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# **Characterization of Tank 9H Salt Dissolution Batch 2A in Support of Tank Closure Cesium Removal (TCCR) 1A Batch 2 Preparations**

**K. M. L. Taylor-Pashow**

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## EXECUTIVE SUMMARY

Savannah River Remediation (SRR) is currently preparing the second batch of material to be processed through the Tank Closure Cesium Removal (TCCR) 1A system. The feed for TCCR 1A consists of dissolved saltcake from Tank 9H. The first batch of salt to make up Batch 2 (Batch 2A) has been dissolved in Tank 9H and will later be transferred to Tank 10H. Savannah River National Laboratory (SRNL) received samples from the batch of dissolved salt for characterization.

Two samples were received for characterization, a surface sample and a variable depth sample (VDS). The surface sample appeared clear, while the VDS sample contained a small amount of solids. Therefore, analyses were performed on both a sample of the filtrate as well as a sample of the digested slurry from the VDS. The sodium concentrations of both the surface and VDS filtrate samples were approximately 6.9 M, and the  $^{137}\text{Cs}$  activity was on the order of  $2.4\text{E}+08$  dpm/mL. The total Cs concentrations were 6.7 mg/L and 7.0 mg/L in the surface sample and VDS filtrate, respectively. The alpha activity was below the detection limit in all samples, with the exception of one replicate from the digested VDS slurry where the alpha activity was measured to be  $1.44\text{E}+05$  dpm/mL. The beta activity in the digested VDS slurry after Cs removal showed an increase of about 6.6X compared to the filtrate sample indicating the presence of other beta emitters (non-Cs) in the solids present in the original slurry.

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## LIST OF ABBREVIATIONS

DI	deionized
ELN	Electronic Laboratory Notebook
IC	ion chromatography
ICP-ES	inductively coupled plasma – emission spectroscopy
ICP-MS	inductively coupled plasma – mass spectrometry
LSC	liquid scintillation counting
M&TE	Measurement and Test Equipment
PMP	polymethylpentene
RSD	relative standard deviation
SRNL	Savannah River National Laboratory
SRR	Savannah River Remediation
TCCR 1A	Tank Closure Cesium Removal 1a
TIC/TOC	total inorganic carbon/total organic carbon
TTQAP	Task Technical and Quality Assurance Plan
TTR	Technical Task Request
VDS	variable depth sample

## 1.0 Introduction

In support of the Tank Closure Cesium Removal 1A (TCCR 1A) program, SRNL analyzed two samples from Tank 9H representing the first batch of material to be transferred from Tank 9H to Tank 10H in preparation of TCCR 1A Batch 2. The small batches of material being transferred from Tank 9H to Tank 10H in preparation of the next TCCR 1A batch are being referred to as Batches 2A, 2B, etc. Tank 10H serves as the feed tank for the TCCR 1A system. After transfer of Batch 1 material from Tank 9H to Tank 10H, additional salt was dissolved in Tank 9H to begin preparations for Batch 2. Beginning on November 8, 2021, 30,089 gallons of domestic water was continuously added to Tank 9H, finishing on November 9, 2021. The contents of the tank were then recirculated for approximately 7 days prior to collecting two samples from the tank on November 17, 2021. A surface (HTF-09-21-114) and a variable depth (HTF-09-21-115) sample were collected from the tank and delivered to SRNL the same day for characterization.

## 2.0 Experimental Procedure

### 2.1 Tank 9H Batch 2A Samples (HTF-09-21-114 and HTF-09-21-115)

Two 200-mL dip samples were received from Tank 9H on November 17, 2021, one surface (198" from the bottom of the tank) and one variable depth sample (VDS, 180" from the bottom of the tank). The samples were then placed into the Shielded Cells, opened, and transferred to clear polymethylpentene (PMP) beakers for observation after shaking by hand (manipulator) to mix. The surface sample (HTF-09-21-114) was colorless and did not contain visible solids, while the VDS (HTF-09-21-115) contained some visible solids and appeared grayish in color. Photographs of the samples are provided in Figure 3-1. The samples were not combined and were analyzed individually. A portion of the variable depth sample (HTF-09-21-115) was filtered to give a filtrate sample that was used for analysis. Both the surface sample and variable depth filtrate sample were characterized using the following methods: gamma spectroscopy (with and without Cs removal), liquid scintillation counting (LSC, with and without Cs removal), ion chromatography (IC) for anions, free hydroxide, total inorganic and total organic carbon (TIC/TOC), inductively couple plasma – emission spectroscopy (ICP-ES), and inductively coupled plasma – mass spectrometry (ICP-MS). The samples were diluted by a factor of approximately 3 with either distilled deionized (DI) water or 3 M nitric acid prior to submission for analysis. Samples of the HTF-09-21-115 slurry were digested with aqua regia and then diluted with DI water prior to analysis by ICP-ES, gamma spectroscopy, and LSC. The densities of the samples were measured using a Measuring & Test Equipment (M&TE) balance in duplicate using 2-mL density tubes. Samples used for density measurements were returned to the sample bottle.

### 2.2 Quality Assurance

Requirements for performing reviews of technical reports and the extent of review are established in manual E7 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.<sup>1</sup> This work was performed following the applicable Task Technical and Quality Assurance Plan (TTQAP).<sup>2</sup> The Task Technical Request (TTR) associated with this work<sup>3</sup> requested a functional classification of Safety Class (see section 9.5 of the TTQAP entitled "Clarification of Safety Significant Functional Classification"). To match the requested functional classification, this report and calculations within received a technical review by design verification.<sup>4</sup> Date are recorded in the Electronic Laboratory Notebook (ELN) system.<sup>5</sup>

### 3.0 Results and Discussion

#### 3.1 Tank 9H Batch 2A Samples

Photographs of the Tank 9H Batch 2A samples are provided in Figure 3-1. The surface sample (HTF-09-21-114) appeared clear and colorless, with no evidence of significant solids, while the variable depth sample (HTF-09-21-115) contained some solids and appeared slightly gray in color.



**Figure 3-1. Photographs of Tank 9H Batch 2A samples HTF-09-21-114 (left) and HTF-09-21-115 (right).**

The densities of the Tank 9H Batch 2A samples are reported in Table 3-1. The densities of all three samples were similar (within analytical uncertainty).

**Table 3-1. Density Measurements of Tank 9H Batch 2A Samples**

Sample	Sample Location	Sample Type	Avg. Density (g/mL)	% RSD <sup>a</sup>
HTF-09-21-114	surface	as received	1.339 <sup>b</sup>	0.21
HTF-09-21-115	variable depth	filtrate	1.352 <sup>c</sup>	1.46
HTF-09-21-115	variable depth	as received (slurry)	1.342 <sup>b</sup>	1.44

<sup>a</sup>Percent relative standard deviation from duplicate measurements. <sup>b</sup>Temperature during density measurements was 21 °C. <sup>c</sup>Temperature during density measurement was 18 °C.

The ICP-ES results of the Tank 9H Batch 2A samples are shown in Table 3-2. Both the surface and the VDS filtrate samples contained detectable amounts of Al, Cr, Mo, Na, P, and S. The surface and the VDS samples had similar sodium concentrations (~6.9 M), consistent with the similar densities, indicating a well-mixed solution in the waste tank. The digested VDS sample contained detectable amounts of Ba, Ca, Fe, K, Mg, Mn, Ni, Si, and Zn in addition to the elements found in the filtrate. The duplicate digestion results gave very different concentrations for some elements (as indicated by the high %RSD values in Table 3-2) indicating heterogeneity in the solids collected in the replicate slurry samples removed for digestion. The first replicate had higher concentrations of Cr (~2.4X), Fe (~11X), Mn (at least ~12X), Ni (at least ~41X), and Zn (~5.8X); while the second replicate contained a higher amount of Ca (~9X).

**Table 3-2. ICP-ES Results for the Tank 9H Batch 2A Samples**

Element	HTF-09-21-114 Original (mg/L)	%RSD <sup>a</sup>	HTF-09-21-115 Filtrate (mg/L)	%RSD <sup>a</sup>	HTF-09-21-115 Slurry (mg/L)	%RSD <sup>a</sup>
Ag	< 0.244	n/a	< 0.251	n/a	< 0.428	n/a
Al	3370	0.393%	3300	0.0421%	5173	0.183%
B	< 1.60	n/a	< 1.65	n/a	< 1.66	n/a
Ba	< 0.448	n/a	< 0.461	n/a	1.78	9.07%
Be	< 0.153	n/a	< 0.158	n/a	< 0.174	n/a
Ca	< 4.24	n/a	< 4.37	n/a	57.3	113%
Cd	< 0.344	n/a	< 0.354	n/a	< 0.393	n/a
Ce	< 6.23	n/a	< 6.42	n/a	< 4.50	n/a
Co	< 0.804	n/a	< 0.828	n/a	< 2.13	n/a
Cr	20.9	0.715%	20.9	0.559%	37.2	59.4%
Cu	< 1.04	n/a	< 1.07	n/a	< 1.64	n/a
Fe	< 0.460	n/a	< 0.474	n/a	162	118%
Gd	< 0.661	n/a	< 0.681	n/a	< 0.756	n/a
K	< 323	n/a	< 333	n/a	219	13.4%
La	< 0.406	n/a	< 0.419	n/a	< 0.464	n/a
Li	< 5.49	n/a	< 5.65	n/a	< 6.26	n/a
Mg	< 0.712	n/a	< 0.733	n/a	5.29	60.8%
Mn	< 0.430	n/a	< 0.443	n/a	5.89 <sup>b</sup>	n/a
Mo	11.6	0.655%	12.1	0.756%	12.3	3.16%
Na	158000	0.576%	159000	0.0421%	152000	1.87%
Ni	< 0.771	n/a	< 0.794	n/a	36.6 <sup>c</sup>	n/a
P	77.4	0.0675%	81.1	0.841%	77.4	0.613%
Pb	< 8.27	n/a	< 8.52	n/a	< 6.33	n/a
S	437	0.422%	446	1.01%	431	0.660%
Sb	< 3.74	n/a	< 3.85	n/a	< 3.36	n/a
Si	< 3.97	n/a	< 4.09	n/a	27.1	7.70%
Sn	< 18.5	n/a	< 19.0	n/a	< 21.1	n/a
Sr	< 0.344	n/a	< 0.354	n/a	< 0.507	n/a
Th	< 9.19	n/a	< 9.47	n/a	< 3.37	n/a
Ti	< 3.68	n/a	< 3.79	n/a	< 2.40	n/a
U	< 7.65	n/a	< 7.88	n/a	< 8.73	n/a
V	< 3.71	n/a	< 3.82	n/a	< 3.31	n/a
Zn	< 0.549	n/a	< 0.565	n/a	5.64	100%
Zr	< 0.492	n/a	< 0.507	n/a	< 1.37	n/a

<sup>a</sup>Percent relative standard deviation from duplicate samples. The reported analytical method uncertainty is 10% (at two sigma).

<sup>b</sup>Single replicate above the method detection limit. The duplicate sample was < 0.490 mg/L. <sup>c</sup>Single replicate above the method detection limit. The duplicate sample was < 0.880 mg/L.

Table 3-3 provides the anion and carbon results for the Tank 9H Batch 2A samples (surface and VDS filtrate). Excellent agreement between the anion and cation sums was obtained for both samples with a difference of only 2%. In the case of the surface sample anions were slightly higher and, in the depth sample the anions were slightly lower.

**Table 3-3. Anion and Carbon Results for the Tank 9H Batch 2A Sample**

Analyte	HTF-09-21-114	%RSD <sup>a</sup>	HTF-09-21-115 Filtrate	%RSD <sup>a</sup>
Free OH <sup>-</sup> (M)	0.223	0.592%	0.223	4.26%
NO <sub>3</sub> <sup>-</sup> (M)	5.54	1.35%	5.21	1.11%
SO <sub>4</sub> <sup>2-</sup> (M)	8.63E-03	1.29%	9.58E-03	0.250%
NO <sub>2</sub> <sup>-</sup> (M)	0.357	0.288%	0.375	0.0754%
C <sub>2</sub> O <sub>4</sub> <sup>2-</sup> (M)	3.51E-03	0.623%	4.10E-03	0.449%
F <sup>-</sup> (M)	< 1.56E-02	n/a	< 1.60E-02	n/a
Cl <sup>-</sup> (M)	< 8.38E-03	n/a	< 8.56E-03	n/a
HCO <sub>2</sub> <sup>-</sup>	< 6.60E-03	n/a	< 6.74E-03	n/a
CO <sub>3</sub> <sup>2-</sup> (M)	0.376	0.579%	0.401	0.879%
Al(OH) <sub>4</sub> <sup>-</sup> (M) <sup>b</sup>	0.125	0.393%	0.122	0.0421%
TOC <sup>c</sup> (mg/L)	143	3.90%	184	1.94%

<sup>a</sup>Percent relative standard deviation from duplicate samples. The reported analytical method uncertainties were 10% (one sigma for the IC anion results and two sigma for the free hydroxide and TIC/TOC results). <sup>b</sup>Based on Al concentration measured by ICP-ES (see Table 3-2). <sup>c</sup>Total organic carbon.

Gamma spectroscopy and liquid scintillation counting (LSC), with and without Cs removal, were performed on the surface and VDS filtrate samples as well as a sample of the digested VDS slurry. The results from these analyses are summarized in Table 3-4. The alpha activity (with and without Cs removal) was below the detection limit in all samples, with the exception of one replicate from the HTF-09-21-115 digested slurry. The <sup>137</sup>Cs and total beta activities (including Cs) were similar across all three samples. The beta activity in the HTF-09-21-115 slurry after Cs removal showed an increase of about 6.6X compared to the filtrate sample indicating the presence of other beta emitters (non-Cs) in the solids present in the original slurry.

**Table 3-4. Alpha, Beta, and Gamma Activity in Tank 10H Qual Samples<sup>a</sup>**

	<sup>137</sup> Cs (dpm/mL)	Alpha Activity (dpm/mL)	Beta Activity (dpm/mL)	Cs Removed	
				Alpha Activity (dpm/mL)	Beta Activity (dpm/mL)
<b>HTF-09-21-114</b>	2.35E+08 (0.0527% RSD)	< 5.58E+04	2.90E+08 (0.484% RSD)	< 1.90E+04	4.01E+05 (6.66% RSD)
<b>HTF-09-21-115 Filtrate</b>	2.43E+08 (1.61% RSD)	< 5.67E+04	3.07E+08 (0.734% RSD)	< 1.51E+04	2.99E+05 (4.39% RSD)
<b>HTF-09-21-115 Slurry</b>	2.40E+08 (4.36% RSD)	< 2.88E+07	2.92E+08 (2.28% RSD)	1.44E+05 <sup>b</sup>	1.97E+06 (48.6% RSD)

<sup>a</sup>The %RSD is the relative standard deviation of duplicate measurements. The reported method uncertainties are 5% for gamma and 10-12% for beta at 1 sigma. <sup>b</sup>Single replicate above the detection limit with a reported method uncertainty of 21.1% at 1 sigma. The replicate sample was < 1.48E+05 dpm/mL.

Gamma spectroscopy was also performed on the surface and VDS filtrate samples after Cs removal to obtain activities of other radionuclides present in lower concentrations than the Cs. Results from these analyses are summarized in Table 3-5. The majority of the isotopes were below the method detection limit with the exception of <sup>126</sup>Sb, <sup>126</sup>Sn, and <sup>241</sup>Am. The <sup>126</sup>Sb and <sup>126</sup>Sn activities were similar in the surface and variable depth samples; while the <sup>241</sup>Am activity was about 3 times higher in the surface sample compared to the VDS filtrate.

**Table 3-5. Activities of Other Radionuclides in Tank 9H Batch 2A Samples**

Radionuclide	HTF-09-21-114 (dpm/mL)	%RSD <sup>a</sup>	Avg. Method Unc.	HTF-09-21-115 Filtrate (dpm/mL)	%RSD <sup>a</sup>	Avg. Method Unc.
<sup>60</sup> Co	< 1.78E+01	n/a	MDA <sup>b</sup>	< 1.64E+01	n/a	MDA
<sup>106</sup> Ru	< 1.73E+02	n/a	MDA	< 1.32E+02	n/a	MDA
<sup>125</sup> Sb	< 1.21E+02	n/a	MDA	< 8.93E+01	n/a	MDA
<sup>126</sup> Sb	3.04E+02	7.10%	5.38%	2.87E+02	2.36%	5.00%
<sup>126</sup> Sn	3.04E+02	7.10%	5.38%	2.87E+02	2.36%	5.00%
<sup>144</sup> Ce	< 1.90E+02	n/a	MDA	< 1.48E+02	n/a	MDA
<sup>154</sup> Eu	< 5.12E+01	n/a	MDA	< 3.96E+01	n/a	MDA
<sup>241</sup> Am	1.71E+02	1.78%	5.37%	4.97E+01	16.2%	12.2%

<sup>a</sup>The %RSD is based on the standard deviation of duplicate samples. <sup>b</sup>MDA = minimum detectable activity.

The isotopic distribution of Cs based on the mass spectrometry results is provided in Table 3-6. The total Cs calculated using the isotopic ratios from the ICP-MS data and the <sup>137</sup>Cs amount from the gamma data is 6.65 mg/L for the surface sample and 6.99 mg/L for the VDS filtrate. These values are approximately 6% and 5% lower, respectively, than the sum of the Cs isotope masses reported by ICP-MS (7.10 mg/L and 7.35 mg/L), within the analytical uncertainty of the methods. The full suite of ICP-MS results are provided in Tables 3-7 and 3-8.

**Table 3-6. Cs Isotopes from ICP-MS for the Tank 9H Batch 2A Samples**

HTF-10-21-114				
Isotope	Mean Concentration (mg/L)	%RSD <sup>a</sup>	Isotopic Distribution, Mass %	Mole Fraction
Cs-133	5.29	0.936	74.6	0.750
Cs-134	< 2.45E-03	n/a	< 0.03	< 3.45E-04
Cs-135	0.505	0.480	7.12	0.0706
Cs-137	1.30	0.902	18.3	0.179
HTF-10-21-115 Filtrate				
Isotope	Mean Concentration (mg/L)	%RSD <sup>a</sup>	Isotopic Distribution, Mass %	Mole Fraction
Cs-133	5.50	0.621	74.9	0.754
Cs-134	< 2.44E-03	n/a	< 0.03	< 3.32E-04
Cs-135	0.523	0.0700	7.11	0.0705
Cs-137	1.32	0.296	18.0	0.176

<sup>a</sup>The %RSD is based on the standard deviation of duplicate samples. The reported method uncertainty is 20% at two sigma.

**Table 3-7. ICP-MS Results for Tank 9H Batch 2A Surface Sample (HTF-09-21-114)**

m/z	Avg. Conc. (µg/L)	% RSD <sup>a</sup>	m/z	Avg. Conc. (µg/L)	% RSD <sup>a</sup>	m/z	Avg. Conc. (µg/L)	% RSD <sup>a</sup>
59	< 5.93E+00	n/a	134	< 2.97E+00	n/a	180	< 2.97E+00	n/a
84	< 2.97E+00	n/a	135	5.06E+02	0.480%	181	< 2.97E+00	n/a
85	6.26E+02	0.629%	136	< 2.97E+00	n/a	182	4.25E+01	0.602%
86	< 2.97E+00	n/a	137	1.30E+03	0.902%	183	2.36E+01	3.01%
87	1.40E+03	0.965%	138	1.51E+01	6.68%	184	5.03E+01	1.37%
88	2.02E+01	0.819%	139	< 2.97E+00	n/a	185	< 2.97E+00	n/a
89	< 2.97E+00	n/a	140	< 2.97E+00	n/a	186	4.72E+01	1.10%
90	4.44E+00	5.72%	141	< 2.97E+00	n/a	187	< 2.97E+00	n/a
91	3.90E+00	1.44%	142	< 2.97E+00	n/a	188	< 8.90E+00	n/a
92	6.28E+01	2.38%	143	< 2.97E+00	n/a	189	< 8.90E+00	n/a
93	4.67E+00	0.608%	144	< 2.97E+00	n/a	191	< 2.97E+00	n/a
94	4.32E+01	0.111%	145	< 2.97E+00	n/a	193	< 2.97E+00	n/a
95	3.58E+03	0.161%	146	< 2.97E+00	n/a	194	< 2.97E+00	n/a
96	7.55E+01	0.728%	147	< 2.97E+00	n/a	195	< 2.97E+00	n/a
97	3.38E+03	0.197%	148	< 2.97E+00	n/a	196	3.89E+00	7.88%
98	3.35E+03	0.995%	149	< 2.97E+00	n/a	198	1.50E+02	1.91%
99	2.21E+03	2.02%	150	< 2.97E+00	n/a	203	< 2.97E+00	n/a
100	3.51E+03	0.340%	151	< 2.97E+00	n/a	204	9.10E+01	2.20%
101	1.99E+02	1.70%	152	< 2.97E+00	n/a	205	< 2.97E+00	n/a
102	1.78E+02	1.34%	153	< 2.97E+00	n/a	206	3.17E+02	1.08%
103	4.29E+02	0.891%	154	< 2.97E+00	n/a	207	2.69E+02	0.120%
104	9.04E+01	1.87%	155	< 2.97E+00	n/a	208	6.58E+02	0.0533%
105	< 2.97E+00	n/a	156	< 2.97E+00	n/a	229	< 2.97E+00	n/a
106	< 2.97E+00	n/a	157	< 2.97E+00	n/a	230	< 2.97E+00	n/a
107	< 2.97E+00	n/a	158	< 2.97E+00	n/a	232	7.98E+00	1.36%
108	< 2.97E+00	n/a	159	< 2.97E+00	n/a	233	< 2.97E+00	n/a
109	< 2.97E+00	n/a	160	< 2.97E+00	n/a	234	< 2.97E+00	n/a
110	< 2.97E+00	n/a	161	< 2.97E+00	n/a	235	8.50E+00	3.53%
111	< 2.97E+00	n/a	162	< 2.97E+00	n/a	236	< 2.97E+00	n/a
112	6.43E+00	1.51%	163	< 2.97E+00	n/a	237	< 2.97E+00	n/a
113	< 2.97E+00	n/a	164	< 2.97E+00	n/a	238	2.50E+02	0.0461%
114	6.32E+00	12.8%	165	< 2.97E+00	n/a	239	< 2.97E+00	n/a
116	8.97E+01	1.40%	166	< 2.97E+00	n/a	240	< 2.97E+00	n/a
117	6.26E+01	2.38%	167	< 2.97E+00	n/a	241	< 2.97E+00	n/a
118	1.80E+02	2.79%	168	< 2.97E+00	n/a	242	< 2.97E+00	n/a
119	6.07E+01	0.561%	169	< 2.97E+00	n/a	243	< 2.97E+00	n/a
120	2.46E+02	0.408%	170	< 2.97E+00	n/a	244	< 2.97E+00	n/a
121	< 2.97E+00	n/a	171	< 2.97E+00	n/a	245	< 2.97E+00	n/a
122	6.55E+01	0.283%	172	< 2.97E+00	n/a	246	< 2.97E+00	n/a
123	< 2.97E+00	n/a	173	< 2.97E+00	n/a	247	< 2.97E+00	n/a
124	9.84E+01	1.31%	174	< 2.97E+00	n/a	248	< 2.97E+00	n/a
125	< 2.97E+00	n/a	175	< 2.97E+00	n/a	249	< 2.97E+00	n/a
126	3.08E+02	2.39%	176	< 2.97E+00	n/a	250	< 2.97E+00	n/a
128	< 2.97E+00	n/a	177	< 2.97E+00	n/a	251	< 2.97E+00	n/a
130	< 2.97E+00	n/a	178	< 2.97E+00	n/a			
133	5.29E+03	0.936%	179	< 2.97E+00	n/a			

<sup>a</sup>The %RSD is based on the standard deviation of duplicate samples. The reported method uncertainty is 20% at two sigma.



**Table 3-8. ICP-MS Results for Tank 9H Batch 2A VDS Filtrate (HTF-09-21-115 Filtrate)**

m/z	Avg. Conc. (µg/L)	% RSD <sup>a</sup>	m/z	Avg. Conc. (µg/L)	% RSD <sup>a</sup>	m/z	Avg. Conc. (µg/L)	% RSD <sup>a</sup>
59	< 6.11E+00	n/a	134	< 3.06E+00	n/a	180	< 3.06E+00	n/a
84	< 3.06E+00	n/a	135	5.24E+02	0.0700%	181	< 3.06E+00	n/a
85	6.55E+02	1.22%	136	< 3.06E+00	n/a	182	4.45E+01	7.05%
86	3.98E+00	12.6%	137	1.33E+03	0.296%	183	2.55E+01	7.85%
87	1.44E+03	0.299%	138	1.82E+01	9.90%	184	5.24E+01	4.85%
88	3.18E+01	1.42%	139	< 3.06E+00	n/a	185	< 3.06E+00	n/a
89	< 3.06E+00	n/a	140	< 3.06E+00	n/a	186	4.90E+01	6.69%
90	< 3.06E+00	n/a	141	< 3.06E+00	n/a	187	< 3.06E+00	n/a
91	< 3.06E+00	n/a	142	< 3.06E+00	n/a	188	< 9.17E+00	n/a
92	6.24E+01	1.59%	143	< 3.06E+00	n/a	189	< 9.17E+00	n/a
93	< 3.06E+00	n/a	144	< 3.06E+00	n/a	191	< 3.06E+00	n/a
94	4.04E+01	4.00%	145	< 3.06E+00	n/a	193	< 3.06E+00	n/a
95	3.66E+03	1.80%	146	< 3.06E+00	n/a	194	< 3.06E+00	n/a
96	7.47E+01	1.11%	147	< 3.06E+00	n/a	195	< 3.06E+00	n/a
97	3.50E+03	0.610%	148	< 3.06E+00	n/a	196	3.73E+00	4.49%
98	3.45E+03	0.308%	149	< 3.06E+00	n/a	198	1.31E+02	1.18%
99	2.29E+03	0.299%	150	< 3.06E+00	n/a	203	< 3.06E+00	n/a
100	3.60E+03	0.922%	151	< 3.06E+00	n/a	204	7.12E+01	1.24%
101	2.01E+02	0.831%	152	< 3.06E+00	n/a	205	< 3.06E+00	n/a
102	1.77E+02	2.37%	153	< 3.06E+00	n/a	206	1.32E+02	0.418%
103	4.35E+02	1.32%	154	< 3.06E+00	n/a	207	1.13E+02	0.731%
104	8.95E+01	0.230%	155	< 3.06E+00	n/a	208	2.74E+02	0.189%
105	< 3.06E+00	n/a	156	< 3.06E+00	n/a	229	< 3.06E+00	n/a
106	< 3.06E+00	n/a	157	< 3.06E+00	n/a	230	< 3.06E+00	n/a
107	< 3.06E+00	n/a	158	< 3.06E+00	n/a	232	4.56E+00 <sup>b</sup>	n/a
108	< 3.06E+00	n/a	159	< 3.06E+00	n/a	233	< 3.06E+00	n/a
109	< 3.06E+00	n/a	160	< 3.06E+00	n/a	234	< 3.06E+00	n/a
110	< 3.06E+00	n/a	161	< 3.06E+00	n/a	235	7.88E+00	2.50%
111	< 3.06E+00	n/a	162	< 3.06E+00	n/a	236	< 3.06E+00	n/a
112	6.85E+00	7.31%	163	< 3.06E+00	n/a	237	< 3.06E+00	n/a
113	< 3.06E+00	n/a	164	< 3.06E+00	n/a	238	2.12E+02	3.48%
114	6.70E+00	2.26%	165	< 3.06E+00	n/a	239	< 3.06E+00	n/a
116	9.12E+01	2.28%	166	< 3.06E+00	n/a	240	< 3.06E+00	n/a
117	6.34E+01	2.49%	167	< 3.06E+00	n/a	241	< 3.06E+00	n/a
118	1.80E+02	0.491%	168	< 3.06E+00	n/a	242	< 3.06E+00	n/a
119	6.06E+01	1.14%	169	< 3.06E+00	n/a	243	< 3.06E+00	n/a
120	2.48E+02	1.22%	170	< 3.06E+00	n/a	244	< 3.06E+00	n/a
121	< 3.06E+00	n/a	171	< 3.06E+00	n/a	245	< 3.06E+00	n/a
122	6.42E+01	0.767%	172	< 3.06E+00	n/a	246	< 3.06E+00	n/a
123	< 3.06E+00	n/a	173	< 3.06E+00	n/a	247	< 3.06E+00	n/a
124	1.01E+02	1.64%	174	< 3.06E+00	n/a	248	< 3.06E+00	n/a
125	< 3.06E+00	n/a	175	< 3.06E+00	n/a	249	< 3.06E+00	n/a
126	3.12E+02	1.24%	176	< 3.06E+00	n/a	250	< 3.06E+00	n/a
128	< 3.06E+00	n/a	177	< 3.06E+00	n/a	251	< 3.06E+00	n/a
130	< 3.06E+00	n/a	178	< 3.06E+00	n/a			
133	5.50E+03	0.621%	179	< 3.06E+00	n/a			

<sup>a</sup>The %RSD is based on the standard deviation of duplicate samples. The reported method uncertainty is 20% at two sigma. <sup>b</sup>Single replicate above the method detection limit. The duplicate sample had a reported concentration of < 3.05E+00 µg/L.

#### 4.0 Conclusions

SRNL received and characterized samples from the first batch of dissolved salt in Tank 9H that will make up Batch 2 for TCCR 1A. The VDS sample received contained a small amount of solids, and therefore analyses were performed on both a sample of the filtrate as well as a sample of the digested slurry from the VDS. The sodium concentrations of both the surface and VDS filtrate samples were approximately 6.9 M, and the  $^{137}\text{Cs}$  activity was on the order of  $2.4\text{E}+08$  dpm/mL. The total Cs concentrations were 6.7 mg/L and 7.0 mg/L in the surface sample and VDS filtrate, respectively. The alpha activity was below the detection limit in all samples, with the exception of one replicate from the digested VDS slurry where the alpha activity was measured to be  $1.44\text{E}+05$  dpm/mL. The beta activity in the digested VDS slurry after Cs removal showed an increase of about 6.6X compared to the filtrate sample indicating the presence of other beta emitters (non-Cs) in the solids present in the original slurry.

## 5.0 References

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<sup>1</sup> “Savannah River National Laboratory Technical Report Design Check Guidelines” WSRC-IM-2002-00011, Rev. 2, August 2004.

<sup>2</sup> L. N. Oji, “Task Technical and Quality Assurance Plan for the Analysis of Tank 9H Salt Solution Supernatant”, SRNL-RP-2019-00463, Rev. 0, July 11, 2019.

<sup>3</sup> T. L. Fellingner, “Analysis of Tank 9H Salt Solution Samples”, X-TTR-H-00088, June 13, 2019.

<sup>4</sup> Savannah River Site Manual E7 “Conduct of Engineering”, Procedure 2.60 Rev. 20 “Technical Reviews”, November 9, 2021.

<sup>5</sup> SRNL Electronic Laboratory Notebook #E7518-00472-06.

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