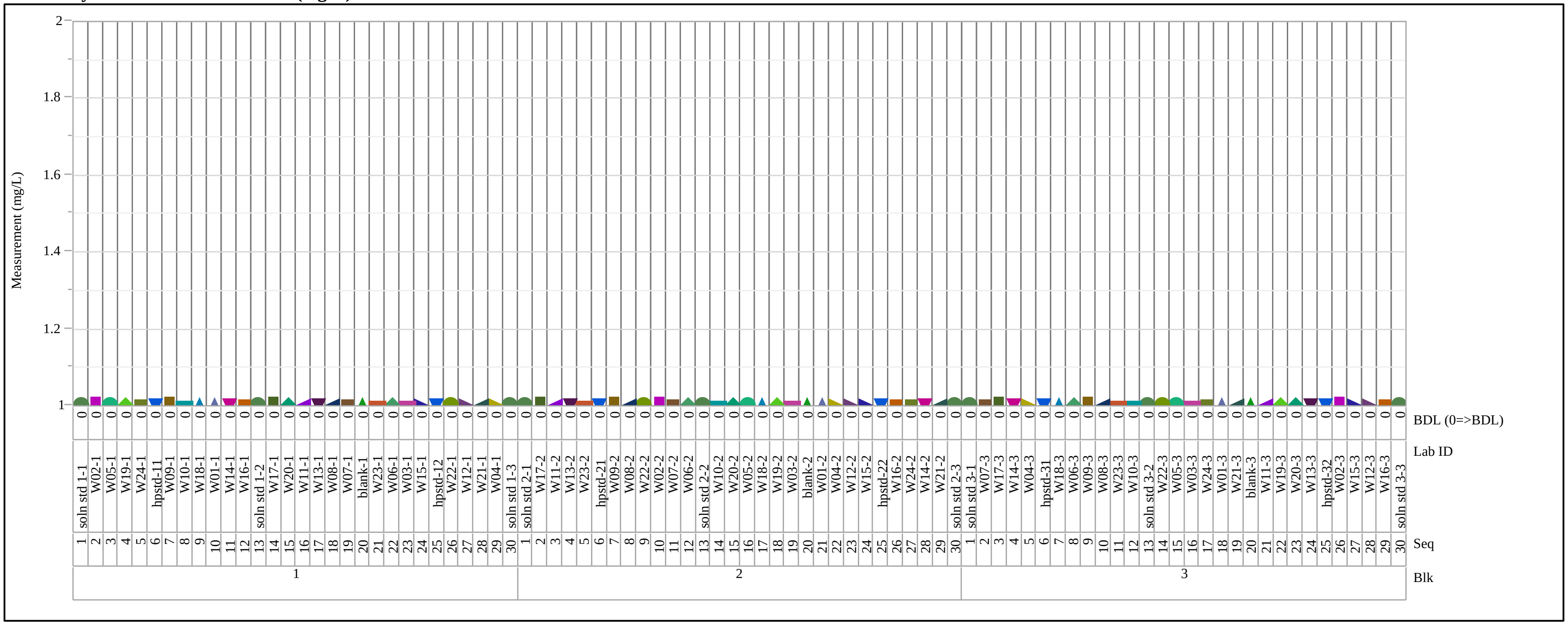


Exhibit F-2. Analysis of Wash Solutions by Solution Identifier

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

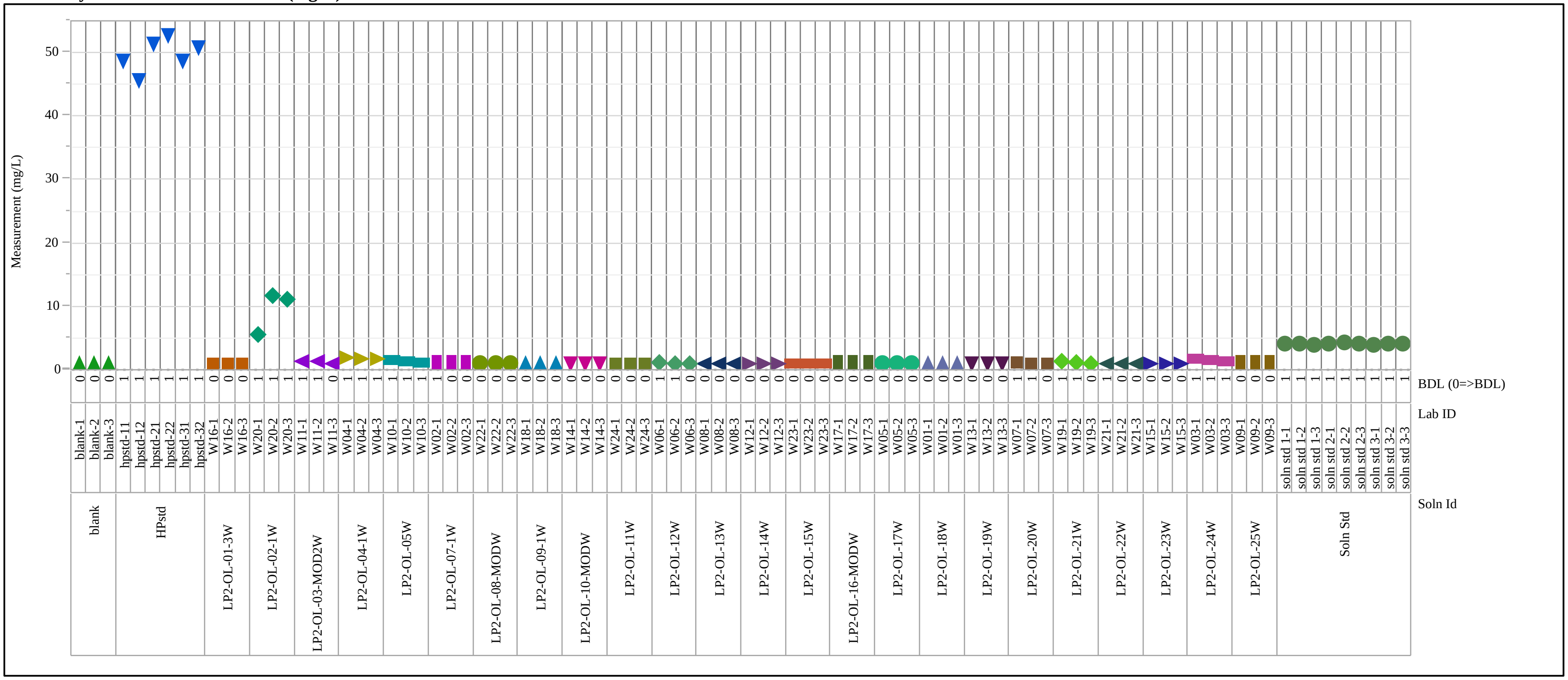


Exhibit F-2. Analysis of Wash Solutions by Solution Identifier (continued)

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

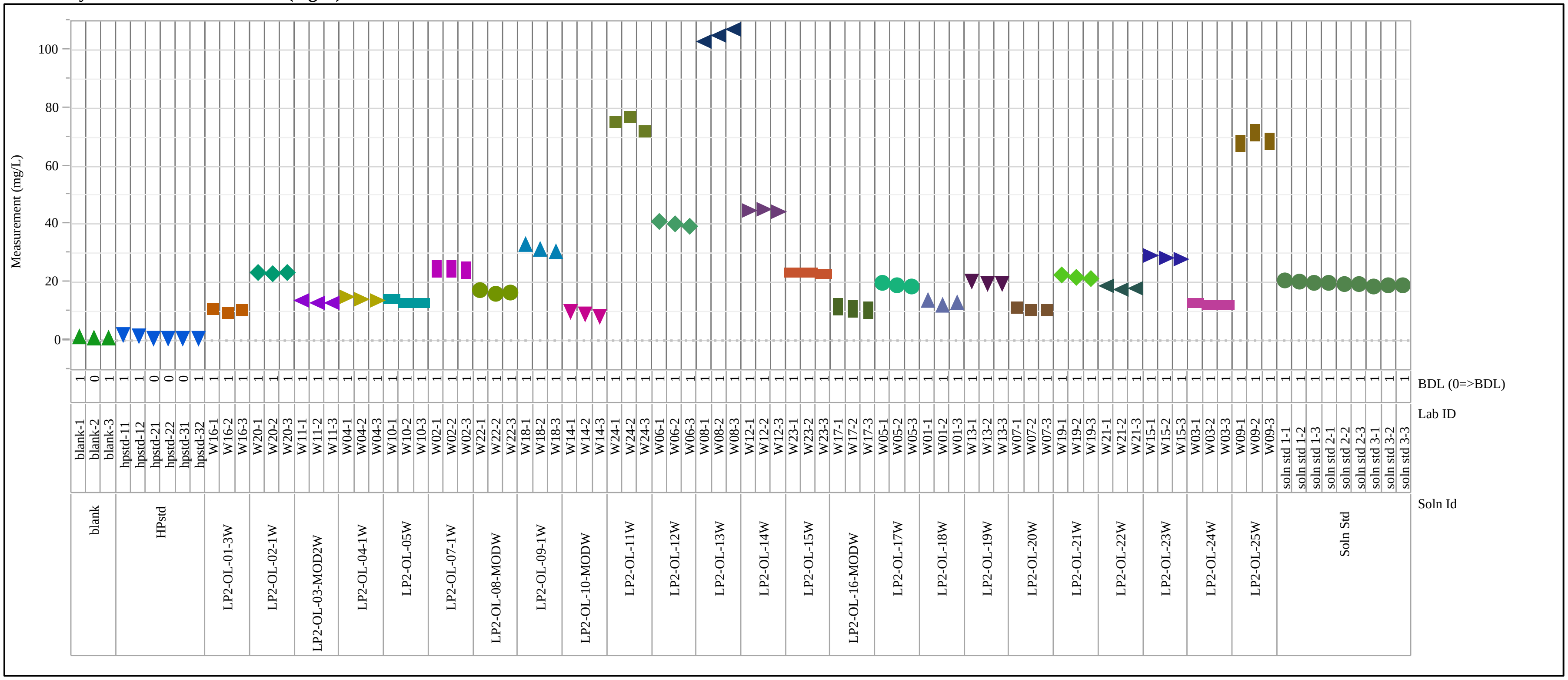


Exhibit F-2. Analysis of Wash Solutions by Solution Identifier (continued)

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

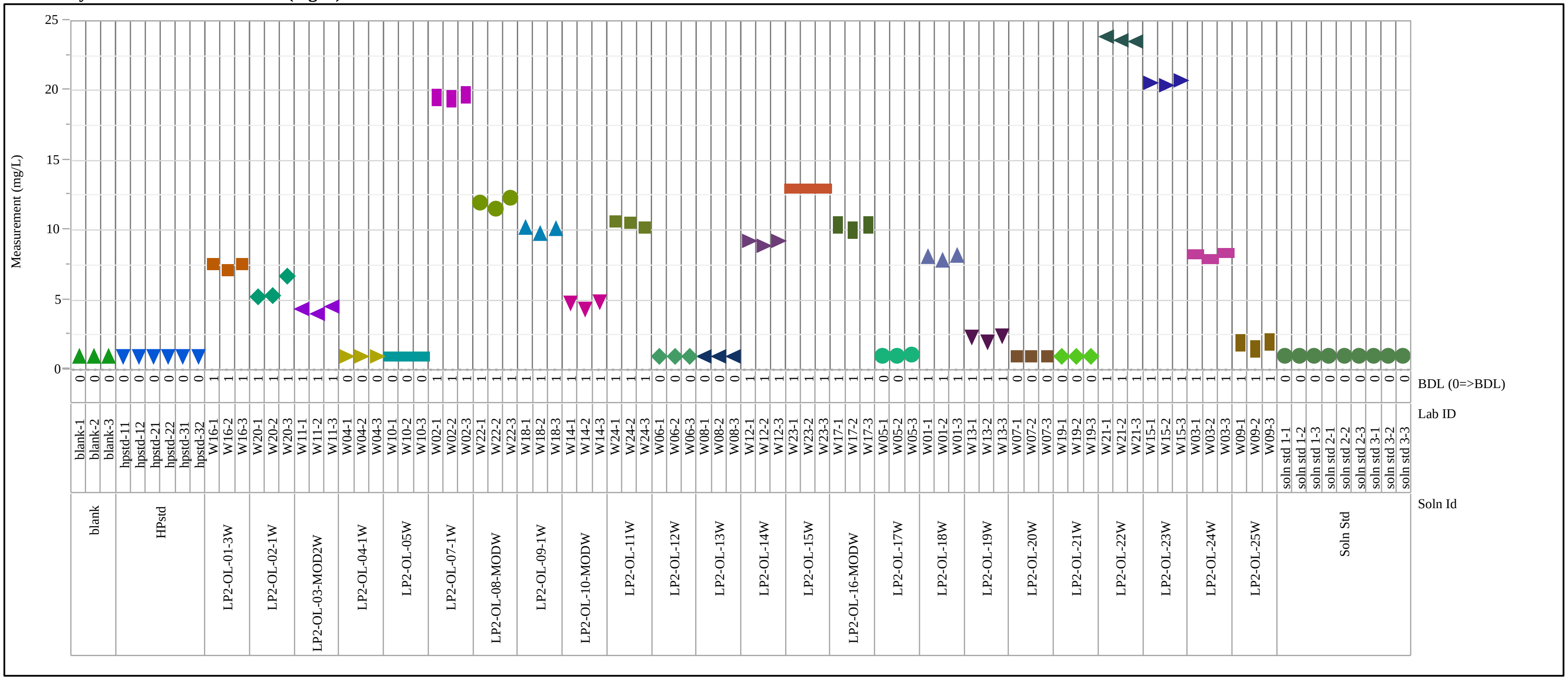


Exhibit F-2. Analysis of Wash Solutions by Solution Identifier (continued)

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

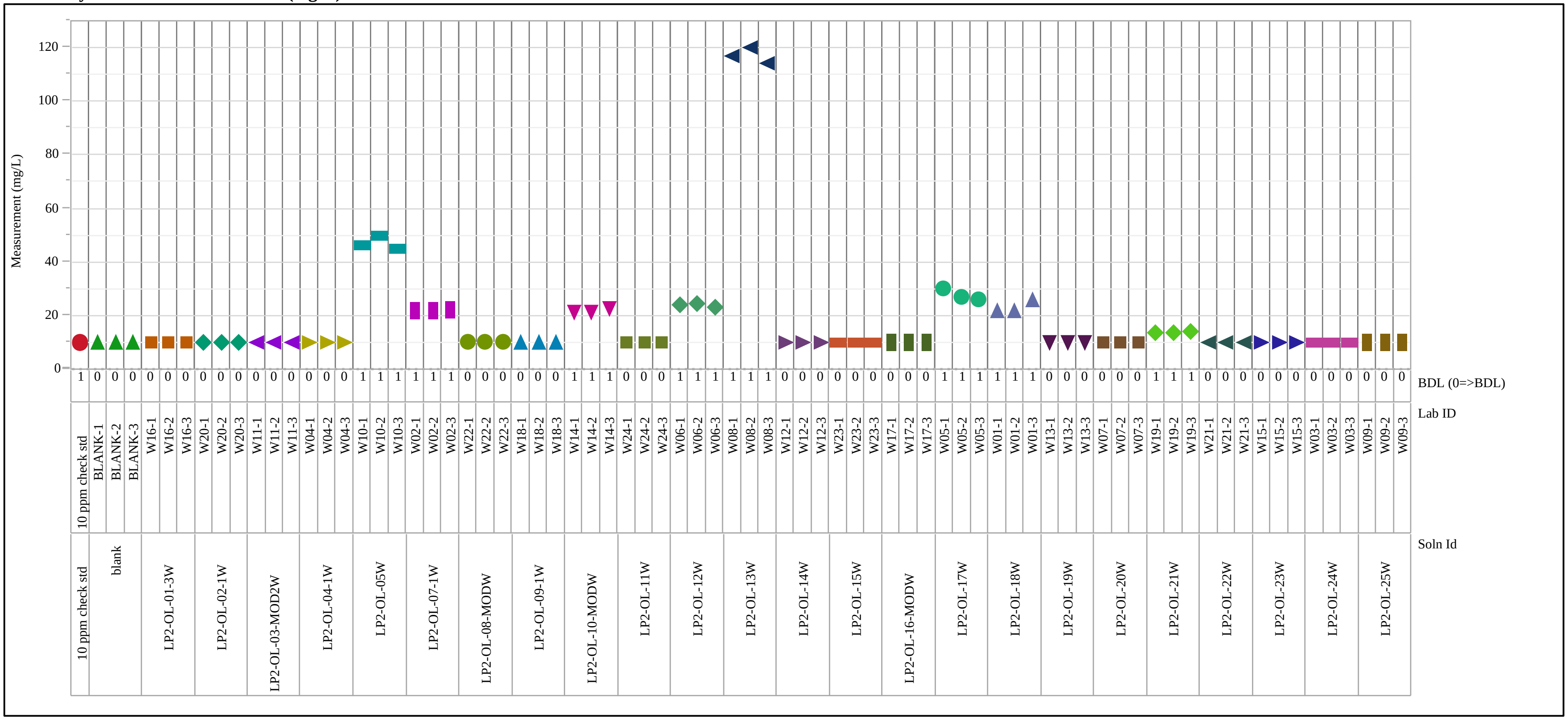


Exhibit F-2. Analysis of Wash Solutions by Solution Identifier (continued)

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

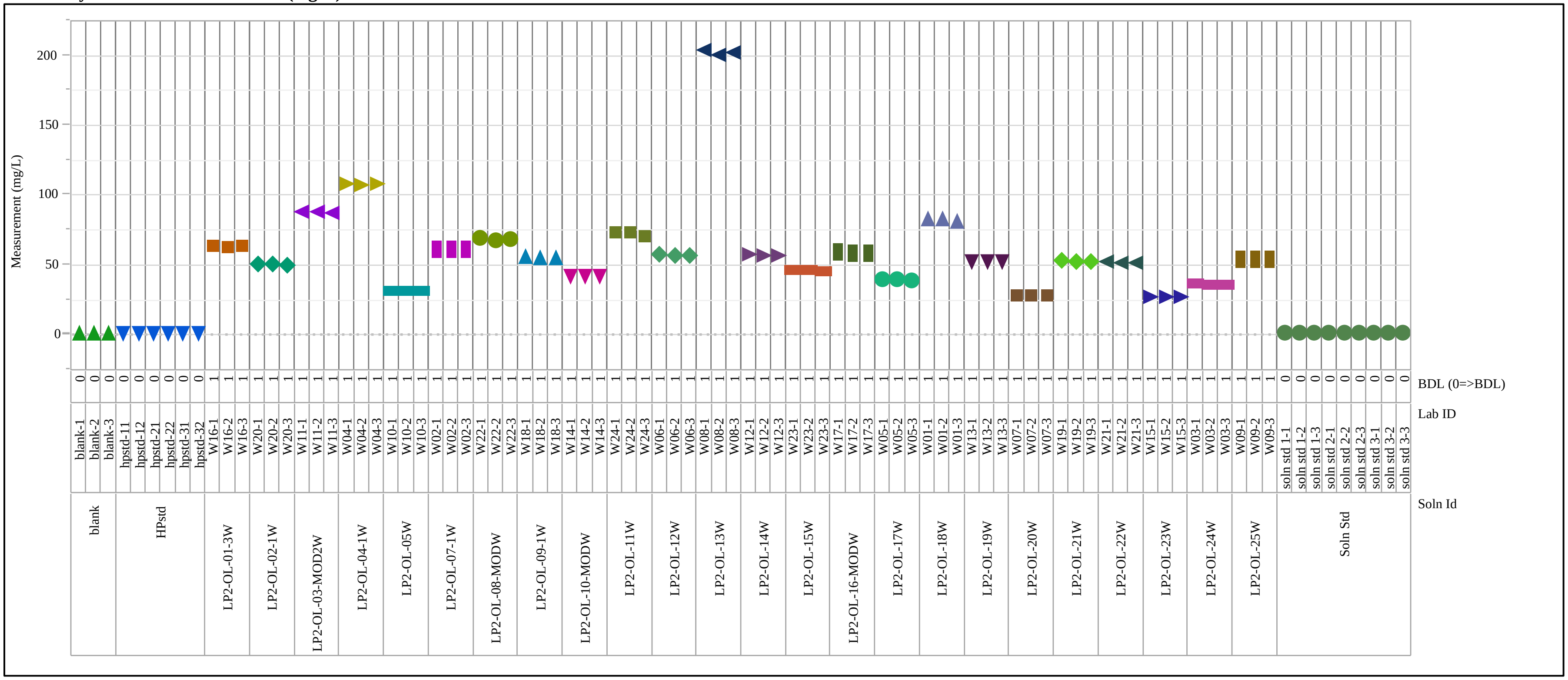


Exhibit F-2. Analysis of Wash Solutions by Solution Identifier (continued)

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

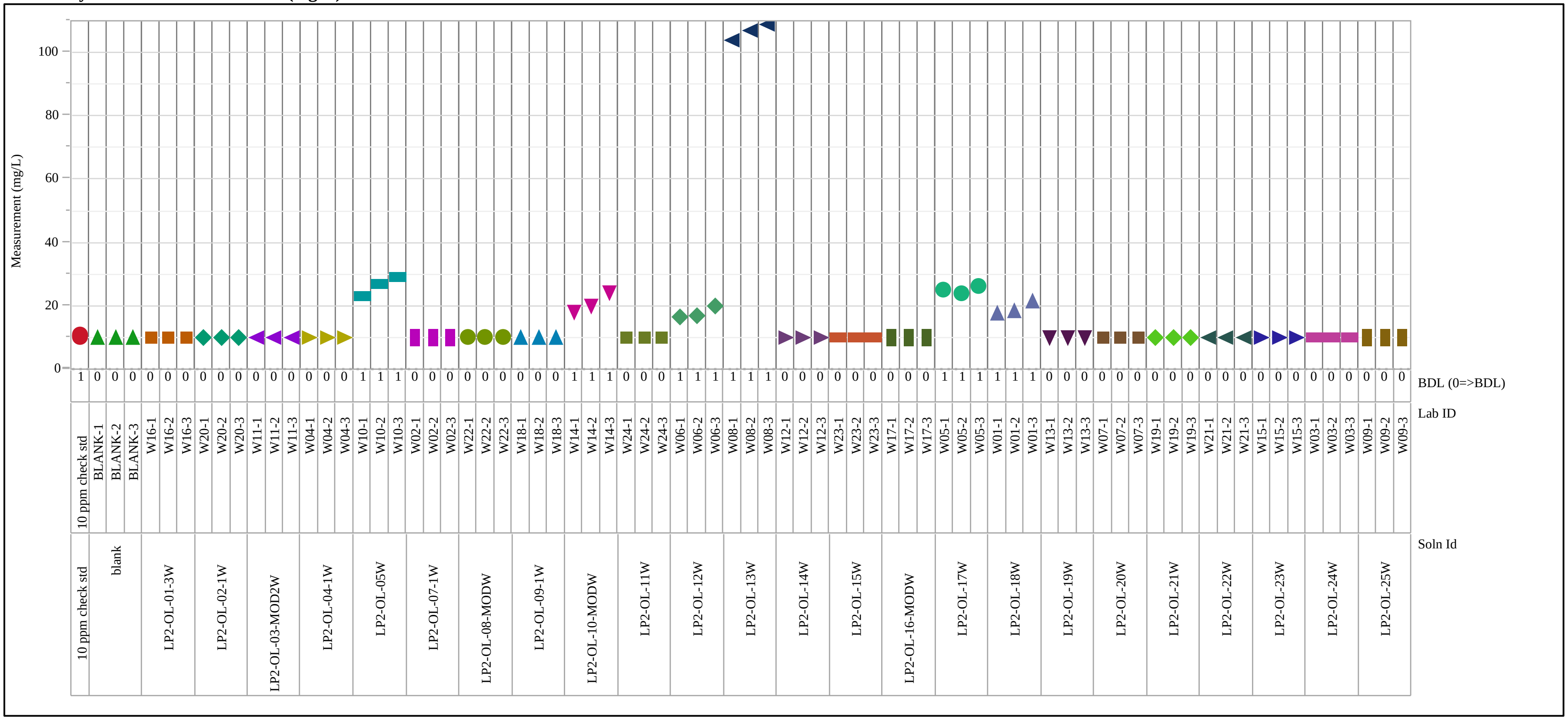


Exhibit F-2. Analysis of Wash Solutions by Solution Identifier (continued)

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

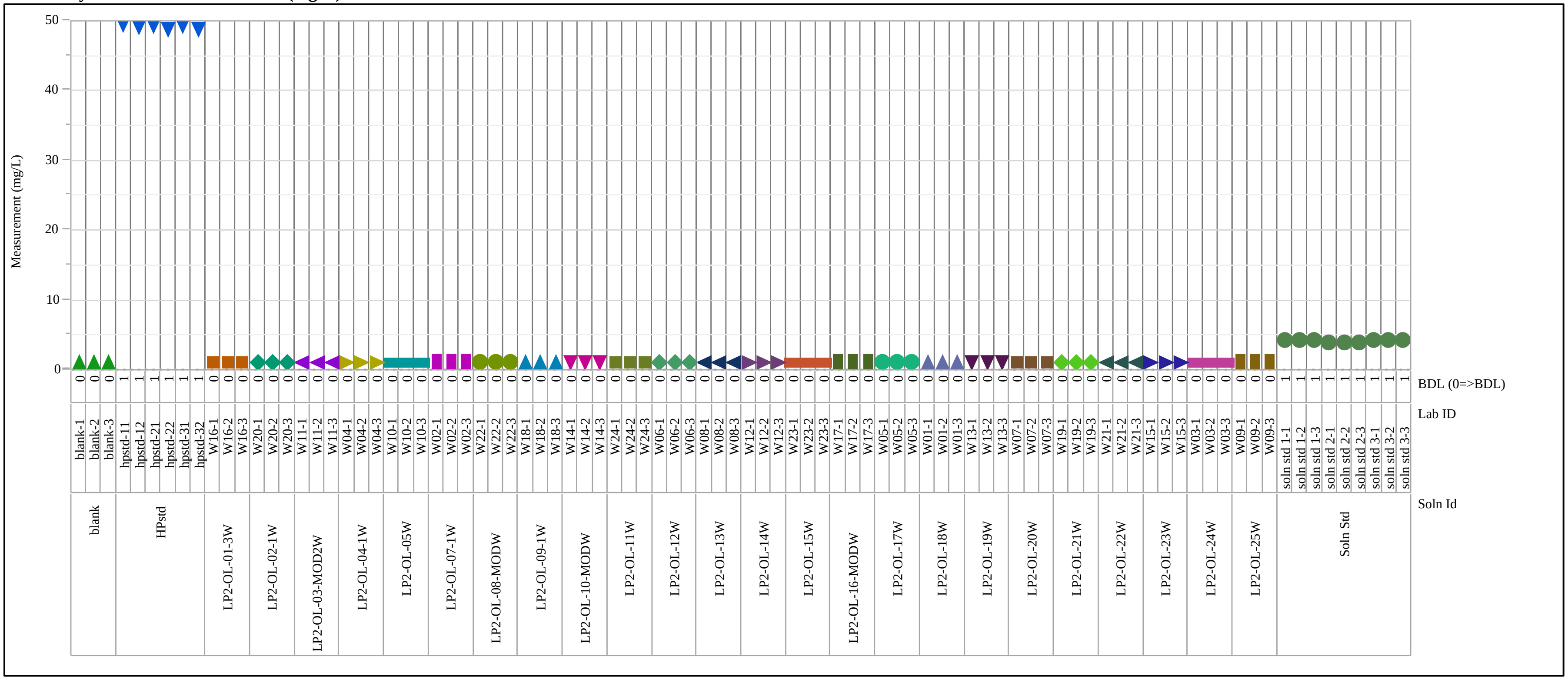


Exhibit F-2. Analysis of Wash Solutions by Solution Identifier (continued)

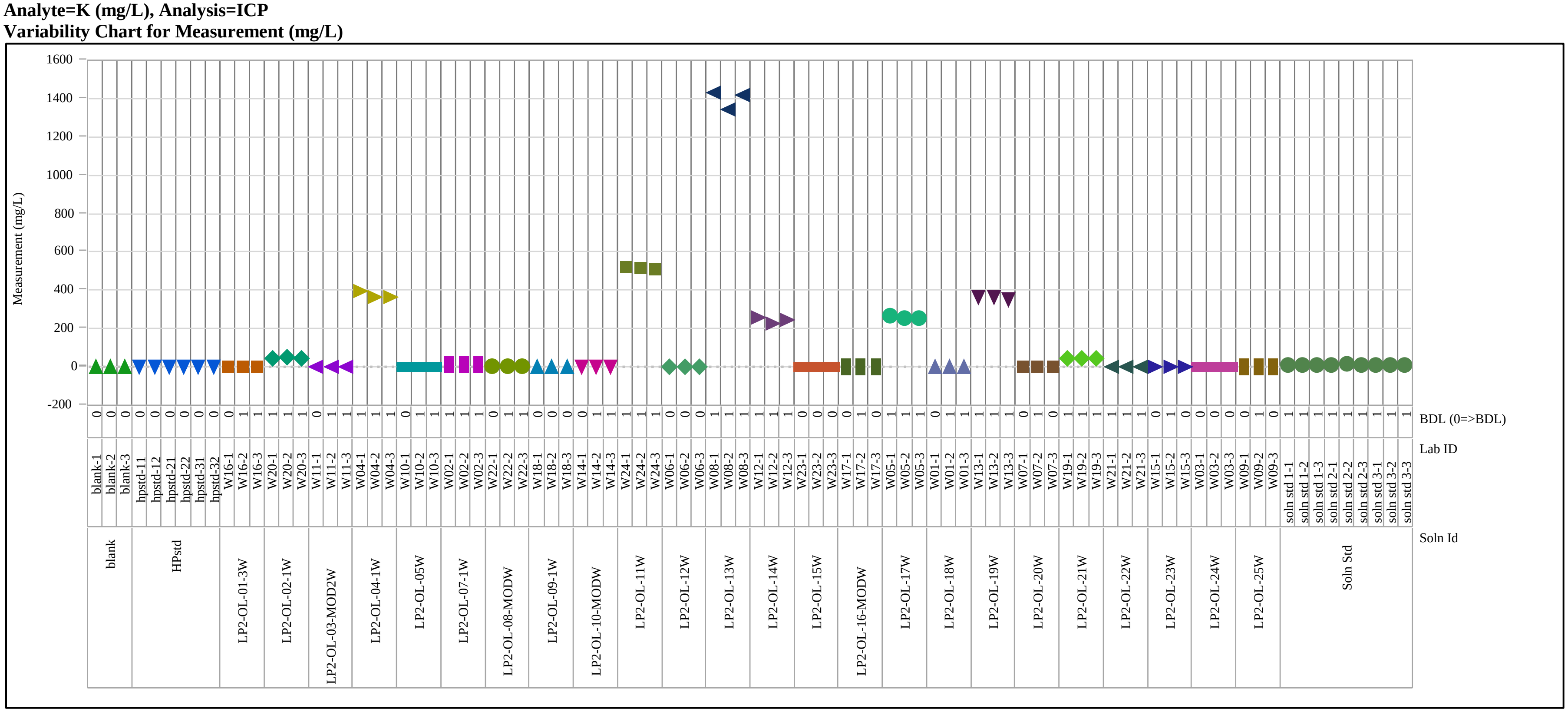


Exhibit F-2. Analysis of Wash Solutions by Solution Identifier (continued)

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

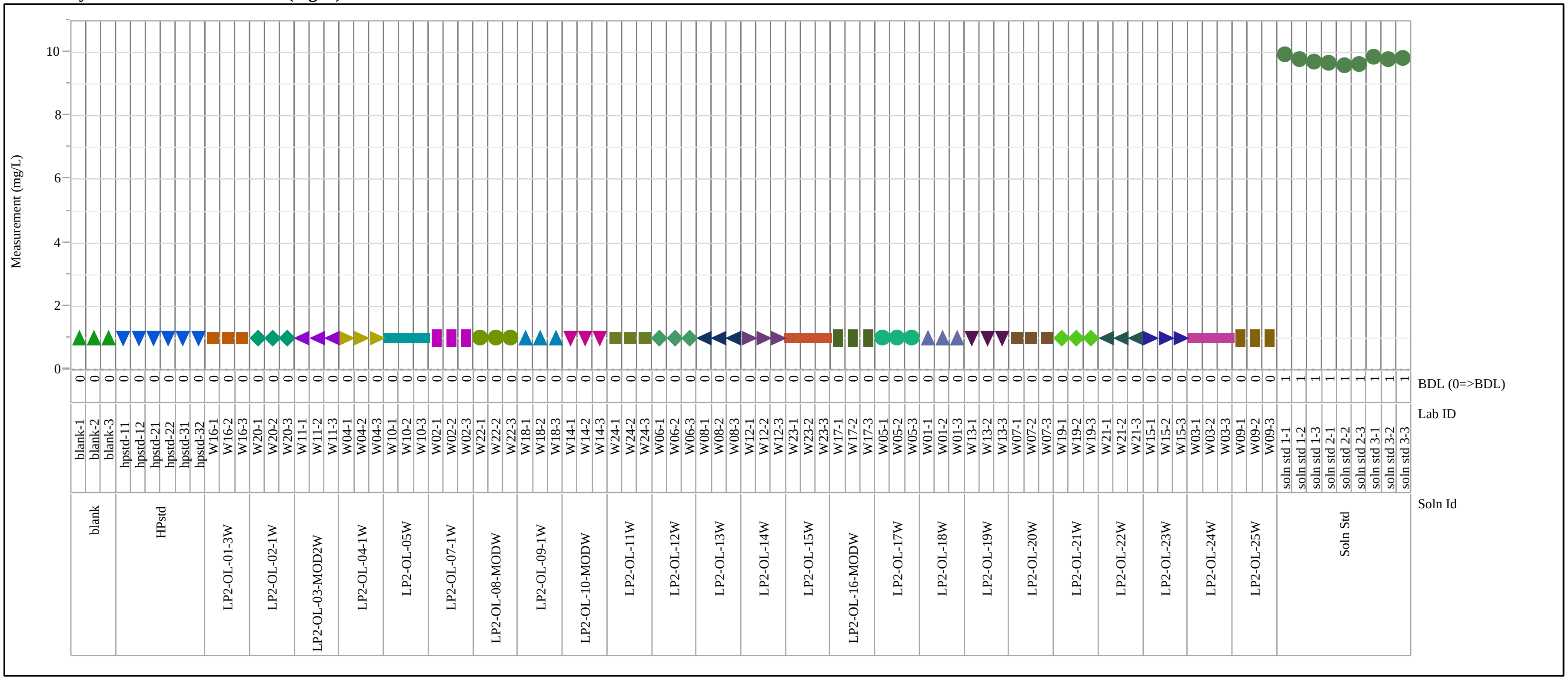


Exhibit F-2. Analysis of Wash Solutions by Solution Identifier (continued)

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

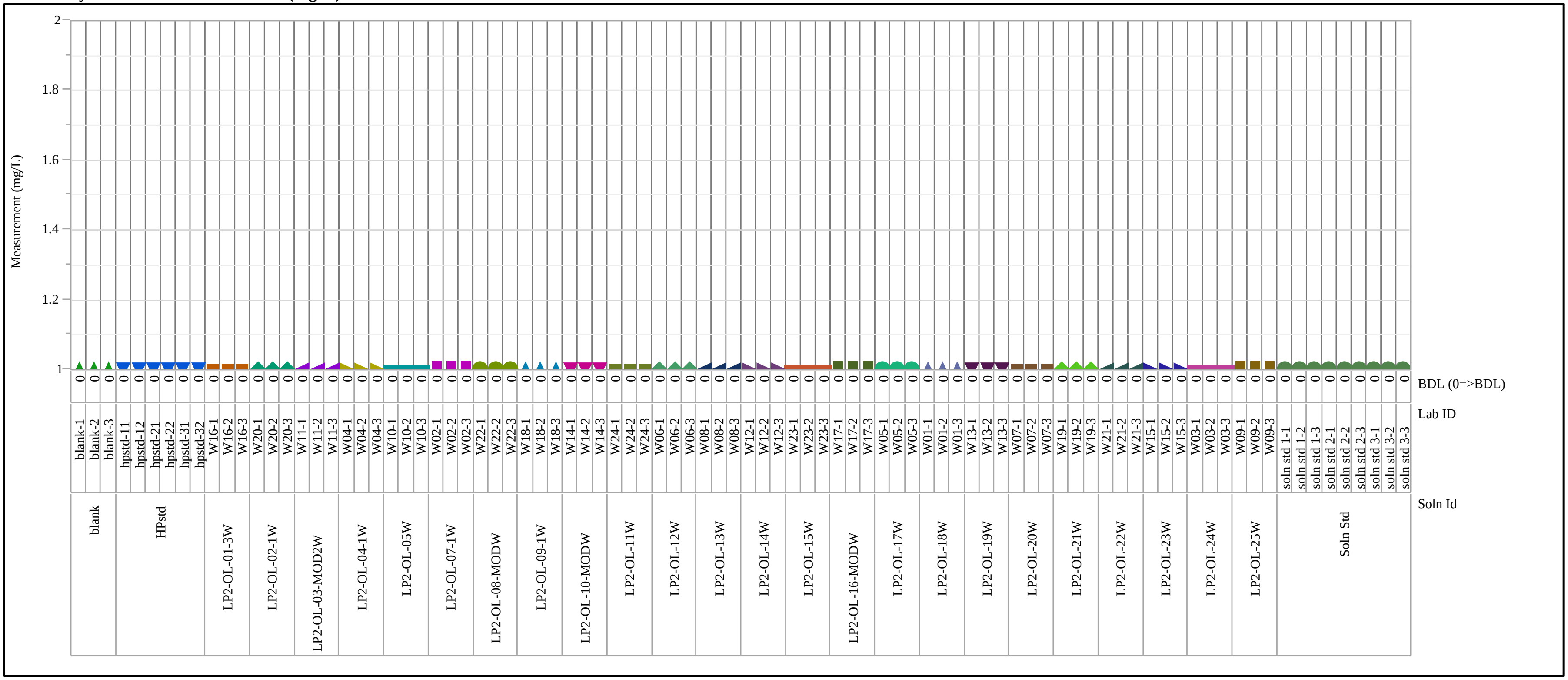


Exhibit F-2. Analysis of Wash Solutions by Solution Identifier (continued)

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

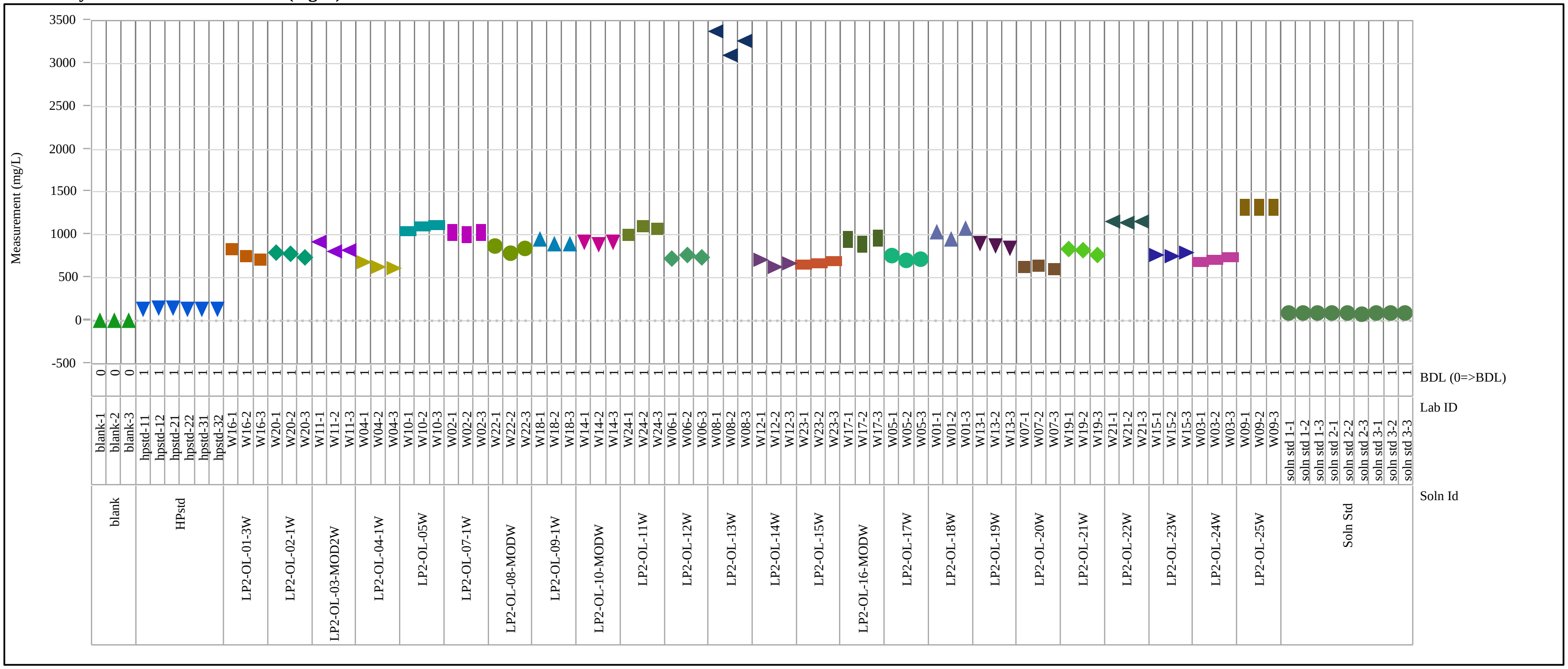


Exhibit F-2. Analysis of Wash Solutions by Solution Identifier (continued)

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

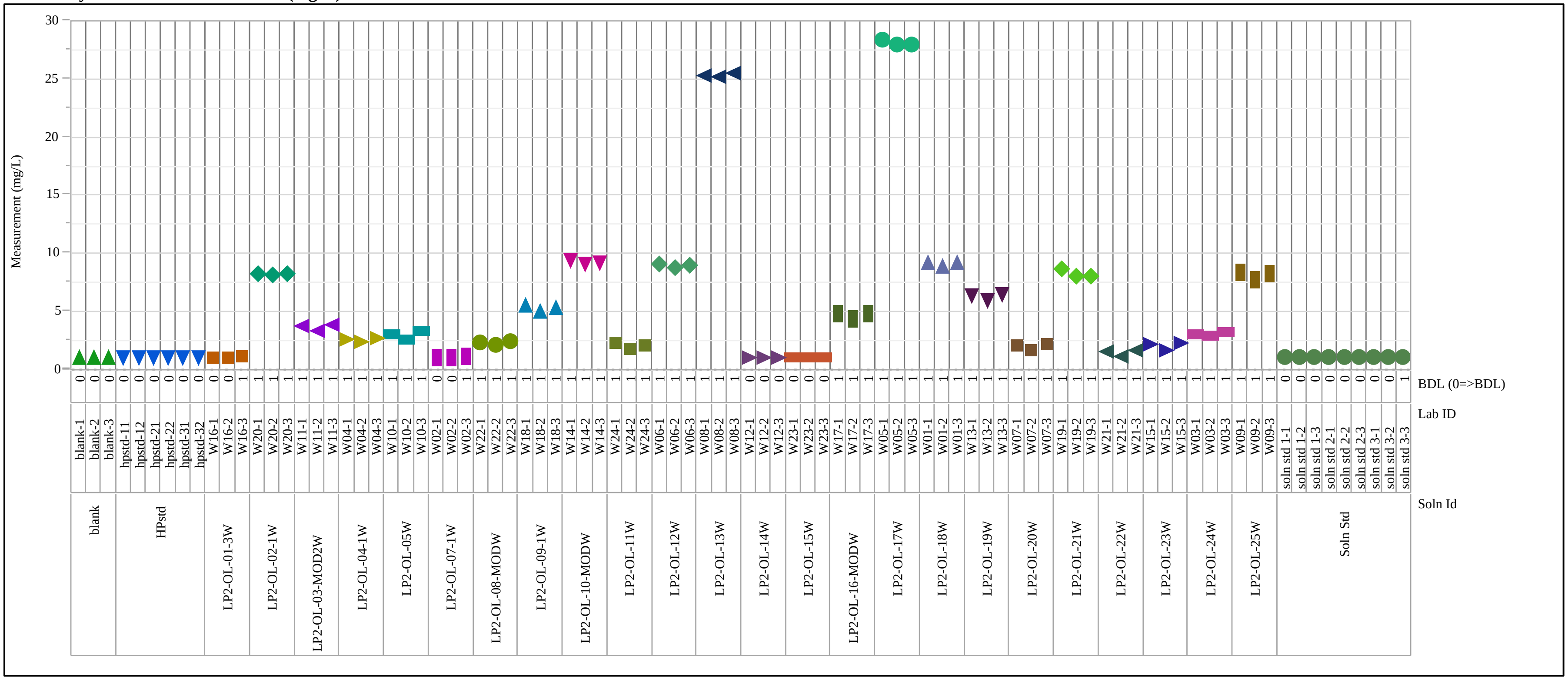


Exhibit F-2. Analysis of Wash Solutions by Solution Identifier (continued)

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

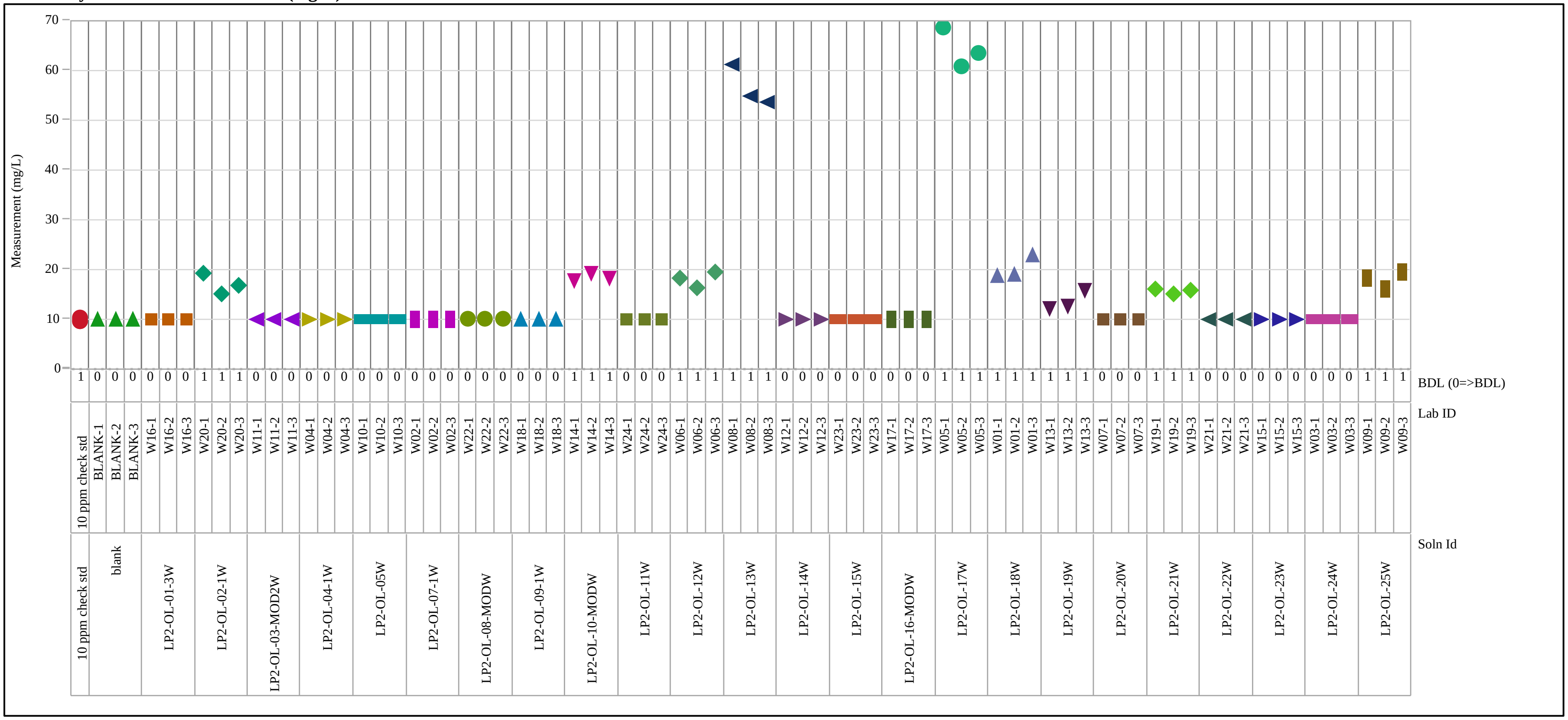


Exhibit F-2. Analysis of Wash Solutions by Solution Identifier (continued)

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

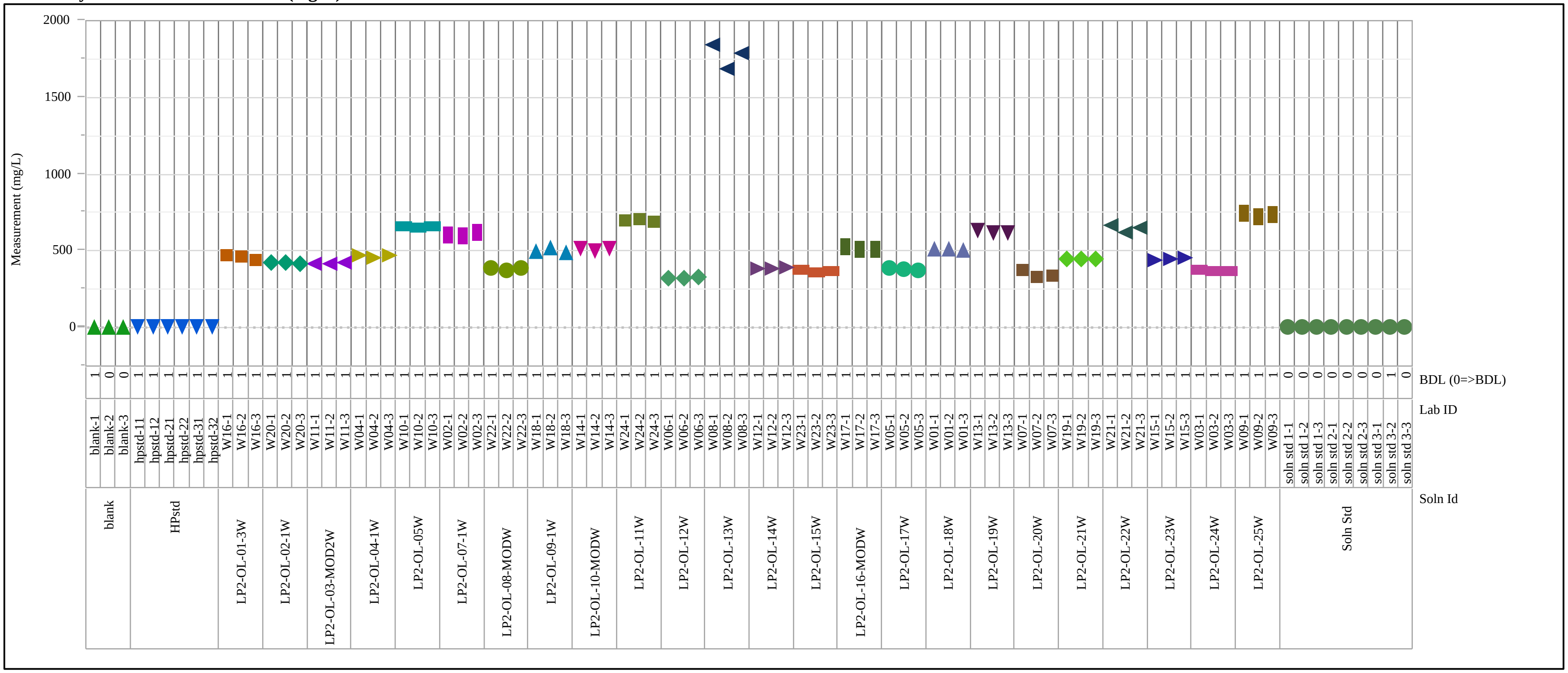


Exhibit F-2. Analysis of Wash Solutions by Solution Identifier (continued)

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

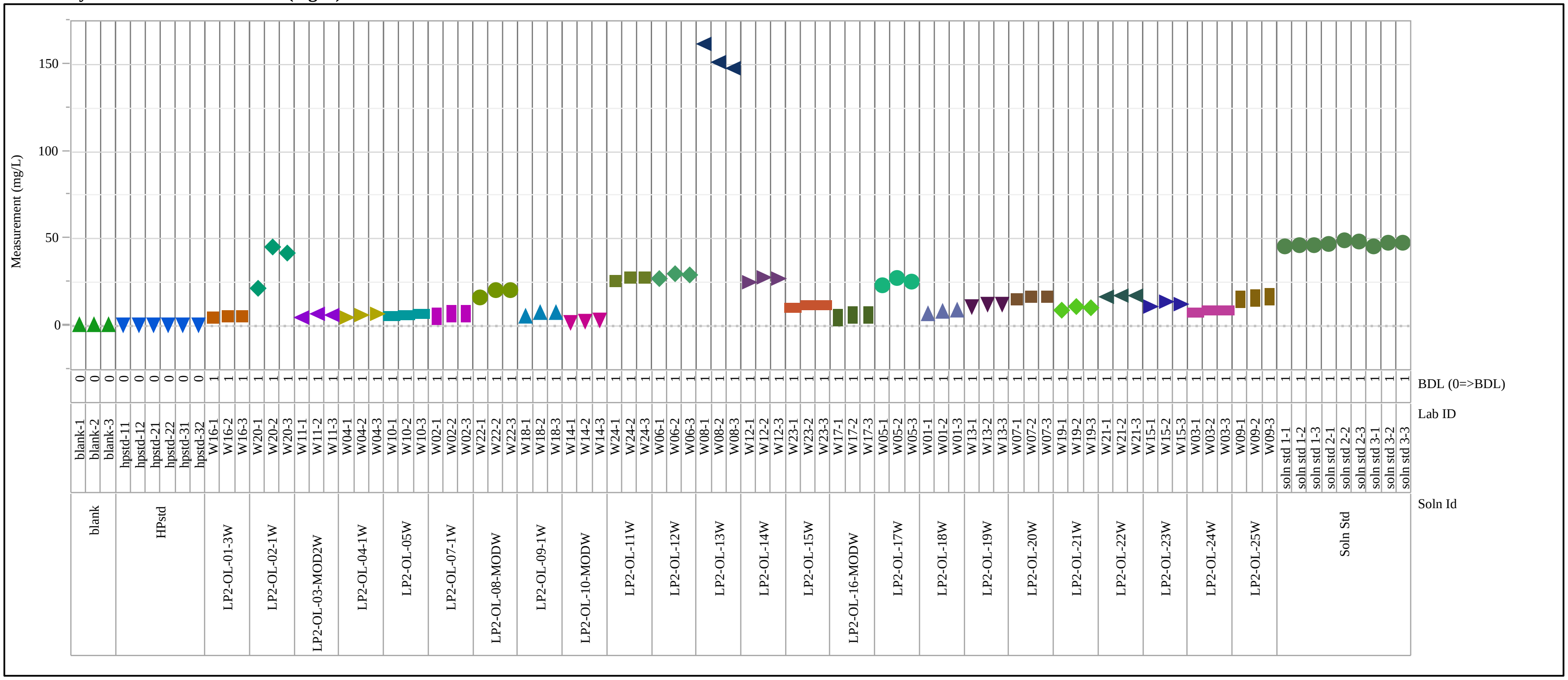


Exhibit F-2. Analysis of Wash Solutions by Solution Identifier (continued)

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

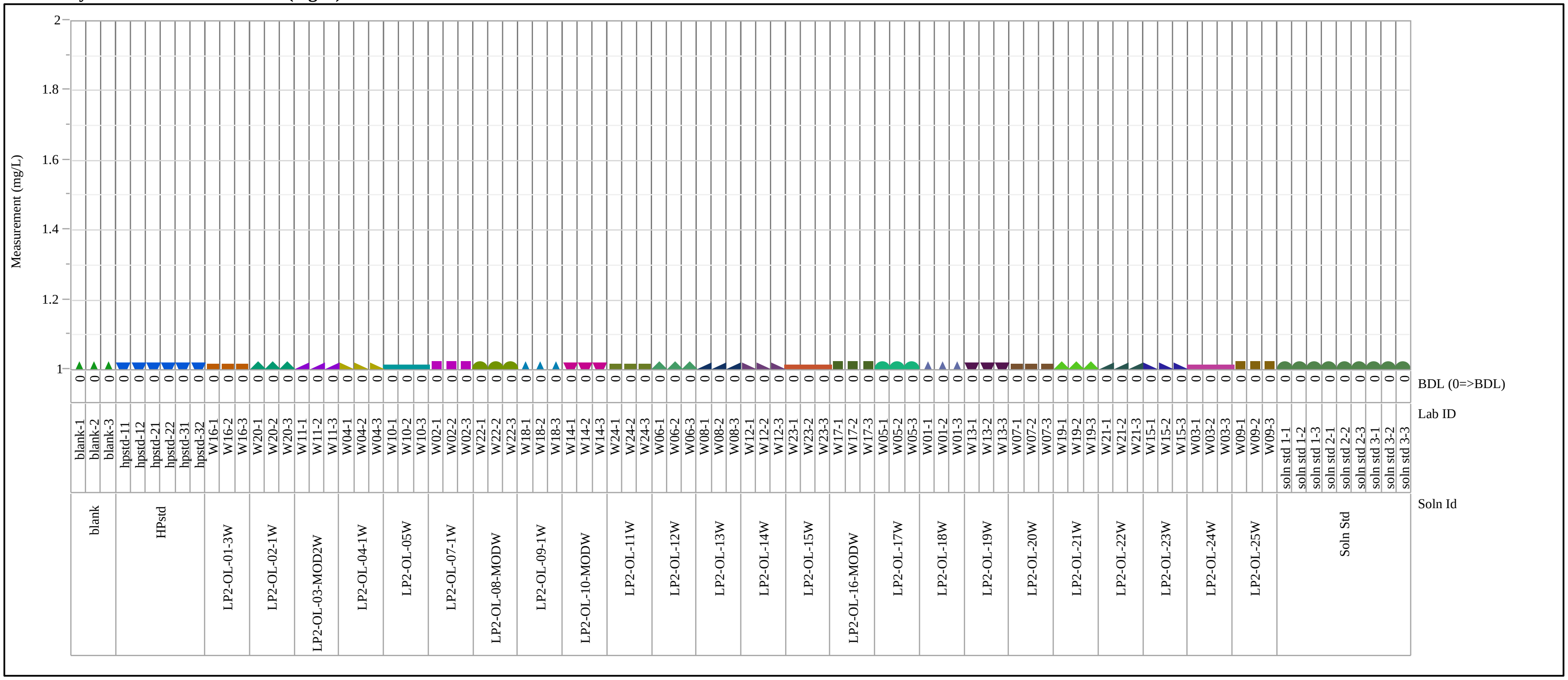


Exhibit F-2. Analysis of Wash Solutions by Solution Identifier (continued)

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

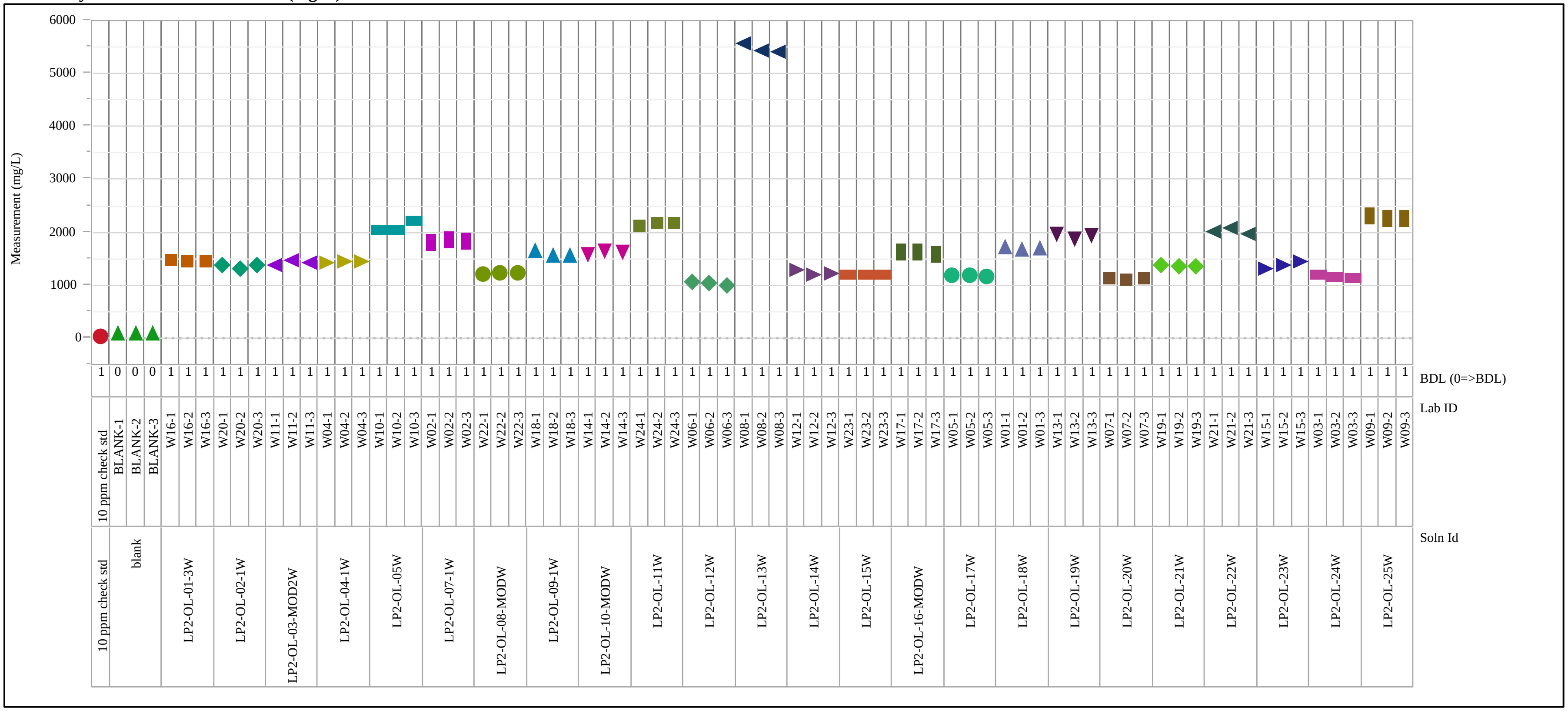


Exhibit F-2. Analysis of Wash Solutions by Solution Identifier (continued)

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

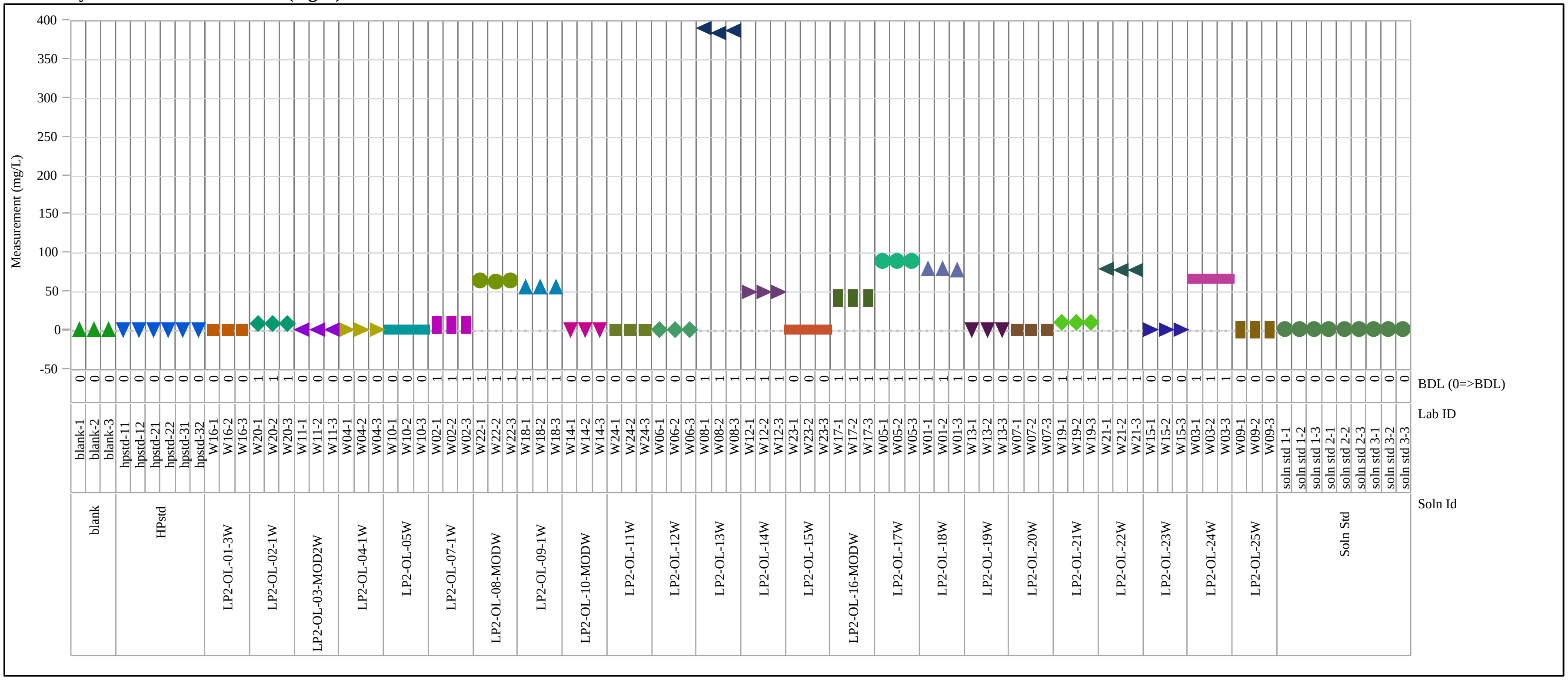


Exhibit F-2. Analysis of Wash Solutions by Solution Identifier (continued)

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

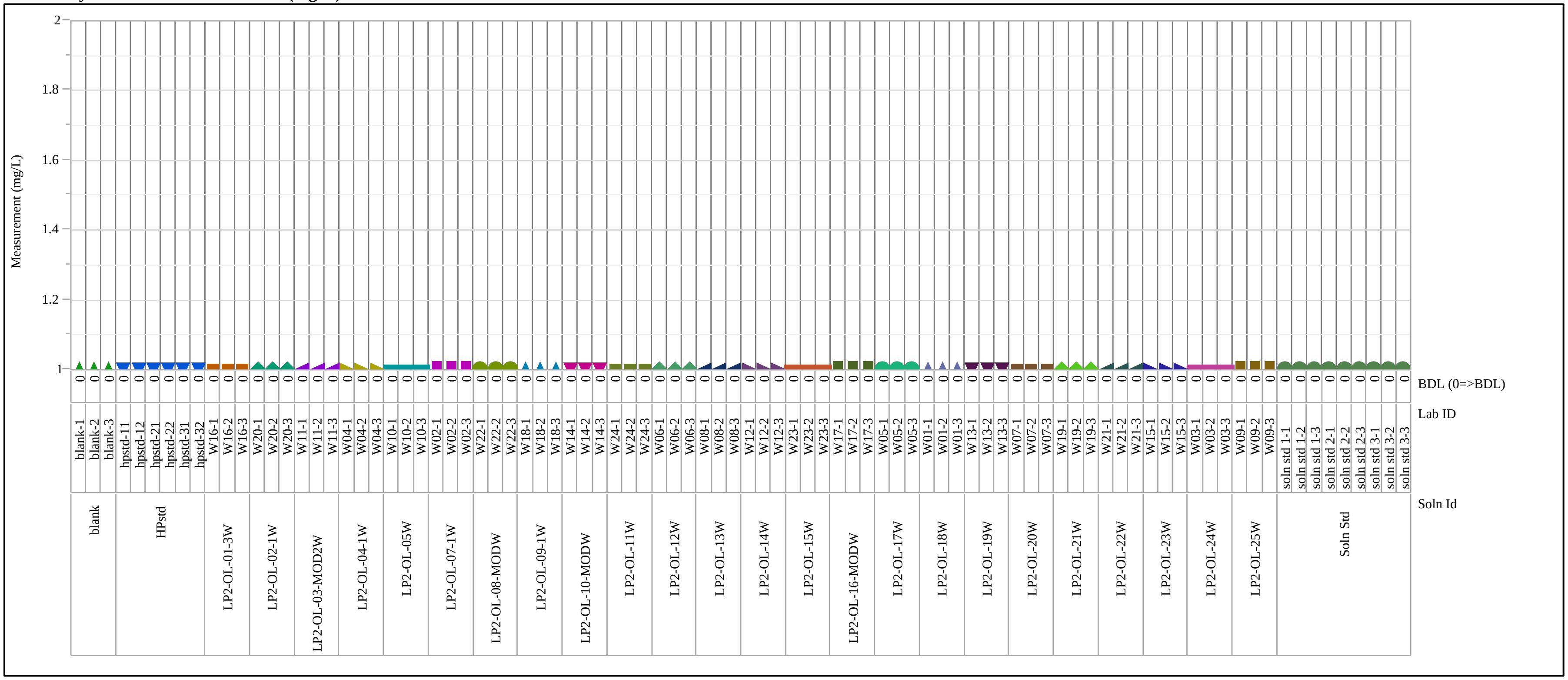
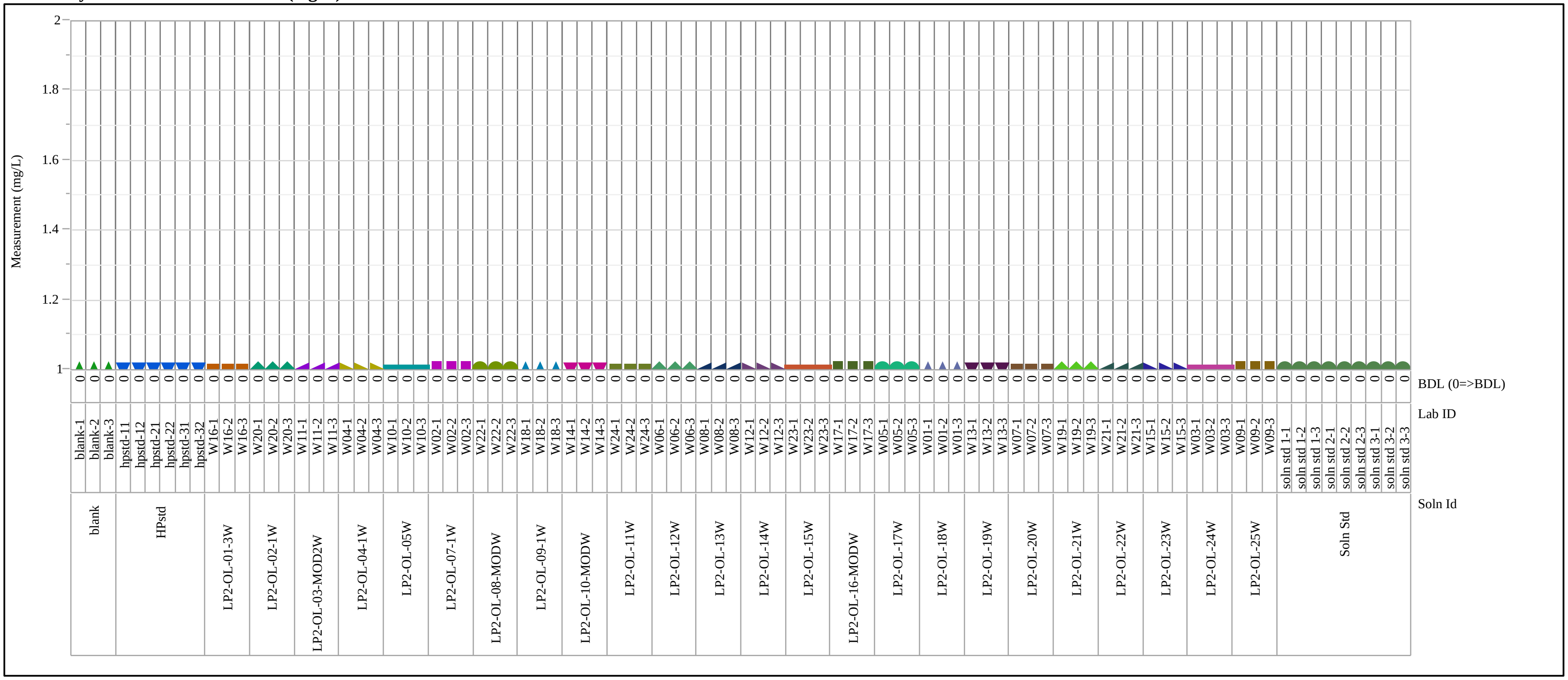


Exhibit F-2. Analysis of Wash Solutions by Solution Identifier (continued)

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



Distribution:

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