WSRC-STI-2007-00477
Revision 0

VARIABILITY STUDY TO DETERMINE THE SOLUBILITY OF IMPURITIES IN PLUTONIUM-BEARING, LANTHANIDE BOROSILICATE GLASS

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

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Prepared For
U.S. Department of Energy

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Keywords: *waste glass, variability study, Pu disposition*

Retention: *permanent*

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REVIEWS AND APPROVALS

AUTHORS:

K.M. Fox, Process Science and Engineering Date

E.N. Hoffman, Materials Science and Technology Date

C.L. Crawford, Process Science and Engineering Date

T.B. Edwards, Statistical Consulting Section Date

D.R. Best, Process Science and Engineering Date

J.C. Marra, Materials Science and Technology Date

TECHNICAL REVIEWER:

D.K. Peeler, Process Science and Engineering Date

APPROVERS

G.T. Chandler, Manager, Materials Performance and Corrosion Technology Date

N.C. Iver, Director, Materials Science and Technology Date

D.P. Eisele, Nuclear Materials Management Engineering Date

R.H. Smith, Technology Manager Date

EXECUTIVE SUMMARY

This study focuses on the development of a compositional envelope that describes the retention of various impurities in lanthanide borosilicate (LaBS) glass for vitrification and immobilization of excess, defense-related plutonium. A limited amount of impurity data for the various plutonium sources is available and projections were made through analysis of the available information. These projections were used to define types and concentrations of impurities in the LaBS glass compositions to be fabricated and tested.

Sixty surrogate glass compositions were developed through a statistically designed approach to cover the anticipated ranges of concentrations for several impurity species expected in the plutonium feeds. An additional four glass compositions containing actual plutonium oxide were selected based on their targeted concentrations of metals and anions. The glasses were fabricated and characterized in the laboratory and shielded cells facility to determine the degree of retention of the impurity components, the impact of the impurities on the durability of each glass, and the degree of crystallization that occurred, both upon quenching and slow cooling.

Overall, the LaBS glass system appears to be very tolerant of most of the impurity types and concentrations projected in the plutonium waste stream. For the surrogate glasses, the measured CuO, Ga_2O_3, Na_2O, NiO, and Ta_2O_5 concentrations fell very close to their target values across the ranges of concentrations targeted in this study for each of these components. The measured CaO and PbO concentrations were consistently higher than the targeted values. The measured Cr_2O_3 and Fe_2O_3 concentrations were very close to the targets except for the one highest targeted value for each of these components. A solubility limit may have been approached in this glass system for K_2O and MgO. The measured Cl^-, F^-, SeO_2 and SO_4^{2-} concentrations were well below their target values for all of the study glasses. This is likely due to volatilization of these species during melting of the glass batch. Note that the degree of volatilization that occurred in this crucible-scale study may differ from the full-scale melter. The measured HfO_2 concentrations were below their target values for all of the surrogate glasses. It is likely that for HfO_2, the solubility limit in the glass was exceeded and some of the HfO_2 batch material remained in the bottom of the crucibles after pouring the glasses.

X-ray diffraction and scanning electron microscopy (SEM) results indicated that some crystalline HfO_2 remained in some of the surrogate glasses with the lowest concentration of impurities. No other crystalline phases were identified. The Product Consistency Test (PCT) results showed that all 60 of the surrogate glass compositions tested were very durable, regardless of thermal history, with the highest normalized release for boron being 0.041 g/L. The pH of the leachate solutions was generally lower than that of conventional waste glasses due to the lack of alkali in the LaBS glass, which likely impacted the PCT results. The normalized release rates for the elements measured were generally too small to attempt to correlate the results with the compositions of the test glasses. The Toxicity Characteristic Leaching Procedure results showed that no hazardous metals were leached from the surrogate glasses in any measurable concentration.

A plutonium-containing crystalline phase with a cross-shaped morphology was identified via SEM in the glasses fabricated with plutonium oxide. This phase was identified in a previous study of plutonium-bearing LaBS glasses and may provide an opportunity to intentionally crystallize some of the plutonium oxide into a highly insoluble form with an intrinsic neutron absorber. Additional work is necessary to better characterize the influence that this phase has on durability of the glass.

The PCT results for the plutonium-containing LaBS glasses with impurities were similar to previous tests conducted on PuO_2-containing glasses without impurities added. The highest normalized release for boron was 0.02 g/L, which bounded the highest normalized release for plutonium of 0.01 g/L.

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LIST OF ABBREVIATIONS

AD	Analytical Development
ANOVA	ANalysis Of VAriance
ARM	Approved Reference Material
bc	bias-corrected
CCC	Can-in-Canister Cooled
DOE	Department Of Energy
DOE-EM	Department Of Energy – Office of Environmental Management
EA	Environmental Assessment
EDS	Energy Dispersive Spectroscopy
HLW	High Level Waste
IC	Ion Chromatography
ICP-AES	Inductively Coupled Plasma – Atomic Emission Spectroscopy
ICP-MS	Inductively Coupled Plasma – Mass Spectroscopy
LaBS	Lanthanide Borosilicate
LM	Lithium Metaborate
LRM	Low-activity Reference Material
MFFF	Mixed oxide Fuel Fabrication Facility
MOX	Mixed OXide
MT	Metric Tons
NL	Normalized Leachate
NMM	Nuclear Materials Management
PCT	Product Consistency Test
PIP	Plutonium Immobilization Program
PF	Peroxide Fusion
ppm	parts per million
PSAL	Process Science Analytical Laboratory
RCRA	Resource Conservation and Recovery Act
SEM	Scanning Electron Microscopy
SRNL	Savannah River National Laboratory
SRS	Savannah River Site
TCLP	Toxicity Characteristic Leaching Procedure
VPWF	Vitrified Plutonium Waste Form
WSRC	Washington Savannah River Company
XRD	X-Ray Diffraction

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1.0 Introduction

In the aftermath of the Cold War, the United States has identified an excess of up to 50 metric tons (MT) of weapons-useable plutonium. The Department of Energy (DOE) was to construct both a Mixed Oxide Fuel Fabrication Facility (MFFF) and a Plutonium Immobilization Program (PIP) facility to disposition this material. In April 2002, DOE decided not to construct the PIP facility and to solely proceed with the construction of the MFFF facility with a focus only on the disposition of weapons-grade plutonium to meet the non-proliferation agreement between Russia and the United States. This action resulted in several metric tons of DOE-Office of Environmental Management (DOE-EM) owned, weapons usable, plutonium-bearing materials having no clear disposition path.

A vitrification technology utilizing a lanthanide borosilicate (LaBS) glass appears to be a viable option to disposition excess weapons-useable plutonium that is not suitable for processing into mixed oxide (MOX) fuel. A significant effort to develop a glass formulation and vitrification process to immobilize plutonium was completed in the mid-1990s to support the PIP. The LaBS glass formulation was found to be capable of immobilizing in excess of 10 wt% Pu and to be tolerant of the impurities accompanying the plutonium material streams.[1, 2] Thus, this waste form could be suitable for the disposition of plutonium owned by the DOE-EM that may not be well characterized and that may contain high levels of impurities. However, the relative tolerance of the glass composition to the various feed impurities needs to be studied.

The can-in-canister technology demonstrated in the PIP[3, 4] could be utilized to dispose of the vitrified plutonium in the federal radioactive waste repository. The can-in-canister technology involves placing small cans of the vitrified Pu form into a high level waste (HLW) glass canister fitted with a rack to hold the cans and then filling the canister with HLW glass to provide proliferation resistance. The completed assembly containing the plutonium glass and the HLW glass would be referred to as the Vitrified Plutonium Waste Form (VPWF).

This study focuses on the development of a composition envelope that describes the degree of retention of various impurities in the LaBS glass. A detailed analysis of the types and concentrations of the impurities expected in the Pu feed stream has recently been issued.[5] A series of glass compositions was selected, as documented in a previous report,[6] based on these projections. These glasses will provide further insight into the impurity tolerance of the LaBS glass.

The results of this glass selection process provided an array of glass compositions to be fabricated and characterized in the laboratory in order to evaluate the retention of various impurity elements, their effects on crystallization and durability response. The array was developed using a layered process to allow for an evaluation of both linear and non-linear effects of the impurities. The majority of the glasses were formulated with Hf as a surrogate for Pu on a mass basis to simplify laboratory experiments. Pu glass testing was implemented for select compositions for comparison with the results of the surrogate testing. This report describes the outcome of the experimental work, including the measured retention[a] of various impurity species in the test glasses, the durability of these glasses, and characterization of any crystallization in the glasses after both quenching and slow cooling.

This work was initiated by an Nuclear Materials Management (NMM) Technical Task Request[7] and is performed under a Savannah River National Laboratory (SRNL) Task Technical and Quality Assurance Plan.[8]

[a] Note that "retention" is used here rather than "solubility" since true equilibrium conditions are not likely to be achieved in this crucible-scale study.

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2.0 Experimental Procedure

2.1 Target Compositions of Selected Glasses

The strategy used in selecting glasses for the impurity variability study is described in a previous report.[6] The target compositions for the surrogate and PuO_2 glasses will be briefly summarized here. Each variability study glass was fabricated with a lanthanide borosilicate glass frit termed LaBS Frit X.[9] The nominal composition of this frit is given in Table 2-1.

Table 2-1. Composition of LaBS Frit X (in wt% oxides).

Component	wt%
Al_2O_3	10.0
B_2O_3	13.0
Gd_2O_3	13.5
HfO_2	7.0
La_2O_3	19.0
Nd_2O_3	15.0
SiO_2	20.0
SrO	2.5

A series of impurity elements and their concentrations was chosen based on an analysis of the anticipated Pu feeds provided by Moore and Allender.[5] An array of 60 surrogate glass compositions was developed to examine the influence of these impurities on the performance of glasses fabricated with Frit X. The surrogate glasses contained Hf in place of Pu on a mass basis. The target compositions of the 60 surrogate glasses are given in Table 2-2. The Glass ID numbers were developed to indicate the concentration of impurities in the Pu feed. For example, Pu35-xx indicates 35 wt % impurities in the Pu feed. In addition, four glasses were fabricated with PuO_2 for comparison with the surrogate glasses. These glass compositions were selected from the array of surrogate glasses, with the selection strategy being described in a previous report.[6] A letter 'B' was appended to the glass identifiers to distinguish the glasses made with PuO_2 from the surrogates (i.e., Pu35-03B, Pu35-06B, Pu35-17B and Pu04-04B). The target compositions of the four glasses fabricated with PuO_2 are given in Table 2-3.

Table 2-2. Target compositions of the variability study surrogate glasses (in wt % oxides).

Glass ID	Cl^-	Ta_2O_5	MgO	K_2O	Fe_2O_3	Na_2O	F^-	CaO	Ga_2O_3	NiO	Cr_2O_3	CuO	SO_4^{2-}
Pu35-01	0.58	0.07	1.62	0.26	0.39	0.80	0.00	0.00	0.95	0.21	0.00	0.15	0.00
Pu35-02	0.58	0.07	1.45	0.74	0.08	0.35	0.45	0.36	0.08	0.15	0.33	0.07	0.17
Pu35-03	0.57	0.18	0.54	0.31	0.14	1.48	0.00	0.77	0.45	0.07	0.64	0.00	0.00
Pu35-04	0.59	0.46	1.06	0.45	0.27	0.56	0.52	0.32	0.36	0.07	0.09	0.07	0.00
Pu35-05	0.58	0.09	0.52	0.78	1.32	0.35	0.00	0.13	0.29	0.00	0.64	0.29	0.00
Pu35-06	0.60	0.10	0.91	0.27	0.97	0.80	0.48	0.29	0.00	0.28	0.22	0.00	0.17
Pu35-07	0.62	1.30	0.54	0.42	0.09	0.61	0.19	0.20	0.08	0.37	0.13	0.16	0.17
Pu35-08	0.62	0.39	0.88	0.77	0.89	0.40	0.30	0.24	0.16	0.25	0.09	0.07	0.00
Pu35-09	0.64	0.11	0.53	1.54	0.00	1.13	0.00	0.10	0.13	0.19	0.08	0.25	0.17
Pu35-10	0.65	0.27	0.81	0.36	0.59	0.67	0.38	0.08	0.71	0.07	0.08	0.07	0.17
Pu35-11	0.69	0.69	0.99	0.38	0.08	0.69	0.06	0.40	0.21	0.17	0.40	0.00	0.17
Pu35-12	0.65	0.59	0.66	0.28	0.19	0.79	0.33	0.08	0.36	0.47	0.40	0.18	0.00
Pu35-13	0.77	0.84	0.76	0.44	0.37	1.09	0.06	0.00	0.08	0.00	0.37	0.15	0.00
Pu35-14	0.80	0.34	0.44	0.20	1.00	1.07	0.08	0.38	0.27	0.07	0.13	0.07	0.00
Pu35-15	1.00	0.00	0.54	0.59	0.00	0.88	0.00	0.00	1.27	0.60	0.00	0.00	0.00
Pu35-16	0.95	0.29	0.73	0.00	0.46	1.23	0.00	0.70	0.15	0.13	0.00	0.29	0.17
Pu35-17	1.11	0.55	0.40	0.43	0.00	1.04	0.06	0.08	0.68	0.07	0.31	0.10	0.17
Pu35-18	0.58	0.07	1.04	1.10	0.08	0.94	0.06	0.57	0.08	0.07	0.48	0.07	0.00
Pu35-19	0.58	0.07	1.38	0.37	0.78	0.78	0.38	0.08	0.08	0.07	0.48	0.07	0.00
Pu35-20	0.58	0.51	0.55	0.85	0.28	0.50	0.29	0.23	0.51	0.29	0.40	0.07	0.00
Pu35-21	0.58	1.14	1.28	0.41	0.08	0.59	0.06	0.08	0.62	0.07	0.09	0.07	0.00
Pu35-22	0.60	0.52	0.69	0.55	0.37	0.74	0.47	0.59	0.08	0.08	0.15	0.22	0.00
Pu35-23	0.59	0.83	0.67	0.16	0.56	0.93	0.09	0.16	0.53	0.12	0.29	0.22	0.00
Pu35-24	0.63	0.15	0.67	0.53	0.41	0.58	0.24	0.40	0.83	0.10	0.37	0.22	0.00
Pu35-25	0.67	0.59	0.48	0.70	0.83	0.48	0.07	0.28	0.26	0.35	0.17	0.22	0.00
Pu35-26	0.66	0.22	0.89	0.25	0.47	0.77	0.10	0.43	0.79	0.22	0.27	0.07	0.00
Pu35-27	0.72	0.67	0.61	0.52	0.46	0.65	0.24	0.32	0.27	0.07	0.48	0.07	0.00
Pu35-28	0.72	0.54	0.93	0.39	0.08	0.74	0.10	0.11	0.41	0.36	0.48	0.22	0.00
Pu35-29	0.84	0.34	0.47	0.84	0.18	0.95	0.36	0.08	0.70	0.07	0.09	0.07	0.00
Pu35-30	0.58	0.07	0.46	1.11	0.08	0.90	0.06	0.46	0.75	0.07	0.08	0.07	0.17
Pu35-31	0.58	0.07	0.60	1.12	0.83	0.47	0.47	0.08	0.08	0.17	0.09	0.07	0.17
Pu35-32	0.58	0.07	1.39	0.26	0.08	0.69	0.40	0.08	0.90	0.07	0.08	0.07	0.17
Pu35-33	0.57	0.07	1.37	0.08	0.56	0.90	0.13	0.44	0.08	0.07	0.48	0.07	0.17
Pu35-34	0.58	0.71	1.38	0.58	0.08	0.48	0.06	0.37	0.08	0.07	0.08	0.22	0.17
Pu35-35	0.58	1.12	0.46	0.07	0.82	0.93	0.06	0.08	0.39	0.07	0.08	0.07	0.17
Pu35-36	0.60	0.51	0.89	0.43	0.11	0.67	0.16	0.08	0.31	0.33	0.37	0.22	0.17
Pu35-37	0.60	0.35	1.02	0.36	0.28	0.65	0.10	0.17	0.36	0.37	0.40	0.07	0.17
Pu35-38	0.66	0.53	0.73	0.45	0.17	0.66	0.31	0.43	0.30	0.18	0.18	0.07	0.17
Pu35-39	0.69	0.50	0.70	0.77	0.29	0.70	0.18	0.08	0.31	0.07	0.31	0.07	0.17
Pu35-40	0.72	0.07	0.65	0.50	0.56	0.65	0.14	0.41	0.39	0.10	0.32	0.22	0.17
Pu35-41	0.93	0.07	1.39	0.34	0.08	0.94	0.06	0.08	0.08	0.44	0.08	0.15	0.17
Pu35-42	0.58	0.21	1.08	0.84	0.17	0.78	0.12	0.16	0.16	0.15	0.34	0.14	0.17
Pu35-43	0.58	0.49	0.65	0.21	0.57	0.74	0.20	0.35	0.35	0.20	0.25	0.14	0.17
Pu35-44	0.58	0.54	0.80	0.31	0.58	0.66	0.19	0.28	0.30	0.15	0.25	0.11	0.17
Pu35-45	0.58	0.70	0.75	0.20	0.46	0.73	0.12	0.23	0.48	0.22	0.17	0.11	0.17
Pu35-46	0.59	0.45	0.73	0.41	0.17	0.63	0.35	0.17	0.54	0.30	0.17	0.15	0.17
Pu35-47	0.61	0.85	0.61	0.25	0.17	0.73	0.12	0.40	0.19	0.29	0.34	0.14	0.17
Pu35-48	0.63	0.35	0.79	0.29	0.50	0.73	0.20	0.37	0.34	0.19	0.23	0.11	0.17
Pu35-49	0.64	0.27	0.77	0.63	0.52	0.64	0.19	0.32	0.19	0.20	0.19	0.14	0.17
Pu35-50	0.64	0.18	0.66	0.69	0.49	0.65	0.20	0.26	0.32	0.24	0.25	0.11	0.17
Pu35-51	0.65	0.32	0.90	0.26	0.56	0.75	0.22	0.16	0.16	0.29	0.32	0.11	0.17
Pu35-52	0.69	0.14	0.82	0.37	0.39	0.71	0.14	0.17	0.58	0.23	0.33	0.14	0.17
Pu35-53	0.70	0.77	0.62	0.47	0.17	0.79	0.35	0.16	0.16	0.15	0.17	0.11	0.17
Pu35-54	0.64	0.46	0.81	0.57	0.42	0.70	0.21	0.28	0.41	0.16	0.30	0.13	0.00
Pu35-55	0.63	0.39	0.84	0.46	0.36	0.72	0.19	0.24	0.32	0.19	0.23	0.12	0.17
Pu04-01	0.12	0.00	0.00	0.21	0.00	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pu04-02	0.00	0.00	0.08	0.07	0.00	0.32	0.12	0.00	0.00	0.00	0.00	0.00	0.00
Pu04-03	0.06	0.00	0.16	0.00	0.17	0.16	0.06	0.00	0.00	0.00	0.00	0.00	0.00
Pu04-04	0.00	0.00	0.08	0.07	0.08	0.08	0.00	0.08	0.00	0.08	0.09	0.07	0.00
Pu04-05	0.12	0.00	0.00	0.00	0.00	0.32	0.12	0.00	0.00	0.00	0.00	0.00	0.00

Table 2-2. Target compositions of the variability study surrogate glasses (in wt % oxides).
(continued)

Glass ID	C	PbO	SeO_2	Cs_2O	HfO_2	Al_2O_3	B_2O_3	Gd_2O_3	La_2O_3	Nd_2O_3	SiO_2	SrO	Total
Pu35-01	0.06	0.00	0.08	0.00	14.86	8.60	11.18	11.61	16.34	12.90	17.20	2.15	100
Pu35-02	0.00	0.06	0.08	0.06	14.92	8.60	11.18	11.61	16.34	12.90	17.20	2.15	100
Pu35-03	0.00	0.00	0.00	0.06	14.81	8.60	11.18	11.61	16.34	12.90	17.20	2.15	100
Pu35-04	0.06	0.08	0.08	0.00	15.00	8.60	11.18	11.61	16.34	12.90	17.20	2.15	100
Pu35-05	0.06	0.07	0.00	0.06	14.85	8.60	11.18	11.61	16.34	12.90	17.20	2.15	100
Pu35-06	0.06	0.00	0.00	0.00	14.87	8.60	11.18	11.61	16.34	12.90	17.20	2.15	100
Pu35-07	0.06	0.06	0.00	0.06	14.96	8.60	11.18	11.61	16.34	12.90	17.20	2.15	100
Pu35-08	0.00	0.00	0.00	0.00	14.95	8.60	11.18	11.61	16.34	12.90	17.20	2.15	100
Pu35-09	0.06	0.08	0.08	0.00	14.92	8.60	11.18	11.61	16.34	12.90	17.20	2.15	100
Pu35-10	0.00	0.06	0.08	0.06	14.90	8.60	11.18	11.61	16.34	12.90	17.20	2.15	100
Pu35-11	0.06	0.07	0.08	0.00	14.87	8.60	11.18	11.61	16.34	12.90	17.20	2.15	100
Pu35-12	0.00	0.00	0.08	0.00	14.96	8.60	11.18	11.61	16.34	12.90	17.20	2.15	100
Pu35-13	0.00	0.08	0.00	0.06	14.96	8.60	11.18	11.61	16.34	12.90	17.20	2.15	100
Pu35-14	0.06	0.06	0.08	0.06	14.90	8.60	11.18	11.61	16.34	12.90	17.20	2.15	100
Pu35-15	0.00	0.08	0.00	0.06	15.00	8.60	11.18	11.61	16.34	12.90	17.20	2.15	100
Pu35-16	0.00	0.06	0.00	0.00	14.85	8.60	11.18	11.61	16.34	12.90	17.20	2.15	100
Pu35-17	0.06	0.00	0.00	0.00	14.95	8.60	11.18	11.61	16.34	12.90	17.20	2.15	100
Pu35-18	0.00	0.00	0.00	0.00	14.88	8.60	11.18	11.61	16.34	12.90	17.20	2.15	100
Pu35-19	0.00	0.00	0.00	0.00	14.89	8.60	11.18	11.61	16.34	12.90	17.20	2.15	100
Pu35-20	0.00	0.00	0.00	0.00	14.95	8.60	11.18	11.61	16.34	12.90	17.20	2.15	100
Pu35-21	0.00	0.00	0.00	0.00	14.94	8.60	11.18	11.61	16.34	12.90	17.20	2.15	100
Pu35-22	0.00	0.00	0.00	0.00	14.98	8.60	11.18	11.61	16.34	12.90	17.20	2.15	100
Pu35-23	0.00	0.00	0.00	0.00	14.88	8.60	11.18	11.61	16.34	12.90	17.20	2.15	100
Pu35-24	0.00	0.00	0.00	0.00	14.90	8.60	11.18	11.61	16.34	12.90	17.20	2.15	100
Pu35-25	0.00	0.00	0.00	0.00	14.92	8.60	11.18	11.61	16.34	12.90	17.20	2.15	100
Pu35-26	0.00	0.00	0.00	0.00	14.87	8.60	11.18	11.61	16.34	12.90	17.20	2.15	100
Pu35-27	0.00	0.00	0.00	0.00	14.94	8.60	11.18	11.61	16.34	12.90	17.20	2.15	100
Pu35-28	0.00	0.00	0.00	0.00	14.93	8.60	11.18	11.61	16.34	12.90	17.20	2.15	100
Pu35-29	0.00	0.00	0.00	0.00	15.03	8.60	11.18	11.61	16.34	12.90	17.20	2.15	100
Pu35-30	0.06	0.06	0.08	0.06	14.88	8.60	11.18	11.61	16.34	12.90	17.20	2.15	100
Pu35-31	0.06	0.06	0.08	0.06	14.95	8.60	11.18	11.61	16.34	12.90	17.20	2.15	100
Pu35-32	0.06	0.06	0.08	0.06	14.90	8.60	11.18	11.61	16.34	12.90	17.20	2.15	100
Pu35-33	0.06	0.06	0.08	0.06	14.78	8.60	11.18	11.61	16.34	12.90	17.20	2.15	100
Pu35-34	0.06	0.06	0.08	0.06	14.89	8.60	11.18	11.61	16.34	12.90	17.20	2.15	100
Pu35-35	0.06	0.06	0.08	0.06	14.85	8.60	11.18	11.61	16.34	12.90	17.20	2.15	100
Pu35-36	0.06	0.06	0.08	0.06	14.89	8.60	11.18	11.61	16.34	12.90	17.20	2.15	100
Pu35-37	0.06	0.06	0.08	0.06	14.85	8.60	11.18	11.61	16.34	12.90	17.20	2.15	100
Pu35-38	0.06	0.06	0.08	0.06	14.93	8.60	11.18	11.61	16.34	12.90	17.20	2.15	100
Pu35-39	0.06	0.06	0.08	0.06	14.92	8.60	11.18	11.61	16.34	12.90	17.20	2.15	100
Pu35-40	0.06	0.06	0.08	0.06	14.86	8.60	11.18	11.61	16.34	12.90	17.20	2.15	100
Pu35-41	0.06	0.06	0.08	0.06	14.93	8.60	11.18	11.61	16.34	12.90	17.20	2.15	100
Pu35-42	0.06	0.06	0.08	0.06	14.88	8.60	11.18	11.61	16.34	12.90	17.20	2.15	100
Pu35-43	0.06	0.06	0.08	0.06	14.85	8.60	11.18	11.61	16.34	12.90	17.20	2.15	100
Pu35-44	0.06	0.06	0.08	0.06	14.86	8.60	11.18	11.61	16.34	12.90	17.20	2.15	100
Pu35-45	0.06	0.06	0.08	0.06	14.86	8.60	11.18	11.61	16.34	12.90	17.20	2.15	100
Pu35-46	0.06	0.06	0.08	0.06	14.92	8.60	11.18	11.61	16.34	12.90	17.20	2.15	100
Pu35-47	0.06	0.06	0.08	0.06	14.88	8.60	11.18	11.61	16.34	12.90	17.20	2.15	100
Pu35-48	0.06	0.06	0.08	0.06	14.86	8.60	11.18	11.61	16.34	12.90	17.20	2.15	100
Pu35-49	0.06	0.06	0.08	0.06	14.89	8.60	11.18	11.61	16.34	12.90	17.20	2.15	100
Pu35-50	0.06	0.06	0.08	0.06	14.89	8.60	11.18	11.61	16.34	12.90	17.20	2.15	100
Pu35-51	0.06	0.06	0.08	0.06	14.87	8.60	11.18	11.61	16.34	12.90	17.20	2.15	100
Pu35-52	0.06	0.06	0.08	0.06	14.86	8.60	11.18	11.61	16.34	12.90	17.20	2.15	100
Pu35-53	0.06	0.06	0.08	0.06	14.97	8.60	11.18	11.61	16.34	12.90	17.20	2.15	100
Pu35-54	0.00	0.00	0.00	0.00	14.93	8.60	11.18	11.61	16.34	12.90	17.20	2.15	100
Pu35-55	0.06	0.06	0.08	0.06	14.88	8.60	11.18	11.61	16.34	12.90	17.20	2.15	100
Pu04-01	0.00	0.00	0.00	0.00	19.45	8.60	11.18	11.61	16.34	12.90	17.20	2.15	100
Pu04-02	0.00	0.00	0.00	0.00	19.43	8.60	11.18	11.61	16.34	12.90	17.20	2.15	100
Pu04-03	0.00	0.00	0.00	0.00	19.42	8.60	11.18	11.61	16.34	12.90	17.20	2.15	100
Pu04-04	0.00	0.00	0.00	0.00	19.39	8.60	11.18	11.61	16.34	12.90	17.20	2.15	100
Pu04-05	0.00	0.00	0.00	0.00	19.46	8.60	11.18	11.61	16.34	12.90	17.20	2.15	100

Table 2-3. Target compositions of the variability study glasses containing PuO_2 (in wt % oxides).

Glass ID	Cl^-	Ta_2O_5	MgO	K_2O	Fe_2O_3	Na_2O	F^-	CaO	Ga_2O_3	NiO	Cr_2O_3	CuO	SO_4
Pu35-03B	0.57	0.18	0.54	0.31	0.14	1.48	0.00	0.77	0.45	0.07	0.64	0.00	0.00
Pu35-06B	0.60	0.10	0.91	0.27	0.97	0.80	0.48	0.29	0.00	0.28	0.22	0.00	0.17
Pu35-17B	1.11	0.55	0.40	0.43	0.00	1.04	0.06	0.08	0.68	0.07	0.31	0.10	0.17
Pu04-04B	0.00	0.00	0.08	0.07	0.08	0.08	0.00	0.08	0.00	0.08	0.09	0.07	0.00
Glass ID	**C**	**PbO**	**SeO_2**	**Cs_2O**	**PuO_2**	**HfO_2**	**Al_2O_3**	**B_2O_3**	**Gd_2O_3**	**La_2O_3**	**Nd_2O_3**	**SiO_2**	**SrO**
Pu35-03B	0.00	0.00	0.00	0.06	8.79	6.02	8.60	11.18	11.61	16.34	12.90	17.20	2.15
Pu35-06B	0.06	0.00	0.00	0.00	8.85	6.02	8.60	11.18	11.61	16.34	12.90	17.20	2.15
Pu35-17B	0.06	0.00	0.00	0.00	8.93	6.02	8.60	11.18	11.61	16.34	12.90	17.20	2.15
Pu04-04B	0.00	0.00	0.00	0.00	9.07	6.02	8.60	11.18	11.61	16.34	12.90	17.20	2.15

2.2 Glass Fabrication

Each variability study glass was prepared from the proper proportions of reagent-grade metal oxides, carbonates, fluorides, chlorides, H_3BO_3, and salts in 150 g batches.[10] The batches were thoroughly mixed and then melted in Pt/Rh crucibles at 1450 ºC for 1 hour. The glass was quenched by pouring onto a stainless steel plate. The resulting glass patty and the remaining contents of the crucible were ground to a fine powder using a ring pulverizer to further aid in mixing. The glass powder was subsequently re-melted at 1450 ºC for one hour and quenched. The glass pour patty was used as a sampling stock for the various property measurements, including chemical composition and durability testing.

Fabrication of the four glasses containing PuO_2 was slightly different since these glasses were prepared in the SRNL shielded cells facility and had to be produced using remotely operated equipment. The glasses were melted twice for 3 hours rather than 1 hour. Quenching after each melt was accomplished by partially submerging the crucibles in a tub of room temperature water rather than pouring onto a stainless steel plate. A hammer was used to pulverize the glasses in between the two melts instead of a ring pulverizer. These differences in fabrication technique should have no significant impact on the ability to compare the results of the surrogate and PuO_2 glass testing.[9]

Approximately 25 g of each glass was heat-treated to simulate cooling within a DWPF-type canister (the can-in-canister disposal method) to gauge the effects of thermal history on the performance of the glass. This cooling schedule will be referred to as the can-in-canister cooled (CCC) heat treatment, and is described in detail in a report by Jones, et al.[11] Note that this heat treatment schedule differs from the canister centerline cooled heat treatment typically performed for HLW glasses at the Savannah River Site (SRS).[12] Visual observations on both quenched and CCC glasses were documented. The CCC was not performed on the glasses fabricated with PuO_2. The analyses of these four glasses will be on the quenched versions only.

2.3 Property Measurements

This section provides a general discussion of the X-ray diffraction analyses, the chemical composition analyses and the Product Consistency Test (PCT) results of the impurity variability study glasses.

2.3.1 *X-Ray Diffraction Analysis*

Although visual observations for crystallization were performed and documented, representative samples for all quenched and CCC glasses were submitted to SRNL Analytical Development (AD) for X-ray diffraction (XRD) analysis. Samples were run under conditions providing a detection limit of approximately 0.5 vol %. That is, if crystals (or undissolved solids) were present at 0.5 vol % or greater, the diffractometer would not only be capable of detecting the crystals but would also allow a qualitative

determination of the type of crystal(s) present. Otherwise, a characteristically high background devoid of crystalline spectral peaks indicates that the glass product is amorphous, suggesting either a completely amorphous product or that the degree of crystallization is below the detection limit.

2.3.2 *Scanning Electron Microscopy*

Samples of select surrogate glasses were prepared for analysis by Scanning Electron Microscopy (SEM) and Energy Dispersive Spectroscopy (EDS). Four of the surrogate glasses (the CCC versions of glasses Pu04-03, Pu04-05, Pu35-20 and Pu35-25) were submitted for analysis since crystalline material was identified in these glasses by XRD. Each of the four glasses fabricated with PuO_2 was also submitted for SEM and EDS analysis to identify any crystalline phases that may be present below the XRD detection limit.

2.3.3 *Density*

The density of each of the surrogate glasses was measured using the Archimedes method with de-ionized water.[13] The density of the de-ionized water was corrected for temperature. To improve the accuracy of the measurements, relatively large chunks of each glass were used and an attempt was made to select samples with no visible cracking or porosity. In some cases, adequate samples of a particular glass were not available. Results of the density measurements for these glasses will be reported as "n/a". The densities of the glasses fabricated with PuO_2 were not measured.

2.3.4 *Compositional Analysis*

To confirm that the as-fabricated glasses met the target compositions, a representative sample from each glass was submitted to the SRNL Process Science Analytical Laboratory (PSAL) for chemical analysis under the auspices of an analytical plan. The plan (see Appendix A) identified the cations and anions to be analyzed and was developed in such a way as to provide the opportunity to evaluate potential sources of bias and error. Samples prepared using lithium-metaborate (LM) were used to measure aluminum (Al), calcium (Ca), chromium (Cr), copper (Cu), iron (Fe), gallium (Ga), gadolinium (Gd), hafnium (Hf), potassium (K), lanthanum (La), magnesium (Mg), sodium (Na), neodymium (Nd), nickel (Ni), lead (Pb), sulfur (S), selenium (Se), silicon (Si), strontium (Sr), and tantalum (Ta) concentrations. Samples prepared using sodium peroxide fusion (PF) were used to measure for boron (B) concentrations. All of the prepared samples were analyzed twice for each element of interest by Inductively Coupled Plasma – Atomic Emission Spectroscopy (ICP-AES), with the instrumentation being re-calibrated between the duplicate analyses. Two glass standards, (Waste Compliance Plan Batch 1[14] and the Low-Activity Reference Material (LRM),[15] were intermittently measured to assess the performance of the ICP-AES instrument over the course of these analyses. Samples of each glass were also prepared for Ion Chromatography (IC) analysis and were measured for the anions chlorine (Cl^-) and fluorine (F^-). The LRM and Batch 1 standards were also included in the IC analysis. It should be noted that some of the glasses were batched with carbon (C) and/or cesium (Cs), but due to difficulty in measuring the concentrations of these elements, they were excluded from the compositional analysis. The chemical compositions of the four glasses fabricated with PuO_2 were not measured due to difficulty in performing the necessary dissolutions in the shielded cells facility. Further analysis of these glasses will be based on their target compositions.

2.3.5 *Product Consistency Test*

The PCT[16] was performed in triplicate on each quenched and CCC glass to assess chemical durability. Also included in the experimental test matrix was the Environmental Assessment (EA) reference glass,[17] the Approved Reference Material (ARM) glass, and blanks from the sample cleaning batch. Samples were ground, washed, and prepared according to the standard procedure.[16] The vessels were closed, sealed, and placed in an oven at 90 ± 2 °C where the samples were maintained at temperature for seven days. Once cooled, the resulting solutions were sampled (filtered and acidified), then labeled and

analyzed by PSAL under the auspices of an analytical plan (see Appendix B). The aim of the plan was to provide an opportunity to assess the consistency (repeatability) of the PCT and analytical procedures in evaluating the chemical durability of the glasses. Normalized release rates for the surrogate glasses were calculated based on target, measured, and bias-corrected (bc) compositions using the average of the common logarithms of the leachate concentrations. Normalized release rates for the PuO_2 glasses were calculated based on target compositions only.

2.3.6 *Toxicity Characteristic Leaching Procedure (TCLP)*

The Toxicity Characteristic Leaching Procedure (TCLP) was performed for a select set of the surrogate glasses since some of the metal impurities included in this study are categorized as hazardous by the Resource Conservation and Recovery Act (RCRA). Eight of the surrogate glass compositions were selected for the TCLP based on their relatively high targeted concentrations of Cr, Pb, Ni and Se. These are compositions Pu35-11, Pu35-36, Pu35-37, Pu35-41, Pu35-47, Pu35-50, Pu35-51, and Pu35-52. The samples were sent to Davis & Floyd, Inc. (Greenwood, SC) for the TCLP analysis. The complete results provided by the laboratory will be included as an appendix to this report.

3.0 Results and Discussion

This section provides analysis of the experimental data. The surrogate glasses will be discussed first, followed by a separate section for discussion of the glasses fabricated with PuO_2.

3.1 Homogeneity

Table 3-1 lists the visual observations and XRD results for the quenched and CCC versions of the surrogate variability study glasses.[a] These results will be summarized below.

[a] For a more detailed description of the visual observations and XRD results, see WSRC-NB-2007-00022.

Table 3-1. Visual observations and XRD results for the variability study glasses.

Glass ID	Heat Treatment	Visual Observations	XRD Results
Pu04-01	quenched	patty: transparent purple with white streak on surface; crucible: milky/purple with undissolved material	amorphous
	CCC	clear, purple glass mixed with white/hazy pieces of glass	hafnium oxide
Pu04-02	quenched	patty: transparent purple with three white streaks on surface; crucible: milky/purple with undissolved material	amorphous
	CCC	transparent, light purple glass with a few milky/white pieces	possible tungsten carbide
Pu04-03	quenched	patty: transparent, brown color with large white streaks on surface; crucible: white undissolved material	hafnium oxide
	CCC	light purple glass with white spots of material melted together	hafnium oxide
Pu04-04	quenched	patty: very dark green with some dark swirls on surface and bulk; crucible: undissolved material along melt line and on bottom	amorphous
	CCC	dark green glass, appear clean	amorphous
Pu04-05	quenched	patty: purple, transparent with a large white swirl; crucible: a lot of undissolved material on bottom	hafnium oxide
	CCC	purple color glass with white pieces of material scattered throughout	hafnium oxide
Pu35-01	quenched	patty: light brown, transparent, clean; crucible: undissolved material on bottom	amorphous
	CCC	mottled gray/purple colors in the glass	possible tungsten carbide
Pu35-02	quenched	patty: very dark green with a light white streak on surface; crucible: undissolved material along melt line and on bottom	amorphous
	CCC	milky, green colored glass with possible crystals throughout	possible tungsten carbide
Pu35-03	quenched	patty: very dark green, clean; crucible: clean	amorphous
	CCC	milky, green colored glass with crystals throughout	amorphous
Pu35-04	quenched	patty: green, transparent, clean; crucible: some undissolved material on bottom	amorphous
	CCC	aqua color with crystals throughout	amorphous
Pu35-05	quenched	patty: dark green with milky green swirls on surface; crucible: undissolved material on bottom	amorphous
	CCC	aqua color with crystals throughout	amorphous
Pu35-06	quenched	patty: dark brown, clean; crucible: very small amount of undissolved material	amorphous
	CCC	pea-green color with crystals throughout	amorphous
Pu35-07	quenched	patty: dark green, clean; crucible: some undissolved material	amorphous
	CCC	aqua color with crystals throughout	amorphous
Pu35-08	quenched	patty: dark green with milky haze on surface; crucible: small amount of undissolved material	amorphous
	CCC	light aqua color with crystals throughout	amorphous
Pu35-09	quenched	patty: aqua blue with creamy swirls on surface; crucible: clean	amorphous
	CCC	very light aqua color with crystals throughout	amorphous
Pu35-10	quenched	patty: green, clean; crucible: white undissolved material in bottom	amorphous
	CCC	light aqua color with crystals throughout	possible tungsten carbide
Pu35-11	quenched	patty: dark green, clean; crucible: a few undissolved solids	amorphous
	CCC	aqua color with crystals throughout	amorphous
Pu35-12	quenched	patty: dark green, clean; crucible: some undissolved material in bottom	amorphous
	CCC	aqua color with crystals throughout	amorphous
Pu35-13	quenched	patty: clean; crucible: very small amount of undissolved material in bottom	amorphous
	CCC	aqua color with crystals throughout	amorphous
Pu35-14	quenched	patty: clean; crucible: some undissolved material in bottom	amorphous
	CCC	grayish/green color with crystals throughout	possible tungsten carbide

Table 3-1. Visual observations and XRD results for the variability study glasses. (continued)

Glass ID	Heat Treatment	Visual Observations	XRD Results
Pu35-15	quenched	patty: brown, transparent, clean; crucible: small amount of undissolved material	amorphous
	CCC	grayish/white color with crystals throughout	amorphous
Pu35-16	quenched	patty: brown, transparent, clean; crucible: some undissolved material on bottom	amorphous
	CCC	light brown, transparent, clean	amorphous
Pu35-17	quenched	patty: green, transparent, clean; crucible: some undissolved material on bottom	amorphous
	CCC	aqua color with crystals throughout	amorphous
Pu35-18	quenched	patty: deep aqua marine color with streaks, bottom a deep mottled color; crucible: undissolved material on bottom	amorphous
	CCC	aqua color with crystals throughout	possible tungsten carbide
Pu35-19	quenched	patty: dark green, clean; crucible: clean	amorphous
	CCC	darker green color with crystals throughout	possible tungsten carbide
Pu35-20	quenched	patty: dark green with some aqua colored streaks on surface; crucible: some undissolved material	amorphous
	CCC	green, crystals throughout	possible tungsten carbide
Pu35-21	quenched	patty: green, transparent, clean; crucible: a lot of undissolved material	amorphous
	CCC	light aqua color with crystals throughout	possible tungsten carbide
Pu35-22	quenched	patty: dark green, clean; crucible: tiny white undissolved solids on bottom and sides	amorphous
	CCC	milky light green with crystals throughout	possible tungsten carbide
Pu35-23	quenched	patty: dark green, clean; crucible: some undissolved material on bottom and sides	amorphous
	CCC	light green with darker swirls and crystals	amorphous
Pu35-24	quenched	patty: dark green, clean; crucible: very few undissolved solids	amorphous
	CCC	milky aqua color with crystals throughout	amorphous
Pu35-25	quenched	patty: dark green with milky haze and swirls on surface; crucible: undissolved material along melt line and some on bottom	amorphous
	CCC	milky green with crystals throughout	possible tungsten carbide
Pu35-26	quenched	patty: dark green, clean; crucible: very few undissolved solids	amorphous
	CCC	medium green with milky swirls, crystals throughout	possible tungsten carbide
Pu35-27	quenched	patty: dark green, clean; crucible: very few undissolved solids	amorphous
	CCC	milky green with crystals throughout	possible tungsten carbide
Pu35-28	quenched	patty: dark green, clean; crucible: a few tiny spots of undissolved material on the bottom and along the melt line	amorphous
	CCC	milky green with crystals throughout	possible tungsten carbide
Pu35-29	quenched	patty: aqua green swirls on surface and through bulk, bottom had a thin, dark green layer; crucible: aqua swirls and undissolved material on the bottom and along the melt line	amorphous
	CCC	creamy light green with crystals	possible tungsten carbide
Pu35-30	quenched	patty: aqua with milky swirls, darker green on bottom; crucible: undissolved material on bottom and along melt line	amorphous
	CCC	creamy light green with crystals	possible tungsten carbide
Pu35-31	quenched	patty: aqua with milky swirls, darker green on bottom; crucible: undissolved material on bottom and along melt line	amorphous
	CCC	light milky olive color with swirls, crystals throughout	possible tungsten carbide
Pu35-32	quenched	patty: green, transparent, clean; crucible: undissolved material on bottom and along melt line	amorphous
	CCC	milky aqua color with darker swirls, crystals throughout	amorphous
Pu35-33	quenched	patty: dark green, clean; crucible: clean, no visible undissolved material	amorphous
	CCC	milky aqua color with darker swirls, crystals throughout	possible tungsten carbide

Table 3-1. Visual observations and XRD results for the variability study glasses. (continued)

Glass ID	Heat Treatment	Visual Observations	XRD Results
Pu35-34	quenched	patty: green, transparent, clean; crucible: some undissolved material on bottom	amorphous
	CCC	aqua color, crystals throughout	possible tungsten carbide
Pu35-35	quenched	patty: dark green, transparent, clean; crucible: tiny amount of undissolved material	amorphous
	CCC	milky green with swirls, crystals throughout	amorphous
Pu35-36	quenched	patty: dark green, clean; crucible: small amount of undissolved material on bottom	amorphous
	CCC	light green with milky swirls	possible tungsten carbide
Pu35-37	quenched	patty: dark green glass, clean; crucible: small amount of undissolved material on bottom	amorphous
	CCC	light green, crystals throughout	possible tungsten carbide
Pu35-38	quenched	patty: transparent, medium green, clean; crucible: small amount of undissolved material on the bottom	amorphous
	CCC	milky green with swirls, crystals throughout	amorphous
Pu35-39	quenched	patty: aqua swirls on surface, thin layer of dark green glass on bottom; crucible: some undissolved material on bottom and along melt line	amorphous
	CCC	milky green with swirls, crystals throughout	amorphous
Pu35-40	quenched	patty: very dark green, clean; crucible: some undissolved material on bottom	amorphous
	CCC	light green with swirls, crystals throughout	possible tungsten carbide
Pu35-41	quenched	patty: very dark green glass, small amount of possibly undissolved material on surface; crucible: undissolved material on bottom	amorphous
	CCC	olive green with swirls, crystals throughout	possible tungsten carbide
Pu35-42	quenched	patty: some aqua green swirls on surface, no undissolved material; crucible: undissolved material on bottom and along melt line	amorphous
	CCC	light creamy green with swirls, crystals throughout	possible tungsten carbide
Pu35-43	quenched	patty: dark green, clean; crucible: undissolved material on bottom and along melt line	amorphous
	CCC	green with milky swirls, crystals throughout	possible tungsten carbide
Pu35-44	quenched	patty: dark green, clean; crucible: undissolved material on bottom and along melt line	amorphous
	CCC	light green with swirls, crystals throughout	possible tungsten carbide
Pu35-45	quenched	patty: green, transparent, clean; crucible: some undissolved material on bottom	amorphous
	CCC	dark green with milky swirls, crystals throughout	amorphous
Pu35-46	quenched	patty: green, transparent, clean; crucible: some undissolved material on bottom	amorphous
	CCC	light green with milky swirls, crystals throughout	possible tungsten carbide
Pu35-47	quenched	patty: green, transparent, clean; crucible: some undissolved material on bottom	amorphous
	CCC	light green, crystals throughout	possible tungsten carbide
Pu35-48	quenched	patty: dark green, clean; crucible: small amount of undissolved material on bottom and along melt line	amorphous
	CCC	green with swirls, crystals throughout	amorphous
Pu35-49	quenched	patty: dark green, clean; crucible: some undissolved material on bottom and along melt line	amorphous
	CCC	light green with milky swirls, crystals throughout	possible tungsten carbide
Pu35-50	quenched	patty: dark green with milky/aqua swirls on surface; crucible: undissolved material on bottom and along melt line	amorphous
	CCC	green with swirls, crystals throughout	amorphous

Table 3-1. Visual observations and XRD results for the variability study glasses. (continued)

Glass ID	Heat Treatment	Visual Observations	XRD Results
Pu35-51	quenched	patty: dark green, clean; crucible: some undissolved material on bottom and along melt line	amorphous
	CCC	light green with swirls, crystals throughout	possible tungsten carbide
Pu35-52	quenched	patty: dark green with light green streak on surface; crucible: undissolved material on bottom and along melt line	amorphous
	CCC	light green with swirls, crystals throughout	possible tungsten carbide
Pu35-53	quenched	patty: dark green, clean; crucible: undissolved material on bottom and along melt line	amorphous
	CCC	aqua, crystals throughout	possible tungsten carbide
Pu35-54	quenched	patty: dark green, clean; crucible: undissolved material on bottom and along melt line	amorphous
	CCC	aqua, crystals throughout	possible tungsten carbide
Pu35-55	quenched	patty: dark green, clean; crucible: undissolved material on bottom and along melt line	amorphous
	CCC	light green with swirls, crystals throughout	possible tungsten carbide

3.1.1 *Visual Observations*

Prior to discussing the visual observations, a few words regarding the terminology used are warranted. The term "surface" refers to the surface of the quenched pour patty or glass sample after the CCC heat treatment. The term "bulk" refers to the cross-section of the quenched pour patty or glass sample after the CCC heat treatment. The use of "clean" indicates that the sample was classified as a single-phase system (i.e., no visible evidence of crystallization).

Visual observations of the quenched variability study glasses (see Table 3-1) indicated that they were generally homogeneous, with some glasses having a small amount of surface crystallization evident in the form of "streaks" or "swirls". Most of the glasses left some visible crystalline material behind in the crucible after pouring. This material is likely to be undissolved HfO_2, which will be confirmed by the XRD results presented in the following section. No visible crystallization was observed in the glasses fabricated with PuO_2.

Visual observations of the CCC variability study glasses identified what appeared to be crystalline material in the majority of the glasses after heat treatment. However, the XRD results, discussed in the following section, do not corroborate these observations. It is likely that the volume of crystallization in the glasses was below the detection limit for XRD.

3.1.2 *XRD Results*

The XRD results are included in Table 3-1 and provide qualitative results regarding crystallization in the surrogate variability study glasses.

All but two of the quenched glasses were amorphous by XRD. This indicates that the glasses were either free of crystalline material, or that any crystallization was below the XRD detection limit of 0.5 vol %. Two of the quenched glasses formulated with 4% impurities in the simulated Pu feed (Pu04-03 and Pu04-05) contained some crystalline HfO_2. The target HfO_2 concentration in these glasses was relatively high at ~19.5 wt %. For the CCC glasses, 3 of the 5 glasses with 4 wt % impurities in the simulated Pu feed (Pu04-01, Pu04-03 and Pu04-05) contained some crystalline HfO_2. Again, this is not unexpected due to the high concentration of HfO_2 in the 4 wt % impurity glasses (i.e., these glasses contain both HfO_2 from the frit and a relatively high concentration of HfO_2 as a surrogate for PuO_2).

The possible presence of trevorite ($NiFe_2O_4$) was identified in several of the CCC glasses. However, later in the analysis, it became apparent that the XRD peak identified as trevorite might instead be tungsten carbide. For example, Figure 3-1 shows an XRD spectrum for the CCC version of glass Pu35-14. A peak at approximately 36 degrees 2θ has been identified as possible trevorite. Compare this with Figure 3-2, which shows an XRD spectrum for the CCC version of glass Pu35-42. For this glass, the peak at approximately 36 degrees 2θ has been identified as tungsten carbide (WC). It is likely that the peaks identified as trevorite are actually tungsten carbide. Tungsten carbide contamination in the glasses may have resulted from wear of the tungsten carbide grinder used between melting steps during fabrication. Also, as will be discussed below, no trevorite or other spinels were identified in the glass by SEM analysis. The presence of a small amount of tungsten carbide in the glasses should not affect the durability of the glasses or their ability to incorporate impurity species, and will therefore have no impact on the outcome of this study.

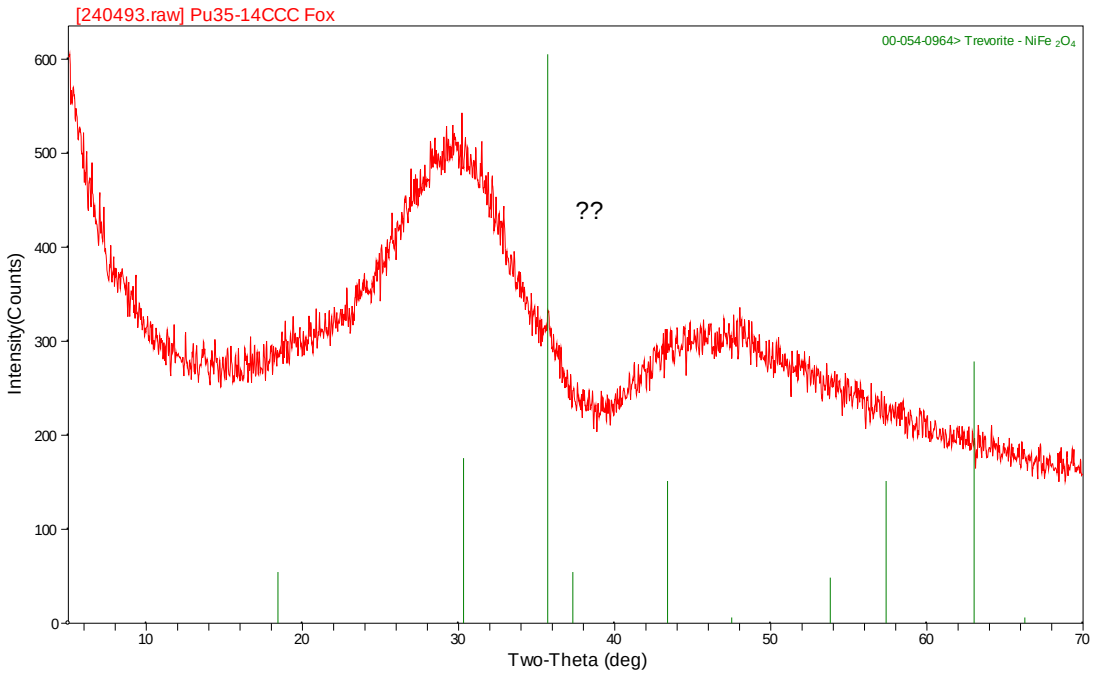

Figure 3-1. XRD results for the CCC version of surrogate glass Pu35-14.

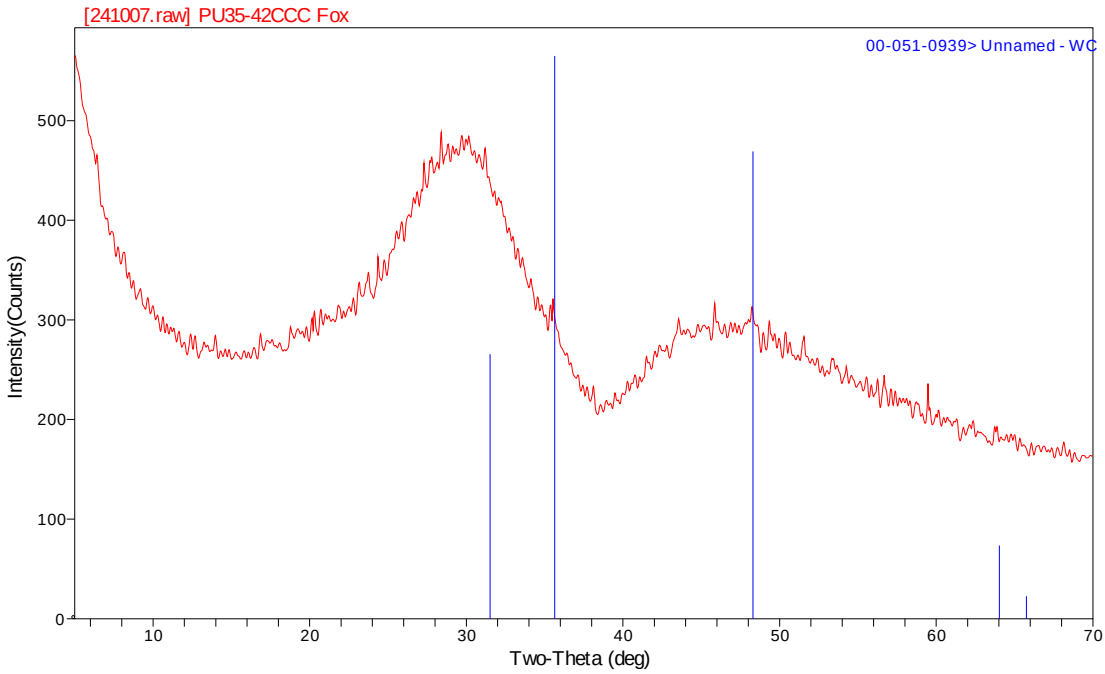

Figure 3-2. XRD results for the CCC version of surrogate glass Pu35-42.

3.1.3 *SEM Results*

SEM and EDS were used to provide further insight into the presence of any crystalline material in the surrogate glasses. Four of the surrogate glasses (the CCC versions of glasses Pu04-03, Pu04-05, Pu35-20 and Pu35-25) were submitted for analysis since crystalline material was identified in these glasses by XRD. Crystalline HfO_2 was identified by XRD in the CCC versions of glasses Pu04-03 and Pu04-05. This was confirmed by SEM and EDS. An example micrograph for glass Pu04-03 is given as Figure 3-3. Crystallites of HfO_2 appear brighter in this backscattered electron image due to their higher average atom mass, and EDS confirmed that the concentration of Hf in these crystallites was much higher than in the surrounding glass matrix. Similar crystallites were observed in glass Pu04-05.

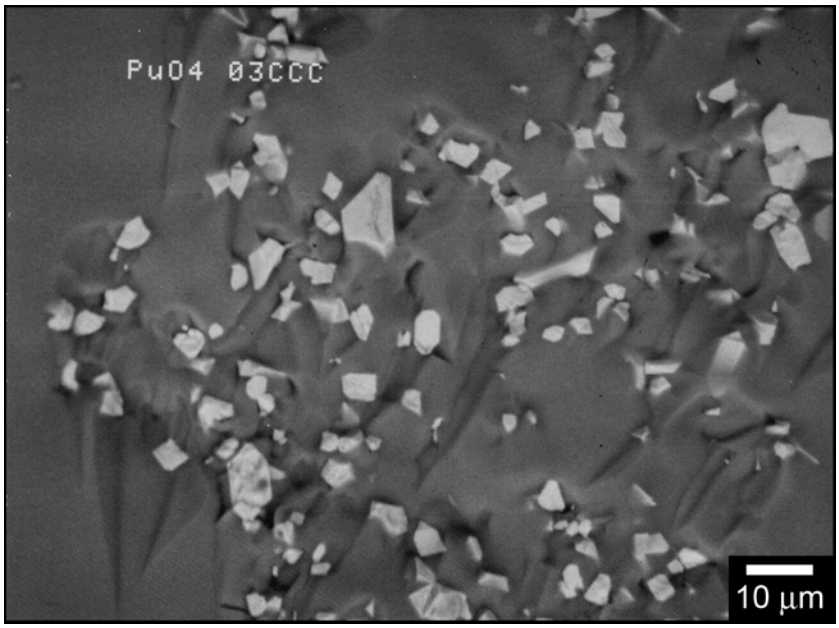

Figure 3-3. SEM micrograph of a fracture surface in the CCC version of glass Pu04-03 showing an area of undissolved HfO_2 (bright crystallites).

For the other two glasses, Pu35-20 and Pu35-25, trevorite was identified as a possible crystalline phase in the CCC versions of these glasses by XRD. As discussed in the previous section, it is more likely that the XRD peak identified as possible trevorite was actually a small amount of tungsten carbide contamination picked up during grinding of the glass. Example micrographs are shown in Figure 3-4 and Figure 3-5 for the CCC versions of Pu35-20 and Pu35-25, respectively. No crystalline material is visible in either image. The small, dark spots are small bubbles or pores in the glass. It is likely that any tungsten carbide present in these samples occupies a very small volume of the glass, and was therefore not observed by SEM.

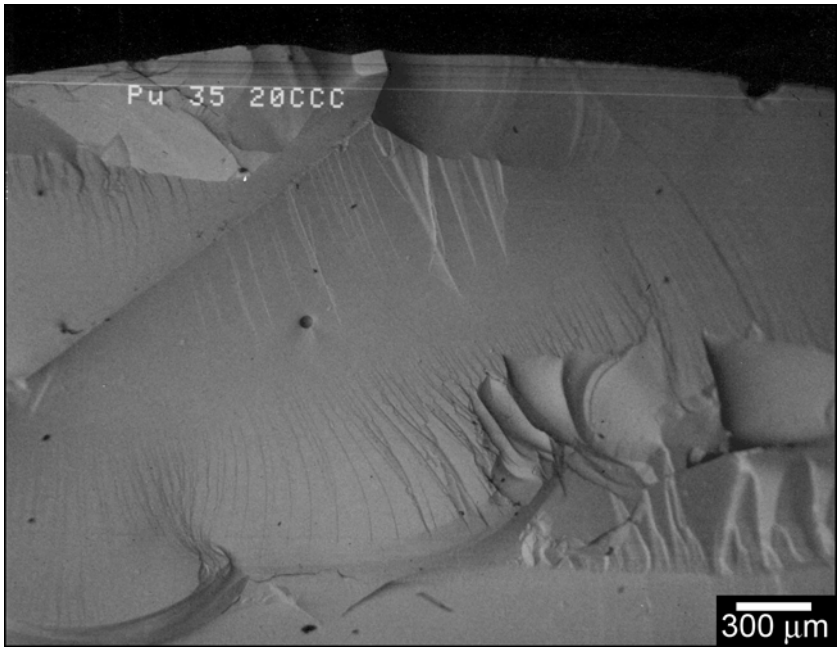

Figure 3-4. SEM micrograph of a fracture surface in the CCC version of glass Pu35-20.

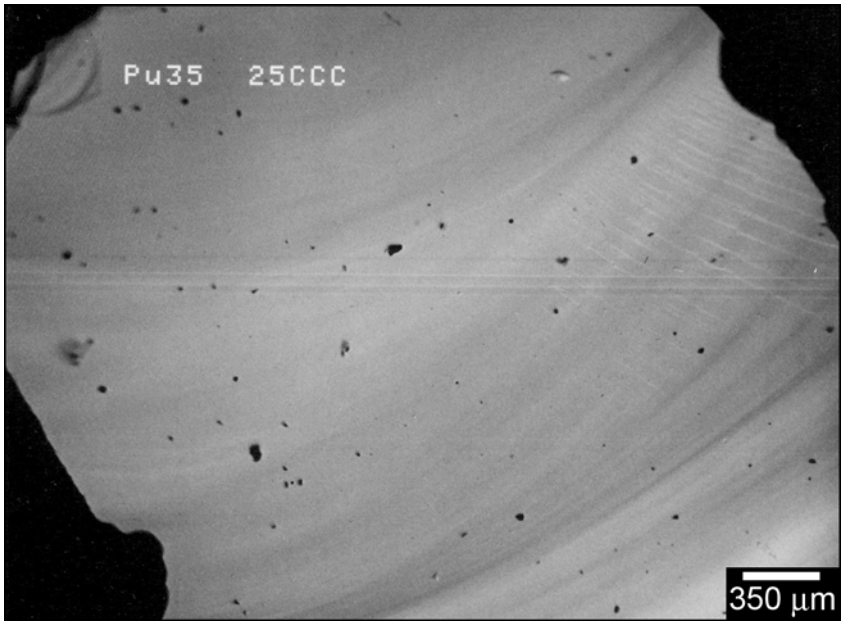

Figure 3-5. SEM micrograph of a fracture surface in the CCC version of glass Pu35-25.

3.2 Density Measurements

The results of the density measurements for the surrogate glasses are given in Table 3-2. In some cases, adequate samples of a particular glass were not available. Results of the density measurements for these glasses are reported as "n/a".

Table 3-2. Measured densities of the surrogate glasses.

Glass ID	Density (g/cm^3)		Glass ID	Density (g/cm^3)		Glass ID	Density (g/cm^3)
Pu04-01	4.25		Pu35-16	n/a		Pu35-36	n/a
Pu04-02	4.27		Pu35-17	4.21		Pu35-37	n/a
Pu04-03	4.32		Pu35-18	4.20		Pu35-38	4.24
Pu04-04	n/a		Pu35-19	4.24		Pu35-39	4.23
Pu04-05	4.24		Pu35-20	4.25		Pu35-40	4.23
Pu35-01	4.24		Pu35-21	4.26		Pu35-41	4.22
Pu35-02	4.23		Pu35-22	4.23		Pu35-42	4.22
Pu35-03	4.19		Pu35-23	n/a		Pu35-43	4.25
Pu35-04	4.24		Pu35-24	4.25		Pu35-44	4.23
Pu35-05	4.25		Pu35-25	4.19		Pu35-45	4.26
Pu35-06	4.25		Pu35-26	4.25		Pu35-46	4.24
Pu35-07	4.27		Pu35-27	4.25		Pu35-47	4.26
Pu35-08	4.25		Pu35-28	4.23		Pu35-48	4.23
Pu35-09	4.18		Pu35-29	4.19		Pu35-49	4.22
Pu35-10	4.23		Pu35-30	4.21		Pu35-50	4.21
Pu35-11	n/a		Pu35-31	4.23		Pu35-51	4.24
Pu35-12	4.26		Pu35-32	4.24		Pu35-52	4.21
Pu35-13	n/a		Pu35-33	4.18		Pu35-53	4.22
Pu35-14	4.25		Pu35-34	4.17		Pu35-54	4.22
Pu35-15	4.24		Pu35-35	4.28		Pu35-55	n/a

The measured densities of all of the surrogate glasses were quite similar, with an average density of 4.23 g/cm^3. Densities of the glasses fabricated with PuO_2 were not measured, but are likely to be somewhat higher than those of the surrogate glasses due to the higher atomic mass of Pu as compared to Hf.

3.3 A Statistical Review of the Chemical Composition Measurements of the Pu Impurity Solubility Study Glasses

In this section, the measured versus targeted compositions of the 60 surrogate glasses are presented and compared. The targeted compositions for these glasses are provided in Table 2-2 and Table D1 of Appendix D. A sum of oxides column is provided in this table as well. Chemical composition measurements for the surrogate glasses were conducted by the PSAL following the analytical plans provided in Appendix A. Three dissolution methods were utilized in measuring these chemical compositions. All of the LM and PF prepared samples were analyzed (once for each element of interest) by ICP-AES. Each glass was prepared once for measurement by IC to determine the concentrations of Cl^- and F^-. For each study glass, duplicate measurements on each of the analytes listed in this paragraph were obtained from the samples prepared by these dissolution methods.

Table D2 in Appendix D provides the elemental concentration measurements derived from the samples prepared using LM, Table D3 in Appendix D provides the measurements derived from the samples prepared using PF, and Table D4 in Appendix D provides the measurements derived from the samples prepared for measurement by the IC method. Measurements for standards (Batch 1 and LRM) that were included in the PSAL analytical plans along with the study glasses are also provided in these tables.

The measured concentrations of the cations listed above were converted to oxide concentrations by multiplying the values for each element by the gravimetric factor for the corresponding oxide. During this process, an elemental concentration that was determined to be below the detection limit of the

analytical procedures used by the PSAL was reduced to half of that detection limit as the oxide concentration was determined.

While no conversion to oxides was necessary for Cl^- and F^-, if a reported measurement for either of these elements was below the detection limit, then the value was reduced to half of the detection limit for the subsequent analyses performed in this report.

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

3.3.1 *Measurements in Analytical Sequence*

Exhibit D1 in Appendix D provides plots of the measurements generated by the PSAL for samples prepared using the LM method. The plots are in analytical sequence with different symbols and colors being used to represent each of the surrogate and standard glasses. Similar plots for the samples prepared using the PF method and for the samples analyzed by IC are provided in Exhibit D2 in Appendix D. These plots include all of the measurement data from Tables D2, D3, and D4. There appear to be no obvious outliers or other problems in these chemical composition measurements.

3.3.2 *Batch 1 and LRM Standard Results*

In this section, the PSAL measurements of the chemical compositions of the Batch 1 and LRM standards are reviewed. These measurements are investigated across the ICP-AES analytical blocks (for Batch 1 and LRM) and across the IC analytical blocks (for LRM), and the results are used to bias correct the measurements for the study glasses.

Exhibit D3 in Appendix D provides statistical analyses of the Batch 1 and LRM results generated by the LM preparation method by block for each oxide of interest. The results include analysis of variance (ANOVA) investigations looking for statistically significant differences between the means of these groups for each of the oxides for each of the standards. The results from the statistical tests for the Batch 1 standard may be summarized as follows: CaO, Cr_2O_3, CuO, Fe_2O_3, MgO, Na_2O, NiO, SiO_2, and SrO have measurements that indicate a significant ICP-AES calibration effect on the block averages at the 5% significance level. The SrO differences are detection limit differences. For the LRM standard, CaO, Cr_2O_3, CuO, Fe_2O_3, Gd_2O_3, MgO, NiO, PbO, SO_4^{2-}, and SiO_2 have measurements that indicate a significant ICP-AES calibration effect on the block averages at the 5% significance level. The Gd_2O_3 differences are detection limit differences. The reference values for the oxide concentrations of the standards are given in the header for each set of measurements in the exhibit.

Exhibit D4 in Appendix D provides a similar set of analyses for the ICP-AES measurements derived from samples prepared via the PF method. There is no indication of a significant ICP-AES calibration effects on the block averages for the B_2O_3 measurements at the 5% significance level. The reference values for the B_2O_3 concentration of the standards are given in the headers in the exhibit.

Exhibit D5 in Appendix D provides a similar set of analyses for the Cl^- and F^- measurements derived from LRM samples measured by IC. There is no indication of a significant IC calibration effects on the block averages for these measurements at the 5% significance level. The reference values for the Cl^- and F^- concentrations of the standard are given in the headers of the exhibit.

Thus, some of these results provide incentive for adjusting the measurements by the effects of the ICP-AES calibration and by the effects of the IC calibrations. Therefore, the oxide measurements of the surrogate glasses were bias corrected for the effect of the ICP-AES calibration on each of the analytical blocks, and the F^- measurements of the surrogate glasses were bias corrected for the effect of the IC calibration on each of the analytical blocks. For the other oxides, bias-correction was conducted for an oxide as long as the oxide concentration in the Batch 1 glass was greater than or equal to 0.1 wt% with the exception of Nd_2O_3. Although the Batch 1 reference value for Nd_2O_3 is 0.147 wt%, the values reported by PSAL were ~ 4 times that amount. Increasing the Nd_2O_3 content of the surrogate glasses by a factor of 4 was not seen as being practical. Also, no bias correction was conducted for Cl^- due to volatility issues for this element. The basis for the bias correction is presented as part of Exhibits D3, D4, and D5 – the average measurement for Batch 1 for each ICP block for Al_2O_3, B_2O_3, CaO, Cr_2O_3, CuO, Fe_2O_3, K_2O, MgO, Na_2O, NiO, and SiO_2 and the average F^- measurement for LRM for each IC block for F. No bias correction was conducted for Cl^-, Ga_2O_3, Gd_2O_3, HfO_2, La_2O_3, Nd_2O_3, PbO, Nd_2O_3, SeO_2, and Ta_2O_5.

The bias correction was conducted as follows. For each oxide (or for F^-), let $\bar{a}_{ij}$ be the average measurement for the i^{th} oxide (or F^-) at analytical block j for Batch 1 (or LRM for F^-), and let t_i be the reference value for the i^{th} oxide for Batch 1 (or for LRM for F^-). (The averages and reference values are provided in Exhibits D3, D4, and D5.) Let $\bar{c}_{ijk}$ be the average measurement for the i^{th} oxide (or for F^-) at analytical block j for the k^{th} glass. The bias adjustment was conducted as follows:

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

Bias-corrected measurements are indicated by a "bc" suffix, and such adjustments were performed for all of the analytes of this study except for Cl^-, Ga_2O_3, Gd_2O_3, HfO_2, La_2O_3, Nd_2O_3, PbO, Nd_2O_3, SeO_2, and Ta_2O_5. Both measured and measured "bc" values are included in the discussion that follows. In these discussions, bias-corrected values for Cl^-, Ga_2O_3, Gd_2O_3, HfO_2, La_2O_3, Nd_2O_3, PbO, Nd_2O_3, SeO_2, and Ta_2O_5 are included for completeness (e.g., to allow a sum of oxides to be computed for the bias-corrected results). These bias-corrected values are the same as the original Cl^-, Ga_2O_3, Gd_2O_3, HfO_2, La_2O_3, Nd_2O_3, PbO, Nd_2O_3, SeO_2, and Ta_2O_5 values.

3.3.3 *Composition Measurements by Glass Number*

Exhibits D6 and D7 in Appendix D provide plots of the oxide concentration measurements by Glass ID (including Batch 1 and LRM) for the measured and bias-corrected (bc) values for the LM and PF preparation methods, respectively. Exhibit D8 provides similar plots for Cl^- and F^- for the IC measurements including the measurements for LRM. Different symbols and colors are used to represent the different glasses and the glasses are grouped by the targeted concentration of the particular analyte. These plots show the individual measurements across the duplicate measurements of each preparation method. A review of the plots presented in these exhibits reveals the repeatability of the individual values for each analyte for each glass. No significant issues in the repeatability of the measurements in these plots are evident. In comparing the measured values to their targeted concentrations, some differences are seen between the measured values and the targeted concentrations for some analytes for some of the glasses. A closer look at these comparisons is presented in the next section.

3.3.4 *Measured versus Targeted Compositions*

The duplicate measurements for each analyte for each surrogate glass (over all of the preparation methods) were averaged to determine a representative chemical composition for each glass. These determinations were conducted both for the measured and for the bias-corrected data. A sum of oxides

was also computed for each glass based upon both the measured and bias-corrected values. Exhibit D9 in Appendix D provides plots showing results for each glass for each analyte to help highlight the comparisons among the measured, bias-corrected, and targeted values.

Some observations from the plots of Exhibit D9 are offered. For almost all of the study glasses (Pu35-33 is the only exception), the measured concentrations of Al_2O_3 are somewhat higher than the targeted value of 8.6 wt%. For all of the study glasses, the measured concentrations of CaO are slightly higher than their targeted values. The Cl^- measurements (for the study and standard glasses) suggest a high degree of volatility for this element. The Cr_2O_3 measurements for glasses that targeted the higher concentrations for this oxide appear to fall below the targets while the measurements for glasses targeting a lower concentration of Cr_2O_3 appear to more in line. For those study glasses with F^- present, the measurements for F^- appear to fall below the targeted concentrations, indicating volatility for this element. The HfO_2 measurements were consistently below their targeted values, and the differences between the measured and targeted concentrations were greater for the Pu04-xx series of study glasses, which targeted higher levels of HfO_2. A general problem with detection limits appears to be seen in the results for PbO. Volatility appears to have reduced the measured concentrations of SeO_2 and SO_4^{2-} to values well below the targets.

Figure 3-6 provides a graphical look at the measured versus targeted concentrations for the surrogate glasses. A plot is shown for each of the elements (converted to an oxide) that was varied in the glass compositions (i.e., the anticipated impurity elements and the Pu surrogate Hf).

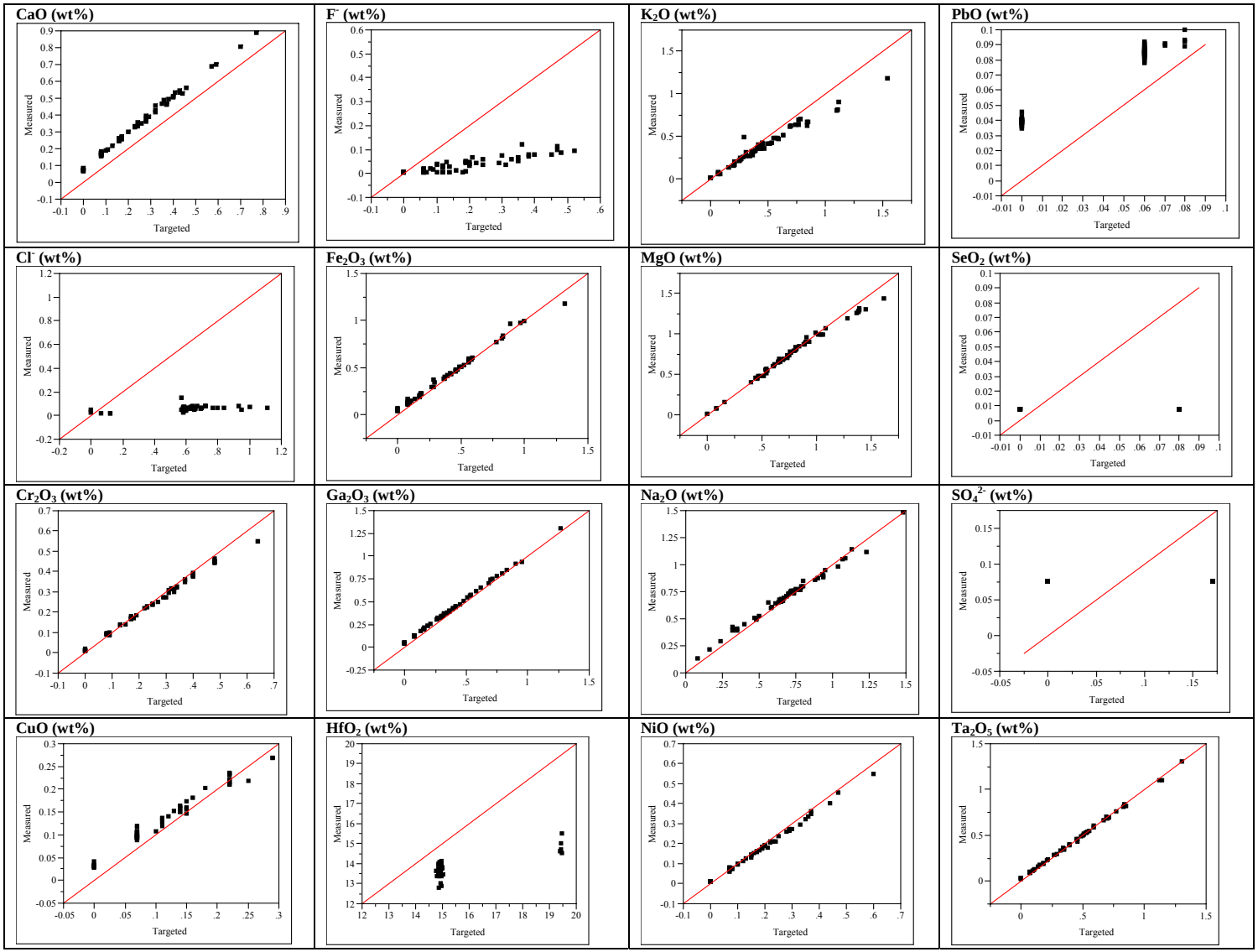

Figure 3-6. Measured versus targeted concentrations for select analytes of the surrogate glasses.

Figure 3-6 shows that the measured CaO and PbO concentrations were consistently higher than the targeted values. The measured Cr_2O_3 and Fe_2O_3 concentrations were very close to the targets except for the one highest targeted value for each of these components. The measured Cl^-, F^-, SeO_2 and SO_4^{2-} concentrations were well below their target values for all of the study glasses.[a] This is likely due to volatilization of these species during melting of the glass batch. The measured HfO_2 concentrations were below their target values for all of the study glasses. It is likely that for HfO_2, the solubility limit in the glass was exceeded and some of the HfO_2 batch material remained in the bottom of the crucibles after pouring the glasses. The measured K_2O concentrations were very close to the target values up to a concentration of about 0.48 wt %, after which the measured concentrations fall below the target values. The measured MgO concentrations were very close to the target values up to a concentration of about 1.1 wt %, after which the measured concentrations fall below the target values. The measured CuO, Ga_2O_3, Na_2O, NiO, and Ta_2O_5 concentrations generally fell very close to their target values across the ranges of concentrations targeted in this study for each of these components.

In summary, these results indicate that a solubility limit may have been approached in this glass system for some components, including K_2O and MgO. Volatility is likely responsible for the low measured concentrations of Cl^-, F^-, SO_4^{2-} and SeO_2.

Table D5 in Appendix D provides a summary of the average compositions as well as the targeted compositions and some associated differences and relative differences. Notice that the targeted sums of oxides for the standard glasses do not sum to 100% due to an incomplete coverage of the oxides in the Batch 1 and LRM glasses. All of the sums of oxides (both measured and bias-corrected) for the surrogate glasses fall within the interval of 95 to 105 wt %. Entries in Table D5 show the relative differences between the measured or bias-corrected values and the targeted values. These differences are shaded when they are greater than or equal to 5%.

Exhibit D10 in Appendix D provides an opportunity to review the outcomes for the impurities (whose measurements are provided here) for each of the surrogate glasses.

3.4 A Statistical Review of the PCT Results for the Surrogate Glasses

The surrogate glasses were subjected to the 7-day PCT Method A to assess their durabilities.[16] Two heat treatments (quenched and CCC) were used during the fabrication of each of the study glasses. Both heat treatments for each surrogate glass were subjected to the PCT in triplicate. PCTs were also conducted in triplicate for samples of the EA glass and for samples of the ARM glass as part of each PCT plan. Blanks (samples consisting only of ASTM Type I water) were also submitted as part of each PCT plan. There were 6 plans in all (see Appendices B and C for details). The plans were provided to the PSAL to support the evaluation of the compositions of the solutions resulting from the PCTs. Samples of a multi-element, standard solution were also included in each analytical plan (as a check on the accuracy of the ICP-AES instrument used for the measurements). In this and the following sections, the measurements generated by the PSAL for these PCTs are presented and reviewed.

Table E1 in Appendix E provides the elemental leachate concentration measurements determined by the PSAL for the solution samples generated by the PCTs. The PCTs for the quenched versions of the glasses were conducted in 3 sets, and the PCTs for the CCC versions of the glasses were conducted in another set of 3 PCTs. One of the quality control checkpoints for the

[a] Note that because of detection limit issues, the measured concentrations of SeO_2 and SO_4^{2-} appear to be high when the target concentration was 0 wt %. The measured concentrations of SeO_2 and SO_4^{2-} were below the detection limits for all of the surrogate glasses.

PCT procedure is solution weight loss over the course of the 7-day test. None of the PCT results for any of the 6 sets of PCTs indicated a solution weight loss problem. Note that for these glasses, the PCT solutions were measured for boron (B), gadolinium (Gd), hafnium (Hf), sodium (Na), and silicon (Si) concentrations. Any measurement in Table E1 below the detection limit of the analytical procedure (indicated by a "<") was replaced by one half of the detection limit in subsequent analyses. In addition to adjustments for detection limits, the values were adjusted for the dilution factors: the values for the surrogate glasses, the blanks, and the ARM glass in Table E1 were multiplied by 1.6667 to determine the values in parts per million (ppm) and the values for EA were multiplied by 16.6667. The last five columns of Table E1 provide the measurements resulting from these adjustments. Note that the measured values for the ARM glass all fall within the specified control limits.[14]

In the sections that follow, the analytical sequence of the measurements is explored, the measurements of the standards are investigated and used to assess the overall accuracy of the ICP-AES measurement process, the measurements for each surrogate glass are reviewed, and plots are provided that explore the effects of heat treatment on the PCTs for these glasses.

3.4.1 *Measurements in Analytical Sequence*

Exhibit E1 in Appendix E provides plots of the leachate (ppm) concentrations for the quenched results in analytical sequence as generated by the PSAL for all of the data as well as plots for the data from only the surrogate glasses. In these plots, ARM is represented by the symbol "▪", EA is represented by a "×", a blank is represented by a "+", and the multi-element solution standard is represented by a "◊". Each surrogate glass is represented by a "▫". Exhibit E2 in Appendix E provides plots of the leachate (ppm) concentrations for the CCC results in analytical sequence as generated by the PSAL for all of the data as well as plots for the data from only the surrogate glasses. As seen by these plots, the analyte concentrations for the elements of interest appear relatively low for most all of the surrogate glasses (quenched and CCC versions). A more detailed discussion of these results is provided below.

3.4.2 *Results for the Samples of the Multi-Element Solution Standard*

Exhibit E3 in Appendix E provides analyses of the PSAL measurements of the samples of the multi-element solution standard by ICP-AES analytical (or calibration) block and PCT set for the quenched glasses. An ANOVA investigating for statistically significant differences among the block averages for these samples for each element of interest is included in these exhibits. Exhibit E4 in Appendix E provides similar investigations for the CCC results. For both the quenched and CCC results, a statistically significant (at approximately a 5% level) difference is seen among the B average measurements over the calibration blocks and PCT sets. However, no bias correction of the PCT results for the study glasses was conducted. This approach was taken since the triplicate PCTs for a single study glass were placed in different calibration blocks. Averaging the ppm values for each set of triplicates helps to minimize the impact of any bias in the ICP-AES measurements.

Table 3-3 summarizes the average measurements and the reference values for the 3 primary elements present in the multi-element solution. The results indicate consistent and accurate measurements from the PSAL processes used to conduct these analyses.

Table 3-3. Results from samples of the multi-element solution standard by PCT plans.

Quenched plans				CCC plans			
Set/Block	B (ppm)	Na (ppm)	Si (ppm)	Set/Block	B (ppm)	Na (ppm)	Si (ppm)
1/1	21.8	83.2	49	1/1	20.5	83.7	49.9
1/1	20.8	82.4	49.1	1/1	20.8	84.8	50.7
1/1	21.6	85	51.8	1/1	20	87.2	49.3
1/2	21.5	82.8	49.7	1/2	21.2	84.2	50.4
1/2	19.2	83.3	49.3	1/2	20.5	86.6	50.8
1/2	19.4	80.5	50	1/2	20.2	88.3	49.1
1/3	20.4	84.7	51.1	1/3	20.9	84.1	49.1
1/3	19.9	84.6	50.5	1/3	20.1	86.9	50.5
1/3	20.3	85.6	50.9	1/3	20	90	50
2/1	20.6	83.5	49.2	2/1	20.8	82	49.5
2/1	20.1	84.8	47.5	2/1	19.4	82.3	49.8
2/1	21.3	86	50.4	2/1	19.7	87.2	48.8
2/2	20.4	85.2	49.4	2/2	20.1	81.3	49.3
2/2	18.6	80.5	46.9	2/2	19.1	80.8	48.4
2/2	18.9	84.3	47.8	2/2	19.6	84.2	50.4
2/3	20.6	83.9	49.8	2/3	20.5	82.4	50
2/3	18.7	82.7	46.4	2/3	19.1	82.5	48.2
2/3	19.8	87.4	48.7	2/3	19.3	84.1	48.4
3/1	19.6	80.2	47.6	3/1	21.2	83.8	49.6
3/1	18.4	82.1	47.3	3/1	20.4	89.3	48.9
3/1	18.8	80.2	48.7	3/1	20.9	87.2	50.4
3/2	20	82.9	47.9	3/2	21.7	85.1	51.2
3/2	19.5	83.9	48.5	3/2	20.7	88.1	50
3/2	19.8	85.2	49.3	3/2	21	84.1	51.4
3/3	20.1	82.6	48.6	3/3	20.2	85.3	48.8
3/3	18.9	82.8	48.7	3/3	20.4	85.7	51.7
3/3	19.7	83.8	49.4	3/3	20.1	87.4	50.8
Grand Average	19.95	83.49	49.02	Grand Average	20.31	85.13	49.83
Reference Value	20	81	50	Reference Value	20	81	50
% difference	-0.24%	3.07%	-1.96%	% difference	1.56%	5.10%	-0.34%

3.4.3 *Measurements by Glass Number*

Exhibit E5 in Appendix E provide plots of the leachate concentrations for the two heat treatments (quenched and CCC) by study glass. These plots allow for the assessment of the repeatability of the measurements, which suggests minor scatter in the triplicate values for some analytes for some of the glasses. Also, note that some differences between the values for the two heat treatments for some glasses are evident for some of the elements of interest. In particular, the concentration of Si in the leachates of many of the CCC versions of the surrogate glasses tended to be somewhat higher than the concentration in the leachates for the quenched versions of the

glasses. However, these differences are too small to have a practical impact on the durability performance of the glasses.

3.4.4 *Normalized PCT Results*

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

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

1. Determine the common logarithm of the elemental parts per million (ppm) leachate concentration for each of the triplicates and each of the elements of interest (these values are provided in Table E2 of Appendix E),

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

Normalizing Using Measured Composition (preferred method)

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

Or Normalizing Using Target Composition

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

Or Normalizing Using Measured Bias-Corrected Composition

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

Table 3-4 summarizes the normalized PCTs for the surrogate glasses.

Table 3-4. Normalized PCTs by Glass ID and compositional view.

Set	Glass ID	Heat Treatment	Composition	log NL [B(g/L)]	log NL [Gd(g/L)]	log NL [Hf(g/L)]	log NL [Na(g/L)]	log NL [Si(g/L)]	NL B(g/L)	NL Gd (g/L)	NL Hf (g/L)	NL Na (g/L)	NL Si (g/L)
1	ARM-1	-	reference	-0.3050	-	-	-0.2755	-0.5648	0.495	-	-	0.530	0.272
1	EA	-	reference	1.2624	-	-	1.1634	0.6078	18.299	-	-	14.568	4.053
2	ARM-1	-	reference	-0.3410	-	-	-0.2569	-0.5794	0.456	-	-	0.554	0.263
2	EA	-	reference	1.2436	-	-	1.1343	0.5940	17.523	-	-	13.623	3.926
3	ARM-1	-	reference	-0.2902	-	-	-0.3009	-0.5710	0.513	-	-	0.500	0.269
3	EA	-	reference	1.2491	-	-	1.1334	0.5853	17.745	-	-	13.595	3.848
1	Pu04-01	ccc	measured	-1.6433	-2.1024	-2.4701	-0.2203	-1.5790	0.023	0.008	0.003	0.602	0.026
1	Pu04-02	ccc	measured	-1.6444	-2.0983	-2.4754	-0.2775	-1.9723	0.023	0.008	0.003	0.528	0.011
1	Pu04-03	ccc	measured	-1.6379	-2.1024	-2.4840	-0.4720	-1.9110	0.023	0.008	0.003	0.337	0.012
1	Pu04-04	ccc	measured	-1.6456	-2.1106	-2.4719	-0.1077	-1.9491	0.023	0.008	0.003	0.780	0.011
1	Pu04-05	ccc	measured	-1.6456	-2.1086	-2.4975	-0.6783	-2.0105	0.023	0.008	0.003	0.210	0.010
1	Pu35-01	ccc	measured	-1.6226	-2.0835	-2.4428	-0.7389	-1.5231	0.024	0.008	0.004	0.182	0.030
1	Pu35-02	ccc	measured	-1.6421	-2.0920	-2.4428	-0.5655	-1.2546	0.023	0.008	0.004	0.272	0.056
1	Pu35-03	ccc	measured	-1.4120	-1.8531	-2.4333	-0.4161	-1.0639	0.039	0.014	0.004	0.384	0.086
1	Pu35-04	ccc	measured	-1.5263	-1.9804	-2.4465	-0.5268	-1.2954	0.030	0.010	0.004	0.297	0.051
1	Pu35-05	ccc	measured	-1.6312	-2.0822	-2.4390	-0.5352	-1.1851	0.023	0.008	0.004	0.292	0.065
1	Pu35-06	ccc	measured	-1.6113	-2.0835	-2.4390	-0.7807	-1.3269	0.024	0.008	0.004	0.166	0.047
1	Pu35-07	ccc	measured	-1.6119	-2.0856	-2.4539	-0.0274	-1.2828	0.024	0.008	0.004	0.939	0.052
1	Pu35-08	ccc	measured	-1.5050	-1.9755	-2.4352	-0.6336	-1.2553	0.031	0.011	0.004	0.233	0.056
1	Pu35-09	ccc	measured	-1.4573	-1.9245	-2.4333	-0.4370	-1.0555	0.035	0.012	0.004	0.366	0.088
1	Pu35-10	ccc	measured	-1.6170	-2.0856	-2.4352	-0.4142	-1.3381	0.024	0.008	0.004	0.385	0.046
1	Pu35-11	ccc	measured	-1.4952	-1.9604	-2.4521	-0.6850	-1.2812	0.032	0.011	0.004	0.207	0.052
1	Pu35-12	ccc	measured	-1.6245	-2.0856	-2.4521	0.0435	-1.2828	0.024	0.008	0.004	1.105	0.052
1	Pu35-13	ccc	measured	-1.5116	-1.9853	-2.4333	-0.4723	-1.1866	0.031	0.010	0.004	0.337	0.065
1	Pu35-14	ccc	measured	-1.6062	-2.0878	-2.4484	-1.1423	-1.3215	0.025	0.008	0.004	0.072	0.048
1	Pu35-15	ccc	measured	-1.6075	-2.0899	-2.4484	-0.0602	-1.2706	0.025	0.008	0.004	0.870	0.054
2	Pu35-16	ccc	measured	-1.6263	-2.0941	-2.4539	-1.5167	-1.6161	0.024	0.008	0.004	0.030	0.024
2	Pu35-17	ccc	measured	-1.6282	-2.0920	-2.4502	-1.3060	-1.2612	0.024	0.008	0.004	0.049	0.055
2	Pu35-18	ccc	measured	-1.4824	-1.9472	-2.4521	-1.0068	-1.0850	0.033	0.011	0.004	0.098	0.082
2	Pu35-19	ccc	measured	-1.6220	-2.0920	-2.4539	-1.8331	-1.3925	0.024	0.008	0.004	0.015	0.041
2	Pu35-20	ccc	measured	-1.6195	-2.0962	-2.4576	-0.3727	-1.2324	0.024	0.008	0.003	0.424	0.059
2	Pu35-21	ccc	measured	-1.6183	-2.0920	-2.4428	-0.6757	-1.3237	0.024	0.008	0.004	0.211	0.047
2	Pu35-22	ccc	measured	-1.6245	-2.0983	-2.4521	-1.0555	-1.2552	0.024	0.008	0.004	0.088	0.056
2	Pu35-23	ccc	measured	-1.6263	-2.0920	-2.4539	-0.7569	-1.3367	0.024	0.008	0.004	0.175	0.046
2	Pu35-24	ccc	measured	-1.6288	-2.0899	-2.4484	-1.7211	-1.3431	0.024	0.008	0.004	0.019	0.045
2	Pu35-25	ccc	measured	-1.6195	-2.0899	-2.3048	-0.5231	-1.2560	0.024	0.008	0.005	0.300	0.055
2	Pu35-26	ccc	measured	-1.6214	-2.0835	-2.4447	-1.0356	-1.4432	0.024	0.008	0.004	0.092	0.036
2	Pu35-27	ccc	measured	-1.6195	-2.0816	-2.4352	-1.6278	-1.6310	0.024	0.008	0.004	0.024	0.023
2	Pu35-28	ccc	measured	-1.6276	-2.0856	-2.4428	-1.1642	-1.3488	0.024	0.008	0.004	0.069	0.045
2	Pu35-29	ccc	measured	-1.6239	-2.0813	-2.4371	-1.1820	-1.2703	0.024	0.008	0.004	0.066	0.054
2	Pu35-30	ccc	measured	-1.6132	-2.0878	-2.4465	-1.4945	-1.2017	0.024	0.008	0.004	0.032	0.063
2	Pu35-31	ccc	measured	-1.6119	-2.0856	-2.4447	-0.5469	-1.2380	0.024	0.008	0.004	0.284	0.058
2	Pu35-32	ccc	measured	-1.6195	-2.0878	-2.4539	-1.7943	-1.5383	0.024	0.008	0.004	0.016	0.029
2	Pu35-33	ccc	measured	-1.6081	-2.0733	-2.4428	-0.7097	-1.5243	0.025	0.008	0.004	0.195	0.030
2	Pu35-34	ccc	measured	-1.6094	-2.0878	-2.4428	-0.4317	-1.2852	0.025	0.008	0.004	0.370	0.052
2	Pu35-35	ccc	measured	-1.6226	-2.0835	-2.2576	-1.1668	-1.4571	0.024	0.008	0.006	0.068	0.035
3	Pu35-36	ccc	measured	-1.4574	-1.9307	-2.4558	-0.4434	-1.1565	0.035	0.012	0.004	0.360	0.070
3	Pu35-37	ccc	measured	-1.6126	-2.0798	-2.4333	-0.6118	-1.2857	0.024	0.008	0.004	0.244	0.052
3	Pu35-38	ccc	measured	-1.6132	-2.0763	-2.4447	-0.6704	-1.2679	0.024	0.008	0.004	0.214	0.054
3	Pu35-39	ccc	measured	-1.6132	-2.0878	-2.4539	-0.8807	-1.2338	0.024	0.008	0.004	0.132	0.058
3	Pu35-40	ccc	measured	-1.6151	-2.0794	-2.4352	-1.0822	-1.2690	0.024	0.008	0.004	0.083	0.054
3	Pu35-41	ccc	measured	-1.4904	-1.9544	-2.4390	-0.9575	-1.2372	0.032	0.011	0.004	0.110	0.058
3	Pu35-42	ccc	measured	-1.6094	-2.0856	-2.4465	-0.7921	-1.1717	0.025	0.008	0.004	0.161	0.067
3	Pu35-43	ccc	measured	-1.4589	-1.9233	-2.4447	-0.1069	-1.3782	0.035	0.012	0.004	0.782	0.042
3	Pu35-44	ccc	measured	-1.6100	-2.0835	-2.4447	-0.6081	-1.3446	0.025	0.008	0.004	0.247	0.045
3	Pu35-45	ccc	measured	-1.6195	-2.0768	-2.4371	-0.8120	-1.4724	0.024	0.008	0.004	0.154	0.034

Table 3-4. Normalized PCTs by Glass ID and compositional view (continued)

Set	Glass ID	Heat Treatment	Composition	log NL [B(g/L)]	log NL [Gd(g/L)]	log NL [Hf(g/L)]	log NL [Na(g/L)]	log NL [Si(g/L)]	NL B(g/L)	NL Gd (g/L)	NL Hf (g/L)	NL Na (g/L)	NL Si (g/L)
3	Pu35-46	ccc	measured	-1.6300	-2.0983	-2.4502	-1.0724	-1.3078	0.023	0.008	0.004	0.085	0.049
3	Pu35-47	ccc	measured	-1.6282	-2.0878	-2.4502	-0.8963	-1.3595	0.024	0.008	0.004	0.127	0.044
3	Pu35-48	ccc	measured	-1.6312	-2.0899	-2.4409	-1.2891	-1.3665	0.023	0.008	0.004	0.051	0.043
3	Pu35-49	ccc	measured	-1.6300	-2.0941	-2.4409	-1.2726	-1.2955	0.023	0.008	0.004	0.053	0.051
3	Pu35-50	ccc	measured	-1.6337	-2.0920	-2.4390	-0.6251	-1.2565	0.023	0.008	0.004	0.237	0.055
3	Pu35-51	ccc	measured	-1.6325	-2.0941	-2.4371	-0.9770	-1.3373	0.023	0.008	0.004	0.105	0.046
3	Pu35-52	ccc	measured	-1.5309	-1.9917	-2.4136	-1.3927	-1.2597	0.029	0.010	0.004	0.040	0.055
3	Pu35-53	ccc	measured	-1.5247	-1.9840	-2.4176	-0.4279	-1.2424	0.030	0.010	0.004	0.373	0.057
3	Pu35-54	ccc	measured	-1.6349	-2.0962	-2.4216	-0.5350	-1.1993	0.023	0.008	0.004	0.292	0.063
3	Pu35-55	ccc	measured	-1.6444	-2.0983	-2.4333	-1.0312	-1.2742	0.023	0.008	0.004	0.093	0.053
1	Pu04-01	ccc	measured bc	-1.6353	-2.1024	-2.4701	-0.1811	-1.5731	0.023	0.008	0.003	0.659	0.027
1	Pu04-02	ccc	measured bc	-1.6365	-2.0983	-2.4754	-0.2383	-1.9664	0.023	0.008	0.003	0.578	0.011
1	Pu04-03	ccc	measured bc	-1.6299	-2.1024	-2.4840	-0.4328	-1.9050	0.023	0.008	0.003	0.369	0.012
1	Pu04-04	ccc	measured bc	-1.6376	-2.1106	-2.4719	-0.0685	-1.9431	0.023	0.008	0.003	0.854	0.011
1	Pu04-05	ccc	measured bc	-1.6376	-2.1086	-2.4975	-0.6391	-2.0046	0.023	0.008	0.003	0.230	0.010
1	Pu35-01	ccc	measured bc	-1.6147	-2.0835	-2.4428	-0.6997	-1.5172	0.024	0.008	0.004	0.200	0.030
1	Pu35-02	ccc	measured bc	-1.6341	-2.0920	-2.4428	-0.5263	-1.2486	0.023	0.008	0.004	0.298	0.056
1	Pu35-03	ccc	measured bc	-1.4041	-1.8531	-2.4333	-0.3769	-1.0580	0.039	0.014	0.004	0.420	0.088
1	Pu35-04	ccc	measured bc	-1.5183	-1.9804	-2.4465	-0.4876	-1.2894	0.030	0.010	0.004	0.325	0.051
1	Pu35-05	ccc	measured bc	-1.6233	-2.0822	-2.4390	-0.4960	-1.1792	0.024	0.008	0.004	0.319	0.066
1	Pu35-06	ccc	measured bc	-1.6232	-2.0835	-2.4390	-0.7416	-1.3301	0.024	0.008	0.004	0.181	0.047
1	Pu35-07	ccc	measured bc	-1.6238	-2.0856	-2.4539	0.0116	-1.2861	0.024	0.008	0.004	1.027	0.052
1	Pu35-08	ccc	measured bc	-1.5169	-1.9755	-2.4352	-0.5945	-1.2586	0.030	0.011	0.004	0.254	0.055
1	Pu35-09	ccc	measured bc	-1.4692	-1.9245	-2.4333	-0.3980	-1.0588	0.034	0.012	0.004	0.400	0.087
1	Pu35-10	ccc	measured bc	-1.6289	-2.0856	-2.4352	-0.3752	-1.3413	0.024	0.008	0.004	0.422	0.046
1	Pu35-11	ccc	measured bc	-1.5071	-1.9604	-2.4521	-0.6460	-1.2844	0.031	0.011	0.004	0.226	0.052
1	Pu35-12	ccc	measured bc	-1.6364	-2.0856	-2.4521	0.0825	-1.2861	0.023	0.008	0.004	1.209	0.052
1	Pu35-13	ccc	measured bc	-1.5235	-1.9853	-2.4333	-0.4333	-1.1899	0.030	0.010	0.004	0.369	0.065
1	Pu35-14	ccc	measured bc	-1.6181	-2.0878	-2.4484	-1.1033	-1.3247	0.024	0.008	0.004	0.079	0.047
1	Pu35-15	ccc	measured bc	-1.6194	-2.0899	-2.4484	-0.0212	-1.2738	0.024	0.008	0.004	0.952	0.053
2	Pu35-16	ccc	measured bc	-1.6237	-2.0941	-2.4539	-1.4735	-1.6053	0.024	0.008	0.004	0.034	0.025
2	Pu35-17	ccc	measured bc	-1.6255	-2.0920	-2.4502	-1.2628	-1.2504	0.024	0.008	0.004	0.055	0.056
2	Pu35-18	ccc	measured bc	-1.4798	-1.9472	-2.4521	-0.9636	-1.0742	0.033	0.011	0.004	0.109	0.084
2	Pu35-19	ccc	measured bc	-1.6194	-2.0920	-2.4539	-1.7900	-1.3817	0.024	0.008	0.004	0.016	0.042
2	Pu35-20	ccc	measured bc	-1.6169	-2.0962	-2.4576	-0.3296	-1.2215	0.024	0.008	0.003	0.468	0.060
2	Pu35-21	ccc	measured bc	-1.6156	-2.0920	-2.4428	-0.6325	-1.3129	0.024	0.008	0.004	0.233	0.049
2	Pu35-22	ccc	measured bc	-1.6218	-2.0983	-2.4521	-1.0123	-1.2444	0.024	0.008	0.004	0.097	0.057
2	Pu35-23	ccc	measured bc	-1.6237	-2.0920	-2.4539	-0.7137	-1.3259	0.024	0.008	0.004	0.193	0.047
2	Pu35-24	ccc	measured bc	-1.6262	-2.0899	-2.4484	-1.6780	-1.3323	0.024	0.008	0.004	0.021	0.047
2	Pu35-25	ccc	measured bc	-1.6169	-2.0899	-2.3048	-0.4799	-1.2452	0.024	0.008	0.005	0.331	0.057
2	Pu35-26	ccc	measured bc	-1.6181	-2.0835	-2.4447	-1.0122	-1.4477	0.024	0.008	0.004	0.097	0.036
2	Pu35-27	ccc	measured bc	-1.6163	-2.0816	-2.4352	-1.6043	-1.6355	0.024	0.008	0.004	0.025	0.023
2	Pu35-28	ccc	measured bc	-1.6243	-2.0856	-2.4428	-1.1407	-1.3533	0.024	0.008	0.004	0.072	0.044
2	Pu35-29	ccc	measured bc	-1.6206	-2.0813	-2.4371	-1.1585	-1.2748	0.024	0.008	0.004	0.069	0.053
2	Pu35-30	ccc	measured bc	-1.6100	-2.0878	-2.4465	-1.4710	-1.2062	0.025	0.008	0.004	0.034	0.062
2	Pu35-31	ccc	measured bc	-1.6087	-2.0856	-2.4447	-0.5234	-1.2425	0.025	0.008	0.004	0.300	0.057
2	Pu35-32	ccc	measured bc	-1.6163	-2.0878	-2.4539	-1.7709	-1.5428	0.024	0.008	0.004	0.017	0.029
2	Pu35-33	ccc	measured bc	-1.6049	-2.0733	-2.4428	-0.6862	-1.5288	0.025	0.008	0.004	0.206	0.030
2	Pu35-34	ccc	measured bc	-1.6061	-2.0878	-2.4428	-0.4082	-1.2897	0.025	0.008	0.004	0.391	0.051
2	Pu35-35	ccc	measured bc	-1.6194	-2.0835	-2.2576	-1.1433	-1.4616	0.024	0.008	0.006	0.072	0.035
3	Pu35-36	ccc	measured bc	-1.4699	-1.9307	-2.4558	-0.4063	-1.1604	0.034	0.012	0.004	0.392	0.069
3	Pu35-37	ccc	measured bc	-1.6251	-2.0798	-2.4333	-0.5748	-1.2895	0.024	0.008	0.004	0.266	0.051
3	Pu35-38	ccc	measured bc	-1.6257	-2.0763	-2.4447	-0.6333	-1.2717	0.024	0.008	0.004	0.233	0.053
3	Pu35-39	ccc	measured bc	-1.6257	-2.0878	-2.4539	-0.8437	-1.2377	0.024	0.008	0.004	0.143	0.058
3	Pu35-40	ccc	measured bc	-1.6276	-2.0794	-2.4352	-1.0452	-1.2728	0.024	0.008	0.004	0.090	0.053
3	Pu35-41	ccc	measured bc	-1.5029	-1.9544	-2.4390	-0.9205	-1.2410	0.031	0.011	0.004	0.120	0.057

Table 3-4. Normalized PCTs by Glass ID and compositional view (continued)

Set	Glass ID	Heat Treatment	Composition	log NL [B(g/L)]	log NL [Gd(g/L)]	log NL [Hf(g/L)]	log NL [Na(g/L)]	log NL [Si(g/L)]	NL B(g/L)	NL Gd (g/L)	NL Hf (g/L)	NL Na (g/L)	NL Si (g/L)
3	Pu35-42	ccc	measured bc	-1.6219	-2.0856	-2.4465	-0.7551	-1.1756	0.024	0.008	0.004	0.176	0.067
3	Pu35-43	ccc	measured bc	-1.4714	-1.9233	-2.4447	-0.0699	-1.3820	0.034	0.012	0.004	0.851	0.041
3	Pu35-44	ccc	measured bc	-1.6225	-2.0835	-2.4447	-0.5711	-1.3485	0.024	0.008	0.004	0.268	0.045
3	Pu35-45	ccc	measured bc	-1.6320	-2.0768	-2.4371	-0.7750	-1.4762	0.023	0.008	0.004	0.168	0.033
3	Pu35-46	ccc	measured bc	-1.6268	-2.0983	-2.4502	-1.0467	-1.3013	0.024	0.008	0.004	0.090	0.050
3	Pu35-47	ccc	measured bc	-1.6249	-2.0878	-2.4502	-0.8705	-1.3529	0.024	0.008	0.004	0.135	0.044
3	Pu35-48	ccc	measured bc	-1.6280	-2.0899	-2.4409	-1.2633	-1.3599	0.024	0.008	0.004	0.055	0.044
3	Pu35-49	ccc	measured bc	-1.6268	-2.0941	-2.4409	-1.2469	-1.2889	0.024	0.008	0.004	0.057	0.051
3	Pu35-50	ccc	measured bc	-1.6304	-2.0920	-2.4390	-0.5994	-1.2499	0.023	0.008	0.004	0.252	0.056
3	Pu35-51	ccc	measured bc	-1.6292	-2.0941	-2.4371	-0.9513	-1.3308	0.023	0.008	0.004	0.112	0.047
3	Pu35-52	ccc	measured bc	-1.5277	-1.9917	-2.4136	-1.3669	-1.2531	0.030	0.010	0.004	0.043	0.056
3	Pu35-53	ccc	measured bc	-1.5215	-1.9840	-2.4176	-0.4021	-1.2358	0.030	0.010	0.004	0.396	0.058
3	Pu35-54	ccc	measured bc	-1.6316	-2.0962	-2.4216	-0.5093	-1.1927	0.023	0.008	0.004	0.310	0.064
3	Pu35-55	ccc	measured bc	-1.6412	-2.0983	-2.4333	-1.0054	-1.2677	0.023	0.008	0.004	0.099	0.054
1	Pu04-01	ccc	targeted	-1.6198	-2.0823	-2.5975	-0.1456	-1.5443	0.024	0.008	0.003	0.715	0.029
1	Pu04-02	ccc	targeted	-1.6198	-2.0823	-2.5971	-0.1651	-1.9353	0.024	0.008	0.003	0.684	0.012
1	Pu04-03	ccc	targeted	-1.6198	-2.0823	-2.5968	-0.3660	-1.8782	0.024	0.008	0.003	0.430	0.013
1	Pu04-04	ccc	targeted	-1.6198	-2.0823	-2.5962	0.0897	-1.9133	0.024	0.008	0.003	1.229	0.012
1	Pu04-05	ccc	targeted	-1.6198	-2.0823	-2.5977	-0.5981	-1.9748	0.024	0.008	0.003	0.252	0.011
1	Pu35-01	ccc	targeted	-1.6198	-2.0823	-2.4806	-0.7154	-1.5026	0.024	0.008	0.003	0.193	0.031
1	Pu35-02	ccc	targeted	-1.6198	-2.0823	-2.4824	-0.5115	-1.2428	0.024	0.008	0.003	0.308	0.057
1	Pu35-03	ccc	targeted	-1.3915	-1.8541	-2.4791	-0.4171	-1.0618	0.041	0.014	0.003	0.383	0.087
1	Pu35-04	ccc	targeted	-1.5124	-1.9749	-2.4847	-0.4677	-1.2803	0.031	0.011	0.003	0.341	0.052
1	Pu35-05	ccc	targeted	-1.6198	-2.0823	-2.4803	-0.4963	-1.1779	0.024	0.008	0.003	0.319	0.066
1	Pu35-06	ccc	targeted	-1.6198	-2.0823	-2.4809	-0.7869	-1.3218	0.024	0.008	0.003	0.163	0.048
1	Pu35-07	ccc	targeted	-1.6198	-2.0823	-2.4835	-0.0091	-1.2745	0.024	0.008	0.003	0.979	0.053
1	Pu35-08	ccc	targeted	-1.5096	-1.9722	-2.4832	-0.5894	-1.2516	0.031	0.011	0.003	0.257	0.056
1	Pu35-09	ccc	targeted	-1.4607	-1.9233	-2.4824	-0.4366	-1.0449	0.035	0.012	0.003	0.366	0.090
1	Pu35-10	ccc	targeted	-1.6198	-2.0823	-2.4818	-0.4073	-1.3279	0.024	0.008	0.003	0.391	0.047
1	Pu35-11	ccc	targeted	-1.4967	-1.9593	-2.4809	-0.6811	-1.2700	0.032	0.011	0.003	0.208	0.054
1	Pu35-12	ccc	targeted	-1.6198	-2.0823	-2.4835	0.0413	-1.2714	0.024	0.008	0.003	1.100	0.054
1	Pu35-13	ccc	targeted	-1.5194	-1.9820	-2.4835	-0.4888	-1.1778	0.030	0.010	0.003	0.325	0.066
1	Pu35-14	ccc	targeted	-1.6198	-2.0823	-2.4818	-1.1555	-1.3098	0.024	0.008	0.003	0.070	0.049
1	Pu35-15	ccc	targeted	-1.6198	-2.0823	-2.4847	-0.0747	-1.2557	0.024	0.008	0.003	0.842	0.056
2	Pu35-16	ccc	targeted	-1.6198	-2.0823	-2.4803	-1.5612	-1.5983	0.024	0.008	0.003	0.027	0.025
2	Pu35-17	ccc	targeted	-1.6198	-2.0823	-2.4832	-1.3342	-1.2388	0.024	0.008	0.003	0.046	0.058
2	Pu35-18	ccc	targeted	-1.4771	-1.9396	-2.4812	-1.0277	-1.0673	0.033	0.011	0.003	0.094	0.086
2	Pu35-19	ccc	targeted	-1.6198	-2.0823	-2.4815	-1.8416	-1.3771	0.024	0.008	0.003	0.014	0.042
2	Pu35-20	ccc	targeted	-1.6198	-2.0823	-2.4832	-0.3577	-1.2090	0.024	0.008	0.003	0.439	0.062
2	Pu35-21	ccc	targeted	-1.6198	-2.0823	-2.4829	-0.6665	-1.3047	0.024	0.008	0.003	0.216	0.050
2	Pu35-22	ccc	targeted	-1.6198	-2.0823	-2.4841	-1.0484	-1.2316	0.024	0.008	0.003	0.089	0.059
2	Pu35-23	ccc	targeted	-1.6198	-2.0823	-2.4812	-0.7702	-1.3208	0.024	0.008	0.003	0.170	0.048
2	Pu35-24	ccc	targeted	-1.6198	-2.0823	-2.4818	-1.7129	-1.3238	0.024	0.008	0.003	0.019	0.047
2	Pu35-25	ccc	targeted	-1.6198	-2.0823	-2.3388	-0.5112	-1.1996	0.024	0.008	0.005	0.308	0.063
2	Pu35-26	ccc	targeted	-1.6198	-2.0823	-2.4809	-1.0431	-1.4349	0.024	0.008	0.003	0.091	0.037
2	Pu35-27	ccc	targeted	-1.6198	-2.0823	-2.4829	-1.6298	-1.6254	0.024	0.008	0.003	0.023	0.024
2	Pu35-28	ccc	targeted	-1.6198	-2.0823	-2.4826	-1.1673	-1.3456	0.024	0.008	0.003	0.068	0.045
2	Pu35-29	ccc	targeted	-1.6198	-2.0823	-2.4855	-1.1847	-1.2647	0.024	0.008	0.003	0.065	0.054
2	Pu35-30	ccc	targeted	-1.6198	-2.0823	-2.4812	-1.5115	-1.1937	0.024	0.008	0.003	0.031	0.064
2	Pu35-31	ccc	targeted	-1.6198	-2.0823	-2.4832	-0.5228	-1.2295	0.024	0.008	0.003	0.300	0.059
2	Pu35-32	ccc	targeted	-1.6198	-2.0823	-2.4818	-1.7883	-1.5300	0.024	0.008	0.003	0.016	0.030
2	Pu35-33	ccc	targeted	-1.6198	-2.0823	-2.4783	-0.7244	-1.4866	0.024	0.008	0.003	0.189	0.033
2	Pu35-34	ccc	targeted	-1.6198	-2.0823	-2.4815	-0.4264	-1.2343	0.024	0.008	0.003	0.375	0.058
2	Pu35-35	ccc	targeted	-1.6198	-2.0823	-2.2840	-1.1814	-1.4552	0.024	0.008	0.005	0.066	0.035
3	Pu35-36	ccc	targeted	-1.4627	-1.9252	-2.4815	-0.4326	-1.1430	0.034	0.012	0.003	0.369	0.072
3	Pu35-37	ccc	targeted	-1.6198	-2.0823	-2.4803	-0.6000	-1.2806	0.024	0.008	0.003	0.251	0.052

Table 3-4. Normalized PCTs by Glass ID and compositional view (continued)

Set	Glass ID	Heat Treatment	Composition	log NL [B(g/L)]	log NL [Gd(g/L)]	log NL [Hf(g/L)]	log NL [Na(g/L)]	log NL [Si(g/L)]	NL B(g/L)	NL Gd (g/L)	NL Hf (g/L)	NL Na (g/L)	NL Si (g/L)
3	Pu35-38	ccc	targeted	-1.6198	-2.0823	-2.4826	-0.6709	-1.2636	0.024	0.008	0.003	0.213	0.055
3	Pu35-39	ccc	targeted	-1.6198	-2.0823	-2.4824	-0.8633	-1.2197	0.024	0.008	0.003	0.137	0.060
3	Pu35-40	ccc	targeted	-1.6198	-2.0823	-2.4806	-1.0792	-1.2631	0.024	0.008	0.003	0.083	0.055
3	Pu35-41	ccc	targeted	-1.4906	-1.9532	-2.4826	-0.9884	-1.2321	0.032	0.011	0.003	0.103	0.059
3	Pu35-42	ccc	targeted	-1.6198	-2.0823	-2.4812	-0.8024	-1.1603	0.024	0.008	0.003	0.158	0.069
3	Pu35-43	ccc	targeted	-1.4617	-1.9243	-2.4803	-0.1141	-1.3704	0.035	0.012	0.003	0.769	0.043
3	Pu35-44	ccc	targeted	-1.6198	-2.0823	-2.4806	-0.6069	-1.3353	0.024	0.008	0.003	0.247	0.046
3	Pu35-45	ccc	targeted	-1.6198	-2.0823	-2.4806	-0.8112	-1.4710	0.024	0.008	0.003	0.154	0.034
3	Pu35-46	ccc	targeted	-1.6198	-2.0823	-2.4824	-1.0649	-1.2850	0.024	0.008	0.003	0.086	0.052
3	Pu35-47	ccc	targeted	-1.6198	-2.0823	-2.4812	-0.8892	-1.3426	0.024	0.008	0.003	0.129	0.045
3	Pu35-48	ccc	targeted	-1.6198	-2.0823	-2.4806	-1.2788	-1.3537	0.024	0.008	0.003	0.053	0.044
3	Pu35-49	ccc	targeted	-1.6198	-2.0823	-2.4815	-1.2567	-1.2716	0.024	0.008	0.003	0.055	0.054
3	Pu35-50	ccc	targeted	-1.6198	-2.0823	-2.4815	-0.6072	-1.2398	0.024	0.008	0.003	0.247	0.058
3	Pu35-51	ccc	targeted	-1.6198	-2.0823	-2.4809	-0.9688	-1.3165	0.024	0.008	0.003	0.107	0.048
3	Pu35-52	ccc	targeted	-1.5194	-1.9820	-2.4806	-1.3727	-1.2412	0.030	0.010	0.003	0.042	0.057
3	Pu35-53	ccc	targeted	-1.5096	-1.9722	-2.4838	-0.4268	-1.2231	0.031	0.011	0.003	0.374	0.060
3	Pu35-54	ccc	targeted	-1.6198	-2.0823	-2.4826	-0.5245	-1.1749	0.024	0.008	0.003	0.299	0.067
3	Pu35-55	ccc	targeted	-1.6198	-2.0823	-2.4812	-1.0157	-1.2442	0.024	0.008	0.003	0.096	0.057
1	ARM-1	-	reference	-0.3146	-	-	-0.2942	-0.5701	0.485	-	-	0.508	0.269
1	EA	-	reference	1.2650	-	-	1.1486	0.6083	18.406	-	-	14.080	4.058
2	ARM-1	-	reference	-0.3348	-	-	-0.3272	-0.5969	0.463	-	-	0.471	0.253
2	EA	-	reference	1.2316	-	-	1.1266	0.5669	17.046	-	-	13.384	3.689
3	ARM-1	-	reference	-0.3525	-	-	-0.3209	-0.5895	0.444	-	-	0.478	0.257
3	EA	-	reference	1.2479	-	-	1.1415	0.5967	17.696	-	-	13.853	3.951
1	Pu04-01	quenched	measured	-1.6433	-2.1024	-2.4701	-0.2755	-2.6166	0.023	0.008	0.003	0.530	0.002
1	Pu04-02	quenched	measured	-1.6444	-2.0983	-2.4754	-0.9291	-3.0214	0.023	0.008	0.003	0.118	0.001
1	Pu04-03	quenched	measured	-1.6379	-2.1024	-2.4840	-1.2596	-3.0172	0.023	0.008	0.003	0.055	0.001
1	Pu04-04	quenched	measured	-1.6456	-2.1106	-2.4719	-1.0500	-2.9142	0.023	0.008	0.003	0.089	0.001
1	Pu04-05	quenched	measured	-1.6456	-2.1086	-2.4975	-1.5348	-3.0202	0.023	0.008	0.003	0.029	0.001
1	Pu35-01	quenched	measured	-1.4983	-1.9592	-2.4428	-1.8761	-3.0050	0.032	0.011	0.004	0.013	0.001
1	Pu35-02	quenched	measured	-1.6421	-2.0920	-2.4428	-1.5475	-2.1433	0.023	0.008	0.004	0.028	0.007
1	Pu35-03	quenched	measured	-1.6403	-2.0813	-2.4333	-2.1188	-2.1621	0.023	0.008	0.004	0.008	0.007
1	Pu35-04	quenched	measured	-1.5195	-1.9736	-2.4465	-1.7568	-2.9996	0.030	0.011	0.004	0.018	0.001
1	Pu35-05	quenched	measured	-1.6312	-2.0822	-2.4390	-0.3195	-1.4066	0.023	0.008	0.004	0.479	0.039
1	Pu35-06	quenched	measured	-1.6113	-2.0835	-2.4390	-1.6683	-2.9895	0.024	0.008	0.004	0.021	0.001
1	Pu35-07	quenched	measured	-1.6119	-2.0856	-2.4539	-1.7531	-2.4360	0.024	0.008	0.004	0.018	0.004
1	Pu35-08	quenched	measured	-1.4984	-1.9689	-2.4352	-1.5957	-2.2966	0.032	0.011	0.004	0.025	0.005
1	Pu35-09	quenched	measured	-1.4334	-1.9005	-2.4333	-1.5291	-1.2420	0.037	0.013	0.004	0.030	0.057
1	Pu35-10	quenched	measured	-1.6170	-2.0856	-2.4352	-1.5775	-2.9946	0.024	0.008	0.004	0.026	0.001
1	Pu35-11	quenched	measured	-1.6183	-2.0835	-2.4521	-1.7922	-2.9956	0.024	0.008	0.004	0.016	0.001
1	Pu35-12	quenched	measured	-1.6245	-2.0856	-2.4521	-1.4460	-2.9959	0.024	0.008	0.004	0.036	0.001
1	Pu35-13	quenched	measured	-1.5101	-1.9839	-2.4333	-1.1520	-2.1021	0.031	0.010	0.004	0.070	0.008
1	Pu35-14	quenched	measured	-1.6062	-2.0878	-2.4484	-1.9657	-2.9962	0.025	0.008	0.004	0.011	0.001
1	Pu35-15	quenched	measured	-1.6075	-2.0899	-2.4484	-1.8796	-2.8892	0.025	0.008	0.004	0.013	0.001
2	Pu35-16	quenched	measured	-1.6263	-2.0941	-2.4539	-1.9948	-2.1515	0.024	0.008	0.004	0.010	0.007
2	Pu35-17	quenched	measured	-1.6282	-2.0920	-2.4502	-1.9383	-1.7594	0.024	0.008	0.004	0.012	0.017
2	Pu35-18	quenched	measured	-1.5205	-1.9853	-2.4521	-1.9017	-1.3572	0.030	0.010	0.004	0.013	0.044
2	Pu35-19	quenched	measured	-1.6220	-2.0920	-2.4539	-1.8331	-2.2149	0.024	0.008	0.004	0.015	0.006
2	Pu35-20	quenched	measured	-1.6195	-2.0962	-2.4576	-1.6635	-1.6366	0.024	0.008	0.003	0.022	0.023
2	Pu35-21	quenched	measured	-1.6183	-2.0920	-2.4428	-1.7295	-2.2770	0.024	0.008	0.004	0.019	0.005
2	Pu35-22	quenched	measured	-1.6245	-2.0983	-2.4521	-1.8258	-2.1771	0.024	0.008	0.004	0.015	0.007
2	Pu35-23	quenched	measured	-1.6263	-2.0920	-2.4539	-1.9046	-2.2643	0.024	0.008	0.004	0.012	0.005
2	Pu35-24	quenched	measured	-1.6288	-2.0899	-2.4484	-1.7211	-2.2611	0.024	0.008	0.004	0.019	0.005
2	Pu35-25	quenched	measured	-1.6195	-2.0899	-2.4484	-1.6427	-1.5638	0.024	0.008	0.004	0.023	0.027
2	Pu35-26	quenched	measured	-1.6214	-2.0835	-2.4447	-1.0859	-2.3150	0.024	0.008	0.004	0.082	0.005
2	Pu35-27	quenched	measured	-1.6195	-2.0816	-2.4352	-1.7604	-2.1915	0.024	0.008	0.004	0.017	0.006

Table 3-4. Normalized PCTs by Glass ID and compositional view (continued)

Set	Glass ID	Heat Treatment	Composition	log NL [B(g/L)]	log NL [Gd(g/L)]	log NL [Hf(g/L)]	log NL [Na(g/L)]	log NL [Si(g/L)]	NL B(g/L)	NL Gd (g/L)	NL Hf (g/L)	NL Na (g/L)	NL Si (g/L)
2	Pu35-28	quenched	measured	-1.6276	-2.0856	-2.4428	-1.8156	-2.2246	0.024	0.008	0.004	0.015	0.006
2	Pu35-29	quenched	measured	-1.6239	-2.0813	-2.4371	-1.5444	-1.5344	0.024	0.008	0.004	0.029	0.029
2	Pu35-30	quenched	measured	-1.6132	-2.0878	-2.4465	-1.8867	-1.3349	0.024	0.008	0.004	0.013	0.046
2	Pu35-31	quenched	measured	-1.6119	-2.0856	-2.4447	-1.6456	-1.4413	0.024	0.008	0.004	0.023	0.036
2	Pu35-32	quenched	measured	-1.6195	-2.0878	-2.4539	-1.7943	-2.3262	0.024	0.008	0.004	0.016	0.005
2	Pu35-33	quenched	measured	-1.6081	-2.0733	-2.4428	-1.8891	-2.3110	0.025	0.008	0.004	0.013	0.005
2	Pu35-34	quenched	measured	-1.6094	-2.0878	-2.4428	-1.6361	-1.8766	0.025	0.008	0.004	0.023	0.013
2	Pu35-35	quenched	measured	-1.6226	-2.0835	-2.4539	-1.9033	-2.2923	0.024	0.008	0.004	0.012	0.005
3	Pu35-36	quenched	measured	-1.6145	-2.0878	-2.4558	-1.7863	-1.6514	0.024	0.008	0.004	0.016	0.022
3	Pu35-37	quenched	measured	-1.6126	-2.0798	-2.4333	-1.7742	-1.8016	0.024	0.008	0.004	0.017	0.016
3	Pu35-38	quenched	measured	-1.6132	-2.0763	-2.4447	-1.7685	-1.9211	0.024	0.008	0.004	0.017	0.012
3	Pu35-39	quenched	measured	-1.6132	-2.0878	-2.4539	-1.8120	-1.4495	0.024	0.008	0.004	0.015	0.036
3	Pu35-40	quenched	measured	-1.6151	-2.0794	-2.4352	-1.7654	-1.9304	0.024	0.008	0.004	0.017	0.012
3	Pu35-41	quenched	measured	-1.4790	-1.9430	-2.4390	-1.8918	-1.9329	0.033	0.011	0.004	0.013	0.012
3	Pu35-42	quenched	measured	-1.6094	-2.0856	-2.4465	-1.8312	-1.5103	0.025	0.008	0.004	0.015	0.031
3	Pu35-43	quenched	measured	-1.6170	-2.0813	-2.4447	-1.8116	-2.0247	0.024	0.008	0.004	0.015	0.009
3	Pu35-44	quenched	measured	-1.6100	-2.0835	-2.4447	-1.7703	-2.0504	0.025	0.008	0.004	0.017	0.009
3	Pu35-45	quenched	measured	-1.6195	-2.0768	-2.4371	-1.8136	-1.7813	0.024	0.008	0.004	0.015	0.017
3	Pu35-46	quenched	measured	-1.6300	-2.0983	-2.4502	-1.7563	-1.8745	0.023	0.008	0.004	0.018	0.013
3	Pu35-47	quenched	measured	-1.6282	-2.0878	-2.4502	-1.8199	-1.9942	0.024	0.008	0.004	0.015	0.010
3	Pu35-48	quenched	measured	-1.6312	-2.0899	-2.4409	-1.8231	-1.9962	0.023	0.008	0.004	0.015	0.010
3	Pu35-49	quenched	measured	-1.6300	-2.0941	-2.4409	-1.7716	-1.7153	0.023	0.008	0.004	0.017	0.019
3	Pu35-50	quenched	measured	-1.6337	-2.0920	-2.4390	-1.7803	-1.5296	0.023	0.008	0.004	0.017	0.030
3	Pu35-51	quenched	measured	-1.5021	-1.9638	-2.4371	-1.8328	-1.9245	0.031	0.011	0.004	0.015	0.012
3	Pu35-52	quenched	measured	-1.6312	-2.0920	-2.4136	-1.8207	-1.5755	0.023	0.008	0.004	0.015	0.027
3	Pu35-53	quenched	measured	-1.6349	-2.0941	-2.4176	-1.8482	-1.7489	0.023	0.008	0.004	0.014	0.018
3	Pu35-54	quenched	measured	-1.6349	-2.0962	-2.4216	-1.8051	-1.7853	0.023	0.008	0.004	0.016	0.016
3	Pu35-55	quenched	measured	-1.6444	-2.0983	-2.4333	-1.8223	-1.6452	0.023	0.008	0.004	0.015	0.023
1	Pu04-01	quenched	measured bc	-1.6353	-2.1024	-2.4701	-0.2363	-2.6106	0.023	0.008	0.003	0.580	0.002
1	Pu04-02	quenched	measured bc	-1.6365	-2.0983	-2.4754	-0.8899	-3.0155	0.023	0.008	0.003	0.129	0.001
1	Pu04-03	quenched	measured bc	-1.6299	-2.1024	-2.4840	-1.2204	-3.0112	0.023	0.008	0.003	0.060	0.001
1	Pu04-04	quenched	measured bc	-1.6376	-2.1106	-2.4719	-1.0108	-2.9082	0.023	0.008	0.003	0.098	0.001
1	Pu04-05	quenched	measured bc	-1.6376	-2.1086	-2.4975	-1.4956	-3.0142	0.023	0.008	0.003	0.032	0.001
1	Pu35-01	quenched	measured bc	-1.4904	-1.9592	-2.4428	-1.8369	-2.9990	0.032	0.011	0.004	0.015	0.001
1	Pu35-02	quenched	measured bc	-1.6341	-2.0920	-2.4428	-1.5083	-2.1373	0.023	0.008	0.004	0.031	0.007
1	Pu35-03	quenched	measured bc	-1.6323	-2.0813	-2.4333	-2.0796	-2.1562	0.023	0.008	0.004	0.008	0.007
1	Pu35-04	quenched	measured bc	-1.5116	-1.9736	-2.4465	-1.7176	-2.9936	0.031	0.011	0.004	0.019	0.001
1	Pu35-05	quenched	measured bc	-1.6233	-2.0822	-2.4390	-0.2803	-1.4007	0.024	0.008	0.004	0.524	0.040
1	Pu35-06	quenched	measured bc	-1.6232	-2.0835	-2.4390	-1.6293	-2.9928	0.024	0.008	0.004	0.023	0.001
1	Pu35-07	quenched	measured bc	-1.6238	-2.0856	-2.4539	-1.7141	-2.4392	0.024	0.008	0.004	0.019	0.004
1	Pu35-08	quenched	measured bc	-1.5103	-1.9689	-2.4352	-1.5567	-2.2999	0.031	0.011	0.004	0.028	0.005
1	Pu35-09	quenched	measured bc	-1.4453	-1.9005	-2.4333	-1.4900	-1.2452	0.036	0.013	0.004	0.032	0.057
1	Pu35-10	quenched	measured bc	-1.6289	-2.0856	-2.4352	-1.5385	-2.9978	0.024	0.008	0.004	0.029	0.001
1	Pu35-11	quenched	measured bc	-1.6302	-2.0835	-2.4521	-1.7532	-2.9989	0.023	0.008	0.004	0.018	0.001
1	Pu35-12	quenched	measured bc	-1.6364	-2.0856	-2.4521	-1.4070	-2.9991	0.023	0.008	0.004	0.039	0.001
1	Pu35-13	quenched	measured bc	-1.5220	-1.9839	-2.4333	-1.1129	-2.1053	0.030	0.010	0.004	0.077	0.008
1	Pu35-14	quenched	measured bc	-1.6181	-2.0878	-2.4484	-1.9266	-2.9994	0.024	0.008	0.004	0.012	0.001
1	Pu35-15	quenched	measured bc	-1.6194	-2.0899	-2.4484	-1.8405	-2.8924	0.024	0.008	0.004	0.014	0.001
2	Pu35-16	quenched	measured bc	-1.6237	-2.0941	-2.4539	-1.9517	-2.1407	0.024	0.008	0.004	0.011	0.007
2	Pu35-17	quenched	measured bc	-1.6255	-2.0920	-2.4502	-1.8952	-1.7485	0.024	0.008	0.004	0.013	0.018
2	Pu35-18	quenched	measured bc	-1.5178	-1.9853	-2.4521	-1.8585	-1.3464	0.030	0.010	0.004	0.014	0.045
2	Pu35-19	quenched	measured bc	-1.6194	-2.0920	-2.4539	-1.7900	-2.2041	0.024	0.008	0.004	0.016	0.006
2	Pu35-20	quenched	measured bc	-1.6169	-2.0962	-2.4576	-1.6203	-1.6258	0.024	0.008	0.003	0.024	0.024
2	Pu35-21	quenched	measured bc	-1.6156	-2.0920	-2.4428	-1.6863	-2.2661	0.024	0.008	0.004	0.021	0.005
2	Pu35-22	quenched	measured bc	-1.6218	-2.0983	-2.4521	-1.7826	-2.1663	0.024	0.008	0.004	0.016	0.007
2	Pu35-23	quenched	measured bc	-1.6237	-2.0920	-2.4539	-1.8614	-2.2535	0.024	0.008	0.004	0.014	0.006

Table 3-4. Normalized PCTs by Glass ID and compositional view (continued)

Set	Glass ID	Heat Treatment	Composition	log NL [B(g/L)]	log NL [Gd(g/L)]	log NL [Hf(g/L)]	log NL [Na(g/L)]	log NL [Si(g/L)]	NL B(g/L)	NL Gd (g/L)	NL Hf (g/L)	NL Na (g/L)	NL Si (g/L)
2	Pu35-24	quenched	measured bc	-1.6262	-2.0899	-2.4484	-1.6780	-2.2503	0.024	0.008	0.004	0.021	0.006
2	Pu35-25	quenched	measured bc	-1.6169	-2.0899	-2.4484	-1.5995	-1.5529	0.024	0.008	0.004	0.025	0.028
2	Pu35-26	quenched	measured bc	-1.6181	-2.0835	-2.4447	-1.0624	-2.3195	0.024	0.008	0.004	0.087	0.005
2	Pu35-27	quenched	measured bc	-1.6163	-2.0816	-2.4352	-1.7369	-2.1960	0.024	0.008	0.004	0.018	0.006
2	Pu35-28	quenched	measured bc	-1.6243	-2.0856	-2.4428	-1.7921	-2.2291	0.024	0.008	0.004	0.016	0.006
2	Pu35-29	quenched	measured bc	-1.6206	-2.0813	-2.4371	-1.5209	-1.5389	0.024	0.008	0.004	0.030	0.029
2	Pu35-30	quenched	measured bc	-1.6100	-2.0878	-2.4465	-1.8632	-1.3394	0.025	0.008	0.004	0.014	0.046
2	Pu35-31	quenched	measured bc	-1.6087	-2.0856	-2.4447	-1.6221	-1.4457	0.025	0.008	0.004	0.024	0.036
2	Pu35-32	quenched	measured bc	-1.6163	-2.0878	-2.4539	-1.7709	-2.3307	0.024	0.008	0.004	0.017	0.005
2	Pu35-33	quenched	measured bc	-1.6049	-2.0733	-2.4428	-1.8656	-2.3155	0.025	0.008	0.004	0.014	0.005
2	Pu35-34	quenched	measured bc	-1.6061	-2.0878	-2.4428	-1.6126	-1.8811	0.025	0.008	0.004	0.024	0.013
2	Pu35-35	quenched	measured bc	-1.6194	-2.0835	-2.4539	-1.8798	-2.2968	0.024	0.008	0.004	0.013	0.005
3	Pu35-36	quenched	measured bc	-1.6270	-2.0878	-2.4558	-1.7493	-1.6552	0.024	0.008	0.004	0.018	0.022
3	Pu35-37	quenched	measured bc	-1.6251	-2.0798	-2.4333	-1.7372	-1.8054	0.024	0.008	0.004	0.018	0.016
3	Pu35-38	quenched	measured bc	-1.6257	-2.0763	-2.4447	-1.7315	-1.9250	0.024	0.008	0.004	0.019	0.012
3	Pu35-39	quenched	measured bc	-1.6257	-2.0878	-2.4539	-1.7749	-1.4534	0.024	0.008	0.004	0.017	0.035
3	Pu35-40	quenched	measured bc	-1.6276	-2.0794	-2.4352	-1.7283	-1.9343	0.024	0.008	0.004	0.019	0.012
3	Pu35-41	quenched	measured bc	-1.4915	-1.9430	-2.4390	-1.8547	-1.9367	0.032	0.011	0.004	0.014	0.012
3	Pu35-42	quenched	measured bc	-1.6219	-2.0856	-2.4465	-1.7942	-1.5142	0.024	0.008	0.004	0.016	0.031
3	Pu35-43	quenched	measured bc	-1.6295	-2.0813	-2.4447	-1.7745	-2.0286	0.023	0.008	0.004	0.017	0.009
3	Pu35-44	quenched	measured bc	-1.6225	-2.0835	-2.4447	-1.7332	-2.0542	0.024	0.008	0.004	0.018	0.009
3	Pu35-45	quenched	measured bc	-1.6320	-2.0768	-2.4371	-1.7765	-1.7852	0.023	0.008	0.004	0.017	0.016
3	Pu35-46	quenched	measured bc	-1.6268	-2.0983	-2.4502	-1.7306	-1.8679	0.024	0.008	0.004	0.019	0.014
3	Pu35-47	quenched	measured bc	-1.6249	-2.0878	-2.4502	-1.7942	-1.9876	0.024	0.008	0.004	0.016	0.010
3	Pu35-48	quenched	measured bc	-1.6280	-2.0899	-2.4409	-1.7973	-1.9897	0.024	0.008	0.004	0.016	0.010
3	Pu35-49	quenched	measured bc	-1.6268	-2.0941	-2.4409	-1.7458	-1.7088	0.024	0.008	0.004	0.018	0.020
3	Pu35-50	quenched	measured bc	-1.6304	-2.0920	-2.4390	-1.7546	-1.5230	0.023	0.008	0.004	0.018	0.030
3	Pu35-51	quenched	measured bc	-1.4989	-1.9638	-2.4371	-1.8070	-1.9179	0.032	0.011	0.004	0.016	0.012
3	Pu35-52	quenched	measured bc	-1.6280	-2.0920	-2.4136	-1.7950	-1.5689	0.024	0.008	0.004	0.016	0.027
3	Pu35-53	quenched	measured bc	-1.6316	-2.0941	-2.4176	-1.8224	-1.7423	0.023	0.008	0.004	0.015	0.018
3	Pu35-54	quenched	measured bc	-1.6316	-2.0962	-2.4216	-1.7793	-1.7787	0.023	0.008	0.004	0.017	0.017
3	Pu35-55	quenched	measured bc	-1.6412	-2.0983	-2.4333	-1.7966	-1.6386	0.023	0.008	0.004	0.016	0.023
1	Pu04-01	quenched	targeted	-1.6198	-2.0823	-2.5975	-0.2007	-2.5818	0.024	0.008	0.003	0.630	0.003
1	Pu04-02	quenched	targeted	-1.6198	-2.0823	-2.5971	-0.8167	-2.9844	0.024	0.008	0.003	0.153	0.001
1	Pu04-03	quenched	targeted	-1.6198	-2.0823	-2.5968	-1.1536	-2.9844	0.024	0.008	0.003	0.070	0.001
1	Pu04-04	quenched	targeted	-1.6198	-2.0823	-2.5962	-0.8526	-2.8784	0.024	0.008	0.003	0.140	0.001
1	Pu04-05	quenched	targeted	-1.6198	-2.0823	-2.5977	-1.4546	-2.9844	0.024	0.008	0.003	0.035	0.001
1	Pu35-01	quenched	targeted	-1.4955	-1.9580	-2.4806	-1.8526	-2.9844	0.032	0.011	0.003	0.014	0.001
1	Pu35-02	quenched	targeted	-1.6198	-2.0823	-2.4824	-1.4936	-2.1315	0.024	0.008	0.003	0.032	0.007
1	Pu35-03	quenched	targeted	-1.6198	-2.0823	-2.4791	-2.1197	-2.1600	0.024	0.008	0.003	0.008	0.007
1	Pu35-04	quenched	targeted	-1.5056	-1.9682	-2.4847	-1.6977	-2.9844	0.031	0.011	0.003	0.020	0.001
1	Pu35-05	quenched	targeted	-1.6198	-2.0823	-2.4803	-0.2806	-1.3994	0.024	0.008	0.003	0.524	0.040
1	Pu35-06	quenched	targeted	-1.6198	-2.0823	-2.4809	-1.6746	-2.9844	0.024	0.008	0.003	0.021	0.001
1	Pu35-07	quenched	targeted	-1.6198	-2.0823	-2.4835	-1.7348	-2.4277	0.024	0.008	0.003	0.018	0.004
1	Pu35-08	quenched	targeted	-1.5030	-1.9656	-2.4832	-1.5515	-2.2929	0.031	0.011	0.003	0.028	0.005
1	Pu35-09	quenched	targeted	-1.4368	-1.8993	-2.4824	-1.5287	-1.2313	0.037	0.013	0.003	0.030	0.059
1	Pu35-10	quenched	targeted	-1.6198	-2.0823	-2.4818	-1.5706	-2.9844	0.024	0.008	0.003	0.027	0.001
1	Pu35-11	quenched	targeted	-1.6198	-2.0823	-2.4809	-1.7883	-2.9844	0.024	0.008	0.003	0.016	0.001
1	Pu35-12	quenched	targeted	-1.6198	-2.0823	-2.4835	-1.4483	-2.9844	0.024	0.008	0.003	0.036	0.001
1	Pu35-13	quenched	targeted	-1.5180	-1.9805	-2.4835	-1.1684	-2.0933	0.030	0.010	0.003	0.068	0.008
1	Pu35-14	quenched	targeted	-1.6198	-2.0823	-2.4818	-1.9789	-2.9844	0.024	0.008	0.003	0.010	0.001
1	Pu35-15	quenched	targeted	-1.6198	-2.0823	-2.4847	-1.8940	-2.8743	0.024	0.008	0.003	0.013	0.001
2	Pu35-16	quenched	targeted	-1.6198	-2.0823	-2.4803	-2.0394	-2.1338	0.024	0.008	0.003	0.009	0.007
2	Pu35-17	quenched	targeted	-1.6198	-2.0823	-2.4832	-1.9665	-1.7370	0.024	0.008	0.003	0.011	0.018
2	Pu35-18	quenched	targeted	-1.5152	-1.9777	-2.4812	-1.9226	-1.3395	0.031	0.011	0.003	0.012	0.046
2	Pu35-19	quenched	targeted	-1.6198	-2.0823	-2.4815	-1.8416	-2.1995	0.024	0.008	0.003	0.014	0.006

Table 3-4. Normalized PCTs by Glass ID and compositional view (continued)

Set	Glass ID	Heat Treatment	Composition	log NL [B(g/L)]	log NL [Gd(g/L)]	log NL [Hf(g/L)]	log NL [Na(g/L)]	log NL [Si(g/L)]	NL B(g/L)	NL Gd (g/L)	NL Hf (g/L)	NL Na (g/L)	NL Si (g/L)
2	Pu35-20	quenched	targeted	-1.6198	-2.0823	-2.4832	-1.6485	-1.6132	0.024	0.008	0.003	0.022	0.024
2	Pu35-21	quenched	targeted	-1.6198	-2.0823	-2.4829	-1.7203	-2.2579	0.024	0.008	0.003	0.019	0.006
2	Pu35-22	quenched	targeted	-1.6198	-2.0823	-2.4841	-1.8187	-2.1534	0.024	0.008	0.003	0.015	0.007
2	Pu35-23	quenched	targeted	-1.6198	-2.0823	-2.4812	-1.9180	-2.2484	0.024	0.008	0.003	0.012	0.006
2	Pu35-24	quenched	targeted	-1.6198	-2.0823	-2.4818	-1.7129	-2.2418	0.024	0.008	0.003	0.019	0.006
2	Pu35-25	quenched	targeted	-1.6198	-2.0823	-2.4824	-1.6307	-1.5074	0.024	0.008	0.003	0.023	0.031
2	Pu35-26	quenched	targeted	-1.6198	-2.0823	-2.4809	-1.0933	-2.3068	0.024	0.008	0.003	0.081	0.005
2	Pu35-27	quenched	targeted	-1.6198	-2.0823	-2.4829	-1.7624	-2.1859	0.024	0.008	0.003	0.017	0.007
2	Pu35-28	quenched	targeted	-1.6198	-2.0823	-2.4826	-1.8187	-2.2213	0.024	0.008	0.003	0.015	0.006
2	Pu35-29	quenched	targeted	-1.6198	-2.0823	-2.4855	-1.5470	-1.5288	0.024	0.008	0.003	0.028	0.030
2	Pu35-30	quenched	targeted	-1.6198	-2.0823	-2.4812	-1.9037	-1.3269	0.024	0.008	0.003	0.012	0.047
2	Pu35-31	quenched	targeted	-1.6198	-2.0823	-2.4832	-1.6216	-1.4327	0.024	0.008	0.003	0.024	0.037
2	Pu35-32	quenched	targeted	-1.6198	-2.0823	-2.4818	-1.7883	-2.3179	0.024	0.008	0.003	0.016	0.005
2	Pu35-33	quenched	targeted	-1.6198	-2.0823	-2.4783	-1.9037	-2.2733	0.024	0.008	0.003	0.012	0.005
2	Pu35-34	quenched	targeted	-1.6198	-2.0823	-2.4815	-1.6307	-1.8257	0.024	0.008	0.003	0.023	0.015
2	Pu35-35	quenched	targeted	-1.6198	-2.0823	-2.4803	-1.9180	-2.2904	0.024	0.008	0.003	0.012	0.005
3	Pu35-36	quenched	targeted	-1.6198	-2.0823	-2.4815	-1.7756	-1.6378	0.024	0.008	0.003	0.017	0.023
3	Pu35-37	quenched	targeted	-1.6198	-2.0823	-2.4803	-1.7624	-1.7965	0.024	0.008	0.003	0.017	0.016
3	Pu35-38	quenched	targeted	-1.6198	-2.0823	-2.4826	-1.7690	-1.9168	0.024	0.008	0.003	0.017	0.012
3	Pu35-39	quenched	targeted	-1.6198	-2.0823	-2.4824	-1.7946	-1.4355	0.024	0.008	0.003	0.016	0.037
3	Pu35-40	quenched	targeted	-1.6198	-2.0823	-2.4806	-1.7624	-1.9245	0.024	0.008	0.003	0.017	0.012
3	Pu35-41	quenched	targeted	-1.4792	-1.9418	-2.4826	-1.9226	-1.9278	0.033	0.011	0.003	0.012	0.012
3	Pu35-42	quenched	targeted	-1.6198	-2.0823	-2.4812	-1.8416	-1.4989	0.024	0.008	0.003	0.014	0.032
3	Pu35-43	quenched	targeted	-1.6198	-2.0823	-2.4803	-1.8187	-2.0169	0.024	0.008	0.003	0.015	0.010
3	Pu35-44	quenched	targeted	-1.6198	-2.0823	-2.4806	-1.7690	-2.0410	0.024	0.008	0.003	0.017	0.009
3	Pu35-45	quenched	targeted	-1.6198	-2.0823	-2.4806	-1.8128	-1.7800	0.024	0.008	0.003	0.015	0.017
3	Pu35-46	quenched	targeted	-1.6198	-2.0823	-2.4824	-1.7488	-1.8516	0.024	0.008	0.003	0.018	0.014
3	Pu35-47	quenched	targeted	-1.6198	-2.0823	-2.4812	-1.8128	-1.9772	0.024	0.008	0.003	0.015	0.011
3	Pu35-48	quenched	targeted	-1.6198	-2.0823	-2.4806	-1.8128	-1.9835	0.024	0.008	0.003	0.015	0.010
3	Pu35-49	quenched	targeted	-1.6198	-2.0823	-2.4815	-1.7557	-1.6914	0.024	0.008	0.003	0.018	0.020
3	Pu35-50	quenched	targeted	-1.6198	-2.0823	-2.4815	-1.7624	-1.5129	0.024	0.008	0.003	0.017	0.031
3	Pu35-51	quenched	targeted	-1.4895	-1.9520	-2.4809	-1.8245	-1.9037	0.032	0.011	0.003	0.015	0.012
3	Pu35-52	quenched	targeted	-1.6198	-2.0823	-2.4806	-1.8007	-1.5570	0.024	0.008	0.003	0.016	0.028
3	Pu35-53	quenched	targeted	-1.6198	-2.0823	-2.4838	-1.8471	-1.7296	0.024	0.008	0.003	0.014	0.019
3	Pu35-54	quenched	targeted	-1.6198	-2.0823	-2.4826	-1.7946	-1.7609	0.024	0.008	0.003	0.016	0.017
3	Pu35-55	quenched	targeted	-1.6198	-2.0823	-2.4812	-1.8068	-1.6152	0.024	0.008	0.003	0.016	0.024

The results of the PCTs indicate that each of the surrogate glasses was highly durable as compared to the EA glass, which is used as a benchmark for defense-related waste glasses destined for the U.S. federal repository.[17] Boron has been found to be released at the same maximum normalized concentration as some high-activity radionuclides, and is therefore typically used to gauge the performance of simulated waste glasses. The concentration of boron in the PCT leachates was below the detection limit of the ICP-AES instrument for most of the surrogate glasses. The highest normalized release for boron measured was 0.041 g/L, which is considerably lower than that of the EA glass (16.695 g/L).[17] The maximum normalized release rates among the 60 surrogate glasses for the other elements measured were also quite low: 0.005 g/L for Hf, 0.014 g/L for Gd, 1.229 g/L for Na and 0.090 g/L for Si. The normalized release rates for the elements measured were generally too small to attempt to correlate the results with the compositions of the test glasses. Note that the pH of the leachate solutions (typically ~8.0) was generally lower than that of conventional HLW glasses developed for defense-related radioactive waste sludges (typically ~10.5) due to the lack of alkali in the LaBS glass. The leachate solution is less corrosive to the glass matrix at a lower pH, so it is likely that this impacted the PCT results

(i.e., a poorer PCT response may be measured if a higher pH solution, more typical of alkaliborosilicate HLW glasses, is used).

3.5 TCLP Results

The results of the TCLP for the selected surrogate glasses are summarized in Table 3-5. For all of the glasses submitted, none of the RCRA hazardous metals were detectable in the leachates at the completion of the test (i.e., the measurements were all below the analytical detection limits). The complete report provided by Davis & Floyd, Inc. is included as Appendix F.

Table 3-5. Results of the TCLP for select surrogate glasses.

Glass ID	Cr (mg/L)	Pb (mg/L)	Ni (mg/L)	Se (mg/L)
Pu35-11	< 0.10	< 0.050	< 0.20	< 0.050
Pu35-36	< 0.10	< 0.050	< 0.20	< 0.050
Pu35-37	< 0.10	< 0.050	< 0.20	< 0.050
Pu35-41	< 0.10	< 0.050	< 0.20	< 0.050
Pu35-47	< 0.10	< 0.050	< 0.20	< 0.050
Pu35-50	< 0.10	< 0.050	< 0.20	< 0.050
Pu35-51	< 0.10	< 0.050	< 0.20	< 0.050
Pu35-52	< 0.10	< 0.050	< 0.20	< 0.050

3.6 Results for the PuO_2 Glasses

An analysis of the experimental data for the glasses fabricated with PuO_2 is provided in the following sections.

3.6.1 *Visual Observations and XRD Results*

The visual observations and XRD results for the PuO_2-containing glasses are summarized in Table 3-6. No crystallization was visible on the surface of the glass after melting. Figure 3-7 is a photograph of these four glasses after being removed from the platinum crucibles in the SRNL shielded cells facility. In addition, all of the glasses were amorphous by XRD. This indicates that the glasses were either free of crystalline material, or that any crystallization was below the XRD detection limit of 0.5 vol %. These results suggest complete dissolution of PuO_2 in the glass matrix.

Table 3-6. Visual observations and XRD results for the glasses fabricated with PuO_2.

Glass ID	Heat Treatment	Visual Observations	XRD Results
Pu35-03B	quenched	no visible crystallization on surface	amorphous
Pu35-06B	quenched	no visible crystallization on surface	amorphous
Pu35-17B	quenched	no visible crystallization on surface	amorphous
Pu04-04B	quenched	no visible crystallization on surface	amorphous

Figure 3-7. Photograph of the four glasses fabricated with PuO_2 in the SRNL shielded cells facility. The glasses are, from left to right, Pu35-03B, Pu35-06B, Pu04-04B and Pu35-17B.

3.6.2 *SEM Characterization*

Each of the glasses fabricated with PuO_2 was submitted to AD for SEM and EDS analysis. Ground samples were used to provide an increased amount of surface area for analysis. Glass Pu04-04B was generally free of any crystalline phases, as shown in Figure 3-8. However, some small areas of crystalline material were located, as shown in Figure 3-9.

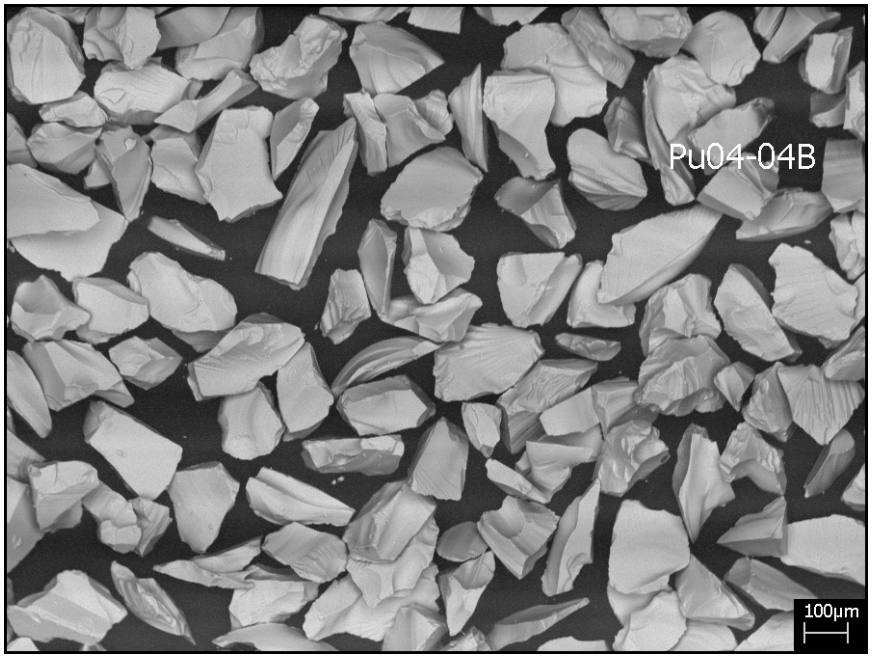

Figure 3-8. SEM micrograph of glass Pu04-04B. This glass was generally free of any crystalline phases.

Figure 3-9. Higher magnification SEM micrograph of glass Pu04-04B, showing a small area of crystalline material.

EDS was used to identify the composition of the crystalline phase in Figure 3-9. A higher magnification image of this region is shown in Figure 3-10. The areas evaluated with EDS are also indicated in this micrograph. The EDS results for Spot-3 are shown in Figure 3-11 and the EDS results for Spot-4 are shown in Figure 3-12. The relative intensities for Pu and Hf are higher in the EDS spectrum for the crystalline phase (Spot-3, Figure 3-11) than in the glass matrix (Spot-4, Figure 3-12), indicating that the crystalline phase is composed mainly of these elements.

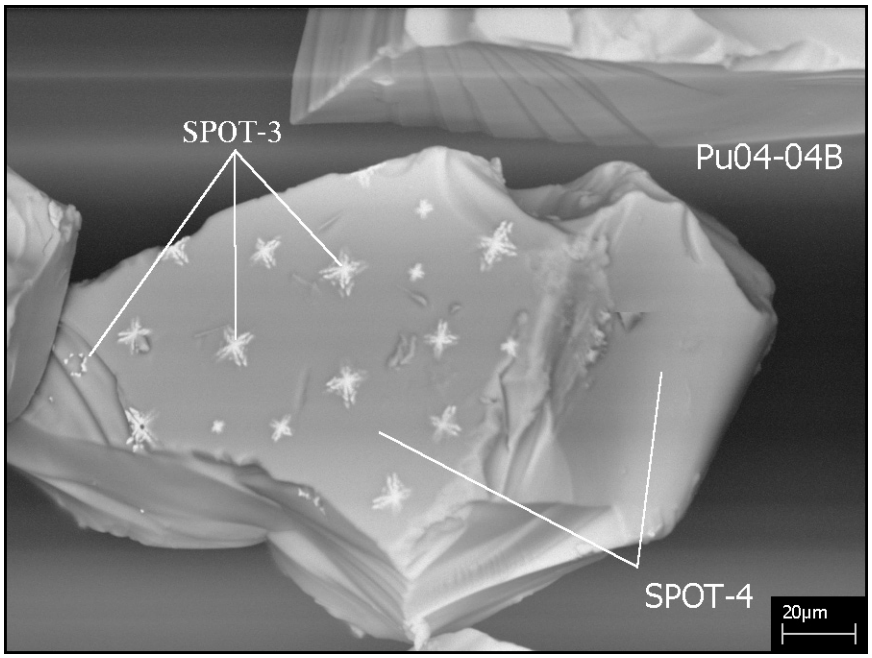

Figure 3-10. SEM micrograph of the crystalline phase identified in glass Pu04-04B. The marked spots indicate areas where EDS spectra were recorded.

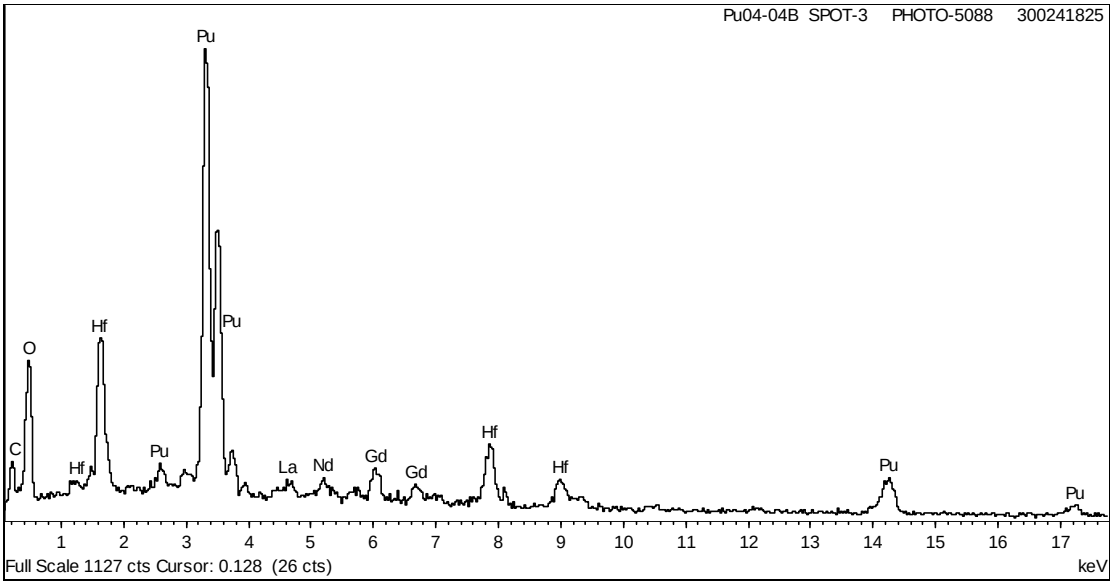

Figure 3-11. EDS spectrum collected at Spot-3 in Figure 3-10.

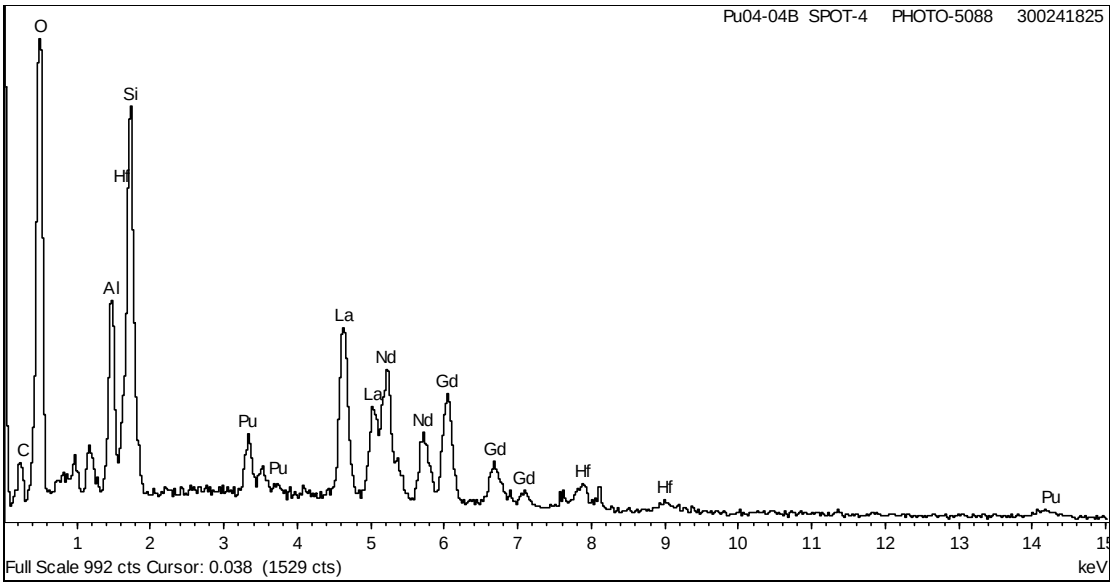

Figure 3-12. EDS spectrum recorded at Spot-4 in Figure 3-10.

A Pu-containing crystalline phase with the morphology shown in Figure 3-10 has been identified in a previous study of Pu-bearing LaBS glasses.[9] The authors of that study identified this phase as a solid solution of PuO_2 and HfO_2.[9] Additional work is necessary to better characterize the effect that this phase has, if any, on durability of the glass.

A small amount of crystallization was identified in glass Pu35-03B via SEM. The crystallization appeared to be confined to the faces of individual particles of the glass, as indicated by the arrows in Figure 3-13. It is possible that these crystals were nucleated at the interface between the glass and the platinum crucible, which may explain why they are limited to only single faces of a small number of glass particles. Alternatively, some PuO_2 may have sunk to the bottom of the crucible, exceeding the solubility limit of the glass at the bottom and resulting in crystallization of a small amount of PuO_2.

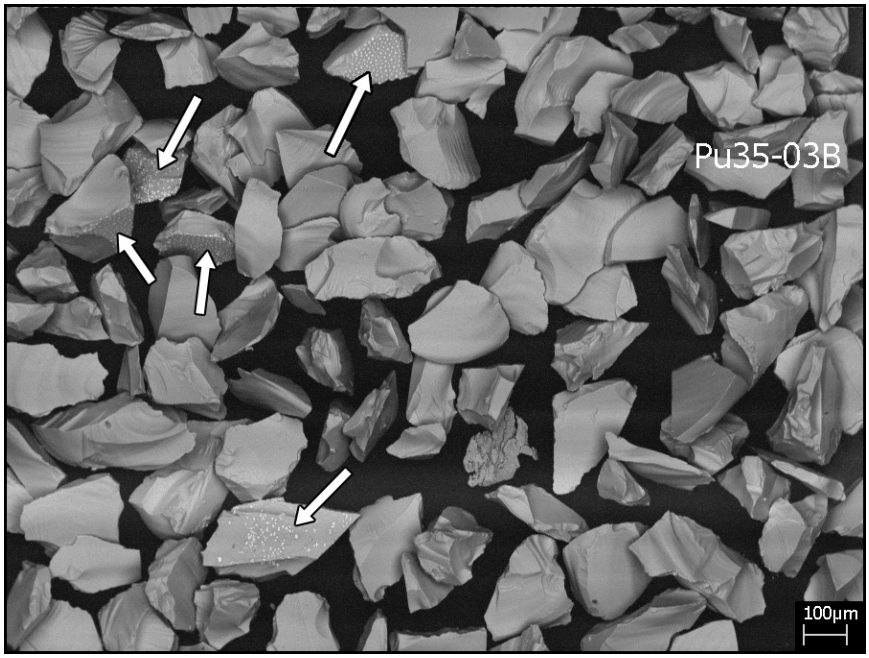

Figure 3-13. SEM micrograph of glass Pu35-03B. The arrows indicate crystallization on the faces of some of the glass particles.

The crystalline phases in this glass included two morphologies, a simple cube or sphere shape, and a cross shape (as seen in glass Pu04-04B). These morphologies are shown at higher magnification in Figure 3-14. EDS was used to compare the composition of each of these phases (Spot-1 and Spot-3) with the glass matrix (Spot-2).

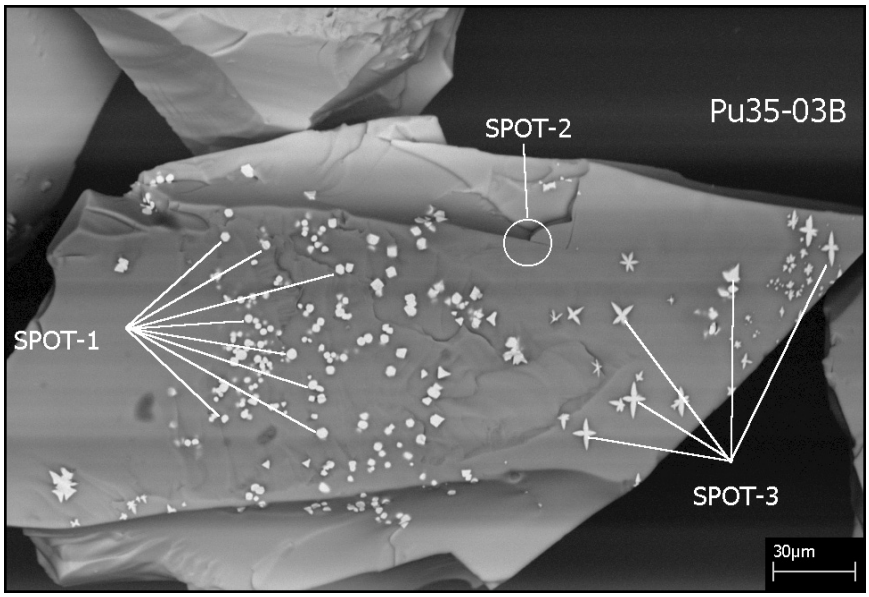

Figure 3-14. Higher magnification SEM micrograph of the two crystalline phases identified in glass Pu35-03B. Areas analyzed by EDS are indicated.

The EDS spectra are shown in Figure 3-15. The relative intensities of the EDS peaks for Spot-1 indicate that this phase consists mainly of Pu. The EDS spectrum collected at Spot-3 indicates that this phase consists mainly of Hf and Pu, similar to the crystalline phase in glass Pu04-04B.

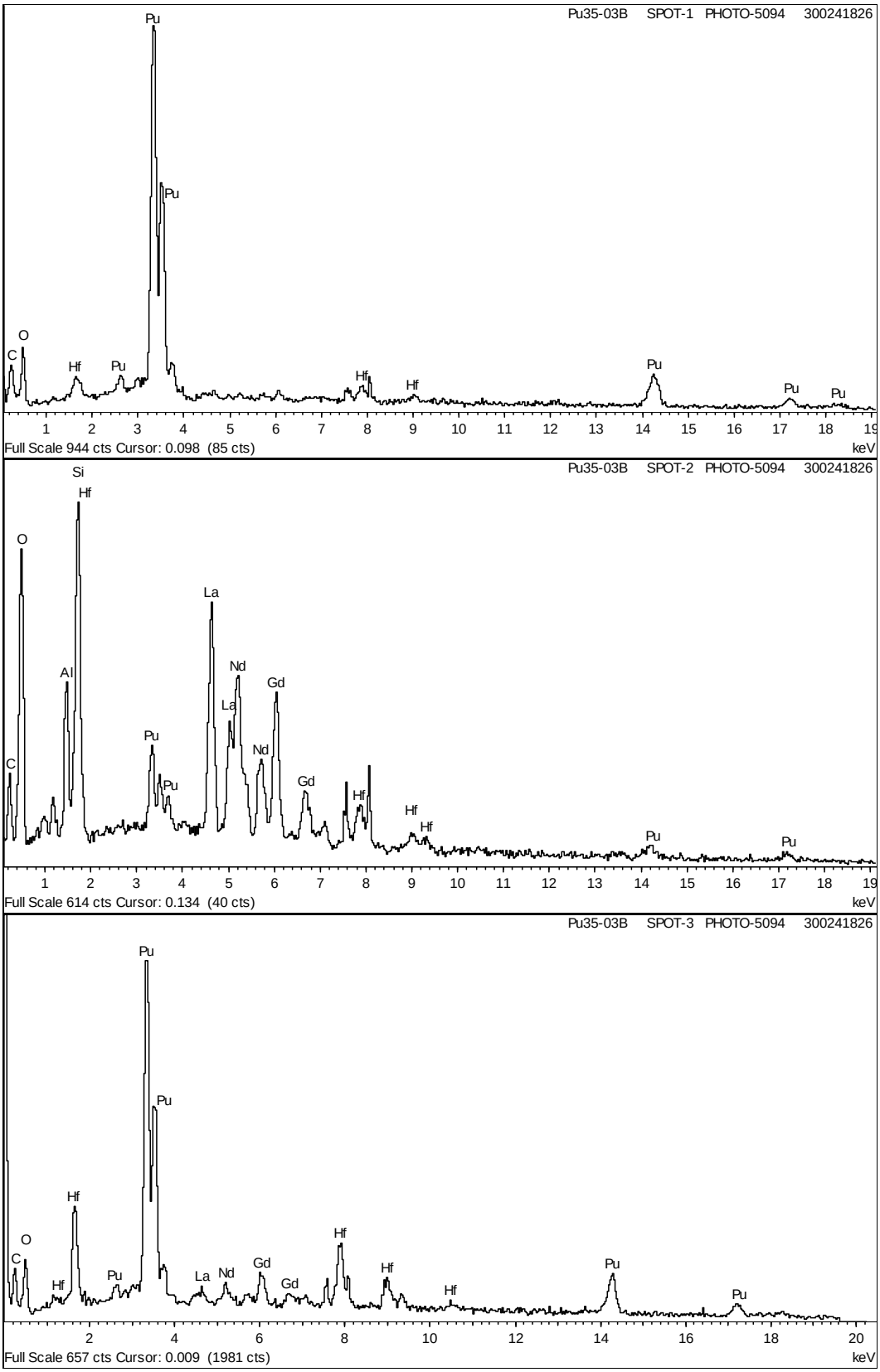

Figure 3-15. EDS spectra corresponding to the spots identified in Figure 3-14.

The SEM results for glasses Pu35-06B and Pu35-17B were similar to each other. Both glasses were generally free of crystallization (Figure 3-16 and Figure 3-17), but a small amount of the cross-shaped phase was identified in each glass (Figure 3-18 and Figure 3-19). EDS spectra were collected for each glass, and the results were similar to those for the cross-shaped phases identified in glasses Pu04-04B and Pu35-03B. Again, additional work needs to be performed to characterize the influence of this crystalline phase on the performance of the glass.

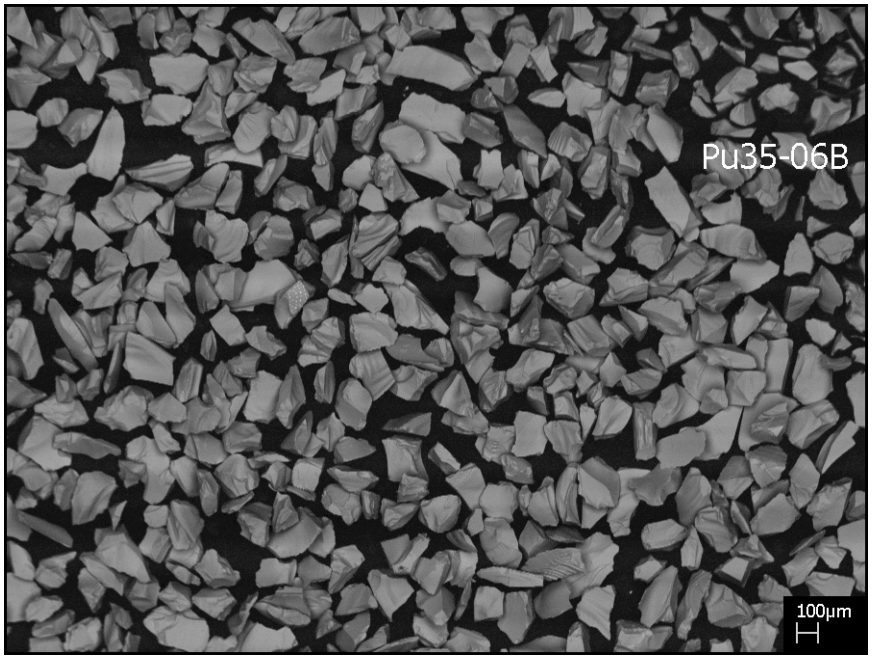

Figure 3-16. SEM micrograph of glass Pu35-06B.

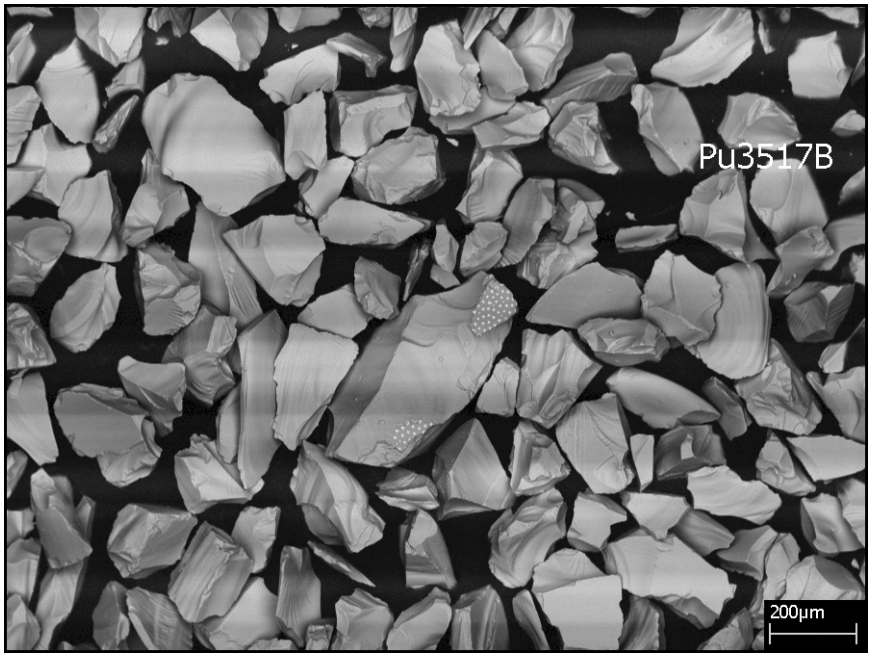

Figure 3-17. SEM micrograph of glass Pu35-17B. Some crystalline material is visible at the center of the image.

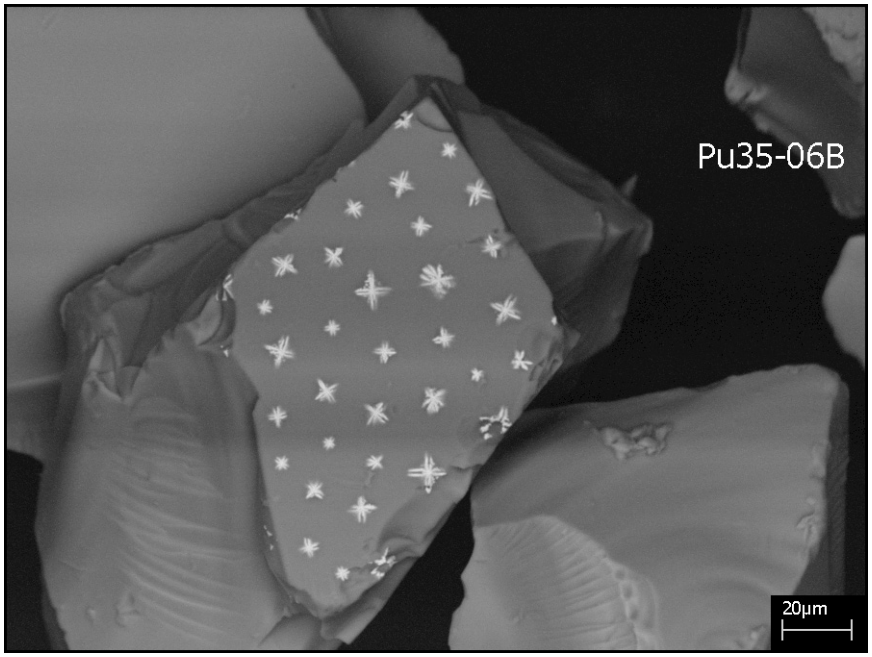

Figure 3-18. Higher magnification SEM micrograph of glass Pu35-06B, showing an area of crystallization on the face of a glass particle.

Figure 3-19. Higher magnification SEM micrograph of glass Pu35-17B, showing an area of crystallization on the face of a glass particle.

3.6.3 *Normalized PCT Results*

The four different PuO_2-containing glasses were leach tested in two separate PCTs via remote handling in the SRNL shielded cells facility. The PCT Method A[16] was followed using a 10:1 mass ratio of leachant to glass. Each PCT included two PuO_2-containing glasses and the EA and ARM reference glasses, all in triplicate. Two blanks (ASTM Type I water only) were also included with each PCT. Leachates for the PuO_2-containing glasses were analyzed by both ICP-AES (for B, Na and Si concentrations) and Inductively Coupled Plasma – Mass Spectroscopy (ICP-MS) (for La, Nd, Gd, Hf and Pu concentrations). Samples of a multielement standard solution were included with the leachates submitted for ICP-AES analysis.

The measured ARM glass leachate concentrations for PCT #1 and PCT #2 and the control range values are given in Table 3-7. The measured values for the ARM glass for both PCTs all fell within the specified control limits.[14] All of the multielement standard solution concentrations, also shown in Table 3-7, agreed with the standard values to within ± 4%.

Table 3-7. PCT results for the ARM reference glass and multielement standard solution included with the PuO_2 glasses.

	B (ppm)	Na (ppm)	Si (ppm)
Control values	12.9 – 22.7	28.9 – 43.6	49.0 – 73.4
ARM (PCT #1)	16.8 ± 0.8	35.9 ± 1.5	62.2 ± 1.8
ARM (PCT #2)	17.7 ± 0.1	37.5 ± 0.3	64.2 ± 0.4
Standard values	20.0	81.0	50.0
Standard Sol'n (PCT #1)	19.3	79.6	50.3
Standard Sol'n (PCT #2)	19.6	80.8	51.2

The leachate concentrations for the PuO_2-containing glasses were normalized using the target compositions as described in Section 3.4.4. The average normalized release values for PCT #1 (Pu04-04B and Pu35-03B) and PCT #2 (Pu35-06B and Pu35-17B) are summarized in Table 3-8. Data for the EA glass are also shown. Measurements that were below the analytical detection limit are indicated by a "<". Comparison of the EA glass results from the two different PCTs to the reference values indicates that NL(B) and NL(Na) average values were slightly below the range of EA reference values for PCT #1. The NL(Si) average is within the (average – one standard deviation) of the reference NL(Si). All of the measured EA values for PCT #2 are in good agreement with the EA reference values.

Table 3-8. PCT results for the glasses fabricated with PuO_2.

Glass ID	NL B (g/L)	NL Na (g/L)	NL Si (g/L)	NL La (g/L)	NL Nd (g/L)	NL Gd (g/L)	NL Hf (g/L)	NL Pu (g/L)	pH
Pu04-04B	0.020	<1.587	0.022	0.0003	0.0001	0.0002	< 0.0001	0.0096	7.15 ± 0.4
Pu35-03B	0.014	<0.085	0.017	0.0001	0.0000	0.0000	< 0.0001	0.0061	7.56 ± 0.3
Pu35-06B	0.017	<0.158	0.017	0.0002	0.0001	0.0001	< 0.0001	0.0061	6.91 ± 0.4
Pu35-17B	0.015	<0.122	0.016	0.0002	0.0001	0.0001	< 0.0001	0.0074	6.57 ± 0.2
EA (PCT #1)*	15.171	11.885	3.649	-	-	-	-	-	11.49 ± 0.05
EA (PCT #2)*	16.943	13.119	3.968	-	-	-	-	-	11.64 ± 0.01

*The reference NL values for the EA glass are 16.695 ± 1.222 g/L for B, 13.346 ± 0.902 g/L for Na, 3.922 ± 0.376 g/L for Si, and a pH of 11.85 ± 0.1.[17]

The NL(B) values for the PuO_2-containing glasses are considerably lower than the EA reference value of 16.695.[17] Overall, the normalized release results for the PuO_2-containing glasses with impurities are similar in magnitude to previous testing performed on PuO_2-containing glasses without any impurities present.[18, 19]

Average pH values for the leachates are shown in the last column of Table 3-8, with the precisions indicating the standard deviation of the three triplicate measurements. Note that, as was observed for the surrogate glasses, the pH of the leachate solutions was generally lower than that of conventional HLW glasses developed for defense-related radioactive waste sludges (typically ~10.5) due to the lack of alkali in the LaBS glass. The leachate solution is less corrosive to the glass matrix at a lower pH, so it is likely that this impacted the PCT results (i.e., a poorer PCT response may be measured if a higher pH solution, more typical of alkaliborosilicate HLW glasses, is used).

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4.0 Conclusions

Sixty surrogate glass compositions were developed through a statistically designed approach to cover the anticipated ranges of concentrations for several impurity species expected in the Pu feed. An additional four glass compositions containing actual PuO_2 were selected based on their targeted concentrations of metals and anions. The glasses were fabricated and characterized in the laboratory and shielded cells facility to determine the degree of retention of the impurity components, the impact of the impurities on the durability of each glass, and the degree of crystallization that occurred, both upon quenching and slow cooling.

Overall, the LaBS glass system appears to be very tolerant of most of the impurity types and concentrations projected in the Pu waste stream. For the surrogate glasses, the measured CuO, Ga_2O_3, Na_2O, NiO, and Ta_2O_5 concentrations fell very close to their target values across the ranges of concentrations targeted in this study for each of these components. The measured CaO and PbO concentrations were consistently higher than the targeted values. The measured Cr_2O_3 and Fe_2O_3 concentrations were very close to the targets except for the one highest targeted value for each of these components. A solubility limit may have been approached in this glass system for K_2O and MgO. The measured Cl^-, F^-, SeO_2 and SO_4^{2-} concentrations were well below their target values for all of the study glasses. This is likely due to volatilization of these species during melting of the glass batch. Note that the degree of volatilization that occurred in this crucible-scale study may differ from the full-scale melter. The measured HfO_2 concentrations were below their target values for all of the surrogate glasses. It is likely that for HfO_2, the solubility limit in the glass was exceeded and some of the HfO_2 batch material remained in the bottom of the crucibles after pouring the glasses.

XRD and SEM results indicated that some crystalline HfO_2 remained in some of the surrogate glasses with the lowest concentration of impurities. No other crystalline phases were identified. The PCT results showed that all 60 of the surrogate glass compositions tested were very durable, with the highest normalized release for boron being 0.041 g/L. Note that the pH of the leachate solutions (typically ~8.0) was generally lower than that of conventional HLW glasses developed for defense-related radioactive waste sludges (typically ~10.5) due to the lack of alkali in the LaBS glass. The leachate solution is less corrosive to the glass matrix at a lower pH, so it is likely that this impacted the PCT results (i.e., a poorer PCT response may be measured if a higher pH solution, more typical of alkaliborosilicate HLW glasses, is used). The normalized release rates for the elements measured were generally too small to attempt to correlate the results with the compositions of the test glasses. The TCLP results showed that no RCRA hazardous metals were leached from the surrogate glasses in any measurable concentration.

A Pu-containing crystalline phase with a cross-shaped morphology was identified via SEM in the glasses fabricated with PuO_2. This phase was identified in a previous study of Pu-bearing LaBS glasses and may provide an opportunity to intentionally crystallize some of the PuO_2 into a highly insoluble form with an intrinsic neutron absorber.[9] Additional work is necessary to better characterize the influence that this phase has on durability of the glass.

The PCT results for the plutonium-containing LaBS glasses with impurities were similar to previous tests conducted on PuO_2-containing glasses without impurities added. The highest normalized release for boron was 0.02 g/L, which bounded the highest normalized release for plutonium of 0.01 g/L.

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5.0 Findings

- The LaBS glass system appears to be a viable solution for vitrification and immobilization of impure Pu feeds.
- The downstream impacts of the impurities that were identified in this study as being volatile should be further examined.
- Future updates to the impurity projections in the expected Pu feed streams will likely require additional experimental work.
- It may be beneficial for the future studies to consider equilibrium conditions and oxidation/reduction in determining solubility limits.
- It may be appropriate for additional durability studies to examine the effects of higher pH leaching solutions on the performance of the LaBS glass.
- Further characterization should be performed on the Pu/Hf crystalline phase identified in the glasses fabricated with PuO_2.

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6.0 Acknowledgements

The authors would like to thank several individuals at SRNL, including: Steve Beard, Phyllis Burkhalter, Vicki Dukes, Jack Durden, Eddie Estochen, Jim Gillam Jr., David Healy, Art Jurgenson, David Missimer, Irene Reamer, Whitney Thomas, Pat Toole, Rodney Walker, Dee Wheeler, Frances Williams, and Phyllis Workman, all of whom made significant contributions to this study.

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Appendix A

SRNL-SCS-2007-00014

An Analytical Plan for Measuring the Chemical Composition of Glasses Fabricated as Part of the Study of Impurity Solubility During Pu Vitrification

SRNL-SCS-2007-00014

May 4, 2007

To: K. M. Fox, 999-W

cc: R. A. Baker, 773-42A
D. R. Best, 786-1A
C. C. Herman, 999-W
E. N. Hoffman, 730-A
J. C. Marra, 773-42A
I. A. Reamer, 999-1W
P. A. Toole, 786-1A
R. C. Tuckfield, 773-42A
R. J. Workman, 999-1W

From: T. B. Edwards, 999-W (819-8464)
Statistical Consulting Section

R. A. Baker, Technical Reviewer — 5/8/2007 Date

R. C. Tuckfield, Manager
Statistical Consulting Section — 5/8/07 Date

An Analytical Plan for Measuring the Chemical Composition of Glasses Fabricated as Part of the Study of Impurity Solubility During Pu Vitrification (U)

1.0 EXECUTIVE SUMMARY

A glass study (WSRC-STI-2007-00076) is underway at the Savannah River National Laboratory (SRNL) to investigate glass formulations and to conduct performance testing to support plutonium (Pu) disposition. Sixty (60) glasses have been selected to be batched and fabricated as part of this study. The selection of these 60 compositions is to be addressed in a separate report. The chemical compositions of the study glasses are to be measured by SRNL's Process Science Analytical Laboratory (PSAL). The measurements for each glass are to be reviewed to assess their closeness to the intended target composition for the glass. This memorandum provides an analytical plan to direct and support the measurement of the chemical compositions of the samples at PSAL.

2.0 INTRODUCTION

A glass study is underway at the Savannah River National Laboratory (SRNL) to investigate glass formulations and to conduct performance testing to support plutonium (Pu) disposition [1]. Sixty (60) glasses have been selected to be batched and fabricated as part of this study. The selection of these 60 compositions is to be addressed in a separate report. The chemical compositions of these glasses are to be measured by SRNL's Process Science Analytical Laboratory (PSAL). The measurements for each glass are to be reviewed to assess their closeness to the intended target composition for the glass. This memorandum provides an analytical plan to direct and support the measurement of the chemical compositions of the samples at PSAL.

Due to the large number of glasses in this study, the glasses are to be grouped into six sets for chemical composition measurements with each group being handled separately. This memorandum provides an analytical plan structured in a manner that facilitates these measurements in sets by PSAL.

3.0 ANALYTICAL PLAN

Two preparation methods, lithium metaborate fusion (LM) and sodium peroxide fusion (PF), are to be used by PSAL to determine cation concentrations for each glass sample using Inductively Coupled Plasma – Atomic Emission Spectrometry (ICP-AES). The anion concentrations of interest for these glasses are to be measured using Ion Chromatography (IC). The preparation method for this analytical procedure will be designated as "ic" in this plan. Each glass is to be prepared in duplicate by the LM, PF, and "ic" methods.

Since this is an impurity solubility study, targeting and measuring small concentrations of several analytes (both cations and anions) in glass are of interest. Table A1 in the Appendix (in 2 parts) provides the target compositions for each of the study glasses. These compositions are being provided to PSAL to assist them in adjusting dilution factors and/or other aspects of their analytical approach to allow better sensitivity to the small concentrations being targeted for some of the analytes. As a consequence, there will be no use of "blind" sample identifiers in this study.

The measurements of interest for this study are to be acquired as follows. The samples prepared by LM are to be measured for aluminum (Al), calcium (Ca), chromium (Cr), copper (Cu), iron (Fe), gallium (Ga), gadolinium (Gd), hafnium (Hf), potassium (K), lanthanum (La), magnesium (Mg), sodium (Na), neodymium (Nd), nickel (Ni), lead (Pb), sulfur (S), selenium (Se), silicon (Si), strontium (Sr), and tantalum (Ta) concentrations. Samples prepared by PF are to be measured for boron (B) concentrations. Samples dissolved by both of these preparation methods are to be measured using ICP-AES. Samples prepared for IC are to be measured for the following anions: chlorine (Cl) and fluorine (F). It should also be noted that some of the glasses were batched with carbon (C) and/or cesium (Cs), so these components may be present in some of the study glasses as well.

Randomizing the preparation steps and randomizing the measurements by ICP-AES and by IC are of primary concern in the development of this analytical plan. The sources of uncertainty for the analytical procedure used by PSAL to determine the cation concentrations for the submitted glass samples are dominated by the dissolution step in the preparation of the sample and by instrument calibrations.

Samples of glass standards will be included in the analytical plan to provide an opportunity for checking the performance of the instrumentation over the course of the analyses and for potential bias correction for each set of results. Specifically, samples of Waste Compliance Plan (WCP) Batch 1 (BCH) [2] (see Table 1 for the reference composition of Batch 1) and samples of the Low-Activity Reference Material (LRM) standard glass (which contains some of the anions of interest – see [3] for details on the chemical composition of this glass) are to be included in the sets of samples submitted to PSAL.

Table 1: Oxide Compositions of WCP Batch 1 (BCH)

Oxide/ Anion	BCH (wt %)
Al_2O_3	4.877
B_2O_3	7.777
BaO	0.151
CaO	1.22
Cr_2O_3	0.107
Cs_2O	0.06
CuO	0.399
Fe_2O_3	12.839
K_2O	3.327
Li_2O	4.429
MgO	1.419
MnO	1.726
Na_2O	9.003
Nd_2O_3	0.147
NiO	0.751
RuO_2	0.0214
SiO_2	50.22
SO_4	~0
TiO_2	0.677
U_3O_8	~0
ZrO_2	0.098

Each glass sample submitted to PSAL will be prepared twice by the LM, the PF, and the "ic" dissolution methods. Every LM- and PF-prepared sample will be read only once by ICP-AES, and every sample prepared by the "ic" method will read only once by IC. This will lead to two measurements for each cation and anion of interest for each submitted glass.

Table 2 presents identifying codes, B01 through B60, for the 60 glass samples (by glass set) developed for this study. The table provides a short-hand naming convention (randomization as part of this naming convention was not used) that is to be employed in analyzing the glasses and reporting the measurements of their compositions.

Table 2: "Short-Hand" Sample Identifiers for Use at PSAL for All Six Sets of Analyses

SET 1		SET 2		SET 3		SET 4		SET 5		SET 6	
Glass ID	**Sample ID**	**Glass ID**	**Sample ID**	**Glass ID**	**Sample ID**	**Glass ID**	**Sample ID**	**Glass ID**	**Sample ID**	**Glass ID**	**Sample ID**
Pu04-01	B01	Pu35-06	B11	Pu35-16	B21	Pu35-26	B31	Pu35-36	B41	Pu35-46	B51
Pu04-02	B02	Pu35-07	B12	Pu35-17	B22	Pu35-27	B32	Pu35-37	B42	Pu35-47	B52
Pu04-03	B03	Pu35-08	B13	Pu35-18	B23	Pu35-28	B33	Pu35-38	B43	Pu35-48	B53
Pu04-04	B04	Pu35-09	B14	Pu35-19	B24	Pu35-29	B34	Pu35-39	B44	Pu35-49	B54
Pu04-05	B05	Pu35-10	B15	Pu35-20	B25	Pu35-30	B35	Pu35-40	B45	Pu35-50	B55
Pu35-01	B06	Pu35-11	B16	Pu35-21	B26	Pu35-31	B36	Pu35-41	B46	Pu35-51	B56
Pu35-02	B07	Pu35-12	B17	Pu35-22	B27	Pu35-32	B37	Pu35-42	B47	Pu35-52	B57
Pu35-03	B08	Pu35-13	B18	Pu35-23	B28	Pu35-33	B38	Pu35-43	B48	Pu35-53	B58
Pu35-04	B09	Pu35-14	B19	Pu35-24	B29	Pu35-34	B39	Pu35-44	B49	Pu35-54	B59
Pu35-05	B10	Pu35-15	B20	Pu35-25	B30	Pu35-35	B40	Pu35-45	B50	Pu35-55	B60

3.1 PREPARATION OF THE SAMPLES

Each glass in each of the six sets of glasses covered in this analytical plan is to be prepared twice by the LM, twice by the PF, and twice by the "ic" dissolution methods. Thus, the total number of prepared glass samples in each of the six sets is determined by $10 \times 3 \times 2 = 60$; this does not include the samples of the BCH and LRM glass standards that are to be prepared.

Table 3 provides blocking and (random) sequencing schema for conducting the preparation steps of the analytical procedures for each set of glasses. One block of preparation work is provided for each preparation method to facilitate the scheduling of activities by work shift for a set of glasses. The identifier for each of the prepared samples indicates the sample identifier (ID) and preparation method along with the number to indicate the preparation number for the sample.

Table 3a: Preparation Blocks by Method for Sets 1, 2, and 3

SET 1			SET 2			SET 3		
LM	**PF**	**"ic"**	**LM**	**PF**	**"ic"**	**LM**	**PF**	**"ic"**
B01LM1	B04PF1	B09ic1	B17LM1	B13PF1	B13ic1	B27LM1	B27PF1	B25ic1
B10LM1	B08PF1	B06ic1	B17LM2	B17PF1	B20ic1	B27LM2	B27PF2	B22ic1
B10LM2	B06PF1	B07ic1	B11LM1	B15PF1	B18ic1	B30LM1	B30PF1	B30ic1
B02LM1	B07PF1	B10ic1	B15LM1	B17PF2	B19ic1	B28LM1	B28PF1	B28ic1
B06LM1	B02PF1	B05ic1	B20LM1	B19PF1	B14ic1	B29LM1	B29PF1	B27ic1
B01LM2	B07PF2	B08ic1	B18LM1	B12PF1	B16ic1	B29LM2	B29PF2	B28ic2
B07LM1	B02PF2	B05ic2	B18LM2	B13PF2	B13ic2	B30LM2	B30PF2	B25ic2
B09LM1	B05PF1	B06ic2	B16LM1	B19PF2	B20ic2	B28LM2	B28PF2	B23ic1
B06LM2	B05PF2	B03ic1	B20LM2	B20PF1	B11ic1	B26LM1	B26PF1	B22ic2
B02LM2	B10PF1	B04ic1	B14LM1	B14PF1	B15ic1	B24LM1	B24PF1	B30ic2
B04LM1	B03PF1	B07ic2	B12LM1	B16PF1	B17ic1	B23LM1	B23PF1	B27ic2
B03LM1	B01PF1	B02ic1	B15LM2	B15PF2	B18ic2	B21LM1	B21PF1	B26ic1
B07LM2	B04PF2	B09ic2	B12LM2	B20PF2	B19ic2	B21LM2	B21PF2	B21ic1
B08LM1	B10PF2	B10ic2	B16LM2	B12PF2	B16ic2	B22LM1	B22PF1	B23ic2
B03LM2	B06PF2	B08ic2	B11LM2	B16PF2	B12ic1	B25LM1	B25PF1	B29ic1
B09LM2	B08PF2	B03ic2	B13LM1	B11PF1	B14ic2	B26LM2	B26PF2	B24ic1
B05LM1	B01PF2	B01ic1	B14LM2	B18PF1	B11ic2	B23LM2	B23PF2	B24ic2
B04LM2	B03PF2	B04ic2	B19LM1	B14PF2	B12ic2	B25LM2	B25PF2	B21ic2
B08LM2	B09PF1	B02ic2	B19LM2	B11PF2	B15ic2	B24LM2	B24PF2	B26ic2
B05LM2	B09PF2	B01ic2	B13LM2	B18PF2	B17ic2	B22LM2	B22PF2	B29ic2

Table 3b: Preparation Blocks by Method for Sets 4, 5, and 6

SET 4			SET 5			SET 6		
LM	**PF**	**"ic"**	**LM**	**PF**	**"ic"**	**LM**	**PF**	**"ic"**
B35LM1	B40PF1	B38ic1	B45LM1	B46PF1	B46ic1	B53LM1	B52PF1	B60ic1
B37LM1	B31PF1	B33ic1	B43LM1	B46PF2	B46ic2	B60LM1	B58PF1	B56ic1
B37LM2	B32PF1	B32ic1	B42LM1	B44PF1	B50ic1	B56LM1	B57PF1	B54ic1
B35LM2	B34PF1	B37ic1	B41LM1	B48PF1	B48ic1	B54LM1	B51PF1	B59ic1
B33LM1	B35PF1	B35ic1	B48LM1	B41PF1	B45ic1	B57LM1	B58PF2	B58ic1
B32LM1	B40PF2	B39ic1	B45LM2	B43PF1	B47ic1	B54LM2	B54PF1	B53ic1
B34LM1	B31PF2	B38ic2	B47LM1	B44PF2	B49ic1	B53LM2	B52PF2	B60ic2
B33LM2	B32PF2	B35ic2	B43LM2	B47PF1	B50ic2	B60LM2	B54PF2	B54ic2
B34LM2	B35PF2	B32ic2	B42LM2	B45PF1	B43ic1	B58LM1	B55PF1	B56ic2
B31LM1	B37PF1	B36ic1	B46LM1	B41PF2	B48ic2	B56LM2	B57PF2	B55ic1
B36LM1	B34PF2	B34ic1	B41LM2	B43PF2	B42ic1	B55LM1	B55PF2	B58ic2
B40LM1	B33PF1	B33ic2	B50LM1	B42PF1	B47ic2	B57LM2	B51PF2	B52ic1
B39LM1	B38PF1	B31ic1	B49LM1	B48PF2	B45ic2	B59LM1	B60PF1	B51ic1
B38LM1	B36PF1	B37ic2	B47LM2	B47PF2	B44ic1	B51LM1	B53PF1	B53ic2
B38LM2	B39PF1	B34ic2	B48LM2	B49PF1	B43ic2	B58LM2	B59PF1	B59ic2
B32LM2	B37PF2	B40ic1	B44LM1	B50PF1	B41ic1	B51LM2	B53PF2	B57ic1
B40LM2	B39PF2	B40ic2	B44LM2	B45PF2	B42ic2	B55LM2	B56PF1	B55ic2
B31LM2	B33PF2	B39ic2	B46LM2	B42PF2	B44ic2	B52LM1	B60PF2	B52ic2
B36LM2	B38PF2	B36ic2	B50LM2	B49PF2	B49ic2	B59LM2	B59PF2	B51ic2
B39LM2	B36PF2	B31ic2	B49LM2	B50PF2	B41ic2	B52LM2	B56PF2	B57ic2

3.2 ICP-AES Calibration Blocks

Cations of interest are to be measured in those glass samples prepared by the LM and PF dissolution methods using ICP-AES instrumentation calibrated for the particular preparation method. Similarly, the IC instrumentation is to be used to measure the glasses prepared by the "ic" method for anions of interest.

Randomized plans for measuring cation concentrations in the LM-prepared and PF-prepared samples and anions in the "ic"-prepared samples are provided in Table 4 for each of the sets of glasses. The identifiers for the BCH and LRM samples have been modified to indicate the set of glasses to which they correspond and that each of these prepared standards is to be read 3 times (mirrored in the corresponding suffix of 1, 2, or 3) per analytical set.

Table 4a: ICP-AES Blocks by Preparation Method & IC Block for Set 1

LM ICP-AES	PF ICP-AES	IC
BCHLM11	BCHPF11	BCHic11
LRMLM11	LRMPF11	LRMic11
B09LM1	B10PF1	B02ic2
B06LM1	B01PF1	B06ic1
B03LM1	B01PF2	B01ic2
B07LM2	B02PF2	B10ic1
B02LM1	B04PF2	B08ic2
B08LM2	B07PF1	B03ic1
B10LM1	B06PF1	B09ic2
B09LM2	B06PF2	B04ic2
B05LM2	B04PF1	B08ic1
B05LM1	B05PF1	B09ic1
BCHLM12	BCHPF12	BCHic12
LRMLM12	LRMPF12	LRMic12
B10LM2	B07PF2	B04ic1
B01LM1	B03PF1	B01ic1
B08LM1	B10PF2	B07ic2
B02LM2	B05PF2	B02ic1
B04LM1	B08PF2	B03ic2
B07LM1	B09PF1	B07ic1
B01LM2	B02PF1	B06ic2
B06LM2	B08PF1	B05ic2
B04LM2	B03PF2	B05ic1
B03LM2	B09PF2	B10ic2
LRMLM13	BCHPF13	BCHic13
BCHLM13	LRMPF13	LRMic13

Table 4b: ICP-AES Blocks by Preparation Method & IC Block for Set 2

LM ICP-AES	PF ICP-AES	IC
BCHLM21	BCHPF21	BCHic21
LRMLM21	LRMPF21	LRMic21
B18LM1	B17PF2	B13ic1
B19LM1	B16PF1	B17ic2
B20LM1	B17PF1	B16ic1
B20LM2	B13PF2	B18ic1
B12LM1	B15PF1	B14ic2
B16LM2	B20PF2	B19ic1
B15LM2	B15PF2	B15ic1
B14LM2	B19PF1	B16ic2
B13LM2	B16PF2	B11ic2
B17LM1	B14PF1	B12ic1
BCHLM22	BCHPF22	BCHic22
LRMLM22	LRMPF22	LRMic22
B18LM2	B14PF2	B12ic2
B19LM2	B12PF1	B18ic2
B15LM1	B13PF1	B20ic2
B13LM1	B18PF2	B20ic1
B17LM2	B11PF1	B13ic2
B16LM1	B11PF2	B15ic2
B11LM1	B12PF2	B17ic1
B11LM2	B18PF1	B19ic2
B12LM2	B20PF1	B14ic1
B14LM1	B19PF2	B11ic1
LRMLM23	BCHPF23	BCHic23
BCHLM23	LRMPF23	LRMic23

1.1.1.1.1.1.1.2

Table 4c: ICP-AES Blocks by Preparation Method & IC Block for Set 3

LM ICP-AES	PF ICP-AES	IC
BCHLM31	BCHPF31	BCHic31
LRMLM31	LRMPF31	LRMic31
B29LM1	B21PF1	B29ic2
B30LM2	B30PF1	B25ic2
B23LM1	B24PF1	B21ic2
B27LM2	B26PF2	B28ic2
B30LM1	B28PF1	B28ic1
B25LM1	B27PF1	B30ic1
B21LM2	B26PF1	B23ic2
B23LM2	B23PF2	B26ic2
B27LM1	B25PF2	B25ic1
B25LM2	B30PF2	B27ic2
BCHLM32	BCHPF32	BCHic32
LRMLM32	LRMPF32	LRMic32
B26LM1	B23PF1	B27ic1
B28LM1	B29PF1	B26ic1
B26LM2	B21PF2	B23ic1
B29LM2	B22PF1	B24ic1
B22LM1	B25PF1	B22ic2
B21LM1	B22PF2	B24ic2
B22LM2	B28PF2	B29ic1
B24LM1	B29PF2	B30ic2
B24LM2	B27PF2	B21ic1
B28LM2	B24PF2	B22ic1
LRMLM33	BCHPF33	BCHic33
BCHLM33	LRMPF33	LRMic33

Table 4d: ICP-AES Blocks by Preparation Method & IC Block for Set 4

LM ICP-AES	PF ICP-AES	IC
BCHLM41	BCHPF41	BCHic41
LRMLM41	LRMPF41	LRMic41
B32LM1	B34PF2	B33ic2
B38LM1	B31PF2	B33ic1
B33LM1	B33PF2	B37ic2
B35LM1	B38PF2	B31ic1
B31LM1	B34PF1	B32ic2
B39LM2	B37PF2	B40ic1
B37LM1	B35PF2	B39ic1
B39LM1	B37PF1	B35ic2
B33LM2	B39PF2	B34ic2
B40LM2	B39PF1	B37ic1
BCHLM42	BCHPF42	BCHic42
LRMLM42	LRMPF42	LRMic42
B36LM2	B40PF1	B35ic1
B31LM2	B36PF1	B39ic2
B38LM2	B35PF1	B38ic2
B40LM1	B36PF2	B40ic2
B37LM2	B32PF1	B31ic2
B36LM1	B38PF1	B32ic1
B34LM1	B32PF2	B36ic2
B32LM2	B31PF1	B36ic1
B35LM2	B40PF2	B34ic1
B34LM2	B33PF1	B38ic1
LRMLM43	BCHPF43	BCHic43
BCHLM43	LRMPF43	LRMic43

1.1.1.1.1.1.1.1.4

Table 4e: ICP-AES Blocks by Preparation Method & IC Block for Set 5

LM ICP-AES	PF ICP-AES	IC
BCHLM51	BCHPF51	BCHic51
LRMLM51	LRMPF51	LRMic51
B45LM2	B46PF2	B44ic1
B49LM2	B44PF1	B48ic1
B43LM2	B45PF1	B41ic1
B50LM2	B47PF1	B50ic2
B45LM1	B46PF1	B45ic2
B43LM1	B49PF2	B49ic1
B41LM2	B43PF2	B46ic2
B49LM1	B45PF2	B42ic1
B42LM2	B41PF1	B47ic1
B44LM2	B42PF1	B43ic2
BCHLM52	BCHPF52	BCHic52
LRMLM52	LRMPF52	LRMic52
B42LM1	B50PF2	B41ic2
B48LM2	B48PF2	B49ic2
B50LM1	B44PF2	B47ic2
B47LM1	B47PF2	B48ic2
B48LM1	B43PF1	B42ic2
B41LM1	B50PF1	B45ic1
B46LM2	B41PF2	B43ic1
B44LM1	B42PF2	B50ic1
B47LM2	B49PF1	B46ic1
B46LM1	B48PF1	B44ic2
LRMLM53	BCHPF53	BCHic53
BCHLM53	LRMPF53	LRMic53

Table 4f: ICP-AES Blocks by Preparation Method & IC Block for Set 6

LM ICP-AES	PF ICP-AES	IC
BCHLM61	BCHPF61	BCHic61
LRMLM61	LRMPF61	LRMic61
B58LM2	B59PF1	B53ic1
B56LM2	B53PF1	B60ic2
B53LM2	B60PF2	B51ic1
B52LM1	B58PF2	B52ic1
B59LM1	B54PF1	B60ic1
B58LM1	B55PF1	B56ic2
B57LM2	B59PF2	B56ic1
B54LM2	B52PF2	B59ic1
B55LM1	B54PF2	B54ic2
B59LM2	B53PF2	B57ic2
BCHLM62	BCHPF62	BCHic62
LRMLM62	LRMPF62	LRMic62
B51LM1	B60PF1	B58ic1
B51LM2	B55PF2	B52ic2
B54LM1	B51PF1	B57ic1
B57LM1	B56PF2	B53ic2
B60LM2	B56PF1	B55ic2
B56LM1	B51PF2	B51ic2
B55LM2	B58PF1	B58ic2
B53LM1	B52PF1	B54ic1
B60LM1	B57PF1	B59ic2
B52LM2	B57PF2	B55ic1
LRMLM63	BCHPF63	BCHic63
BCHLM63	LRMPF63	LRMic63

1.1.1.1.1.1.1.6

4.0 CONCLUDING COMMENTS

In summary, this analytical plan identifies for each of the six sets of glasses: three preparation blocks in Table 3 and two ICP-AES blocks and one IC block in Table 4 for use by PSAL. The sequencing of the activities associated with each of the steps in the analytical procedures has been randomized. The size of each of the blocks was selected so that it could be completed in a single work shift.

If a problem is discovered while measuring samples in a calibration block, the instrument should be re-calibrated and the block of samples re-measured in its entirety. If for some reason the measurements are not conducted in the sequences presented in this report, a record should be made of the actual order used along with any explanative comments.

The analytical plan indicated in the preceding tables should be modified by the personnel of PSAL to include any calibration check standards and/or other standards that are part of their routine operating procedures. It is also recommended that the solutions resulting from each of the prepared samples be archived for some period, considering the "shelf-life" of the solutions, in case questions arise during data analysis. This would allow for the solutions to be rerun without additional preparations, thus minimizing cost.

5.0 REFERENCES

[1] Marra, J.C., K.M. Fox, and E.N. Hoffman, "Task Technical & QA Plan: Glass Formulation and Performance Testing to Support Pu Disposition," WSRC-STI-2007-00076, February 2007.

[2] Jantzen, C.M., J.B. Pickett, K.G. Brown, T.B. Edwards, and D.C. Beam, "Process/ Product Models for the Defense Waste Processing Facility (DWPF): Part I. Predicting Glass Durability from Composition Using a Thermodynamic Hydration Energy Reaction Model (THERMO^{TM}) (U)," WSRC-TR-93-673, Revision 1, Volume 2, Table B.1, pp. B.9, 1995.

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

Appendix

Table A1. Selected Compositions for Study Glasses (part 1)

Glass ID	Cl	Ta2O5	MgO	K2O	Fe2O3	Na2O	F	CaO	Ga2O3	NiO	Cr2O3	CuO	SO4	C	PbO	SeO2	Cs2O
Pu04-01	0.30	0.00	0.00	0.54	0.00	0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pu04-02	0.00	0.00	0.20	0.18	0.00	0.80	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pu04-03	0.15	0.00	0.39	0.00	0.42	0.40	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pu04-04	0.00	0.00	0.20	0.18	0.21	0.20	0.00	0.21	0.00	0.19	0.22	0.18	0.00	0.00	0.00	0.00	0.00
Pu04-05	0.30	0.00	0.00	0.00	0.00	0.80	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pu35-01	1.44	0.18	4.05	0.66	0.98	1.99	0.00	0.00	2.36	0.52	0.00	0.37	0.00	0.14	0.00	0.20	0.00
Pu35-02	1.45	0.18	3.62	1.85	0.21	0.89	1.12	0.91	0.20	0.38	0.83	0.18	0.43	0.00	0.16	0.20	0.15
Pu35-03	1.43	0.46	1.35	0.76	0.34	3.71	0.00	1.93	1.12	0.18	1.59	0.00	0.00	0.00	0.00	0.00	0.15
Pu35-04	1.46	1.14	2.64	1.12	0.67	1.39	1.29	0.80	0.90	0.19	0.21	0.18	0.00	0.15	0.19	0.21	0.00
Pu35-05	1.44	0.23	1.31	1.95	3.29	0.87	0.00	0.31	0.73	0.00	1.60	0.72	0.00	0.14	0.19	0.00	0.15
Pu35-06	1.50	0.25	2.28	0.68	2.43	2.00	1.21	0.72	0.00	0.69	0.56	0.00	0.43	0.14	0.00	0.00	0.00
Pu35-07	1.55	3.24	1.35	1.06	0.22	1.53	0.47	0.49	0.20	0.94	0.33	0.39	0.44	0.15	0.16	0.00	0.15
Pu35-08	1.56	0.96	2.20	1.92	2.23	1.01	0.75	0.61	0.41	0.63	0.21	0.18	0.00	0.00	0.00	0.00	0.00
Pu35-09	1.60	0.26	1.33	3.85	0.00	2.83	0.00	0.26	0.34	0.47	0.21	0.62	0.44	0.15	0.19	0.20	0.00
Pu35-10	1.62	0.67	2.02	0.91	1.46	1.67	0.95	0.20	1.77	0.18	0.21	0.18	0.43	0.00	0.16	0.20	0.15
Pu35-11	1.71	1.74	2.49	0.95	0.21	1.72	0.14	1.01	0.53	0.42	1.00	0.00	0.43	0.14	0.19	0.20	0.00
Pu35-12	1.61	1.49	1.66	0.71	0.48	1.97	0.82	0.20	0.89	1.18	0.99	0.45	0.00	0.00	0.00	0.20	0.00
Pu35-13	1.94	2.11	1.89	1.09	0.94	2.72	0.15	0.00	0.20	0.00	0.92	0.37	0.00	0.00	0.19	0.00	0.15
Pu35-14	2.00	0.86	1.10	0.49	2.49	2.67	0.20	0.95	0.67	0.18	0.33	0.18	0.00	0.14	0.16	0.20	0.15
Pu35-15	2.51	0.00	1.35	1.46	0.00	2.21	0.00	0.00	3.19	1.49	0.00	0.00	0.00	0.00	0.19	0.00	0.16
Pu35-16	2.37	0.73	1.83	0.00	1.16	3.06	0.00	1.75	0.38	0.33	0.00	0.72	0.43	0.00	0.16	0.00	0.00
Pu35-17	2.76	1.38	1.00	1.08	0.00	2.59	0.15	0.20	1.71	0.19	0.79	0.24	0.44	0.15	0.00	0.00	0.00
Pu35-18	1.45	0.18	2.60	2.74	0.21	2.34	0.14	1.42	0.19	0.18	1.20	0.18	0.00	0.00	0.00	0.00	0.00
Pu35-19	1.45	0.18	3.46	0.93	1.95	1.94	0.95	0.20	0.19	0.18	1.21	0.18	0.00	0.00	0.00	0.00	0.00
Pu35-20	1.46	1.29	1.37	2.11	0.71	1.24	0.72	0.57	1.27	0.73	1.00	0.18	0.00	0.00	0.00	0.00	0.00
Pu35-21	1.45	2.84	3.20	1.03	0.21	1.48	0.15	0.20	1.56	0.19	0.21	0.18	0.00	0.00	0.00	0.00	0.00
Pu35-22	1.49	1.30	1.71	1.38	0.93	1.85	1.17	1.47	0.20	0.20	0.36	0.55	0.00	0.00	0.00	0.00	0.00
Pu35-23	1.47	2.06	1.67	0.39	1.41	2.34	0.22	0.39	1.33	0.29	0.73	0.54	0.00	0.00	0.00	0.00	0.00
Pu35-24	1.58	0.39	1.67	1.31	1.01	1.45	0.61	1.00	2.06	0.24	0.92	0.54	0.00	0.00	0.00	0.00	0.00
Pu35-25	1.66	1.48	1.21	1.75	2.07	1.19	0.18	0.70	0.65	0.86	0.43	0.54	0.00	0.00	0.00	0.00	0.00
Pu35-26	1.66	0.55	2.24	0.63	1.18	1.93	0.25	1.07	1.97	0.56	0.66	0.18	0.00	0.00	0.00	0.00	0.00
Pu35-27	1.79	1.67	1.52	1.31	1.15	1.62	0.59	0.81	0.68	0.19	1.21	0.18	0.00	0.00	0.00	0.00	0.00
Pu35-28	1.80	1.35	2.33	0.98	0.21	1.84	0.25	0.28	1.02	0.90	1.21	0.55	0.00	0.00	0.00	0.00	0.00
Pu35-29	2.10	0.85	1.17	2.10	0.45	2.38	0.89	0.21	1.75	0.19	0.21	0.18	0.00	0.00	0.00	0.00	0.00
Pu35-30	1.44	0.18	1.15	2.78	0.21	2.26	0.14	1.14	1.89	0.18	0.21	0.18	0.43	0.14	0.16	0.20	0.15
Pu35-31	1.46	0.18	1.49	2.81	2.08	1.18	1.17	0.20	0.20	0.43	0.21	0.18	0.44	0.15	0.16	0.20	0.15

Appendix *(continued)*

Table A1. Selected Compositions for Study Glasses (part 1)
(continued)

Glass ID	Cl	Ta2O5	MgO	K2O	Fe2O3	Na2O	F	CaO	Ga2O3	NiO	Cr2O3	CuO	SO4	C	PbO	SeO2	Cs2O
Pu35-32	1.45	0.18	3.47	0.65	0.21	1.73	0.99	0.20	2.26	0.18	0.21	0.18	0.43	0.14	0.16	0.20	0.15
Pu35-33	1.43	0.17	3.42	0.19	1.39	2.25	0.32	1.10	0.19	0.18	1.19	0.18	0.43	0.14	0.15	0.20	0.15
Pu35-34	1.45	1.78	3.46	1.44	0.21	1.20	0.14	0.91	0.19	0.18	0.21	0.54	0.43	0.14	0.16	0.20	0.15
Pu35-35	1.44	2.81	1.15	0.17	2.06	2.33	0.14	0.20	0.97	0.18	0.21	0.18	0.43	0.14	0.16	0.20	0.15
Pu35-36	1.50	1.28	2.23	1.08	0.27	1.68	0.41	0.20	0.77	0.81	0.93	0.54	0.43	0.14	0.16	0.20	0.15
Pu35-37	1.50	0.87	2.54	0.91	0.69	1.64	0.25	0.43	0.90	0.93	0.99	0.18	0.43	0.14	0.16	0.20	0.15
Pu35-38	1.65	1.31	1.82	1.12	0.43	1.65	0.77	1.07	0.75	0.45	0.44	0.18	0.44	0.15	0.16	0.20	0.15
Pu35-39	1.72	1.26	1.74	1.92	0.72	1.75	0.44	0.20	0.77	0.18	0.76	0.18	0.43	0.15	0.16	0.20	0.15
Pu35-40	1.80	0.18	1.61	1.25	1.40	1.63	0.36	1.02	0.97	0.26	0.80	0.54	0.43	0.14	0.16	0.20	0.15
Pu35-41	2.32	0.18	3.48	0.86	0.21	2.35	0.15	0.20	0.20	1.11	0.21	0.38	0.44	0.15	0.16	0.20	0.15
Pu35-42	1.44	0.53	2.69	2.09	0.41	1.95	0.29	0.40	0.39	0.37	0.84	0.36	0.43	0.14	0.16	0.20	0.15
Pu35-43	1.44	1.22	1.62	0.53	1.43	1.86	0.50	0.88	0.87	0.50	0.62	0.36	0.43	0.14	0.16	0.20	0.15
Pu35-44	1.44	1.36	1.99	0.77	1.45	1.64	0.47	0.69	0.75	0.37	0.62	0.27	0.43	0.14	0.16	0.20	0.15
Pu35-45	1.44	1.75	1.87	0.51	1.14	1.83	0.29	0.57	1.19	0.54	0.42	0.27	0.43	0.14	0.16	0.20	0.15
Pu35-46	1.46	1.13	1.83	1.03	0.43	1.57	0.87	0.43	1.36	0.74	0.42	0.36	0.44	0.15	0.16	0.20	0.15
Pu35-47	1.54	2.12	1.54	0.62	0.41	1.82	0.29	1.01	0.48	0.74	0.84	0.36	0.43	0.14	0.16	0.20	0.15
Pu35-48	1.57	0.86	1.99	0.71	1.24	1.82	0.51	0.92	0.85	0.49	0.57	0.27	0.43	0.14	0.16	0.20	0.15
Pu35-49	1.61	0.67	1.92	1.58	1.30	1.60	0.47	0.79	0.47	0.50	0.47	0.36	0.43	0.14	0.16	0.20	0.15
Pu35-50	1.61	0.45	1.66	1.72	1.22	1.64	0.49	0.66	0.81	0.59	0.63	0.27	0.43	0.14	0.16	0.20	0.15
Pu35-51	1.62	0.81	2.26	0.66	1.41	1.87	0.56	0.40	0.39	0.73	0.80	0.27	0.43	0.14	0.16	0.20	0.15
Pu35-52	1.73	0.35	2.04	0.93	0.98	1.78	0.35	0.43	1.45	0.58	0.81	0.36	0.43	0.14	0.16	0.20	0.15
Pu35-53	1.75	1.93	1.55	1.17	0.42	1.97	0.88	0.41	0.39	0.37	0.43	0.27	0.44	0.15	0.16	0.21	0.15
Pu35-54	1.61	1.16	2.03	1.43	1.06	1.74	0.53	0.69	1.02	0.41	0.74	0.32	0.00	0.00	0.00	0.00	0.00
Pu35-55	1.58	0.98	2.10	1.15	0.91	1.79	0.47	0.60	0.81	0.48	0.58	0.30	0.43	0.14	0.16	0.20	0.15

Appendix *(continued)*

Table A1. Selected Compositions for Study Glasses (part 2)

Glass ID	HfO2	Al2O3	B2O3	Gd2O3	La2O3	Nd2O3	SiO2	SrO
Pu04-01	38.12	6.50	8.45	8.78	12.35	9.75	13.00	1.63
Pu04-02	38.08	6.50	8.45	8.78	12.35	9.75	13.00	1.63
Pu04-03	38.04	6.50	8.45	8.78	12.35	9.75	13.00	1.63
Pu04-04	37.97	6.50	8.45	8.78	12.35	9.75	13.00	1.63
Pu04-05	38.16	6.50	8.45	8.78	12.35	9.75	13.00	1.63
Pu35-01	26.65	6.50	8.45	8.78	12.35	9.75	13.00	1.63
Pu35-02	26.80	6.50	8.45	8.78	12.35	9.75	13.00	1.63
Pu35-03	26.52	6.50	8.45	8.78	12.35	9.75	13.00	1.63
Pu35-04	27.01	6.50	8.45	8.78	12.35	9.75	13.00	1.63
Pu35-05	26.62	6.50	8.45	8.78	12.35	9.75	13.00	1.63
Pu35-06	26.66	6.50	8.45	8.78	12.35	9.75	13.00	1.63
Pu35-07	26.90	6.50	8.45	8.78	12.35	9.75	13.00	1.63
Pu35-08	26.87	6.50	8.45	8.78	12.35	9.75	13.00	1.63
Pu35-09	26.81	6.50	8.45	8.78	12.35	9.75	13.00	1.63
Pu35-10	26.75	6.50	8.45	8.78	12.35	9.75	13.00	1.63
Pu35-11	26.66	6.50	8.45	8.78	12.35	9.75	13.00	1.63
Pu35-12	26.89	6.50	8.45	8.78	12.35	9.75	13.00	1.63
Pu35-13	26.89	6.50	8.45	8.78	12.35	9.75	13.00	1.63
Pu35-14	26.76	6.50	8.45	8.78	12.35	9.75	13.00	1.63
Pu35-15	26.99	6.50	8.45	8.78	12.35	9.75	13.00	1.63
Pu35-16	26.63	6.50	8.45	8.78	12.35	9.75	13.00	1.63
Pu35-17	26.88	6.50	8.45	8.78	12.35	9.75	13.00	1.63
Pu35-18	26.71	6.50	8.45	8.78	12.35	9.75	13.00	1.63
Pu35-19	26.73	6.50	8.45	8.78	12.35	9.75	13.00	1.63
Pu35-20	26.89	6.50	8.45	8.78	12.35	9.75	13.00	1.63
Pu35-21	26.84	6.50	8.45	8.78	12.35	9.75	13.00	1.63
Pu35-22	26.94	6.50	8.45	8.78	12.35	9.75	13.00	1.63
Pu35-23	26.70	6.50	8.45	8.78	12.35	9.75	13.00	1.63
Pu35-24	26.76	6.50	8.45	8.78	12.35	9.75	13.00	1.63
Pu35-25	26.80	6.50	8.45	8.78	12.35	9.75	13.00	1.63
Pu35-26	26.66	6.50	8.45	8.78	12.35	9.75	13.00	1.63
Pu35-27	26.84	6.50	8.45	8.78	12.35	9.75	13.00	1.63
Pu35-28	26.83	6.50	8.45	8.78	12.35	9.75	13.00	1.63
Pu35-29	27.07	6.50	8.45	8.78	12.35	9.75	13.00	1.63
Pu35-30	26.69	6.50	8.45	8.78	12.35	9.75	13.00	1.63
Pu35-31	26.88	6.50	8.45	8.78	12.35	9.75	13.00	1.63
Pu35-32	26.76	6.50	8.45	8.78	12.35	9.75	13.00	1.63
Pu35-33	26.46	6.50	8.45	8.78	12.35	9.75	13.00	1.63
Pu35-34	26.73	6.50	8.45	8.78	12.35	9.75	13.00	1.63
Pu35-35	26.62	6.50	8.45	8.78	12.35	9.75	13.00	1.63
Pu35-36	26.73	6.50	8.45	8.78	12.35	9.75	13.00	1.63
Pu35-37	26.63	6.50	8.45	8.78	12.35	9.75	13.00	1.63
Pu35-38	26.82	6.50	8.45	8.78	12.35	9.75	13.00	1.63
Pu35-39	26.80	6.50	8.45	8.78	12.35	9.75	13.00	1.63
Pu35-40	26.65	6.50	8.45	8.78	12.35	9.75	13.00	1.63
Pu35-41	26.82	6.50	8.45	8.78	12.35	9.75	13.00	1.63
Pu35-42	26.70	6.50	8.45	8.78	12.35	9.75	13.00	1.63
Pu35-43	26.63	6.50	8.45	8.78	12.35	9.75	13.00	1.63
Pu35-44	26.65	6.50	8.45	8.78	12.35	9.75	13.00	1.63
Pu35-45	26.64	6.50	8.45	8.78	12.35	9.75	13.00	1.63
Pu35-46	26.81	6.50	8.45	8.78	12.35	9.75	13.00	1.63
Pu35-47	26.70	6.50	8.45	8.78	12.35	9.75	13.00	1.63
Pu35-48	26.66	6.50	8.45	8.78	12.35	9.75	13.00	1.63
Pu35-49	26.72	6.50	8.45	8.78	12.35	9.75	13.00	1.63
Pu35-50	26.71	6.50	8.45	8.78	12.35	9.75	13.00	1.63

Appendix *(continued)*

Table A1. Selected Compositions for Study Glasses (part 2)
(continued)

Glass ID	HfO2	Al2O3	B2O3	Gd2O3	La2O3	Nd2O3	SiO2	SrO
Pu35-51	26.68	6.50	8.45	8.78	12.35	9.75	13.00	1.63
Pu35-52	26.66	6.50	8.45	8.78	12.35	9.75	13.00	1.63
Pu35-53	26.92	6.50	8.45	8.78	12.35	9.75	13.00	1.63
Pu35-54	26.82	6.50	8.45	8.78	12.35	9.75	13.00	1.63
Pu35-55	26.71	6.50	8.45	8.78	12.35	9.75	13.00	1.63

Appendix B

SRNL-SCS-2007-00019

Analytical Plans for Measuring the PCT Solutions for the Quenched Glasses Fabricated as Part of the Study of Impurity Solubility during Pu Vitrification

SRNL-SCS-2007-00019

May 15, 2007

To: K. M. Fox, SRNL

cc: R. A. Baker, 773-42A
D. R. Best, 786-1A (wo)
E.N. Hoffman, 730-A
J. C. Marra, 773-42A
I. A. Reamer, 999-1W
P. A. Toole, 786-1A (wo)
R. C. Tuckfield, 773-42A
R. J. Workman, 999-1W

From: T. B. Edwards, 999-W (819-8464)
Statistical Consulting Section

wo – without glass identifiers

R. A. Baker, Technical Reviewer — 5/18/2007 Date

R. C. Tuckfield, Manager
Statistical Consulting Section — 5/18/07 Date

Analytical Plans for Measuring the PCT Solutions for the Quenched Glasses Fabricated as Part of the Study of Impurity Solubility during Pu Vitrification (U)

1.0 EXECUTIVE SUMMARY

A glass study (WSRC-STI-2007-00076) is underway at the Savannah River National Laboratory (SRNL) to investigate glass formulations and to conduct performance testing to support plutonium (Pu) disposition. Sixty (60) glasses have been selected to be batched and fabricated as part of this study. The selection of these 60 compositions is to be addressed in a separate report. The durabilities of the glasses are to be measured using the Product Consistency Test (PCT) as defined in ASTM C-1285-2002. Two heat treatments are to be utilized during the fabrication of each of these glasses. Specifically, each of the glasses is to be quenched (i.e., rapidly cooled) and cooled in accordance with the centerline-canister-cooling (ccc) regime. Both heat treatments of each glass are to be subjected to the PCT. The PCT solutions are to be analyzed by SRNL's Process Science Analytical Laboratory (PSAL).

Due to the large number of glasses in this study (60 quenched and 60 ccc glasses in total), the PCTs are to be conducted in 6 sets. Twenty glasses are to be included in each set starting with the quenched and then working through the ccc glasses. This memorandum provides analytical plans for the PCTs for the 3 sets of quenched glasses, which are labeled as Pu04-01 through Pu04-05 and Pu35-01 through Pu35-55, that are to be measured by PSAL.

2.0 INTRODUCTION

A glass study is underway at the Savannah River National Laboratory (SRNL) to investigate glass formulations and to conduct performance testing to support plutonium (Pu) disposition [1]. Sixty (60) glasses have been selected to be batched and fabricated as part of this study. The selection of these 60 compositions is to be addressed in a separate report. The durabilities of the glasses are to be measured using the Product Consistency Test (PCT) as defined in ASTM C-1285-2002 [2]. Two heat treatments are to be utilized during the fabrication of each of these glasses. Specifically, each of the glasses is to be quenched (i.e., rapidly cooled) and cooled in accordance with the centerline-canister-cooling (ccc) regime. Both heat treatments of each glass are to be subjected to the PCT. The PCT solutions are to be analyzed by SRNL's Process Science Analytical Laboratory (PSAL).

Due to the large number of glasses in this study (60 quenched and 60 ccc glasses in total), the PCTs are to be conducted in 6 sets. Twenty glasses are to be included in each set starting with the quenched and then working through the ccc glasses. This memorandum provides analytical plans for the PCTs for the 3 sets of quenched glasses. The glass identifiers for each of the 3 sets of PCTs are provided in Table 1.

Table 1: Three Sets of Quenched Glass Identifiers Covered in These Plans

Set 1	Set 2	Set 3
Pu04-01	Pu35-16	Pu35-36
Pu04-02	Pu35-17	Pu35-37
Pu04-03	Pu35-18	Pu35-38
Pu04-04	Pu35-19	Pu35-39
Pu04-05	Pu35-20	Pu35-40
Pu35-01	Pu35-21	Pu35-41
Pu35-02	Pu35-22	Pu35-42
Pu35-03	Pu35-23	Pu35-43
Pu35-04	Pu35-24	Pu35-44
Pu35-05	Pu35-25	Pu35-45
Pu35-06	Pu35-26	Pu35-46
Pu35-07	Pu35-27	Pu35-47
Pu35-08	Pu35-28	Pu35-48
Pu35-09	Pu35-29	Pu35-49
Pu35-10	Pu35-30	Pu35-50
Pu35-11	Pu35-31	Pu35-51
Pu35-12	Pu35-32	Pu35-52
Pu35-13	Pu35-33	Pu35-53
Pu35-14	Pu35-34	Pu35-54
Pu35-15	Pu35-35	Pu35-55

3.0 DISCUSSION

Each of the 20 study glasses in each set of Table 1 is to be subjected to the PCT in triplicate. In addition to PCTs for the study glasses of the set, triplicate PCTs are to be conducted on a sample of the Approved Reference Material – One (ARM-1) glass and a sample of the Environmental Assessment (EA) glass. Two reagent blank samples are also to be included in these tests. This results in 68 sample solutions being required to complete the PCTs for each of the 3 sets of quenched glasses.

For all 3 sets, the leachates from the PCTs will be diluted by adding 4 mL of 0.4 M HNO_3 to 6 mL of the leachate (a 6:10 volume to volume, v:v, dilution) before being submitted to PSAL. The leachates of EA will be further diluted (1:10 v:v) with deionized water prior to submission to PSAL in order to prevent problems with the nebulizer. Note that additional dilutions for the ccc versions of one or more of the study glasses may be needed due to a possible low durability of some of the glasses. Upon termination of the PCT, a decision is to be made (by the technicians and a PSAL representative, if called by the technician) as to whether additional dilutions are needed for these solutions to mitigate any potential gelling issues. Any extra dilutions are to be reported, and guidance is to be given as to how the dilutions are to be handled in the statistical assessment of the measurement data. More specifically, PSAL will be responsible for indicating if any additional dilutions were made and how they were, or how they should be, accounted for in the reported measurements.

Table 2 presents identifying codes for the individual solutions required for the PCTs of the study glasses and of the standards (EA, ARM-1, and blanks) for each of the 3 sets of quenched PCTs: C01 through C68 for Set #1, D01 through D68 for Set #2, and E01 through E68 for Set #3. This provides a naming convention for each set of PCTs that is to be used by PSAL in analyzing the solutions and reporting the relevant concentration measurements.[a]

[a] Renaming these samples ensures that they will be processed as blind samples by PSAL. This table does not contain the solution identifiers for those on the distribution list with a "wo" following their names.

Table 2: Identifiers for the PCT Solutions for Each Set

Set #1				Set #2				Set #3			
Original Sample	Solution Identifier	Original Sample	Solution Identifier	Original Sample	Solution Identifier	Original Sample	Solution Identifier	Original Sample	Solution Identifier	Original Sample	Solution Identifier
Pu04-01	C04	Pu35-08	C08	Pu35-16	D51	Pu35-28	D19	Pu35-36	E42	Pu35-48	E64
Pu04-01	C41	Pu35-08	C17	Pu35-16	D05	Pu35-28	D26	Pu35-36	E12	Pu35-48	E60
Pu04-01	C44	Pu35-08	C01	Pu35-16	D46	Pu35-28	D41	Pu35-36	E23	Pu35-48	E58
Pu04-02	C27	Pu35-09	C50	Pu35-17	D37	Pu35-29	D44	Pu35-37	E16	Pu35-49	E43
Pu04-02	C48	Pu35-09	C18	Pu35-17	D68	Pu35-29	D61	Pu35-37	E25	Pu35-49	E04
Pu04-02	C15	Pu35-09	C40	Pu35-17	D47	Pu35-29	D43	Pu35-37	E39	Pu35-49	E17
Pu04-03	C26	Pu35-10	C33	Pu35-18	D67	Pu35-30	D27	Pu35-38	E06	Pu35-50	E27
Pu04-03	C61	Pu35-10	C23	Pu35-18	D24	Pu35-30	D53	Pu35-38	E02	Pu35-50	E52
Pu04-03	C65	Pu35-10	C06	Pu35-18	D38	Pu35-30	D10	Pu35-38	E13	Pu35-50	E05
Pu04-04	C59	Pu35-11	C47	Pu35-19	D54	Pu35-31	D32	Pu35-39	E33	Pu35-51	E08
Pu04-04	C53	Pu35-11	C51	Pu35-19	D40	Pu35-31	D29	Pu35-39	E36	Pu35-51	E10
Pu04-04	C55	Pu35-11	C66	Pu35-19	D20	Pu35-31	D17	Pu35-39	E07	Pu35-51	E67
Pu04-05	C10	Pu35-12	C34	Pu35-20	D36	Pu35-32	D13	Pu35-40	E55	Pu35-52	E32
Pu04-05	C03	Pu35-12	C20	Pu35-20	D07	Pu35-32	D31	Pu35-40	E41	Pu35-52	E14
Pu04-05	C49	Pu35-12	C42	Pu35-20	D22	Pu35-32	D25	Pu35-40	E44	Pu35-52	E61
Pu35-01	C67	Pu35-13	C09	Pu35-21	D64	Pu35-33	D02	Pu35-41	E31	Pu35-53	E37
Pu35-01	C39	Pu35-13	C68	Pu35-21	D30	Pu35-33	D60	Pu35-41	E34	Pu35-53	E09
Pu35-01	C62	Pu35-13	C12	Pu35-21	D23	Pu35-33	D59	Pu35-41	E18	Pu35-53	E49
Pu35-02	C11	Pu35-14	C64	Pu35-22	D15	Pu35-34	D56	Pu35-42	E68	Pu35-54	E63
Pu35-02	C57	Pu35-14	C29	Pu35-22	D33	Pu35-34	D39	Pu35-42	E47	Pu35-54	E45
Pu35-02	C19	Pu35-14	C46	Pu35-22	D45	Pu35-34	D04	Pu35-42	E20	Pu35-54	E57
Pu35-03	C14	Pu35-15	C07	Pu35-23	D57	Pu35-35	D65	Pu35-43	E51	Pu35-55	E59
Pu35-03	C58	Pu35-15	C02	Pu35-23	D42	Pu35-35	D52	Pu35-43	E11	Pu35-55	E15
Pu35-03	C30	Pu35-15	C37	Pu35-23	D14	Pu35-35	D49	Pu35-43	E03	Pu35-55	E48
Pu35-04	C38	EA	C05	Pu35-24	D12	EA	D66	Pu35-44	E38	EA	E62
Pu35-04	C52	EA	C36	Pu35-24	D06	EA	D08	Pu35-44	E56	EA	E29
Pu35-04	C24	EA	C54	Pu35-24	D50	EA	D09	Pu35-44	E53	EA	E30
Pu35-05	C13	ARM-1	C28	Pu35-25	D16	ARM-1	D34	Pu35-45	E22	ARM-1	E46
Pu35-05	C32	ARM-1	C43	Pu35-25	D35	ARM-1	D63	Pu35-45	E40	ARM-1	E26
Pu35-05	C60	ARM-1	C16	Pu35-25	D01	ARM-1	D58	Pu35-45	E19	ARM-1	E01
Pu35-06	C31	blank	C21	Pu35-26	D48	blank	D21	Pu35-46	E50	blank	E54
Pu35-06	C56	blank	C63	Pu35-26	D18	blank	D28	Pu35-46	E24	blank	E21
Pu35-06	C45			Pu35-26	D55			Pu35-46	E28		
Pu35-07	C25			Pu35-27	D62			Pu35-47	E35		
Pu35-07	C22			Pu35-27	D11			Pu35-47	E66		
Pu35-07	C35			Pu35-27	D03			Pu35-47	E65		

4.0 ANALYTICAL PLANS

The analytical plans for PSAL are provided in this section. Each of the solution samples in each of the sets submitted to PSAL is to be analyzed only once for each of the following: boron (B), gadolinium (Gd), hafnium (Hf), sodium (Na), and silicon (Si). The measurements are to be made in parts per million (ppm). The analytical procedure used by PSAL to determine the concentrations utilizes an Inductively Coupled Plasma – Atomic Emission Spectrometer (ICP-AES). The PCT solutions for each set (as identified in Table 2) are grouped in three ICP-AES blocks for processing by PSAL in Table 3. Each block requires a different calibration of the ICP-AES.

Table 3: ICP-AES Calibration Blocks for the Leachate Measurements for Each Set

Set #1			Set #2			Set #3		
Block 1	Block 2	Block 3	Block 1	Block 2	Block 3	Block 1	Block 2	Block 3
std-11-1	std-12-1	std-13-1	std-21-1	std-22-1	std-23-1	std-31-1	std-32-1	std-33-1
C62	C40	C44	D47	D43	D09	E61	E31	E14
C45	C12	C28	D30	D20	D24	E23	E37	E38
C49	C35	C30	D38	D62	D01	E21	E33	E44
C08	C02	C63	D21	D05	D28	E04	E01	E10
C55	C53	C68	D26	D60	D34	E30	E40	E62
C32	C56	C07	D56	D64	D59	E41	E51	E05
C21	C57	C67	D65	D48	D51	E67	E47	E59
C37	C47	C52	D12	D08	D37	E46	E48	E26
C42	C39	C19	D10	D58	D39	E49	E29	E58
C51	C34	C20	D03	D35	D41	E07	E45	E25
C50	C03	C18	D55	D22	D25	E64	E60	E54
std-11-2	std-12-2	std-13-2	std-21-2	std-22-2	std-23-2	std-31-2	std-32-2	std-33-2
C24	C17	C25	D29	D27	D32	E52	E08	E02
C23	C14	C54	D13	D31	D18	E34	E27	E18
C15	C43	C31	D14	D15	D40	E20	E24	E57
C58	C33	C66	D63	D06	D45	E03	E32	E09
C11	C46	C13	D46	D67	D23	E63	E43	E68
C36	C41	C64	D16	D04	D57	E56	E55	E42
C16	C60	C61	D02	D52	D49	E35	E16	E36
C09	C27	C48	D66	D19	D07	E22	E53	E28
C29	C05	C01	D33	D42	D11	E39	E65	E17
C04	C65	C59	D54	D17	D53	E15	E06	E66
C22	C38	C06	D36	D68	D50	E13	E12	E11
C26	std-12-3	C10	D61	std-22-3	D44	E50	std-32-3	E19
std-11-3		std-13-3	std-21-3		std-23-3	std-31-3		std-33-3

A multi-element solution standard (denoted by "std-ij-k" where i=1, 2, and 3 represents the set number, j=1, 2, and 3 represents the block number for the set, and k=1, 2, and 3 represents the position in the block) was added at the beginning, middle, and end of each of the three blocks for each of the three sets. This standard may be useful in checking and correcting for bias in the concentration measurements arising from the ICP calibrations.

5.0 SUMMARY

In summary, these analytical plans provide identifiers for the PCT solutions for each set in Table 2 and three ICP-AES calibration blocks for each set of quenched PCTs in Table 3 for PSAL to use in conducting the boron (B), gadolinium (Gd), hafnium (Hf), sodium (Na), and silicon (Si) concentration measurements. The sequencing of the activities associated with each of the steps in the analytical procedure for each set has been randomized. The size of the blocks for each set of PCTs was selected so that each block could be completed in a single work shift. If for some reason the measurements are not conducted in the sequence presented in this memorandum, the actual order should be recorded along with any explanative comments.

The analytical plans indicated in the preceding tables should be modified by the personnel of PSAL to include any calibration check standards and/or other standards that are part of their standard operating procedures.

6.0 REFERENCES

[1] J.C. Marra, K.M. Fox, and E.N. Hoffman, "Task Technical & QA Plan: Glass Formulation and Performance Testing to Support Pu Disposition," WSRC-STI-2007-00076, February 2007.

[2] ASTM C-1285-2002, "Standard Test Methods for Determining Chemical Durability of Nuclear Waste Glasses: The Product Consistency Test (PCT)," ASTM, 2002.

Appendix C

SRNL-SCS-2007-00028

Analytical Plans for Measuring the PCT Solutions for the CCC Glasses Fabricated as Part of the Study of Impurity Solubility during Pu Vitrification

SRNL-SCS-2007-00028

June 6, 2007

To: K. M. Fox, SRNL

cc: D. R. Best, 786-1A (wo)
C. C. Herman, 999-W
E. N. Hoffman, 730-A
M. D. Joner, 999-W
J. C. Marra, 773-42A
I. A. Reamer, 999-1W
P. A. Toole, 786-1A (wo)
R. C. Tuckfield, 773-42A
R. J. Workman, 999-1W

From: T. B. Edwards, 999-W (819-8464)
Statistical Consulting Section

wo – without glass identifiers

M. D. Joner, Technical Reviewer — 6.7.2007 Date

R. C. Tuckfield, Manager — 6/7/2007 Date
Statistical Consulting Section

Analytical Plans for Measuring the PCT Solutions for the CCC Glasses Fabricated as Part of the Study of Impurity Solubility during Pu Vitrification (U)

1.0 EXECUTIVE SUMMARY

A glass study (WSRC-STI-2007-00076) is underway at the Savannah River National Laboratory (SRNL) to investigate glass formulations and to conduct performance testing to support plutonium (Pu) disposition. Sixty (60) glasses have been selected to be batched and fabricated as part of this study. The selection of these 60 compositions is to be addressed in a separate report. The durabilities of the glasses are to be measured using the Product Consistency Test (PCT) as defined in ASTM C-1285-2002. Two heat treatments are to be utilized during the fabrication of each of these glasses. Specifically, each of the glasses is to be (1) quenched (i.e., rapidly cooled) and (2) cooled in accordance with the centerline-canister-cooling (ccc) regime. Both heat treatments of each glass are to be subjected to the PCT. The PCT solutions are to be analyzed by SRNL's Process Science Analytical Laboratory (PSAL).

Due to the large number of glasses in this study (60 quenched and 60 ccc glasses in total), the PCTs are to be conducted in 6 sets. Twenty glasses are to be included in each set starting with the quenched and then working through the ccc glasses. This memorandum provides analytical plans for the PCTs for the 3 sets of ccc glasses, which are labeled as Pu04-01 through Pu04-05 and Pu35-01 through Pu35-55, that are to be measured by PSAL.

2.0 INTRODUCTION

A glass study is underway at the Savannah River National Laboratory (SRNL) to investigate glass formulations and to conduct performance testing to support plutonium (Pu) disposition [1]. Sixty (60) glasses have been selected to be batched and fabricated as part of this study. The selection of these 60 compositions is to be addressed in a separate report. The durabilities of the glasses are to be measured using the Product Consistency Test (PCT) as defined in ASTM C-1285-2002 [2]. Two heat treatments are to be utilized during the fabrication of each of these glasses. Specifically, each of the glasses is to be (1) quenched (i.e., rapidly cooled) and (2) cooled in accordance with the centerline-canister-cooling (ccc) regime. Both heat treatments of each glass are to be subjected to the PCT. The PCT solutions are to be analyzed by SRNL's Process Science Analytical Laboratory (PSAL).

Due to the large number of glasses in this study (60 quenched and 60 ccc glasses in total), the PCTs are to be conducted in 6 sets. Twenty glasses are to be included in each set starting with the quenched and then working through the ccc glasses. This memorandum provides analytical plans for the PCTs for the 3 sets of ccc glasses. The glass identifiers for each of the 3 sets of PCTs are provided in Table 1.

Table 1: Three Sets of CCC Glass Identifiers Covered in These Plans

Set 1	Set 2	Set 3
Pu04-01	Pu35-16	Pu35-36
Pu04-02	Pu35-17	Pu35-37
Pu04-03	Pu35-18	Pu35-38
Pu04-04	Pu35-19	Pu35-39
Pu04-05	Pu35-20	Pu35-40
Pu35-01	Pu35-21	Pu35-41
Pu35-02	Pu35-22	Pu35-42
Pu35-03	Pu35-23	Pu35-43
Pu35-04	Pu35-24	Pu35-44
Pu35-05	Pu35-25	Pu35-45
Pu35-06	Pu35-26	Pu35-46
Pu35-07	Pu35-27	Pu35-47
Pu35-08	Pu35-28	Pu35-48
Pu35-09	Pu35-29	Pu35-49
Pu35-10	Pu35-30	Pu35-50
Pu35-11	Pu35-31	Pu35-51
Pu35-12	Pu35-32	Pu35-52
Pu35-13	Pu35-33	Pu35-53
Pu35-14	Pu35-34	Pu35-54
Pu35-15	Pu35-35	Pu35-55

3.0 DISCUSSION

Each of the 20 study glasses in each set of Table 1 is to be subjected to the PCT in triplicate. In addition to PCTs for the study glasses of the set, triplicate PCTs are to be conducted on a sample of the Approved Reference Material – One (ARM-1) glass and a sample of the Environmental Assessment (EA) glass. Two reagent blank samples are also to be included in these tests. This results in 68 sample solutions being required to complete the PCTs for each of the 3 sets of ccc glasses.

For all 3 sets, the leachates from the PCTs will be diluted by adding 4 mL of 0.4 M HNO_3 to 6 mL of the leachate (a 6:10 volume to volume, v:v, dilution) before being submitted to PSAL. The leachates of EA will be further diluted (1:10 v:v) with deionized water prior to submission to PSAL in order to prevent problems with the nebulizer. Note that additional dilutions for the ccc versions of one or more of the study glasses may be needed due to a possible low durability of some of the glasses. Upon termination of the PCT, a decision is to be made (by the technicians and a PSAL representative, if called by the technician) as to whether additional dilutions are needed for these solutions to mitigate any potential gelling issues. Any extra dilutions are to be reported, and guidance is to be given as to how the dilutions are to be handled in the statistical assessment of the measurement data. More specifically, PSAL will be responsible for indicating if any additional dilutions were made and how they were, or how they should be, accounted for in the reported measurements.

Table 2 presents identifying codes for the individual solutions required for the PCTs of the study glasses and of the standards (EA, ARM-1, and blanks) for each of the 3 sets of ccc PCTs: L01 through L68 for Set #1, M01 through M68 for Set #2, and N01 through N68 for Set #3. This provides a naming convention for each set of PCTs that is to be used by PSAL in analyzing the solutions and reporting the relevant concentration measurements.[a]

[a] Renaming these samples ensures that they will be processed as blind samples by PSAL. This table does not contain the solution identifiers for those on the distribution list with a "wo" following their names.

Table 2: Identifiers for the PCT Solutions for Each Set

Set #1				Set #2				Set #3			
Original Sample	Solution Identifier	Original Sample	Solution Identifier	Original Sample	Solution Identifier	Original Sample	Solution Identifier	Original Sample	Solution Identifier	Original Sample	Solution Identifier
Pu04-01	L04	Pu35-08	L08	Pu35-16	M51	Pu35-28	M19	Pu35-36	N42	Pu35-48	N64
Pu04-01	L41	Pu35-08	L17	Pu35-16	M05	Pu35-28	M26	Pu35-36	N12	Pu35-48	N60
Pu04-01	L44	Pu35-08	L01	Pu35-16	M46	Pu35-28	M41	Pu35-36	N23	Pu35-48	N58
Pu04-02	L27	Pu35-09	L50	Pu35-17	M37	Pu35-29	M44	Pu35-37	N16	Pu35-49	N43
Pu04-02	L48	Pu35-09	L18	Pu35-17	M68	Pu35-29	M61	Pu35-37	N25	Pu35-49	N04
Pu04-02	L15	Pu35-09	L40	Pu35-17	M47	Pu35-29	M43	Pu35-37	N39	Pu35-49	N17
Pu04-03	L26	Pu35-10	L33	Pu35-18	M67	Pu35-30	M27	Pu35-38	N06	Pu35-50	N27
Pu04-03	L61	Pu35-10	L23	Pu35-18	M24	Pu35-30	M53	Pu35-38	N02	Pu35-50	N52
Pu04-03	L65	Pu35-10	L06	Pu35-18	M38	Pu35-30	M10	Pu35-38	N13	Pu35-50	N05
Pu04-04	L59	Pu35-11	L47	Pu35-19	M54	Pu35-31	M32	Pu35-39	N33	Pu35-51	N08
Pu04-04	L53	Pu35-11	L51	Pu35-19	M40	Pu35-31	M29	Pu35-39	N36	Pu35-51	N10
Pu04-04	L55	Pu35-11	L66	Pu35-19	M20	Pu35-31	M17	Pu35-39	N07	Pu35-51	N67
Pu04-05	L10	Pu35-12	L34	Pu35-20	M36	Pu35-32	M13	Pu35-40	N55	Pu35-52	N32
Pu04-05	L03	Pu35-12	L20	Pu35-20	M07	Pu35-32	M31	Pu35-40	N41	Pu35-52	N14
Pu04-05	L49	Pu35-12	L42	Pu35-20	M22	Pu35-32	M25	Pu35-40	N44	Pu35-52	N61
Pu35-01	L67	Pu35-13	L09	Pu35-21	M64	Pu35-33	M02	Pu35-41	N31	Pu35-53	N37
Pu35-01	L39	Pu35-13	L68	Pu35-21	M30	Pu35-33	M60	Pu35-41	N34	Pu35-53	N09
Pu35-01	L62	Pu35-13	L12	Pu35-21	M23	Pu35-33	M59	Pu35-41	N18	Pu35-53	N49
Pu35-02	L11	Pu35-14	L64	Pu35-22	M15	Pu35-34	M56	Pu35-42	N68	Pu35-54	N63
Pu35-02	L57	Pu35-14	L29	Pu35-22	M33	Pu35-34	M39	Pu35-42	N47	Pu35-54	N45
Pu35-02	L19	Pu35-14	L46	Pu35-22	M45	Pu35-34	M04	Pu35-42	N20	Pu35-54	N57
Pu35-03	L14	Pu35-15	L07	Pu35-23	M57	Pu35-35	M65	Pu35-43	N51	Pu35-55	N59
Pu35-03	L58	Pu35-15	L02	Pu35-23	M42	Pu35-35	M52	Pu35-43	N11	Pu35-55	N15
Pu35-03	L30	Pu35-15	L37	Pu35-23	M14	Pu35-35	M49	Pu35-43	N03	Pu35-55	N48
Pu35-04	L38	EA	L05	Pu35-24	M12	EA	M66	Pu35-44	N38	EA	N62
Pu35-04	L52	EA	L36	Pu35-24	M06	EA	M08	Pu35-44	N56	EA	N29
Pu35-04	L24	EA	L54	Pu35-24	M50	EA	M09	Pu35-44	N53	EA	N30
Pu35-05	L13	ARM-1	L28	Pu35-25	M16	ARM-1	M34	Pu35-45	N22	ARM-1	N46
Pu35-05	L32	ARM-1	L43	Pu35-25	M35	ARM-1	M63	Pu35-45	N40	ARM-1	N26
Pu35-05	L60	ARM-1	L16	Pu35-25	M01	ARM-1	M58	Pu35-45	N19	ARM-1	N01
Pu35-06	L31	blank	L21	Pu35-26	M48	blank	M21	Pu35-46	N50	blank	N54
Pu35-06	L56	blank	L63	Pu35-26	M18	blank	M28	Pu35-46	N24	blank	N21
Pu35-06	L45			Pu35-26	M55			Pu35-46	N28		
Pu35-07	L25			Pu35-27	M62			Pu35-47	N35		
Pu35-07	L22			Pu35-27	M11			Pu35-47	N66		
Pu35-07	L35			Pu35-27	M03			Pu35-47	N65		

4.0 ANALYTICAL PLANS

The analytical plans for PSAL are provided in this section. Each of the solution samples in each of the sets submitted to PSAL is to be analyzed only once for each of the following: boron (B), gadolinium (Gd), hafnium (Hf), sodium (Na), and silicon (Si). The measurements are to be made in parts per million (ppm). The analytical procedure used by PSAL to determine the concentrations utilizes an Inductively Coupled Plasma – Atomic Emission Spectrometer (ICP-AES). The PCT solutions for each set (as identified in Table 2) are grouped in three ICP-AES blocks for processing by PSAL in Table 3. Each block requires a different calibration of the ICP-AES.

A multi-element solution standard (denoted by "std-ij-k" where i=1, 2, and 3 represents the set number, j=1, 2, and 3 represents the block number for the set, and k=1, 2, and 3 represents the position in the block) was added at the beginning, middle, and end of each of the three blocks for each of the three sets. This standard may be useful in checking and correcting for bias in the concentration measurements arising from the ICP calibrations.

Table 3: ICP-AES Calibration Blocks for the Leachate Measurements for Each Set

Set #1			Set #2			Set #3		
Block 1	Block 2	Block 3	Block 1	Block 2	Block 3	Block 1	Block 2	Block 3
std-11-1	std-12-1	std-13-1	std-21-1	std-22-1	std-23-1	std-31-1	std-32-1	std-33-1
L62	L40	L44	M47	M43	M09	N61	N31	N14
L45	L12	L28	M30	M20	M24	N23	N37	N38
L49	L35	L30	M38	M62	M01	N21	N33	N44
L08	L02	L63	M21	M05	M28	N04	N01	N10
L55	L53	L68	M26	M60	M34	N30	N40	N62
L32	L56	L07	M56	M64	M59	N41	N51	N05
L21	L57	L67	M65	M48	M51	N67	N47	N59
L37	L47	L52	M12	M08	M37	N46	N48	N26
L42	L39	L19	M10	M58	M39	N49	N29	N58
L51	L34	L20	M03	M35	M41	N07	N45	N25
L50	L03	L18	M55	M22	M25	N64	N60	N54
std-11-2	std-12-2	std-13-2	std-21-2	std-22-2	std-23-2	std-31-2	std-32-2	std-33-2
L24	L17	L25	M29	M27	M32	N52	N08	N02
L23	L14	L54	M13	M31	M18	N34	N27	N18
L15	L43	L31	M14	M15	M40	N20	N24	N57
L58	L33	L66	M63	M06	M45	N03	N32	N09
L11	L46	L13	M46	M67	M23	N63	N43	N68
L36	L41	L64	M16	M04	M57	N56	N55	N42
L16	L60	L61	M02	M52	M49	N35	N16	N36
L09	L27	L48	M66	M19	M07	N22	N53	N28
L29	L05	L01	M33	M42	M11	N39	N65	N17
L04	L65	L59	M54	M17	M53	N15	N06	N66
L22	L38	L06	M36	M68	M50	N13	N12	N11
L26	std-12-3	L10	M61	std-22-3	M44	N50	std-32-3	N19
std-11-3		std-13-3	std-21-3		std-23-3	std-31-3		std-33-3

5.0 SUMMARY

In summary, these analytical plans provide identifiers for the PCT solutions for each set in Table 2 and three ICP-AES calibration blocks for each set of ccc PCTs in Table 3 for PSAL to use in conducting the boron (B), gadolinium (Gd), hafnium (Hf), sodium (Na), and silicon (Si) concentration measurements. The sequencing of the activities associated with each of the steps in the analytical procedure for each set has been randomized. The size of the blocks for each set of PCTs was selected so that each block could be completed in a single work shift. If for some reason the measurements are not conducted in the sequence presented in this memorandum, the actual order should be recorded along with any explanative comments.

The analytical plans indicated in the preceding tables should be modified by the personnel of PSAL to include any calibration check standards and/or other standards that are part of their standard operating procedures.

6.0 REFERENCES

[1] J.C. Marra, K.M. Fox, and E.N. Hoffman, "Task Technical & QA Plan: Glass Formulation and Performance Testing to Support Pu Disposition," WSRC-STI-2007-00076, February 2007.

[2] ASTM C-1285-2002, "Standard Test Methods for Determining Chemical Durability of Nuclear Waste Glasses: The Product Consistency Test (PCT)," ASTM, 2002.

Appendix D

Tables and Exhibits Supporting the Analysis of the Chemical Composition Measurements of the Surrogate Pu Impurity Variability Study Glasses

Table D1. Targeted Oxide Concentrations (as wt % oxides) for the Pu/Impurity Solubility Study Glasses (part 1)

Glass ID	Cl	Ta_2O_5	MgO	K_2O	Fe_2O_3	Na_2O	F	CaO	Ga_2O_3	NiO	Cr_2O_3	CuO	SO_4	C	PbO	SeO_2	Cs_2O
Pu35-01	0.58	0.07	1.62	0.26	0.39	0.80	0.00	0.00	0.95	0.21	0.00	0.15	0.00	0.06	0.00	0.08	0.00
Pu35-02	0.58	0.07	1.45	0.74	0.08	0.35	0.45	0.36	0.08	0.15	0.33	0.07	0.17	0.00	0.06	0.08	0.06
Pu35-03	0.57	0.18	0.54	0.31	0.14	1.48	0.00	0.77	0.45	0.07	0.64	0.00	0.00	0.00	0.00	0.00	0.06
Pu35-04	0.59	0.46	1.06	0.45	0.27	0.56	0.52	0.32	0.36	0.07	0.09	0.07	0.00	0.06	0.08	0.08	0.00
Pu35-05	0.58	0.09	0.52	0.78	1.32	0.35	0.00	0.13	0.29	0.00	0.64	0.29	0.00	0.06	0.07	0.00	0.06
Pu35-06	0.60	0.10	0.91	0.27	0.97	0.80	0.48	0.29	0.00	0.28	0.22	0.00	0.17	0.06	0.00	0.00	0.00
Pu35-07	0.62	1.30	0.54	0.42	0.09	0.61	0.19	0.20	0.08	0.37	0.13	0.16	0.17	0.06	0.06	0.00	0.06
Pu35-08	0.62	0.39	0.88	0.77	0.89	0.40	0.30	0.24	0.16	0.25	0.09	0.07	0.00	0.00	0.00	0.00	0.00
Pu35-09	0.64	0.11	0.53	1.54	0.00	1.13	0.00	0.10	0.13	0.19	0.08	0.25	0.17	0.06	0.08	0.08	0.00
Pu35-10	0.65	0.27	0.81	0.36	0.59	0.67	0.38	0.08	0.71	0.07	0.08	0.07	0.17	0.00	0.06	0.08	0.06
Pu35-11	0.69	0.69	0.99	0.38	0.08	0.69	0.06	0.40	0.21	0.17	0.40	0.00	0.17	0.06	0.07	0.08	0.00
Pu35-12	0.65	0.59	0.66	0.28	0.19	0.79	0.33	0.08	0.36	0.47	0.40	0.18	0.00	0.00	0.00	0.08	0.00
Pu35-13	0.77	0.84	0.76	0.44	0.37	1.09	0.06	0.00	0.08	0.00	0.37	0.15	0.00	0.00	0.08	0.00	0.06
Pu35-14	0.80	0.34	0.44	0.20	1.00	1.07	0.08	0.38	0.27	0.07	0.13	0.07	0.00	0.06	0.06	0.08	0.06
Pu35-15	1.00	0.00	0.54	0.59	0.00	0.88	0.00	0.00	1.27	0.60	0.00	0.00	0.00	0.00	0.08	0.00	0.06
Pu35-16	0.95	0.29	0.73	0.00	0.46	1.23	0.00	0.70	0.15	0.13	0.00	0.29	0.17	0.00	0.06	0.00	0.00
Pu35-17	1.11	0.55	0.40	0.43	0.00	1.04	0.06	0.08	0.68	0.07	0.31	0.10	0.17	0.06	0.00	0.00	0.00
Pu35-18	0.58	0.07	1.04	1.10	0.08	0.94	0.06	0.57	0.08	0.07	0.48	0.07	0.00	0.00	0.00	0.00	0.00
Pu35-19	0.58	0.07	1.38	0.37	0.78	0.78	0.38	0.08	0.08	0.07	0.48	0.07	0.00	0.00	0.00	0.00	0.00
Pu35-20	0.58	0.51	0.55	0.85	0.28	0.50	0.29	0.23	0.51	0.29	0.40	0.07	0.00	0.00	0.00	0.00	0.00
Pu35-21	0.58	1.14	1.28	0.41	0.08	0.59	0.06	0.08	0.62	0.07	0.09	0.07	0.00	0.00	0.00	0.00	0.00
Pu35-22	0.60	0.52	0.69	0.55	0.37	0.74	0.47	0.59	0.08	0.08	0.15	0.22	0.00	0.00	0.00	0.00	0.00
Pu35-23	0.59	0.83	0.67	0.16	0.56	0.93	0.09	0.16	0.53	0.12	0.29	0.22	0.00	0.00	0.00	0.00	0.00
Pu35-24	0.63	0.15	0.67	0.53	0.41	0.58	0.24	0.40	0.83	0.10	0.37	0.22	0.00	0.00	0.00	0.00	0.00
Pu35-25	0.67	0.59	0.48	0.70	0.83	0.48	0.07	0.28	0.26	0.35	0.17	0.22	0.00	0.00	0.00	0.00	0.00
Pu35-26	0.66	0.22	0.89	0.25	0.47	0.77	0.10	0.43	0.79	0.22	0.27	0.07	0.00	0.00	0.00	0.00	0.00
Pu35-27	0.72	0.67	0.61	0.52	0.46	0.65	0.24	0.32	0.27	0.07	0.48	0.07	0.00	0.00	0.00	0.00	0.00
Pu35-28	0.72	0.54	0.93	0.39	0.08	0.74	0.10	0.11	0.41	0.36	0.48	0.22	0.00	0.00	0.00	0.00	0.00
Pu35-29	0.84	0.34	0.47	0.84	0.18	0.95	0.36	0.08	0.70	0.07	0.09	0.07	0.00	0.00	0.00	0.00	0.00
Pu35-30	0.58	0.07	0.46	1.11	0.08	0.90	0.06	0.46	0.75	0.07	0.08	0.07	0.17	0.06	0.06	0.08	0.06
Pu35-31	0.58	0.07	0.60	1.12	0.83	0.47	0.47	0.08	0.08	0.17	0.09	0.07	0.17	0.06	0.06	0.08	0.06
Pu35-32	0.58	0.07	1.39	0.26	0.08	0.69	0.40	0.08	0.90	0.07	0.08	0.07	0.17	0.06	0.06	0.08	0.06
Pu35-33	0.57	0.07	1.37	0.08	0.56	0.90	0.13	0.44	0.08	0.07	0.48	0.07	0.17	0.06	0.06	0.08	0.06
Pu35-34	0.58	0.71	1.38	0.58	0.08	0.48	0.06	0.37	0.08	0.07	0.08	0.22	0.17	0.06	0.06	0.08	0.06
Pu35-35	0.58	1.12	0.46	0.07	0.82	0.93	0.06	0.08	0.39	0.07	0.08	0.07	0.17	0.06	0.06	0.08	0.06
Pu35-36	0.60	0.51	0.89	0.43	0.11	0.67	0.16	0.08	0.31	0.33	0.37	0.22	0.17	0.06	0.06	0.08	0.06
Pu35-37	0.60	0.35	1.02	0.36	0.28	0.65	0.10	0.17	0.36	0.37	0.40	0.07	0.17	0.06	0.06	0.08	0.06
Pu35-38	0.66	0.53	0.73	0.45	0.17	0.66	0.31	0.43	0.30	0.18	0.18	0.07	0.17	0.06	0.06	0.08	0.06
Pu35-39	0.69	0.50	0.70	0.77	0.29	0.70	0.18	0.08	0.31	0.07	0.31	0.07	0.17	0.06	0.06	0.08	0.06
Pu35-40	0.72	0.07	0.65	0.50	0.56	0.65	0.14	0.41	0.39	0.10	0.32	0.22	0.17	0.06	0.06	0.08	0.06
Pu35-41	0.93	0.07	1.39	0.34	0.08	0.94	0.06	0.08	0.08	0.44	0.08	0.15	0.17	0.06	0.06	0.08	0.06
Pu35-42	0.58	0.21	1.08	0.84	0.17	0.78	0.12	0.16	0.16	0.15	0.34	0.14	0.17	0.06	0.06	0.08	0.06
Pu35-43	0.58	0.49	0.65	0.21	0.57	0.74	0.20	0.35	0.35	0.20	0.25	0.14	0.17	0.06	0.06	0.08	0.06
Pu35-44	0.58	0.54	0.80	0.31	0.58	0.66	0.19	0.28	0.30	0.15	0.25	0.11	0.17	0.06	0.06	0.08	0.06
Pu35-45	0.58	0.70	0.75	0.20	0.46	0.73	0.12	0.23	0.48	0.22	0.17	0.11	0.17	0.06	0.06	0.08	0.06

Table D1. Targeted Oxide Concentrations (as wt % oxides) for the Pu/Impurity Solubility Study Glasses (part 1, continued)

Glass ID	Cl	Ta_2O_5	MgO	K_2O	Fe_2O_3	Na_2O	F	CaO	Ga_2O_3	NiO	Cr_2O_3	CuO	SO_4	C	PbO	SeO_2	Cs_2O
Pu35-46	0.59	0.45	0.73	0.41	0.17	0.63	0.35	0.17	0.54	0.30	0.17	0.15	0.17	0.06	0.06	0.08	0.06
Pu35-47	0.61	0.85	0.61	0.25	0.17	0.73	0.12	0.40	0.19	0.29	0.34	0.14	0.17	0.06	0.06	0.08	0.06
Pu35-48	0.63	0.35	0.79	0.29	0.50	0.73	0.20	0.37	0.34	0.19	0.23	0.11	0.17	0.06	0.06	0.08	0.06
Pu35-49	0.64	0.27	0.77	0.63	0.52	0.64	0.19	0.32	0.19	0.20	0.19	0.14	0.17	0.06	0.06	0.08	0.06
Pu35-50	0.64	0.18	0.66	0.69	0.49	0.65	0.20	0.26	0.32	0.24	0.25	0.11	0.17	0.06	0.06	0.08	0.06
Pu35-51	0.65	0.32	0.90	0.26	0.56	0.75	0.22	0.16	0.16	0.29	0.32	0.11	0.17	0.06	0.06	0.08	0.06
Pu35-52	0.69	0.14	0.82	0.37	0.39	0.71	0.14	0.17	0.58	0.23	0.33	0.14	0.17	0.06	0.06	0.08	0.06
Pu35-53	0.70	0.77	0.62	0.47	0.17	0.79	0.35	0.16	0.16	0.15	0.17	0.11	0.17	0.06	0.06	0.08	0.06
Pu35-54	0.64	0.46	0.81	0.57	0.42	0.70	0.21	0.28	0.41	0.16	0.30	0.13	0.00	0.00	0.00	0.00	0.00
Pu35-55	0.63	0.39	0.84	0.46	0.36	0.72	0.19	0.24	0.32	0.19	0.23	0.12	0.17	0.06	0.06	0.08	0.06
Pu04-01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pu04-02	0.12	0.00	0.00	0.21	0.00	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pu04-03	0.00	0.00	0.08	0.07	0.00	0.32	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pu04-04	0.06	0.00	0.16	0.00	0.17	0.16	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pu04-05	0.00	0.00	0.08	0.07	0.08	0.08	0.00	0.08	0.00	0.08	0.09	0.07	0.00	0.00	0.00	0.00	0.00

Table D1. Targeted Oxide Concentrations (as wt%'s) for the Pu/Impurity Solubility Study Glasses (part 2)

Glass ID	HfO_2	Al_2O_3	B_2O_3	Gd_2O_3	La_2O_3	Nd_2O_3	SiO_2	SrO
Pu35-01	14.86	8.60	11.18	11.61	16.34	12.90	17.20	2.15
Pu35-02	14.92	8.60	11.18	11.61	16.34	12.90	17.20	2.15
Pu35-03	14.81	8.60	11.18	11.61	16.34	12.90	17.20	2.15
Pu35-04	15.00	8.60	11.18	11.61	16.34	12.90	17.20	2.15
Pu35-05	14.85	8.60	11.18	11.61	16.34	12.90	17.20	2.15
Pu35-06	14.87	8.60	11.18	11.61	16.34	12.90	17.20	2.15
Pu35-07	14.96	8.60	11.18	11.61	16.34	12.90	17.20	2.15
Pu35-08	14.95	8.60	11.18	11.61	16.34	12.90	17.20	2.15
Pu35-09	14.92	8.60	11.18	11.61	16.34	12.90	17.20	2.15
Pu35-10	14.90	8.60	11.18	11.61	16.34	12.90	17.20	2.15
Pu35-11	14.87	8.60	11.18	11.61	16.34	12.90	17.20	2.15
Pu35-12	14.96	8.60	11.18	11.61	16.34	12.90	17.20	2.15
Pu35-13	14.96	8.60	11.18	11.61	16.34	12.90	17.20	2.15
Pu35-14	14.90	8.60	11.18	11.61	16.34	12.90	17.20	2.15
Pu35-15	15.00	8.60	11.18	11.61	16.34	12.90	17.20	2.15
Pu35-16	14.85	8.60	11.18	11.61	16.34	12.90	17.20	2.15
Pu35-17	14.95	8.60	11.18	11.61	16.34	12.90	17.20	2.15
Pu35-18	14.88	8.60	11.18	11.61	16.34	12.90	17.20	2.15
Pu35-19	14.89	8.60	11.18	11.61	16.34	12.90	17.20	2.15
Pu35-20	14.95	8.60	11.18	11.61	16.34	12.90	17.20	2.15
Pu35-21	14.94	8.60	11.18	11.61	16.34	12.90	17.20	2.15
Pu35-22	14.98	8.60	11.18	11.61	16.34	12.90	17.20	2.15
Pu35-23	14.88	8.60	11.18	11.61	16.34	12.90	17.20	2.15
Pu35-24	14.90	8.60	11.18	11.61	16.34	12.90	17.20	2.15
Pu35-25	14.92	8.60	11.18	11.61	16.34	12.90	17.20	2.15
Pu35-26	14.87	8.60	11.18	11.61	16.34	12.90	17.20	2.15
Pu35-27	14.94	8.60	11.18	11.61	16.34	12.90	17.20	2.15
Pu35-28	14.93	8.60	11.18	11.61	16.34	12.90	17.20	2.15
Pu35-29	15.03	8.60	11.18	11.61	16.34	12.90	17.20	2.15
Pu35-30	14.88	8.60	11.18	11.61	16.34	12.90	17.20	2.15
Pu35-31	14.95	8.60	11.18	11.61	16.34	12.90	17.20	2.15
Pu35-32	14.90	8.60	11.18	11.61	16.34	12.90	17.20	2.15
Pu35-33	14.78	8.60	11.18	11.61	16.34	12.90	17.20	2.15
Pu35-34	14.89	8.60	11.18	11.61	16.34	12.90	17.20	2.15
Pu35-35	14.85	8.60	11.18	11.61	16.34	12.90	17.20	2.15
Pu35-36	14.89	8.60	11.18	11.61	16.34	12.90	17.20	2.15
Pu35-37	14.85	8.60	11.18	11.61	16.34	12.90	17.20	2.15
Pu35-38	14.93	8.60	11.18	11.61	16.34	12.90	17.20	2.15
Pu35-39	14.92	8.60	11.18	11.61	16.34	12.90	17.20	2.15
Pu35-40	14.86	8.60	11.18	11.61	16.34	12.90	17.20	2.15
Pu35-41	14.93	8.60	11.18	11.61	16.34	12.90	17.20	2.15
Pu35-42	14.88	8.60	11.18	11.61	16.34	12.90	17.20	2.15
Pu35-43	14.85	8.60	11.18	11.61	16.34	12.90	17.20	2.15
Pu35-44	14.86	8.60	11.18	11.61	16.34	12.90	17.20	2.15
Pu35-45	14.86	8.60	11.18	11.61	16.34	12.90	17.20	2.15
Pu35-46	14.92	8.60	11.18	11.61	16.34	12.90	17.20	2.15
Pu35-47	14.88	8.60	11.18	11.61	16.34	12.90	17.20	2.15
Pu35-48	14.86	8.60	11.18	11.61	16.34	12.90	17.20	2.15
Pu35-49	14.89	8.60	11.18	11.61	16.34	12.90	17.20	2.15
Pu35-50	14.89	8.60	11.18	11.61	16.34	12.90	17.20	2.15
Pu35-51	14.87	8.60	11.18	11.61	16.34	12.90	17.20	2.15
Pu35-52	14.86	8.60	11.18	11.61	16.34	12.90	17.20	2.15
Pu35-53	14.97	8.60	11.18	11.61	16.34	12.90	17.20	2.15
Pu35-54	14.93	8.60	11.18	11.61	16.34	12.90	17.20	2.15
Pu35-55	14.88	8.60	11.18	11.61	16.34	12.90	17.20	2.15
Pu04-01	6.02	8.60	11.18	11.61	16.34	12.90	17.20	2.15
Pu04-02	19.45	8.60	11.18	11.61	16.34	12.90	17.20	2.15
Pu04-03	19.43	8.60	11.18	11.61	16.34	12.90	17.20	2.15
Pu04-04	19.42	8.60	11.18	11.61	16.34	12.90	17.20	2.15
Pu04-05	19.39	8.60	11.18	11.61	16.34	12.90	17.20	2.15

Table D2. Measured Elemental Concentrations (wt %) for Samples Prepared Using Lithium Metaborate

Glass ID	Block	Seq.	Lab ID	Al (wt %)	Ca (wt %)	Cr (wt %)	Cu (wt %)	Fe (wt %)	Ga (wt %)	Gd (wt %)	Hf (wt %)	K (wt %)	La (wt %)	Mg (wt %)	Na (wt %)	Nd (wt %)	Ni (wt %)	Pb (wt %)	S (wt %)	Se (wt %)	Si (wt %)	Sr (wt %)	Ta (wt %)
Batch 1	1	1	BCHLM11	2.62	0.883	0.074	0.302	8.95	<0.010	0.319	0.115	3.17	0.637	0.845	7.34	0.539	0.52	<0.010	<0.050	<0.010	23.9	0.037	<0.010
LRM	1	2	LRMLM11	5.35	0.359	0.131	0.012	0.893	<0.010	0.005	0.015	1.29	0.011	0.055	15.9	<0.010	0.13	0.079	0.081	<0.010	25.4	<0.010	<0.010
Pu35-04	1	3	B09LM1	4.82	0.333	0.055	0.079	0.199	0.287	10.2	11.5	0.353	14	0.595	0.493	11.3	0.055	0.086	<0.050	<0.010	8.36	1.9	0.353
Pu35-01	1	4	B06LM1	4.74	0.058	0.006	0.124	0.296	0.692	10	11.6	0.197	13.7	0.861	0.62	11.1	0.139	0.034	<0.050	<0.010	8.39	1.88	0.065
Pu04-03	1	5	B03LM1	4.97	0.044	0.006	0.023	0.126	0.027	10.5	12.8	<0.010	14.3	0.088	0.148	11.6	<0.010	0.035	<0.050	<0.010	8.67	1.97	0.016
Pu35-02	1	6	B07LM2	4.82	0.344	0.199	0.071	0.076	0.082	10.2	11.4	0.519	13.6	0.782	0.288	11.2	0.097	0.079	<0.050	<0.010	8.2	1.92	0.066
Pu04-02	1	7	B02LM1	4.98	0.053	0.006	0.024	0.025	0.027	10.4	12.4	0.067	14.1	0.042	0.34	11.4	<0.010	0.035	<0.050	<0.010	8.75	1.95	0.016
Pu35-03	1	8	B08LM2	4.63	0.629	0.37	0.025	0.11	0.34	10	11.2	0.25	13.7	0.304	1.08	11	0.044	0.033	<0.050	<0.010	8.03	1.83	0.143
Pu35-05	1	9	B10LM1	4.82	0.155	0.383	0.218	0.835	0.242	10.3	11.9	0.591	13.8	0.293	0.291	11.3	<0.010	0.085	<0.050	<0.010	8.4	1.94	0.081
Pu35-04	1	10	B09LM2	4.79	0.311	0.055	0.075	0.199	0.281	10.2	11.8	0.346	14	0.585	0.459	11.3	0.056	0.084	<0.050	<0.010	8.29	1.89	0.343
Pu04-05	1	11	B05LM2	4.98	0.045	0.006	0.023	0.019	0.027	10.7	13.3	<0.010	14	<0.010	0.274	11.8	<0.010	0.035	<0.050	<0.010	8.77	1.94	0.016
Pu04-05	1	12	B05LM1	4.94	0.05	0.006	0.023	0.019	0.027	10.7	12.9	<0.010	13.9	<0.010	0.297	11.7	<0.010	0.036	<0.050	<0.010	8.69	1.92	0.016
Batch 1	1	13	BCHLM12	2.62	0.885	0.073	0.299	8.98	<0.010	0.313	0.138	3.11	0.623	0.846	7.22	0.529	0.517	<0.010	<0.050	<0.010	23.8	0.038	<0.010
LRM	1	14	LRMLM12	5.04	0.361	0.13	0.012	0.882	<0.010	0.005	0.043	1.21	0.01	0.055	15.4	<0.010	0.128	0.078	0.085	<0.010	24.8	<0.010	<0.010
Pu35-05	1	15	B10LM2	4.59	0.145	0.363	0.208	0.799	0.231	9.84	11	0.558	13.3	0.281	0.277	10.9	<0.010	0.082	<0.050	<0.010	7.95	1.83	0.078
Pu04-01	1	16	B01LM1	5.03	0.051	0.008	0.023	0.031	0.028	10.6	12.3	0.166	14.5	<0.010	0.214	11.7	<0.010	0.036	<0.050	<0.010	8.74	1.97	0.015
Pu35-03	1	17	B08LM1	4.74	0.637	0.373	0.025	0.109	0.343	10.1	11.4	0.257	13.7	0.3	1.111	11.2	0.044	0.032	<0.050	<0.010	8.13	1.89	0.147
Pu04-02	1	18	B02LM2	4.99	0.056	0.006	0.023	0.021	0.028	10.5	12.5	0.049	14.4	0.041	0.275	11.6	<0.010	0.035	<0.050	<0.010	8.76	1.96	0.015
Pu04-04	1	19	B04LM1	5.03	0.119	0.057	0.085	0.076	0.027	10.7	12.6	0.051	13.8	0.041	0.083	11.8	0.055	0.036	<0.050	<0.010	8.7	1.93	0.015
Pu35-02	1	20	B07LM1	4.88	0.349	0.205	0.075	0.082	0.083	10.4	11.7	0.522	13.9	0.782	0.3	11.5	0.099	0.081	<0.050	<0.010	8.32	1.95	0.068
Pu04-01	1	21	B01LM2	5.05	0.047	0.012	0.024	0.044	0.027	10.5	12.3	0.152	14.3	<0.010	0.209	11.7	<0.010	0.036	<0.050	<0.010	8.68	1.98	0.015
Pu35-01	1	22	B06LM2	4.82	0.057	0.005	0.122	0.278	0.69	10.2	11.5	0.203	13.9	0.857	0.633	11.3	0.138	0.033	<0.050	<0.010	8.47	1.9	0.061
Pu04-04	1	23	B04LM2	5.08	0.128	0.056	0.08	0.081	0.025	10.8	12.1	0.054	13.9	0.041	0.104	12	0.053	0.034	<0.050	<0.010	8.76	1.96	0.014
Pu04-03	1	24	B03LM2	5	0.05	0.005	0.026	0.126	0.029	10.6	12.6	<0.010	14.4	0.09	0.155	11.7	<0.010	0.035	<0.050	<0.010	8.67	1.95	0.016
Batch 1	1	25	BCHLM13	2.63	0.894	0.071	0.3	8.81	<0.010	0.312	0.147	3.2	0.619	0.809	7.37	0.527	0.508	<0.010	<0.050	<0.010	23.7	0.038	<0.010
LRM	1	26	LRMLM13	5.17	0.365	0.13	0.012	0.88	<0.010	0.005	0.05	1.25	0.011	0.054	15.8	<0.010	0.127	0.079	0.082	<0.010	24.7	<0.010	<0.010
Batch 1	2	1	BCHLM21	2.56	0.882	0.077	0.306	8.73	<0.010	0.33	0.117	3.09	0.662	0.892	7.13	0.552	0.541	<0.010	<0.050	<0.010	23.2	0.034	<0.010
LRM	2	2	LRMLM11	5.16	0.355	0.138	0.009	0.943	<0.010	0.005	0.011	1.27	0.011	0.057	15.6	<0.010	0.135	0.082	0.081	<0.010	24.5	<0.010	<0.010
Pu35-13	2	3	B18LM1	4.75	0.042	0.246	0.139	0.272	0.087	10.2	11.4	0.299	13.8	0.467	0.781	11.2	<0.010	0.092	<0.050	<0.010	8.28	1.89	0.687
Pu35-14	2	4	B19LM1	4.83	0.352	0.091	0.074	0.676	0.227	10.2	11.7	0.127	13.8	0.266	0.765	11.3	0.052	0.078	<0.050	<0.010	8.23	1.94	0.288
Pu35-15	2	5	B20LM1	4.89	0.046	0.006	0.02	0.024	0.967	10.3	11.9	0.385	14	0.327	0.632	11.5	0.431	0.083	<0.050	<0.010	8.39	1.96	0.014
Pu35-15	2	6	B20LM2	4.84	0.044	0.005	0.021	0.02	0.957	10.2	11.5	0.382	13.8	0.322	0.631	11.3	0.422	0.081	<0.050	<0.010	8.25	1.93	0.014
Pu35-07	2	7	B12LM1	4.82	0.216	0.088	0.142	0.078	0.083	10.2	11.9	0.334	13.8	0.331	0.469	11.3	0.277	0.081	<0.050	<0.010	8.27	1.94	1.049
Pu35-11	2	8	B16LM2	4.74	0.36	0.265	0.032	0.08	0.183	10.1	11.8	0.257	13.6	0.603	0.516	11.1	0.125	0.081	<0.050	<0.010	8.28	1.91	0.568
Pu35-10	2	9	B15LM2	4.78	0.109	0.06	0.075	0.417	0.557	10.2	11.6	0.267	13.8	0.502	0.514	11.3	0.053	0.077	<0.050	<0.010	8.31	1.91	0.226
Pu35-09	2	10	B14LM2	4.88	0.131	0.06	0.176	0.019	0.128	10.3	11.7	0.986	14	0.334	0.852	11.4	0.135	0.086	<0.050	<0.010	8.43	1.95	0.099
Pu35-08	2	11	B13LM2	4.8	0.246	0.074	0.079	0.713	0.151	10.2	11.7	0.548	13.9	0.546	0.325	11.3	0.196	0.034	<0.050	<0.010	8.36	1.91	0.323
Pu35-12	2	12	B17LM1	4.82	0.114	0.259	0.162	0.153	0.295	10.2	11.8	0.205	13.7	0.411	0.589	11.3	0.354	0.037	<0.050	<0.010	8.21	1.94	0.493
Batch 1	2	13	BCHLM21	2.65	0.893	0.077	0.311	8.52	<0.010	0.337	0.122	3.27	0.675	0.906	7.39	0.563	0.55	<0.010	<0.050	<0.010	23.3	0.035	<0.010
LRM	2	14	LRMLM21	5.16	0.36	0.136	0.009	0.922	<0.010	0.006	0.077	1.3	0.015	0.056	15.7	<0.010	0.132	0.08	0.08	<0.010	24.2	<0.010	<0.010
Pu35-13	2	15	B18LM2	4.81	0.044	0.243	0.136	0.27	0.086	10.1	11.2	0.29	13.5	0.464	0.776	11.2	<0.010	0.092	<0.050	<0.010	8.13	1.94	0.679
Pu35-14	2	16	B19LM2	4.83	0.349	0.095	0.075	0.702	0.23	10.2	11.7	0.125	13.8	0.276	0.775	11.3	0.054	0.083	<0.050	<0.010	8.29	1.94	0.295

Table D2. Measured Elemental Concentrations (wt %) for Samples Prepared Using Lithium Metaborate (continued)

Glass ID	Block	Seq.	Lab ID	Al (wt %)	Ca (wt %)	Cr (wt %)	Cu (wt %)	Fe (wt %)	Ga (wt %)	Gd (wt %)	Hf (wt %)	K (wt %)	La (wt %)	Mg (wt %)	Na (wt %)	Nd (wt %)	Ni (wt %)	Pb (wt %)	S (wt %)	Se (wt %)	Si (wt %)	Sr (wt %)	Ta (wt %)
Pu35-10	2	17	B15LM1	4.76	0.105	0.058	0.072	0.412	0.544	10.1	11.1	0.258	13.6	0.499	0.496	11.1	0.055	0.077	<0.050	<0.010	8.15	1.91	0.217
Pu35-08	2	18	B13LM1	4.73	0.257	0.056	0.082	0.628	0.157	10.1	11	0.593	13.9	0.495	0.332	11.3	0.172	0.05	<0.050	<0.010	7.86	1.91	0.307
Pu35-12	2	19	B17LM2	4.85	0.11	0.257	0.159	0.152	0.289	10.1	11.8	0.201	13.6	0.411	0.577	11.3	0.352	0.037	<0.050	<0.010	8.3	1.98	0.489
Pu35-11	2	20	B16LM1	4.78	0.359	0.266	0.03	0.074	0.185	10.1	11.8	0.26	13.6	0.614	0.517	11.2	0.126	0.084	<0.050	<0.010	8.22	1.93	0.569
Pu35-06	2	21	B11LM1	4.77	0.274	0.148	0.022	0.673	0.024	10.1	11.5	0.189	13.7	0.568	0.579	11.1	0.201	0.036	<0.050	<0.010	8.15	1.92	0.091
Pu35-06	2	22	B11LM2	4.79	0.276	0.148	0.021	0.68	0.024	10.1	11.4	0.189	13.6	0.575	0.591	11.2	0.203	0.037	<0.050	<0.010	8.12	1.93	0.09
Pu35-07	2	23	B12LM2	4.73	0.201	0.093	0.144	0.088	0.084	10.1	11.8	0.325	13.7	0.341	0.475	11.1	0.285	0.083	<0.050	<0.010	8.12	1.92	1.066
Pu35-09	2	24	B14LM1	4.68	0.128	0.06	0.17	0.035	0.124	9.9	10.9	0.953	13.5	0.329	0.826	11	0.135	0.086	<0.050	<0.010	8.05	1.89	0.092
Batch 1	2	25	BCHLM23	2.63	0.879	0.079	0.306	8.65	<0.010	0.336	0.123	3.21	0.678	0.927	7.4	0.559	0.561	<0.010	<0.050	<0.010	23.4	0.034	<0.010
LRM	2	26	LRMLM23	5.15	0.35	0.138	0.008	0.946	<0.010	0.005	0.074	1.28	0.011	0.058	15.8	<0.010	0.136	0.082	0.084	<0.010	24.7	<0.010	<0.010
Batch 1	3	1	BCHLM31	2.63	0.868	0.073	0.303	9.13	<0.010	0.324	0.116	3.16	0.646	0.836	7.35	0.548	0.524	<0.010	<0.050	<0.010	24.1	0.035	<0.010
LRM	3	2	LRMLM31	5.35	0.357	0.132	0.011	0.905	<0.010	0.005	0.01	1.27	0.011	0.054	15.8	<0.010	0.129	0.078	0.075	<0.010	25.7	<0.010	<0.010
Pu35-24	3	3	B29LM1	4.71	0.359	0.232	0.173	0.282	0.628	10.2	11.5	0.353	14.1	0.391	0.44	11.2	0.068	0.036	<0.050	<0.010	8.43	1.84	0.138
Pu35-25	3	4	B30LM2	4.7	0.266	0.116	0.183	0.57	0.218	10.2	11.7	0.516	13.9	0.285	0.365	11.2	0.249	0.035	<0.050	<0.010	9.16	1.85	0.472
Pu35-18	3	5	B23LM1	4.62	0.481	0.328	0.075	0.144	0.085	10.1	11.7	0.663	13.8	0.592	0.669	11	0.062	0.036	<0.050	<0.010	8.27	1.81	0.068
Pu35-22	3	6	B27LM2	4.75	0.495	0.094	0.185	0.26	0.085	10.4	11.7	0.385	14.3	0.407	0.56	11.2	0.057	0.035	<0.050	<0.010	8.44	1.85	0.42
Pu35-25	3	7	B30LM1	4.71	0.269	0.124	0.183	0.581	0.216	10.3	11.7	0.516	14	0.278	0.367	11.1	0.249	0.033	<0.050	<0.010	9.15	1.84	0.468
Pu35-20	3	8	B25LM1	4.81	0.228	0.25	0.082	0.198	0.399	10.4	11.9	0.55	14.3	0.319	0.381	11.4	0.206	0.036	<0.050	<0.010	8.48	1.88	0.416
Pu35-16	3	9	B21LM2	4.69	0.568	0.004	0.214	0.306	0.14	10.2	11.6	<0.010	13.8	0.413	0.815	11.1	0.093	0.071	<0.050	<0.010	8.26	1.82	0.231
Pu35-18	3	10	B23LM2	4.77	0.496	0.303	0.075	0.076	0.084	10.4	11.9	0.665	14.3	0.591	0.66	11.4	0.051	0.035	<0.050	<0.010	8.48	1.86	0.066
Pu35-22	3	11	B27LM1	4.84	0.501	0.093	0.185	0.263	0.086	10.5	11.9	0.391	14.4	0.408	0.556	11.5	0.057	0.035	<0.050	<0.010	8.54	1.9	0.421
Pu35-20	3	12	B25LM2	4.8	0.229	0.256	0.083	0.203	0.404	10.4	12	0.553	14.4	0.328	0.387	11.4	0.213	0.037	<0.050	<0.010	8.49	1.88	0.421
Batch 1	3	13	BCHLM32	2.63	0.866	0.075	0.305	9.1	<0.010	0.33	0.147	3.11	0.657	0.856	7.24	0.551	0.533	<0.010	<0.050	<0.010	24	0.035	<0.010
LRM	3	14	LRMLM32	5.1	0.349	0.133	0.01	0.917	<0.010	0.005	0.056	1.22	0.01	0.055	15.5	<0.010	0.131	0.08	0.078	<0.010	25	<0.010	<0.010
Pu35-21	3	15	B26LM1	4.75	0.145	0.055	0.096	0.071	0.483	10.3	11.4	0.295	14.1	0.712	0.451	11.3	0.056	0.036	<0.050	<0.010	8.39	1.86	0.893
Pu35-23	3	16	B28LM1	4.74	0.173	0.186	0.189	0.387	0.418	10.3	11.9	0.107	14.2	0.395	0.672	11.3	0.086	0.036	<0.050	<0.010	8.38	1.87	0.658
Pu35-21	3	17	B26LM2	4.74	0.112	0.056	0.092	0.074	0.48	10.3	11.7	0.293	14.1	0.718	0.443	11.3	0.056	0.036	<0.050	<0.010	8.41	1.87	0.894
Pu35-24	3	18	B29LM2	4.73	0.361	0.238	0.17	0.319	0.621	10.3	11.9	0.342	14.1	0.392	0.437	11.2	0.072	0.037	<0.050	<0.010	8.38	1.85	0.139
Pu35-17	3	19	B22LM1	4.71	0.117	0.202	0.085	0.026	0.52	10.3	11.8	0.287	14.1	0.236	0.725	11.2	0.052	0.038	<0.050	<0.010	8.47	1.84	0.439
Pu35-16	3	20	B21LM1	4.87	0.574	0.004	0.214	0.32	0.144	10.5	12.1	<0.010	14.2	0.43	0.832	11.5	0.097	0.075	<0.050	<0.010	8.49	1.91	0.237
Pu35-17	3	21	B22LM2	4.76	0.114	0.215	0.085	0.06	0.518	10.3	11.7	0.286	14	0.236	0.721	11.3	0.059	0.037	<0.050	<0.010	8.46	1.86	0.44
Pu35-19	3	22	B24LM1	4.72	0.112	0.298	0.073	0.52	0.084	10.3	11.8	0.23	14.1	0.771	0.57	11.2	0.048	0.035	<0.050	<0.010	8.33	1.86	0.068
Pu35-19	3	23	B24LM2	4.76	0.11	0.307	0.073	0.541	0.084	10.3	11.9	0.226	14	0.763	0.565	11.2	0.056	0.035	<0.050	<0.010	8.33	1.88	0.067
Pu35-23	3	24	B28LM2	4.77	0.167	0.184	0.185	0.392	0.411	10.3	11.8	0.103	14	0.389	0.666	11.2	0.087	0.036	<0.050	<0.010	8.3	1.9	0.647
Batch 1	3	25	BCHLM33	2.7	0.857	0.073	0.3	8.95	<0.010	0.324	0.143	3.26	0.647	0.848	7.54	0.542	0.527	<0.010	<0.050	<0.010	24.1	0.035	<0.010
LRM	3	26	LRMLM33	5.23	0.345	0.132	0.01	0.91	<0.010	0.005	0.053	1.3	0.01	0.055	16.2	<0.010	0.13	0.079	0.078	<0.010	25.3	<0.010	<0.010
Batch 1	4	1	BCHLM41	2.58	0.865	0.076	0.305	8.8	<0.010	0.331	0.118	3.1	0.66	0.87	7.04	0.551	0.536	<0.010	<0.050	<0.010	23.4	0.035	<0.010
LRM	4	2	LRMLM41	5.17	0.348	0.137	0.011	0.926	<0.010	0.006	0.012	1.24	0.012	0.058	15.5	<0.010	0.134	0.083	0.081	<0.010	24.7	<0.010	<0.010
Pu35-27	4	3	B32LM1	4.69	0.303	0.305	0.085	0.322	0.233	10.2	11.3	0.342	13.9	0.359	0.48	11.2	0.056	0.037	<0.050	<0.010	8.25	1.82	0.54
Pu35-33	4	4	B38LM1	4.51	0.372	0.296	0.074	0.37	0.084	9.94	11.5	0.042	13.6	0.746	0.652	10.8	0.053	0.079	<0.050	<0.010	8.79	1.78	0.07
Pu35-28	4	5	B33LM1	4.69	0.136	0.308	0.18	0.079	0.322	10.2	11.6	0.271	13.7	0.545	0.543	11.2	0.262	0.038	<0.050	<0.010	8.15	1.88	0.436
Pu35-30	4	6	B35LM1	4.74	0.398	0.062	0.069	0.08	0.578	10.3	11.7	0.666	14.1	0.275	0.644	11.3	0.05	0.081	<0.050	<0.010	8.22	1.88	0.073
Pu35-26	4	7	B31LM1	4.72	0.374	0.169	0.077	0.33	0.595	10.2	11.6	0.171	13.8	0.522	0.558	11.3	0.161	0.037	<0.050	<0.010	8.22	1.86	0.187
Pu35-34	4	8	B39LM2	4.68	0.327	0.058	0.167	0.076	0.087	10.2	11.6	0.397	13.9	0.772	0.361	11.2	0.051	0.086	<0.050	<0.010	9.06	1.86	0.563

Table D2. Measured Elemental Concentrations (wt %) for Samples Prepared Using Lithium Metaborate (continued)

Glass ID	Block	Seq.	Lab ID	Al (wt %)	Ca (wt %)	Cr (wt %)	Cu (wt %)	Fe (wt %)	Ga (wt %)	Gd (wt %)	Hf (wt %)	K (wt %)	La (wt %)	Mg (wt %)	Na (wt %)	Nd (wt %)	Ni (wt %)	Pb (wt %)	S (wt %)	Se (wt %)	Si (wt %)	Sr (wt %)	Ta (wt %)
Pu35-32	4	9	B37LM1	4.75	0.11	0.058	0.072	0.073	0.675	10.4	11.9	0.184	14.1	0.768	0.515	11.4	0.053	0.083	<0.050	<0.010	8.25	1.88	0.07
Pu35-34	4	10	B39LM1	4.71	0.326	0.065	0.167	0.104	0.087	10.2	11.5	0.396	13.8	0.753	0.36	11.2	0.056	0.084	<0.050	<0.010	9.02	1.85	0.557
Pu35-28	4	11	B33LM2	4.69	0.134	0.302	0.173	0.075	0.315	10.1	11.5	0.27	13.7	0.532	0.547	11.2	0.257	0.037	<0.050	<0.010	8.05	1.82	0.429
Pu35-35	4	12	B40LM2	4.61	0.109	0.066	0.093	0.569	0.307	10.2	11.9	0.038	13.9	0.266	0.67	11.2	0.061	0.081	<0.050	<0.010	8.09	1.82	0.891
Batch 1	4	13	BCHLM42	2.53	0.865	0.075	0.301	8.98	<0.010	0.325	0.149	3.01	0.65	0.859	6.91	0.551	0.535	<0.010	<0.050	<0.010	23.2	0.035	<0.010
LRM	4	14	LRMLM42	4.98	0.351	0.134	0.011	0.914	<0.010	0.006	0.065	1.17	0.012	0.057	14.9	<0.010	0.133	0.081	0.081	<0.010	24.3	<0.010	<0.010
Pu35-31	4	15	B36LM2	4.68	0.11	0.066	0.071	0.587	0.086	10.2	11.4	0.747	14	0.352	0.367	11.4	0.121	0.082	<0.050	<0.010	8.23	1.86	0.069
Pu35-26	4	16	B31LM2	4.59	0.377	0.167	0.077	0.33	0.594	10	11.6	0.171	13.7	0.515	0.565	11.1	0.161	0.036	<0.050	<0.010	8.17	1.78	0.186
Pu35-33	4	17	B38LM2	4.48	0.375	0.302	0.072	0.393	0.086	9.79	11.6	0.042	13.5	0.76	0.639	10.9	0.056	0.08	<0.050	<0.010	8.75	1.78	0.069
Pu35-35	4	18	B40LM1	4.57	0.121	0.06	0.091	0.555	0.307	10	11.8	0.038	13.8	0.269	0.664	11.1	0.059	0.082	<0.050	<0.010	8.06	1.83	0.892
Pu35-32	4	19	B37LM2	4.65	0.109	0.058	0.071	0.074	0.679	10	11.8	0.182	13.8	0.786	0.523	11.2	0.054	0.085	<0.050	<0.010	8.14	1.87	0.07
Pu35-31	4	20	B36LM1	4.68	0.128	0.059	0.072	0.578	0.087	10.1	11.8	0.738	13.8	0.36	0.37	11.2	0.12	0.084	<0.050	<0.010	8.17	1.89	0.07
Pu35-29	4	21	B34LM1	4.65	0.119	0.059	0.084	0.154	0.54	10	11.4	0.553	13.8	0.283	0.699	11.1	0.056	0.039	<0.050	<0.010	8.12	1.87	0.282
Pu35-27	4	22	B32LM2	4.63	0.302	0.304	0.084	0.339	0.23	9.91	11.4	0.335	13.4	0.358	0.48	11	0.058	0.038	<0.050	<0.010	8.04	1.83	0.533
Pu35-30	4	23	B35LM2	4.7	0.398	0.061	0.068	0.076	0.571	10.1	11.6	0.663	13.8	0.273	0.64	11.1	0.05	0.081	<0.050	<0.010	8.16	1.9	0.072
Pu35-29	4	24	B34LM2	4.77	0.122	0.059	0.086	0.155	0.544	10.1	11.4	0.55	13.8	0.282	0.702	11.2	0.054	0.039	<0.050	<0.010	8.17	1.94	0.284
Batch 1	4	25	BCHLM43	2.57	0.866	0.076	0.302	8.63	<0.010	0.328	0.12	3.16	0.655	0.871	7.2	0.551	0.542	<0.010	<0.050	<0.010	23.1	0.035	<0.010
LRM	4	26	LRMLM43	5.06	0.342	0.132	0.011	0.91	<0.010	0.007	0.09	1.23	0.014	0.057	15.5	<0.010	0.132	0.08	0.079	<0.010	24.2	<0.010	<0.010
Batch 1	5	1	BCHLM51	2.61	0.878	0.076	0.305	8.83	<0.010	0.328	0.117	3.16	0.655	0.878	7.34	0.551	0.537	<0.010	<0.050	<0.010	23.5	0.04	<0.010
LRM	5	2	LRMLM51	5.2	0.36	0.137	0.013	0.931	<0.010	0.006	0.01	1.28	0.012	0.057	15.5	<0.010	0.134	0.082	0.088	<0.010	24.8	<0.010	<0.010
Pu35-40	5	3	B45LM2	4.67	0.377	0.217	0.166	0.423	0.313	10.1	11.2	0.341	13.8	0.393	0.487	11.1	0.078	0.079	<0.050	<0.010	8.21	1.86	0.071
Pu35-44	5	4	B49LM2	4.62	0.274	0.161	0.106	0.403	0.245	10	11.4	0.217	13.7	0.475	0.489	11	0.109	0.079	<0.050	<0.010	8.14	1.86	0.437
Pu35-38	5	5	B43LM2	4.58	0.384	0.115	0.078	0.14	0.242	9.87	11.4	0.307	13.5	0.432	0.486	10.8	0.126	0.079	<0.050	<0.010	8.02	1.83	0.422
Pu35-45	5	6	B50LM2	4.53	0.233	0.109	0.107	0.316	0.368	9.79	11.3	0.125	13.4	0.439	0.542	10.8	0.158	0.078	<0.050	<0.010	8.01	1.81	0.552
Pu35-40	5	7	B45LM1	4.58	0.376	0.21	0.166	0.397	0.31	9.91	11.5	0.341	13.6	0.387	0.484	10.9	0.075	0.077	<0.050	<0.010	8.09	1.82	0.07
Pu35-38	5	8	B43LM1	4.67	0.386	0.115	0.079	0.139	0.243	10	11.8	0.314	13.9	0.435	0.492	11	0.126	0.077	<0.050	<0.010	8.22	1.88	0.424
Pu35-36	5	9	B41LM2	4.68	0.115	0.239	0.17	0.101	0.248	10.1	11.8	0.302	13.8	0.522	0.505	11.1	0.229	0.077	<0.050	<0.010	8.21	1.88	0.409
Pu35-44	5	10	B49LM1	4.75	0.282	0.16	0.106	0.4	0.245	10.2	11.8	0.221	14	0.47	0.493	11.2	0.109	0.08	<0.050	<0.010	8.29	1.91	0.433
Pu35-37	5	11	B42LM2	4.71	0.192	0.264	0.078	0.276	0.284	10.1	11.6	0.243	13.8	0.587	0.504	11.1	0.271	0.077	<0.050	<0.010	8.19	1.88	0.282
Pu35-39	5	12	B44LM2	4.72	0.117	0.196	0.077	0.228	0.248	10.1	11.7	0.515	13.8	0.407	0.536	11.1	0.053	0.075	<0.050	<0.010	8.2	1.9	0.398
Batch 1	5	13	BCHLM52	2.62	0.883	0.075	0.3	8.64	<0.010	0.322	0.147	3.19	0.647	0.868	7.21	0.546	0.534	<0.010	<0.050	<0.010	23.2	0.04	<0.010
LRM	5	14	LRMLM52	5.2	0.364	0.134	0.012	0.923	<0.010	0.006	0.066	1.29	0.012	0.056	15.8	<0.010	0.132	0.08	0.081	<0.010	24.6	<0.010	<0.010
Pu35-37	5	15	B42LM1	4.62	0.189	0.253	0.074	0.226	0.282	9.93	11	0.233	13.6	0.597	0.487	10.9	0.267	0.076	<0.050	<0.010	8.08	1.85	0.282
Pu35-43	5	16	B48LM2	4.72	0.331	0.163	0.127	0.401	0.28	10.1	11.6	0.138	13.7	0.39	0.543	11.2	0.149	0.079	<0.050	<0.010	8.22	1.9	0.397
Pu35-45	5	17	B50LM1	4.7	0.233	0.112	0.108	0.321	0.372	10.1	11.5	0.125	13.6	0.445	0.543	11.1	0.161	0.079	<0.050	<0.010	8.12	1.89	0.556
Pu35-42	5	18	B47LM1	4.71	0.181	0.221	0.118	0.131	0.142	10.1	11.6	0.503	13.7	0.639	0.562	11.2	0.109	0.08	<0.050	<0.010	8.22	1.9	0.18
Pu35-43	5	19	B48LM1	4.71	0.329	0.162	0.124	0.402	0.278	10	11.6	0.137	13.6	0.387	0.537	11	0.148	0.078	<0.050	<0.010	8.15	1.88	0.394
Pu35-36	5	20	B41LM1	4.82	0.121	0.242	0.172	0.1	0.252	10.3	12	0.311	14	0.527	0.514	11.3	0.232	0.079	<0.050	<0.010	8.38	1.94	0.412
Pu35-41	5	21	B46LM2	4.8	0.12	0.06	0.117	0.074	0.083	10.2	11.5	0.223	13.7	0.784	0.653	11.1	0.311	0.072	<0.050	<0.010	8.22	1.95	0.07
Pu35-39	5	22	B44LM1	4.85	0.119	0.201	0.079	0.234	0.253	10.3	12	0.525	14	0.42	0.545	11.4	0.054	0.078	<0.050	<0.010	8.41	1.95	0.409
Pu35-42	5	23	B47LM2	4.78	0.186	0.22	0.118	0.131	0.143	10.2	11.7	0.517	13.8	0.638	0.568	11.3	0.114	0.081	<0.050	<0.010	8.29	1.93	0.181
Pu35-41	5	24	B46LM1	4.69	0.116	0.061	0.115	0.076	0.083	10	11.4	0.216	13.6	0.784	0.646	11.1	0.311	0.072	<0.050	<0.010	8.05	1.89	0.07
Batch 1	5	25	BCHLM53	2.57	0.897	0.075	0.303	8.59	<0.010	0.324	0.148	3.18	0.651	0.872	7.27	0.55	0.539	<0.010	<0.050	<0.010	23.1	0.04	<0.010
LRM	5	26	LRMLM53	5.1	0.364	0.135	0.012	0.932	<0.010	0.006	0.07	1.27	0.012	0.057	15.6	<0.010	0.133	0.08	0.088	<0.010	24.3	<0.010	<0.010

Table D2. Measured Elemental Concentrations (wt %) for Samples Prepared Using Lithium Metaborate (continued)

Glass ID	Block	Seq.	Lab ID	Al (wt %)	Ca (wt %)	Cr (wt %)	Cu (wt %)	Fe (wt %)	Ga (wt %)	Gd (wt %)	Hf (wt %)	K (wt %)	La (wt %)	Mg (wt %)	Na (wt %)	Nd (wt %)	Ni (wt %)	Pb (wt %)	S (wt %)	Se (wt %)	Si (wt %)	Sr (wt %)	Ta (wt %)
Batch 1	6	1	BCHLM61	2.6	0.856	0.076	0.3	8.96	<0.010	0.326	0.118	3.08	0.653	0.879	7.07	0.548	0.537	<0.010	<0.050	<0.010	23.7	0.035	<0.010
LRM	6	2	LRMLM61	5.17	0.35	0.136	0.012	0.925	<0.010	0.005	0.013	1.25	0.012	0.057	15.3	<0.010	0.134	0.08	0.081	<0.010	24.9	<0.010	<0.010
Pu35-53	6	3	B58LM2	4.87	0.174	0.113	0.11	0.128	0.144	10.4	10.8	0.297	14.4	0.372	0.579	11.4	0.106	0.074	<0.050	<0.010	8.46	1.98	0.617
Pu35-51	6	4	B56LM2	4.9	0.169	0.21	0.102	0.393	0.144	10.4	11.3	0.174	14.4	0.538	0.556	11.3	0.212	0.077	<0.050	<0.010	8.49	1.99	0.269
Pu35-48	6	5	B53LM2	4.83	0.33	0.154	0.1	0.351	0.274	10.3	11.4	0.614	13.9	0.475	0.563	11.2	0.141	0.081	<0.050	<0.010	8.28	1.96	0.265
Pu35-47	6	6	B52LM1	4.84	0.352	0.222	0.13	0.131	0.168	10.4	11.9	0.166	14.2	0.369	0.544	11.3	0.211	0.078	<0.050	<0.010	8.45	1.95	0.673
Pu35-54	6	7	B59LM1	4.83	0.255	0.185	0.12	0.295	0.323	10.3	10.9	0.394	14.3	0.477	0.532	11.3	0.115	0.031	<0.050	<0.010	8.42	1.97	0.368
Pu35-53	6	8	B58LM1	4.83	0.171	0.115	0.106	0.129	0.142	10.3	11	0.276	14.3	0.376	0.596	11.3	0.113	0.077	<0.050	<0.010	8.35	1.96	0.621
Pu35-52	6	9	B57LM2	4.81	0.177	0.209	0.119	0.279	0.447	10.1	10.6	0.251	14	0.482	0.549	11.2	0.163	0.078	<0.050	<0.010	8.26	1.96	0.119
Pu35-49	6	10	B54LM2	4.91	0.294	0.125	0.124	0.365	0.166	10.3	11.5	0.41	14.2	0.462	0.497	11.4	0.147	0.077	<0.050	<0.010	8.47	1.99	0.226
Pu35-50	6	11	B55LM1	4.88	0.25	0.161	0.094	0.352	0.26	10.3	11.5	0.498	14.1	0.393	0.51	11.2	0.165	0.075	<0.050	<0.010	8.36	1.99	0.151
Pu35-54	6	12	B59LM2	4.95	0.256	0.185	0.121	0.294	0.326	10.5	11.1	0.399	14.5	0.478	0.532	11.5	0.116	0.032	<0.050	<0.010	8.59	2.03	0.371
Batch 1	6	13	BCHLM62	2.66	0.858	0.076	0.3	9.02	<0.010	0.234	0.122	3.22	0.466	0.852	7.09	0.422	0.535	<0.010	<0.050	<0.010	24	0.023	<0.010
LRM	6	14	LRMLM62	5.4	0.342	0.137	0.011	0.938	<0.010	0.005	0.079	1.32	0.012	0.058	15.5	<0.010	0.134	0.081	0.082	<0.010	25.6	<0.010	<0.010
Pu35-46	6	15	B51LM1	4.87	0.188	0.111	0.126	0.133	0.423	10.4	11.6	0.287	14.2	0.44	0.471	11.3	0.213	0.079	<0.050	<0.010	8.43	1.99	0.367
Pu35-46	6	16	B51LM2	4.95	0.189	0.109	0.128	0.147	0.422	10.5	11.9	0.294	14.3	0.432	0.48	11.5	0.209	0.076	<0.050	<0.010	8.52	2.03	0.364
Pu35-49	6	17	B54LM1	4.91	0.295	0.122	0.124	0.36	0.168	10.4	11.5	0.434	14.3	0.453	0.488	11.4	0.142	0.08	<0.050	<0.010	8.52	2	0.222
Pu35-52	6	18	B57LM1	4.91	0.178	0.211	0.119	0.28	0.448	10.5	11	0.258	14.5	0.485	0.554	11.4	0.163	0.077	<0.050	<0.010	8.52	2	0.122
Pu35-55	6	19	B60LM2	4.88	0.229	0.152	0.108	0.262	0.264	10.4	11.2	0.327	14.4	0.503	0.54	11.4	0.14	0.078	<0.050	<0.010	8.59	1.98	0.316
Pu35-51	6	20	B56LM1	4.86	0.17	0.21	0.1	0.397	0.144	10.3	11.5	0.18	14.2	0.545	0.578	11.3	0.214	0.078	<0.050	<0.010	8.38	1.97	0.269
Pu35-50	6	21	B55LM2	4.9	0.245	0.161	0.094	0.344	0.26	10.3	11.4	0.509	14.2	0.392	0.495	11.3	0.162	0.076	<0.050	<0.010	8.35	2.01	0.15
Pu35-48	6	22	B53LM1	4.86	0.329	0.15	0.099	0.345	0.271	10.2	11.6	0.192	13.8	0.464	0.546	11.3	0.136	0.079	<0.050	<0.010	8.28	2.01	0.276
Pu35-55	6	23	B60LM1	5.02	0.242	0.153	0.113	0.263	0.27	10.5	11.4	0.346	14.6	0.508	0.567	11.7	0.142	0.077	<0.050	<0.010	8.64	2.06	0.321
Pu35-47	6	24	B52LM2	4.83	0.364	0.21	0.129	0.125	0.165	10	11.6	0.176	13.6	0.351	0.557	11.1	0.198	0.071	<0.050	<0.010	8.27	2	0.65
Batch 1	6	25	BCHLM63	2.64	0.863	0.076	0.299	8.76	<0.010	0.146	0.086	3.25	0.291	0.827	7.1	0.303	0.529	<0.010	<0.050	<0.010	23.8	0.011	<0.010
LRM	6	26	LRMLM63	5.38	0.345	0.136	0.011	0.926	<0.010	0.005	0.071	1.36	0.011	0.057	15.8	<0.010	0.133	0.08	0.086	<0.010	25.2	<0.010	<0.010

Table D3. Measured Elemental Concentrations (wt %) for Samples Prepared Using Peroxide Fusion

Glass ID	Block	Sequence	Lab ID	B (wt%)
Batch 1	1	1	BCHPF11	2.48
LRM	1	2	LRMPF11	2.46
Pu35-05	1	3	B10PF1	3.58
Pu04-01	1	4	B01PF1	3.68
Pu04-01	1	5	B01PF2	3.65
Pu04-02	1	6	B02PF2	3.64
Pu04-04	1	7	B04PF2	3.71
Pu35-02	1	8	B07PF1	3.62
Pu35-01	1	9	B06PF1	3.52
Pu35-01	1	10	B06PF2	3.47
Pu04-04	1	11	B04PF1	3.66
Pu04-05	1	12	B05PF1	3.67
Batch 1	1	13	BCHPF12	2.44
LRM	1	14	LRMPF12	2.47
Pu35-02	1	15	B07PF2	3.69
Pu04-03	1	16	B03PF1	3.59
Pu35-05	1	17	B10PF2	3.55
Pu04-05	1	18	B05PF2	3.7
Pu35-03	1	19	B08PF2	3.61
Pu35-04	1	20	B09PF1	3.58
Pu04-02	1	21	B02PF1	3.71
Pu35-03	1	22	B08PF1	3.67
Pu04-03	1	23	B03PF2	3.65
Pu35-04	1	24	B09PF2	3.59
Batch 1	1	25	BCHPF13	2.46
LRM	1	26	LRMPF13	2.45
Batch 1	2	1	BCHPF21	2.47
LRM	2	2	LRMPF11	2.4
Pu35-12	2	3	B17PF2	3.53
Pu35-11	2	4	B16PF1	3.51
Pu35-12	2	5	B17PF1	3.49
Pu35-08	2	6	B13PF2	3.49
Pu35-10	2	7	B15PF1	3.45
Pu35-15	2	8	B20PF2	3.4
Pu35-10	2	9	B15PF2	3.45
Pu35-14	2	10	B19PF1	3.38
Pu35-11	2	11	B16PF2	3.41
Pu35-09	2	12	B14PF1	3.43
Batch 1	2	13	BCHPF21	2.29
LRM	2	14	LRMPF21	2.34
Pu35-09	2	15	B14PF2	3.46
Pu35-07	2	16	B12PF1	3.37
Pu35-08	2	17	B13PF1	3.38
Pu35-13	2	18	B18PF2	3.42
Pu35-06	2	19	B11PF1	3.41
Pu35-06	2	20	B11PF2	3.4
Pu35-07	2	21	B12PF2	3.45
Pu35-13	2	22	B18PF1	3.4
Pu35-15	2	23	B20PF1	3.35
Pu35-14	2	24	B19PF2	3.35
Batch 1	2	25	BCHPF23	2.29
LRM	2	26	LRMPF23	2.34
Batch 1	3	1	BCHPF31	2.48
LRM	3	2	LRMPF31	2.43
Pu35-16	3	3	B21PF1	3.52
Pu35-25	3	4	B30PF1	3.47
Pu35-19	3	5	B24PF1	3.46
Pu35-21	3	6	B26PF2	3.46
Pu35-23	3	7	B28PF1	3.5
Pu35-22	3	8	B27PF1	3.46
Pu35-21	3	9	B26PF1	3.46
Pu35-18	3	10	B23PF2	3.43
Pu35-20	3	11	B25PF2	3.42
Pu35-25	3	12	B30PF2	3.47

Table D3. Measured Elemental Concentrations (wt %) for Samples Prepared Using Peroxide Fusion (continued)

Glass ID	Block	Sequence	Lab ID	B (wt%)
Batch 1	3	13	BCHPF32	2.43
LRM	3	14	LRMPF32	2.41
Pu35-18	3	15	B23PF1	3.6
Pu35-24	3	16	B29PF1	3.54
Pu35-16	3	17	B21PF2	3.53
Pu35-17	3	18	B22PF1	3.55
Pu35-20	3	19	B25PF1	3.52
Pu35-17	3	20	B22PF2	3.53
Pu35-23	3	21	B28PF2	3.55
Pu35-24	3	22	B29PF2	3.55
Pu35-22	3	23	B27PF2	3.56
Pu35-19	3	24	B24PF2	3.52
Batch 1	3	25	BCHPF33	2.38
LRM	3	26	LRMPF33	2.42
Batch 1	4	1	BCHPF41	2.52
LRM	4	2	LRMPF41	2.44
Pu35-29	4	3	B34PF2	3.48
Pu35-26	4	4	B31PF2	3.44
Pu35-28	4	5	B33PF2	3.51
Pu35-33	4	6	B38PF2	3.38
Pu35-29	4	7	B34PF1	3.53
Pu35-32	4	8	B37PF2	3.39
Pu35-30	4	9	B35PF2	3.41
Pu35-32	4	10	B37PF1	3.55
Pu35-34	4	11	B39PF2	3.39
Pu35-34	4	12	B39PF1	3.39
Batch 1	4	13	BCHPF42	2.38
LRM	4	14	LRMPF42	2.34
Pu35-35	4	15	B40PF1	3.46
Pu35-31	4	16	B36PF1	3.43
Pu35-30	4	17	B35PF1	3.43
Pu35-31	4	18	B36PF2	3.39
Pu35-27	4	19	B32PF1	3.47
Pu35-33	4	20	B38PF1	3.38
Pu35-27	4	21	B32PF2	3.47
Pu35-26	4	22	B31PF1	3.53
Pu35-35	4	23	B40PF2	3.53
Pu35-28	4	24	B33PF1	3.56
Batch 1	4	25	BCHPF43	2.4
LRM	4	26	LRMPF43	2.47
Batch 1	5	1	BCHPF51	2.42
LRM	5	2	LRMPF51	2.41
Pu35-41	5	3	B46PF2	3.54
Pu35-39	5	4	B44PF1	3.44
Pu35-40	5	5	B45PF1	3.45
Pu35-42	5	6	B47PF1	3.38
Pu35-41	5	7	B46PF1	3.4
Pu35-44	5	8	B49PF2	3.46
Pu35-38	5	9	B43PF2	3.44
Pu35-40	5	10	B45PF2	3.42
Pu35-36	5	11	B41PF1	3.44
Pu35-37	5	12	B42PF1	3.41
Batch 1	5	13	BCHPF52	2.31
LRM	5	14	LRMPF52	2.35
Pu35-45	5	15	B50PF2	3.53
Pu35-43	5	16	B48PF2	3.52
Pu35-39	5	17	B44PF2	3.4
Pu35-42	5	18	B47PF2	3.4
Pu35-38	5	19	B43PF1	3.4
Pu35-45	5	20	B50PF1	3.41
Pu35-36	5	21	B41PF2	3.42
Pu35-37	5	22	B42PF2	3.42
Pu35-44	5	23	B49PF1	3.33
Pu35-43	5	24	B48PF1	3.38
Batch 1	5	25	BCHPF53	2.31
LRM	5	26	LRMPF53	2.34

Table D3. Measured Elemental Concentrations (wt %) for Samples Prepared Using Peroxide Fusion (continued)

Glass ID	Block	Sequence	Lab ID	B (wt%)
Batch 1	6	1	BCHPF61	2.48
LRM	6	2	LRMPF61	2.51
Pu35-54	6	3	B59PF1	3.63
Pu35-48	6	4	B53PF1	3.6
Pu35-55	6	5	B60PF2	3.65
Pu35-53	6	6	B58PF2	3.57
Pu35-49	6	7	B54PF1	3.56
Pu35-50	6	8	B55PF1	3.58
Pu35-54	6	9	B59PF2	3.56
Pu35-47	6	10	B52PF2	3.53
Pu35-49	6	11	B54PF2	3.55
Pu35-48	6	12	B53PF2	3.53
Batch 1	6	13	BCHPF62	2.41
LRM	6	14	LRMPF62	2.4
Pu35-55	6	15	B60PF1	3.7
Pu35-50	6	16	B55PF2	3.59
Pu35-46	6	17	B51PF1	3.53
Pu35-51	6	18	B56PF2	3.58
Pu35-51	6	19	B56PF1	3.57
Pu35-46	6	20	B51PF2	3.58
Pu35-53	6	21	B58PF1	3.62
Pu35-47	6	22	B52PF1	3.55
Pu35-52	6	23	B57PF1	3.58
Pu35-52	6	24	B57PF2	3.55
Batch 1	6	25	BCHPF63	2.41
LRM	6	26	LRMPF63	2.4

Table D4. Measured Elemental Concentrations (wt %) for Samples Prepared for Analysis by IC

Glass ID	Block	Sequence	Lab ID	F (wt %) ar	Cl (wt %) ar
LRM	1	1	LRMIC11	0.84	<0.100
Pu04-02	1	2	B02IC2	0.016	0.025
Pu35-01	1	3	B06IC1	0	0.059
Pu04-01	1	4	B01IC2	0	0.012
Pu35-05	1	5	B10IC1	0	0.048
Pu35-03	1	6	B08IC2	0	0.137
Pu04-03	1	7	B03IC1	0	0.009
Pu35-04	1	8	B09IC2	0.09	0.035
Pu04-04	1	9	B04IC2	0	0.041
Pu35-03	1	10	B08IC1	0	0.142
Pu35-04	1	11	B09IC1	0.092	0.027
LRM	1	12	LRMIC12	0.818	<0.100
Pu04-04	1	13	B04IC1	0	0.034
Pu04-01	1	14	B01IC1	0	0.01
Pu35-02	1	15	B07IC2	0.07	0.018
Pu04-02	1	16	B02IC1	0.024	0.011
Pu04-03	1	17	B03IC2	0	0.011
Pu35-02	1	18	B07IC1	0.079	0.019
Pu35-01	1	19	B06IC2	0	0.056
Pu04-05	1	20	B05IC1		
Pu04-05	1	21	B05IC2	0.027	0.012
Pu35-05	1	22	B10IC2	0	0.038
LRM	1	23	LRMIC13	0.819	<0.100
LRM	2	1	LRMIC21	0.812	<0.100
Pu35-08	2	2	B13IC1	0.071	0.05
Pu35-12	2	3	B17IC2	0.055	0.042
Pu35-11	2	4	B16IC1	0.011	0.042
Pu35-13	2	5	B18IC1	0.012	0.055
Pu35-09	2	6	B14IC2	0	0.048
Pu35-14	2	7	B19IC1	0.017	0.058
Pu35-10	2	8	B15IC1	0.048	0.047
Pu35-11	2	9	B16IC2	0.014	0.052
Pu35-06	2	10	B11IC2	0.077	0.034
Pu35-07	2	11	B12IC1	0.04	0.051
LRM	2	12	LRMIC22	0.812	<0.100
Pu35-07	2	13	B12IC2	0.051	0.053
Pu35-13	2	14	B18IC2	0.012	0.055
Pu35-15	2	15	B20IC2	0	0.055
Pu35-15	2	16	B20IC1	0	0.068
Pu35-08	2	17	B13IC2	0.071	0.042
Pu35-10	2	18	B15IC2	0.083	0.054
Pu35-12	2	19	B17IC1	0.053	0.039
Pu35-14	2	20	B19IC2	0.014	0.059
Pu35-09	2	21	B14IC1	0	0.05
Pu35-06	2	22	B11IC1	0.089	0.035
LRM	2	23	LRMIC23	0.806	<0.100
LRM	3	1	LRMIC31	0.811	<0.100
Pu35-24	3	2	B29IC2	0.033	0.073
Pu35-20	3	3	B25IC2	0.04	0.048
Pu35-16	3	4	B21IC2	0	0.036
Pu35-23	3	5	B28IC1		
Pu35-23	3	6	B28IC2	0.011	0.063
Pu35-25	3	7	B30IC1	0	0.083
Pu35-18	3	8	B23IC2	0	0.033
Pu35-21	3	9	B26IC2	0	0.039
Pu35-20	3	10	B25IC1	0.04	0.049
Pu35-22	3	11	B27IC2	0.091	0.049
LRM	3	12	LRMIC32	0.811	<0.100
Pu35-22	3	13	B27IC1	0.099	0.062
Pu35-21	3	14	B26IC1	0	0.087
Pu35-18	3	15	B23IC1	0	0.033
Pu35-19	3	16	B24IC1	0.077	0.056
Pu35-17	3	17	B22IC2	0	0.067
Pu35-19	3	18	B24IC2	0.075	0.047

Table D4. Measured Elemental Concentrations (wt %) for Samples Prepared for Analysis by IC (continued)

Glass ID	Block	Sequence	Lab ID	F (wt %) ar	Cl (wt %) ar
Pu35-24	3	19	B29IC1	0.029	0.037
Pu35-25	3	20	B30IC2	0	0.064
Pu35-16	3	21	B21IC1	0	0.049
Pu35-17	3	22	B22IC1	0	0.051
LRM	3	23	LRMIC33	0.809	<0.100
LRM	4	1	LRMIC41	0.812	<0.100
Pu35-28	4	2	B33IC2	0.03	0.082
Pu35-28	4	3	B33IC1	0.039	0.064
Pu35-32	4	4	B37IC2	0.073	0.04
Pu35-26	4	5	B31IC1	0.032	0.047
Pu35-27	4	6	B32IC2	0.062	0.049
Pu35-35	4	7	B40IC1	0.016	0.051
Pu35-34	4	8	B39IC1	0	0.059
Pu35-30	4	9	B35IC2	0	0.032
Pu35-29	4	10	B34IC2	0.115	0.063
Pu35-32	4	11	B37IC1	0.076	0.043
LRM	4	12	LRMIC42	0.821	<0.100
Pu35-30	4	13	B35IC1	0	0.034
Pu35-34	4	14	B39IC2	0.014	0.044
Pu35-33	4	15	B38IC2	0.044	0.047
Pu35-35	4	16	B40IC2	0.016	0.046
Pu35-26	4	17	B31IC2	0.033	0.048
Pu35-27	4	18	B32IC1	0.048	0.09
Pu35-31	4	19	B36IC2	0.114	0.037
Pu35-31	4	20	B36IC1	0.104	0.04
Pu35-29	4	21	B34IC1	0.117	0.058
Pu35-33	4	22	B38IC1	0.04	0.04
LRM	4	23	LRMIC43	0.824	<0.100
LRM	5	1	LRMIC51	0.809	<0.100
Pu35-39	5	2	B44IC1	0	0.05
Pu35-43	5	3	B48IC1	0.021	0.042
Pu35-36	5	4	B41IC1	0	0.061
Pu35-45	5	5	B50IC2	0	0.048
Pu35-40	5	6	B45IC2	0	0.077
Pu35-44	5	7	B49IC1	0	0.046
Pu35-41	5	8	B46IC2	0	0.082
Pu35-37	5	9	B42IC1	0	0.046
Pu35-42	5	10	B47IC1	0	0.034
Pu35-38	5	11	B43IC2	0.037	0.051
LRM	5	12	LRMIC52	0.805	<0.100
Pu35-36	5	13	B41IC2	0.02	0.051
Pu35-44	5	14	B49IC2	0.011	0.049
Pu35-42	5	15	B47IC2	0	0.035
Pu35-43	5	16	B48IC2	0.033	0.043
Pu35-37	5	17	B42IC2	0	0.043
Pu35-40	5	18	B45IC1	0	0.061
Pu35-38	5	19	B43IC1	0.029	0.055
Pu35-45	5	20	B50IC1	0	0.047
Pu35-41	5	21	B46IC1	0	0.063
Pu35-39	5	22	B44IC2	0	0.056
LRM	5	23	LRMIC53	0.813	<0.100
LRM	6	1	LRMIC61	0.815	<0.100
Pu35-48	6	2	B53IC1	0.037	0.054
Pu35-55	6	3	B60IC2	0.044	0.055
Pu35-46	6	4	B51IC1	0.06	0.075
Pu35-47	6	5	B52IC1	0.028	0.055
Pu35-55	6	6	B60IC1	0.05	0.078
Pu35-51	6	7	B56IC2	0.04	0.047
Pu35-51	6	8	B56IC1	0.041	0.056
Pu35-54	6	9	B59IC1	0.083	0.053
Pu35-49	6	10	B54IC2	0.054	0.054
Pu35-52	6	11	B57IC2	0.023	0.061
LRM	6	12	LRMIC62	0.822	<0.100
Pu35-53	6	13	B58IC1	0.048	0.054
Pu35-47	6	14	B52IC2	0.025	0.046
Pu35-52	6	15	B57IC1	0.028	0.043

Table D4. Measured Elemental Concentrations (wt %) for Samples Prepared for Analysis by IC (continued)

Glass ID	Block	Sequence	Lab ID	F (wt %) ar	Cl (wt %) ar
Pu35-48	6	16	B53IC2	0.036	0.058
Pu35-50	6	17	B55IC2	0.043	0.081
Pu35-46	6	18	B51IC2	0.068	0.054
Pu35-53	6	19	B58IC2	0.048	0.057
Pu35-49	6	20	B54IC1	0.028	0.059
Pu35-54	6	21	B59IC2	0.041	0.076
Pu35-50	6	22	B55IC1	0.041	0.058
LRM	6	23	LRMIC63	0.812	<0.100

Table D5. Average Measured and Bias-Corrected Chemical Compositions Versus Targeted Compositions by Oxide by Study Glass

Glass ID	Oxide	Measured (wt %)	Measured Bias-Corrected (wt %)	Targeted (wt %)	Diff of Measured	Diff of Meas BC	% Diff of Measured	% Diff of Meas BC
Batch 1	Al_2O_3 (wt %)	4.9389	4.8770	4.8770	0.0619	0.0000	1.3%	0.0%
Batch 1	B_2O_3 (wt %)	7.7564	7.7770	7.7770	-0.0206	0.0000	-0.3%	0.0%
Batch 1	CaO (wt %)	1.2234	1.2200	1.2200	0.0034	0.0000	0.3%	0.0%
Batch 1	Cl (wt %)				0.0000	0.0000		
Batch 1	Cr_2O_3 (wt %)	0.1099	0.1070	0.1070	0.0029	0.0000	2.7%	0.0%
Batch 1	CuO (wt %)	0.3788	0.3990	0.3990	-0.0202	0.0000	-5.1%	0.0%
Batch 1	F (wt %)				0.0000	0.0000		
Batch 1	Fe_2O_3 (wt %)	12.6314	12.8390	12.8390	-0.2076	0.0000	-1.6%	0.0%
Batch 1	Ga_2O_3 (wt %)	0.0067	0.0067	0.0000				
Batch 1	Gd_2O_3 (wt %)	0.3579	0.3579	0.0000	0.3579	0.3579		
Batch 1	HfO_2 (wt %)	0.1502	0.1502	0.0000	0.1502	0.1502		
Batch 1	K_2O (wt %)	3.8099	3.3270	3.3270	0.4829	0.0000	14.5%	0.0%
Batch 1	La_2O_3 (wt %)	0.7279	0.7279	0.0000	0.7279	0.7279		
Batch 1	MgO (wt %)	1.4318	1.4190	1.4190	0.0128	0.0000	0.9%	0.0%
Batch 1	Na_2O (wt %)	9.7513	9.0030	9.0030	0.7483	0.0000	8.3%	0.0%
Batch 1	Nd_2O_3 (wt %)	0.6145	0.6145	0.1470	0.4675	0.4675	318.0%	318.0%
Batch 1	NiO (wt %)	0.6790	0.7510	0.7510	-0.0720	0.0000	-9.6%	0.0%
Batch 1	PbO (wt %)	0.0054	0.0054	0.0000	0.0054	0.0054		
Batch 1	SeO_2 (wt %)	0.0070	0.0070	0.0000	0.0070	0.0070		
Batch 1	Si_2O_3 (wt %)	50.4518	50.2200	50.2200	0.2318	0.0000	0.5%	0.0%
Batch 1	SO_4 (wt %)	0.0749	0.0749	0.0000	0.0749	0.0749		
Batch 1	SrO (wt %)	0.0404	0.0404	0.0000	0.0404	0.0404		
Batch 1	Ta_2O_5 (wt %)	0.0061	0.0061	0.0000	0.0061	0.0061		
Batch 1	Sum (wt %)	95.1536	93.9301	92.0860	3.0676	1.8441	3.3%	2.0%
LRM	Al_2O_3 (wt %)	9.8013	9.6783	10.0000	-0.1987	-0.3217	-2.0%	-3.2%
LRM	B_2O_3 (wt %)	7.7600	7.7811	8.0000	-0.2400	-0.2189	-3.0%	-2.7%
LRM	CaO (wt %)	0.4949	0.4935	0.5000	-0.0051	-0.0065	-1.0%	-1.3%
LRM	Cl (wt %)	0.0500	0.0500	0.8000	-0.7500	-0.7500	-93.8%	-93.8%
LRM	Cr_2O_3 (wt %)	0.1963	0.1912	0.2000	-0.0037	-0.0088	-1.8%	-4.4%
LRM	CuO (wt %)	0.0137	0.0144	0.0000	0.0137	0.0144		
LRM	F (wt %)	0.8151	1.0000	1.0000	-0.1849	0.0000	-18.5%	0.0%
LRM	Fe_2O_3 (wt %)	1.3124	1.3346	1.0000	0.3124	0.3346	31.2%	33.5%
LRM	Ga_2O_3 (wt %)	0.0067	0.0067	0.0000	0.0067	0.0067		
LRM	Gd_2O_3 (wt %)	0.0063	0.0063	0.0000	0.0063	0.0063		
LRM	HfO_2 (wt %)	0.0567	0.0567	0.0000	0.0567	0.0567		
LRM	K_2O (wt %)	1.5258	1.3323	1.5000	0.0258	-0.1677	1.7%	-11.2%
LRM	La_2O_3 (wt %)	0.0136	0.0136	0.0000	0.0136	0.0136		
LRM	MgO (wt %)	0.0933	0.0925	0.1000	-0.0067	-0.0075	-6.7%	-7.5%
LRM	Na_2O (wt %)	21.0513	19.4381	20.0000	1.0513	-0.5619	5.3%	-2.8%
LRM	Nd_2O_3 (wt %)	0.0058	0.0058	0.0000	0.0058	0.0058		
LRM	NiO (wt %)	0.1680	0.1859	0.1000	0.0680	0.0859	68.0%	85.9%
LRM	PbO (wt %)	0.0864	0.0864	0.1000	-0.0136	-0.0136	-13.6%	-13.6%
LRM	SeO_2 (wt %)	0.0070	0.0070	0.0000	0.0070	0.0070		
LRM	Si_2O_3 (wt %)	53.1141	52.8695	54.3700	-1.2559	-1.5005	-2.3%	-2.8%
LRM	SO_4 (wt %)	0.2448	0.2448	0.2400	0.0048	0.0048	2.0%	2.0%
LRM	SrO (wt %)	0.0059	0.0059	0.0000	0.0059	0.0059		
LRM	Ta_2O_5 (wt %)	0.0061	0.0061	0.0000	0.0061	0.0061		
LRM	Sum (wt %)	96.8356	94.9009	97.9100	-1.0744	-3.0091	-1.1%	-3.1%
Pu04-01	Al_2O_3 (wt %)	9.5231	9.3698	8.6000	0.9231	0.7698	10.7%	9.0%
Pu04-01	B_2O_3 (wt %)	11.8009	11.5865	11.1800	0.6209	0.4065	5.6%	3.6%
Pu04-01	CaO (wt %)	0.0686	0.0674	0.0000	0.0686	0.0674		
Pu04-01	Cl (wt %)	0.0110	0.0110	0.1200	-0.1090	-0.1090	-90.8%	-90.8%
Pu04-01	Cr_2O_3 (wt %)	0.0146	0.0147	0.0000	0.0146	0.0147		
Pu04-01	CuO (wt %)	0.0294	0.0312	0.0000	0.0294	0.0312		
Pu04-01	F (wt %)	0.0000	0.0000	0.0000	0.0000	0.0000		
Pu04-01	Fe_2O_3 (wt %)	0.0536	0.0540	0.0000	0.0536	0.0540		

Table D5. Average Measured and Bias-Corrected Chemical Compositions Versus Targeted Compositions by Oxide by Study Glass (continued)

Glass ID	Oxide	Measured (wt %)	Measured Bias-Corrected (wt %)	Targeted (wt %)	Diff of Measured	Diff of Meas BC	% Diff of Measured	% Diff of Meas BC
Pu04-01	Ga_2O_3 (wt %)	0.0370	0.0370	0.0000	0.0370	0.0370		
Pu04-01	Gd_2O_3 (wt %)	12.1599	12.1599	11.6100	0.5499	0.5499	4.7%	4.7%
Pu04-01	HfO_2 (wt %)	14.5054	14.5054	19.4500	-4.9446	-4.9446	-25.4%	-25.4%
Pu04-01	K_2O (wt %)	0.1915	0.1674	0.2100	-0.0185	-0.0426	-8.8%	-20.3%
Pu04-01	La_2O_3 (wt %)	16.8883	16.8883	16.3400	0.5483	0.5483	3.4%	3.4%
Pu04-01	MgO (wt %)	0.0083	0.0085	0.0000	0.0083	0.0085		
Pu04-01	Na_2O (wt %)	0.2851	0.2605	0.2400	0.0451	0.0205	18.8%	8.5%
Pu04-01	Nd_2O_3 (wt %)	13.6469	13.6469	12.9000	0.7469	0.7469	5.8%	5.8%
Pu04-01	NiO (wt %)	0.0064	0.0073	0.0000	0.0064	0.0073		
Pu04-01	PbO (wt %)	0.0388	0.0388	0.0000	0.0388	0.0388		
Pu04-01	SeO_2 (wt %)	0.0070	0.0070	0.0000	0.0070	0.0070		
Pu04-01	Si_2O_3 (wt %)	18.6333	18.3788	17.2000	1.4333	1.1788	8.3%	6.9%
Pu04-01	SO_4 (wt %)	0.0749	0.0749	0.0000	0.0749	0.0749		
Pu04-01	SrO (wt %)	2.3356	2.3356	2.1500	0.1856	0.1856	8.6%	8.6%
Pu04-01	Ta_2O_5 (wt %)	0.0183	0.0183	0.0000	0.0183	0.0183		
Pu04-01	Sum (wt %)	100.3380	99.6693	100.0000	0.3380	-0.3307	0.3%	-0.3%
Pu04-02	Al_2O_3 (wt %)	9.4192	9.2675	8.6000	0.8192	0.6675	9.5%	7.8%
Pu04-02	B_2O_3 (wt %)	11.8331	11.6181	11.1800	0.6531	0.4381	5.8%	3.9%
Pu04-02	CaO (wt %)	0.0763	0.0749	0.0000	0.0763	0.0749		
Pu04-02	Cl (wt %)	0.0180	0.0180	0.0000	0.0180	0.0180		
Pu04-02	Cr_2O_3 (wt %)	0.0088	0.0088	0.0000	0.0088	0.0088		
Pu04-02	CuO (wt %)	0.0294	0.0312	0.0000	0.0294	0.0312		
Pu04-02	F (wt %)	0.0200	0.0242	0.1200	-0.1000	-0.0958	-83.3%	-79.8%
Pu04-02	Fe_2O_3 (wt %)	0.0329	0.0331	0.0000	0.0329	0.0331		
Pu04-02	Ga_2O_3 (wt %)	0.0370	0.0370	0.0000	0.0370	0.0370		
Pu04-02	Gd_2O_3 (wt %)	12.0447	12.0447	11.6100	0.4347	0.4347	3.7%	3.7%
Pu04-02	HfO_2 (wt %)	14.6823	14.6823	19.4300	-4.7477	-4.7477	-24.4%	-24.4%
Pu04-02	K_2O (wt %)	0.0699	0.0611	0.0700	-0.0001	-0.0089	-0.2%	-12.8%
Pu04-02	La_2O_3 (wt %)	16.7124	16.7124	16.3400	0.3724	0.3724	2.3%	2.3%
Pu04-02	MgO (wt %)	0.0688	0.0707	0.0800	-0.0112	-0.0093	-14.0%	-11.7%
Pu04-02	Na_2O (wt %)	0.4145	0.3787	0.3200	0.0945	0.0587	29.5%	18.3%
Pu04-02	Nd_2O_3 (wt %)	13.4136	13.4136	12.9000	0.5136	0.5136	4.0%	4.0%
Pu04-02	NiO (wt %)	0.0064	0.0073	0.0000	0.0064	0.0073		
Pu04-02	PbO (wt %)	0.0377	0.0377	0.0000	0.0377	0.0377		
Pu04-02	SeO_2 (wt %)	0.0070	0.0070	0.0000	0.0070	0.0070		
Pu04-02	Si_2O_3 (wt %)	18.7296	18.4738	17.2000	1.5296	1.2738	8.9%	7.4%
Pu04-02	SO_4 (wt %)	0.0749	0.0749	0.0000	0.0749	0.0749		
Pu04-02	SrO (wt %)	2.3120	2.3120	2.1500	0.1620	0.1620	7.5%	7.5%
Pu04-02	Ta_2O_5 (wt %)	0.0189	0.0189	0.0000	0.0189	0.0189		
Pu04-02	Sum (wt %)	100.0672	99.4079	100.0000	0.0672	-0.5921	0.1%	-0.6%
Pu04-03	Al_2O_3 (wt %)	9.4192	9.2675	8.6000	0.8192	0.6675	9.5%	7.8%
Pu04-03	B_2O_3 (wt %)	11.6560	11.4442	11.1800	0.4760	0.2642	4.3%	2.4%
Pu04-03	CaO (wt %)	0.0658	0.0646	0.0000	0.0658	0.0646		
Pu04-03	Cl (wt %)	0.0100	0.0100	0.0600	-0.0500	-0.0500	-83.3%	-83.3%
Pu04-03	Cr_2O_3 (wt %)	0.0080	0.0081	0.0000	0.0080	0.0081		
Pu04-03	CuO (wt %)	0.0307	0.0325	0.0000	0.0307	0.0325		
Pu04-03	F (wt %)	0.0000	0.0000	0.0600	-0.0600	-0.0600	-100.0%	-100.0%
Pu04-03	Fe_2O_3 (wt %)	0.1801	0.1815	0.1700	0.0101	0.0115	6.0%	6.8%
Pu04-03	Ga_2O_3 (wt %)	0.0376	0.0376	0.0000	0.0376	0.0376		
Pu04-03	Gd_2O_3 (wt %)	12.1599	12.1599	11.6100	0.5499	0.5499	4.7%	4.7%
Pu04-03	HfO_2 (wt %)	14.9771	14.9771	19.4200	-4.4429	-4.4429	-22.9%	-22.9%
Pu04-03	K_2O (wt %)	0.0060	0.0053	0.0000	0.0060	0.0053		
Pu04-03	La_2O_3 (wt %)	16.8297	16.8297	16.3400	0.4897	0.4897	3.0%	3.0%
Pu04-03	MgO (wt %)	0.1476	0.1515	0.1600	-0.0124	-0.0085	-7.8%	-5.3%
Pu04-03	Na_2O (wt %)	0.2042	0.1866	0.1600	0.0442	0.0266	27.6%	16.6%
Pu04-03	Nd_2O_3 (wt %)	13.5886	13.5886	12.9000	0.6886	0.6886	5.3%	5.3%
Pu04-03	NiO (wt %)	0.0064	0.0073	0.0000	0.0064	0.0073		
Pu04-03	PbO (wt %)	0.0377	0.0377	0.0000	0.0377	0.0377		

Table D5. Average Measured and Bias-Corrected Chemical Compositions Versus Targeted Compositions by Oxide by Study Glass (continued)

Glass ID	Oxide	Measured (wt %)	Measured Bias-Corrected (wt %)	Targeted (wt %)	Diff of Measured	Diff of Meas BC	% Diff of Measured	% Diff of Meas BC
Pu04-03	SeO_2 (wt %)	0.0070	0.0070	0.0000	0.0070	0.0070		
Pu04-03	Si_2O_3 (wt %)	18.5477	18.2944	17.2000	1.3477	1.0944	7.8%	6.4%
Pu04-03	SO_4 (wt %)	0.0749	0.0749	0.0000	0.0749	0.0749		
Pu04-03	SrO (wt %)	2.3179	2.3179	2.1500	0.1679	0.1679	7.8%	7.8%
Pu04-03	Ta_2O_5 (wt %)	0.0195	0.0195	0.0000	0.0195	0.0195		
Pu04-03	Sum (wt %)	100.3317	99.7036	100.0100	0.3217	-0.3064	0.3%	-0.3%
Pu04-04	Al_2O_3 (wt %)	9.5514	9.3977	8.6000	0.9514	0.7977	11.1%	9.3%
Pu04-04	B_2O_3 (wt %)	11.8653	11.6497	11.1800	0.6853	0.4697	6.1%	4.2%
Pu04-04	CaO (wt %)	0.1728	0.1698	0.0800	0.0928	0.0898	116.0%	112.3%
Pu04-04	Cl (wt %)	0.0375	0.0375	0.0000	0.0375	0.0375		
Pu04-04	Cr_2O_3 (wt %)	0.0826	0.0832	0.0900	-0.0074	-0.0068	-8.2%	-7.6%
Pu04-04	CuO (wt %)	0.1033	0.1096	0.0700	0.0333	0.0396	47.5%	56.6%
Pu04-04	F (wt %)	0.0000	0.0000	0.0000	0.0000	0.0000		
Pu04-04	Fe_2O_3 (wt %)	0.1122	0.1131	0.0800	0.0322	0.0331	40.3%	41.3%
Pu04-04	Ga_2O_3 (wt %)	0.0349	0.0349	0.0000	0.0349	0.0349		
Pu04-04	Gd_2O_3 (wt %)	12.3905	12.3905	11.6100	0.7805	0.7805	6.7%	6.7%
Pu04-04	HfO_2 (wt %)	14.5644	14.5644	19.3900	-4.8256	-4.8256	-24.9%	-24.9%
Pu04-04	K_2O (wt %)	0.0632	0.0553	0.0700	-0.0068	-0.0147	-9.7%	-21.0%
Pu04-04	La_2O_3 (wt %)	16.2433	16.2433	16.3400	-0.0967	-0.0967	-0.6%	-0.6%
Pu04-04	MgO (wt %)	0.0680	0.0698	0.0800	-0.0120	-0.0102	-15.0%	-12.7%
Pu04-04	Na_2O (wt %)	0.1260	0.1152	0.0800	0.0460	0.0352	57.5%	43.9%
Pu04-04	Nd_2O_3 (wt %)	13.8802	13.8802	12.9000	0.9802	0.9802	7.6%	7.6%
Pu04-04	NiO (wt %)	0.0687	0.0787	0.0800	-0.0113	-0.0013	-14.1%	-1.6%
Pu04-04	PbO (wt %)	0.0377	0.0377	0.0000	0.0377	0.0377		
Pu04-04	SeO_2 (wt %)	0.0070	0.0070	0.0000	0.0070	0.0070		
Pu04-04	Si_2O_3 (wt %)	18.6761	18.4210	17.2000	1.4761	1.2210	8.6%	7.1%
Pu04-04	SO_4 (wt %)	0.0749	0.0749	0.0000	0.0749	0.0749		
Pu04-04	SrO (wt %)	2.3002	2.3002	2.1500	0.1502	0.1502	7.0%	7.0%
Pu04-04	Ta_2O_5 (wt %)	0.0177	0.0177	0.0000	0.0177	0.0177		
Pu04-04	Sum (wt %)	100.4779	99.8513	100.0000	0.4779	-0.1487	0.5%	-0.1%
Pu04-05	Al_2O_3 (wt %)	9.3719	9.2211	8.6000	0.7719	0.6211	9.0%	7.2%
Pu04-05	B_2O_3 (wt %)	11.8653	11.6497	11.1800	0.6853	0.4697	6.1%	4.2%
Pu04-05	CaO (wt %)	0.0665	0.0653	0.0000	0.0665	0.0653		
Pu04-05	Cl (wt %)	0.0120	0.0120	0.1200	-0.1080	-0.1080	-90.0%	-90.0%
Pu04-05	Cr_2O_3 (wt %)	0.0088	0.0088	0.0000	0.0088	0.0088		
Pu04-05	CuO (wt %)	0.0288	0.0306	0.0000	0.0288	0.0306		
Pu04-05	F (wt %)	0.0270	0.0327	0.1200	-0.0930	-0.0873	-77.5%	-72.7%
Pu04-05	Fe_2O_3 (wt %)	0.0272	0.0274	0.0000	0.0272	0.0274		
Pu04-05	Ga_2O_3 (wt %)	0.0363	0.0363	0.0000	0.0363	0.0363		
Pu04-05	Gd_2O_3 (wt %)	12.3328	12.3328	11.6100	0.7228	0.7228	6.2%	6.2%
Pu04-05	HfO_2 (wt %)	15.4488	15.4488	19.4600	-4.0112	-4.0112	-20.6%	-20.6%
Pu04-05	K_2O (wt %)	0.0060	0.0053	0.0000	0.0060	0.0053		
Pu04-05	La_2O_3 (wt %)	16.3606	16.3606	16.3400	0.0206	0.0206	0.1%	0.1%
Pu04-05	MgO (wt %)	0.0083	0.0085	0.0000	0.0083	0.0085		
Pu04-05	Na_2O (wt %)	0.3849	0.3516	0.3200	0.0649	0.0316	20.3%	9.9%
Pu04-05	Nd_2O_3 (wt %)	13.7052	13.7052	12.9000	0.8052	0.8052	6.2%	6.2%
Pu04-05	NiO (wt %)	0.0064	0.0073	0.0000	0.0064	0.0073		
Pu04-05	PbO (wt %)	0.0382	0.0382	0.0000	0.0382	0.0382		
Pu04-05	SeO_2 (wt %)	0.0070	0.0070	0.0000	0.0070	0.0070		
Pu04-05	Si_2O_3 (wt %)	18.6761	18.4210	17.2000	1.4761	1.2210	8.6%	7.1%
Pu04-05	SO_4 (wt %)	0.0749	0.0749	0.0000	0.0749	0.0749		
Pu04-05	SrO (wt %)	2.2824	2.2824	2.1500	0.1324	0.1324	6.2%	6.2%
Pu04-05	Ta_2O_5 (wt %)	0.0195	0.0195	0.0000	0.0195	0.0195		
Pu04-05	Sum (wt %)	100.7949	100.1471	100.0000	0.7949	0.1471	0.8%	0.1%
Pu35-01	Al_2O_3 (wt %)	9.0318	8.8864	8.6000	0.4318	0.2864	5.0%	3.3%
Pu35-01	B_2O_3 (wt %)	11.2536	11.0490	11.1800	0.0736	-0.1310	0.7%	-1.2%
Pu35-01	CaO (wt %)	0.0805	0.0791	0.0000	0.0805	0.0791		
Pu35-01	Cl (wt %)	0.0575	0.0575	0.5800	-0.5225	-0.5225	-90.1%	-90.1%

Table D5. Average Measured and Bias-Corrected Chemical Compositions Versus Targeted Compositions by Oxide by Study Glass (continued)

Glass ID	Oxide	Measured (wt %)	Measured Bias-Corrected (wt %)	Targeted (wt %)	Diff of Measured	Diff of Meas BC	% Diff of Measured	% Diff of Meas BC
Pu35-01	Cr_2O_3 (wt %)	0.0080	0.0081	0.0000	0.0080	0.0081		
Pu35-01	CuO (wt %)	0.1540	0.1634	0.1500	0.0040	0.0134	2.6%	8.9%
Pu35-01	F (wt %)	0.0000	0.0000	0.0000	0.0000	0.0000		
Pu35-01	Fe_2O_3 (wt %)	0.4103	0.4134	0.3900	0.0203	0.0234	5.2%	6.0%
Pu35-01	Ga_2O_3 (wt %)	0.9288	0.9288	0.9500	-0.0212	-0.0212	-2.2%	-2.2%
Pu35-01	Gd_2O_3 (wt %)	11.6413	11.6413	11.6100	0.0313	0.0313	0.3%	0.3%
Pu35-01	HfO_2 (wt %)	13.6209	13.6209	14.8600	-1.2391	-1.2391	-8.3%	-8.3%
Pu35-01	K_2O (wt %)	0.2409	0.2106	0.2600	-0.0191	-0.0494	-7.3%	-19.0%
Pu35-01	La_2O_3 (wt %)	16.1846	16.1846	16.3400	-0.1554	-0.1554	-1.0%	-1.0%
Pu35-01	MgO (wt %)	1.4245	1.4627	1.6200	-0.1955	-0.1573	-12.1%	-9.7%
Pu35-01	Na_2O (wt %)	0.8445	0.7716	0.8000	0.0445	-0.0284	5.6%	-3.6%
Pu35-01	Nd_2O_3 (wt %)	13.0637	13.0637	12.9000	0.1637	0.1637	1.3%	1.3%
Pu35-01	NiO (wt %)	0.1762	0.2020	0.2100	-0.0338	-0.0080	-16.1%	-3.8%
Pu35-01	PbO (wt %)	0.0361	0.0361	0.0000	0.0361	0.0361		
Pu35-01	SeO_2 (wt %)	0.0070	0.0070	0.0800	-0.0730	-0.0730	-91.2%	-91.2%
Pu35-01	Si_2O_3 (wt %)	18.0343	17.7880	17.2000	0.8343	0.5880	4.9%	3.4%
Pu35-01	SO_4 (wt %)	0.0749	0.0749	0.0000	0.0749	0.0749		
Pu35-01	SrO (wt %)	2.2351	2.2351	2.1500	0.0851	0.0851	4.0%	4.0%
Pu35-01	Ta_2O_5 (wt %)	0.0769	0.0769	0.0700	0.0069	0.0069	9.9%	9.9%
Pu35-01	Sum (wt %)	99.5855	98.9612	99.9500	-0.3645	-0.9888	-0.4%	-1.0%
Pu35-02	Al_2O_3 (wt %)	9.1641	9.0166	8.6000	0.5641	0.4166	6.6%	4.8%
Pu35-02	B_2O_3 (wt %)	11.7687	11.5549	11.1800	0.5887	0.3749	5.3%	3.4%
Pu35-02	CaO (wt %)	0.4848	0.4764	0.3600	0.1248	0.1164	34.7%	32.3%
Pu35-02	Cl (wt %)	0.0185	0.0185	0.5800	-0.5615	-0.5615	-96.8%	-96.8%
Pu35-02	Cr_2O_3 (wt %)	0.2952	0.2974	0.3300	-0.0348	-0.0326	-10.5%	-9.9%
Pu35-02	CuO (wt %)	0.0914	0.0970	0.0700	0.0214	0.0270	30.5%	38.5%
Pu35-02	F (wt %)	0.0745	0.0902	0.4500	-0.3755	-0.3598	-83.4%	-79.9%
Pu35-02	Fe_2O_3 (wt %)	0.1129	0.1138	0.0800	0.0329	0.0338	41.2%	42.2%
Pu35-02	Ga_2O_3 (wt %)	0.1109	0.1109	0.0800	0.0309	0.0309	38.6%	38.6%
Pu35-02	Gd_2O_3 (wt %)	11.8718	11.8718	11.6100	0.2618	0.2618	2.3%	2.3%
Pu35-02	HfO_2 (wt %)	13.6209	13.6209	14.9200	-1.2991	-1.2991	-8.7%	-8.7%
Pu35-02	K_2O (wt %)	0.6270	0.5480	0.7400	-0.1130	-0.1920	-15.3%	-25.9%
Pu35-02	La_2O_3 (wt %)	16.1260	16.1260	16.3400	-0.2140	-0.2140	-1.3%	-1.3%
Pu35-02	MgO (wt %)	1.2968	1.3316	1.4500	-0.1532	-0.1184	-10.6%	-8.2%
Pu35-02	Na_2O (wt %)	0.3963	0.3621	0.3500	0.0463	0.0121	13.2%	3.5%
Pu35-02	Nd_2O_3 (wt %)	13.2386	13.2386	12.9000	0.3386	0.3386	2.6%	2.6%
Pu35-02	NiO (wt %)	0.1247	0.1429	0.1500	-0.0253	-0.0071	-16.9%	-4.7%
Pu35-02	PbO (wt %)	0.0862	0.0862	0.0600	0.0262	0.0262	43.6%	43.6%
Pu35-02	SeO_2 (wt %)	0.0070	0.0070	0.0800	-0.0730	-0.0730	-91.2%	-91.2%
Pu35-02	Si_2O_3 (wt %)	17.6706	17.4293	17.2000	0.4706	0.2293	2.7%	1.3%
Pu35-02	SO_4 (wt %)	0.0749	0.0749	0.1700	-0.0951	-0.0951	-55.9%	-55.9%
Pu35-02	SrO (wt %)	2.2883	2.2883	2.1500	0.1383	0.1383	6.4%	6.4%
Pu35-02	Ta_2O_5 (wt %)	0.0818	0.0818	0.0700	0.0118	0.0118	16.9%	16.9%
Pu35-02	Sum (wt %)	99.6321	98.9851	99.9200	-0.2879	-0.9349	-0.3%	-0.9%
Pu35-03	Al_2O_3 (wt %)	8.8523	8.7098	8.6000	0.2523	0.1098	2.9%	1.3%
Pu35-03	B_2O_3 (wt %)	11.7204	11.5074	11.1800	0.5404	0.3274	4.8%	2.9%
Pu35-03	CaO (wt %)	0.8857	0.8703	0.7700	0.1157	0.1003	15.0%	13.0%
Pu35-03	Cl (wt %)	0.1395	0.1395	0.5700	-0.4305	-0.4305	-75.5%	-75.5%
Pu35-03	Cr_2O_3 (wt %)	0.5430	0.5470	0.6400	-0.0970	-0.0930	-15.2%	-14.5%
Pu35-03	CuO (wt %)	0.0313	0.0332	0.0000	0.0313	0.0332		
Pu35-03	F (wt %)	0.0000	0.0000	0.0000	0.0000	0.0000		
Pu35-03	Fe_2O_3 (wt %)	0.1566	0.1577	0.1400	0.0166	0.0177	11.8%	12.7%
Pu35-03	Ga_2O_3 (wt %)	0.4590	0.4590	0.4500	0.0090	0.0090	2.0%	2.0%
Pu35-03	Gd_2O_3 (wt %)	11.5836	11.5836	11.6100	-0.0264	-0.0264	-0.2%	-0.2%
Pu35-03	HfO_2 (wt %)	13.3261	13.3261	14.8100	-1.4839	-1.4839	-10.0%	-10.0%
Pu35-03	K_2O (wt %)	0.3054	0.2669	0.3100	-0.0046	-0.0431	-1.5%	-13.9%
Pu35-03	La_2O_3 (wt %)	16.0674	16.0674	16.3400	-0.2726	-0.2726	-1.7%	-1.7%
Pu35-03	MgO (wt %)	0.5008	0.5142	0.5400	-0.0392	-0.0258	-7.3%	-4.8%

Table D5. Average Measured and Bias-Corrected Chemical Compositions Versus Targeted Compositions by Oxide by Study Glass (continued)

Glass ID	Oxide	Measured (wt %)	Measured Bias-Corrected (wt %)	Targeted (wt %)	Diff of Measured	Diff of Meas BC	% Diff of Measured	% Diff of Meas BC
Pu35-03	Na_2O (wt %)	1.4767	1.3492	1.4800	-0.0033	-0.1308	-0.2%	-8.8%
Pu35-03	Nd_2O_3 (wt %)	12.9470	12.9470	12.9000	0.0470	0.0470	0.4%	0.4%
Pu35-03	NiO (wt %)	0.0560	0.0642	0.0700	-0.0140	-0.0058	-20.0%	-8.3%
Pu35-03	PbO (wt %)	0.0350	0.0350	0.0000	0.0350	0.0350		
Pu35-03	SeO_2 (wt %)	0.0070	0.0070	0.0000	0.0070	0.0070		
Pu35-03	Si_2O_3 (wt %)	17.2855	17.0495	17.2000	0.0855	-0.1505	0.5%	-0.9%
Pu35-03	SO_4 (wt %)	0.0749	0.0749	0.0000	0.0749	0.0749		
Pu35-03	SrO (wt %)	2.1996	2.1996	2.1500	0.0496	0.0496	2.3%	2.3%
Pu35-03	Ta_2O_5 (wt %)	0.1770	0.1770	0.1800	-0.0030	-0.0030	-1.6%	-1.6%
Pu35-03	Sum (wt %)	98.8300	98.0858	99.9400	-1.1100	-1.8542	-1.1%	-1.9%
Pu35-04	Al_2O_3 (wt %)	9.0790	8.9329	8.6000	0.4790	0.3329	5.6%	3.9%
Pu35-04	B_2O_3 (wt %)	11.5433	11.3336	11.1800	0.3633	0.1536	3.2%	1.4%
Pu35-04	CaO (wt %)	0.4505	0.4427	0.3200	0.1305	0.1227	40.8%	38.3%
Pu35-04	Cl (wt %)	0.0310	0.0310	0.5900	-0.5590	-0.5590	-94.7%	-94.7%
Pu35-04	Cr_2O_3 (wt %)	0.0804	0.0810	0.0900	-0.0096	-0.0090	-10.7%	-10.0%
Pu35-04	CuO (wt %)	0.0964	0.1023	0.0700	0.0264	0.0323	37.7%	46.1%
Pu35-04	F (wt %)	0.0910	0.1102	0.5200	-0.4290	-0.4098	-82.5%	-78.8%
Pu35-04	Fe_2O_3 (wt %)	0.2845	0.2866	0.2700	0.0145	0.0166	5.4%	6.2%
Pu35-04	Ga_2O_3 (wt %)	0.3818	0.3818	0.3600	0.0218	0.0218	6.0%	6.0%
Pu35-04	Gd_2O_3 (wt %)	11.7565	11.7565	11.6100	0.1465	0.1465	1.3%	1.3%
Pu35-04	HfO_2 (wt %)	13.7388	13.7388	15.0000	-1.2612	-1.2612	-8.4%	-8.4%
Pu35-04	K_2O (wt %)	0.4210	0.3680	0.4500	-0.0290	-0.0820	-6.4%	-18.2%
Pu35-04	La_2O_3 (wt %)	16.4192	16.4192	16.3400	0.0792	0.0792	0.5%	0.5%
Pu35-04	MgO (wt %)	0.9784	1.0047	1.0600	-0.0816	-0.0553	-7.7%	-5.2%
Pu35-04	Na_2O (wt %)	0.6416	0.5862	0.5600	0.0816	0.0262	14.6%	4.7%
Pu35-04	Nd_2O_3 (wt %)	13.1803	13.1803	12.9000	0.2803	0.2803	2.2%	2.2%
Pu35-04	NiO (wt %)	0.0706	0.0809	0.0700	0.0006	0.0109	0.9%	15.6%
Pu35-04	PbO (wt %)	0.0916	0.0916	0.0800	0.0116	0.0116	14.5%	14.5%
Pu35-04	SeO_2 (wt %)	0.0070	0.0070	0.0800	-0.0730	-0.0730	-91.2%	-91.2%
Pu35-04	Si_2O_3 (wt %)	17.8097	17.5664	17.2000	0.6097	0.3664	3.5%	2.1%
Pu35-04	SO_4 (wt %)	0.0749	0.0749	0.0000	0.0749	0.0749		
Pu35-04	SrO (wt %)	2.2410	2.2410	2.1500	0.0910	0.0910	4.2%	4.2%
Pu35-04	Ta_2O_5 (wt %)	0.4249	0.4249	0.4600	-0.0351	-0.0351	-7.6%	-7.6%
Pu35-04	Sum (wt %)	99.8936	99.2426	99.9600	-0.0664	-0.7174	-0.1%	-0.7%
Pu35-05	Al_2O_3 (wt %)	8.8901	8.7470	8.6000	0.2901	0.1470	3.4%	1.7%
Pu35-05	B_2O_3 (wt %)	11.4789	11.2703	11.1800	0.2989	0.0903	2.7%	0.8%
Pu35-05	CaO (wt %)	0.2099	0.2062	0.1300	0.0799	0.0762	61.4%	58.6%
Pu35-05	Cl (wt %)	0.0430	0.0430	0.5800	-0.5370	-0.5370	-92.6%	-92.6%
Pu35-05	Cr_2O_3 (wt %)	0.5452	0.5492	0.6400	-0.0948	-0.0908	-14.8%	-14.2%
Pu35-05	CuO (wt %)	0.2666	0.2830	0.2900	-0.0234	-0.0070	-8.1%	-2.4%
Pu35-05	F (wt %)	0.0000	0.0000	0.0000	0.0000	0.0000		
Pu35-05	Fe_2O_3 (wt %)	1.1681	1.1768	1.3200	-0.1519	-0.1432	-11.5%	-10.8%
Pu35-05	Ga_2O_3 (wt %)	0.3179	0.3179	0.2900	0.0279	0.0279	9.6%	9.6%
Pu35-05	Gd_2O_3 (wt %)	11.6067	11.6067	11.6100	-0.0033	-0.0033	0.0%	0.0%
Pu35-05	HfO_2 (wt %)	13.5030	13.5030	14.8500	-1.3470	-1.3470	-9.1%	-9.1%
Pu35-05	K_2O (wt %)	0.6920	0.6049	0.7800	-0.0880	-0.1751	-11.3%	-22.5%
Pu35-05	La_2O_3 (wt %)	15.8914	15.8914	16.3400	-0.4486	-0.4486	-2.7%	-2.7%
Pu35-05	MgO (wt %)	0.4759	0.4887	0.5200	-0.0441	-0.0313	-8.5%	-6.0%
Pu35-05	Na_2O (wt %)	0.3828	0.3498	0.3500	0.0328	-0.0002	9.4%	-0.1%
Pu35-05	Nd_2O_3 (wt %)	12.9470	12.9470	12.9000	0.0470	0.0470	0.4%	0.4%
Pu35-05	NiO (wt %)	0.0064	0.0073	0.0000	0.0064	0.0073		
Pu35-05	PbO (wt %)	0.0899	0.0899	0.0700	0.0199	0.0199	28.5%	28.5%
Pu35-05	SeO_2 (wt %)	0.0070	0.0070	0.0000	0.0070	0.0070		
Pu35-05	Si_2O_3 (wt %)	17.4888	17.2499	17.2000	0.2888	0.0499	1.7%	0.3%
Pu35-05	SO_4 (wt %)	0.0749	0.0749	0.0000	0.0749	0.0749		
Pu35-05	SrO (wt %)	2.2292	2.2292	2.1500	0.0792	0.0792	3.7%	3.7%
Pu35-05	Ta_2O_5 (wt %)	0.0971	0.0971	0.0900	0.0071	0.0071	7.9%	7.9%
Pu35-05	Sum (wt %)	98.4119	97.7404	99.8900	-1.4781	-2.1496	-1.5%	-2.2%

Table D5. Average Measured and Bias-Corrected Chemical Compositions Versus Targeted Compositions by Oxide by Study Glass (continued)

Glass ID	Oxide	Measured (wt %)	Measured Bias-Corrected (wt %)	Targeted (wt %)	Diff of Measured	Diff of Meas BC	% Diff of Measured	% Diff of Meas BC
Pu35-06	Al_2O_3 (wt %)	9.0318	8.9204	8.6000	0.4318	0.3204	5.0%	3.7%
Pu35-06	B_2O_3 (wt %)	10.9638	11.2684	11.1800	-0.2162	0.0884	-1.9%	0.8%
Pu35-06	CaO (wt %)	0.3848	0.3792	0.2900	0.0948	0.0892	32.7%	30.8%
Pu35-06	Cl (wt %)	0.0345	0.0345	0.6000	-0.5655	-0.5655	-94.3%	-94.3%
Pu35-06	Cr_2O_3 (wt %)	0.2163	0.2039	0.2200	-0.0037	-0.0161	-1.7%	-7.3%
Pu35-06	CuO (wt %)	0.0269	0.0279	0.0000	0.0269	0.0279		
Pu35-06	F (wt %)	0.0830	0.1025	0.4800	-0.3970	-0.3775	-82.7%	-78.7%
Pu35-06	Fe_2O_3 (wt %)	0.9672	1.0061	0.9700	-0.0028	0.0361	-0.3%	3.7%
Pu35-06	Ga_2O_3 (wt %)	0.0323	0.0323	0.0000	0.0323	0.0323		
Pu35-06	Gd_2O_3 (wt %)	11.6413	11.6413	11.6100	0.0313	0.0313	0.3%	0.3%
Pu35-06	HfO_2 (wt %)	13.5030	13.5030	14.8700	-1.3670	-1.3670	-9.2%	-9.2%
Pu35-06	K_2O (wt %)	0.2277	0.1971	0.2700	-0.0423	-0.0729	-15.7%	-27.0%
Pu35-06	La_2O_3 (wt %)	16.0087	16.0087	16.3400	-0.3313	-0.3313	-2.0%	-2.0%
Pu35-06	MgO (wt %)	0.9477	0.8928	0.9100	0.0377	-0.0172	4.1%	-1.9%
Pu35-06	Na_2O (wt %)	0.7886	0.7208	0.8000	-0.0114	-0.0792	-1.4%	-9.9%
Pu35-06	Nd_2O_3 (wt %)	13.0054	13.0054	12.9000	0.1054	0.1054	0.8%	0.8%
Pu35-06	NiO (wt %)	0.2570	0.2755	0.2800	-0.0230	-0.0045	-8.2%	-1.6%
Pu35-06	PbO (wt %)	0.0393	0.0393	0.0000	0.0393	0.0393		
Pu35-06	SeO_2 (wt %)	0.0070	0.0070	0.0000	0.0070	0.0070		
Pu35-06	Si_2O_3 (wt %)	17.4032	17.5339	17.2000	0.2032	0.3339	1.2%	1.9%
Pu35-06	SO_4 (wt %)	0.0749	0.0749	0.1700	-0.0951	-0.0951	-55.9%	-55.9%
Pu35-06	SrO (wt %)	2.2765	2.2765	2.1500	0.1265	0.1265	5.9%	5.9%
Pu35-06	Ta_2O_5 (wt %)	0.1105	0.1105	0.1000	0.0105	0.0105	10.5%	10.5%
Pu35-06	Sum (wt %)	98.0313	98.2618	99.9400	-1.9087	-1.6782	-1.9%	-1.7%
Pu35-07	Al_2O_3 (wt %)	9.0224	8.9111	8.6000	0.4224	0.3111	4.9%	3.6%
Pu35-07	B_2O_3 (wt %)	10.9799	11.2849	11.1800	-0.2001	0.1049	-1.8%	0.9%
Pu35-07	CaO (wt %)	0.2917	0.2875	0.2000	0.0917	0.0875	45.9%	43.8%
Pu35-07	Cl (wt %)	0.0520	0.0520	0.6200	-0.5680	-0.5680	-91.6%	-91.6%
Pu35-07	Cr_2O_3 (wt %)	0.1323	0.1247	0.1300	0.0023	-0.0053	1.7%	-4.1%
Pu35-07	CuO (wt %)	0.1790	0.1855	0.1600	0.0190	0.0255	11.9%	15.9%
Pu35-07	F (wt %)	0.0455	0.0562	0.1900	-0.1445	-0.1338	-76.1%	-70.4%
Pu35-07	Fe_2O_3 (wt %)	0.1187	0.1234	0.0900	0.0287	0.0334	31.9%	37.1%
Pu35-07	Ga_2O_3 (wt %)	0.1122	0.1122	0.0800	0.0322	0.0322	40.3%	40.3%
Pu35-07	Gd_2O_3 (wt %)	11.6989	11.6989	11.6100	0.0889	0.0889	0.8%	0.8%
Pu35-07	HfO_2 (wt %)	13.9747	13.9747	14.9600	-0.9853	-0.9853	-6.6%	-6.6%
Pu35-07	K_2O (wt %)	0.3969	0.3437	0.4200	-0.0231	-0.0763	-5.5%	-18.2%
Pu35-07	La_2O_3 (wt %)	16.1260	16.1260	16.3400	-0.2140	-0.2140	-1.3%	-1.3%
Pu35-07	MgO (wt %)	0.5572	0.5249	0.5400	0.0172	-0.0151	3.2%	-2.8%
Pu35-07	Na_2O (wt %)	0.6363	0.5816	0.6100	0.0263	-0.0284	4.3%	-4.7%
Pu35-07	Nd_2O_3 (wt %)	13.0637	13.0637	12.9000	0.1637	0.1637	1.3%	1.3%
Pu35-07	NiO (wt %)	0.3576	0.3832	0.3700	-0.0124	0.0132	-3.4%	3.6%
Pu35-07	PbO (wt %)	0.0883	0.0883	0.0600	0.0283	0.0283	47.2%	47.2%
Pu35-07	SeO_2 (wt %)	0.0070	0.0070	0.0000	0.0070	0.0070		
Pu35-07	Si_2O_3 (wt %)	17.5316	17.6632	17.2000	0.3316	0.4632	1.9%	2.7%
Pu35-07	SO_4 (wt %)	0.0749	0.0749	0.1700	-0.0951	-0.0951	-55.9%	-55.9%
Pu35-07	SrO (wt %)	2.2824	2.2824	2.1500	0.1324	0.1324	6.2%	6.2%
Pu35-07	Ta_2O_5 (wt %)	1.2912	1.2912	1.3000	-0.0088	-0.0088	-0.7%	-0.7%
Pu35-07	Sum (wt %)	99.0203	99.2413	99.8800	-0.8597	-0.6387	-0.9%	-0.6%
Pu35-08	Al_2O_3 (wt %)	9.0035	8.8924	8.6000	0.4035	0.2924	4.7%	3.4%
Pu35-08	B_2O_3 (wt %)	11.0604	11.3676	11.1800	-0.1196	0.1876	-1.1%	1.7%
Pu35-08	CaO (wt %)	0.3519	0.3468	0.2400	0.1119	0.1068	46.6%	44.5%
Pu35-08	Cl (wt %)	0.0460	0.0460	0.6200	-0.5740	-0.5740	-92.6%	-92.6%
Pu35-08	Cr_2O_3 (wt %)	0.0950	0.0895	0.0900	0.0050	-0.0005	5.6%	-0.5%
Pu35-08	CuO (wt %)	0.1008	0.1044	0.0700	0.0308	0.0344	44.0%	49.1%
Pu35-08	F (wt %)	0.0710	0.0877	0.3000	-0.2290	-0.2123	-76.3%	-70.8%
Pu35-08	Fe_2O_3 (wt %)	0.9586	0.9971	0.8900	0.0686	0.1071	7.7%	12.0%
Pu35-08	Ga_2O_3 (wt %)	0.2070	0.2070	0.1600	0.0470	0.0470	29.4%	29.4%
Pu35-08	Gd_2O_3 (wt %)	11.6989	11.6989	11.6100	0.0889	0.0889	0.8%	0.8%

Table D5. Average Measured and Bias-Corrected Chemical Compositions Versus Targeted Compositions by Oxide by Study Glass (continued)

Glass ID	Oxide	Measured (wt %)	Measured Bias-Corrected (wt %)	Targeted (wt %)	Diff of Measured	Diff of Meas BC	% Diff of Measured	% Diff of Meas BC
Pu35-08	HfO_2 (wt %)	13.3851	13.3851	14.9500	-1.5649	-1.5649	-10.5%	-10.5%
Pu35-08	K_2O (wt %)	0.6872	0.5950	0.7700	-0.0828	-0.1750	-10.8%	-22.7%
Pu35-08	La_2O_3 (wt %)	16.3019	16.3019	16.3400	-0.0381	-0.0381	-0.2%	-0.2%
Pu35-08	MgO (wt %)	0.8631	0.8131	0.8800	-0.0169	-0.0669	-1.9%	-7.6%
Pu35-08	Na_2O (wt %)	0.4428	0.4048	0.4000	0.0428	0.0048	10.7%	1.2%
Pu35-08	Nd_2O_3 (wt %)	13.1803	13.1803	12.9000	0.2803	0.2803	2.2%	2.2%
Pu35-08	NiO (wt %)	0.2341	0.2509	0.2500	-0.0159	0.0009	-6.3%	0.4%
Pu35-08	PbO (wt %)	0.0452	0.0452	0.0000	0.0452	0.0452		
Pu35-08	SeO_2 (wt %)	0.0070	0.0070	0.0000	0.0070	0.0070		
Pu35-08	Si_2O_3 (wt %)	17.3497	17.4800	17.2000	0.1497	0.2800	0.9%	1.6%
Pu35-08	SO_4 (wt %)	0.0749	0.0749	0.0000	0.0749	0.0749		
Pu35-08	SrO (wt %)	2.2588	2.2588	2.1500	0.1088	0.1088	5.1%	5.1%
Pu35-08	Ta_2O_5 (wt %)	0.3846	0.3846	0.3900	-0.0054	-0.0054	-1.4%	-1.4%
Pu35-08	Sum (wt %)	98.8079	99.0192	99.9900	-1.1821	-0.9708	-1.2%	-1.0%
Pu35-09	Al_2O_3 (wt %)	9.0318	8.9204	8.6000	0.4318	0.3204	5.0%	3.7%
Pu35-09	B_2O_3 (wt %)	11.0926	11.4007	11.1800	-0.0874	0.2207	-0.8%	2.0%
Pu35-09	CaO (wt %)	0.1812	0.1786	0.1000	0.0812	0.0786	81.2%	78.6%
Pu35-09	Cl (wt %)	0.0490	0.0490	0.6400	-0.5910	-0.5910	-92.3%	-92.3%
Pu35-09	Cr_2O_3 (wt %)	0.0877	0.0827	0.0800	0.0077	0.0027	9.6%	3.3%
Pu35-09	CuO (wt %)	0.2166	0.2244	0.2500	-0.0334	-0.0256	-13.4%	-10.3%
Pu35-09	F (wt %)	0.0000	0.0000	0.0000	0.0000	0.0000		
Pu35-09	Fe_2O_3 (wt %)	0.0386	0.0402	0.0000	0.0386	0.0402		
Pu35-09	Ga_2O_3 (wt %)	0.1694	0.1694	0.1300	0.0394	0.0394	30.3%	30.3%
Pu35-09	Gd_2O_3 (wt %)	11.6413	11.6413	11.6100	0.0313	0.0313	0.3%	0.3%
Pu35-09	HfO_2 (wt %)	13.3261	13.3261	14.9200	-1.5939	-1.5939	-10.7%	-10.7%
Pu35-09	K_2O (wt %)	1.1679	1.0111	1.5400	-0.3721	-0.5289	-24.2%	-34.3%
Pu35-09	La_2O_3 (wt %)	16.1260	16.1260	16.3400	-0.2140	-0.2140	-1.3%	-1.3%
Pu35-09	MgO (wt %)	0.5497	0.5179	0.5300	0.0197	-0.0121	3.7%	-2.3%
Pu35-09	Na_2O (wt %)	1.1310	1.0338	1.1300	0.0010	-0.0962	0.1%	-8.5%
Pu35-09	Nd_2O_3 (wt %)	13.0637	13.0637	12.9000	0.1637	0.1637	1.3%	1.3%
Pu35-09	NiO (wt %)	0.1718	0.1841	0.1900	-0.0182	-0.0059	-9.6%	-3.1%
Pu35-09	PbO (wt %)	0.0926	0.0926	0.0800	0.0126	0.0126	15.8%	15.8%
Pu35-09	SeO_2 (wt %)	0.0070	0.0070	0.0800	-0.0730	-0.0730	-91.2%	-91.2%
Pu35-09	Si_2O_3 (wt %)	17.6278	17.7602	17.2000	0.4278	0.5602	2.5%	3.3%
Pu35-09	SO_4 (wt %)	0.0749	0.0749	0.1700	-0.0951	-0.0951	-55.9%	-55.9%
Pu35-09	SrO (wt %)	2.2706	2.2706	2.1500	0.1206	0.1206	5.6%	5.6%
Pu35-09	Ta_2O_5 (wt %)	0.1166	0.1166	0.1100	0.0066	0.0066	6.0%	6.0%
Pu35-09	Sum (wt %)	98.2338	98.2912	99.9300	-1.6962	-1.6388	-1.7%	-1.6%
Pu35-10	Al_2O_3 (wt %)	9.0129	8.9018	8.6000	0.4129	0.3018	4.8%	3.5%
Pu35-10	B_2O_3 (wt %)	11.1087	11.4173	11.1800	-0.0713	0.2373	-0.6%	2.1%
Pu35-10	CaO (wt %)	0.1497	0.1476	0.0800	0.0697	0.0676	87.1%	84.4%
Pu35-10	Cl (wt %)	0.0505	0.0505	0.6500	-0.5995	-0.5995	-92.2%	-92.2%
Pu35-10	Cr_2O_3 (wt %)	0.0862	0.0813	0.0800	0.0062	0.0013	7.8%	1.6%
Pu35-10	CuO (wt %)	0.0920	0.0953	0.0700	0.0220	0.0253	31.4%	36.2%
Pu35-10	F (wt %)	0.0655	0.0809	0.3800	-0.3145	-0.2991	-82.8%	-78.7%
Pu35-10	Fe_2O_3 (wt %)	0.5926	0.6164	0.5900	0.0026	0.0264	0.4%	4.5%
Pu35-10	Ga_2O_3 (wt %)	0.7400	0.7400	0.7100	0.0300	0.0300	4.2%	4.2%
Pu35-10	Gd_2O_3 (wt %)	11.6989	11.6989	11.6100	0.0889	0.0889	0.8%	0.8%
Pu35-10	HfO_2 (wt %)	13.3851	13.3851	14.9000	-1.5149	-1.5149	-10.2%	-10.2%
Pu35-10	K_2O (wt %)	0.3162	0.2738	0.3600	-0.0438	-0.0862	-12.2%	-24.0%
Pu35-10	La_2O_3 (wt %)	16.0674	16.0674	16.3400	-0.2726	-0.2726	-1.7%	-1.7%
Pu35-10	MgO (wt %)	0.8300	0.7819	0.8100	0.0200	-0.0281	2.5%	-3.5%
Pu35-10	Na_2O (wt %)	0.6807	0.6222	0.6700	0.0107	-0.0478	1.6%	-7.1%
Pu35-10	Nd_2O_3 (wt %)	13.0637	13.0637	12.9000	0.1637	0.1637	1.3%	1.3%
Pu35-10	NiO (wt %)	0.0687	0.0736	0.0700	-0.0013	0.0036	-1.8%	5.2%
Pu35-10	PbO (wt %)	0.0829	0.0829	0.0600	0.0229	0.0229	38.2%	38.2%
Pu35-10	SeO_2 (wt %)	0.0070	0.0070	0.0800	-0.0730	-0.0730	-91.2%	-91.2%
Pu35-10	Si_2O_3 (wt %)	17.6064	17.7387	17.2000	0.4064	0.5387	2.4%	3.1%

Table D5. Average Measured and Bias-Corrected Chemical Compositions Versus Targeted Compositions by Oxide by Study Glass (continued)

Glass ID	Oxide	Measured (wt %)	Measured Bias-Corrected (wt %)	Targeted (wt %)	Diff of Measured	Diff of Meas BC	% Diff of Measured	% Diff of Meas BC
Pu35-10	SO_4 (wt %)	0.0749	0.0749	0.1700	-0.0951	-0.0951	-55.9%	-55.9%
Pu35-10	SrO (wt %)	2.2588	2.2588	2.1500	0.1088	0.1088	5.1%	5.1%
Pu35-10	Ta_2O_5 (wt %)	0.2705	0.2705	0.2700	0.0005	0.0005	0.2%	0.2%
Pu35-10	Sum (wt %)	98.3093	98.5303	99.9300	-1.6207	-1.3997	-1.6%	-1.4%
Pu35-11	Al_2O_3 (wt %)	8.9940	8.8831	8.6000	0.3940	0.2831	4.6%	3.3%
Pu35-11	B_2O_3 (wt %)	11.1409	11.4504	11.1800	-0.0391	0.2704	-0.4%	2.4%
Pu35-11	CaO (wt %)	0.5030	0.4958	0.4000	0.1030	0.0958	25.8%	23.9%
Pu35-11	Cl (wt %)	0.0470	0.0470	0.6900	-0.6430	-0.6430	-93.2%	-93.2%
Pu35-11	Cr_2O_3 (wt %)	0.3881	0.3658	0.4000	-0.0119	-0.0342	-3.0%	-8.6%
Pu35-11	CuO (wt %)	0.0388	0.0402	0.0000	0.0388	0.0402		
Pu35-11	F (wt %)	0.0125	0.0154	0.0600	-0.0475	-0.0446	-79.2%	-74.3%
Pu35-11	Fe_2O_3 (wt %)	0.1101	0.1145	0.0800	0.0301	0.0345	37.6%	43.1%
Pu35-11	Ga_2O_3 (wt %)	0.2473	0.2473	0.2100	0.0373	0.0373	17.8%	17.8%
Pu35-11	Gd_2O_3 (wt %)	11.6413	11.6413	11.6100	0.0313	0.0313	0.3%	0.3%
Pu35-11	HfO_2 (wt %)	13.9157	13.9157	14.8700	-0.9543	-0.9543	-6.4%	-6.4%
Pu35-11	K_2O (wt %)	0.3114	0.2696	0.3800	-0.0686	-0.1104	-18.1%	-29.1%
Pu35-11	La_2O_3 (wt %)	15.9501	15.9501	16.3400	-0.3899	-0.3899	-2.4%	-2.4%
Pu35-11	MgO (wt %)	1.0091	0.9506	0.9900	0.0191	-0.0394	1.9%	-4.0%
Pu35-11	Na_2O (wt %)	0.6962	0.6364	0.6900	0.0062	-0.0536	0.9%	-7.8%
Pu35-11	Nd_2O_3 (wt %)	13.0054	13.0054	12.9000	0.1054	0.1054	0.8%	0.8%
Pu35-11	NiO (wt %)	0.1597	0.1712	0.1700	-0.0103	0.0012	-6.1%	0.7%
Pu35-11	PbO (wt %)	0.0889	0.0889	0.0700	0.0189	0.0189	27.0%	27.0%
Pu35-11	SeO_2 (wt %)	0.0070	0.0070	0.0800	-0.0730	-0.0730	-91.2%	-91.2%
Pu35-11	Si_2O_3 (wt %)	17.6492	17.7818	17.2000	0.4492	0.5818	2.6%	3.4%
Pu35-11	SO_4 (wt %)	0.0749	0.0749	0.1700	-0.0951	-0.0951	-55.9%	-55.9%
Pu35-11	SrO (wt %)	2.2706	2.2706	2.1500	0.1206	0.1206	5.6%	5.6%
Pu35-11	Ta_2O_5 (wt %)	0.6941	0.6941	0.6900	0.0041	0.0041	0.6%	0.6%
Pu35-11	Sum (wt %)	98.9553	99.1170	99.9300	-0.9747	-0.8130	-1.0%	-0.8%
Pu35-12	Al_2O_3 (wt %)	9.1357	9.0231	8.6000	0.5357	0.4231	6.2%	4.9%
Pu35-12	B_2O_3 (wt %)	11.3018	11.6159	11.1800	0.1218	0.4359	1.1%	3.9%
Pu35-12	CaO (wt %)	0.1567	0.1545	0.0800	0.0767	0.0745	95.9%	93.1%
Pu35-12	Cl (wt %)	0.0405	0.0405	0.6500	-0.6095	-0.6095	-93.8%	-93.8%
Pu35-12	Cr_2O_3 (wt %)	0.3771	0.3554	0.4000	-0.0229	-0.0446	-5.7%	-11.1%
Pu35-12	CuO (wt %)	0.2009	0.2081	0.1800	0.0209	0.0281	11.6%	15.6%
Pu35-12	F (wt %)	0.0540	0.0667	0.3300	-0.2760	-0.2633	-83.6%	-79.8%
Pu35-12	Fe_2O_3 (wt %)	0.2180	0.2268	0.1900	0.0280	0.0368	14.8%	19.4%
Pu35-12	Ga_2O_3 (wt %)	0.3925	0.3925	0.3600	0.0325	0.0325	9.0%	9.0%
Pu35-12	Gd_2O_3 (wt %)	11.6989	11.6989	11.6100	0.0889	0.0889	0.8%	0.8%
Pu35-12	HfO_2 (wt %)	13.9157	13.9157	14.9600	-1.0443	-1.0443	-7.0%	-7.0%
Pu35-12	K_2O (wt %)	0.2445	0.2117	0.2800	-0.0355	-0.0683	-12.7%	-24.4%
Pu35-12	La_2O_3 (wt %)	16.0087	16.0087	16.3400	-0.3313	-0.3313	-2.0%	-2.0%
Pu35-12	MgO (wt %)	0.6816	0.6421	0.6600	0.0216	-0.0179	3.3%	-2.7%
Pu35-12	Na_2O (wt %)	0.7859	0.7184	0.7900	-0.0041	-0.0716	-0.5%	-9.1%
Pu35-12	Nd_2O_3 (wt %)	13.1803	13.1803	12.9000	0.2803	0.2803	2.2%	2.2%
Pu35-12	NiO (wt %)	0.4492	0.4814	0.4700	-0.0208	0.0114	-4.4%	2.4%
Pu35-12	PbO (wt %)	0.0399	0.0399	0.0000	0.0399	0.0399		
Pu35-12	SeO_2 (wt %)	0.0070	0.0070	0.0800	-0.0730	-0.0730	-91.2%	-91.2%
Pu35-12	Si_2O_3 (wt %)	17.6599	17.7925	17.2000	0.4599	0.5925	2.7%	3.4%
Pu35-12	SO_4 (wt %)	0.0749	0.0749	0.0000	0.0749	0.0749		
Pu35-12	SrO (wt %)	2.3179	2.3179	2.1500	0.1679	0.1679	7.8%	7.8%
Pu35-12	Ta_2O_5 (wt %)	0.5995	0.5995	0.5900	0.0095	0.0095	1.6%	1.6%
Pu35-12	Sum (wt %)	99.5413	99.7724	100.0000	-0.4587	-0.2276	-0.5%	-0.2%
Pu35-13	Al_2O_3 (wt %)	9.0318	8.9204	8.6000	0.4318	0.3204	5.0%	3.7%
Pu35-13	B_2O_3 (wt %)	10.9799	11.2849	11.1800	-0.2001	0.1049	-1.8%	0.9%
Pu35-13	CaO (wt %)	0.0602	0.0593	0.0000	0.0602	0.0593		
Pu35-13	Cl (wt %)	0.0550	0.0550	0.7700	-0.7150	-0.7150	-92.9%	-92.9%
Pu35-13	Cr_2O_3 (wt %)	0.3574	0.3368	0.3700	-0.0126	-0.0332	-3.4%	-9.0%
Pu35-13	CuO (wt %)	0.1721	0.1783	0.1500	0.0221	0.0283	14.7%	18.9%

Table D5. Average Measured and Bias-Corrected Chemical Compositions Versus Targeted Compositions by Oxide by Study Glass (continued)

Glass ID	Oxide	Measured (wt %)	Measured Bias-Corrected (wt %)	Targeted (wt %)	Diff of Measured	Diff of Meas BC	% Diff of Measured	% Diff of Meas BC
Pu35-13	F (wt %)	0.0120	0.0148	0.0600	-0.0480	-0.0452	-80.0%	-75.3%
Pu35-13	Fe_2O_3 (wt %)	0.3874	0.4030	0.3700	0.0174	0.0330	4.7%	8.9%
Pu35-13	Ga_2O_3 (wt %)	0.1163	0.1163	0.0800	0.0363	0.0363	45.3%	45.3%
Pu35-13	Gd_2O_3 (wt %)	11.6989	11.6989	11.6100	0.0889	0.0889	0.8%	0.8%
Pu35-13	HfO_2 (wt %)	13.3261	13.3261	14.9600	-1.6339	-1.6339	-10.9%	-10.9%
Pu35-13	K_2O (wt %)	0.3548	0.3071	0.4400	-0.0852	-0.1329	-19.4%	-30.2%
Pu35-13	La_2O_3 (wt %)	16.0087	16.0087	16.3400	-0.3313	-0.3313	-2.0%	-2.0%
Pu35-13	MgO (wt %)	0.7719	0.7272	0.7600	0.0119	-0.0328	1.6%	-4.3%
Pu35-13	Na_2O (wt %)	1.0494	0.9592	1.0900	-0.0406	-0.1308	-3.7%	-12.0%
Pu35-13	Nd_2O_3 (wt %)	13.0637	13.0637	12.9000	0.1637	0.1637	1.3%	1.3%
Pu35-13	NiO (wt %)	0.0064	0.0068	0.0000	0.0064	0.0068		
Pu35-13	PbO (wt %)	0.0991	0.0991	0.0800	0.0191	0.0191	23.9%	23.9%
Pu35-13	SeO_2 (wt %)	0.0070	0.0070	0.0000	0.0070	0.0070		
Pu35-13	Si_2O_3 (wt %)	17.5530	17.6848	17.2000	0.3530	0.4848	2.1%	2.8%
Pu35-13	SO_4 (wt %)	0.0749	0.0749	0.0000	0.0749	0.0749		
Pu35-13	SrO (wt %)	2.2647	2.2647	2.1500	0.1147	0.1147	5.3%	5.3%
Pu35-13	Ta_2O_5 (wt %)	0.8339	0.8339	0.8400	-0.0061	-0.0061	-0.7%	-0.7%
Pu35-13	Sum (wt %)	98.2845	98.4311	99.9500	-1.6655	-1.5189	-1.7%	-1.5%
Pu35-14	Al_2O_3 (wt %)	9.1263	9.0137	8.6000	0.5263	0.4137	6.1%	4.8%
Pu35-14	B_2O_3 (wt %)	10.8350	11.1360	11.1800	-0.3450	-0.0440	-3.1%	-0.4%
Pu35-14	CaO (wt %)	0.4904	0.4834	0.3800	0.1104	0.1034	29.1%	27.2%
Pu35-14	Cl (wt %)	0.0585	0.0585	0.8000	-0.7415	-0.7415	-92.7%	-92.7%
Pu35-14	Cr_2O_3 (wt %)	0.1359	0.1281	0.1300	0.0059	-0.0019	4.6%	-1.4%
Pu35-14	CuO (wt %)	0.0933	0.0966	0.0700	0.0233	0.0266	33.2%	38.0%
Pu35-14	F (wt %)	0.0155	0.0191	0.0800	-0.0645	-0.0609	-80.6%	-76.1%
Pu35-14	Fe_2O_3 (wt %)	0.9851	1.0246	1.0000	-0.0149	0.0246	-1.5%	2.5%
Pu35-14	Ga_2O_3 (wt %)	0.3071	0.3071	0.2700	0.0371	0.0371	13.8%	13.8%
Pu35-14	Gd_2O_3 (wt %)	11.7565	11.7565	11.6100	0.1465	0.1465	1.3%	1.3%
Pu35-14	HfO_2 (wt %)	13.7978	13.7978	14.9000	-1.1022	-1.1022	-7.4%	-7.4%
Pu35-14	K_2O (wt %)	0.1518	0.1314	0.2000	-0.0482	-0.0686	-24.1%	-34.3%
Pu35-14	La_2O_3 (wt %)	16.1846	16.1846	16.3400	-0.1554	-0.1554	-1.0%	-1.0%
Pu35-14	MgO (wt %)	0.4494	0.4234	0.4400	0.0094	-0.0166	2.1%	-3.8%
Pu35-14	Na_2O (wt %)	1.0380	0.9488	1.0700	-0.0320	-0.1212	-3.0%	-11.3%
Pu35-14	Nd_2O_3 (wt %)	13.1803	13.1803	12.9000	0.2803	0.2803	2.2%	2.2%
Pu35-14	NiO (wt %)	0.0674	0.0723	0.0700	-0.0026	0.0023	-3.7%	3.3%
Pu35-14	PbO (wt %)	0.0867	0.0867	0.0600	0.0267	0.0267	44.5%	44.5%
Pu35-14	SeO_2 (wt %)	0.0070	0.0070	0.0800	-0.0730	-0.0730	-91.2%	-91.2%
Pu35-14	Si_2O_3 (wt %)	17.6706	17.8033	17.2000	0.4706	0.6033	2.7%	3.5%
Pu35-14	SO_4 (wt %)	0.0749	0.0749	0.0000	0.0749	0.0749		
Pu35-14	SrO (wt %)	2.2942	2.2942	2.1500	0.1442	0.1442	6.7%	6.7%
Pu35-14	Ta_2O_5 (wt %)	0.3559	0.3559	0.3400	0.0159	0.0159	4.7%	4.7%
Pu35-14	Sum (wt %)	99.1624	99.3845	99.8700	-0.7076	-0.4855	-0.7%	-0.5%
Pu35-15	Al_2O_3 (wt %)	9.1924	9.0791	8.6000	0.5924	0.4791	6.9%	5.6%
Pu35-15	B_2O_3 (wt %)	10.8672	11.1691	11.1800	-0.3128	-0.0109	-2.8%	-0.1%
Pu35-15	CaO (wt %)	0.0630	0.0621	0.0000	0.0630	0.0621		
Pu35-15	Cl (wt %)	0.0615	0.0615	1.0000	-0.9385	-0.9385	-93.9%	-93.9%
Pu35-15	Cr_2O_3 (wt %)	0.0080	0.0076	0.0000	0.0080	0.0076		
Pu35-15	CuO (wt %)	0.0257	0.0266	0.0000	0.0257	0.0266		
Pu35-15	F (wt %)	0.0000	0.0000	0.0000	0.0000	0.0000		
Pu35-15	Fe_2O_3 (wt %)	0.0315	0.0327	0.0000	0.0315	0.0327		
Pu35-15	Ga_2O_3 (wt %)	1.2931	1.2931	1.2700	0.0231	0.0231	1.8%	1.8%
Pu35-15	Gd_2O_3 (wt %)	11.8142	11.8142	11.6100	0.2042	0.2042	1.8%	1.8%
Pu35-15	HfO_2 (wt %)	13.7978	13.7978	15.0000	-1.2022	-1.2022	-8.0%	-8.0%
Pu35-15	K_2O (wt %)	0.4620	0.4000	0.5900	-0.1280	-0.1900	-21.7%	-32.2%
Pu35-15	La_2O_3 (wt %)	16.3019	16.3019	16.3400	-0.0381	-0.0381	-0.2%	-0.2%
Pu35-15	MgO (wt %)	0.5381	0.5069	0.5400	-0.0019	-0.0331	-0.3%	-6.1%
Pu35-15	Na_2O (wt %)	0.8513	0.7781	0.8800	-0.0287	-0.1019	-3.3%	-11.6%
Pu35-15	Nd_2O_3 (wt %)	13.2970	13.2970	12.9000	0.3970	0.3970	3.1%	3.1%

Table D5. Average Measured and Bias-Corrected Chemical Compositions Versus Targeted Compositions by Oxide by Study Glass (continued)

Glass ID	Oxide	Measured (wt %)	Measured Bias-Corrected (wt %)	Targeted (wt %)	Diff of Measured	Diff of Meas BC	% Diff of Measured	% Diff of Meas BC
Pu35-15	NiO (wt %)	0.5427	0.5817	0.6000	-0.0573	-0.0183	-9.5%	-3.1%
Pu35-15	PbO (wt %)	0.0883	0.0883	0.0800	0.0083	0.0083	10.4%	10.4%
Pu35-15	SeO_2 (wt %)	0.0070	0.0070	0.0000	0.0070	0.0070		
Pu35-15	Si_2O_3 (wt %)	17.7990	17.9326	17.2000	0.5990	0.7326	3.5%	4.3%
Pu35-15	SO_4 (wt %)	0.0749	0.0749	0.0000	0.0749	0.0749		
Pu35-15	SrO (wt %)	2.3002	2.3002	2.1500	0.1502	0.1502	7.0%	7.0%
Pu35-15	Ta_2O_5 (wt %)	0.0171	0.0171	0.0000	0.0171	0.0171		
Pu35-15	Sum (wt %)	99.4337	99.6294	99.9400	-0.5063	-0.3106	-0.5%	-0.3%
Pu35-16	Al_2O_3 (wt %)	9.0318	8.7860	8.6000	0.4318	0.1860	5.0%	2.2%
Pu35-16	B_2O_3 (wt %)	11.3501	11.2814	11.1800	0.1701	0.1014	1.5%	0.9%
Pu35-16	CaO (wt %)	0.7989	0.8066	0.7000	0.0989	0.1066	14.1%	15.2%
Pu35-16	Cl (wt %)	0.0425	0.0425	0.9500	-0.9075	-0.9075	-95.5%	-95.5%
Pu35-16	Cr_2O_3 (wt %)	0.0058	0.0058	0.0000	0.0058	0.0058		
Pu35-16	CuO (wt %)	0.2679	0.2821	0.2900	-0.0221	-0.0079	-7.6%	-2.7%
Pu35-16	F (wt %)	0.0000	0.0000	0.0000	0.0000	0.0000		
Pu35-16	Fe_2O_3 (wt %)	0.4475	0.4436	0.4600	-0.0125	-0.0164	-2.7%	-3.6%
Pu35-16	Ga_2O_3 (wt %)	0.1909	0.1909	0.1500	0.0409	0.0409	27.3%	27.3%
Pu35-16	Gd_2O_3 (wt %)	11.9294	11.9294	11.6100	0.3194	0.3194	2.8%	2.8%
Pu35-16	HfO_2 (wt %)	13.9747	13.9747	14.8500	-0.8753	-0.8753	-5.9%	-5.9%
Pu35-16	K_2O (wt %)	0.0060	0.0052	0.0000	0.0060	0.0052		
Pu35-16	La_2O_3 (wt %)	16.4192	16.4192	16.3400	0.0792	0.0792	0.5%	0.5%
Pu35-16	MgO (wt %)	0.6990	0.7064	0.7300	-0.0310	-0.0236	-4.3%	-3.2%
Pu35-16	Na_2O (wt %)	1.1101	1.0051	1.2300	-0.1199	-0.2249	-9.7%	-18.3%
Pu35-16	Nd_2O_3 (wt %)	13.1803	13.1803	12.9000	0.2803	0.2803	2.2%	2.2%
Pu35-16	NiO (wt %)	0.1209	0.1351	0.1300	-0.0091	0.0051	-7.0%	3.9%
Pu35-16	PbO (wt %)	0.0786	0.0786	0.0600	0.0186	0.0186	31.1%	31.1%
Pu35-16	SeO_2 (wt %)	0.0070	0.0070	0.0000	0.0070	0.0070		
Pu35-16	Si_2O_3 (wt %)	17.9166	17.4761	17.2000	0.7166	0.2761	4.2%	1.6%
Pu35-16	SO_4 (wt %)	0.0749	0.0749	0.1700	-0.0951	-0.0951	-55.9%	-55.9%
Pu35-16	SrO (wt %)	2.2055	2.2055	2.1500	0.0555	0.0555	2.6%	2.6%
Pu35-16	Ta_2O_5 (wt %)	0.2857	0.2857	0.2900	-0.0043	-0.0043	-1.5%	-1.5%
Pu35-16	Sum (wt %)	100.1436	99.3223	99.9900	0.1536	-0.6677	0.2%	-0.7%
Pu35-17	Al_2O_3 (wt %)	8.9468	8.7032	8.6000	0.3468	0.1032	4.0%	1.2%
Pu35-17	B_2O_3 (wt %)	11.3984	11.3295	11.1800	0.2184	0.1495	2.0%	1.3%
Pu35-17	CaO (wt %)	0.1616	0.1632	0.0800	0.0816	0.0832	102.0%	103.9%
Pu35-17	Cl (wt %)	0.0590	0.0590	1.1100	-1.0510	-1.0510	-94.7%	-94.7%
Pu35-17	Cr_2O_3 (wt %)	0.3047	0.3028	0.3100	-0.0053	-0.0072	-1.7%	-2.3%
Pu35-17	CuO (wt %)	0.1064	0.1121	0.1000	0.0064	0.0121	6.4%	12.1%
Pu35-17	F (wt %)	0.0000	0.0000	0.0600	-0.0600	-0.0600	-100.0%	-100.0%
Pu35-17	Fe_2O_3 (wt %)	0.0615	0.0609	0.0000	0.0615	0.0609		
Pu35-17	Ga_2O_3 (wt %)	0.6976	0.6976	0.6800	0.0176	0.0176	2.6%	2.6%
Pu35-17	Gd_2O_3 (wt %)	11.8718	11.8718	11.6100	0.2618	0.2618	2.3%	2.3%
Pu35-17	HfO_2 (wt %)	13.8568	13.8568	14.9500	-1.0932	-1.0932	-7.3%	-7.3%
Pu35-17	K_2O (wt %)	0.3451	0.3001	0.4300	-0.0849	-0.1299	-19.7%	-30.2%
Pu35-17	La_2O_3 (wt %)	16.4778	16.4778	16.3400	0.1378	0.1378	0.8%	0.8%
Pu35-17	MgO (wt %)	0.3914	0.3955	0.4000	-0.0086	-0.0045	-2.2%	-1.1%
Pu35-17	Na_2O (wt %)	0.9746	0.8824	1.0400	-0.0654	-0.1576	-6.3%	-15.2%
Pu35-17	Nd_2O_3 (wt %)	13.1220	13.1220	12.9000	0.2220	0.2220	1.7%	1.7%
Pu35-17	NiO (wt %)	0.0706	0.0789	0.0700	0.0006	0.0089	0.9%	12.8%
Pu35-17	PbO (wt %)	0.0404	0.0404	0.0000	0.0404	0.0404		
Pu35-17	SeO_2 (wt %)	0.0070	0.0070	0.0000	0.0070	0.0070		
Pu35-17	Si_2O_3 (wt %)	18.1092	17.6639	17.2000	0.9092	0.4639	5.3%	2.7%
Pu35-17	SO_4 (wt %)	0.0749	0.0749	0.1700	-0.0951	-0.0951	-55.9%	-55.9%
Pu35-17	SrO (wt %)	2.1878	2.1878	2.1500	0.0378	0.0378	1.8%	1.8%
Pu35-17	Ta_2O_5 (wt %)	0.5366	0.5366	0.5500	-0.0134	-0.0134	-2.4%	-2.4%
Pu35-17	Sum (wt %)	99.8021	98.9243	99.9300	-0.1279	-1.0057	-0.1%	-1.0%
Pu35-18	Al_2O_3 (wt %)	8.8712	8.6297	8.6000	0.2712	0.0297	3.2%	0.3%
Pu35-18	B_2O_3 (wt %)	11.3179	11.2494	11.1800	0.1379	0.0694	1.2%	0.6%

Table D5. Average Measured and Bias-Corrected Chemical Compositions Versus Targeted Compositions by Oxide by Study Glass (continued)

Glass ID	Oxide	Measured (wt %)	Measured Bias-Corrected (wt %)	Targeted (wt %)	Diff of Measured	Diff of Meas BC	% Diff of Measured	% Diff of Meas BC
Pu35-18	CaO (wt %)	0.6835	0.6900	0.5700	0.1135	0.1200	19.9%	21.1%
Pu35-18	Cl (wt %)	0.0330	0.0330	0.5800	-0.5470	-0.5470	-94.3%	-94.3%
Pu35-18	Cr_2O_3 (wt %)	0.4611	0.4583	0.4800	-0.0189	-0.0217	-3.9%	-4.5%
Pu35-18	CuO (wt %)	0.0939	0.0989	0.0700	0.0239	0.0289	34.1%	41.2%
Pu35-18	F (wt %)	0.0000	0.0000	0.0600	-0.0600	-0.0600	-100.0%	-100.0%
Pu35-18	Fe_2O_3 (wt %)	0.1573	0.1559	0.0800	0.0773	0.0759	96.6%	94.9%
Pu35-18	Ga_2O_3 (wt %)	0.1136	0.1136	0.0800	0.0336	0.0336	42.0%	42.0%
Pu35-18	Gd_2O_3 (wt %)	11.8142	11.8142	11.6100	0.2042	0.2042	1.8%	1.8%
Pu35-18	HfO_2 (wt %)	13.9157	13.9157	14.8800	-0.9643	-0.9643	-6.5%	-6.5%
Pu35-18	K_2O (wt %)	0.7999	0.6954	1.1000	-0.3001	-0.4046	-27.3%	-36.8%
Pu35-18	La_2O_3 (wt %)	16.4778	16.4778	16.3400	0.1378	0.1378	0.8%	0.8%
Pu35-18	MgO (wt %)	0.9809	0.9913	1.0400	-0.0591	-0.0487	-5.7%	-4.7%
Pu35-18	Na_2O (wt %)	0.8957	0.8110	0.9400	-0.0443	-0.1290	-4.7%	-13.7%
Pu35-18	Nd_2O_3 (wt %)	13.0637	13.0637	12.9000	0.1637	0.1637	1.3%	1.3%
Pu35-18	NiO (wt %)	0.0719	0.0804	0.0700	0.0019	0.0104	2.7%	14.8%
Pu35-18	PbO (wt %)	0.0382	0.0382	0.0000	0.0382	0.0382		
Pu35-18	SeO_2 (wt %)	0.0070	0.0070	0.0000	0.0070	0.0070		
Pu35-18	Si_2O_3 (wt %)	17.9166	17.4761	17.2000	0.7166	0.2761	4.2%	1.6%
Pu35-18	SO_4 (wt %)	0.0749	0.0749	0.0000	0.0749	0.0749		
Pu35-18	SrO (wt %)	2.1701	2.1701	2.1500	0.0201	0.0201	0.9%	0.9%
Pu35-18	Ta_2O_5 (wt %)	0.0818	0.0818	0.0700	0.0118	0.0118	16.9%	16.9%
Pu35-18	Sum (wt %)	100.0400	99.1265	100.0000	0.0400	-0.8735	0.0%	-0.9%
Pu35-19	Al_2O_3 (wt %)	8.9562	8.7124	8.6000	0.3562	0.1124	4.1%	1.3%
Pu35-19	B_2O_3 (wt %)	11.2375	11.1694	11.1800	0.0575	-0.0106	0.5%	-0.1%
Pu35-19	CaO (wt %)	0.1553	0.1568	0.0800	0.0753	0.0768	94.1%	96.0%
Pu35-19	Cl (wt %)	0.0515	0.0515	0.5800	-0.5285	-0.5285	-91.1%	-91.1%
Pu35-19	Cr_2O_3 (wt %)	0.4421	0.4394	0.4800	-0.0379	-0.0406	-7.9%	-8.5%
Pu35-19	CuO (wt %)	0.0914	0.0962	0.0700	0.0214	0.0262	30.5%	37.5%
Pu35-19	F (wt %)	0.0760	0.0938	0.3800	-0.3040	-0.2862	-80.0%	-75.3%
Pu35-19	Fe_2O_3 (wt %)	0.7585	0.7518	0.7800	-0.0215	-0.0282	-2.8%	-3.6%
Pu35-19	Ga_2O_3 (wt %)	0.1129	0.1129	0.0800	0.0329	0.0329	41.1%	41.1%
Pu35-19	Gd_2O_3 (wt %)	11.8718	11.8718	11.6100	0.2618	0.2618	2.3%	2.3%
Pu35-19	HfO_2 (wt %)	13.9747	13.9747	14.8900	-0.9153	-0.9153	-6.1%	-6.1%
Pu35-19	K_2O (wt %)	0.2746	0.2388	0.3700	-0.0954	-0.1312	-25.8%	-35.5%
Pu35-19	La_2O_3 (wt %)	16.4778	16.4778	16.3400	0.1378	0.1378	0.8%	0.8%
Pu35-19	MgO (wt %)	1.2719	1.2855	1.3800	-0.1081	-0.0945	-7.8%	-6.8%
Pu35-19	Na_2O (wt %)	0.7650	0.6926	0.7800	-0.0150	-0.0874	-1.9%	-11.2%
Pu35-19	Nd_2O_3 (wt %)	13.0637	13.0637	12.9000	0.1637	0.1637	1.3%	1.3%
Pu35-19	NiO (wt %)	0.0662	0.0740	0.0700	-0.0038	0.0040	-5.5%	5.7%
Pu35-19	PbO (wt %)	0.0377	0.0377	0.0000	0.0377	0.0377		
Pu35-19	SeO_2 (wt %)	0.0070	0.0070	0.0000	0.0070	0.0070		
Pu35-19	Si_2O_3 (wt %)	17.8204	17.3822	17.2000	0.6204	0.1822	3.6%	1.1%
Pu35-19	SO_4 (wt %)	0.0749	0.0749	0.0000	0.0749	0.0749		
Pu35-19	SrO (wt %)	2.2115	2.2115	2.1500	0.0615	0.0615	2.9%	2.9%
Pu35-19	Ta_2O_5 (wt %)	0.0824	0.0824	0.0700	0.0124	0.0124	17.7%	17.7%
Pu35-19	Sum (wt %)	99.8810	99.0589	99.9900	-0.1090	-0.9311	-0.1%	-0.9%
Pu35-20	Al_2O_3 (wt %)	9.0790	8.8319	8.6000	0.4790	0.2319	5.6%	2.7%
Pu35-20	B_2O_3 (wt %)	11.1731	11.1054	11.1800	-0.0069	-0.0746	-0.1%	-0.7%
Pu35-20	CaO (wt %)	0.3197	0.3228	0.2300	0.0897	0.0928	39.0%	40.3%
Pu35-20	Cl (wt %)	0.0485	0.0485	0.5800	-0.5315	-0.5315	-91.6%	-91.6%
Pu35-20	Cr_2O_3 (wt %)	0.3698	0.3675	0.4000	-0.0302	-0.0325	-7.6%	-8.1%
Pu35-20	CuO (wt %)	0.1033	0.1088	0.0700	0.0333	0.0388	47.5%	55.4%
Pu35-20	F (wt %)	0.0400	0.0494	0.2900	-0.2500	-0.2406	-86.2%	-83.0%
Pu35-20	Fe_2O_3 (wt %)	0.2867	0.2841	0.2800	0.0067	0.0041	2.4%	1.5%
Pu35-20	Ga_2O_3 (wt %)	0.5397	0.5397	0.5100	0.0297	0.0297	5.8%	5.8%
Pu35-20	Gd_2O_3 (wt %)	11.9870	11.9870	11.6100	0.3770	0.3770	3.2%	3.2%
Pu35-20	HfO_2 (wt %)	14.0926	14.0926	14.9500	-0.8574	-0.8574	-5.7%	-5.7%
Pu35-20	K_2O (wt %)	0.6643	0.5776	0.8500	-0.1857	-0.2724	-21.8%	-32.0%

Table D5. Average Measured and Bias-Corrected Chemical Compositions Versus Targeted Compositions by Oxide by Study Glass (continued)

Glass ID	Oxide	Measured (wt %)	Measured Bias-Corrected (wt %)	Targeted (wt %)	Diff of Measured	Diff of Meas BC	% Diff of Measured	% Diff of Meas BC
Pu35-20	La_2O_3 (wt %)	16.8297	16.8297	16.3400	0.4897	0.4897	3.0%	3.0%
Pu35-20	MgO (wt %)	0.5365	0.5422	0.5500	-0.0135	-0.0078	-2.5%	-1.4%
Pu35-20	Na_2O (wt %)	0.5176	0.4687	0.5000	0.0176	-0.0313	3.5%	-6.3%
Pu35-20	Nd_2O_3 (wt %)	13.2970	13.2970	12.9000	0.3970	0.3970	3.1%	3.1%
Pu35-20	NiO (wt %)	0.2666	0.2980	0.2900	-0.0234	0.0080	-8.1%	2.8%
Pu35-20	PbO (wt %)	0.0393	0.0393	0.0000	0.0393	0.0393		
Pu35-20	SeO_2 (wt %)	0.0070	0.0070	0.0000	0.0070	0.0070		
Pu35-20	Si_2O_3 (wt %)	18.1520	17.7057	17.2000	0.9520	0.5057	5.5%	2.9%
Pu35-20	SO_4 (wt %)	0.0749	0.0749	0.0000	0.0749	0.0749		
Pu35-20	SrO (wt %)	2.2233	2.2233	2.1500	0.0733	0.0733	3.4%	3.4%
Pu35-20	Ta_2O_5 (wt %)	0.5110	0.5110	0.5100	0.0010	0.0010	0.2%	0.2%
Pu35-20	Sum (wt %)	101.1585	100.3120	99.9900	1.1685	0.3220	1.2%	0.3%
Pu35-21	Al_2O_3 (wt %)	8.9657	8.7216	8.6000	0.3657	0.1216	4.3%	1.4%
Pu35-21	B_2O_3 (wt %)	11.1409	11.0734	11.1800	-0.0391	-0.1066	-0.4%	-1.0%
Pu35-21	CaO (wt %)	0.1798	0.1815	0.0800	0.0998	0.1015	124.7%	126.9%
Pu35-21	Cl (wt %)	0.0630	0.0630	0.5800	-0.5170	-0.5170	-89.1%	-89.1%
Pu35-21	Cr_2O_3 (wt %)	0.0811	0.0806	0.0900	-0.0089	-0.0094	-9.9%	-10.4%
Pu35-21	CuO (wt %)	0.1177	0.1239	0.0700	0.0477	0.0539	68.1%	77.0%
Pu35-21	F (wt %)	0.0000	0.0000	0.0600	-0.0600	-0.0600	-100.0%	-100.0%
Pu35-21	Fe_2O_3 (wt %)	0.1037	0.1027	0.0800	0.0237	0.0227	29.6%	28.4%
Pu35-21	Ga_2O_3 (wt %)	0.6472	0.6472	0.6200	0.0272	0.0272	4.4%	4.4%
Pu35-21	Gd_2O_3 (wt %)	11.8718	11.8718	11.6100	0.2618	0.2618	2.3%	2.3%
Pu35-21	HfO_2 (wt %)	13.6209	13.6209	14.9400	-1.3191	-1.3191	-8.8%	-8.8%
Pu35-21	K_2O (wt %)	0.3542	0.3079	0.4100	-0.0558	-0.1021	-13.6%	-24.9%
Pu35-21	La_2O_3 (wt %)	16.5365	16.5365	16.3400	0.1965	0.1965	1.2%	1.2%
Pu35-21	MgO (wt %)	1.1857	1.1983	1.2800	-0.0943	-0.0817	-7.4%	-6.4%
Pu35-21	Na_2O (wt %)	0.6026	0.5456	0.5900	0.0126	-0.0444	2.1%	-7.5%
Pu35-21	Nd_2O_3 (wt %)	13.1803	13.1803	12.9000	0.2803	0.2803	2.2%	2.2%
Pu35-21	NiO (wt %)	0.0713	0.0797	0.0700	0.0013	0.0097	1.8%	13.8%
Pu35-21	PbO (wt %)	0.0388	0.0388	0.0000	0.0388	0.0388		
Pu35-21	SeO_2 (wt %)	0.0070	0.0070	0.0000	0.0070	0.0070		
Pu35-21	Si_2O_3 (wt %)	17.9701	17.5283	17.2000	0.7701	0.3283	4.5%	1.9%
Pu35-21	SO_4 (wt %)	0.0749	0.0749	0.0000	0.0749	0.0749		
Pu35-21	SrO (wt %)	2.2055	2.2055	2.1500	0.0555	0.0555	2.6%	2.6%
Pu35-21	Ta_2O_5 (wt %)	1.0910	1.0910	1.1400	-0.0490	-0.0490	-4.3%	-4.3%
Pu35-21	Sum (wt %)	100.1095	99.2805	99.9900	0.1195	-0.7095	0.1%	-0.7%
Pu35-22	Al_2O_3 (wt %)	9.0602	8.8135	8.6000	0.4602	0.2135	5.4%	2.5%
Pu35-22	B_2O_3 (wt %)	11.3018	11.2334	11.1800	0.1218	0.0534	1.1%	0.5%
Pu35-22	CaO (wt %)	0.6968	0.7035	0.5900	0.1068	0.1135	18.1%	19.2%
Pu35-22	Cl (wt %)	0.0555	0.0555	0.6000	-0.5445	-0.5445	-90.8%	-90.8%
Pu35-22	Cr_2O_3 (wt %)	0.1367	0.1358	0.1500	-0.0133	-0.0142	-8.9%	-9.5%
Pu35-22	CuO (wt %)	0.2316	0.2439	0.2200	0.0116	0.0239	5.3%	10.9%
Pu35-22	F (wt %)	0.0950	0.1172	0.4700	-0.3750	-0.3528	-79.8%	-75.1%
Pu35-22	Fe_2O_3 (wt %)	0.3739	0.3706	0.3700	0.0039	0.0006	1.0%	0.2%
Pu35-22	Ga_2O_3 (wt %)	0.1149	0.1149	0.0800	0.0349	0.0349	43.7%	43.7%
Pu35-22	Gd_2O_3 (wt %)	12.0447	12.0447	11.6100	0.4347	0.4347	3.7%	3.7%
Pu35-22	HfO_2 (wt %)	13.9157	13.9157	14.9800	-1.0643	-1.0643	-7.1%	-7.1%
Pu35-22	K_2O (wt %)	0.4674	0.4064	0.5500	-0.0826	-0.1436	-15.0%	-26.1%
Pu35-22	La_2O_3 (wt %)	16.8297	16.8297	16.3400	0.4897	0.4897	3.0%	3.0%
Pu35-22	MgO (wt %)	0.6758	0.6830	0.6900	-0.0142	-0.0070	-2.1%	-1.0%
Pu35-22	Na_2O (wt %)	0.7522	0.6810	0.7400	0.0122	-0.0590	1.6%	-8.0%
Pu35-22	Nd_2O_3 (wt %)	13.2386	13.2386	12.9000	0.3386	0.3386	2.6%	2.6%
Pu35-22	NiO (wt %)	0.0725	0.0811	0.0800	-0.0075	0.0011	-9.3%	1.3%
Pu35-22	PbO (wt %)	0.0377	0.0377	0.0000	0.0377	0.0377		
Pu35-22	SeO_2 (wt %)	0.0070	0.0070	0.0000	0.0070	0.0070		
Pu35-22	Si_2O_3 (wt %)	18.1627	17.7161	17.2000	0.9627	0.5161	5.6%	3.0%
Pu35-22	SO_4 (wt %)	0.0749	0.0749	0.0000	0.0749	0.0749		
Pu35-22	SrO (wt %)	2.2174	2.2174	2.1500	0.0674	0.0674	3.1%	3.1%

Table D5. Average Measured and Bias-Corrected Chemical Compositions Versus Targeted Compositions by Oxide by Study Glass (continued)

Glass ID	Oxide	Measured (wt %)	Measured Bias-Corrected (wt %)	Targeted (wt %)	Diff of Measured	Diff of Meas BC	% Diff of Measured	% Diff of Meas BC
Pu35-22	Ta_2O_5 (wt %)	0.5134	0.5134	0.5200	-0.0066	-0.0066	-1.3%	-1.3%
Pu35-22	Sum (wt %)	101.0760	100.2351	100.0200	1.0560	0.2151	1.1%	0.2%
Pu35-23	Al_2O_3 (wt %)	8.9846	8.7400	8.6000	0.3846	0.1400	4.5%	1.6%
Pu35-23	B_2O_3 (wt %)	11.3501	11.2814	11.1800	0.1701	0.1014	1.5%	0.9%
Pu35-23	CaO (wt %)	0.2379	0.2401	0.1600	0.0779	0.0801	48.7%	50.1%
Pu35-23	Cl (wt %)	0.0630	0.0630	0.5900	-0.5270	-0.5270	-89.3%	-89.3%
Pu35-23	Cr_2O_3 (wt %)	0.2704	0.2687	0.2900	-0.0196	-0.0213	-6.8%	-7.3%
Pu35-23	CuO (wt %)	0.2341	0.2465	0.2200	0.0141	0.0265	6.4%	12.1%
Pu35-23	F (wt %)	0.0110	0.0136	0.0900	-0.0790	-0.0764	-87.8%	-84.9%
Pu35-23	Fe_2O_3 (wt %)	0.5569	0.5520	0.5600	-0.0031	-0.0080	-0.6%	-1.4%
Pu35-23	Ga_2O_3 (wt %)	0.5572	0.5572	0.5300	0.0272	0.0272	5.1%	5.1%
Pu35-23	Gd_2O_3 (wt %)	11.8718	11.8718	11.6100	0.2618	0.2618	2.3%	2.3%
Pu35-23	HfO_2 (wt %)	13.9747	13.9747	14.8800	-0.9053	-0.9053	-6.1%	-6.1%
Pu35-23	K_2O (wt %)	0.1265	0.1100	0.1600	-0.0335	-0.0500	-20.9%	-31.3%
Pu35-23	La_2O_3 (wt %)	16.5365	16.5365	16.3400	0.1965	0.1965	1.2%	1.2%
Pu35-23	MgO (wt %)	0.6501	0.6570	0.6700	-0.0199	-0.0130	-3.0%	-1.9%
Pu35-23	Na_2O (wt %)	0.9018	0.8165	0.9300	-0.0282	-0.1135	-3.0%	-12.2%
Pu35-23	Nd_2O_3 (wt %)	13.1220	13.1220	12.9000	0.2220	0.2220	1.7%	1.7%
Pu35-23	NiO (wt %)	0.1101	0.1230	0.1200	-0.0099	0.0030	-8.3%	2.5%
Pu35-23	PbO (wt %)	0.0388	0.0388	0.0000	0.0388	0.0388		
Pu35-23	SeO_2 (wt %)	0.0070	0.0070	0.0000	0.0070	0.0070		
Pu35-23	Si_2O_3 (wt %)	17.8418	17.4031	17.2000	0.6418	0.2031	3.7%	1.2%
Pu35-23	SO_4 (wt %)	0.0749	0.0749	0.0000	0.0749	0.0749		
Pu35-23	SrO (wt %)	2.2292	2.2292	2.1500	0.0792	0.0792	3.7%	3.7%
Pu35-23	Ta_2O_5 (wt %)	0.7967	0.7967	0.8300	-0.0333	-0.0333	-4.0%	-4.0%
Pu35-23	Sum (wt %)	100.5469	99.7237	100.0100	0.5369	-0.2863	0.5%	-0.3%
Pu35-24	Al_2O_3 (wt %)	8.9184	8.6757	8.6000	0.3184	0.0757	3.7%	0.9%
Pu35-24	B_2O_3 (wt %)	11.4145	11.3455	11.1800	0.2345	0.1655	2.1%	1.5%
Pu35-24	CaO (wt %)	0.5037	0.5085	0.4000	0.1037	0.1085	25.9%	27.1%
Pu35-24	Cl (wt %)	0.0550	0.0550	0.6300	-0.5750	-0.5750	-91.3%	-91.3%
Pu35-24	Cr_2O_3 (wt %)	0.3435	0.3413	0.3700	-0.0265	-0.0287	-7.2%	-7.7%
Pu35-24	CuO (wt %)	0.2147	0.2261	0.2200	-0.0053	0.0061	-2.4%	2.8%
Pu35-24	F (wt %)	0.0310	0.0383	0.2400	-0.2090	-0.2017	-87.1%	-84.1%
Pu35-24	Fe_2O_3 (wt %)	0.4296	0.4258	0.4100	0.0196	0.0158	4.8%	3.9%
Pu35-24	Ga_2O_3 (wt %)	0.8395	0.8395	0.8300	0.0095	0.0095	1.1%	1.1%
Pu35-24	Gd_2O_3 (wt %)	11.8142	11.8142	11.6100	0.2042	0.2042	1.8%	1.8%
Pu35-24	HfO_2 (wt %)	13.7978	13.7978	14.9000	-1.1022	-1.1022	-7.4%	-7.4%
Pu35-24	K_2O (wt %)	0.4186	0.3639	0.5300	-0.1114	-0.1661	-21.0%	-31.3%
Pu35-24	La_2O_3 (wt %)	16.5365	16.5365	16.3400	0.1965	0.1965	1.2%	1.2%
Pu35-24	MgO (wt %)	0.6492	0.6561	0.6700	-0.0208	-0.0139	-3.1%	-2.1%
Pu35-24	Na_2O (wt %)	0.5911	0.5352	0.5800	0.0111	-0.0448	1.9%	-7.7%
Pu35-24	Nd_2O_3 (wt %)	13.0637	13.0637	12.9000	0.1637	0.1637	1.3%	1.3%
Pu35-24	NiO (wt %)	0.0891	0.0996	0.1000	-0.0109	-0.0004	-10.9%	-0.4%
Pu35-24	PbO (wt %)	0.0393	0.0393	0.0000	0.0393	0.0393		
Pu35-24	SeO_2 (wt %)	0.0070	0.0070	0.0000	0.0070	0.0070		
Pu35-24	Si_2O_3 (wt %)	17.9808	17.5387	17.2000	0.7808	0.3387	4.5%	2.0%
Pu35-24	SO_4 (wt %)	0.0749	0.0749	0.0000	0.0749	0.0749		
Pu35-24	SrO (wt %)	2.1819	2.1819	2.1500	0.0319	0.0319	1.5%	1.5%
Pu35-24	Ta_2O_5 (wt %)	0.1691	0.1691	0.1500	0.0191	0.0191	12.7%	12.7%
Pu35-24	Sum (wt %)	100.1631	99.3336	100.0100	0.1531	-0.6764	0.2%	-0.7%
Pu35-25	Al_2O_3 (wt %)	8.8901	8.6481	8.6000	0.2901	0.0481	3.4%	0.6%
Pu35-25	B_2O_3 (wt %)	11.1731	11.1054	11.1800	-0.0069	-0.0746	-0.1%	-0.7%
Pu35-25	CaO (wt %)	0.3743	0.3779	0.2800	0.0943	0.0979	33.7%	35.0%
Pu35-25	Cl (wt %)	0.0735	0.0735	0.6700	-0.5965	-0.5965	-89.0%	-89.0%
Pu35-25	Cr_2O_3 (wt %)	0.1754	0.1743	0.1700	0.0054	0.0043	3.2%	2.5%
Pu35-25	CuO (wt %)	0.2291	0.2412	0.2200	0.0091	0.0212	4.1%	9.7%
Pu35-25	F (wt %)	0.0000	0.0000	0.0700	-0.0700	-0.0700	-100.0%	-100.0%
Pu35-25	Fe_2O_3 (wt %)	0.8228	0.8155	0.8300	-0.0072	-0.0145	-0.9%	-1.7%

Table D5. Average Measured and Bias-Corrected Chemical Compositions Versus Targeted Compositions by Oxide by Study Glass (continued)

Glass ID	Oxide	Measured (wt %)	Measured Bias-Corrected (wt %)	Targeted (wt %)	Diff of Measured	Diff of Meas BC	% Diff of Measured	% Diff of Meas BC
Pu35-25	Ga_2O_3 (wt %)	0.2917	0.2917	0.2600	0.0317	0.0317	12.2%	12.2%
Pu35-25	Gd_2O_3 (wt %)	11.8142	11.8142	11.6100	0.2042	0.2042	1.8%	1.8%
Pu35-25	HfO_2 (wt %)	13.7978	13.7978	14.9200	-1.1222	-1.1222	-7.5%	-7.5%
Pu35-25	K_2O (wt %)	0.6216	0.5404	0.7000	-0.0784	-0.1596	-11.2%	-22.8%
Pu35-25	La_2O_3 (wt %)	16.3606	16.3606	16.3400	0.0206	0.0206	0.1%	0.1%
Pu35-25	MgO (wt %)	0.4668	0.4718	0.4800	-0.0132	-0.0082	-2.7%	-1.7%
Pu35-25	Na_2O (wt %)	0.4934	0.4467	0.4800	0.0134	-0.0333	2.8%	-6.9%
Pu35-25	Nd_2O_3 (wt %)	13.0054	13.0054	12.9000	0.1054	0.1054	0.8%	0.8%
Pu35-25	NiO (wt %)	0.3169	0.3542	0.3500	-0.0331	0.0042	-9.5%	1.2%
Pu35-25	PbO (wt %)	0.0366	0.0366	0.0000	0.0366	0.0366		
Pu35-25	SeO_2 (wt %)	0.0070	0.0070	0.0000	0.0070	0.0070		
Pu35-25	Si_2O_3 (wt %)	19.5853	19.1038	17.2000	2.3853	1.9038	13.9%	11.1%
Pu35-25	SO_4 (wt %)	0.0749	0.0749	0.0000	0.0749	0.0749		
Pu35-25	SrO (wt %)	2.1819	2.1819	2.1500	0.0319	0.0319	1.5%	1.5%
Pu35-25	Ta_2O_5 (wt %)	0.5739	0.5739	0.5900	-0.0161	-0.0161	-2.7%	-2.7%
Pu35-25	Sum (wt %)	101.3660	100.4967	100.0000	1.3660	0.4967	1.4%	0.5%
Pu35-26	Al_2O_3 (wt %)	8.7956	8.8681	8.6000	0.1956	0.2681	2.3%	3.1%
Pu35-26	B_2O_3 (wt %)	11.2214	11.1382	11.1800	0.0414	-0.0418	0.4%	-0.4%
Pu35-26	CaO (wt %)	0.5254	0.5294	0.4300	0.0954	0.0994	22.2%	23.1%
Pu35-26	Cl (wt %)	0.0475	0.0475	0.6600	-0.6125	-0.6125	-92.8%	-92.8%
Pu35-26	Cr_2O_3 (wt %)	0.2455	0.2376	0.2700	-0.0245	-0.0324	-9.1%	-12.0%
Pu35-26	CuO (wt %)	0.0964	0.1015	0.0700	0.0264	0.0315	37.7%	45.0%
Pu35-26	F (wt %)	0.0325	0.0397	0.1000	-0.0675	-0.0603	-67.5%	-60.3%
Pu35-26	Fe_2O_3 (wt %)	0.4718	0.4813	0.4700	0.0018	0.0113	0.4%	2.4%
Pu35-26	Ga_2O_3 (wt %)	0.7991	0.7991	0.7900	0.0091	0.0091	1.2%	1.2%
Pu35-26	Gd_2O_3 (wt %)	11.6413	11.6413	11.6100	0.0313	0.0313	0.3%	0.3%
Pu35-26	HfO_2 (wt %)	13.6799	13.6799	14.8700	-1.1901	-1.1901	-8.0%	-8.0%
Pu35-26	K_2O (wt %)	0.2060	0.1841	0.2500	-0.0440	-0.0659	-17.6%	-26.4%
Pu35-26	La_2O_3 (wt %)	16.1260	16.1260	16.3400	-0.2140	-0.2140	-1.3%	-1.3%
Pu35-26	MgO (wt %)	0.8598	0.8489	0.8900	-0.0302	-0.0411	-3.4%	-4.6%
Pu35-26	Na_2O (wt %)	0.7569	0.7170	0.7700	-0.0131	-0.0530	-1.7%	-6.9%
Pu35-26	Nd_2O_3 (wt %)	13.0637	13.0637	12.9000	0.1637	0.1637	1.3%	1.3%
Pu35-26	NiO (wt %)	0.2049	0.2249	0.2200	-0.0151	0.0049	-6.9%	2.2%
Pu35-26	PbO (wt %)	0.0393	0.0393	0.0000	0.0393	0.0393		
Pu35-26	SeO_2 (wt %)	0.0070	0.0070	0.0000	0.0070	0.0070		
Pu35-26	Si_2O_3 (wt %)	17.5316	17.7139	17.2000	0.3316	0.5139	1.9%	3.0%
Pu35-26	SO_4 (wt %)	0.0749	0.0749	0.0000	0.0749	0.0749		
Pu35-26	SrO (wt %)	2.1523	2.1523	2.1500	0.0023	0.0023	0.1%	0.1%
Pu35-26	Ta_2O_5 (wt %)	0.2277	0.2277	0.2200	0.0077	0.0077	3.5%	3.5%
Pu35-26	Sum (wt %)	98.8065	98.9434	99.9900	-1.1835	-1.0466	-1.2%	-1.0%
Pu35-27	Al_2O_3 (wt %)	8.8051	8.8777	8.6000	0.2051	0.2777	2.4%	3.2%
Pu35-27	B_2O_3 (wt %)	11.1731	11.0902	11.1800	-0.0069	-0.0898	-0.1%	-0.8%
Pu35-27	CaO (wt %)	0.4233	0.4265	0.3200	0.1033	0.1065	32.3%	33.3%
Pu35-27	Cl (wt %)	0.0695	0.0695	0.7200	-0.6505	-0.6505	-90.3%	-90.3%
Pu35-27	Cr_2O_3 (wt %)	0.4451	0.4306	0.4800	-0.0349	-0.0494	-7.3%	-10.3%
Pu35-27	CuO (wt %)	0.1058	0.1114	0.0700	0.0358	0.0414	51.1%	59.1%
Pu35-27	F (wt %)	0.0550	0.0672	0.2400	-0.1850	-0.1728	-77.1%	-72.0%
Pu35-27	Fe_2O_3 (wt %)	0.4725	0.4820	0.4600	0.0125	0.0220	2.7%	4.8%
Pu35-27	Ga_2O_3 (wt %)	0.3112	0.3112	0.2700	0.0412	0.0412	15.3%	15.3%
Pu35-27	Gd_2O_3 (wt %)	11.5894	11.5894	11.6100	-0.0206	-0.0206	-0.2%	-0.2%
Pu35-27	HfO_2 (wt %)	13.3851	13.3851	14.9400	-1.5549	-1.5549	-10.4%	-10.4%
Pu35-27	K_2O (wt %)	0.4078	0.3645	0.5200	-0.1122	-0.1555	-21.6%	-29.9%
Pu35-27	La_2O_3 (wt %)	16.0087	16.0087	16.3400	-0.3313	-0.3313	-2.0%	-2.0%
Pu35-27	MgO (wt %)	0.5945	0.5870	0.6100	-0.0155	-0.0230	-2.5%	-3.8%
Pu35-27	Na_2O (wt %)	0.6470	0.6130	0.6500	-0.0030	-0.0370	-0.5%	-5.7%
Pu35-27	Nd_2O_3 (wt %)	12.9470	12.9470	12.9000	0.0470	0.0470	0.4%	0.4%
Pu35-27	NiO (wt %)	0.0725	0.0796	0.0700	0.0025	0.0096	3.6%	13.7%
Pu35-27	PbO (wt %)	0.0404	0.0404	0.0000	0.0404	0.0404		

Table D5. Average Measured and Bias-Corrected Chemical Compositions Versus Targeted Compositions by Oxide by Study Glass (continued)

Glass ID	Oxide	Measured (wt %)	Measured Bias-Corrected (wt %)	Targeted (wt %)	Diff of Measured	Diff of Meas BC	% Diff of Measured	% Diff of Meas BC
Pu35-27	SeO_2 (wt %)	0.0070	0.0070	0.0000	0.0070	0.0070		
Pu35-27	Si_2O_3 (wt %)	17.4246	17.6058	17.2000	0.2246	0.4058	1.3%	2.4%
Pu35-27	SO_4 (wt %)	0.0749	0.0749	0.0000	0.0749	0.0749		
Pu35-27	SrO (wt %)	2.1582	2.1582	2.1500	0.0082	0.0082	0.4%	0.4%
Pu35-27	Ta_2O_5 (wt %)	0.6551	0.6551	0.6700	-0.0149	-0.0149	-2.2%	-2.2%
Pu35-27	Sum (wt %)	97.8727	97.9819	100.0000	-2.1273	-2.0181	-2.1%	-2.0%
Pu35-28	Al_2O_3 (wt %)	8.8618	8.9348	8.6000	0.2618	0.3348	3.0%	3.9%
Pu35-28	B_2O_3 (wt %)	11.3823	11.2980	11.1800	0.2023	0.1180	1.8%	1.1%
Pu35-28	CaO (wt %)	0.1889	0.1903	0.1100	0.0789	0.0803	71.7%	73.0%
Pu35-28	Cl (wt %)	0.0730	0.0730	0.7200	-0.6470	-0.6470	-89.9%	-89.9%
Pu35-28	Cr_2O_3 (wt %)	0.4458	0.4313	0.4800	-0.0342	-0.0487	-7.1%	-10.1%
Pu35-28	CuO (wt %)	0.2209	0.2327	0.2200	0.0009	0.0127	0.4%	5.8%
Pu35-28	F (wt %)	0.0345	0.0421	0.1000	-0.0655	-0.0579	-65.5%	-57.9%
Pu35-28	Fe_2O_3 (wt %)	0.1101	0.1123	0.0800	0.0301	0.0323	37.6%	40.4%
Pu35-28	Ga_2O_3 (wt %)	0.4281	0.4281	0.4100	0.0181	0.0181	4.4%	4.4%
Pu35-28	Gd_2O_3 (wt %)	11.6989	11.6989	11.6100	0.0889	0.0889	0.8%	0.8%
Pu35-28	HfO_2 (wt %)	13.6209	13.6209	14.9300	-1.3091	-1.3091	-8.8%	-8.8%
Pu35-28	K_2O (wt %)	0.3258	0.2912	0.3900	-0.0642	-0.0988	-16.5%	-25.3%
Pu35-28	La_2O_3 (wt %)	16.0674	16.0674	16.3400	-0.2726	-0.2726	-1.7%	-1.7%
Pu35-28	MgO (wt %)	0.8930	0.8817	0.9300	-0.0370	-0.0483	-4.0%	-5.2%
Pu35-28	Na_2O (wt %)	0.7347	0.6960	0.7400	-0.0053	-0.0440	-0.7%	-5.9%
Pu35-28	Nd_2O_3 (wt %)	13.0637	13.0637	12.9000	0.1637	0.1637	1.3%	1.3%
Pu35-28	NiO (wt %)	0.3302	0.3625	0.3600	-0.0298	0.0025	-8.3%	0.7%
Pu35-28	PbO (wt %)	0.0404	0.0404	0.0000	0.0404	0.0404		
Pu35-28	SeO_2 (wt %)	0.0070	0.0070	0.0000	0.0070	0.0070		
Pu35-28	Si_2O_3 (wt %)	17.3283	17.5086	17.2000	0.1283	0.3086	0.7%	1.8%
Pu35-28	SO_4 (wt %)	0.0749	0.0749	0.0000	0.0749	0.0749		
Pu35-28	SrO (wt %)	2.1878	2.1878	2.1500	0.0378	0.0378	1.8%	1.8%
Pu35-28	Ta_2O_5 (wt %)	0.5281	0.5281	0.5400	-0.0119	-0.0119	-2.2%	-2.2%
Pu35-28	Sum (wt %)	98.6465	98.7716	99.9900	-1.3435	-1.2184	-1.3%	-1.2%
Pu35-29	Al_2O_3 (wt %)	8.8995	8.9729	8.6000	0.2995	0.3729	3.5%	4.3%
Pu35-29	B_2O_3 (wt %)	11.2857	11.2021	11.1800	0.1057	0.0221	0.9%	0.2%
Pu35-29	CaO (wt %)	0.1686	0.1699	0.0800	0.0886	0.0899	110.8%	112.4%
Pu35-29	Cl (wt %)	0.0605	0.0605	0.8400	-0.7795	-0.7795	-92.8%	-92.8%
Pu35-29	Cr_2O_3 (wt %)	0.0862	0.0834	0.0900	-0.0038	-0.0066	-4.2%	-7.3%
Pu35-29	CuO (wt %)	0.1064	0.1121	0.0700	0.0364	0.0421	52.0%	60.1%
Pu35-29	F (wt %)	0.1160	0.1416	0.3600	-0.2440	-0.2184	-67.8%	-60.7%
Pu35-29	Fe_2O_3 (wt %)	0.2209	0.2253	0.1800	0.0409	0.0453	22.7%	25.2%
Pu35-29	Ga_2O_3 (wt %)	0.7286	0.7286	0.7000	0.0286	0.0286	4.1%	4.1%
Pu35-29	Gd_2O_3 (wt %)	11.5836	11.5836	11.6100	-0.0264	-0.0264	-0.2%	-0.2%
Pu35-29	HfO_2 (wt %)	13.4440	13.4440	15.0300	-1.5860	-1.5860	-10.6%	-10.6%
Pu35-29	K_2O (wt %)	0.6643	0.5938	0.8400	-0.1757	-0.2462	-20.9%	-29.3%
Pu35-29	La_2O_3 (wt %)	16.1846	16.1846	16.3400	-0.1554	-0.1554	-1.0%	-1.0%
Pu35-29	MgO (wt %)	0.4685	0.4625	0.4700	-0.0015	-0.0075	-0.3%	-1.6%
Pu35-29	Na_2O (wt %)	0.9443	0.8946	0.9500	-0.0057	-0.0554	-0.6%	-5.8%
Pu35-29	Nd_2O_3 (wt %)	13.0054	13.0054	12.9000	0.1054	0.1054	0.8%	0.8%
Pu35-29	NiO (wt %)	0.0700	0.0768	0.0700	0.0000	0.0068	0.0%	9.7%
Pu35-29	PbO (wt %)	0.0420	0.0420	0.0000	0.0420	0.0420		
Pu35-29	SeO_2 (wt %)	0.0070	0.0070	0.0000	0.0070	0.0070		
Pu35-29	Si_2O_3 (wt %)	17.4246	17.6058	17.2000	0.2246	0.4058	1.3%	2.4%
Pu35-29	SO_4 (wt %)	0.0749	0.0749	0.0000	0.0749	0.0749		
Pu35-29	SrO (wt %)	2.2529	2.2529	2.1500	0.1029	0.1029	4.8%	4.8%
Pu35-29	Ta_2O_5 (wt %)	0.3455	0.3455	0.3400	0.0055	0.0055	1.6%	1.6%
Pu35-29	Sum (wt %)	98.1841	98.2699	100.0000	-1.8159	-1.7301	-1.8%	-1.7%
Pu35-30	Al_2O_3 (wt %)	8.9184	8.9920	8.6000	0.3184	0.3920	3.7%	4.6%
Pu35-30	B_2O_3 (wt %)	11.0121	10.9304	11.1800	-0.1679	-0.2496	-1.5%	-2.2%
Pu35-30	CaO (wt %)	0.5569	0.5611	0.4600	0.0969	0.1011	21.1%	22.0%
Pu35-30	Cl (wt %)	0.0330	0.0330	0.5800	-0.5470	-0.5470	-94.3%	-94.3%

Table D5. Average Measured and Bias-Corrected Chemical Compositions Versus Targeted Compositions by Oxide by Study Glass (continued)

Glass ID	Oxide	Measured (wt %)	Measured Bias-Corrected (wt %)	Targeted (wt %)	Diff of Measured	Diff of Meas BC	% Diff of Measured	% Diff of Meas BC
Pu35-30	Cr_2O_3 (wt %)	0.0899	0.0870	0.0800	0.0099	0.0070	12.4%	8.7%
Pu35-30	CuO (wt %)	0.0857	0.0903	0.0700	0.0157	0.0203	22.5%	29.0%
Pu35-30	F (wt %)	0.0000	0.0000	0.0600	-0.0600	-0.0600	-100.0%	-100.0%
Pu35-30	Fe_2O_3 (wt %)	0.1115	0.1138	0.0800	0.0315	0.0338	39.4%	42.2%
Pu35-30	Ga_2O_3 (wt %)	0.7722	0.7722	0.7500	0.0222	0.0222	3.0%	3.0%
Pu35-30	Gd_2O_3 (wt %)	11.7565	11.7565	11.6100	0.1465	0.1465	1.3%	1.3%
Pu35-30	HfO_2 (wt %)	13.7388	13.7388	14.8800	-1.1412	-1.1412	-7.7%	-7.7%
Pu35-30	K_2O (wt %)	0.8005	0.7155	1.1100	-0.3095	-0.3945	-27.9%	-35.5%
Pu35-30	La_2O_3 (wt %)	16.3606	16.3606	16.3400	0.0206	0.0206	0.1%	0.1%
Pu35-30	MgO (wt %)	0.4544	0.4486	0.4600	-0.0056	-0.0114	-1.2%	-2.5%
Pu35-30	Na_2O (wt %)	0.8654	0.8198	0.9000	-0.0346	-0.0802	-3.8%	-8.9%
Pu35-30	Nd_2O_3 (wt %)	13.0637	13.0637	12.9000	0.1637	0.1637	1.3%	1.3%
Pu35-30	NiO (wt %)	0.0636	0.0698	0.0700	-0.0064	-0.0002	-9.1%	-0.2%
Pu35-30	PbO (wt %)	0.0873	0.0873	0.0600	0.0273	0.0273	45.4%	45.4%
Pu35-30	SeO_2 (wt %)	0.0070	0.0070	0.0800	-0.0730	-0.0730	-91.2%	-91.2%
Pu35-30	Si_2O_3 (wt %)	17.5209	17.7031	17.2000	0.3209	0.5031	1.9%	2.9%
Pu35-30	SO_4 (wt %)	0.0749	0.0749	0.1700	-0.0951	-0.0951	-55.9%	-55.9%
Pu35-30	SrO (wt %)	2.2351	2.2351	2.1500	0.0851	0.0851	4.0%	4.0%
Pu35-30	Ta_2O_5 (wt %)	0.0885	0.0885	0.0700	0.0185	0.0185	26.5%	26.5%
Pu35-30	Sum (wt %)	98.6969	98.7491	99.8600	-1.1631	-1.1109	-1.2%	-1.1%
Pu35-31	Al_2O_3 (wt %)	8.8429	8.9158	8.6000	0.2429	0.3158	2.8%	3.7%
Pu35-31	B_2O_3 (wt %)	10.9799	10.8985	11.1800	-0.2001	-0.2815	-1.8%	-2.5%
Pu35-31	CaO (wt %)	0.1665	0.1678	0.0800	0.0865	0.0878	108.1%	109.7%
Pu35-31	Cl (wt %)	0.0385	0.0385	0.5800	-0.5415	-0.5415	-93.4%	-93.4%
Pu35-31	Cr_2O_3 (wt %)	0.0914	0.0884	0.0900	0.0014	-0.0016	1.5%	-1.8%
Pu35-31	CuO (wt %)	0.0895	0.0943	0.0700	0.0195	0.0243	27.9%	34.7%
Pu35-31	F (wt %)	0.1090	0.1331	0.4700	-0.3610	-0.3369	-76.8%	-71.7%
Pu35-31	Fe_2O_3 (wt %)	0.8328	0.8495	0.8300	0.0028	0.0195	0.3%	2.4%
Pu35-31	Ga_2O_3 (wt %)	0.1163	0.1163	0.0800	0.0363	0.0363	45.3%	45.3%
Pu35-31	Gd_2O_3 (wt %)	11.6989	11.6989	11.6100	0.0889	0.0889	0.8%	0.8%
Pu35-31	HfO_2 (wt %)	13.6799	13.6799	14.9500	-1.2701	-1.2701	-8.5%	-8.5%
Pu35-31	K_2O (wt %)	0.8944	0.7994	1.1200	-0.2256	-0.3206	-20.1%	-28.6%
Pu35-31	La_2O_3 (wt %)	16.3019	16.3019	16.3400	-0.0381	-0.0381	-0.2%	-0.2%
Pu35-31	MgO (wt %)	0.5904	0.5829	0.6000	-0.0096	-0.0171	-1.6%	-2.9%
Pu35-31	Na_2O (wt %)	0.4967	0.4706	0.4700	0.0267	0.0006	5.7%	0.1%
Pu35-31	Nd_2O_3 (wt %)	13.1803	13.1803	12.9000	0.2803	0.2803	2.2%	2.2%
Pu35-31	NiO (wt %)	0.1533	0.1683	0.1700	-0.0167	-0.0017	-9.8%	-1.0%
Pu35-31	PbO (wt %)	0.0894	0.0894	0.0600	0.0294	0.0294	49.0%	49.0%
Pu35-31	SeO_2 (wt %)	0.0070	0.0070	0.0800	-0.0730	-0.0730	-91.2%	-91.2%
Pu35-31	Si_2O_3 (wt %)	17.5423	17.7247	17.2000	0.3423	0.5247	2.0%	3.1%
Pu35-31	SO_4 (wt %)	0.0749	0.0749	0.1700	-0.0951	-0.0951	-55.9%	-55.9%
Pu35-31	SrO (wt %)	2.2174	2.2174	2.1500	0.0674	0.0674	3.1%	3.1%
Pu35-31	Ta_2O_5 (wt %)	0.0849	0.0849	0.0700	0.0149	0.0149	21.2%	21.2%
Pu35-31	Sum (wt %)	98.2783	98.3825	99.8700	-1.5917	-1.4875	-1.6%	-1.5%
Pu35-32	Al_2O_3 (wt %)	8.8807	8.9539	8.6000	0.2807	0.3539	3.3%	4.1%
Pu35-32	B_2O_3 (wt %)	11.1731	11.0902	11.1800	-0.0069	-0.0898	-0.1%	-0.8%
Pu35-32	CaO (wt %)	0.1532	0.1544	0.0800	0.0732	0.0744	91.5%	93.0%
Pu35-32	Cl (wt %)	0.0415	0.0415	0.5800	-0.5385	-0.5385	-92.8%	-92.8%
Pu35-32	Cr_2O_3 (wt %)	0.0848	0.0820	0.0800	0.0048	0.0020	6.0%	2.5%
Pu35-32	CuO (wt %)	0.0895	0.0943	0.0700	0.0195	0.0243	27.9%	34.7%
Pu35-32	F (wt %)	0.0745	0.0910	0.4000	-0.3255	-0.3090	-81.4%	-77.3%
Pu35-32	Fe_2O_3 (wt %)	0.1051	0.1072	0.0800	0.0251	0.0272	31.4%	34.0%
Pu35-32	Ga_2O_3 (wt %)	0.9100	0.9100	0.9000	0.0100	0.0100	1.1%	1.1%
Pu35-32	Gd_2O_3 (wt %)	11.7565	11.7565	11.6100	0.1465	0.1465	1.3%	1.3%
Pu35-32	HfO_2 (wt %)	13.9747	13.9747	14.9000	-0.9253	-0.9253	-6.2%	-6.2%
Pu35-32	K_2O (wt %)	0.2204	0.1970	0.2600	-0.0396	-0.0630	-15.2%	-24.2%
Pu35-32	La_2O_3 (wt %)	16.3606	16.3606	16.3400	0.0206	0.0206	0.1%	0.1%
Pu35-32	MgO (wt %)	1.2885	1.2722	1.3900	-0.1015	-0.1178	-7.3%	-8.5%

Table D5. Average Measured and Bias-Corrected Chemical Compositions Versus Targeted Compositions by Oxide by Study Glass (continued)

Glass ID	Oxide	Measured (wt %)	Measured Bias-Corrected (wt %)	Targeted (wt %)	Diff of Measured	Diff of Meas BC	% Diff of Measured	% Diff of Meas BC
Pu35-32	Na_2O (wt %)	0.6996	0.6628	0.6900	0.0096	-0.0272	1.4%	-3.9%
Pu35-32	Nd_2O_3 (wt %)	13.1803	13.1803	12.9000	0.2803	0.2803	2.2%	2.2%
Pu35-32	NiO (wt %)	0.0681	0.0747	0.0700	-0.0019	0.0047	-2.7%	6.8%
Pu35-32	PbO (wt %)	0.0905	0.0905	0.0600	0.0305	0.0305	50.8%	50.8%
Pu35-32	SeO_2 (wt %)	0.0070	0.0070	0.0800	-0.0730	-0.0730	-91.2%	-91.2%
Pu35-32	Si_2O_3 (wt %)	17.5316	17.7139	17.2000	0.3316	0.5139	1.9%	3.0%
Pu35-32	SO_4 (wt %)	0.0749	0.0749	0.1700	-0.0951	-0.0951	-55.9%	-55.9%
Pu35-32	SrO (wt %)	2.2174	2.2174	2.1500	0.0674	0.0674	3.1%	3.1%
Pu35-32	Ta_2O_5 (wt %)	0.0855	0.0855	0.0700	0.0155	0.0155	22.1%	22.1%
Pu35-32	Sum (wt %)	99.0679	99.1924	99.8600	-0.7921	-0.6676	-0.8%	-0.7%
Pu35-33	Al_2O_3 (wt %)	8.4933	8.5633	8.6000	-0.1067	-0.0367	-1.2%	-0.4%
Pu35-33	B_2O_3 (wt %)	10.8833	10.8026	11.1800	-0.2967	-0.3774	-2.7%	-3.4%
Pu35-33	CaO (wt %)	0.5226	0.5266	0.4400	0.0826	0.0866	18.8%	19.7%
Pu35-33	Cl (wt %)	0.0435	0.0435	0.5700	-0.5265	-0.5265	-92.4%	-92.4%
Pu35-33	Cr_2O_3 (wt %)	0.4370	0.4228	0.4800	-0.0430	-0.0572	-9.0%	-11.9%
Pu35-33	CuO (wt %)	0.0914	0.0962	0.0700	0.0214	0.0262	30.5%	37.5%
Pu35-33	F (wt %)	0.0420	0.0513	0.1300	-0.0880	-0.0787	-67.7%	-60.6%
Pu35-33	Fe_2O_3 (wt %)	0.5454	0.5564	0.5600	-0.0146	-0.0036	-2.6%	-0.6%
Pu35-33	Ga_2O_3 (wt %)	0.1143	0.1143	0.0800	0.0343	0.0343	42.8%	42.8%
Pu35-33	Gd_2O_3 (wt %)	11.3704	11.3704	11.6100	-0.2396	-0.2396	-2.1%	-2.1%
Pu35-33	HfO_2 (wt %)	13.6209	13.6209	14.7800	-1.1591	-1.1591	-7.8%	-7.8%
Pu35-33	K_2O (wt %)	0.0506	0.0452	0.0800	-0.0294	-0.0348	-36.8%	-43.5%
Pu35-33	La_2O_3 (wt %)	15.8914	15.8914	16.3400	-0.4486	-0.4486	-2.7%	-2.7%
Pu35-33	MgO (wt %)	1.2487	1.2329	1.3700	-0.1213	-0.1371	-8.9%	-10.0%
Pu35-33	Na_2O (wt %)	0.8701	0.8243	0.9000	-0.0299	-0.0757	-3.3%	-8.4%
Pu35-33	Nd_2O_3 (wt %)	12.6554	12.6554	12.9000	-0.2446	-0.2446	-1.9%	-1.9%
Pu35-33	NiO (wt %)	0.0694	0.0761	0.0700	-0.0006	0.0061	-0.9%	8.7%
Pu35-33	PbO (wt %)	0.0856	0.0856	0.0600	0.0256	0.0256	42.7%	42.7%
Pu35-33	SeO_2 (wt %)	0.0070	0.0070	0.0800	-0.0730	-0.0730	-91.2%	-91.2%
Pu35-33	Si_2O_3 (wt %)	18.7617	18.9568	17.2000	1.5617	1.7568	9.1%	10.2%
Pu35-33	SO_4 (wt %)	0.0749	0.0749	0.1700	-0.0951	-0.0951	-55.9%	-55.9%
Pu35-33	SrO (wt %)	2.1050	2.1050	2.1500	-0.0450	-0.0450	-2.1%	-2.1%
Pu35-33	Ta_2O_5 (wt %)	0.0849	0.0849	0.0700	0.0149	0.0149	21.2%	21.2%
Pu35-33	Sum (wt %)	98.0688	98.2079	99.8900	-1.8212	-1.6821	-1.8%	-1.7%
Pu35-34	Al_2O_3 (wt %)	8.8712	8.9443	8.6000	0.2712	0.3443	3.2%	4.0%
Pu35-34	B_2O_3 (wt %)	10.9155	10.8345	11.1800	-0.2645	-0.3455	-2.4%	-3.1%
Pu35-34	CaO (wt %)	0.4568	0.4603	0.3700	0.0868	0.0903	23.5%	24.4%
Pu35-34	Cl (wt %)	0.0515	0.0515	0.5800	-0.5285	-0.5285	-91.1%	-91.1%
Pu35-34	Cr_2O_3 (wt %)	0.0899	0.0870	0.0800	0.0099	0.0070	12.4%	8.7%
Pu35-34	CuO (wt %)	0.2091	0.2202	0.2200	-0.0109	0.0002	-5.0%	0.1%
Pu35-34	F (wt %)	0.0070	0.0085	0.0600	-0.0530	-0.0515	-88.3%	-85.8%
Pu35-34	Fe_2O_3 (wt %)	0.1287	0.1313	0.0800	0.0487	0.0513	60.8%	64.1%
Pu35-34	Ga_2O_3 (wt %)	0.1169	0.1169	0.0800	0.0369	0.0369	46.2%	46.2%
Pu35-34	Gd_2O_3 (wt %)	11.7565	11.7565	11.6100	0.1465	0.1465	1.3%	1.3%
Pu35-34	HfO_2 (wt %)	13.6209	13.6209	14.8900	-1.2691	-1.2691	-8.5%	-8.5%
Pu35-34	K_2O (wt %)	0.4776	0.4269	0.5800	-0.1024	-0.1531	-17.7%	-26.4%
Pu35-34	La_2O_3 (wt %)	16.2433	16.2433	16.3400	-0.0967	-0.0967	-0.6%	-0.6%
Pu35-34	MgO (wt %)	1.2645	1.2484	1.3800	-0.1155	-0.1316	-8.4%	-9.5%
Pu35-34	Na_2O (wt %)	0.4860	0.4604	0.4800	0.0060	-0.0196	1.2%	-4.1%
Pu35-34	Nd_2O_3 (wt %)	13.0637	13.0637	12.9000	0.1637	0.1637	1.3%	1.3%
Pu35-34	NiO (wt %)	0.0681	0.0747	0.0700	-0.0019	0.0047	-2.7%	6.8%
Pu35-34	PbO (wt %)	0.0916	0.0916	0.0600	0.0316	0.0316	52.6%	52.6%
Pu35-34	SeO_2 (wt %)	0.0070	0.0070	0.0800	-0.0730	-0.0730	-91.2%	-91.2%
Pu35-34	Si_2O_3 (wt %)	19.3393	19.5404	17.2000	2.1393	2.3404	12.4%	13.6%
Pu35-34	SO_4 (wt %)	0.0749	0.0749	0.1700	-0.0951	-0.0951	-55.9%	-55.9%
Pu35-34	SrO (wt %)	2.1937	2.1937	2.1500	0.0437	0.0437	2.0%	2.0%
Pu35-34	Ta_2O_5 (wt %)	0.6838	0.6838	0.7100	-0.0262	-0.0262	-3.7%	-3.7%
Pu35-34	Sum (wt %)	100.2173	100.3408	99.8700	0.3473	0.4708	0.3%	0.5%

Table D5. Average Measured and Bias-Corrected Chemical Compositions Versus Targeted Compositions by Oxide by Study Glass (continued)

Glass ID	Oxide	Measured (wt %)	Measured Bias-Corrected (wt %)	Targeted (wt %)	Diff of Measured	Diff of Meas BC	% Diff of Measured	% Diff of Meas BC
Pu35-35	Al_2O_3 (wt %)	8.6728	8.7443	8.6000	0.0728	0.1443	0.8%	1.7%
Pu35-35	B_2O_3 (wt %)	11.2536	11.1701	11.1800	0.0736	-0.0099	0.7%	-0.1%
Pu35-35	CaO (wt %)	0.1609	0.1621	0.0800	0.0809	0.0821	101.1%	102.7%
Pu35-35	Cl (wt %)	0.0485	0.0485	0.5800	-0.5315	-0.5315	-91.6%	-91.6%
Pu35-35	Cr_2O_3 (wt %)	0.0921	0.0891	0.0800	0.0121	0.0091	15.1%	11.4%
Pu35-35	CuO (wt %)	0.1152	0.1213	0.0700	0.0452	0.0513	64.5%	73.3%
Pu35-35	F (wt %)	0.0160	0.0195	0.0600	-0.0440	-0.0405	-73.3%	-67.4%
Pu35-35	Fe_2O_3 (wt %)	0.8035	0.8196	0.8200	-0.0165	-0.0004	-2.0%	0.0%
Pu35-35	Ga_2O_3 (wt %)	0.4127	0.4127	0.3900	0.0227	0.0227	5.8%	5.8%
Pu35-35	Gd_2O_3 (wt %)	11.6413	11.6413	11.6100	0.0313	0.0313	0.3%	0.3%
Pu35-35	HfO_2 (wt %)	13.9747	13.9747	14.8500	-0.8753	-0.8753	-5.9%	-5.9%
Pu35-35	K_2O (wt %)	0.0458	0.0409	0.0700	-0.0242	-0.0291	-34.6%	-41.6%
Pu35-35	La_2O_3 (wt %)	16.2433	16.2433	16.3400	-0.0967	-0.0967	-0.6%	-0.6%
Pu35-35	MgO (wt %)	0.4436	0.4380	0.4600	-0.0164	-0.0220	-3.6%	-4.8%
Pu35-35	Na_2O (wt %)	0.8991	0.8518	0.9300	-0.0309	-0.0782	-3.3%	-8.4%
Pu35-35	Nd_2O_3 (wt %)	13.0054	13.0054	12.9000	0.1054	0.1054	0.8%	0.8%
Pu35-35	NiO (wt %)	0.0764	0.0838	0.0700	0.0063	0.0138	9.1%	19.7%
Pu35-35	PbO (wt %)	0.0878	0.0878	0.0600	0.0278	0.0278	46.3%	46.3%
Pu35-35	SeO_2 (wt %)	0.0070	0.0070	0.0800	-0.0730	-0.0730	-91.2%	-91.2%
Pu35-35	Si_2O_3 (wt %)	17.2748	17.4545	17.2000	0.0748	0.2545	0.4%	1.5%
Pu35-35	SO_4 (wt %)	0.0749	0.0749	0.1700	-0.0951	-0.0951	-55.9%	-55.9%
Pu35-35	SrO (wt %)	2.1582	2.1582	2.1500	0.0082	0.0082	0.4%	0.4%
Pu35-35	Ta_2O_5 (wt %)	1.0885	1.0885	1.1200	-0.0315	-0.0315	-2.8%	-2.8%
Pu35-35	Sum (wt %)	98.5959	98.7373	99.8700	-1.2741	-1.1327	-1.3%	-1.1%
Pu35-36	Al_2O_3 (wt %)	8.9751	8.9099	8.6000	0.3751	0.3099	4.4%	3.6%
Pu35-36	B_2O_3 (wt %)	11.0443	11.3672	11.1800	-0.1357	0.1872	-1.2%	1.7%
Pu35-36	CaO (wt %)	0.1651	0.1625	0.0800	0.0851	0.0825	106.4%	103.1%
Pu35-36	Cl (wt %)	0.0560	0.0560	0.6000	-0.5440	-0.5440	-90.7%	-90.7%
Pu35-36	Cr_2O_3 (wt %)	0.3515	0.3416	0.3700	-0.0185	-0.0284	-5.0%	-7.7%
Pu35-36	CuO (wt %)	0.2141	0.2254	0.2200	-0.0059	0.0054	-2.7%	2.5%
Pu35-36	F (wt %)	0.0100	0.0124	0.1600	-0.1500	-0.1476	-93.8%	-92.3%
Pu35-36	Fe_2O_3 (wt %)	0.1437	0.1485	0.1100	0.0337	0.0385	30.6%	35.0%
Pu35-36	Ga_2O_3 (wt %)	0.3361	0.3361	0.3100	0.0261	0.0261	8.4%	8.4%
Pu35-36	Gd_2O_3 (wt %)	11.7565	11.7565	11.6100	0.1465	0.1465	1.3%	1.3%
Pu35-36	HfO_2 (wt %)	14.0337	14.0337	14.8900	-0.8563	-0.8563	-5.8%	-5.8%
Pu35-36	K_2O (wt %)	0.3692	0.3210	0.4300	-0.0608	-0.1090	-14.1%	-25.3%
Pu35-36	La_2O_3 (wt %)	16.3019	16.3019	16.3400	-0.0381	-0.0381	-0.2%	-0.2%
Pu35-36	MgO (wt %)	0.8698	0.8529	0.8900	-0.0202	-0.0371	-2.3%	-4.2%
Pu35-36	Na_2O (wt %)	0.6868	0.6307	0.6700	0.0168	-0.0393	2.5%	-5.9%
Pu35-36	Nd_2O_3 (wt %)	13.0637	13.0637	12.9000	0.1637	0.1637	1.3%	1.3%
Pu35-36	NiO (wt %)	0.2933	0.3226	0.3300	-0.0367	-0.0074	-11.1%	-2.3%
Pu35-36	PbO (wt %)	0.0840	0.0840	0.0600	0.0240	0.0240	40.0%	40.0%
Pu35-36	SeO_2 (wt %)	0.0070	0.0070	0.0800	-0.0730	-0.0730	-91.2%	-91.2%
Pu35-36	Si_2O_3 (wt %)	17.7455	17.9044	17.2000	0.5455	0.7044	3.2%	4.1%
Pu35-36	SO_4 (wt %)	0.0749	0.0749	0.1700	-0.0951	-0.0951	-55.9%	-55.9%
Pu35-36	SrO (wt %)	2.2588	2.2588	2.1500	0.1088	0.1088	5.1%	5.1%
Pu35-36	Ta_2O_5 (wt %)	0.5012	0.5012	0.5100	-0.0088	-0.0088	-1.7%	-1.7%
Pu35-36	Sum (wt %)	99.3421	99.6728	99.8600	-0.5179	-0.1872	-0.5%	-0.2%
Pu35-37	Al_2O_3 (wt %)	8.8145	8.7505	8.6000	0.2145	0.1505	2.5%	1.7%
Pu35-37	B_2O_3 (wt %)	10.9960	11.3175	11.1800	-0.1840	0.1375	-1.6%	1.2%
Pu35-37	CaO (wt %)	0.2665	0.2623	0.1700	0.0965	0.0923	56.8%	54.3%
Pu35-37	Cl (wt %)	0.0445	0.0445	0.6000	-0.5555	-0.5555	-92.6%	-92.6%
Pu35-37	Cr_2O_3 (wt %)	0.3778	0.3672	0.4000	-0.0222	-0.0328	-5.5%	-8.2%
Pu35-37	CuO (wt %)	0.0951	0.1002	0.0700	0.0251	0.0302	35.9%	43.1%
Pu35-37	F (wt %)	0.0000	0.0000	0.1000	-0.1000	-0.1000	-100.0%	-100.0%
Pu35-37	Fe_2O_3 (wt %)	0.3589	0.3710	0.2800	0.0789	0.0910	28.2%	32.5%
Pu35-37	Ga_2O_3 (wt %)	0.3804	0.3804	0.3600	0.0204	0.0204	5.7%	5.7%
Pu35-37	Gd_2O_3 (wt %)	11.5433	11.5433	11.6100	-0.0667	-0.0667	-0.6%	-0.6%

Table D5. Average Measured and Bias-Corrected Chemical Compositions Versus Targeted Compositions by Oxide by Study Glass (continued)

Glass ID	Oxide	Measured (wt %)	Measured Bias-Corrected (wt %)	Targeted (wt %)	Diff of Measured	Diff of Meas BC	% Diff of Measured	% Diff of Meas BC
Pu35-37	HfO_2 (wt %)	13.3261	13.3261	14.8500	-1.5239	-1.5239	-10.3%	-10.3%
Pu35-37	K_2O (wt %)	0.2867	0.2493	0.3600	-0.0733	-0.1107	-20.4%	-30.8%
Pu35-37	La_2O_3 (wt %)	16.0674	16.0674	16.3400	-0.2726	-0.2726	-1.7%	-1.7%
Pu35-37	MgO (wt %)	0.9817	0.9626	1.0200	-0.0383	-0.0574	-3.8%	-5.6%
Pu35-37	Na_2O (wt %)	0.6679	0.6133	0.6500	0.0179	-0.0367	2.8%	-5.6%
Pu35-37	Nd_2O_3 (wt %)	12.8304	12.8304	12.9000	-0.0696	-0.0696	-0.5%	-0.5%
Pu35-37	NiO (wt %)	0.3423	0.3764	0.3700	-0.0277	0.0064	-7.5%	1.7%
Pu35-37	PbO (wt %)	0.0824	0.0824	0.0600	0.0224	0.0224	37.3%	37.3%
Pu35-37	SeO_2 (wt %)	0.0070	0.0070	0.0800	-0.0730	-0.0730	-91.2%	-91.2%
Pu35-37	Si_2O_3 (wt %)	17.4032	17.5590	17.2000	0.2032	0.3590	1.2%	2.1%
Pu35-37	SO_4 (wt %)	0.0749	0.0749	0.1700	-0.0951	-0.0951	-55.9%	-55.9%
Pu35-37	SrO (wt %)	2.2055	2.2055	2.1500	0.0555	0.0555	2.6%	2.6%
Pu35-37	Ta_2O_5 (wt %)	0.3443	0.3443	0.3500	-0.0057	-0.0057	-1.6%	-1.6%
Pu35-37	Sum (wt %)	97.4969	97.8355	99.8700	-2.3731	-2.0345	-2.4%	-2.0%
Pu35-38	Al_2O_3 (wt %)	8.7389	8.6754	8.6000	0.1389	0.0754	1.6%	0.9%
Pu35-38	B_2O_3 (wt %)	11.0121	11.3341	11.1800	-0.1679	0.1541	-1.5%	1.4%
Pu35-38	CaO (wt %)	0.5387	0.5301	0.4300	0.1087	0.1001	25.3%	23.3%
Pu35-38	Cl (wt %)	0.0530	0.0530	0.6600	-0.6070	-0.6070	-92.0%	-92.0%
Pu35-38	Cr_2O_3 (wt %)	0.1681	0.1633	0.1800	-0.0119	-0.0167	-6.6%	-9.3%
Pu35-38	CuO (wt %)	0.0983	0.1035	0.0700	0.0283	0.0335	40.4%	47.8%
Pu35-38	F (wt %)	0.0330	0.0408	0.3100	-0.2770	-0.2692	-89.4%	-86.8%
Pu35-38	Fe_2O_3 (wt %)	0.1994	0.2062	0.1700	0.0294	0.0362	17.3%	21.3%
Pu35-38	Ga_2O_3 (wt %)	0.3260	0.3260	0.3000	0.0260	0.0260	8.7%	8.7%
Pu35-38	Gd_2O_3 (wt %)	11.4511	11.4511	11.6100	-0.1589	-0.1589	-1.4%	-1.4%
Pu35-38	HfO_2 (wt %)	13.6799	13.6799	14.9300	-1.2501	-1.2501	-8.4%	-8.4%
Pu35-38	K_2O (wt %)	0.3740	0.3252	0.4500	-0.0760	-0.1248	-16.9%	-27.7%
Pu35-38	La_2O_3 (wt %)	16.0674	16.0674	16.3400	-0.2726	-0.2726	-1.7%	-1.7%
Pu35-38	MgO (wt %)	0.7189	0.7049	0.7300	-0.0111	-0.0251	-1.5%	-3.4%
Pu35-38	Na_2O (wt %)	0.6592	0.6053	0.6600	-0.0008	-0.0547	-0.1%	-8.3%
Pu35-38	Nd_2O_3 (wt %)	12.7138	12.7138	12.9000	-0.1862	-0.1862	-1.4%	-1.4%
Pu35-38	NiO (wt %)	0.1603	0.1763	0.1800	-0.0197	-0.0037	-10.9%	-2.0%
Pu35-38	PbO (wt %)	0.0840	0.0840	0.0600	0.0240	0.0240	40.0%	40.0%
Pu35-38	SeO_2 (wt %)	0.0070	0.0070	0.0800	-0.0730	-0.0730	-91.2%	-91.2%
Pu35-38	Si_2O_3 (wt %)	17.3711	17.5266	17.2000	0.1711	0.3266	1.0%	1.9%
Pu35-38	SO_4 (wt %)	0.0749	0.0749	0.1700	-0.0951	-0.0951	-55.9%	-55.9%
Pu35-38	SrO (wt %)	2.1937	2.1937	2.1500	0.0437	0.0437	2.0%	2.0%
Pu35-38	Ta_2O_5 (wt %)	0.5165	0.5165	0.5300	-0.0135	-0.0135	-2.6%	-2.6%
Pu35-38	Sum (wt %)	97.2392	97.5590	99.8900	-2.6508	-2.3310	-2.7%	-2.3%
Pu35-39	Al_2O_3 (wt %)	9.0413	8.9756	8.6000	0.4413	0.3756	5.1%	4.4%
Pu35-39	B_2O_3 (wt %)	11.0121	11.3341	11.1800	-0.1679	0.1541	-1.5%	1.4%
Pu35-39	CaO (wt %)	0.1651	0.1625	0.0800	0.0851	0.0825	106.4%	103.1%
Pu35-39	Cl (wt %)	0.0530	0.0530	0.6900	-0.6370	-0.6370	-92.3%	-92.3%
Pu35-39	Cr_2O_3 (wt %)	0.2901	0.2819	0.3100	-0.0199	-0.0281	-6.4%	-9.1%
Pu35-39	CuO (wt %)	0.0976	0.1028	0.0700	0.0276	0.0328	39.5%	46.9%
Pu35-39	F (wt %)	0.0000	0.0000	0.1800	-0.1800	-0.1800	-100.0%	-100.0%
Pu35-39	Fe_2O_3 (wt %)	0.3303	0.3414	0.2900	0.0403	0.0514	13.9%	17.7%
Pu35-39	Ga_2O_3 (wt %)	0.3367	0.3367	0.3100	0.0267	0.0267	8.6%	8.6%
Pu35-39	Gd_2O_3 (wt %)	11.7565	11.7565	11.6100	0.1465	0.1465	1.3%	1.3%
Pu35-39	HfO_2 (wt %)	13.9747	13.9747	14.9200	-0.9453	-0.9453	-6.3%	-6.3%
Pu35-39	K_2O (wt %)	0.6264	0.5446	0.7700	-0.1436	-0.2254	-18.7%	-29.3%
Pu35-39	La_2O_3 (wt %)	16.3019	16.3019	16.3400	-0.0381	-0.0381	-0.2%	-0.2%
Pu35-39	MgO (wt %)	0.6857	0.6724	0.7000	-0.0143	-0.0276	-2.0%	-3.9%
Pu35-39	Na_2O (wt %)	0.7286	0.6690	0.7000	0.0286	-0.0310	4.1%	-4.4%
Pu35-39	Nd_2O_3 (wt %)	13.1220	13.1220	12.9000	0.2220	0.2220	1.7%	1.7%
Pu35-39	NiO (wt %)	0.0681	0.0749	0.0700	-0.0019	0.0049	-2.7%	7.0%
Pu35-39	PbO (wt %)	0.0824	0.0824	0.0600	0.0224	0.0224	37.3%	37.3%
Pu35-39	SeO_2 (wt %)	0.0070	0.0070	0.0800	-0.0730	-0.0730	-91.2%	-91.2%
Pu35-39	Si_2O_3 (wt %)	17.7669	17.9259	17.2000	0.5669	0.7259	3.3%	4.2%

Table D5. Average Measured and Bias-Corrected Chemical Compositions Versus Targeted Compositions by Oxide by Study Glass (continued)

Glass ID	Oxide	Measured (wt %)	Measured Bias-Corrected (wt %)	Targeted (wt %)	Diff of Measured	Diff of Meas BC	% Diff of Measured	% Diff of Meas BC
Pu35-39	SO_4 (wt %)	0.0749	0.0749	0.1700	-0.0951	-0.0951	-55.9%	-55.9%
Pu35-39	SrO (wt %)	2.2765	2.2765	2.1500	0.1265	0.1265	5.9%	5.9%
Pu35-39	Ta_2O_5 (wt %)	0.4927	0.4927	0.5000	-0.0073	-0.0073	-1.5%	-1.5%
Pu35-39	Sum (wt %)	99.2905	99.5635	99.8800	-0.5895	-0.3165	-0.6%	-0.3%
Pu35-40	Al_2O_3 (wt %)	8.7389	8.6754	8.6000	0.1389	0.0754	1.6%	0.9%
Pu35-40	B_2O_3 (wt %)	11.0604	11.3838	11.1800	-0.1196	0.2038	-1.1%	1.8%
Pu35-40	CaO (wt %)	0.5268	0.5184	0.4100	0.1168	0.1084	28.5%	26.4%
Pu35-40	Cl (wt %)	0.0690	0.0690	0.7200	-0.6510	-0.6510	-90.4%	-90.4%
Pu35-40	Cr_2O_3 (wt %)	0.3121	0.3032	0.3200	-0.0079	-0.0168	-2.5%	-5.2%
Pu35-40	CuO (wt %)	0.2078	0.2188	0.2200	-0.0122	-0.0012	-5.5%	-0.5%
Pu35-40	F (wt %)	0.0000	0.0000	0.1400	-0.1400	-0.1400	-100.0%	-100.0%
Pu35-40	Fe_2O_3 (wt %)	0.5862	0.6060	0.5600	0.0262	0.0460	4.7%	8.2%
Pu35-40	Ga_2O_3 (wt %)	0.4187	0.4187	0.3900	0.0287	0.0287	7.4%	7.4%
Pu35-40	Gd_2O_3 (wt %)	11.5318	11.5318	11.6100	-0.0782	-0.0782	-0.7%	-0.7%
Pu35-40	HfO_2 (wt %)	13.3851	13.3851	14.8600	-1.4749	-1.4749	-9.9%	-9.9%
Pu35-40	K_2O (wt %)	0.4108	0.3571	0.5000	-0.0892	-0.1429	-17.8%	-28.6%
Pu35-40	La_2O_3 (wt %)	16.0674	16.0674	16.3400	-0.2726	-0.2726	-1.7%	-1.7%
Pu35-40	MgO (wt %)	0.6467	0.6342	0.6500	-0.0033	-0.0158	-0.5%	-2.4%
Pu35-40	Na_2O (wt %)	0.6545	0.6010	0.6500	0.0045	-0.0490	0.7%	-7.5%
Pu35-40	Nd_2O_3 (wt %)	12.8304	12.8304	12.9000	-0.0696	-0.0696	-0.5%	-0.5%
Pu35-40	NiO (wt %)	0.0973	0.1071	0.1000	-0.0027	0.0071	-2.7%	7.1%
Pu35-40	PbO (wt %)	0.0840	0.0840	0.0600	0.0240	0.0240	40.0%	40.0%
Pu35-40	SeO_2 (wt %)	0.0070	0.0070	0.0800	-0.0730	-0.0730	-91.2%	-91.2%
Pu35-40	Si_2O_3 (wt %)	17.4353	17.5914	17.2000	0.2353	0.3914	1.4%	2.3%
Pu35-40	SO_4 (wt %)	0.0749	0.0749	0.1700	-0.0951	-0.0951	-55.9%	-55.9%
Pu35-40	SrO (wt %)	2.1760	2.1760	2.1500	0.0260	0.0260	1.2%	1.2%
Pu35-40	Ta_2O_5 (wt %)	0.0861	0.0861	0.0700	0.0161	0.0161	23.0%	23.0%
Pu35-40	Sum (wt %)	97.4070	97.7267	99.8800	-2.4730	-2.1533	-2.5%	-2.2%
Pu35-41	Al_2O_3 (wt %)	8.9657	8.9005	8.6000	0.3657	0.3005	4.3%	3.5%
Pu35-41	B_2O_3 (wt %)	11.1731	11.4998	11.1800	-0.0069	0.3198	-0.1%	2.9%
Pu35-41	CaO (wt %)	0.1651	0.1625	0.0800	0.0851	0.0825	106.4%	103.1%
Pu35-41	Cl (wt %)	0.0725	0.0725	0.9300	-0.8575	-0.8575	-92.2%	-92.2%
Pu35-41	Cr_2O_3 (wt %)	0.0884	0.0859	0.0800	0.0084	0.0059	10.5%	7.4%
Pu35-41	CuO (wt %)	0.1452	0.1529	0.1500	-0.0048	0.0029	-3.2%	1.9%
Pu35-41	F (wt %)	0.0000	0.0000	0.0600	-0.0600	-0.0600	-100.0%	-100.0%
Pu35-41	Fe_2O_3 (wt %)	0.1072	0.1109	0.0800	0.0272	0.0309	34.0%	38.6%
Pu35-41	Ga_2O_3 (wt %)	0.1116	0.1116	0.0800	0.0316	0.0316	39.5%	39.5%
Pu35-41	Gd_2O_3 (wt %)	11.6413	11.6413	11.6100	0.0313	0.0313	0.3%	0.3%
Pu35-41	HfO_2 (wt %)	13.5030	13.5030	14.9300	-1.4270	-1.4270	-9.6%	-9.6%
Pu35-41	K_2O (wt %)	0.2644	0.2299	0.3400	-0.0756	-0.1101	-22.2%	-32.4%
Pu35-41	La_2O_3 (wt %)	16.0087	16.0087	16.3400	-0.3313	-0.3313	-2.0%	-2.0%
Pu35-41	MgO (wt %)	1.3001	1.2748	1.3900	-0.0899	-0.1152	-6.5%	-8.3%
Pu35-41	Na_2O (wt %)	0.8755	0.8040	0.9400	-0.0645	-0.1360	-6.9%	-14.5%
Pu35-41	Nd_2O_3 (wt %)	12.9470	12.9470	12.9000	0.0470	0.0470	0.4%	0.4%
Pu35-41	NiO (wt %)	0.3957	0.4352	0.4400	-0.0443	-0.0048	-10.1%	-1.1%
Pu35-41	PbO (wt %)	0.0776	0.0776	0.0600	0.0176	0.0176	29.3%	29.3%
Pu35-41	SeO_2 (wt %)	0.0070	0.0070	0.0800	-0.0730	-0.0730	-91.2%	-91.2%
Pu35-41	Si_2O_3 (wt %)	17.4032	17.5590	17.2000	0.2032	0.3590	1.2%	2.1%
Pu35-41	SO_4 (wt %)	0.0749	0.0749	0.1700	-0.0951	-0.0951	-55.9%	-55.9%
Pu35-41	SrO (wt %)	2.2706	2.2706	2.1500	0.1206	0.1206	5.6%	5.6%
Pu35-41	Ta_2O_5 (wt %)	0.0855	0.0855	0.0700	0.0155	0.0155	22.1%	22.1%
Pu35-41	Sum (wt %)	97.6833	98.0150	99.8600	-2.1767	-1.8450	-2.2%	-1.8%
Pu35-42	Al_2O_3 (wt %)	8.9657	8.9005	8.6000	0.3657	0.3005	4.3%	3.5%
Pu35-42	B_2O_3 (wt %)	10.9155	11.2347	11.1800	-0.2645	0.0547	-2.4%	0.5%
Pu35-42	CaO (wt %)	0.2568	0.2527	0.1600	0.0968	0.0927	60.5%	57.9%
Pu35-42	Cl (wt %)	0.0345	0.0345	0.5800	-0.5455	-0.5455	-94.1%	-94.1%
Pu35-42	Cr_2O_3 (wt %)	0.3223	0.3132	0.3400	-0.0177	-0.0268	-5.2%	-7.9%
Pu35-42	CuO (wt %)	0.1477	0.1556	0.1400	0.0077	0.0156	5.5%	11.1%

Table D5. Average Measured and Bias-Corrected Chemical Compositions Versus Targeted Compositions by Oxide by Study Glass (continued)

Glass ID	Oxide	Measured (wt %)	Measured Bias-Corrected (wt %)	Targeted (wt %)	Diff of Measured	Diff of Meas BC	% Diff of Measured	% Diff of Meas BC
Pu35-42	F (wt %)	0.0000	0.0000	0.1200	-0.1200	-0.1200	-100.0%	-100.0%
Pu35-42	Fe_2O_3 (wt %)	0.1873	0.1936	0.1700	0.0173	0.0236	10.2%	13.9%
Pu35-42	Ga_2O_3 (wt %)	0.1915	0.1915	0.1600	0.0315	0.0315	19.7%	19.7%
Pu35-42	Gd_2O_3 (wt %)	11.6989	11.6989	11.6100	0.0889	0.0889	0.8%	0.8%
Pu35-42	HfO_2 (wt %)	13.7388	13.7388	14.8800	-1.1412	-1.1412	-7.7%	-7.7%
Pu35-42	K_2O (wt %)	0.6143	0.5341	0.8400	-0.2257	-0.3059	-26.9%	-36.4%
Pu35-42	La_2O_3 (wt %)	16.1260	16.1260	16.3400	-0.2140	-0.2140	-1.3%	-1.3%
Pu35-42	MgO (wt %)	1.0588	1.0382	1.0800	-0.0212	-0.0418	-2.0%	-3.9%
Pu35-42	Na_2O (wt %)	0.7616	0.6994	0.7800	-0.0184	-0.0806	-2.4%	-10.3%
Pu35-42	Nd_2O_3 (wt %)	13.1220	13.1220	12.9000	0.2220	0.2220	1.7%	1.7%
Pu35-42	NiO (wt %)	0.1419	0.1560	0.1500	-0.0081	0.0060	-5.4%	4.0%
Pu35-42	PbO (wt %)	0.0867	0.0867	0.0600	0.0267	0.0267	44.5%	44.5%
Pu35-42	SeO_2 (wt %)	0.0070	0.0070	0.0800	-0.0730	-0.0730	-91.2%	-91.2%
Pu35-42	Si_2O_3 (wt %)	17.6599	17.8180	17.2000	0.4599	0.6180	2.7%	3.6%
Pu35-42	SO_4 (wt %)	0.0749	0.0749	0.1700	-0.0951	-0.0951	-55.9%	-55.9%
Pu35-42	SrO (wt %)	2.2647	2.2647	2.1500	0.1147	0.1147	5.3%	5.3%
Pu35-42	Ta_2O_5 (wt %)	0.2204	0.2204	0.2100	0.0104	0.0104	4.9%	4.9%
Pu35-42	Sum (wt %)	98.5973	98.8615	99.9000	-1.3027	-1.0385	-1.3%	-1.0%
Pu35-43	Al_2O_3 (wt %)	8.9090	8.8443	8.6000	0.3090	0.2443	3.6%	2.8%
Pu35-43	B_2O_3 (wt %)	11.1087	11.4335	11.1800	-0.0713	0.2535	-0.6%	2.3%
Pu35-43	CaO (wt %)	0.4617	0.4544	0.3500	0.1117	0.1044	31.9%	29.8%
Pu35-43	Cl (wt %)	0.0425	0.0425	0.5800	-0.5375	-0.5375	-92.7%	-92.7%
Pu35-43	Cr_2O_3 (wt %)	0.2375	0.2308	0.2500	-0.0125	-0.0192	-5.0%	-7.7%
Pu35-43	CuO (wt %)	0.1571	0.1654	0.1400	0.0171	0.0254	12.2%	18.2%
Pu35-43	F (wt %)	0.0270	0.0334	0.2000	-0.1730	-0.1666	-86.5%	-83.3%
Pu35-43	Fe_2O_3 (wt %)	0.5740	0.5934	0.5700	0.0040	0.0234	0.7%	4.1%
Pu35-43	Ga_2O_3 (wt %)	0.3750	0.3750	0.3500	0.0250	0.0250	7.2%	7.2%
Pu35-43	Gd_2O_3 (wt %)	11.5836	11.5836	11.6100	-0.0264	-0.0264	-0.2%	-0.2%
Pu35-43	HfO_2 (wt %)	13.6799	13.6799	14.8500	-1.1701	-1.1701	-7.9%	-7.9%
Pu35-43	K_2O (wt %)	0.1656	0.1440	0.2100	-0.0444	-0.0660	-21.1%	-31.4%
Pu35-43	La_2O_3 (wt %)	16.0087	16.0087	16.3400	-0.3313	-0.3313	-2.0%	-2.0%
Pu35-43	MgO (wt %)	0.6442	0.6317	0.6500	-0.0058	-0.0183	-0.9%	-2.8%
Pu35-43	Na_2O (wt %)	0.7279	0.6684	0.7400	-0.0121	-0.0716	-1.6%	-9.7%
Pu35-43	Nd_2O_3 (wt %)	12.9470	12.9470	12.9000	0.0470	0.0470	0.4%	0.4%
Pu35-43	NiO (wt %)	0.1890	0.2078	0.2000	-0.0110	0.0078	-5.5%	3.9%
Pu35-43	PbO (wt %)	0.0846	0.0846	0.0600	0.0246	0.0246	40.9%	40.9%
Pu35-43	SeO_2 (wt %)	0.0070	0.0070	0.0800	-0.0730	-0.0730	-91.2%	-91.2%
Pu35-43	Si_2O_3 (wt %)	17.5102	17.6669	17.2000	0.3102	0.4669	1.8%	2.7%
Pu35-43	SO_4 (wt %)	0.0749	0.0749	0.1700	-0.0951	-0.0951	-55.9%	-55.9%
Pu35-43	SrO (wt %)	2.2351	2.2351	2.1500	0.0851	0.0851	4.0%	4.0%
Pu35-43	Ta_2O_5 (wt %)	0.4829	0.4829	0.4900	-0.0071	-0.0071	-1.4%	-1.4%
Pu35-43	Sum (wt %)	98.2333	98.5954	99.8700	-1.6367	-1.2746	-1.6%	-1.3%
Pu35-44	Al_2O_3 (wt %)	8.8523	8.7880	8.6000	0.2523	0.1880	2.9%	2.2%
Pu35-44	B_2O_3 (wt %)	10.9316	11.2512	11.1800	-0.2484	0.0712	-2.2%	0.6%
Pu35-44	CaO (wt %)	0.3890	0.3828	0.2800	0.1090	0.1028	38.9%	36.7%
Pu35-44	Cl (wt %)	0.0475	0.0475	0.5800	-0.5325	-0.5325	-91.8%	-91.8%
Pu35-44	Cr_2O_3 (wt %)	0.2346	0.2280	0.2500	-0.0154	-0.0220	-6.2%	-8.8%
Pu35-44	CuO (wt %)	0.1327	0.1397	0.1100	0.0227	0.0297	20.6%	27.0%
Pu35-44	F (wt %)	0.0055	0.0068	0.1900	-0.1845	-0.1832	-97.1%	-96.4%
Pu35-44	Fe_2O_3 (wt %)	0.5740	0.5934	0.5800	-0.0060	0.0134	-1.0%	2.3%
Pu35-44	Ga_2O_3 (wt %)	0.3293	0.3293	0.3000	0.0293	0.0293	9.8%	9.8%
Pu35-44	Gd_2O_3 (wt %)	11.6413	11.6413	11.6100	0.0313	0.0313	0.3%	0.3%
Pu35-44	HfO_2 (wt %)	13.6799	13.6799	14.8600	-1.1801	-1.1801	-7.9%	-7.9%
Pu35-44	K_2O (wt %)	0.2638	0.2294	0.3100	-0.0462	-0.0806	-14.9%	-26.0%
Pu35-44	La_2O_3 (wt %)	16.2433	16.2433	16.3400	-0.0967	-0.0967	-0.6%	-0.6%
Pu35-44	MgO (wt %)	0.7835	0.7683	0.8000	-0.0165	-0.0317	-2.1%	-4.0%
Pu35-44	Na_2O (wt %)	0.6619	0.6078	0.6600	0.0019	-0.0522	0.3%	-7.9%
Pu35-44	Nd_2O_3 (wt %)	12.9470	12.9470	12.9000	0.0470	0.0470	0.4%	0.4%

Table D5. Average Measured and Bias-Corrected Chemical Compositions Versus Targeted Compositions by Oxide by Study Glass (continued)

Glass ID	Oxide	Measured (wt %)	Measured Bias-Corrected (wt %)	Targeted (wt %)	Diff of Measured	Diff of Meas BC	% Diff of Measured	% Diff of Meas BC
Pu35-44	NiO (wt %)	0.1387	0.1525	0.1500	-0.0113	0.0025	-7.5%	1.7%
Pu35-44	PbO (wt %)	0.0856	0.0856	0.0600	0.0256	0.0256	42.7%	42.7%
Pu35-44	SeO_2 (wt %)	0.0070	0.0070	0.0800	-0.0730	-0.0730	-91.2%	-91.2%
Pu35-44	Si_2O_3 (wt %)	17.5743	17.7317	17.2000	0.3743	0.5317	2.2%	3.1%
Pu35-44	SO_4 (wt %)	0.0749	0.0749	0.1700	-0.0951	-0.0951	-55.9%	-55.9%
Pu35-44	SrO (wt %)	2.2292	2.2292	2.1500	0.0792	0.0792	3.7%	3.7%
Pu35-44	Ta_2O_5 (wt %)	0.5311	0.5311	0.5400	-0.0089	-0.0089	-1.6%	-1.6%
Pu35-44	Sum (wt %)	98.3581	98.6958	99.9000	-1.5419	-1.2042	-1.5%	-1.2%
Pu35-45	Al_2O_3 (wt %)	8.7200	8.6567	8.6000	0.1200	0.0567	1.4%	0.7%
Pu35-45	B_2O_3 (wt %)	11.1731	11.4998	11.1800	-0.0069	0.3198	-0.1%	2.9%
Pu35-45	CaO (wt %)	0.3260	0.3208	0.2300	0.0960	0.0908	41.7%	39.5%
Pu35-45	Cl (wt %)	0.0475	0.0475	0.5800	-0.5325	-0.5325	-91.8%	-91.8%
Pu35-45	Cr_2O_3 (wt %)	0.1615	0.1569	0.1700	-0.0085	-0.0131	-5.0%	-7.7%
Pu35-45	CuO (wt %)	0.1346	0.1417	0.1100	0.0246	0.0317	22.3%	28.8%
Pu35-45	F (wt %)	0.0000	0.0000	0.1200	-0.1200	-0.1200	-100.0%	-100.0%
Pu35-45	Fe_2O_3 (wt %)	0.4554	0.4707	0.4600	-0.0046	0.0107	-1.0%	2.3%
Pu35-45	Ga_2O_3 (wt %)	0.4974	0.4974	0.4800	0.0174	0.0174	3.6%	3.6%
Pu35-45	Gd_2O_3 (wt %)	11.4626	11.4626	11.6100	-0.1474	-0.1474	-1.3%	-1.3%
Pu35-45	HfO_2 (wt %)	13.4440	13.4440	14.8600	-1.4160	-1.4160	-9.5%	-9.5%
Pu35-45	K_2O (wt %)	0.1506	0.1309	0.2000	-0.0494	-0.0691	-24.7%	-34.5%
Pu35-45	La_2O_3 (wt %)	15.8328	15.8328	16.3400	-0.5072	-0.5072	-3.1%	-3.1%
Pu35-45	MgO (wt %)	0.7330	0.7187	0.7500	-0.0170	-0.0313	-2.3%	-4.2%
Pu35-45	Na_2O (wt %)	0.7313	0.6715	0.7300	0.0013	-0.0585	0.2%	-8.0%
Pu35-45	Nd_2O_3 (wt %)	12.7721	12.7721	12.9000	-0.1279	-0.1279	-1.0%	-1.0%
Pu35-45	NiO (wt %)	0.2030	0.2232	0.2200	-0.0170	0.0032	-7.7%	1.5%
Pu35-45	PbO (wt %)	0.0846	0.0846	0.0600	0.0246	0.0246	40.9%	40.9%
Pu35-45	SeO_2 (wt %)	0.0070	0.0070	0.0800	-0.0730	-0.0730	-91.2%	-91.2%
Pu35-45	Si_2O_3 (wt %)	17.2535	17.4079	17.2000	0.0535	0.2079	0.3%	1.2%
Pu35-45	SO_4 (wt %)	0.0749	0.0749	0.1700	-0.0951	-0.0951	-55.9%	-55.9%
Pu35-45	SrO (wt %)	2.1878	2.1878	2.1500	0.0378	0.0378	1.8%	1.8%
Pu35-45	Ta_2O_5 (wt %)	0.6764	0.6764	0.7000	-0.0236	-0.0236	-3.4%	-3.4%
Pu35-45	Sum (wt %)	97.1289	97.4861	99.9000	-2.7711	-2.4139	-2.8%	-2.4%
Pu35-46	Al_2O_3 (wt %)	9.2774	9.0934	8.6000	0.6774	0.4934	7.9%	5.7%
Pu35-46	B_2O_3 (wt %)	11.4467	11.3619	11.1800	0.2667	0.1819	2.4%	1.6%
Pu35-46	CaO (wt %)	0.2637	0.2677	0.1700	0.0937	0.0977	55.1%	57.5%
Pu35-46	Cl (wt %)	0.0645	0.0645	0.5900	-0.5255	-0.5255	-89.1%	-89.1%
Pu35-46	Cr_2O_3 (wt %)	0.1608	0.1549	0.1700	-0.0092	-0.0151	-5.4%	-8.9%
Pu35-46	CuO (wt %)	0.1590	0.1691	0.1500	0.0090	0.0191	6.0%	12.7%
Pu35-46	F (wt %)	0.0640	0.0784	0.3500	-0.2860	-0.2716	-81.7%	-77.6%
Pu35-46	Fe_2O_3 (wt %)	0.2002	0.2017	0.1700	0.0302	0.0317	17.7%	18.6%
Pu35-46	Ga_2O_3 (wt %)	0.5679	0.5679	0.5400	0.0279	0.0279	5.2%	5.2%
Pu35-46	Gd_2O_3 (wt %)	12.0447	12.0447	11.6100	0.4347	0.4347	3.7%	3.7%
Pu35-46	HfO_2 (wt %)	13.8568	13.8568	14.9200	-1.0632	-1.0632	-7.1%	-7.1%
Pu35-46	K_2O (wt %)	0.3499	0.3036	0.4100	-0.0601	-0.1064	-14.6%	-25.9%
Pu35-46	La_2O_3 (wt %)	16.7124	16.7124	16.3400	0.3724	0.3724	2.3%	2.3%
Pu35-46	MgO (wt %)	0.7230	0.7256	0.7300	-0.0070	-0.0044	-1.0%	-0.6%
Pu35-46	Na_2O (wt %)	0.6410	0.6041	0.6300	0.0110	-0.0259	1.7%	-4.1%
Pu35-46	Nd_2O_3 (wt %)	13.2970	13.2970	12.9000	0.3970	0.3970	3.1%	3.1%
Pu35-46	NiO (wt %)	0.2685	0.2969	0.3000	-0.0315	-0.0031	-10.5%	-1.0%
Pu35-46	PbO (wt %)	0.0835	0.0835	0.0600	0.0235	0.0235	39.1%	39.1%
Pu35-46	SeO_2 (wt %)	0.0070	0.0070	0.0800	-0.0730	-0.0730	-91.2%	-91.2%
Pu35-46	Si_2O_3 (wt %)	18.1306	17.8580	17.2000	0.9306	0.6580	5.4%	3.8%
Pu35-46	SO_4 (wt %)	0.0749	0.0749	0.1700	-0.0951	-0.0951	-55.9%	-55.9%
Pu35-46	SrO (wt %)	2.3770	2.3770	2.1500	0.2270	0.2270	10.6%	10.6%
Pu35-46	Ta_2O_5 (wt %)	0.4463	0.4463	0.4500	-0.0037	-0.0037	-0.8%	-0.8%
Pu35-46	Sum (wt %)	101.2168	100.6472	99.8700	1.3468	0.7772	1.3%	0.8%
Pu35-47	Al_2O_3 (wt %)	9.1357	8.9545	8.6000	0.5357	0.3545	6.2%	4.1%
Pu35-47	B_2O_3 (wt %)	11.3984	11.3139	11.1800	0.2184	0.1339	2.0%	1.2%

Table D5. Average Measured and Bias-Corrected Chemical Compositions Versus Targeted Compositions by Oxide by Study Glass (continued)

Glass ID	Oxide	Measured (wt %)	Measured Bias-Corrected (wt %)	Targeted (wt %)	Diff of Measured	Diff of Meas BC	% Diff of Measured	% Diff of Meas BC
Pu35-47	CaO (wt %)	0.5009	0.5085	0.4000	0.1009	0.1085	25.2%	27.1%
Pu35-47	Cl (wt %)	0.0505	0.0505	0.6100	-0.5595	-0.5595	-91.7%	-91.7%
Pu35-47	Cr_2O_3 (wt %)	0.3157	0.3041	0.3400	-0.0243	-0.0359	-7.1%	-10.6%
Pu35-47	CuO (wt %)	0.1621	0.1724	0.1400	0.0221	0.0324	15.8%	23.2%
Pu35-47	F (wt %)	0.0265	0.0325	0.1200	-0.0935	-0.0875	-77.9%	-72.9%
Pu35-47	Fe_2O_3 (wt %)	0.1830	0.1844	0.1700	0.0130	0.0144	7.6%	8.5%
Pu35-47	Ga_2O_3 (wt %)	0.2238	0.2238	0.1900	0.0338	0.0338	17.8%	17.8%
Pu35-47	Gd_2O_3 (wt %)	11.7565	11.7565	11.6100	0.1465	0.1465	1.3%	1.3%
Pu35-47	HfO_2 (wt %)	13.8568	13.8568	14.8800	-1.0232	-1.0232	-6.9%	-6.9%
Pu35-47	K_2O (wt %)	0.2060	0.1787	0.2500	-0.0440	-0.0713	-17.6%	-28.5%
Pu35-47	La_2O_3 (wt %)	16.3019	16.3019	16.3400	-0.0381	-0.0381	-0.2%	-0.2%
Pu35-47	MgO (wt %)	0.5970	0.5991	0.6100	-0.0130	-0.0109	-2.1%	-1.8%
Pu35-47	Na_2O (wt %)	0.7421	0.6994	0.7300	0.0121	-0.0306	1.7%	-4.2%
Pu35-47	Nd_2O_3 (wt %)	13.0637	13.0637	12.9000	0.1637	0.1637	1.3%	1.3%
Pu35-47	NiO (wt %)	0.2602	0.2878	0.2900	-0.0298	-0.0022	-10.3%	-0.8%
Pu35-47	PbO (wt %)	0.0803	0.0803	0.0600	0.0203	0.0203	33.8%	33.8%
Pu35-47	SeO_2 (wt %)	0.0070	0.0070	0.0800	-0.0730	-0.0730	-91.2%	-91.2%
Pu35-47	Si_2O_3 (wt %)	17.8845	17.6156	17.2000	0.6845	0.4156	4.0%	2.4%
Pu35-47	SO_4 (wt %)	0.0749	0.0749	0.1700	-0.0951	-0.0951	-55.9%	-55.9%
Pu35-47	SrO (wt %)	2.3356	2.3356	2.1500	0.1856	0.1856	8.6%	8.6%
Pu35-47	Ta_2O_5 (wt %)	0.8077	0.8077	0.8500	-0.0423	-0.0423	-5.0%	-5.0%
Pu35-47	Sum (wt %)	99.9709	99.4096	99.8700	0.1009	-0.4604	0.1%	-0.5%
Pu35-48	Al_2O_3 (wt %)	9.1546	8.9731	8.6000	0.5546	0.3731	6.4%	4.3%
Pu35-48	B_2O_3 (wt %)	11.4789	11.3938	11.1800	0.2989	0.2138	2.7%	1.9%
Pu35-48	CaO (wt %)	0.4610	0.4680	0.3700	0.0910	0.0980	24.6%	26.5%
Pu35-48	Cl (wt %)	0.0560	0.0560	0.6300	-0.5740	-0.5740	-91.1%	-91.1%
Pu35-48	Cr_2O_3 (wt %)	0.2222	0.2140	0.2300	-0.0078	-0.0160	-3.4%	-7.0%
Pu35-48	CuO (wt %)	0.1246	0.1325	0.1100	0.0146	0.0225	13.2%	20.4%
Pu35-48	F (wt %)	0.0365	0.0447	0.2000	-0.1635	-0.1553	-81.8%	-77.6%
Pu35-48	Fe_2O_3 (wt %)	0.4975	0.5013	0.5000	-0.0025	0.0013	-0.5%	0.3%
Pu35-48	Ga_2O_3 (wt %)	0.3663	0.3663	0.3400	0.0263	0.0263	7.7%	7.7%
Pu35-48	Gd_2O_3 (wt %)	11.8142	11.8142	11.6100	0.2042	0.2042	1.8%	1.8%
Pu35-48	HfO_2 (wt %)	13.5620	13.5620	14.8600	-1.2981	-1.2981	-8.7%	-8.7%
Pu35-48	K_2O (wt %)	0.4855	0.4212	0.2900	0.1955	0.1312	67.4%	45.2%
Pu35-48	La_2O_3 (wt %)	16.2433	16.2433	16.3400	-0.0967	-0.0967	-0.6%	-0.6%
Pu35-48	MgO (wt %)	0.7786	0.7813	0.7900	-0.0114	-0.0087	-1.4%	-1.1%
Pu35-48	Na_2O (wt %)	0.7475	0.7044	0.7300	0.0175	-0.0256	2.4%	-3.5%
Pu35-48	Nd_2O_3 (wt %)	13.1220	13.1220	12.9000	0.2220	0.2220	1.7%	1.7%
Pu35-48	NiO (wt %)	0.1762	0.1949	0.1900	-0.0138	0.0049	-7.2%	2.6%
Pu35-48	PbO (wt %)	0.0862	0.0862	0.0600	0.0262	0.0262	43.6%	43.6%
Pu35-48	SeO_2 (wt %)	0.0070	0.0070	0.0800	-0.0730	-0.0730	-91.2%	-91.2%
Pu35-48	Si_2O_3 (wt %)	17.7134	17.4471	17.2000	0.5134	0.2471	3.0%	1.4%
Pu35-48	SO_4 (wt %)	0.0749	0.0749	0.1700	-0.0951	-0.0951	-55.9%	-55.9%
Pu35-48	SrO (wt %)	2.3475	2.3475	2.1500	0.1975	0.1975	9.2%	9.2%
Pu35-48	Ta_2O_5 (wt %)	0.3303	0.3303	0.3500	-0.0197	-0.0197	-5.6%	-5.6%
Pu35-48	Sum (wt %)	99.8860	99.2858	99.8800	0.0060	-0.5942	0.0%	-0.6%
Pu35-49	Al_2O_3 (wt %)	9.2774	9.0934	8.6000	0.6774	0.4934	7.9%	5.7%
Pu35-49	B_2O_3 (wt %)	11.4467	11.3619	11.1800	0.2667	0.1819	2.4%	1.6%
Pu35-49	CaO (wt %)	0.4121	0.4183	0.3200	0.0921	0.0983	28.8%	30.7%
Pu35-49	Cl (wt %)	0.0565	0.0565	0.6400	-0.5835	-0.5835	-91.2%	-91.2%
Pu35-49	Cr_2O_3 (wt %)	0.1805	0.1739	0.1900	-0.0095	-0.0161	-5.0%	-8.5%
Pu35-49	CuO (wt %)	0.1552	0.1651	0.1400	0.0152	0.0251	10.9%	17.9%
Pu35-49	F (wt %)	0.0410	0.0502	0.1900	-0.1490	-0.1398	-78.4%	-73.6%
Pu35-49	Fe_2O_3 (wt %)	0.5183	0.5222	0.5200	-0.0017	0.0022	-0.3%	0.4%
Pu35-49	Ga_2O_3 (wt %)	0.2245	0.2245	0.1900	0.0345	0.0345	18.1%	18.1%
Pu35-49	Gd_2O_3 (wt %)	11.9294	11.9294	11.6100	0.3194	0.3194	2.8%	2.8%
Pu35-49	HfO_2 (wt %)	13.5620	13.5620	14.8900	-1.3281	-1.3281	-8.9%	-8.9%
Pu35-49	K_2O (wt %)	0.5083	0.4410	0.6300	-0.1217	-0.1890	-19.3%	-30.0%

Table D5. Average Measured and Bias-Corrected Chemical Compositions Versus Targeted Compositions by Oxide by Study Glass (continued)

Glass ID	Oxide	Measured (wt %)	Measured Bias-Corrected (wt %)	Targeted (wt %)	Diff of Measured	Diff of Meas BC	% Diff of Measured	% Diff of Meas BC
Pu35-49	La_2O_3 (wt %)	16.7124	16.7124	16.3400	0.3724	0.3724	2.3%	2.3%
Pu35-49	MgO (wt %)	0.7587	0.7614	0.7700	-0.0113	-0.0086	-1.5%	-1.1%
Pu35-49	Na_2O (wt %)	0.6639	0.6257	0.6400	0.0239	-0.0143	3.7%	-2.2%
Pu35-49	Nd_2O_3 (wt %)	13.2970	13.2970	12.9000	0.3970	0.3970	3.1%	3.1%
Pu35-49	NiO (wt %)	0.1839	0.2033	0.2000	-0.0161	0.0033	-8.1%	1.7%
Pu35-49	PbO (wt %)	0.0846	0.0846	0.0600	0.0246	0.0246	40.9%	40.9%
Pu35-49	SeO_2 (wt %)	0.0070	0.0070	0.0800	-0.0730	-0.0730	-91.2%	-91.2%
Pu35-49	Si_2O_3 (wt %)	18.1734	17.9001	17.2000	0.9734	0.7001	5.7%	4.1%
Pu35-49	SO_4 (wt %)	0.0749	0.0749	0.1700	-0.0951	-0.0951	-55.9%	-55.9%
Pu35-49	SrO (wt %)	2.3593	2.3593	2.1500	0.2093	0.2093	9.7%	9.7%
Pu35-49	Ta_2O_5 (wt %)	0.2735	0.2735	0.2700	0.0035	0.0035	1.3%	1.3%
Pu35-49	Sum (wt %)	100.9004	100.2975	99.8800	1.0204	0.4175	1.0%	0.4%
Pu35-50	Al_2O_3 (wt %)	9.2397	9.0564	8.6000	0.6397	0.4564	7.4%	5.3%
Pu35-50	B_2O_3 (wt %)	11.5433	11.4578	11.1800	0.3633	0.2778	3.2%	2.5%
Pu35-50	CaO (wt %)	0.3463	0.3515	0.2600	0.0863	0.0915	33.2%	35.2%
Pu35-50	Cl (wt %)	0.0695	0.0695	0.6400	-0.5705	-0.5705	-89.1%	-89.1%
Pu35-50	Cr_2O_3 (wt %)	0.2353	0.2267	0.2500	-0.0147	-0.0233	-5.9%	-9.3%
Pu35-50	CuO (wt %)	0.1177	0.1252	0.1100	0.0077	0.0152	7.0%	13.8%
Pu35-50	F (wt %)	0.0420	0.0515	0.2000	-0.1580	-0.1485	-79.0%	-74.3%
Pu35-50	Fe_2O_3 (wt %)	0.4975	0.5013	0.4900	0.0075	0.0113	1.5%	2.3%
Pu35-50	Ga_2O_3 (wt %)	0.3495	0.3495	0.3200	0.0295	0.0295	9.2%	9.2%
Pu35-50	Gd_2O_3 (wt %)	11.8718	11.8718	11.6100	0.2618	0.2618	2.3%	2.3%
Pu35-50	HfO_2 (wt %)	13.5030	13.5030	14.8900	-1.3870	-1.3870	-9.3%	-9.3%
Pu35-50	K_2O (wt %)	0.6065	0.5262	0.6900	-0.0835	-0.1638	-12.1%	-23.7%
Pu35-50	La_2O_3 (wt %)	16.5951	16.5951	16.3400	0.2551	0.2551	1.6%	1.6%
Pu35-50	MgO (wt %)	0.6509	0.6532	0.6600	-0.0091	-0.0068	-1.4%	-1.0%
Pu35-50	Na_2O (wt %)	0.6774	0.6384	0.6500	0.0274	-0.0116	4.2%	-1.8%
Pu35-50	Nd_2O_3 (wt %)	13.1220	13.1220	12.9000	0.2220	0.2220	1.7%	1.7%
Pu35-50	NiO (wt %)	0.2081	0.2301	0.2400	-0.0319	-0.0099	-13.3%	-4.1%
Pu35-50	PbO (wt %)	0.0813	0.0813	0.0600	0.0213	0.0213	35.5%	35.5%
Pu35-50	SeO_2 (wt %)	0.0070	0.0070	0.0800	-0.0730	-0.0730	-91.2%	-91.2%
Pu35-50	Si_2O_3 (wt %)	17.8739	17.6051	17.2000	0.6739	0.4051	3.9%	2.4%
Pu35-50	SO_4 (wt %)	0.0749	0.0749	0.1700	-0.0951	-0.0951	-55.9%	-55.9%
Pu35-50	SrO (wt %)	2.3652	2.3652	2.1500	0.2152	0.2152	10.0%	10.0%
Pu35-50	Ta_2O_5 (wt %)	0.1838	0.1838	0.1800	0.0038	0.0038	2.1%	2.1%
Pu35-50	Sum (wt %)	100.2616	99.6463	99.8700	0.3916	-0.2237	0.4%	-0.2%
Pu35-51	Al_2O_3 (wt %)	9.2208	9.0379	8.6000	0.6208	0.4379	7.2%	5.1%
Pu35-51	B_2O_3 (wt %)	11.5111	11.4258	11.1800	0.3311	0.2458	3.0%	2.2%
Pu35-51	CaO (wt %)	0.2372	0.2407	0.1600	0.0772	0.0807	48.2%	50.5%
Pu35-51	Cl (wt %)	0.0515	0.0515	0.6500	-0.5985	-0.5985	-92.1%	-92.1%
Pu35-51	Cr_2O_3 (wt %)	0.3069	0.2957	0.3200	-0.0131	-0.0243	-4.1%	-7.6%
Pu35-51	CuO (wt %)	0.1264	0.1345	0.1100	0.0164	0.0245	14.9%	22.3%
Pu35-51	F (wt %)	0.0405	0.0496	0.2200	-0.1795	-0.1704	-81.6%	-77.4%
Pu35-51	Fe_2O_3 (wt %)	0.5647	0.5690	0.5600	0.0047	0.0090	0.8%	1.6%
Pu35-51	Ga_2O_3 (wt %)	0.1936	0.1936	0.1600	0.0336	0.0336	21.0%	21.0%
Pu35-51	Gd_2O_3 (wt %)	11.9294	11.9294	11.6100	0.3194	0.3194	2.8%	2.8%
Pu35-51	HfO_2 (wt %)	13.4440	13.4440	14.8700	-1.4260	-1.4260	-9.6%	-9.6%
Pu35-51	K_2O (wt %)	0.2132	0.1850	0.2600	-0.0468	-0.0750	-18.0%	-28.9%
Pu35-51	La_2O_3 (wt %)	16.7710	16.7710	16.3400	0.4310	0.4310	2.6%	2.6%
Pu35-51	MgO (wt %)	0.8980	0.9012	0.9000	-0.0020	0.0012	-0.2%	0.1%
Pu35-51	Na_2O (wt %)	0.7643	0.7203	0.7500	0.0143	-0.0297	1.9%	-4.0%
Pu35-51	Nd_2O_3 (wt %)	13.1803	13.1803	12.9000	0.2803	0.2803	2.2%	2.2%
Pu35-51	NiO (wt %)	0.2710	0.2997	0.2900	-0.0190	0.0097	-6.5%	3.4%
Pu35-51	PbO (wt %)	0.0835	0.0835	0.0600	0.0235	0.0235	39.1%	39.1%
Pu35-51	SeO_2 (wt %)	0.0070	0.0070	0.0800	-0.0730	-0.0730	-91.2%	-91.2%
Pu35-51	Si_2O_3 (wt %)	18.0450	17.7737	17.2000	0.8450	0.5737	4.9%	3.3%
Pu35-51	SO_4 (wt %)	0.0749	0.0749	0.1700	-0.0951	-0.0951	-55.9%	-55.9%
Pu35-51	SrO (wt %)	2.3415	2.3415	2.1500	0.1915	0.1915	8.9%	8.9%

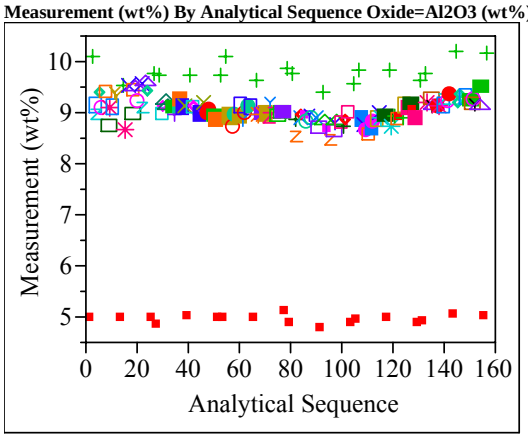
Table D5. Average Measured and Bias-Corrected Chemical Compositions Versus Targeted Compositions by Oxide by Study Glass (continued)

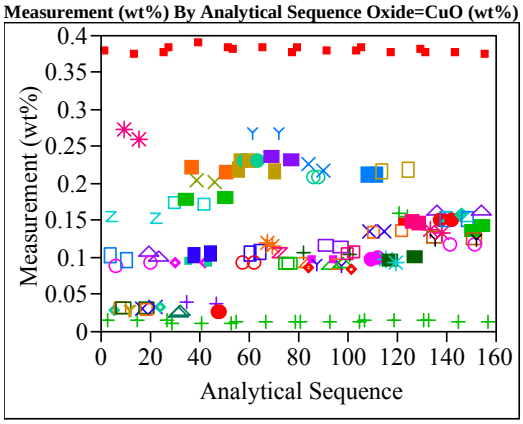
Glass ID	Oxide	Measured (wt %)	Measured Bias-Corrected (wt %)	Targeted (wt %)	Diff of Measured	Diff of Meas BC	% Diff of Measured	% Diff of Meas BC
Pu35-51	Ta_2O_5 (wt %)	0.3284	0.3284	0.3200	0.0084	0.0084	2.6%	2.6%
Pu35-51	Sum (wt %)	100.6045	100.0383	99.8600	0.7445	0.1783	0.7%	0.2%
Pu35-52	Al_2O_3 (wt %)	9.1830	9.0008	8.6000	0.5830	0.4008	6.8%	4.7%
Pu35-52	B_2O_3 (wt %)	11.4789	11.3938	11.1800	0.2989	0.2138	2.7%	1.9%
Pu35-52	CaO (wt %)	0.2484	0.2521	0.1700	0.0784	0.0821	46.1%	48.3%
Pu35-52	Cl (wt %)	0.0520	0.0520	0.6900	-0.6380	-0.6380	-92.5%	-92.5%
Pu35-52	Cr_2O_3 (wt %)	0.3069	0.2957	0.3300	-0.0231	-0.0343	-7.0%	-10.4%
Pu35-52	CuO (wt %)	0.1490	0.1584	0.1400	0.0090	0.0184	6.4%	13.2%
Pu35-52	F (wt %)	0.0255	0.0312	0.1400	-0.1145	-0.1088	-81.8%	-77.7%
Pu35-52	Fe_2O_3 (wt %)	0.3996	0.4026	0.3900	0.0096	0.0126	2.5%	3.2%
Pu35-52	Ga_2O_3 (wt %)	0.6015	0.6015	0.5800	0.0215	0.0215	3.7%	3.7%
Pu35-52	Gd_2O_3 (wt %)	11.8718	11.8718	11.6100	0.2618	0.2618	2.3%	2.3%
Pu35-52	HfO_2 (wt %)	12.7364	12.7364	14.8600	-2.1236	-2.1236	-14.3%	-14.3%
Pu35-52	K_2O (wt %)	0.3066	0.2660	0.3700	-0.0634	-0.1040	-17.1%	-28.1%
Pu35-52	La_2O_3 (wt %)	16.7124	16.7124	16.3400	0.3724	0.3724	2.3%	2.3%
Pu35-52	MgO (wt %)	0.8018	0.8046	0.8200	-0.0182	-0.0154	-2.2%	-1.9%
Pu35-52	Na_2O (wt %)	0.7434	0.7006	0.7100	0.0334	-0.0094	4.7%	-1.3%
Pu35-52	Nd_2O_3 (wt %)	13.1803	13.1803	12.9000	0.2803	0.2803	2.2%	2.2%
Pu35-52	NiO (wt %)	0.2074	0.2294	0.2300	-0.0226	-0.0006	-9.8%	-0.3%
Pu35-52	PbO (wt %)	0.0835	0.0835	0.0600	0.0235	0.0235	39.1%	39.1%
Pu35-52	SeO_2 (wt %)	0.0070	0.0070	0.0800	-0.0730	-0.0730	-91.2%	-91.2%
Pu35-52	Si_2O_3 (wt %)	17.9487	17.6788	17.2000	0.7487	0.4788	4.4%	2.8%
Pu35-52	SO_4 (wt %)	0.0749	0.0749	0.1700	-0.0951	-0.0951	-55.9%	-55.9%
Pu35-52	SrO (wt %)	2.3415	2.3415	2.1500	0.1915	0.1915	8.9%	8.9%
Pu35-52	Ta_2O_5 (wt %)	0.1471	0.1471	0.1400	0.0071	0.0071	5.1%	5.1%
Pu35-52	Sum (wt %)	99.6078	99.0228	99.8600	-0.2522	-0.8372	-0.3%	-0.8%
Pu35-53	Al_2O_3 (wt %)	9.1641	8.9823	8.6000	0.5641	0.3823	6.6%	4.4%
Pu35-53	B_2O_3 (wt %)	11.5755	11.4897	11.1800	0.3955	0.3097	3.5%	2.8%
Pu35-53	CaO (wt %)	0.2414	0.2450	0.1600	0.0814	0.0850	50.9%	53.1%
Pu35-53	Cl (wt %)	0.0555	0.0555	0.7000	-0.6445	-0.6445	-92.1%	-92.1%
Pu35-53	Cr_2O_3 (wt %)	0.1666	0.1605	0.1700	-0.0034	-0.0095	-2.0%	-5.6%
Pu35-53	CuO (wt %)	0.1352	0.1438	0.1100	0.0252	0.0338	22.9%	30.7%
Pu35-53	F (wt %)	0.0480	0.0588	0.3500	-0.3020	-0.2912	-86.3%	-83.2%
Pu35-53	Fe_2O_3 (wt %)	0.1837	0.1851	0.1700	0.0137	0.0151	8.1%	8.9%
Pu35-53	Ga_2O_3 (wt %)	0.1922	0.1922	0.1600	0.0322	0.0322	20.1%	20.1%
Pu35-53	Gd_2O_3 (wt %)	11.9294	11.9294	11.6100	0.3194	0.3194	2.8%	2.8%
Pu35-53	HfO_2 (wt %)	12.8544	12.8544	14.9700	-2.1156	-2.1156	-14.1%	-14.1%
Pu35-53	K_2O (wt %)	0.3451	0.2994	0.4700	-0.1249	-0.1706	-26.6%	-36.3%
Pu35-53	La_2O_3 (wt %)	16.8297	16.8297	16.3400	0.4897	0.4897	3.0%	3.0%
Pu35-53	MgO (wt %)	0.6202	0.6224	0.6200	0.0002	0.0024	0.0%	0.4%
Pu35-53	Na_2O (wt %)	0.7920	0.7464	0.7900	0.0020	-0.0436	0.2%	-5.5%
Pu35-53	Nd_2O_3 (wt %)	13.2386	13.2386	12.9000	0.3386	0.3386	2.6%	2.6%
Pu35-53	NiO (wt %)	0.1393	0.1541	0.1500	-0.0107	0.0041	-7.1%	2.7%
Pu35-53	PbO (wt %)	0.0813	0.0813	0.0600	0.0213	0.0213	35.5%	35.5%
Pu35-53	SeO_2 (wt %)	0.0070	0.0070	0.0800	-0.0730	-0.0730	-91.2%	-91.2%
Pu35-53	Si_2O_3 (wt %)	17.9808	17.7105	17.2000	0.7808	0.5105	4.5%	3.0%
Pu35-53	SO_4 (wt %)	0.0749	0.0749	0.1700	-0.0951	-0.0951	-55.9%	-55.9%
Pu35-53	SrO (wt %)	2.3297	2.3297	2.1500	0.1797	0.1797	8.4%	8.4%
Pu35-53	Ta_2O_5 (wt %)	0.7558	0.7558	0.7700	-0.0142	-0.0142	-1.8%	-1.8%
Pu35-53	Sum (wt %)	99.7405	99.1466	99.8800	-0.1395	-0.7334	-0.1%	-0.7%
Pu35-54	Al_2O_3 (wt %)	9.2397	9.0564	8.6000	0.6397	0.4564	7.4%	5.3%
Pu35-54	B_2O_3 (wt %)	11.5755	11.4897	11.1800	0.3955	0.3097	3.5%	2.8%
Pu35-54	CaO (wt %)	0.3575	0.3629	0.2800	0.0775	0.0829	27.7%	29.6%
Pu35-54	Cl (wt %)	0.0645	0.0645	0.6400	-0.5755	-0.5755	-89.9%	-89.9%
Pu35-54	Cr_2O_3 (wt %)	0.2704	0.2605	0.3000	-0.0296	-0.0395	-9.9%	-13.2%
Pu35-54	CuO (wt %)	0.1508	0.1604	0.1300	0.0208	0.0304	16.0%	23.4%
Pu35-54	F (wt %)	0.0620	0.0760	0.2100	-0.1480	-0.1340	-70.5%	-63.8%
Pu35-54	Fe_2O_3 (wt %)	0.4210	0.4242	0.4200	0.0010	0.0042	0.2%	1.0%

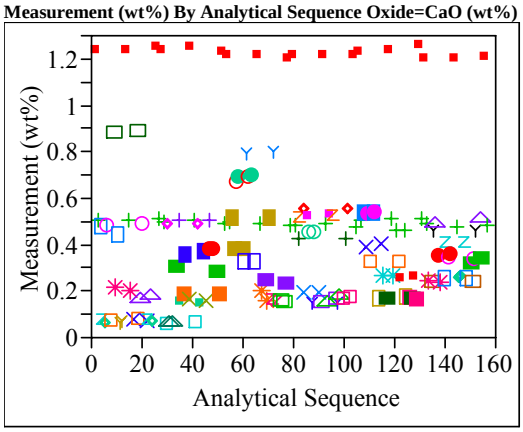
Table D5. Average Measured and Bias-Corrected Chemical Compositions Versus Targeted Compositions by Oxide by Study Glass (continued)

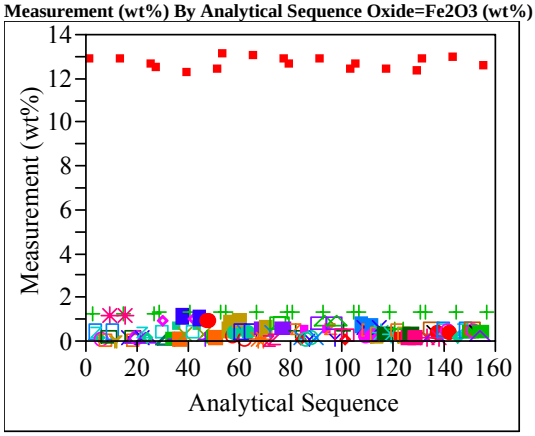
Glass ID	Oxide	Measured (wt %)	Measured Bias-Corrected (wt %)	Targeted (wt %)	Diff of Measured	Diff of Meas BC	% Diff of Measured	% Diff of Meas BC
Pu35-54	Ga_2O_3 (wt %)	0.4362	0.4362	0.4100	0.0262	0.0262	6.4%	6.4%
Pu35-54	Gd_2O_3 (wt %)	11.9870	11.9870	11.6100	0.3770	0.3770	3.2%	3.2%
Pu35-54	HfO_2 (wt %)	12.9723	12.9723	14.9300	-1.9577	-1.9577	-13.1%	-13.1%
Pu35-54	K_2O (wt %)	0.4776	0.4144	0.5700	-0.0924	-0.1556	-16.2%	-27.3%
Pu35-54	La_2O_3 (wt %)	16.8883	16.8883	16.3400	0.5483	0.5483	3.4%	3.4%
Pu35-54	MgO (wt %)	0.7918	0.7947	0.8100	-0.0182	-0.0153	-2.2%	-1.9%
Pu35-54	Na_2O (wt %)	0.7171	0.6759	0.7000	0.0171	-0.0241	2.4%	-3.4%
Pu35-54	Nd_2O_3 (wt %)	13.2970	13.2970	12.9000	0.3970	0.3970	3.1%	3.1%
Pu35-54	NiO (wt %)	0.1470	0.1625	0.1600	-0.0130	0.0025	-8.1%	1.6%
Pu35-54	PbO (wt %)	0.0339	0.0339	0.0000	0.0339	0.0339		
Pu35-54	SeO_2 (wt %)	0.0070	0.0070	0.0000	0.0070	0.0070		
Pu35-54	Si_2O_3 (wt %)	18.1947	17.9212	17.2000	0.9947	0.7212	5.8%	4.2%
Pu35-54	SO_4 (wt %)	0.0749	0.0749	0.0000	0.0749	0.0749		
Pu35-54	SrO (wt %)	2.3652	2.3652	2.1500	0.2152	0.2152	10.0%	10.0%
Pu35-54	Ta_2O_5 (wt %)	0.4512	0.4512	0.4600	-0.0088	-0.0088	-1.9%	-1.9%
Pu35-54	Sum (wt %)	100.9828	100.3762	100.0000	0.9828	0.3762	1.0%	0.4%
Pu35-55	Al_2O_3 (wt %)	9.3530	9.1675	8.6000	0.7530	0.5675	8.8%	6.6%
Pu35-55	B_2O_3 (wt %)	11.8331	11.7454	11.1800	0.6531	0.5654	5.8%	5.1%
Pu35-55	CaO (wt %)	0.3295	0.3345	0.2400	0.0895	0.0945	37.3%	39.4%
Pu35-55	Cl (wt %)	0.0665	0.0665	0.6300	-0.5635	-0.5635	-89.4%	-89.4%
Pu35-55	Cr_2O_3 (wt %)	0.2229	0.2147	0.2300	-0.0071	-0.0153	-3.1%	-6.7%
Pu35-55	CuO (wt %)	0.1383	0.1471	0.1200	0.0183	0.0271	15.3%	22.6%
Pu35-55	F (wt %)	0.0470	0.0576	0.1900	-0.1430	-0.1324	-75.3%	-69.7%
Pu35-55	Fe_2O_3 (wt %)	0.3753	0.3781	0.3600	0.0153	0.0181	4.2%	5.0%
Pu35-55	Ga_2O_3 (wt %)	0.3589	0.3589	0.3200	0.0389	0.0389	12.2%	12.2%
Pu35-55	Gd_2O_3 (wt %)	12.0447	12.0447	11.6100	0.4347	0.4347	3.7%	3.7%
Pu35-55	HfO_2 (wt %)	13.3261	13.3261	14.8800	-1.5539	-1.5539	-10.4%	-10.4%
Pu35-55	K_2O (wt %)	0.4053	0.3517	0.4600	-0.0547	-0.1083	-11.9%	-23.5%
Pu35-55	La_2O_3 (wt %)	17.0056	17.0056	16.3400	0.6656	0.6656	4.1%	4.1%
Pu35-55	MgO (wt %)	0.8383	0.8412	0.8400	-0.0017	0.0012	-0.2%	0.1%
Pu35-55	Na_2O (wt %)	0.7461	0.7032	0.7200	0.0261	-0.0168	3.6%	-2.3%
Pu35-55	Nd_2O_3 (wt %)	13.4719	13.4719	12.9000	0.5719	0.5719	4.4%	4.4%
Pu35-55	NiO (wt %)	0.1794	0.1984	0.1900	-0.0106	0.0084	-5.6%	4.4%
Pu35-55	PbO (wt %)	0.0835	0.0835	0.0600	0.0235	0.0235	39.1%	39.1%
Pu35-55	SeO_2 (wt %)	0.0070	0.0070	0.0800	-0.0730	-0.0730	-91.2%	-91.2%
Pu35-55	Si_2O_3 (wt %)	18.4301	18.1529	17.2000	1.2301	0.9529	7.2%	5.5%
Pu35-55	SO_4 (wt %)	0.0749	0.0749	0.1700	-0.0951	-0.0951	-55.9%	-55.9%
Pu35-55	SrO (wt %)	2.3889	2.3889	2.1500	0.2389	0.2389	11.1%	11.1%
Pu35-55	Ta_2O_5 (wt %)	0.3889	0.3889	0.3900	-0.0011	-0.0011	-0.3%	-0.3%
Pu35-55	Sum (wt %)	102.1152	101.5092	99.8600	2.2552	1.6492	2.3%	1.7%

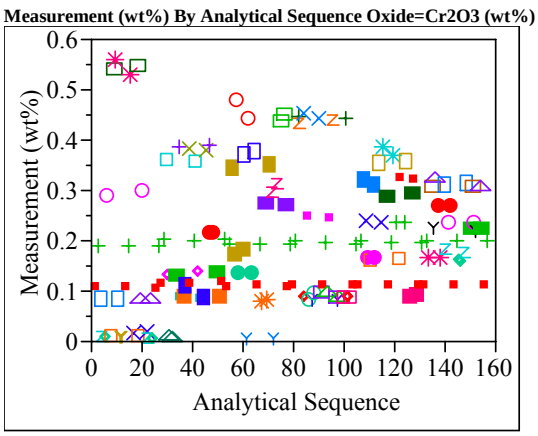
Exhibit D1. Oxide Measurements in Analytical Sequence for Samples Prepared Using the LM Method











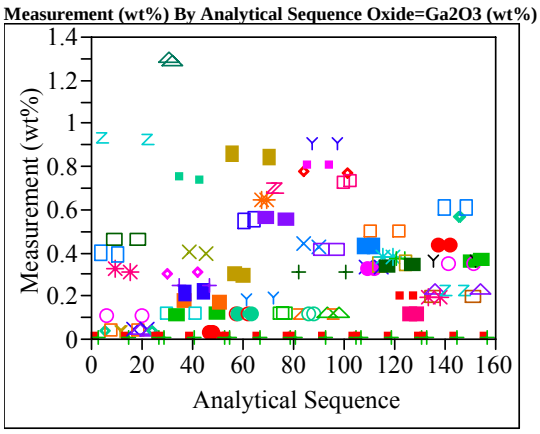
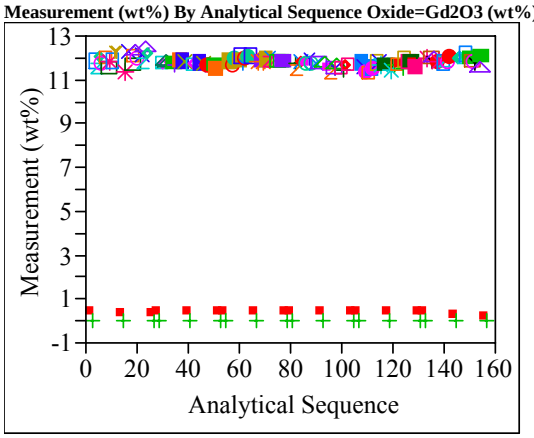
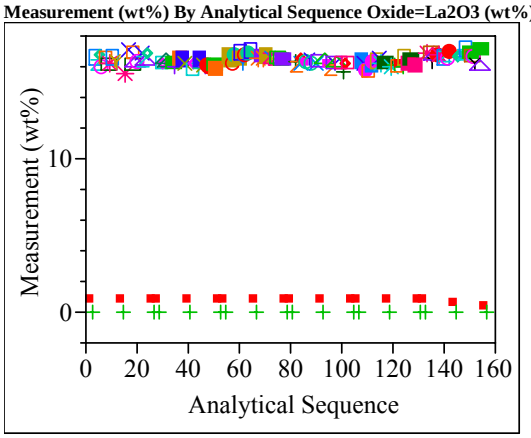
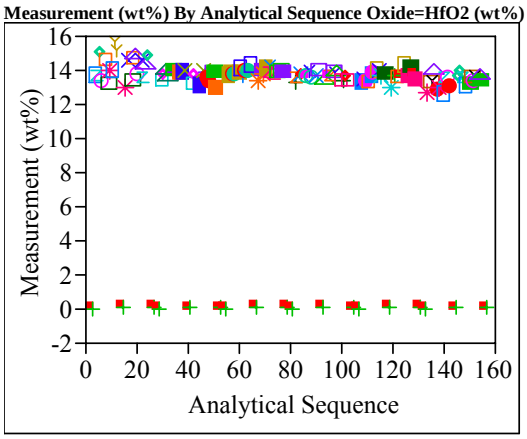
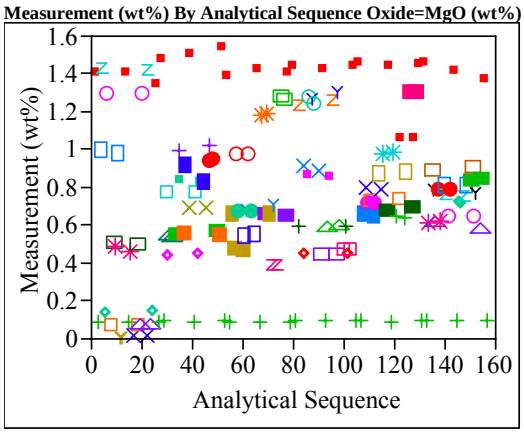


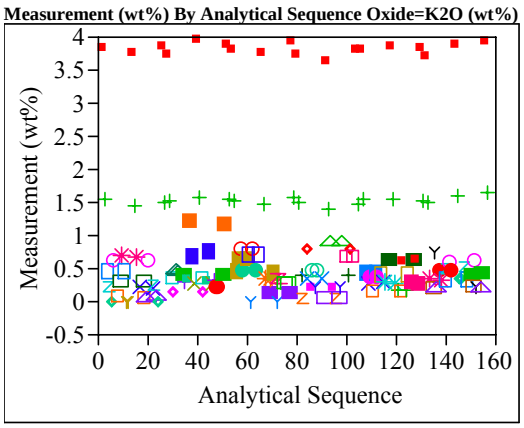
Exhibit D1. Oxide Measurements in Analytical Sequence for Samples Prepared Using the LM Method (continued)











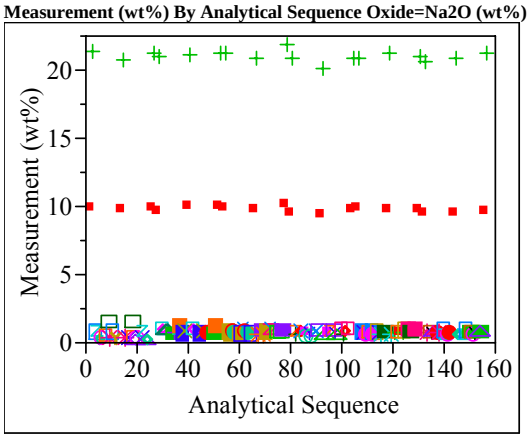
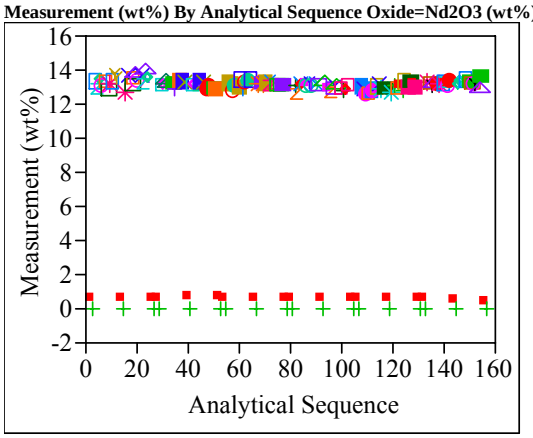
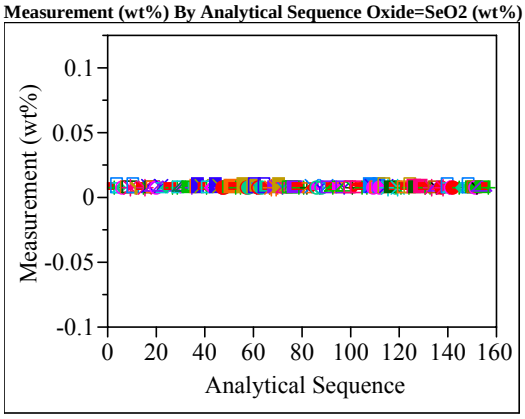
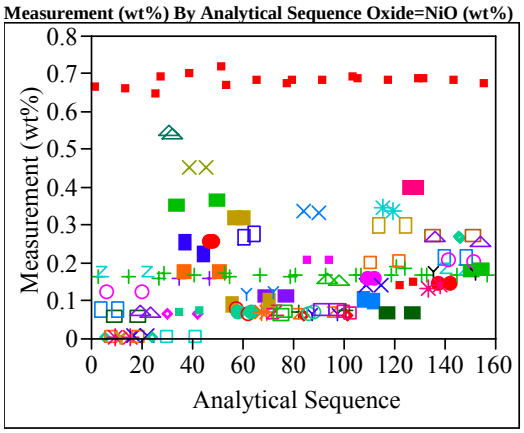
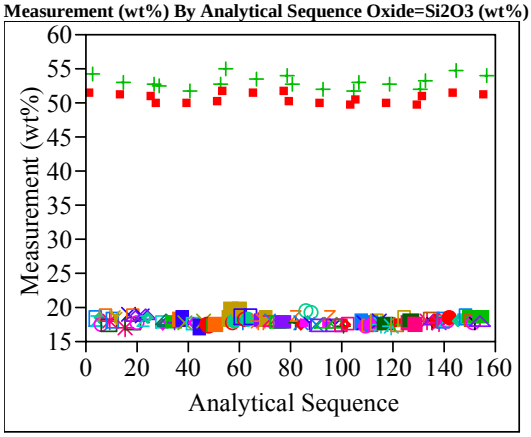


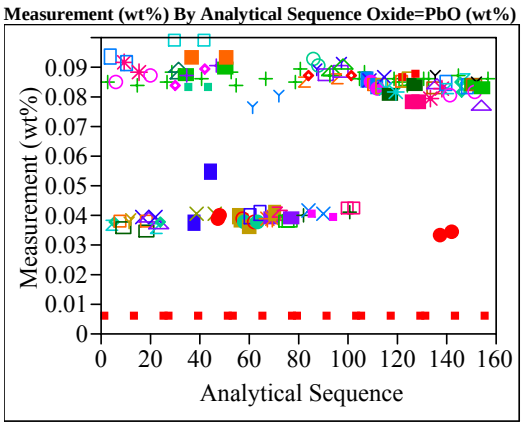
Exhibit D1. Oxide Measurements in Analytical Sequence for Samples Prepared Using the LM Method (continued)











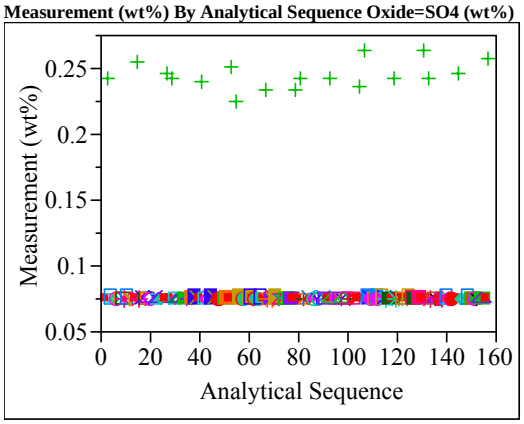
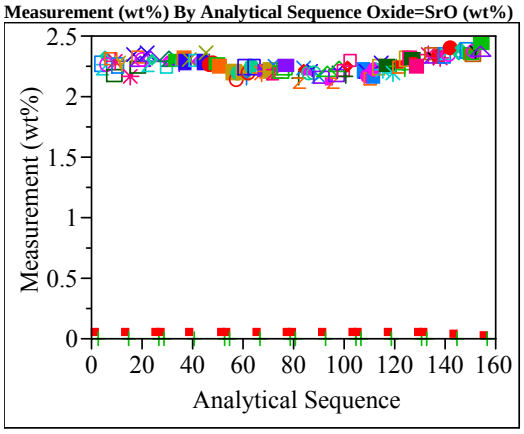


Exhibit D1. Oxide Measurements in Analytical Sequence for Samples Prepared Using the LM Method (continued)



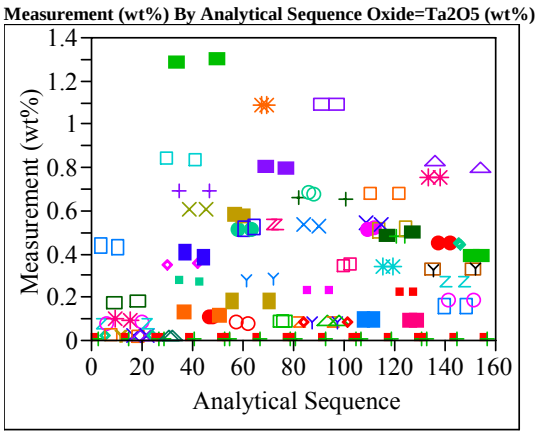
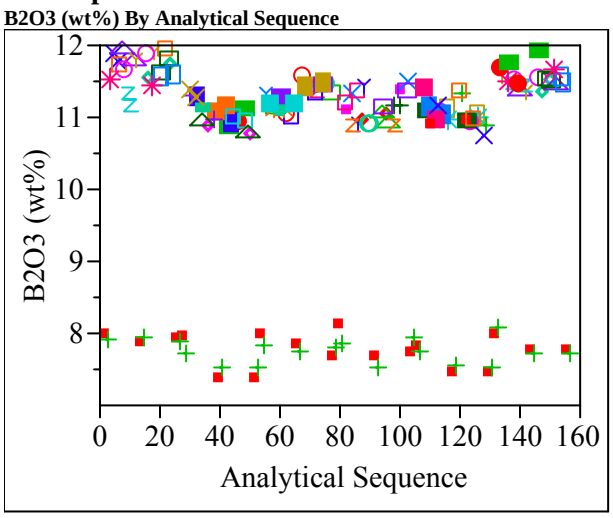
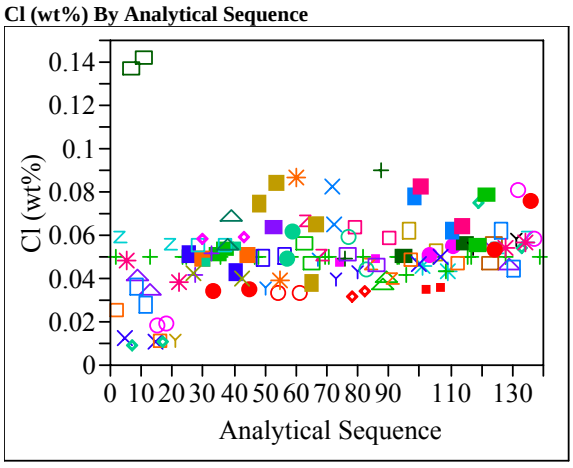


Exhibit D2. Measurements in Analytical Sequence for Samples Prepared Using the PF Method and for Samples Prepared for Measurements by IC

PF Preparation



Measurements by IC



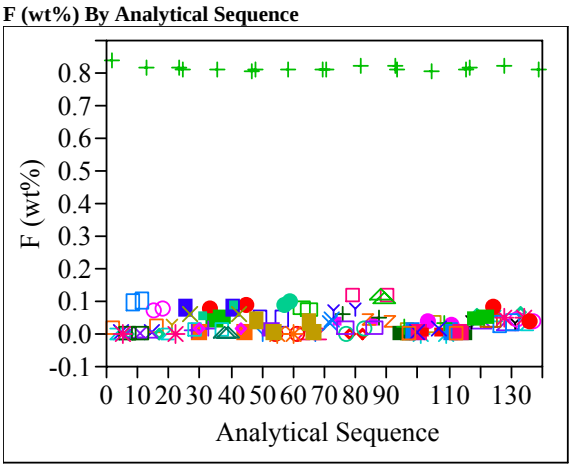
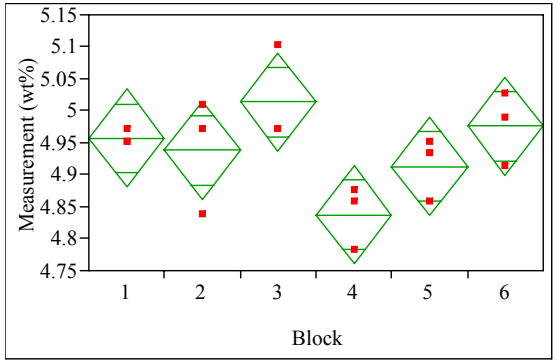


Exhibit D3. PSAL Measurements by Analytical Block for Samples of the Standard Glasses Prepared Using the LM Method

Oneway Analysis of Measurement (wt%) By Block
Glass ID=Batch 1, Oxide=Al2O3 (wt%)
Reference Value = 4.877 wt%



Oneway Anova
Summary of Fit

Rsquare	0.552006
Adj Rsquare	0.365342
Root Mean Square Error	0.060902
Mean of Response	4.938943
Observations (or Sum Wgts)	18

Analysis of Variance

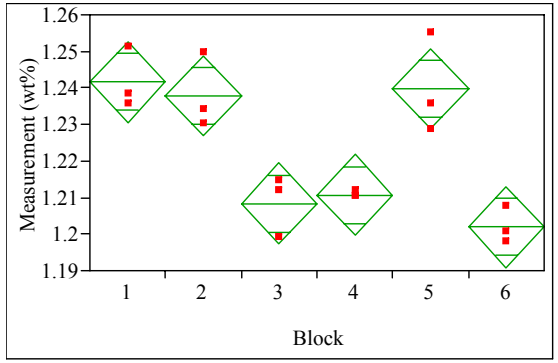
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Block	5	0.05484240	0.010968	2.9572	0.0575
Error	12	0.04450862	0.003709		
C. Total	17	0.09935102			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1	3	4.95679	0.03516	4.8802	5.0334
2	3	4.93789	0.03516	4.8613	5.0145
3	3	5.01347	0.03516	4.9369	5.0901
4	3	4.83712	0.03516	4.7605	4.9137
5	3	4.91270	0.03516	4.8361	4.9893
6	3	4.97568	0.03516	4.8991	5.0523

Std Error uses a pooled estimate of error variance

Oneway Analysis of Measurement (wt%) By Block
Glass ID=Batch 1, Oxide=CaO (wt%)
Reference Value = 1.200 wt%



Oneway Anova
Summary of Fit

Rsquare	0.844029
Adj Rsquare	0.77904
Root Mean Square Error	0.008726
Mean of Response	1.223367
Observations (or Sum Wgts)	18

Analysis of Variance

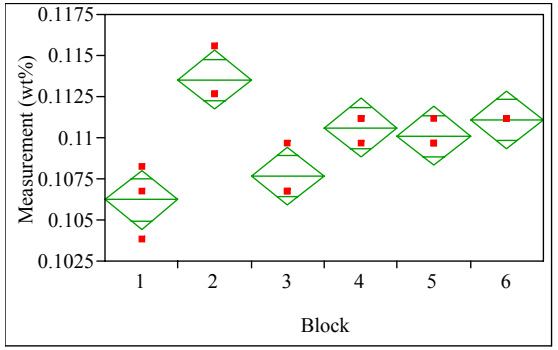
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Block	5	0.00494400	0.000989	12.9874	0.0002
Error	12	0.00091362	0.000076		
C. Total	17	0.00585762			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1	3	1.24156	0.00504	1.2306	1.2525
2	3	1.23783	0.00504	1.2268	1.2488
3	3	1.20844	0.00504	1.1975	1.2194
4	3	1.21077	0.00504	1.1998	1.2218
5	3	1.23969	0.00504	1.2287	1.2507
6	3	1.20191	0.00504	1.1909	1.2129

Std Error uses a pooled estimate of error variance

Oneway Analysis of Measurement (wt%) By Block
Glass ID=Batch 1, Oxide=Cr2O3 (wt%)
Reference Value = 0.107 wt%



Oneway Anova
Summary of Fit

Rsquare	0.806268
Adj Rsquare	0.725546
Root Mean Square Error	0.00142
Mean of Response	0.109864
Observations (or Sum Wgts)	18

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Block	5	0.00010076	0.000020	9.9882	0.0006
Error	12	0.00002421	2.018e-6		
C. Total	17	0.00012497			

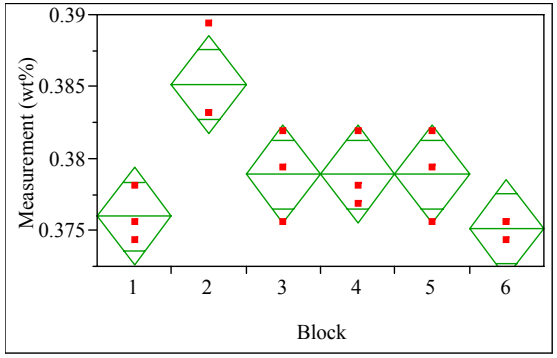
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1	3	0.106210	0.00082	0.10442	0.10800
2	3	0.113518	0.00082	0.11173	0.11530
3	3	0.107671	0.00082	0.10588	0.10946
4	3	0.110594	0.00082	0.10881	0.11238
5	3	0.110107	0.00082	0.10832	0.11189
6	3	0.111082	0.00082	0.10929	0.11287

Std Error uses a pooled estimate of error variance

Exhibit D3. PSAL Measurements by Analytical Block for Samples of the Standard Glasses Prepared Using the LM Method (continued)

Oneway Analysis of Measurement (wt%) By Block
Glass ID=Batch 1, Oxide=CuO (wt%)
Reference Value = 0.399 wt%



Oneway Anova
Summary of Fit

Rsquare	0.678674
Adj Rsquare	0.544788
Root Mean Square Error	0.002704
Mean of Response	0.378809
Observations (or Sum Wgts)	18

Analysis of Variance

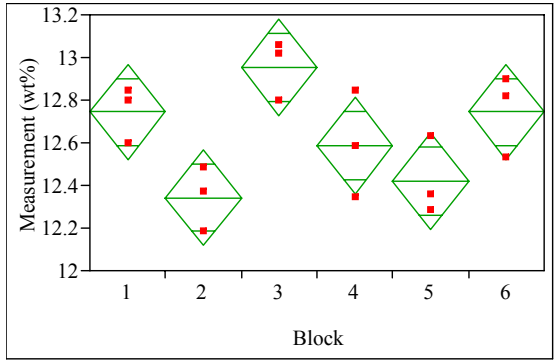
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Block	5	0.00018534	0.000037	5.0690	0.0100
Error	12	0.00008775	7.313e-6		
C. Total	17	0.00027309			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1	3	0.375957	0.00156	0.37256	0.37936
2	3	0.385137	0.00156	0.38174	0.38854
3	3	0.378878	0.00156	0.37548	0.38228
4	3	0.378878	0.00156	0.37548	0.38228
5	3	0.378878	0.00156	0.37548	0.38228
6	3	0.375123	0.00156	0.37172	0.37852

Std Error uses a pooled estimate of error variance

Oneway Analysis of Measurement (wt%) By Block
Glass ID=Batch 1, Oxide=Fe2O3 (wt%)
Reference Value = 12.839 wt%



Oneway Anova
Summary of Fit

Rsquare	0.668927
Adj Rsquare	0.530981
Root Mean Square Error	0.178919
Mean of Response	12.6314
Observations (or Sum Wgts)	18

Analysis of Variance

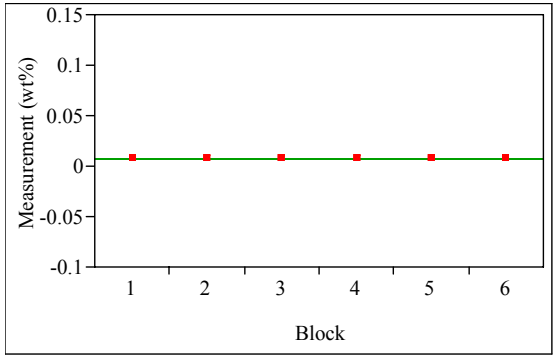
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Block	5	0.7761568	0.155231	4.8492	0.0117
Error	12	0.3841436	0.032012		
C. Total	17	1.1603005			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1	3	12.7434	0.10330	12.518	12.968
2	3	12.3431	0.10330	12.118	12.568
3	3	12.9531	0.10330	12.728	13.178
4	3	12.5861	0.10330	12.361	12.811
5	3	12.4193	0.10330	12.194	12.644
6	3	12.7434	0.10330	12.518	12.968

Std Error uses a pooled estimate of error variance

Oneway Analysis of Measurement (wt%) By Block
Glass ID=Batch 1, Oxide=Ga2O3 (wt%)
Reference Value = 0.0 wt%



Oneway Anova
Summary of Fit

Rsquare	.
Adj Rsquare	.
Root Mean Square Error	0
Mean of Response	0.006721
Observations (or Sum Wgts)	18

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Block	5	0	0	.	.
Error	12	0	0		
C. Total	17	0			

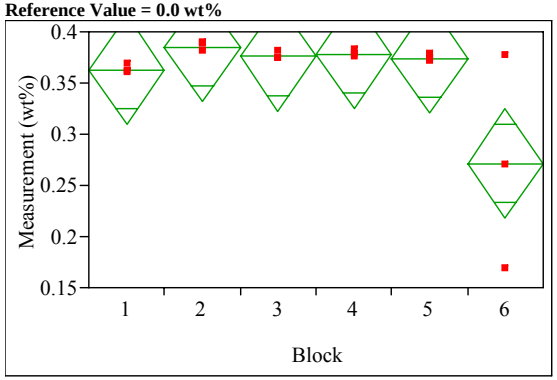
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1	3	0.006721	0	0.00672	0.00672
2	3	0.006721	0	0.00672	0.00672
3	3	0.006721	0	0.00672	0.00672
4	3	0.006721	0	0.00672	0.00672
5	3	0.006721	0	0.00672	0.00672
6	3	0.006721	0	0.00672	0.00672

Std Error uses a pooled estimate of error variance

Exhibit D3. PSAL Measurements by Analytical Block for Samples of the Standard Glasses Prepared Using the LM Method (continued)

Oneway Analysis of Measurement (wt%) By Block
Glass ID=Batch 1, Oxide=Gd2O3 (wt%)
Reference Value = 0.0 wt%



Oneway Anova
Summary of Fit

Rsquare	0.562079
Adj Rsquare	0.379612
Root Mean Square Error	0.042507
Mean of Response	0.357882
Observations (or Sum Wgts)	18

Analysis of Variance

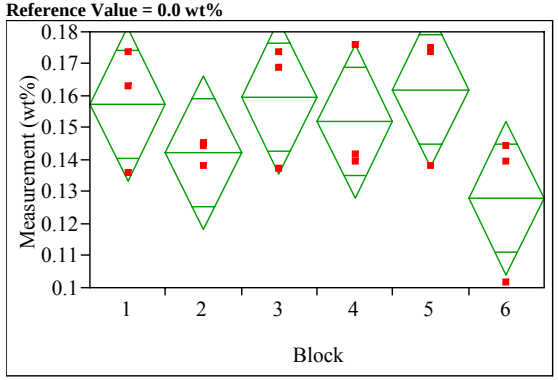
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Block	5	0.02782892	0.005566	3.0804	0.0512
Error	12	0.02168179	0.001807		
C. Total	17	0.04951071			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1	3	0.362685	0.02454	0.30921	0.41616
2	3	0.385353	0.02454	0.33188	0.43882
3	3	0.375748	0.02454	0.32228	0.42922
4	3	0.378053	0.02454	0.32458	0.43152
5	3	0.374211	0.02454	0.32074	0.42768
6	3	0.271245	0.02454	0.21777	0.32472

Std Error uses a pooled estimate of error variance

Oneway Analysis of Measurement (wt%) By Block
Glass ID=Batch 1, Oxide=HfO2 (wt%)
Reference Value = 0.0 wt%



Oneway Anova
Summary of Fit

Rsquare	0.363032
Adj Rsquare	0.097629
Root Mean Square Error	0.019062
Mean of Response	0.15023
Observations (or Sum Wgts)	18

Analysis of Variance

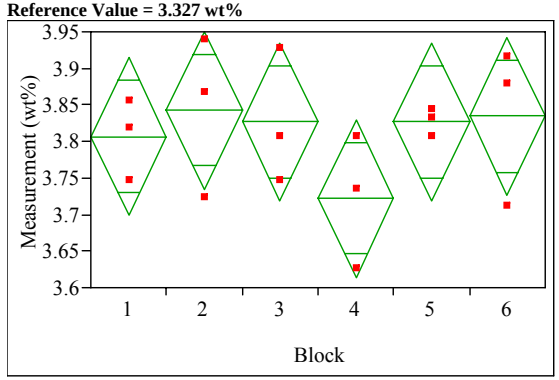
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Block	5	0.00248519	0.000497	1.3679	0.3029
Error	12	0.00436046	0.000363		
C. Total	17	0.00684565			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1	3	0.157240	0.01101	0.13326	0.18122
2	3	0.142302	0.01101	0.11832	0.16628
3	3	0.159599	0.01101	0.13562	0.18358
4	3	0.152130	0.01101	0.12815	0.17611
5	3	0.161957	0.01101	0.13798	0.18594
6	3	0.128151	0.01101	0.10417	0.15213

Std Error uses a pooled estimate of error variance

Oneway Analysis of Measurement (wt%) By Block
Glass ID=Batch 1, Oxide=K2O (wt%)
Reference Value = 3.327 wt%



Oneway Anova
Summary of Fit

Rsquare	0.252095
Adj Rsquare	-0.05953
Root Mean Square Error	0.085885
Mean of Response	3.809882
Observations (or Sum Wgts)	18

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Block	5	0.02983543	0.005967	0.8090	0.5651
Error	12	0.08851473	0.007376		
C. Total	17	0.11835016			

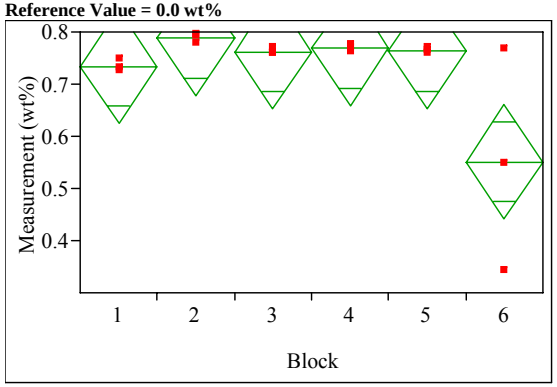
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1	3	3.80654	0.04959	3.6985	3.9146
2	3	3.84267	0.04959	3.7346	3.9507
3	3	3.82661	0.04959	3.7186	3.9347
4	3	3.72221	0.04959	3.6142	3.8303
5	3	3.82661	0.04959	3.7186	3.9347
6	3	3.83464	0.04959	3.7266	3.9427

Std Error uses a pooled estimate of error variance

Exhibit D3. PSAL Measurements by Analytical Block for Samples of the Standard Glasses Prepared Using the LM Method (continued)

Oneway Analysis of Measurement (wt%) By Block
Glass ID=Batch 1, Oxide=La2O3 (wt%)
Reference Value = 0.0 wt%



Oneway Anova
Summary of Fit

Rsquare	0.562468
Adj Rsquare	0.380163
Root Mean Square Error	0.086994
Mean of Response	0.727918
Observations (or Sum Wgts)	18

Analysis of Variance

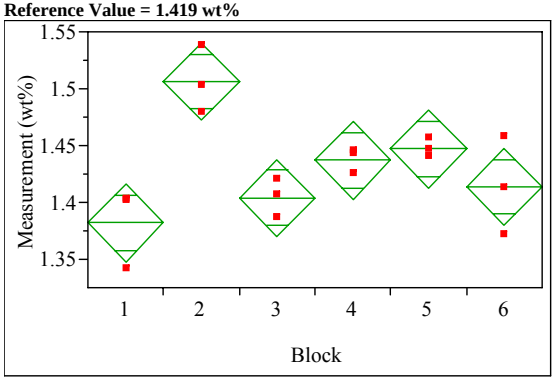
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Block	5	0.11674720	0.023349	3.0853	0.0510
Error	12	0.09081519	0.007568		
C. Total	17	0.20756239			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1	3	0.734564	0.05023	0.62513	0.84400
2	3	0.787731	0.05023	0.67830	0.89716
3	3	0.762320	0.05023	0.65289	0.87175
4	3	0.768184	0.05023	0.65875	0.87762
5	3	0.763493	0.05023	0.65406	0.87293
6	3	0.551216	0.05023	0.44178	0.66065

Std Error uses a pooled estimate of error variance

Oneway Analysis of Measurement (wt%) By Block
Glass ID=Batch 1, Oxide=MgO (wt%)
Reference Value = 1.419 wt%



Oneway Anova
Summary of Fit

Rsquare	0.761754
Adj Rsquare	0.662485
Root Mean Square Error	0.027097
Mean of Response	1.431758
Observations (or Sum Wgts)	18

Analysis of Variance

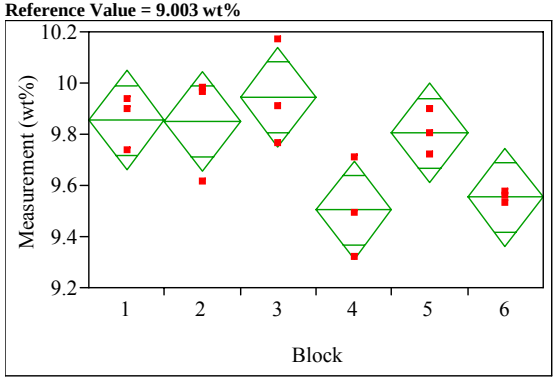
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Block	5	0.02817134	0.005634	7.6736	0.0019
Error	12	0.00881087	0.000734		
C. Total	17	0.03698221			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1	3	1.38192	0.01564	1.3478	1.4160
2	3	1.50629	0.01564	1.4722	1.5404
3	3	1.40403	0.01564	1.3699	1.4381
4	3	1.43719	0.01564	1.4031	1.4713
5	3	1.44714	0.01564	1.4131	1.4812
6	3	1.41398	0.01564	1.3799	1.4481

Std Error uses a pooled estimate of error variance

Oneway Analysis of Measurement (wt%) By Block
Glass ID=Batch 1, Oxide=Na2O (wt%)
Reference Value = 9.003 wt%



Oneway Anova
Summary of Fit

Rsquare	0.628952
Adj Rsquare	0.474349
Root Mean Square Error	0.154024
Mean of Response	9.751282
Observations (or Sum Wgts)	18

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Block	5	0.48255216	0.096510	4.0682	0.0216
Error	12	0.28467963	0.023723		
C. Total	17	0.76723178			

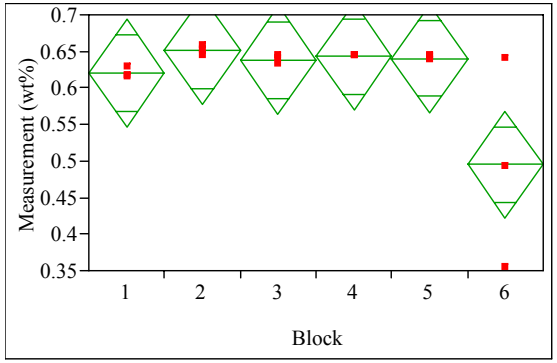
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1	3	9.85388	0.08893	9.6601	10.048
2	3	9.84939	0.08893	9.6556	10.043
3	3	9.94375	0.08893	9.7500	10.137
4	3	9.50340	0.08893	9.3096	9.697
5	3	9.80445	0.08893	9.6107	9.998
6	3	9.55283	0.08893	9.3591	9.747

Std Error uses a pooled estimate of error variance

Exhibit D3. PSAL Measurements by Analytical Block for Samples of the Standard Glasses Prepared Using the LM Method (continued)

Oneway Analysis of Measurement (wt%) By Block
Glass ID=Batch 1, Oxide=Nd2O3 (wt%)
Reference Value = 0.147 wt%



Oneway Anova
Summary of Fit

Rsquare	0.563089
Adj Rsquare	0.381043
Root Mean Square Error	0.058535
Mean of Response	0.614498
Observations (or Sum Wgts)	18

Analysis of Variance

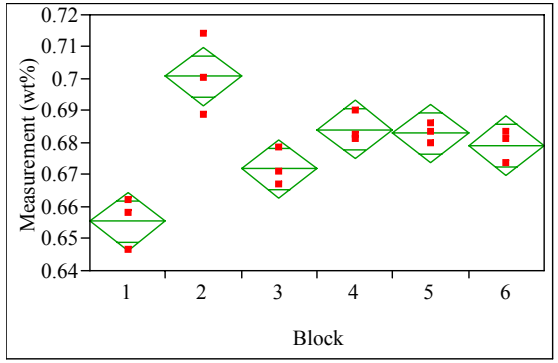
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Block	5	0.05298991	0.010598	3.0931	0.0506
Error	12	0.04111579	0.003426		
C. Total	17	0.09410570			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1	3	0.620136	0.03380	0.54650	0.69377
2	3	0.650851	0.03380	0.57722	0.72448
3	3	0.638021	0.03380	0.56439	0.71165
4	3	0.642686	0.03380	0.56905	0.71632
5	3	0.640354	0.03380	0.56672	0.71399
6	3	0.494942	0.03380	0.42131	0.56858

Std Error uses a pooled estimate of error variance

Oneway Analysis of Measurement (wt%) By Block
Glass ID=Batch 1, Oxide=NiO (wt%)
Reference Value = 0.751 wt%



Oneway Anova
Summary of Fit

Rsquare	0.840072
Adj Rsquare	0.773435
Root Mean Square Error	0.007316
Mean of Response	0.67902
Observations (or Sum Wgts)	18

Analysis of Variance

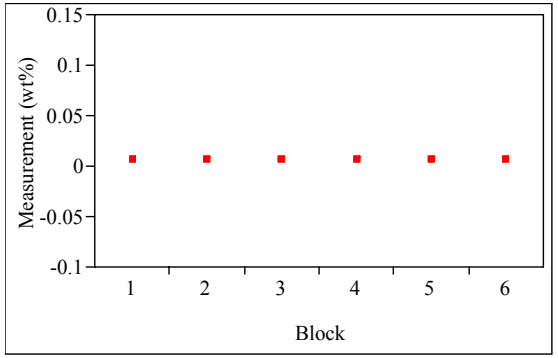
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Block	5	0.00337390	0.000675	12.6067	0.0002
Error	12	0.00064230	0.000054		
C. Total	17	0.00401621			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1	3	0.655338	0.00422	0.64613	0.66454
2	3	0.700723	0.00422	0.69152	0.70993
3	3	0.671880	0.00422	0.66268	0.68108
4	3	0.684181	0.00422	0.67498	0.69338
5	3	0.682908	0.00422	0.67371	0.69211
6	3	0.679091	0.00422	0.66989	0.68829

Std Error uses a pooled estimate of error variance

Oneway Analysis of Measurement (wt%) By Block
Glass ID=Batch 1, Oxide=PbO (wt%)
Reference Value = 0.0 wt%



Oneway Anova
Summary of Fit

Rsquare	.
Adj Rsquare	.
Root Mean Square Error	.
Mean of Response	0.005386
Observations (or Sum Wgts)	18

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Block	5	1.3542e-35	2.708e-36	-2.4000	0.0000
Error	12	-1.354e-35	-1.13e-36		
C. Total	17	0			

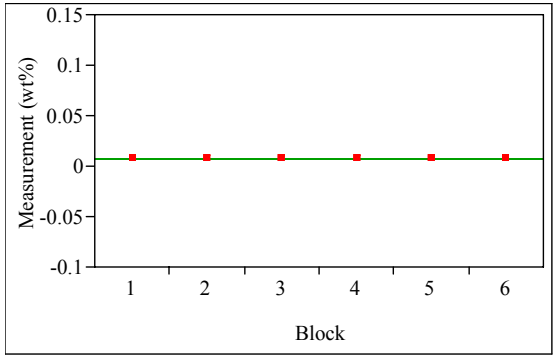
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1	3	0.005386	.	.	.
2	3	0.005386	.	.	.
3	3	0.005386	.	.	.
4	3	0.005386	.	.	.
5	3	0.005386	.	.	.
6	3	0.005386	.	.	.

Std Error uses a pooled estimate of error variance

Exhibit D3. PSAL Measurements by Analytical Block for Samples of the Standard Glasses Prepared Using the LM Method (continued)

Oneway Analysis of Measurement (wt%) By Block
Glass ID=Batch 1, Oxide=SeO2 (wt%)
Reference Value = 0.0 wt%



Oneway Anova
Summary of Fit

Rsquare	0
Adj Rsquare	-0.41667
Root Mean Square Error	1.06e-18
Mean of Response	0.007027
Observations (or Sum Wgts)	18

Analysis of Variance

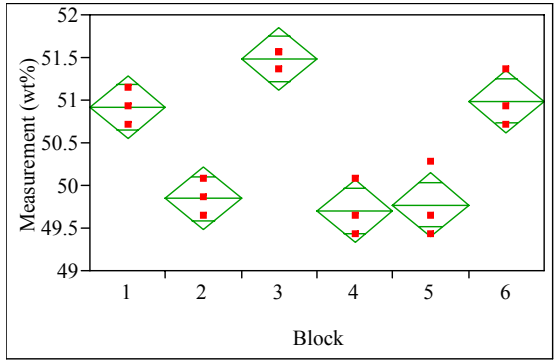
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Block	5	0	0	0.0000	1.0000
Error	12	1.3542e-35	1.128e-36		
C. Total	17	1.3542e-35			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1	3	0.007027	6.133e-19	0.00703	0.00703
2	3	0.007027	6.133e-19	0.00703	0.00703
3	3	0.007027	6.133e-19	0.00703	0.00703
4	3	0.007027	6.133e-19	0.00703	0.00703
5	3	0.007027	6.133e-19	0.00703	0.00703
6	3	0.007027	6.133e-19	0.00703	0.00703

Std Error uses a pooled estimate of error variance

Oneway Analysis of Measurement (wt%) By Block
Glass ID=Batch 1, Oxide=Si2O3 (wt%)
Reference Value = 50.22 wt%



Oneway Anova
Summary of Fit

Rsquare	0.895304
Adj Rsquare	0.851681
Root Mean Square Error	0.294019
Mean of Response	50.45183
Observations (or Sum Wgts)	18

Analysis of Variance

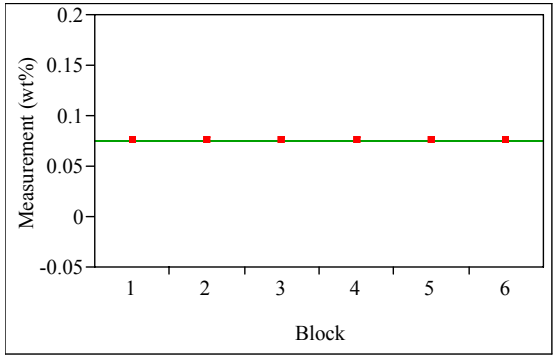
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Block	5	8.8709850	1.77420	20.5235	<.0001
Error	12	1.0373637	0.08645		
C. Total	17	9.9083487			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1	3	50.9153	0.16975	50.545	51.285
2	3	49.8457	0.16975	49.476	50.216
3	3	51.4858	0.16975	51.116	51.856
4	3	49.7031	0.16975	49.333	50.073
5	3	49.7744	0.16975	49.405	50.144
6	3	50.9867	0.16975	50.617	51.357

Std Error uses a pooled estimate of error variance

Oneway Analysis of Measurement (wt%) By Block
Glass ID=Batch 1, Oxide=SO4 (wt%)
Reference Value = 0.0 wt%



Oneway Anova
Summary of Fit

Rsquare	.
Adj Rsquare	.
Root Mean Square Error	0
Mean of Response	0.074898
Observations (or Sum Wgts)	18

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Block	5	0	0	.	.
Error	12	0	0		
C. Total	17	0			

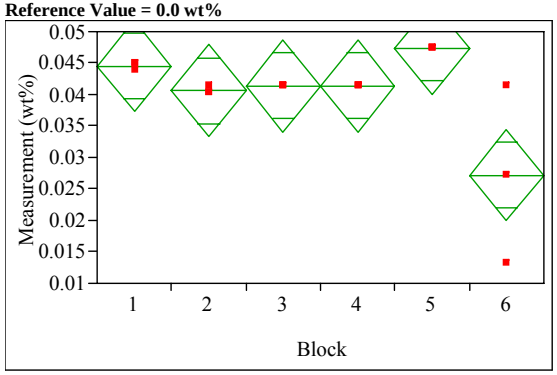
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1	3	0.074898	0	0.07490	0.07490
2	3	0.074898	0	0.07490	0.07490
3	3	0.074898	0	0.07490	0.07490
4	3	0.074898	0	0.07490	0.07490
5	3	0.074898	0	0.07490	0.07490
6	3	0.074898	0	0.07490	0.07490

Std Error uses a pooled estimate of error variance

Exhibit D3. PSAL Measurements by Analytical Block for Samples of the Standard Glasses Prepared Using the LM Method (continued)

Oneway Analysis of Measurement (wt%) By Block
Glass ID=Batch 1, Oxide=SrO (wt%)
Reference Value = 0.0 wt%



Oneway Anova
Summary of Fit

Rsquare	0.641248
Adj Rsquare	0.491768
Root Mean Square Error	0.005807
Mean of Response	0.040406
Observations (or Sum Wgts)	18

Analysis of Variance

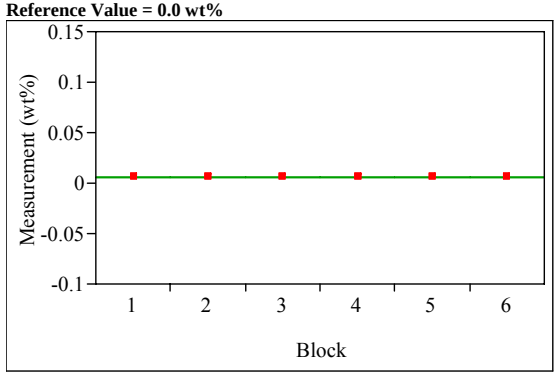
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Block	5	0.00072328	0.000145	4.2899	0.0180
Error	12	0.00040465	0.000034		
C. Total	17	0.00112792			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1	3	0.044545	0.00335	0.03724	0.05185
2	3	0.040603	0.00335	0.03330	0.04791
3	3	0.041391	0.00335	0.03409	0.04870
4	3	0.041391	0.00335	0.03409	0.04870
5	3	0.047304	0.00335	0.04000	0.05461
6	3	0.027200	0.00335	0.01990	0.03450

Std Error uses a pooled estimate of error variance

Oneway Analysis of Measurement (wt%) By Block
Glass ID=Batch 1, Oxide=Ta2O5 (wt%)
Reference Value = 0.0 wt%



Oneway Anova
Summary of Fit

Rsquare	.
Adj Rsquare	.
Root Mean Square Error	0
Mean of Response	0.006105
Observations (or Sum Wgts)	18

Analysis of Variance

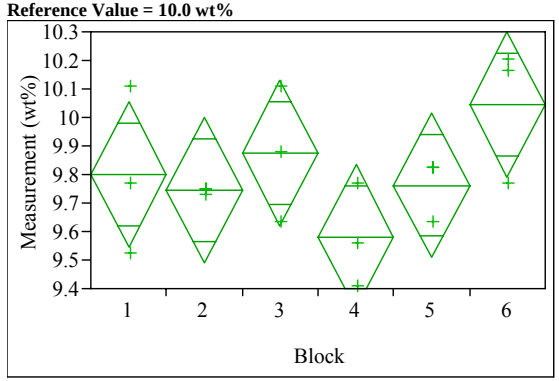
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Block	5	0	0	.	.
Error	12	0	0		
C. Total	17	0			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1	3	0.006105	0	0.00611	0.00611
2	3	0.006105	0	0.00611	0.00611
3	3	0.006105	0	0.00611	0.00611
4	3	0.006105	0	0.00611	0.00611
5	3	0.006105	0	0.00611	0.00611
6	3	0.006105	0	0.00611	0.00611

Std Error uses a pooled estimate of error variance

Oneway Analysis of Measurement (wt%) By Block
Glass ID=LRM, Oxide=Al2O3 (wt%)
Reference Value = 10.0 wt%



Oneway Anova
Summary of Fit

Rsquare	0.422259
Adj Rsquare	0.181533
Root Mean Square Error	0.201989
Mean of Response	9.801256
Observations (or Sum Wgts)	18

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Block	5	0.35783424	0.071567	1.7541	0.1970
Error	12	0.48959483	0.040800		
C. Total	17	0.84742907			

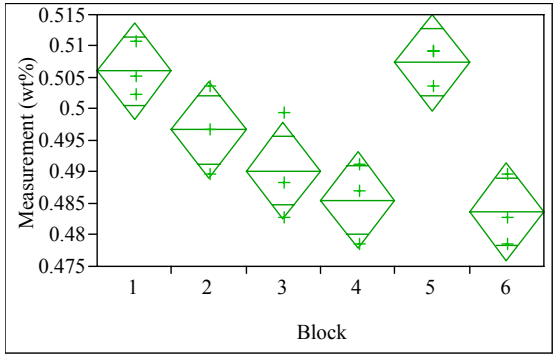
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1	3	9.8002	0.11662	9.5461	10.054
2	3	9.7435	0.11662	9.4894	9.998
3	3	9.8758	0.11662	9.6217	10.130
4	3	9.5798	0.11662	9.3257	9.834
5	3	9.7624	0.11662	9.5083	10.017
6	3	10.0458	0.11662	9.7918	10.300

Std Error uses a pooled estimate of error variance

Exhibit D3. PSAL Measurements by Analytical Block for Samples of the Standard Glasses Prepared Using the LM Method (continued)

Oneway Analysis of Measurement (wt%) By Block
Glass ID=LRM, Oxide=CaO (wt%)
Reference Value = 0.5 wt%



Oneway Anova
Summary of Fit

Rsquare	0.777477
Adj Rsquare	0.68476
Root Mean Square Error	0.006108
Mean of Response	0.494928
Observations (or Sum Wgts)	18

Analysis of Variance

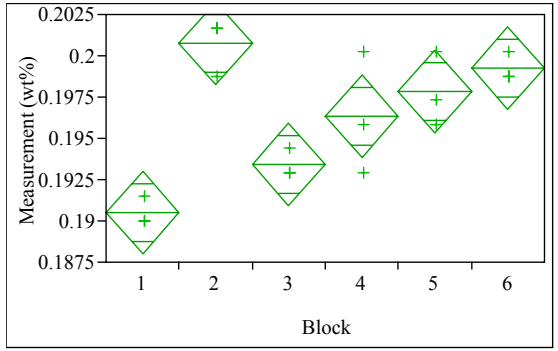
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Block	5	0.00156414	0.000313	8.3854	0.0013
Error	12	0.00044767	0.000037		
C. Total	17	0.00201182			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1	3	0.506044	0.00353	0.49836	0.51373
2	3	0.496716	0.00353	0.48903	0.50440
3	3	0.490186	0.00353	0.48250	0.49787
4	3	0.485522	0.00353	0.47784	0.49321
5	3	0.507443	0.00353	0.49976	0.51513
6	3	0.483657	0.00353	0.47597	0.49134

Std Error uses a pooled estimate of error variance

Oneway Analysis of Measurement (wt%) By Block
Glass ID=LRM, Oxide=Cr2O3 (wt%)
Reference Value = 0.2 wt%



Oneway Anova
Summary of Fit

Rsquare	0.822581
Adj Rsquare	0.748656
Root Mean Square Error	0.001979
Mean of Response	0.196342
Observations (or Sum Wgts)	18

Analysis of Variance

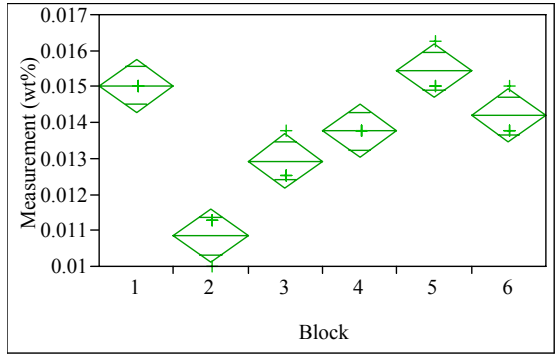
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Block	5	0.00021790	0.000044	11.1273	0.0004
Error	12	0.00004700	3.917e-6		
C. Total	17	0.00026490			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1	3	0.190495	0.00114	0.18801	0.19298
2	3	0.200726	0.00114	0.19824	0.20322
3	3	0.193418	0.00114	0.19093	0.19591
4	3	0.196342	0.00114	0.19385	0.19883
5	3	0.197803	0.00114	0.19531	0.20029
6	3	0.199265	0.00114	0.19678	0.20175

Std Error uses a pooled estimate of error variance

Oneway Analysis of Measurement (wt%) By Block
Glass ID=LRM, Oxide=CuO (wt%)
Reference Value = 0.0 wt%



Oneway Anova
Summary of Fit

Rsquare	0.907869
Adj Rsquare	0.869482
Root Mean Square Error	0.00059
Mean of Response	0.0137
Observations (or Sum Wgts)	18

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Block	5	0.00004118	8.2355e-6	23.6500	<.0001
Error	12	0.00000418	3.4822e-7		
C. Total	17	0.00004536			

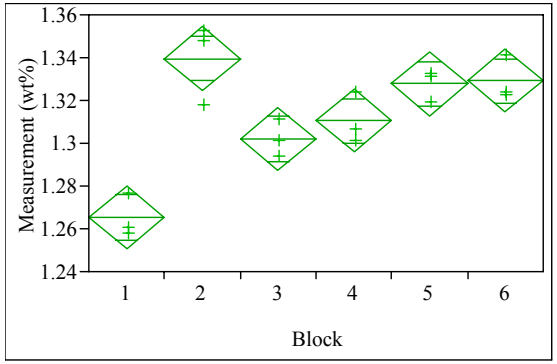
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1	3	0.015022	0.00034	0.01428	0.01576
2	3	0.010849	0.00034	0.01011	0.01159
3	3	0.012935	0.00034	0.01219	0.01368
4	3	0.013770	0.00034	0.01303	0.01451
5	3	0.015439	0.00034	0.01470	0.01618
6	3	0.014187	0.00034	0.01344	0.01493

Std Error uses a pooled estimate of error variance

Exhibit D3. PSAL Measurements by Analytical Block for Samples of the Standard Glasses Prepared Using the LM Method (continued)

Oneway Analysis of Measurement (wt%) By Block
Glass ID=LRM, Oxide=Fe2O3 (wt%)
Reference Value = 1.0 wt%



Oneway Anova
Summary of Fit

Rsquare	0.867456
Adj Rsquare	0.812229
Root Mean Square Error	0.011707
Mean of Response	1.312385
Observations (or Sum Wgts)	18

Analysis of Variance

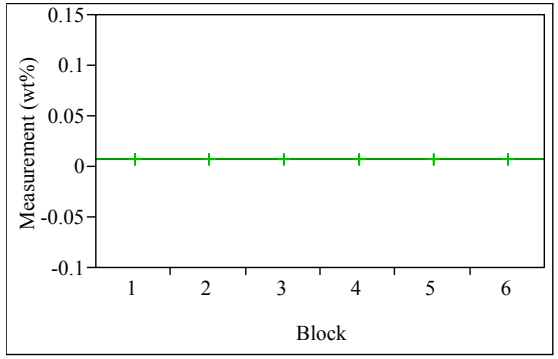
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Block	5	0.01076449	0.002153	15.7072	<.0001
Error	12	0.00164477	0.000137		
C. Total	17	0.01240927			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1	3	1.26528	0.00676	1.2506	1.2800
2	3	1.33963	0.00676	1.3249	1.3544
3	3	1.30198	0.00676	1.2873	1.3167
4	3	1.31056	0.00676	1.2958	1.3253
5	3	1.32771	0.00676	1.3130	1.3424
6	3	1.32914	0.00676	1.3144	1.3439

Std Error uses a pooled estimate of error variance

Oneway Analysis of Measurement (wt%) By Block
Glass ID=LRM, Oxide=Ga2O3 (wt%)
Reference Value = 0.0 wt%



Oneway Anova
Summary of Fit

Rsquare	.
Adj Rsquare	.
Root Mean Square Error	0
Mean of Response	0.006721
Observations (or Sum Wgts)	18

Analysis of Variance

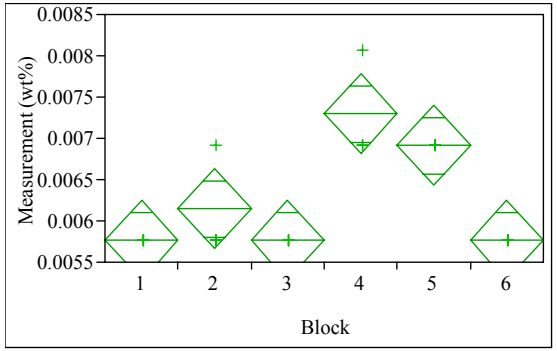
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Block	5	0	0	.	.
Error	12	0	0		
C. Total	17	0			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1	3	0.006721	0	0.00672	0.00672
2	3	0.006721	0	0.00672	0.00672
3	3	0.006721	0	0.00672	0.00672
4	3	0.006721	0	0.00672	0.00672
5	3	0.006721	0	0.00672	0.00672
6	3	0.006721	0	0.00672	0.00672

Std Error uses a pooled estimate of error variance

Oneway Analysis of Measurement (wt%) By Block
Glass ID=LRM, Oxide=Gd2O3 (wt%)
Reference Value = 0.0 wt%



Oneway Anova
Summary of Fit

Rsquare	0.793103
Adj Rsquare	0.706897
Root Mean Square Error	0.000384
Mean of Response	0.006275
Observations (or Sum Wgts)	18

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Block	5	0.00000679	1.358e-6	9.2000	0.0009
Error	12	1.77132e-6	1.4761e-7		
C. Total	17	8.56136e-6			

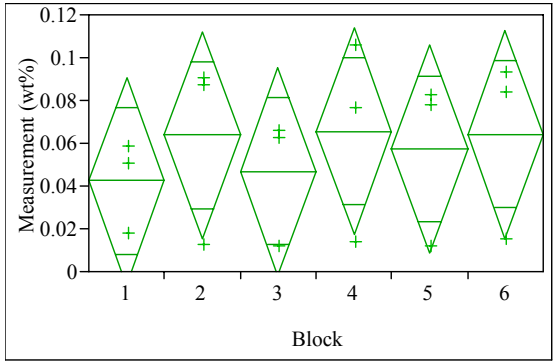
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1	3	0.005763	0.00022	0.00528	0.00625
2	3	0.006147	0.00022	0.00566	0.00663
3	3	0.005763	0.00022	0.00528	0.00625
4	3	0.007300	0.00022	0.00682	0.00778
5	3	0.006916	0.00022	0.00643	0.00740
6	3	0.005763	0.00022	0.00528	0.00625

Std Error uses a pooled estimate of error variance

Exhibit D3. PSAL Measurements by Analytical Block for Samples of the Standard Glasses Prepared Using the LM Method (continued)

Oneway Analysis of Measurement (wt%) By Block
Glass ID=LRM, Oxide=HfO2 (wt%)
Reference Value = 0.0 wt%



Oneway Anova
Summary of Fit

Rsquare	0.075527
Adj Rsquare	-0.30967
Root Mean Square Error	0.038526
Mean of Response	0.056672
Observations (or Sum Wgts)	18

Analysis of Variance

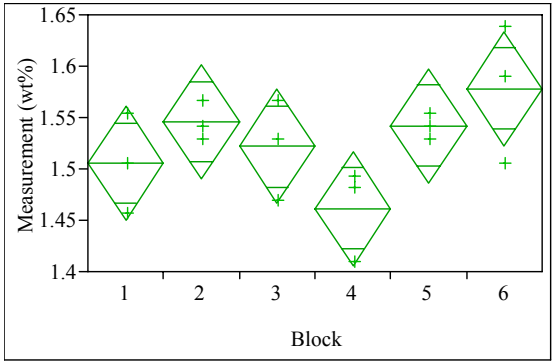
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Block	5	0.00145511	0.000291	0.1961	0.9581
Error	12	0.01781085	0.001484		
C. Total	17	0.01926596			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1	3	0.042455	0.02224	-0.0060	0.09092
2	3	0.063682	0.02224	0.0152	0.11215
3	3	0.046779	0.02224	-0.0017	0.09524
4	3	0.065648	0.02224	0.0172	0.11411
5	3	0.057393	0.02224	0.0089	0.10586
6	3	0.064075	0.02224	0.0156	0.11254

Std Error uses a pooled estimate of error variance

Oneway Analysis of Measurement (wt%) By Block
Glass ID=LRM, Oxide=K2O (wt%)
Reference Value = 1.5 wt%



Oneway Anova
Summary of Fit

Rsquare	0.503067
Adj Rsquare	0.296012
Root Mean Square Error	0.04426
Mean of Response	1.525827
Observations (or Sum Wgts)	18

Analysis of Variance

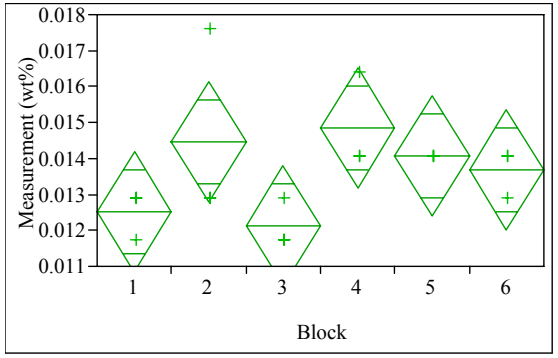
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Block	5	0.02379740	0.004759	2.4296	0.0964
Error	12	0.02350719	0.001959		
C. Total	17	0.04730459			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1	3	1.50575	0.02555	1.4501	1.5614
2	3	1.54590	0.02555	1.4902	1.6016
3	3	1.52181	0.02555	1.4661	1.5775
4	3	1.46158	0.02555	1.4059	1.5173
5	3	1.54189	0.02555	1.4862	1.5976
6	3	1.57803	0.02555	1.5223	1.6337

Std Error uses a pooled estimate of error variance

Oneway Analysis of Measurement (wt%) By Block
Glass ID=LRM, Oxide=La2O3 (wt%)
Reference Value = 0.0 wt%



Oneway Anova
Summary of Fit

Rsquare	0.45776
Adj Rsquare	0.231827
Root Mean Square Error	0.001326
Mean of Response	0.013618
Observations (or Sum Wgts)	18

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Block	5	0.00001780	3.5609e-6	2.0261	0.1468
Error	12	0.00002109	1.7575e-6		
C. Total	17	0.00003889			

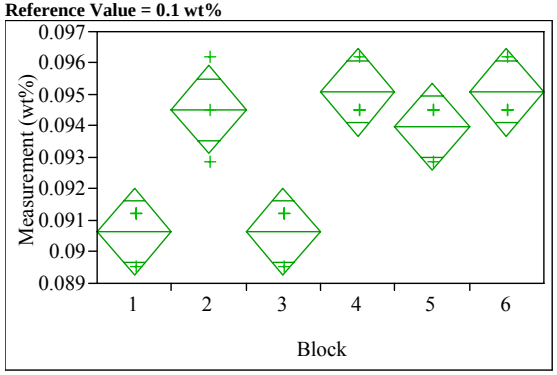
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1	3	0.012510	0.00077	0.01084	0.01418
2	3	0.014465	0.00077	0.01280	0.01613
3	3	0.012119	0.00077	0.01045	0.01379
4	3	0.014855	0.00077	0.01319	0.01652
5	3	0.014074	0.00077	0.01241	0.01574
6	3	0.013683	0.00077	0.01201	0.01535

Std Error uses a pooled estimate of error variance

Exhibit D3. PSAL Measurements by Analytical Block for Samples of the Standard Glasses Prepared Using the LM Method (continued)

Oneway Analysis of Measurement (wt%) By Block
Glass ID=LRM, Oxide=MgO (wt%)
Reference Value = 0.1 wt%



Oneway Anova
Summary of Fit

Rsquare	0.819887
Adj Rsquare	0.744841
Root Mean Square Error	0.001106
Mean of Response	0.093325
Observations (or Sum Wgts)	18

Analysis of Variance

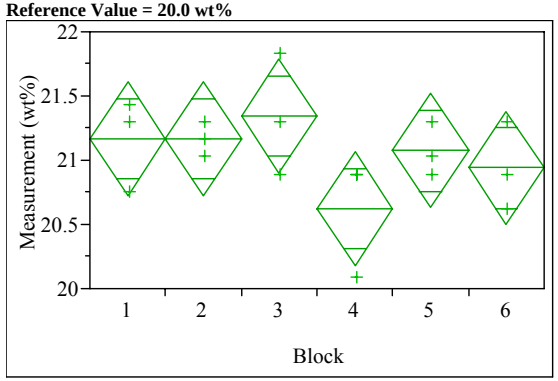
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Block	5	0.00006676	0.000013	10.9250	0.0004
Error	12	0.00001467	1.222e-6		
C. Total	17	0.00008143			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1	3	0.090654	0.00064	0.08926	0.09204
2	3	0.094523	0.00064	0.09313	0.09591
3	3	0.090654	0.00064	0.08926	0.09204
4	3	0.095076	0.00064	0.09369	0.09647
5	3	0.093970	0.00064	0.09258	0.09536
6	3	0.095076	0.00064	0.09369	0.09647

Std Error uses a pooled estimate of error variance

Oneway Analysis of Measurement (wt%) By Block
Glass ID=LRM, Oxide=Na2O (wt%)
Reference Value = 20.0 wt%



Oneway Anova
Summary of Fit

Rsquare	0.381132
Adj Rsquare	0.12327
Root Mean Square Error	0.352376
Mean of Response	21.05127
Observations (or Sum Wgts)	18

Analysis of Variance

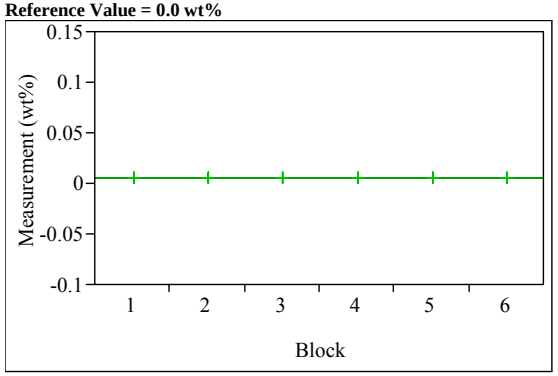
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Block	5	0.9176375	0.183528	1.4780	0.2676
Error	12	1.4900253	0.124169		
C. Total	17	2.4076628			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1	3	21.1636	0.20344	20.720	21.607
2	3	21.1636	0.20344	20.720	21.607
3	3	21.3433	0.20344	20.900	21.787
4	3	20.6244	0.20344	20.181	21.068
5	3	21.0737	0.20344	20.630	21.517
6	3	20.9389	0.20344	20.496	21.382

Std Error uses a pooled estimate of error variance

Oneway Analysis of Measurement (wt%) By Block
Glass ID=LRM, Oxide=Nd2O3 (wt%)
Reference Value = 0.0 wt%



Oneway Anova
Summary of Fit

Rsquare	.
Adj Rsquare	.
Root Mean Square Error	0
Mean of Response	0.005832
Observations (or Sum Wgts)	18

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Block	5	0	0	.	.
Error	12	0	0		
C. Total	17	0			

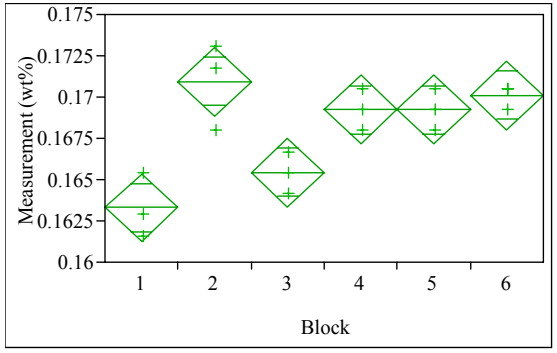
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1	3	0.005832	0	0.00583	0.00583
2	3	0.005832	0	0.00583	0.00583
3	3	0.005832	0	0.00583	0.00583
4	3	0.005832	0	0.00583	0.00583
5	3	0.005832	0	0.00583	0.00583
6	3	0.005832	0	0.00583	0.00583

Std Error uses a pooled estimate of error variance

Exhibit D3. PSAL Measurements by Analytical Block for Samples of the Standard Glasses Prepared Using the LM Method (continued)

Oneway Analysis of Measurement (wt%) By Block
Glass ID=LRM, Oxide=NiO (wt%)
Reference Value = 0.1 wt%



Oneway Anova
Summary of Fit

Rsquare	0.80572
Adj Rsquare	0.724771
Root Mean Square Error	0.001643
Mean of Response	0.168041
Observations (or Sum Wgts)	18

Analysis of Variance

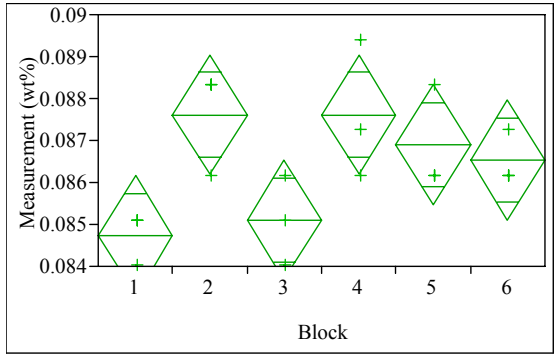
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Block	5	0.00013431	0.000027	9.9533	0.0006
Error	12	0.00003239	2.699e-6		
C. Total	17	0.00016669			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1	3	0.163304	0.00095	0.16124	0.16537
2	3	0.170939	0.00095	0.16887	0.17301
3	3	0.165425	0.00095	0.16336	0.16749
4	3	0.169243	0.00095	0.16718	0.17131
5	3	0.169243	0.00095	0.16718	0.17131
6	3	0.170091	0.00095	0.16802	0.17216

Std Error uses a pooled estimate of error variance

Oneway Analysis of Measurement (wt%) By Block
Glass ID=LRM, Oxide=PbO (wt%)
Reference Value = 0.1 wt%



Oneway Anova
Summary of Fit

Rsquare	0.597315
Adj Rsquare	0.42953
Root Mean Square Error	0.001135
Mean of Response	0.086415
Observations (or Sum Wgts)	18

Analysis of Variance

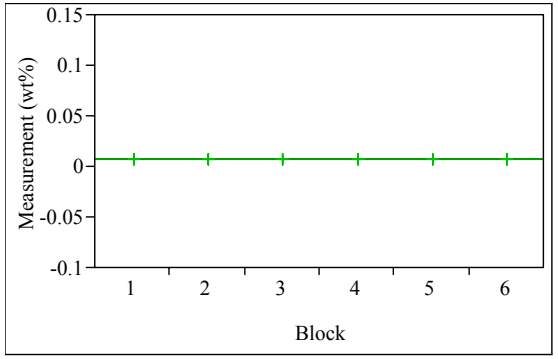
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Block	5	0.00002295	4.5899e-6	3.5600	0.0332
Error	12	0.00001547	1.2893e-6		
C. Total	17	0.00003842			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1	3	0.084740	0.00066	0.08331	0.08617
2	3	0.087612	0.00066	0.08618	0.08904
3	3	0.085099	0.00066	0.08367	0.08653
4	3	0.087612	0.00066	0.08618	0.08904
5	3	0.086894	0.00066	0.08547	0.08832
6	3	0.086535	0.00066	0.08511	0.08796

Std Error uses a pooled estimate of error variance

Oneway Analysis of Measurement (wt%) By Block
Glass ID=LRM, Oxide=SeO2 (wt%)
Reference Value = 0.0 wt%



Oneway Anova
Summary of Fit

Rsquare	0
Adj Rsquare	-0.41667
Root Mean Square Error	1.06e-18
Mean of Response	0.007027
Observations (or Sum Wgts)	18

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Block	5	0	0	0.0000	1.0000
Error	12	1.3542e-35	1.128e-36		
C. Total	17	1.3542e-35			

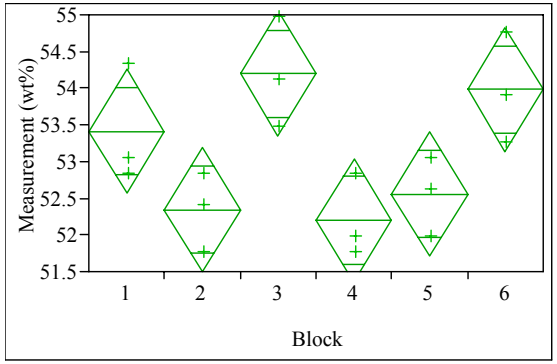
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1	3	0.007027	6.133e-19	0.00703	0.00703
2	3	0.007027	6.133e-19	0.00703	0.00703
3	3	0.007027	6.133e-19	0.00703	0.00703
4	3	0.007027	6.133e-19	0.00703	0.00703
5	3	0.007027	6.133e-19	0.00703	0.00703
6	3	0.007027	6.133e-19	0.00703	0.00703

Std Error uses a pooled estimate of error variance

Exhibit D3. PSAL Measurements by Analytical Block for Samples of the Standard Glasses Prepared Using the LM Method (continued)

Oneway Analysis of Measurement (wt%) By Block
Glass ID=LRM, Oxide=Si2O3 (wt%)
Reference Value = 54.37 wt%



Oneway Anova
Summary of Fit

Rsquare	0.677311
Adj Rsquare	0.542857
Root Mean Square Error	0.668947
Mean of Response	53.11407
Observations (or Sum Wgts)	18

Analysis of Variance

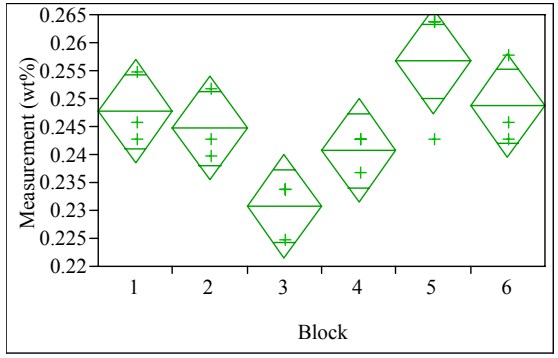
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Block	5	11.271160	2.25423	5.0375	0.0102
Error	12	5.369883	0.44749		
C. Total	17	16.641042			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1	3	53.4112	0.38622	52.570	54.253
2	3	52.3415	0.38622	51.500	53.183
3	3	54.1956	0.38622	53.354	55.037
4	3	52.1989	0.38622	51.357	53.040
5	3	52.5555	0.38622	51.714	53.397
6	3	53.9817	0.38622	53.140	54.823

Std Error uses a pooled estimate of error variance

Oneway Analysis of Measurement (wt%) By Block
Glass ID=LRM, Oxide=SO4 (wt%)
Reference Value = 0.24 wt%



Oneway Anova
Summary of Fit

Rsquare	0.635959
Adj Rsquare	0.484275
Root Mean Square Error	0.007372
Mean of Response	0.244832
Observations (or Sum Wgts)	18

Analysis of Variance

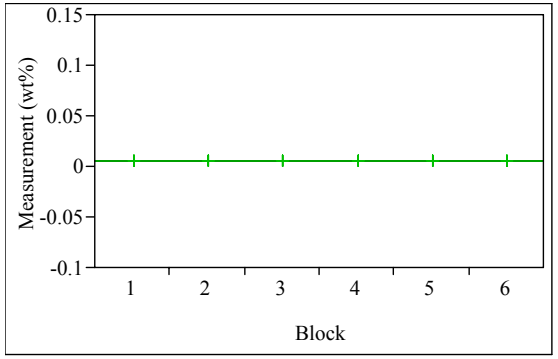
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Block	5	0.00113938	0.000228	4.1927	0.0195
Error	12	0.00065221	0.000054		
C. Total	17	0.00179159			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1	3	0.247661	0.00426	0.23839	0.25693
2	3	0.244665	0.00426	0.23539	0.25394
3	3	0.230684	0.00426	0.22141	0.23996
4	3	0.240671	0.00426	0.23140	0.24994
5	3	0.256649	0.00426	0.24737	0.26592
6	3	0.248660	0.00426	0.23939	0.25793

Std Error uses a pooled estimate of error variance

Oneway Analysis of Measurement (wt%) By Block
Glass ID=LRM, Oxide=SrO (wt%)
Reference Value = 0.0 wt%



Oneway Anova
Summary of Fit

Rsquare	.
Adj Rsquare	.
Root Mean Square Error	0
Mean of Response	0.005913
Observations (or Sum Wgts)	18

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Block	5	0	0	.	.
Error	12	0	0		
C. Total	17	0			

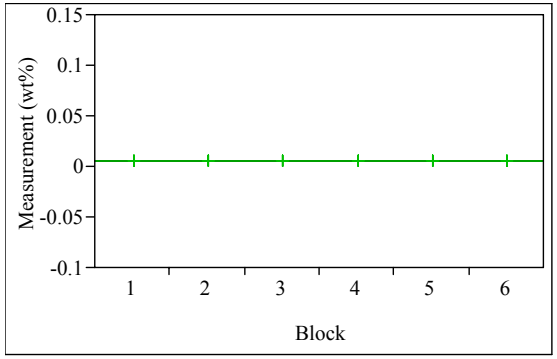
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1	3	0.005913	0	0.00591	0.00591
2	3	0.005913	0	0.00591	0.00591
3	3	0.005913	0	0.00591	0.00591
4	3	0.005913	0	0.00591	0.00591
5	3	0.005913	0	0.00591	0.00591
6	3	0.005913	0	0.00591	0.00591

Std Error uses a pooled estimate of error variance

Exhibit D3. PSAL Measurements by Analytical Block for Samples of the Standard Glasses Prepared Using the LM Method (continued)

Oneway Analysis of Measurement (wt%) By Block
Glass ID=LRM, Oxide=Ta2O5 (wt%)
Reference Value = 0.0 wt%



Oneway Anova
Summary of Fit

Rsquare	.
Adj Rsquare	.
Root Mean Square Error	0
Mean of Response	0.006105
Observations (or Sum Wgts)	18

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Block	5	0	0	.	.
Error	12	0	0		
C. Total	17	0			

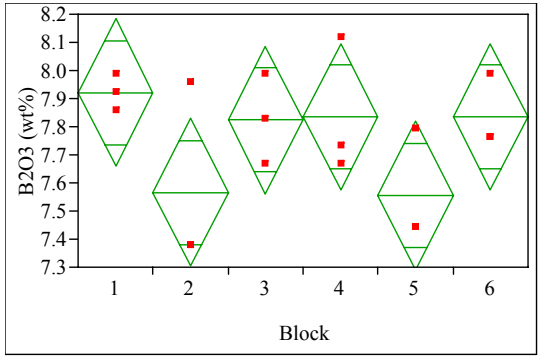
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1	3	0.006105	0	0.00611	0.00611
2	3	0.006105	0	0.00611	0.00611
3	3	0.006105	0	0.00611	0.00611
4	3	0.006105	0	0.00611	0.00611
5	3	0.006105	0	0.00611	0.00611
6	3	0.006105	0	0.00611	0.00611

Std Error uses a pooled estimate of error variance

Exhibit D4: PSAL Measurements by Analytical Block for Samples of the Standard Glasses Prepared Using the PF Method

Oneway Analysis of B2O3 (wt%) By Block Glass ID=Batch 1
Reference Value = 7.777 wt%



Oneway Anova
Summary of Fit

Rsquare	0.409257
Adj Rsquare	0.163115
Root Mean Square Error	0.208259
Mean of Response	7.756381
Observations (or Sum Wgts)	18

Analysis of Variance

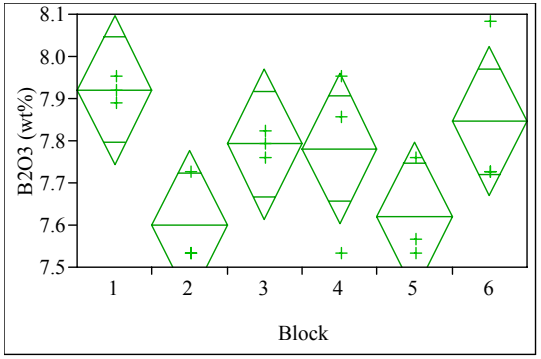
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Block	5	0.36056751	0.072114	1.6627	0.2179
Error	12	0.52046135	0.043372		
C. Total	17	0.88102887			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1	3	7.92095	0.12024	7.6590	8.1829
2	3	7.56677	0.12024	7.3048	7.8287
3	3	7.82436	0.12024	7.5624	8.0863
4	3	7.83509	0.12024	7.5731	8.0971
5	3	7.55603	0.12024	7.2941	7.8180
6	3	7.83509	0.12024	7.5731	8.0971

Std Error uses a pooled estimate of error variance

Oneway Analysis of B2O3 (wt%) By Block Glass ID=LRM
Reference Value = 8.0 wt%



Oneway Anova
Summary of Fit

Rsquare	0.502165
Adj Rsquare	0.294733
Root Mean Square Error	0.140966
Mean of Response	7.759959
Observations (or Sum Wgts)	18

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Block	5	0.24053194	0.048106	2.4209	0.0973
Error	12	0.23845839	0.019872		
C. Total	17	0.47899033			

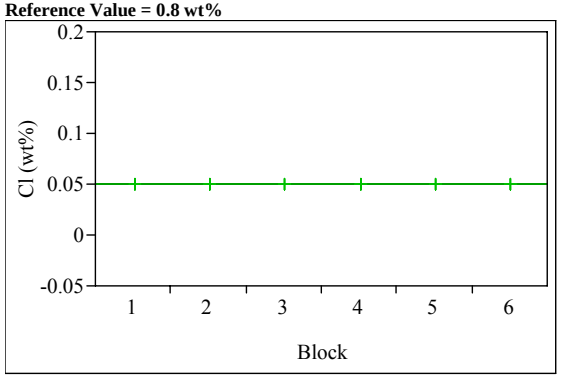
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1	3	7.92095	0.08139	7.7436	8.0983
2	3	7.59896	0.08139	7.4216	7.7763
3	3	7.79216	0.08139	7.6148	7.9695
4	3	7.78143	0.08139	7.6041	7.9588
5	3	7.62043	0.08139	7.4431	7.7978
6	3	7.84582	0.08139	7.6685	8.0232

Std Error uses a pooled estimate of error variance

Exhibit D5: PSAL IC Measurements by Analytical Block for Samples of the LRM Standard Glass

Oneway Analysis of Cl (wt%) By Block Glass ID=LRM
Reference Value = 0.8 wt%



Oneway Anova
Summary of Fit

Rsquare	0
Adj Rsquare	-0.41667
Root Mean Square Error	8.5e-18
Mean of Response	0.05
Observations (or Sum Wgts)	18

Analysis of Variance

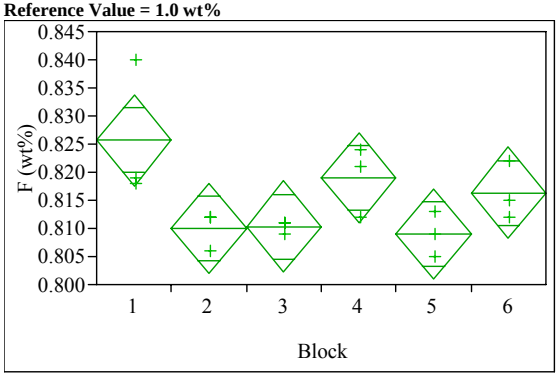
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Block	5	0	0	0.0000	1.0000
Error	12	8.6667e-34	7.222e-35		
C. Total	17	8.6667e-34			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1	3	0.050000	4.907e-18	0.05000	0.05000
2	3	0.050000	4.907e-18	0.05000	0.05000
3	3	0.050000	4.907e-18	0.05000	0.05000
4	3	0.050000	4.907e-18	0.05000	0.05000
5	3	0.050000	4.907e-18	0.05000	0.05000
6	3	0.050000	4.907e-18	0.05000	0.05000

Std Error uses a pooled estimate of error variance

Oneway Analysis of F (wt%) By Block Glass ID=LRM
Reference Value = 1.0 wt%



Oneway Anova
Summary of Fit

Rsquare	0.56352
Adj Rsquare	0.381653
Root Mean Square Error	0.006442
Mean of Response	0.815056
Observations (or Sum Wgts)	18

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Block	5	0.00064294	0.000129	3.0985	0.0503
Error	12	0.00049800	0.000041		
C. Total	17	0.00114094			

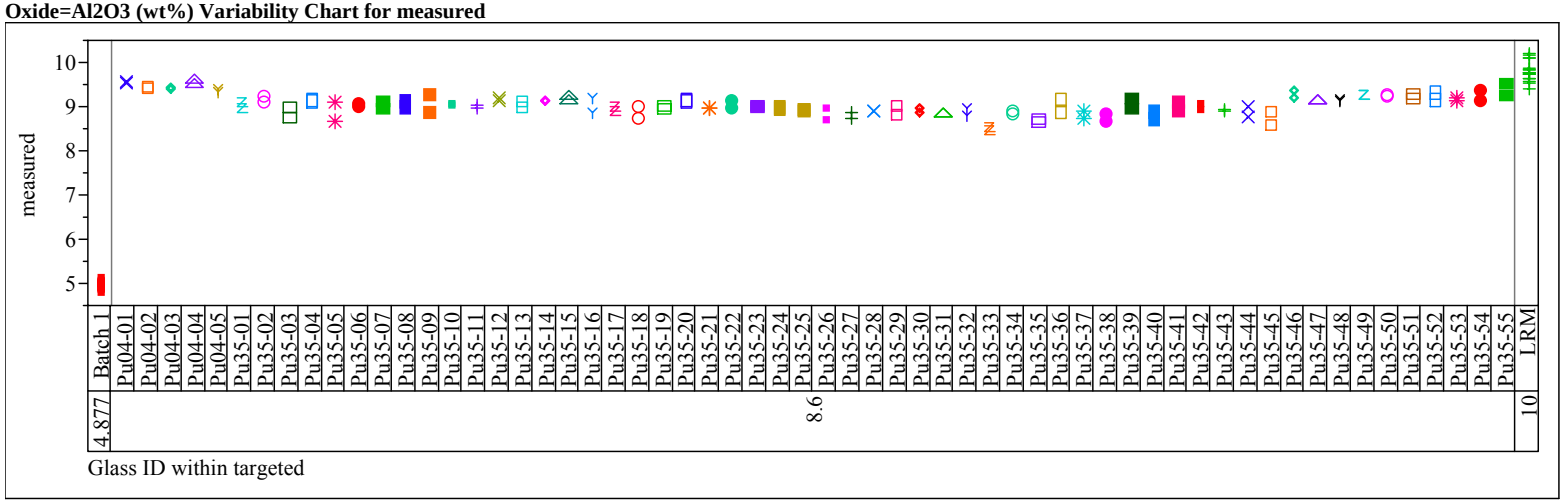
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1	3	0.825667	0.00372	0.81756	0.83377
2	3	0.810000	0.00372	0.80190	0.81810
3	3	0.810333	0.00372	0.80223	0.81844
4	3	0.819000	0.00372	0.81090	0.82710
5	3	0.809000	0.00372	0.80090	0.81710
6	3	0.816333	0.00372	0.80823	0.82444

Std Error uses a pooled estimate of error variance

Exhibit D6. Measured and Measured Bias-Corrected Oxide Weight Percents by Glass ID by Targeted Value for the Glasses Prepared Using the LM Method

Oxide=Al2O3 (wt%) Variability Chart for measured



Oxide=Al2O3 (wt%) Variability Chart for measured bc

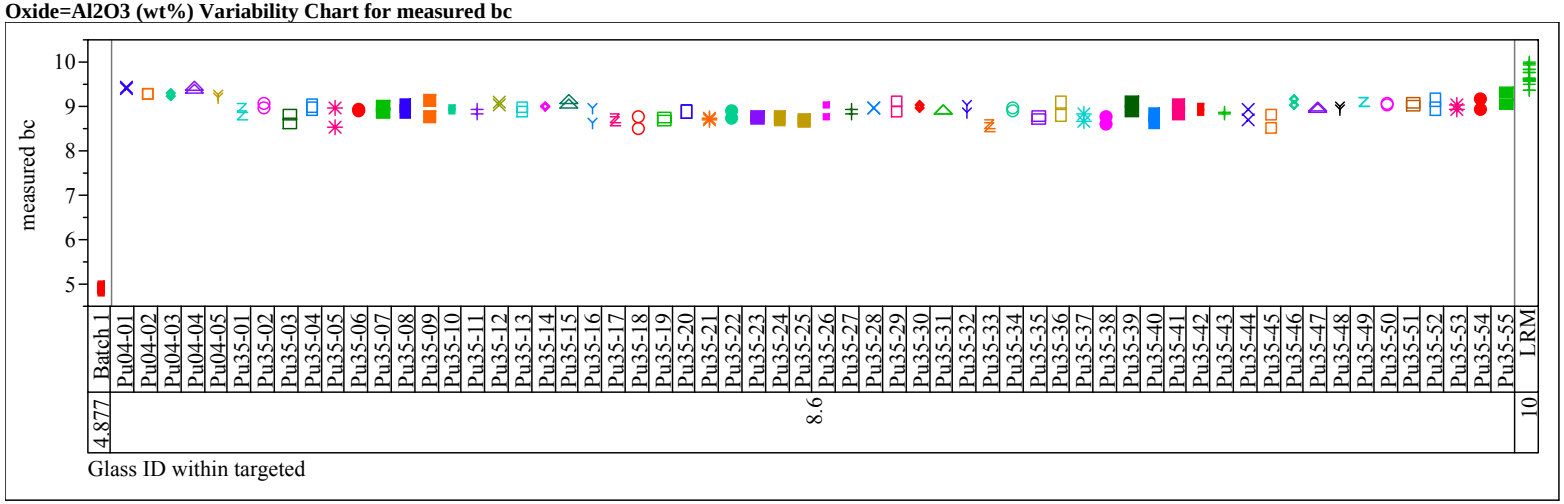
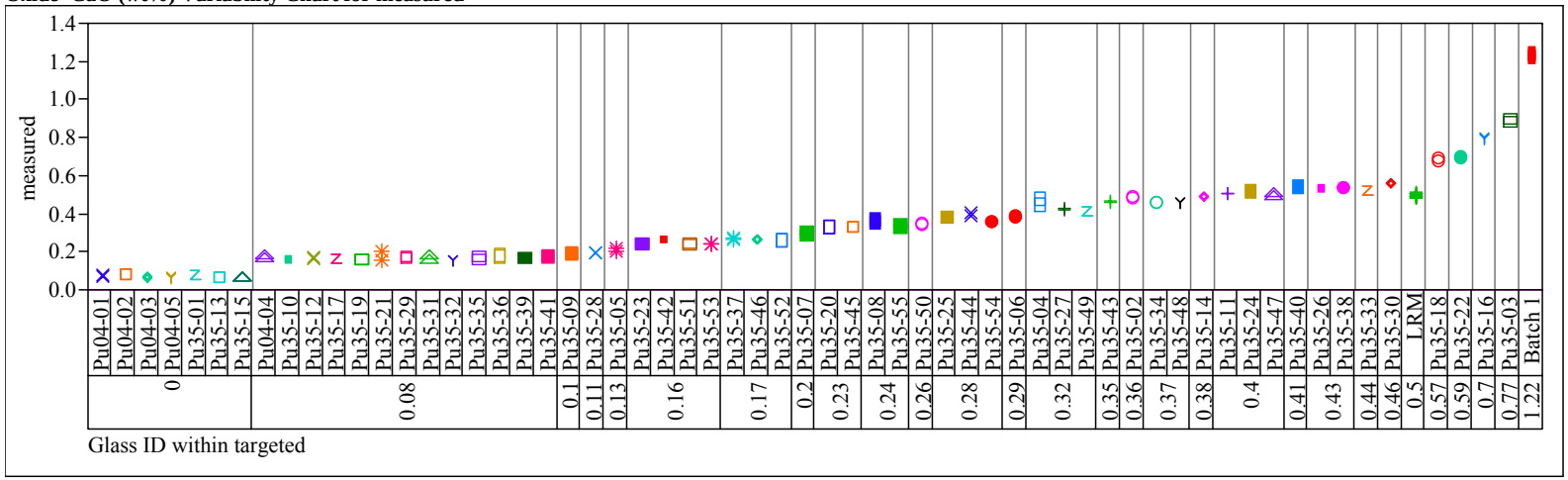


Exhibit D6. Measured and Measured Bias-Corrected Oxide Weight Percents by Glass ID by Targeted Value for the Glasses Prepared Using the LM Method (continued)

Oxide=CaO (wt%) Variability Chart for measured



Oxide=CaO (wt%) Variability Chart for measured bc

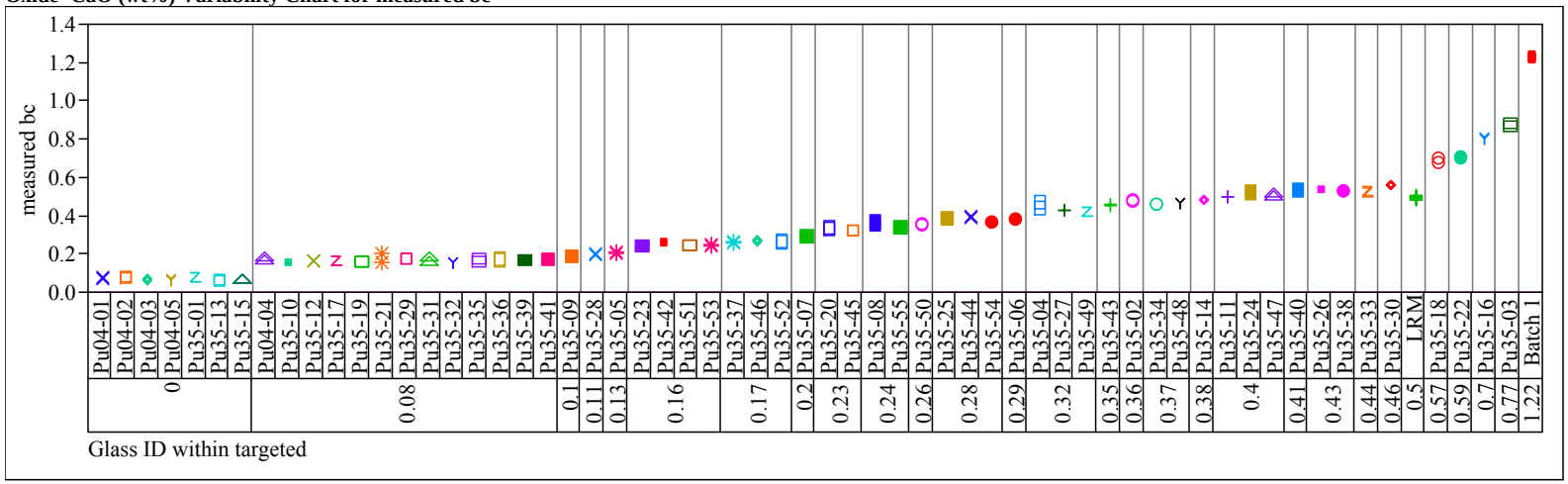
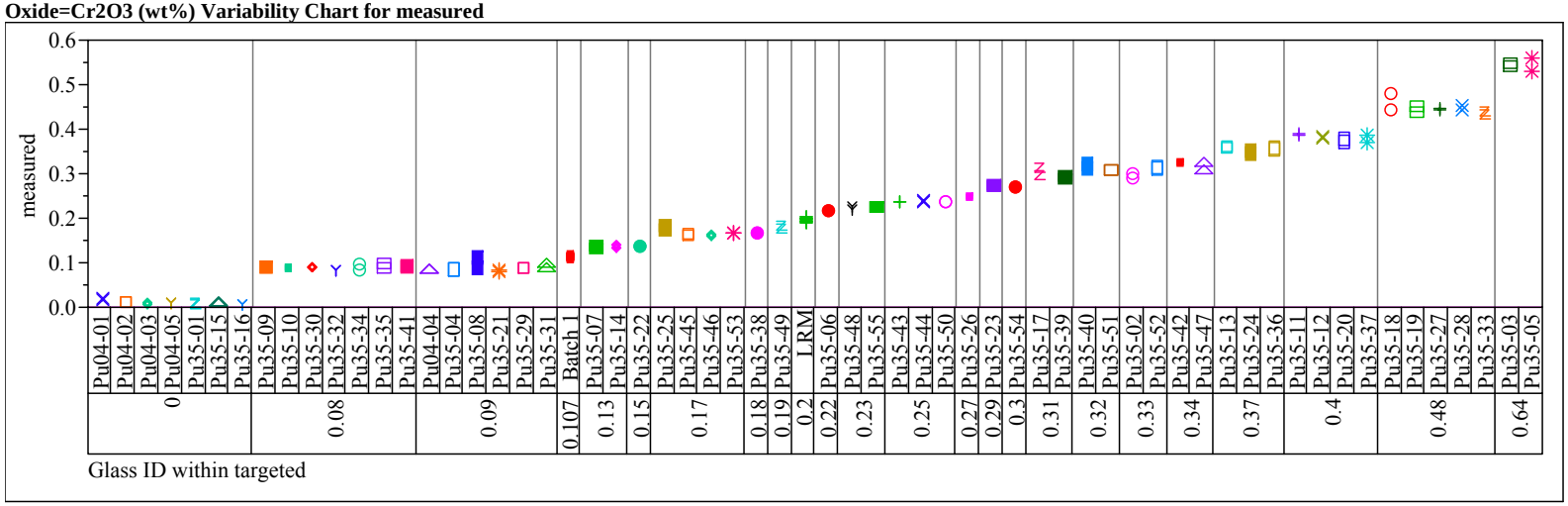


Exhibit D6. Measured and Measured Bias-Corrected Oxide Weight Percents by Glass ID by Targeted Value for the Glasses Prepared Using the LM Method (continued)

Oxide=Cr2O3 (wt%) Variability Chart for measured



Oxide=Cr2O3 (wt%) Variability Chart for measured bc

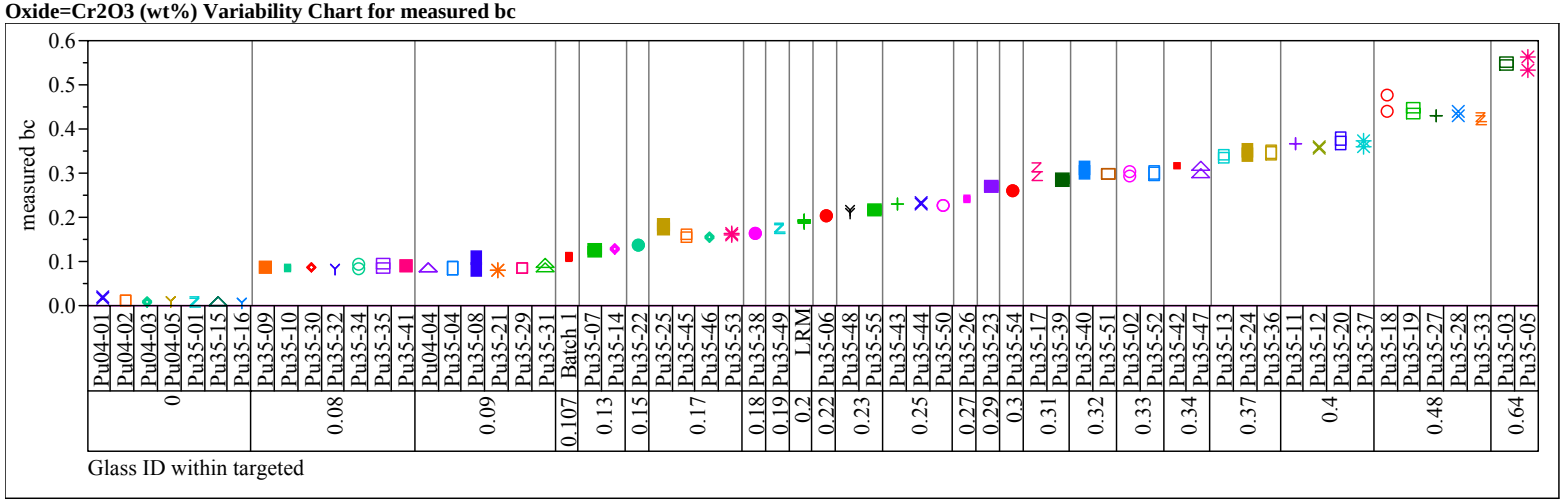
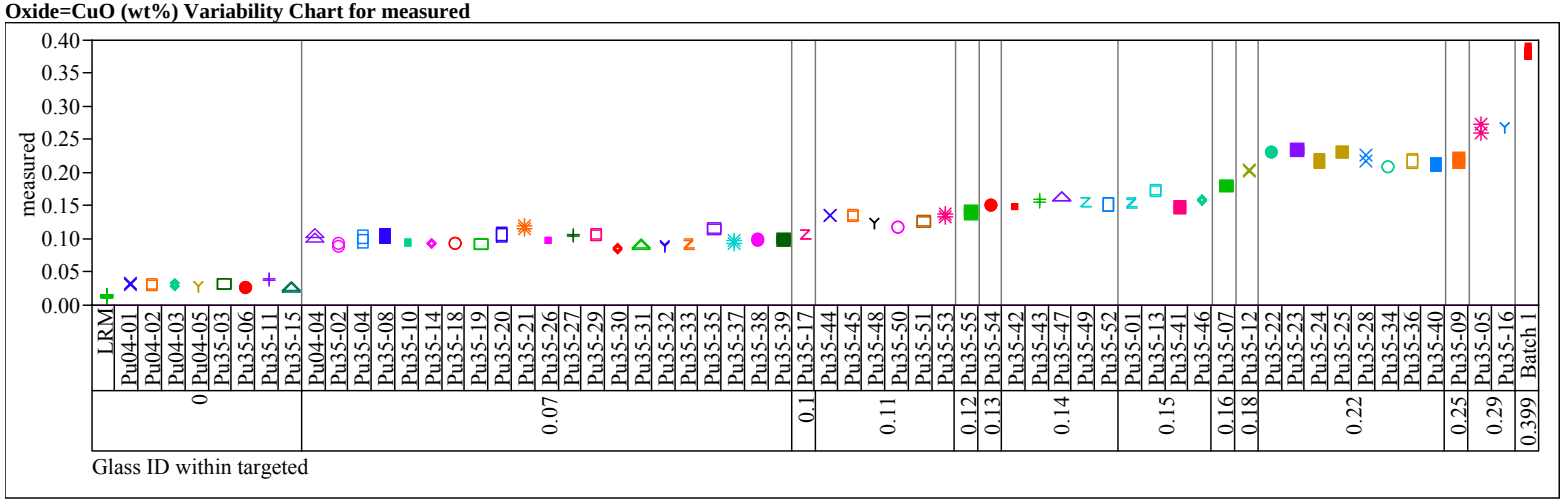


Exhibit D6. Measured and Measured Bias-Corrected Oxide Weight Percents by Glass ID by Targeted Value for the Glasses Prepared Using the LM Method (continued)

Oxide=CuO (wt%) Variability Chart for measured



Oxide=CuO (wt%) Variability Chart for measured bc

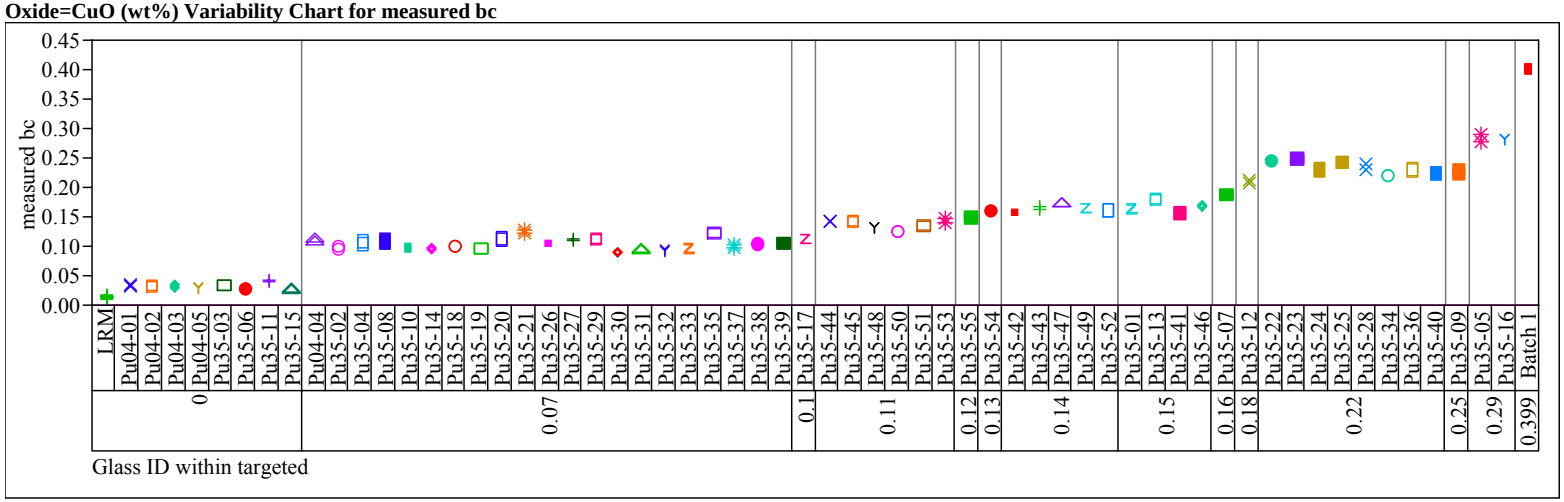
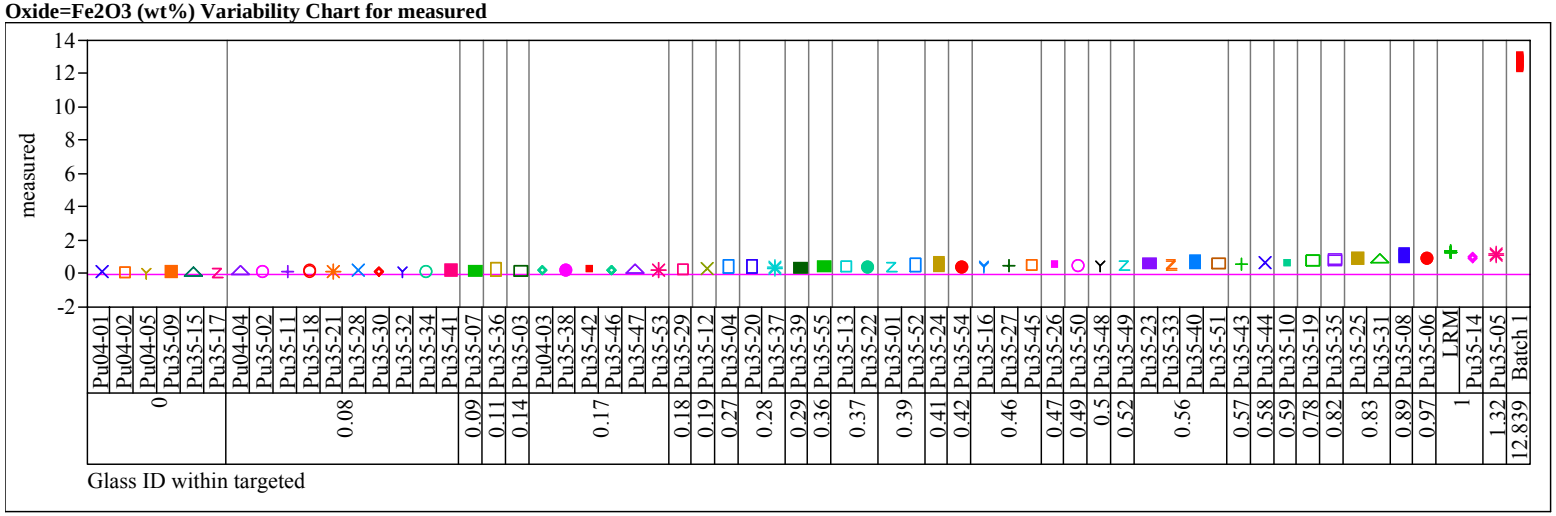


Exhibit D6. Measured and Measured Bias-Corrected Oxide Weight Percents by Glass ID by Targeted Value for the Glasses Prepared Using the LM Method (continued)

Oxide=Fe2O3 (wt%) Variability Chart for measured



Oxide=Fe2O3 (wt%) Variability Chart for measured bc

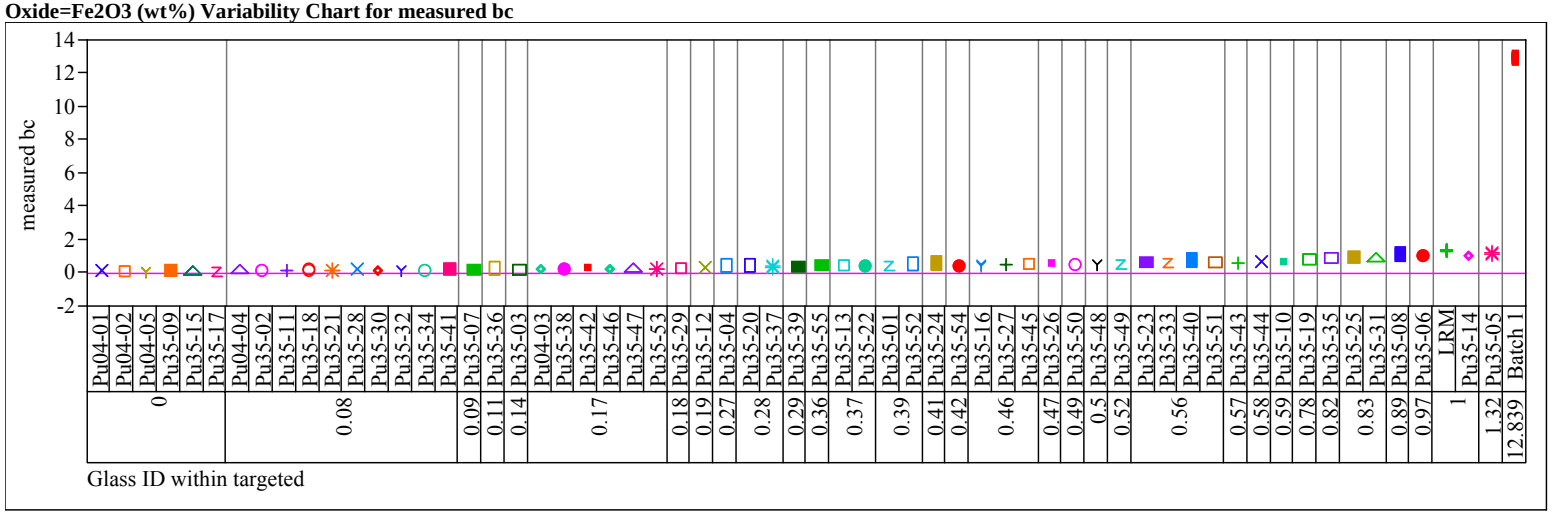
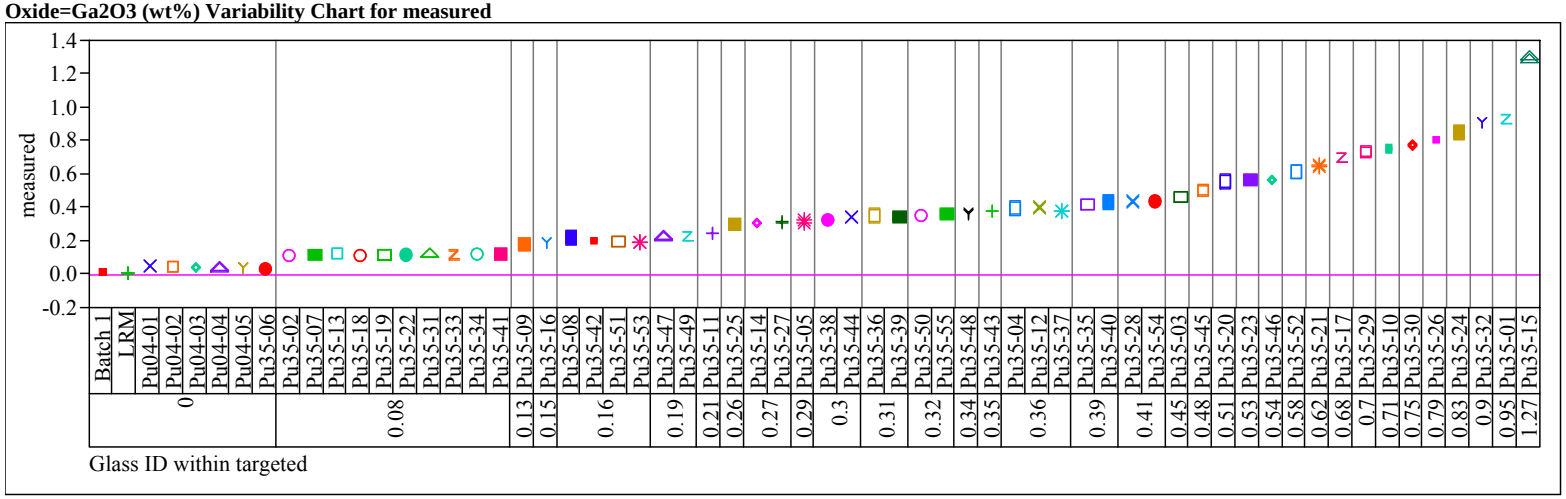


Exhibit D6. Measured and Measured Bias-Corrected Oxide Weight Percents by Glass ID by Targeted Value for the Glasses Prepared Using the LM Method (continued)

Oxide=Ga2O3 (wt%) Variability Chart for measured



Oxide=Ga2O3 (wt%) Variability Chart for measured bc

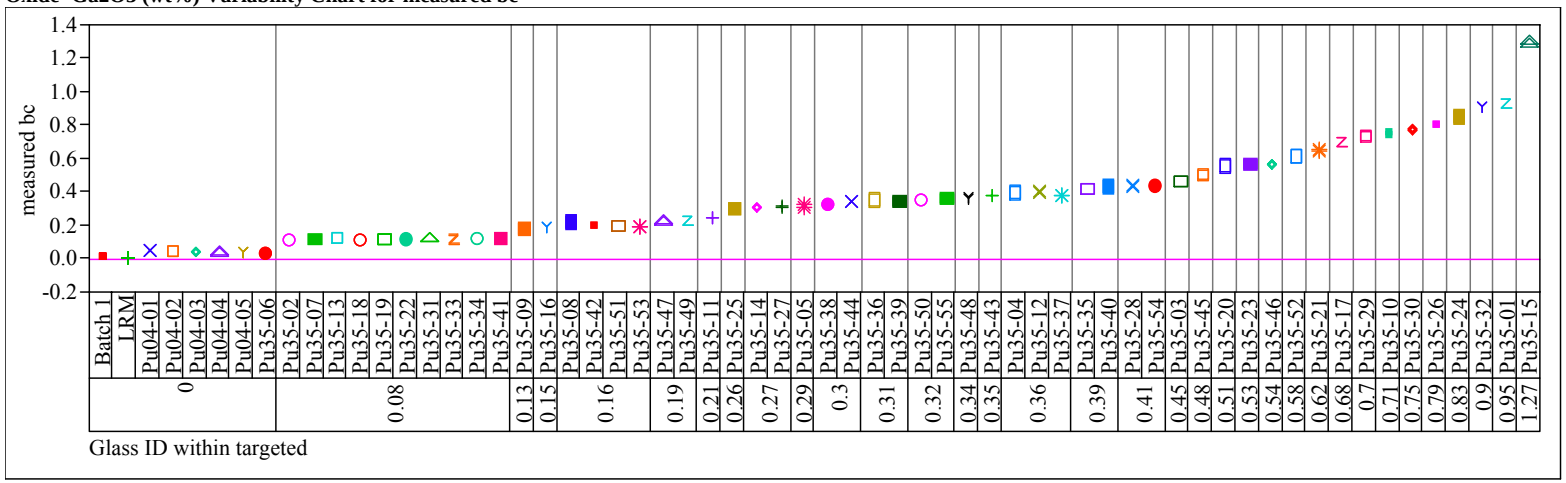
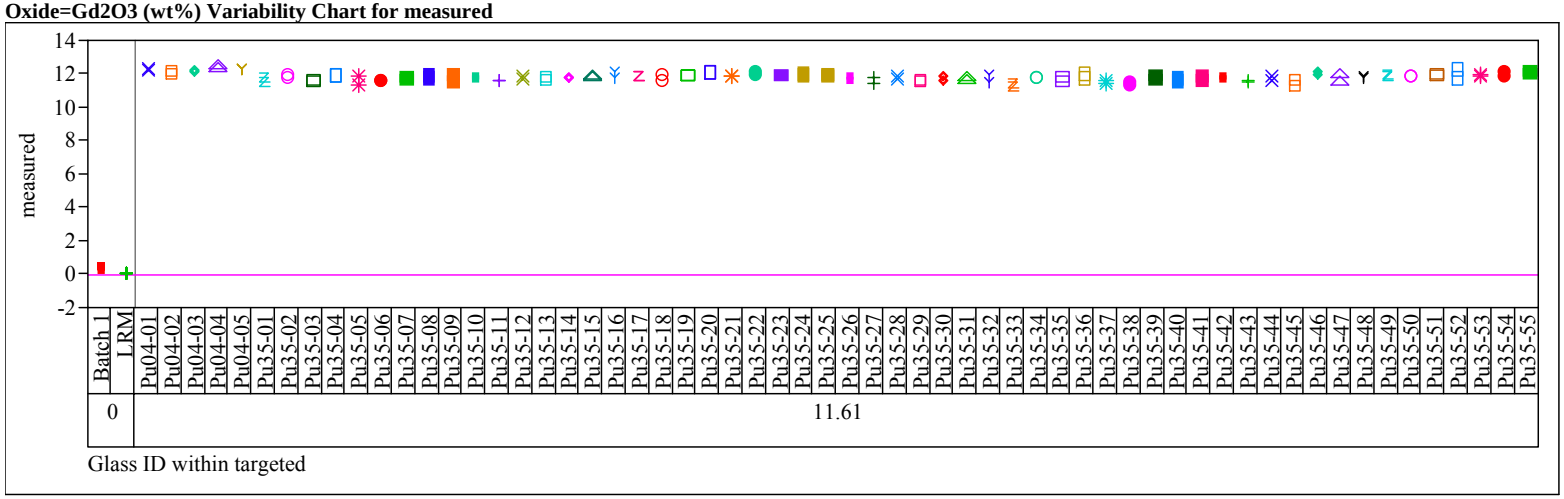


Exhibit D6. Measured and Measured Bias-Corrected Oxide Weight Percents by Glass ID by Targeted Value for the Glasses Prepared Using the LM Method (continued)

Oxide=Gd2O3 (wt%) Variability Chart for measured



Oxide=Gd2O3 (wt%) Variability Chart for measured bc

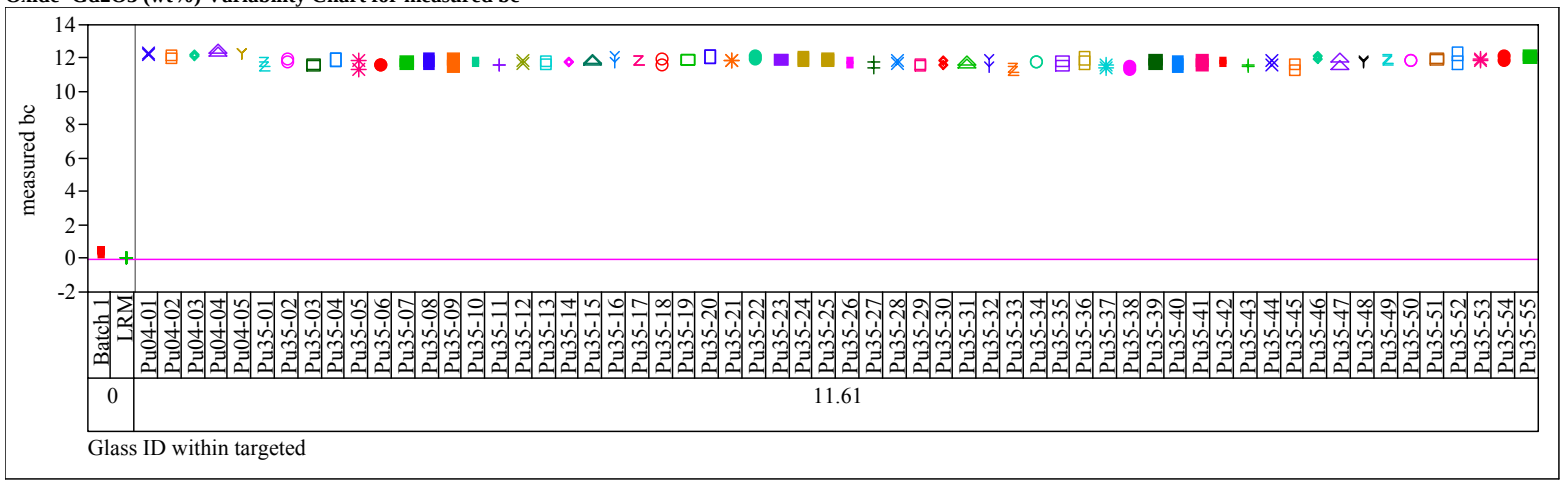
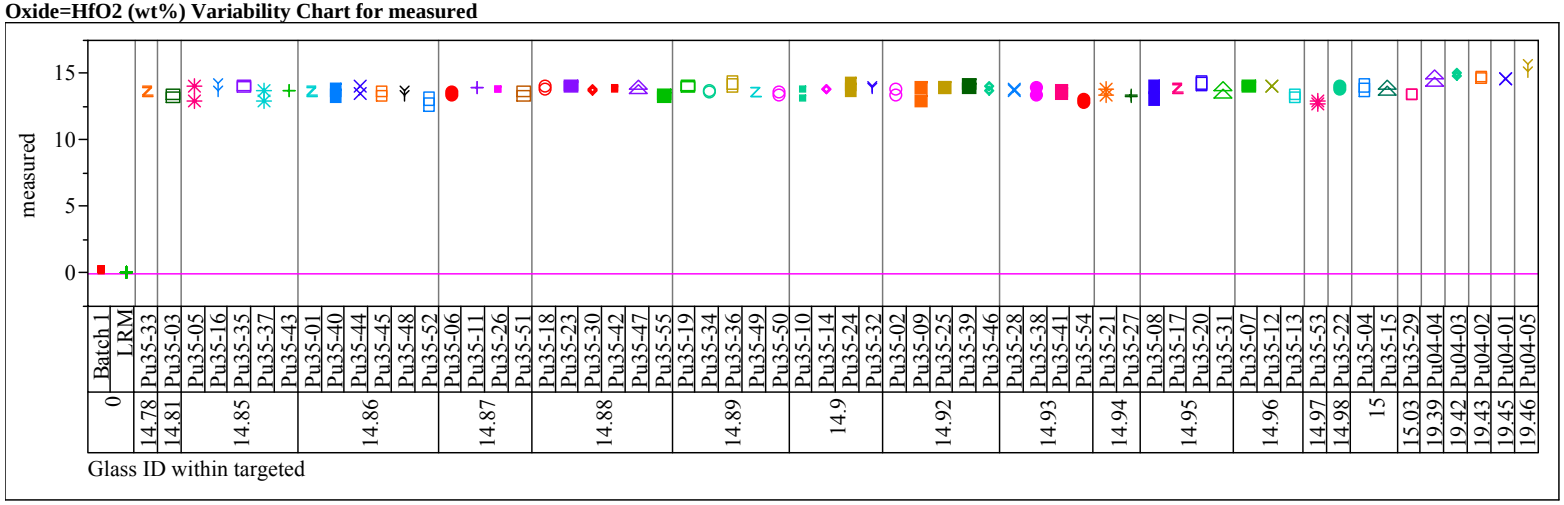


Exhibit D6. Measured and Measured Bias-Corrected Oxide Weight Percents by Glass ID by Targeted Value for the Glasses Prepared Using the LM Method (continued)

Oxide=HfO2 (wt%) Variability Chart for measured



Oxide=HfO2 (wt%) Variability Chart for measured bc

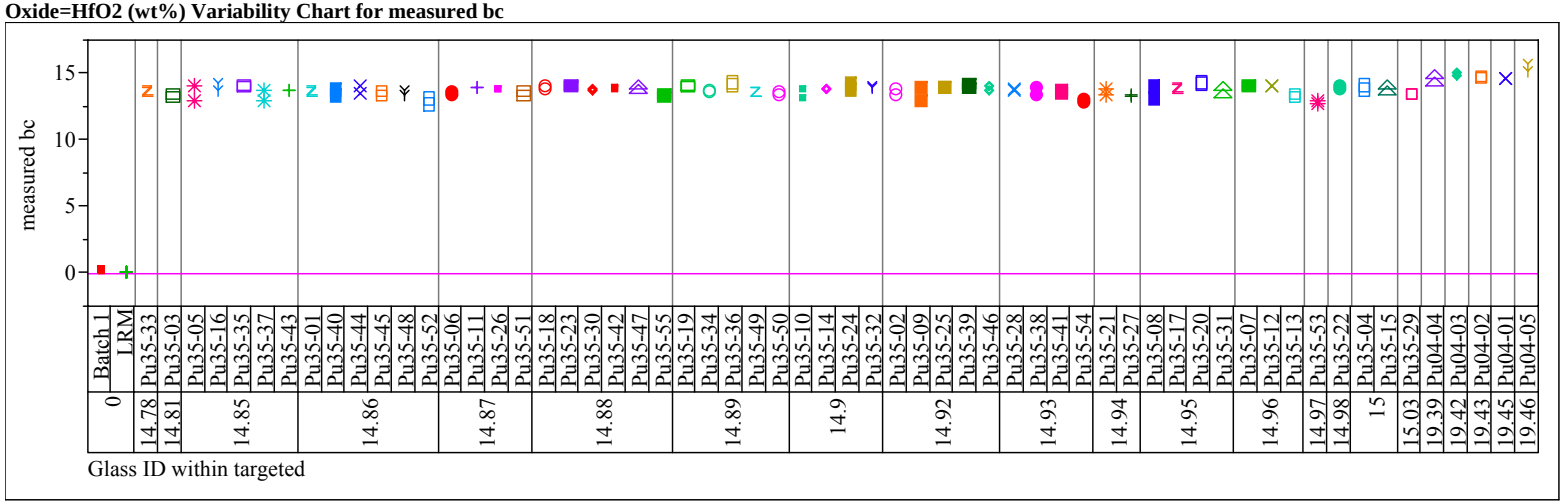
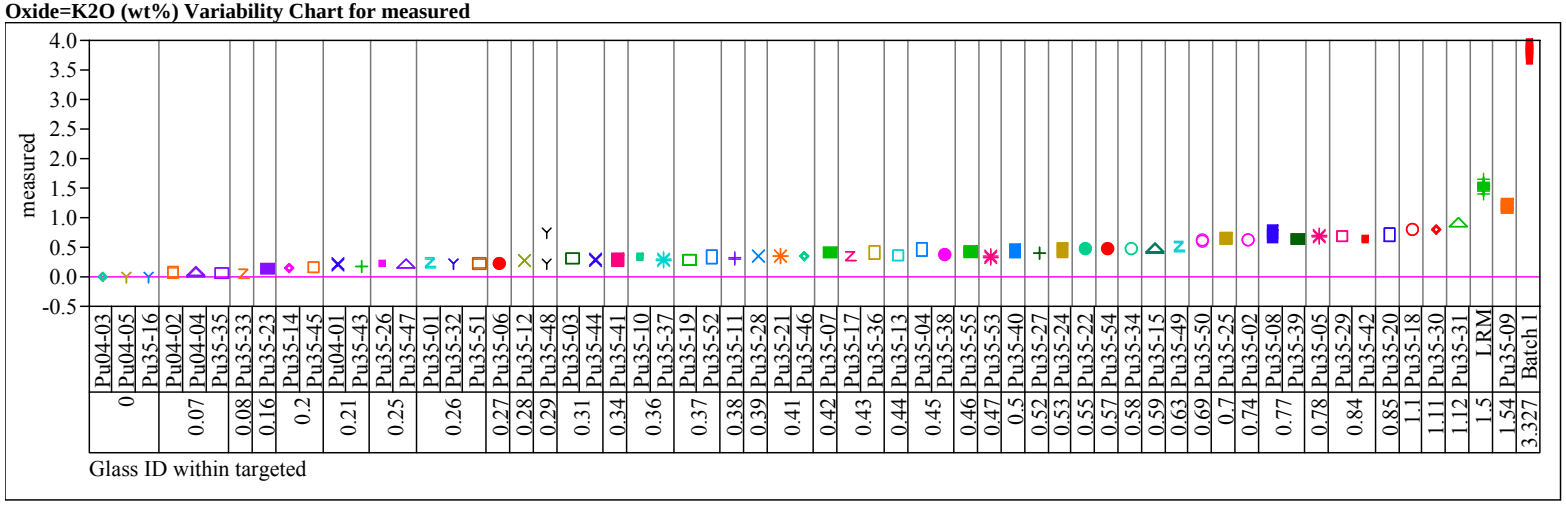


Exhibit D6. Measured and Measured Bias-Corrected Oxide Weight Percents by Glass ID by Targeted Value for the Glasses Prepared Using the LM Method (continued)

Oxide=K2O (wt%) Variability Chart for measured



Oxide=K2O (wt%) Variability Chart for measured bc

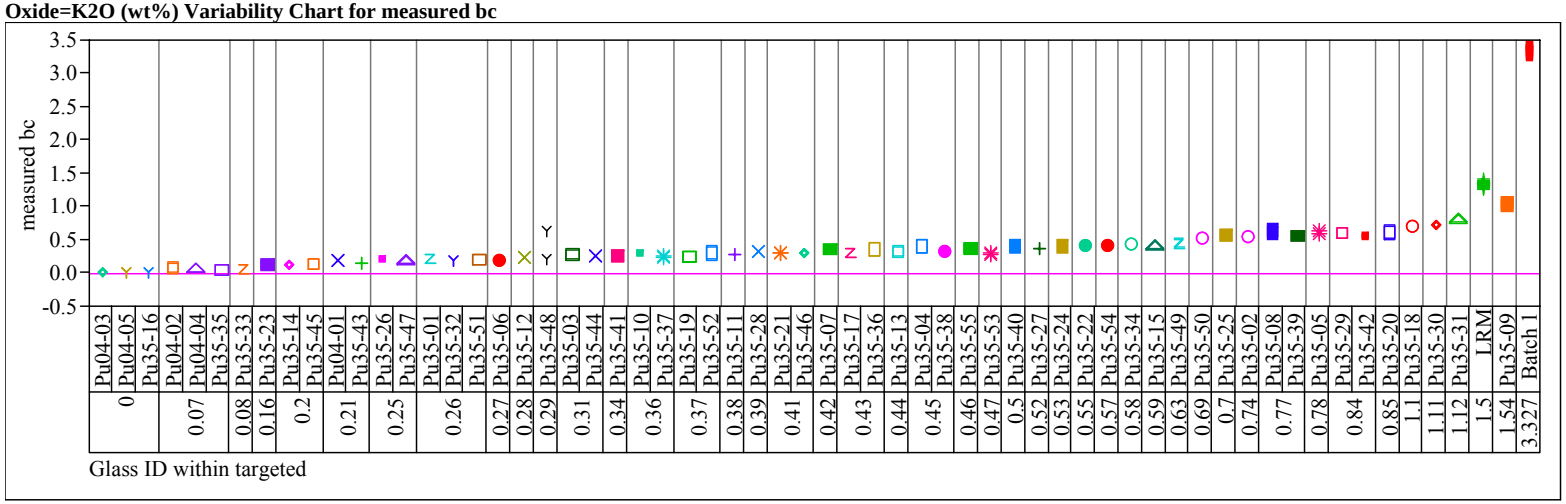
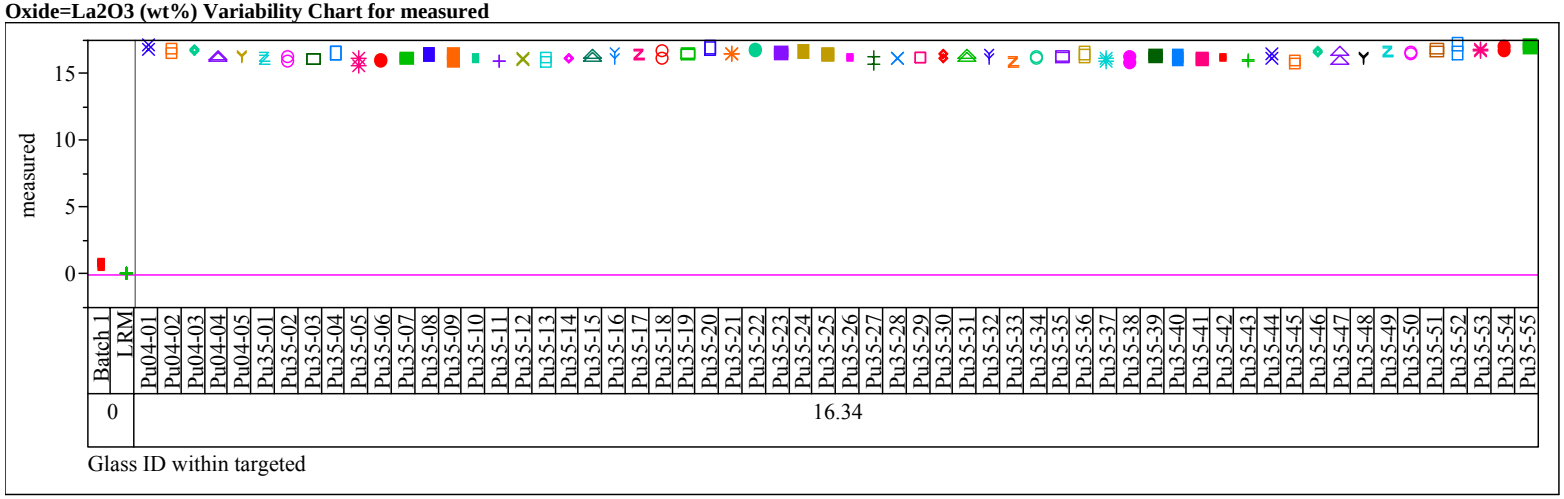


Exhibit D6. Measured and Measured Bias-Corrected Oxide Weight Percents by Glass ID by Targeted Value for the Glasses Prepared Using the LM Method (continued)

Oxide=La2O3 (wt%) Variability Chart for measured



Oxide=La2O3 (wt%) Variability Chart for measured bc

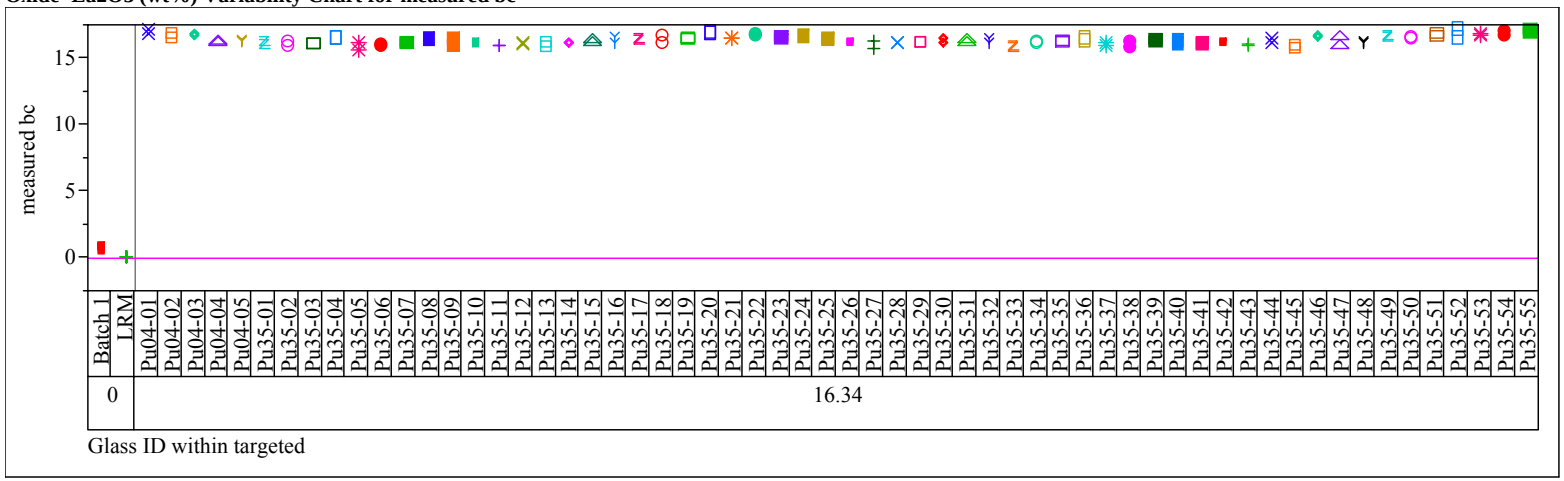
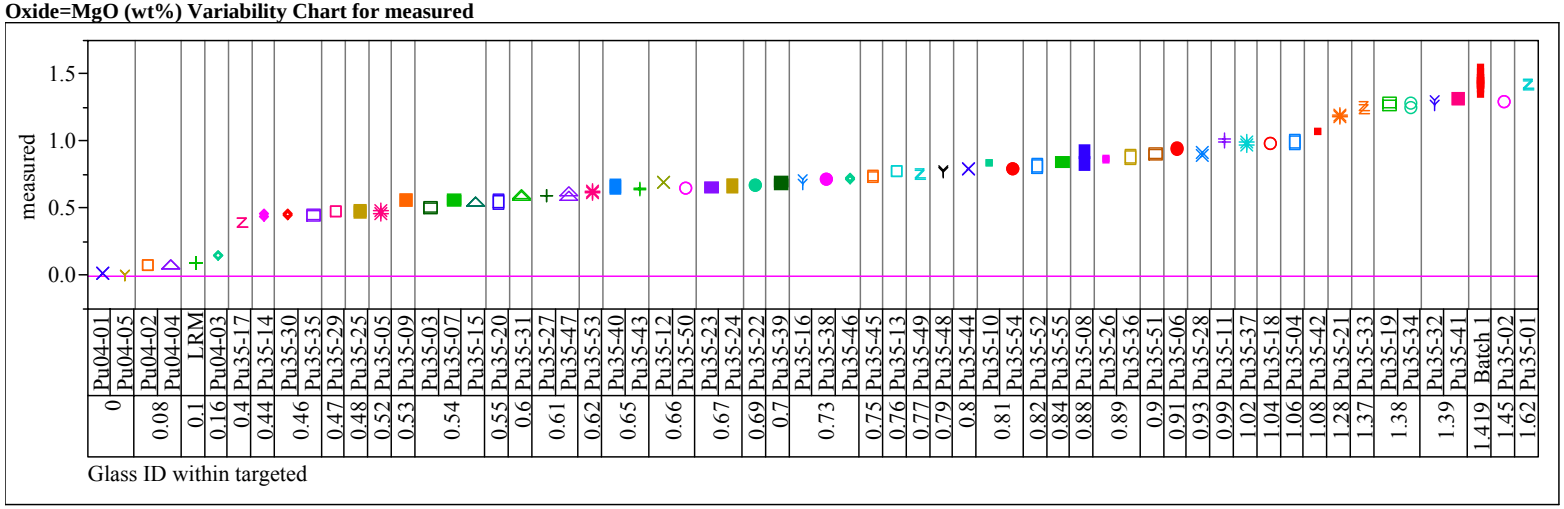


Exhibit D6. Measured and Measured Bias-Corrected Oxide Weight Percents by Glass ID by Targeted Value for the Glasses Prepared Using the LM Method (continued)

Oxide=MgO (wt%) Variability Chart for measured



Oxide=MgO (wt%) Variability Chart for measured bc

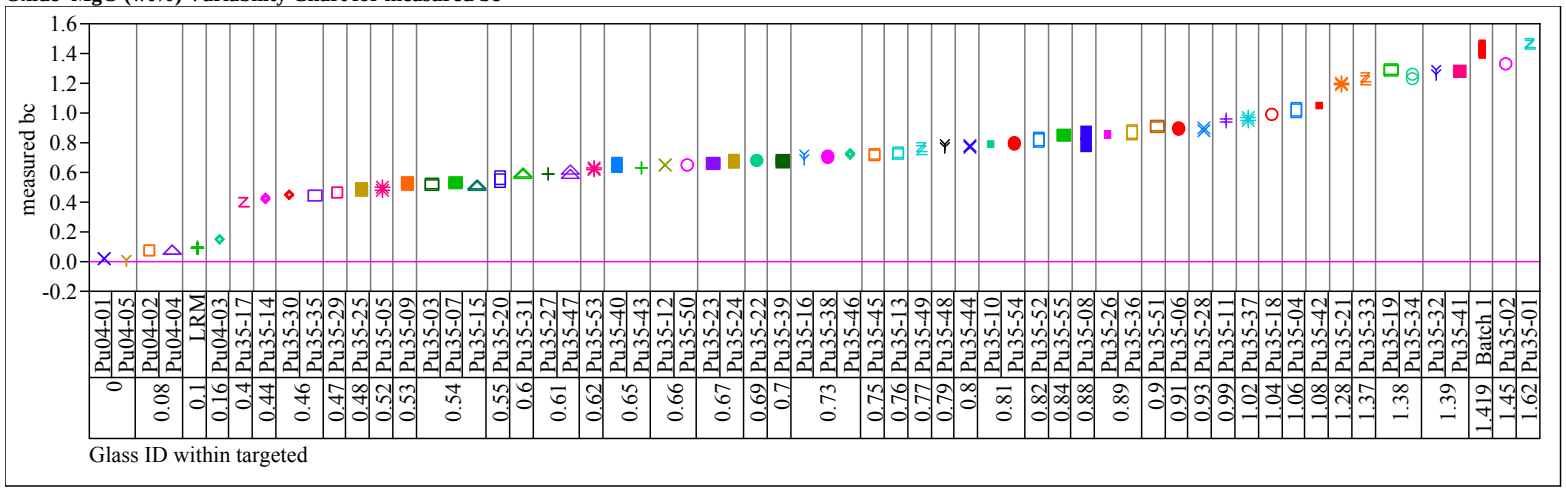
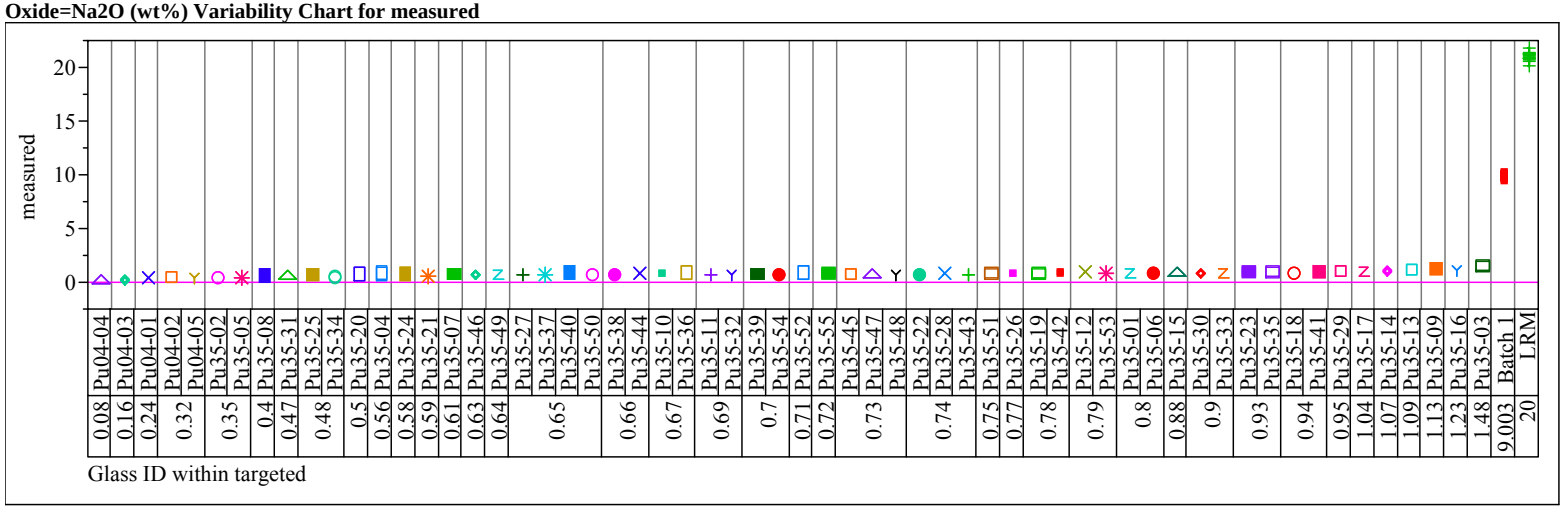


Exhibit D6. Measured and Measured Bias-Corrected Oxide Weight Percents by Glass ID by Targeted Value for the Glasses Prepared Using the LM Method (continued)

Oxide=Na2O (wt%) Variability Chart for measured



Oxide=Na2O (wt%) Variability Chart for measured bc

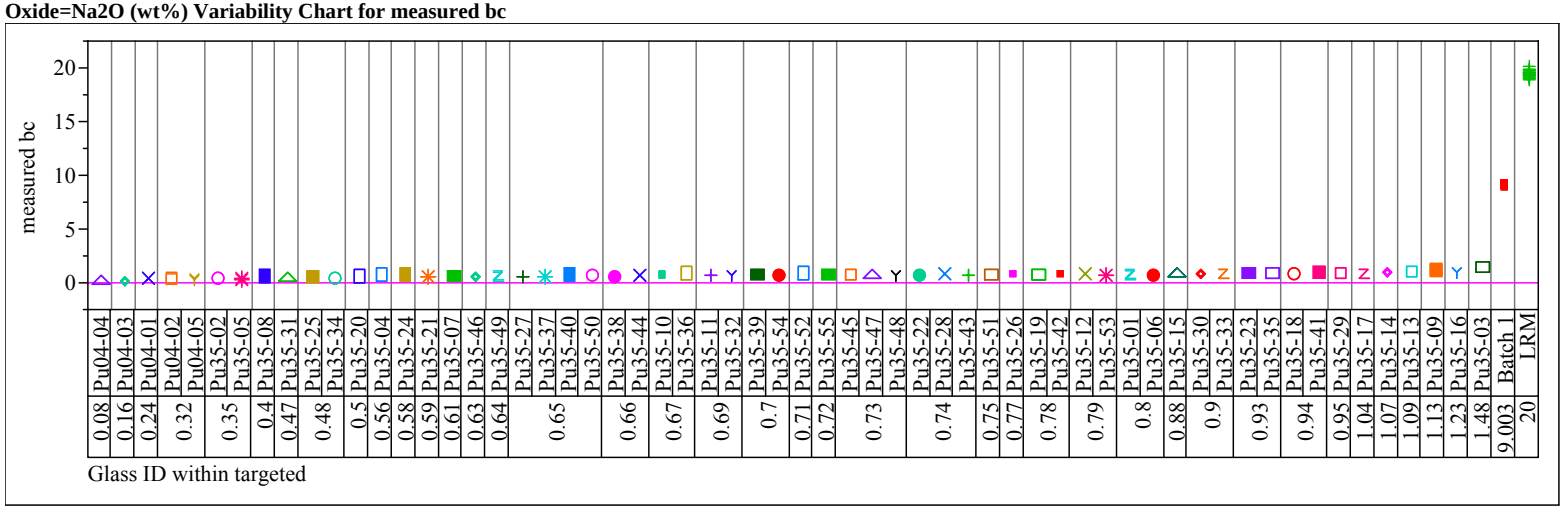
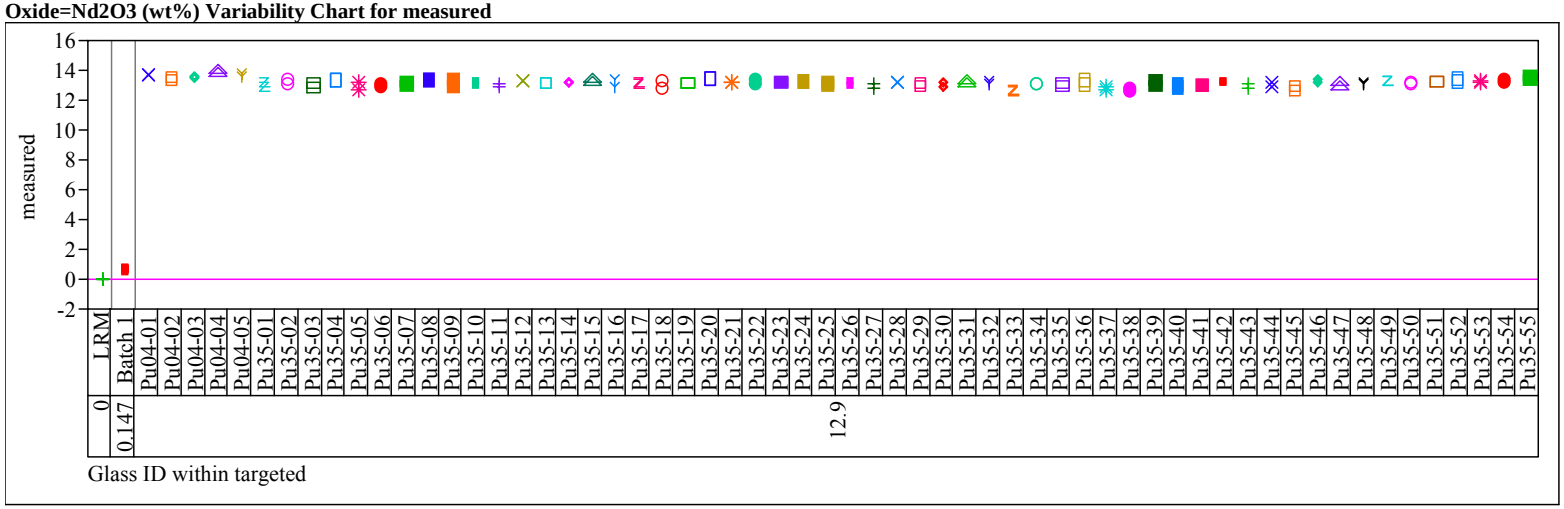


Exhibit D6. Measured and Measured Bias-Corrected Oxide Weight Percents by Glass ID by Targeted Value for the Glasses Prepared Using the LM Method (continued)

Oxide=Nd2O3 (wt%) Variability Chart for measured



Oxide=Nd2O3 (wt%) Variability Chart for measured bc

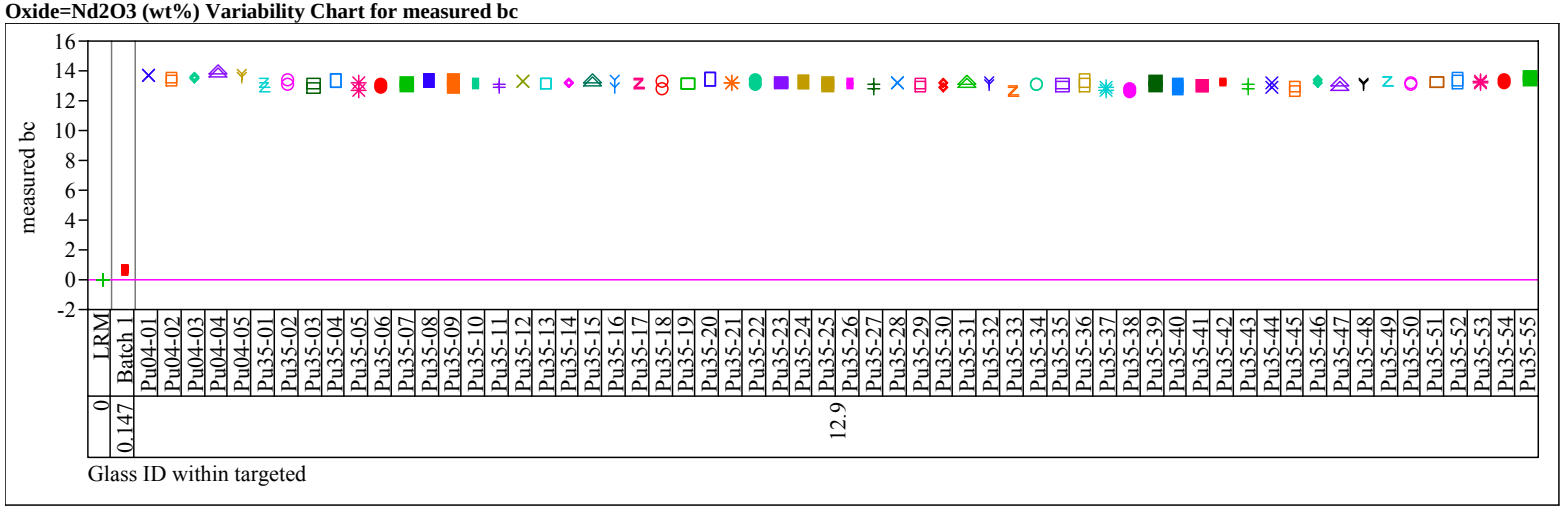
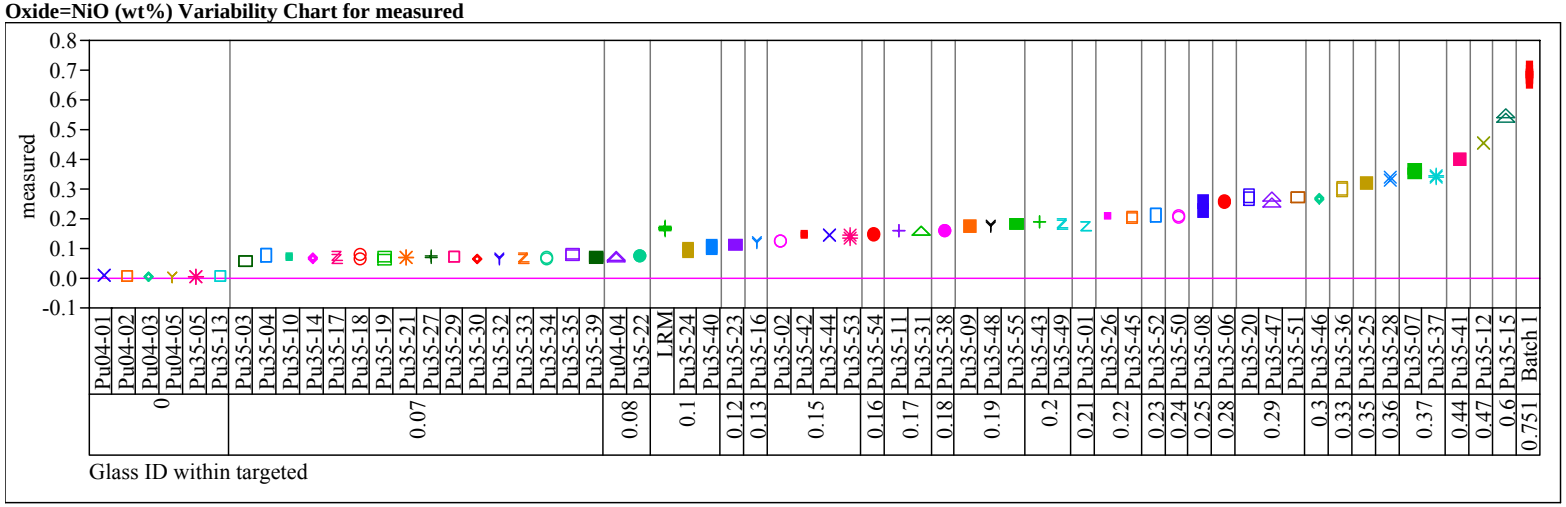


Exhibit D6. Measured and Measured Bias-Corrected Oxide Weight Percents by Glass ID by Targeted Value for the Glasses Prepared Using the LM Method (continued)

Oxide=NiO (wt%) Variability Chart for measured



Oxide=NiO (wt%) Variability Chart for measured bc

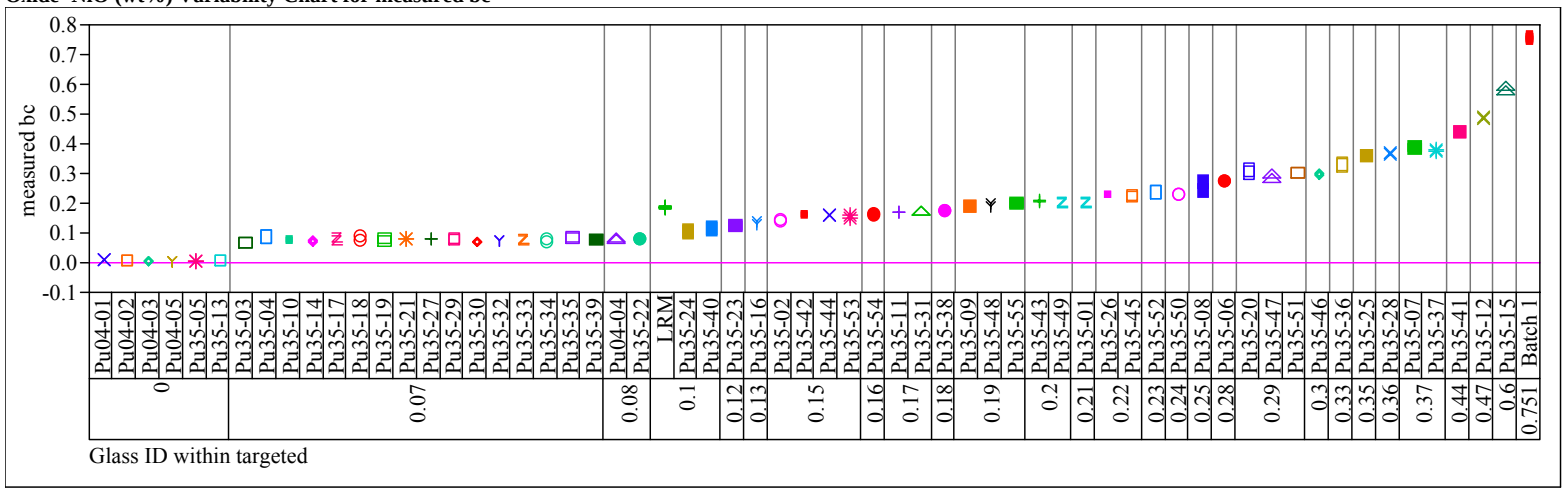
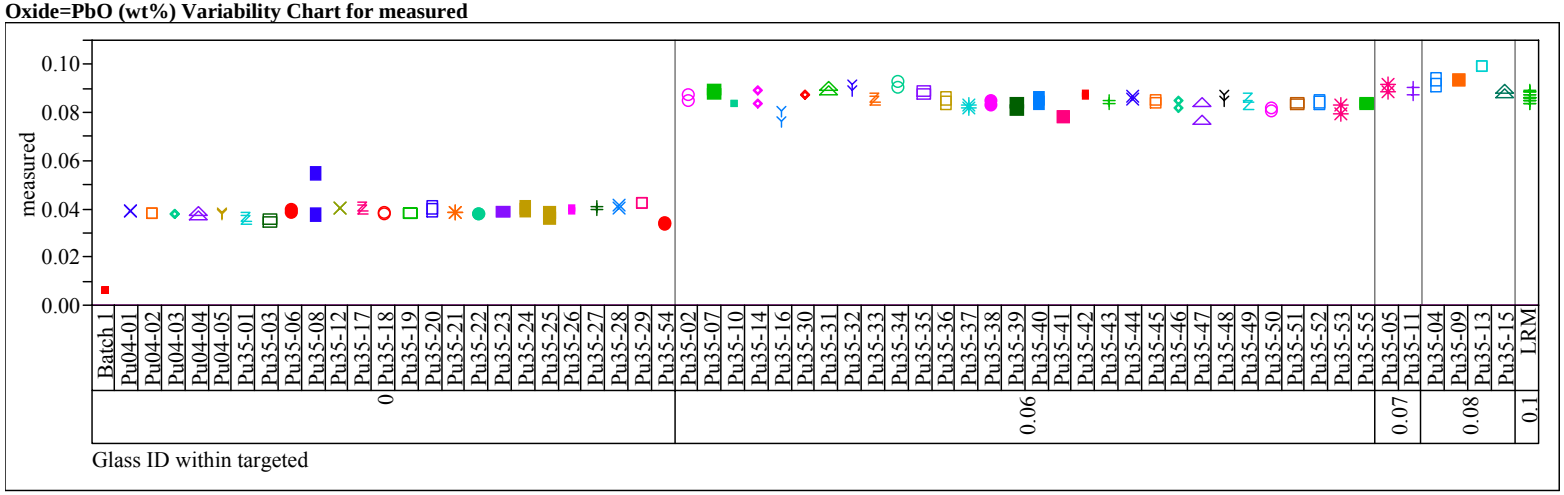


Exhibit D6. Measured and Measured Bias-Corrected Oxide Weight Percents by Glass ID by Targeted Value for the Glasses Prepared Using the LM Method (continued)

Oxide=PbO (wt%) Variability Chart for measured



Oxide=PbO (wt%) Variability Chart for measured bc

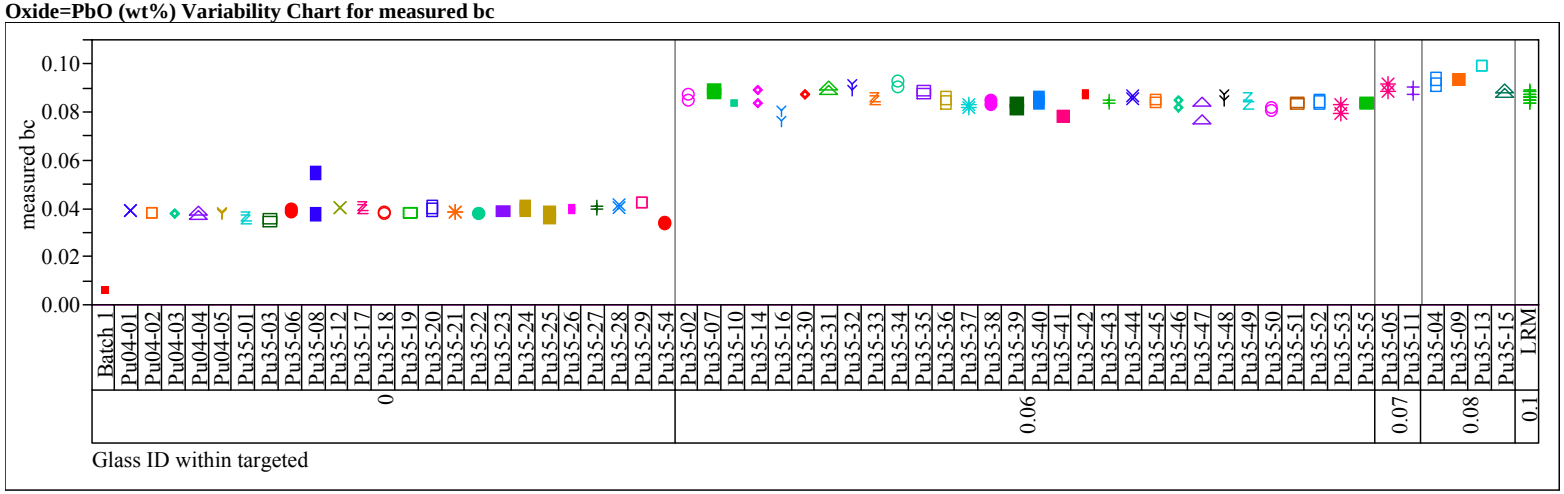
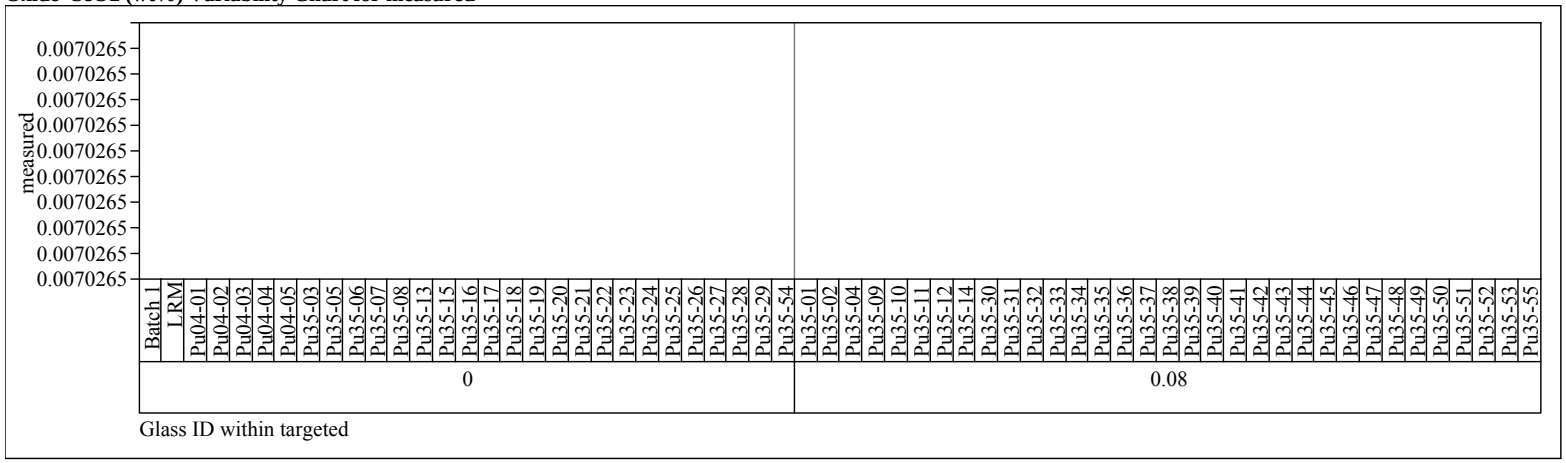


Exhibit D6. Measured and Measured Bias-Corrected Oxide Weight Percents by Glass ID by Targeted Value for the Glasses Prepared Using the LM Method (continued)

Oxide=SeO2 (wt%) Variability Chart for measured



Oxide=SeO2 (wt%) Variability Chart for measured bc

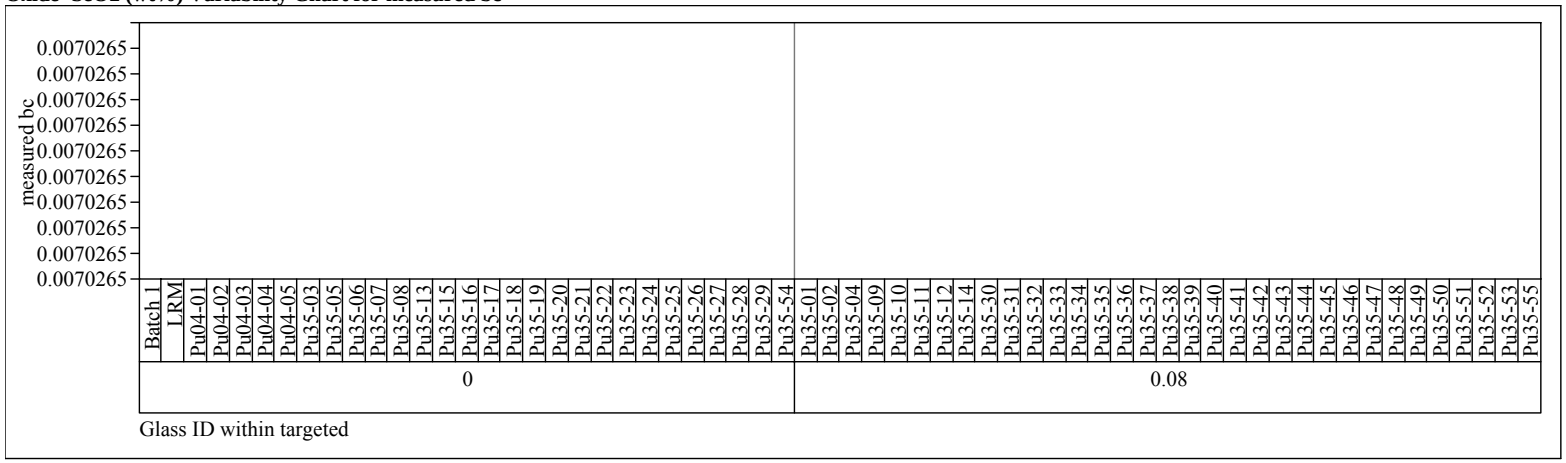
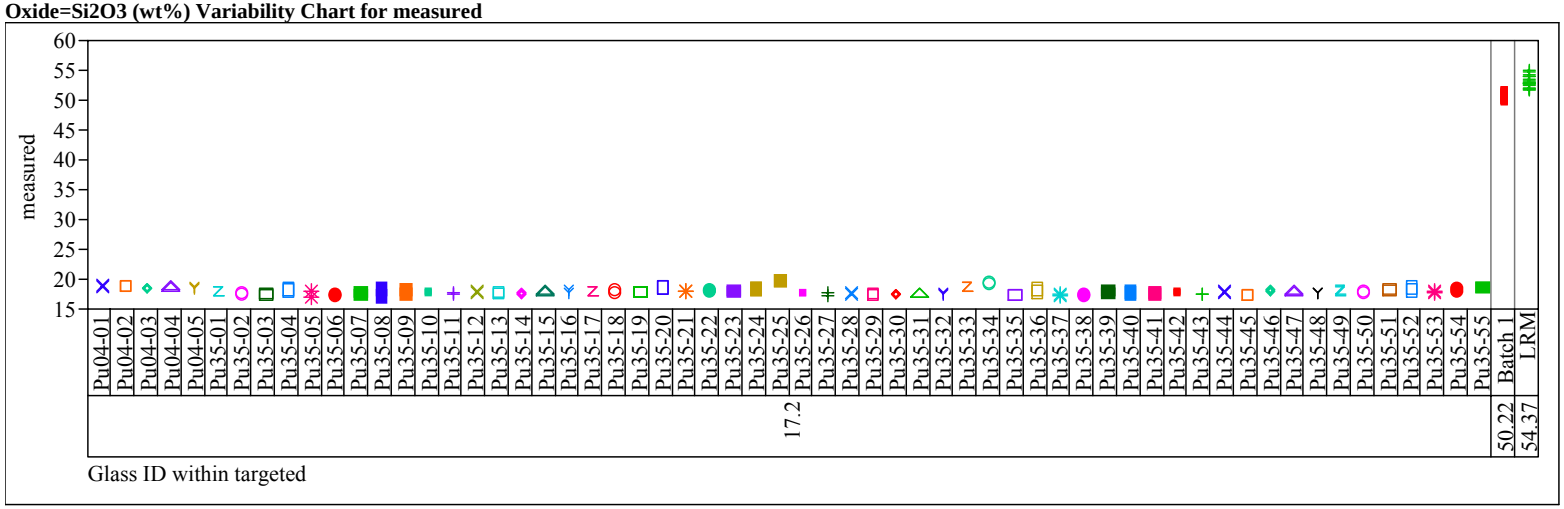


Exhibit D6. Measured and Measured Bias-Corrected Oxide Weight Percents by Glass ID by Targeted Value for the Glasses Prepared Using the LM Method (continued)

Oxide=Si2O3 (wt%) Variability Chart for measured



Oxide=Si2O3 (wt%) Variability Chart for measured bc

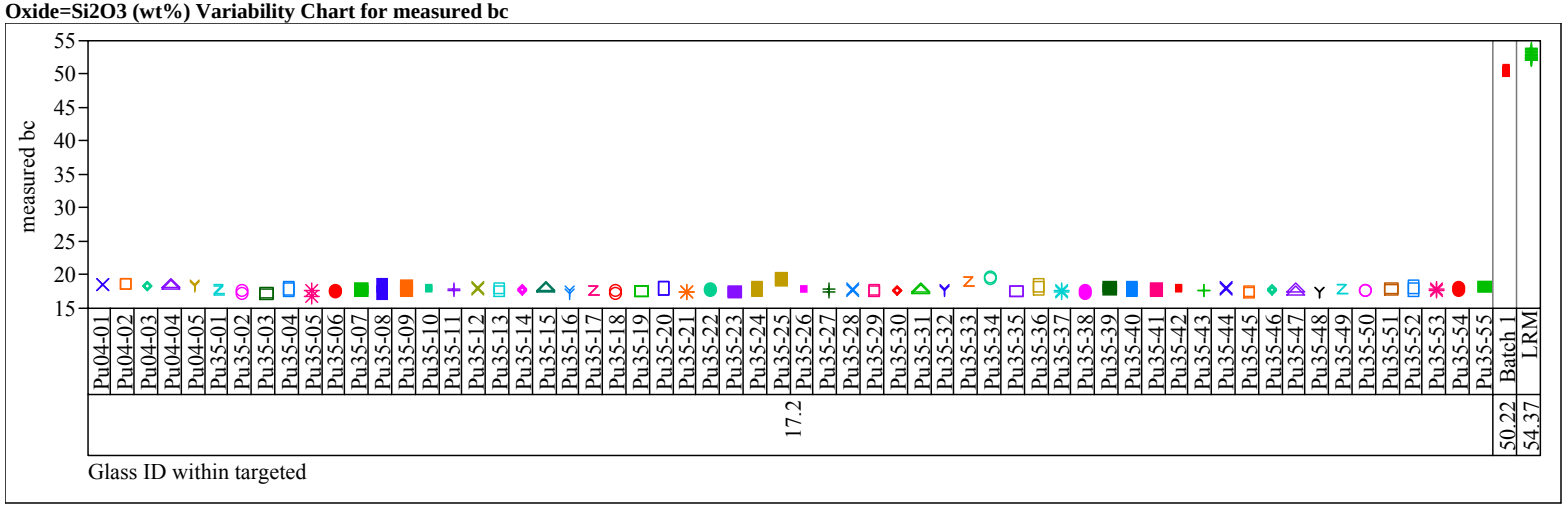
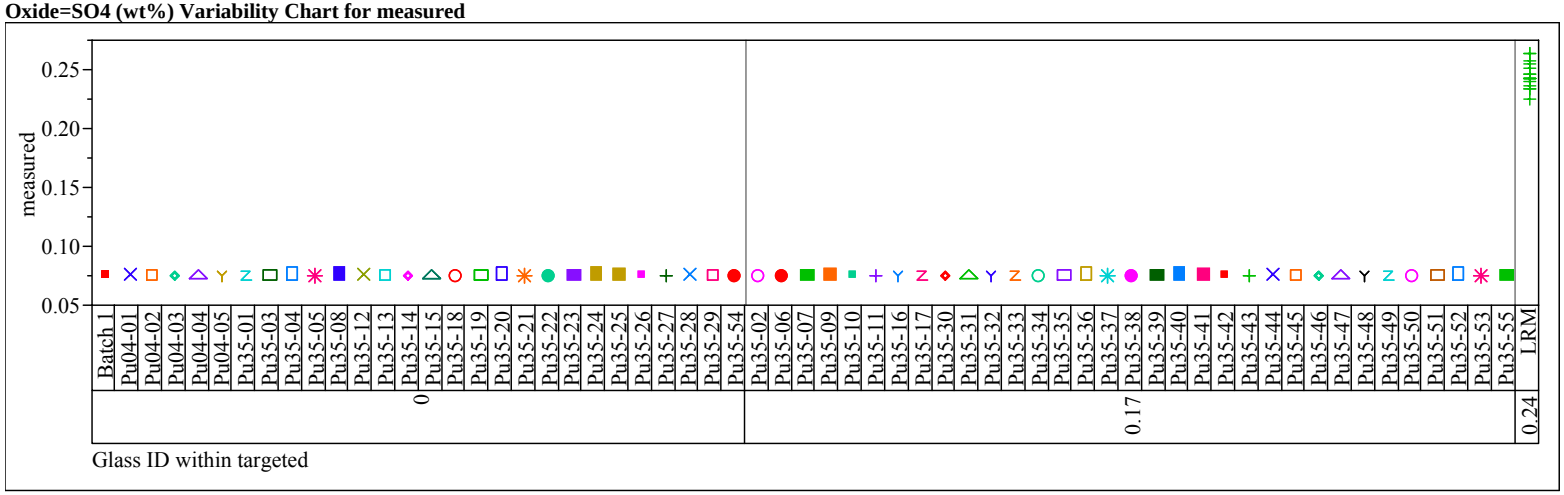


Exhibit D6. Measured and Measured Bias-Corrected Oxide Weight Percents by Glass ID by Targeted Value for the Glasses Prepared Using the LM Method (continued)

Oxide=SO4 (wt%) Variability Chart for measured



Oxide=SO4 (wt%) Variability Chart for measured bc

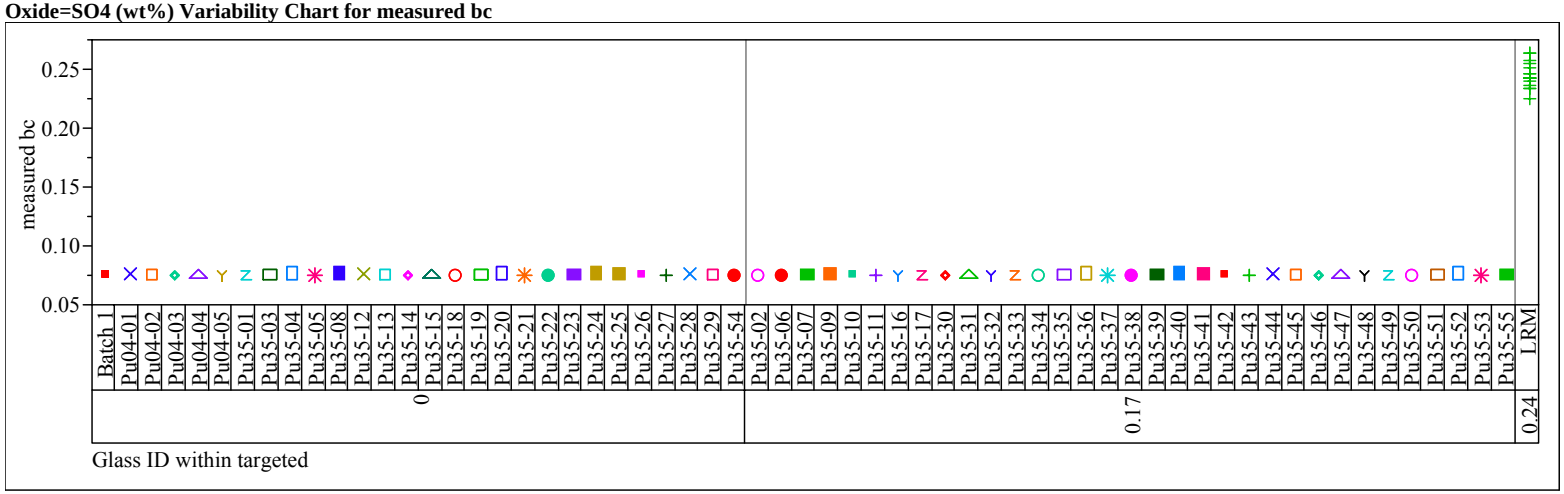
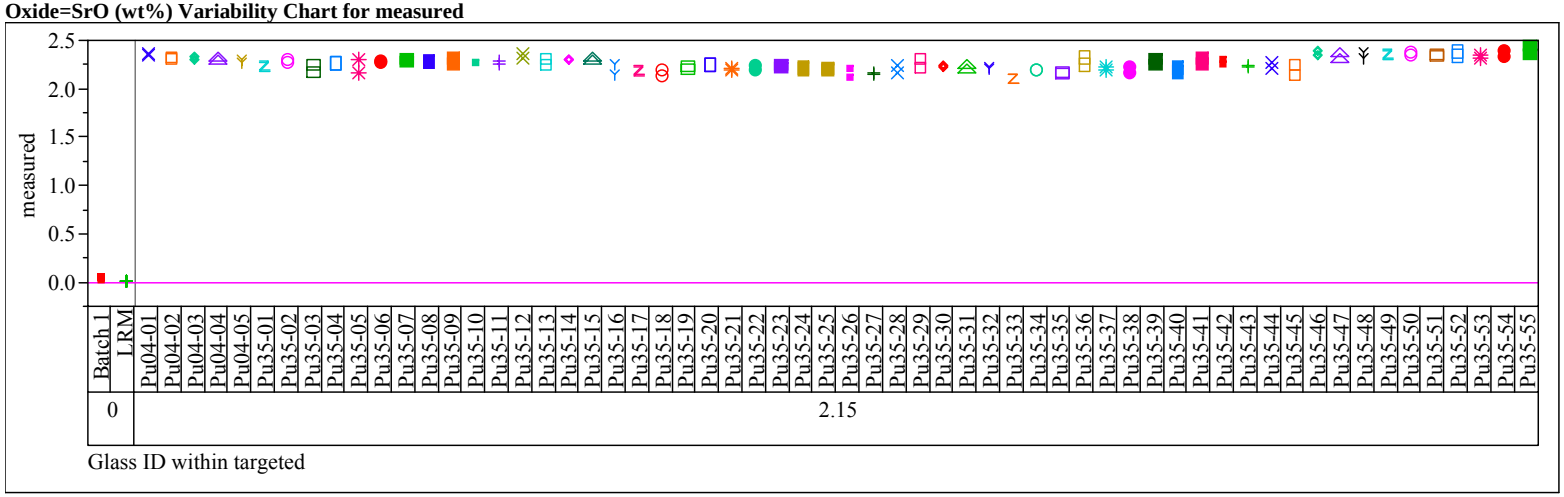


Exhibit D6. Measured and Measured Bias-Corrected Oxide Weight Percents by Glass ID by Targeted Value for the Glasses Prepared Using the LM Method (continued)

Oxide=SrO (wt%) Variability Chart for measured



Oxide=SrO (wt%) Variability Chart for measured bc

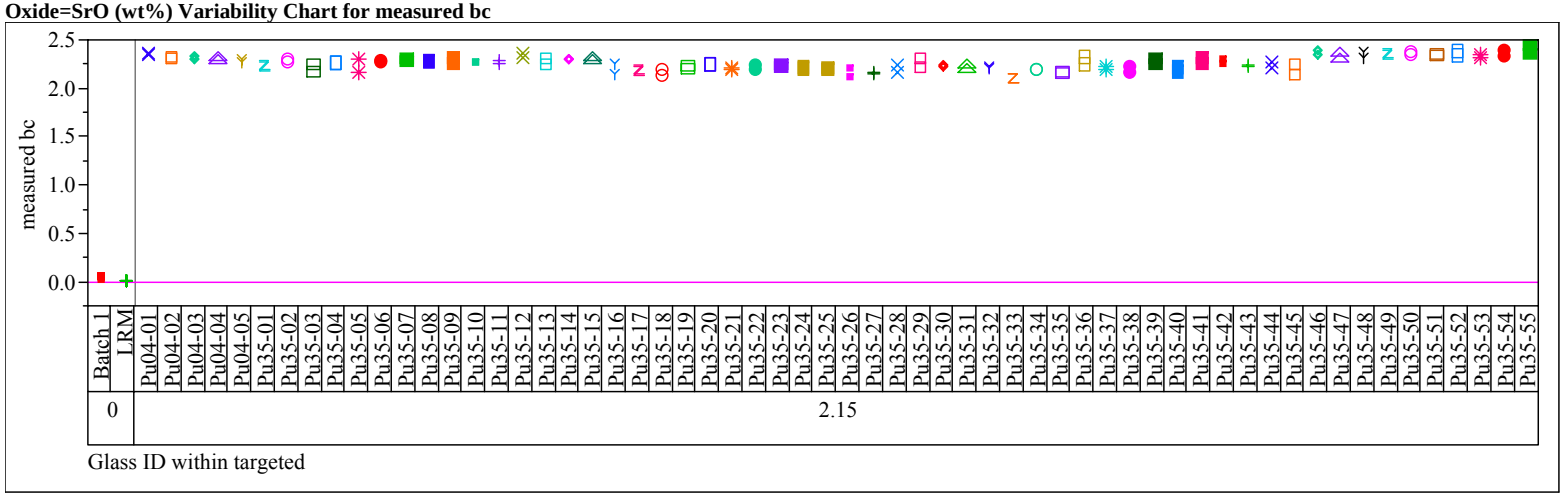
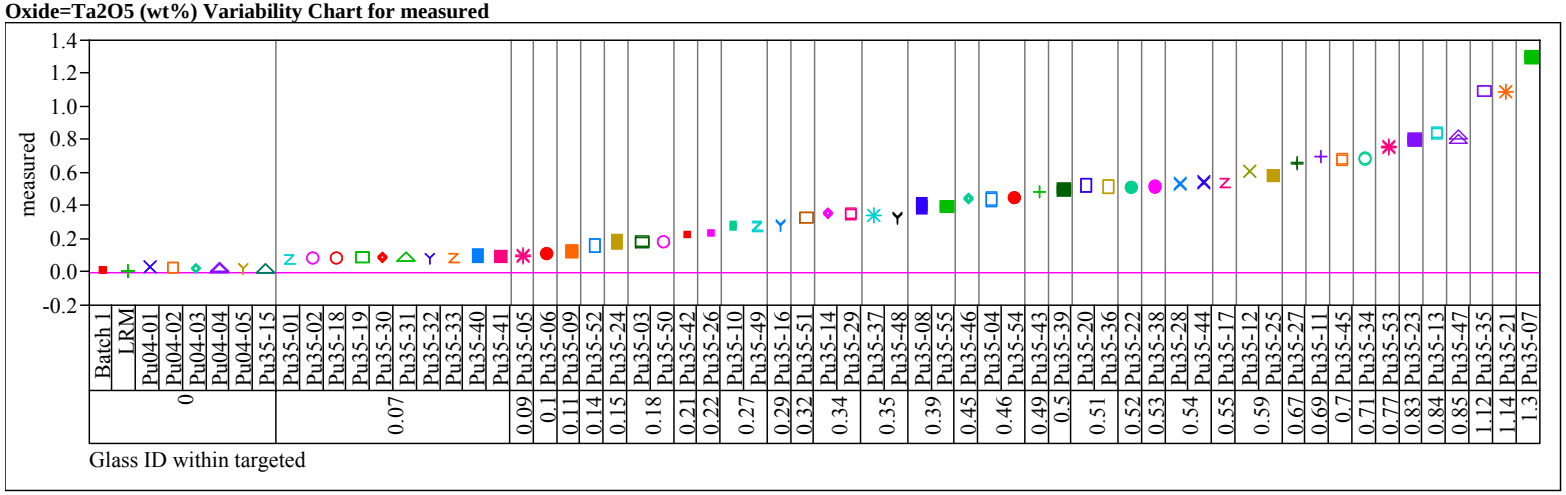


Exhibit D6. Measured and Measured Bias-Corrected Oxide Weight Percents by Glass ID by Targeted Value for the Glasses Prepared Using the LM Method (continued)

Oxide=Ta2O5 (wt%) Variability Chart for measured



Oxide=Ta2O5 (wt%) Variability Chart for measured bc

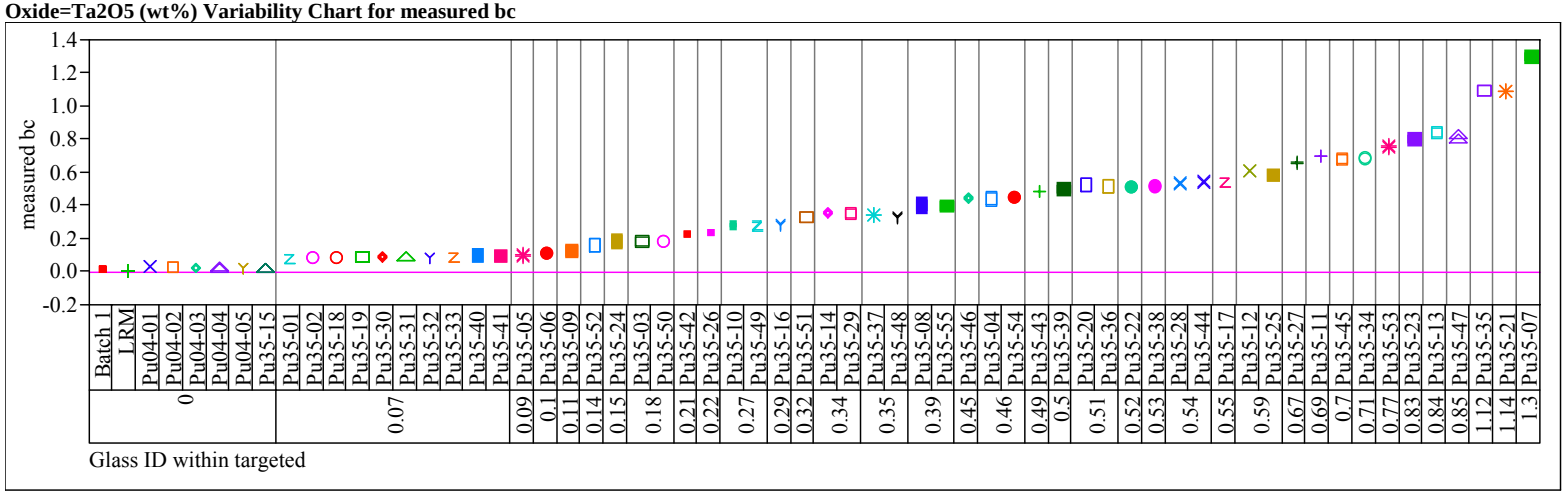
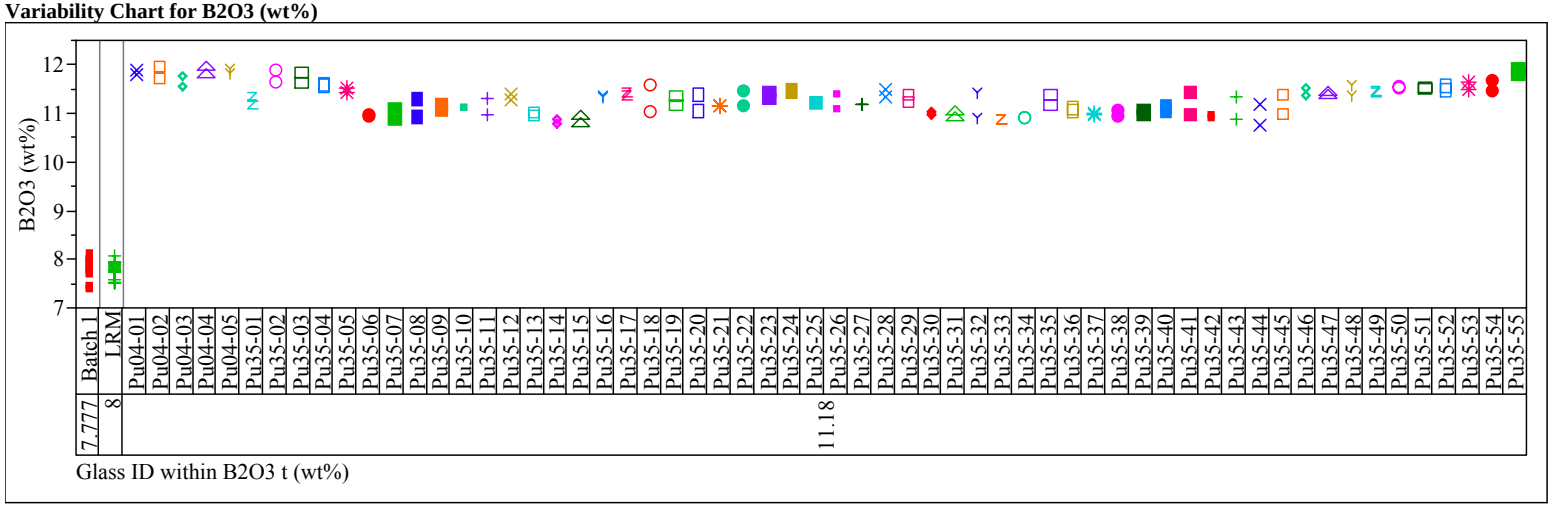


Exhibit D7. Measured and Measured Bias-Corrected Oxide Weight Percents by Glass ID by Targeted Value for the Glasses Prepared Using the PF Method

Variability Chart for B2O3 (wt%)



Variability Chart for B2O3 bc (wt%)

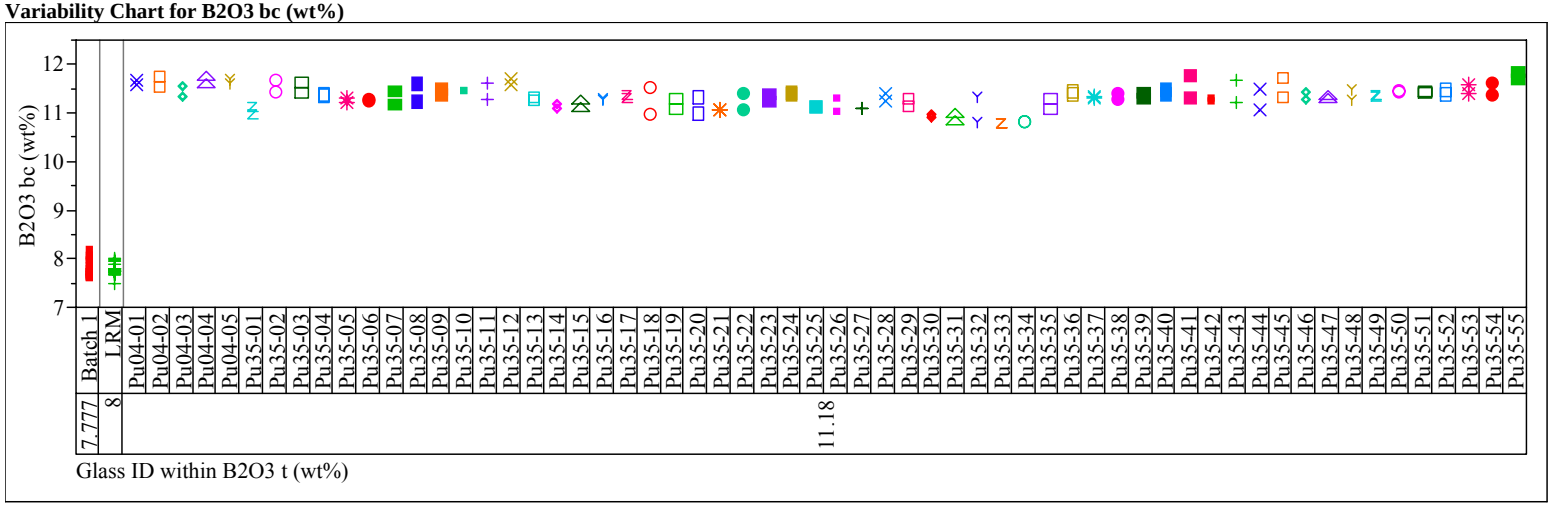
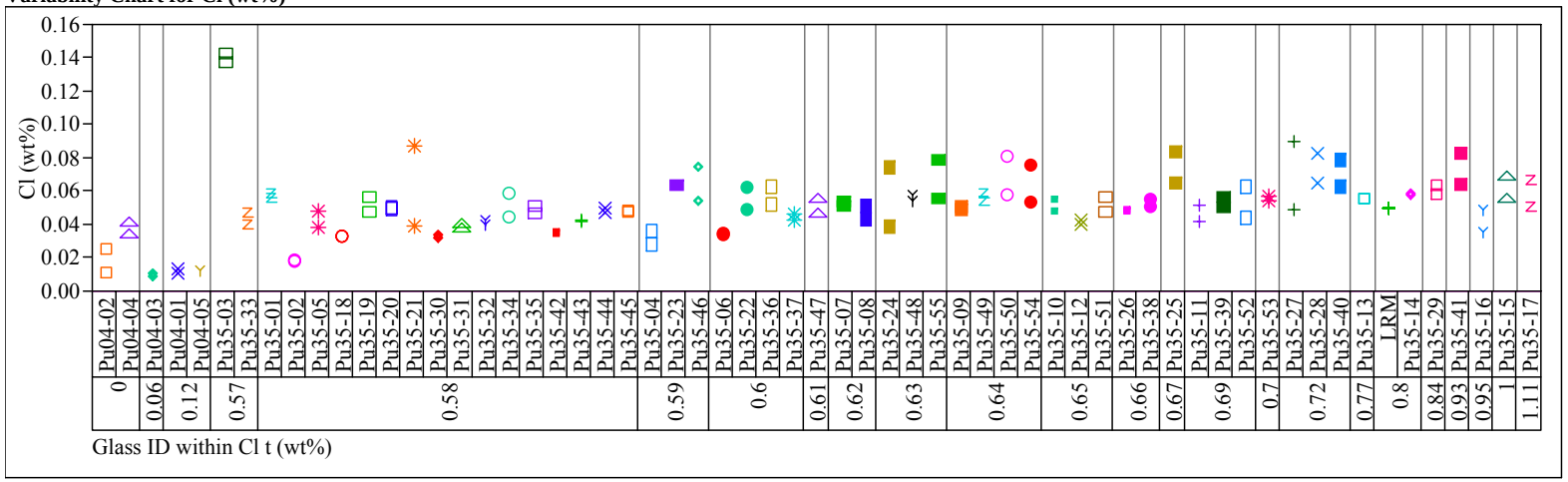


Exhibit D8. IC Measured and Measured Bias-Corrected Weight Percents by Glass ID by Targeted Concentration

Variability Chart for Cl (wt%)



Variability Chart for Cl bc (wt%)

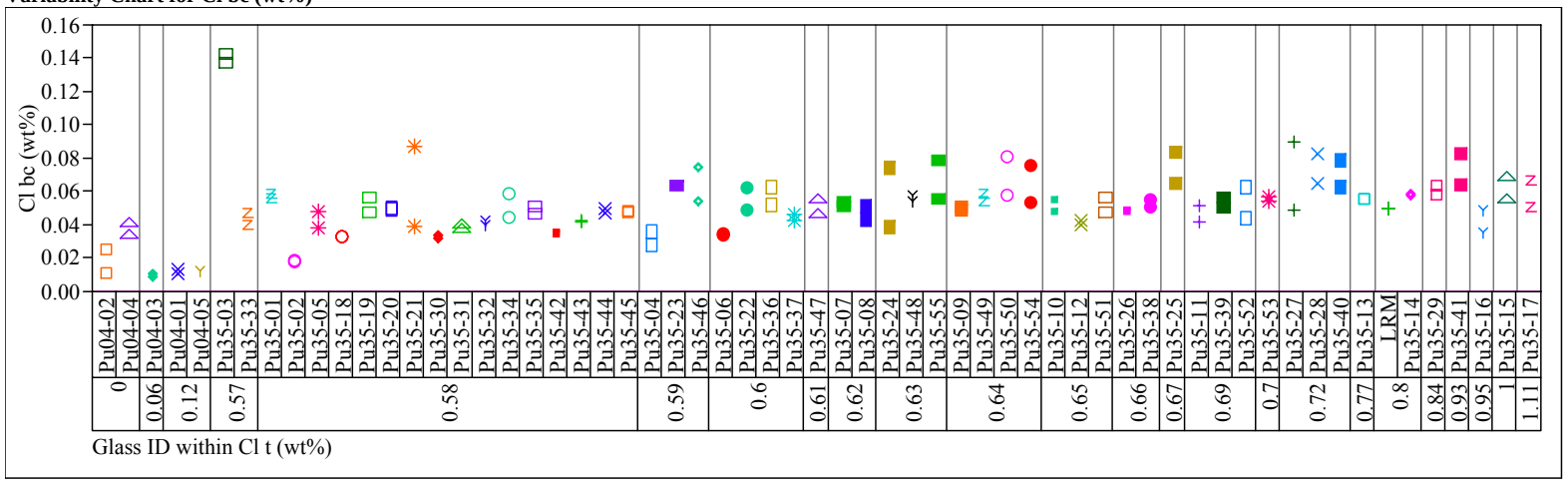
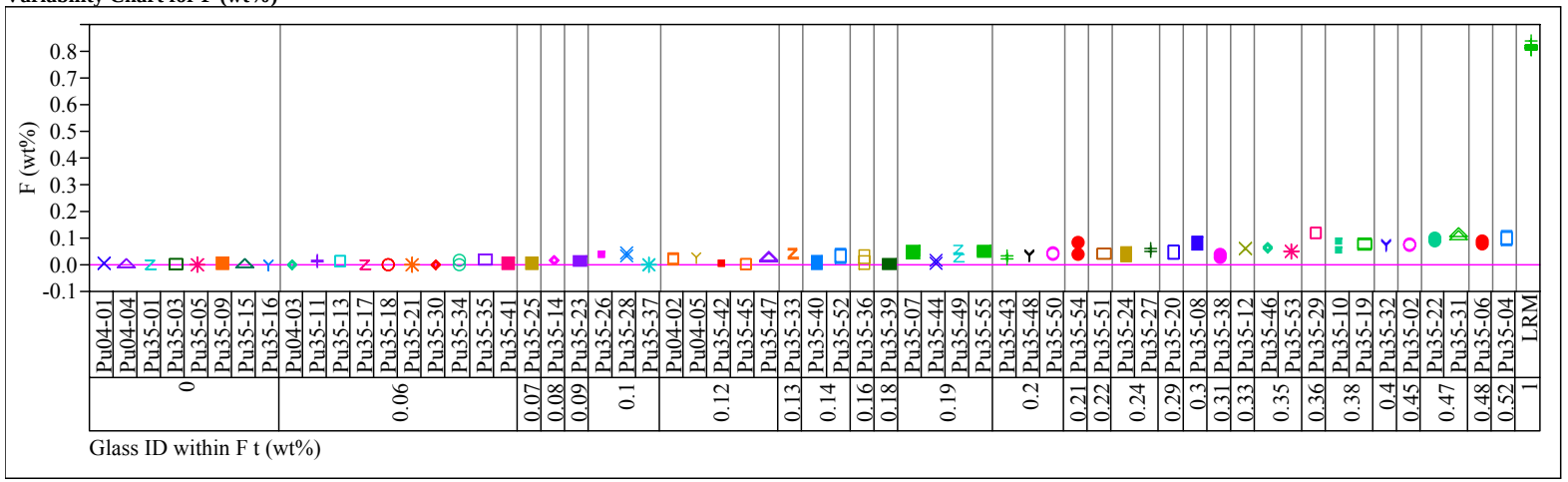


Exhibit D8. IC Measured and Measured Bias-Corrected Weight Percents by Glass ID by Targeted Concentration (continued)

Variability Chart for F (wt%)



Variability Chart for F bc (wt%)

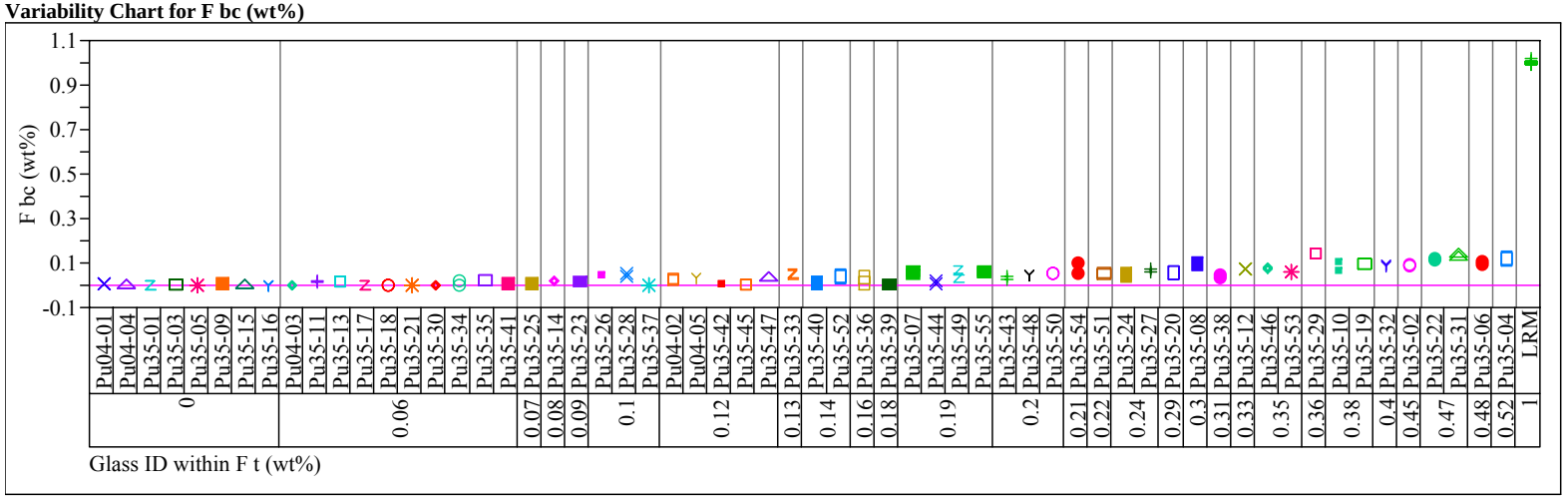


Exhibit D9. Average Measured and Bias-Corrected (bc) Versus Targeted Compositions by Glass ID by Analyte

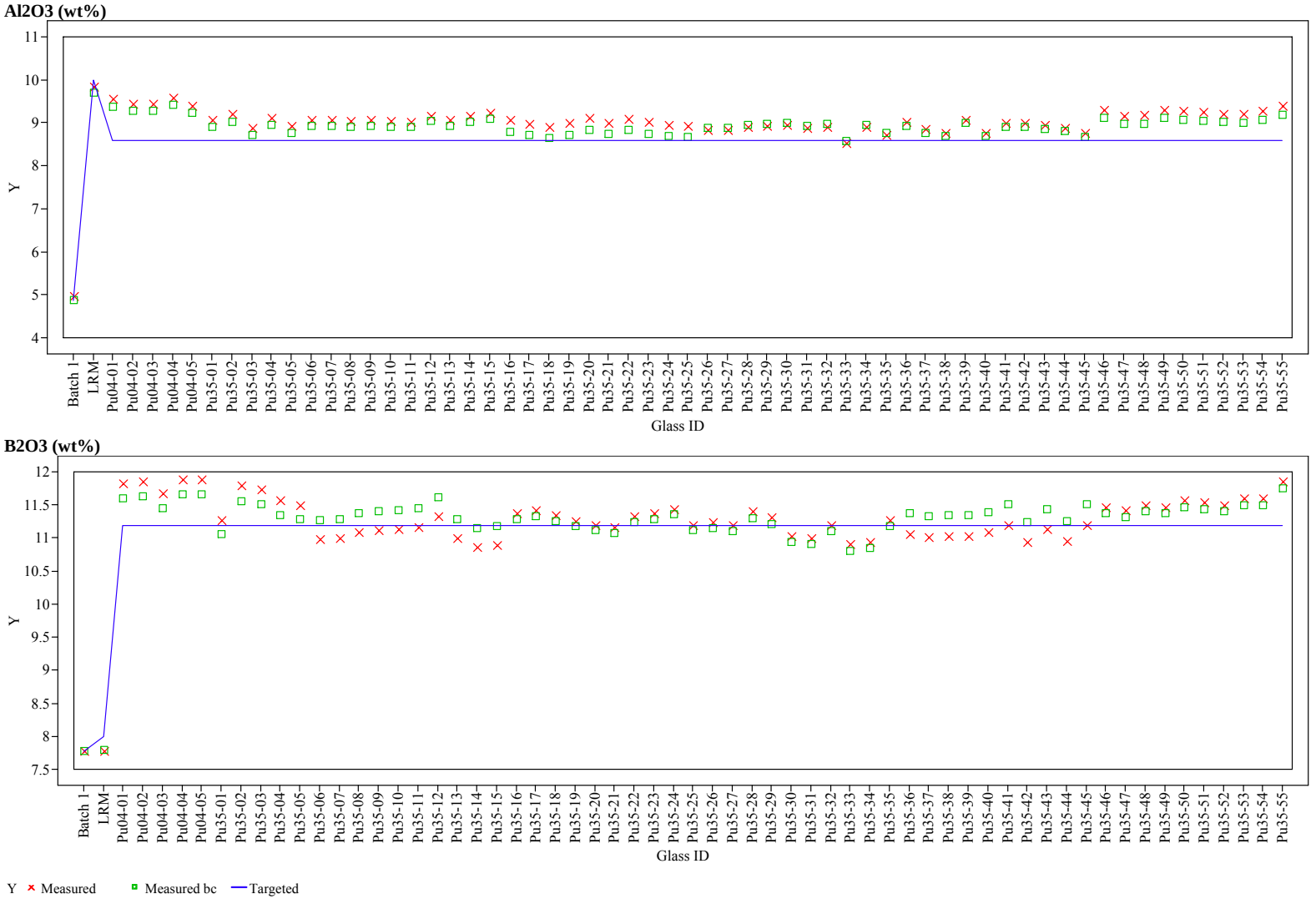


Exhibit D9. Average Measured and Bias-Corrected (bc) Versus Targeted Compositions by Glass ID by Analyte (continued)

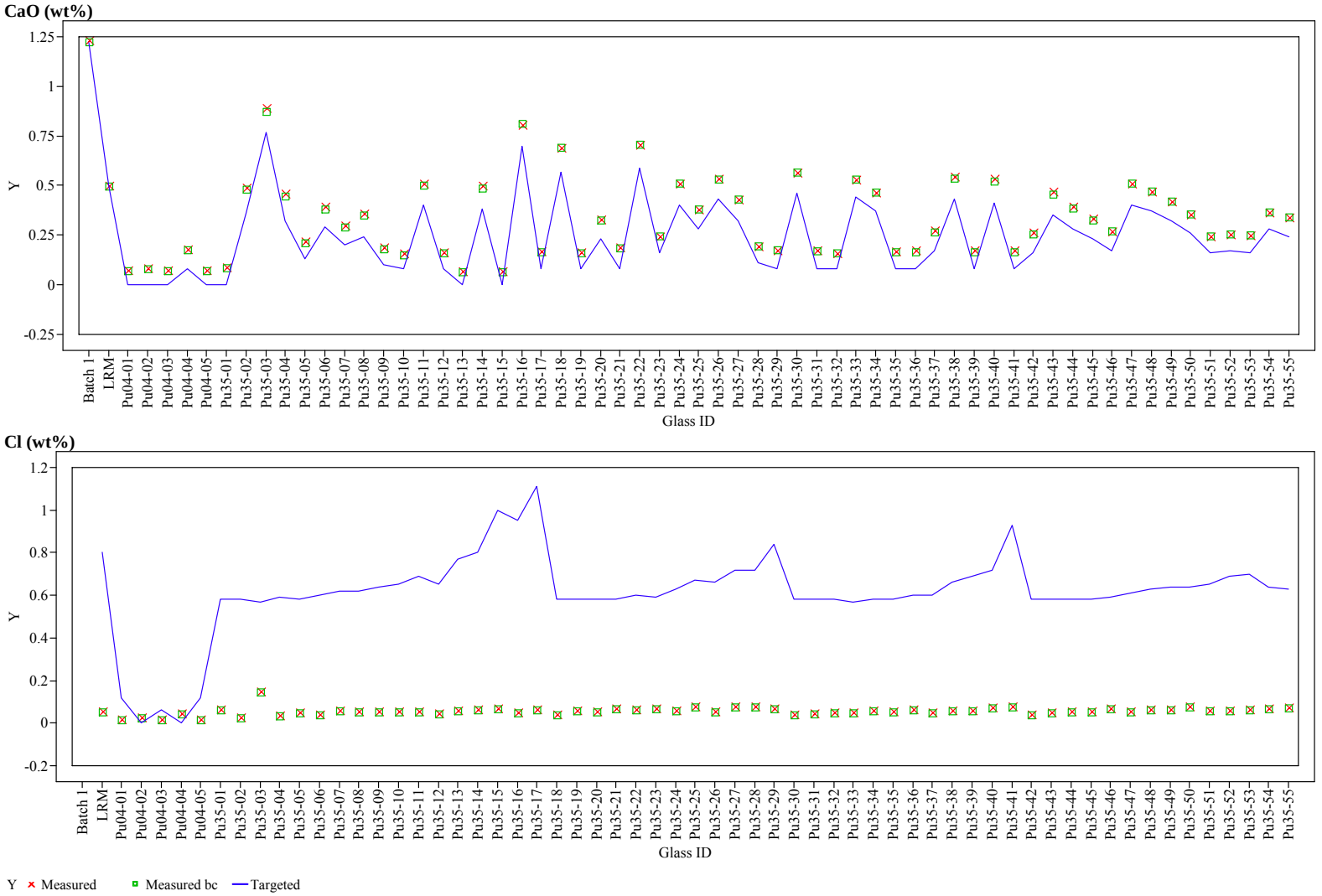


Exhibit D9. Average Measured and Bias-Corrected (bc) Versus Targeted Compositions by Glass ID by Analyte (continued)

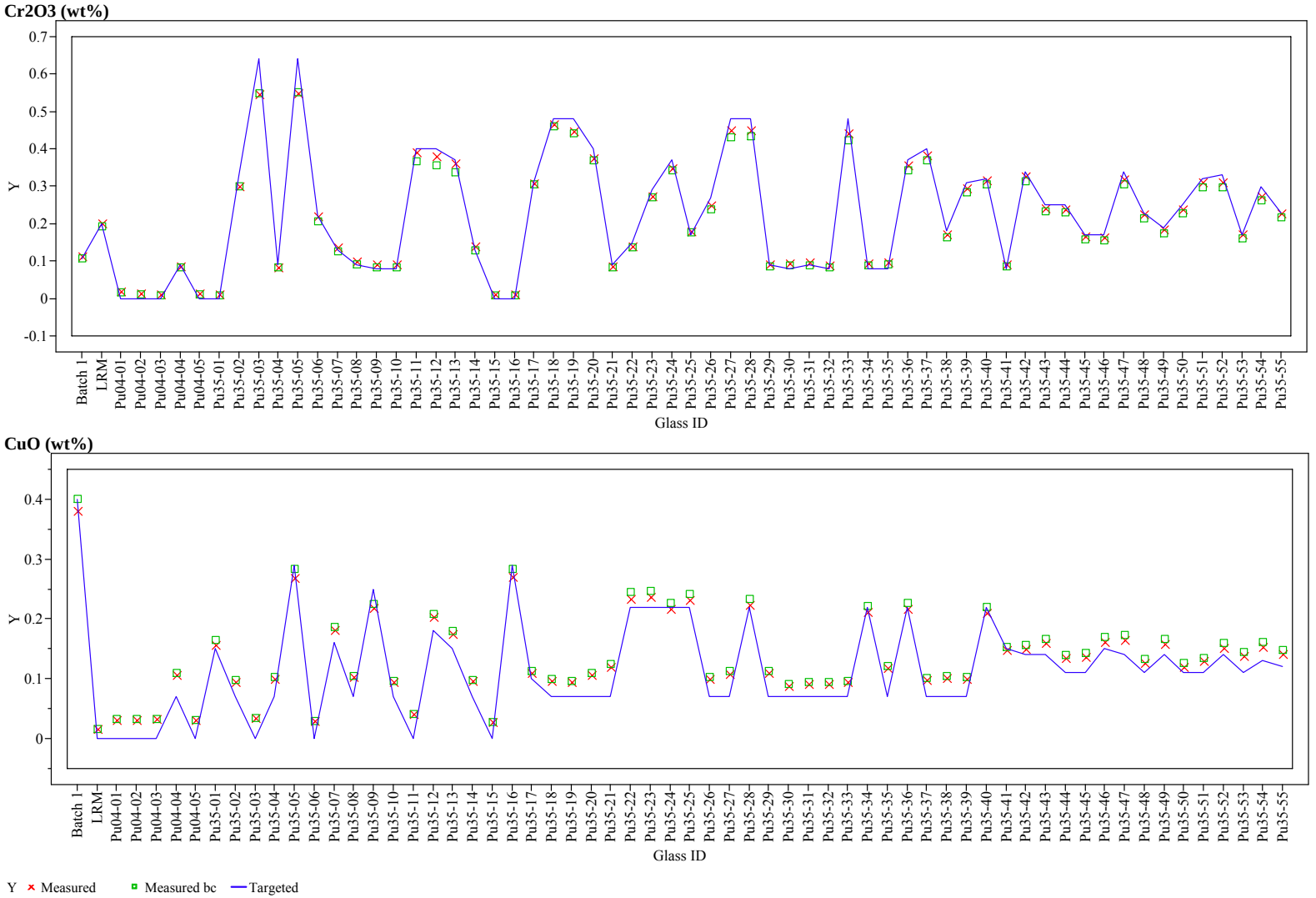


Exhibit D9. Average Measured and Bias-Corrected (bc) Versus Targeted Compositions by Glass ID by Analyte (continued)

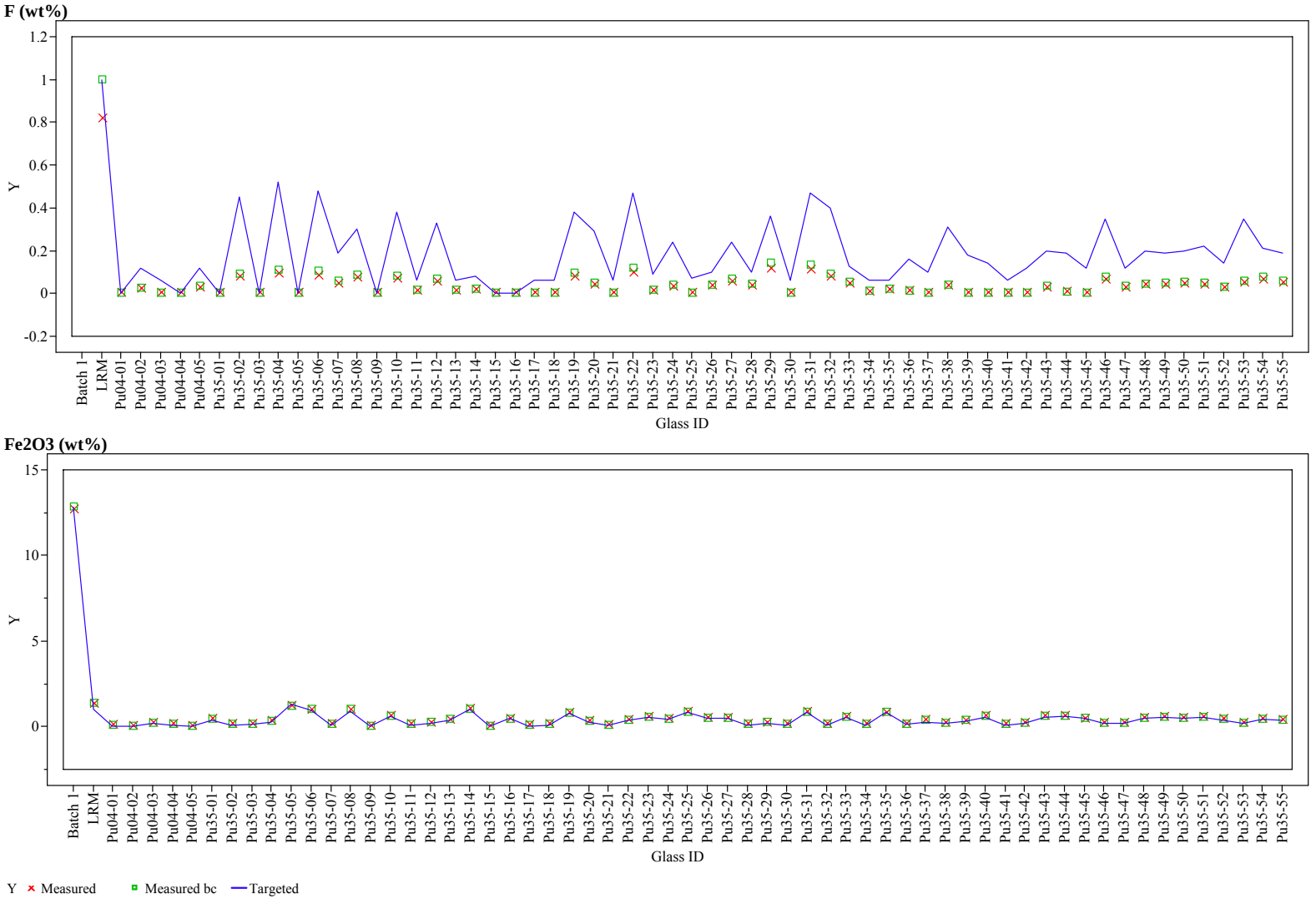


Exhibit D9. Average Measured and Bias-Corrected (bc) Versus Targeted Compositions by Glass ID by Analyte (continued)

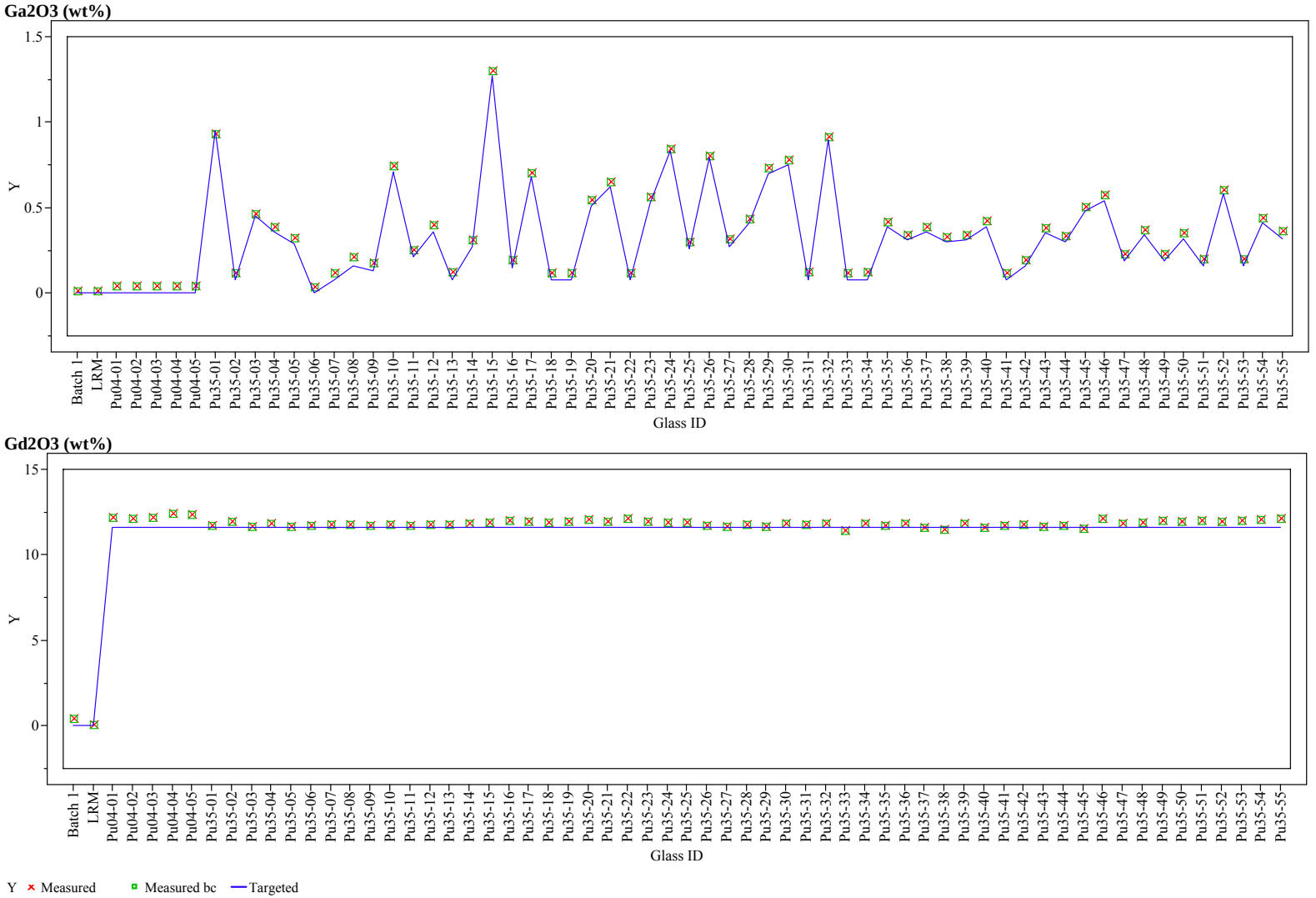


Exhibit D9. Average Measured and Bias-Corrected (bc) Versus Targeted Compositions by Glass ID by Analyte (continued)

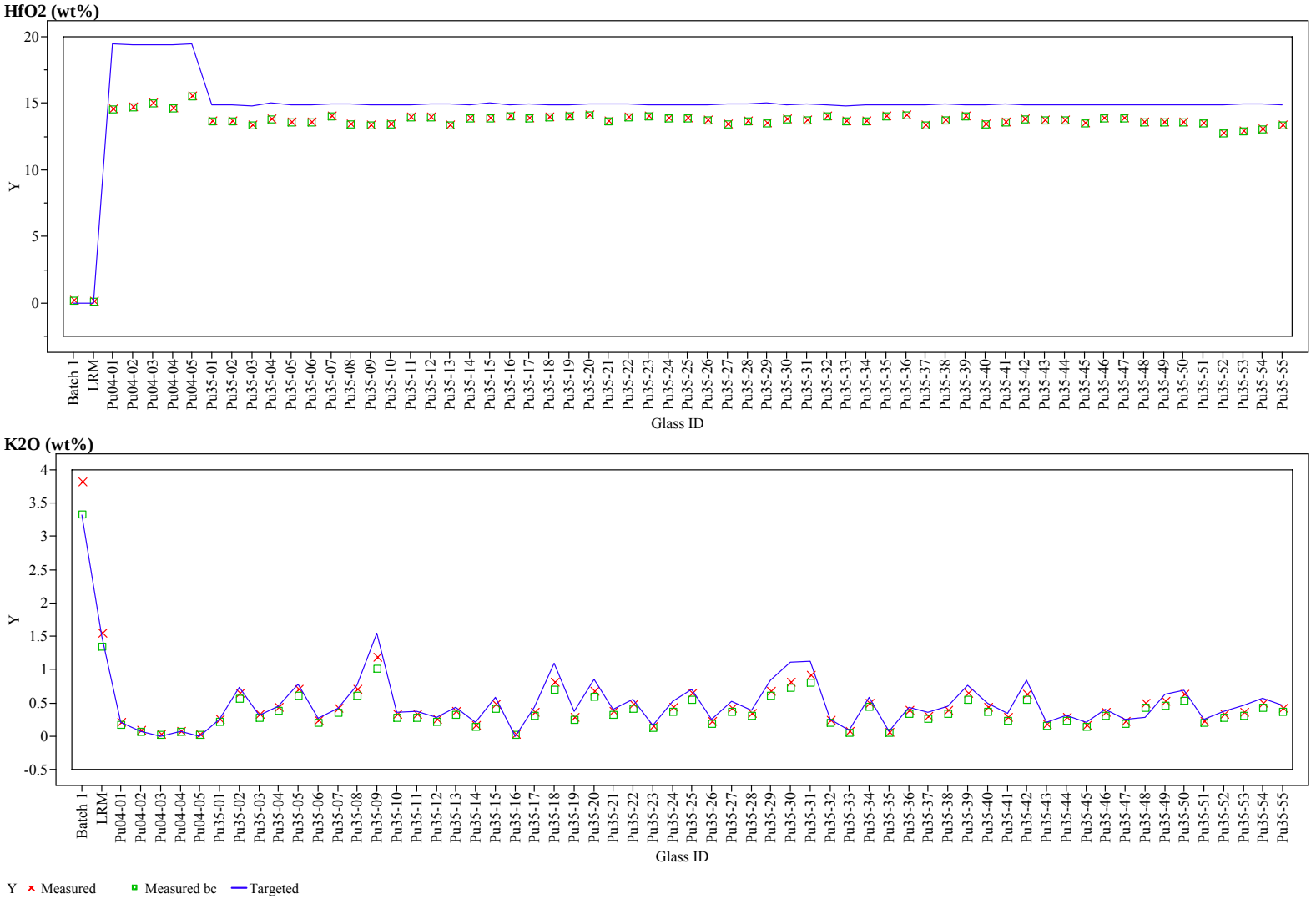


Exhibit D9. Average Measured and Bias-Corrected (bc) Versus Targeted Compositions by Glass ID by Analyte (continued)

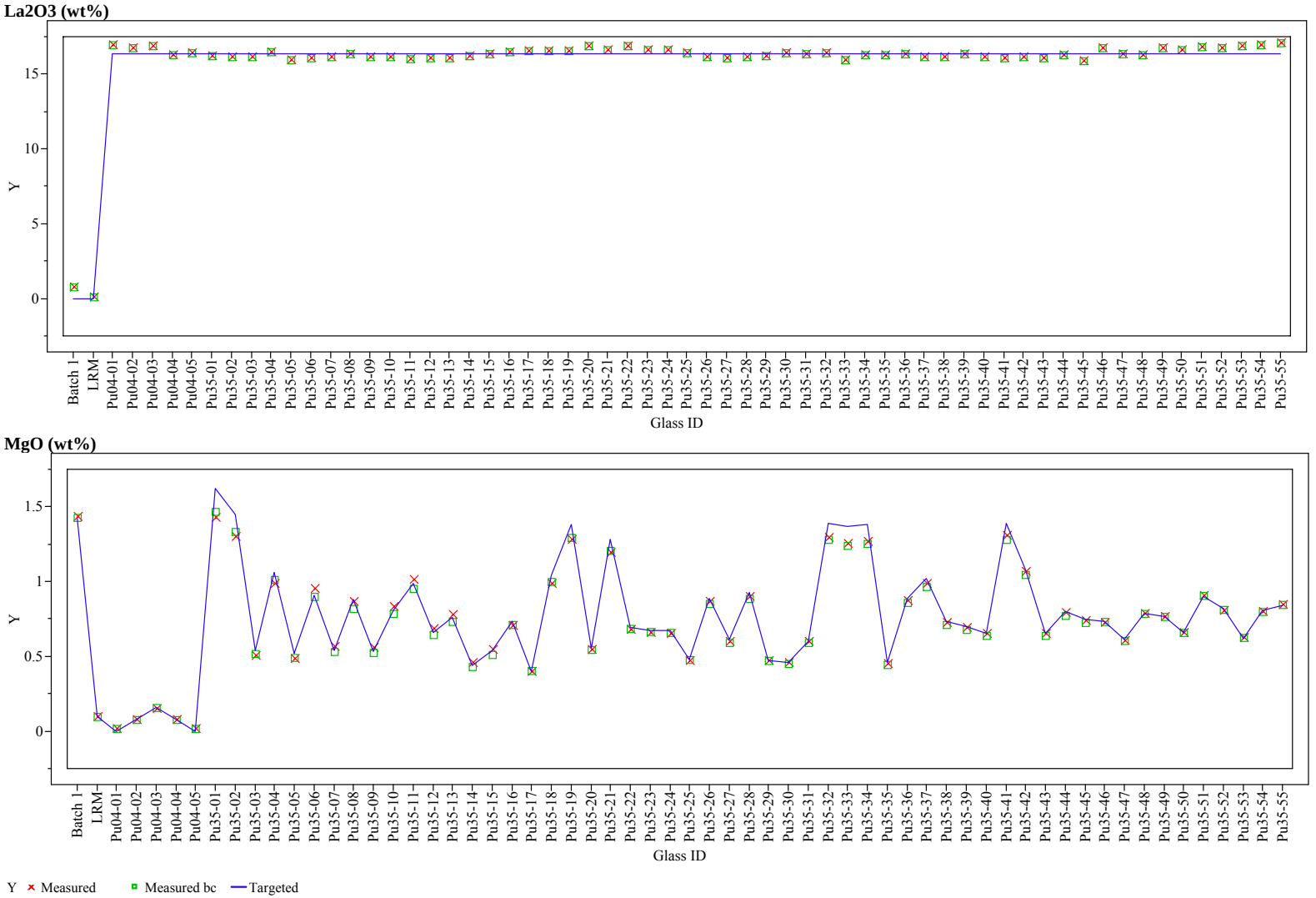


Exhibit D9. Average Measured and Bias-Corrected (bc) Versus Targeted Compositions by Glass ID by Analyte (continued)

Exhibit D9. Average Measured and Bias-Corrected (bc) Versus Targeted Compositions by Glass ID by Analyte (continued)

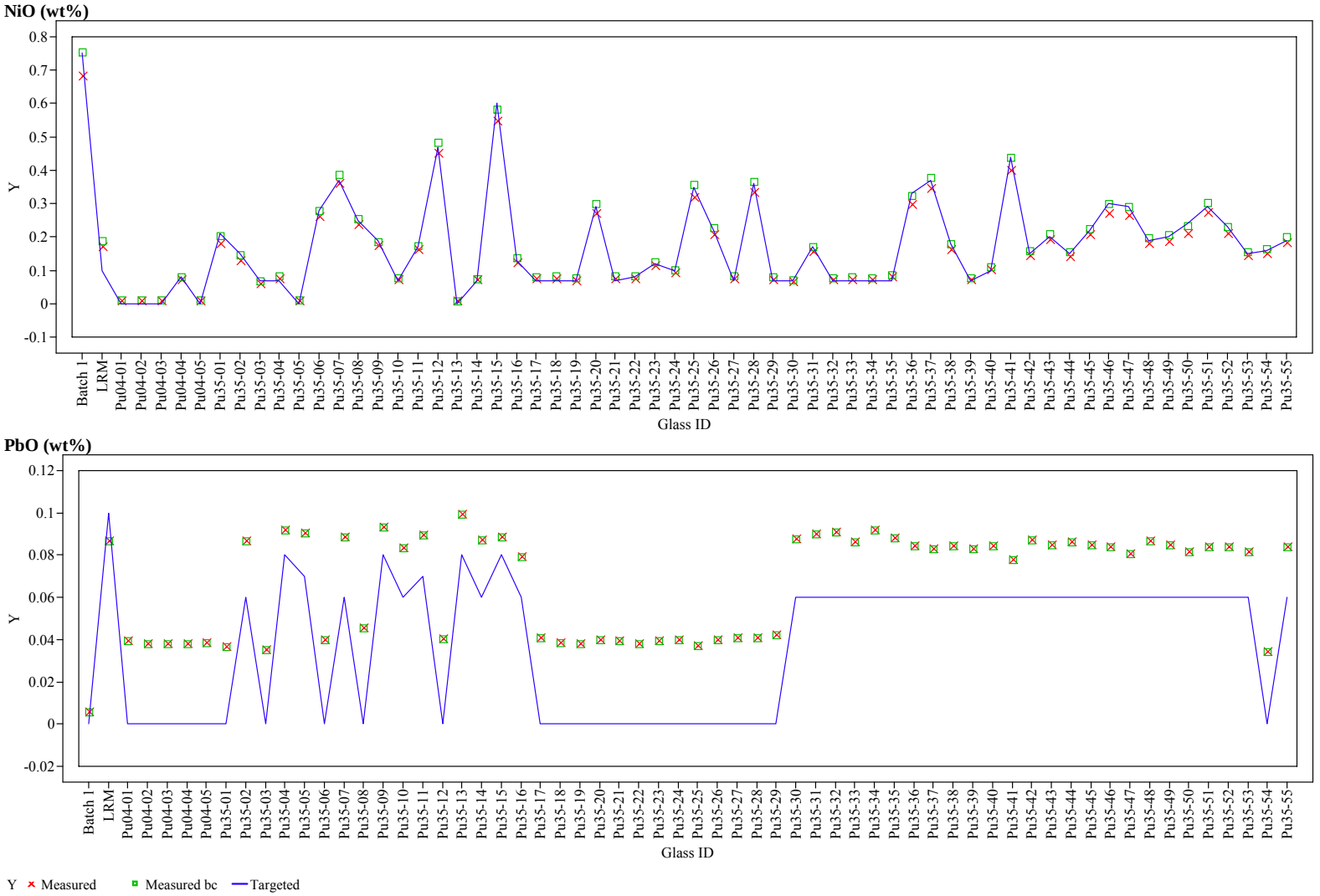


Exhibit D9. Average Measured and Bias-Corrected (bc) Versus Targeted Compositions by Glass ID by Analyte (continued)

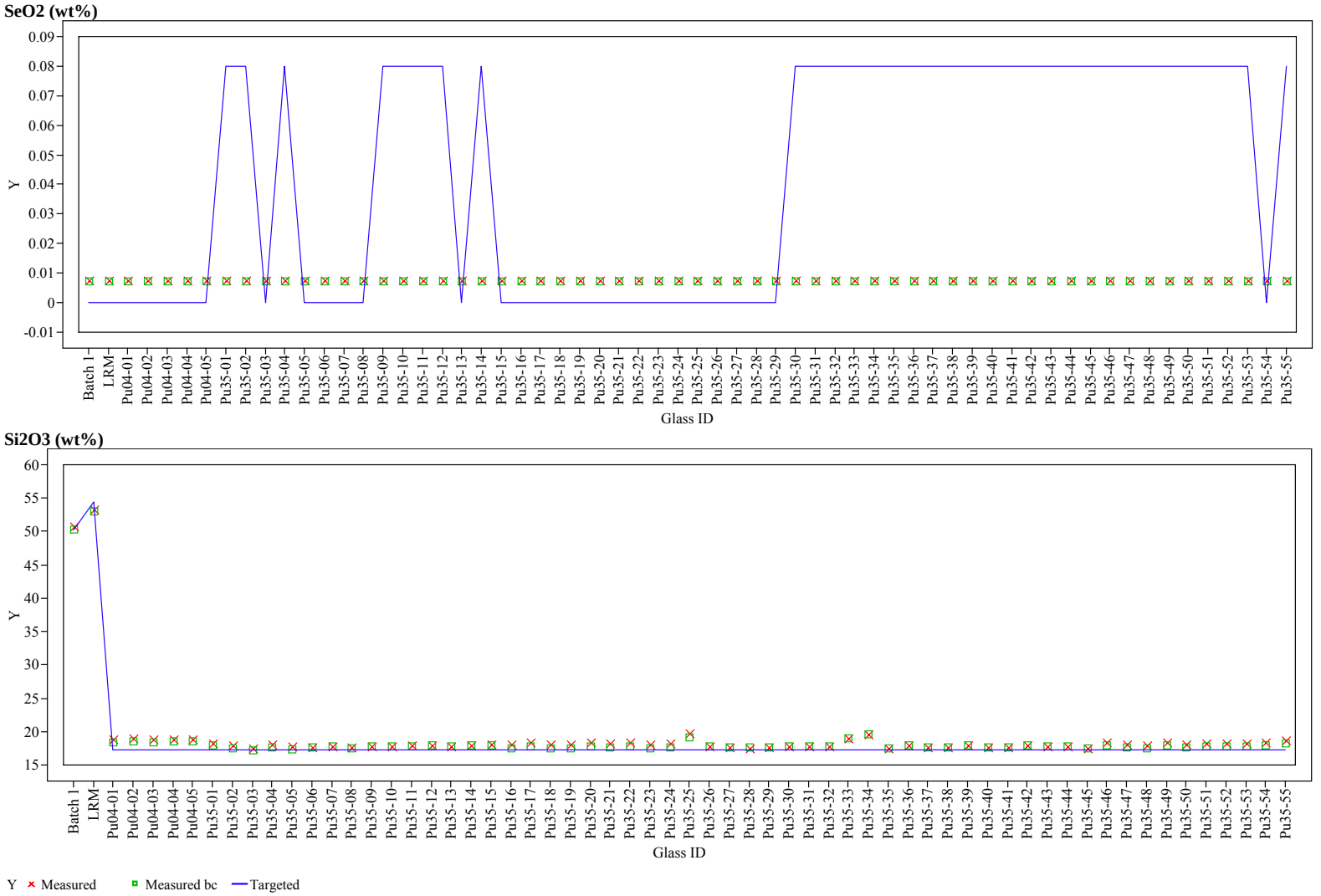


Exhibit D9. Average Measured and Bias-Corrected (bc) Versus Targeted Compositions by Glass ID by Analyte (continued)

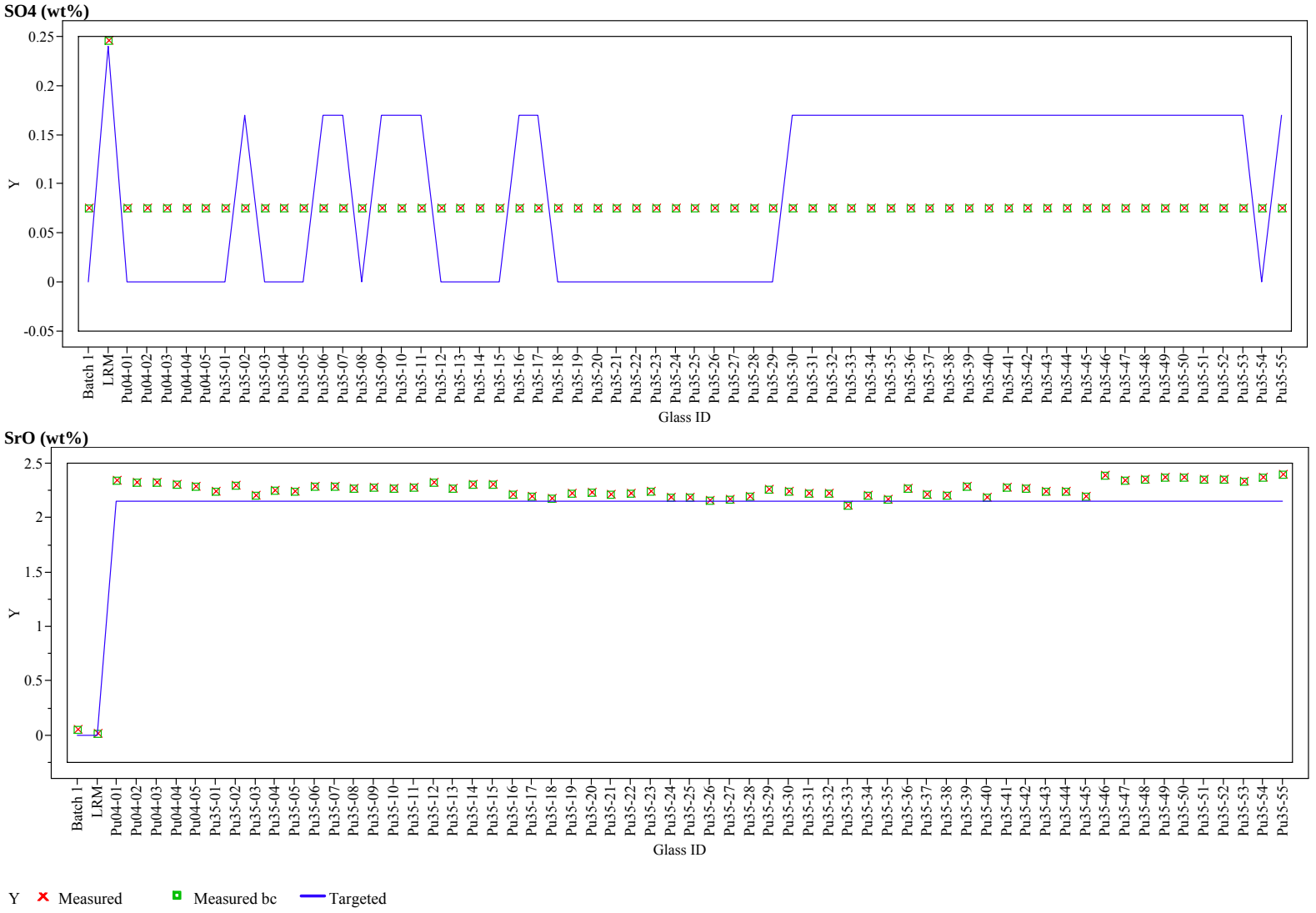
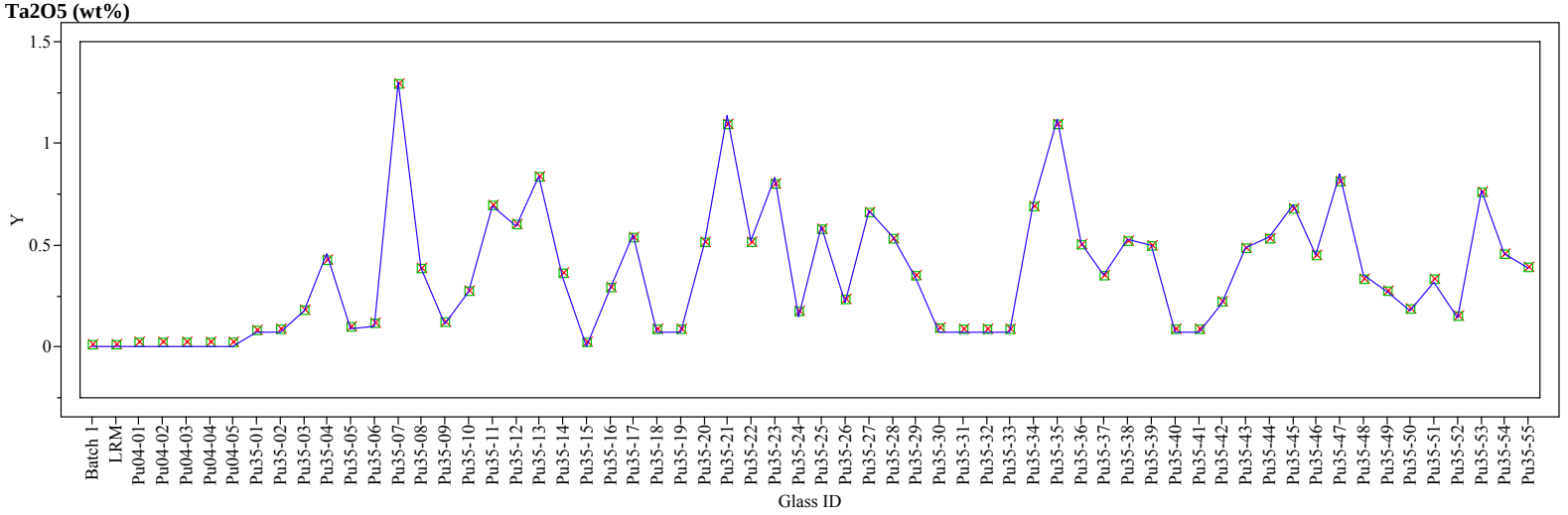


Exhibit D9. Average Measured and Bias-Corrected (bc) Versus Targeted Compositions by Glass ID by Analyte (continued)

Ta2O5 (wt%)



Sum of Oxides

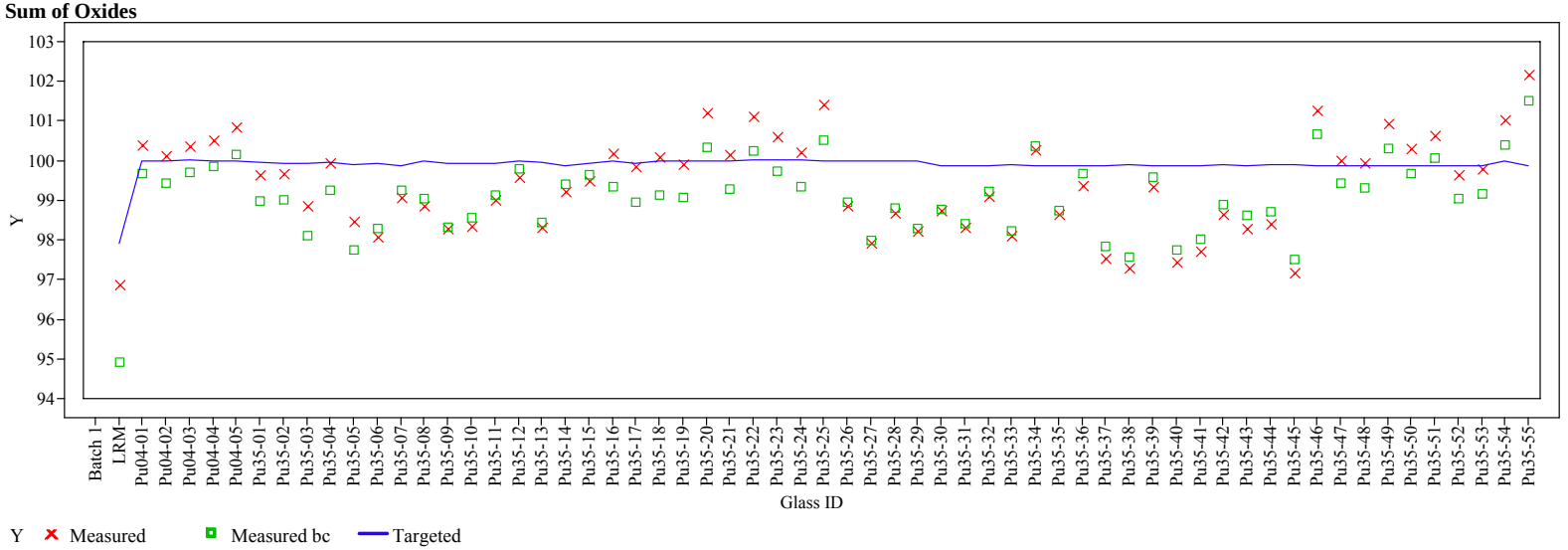
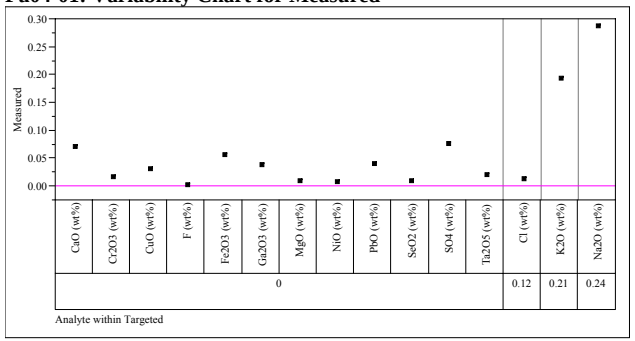
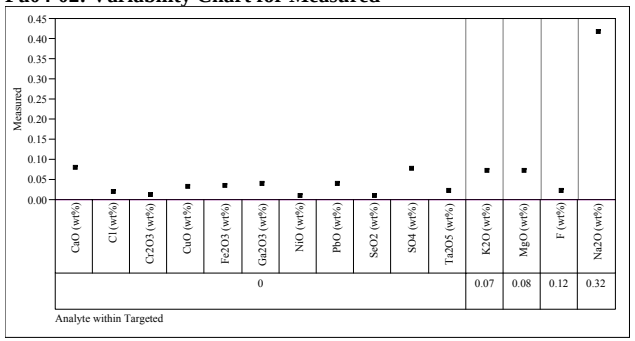


Exhibit D10. Measured Impurity Levels by Study Glass Sorted by Targeted Concentrations

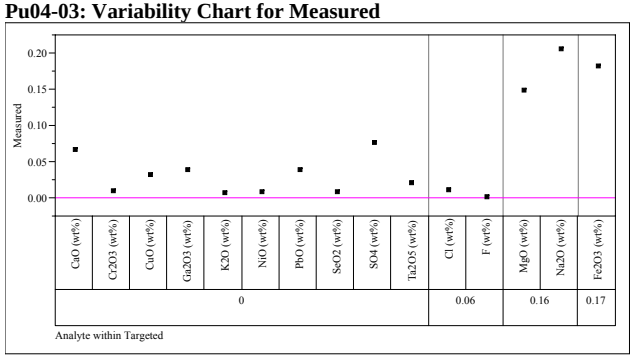
Pu04-01: Variability Chart for Measured



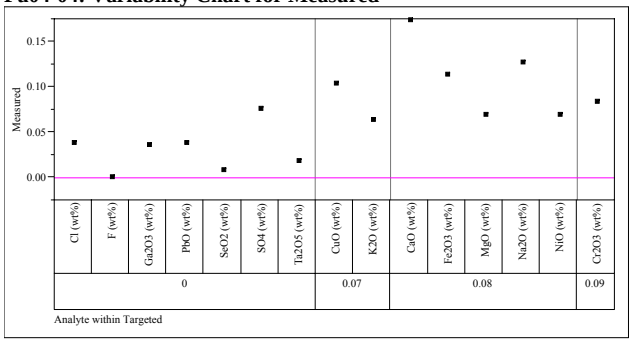
Pu04-02: Variability Chart for Measured



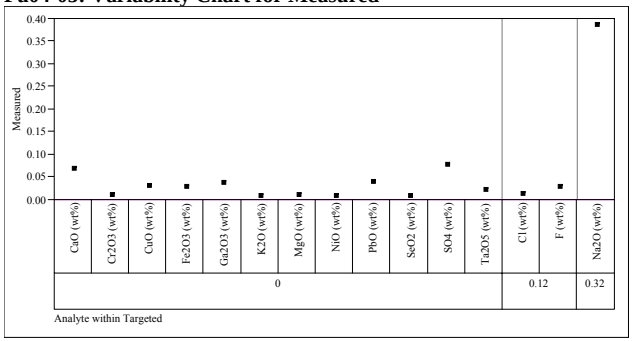
Pu04-03: Variability Chart for Measured



Pu04-04: Variability Chart for Measured



Pu04-05: Variability Chart for Measured



Pu35-01: Variability Chart for Measured

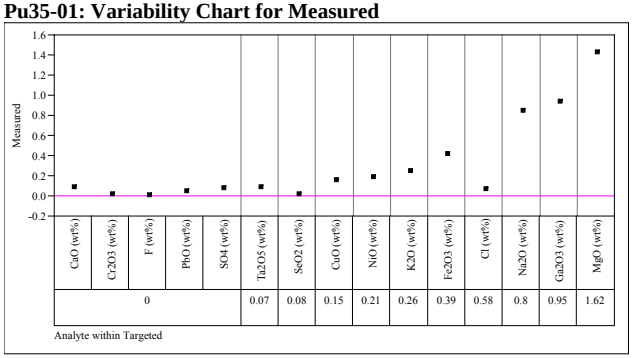
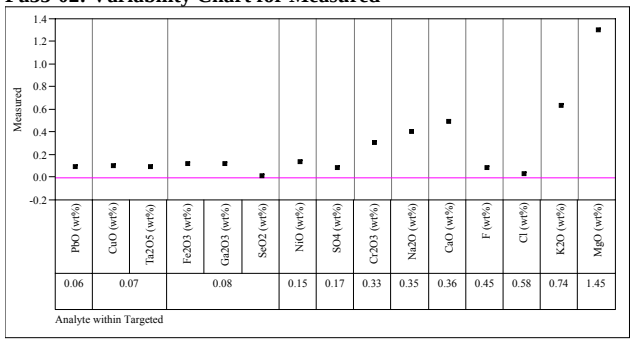
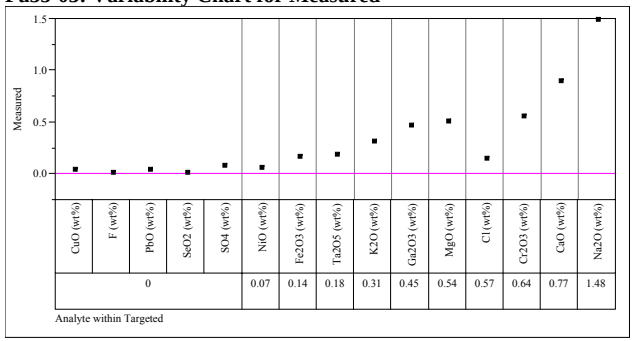


Exhibit D10. Measured Impurity Levels by Study Glass Sorted by Targeted Concentrations (continued)

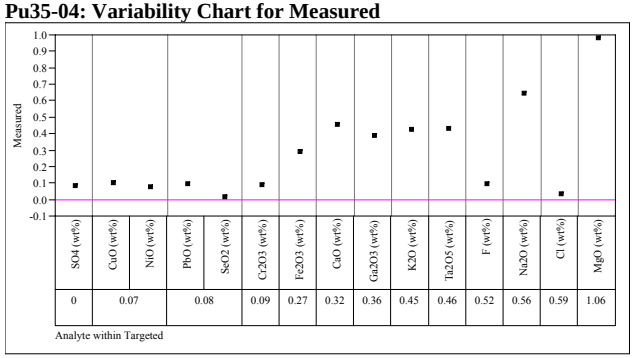
Pu35-02: Variability Chart for Measured



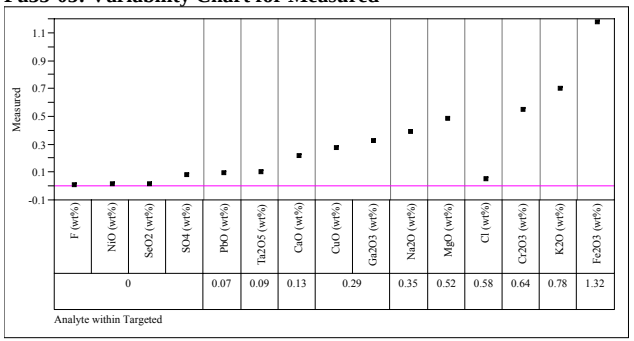
Pu35-03: Variability Chart for Measured



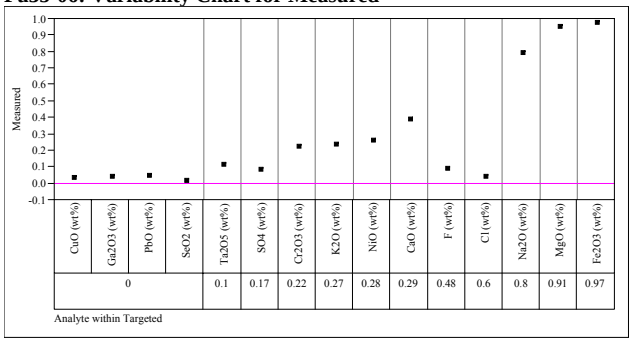
Pu35-04: Variability Chart for Measured



Pu35-05: Variability Chart for Measured



Pu35-06: Variability Chart for Measured



Pu35-07: Variability Chart for Measured

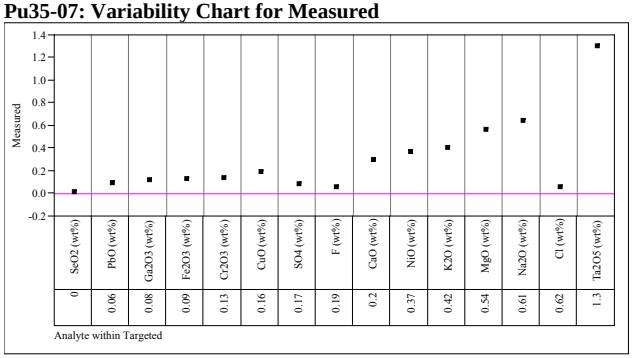
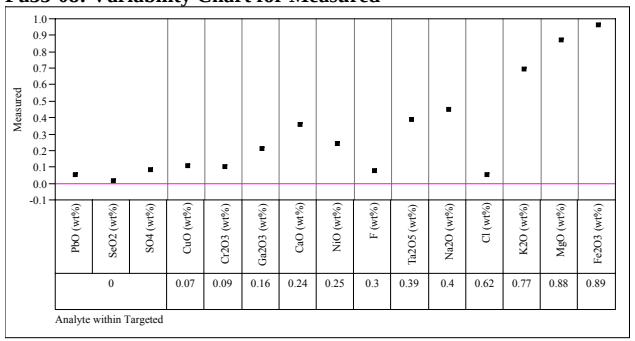
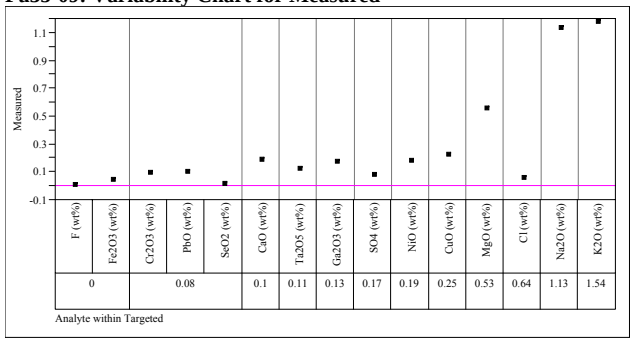


Exhibit D10. Measured Impurity Levels by Study Glass Sorted by Targeted Concentrations (continued)

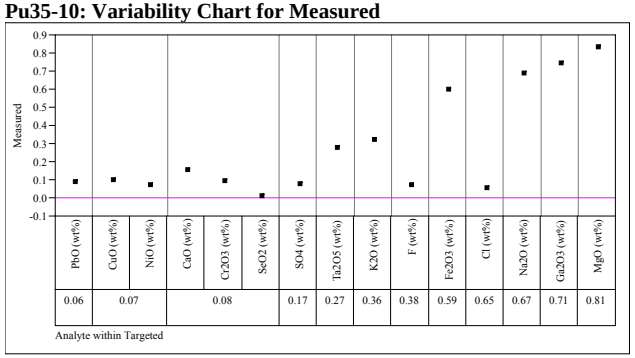
Pu35-08: Variability Chart for Measured



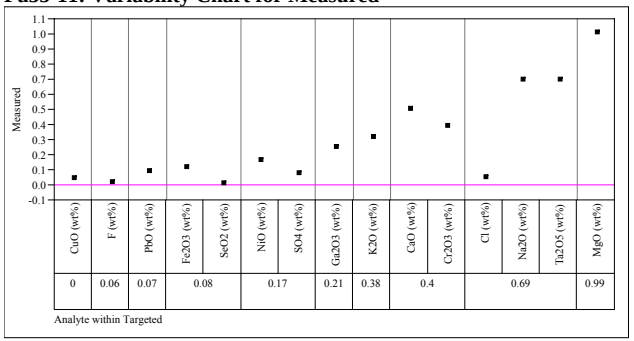
Pu35-09: Variability Chart for Measured



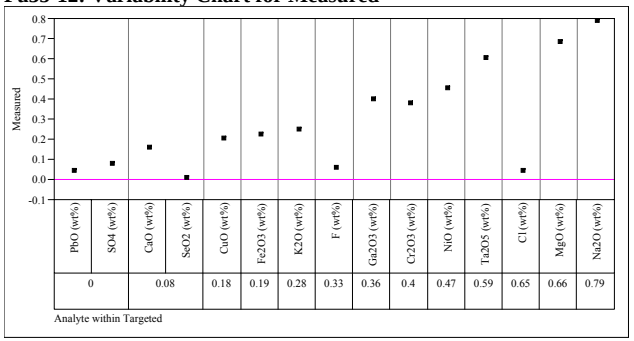
Pu35-10: Variability Chart for Measured



Pu35-11: Variability Chart for Measured



Pu35-12: Variability Chart for Measured



Pu35-13: Variability Chart for Measured

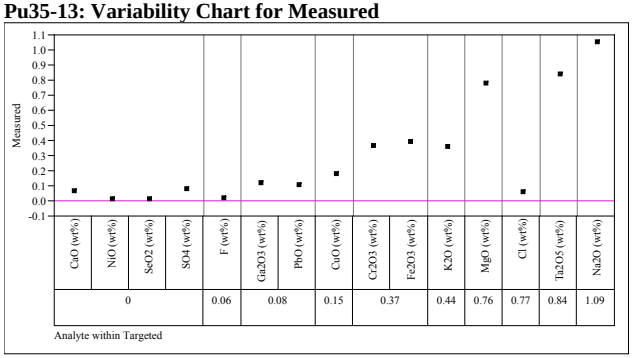
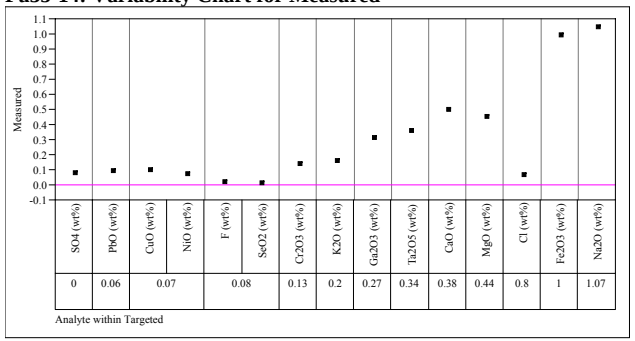
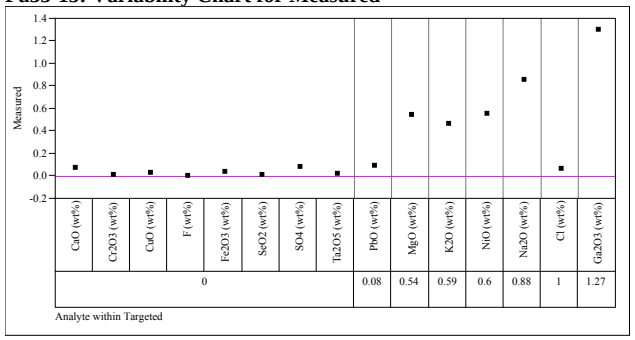


Exhibit D10. Measured Impurity Levels by Study Glass Sorted by Targeted Concentrations (continued)

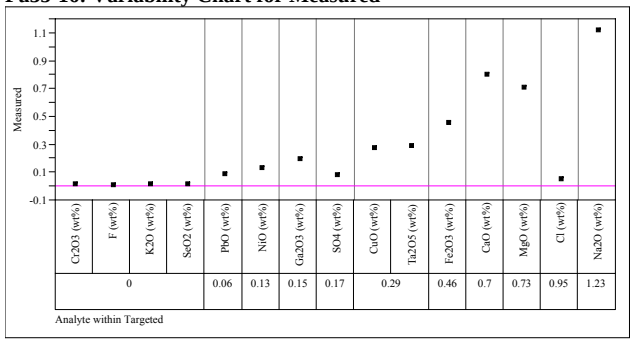
Pu35-14: Variability Chart for Measured



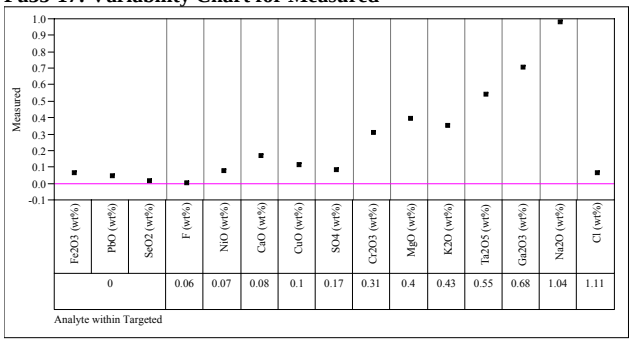
Pu35-15: Variability Chart for Measured



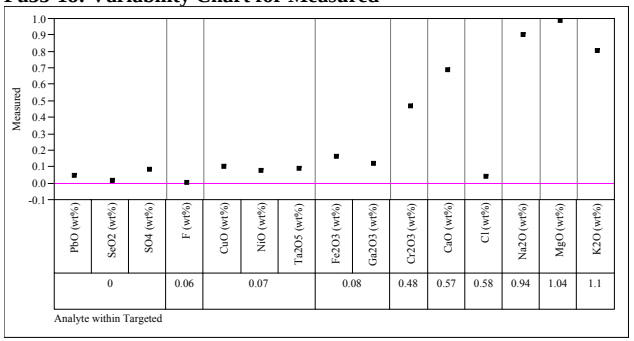
Pu35-16: Variability Chart for Measured



Pu35-17: Variability Chart for Measured



Pu35-18: Variability Chart for Measured



Pu35-19: Variability Chart for Measured

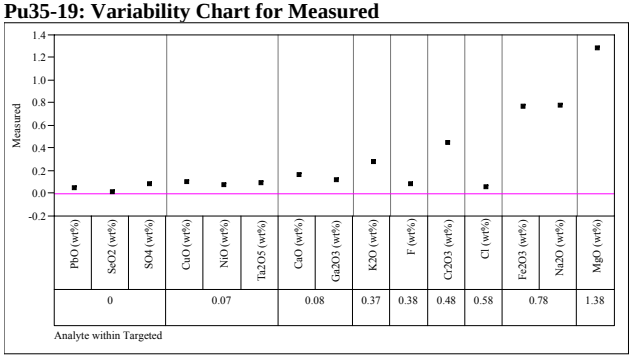
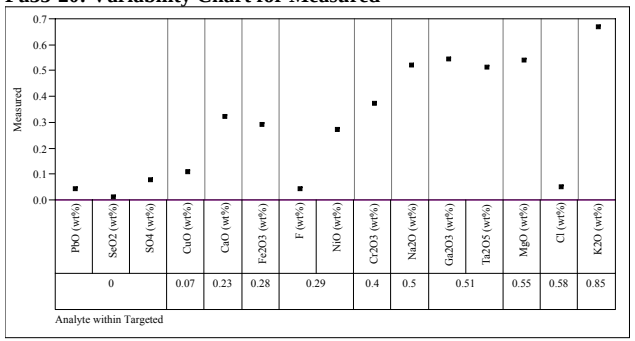
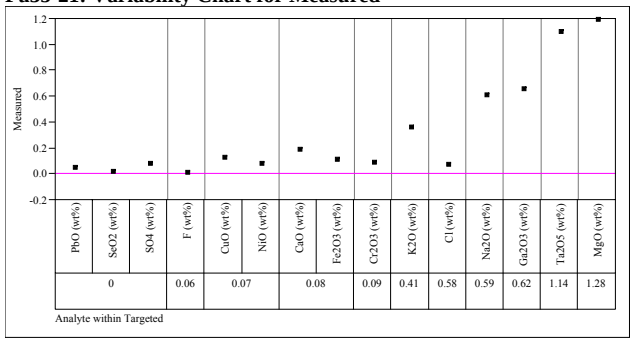


Exhibit D10. Measured Impurity Levels by Study Glass Sorted by Targeted Concentrations (continued)

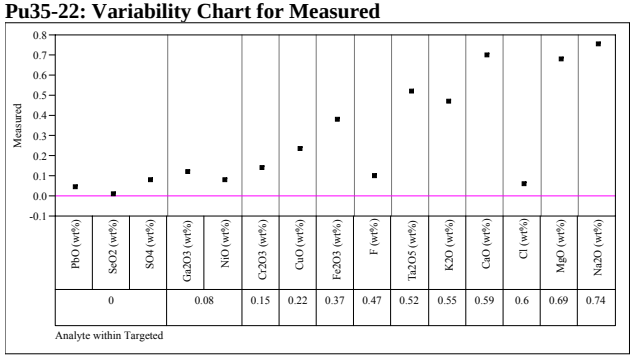
Pu35-20: Variability Chart for Measured



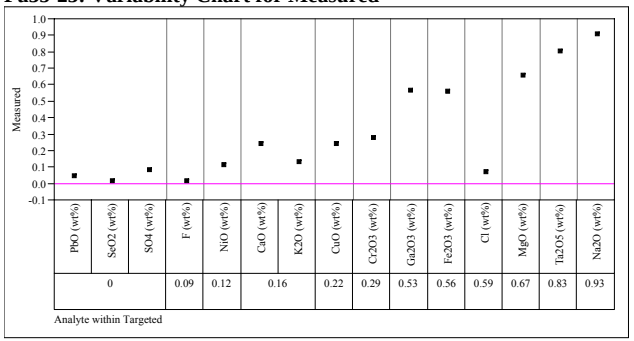
Pu35-21: Variability Chart for Measured



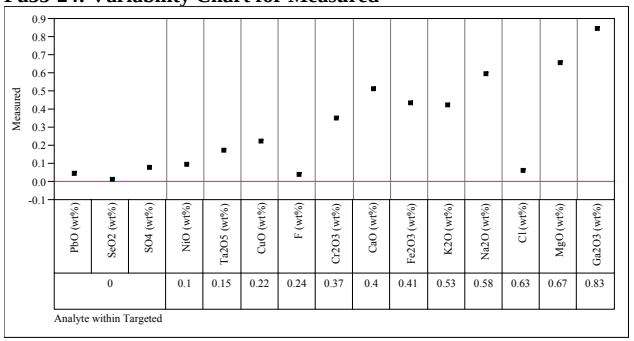
Pu35-22: Variability Chart for Measured



Pu35-23: Variability Chart for Measured



Pu35-24: Variability Chart for Measured



Pu35-25: Variability Chart for Measured

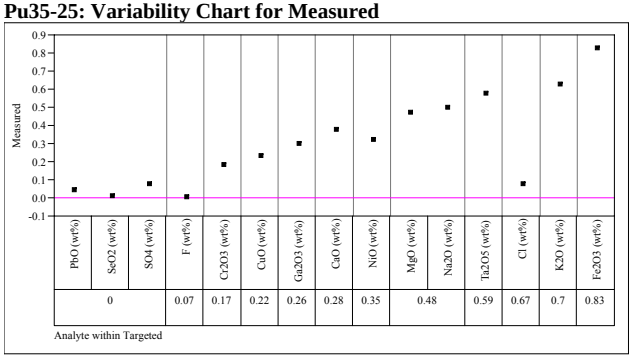
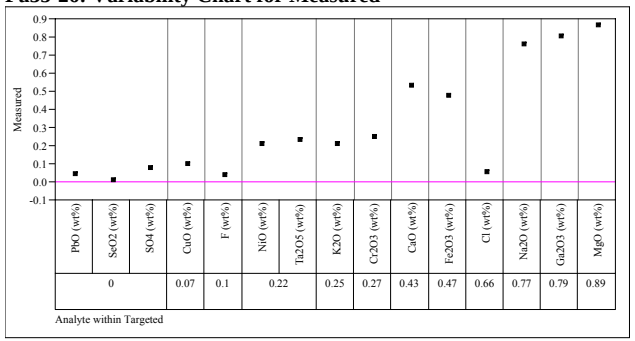
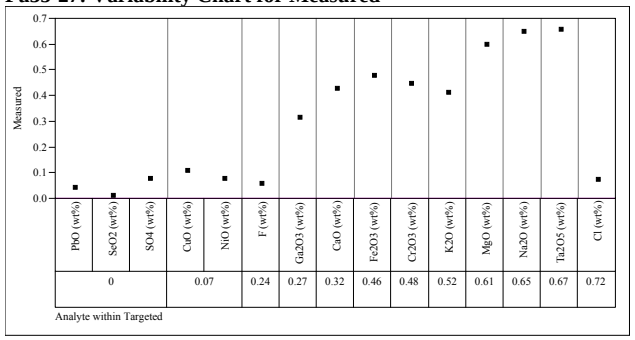


Exhibit D10. Measured Impurity Levels by Study Glass Sorted by Targeted Concentrations (continued)

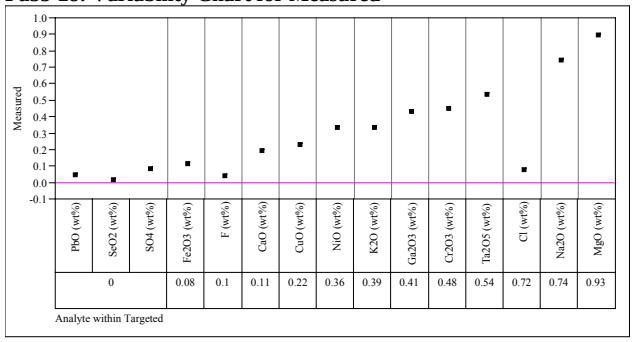
Pu35-26: Variability Chart for Measured



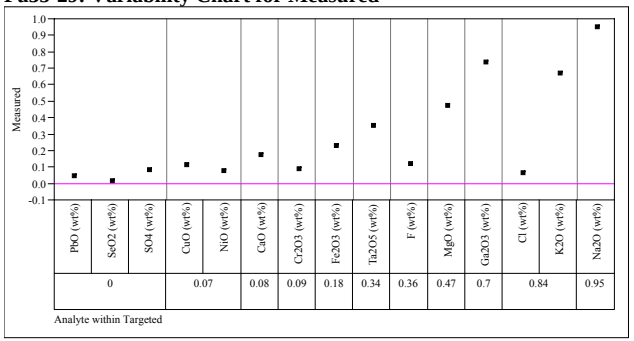
Pu35-27: Variability Chart for Measured



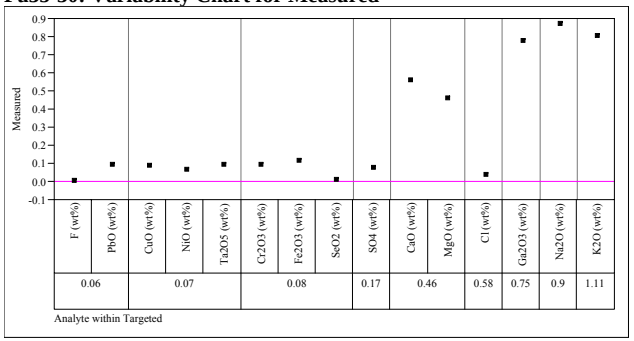
Pu35-28: Variability Chart for Measured



Pu35-29: Variability Chart for Measured



Pu35-30: Variability Chart for Measured



Pu35-31: Variability Chart for Measured

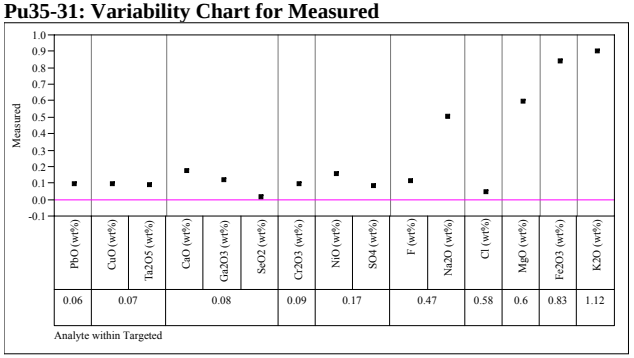
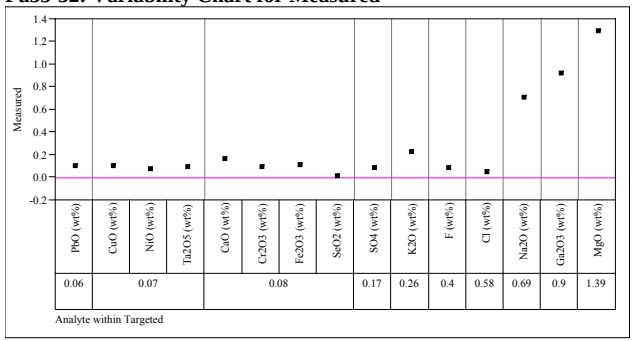
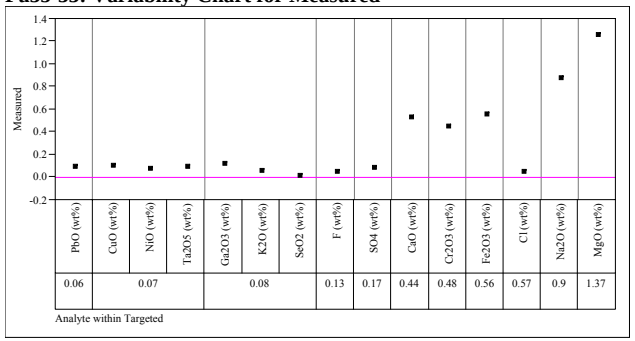


Exhibit D10. Measured Impurity Levels by Study Glass Sorted by Targeted Concentrations (continued)

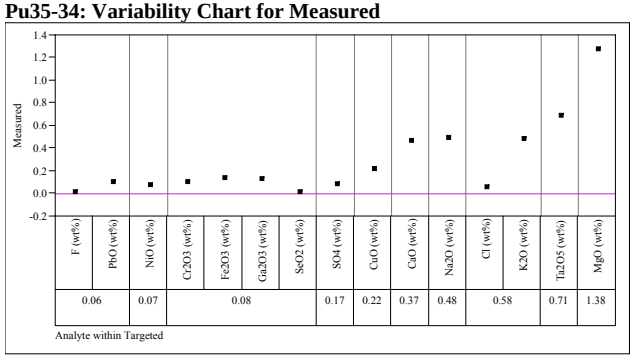
Pu35-32: Variability Chart for Measured



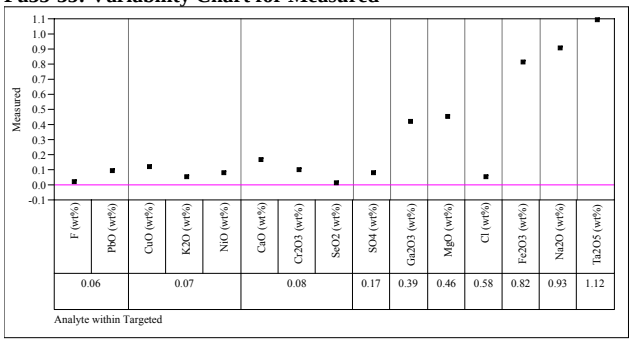
Pu35-33: Variability Chart for Measured



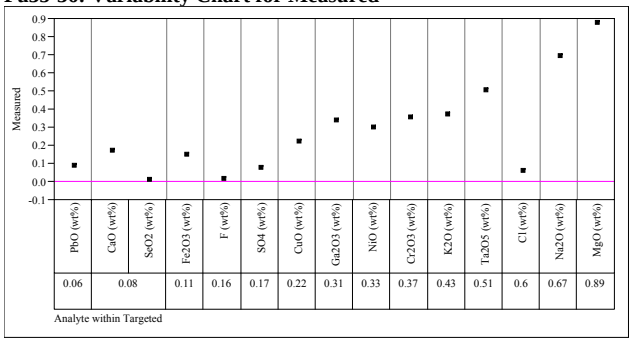
Pu35-34: Variability Chart for Measured



Pu35-35: Variability Chart for Measured



Pu35-36: Variability Chart for Measured



Pu35-37: Variability Chart for Measured

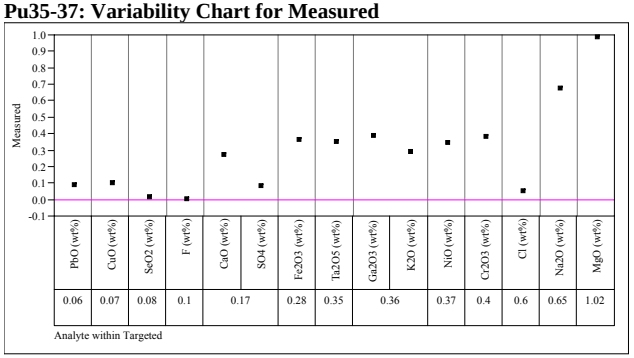
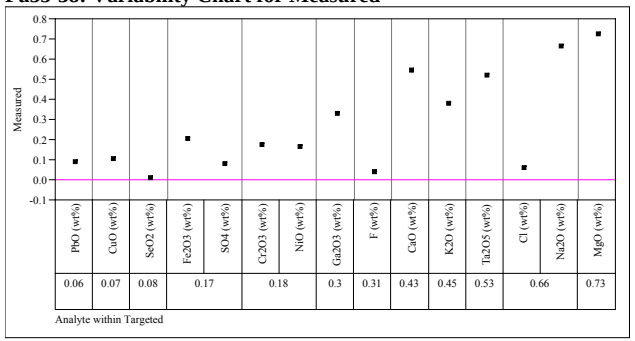
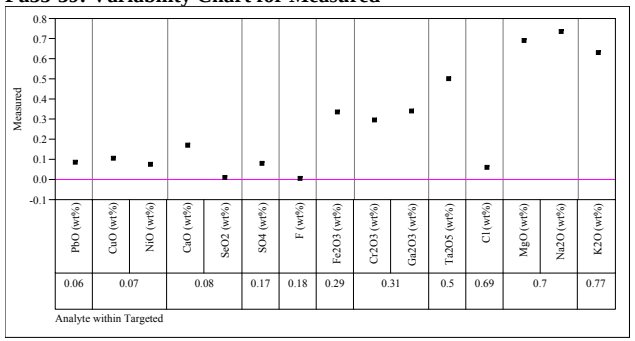


Exhibit D10. Measured Impurity Levels by Study Glass Sorted by Targeted Concentrations (continued)

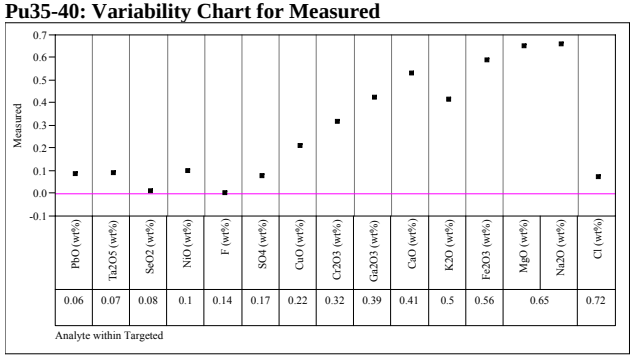
Pu35-38: Variability Chart for Measured



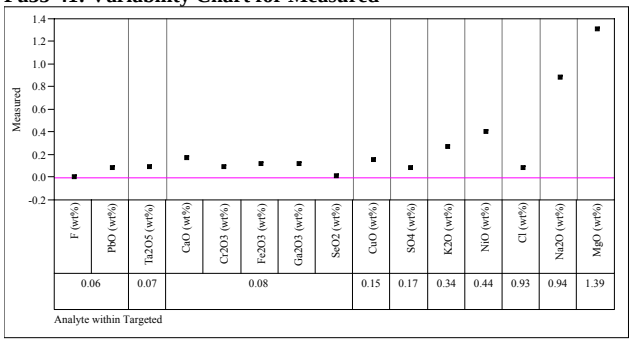
Pu35-39: Variability Chart for Measured



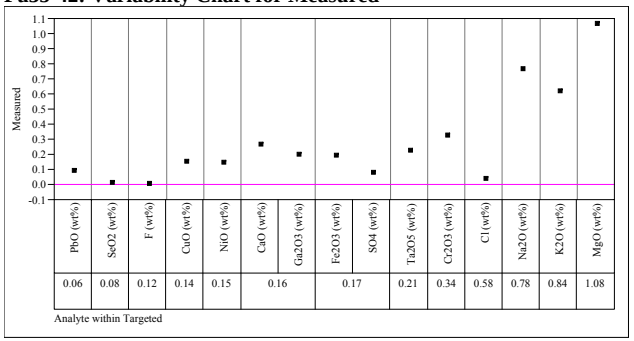
Pu35-40: Variability Chart for Measured



Pu35-41: Variability Chart for Measured



Pu35-42: Variability Chart for Measured



Pu35-43: Variability Chart for Measured

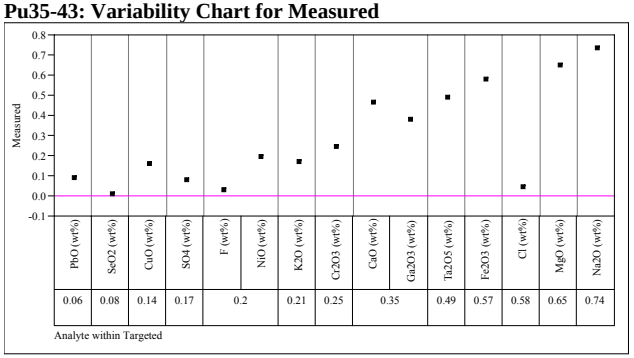
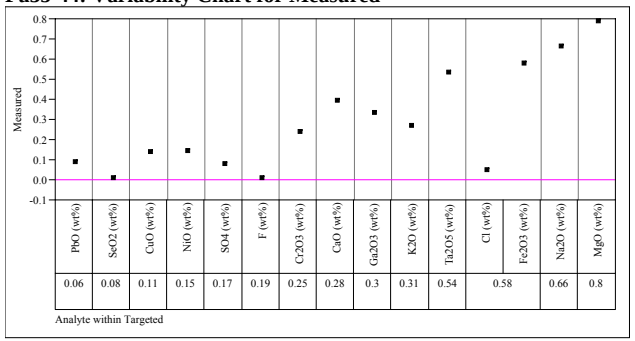
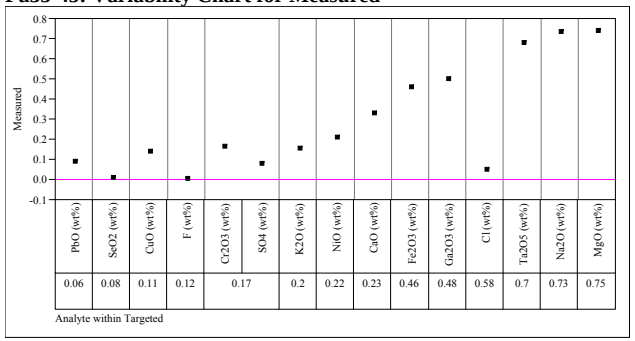


Exhibit D10. Measured Impurity Levels by Study Glass Sorted by Targeted Concentrations (continued)

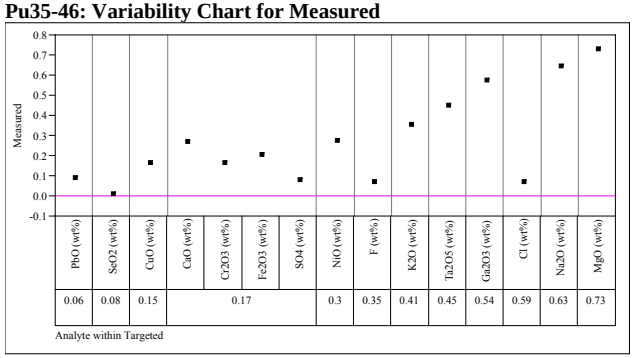
Pu35-44: Variability Chart for Measured



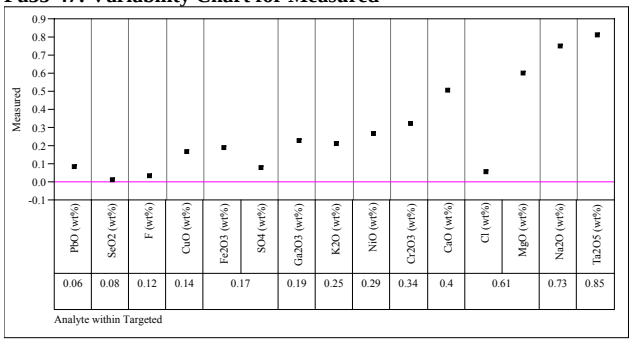
Pu35-45: Variability Chart for Measured



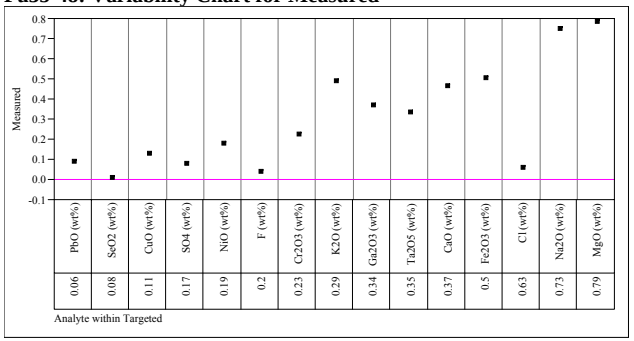
Pu35-46: Variability Chart for Measured



Pu35-47: Variability Chart for Measured



Pu35-48: Variability Chart for Measured



Pu35-49: Variability Chart for Measured

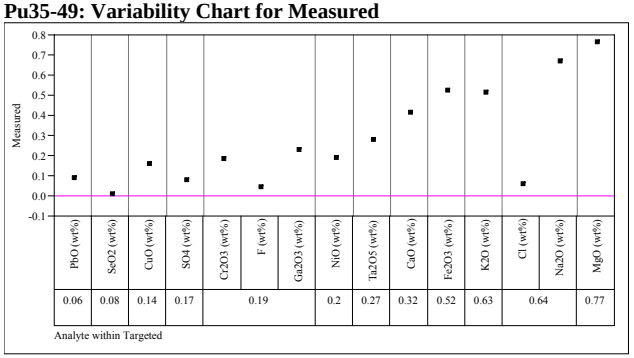
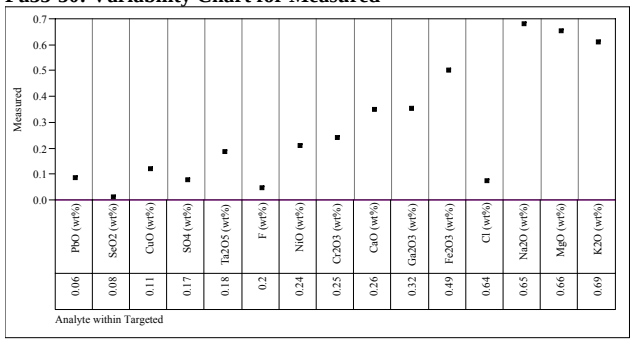
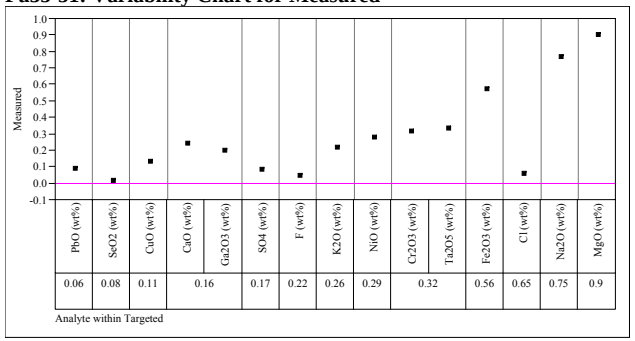


Exhibit D10. Measured Impurity Levels by Study Glass Sorted by Targeted Concentrations (continued)

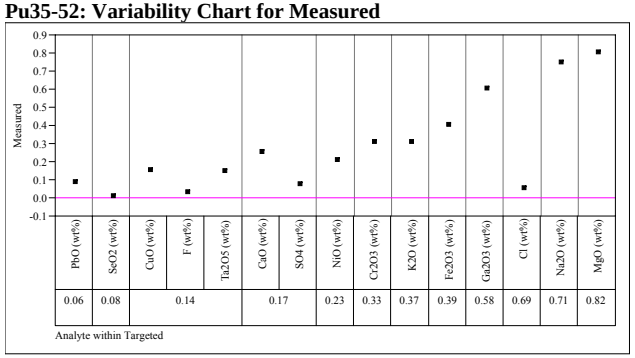
Pu35-50: Variability Chart for Measured



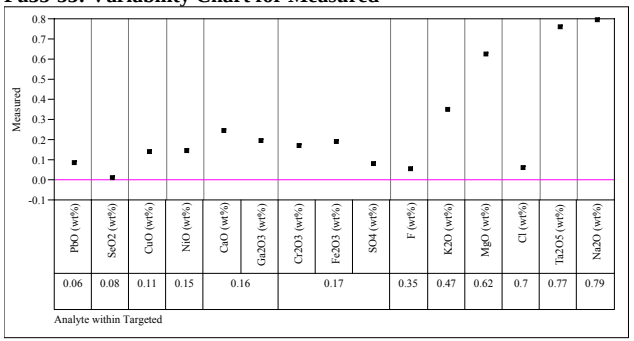
Pu35-51: Variability Chart for Measured



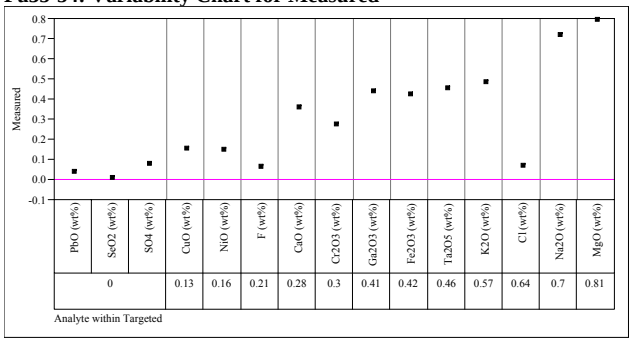
Pu35-52: Variability Chart for Measured



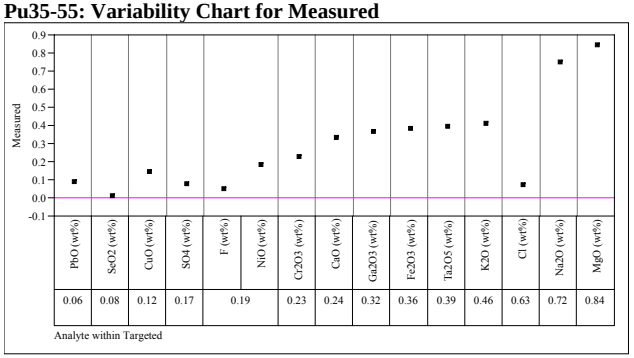
Pu35-53: Variability Chart for Measured



Pu35-54: Variability Chart for Measured



Pu35-55: Variability Chart for Measured



Appendix E

Tables and Exhibits Supporting the Analysis of the PCT Results
for the Surrogate Pu Impurity Variability Study Glasses

Table E1. Laboratory Measurements of the PCT Solutions for the Pu Study Glasses As Reported (ar) and After the Appropriate Adjustments (in parts per million, ppm)

Heat Treament	Set	Glass ID	Block	Seq	SRNL-ML ID	B ar	Gd ar	Hf ar	Na ar	Si ar	B (ppm)	Gd (ppm)	Hf (ppm)	Na (ppm)	Si (ppm)
	1	Soln Std	1	1	STD-11-1	21.8	<0.100	<0.500	83.2	49	21.8	0.05	0.25	83.2	49
quenched	1	Pu35-01	1	2	C62	1.18	<0.100	<0.500	<0.100	<0.100	1.966706	0.083335	0.416675	0.083335	0.083335
quenched	1	Pu35-06	1	3	C45	<1.00	<0.100	<0.500	<0.100	<0.100	0.83335	0.083335	0.416675	0.083335	0.083335
quenched	1	Pu04-05	1	4	C49	<1.00	<0.100	<0.500	<0.100	<0.100	0.83335	0.083335	0.416675	0.083335	0.083335
quenched	1	Pu35-08	1	5	C08	<1.00	<0.100	<0.500	<0.100	<0.100	0.83335	0.083335	0.416675	0.083335	0.083335
quenched	1	Pu04-04	1	6	C55	<1.00	<0.100	<0.500	<0.100	<0.100	0.83335	0.083335	0.416675	0.083335	0.083335
quenched	1	Pu35-05	1	7	C32	<1.00	<0.100	<0.500	<0.100	2.39	0.83335	0.083335	0.416675	0.083335	3.983413
	1	blank	1	8	C21	<1.00	<0.100	<0.500	<0.100	<0.100	0.83335	0.083335	0.416675	0.083335	0.083335
quenched	1	Pu35-15	1	9	C37	<1.00	<0.100	<0.500	<0.100	<0.100	0.83335	0.083335	0.416675	0.083335	0.083335
quenched	1	Pu35-12	1	10	C42	<1.00	<0.100	<0.500	<0.100	<0.100	0.83335	0.083335	0.416675	0.083335	0.083335
quenched	1	Pu35-11	1	11	C51	<1.00	<0.100	<0.500	<0.100	<0.100	0.83335	0.083335	0.416675	0.083335	0.083335
quenched	1	Pu35-09	1	12	C50	<1.00	<0.100	<0.500	<0.100	2.15	0.83335	0.083335	0.416675	0.083335	3.583405
	1	Soln Std	1	13	STD-11-2	20.8	<0.100	<0.500	82.4	49.1	20.8	0.05	0.25	82.4	49.1
quenched	1	Pu35-04	1	14	C24	1.1	<0.100	<0.500	<0.100	<0.100	1.83337	0.083335	0.416675	0.083335	0.083335
quenched	1	Pu35-10	1	15	C23	<1.00	<0.100	<0.500	<0.100	<0.100	0.83335	0.083335	0.416675	0.083335	0.083335
quenched	1	Pu04-02	1	16	C15	<1.00	<0.100	<0.500	<0.100	<0.100	0.83335	0.083335	0.416675	0.083335	0.083335
quenched	1	Pu35-03	1	17	C58	<1.00	<0.100	<0.500	<0.100	<0.100	0.83335	0.083335	0.416675	0.083335	0.083335
quenched	1	Pu35-02	1	18	C11	<1.00	<0.100	<0.500	<0.100	2.09	0.83335	0.083335	0.416675	0.083335	3.483403
	1	EA	1	19	C36	41.3	<0.100	<0.500	108	58.3	688.33471	0.833335	4.166675	1800.0036	971.66861
	1	ARM-1	1	20	C16	11.1	<0.100	<0.500	21.3	35.5	18.50037	0.083335	0.416675	35.50071	59.16785
quenched	1	Pu35-13	1	21	C09	<1.00	<0.100	<0.500	<0.100	<0.100	0.83335	0.083335	0.416675	0.083335	0.083335
quenched	1	Pu35-14	1	22	C29	<1.00	<0.100	<0.500	<0.100	<0.100	0.83335	0.083335	0.416675	0.083335	0.083335
quenched	1	Pu04-01	1	23	C04	<1.00	<0.100	<0.500	<0.100	<0.100	0.83335	0.083335	0.416675	0.083335	0.083335
quenched	1	Pu35-07	1	24	C22	<1.00	<0.100	<0.500	<0.100	<0.100	0.83335	0.083335	0.416675	0.083335	0.083335
quenched	1	Pu04-03	1	25	C26	<1.00	<0.100	<0.500	<0.100	<0.100	0.83335	0.083335	0.416675	0.083335	0.083335
	1	Soln Std	1	26	STD-11-3	21.6	<0.100	<0.500	85	51.8	21.6	0.05	0.25	85	51.8
	1	Soln Std	2	1	STD-12-1	21.5	<0.100	<0.500	82.8	49.7	21.5	0.05	0.25	82.8	49.7
quenched	1	Pu35-09	2	2	C40	1.77	<0.100	<0.500	<0.100	3.01	2.950059	0.083335	0.416675	0.083335	5.016767
quenched	1	Pu35-13	2	3	C12	1.01	<0.100	<0.500	1.16	0.564	1.683367	0.083335	0.416675	1.933372	0.9400188
quenched	1	Pu35-07	2	4	C35	<1.00	<0.100	<0.500	<0.100	0.1	0.83335	0.083335	0.416675	0.083335	0.16667
quenched	1	Pu35-15	2	5	C02	<1.00	<0.100	<0.500	<0.100	0.107	0.83335	0.083335	0.416675	0.083335	0.1783369
quenched	1	Pu04-04	2	6	C53	<1.00	<0.100	<0.500	<0.100	<0.100	0.83335	0.083335	0.416675	0.083335	0.083335
quenched	1	Pu35-06	2	7	C56	<1.00	<0.100	<0.500	<0.100	<0.100	0.83335	0.083335	0.416675	0.083335	0.083335

Table E1. Laboratory Measurements of the PCT Solutions for the Pu Study Glasses As Reported (ar) and After the Appropriate Adjustments (in parts per million, ppm)
(continued)

Heat Treament	Set	Glass ID	Block	Seq	SRNL-ML ID	B ar	Gd ar	Hf ar	Na ar	Si ar	B (ppm)	Gd (ppm)	Hf (ppm)	Na (ppm)	Si (ppm)
quenched	1	Pu35-02	2	8	C57	<1.00	<0.100	<0.500	<0.100	<0.100	0.83335	0.083335	0.416675	0.083335	0.083335
quenched	1	Pu35-11	2	9	C47	<1.00	<0.100	<0.500	<0.100	<0.100	0.83335	0.083335	0.416675	0.083335	0.083335
quenched	1	Pu35-01	2	10	C39	<1.00	<0.100	<0.500	<0.100	<0.100	0.83335	0.083335	0.416675	0.083335	0.083335
quenched	1	Pu35-12	2	11	C34	<1.00	<0.100	<0.500	<0.100	<0.100	0.83335	0.083335	0.416675	0.083335	0.083335
quenched	1	Pu04-05	2	12	C03	<1.00	<0.100	<0.500	<0.100	<0.100	0.83335	0.083335	0.416675	0.083335	0.083335
	1	Soln Std	2	13	STD-12-2	19.2	<0.100	<0.500	83.3	49.3	19.2	0.05	0.25	83.3	49.3
quenched	1	Pu35-08	2	14	C17	1.12	<0.100	<0.500	<0.100	0.827	1.866704	0.083335	0.416675	0.083335	1.3783609
quenched	1	Pu35-03	2	15	C14	<1.00	<0.100	<0.500	<0.100	0.44	0.83335	0.083335	0.416675	0.083335	0.733348
	1	ARM-1	2	16	C43	9.57	<0.100	<0.500	20.7	35.4	15.950319	0.083335	0.416675	34.50069	59.00118
quenched	1	Pu35-10	2	17	C33	<1.00	<0.100	<0.500	0.206	<0.100	0.83335	0.083335	0.416675	0.3433402	0.083335
quenched	1	Pu35-14	2	18	C46	<1.00	<0.100	<0.500	<0.100	<0.100	0.83335	0.083335	0.416675	0.083335	0.083335
quenched	1	Pu04-01	2	19	C41	<1.00	<0.100	<0.500	10.9	<0.100	0.83335	0.083335	0.416675	18.16703	0.083335
quenched	1	Pu35-05	2	20	C60	<1.00	<0.100	<0.500	8.57	1.55	0.83335	0.083335	0.416675	14.283619	2.583385
quenched	1	Pu04-02	2	21	C27	<1.00	<0.100	<0.500	4.1	<0.100	0.83335	0.083335	0.416675	6.83347	0.083335
	1	EA	2	22	C05	36.9	<0.100	<0.500	101	53.8	615.00123	0.833335	4.166675	1683.3367	896.66846
quenched	1	Pu04-03	2	23	C65	<1.00	<0.100	<0.500	<0.100	<0.100	0.83335	0.083335	0.416675	0.083335	0.083335
quenched	1	Pu35-04	2	24	C38	<1.00	<0.100	<0.500	<0.100	<0.100	0.83335	0.083335	0.416675	0.083335	0.083335
	1	Soln Std	2	25	STD-12-3	19.4	<0.100	<0.500	80.5	50	19.4	0.05	0.25	80.5	50
	1	Soln Std	3	1	STD-13-1	20.4	<0.100	<0.500	84.7	51.1	20.4	0.05	0.25	84.7	51.1
quenched	1	Pu04-01	3	2	C44	<1.00	<0.100	<0.500	0.559	0.807	0.83335	0.083335	0.416675	0.9316853	1.3450269
	1	ARM-1	3	3	C28	10	<0.100	<0.500	23.7	34.4	16.667	0.083335	0.416675	39.50079	57.33448
quenched	1	Pu35-03	3	4	C30	<1.00	<0.100	<0.500	<0.100	1.69	0.83335	0.083335	0.416675	0.083335	2.816723
	1	blank	3	5	C63	<1.00	<0.100	<0.500	<0.100	<0.100	0.83335	0.083335	0.416675	0.083335	0.083335
quenched	1	Pu35-13	3	6	C68	<1.00	<0.100	<0.500	0.615	2.09	0.83335	0.083335	0.416675	1.0250205	3.483403
quenched	1	Pu35-15	3	7	C07	<1.00	<0.100	<0.500	<0.100	<0.100	0.83335	0.083335	0.416675	0.083335	0.083335
quenched	1	Pu35-01	3	8	C67	<1.00	<0.100	<0.500	<0.100	<0.100	0.83335	0.083335	0.416675	0.083335	0.083335
quenched	1	Pu35-04	3	9	C52	<1.00	<0.100	<0.500	<0.100	<0.100	0.83335	0.083335	0.416675	0.083335	0.083335
quenched	1	Pu35-02	3	10	C19	<1.00	<0.100	<0.500	<0.100	0.433	0.83335	0.083335	0.416675	0.083335	0.7216811
quenched	1	Pu35-12	3	11	C20	<1.00	<0.100	<0.500	0.786	<0.100	0.83335	0.083335	0.416675	1.3100262	0.083335
quenched	1	Pu35-09	3	12	C18	<1.00	<0.100	<0.500	1.32	3.51	0.83335	0.083335	0.416675	2.200044	5.850117
	1	Soln Std	3	13	STD-13-2	19.9	<0.100	<0.500	84.6	50.5	19.9	0.05	0.25	84.6	50.5
quenched	1	Pu35-07	3	14	C25	<1.00	<0.100	<0.500	<0.100	1.17	0.83335	0.083335	0.416675	0.083335	1.950039
	1	EA	3	15	C54	38.2	<0.100	<0.500	107	54.4	636.66794	0.833335	4.166675	1783.3369	906.66848
quenched	1	Pu35-06	3	16	C31	<1.00	<0.100	<0.500	0.171	<0.100	0.83335	0.083335	0.416675	0.2850057	0.083335

Table E1. Laboratory Measurements of the PCT Solutions for the Pu Study Glasses As Reported (ar) and After the Appropriate Adjustments (in parts per million, ppm)
(continued)

Heat Treament	Set	Glass ID	Block	Seq	SRNL-ML ID	B ar	Gd ar	Hf ar	Na ar	Si ar	B (ppm)	Gd (ppm)	Hf (ppm)	Na (ppm)	Si (ppm)
quenched	1	Pu35-11	3	17	C66	<1.00	<0.100	<0.500	<0.100	<0.100	0.83335	0.083335	0.416675	0.083335	0.083335
quenched	1	Pu35-05	3	18	C13	<1.00	<0.100	<0.500	1.27	1.92	0.83335	0.083335	0.416675	2.116709	3.200064
quenched	1	Pu35-14	3	19	C64	<1.00	<0.100	<0.500	<0.100	<0.100	0.83335	0.083335	0.416675	0.083335	0.083335
quenched	1	Pu04-03	3	20	C61	<1.00	<0.100	<0.500	<0.100	<0.100	0.83335	0.083335	0.416675	0.083335	0.083335
quenched	1	Pu04-02	3	21	C48	<1.00	<0.100	<0.500	<0.100	<0.100	0.83335	0.083335	0.416675	0.083335	0.083335
quenched	1	Pu35-08	3	22	C01	<1.00	<0.100	<0.500	<0.100	0.359	0.83335	0.083335	0.416675	0.083335	0.5983453
quenched	1	Pu04-04	3	23	C59	<1.00	<0.100	<0.500	<0.100	0.104	0.83335	0.083335	0.416675	0.083335	0.1733368
quenched	1	Pu35-10	3	24	C06	<1.00	<0.100	<0.500	<0.100	<0.100	0.83335	0.083335	0.416675	0.083335	0.083335
quenched	1	Pu04-05	3	25	C10	<1.00	<0.100	<0.500	<0.100	<0.100	0.83335	0.083335	0.416675	0.083335	0.083335
	1	Soln Std	3	26	STD-13-3	20.3	<0.100	<0.500	85.6	50.9	20.3	0.05	0.25	85.6	50.9
	2	Soln Std	1	1	STD-21-1	20.6	<0.100	<0.500	83.5	49.2	20.6	0.05	0.25	83.5	49.2
quenched	2	Pu35-17	1	2	D47	<1.00	<0.100	<0.500	<0.100	0.496	0.83335	0.083335	0.416675	0.083335	0.8266832
quenched	2	Pu35-21	1	3	D30	<1.00	<0.100	<0.500	<0.100	<0.100	0.83335	0.083335	0.416675	0.083335	0.083335
quenched	2	Pu35-18	1	4	D38	<1.00	<0.100	<0.500	<0.100	1.73	0.83335	0.083335	0.416675	0.083335	2.883391
	2	blank	1	5	D21	<1.00	<0.100	<0.500	<0.100	<0.100	0.83335	0.083335	0.416675	0.083335	0.083335
quenched	2	Pu35-28	1	6	D26	<1.00	<0.100	<0.500	<0.100	<0.100	0.83335	0.083335	0.416675	0.083335	0.083335
quenched	2	Pu35-34	1	7	D56	<1.00	<0.100	<0.500	<0.100	0.369	0.83335	0.083335	0.416675	0.083335	0.6150123
quenched	2	Pu35-35	1	8	D65	<1.00	<0.100	<0.500	<0.100	<0.100	0.83335	0.083335	0.416675	0.083335	0.083335
quenched	2	Pu35-24	1	9	D12	<1.00	<0.100	<0.500	<0.100	<0.100	0.83335	0.083335	0.416675	0.083335	0.083335
quenched	2	Pu35-30	1	10	D10	<1.00	<0.100	<0.500	<0.100	2.46	0.83335	0.083335	0.416675	0.083335	4.100082
quenched	2	Pu35-27	1	11	D03	<1.00	<0.100	<0.500	<0.100	<0.100	0.83335	0.083335	0.416675	0.083335	0.083335
quenched	2	Pu35-26	1	12	D55	<1.00	<0.100	<0.500	<0.100	<0.100	0.83335	0.083335	0.416675	0.083335	0.083335
	2	Soln Std	1	13	STD-21-2	20.1	<0.100	<0.500	84.8	47.5	20.1	0.05	0.25	84.8	47.5
quenched	2	Pu35-31	1	14	D29	<1.00	<0.100	<0.500	<0.100	1.05	0.83335	0.083335	0.416675	0.083335	1.750035
quenched	2	Pu35-32	1	15	D13	<1.00	<0.100	<0.500	<0.100	<0.100	0.83335	0.083335	0.416675	0.083335	0.083335
quenched	2	Pu35-23	1	16	D14	<1.00	<0.100	<0.500	<0.100	<0.100	0.83335	0.083335	0.416675	0.083335	0.083335
	2	ARM-1	1	17	D63	10.1	<0.100	<0.500	19.9	33.2	16.83367	0.083335	0.416675	33.16733	55.33444
quenched	2	Pu35-16	1	18	D46	<1.00	<0.100	<0.500	<0.100	<0.100	0.83335	0.083335	0.416675	0.083335	0.083335
quenched	2	Pu35-25	1	19	D16	<1.00	<0.100	<0.500	<0.100	0.762	0.83335	0.083335	0.416675	0.083335	1.2700254
quenched	2	Pu35-33	1	20	D02	<1.00	<0.100	<0.500	<0.100	<0.100	0.83335	0.083335	0.416675	0.083335	0.083335
	2	EA	1	21	D66	38.3	<0.100	<0.500	106	52.2	638.33461	0.833335	4.166675	1766.6702	870.00174
quenched	2	Pu35-22	1	22	D33	<1.00	<0.100	<0.500	<0.100	<0.100	0.83335	0.083335	0.416675	0.083335	0.083335
quenched	2	Pu35-19	1	23	D54	<1.00	<0.100	<0.500	<0.100	<0.100	0.83335	0.083335	0.416675	0.083335	0.083335
quenched	2	Pu35-20	1	24	D36	<1.00	<0.100	<0.500	<0.100	0.559	0.83335	0.083335	0.416675	0.083335	0.9316853

Table E1. Laboratory Measurements of the PCT Solutions for the Pu Study Glasses As Reported (ar) and After the Appropriate Adjustments (in parts per million, ppm)
(continued)

Heat Treament	Set	Glass ID	Block	Seq	SRNL-ML ID	B ar	Gd ar	Hf ar	Na ar	Si ar	B (ppm)	Gd (ppm)	Hf (ppm)	Na (ppm)	Si (ppm)
quenched	2	Pu35-29	1	25	D61	<1.00	<0.100	<0.500	<0.100	0.815	0.83335	0.083335	0.416675	0.083335	1.3583605
	2	Soln Std	1	26	STD-21-3	21.3	<0.100	<0.500	86	50.4	21.3	0.05	0.25	86	50.4
	2	Soln Std	2	1	STD-22-1	20.4	<0.100	<0.500	85.2	49.4	20.4	0.05	0.25	85.2	49.4
quenched	2	Pu35-29	2	2	D43	<1.00	<0.100	<0.500	<0.100	1.85	0.83335	0.083335	0.416675	0.083335	3.083395
quenched	2	Pu35-19	2	3	D20	<1.00	<0.100	<0.500	<0.100	0.635	0.83335	0.083335	0.416675	0.083335	1.0583545
quenched	2	Pu35-27	2	4	D62	<1.00	<0.100	<0.500	<0.100	0.799	0.83335	0.083335	0.416675	0.083335	1.3316933
quenched	2	Pu35-16	2	5	D05	<1.00	<0.100	<0.500	<0.100	0.901	0.83335	0.083335	0.416675	0.083335	1.5016967
quenched	2	Pu35-33	2	6	D60	<1.00	<0.100	<0.500	<0.100	0.625	0.83335	0.083335	0.416675	0.083335	1.0416875
quenched	2	Pu35-21	2	7	D64	<1.00	<0.100	<0.500	<0.100	0.599	0.83335	0.083335	0.416675	0.083335	0.9983533
quenched	2	Pu35-26	2	8	D48	<1.00	<0.100	<0.500	<0.100	0.48	0.83335	0.083335	0.416675	0.083335	0.800016
	2	EA	2	9	D08	34.3	<0.100	<0.500	97.2	49.5	571.66781	0.833335	4.166675	1620.00324	825.00165
	2	ARM-1	2	10	D58	9.6	<0.100	<0.500	20.2	33.7	16.00032	0.083335	0.416675	33.66734	56.16779
quenched	2	Pu35-25	2	11	D35	<1.00	<0.100	<0.500	<0.100	2.16	0.83335	0.083335	0.416675	0.083335	3.600072
quenched	2	Pu35-20	2	12	D22	<1.00	<0.100	<0.500	<0.100	1.67	0.83335	0.083335	0.416675	0.083335	2.783389
	2	Soln Std	2	13	STD-22-2	18.6	<0.100	<0.500	80.5	46.9	18.6	0.05	0.25	80.5	46.9
quenched	2	Pu35-30	2	14	D27	<1.00	<0.100	<0.500	<0.100	2.12	0.83335	0.083335	0.416675	0.083335	3.533404
quenched	2	Pu35-32	2	15	D31	<1.00	<0.100	<0.500	<0.100	0.417	0.83335	0.083335	0.416675	0.083335	0.6950139
quenched	2	Pu35-22	2	16	D15	<1.00	<0.100	<0.500	<0.100	0.911	0.83335	0.083335	0.416675	0.083335	1.5183637
quenched	2	Pu35-24	2	17	D06	<1.00	<0.100	<0.500	<0.100	0.591	0.83335	0.083335	0.416675	0.083335	0.9850197
quenched	2	Pu35-18	2	18	D67	<1.00	<0.100	<0.500	<0.100	2.42	0.83335	0.083335	0.416675	0.083335	4.033414
quenched	2	Pu35-34	2	19	D04	<1.00	<0.100	<0.500	<0.100	0.948	0.83335	0.083335	0.416675	0.083335	1.5800316
quenched	2	Pu35-35	2	20	D52	<1.00	<0.100	<0.500	<0.100	0.519	0.83335	0.083335	0.416675	0.083335	0.8650173
quenched	2	Pu35-28	2	21	D19	<1.00	<0.100	<0.500	<0.100	0.655	0.83335	0.083335	0.416675	0.083335	1.0916885
quenched	2	Pu35-23	2	22	D42	<1.00	<0.100	<0.500	<0.100	0.541	0.83335	0.083335	0.416675	0.083335	0.9016847
quenched	2	Pu35-31	2	23	D17	<1.00	<0.100	<0.500	<0.100	2.34	0.83335	0.083335	0.416675	0.083335	3.900078
quenched	2	Pu35-17	2	24	D68	<1.00	<0.100	<0.500	<0.100	1.18	0.83335	0.083335	0.416675	0.083335	1.966706
	2	Soln Std	2	25	STD-22-3	18.9	<0.100	<0.500	84.3	47.8	18.9	0.05	0.25	84.3	47.8
	2	Soln Std	3	1	STD-23-1	20.6	<0.100	<0.500	83.9	49.8	20.6	0.05	0.25	83.9	49.8
	2	EA	3	2	D09	35.2	<0.100	<0.500	97.3	49.6	586.66784	0.833335	4.166675	1621.66991	826.66832
quenched	2	Pu35-18	3	3	D24	1.03	<0.100	<0.500	<0.100	2.57	1.716701	0.083335	0.416675	0.083335	4.283419
quenched	2	Pu35-25	3	4	D01	<1.00	<0.100	<0.500	<0.100	2.05	0.83335	0.083335	0.416675	0.083335	3.416735
	2	blank	3	5	D28	<1.00	<0.100	<0.500	<0.100	0.0629	0.83335	0.083335	0.416675	0.083335	0.10483543
	2	ARM-1	3	6	D34	9.53	<0.100	<0.500	20.7	32.1	15.883651	0.083335	0.416675	34.50069	53.50107
quenched	2	Pu35-33	3	7	D59	<1.00	<0.100	<0.500	<0.100	0.544	0.83335	0.083335	0.416675	0.083335	0.9066848

Table E1. Laboratory Measurements of the PCT Solutions for the Pu Study Glasses As Reported (ar) and After the Appropriate Adjustments (in parts per million, ppm)
(continued)

Heat Treament	Set	Glass ID	Block	Seq	SRNL-ML ID	B ar	Gd ar	Hf ar	Na ar	Si ar	B (ppm)	Gd (ppm)	Hf (ppm)	Na (ppm)	Si (ppm)
quenched	2	Pu35-16	3	8	D51	<1.00	<0.100	<0.500	<0.100	0.989	0.83335	0.083335	0.416675	0.083335	1.6483663
quenched	2	Pu35-17	3	9	D37	<1.00	<0.100	<0.500	<0.100	1.18	0.83335	0.083335	0.416675	0.083335	1.966706
quenched	2	Pu35-34	3	10	D39	<1.00	<0.100	<0.500	<0.100	1.07	0.83335	0.083335	0.416675	0.083335	1.783369
quenched	2	Pu35-28	3	11	D41	<1.00	<0.100	<0.500	<0.100	0.743	0.83335	0.083335	0.416675	0.083335	1.2383581
quenched	2	Pu35-32	3	12	D25	<1.00	<0.100	<0.500	<0.100	0.599	0.83335	0.083335	0.416675	0.083335	0.9983533
	2	Soln Std	3	13	STD23-2	18.7	<0.100	<0.500	82.7	46.4	18.7	0.05	0.25	82.7	46.4
quenched	2	Pu35-31	3	14	D32	<1.00	<0.100	<0.500	<0.100	2.3	0.83335	0.083335	0.416675	0.083335	3.83341
quenched	2	Pu35-26	3	15	D18	<1.00	<0.100	<0.500	8.45	0.562	0.83335	0.083335	0.416675	14.083615	0.9366854
quenched	2	Pu35-19	3	16	D40	<1.00	0.213	<0.500	<0.100	0.891	0.83335	0.3550071	0.416675	0.083335	1.4850297
quenched	2	Pu35-22	3	17	D45	<1.00	<0.100	<0.500	<0.100	0.854	0.83335	0.083335	0.416675	0.083335	1.4233618
quenched	2	Pu35-21	3	18	D23	<1.00	<0.100	<0.500	<0.100	0.631	0.83335	0.083335	0.416675	0.083335	1.0516877
quenched	2	Pu35-23	3	19	D57	<1.00	<0.100	<0.500	<0.100	0.746	0.83335	0.083335	0.416675	0.083335	1.2433582
quenched	2	Pu35-35	3	20	D49	<1.00	<0.100	<0.500	<0.100	0.582	0.83335	0.083335	0.416675	0.083335	0.9700194
quenched	2	Pu35-20	3	21	D07	<1.00	<0.100	<0.500	<0.100	1.74	0.83335	0.083335	0.416675	0.083335	2.900058
quenched	2	Pu35-27	3	22	D11	<1.00	<0.100	<0.500	<0.100	0.778	0.83335	0.083335	0.416675	0.083335	1.2966926
quenched	2	Pu35-30	3	23	D53	<1.00	<0.100	<0.500	<0.100	2.25	0.83335	0.083335	0.416675	0.083335	3.750075
quenched	2	Pu35-24	3	24	D50	<1.00	<0.100	<0.500	<0.100	0.715	0.83335	0.083335	0.416675	0.083335	1.1916905
quenched	2	Pu35-29	3	25	D44	<1.00	<0.100	<0.500	0.691	1.93	0.83335	0.083335	0.416675	1.1516897	3.216731
	2	Soln Std	3	26	STD-23-3	19.8	<0.100	<0.500	87.4	48.7	19.8	0.05	0.25	87.4	48.7
	3	Soln Std	1	1	STD-11-1	19.6	<0.100	<0.500	80.2	47.6	19.6	0.05	0.25	80.2	47.6
quenched	3	Pu35-52	1	2	E61	<1.00	<0.100	<0.500	<0.100	1.14	0.83335	0.083335	0.416675	0.083335	1.900038
quenched	3	Pu35-36	1	3	E23	<1.00	<0.100	<0.500	<0.100	0.985	0.83335	0.083335	0.416675	0.083335	1.6416995
	3	blank	1	4	E21	<1.00	<0.100	<0.500	<0.100	<0.100	0.83335	0.083335	0.416675	0.083335	0.083335
quenched	3	Pu35-49	1	5	E04	<1.00	<0.100	<0.500	<0.100	0.823	0.83335	0.083335	0.416675	0.083335	1.3716941
quenched	3	EA	1	6	E30	36.7	<0.100	<0.500	102.3	53.5	611.66789	0.833335	4.166675	1705.00341	891.66845
quenched	3	Pu35-40	1	7	E41	<1.00	<0.100	<0.500	<0.100	0.399	0.83335	0.083335	0.416675	0.083335	0.6650133
quenched	3	Pu35-51	1	8	E67	<1.00	<0.100	<0.500	<0.100	0.487	0.83335	0.083335	0.416675	0.083335	0.8116829
	3	ARM-1	1	9	E46	8.86	<0.100	<0.500	19.7	33.1	14.766962	0.083335	0.416675	32.83399	55.16777
quenched	3	Pu35-53	1	10	E49	<1.00	<0.100	<0.500	<0.100	0.666	0.83335	0.083335	0.416675	0.083335	1.1100222
quenched	3	Pu35-39	1	11	E07	<1.00	<0.100	<0.500	<0.100	1.59	0.83335	0.083335	0.416675	0.083335	2.650053
quenched	3	Pu35-48	1	12	E64	<1.00	<0.100	<0.500	<0.100	0.348	0.83335	0.083335	0.416675	0.083335	0.5800116
	3	Soln Std	1	13	STD-11-2	18.4	<0.100	<0.500	82.1	47.3	18.4	0.05	0.25	82.1	47.3
quenched	3	Pu35-50	1	14	E52	<1.00	<0.100	<0.500	<0.100	1.32	0.83335	0.083335	0.416675	0.083335	2.200044
quenched	3	Pu35-41	1	15	E34	<1.00	<0.100	<0.500	<0.100	0.44	0.83335	0.083335	0.416675	0.083335	0.733348

Table E1. Laboratory Measurements of the PCT Solutions for the Pu Study Glasses As Reported (ar) and After the Appropriate Adjustments (in parts per million, ppm)
(continued)

Heat Treament	Set	Glass ID	Block	Seq	SRNL-ML ID	B ar	Gd ar	Hf ar	Na ar	Si ar	B (ppm)	Gd (ppm)	Hf (ppm)	Na (ppm)	Si (ppm)
quenched	3	Pu35-42	1	16	E20	<1.00	<0.100	<0.500	<0.100	1.25	0.83335	0.083335	0.416675	0.083335	2.083375
quenched	3	Pu35-43	1	17	E03	<1.00	<0.100	<0.500	<0.100	0.28	0.83335	0.083335	0.416675	0.083335	0.466676
quenched	3	Pu35-54	1	18	E63	<1.00	<0.100	<0.500	<0.100	0.562	0.83335	0.083335	0.416675	0.083335	0.9366854
quenched	3	Pu35-44	1	19	E56	<1.00	<0.100	<0.500	<0.100	0.243	0.83335	0.083335	0.416675	0.083335	0.4050081
quenched	3	Pu35-47	1	20	E35	<1.00	<0.100	<0.500	<0.100	0.34	0.83335	0.083335	0.416675	0.083335	0.566678
quenched	3	Pu35-45	1	21	E22	<1.00	<0.100	<0.500	<0.100	0.541	0.83335	0.083335	0.416675	0.083335	0.9016847
quenched	3	Pu35-37	1	22	E39	<1.00	<0.100	<0.500	<0.100	0.58	0.83335	0.083335	0.416675	0.083335	0.966686
quenched	3	Pu35-55	1	23	E15	<1.00	<0.100	<0.500	<0.100	0.604	0.83335	0.083335	0.416675	0.083335	1.0066868
quenched	3	Pu35-38	1	24	E13	<1.00	<0.100	<0.500	<0.100	0.362	0.83335	0.083335	0.416675	0.083335	0.6033454
quenched	3	Pu35-46	1	25	E50	<1.00	<0.100	<0.500	<0.100	0.557	0.83335	0.083335	0.416675	0.083335	0.9283519
	3	Soln Std	1	26	STD-11-3	18.8	<0.100	<0.500	80.2	48.7	18.8	0.05	0.25	80.2	48.7
	3	Soln Std	2	1	STD-12-1	20	<0.100	<0.500	82.9	47.9	20	0.05	0.25	82.9	47.9
quenched	3	Pu35-41	2	2	E31	1.32	<0.100	<0.500	<0.100	0.764	2.200044	0.083335	0.416675	0.083335	1.2733588
quenched	3	Pu35-53	2	3	E37	<1.00	<0.100	<0.500	<0.100	1.21	0.83335	0.083335	0.416675	0.083335	2.016707
quenched	3	Pu35-39	2	4	E33	<1.00	<0.100	<0.500	<0.100	1.97	0.83335	0.083335	0.416675	0.083335	3.283399
	3	ARM-1	2	5	E01	10	<0.100	<0.500	21.1	34.4	16.667	0.083335	0.416675	35.16737	57.33448
quenched	3	Pu35-45	2	6	E40	<1.00	<0.100	<0.500	<0.100	1.25	0.83335	0.083335	0.416675	0.083335	2.083375
quenched	3	Pu35-43	2	7	E51	<1.00	<0.100	<0.500	<0.100	0.698	0.83335	0.083335	0.416675	0.083335	1.1633566
quenched	3	Pu35-42	2	8	E47	<1.00	<0.100	<0.500	<0.100	1.8	0.83335	0.083335	0.416675	0.083335	3.00006
quenched	3	Pu35-55	2	9	E48	<1.00	<0.100	<0.500	<0.100	1.56	0.83335	0.083335	0.416675	0.083335	2.600052
	3	EA	2	10	E29	38.2	<0.100	<0.500	105.7	55	636.66794	0.833335	4.166675	1761.67019	916.6685
quenched	3	Pu35-54	2	11	E45	<1.00	<0.100	<0.500	<0.100	1.21	0.83335	0.083335	0.416675	0.083335	2.016707
quenched	3	Pu35-48	2	12	E60	<1.00	<0.100	<0.500	<0.100	0.744	0.83335	0.083335	0.416675	0.083335	1.2400248
	3	Soln Std	2	13	STD-12-2	19.5	<0.100	<0.500	83.9	48.5	19.5	0.05	0.25	83.9	48.5
quenched	3	Pu35-51	2	14	E08	1.23	<0.100	<0.500	<0.100	0.869	2.050041	0.083335	0.416675	0.083335	1.4483623
quenched	3	Pu35-50	2	15	E27	<1.00	<0.100	<0.500	<0.100	1.72	0.83335	0.083335	0.416675	0.083335	2.866724
quenched	3	Pu35-46	2	16	E24	<1.00	<0.100	<0.500	<0.100	0.886	0.83335	0.083335	0.416675	0.083335	1.4766962
quenched	3	Pu35-52	2	17	E32	<1.00	<0.100	<0.500	<0.100	1.49	0.83335	0.083335	0.416675	0.083335	2.483383
quenched	3	Pu35-49	2	18	E43	<1.00	<0.100	<0.500	<0.100	1.19	0.83335	0.083335	0.416675	0.083335	1.983373
quenched	3	Pu35-40	2	19	E55	<1.00	<0.100	<0.500	<0.100	0.813	0.83335	0.083335	0.416675	0.083335	1.3550271
quenched	3	Pu35-37	2	20	E16	<1.00	<0.100	<0.500	<0.100	0.917	0.83335	0.083335	0.416675	0.083335	1.5283639
quenched	3	Pu35-44	2	21	E53	<1.00	<0.100	<0.500	<0.100	0.617	0.83335	0.083335	0.416675	0.083335	1.0283539
quenched	3	Pu35-47	2	22	E65	<1.00	<0.100	<0.500	<0.100	0.736	0.83335	0.083335	0.416675	0.083335	1.2266912
quenched	3	Pu35-38	2	23	E06	<1.00	<0.100	<0.500	<0.100	0.854	0.83335	0.083335	0.416675	0.083335	1.4233618

Table E1. Laboratory Measurements of the PCT Solutions for the Pu Study Glasses As Reported (ar) and After the Appropriate Adjustments (in parts per million, ppm)
(continued)

Heat Treament	Set	Glass ID	Block	Seq	SRNL-ML ID	B ar	Gd ar	Hf ar	Na ar	Si ar	B (ppm)	Gd (ppm)	Hf (ppm)	Na (ppm)	Si (ppm)
quenched	3	Pu35-36	2	24	E12	<1.00	<0.100	<0.500	<0.100	1.3	0.83335	0.083335	0.416675	0.083335	2.16671
	3	Soln Std	2	25	STD-12-3	19.8	<0.100	<0.500	85.2	49.3	19.8	0.05	0.25	85.2	49.3
	3	Soln Std	3	1	STD-13-1	20.1	<0.100	<0.500	82.6	48.6	20.1	0.05	0.25	82.6	48.6
quenched	3	Pu35-52	3	2	E14	<1.00	<0.100	<0.500	<0.100	1.41	0.83335	0.083335	0.416675	0.083335	2.350047
quenched	3	Pu35-44	3	3	E38	<1.00	<0.100	<0.500	<0.100	0.564	0.83335	0.083335	0.416675	0.083335	0.9400188
quenched	3	Pu35-40	3	4	E44	<1.00	<0.100	<0.500	<0.100	0.583	0.83335	0.083335	0.416675	0.083335	0.9716861
quenched	3	Pu35-51	3	5	E10	<1.00	<0.100	<0.500	<0.100	0.516	0.83335	0.083335	0.416675	0.083335	0.8600172
	3	EA	3	6	E62	36.9	<0.100	<0.500	102.8	53.5	615.00123	0.833335	4.166675	1713.33676	891.66845
quenched	3	Pu35-50	3	7	E05	<1.00	<0.100	<0.500	<0.100	1.43	0.83335	0.083335	0.416675	0.083335	2.383381
quenched	3	Pu35-55	3	8	E59	<1.00	<0.100	<0.500	<0.100	1.7	0.83335	0.083335	0.416675	0.083335	2.83339
	3	ARM-1	3	9	E26	9.23	<0.100	<0.500	20.9	33.2	15.383641	0.083335	0.416675	34.83403	55.33444
quenched	3	Pu35-48	3	10	E58	<1.00	<0.100	<0.500	<0.100	0.486	0.83335	0.083335	0.416675	0.083335	0.8100162
quenched	3	Pu35-37	3	11	E25	<1.00	<0.100	<0.500	<0.100	0.861	0.83335	0.083335	0.416675	0.083335	1.4350287
	3	blank	3	12	E54	<1.00	<0.100	<0.500	<0.100	<0.100	0.83335	0.083335	0.416675	0.083335	0.083335
	3	Soln Std	3	13	STD-13-2	18.9	<0.100	<0.500	82.8	48.7	18.9	0.05	0.25	82.8	48.7
quenched	3	Pu35-38	3	14	E02	<1.00	<0.100	<0.500	<0.100	0.645	0.83335	0.083335	0.416675	0.083335	1.0750215
quenched	3	Pu35-41	3	15	E18	<1.00	<0.100	<0.500	<0.100	0.55	0.83335	0.083335	0.416675	0.083335	0.916685
quenched	3	Pu35-54	3	16	E57	<1.00	<0.100	<0.500	<0.100	0.861	0.83335	0.083335	0.416675	0.083335	1.4350287
quenched	3	Pu35-53	3	17	E09	<1.00	<0.100	<0.500	<0.100	0.902	0.83335	0.083335	0.416675	0.083335	1.5033634
quenched	3	Pu35-42	3	18	E68	<1.00	<0.100	<0.500	<0.100	1.59	0.83335	0.083335	0.416675	0.083335	2.650053
quenched	3	Pu35-36	3	19	E42	<1.00	<0.100	<0.500	<0.100	1.07	0.83335	0.083335	0.416675	0.083335	1.783369
quenched	3	Pu35-39	3	20	E36	<1.00	<0.100	<0.500	<0.100	1.77	0.83335	0.083335	0.416675	0.083335	2.950059
quenched	3	Pu35-46	3	21	E28	<1.00	<0.100	<0.500	<0.100	0.634	0.83335	0.083335	0.416675	0.083335	1.0566878
quenched	3	Pu35-49	3	22	E17	<1.00	<0.100	<0.500	<0.100	0.966	0.83335	0.083335	0.416675	0.083335	1.6100322
quenched	3	Pu35-47	3	23	E66	<1.00	<0.100	<0.500	<0.100	0.525	0.83335	0.083335	0.416675	0.083335	0.8750175
quenched	3	Pu35-43	3	24	E11	<1.00	<0.100	<0.500	<0.100	0.511	0.83335	0.083335	0.416675	0.083335	0.8516837
quenched	3	Pu35-45	3	25	E19	<1.00	<0.100	<0.500	<0.100	0.759	0.83335	0.083335	0.416675	0.083335	1.2650253
	3	Soln Std	3	26	STD-13-3	19.7	<0.100	<0.500	83.8	49.4	19.7	0.05	0.25	83.8	49.4
	1	Soln Std	1	1	STD-11-1	20.5	<0.100	<0.500	83.7	49.9	20.5	0.05	.	83.7	49.9
ccc	1	Pu35-01	1	2	L62	<1.00	<0.100	<0.500	1.2	1.34	0.83335	0.083335	0.416675	2.00004	2.233378
ccc	1	Pu35-06	1	3	L45	<1.00	<0.100	<0.500	1	2.06	0.83335	0.083335	0.416675	1.6667	3.433402
ccc	1	Pu04-05	1	4	L49	<1.00	0.562	<0.500	0.658	0.407	0.83335	0.9366854	0.416675	1.0966886	0.6783469
ccc	1	Pu35-08	1	5	L08	<1.00	<0.100	<0.500	<0.100	2.43	0.83335	0.083335	0.416675	0.083335	4.050081
ccc	1	Pu04-04	1	6	L55	<1.00	<0.100	<0.500	0.72	0.231	0.83335	0.083335	0.416675	1.200024	0.3850077

Table E1. Laboratory Measurements of the PCT Solutions for the Pu Study Glasses As Reported (ar) and After the Appropriate Adjustments (in parts per million, ppm)
(continued)

Heat Treament	Set	Glass ID	Block	Seq	SRNL-ML ID	B ar	Gd ar	Hf ar	Na ar	Si ar	B (ppm)	Gd (ppm)	Hf (ppm)	Na (ppm)	Si (ppm)
ccc	1	Pu35-05	1	7	L32	<1.00	<0.100	<0.500	1.41	4.7	0.83335	0.083335	0.416675	2.350047	7.83349
ccc	1	blank	1	8	L21	<1.00	<0.100	<0.500	1.11	<0.100	0.83335	0.083335	0.416675	1.850037	0.083335
ccc	1	Pu35-15	1	9	L37	<1.00	<0.100	<0.500	3.53	2.53	0.83335	0.083335	0.416675	5.883451	4.216751
ccc	1	Pu35-12	1	10	L42	<1.00	<0.100	<0.500	3.57	2.08	0.83335	0.083335	0.416675	5.950119	3.466736
ccc	1	Pu35-11	1	11	L51	1.17	0.495	<0.500	1.02	2.29	1.950039	0.8250165	0.416675	1.700034	3.816743
ccc	1	Pu35-09	1	12	L50	<1.00	0.704	<0.500	9.88	4.08	0.83335	1.1733568	0.416675	16.466996	6.800136
ccc	1	Soln Std	1	13	STD-11-2	20.8	<0.100	<0.500	84.8	50.7	20.8	0.05	.	84.8	50.7
ccc	1	Pu35-04	1	14	L24	1.05	<0.100	<0.500	1.98	2.36	1.750035	0.083335	0.416675	3.300066	3.933412
ccc	1	Pu35-10	1	15	L23	<1.00	<0.100	<0.500	1.99	2.02	0.83335	0.083335	0.416675	3.316733	3.366734
ccc	1	Pu04-02	1	16	L15	<1.00	<0.100	<0.500	3.39	0.314	0.83335	0.083335	0.416675	5.650113	0.5233438
ccc	1	Pu35-03	1	17	L58	<1.00	<0.100	<0.500	1.53	3.75	0.83335	0.083335	0.416675	2.550051	6.250125
ccc	1	Pu35-02	1	18	L11	<1.00	<0.100	<0.500	<0.100	2.5	0.83335	0.083335	0.416675	0.083335	4.16675
ccc	1	EA	1	19	L36	38.5	0.743	<0.500	105	55.5	641.66795	12.383358	4.166675	1750.0035	925.00185
ccc	1	ARM-1	1	20	L16	10.3	<0.100	<0.500	22	34.5	17.16701	0.083335	0.416675	36.6674	57.50115
ccc	1	Pu35-13	1	21	L09	<1.00	0.277	<0.500	2.44	3.02	0.83335	0.4616759	0.416675	4.066748	5.033434
ccc	1	Pu35-14	1	22	L29	<1.00	0.143	<0.500	0.62	1.94	0.83335	0.2383381	0.416675	1.033354	3.233398
ccc	1	Pu04-01	1	23	L04	<1.00	0.674	<0.500	5.83	0.889	0.83335	1.1233558	0.416675	9.716861	1.4816963
ccc	1	Pu35-07	1	24	L22	<1.00	<0.100	<0.500	3.5	2.39	0.83335	0.083335	0.416675	5.83345	3.983413
ccc	1	Pu04-03	1	25	L26	<1.00	0.73	<0.500	0.565	0.501	0.83335	1.216691	0.416675	0.9416855	0.8350167
ccc	1	Soln Std	1	26	STD-11-3	20	<0.100	<0.500	87.2	49.3	20	0.05	.	87.2	49.3
ccc	1	Soln Std	2	1	STD-12-1	21.2	<0.100	<0.500	84.2	50.4	21.2	0.05	.	84.2	50.4
ccc	1	Pu35-09	2	2	L40	1.5	0.602	<0.500	0.939	4.65	2.50005	1.0033534	0.416675	1.5650313	7.750155
ccc	1	Pu35-13	2	3	L12	1	<0.100	<0.500	1.83	3.5	1.6667	0.083335	0.416675	3.050061	5.83345
ccc	1	Pu35-07	2	4	L35	<1.00	0.463	<0.500	11.5	3.19	0.83335	0.7716821	0.416675	19.16705	5.316773
ccc	1	Pu35-15	2	5	L02	<1.00	<0.100	<0.500	1.78	3.01	0.83335	0.083335	0.416675	2.966726	5.016767
ccc	1	Pu04-04	2	6	L53	<1.00	1.019	<0.500	<0.100	1.28	0.83335	1.6983673	0.416675	0.083335	2.133376
ccc	1	Pu35-06	2	7	L56	<1.00	0.77	<0.500	0.611	2.6	0.83335	1.283359	0.416675	1.0183537	4.33342
ccc	1	Pu35-02	2	8	L57	<1.00	0.656	<0.500	5.59	3.19	0.83335	1.0933552	0.416675	9.316853	5.316773
ccc	1	Pu35-11	2	9	L47	<1.00	0.441	<0.500	5.14	3.05	0.83335	0.7350147	0.416675	8.566838	5.083435
ccc	1	Pu35-01	2	10	L39	<1.00	<0.100	<0.500	0.39	1.69	0.83335	0.083335	0.416675	0.650013	2.816723
ccc	1	Pu35-12	2	11	L34	<1.00	0.391	<0.500	4.11	3.26	0.83335	0.6516797	0.416675	6.850137	5.433442
ccc	1	Pu04-05	2	12	L03	<1.00	<0.100	<0.500	1.41	0.7	0.83335	0.083335	0.416675	2.350047	1.16669
ccc	1	Soln Std	2	13	STD-12-2	20.5	<0.100	<0.500	86.6	50.8	20.5	0.05	.	86.6	50.8
ccc	1	Pu35-08	2	14	L17	1.07	<0.100	<0.500	2.27	3.29	1.783369	0.083335	0.416675	3.783409	5.483443

Table E1. Laboratory Measurements of the PCT Solutions for the Pu Study Glasses As Reported (ar) and After the Appropriate Adjustments (in parts per million, ppm)
(continued)

Heat Treament	Set	Glass ID	Block	Seq	SRNL-ML ID	B ar	Gd ar	Hf ar	Na ar	Si ar	B (ppm)	Gd (ppm)	Hf (ppm)	Na (ppm)	Si (ppm)
ccc	1	Pu35-03	2	15	L14	1.12	0.919	<0.500	1.41	4.44	1.866704	1.5316973	0.416675	2.350047	7.400148
ccc	1	ARM-1	2	16	L43	10.6	0.731	<0.500	23.6	36.6	17.66702	1.2183577	0.416675	39.33412	61.00122
ccc	1	Pu35-10	2	17	L33	<1.00	<0.100	<0.500	1.95	2.53	0.83335	0.083335	0.416675	3.250065	4.216751
ccc	1	Pu35-14	2	18	L46	<1.00	<0.100	<0.500	<0.100	2.56	0.83335	0.083335	0.416675	0.083335	4.266752
ccc	1	Pu04-01	2	19	L41	<1.00	0.451	<0.500	<0.100	1.7	0.83335	0.7516817	0.416675	0.083335	2.83339
ccc	1	Pu35-05	2	20	L60	<1.00	0.567	<0.500	<0.100	2.9	0.83335	0.9450189	0.416675	0.083335	4.83343
ccc	1	Pu04-02	2	21	L27	<1.00	<0.100	<0.500	<0.100	0.695	0.83335	0.083335	0.416675	0.083335	1.1583565
ccc	1	EA	2	22	L05	39.1	0.9	<0.500	108	56	651.66797	15.00003	4.166675	1800.0036	933.3352
ccc	1	Pu04-03	2	23	L65	<1.00	<0.100	<0.500	<0.100	0.762	0.83335	0.083335	0.416675	0.083335	1.2700254
ccc	1	Pu35-04	2	24	L38	<1.00	<0.100	<0.500	0.709	2.58	0.83335	0.083335	0.416675	1.1816903	4.300086
ccc	1	Soln Std	2	25	STD-12-3	20.2	<0.100	<0.500	88.3	49.1	20.2	0.05	.	88.3	49.1
ccc	1	Soln Std	3	1	STD-13-1	20.9	<0.100	<0.500	84.1	49.1	20.9	0.05	.	84.1	49.1
ccc	1	Pu04-01	3	2	L44	<1.00	<0.100	<0.500	1.53	1.73	0.83335	0.083335	0.416675	2.550051	2.883391
ccc	1	ARM-1	3	3	L28	10.4	0.854	<0.500	22.9	35.5	17.33368	1.4233618	0.416675	38.16743	59.16785
ccc	1	Pu35-03	3	4	L30	1.08	0.151	<0.500	7.43	4.4	1.800036	0.2516717	0.416675	12.383581	7.33348
ccc	1	blank	3	5	L63	<1.00	<0.100	<0.500	0.988	<0.100	0.83335	0.083335	0.416675	1.6466996	0.083335
ccc	1	Pu35-13	3	6	L68	<1.00	<0.100	<0.500	0.874	3.11	0.83335	0.083335	0.416675	1.4566958	5.183437
ccc	1	Pu35-15	3	7	L07	<1.00	<0.100	<0.500	5.71	2.52	0.83335	0.083335	0.416675	9.516857	4.200084
ccc	1	Pu35-01	3	8	L67	<1.00	0.105	<0.500	0.689	1.54	0.83335	0.1750035	0.416675	1.1483563	2.566718
ccc	1	Pu35-04	3	9	L52	<1.00	0.571	<0.500	0.436	2.66	0.83335	0.9516857	0.416675	0.7266812	4.433422
ccc	1	Pu35-02	3	10	L19	<1.00	<0.100	<0.500	0.395	2.63	0.83335	0.083335	0.416675	0.6583465	4.383421
ccc	1	Pu35-12	3	11	L20	<1.00	0.417	<0.500	3.94	2.54	0.83335	0.6950139	0.416675	6.566798	4.233418
ccc	1	Pu35-09	3	12	L18	<1.00	<0.100	<0.500	0.672	4.34	0.83335	0.083335	0.416675	1.1200224	7.233478
ccc	1	Soln Std	3	13	STD-13-2	20.1	<0.100	<0.500	86.9	50.5	20.1	0.05	.	86.9	50.5
ccc	1	Pu35-07	3	14	L25	<1.00	0.206	<0.500	0.467	2.21	0.83335	0.3433402	0.416675	0.7783489	3.683407
ccc	1	EA	3	15	L54	38	<0.100	<0.500	114	54.7	633.3346	0.833335	4.166675	1900.0038	911.66849
ccc	1	Pu35-06	3	16	L31	<1.00	0.225	<0.500	0.322	2.27	0.83335	0.3750075	0.416675	0.5366774	3.783409
ccc	1	Pu35-11	3	17	L66	<1.00	<0.100	<0.500	<0.100	2.49	0.83335	0.083335	0.416675	0.083335	4.150083
ccc	1	Pu35-05	3	18	L13	<1.00	<0.100	<0.500	1.74	2.41	0.83335	0.083335	0.416675	2.900058	4.016747
ccc	1	Pu35-14	3	19	L64	<1.00	1.5	<0.500	1.19	2.66	0.83335	2.50005	0.416675	1.983373	4.433422
ccc	1	Pu04-03	3	20	L61	<1.00	<0.100	<0.500	1.02	0.682	0.83335	0.083335	0.416675	1.700034	1.1366894
ccc	1	Pu04-02	3	21	L48	<1.00	<0.100	<0.500	5.45	0.804	0.83335	0.083335	0.416675	9.083515	1.3400268
ccc	1	Pu35-08	3	22	L01	<1.00	<0.100	<0.500	0.848	2.47	0.83335	0.083335	0.416675	1.4133616	4.116749
ccc	1	Pu04-04	3	23	L59	<1.00	<0.100	<0.500	2.33	0.691	0.83335	0.083335	0.416675	3.883411	1.1516897

Table E1. Laboratory Measurements of the PCT Solutions for the Pu Study Glasses As Reported (ar) and After the Appropriate Adjustments (in parts per million, ppm)
(continued)

Heat Treament	Set	Glass ID	Block	Seq	SRNL-ML ID	B ar	Gd ar	Hf ar	Na ar	Si ar	B (ppm)	Gd (ppm)	Hf (ppm)	Na (ppm)	Si (ppm)
ccc	1	Pu35-10	3	24	L06	<1.00	<0.100	<0.500	0.41	2.28	0.83335	0.083335	0.416675	0.683347	3.800076
ccc	1	Pu04-05	3	25	L10	<1.00	<0.100	<0.500	<0.100	0.469	0.83335	0.083335	0.416675	0.083335	0.7816823
ccc	1	Soln Std	3	26	STD-13-3	20	<0.100	<0.500	90	50	20	0.05	.	90	50
ccc	2	Soln Std	1	1	STD-11-1	20.8	<0.100	<0.500	82	49.5	20.8	0.05	.	82	49.5
ccc	2	Pu35-17	1	2	M47	<1.00	<0.100	<0.500	0.498	2.86	0.83335	0.083335	0.416675	0.8300166	4.766762
ccc	2	Pu35-21	1	3	M30	<1.00	<0.100	<0.500	2.59	2.49	0.83335	0.083335	0.416675	4.316753	4.150083
ccc	2	Pu35-18	1	4	M38	<1.00	<0.100	<0.500	1.12	4.13	0.83335	0.083335	0.416675	1.866704	6.883471
ccc	2	blank	1	5	M21	<1.00	<0.100	<0.500	4.19	0.176	0.83335	0.083335	0.416675	6.983473	0.2933392
ccc	2	Pu35-28	1	6	M26	<1.00	<0.100	<0.500	4.5	2.12	0.83335	0.083335	0.416675	7.50015	3.533404
ccc	2	Pu35-34	1	7	M56	<1.00	<0.100	<0.500	7.77	2.88	0.83335	0.083335	0.416675	12.950259	4.800096
ccc	2	Pu35-35	1	8	M65	<1.00	<0.100	0.97	0.643	1.63	0.83335	0.083335	1.616699	1.0716881	2.716721
ccc	2	Pu35-24	1	9	M12	<1.00	<0.100	<0.500	<0.100	2.25	0.83335	0.083335	0.416675	0.083335	3.750075
ccc	2	Pu35-30	1	10	M10	<1.00	<0.100	<0.500	<0.100	3.06	0.83335	0.083335	0.416675	0.083335	5.100102
ccc	2	Pu35-27	1	11	M03	<1.00	0.46	<0.500	0.125	2.51	0.83335	0.766682	0.416675	0.2083375	4.183417
ccc	2	Pu35-26	1	12	M55	<1.00	<0.100	<0.500	4.24	1.8	0.83335	0.083335	0.416675	7.066808	3.00006
ccc	2	Soln Std	1	13	STD-11-2	19.4	<0.100	<0.500	82.3	49.8	19.4	0.05	.	82.3	49.8
ccc	2	Pu35-31	1	14	M29	<1.00	<0.100	<0.500	5.44	3.01	0.83335	0.083335	0.416675	9.066848	5.016767
ccc	2	Pu35-32	1	15	M13	<1.00	<0.100	<0.500	<0.100	1.48	0.83335	0.083335	0.416675	0.083335	2.466716
ccc	2	Pu35-23	1	16	M14	<1.00	<0.100	<0.500	8.47	2.25	0.83335	0.083335	0.416675	14.116949	3.750075
ccc	2	ARM-1	1	17	M63	9.54	<0.100	<0.500	30.4	35	15.900318	0.083335	0.416675	50.66768	58.3345
ccc	2	Pu35-16	1	18	M46	<1.00	<0.100	<0.500	1.36	1.2	0.83335	0.083335	0.416675	2.266712	2.00004
ccc	2	Pu35-25	1	19	M16	<1.00	<0.100	0.674	11.7	3.42	0.83335	0.083335	1.123356	19.50039	5.700114
ccc	2	Pu35-33	1	20	M02	<1.00	<0.100	<0.500	5.64	1.84	0.83335	0.083335	0.416675	9.400188	3.066728
ccc	2	EA	1	21	M66	37.6	<0.100	<0.500	107	55.1	626.66792	0.833335	4.166675	1783.3369	918.33517
ccc	2	Pu35-22	1	22	M33	<1.00	0.324	<0.500	<0.100	2.74	0.83335	0.5400108	0.416675	0.083335	4.566758
ccc	2	Pu35-19	1	23	M54	<1.00	<0.100	<0.500	<0.100	2.33	0.83335	0.083335	0.416675	0.083335	3.883411
ccc	2	Pu35-20	1	24	M36	<1.00	<0.100	<0.500	13.6	3.23	0.83335	0.083335	0.416675	22.66712	5.383441
ccc	2	Pu35-29	1	25	M61	<1.00	<0.100	<0.500	1.38	3.03	0.83335	0.083335	0.416675	2.300046	5.050101
ccc	2	Soln Std	1	26	STD-11-3	19.7	<0.100	<0.500	87.2	48.8	19.7	0.05	.	87.2	48.8
ccc	2	Soln Std	2	1	STD-12-1	20.1	<0.100	<0.500	81.3	49.3	20.1	0.05	.	81.3	49.3
ccc	2	Pu35-29	2	2	M43	<1.00	<0.100	<0.500	<0.100	2.06	0.83335	0.083335	0.416675	0.083335	3.433402
ccc	2	Pu35-19	2	3	M20	<1.00	<0.100	<0.500	<0.100	1.29	0.83335	0.083335	0.416675	0.083335	2.150043
ccc	2	Pu35-27	2	4	M62	<1.00	<0.100	<0.500	<0.100	0.227	0.83335	0.083335	0.416675	0.083335	0.3783409
ccc	2	Pu35-16	2	5	M05	<1.00	<0.100	<0.500	<0.100	0.824	0.83335	0.083335	0.416675	0.083335	1.3733608

Table E1. Laboratory Measurements of the PCT Solutions for the Pu Study Glasses As Reported (ar) and After the Appropriate Adjustments (in parts per million, ppm)
(continued)

Heat Treament	Set	Glass ID	Block	Seq	SRNL-ML ID	B ar	Gd ar	Hf ar	Na ar	Si ar	B (ppm)	Gd (ppm)	Hf (ppm)	Na (ppm)	Si (ppm)
ccc	2	Pu35-33	2	6	M60	<1.00	<0.100	<0.500	1.53	1.26	0.83335	0.083335	0.416675	2.550051	2.100042
ccc	2	Pu35-21	2	7	M64	<1.00	<0.100	<0.500	<0.100	2.05	0.83335	0.083335	0.416675	0.083335	3.416735
ccc	2	Pu35-26	2	8	M48	<1.00	<0.100	<0.500	0.141	1.69	0.83335	0.083335	0.416675	0.2350047	2.816723
ccc	2	EA	2	9	M08	36.6	<0.100	<0.500	98.8	52.7	610.00122	0.833335	4.166675	1646.66996	878.33509
ccc	2	ARM-1	2	10	M58	9.01	<0.100	<0.500	20.5	33	15.016967	0.083335	0.416675	34.16735	55.0011
ccc	2	Pu35-25	2	11	M35	<1.00	<0.100	<0.500	0.488	2.71	0.83335	0.083335	0.416675	0.8133496	4.516757
ccc	2	Pu35-20	2	12	M22	<1.00	<0.100	<0.500	1.37	2.82	0.83335	0.083335	0.416675	2.283379	4.700094
ccc	2	Soln Std	2	13	STD-12-2	19.1	<0.100	<0.500	80.8	48.4	19.1	0.05	.	80.8	48.4
ccc	2	Pu35-30	2	14	M27	<1.00	<0.100	<0.500	0.751	2.84	0.83335	0.083335	0.416675	1.2516917	4.733428
ccc	2	Pu35-32	2	15	M31	<1.00	<0.100	<0.500	<0.100	1.25	0.83335	0.083335	0.416675	0.083335	2.083375
ccc	2	Pu35-22	2	16	M15	<1.00	<0.100	<0.500	0.275	2.74	0.83335	0.083335	0.416675	0.4583425	4.566758
ccc	2	Pu35-24	2	17	M06	<1.00	<0.100	<0.500	<0.100	2.14	0.83335	0.083335	0.416675	0.083335	3.566738
ccc	2	Pu35-18	2	18	M67	<1.00	<0.100	<0.500	1.08	3.99	0.83335	0.083335	0.416675	1.800036	6.650133
ccc	2	Pu35-34	2	19	M04	<1.00	<0.100	<0.500	1.32	2.75	0.83335	0.083335	0.416675	2.200044	4.583425
ccc	2	Pu35-35	2	20	M52	<1.00	<0.100	<0.500	0.63	1.57	0.83335	0.083335	0.416675	1.050021	2.616719
ccc	2	Pu35-28	2	21	M19	<1.00	<0.100	<0.500	<0.100	1.97	0.83335	0.083335	0.416675	0.083335	3.283399
ccc	2	Pu35-23	2	22	M42	<1.00	<0.100	<0.500	0.819	2.23	0.83335	0.083335	0.416675	1.3650273	3.716741
ccc	2	Pu35-31	2	23	M17	<1.00	<0.100	<0.500	0.909	2.33	0.83335	0.083335	0.416675	1.5150303	3.883411
ccc	2	Pu35-17	2	24	M68	<1.00	<0.100	<0.500	0.396	2.48	0.83335	0.083335	0.416675	0.6600132	4.133416
ccc	2	Soln Std	2	25	STD-12-3	19.6	<0.100	<0.500	84.2	50.4	19.6	0.05	.	84.2	50.4
ccc	2	Soln Std	3	1	STD-13-1	20.5	<0.100	<0.500	82.4	50	20.5	0.05	.	82.4	50
ccc	2	EA	3	2	M09	36.5	<0.100	<0.500	100	53.2	608.33455	0.833335	4.166675	1666.67	886.66844
ccc	2	Pu35-18	3	3	M24	1.34	<0.100	<0.500	<0.100	4.28	2.233378	0.083335	0.416675	0.083335	7.133476
ccc	2	Pu35-25	3	4	M01	<1.00	<0.100	<0.500	<0.100	3.05	0.83335	0.083335	0.416675	0.083335	5.083435
ccc	2	blank	3	5	M28	<1.00	<0.100	<0.500	<0.100	0.123	0.83335	0.083335	0.416675	0.083335	0.2050041
ccc	2	ARM-1	3	6	M34	10.3	<0.100	<0.500	21.7	35.1	17.16701	0.083335	0.416675	36.16739	58.50117
ccc	2	Pu35-33	3	7	M59	<1.00	<0.100	<0.500	<0.100	1.68	0.83335	0.083335	0.416675	0.083335	2.800056
ccc	2	Pu35-16	3	8	M51	<1.00	<0.100	<0.500	<0.100	1.82	0.83335	0.083335	0.416675	0.083335	3.033394
ccc	2	Pu35-17	3	9	M37	<1.00	<0.100	<0.500	<0.100	3.04	0.83335	0.083335	0.416675	0.083335	5.066768
ccc	2	Pu35-34	3	10	M39	<1.00	<0.100	<0.500	<0.100	2.81	0.83335	0.083335	0.416675	0.083335	4.683427
ccc	2	Pu35-28	3	11	M41	<1.00	<0.100	<0.500	<0.100	2.47	0.83335	0.083335	0.416675	0.083335	4.116749
ccc	2	Pu35-32	3	12	M25	<1.00	<0.100	<0.500	<0.100	1.56	0.83335	0.083335	0.416675	0.083335	2.600052
ccc	2	Soln Std	3	13	STD-13-2	19.1	<0.100	<0.500	82.5	48.2	19.1	0.05	.	82.5	48.2
ccc	2	Pu35-31	3	14	M32	<1.00	<0.100	<0.500	<0.100	3.28	0.83335	0.083335	0.416675	0.083335	5.466776

Table E1. Laboratory Measurements of the PCT Solutions for the Pu Study Glasses As Reported (ar) and After the Appropriate Adjustments (in parts per million, ppm)
(continued)

Heat Treament	Set	Glass ID	Block	Seq	SRNL-ML ID	B ar	Gd ar	Hf ar	Na ar	Si ar	B (ppm)	Gd (ppm)	Hf (ppm)	Na (ppm)	Si (ppm)
ccc	2	Pu35-26	3	15	M18	<1.00	<0.100	<0.500	<0.100	1.83	0.83335	0.083335	0.416675	0.083335	3.050061
ccc	2	Pu35-19	3	16	M40	<1.00	<0.100	<0.500	<0.100	2.76	0.83335	0.083335	0.416675	0.083335	4.600092
ccc	2	Pu35-22	3	17	M45	<1.00	<0.100	<0.500	1.86	3.02	0.83335	0.083335	0.416675	3.100062	5.033434
ccc	2	Pu35-21	3	18	M23	<1.00	<0.100	<0.500	1.4	2.68	0.83335	0.083335	0.416675	2.33338	4.466756
ccc	2	Pu35-23	3	19	M57	<1.00	<0.100	<0.500	<0.100	2.44	0.83335	0.083335	0.416675	0.083335	4.066748
ccc	2	Pu35-35	3	20	M49	<1.00	<0.100	<0.500	<0.100	1.89	0.83335	0.083335	0.416675	0.083335	3.150063
ccc	2	Pu35-20	3	21	M07	<1.00	<0.100	<0.500	<0.100	2.91	0.83335	0.083335	0.416675	0.083335	4.850097
ccc	2	Pu35-27	3	22	M11	<1.00	<0.100	<0.500	<0.100	2.62	0.83335	0.083335	0.416675	0.083335	4.366754
ccc	2	Pu35-30	3	23	M53	<1.00	<0.100	<0.500	<0.100	3.39	0.83335	0.083335	0.416675	0.083335	5.650113
ccc	2	Pu35-24	3	24	M50	<1.00	<0.100	<0.500	<0.100	2.49	0.83335	0.083335	0.416675	0.083335	4.150083
ccc	2	Pu35-29	3	25	M44	<1.00	<0.100	<0.500	0.306	2.89	0.83335	0.083335	0.416675	0.5100102	4.816763
ccc	2	Soln Std	3	26	STD-13-3	19.3	<0.100	<0.500	84.1	48.4	19.3	0.05	.	84.1	48.4
ccc	3	Soln Std	1	1	STD-11-1	21.2	<0.100	<0.500	83.8	49.6	21.2	0.05	.	83.8	49.6
ccc	3	Pu35-52	1	2	N61	1	<0.100	<0.500	0.962	2.83	1.6667	0.083335	0.416675	1.6033654	4.716761
ccc	3	Pu35-36	1	3	N23	1.48	<0.100	<0.500	1.14	3.46	2.466716	0.083335	0.416675	1.900038	5.766782
ccc	3	blank	1	4	N21	<1.00	<0.100	<0.500	0.407	<0.100	0.83335	0.083335	0.416675	0.6783469	0.083335
ccc	3	Pu35-49	1	5	N04	<1.00	<0.100	<0.500	1.57	2.56	0.83335	0.083335	0.416675	2.616719	4.266752
ccc	3	EA	1	6	N30	37.6	<0.100	<0.500	102	51.8	626.66792	0.833335	4.166675	1700.0034	863.33506
ccc	3	Pu35-40	1	7	N41	<1.00	<0.100	<0.500	0.573	2.61	0.83335	0.083335	0.416675	0.9550191	4.350087
ccc	3	Pu35-51	1	8	N67	<1.00	<0.100	<0.500	0.983	2.49	0.83335	0.083335	0.416675	1.6383661	4.150083
ccc	3	ARM-1	1	9	N46	10.7	<0.100	<0.500	22	33.9	17.83369	0.083335	0.416675	36.6674	56.50113
ccc	3	Pu35-53	1	10	N49	<1.00	<0.100	<0.500	1.94	2.47	0.83335	0.083335	0.416675	3.233398	4.116749
ccc	3	Pu35-39	1	11	N07	<1.00	<0.100	<0.500	2.88	2.81	0.83335	0.083335	0.416675	4.800096	4.683427
ccc	3	Pu35-48	1	12	N64	<1.00	<0.100	<0.500	2	1.91	0.83335	0.083335	0.416675	3.3334	3.183397
ccc	3	Soln Std	1	13	STD-11-2	20.4	<0.100	<0.500	89.3	48.9	20.4	0.05	.	89.3	48.9
ccc	3	Pu35-50	1	14	N52	<1.00	<0.100	<0.500	0.723	2.74	0.83335	0.083335	0.416675	1.2050241	4.566758
ccc	3	Pu35-41	1	15	N34	<1.00	<0.100	<0.500	0.864	2.76	0.83335	0.083335	0.416675	1.4400288	4.600092
ccc	3	Pu35-42	1	16	N20	<1.00	<0.100	<0.500	1.17	3.2	0.83335	0.083335	0.416675	1.950039	5.33344
ccc	3	Pu35-43	1	17	N03	<1.00	<0.100	<0.500	0.852	2.04	0.83335	0.083335	0.416675	1.4200284	3.400068
ccc	3	Pu35-54	1	18	N63	<1.00	<0.100	<0.500	1.19	2.77	0.83335	0.083335	0.416675	1.983373	4.616759
ccc	3	Pu35-44	1	19	N56	<1.00	<0.100	<0.500	0.939	2.15	0.83335	0.083335	0.416675	1.5650313	3.583405
ccc	3	Pu35-47	1	20	N35	<1.00	<0.100	<0.500	0.843	2.09	0.83335	0.083335	0.416675	1.4050281	3.483403
ccc	3	Pu35-45	1	21	N22	<1.00	<0.100	<0.500	1.42	1.58	0.83335	0.083335	0.416675	2.366714	2.633386
ccc	3	Pu35-37	1	22	N39	<1.00	<0.100	<0.500	2.49	2.41	0.83335	0.083335	0.416675	4.150083	4.016747

Table E1. Laboratory Measurements of the PCT Solutions for the Pu Study Glasses As Reported (ar) and After the Appropriate Adjustments (in parts per million, ppm)
(continued)

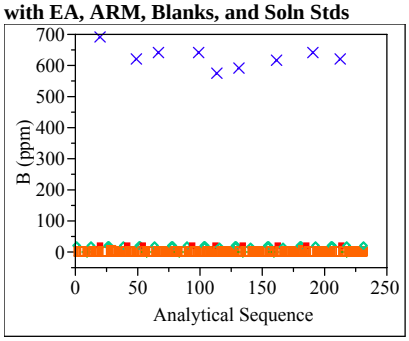
Heat Treament	Set	Glass ID	Block	Seq	SRNL-ML ID	B ar	Gd ar	Hf ar	Na ar	Si ar	B (ppm)	Gd (ppm)	Hf (ppm)	Na (ppm)	Si (ppm)
ccc	3	Pu35-55	1	23	N15	<1.00	<0.100	<0.500	0.833	2.56	0.83335	0.083335	0.416675	1.3883611	4.266752
ccc	3	Pu35-38	1	24	N13	<1.00	<0.100	<0.500	1.36	2.66	0.83335	0.083335	0.416675	2.266712	4.433422
ccc	3	Pu35-46	1	25	N50	<1.00	<0.100	<0.500	1.31	2.2	0.83335	0.083335	0.416675	2.183377	3.66674
ccc	3	Soln Std	1	26	STD-11-3	20.9	<0.100	<0.500	87.2	50.4	20.9	0.05	.	87.2	50.4
ccc	3	Soln Std	2	1	STD-12-1	21.7	<0.100	<0.500	85.1	51.2	21.7	0.05	.	85.1	51.2
ccc	3	Pu35-41	2	2	N31	1.22	<0.100	<0.500	0.363	3.01	2.033374	0.083335	0.416675	0.6050121	5.016767
ccc	3	Pu35-53	2	3	N37	1.07	<0.100	<0.500	23.5	3.11	1.783369	0.083335	0.416675	39.16745	5.183437
ccc	3	Pu35-39	2	4	N33	<1.00	<0.100	<0.500	0.54	3.15	0.83335	0.083335	0.416675	0.900018	5.250105
ccc	3	ARM-1	2	5	N01	11.3	<0.100	<0.500	20.9	35.9	18.83371	0.083335	0.416675	34.83403	59.83453
ccc	3	Pu35-45	2	6	N40	<1.00	<0.100	<0.500	1.78	1.83	0.83335	0.083335	0.416675	2.966726	3.050061
ccc	3	Pu35-43	2	7	N51	<1.00	<0.100	<0.500	1.87	2.29	0.83335	0.083335	0.416675	3.116729	3.816743
ccc	3	Pu35-42	2	8	N47	<1.00	<0.100	<0.500	<0.100	3.23	0.83335	0.083335	0.416675	0.083335	5.383441
ccc	3	Pu35-55	2	9	N48	<1.00	<0.100	<0.500	0.709	3.22	0.83335	0.083335	0.416675	1.1816903	5.366774
ccc	3	EA	2	10	N29	37.5	<0.100	<0.500	103	52.6	625.00125	0.833335	4.166675	1716.6701	876.66842
ccc	3	Pu35-54	2	11	N45	<1.00	<0.100	<0.500	1.36	3.42	0.83335	0.083335	0.416675	2.266712	5.700114
ccc	3	Pu35-48	2	12	N60	<1.00	<0.100	<0.500	<0.100	2.3	0.83335	0.083335	0.416675	0.083335	3.83341
ccc	3	Soln Std	2	13	STD-12-2	20.7	<0.100	<0.500	88.1	50	20.7	0.05	.	88.1	50
ccc	3	Pu35-51	2	14	N08	<1.00	<0.100	<0.500	0.939	2.47	0.83335	0.083335	0.416675	1.5650313	4.116749
ccc	3	Pu35-50	2	15	N27	<1.00	<0.100	<0.500	3.08	2.58	0.83335	0.083335	0.416675	5.133436	4.300086
ccc	3	Pu35-46	2	16	N24	<1.00	<0.100	<0.500	0.215	2.63	0.83335	0.083335	0.416675	0.3583405	4.383421
ccc	3	Pu35-52	2	17	N32	<1.00	<0.100	<0.500	<0.100	2.63	0.83335	0.083335	0.416675	0.083335	4.383421
ccc	3	Pu35-49	2	18	N43	<1.00	<0.100	<0.500	<0.100	2.72	0.83335	0.083335	0.416675	0.083335	4.533424
ccc	3	Pu35-40	2	19	N55	<1.00	<0.100	<0.500	0.489	2.9	0.83335	0.083335	0.416675	0.8150163	4.83343
ccc	3	Pu35-37	2	20	N16	<1.00	<0.100	<0.500	0.507	2.83	0.83335	0.083335	0.416675	0.8450169	4.716761
ccc	3	Pu35-44	2	21	N53	<1.00	<0.100	<0.500	0.94	2.3	0.83335	0.083335	0.416675	1.566698	3.83341
ccc	3	Pu35-47	2	22	N65	<1.00	<0.100	<0.500	1.75	2.47	0.83335	0.083335	0.416675	2.916725	4.116749
ccc	3	Pu35-38	2	23	N06	<1.00	<0.100	<0.500	0.463	2.68	0.83335	0.083335	0.416675	0.7716821	4.466756
ccc	3	Pu35-36	2	24	N12	<1.00	<0.100	<0.500	0.737	3.73	0.83335	0.083335	0.416675	1.2283579	6.216791
ccc	3	Soln Std	2	25	STD-12-3	21	<0.100	<0.500	84.1	51.4	21	0.05	.	84.1	51.4
ccc	3	Soln Std	3	1	STD-13-1	20.2	<0.100	<0.500	85.3	48.8	20.2	0.05	.	85.3	48.8
ccc	3	Pu35-52	3	2	N14	<1.00	<0.100	<0.500	<0.100	2.85	0.83335	0.083335	0.416675	0.083335	4.750095
ccc	3	Pu35-44	3	3	N38	<1.00	<0.100	<0.500	0.434	2.24	0.83335	0.083335	0.416675	0.7233478	3.733408
ccc	3	Pu35-40	3	4	N44	<1.00	<0.100	<0.500	<0.100	2.41	0.83335	0.083335	0.416675	0.083335	4.016747
ccc	3	Pu35-51	3	5	N10	<1.00	<0.100	<0.500	<0.100	2.05	0.83335	0.083335	0.416675	0.083335	3.416735

Table E1. Laboratory Measurements of the PCT Solutions for the Pu Study Glasses As Reported (ar) and After the Appropriate Adjustments (in parts per million, ppm)
(continued)

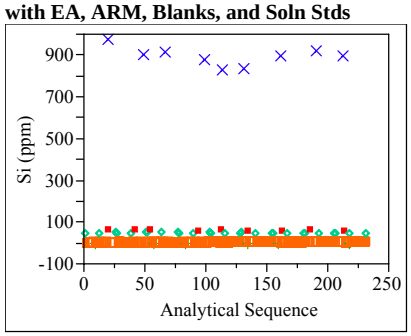
Heat Treament	Set	Glass ID	Block	Seq	SRNL-ML ID	B ar	Gd ar	Hf ar	Na ar	Si ar	B (ppm)	Gd (ppm)	Hf (ppm)	Na (ppm)	Si (ppm)
ccc	3	EA	3	6	N62	37	<0.100	<0.500	100	53.4	616.6679	0.833335	4.166675	1666.67	890.00178
ccc	3	Pu35-50	3	7	N05	<1.00	<0.100	<0.500	0.164	3.03	0.83335	0.083335	0.416675	0.2733388	5.050101
ccc	3	Pu35-55	3	8	N59	<1.00	<0.100	<0.500	<0.100	2.52	0.83335	0.083335	0.416675	0.083335	4.200084
ccc	3	ARM-1	3	9	N26	10.4	<0.100	<0.500	21.7	35.3	17.33368	0.083335	0.416675	36.16739	58.83451
ccc	3	Pu35-48	3	10	N58	<1.00	<0.100	<0.500	<0.100	2.22	0.83335	0.083335	0.416675	0.083335	3.700074
ccc	3	Pu35-37	3	11	N25	<1.00	<0.100	<0.500	0.304	2.37	0.83335	0.083335	0.416675	0.5066768	3.950079
ccc	3	blank	3	12	N54	<1.00	<0.100	<0.500	1.97	<0.100	0.83335	0.083335	0.416675	3.283399	0.083335
ccc	3	Soln Std	3	13	STD-13-2	20.4	<0.100	<0.500	85.7	51.7	20.4	0.05	.	85.7	51.7
ccc	3	Pu35-38	3	14	N02	<1.00	<0.100	<0.500	0.391	2.55	0.83335	0.083335	0.416675	0.6516797	4.250085
ccc	3	Pu35-41	3	15	N18	<1.00	<0.100	<0.500	0.253	2.72	0.83335	0.083335	0.416675	0.4216751	4.533424
ccc	3	Pu35-54	3	16	N57	<1.00	<0.100	<0.500	0.499	3.54	0.83335	0.083335	0.416675	0.8316833	5.900118
ccc	3	Pu35-53	3	17	N09	<1.00	<0.100	<0.500	<0.100	3.13	0.83335	0.083335	0.416675	0.083335	5.216771
ccc	3	Pu35-42	3	18	N68	<1.00	<0.100	<0.500	2.8	3.59	0.83335	0.083335	0.416675	4.66676	5.983453
ccc	3	Pu35-36	3	19	N42	<1.00	<0.100	<0.500	1.59	3.24	0.83335	0.083335	0.416675	2.650053	5.400108
ccc	3	Pu35-39	3	20	N36	<1.00	<0.100	<0.500	<0.100	2.78	0.83335	0.083335	0.416675	0.083335	4.633426
ccc	3	Pu35-46	3	21	N28	<1.00	<0.100	<0.500	<0.100	2.71	0.83335	0.083335	0.416675	0.083335	4.516757
ccc	3	Pu35-49	3	22	N17	<1.00	<0.100	<0.500	<0.100	2.47	0.83335	0.083335	0.416675	0.083335	4.116749
ccc	3	Pu35-47	3	23	N66	<1.00	<0.100	<0.500	<0.100	2.04	0.83335	0.083335	0.416675	0.083335	3.400068
ccc	3	Pu35-43	3	24	N11	1.49	<0.100	<0.500	10.2	1.86	2.483383	0.083335	0.416675	17.00034	3.100062
ccc	3	Pu35-45	3	25	N19	<1.00	<0.100	<0.500	<0.100	1.5	0.83335	0.083335	0.416675	0.083335	2.50005
ccc	3	Soln Std	3	26	STD-13-3	20.1	<0.100	<0.500	87.4	50.8	20.1	0.05	.	87.4	50.8

Exhibit E1. Laboratory PCT Measurements in Analytical Sequence for Quenched Study Glasses with and without EA, ARM, Blanks, and Solution Standards

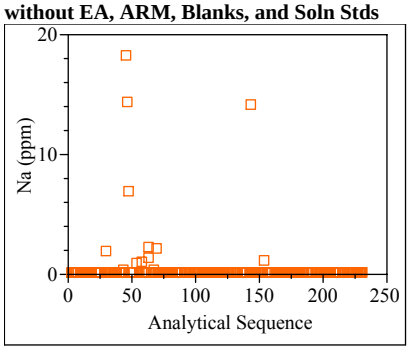
B (ppm) By Analytical Sequence with EA, ARM, Blanks, and Soln Stds



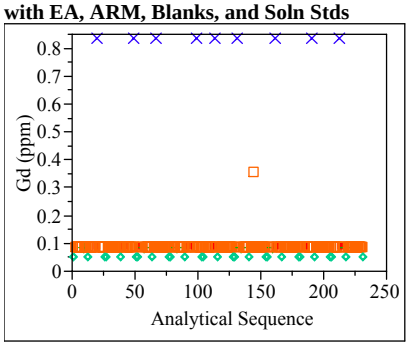
Si (ppm) By Analytical Sequence with Others with EA, ARM, Blanks, and Soln Stds



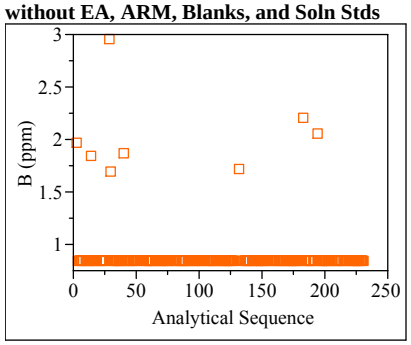
Na (ppm) By Analytical Sequence without EA, ARM, Blanks, and Soln Stds



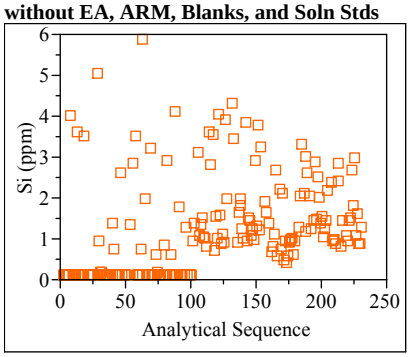
Gd (ppm) By Analytical Sequence with EA, ARM, Blanks, and Soln Stds



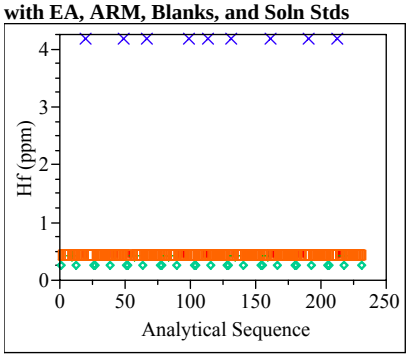
B (ppm) By Analytical Sequence without EA, ARM, Blanks, and Soln Stds



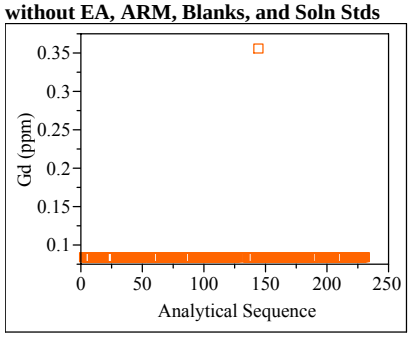
Si (ppm) By Analytical Sequence without EA, ARM, Blanks, and Soln Stds



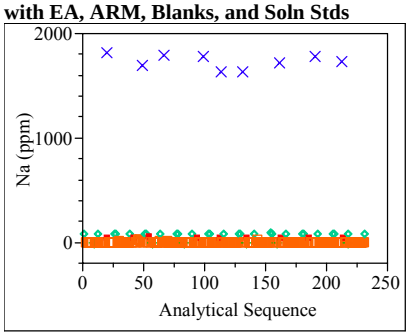
Hf (ppm) By Analytical Sequence with EA, ARM, Blanks, and Soln Stds



Gd (ppm) By Analytical Sequence without EA, ARM, Blanks, and Soln Stds



Na (ppm) By Analytical Sequence with EA, ARM, Blanks, and Soln Stds



Hf (ppm) By Analytical Sequence without EA, ARM, Blanks, and Soln Stds

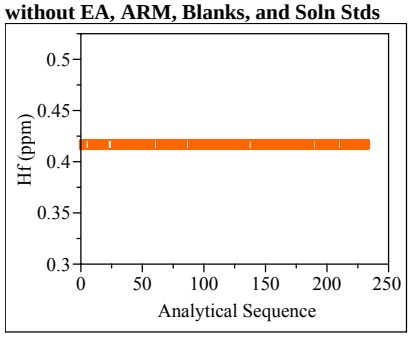
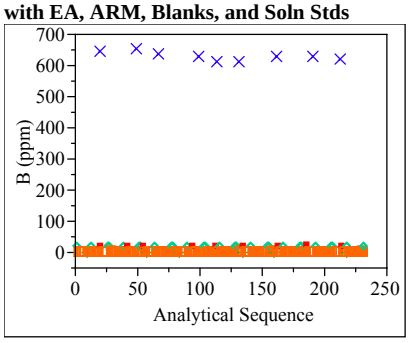
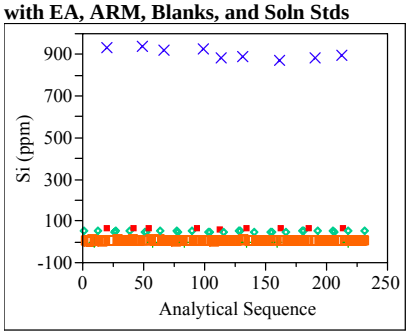


Exhibit E2. Laboratory PCT Measurements in Analytical Sequence for CCC Study Glasses with and without EA, ARM, Blanks, and Solution Standards

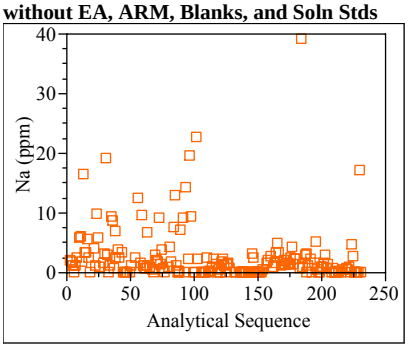
B (ppm) By Analytical Sequence with EA, ARM, Blanks, and Soln Stds



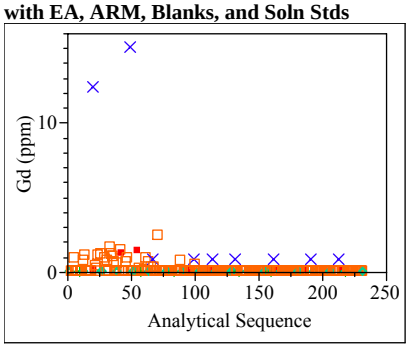
Si (ppm) By Analytical Sequence with EA, ARM, Blanks, and Soln Stds



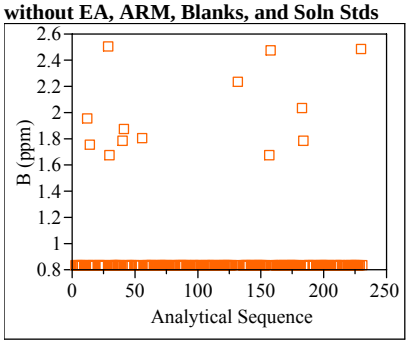
Na (ppm) By Analytical Sequence without EA, ARM, Blanks, and Soln Stds



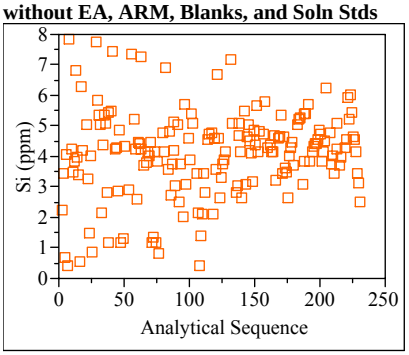
Gd (ppm) By Analytical Sequence with EA, ARM, Blanks, and Soln Stds



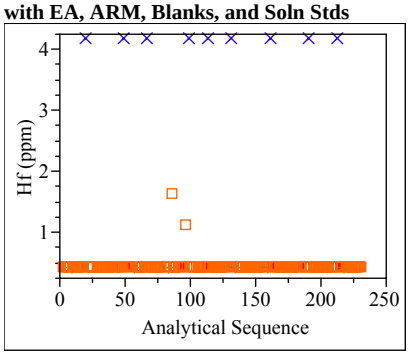
B (ppm) By Analytical Sequence without EA, ARM, Blanks, and Soln Stds



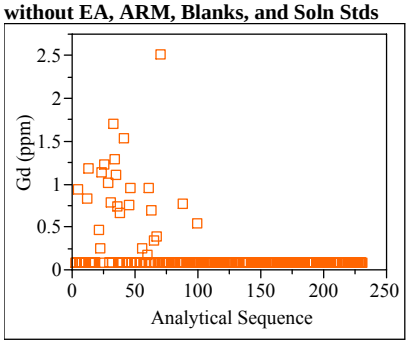
Si (ppm) By Analytical Sequence without EA, ARM, Blanks, and Soln Stds



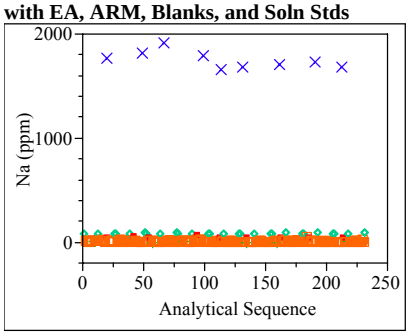
Hf (ppm) By Analytical Sequence with EA, ARM, Blanks, and Soln Stds



Gd (ppm) By Analytical Sequence without EA, ARM, Blanks, and Soln Stds



Na (ppm) By Analytical Sequence with EA, ARM, Blanks, and Soln Stds



Hf (ppm) By Analytical Sequence without EA, ARM, Blanks, and Soln Stds

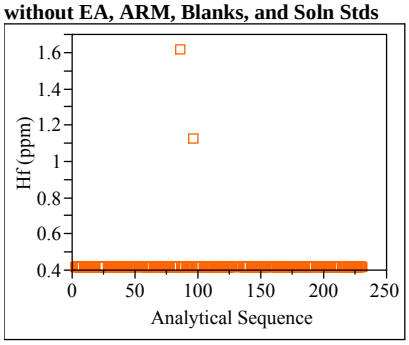
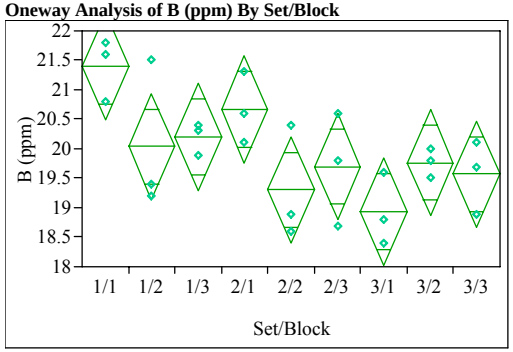


Exhibit E3. Measurements of the Multi-Element Solution Standard by PCT Set and ICP-AES Calibration Block for Quenched Glass Plans

(Note Gd and Hf are not in this Standard)

Oneway Analysis of B (ppm) By Set/Block



Oneway Anova
Summary of Fit

Rsquare	0.568766
Adj Rsquare	0.377106
Root Mean Square Error	0.744362
Mean of Response	19.95185
Observations (or Sum Wgts)	27

Analysis of Variance

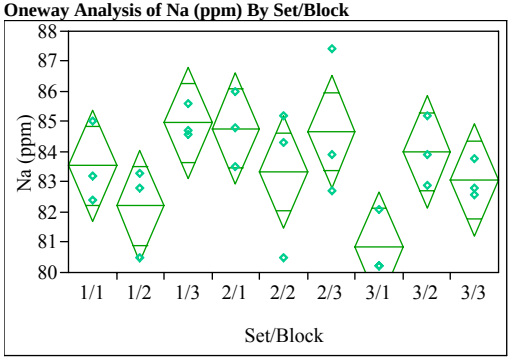
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block	8	13.154074	1.64426	2.9676	0.0263
Error	18	9.973333	0.55407		
C. Total	26	23.127407			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1/1	3	21.4000	0.42976	20.497	22.303
1/2	3	20.0333	0.42976	19.130	20.936
1/3	3	20.2000	0.42976	19.297	21.103
2/1	3	20.6667	0.42976	19.764	21.570
2/2	3	19.3000	0.42976	18.397	20.203
2/3	3	19.7000	0.42976	18.797	20.603
3/1	3	18.9333	0.42976	18.030	19.836
3/2	3	19.7667	0.42976	18.864	20.670
3/3	3	19.5667	0.42976	18.664	20.470

Std Error uses a pooled estimate of error variance

Oneway Analysis of Na (ppm) By Set/Block



Oneway Anova
Summary of Fit

Rsquare	0.506698
Adj Rsquare	0.287453
Root Mean Square Error	1.527646
Mean of Response	83.48519
Observations (or Sum Wgts)	27

Analysis of Variance

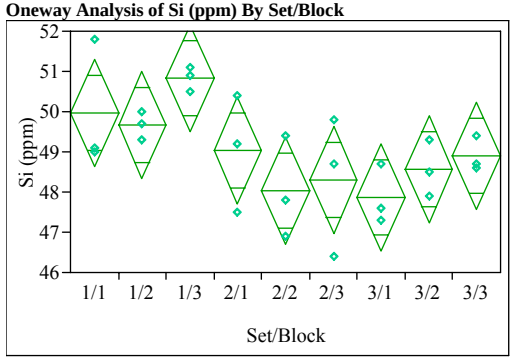
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block	8	43.147407	5.39343	2.3111	0.0667
Error	18	42.006667	2.33370		
C. Total	26	85.154074			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1/1	3	83.5333	0.88199	81.680	85.386
1/2	3	82.2000	0.88199	80.347	84.053
1/3	3	84.9667	0.88199	83.114	86.820
2/1	3	84.7667	0.88199	82.914	86.620
2/2	3	83.3333	0.88199	81.480	85.186
2/3	3	84.6667	0.88199	82.814	86.520
3/1	3	80.8333	0.88199	78.980	82.686
3/2	3	84.0000	0.88199	82.147	85.853
3/3	3	83.0667	0.88199	81.214	84.920

Std Error uses a pooled estimate of error variance

Oneway Analysis of Si (ppm) By Set/Block



Oneway Anova
Summary of Fit

Rsquare	0.517224
Adj Rsquare	0.302656
Root Mean Square Error	1.090532
Mean of Response	49.01852
Observations (or Sum Wgts)	27

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block	8	22.934074	2.86676	2.4105	0.0577
Error	18	21.406667	1.18926		
C. Total	26	44.340741			

Means for Oneway Anova

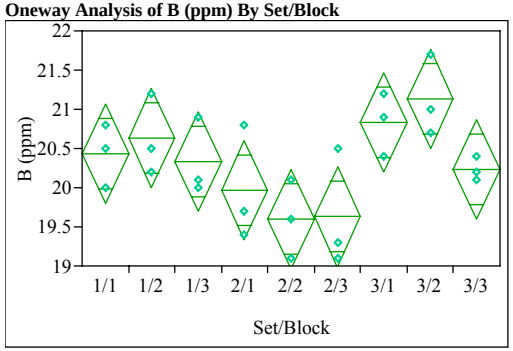
Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1/1	3	49.9667	0.62962	48.644	51.289
1/2	3	49.6667	0.62962	48.344	50.989
1/3	3	50.8333	0.62962	49.511	52.156
2/1	3	49.0333	0.62962	47.711	50.356
2/2	3	48.0333	0.62962	46.711	49.356
2/3	3	48.3000	0.62962	46.977	49.623
3/1	3	47.8667	0.62962	46.544	49.189
3/2	3	48.5667	0.62962	47.244	49.889
3/3	3	48.9000	0.62962	47.577	50.223

Std Error uses a pooled estimate of error variance

Exhibit E4. Measurements of the Multi-Element Solution Standard by PCT Set and ICP-AES Calibration Block for CCC Glass Plans

(Note Gd and Hf are not in this Standard)

Oneway Analysis of B (ppm) By Set/Block



Oneway Anova
Summary of Fit

Rsquare	0.565521
Adj Rsquare	0.37242
Root Mean Square Error	0.525639
Mean of Response	20.31111
Observations (or Sum Wgts)	27

Analysis of Variance

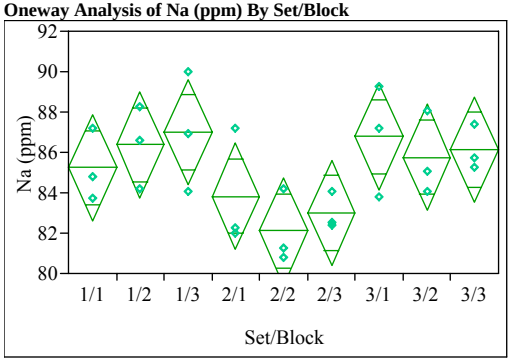
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block	8	6.473333	0.809167	2.9286	0.0278
Error	18	4.973333	0.276296		
C. Total	26	11.446667			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1/1	3	20.4333	0.30348	19.796	21.071
1/2	3	20.6333	0.30348	19.996	21.271
1/3	3	20.3333	0.30348	19.696	20.971
2/1	3	19.9667	0.30348	19.329	20.604
2/2	3	19.6000	0.30348	18.962	20.238
2/3	3	19.6333	0.30348	18.996	20.271
3/1	3	20.8333	0.30348	20.196	21.471
3/2	3	21.1333	0.30348	20.496	21.771
3/3	3	20.2333	0.30348	19.596	20.871

Std Error uses a pooled estimate of error variance

Oneway Analysis of Na (ppm) By Set/Block



Oneway Anova
Summary of Fit

Rsquare	0.465519
Adj Rsquare	0.227972
Root Mean Square Error	2.16641
Mean of Response	85.13333
Observations (or Sum Wgts)	27

Analysis of Variance

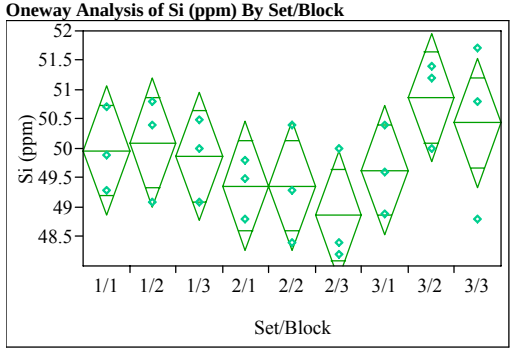
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block	8	73.58000	9.19750	1.9597	0.1124
Error	18	84.48000	4.69333		
C. Total	26	158.06000			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1/1	3	85.2333	1.2508	82.606	87.861
1/2	3	86.3667	1.2508	83.739	88.994
1/3	3	87.0000	1.2508	84.372	89.628
2/1	3	83.8333	1.2508	81.206	86.461
2/2	3	82.1000	1.2508	79.472	84.728
2/3	3	83.0000	1.2508	80.372	85.628
3/1	3	86.7667	1.2508	84.139	89.394
3/2	3	85.7667	1.2508	83.139	88.394
3/3	3	86.1333	1.2508	83.506	88.761

Std Error uses a pooled estimate of error variance

Oneway Analysis of Si (ppm) By Set/Block



Oneway Anova
Summary of Fit

Rsquare	0.373484
Adj Rsquare	0.095033
Root Mean Square Error	0.90472
Mean of Response	49.82963
Observations (or Sum Wgts)	27

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Set/Block	8	8.782963	1.09787	1.3413	0.2861
Error	18	14.733333	0.81852		
C. Total	26	23.516296			

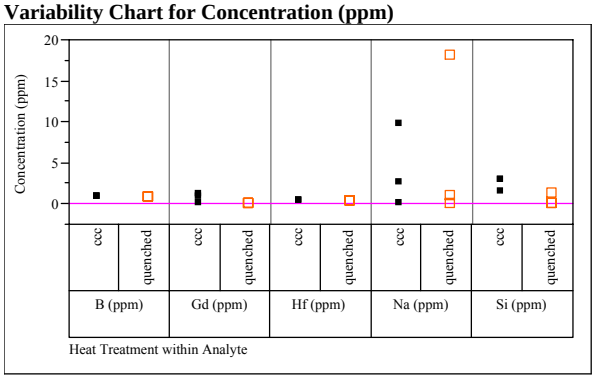
Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1/1	3	49.9667	0.52234	48.869	51.064
1/2	3	50.1000	0.52234	49.003	51.197
1/3	3	49.8667	0.52234	48.769	50.964
2/1	3	49.3667	0.52234	48.269	50.464
2/2	3	49.3667	0.52234	48.269	50.464
2/3	3	48.8667	0.52234	47.769	49.964
3/1	3	49.6333	0.52234	48.536	50.731
3/2	3	50.8667	0.52234	49.769	51.964
3/3	3	50.4333	0.52234	49.336	51.531

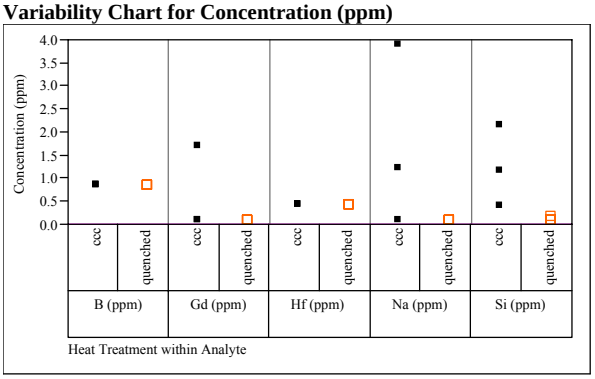
Std Error uses a pooled estimate of error variance

Exhibit E5. Laboratory PCT Measurements by Pu Glass ID for both Quenched and CCC Versions

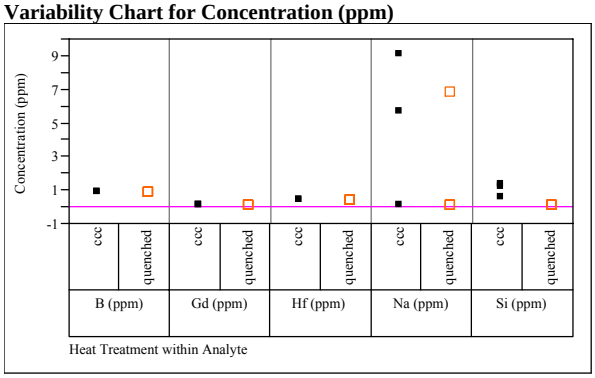
Glass ID=Pu04-01
Variability Chart for Concentration (ppm)



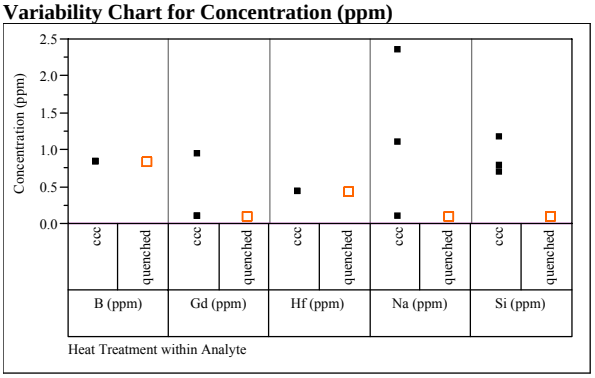
Glass ID=Pu04-04
Variability Chart for Concentration (ppm)



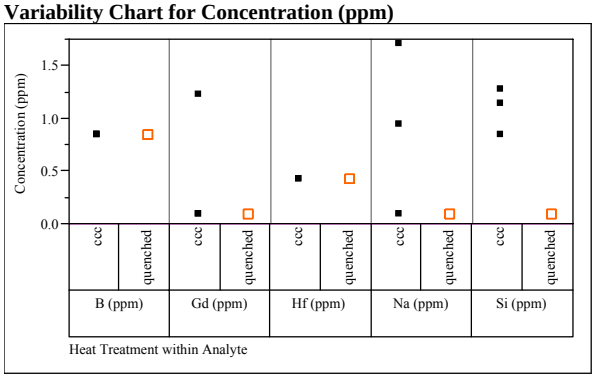
Glass ID=Pu04-02
Variability Chart for Concentration (ppm)



Glass ID=Pu04-05
Variability Chart for Concentration (ppm)



Glass ID=Pu04-03
Variability Chart for Concentration (ppm)



Glass ID=Pu35-01
Variability Chart for Concentration (ppm)

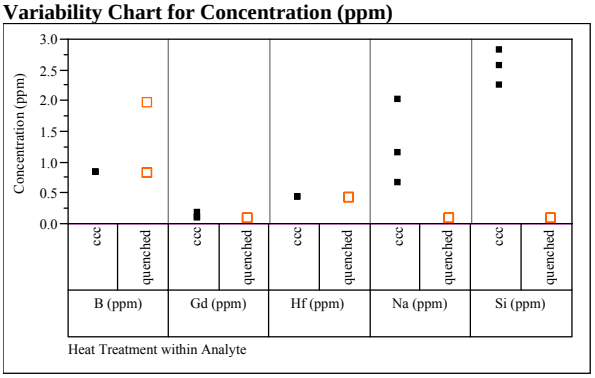
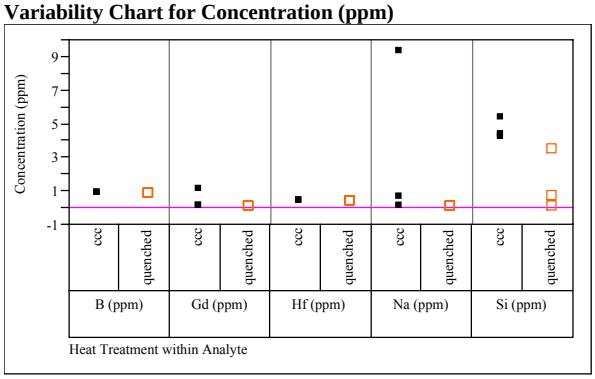
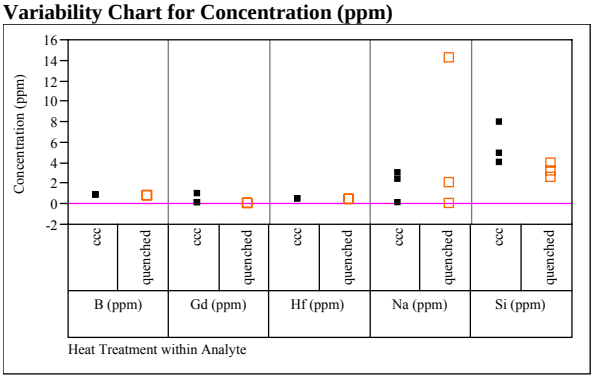


Exhibit E5. Laboratory PCT Measurements by Pu Glass ID for both Quenched and CCC Versions (continued)

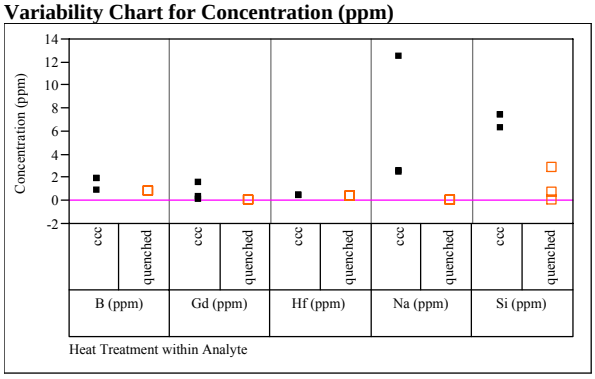
Glass ID=Pu35-02
Variability Chart for Concentration (ppm)



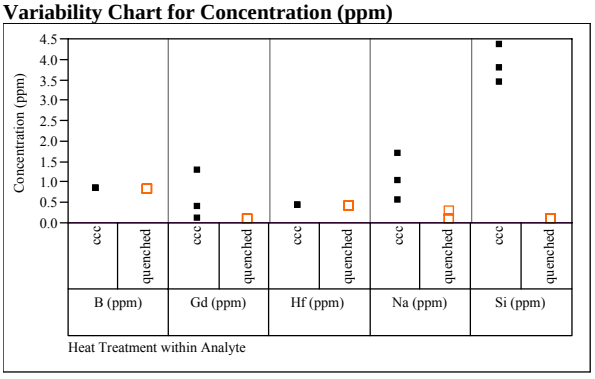
Glass ID=Pu35-05
Variability Chart for Concentration (ppm)



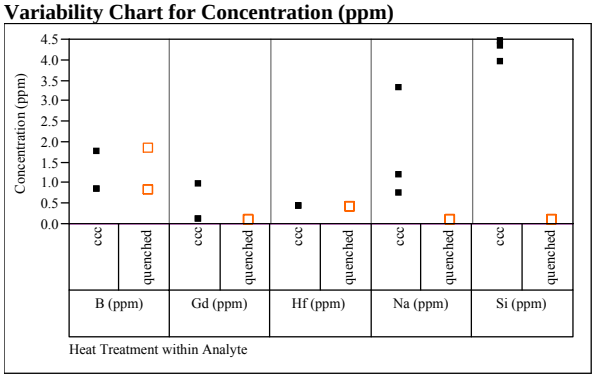
Glass ID=Pu35-03
Variability Chart for Concentration (ppm)



Glass ID=Pu35-06
Variability Chart for Concentration (ppm)



Glass ID=Pu35-04
Variability Chart for Concentration (ppm)



Glass ID=Pu35-07
Variability Chart for Concentration (ppm)

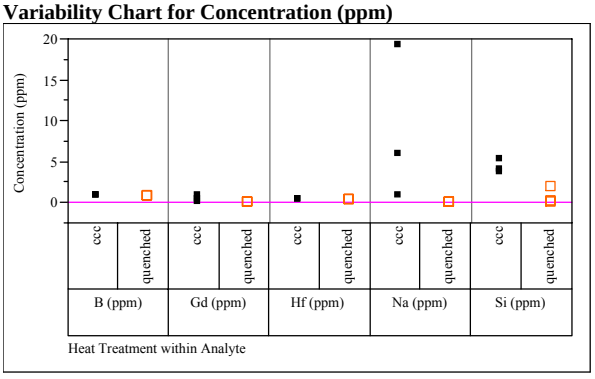
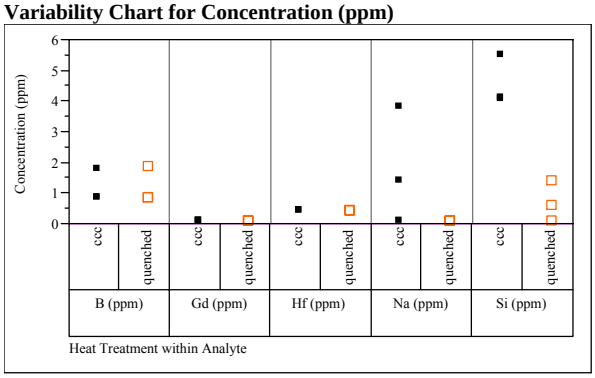
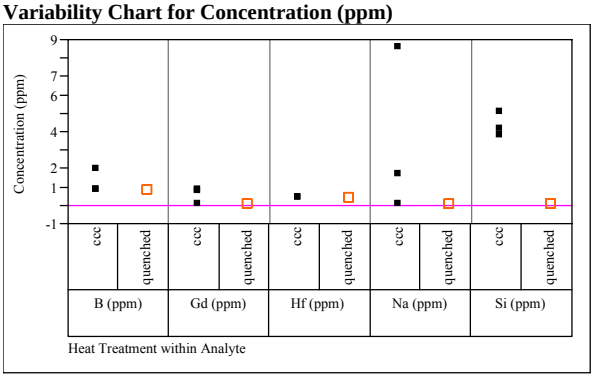


Exhibit E5. Laboratory PCT Measurements by Pu Glass ID for both Quenched and CCC Versions (continued)

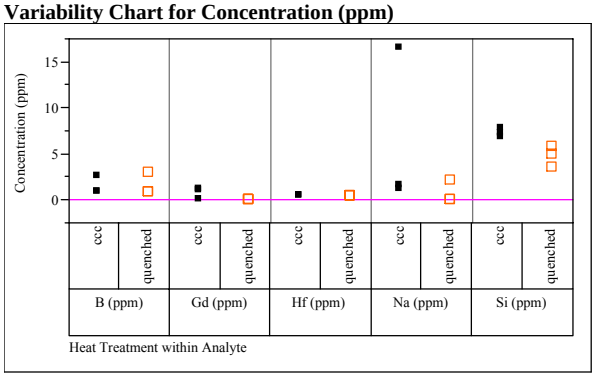
Glass ID=Pu35-08
Variability Chart for Concentration (ppm)



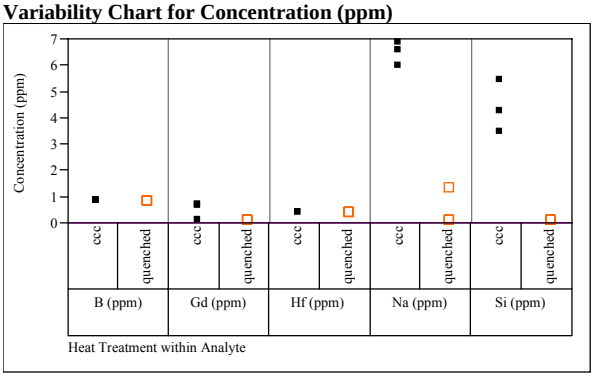
Glass ID=Pu35-11
Variability Chart for Concentration (ppm)



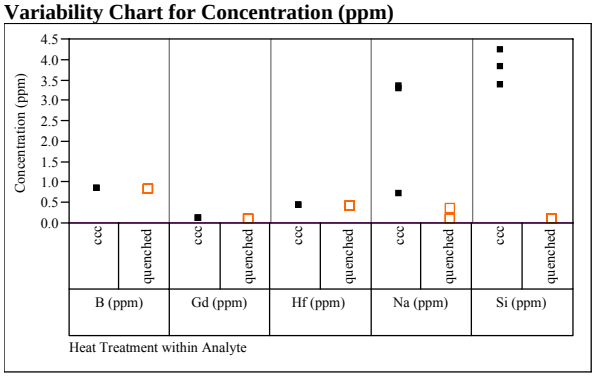
Glass ID=Pu35-09
Variability Chart for Concentration (ppm)



Glass ID=Pu35-12
Variability Chart for Concentration (ppm)



Glass ID=Pu35-10
Variability Chart for Concentration (ppm)



Glass ID=Pu35-13
Variability Chart for Concentration (ppm)

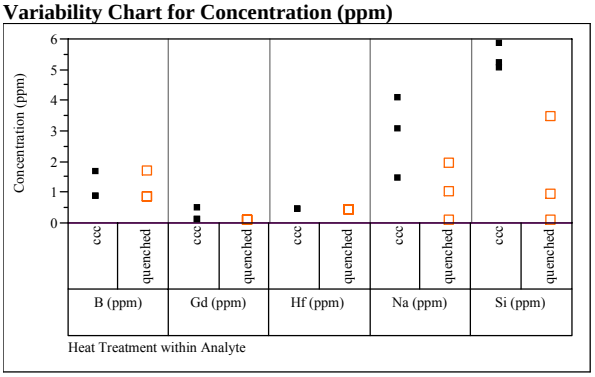
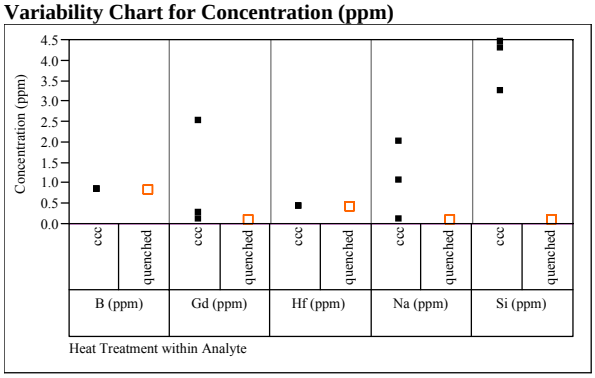
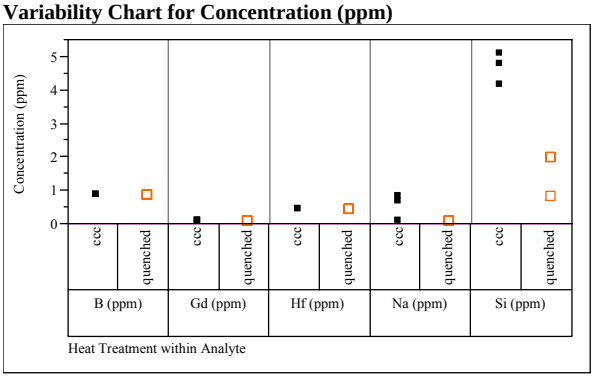


Exhibit E5. Laboratory PCT Measurements by Pu Glass ID for both Quenched and CCC Versions (continued)

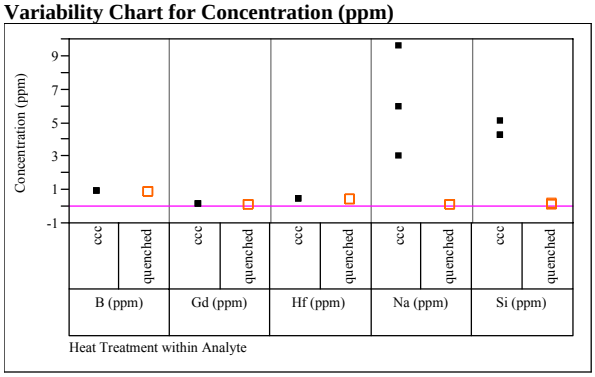
Glass ID=Pu35-14
Variability Chart for Concentration (ppm)



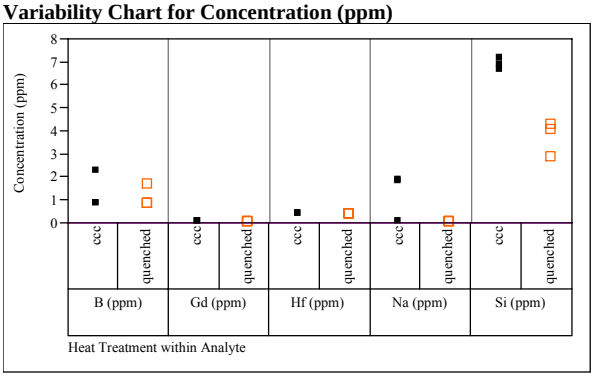
Glass ID=Pu35-17
Variability Chart for Concentration (ppm)



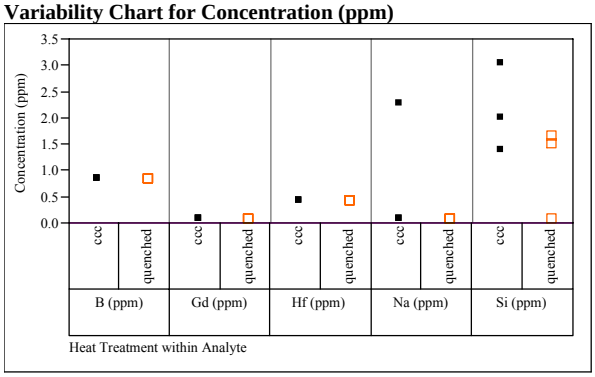
Glass ID=Pu35-15
Variability Chart for Concentration (ppm)



Glass ID=Pu35-18
Variability Chart for Concentration (ppm)



Glass ID=Pu35-16
Variability Chart for Concentration (ppm)



Glass ID=Pu35-19
Variability Chart for Concentration (ppm)

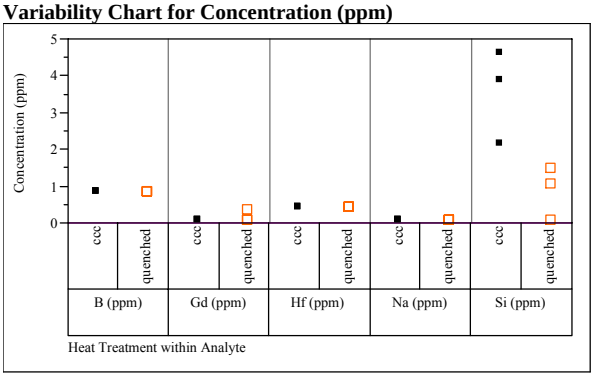
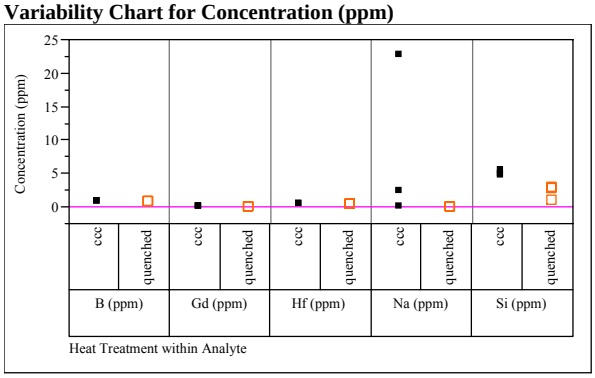
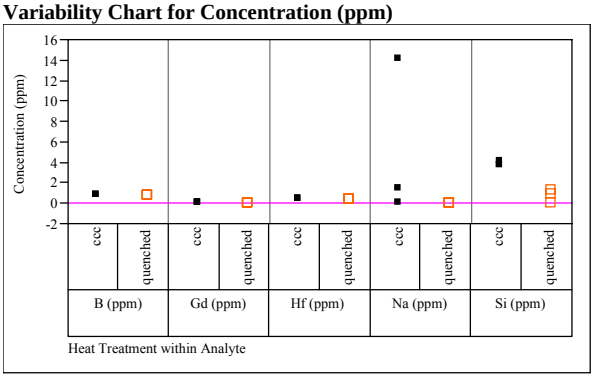


Exhibit E5. Laboratory PCT Measurements by Pu Glass ID for both Quenched and CCC Versions (continued)

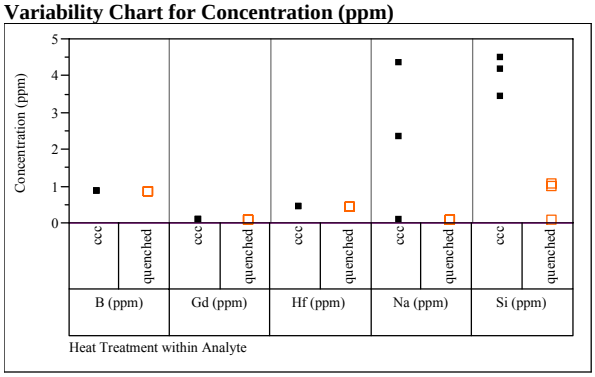
Glass ID=Pu35-20
Variability Chart for Concentration (ppm)



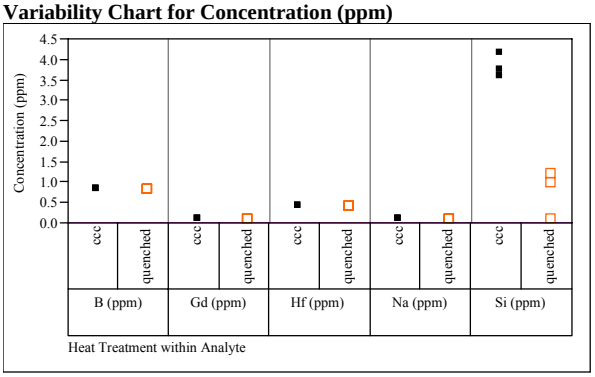
Glass ID=Pu35-23
Variability Chart for Concentration (ppm)



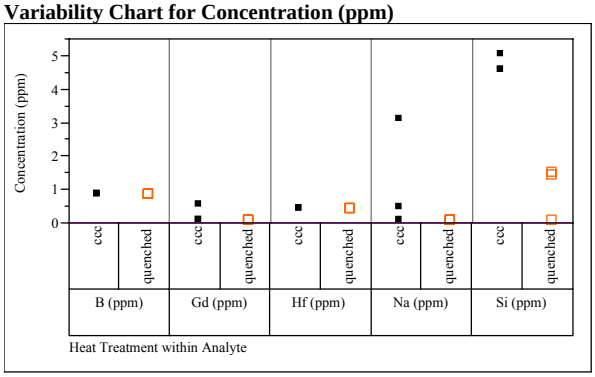
Glass ID=Pu35-21
Variability Chart for Concentration (ppm)



Glass ID=Pu35-24
Variability Chart for Concentration (ppm)



Glass ID=Pu35-22
Variability Chart for Concentration (ppm)



Glass ID=Pu35-25
Variability Chart for Concentration (ppm)

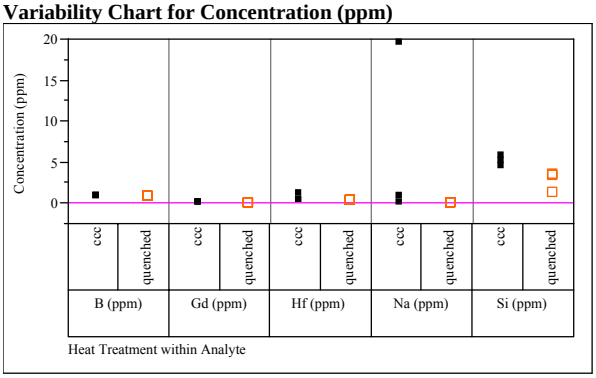
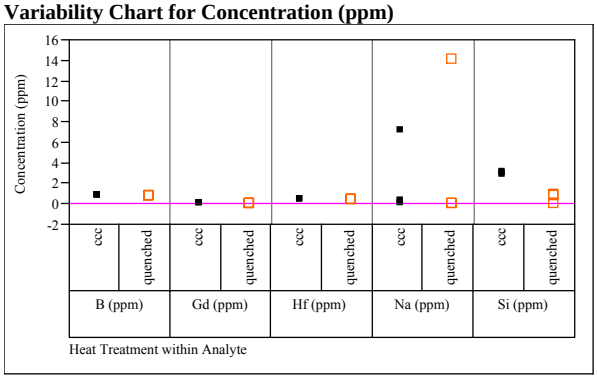
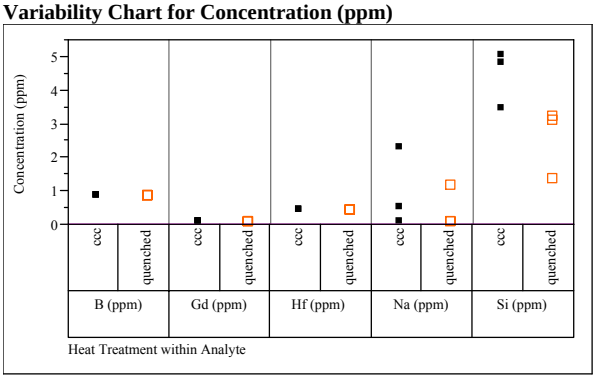


Exhibit E5. Laboratory PCT Measurements by Pu Glass ID for both Quenched and CCC Versions (continued)

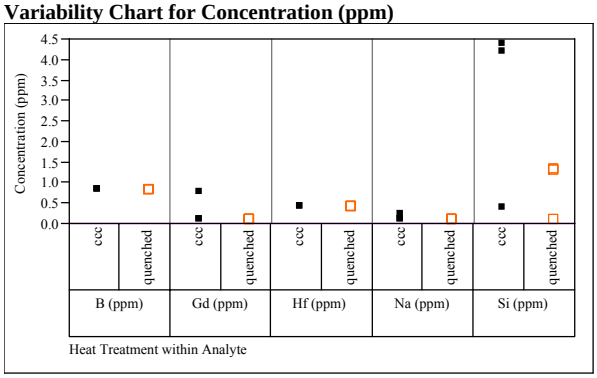
Glass ID=Pu35-26
Variability Chart for Concentration (ppm)



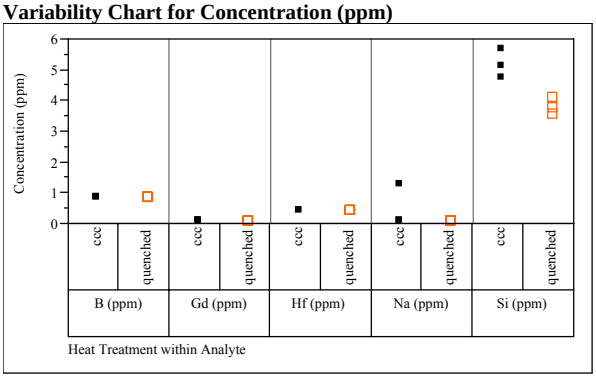
Glass ID=Pu35-29
Variability Chart for Concentration (ppm)



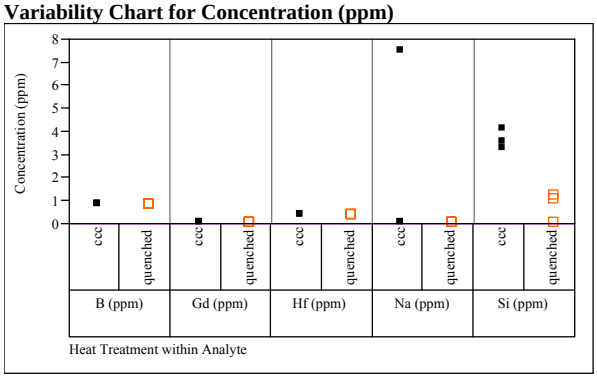
Glass ID=Pu35-27
Variability Chart for Concentration (ppm)



Glass ID=Pu35-30
Variability Chart for Concentration (ppm)



Glass ID=Pu35-28
Variability Chart for Concentration (ppm)



Glass ID=Pu35-31
Variability Chart for Concentration (ppm)

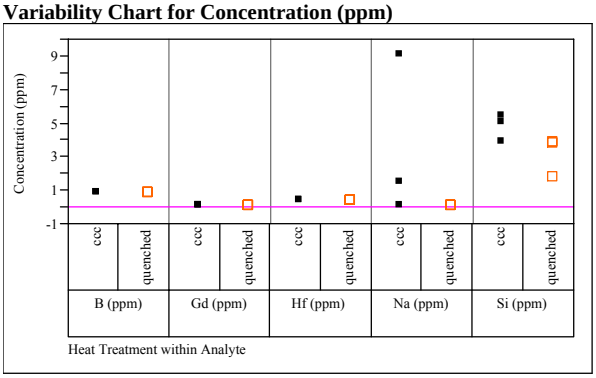
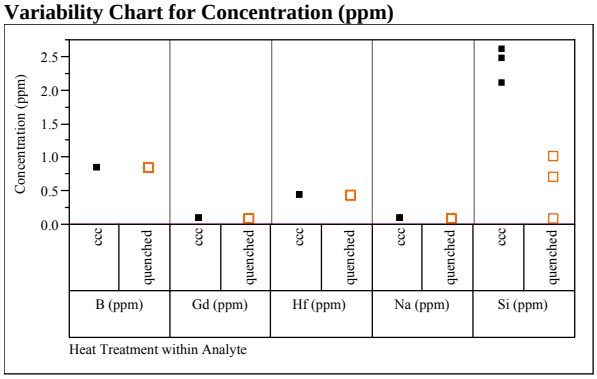
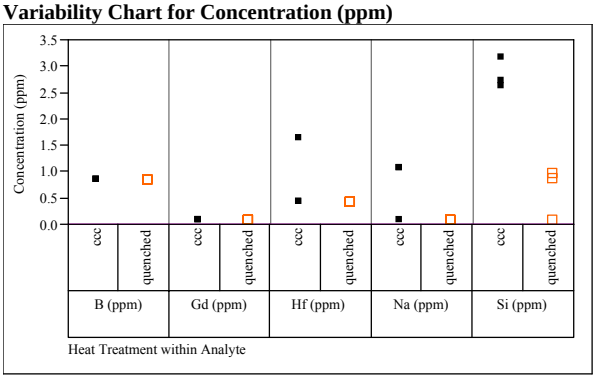


Exhibit E5. Laboratory PCT Measurements by Pu Glass ID for both Quenched and CCC Versions (continued)

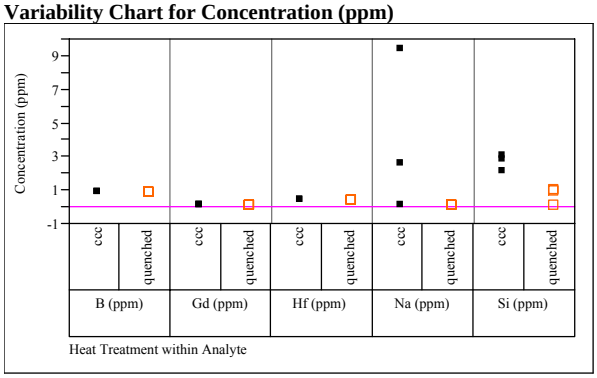
Glass ID=Pu35-32
Variability Chart for Concentration (ppm)



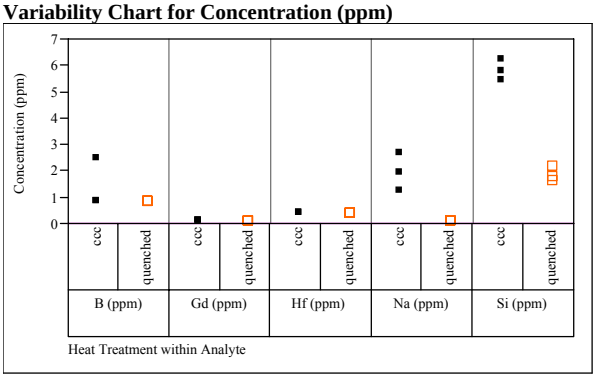
Glass ID=Pu35-35
Variability Chart for Concentration (ppm)



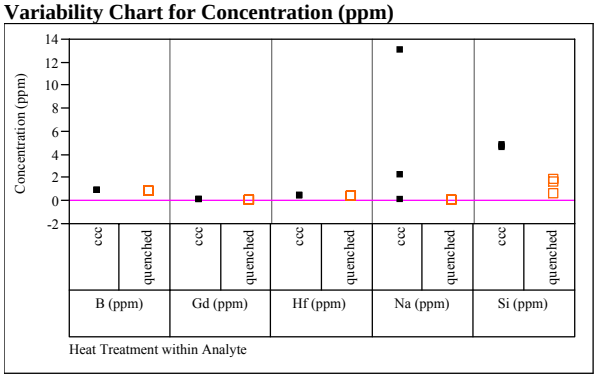
Glass ID=Pu35-33
Variability Chart for Concentration (ppm)



Glass ID=Pu35-36
Variability Chart for Concentration (ppm)



Glass ID=Pu35-34
Variability Chart for Concentration (ppm)



Glass ID=Pu35-37
Variability Chart for Concentration (ppm)

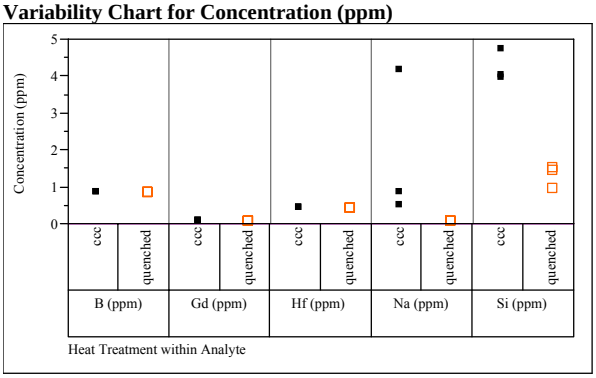
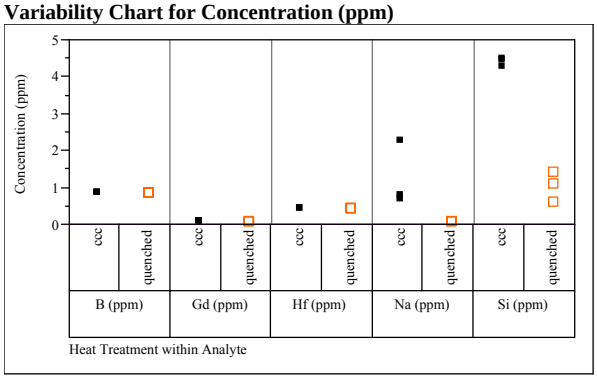
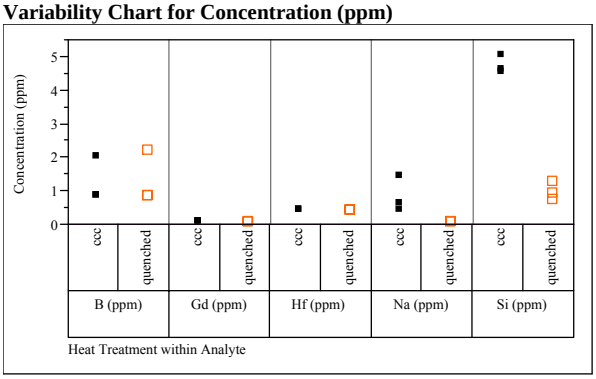


Exhibit E5. Laboratory PCT Measurements by Pu Glass ID for both Quenched and CCC Versions (continued)

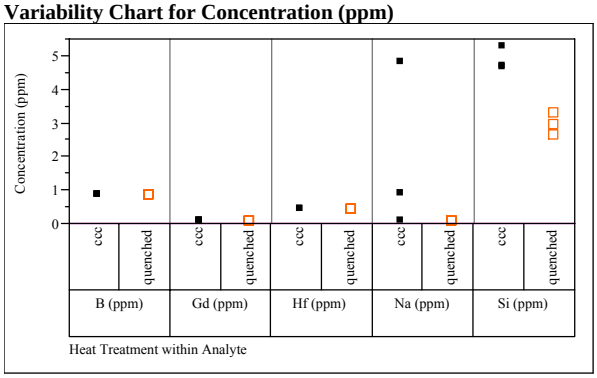
Glass ID=Pu35-38
Variability Chart for Concentration (ppm)



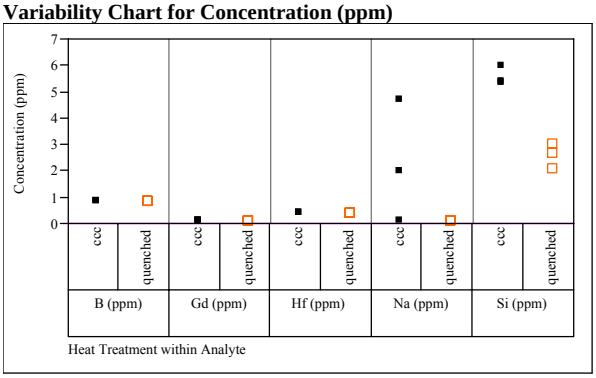
Glass ID=Pu35-41
Variability Chart for Concentration (ppm)



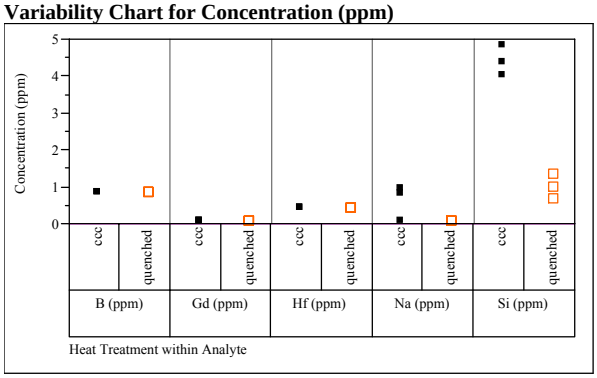
Glass ID=Pu35-39
Variability Chart for Concentration (ppm)



Glass ID=Pu35-42
Variability Chart for Concentration (ppm)



Glass ID=Pu35-40
Variability Chart for Concentration (ppm)



Glass ID=Pu35-43
Variability Chart for Concentration (ppm)

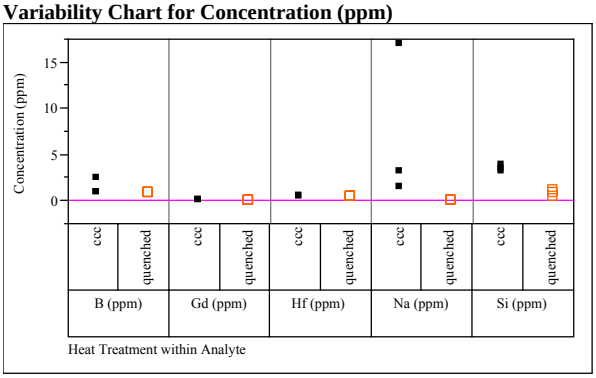
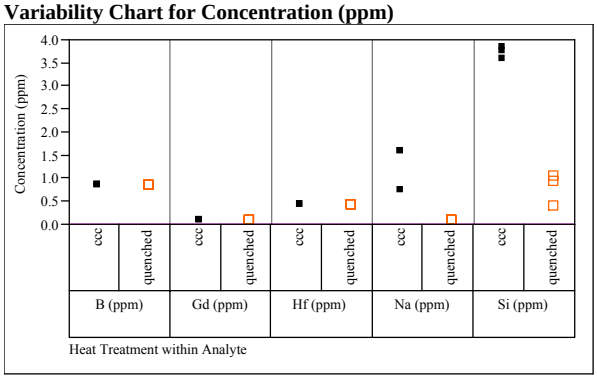
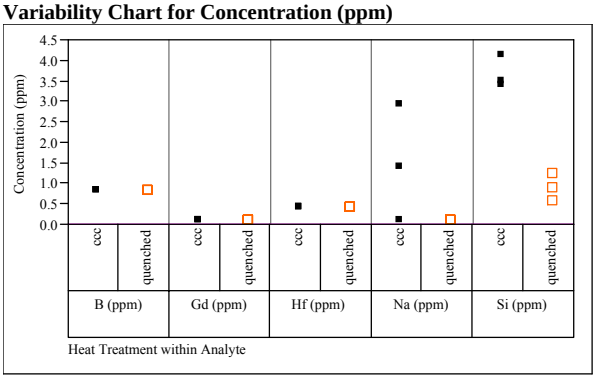


Exhibit E5. Laboratory PCT Measurements by Pu Glass ID for both Quenched and CCC Versions (continued)

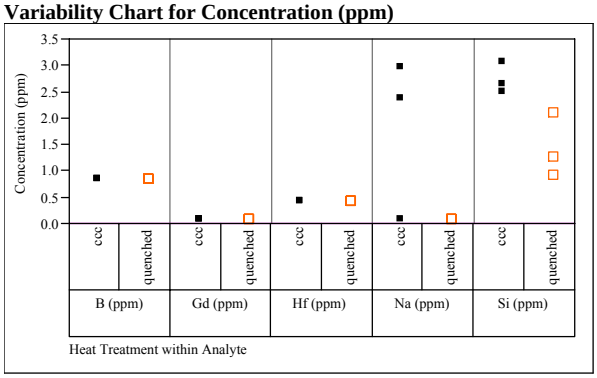
Glass ID=Pu35-44
Variability Chart for Concentration (ppm)



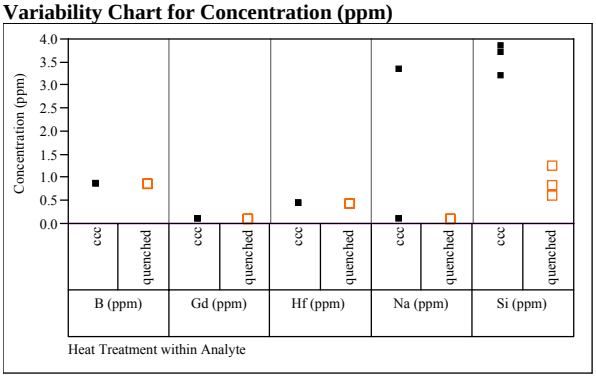
Glass ID=Pu35-47
Variability Chart for Concentration (ppm)



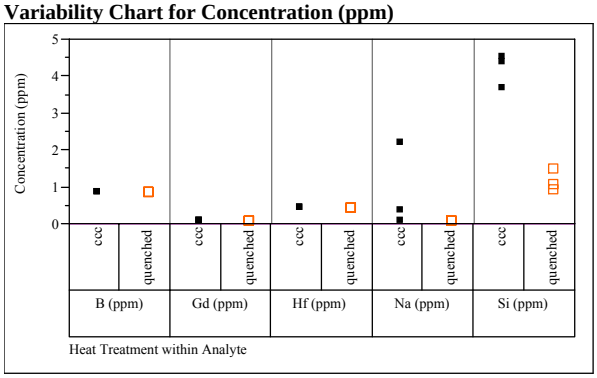
Glass ID=Pu35-45
Variability Chart for Concentration (ppm)



Glass ID=Pu35-48
Variability Chart for Concentration (ppm)



Glass ID=Pu35-46
Variability Chart for Concentration (ppm)



Glass ID=Pu35-49
Variability Chart for Concentration (ppm)

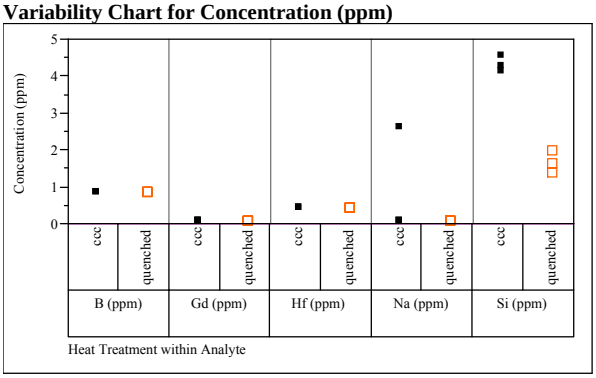
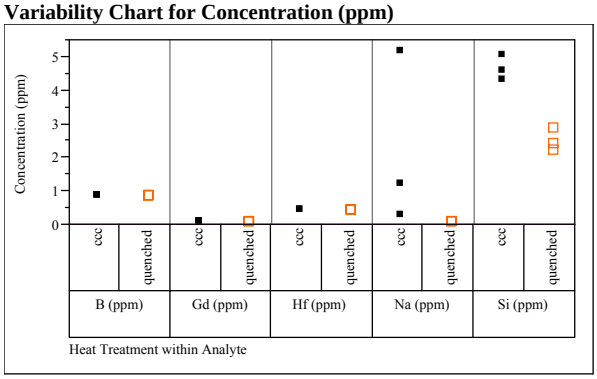
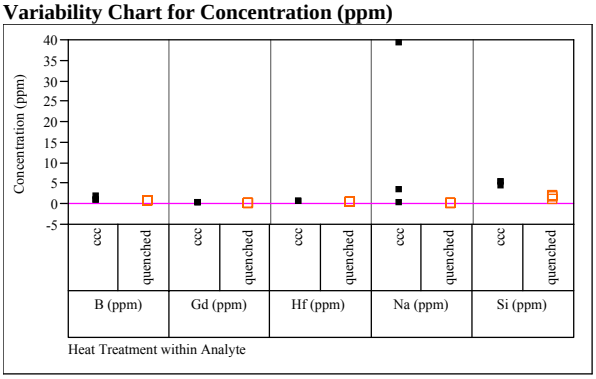


Exhibit E5. Laboratory PCT Measurements by Pu Glass ID for both Quenched and CCC Versions (continued)

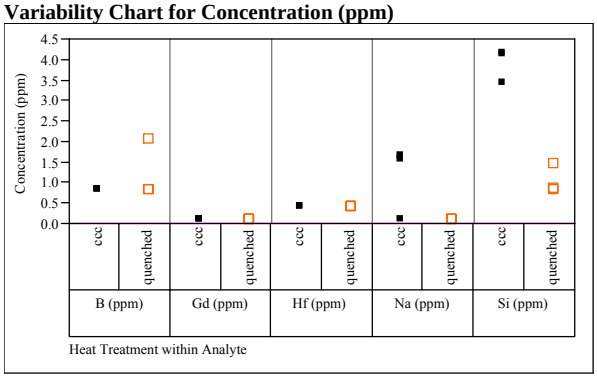
Glass ID=Pu35-50
Variability Chart for Concentration (ppm)



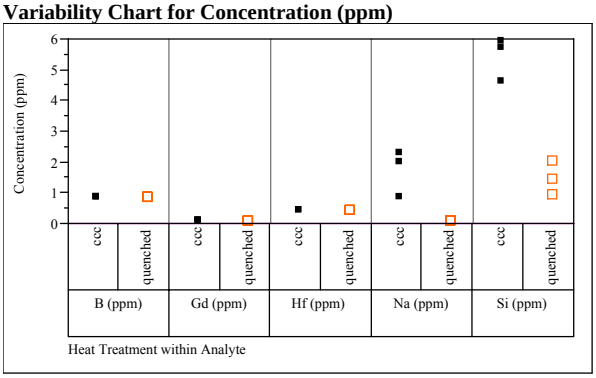
Glass ID=Pu35-53
Variability Chart for Concentration (ppm)



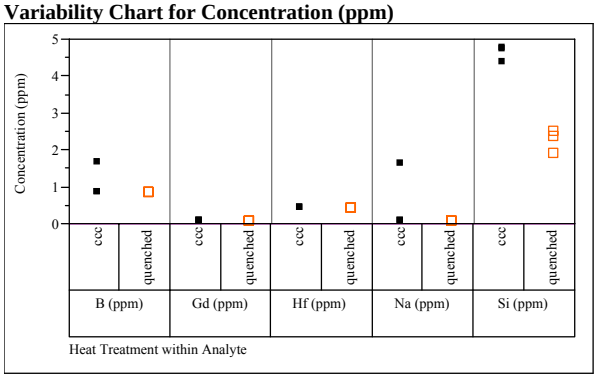
Glass ID=Pu35-51
Variability Chart for Concentration (ppm)



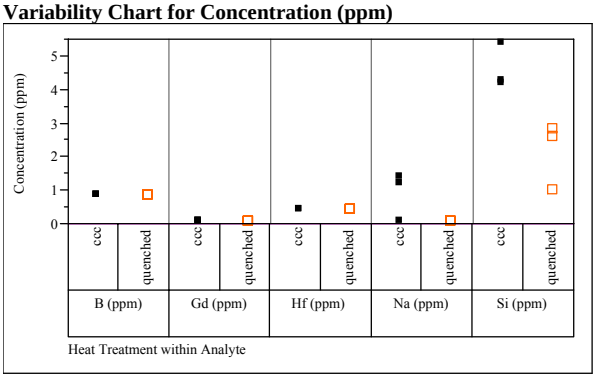
Glass ID=Pu35-54
Variability Chart for Concentration (ppm)



Glass ID=Pu35-52
Variability Chart for Concentration (ppm)



Glass ID=Pu35-55
Variability Chart for Concentration (ppm)



Appendix F

Laboratory Analysis Report:
Toxicity Characteristic Leaching Procedure Results

DAVIS & FLOYD

LABORATORY ANALYSIS REPORT

September 10, 2007

JAMES KOCH II
WASHINGTON SAVANNAH RIVER COMPANY
735-B, ROOM 133
AIKEN, SC 29804-6809

Report ID : AE2122
Page 1 of 16

Login Number	:L07082202
Project Number	:62664.00
Description	:WSCR JOB 07239

Dear James Koch Ii:

We are pleased to provide the enclosed analytical results for the samples received by Davis & Floyd, Inc. on August 21, 2007.

A formal Quality Assurance/Quality Control program is maintained by Davis & Floyd, which is designed to meet or exceed the EPA, NELAC or other appropriate regulatory requirements. All analytical analyses for this project met QA/QC criteria and the results are within the 99% confidence interval for each method unless otherwise stated in the footnotes. This report is to be reproduced only in full.

Feel free to contact our Client Services Representative at (864) 229-4413 if further explanation of the analysis is required. Unless other arrangements have been made, samples will be disposed of or returned 14 days from the date of the report. We appreciate the opportunity to provide services to your firm.

Sincerely,
DAVIS & FLOYD, INC.

John H. McCord, Jr.
Laboratory Manager

CHAIN-OF-CUSTODY

L07083202

Labora

WSRC-STI-2007-00477 Revision 0 Appendix F

07239

Contract Number AC39041N

Customer Name:	Crawford, Charles
Customer Department:	WTT/ITS
Customer Address:	773-41A, Rm180
Customer Phone/Beeper:	5-8049 18277

KJ

Ship to:

Company: Davis & Floyd
Address: 816 East Durst Ave. Greenwood, SC 29649
Attention: Carl Burrell

Washington Savannah River Company
Aiken, SC 29808

Environmental Services Section
Waste Sample Management Group

COC creation date. 8/13/07

Matrix: S=Soil,SO=Solid,SL=Sludge,O=Organic,A=Aqueous, SM=Smear

Sample Analysis Requested

Sample ID:	07239-Pn35-11	07239-Pn35-36	07239-Pn35-37
Collect Date	8/16/07	8/16/07	8/16/07
Collect Time	0800	0805	0810
No. Containers	1	1	1
Matrix	SO	SO	SO
TCLP, Metals (Prep & Analysis) (33) Report Ni, Cr, Pb, Se only.	✓	✓	✓

Page 2

28 Day TAT

STR Authorization James Koch

1 Relinquished by:	Date/Time	Received by:	2 Relinquished by:	Date/Time	Received by:
(Print) Charles L Crawford	Date 8/16/07	(Print) Jason Rhodes	(Print) Jason Rhodes	Date 8/16/07	(Print) Minnie Hightower
(Sign) C L Crawford	Time 0930	(Sign)	(Sign)	Time 1000	(Sign) Minnie Hightower
3 Relinquished by:	Date/Time	Received by:	**4** Relinquished by:	Date/Time	Received by:
(Print) Minnie Hightower	8/20/07	(Print) CLS	(Print)	8.21.07	(Print) Tisa S. McCall
(Sign) Minnie Hightower	Time 1300	(Sign) Shipping	(Sign)	Time 11:54	(Sign) Tisa S. McCall

Cooler # 901

CHAIN-OF-CUSTODY

Labora

WSRC-STI-2007-00277 Revision 0 Appendix F

07239

Contract Number AC39041N

Customer Name:	Crawford, Charles
Customer Department:	WTT/ITS
Customer Address:	773-41A, Rm180
Customer Phone/Beeper:	5-8049 18277

KJ

Ship to:

Company: Davis & Floyd
Address: 816 East Durst Ave. Greenwood, SC 29649
Attention: Carl Burrell

Washington Savannah River Company
Aiken, SC 29808

Environmental Services Section
Waste Sample Management Group

COC creation date. 8/13/07

Matrix: S=Soil,SO=Solid,SL=Sludge,O=Organic,A=Aqueous, SM=Smear

Sample Analysis Requested

Sample Analysis Requested	Sample ID: 07239-Pn35-41	Sample ID: 07239-Pn35-47	Sample ID: 07239-Pn35-50
	Collect Date 8/16/07	Collect Date 8/16/07	Collect Date 8/16/07
	Collect Time 0815	Collect Time 0820	Collect Time 0825
	No. Containers 1	No. Containers 1	No. Containers 1
	Matrix SO	Matrix SO	Matrix SO
TCLP, Metals (Prep & Analysis) (33) Report Ni, Cr, Pb, Se only.	✓	✓	✓

Page 3

28 Day TAT

STR Authorization James Koch

1 Relinquished by:	Date/Time	Received by:	2 Relinquished by:	Date/Time	Received by:
(Print) Charles L. Crawford	Date 8-16-07	(Print) Jason Dugger	(Print) Jason Dugger	Date 8/16/07	(Print) Minnie Hightower
(Sign) C L Crawford	Time 0930	(Sign)	(Sign)	Time 1000	(Sign) Minnie Hightower
3 Relinquished by:	Date/Time	Received by:	**4** Relinquished by:	Date/Time	Received by:
(Print) Minnie Hightower	8/20/07	(Print) C/S	(Print)	8.21.07	(Print) Tisa S. McCall
(Sign) Minnie Hightower	Time 1300	(Sign) Shipping	(Sign)	Time 11:54	(Sign) Tisa S. McCall

Cooler # 901

CHAIN-OF-CUSTODY

Labora

WSRC-STI-2007-00477 Revision 0 Appendix F

07239

Contract Number
AC39041N

Customer Name:	Crawford, Charles
Customer Department:	WTT/ITS
Customer Address:	773-41A, Rm180
Customer Phone/Beeper:	5-8049 18277

KJ

Ship to:

Company:	Davis & Floyd
Address:	816 East Durst Ave. Greenwood, SC 29649
Attention:	Carl Burrell

Washington Savannah River Company
Aiken, SC 29808

Environmental Services Section
Waste Sample Management Group

COC creation date. 8/13/07

Matrix: S=Soil,SO=Solid,SL=Sludge,O=Organic,A=Aqueous, SM=Smear

Sample Analysis Requested

Sample Analysis Requested	Sample ID: 07239-Pu35-51	Sample ID: 07239-Pu35-52	Sample ID:
	Collect Date: 8/16/07	Collect Date: 8/16/07	Collect Date:
	Collect Time: 0830	Collect Time: 0835	Collect Time:
	No. Containers: 1	No. Containers: 1	No. Containers:
	Matrix: SO	Matrix: SO	Matrix:
TCLP, Metals (Prep & Analysis) (33) Report Ni, Cr, Pb, Se only.	✓	✓	

28 Day TAT

STR Authorization James Koch

1 Relinquished by:	Date/Time	Received by:	2 Relinquished by:	Date/Time	Received by:
(Print) Charles L. Crawford	Date 8-16-07	(Print) Jason Durden	(Print) Jason Durden	Date 8/16/07	(Print) Minnie Hightower
(Sign) C L Crawford	Time 0930	(Sign)	(Sign)	Time 1000	(Sign) Minnie Hightower
3 Relinquished by:	Date/Time	Received by:	**4** Relinquished by:	Date/Time	Received by:
(Print) Minnie Hightower	8/20/07	(Print) C/S	(Print)	8.21.07	(Print) Tisa S. McCall
(Sign) Minnie Hightower	Time 1306	(Sign) Shipping	(Sign)	Time 11:54	(Sign) Tisa S. McCall

Cooler # 901

DAVIS & FLOYD

LABORATORY ANALYSIS REPORT

CASE NARRATIVE REPORT
For
Washington Savannah River Co. (WSRC)
Contract No. AC39041N
Job No. 07239

Date: September 10, 2007

Laboratory Identification:

Davis & Floyd, Inc.

Summary:

Sample Receipt

On August 10, 2007, the Davis & Floyd, Inc. laboratory received eight solid wastesamples from the Washington Savannah River Co. The sample listed on the Chain-of-Custody (COC) form arrived in a cooler at a temperature of 7 degrees C. A twenty-eight day turnaround was requested on the COC.

The sample was logged into LIMS, labeled, and stored according to the D&F Standard Operating Procedure (SOP) 20016_04.

The samples received were logged into LIMS as follows:

WSRC ID	D&F Login Number
07239-Pu35-11	L07082202-01
07239-Pu35-36	L07082202-02
07239-Pu35-37	L07082202-03
07239-Pu35-41	L07082202-04
07239-Pu35-47	L07082202-05
07239-Pu35-50	L07082202-06
07239-Pu35-51	L07082202-07
07239-Pu35-52	L07082202-08

Case Narrative

Sample analyses were conducted using methodology outlined in the appropriate D&F Lab SOP. Any technical or administrative problems during analysis, data review, and reduction are written by analytical fraction in the enclosed narratives.

Data Package

The enclosed data package contains the following sections: Case Narrative, Certificate of Analysis, QC Summaries, Chain of Custody, Nonconformance Reports if applicable, and Electronic Data Hardcopy Report.

The Certificate of Analysis contains the following headings:

Davis & Floyd, Inc. | PO Drawer 428 | Greenwood, SC 29648 | 819 E. Durst Avenue | Greenwood, SC 29649 | (864) 229-4413 | Fax (864) 229-7119

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LABORATORY ANALYSIS REPORT

Client ID:	Client sample Identification
Sample ID:	D&F laboratory identification number
Matrix:	Sample matrix
Date Collected:	Date of sample collection
Date Received:	Date of sample receipt by laboratory

The detail on the Certificate includes the following:

Parameter:	Analyte or characteristic tested in sample
Result:	Final result of each parameter
Qual:	Qualifier used for data interpretation
RDL:	Report detection limit
MDL:	Method detection limit
Units:	Units of final result
Analyst:	Initials of analyst performing the test
Date:	Date of analysis
Time:	Time of analysis

The QC Summary Report contains the following sections and headings:

QC Batch Report – Batch Sample List

WorkGroup:	WorkGroup number identifies the analytical batch
Description:	Type of analysis for analytical batch
Matrix:	Sample matrix
Prep Method:	Preparation method if applicable
Analytical Method:	Analytical method performed for this analytical batch

Sample ID:	D&F laboratory identification number
Client ID:	Client sample identification
Run #:	Sequence number for multiple analyses of the same sample
PREP Date Time:	Date and time sample prep method performed
ANALYTICAL Date Time:	Date and time analytical method performed
Analyst:	Initials of analyst performing test
Dilution:	Dilution factor used in the analysis

QC Batch Report – Surrogate % Recovery

WorkGroup:	WorkGroup number identifies the analytical batch
Matrix:	Sample matrix
Prep Method:	Preparation method if applicable
Analytical Method:	Analytical method performed for this analytical batch

Sample Number:	D&F laboratory identification number
Measure Date:	Date and time analytical method performed
XXX	Abbreviation of surrogate compound
nn-nnn	Laboratory limits for % surrogate recovery

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LABORATORY ANALYSIS REPORT

QC Batch Report – Method Blanks

WorkGroup:	WorkGroup number identifies the analytical batch
Blank:	Method blank identification number
Matrix:	Sample matrix
Parameter:	Analyte or characteristic tested in sample
Result:	Final result of each parameter
Qual:	Qualifier used for data interpretation
RDL:	Report detection limit
MDL:	Method detection limit
Units:	Units of final result
Analyst:	Initials of analyst performing the test
Date:	Date of analysis
Time:	Time of analysis

QC Batch Report – Matrix Spikes and Duplicates

WorkGroup:	WorkGroup number identifies the analytical batch
MS/MSD:	Matrix spike & matrix spike duplicate identification number
Matrix:	Sample matrix
Prep Method:	Preparation method if applicable
Analytical Method:	Analytical method performed for this analytical batch

Matrix Spike

Parameter:	Analyte or characteristic tested in sample
Spike Added:	Concentration of spike added to the sample
Sample Conc:	Concentration of sample before spike added
MS Conc:	Concentration of spiked sample analyzed
Units:	Units of final result
MS % REC:	Calculated % recovery of matrix spike
Limits % REC:	Laboratory established limits for % recovery

Matrix Spike Duplicate

Parameter:	Analyte or characteristic tested in sample
Spike Added:	Concentration of spike added to the sample
MSD Conc:	Concentration of spiked sample analyzed
Units:	Units of final result
MSD % REC:	Calculated % recovery of matrix spike
% RPD	Relative percent difference between MS & MSD
Limits %RPD:	Laboratory established upper limits for % RPD
Limits % REC:	Laboratory established limits for MSD % recovery

QC Batch Report – Laboratory Control Standards and Duplicates

WorkGroup:	WorkGroup number identifies the analytical batch

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LABORATORY ANALYSIS REPORT

LCS:	Matrix spike & matrix spike duplicate identification number
Matrix:	Sample matrix
Prep Method:	Preparation method if applicable
Analytical Method:	Analytical method performed for this analytical batch

Parameter:	Analyte or characteristic tested in sample
Spike Added:	Concentration of spike added to the LCS
LCS Conc:	Concentration of spiked LCS analyzed
Units:	Units of final result
LCS % REC:	Calculated % recovery of LCS
Limits % REC:	Laboratory established limits for LCS % recovery

The following are definitions of report limits used by Davis & Floyd, Inc.:

MDL Method Detection Limit: The minimum level of an analyte that can be determined (identified not quantified) with 99% confidence. The valued are normally achieved by preparing and analyzing seven aliquots of laboratory water spiked 1 to 5 times the estimated MDL, taking the standard deviation and multiplying it against the one-tailed t-statistic at 99%. This computed value is then verified for reasonableness by repeating the study using the concentration found in the initial study, calculating an F-ratio, and computing the final limit. Sample preparation and dilution factors are applied to these limits when they are reported.

The MDL is the minimum concentration of a substance that can be identified, measured, and reported with 99% confidence that the analyte concentration is above zero. It answers the question "Is It Present".

RDL Report Detection Limit: The lowest concentration that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions. The RDL is generally 5 to 10 times the calculated MDL. However, it may be nominally chosen within these guidelines to simplify data reporting. For many analytes the RDL analyte concentration is selected as the lowest non-zero standard in the calibration curve. Sample RDL's are highly matrix-dependant. Sample preparation and dilution factors are applied to these limits when they are reported.

The RDL is always $\geq$ MDL

The RDL is the lowest level at which a chemical substance may be accurately and reproducibly quantitated. It answers the question "How Much is Present".

Interpretation of RESULTS column on the Certificate of Analysis:

If the final concentration in the sample was found to be above the RDL, then the value reported is reported without a flag;

If the final concentration in the sample was found to be below the RDL but above the MDL, then the value reported is flagged with a "J";

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LABORATORY ANALYSIS REPORT

If the final concentration in the sample was found to be below the MDL, the value reported is flagged with a "U".

Davis & Floyd Inc. maintains acceptance criteria for QC samples through use of statistical process control (SPC). The SPC limits are used to qualify data usability. The flagging criterion identified in WSRC AN98 Format does not necessarily coincide with the laboratory SPC criteria. There may be instances where the Electronic Data Deliverable (EDD) has flagged data based on the AN98 criteria and the lab has not identified the data to be outside of the established control limits.

Those instances where the QC has not met laboratory SPC established criteria will be noted in the section case narratives that are included in this package.

This data package, to the best of my knowledge is in compliance with technical and administrative requirements.

John H. McCord Jr.
Laboratory Manager

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LABORATORY ANALYSIS REPORT

ICP-AE Trace Metals
Washington Savannah River Co (WSRC)
Job 07239

Method/Analysis Information

Procedure: Trace Metals by Inductively-Coupled Plasma (ICP)

Analytical Method: SW846 6010B

Prep Method: SW846 1311, SW846 3010A

Analytical Batch Number: WG48646

System Configuration

The analysis was performed on an inductively coupled plasma atomic emission spectrometer. The instrument is equipped with a Glass Expansion nebulizer, cyclonic spray chamber, internal standard, and lithium ionization suppressant. Operating conditions for the VARO ICP are set at a power level of 1000 watts. The instrument has a peristaltic pump flow rate of 15 RPM, argon gas flows of 1.5 L/min for the auxiliary gas, 16.5 L/min for the torch gas, and a pressure setting of 0.85 L/min for the nebulizer.

Sample Preparation

All samples were prepared in accordance with the referenced SW-846 procedures.

Sample Analysis

The following client and QC samples were analyzed to complete this sample delivery group using the methods referenced in the Analysis Information section:

Sample ID	Client ID
L07082202-01	07239-PU35-11
L07082202-02	07239-PU35-36
L07082202-03	07239-PU35-37
L07082202-04	07239-PU35-41
L07082202-05	07239-PU35-47
L07082202-06	07239-PU35-50
L07082202-07	07239-PU35-51
L07082202-08	07239-PU35-52
MB48646:1	Method Blank (MB)

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LCS48646:1	Laboratory Control Sample (LCS)
MS07082202-08:48646	07239-PU35-52 Matrix Spike
MSD07082202-08:48646	07239-PU35-52 Matrix Spike Duplicate
EB48646:1	Extraction Blank (EB)

Preparation/Analytical Method Verification

Procedures for preparation, analysis, and reporting of analytical data are documented by the laboratory in SOP 45013_07, SOP 32101_08 and SOP 32302_08.

Calibration Information

Initial Calibration
Instrument calibrations are conducted using method and instrument manufacturer's specifications. All initial calibration requirements have been met for this analysis.

CRDL Standard
The CRDL standard recovery met the advisory limits.

ICSA/ICSAB Requirements
The interference check samples ICSA and ICSAB associated with this SDG met the established acceptance criteria.

Continuing Calibration Blanks (CCB) Requirements
All continuing calibration blanks (CCB) bracketing sample analyses associated with the SDG met the established acceptance criteria.

Continuing Calibration Verification (CCV) Requirements
All continuing calibration verification (CCV) standards bracketing sample analyses associated with this job met the recovery acceptance criteria.

Quality Control (QC) Information

Method Blank Acceptance
The Method Blank (MB) and the Extraction Blank (EB) analyzed with this job did not contain the analytes of interest at a concentration greater than the reporting limit.

LCS Recovery Statement
The LCS recoveries for this job were within the required acceptance limits.

QC Sample Designation
Sample L07082202-08 from job 07239 was designated as the quality control sample for the ICP batch WG48646. The batch included a Matrix Spike (MS) and a Matrix Spike Duplicate (MSD).

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MS/MSD Recovery Statement
The percent recoveries (%R) obtained from the MS/MSD analyses are evaluated when the sample concentration is less than four times (4X) the spike concentration added. The TCLP aqueous sample and the MS and MSD were diluted by a factor of 10 prior to digestion. The laboratory normally dilutes all TCLP extracts by a factor of 10 so the matrix spike and matrix spike duplicate were evaluated even though they were diluted by a factor of more than 4. All applicable elements in the MS and MSD analyses met the established recovery acceptance criteria.

MS/MSD RPD Statement
The relative percent difference (RPD) between the MS and MSD analyses are not evaluated when the sample concentration is greater than four times (4X) the spike concentration added. The RPD for all analytes in this job were within the required acceptance limits.

Technical Information

Holding Time Specifications
All of the samples were prepared and analyzed within the required holding time period.

Sample Preservation and Integrity
Sample integrity was met for all samples in this job.

Sample Dilutions
Dilutions are performed to minimize matrix interferences resulting from elevated mineral elements concentrations present in samples and/or to bring over range target analyte concentrations into the linear calibration range of the instrument. A 10X factor was introduced during preparation of all samples for this job due to the preparation procedure used for ICP analysis (SW846 3010A TCLP).

Miscellaneous Information

Nonconformance (NCR) Documentation
Corrective Action Reports (CAR) are generated to document procedural anomalies that may deviate from reference SOP or contractual documents. No CARs were generated for this job.

Review Validation
The laboratory requires all analytical data to be verified by a qualified data validator. In addition, all data designated for CLP or CLP-like packaging will receive a third level validation upon completion of the data package.

The following data validator verified the information presented in this case narrative:

Reviewer: Mary P Mann Date: 09-10-07

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Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

RDL	Report Detection Limit	**MDL**	Method Detection Limit
TIC	Tentatively Identified Compounds	**MSL**	Mean Sea Level
TNTC	Too Numerous To Count	**MPN**	Most Probable Number
BTU	British Thermal Units	**NTU**	Nephelometric Turbidity Units
C	Degrees Centigrade	**F**	Degrees Fahrenheit
umhos/cm	micromhos/cm	**meq**	milliequivalents
kg	kilogram(s)	**g**	gram(s)
mg	milligram(s)	**ug**	microgram(s)
l	liter(s)	**ml**	milliliters(s)
ul	microliter(s)	**m3**	cubic meter(s)
lb	pound(s)	**ft3**	cubic foot(feet)
ft	foot(feet)	**su**	Standard Units

mg/l, mg/kg Units of concentration in milligrams per liter for liquids and milligrams per kilogram for solids. Also referred to as Parts Per Million or "ppm" when the assumption is made that the specific gravity or density is one (1 g/ml).

ug/l, ug/kg Units of concentration in micrograms per liter for liquids and micrograms per kilograms for solids. Also referred to as Parts Per Billion or "ppb" when the assumption is made that the specific gravity or density is one (1 g/ml).

wt% Units of concentration expressed on a weight/weight basis (e.g. grams per 100 grams).

< Less Than – The number following the sign is the limit of quantitation, the smallest amount of analyte that can be reliably determined using this test.

> Greater Than

Data Qualifiers:

- **A** TIC is a possible aldol-condensation product resulting from sample extraction, (Organics)
- **B** Analyte also detected in the method blank.
- **C** Amendable Cyanide is a negative value due to an unknown interference.
- **E** Estimated concentration due to interference.
- **J** Estimated value below RDL or estimated value for TIC. (Organics)
- **P** Concentration difference between primary and confirmation columns >25%. (Organics) The lower result is reported.
- **U** Final concentration is below the detection limit.
- **X** Matrix interference which requires dilution or prevents the reporting of a result. Detection limits have been adjusted where applicable.
- ***** Defined in report comments.

Solid samples (i.e. soil, sludge, and solid waste) are reported on a dry weight basis unless otherwise noted.

Test results relate only to the sample tested. Clients should be aware that a critical step in a chemical or biological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of the material involved, the test results will be meaningless. If you have any questions regarding the proper techniques of collecting samples, please contact us. However, we cannot be held responsible for sample integrity unless sampling has been performed by a member of our staff.

REPRESENTATION AND LIMITATION OF LIABILITY – The accuracy of all analytical results for samples begins as it is received by the laboratory. Integrity of the sample begins at the time it is placed in the possession of authorized Davis & Floyd, Inc. Laboratories personnel. All other warranties, expressed or implied, are disclaimed. Liability is limited to the cost of the analysis.

Davis & Floyd, Inc.
AD07_03 (12/06)

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LABORATORY ANALYSIS REPORT

NELAC Certification Number: E87633

Client : **WASHINGTON SAVANNAH RIVER COMPANY**
735-B, ROOM 133
AIKEN, SC 29804-6809
Contact : James Koch Ii

Project Number: 62664.00

Report Date : September 10, 2007
Page 2 of 16 Report ID: AE2122

Certificate of Analysis Report

Sample ID	Client ID	Date Collected	Date Received
L07082202-01	07239-PU35-11	08/16/2007 0800	08/21/2007
L07082202-02	07239-PU35-36	08/16/2007 0805	08/21/2007
L07082202-03	07239-PU35-37	08/16/2007 0810	08/21/2007
L07082202-04	07239-PU35-41	08/16/2007 0815	08/21/2007
L07082202-05	07239-PU35-47	08/16/2007 0820	08/21/2007
L07082202-06	07239-PU35-50	08/16/2007 0825	08/21/2007
L07082202-07	07239-PU35-51	08/16/2007 0830	08/21/2007
L07082202-08	07239-PU35-52	08/16/2007 0835	08/21/2007

This data report has been prepared and reviewed in accordance with standard operating procedures. Please direct any questions to your Project Manager.

Reviewed by John H. McCord, Jr.
Laboratory Manager

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LABORATORY ANALYSIS REPORT

NELAC Certification Number: E87633

Client : **WASHINGTON SAVANNAH RIVER COMPANY**
735-B, ROOM 133
AIKEN, SC 29804-6809
Contact : James Koch Ii

Project Number: 62664.00

Report Date : September 10, 2007
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Certificate of Analysis - 07239

Client ID: **07239-PU35-11**

Matrix : Leachate

Sample ID : L07082202-01
Date Collected: 08/16/2007 0800
Date Received : 08/21/2007

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Trace Metals TCLP									
SW846 1311/6010B									
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	09/04/2007	1447
LEAD, TOTAL	<	0.050	U	0.050	5.0	mg/l	BDL	09/04/2007	1447
NICKEL, TOTAL	<	0.20	U	0.20		mg/l	BDL	09/04/2007	1447
SELENIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	09/04/2007	1447

Prep Procedure	Method	Analyst	Prep Date
Analytical Prep Procedures:			
TCLP EXTRACTION	SW846 1311	WSO	08/28/2007 1400
METALS PREP ICP	SW846 3010	DHR	08/30/2007 1345

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Client : **WASHINGTON SAVANNAH RIVER COMPANY**
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Certificate of Analysis - 07239

Client ID: **07239-PU35-36**

Matrix : Leachate

Sample ID : L07082202-02
Date Collected: 08/16/2007 0805
Date Received : 08/21/2007

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Trace Metals TCLP									
SW846 1311/6010B									
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	09/04/2007	1451
LEAD, TOTAL	<	0.050	U	0.050	5.0	mg/l	BDL	09/04/2007	1451
NICKEL, TOTAL	<	0.20	U	0.20		mg/l	BDL	09/04/2007	1451
SELENIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	09/04/2007	1451

Prep Procedure	Method	Analyst	Prep Date
Analytical Prep Procedures:			
TCLP EXTRACTION	SW846 1311	WSO	08/28/2007 1400
METALS PREP ICP	SW846 3010	DHR	08/30/2007 1345

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Client : **WASHINGTON SAVANNAH RIVER COMPANY**
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AIKEN, SC 29804-6809
Contact : James Koch Ii

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Certificate of Analysis - 07239

Client ID: **07239-PU35-37**

Matrix : Leachate

Sample ID : L07082202-03
Date Collected: 08/16/2007 0810
Date Received : 08/21/2007

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Trace Metals TCLP									
SW846 1311/6010B									
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	09/04/2007	1454
LEAD, TOTAL	<	0.050	U	0.050	5.0	mg/l	BDL	09/04/2007	1454
NICKEL, TOTAL	<	0.20	U	0.20		mg/l	BDL	09/04/2007	1454
SELENIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	09/04/2007	1454

Prep Procedure	Method	Analyst	Prep Date
Analytical Prep Procedures:			
TCLP EXTRACTION	SW846 1311	WSO	08/28/2007 1400
METALS PREP ICP	SW846 3010	DHR	08/30/2007 1345

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Certificate of Analysis - 07239

Client ID: **07239-PU35-41**

Matrix : Leachate

Sample ID : L07082202-04
Date Collected: 08/16/2007 0815
Date Received : 08/21/2007

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Trace Metals TCLP									
SW846 1311/6010B									
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	09/04/2007	1458
LEAD, TOTAL	<	0.050	U	0.050	5.0	mg/l	BDL	09/04/2007	1458
NICKEL, TOTAL	<	0.20	U	0.20		mg/l	BDL	09/04/2007	1458
SELENIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	09/04/2007	1458

Prep Procedure	Method	Analyst	Prep Date
Analytical Prep Procedures:			
TCLP EXTRACTION	SW846 1311	WSO	08/28/2007 1400
METALS PREP ICP	SW846 3010	DHR	08/30/2007 1345

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Project Number: 62664.00

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Certificate of Analysis - 07239

Client ID: **07239-PU35-47**

Matrix : Leachate

Sample ID : L07082202-05
Date Collected: 08/16/2007 0820
Date Received : 08/21/2007

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Trace Metals TCLP									
SW846 1311/6010B									
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	09/04/2007	1502
LEAD, TOTAL	<	0.050	U	0.050	5.0	mg/l	BDL	09/04/2007	1502
NICKEL, TOTAL	<	0.20	U	0.20		mg/l	BDL	09/04/2007	1502
SELENIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	09/04/2007	1502

Prep Procedure	Method	Analyst	Prep Date
Analytical Prep Procedures:			
TCLP EXTRACTION	SW846 1311	WSO	08/28/2007 1400
METALS PREP ICP	SW846 3010	DHR	08/30/2007 1345

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LABORATORY ANALYSIS REPORT

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Client : **WASHINGTON SAVANNAH RIVER COMPANY**
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AIKEN, SC 29804-6809
Contact : James Koch Ii

Project Number: 62664.00

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Certificate of Analysis - 07239

Client ID: **07239-PU35-50**

Matrix : Leachate

Sample ID : L07082202-06
Date Collected: 08/16/2007 0825
Date Received : 08/21/2007

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Trace Metals TCLP									
SW846 1311/6010B									
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	09/04/2007	1505
LEAD, TOTAL	<	0.050	U	0.050	5.0	mg/l	BDL	09/04/2007	1505
NICKEL, TOTAL	<	0.20	U	0.20		mg/l	BDL	09/04/2007	1505
SELENIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	09/04/2007	1505

Prep Procedure	Method	Analyst	Prep Date
Analytical Prep Procedures:			
TCLP EXTRACTION	SW846 1311	WSO	08/28/2007 1400
METALS PREP ICP	SW846 3010	DHR	08/30/2007 1345

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LABORATORY ANALYSIS REPORT

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735-B, ROOM 133
AIKEN, SC 29804-6809
Contact : James Koch Ii

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Certificate of Analysis - 07239

Client ID: **07239-PU35-51**

Matrix : Leachate

Sample ID : L07082202-07
Date Collected: 08/16/2007 0830
Date Received : 08/21/2007

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Trace Metals TCLP									
SW846 1311/6010B									
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	09/04/2007	1509
LEAD, TOTAL	<	0.050	U	0.050	5.0	mg/l	BDL	09/04/2007	1509
NICKEL, TOTAL	<	0.20	U	0.20		mg/l	BDL	09/04/2007	1509
SELENIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	09/04/2007	1509

Prep Procedure	Method	Analyst	Prep Date
Analytical Prep Procedures:			
TCLP EXTRACTION	SW846 1311	WSO	08/28/2007 1400
METALS PREP ICP	SW846 3010	DHR	08/30/2007 1345

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Project Number: 62664.00

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Certificate of Analysis - 07239

Client ID: **07239-PU35-52**

Matrix : Leachate

Sample ID : L07082202-08
Date Collected: 08/16/2007 0835
Date Received : 08/21/2007

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Trace Metals TCLP									
SW846 1311/6010B									
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	09/04/2007	1520
LEAD, TOTAL	<	0.050	U	0.050	5.0	mg/l	BDL	09/04/2007	1520
NICKEL, TOTAL	<	0.20	U	0.20		mg/l	BDL	09/04/2007	1520
SELENIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	09/04/2007	1520

Prep Procedure	Method	Analyst	Prep Date
Analytical Prep Procedures:			
TCLP EXTRACTION	SW846 1311	WSO	08/28/2007 1400
METALS PREP ICP	SW846 3010	DHR	08/30/2007 1345

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LABORATORY ANALYSIS REPORT

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Contact : James Koch Ii

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QC Summary Data

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LABORATORY ANALYSIS REPORT

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AIKEN, SC 29804-6809
Contact : James Koch Ii

Project Number: 62664.00

Report Date : September 10, 2007
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QC Batch Report - Batch Sample List

WorkGroup : **WG48646**
Description: **3010A TCLP (6)**

Matrix : Leachate
Prep Method : SW846 3010
Analtyical Method: SW846 1311/6010B

Sample ID	Client ID	Run#	PREP Date Time	ANALYTICAL Date Time	Analyst	Dilution
L07082202-01	07239-PU35-11	1	08/30/2007 1345	09/04/2007 1447	BDL	1
L07082202-02	07239-PU35-36	1	08/30/2007 1345	09/04/2007 1451	BDL	1
L07082202-03	07239-PU35-37	1	08/30/2007 1345	09/04/2007 1454	BDL	1
L07082202-04	07239-PU35-41	1	08/30/2007 1345	09/04/2007 1458	BDL	1
L07082202-05	07239-PU35-47	1	08/30/2007 1345	09/04/2007 1502	BDL	1
L07082202-06	07239-PU35-50	1	08/30/2007 1345	09/04/2007 1505	BDL	1
L07082202-07	07239-PU35-51	1	08/30/2007 1345	09/04/2007 1509	BDL	1
L07082202-08	07239-PU35-52	1	08/30/2007 1345	09/04/2007 1520	BDL	1
EB48646:1	Extraction Blank	1	08/30/2007 1345	09/04/2007 1538	BDL	1
MB48646:1	Method Blank	1	08/30/2007 1345	09/04/2007 1440	BDL	1
LCS48646:1	Laboratory Control Spike	1	08/30/2007 1345	09/04/2007 1443	BDL	1
MS07082202-08:48646	Matrix Spike	1	08/30/2007 1345	09/04/2007 1523	BDL	1
MSD07082202-08:48646	Matrix Spike Duplicate	1	08/30/2007 1345	09/04/2007 1527	BDL	1

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LABORATORY ANALYSIS REPORT

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735-B, ROOM 133
AIKEN, SC 29804-6809
Contact : James Koch Ii

Project Number: 62664.00

Report Date : September 10, 2007
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QC Batch Report - Method Blanks

WorkGroup: **WG48646**
Blank : **EB48646:1**

Matrix: Leachate

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Trace Metals TCLP									
SW846 1311/6010B									
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	09/04/2007	1538
LEAD, TOTAL	<	0.050	U	0.050	5.0	mg/l	BDL	09/04/2007	1538
NICKEL, TOTAL	<	0.20	U	0.20		mg/l	BDL	09/04/2007	1538
SELENIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	09/04/2007	1538

Prep Procedure	Method	Analyst	Prep Date
Analytical Prep Procedures:			
METALS PREP ICP	SW846 3010	DHR	08/30/2007 1345

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LABORATORY ANALYSIS REPORT

NELAC Certification Number: E87633

Client : **WASHINGTON SAVANNAH RIVER COMPANY**
735-B, ROOM 133
AIKEN, SC 29804-6809
Contact : James Koch Ii

Project Number: 62664.00

Report Date : September 10, 2007
Page 14 of 16 Report ID: AE2122

QC Batch Report - Method Blanks

WorkGroup: **WG48646**
Blank : **MB48646:1**

Matrix: Leachate

Parameter		Result	Qual	RDL	Limit	Units	Analyst	Date	Time
Trace Metals TCLP									
SW846 1311/6010B									
CHROMIUM, TOTAL	<	0.10	U	0.10	5.0	mg/l	BDL	09/04/2007	1440
LEAD, TOTAL	<	0.050	U	0.050	5.0	mg/l	BDL	09/04/2007	1440
NICKEL, TOTAL	<	0.20	U	0.20		mg/l	BDL	09/04/2007	1440
SELENIUM, TOTAL	<	0.050	U	0.050	1.0	mg/l	BDL	09/04/2007	1440

Prep Procedure	Method	Analyst	Prep Date
Analytical Prep Procedures:			
METALS PREP ICP	SW846 3010	DHR	08/30/2007 1345

DAVIS & FLOYD

LABORATORY ANALYSIS REPORT

NELAC Certification Number: E87633

Client : **WASHINGTON SAVANNAH RIVER COMPANY**
735-B, ROOM 133
AIKEN, SC 29804-6809
Contact : James Koch Ii

Project Number: 62664.00

Report Date : September 10, 2007
Page 15 of 16 Report ID: AE2122

QC Batch Report - Matrix Spikes and Duplicates

WorkGroup: **WG48646**
MS/MSD : **MS07082202-08:48646**
MSD07082202-08:48646

Matrix : Leachate
Prep Method : SW846 3010
Analtyical Method: SW846 1311/6010B

Parameter	Spike Added	Sample Conc	MS Conc	Units	MS %REC	Limits %REC
CHROMIUM, TOTAL	5.00	< 0.100	4.49	mg/l	90	90-110
LEAD, TOTAL	5.00	< 0.0500	4.95	mg/l	99	90-110
NICKEL, TOTAL	10.00	< 0.200	9.50	mg/l	95	50-150
SELENIUM, TOTAL	5.00	< 0.0500	5.01	mg/l	100	86-110

Parameter	Spike Added	MSD Conc	Units	MSD %REC	%RPD	Limits %RPD	%REC
CHROMIUM, TOTAL	5.00	4.52	mg/l	90	1	10	90-110
LEAD, TOTAL	5.00	4.97	mg/l	99	1	10	90-110
NICKEL, TOTAL	10.00	9.63	mg/l	96	1	20	50-150
SELENIUM, TOTAL	5.00	5.08	mg/l	102	1	10	86-110

NOTE: MS/MSD % recoveries are not evaluated if the sample concentration is greater than four times the spike added.

DAVIS & FLOYD

LABORATORY ANALYSIS REPORT

NELAC Certification Number: E87633

Client : **WASHINGTON SAVANNAH RIVER COMPANY**
735-B, ROOM 133
AIKEN, SC 29804-6809
Contact : James Koch Ii

Project Number: 62664.00

Report Date : September 10, 2007
Page 16 of 16 Report ID: AE2122

QC Batch Report - Laboratory Control Standards and Duplicates

WorkGroup: **WG48646**
LCS : **LCS48646:1**

Matrix : Leachate
Prep Method : SW846 3010
Analtyical Method: SW846 1311/6010B

Parameter	Spike Added	LCS Conc	Units	LCS %REC	Limits %REC
CHROMIUM, TOTAL	10.00	9.11	mg/l	91	90-110
LEAD, TOTAL	10.00	10.16	mg/l	102	90-110
NICKEL, TOTAL	20.00	19.41	mg/l	97	90-110
SELENIUM, TOTAL	10.00	10.42	mg/l	104	87-110

DAVIS & FLOYD, INC.
LOGIN REPORT (ln01)
August 22 2007, 08:36 am

Login Number: L07082202
Account: WASSAV WASHINGTON SAVANNAH RIVER COMPANY
Project: 62664.00 MISC. ANALYTICAL SERVICES

Laboratory Sample Number	Client Sample Number	Collect Date	Receive Date	PR	Due Date
L07082202-01	07239-PU35-11	16-AUG-2007 08:00	21-AUG-2007	S	14-SEP-2007
NON-RAD					
Leachate	P TM/TCLP+PREP	-----	PH NA	Remarks	
Leachate	C OP/TCLP/EXT	D018406			
Leachate	C TM/CR/TCLP/6010	D018407			
Leachate	C TM/PB/TCLP/6010	D018407			
Leachate	C TM/SE/TCLP/6010	D018407			
Leachate	S TM/NI/TCLP/6010	D018407			
L07082202-02	07239-PU35-36	16-AUG-2007 08:05	21-AUG-2007	S	14-SEP-2007
NON-RAD					
Leachate	P TM/TCLP+PREP	-----	PH NA	Remarks	
Leachate	C OP/TCLP/EXT	D018408			
Leachate	C TM/CR/TCLP/6010	D018409			
Leachate	C TM/PB/TCLP/6010	D018409			
Leachate	C TM/SE/TCLP/6010	D018409			
Leachate	S TM/NI/TCLP/6010	D018409			
L07082202-03	07239-PU35-37	16-AUG-2007 08:10	21-AUG-2007	S	14-SEP-2007
NON-RAD					
Leachate	P TM/TCLP+PREP	-----	PH NA	Remarks	
Leachate	C OP/TCLP/EXT	D018410			
Leachate	C TM/CR/TCLP/6010	D018411			
Leachate	C TM/PB/TCLP/6010	D018411			
Leachate	C TM/SE/TCLP/6010	D018411			
Leachate	S TM/NI/TCLP/6010	D018411			
L07082202-04	07239-PU35-41	16-AUG-2007 08:15	21-AUG-2007	S	14-SEP-2007
NON-RAD					
Leachate	P TM/TCLP+PREP	-----	PH NA	Remarks	
Leachate	C OP/TCLP/EXT	D018412			
Leachate	C TM/CR/TCLP/6010	D018413			
Leachate	C TM/PB/TCLP/6010	D018413			
Leachate	C TM/SE/TCLP/6010	D018413			
Leachate	S TM/NI/TCLP/6010	D018413			

COC Record (Present / Absent)
Sample Condition (Intact / Broken / Leaking)
Info on COC Records and Samples Agree (Yes / No / NA)
Sample Temp. 7° *Received on Ice (Yes / No)*

Encore Samples (Yes / No / NA)
NON-*RAD Samples (Yes / No)*
Shipping Container Dose < 500 urem/hr (Yes / No / NA)
Remarks: Swipe OK = alpha < 20 dpm/100cm2 & beta < 1000 dpm/cm2

Reviewed: 8-29-07 Date

Signature: 8.22.07 Date

DAVIS & FLOYD, INC.
LOGIN REPORT (ln01)
August 22 2007, 08:36 am

Login Number: L07082202
Account: WASSAV WASHINGTON SAVANNAH RIVER COMPANY
Project: 62664.00 MISC. ANALYTICAL SERVICES

Laboratory Sample Number	Client Sample Number	Collect Date	Receive Date	PR	Due Date
L07082202-05	07239-PU35-47	16-AUG-2007 08:20	21-AUG-2007	S	14-SEP-2007
NON-RAD					

				PH	Remarks
Leachate	P	TM/TCLP+PREP	-----	NA	
Leachate	C	OP/TCLP/EXT	D018414		
Leachate	C	TM/CR/TCLP/6010	D018415		
Leachate	C	TM/PB/TCLP/6010	D018415		
Leachate	C	TM/SE/TCLP/6010	D018415		
Leachate	S	TM/NI/TCLP/6010	D018415		

L07082202-06	07239-PU35-50	16-AUG-2007 08:25	21-AUG-2007	S	14-SEP-2007
NON-RAD					

				PH	Remarks
Leachate	P	TM/TCLP+PREP	-----	NA	
Leachate	C	OP/TCLP/EXT	D018416		
Leachate	C	TM/CR/TCLP/6010	D018417		
Leachate	C	TM/PB/TCLP/6010	D018417		
Leachate	C	TM/SE/TCLP/6010	D018417		
Leachate	S	TM/NI/TCLP/6010	D018417		

L07082202-07	07239-PU35-51	16-AUG-2007 08:30	21-AUG-2007	S	14-SEP-2007
NON-RAD					

				PH	Remarks
Leachate	P	TM/TCLP+PREP	-----	NA	
Leachate	C	OP/TCLP/EXT	D018418		
Leachate	C	TM/CR/TCLP/6010	D018419		
Leachate	C	TM/PB/TCLP/6010	D018419		
Leachate	C	TM/SE/TCLP/6010	D018419		
Leachate	S	TM/NI/TCLP/6010	D018419		

L07082202-08	07239-PU35-52	16-AUG-2007 08:35	21-AUG-2007	S	14-SEP-2007
NON-RAD					

				PH	Remarks
Leachate	P	TM/TCLP+PREP	-----	NA	
Leachate	C	OP/TCLP/EXT	D018420		
Leachate	C	TM/CR/TCLP/6010	D018421		
Leachate	C	TM/PB/TCLP/6010	D018421		
Leachate	C	TM/SE/TCLP/6010	D018421		
Leachate	S	TM/NI/TCLP/6010	D018421		

DAVIS & FLOYD Engineering Architecture Environmental & Laboratory Services

Survey Form

Date: 8.21.07 Time: 15:09 Surveyor: Tisa S. McCall

Survey Type: Swipe
Location: Sample receiving
Purpose:
Comments:

Instrument Data

Mfg.	Tec-3	Tec-3
Model		
Serial #		
Cal Due	01.02.08	01.02.08
Efficiency	85	29.3
MDA	18.0	223.7
Mfg.		
Model		
Serial #		
Cal Due		
Efficiency		
MDA		

SURVEY RESULTS

		ALPHA			BETA		
SWIPE	LOCATION	Swipe	Direct	Wipe	Swipe	Direct	Wipe
#	Sample Number	dpm/100cm²	dpm/wipe	dpm/100cm²	dpm/100cm²	dpm/100cm²	dpm/wipe
1	Outside of cooler 0901	<			<		
2	Outside of cooler 0529	<			<		
3	bag containing paperwork 0529	<			<		
4	bag containing samples 0529	<			<		
5	06355-211F-RS-1B 50g	<			<		
6	06355-211F-RS-1B Full	<			<		
7	bag containing paperwork 0901	<			<		
8	bag containing samples 0901	<			<		
9	07339-Pu35-11	<			<		
10	07339-Pu35-36	<			<		
11	07339-Pu35-37	<			<		
12	07339-Pu35-41	<			<		
13	07339-Pu35-47	<			<		
14	07339-Pu35-50	<			<		
15	07339-Pu35-51	<			<		

Reviewed by RSO: _____ Date: _____ Time: _____

DAVIS & FLOYD Engineering Architecture Environmental & Laboratory Services

Survey Form

Date: 8.31.07 Time: 15:09 Surveyor: Tisa S. McCall

Survey Type: Swipe
Location: Sample receiving
Purpose:
Comments:

Instrument Data

Mfg.	Tec-3	Tec-3
Model		
Serial #		
Cal Due	01.02.08	01.02.08
Efficiency	85	29.3
MDA	18.0	233.7
Mfg.		
Model		
Serial #		
Cal Due		
Efficiency		
MDA		

SURVEY RESULTS

		ALPHA			BETA		
SWIPE #	LOCATION Sample Number	Swipe dpm/100cm²	Direct dpm/wipe	Wipe dpm/100cm²	Swipe dpm/100cm²	Direct dpm/100cm²	Wipe dpm/wipe
1	07239-PU35-52	<			<		
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							

Reviewed by RSO: _____ Date: _____ Time: _____

Distribution:

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D.A. Crowley, 999-W
R.E. Edwards, 773-A
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E.G. Estochen, 773-A
K.M. Fox, 999-W
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T.A. Nance, 773-42A
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R.H. Smith, 730-1B
E.C. Tefft, 730-1B