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Results of Analyses of Tank 23H and 24H Saltstone WAC Samples HTK-521 – HTK-528

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SUMMARY

Results of analyses of samples pulled from tanks 23H and 24H in November of 2002 are presented herein.

The initial samples pulled from the 60-inch level of Tank 23H contained considerable solids. However, a later set of samples pulled from the 60-inch level of Tank 23H indicated that the solids had settled. The initial Tank 23H composite sample was filtered. The filtrate and the solids were analyzed separately. The results of these analyses are documented herein.

INTRODUCTION

Eight samples were pulled from Tanks 23H and 24H in November of 2002 and transferred to the Savannah River Technology Center for analysis to determine whether material from the tanks could be transferred directly to the SPF for processing. The SPF, located in Z Area, is permitted as a wastewater treatment plant per the South Carolina Pollution Control Act, Title 48, Chapter 1. The aqueous waste is received and treated in the SPF to produce saltstone grout that is then transferred to the Saltstone Disposal Facility (SDF) for final disposal. The waste processed by the SPF must conform to requirements of this permit, additional Department of Energy (DOE) requirements and other limits imposed to protect the facility safety analysis. These limits are described in Procedure 4.01 of the Savannah River Site WAC Manual. The procedure also describes analytical checks required to verify compliance with the WAC prior to transferring aqueous waste to the Saltstone Production Facility.¹ Aqueous waste meeting the WAC limits can be safely transferred, stored and treated in the SPF for subsequent disposal as saltstone in the SDF.

Because the schedule for this sample was considered critical, work on this sample was initiated prior to completion of the task technical and quality assurance plan with the approval of SRTC management.² A task technical and quality assurance plan is currently being drafted for this work and will also serve as a guide for analysis of future Saltstone WAC samples.

DISCUSSION**Experimental**

Two samples from each of the tanks at 2 different levels were pulled and composited. Table 1 shows how the samples were composited. Figure 1 shows the composited samples. All of the samples were relatively clear except the samples pulled from Tank 23H at the 60-inch elevation. Each composite sample was divided and submitted to the SRTC Analytical Development Section (ADS) for the required analyses.

Table 1. Sampling Locations for Tanks 23H and 24H Samples

<u>Composite Sample</u>	<u>Tank</u>	<u>Elevation above Tank Bottom</u>	<u>Sample IDs</u>
1	Tank 23	60 inches	HTK-521 HTK-522
2	Tank 23	100 inches	HTK-523 HTK-524
3	Tank 24H	60 inches	HTK-525 HTK-526
4	Tank 24H	100 inches	HTK-527 HTK-528

Figure 1. Tanks 23H and 24H Samples



Left to Right: Tank 23H – 60 inches (HTK-521&522), Tank 23H – 100 inches (HTK-523&524), Tank 24H – 60 inches (HTK-525&526), Tank 24H – 100 inches (HTK-527&528)

Two later samples were pulled from the 60” level of Tank 23H (HTK-529 and 530). The samples were relatively clear indicating the solids had settled (Figure 2). It was decided not to analyze the new samples since the original samples met with favorable results.

Figure 2. Tank 23H – Second Set of Samples from 60”

Supernate was analyzed for all four samples. The sample from the 60-inch level of Tank 23H contained considerable solids. For this sample, both solids and filtrate were analyzed separately. Both values are given below.

Hazardous metals analysis was completed using inductively coupled plasma-emission spectroscopy (ICP-ES) for Ag, Ba, Cd, Cr and Pb and atomic absorption (AA) for As and Se. Though not a part of the WAC, additional metals analyses were performed using ICP-ES and are included herein per request from the customer. Cold vapor atomic absorption (CVAA) was used to detect Hg. Gas chromatography/Mass spectrometry (GC/MS) was used to analyze for volatile and semivolatile organic compounds. Ion pair chromatography (IPC) was used to analyze for ethylenediaminetetraacetic acid (EDTA). No analysis was made for sodium tetrphenylborate (NaTPB) since process knowledge dictates that there is no NaTPB in the Tanks 23H or 24H.

Radiochemical analyses were conducted using several counting methods. Chemical separations were performed prior to counting the samples for some of the species. The results are provided in units of pCi/mL.

Several different sample preparation methods were used, depending on the both the appearance of the sample and the analytical method employed. Sample preparation and analysis methods are given in Table 2.

Table 2. Sample Preparation and Analytical Methods

<u>Tank and Elevation</u>	<u>Sample Preparation</u>	<u>Analytical Methods</u>	<u>LIMS #s</u>
Tank 23H – 60”	None	Volatile Organic Semivolatile Organic Ion-Pair Chromatography	300189149
	None	Free OH Carbonate	300189161
	Filtration - Solids and Acid Dissolution of Solids	ICP-ES, AA, CVAA, ICP-MS, PuTTA	300189175
	Filtration – Filtrate	IC-anions, IC-Cations, ICP-ES, AA, CVAA, ICP-MS	300189177
	Filtration-Filtrate	Pm-147/Sm-151, Pu-238/241. Gamma Scan, Tk50 Rad Screen, C-14, Ni-59/63, Sr-90, Tc-99, I-129, tritium, Specific Gravity	300189178
	Filtration-Solids and Acid Dissolution of Solids	Pm-147/Sm-151, Pu-238/241. Gamma Scan, Tk50 Rad Screen, C-14, Ni-59/63, Sr-90, Tc-99, I-129, tritium	300189209
	None	Suspended Solids, Dissolved Solids, Particle Size	300189179
Tank 23H – 100” Tank 24H - 60” Tank 24H - 100”	None	Volatile Organic Semivolatile Organic Ion-Pair Chromatography	300189149 300189151 300189152
	None	Free OH Carbonate	300189159 300189160 300189158
	None	Soluble Solids	300189168 300189169 300189170
	None	C-14, I-129, tritium, specific gravity	300189171 300189172 300189167
	Acid Dissolution	Ni-59/63, Sr-90. Tc-99. Pm- 147/Sm-151, Pu-238/241, Gamma Scan, Tk 50 Rad Screen, ICP-ES, AA, CVAA, ICP-MS	300189173 300189174 300189165 300189166 300189167
	None	IC-Cations, IC-Anions	300189164 300189162 300189163

Results

Results for the Tank 23H samples are given in Table 3 but only the filtrate values have been included in the average for the tank. Results of the Tank 24H samples are given in Table 4. Results of each of two analyses are given along with an average and standard deviation. In cases where one or both of the results are below the limit of detection, no standard deviation is given. No attempt has been made to compare the results to the WAC limits, since at the time of preparation of this report, the WAC was being revised.

It should be noted that the filtration step could have removed solids that would not have settled by themselves. Therefore the Tank 23H – 60” filtrate analyses may not be completely representative of material that would be transferred to Tank 50H.

Many of the radionuclides requested are not expected to be present in measurable quantities in SRS waste. Some of these radionuclides are both time-consuming and expensive to analyze. For this reason the concentrations of many radionuclides are inferred rather than directly analyzed. For instance, we obtained a total alpha concentration. By inference, the concentration of individual alpha emitters cannot be any greater than the total alpha concentration. Therefore the total alpha also represents an upper limit on individual isotopes. Due to the statistics of counting, it is possible for an individually measured alpha-emitting isotope (e.g., ²³⁸Pu) to be measured at a slightly higher concentration than the total alpha concentration. The value given for Pu-239 is actually a combination of Pu-239 and Pu-240.

For minor beta-gamma emitters, a similar method was employed. A gamma scan and total beta count were performed. This gave gross beta and some individual beta-gamma isotopes. A separate total beta count was performed after a chemical separation technique was used to remove the ¹³⁷Cs. The ⁹⁰Sr and ⁹⁰Y results (twice the ⁹⁰Sr) are subtracted from the Cs-free beta-gamma result to give a beta-gamma result that approximates the regulatory “other beta-gamma”. Both values are given in the tables. Due to the statistics involved in counting, this calculated “other beta-gamma” result was negative for the Tank 24H samples. Since it appears that Tank 24 material will not be immediately transferred to Tank 50H for processing through the SPF, it was decided to report the these values as not detected (nd) in Table 4.

Ion-Chromatography analysis for the Tank 23H – 60” sample was initially performed on an acidified sample aliquot, which affected both the nitrate and nitrite concentrations. Since a second composite pulled from the same location (HTK-529 and HTK-530) was available, it was submitted for IC. The IC results reported in Table 3 are from the HTK-529 and HTK-530 composite. All other results reported in the table are from the original composite (HTK-521 and HTK-522).

Table 3. Analytical Results of the Samples Pulled from Tank 23H

Species	Supernate					Solids	
	Units	60" - Filtrate	100"	Average	St. Dev.	Units	60 " Solids
Radiochemistry							
Pu-238/241							
Pu-238	pCi/mL	4.00E+00	2.51E+01	1.45E+01	1.49E+01	dpm/g	4.01E+06
Pu-239	pCi/mL	< 9.05E-01	5.13E-01	≤ 7.09E-01	-	dpm/g	< 4.07E+04
Pu-241	pCi/mL	< 3.62E+01	< 3.81E+01	< 3.71E+01	-	dpm/g	6.48E+04
Ni-59/63							
Ni-59	pCi/mL	< 1.00E+00	< 1.18E+00	< 1.09E+00	-	-	na
Ni-63	pCi/mL	< 9.19E+00	< 6.64E+00	< 7.92E+00	-	-	na

Table 3 (cont'd). Analytical Results of the Samples Pulled from Tank 23H

Species	Supernate					Solids	
	Units	60" - Filtrate	100"	Average	St. Dev.	Units	60 " Solids
Tc-99							
Tc-99	pCi/mL	2.17E+02	1.38E+02	1.78E+02	5.55E+01	dpm/g	2.21E+03
Sr-90							
Sr-90	pCi/mL	< 9.10E+01	3.40E+02	≤ 2.16E+02	-	dpm/g	1.28E+06
Gamma Scan							
Co-60	pCi/mL	< 5.72E+00	< 5.32E+00	< 5.52E+00	-	dpm/g	1.02E+04
Ru-106	pCi/mL	< 4.91E+01	< 4.48E+01	< 4.69E+01	-	dpm/g	< 3.19E+03
Sb-125	pCi/mL	< 1.67E+01	< 1.34E+01	< 1.50E+01	-	dpm/g	< 1.80E+03
Cs-137	pCi/mL	8.15E+04	3.14E+04	5.64E+04	3.54E+04	dpm/g	5.07E+06
Eu-154	pCi/mL	< 5.45E+00	< 5.14E+00	< 5.29E+00	-	dpm/g	2.16E+03
Eu-155	pCi/mL	< 9.19E+00	< 8.20E+00	< 8.69E+00	-	dpm/g	< 6.60E+02
Al-26	pCi/mL	< 5.54E+00	< 4.68E+00	< 5.11E+00	-	-	na
Nb-94	pCi/mL	< 4.91E+00	< 4.49E+00	< 4.70E+00	-	dpm/g	< 8.44E+01
Sn-126	pCi/mL	< 7.25E+00	< 6.80E+00	< 7.03E+00	-	dpm/g	< 5.71E+02
Eu-152	pCi/mL	< 3.11E+01	< 3.14E+01	< 3.13E+01	-	dpm/g	2.54E+03
Ra-226	pCi/mL	< 9.82E+01	< 1.23E+02	< 1.11E+02	-	dpm/g	< 7.65E+03
Pa-231	pCi/mL	< 1.34E+02	< 1.30E+02	< 1.32E+02	-	dpm/g	< 1.47E+04
Np-237	pCi/mL	< 9.37E+00	< 8.06E+00	< 8.72E+00	-	dpm/g	< 1.01E+03
Am-241	pCi/mL	< 1.67E+01	< 1.51E+01	< 1.59E+01	-	dpm/g	6.04E+04
Ra-228	pCi/mL	< 2.45E+01	< 2.54E+01	< 2.50E+01	-	dpm/g	< 6.18E+02
Ac-227	pCi/mL	< 1.34E+02	< 1.30E+02	< 1.32E+02	-	-	na
Derived from Other Beta-Gamma							
Am-242m	pCi/mL	<9.58E+02	<5.16E+02	<7.38E+02	-	-	na
Bk-249	pCi/mL	<7.92E+02	<4.27E+02	<6.10E+02	-	-	na
Tritium							
Tritium	pCi/mL	1.01E+03	1.46E+03	1.24E+03	3.18E+02	uCi/g	1.02E-03
Gross Alpha							
Total Alpha	pCi/mL	< 9.19E+01	< 8.75E+01	< 8.97E+01	-	dpm/g	3.90E+06
Rad Screen							
Total Beta	pCi/mL	9.78E+04	3.77E+04	6.77E+04	4.25E+04	dpm/g	1.04E+07
Beta/Gamma (Cs-Free)	pCi/mL	7.92E+02	1.11E+03	9.53E+02	2.27E+02	-	na
Other Beta Gamma (calculated)	pCi/mL	7.92E+02	4.27E+02	6.10E+02	2.58E+02	-	na
C-14							
C-14	pCi/mL	3.01E+01	1.87E+01	2.44E+01	8.09E+00	dpm/g	1.13E+03

Table 3 (cont'd). Analytical Results of the Samples Pulled from Tank 23H

Species	Supernate					Solids	
	Units	60" - Filtrate	100"	Average	St. Dev.	Units	60" Solids
Se-79							
Se-79	pCi/mL	-	-	<7.33E+00	-	dpm/g	< 1.04E+07
I-129							
I-129	pCi/mL	< 2.04E+00	< 6.58E-01	< 1.35E+00	-	dpm/g	3.88E+01
Bound by Gross Alpha							
Cm-248	pCi/mL	<1E+02	<9.54E+01	<9.78E+01	-	dpm/g	<4.25E+06
Cf-252	pCi/mL	<9.48E+01	<9.03E+01	<9.26E+01	-	dpm/g	<4.02E+06
All other ^α	pCi/mL	< 9.19E+01	< 8.75E+01	< 8.97E+01	-	dpm/g	< 3.90E+06
IPC							
EDTA	mg/L	< 2.00E+01	< 2.00E+01	< 2.00E+01	-	-	na
ICP-ES							
Ag	mg/L	< 1.81E-02	< 9.00E-03	< 1.35E-02	-	ug/g	6.72E-01
Al	mg/L	2.23E+01	5.56E+00	1.39E+01	1.18E+01	ug/g	1.28E+02
B	mg/L	4.74E+00	3.74E-01	2.56E+00	3.09E+00	-	na
Ba	mg/L	< 4.22E-02	< 2.10E-02	< 3.16E-02	-	ug/g	4.82E+02
Be	mg/L	< 2.01E-03	3.00E-03	≤ 2.51E-03	-	ug/g	6.73E-01
Ca	mg/L	5.10E+00	3.17E+00	4.13E+00	1.36E+00	ug/g	1.05E+04
Cd	mg/L	< 9.05E-03	< 5.00E-03	< 7.02E-03	-	ug/g	1.30E+01
Cr	mg/L	4.21E+00	1.91E+00	3.06E+00	1.63E+00	ug/g	2.75E+02
Cu	mg/L	8.94E-02	8.20E-02	8.57E-02	5.26E-03	ug/g	1.05E+02
Fe	mg/L	4.92E-02	1.60E-01	1.05E-01	7.83E-02	ug/g	1.18E+04
Li	mg/L	8.90E-01	5.50E-02	4.73E-01	5.91E-01	ug/g	2.63E+01
Mg	mg/L	8.44E-02	< 6.00E-03	≤ 4.52E-02	-	ug/g	2.30E+03
Mn	mg/L	< 2.01E-03	< 1.00E-03	< 1.51E-03	-	ug/g	3.91E+02
Na	mg/L	1.52E+04	1.24E+04	1.38E+04	1.96E+03	ug/g	2.88E+04
Ni	mg/L	3.02E-02	1.50E-02	2.26E-02	1.07E-02	ug/g	9.15E+01
P	mg/L	4.48E+01	3.26E+00	2.40E+01	2.94E+01	ug/g	3.42E+04
Pb	mg/L	1.17E-01	< 3.50E-02	≤ 7.58E-02	-	ug/g	7.75E+02
S	mg/L	3.75E+01	3.88E+01	3.81E+01	9.29E-01	ug/g	1.03E+03
Si	mg/L	2.61E+02	1.09E+02	1.85E+02	1.08E+02	ug/g	1.83E+05
Sr	mg/L	1.09E+00	6.89E-01	8.87E-01	2.80E-01	ug/g	2.40E+03
Ti	mg/L	< 1.71E-02	< 8.00E-03	< 1.25E-02	-	ug/g	2.81E+02
U	mg/L	8.44E-01	5.76E-01	7.10E-01	1.90E-01	ug/g	8.58E+02
V	mg/L	7.54E-02	3.20E-02	5.37E-02	3.07E-02	ug/g	1.48E+00
Zn	mg/L	1.19E+00	2.50E+00	1.84E+00	9.29E-01	ug/g	1.04E+03

Table 3 (cont'd). Analytical Results of the Samples Pulled from Tank 23H

Species	Supernate					Solids	
	Units	60" - Filtrate	100"	Average	St. Dev.	Units	60" Solids
Zr	mg/L	< 5.03E-02	< 2.50E-02	< 3.76E-02	-	ug/g	1.92E+00
Sb	mg/L	< 8.34E-01	< 4.16E-01	< 6.25E-01	-	ug/g	8.30E-01
AA							
As	mg/L	6.07E-02	1.65E-01	1.13E-01	7.38E-02	ug/g	1.91E+00
K	mg/L	2.33E+01	3.17E+01	2.75E+01	5.94E+00	ug/g	3.97E+02
Se	mg/L	< 4.99E-02	9.42E-02	≤ 7.21E-02	-	ug/g	1.91E+00
CVAA-Hg							
Hg	mg/L	9.32E+00	3.54E-01	4.84E+00	6.34E+00	ug/g	1.57E+03
VOA GC-MS							
Benzene	mg/L	< 5.00E-02	< 5.00E-02	< 5.00E-02	-	-	na
Butanol	mg/L	< 5.00E-01	< 5.00E-01	< 5.00E-01	-	-	na
Isopropanol	mg/L	< 5.00E-01	< 5.00E-01	< 5.00E-01	-	-	na
Toluene	mg/L	9.60E-02	4.60E-02	7.10E-02	3.54E-02	-	na
SVOA GC-MS							
TBP	mg/L	< 1.00E+00	< 1.00E+00	< 1.00E+00	-	-	na
Phenol	mg/L	< 1.00E+00	< 1.00E+00	< 1.00E+00	-	-	na
Oil	mg/L	7.70E+02	< 1.00E+01	≤ 3.90E+02	-	-	na
2,4-bis(1,1-dimethylethyl)phenol (BBP)	mg/L	< 1.00E+00	1.10E+00	≤ 1.05E+00	-	-	na
IC-Anions							
F ⁻	M	8.42E-04	< 1.05E-03	≤ 9.47E-04	--	-	na
CHO ₂ ⁻	M	< 2.22E-04	< 2.22E-03	< 1.22E-03	--	-	na
Cl ⁻	M	8.46E-05	< 5.64E-04	≤ 3.24E-04	--	-	na
NO ₂ ⁻	M	1.49E-01	1.58E-01	1.53E-01	7E-03	-	na
NO ₃ ⁻	M	5.08E-02	3.90E-02	4.49E-02	8.3E-03	-	na
PO ₄ ⁻⁻⁻	M	4.00E-04	< 1.05E-03	≤ 7.27E-04	--	-	na
SO ₄ ⁻⁻	M	6.66E-04	9.68E-04	8.17E-04	2.13E-04	-	na
C ₂ O ₄ ⁻⁻	M	< 1.02E-04	< 1.14E-03	≤ 6.19E-04	--	-	na
NH ₄ ⁺	mg/L	< 10	< 10	< 10	--	-	na
Wet Chemistry							
Total Base	M	3.56E-01	2.16E-01	2.86E-01	9.90E-02	-	na
Free OH	M	2.67E-01	1.04E-01	1.86E-01	1.15E-01	-	na
CO ₃ ⁻⁻	M	7.00E-02	7.00E-02	7.00E-02	0.00E+00	-	Na
Dissolved Solids	Wt%	3.50	2.96	3.23	0.38		
Suspended Solids	Wt%	na	na	na	na	Wt %	6.28

α All includes the following isotopes: Th-229, Th-230, Th-232, U-232, U-233, U-234, U-235, U-238, Pu-244, Am-243, Cm-242, Cm-243, Cm-245, Cm-247, Cf-249 and Cf-251. Since the gross alpha was below the detection limit, no single alpha isotope can be above the given lower limit of detection for total alpha. All of these isotopes decay 100% by alpha.

na Not analyzed.

Table4. Analytical Results of the Samples Pulled from Tank 24H

Supernate					
Species	Units	60"	100"	Average	St. Dev.
Radiochemistry					
Pu-238/241					
Pu-238	pCi/mL	1.14E+03	1.90E+02	6.66E+02	6.73E+02
Pu-239	pCi/mL	9.92E+01	1.55E+01	5.74E+01	5.92E+01
Pu-241	pCi/mL	2.99E+02	6.06E+01	1.80E+02	1.69E+02
Ni-59/63					
Ni-59	pCi/mL	< 1.03E+00	< 3.78E-01	< 7.06E-01	-
Ni-63	pCi/mL	< 5.29E+01	< 2.74E+01	< 4.01E+01	-
Tc-99					
Tc-99	pCi/mL	2.60E+02	3.99E+02	3.29E+02	9.84E+01
Sr-90					
Sr-90	pCi/mL	4.52E+04	5.74E+04	5.13E+04	8.60E+03
Gamma Scan					
Co-60	pCi/mL	< 5.45E+00	< 5.59E+00	< 5.52E+00	-
Ru-106	pCi/mL	< 1.47E+02	< 9.50E+01	< 1.21E+02	-
Sb-125	pCi/mL	< 7.07E+01	< 5.59E+00	< 3.82E+01	-
Cs-137	pCi/mL	4.02E+06	1.51E+06	2.77E+06	1.78E+06
Eu-154	pCi/mL	< 1.80E+01	< 1.52E+01	< 1.66E+01	-
Eu-155	pCi/mL	< 3.18E+01	< 2.37E+01	< 2.78E+01	-
Al-26	pCi/mL	< 5.23E+00	< 5.99E+00	< 5.61E+00	-
Nb-94	pCi/mL	< 5.05E+00	< 5.14E+00	< 5.09E+00	-
Sn-126	pCi/mL	< 2.78E+01	< 2.06E+01	< 2.42E+01	-
Eu-152	pCi/mL	< 3.89E+01	< 3.86E+01	< 3.87E+01	-
Ra-226	pCi/mL	< 3.48E+02	< 2.32E+02	< 2.90E+02	-
Pa-231	pCi/mL	< 5.72E+02	< 3.56E+02	< 4.64E+02	-
Np-237	pCi/mL	< 3.86E+01	< 2.41E+01	< 3.13E+01	-
Am-241	pCi/mL	< 6.58E+01	< 5.05E+01	< 5.81E+01	-
Ra-228	pCi/mL	< 2.58E+01	< 2.62E+01	< 2.60E+01	-
Ac-227	pCi/mL	< 5.72E+02	< 3.56E+02	< 4.64E+02	-

Table4 (cont'd). Analytical Results of the Samples Pulled from Tank 24H

Supernate					
Species	Units	60"	100"	Average	St. Dev.
Derived from Other Beta-Gamma					
Am-242m	pCi/mL	nd	nd	-	-
Bk-249	pCi/mL	nd	nd	-	-
Tritium					
Tritium	pCi/mL	3.74E+00	1.92E+00	2.83E+00	1.29E+00
Gross Alpha					
Total Alpha	pCi/mL	< 9.36E+02	< 7.67E+02	< 8.51E+02	-
Rad Screen					
Total Beta	pCi/mL	5.10E+06	1.85E+06	3.48E+06	2.30E+06
Beta/Gamma (Cs-Free)	pCi/mL	8.24E+04	1.05E+05	9.37E+04	1.61E+04
Other Beta/Gamma (calculated)	pCi/mL	nd	nd	-	-
C-14					
C-14	pCi/mL	2.69E+01	1.41E+01	2.05E+01	9.11E+00
Se-79					
Se-79	pCi/mL	< 8.24E+04	< 1.05E+05	< 9.37E+04	-
I-129					
I-129	pCi/mL	< 9.73E+00	7.66E+00	8.69E+00	1.47E+00
Bound by Gross Alpha					
Cm-248	pCi/mL	<1.02E03	<8.36E02	<9.28E02	-
Cf-252	pCi/mL	<9.66E02	<7.91E02	<8.78E02	-
All α	pCi/mL	< 9.36E+02	< 7.67E+02	< 8.51E+02	-
IPC					
EDTA	mg/L	< 2.00E+01	< 2.00E+01	< 2.00E+01	-
ICP-ES					
Ag	mg/L	4.47E-02	6.22E-02	5.34E-02	1.24E-02
Al	mg/L	1.77E+02	9.21E+01	1.34E+02	5.98E+01
B	mg/L	2.19E+01	8.29E+00	1.51E+01	9.64E+00
Ba	mg/L	< 5.30E-02	< 3.97E-02	< 4.64E-02	-
Be	mg/L	< 3.12E-03	< 2.04E-03	< 2.58E-03	-
Ca	mg/L	1.89E+00	2.04E+00	1.96E+00	1.04E-01
Cd	mg/L	< 1.14E-02	< 9.17E-03	< 1.03E-02	-
Cr	mg/L	4.20E+00	1.59E+00	2.89E+00	1.84E+00
Cu	mg/L	1.12E-01	9.37E-02	1.03E-01	1.31E-02
Fe	mg/L	1.98E+00	9.75E-01	1.48E+00	7.14E-01

Table4 (cont'd). Analytical Results of the Samples Pulled from Tank 24H

Supernate					
Species	Units	60"	100"	Average	St. Dev.
Li	mg/L	1.78E+01	2.75E+00	1.03E+01	1.06E+01
Mg	mg/L	4.57E-02	1.63E-02	3.10E-02	2.08E-02
Mn	mg/L	1.97E-02	9.17E-03	1.45E-02	7.47E-03
Na	mg/L	2.92E+04	2.35E+04	2.64E+04	4.00E+03
Ni	mg/L	3.84E-02	< 2.85E-02	≤ 3.35E-02	7.01E-03
P	mg/L	1.64E+01	6.84E+00	1.16E+01	6.77E+00
Pb	mg/L	< 8.94E-02	< 6.73E-02	< 7.83E-02	-
S	mg/L	4.52E+01	2.01E+01	3.26E+01	1.78E+01
Si	mg/L	6.51E+01	4.74E+01	5.63E+01	1.26E+01
Sr	mg/L	4.18E-01	4.40E-01	4.29E-01	1.59E-02
Ti	mg/L	2.18E-02	1.63E-02	1.91E-02	3.90E-03
U	mg/L	6.61E+00	1.06E+01	8.60E+00	2.82E+00
V	mg/L	2.29E-02	7.13E-03	1.50E-02	1.11E-02
Zn	mg/L	4.11E-01	4.35E-01	4.23E-01	1.67E-02
Zr	mg/L	< 6.34E-02	< 4.79E-02	< 5.56E-02	-
Sb	mg/L	< 1.06E+00	< 7.97E-01	< 9.28E-01	-
AA					
As	mg/L	3.08E-01	4.83E-02	1.78E-01	1.84E-01
K	mg/L	2.65E+01	1.47E+01	2.06E+01	8.34E+00
Se	mg/L	6.62E-02	< 4.70E-02	≤ 5.66E-02	1.36E-02
CVAA-Hg					
Hg	mg/L	1.35E+01	1.45E+01	1.40E+01	7.07E-01
VOA GC-MS					
Benzene	mg/L	< 5.00E-02	< 5.00E-02	< 5.00E-02	-
Butanol	mg/L	< 5.00E-01	< 5.00E-01	< 5.00E-01	-
Isopropanol	mg/L	< 5.00E-01	< 5.00E-01	< 5.00E-01	-
Toluene	mg/L	6.30E-02	1.00E-01	8.15E-02	2.62E-02
SVOA GC-MS					
TBP	mg/L	< 1.00E+00	< 1.00E+00	< 1.00E+00	-
Phenol	mg/L	< 1.00E+00	< 1.00E+00	< 1.00E+00	-
Oil	mg/L	< 2.00E+01	< 2.00E+01	< 2.00E+01	-
BBP	mg/L	< 1.00E+00	1.20E+00	1.10E+00	1.41E-01
IC-Anions					
F ⁻	M	< 1.05E-03	< 1.05E-03	< 1.05E-03	-
CHO ₂ ⁻	M	1.67E-03	2.75E-03	2.21E-03	7.70E-04

Table4 (cont'd). Analytical Results of the Samples Pulled from Tank 24H

Supernate					
Species	Units	60"	100"	Average	St. Dev.
Cl ⁻	M	2.51E-03	9.59E-04	1.73E-03	1.10E-03
NO ₂ ⁻	M	4.20E-01	3.15E-01	3.67E-01	7.38E-02
NO ₃ ⁻	M	3.42E-02	6.14E-02	4.78E-02	1.93E-02
PO ₄ ³⁻	M	< 1.05E-03	< 1.05E-03	< 1.05E-03	-
SO ₄ ²⁻	M	7.70E-04	4.06E-04	5.88E-04	2.58E-04
C ₂ O ₄ ²⁻	M	< 1.14E-03	< 1.14E-03	< 1.14E-03	-
NH ₄ ⁺	mg/L	<10	<10	<10	--
Wet Chemistry					
Total Base	M	5.16E-01	5.58E-01	5.37E-01	2.97E-02
Free OH	M	2.85E-01	4.35E-01	3.60E-01	1.06E-01
CO ₃ ²⁻	M	1.50E-01	7.00E-02	1.10E-01	5.66E-02
Dissolved Solids	Wt %	6.93	5.67	6.30	0.89

α All includes the following isotopes: Th-229, Th-230, Th-232, U-232, U-233, U-234, U-235, U-238, Pu-244, Am-243, Cm-242, Cm-243, Cm-245, Cm-247, Cf-249 and Cf-251. Since no alpha was detected, no single alpha isotope can be above the given lower limit of detection for total alpha. All of these isotopes decay 100% by alpha

nd Other beta-gamma was calculated by subtracting the Sr-90, Y-90 and Tc-99 from the Cs-free total beta. The result was a negative value indicating that within the counting statistics Sr-90, Y-90 and Tc-99 account for all of the Cs-free total beta. Because a negative number is not physically possible, this is reported as not detected or "nd".

Quality Assurance

Data for these analyses are recorded in laboratory notebooks WSRC-NB-2003-00024 and succeeding notebooks.

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² W. B. Van Pelt, "Exemption to Start Work – Characterization of Tanks 23H and 24H Samples with Parallel Development of a Technical Task Plan," SRT-LWP-2002-00131, November 22, 2002.

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