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Analysis of the Sludge Batch 7b (Macrobatch 9) DWPF Pour Stream Glass Sample

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EXECUTIVE SUMMARY

The Defense Waste Processing Facility (DWPF) began processing Sludge Batch 7b (SB7b), also referred to as Macrobatch 9 (MB9), in January 2012. SB7b is a blend of the heel of Tank 40 from Sludge Batch 7a (SB7a) and the SB7b material that was transferred to Tank 40 from Tank 51. SB7b was processed using Frit 418.

During processing of each sludge batch, the DWPF is required to take at least one glass sample to meet the objectives of the Glass Product Control Program (GPCP), which is governed by the DWPF Waste Form Compliance Plan, and to complete the necessary Production Records so that the final glass product may be disposed of at a Federal Repository. Two pour stream glass samples were collected while processing SB7b. The samples were transferred to the Savannah River National Laboratory (SRNL) where one was analyzed and the other was archived. The following conclusions were drawn from the analytical results provided in this report:

- The sum of oxides for the official SB7b pour stream glass is within the Product Composition Control System (PCCS) limits (95-105 wt%).

- The average calculated Waste Dilution Factor (WDF) for SB7b is 2.3. In general, the measured radionuclide content of the official SB7b pour stream glass is in good agreement with the calculated values from the Tank 40 dried sludge results from the SB7b Waste Acceptance Program Specification (WAPS) sample.

- As in previous pour stream samples, ruthenium and rhodium inclusions were detected by Scanning Electron Microscopy-Electron Dispersive Spectroscopy (SEM-EDS) in the SB7b pour stream sample.

- The Product Consistency Test (PCT) results indicate that the official SB7b pour stream glass meets the waste acceptance criteria for durability with a normalized boron release of 0.8 g/L, which is an order of magnitude less than the Environmental Assessment (EA) glass.

- The measured density of the SB7b pour stream glass was 2.70 g/cm^3.

- The $Fe^{2+}/\sum Fe$ ratio of the SB7b pour stream samples was 0.07.

Revision 1 of this report includes the following updates:

- Table 3-2: percent relative standard deviation (%RSD) for Sb_2O_3
- Table 3-4: radionuclide concentrations of the SB7b WAPS sample in Ci/kg, % RSD value for Zr-93
- Table 3-5: measured concentrations of noble metals in the SB7b glass and percent relative standard error (%RSE)
- Table 3-6: published %RSD for the lithium normalized release (NL Li) in the EA glass

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LIST OF ABBREVIATIONS

AD	Analytical Development
ARG-1	Analytical Reference Glass 1
AR	Aqua Regia
ARM	Approved Reference Material
ASP	Analytical Study Plan
CPC	Chemical Process Cell
DWPF	Defense Waste Processing Facility
EA	Environmental Assessment
EDS	Electron Dispersive Spectroscopy
GPCP	Glass Product Control Program
ICP-AES	Inductively Coupled Plasma – Atomic Emission Spectroscopy
ICP-MS	Inductively Coupled Plasma – Mass Spectrometry
MB	Macrobatch
MFT	Melter Feed Tank
PCCS	Product Composition Control System
PCT	Product Consistency Test
PF	Peroxide Fusion
PS	Pour Stream
REDOX	REDuction/OXidation
%RSD	percent relative standard deviation
%RSE	percent relative standard error
SB	Sludge Batch
SEM	Scanning Electron Microscopy
SME	Slurry Mix Evaporator
SRAT	Sludge Receipt and Adjustment Tank
SRNL	Savannah River National Laboratory
THERMO	Thermodynamic Hydration Energy Reaction MOdel
TTQAP	Task Technical and Quality Assurance Plan
UV-Vis	Ultraviolet-Visible
WAPS	Waste Acceptance Product Specifications
WCP	Waste Form Compliance Plan
WDF	Waste Dilution Factor

1.0 Introduction

The Defense Waste Processing Facility (DWPF) began processing Sludge Batch 7b (SB7b), also referred to as Macrobatch 9 (MB9), in January 2012. SB7b was a blend of transfers of material from Tank 7 and the Sludge Batch 7a (SB7a) heel in Tank 40.[1] Frit 418 was used during processing of SB7b.[2]

Sludge is received into the DWPF Chemical Process Cell (CPC) and is processed through the Sludge Receipt and Adjustment Tank (SRAT) and Slurry Mix Evaporator (SME) tank where the frit is added. The treated sludge slurry and frit is then transferred to the Melter Feed Tank (MFT) and fed to the melter. During processing of each sludge batch, the DWPF is required to take at least one glass sample to meet the objectives of the Glass Product Control Program[3] (GPCP), which is governed by the DWPF Waste Form Compliance Plan, and to complete the necessary Production Records so that the final glass product may be disposed of at a Federal Repository.

The DWPF requested various analyses of a radioactive glass sample obtained from the melter pour stream during processing of SB7b.[4] Sample analysis followed the Task Technical and Quality Assurance Plan (TTQAP)[5] and an Analytical Study Plan (ASP).[6] Two pour stream (PS) glass samples were delivered to the Savannah River National Laboratory (SRNL) from the DWPF (Table 1-1). The sample collected while filling canister S04023 was selected as the official pour stream sample for SB7b and full analysis was requested. This report details the visual observations of the as-received SB7b PS glass sample glass sample as well as results for the chemical composition, Product Consistency Test (PCT), radionuclide content, noble metals, and glass density. The sample collected while filling canister S04025 was archived in Cell 16 of the SRNL Shielded Cells according to procedure.[7]

Table 1-1. DWPF Pour Stream Glass Sample Information

Glass Canister	Sample Date	MFT Batch	Primary Container	Notes
S04023	April 2013	661	PC0122	Analysis
S04025	April 2013	661	PC0123	Archive

Revision 1 of this report includes the following updates (as noted by revision bars):

- Table 3-2: percent relative standard deviation (%RSD) for Sb_2O_3
- Table 3-4: radionuclide concentrations of the SB7b Waste Acceptance Product Specification (WAPS) sample in Ci/kg, % RSD value for Zr-93
- Table 3-5: measured concentrations of noble metals in the SB7b glass and percent relative standard error (%RSE)
- Table 3-6: published %RSD for the lithium normalized release (NL Li) in the EA glass

2.0 Experimental Procedure

2.1 Visual Examination, Extraction and Washing

Upon arrival at SRNL, the SB7b PS glass sample was inspected, removed from the Pt/Au collection boat and washed according to procedure prior to analysis.[8]

2.2 Chemical Composition

A subsample of SB7b PS glass was ground and then sieved to -200 mesh. Quadruplicate samples of the pour stream glass were digested by two separate methods: aqua regia[9] (AR) and sodium peroxide fusion[10] (PF). Three Analytical Reference Glass[11] (ARG-1) standards were also

digested by each method and submitted along with the samples. All of the prepared samples were submitted to Analytical Development (AD) and analyzed by Inductively Coupled Plasma-Atomic Emission Spectroscopy (ICP-AES). A multi-element standard and blank were also included in the analyses in order to assess the performance of the instrument over the course of the analyses.

2.3 Radionuclide Composition

The SB7b PS glass sample was prepared in quadruplicate using a PF digestion and was analyzed by AD using Inductively Coupled Plasma – Mass Spectroscopy (ICP-MS) to determine actinide and fission product content. Aliquots of the PF and AR digestions were analyzed by counting methods and alpha spectroscopy to calculate the radionuclide concentration.[a] An aliquot was collected in quadruplicate using the AR digestion and was analyzed by beta counting to determine Tc-99 content. The reportable radionuclides for the GPCP and WCP[12] not measured in this study were calculated from the SB7b total dried solids results[13] using a calculated Waste Dilution Factor (WDF).

2.4 Noble Metals

Noble metal concentrations were analyzed in the SB7b PS glass sample using ICP-MS from the PF dissolution. The total silver concentration is calculated using the measured concentration of ^{109}Ag and the calculated concentration of ^{107}Ag.[14] Due to interference from Cd, the palladium concentration is calculated using the sum of the measured concentration of ^{105}Pd and the calculated concentrations of ^{106}Pd, ^{107}Pd, ^{108}Pd, and ^{110}Pd using their fission yields.[14] The total concentration of ruthenium is calculated from the sum of the measured concentrations of three isotopes: ^{101}Ru, ^{102}Ru, and ^{104}Ru. The reported concentration of rhodium is from the measured concentration of a single isotope, ^{103}Rh.

In addition, a sample of SB7b PS glass sample (-200 mesh) was analyzed using Scanning Electron Microscopy (SEM) along with Energy Dispersive Spectroscopy (EDS) to image and analyze any inhomogeneities in the glass.

2.5 PCT

The PCT was performed on quadruplicate samples of SB7b PS glass sample to assess chemical durability using Method A of the procedure.[15] Also included was the Environmental Assessment (EA) glass, the Approved Reference Material (ARM) glass and blanks from the sample cleaning batch.[16] Samples were ground, washed and prepared according to standard procedure. ARM and EA were only prepared in triplicate. The resulting solutions were sampled (filtered and acidified) and analyzed by AD. Samples of a multi-element standard were also included with the glass samples as a check of the accuracy of the ICP-AES. Normalized release rates were calculated based on the average measured composition using the average of the leachate concentrations.[b,c,d,16]

2.6 Density

The density of SB7b PS glass sample was measured in triplicate with a Hubbard specific gravity bottle. By using the masses of the empty bottle (m_0), bottle and sample (m_1), bottle, sample and water (m_2) and bottle and water (m_3), the density of the sample (ρ_s) is calculated by

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[a] Zr-93 content was determined using the AR dissolution.
[b] ASTM C1285 states that the sample mass must be ≥ 1g; however, the sample mass of EA-2 was 0.998 g. The difference of 0.002 g will not have any impact on the technical conclusions in this report.
[c] The measured concentration of uranium in the SB7b-3 leachate was below the detection limit. It was excluded from the normalized release rate calculation.
[d] The average measured compositions for ARM and EA were taken from Table B.1, page B.8 of Reference 16.

$$\rho_s = \frac{\rho_{H2O}(m_1 - m_0)}{(m_3 - m_0) - (m_2 - m_1)}$$

where ρ_{H2O}[e] is the density of water at the measurement temperature. A reference glass[f] was measured prior to its placement into the shielded cells via the Archimedes method.[17] This same sample was remeasured in the shielded cells in order to verify the measurement technique.

2.7 REDOX

A sample of SB7b PS glass was ground and then sieved to -200 mesh. The ground SB7b glass was then prepared for REDOX measurement and analyzed via UV-Vis spectroscopy according to procedure.[18] In addition to the pour stream sample, the EA glass was included in each set of measurements as an internal check of the measured REDOX value.

2.8 Quality Assurance

Requirements for performing reviews of technical reports and the extent of review are established in Manual E7, Procedure 2.60. SRNL documents the extent and type of review using the SRNL Technical Report Design Checklist contained in WSRC-IM-2002-00011, Rev. 2.[19]

3.0 Results and Discussion

3.1 Visual Examination

Upon receipt inspection, the SB7b glass sample appeared black and shiny with no visible signs of any surface films. Surface films have been observed on the surfaces of previous pour stream samples[20,21] and have been attributed to salt deposits.

3.2 Chemical Composition

Table A-1 and Table A-2 in Appendix A provide the measured elemental data from glasses prepared using aqua regia and peroxide fusion, respectively. Detectable values were measured for the blank sample for Ba, Ca, Na and Zn (AR) and Fe, Li and Mg (PF). All of the blank measured values were less than 10% of the lowest measured sample value for either ARG-1 or the SB7b PS sample except for Zn. The concentration of Zn is so low that there is no practical significance.

3.2.1 *ARG-1*

Table 3-1 shows a comparison of the published[11] and measured composition of the ARG-1 glass. The measured value is the average of three replicates from either the aqua regia or peroxide fusion data as noted in the table. In general, the measured values are consistent with the published values and relative standard deviation (%RSD) values for the major glass components (> 0.5 wt%) are less than 10%, indicating good precision in the results. The sum of oxides is within the Product Composition Control System (PCCS) acceptance limits (the interval of 95 to 105 wt%).

3.2.2 *SB7b PS glass sample*

Table 3-2 lists the oxide composition of the SB7b PS glass sample glass. The measured value is the average of four replicates from either the aqua regia or peroxide fusion data as noted in the table. Some of the analytes were below the detection limit of the instrument and are noted by a result preceded by a "<." The %RSD values for the major glass components (> 0.5 wt%) are less

[e] The density of H_2O was assumed to be 1 g/cm^3 for all measurements.
[f] The density of a sample of NIST 1830 glass was determined to be 2.49 g/cm^3 using the Archimedes method.

than 10%, indicating good precision in the results. The sum of oxides is within the Product Composition Control System (PCCS) acceptance limits (the interval of 95 to 105 wt%).

Table 3-1. Published[11] and Measured Values of ARG-1

Oxide	Published (wt%)	Measured (wt%)	% RSD	Oxide	Published (wt%)	Measured (wt%)	% RSD
Al_2O_3	4.73	4.72	1.6	MnO	1.88	1.80	1.8
B_2O_3	8.67	8.19	1.8	Na_2O	11.5	10.84	5.1
BaO	0.09	0.09	5.2	NiO	1.05	0.93	0.3
CaO	1.43	1.43	5.1	P_2O_5	0.22	0.27	7.6
Cr_2O_3	0.09	0.09	3.4	SiO_2	47.9	47.42	5.8
Fe_2O_3	14.0	13.69	1.4	TiO_2	1.15	1.10	0.5
K_2O	2.71	2.47	6.4	ZnO	0.02	0.02	3.8
Li_2O	3.21	3.07	1.5	ZrO_2	0.13	0.06	23.4
MgO	0.86	0.84	1.7	Total	99.64	97.03	---

Peroxide Fusion: Al, B, Fe, Li, Mg, Mn, Ni, Si and Ti
Aqua Regia: Ba, Ca, Cr, K, Na, P, Zn and Zr

Table 3-2. Average Measured Composition of SB7b PS glass sample

Oxide	Measured (wt%)	%RSD	Oxide	Measured (wt%)	%RSD
Al_2O_3	7.58	2.4	MoO_3	<0.01	2.1
B_2O_3	4.72	2.0	Na_2O	14.42	2.6
BaO	0.05	2.5	NiO	1.38	2.9
BeO	<0.001	2.2	P_2O_5	0.15	24.8
CaO	0.43	2.5	PbO	0.02	3.2
CdO	0.02	2.3	SO_4	0.48	3.1
Ce_2O_3	0.07	3.0	Sb_2O_3	<0.03	2.2
CoO	0.01	4.6	SiO_2	49.42	2.8
Cr_2O_3	0.08	2.2	SnO_2	<0.01	2.2
CuO	0.19	1.3	SrO	0.02	2.8
Fe_2O_3	8.67	1.8	ThO_2	0.53	4.2
Gd_2O_3	0.04	4.1	TiO_2	0.25	1.3
K_2O	<0.34	2.1	U_3O_8	2.56	2.8
La_2O_3	0.04	4.4	V_2O_5	<0.001	2.2
Li_2O	4.83	3.1	ZnO	0.05	2.6
MgO	0.22	2.2	ZrO_2	0.09	46.7
MnO	1.66	1.7	Total	98.38	---

Peroxide Fusion: Al, B, Cu, Fe, Li, Mg, Mn, Ni, Si, Th, Ti and U
Aqua Regia: Ba, Be, Ca, Cd, Ce, Co, Cr, Gd, K, La, Mo, Na, P, Pb, S, Sb, Sn, Sr, V, Zn and Zr

3.2.3 *WDF*

The WDF for a specific sludge batch is given by

$$WDF(i) = \frac{CS(i)}{CG(i)}$$

where *CS(i)* is the concentration of component *i* in the dried Tank 40 sludge[22] (as measured) and *CG(i)* is the concentration of component *i* in the corresponding pour stream glass sample. Table 3-3 contains the calculated WDF values for Al, Ca, Fe and Mn for SB7b. The average WDF value will be used in Section 3.3 to calculate the concentration of radionuclides that were not directly measured in the glass.

Table 3-3. Waste Dilution Factor for the SB7b PS glass sample Glass

Element	Concentration (wt%)		WDF
	SB7b WAPS	Glass	
Al	9.18	4.01	2.3
Ca	0.699	0.311	2.2
Fe	13.9	6.07	2.3
Mn	3.09	1.28	2.4
Average	---	---	2.3

3.3 Radionuclide Composition

Based on measurements and analytical detection limits, twenty-seven radionuclides were identified as reportable for DWPF SB7b (MB9) as specified by the Waste Acceptance Product Specification (WAPS).[13,23,g,h] Selected radionuclides were directly measured in quadruplicate either by gamma counting, beta counting, alpha spectroscopy or ICP-MS. Table A-3 through Table A-5 in Appendix A provide the actual measured radiological chemical data and ICP-MS data, respectively.

Table 3-4 lists the average concentrations of these radionuclides.[i] Some of the analytes were below the detection limit of the instrument and are noted by a result preceded with a "<." The content of each radionuclide was also calculated from measured values of the Tank 40 dried SB7b sludge and the average WDF value shown in Table 3-3.[22] It should be noted that the measured SB7b glass concentrations include the Cs-137 additions from the Cs-laden strip effluent stream that was processed at DWPF, whereas the SB7b WAPS concentrations and the calculated concentrations for the SB7b glass are based on the sludge stream only. While the %RSD for Zr-93 is 98.6%, the average measured concentration is consistent with the calculated concentration based on the concentration in the SB7b WAPS sample and WDF.

3.4 Noble Metals

The average measured concentrations of the noble metals based on quadruplicate measurements

[g] Th-229 was identified as reportable for SB7b; however, there is no direct method for measuring its concentration, so its value will not be presented in this report. Based on the calculated values in SRNL-STI-2012-00294, Th-229 becomes reportable in the year 3115, which is of no practical significance to this study. Total ThO_2 is reported in Table 3-2.

[h] In addition to the twenty-seven radionuclides identified above, U-235 and U-236 are also reportable per the requirements of the WAPS.

[i] Th-232 was also added to the list as it was measured at greater than 0.2 wt% by ICP-MS.

of SB7b PS glass sample are listed in Table 3-5. Table A-4 in Appendix A provides the actual measured ICP-MS data. Since one of the replicates for mass 105 was below the detection limit, Cohen's method[24] for a normal distribution was used to estimate both the mean and standard deviation. All four of the measured concentrations of mass 109 were below the detection limit. Thus, the mean and variance were estimated assuming a uniform distribution based on the highest non-detect value. The calculated noble metal concentration in the glass is determined from the concentration in the Tank 40 dried sludge[22] and the average WDF value (Table 3-3).

In addition to ICP-MS, the SB7b PS glass sample was also analyzed with SEM-EDS for noble metal inclusions. Examination of the glass with EDS indicated the presence of both Ru and Rh, which corresponds to the results of the ICP-MS noble metals analysis in Table 3-5.[j] Noble metal inclusions have been observed in previous pour stream samples from SB4 through SB7a.[20,25,26]

Table 3-4. Reportable Radionuclide Concentration in the SB7b PS glass sample Glass

Radionuclide	SB7b WAPS		SB7b Glass Calculated	SB7b Glass Measured		
	(Ci/kg)	wt%	wt%	(Ci/kg)	wt%	%RSD
Cl-36	<4.1E-06	<1.2E-05	<5.2E-06	---	---	---
Ni-59	2.6E-03	3.2E-03	1.4E-03	---	---	---
Ni-63	1.6E-01	2.6E-04	1.1E-04	---	---	---
Se-79	1.5E-05	2.2E-05	9.6E-06	---	---	---
Sr-90	1.3E+01	9.3E-03	4.0E-03	4.6E+00	3.4E-03	4.8
Zr-93	4.6E-04	1.8E-02	8.0E-03	1.6E-04	6.4E-03	98.6
Nb-93m	4.2E-04	1.5E-07	6.5E-08	---	---	---
Tc-99	9.7E-05	5.7E-04	2.5E-04	7.1E-06	4.2E-05	5.5
Cd-113m	3.3E-03	1.5E-06	6.7E-07	---	---	---
Sn-121m	5.0E-04	8.4E-07	3.6E-07	---	---	---
Sn-126	<7.0E-04	<2.5E-03	<1.1E-03	---	---	---
Cs-137	6.4E-01	7.4E-04	3.2E-04	7.9E-01	9.1E-04	3.3
Sm-151	2.5E-01	9.4E-04	4.1E-04	---	---	---
Th-232	1.2E-06	1.1E+00	4.7E-01	4.8E-07	4.4E-01	0.7
U-233	4.2E-05	4.4E-04	1.9E-04	<3.8E-05	<3.9E-04	3.4
U-234	4.1E-05	6.5E-04	2.8E-04	<2.4E-05	<3.9E-04	3.4
U-235	6.1E-07	2.8E-02	1.2E-02	2.4E-07	1.1E-02	5.5
U-236	9.0E-07	1.4E-03	6.1E-04	4.0E-07	6.3E-04	15.1
U-238	1.6E-05	4.8E+00	2.1E+00	6.8E-06	2.0E+00	1.8
Np-237	2.5E-05	3.5E-03	1.5E-03	9.2E-06	1.3E-03	6.3
Pu-238	1.4E-01	8.3E-04	3.6E-04	5.4E-02	3.2E-04	4.2
Pu-239	1.1E-02	1.7E-02	7.5E-03	4.8E-03	7.7E-03	2.3
Pu-240	3.6E-03	1.6E-03	6.8E-04	1.5E-03	6.5E-04	4.0
Pu-241	5.1E-02	4.9E-05	2.1E-05	1.8E-02	1.7E-05	4.0
Pu-242	<9.0E-06	<2.4E-04	<1.0E-04	<1.5E-05	<3.9E-04	3.4
Am-241	3.6E-02	1.0E-03	4.5E-04	1.5E-02	4.4E-04	3.3
Am-243	5.0E-04	2.5E-04	1.1E-04	---	---	---
Cm-244	1.8E-02	2.2E-05	9.7E-06	---	---	---
Cm-246	6.6E-06	2.2E-06	9.3E-07	---	---	---

Alpha Spectroscopy:	Pu-238
Beta Counting:	Sr-90, Tc-99 and Pu-241
Gamma Counting:	Cs-137 and Am-241
ICP-MS:	Zr-93, Th-232, U-233, U-234, U-235, U-236, U-238, Np-237, Pu-239, Pu-240 and Pu-242

[j] More details can be found in SRNL electronic laboratory notebook L3293-00022-10.

Table 3-5. Noble Metals Concentrations in the SB7b PS glass sample Glass (wt.%)

Noble Metal	SB7b WAPS	SB7b Glass Calculated	SB7b Glass Measured	%RSE
Ag	0.0118	0.0051	0.0103	18.35
Pd	0.00254	0.0011	0.000725	7.18
Rh	0.0207	0.0090	0.00678	3.31
Ru	0.102	0.044	0.0212	1.74

%RSE – percent relative standard error

3.5 PCT

The average normalized release values for ARM[16], EA (published[27] and measured) and SB7b PS glass sample are shown in Table 3-6. No water loss issues were observed over the course of the test. Table A-6 through Table A-8[k] in Appendix A provides the as-received elemental leachate concentrations for the solutions samples generated by the PCTs. The normalized release values of the pour stream glass for B, Li, Na and Si are very acceptable with respect to the EA glass benchmark values provided in Table 3-6 and meet the acceptance criteria as defined in the WAPS.[l,28]

3.6 Density

The average density of the SB7b PS glass sample glass was determined to be 2.70 g/cm^3. Data from the density measurements are shown in Table A-9 in Appendix A.

3.7 REDOX

The average value of $Fe^{2+}/\sum Fe$ and Fe^{2+}/Fe^{3+} for the SB7b pour stream sample were 0.07 and 0.08, respectively. The EA glass results are consistent with the target values (0.22-0.23±0.01 for Fe^{2+}/Fe^{3+}), indicating that the measurements were in control.[27] Complete sets of data for each of the replicates and EA samples included with the individual sets are shown in Table A-10 in Appendix A.

Table 3-6. Normalized PCT Results for the SB7b PS glass sample Glass (g/L)

Glass ID	NL B	NL Li	NL Na	NL Si	NL U
ARM	0.4	0.5	0.5	0.3	---
St. Dev.	0.006	0.003	0.004	0.001	---
%RSD	1.5	0.6	0.9	0.6	---
EA - Measured	16.6	9.4	13.2	4.0	---
St. Dev.	0.1	0.1	0.1	0.02	---
%RSD	0.7	0.7	0.7	0.4	---
EA - Published	16.7	9.6	13.3	3.9	---
St. Dev.	1.2	0.7	0.9	0.4	---
%RSD	7	8	7	10	---
SB7b PS	0.8	0.9	1.0	0.5	0.4
St. Dev.	0.007	0.005	0.007	0.003	0.004
%RSD	1.0	0.6	0.7	0.6	0.9

[k] As-measured radionuclide data are shown in Tables 5-8 and 5-9.

[l] The normalized release of boron, sodium, and lithium from the waste glass must be at least two standard deviations better than the EA glass.

4.0 Conclusions

- The sum of oxides for the SB7b pour stream glass is within the PCCS limits (95-105 wt%).

- The average calculated WDF for SB7b is 2.3. In general, the measured radionuclide content of the official SB7b pour stream glass is in good agreement with the calculated values from the Tank 40 dried sludge results from the SB7b WAPS sample.

- As in previous pour stream samples, ruthenium and rhodium inclusions were detected by SEM-EDS in the official SB7b pour stream sample.

- The PCT results indicate that the official SB7b pour stream glass meets the waste acceptance criteria for durability with a normalized boron release of 0.8 g/L, which is an order of magnitude less than the EA glass.

- The measured density of the SB7b pour stream glass was 2.70 g/cm^3.

- The $Fe^{2+}/\sum Fe$ ratio of the SB7b pour stream sample was 0.07.

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Appendix A. Supplemental Data Tables

Table A-1. Measured Elemental Concentrations (µg/g) for Glasses (AR)

Glass ID	ARG-1			SB7b PS				Blank
Lab ID	300305016	300305018	300305020	300305015	300305017	300305019	300305021	300305013
Replicate	1	2	3	1	2	3	4	1
Al	23600	23300	21600	39300	41500	40000	38900	< 63
B	25700	25500	23500	15000	15800	15200	14500	< 15.9
Ba	812	805	738	441	461	446	435	5.36
Be	22.1	21.4	19.6	< 3.13	< 3.09	< 3.04	< 3.2	< 0.32
Ca	10600	10500	9650	3060	3210	3120	3040	33.8
Cd	< 10.5	< 10.9	< 12.2	132	138	134	131	< 11.4
Ce	< 60.2	< 62.5	< 69.7	615	650	631	608	< 65.5
Co	72.6	72.1	64.9	59.8	62.7	63.8	57.6	< 9.44
Cr	617	612	579	545	569	555	542	< 10.7
Cu	21	24.2	21.1	1700	1790	1720	1670	< 9.84
Fe	93900	92700	85100	58200	61400	59500	57700	1700
Gd	< 174	< 181	< 202	361	378	389	356	< 19
K	21400	21100	19000	< 2820	< 2780	< 2740	< 2880	< 288
La	< 92.6	< 96.2	< 107	351	380	344	353	< 10.1
Li	14200	13900	12900	23100	24000	23800	22900	< 5.52
Mg	4960	4950	4560	1330	1390	1350	1310	6.36
Mn	14000	13800	12700	12900	13500	13100	12800	12.5
Mo	< 72.3	< 75	< 83.7	< 76.8	< 75.9	< 74.8	< 78.6	< 78.6
Na	83200	82400	75700	105000	111000	107000	105000	122
Ni	8120	7970	7300	11800	12400	11900	11700	< 16.6
P	1230	1180	1060	687	681	806	424	< 133
Pb	< 60.1	< 62.4	< 69.6	181	168	177	178	< 65.4
S*	< 1040	< 1080	< 1200	1610	1590	1670	1550	< 1130
Sb	< 253	< 263	< 293	< 269	< 266	< 262	< 276	< 276
Si	3900	1530	1260	6450	4930	3170	3060	< 164
Sn	< 86.9	< 90.2	< 101	< 92.3	< 91.3	< 89.9	< 94.6	< 94.6
Sr	29.6	29.4	26.8	191	200	193	187	< 0.4
Th	< 299	< 311	< 346	4730	5140	4970	4970	< 32.6
Ti	5620	5220	5390	1330	1470	1440	1340	< 4.64
U	< 2370	< 2460	< 2740	21800	22500	22000	21700	< 257
V	101	99.4	91.3	< 4.92	< 4.86	< 4.79	< 5.04	< 5.04
Zn	187	189	176	413	432	416	407	255
Zr	608	409	420	619	581	1050	325	< 3.92

*Axial

Table A-2. Measured Elemental Concentrations (µg/g) for Glasses (PF)

Glass ID	ARG-1			SB7b PS				Blank
Lab ID	300305036	300305038	300305040	300305035	300305037	300305039	300305041	300305033
Replicate	1	2	3	1	2	3	4	1
Al	24500	25200	25200	39500	40200	39300	41400	< 630
B	25000	25400	25900	14600	14700	14300	15000	< 159
Ba	737	761	782	388	399	372	412	< 49.6
Be	26.2	27.2	24.2	< 9.09	< 9.41	< 9.72	< 9.02	< 9.6
Ca	12600	11600	12100	4840	4860	5480	4820	2310
Cd	< 117	< 105	< 108	139	129	123	129	< 114
Ce	< 671	< 602	< 620	< 620	< 642	< 663	< 616	< 655
Co	< 152	< 136	< 140	< 140	< 145	< 150	< 139	< 148
Cr	621	632	655	550	568	599	580	< 178
Cu	< 80.3	< 72.1	< 74.2	1540	1580	1540	1570	< 78.4
Fe	94400	95800	97100	59300	60400	61300	61700	293
Gd	< 194	< 174	< 180	< 180	< 186	< 192	< 178	< 190
K	28200	30700	33400	4640	7950	10900	11400	3090
La	< 102	96.3	< 94.7	319	322	333	349	< 100
Li	14100	14200	14500	23000	22900	21500	22400	87.2
Mg	5030	5050	5190	1290	1320	1260	1320	5.6
Mn	13700	13900	14200	12700	12900	12600	13100	< 12.8
Mo	< 806	< 723	< 745	< 745	< 771	< 796	< 739	< 786
Ni	7300	7310	7270	10700	10800	10600	11300	< 868
P	< 3940	< 3530	< 3640	< 3640	< 3770	< 3890	< 3610	< 3840
Pb	< 670	< 601	< 620	< 620	< 642	< 662	< 615	< 654
S	< 49200	< 44100	< 45500	< 45500	< 47100	< 48600	< 45100	< 48000
Sb	< 2830	< 2530	< 2610	< 2610	< 2700	< 2790	< 2590	< 2760
Si	207000	227000	231000	225000	231000	228000	240000	< 1640
Sn	< 969	< 869	< 895	< 895	< 927	< 957	< 889	< 946
Sr	48.8	47.5	51.5	195	199	192	198	14.8
Th	< 536	< 481	< 495	4660	4460	4880	4490	< 523
Ti	6540	6560	6600	1530	1530	1500	1550	< 33.6
U	< 4970	< 4460	< 4590	21800	20800	22100	22000	< 4850
V	112	113	115	< 47.7	< 49.4	< 51	< 47.4	< 50.4
Zn	195	197	210	413	428	426	445	< 130

Table A-3. As-Measured Radionuclide Concentrations (dpm/g) via Gamma and Beta Counting and Alpha Spectroscopy

Sample ID	SB7b PS				Blank
Lab ID	300305049	300305050	300305051	300305052	300305048
Replicate	1	2	3	4	1
Sr-90	1.1E+10	1.0E+10	9.6E+09	1.1E+10	<1.79E+06
Tc-99	1.57E+04	1.69E+04	1.57E+04	1.48E+04	<1.61E+03
Cs-137	1.77E+09	1.82E+09	1.68E+09	1.76E+09	<2.93E+06
Pu-238	1.17E+08	1.16E+08	1.21E+08	1.27E+08	<1.59E+06
Am-241	3.50E+07	3.33E+07	3.26E+07	3.27E+07	<2.13E+04
Pu-241	3.79E+07	3.84E+07	3.90E+07	4.14E+07	<8.90E+04

Table A-4. As-Measured Concentrations of m/z (µg/g) via ICP-MS (PF)

Sample ID		SB7b PS				Blank
Lab ID		300305044	300305045	300305046	300305047	300305043
Replicate		1	2	3	4	1
m/z	59	5.97E+01	5.94E+01	6.41E+01	6.63E+01	< 6.00E+00
	69	1.25E+01	< 1.18E+01	< 1.21E+01	< 1.13E+01	< 1.20E+01
	71	< 7.58E+00	< 7.84E+00	< 8.10E+00	< 7.52E+00	< 8.00E+00
	82	< 4.47E+02	< 4.63E+02	< 4.78E+02	< 4.44E+02	< 4.72E+02
	84	< 6.63E+01	< 6.86E+01	< 7.09E+01	< 6.58E+01	< 7.00E+01
	85	< 5.68E+00	< 5.88E+00	< 6.07E+00	< 5.64E+00	< 6.00E+00
	86	< 1.52E+01	< 1.57E+01	< 1.62E+01	< 1.50E+01	< 1.60E+01
	87	5.85E+00	6.55E+00	8.72E+00	6.62E+00	< 4.00E+00
	88	1.36E+02	1.40E+02	1.36E+02	1.54E+02	1.39E+01
	89	1.24E+02	1.29E+02	1.28E+02	1.16E+02	< 4.00E+00
	90	5.45E+04	4.32E+04	1.08E+05	4.86E+04	4.05E+04
	91	1.14E+04	9.12E+03	2.21E+04	1.02E+04	8.49E+03
	92	1.88E+04	1.54E+04	3.70E+04	1.73E+04	1.43E+04
	93	2.19E+02	2.06E+02	2.24E+02	2.05E+02	2.88E+01
	94	1.88E+04	1.54E+04	3.67E+04	1.71E+04	1.43E+04
	95	7.19E+00	1.02E+01	8.67E+00	7.21E+00	< 6.00E+00
	96	3.47E+03	2.81E+03	6.64E+03	3.13E+03	2.51E+03
	97	4.32E+00	4.21E+00	< 4.05E+00	4.55E+00	< 4.00E+00
	98	< 9.47E+00	< 9.80E+00	< 1.01E+01	1.24E+01	< 1.00E+01
	99	< 3.79E+00	< 3.92E+00	< 4.05E+00	< 3.76E+00	< 4.00E+00
	100	< 1.14E+01	< 1.18E+01	< 1.21E+01	< 1.13E+01	< 1.20E+01
	101	8.30E+01	8.09E+01	7.94E+01	8.97E+01	< 4.00E+00
	102	8.46E+01	8.36E+01	7.33E+01	7.88E+01	< 6.00E+00
	103	6.96E+01	7.13E+01	6.12E+01	6.90E+01	< 4.00E+00
	104	4.66E+01	4.93E+01	4.76E+01	5.28E+01	< 4.00E+00
	105	4.83E+00	4.97E+00	4.20E+00	< 3.76E+00	< 4.00E+00
	106	2.37E+02	2.14E+02	4.94E+02	2.17E+02	1.75E+02
	107	8.77E+01	8.12E+01	1.59E+02	8.20E+01	5.74E+01
	108	9.22E+01	7.44E+01	1.53E+02	8.10E+01	6.20E+01
	109	< 2.27E+01	< 2.35E+01	< 2.43E+01	< 2.26E+01	< 2.40E+01
	110	1.09E+02	9.48E+01	1.92E+02	9.83E+01	7.34E+01
	111	2.34E+01	2.25E+01	3.33E+01	2.60E+01	4.80E+00
	112	5.11E+01	4.14E+01	6.19E+01	4.93E+01	1.32E+01
	113	< 1.57E+02	< 1.63E+02	< 1.68E+02	< 1.56E+02	< 1.66E+02
	114	4.41E+01	3.98E+01	3.92E+01	3.96E+01	< 4.00E+00
	116	5.78E+01	6.40E+01	7.25E+01	6.34E+01	2.48E+01
	117	9.49E+00	8.00E+00	1.62E+01	8.99E+00	1.26E+01
	118	2.57E+01	2.71E+01	4.39E+01	2.74E+01	3.31E+01
	119	1.10E+02	1.13E+02	1.14E+02	1.11E+02	1.09E+01
	120	3.78E+01	3.50E+01	5.95E+01	3.67E+01	4.57E+01

Table A-4 cont. As-Measured Concentrations of m/z (µg/g) via ICP-MS (PF)

Sample ID		SB7b PS				Blank
Lab ID		300305044	300305045	300305046	300305047	300305043
Replicate		1	2	3	4	1
m/z	121	< 1.52E+01	< 1.57E+01	< 1.62E+01	< 1.50E+01	< 1.60E+01
	122	6.35E+00	5.60E+00	1.13E+01	7.40E+00	9.47E+00
	123	< 3.79E+00	< 3.92E+00	< 4.05E+00	< 3.76E+00	< 4.00E+00
	124	1.56E+01	9.31E+00	1.61E+01	1.22E+01	1.43E+01
	125	< 3.79E+00	< 3.92E+00	< 4.05E+00	< 3.76E+00	< 4.00E+00
	126	< 2.46E+01	< 2.55E+01	< 2.63E+01	< 2.44E+01	< 2.60E+01
	128	< 1.00E+02	< 1.04E+02	< 1.07E+02	< 9.96E+01	< 1.06E+02
	130	< 2.63E+02	< 2.73E+02	< 2.81E+02	< 2.61E+02	< 2.78E+02
	133	3.05E+01	3.23E+01	2.86E+01	3.19E+01	< 1.00E+01
	134	< 2.46E+01	< 2.55E+01	< 2.63E+01	< 2.44E+01	< 2.60E+01
	135	5.44E+00	5.34E+00	6.34E+00	7.13E+00	< 4.00E+00
	136	< 3.03E+01	< 3.14E+01	< 3.24E+01	< 3.01E+01	< 3.20E+01
	137	8.44E+01	8.55E+01	8.53E+01	8.75E+01	< 4.00E+00
	138	3.28E+02	3.43E+02	3.15E+02	3.16E+02	4.87E+00
	139	3.26E+02	3.35E+02	3.19E+02	3.42E+02	< 4.00E+00
	140	2.63E+02	2.64E+02	2.60E+02	2.58E+02	< 4.00E+00
	141	2.48E+02	2.25E+02	2.34E+02	2.26E+02	< 4.00E+00
	142	2.60E+02	2.50E+02	2.52E+02	2.35E+02	< 4.00E+00
	143	2.39E+02	2.36E+02	2.41E+02	2.36E+02	< 4.00E+00
	144	2.46E+02	2.49E+02	2.52E+02	2.47E+02	< 4.00E+00
	145	1.69E+02	1.63E+02	1.67E+02	1.66E+02	< 4.00E+00
	146	1.42E+02	1.35E+02	1.48E+02	1.38E+02	< 4.00E+00
	147	9.65E+01	9.97E+01	9.95E+01	9.27E+01	< 4.00E+00
	148	8.68E+01	7.94E+01	7.89E+01	7.98E+01	< 4.00E+00
	149	5.03E+00	5.69E+00	6.05E+00	5.57E+00	< 4.00E+00
	150	8.21E+01	7.85E+01	8.64E+01	7.55E+01	< 4.00E+00
	151	9.35E+00	9.88E+00	8.27E+00	7.56E+00	< 4.00E+00
	152	2.71E+01	2.94E+01	3.00E+01	2.74E+01	< 4.00E+00
	153	1.34E+01	1.14E+01	1.34E+01	1.45E+01	< 4.00E+00
	154	1.25E+01	1.09E+01	1.42E+01	1.20E+01	< 4.00E+00
	155	4.87E+01	4.84E+01	4.81E+01	4.36E+01	< 4.00E+00
	156	7.56E+01	6.81E+01	6.79E+01	6.57E+01	< 4.00E+00
	157	4.26E+01	4.59E+01	4.87E+01	4.44E+01	< 4.00E+00
	158	8.23E+01	7.33E+01	8.10E+01	7.31E+01	< 4.00E+00
	159	< 3.79E+00	< 3.92E+00	< 4.05E+00	< 3.76E+00	< 4.00E+00
	160	6.27E+01	6.90E+01	6.49E+01	6.12E+01	< 4.00E+00
	161	< 3.79E+00	< 3.92E+00	< 4.05E+00	< 3.76E+00	< 4.00E+00
	162	< 3.79E+00	< 3.92E+00	< 4.05E+00	< 3.76E+00	< 4.00E+00
	163	< 3.79E+00	< 3.92E+00	< 4.05E+00	< 3.76E+00	< 4.00E+00
	164	< 3.79E+00	< 3.92E+00	< 4.05E+00	< 3.76E+00	< 4.00E+00

Table A-4 cont. As-Measured Concentrations of m/z (µg/g) via ICP-MS (PF)

Sample ID		SB7b PS				Blank
Lab ID		300305044	300305045	300305046	300305047	300305043
Replicate		1	2	3	4	1
m/z	165	< 3.79E+00	< 3.92E+00	< 4.05E+00	< 3.76E+00	< 4.00E+00
	166	< 3.79E+00	< 3.92E+00	< 4.05E+00	< 3.76E+00	< 4.00E+00
	167	< 3.79E+00	< 3.92E+00	< 4.05E+00	< 3.76E+00	< 4.00E+00
	168	< 3.79E+00	< 3.92E+00	< 4.05E+00	< 3.76E+00	< 4.00E+00
	169	< 3.79E+00	< 3.92E+00	< 4.05E+00	< 3.76E+00	< 4.00E+00
	170	< 3.79E+00	< 3.92E+00	< 4.05E+00	< 3.76E+00	< 4.00E+00
	171	< 3.79E+00	< 3.92E+00	< 4.05E+00	< 3.76E+00	< 4.00E+00
	172	< 3.79E+00	< 3.92E+00	< 4.05E+00	< 3.76E+00	< 4.00E+00
	173	< 3.79E+00	< 3.92E+00	< 4.05E+00	< 3.76E+00	< 4.00E+00
	174	< 3.79E+00	< 3.92E+00	4.78E+00	< 3.76E+00	< 4.00E+00
	175	< 3.79E+00	< 3.92E+00	< 4.05E+00	< 3.76E+00	< 4.00E+00
	176	5.75E+01	4.35E+01	1.07E+02	5.03E+01	3.78E+01
	177	1.96E+02	1.60E+02	3.71E+02	1.72E+02	1.49E+02
	178	2.96E+02	2.53E+02	5.73E+02	2.65E+02	2.22E+02
	179	1.50E+02	1.26E+02	2.96E+02	1.33E+02	1.14E+02
	180	3.55E+02	3.00E+02	7.22E+02	3.23E+02	2.74E+02
	181	< 1.89E+01	< 1.96E+01	< 2.02E+01	< 1.88E+01	< 2.00E+01
	182	< 9.47E+00	< 9.80E+00	< 1.01E+01	< 9.40E+00	< 1.00E+01
	183	< 5.68E+00	< 5.88E+00	< 6.07E+00	< 5.64E+00	< 6.00E+00
	184	< 1.52E+01	< 1.57E+01	< 1.62E+01	< 1.50E+01	< 1.60E+01
	185	< 5.68E+00	< 5.88E+00	< 6.07E+00	< 5.64E+00	< 6.00E+00
	186	< 5.68E+00	< 5.88E+00	< 6.07E+00	< 5.64E+00	< 6.00E+00
	187	< 3.79E+00	< 3.92E+00	< 4.05E+00	< 3.76E+00	< 4.00E+00
	191	< 7.58E+00	< 7.84E+00	< 8.10E+00	< 7.52E+00	< 8.00E+00
	193	< 1.14E+01	< 1.18E+01	< 1.21E+01	< 1.13E+01	< 1.20E+01
	194	5.64E+00	< 3.92E+00	1.23E+01	6.62E+00	4.20E+00
	195	< 3.79E+00	< 3.92E+00	7.10E+00	5.06E+00	< 4.00E+00
	196	7.03E+00	< 3.92E+00	1.18E+01	5.99E+00	4.03E+00
	197	< 2.63E+02	< 2.73E+02	< 2.81E+02	< 2.61E+02	< 2.78E+02
	198	< 1.14E+01	< 1.18E+01	< 1.21E+01	< 1.13E+01	< 1.20E+01
	203	< 3.79E+00	< 3.92E+00	< 4.05E+00	< 3.76E+00	< 4.00E+00
	204	< 3.79E+00	< 3.92E+00	< 4.05E+00	< 3.76E+00	< 4.00E+00
	205	< 7.58E+00	< 7.84E+00	< 8.10E+00	< 7.52E+00	< 8.00E+00
	206	3.50E+01	2.97E+01	3.47E+01	3.22E+01	< 8.00E+00
	207	3.48E+01	3.18E+01	3.77E+01	2.45E+01	< 8.00E+00
	208	6.83E+01	6.34E+01	6.57E+01	7.30E+01	< 2.00E+01
	230	< 3.79E+00	< 3.92E+00	< 4.05E+00	< 3.76E+00	< 4.00E+00
	232	4.33E+03	4.38E+03	4.36E+03	4.39E+03	< 6.00E+00
	233	< 3.79E+00	< 3.92E+00	< 4.05E+00	< 3.76E+00	< 4.00E+00
	234	< 3.79E+00	< 3.92E+00	< 4.05E+00	< 3.76E+00	< 4.00E+00

Table A-4 cont. As-Measured Concentrations of m/z (µg/g) via ICP-MS (PF)

Sample ID		SB7b PS				Blank
Lab ID		300305044	300305045	300305046	300305047	300305043
Replicate		1	2	3	4	1
m/z	235	1.12E+02	1.03E+02	1.15E+02	1.17E+02	< 4.00E+00
	236	6.93E+00	6.60E+00	6.65E+00	4.85E+00	< 4.00E+00
	237	1.33E+01	1.26E+01	1.40E+01	1.21E+01	< 4.00E+00
	238	2.03E+04	2.01E+04	1.97E+04	2.06E+04	< 8.00E+00
	239	7.95E+01	7.69E+01	7.53E+01	7.65E+01	< 4.00E+00
	240	6.62E+00	6.81E+00	6.44E+00	6.19E+00	< 4.00E+00
	241	< 3.79E+00	< 3.92E+00	< 4.05E+00	4.46E+00	< 4.00E+00
	242	< 3.79E+00	< 3.92E+00	< 4.05E+00	< 3.76E+00	< 4.00E+00
	243	< 3.79E+00	< 3.92E+00	< 4.05E+00	< 3.76E+00	< 4.00E+00
	244	< 3.79E+00	< 3.92E+00	< 4.05E+00	< 3.76E+00	< 4.00E+00

Table A-5. As-Measured Concentrations of m/z (µg/g) via ICP-MS (AR)

Sample ID		SB7b PS				Blank
Lab ID		300305024	300305025	300305026	300305027	300305023
Replicate		1	2	3	4	1
m/z	59	6.05E+01	6.20E+01	6.26E+01	6.35E+01	< 1.80E+01
	69	7.21E+00	9.76E+00	1.03E+01	8.85E+00	< 4.00E+00
	71	< 3.91E+00	< 3.86E+00	< 3.80E+00	< 4.00E+00	< 4.00E+00
	82	< 6.91E+02	< 6.83E+02	< 6.73E+02	< 7.08E+02	< 7.08E+02
	84	< 4.10E+01	< 4.05E+01	< 3.99E+01	< 4.20E+01	< 4.20E+01
	85	< 3.91E+00	< 3.86E+00	< 3.80E+00	< 4.00E+00	< 4.00E+00
	86	< 4.49E+01	< 4.44E+01	< 4.37E+01	< 4.60E+01	< 4.60E+01
	87	6.60E+00	6.22E+00	6.83E+00	5.63E+00	< 4.00E+00
	88	1.25E+02	1.30E+02	1.36E+02	1.34E+02	< 4.00E+00
	89	1.42E+02	1.34E+02	1.40E+02	1.32E+02	< 4.00E+00
	90	8.42E+01	9.79E+01	1.73E+02	6.07E+01	< 6.00E+00
	91	3.89E+01	4.09E+01	1.18E+02	7.89E+00	< 4.00E+00
	92	4.73E+01	4.55E+01	1.35E+02	< 1.60E+01	< 1.60E+01
	93	4.30E+01	4.58E+01	1.55E+02	1.13E+01	< 6.00E+00
	94	4.96E+01	4.82E+01	1.43E+02	1.30E+01	< 4.00E+00
	95	1.21E+01	< 1.16E+01	< 1.14E+01	< 1.20E+01	< 1.20E+01
	96	5.35E+01	5.74E+01	1.46E+02	1.00E+01	< 1.00E+01
	97	< 7.81E+00	< 7.72E+00	< 7.60E+00	< 8.00E+00	< 8.00E+00
	98	1.30E+01	8.10E+00	4.86E+00	1.03E+01	< 4.00E+00
	99	< 3.91E+00	< 3.86E+00	< 3.80E+00	< 4.00E+00	< 4.00E+00
	100	< 7.81E+00	< 7.72E+00	< 7.60E+00	< 8.00E+00	< 8.00E+00
	101	1.84E+01	1.98E+01	2.10E+01	2.04E+01	< 4.00E+00
	102	2.06E+01	1.69E+01	1.91E+01	1.63E+01	< 4.00E+00
	103	1.48E+01	1.44E+01	1.34E+01	1.19E+01	< 4.00E+00
	104	1.16E+01	1.09E+01	1.08E+01	9.62E+00	< 4.00E+00
	105	< 5.86E+00	< 5.79E+00	< 5.70E+00	< 6.00E+00	< 6.00E+00
	106	1.12E+01	1.22E+01	1.15E+01	1.19E+01	< 4.00E+00
	107	< 5.86E+00	< 5.79E+00	< 5.70E+00	< 6.00E+00	< 6.00E+00
	108	< 3.91E+00	< 3.86E+00	< 3.80E+00	< 4.00E+00	< 4.00E+00
	109	< 5.86E+00	< 5.79E+00	< 5.70E+00	< 6.00E+00	< 6.00E+00
	110	1.33E+01	1.45E+01	1.48E+01	1.68E+01	< 4.00E+00
	111	1.91E+01	2.30E+01	2.05E+01	1.53E+01	< 4.00E+00
	112	3.42E+01	3.12E+01	3.26E+01	3.21E+01	< 4.00E+00
	113	< 1.95E+02	< 1.93E+02	< 1.90E+02	< 2.00E+02	< 2.00E+02
	114	3.72E+01	4.01E+01	4.12E+01	4.09E+01	< 4.00E+00
	116	4.60E+01	4.68E+01	4.37E+01	4.77E+01	< 4.00E+00
	117	< 3.91E+00	< 3.86E+00	< 3.80E+00	< 4.00E+00	< 4.00E+00
	118	< 5.86E+00	< 5.79E+00	< 5.70E+00	< 6.00E+00	< 6.00E+00
	119	8.93E+01	9.35E+01	9.20E+01	9.11E+01	< 4.00E+00
	120	< 5.86E+00	< 5.79E+00	< 5.70E+00	< 6.00E+00	< 6.00E+00

Table A-5 cont. As-Measured Concentrations of m/z (µg/g) via ICP-MS (AR)

Sample ID		SB7b PS				Blank
Lab ID		300305024	300305025	300305026	300305027	300305023
Replicate		1	2	3	4	1
m/z	121	< 7.81E+00	< 7.72E+00	< 7.60E+00	< 8.00E+00	< 8.00E+00
	122	< 3.91E+00	< 3.86E+00	< 3.80E+00	< 4.00E+00	< 4.00E+00
	123	< 5.86E+00	< 5.79E+00	< 5.70E+00	< 6.00E+00	< 6.00E+00
	124	< 5.86E+00	< 5.79E+00	< 5.70E+00	< 6.00E+00	< 6.00E+00
	125	< 3.91E+00	< 3.86E+00	< 3.80E+00	< 4.00E+00	< 4.00E+00
	126	< 1.56E+01	< 1.54E+01	< 1.52E+01	< 1.60E+01	< 1.60E+01
	128	< 1.46E+02	< 1.45E+02	< 1.43E+02	< 1.50E+02	< 1.50E+02
	130	< 6.64E+01	< 6.56E+01	7.54E+01	7.11E+01	< 6.80E+01
	133	2.94E+01	2.98E+01	2.92E+01	3.26E+01	< 4.00E+00
	134	< 1.95E+01	< 1.93E+01	< 1.90E+01	< 2.00E+01	< 2.00E+01
	135	6.82E+00	6.09E+00	5.68E+00	6.93E+00	< 4.00E+00
	136	< 2.15E+01	< 2.12E+01	< 2.09E+01	< 2.20E+01	< 2.20E+01
	137	8.34E+01	8.90E+01	9.00E+01	8.65E+01	< 4.00E+00
	138	3.40E+02	3.52E+02	3.45E+02	3.31E+02	< 1.00E+01
	139	3.57E+02	3.90E+02	3.75E+02	3.60E+02	< 4.00E+00
	140	3.12E+02	3.27E+02	3.29E+02	3.12E+02	< 4.00E+00
	141	2.88E+02	3.10E+02	2.95E+02	2.77E+02	< 4.00E+00
	142	2.94E+02	3.15E+02	3.11E+02	2.90E+02	< 4.00E+00
	143	2.84E+02	2.95E+02	2.83E+02	2.79E+02	< 4.00E+00
	144	3.01E+02	3.17E+02	2.97E+02	2.95E+02	< 4.00E+00
	145	1.92E+02	2.14E+02	2.02E+02	1.97E+02	< 4.00E+00
	146	1.72E+02	1.74E+02	1.68E+02	1.67E+02	< 4.00E+00
	147	1.11E+02	1.09E+02	1.12E+02	1.09E+02	< 4.00E+00
	148	1.05E+02	1.12E+02	1.04E+02	1.05E+02	< 4.00E+00
	149	6.85E+00	6.96E+00	6.50E+00	6.25E+00	< 4.00E+00
	150	9.06E+01	1.01E+02	9.71E+01	9.44E+01	< 4.00E+00
	151	8.87E+00	1.11E+01	1.13E+01	1.13E+01	< 4.00E+00
	152	3.07E+01	3.25E+01	2.94E+01	3.04E+01	< 4.00E+00
	153	1.38E+01	1.38E+01	1.35E+01	1.40E+01	< 4.00E+00
	154	1.32E+01	1.82E+01	1.18E+01	1.37E+01	< 4.00E+00
	155	5.44E+01	5.50E+01	5.37E+01	5.46E+01	< 4.00E+00
	156	7.37E+01	7.74E+01	7.55E+01	6.74E+01	< 4.00E+00
	157	5.30E+01	5.75E+01	5.50E+01	4.84E+01	< 4.00E+00
	158	8.92E+01	9.21E+01	9.04E+01	8.45E+01	< 4.00E+00
	159	< 3.91E+00	< 3.86E+00	< 3.80E+00	< 4.00E+00	< 4.00E+00
	160	7.84E+01	7.90E+01	7.93E+01	7.42E+01	< 4.00E+00
	161	< 3.91E+00	< 3.86E+00	< 3.80E+00	< 4.00E+00	< 4.00E+00
	162	< 3.91E+00	< 3.86E+00	< 3.80E+00	< 4.00E+00	< 4.00E+00
	163	< 3.91E+00	< 3.86E+00	< 3.80E+00	< 4.00E+00	< 4.00E+00
	164	< 3.91E+00	< 3.86E+00	< 3.80E+00	< 4.00E+00	< 4.00E+00

Table A-5 cont. As-Measured Concentrations of m/z (µg/g) via ICP-MS (AR)

Sample ID		SB7b PS				Blank
Lab ID		300305024	300305025	300305026	300305027	300305023
Replicate		1	2	3	4	1
m/z	121	< 1.56E+01	< 1.54E+01	< 1.52E+01	< 1.60E+01	< 1.60E+01
	122	< 3.91E+00	< 3.86E+00	< 3.80E+00	< 4.00E+00	< 4.00E+00
	123	< 3.91E+00	< 3.86E+00	< 3.80E+00	< 4.00E+00	< 4.00E+00
	124	< 3.91E+00	< 3.86E+00	< 3.80E+00	< 4.00E+00	< 4.00E+00
	125	< 3.91E+00	< 3.86E+00	< 3.80E+00	< 4.00E+00	< 4.00E+00
	126	< 2.54E+01	< 2.51E+01	< 2.47E+01	< 2.60E+01	< 2.60E+01
	128	< 1.04E+02	< 1.02E+02	< 1.01E+02	< 1.06E+02	< 1.06E+02
	130	< 2.71E+02	< 2.68E+02	< 2.64E+02	< 2.78E+02	< 2.78E+02
	133	< 9.77E+00	3.17E+01	3.04E+01	2.78E+01	< 1.00E+01
	134	< 2.54E+01	< 2.51E+01	< 2.47E+01	< 2.60E+01	< 2.60E+01
	135	< 3.91E+00	6.57E+00	7.12E+00	5.03E+00	< 4.00E+00
	136	< 3.13E+01	< 3.09E+01	< 3.04E+01	< 3.20E+01	< 3.20E+01
	137	< 3.91E+00	8.08E+01	8.23E+01	8.66E+01	< 4.00E+00
	138	< 3.91E+00	3.33E+02	3.36E+02	3.28E+02	< 4.00E+00
	139	< 3.91E+00	3.56E+02	3.55E+02	3.44E+02	< 4.00E+00
	140	< 3.91E+00	3.17E+02	2.98E+02	2.76E+02	< 4.00E+00
	141	< 3.91E+00	2.95E+02	2.85E+02	2.75E+02	< 4.00E+00
	142	< 3.91E+00	3.04E+02	2.91E+02	2.76E+02	< 4.00E+00
	143	< 3.91E+00	2.97E+02	2.87E+02	2.57E+02	< 4.00E+00
	144	< 3.91E+00	3.14E+02	3.00E+02	2.79E+02	< 4.00E+00
	145	< 3.91E+00	2.08E+02	1.99E+02	1.97E+02	< 4.00E+00
	146	< 3.91E+00	1.71E+02	1.66E+02	1.58E+02	< 4.00E+00
	147	< 3.91E+00	1.10E+02	1.17E+02	1.07E+02	< 4.00E+00
	148	< 3.91E+00	1.02E+02	9.63E+01	8.84E+01	< 4.00E+00
	149	< 3.91E+00	6.29E+00	6.79E+00	6.36E+00	< 4.00E+00
	150	< 3.91E+00	9.39E+01	9.05E+01	9.13E+01	< 4.00E+00
	151	< 3.91E+00	1.02E+01	8.67E+00	8.73E+00	< 4.00E+00
	152	< 3.91E+00	3.29E+01	3.29E+01	2.96E+01	< 4.00E+00
	153	< 3.91E+00	1.35E+01	1.40E+01	1.38E+01	< 4.00E+00
	154	< 3.91E+00	1.40E+01	1.43E+01	1.67E+01	< 4.00E+00
	155	< 3.91E+00	5.54E+01	5.88E+01	4.96E+01	< 4.00E+00
	156	< 3.91E+00	8.14E+01	7.53E+01	6.99E+01	< 4.00E+00
	157	< 3.91E+00	5.54E+01	5.38E+01	5.02E+01	< 4.00E+00
	158	< 3.91E+00	8.56E+01	9.37E+01	8.75E+01	< 4.00E+00
	159	< 3.91E+00	< 3.86E+00	< 3.80E+00	< 4.00E+00	< 4.00E+00
	160	< 3.91E+00	7.17E+01	8.25E+01	7.10E+01	< 4.00E+00
	161	< 3.91E+00	< 3.86E+00	< 3.80E+00	< 4.00E+00	< 4.00E+00
	162	< 3.91E+00	< 3.86E+00	< 3.80E+00	< 4.00E+00	< 4.00E+00
	163	< 3.91E+00	< 3.86E+00	< 3.80E+00	< 4.00E+00	< 4.00E+00
	164	< 3.91E+00	< 3.86E+00	< 3.80E+00	< 4.00E+00	< 4.00E+00

Table A-5 cont. As-Measured Concentrations of m/z (µg/g) via ICP-MS (AR)

Sample ID		SB7b PS				Blank
Lab ID		300305024	300305025	300305026	300305027	300305023
Replicate		1	2	3	4	1
m/z	165	< 3.91E+00	< 3.86E+00	< 3.80E+00	< 4.00E+00	< 4.00E+00
	166	< 3.91E+00	< 3.86E+00	< 3.80E+00	< 4.00E+00	< 4.00E+00
	167	< 3.91E+00	< 3.86E+00	< 3.80E+00	< 4.00E+00	< 4.00E+00
	168	< 3.91E+00	< 3.86E+00	< 3.80E+00	< 4.00E+00	< 4.00E+00
	169	< 3.91E+00	< 3.86E+00	< 3.80E+00	< 4.00E+00	< 4.00E+00
	170	< 3.91E+00	< 3.86E+00	< 3.80E+00	< 4.00E+00	< 4.00E+00
	171	< 3.91E+00	< 3.86E+00	< 3.80E+00	< 4.00E+00	< 4.00E+00
	172	< 3.91E+00	< 3.86E+00	< 3.80E+00	< 4.00E+00	< 4.00E+00
	173	< 3.91E+00	< 3.86E+00	< 3.80E+00	< 4.00E+00	< 4.00E+00
	174	< 3.91E+00	< 3.86E+00	< 3.80E+00	< 4.00E+00	< 4.00E+00
	175	< 3.91E+00	< 3.86E+00	< 3.80E+00	< 4.00E+00	< 4.00E+00
	176	< 3.91E+00	< 3.86E+00	< 3.80E+00	< 4.00E+00	< 4.00E+00
	177	< 3.91E+00	< 3.86E+00	< 3.80E+00	< 4.00E+00	< 4.00E+00
	178	< 5.86E+00	< 5.79E+00	< 5.70E+00	< 6.00E+00	< 6.00E+00
	179	< 3.91E+00	< 3.86E+00	< 3.80E+00	< 4.00E+00	< 4.00E+00
	180	< 3.91E+00	< 3.86E+00	< 3.80E+00	< 4.00E+00	< 4.00E+00
	181	< 3.91E+00	< 3.86E+00	< 3.80E+00	< 4.00E+00	< 4.00E+00
	182	< 7.81E+00	< 7.72E+00	< 7.60E+00	< 8.00E+00	< 8.00E+00
	183	< 5.86E+00	< 5.79E+00	< 5.70E+00	< 6.00E+00	< 6.00E+00
	184	< 7.81E+00	< 7.72E+00	< 7.60E+00	< 8.00E+00	< 8.00E+00
	185	< 3.91E+00	< 3.86E+00	< 3.80E+00	< 4.00E+00	< 4.00E+00
	186	< 1.17E+01	< 1.16E+01	< 1.14E+01	< 1.20E+01	< 1.20E+01
	187	< 3.91E+00	< 3.86E+00	< 3.80E+00	< 4.00E+00	< 4.00E+00
	191	< 7.81E+00	< 7.72E+00	< 7.60E+00	< 8.00E+00	< 8.00E+00
	193	< 1.17E+01	< 1.16E+01	< 1.14E+01	< 1.20E+01	< 1.20E+01
	194	< 3.91E+00	< 3.86E+00	< 3.80E+00	< 4.00E+00	< 4.00E+00
	195	< 3.91E+00	< 3.86E+00	< 3.80E+00	< 4.00E+00	< 4.00E+00
	196	< 5.86E+00	< 5.79E+00	< 5.70E+00	< 6.00E+00	< 6.00E+00
	197	< 1.46E+02	< 1.45E+02	< 1.43E+02	< 1.50E+02	< 1.50E+02
	198	< 7.81E+00	< 7.72E+00	< 7.60E+00	< 8.00E+00	< 8.00E+00
	203	< 3.91E+00	< 3.86E+00	< 3.80E+00	< 4.00E+00	< 4.00E+00
	204	< 3.91E+00	< 3.86E+00	< 3.80E+00	< 4.00E+00	< 4.00E+00
	205	< 5.86E+00	< 5.79E+00	< 5.70E+00	< 6.00E+00	< 6.00E+00
	206	3.46E+01	3.76E+01	3.83E+01	3.25E+01	< 8.00E+00
	207	2.90E+01	3.16E+01	3.54E+01	2.85E+01	< 6.00E+00
	208	6.51E+01	7.00E+01	7.51E+01	6.36E+01	< 6.00E+00
	230	< 3.91E+00	< 3.86E+00	< 3.80E+00	< 4.00E+00	< 4.00E+00
	232	4.62E+03	5.32E+03	4.93E+03	4.59E+03	< 4.00E+00
	233	< 3.91E+00	< 3.86E+00	< 3.80E+00	< 4.00E+00	< 4.00E+00
	234	< 3.91E+00	< 3.86E+00	< 3.80E+00	< 4.00E+00	< 4.00E+00

Table A-5 cont. As-Measured Concentrations of m/z (µg/g) via ICP-MS (AR)

Sample ID		SB7b PS				Blank
Lab ID		300305024	300305025	300305026	300305027	300305023
Replicate		1	2	3	4	1
m/z	235	1.15E+02	1.30E+02	1.21E+02	1.19E+02	< 4.00E+00
	236	5.16E+00	6.61E+00	5.23E+00	6.22E+00	< 4.00E+00
	237	1.53E+01	1.29E+01	1.87E+01	1.47E+01	< 4.00E+00
	238	2.16E+04	2.33E+04	2.18E+04	2.11E+04	< 4.00E+00
	239	8.25E+01	9.00E+01	8.79E+01	8.14E+01	< 4.00E+00
	240	7.32E+00	7.04E+00	9.01E+00	8.46E+00	< 4.00E+00
	241	6.43E+00	5.13E+00	4.95E+00	6.05E+00	< 4.00E+00
	242	< 3.91E+00	< 3.86E+00	< 3.80E+00	< 4.00E+00	< 4.00E+00
	243	< 3.91E+00	< 3.86E+00	< 3.80E+00	< 4.00E+00	< 4.00E+00
	244	< 3.91E+00	< 3.86E+00	< 3.80E+00	< 4.00E+00	< 4.00E+00

Table A-6. As-Received Measurements of the PCT Solutions (mg/L)

Sample ID	Blank		Standard		ARM		EA			SB7b PS			
Lab ID	300305649	300305650	300305661	300305654	300305655	300305656	300305651	300305652	300305653	300305657	300305658	300305659	300305660
Replicate	1	2	1	1	2	3	1	2	3	1	2	3	4
Ag	< 0.0675	< 0.0675	< 0.0675	< 0.0675	< 0.0675	< 0.0675	< 0.0675	< 0.0675	< 0.0675	< 0.0675	< 0.0675	< 0.0675	< 0.0675
Al	< 0.172	< 0.172	4.13	3.08	2.8	2.96	< 0.172	< 0.172	< 0.172	11.4	11.2	11.3	11.1
B	< 0.267	< 0.267	20.1	9.01	8.64	8.7	34.3	33.8	34.3	6.58	6.5	6.3	6.47
Ba	< 0.0265	< 0.0265	< 0.0265	< 0.0265	< 0.0265	< 0.0265	< 0.0265	< 0.0265	< 0.0265	< 0.0265	< 0.0265	< 0.0265	< 0.0265
Be	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Ca	0.147	0.106	0.056	0.126	0.136	0.135	0.0565	0.0495	0.051	0.18	0.191	0.166	0.162
Cd	< 0.061	< 0.061	< 0.061	< 0.061	< 0.061	< 0.061	< 0.061	< 0.061	< 0.061	< 0.061	< 0.061	< 0.061	< 0.061
Ce	< 0.502	< 0.502	< 0.502	< 0.502	< 0.502	< 0.502	< 0.502	< 0.502	< 0.502	< 0.502	< 0.502	< 0.502	< 0.502
Co	< 0.106	< 0.106	< 0.106	< 0.106	< 0.106	< 0.106	< 0.106	< 0.106	< 0.106	< 0.106	< 0.106	< 0.106	< 0.106
Cr	< 0.0675	< 0.0675	< 0.0675	< 0.0675	< 0.0675	< 0.0675	< 0.0675	< 0.0675	< 0.0675	0.0865	0.0685	0.0685	0.0735
Cu	< 0.045	< 0.045	< 0.045	< 0.045	< 0.045	< 0.045	< 0.045	< 0.045	< 0.045	< 0.045	< 0.045	< 0.045	< 0.045
Fe	< 0.113	< 0.113	4.23	< 0.113	< 0.113	< 0.113	< 0.113	< 0.113	< 0.113	4.03	3.83	3.64	3.65
Gd	< 0.096	< 0.096	< 0.096	< 0.096	< 0.096	< 0.096	< 0.096	< 0.096	< 0.096	< 0.096	< 0.096	< 0.096	< 0.096
K	< 2.6	< 2.6	9.44	< 2.6	< 2.6	< 2.6	< 2.6	< 2.6	< 2.6	< 2.6	< 2.6	< 2.6	< 2.6
La	< 0.039	< 0.039	< 0.039	< 0.039	< 0.039	< 0.039	< 0.039	< 0.039	< 0.039	< 0.039	< 0.039	< 0.039	< 0.039
Li	< 0.0475	< 0.0475	10.1	7.02	6.91	6.94	11	10.8	10.9	11.2	11	10.9	11
Mg	0.0268	0.0273	< 0.005	0.0155	0.0138	0.0138	< 0.005	< 0.005	< 0.005	0.084	0.0833	0.076	0.0773

Table A-6 cont. As-Received Measurements of the PCT Solutions (mg/L)

Sample ID	Blank		Standard	ARM			EA			SB7b PS			
Lab ID	300305649	300305650	300305661	300305654	300305655	300305656	300305651	300305652	300305653	300305657	300305658	300305659	300305660
Replicate	1	2	1	1	2	3	1	2	3	1	2	3	4
Mn	< 0.012	< 0.012	0.0238	< 0.012	< 0.012	< 0.012	< 0.012	< 0.012	< 0.012	0.686	0.651	0.611	0.612
Mo	< 0.415	< 0.415	< 0.415	2.87	2.85	2.8	< 0.415	< 0.415	< 0.415	< 0.415	< 0.415	< 0.415	< 0.415
Na	1.16	1.27	85	20.9	20.4	20.6	97.2	95.8	97.1	62.4	61.2	60.5	60.9
Ni	< 0.135	< 0.135	< 0.135	< 0.135	< 0.135	< 0.135	< 0.135	< 0.135	< 0.135	0.481	0.457	0.417	0.412
P	< 0.911	< 0.911	< 0.911	< 0.911	< 0.911	< 0.911	< 0.911	< 0.911	< 0.911	< 0.911	< 0.911	< 0.911	< 0.911
Pb	< 0.49	< 0.49	< 0.49	< 0.49	< 0.49	< 0.49	< 0.49	< 0.49	< 0.49	< 0.49	< 0.49	< 0.49	< 0.49
S	< 40	< 40	< 40	< 40	< 40	< 40	< 40	< 40	< 40	< 40	< 40	< 40	< 40
Sb	< 1.45	< 1.45	< 1.45	< 1.45	< 1.45	< 1.45	< 1.45	< 1.45	< 1.45	< 1.45	< 1.45	< 1.45	< 1.45
Si	< 0.967	< 0.967	50.7	32.9	32.4	32.9	53.4	53	53.3	72.2	71.4	70.4	71.6
Sn	< 0.581	< 0.581	< 0.581	< 0.581	< 0.581	< 0.581	< 0.581	< 0.581	< 0.581	< 0.581	< 0.581	< 0.581	< 0.581
Sr	< 0.005	< 0.005	< 0.005	0.00725	0.00875	0.00875	< 0.005	< 0.005	< 0.005	0.0055	0.00525	< 0.005	< 0.005
Th	< 0.283	< 0.283	< 0.283	< 0.283	< 0.283	< 0.283	< 0.283	< 0.283	< 0.283	0.721	0.672	0.557	0.618
Ti	< 0.0345	< 0.0345	< 0.0345	< 0.0345	< 0.0345	< 0.0345	< 0.0345	< 0.0345	< 0.0345	0.0895	0.0908	0.08	0.0813
U	< 4.87	< 4.87	< 4.87	< 4.87	< 4.87	< 4.87	< 4.87	< 4.87	< 4.87	5.22	5.38	< 4.87	5.28
V	< 0.0355	< 0.0355	< 0.0355	< 0.0355	< 0.0355	< 0.0355	< 0.0355	< 0.0355	< 0.0355	< 0.0355	< 0.0355	< 0.0355	< 0.0355
Zn	< 0.04	< 0.04	< 0.04	0.101	0.111	0.104	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04
Zr	< 0.044	< 0.044	< 0.044	< 0.044	< 0.044	< 0.044	< 0.044	< 0.044	< 0.044	0.079	0.0575	0.083	0.0633

Table A-7. As-Measured Concentrations (µg/L) for the PCT Solutions via ICP-MS

Sample ID	Blank	SB7b PS			
Lab ID	300305649	300305657	300305658	300305659	300305660
Replicate	1	1	2	3	4
51	< 4.00E+01	< 4.00E+01	< 4.00E+01	< 4.00E+01	< 4.00E+01
59	< 3.50E+01	< 3.50E+01	< 3.50E+01	< 3.50E+01	< 3.50E+01
69	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
71	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
82	< 8.40E+02	< 8.40E+02	< 8.40E+02	< 8.40E+02	< 8.40E+02
84	< 3.40E+02	< 3.40E+02	< 3.40E+02	< 3.40E+02	< 3.40E+02
85	< 3.50E+01	< 3.50E+01	< 3.50E+01	< 3.50E+01	< 3.50E+01
86	< 9.00E+01	< 9.00E+01	< 9.00E+01	< 9.00E+01	< 9.00E+01
87	< 1.50E+01	< 1.50E+01	< 1.50E+01	< 1.50E+01	< 1.50E+01
88	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
89	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
90	< 4.00E+01	< 4.00E+01	< 4.00E+01	< 4.00E+01	< 4.00E+01
91	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
92	< 1.50E+01	< 1.50E+01	< 1.50E+01	< 1.50E+01	< 1.50E+01
93	< 2.50E+01	< 2.50E+01	< 2.50E+01	< 2.50E+01	< 2.50E+01
94	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
95	< 1.50E+01	< 1.50E+01	< 1.50E+01	< 1.50E+01	< 1.50E+01
96	< 1.50E+01	< 1.50E+01	< 1.50E+01	< 1.50E+01	< 1.50E+01
97	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
98	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
m/z 99	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
100	< 1.50E+01	< 1.50E+01	< 1.50E+01	< 1.50E+01	< 1.50E+01
101	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
102	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
103	< 1.50E+01	< 1.50E+01	< 1.50E+01	< 1.50E+01	< 1.50E+01
104	< 1.50E+01	< 1.50E+01	< 1.50E+01	< 1.50E+01	< 1.50E+01
105	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
106	< 1.50E+01	< 1.50E+01	< 1.50E+01	< 1.50E+01	< 1.50E+01
107	< 2.50E+01	< 2.50E+01	< 2.50E+01	< 2.50E+01	< 2.50E+01
108	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
109	< 3.00E+01	< 3.00E+01	< 3.00E+01	< 3.00E+01	< 3.00E+01
110	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
111	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
112	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
113	< 3.95E+02	< 3.95E+02	< 3.95E+02	< 3.95E+02	< 3.95E+02
114	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
116	< 1.50E+01	< 1.50E+01	< 1.50E+01	< 1.50E+01	< 1.50E+01
117	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
118	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
119	< 1.50E+01	2.24E+01	1.93E+01	1.84E+01	1.86E+01
120	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01

Table A-7 cont. As-Measured Concentrations (µg/L) for the PCT Solutions via ICP-MS

Sample ID	Blank	SB7b PS			
Lab ID	300305649	300305657	300305658	300305659	300305660
Replicate	1	1	2	3	4
121	< 2.00E+01	< 2.00E+01	< 2.00E+01	< 2.00E+01	< 2.00E+01
122	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
123	< 2.50E+01	< 2.50E+01	< 2.50E+01	< 2.50E+01	< 2.50E+01
124	< 3.50E+01	< 3.50E+01	< 3.50E+01	< 3.50E+01	< 3.50E+01
125	< 1.50E+01	< 1.50E+01	< 1.50E+01	< 1.50E+01	< 1.50E+01
126	< 3.50E+01	< 3.50E+01	< 3.50E+01	< 3.50E+01	< 3.50E+01
128	< 3.40E+02	< 3.40E+02	< 3.40E+02	< 3.40E+02	< 3.40E+02
130	< 1.00E+02	< 1.00E+02	< 1.00E+02	< 1.00E+02	< 1.00E+02
133	< 3.50E+01	< 3.50E+01	< 3.50E+01	< 3.50E+01	< 3.50E+01
134	< 6.00E+01	< 6.00E+01	< 6.00E+01	< 6.00E+01	< 6.00E+01
135	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
136	< 1.15E+02	< 1.15E+02	< 1.15E+02	< 1.15E+02	< 1.15E+02
137	< 1.50E+01	< 1.50E+01	< 1.50E+01	< 1.50E+01	< 1.50E+01
138	< 3.00E+01	< 3.00E+01	< 3.00E+01	< 3.00E+01	< 3.00E+01
139	< 1.00E+01	1.53E+01	1.40E+01	1.55E+01	1.77E+01
140	< 1.00E+01	2.31E+01	2.54E+01	2.56E+01	1.60E+01
141	< 2.00E+01	< 2.00E+01	< 2.00E+01	< 2.00E+01	< 2.00E+01
142	< 1.00E+01	1.80E+01	2.32E+01	1.85E+01	2.19E+01
143	< 2.50E+01	< 2.50E+01	< 2.50E+01	< 2.50E+01	< 2.50E+01
144	< 2.00E+01	< 2.00E+01	< 2.00E+01	< 2.00E+01	< 2.00E+01
m/z 145	< 2.00E+01	< 2.00E+01	< 2.00E+01	< 2.00E+01	< 2.00E+01
146	< 2.00E+01	< 2.00E+01	< 2.00E+01	< 2.00E+01	< 2.00E+01
147	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
148	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
149	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
150	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
151	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
152	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
153	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
154	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
155	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
156	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
157	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
158	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
159	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
160	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
161	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
162	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
163	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
164	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
165	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01

Table A-7 cont. As-Measured Concentrations (µg/L) for the PCT Solutions via ICP-MS

Sample ID		Blank	SB7b PS			
Lab ID		300305649	300305657	300305658	300305659	300305660
Replicate		1	1	2	3	4
m/z	166	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
	167	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
	168	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
	169	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
	170	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
	171	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
	172	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
	173	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
	174	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
	175	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
	176	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
	177	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
	178	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
	179	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
	180	< 1.50E+01	< 1.50E+01	< 1.50E+01	< 1.50E+01	< 1.50E+01
	181	< 2.50E+01	< 2.50E+01	< 2.50E+01	< 2.50E+01	< 2.50E+01
	182	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
	183	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
	184	< 2.00E+01	< 2.00E+01	< 2.00E+01	< 2.00E+01	< 2.00E+01
	185	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
	186	< 2.00E+01	< 2.00E+01	< 2.00E+01	< 2.00E+01	< 2.00E+01
	187	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
	191	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
	193	< 2.50E+01	< 2.50E+01	< 2.50E+01	< 2.50E+01	< 2.50E+01
	194	< 2.50E+01	< 2.50E+01	< 2.50E+01	< 2.50E+01	< 2.50E+01
	195	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
	196	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
	198	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
	203	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
	204	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
	205	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
	206	< 2.50E+01	< 2.50E+01	< 2.50E+01	< 2.50E+01	< 2.50E+01
	207	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
	208	< 1.50E+01	< 1.50E+01	< 1.50E+01	< 1.50E+01	< 1.50E+01
	230	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
	232	< 1.00E+01	5.73E+02	5.96E+02	5.48E+02	5.49E+02
	233	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
	234	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
	235	< 1.00E+01	3.05E+01	3.40E+01	3.14E+01	3.16E+01
	236	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
	237	< 2.00E+01	< 2.00E+01	< 2.00E+01	< 2.00E+01	< 2.00E+01

Table A-7 cont. As-Measured Concentrations (µg/L) for the PCT Solutions via ICP-MS

Sample ID		Blank	SB7b PS			
Lab ID		300305649	300305657	300305658	300305659	300305660
Replicate		1	1	2	3	4
m/z	238	< 1.00E+01	4.62E+03	4.74E+03	4.46E+03	4.67E+03
	239	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
	240	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
	241	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
	242	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
	243	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01
	244	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01	< 1.00E+01

Table A-8. As-Measured Radionuclide Concentrations (dpm/mL) for the PCT Solutions via Gamma and Beta Counting

Sample ID	SB7b PS			
Lab ID	300305657	300305658	300305659	300305660
Replicate	1	2	3	4
Co-60	6.32E+01	4.54E+01	5.20E+01	5.10E+01
Cs-137	3.41E+05	3.30E+05	3.58E+05	3.16E+05
Eu-154	7.75E+02	7.27E+02	6.66E+02	5.79E+02
Am-241	2.73E+03	2.52E+03	2.74E+03	2.35E+03
Sr-90	3.38E+05	3.56E+05	3.02E+05	NA

Sr-90 results for 300305660 are not available due to a sample preparation error.

Table A-9. Density Measurement Data

Parameter	NIST 1830			SB7b PS		
m0 (g)	30.491	30.493	30.49	30.488	30.486	30.488
m1 (g)	41.15	41.148	41.148	46.377	46.368	46.367
m2 (g)	64.788	64.818	64.806	68.433	68.441	68.456
m3(g)	58.386	58.46	58.39	58.432	58.431	58.457
Density (g/cm^3)	2.50	2.48	2.51	2.70	2.70	2.70
%RSD		0.7			0.1	

Table A-10. SB7b Pour Stream Glass REDOX Data

Sample ID	Trial	Fe^{2+}	$\sum Fe$	Fe^{3+}	$Fe^{2+}/\sum Fe$	Fe^{2+}/Fe^{3+}
EA	---	0.0938	0.5482	0.4544	0.17	0.21
SB7b PS	1	0.0407	0.5761	0.5354	0.07	0.08
	2	0.0358	0.503	0.4672	0.07	0.08