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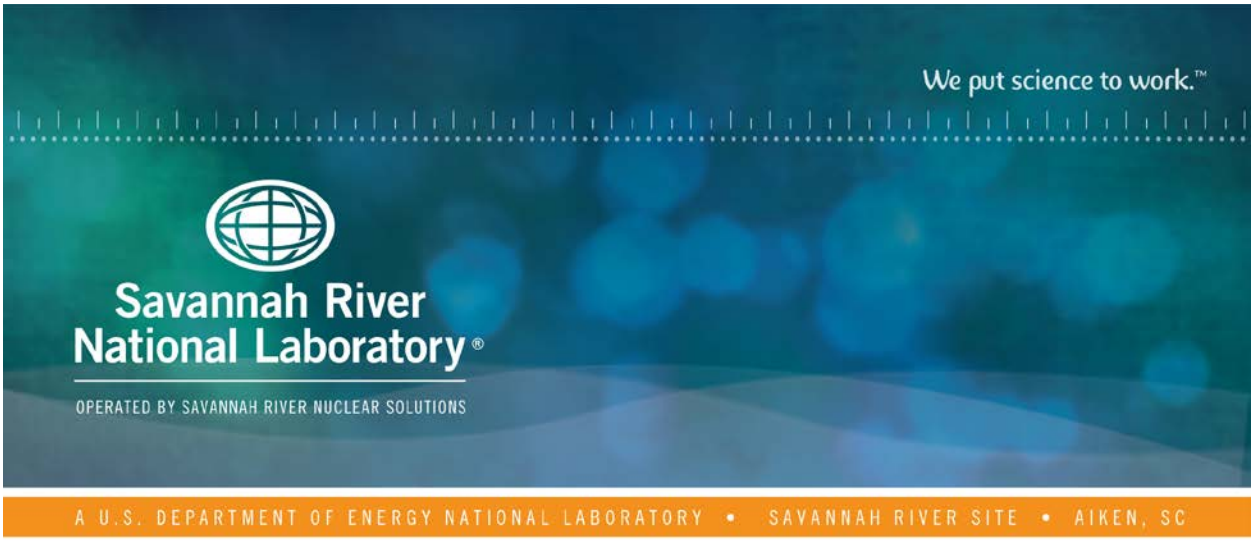

Characterization of the Sulfur Saturated Versions of the High-Chromium Matrix Glasses

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May 2020

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EXECUTIVE SUMMARY

In this report, the Savannah River National Laboratory provides chemical analysis of a series of sulfur saturated melt versions of simulated nuclear waste glasses, and chemical analysis of the wash solutions resulting from the preparation of these glasses. The glasses were selected and fabricated by the Pacific Northwest National Laboratory as part of a broader study of the influence of glass composition on chemical durability, sulfur retention, and other properties. The resulting data will be used in the development of improved property/composition models to support operation of the Hanford Tank Waste Treatment and Immobilization Plant.

Some degree of scatter among the Al_2O_3, B_2O_3, CaO, K_2O, Na_2O, and SiO_2 measurements was noted for the study glasses. The measured concentrations of B_2O_3, chlorine, and fluorine were below the targeted values for most of the study glasses, likely because of volatility during the multiple melting steps. The measured concentrations of Cr_2O_3 and K_2O were generally low relative to the targeted values. These components were identified in the wash solutions, indicating partitioning to the excess sulfate phase that was washed from the glasses prior to analyses. As expected, the measured concentrations of SO_3 in the glasses were higher than targeted due to the use of the sulfur saturation method in fabricating these glasses.

Minor scatter among the triplicate measurements of some of the analytes of the wash solutions was noted. The wash solutions contained mainly sulfur and sodium, with moderate concentrations of chromium and potassium.

Revision 1 of this report corrects the omission of Al_2O_3 values from Table A-4 in Appendix A.

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LIST OF ABBREVIATIONS

AD	Acid Dissolution
ARG-1	Analytical Reference Glass-1
BDL	Below Detection Limit
DOE	U.S. Department of Energy
IC	Ion Chromatography
ICP-OES	Inductively Coupled Plasma – Optical Emission Spectroscopy
HLW	High Level Waste
KH	Potassium Hydroxide fusion
LAW	Low Activity Waste
LRM	Low-level Reference Material
ORP	Office of River Protection
PF	Sodium Peroxide Fusion
PNNL	Pacific Northwest National Laboratory
SRNL	Savannah River National Laboratory
SSM	Sulfur Saturated Melt
TTQAP	Task Technical and Quality Assurance Plan
wt %	Weight Percent
WTP	Hanford Tank Waste Treatment and Immobilization Plant

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 Tank Waste Treatment and Immobilization Plant (WTP) at the Hanford Site in Washington to remediate 55 million gallons of radioactive waste that is temporarily stored in 177 underground tanks. The low-activity waste (LAW) fraction will be partitioned from the high-level waste (HLW). Both the LAW and HLW will then be vitrified into borosilicate glass using Joule-heated ceramic melters.

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

In this report, SRNL provides chemical analysis of a series of sulfur saturated melt (SSM) versions of simulated WTP glass products, and chemical analysis of the wash solutions resulting from the preparation of these glasses. The glasses were fabricated at the Pacific Northwest National Laboratory (PNNL). The glasses were selected by PNNL as part of a broader study of the influence of glass composition on chemical durability, sulfur retention, and other properties.[2,3] The glasses were designated the DHW19M-series glasses. The resulting data will be used in the development of improved property/composition models to support WTP operation.

2.0 Experimental Procedure

2.1 Quality Assurance

Requirements for performing reviews of technical reports and the extent of review are established in Savannah River Site Manual E7, Procedure 2.60. SRNL documents the extent and type of review using the SRNL Technical Report Design Checklist contained in WSRC-IM-2002-00011, Rev. 2. Laboratory data for this study were recorded in the SRNL Electronic Laboratory Notebook system, experiments C3489-00079-29 and C3489-00079-32. The glasses provided by PNNL were fabricated following a Task Plan.[4]

2.2 Glasses Selected for Study

The baseline (quenched) glass compositions in this study were selected and fabricated by PNNL. Characterization of the baseline glasses has been reported earlier.[5,6] PNNL employed a sulfur saturation methodology[7] to determine the maximum sulfur retention for the selected glass compositions. Samples of each of the SSM versions of the study glasses, along with samples of the wash solutions resulting from the preparation of each of the SSM glasses were received at SRNL for chemical composition analyses. PNNL identifiers for the glass samples and the associated SRNL sample identifiers are listed in Table 2-1. Similarly, identifiers for the wash solutions are listed in Table 2-2.

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

Table 2-1. Identifiers for the SSM Glass Samples

PNNL Glass ID	SRNL Sample ID		PNNL Glass ID	SRNL Sample ID
DHW19M-1-3-SSM-S	S-10511		DHW19M-18-SSM-S	S-10528
DHW19M-2-3-SSM-S	S-10512		DHW19M-19-SSM-S	S-10529
DHW19M-3-1-SSM-S	S-10513		DHW19M-20-SSM-S	S-10530
DHW19M-4-SSM-S	S-10514		DHW19M-21-SSM-S	S-10531
DHW19M-5-SSM-S	S-10515		DHW19M-22-1-SSM-S	S-10532
DHW19M-6-1-SSM-S	S-10516		DHW19M-23-SSM-S	S-10533
DHW19M-7-1-SSM-S	S-10517		DHW19M-24-SSM-S	S-10534
DHW19M-8-SSM-S	S-10518		DHW19M-25-SSM-S	S-10535
DHW19M-9-SSM-S	S-10519		DHW19M-26-SSM-S	S-10536
DHW19M-10-SSM-S	S-10520		DHW19M-27-SSM-S	S-10537
DHW19M-11-SSM-S	S-10521		DHW19M-28-SSM-S	S-10538
DHW19M-12-SSM-S	S-10522		DHW19M-29-SSM-S	S-10539
DHW19M-13-SSM-S	S-10523		DHW19M-30-SSM-S	S-10540
DHW19M-14-SSM-S	S-10524		DHW19M-31-SSM-S	S-10541
DHW19M-15-SSM-S	S-10525		DHW19M-32-SSM-S	S-10542
DHW19M-16-SSM-S	S-10526		DHW19M-33-SSM-S	S-10543
DHW19M-17-1-SSM-S	S-10527			

Table 2-2. Identifiers for the Wash Solutions

PNNL Wash Solution ID	SRNL Sample ID		PNNL Wash Solution ID	SRNL Sample ID
DHW19M-1-3-SSM-W	S-10478		DHW19M-18-SSM-W	S-10495
DHW19M-2-3-SSM-W	S-10479		DHW19M-19-SSM-W	S-10496
DHW19M-3-1-SSM-W	S-10480		DHW19M-20-SSM-W	S-10497
DHW19M-4-SSM-W	S-10481		DHW19M-21-SSM-W	S-10498
DHW19M-5-SSM-W	S-10482		DHW19M-22-1-SSM-W	S-10499
DHW19M-6-1-SSM-W	S-10483		DHW19M-23-SSM-W	S-10500
DHW19M-7-1-SSM-W	S-10484		DHW19M-24-SSM-W	S-10501
DHW19M-8-SSM-W	S-10485		DHW19M-25-SSM-W	S-10502
DHW19M-9-SSM-W	S-10486		DHW19M-26-SSM-W	S-10503
DHW19M-10-SSM-W	S-10487		DHW19M-27-SSM-W	S-10504
DHW19M-11-SSM-W	S-10488		DHW19M-28-SSM-W	S-10505
DHW19M-12-SSM-W	S-10489		DHW19M-29-SSM-W	S-10506
DHW19M-13-SSM-W	S-10490		DHW19M-30-SSM-W	S-10507
DHW19M-14-SSM-W	S-10491		DHW19M-31-SSM-W	S-10508
DHW19M-15-SSM-W	S-10492		DHW19M-32-SSM-W	S-10509
DHW19M-16-SSM-W	S-10493		DHW19M-33-SSM-W	S-10510
DHW19M-17-1-SSM-W	S-10494			

2.3 Glass Composition Analysis

Chemical analyses were performed under the auspices of an analytical plan[8] on a representative sample of each of the SSM glasses listed in Table 2-1 to allow for comparisons with the targeted and quenched compositions. Three dissolution techniques, sodium peroxide fusion (PF),[9] an acid dissolution (AD),[10] and potassium hydroxide fusion (KH),[11] were used for preparing each of the glass samples, in duplicate, for analysis. Note that the analytical plan specified both PF and AD for analyses of phosphorus and zirconium. The results were reviewed and the method that provided better recovery of the analyte (closer to the targeted

value) was selected for reporting. This approach was taken based on previous work that showed variable effectiveness of the preparation methods for these components.[12]

Each of the duplicate samples was analyzed twice for each element of interest by Inductively Coupled Plasma – Optical Emission Spectroscopy (ICP-OES)[13] or ion chromatography (IC),[14] for a total of four measurements per element per glass. Glass standards were also intermittently measured to assess the performance of the ICP-OES and IC instruments over the course of these analyses. Specifically, several samples of the Analytical Reference Glass-1 (ARG-1)[15] and several samples of the Low-level Reference Material (LRM)[16] were included as part of the analytical plans. The set of Corning, Inc., Glass Composition Mean wt% measurements of the ARG-1 standard glass[15] is used as the reference composition for this glass. The LRM composition reported as the "Consensus Average" is used as the reference composition of this glass.[16] The preparation and measurement methods used for each of the reported glass components are listed in Table 2-3.

Table 2-3. Preparation and Measurement Methods Used in Reporting the Concentrations of Each of the Analytes of the SSM Glasses

Analyte	Preparation Method	Measurement Method
Al	PF	ICP-OES
B	PF	ICP-OES
Ca	PF	ICP-OES
Cl	KH	IC
Cr	PF	ICP-OES
F	KH	IC
Fe	PF	ICP-OES
K	AD	ICP-OES
Li	PF	ICP-OES
Mn	PF	ICP-OES
Na	AD	ICP-OES
Ni	PF	ICP-OES
P	AD	ICP-OES
Pb	AD	ICP-OES
S	AD	ICP-OES
Si	PF	ICP-OES
Zr	AD	ICP-OES

2.4 Wash Solution Analysis

Chemical analyses were performed under the auspices of an analytical plan[8] on a representative sample of each of the wash solutions resulting from the preparation of the SSM versions of the glasses, as listed in Table 2-2. The samples were diluted based on the expected concentrations of the species in solution in preparation for the analyses.

Each of the samples was analyzed in triplicate for each element of interest by ICP-OES[13] and IC.[14] Solution standards and blanks were also intermittently measured to assess the performance of the ICP-OES and IC instruments over the course of these analyses. The measurement methods used for each of the reported wash solution components are listed in Table 2-4. Note that chromate concentrations were not measured by IC due to an inability to procure a chromate calibration standard within a reasonable amount of time.

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

Analyte	Measurement Method
Al	ICP-OES
B	ICP-OES
Ca	ICP-OES
Cl^-	IC
Cr	ICP-OES
CrO_4^{2-}	not measured
F^-	IC
Fe	ICP-OES
K	ICP-OES
Li	ICP-OES
Mn	ICP-OES
Na	ICP-OES
Ni	ICP-OES
P	ICP-OES
Pb	ICP-OES
PO_4^-	IC
S	ICP-OES
SO_4^{2-}	IC
Si	ICP-OES
Zr	ICP-OES

3.0 Results and Discussion

3.1 Review and Evaluation of the SSM Glass Composition Measurements

Table A-1 in Appendix A provides the elemental concentration measurements in wt % for the study glasses as prepared by the PF method. Table A-2 in Appendix A provides the elemental concentration measurements in wt % for the study glasses as prepared by the AD method. Table A-3 in Appendix A provides the elemental concentration measurements in wt % for the study glasses as prepared by the KH method. Elemental measurements for samples of the ARG-1 and LRM standard glasses are also included in the tables of Appendix A. These unprocessed data are provided so that the values are readily available should they be of interest for future reviews.

In the sections that follow, the analytical sequences of the measurements are explored, the measurements of the LRM standard glass are investigated, the measurements for each glass are reviewed, the average chemical composition for each glass is determined, and comparisons are made between the measurements and the targeted and quenched (previously reported[5]) compositions of the glasses. JMP™ Pro Version 14.3.0 (SAS Institute, Inc.)[17] was used to support these analyses.

3.1.1 Treatment of Detection Limits

The elemental concentrations in Table A-1 through Table A-3 of Appendix A 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 A-1 in Appendix A provides plots of the wt % measurements generated for each sample by oxide and analytical block. The plots are in analytical sequence within each calibration block with different symbols and colors being used to represent each of the study and standard glasses. These plots include all of the measurement data from Table A-1 through Table A-3 in Appendix A, with each plotted point identified by its Lab ID (from the analytical study plan). Plotting the data in this format provides an opportunity to identify gross trends in performance of the analytical instruments within and among calibration blocks. A review of these plots did not identify any gross patterns or trends in the analytical process over the course of these measurements. In all cases, the instrument check standards were within specification. Any minor calibration effects typical of ICP-OES analyses are mitigated by taking the average of the measurements for each analyte.

3.1.3 Composition Measurements by Glass Identifier

Exhibit A-2 in Appendix A provides plots of the oxide concentration measurements by the PNNL Glass ID (including the ARG-1 and LRM reference glasses) by Lab ID grouped by targeted concentration. Different symbols and colors are used to represent the different glasses. These plots show the individual measurements across the duplicates of each preparation method and the two instrument calibrations for each glass. Plotting the data in this format provides an opportunity to review the values for each individual glass as a function of the duplicate preparations and duplicate measurements. A review of the plots presented in these exhibits reveals the repeatability of the four individual values for each oxide for each glass. Some degree of scatter among the Al_2O_3, B_2O_3, CaO, K_2O, Na_2O, and SiO_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 A-3 in Appendix A provides a comparison of the LRM results to their acceptability limits utilized by SRNL.[13] 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 A-1 through Table A-3 in Appendix A) were averaged to determine a representative chemical composition for each glass. A sum of oxides was also computed for each glass based upon the averaged, measured values. Exhibit A-4 in Appendix A provides plots showing the result for each glass for each oxide to allow PNNL to draw comparisons between the measured and targeted values. The following observations are offered from a review of these plots:

- The measured concentrations of B_2O_3, chlorine, and fluorine are below the targeted values for most of the study glasses, likely because of volatility during the multiple melting steps.
- The measured concentrations of Cr_2O_3 and K_2O are generally low relative to the targeted values.
    - As will be shown later, these components are present in the wash solutions, indicating partitioning to the excess sulfate phase that was washed from the glasses prior to analyses.
- The measured Na_2O concentrations are below the targeted values for some of the study glasses.
    - This result may indicate that sodium partitioned to the excess sulfate phase.

    - It may also be a reflection of the low measured Na_2O concentrations in the quenched versions of the glasses.[5]
- There are some deviations in the measured SiO_2 concentrations, both above and below the targeted values, for the SSM glasses.
- As expected, the measured concentrations of SO_3 in the SSM glasses are higher than targeted due to the use of the sulfur saturation method in fabricating these glasses.

Table A-4 in Appendix A provides a summary of the average compositions as well as the targeted compositions and some associated differences and relative differences. All the measured sums of oxides for the study glasses fall within the interval of about 95.7 to 98.7 wt %, indicating acceptable recovery of the glass components. These values reflect some degree of volatility during the repeated melting steps, as well as partitioning of some components to the excess sulfate phase. Entries in Table A-4 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 A-5 in Appendix A provides a comparison of the measured oxide concentrations among the baseline (quenched) and SSM versions of the study glasses. A review of Exhibit A-5 led to several observations:

- The measured concentrations of Al_2O_3, B_2O_3, CaO, and SiO_2 for the SSM versions varied (higher and lower) compared to those of the quenched versions of the glasses.
- The measured concentrations of Cl^-, Cr_2O_3, F^-, and K_2O were lower for most of the SSM glasses as compared to those of the quenched versions. Similar results for these components were noted in earlier studies of SSM glasses for WTP.[12,18]
- The measured concentrations of Li_2O are somewhat higher for the SSM versions of the glasses as compared to the quenched versions.
- The measured Na_2O concentrations were higher for most of the SSM glasses relative to those of the quenched versions, although they remain below the targeted values. Similar results for Na_2O were noted in an earlier study of SSM glasses.[18]
- The measured concentrations of P_2O_5 and PbO were lower for many of the SSM versions of the glasses as compared to the quenched versions, although the concentrations of these two components are small.
- The measured SO_3 concentrations were higher for SSM versions of the study glasses, as expected.

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

3.3 Review and Evaluation of Wash Solution Measurements

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

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

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 14.3.0 (SAS Institute, Inc.)[17] was used to support these analyses.

3.3.1 Treatment of Detection Limits

The elemental and anion concentrations in Table B-1 and Table B-2 of Appendix B include measurements that were reported to be below the detection limit 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.

3.3.2 Measurements in Analytical Sequence

Exhibit B-1 in Appendix B 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 B-1 and Table B-2 in Appendix B, 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. The data for PO_4^{3-} concentrations measured by IC show a downward shift in the measured values from Blocks 1-3 to Blocks 4-6, which is likely the result of a minor change in calibration (note that data for the standard solutions remain consistent for all blocks). Further review of these plots did not identify any other gross patterns or trends in the analytical process over the course of the measurements.

3.3.3 Composition Measurements by Wash Solution Identifier

Exhibit B-2 in Appendix B provides plots of the elemental and anion concentration measurements grouped by the wash solution identifier (including the blanks and standard solutions). Different symbols and colors are used to represent the different solutions. Plotting the data in this format provides an opportunity to review the values for each individual solution as a function of the triplicate measurements. A review of the plots presented in these exhibits reveals the repeatability of the three individual values for each analyte for each solution. Minor scatter among the triplicate measurements of some of the analytes of the solutions was noted. These observations were not considered to indicate an error in preparation or measurement that had to be addressed in treatment of the data. Therefore, the entire set of measurement data was used in determining representative, measured compositions for the wash solutions.

3.3.4 Results for the Standard Solutions

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

3.3.5 Measured Compositions of the Wash Solutions

From the discussion of Section 3.3.3, all of the measurements for each analyte for each wash solution (i.e., all of the measurements in Table B-1 and Table B-2 of Appendix B) were averaged to determine a representative chemical composition for each solution. Table B-4 in Appendix B provides a summary of the average measured compositions of the wash solutions. The concentrations of PO_4^{3-} and SO_4^{2-} reported in these tables include the measured values from both ICP-OES and IC for comparison. The measured S and P concentrations from the ICP-OES analyses were converted to PO_4^{3-} and SO_4^{2-} concentrations by multiplying by the appropriate gravimetric factors to support these comparisons. A graphical representation of the average chemical composition data for each wash solution is provided in Exhibit B-3.

The following observations are offered from a review of Table B-4 and Exhibit B-3:

- The measured concentrations of Al, Cl, F, Fe, Mn, Ni, Pb, and Zr in the wash solutions were near or below the detection limits.
- The measured concentrations of B in the wash solutions were about 10-65 mg/L.
- The measured concentrations of Ca in the wash solutions were about 1-20 mg/L.
- The measured concentrations of Cr (about 50-320 mg/L) and K (about 10-600 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 Li in the wash solutions were about 1-42 mg/L.
- The measured concentrations of Na in the wash solutions were in the range of about 500-1100 mg/L. This could be attributed to both the excess sodium sulfate added as part of the SSM preparation process and to partitioning of additional Na from the glass melt to the sulfate layer.
- The measured concentrations of P were similar by both the ICP-OES and IC methods (ICP-OES data converted to PO_4^{3-} basis for comparison) and were in the range of about 5-30 mg/L PO_4^{3-}.
- The measured concentrations of S were similar by both the ICP-OES and IC methods (ICP-OES data converted to SO_4^{2-} basis for comparison) and were in the range of about 700-2000 mg/L SO_4^{2-}.
- The measured concentrations of Si ranged from about 5-25 mg/L.

4.0 Summary

In this report, SRNL provides chemical analysis of a series of sulfur saturated melt versions of simulated WTP glass products, and chemical analysis of the wash solutions resulting from the preparation of these glasses. The glasses were selected and fabricated by PNNL as part of a broader study of the influence of glass composition on chemical durability, sulfur retention, and other properties. The resulting data will be used in the development of improved property/composition models to support WTP operation.

PNNL employed a sulfur saturation methodology to determine the maximum sulfur retention for the selected glass compositions. Samples of each of the SSM versions of the study glasses, along with samples of the wash solutions resulting from the preparation of each of the SSM glasses were received at SRNL for chemical composition analyses.

Samples of the glasses were dissolved by three methods to support chemical composition analyses by ICP-OES and IC. Some degree of scatter among the Al_2O_3, B_2O_3, CaO, K_2O, Na_2O, and SiO_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. The measured concentrations of B_2O_3, chlorine, and fluorine were below the targeted values for most of the study glasses, likely because of volatility during the multiple melting steps. The measured concentrations of Cr_2O_3 and K_2O were generally low relative to the targeted values. These components were identified in the wash solutions, indicating partitioning to the excess sulfate phase that was washed from the glasses prior to analyses. As expected, the measured concentrations of SO_3 in the SSM glasses were higher than targeted due to the use of the sulfur saturation method in fabricating these glasses.

No issues with the analytical process were found for the wash solution measurements. Minor scatter among the triplicate measurements of some of the analytes of the solutions was noted. The wash solutions contained mainly sulfur and sodium, with moderate concentrations of chromium and potassium. Minor amounts of boron, calcium, lithium, phosphorus, and silicon were also present in the solutions.

5.0 References

1. Fox, K. M., "Task Technical and Quality Assurance Plan for Hanford Waste Glass Development and Characterization," *U.S. Department of Energy Report SRNL-RP-2013-00692, Revision 1,* Savannah River National Laboratory, Aiken, SC (2016).

2. Peeler, D. K., D. S. Kim, J. D. Vienna, M. J. Schweiger, and G. F. Piepel, "Office of River Protection Advanced Low-Activity Waste Glass Research and Development Plan," *U.S. Department of Energy Report PNNL-24883, EWG-RPT-008,* Pacific Northwest National Laboratory, Richland, WA (2015).

3. Peeler, D. K., J. D. Vienna, M. J. Schweiger, and K. M. Fox, "Advanced High-Level Waste Glass Research and Development Plan," *U.S. Department of Energy Report PNNL-24450,* Pacific Northwest National Laboratory, Richland, WA (2015).

4. Russell, R. L., *EWG-TP-0088,* Pacific Northwest National Laboratory, Richland, WA (2019).

5. Fox, K. M. and T. B. Edwards, "Composition Measurements of the Quenched, High-Chromium Matrix Glasses," *U.S. Department of Energy Report SRNL-STI-2020-00082, Rev. 0,* Savannah River National Laboratory, Aiken, SC (2020).

6. Fox, K. M., M. C. Hsieh, and T. B. Edwards, "Product Consistency Test Results for the High-Chromium Matrix Glasses," *U.S. Department of Energy Report SRNL-STI-2020-00136, Rev. 0,* Savannah River National Laboratory, Aiken, SC (2020).

7. Skidmore, C. H., J. D. Vienna, T. Jin, D. Kim, B. A. Stanfill, K. M. Fox, and A. A. Kruger, "Sulfur solubility in low activity waste glass and its correlation to melter tolerance," *International Journal of Applied Glass Science,* **10** 558-568 (2019).

8. Hsieh, M. C. and T. B. Edwards, *SRNL-L3310-2020-00007,* Savannah River National Laboratory, Aiken, SC (2020).

9. Best, D. R., "Dissolution of Glass, Sludge, and Slurry Samples Using Na_2O_2/NaOH/HCl," *Manual L29, ITS-0040, Revision 2,* Savannah River National Laboratory, Aiken, SC (2013).

10. Fox, K. M. and T. B. Edwards, "Chemical Composition Analysis and Product Consistency Tests to Support Enhanced Hanford Waste Glass Models: Results for the Third Set of High Alumina Outer Layer Matrix Glasses," *U.S. Department of Energy Report SRNL-STI-2015-00652, Revision 0,* Savannah River National Laboratory, Aiken, SC (2015).

11. "Sample Dissolution Using Potassium Hydroxide Fusion," *Manual L29, ITS-0035, Revision 3,* Savannah River National Laboratory, Aiken, SC (2015).

12. Fox, K. M., T. B. Edwards, M. C. Hsieh, and W. T. Riley, "Sulfur Solubility Testing and Characterization of Hanford LAW Phase 2, Outer Layer Matrix Glasses," *U.S. Department of Energy Report SRNL-STI-2018-00150, Revision 0,* Savannah River National Laboratory, Aiken, SC (2018).

13. "Calibration, Verification, and Operation of the Agilent 730 ES Inductively Coupled Plasma-Atomic Emission Spectrometer," *Manual L29, Procedure ITS-0079, Revision 8,* Savannah River National Laboratory, Aiken, SC (2017).

14. Best, D. R., "Anion Analysis Using the Dionex DX-500 and ICS-5000 Ion Chromatograph," *Manual L29, Procedure ITS-0027, Revision 3,* Savannah River National Laboratory, Aiken, SC (2011).

15. Smith, G. L., "Characterization of Analytical Reference Glass-1 (ARG-1)," *U.S. Department of Energy Report PNL-8992,* Pacific Northwest National Laboratory, Richland, WA (1993).

16. Ebert, W. L. and S. F. Wolfe, "Round-robin Testing of a Reference Glass for Low-Activity Waste Forms," *U.S. Department of Energy Report ANL-99/22,* Argonne National Laboratory, Argonne, IL (1999).

17. **JMP™ Pro, Ver. 14.3.0,** [Computer Software] SAS Institue Inc., Cary, NC (2018).

18. Fox, K. M., T. B. Edwards, M. C. Hsieh, and W. T. Riley, "Characterization of Hanford LAW Phase 3 Glasses," *U.S. Department of Energy Report SRNL-STI-2018-00649, Revision 2,* Savannah River National Laboratory, Aiken, SC (2020).

Appendix A Tables and Exhibits Supporting the SSM Glass Composition Measurements

Table A-1. Measurements of the Samples Prepared by PF in Analytical Sequence

Glass ID	Block	Sub-Blk	Sequence	Lab ID	Al (wt%)	B (wt%)	Ca (wt%)	Cr (wt%)	Fe (wt%)	Li (wt%)	Mn (wt%)	Ni (wt%)	Si (wt%)
LRM	1	1	1	LRMPF111	5.37	2.40	0.541	0.130	1.16	<0.100	0.257	0.128	26.2
ARG-1	1	1	2	ARGPF111	2.57	2.59	1.11	<0.100	10.0	1.63	1.49	0.745	22.9
DHW19M-7-1-SSM-S	1	1	3	S-10517PF11	3.27	4.06	0.307	0.551	4.28	1.89	<0.100	0.130	21.0
DHW19M-1-3-SSM-S	1	1	4	S-10511PF21	3.00	3.63	2.82	1.27	3.94	1.65	<0.100	0.114	21.0
DHW19M-8-SSM-S	1	1	5	S-10518PF11	2.37	3.95	1.19	1.13	2.56	0.835	0.103	<0.100	21.8
DHW19M-4-SSM-S	1	1	6	S-10514PF11	3.18	2.87	2.00	0.436	4.87	0.415	0.215	0.251	21.5
DHW19M-8-SSM-S	1	1	7	S-10518PF21	2.84	4.01	1.25	1.11	3.65	0.825	0.501	0.201	21.9
DHW19M-5-SSM-S	1	1	8	S-10515PF21	3.42	5.10	1.69	0.779	3.47	1.35	0.137	0.142	19.8
DHW19M-6-1-SSM-S	1	1	9	S-10516PF11	3.28	2.77	1.28	0.655	0.722	0.101	<0.100	<0.100	24.8
DHW19M-9-SSM-S	1	1	10	S-10519PF11	3.90	5.07	0.287	1.03	3.84	0.209	0.203	0.159	19.2
DHW19M-7-1-SSM-S	1	1	11	S-10517PF21	3.24	4.01	0.199	0.543	4.33	1.87	<0.100	<0.100	21.1
LRM	1	1	12	LRMPF112	5.54	2.39	0.599	0.143	1.14	<0.100	0.254	0.114	26.4
ARG-1	1	1	13	ARGPF112	2.64	2.63	1.19	<0.100	9.85	1.64	1.49	0.726	22.6
DHW19M-6-1-SSM-S	1	1	14	S-10516PF21	3.35	2.83	1.32	0.681	0.736	0.103	<0.100	<0.100	25.1
DHW19M-3-1-SSM-S	1	1	15	S-10513PF21	2.13	2.96	0.184	0.676	3.26	0.253	0.200	0.219	24.5
DHW19M-4-SSM-S	1	1	16	S-10514PF21	3.24	2.93	2.08	0.438	4.89	0.424	0.222	0.252	22.1
DHW19M-9-SSM-S	1	1	17	S-10519PF21	4.13	5.02	0.362	1.00	4.49	0.203	0.607	0.210	19.2
DHW19M-1-3-SSM-S	1	1	18	S-10511PF11	3.07	3.67	3.01	1.28	4.03	1.66	0.200	0.131	21.4
DHW19M-5-SSM-S	1	1	19	S-10515PF11	3.28	5.16	1.62	0.777	3.42	1.30	0.150	0.171	19.6
DHW19M-2-3-SSM-S	1	1	20	S-10512PF21	3.88	3.23	1.51	1.21	1.80	0.362	0.210	0.268	24.6
DHW19M-3-1-SSM-S	1	1	21	S-10513PF11	2.17	3.00	0.310	0.714	3.29	0.258	0.326	0.263	24.8
DHW19M-2-3-SSM-S	1	1	22	S-10512PF11	3.69	3.18	1.40	1.22	1.58	0.359	0.204	0.142	24.1
LRM	1	1	23	LRMPF113	5.53	2.39	0.598	0.137	1.13	<0.100	0.255	0.122	25.9
ARG-1	1	1	24	ARGPF113	2.62	2.57	1.18	<0.100	9.79	1.63	1.48	0.720	22.3

Table A-1. Measurements of the Samples Prepared by PF in Analytical Sequence **(continued)**

Glass ID	Block	Sub-Blk	Sequence	Lab ID	Al (wt%)	B (wt%)	Ca (wt%)	Cr (wt%)	Fe (wt%)	Li (wt%)	Mn (wt%)	Ni (wt%)	Si (wt%)
LRM	1	2	1	LRMPF121	5.40	2.44	0.545	0.142	1.17	<0.100	0.260	0.132	25.8
ARG-1	1	2	2	ARGPF121	2.57	2.64	1.11	<0.100	10.1	1.67	1.51	0.766	22.5
DHW19M-1-3-SSM-S	1	2	3	S-10511PF22	2.89	3.63	2.66	1.24	4.00	1.66	<0.100	0.121	20.6
DHW19M-8-SSM-S	1	2	4	S-10518PF22	2.75	3.97	1.16	1.09	3.73	0.829	0.507	0.222	21.7
DHW19M-2-3-SSM-S	1	2	5	S-10512PF22	3.79	3.23	1.43	1.21	1.85	0.368	0.214	0.294	24.4
DHW19M-5-SSM-S	1	2	6	S-10515PF22	3.30	5.03	1.58	0.780	3.54	1.36	0.139	0.153	19.2
DHW19M-1-3-SSM-S	1	2	7	S-10511PF12	2.96	3.66	2.84	1.23	4.11	1.68	0.201	0.156	21.4
DHW19M-2-3-SSM-S	1	2	8	S-10512PF12	3.55	3.19	1.30	1.18	1.61	0.361	0.207	0.159	23.8
DHW19M-9-SSM-S	1	2	9	S-10519PF22	3.97	4.88	0.298	0.948	4.53	0.201	0.611	0.222	18.7
DHW19M-4-SSM-S	1	2	10	S-10514PF22	3.13	2.92	1.94	0.442	4.96	0.426	0.222	0.275	21.7
DHW19M-5-SSM-S	1	2	11	S-10515PF12	3.16	5.02	1.49	0.769	3.47	1.32	0.150	0.175	19.5
LRM	1	2	12	LRMPF122	5.39	2.41	0.544	0.136	1.16	<0.100	0.258	0.140	25.8
ARG-1	1	2	13	ARGPF122	2.55	2.62	1.10	<0.100	10.1	1.66	1.50	0.769	22.4
DHW19M-9-SSM-S	1	2	14	S-10519PF12	3.79	5.02	0.200	1.00	3.92	0.209	0.206	0.181	18.9
DHW19M-3-1-SSM-S	1	2	15	S-10513PF22	2.05	2.96	0.139	0.657	3.32	0.251	0.204	0.243	24.0
DHW19M-6-1-SSM-S	1	2	16	S-10516PF12	3.20	2.78	1.20	0.641	0.733	<0.100	<0.100	<0.100	24.6
DHW19M-8-SSM-S	1	2	17	S-10518PF12	2.28	3.90	1.09	1.07	2.58	0.836	0.102	<0.100	21.5
DHW19M-7-1-SSM-S	1	2	18	S-10517PF22	3.15	3.98	0.145	0.533	4.44	1.91	<0.100	0.114	20.5
DHW19M-3-1-SSM-S	1	2	19	S-10513PF12	2.09	2.98	0.252	0.698	3.33	0.258	0.327	0.283	24.5
DHW19M-4-SSM-S	1	2	20	S-10514PF12	3.12	2.91	1.91	0.444	5.02	0.421	0.219	0.271	21.7
DHW19M-7-1-SSM-S	1	2	21	S-10517PF12	3.21	4.04	0.267	0.530	4.39	1.94	<0.100	0.156	21.1
DHW19M-6-1-SSM-S	1	2	22	S-10516PF22	3.26	2.82	1.22	0.657	0.750	0.101	<0.100	<0.100	24.9
LRM	1	2	23	LRMPF123	5.41	2.44	0.548	0.141	1.16	<0.100	0.258	0.132	26.1
ARG-1	1	2	24	ARGPF123	2.57	2.64	1.11	<0.100	10.0	1.67	1.51	0.761	22.7
LRM	2	1	1	LRMPF211	5.10	2.31	0.493	0.102	1.10	<0.100	0.236	0.101	24.8

Table A-1. Measurements of the Samples Prepared by PF in Analytical Sequence **(continued)**

Glass ID	Block	Sub-Blk	Sequence	Lab ID	Al (wt%)	B (wt%)	Ca (wt%)	Cr (wt%)	Fe (wt%)	Li (wt%)	Mn (wt%)	Ni (wt%)	Si (wt%)
ARG-1	2	1	2	ARGPF211	2.42	2.53	1.04	<0.100	9.68	1.71	1.41	0.702	21.6
DHW19M-14-SSM-S	2	1	3	S-10524PF21	1.01	2.89	1.35	0.839	2.27	1.43	0.241	<0.100	24.8
DHW19M-10-SSM-S	2	1	4	S-10520PF21	2.37	5.10	3.55	0.887	2.96	0.478	0.176	<0.100	18.8
DHW19M-14-SSM-S	2	1	5	S-10524PF11	1.00	2.87	1.34	0.856	2.27	1.42	0.242	<0.100	24.7
DHW19M-13-SSM-S	2	1	6	S-10523PF11	3.14	4.52	3.30	0.533	1.81	1.62	0.202	0.134	20.6
DHW19M-11-SSM-S	2	1	7	S-10521PF21	2.44	5.64	0.450	0.804	1.14	1.83	0.180	0.113	21.3
DHW19M-16-SSM-S	2	1	8	S-10526PF21	3.26	3.47	0.449	0.785	4.73	1.92	<0.100	<0.100	23.1
DHW19M-17-1-SSM-S	2	1	9	S-10527PF11	1.29	4.48	3.38	1.20	0.314	0.168	0.194	0.138	22.3
DHW19M-13-SSM-S	2	1	10	S-10523PF21	3.10	4.38	3.28	0.534	1.81	1.44	0.202	0.133	19.8
LRM	2	1	11	LRMPF212	4.97	2.33	0.470	0.109	1.17	<0.100	0.246	0.120	25.5
ARG-1	2	1	12	ARGPF212	2.37	2.55	1.01	<0.100	10.3	1.69	1.47	0.764	22.2
DHW19M-15-SSM-S	2	1	13	S-10525PF21	1.62	5.09	2.94	0.961	0.702	1.97	0.100	<0.100	22.6
DHW19M-17-1-SSM-S	2	1	14	S-10527PF21	1.32	4.61	3.46	1.23	0.321	0.173	0.198	0.147	22.7
DHW19M-12-SSM-S	2	1	15	S-10522PF21	2.16	3.24	2.89	1.09	2.26	0.718	<0.100	<0.100	25.1
DHW19M-12-SSM-S	2	1	16	S-10522PF11	2.15	3.30	2.82	1.09	2.28	0.719	<0.100	<0.100	25.3
DHW19M-15-SSM-S	2	1	17	S-10525PF11	1.59	5.11	2.91	0.950	0.710	1.93	0.125	<0.100	22.4
DHW19M-11-SSM-S	2	1	18	S-10521PF11	2.44	5.62	0.411	0.787	1.13	1.80	0.177	0.121	21.1
DHW19M-10-SSM-S	2	1	19	S-10520PF11	2.40	5.10	3.51	0.904	2.94	0.473	0.173	0.107	18.7
DHW19M-16-SSM-S	2	1	20	S-10526PF11	3.22	3.35	0.385	0.776	4.77	1.70	<0.100	<0.100	22.1
LRM	2	1	21	LRMPF213	4.98	2.34	0.473	0.108	1.17	<0.100	0.244	0.122	25.7
ARG-1	2	1	22	ARGPF213	2.36	2.57	1.01	<0.100	10.3	1.67	1.47	0.764	22.3
LRM	2	2	1	LRMPF221	4.99	2.31	0.487	0.114	1.11	<0.100	0.245	0.109	24.6
ARG-1	2	2	2	ARGPF221	2.36	2.52	1.00	<0.100	9.58	1.68	1.44	0.726	21.4
DHW19M-12-SSM-S	2	2	3	S-10522PF12	2.15	3.18	2.73	1.04	2.12	0.713	<0.100	<0.100	24.2
DHW19M-17-1-SSM-S	2	2	4	S-10527PF22	1.33	4.52	3.38	1.18	0.316	0.176	0.196	0.136	21.6

Table A-1. Measurements of the Samples Prepared by PF in Analytical Sequence **(continued)**

Glass ID	Block	Sub-Blk	Sequence	Lab ID	Al (wt%)	B (wt%)	Ca (wt%)	Cr (wt%)	Fe (wt%)	Li (wt%)	Mn (wt%)	Ni (wt%)	Si (wt%)
DHW19M-10-SSM-S	2	2	5	S-10520PF12	2.41	5.02	3.44	0.895	2.76	0.477	0.175	0.105	17.9
DHW19M-11-SSM-S	2	2	6	S-10521PF22	2.43	5.52	0.454	0.791	1.06	1.80	0.177	0.117	20.2
DHW19M-16-SSM-S	2	2	7	S-10526PF12	3.20	3.27	0.397	0.776	4.46	1.69	<0.100	<0.100	21.3
DHW19M-14-SSM-S	2	2	8	S-10524PF22	1.03	2.83	1.36	0.849	2.16	1.45	0.241	<0.100	24.3
DHW19M-12-SSM-S	2	2	9	S-10522PF22	2.18	3.15	2.85	1.03	2.13	0.733	<0.100	<0.100	24.3
DHW19M-13-SSM-S	2	2	10	S-10523PF22	3.09	4.28	3.21	0.514	1.70	1.44	0.198	0.138	18.9
LRM	2	2	11	LRMPF222	4.97	2.29	0.483	0.120	1.11	<0.100	0.244	0.114	24.5
ARG-1	2	2	12	ARGPF222	2.37	2.52	1.01	<0.100	9.65	1.68	1.44	0.722	21.4
DHW19M-14-SSM-S	2	2	13	S-10524PF12	1.00	2.78	1.33	0.820	2.11	1.42	0.235	<0.100	23.4
DHW19M-13-SSM-S	2	2	14	S-10523PF12	3.10	4.31	3.18	0.497	1.67	1.58	0.196	0.135	19.3
DHW19M-15-SSM-S	2	2	15	S-10525PF22	1.61	4.88	2.86	0.913	0.670	1.96	<0.100	<0.100	21.5
DHW19M-16-SSM-S	2	2	16	S-10526PF22	3.22	3.32	0.446	0.748	4.34	1.87	<0.100	<0.100	21.5
DHW19M-15-SSM-S	2	2	17	S-10525PF12	1.58	4.91	2.84	0.915	0.669	1.91	0.123	<0.100	21.5
DHW19M-17-1-SSM-S	2	2	18	S-10527PF12	1.30	4.38	3.32	1.17	0.311	0.173	0.193	0.137	21.4
DHW19M-10-SSM-S	2	2	19	S-10520PF22	2.37	4.91	3.43	0.844	2.74	0.469	0.172	0.107	17.8
DHW19M-11-SSM-S	2	2	20	S-10521PF12	2.41	5.45	0.417	0.781	1.05	1.78	0.174	0.115	20.0
LRM	2	2	21	LRMPF223	4.98	2.28	0.483	0.106	1.11	<0.100	0.241	0.121	24.7
ARG-1	2	2	22	ARGPF223	2.37	2.51	0.997	<0.100	9.58	1.68	1.43	0.719	21.4
LRM	3	1	1	LRMPF311	5.24	2.39	0.529	<0.100	1.11	<0.100	0.242	0.112	25.4
ARG-1	3	1	2	ARGPF311	2.49	2.57	1.08	<0.100	9.65	1.52	1.45	0.723	22.1
DHW19M-19-SSM-S	3	1	3	S-10529PF11	1.96	5.84	3.82	1.41	3.53	0.619	<0.100	<0.100	19.9
DHW19M-25-SSM-S	3	1	4	S-10535PF11	2.02	3.44	0.552	1.46	1.52	0.196	0.137	<0.100	25.5
DHW19M-22-1-SSM-S	3	1	5	S-10532PF21	1.25	4.70	2.97	1.03	0.116	0.552	0.124	<0.100	23.8
DHW19M-24-SSM-S	3	1	6	S-10534PF11	2.89	3.94	2.65	0.557	1.34	0.762	0.143	<0.100	22.8
DHW19M-20-SSM-S	3	1	7	S-10530PF21	2.39	4.06	1.33	1.05	2.50	0.828	<0.100	<0.100	21.9

Table A-1. Measurements of the Samples Prepared by PF in Analytical Sequence **(continued)**

Glass ID	Block	Sub-Blk	Sequence	Lab ID	Al (wt%)	B (wt%)	Ca (wt%)	Cr (wt%)	Fe (wt%)	Li (wt%)	Mn (wt%)	Ni (wt%)	Si (wt%)
DHW19M-19-SSM-S	3	1	8	S-10529PF21	1.94	5.73	3.77	1.37	3.46	0.608	<0.100	<0.100	19.8
DHW19M-25-SSM-S	3	1	9	S-10535PF21	2.03	3.36	0.641	1.43	1.49	0.195	0.133	<0.100	25.4
DHW19M-23-SSM-S	3	1	10	S-10533PF11	3.38	5.61	0.358	1.13	1.79	<0.100	<0.100	<0.100	22.1
LRM	3	1	11	LRMPF312	5.33	2.47	0.621	0.110	1.10	<0.100	0.246	<0.100	25.6
ARG-1	3	1	12	ARGPF312	2.65	2.69	1.21	<0.100	9.71	1.60	1.48	0.711	22.2
DHW19M-20-SSM-S	3	1	13	S-10530PF11	2.37	3.97	1.31	1.04	2.45	0.824	<0.100	<0.100	21.5
DHW19M-18-SSM-S	3	1	14	S-10528PF21	1.54	3.84	1.11	0.743	4.30	0.590	0.177	<0.100	22.9
DHW19M-24-SSM-S	3	1	15	S-10534PF21	2.89	3.90	2.73	0.559	1.32	0.764	0.141	<0.100	22.5
DHW19M-22-1-SSM-S	3	1	16	S-10532PF11	1.28	4.68	3.00	1.02	0.147	0.544	0.123	<0.100	23.9
DHW19M-18-SSM-S	3	1	17	S-10528PF11	1.55	3.89	1.18	0.743	4.33	0.590	0.178	0.150	22.7
DHW19M-21-SSM-S	3	1	18	S-10531PF11	3.74	2.72	3.07	0.479	0.129	1.43	<0.100	<0.100	21.2
DHW19M-23-SSM-S	3	1	19	S-10533PF21	3.37	5.52	0.270	1.08	1.77	<0.100	<0.100	<0.100	21.9
DHW19M-21-SSM-S	3	1	20	S-10531PF21	3.72	2.75	2.94	0.465	0.128	1.43	<0.100	<0.100	21.4
LRM	3	1	21	LRMPF313	5.28	2.44	0.619	0.105	1.10	<0.100	0.246	<0.100	25.6
ARG-1	3	1	22	ARGPF313	2.64	2.66	1.22	<0.100	9.67	1.60	1.47	0.707	22.3
LRM	3	2	1	LRMPF321	5.19	2.36	0.579	0.134	1.15	<0.100	0.246	0.115	24.8
ARG-1	3	2	2	ARGPF321	2.49	2.58	1.16	<0.100	9.85	1.72	1.46	0.725	21.8
DHW19M-23-SSM-S	3	2	3	S-10533PF12	3.21	5.38	0.329	1.11	1.84	<0.100	<0.100	<0.100	21.6
DHW19M-20-SSM-S	3	2	4	S-10530PF22	2.25	3.89	1.29	1.05	2.55	0.884	<0.100	<0.100	21.3
DHW19M-19-SSM-S	3	2	5	S-10529PF22	1.81	5.50	3.70	1.35	3.55	0.653	<0.100	<0.100	19.5
DHW19M-25-SSM-S	3	2	6	S-10535PF22	1.92	3.28	0.612	1.46	1.54	0.209	0.137	<0.100	24.9
DHW19M-23-SSM-S	3	2	7	S-10533PF22	3.15	5.34	0.241	1.12	1.83	<0.100	<0.100	<0.100	21.3
DHW19M-18-SSM-S	3	2	8	S-10528PF22	1.46	3.70	1.06	0.738	4.40	0.629	0.179	<0.100	22.3
DHW19M-21-SSM-S	3	2	9	S-10531PF12	3.53	2.65	3.01	0.487	0.150	1.55	<0.100	<0.100	21.1
DHW19M-22-1-SSM-S	3	2	10	S-10532PF22	1.18	4.44	2.90	0.977	0.136	0.594	0.125	<0.100	23.1

Table A-1. Measurements of the Samples Prepared by PF in Analytical Sequence **(continued)**

Glass ID	Block	Sub-Blk	Sequence	Lab ID	Al (wt%)	B (wt%)	Ca (wt%)	Cr (wt%)	Fe (wt%)	Li (wt%)	Mn (wt%)	Ni (wt%)	Si (wt%)
LRM	3	2	11	LRMPF322	5.23	2.37	0.584	0.133	1.14	<0.100	0.247	0.105	25.0
ARG-1	3	2	12	ARGPF322	2.49	2.59	1.16	<0.100	9.89	1.71	1.46	0.730	21.8
DHW19M-20-SSM-S	3	2	13	S-10530PF12	2.25	3.86	1.28	1.06	2.52	0.886	<0.100	<0.100	21.1
DHW19M-21-SSM-S	3	2	14	S-10531PF22	3.51	2.66	2.86	0.486	0.152	1.53	<0.100	<0.100	20.9
DHW19M-25-SSM-S	3	2	15	S-10535PF12	1.91	3.21	0.516	1.40	1.53	0.207	0.136	<0.100	24.9
DHW19M-18-SSM-S	3	2	16	S-10528PF12	1.47	3.69	1.13	0.744	4.39	0.631	0.180	0.152	22.4
DHW19M-24-SSM-S	3	2	17	S-10534PF22	2.72	3.76	2.66	0.559	1.37	0.818	0.144	<0.100	22.1
DHW19M-24-SSM-S	3	2	18	S-10534PF12	2.73	3.79	2.59	0.552	1.38	0.819	0.144	<0.100	22.2
DHW19M-19-SSM-S	3	2	19	S-10529PF12	1.83	5.56	3.68	1.33	3.54	0.655	<0.100	<0.100	19.3
DHW19M-22-1-SSM-S	3	2	20	S-10532PF12	1.20	4.48	2.91	1.01	0.162	0.580	0.125	<0.100	23.3
LRM	3	2	21	LRMPF323	5.27	2.38	0.593	0.134	1.14	<0.100	0.249	0.108	25.0
ARG-1	3	2	22	ARGPF323	2.51	2.59	1.18	<0.100	9.88	1.73	1.46	0.727	21.9
LRM	4	1	1	LRMPF411	5.21	2.39	0.541	0.116	1.10	<0.100	0.243	0.110	25.0
ARG-1	4	1	2	ARGPF411	2.50	2.58	1.13	<0.100	9.63	1.60	1.44	0.719	21.6
DHW19M-29-SSM-S	4	1	3	S-10539PF21	1.09	2.95	1.31	0.873	2.13	1.36	0.155	<0.100	24.9
DHW19M-31-SSM-S	4	1	4	S-10541PF11	3.61	5.91	2.08	0.680	3.99	1.04	0.100	<0.100	18.7
DHW19M-29-SSM-S	4	1	5	S-10539PF11	1.09	2.95	1.29	0.886	2.14	1.36	0.155	<0.100	24.8
DHW19M-31-SSM-S	4	1	6	S-10541PF21	3.61	5.89	2.06	0.670	3.99	1.04	<0.100	<0.100	18.7
DHW19M-26-SSM-S	4	1	7	S-10536PF21	2.14	3.48	2.63	0.688	4.01	0.904	0.193	0.119	20.5
DHW19M-33-SSM-S	4	1	8	S-10543PF11	2.83	3.66	0.895	0.830	4.70	0.165	0.159	<0.100	20.3
DHW19M-33-SSM-S	4	1	9	S-10543PF21	2.87	3.71	0.916	0.826	4.74	0.166	0.161	<0.100	20.4
DHW19M-28-SSM-S	4	1	10	S-10538PF11	1.62	4.30	0.369	0.706	0.172	1.58	<0.100	<0.100	23.7
LRM	4	1	11	LRMPF412	5.42	2.45	0.465	0.145	1.11	<0.100	0.249	0.113	25.3
ARG-1	4	1	12	ARGPF412	2.58	2.65	0.995	<0.100	9.78	1.63	1.47	0.724	22.1
DHW19M-30-SSM-S	4	1	13	S-10540PF21	3.62	4.39	1.87	0.783	1.06	0.290	<0.100	<0.100	20.7

Table A-1. Measurements of the Samples Prepared by PF in Analytical Sequence **(continued)**

Glass ID	Block	Sub-Blk	Sequence	Lab ID	Al (wt%)	B (wt%)	Ca (wt%)	Cr (wt%)	Fe (wt%)	Li (wt%)	Mn (wt%)	Ni (wt%)	Si (wt%)
DHW19M-27-SSM-S	4	1	14	S-10537PF21	3.50	2.90	2.46	0.540	0.119	1.40	<0.100	<0.100	20.6
DHW19M-30-SSM-S	4	1	15	S-10540PF11	3.61	4.38	1.86	0.809	1.05	0.288	<0.100	<0.100	20.7
DHW19M-27-SSM-S	4	1	16	S-10537PF11	3.51	2.94	2.50	0.526	0.114	1.39	<0.100	<0.100	20.6
DHW19M-26-SSM-S	4	1	17	S-10536PF11	2.13	3.44	2.59	0.664	3.97	0.898	0.192	0.118	20.4
DHW19M-32-SSM-S	4	1	18	S-10542PF21	1.32	4.89	1.64	1.14	1.86	1.29	0.147	<0.100	21.7
DHW19M-28-SSM-S	4	1	19	S-10538PF21	1.61	4.29	0.206	0.679	0.169	1.55	<0.100	<0.100	24.2
DHW19M-32-SSM-S	4	1	20	S-10542PF11	1.35	4.91	1.68	1.14	1.88	1.31	0.148	<0.100	22.2
LRM	4	1	21	LRMPF413	5.40	2.39	0.459	0.169	1.10	<0.100	0.245	0.118	25.2
ARG-1	4	1	22	ARGPF413	2.60	2.65	1.00	<0.100	9.72	1.63	1.46	0.711	21.9
LRM	4	2	1	LRMPF421	5.20	2.36	0.453	<0.100	1.13	<0.100	0.241	<0.100	24.6
ARG-1	4	2	2	ARGPF421	2.55	2.53	1.09	<0.100	9.45	1.47	1.37	0.623	20.6
DHW19M-29-SSM-S	4	2	3	S-10539PF22	1.08	2.81	1.35	0.796	2.19	1.26	0.151	<0.100	24.1
DHW19M-28-SSM-S	4	2	4	S-10538PF12	1.59	4.05	0.373	0.593	0.170	1.45	<0.100	<0.100	23.3
DHW19M-30-SSM-S	4	2	5	S-10540PF12	3.53	4.17	1.91	0.709	1.07	0.267	<0.100	<0.100	20.1
DHW19M-31-SSM-S	4	2	6	S-10541PF12	3.56	5.69	2.15	0.561	4.06	0.962	<0.100	<0.100	18.1
DHW19M-32-SSM-S	4	2	7	S-10542PF12	1.33	4.72	1.74	1.04	1.91	1.20	0.143	<0.100	21.4
DHW19M-33-SSM-S	4	2	8	S-10543PF22	2.84	3.51	0.960	0.701	4.77	0.155	0.156	<0.100	19.8
DHW19M-30-SSM-S	4	2	9	S-10540PF22	3.59	4.18	1.97	0.720	1.06	0.267	<0.100	<0.100	20.2
DHW19M-29-SSM-S	4	2	10	S-10539PF12	1.10	2.87	1.40	0.810	2.19	1.26	0.152	<0.100	24.2
LRM	4	2	11	LRMPF422	5.33	2.33	0.493	<0.100	1.11	<0.100	0.239	<0.100	24.5
ARG-1	4	2	12	ARGPF422	2.53	2.49	1.08	<0.100	9.38	1.47	1.36	0.629	20.6
DHW19M-28-SSM-S	4	2	13	S-10538PF22	1.61	4.20	0.245	0.615	0.166	1.45	<0.100	<0.100	23.4
DHW19M-27-SSM-S	4	2	14	S-10537PF12	3.49	2.81	2.68	0.464	0.110	1.28	<0.100	<0.100	20.0
DHW19M-27-SSM-S	4	2	15	S-10537PF22	3.54	2.84	2.68	0.455	0.112	1.31	<0.100	<0.100	20.2
DHW19M-32-SSM-S	4	2	16	S-10542PF22	1.36	4.79	1.81	1.08	1.89	1.21	0.144	<0.100	21.3

Table A-1. Measurements of the Samples Prepared by PF in Analytical Sequence **(continued)**

Glass ID	Block	Sub-Blk	Sequence	Lab ID	Al (wt%)	B (wt%)	Ca (wt%)	Cr (wt%)	Fe (wt%)	Li (wt%)	Mn (wt%)	Ni (wt%)	Si (wt%)
DHW19M-26-SSM-S	4	2	17	S-10536PF12	2.17	3.38	2.84	0.604	4.02	0.849	0.186	<0.100	19.9
DHW19M-33-SSM-S	4	2	18	S-10543PF12	2.87	3.54	0.991	0.702	4.70	0.157	0.155	<0.100	19.7
DHW19M-31-SSM-S	4	2	19	S-10541PF22	3.67	5.75	2.26	0.594	4.02	0.981	<0.100	<0.100	18.3
DHW19M-26-SSM-S	4	2	20	S-10536PF22	2.16	3.36	2.83	0.606	4.02	0.847	0.186	<0.100	19.8
LRM	4	2	21	LRMPF423	5.37	2.34	0.515	<0.100	1.10	<0.100	0.236	<0.100	24.3
ARG-1	4	2	22	ARGPF423	2.54	2.50	1.08	<0.100	9.35	1.47	1.36	0.615	20.8

Table A-2. Measurements of the Samples Prepared by AD in Analytical Sequence

Glass ID	Block	Sub-Blk	Sequence	Lab ID	K (wt%)	Na (wt%)	P (wt%)	Pb (wt%)	S (wt%)	Zr (wt%)
LRM	1	1	1	LRMAD111	1.12	15.8	0.217	0.0876	0.0778	0.734
ARG-1	1	1	2	ARG1AD111	2.15	8.68	0.113	<0.0500	<0.0500	0.103
DHW19M-7-1-SSM-S	1	1	3	S-10517AD11	4.31	12.8	0.0581	0.0890	0.731	<0.0500
DHW19M-9-SSM-S	1	1	4	S-10519AD11	3.85	15.3	0.142	0.209	0.472	0.0852
DHW19M-5-SSM-S	1	1	5	S-10515AD21	2.82	13.2	0.0990	0.149	0.691	0.0527
DHW19M-3-1-SSM-S	1	1	6	S-10513AD11	5.02	12.1	0.138	0.212	0.462	0.0822
DHW19M-6-1-SSM-S	1	1	7	S-10516AD21	4.67	13.2	0.0639	0.0864	0.504	<0.0500
DHW19M-2-3-SSM-S	1	1	8	S-10512AD11	0.354	14.4	0.152	0.218	0.480	0.0878
DHW19M-7-1-SSM-S	1	1	9	S-10517AD21	3.91	11.5	0.0567	0.0849	0.707	<0.0500
DHW19M-5-SSM-S	1	1	10	S-10515AD11	2.56	11.9	0.0935	0.139	0.679	<0.0500
DHW19M-4-SSM-S	1	1	11	S-10514AD21	2.55	13.5	0.147	0.217	0.518	0.0825
LRM	1	1	12	LRMAD112	0.997	14.0	0.214	0.0842	0.0594	0.683
ARG-1	1	1	13	ARG1AD112	1.90	7.74	0.109	<0.0500	<0.0500	0.0929
DHW19M-8-SSM-S	1	1	14	S-10518AD21	2.09	14.0	0.0659	0.101	0.682	<0.0500
DHW19M-9-SSM-S	1	1	15	S-10519AD21	3.46	13.7	0.134	0.200	0.454	0.0812
DHW19M-4-SSM-S	1	1	16	S-10514AD11	2.59	13.7	0.144	0.215	0.523	0.0842
DHW19M-3-1-SSM-S	1	1	17	S-10513AD21	4.85	11.6	0.133	0.203	0.436	0.0767
DHW19M-1-3-SSM-S	1	1	18	S-10511AD11	0.307	12.8	<0.0500	0.0714	0.706	<0.0500
DHW19M-1-3-SSM-S	1	1	19	S-10511AD21	0.328	12.8	0.0564	0.0762	0.715	<0.0500
DHW19M-8-SSM-S	1	1	20	S-10518AD11	2.09	13.9	0.0698	0.0988	0.679	<0.0500
DHW19M-6-1-SSM-S	1	1	21	S-10516AD11	4.51	12.7	0.0555	0.0869	0.497	<0.0500
DHW19M-2-3-SSM-S	1	1	22	S-10512AD21	0.367	14.1	0.140	0.214	0.481	0.0851
LRM	1	1	23	LRMAD113	1.01	13.9	0.220	0.0787	0.0760	0.690
ARG-1	1	1	24	ARG1AD113	1.93	7.67	0.115	<0.0500	<0.0500	0.0955
LRM	1	2	1	LRMAD121	1.15	14.2	0.227	0.0900	0.0825	0.765

Table A-2. Measurements of the Samples Prepared by AD in Analytical Sequence **(continued)**

Glass ID	Block	Sub-Blk	Sequence	Lab ID	K (wt%)	Na (wt%)	P (wt%)	Pb (wt%)	S (wt%)	Zr (wt%)
ARG-1	1	2	2	ARG1AD121	2.22	7.82	0.118	<0.0500	<0.0500	0.114
DHW19M-9-SSM-S	1	2	3	S-10519AD22	4.01	13.8	0.138	0.214	0.471	0.0939
DHW19M-4-SSM-S	1	2	4	S-10514AD22	2.96	13.8	0.153	0.227	0.554	0.0919
DHW19M-2-3-SSM-S	1	2	5	S-10512AD12	0.421	14.0	0.149	0.229	0.494	0.0921
DHW19M-1-3-SSM-S	1	2	6	S-10511AD12	0.356	12.8	0.0507	0.0773	0.731	<0.0500
DHW19M-9-SSM-S	1	2	7	S-10519AD12	4.02	13.5	0.139	0.218	0.476	0.0861
DHW19M-8-SSM-S	1	2	8	S-10518AD22	2.41	14.1	0.0704	0.105	0.717	<0.0500
DHW19M-5-SSM-S	1	2	9	S-10515AD22	2.99	12.1	0.102	0.154	0.735	0.0539
DHW19M-7-1-SSM-S	1	2	10	S-10517AD12	4.38	11.2	0.0637	0.0866	0.752	<0.0500
DHW19M-6-1-SSM-S	1	2	11	S-10516AD12	5.08	12.6	0.0625	0.0912	0.509	<0.0500
LRM	1	2	12	LRMAD122	1.16	14.1	0.224	0.0868	0.0664	0.720
ARG-1	1	2	13	ARG1AD122	2.19	7.68	0.122	<0.0500	<0.0500	0.100
DHW19M-4-SSM-S	1	2	14	S-10514AD12	2.96	13.7	0.152	0.225	0.549	0.0937
DHW19M-8-SSM-S	1	2	15	S-10518AD12	2.37	13.8	0.0626	0.103	0.707	<0.0500
DHW19M-1-3-SSM-S	1	2	16	S-10511AD22	0.373	12.8	0.0515	0.0796	0.741	<0.0500
DHW19M-5-SSM-S	1	2	17	S-10515AD12	2.99	12.1	0.0968	0.148	0.748	0.0528
DHW19M-7-1-SSM-S	1	2	18	S-10517AD22	4.39	11.2	0.0614	0.0895	0.744	<0.0500
DHW19M-3-1-SSM-S	1	2	19	S-10513AD12	5.56	11.7	0.132	0.214	0.471	0.0830
DHW19M-3-1-SSM-S	1	2	20	S-10513AD22	5.48	11.4	0.138	0.215	0.445	0.0810
DHW19M-2-3-SSM-S	1	2	21	S-10512AD22	0.401	14.0	0.156	0.233	0.501	0.0908
DHW19M-6-1-SSM-S	1	2	22	S-10516AD22	5.12	12.5	0.0626	0.0863	0.522	<0.0500
LRM	1	2	23	LRMAD123	1.17	14.0	0.230	0.0903	0.0750	0.725
ARG-1	1	2	24	ARG1AD123	2.20	7.69	0.120	<0.0500	<0.0500	0.100
LRM	2	1	1	LRMAD211	1.13	15.1	0.204	0.0805	0.0918	0.674
ARG-1	2	1	2	ARG1AD211	2.18	8.31	0.0962	<0.0500	<0.0500	0.0965

Table A-2. Measurements of the Samples Prepared by AD in Analytical Sequence **(continued)**

Glass ID	Block	Sub-Blk	Sequence	Lab ID	K (wt%)	Na (wt%)	P (wt%)	Pb (wt%)	S (wt%)	Zr (wt%)
DHW19M-15-SSM-S	2	1	3	S-10525AD21	<0.0500	12.5	0.0734	0.109	0.832	<0.0500
DHW19M-17-1-SSM-S	2	1	4	S-10527AD11	4.69	12.1	0.146	0.206	0.527	0.0872
DHW19M-16-SSM-S	2	1	5	S-10526AD21	1.57	13.2	<0.0500	0.0889	0.495	<0.0500
DHW19M-11-SSM-S	2	1	6	S-10521AD21	2.58	12.2	0.127	0.181	0.664	0.0770
DHW19M-10-SSM-S	2	1	7	S-10520AD11	1.54	15.4	0.128	0.179	0.733	0.0719
DHW19M-13-SSM-S	2	1	8	S-10523AD21	0.979	14.7	0.144	0.205	0.847	0.0808
DHW19M-12-SSM-S	2	1	9	S-10522AD11	1.23	11.9	<0.0500	0.0814	0.441	<0.0500
DHW19M-10-SSM-S	2	1	10	S-10520AD21	1.53	15.3	0.119	0.178	0.702	0.0705
LRM	2	1	11	LRMAD212	1.16	15.2	0.200	0.0767	0.0711	0.659
ARG-1	2	1	12	ARG1AD212	2.18	8.31	0.0940	<0.0500	<0.0500	0.0936
DHW19M-13-SSM-S	2	1	13	S-10523AD11	0.964	14.7	0.145	0.205	0.825	0.0815
DHW19M-14-SSM-S	2	1	14	S-10524AD11	0.0596	15.3	0.103	0.158	0.713	0.0629
DHW19M-12-SSM-S	2	1	15	S-10522AD21	1.25	12.0	<0.0500	0.0799	0.417	<0.0500
DHW19M-15-SSM-S	2	1	16	S-10525AD11	<0.0500	12.8	0.0673	0.102	0.824	<0.0500
DHW19M-17-1-SSM-S	2	1	17	S-10527AD21	4.71	12.1	0.145	0.205	0.511	0.0842
DHW19M-14-SSM-S	2	1	18	S-10524AD21	0.0504	15.1	0.102	0.163	0.722	0.0632
DHW19M-16-SSM-S	2	1	19	S-10526AD11	1.61	13.3	0.0584	0.0886	0.486	<0.0500
DHW19M-11-SSM-S	2	1	20	S-10521AD11	2.63	12.3	0.123	0.178	0.678	0.0751
LRM	2	1	21	LRMAD213	1.18	15.3	0.194	0.0730	0.0696	0.650
ARG-1	2	1	22	ARG1AD213	2.18	8.35	0.102	<0.0500	<0.0500	0.0925
LRM	2	2	1	LRMAD221	1.10	14.8	0.213	0.0783	0.0913	0.678
ARG-1	2	2	2	ARG1AD221	2.06	8.11	0.109	<0.0500	<0.0500	0.0974
DHW19M-13-SSM-S	2	2	3	S-10523AD12	0.936	14.4	0.150	0.220	0.877	0.0856
DHW19M-15-SSM-S	2	2	4	S-10525AD22	<0.0500	12.5	0.0766	0.111	0.858	<0.0500
DHW19M-14-SSM-S	2	2	5	S-10524AD12	0.0826	14.9	0.113	0.167	0.768	0.0654

Table A-2. Measurements of the Samples Prepared by AD in Analytical Sequence **(continued)**

Glass ID	Block	Sub-Blk	Sequence	Lab ID	K (wt%)	Na (wt%)	P (wt%)	Pb (wt%)	S (wt%)	Zr (wt%)
DHW19M-14-SSM-S	2	2	6	S-10524AD22	0.0749	14.9	0.117	0.173	0.783	0.0668
DHW19M-12-SSM-S	2	2	7	S-10522AD22	1.20	11.6	0.0555	0.0837	0.450	<0.0500
DHW19M-16-SSM-S	2	2	8	S-10526AD12	1.55	13.1	0.0646	0.103	0.525	<0.0500
DHW19M-13-SSM-S	2	2	9	S-10523AD22	0.945	14.8	0.146	0.216	0.849	0.0839
DHW19M-10-SSM-S	2	2	10	S-10520AD22	1.47	15.2	0.131	0.191	0.732	0.0740
LRM	2	2	11	LRMAD222	1.13	15.0	0.206	0.0845	0.0836	0.676
ARG-1	2	2	12	ARG1AD222	2.08	8.25	0.108	<0.0500	<0.0500	0.0975
DHW19M-16-SSM-S	2	2	13	S-10526AD22	1.49	13.1	0.0643	0.0978	0.489	<0.0500
DHW19M-11-SSM-S	2	2	14	S-10521AD12	2.49	12.1	0.134	0.192	0.695	0.0782
DHW19M-12-SSM-S	2	2	15	S-10522AD12	1.20	11.7	0.0565	0.0815	0.487	<0.0500
DHW19M-15-SSM-S	2	2	16	S-10525AD12	<0.0500	12.5	0.0797	0.109	0.862	<0.0500
DHW19M-17-1-SSM-S	2	2	17	S-10527AD12	4.55	11.9	0.152	0.222	0.559	0.0876
DHW19M-11-SSM-S	2	2	18	S-10521AD22	2.48	12.1	0.129	0.196	0.682	0.0781
DHW19M-10-SSM-S	2	2	19	S-10520AD12	1.47	15.3	0.130	0.186	0.745	0.0732
DHW19M-17-1-SSM-S	2	2	20	S-10527AD22	4.48	11.9	0.147	0.213	0.554	0.0874
LRM	2	2	21	LRMAD223	1.13	14.8	0.208	0.0803	0.0955	0.670
ARG-1	2	2	22	ARG1AD223	2.06	8.21	0.108	<0.0500	<0.0500	0.0962
LRM	3	1	1	LRMAD311	1.12	15.2	0.211	0.0838	0.0737	0.679
ARG-1	3	1	2	ARG1AD311	2.11	8.29	0.108	<0.0500	<0.0500	0.0980
DHW19M-19-SSM-S	3	1	3	S-10529AD11	1.81	12.5	0.0505	0.0755	0.635	<0.0500
DHW19M-20-SSM-S	3	1	4	S-10530AD21	2.27	15.3	0.0692	0.0971	0.673	<0.0500
DHW19M-22-1-SSM-S	3	1	5	S-10532AD11	0.787	14.7	0.0907	0.129	0.672	<0.0500
DHW19M-25-SSM-S	3	1	6	S-10535AD11	2.62	13.9	0.0890	0.141	0.427	0.0605
DHW19M-19-SSM-S	3	1	7	S-10529AD21	1.80	12.4	<0.0500	0.0677	0.595	<0.0500
DHW19M-23-SSM-S	3	1	8	S-10533AD21	0.834	15.0	<0.0500	0.0696	0.367	<0.0500

Table A-2. Measurements of the Samples Prepared by AD in Analytical Sequence **(continued)**

Glass ID	Block	Sub-Blk	Sequence	Lab ID	K (wt%)	Na (wt%)	P (wt%)	Pb (wt%)	S (wt%)	Zr (wt%)
DHW19M-24-SSM-S	3	1	9	S-10534AD11	3.40	13.1	0.0983	0.146	0.590	0.0579
DHW19M-25-SSM-S	3	1	10	S-10535AD21	2.62	13.7	0.0884	0.138	0.412	0.0598
LRM	3	1	11	LRMAD312	1.10	15.2	0.218	0.0809	0.0793	0.670
ARG-1	3	1	12	ARG1AD312	2.08	8.36	0.108	<0.0500	<0.0500	0.0967
DHW19M-20-SSM-S	3	1	13	S-10530AD11	2.23	15.3	0.0575	0.0949	0.581	<0.0500
DHW19M-18-SSM-S	3	1	14	S-10528AD11	1.73	14.0	0.123	0.174	0.505	0.0708
DHW19M-18-SSM-S	3	1	15	S-10528AD21	1.75	14.1	0.122	0.174	0.494	0.0707
DHW19M-22-1-SSM-S	3	1	16	S-10532AD21	0.763	14.7	0.0861	0.133	0.690	<0.0500
DHW19M-23-SSM-S	3	1	17	S-10533AD11	0.835	14.9	<0.0500	0.0677	0.370	<0.0500
DHW19M-24-SSM-S	3	1	18	S-10534AD21	3.38	13.2	0.0944	0.146	0.597	0.0581
DHW19M-21-SSM-S	3	1	19	S-10531AD11	3.15	16.1	0.0591	0.0790	0.916	<0.0500
DHW19M-21-SSM-S	3	1	20	S-10531AD21	3.09	15.9	0.0522	0.0743	0.901	<0.0500
LRM	3	1	21	LRMAD313	1.06	15.0	0.196	0.0725	0.0946	0.646
ARG-1	3	1	22	ARG1AD313	2.04	8.24	0.105	<0.0500	<0.0500	0.0929
LRM	3	2	1	LRMAD321	1.12	14.8	0.202	0.0833	0.0740	0.657
ARG-1	3	2	2	ARG1AD321	2.08	8.09	0.103	<0.0500	<0.0500	0.0949
DHW19M-22-1-SSM-S	3	2	3	S-10532AD22	0.801	14.3	0.0945	0.148	0.672	0.0505
DHW19M-21-SSM-S	3	2	4	S-10531AD22	3.16	15.8	0.0555	0.0862	0.912	<0.0500
DHW19M-18-SSM-S	3	2	5	S-10528AD12	1.75	13.6	0.125	0.186	0.509	0.0723
DHW19M-24-SSM-S	3	2	6	S-10534AD12	3.40	12.7	0.110	0.160	0.583	0.0594
DHW19M-25-SSM-S	3	2	7	S-10535AD22	2.66	13.6	0.0960	0.146	0.411	0.0609
DHW19M-19-SSM-S	3	2	8	S-10529AD12	1.83	12.2	0.0507	0.0786	0.614	<0.0500
DHW19M-18-SSM-S	3	2	9	S-10528AD22	1.80	13.8	0.118	0.194	0.497	0.0730
DHW19M-23-SSM-S	3	2	10	S-10533AD22	0.864	14.8	<0.0500	0.0730	0.372	<0.0500
LRM	3	2	11	LRMAD322	1.11	14.7	0.208	0.0865	0.0721	0.657

Table A-2. Measurements of the Samples Prepared by AD in Analytical Sequence **(continued)**

Glass ID	Block	Sub-Blk	Sequence	Lab ID	K (wt%)	Na (wt%)	P (wt%)	Pb (wt%)	S (wt%)	Zr (wt%)
ARG-1	3	2	12	ARG1AD322	2.08	8.19	0.105	<0.0500	<0.0500	0.0948
DHW19M-20-SSM-S	3	2	13	S-10530AD22	2.28	14.8	0.0614	0.0940	0.602	<0.0500
DHW19M-23-SSM-S	3	2	14	S-10533AD12	0.863	14.7	<0.0500	0.0709	0.379	<0.0500
DHW19M-25-SSM-S	3	2	15	S-10535AD12	2.65	13.7	0.0936	0.154	0.402	0.0615
DHW19M-21-SSM-S	3	2	16	S-10531AD12	3.17	15.8	0.0559	0.0813	0.896	<0.0500
DHW19M-19-SSM-S	3	2	17	S-10529AD22	1.80	12.1	<0.0500	0.0726	0.598	<0.0500
DHW19M-24-SSM-S	3	2	18	S-10534AD22	3.39	12.8	0.109	0.164	0.596	0.0584
DHW19M-20-SSM-S	3	2	19	S-10530AD12	2.26	14.8	0.0652	0.0993	0.633	<0.0500
DHW19M-22-1-SSM-S	3	2	20	S-10532AD12	0.812	14.5	0.0928	0.138	0.697	0.0504
LRM	3	2	21	LRMAD323	1.09	14.8	0.207	0.0818	0.0682	0.654
ARG-1	3	2	22	ARG1AD323	2.08	8.17	0.105	<0.0500	<0.0500	0.0949
LRM	4	1	1	LRMAD411	1.14	15.5	0.201	0.0840	0.105	0.658
ARG-1	4	1	2	ARG1AD411	2.15	8.41	0.106	<0.0500	<0.0500	0.0952
DHW19M-33-SSM-S	4	1	3	S-10543AD11	5.89	13.0	0.114	0.162	0.391	0.0702
DHW19M-29-SSM-S	4	1	4	S-10539AD21	0.0657	15.4	0.112	0.158	0.770	0.0652
DHW19M-26-SSM-S	4	1	5	S-10536AD11	3.57	14.1	0.133	0.203	0.655	0.0858
DHW19M-32-SSM-S	4	1	6	S-10542AD11	1.49	13.6	0.112	0.156	0.713	0.0651
DHW19M-33-SSM-S	4	1	7	S-10543AD21	5.92	13.0	0.111	0.156	0.381	0.0690
DHW19M-32-SSM-S	4	1	8	S-10542AD21	1.47	13.7	0.102	0.152	0.737	0.0648
DHW19M-29-SSM-S	4	1	9	S-10539AD11	<0.0500	15.4	0.110	0.160	0.768	0.0643
DHW19M-30-SSM-S	4	1	10	S-10540AD11	5.45	12.7	0.0731	0.101	0.479	<0.0500
LRM	4	1	11	LRMAD412	1.11	15.3	0.205	0.0791	0.0966	0.645
ARG-1	4	1	12	ARG1AD412	2.14	8.40	0.100	<0.0500	<0.0500	0.0929
DHW19M-28-SSM-S	4	1	13	S-10538AD11	2.51	13.5	<0.0500	0.0682	0.735	<0.0500
DHW19M-31-SSM-S	4	1	14	S-10541AD21	0.247	13.6	0.0799	0.101	0.612	<0.0500

Table A-2. Measurements of the Samples Prepared by AD in Analytical Sequence **(continued)**

Glass ID	Block	Sub-Blk	Sequence	Lab ID	K (wt%)	Na (wt%)	P (wt%)	Pb (wt%)	S (wt%)	Zr (wt%)
DHW19M-27-SSM-S	4	1	15	S-10537AD21	3.59	16.4	0.0508	0.0712	0.919	<0.0500
DHW19M-27-SSM-S	4	1	16	S-10537AD11	3.57	16.2	0.0520	0.0704	0.923	<0.0500
DHW19M-26-SSM-S	4	1	17	S-10536AD21	3.62	14.1	0.145	0.197	0.640	0.0846
DHW19M-30-SSM-S	4	1	18	S-10540AD21	5.48	12.7	0.0661	0.101	0.464	<0.0500
DHW19M-31-SSM-S	4	1	19	S-10541AD11	0.277	13.8	0.0712	0.0956	0.626	<0.0500
DHW19M-28-SSM-S	4	1	20	S-10538AD21	2.49	13.4	<0.0500	0.0658	0.740	<0.0500
LRM	4	1	21	LRMAD413	1.14	15.4	0.195	0.0730	0.0800	0.639
ARG-1	4	1	22	ARG1AD413	2.15	8.47	0.111	<0.0500	<0.0500	0.0924
LRM	4	2	1	LRMAD421	1.13	15.4	0.215	0.0824	0.107	0.670
ARG-1	4	2	2	ARG1AD421	2.07	8.45	0.118	<0.0500	<0.0500	0.0967
DHW19M-29-SSM-S	4	2	3	S-10539AD12	0.0717	15.4	0.120	0.168	0.771	0.0663
DHW19M-30-SSM-S	4	2	4	S-10540AD22	5.28	12.7	0.0702	0.110	0.465	<0.0500
DHW19M-26-SSM-S	4	2	5	S-10536AD22	3.50	14.1	0.144	0.214	0.665	0.0874
DHW19M-26-SSM-S	4	2	6	S-10536AD12	3.47	14.0	0.150	0.214	0.662	0.0870
DHW19M-32-SSM-S	4	2	7	S-10542AD12	1.41	13.5	0.123	0.159	0.716	0.0648
DHW19M-28-SSM-S	4	2	8	S-10538AD22	2.40	13.6	0.0543	0.0798	0.771	<0.0500
DHW19M-33-SSM-S	4	2	9	S-10543AD12	5.76	13.0	0.117	0.174	0.390	0.0693
DHW19M-28-SSM-S	4	2	10	S-10538AD12	2.37	13.5	0.0512	0.0794	0.756	<0.0500
LRM	4	2	11	LRMAD422	1.11	15.5	0.210	0.0849	0.100	0.659
ARG-1	4	2	12	ARG1AD422	2.11	8.53	0.104	<0.0500	<0.0500	0.0945
DHW19M-29-SSM-S	4	2	13	S-10539AD22	<0.0500	15.4	0.118	0.178	0.776	0.0679
DHW19M-33-SSM-S	4	2	14	S-10543AD22	5.74	13.1	0.114	0.174	0.412	0.0702
DHW19M-27-SSM-S	4	2	15	S-10537AD12	3.47	16.3	0.0575	0.0841	0.943	<0.0500
DHW19M-32-SSM-S	4	2	16	S-10542AD22	1.43	13.6	0.120	0.163	0.724	0.0654
DHW19M-31-SSM-S	4	2	17	S-10541AD22	0.232	13.6	0.0778	0.0983	0.625	<0.0500

Table A-2. Measurements of the Samples Prepared by AD in Analytical Sequence **(continued)**

Glass ID	Block	Sub-Blk	Sequence	Lab ID	K (wt%)	Na (wt%)	P (wt%)	Pb (wt%)	S (wt%)	Zr (wt%)
DHW19M-27-SSM-S	4	2	18	S-10537AD22	3.44	16.4	0.0573	0.0841	0.938	<0.0500
DHW19M-30-SSM-S	4	2	19	S-10540AD12	5.34	12.9	0.0786	0.109	0.490	<0.0500
DHW19M-31-SSM-S	4	2	20	S-10541AD12	0.268	13.7	0.0761	0.116	0.637	<0.0500
LRM	4	2	21	LRMAD423	1.10	15.4	0.212	0.0829	0.0745	0.660
ARG-1	4	2	22	ARG1AD423	2.06	8.46	0.109	<0.0500	<0.0500	0.0946

Table A-3. Measurements of the Samples Prepared by KH in Analytical Sequence

Glass ID	Block	Sub-Blk	Sequence	Lab ID	Cl (wt%)	F (wt%)
LRM	1	1	1	LRMKH111	<0.0250	0.909
DHW19M-1-3-SSM-S	1	1	2	S-10511KH11	<0.0250	<0.0250
DHW19M-5-SSM-S	1	1	3	S-10515KH11	<0.0250	0.0360
DHW19M-6-1-SSM-S	1	1	4	S-10516KH21	<0.0250	<0.0250
DHW19M-2-3-SSM-S	1	1	5	S-10512KH11	0.0335	0.0544
DHW19M-7-1-SSM-S	1	1	6	S-10517KH11	<0.0250	<0.0250
DHW19M-8-SSM-S	1	1	7	S-10518KH11	<0.0250	<0.0250
DHW19M-4-SSM-S	1	1	8	S-10514KH21	<0.0250	0.0517
DHW19M-9-SSM-S	1	1	9	S-10519KH11	<0.0250	0.0500
DHW19M-5-SSM-S	1	1	10	S-10515KH21	<0.0250	0.0350
LRM	1	1	11	LRMKH112	<0.0250	0.899
DHW19M-3-1-SSM-S	1	1	12	S-10513KH21	0.0252	0.0399
DHW19M-7-1-SSM-S	1	1	13	S-10517KH21	<0.0250	<0.0250
DHW19M-1-3-SSM-S	1	1	14	S-10511KH21	<0.0250	<0.0250
DHW19M-6-1-SSM-S	1	1	15	S-10516KH11	<0.0250	<0.0250
DHW19M-9-SSM-S	1	1	16	S-10519KH21	<0.0250	0.0518
DHW19M-4-SSM-S	1	1	17	S-10514KH11	<0.0250	0.0522
DHW19M-3-1-SSM-S	1	1	18	S-10513KH11	0.0252	0.0410
DHW19M-2-3-SSM-S	1	1	19	S-10512KH21	0.0330	0.0519
DHW19M-8-SSM-S	1	1	20	S-10518KH21	<0.0250	<0.0250
LRM	1	1	21	LRMKH113	<0.0250	0.898
LRM	1	2	1	LRMKH121	<0.0250	0.909
DHW19M-9-SSM-S	1	2	2	S-10519KH22	<0.0250	0.0534
DHW19M-4-SSM-S	1	2	3	S-10514KH12	<0.0250	0.0543
DHW19M-2-3-SSM-S	1	2	4	S-10512KH22	0.0337	0.0534
DHW19M-6-1-SSM-S	1	2	5	S-10516KH12	<0.0250	<0.0250
DHW19M-2-3-SSM-S	1	2	6	S-10512KH12	0.0331	0.0551
DHW19M-6-1-SSM-S	1	2	7	S-10516KH22	<0.0250	<0.0250
DHW19M-5-SSM-S	1	2	8	S-10515KH12	<0.0250	0.0362
DHW19M-3-1-SSM-S	1	2	9	S-10513KH12	0.0259	0.0427
DHW19M-8-SSM-S	1	2	10	S-10518KH22	<0.0250	0.0254
LRM	1	2	11	LRMKH122	<0.0250	0.908
DHW19M-3-1-SSM-S	1	2	12	S-10513KH22	0.0279	0.0423
DHW19M-7-1-SSM-S	1	2	13	S-10517KH22	<0.0250	<0.0250
DHW19M-5-SSM-S	1	2	14	S-10515KH22	<0.0250	0.0369
DHW19M-8-SSM-S	1	2	15	S-10518KH12	<0.0250	0.0251

Table A-3. Measurements of the Samples Prepared by KH in Analytical Sequence (continued)

Glass ID	Block	Sub-Blk	Sequence	Lab ID	Cl (wt%)	F (wt%)
DHW19M-1-3-SSM-S	1	2	16	S-10511KH12	<0.0250	<0.0250
DHW19M-4-SSM-S	1	2	17	S-10514KH22	<0.0250	0.0543
DHW19M-7-1-SSM-S	1	2	18	S-10517KH12	<0.0250	<0.0250
DHW19M-9-SSM-S	1	2	19	S-10519KH12	<0.0250	0.0526
DHW19M-1-3-SSM-S	1	2	20	S-10511KH22	<0.0250	<0.0250
LRM	1	2	21	LRMKH123	<0.0250	0.906
LRM	2	1	1	LRMKH211	<0.0250	0.899
DHW19M-16-SSM-S	2	1	2	S-10526KH21	<0.0250	<0.0250
DHW19M-17-1-SSM-S	2	1	3	S-10527KH21	<0.0250	0.0454
DHW19M-11-SSM-S	2	1	4	S-10521KH21	0.0273	0.0407
DHW19M-10-SSM-S	2	1	5	S-10520KH11	0.0293	0.0473
DHW19M-15-SSM-S	2	1	6	S-10525KH21	<0.0250	<0.0250
DHW19M-12-SSM-S	2	1	7	S-10522KH21	<0.0250	<0.0250
DHW19M-14-SSM-S	2	1	8	S-10524KH21	0.0350	0.0416
DHW19M-15-SSM-S	2	1	9	S-10525KH11	<0.0250	<0.0250
LRM	2	1	10	LRMKH212	<0.0250	0.897
DHW19M-13-SSM-S	2	1	11	S-10523KH21	0.0315	0.0582
DHW19M-12-SSM-S	2	1	12	S-10522KH11	<0.0250	<0.0250
DHW19M-14-SSM-S	2	1	13	S-10524KH11	0.0329	0.0429
DHW19M-13-SSM-S	2	1	14	S-10523KH11	<0.0250	0.0576
DHW19M-16-SSM-S	2	1	15	S-10526KH11	<0.0250	<0.0250
DHW19M-10-SSM-S	2	1	16	S-10520KH21	0.0294	0.0455
DHW19M-17-1-SSM-S	2	1	17	S-10527KH11	<0.0250	0.0443
DHW19M-11-SSM-S	2	1	18	S-10521KH11	0.0252	0.0401
LRM	2	1	19	LRMKH213	<0.0250	0.893
LRM	2	2	1	LRMKH221	<0.0250	0.900
DHW19M-13-SSM-S	2	2	2	S-10523KH22	0.0319	0.0577
DHW19M-16-SSM-S	2	2	3	S-10526KH22	<0.0250	<0.0250
DHW19M-10-SSM-S	2	2	4	S-10520KH22	0.0298	0.0454
DHW19M-13-SSM-S	2	2	5	S-10523KH12	0.0251	0.0571
DHW19M-14-SSM-S	2	2	6	S-10524KH22	0.0354	0.0411
DHW19M-11-SSM-S	2	2	7	S-10521KH22	0.0267	0.0394
DHW19M-11-SSM-S	2	2	8	S-10521KH12	0.0253	0.0399
DHW19M-16-SSM-S	2	2	9	S-10526KH12	<0.0250	<0.0250
LRM	2	2	10	LRMKH222	<0.0250	0.901
DHW19M-12-SSM-S	2	2	11	S-10522KH12	<0.0250	<0.0250

Table A-3. Measurements of the Samples Prepared by KH in Analytical Sequence (continued)

Glass ID	Block	Sub-Blk	Sequence	Lab ID	Cl (wt%)	F (wt%)
DHW19M-12-SSM-S	2	2	12	S-10522KH22	<0.0250	<0.0250
DHW19M-15-SSM-S	2	2	13	S-10525KH12	<0.0250	<0.0250
DHW19M-17-1-SSM-S	2	2	14	S-10527KH12	<0.0250	0.0443
DHW19M-15-SSM-S	2	2	15	S-10525KH22	<0.0250	<0.0250
DHW19M-14-SSM-S	2	2	16	S-10524KH12	0.0329	0.0431
DHW19M-17-1-SSM-S	2	2	17	S-10527KH22	<0.0250	0.0446
DHW19M-10-SSM-S	2	2	18	S-10520KH12	0.0288	0.0459
LRM	2	2	19	LRMKH223	<0.0250	0.899
LRM	3	1	1	LRMKH311	<0.0250	0.883
DHW19M-18-SSM-S	3	1	2	S-10528KH21	<0.0250	0.0323
DHW19M-24-SSM-S	3	1	3	S-10534KH21	<0.0250	0.0326
DHW19M-23-SSM-S	3	1	4	S-10533KH21	<0.0250	<0.0250
DHW19M-18-SSM-S	3	1	5	S-10528KH11	<0.0250	0.0326
DHW19M-24-SSM-S	3	1	6	S-10534KH11	<0.0250	0.0325
DHW19M-23-SSM-S	3	1	7	S-10533KH11	<0.0250	<0.0250
DHW19M-20-SSM-S	3	1	8	S-10530KH11	<0.0250	<0.0250
DHW19M-19-SSM-S	3	1	9	S-10529KH11	<0.0250	<0.0250
LRM	3	1	10	LRMKH312	<0.0250	0.883
DHW19M-22-1-SSM-S	3	1	11	S-10532KH21	0.0259	0.0267
DHW19M-22-1-SSM-S	3	1	12	S-10532KH11	<0.0250	0.0268
DHW19M-21-SSM-S	3	1	13	S-10531KH11	<0.0250	<0.0250
DHW19M-20-SSM-S	3	1	14	S-10530KH21	<0.0250	<0.0250
DHW19M-19-SSM-S	3	1	15	S-10529KH21	<0.0250	<0.0250
DHW19M-25-SSM-S	3	1	16	S-10535KH21	<0.0250	0.0262
DHW19M-25-SSM-S	3	1	17	S-10535KH11	<0.0250	0.0273
DHW19M-21-SSM-S	3	1	18	S-10531KH21	<0.0250	<0.0250
LRM	3	1	19	LRMKH313	<0.0250	0.881
LRM	3	2	1	LRMKH321	<0.0250	0.877
DHW19M-22-1-SSM-S	3	2	2	S-10532KH22	<0.0250	0.0250
DHW19M-23-SSM-S	3	2	3	S-10533KH12	<0.0250	<0.0250
DHW19M-20-SSM-S	3	2	4	S-10530KH12	<0.0250	<0.0250
DHW19M-18-SSM-S	3	2	5	S-10528KH12	<0.0250	0.0318
DHW19M-23-SSM-S	3	2	6	S-10533KH22	<0.0250	<0.0250
DHW19M-24-SSM-S	3	2	7	S-10534KH22	<0.0250	0.0316
DHW19M-21-SSM-S	3	2	8	S-10531KH22	<0.0250	<0.0250
DHW19M-22-1-SSM-S	3	2	9	S-10532KH12	<0.0250	0.0253

Table A-3. Measurements of the Samples Prepared by KH in Analytical Sequence (continued)

Glass ID	Block	Sub-Blk	Sequence	Lab ID	Cl (wt%)	F (wt%)
LRM	3	2	10	LRMKH322	<0.0250	0.869
DHW19M-24-SSM-S	3	2	11	S-10534KH12	<0.0250	0.0309
DHW19M-19-SSM-S	3	2	12	S-10529KH12	<0.0250	<0.0250
DHW19M-25-SSM-S	3	2	13	S-10535KH22	<0.0250	<0.0250
DHW19M-20-SSM-S	3	2	14	S-10530KH22	<0.0250	<0.0250
DHW19M-21-SSM-S	3	2	15	S-10531KH12	<0.0250	<0.0250
DHW19M-25-SSM-S	3	2	16	S-10535KH12	<0.0250	0.0252
DHW19M-18-SSM-S	3	2	17	S-10528KH22	<0.0250	0.0302
DHW19M-19-SSM-S	3	2	18	S-10529KH22	<0.0250	<0.0250
LRM	3	2	19	LRMKH323	<0.0250	0.859
LRM	4	1	1	LRMKH411	<0.0250	0.931
DHW19M-30-SSM-S	4	1	2	S-10540KH21	<0.0250	0.0254
DHW19M-31-SSM-S	4	1	3	S-10541KH21	<0.0250	0.0299
DHW19M-27-SSM-S	4	1	4	S-10537KH21	<0.0250	0.0287
DHW19M-32-SSM-S	4	1	5	S-10542KH11	0.0250	0.0417
DHW19M-32-SSM-S	4	1	6	S-10542KH21	<0.0250	0.0404
DHW19M-28-SSM-S	4	1	7	S-10538KH21	<0.0250	<0.0250
DHW19M-29-SSM-S	4	1	8	S-10539KH11	0.0290	0.0448
DHW19M-33-SSM-S	4	1	9	S-10543KH11	<0.0250	0.0433
LRM	4	1	10	LRMKH412	<0.0250	0.915
DHW19M-28-SSM-S	4	1	11	S-10538KH11	<0.0250	<0.0250
DHW19M-33-SSM-S	4	1	12	S-10543KH21	<0.0250	0.0430
DHW19M-27-SSM-S	4	1	13	S-10537KH11	<0.0250	0.0272
DHW19M-30-SSM-S	4	1	14	S-10540KH11	<0.0250	<0.0250
DHW19M-31-SSM-S	4	1	15	S-10541KH11	<0.0250	0.0276
DHW19M-29-SSM-S	4	1	16	S-10539KH21	0.0307	0.0423
DHW19M-26-SSM-S	4	1	17	S-10536KH11	<0.0250	0.0643
DHW19M-26-SSM-S	4	1	18	S-10536KH21	<0.0250	0.0648
LRM	4	1	19	LRMKH413	<0.0250	0.891
LRM	4	2	1	LRMKH421	<0.0250	0.903
DHW19M-29-SSM-S	4	2	2	S-10539KH12	0.0288	0.0457
DHW19M-28-SSM-S	4	2	3	S-10538KH12	<0.0250	<0.0250
DHW19M-32-SSM-S	4	2	4	S-10542KH22	<0.0250	0.0403
DHW19M-33-SSM-S	4	2	5	S-10543KH12	<0.0250	0.0442
DHW19M-27-SSM-S	4	2	6	S-10537KH22	<0.0250	0.0282
DHW19M-32-SSM-S	4	2	7	S-10542KH12	<0.0250	0.0415

Table A-3. Measurements of the Samples Prepared by KH in Analytical Sequence (continued)

Glass ID	Block	Sub-Blk	Sequence	Lab ID	Cl (wt%)	F (wt%)
DHW19M-26-SSM-S	4	2	8	S-10536KH22	<0.0250	0.0670
DHW19M-31-SSM-S	4	2	9	S-10541KH12	<0.0250	0.0292
LRM	4	2	10	LRMKH422	<0.0250	0.904
DHW19M-26-SSM-S	4	2	11	S-10536KH12	<0.0250	0.0675
DHW19M-30-SSM-S	4	2	12	S-10540KH12	<0.0250	<0.0250
DHW19M-29-SSM-S	4	2	13	S-10539KH22	0.0323	0.0450
DHW19M-30-SSM-S	4	2	14	S-10540KH22	<0.0250	<0.0250
DHW19M-33-SSM-S	4	2	15	S-10543KH22	<0.0250	0.0449
DHW19M-31-SSM-S	4	2	16	S-10541KH22	<0.0250	0.0297
DHW19M-28-SSM-S	4	2	17	S-10538KH22	<0.0250	<0.0250
DHW19M-27-SSM-S	4	2	18	S-10537KH12	<0.0250	0.0290
LRM	4	2	19	LRMKH423	<0.0250	0.907

Table A-4. Comparison of Measured and Targeted Compositions

Glass ID	Oxide	Measured (wt %)	Targeted (wt %)	Difference of Measured versus Targeted	% Difference of Measured versus Targeted
ARG-1	Al2O3	4.75	4.73	0.020	
ARG-1	B2O3	8.31	8.67	-0.360	-4.2%
ARG-1	CaO	1.53	1.43	0.100	
ARG-1	Cl	0	0	0.000	
ARG-1	Cr2O3	<0.146	0.093	0.053	
ARG-1	F	0	0	0.000	
ARG-1	Fe2O3	14.0	14	0.000	0.0%
ARG-1	K2O	2.53	2.71	-0.180	
ARG-1	Li2O	3.51	3.21	0.300	
ARG-1	MnO	1.88	1.88	0.000	
ARG-1	Na2O	11.1	11.5	-0.400	-3.5%
ARG-1	NiO	0.913	1.05	-0.137	
ARG-1	P2O5	0.248	0.22	0.028	
ARG-1	PbO	<0.0539	0	0.054	
ARG-1	SO3	<0.125	0	0.125	
ARG-1	SiO2	46.8	47.9	-1.100	-2.3%
ARG-1	ZrO2	0.130	0.13	0.000	
ARG-1	Sum	96	97.5	-1.500	-1.5%
LRM	Al2O3	9.93	9.51	0.420	4.4%
LRM	B2O3	7.65	7.85	-0.200	-2.5%
LRM	CaO	0.741	0.54	0.201	
LRM	Cl	<0.0250	0	0.025	
LRM	Cr2O3	<0.179	0.19	-0.011	
LRM	F	0.897	0.86	0.037	
LRM	Fe2O3	1.61	1.38	0.230	
LRM	K2O	1.34	1.48	-0.140	
LRM	Li2O	<0.215	0.11	0.105	
LRM	MnO	0.319	0.08	0.239	
LRM	Na2O	20.1	20.03	0.070	0.3%
LRM	NiO	<0.145	0.19	-0.045	
LRM	P2O5	0.481	0.54	-0.059	
LRM	PbO	0.0882	0.1	-0.012	
LRM	SO3	0.204	0.3	-0.096	
LRM	SiO2	54.0	54.2	-0.200	-0.4%
LRM	ZrO2	0.913	0.93	-0.017	
LRM	Sum	98.8	98.3	0.500	0.5%
DHW19M-1-3-SSM-S	Al2O3	5.63	5.57	0.060	1.1%
DHW19M-1-3-SSM-S	B2O3	11.7	12.53	-0.830	-6.6%
DHW19M-1-3-SSM-S	CaO	3.96	3.61	0.350	
DHW19M-1-3-SSM-S	Cl	<0.0250	0.04	-0.015	
DHW19M-1-3-SSM-S	Cr2O3	1.84	2.46	-0.620	

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

Glass ID	Oxide	Measured (wt %)	Targeted (wt %)	Difference of Measured versus Targeted	% Difference of Measured versus Targeted
DHW19M-1-3-SSM-S	F	<0.0250	0.04	-0.015	
DHW19M-1-3-SSM-S	Fe2O3	5.75	5.64	0.110	2.0%
DHW19M-1-3-SSM-S	K2O	0.411	0.62	-0.209	
DHW19M-1-3-SSM-S	Li2O	3.58	3.47	0.110	
DHW19M-1-3-SSM-S	MnO	<0.194	0.09	0.104	
DHW19M-1-3-SSM-S	Na2O	17.2	19.37	-2.170	-11.2%
DHW19M-1-3-SSM-S	NiO	0.167	0.09	0.077	
DHW19M-1-3-SSM-S	P2O5	<0.119	0.13	-0.011	
DHW19M-1-3-SSM-S	PbO	0.0820	0.09	-0.008	
DHW19M-1-3-SSM-S	SO3	1.81	0.57	1.240	
DHW19M-1-3-SSM-S	SiO2	45.1	45.64	-0.540	-1.2%
DHW19M-1-3-SSM-S	ZrO2	<0.0675	0.04	0.028	
DHW19M-1-3-SSM-S	Sum	97.7	100	-2.300	-2.3%
DHW19M-2-3-SSM-S	Al2O3	7.04	6.74	0.300	4.5%
DHW19M-2-3-SSM-S	B2O3	10.3	10.94	-0.640	-5.9%
DHW19M-2-3-SSM-S	CaO	1.97	1.79	0.180	
DHW19M-2-3-SSM-S	Cl	0.0333	0.13	-0.097	
DHW19M-2-3-SSM-S	Cr2O3	1.76	2.17	-0.410	
DHW19M-2-3-SSM-S	F	0.0537	0.13	-0.076	
DHW19M-2-3-SSM-S	Fe2O3	2.44	2.3	0.140	
DHW19M-2-3-SSM-S	K2O	0.465	0.67	-0.205	
DHW19M-2-3-SSM-S	Li2O	0.780	0.75	0.030	
DHW19M-2-3-SSM-S	MnO	0.269	0.26	0.009	
DHW19M-2-3-SSM-S	Na2O	19.0	21.47	-2.470	-11.5%
DHW19M-2-3-SSM-S	NiO	0.274	0.26	0.014	
DHW19M-2-3-SSM-S	P2O5	0.342	0.39	-0.048	
DHW19M-2-3-SSM-S	PbO	0.241	0.26	-0.019	
DHW19M-2-3-SSM-S	SO3	1.22	0.74	0.480	
DHW19M-2-3-SSM-S	SiO2	51.7	50.87	0.830	1.6%
DHW19M-2-3-SSM-S	ZrO2	0.120	0.13	-0.010	
DHW19M-2-3-SSM-S	Sum	98	100	-2.000	-2.0%
DHW19M-3-1-SSM-S	Al2O3	3.99	3.77	0.220	
DHW19M-3-1-SSM-S	B2O3	9.59	10.38	-0.790	-7.6%
DHW19M-3-1-SSM-S	CaO	0.309	0.18	0.129	
DHW19M-3-1-SSM-S	Cl	0.0260	0.12	-0.094	
DHW19M-3-1-SSM-S	Cr2O3	1.00	1.32	-0.320	
DHW19M-3-1-SSM-S	F	0.0415	0.12	-0.079	
DHW19M-3-1-SSM-S	Fe2O3	4.72	4.52	0.200	
DHW19M-3-1-SSM-S	K2O	6.29	8.64	-2.350	-27.2%
DHW19M-3-1-SSM-S	Li2O	0.549	0.52	0.029	
DHW19M-3-1-SSM-S	MnO	0.341	0.24	0.101	

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

Glass ID	Oxide	Measured (wt %)	Targeted (wt %)	Difference of Measured versus Targeted	% Difference of Measured versus Targeted
DHW19M-3-1-SSM-S	Na2O	15.8	17.02	-1.220	-7.2%
DHW19M-3-1-SSM-S	NiO	0.320	0.24	0.080	
DHW19M-3-1-SSM-S	P2O5	0.310	0.36	-0.050	
DHW19M-3-1-SSM-S	PbO	0.227	0.24	-0.013	
DHW19M-3-1-SSM-S	SO3	1.13	0.8	0.330	
DHW19M-3-1-SSM-S	SiO2	52.3	51.41	0.890	1.7%
DHW19M-3-1-SSM-S	ZrO2	0.109	0.12	-0.011	
DHW19M-3-1-SSM-S	Sum	97.1	100	-2.900	-2.9%
DHW19M-4-SSM-S	Al2O3	5.99	5.58	0.410	7.3%
DHW19M-4-SSM-S	B2O3	9.36	10.27	-0.910	-8.9%
DHW19M-4-SSM-S	CaO	2.77	2.4	0.370	
DHW19M-4-SSM-S	Cl	<0.0250	0.13	-0.105	
DHW19M-4-SSM-S	Cr2O3	0.643	1.15	-0.507	
DHW19M-4-SSM-S	F	0.0531	0.13	-0.077	
DHW19M-4-SSM-S	Fe2O3	7.06	6.88	0.180	2.6%
DHW19M-4-SSM-S	K2O	3.33	4.89	-1.560	
DHW19M-4-SSM-S	Li2O	0.907	0.85	0.057	
DHW19M-4-SSM-S	MnO	0.283	0.26	0.023	
DHW19M-4-SSM-S	Na2O	18.5	20.6	-2.100	-10.2%
DHW19M-4-SSM-S	NiO	0.333	0.26	0.073	
DHW19M-4-SSM-S	P2O5	0.341	0.4	-0.059	
DHW19M-4-SSM-S	PbO	0.238	0.26	-0.022	
DHW19M-4-SSM-S	SO3	1.34	0.56	0.780	
DHW19M-4-SSM-S	SiO2	46.6	45.25	1.350	3.0%
DHW19M-4-SSM-S	ZrO2	0.119	0.13	-0.011	
DHW19M-4-SSM-S	Sum	97.9	100	-2.100	-2.1%
DHW19M-5-SSM-S	Al2O3	6.21	5.94	0.270	4.5%
DHW19M-5-SSM-S	B2O3	16.3	17.6	-1.300	-7.4%
DHW19M-5-SSM-S	CaO	2.23	2.01	0.220	
DHW19M-5-SSM-S	Cl	<0.0250	0.08	-0.055	
DHW19M-5-SSM-S	Cr2O3	1.13	1.48	-0.350	
DHW19M-5-SSM-S	F	0.0360	0.08	-0.044	
DHW19M-5-SSM-S	Fe2O3	4.97	4.94	0.030	
DHW19M-5-SSM-S	K2O	3.42	4.77	-1.350	
DHW19M-5-SSM-S	Li2O	2.87	2.74	0.130	
DHW19M-5-SSM-S	MnO	0.186	0.17	0.016	
DHW19M-5-SSM-S	Na2O	16.6	17.34	-0.740	-4.3%
DHW19M-5-SSM-S	NiO	0.204	0.17	0.034	
DHW19M-5-SSM-S	P2O5	0.224	0.25	-0.026	
DHW19M-5-SSM-S	PbO	0.159	0.17	-0.011	
DHW19M-5-SSM-S	SO3	1.78	0.68	1.100	

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

Glass ID	Oxide	Measured (wt %)	Targeted (wt %)	Difference of Measured versus Targeted	% Difference of Measured versus Targeted
DHW19M-5-SSM-S	SiO2	41.8	41.5	0.300	0.7%
DHW19M-5-SSM-S	ZrO2	<0.0707	0.08	-0.009	
DHW19M-5-SSM-S	Sum	98.2	100	-1.800	-1.8%
DHW19M-6-1-SSM-S	Al2O3	6.18	5.46	0.720	13.2%
DHW19M-6-1-SSM-S	B2O3	9.01	10	-0.990	-9.9%
DHW19M-6-1-SSM-S	CaO	1.76	1.56	0.200	
DHW19M-6-1-SSM-S	Cl	<0.0250	0.05	-0.025	
DHW19M-6-1-SSM-S	Cr2O3	0.962	1.23	-0.268	
DHW19M-6-1-SSM-S	F	<0.0250	0.05	-0.025	
DHW19M-6-1-SSM-S	Fe2O3	1.05	1.01	0.040	
DHW19M-6-1-SSM-S	K2O	5.84	7.97	-2.130	-26.7%
DHW19M-6-1-SSM-S	Li2O	<0.218	0.06	0.158	
DHW19M-6-1-SSM-S	MnO	<0.129	0.1	0.029	
DHW19M-6-1-SSM-S	Na2O	17.2	18.6	-1.400	-7.5%
DHW19M-6-1-SSM-S	NiO	<0.127	0.1	0.027	
DHW19M-6-1-SSM-S	P2O5	0.140	0.15	-0.010	
DHW19M-6-1-SSM-S	PbO	0.0945	0.1	-0.006	
DHW19M-6-1-SSM-S	SO3	1.27	0.39	0.880	
DHW19M-6-1-SSM-S	SiO2	53.1	53.12	-0.020	0.0%
DHW19M-6-1-SSM-S	ZrO2	<0.0675	0.05	0.018	
DHW19M-6-1-SSM-S	Sum	97.2	100	-2.800	-2.8%
DHW19M-7-1-SSM-S	Al2O3	6.08	5.84	0.240	4.1%
DHW19M-7-1-SSM-S	B2O3	13.0	14.26	-1.260	-8.8%
DHW19M-7-1-SSM-S	CaO	0.321	0.18	0.141	
DHW19M-7-1-SSM-S	Cl	<0.0250	0.05	-0.025	
DHW19M-7-1-SSM-S	Cr2O3	0.788	1.03	-0.242	
DHW19M-7-1-SSM-S	F	<0.0250	0.05	-0.025	
DHW19M-7-1-SSM-S	Fe2O3	6.23	6.16	0.070	1.1%
DHW19M-7-1-SSM-S	K2O	5.11	6.92	-1.810	-26.2%
DHW19M-7-1-SSM-S	Li2O	4.09	3.93	0.160	
DHW19M-7-1-SSM-S	MnO	<0.129	0.1	0.029	
DHW19M-7-1-SSM-S	Na2O	15.8	16.34	-0.540	-3.3%
DHW19M-7-1-SSM-S	NiO	<0.159	0.1	0.059	
DHW19M-7-1-SSM-S	P2O5	0.137	0.15	-0.013	
DHW19M-7-1-SSM-S	PbO	0.0943	0.1	-0.006	
DHW19M-7-1-SSM-S	SO3	1.83	0.13	1.700	
DHW19M-7-1-SSM-S	SiO2	44.7	44.61	0.090	0.2%
DHW19M-7-1-SSM-S	ZrO2	<0.0675	0.05	0.018	
DHW19M-7-1-SSM-S	Sum	98.6	100	-1.400	-1.4%
DHW19M-8-SSM-S	Al2O3	4.84	4.15	0.690	
DHW19M-8-SSM-S	B2O3	12.7	13.75	-1.050	-7.6%

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

Glass ID	Oxide	Measured (wt %)	Targeted (wt %)	Difference of Measured versus Targeted	% Difference of Measured versus Targeted
DHW19M-8-SSM-S	CaO	1.64	1.45	0.190	
DHW19M-8-SSM-S	Cl	<0.0250	0.06	-0.035	
DHW19M-8-SSM-S	Cr2O3	1.61	2.24	-0.630	
DHW19M-8-SSM-S	F	<0.0251	0.06	-0.035	
DHW19M-8-SSM-S	Fe2O3	4.48	3.71	0.770	
DHW19M-8-SSM-S	K2O	2.70	3.92	-1.220	
DHW19M-8-SSM-S	Li2O	1.79	1.69	0.100	
DHW19M-8-SSM-S	MnO	0.392	0.12	0.272	
DHW19M-8-SSM-S	Na2O	18.8	21.19	-2.390	-11.3%
DHW19M-8-SSM-S	NiO	<0.198	0.12	0.078	
DHW19M-8-SSM-S	P2O5	0.154	0.18	-0.026	
DHW19M-8-SSM-S	PbO	0.110	0.12	-0.010	
DHW19M-8-SSM-S	SO3	1.74	0.7	1.040	
DHW19M-8-SSM-S	SiO2	46.5	46.48	0.020	0.0%
DHW19M-8-SSM-S	ZrO2	<0.0675	0.06	0.008	
DHW19M-8-SSM-S	Sum	97.8	100	-2.200	-2.2%
DHW19M-9-SSM-S	Al2O3	7.46	6.8	0.660	9.7%
DHW19M-9-SSM-S	B2O3	16.1	17.04	-0.940	-5.5%
DHW19M-9-SSM-S	CaO	0.401	0.26	0.141	
DHW19M-9-SSM-S	Cl	<0.0250	0.12	-0.095	
DHW19M-9-SSM-S	Cr2O3	1.46	2.43	-0.970	
DHW19M-9-SSM-S	F	0.0520	0.12	-0.068	
DHW19M-9-SSM-S	Fe2O3	6.00	5.4	0.600	11.1%
DHW19M-9-SSM-S	K2O	4.62	6.54	-1.920	-29.4%
DHW19M-9-SSM-S	Li2O	0.442	0.42	0.022	
DHW19M-9-SSM-S	MnO	0.525	0.24	0.285	
DHW19M-9-SSM-S	Na2O	18.9	20.6	-1.700	-8.3%
DHW19M-9-SSM-S	NiO	0.245	0.24	0.005	
DHW19M-9-SSM-S	P2O5	0.317	0.36	-0.043	
DHW19M-9-SSM-S	PbO	0.226	0.24	-0.014	
DHW19M-9-SSM-S	SO3	1.17	0.13	1.040	
DHW19M-9-SSM-S	SiO2	40.6	38.94	1.660	4.3%
DHW19M-9-SSM-S	ZrO2	0.117	0.12	-0.003	
DHW19M-9-SSM-S	Sum	98.7	100	-1.300	-1.3%
DHW19M-10-SSM-S	Al2O3	4.51	4.79	-0.280	
DHW19M-10-SSM-S	B2O3	16.2	17.68	-1.480	-8.4%
DHW19M-10-SSM-S	CaO	4.87	4.88	-0.010	
DHW19M-10-SSM-S	Cl	0.0293	0.11	-0.081	
DHW19M-10-SSM-S	Cr2O3	1.29	1.79	-0.500	
DHW19M-10-SSM-S	F	0.0461	0.11	-0.064	
DHW19M-10-SSM-S	Fe2O3	4.08	4.17	-0.090	

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

Glass ID	Oxide	Measured (wt %)	Targeted (wt %)	Difference of Measured versus Targeted	% Difference of Measured versus Targeted
DHW19M-10-SSM-S	K2O	1.81	2.46	-0.650	
DHW19M-10-SSM-S	Li2O	1.02	0.94	0.080	
DHW19M-10-SSM-S	MnO	0.225	0.23	-0.005	
DHW19M-10-SSM-S	Na2O	20.6	20.97	-0.370	-1.8%
DHW19M-10-SSM-S	NiO	<0.133	0.23	-0.097	
DHW19M-10-SSM-S	P2O5	0.291	0.34	-0.049	
DHW19M-10-SSM-S	PbO	0.198	0.23	-0.032	
DHW19M-10-SSM-S	SO3	1.82	0.73	1.090	
DHW19M-10-SSM-S	SiO2	39.1	40.23	-1.130	-2.8%
DHW19M-10-SSM-S	ZrO2	0.0978	0.11	-0.012	
DHW19M-10-SSM-S	Sum	96.3	100	-3.700	-3.7%
DHW19M-11-SSM-S	Al2O3	4.59	4.86	-0.270	
DHW19M-11-SSM-S	B2O3	17.9	19.89	-1.990	-10.0%
DHW19M-11-SSM-S	CaO	0.606	0.57	0.036	
DHW19M-11-SSM-S	Cl	0.0261	0.12	-0.094	
DHW19M-11-SSM-S	Cr2O3	1.16	1.45	-0.290	
DHW19M-11-SSM-S	F	0.0400	0.12	-0.080	
DHW19M-11-SSM-S	Fe2O3	1.56	1.59	-0.030	
DHW19M-11-SSM-S	K2O	3.07	4.05	-0.980	
DHW19M-11-SSM-S	Li2O	3.87	3.57	0.300	
DHW19M-11-SSM-S	MnO	0.229	0.24	-0.011	
DHW19M-11-SSM-S	Na2O	16.4	16.09	0.310	1.9%
DHW19M-11-SSM-S	NiO	0.148	0.24	-0.092	
DHW19M-11-SSM-S	P2O5	0.294	0.36	-0.066	
DHW19M-11-SSM-S	PbO	0.201	0.24	-0.039	
DHW19M-11-SSM-S	SO3	1.70	0.24	1.460	
DHW19M-11-SSM-S	SiO2	44.2	46.25	-2.050	-4.4%
DHW19M-11-SSM-S	ZrO2	0.104	0.12	-0.016	
DHW19M-11-SSM-S	Sum	96.1	100	-3.900	-3.9%
DHW19M-12-SSM-S	Al2O3	4.08	4.3	-0.220	
DHW19M-12-SSM-S	B2O3	10.4	11.31	-0.910	-8.0%
DHW19M-12-SSM-S	CaO	3.95	3.97	-0.020	
DHW19M-12-SSM-S	Cl	<0.0250	0.05	-0.025	
DHW19M-12-SSM-S	Cr2O3	1.55	1.87	-0.320	
DHW19M-12-SSM-S	F	<0.0250	0.05	-0.025	
DHW19M-12-SSM-S	Fe2O3	3.14	3.23	-0.090	
DHW19M-12-SSM-S	K2O	1.47	1.94	-0.470	
DHW19M-12-SSM-S	Li2O	1.55	1.45	0.100	
DHW19M-12-SSM-S	MnO	<0.129	0.1	0.029	
DHW19M-12-SSM-S	Na2O	15.9	16.01	-0.110	-0.7%
DHW19M-12-SSM-S	NiO	<0.127	0.1	0.027	

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

Glass ID	Oxide	Measured (wt %)	Targeted (wt %)	Difference of Measured versus Targeted	% Difference of Measured versus Targeted
DHW19M-12-SSM-S	P2O5	<0.121	0.15	-0.029	
DHW19M-12-SSM-S	PbO	0.0879	0.1	-0.012	
DHW19M-12-SSM-S	SO3	1.12	0.22	0.900	
DHW19M-12-SSM-S	SiO2	52.9	55.1	-2.200	-4.0%
DHW19M-12-SSM-S	ZrO2	<0.0675	0.05	0.018	
DHW19M-12-SSM-S	Sum	96.6	100	-3.400	-3.4%
DHW19M-13-SSM-S	Al2O3	5.87	6.27	-0.400	-6.4%
DHW19M-13-SSM-S	B2O3	14.1	15.72	-1.620	-10.3%
DHW19M-13-SSM-S	CaO	4.54	4.67	-0.130	
DHW19M-13-SSM-S	Cl	<0.0284	0.13	-0.102	
DHW19M-13-SSM-S	Cr2O3	0.759	1.02	-0.261	
DHW19M-13-SSM-S	F	0.0576	0.13	-0.072	
DHW19M-13-SSM-S	Fe2O3	2.49	2.59	-0.100	
DHW19M-13-SSM-S	K2O	1.15	1.63	-0.480	
DHW19M-13-SSM-S	Li2O	3.27	2.83	0.440	
DHW19M-13-SSM-S	MnO	0.257	0.27	-0.013	
DHW19M-13-SSM-S	Na2O	19.7	20.07	-0.370	-1.8%
DHW19M-13-SSM-S	NiO	0.172	0.27	-0.098	
DHW19M-13-SSM-S	P2O5	0.335	0.4	-0.065	
DHW19M-13-SSM-S	PbO	0.228	0.27	-0.042	
DHW19M-13-SSM-S	SO3	2.12	0.45	1.670	
DHW19M-13-SSM-S	SiO2	42.0	43.15	-1.150	-2.7%
DHW19M-13-SSM-S	ZrO2	0.112	0.13	-0.018	
DHW19M-13-SSM-S	Sum	97.2	100	-2.800	-2.8%
DHW19M-14-SSM-S	Al2O3	1.91	2	-0.090	
DHW19M-14-SSM-S	B2O3	9.16	10.19	-1.030	-10.1%
DHW19M-14-SSM-S	CaO	1.88	1.93	-0.050	
DHW19M-14-SSM-S	Cl	0.0340	0.1	-0.066	
DHW19M-14-SSM-S	Cr2O3	1.23	1.54	-0.310	
DHW19M-14-SSM-S	F	0.0422	0.1	-0.058	
DHW19M-14-SSM-S	Fe2O3	3.15	3.27	-0.120	
DHW19M-14-SSM-S	K2O	0.0806	0.12	-0.039	
DHW19M-14-SSM-S	Li2O	3.08	2.89	0.190	
DHW19M-14-SSM-S	MnO	0.309	0.21	0.099	
DHW19M-14-SSM-S	Na2O	20.3	20.87	-0.570	-2.7%
DHW19M-14-SSM-S	NiO	<0.127	0.21	-0.083	
DHW19M-14-SSM-S	P2O5	0.249	0.31	-0.061	
DHW19M-14-SSM-S	PbO	0.178	0.21	-0.032	
DHW19M-14-SSM-S	SO3	1.86	0.35	1.510	
DHW19M-14-SSM-S	SiO2	52.0	55.6	-3.600	-6.5%
DHW19M-14-SSM-S	ZrO2	0.0872	0.1	-0.013	

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

Glass ID	Oxide	Measured (wt %)	Targeted (wt %)	Difference of Measured versus Targeted	% Difference of Measured versus Targeted
DHW19M-14-SSM-S	Sum	95.7	100	-4.300	-4.3%
DHW19M-15-SSM-S	Al2O3	3.02	3.23	-0.210	
DHW19M-15-SSM-S	B2O3	16.1	17.89	-1.790	-10.0%
DHW19M-15-SSM-S	CaO	4.04	4.19	-0.150	
DHW19M-15-SSM-S	Cl	<0.0250	0.07	-0.045	
DHW19M-15-SSM-S	Cr2O3	1.37	1.64	-0.270	
DHW19M-15-SSM-S	F	<0.0250	0.07	-0.045	
DHW19M-15-SSM-S	Fe2O3	0.983	1.01	-0.027	
DHW19M-15-SSM-S	K2O	<0.0602	0.01	0.050	
DHW19M-15-SSM-S	Li2O	4.18	3.86	0.320	
DHW19M-15-SSM-S	MnO	<0.144	0.14	0.004	
DHW19M-15-SSM-S	Na2O	17.0	16.8	0.200	1.2%
DHW19M-15-SSM-S	NiO	<0.127	0.14	-0.013	
DHW19M-15-SSM-S	P2O5	0.170	0.21	-0.040	
DHW19M-15-SSM-S	PbO	0.116	0.14	-0.024	
DHW19M-15-SSM-S	SO3	2.11	0.6	1.510	
DHW19M-15-SSM-S	SiO2	47.0	49.93	-2.930	-5.9%
DHW19M-15-SSM-S	ZrO2	<0.0675	0.07	-0.002	
DHW19M-15-SSM-S	Sum	96.5	100	-3.500	-3.5%
DHW19M-16-SSM-S	Al2O3	6.10	6.35	-0.250	-3.9%
DHW19M-16-SSM-S	B2O3	10.8	11.73	-0.930	-7.9%
DHW19M-16-SSM-S	CaO	0.587	0.55	0.037	
DHW19M-16-SSM-S	Cl	<0.0250	0.06	-0.035	
DHW19M-16-SSM-S	Cr2O3	1.13	1.69	-0.560	
DHW19M-16-SSM-S	F	<0.0250	0.06	-0.035	
DHW19M-16-SSM-S	Fe2O3	6.54	6.77	-0.230	-3.4%
DHW19M-16-SSM-S	K2O	1.87	2.47	-0.600	
DHW19M-16-SSM-S	Li2O	3.86	3.36	0.500	
DHW19M-16-SSM-S	MnO	<0.129	0.12	0.009	
DHW19M-16-SSM-S	Na2O	17.7	18.08	-0.380	-2.1%
DHW19M-16-SSM-S	NiO	<0.127	0.12	0.007	
DHW19M-16-SSM-S	P2O5	<0.136	0.18	-0.044	
DHW19M-16-SSM-S	PbO	0.102	0.12	-0.018	
DHW19M-16-SSM-S	SO3	1.25	0.38	0.870	
DHW19M-16-SSM-S	SiO2	47.1	47.9	-0.800	-1.7%
DHW19M-16-SSM-S	ZrO2	<0.0675	0.06	0.008	
DHW19M-16-SSM-S	Sum	97.5	100	-2.500	-2.5%
DHW19M-17-1-SSM-S	Al2O3	2.48	2.54	-0.060	
DHW19M-17-1-SSM-S	B2O3	14.5	16.17	-1.670	-10.3%
DHW19M-17-1-SSM-S	CaO	4.74	4.61	0.130	
DHW19M-17-1-SSM-S	Cl	<0.0250	0.13	-0.105	

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

Glass ID	Oxide	Measured (wt %)	Targeted (wt %)	Difference of Measured versus Targeted	% Difference of Measured versus Targeted
DHW19M-17-1-SSM-S	Cr2O3	1.75	2.29	-0.540	
DHW19M-17-1-SSM-S	F	0.0446	0.13	-0.085	
DHW19M-17-1-SSM-S	Fe2O3	0.451	0.41	0.041	
DHW19M-17-1-SSM-S	K2O	5.55	7.75	-2.200	-28.4%
DHW19M-17-1-SSM-S	Li2O	0.371	0.33	0.041	
DHW19M-17-1-SSM-S	MnO	0.252	0.26	-0.008	
DHW19M-17-1-SSM-S	Na2O	16.2	16.07	0.130	0.8%
DHW19M-17-1-SSM-S	NiO	0.177	0.26	-0.083	
DHW19M-17-1-SSM-S	P2O5	0.338	0.39	-0.052	
DHW19M-17-1-SSM-S	PbO	0.228	0.26	-0.032	
DHW19M-17-1-SSM-S	SO3	1.34	0.3	1.040	
DHW19M-17-1-SSM-S	SiO2	47.1	47.97	-0.870	-1.8%
DHW19M-17-1-SSM-S	ZrO2	0.117	0.13	-0.013	
DHW19M-17-1-SSM-S	Sum	95.7	100	-4.300	-4.3%
DHW19M-18-SSM-S	Al2O3	2.84	2.7	0.140	
DHW19M-18-SSM-S	B2O3	12.2	12.97	-0.770	-5.9%
DHW19M-18-SSM-S	CaO	1.57	1.26	0.310	
DHW19M-18-SSM-S	Cl	<0.0250	0.11	-0.085	
DHW19M-18-SSM-S	Cr2O3	1.08	1.38	-0.300	
DHW19M-18-SSM-S	F	0.0317	0.11	-0.078	
DHW19M-18-SSM-S	Fe2O3	6.23	6.51	-0.280	-4.3%
DHW19M-18-SSM-S	K2O	2.11	2.91	-0.800	
DHW19M-18-SSM-S	Li2O	1.31	1.23	0.080	
DHW19M-18-SSM-S	MnO	0.231	0.23	0.001	
DHW19M-18-SSM-S	Na2O	18.7	19.41	-0.710	-3.7%
DHW19M-18-SSM-S	NiO	<0.160	0.23	-0.070	
DHW19M-18-SSM-S	P2O5	0.279	0.34	-0.061	
DHW19M-18-SSM-S	PbO	0.196	0.23	-0.034	
DHW19M-18-SSM-S	SO3	1.25	0.39	0.860	
DHW19M-18-SSM-S	SiO2	48.3	49.88	-1.580	-3.2%
DHW19M-18-SSM-S	ZrO2	0.0969	0.11	-0.013	
DHW19M-18-SSM-S	Sum	96.6	100	-3.400	-3.4%
DHW19M-19-SSM-S	Al2O3	3.56	3.44	0.120	
DHW19M-19-SSM-S	B2O3	18.2	19.14	-0.940	-4.9%
DHW19M-19-SSM-S	CaO	5.23	4.69	0.540	
DHW19M-19-SSM-S	Cl	<0.0250	0.04	-0.015	
DHW19M-19-SSM-S	Cr2O3	1.99	2.29	-0.300	
DHW19M-19-SSM-S	F	<0.0250	0.04	-0.015	
DHW19M-19-SSM-S	Fe2O3	5.03	5.23	-0.200	-3.8%
DHW19M-19-SSM-S	K2O	2.18	3.01	-0.830	
DHW19M-19-SSM-S	Li2O	1.36	1.29	0.070	

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

Glass ID	Oxide	Measured (wt %)	Targeted (wt %)	Difference of Measured versus Targeted	% Difference of Measured versus Targeted
DHW19M-19-SSM-S	MnO	<0.129	0.09	0.039	
DHW19M-19-SSM-S	Na2O	16.6	16.65	-0.050	-0.3%
DHW19M-19-SSM-S	NiO	<0.127	0.09	0.037	
DHW19M-19-SSM-S	P2O5	<0.115	0.13	-0.015	
DHW19M-19-SSM-S	PbO	0.0793	0.09	-0.011	
DHW19M-19-SSM-S	SO3	1.52	0.79	0.730	
DHW19M-19-SSM-S	SiO2	41.9	42.95	-1.050	-2.4%
DHW19M-19-SSM-S	ZrO2	<0.0675	0.04	0.028	
DHW19M-19-SSM-S	Sum	98.1	100	-1.900	-1.9%
DHW19M-20-SSM-S	Al2O3	4.37	4.15	0.220	
DHW19M-20-SSM-S	B2O3	12.7	13.75	-1.050	-7.6%
DHW19M-20-SSM-S	CaO	1.82	1.45	0.370	
DHW19M-20-SSM-S	Cl	<0.0250	0.06	-0.035	
DHW19M-20-SSM-S	Cr2O3	1.53	2.24	-0.710	
DHW19M-20-SSM-S	F	<0.0250	0.06	-0.035	
DHW19M-20-SSM-S	Fe2O3	3.58	3.71	-0.130	
DHW19M-20-SSM-S	K2O	2.72	3.92	-1.200	
DHW19M-20-SSM-S	Li2O	1.84	1.69	0.150	
DHW19M-20-SSM-S	MnO	<0.129	0.12	0.009	
DHW19M-20-SSM-S	Na2O	20.3	21.19	-0.890	-4.2%
DHW19M-20-SSM-S	NiO	<0.127	0.12	0.007	
DHW19M-20-SSM-S	P2O5	0.145	0.18	-0.035	
DHW19M-20-SSM-S	PbO	0.104	0.12	-0.016	
DHW19M-20-SSM-S	SO3	1.55	0.7	0.850	
DHW19M-20-SSM-S	SiO2	45.9	46.48	-0.580	-1.2%
DHW19M-20-SSM-S	ZrO2	<0.0675	0.06	0.008	
DHW19M-20-SSM-S	Sum	96.9	100	-3.100	-3.1%
DHW19M-21-SSM-S	Al2O3	6.85	6.72	0.130	1.9%
DHW19M-21-SSM-S	B2O3	8.68	10.41	-1.730	-16.6%
DHW19M-21-SSM-S	CaO	4.15	3.57	0.580	
DHW19M-21-SSM-S	Cl	<0.0250	0.05	-0.025	
DHW19M-21-SSM-S	Cr2O3	0.700	1	-0.300	
DHW19M-21-SSM-S	F	<0.0250	0.05	-0.025	
DHW19M-21-SSM-S	Fe2O3	0.200	0.17	0.030	
DHW19M-21-SSM-S	K2O	3.78	5.61	-1.830	-32.6%
DHW19M-21-SSM-S	Li2O	3.20	2.9	0.300	
DHW19M-21-SSM-S	MnO	<0.129	0.1	0.029	
DHW19M-21-SSM-S	Na2O	21.4	21.79	-0.390	-1.8%
DHW19M-21-SSM-S	NiO	<0.127	0.1	0.027	
DHW19M-21-SSM-S	P2O5	0.128	0.14	-0.012	
DHW19M-21-SSM-S	PbO	0.0864	0.1	-0.014	

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

Glass ID	Oxide	Measured (wt %)	Targeted (wt %)	Difference of Measured versus Targeted	% Difference of Measured versus Targeted
DHW19M-21-SSM-S	SO3	2.26	0.34	1.920	
DHW19M-21-SSM-S	SiO2	45.2	46.9	-1.700	-3.6%
DHW19M-21-SSM-S	ZrO2	<0.0675	0.05	0.018	
DHW19M-21-SSM-S	Sum	97	100	-3.000	-3.0%
DHW19M-22-1-SSM-S	Al2O3	2.32	2.24	0.080	
DHW19M-22-1-SSM-S	B2O3	14.7	15.56	-0.860	-5.5%
DHW19M-22-1-SSM-S	CaO	4.12	3.64	0.480	
DHW19M-22-1-SSM-S	Cl	<0.0252	0.08	-0.055	
DHW19M-22-1-SSM-S	Cr2O3	1.47	1.69	-0.220	
DHW19M-22-1-SSM-S	F	0.0260	0.08	-0.054	
DHW19M-22-1-SSM-S	Fe2O3	0.200	0.15	0.050	
DHW19M-22-1-SSM-S	K2O	0.952	1.27	-0.318	
DHW19M-22-1-SSM-S	Li2O	1.22	1.15	0.070	
DHW19M-22-1-SSM-S	MnO	0.160	0.17	-0.010	
DHW19M-22-1-SSM-S	Na2O	19.6	20.25	-0.650	-3.2%
DHW19M-22-1-SSM-S	NiO	<0.127	0.17	-0.043	
DHW19M-22-1-SSM-S	P2O5	0.209	0.25	-0.041	
DHW19M-22-1-SSM-S	PbO	0.148	0.17	-0.022	
DHW19M-22-1-SSM-S	SO3	1.70	0.1	1.600	
DHW19M-22-1-SSM-S	SiO2	50.4	52.95	-2.550	-4.8%
DHW19M-22-1-SSM-S	ZrO2	<0.0678	0.08	-0.012	
DHW19M-22-1-SSM-S	Sum	97.4	100	-2.600	-2.6%
DHW19M-23-SSM-S	Al2O3	6.19	5.96	0.230	3.9%
DHW19M-23-SSM-S	B2O3	17.6	18.23	-0.630	-3.5%
DHW19M-23-SSM-S	CaO	0.419	0.23	0.189	
DHW19M-23-SSM-S	Cl	<0.0250	0.05	-0.025	
DHW19M-23-SSM-S	Cr2O3	1.62	1.94	-0.320	
DHW19M-23-SSM-S	F	<0.0250	0.05	-0.025	
DHW19M-23-SSM-S	Fe2O3	2.58	2.66	-0.080	
DHW19M-23-SSM-S	K2O	1.02	1.38	-0.360	
DHW19M-23-SSM-S	Li2O	<0.215	0.05	0.165	
DHW19M-23-SSM-S	MnO	<0.129	0.09	0.039	
DHW19M-23-SSM-S	Na2O	20.0	20.99	-0.990	-4.7%
DHW19M-23-SSM-S	NiO	<0.127	0.09	0.037	
DHW19M-23-SSM-S	P2O5	<0.115	0.14	-0.025	
DHW19M-23-SSM-S	PbO	0.0757	0.09	-0.014	
DHW19M-23-SSM-S	SO3	0.928	0.78	0.148	
DHW19M-23-SSM-S	SiO2	46.5	47.22	-0.720	-1.5%
DHW19M-23-SSM-S	ZrO2	<0.0675	0.05	0.018	
DHW19M-23-SSM-S	Sum	97.6	100	-2.400	-2.4%
DHW19M-24-SSM-S	Al2O3	5.30	5.15	0.150	2.9%

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

Glass ID	Oxide	Measured (wt %)	Targeted (wt %)	Difference of Measured versus Targeted	% Difference of Measured versus Targeted
DHW19M-24-SSM-S	B2O3	12.4	13.27	-0.870	-6.6%
DHW19M-24-SSM-S	CaO	3.72	3.16	0.560	
DHW19M-24-SSM-S	Cl	<0.0250	0.09	-0.065	
DHW19M-24-SSM-S	Cr2O3	0.814	1.07	-0.256	
DHW19M-24-SSM-S	F	0.0319	0.09	-0.058	
DHW19M-24-SSM-S	Fe2O3	1.93	2.02	-0.090	
DHW19M-24-SSM-S	K2O	4.09	5.52	-1.430	-25.9%
DHW19M-24-SSM-S	Li2O	1.70	1.58	0.120	
DHW19M-24-SSM-S	MnO	0.185	0.19	-0.005	
DHW19M-24-SSM-S	Na2O	17.4	17.45	-0.050	-0.3%
DHW19M-24-SSM-S	NiO	<0.127	0.19	-0.063	
DHW19M-24-SSM-S	P2O5	0.235	0.28	-0.045	
DHW19M-24-SSM-S	PbO	0.166	0.19	-0.024	
DHW19M-24-SSM-S	SO3	1.48	0.24	1.240	
DHW19M-24-SSM-S	SiO2	47.9	49.42	-1.520	-3.1%
DHW19M-24-SSM-S	ZrO2	0.0790	0.09	-0.011	
DHW19M-24-SSM-S	Sum	97.6	100	-2.400	-2.4%
DHW19M-25-SSM-S	Al2O3	3.72	3.53	0.190	
DHW19M-25-SSM-S	B2O3	10.7	11.34	-0.640	-5.6%
DHW19M-25-SSM-S	CaO	0.812	0.6	0.212	
DHW19M-25-SSM-S	Cl	<0.0250	0.09	-0.065	
DHW19M-25-SSM-S	Cr2O3	2.10	2.49	-0.390	
DHW19M-25-SSM-S	F	<0.0259	0.09	-0.064	
DHW19M-25-SSM-S	Fe2O3	2.17	2.22	-0.050	
DHW19M-25-SSM-S	K2O	3.18	4.36	-1.180	
DHW19M-25-SSM-S	Li2O	0.434	0.41	0.024	
DHW19M-25-SSM-S	MnO	0.175	0.18	-0.005	
DHW19M-25-SSM-S	Na2O	18.5	19.08	-0.580	-3.0%
DHW19M-25-SSM-S	NiO	<0.127	0.18	-0.053	
DHW19M-25-SSM-S	P2O5	0.210	0.27	-0.060	
DHW19M-25-SSM-S	PbO	0.156	0.18	-0.024	
DHW19M-25-SSM-S	SO3	1.03	0.47	0.560	
DHW19M-25-SSM-S	SiO2	53.8	54.42	-0.620	-1.1%
DHW19M-25-SSM-S	ZrO2	0.0820	0.09	-0.008	
DHW19M-25-SSM-S	Sum	97.2	100	-2.800	-2.8%
DHW19M-26-SSM-S	Al2O3	4.06	3.93	0.130	
DHW19M-26-SSM-S	B2O3	11.0	11.91	-0.910	-7.6%
DHW19M-26-SSM-S	CaO	3.81	3.66	0.150	
DHW19M-26-SSM-S	Cl	<0.0250	0.13	-0.105	
DHW19M-26-SSM-S	Cr2O3	0.936	1.44	-0.504	
DHW19M-26-SSM-S	F	0.0659	0.13	-0.064	

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

Glass ID	Oxide	Measured (wt %)	Targeted (wt %)	Difference of Measured versus Targeted	% Difference of Measured versus Targeted
DHW19M-26-SSM-S	Fe2O3	5.73	5.95	-0.220	-3.7%
DHW19M-26-SSM-S	K2O	4.26	5.84	-1.580	-27.1%
DHW19M-26-SSM-S	Li2O	1.88	1.87	0.010	
DHW19M-26-SSM-S	MnO	0.245	0.25	-0.005	
DHW19M-26-SSM-S	Na2O	19.0	18.74	0.260	1.4%
DHW19M-26-SSM-S	NiO	<0.139	0.25	-0.111	
DHW19M-26-SSM-S	P2O5	0.328	0.38	-0.052	
DHW19M-26-SSM-S	PbO	0.223	0.25	-0.027	
DHW19M-26-SSM-S	SO3	1.64	0.75	0.890	
DHW19M-26-SSM-S	SiO2	43.1	44.39	-1.290	-2.9%
DHW19M-26-SSM-S	ZrO2	0.116	0.13	-0.014	
DHW19M-26-SSM-S	Sum	96.6	100	-3.400	-3.4%
DHW19M-27-SSM-S	Al2O3	6.63	6.72	-0.090	-1.3%
DHW19M-27-SSM-S	B2O3	9.24	10.41	-1.170	-11.2%
DHW19M-27-SSM-S	CaO	3.61	3.57	0.040	
DHW19M-27-SSM-S	Cl	<0.0250	0.05	-0.025	
DHW19M-27-SSM-S	Cr2O3	0.725	1	-0.275	
DHW19M-27-SSM-S	F	0.0283	0.05	-0.022	
DHW19M-27-SSM-S	Fe2O3	0.162	0.17	-0.008	
DHW19M-27-SSM-S	K2O	4.23	5.61	-1.380	-24.6%
DHW19M-27-SSM-S	Li2O	2.90	2.9	0.000	
DHW19M-27-SSM-S	MnO	<0.129	0.1	0.029	
DHW19M-27-SSM-S	Na2O	22.0	21.79	0.210	1.0%
DHW19M-27-SSM-S	NiO	<0.127	0.1	0.027	
DHW19M-27-SSM-S	P2O5	0.125	0.14	-0.015	
DHW19M-27-SSM-S	PbO	0.0834	0.1	-0.017	
DHW19M-27-SSM-S	SO3	2.32	0.34	1.980	
DHW19M-27-SSM-S	SiO2	43.5	46.9	-3.400	-7.2%
DHW19M-27-SSM-S	ZrO2	<0.0675	0.05	0.018	
DHW19M-27-SSM-S	Sum	95.9	100	-4.100	-4.1%
DHW19M-28-SSM-S	Al2O3	3.03	2.98	0.050	
DHW19M-28-SSM-S	B2O3	13.6	14.88	-1.280	-8.6%
DHW19M-28-SSM-S	CaO	0.417	0.32	0.097	
DHW19M-28-SSM-S	Cl	<0.0250	0.04	-0.015	
DHW19M-28-SSM-S	Cr2O3	0.947	1.14	-0.193	
DHW19M-28-SSM-S	F	<0.0250	0.04	-0.015	
DHW19M-28-SSM-S	Fe2O3	0.242	0.25	-0.008	
DHW19M-28-SSM-S	K2O	2.94	3.83	-0.890	
DHW19M-28-SSM-S	Li2O	3.24	3.26	-0.020	
DHW19M-28-SSM-S	MnO	<0.129	0.09	0.039	
DHW19M-28-SSM-S	Na2O	18.2	17.93	0.270	1.5%

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

Glass ID	Oxide	Measured (wt %)	Targeted (wt %)	Difference of Measured versus Targeted	% Difference of Measured versus Targeted
DHW19M-28-SSM-S	NiO	<0.127	0.09	0.037	
DHW19M-28-SSM-S	P2O5	<0.118	0.13	-0.012	
DHW19M-28-SSM-S	PbO	0.0790	0.09	-0.011	
DHW19M-28-SSM-S	SO3	1.87	0.35	1.520	
DHW19M-28-SSM-S	SiO2	50.6	54.54	-3.940	-7.2%
DHW19M-28-SSM-S	ZrO2	<0.0675	0.04	0.028	
DHW19M-28-SSM-S	Sum	95.7	100	-4.300	-4.3%
DHW19M-29-SSM-S	Al2O3	2.06	2	0.060	
DHW19M-29-SSM-S	B2O3	9.31	10.19	-0.880	-8.6%
DHW19M-29-SSM-S	CaO	1.87	1.93	-0.060	
DHW19M-29-SSM-S	Cl	0.0302	0.1	-0.070	
DHW19M-29-SSM-S	Cr2O3	1.23	1.54	-0.310	
DHW19M-29-SSM-S	F	0.0444	0.1	-0.056	
DHW19M-29-SSM-S	Fe2O3	3.09	3.27	-0.180	
DHW19M-29-SSM-S	K2O	<0.0715	0.12	-0.049	
DHW19M-29-SSM-S	Li2O	2.82	2.89	-0.070	
DHW19M-29-SSM-S	MnO	0.198	0.21	-0.012	
DHW19M-29-SSM-S	Na2O	20.8	20.87	-0.070	-0.3%
DHW19M-29-SSM-S	NiO	<0.127	0.21	-0.083	
DHW19M-29-SSM-S	P2O5	0.264	0.31	-0.046	
DHW19M-29-SSM-S	PbO	0.179	0.21	-0.031	
DHW19M-29-SSM-S	SO3	1.93	0.35	1.580	
DHW19M-29-SSM-S	SiO2	52.4	55.6	-3.200	-5.8%
DHW19M-29-SSM-S	ZrO2	0.0890	0.1	-0.011	
DHW19M-29-SSM-S	Sum	96.5	100	-3.500	-3.5%
DHW19M-30-SSM-S	Al2O3	6.78	6.61	0.170	2.6%
DHW19M-30-SSM-S	B2O3	13.8	15.23	-1.430	-9.4%
DHW19M-30-SSM-S	CaO	2.66	2.58	0.080	
DHW19M-30-SSM-S	Cl	<0.0250	0.06	-0.035	
DHW19M-30-SSM-S	Cr2O3	1.10	1.68	-0.580	
DHW19M-30-SSM-S	F	<0.0251	0.06	-0.035	
DHW19M-30-SSM-S	Fe2O3	1.51	1.55	-0.040	
DHW19M-30-SSM-S	K2O	6.49	8.84	-2.350	-26.6%
DHW19M-30-SSM-S	Li2O	0.598	0.6	-0.002	
DHW19M-30-SSM-S	MnO	<0.129	0.13	-0.001	
DHW19M-30-SSM-S	Na2O	17.2	16.75	0.450	2.7%
DHW19M-30-SSM-S	NiO	<0.127	0.13	-0.003	
DHW19M-30-SSM-S	P2O5	0.165	0.19	-0.025	
DHW19M-30-SSM-S	PbO	0.113	0.13	-0.017	
DHW19M-30-SSM-S	SO3	1.18	0.12	1.060	
DHW19M-30-SSM-S	SiO2	43.7	45.28	-1.580	-3.5%

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

Glass ID	Oxide	Measured (wt %)	Targeted (wt %)	Difference of Measured versus Targeted	% Difference of Measured versus Targeted
DHW19M-30-SSM-S	ZrO2	<0.0675	0.06	0.008	
DHW19M-30-SSM-S	Sum	95.7	100	-4.300	-4.3%
DHW19M-31-SSM-S	Al2O3	6.82	6.8	0.020	0.3%
DHW19M-31-SSM-S	B2O3	18.7	19.67	-0.970	-4.9%
DHW19M-31-SSM-S	CaO	2.99	2.91	0.080	
DHW19M-31-SSM-S	Cl	<0.0250	0.07	-0.045	
DHW19M-31-SSM-S	Cr2O3	0.915	1.13	-0.215	
DHW19M-31-SSM-S	F	0.0291	0.07	-0.041	
DHW19M-31-SSM-S	Fe2O3	5.74	6.02	-0.280	-4.7%
DHW19M-31-SSM-S	K2O	0.308	0.46	-0.152	
DHW19M-31-SSM-S	Li2O	2.17	2.19	-0.020	
DHW19M-31-SSM-S	MnO	<0.129	0.13	-0.001	
DHW19M-31-SSM-S	Na2O	18.4	18.42	-0.020	-0.1%
DHW19M-31-SSM-S	NiO	<0.127	0.13	-0.003	
DHW19M-31-SSM-S	P2O5	0.175	0.2	-0.025	
DHW19M-31-SSM-S	PbO	0.110	0.13	-0.020	
DHW19M-31-SSM-S	SO3	1.56	0.48	1.080	
DHW19M-31-SSM-S	SiO2	39.5	41.12	-1.620	-3.9%
DHW19M-31-SSM-S	ZrO2	<0.0675	0.07	-0.002	
DHW19M-31-SSM-S	Sum	97.8	100	-2.200	-2.2%
DHW19M-32-SSM-S	Al2O3	2.53	2.43	0.100	
DHW19M-32-SSM-S	B2O3	15.5	16.8	-1.300	-7.7%
DHW19M-32-SSM-S	CaO	2.40	2.36	0.040	
DHW19M-32-SSM-S	Cl	<0.0250	0.1	-0.075	
DHW19M-32-SSM-S	Cr2O3	1.61	2.02	-0.410	
DHW19M-32-SSM-S	F	0.0410	0.1	-0.059	
DHW19M-32-SSM-S	Fe2O3	2.70	2.84	-0.140	
DHW19M-32-SSM-S	K2O	1.75	2.37	-0.620	
DHW19M-32-SSM-S	Li2O	2.70	2.68	0.020	
DHW19M-32-SSM-S	MnO	0.188	0.2	-0.012	
DHW19M-32-SSM-S	Na2O	18.3	18.29	0.010	0.1%
DHW19M-32-SSM-S	NiO	<0.127	0.2	-0.073	
DHW19M-32-SSM-S	P2O5	0.261	0.3	-0.039	
DHW19M-32-SSM-S	PbO	0.170	0.2	-0.030	
DHW19M-32-SSM-S	SO3	1.80	0.34	1.460	
DHW19M-32-SSM-S	SiO2	46.3	48.67	-2.370	-4.9%
DHW19M-32-SSM-S	ZrO2	0.0878	0.1	-0.012	
DHW19M-32-SSM-S	Sum	96.5	100	-3.500	-3.5%
DHW19M-33-SSM-S	Al2O3	5.38	5.09	0.290	5.7%
DHW19M-33-SSM-S	B2O3	11.6	12.52	-0.920	-7.3%
DHW19M-33-SSM-S	CaO	1.32	1.19	0.130	

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

Glass ID	Oxide	Measured (wt %)	Targeted (wt %)	Difference of Measured versus Targeted	% Difference of Measured versus Targeted
DHW19M-33-SSM-S	Cl	<0.0250	0.1	-0.075	
DHW19M-33-SSM-S	Cr2O3	1.12	2.06	-0.940	
DHW19M-33-SSM-S	F	0.0439	0.1	-0.056	
DHW19M-33-SSM-S	Fe2O3	6.76	6.83	-0.070	-1.0%
DHW19M-33-SSM-S	K2O	7.02	9.69	-2.670	-27.6%
DHW19M-33-SSM-S	Li2O	0.346	0.35	-0.004	
DHW19M-33-SSM-S	MnO	0.203	0.2	0.003	
DHW19M-33-SSM-S	Na2O	17.5	17.25	0.250	1.4%
DHW19M-33-SSM-S	NiO	<0.127	0.2	-0.073	
DHW19M-33-SSM-S	P2O5	0.261	0.3	-0.039	
DHW19M-33-SSM-S	PbO	0.179	0.2	-0.021	
DHW19M-33-SSM-S	SO3	0.983	0.62	0.363	
DHW19M-33-SSM-S	SiO2	42.9	43.2	-0.300	-0.7%
DHW19M-33-SSM-S	ZrO2	0.0941	0.1	-0.006	
DHW19M-33-SSM-S	Sum	95.9	100	-4.100	-4.1%

Exhibit A-1. Plots of Oxide Measurements in Analytical Sequence for the Group 1 Glasses

Oxide=Al2O3, Prep Method=PF
Variability Chart for Measured (wt%)

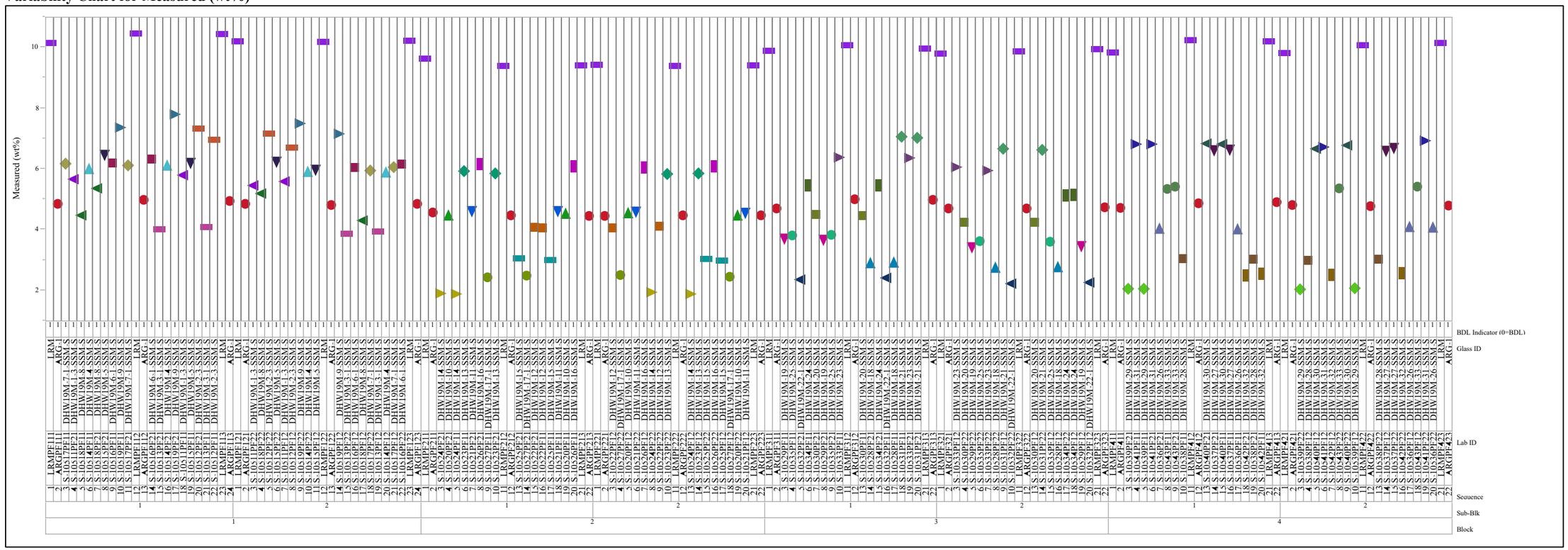


Exhibit A-1. Plots of Oxide Measurements in Analytical Sequence for the Group 1 Glasses (continued)

Oxide=B2O3, Prep Method=PF
Variability Chart for Measured (wt%)

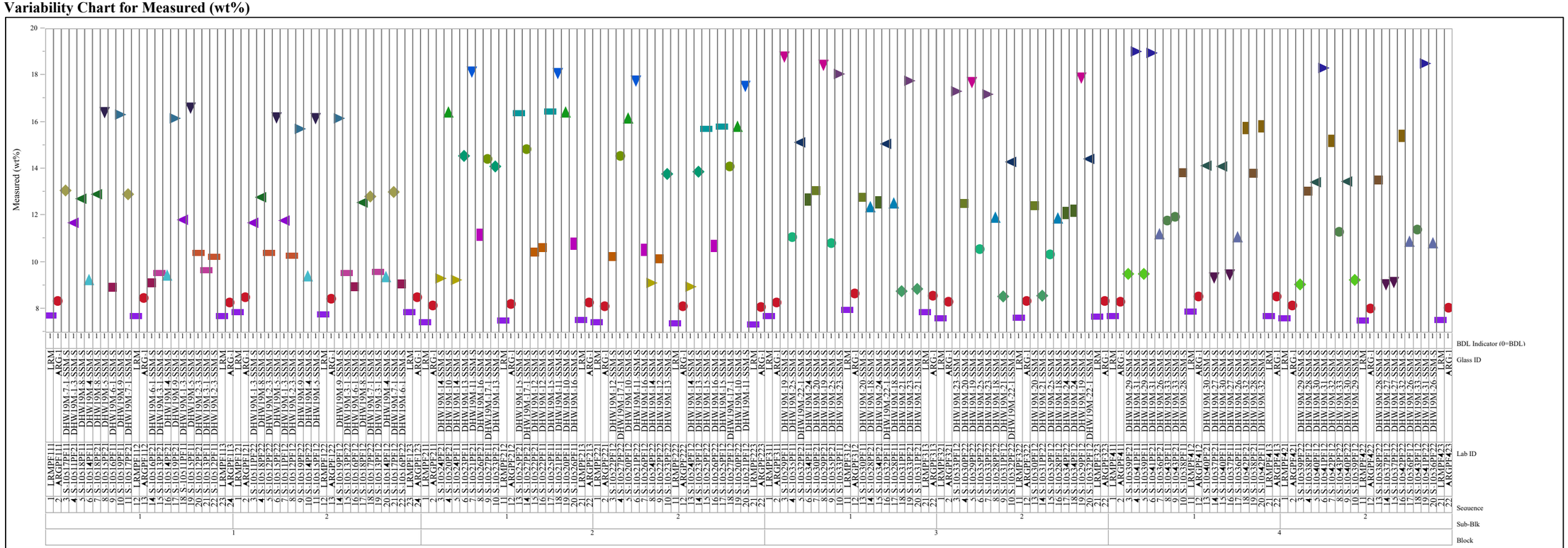


Exhibit A-1. Plots of Oxide Measurements in Analytical Sequence for the Group 1 Glasses (continued)

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

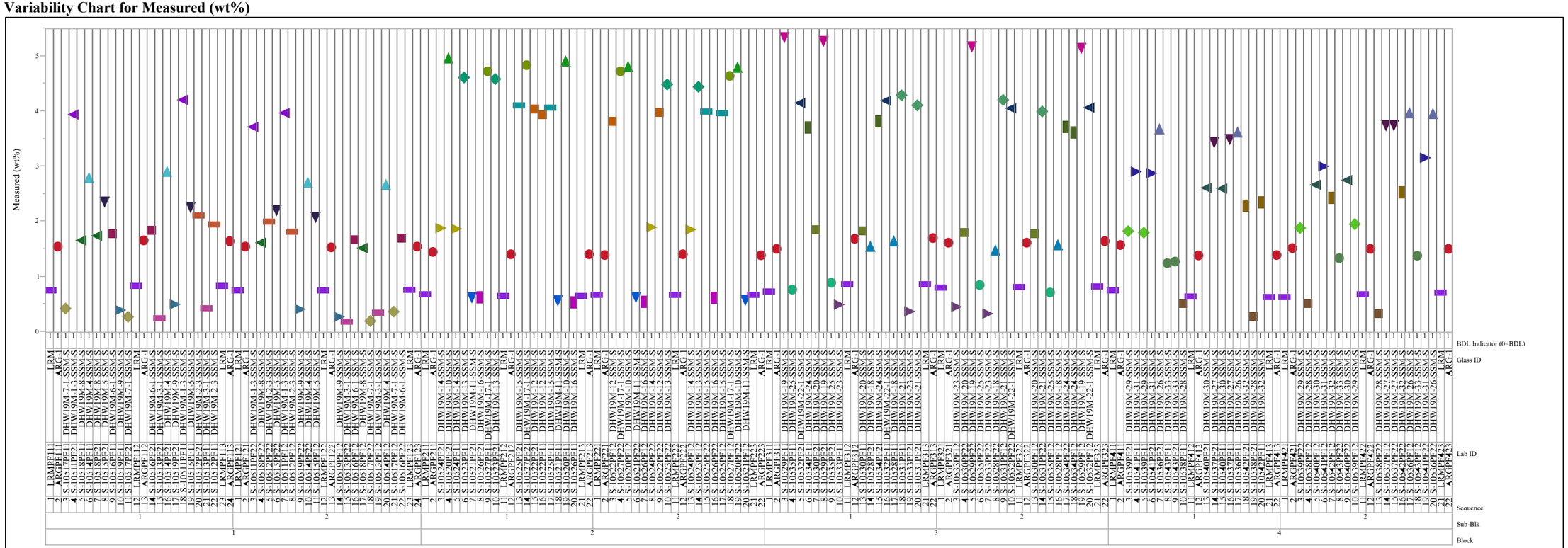


Exhibit A-1. Plots of Oxide Measurements in Analytical Sequence for the Group 1 Glasses (continued)

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

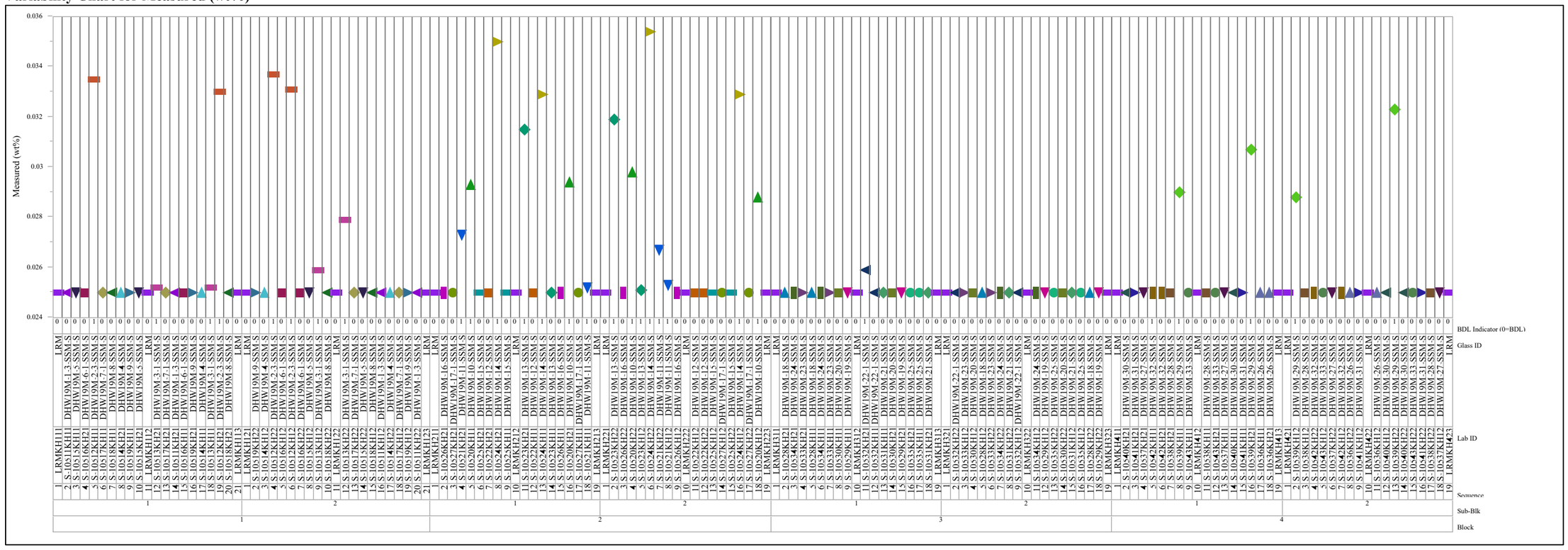


Exhibit A-1. Plots of Oxide Measurements in Analytical Sequence for the Group 1 Glasses (continued)

Oxide=Cr2O3, Prep Method=PF
Variability Chart for Measured (wt%)

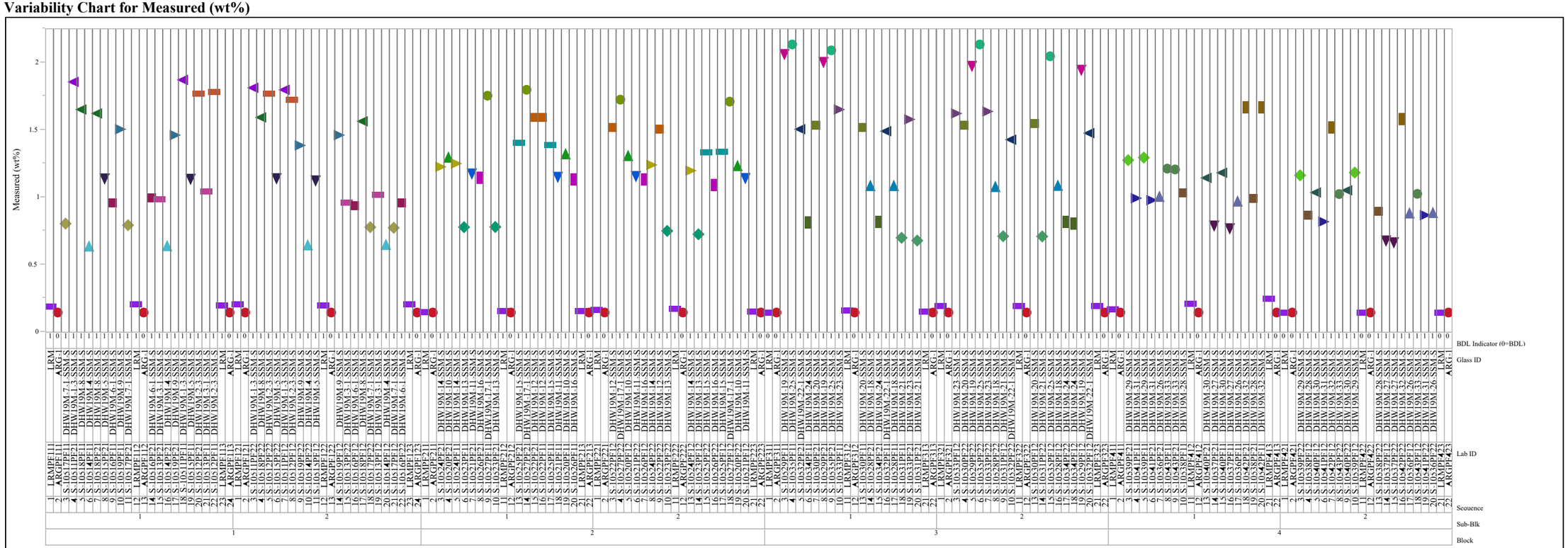


Exhibit A-1. Plots of Oxide Measurements in Analytical Sequence for the Group 1 Glasses (continued)

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

Exhibit A-1. Plots of Oxide Measurements in Analytical Sequence for the Group 1 Glasses (continued)

Oxide=Fe2O3, Prep Method=PF
Variability Chart for Measured (wt%)

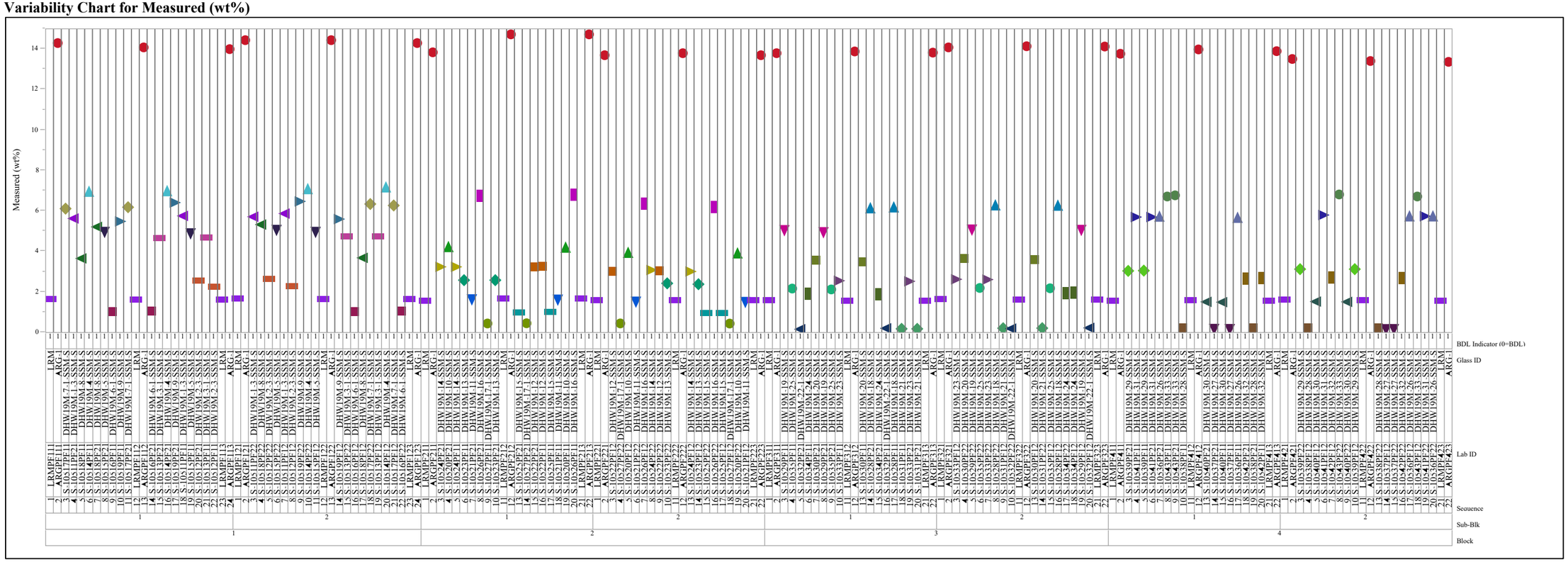


Exhibit A-1. Plots of Oxide Measurements in Analytical Sequence for the Group 1 Glasses (continued)

Oxide=K2O, Prep Method=AD
Variability Chart for Measured (wt%)

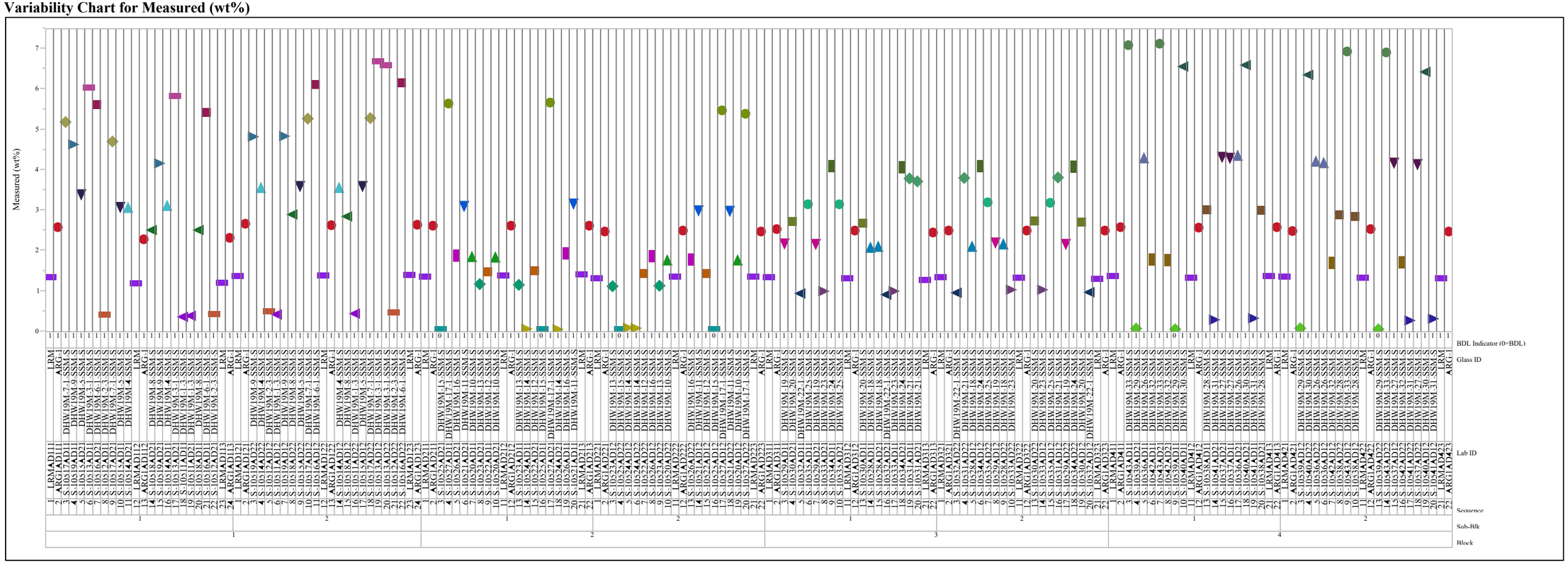


Exhibit A-1. Plots of Oxide Measurements in Analytical Sequence for the Group 1 Glasses (continued)

Oxide=Li2O, Prep Method=PF
Variability Chart for Measured (wt%)

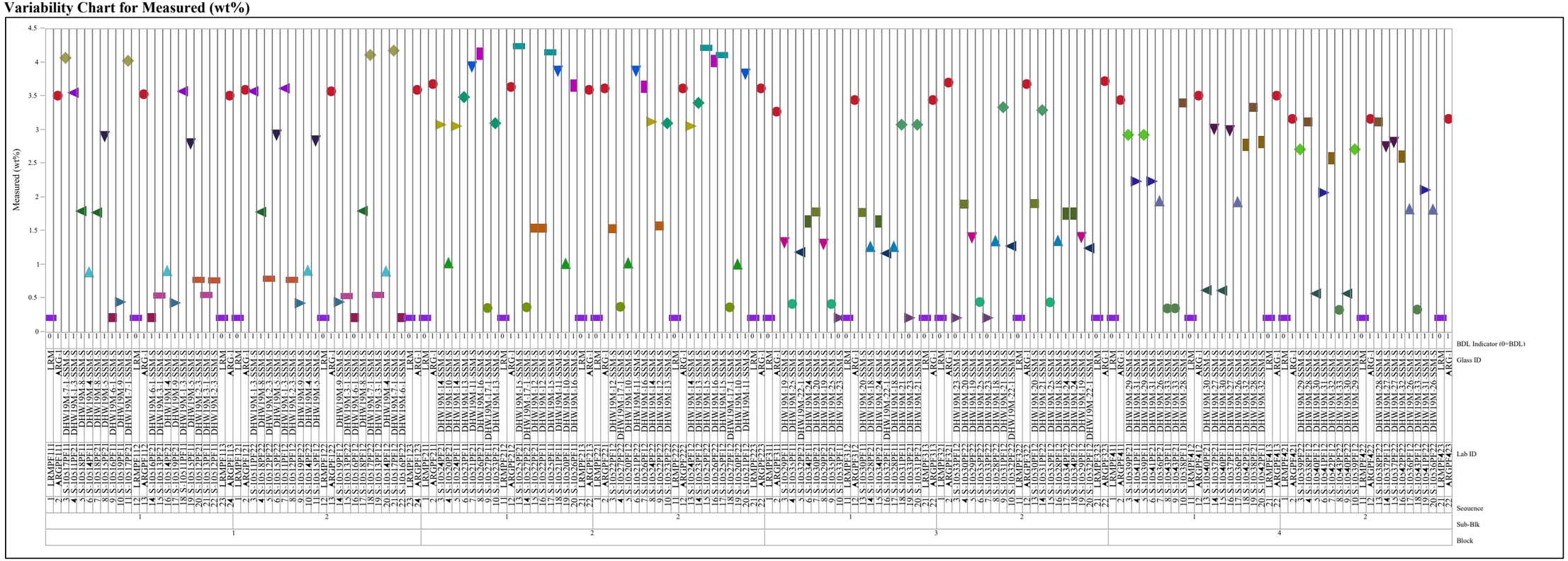


Exhibit A-1. Plots of Oxide Measurements in Analytical Sequence for the Group 1 Glasses (continued)

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

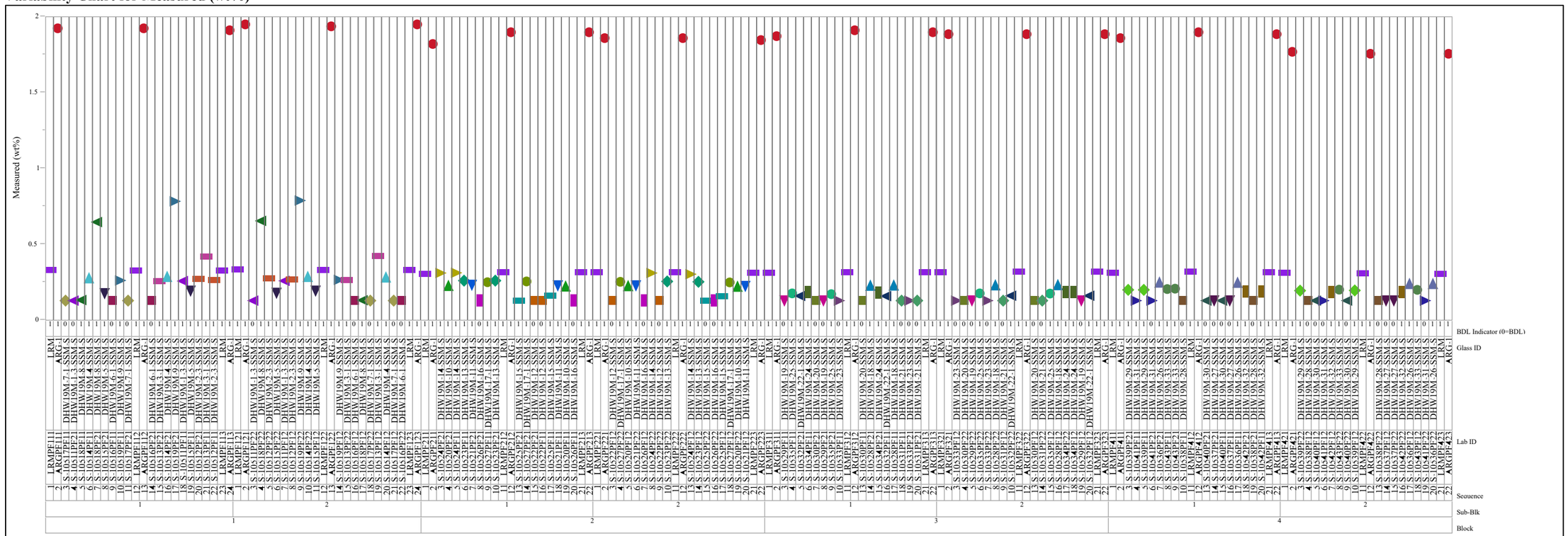


Exhibit A-1. Plots of Oxide Measurements in Analytical Sequence for the Group 1 Glasses (continued)

Oxide=Na2O, Prep Method=AD
Variability Chart for Measured (wt%)

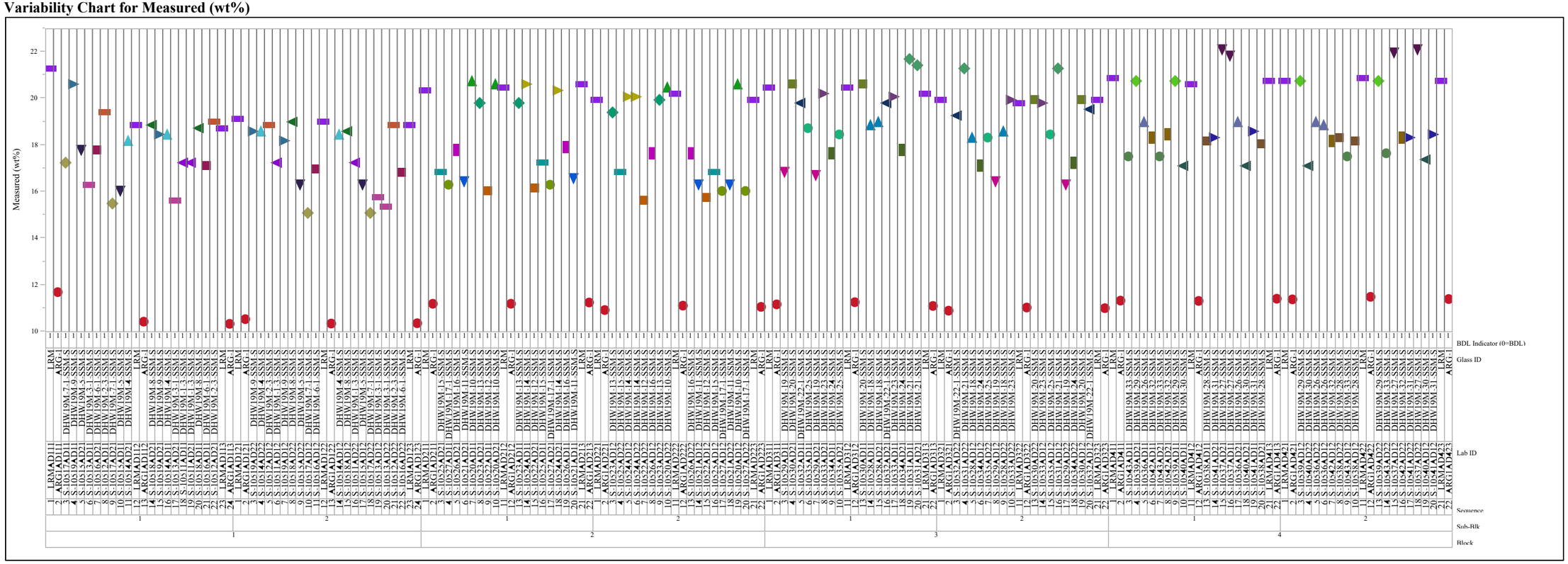


Exhibit A-1. Plots of Oxide Measurements in Analytical Sequence for the Group 1 Glasses (continued)

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

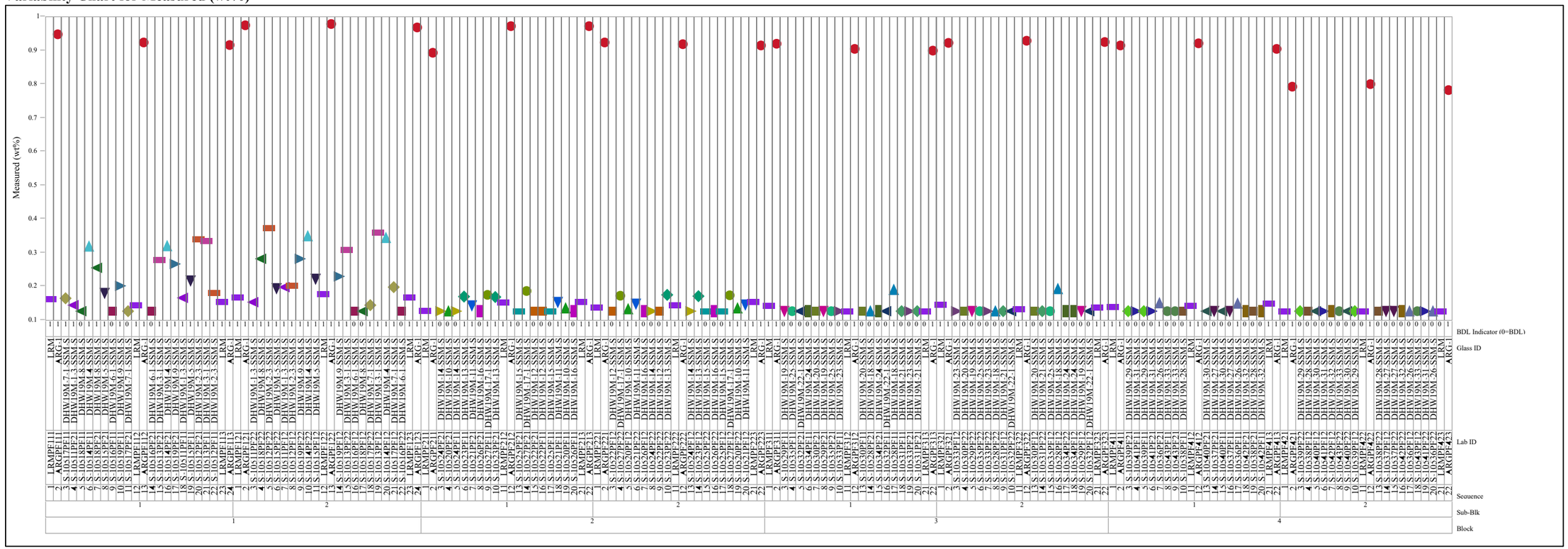


Exhibit A-1. Plots of Oxide Measurements in Analytical Sequence for the Group 1 Glasses (continued)

Oxide=P2O5, Prep Method=AD
Variability Chart for Measured (wt%)

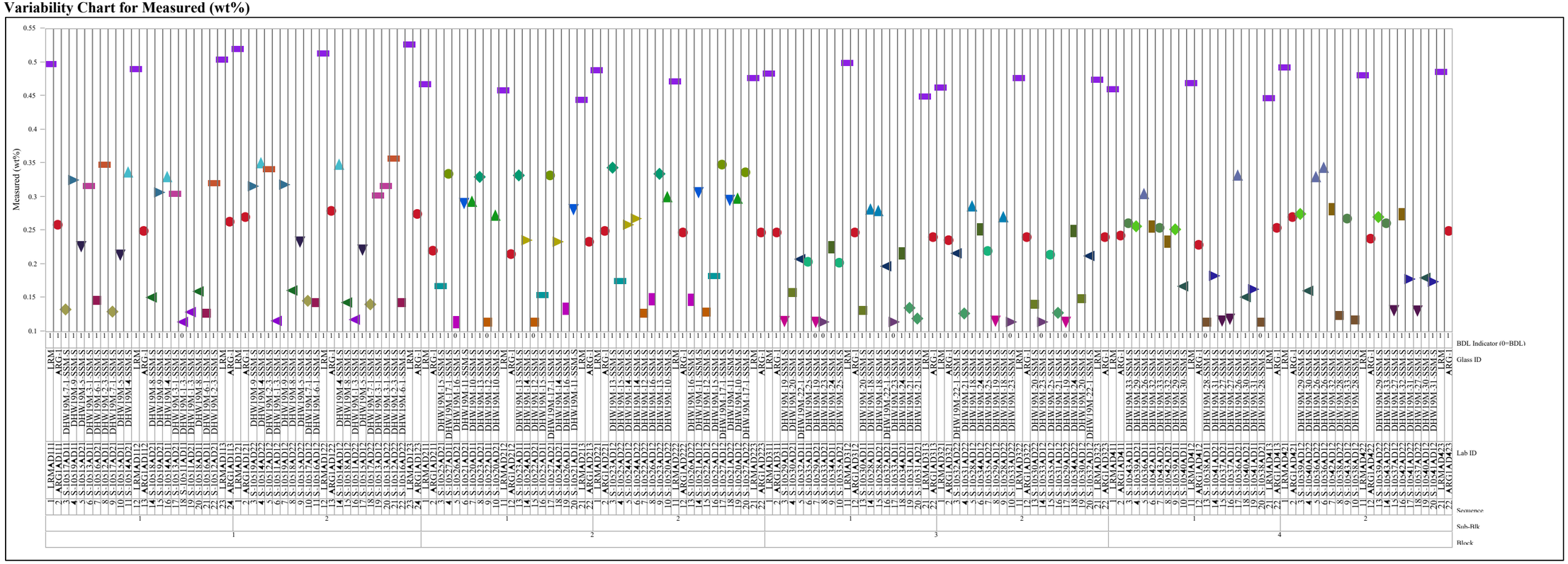


Exhibit A-1. Plots of Oxide Measurements in Analytical Sequence for the Group 1 Glasses (continued)

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

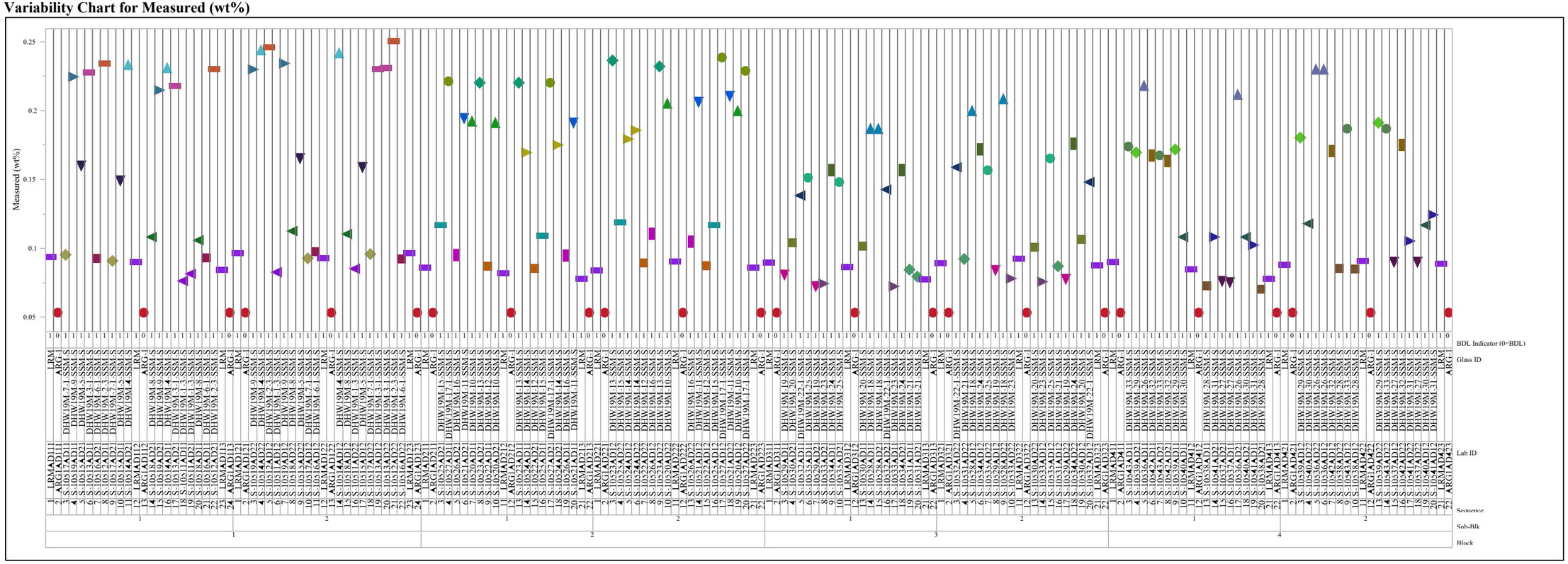


Exhibit A-1. Plots of Oxide Measurements in Analytical Sequence for the Group 1 Glasses (continued)

Oxide=SiO2, Prep Method=PF
Variability Chart for Measured (wt%)

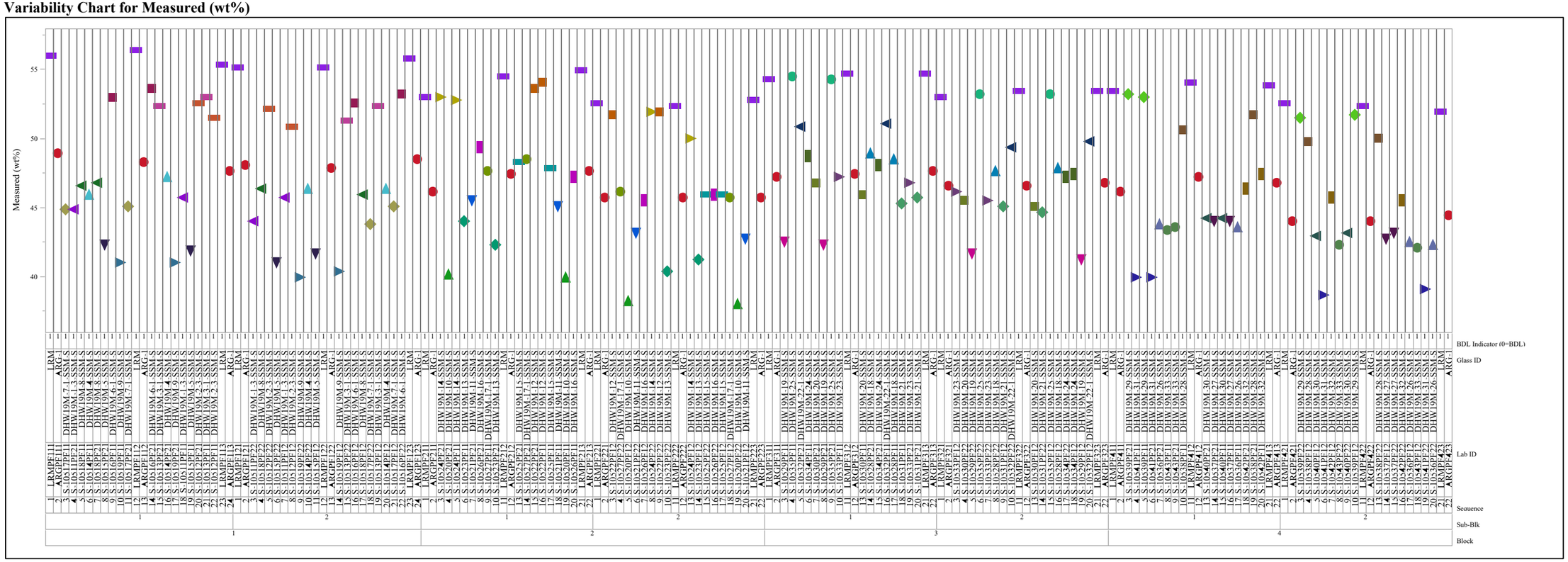


Exhibit A-1. Plots of Oxide Measurements in Analytical Sequence for the Group 1 Glasses (continued)

Oxide=SO3, Prep Method=AD
Variability Chart for Measured (wt%)

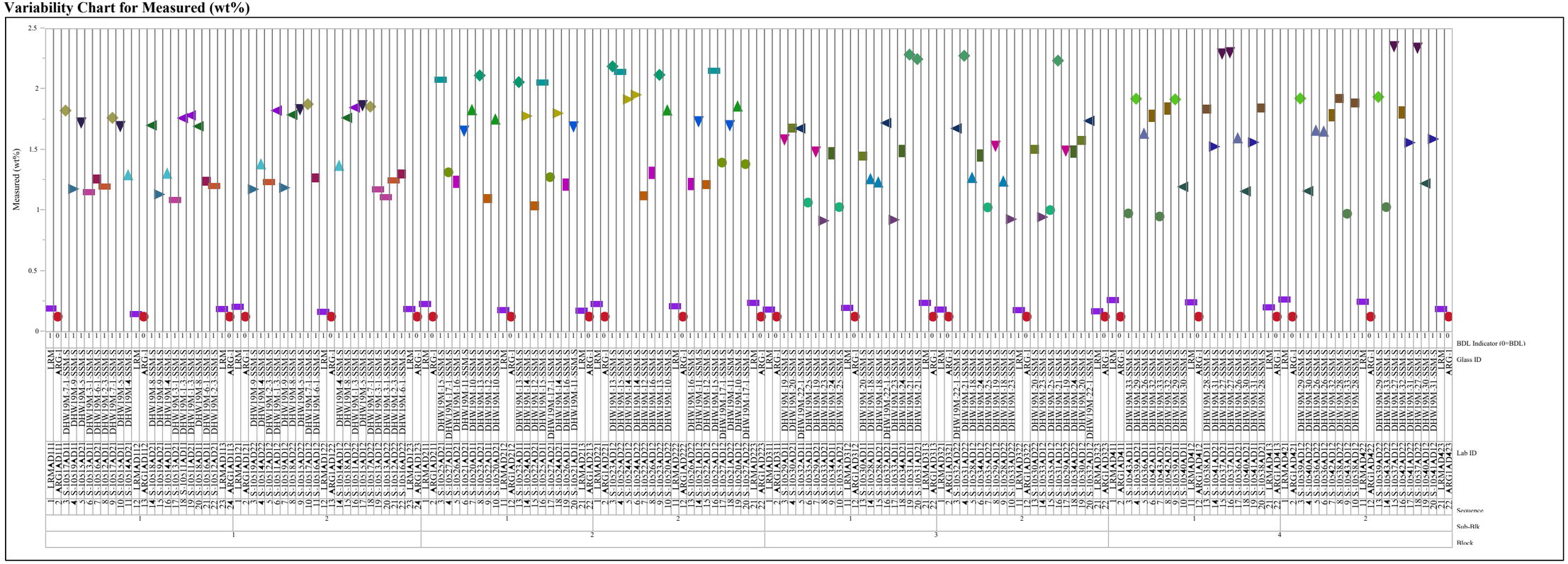


Exhibit A-1. Plots of Oxide Measurements in Analytical Sequence for the Group 1 Glasses (continued)

Oxide=ZrO2, Prep Method=AD
Variability Chart for Measured (wt%)

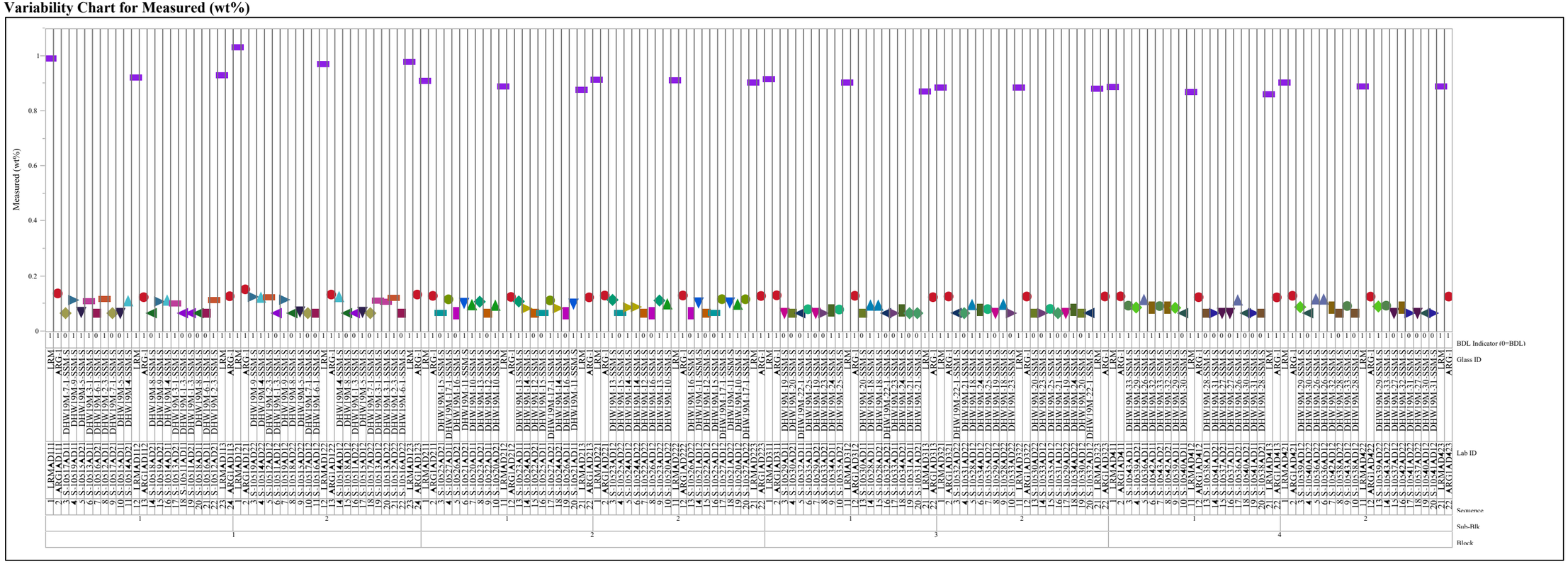


Exhibit A-2. Plots of Oxide Measurements by Glass Identifier Grouped by Targeted Concentrations

Oxide=Al2O3, Prep Method=PF
Variability Chart for Measured (wt%)

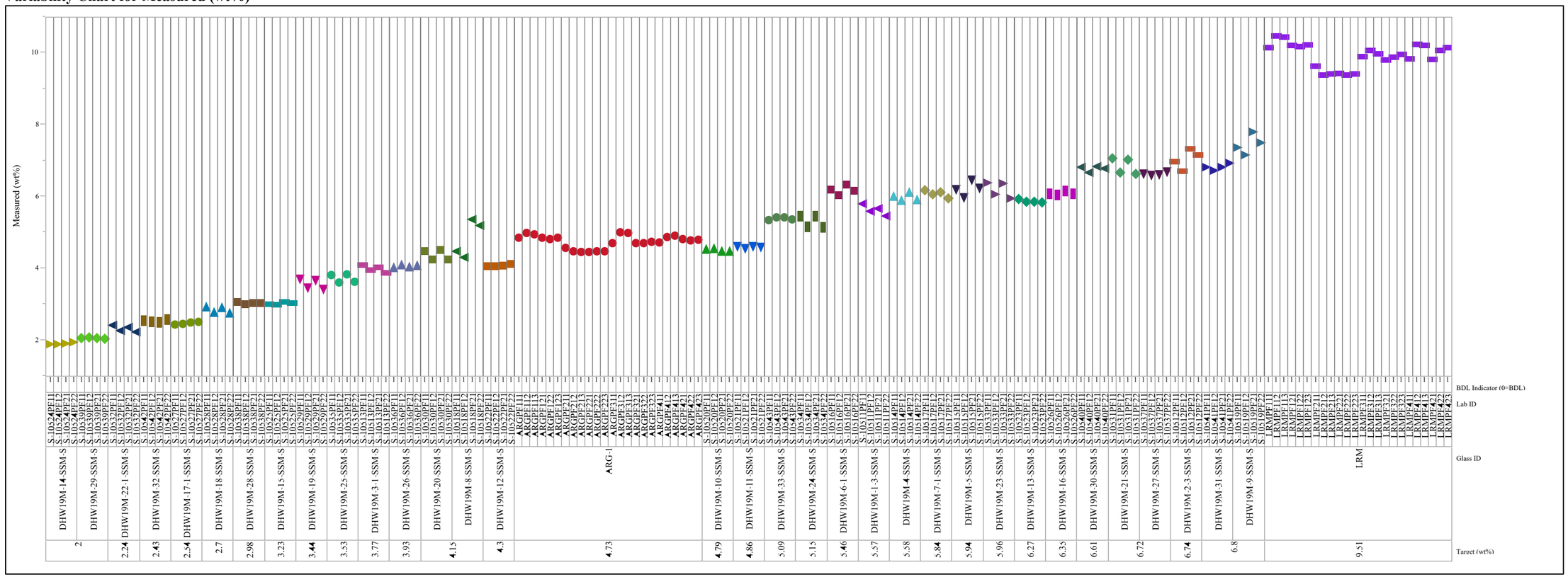


Exhibit A-2. Plots of Oxide Measurements by Glass Identifier Grouped by Targeted Concentrations (continued)

Oxide=B2O3, Prep Method=PF
Variability Chart for Measured (wt%)

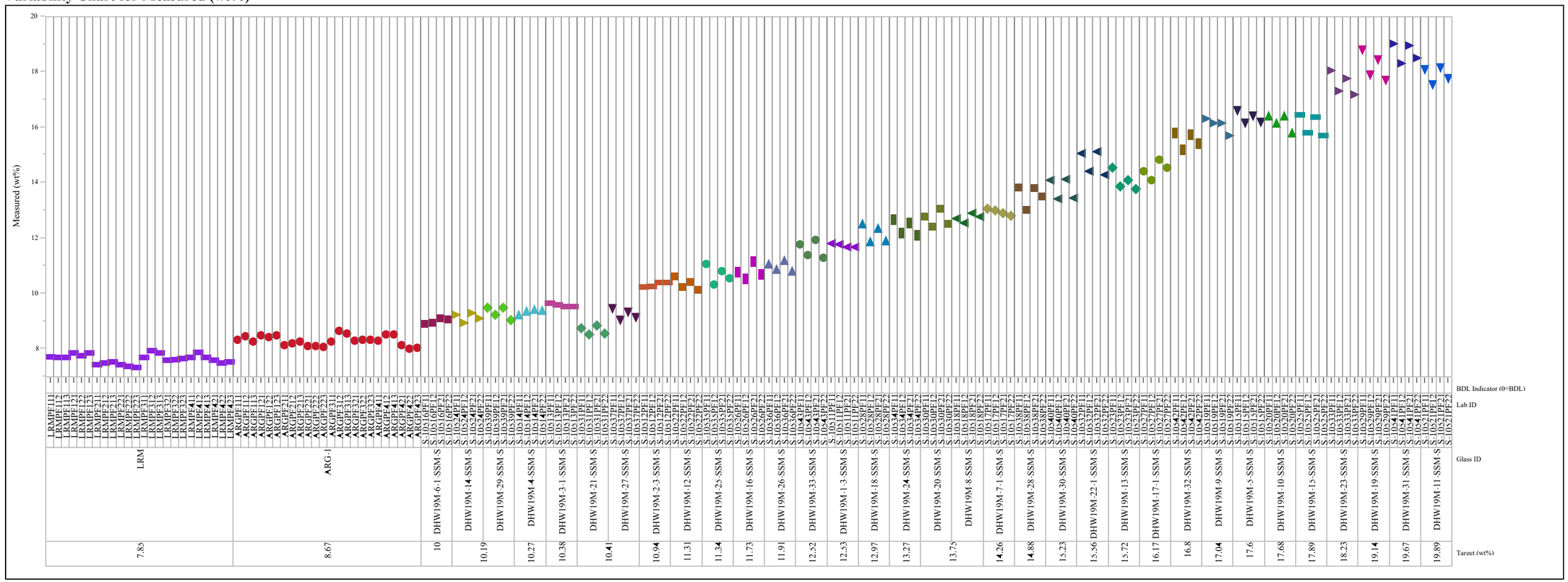


Exhibit A-2. Plots of Oxide Measurements by Glass Identifier Grouped by Targeted Concentrations (continued)

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

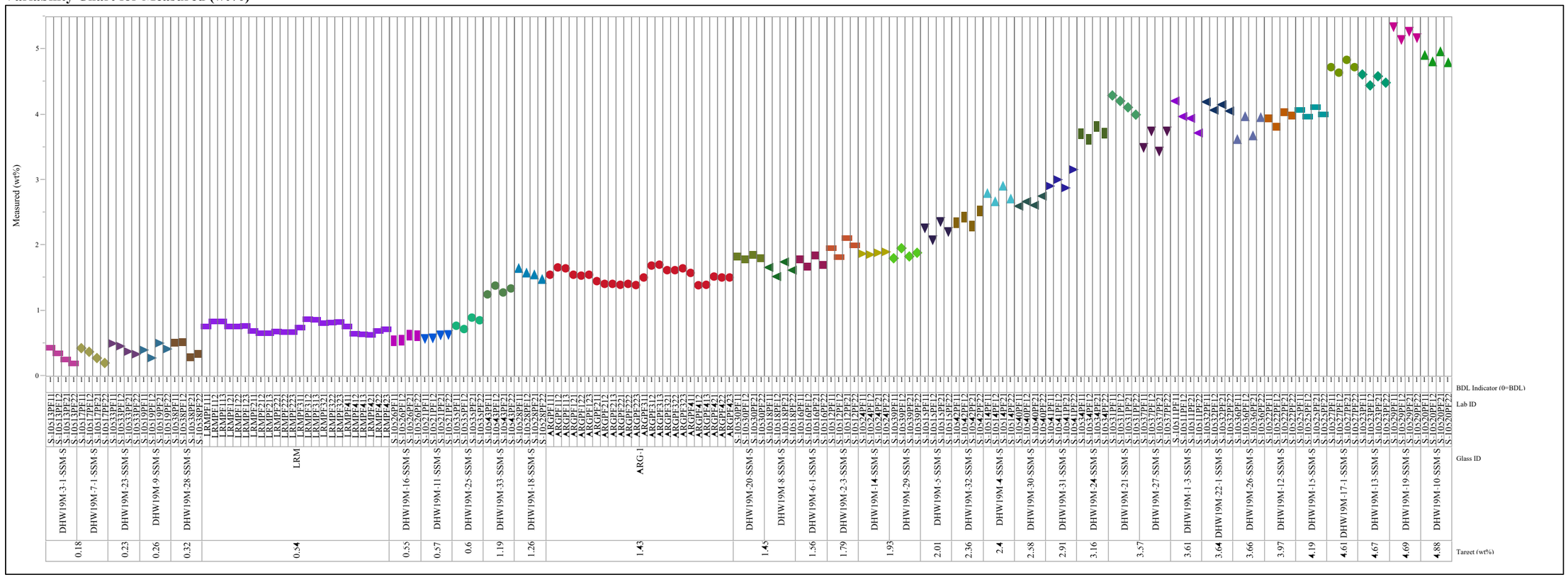


Exhibit A-2. Plots of Oxide Measurements by Glass Identifier Grouped by Targeted Concentrations (continued)

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

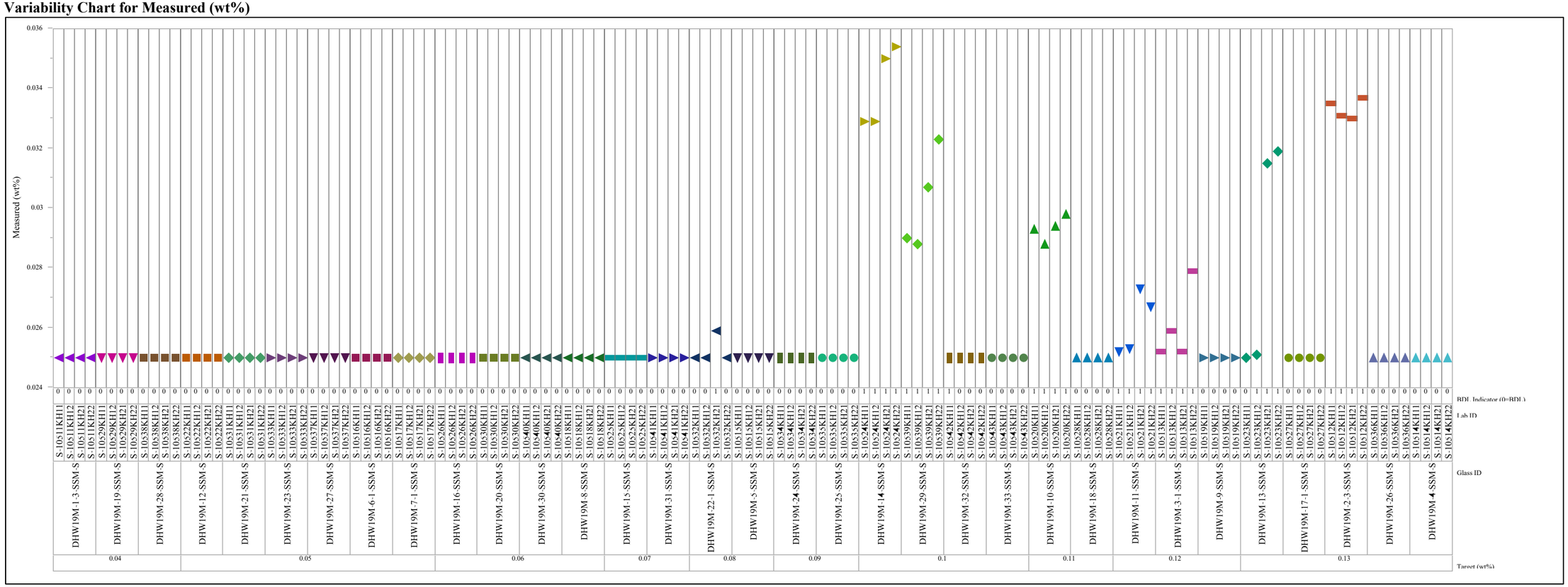


Exhibit A-2. Plots of Oxide Measurements by Glass Identifier Grouped by Targeted Concentrations (continued)

Oxide=Cr2O3, Prep Method=PF
Variability Chart for Measured (wt%)

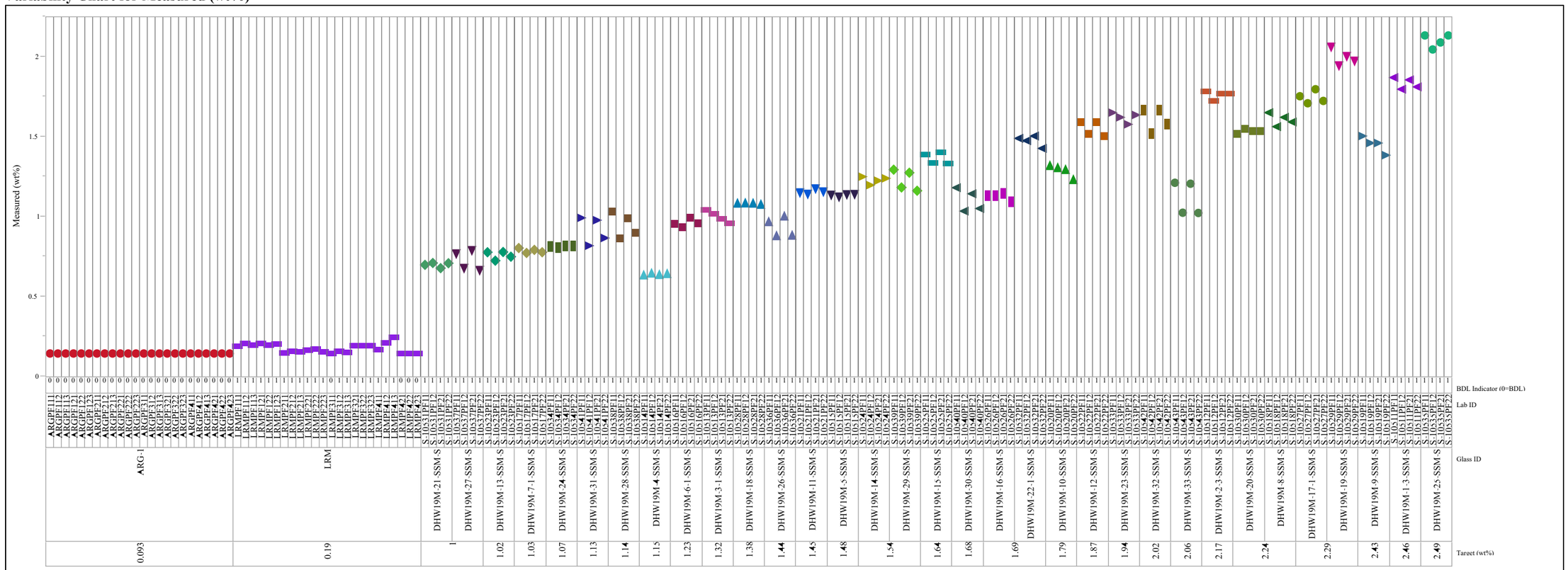


Exhibit A-2. Plots of Oxide Measurements by Glass Identifier Grouped by Targeted Concentrations (continued)

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

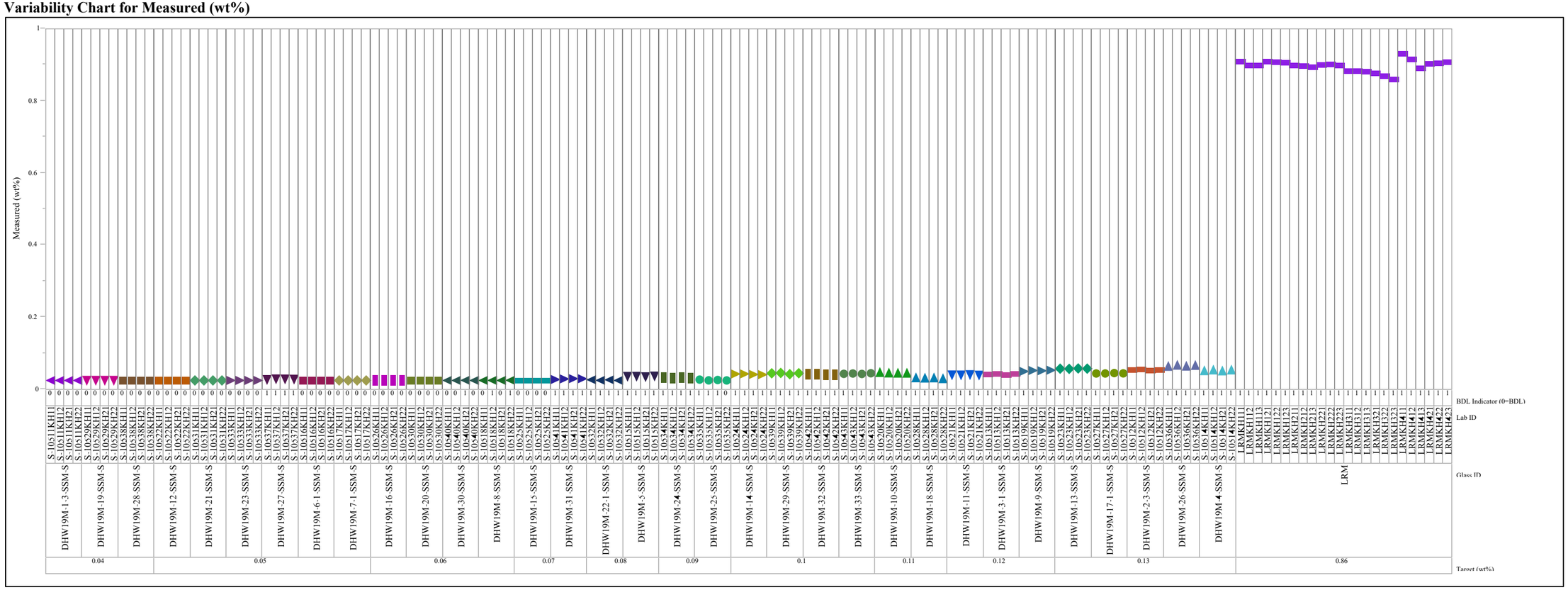


Exhibit A-2. Plots of Oxide Measurements by Glass Identifier Grouped by Targeted Concentrations (continued)

Oxide=Fe2O3, Prep Method=PF
Variability Chart for Measured (wt%)

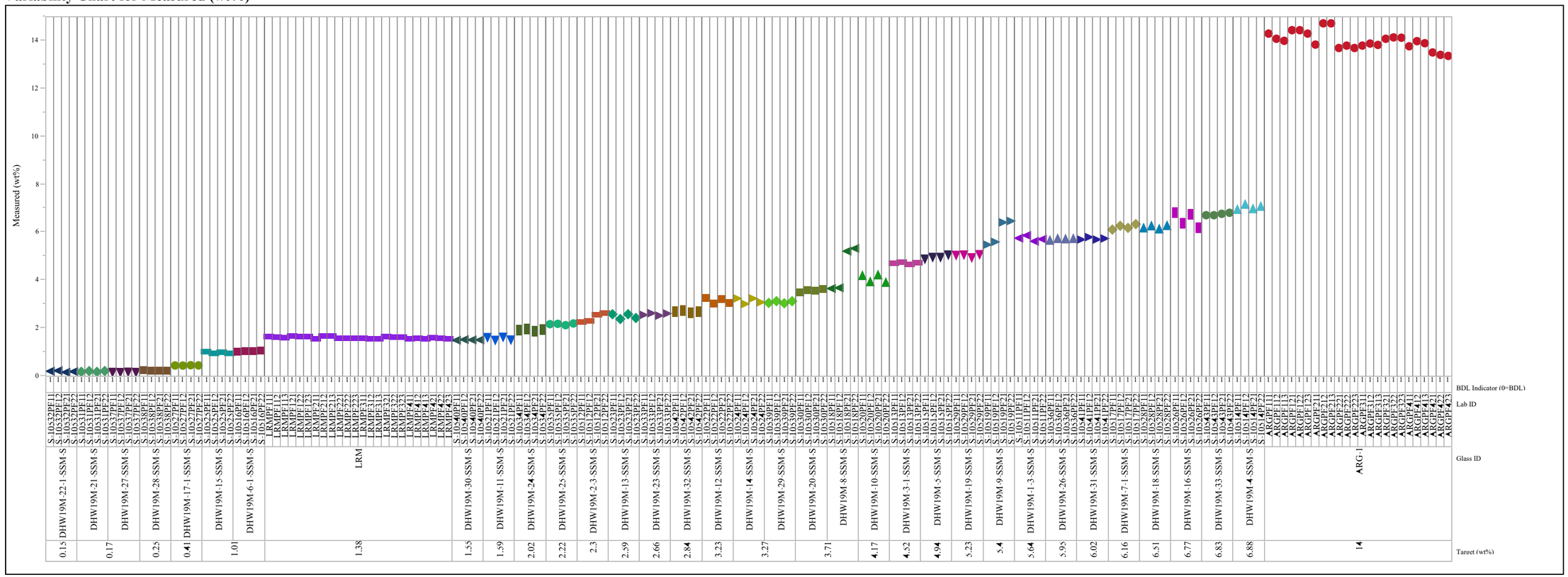


Exhibit A-2. Plots of Oxide Measurements by Glass Identifier Grouped by Targeted Concentrations (continued)

Oxide=K2O, Prep Method=AD
Variability Chart for Measured (wt%)

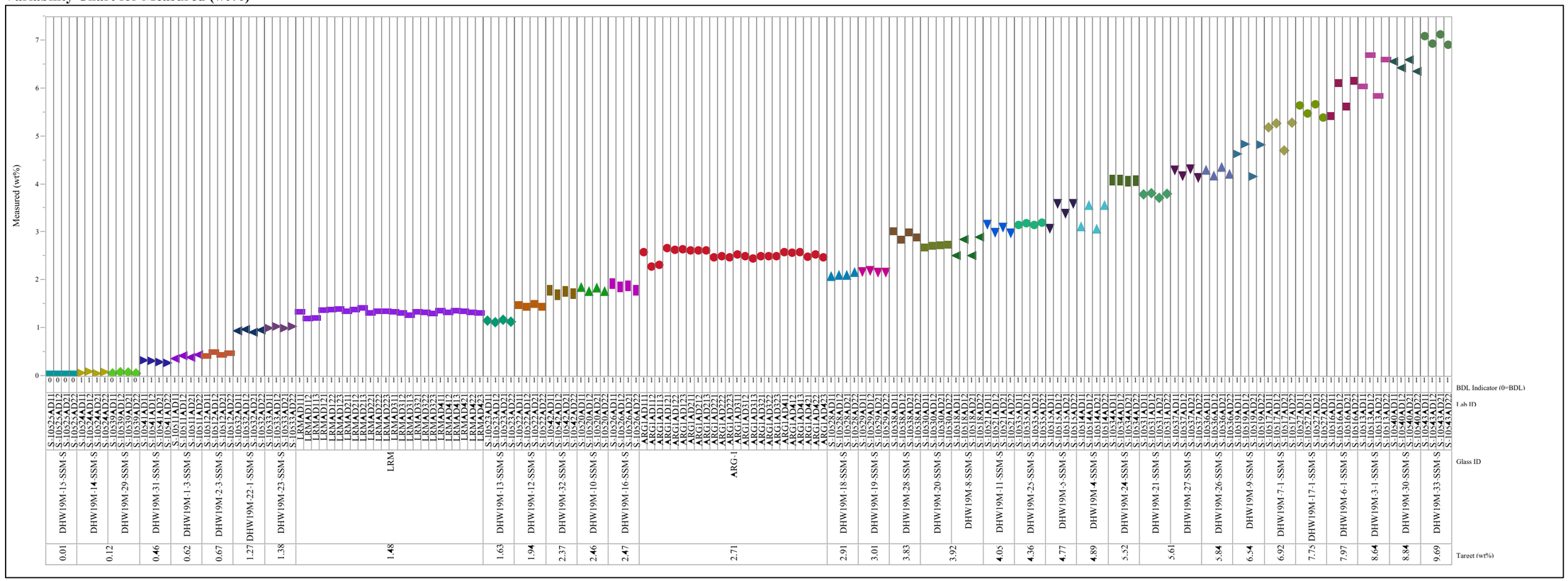


Exhibit A-2. Plots of Oxide Measurements by Glass Identifier Grouped by Targeted Concentrations (continued)

Oxide=Li2O, Prep Method=PF
Variability Chart for Measured (wt%)

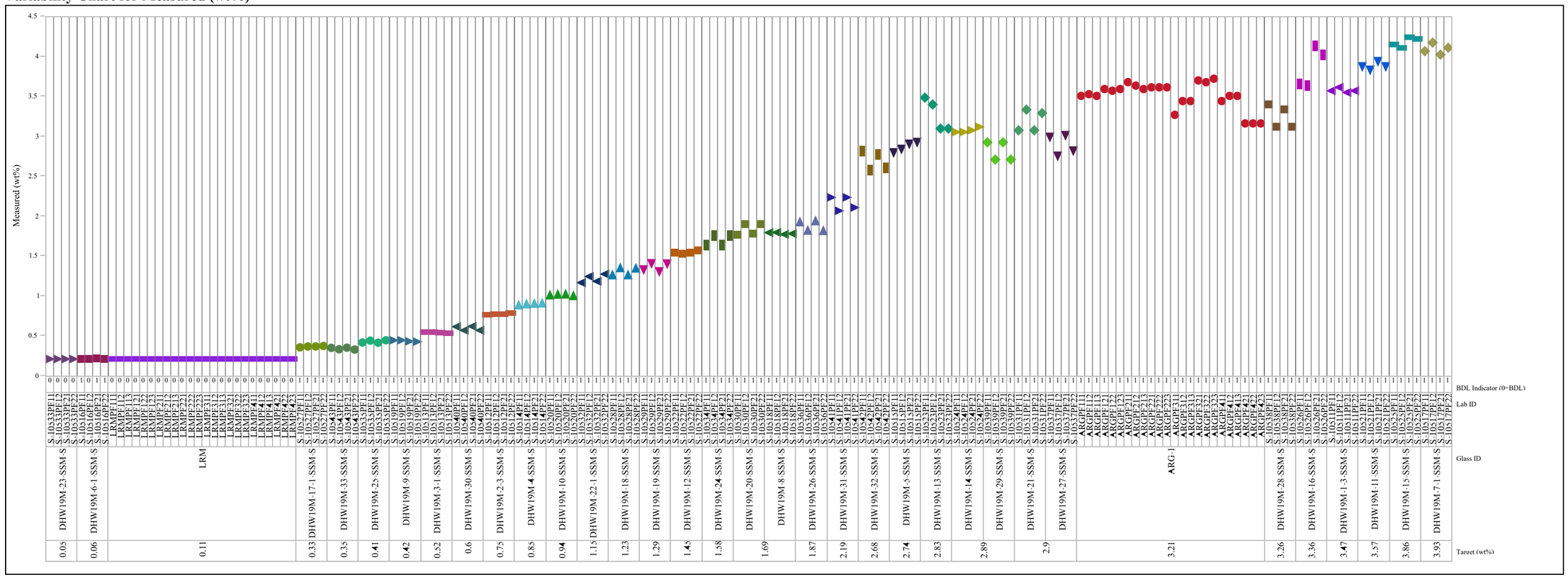


Exhibit A-2. Plots of Oxide Measurements by Glass Identifier Grouped by Targeted Concentrations (continued)

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

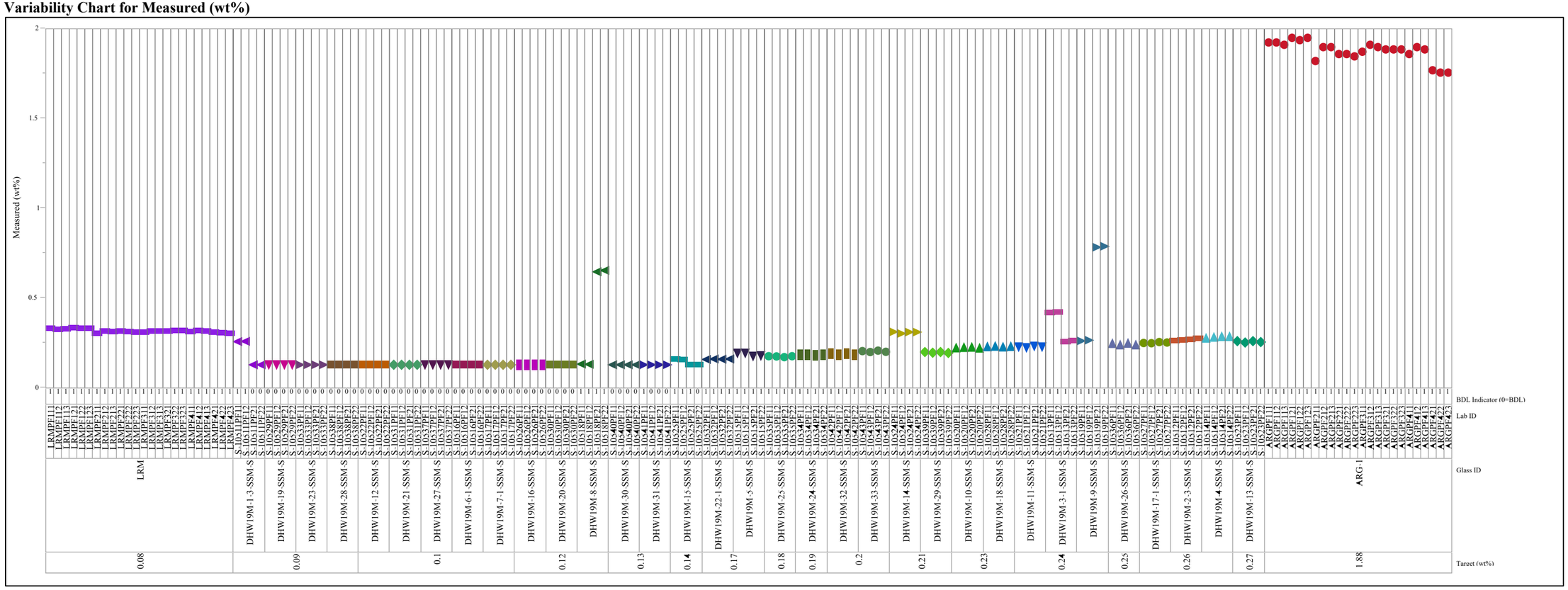


Exhibit A-2. Plots of Oxide Measurements by Glass Identifier Grouped by Targeted Concentrations (continued)

Oxide=Na2O, Prep Method=AD
Variability Chart for Measured (wt%)

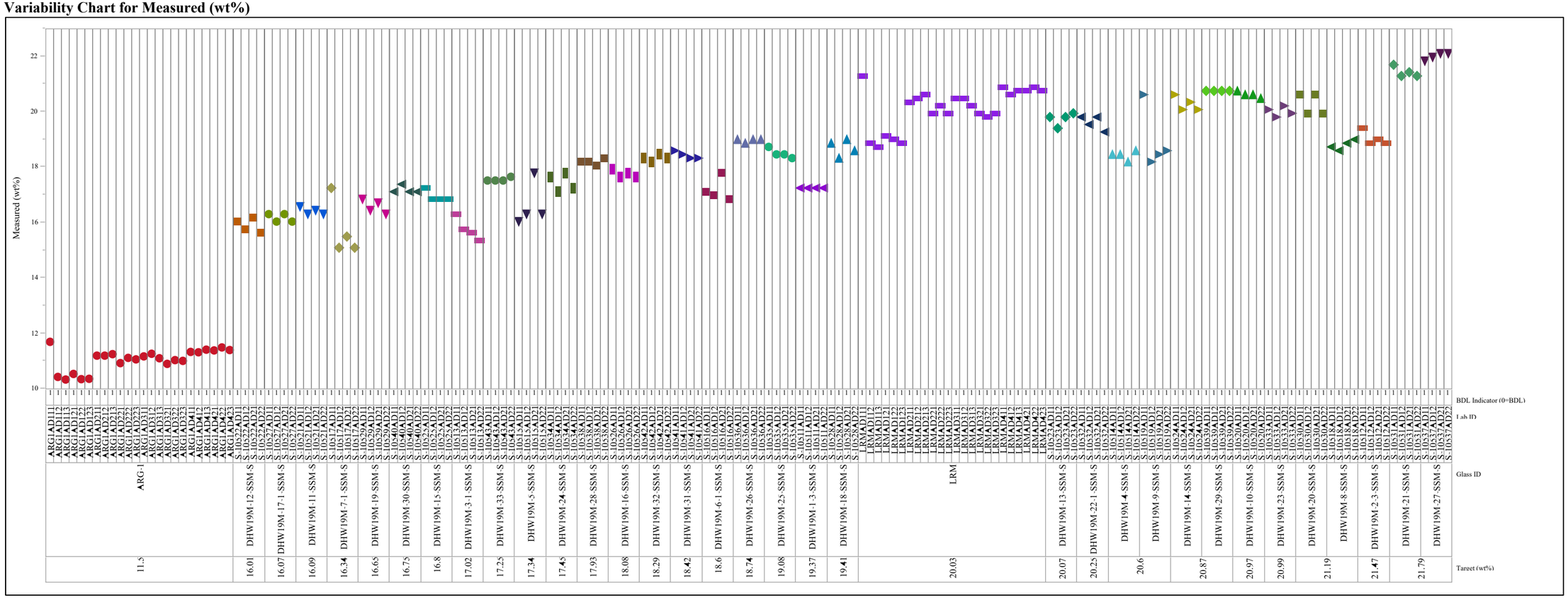


Exhibit A-2. Plots of Oxide Measurements by Glass Identifier Grouped by Targeted Concentrations (continued)

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

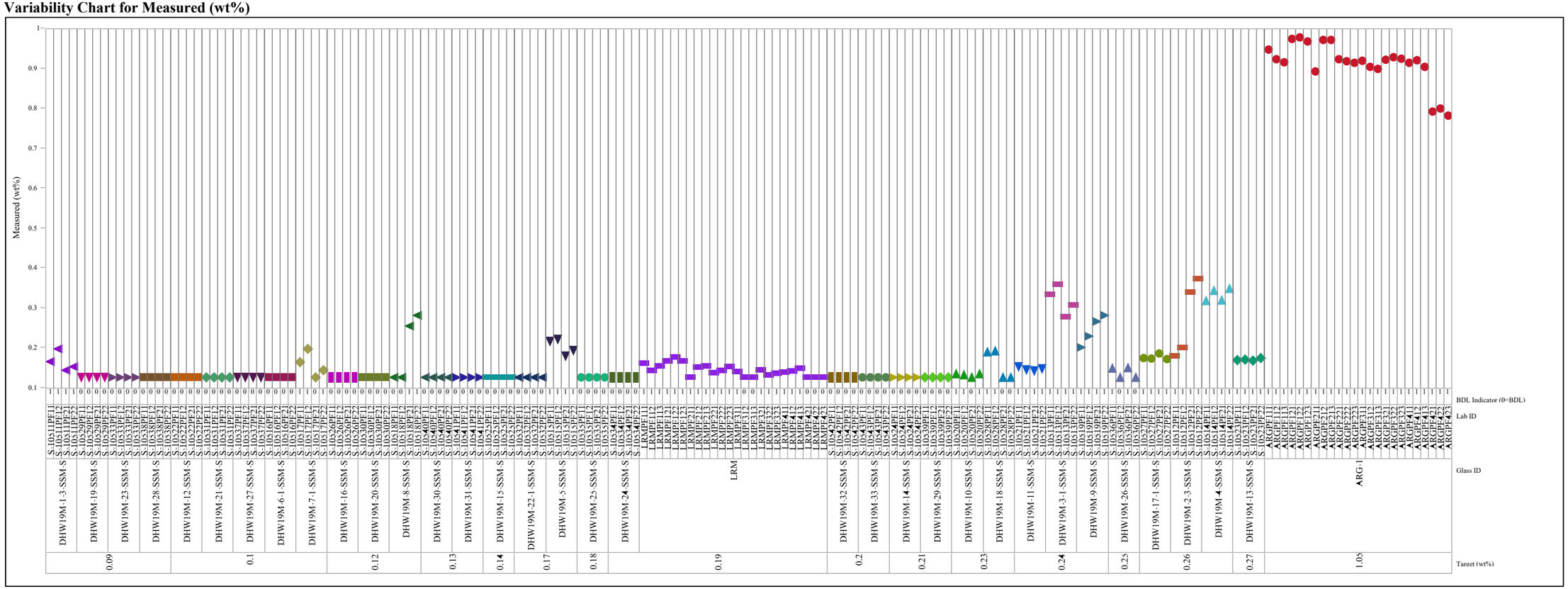


Exhibit A-2. Plots of Oxide Measurements by Glass Identifier Grouped by Targeted Concentrations (continued)

Oxide=P2O5, Prep Method=AD
Variability Chart for Measured (wt%)

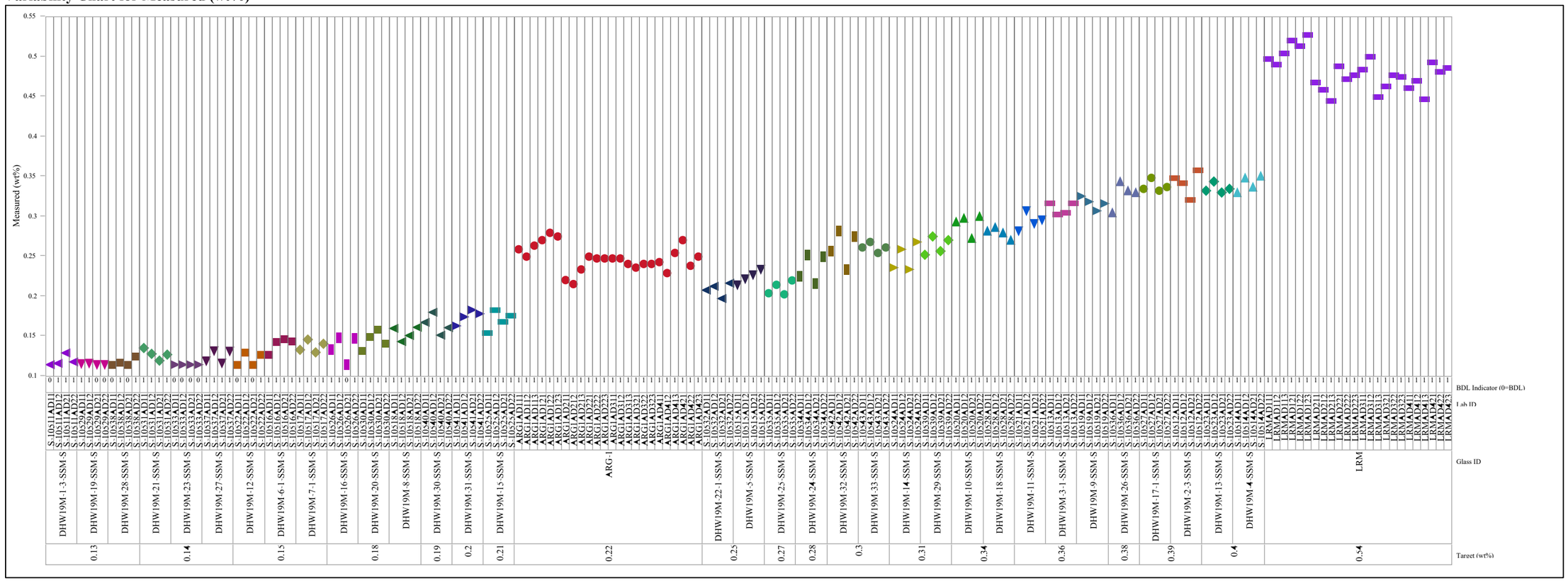


Exhibit A-2. Plots of Oxide Measurements by Glass Identifier Grouped by Targeted Concentrations (continued)

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

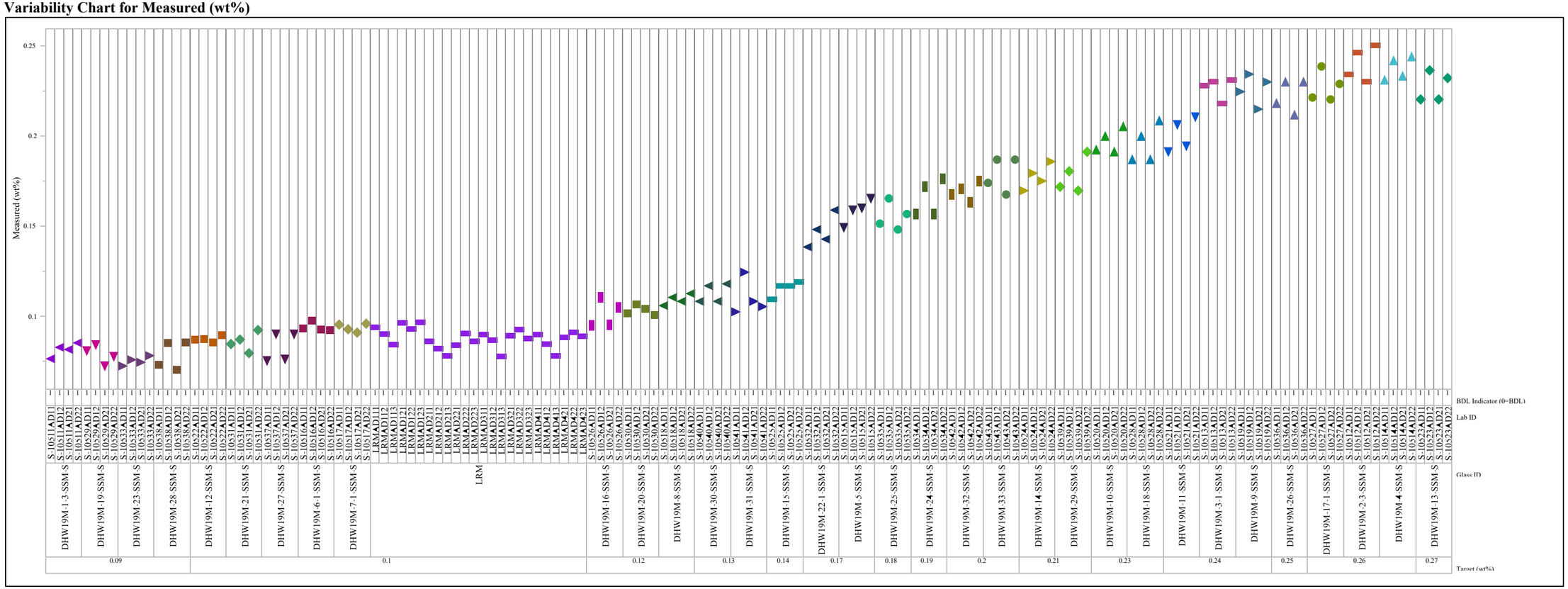


Exhibit A-2. Plots of Oxide Measurements by Glass Identifier Grouped by Targeted Concentrations (continued)

Oxide=SiO2, Prep Method=PF
Variability Chart for Measured (wt%)

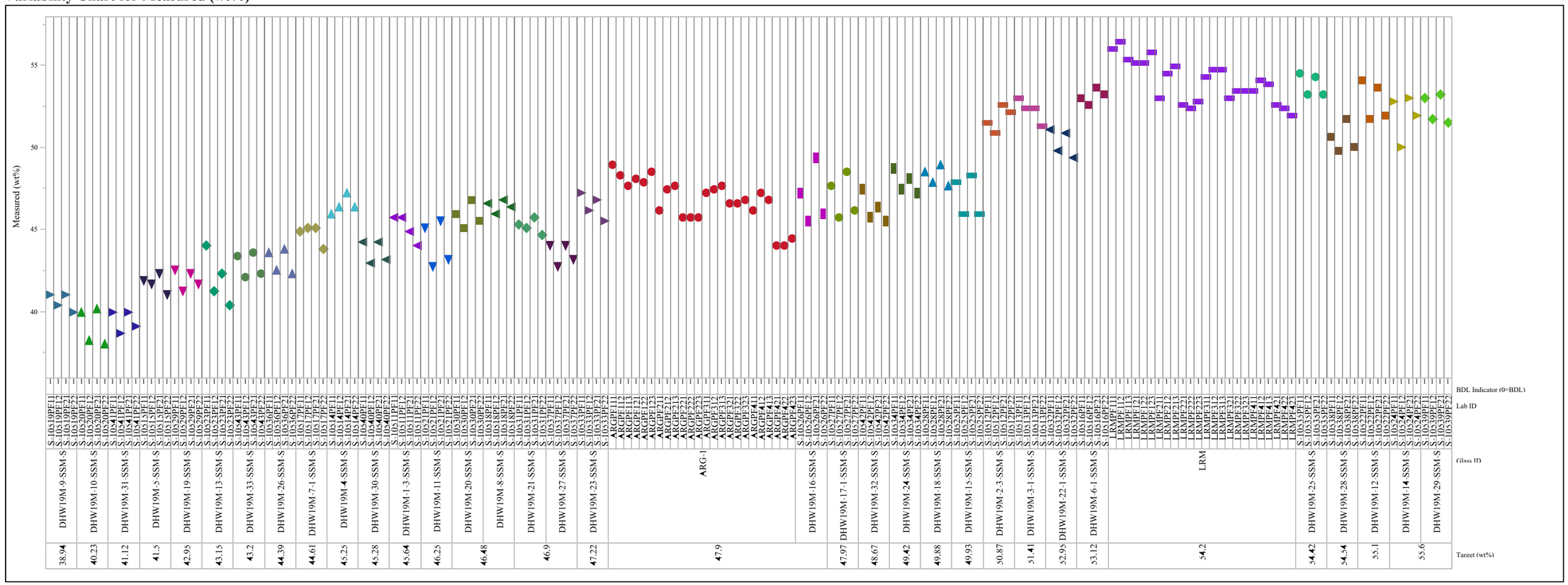


Exhibit A-2. Plots of Oxide Measurements by Glass Identifier Grouped by Targeted Concentrations (continued)

Oxide=SO3, Prep Method=AD
Variability Chart for Measured (wt%)

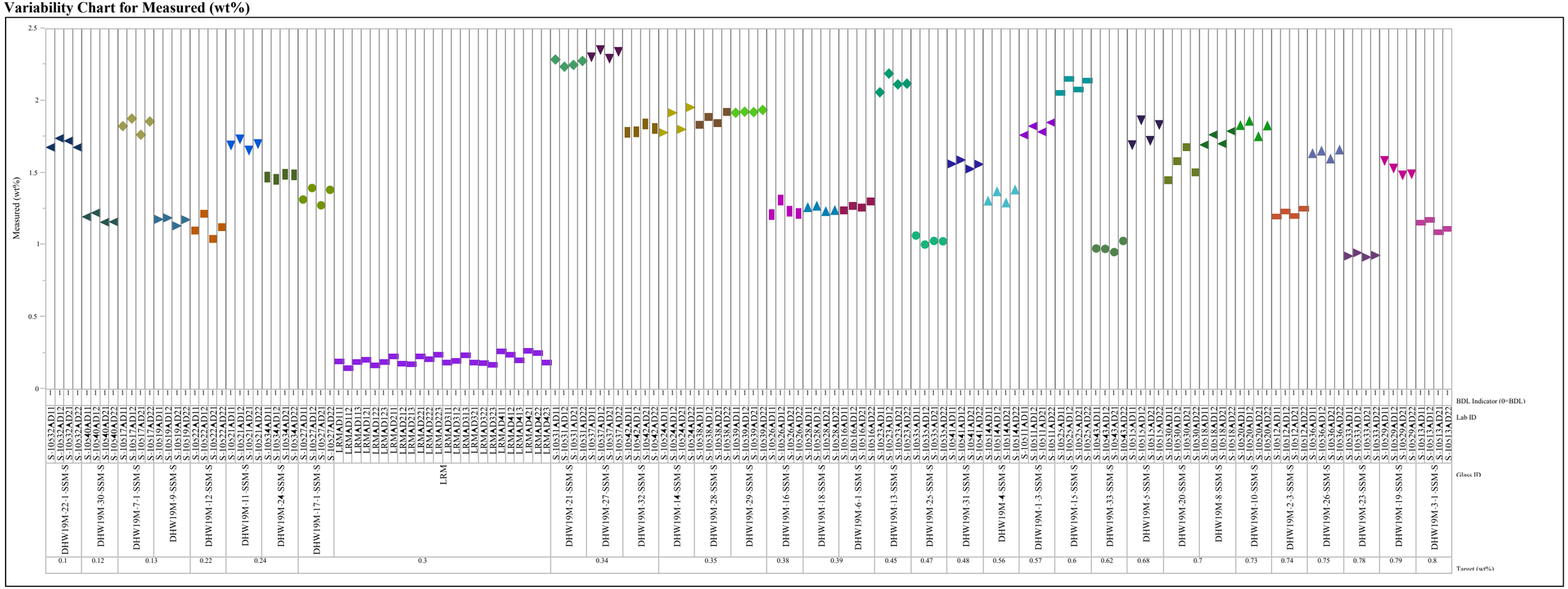


Exhibit A-2. Plots of Oxide Measurements by Glass Identifier Grouped by Targeted Concentrations (continued)

Oxide=ZrO2, Prep Method=AD
Variability Chart for Measured (wt%)

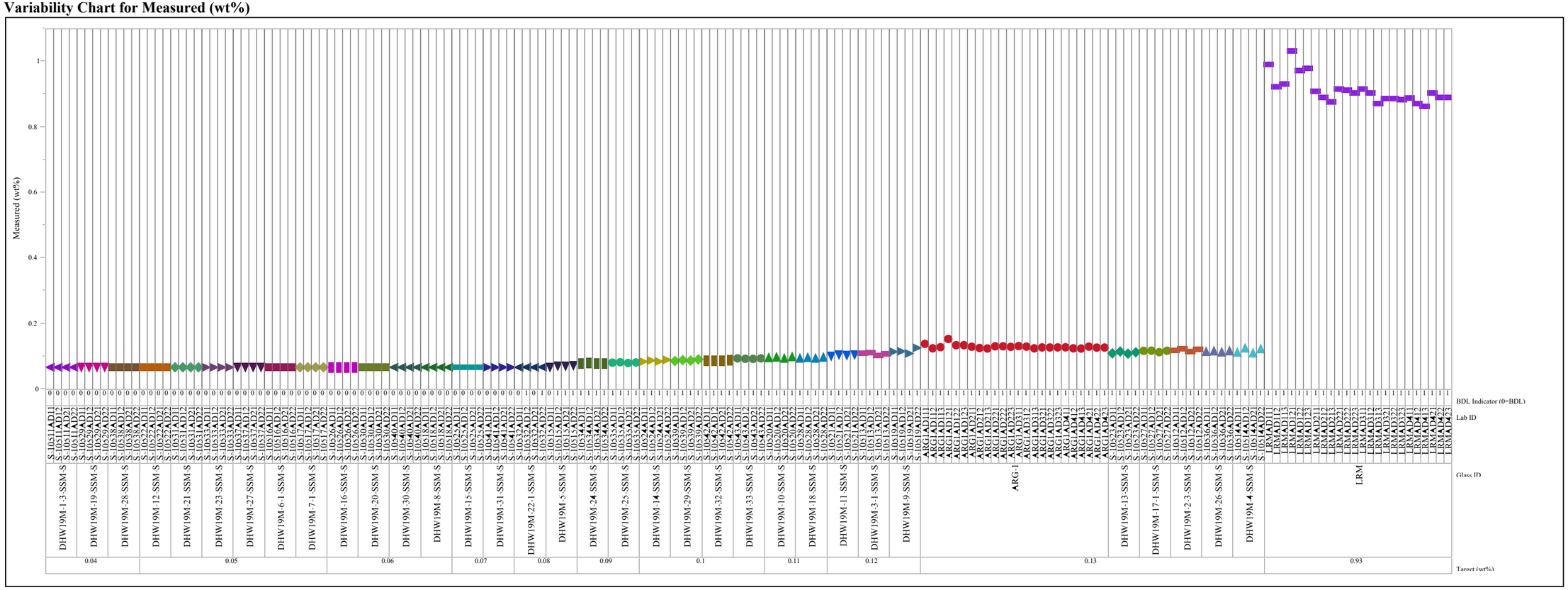
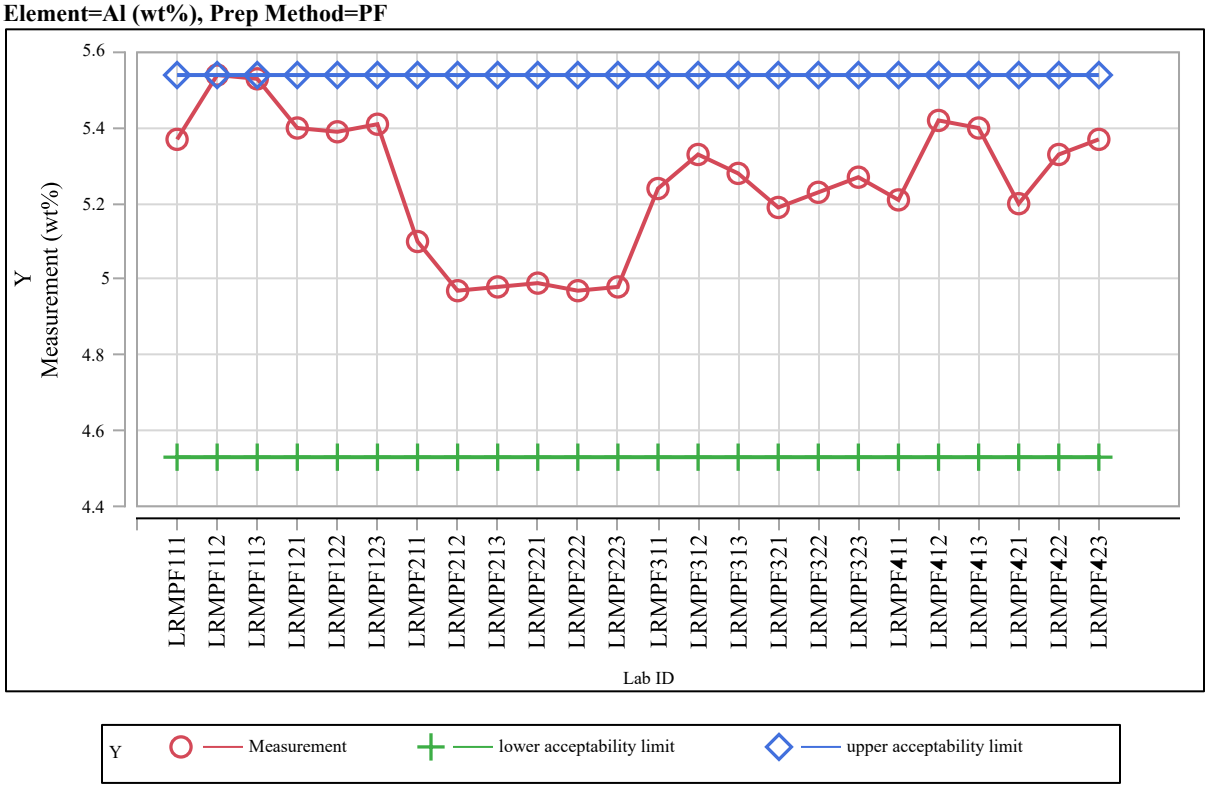


Exhibit A-3. Acceptability Evaluation for Measurements of the LRM Glass

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



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

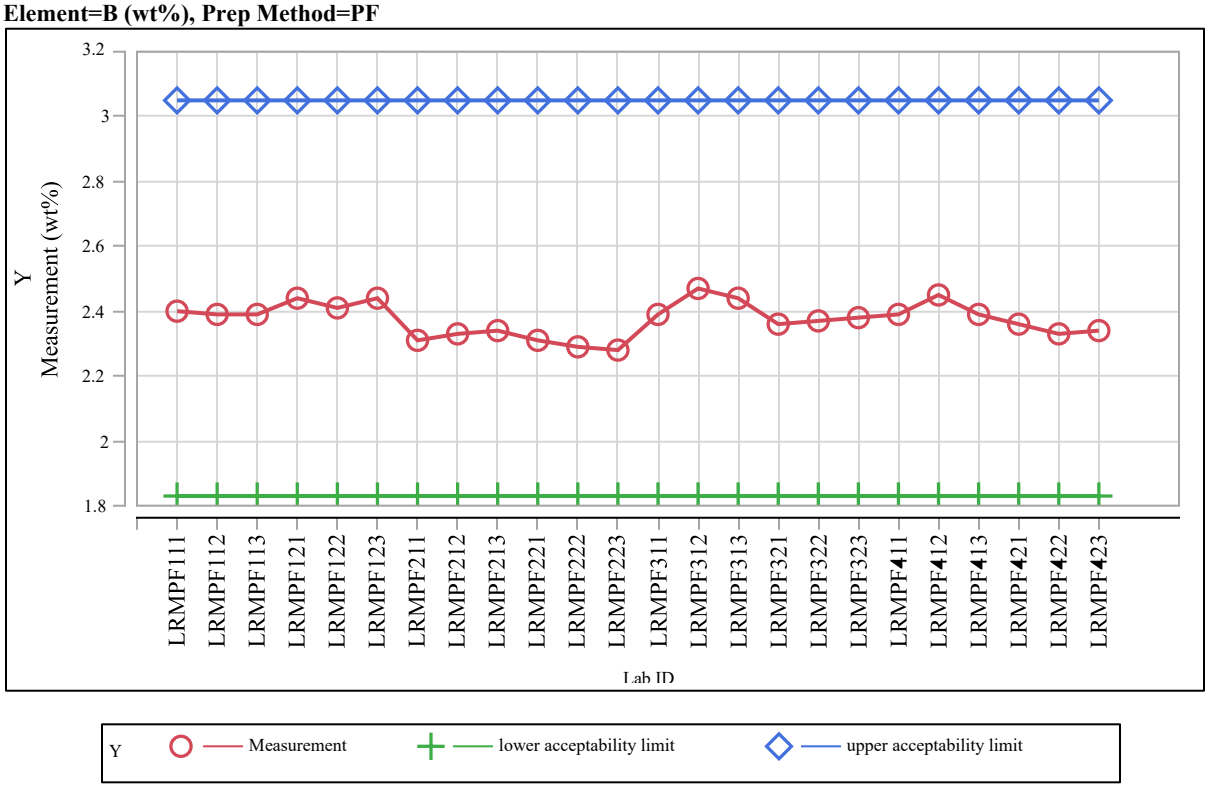
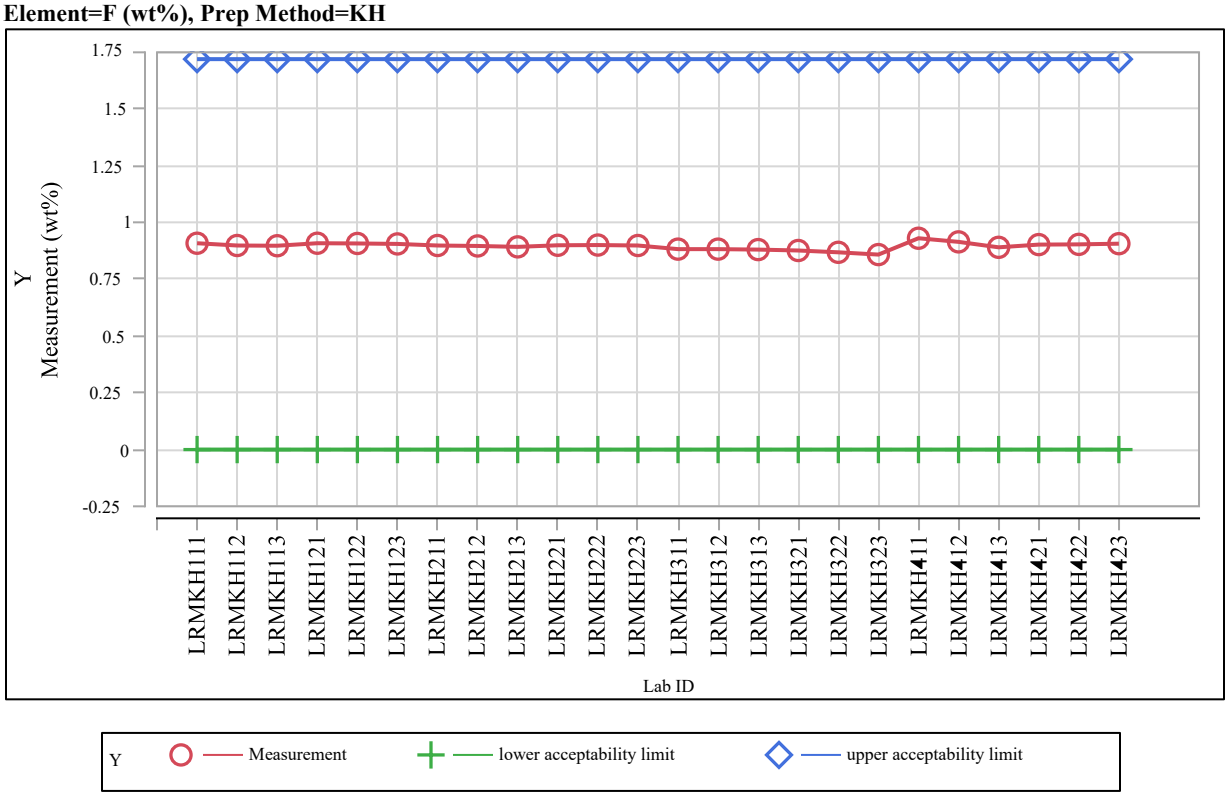


Exhibit A-3. Acceptability Evaluation for Measurements of the LRM Glass (continued)

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



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

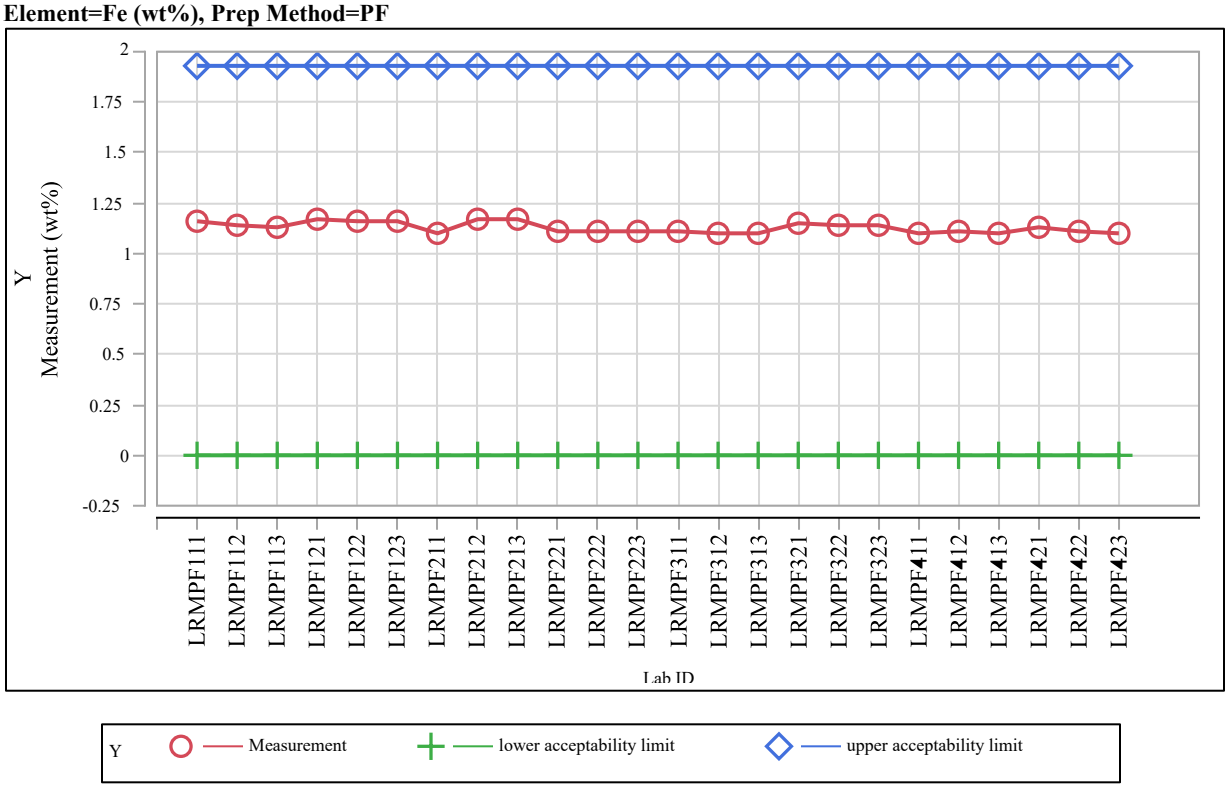
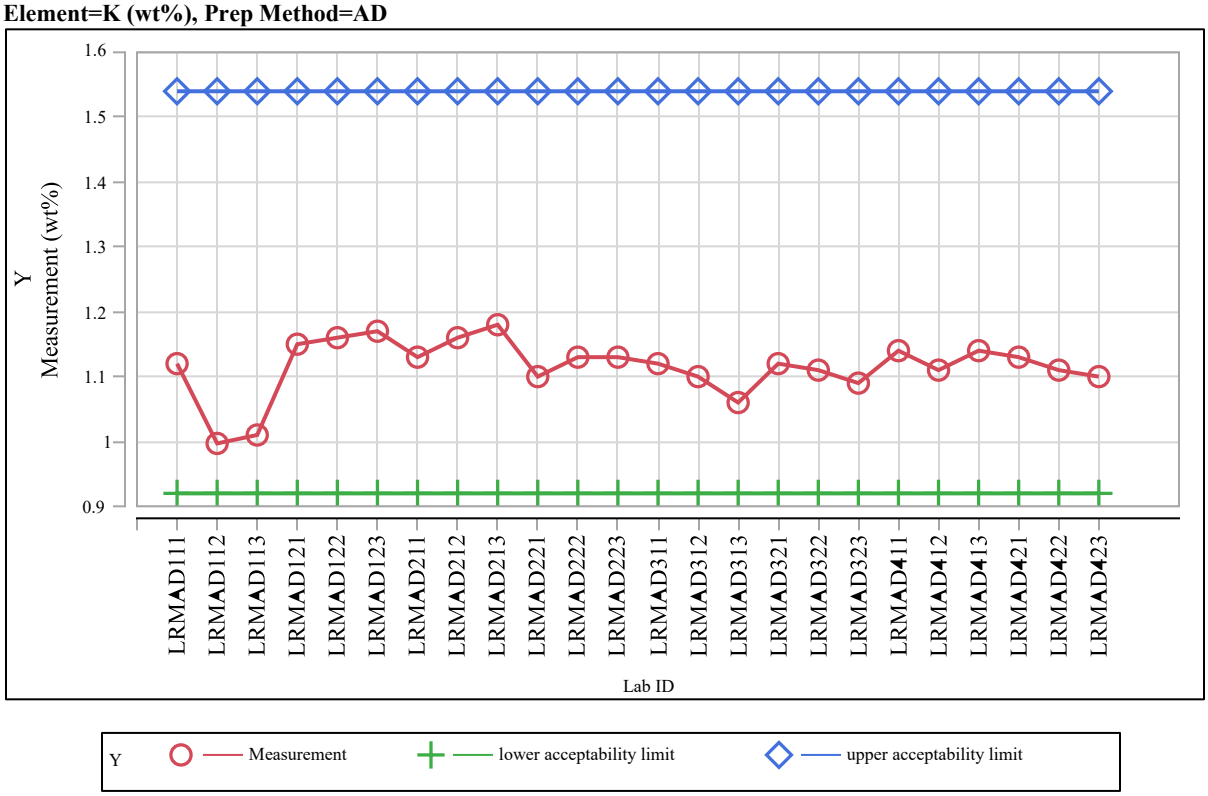


Exhibit A-3. Acceptability Evaluation for Measurements of the LRM Glass (continued)

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



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

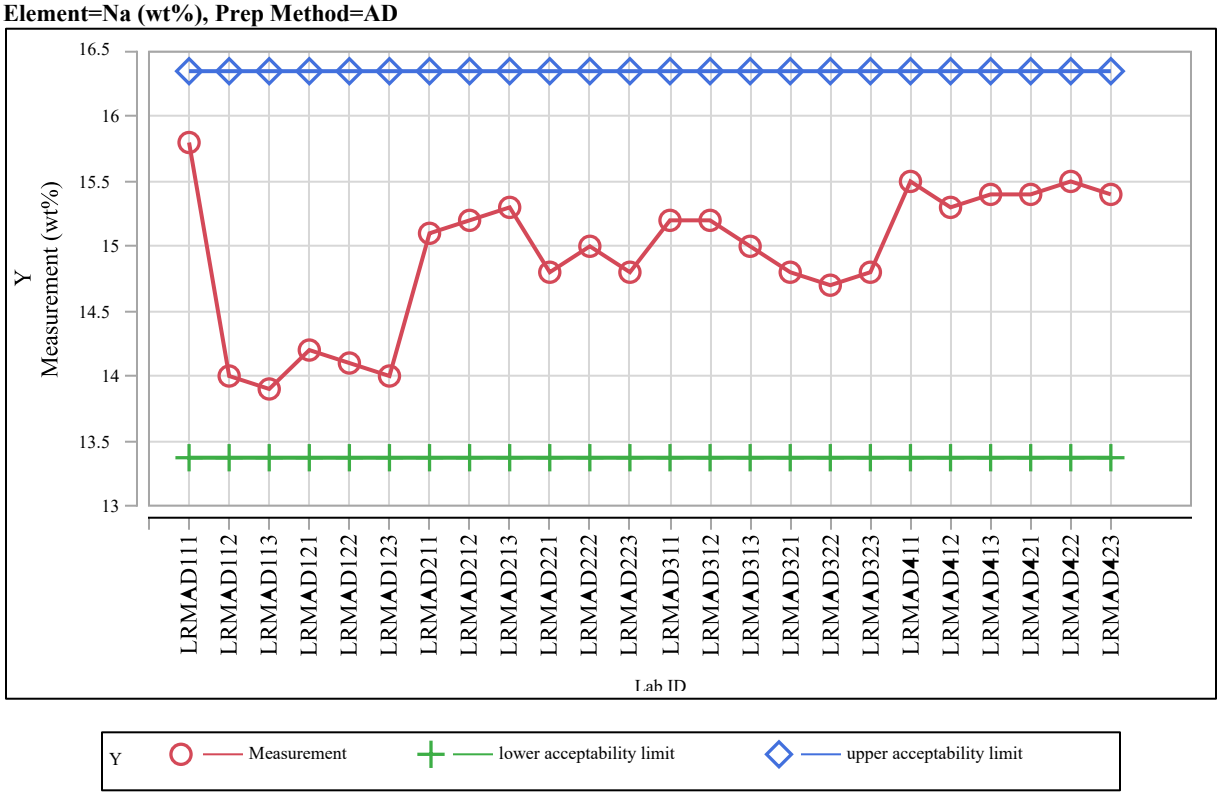
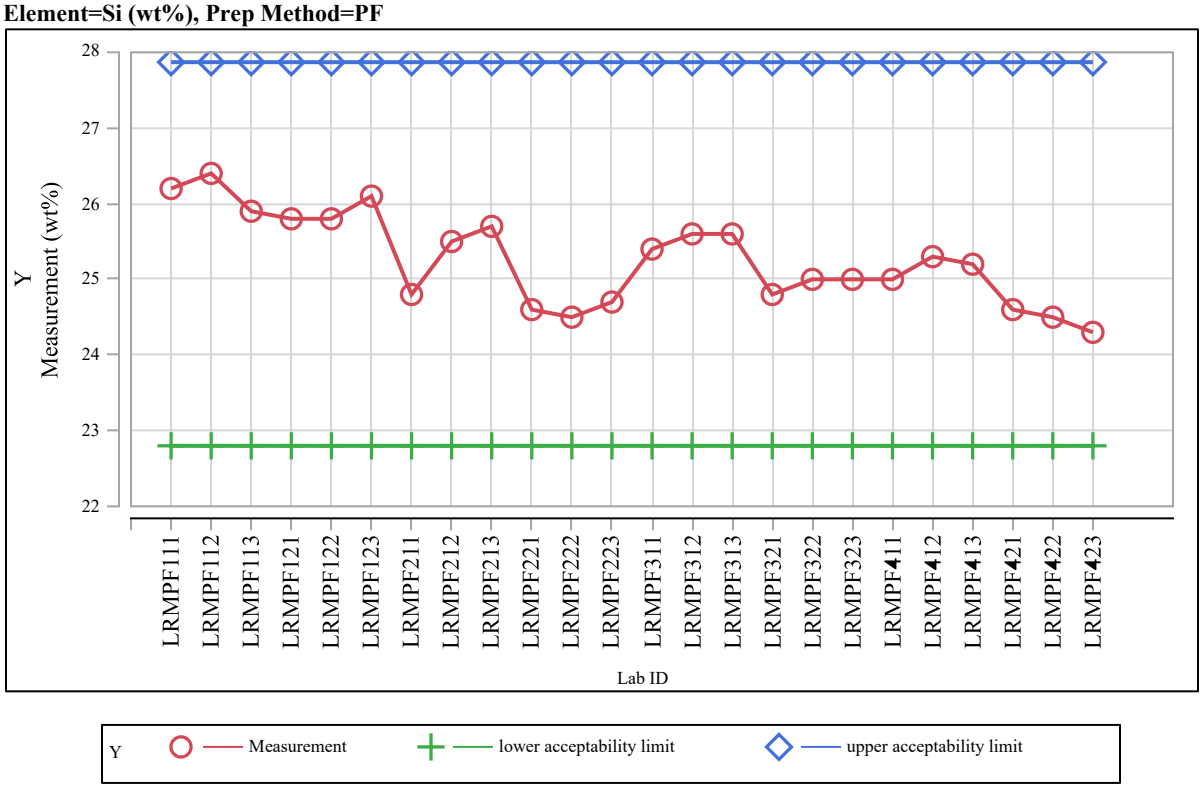


Exhibit A-3. Acceptability Evaluation for Measurements of the LRM Glass (continued)

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



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

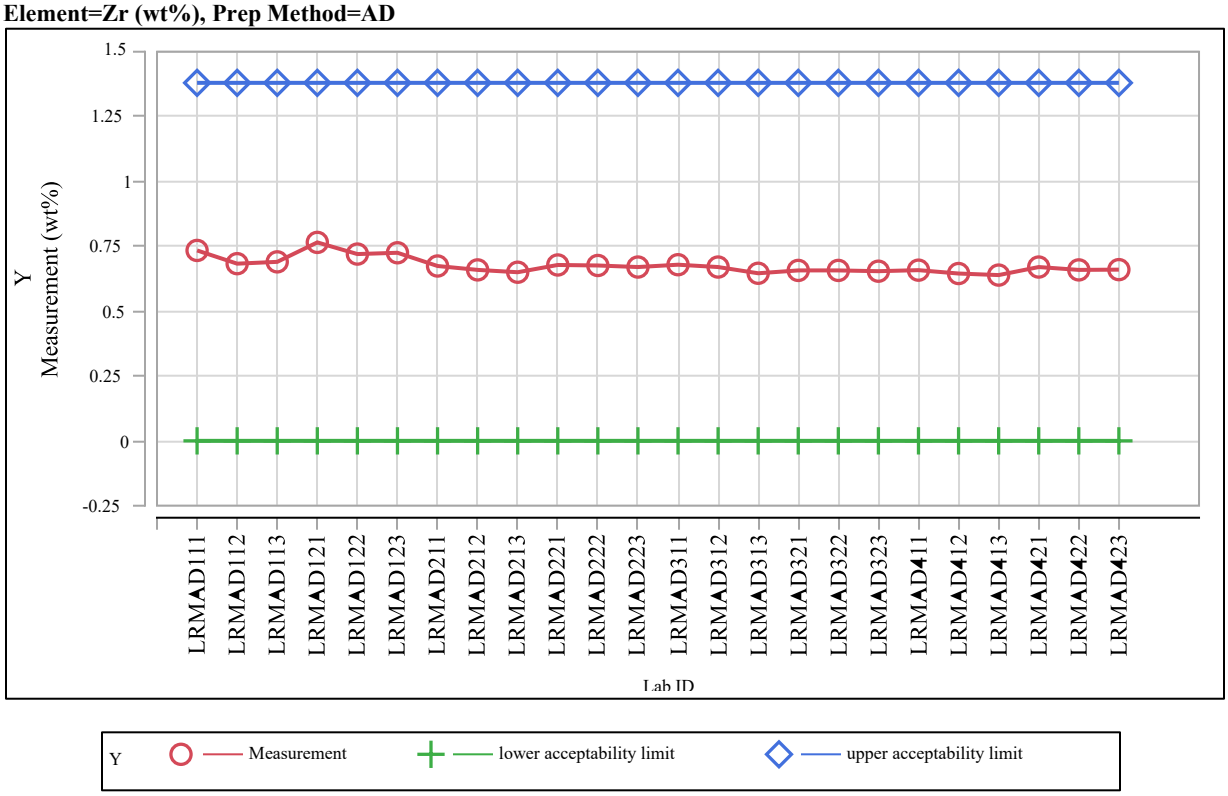


Exhibit A-4. Measured versus Targeted Concentrations by Glass ID by Oxide

Oxide=Al2O3, Prep Method=PF

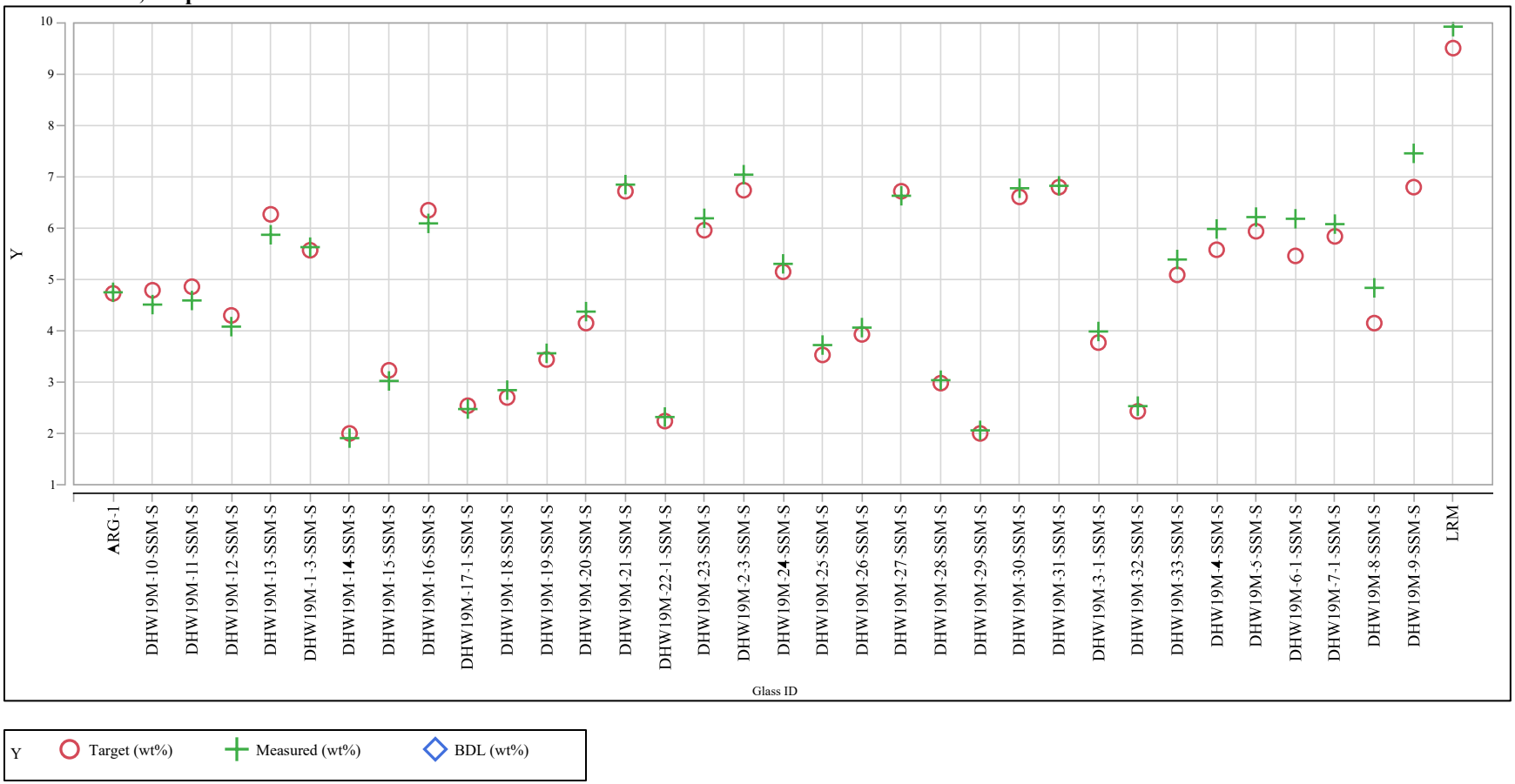


Exhibit A-4. Measured versus Targeted Concentrations by Glass ID by Oxide (continued)

Oxide=B2O3, Prep Method=PF

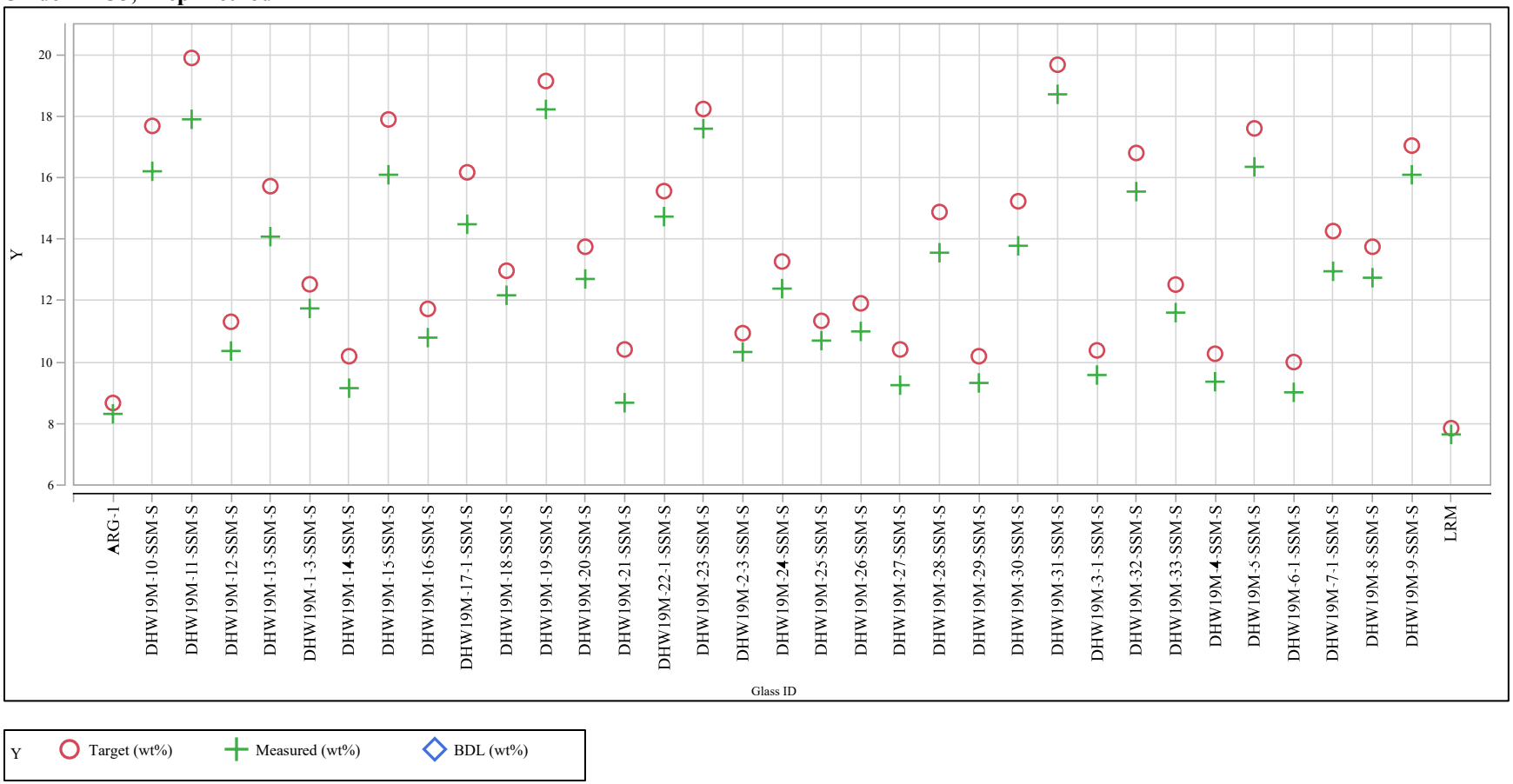


Exhibit A-4. Measured versus Targeted Concentrations by Glass ID by Oxide (continued)

Oxide=CaO, Prep Method=PF

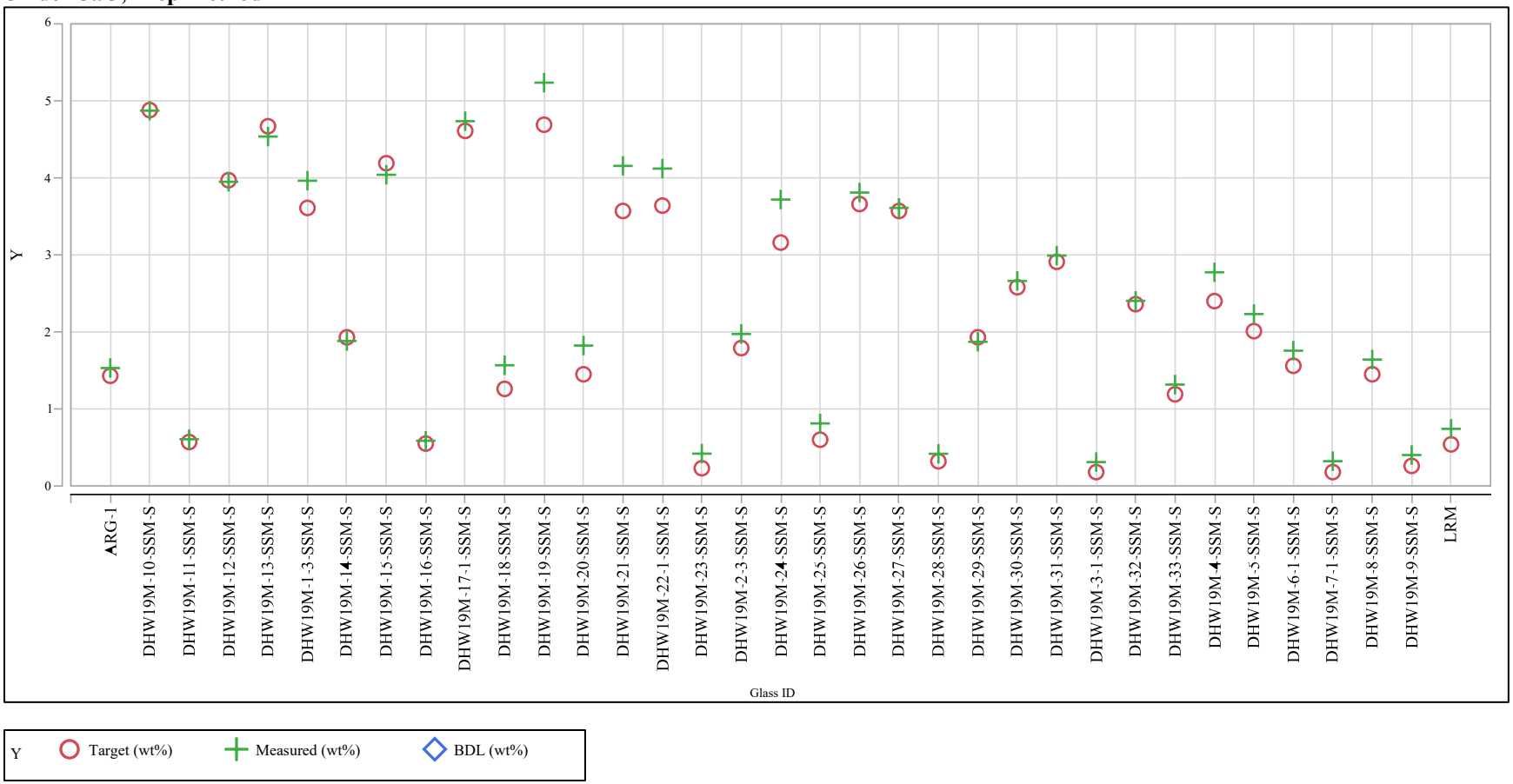


Exhibit A-4. Measured versus Targeted Concentrations by Glass ID by Oxide (continued)

Oxide=Cl, Prep Method=KH

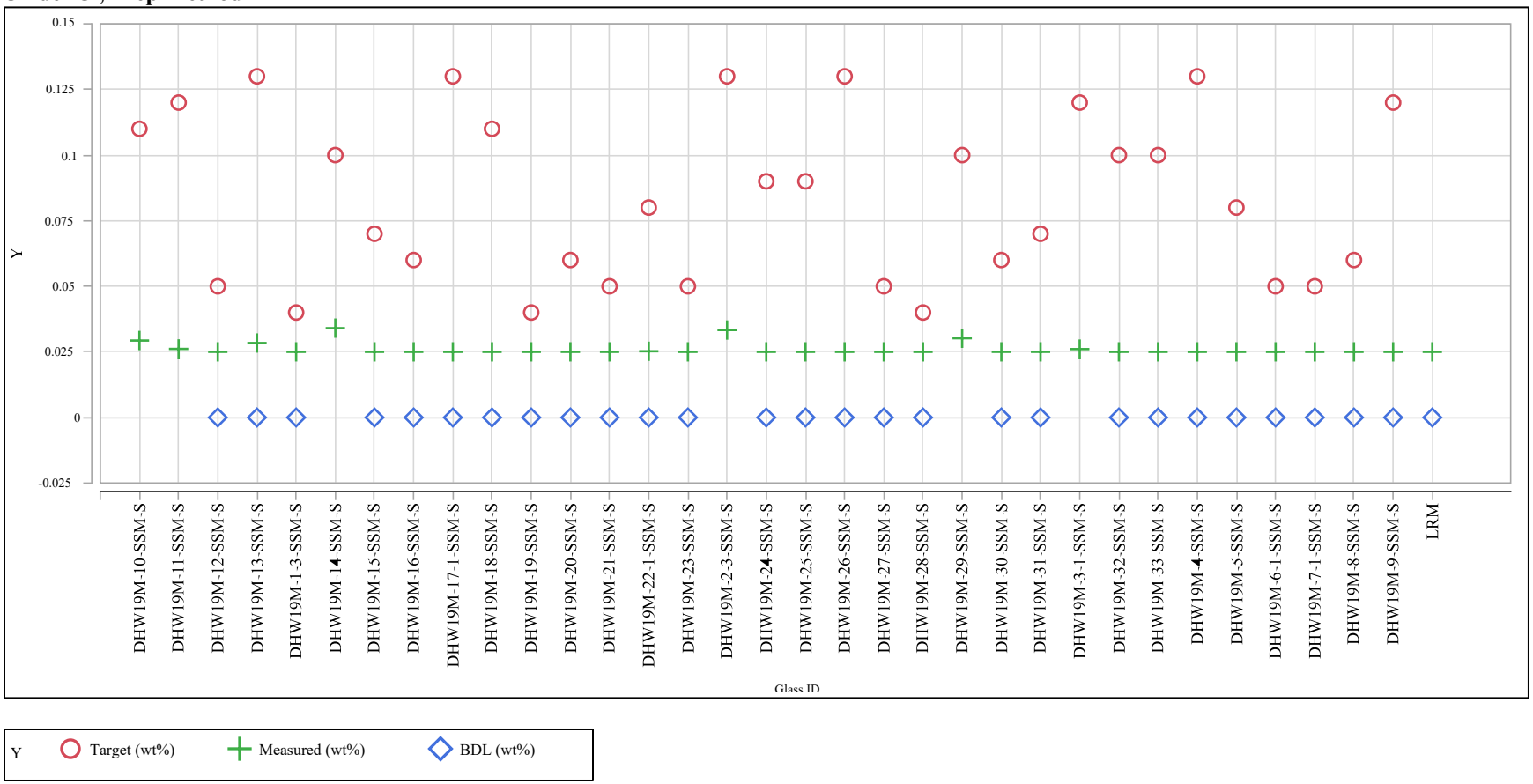


Exhibit A-4. Measured versus Targeted Concentrations by Glass ID by Oxide (continued)

Oxide=Cr2O3, Prep Method=PF

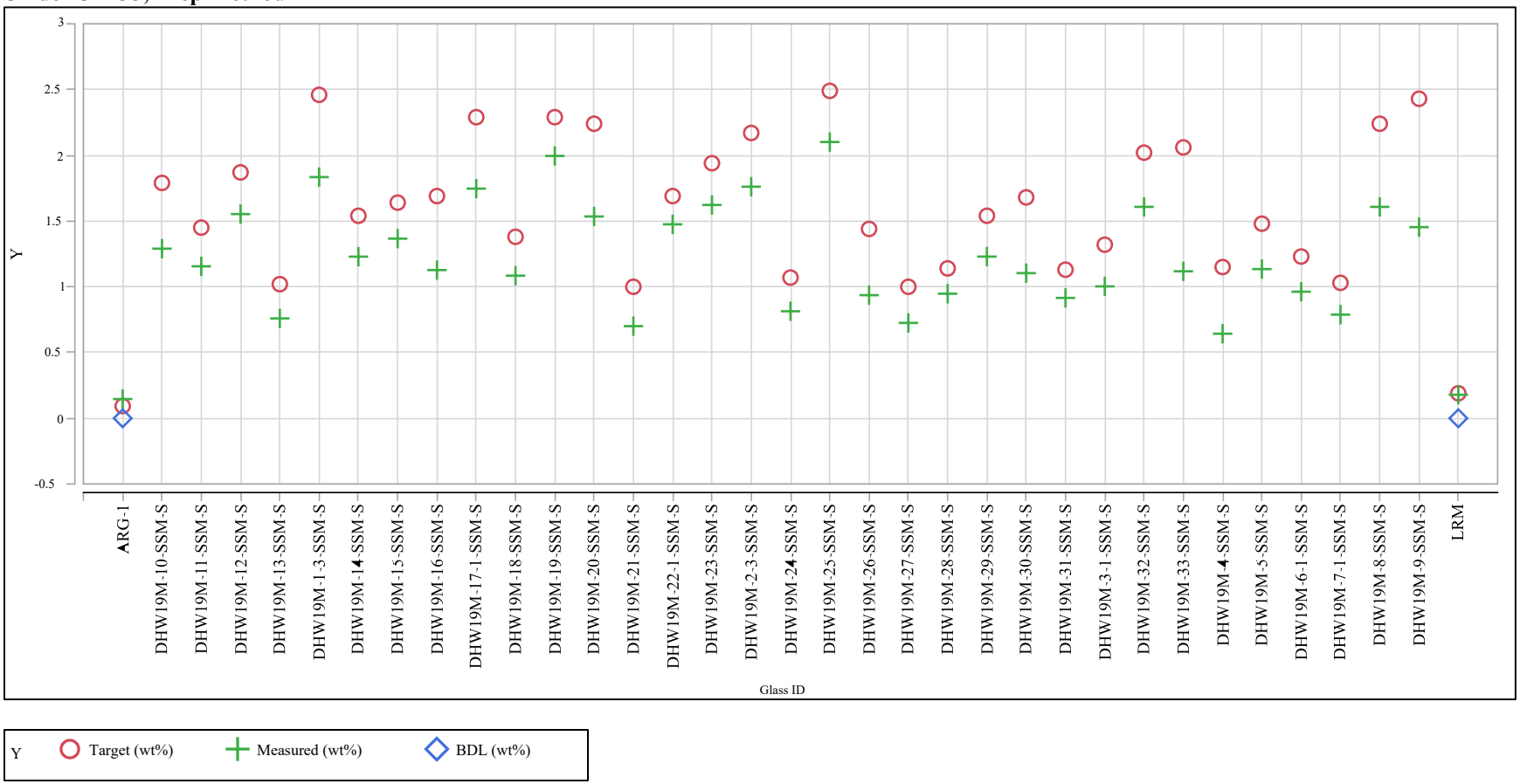


Exhibit A-4. Measured versus Targeted Concentrations by Glass ID by Oxide (continued)

Oxide=F, Prep Method=KH

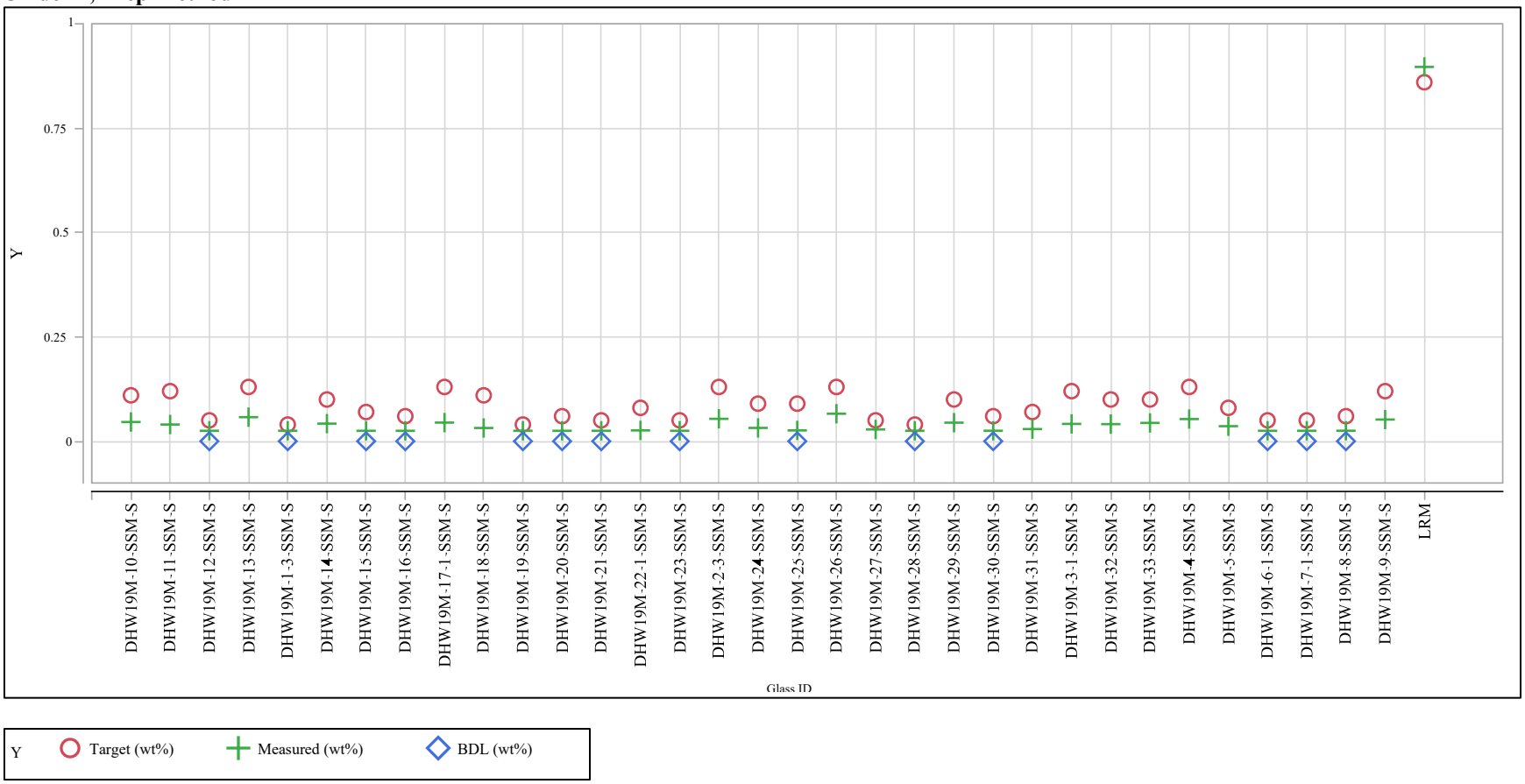


Exhibit A-4. Measured versus Targeted Concentrations by Glass ID by Oxide (continued)

Oxide=Fe2O3, Prep Method=PF

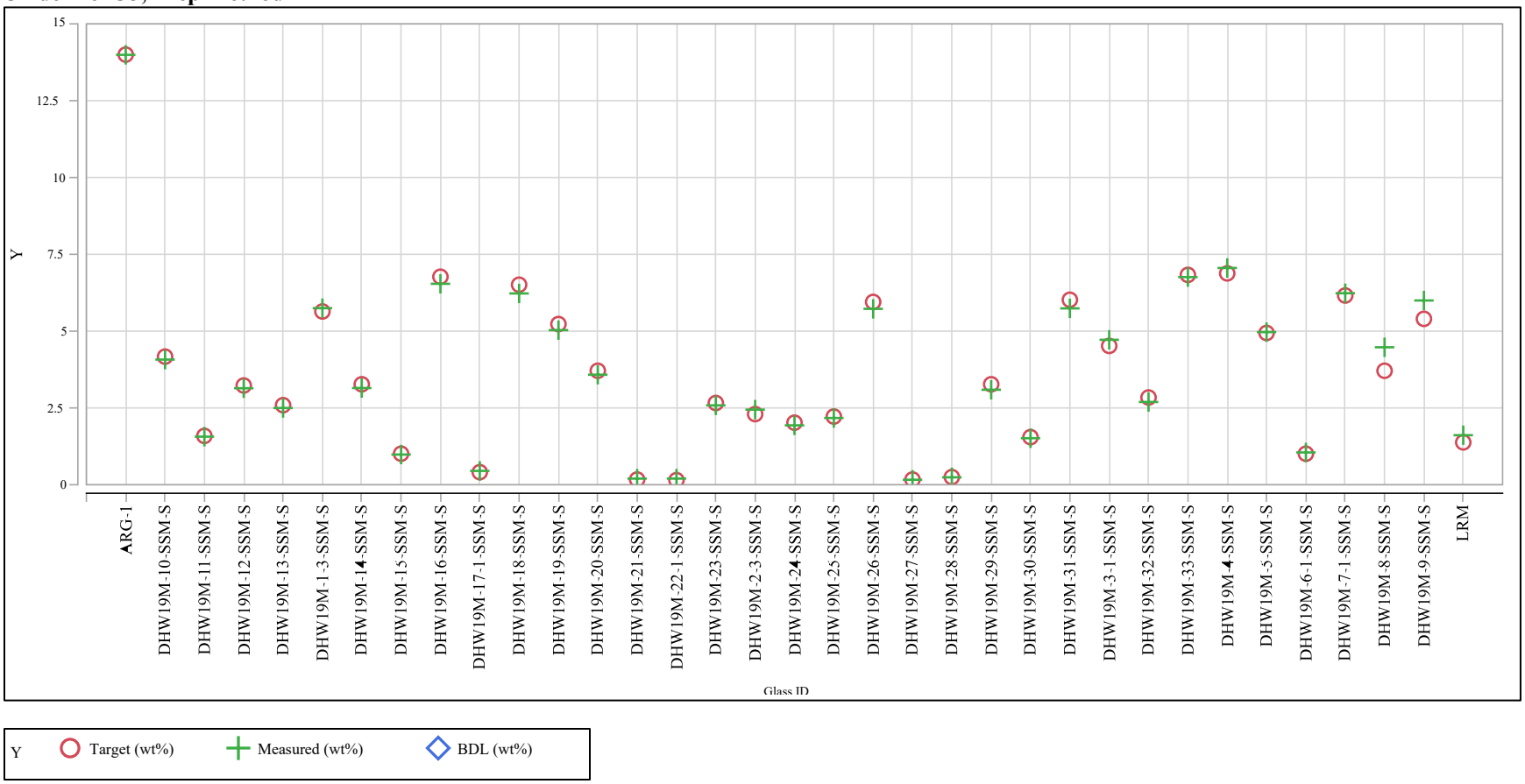


Exhibit A-4. Measured versus Targeted Concentrations by Glass ID by Oxide (continued)

Oxide=K2O, Prep Method=AD

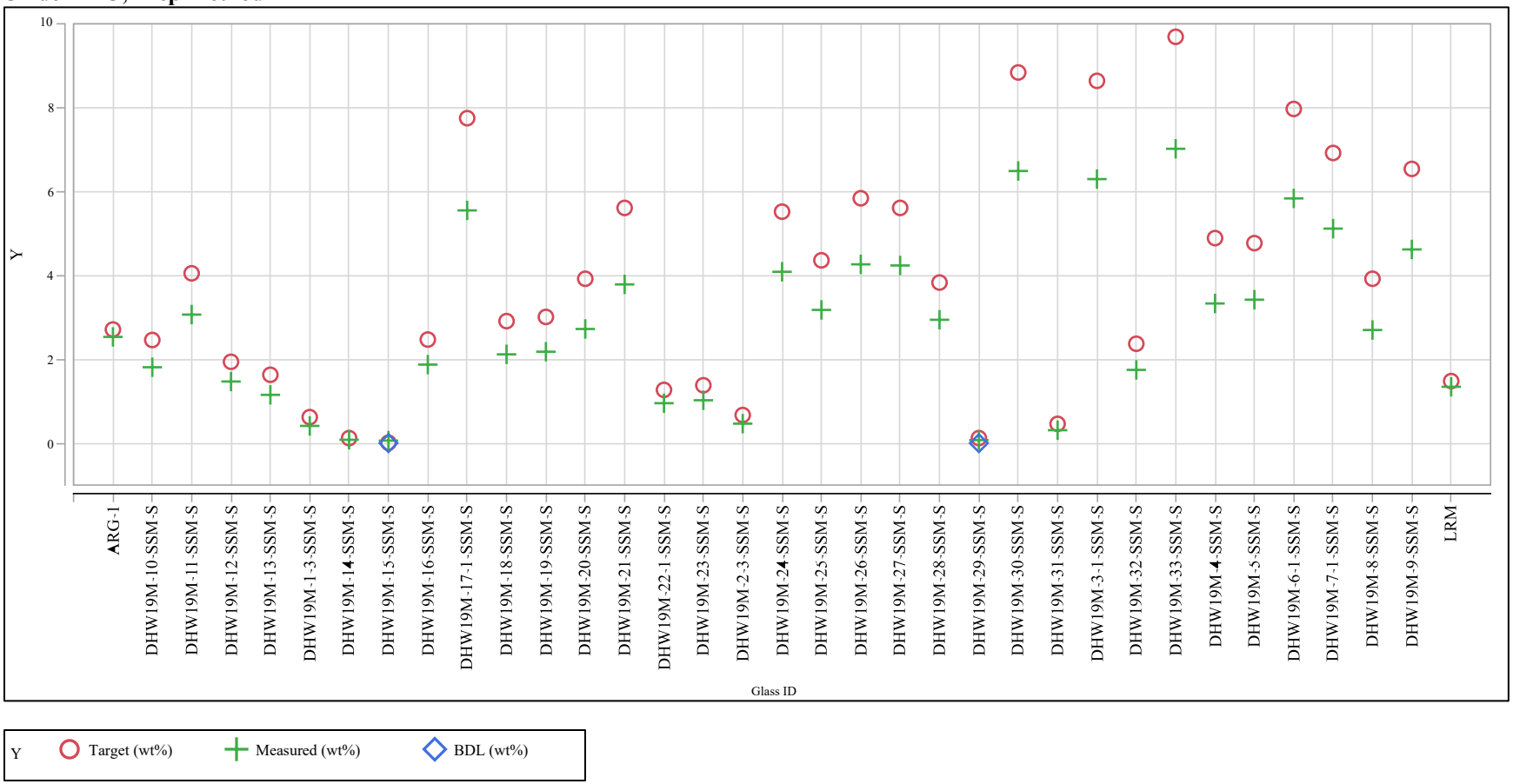


Exhibit A-4. Measured versus Targeted Concentrations by Glass ID by Oxide (continued)

Oxide=Li2O, Prep Method=PF

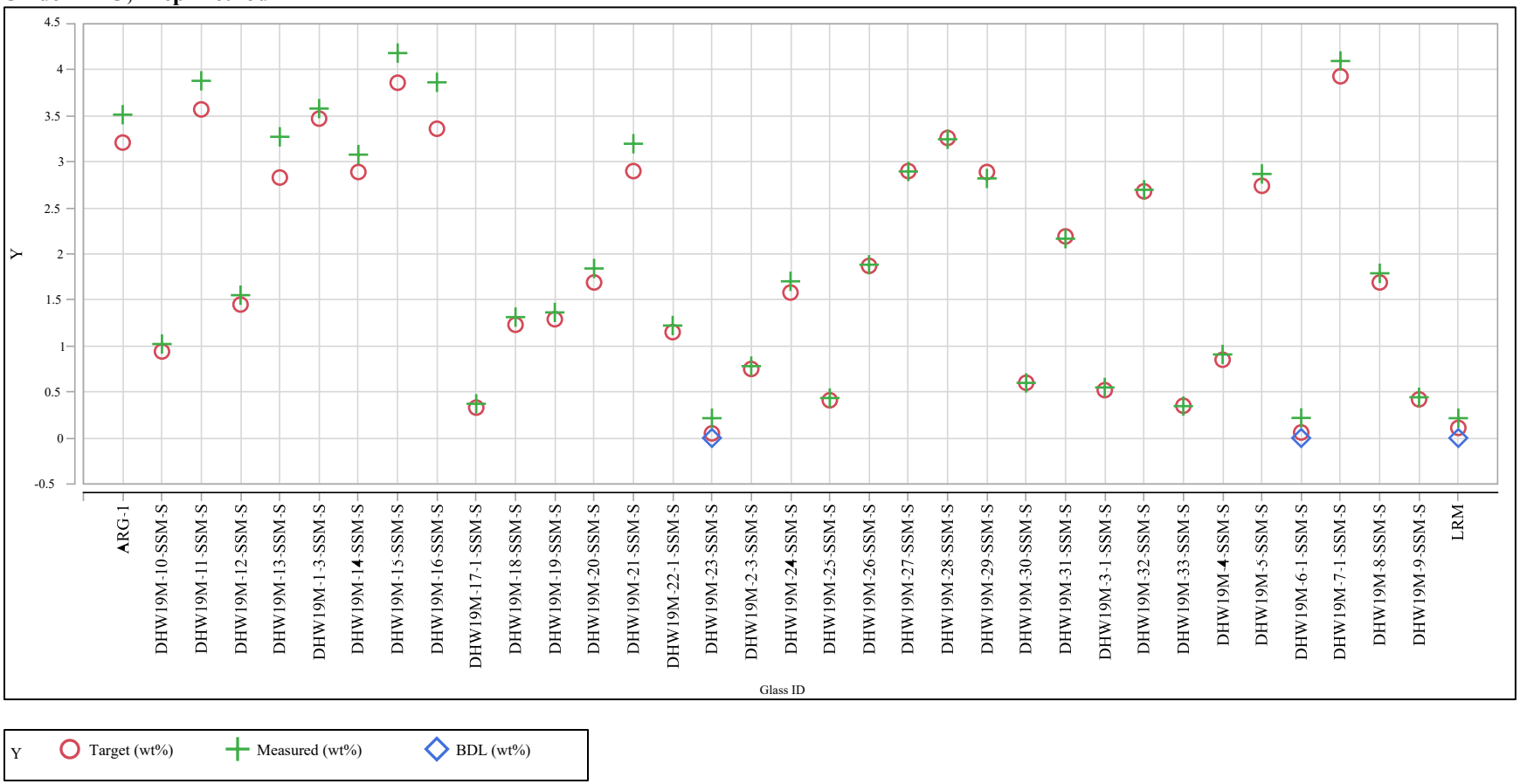


Exhibit A-4. Measured versus Targeted Concentrations by Glass ID by Oxide (continued)

Oxide=MnO, Prep Method=PF

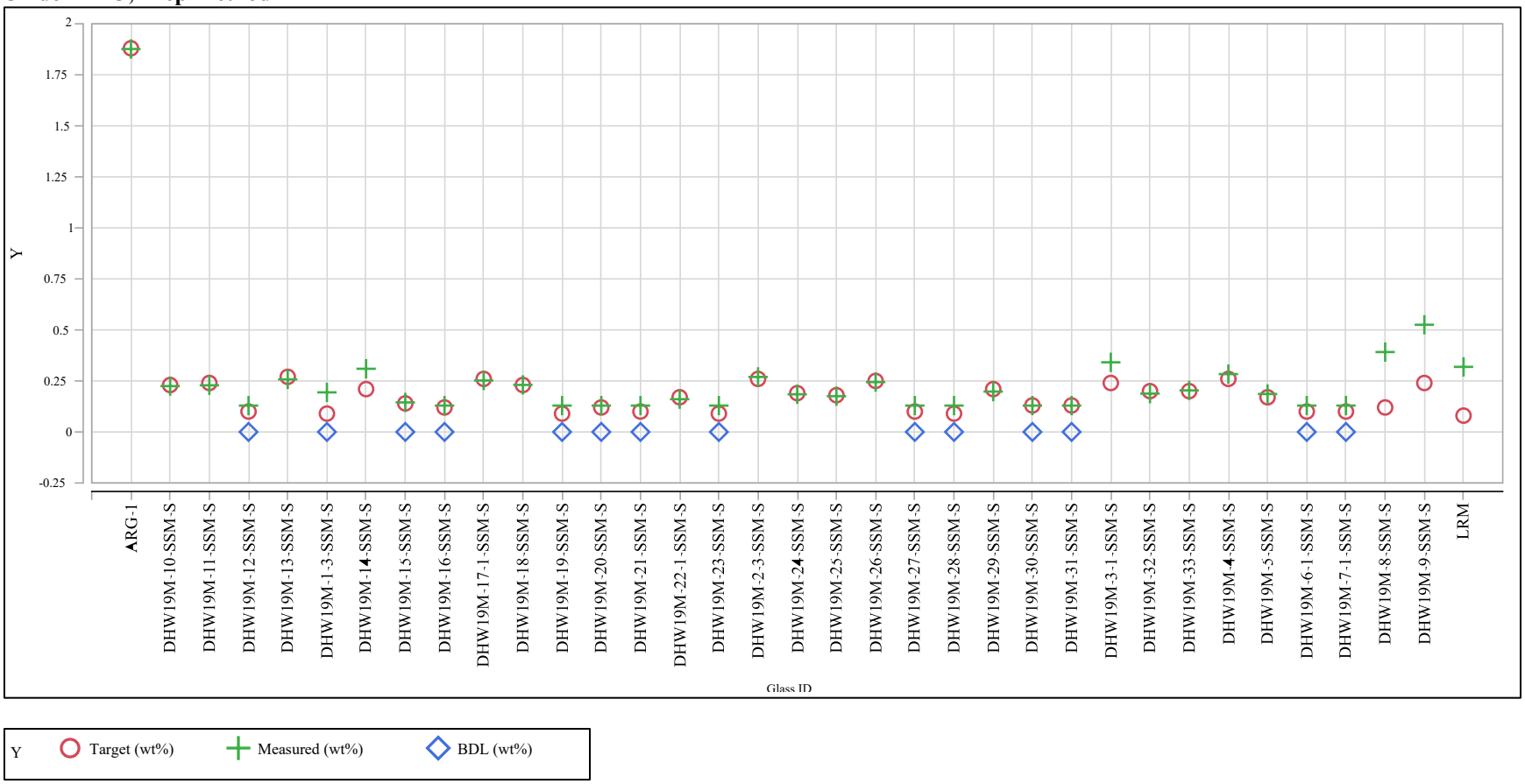


Exhibit A-4. Measured versus Targeted Concentrations by Glass ID by Oxide (continued)

Oxide=Na2O, Prep Method=AD

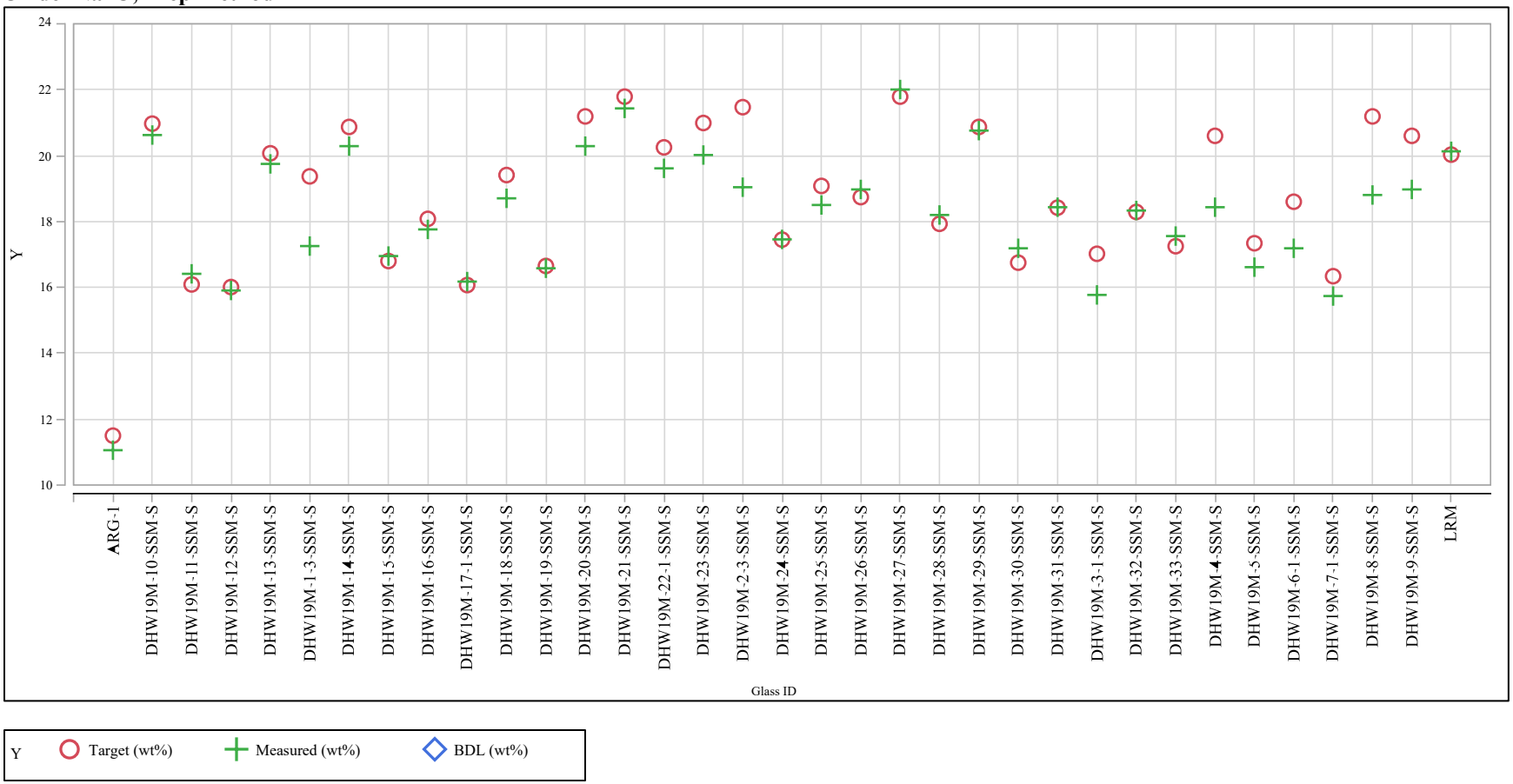


Exhibit A-4. Measured versus Targeted Concentrations by Glass ID by Oxide (continued)

Oxide=NiO, Prep Method=PF

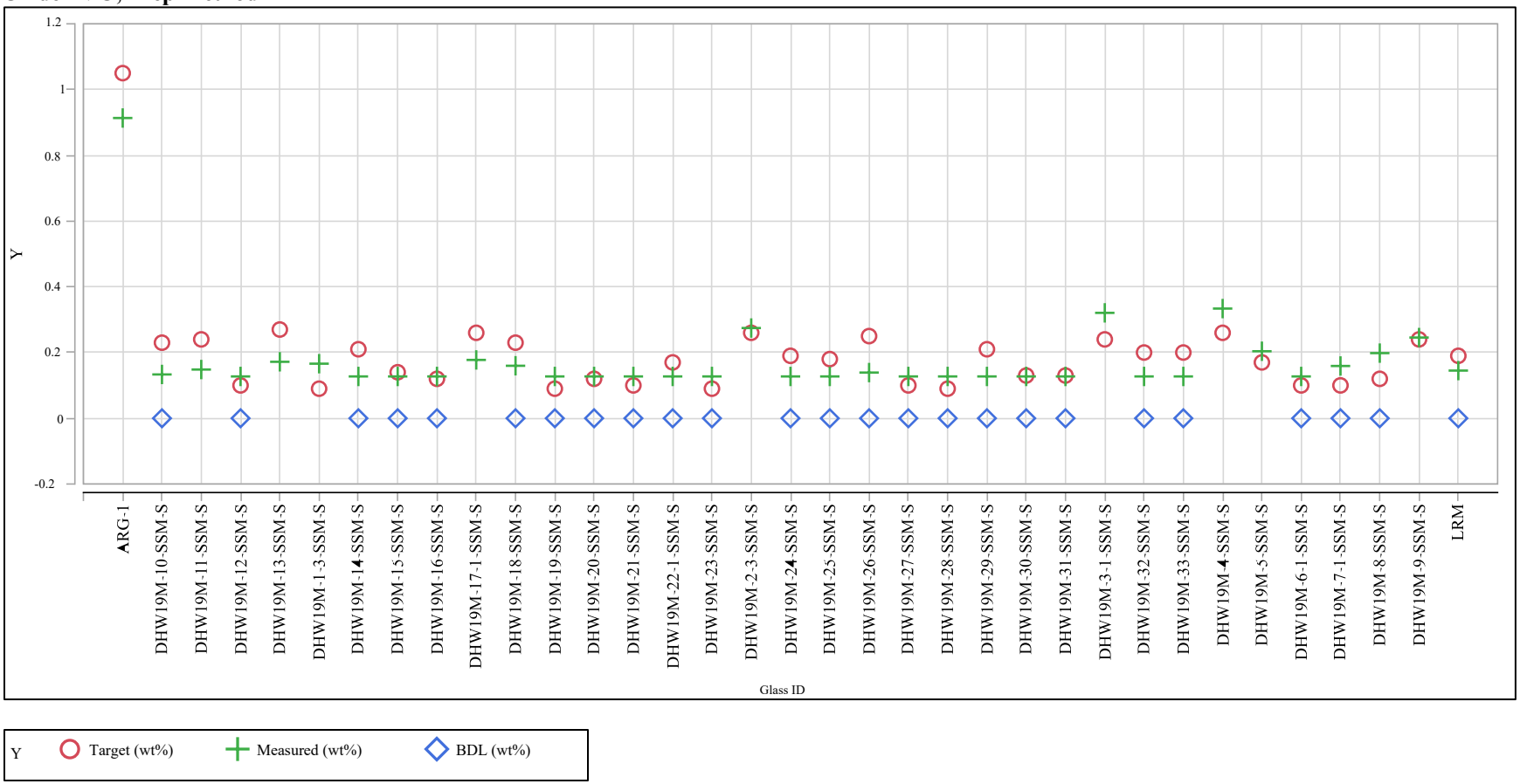


Exhibit A-4. Measured versus Targeted Concentrations by Glass ID by Oxide (continued)

Oxide=P2O5, Prep Method=AD

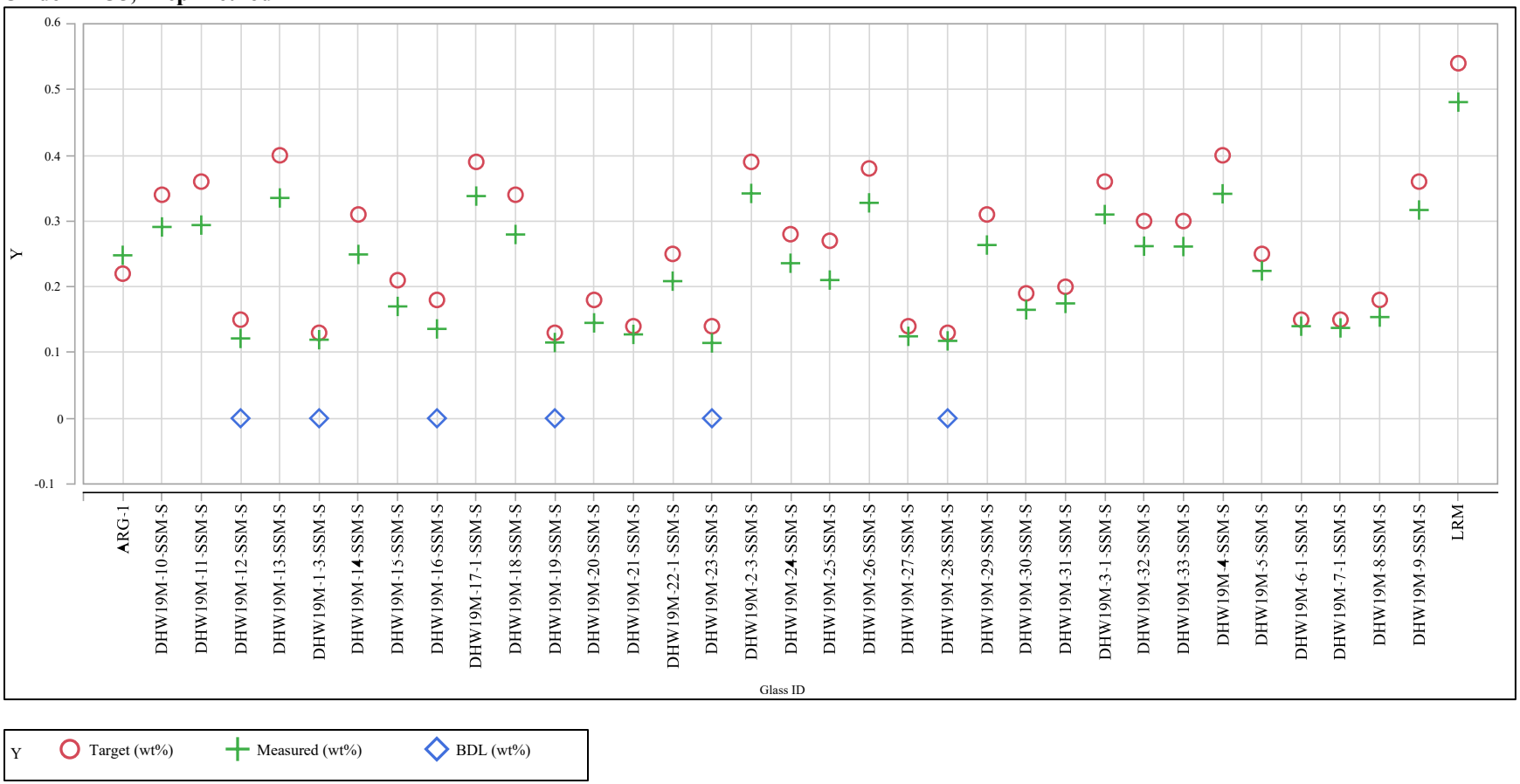


Exhibit A-4. Measured versus Targeted Concentrations by Glass ID by Oxide (continued)

Oxide=PbO, Prep Method=AD

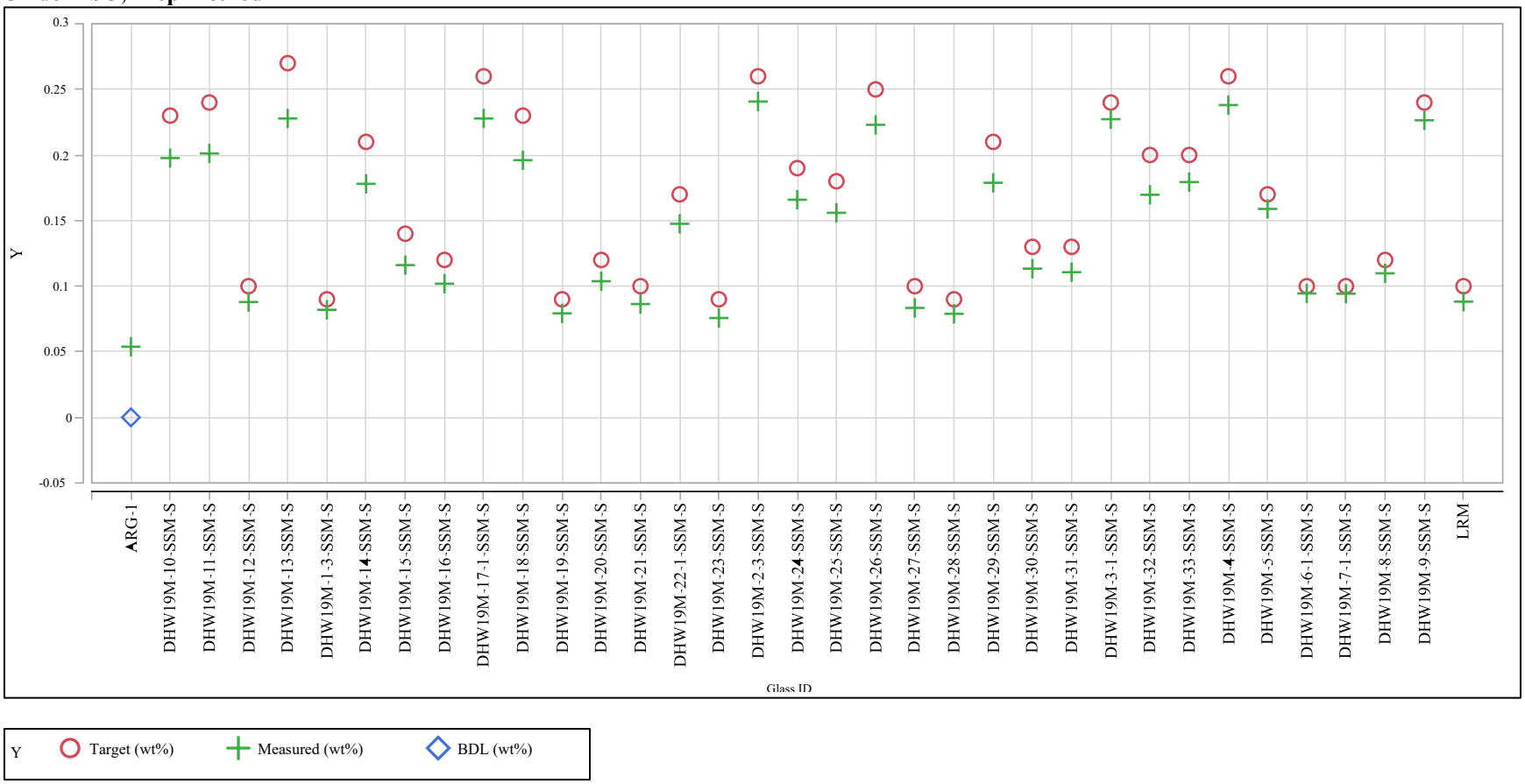


Exhibit A-4. Measured versus Targeted Concentrations by Glass ID by Oxide (continued)

Oxide=SiO2, Prep Method=PF

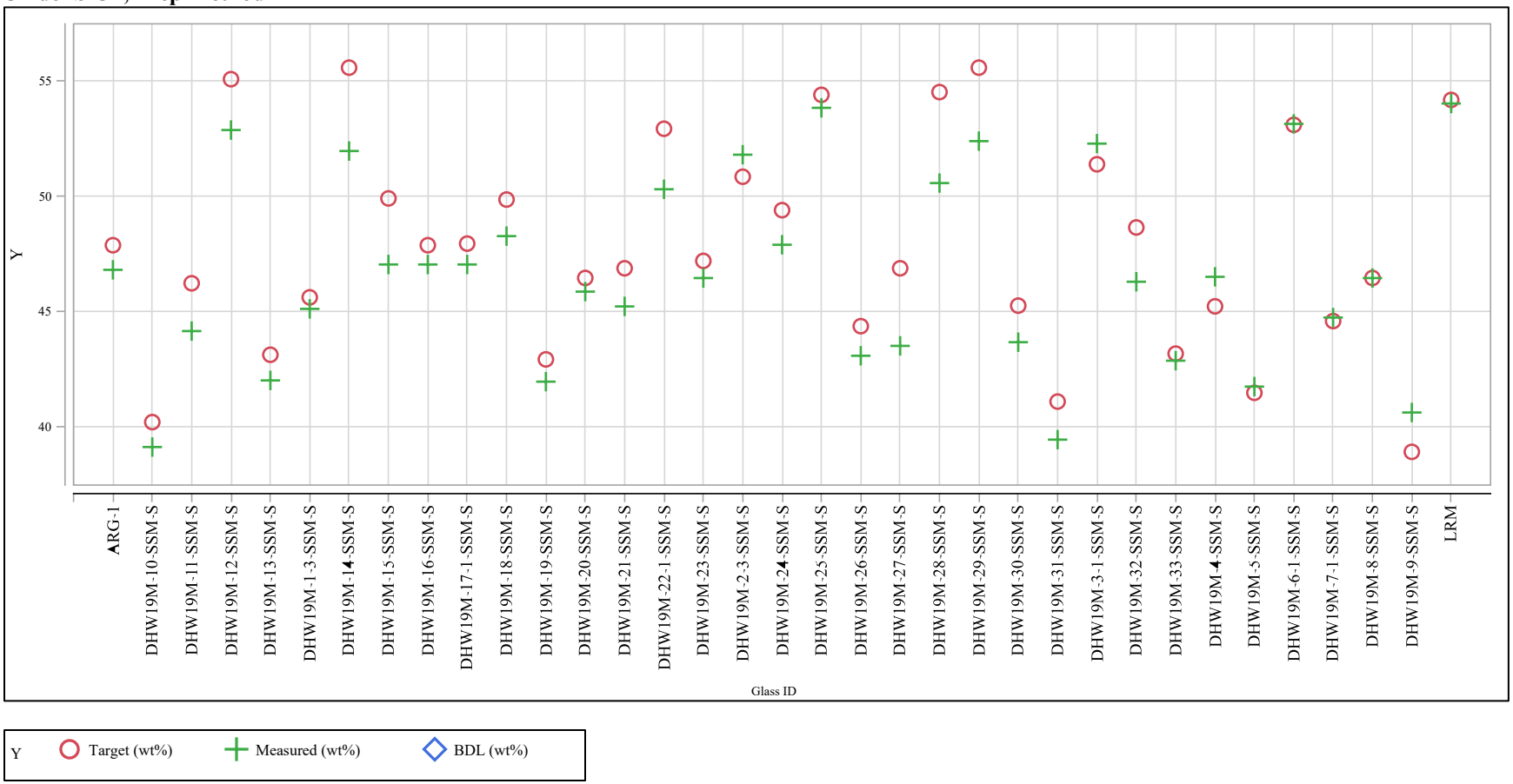


Exhibit A-4. Measured versus Targeted Concentrations by Glass ID by Oxide (continued)

Oxide=SO3, Prep Method=AD

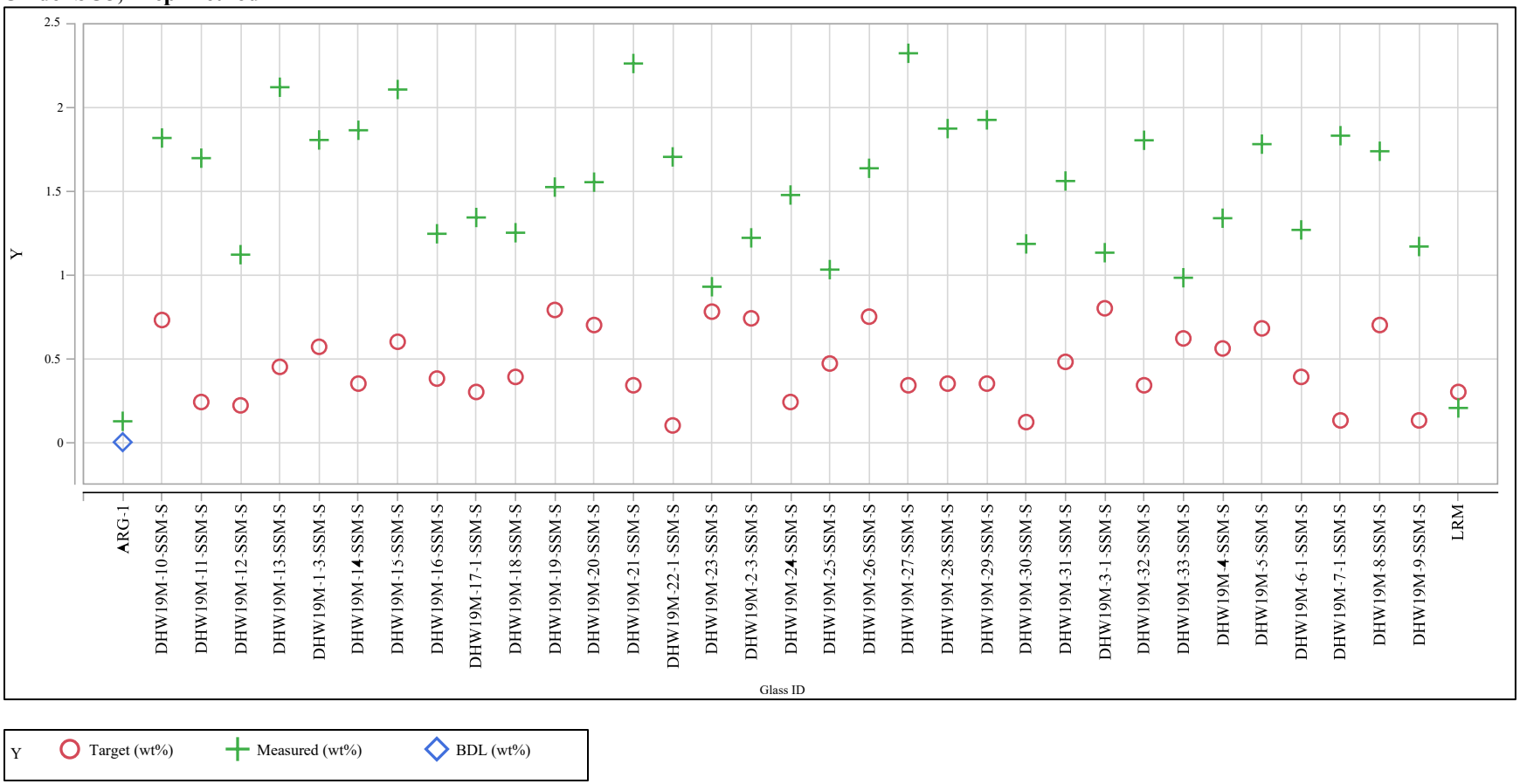


Exhibit A-4. Measured versus Targeted Concentrations by Glass ID by Oxide (continued)

Oxide=ZrO2, Prep Method=AD

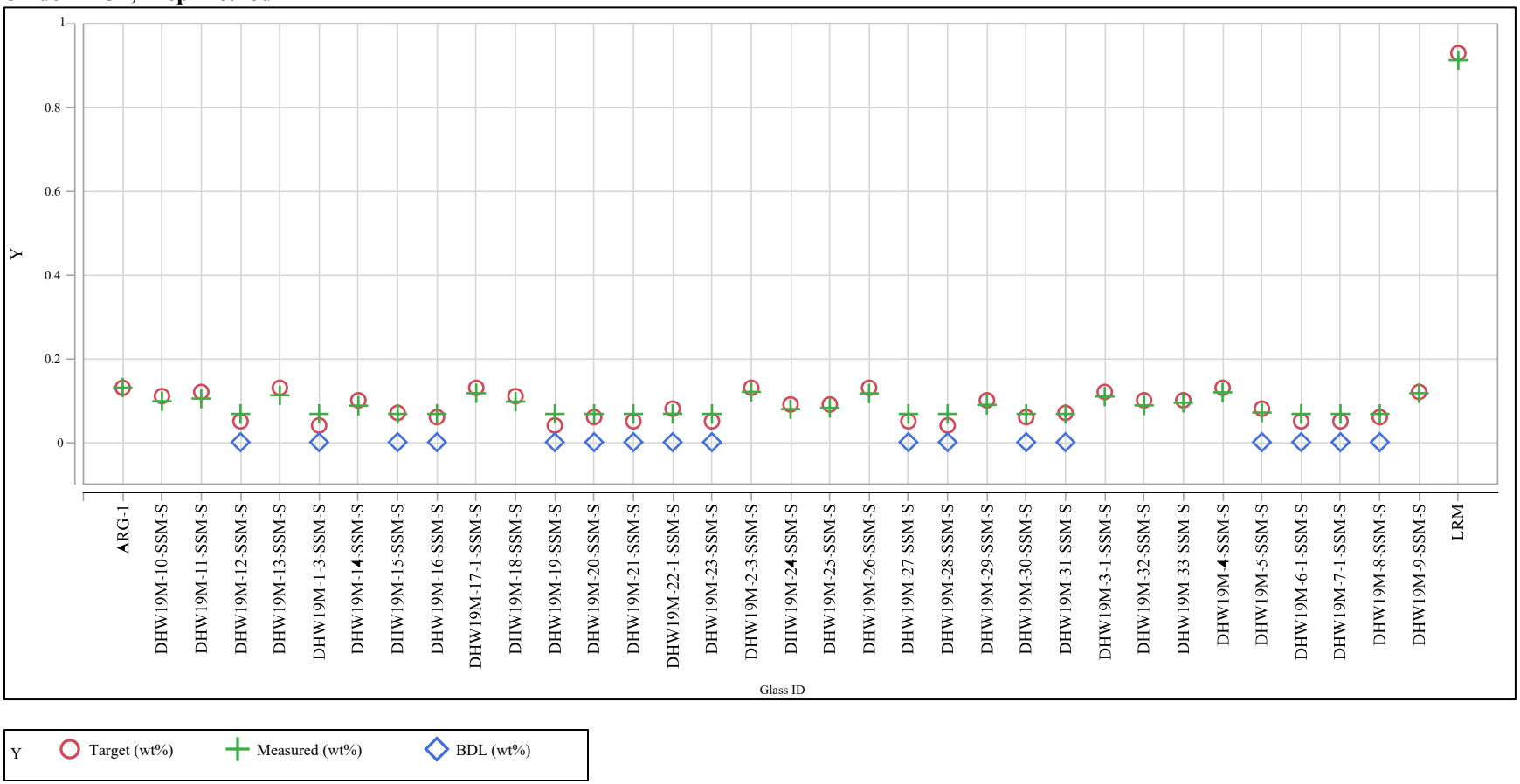


Exhibit A-4. Measured versus Targeted Concentrations by Glass ID by Oxide (continued)

Analyte=Sum of Oxides

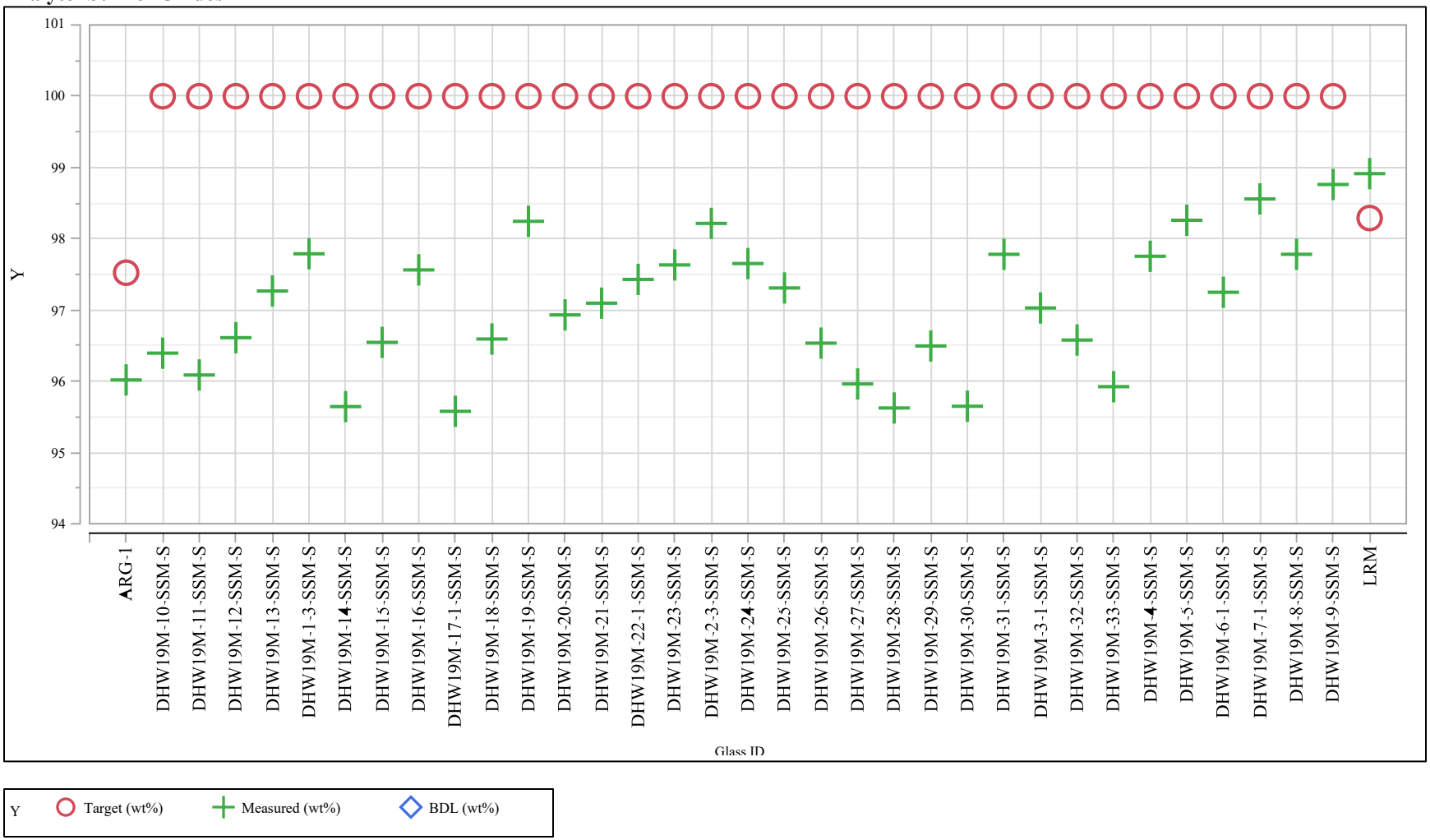


Exhibit A-5. Comparisons of the Measured Compositions of the Quenched and SSM Versions of the Study Glasses

Analyte=Al2O3
Variability Chart for Measured (wt%)

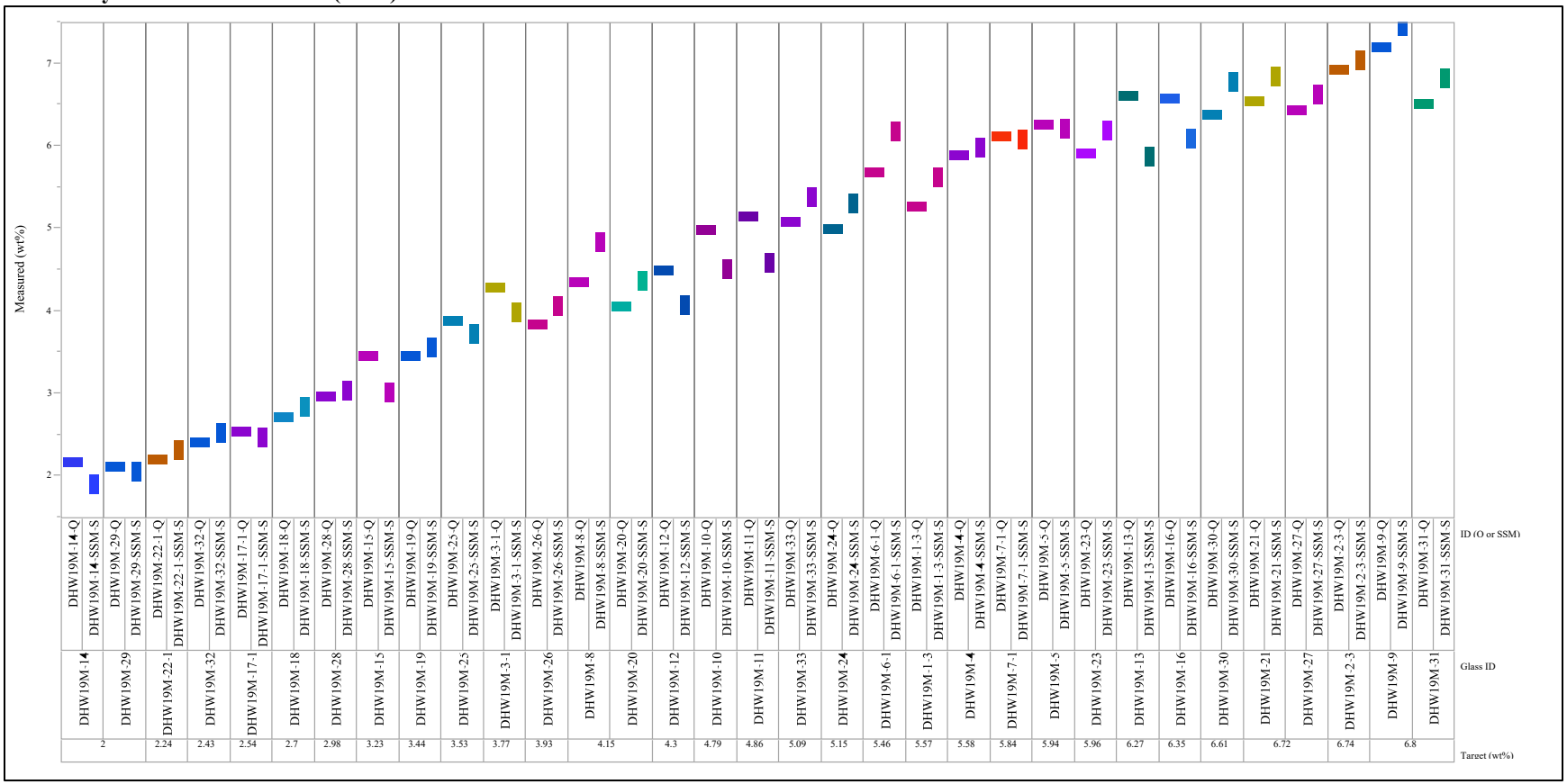


Exhibit A-5. Comparisons of the Measured Compositions of the Quenched and SSM Versions of the Study Glasses (continued)

Analyte=B2O3
Variability Chart for Measured (wt%)

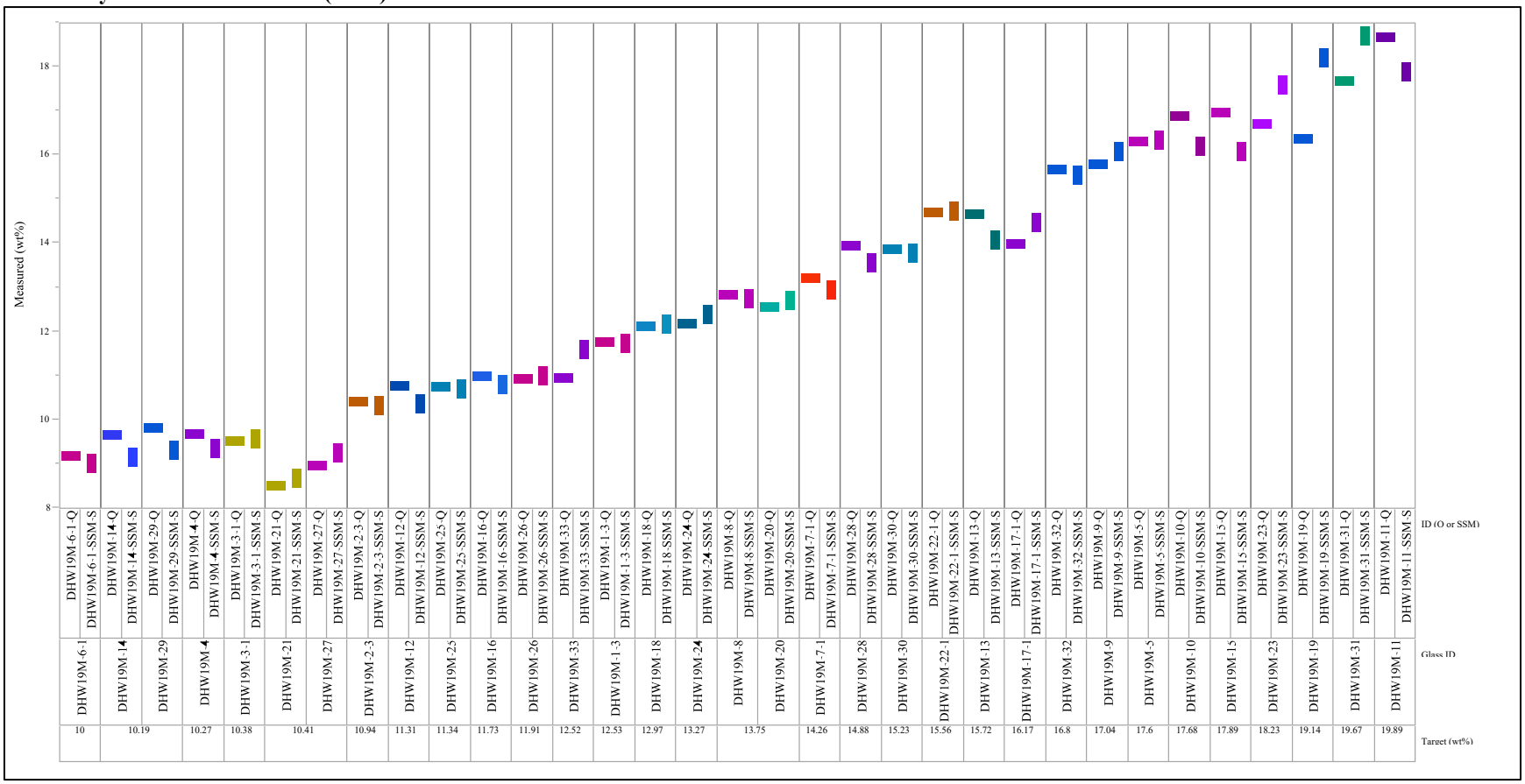


Exhibit A-5. Comparisons of the Measured Compositions of the Quenched and SSM Versions of the Study Glasses (continued)

Analyte=CaO
Variability Chart for Measured (wt%)

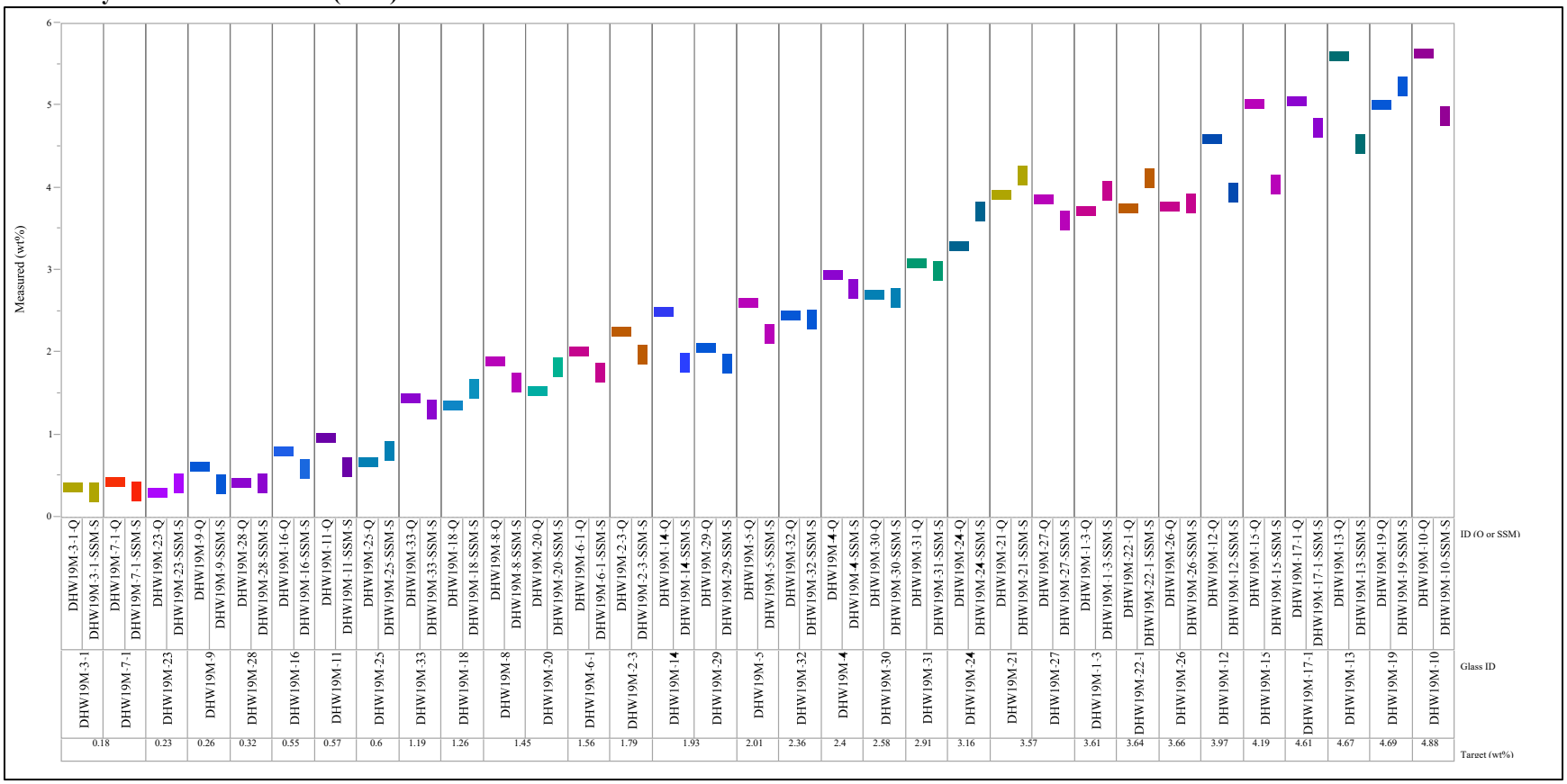


Exhibit A-5. Comparisons of the Measured Compositions of the Quenched and SSM Versions of the Study Glasses (continued)

Analyte=Cl
Variability Chart for Measured (wt%)

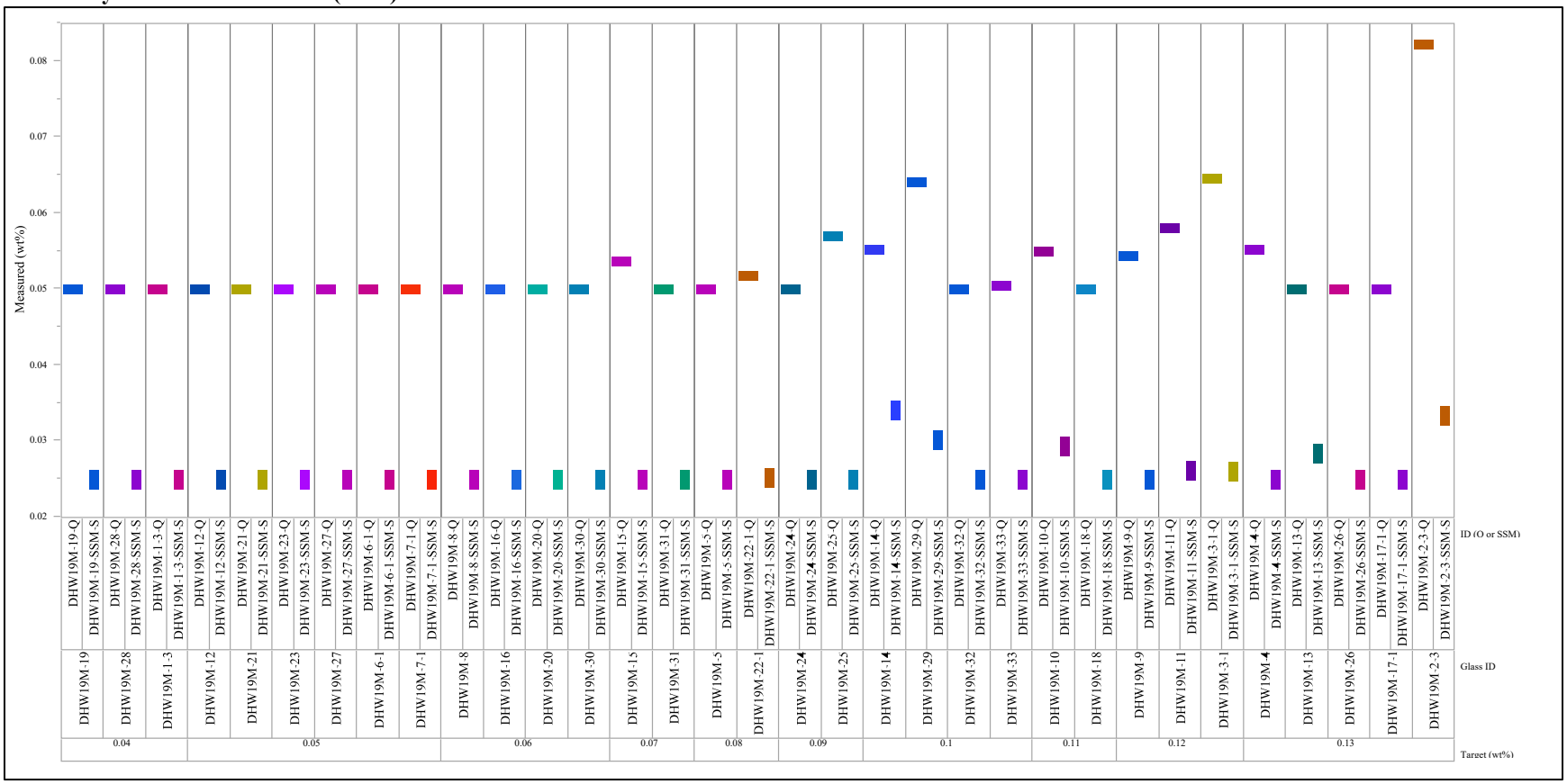


Exhibit A-5. Comparisons of the Measured Compositions of the Quenched and SSM Versions of the Study Glasses (continued)

Analyte=Cr2O3
Variability Chart for Measured (wt%)

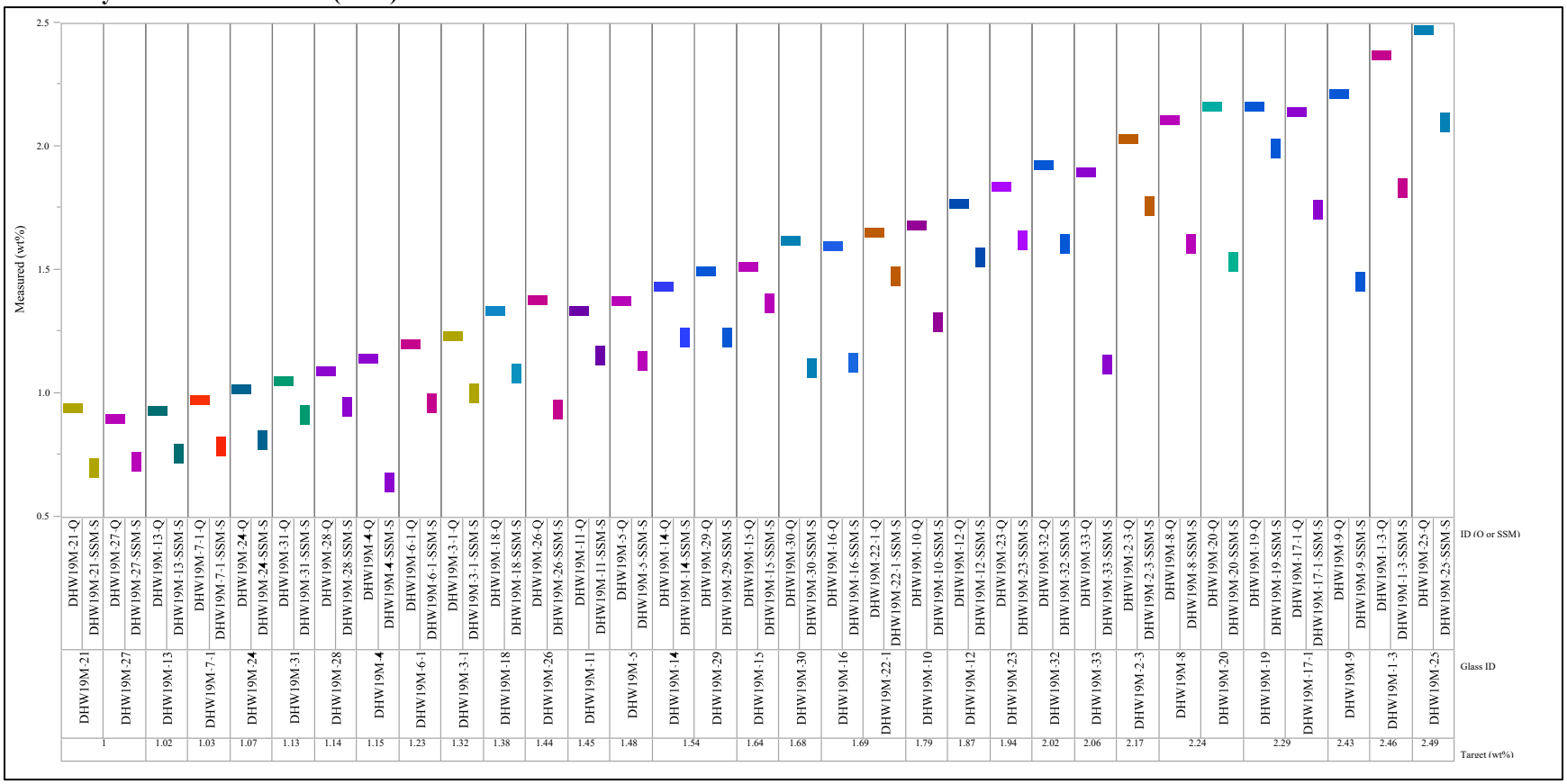


Exhibit A-5. Comparisons of the Measured Compositions of the Quenched and SSM Versions of the Study Glasses (continued)

Analyte=F
Variability Chart for Measured (wt%)

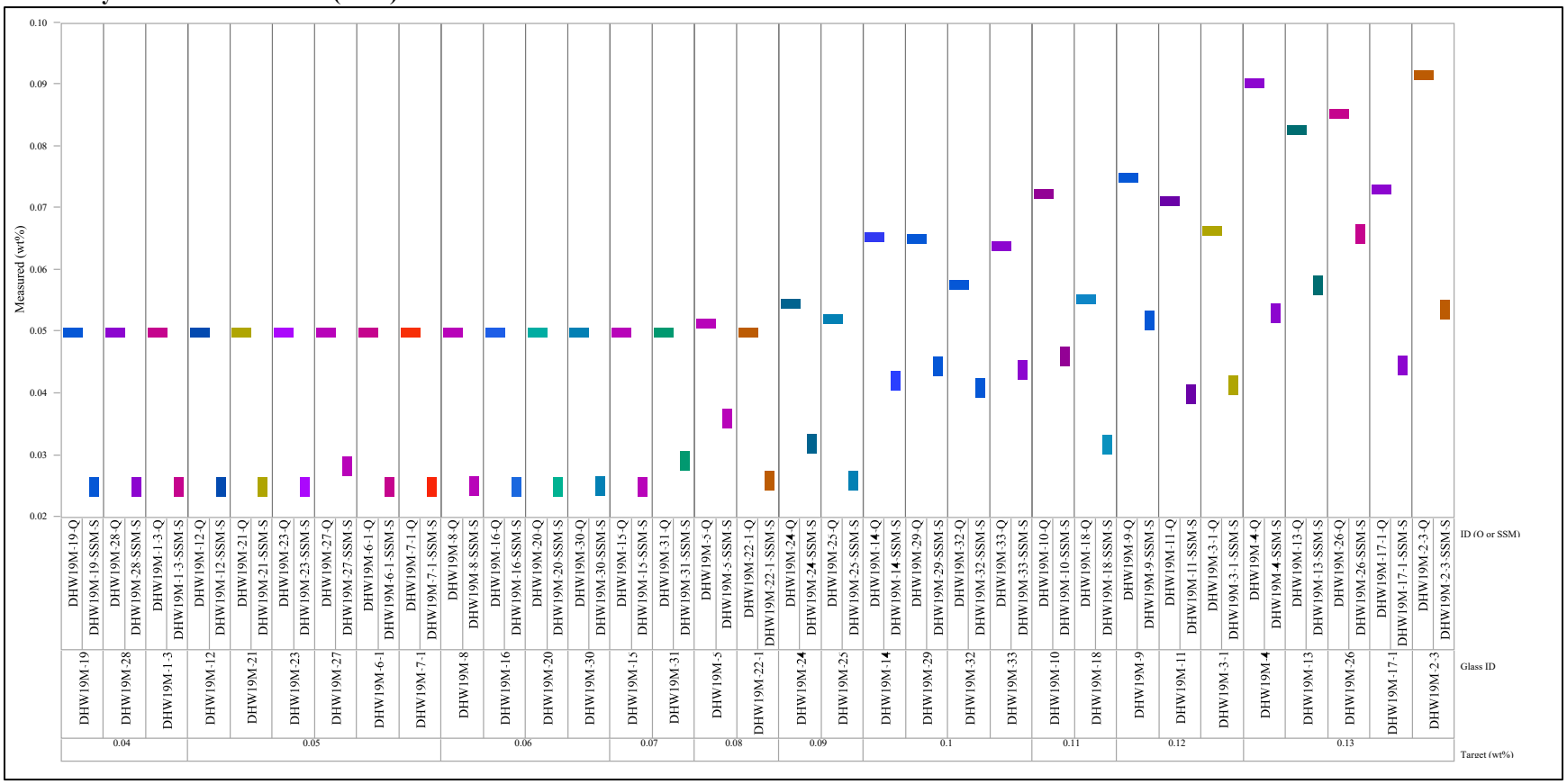


Exhibit A-5. Comparisons of the Measured Compositions of the Quenched and SSM Versions of the Study Glasses (continued)

Analyte=Fe2O3
Variability Chart for Measured (wt%)

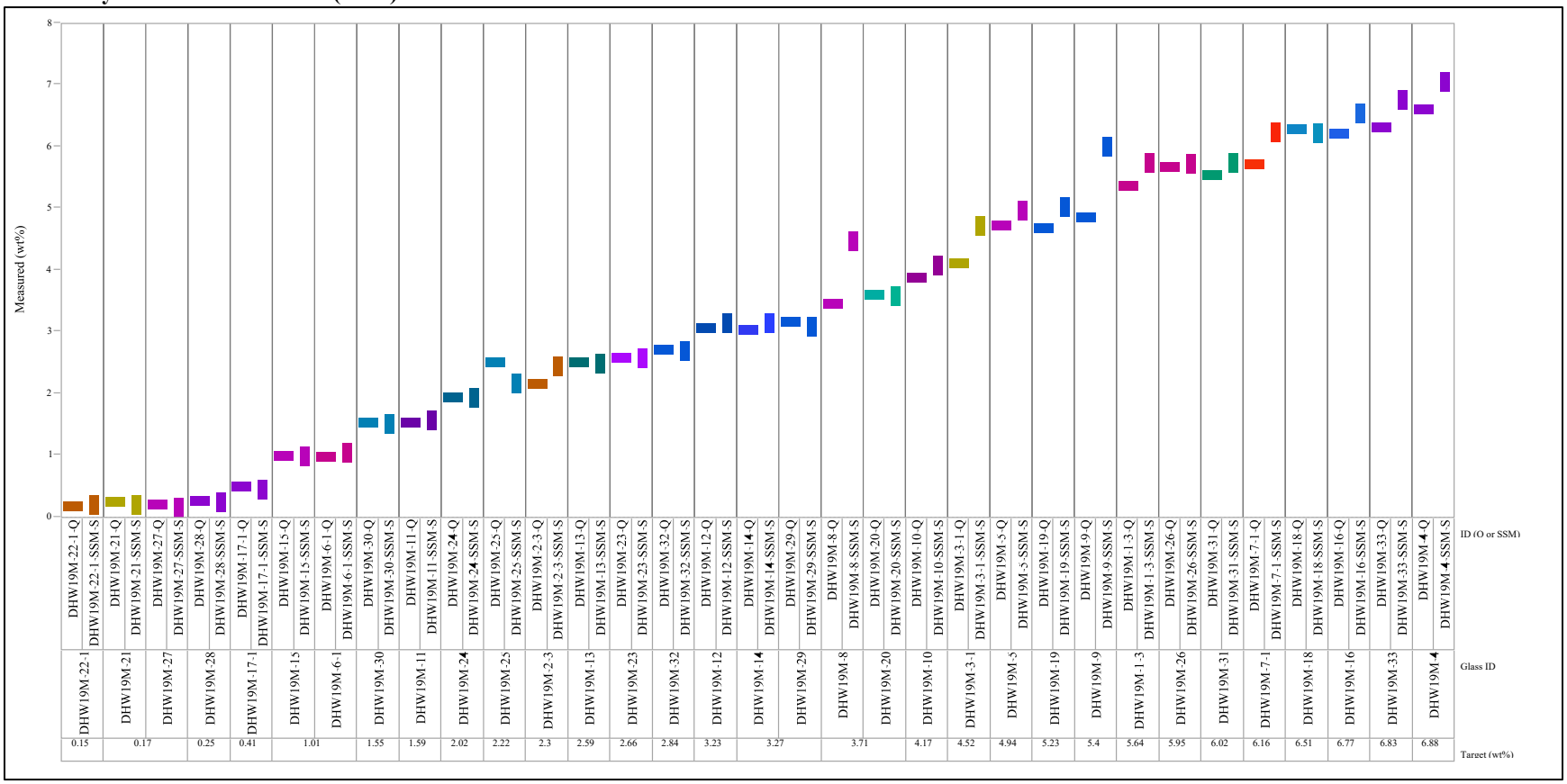


Exhibit A-5. Comparisons of the Measured Compositions of the Quenched and SSM Versions of the Study Glasses (continued)

Analyte=K2O
Variability Chart for Measured (wt%)

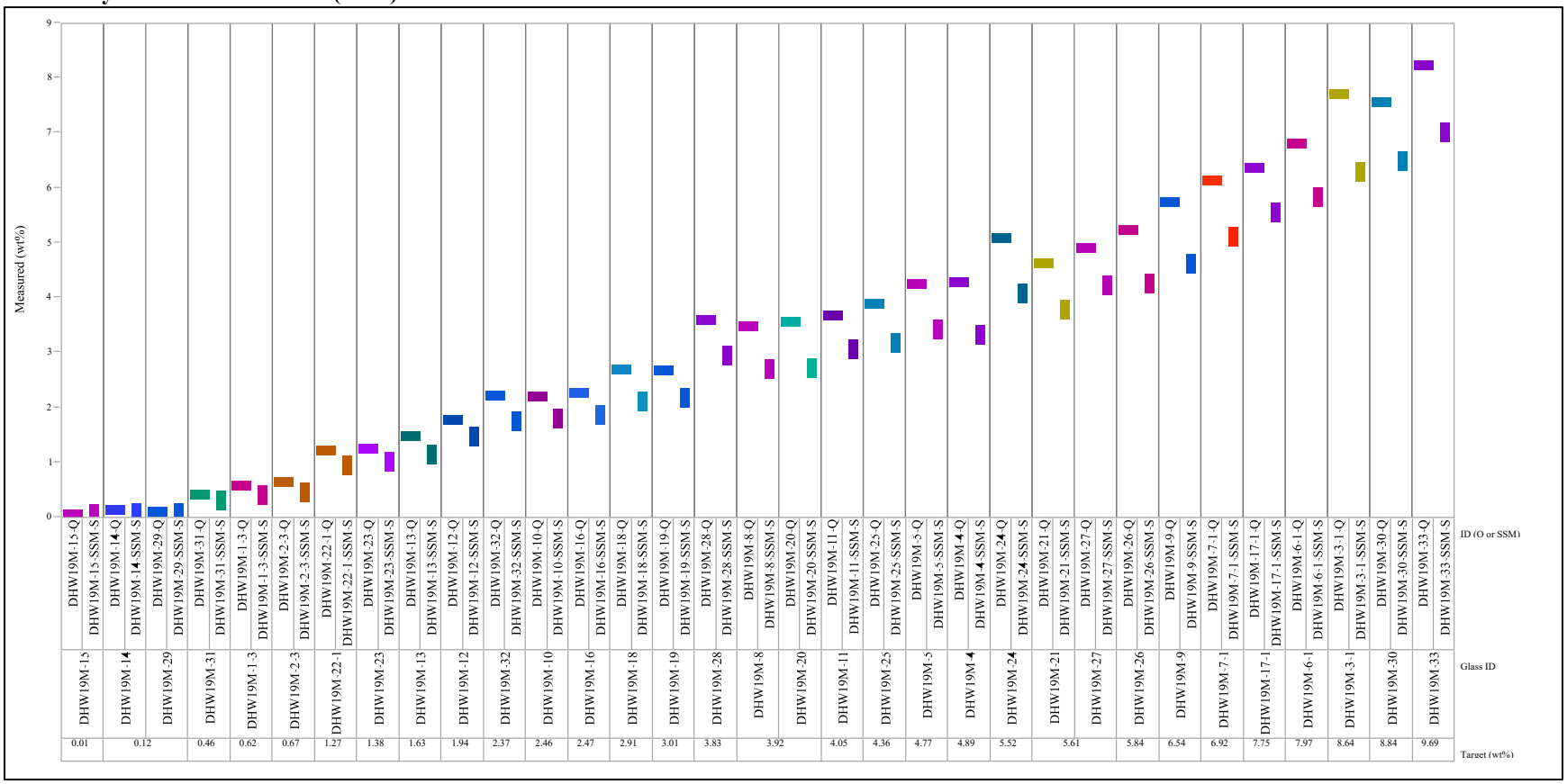


Exhibit A-5. Comparisons of the Measured Compositions of the Quenched and SSM Versions of the Study Glasses (continued)

Analyte=Li2O
Variability Chart for Measured (wt%)

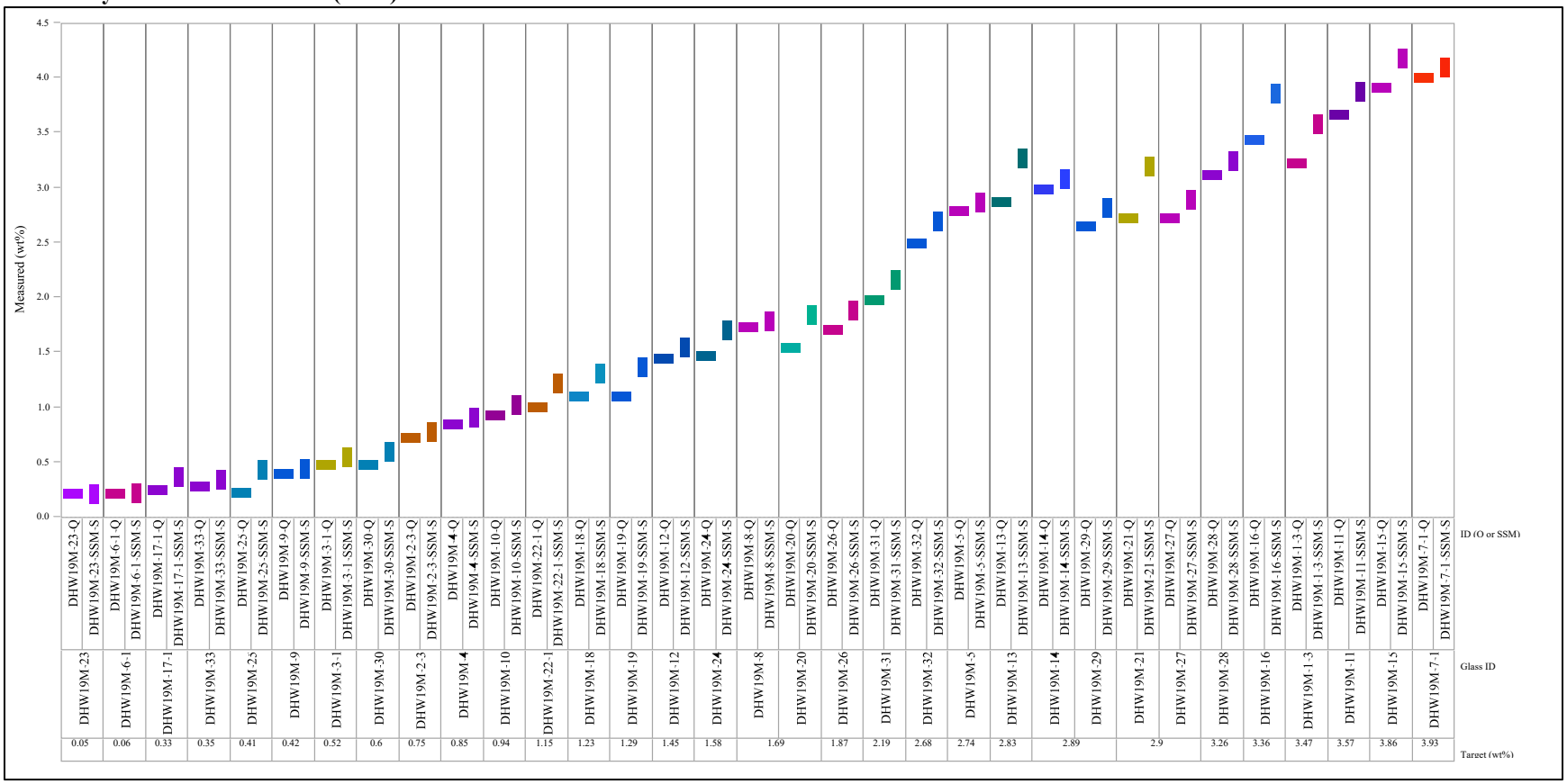


Exhibit A-5. Comparisons of the Measured Compositions of the Quenched and SSM Versions of the Study Glasses (continued)

Analyte=MnO
Variability Chart for Measured (wt%)

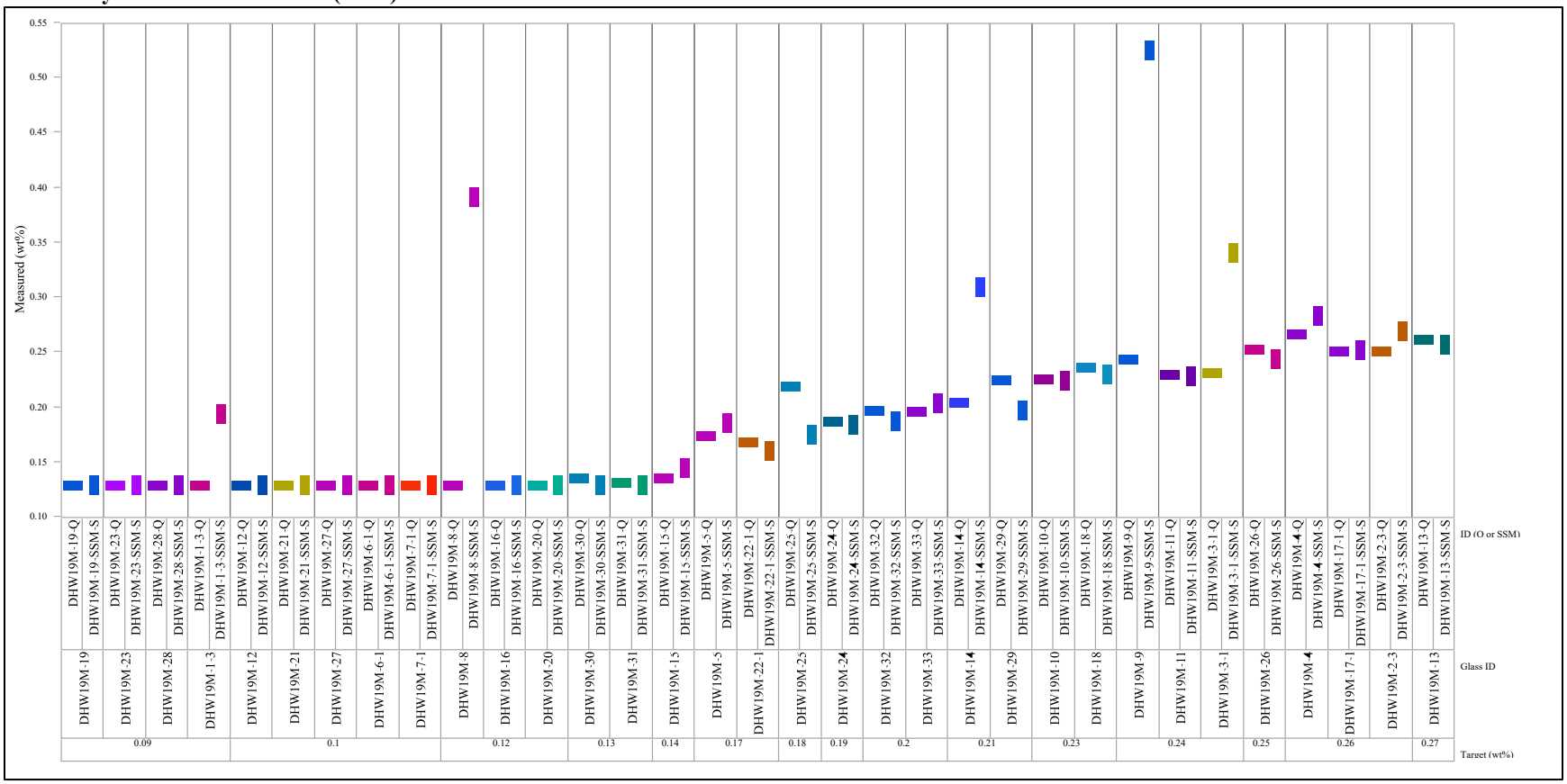


Exhibit A-5. Comparisons of the Measured Compositions of the Quenched and SSM Versions of the Study Glasses (continued)

Analyte=Na2O
Variability Chart for Measured (wt%)

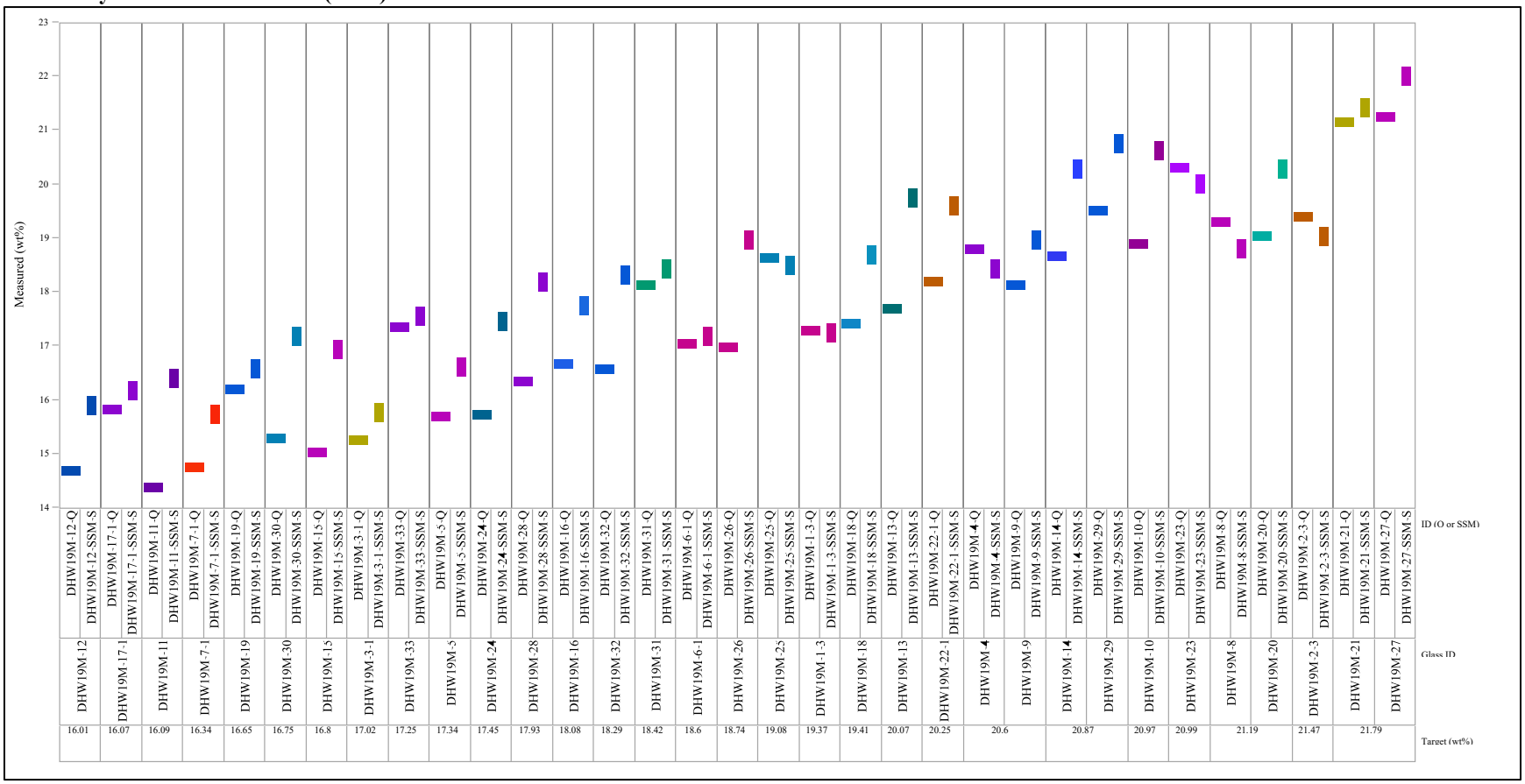


Exhibit A-5. Comparisons of the Measured Compositions of the Quenched and SSM Versions of the Study Glasses (continued)

Analyte=NiO
Variability Chart for Measured (wt%)

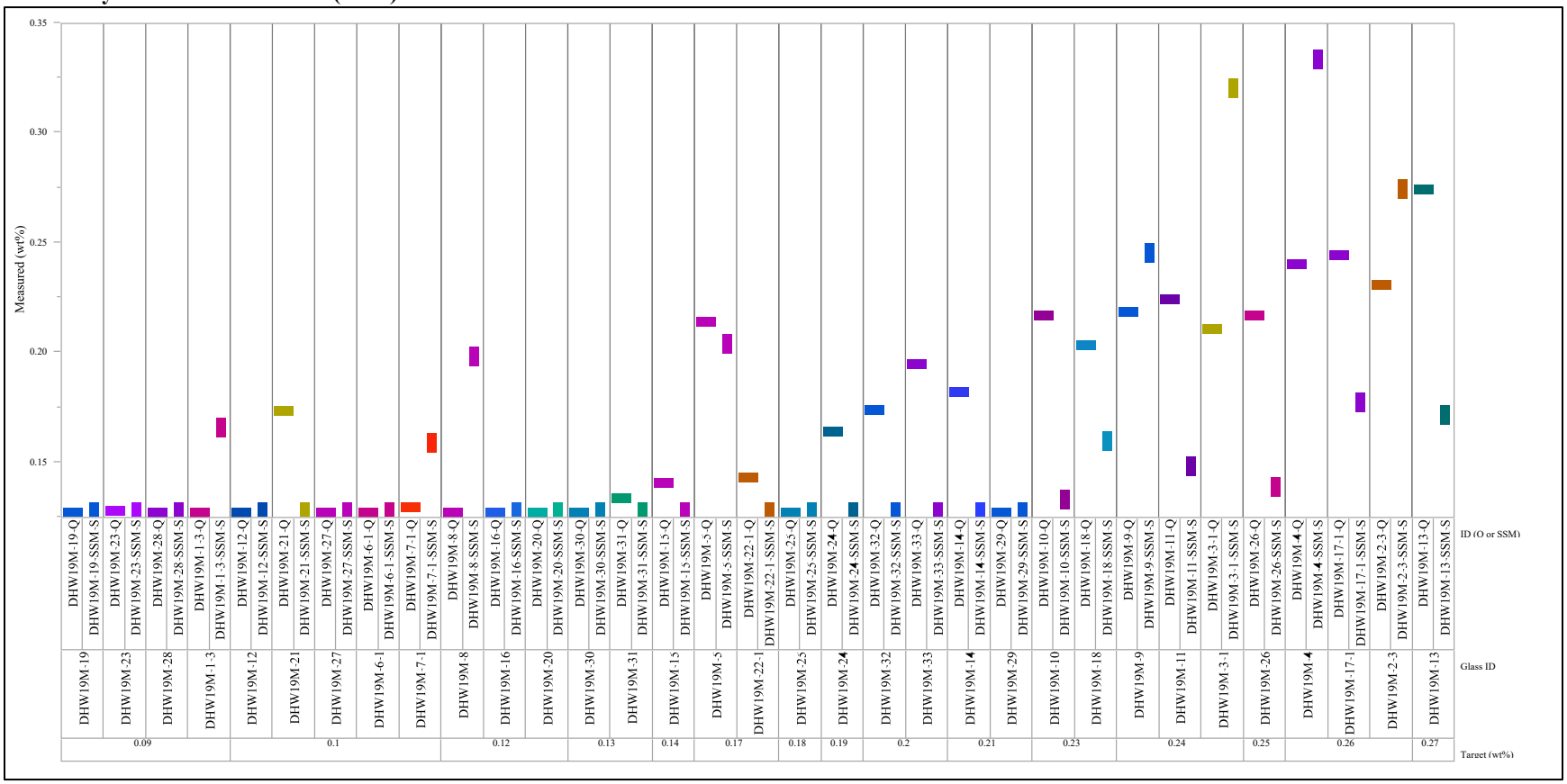


Exhibit A-5. Comparisons of the Measured Compositions of the Quenched and SSM Versions of the Study Glasses (continued)

Analyte=P2O5
Variability Chart for Measured (wt%)

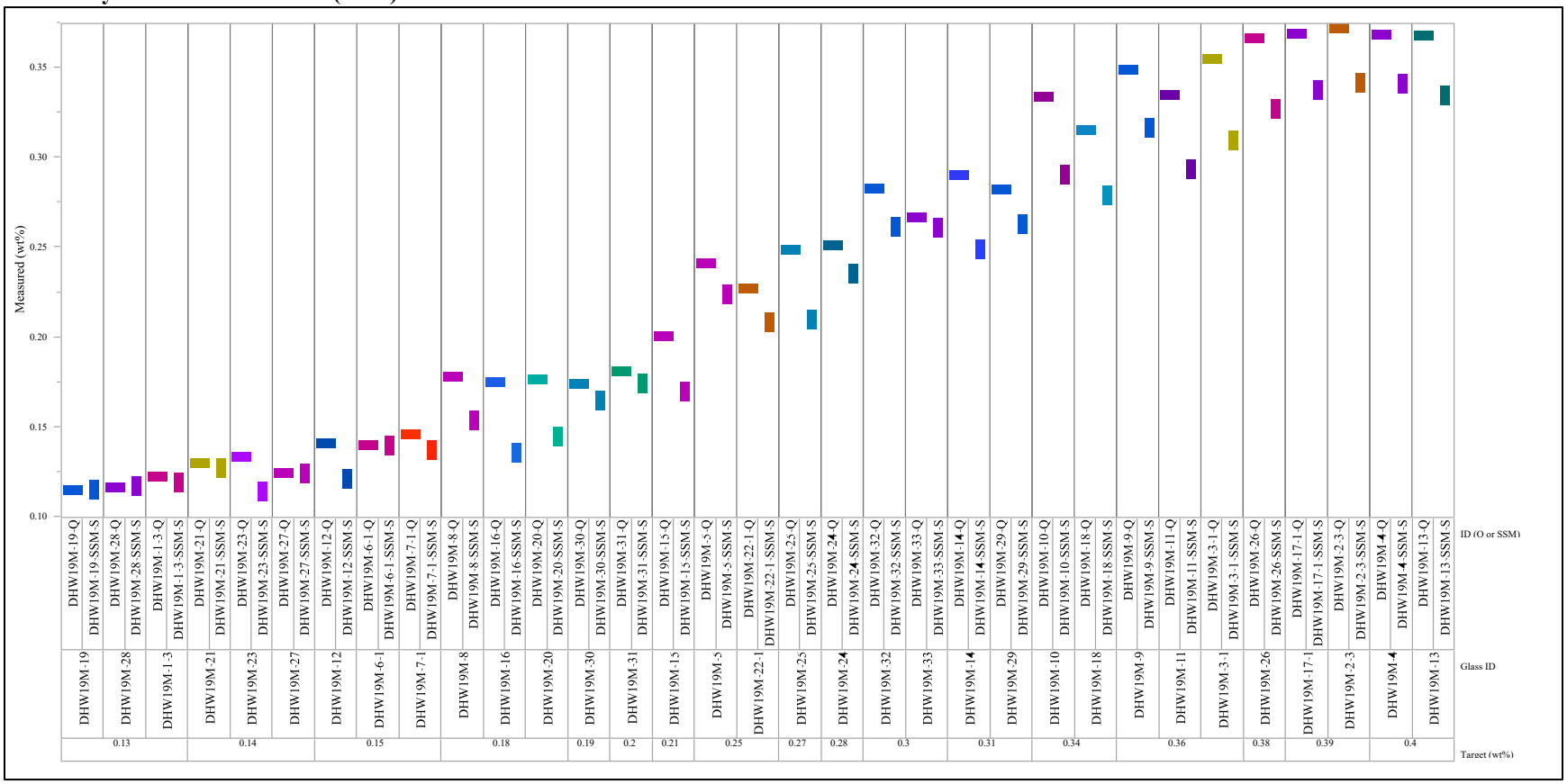


Exhibit A-5. Comparisons of the Measured Compositions of the Quenched and SSM Versions of the Study Glasses (continued)

Analyte=PbO
Variability Chart for Measured (wt%)

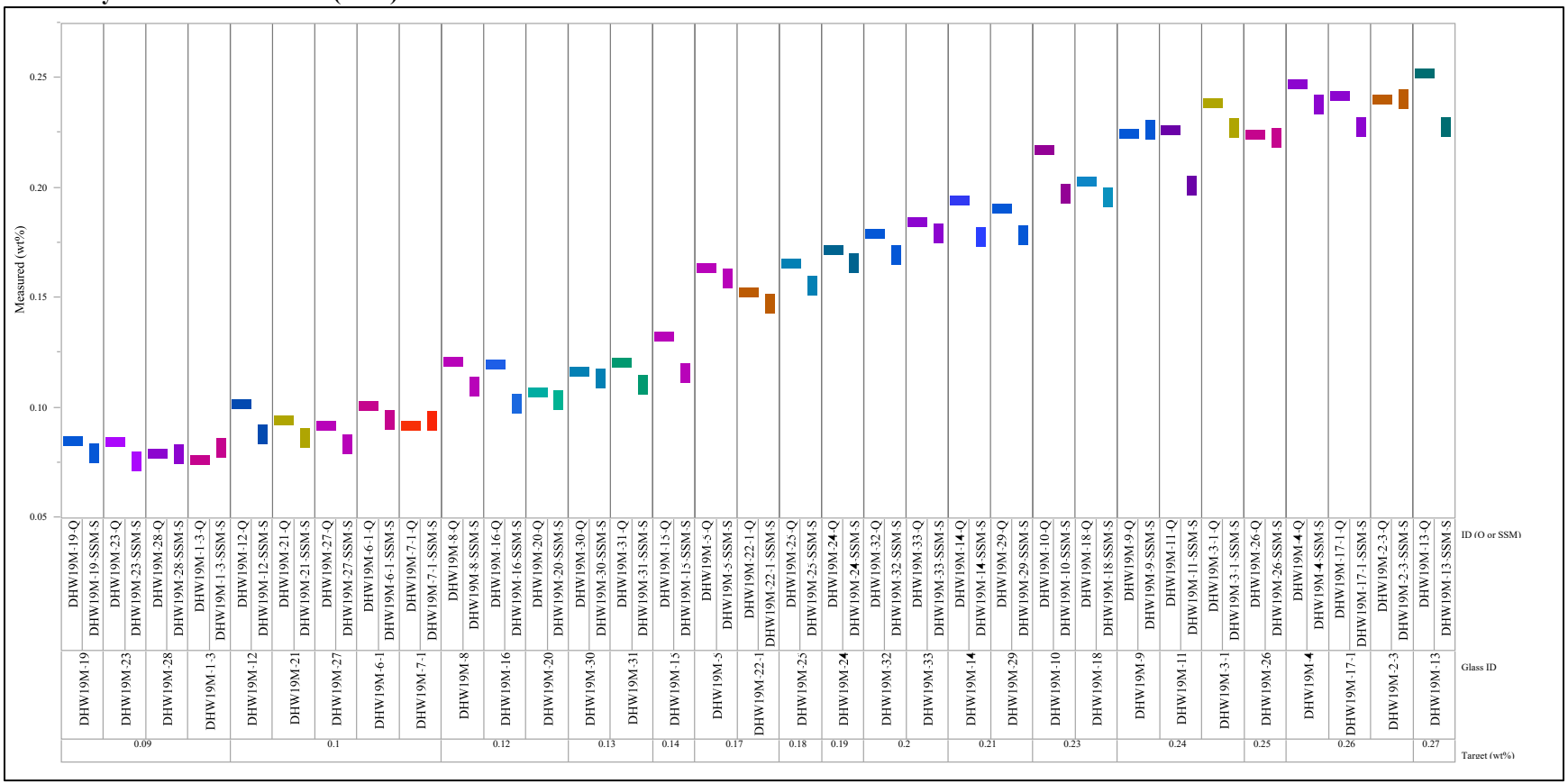


Exhibit A-5. Comparisons of the Measured Compositions of the Quenched and SSM Versions of the Study Glasses (continued)

Analyte=SiO2
Variability Chart for Measured (wt%)

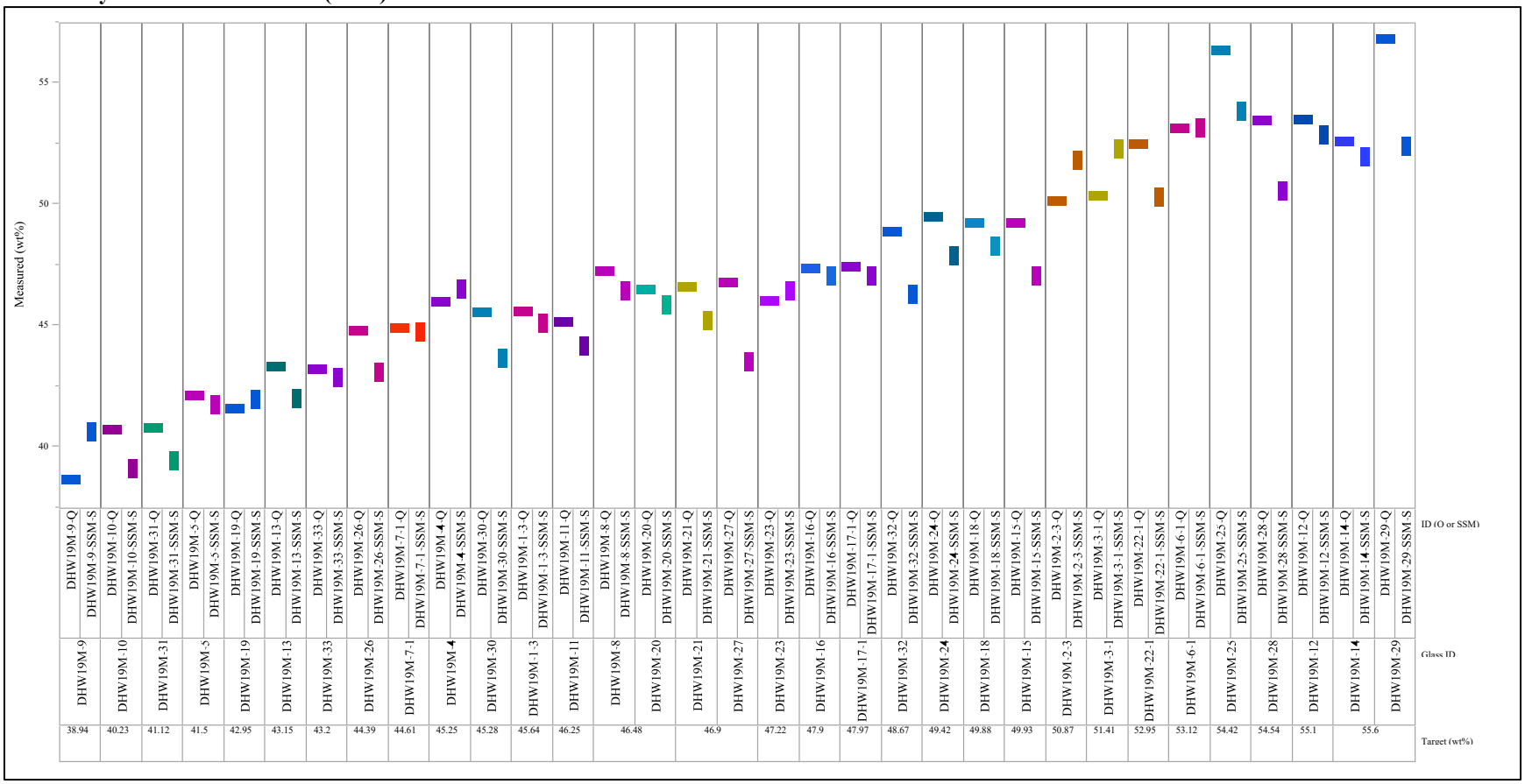


Exhibit A-5. Comparisons of the Measured Compositions of the Quenched and SSM Versions of the Study Glasses (continued)

Analyte=SO3
Variability Chart for Measured (wt%)

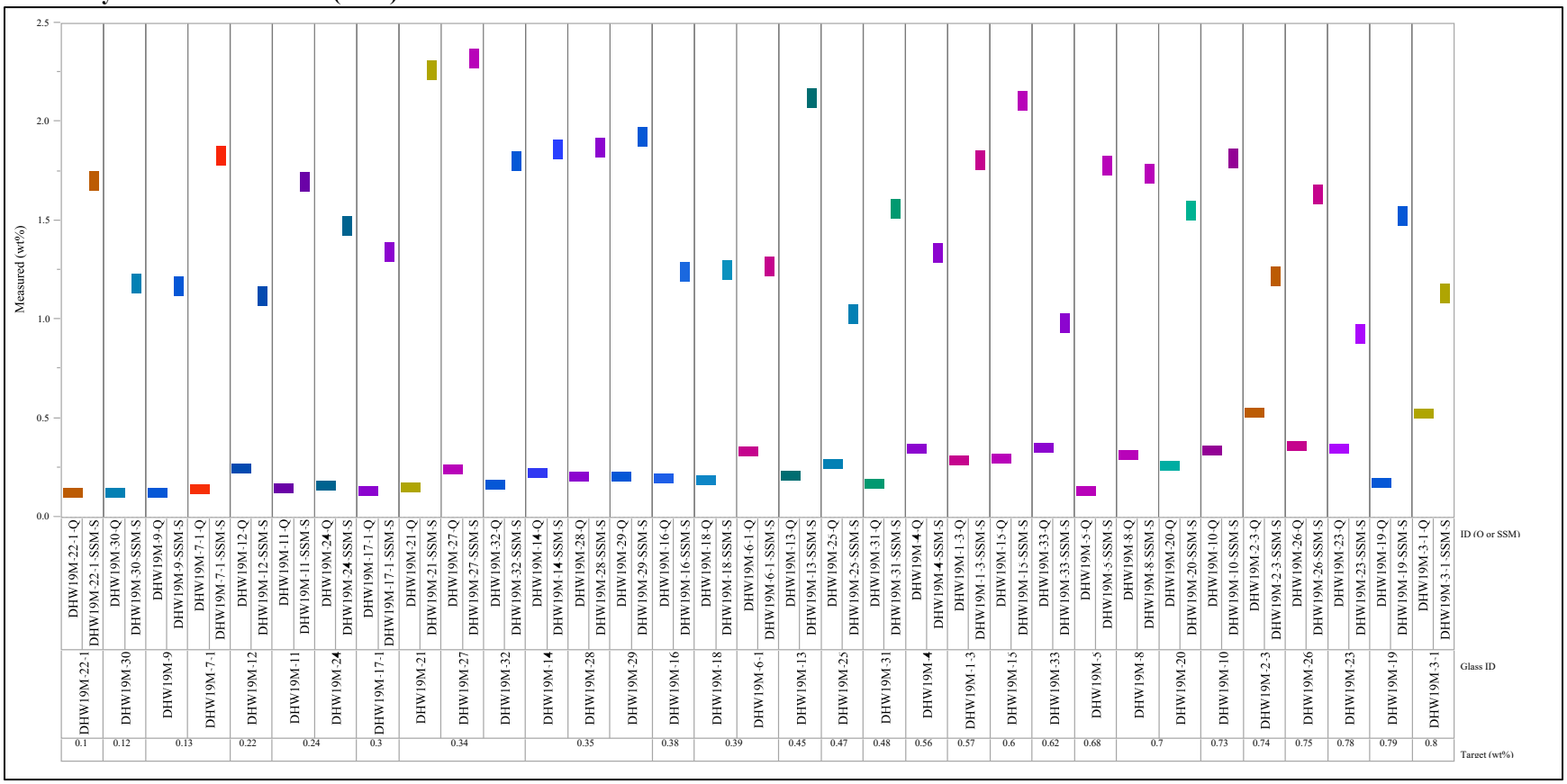


Exhibit A-5. Comparisons of the Measured Compositions of the Quenched and SSM Versions of the Study Glasses (continued)

Analyte=ZrO2
Variability Chart for Measured (wt%)

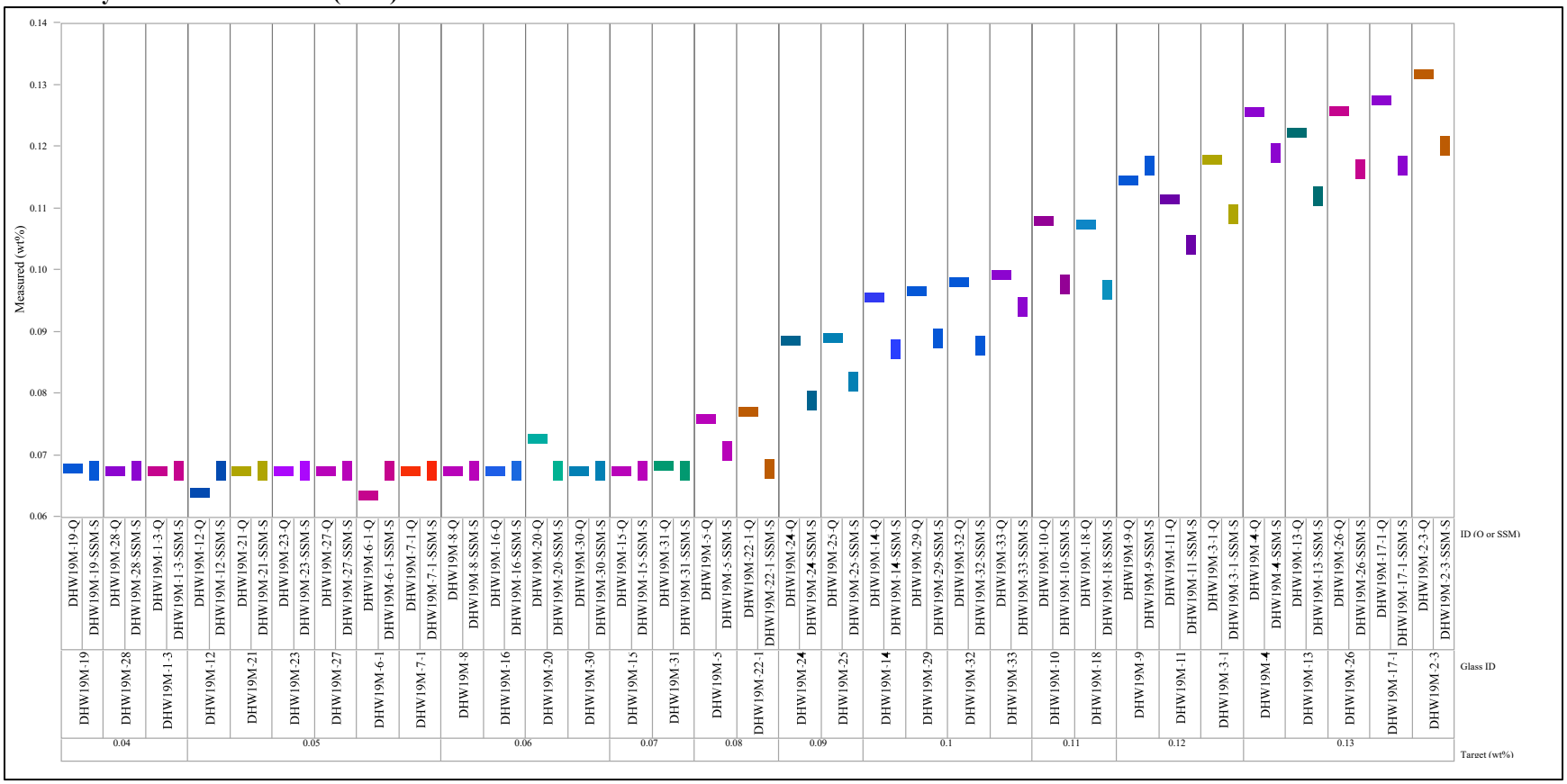
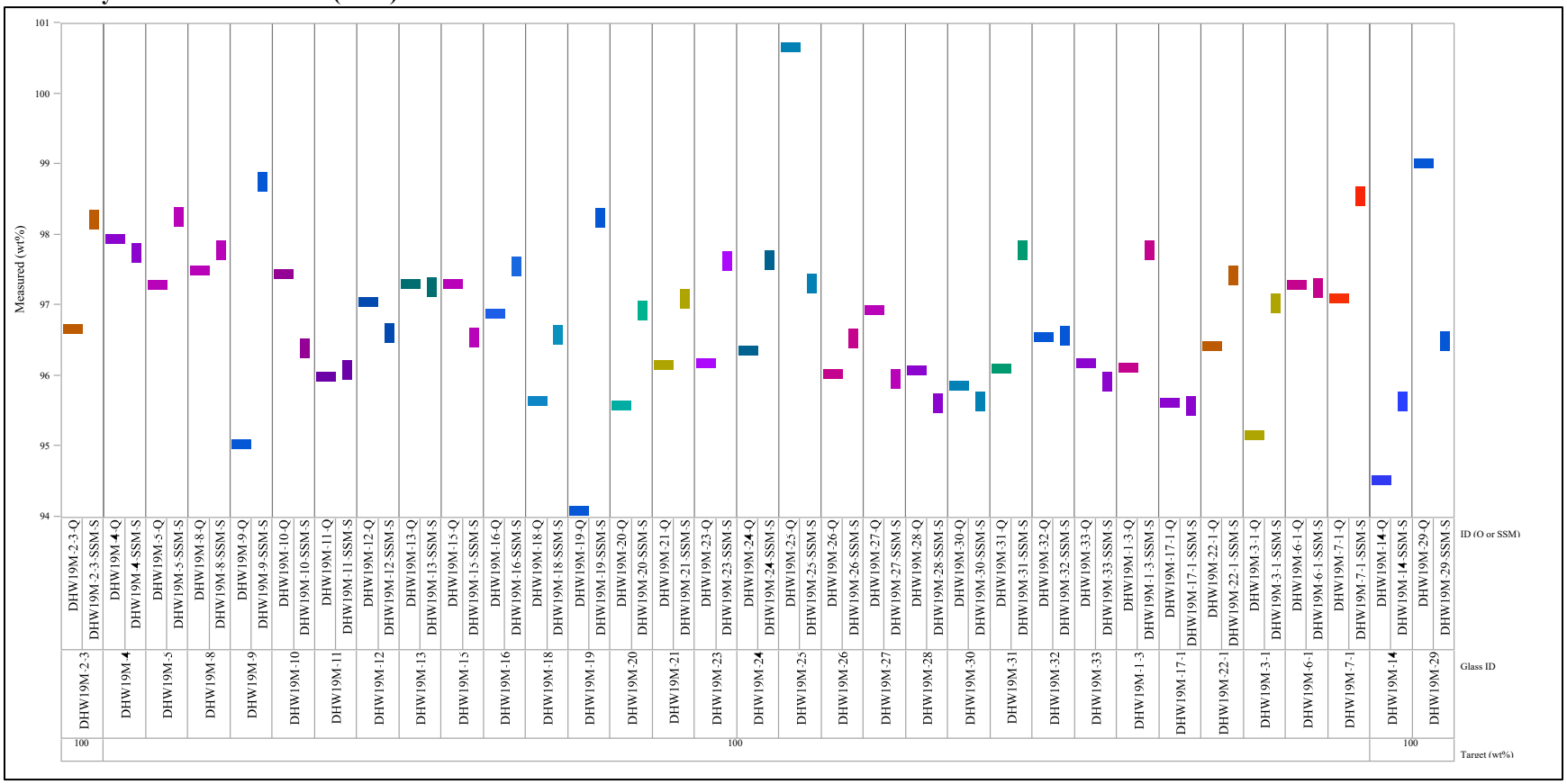


Exhibit A-5. Comparisons of the Measured Compositions of the Quenched and SSM Versions of the Study Glasses (continued)

Sum of Oxides
Variability Chart for Measured (wt%)



Appendix B Tables and Exhibits Supporting the Wash Solution Composition Measurements

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

Solution ID	Blk	Seq	Lab ID	Al	B	Ca	Cr	Fe	K	Li	Mn	Na	Ni	P	Pb	S	Si	Zr
soln std	1	1	soln std-11	4.21	20.6	<1.00	<1.00	3.89	9.74	9.42	<1.00	82.0	<1.00	<1.00	<1.00	<1.00	49.4	<1.00
DHW19M-15-SSM-W	1	2	S-10492-1	<1.00	21.4	8.46	40.1	<1.00	<1.00	27.6	<1.00	478	<1.00	1.79	<1.00	295	24.1	<1.00
DHW19M-9-SSM-W	1	3	S-10486-1	<1.00	64.0	<1.00	317	<1.00	373	8.29	<1.00	1020	<1.00	8.89	<1.00	542	10.7	<1.00
sustd	1	4	sustd-11	50.1	<1.00	<1.00	<1.00	46.9	<1.00	<1.00	20.1	157	9.68	<1.00	<1.00	10.1	<1.00	<1.00
DHW19M-3-1-SSM-W	1	5	S-10480-1	<1.00	29.1	<1.00	114	<1.00	489	8.69	<1.00	879	<1.00	8.18	<1.00	657	10.6	<1.00
DHW19M-12-SSM-W	1	6	S-10489-1	<1.00	11.9	15.1	67.6	<1.00	81.7	19.1	<1.00	776	<1.00	2.11	<1.00	526	6.26	<1.00
blank	1	7	blank-11	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
DHW19M-16-SSM-W	1	8	S-10493-1	<1.00	22.7	<1.00	127	<1.00	102	39.7	<1.00	725	<1.00	3.12	<1.00	455	9.55	<1.00
DHW19M-11-SSM-W	1	9	S-10488-1	<1.00	33.8	1.21	62.4	<1.00	124	37.7	<1.00	572	<1.00	4.66	<1.00	392	15.7	<1.00
DHW19M-6-1-SSM-W	1	10	S-10483-1	<1.00	24.6	3.07	87.7	<1.00	395	<1.00	<1.00	822	<1.00	3.08	<1.00	598	15.0	<1.00
soln std	1	11	soln std-12	4.12	20.6	<1.00	<1.00	3.94	9.73	9.65	<1.00	84.3	<1.00	<1.00	<1.00	<1.00	49.5	<1.00
DHW19M-7-1-SSM-W	1	12	S-10484-1	<1.00	37.8	<1.00	74.6	<1.00	268	41.4	<1.00	594	<1.00	2.25	<1.00	434	17.9	<1.00
DHW19M-14-SSM-W	1	13	S-10491-1	<1.00	15.1	2.73	64.5	<1.00	4.81	24.1	<1.00	715	<1.00	4.17	<1.00	426	19.5	<1.00
DHW19M-8-SSM-W	1	14	S-10485-1	<1.00	33.3	2.76	201	<1.00	188	19.4	<1.00	857	<1.00	3.28	<1.00	491	14.4	<1.00
blank	1	15	blank-12	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
DHW19M-13-SSM-W	1	16	S-10490-1	1.07	25.2	6.63	64.9	<1.00	59.7	21.6	<1.00	596	<1.00	4.29	<1.00	357	16.6	<1.00
DHW19M-2-3-SSM-W	1	17	S-10479-1	<1.00	24.8	4.89	129	<1.00	37.6	12.6	<1.00	1120	<1.00	9.21	<1.00	644	9.97	<1.00
DHW19M-10-SSM-W	1	18	S-10487-1	<1.00	36.3	10.5	134	<1.00	108	10.8	<1.00	785	<1.00	3.81	<1.00	442	12.5	<1.00
sustd	1	19	sustd-12	51.7	<1.00	<1.00	<1.00	45.6	<1.00	<1.00	19.9	159	9.38	<1.00	<1.00	9.47	<1.00	<1.00
DHW19M-1-3-SSM-W	1	20	S-10478-1	<1.00	24.3	9.17	199	<1.00	34.3	42.9	<1.00	840	<1.00	2.07	<1.00	476	9.76	<1.00
DHW19M-17-1-SSM-W	1	21	S-10494-1	<1.00	32.8	14.6	156	<1.00	371	5.32	<1.00	749	<1.00	4.71	<1.00	514	20.0	<1.00
sustd	1	22	sustd-13	51.7	<1.00	<1.00	<1.00	45.5	<1.00	<1.00	19.9	160	9.33	<1.00	<1.00	9.39	<1.00	<1.00
DHW19M-4-SSM-W	1	23	S-10481-1	1.16	28.0	3.79	166	<1.00	273	11.6	<1.00	939	<1.00	8.05	<1.00	571	11.2	<1.00
DHW19M-5-SSM-W	1	24	S-10482-1	1.02	32.8	4.40	110	<1.00	193	31.5	<1.00	659	<1.00	3.14	<1.00	444	9.46	<1.00
soln std	1	25	soln std-13	4.18	20.5	<1.00	<1.00	3.81	10.2	9.66	<1.00	85.1	<1.00	<1.00	<1.00	<1.00	48.7	<1.00
soln std	2	1	soln std-21	4.06	19.8	<1.00	<1.00	4.10	9.78	9.44	<1.00	81.3	<1.00	<1.00	<1.00	<1.00	50.0	<1.00
DHW19M-14-SSM-W	2	2	S-10491-2	<1.00	14.3	2.68	68.1	<1.00	4.88	24.0	<1.00	688	<1.00	4.31	<1.00	412	20.0	<1.00
DHW19M-5-SSM-W	2	3	S-10482-2	<1.00	30.8	4.30	107	<1.00	180	30.2	<1.00	632	<1.00	3.35	<1.00	422	9.57	<1.00
sustd	2	4	sustd-21	49.6	<1.00	<1.00	<1.00	50.8	<1.00	<1.00	20.4	162	10.2	<1.00	<1.00	10.5	<1.00	<1.00
DHW19M-10-SSM-W	2	5	S-10487-2	<1.00	34.3	10.4	135	<1.00	102	10.2	<1.00	748	<1.00	4.09	<1.00	430	12.8	<1.00
DHW19M-13-SSM-W	2	6	S-10490-2	<1.00	23.7	6.49	67.6	<1.00	54.2	21.1	<1.00	573	<1.00	4.43	<1.00	347	16.8	<1.00
blank	2	7	blank-21	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
DHW19M-11-SSM-W	2	8	S-10488-2	<1.00	33.3	1.20	66.2	<1.00	125	37.4	<1.00	556	<1.00	4.76	<1.00	383	16.2	<1.00
DHW19M-6-1-SSM-W	2	9	S-10483-2	<1.00	23.5	3.05	92.3	<1.00	389	<1.00	<1.00	796	<1.00	3.08	<1.00	579	15.3	<1.00
DHW19M-4-SSM-W	2	10	S-10481-2	<1.00	26.2	3.75	165	<1.00	258	11.2	<1.00	904	<1.00	8.45	<1.00	560	11.5	<1.00
soln std	2	11	soln std-22	4.00	19.9	<1.00	<1.00	4.09	9.54	9.64	<1.00	81.4	<1.00	<1.00	<1.00	<1.00	50.2	<1.00
DHW19M-12-SSM-W	2	12	S-10489-2	<1.00	11.1	15.3	70.9	<1.00	77.2	18.6	<1.00	748	<1.00	2.31	<1.00	514	6.34	<1.00
DHW19M-17-1-SSM-W	2	13	S-10494-2	<1.00	30.5	14.6	154	<1.00	363	5.00	<1.00	718	<1.00	4.81	<1.00	500	20.5	<1.00
DHW19M-1-3-SSM-W	2	14	S-10478-2	<1.00	23.0	9.15	197	<1.00	32.1	41.1	<1.00	811	<1.00	2.23	<1.00	466	10.1	<1.00
blank	2	15	blank-22	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
DHW19M-15-SSM-W	2	16	S-10492-2	<1.00	20.6	11.4	56.9	<1.00	1.21	27.6	<1.00	466	<1.00	2.63	<1.00	294	32.7	<1.00

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

Solution ID	Blk	Seq	Lab ID	Al	B	Ca	Cr	Fe	K	Li	Mn	Na	Ni	P	Pb	S	Si	Zr
DHW19M-16-SSM-W	2	17	S-10493-2	<1.00	22.1	<1.00	126	<1.00	94.9	38.9	<1.00	704	<1.00	3.39	<1.00	445	9.84	<1.00
DHW19M-9-SSM-W	2	18	S-10486-2	<1.00	62.4	<1.00	317	<1.00	366	8.37	<1.00	990	<1.00	9.28	<1.00	534	10.7	<1.00
sustd	2	19	sustd-22	49.9	<1.00	<1.00	<1.00	50.7	<1.00	<1.00	20.5	159	10.2	<1.00	<1.00	10.4	<1.00	<1.00
DHW19M-2-3-SSM-W	2	20	S-10479-2	<1.00	23.5	4.86	131	<1.00	33.7	12.2	<1.00	1060	<1.00	9.42	<1.00	622	10.2	<1.00
DHW19M-3-1-SSM-W	2	21	S-10480-2	<1.00	28.0	<1.00	115	<1.00	473	8.43	<1.00	854	<1.00	8.55	<1.00	644	10.9	<1.00
sustd	2	22	sustd-23	49.9	<1.00	<1.00	<1.00	50.7	<1.00	<1.00	20.3	158	10.2	<1.00	<1.00	10.2	<1.00	<1.00
DHW19M-8-SSM-W	2	23	S-10485-2	<1.00	32.1	2.74	204	<1.00	182	19.3	<1.00	812	<1.00	3.37	<1.00	472	14.8	<1.00
DHW19M-7-1-SSM-W	2	24	S-10484-2	<1.00	36.7	<1.00	78.8	<1.00	257	40.6	<1.00	573	<1.00	2.37	<1.00	427	18.1	<1.00
soln std	2	25	soln std-23	4.05	19.9	<1.00	<1.00	4.10	10.3	9.61	<1.00	86.2	<1.00	<1.00	<1.00	<1.00	50.2	<1.00
soln std	3	1	soln std-31	4.13	20.4	<1.00	<1.00	4.17	9.46	9.12	<1.00	81.9	<1.00	<1.00	<1.00	<1.00	49.9	<1.00
DHW19M-2-3-SSM-W	3	2	S-10479-3	<1.00	24.0	4.96	128	<1.00	35.6	12.3	<1.00	1070	<1.00	9.64	<1.00	633	10.2	<1.00
DHW19M-12-SSM-W	3	3	S-10489-3	<1.00	11.4	16.0	76.5	<1.00	80.0	18.3	<1.00	748	<1.00	2.34	<1.00	524	6.31	<1.00
sustd	3	4	sustd-31	49.0	<1.00	<1.00	<1.00	49.6	<1.00	<1.00	20.3	152	9.78	<1.00	<1.00	9.43	<1.00	<1.00
DHW19M-11-SSM-W	3	5	S-10488-3	<1.00	33.7	1.24	71.4	<1.00	118	36.2	<1.00	559	<1.00	4.93	<1.00	383	16.2	<1.00
DHW19M-8-SSM-W	3	6	S-10485-3	<1.00	32.9	2.77	198	<1.00	179	18.9	<1.00	811	<1.00	3.46	<1.00	473	14.8	<1.00
blank	3	7	blank-31	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
DHW19M-9-SSM-W	3	8	S-10486-3	<1.00	63.9	<1.00	314	<1.00	354	8.25	<1.00	995	<1.00	9.35	<1.00	542	10.7	<1.00
DHW19M-1-3-SSM-W	3	9	S-10478-3	<1.00	23.7	9.33	192	<1.00	33.3	40.5	<1.00	814	<1.00	2.20	<1.00	469	10.0	<1.00
DHW19M-14-SSM-W	3	10	S-10491-3	<1.00	14.6	2.76	73.1	<1.00	5.10	23.5	<1.00	683	<1.00	4.29	<1.00	413	20.0	<1.00
soln std	3	11	soln std-32	4.14	20.4	<1.00	<1.00	4.14	9.42	9.16	<1.00	80.9	<1.00	<1.00	<1.00	<1.00	49.9	<1.00
DHW19M-7-1-SSM-W	3	12	S-10484-3	<1.00	37.3	<1.00	83.2	<1.00	262	39.5	<1.00	577	<1.00	2.37	<1.00	426	18.0	<1.00
DHW19M-6-1-SSM-W	3	13	S-10483-3	<1.00	23.8	3.09	101	<1.00	378	<1.00	<1.00	797	<1.00	3.18	<1.00	585	15.2	<1.00
DHW19M-5-SSM-W	3	14	S-10482-3	<1.00	31.3	4.34	108	<1.00	172	28.9	<1.00	618	<1.00	3.41	<1.00	423	9.48	<1.00
blank	3	15	blank-32	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
DHW19M-10-SSM-W	3	16	S-10487-3	<1.00	34.5	10.1	132	<1.00	95.1	9.38	<1.00	749	<1.00	4.02	<1.00	432	12.7	<1.00
DHW19M-17-1-SSM-W	3	17	S-10494-3	<1.00	31.4	14.2	155	<1.00	358	4.48	<1.00	721	<1.00	4.76	<1.00	504	20.2	<1.00
DHW19M-16-SSM-W	3	18	S-10493-3	<1.00	22.0	<1.00	125	<1.00	94.6	36.2	<1.00	708	<1.00	3.36	<1.00	454	9.54	<1.00
sustd	3	19	sustd-32	49.3	<1.00	<1.00	<1.00	49.2	<1.00	<1.00	20.2	155	9.72	<1.00	<1.00	9.45	<1.00	<1.00
DHW19M-3-1-SSM-W	3	20	S-10480-3	<1.00	28.1	<1.00	113	<1.00	462	8.08	<1.00	854	<1.00	8.51	<1.00	652	10.8	<1.00
DHW19M-4-SSM-W	3	21	S-10481-3	<1.00	26.9	3.67	165	<1.00	252	11.0	<1.00	892	<1.00	8.42	<1.00	563	11.1	<1.00
sustd	3	22	sustd-33	49.5	<1.00	<1.00	<1.00	49.2	<1.00	<1.00	20.2	149	9.71	<1.00	<1.00	10.7	<1.00	<1.00
DHW19M-15-SSM-W	3	23	S-10492-3	<1.00	20.9	8.61	41.9	<1.00	<1.00	26.5	<1.00	468	<1.00	1.89	<1.00	295	24.0	<1.00
DHW19M-13-SSM-W	3	24	S-10490-3	<1.00	24.1	6.43	66.0	<1.00	53.9	21.6	<1.00	571	<1.00	4.27	<1.00	353	16.1	<1.00
soln std	3	25	soln std-33	4.17	20.1	<1.00	<1.00	4.13	9.64	9.20	<1.00	80.5	<1.00	<1.00	<1.00	<1.00	49.7	<1.00
soln std	4	1	soln std-41	4.07	20.0	<1.00	<1.00	4.01	9.48	10.2	<1.00	79.1	<1.00	<1.00	<1.00	<1.00	50.6	<1.00
DHW19M-20-SSM-W	4	2	S-10497-1	<1.00	36.5	2.53	230	<1.00	189	23.2	<1.00	885	<1.00	3.77	<1.00	492	21.1	<1.00
DHW19M-23-SSM-W	4	3	S-10500-1	<1.00	35.2	1.02	110	<1.00	61.5	1.15	<1.00	1060	<1.00	3.22	<1.00	621	7.98	<1.00
sustd	4	4	sustd-41	46.8	<1.00	<1.00	<1.00	49.2	<1.00	<1.00	19.7	153	10.3	<1.00	<1.00	10.2	<1.00	<1.00
DHW19M-26-SSM-W	4	5	S-10503-1	<1.00	28.0	4.92	160	<1.00	302	24.3	<1.00	769	<1.00	5.89	<1.00	516	13.6	<1.00
DHW19M-29-SSM-W	4	6	S-10506-1	<1.00	13.3	2.36	69.7	<1.00	4.75	24.9	<1.00	676	<1.00	4.22	<1.00	398	18.4	<1.00
blank	4	7	blank-41	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00

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

Solution ID	Blk	Seq	Lab ID	Al	B	Ca	Cr	Fe	K	Li	Mn	Na	Ni	P	Pb	S	Si	Zr
DHW19M-32-SSM-W	4	8	S-10509-1	<1.00	25.0	5.08	99.7	<1.00	83.7	28.4	<1.00	628	<1.00	3.77	<1.00	389	22.9	<1.00
DHW19M-27-SSM-W	4	9	S-10504-1	<1.00	23.6	2.85	81.4	<1.00	194	20.0	<1.00	557	<1.00	1.81	<1.00	332	26.1	<1.00
DHW19M-30-SSM-W	4	10	S-10507-1	<1.00	34.4	6.25	165	<1.00	406	8.88	<1.00	718	<1.00	3.18	<1.00	498	11.9	<1.00
soln std	4	11	soln std-42	4.06	21.1	<1.00	<1.00	4.01	9.53	10.1	<1.00	81.3	<1.00	<1.00	<1.00	<1.00	50.4	<1.00
DHW19M-19-SSM-W	4	12	S-10496-1	<1.00	29.9	19.2	94.0	<1.00	125	20.7	<1.00	732	<1.00	1.54	<1.00	481	15.4	<1.00
DHW19M-21-SSM-W	4	13	S-10498-1	<1.00	18.7	2.79	80.6	<1.00	176	20.7	<1.00	522	<1.00	1.79	<1.00	320	18.7	<1.00
DHW19M-18-SSM-W	4	14	S-10495-1	<1.00	23.0	2.11	88.5	<1.00	116	17.1	<1.00	804	<1.00	5.87	<1.00	507	15.4	<1.00
blank	4	15	blank-42	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
DHW19M-22-1-SSM-W	4	16	S-10499-1	<1.00	18.5	7.38	55.2	<1.00	42.6	10.5	<1.00	641	<1.00	2.77	<1.00	386	18.8	<1.00
DHW19M-25-SSM-W	4	17	S-10502-1	<1.00	21.0	1.52	132	<1.00	198	6.56	<1.00	881	<1.00	6.06	<1.00	555	14.8	<1.00
DHW19M-24-SSM-W	4	18	S-10501-1	<1.00	22.1	6.29	77.9	<1.00	228	18.9	<1.00	678	<1.00	3.87	<1.00	473	12.2	<1.00
sustd	4	19	sustd-42	46.8	<1.00	<1.00	<1.00	49.3	<1.00	<1.00	19.7	161	10.3	<1.00	<1.00	9.97	<1.00	<1.00
DHW19M-28-SSM-W	4	20	S-10505-1	<1.00	24.4	<1.00	49.3	<1.00	118	30.0	<1.00	588	<1.00	1.85	<1.00	391	26.6	<1.00
DHW19M-31-SSM-W	4	21	S-10508-1	<1.00	26.0	9.86	58.4	<1.00	15.6	29.3	<1.00	664	<1.00	2.51	<1.00	453	7.54	<1.00
sustd	4	22	sustd-43	47.2	<1.00	<1.00	<1.00	49.4	<1.00	<1.00	19.7	161	10.4	<1.00	<1.00	9.88	<1.00	<1.00
DHW19M-33-SSM-W	4	23	S-10510-1	<1.00	45.4	3.55	302	<1.00	621	8.07	<1.00	922	<1.00	7.91	<1.00	623	11.3	<1.00
soln std	4	24	soln std-43	4.00	20.9	<1.00	<1.00	4.01	10.1	10.2	<1.00	81.8	<1.00	<1.00	<1.00	<1.00	50.8	<1.00
soln std	5	1	soln std-51	4.09	20.2	<1.00	<1.00	4.08	9.26	10.0	<1.00	80.5	<1.00	<1.00	<1.00	<1.00	49.4	<1.00
DHW19M-24-SSM-W	5	2	S-10501-2	<1.00	22.5	6.48	78.2	<1.00	224	18.6	<1.00	671	<1.00	3.90	<1.00	489	12.2	<1.00
DHW19M-23-SSM-W	5	3	S-10500-2	<1.00	36.9	1.06	110	<1.00	61.6	1.14	<1.00	1020	<1.00	3.33	<1.00	638	8.51	<1.00
sustd	5	4	sustd-51	47.9	<1.00	<1.00	<1.00	48.9	<1.00	<1.00	19.2	152	9.89	<1.00	<1.00	10.1	<1.00	<1.00
DHW19M-33-SSM-W	5	5	S-10510-2	<1.00	46.5	3.67	300	<1.00	616	7.92	<1.00	935	<1.00	7.66	<1.00	637	11.3	<1.00
DHW19M-28-SSM-W	5	6	S-10505-2	<1.00	24.3	<1.00	47.5	<1.00	114	29.2	<1.00	589	<1.00	1.71	<1.00	406	25.9	<1.00
blank	5	7	blank-51	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
DHW19M-21-SSM-W	5	8	S-10498-2	<1.00	18.9	2.87	81.8	<1.00	173	18.8	<1.00	523	<1.00	1.72	<1.00	319	18.5	<1.00
DHW19M-22-1-SSM-W	5	9	S-10499-2	<1.00	18.6	7.46	55.4	<1.00	42.2	10.3	<1.00	643	<1.00	2.67	<1.00	397	18.6	<1.00
DHW19M-19-SSM-W	5	10	S-10496-2	<1.00	29.7	19.7	96.1	<1.00	118	20.4	<1.00	756	<1.00	1.56	<1.00	487	15.3	<1.00
soln std	5	11	soln std-52	4.09	21.2	<1.00	<1.00	4.07	9.46	9.57	<1.00	82.6	<1.00	<1.00	<1.00	<1.00	49.2	<1.00
DHW19M-31-SSM-W	5	12	S-10508-2	<1.00	26.2	10.3	57.1	<1.00	17.2	28.8	<1.00	752	<1.00	2.38	<1.00	457	7.38	<1.00
DHW19M-25-SSM-W	5	13	S-10502-2	<1.00	21.2	1.59	125	<1.00	190	6.49	<1.00	878	<1.00	5.89	<1.00	566	14.5	<1.00
DHW19M-26-SSM-W	5	14	S-10503-2	<1.00	28.3	5.03	144	<1.00	280	24.1	<1.00	723	<1.00	5.92	<1.00	525	13.7	<1.00
blank	5	15	blank-52	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
DHW19M-18-SSM-W	5	16	S-10495-2	<1.00	23.0	2.15	89.7	<1.00	113	16.9	<1.00	805	<1.00	5.86	<1.00	518	15.3	<1.00
DHW19M-27-SSM-W	5	17	S-10504-2	<1.00	23.7	2.93	80.4	<1.00	201	19.5	<1.00	578	<1.00	1.65	<1.00	339	25.7	<1.00
DHW19M-32-SSM-W	5	18	S-10509-2	<1.00	25.0	4.99	101	<1.00	83.6	27.9	<1.00	666	<1.00	3.79	<1.00	404	22.5	<1.00
sustd	5	19	sustd-52	47.7	<1.00	<1.00	<1.00	50.7	<1.00	<1.00	19.6	153	10.4	<1.00	<1.00	9.81	<1.00	<1.00
DHW19M-20-SSM-W	5	20	S-10497-2	<1.00	36.8	2.62	210	<1.00	192	23.0	<1.00	921	<1.00	3.70	<1.00	660	21.0	<1.00
DHW19M-29-SSM-W	5	21	S-10506-2	<1.00	13.6	2.34	73.0	<1.00	4.66	24.5	<1.00	678	<1.00	4.38	<1.00	407	18.7	<1.00
sustd	5	22	sustd-53	51.1	1.07	<1.00	<1.00	52.0	<1.00	<1.00	20.5	148	10.5	<1.00	<1.00	9.74	<1.00	<1.00
DHW19M-30-SSM-W	5	23	S-10507-2	<1.00	34.9	6.34	151	<1.00	413	8.66	<1.00	739	<1.00	3.22	<1.00	502	11.4	<1.00
soln std	5	24	soln std-53	4.32	20.5	<1.00	<1.00	4.17	9.69	9.93	<1.00	82.5	<1.00	<1.00	<1.00	<1.00	50.3	<1.00

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

Solution ID	Blk	Seq	Lab ID	Al	B	Ca	Cr	Fe	K	Li	Mn	Na	Ni	P	Pb	S	Si	Zr
soln std	6	1	soln std-61	4.25	20.5	<1.00	<1.00	4.23	9.78	10.0	<1.00	80.2	<1.00	<1.00	<1.00	1.10	50.7	<1.00
DHW19M-21-SSM-W	6	2	S-10498-3	<1.00	18.8	2.96	81.5	<1.00	183	19.3	<1.00	529	<1.00	1.85	<1.00	331	18.5	<1.00
DHW19M-26-SSM-W	6	3	S-10503-3	<1.00	27.7	5.18	158	<1.00	304	24.9	<1.00	767	<1.00	5.80	<1.00	533	13.5	<1.00
sustd	6	4	sustd-61	48.9	<1.00	<1.00	<1.00	52.3	<1.00	<1.00	20.4	156	10.4	<1.00	<1.00	10.4	<1.00	<1.00
DHW19M-18-SSM-W	6	5	S-10495-3	<1.00	23.4	2.24	87.9	<1.00	123	17.2	<1.00	835	<1.00	5.73	<1.00	528	15.2	<1.00
DHW19M-29-SSM-W	6	6	S-10506-3	<1.00	13.6	2.45	70.9	<1.00	4.29	24.1	<1.00	698	<1.00	4.25	<1.00	420	18.5	<1.00
blank	6	7	blank-61	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
DHW19M-22-1-SSM-W	6	8	S-10499-3	<1.00	18.5	7.71	54.9	<1.00	42.7	10.7	<1.00	629	<1.00	2.75	<1.00	394	18.7	<1.00
DHW19M-24-SSM-W	6	9	S-10501-3	<1.00	22.2	6.71	76.1	<1.00	235	19.0	<1.00	689	<1.00	3.79	<1.00	457	12.0	<1.00
DHW19M-27-SSM-W	6	10	S-10504-3	<1.00	23.6	3.01	80.1	<1.00	193	20.2	<1.00	548	<1.00	1.67	<1.00	345	25.9	<1.00
soln std	6	11	soln std-62	4.28	21.6	<1.00	<1.00	4.16	9.32	10.2	<1.00	84.3	<1.00	<1.00	<1.00	<1.00	50.7	<1.00
DHW19M-25-SSM-W	6	12	S-10502-3	<1.00	21.1	1.57	119	<1.00	207	6.71	<1.00	917	<1.00	5.79	<1.00	578	14.6	<1.00
DHW19M-28-SSM-W	6	13	S-10505-3	<1.00	24.7	<1.00	47.8	<1.00	116	29.7	<1.00	580	<1.00	1.81	<1.00	413	26.3	<1.00
DHW19M-31-SSM-W	6	14	S-10508-3	<1.00	26.3	10.5	56.8	<1.00	17.2	29.8	<1.00	707	<1.00	2.52	<1.00	468	6.92	<1.00
blank	6	15	blank-62	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
DHW19M-20-SSM-W	6	16	S-10497-3	<1.00	35.1	2.59	217	<1.00	186	21.7	<1.00	880	<1.00	3.49	<1.00	512	20.2	<1.00
DHW19M-19-SSM-W	6	17	S-10496-3	<1.00	30.1	20.4	94.7	<1.00	129	20.6	<1.00	760	<1.00	1.54	<1.00	485	15.2	<1.00
DHW19M-32-SSM-W	6	18	S-10509-3	<1.00	25.2	5.07	101	<1.00	85.2	27.0	<1.00	655	<1.00	3.81	<1.00	415	22.8	<1.00
sustd	6	19	sustd-62	49.2	2.97	<1.00	<1.00	52.0	<1.00	<1.00	20.3	158	10.4	<1.00	<1.00	10.7	<1.00	<1.00
DHW19M-30-SSM-W	6	20	S-10507-3	<1.00	34.9	6.49	152	<1.00	392	8.99	<1.00	687	<1.00	3.18	<1.00	514	11.2	<1.00
DHW19M-23-SSM-W	6	21	S-10500-3	<1.00	37.4	1.11	108	<1.00	62.8	1.16	<1.00	1020	<1.00	3.34	<1.00	638	8.42	<1.00
sustd	6	22	sustd-63	49.8	1.17	<1.00	<1.00	50.4	<1.00	<1.00	19.7	157	10.0	<1.00	<1.00	10.6	<1.00	<1.00
DHW19M-33-SSM-W	6	23	S-10510-3	<1.00	46.7	3.66	283	<1.00	642	8.17	<1.00	966	<1.00	7.54	<1.00	635	10.3	<1.00
soln std	6	24	soln std-63	4.34	20.8	<1.00	<1.00	4.23	9.33	10.1	<1.00	81.1	<1.00	<1.00	<1.00	1.11	51.2	<1.00

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

Solution ID	Blk	Seq	Lab ID	Fluoride	Chloride	Sulfate	Phosphate
1 ppm ck std	1	1	1 ppm ck std	0.990	0.904	0.949	1.03
SPEX 1 ppm std	1	2	SPEX 1 ppm	0.994	1.03	0.936	1.02
DHW19M-17-1-SSM-W	1	3	S-10494-1	<10.0	<10.0	1430	20.7
DHW19M-10-SSM-W	1	4	S-10487-1	<10.0	<10.0	1250	14.3
DHW19M-11-SSM-W	1	5	S-10488-1	<10.0	<10.0	1080	20.6
DHW19M-15-SSM-W	1	6	S-10492-1	<10.0	<10.0	811	<10.0
DHW19M-5-SSM-W	1	7	S-10482-1	<10.0	<10.0	1180	11.9
DHW19M-13-SSM-W	1	8	S-10490-1	<10.0	<10.0	850	13.3
DHW19M-16-SSM-W	1	9	S-10493-1	<10.0	<10.0	998	10.3
DHW19M-8-SSM-W	1	10	S-10485-1	<10.0	<10.0	1330	<10.0
DHW19M-4-SSM-W	1	11	S-10481-1	<10.0	<10.0	1630	33.6
Blank	1	12	Blank-1	<10.0	<10.0	<10.0	<10.0
DHW19M-7-1-SSM-W	1	13	S-10484-1	<10.0	<10.0	925	<10.0
DHW19M-6-1-SSM-W	1	14	S-10483-1	<10.0	<10.0	1240	11.7
DHW19M-14-SSM-W	1	15	S-10491-1	<10.0	<10.0	1100	19.9
DHW19M-12-SSM-W	1	16	S-10489-1	<10.0	<10.0	1200	<10.0
DHW19M-3-1-SSM-W	1	17	S-10480-1	<10.0	<10.0	1430	20.5
DHW19M-1-3-SSM-W	1	18	S-10478-1	<10.0	<10.0	1230	10.4
DHW19M-2-3-SSM-W	1	19	S-10479-1	<10.0	<10.0	1560	25.2
DHW19M-9-SSM-W	1	20	S-10486-1	<10.0	<10.0	1510	24.7
1 ppm ck std	1	21	1 ppm ck std	0.973	0.933	0.912	0.923
1 ppm ck std	2	1	1 ppm ck std	0.981	0.983	0.913	0.962
SPEX 1 ppm std	2	2	SPEX 1 ppm	1.01	1.04	0.935	1.06
DHW19M-12-SSM-W	2	3	S-10489-2	<10.0	<10.0	1220	<10.0
DHW19M-3-1-SSM-W	2	4	S-10480-2	<10.0	<10.0	1450	17.7
DHW19M-9-SSM-W	2	5	S-10486-2	<10.0	<10.0	1530	26.3
DHW19M-7-1-SSM-W	2	6	S-10484-2	<10.0	<10.0	963	<10.0
DHW19M-17-1-SSM-W	2	7	S-10494-2	<10.0	<10.0	1470	19.5
DHW19M-5-SSM-W	2	8	S-10482-2	<10.0	<10.0	1260	14.9
DHW19M-11-SSM-W	2	9	S-10488-2	<10.0	<10.0	1140	19.7
DHW19M-15-SSM-W	2	10	S-10492-2	<10.0	<10.0	875	<10.0
DHW19M-13-SSM-W	2	11	S-10490-2	<10.0	<10.0	920	18.0
Blank	2	12	Blank-2	<10.0	<10.0	<10.0	<10.0
DHW19M-16-SSM-W	2	13	S-10493-2	<10.0	<10.0	1080	11.1
DHW19M-10-SSM-W	2	14	S-10487-2	<10.0	<10.0	1310	12.6
DHW19M-1-3-SSM-W	2	15	S-10478-2	<10.0	<10.0	1310	12.9
DHW19M-8-SSM-W	2	16	S-10485-2	<10.0	<10.0	1430	<10.0
DHW19M-6-1-SSM-W	2	17	S-10483-2	<10.0	<10.0	1340	10.8
DHW19M-2-3-SSM-W	2	18	S-10479-2	<10.0	<10.0	1660	31.9
DHW19M-14-SSM-W	2	19	S-10491-2	<10.0	<10.0	1190	18.5
DHW19M-4-SSM-W	2	20	S-10481-2	<10.0	<10.0	1600	32.6
1 ppm ck std	2	21	1 ppm ck std	1.03	1.02	0.908	1.02
1 ppm ck std	3	1	1 ppm ck std	1.03	1.03	0.913	1.03
SPEX 1 ppm std	3	2	SPEX 1 ppm	1.01	1.05	0.934	1.07
DHW19M-6-1-SSM-W	3	3	S-10483-3	<10.0	<10.0	1350	11.1
DHW19M-15-SSM-W	3	4	S-10492-3	<10.0	<10.0	894	<10.0
DHW19M-16-SSM-W	3	5	S-10493-3	<10.0	<10.0	1100	12.5
DHW19M-5-SSM-W	3	6	S-10482-3	<10.0	<10.0	1290	14.6
DHW19M-9-SSM-W	3	7	S-10486-3	<10.0	<10.0	1630	30.8
DHW19M-2-3-SSM-W	3	8	S-10479-3	<10.0	<10.0	1680	28.0
DHW19M-12-SSM-W	3	9	S-10489-3	<10.0	<10.0	1300	<10.0
DHW19M-8-SSM-W	3	10	S-10485-3	<10.0	<10.0	1410	<10.0

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

Solution ID	Blk	Seq	Lab ID	Fluoride	Chloride	Sulfate	Phosphate
DHW19M-11-SSM-W	3	11	S-10488-3	<10.0	<10.0	1160	23.5
Blank	3	12	Blank-3	<10.0	<10.0	<10.0	<10.0
DHW19M-1-3-SSM-W	3	13	S-10478-3	<10.0	<10.0	1320	10.5
DHW19M-4-SSM-W	3	14	S-10481-3	<10.0	<10.0	1610	30.8
DHW19M-14-SSM-W	3	15	S-10491-3	<10.0	<10.0	1200	19.3
DHW19M-10-SSM-W	3	16	S-10487-3	<10.0	<10.0	1340	17.0
DHW19M-7-1-SSM-W	3	17	S-10484-3	<10.0	<10.0	1010	<10.0
DHW19M-17-1-SSM-W	3	18	S-10494-3	<10.0	<10.0	1520	19.3
DHW19M-13-SSM-W	3	19	S-10490-3	<10.0	<10.0	941	15.7
DHW19M-3-1-SSM-W	3	20	S-10480-3	<10.0	<10.0	1540	20.3
1 ppm ck std	3	21	1 ppm ck std	1.04	1.03	0.917	1.00
1 ppm ck std	4	1	1 ppm ck std	1.05	1.09	1.09	1.10
SPEX 1 ppm std	4	2	SPEX 1 ppm	1.08	1.10	1.05	1.05
DHW19M-18-SSM-W	4	3	S-10495-1	<10.0	<10.0	1240	10.3
DHW19M-30-SSM-W	4	4	S-10507-1	<10.0	<10.0	1030	<10.0
DHW19M-19-SSM-W	4	5	S-10496-1	<10.0	<10.0	1080	<10.0
DHW19M-32-SSM-W	4	6	S-10509-1	<10.0	<10.0	1000	<10.0
DHW19M-26-SSM-W	4	7	S-10503-1	<10.0	<10.0	933	<10.0
DHW19M-23-SSM-W	4	8	S-10500-1	<10.0	<10.0	1830	<10.0
DHW19M-27-SSM-W	4	9	S-10504-1	<10.0	<10.0	783	<10.0
DHW19M-24-SSM-W	4	10	S-10501-1	<10.0	<10.0	1060	<10.0
DHW19M-21-SSM-W	4	11	S-10498-1	<10.0	<10.0	684	<10.0
Blank	4	12	Blank-4	<10.0	<10.0	<10.0	<10.0
DHW19M-22-1-SSM-W	4	13	S-10499-1	<10.0	<10.0	982	<10.0
DHW19M-20-SSM-W	4	14	S-10497-1	<10.0	<10.0	1370	<10.0
DHW19M-29-SSM-W	4	15	S-10506-1	<10.0	<10.0	1150	<10.0
DHW19M-33-SSM-W	4	16	S-10510-1	<10.0	<10.0	1400	13.7
DHW19M-31-SSM-W	4	17	S-10508-1	<10.0	<10.0	1180	<10.0
DHW19M-25-SSM-W	4	18	S-10502-1	<10.0	<10.0	1530	12.6
DHW19M-28-SSM-W	4	19	S-10505-1	<10.0	<10.0	1160	<10.0
1 ppm ck std	4	20	1 ppm ck std	1.07	1.10	1.09	1.08
1 ppm ck std	5	1	1 ppm ck std	0.906	0.950	0.939	0.938
SPEX 1 ppm std	5	2	SPEX 1 ppm	1.03	1.09	1.04	1.05
DHW19M-32-SSM-W	5	3	S-10509-2	<10.0	<10.0	1010	<10.0
DHW19M-19-SSM-W	5	4	S-10496-2	<10.0	<10.0	1090	<10.0
DHW19M-25-SSM-W	5	5	S-10502-2	<10.0	<10.0	1540	12.0
DHW19M-27-SSM-W	5	6	S-10504-2	<10.0	<10.0	790	<10.0
DHW19M-23-SSM-W	5	7	S-10500-2	<10.0	<10.0	1840	<10.0
DHW19M-33-SSM-W	5	8	S-10510-2	<10.0	<10.0	1410	13.1
DHW19M-26-SSM-W	5	9	S-10503-2	<10.0	<10.0	947	<10.0
DHW19M-22-1-SSM-W	5	10	S-10499-2	<10.0	<10.0	995	<10.0
DHW19M-30-SSM-W	5	11	S-10507-2	<10.0	<10.0	1050	<10.0
Blank	5	12	Blank-5	<10.0	<10.0	<10.0	<10.0
DHW19M-18-SSM-W	5	13	S-10495-2	<10.0	<10.0	1260	10.9
DHW19M-31-SSM-W	5	14	S-10508-2	<10.0	<10.0	1190	<10.0
DHW19M-20-SSM-W	5	15	S-10497-2	<10.0	<10.0	1380	<10.0
DHW19M-29-SSM-W	5	16	S-10506-2	<10.0	<10.0	1160	<10.0
DHW19M-24-SSM-W	5	17	S-10501-2	<10.0	<10.0	1080	<10.0
DHW19M-21-SSM-W	5	18	S-10498-2	<10.0	<10.0	696	<10.0
DHW19M-28-SSM-W	5	19	S-10505-2	<10.0	<10.0	1180	<10.0
1 ppm ck std	5	20	1 ppm ck std	0.945	0.947	0.965	0.929
1 ppm ck std	6	1	1 ppm ck std	1.07	1.10	1.09	1.07
SPEX 1 ppm std	6	2	SPEX 1 ppm	1.02	1.07	1.04	1.03

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

Solution ID	Blk	Seq	Lab ID	Fluoride	Chloride	Sulfate	Phosphate
DHW19M-27-SSM-W	6	3	S-10504-3	<10.0	<10.0	809	<10.0
DHW19M-30-SSM-W	6	4	S-10507-3	<10.0	<10.0	1060	<10.0
DHW19M-25-SSM-W	6	5	S-10502-3	<10.0	<10.0	1570	14.8
DHW19M-33-SSM-W	6	6	S-10510-3	<10.0	<10.0	1450	15.6
DHW19M-28-SSM-W	6	7	S-10505-3	<10.0	<10.0	1210	<10.0
DHW19M-31-SSM-W	6	8	S-10508-3	<10.0	<10.0	1230	<10.0
DHW19M-19-SSM-W	6	9	S-10496-3	<10.0	<10.0	1130	<10.0
DHW19M-26-SSM-W	6	10	S-10503-3	<10.0	<10.0	977	<10.0
DHW19M-24-SSM-W	6	11	S-10501-3	<10.0	<10.0	1100	<10.0
Blank	6	12	Blank-6	<10.0	<10.0	<10.0	<10.0
DHW19M-23-SSM-W	6	13	S-10500-3	<10.0	<10.0	1890	<10.0
DHW19M-29-SSM-W	6	14	S-10506-3	<10.0	<10.0	1180	10.4
DHW19M-18-SSM-W	6	15	S-10495-3	<10.0	<10.0	1290	13.0
DHW19M-32-SSM-W	6	16	S-10509-3	<10.0	<10.0	1040	<10.0
DHW19M-20-SSM-W	6	17	S-10497-3	<10.0	<10.0	1410	<10.0
DHW19M-22-1-SSM-W	6	18	S-10499-3	<10.0	<10.0	1020	<10.0
DHW19M-21-SSM-W	6	19	S-10498-3	<10.0	<10.0	715	<10.0
1 ppm ck std	6	20	1 ppm ck std	1.03	1.04	1.02	0.978

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

Solution ID	Analyte	Instrument	Reference Value (mg/L)	Mean Measurement (mg/L)
1 ppm ck std	F	IC	1	1.01
1 ppm ck std	Cl	IC	1	1.01
1 ppm ck std	SO4	IC	1	0.98
1 ppm ck std	PO4	IC	1	1.00
SPEX 1 ppm std	F	IC	1	1.02
SPEX 1 ppm std	Cl	IC	1	1.06
SPEX 1 ppm std	SO4	IC	1	0.99
SPEX 1 ppm std	PO4	IC	1	1.05
soln std	Al	ICP-OES	4	4.14
soln std	B	ICP-OES	20	20.49
soln std	Ca	ICP-OES	0	<1
soln std	Cr	ICP-OES	0	<1
soln std	Fe	ICP-OES	4	4.07
soln std	K	ICP-OES	10	9.65
soln std	Li	ICP-OES	10	9.74
soln std	Mn	ICP-OES	0	<1
soln std	Na	ICP-OES	81	82.06
soln std	Ni	ICP-OES	0	<1
soln std	P	ICP-OES	0	<1
soln std	Pb	ICP-OES	0	<1
soln std	S	ICP-OES	0	<1.1
soln std	Si	ICP-OES	50	50.03
soln std	Zr	ICP-OES	0	<1
sustd	Al	ICP-OES	50	49.2
sustd	B	ICP-OES	0	<1.7
sustd	Ca	ICP-OES	0	<1
sustd	Cr	ICP-OES	0	<1
sustd	Fe	ICP-OES	50	49.6
sustd	K	ICP-OES	0	<1
sustd	Li	ICP-OES	0	<1
sustd	Mn	ICP-OES	20	20.0
sustd	Na	ICP-OES	150	156.0
sustd	Ni	ICP-OES	10	10.0
sustd	P	ICP-OES	0	<1
sustd	Pb	ICP-OES	0	<1
sustd	S	ICP-OES	10	10.1
sustd	Si	ICP-OES	0	<1
sustd	Zr	ICP-OES	0	<1

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

Table B-4. Average Measurements of the Wash Solutions

Solution ID	Analyte	Analysis	Average Measured Concentration (mg/L)
DHW19M-1-3-SSM-W	Al	ICP-OES	<1
DHW19M-1-3-SSM-W	B	ICP-OES	23.6
DHW19M-1-3-SSM-W	Ca	ICP-OES	9.22
DHW19M-1-3-SSM-W	Cl	IC	<10
DHW19M-1-3-SSM-W	Cr	ICP-OES	196
DHW19M-1-3-SSM-W	F	IC	<10
DHW19M-1-3-SSM-W	Fe	ICP-OES	<1
DHW19M-1-3-SSM-W	K	ICP-OES	33.2
DHW19M-1-3-SSM-W	Li	ICP-OES	41.5
DHW19M-1-3-SSM-W	Mn	ICP-OES	<1
DHW19M-1-3-SSM-W	Na	ICP-OES	822
DHW19M-1-3-SSM-W	Ni	ICP-OES	<1
DHW19M-1-3-SSM-W	P	ICP-OES	2.17
DHW19M-1-3-SSM-W	PO4	IC	11.3
DHW19M-1-3-SSM-W	PO4	ICP-OES	6.7
DHW19M-1-3-SSM-W	Pb	ICP-OES	<1
DHW19M-1-3-SSM-W	S	ICP-OES	470
DHW19M-1-3-SSM-W	SO4	IC	1290
DHW19M-1-3-SSM-W	SO4	ICP-OES	1408
DHW19M-1-3-SSM-W	Si	ICP-OES	9.94
DHW19M-1-3-SSM-W	Zr	ICP-OES	<1
DHW19M-2-3-SSM-W	Al	ICP-OES	<1
DHW19M-2-3-SSM-W	B	ICP-OES	24.1
DHW19M-2-3-SSM-W	Ca	ICP-OES	4.9
DHW19M-2-3-SSM-W	Cl	IC	<10
DHW19M-2-3-SSM-W	Cr	ICP-OES	129
DHW19M-2-3-SSM-W	F	IC	<10
DHW19M-2-3-SSM-W	Fe	ICP-OES	<1
DHW19M-2-3-SSM-W	K	ICP-OES	35.6
DHW19M-2-3-SSM-W	Li	ICP-OES	12.4
DHW19M-2-3-SSM-W	Mn	ICP-OES	<1
DHW19M-2-3-SSM-W	Na	ICP-OES	1080
DHW19M-2-3-SSM-W	Ni	ICP-OES	<1
DHW19M-2-3-SSM-W	P	ICP-OES	9.42
DHW19M-2-3-SSM-W	PO4	IC	28.4
DHW19M-2-3-SSM-W	PO4	ICP-OES	28.9
DHW19M-2-3-SSM-W	Pb	ICP-OES	<1
DHW19M-2-3-SSM-W	S	ICP-OES	633
DHW19M-2-3-SSM-W	SO4	IC	1630
DHW19M-2-3-SSM-W	SO4	ICP-OES	1896
DHW19M-2-3-SSM-W	Si	ICP-OES	10.1
DHW19M-2-3-SSM-W	Zr	ICP-OES	<1
DHW19M-3-1-SSM-W	Al	ICP-OES	<1
DHW19M-3-1-SSM-W	B	ICP-OES	28.4
DHW19M-3-1-SSM-W	Ca	ICP-OES	<1
DHW19M-3-1-SSM-W	Cl	IC	<10
DHW19M-3-1-SSM-W	Cr	ICP-OES	114
DHW19M-3-1-SSM-W	F	IC	<10
DHW19M-3-1-SSM-W	Fe	ICP-OES	<1
DHW19M-3-1-SSM-W	K	ICP-OES	475
DHW19M-3-1-SSM-W	Li	ICP-OES	8.4
DHW19M-3-1-SSM-W	Mn	ICP-OES	<1

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

Solution ID	Analyte	Analysis	Average Measured Concentration (mg/L)
DHW19M-3-1-SSM-W	Na	ICP-OES	862
DHW19M-3-1-SSM-W	Ni	ICP-OES	<1
DHW19M-3-1-SSM-W	P	ICP-OES	8.41
DHW19M-3-1-SSM-W	PO4	IC	19.5
DHW19M-3-1-SSM-W	PO4	ICP-OES	25.8
DHW19M-3-1-SSM-W	Pb	ICP-OES	<1
DHW19M-3-1-SSM-W	S	ICP-OES	651
DHW19M-3-1-SSM-W	SO4	IC	1470
DHW19M-3-1-SSM-W	SO4	ICP-OES	1950
DHW19M-3-1-SSM-W	Si	ICP-OES	10.7
DHW19M-3-1-SSM-W	Zr	ICP-OES	<1
DHW19M-4-SSM-W	Al	ICP-OES	<1.05
DHW19M-4-SSM-W	B	ICP-OES	27
DHW19M-4-SSM-W	Ca	ICP-OES	3.73
DHW19M-4-SSM-W	Cl	IC	<10
DHW19M-4-SSM-W	Cr	ICP-OES	165
DHW19M-4-SSM-W	F	IC	<10
DHW19M-4-SSM-W	Fe	ICP-OES	<1
DHW19M-4-SSM-W	K	ICP-OES	261
DHW19M-4-SSM-W	Li	ICP-OES	11.3
DHW19M-4-SSM-W	Mn	ICP-OES	<1
DHW19M-4-SSM-W	Na	ICP-OES	912
DHW19M-4-SSM-W	Ni	ICP-OES	<1
DHW19M-4-SSM-W	P	ICP-OES	8.31
DHW19M-4-SSM-W	PO4	IC	32.3
DHW19M-4-SSM-W	PO4	ICP-OES	25.5
DHW19M-4-SSM-W	Pb	ICP-OES	<1
DHW19M-4-SSM-W	S	ICP-OES	565
DHW19M-4-SSM-W	SO4	IC	1610
DHW19M-4-SSM-W	SO4	ICP-OES	1693
DHW19M-4-SSM-W	Si	ICP-OES	11.2
DHW19M-4-SSM-W	Zr	ICP-OES	<1
DHW19M-5-SSM-W	Al	ICP-OES	<1.01
DHW19M-5-SSM-W	B	ICP-OES	31.6
DHW19M-5-SSM-W	Ca	ICP-OES	4.35
DHW19M-5-SSM-W	Cl	IC	<10
DHW19M-5-SSM-W	Cr	ICP-OES	109
DHW19M-5-SSM-W	F	IC	<10
DHW19M-5-SSM-W	Fe	ICP-OES	<1
DHW19M-5-SSM-W	K	ICP-OES	182
DHW19M-5-SSM-W	Li	ICP-OES	30.2
DHW19M-5-SSM-W	Mn	ICP-OES	<1
DHW19M-5-SSM-W	Na	ICP-OES	636
DHW19M-5-SSM-W	Ni	ICP-OES	<1
DHW19M-5-SSM-W	P	ICP-OES	3.3
DHW19M-5-SSM-W	PO4	IC	13.8
DHW19M-5-SSM-W	PO4	ICP-OES	10.1
DHW19M-5-SSM-W	Pb	ICP-OES	<1
DHW19M-5-SSM-W	S	ICP-OES	430
DHW19M-5-SSM-W	SO4	IC	1240
DHW19M-5-SSM-W	SO4	ICP-OES	1288
DHW19M-5-SSM-W	Si	ICP-OES	9.51

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

Solution ID	Analyte	Analysis	Average Measured Concentration (mg/L)
DHW19M-5-SSM-W	Zr	ICP-OES	<1
DHW19M-6-1-SSM-W	Al	ICP-OES	<1
DHW19M-6-1-SSM-W	B	ICP-OES	24
DHW19M-6-1-SSM-W	Ca	ICP-OES	3.07
DHW19M-6-1-SSM-W	Cl	IC	<10
DHW19M-6-1-SSM-W	Cr	ICP-OES	93.5
DHW19M-6-1-SSM-W	F	IC	<10
DHW19M-6-1-SSM-W	Fe	ICP-OES	<1
DHW19M-6-1-SSM-W	K	ICP-OES	387
DHW19M-6-1-SSM-W	Li	ICP-OES	<1
DHW19M-6-1-SSM-W	Mn	ICP-OES	<1
DHW19M-6-1-SSM-W	Na	ICP-OES	805
DHW19M-6-1-SSM-W	Ni	ICP-OES	<1
DHW19M-6-1-SSM-W	P	ICP-OES	3.11
DHW19M-6-1-SSM-W	PO4	IC	11.2
DHW19M-6-1-SSM-W	PO4	ICP-OES	9.5
DHW19M-6-1-SSM-W	Pb	ICP-OES	<1
DHW19M-6-1-SSM-W	S	ICP-OES	587
DHW19M-6-1-SSM-W	SO4	IC	1310
DHW19M-6-1-SSM-W	SO4	ICP-OES	1759
DHW19M-6-1-SSM-W	Si	ICP-OES	15.2
DHW19M-6-1-SSM-W	Zr	ICP-OES	<1
DHW19M-7-1-SSM-W	Al	ICP-OES	<1
DHW19M-7-1-SSM-W	B	ICP-OES	37.3
DHW19M-7-1-SSM-W	Ca	ICP-OES	<1
DHW19M-7-1-SSM-W	Cl	IC	<10
DHW19M-7-1-SSM-W	Cr	ICP-OES	78.8
DHW19M-7-1-SSM-W	F	IC	<10
DHW19M-7-1-SSM-W	Fe	ICP-OES	<1
DHW19M-7-1-SSM-W	K	ICP-OES	262
DHW19M-7-1-SSM-W	Li	ICP-OES	40.5
DHW19M-7-1-SSM-W	Mn	ICP-OES	<1
DHW19M-7-1-SSM-W	Na	ICP-OES	581
DHW19M-7-1-SSM-W	Ni	ICP-OES	<1
DHW19M-7-1-SSM-W	P	ICP-OES	2.33
DHW19M-7-1-SSM-W	PO4	IC	<10
DHW19M-7-1-SSM-W	PO4	ICP-OES	7.1
DHW19M-7-1-SSM-W	Pb	ICP-OES	<1
DHW19M-7-1-SSM-W	S	ICP-OES	429
DHW19M-7-1-SSM-W	SO4	IC	966
DHW19M-7-1-SSM-W	SO4	ICP-OES	1285
DHW19M-7-1-SSM-W	Si	ICP-OES	18
DHW19M-7-1-SSM-W	Zr	ICP-OES	<1
DHW19M-8-SSM-W	Al	ICP-OES	<1
DHW19M-8-SSM-W	B	ICP-OES	32.8
DHW19M-8-SSM-W	Ca	ICP-OES	2.75
DHW19M-8-SSM-W	Cl	IC	<10
DHW19M-8-SSM-W	Cr	ICP-OES	201
DHW19M-8-SSM-W	F	IC	<10
DHW19M-8-SSM-W	Fe	ICP-OES	<1
DHW19M-8-SSM-W	K	ICP-OES	183
DHW19M-8-SSM-W	Li	ICP-OES	19.2

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

Solution ID	Analyte	Analysis	Average Measured Concentration (mg/L)
DHW19M-8-SSM-W	Mn	ICP-OES	<1
DHW19M-8-SSM-W	Na	ICP-OES	827
DHW19M-8-SSM-W	Ni	ICP-OES	<1
DHW19M-8-SSM-W	P	ICP-OES	3.37
DHW19M-8-SSM-W	PO4	IC	<10
DHW19M-8-SSM-W	PO4	ICP-OES	10.3
DHW19M-8-SSM-W	Pb	ICP-OES	<1
DHW19M-8-SSM-W	S	ICP-OES	479
DHW19M-8-SSM-W	SO4	IC	1390
DHW19M-8-SSM-W	SO4	ICP-OES	1435
DHW19M-8-SSM-W	Si	ICP-OES	14.7
DHW19M-8-SSM-W	Zr	ICP-OES	<1
DHW19M-9-SSM-W	Al	ICP-OES	<1
DHW19M-9-SSM-W	B	ICP-OES	63.5
DHW19M-9-SSM-W	Ca	ICP-OES	<1
DHW19M-9-SSM-W	Cl	IC	<10
DHW19M-9-SSM-W	Cr	ICP-OES	316
DHW19M-9-SSM-W	F	IC	<10
DHW19M-9-SSM-W	Fe	ICP-OES	<1
DHW19M-9-SSM-W	K	ICP-OES	364
DHW19M-9-SSM-W	Li	ICP-OES	8.3
DHW19M-9-SSM-W	Mn	ICP-OES	<1
DHW19M-9-SSM-W	Na	ICP-OES	1000
DHW19M-9-SSM-W	Ni	ICP-OES	<1
DHW19M-9-SSM-W	P	ICP-OES	9.17
DHW19M-9-SSM-W	PO4	IC	27.3
DHW19M-9-SSM-W	PO4	ICP-OES	28.1
DHW19M-9-SSM-W	Pb	ICP-OES	<1
DHW19M-9-SSM-W	S	ICP-OES	540
DHW19M-9-SSM-W	SO4	IC	1560
DHW19M-9-SSM-W	SO4	ICP-OES	1618
DHW19M-9-SSM-W	Si	ICP-OES	10.7
DHW19M-9-SSM-W	Zr	ICP-OES	<1
DHW19M-10-SSM-W	Al	ICP-OES	<1
DHW19M-10-SSM-W	B	ICP-OES	35
DHW19M-10-SSM-W	Ca	ICP-OES	10.3
DHW19M-10-SSM-W	Cl	IC	<10
DHW19M-10-SSM-W	Cr	ICP-OES	133
DHW19M-10-SSM-W	F	IC	<10
DHW19M-10-SSM-W	Fe	ICP-OES	<1
DHW19M-10-SSM-W	K	ICP-OES	102
DHW19M-10-SSM-W	Li	ICP-OES	10.1
DHW19M-10-SSM-W	Mn	ICP-OES	<1
DHW19M-10-SSM-W	Na	ICP-OES	761
DHW19M-10-SSM-W	Ni	ICP-OES	<1
DHW19M-10-SSM-W	P	ICP-OES	3.97
DHW19M-10-SSM-W	PO4	IC	14.6
DHW19M-10-SSM-W	PO4	ICP-OES	12.2
DHW19M-10-SSM-W	Pb	ICP-OES	<1
DHW19M-10-SSM-W	S	ICP-OES	435
DHW19M-10-SSM-W	SO4	IC	1300
DHW19M-10-SSM-W	SO4	ICP-OES	1303

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

Solution ID	Analyte	Analysis	Average Measured Concentration (mg/L)
DHW19M-10-SSM-W	Si	ICP-OES	12.6
DHW19M-10-SSM-W	Zr	ICP-OES	<1
DHW19M-11-SSM-W	Al	ICP-OES	<1
DHW19M-11-SSM-W	B	ICP-OES	33.6
DHW19M-11-SSM-W	Ca	ICP-OES	1.21
DHW19M-11-SSM-W	Cl	IC	<10
DHW19M-11-SSM-W	Cr	ICP-OES	66.7
DHW19M-11-SSM-W	F	IC	<10
DHW19M-11-SSM-W	Fe	ICP-OES	<1
DHW19M-11-SSM-W	K	ICP-OES	122
DHW19M-11-SSM-W	Li	ICP-OES	37.1
DHW19M-11-SSM-W	Mn	ICP-OES	<1
DHW19M-11-SSM-W	Na	ICP-OES	562
DHW19M-11-SSM-W	Ni	ICP-OES	<1
DHW19M-11-SSM-W	P	ICP-OES	4.78
DHW19M-11-SSM-W	PO4	IC	21.2
DHW19M-11-SSM-W	PO4	ICP-OES	14.7
DHW19M-11-SSM-W	Pb	ICP-OES	<1
DHW19M-11-SSM-W	S	ICP-OES	386
DHW19M-11-SSM-W	SO4	IC	1130
DHW19M-11-SSM-W	SO4	ICP-OES	1156
DHW19M-11-SSM-W	Si	ICP-OES	16
DHW19M-11-SSM-W	Zr	ICP-OES	<1
DHW19M-12-SSM-W	Al	ICP-OES	<1
DHW19M-12-SSM-W	B	ICP-OES	11.5
DHW19M-12-SSM-W	Ca	ICP-OES	15.5
DHW19M-12-SSM-W	Cl	IC	<10
DHW19M-12-SSM-W	Cr	ICP-OES	71.7
DHW19M-12-SSM-W	F	IC	<10
DHW19M-12-SSM-W	Fe	ICP-OES	<1
DHW19M-12-SSM-W	K	ICP-OES	79.6
DHW19M-12-SSM-W	Li	ICP-OES	18.7
DHW19M-12-SSM-W	Mn	ICP-OES	<1
DHW19M-12-SSM-W	Na	ICP-OES	757
DHW19M-12-SSM-W	Ni	ICP-OES	<1
DHW19M-12-SSM-W	P	ICP-OES	2.25
DHW19M-12-SSM-W	PO4	IC	<10
DHW19M-12-SSM-W	PO4	ICP-OES	6.9
DHW19M-12-SSM-W	Pb	ICP-OES	<1
DHW19M-12-SSM-W	S	ICP-OES	521
DHW19M-12-SSM-W	SO4	IC	1240
DHW19M-12-SSM-W	SO4	ICP-OES	1561
DHW19M-12-SSM-W	Si	ICP-OES	6.3
DHW19M-12-SSM-W	Zr	ICP-OES	<1
DHW19M-13-SSM-W	Al	ICP-OES	<1.02
DHW19M-13-SSM-W	B	ICP-OES	24.4
DHW19M-13-SSM-W	Ca	ICP-OES	6.52
DHW19M-13-SSM-W	Cl	IC	<10
DHW19M-13-SSM-W	Cr	ICP-OES	66.1
DHW19M-13-SSM-W	F	IC	<10
DHW19M-13-SSM-W	Fe	ICP-OES	<1
DHW19M-13-SSM-W	K	ICP-OES	56

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

Solution ID	Analyte	Analysis	Average Measured Concentration (mg/L)
DHW19M-13-SSM-W	Li	ICP-OES	21.4
DHW19M-13-SSM-W	Mn	ICP-OES	<1
DHW19M-13-SSM-W	Na	ICP-OES	580
DHW19M-13-SSM-W	Ni	ICP-OES	<1
DHW19M-13-SSM-W	P	ICP-OES	4.33
DHW19M-13-SSM-W	PO4	IC	15.6
DHW19M-13-SSM-W	PO4	ICP-OES	13.3
DHW19M-13-SSM-W	Pb	ICP-OES	<1
DHW19M-13-SSM-W	S	ICP-OES	352
DHW19M-13-SSM-W	SO4	IC	904
DHW19M-13-SSM-W	SO4	ICP-OES	1055
DHW19M-13-SSM-W	Si	ICP-OES	16.5
DHW19M-13-SSM-W	Zr	ICP-OES	<1
DHW19M-14-SSM-W	Al	ICP-OES	<1
DHW19M-14-SSM-W	B	ICP-OES	14.7
DHW19M-14-SSM-W	Ca	ICP-OES	2.72
DHW19M-14-SSM-W	Cl	IC	<10
DHW19M-14-SSM-W	Cr	ICP-OES	68.6
DHW19M-14-SSM-W	F	IC	<10
DHW19M-14-SSM-W	Fe	ICP-OES	<1
DHW19M-14-SSM-W	K	ICP-OES	4.93
DHW19M-14-SSM-W	Li	ICP-OES	23.9
DHW19M-14-SSM-W	Mn	ICP-OES	<1
DHW19M-14-SSM-W	Na	ICP-OES	695
DHW19M-14-SSM-W	Ni	ICP-OES	<1
DHW19M-14-SSM-W	P	ICP-OES	4.26
DHW19M-14-SSM-W	PO4	IC	19.2
DHW19M-14-SSM-W	PO4	ICP-OES	13.1
DHW19M-14-SSM-W	Pb	ICP-OES	<1
DHW19M-14-SSM-W	S	ICP-OES	417
DHW19M-14-SSM-W	SO4	IC	1160
DHW19M-14-SSM-W	SO4	ICP-OES	1249
DHW19M-14-SSM-W	Si	ICP-OES	19.8
DHW19M-14-SSM-W	Zr	ICP-OES	<1
DHW19M-15-SSM-W	Al	ICP-OES	<1
DHW19M-15-SSM-W	B	ICP-OES	20.9
DHW19M-15-SSM-W	Ca	ICP-OES	9.48
DHW19M-15-SSM-W	Cl	IC	<10
DHW19M-15-SSM-W	Cr	ICP-OES	46.3
DHW19M-15-SSM-W	F	IC	<10
DHW19M-15-SSM-W	Fe	ICP-OES	<1
DHW19M-15-SSM-W	K	ICP-OES	<1.07
DHW19M-15-SSM-W	Li	ICP-OES	27.2
DHW19M-15-SSM-W	Mn	ICP-OES	<1
DHW19M-15-SSM-W	Na	ICP-OES	471
DHW19M-15-SSM-W	Ni	ICP-OES	<1
DHW19M-15-SSM-W	P	ICP-OES	2.1
DHW19M-15-SSM-W	PO4	IC	<10
DHW19M-15-SSM-W	PO4	ICP-OES	6.4
DHW19M-15-SSM-W	Pb	ICP-OES	<1
DHW19M-15-SSM-W	S	ICP-OES	295
DHW19M-15-SSM-W	SO4	IC	860

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

Solution ID	Analyte	Analysis	Average Measured Concentration (mg/L)
DHW19M-15-SSM-W	SO4	ICP-OES	884
DHW19M-15-SSM-W	Si	ICP-OES	26.9
DHW19M-15-SSM-W	Zr	ICP-OES	<1
DHW19M-16-SSM-W	Al	ICP-OES	<1
DHW19M-16-SSM-W	B	ICP-OES	22.2
DHW19M-16-SSM-W	Ca	ICP-OES	<1
DHW19M-16-SSM-W	Cl	IC	<10
DHW19M-16-SSM-W	Cr	ICP-OES	126
DHW19M-16-SSM-W	F	IC	<10
DHW19M-16-SSM-W	Fe	ICP-OES	<1
DHW19M-16-SSM-W	K	ICP-OES	97.1
DHW19M-16-SSM-W	Li	ICP-OES	38.2
DHW19M-16-SSM-W	Mn	ICP-OES	<1
DHW19M-16-SSM-W	Na	ICP-OES	712
DHW19M-16-SSM-W	Ni	ICP-OES	<1
DHW19M-16-SSM-W	P	ICP-OES	3.29
DHW19M-16-SSM-W	PO4	IC	11.3
DHW19M-16-SSM-W	PO4	ICP-OES	10.1
DHW19M-16-SSM-W	Pb	ICP-OES	<1
DHW19M-16-SSM-W	S	ICP-OES	451
DHW19M-16-SSM-W	SO4	IC	1060
DHW19M-16-SSM-W	SO4	ICP-OES	1351
DHW19M-16-SSM-W	Si	ICP-OES	9.64
DHW19M-16-SSM-W	Zr	ICP-OES	<1
DHW19M-17-1-SSM-W	Al	ICP-OES	<1
DHW19M-17-1-SSM-W	B	ICP-OES	31.6
DHW19M-17-1-SSM-W	Ca	ICP-OES	14.5
DHW19M-17-1-SSM-W	Cl	IC	<10
DHW19M-17-1-SSM-W	Cr	ICP-OES	155
DHW19M-17-1-SSM-W	F	IC	<10
DHW19M-17-1-SSM-W	Fe	ICP-OES	<1
DHW19M-17-1-SSM-W	K	ICP-OES	364
DHW19M-17-1-SSM-W	Li	ICP-OES	4.93
DHW19M-17-1-SSM-W	Mn	ICP-OES	<1
DHW19M-17-1-SSM-W	Na	ICP-OES	729
DHW19M-17-1-SSM-W	Ni	ICP-OES	<1
DHW19M-17-1-SSM-W	P	ICP-OES	4.76
DHW19M-17-1-SSM-W	PO4	IC	19.8
DHW19M-17-1-SSM-W	PO4	ICP-OES	14.6
DHW19M-17-1-SSM-W	Pb	ICP-OES	<1
DHW19M-17-1-SSM-W	S	ICP-OES	506
DHW19M-17-1-SSM-W	SO4	IC	1470
DHW19M-17-1-SSM-W	SO4	ICP-OES	1516
DHW19M-17-1-SSM-W	Si	ICP-OES	20.2
DHW19M-17-1-SSM-W	Zr	ICP-OES	<1
DHW19M-18-SSM-W	Al	ICP-OES	<1
DHW19M-18-SSM-W	B	ICP-OES	23.1
DHW19M-18-SSM-W	Ca	ICP-OES	2.16
DHW19M-18-SSM-W	Cl	IC	<10
DHW19M-18-SSM-W	Cr	ICP-OES	88.7
DHW19M-18-SSM-W	F	IC	<10
DHW19M-18-SSM-W	Fe	ICP-OES	<1

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

Solution ID	Analyte	Analysis	Average Measured Concentration (mg/L)
DHW19M-18-SSM-W	K	ICP-OES	117
DHW19M-18-SSM-W	Li	ICP-OES	17.1
DHW19M-18-SSM-W	Mn	ICP-OES	<1
DHW19M-18-SSM-W	Na	ICP-OES	815
DHW19M-18-SSM-W	Ni	ICP-OES	<1
DHW19M-18-SSM-W	P	ICP-OES	5.82
DHW19M-18-SSM-W	PO4	IC	11.4
DHW19M-18-SSM-W	PO4	ICP-OES	17.8
DHW19M-18-SSM-W	Pb	ICP-OES	<1
DHW19M-18-SSM-W	S	ICP-OES	518
DHW19M-18-SSM-W	SO4	IC	1260
DHW19M-18-SSM-W	SO4	ICP-OES	1552
DHW19M-18-SSM-W	Si	ICP-OES	15.3
DHW19M-18-SSM-W	Zr	ICP-OES	<1
DHW19M-19-SSM-W	Al	ICP-OES	<1
DHW19M-19-SSM-W	B	ICP-OES	29.9
DHW19M-19-SSM-W	Ca	ICP-OES	19.8
DHW19M-19-SSM-W	Cl	IC	<10
DHW19M-19-SSM-W	Cr	ICP-OES	94.9
DHW19M-19-SSM-W	F	IC	<10
DHW19M-19-SSM-W	Fe	ICP-OES	<1
DHW19M-19-SSM-W	K	ICP-OES	124
DHW19M-19-SSM-W	Li	ICP-OES	20.5
DHW19M-19-SSM-W	Mn	ICP-OES	<1
DHW19M-19-SSM-W	Na	ICP-OES	749
DHW19M-19-SSM-W	Ni	ICP-OES	<1
DHW19M-19-SSM-W	P	ICP-OES	1.54
DHW19M-19-SSM-W	PO4	IC	<10
DHW19M-19-SSM-W	PO4	ICP-OES	4.7
DHW19M-19-SSM-W	Pb	ICP-OES	<1
DHW19M-19-SSM-W	S	ICP-OES	484
DHW19M-19-SSM-W	SO4	IC	1100
DHW19M-19-SSM-W	SO4	ICP-OES	1450
DHW19M-19-SSM-W	Si	ICP-OES	15.3
DHW19M-19-SSM-W	Zr	ICP-OES	<1
DHW19M-20-SSM-W	Al	ICP-OES	<1
DHW19M-20-SSM-W	B	ICP-OES	36.1
DHW19M-20-SSM-W	Ca	ICP-OES	2.58
DHW19M-20-SSM-W	Cl	IC	<10
DHW19M-20-SSM-W	Cr	ICP-OES	219
DHW19M-20-SSM-W	F	IC	<10
DHW19M-20-SSM-W	Fe	ICP-OES	<1
DHW19M-20-SSM-W	K	ICP-OES	189
DHW19M-20-SSM-W	Li	ICP-OES	22.6
DHW19M-20-SSM-W	Mn	ICP-OES	<1
DHW19M-20-SSM-W	Na	ICP-OES	895
DHW19M-20-SSM-W	Ni	ICP-OES	<1
DHW19M-20-SSM-W	P	ICP-OES	3.65
DHW19M-20-SSM-W	PO4	IC	<10
DHW19M-20-SSM-W	PO4	ICP-OES	11.2
DHW19M-20-SSM-W	Pb	ICP-OES	<1
DHW19M-20-SSM-W	S	ICP-OES	555

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

Solution ID	Analyte	Analysis	Average Measured Concentration (mg/L)
DHW19M-20-SSM-W	SO4	IC	1390
DHW19M-20-SSM-W	SO4	ICP-OES	1663
DHW19M-20-SSM-W	Si	ICP-OES	20.8
DHW19M-20-SSM-W	Zr	ICP-OES	<1
DHW19M-21-SSM-W	Al	ICP-OES	<1
DHW19M-21-SSM-W	B	ICP-OES	18.8
DHW19M-21-SSM-W	Ca	ICP-OES	2.87
DHW19M-21-SSM-W	Cl	IC	<10
DHW19M-21-SSM-W	Cr	ICP-OES	81.3
DHW19M-21-SSM-W	F	IC	<10
DHW19M-21-SSM-W	Fe	ICP-OES	<1
DHW19M-21-SSM-W	K	ICP-OES	177
DHW19M-21-SSM-W	Li	ICP-OES	19.6
DHW19M-21-SSM-W	Mn	ICP-OES	<1
DHW19M-21-SSM-W	Na	ICP-OES	525
DHW19M-21-SSM-W	Ni	ICP-OES	<1
DHW19M-21-SSM-W	P	ICP-OES	1.78
DHW19M-21-SSM-W	PO4	IC	<10
DHW19M-21-SSM-W	PO4	ICP-OES	5.5
DHW19M-21-SSM-W	Pb	ICP-OES	<1
DHW19M-21-SSM-W	S	ICP-OES	323
DHW19M-21-SSM-W	SO4	IC	698
DHW19M-21-SSM-W	SO4	ICP-OES	968
DHW19M-21-SSM-W	Si	ICP-OES	18.6
DHW19M-21-SSM-W	Zr	ICP-OES	<1
DHW19M-22-1-SSM-W	Al	ICP-OES	<1
DHW19M-22-1-SSM-W	B	ICP-OES	18.5
DHW19M-22-1-SSM-W	Ca	ICP-OES	7.52
DHW19M-22-1-SSM-W	Cl	IC	<10
DHW19M-22-1-SSM-W	Cr	ICP-OES	55.1
DHW19M-22-1-SSM-W	F	IC	<10
DHW19M-22-1-SSM-W	Fe	ICP-OES	<1
DHW19M-22-1-SSM-W	K	ICP-OES	42.5
DHW19M-22-1-SSM-W	Li	ICP-OES	10.5
DHW19M-22-1-SSM-W	Mn	ICP-OES	<1
DHW19M-22-1-SSM-W	Na	ICP-OES	638
DHW19M-22-1-SSM-W	Ni	ICP-OES	<1
DHW19M-22-1-SSM-W	P	ICP-OES	2.73
DHW19M-22-1-SSM-W	PO4	IC	<10
DHW19M-22-1-SSM-W	PO4	ICP-OES	8.4
DHW19M-22-1-SSM-W	Pb	ICP-OES	<1
DHW19M-22-1-SSM-W	S	ICP-OES	392
DHW19M-22-1-SSM-W	SO4	IC	999
DHW19M-22-1-SSM-W	SO4	ICP-OES	1174
DHW19M-22-1-SSM-W	Si	ICP-OES	18.7
DHW19M-22-1-SSM-W	Zr	ICP-OES	<1
DHW19M-23-SSM-W	Al	ICP-OES	<1
DHW19M-23-SSM-W	B	ICP-OES	36.5
DHW19M-23-SSM-W	Ca	ICP-OES	1.06
DHW19M-23-SSM-W	Cl	IC	<10
DHW19M-23-SSM-W	Cr	ICP-OES	109
DHW19M-23-SSM-W	F	IC	<10

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

Solution ID	Analyte	Analysis	Average Measured Concentration (mg/L)
DHW19M-23-SSM-W	Fe	ICP-OES	<1
DHW19M-23-SSM-W	K	ICP-OES	62
DHW19M-23-SSM-W	Li	ICP-OES	1.15
DHW19M-23-SSM-W	Mn	ICP-OES	<1
DHW19M-23-SSM-W	Na	ICP-OES	1030
DHW19M-23-SSM-W	Ni	ICP-OES	<1
DHW19M-23-SSM-W	P	ICP-OES	3.29
DHW19M-23-SSM-W	PO4	IC	<10
DHW19M-23-SSM-W	PO4	ICP-OES	10.1
DHW19M-23-SSM-W	Pb	ICP-OES	<1
DHW19M-23-SSM-W	S	ICP-OES	632
DHW19M-23-SSM-W	SO4	IC	1850
DHW19M-23-SSM-W	SO4	ICP-OES	1893
DHW19M-23-SSM-W	Si	ICP-OES	8.3
DHW19M-23-SSM-W	Zr	ICP-OES	<1
DHW19M-24-SSM-W	Al	ICP-OES	<1
DHW19M-24-SSM-W	B	ICP-OES	22.3
DHW19M-24-SSM-W	Ca	ICP-OES	6.49
DHW19M-24-SSM-W	Cl	IC	<10
DHW19M-24-SSM-W	Cr	ICP-OES	77.4
DHW19M-24-SSM-W	F	IC	<10
DHW19M-24-SSM-W	Fe	ICP-OES	<1
DHW19M-24-SSM-W	K	ICP-OES	229
DHW19M-24-SSM-W	Li	ICP-OES	18.8
DHW19M-24-SSM-W	Mn	ICP-OES	<1
DHW19M-24-SSM-W	Na	ICP-OES	679
DHW19M-24-SSM-W	Ni	ICP-OES	<1
DHW19M-24-SSM-W	P	ICP-OES	3.85
DHW19M-24-SSM-W	PO4	IC	<10
DHW19M-24-SSM-W	PO4	ICP-OES	11.8
DHW19M-24-SSM-W	Pb	ICP-OES	<1
DHW19M-24-SSM-W	S	ICP-OES	473
DHW19M-24-SSM-W	SO4	IC	1080
DHW19M-24-SSM-W	SO4	ICP-OES	1417
DHW19M-24-SSM-W	Si	ICP-OES	12.1
DHW19M-24-SSM-W	Zr	ICP-OES	<1
DHW19M-25-SSM-W	Al	ICP-OES	<1
DHW19M-25-SSM-W	B	ICP-OES	21.1
DHW19M-25-SSM-W	Ca	ICP-OES	1.56
DHW19M-25-SSM-W	Cl	IC	<10
DHW19M-25-SSM-W	Cr	ICP-OES	125
DHW19M-25-SSM-W	F	IC	<10
DHW19M-25-SSM-W	Fe	ICP-OES	<1
DHW19M-25-SSM-W	K	ICP-OES	198
DHW19M-25-SSM-W	Li	ICP-OES	6.59
DHW19M-25-SSM-W	Mn	ICP-OES	<1
DHW19M-25-SSM-W	Na	ICP-OES	892
DHW19M-25-SSM-W	Ni	ICP-OES	<1
DHW19M-25-SSM-W	P	ICP-OES	5.91
DHW19M-25-SSM-W	PO4	IC	13.1
DHW19M-25-SSM-W	PO4	ICP-OES	18.1
DHW19M-25-SSM-W	Pb	ICP-OES	<1

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

Solution ID	Analyte	Analysis	Average Measured Concentration (mg/L)
DHW19M-25-SSM-W	S	ICP-OES	566
DHW19M-25-SSM-W	SO4	IC	1550
DHW19M-25-SSM-W	SO4	ICP-OES	1696
DHW19M-25-SSM-W	Si	ICP-OES	14.6
DHW19M-25-SSM-W	Zr	ICP-OES	<1
DHW19M-26-SSM-W	Al	ICP-OES	<1
DHW19M-26-SSM-W	B	ICP-OES	28
DHW19M-26-SSM-W	Ca	ICP-OES	5.04
DHW19M-26-SSM-W	Cl	IC	<10
DHW19M-26-SSM-W	Cr	ICP-OES	154
DHW19M-26-SSM-W	F	IC	<10
DHW19M-26-SSM-W	Fe	ICP-OES	<1
DHW19M-26-SSM-W	K	ICP-OES	295
DHW19M-26-SSM-W	Li	ICP-OES	24.4
DHW19M-26-SSM-W	Mn	ICP-OES	<1
DHW19M-26-SSM-W	Na	ICP-OES	753
DHW19M-26-SSM-W	Ni	ICP-OES	<1
DHW19M-26-SSM-W	P	ICP-OES	5.87
DHW19M-26-SSM-W	PO4	IC	<10
DHW19M-26-SSM-W	PO4	ICP-OES	18
DHW19M-26-SSM-W	Pb	ICP-OES	<1
DHW19M-26-SSM-W	S	ICP-OES	524
DHW19M-26-SSM-W	SO4	IC	953
DHW19M-26-SSM-W	SO4	ICP-OES	1570
DHW19M-26-SSM-W	Si	ICP-OES	13.6
DHW19M-26-SSM-W	Zr	ICP-OES	<1
DHW19M-27-SSM-W	Al	ICP-OES	<1
DHW19M-27-SSM-W	B	ICP-OES	23.6
DHW19M-27-SSM-W	Ca	ICP-OES	2.93
DHW19M-27-SSM-W	Cl	IC	<10
DHW19M-27-SSM-W	Cr	ICP-OES	80.6
DHW19M-27-SSM-W	F	IC	<10
DHW19M-27-SSM-W	Fe	ICP-OES	<1
DHW19M-27-SSM-W	K	ICP-OES	196
DHW19M-27-SSM-W	Li	ICP-OES	19.9
DHW19M-27-SSM-W	Mn	ICP-OES	<1
DHW19M-27-SSM-W	Na	ICP-OES	561
DHW19M-27-SSM-W	Ni	ICP-OES	<1
DHW19M-27-SSM-W	P	ICP-OES	1.71
DHW19M-27-SSM-W	PO4	IC	<10
DHW19M-27-SSM-W	PO4	ICP-OES	5.2
DHW19M-27-SSM-W	Pb	ICP-OES	<1
DHW19M-27-SSM-W	S	ICP-OES	339
DHW19M-27-SSM-W	SO4	IC	794
DHW19M-27-SSM-W	SO4	ICP-OES	1016
DHW19M-27-SSM-W	Si	ICP-OES	25.9
DHW19M-27-SSM-W	Zr	ICP-OES	<1
DHW19M-28-SSM-W	Al	ICP-OES	<1
DHW19M-28-SSM-W	B	ICP-OES	24.5
DHW19M-28-SSM-W	Ca	ICP-OES	<1
DHW19M-28-SSM-W	Cl	IC	<10
DHW19M-28-SSM-W	Cr	ICP-OES	48.2

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

Solution ID	Analyte	Analysis	Average Measured Concentration (mg/L)
DHW19M-28-SSM-W	F	IC	<10
DHW19M-28-SSM-W	Fe	ICP-OES	<1
DHW19M-28-SSM-W	K	ICP-OES	116
DHW19M-28-SSM-W	Li	ICP-OES	29.6
DHW19M-28-SSM-W	Mn	ICP-OES	<1
DHW19M-28-SSM-W	Na	ICP-OES	586
DHW19M-28-SSM-W	Ni	ICP-OES	<1
DHW19M-28-SSM-W	P	ICP-OES	1.79
DHW19M-28-SSM-W	PO4	IC	<10
DHW19M-28-SSM-W	PO4	ICP-OES	5.5
DHW19M-28-SSM-W	Pb	ICP-OES	<1
DHW19M-28-SSM-W	S	ICP-OES	403
DHW19M-28-SSM-W	SO4	IC	1180
DHW19M-28-SSM-W	SO4	ICP-OES	1207
DHW19M-28-SSM-W	Si	ICP-OES	26.3
DHW19M-28-SSM-W	Zr	ICP-OES	<1
DHW19M-29-SSM-W	Al	ICP-OES	<1
DHW19M-29-SSM-W	B	ICP-OES	13.5
DHW19M-29-SSM-W	Ca	ICP-OES	2.38
DHW19M-29-SSM-W	Cl	IC	<10
DHW19M-29-SSM-W	Cr	ICP-OES	71.2
DHW19M-29-SSM-W	F	IC	<10
DHW19M-29-SSM-W	Fe	ICP-OES	<1
DHW19M-29-SSM-W	K	ICP-OES	4.56
DHW19M-29-SSM-W	Li	ICP-OES	24.5
DHW19M-29-SSM-W	Mn	ICP-OES	<1
DHW19M-29-SSM-W	Na	ICP-OES	684
DHW19M-29-SSM-W	Ni	ICP-OES	<1
DHW19M-29-SSM-W	P	ICP-OES	4.28
DHW19M-29-SSM-W	PO4	IC	<10.1
DHW19M-29-SSM-W	PO4	ICP-OES	13.1
DHW19M-29-SSM-W	Pb	ICP-OES	<1
DHW19M-29-SSM-W	S	ICP-OES	408
DHW19M-29-SSM-W	SO4	IC	1160
DHW19M-29-SSM-W	SO4	ICP-OES	1222
DHW19M-29-SSM-W	Si	ICP-OES	18.5
DHW19M-29-SSM-W	Zr	ICP-OES	<1
DHW19M-30-SSM-W	Al	ICP-OES	<1
DHW19M-30-SSM-W	B	ICP-OES	34.7
DHW19M-30-SSM-W	Ca	ICP-OES	6.36
DHW19M-30-SSM-W	Cl	IC	<10
DHW19M-30-SSM-W	Cr	ICP-OES	156
DHW19M-30-SSM-W	F	IC	<10
DHW19M-30-SSM-W	Fe	ICP-OES	<1
DHW19M-30-SSM-W	K	ICP-OES	404
DHW19M-30-SSM-W	Li	ICP-OES	8.84
DHW19M-30-SSM-W	Mn	ICP-OES	<1
DHW19M-30-SSM-W	Na	ICP-OES	715
DHW19M-30-SSM-W	Ni	ICP-OES	<1
DHW19M-30-SSM-W	P	ICP-OES	3.19
DHW19M-30-SSM-W	PO4	IC	<10
DHW19M-30-SSM-W	PO4	ICP-OES	9.8

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

Solution ID	Analyte	Analysis	Average Measured Concentration (mg/L)
DHW19M-30-SSM-W	Pb	ICP-OES	<1
DHW19M-30-SSM-W	S	ICP-OES	505
DHW19M-30-SSM-W	SO4	IC	1050
DHW19M-30-SSM-W	SO4	ICP-OES	1513
DHW19M-30-SSM-W	Si	ICP-OES	11.5
DHW19M-30-SSM-W	Zr	ICP-OES	<1
DHW19M-31-SSM-W	Al	ICP-OES	<1
DHW19M-31-SSM-W	B	ICP-OES	26.2
DHW19M-31-SSM-W	Ca	ICP-OES	10.2
DHW19M-31-SSM-W	Cl	IC	<10
DHW19M-31-SSM-W	Cr	ICP-OES	57.4
DHW19M-31-SSM-W	F	IC	<10
DHW19M-31-SSM-W	Fe	ICP-OES	<1
DHW19M-31-SSM-W	K	ICP-OES	16.6
DHW19M-31-SSM-W	Li	ICP-OES	29.3
DHW19M-31-SSM-W	Mn	ICP-OES	<1
DHW19M-31-SSM-W	Na	ICP-OES	707
DHW19M-31-SSM-W	Ni	ICP-OES	<1
DHW19M-31-SSM-W	P	ICP-OES	2.47
DHW19M-31-SSM-W	PO4	IC	<10
DHW19M-31-SSM-W	PO4	ICP-OES	7.6
DHW19M-31-SSM-W	Pb	ICP-OES	<1
DHW19M-31-SSM-W	S	ICP-OES	459
DHW19M-31-SSM-W	SO4	IC	1200
DHW19M-31-SSM-W	SO4	ICP-OES	1375
DHW19M-31-SSM-W	Si	ICP-OES	7.28
DHW19M-31-SSM-W	Zr	ICP-OES	<1
DHW19M-32-SSM-W	Al	ICP-OES	<1
DHW19M-32-SSM-W	B	ICP-OES	25.1
DHW19M-32-SSM-W	Ca	ICP-OES	5.04
DHW19M-32-SSM-W	Cl	IC	<10
DHW19M-32-SSM-W	Cr	ICP-OES	100
DHW19M-32-SSM-W	F	IC	<10
DHW19M-32-SSM-W	Fe	ICP-OES	<1
DHW19M-32-SSM-W	K	ICP-OES	84.1
DHW19M-32-SSM-W	Li	ICP-OES	27.8
DHW19M-32-SSM-W	Mn	ICP-OES	<1
DHW19M-32-SSM-W	Na	ICP-OES	649
DHW19M-32-SSM-W	Ni	ICP-OES	<1
DHW19M-32-SSM-W	P	ICP-OES	3.79
DHW19M-32-SSM-W	PO4	IC	<10
DHW19M-32-SSM-W	PO4	ICP-OES	11.6
DHW19M-32-SSM-W	Pb	ICP-OES	<1
DHW19M-32-SSM-W	S	ICP-OES	403
DHW19M-32-SSM-W	SO4	IC	1020
DHW19M-32-SSM-W	SO4	ICP-OES	1207
DHW19M-32-SSM-W	Si	ICP-OES	22.8
DHW19M-32-SSM-W	Zr	ICP-OES	<1
DHW19M-33-SSM-W	Al	ICP-OES	<1
DHW19M-33-SSM-W	B	ICP-OES	46.2
DHW19M-33-SSM-W	Ca	ICP-OES	3.63
DHW19M-33-SSM-W	Cl	IC	<10

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

Solution ID	Analyte	Analysis	Average Measured Concentration (mg/L)
DHW19M-33-SSM-W	Cr	ICP-OES	295
DHW19M-33-SSM-W	F	IC	<10
DHW19M-33-SSM-W	Fe	ICP-OES	<1
DHW19M-33-SSM-W	K	ICP-OES	626
DHW19M-33-SSM-W	Li	ICP-OES	8.05
DHW19M-33-SSM-W	Mn	ICP-OES	<1
DHW19M-33-SSM-W	Na	ICP-OES	941
DHW19M-33-SSM-W	Ni	ICP-OES	<1
DHW19M-33-SSM-W	P	ICP-OES	7.7
DHW19M-33-SSM-W	PO4	IC	14.1
DHW19M-33-SSM-W	PO4	ICP-OES	23.6
DHW19M-33-SSM-W	Pb	ICP-OES	<1
DHW19M-33-SSM-W	S	ICP-OES	631
DHW19M-33-SSM-W	SO4	IC	1420
DHW19M-33-SSM-W	SO4	ICP-OES	1890
DHW19M-33-SSM-W	Si	ICP-OES	11
DHW19M-33-SSM-W	Zr	ICP-OES	<1

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

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

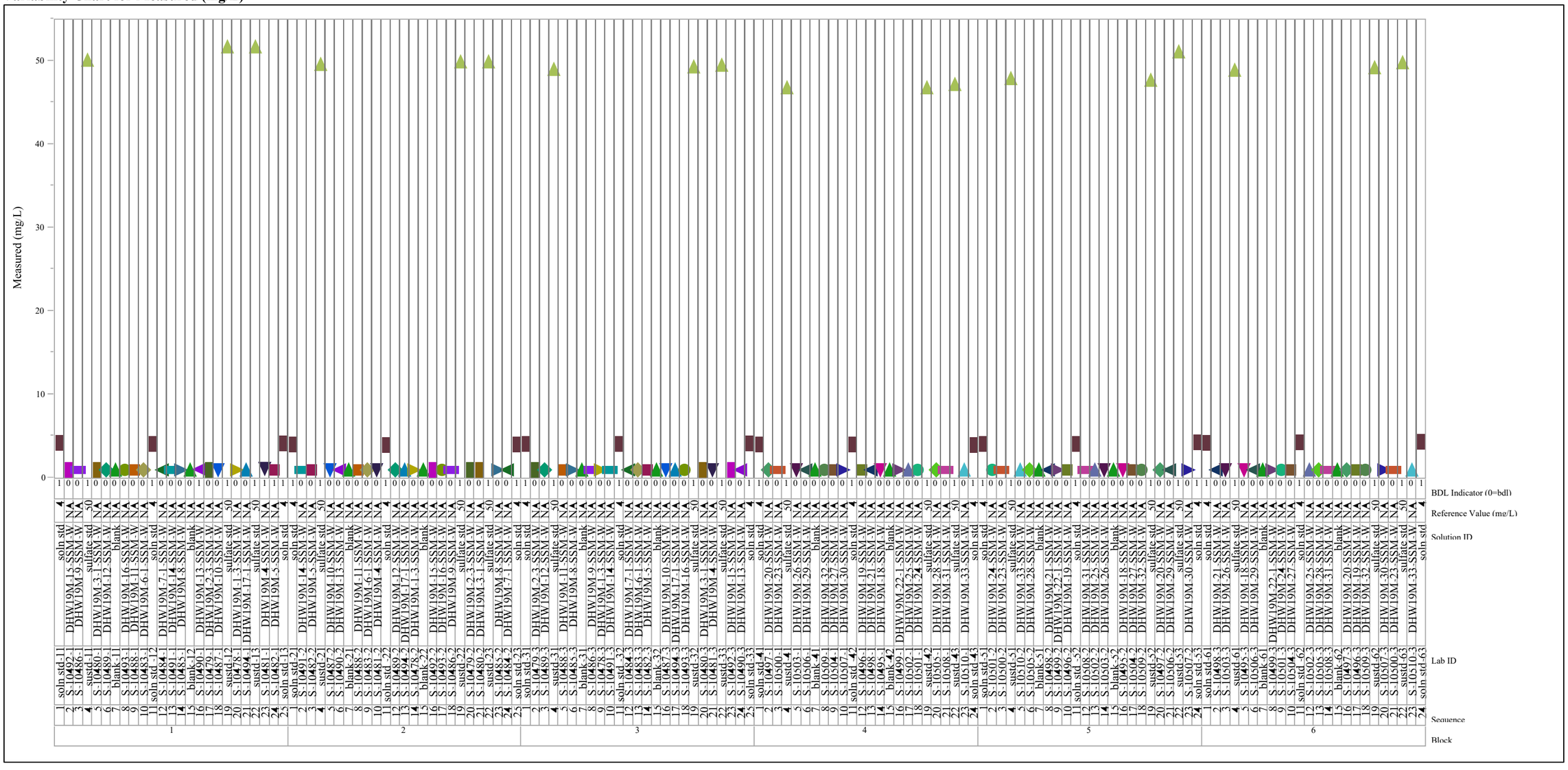


Exhibit B-1. Measurements of Wash Solutions by Analyte Grouped by Block in Analytical Sequence (continued)

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

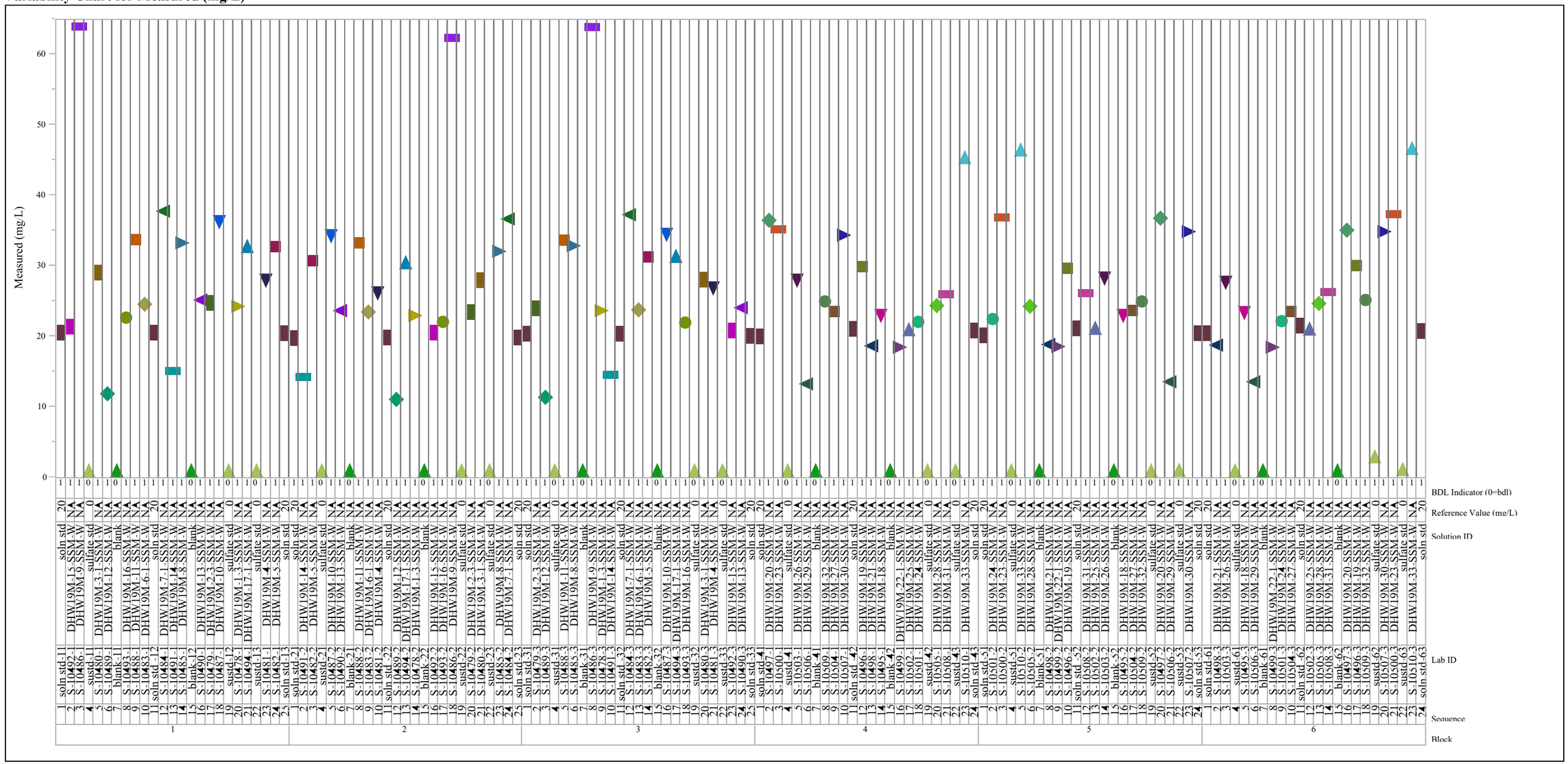


Exhibit B-1. Measurements of Wash Solutions by Analyte Grouped by Block in Analytical Sequence (continued)

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

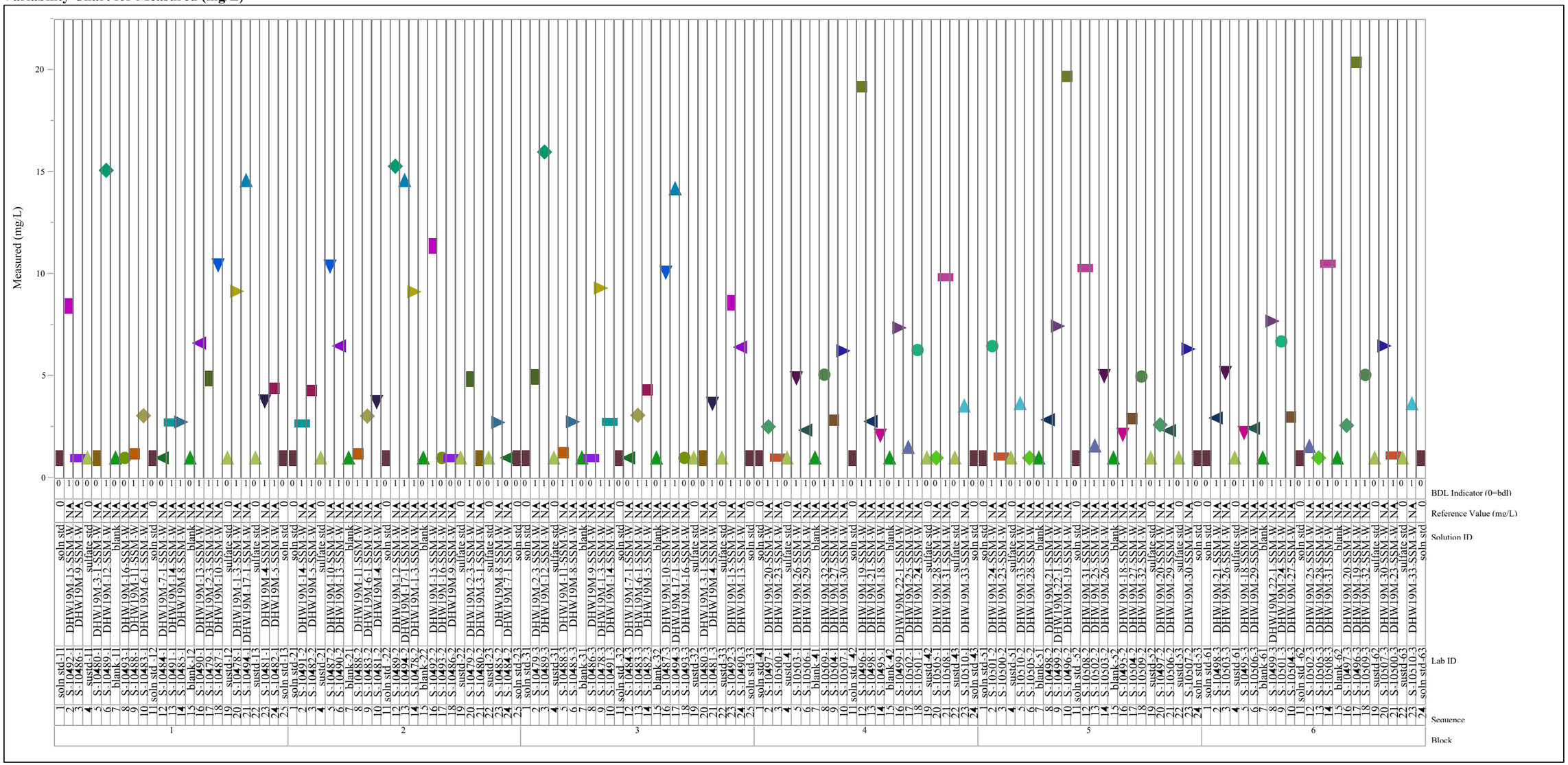


Exhibit B-1. Measurements of Wash Solutions by Analyte Grouped by Block in Analytical Sequence (continued)

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

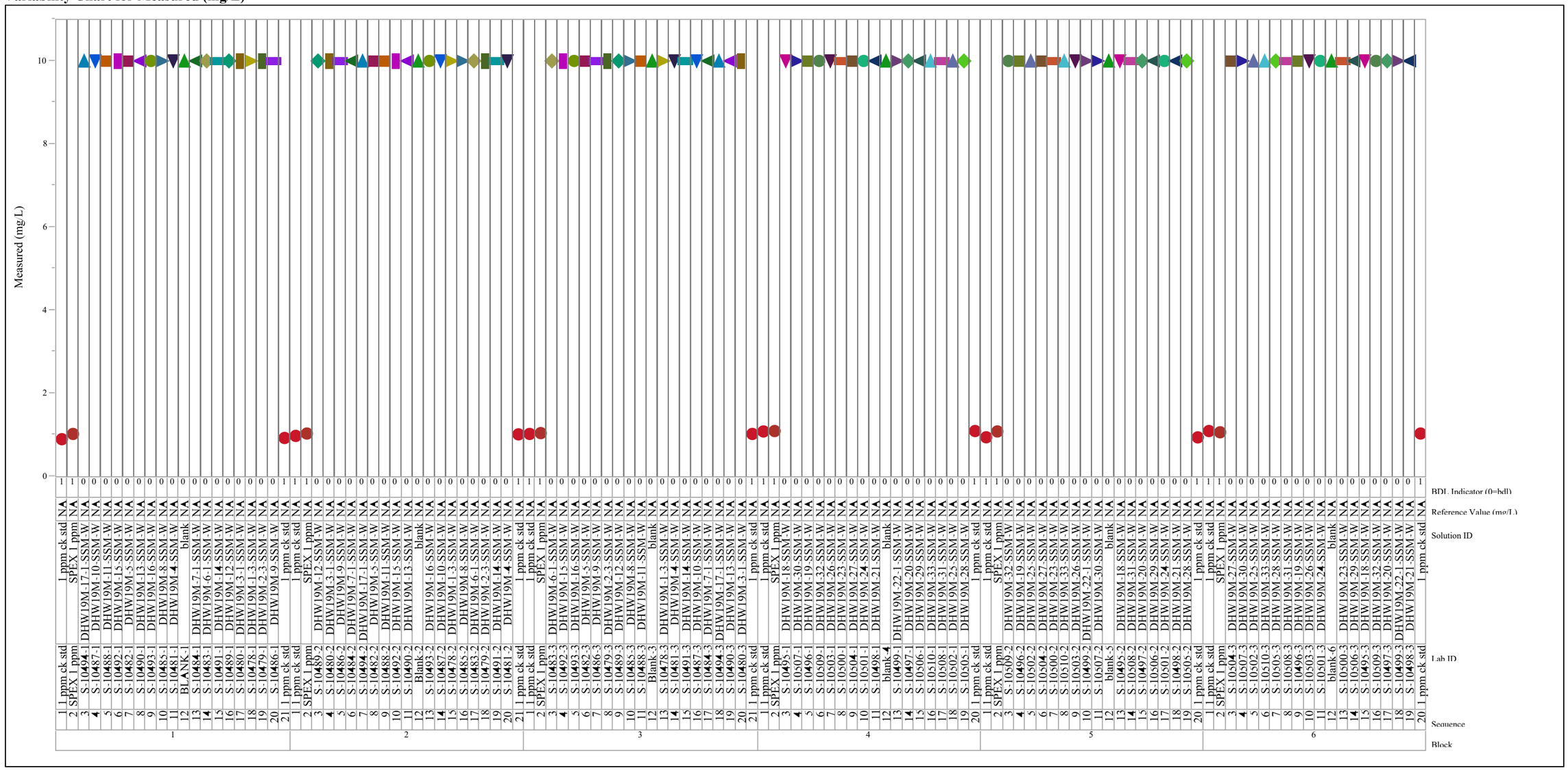


Exhibit B-1. Measurements of Wash Solutions by Analyte Grouped by Block in Analytical Sequence (continued)

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

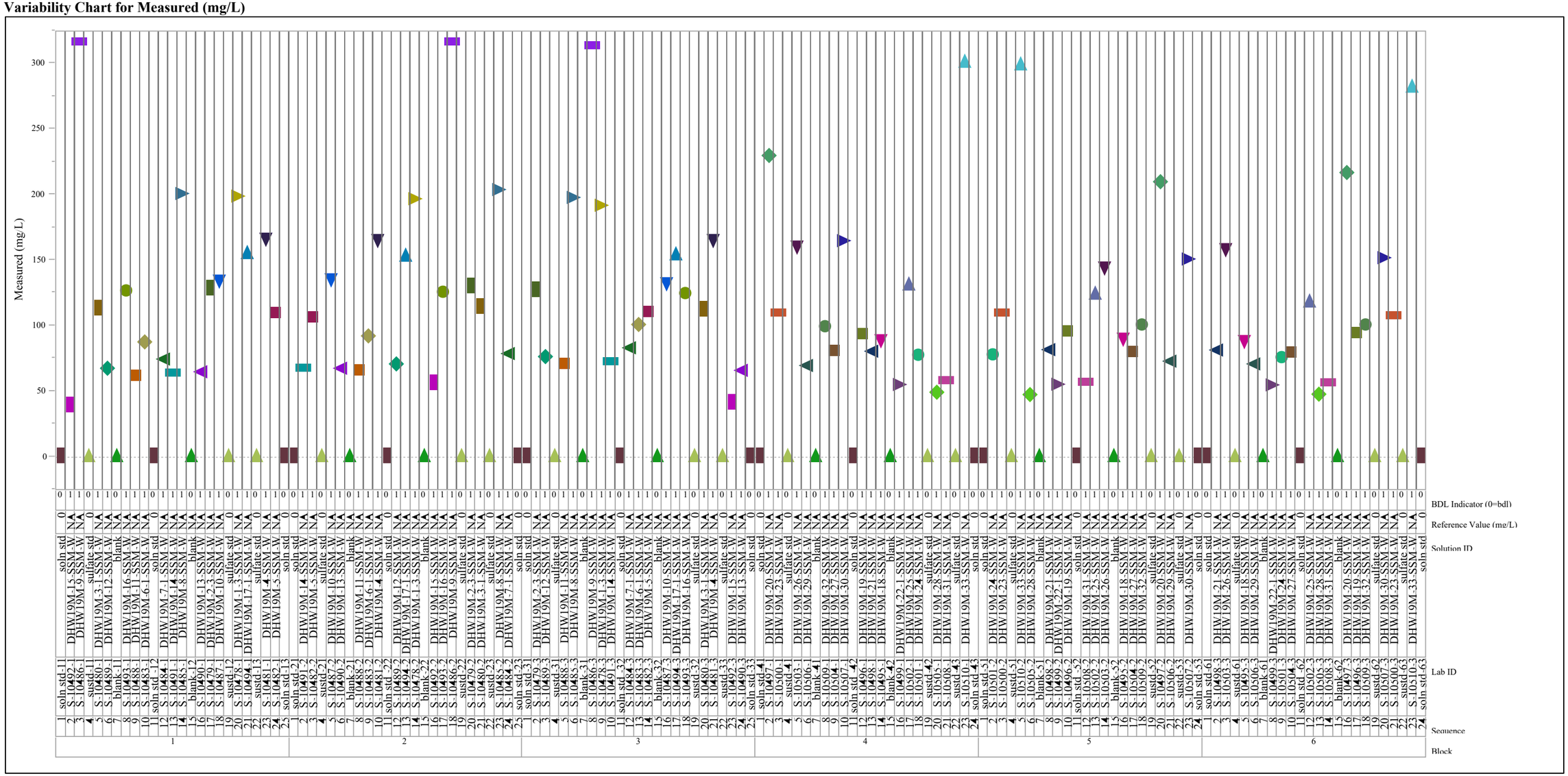


Exhibit B-1. Measurements of Wash Solutions by Analyte Grouped by Block in Analytical Sequence (continued)

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

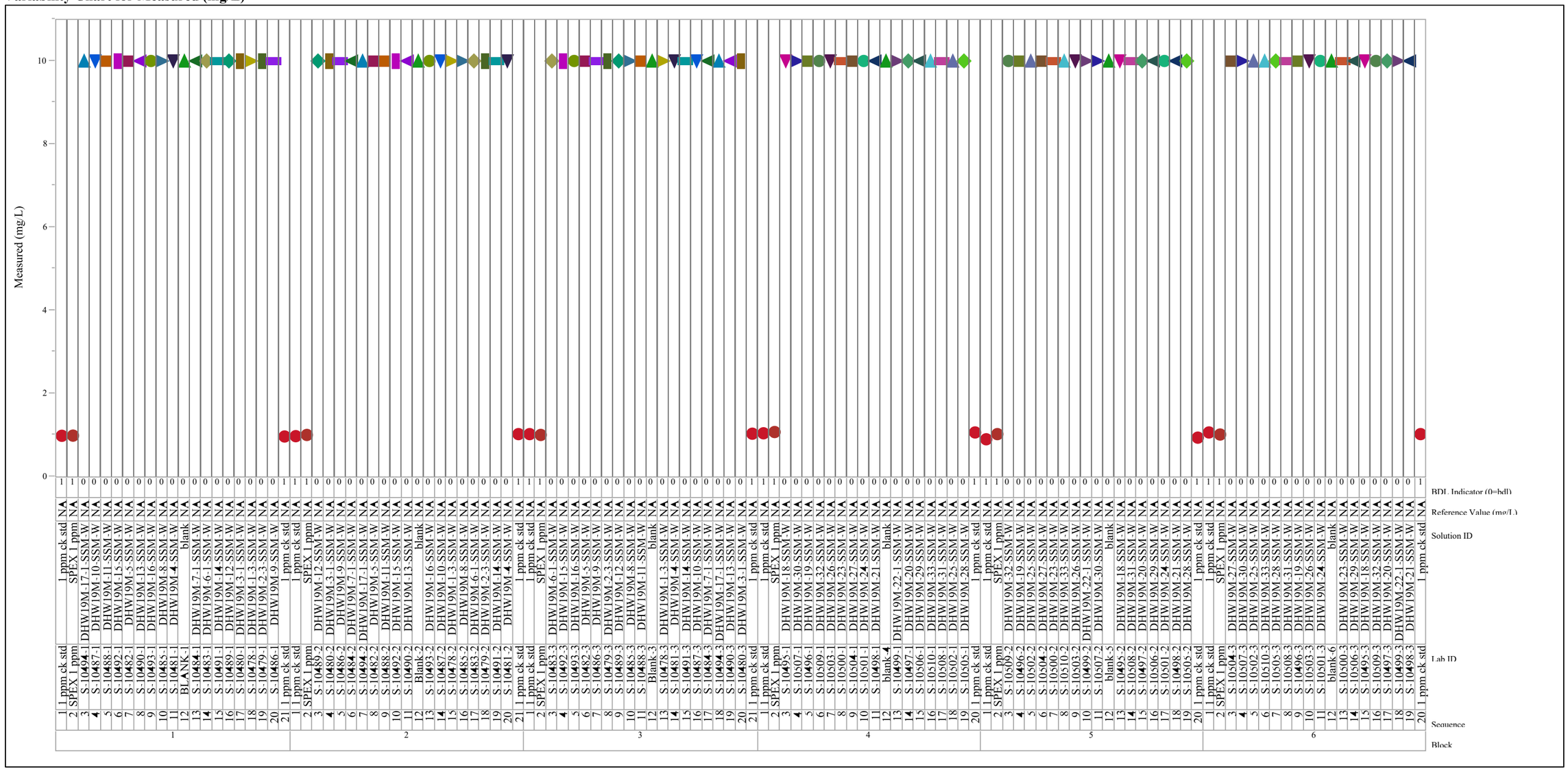


Exhibit B-1. Measurements of Wash Solutions by Analyte Grouped by Block in Analytical Sequence (continued)

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

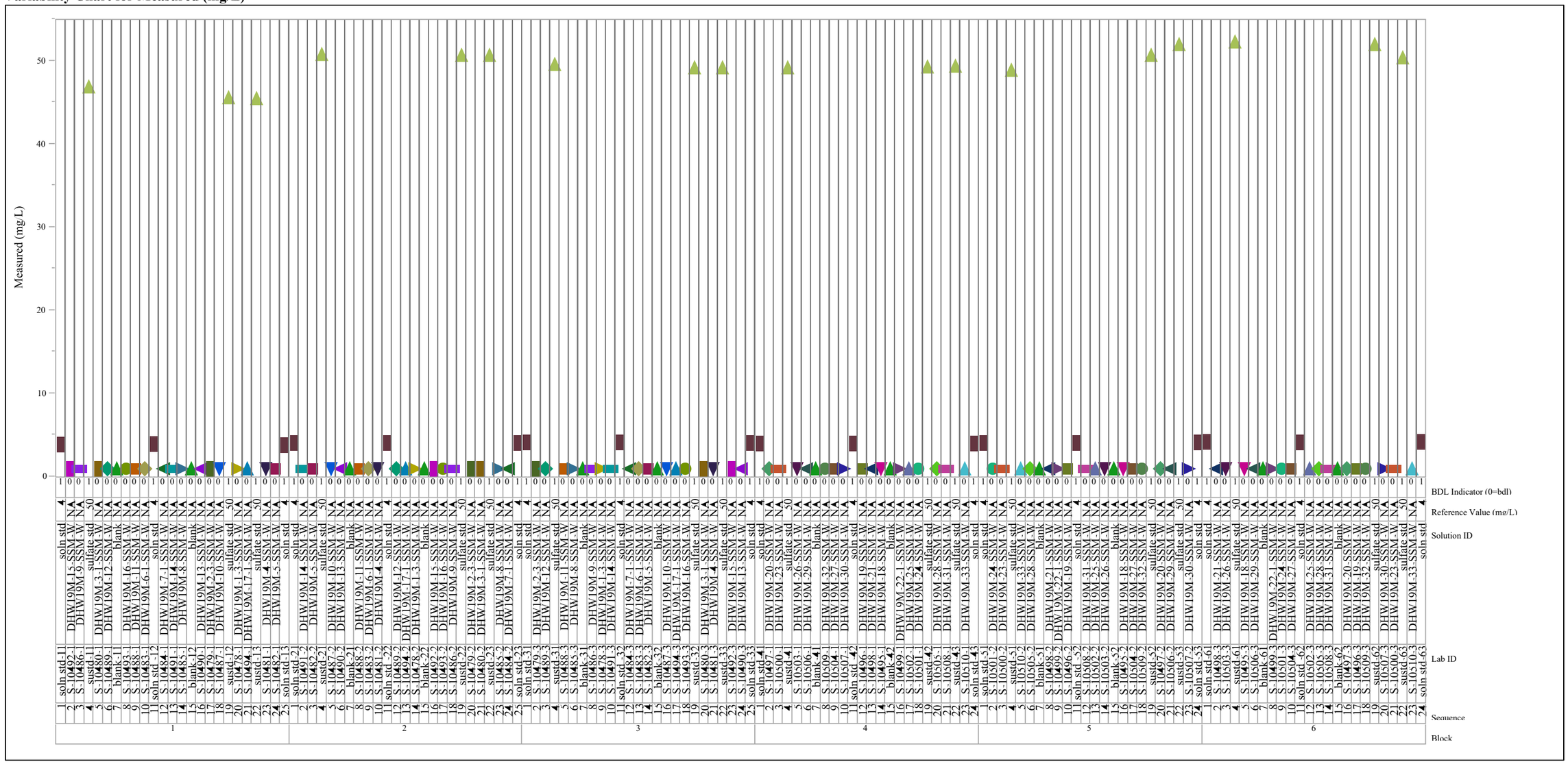


Exhibit B-1. Measurements of Wash Solutions by Analyte Grouped by Block in Analytical Sequence (continued)

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

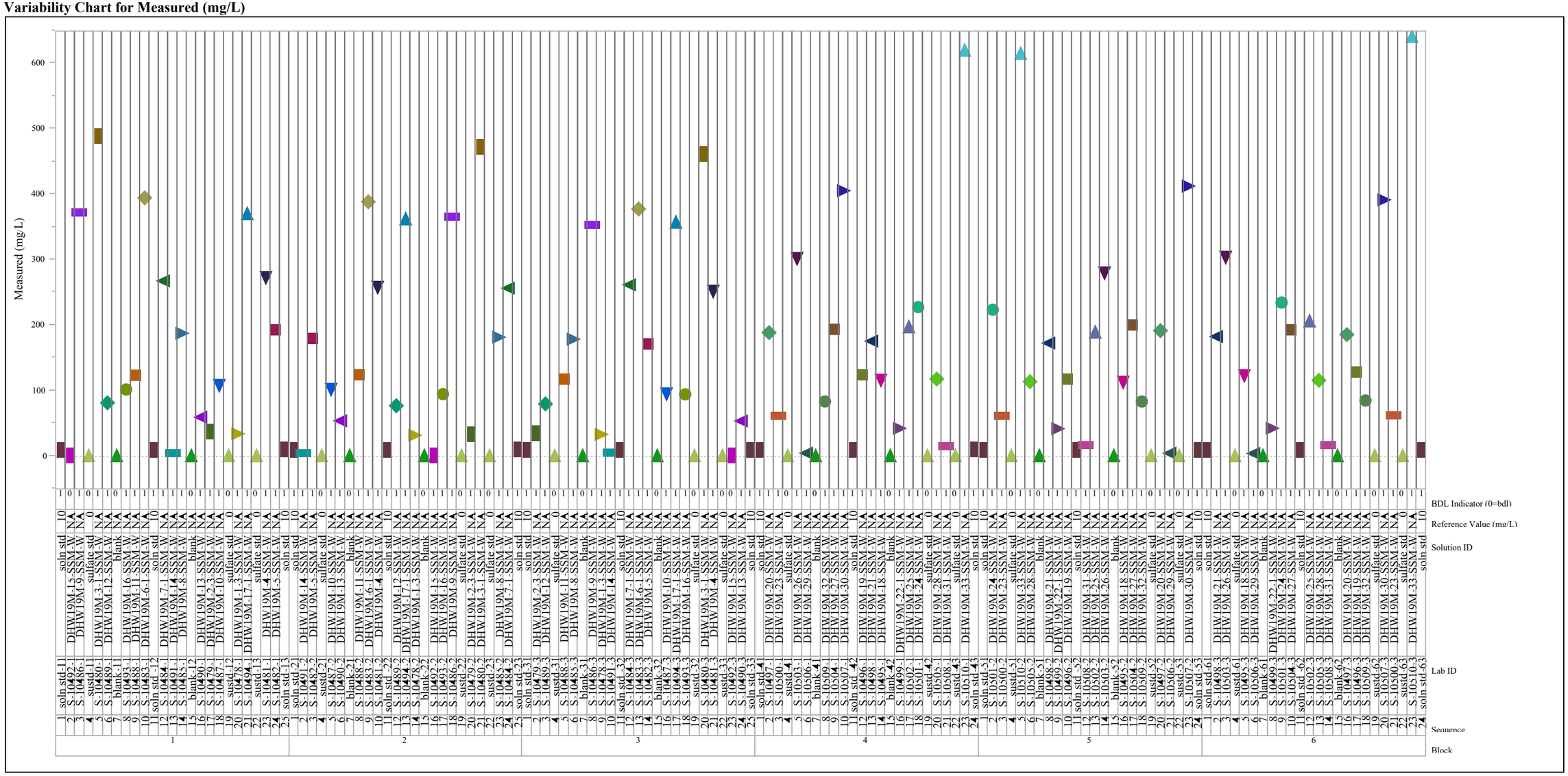


Exhibit B-1. Measurements of Wash Solutions by Analyte Grouped by Block in Analytical Sequence (continued)

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

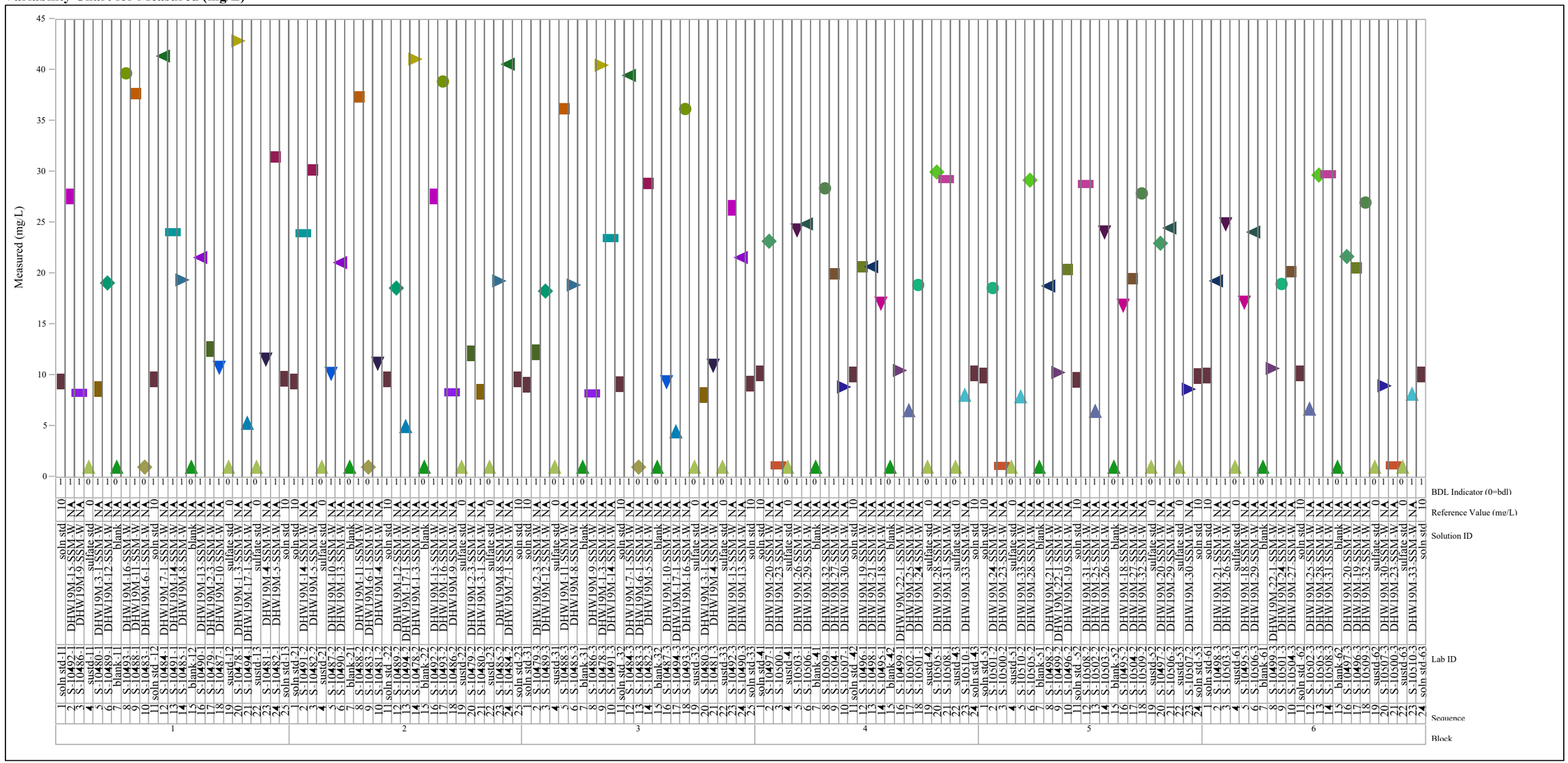


Exhibit B-1. Measurements of Wash Solutions by Analyte Grouped by Block in Analytical Sequence (continued)

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

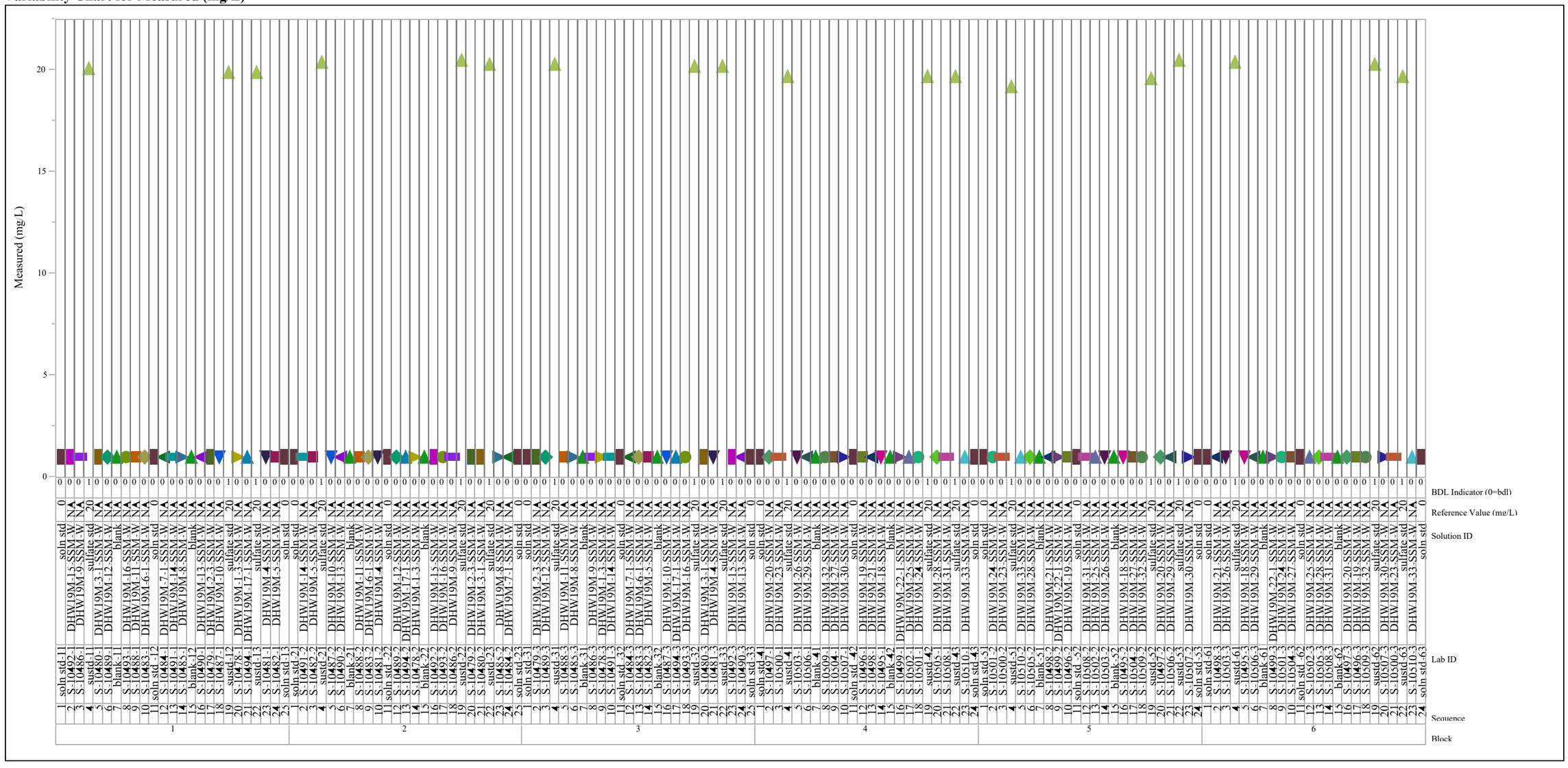


Exhibit B-1. Measurements of Wash Solutions by Analyte Grouped by Block in Analytical Sequence (continued)

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

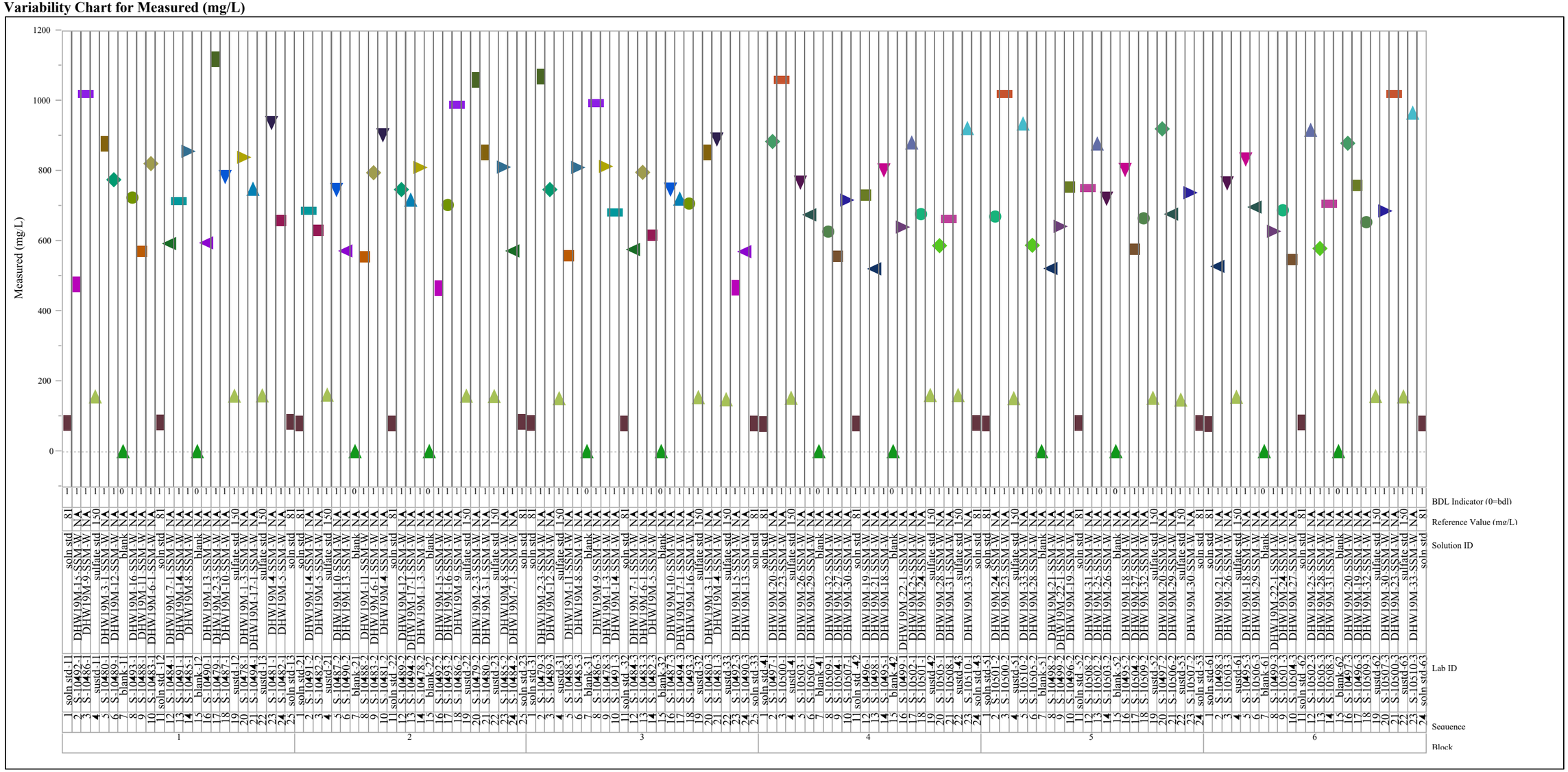


Exhibit B-1. Measurements of Wash Solutions by Analyte Grouped by Block in Analytical Sequence (continued)

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

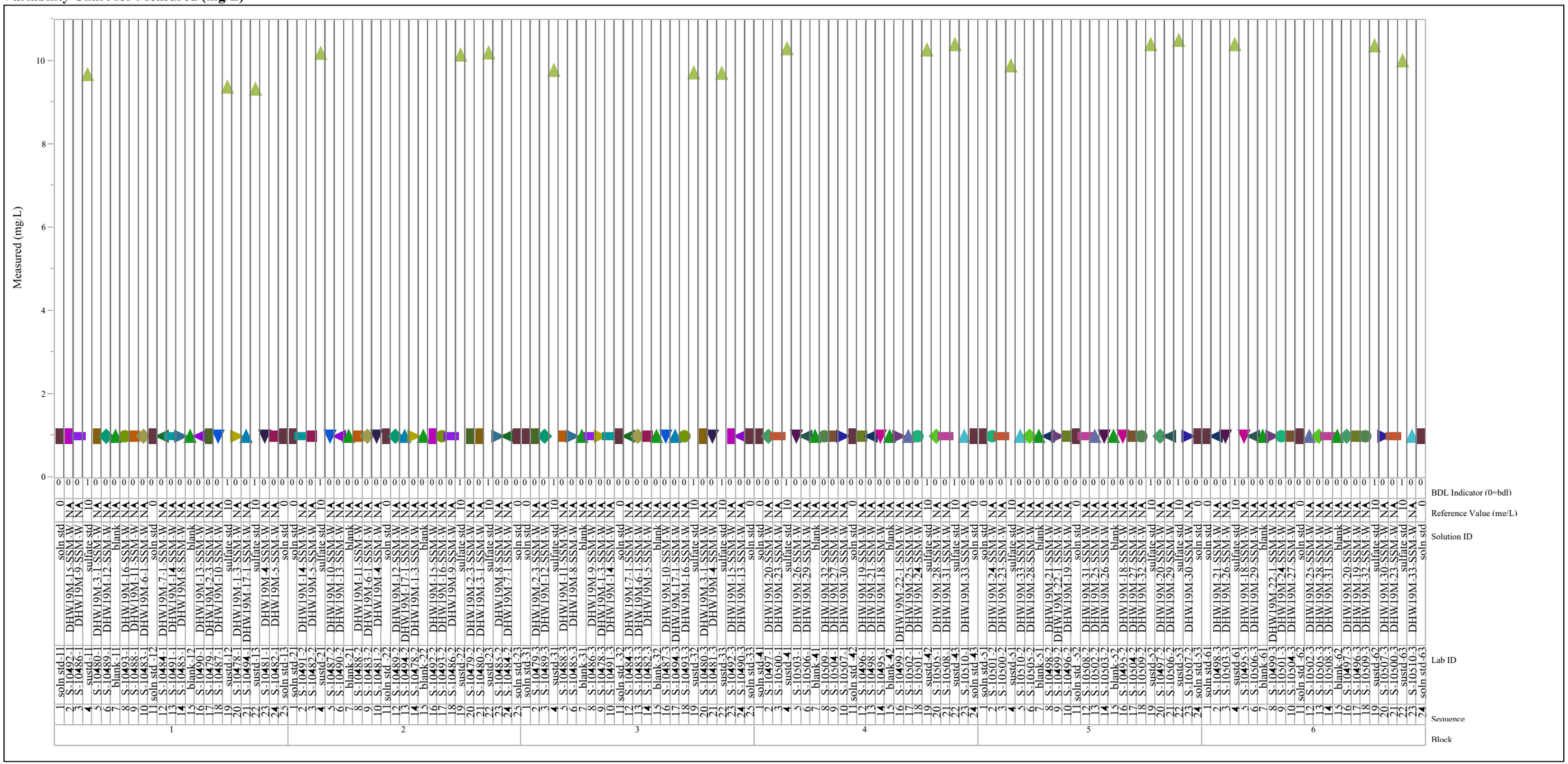


Exhibit B-1. Measurements of Wash Solutions by Analyte Grouped by Block in Analytical Sequence (continued)

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

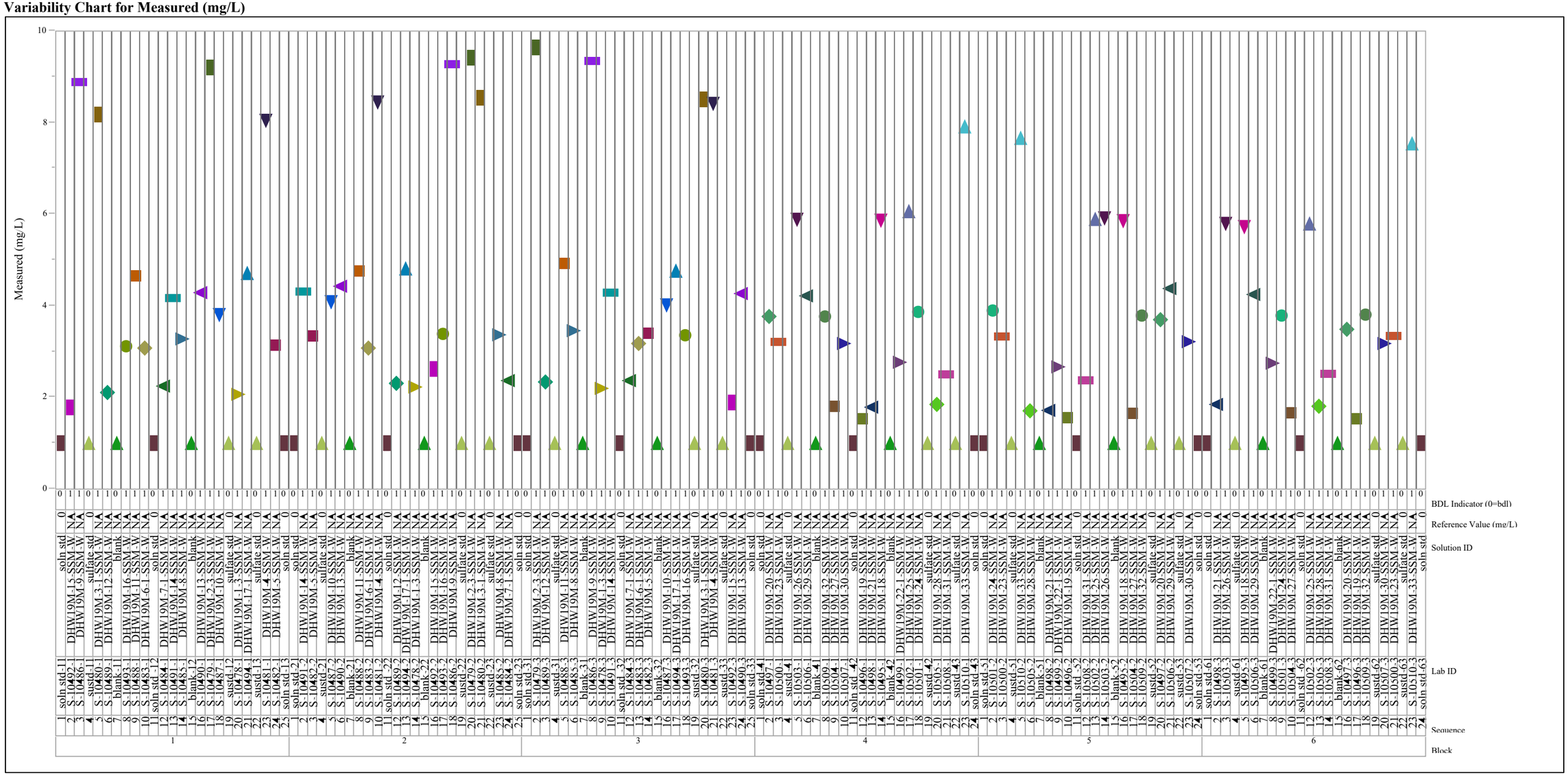


Exhibit B-1. Measurements of Wash Solutions by Analyte Grouped by Block in Analytical Sequence (continued)

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

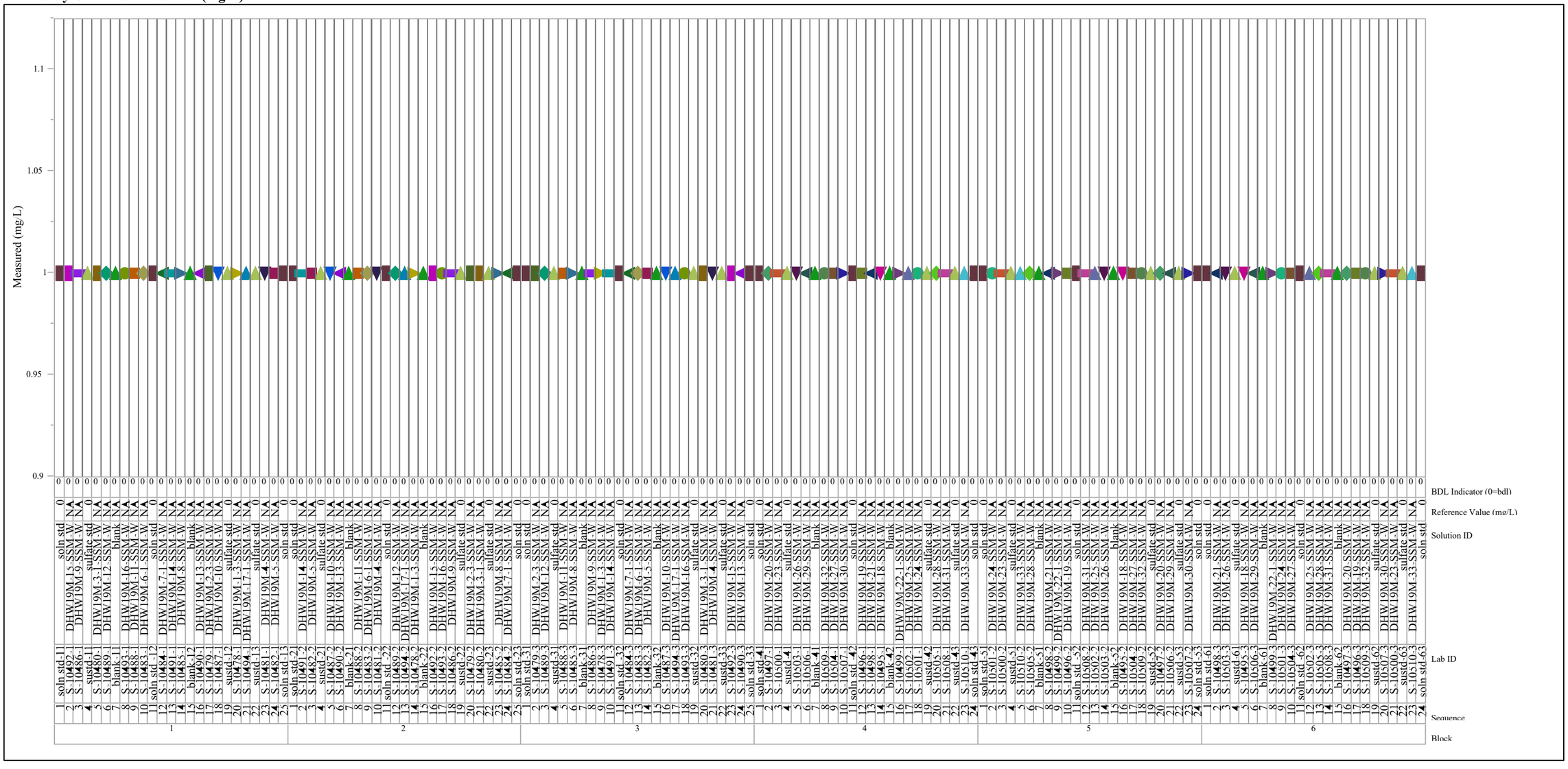


Exhibit B-1. Measurements of Wash Solutions by Analyte Grouped by Block in Analytical Sequence (continued)

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

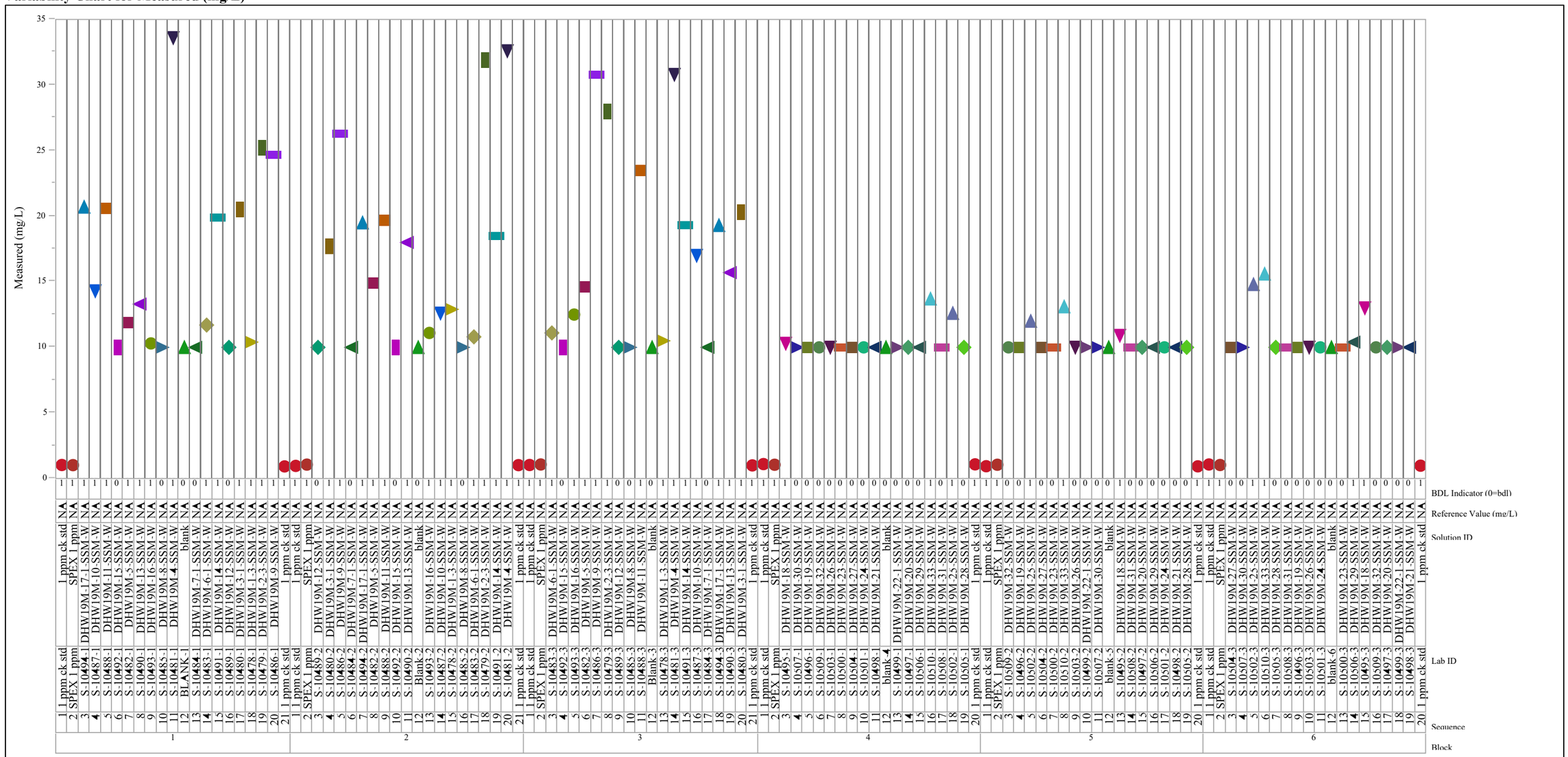


Exhibit B-1. Measurements of Wash Solutions by Analyte Grouped by Block in Analytical Sequence (continued)

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

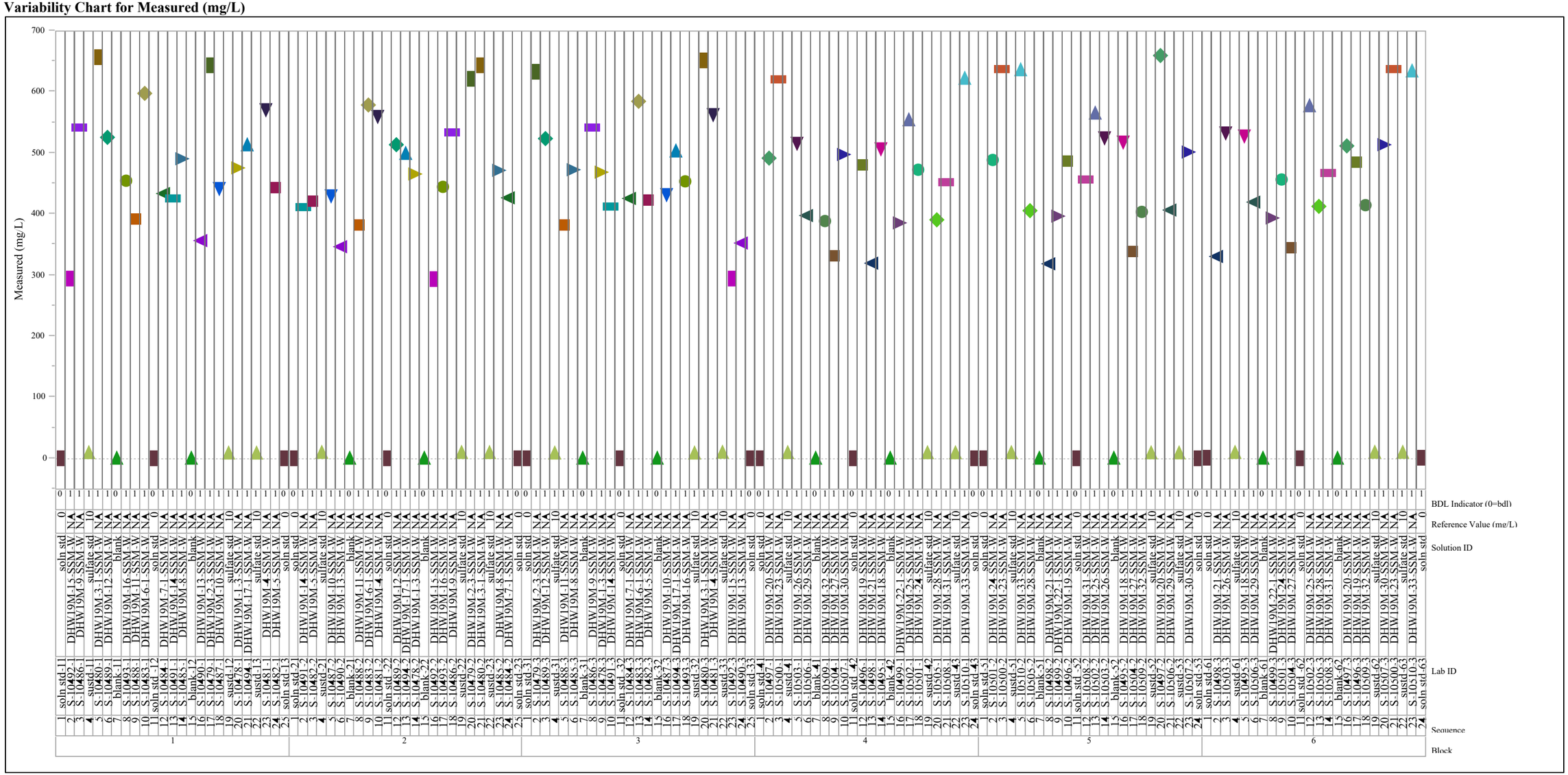


Exhibit B-1. Measurements of Wash Solutions by Analyte Grouped by Block in Analytical Sequence (continued)

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

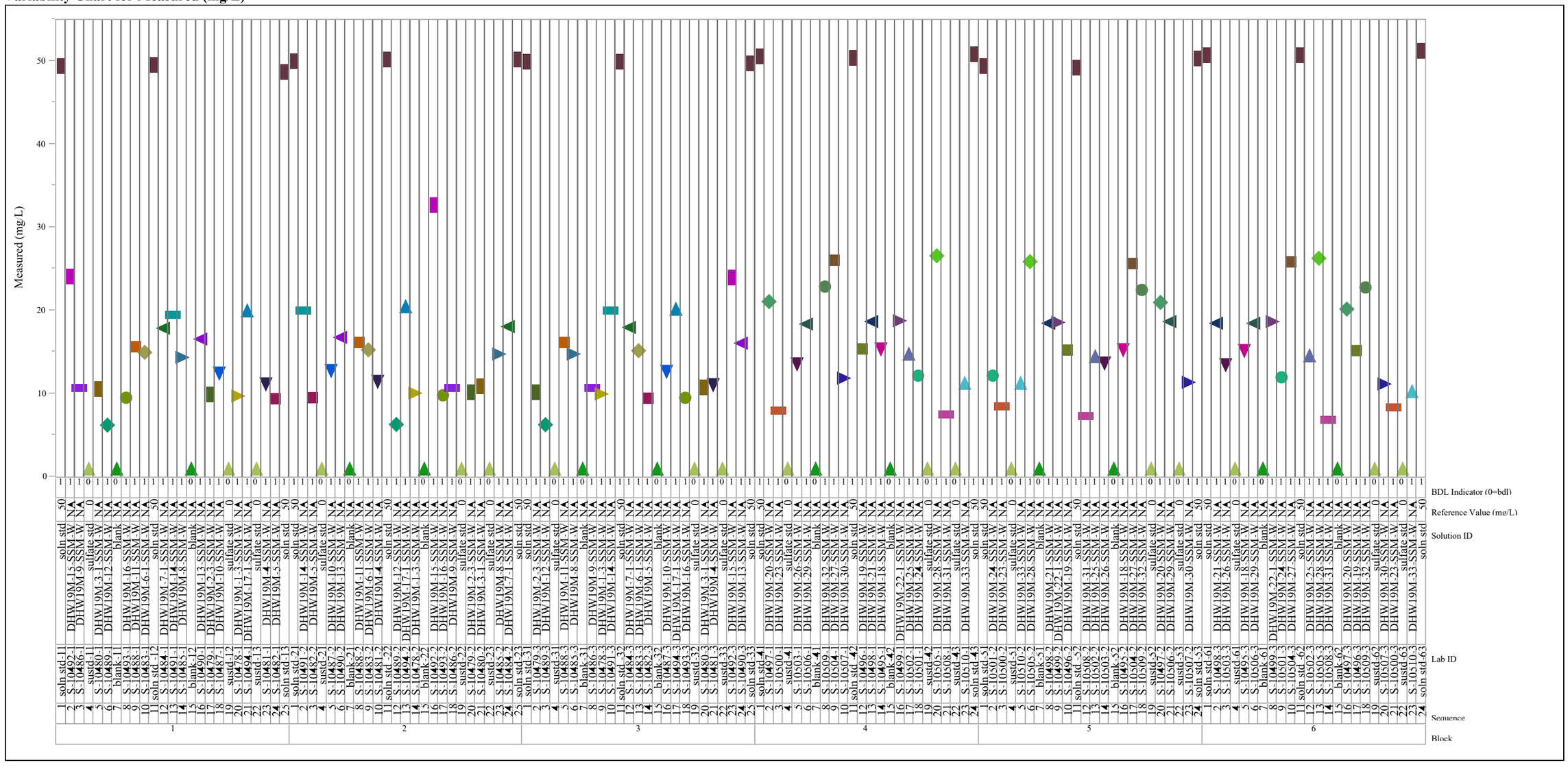


Exhibit B-1. Measurements of Wash Solutions by Analyte Grouped by Block in Analytical Sequence (continued)

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

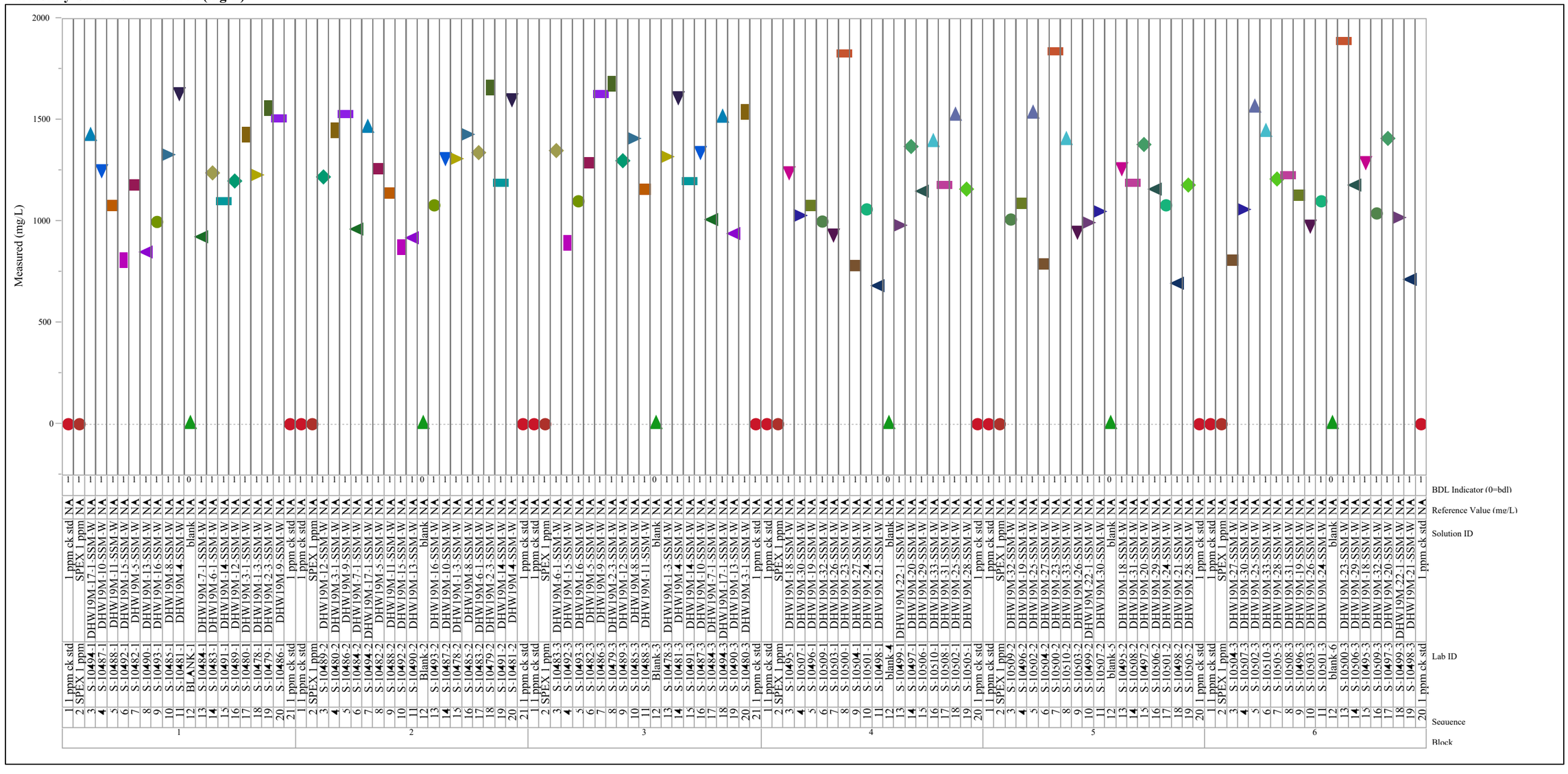


Exhibit B-1. Measurements of Wash Solutions by Analyte Grouped by Block in Analytical Sequence (continued)

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

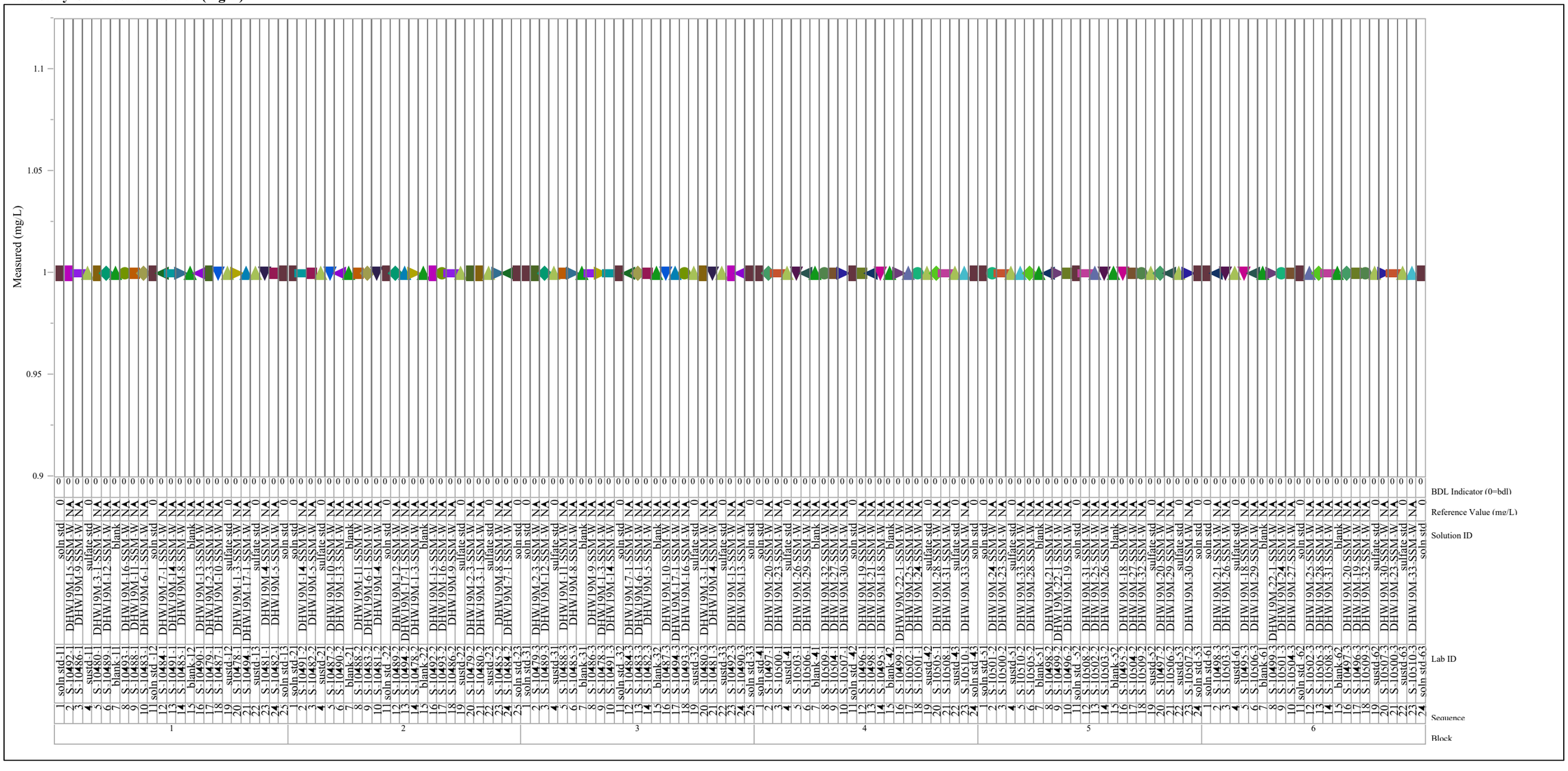


Exhibit B-2. Measurements of Wash Solutions by Analyte Grouped by Solution ID

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

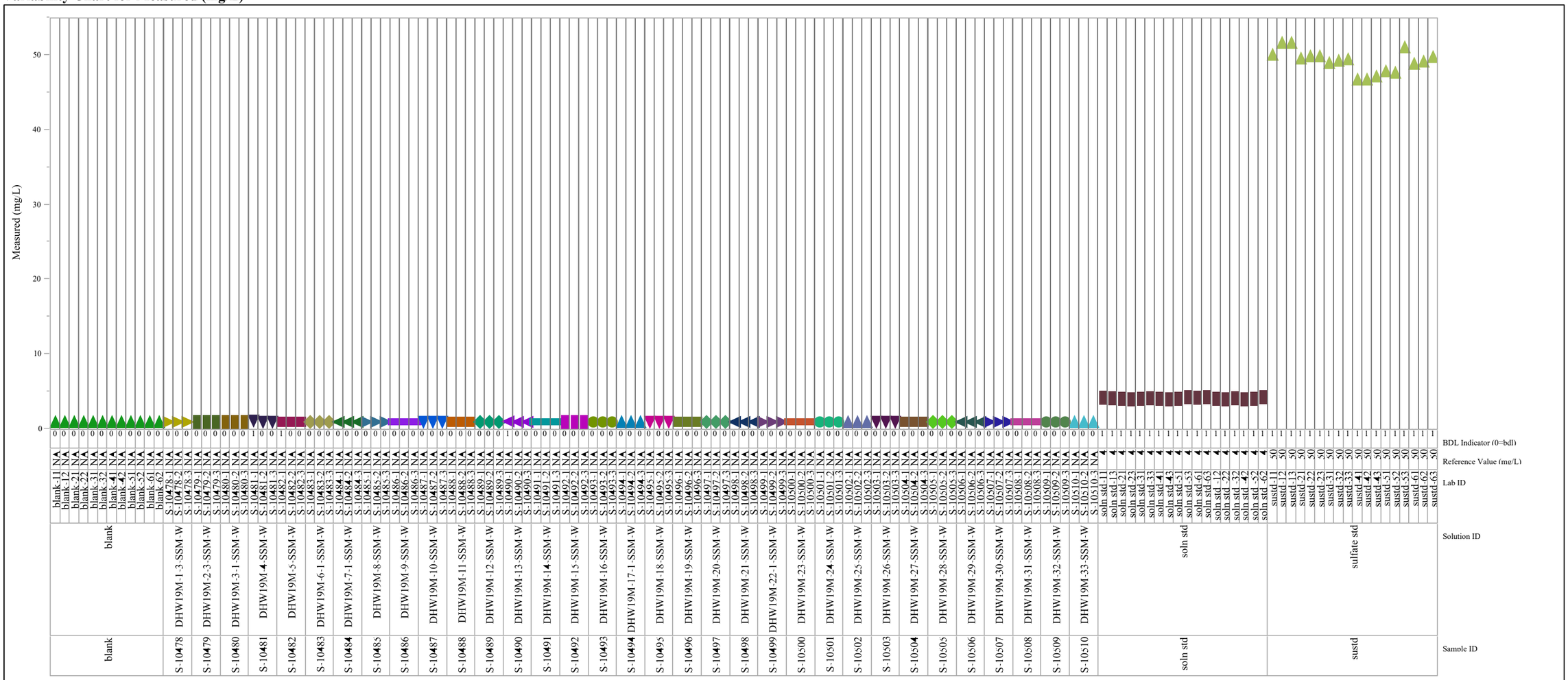


Exhibit B-2. Measurements of Wash Solutions by Analyte Grouped by Solution ID (continued)

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

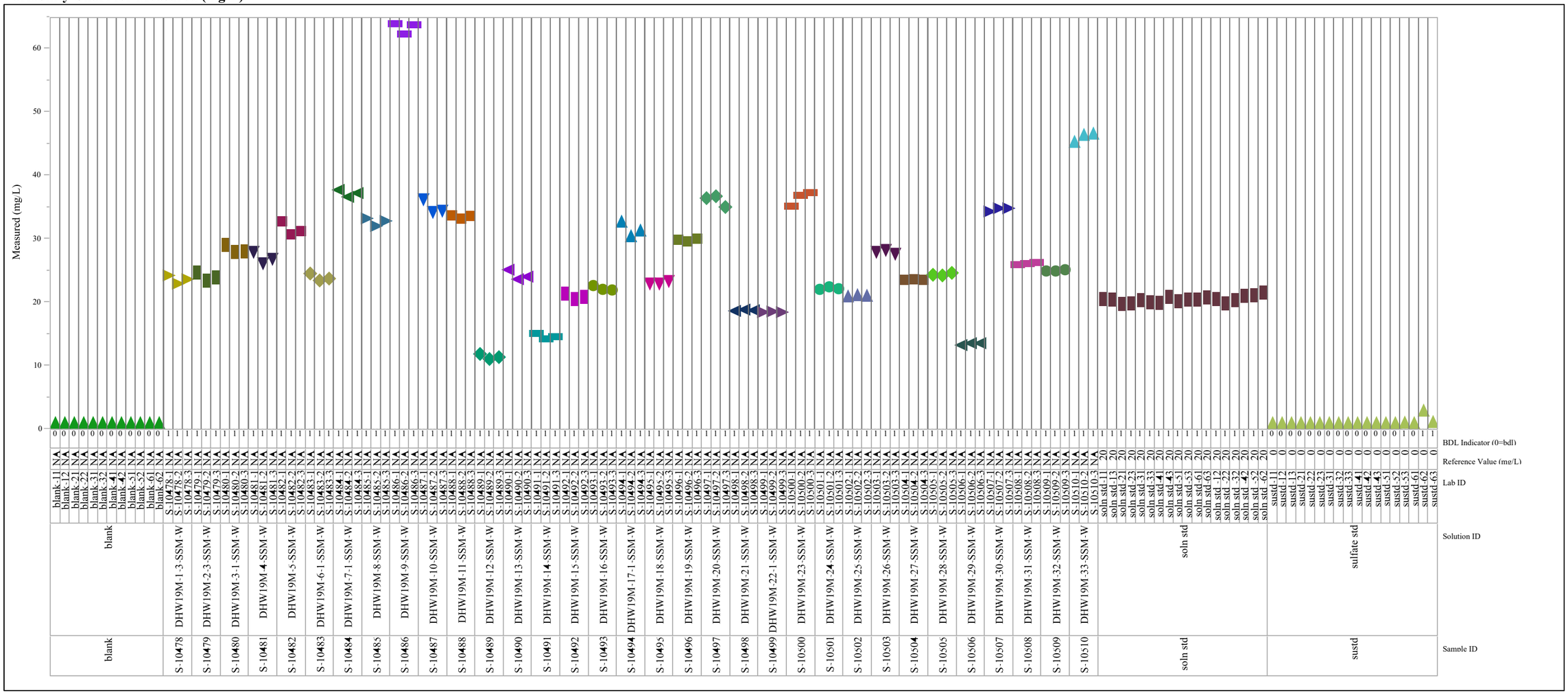


Exhibit B-2. Measurements of Wash Solutions by Analyte Grouped by Solution ID (continued)

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

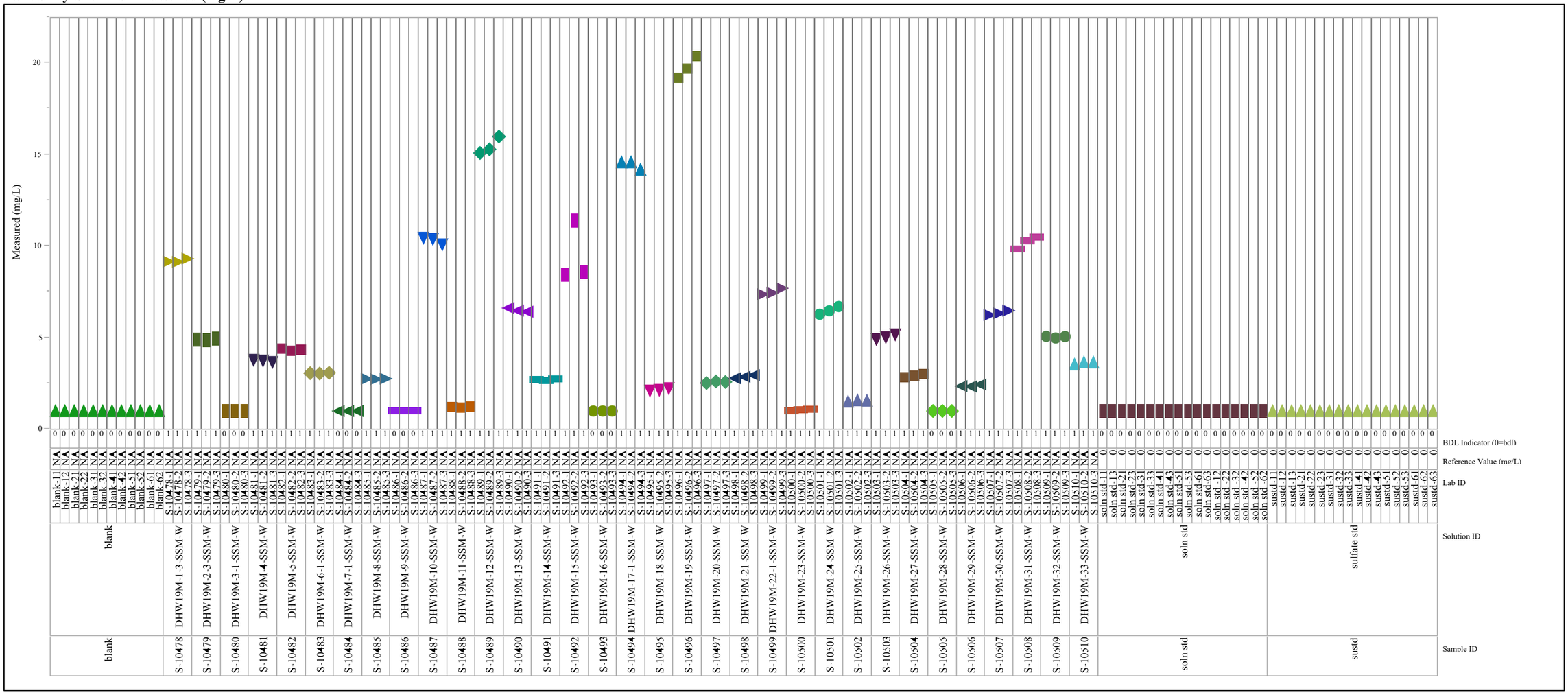
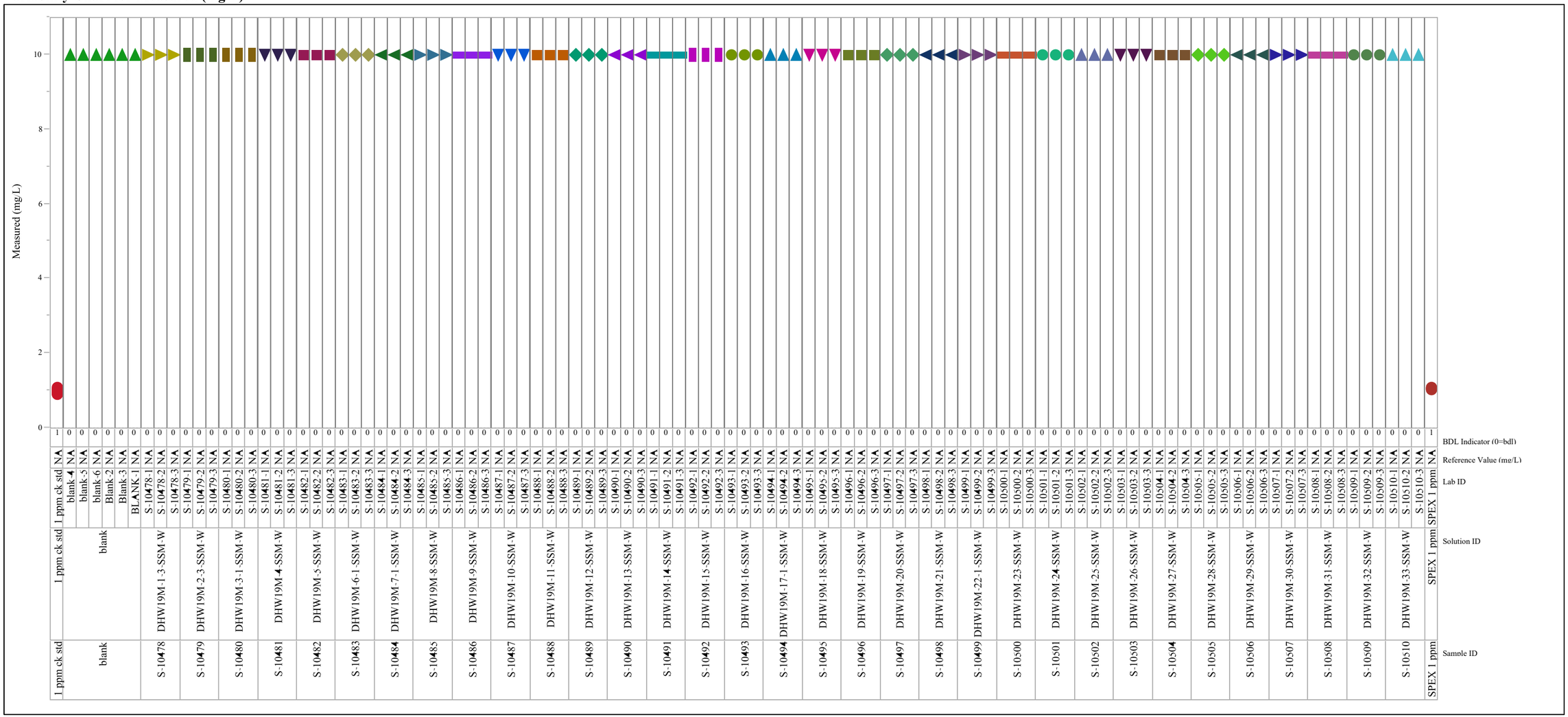


Exhibit B-2. Measurements of Wash Solutions by Analyte Grouped by Solution ID (continued)

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



1 ppm ck std	1 ppm ck std	1 ppm ck std	SPEX 1 ppm
1	NA	NA	NA
blank	blank-4	NA	NA
blank	blank-5	NA	NA
blank	blank-6	NA	NA
blank	Blank-2	NA	NA
blank	Blank-3	NA	NA
blank	BLANK-1	NA	NA
S-10478	DHW19M-1-3-SSM-W	S-10478-1	NA
S-10478	DHW19M-1-3-SSM-W	S-10478-2	NA
S-10478	DHW19M-1-3-SSM-W	S-10478-3	NA
S-10479	DHW19M-2-3-SSM-W	S-10479-1	NA
S-10479	DHW19M-2-3-SSM-W	S-10479-2	NA
S-10479	DHW19M-2-3-SSM-W	S-10479-3	NA
S-10480	DHW19M-3-1-SSM-W	S-10480-1	NA
S-10480	DHW19M-3-1-SSM-W	S-10480-2	NA
S-10480	DHW19M-3-1-SSM-W	S-10480-3	NA
S-10481	DHW19M-4-SSM-W	S-10481-1	NA
S-10481	DHW19M-4-SSM-W	S-10481-2	NA
S-10481	DHW19M-4-SSM-W	S-10481-3	NA
S-10482	DHW19M-5-SSM-W	S-10482-1	NA
S-10482	DHW19M-5-SSM-W	S-10482-2	NA
S-10482	DHW19M-5-SSM-W	S-10482-3	NA
S-10483	DHW19M-6-1-SSM-W	S-10483-1	NA
S-10483	DHW19M-6-1-SSM-W	S-10483-2	NA
S-10483	DHW19M-6-1-SSM-W	S-10483-3	NA
S-10484	DHW19M-7-1-SSM-W	S-10484-1	NA
S-10484	DHW19M-7-1-SSM-W	S-10484-2	NA
S-10484	DHW19M-7-1-SSM-W	S-10484-3	NA
S-10485	DHW19M-8-SSM-W	S-10485-1	NA
S-10485	DHW19M-8-SSM-W	S-10485-2	NA
S-10485	DHW19M-8-SSM-W	S-10485-3	NA
S-10486	DHW19M-9-SSM-W	S-10486-1	NA
S-10486	DHW19M-9-SSM-W	S-10486-2	NA
S-10486	DHW19M-9-SSM-W	S-10486-3	NA
S-10487	DHW19M-10-SSM-W	S-10487-1	NA
S-10487	DHW19M-10-SSM-W	S-10487-2	NA
S-10487	DHW19M-10-SSM-W	S-10487-3	NA
S-10488	DHW19M-11-SSM-W	S-10488-1	NA
S-10488	DHW19M-11-SSM-W	S-10488-2	NA
S-10488	DHW19M-11-SSM-W	S-10488-3	NA
S-10489	DHW19M-12-SSM-W	S-10489-1	NA
S-10489	DHW19M-12-SSM-W	S-10489-2	NA
S-10489	DHW19M-12-SSM-W	S-10489-3	NA
S-10490	DHW19M-13-SSM-W	S-10490-1	NA
S-10490	DHW19M-13-SSM-W	S-10490-2	NA
S-10490	DHW19M-13-SSM-W	S-10490-3	NA
S-10491	DHW19M-14-SSM-W	S-10491-1	NA
S-10491	DHW19M-14-SSM-W	S-10491-2	NA
S-10491	DHW19M-14-SSM-W	S-10491-3	NA
S-10492	DHW19M-15-SSM-W	S-10492-1	NA
S-10492	DHW19M-15-SSM-W	S-10492-2	NA
S-10492	DHW19M-15-SSM-W	S-10492-3	NA
S-10493	DHW19M-16-SSM-W	S-10493-1	NA
S-10493	DHW19M-16-SSM-W	S-10493-2	NA
S-10493	DHW19M-16-SSM-W	S-10493-3	NA
S-10494	DHW19M-17-1-SSM-W	S-10494-1	NA
S-10494	DHW19M-17-1-SSM-W	S-10494-2	NA
S-10494	DHW19M-17-1-SSM-W	S-10494-3	NA
S-10495	DHW19M-18-SSM-W	S-10495-1	NA
S-10495	DHW19M-18-SSM-W	S-10495-2	NA
S-10495	DHW19M-18-SSM-W	S-10495-3	NA
S-10496	DHW19M-19-SSM-W	S-10496-1	NA
S-10496	DHW19M-19-SSM-W	S-10496-2	NA
S-10496	DHW19M-19-SSM-W	S-10496-3	NA
S-10497	DHW19M-20-SSM-W	S-10497-1	NA
S-10497	DHW19M-20-SSM-W	S-10497-2	NA
S-10497	DHW19M-20-SSM-W	S-10497-3	NA
S-10498	DHW19M-21-SSM-W	S-10498-1	NA
S-10498	DHW19M-21-SSM-W	S-10498-2	NA
S-10498	DHW19M-21-SSM-W	S-10498-3	NA
S-10499	DHW19M-22-1-SSM-W	S-10499-1	NA
S-10499	DHW19M-22-1-SSM-W	S-10499-2	NA
S-10499	DHW19M-22-1-SSM-W	S-10499-3	NA
S-10500	DHW19M-23-SSM-W	S-10500-1	NA
S-10500	DHW19M-23-SSM-W	S-10500-2	NA
S-10500	DHW19M-23-SSM-W	S-10500-3	NA
S-10501	DHW19M-24-SSM-W	S-10501-1	NA
S-10501	DHW19M-24-SSM-W	S-10501-2	NA
S-10501	DHW19M-24-SSM-W	S-10501-3	NA
S-10502	DHW19M-25-SSM-W	S-10502-1	NA
S-10502	DHW19M-25-SSM-W	S-10502-2	NA
S-10502	DHW19M-25-SSM-W	S-10502-3	NA
S-10503	DHW19M-26-SSM-W	S-10503-1	NA
S-10503	DHW19M-26-SSM-W	S-10503-2	NA
S-10503	DHW19M-26-SSM-W	S-10503-3	NA
S-10504	DHW19M-27-SSM-W	S-10504-1	NA
S-10504	DHW19M-27-SSM-W	S-10504-2	NA
S-10504	DHW19M-27-SSM-W	S-10504-3	NA
S-10505	DHW19M-28-SSM-W	S-10505-1	NA
S-10505	DHW19M-28-SSM-W	S-10505-2	NA
S-10505	DHW19M-28-SSM-W	S-10505-3	NA
S-10506	DHW19M-29-SSM-W	S-10506-1	NA
S-10506	DHW19M-29-SSM-W	S-10506-2	NA
S-10506	DHW19M-29-SSM-W	S-10506-3	NA
S-10507	DHW19M-30-SSM-W	S-10507-1	NA
S-10507	DHW19M-30-SSM-W	S-10507-2	NA
S-10507	DHW19M-30-SSM-W	S-10507-3	NA
S-10508	DHW19M-31-SSM-W	S-10508-1	NA
S-10508	DHW19M-31-SSM-W	S-10508-2	NA
S-10508	DHW19M-31-SSM-W	S-10508-3	NA
S-10509	DHW19M-32-SSM-W	S-10509-1	NA
S-10509	DHW19M-32-SSM-W	S-10509-2	NA
S-10509	DHW19M-32-SSM-W	S-10509-3	NA
S-10510	DHW19M-33-SSM-W	S-10510-1	NA
S-10510	DHW19M-33-SSM-W	S-10510-2	NA
S-10510	DHW19M-33-SSM-W	S-10510-3	NA
SPEX 1 ppm	SPEX 1 ppm	SPEX 1 ppm	NA

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

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

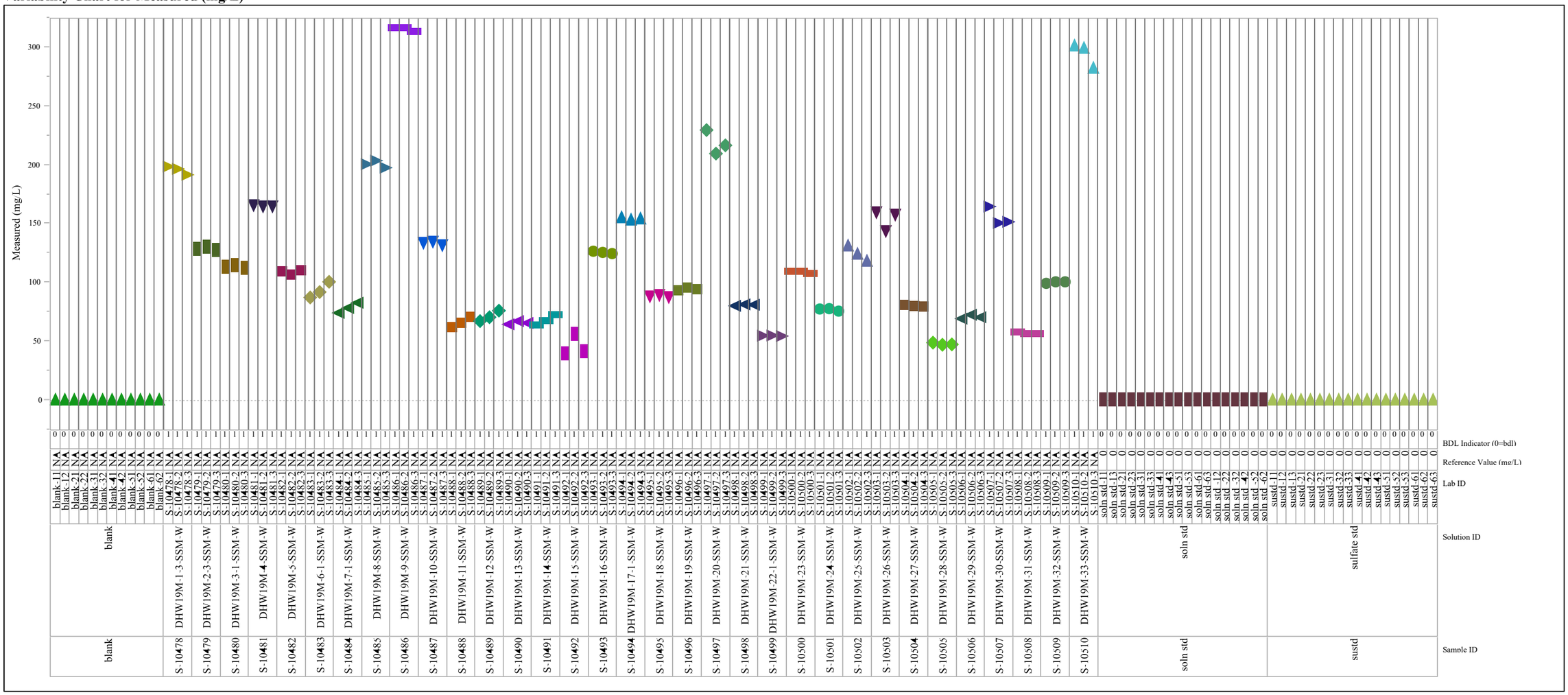
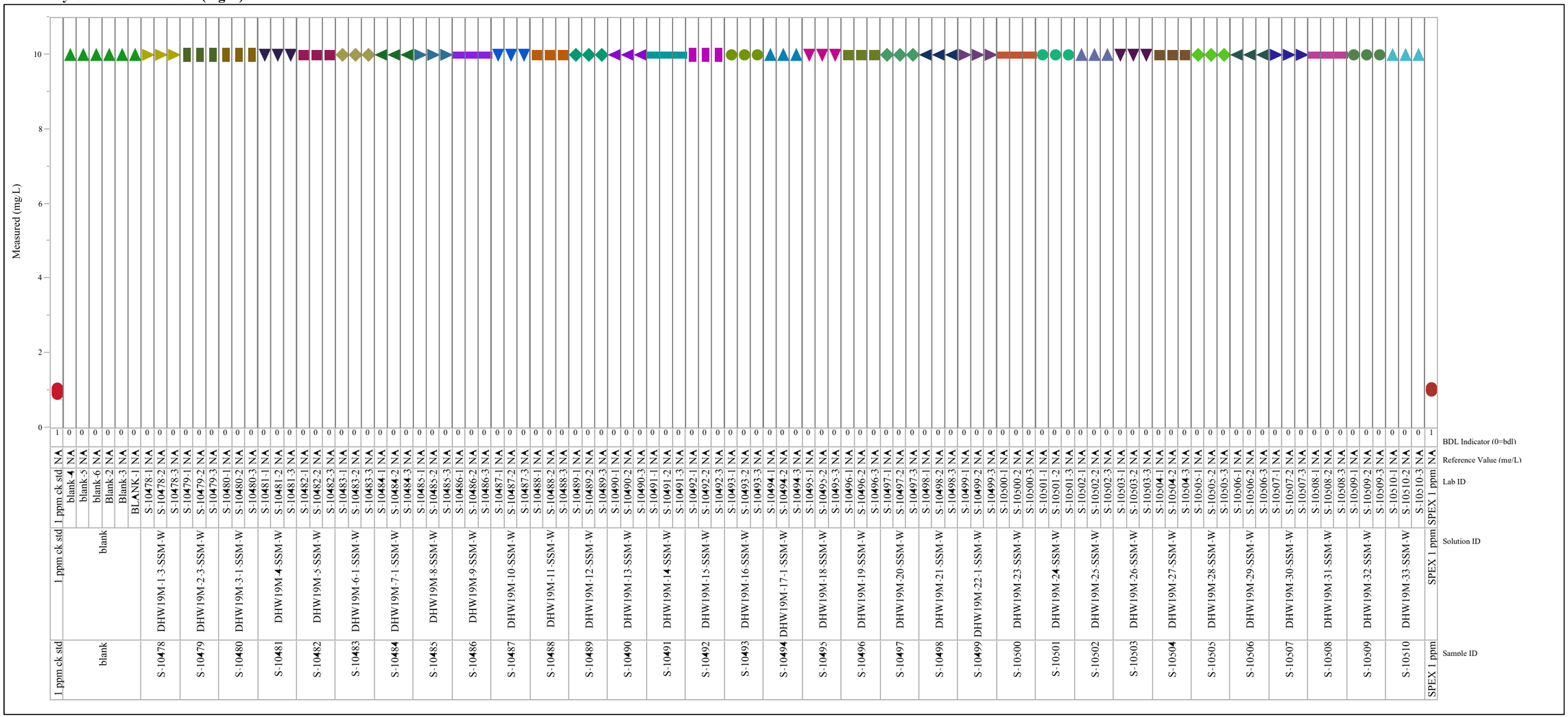


Exhibit B-2. Measurements of Wash Solutions by Analyte Grouped by Solution ID (continued)

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



1 ppm ck std	1 ppm ck std	1 ppm ck std	Lab ID	BDL Indicator (0=bdl)	Reference Value (mg/L)
S-10510	DHW19M-33-SSM-W	SPEX 1 ppm	S-10510-2	0	NA
			S-10510-3	0	NA
			S-10510-1	0	NA
S-10509	DHW19M-32-SSM-W		S-10509-2	0	NA
			S-10509-3	0	NA
			S-10509-1	0	NA
S-10508	DHW19M-31-SSM-W		S-10508-2	0	NA
			S-10508-3	0	NA
			S-10508-1	0	NA
S-10507	DHW19M-30-SSM-W		S-10507-2	0	NA
			S-10507-3	0	NA
			S-10507-1	0	NA
S-10506	DHW19M-29-SSM-W		S-10506-2	0	NA
			S-10506-3	0	NA
			S-10506-1	0	NA
S-10505	DHW19M-28-SSM-W		S-10505-2	0	NA
			S-10505-3	0	NA
			S-10505-1	0	NA
S-10504	DHW19M-27-SSM-W		S-10504-2	0	NA
			S-10504-3	0	NA
			S-10504-1	0	NA
S-10503	DHW19M-26-SSM-W		S-10503-2	0	NA
			S-10503-3	0	NA
			S-10503-1	0	NA
S-10502	DHW19M-25-SSM-W		S-10502-2	0	NA
			S-10502-3	0	NA
			S-10502-1	0	NA
S-10501	DHW19M-24-SSM-W		S-10501-2	0	NA
			S-10501-3	0	NA
			S-10501-1	0	NA
S-10500	DHW19M-23-SSM-W		S-10500-2	0	NA
			S-10500-3	0	NA
			S-10500-1	0	NA
S-10499	DHW19M-22-1-SSM-W		S-10499-2	0	NA
			S-10499-3	0	NA
			S-10499-1	0	NA
S-10498	DHW19M-21-SSM-W		S-10498-2	0	NA
			S-10498-3	0	NA
			S-10498-1	0	NA
S-10497	DHW19M-20-SSM-W		S-10497-2	0	NA
			S-10497-3	0	NA
			S-10497-1	0	NA
S-10496	DHW19M-19-SSM-W		S-10496-2	0	NA
			S-10496-3	0	NA
			S-10496-1	0	NA
S-10495	DHW19M-18-SSM-W		S-10495-2	0	NA
			S-10495-3	0	NA
			S-10495-1	0	NA
S-10494	DHW19M-17-1-SSM-W		S-10494-2	0	NA
			S-10494-3	0	NA
			S-10494-1	0	NA
S-10493	DHW19M-16-SSM-W		S-10493-2	0	NA
			S-10493-3	0	NA
			S-10493-1	0	NA
S-10492	DHW19M-15-SSM-W		S-10492-2	0	NA
			S-10492-3	0	NA
			S-10492-1	0	NA
S-10491	DHW19M-14-SSM-W		S-10491-2	0	NA
			S-10491-3	0	NA
			S-10491-1	0	NA
S-10490	DHW19M-13-SSM-W		S-10490-2	0	NA
			S-10490-3	0	NA
			S-10490-1	0	NA
S-10489	DHW19M-12-SSM-W		S-10489-2	0	NA
			S-10489-3	0	NA
			S-10489-1	0	NA
S-10488	DHW19M-11-SSM-W		S-10488-2	0	NA
			S-10488-3	0	NA
			S-10488-1	0	NA
S-10487	DHW19M-10-SSM-W		S-10487-2	0	NA
			S-10487-3	0	NA
			S-10487-1	0	NA
S-10486	DHW19M-9-SSM-W		S-10486-2	0	NA
			S-10486-3	0	NA
			S-10486-1	0	NA
S-10485	DHW19M-8-SSM-W		S-10485-2	0	NA
			S-10485-3	0	NA
			S-10485-1	0	NA
S-10484	DHW19M-7-1-SSM-W		S-10484-2	0	NA
			S-10484-3	0	NA
			S-10484-1	0	NA
S-10483	DHW19M-6-1-SSM-W		S-10483-2	0	NA
			S-10483-3	0	NA
			S-10483-1	0	NA
S-10482	DHW19M-5-SSM-W		S-10482-2	0	NA
			S-10482-3	0	NA
			S-10482-1	0	NA
S-10481	DHW19M-4-SSM-W		S-10481-2	0	NA
			S-10481-3	0	NA
			S-10481-1	0	NA
S-10480	DHW19M-3-1-SSM-W		S-10480-2	0	NA
			S-10480-3	0	NA
			S-10480-1	0	NA
S-10479	DHW19M-2-3-SSM-W		S-10479-2	0	NA
			S-10479-3	0	NA
			S-10479-1	0	NA
S-10478	DHW19M-1-3-SSM-W		S-10478-2	0	NA
			S-10478-3	0	NA
			S-10478-1	0	NA
	blank		BLANK-1	0	NA
			Blank-3	0	NA
			Blank-2	0	NA
			blank-6	0	NA
			blank-5	0	NA
			blank-4	0	NA
1 ppm ck std	1 ppm ck std	1 ppm ck std	SPEX 1 ppm	1	NA

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

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

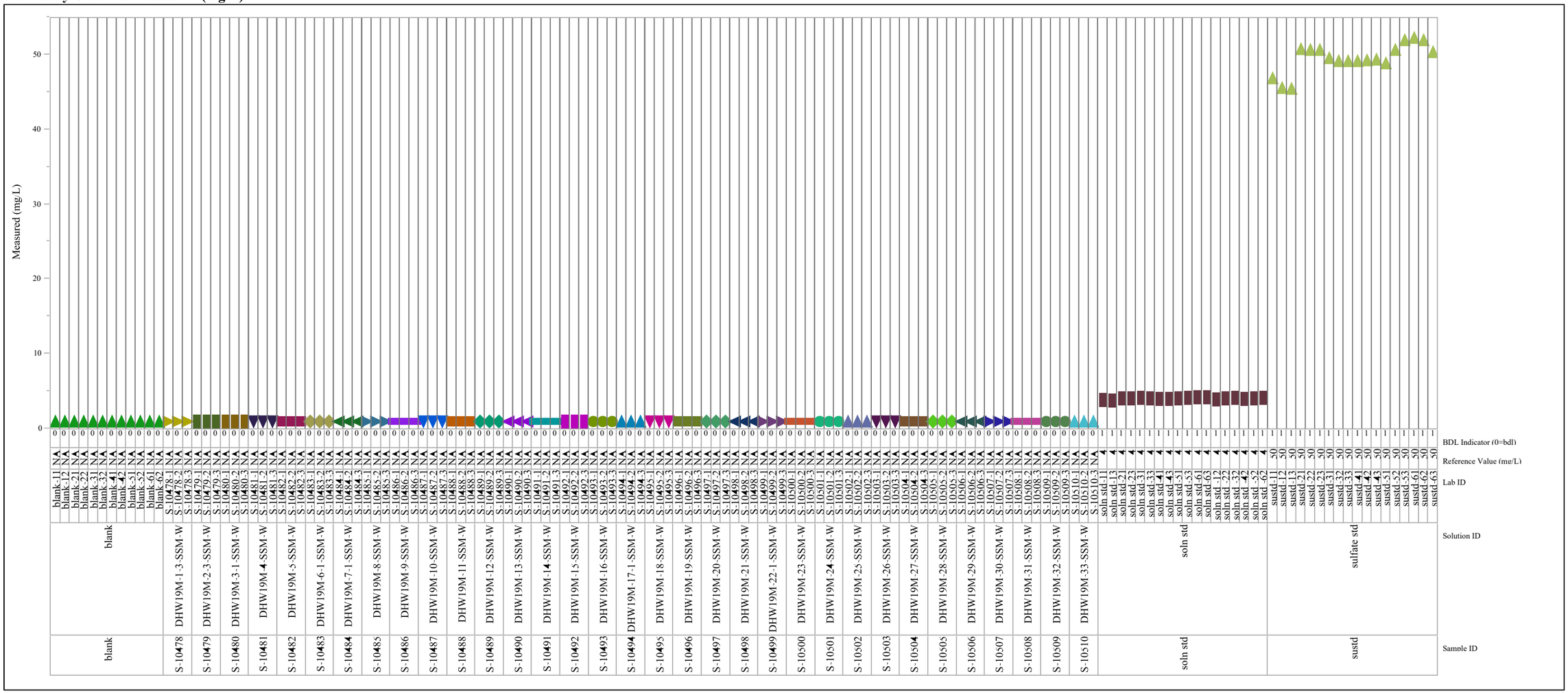


Exhibit B-2. Measurements of Wash Solutions by Analyte Grouped by Solution ID (continued)

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

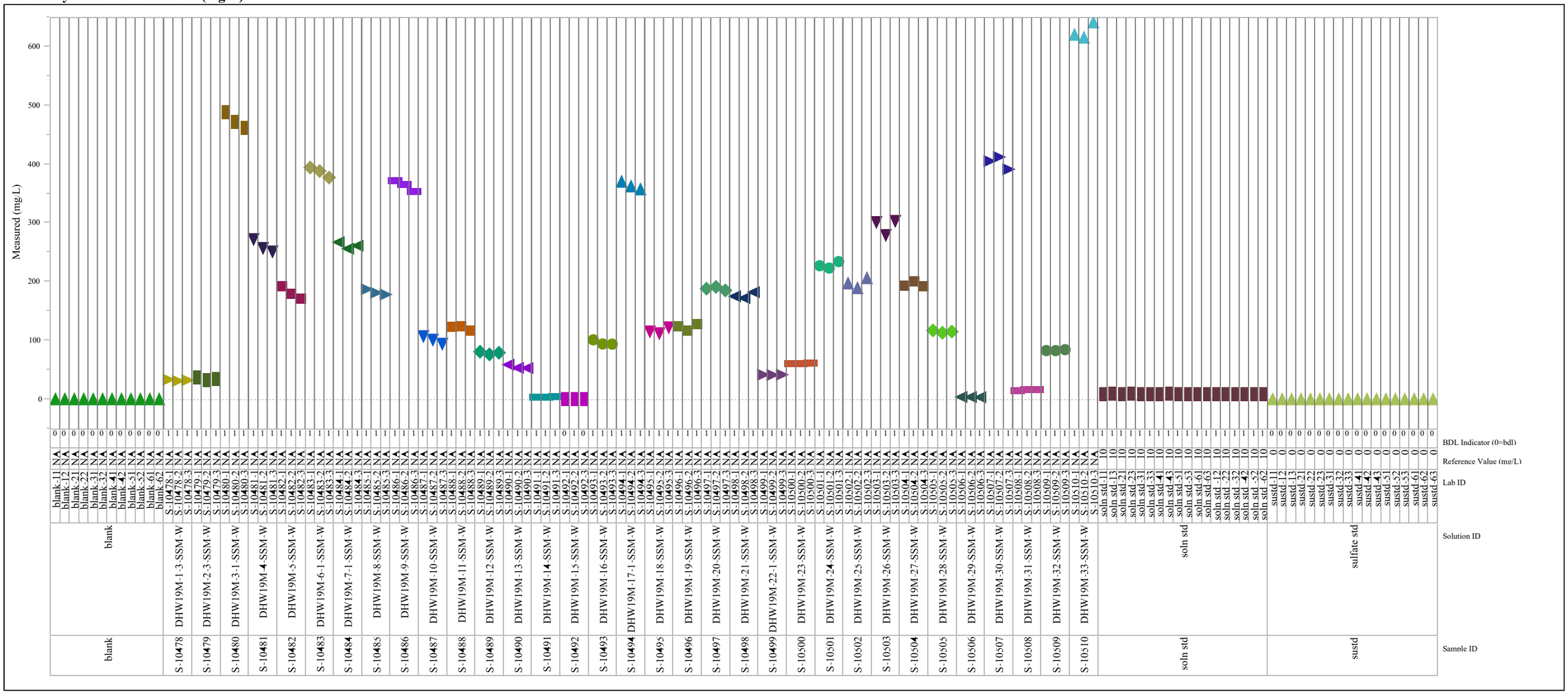


Exhibit B-2. Measurements of Wash Solutions by Analyte Grouped by Solution ID (continued)

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

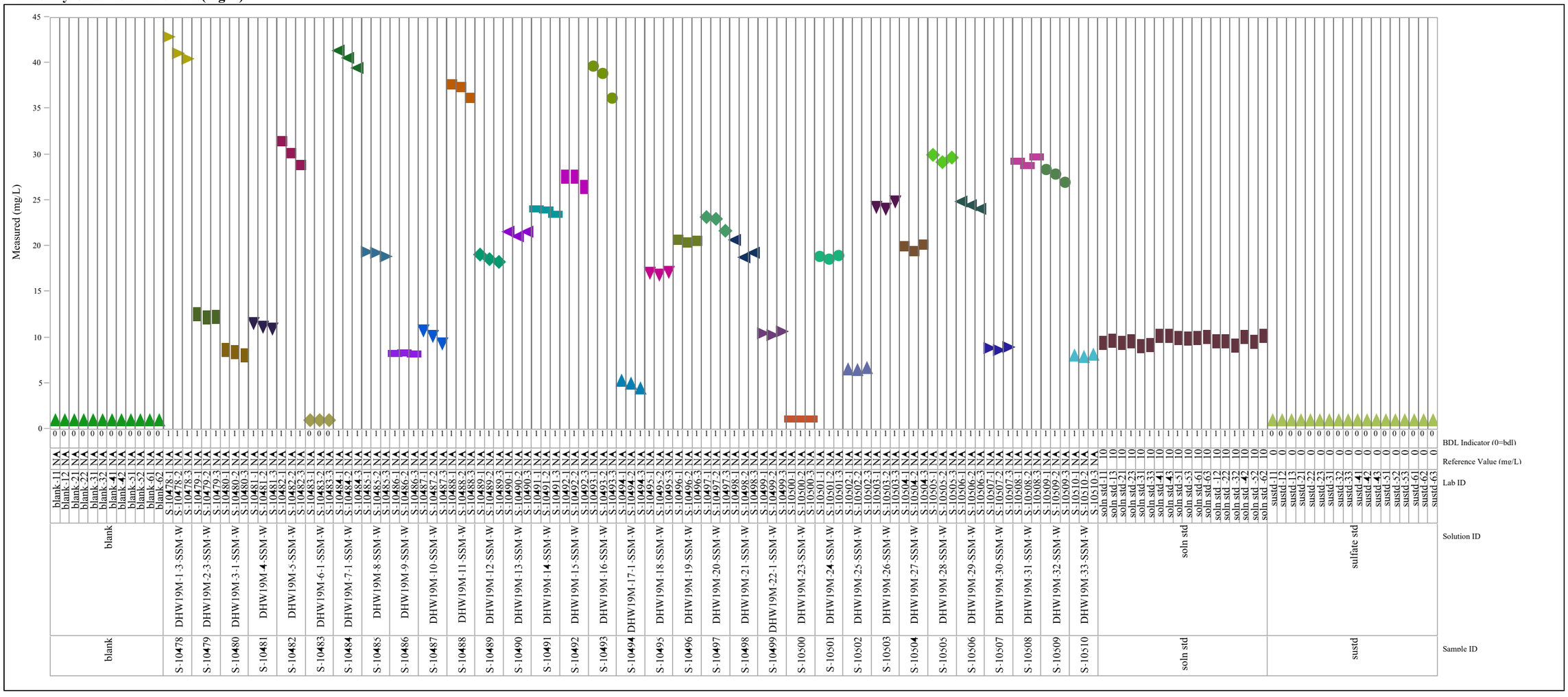


Exhibit B-2. Measurements of Wash Solutions by Analyte Grouped by Solution ID (continued)

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

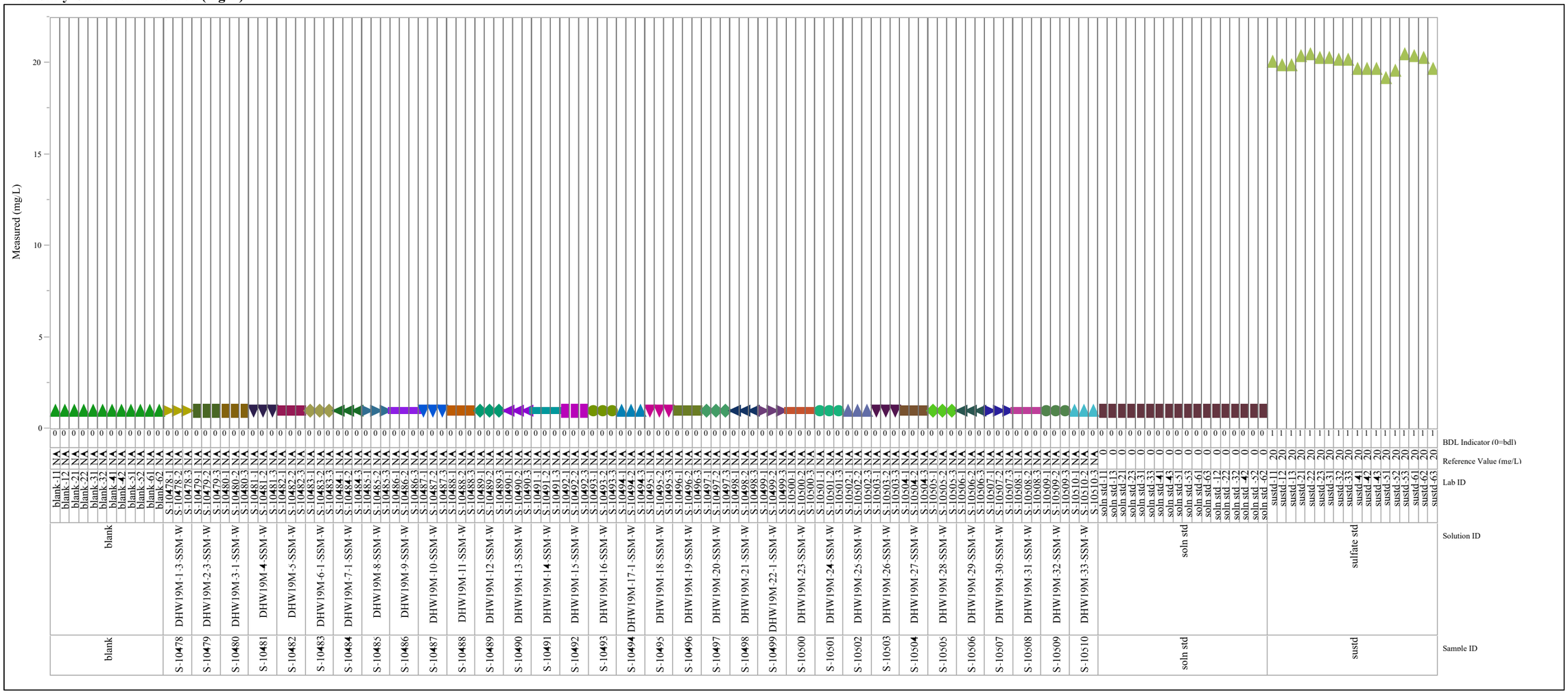


Exhibit B-2. Measurements of Wash Solutions by Analyte Grouped by Solution ID (continued)

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

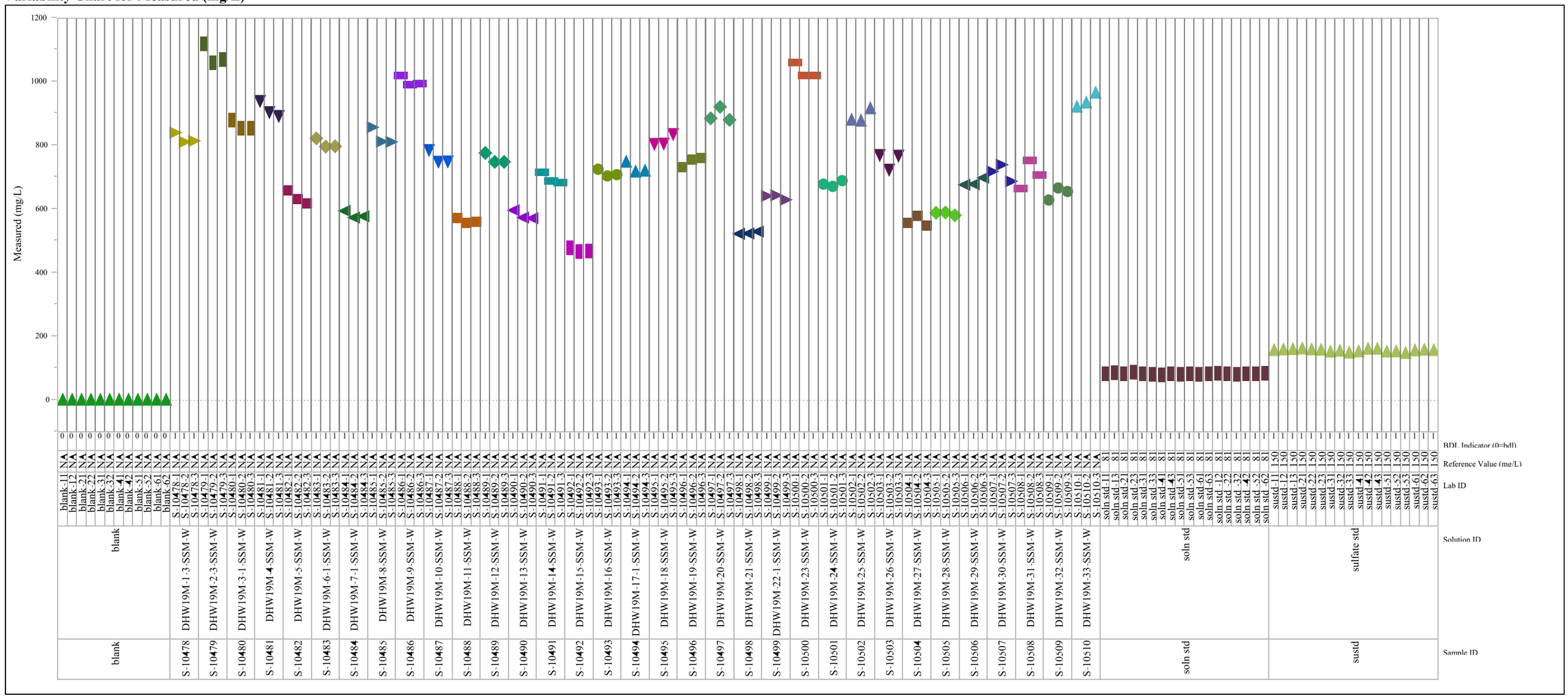


Exhibit B-2. Measurements of Wash Solutions by Analyte Grouped by Solution ID (continued)

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

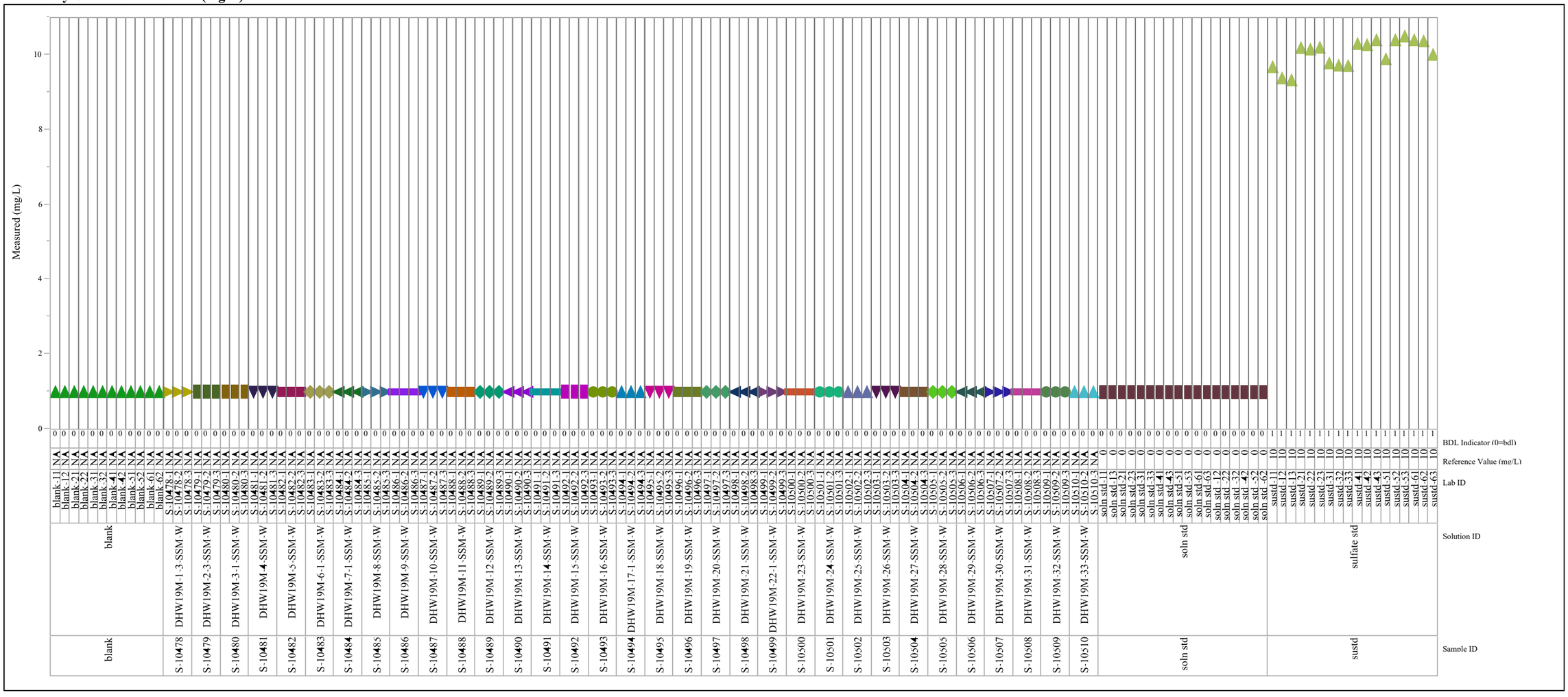


Exhibit B-2. Measurements of Wash Solutions by Analyte Grouped by Solution ID (continued)

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

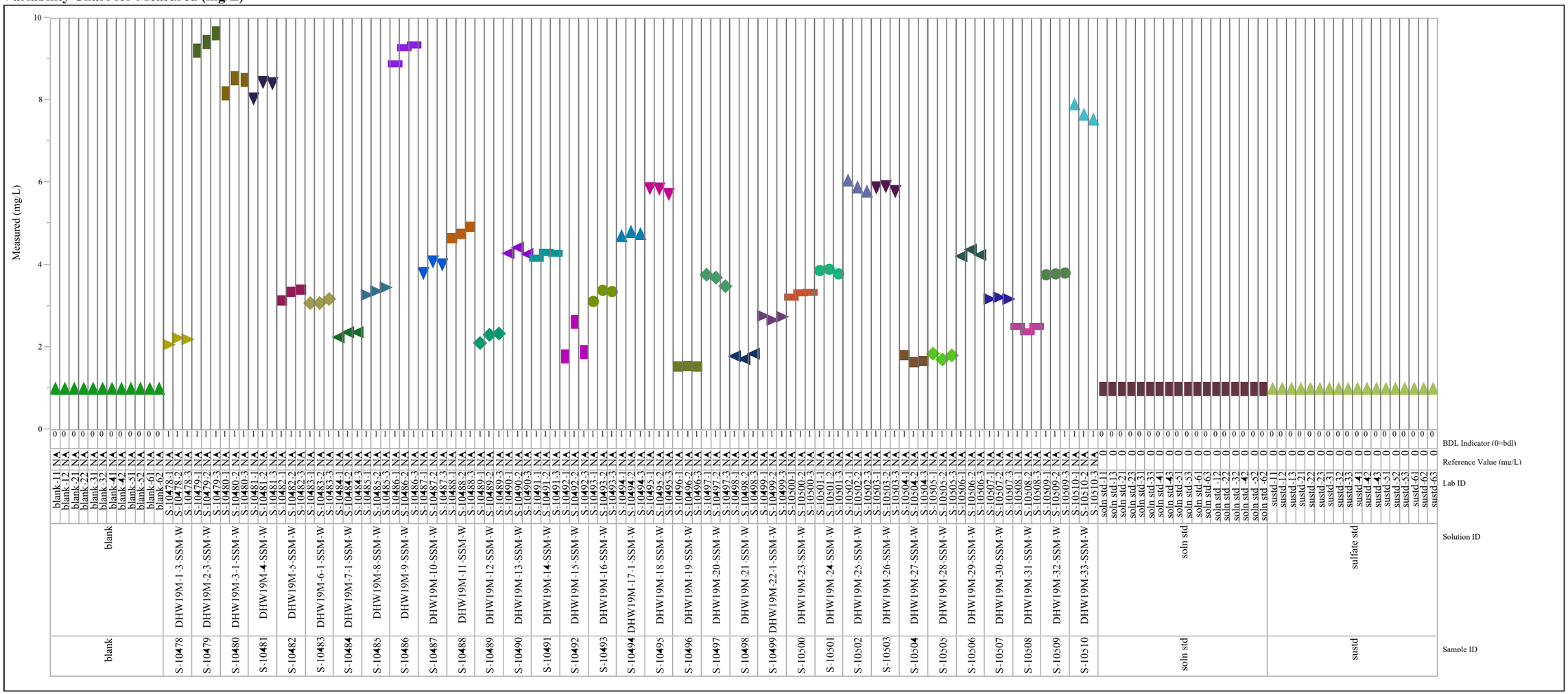


Exhibit B-2. Measurements of Wash Solutions by Analyte Grouped by Solution ID (continued)

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

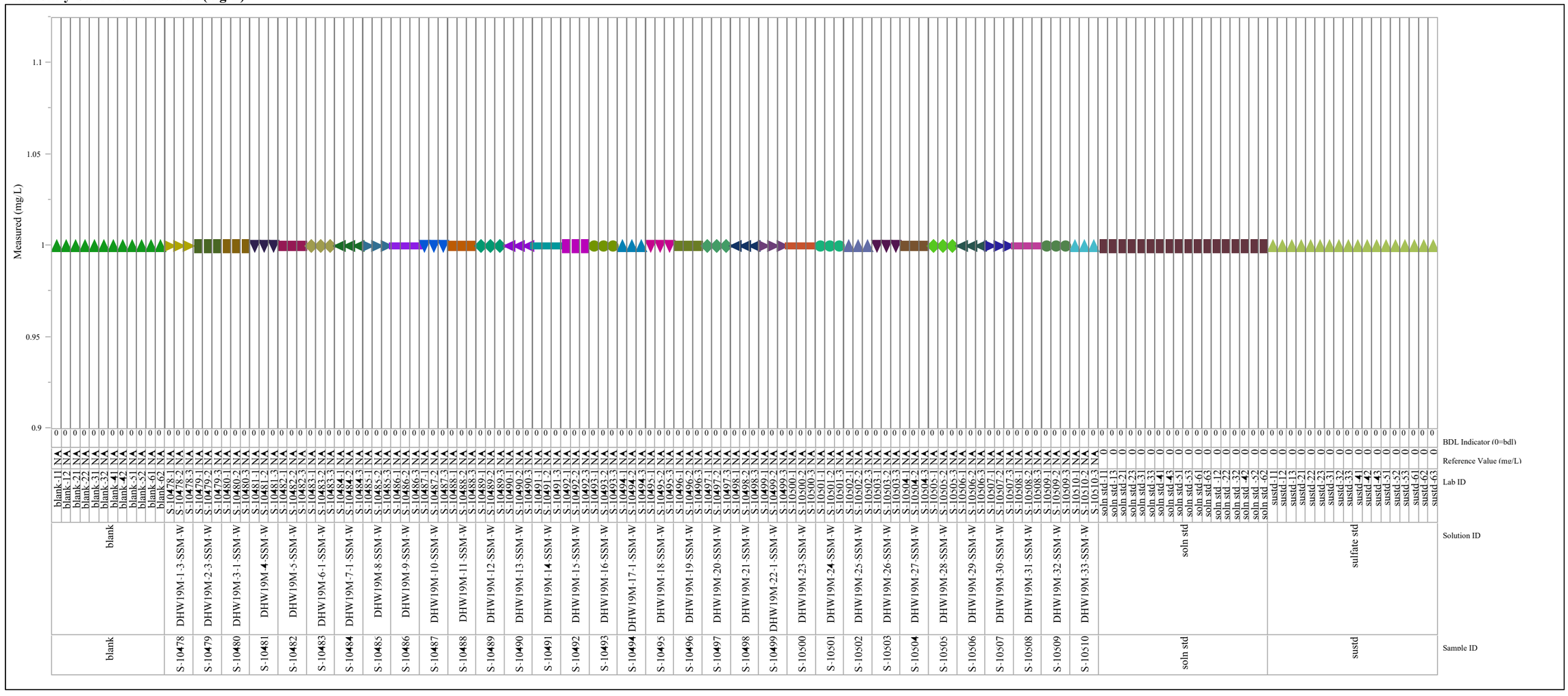


Exhibit B-2. Measurements of Wash Solutions by Analyte Grouped by Solution ID (continued)

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

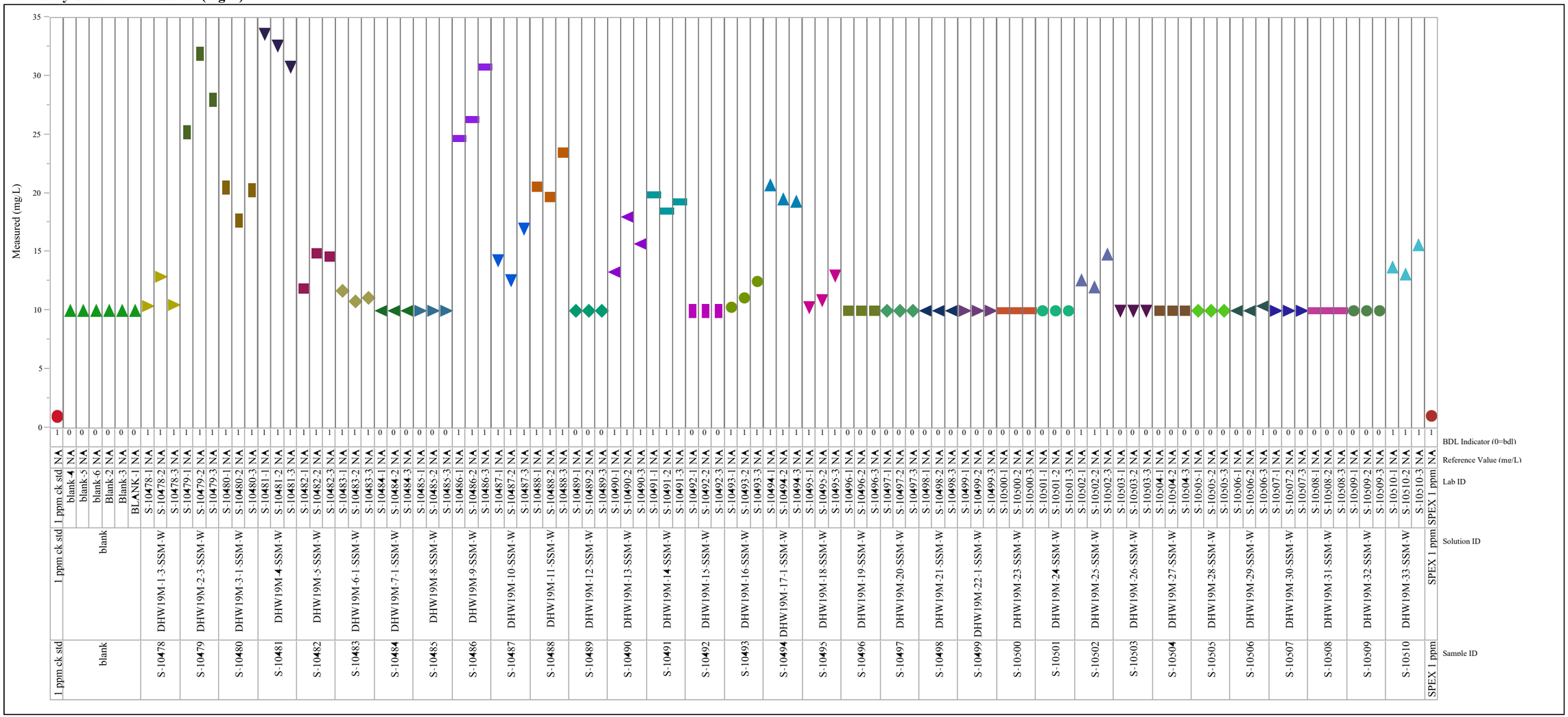


Exhibit B-2. Measurements of Wash Solutions by Analyte Grouped by Solution ID (continued)

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

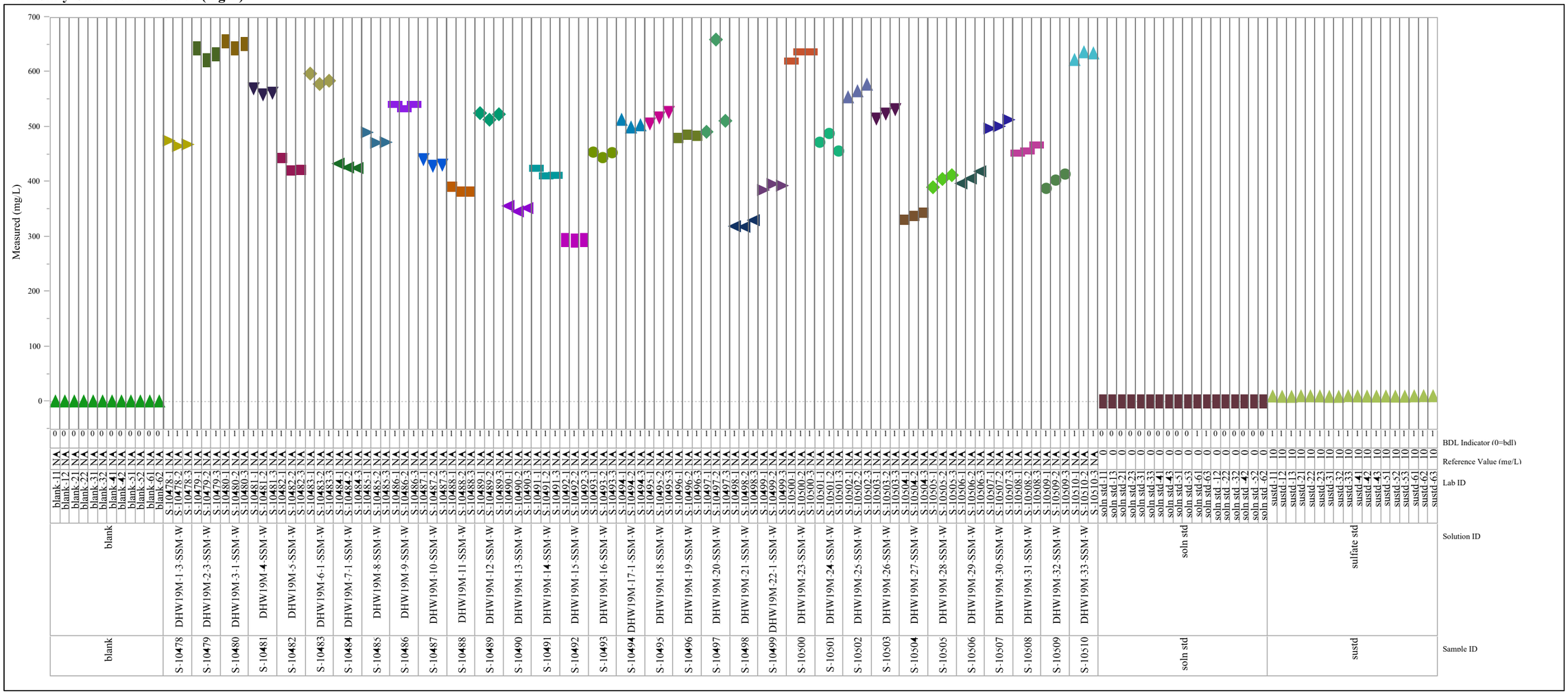


Exhibit B-2. Measurements of Wash Solutions by Analyte Grouped by Solution ID (continued)

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

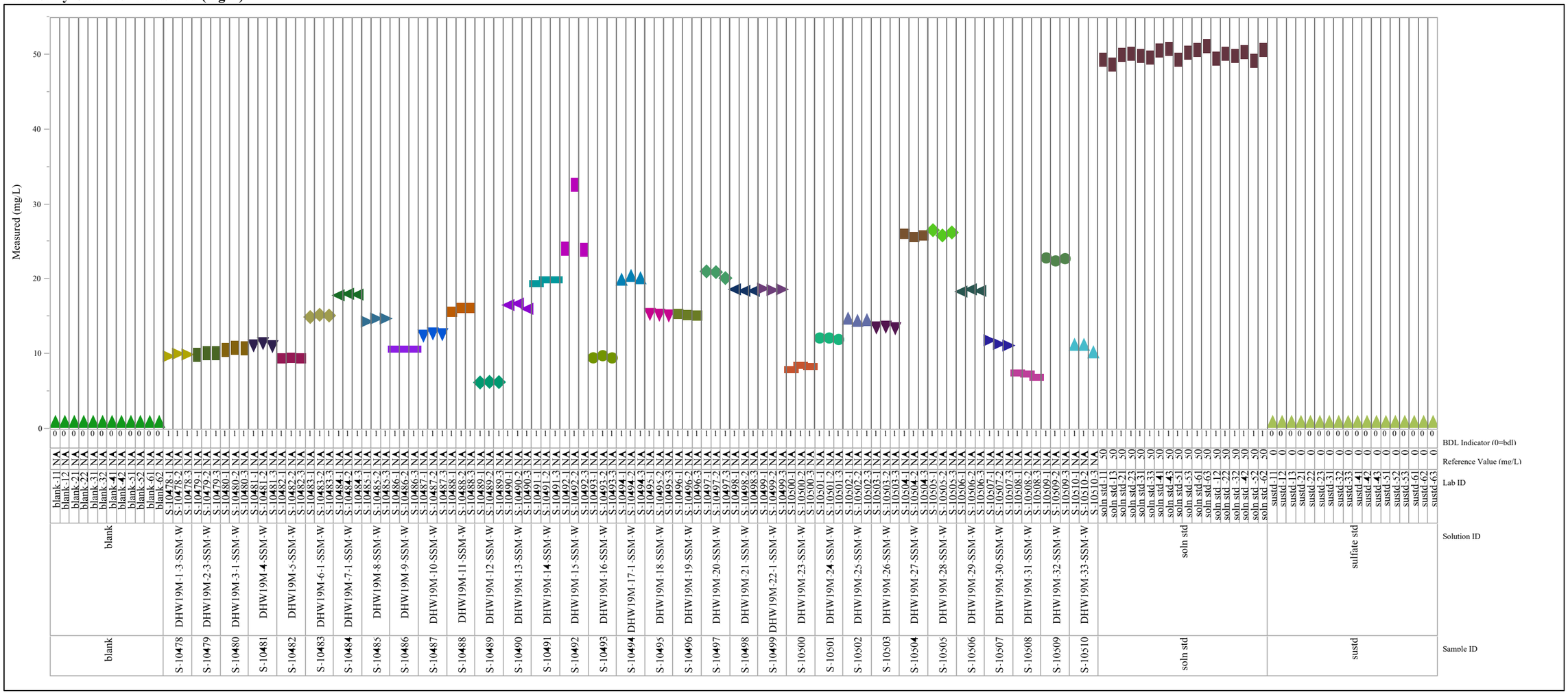


Exhibit B-2. Measurements of Wash Solutions by Analyte Grouped by Solution ID (continued)

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

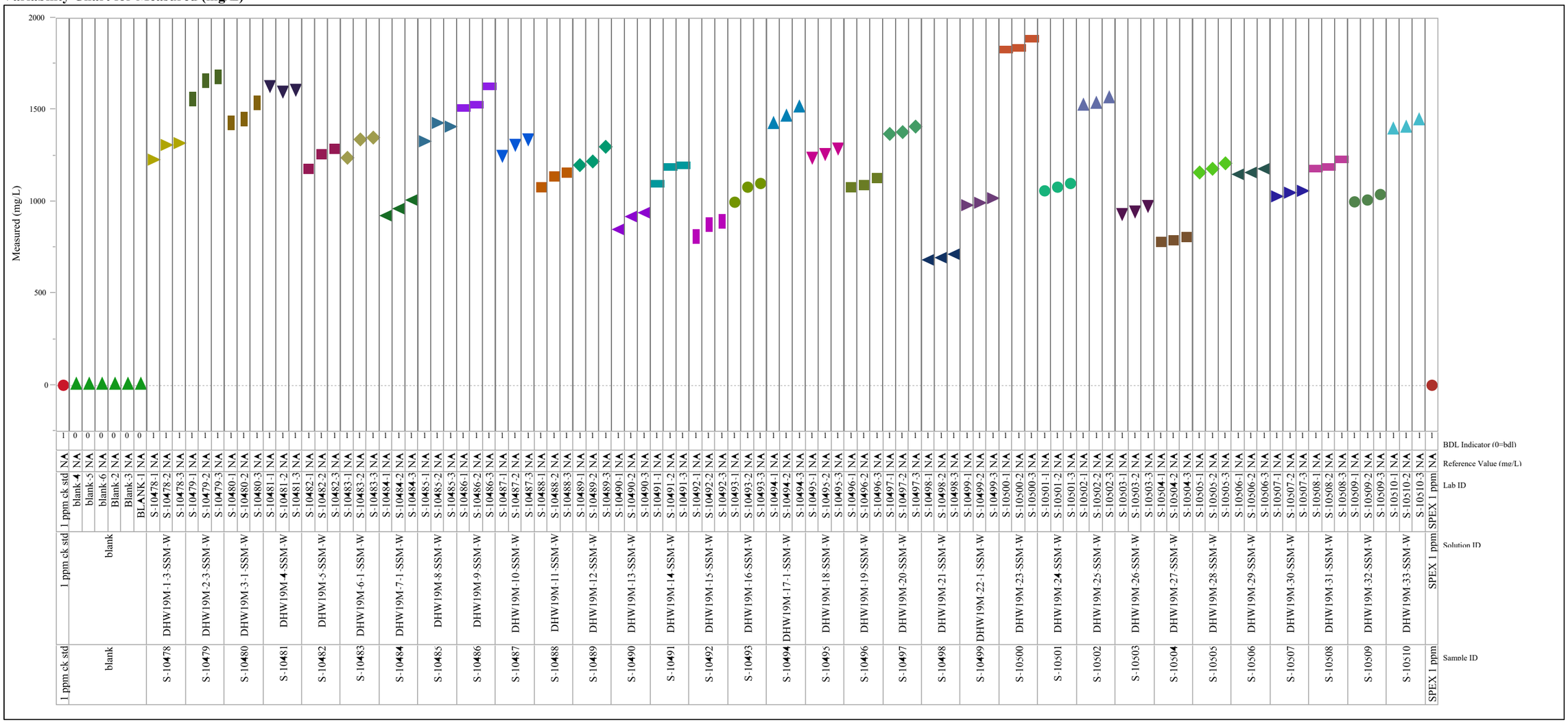


Exhibit B-2. Measurements of Wash Solutions by Analyte Grouped by Solution ID (continued)

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

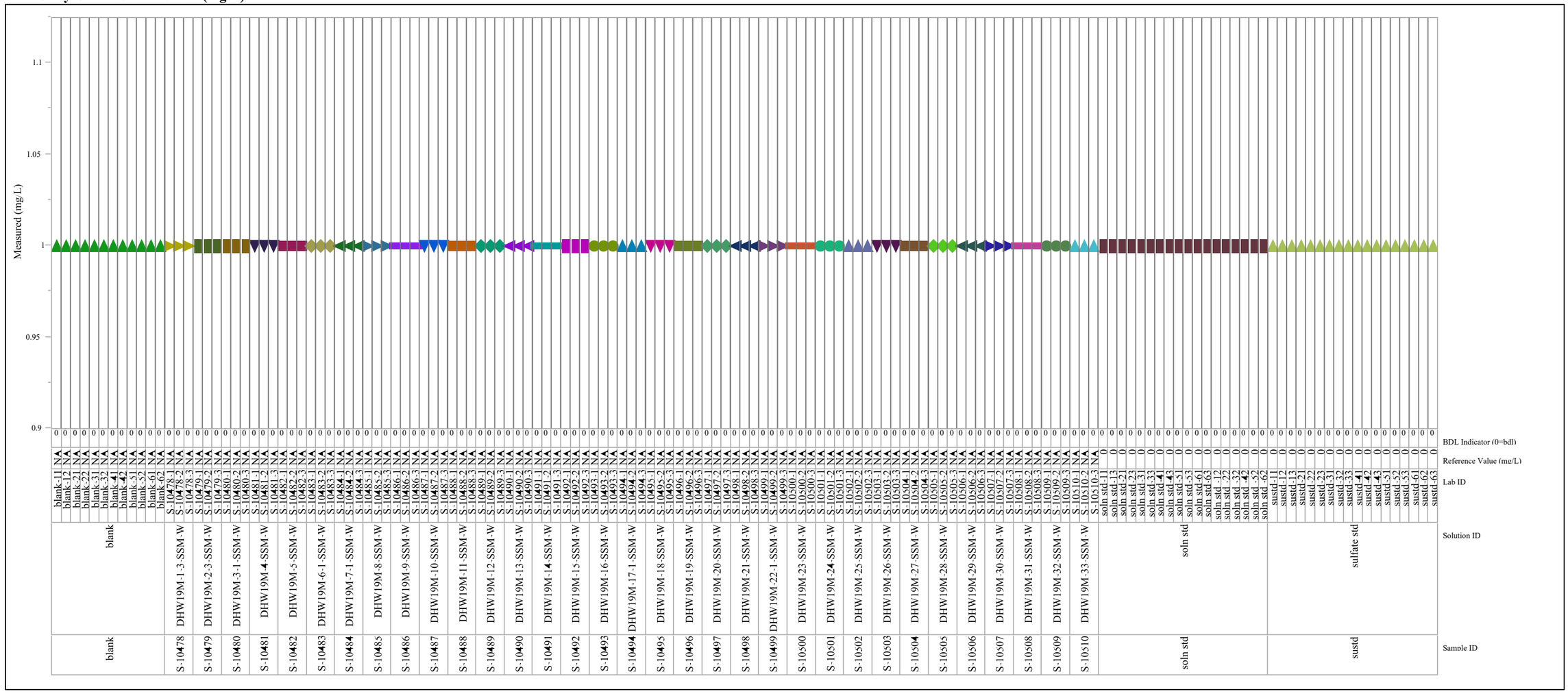


Exhibit B-3. Average Measurements of Wash Solutions by Analyte Grouped by Solution Identifier

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

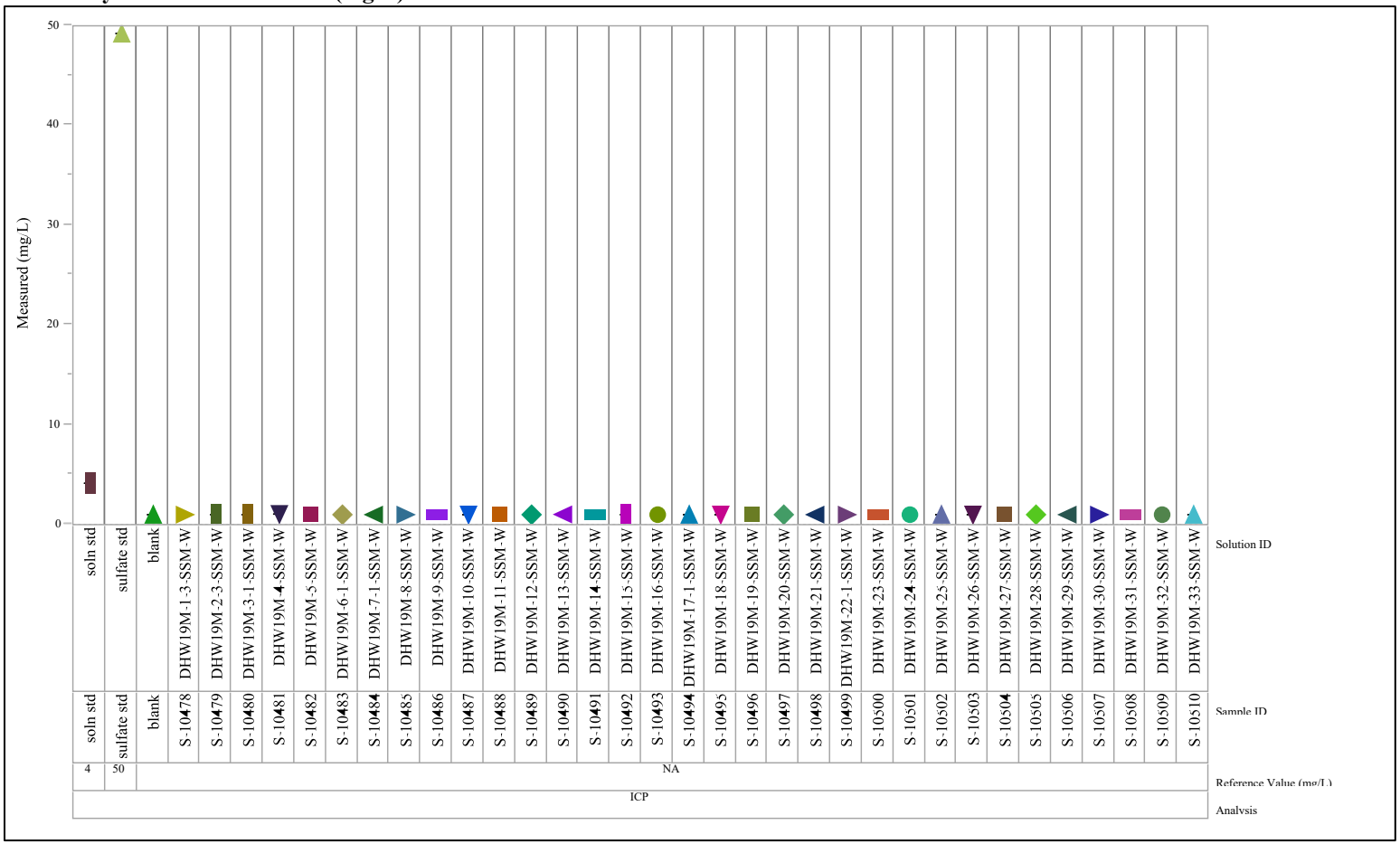


Exhibit B-3. Average Measurements of Wash Solutions by Analyte Grouped by Solution Identifier (continued)

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

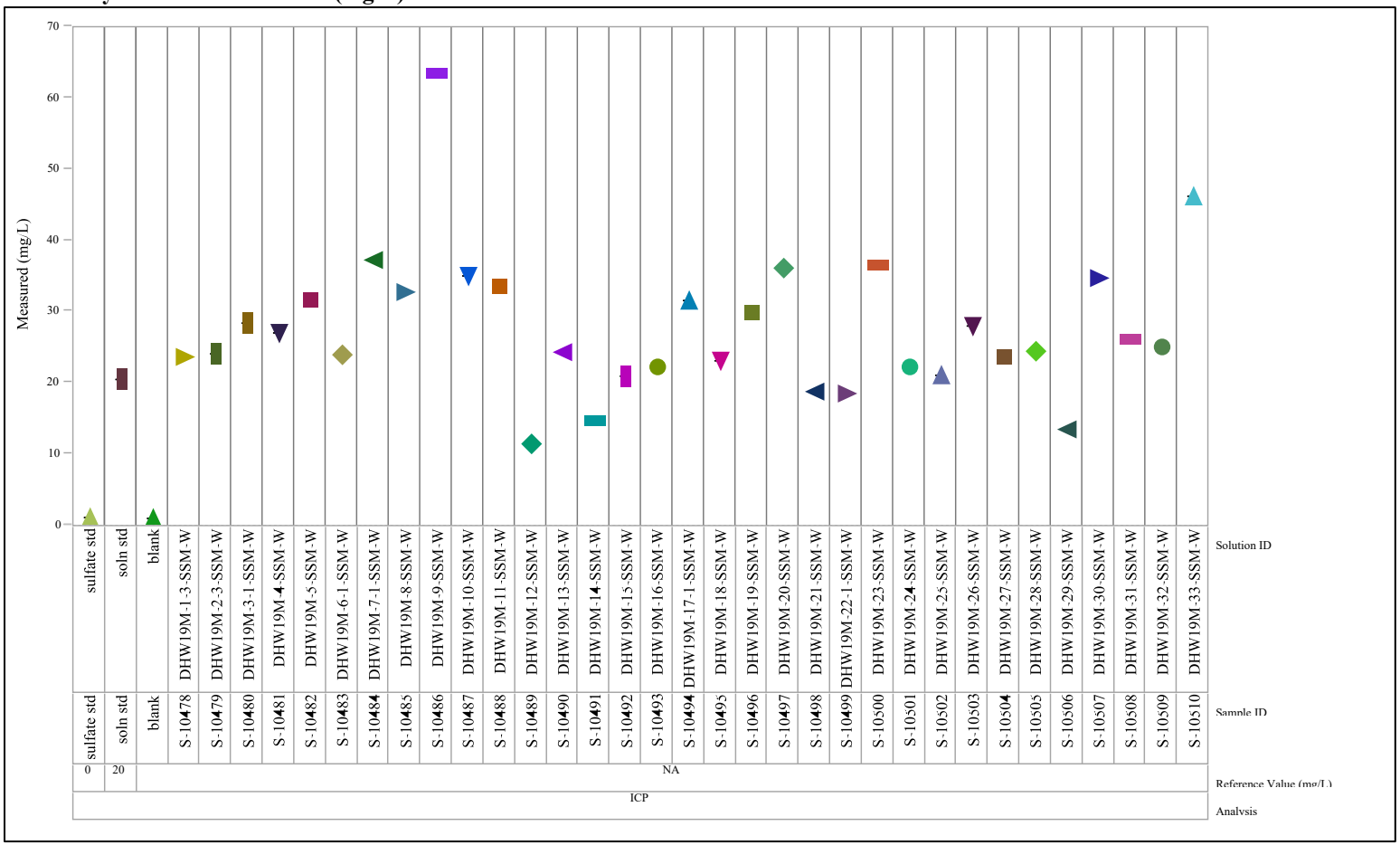


Exhibit B-3. Average Measurements of Wash Solutions by Analyte Grouped by Solution Identifier (continued)

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

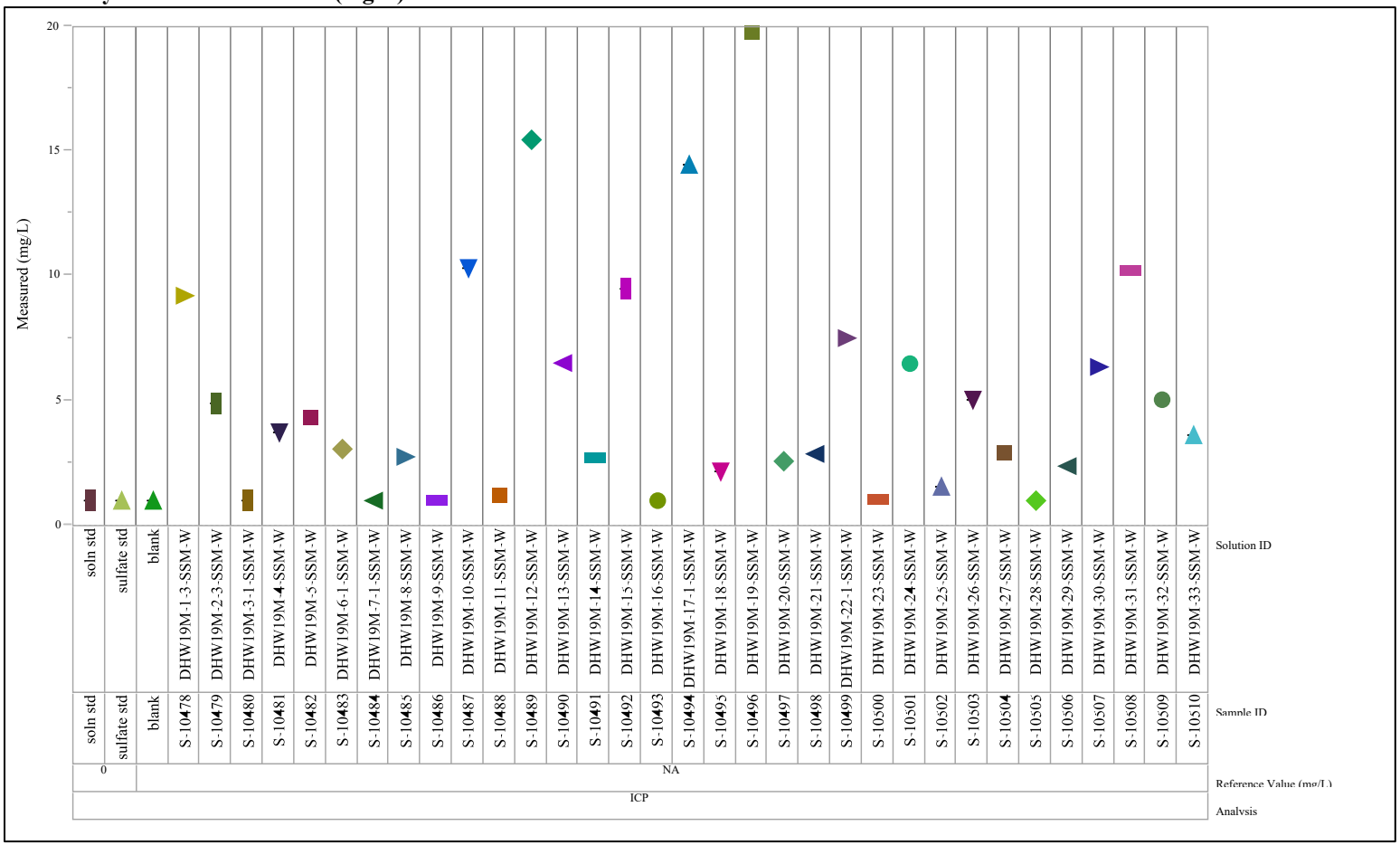


Exhibit B-3. Average Measurements of Wash Solutions by Analyte Grouped by Solution Identifier (continued)

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

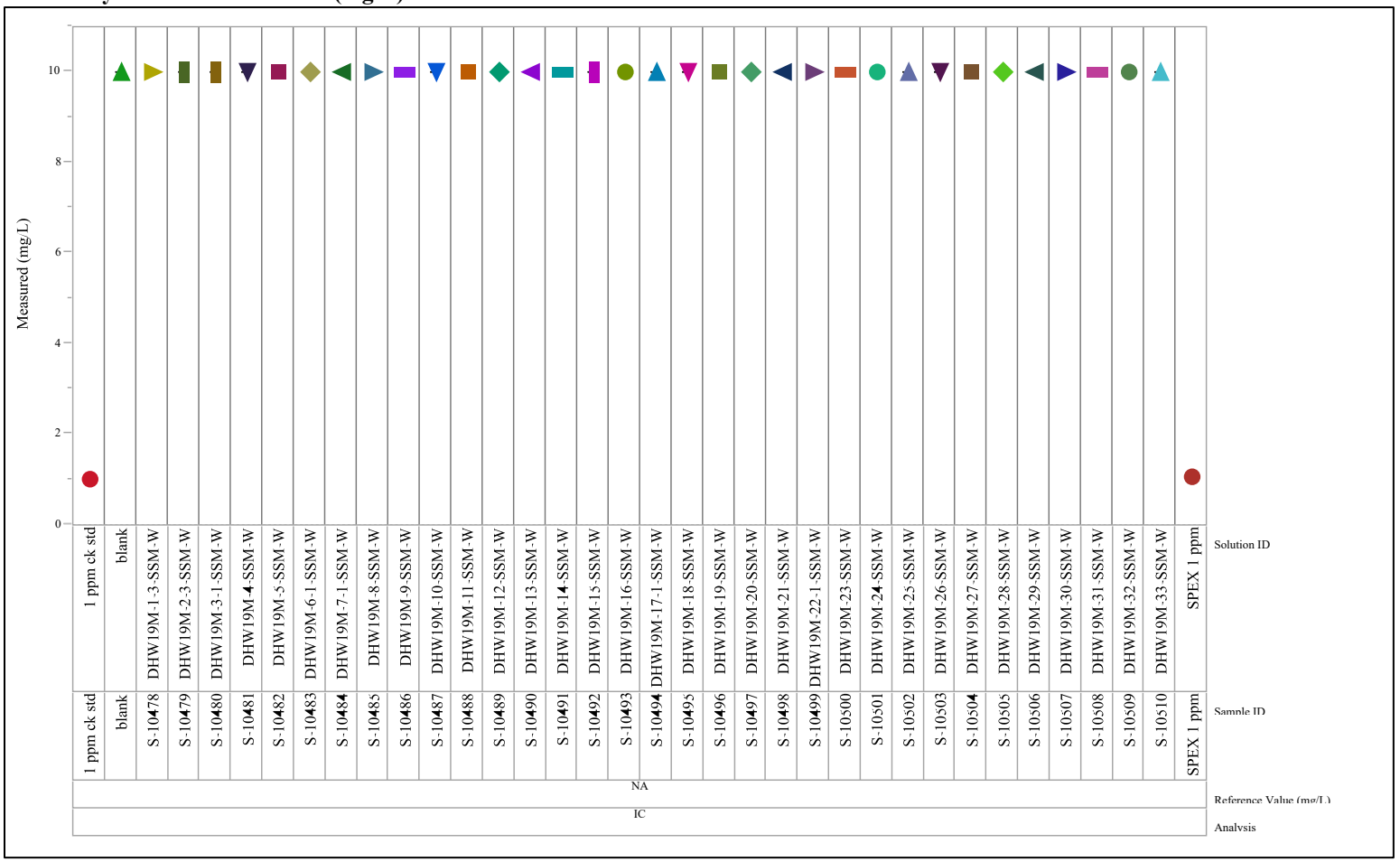


Exhibit B-3. Average Measurements of Wash Solutions by Analyte Grouped by Solution Identifier (continued)

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

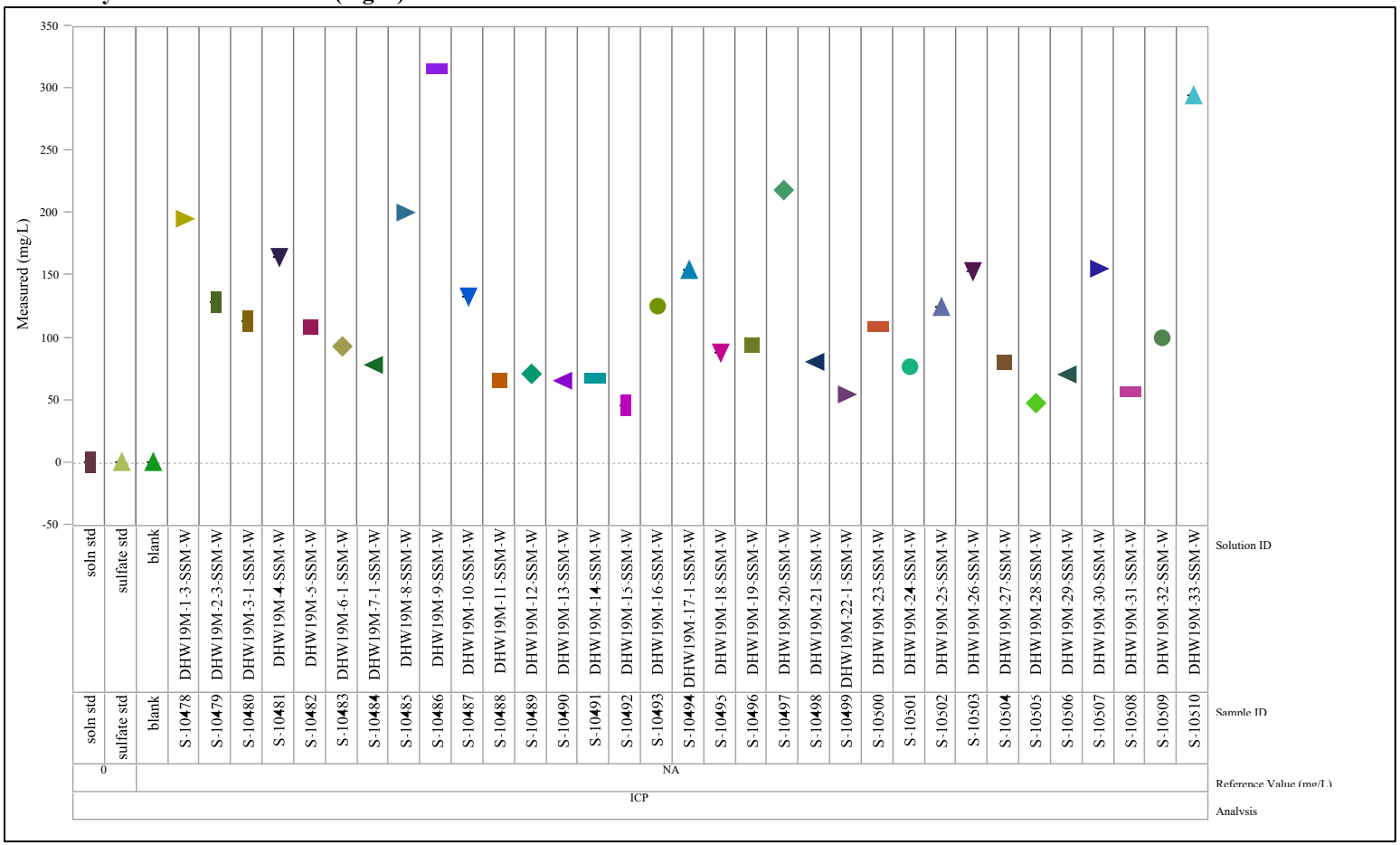


Exhibit B-3. Average Measurements of Wash Solutions by Analyte Grouped by Solution Identifier (continued)

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

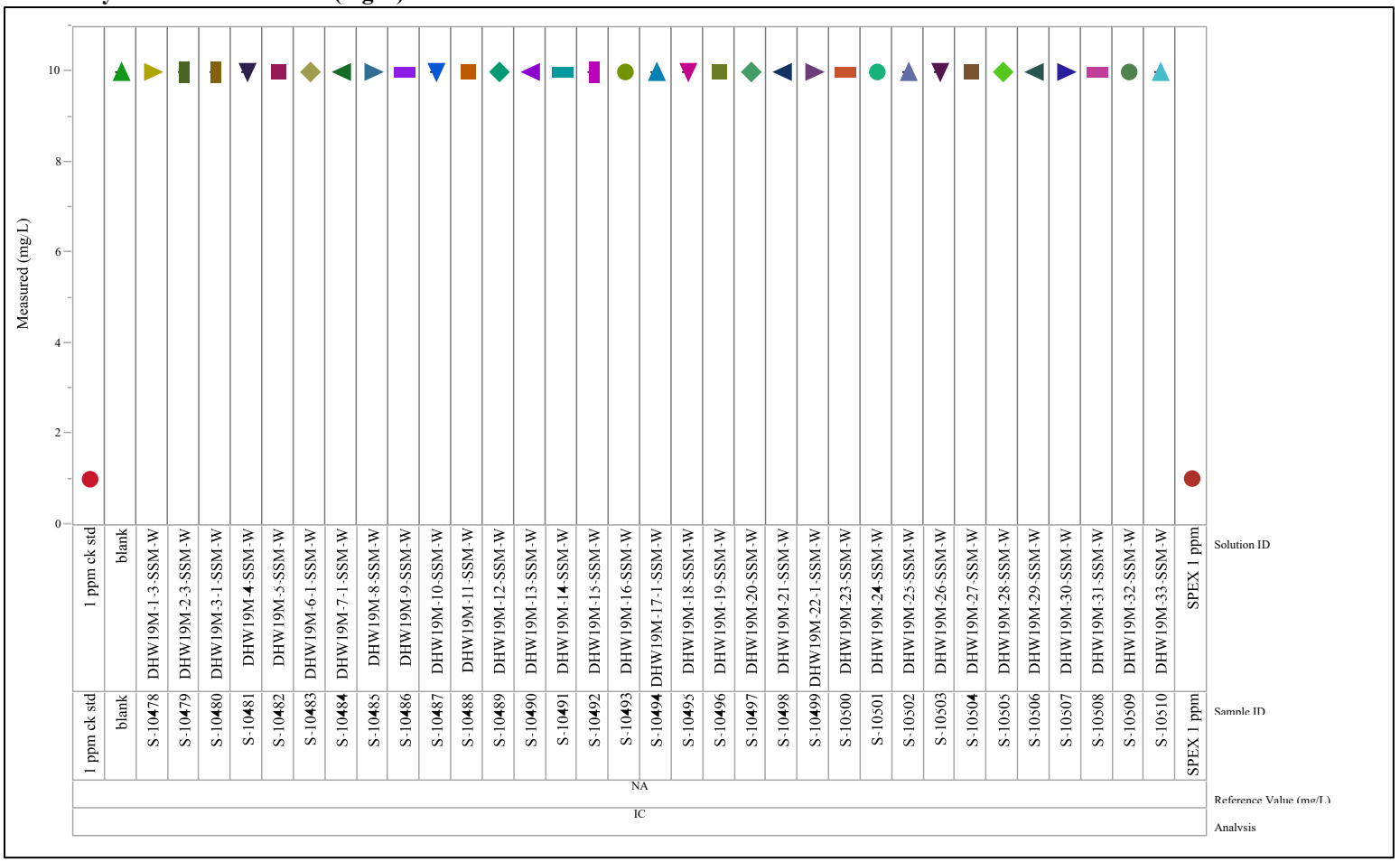


Exhibit B-3. Average Measurements of Wash Solutions by Analyte Grouped by Solution Identifier (continued)

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

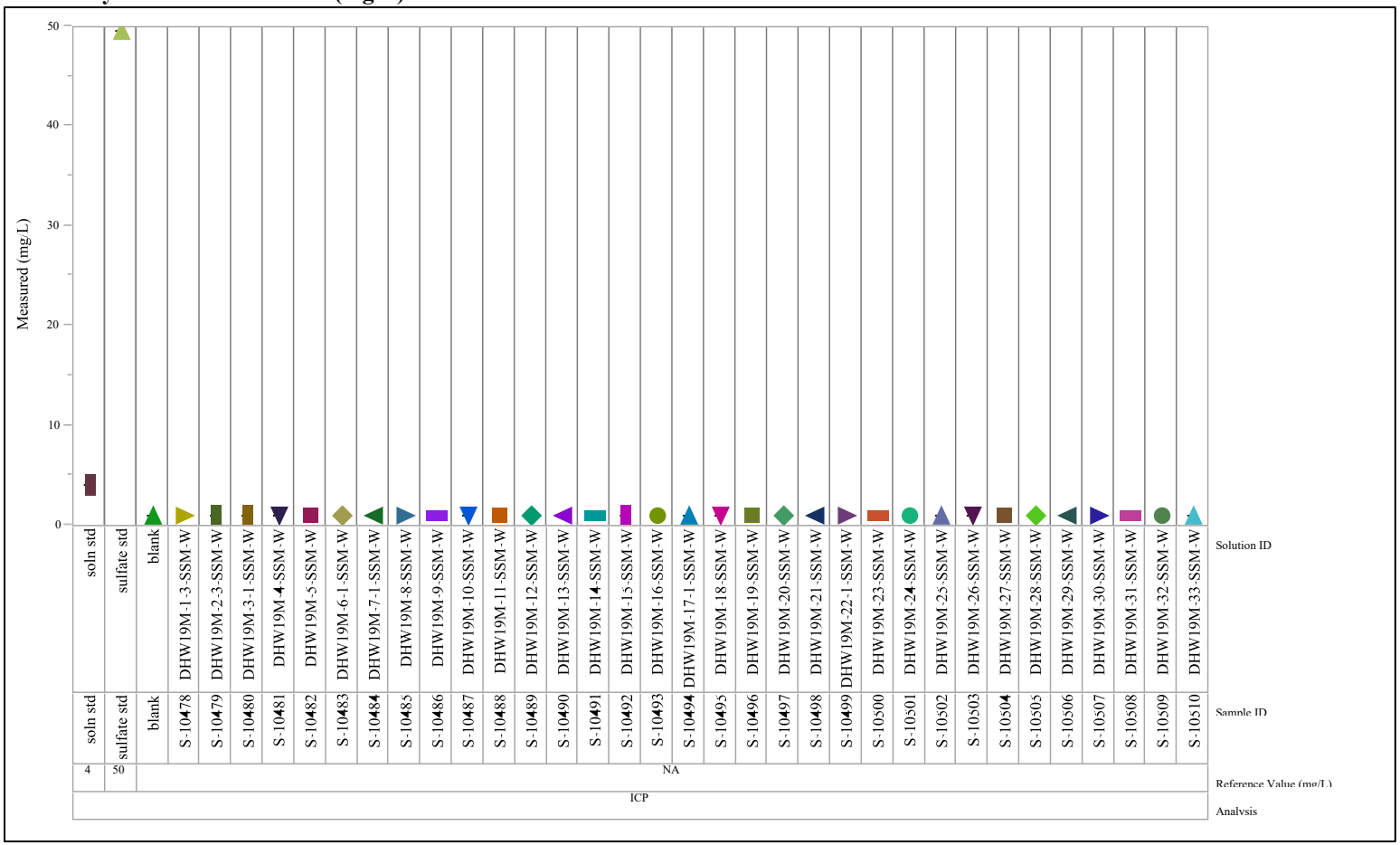


Exhibit B-3. Average Measurements of Wash Solutions by Analyte Grouped by Solution Identifier (continued)

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

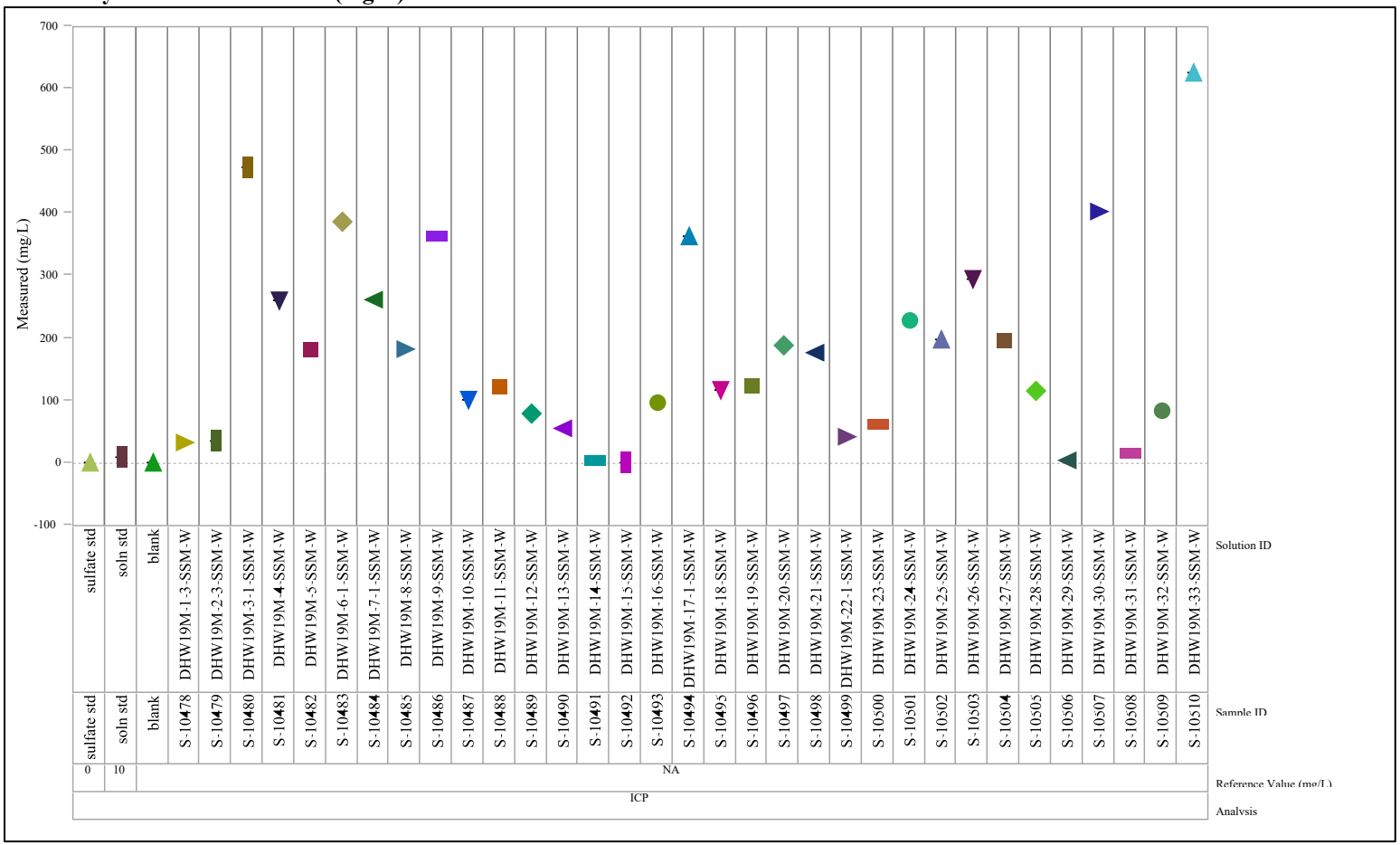


Exhibit B-3. Average Measurements of Wash Solutions by Analyte Grouped by Solution Identifier (continued)

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

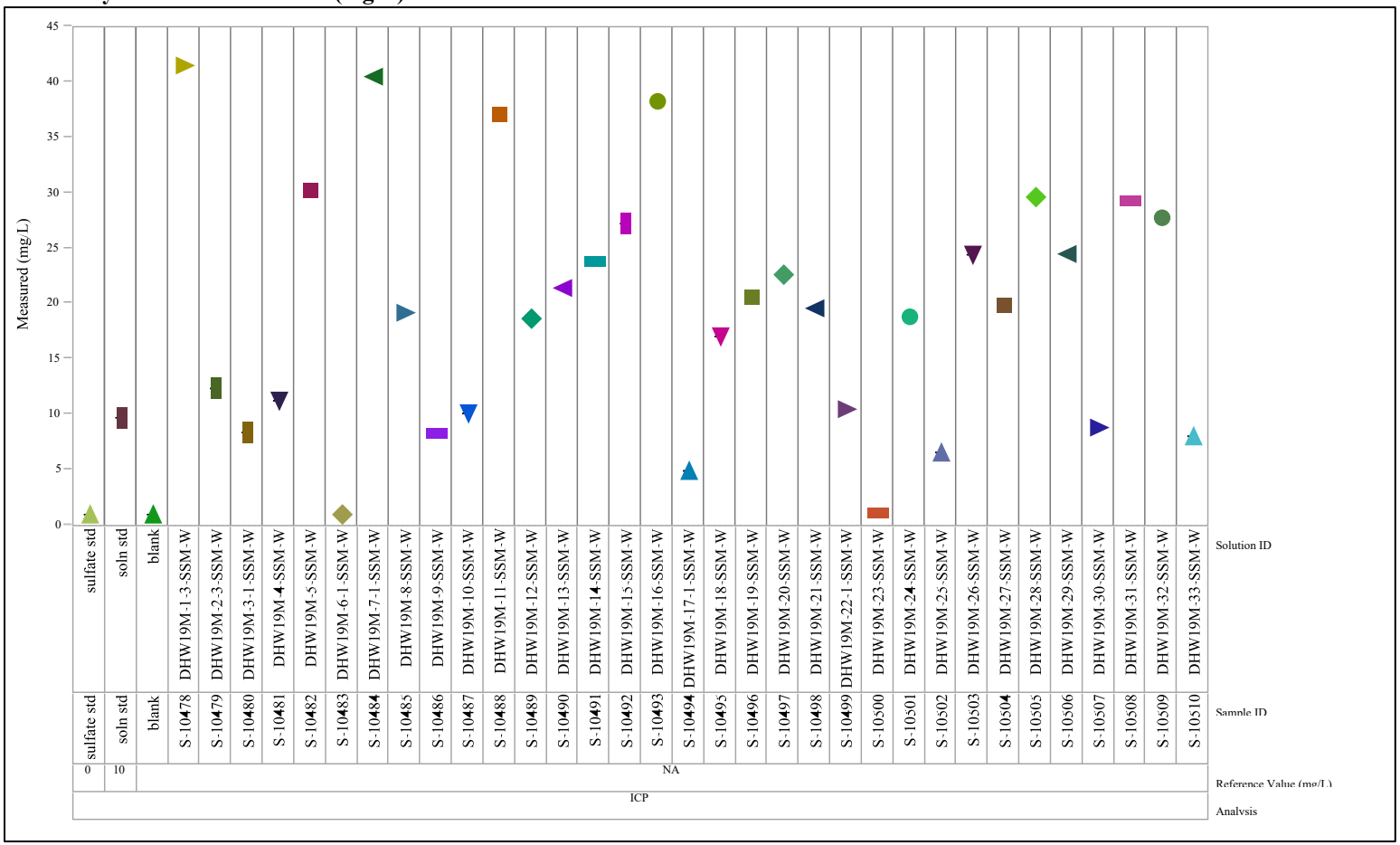


Exhibit B-3. Average Measurements of Wash Solutions by Analyte Grouped by Solution Identifier (continued)

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

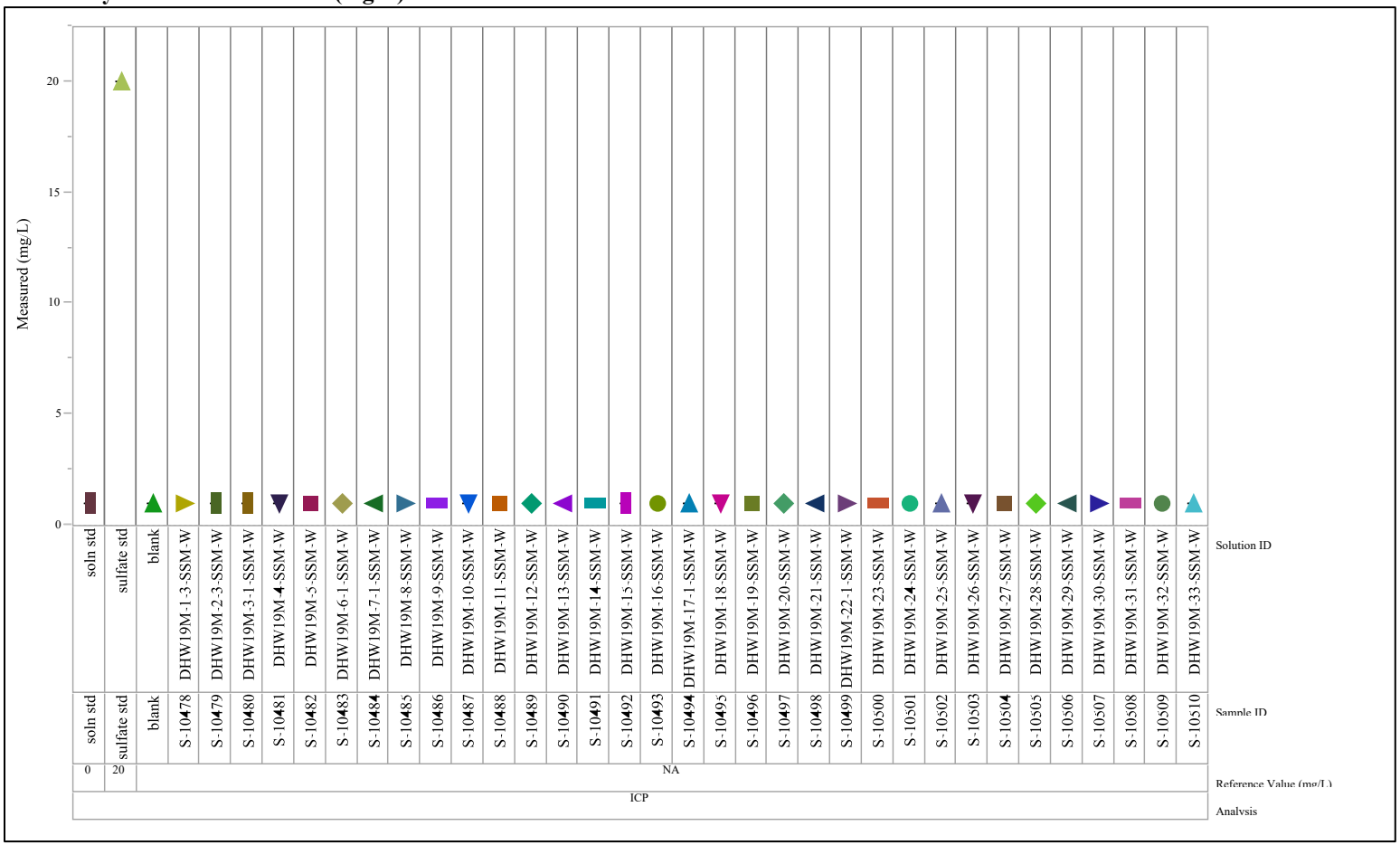


Exhibit B-3. Average Measurements of Wash Solutions by Analyte Grouped by Solution Identifier (continued)

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

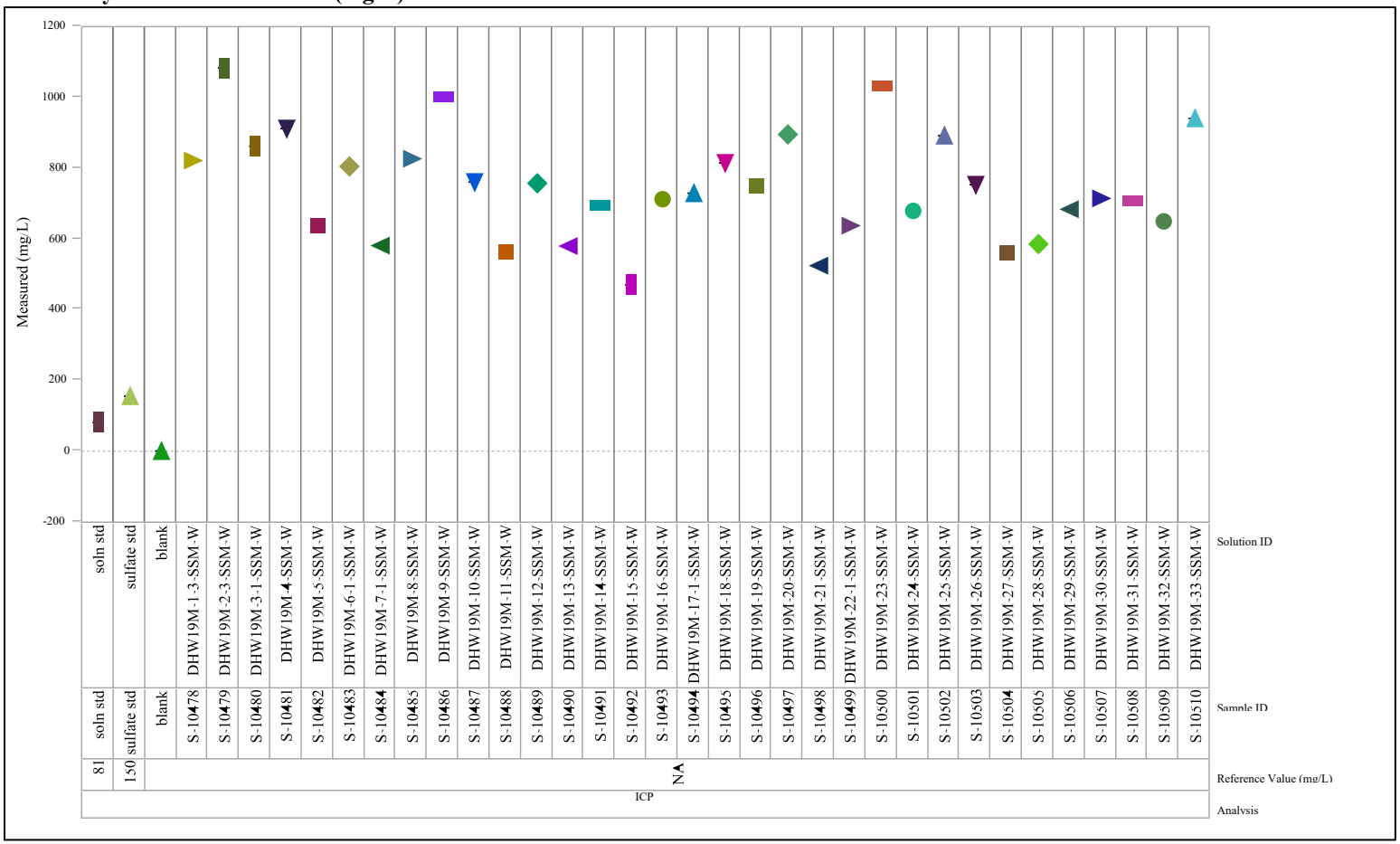


Exhibit B-3. Average Measurements of Wash Solutions by Analyte Grouped by Solution Identifier (continued)

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

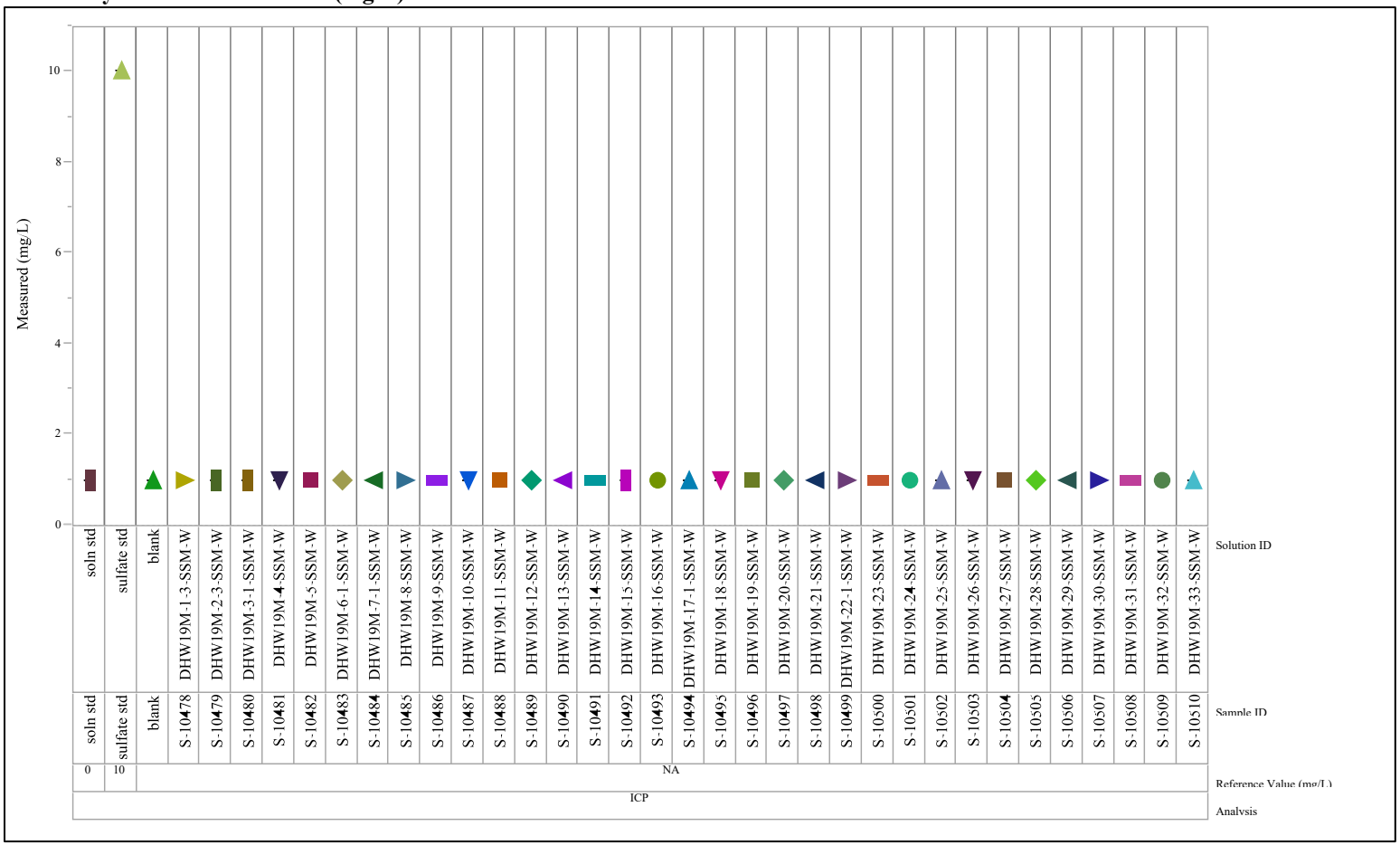


Exhibit B-3. Average Measurements of Wash Solutions by Analyte Grouped by Solution Identifier (continued)

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

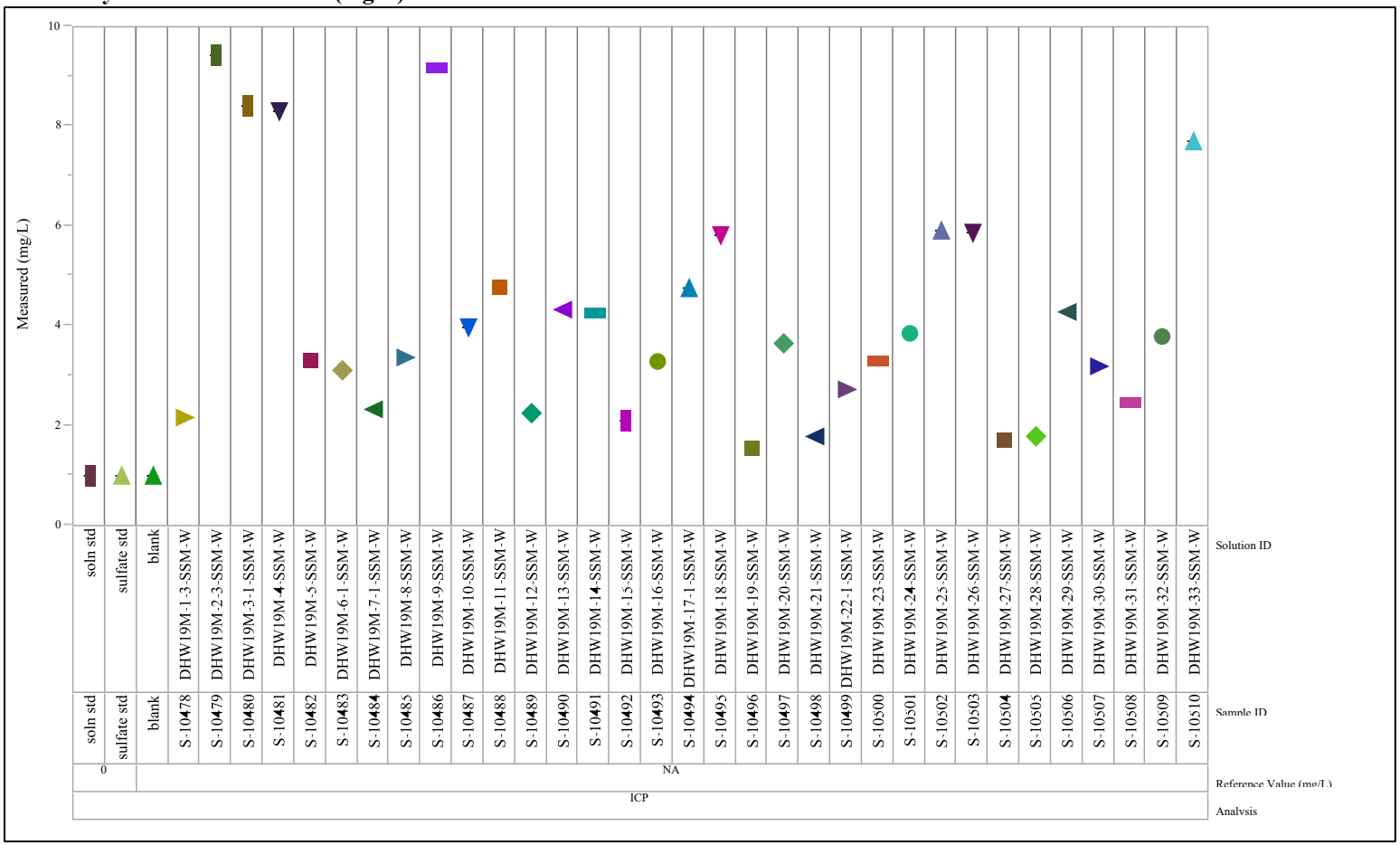


Exhibit B-3. Average Measurements of Wash Solutions by Analyte Grouped by Solution Identifier (continued)

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

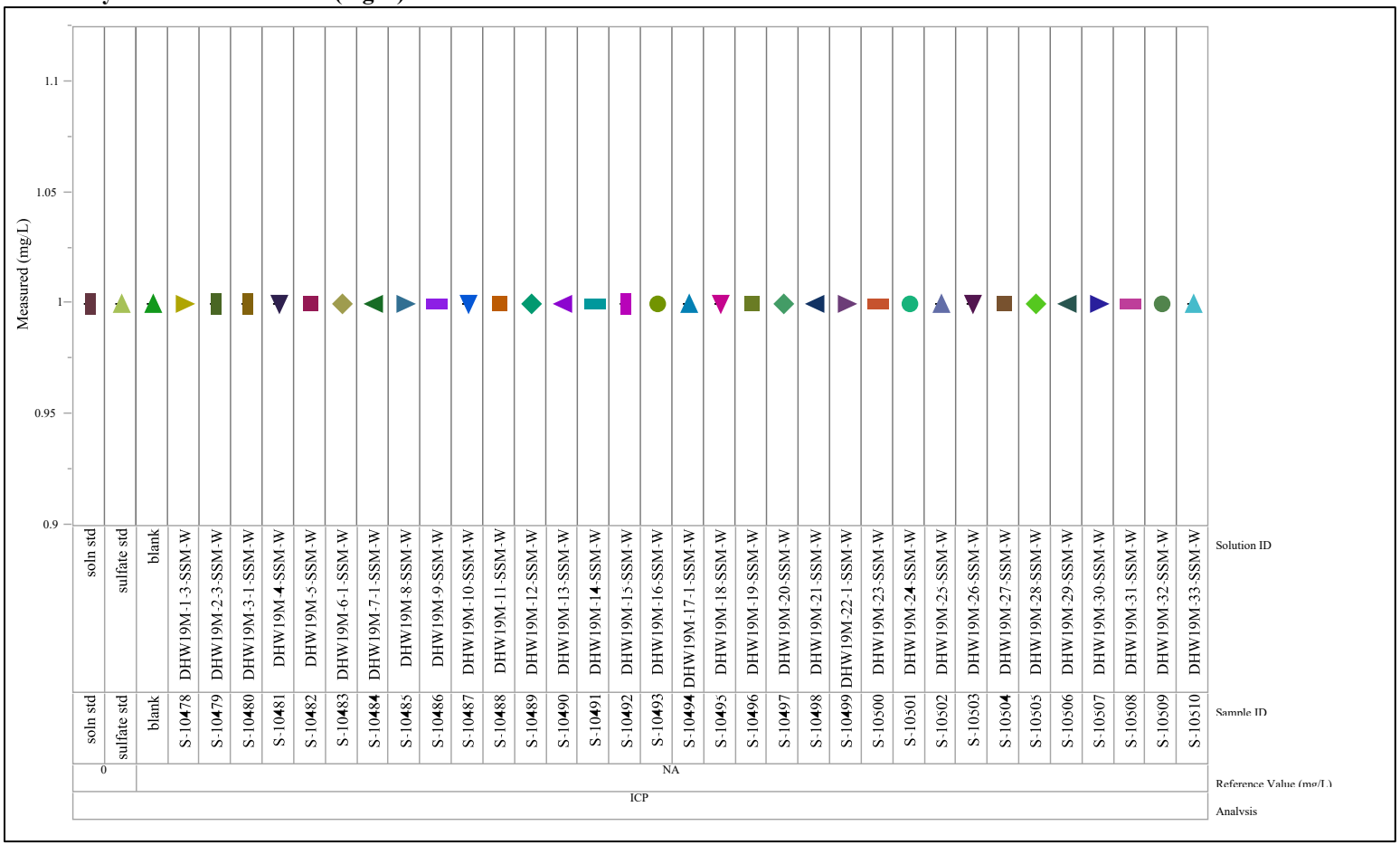


Exhibit B-3. Average Measurements of Wash Solutions by Analyte Grouped by Solution Identifier (continued)

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

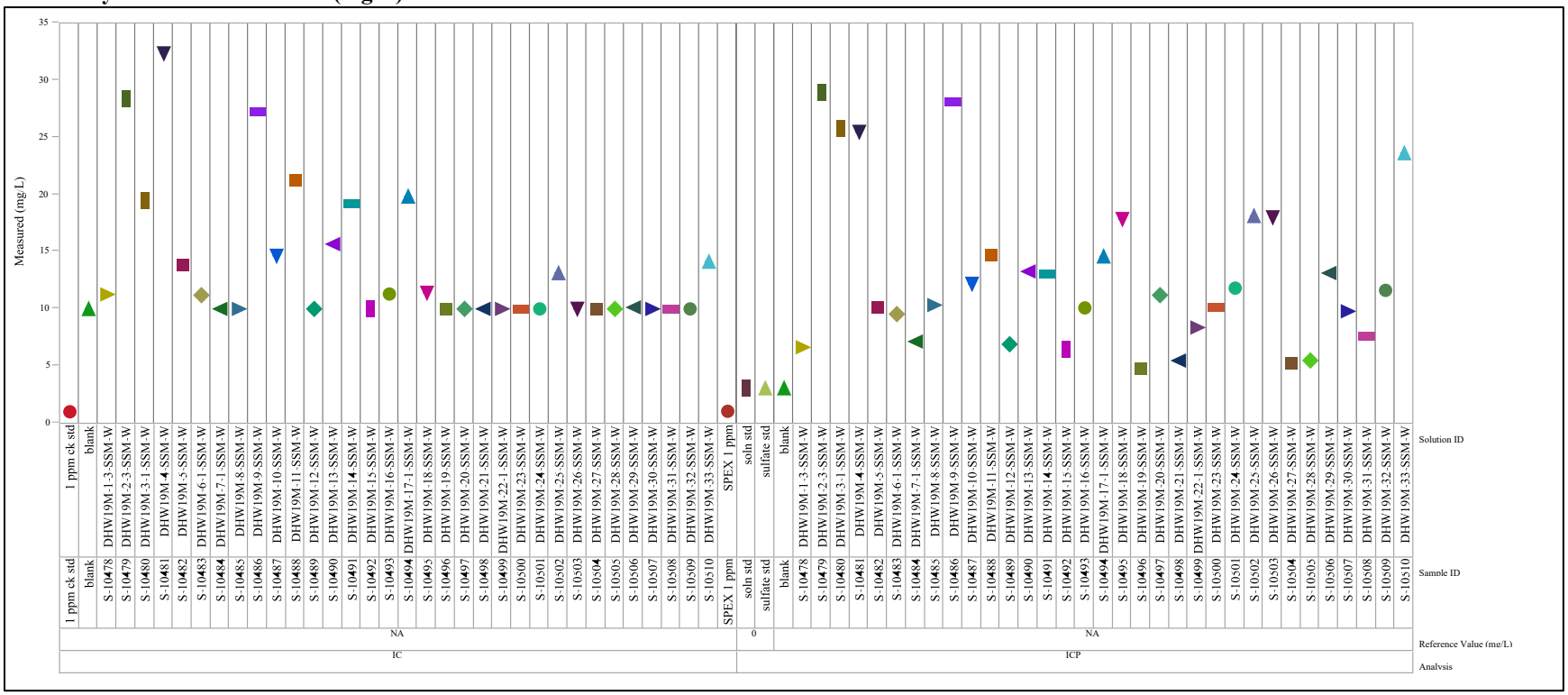


Exhibit B-3. Average Measurements of Wash Solutions by Analyte Grouped by Solution Identifier (continued)

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

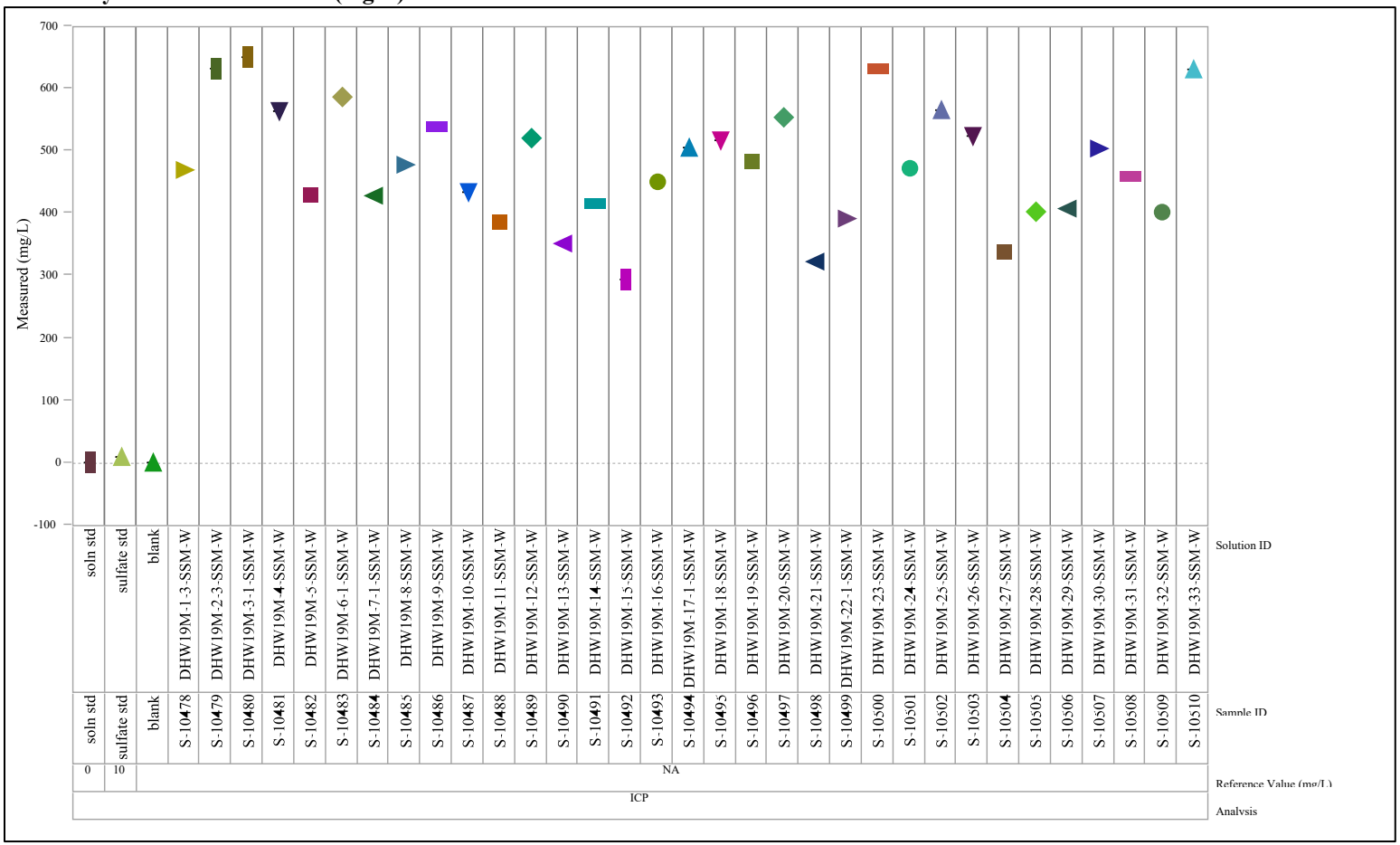


Exhibit B-3. Average Measurements of Wash Solutions by Analyte Grouped by Solution Identifier (continued)

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

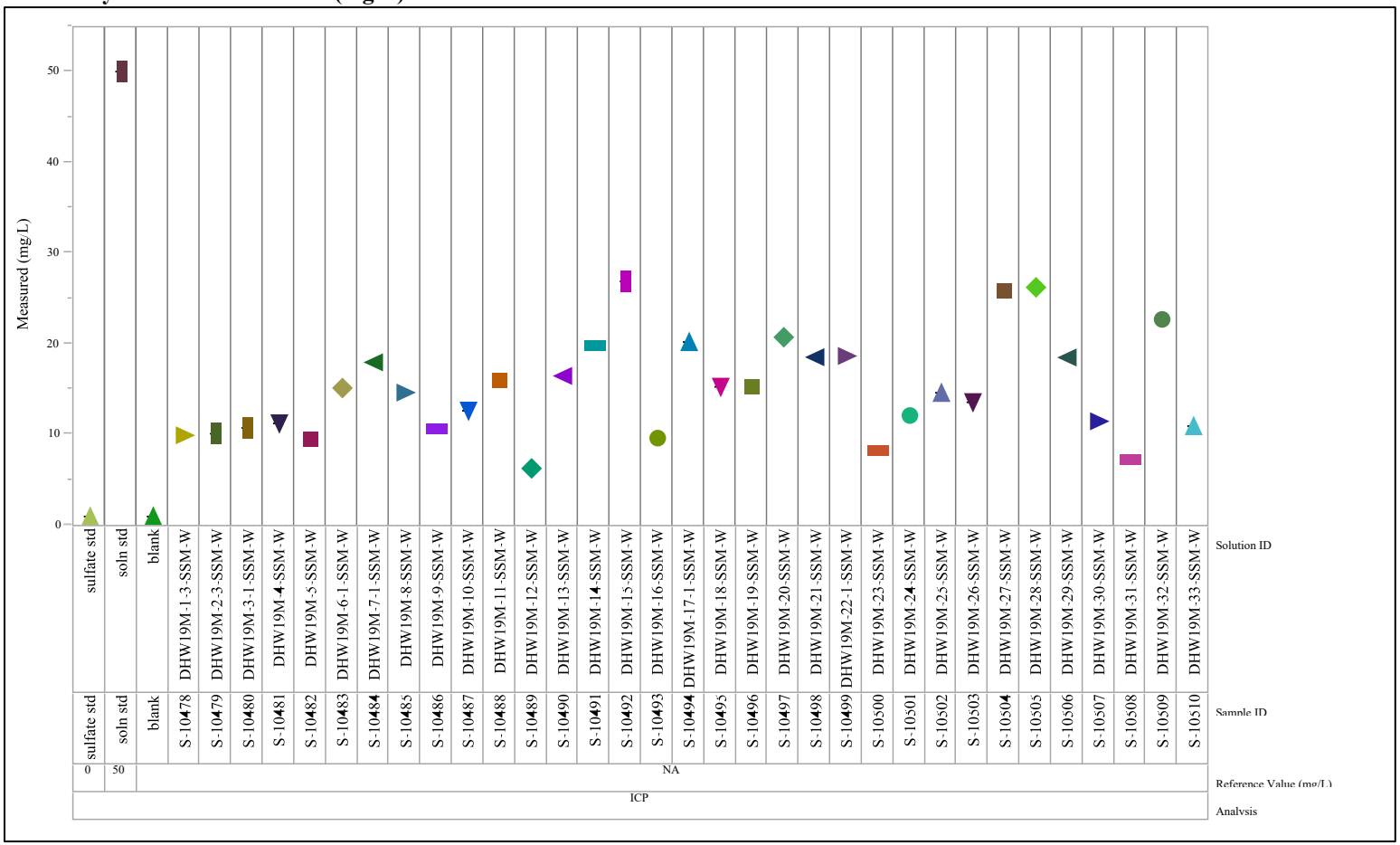


Exhibit B-3. Average Measurements of Wash Solutions by Analyte Grouped by Solution Identifier (continued)

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

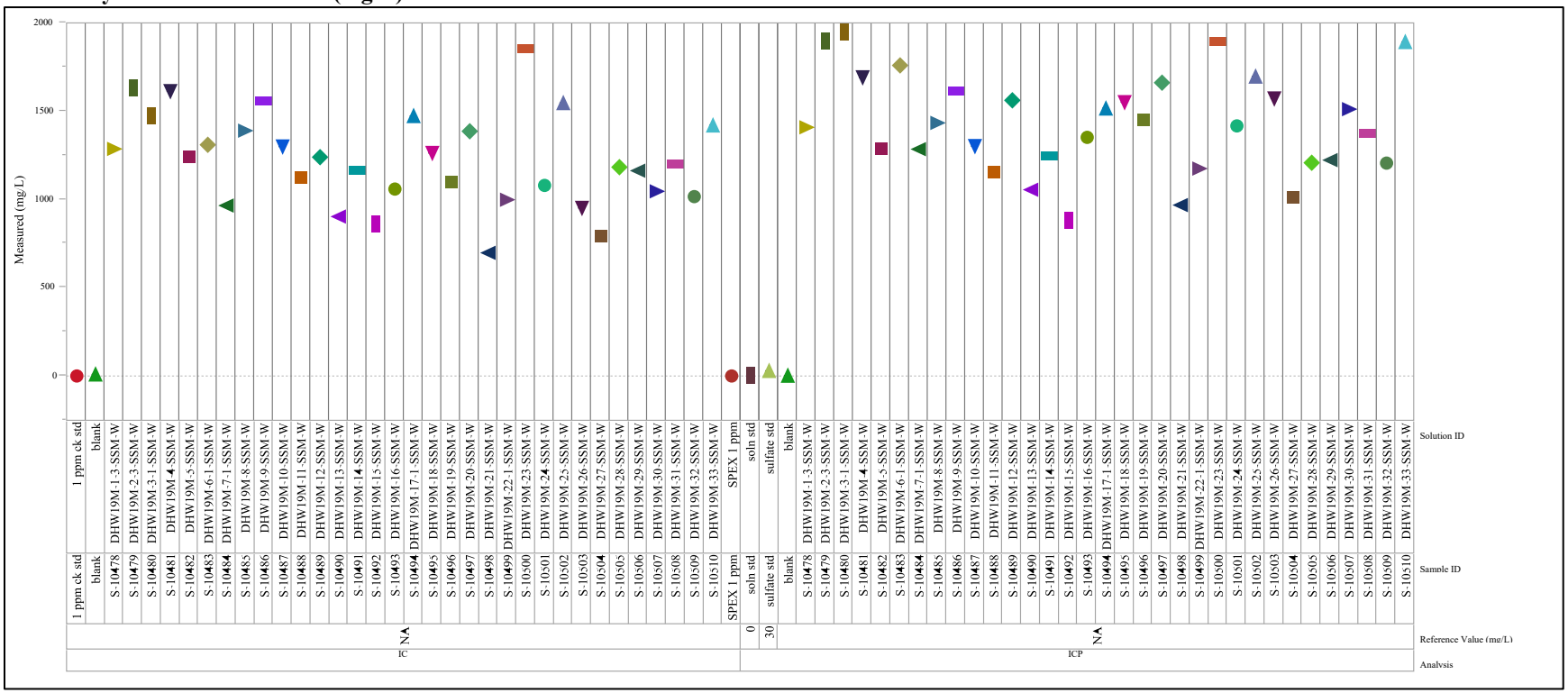
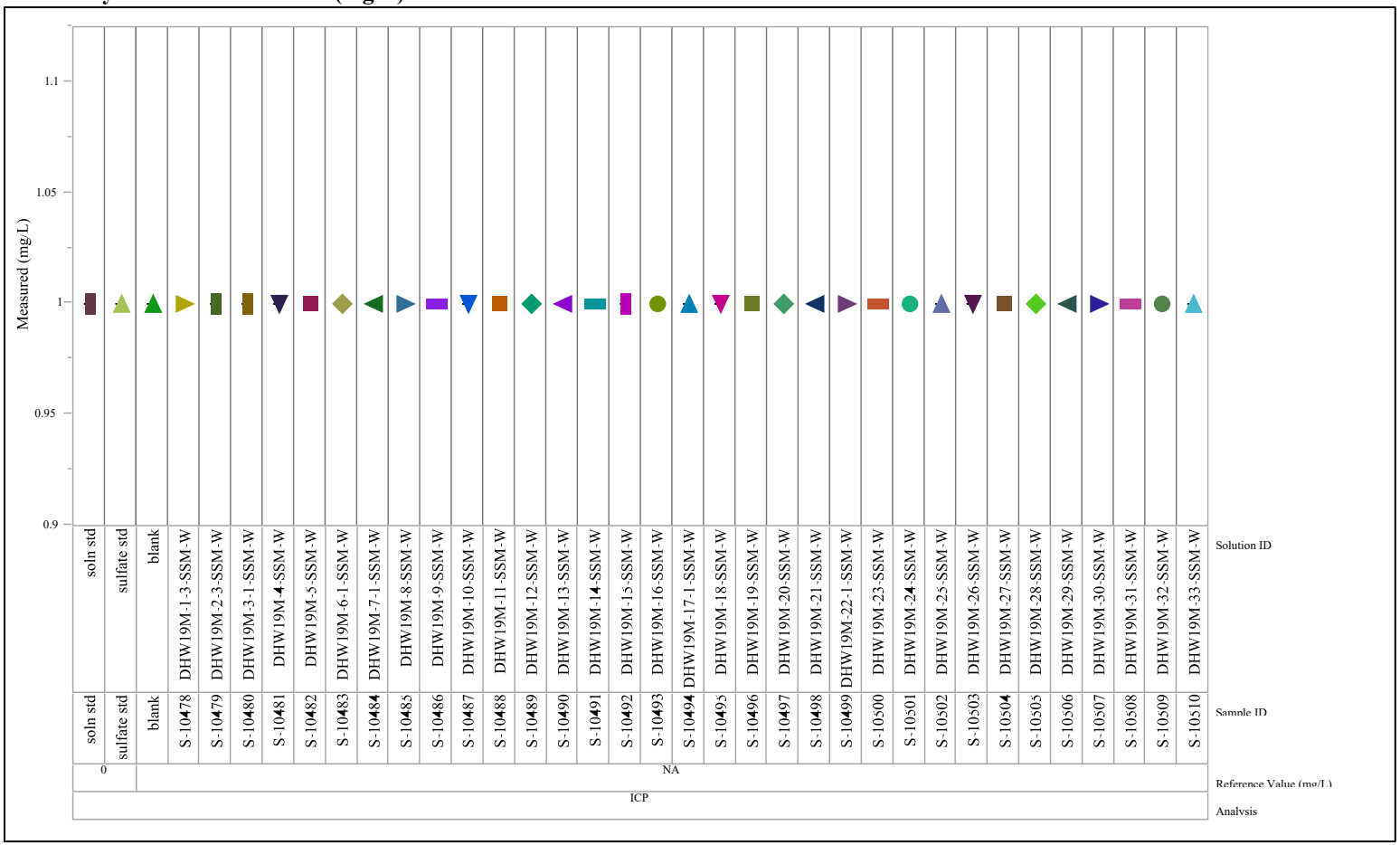


Exhibit B-3. Average Measurements of Wash Solutions by Analyte Grouped by Solution Identifier (continued)

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



Distribution:

J. W. Amoroso, 999-W
A. D. Cozzi, 999-W
C. L. Crawford, 773-42A
W. C. Eaton, PNNL
A. P. Fellinger, 773-42A
S. D. Fink, 773-A
K. M. Fox, 999-W
B. L. Garcia-Diaz, 999-2W
V. Gervasio, PNNL
H. K. Hall, 999-1W
C. C. Herman, 773-A
A. M. Howe, 999-W
M. C. Hsieh, 999-W
T. Jin, PNNL
F. C. Johnson, 999-W
D. S. Kim, PNNL
A. A. Kruger, DOE-ORP
B. Lee, 999-W
C. E. Lonergan, PNNL
J. Manna, 999-W
D. J. McCabe, 773-42A
D. L. McClane, 999-W
G. A. Morgan, 999-W
F. M. Pennebaker, 773-42A
W. T. Riley, 999-1W
R. L. Russell, PNNL
T. E. Skidmore, 730-A
C. L. Trivelpiece, 999-W
J. D. Vienna, PNNL
B. J. Wiedenman, 773-42A
Records Administration (EDWS)