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Analysis of Tank 38H (HTF-38-15-119, 127) Surface, Subsurface and Tank 43H (HTF-43-15-116, 117 and 118) Surface, Feed Pump Suction and Jet Suction Subsurface Supernatant Samples in Support of Enrichment, Corrosion Control and Salt Batch Planning Programs

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EXECUTIVE SUMMARY

This report provides the results of analyses on Tanks 38H and 43H surface and subsurface supernatant liquid samples in support of the Enrichment Control Program (ECP), the Corrosion Control program (CCP) and the Salt Batch 10 Planning Program.

The U-235 mass divided by the total uranium mass for the samples analyzed for uranium content (Tank 38H surface, Tank 38H subsurface, Tank 43H surface, and Tank 43H sub surface (Feed suction pump) averaged 8.20E-03 ± 4.12E-05, 6.22E-03 ± 2.89E-05, 6.27E-03 ± 5.03E-05, and 6.23E-03 ± 3.06E-05, respectively.

The average U-235 concentration in the Tank 38H samples ranged from 4.61E-01 to 5.37E-02 mg/L, and the U-238 concentration in the Tank 38H samples ranged from 6.50E+00 to 7.37E+01 mg/L. Similarly, the average U-235 concentration in the Tank 43H samples averaged 4.30E-01 mg/L, and the U-238 concentration in the Tank 43H samples analyzed for uranium content ranged from 6.82E+01 to 6.85E+01 mg/L. Thus, the U-235 to total uranium ratios in these tanks 38H and 43H samples are in line with prior 2H-evaporator ECP samples.

The calculated U-235 equivalent for all the samples analyzed (Tank 38H surface, Tank 38H subsurface, Tank 43H surface, Tank 43H sub surface (Feed suction pump) and Tank 43H subsurface sample(Jet suction sample)) are ≤ 1.0 wt%. This means that the evaporator system feed requirements, waste that has a U-235 equivalent enrichment of ≤ 5.5 wt% and a plutonium content of the fissionable elements of ≤ 2 wt%, are met.

The measured sodium and silicon concentrations averaged, respectively, 1.49 M and 34.5 mg/L in the Tank 38H surface sample. The measured sodium and silicon concentrations averaged, respectively, 5.90 M and 135 mg/L in the Tank 43H surface sample and 6.08 M and 130.1 mg/L in the Tank 43H subsurface (jet suction sample).

The measured aluminum and free-OH concentrations in Tank 38H surface sample averaged 0.047 M and 0.33 M, respectively. The measured aluminum and free-OH concentrations in Tank 43H surface sample averaged 0.029 M and 2.21 M, respectively, while these values were 0.033 M and 2.26 M, respectively, for the Tank 43H subsurface jet suction sample.

The nitrate and nitrite concentrations in the Tank 38H surface sample, Tank 43H surface sample and Tank 43H subsurface sample (jet suction sample) averaged 0.176 M, 0.404 M; 0.85 M, 1.78 M; and 0.87 M, 1.79 M, respectively. In general, the nitrate, nitrite and free-OH concentrations of the Tank 43H samples were all higher than those of the Tank 38H sample.

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LIST OF ABBREVIATIONS

CCP	Corrosion Control Program
ECP	Enrichment Control Program
HTF	H Tank Farm
IC	Ion Chromatography
ICP-MS	Inductively Coupled Plasma-Mass Spectrometry
ICP-ES	Inductively Coupled Plasma – Emission Spectrometry
SpG	Specific Gravity
SRNL	Savannah River National Laboratory
SRR	Savannah River Remediation
VDS	Variable Depth Sample
TIC	Total Inorganic Carbon
TTQAP	Task Technical and Quality Assurance Plan

1.0 Introduction

Compositional feed limits have been established to ensure that a nuclear criticality event for the 2H and 3H Evaporators[i] is not possible. The limits are established by the Enrichment and Corrosion Control Programs. The Enrichment Control Program (ECP) requires feed sampling to determine the equivalent enriched uranium content prior to transfer of waste other than recycle transfers (requires sampling to determine the equivalent enriched uranium at two locations in Tanks 38H and 43H every 26 weeks)[ii]. The Corrosion Control Program (CCP) establishes concentration and temperature limits for key constituents and periodic sampling and analysis to confirm that waste supernate is within these limits [iii].

In October 2015, Savannah River Remediation (SRR) sampled from two locations within Tanks 38H and 43H. As summarized in Tables 1 and 2, these supernatant samples were delivered to the Savannah River National Laboratory (SRNL) in late October, 2015 for analyses to support the ECP and CCP. The Tank 38H and 43H surface samples were identified as HTF-38-15-119 and HTF-43-15-116, respectively, while the Tank 38H and 43H subsurface samples were identified as HTF-38-15-127 and HTF-43-15-117 (Tank 43H feed pump suction sample) and HTF-43-15-118 (Tank 43H jet suction sample), respectively. Five samples, in all, (two from Tank 38H and three from Tank 43H) were delivered to SRNL.

The Tank 38H variable depth sample (HTF-38-15-127) was taken at a depth of 275 inches from the Tank 38H bottom while the Tank 43H variable depth samples (HTF-43-15-117, 118) were taken at a depth of 161 inches from the tank 43H bottom and a depth of 96 inches from the Tank 43H bottom. The Tank 43H surface and jet suction samples are also considered as Salt Batch 10 planning samples.

Tanks 38H and 43H serve, respectively, as the drop tank and the feed tank for the 2H-evaporator system. This work is governed by the Technical Task Request and the experimental details are presented in the Task Technical and Quality Assurance Plan.[iv,v] 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.

2.0 General Supernatant Sample Description

Table 2 contains a description of the sampling locations and the quantity of material received for the “as-received” Tank 38H and 43H samples. As shown in Figure 1, four of the five samples were essentially free of any visible settled insoluble solids, although the variable depth samples from Tanks 43H were cloudy and hazy. The Tank 38H variable depth sampling bottle (HTF-38-15-120) from the plant contained only two drops of sample liquid. This is considered to be essentially an empty container. Two of the Tank 43H samples contained, respectively, 45 and 35 mL liquid samples instead of the normal 80 mL sample volumes (Tank 43 surface sample HTF-43-15-116 and Feed pump suction sample HTF-43-15-117).

The plant had to resample for the variable Tank 38 sample and the other two Tank 43H samples (sample HTF-43-15-116 and Feed pump suction sample HTF-43-15-117). The new samples were delivered to SRNL on October 21, 2015. These new Tank 38H and 43H samples were identified as HTF-38-15-127 (replacement for Tank 38H variable depth sample HTF-38-15-120), HTF-43-15-124, HTF-43-15-125, and HTF-43-15-126.

The volume of samples from the resamples, as shown in Figure 2, averaged about 80 mL. The data presented in this report for Tank 43H are based on the original Tank 43H samples as shown in Table 1. The data presented in this report for the new Tank 38H sample (HTF-38-15-127) is a replacement for the original Tank 38 variable depth sample with insufficient amount of material for analysis.

In general, the visual appearance of these samples was consistent with supernatant liquid containing <1 wt. % insoluble solids.

3.0 Experimental

Analysis for the ECP was performed on four samples (Tank 38 surface sample: HTF-38-15-119, Tank 38 variable depth sample: HTF-38-15-127, Tank 43 surface sample: HTF-43-15-116 and Tank 43 feed pump suction sample: HTF-43-15-117) and analysis for CCP was also performed on the three samples (Tank 38 surface sample: HTF-38-15-119, Tank 43 surface sample: HTF-43-15-116 and Tank 43 jet suction sample: HTF-43-15-118). The ECP and CCP analysis requirements for the Tank 38H and 43H slurry supernatant samples are summarized in Table 1. The ECP analysis includes inductively-coupled plasm-mass spectroscopy (ICP-MS) for uranium isotopic analysis and radiochemical separation and counting methods for Pu-238, Pu-239/240, and Pu-241. The preparation for ECP analyses was by dilution with 2M nitric acid. The CCP analysis includes ion chromatography (IC) for anions (nitrate and nitrite), acid titration for free hydroxide, and gamma scan for detectable gamma-emitting isotopes. The preparation for IC and titration analyses was by dilution with de-ionized water. Preparation of samples for inductively-coupled plasma – emissions spectroscopy (ICP-ES) measurement for silicon and other elements was performed by warm acid strike, which yielded an approximately 50-fold dilution. Twenty milliliters of 3 M nitric acid were added to two milliliters of sample, and the mixture was heated at 90 °C for four hours before dilution to 100 milliliters. This method was previously determined to be the optimal method for accurate silicon measurement in this waste matrix.[vi]

Two mL portions of the select Tanks 38H and 43H samples for Tc-99 and I-129 analysis, as shown in Table 1 suite of analysis, were taken out of the Shielded cell without dilution to enhance detection for both Tc-99 and I-129. For Tc-99 analysis, the samples were spiked with Tc-99m and the technetium species were extracted from the matrix using an Aliquat-336 based solid phase extractant. Tc-99 concentrations were measured by liquid scintillation analysis. Tc-99m yields were measured with a NaI-well gamma spectrometer, and were used to correct the Tc-99 analyses for any technetium losses from the radiochemical separations.

For I-129 analysis, the Tank 38H and 43H samples were dissolved in concentrated acid with an added KI carrier. A matrix blank and matrix blank containing an I-129 spike were also prepared. The samples were rendered caustic, and decontaminated by strikes with crystalline silico-titinate (CST) and monosodium titinate (MST) followed by a filtration step. The samples were then acidified and treated with Actinide and AMP resins to facilitate removal of interfering isotopes. Sodium sulfite was added to the material to reduce the iodine. Silver nitrate was added to the solution to precipitate the iodine as AgI, which was separated via filtration. The filtrate was analyzed for I-129 content using low energy photon/x-ray, thin-windowed, semi-planar, high purity germanium spectrometers. Elemental iodine yields were measured by neutron activation analysis, and were used to correct the I-129 analyses for any iodine losses from the radiochemical separation.

Analysis of the Tank 38H and 43H samples for mercury involved digestion of the samples in acidic media (digested mercury analysis- CV Hg Digested) followed by cold vapor analysis. This

CV-Hg Digested mercury method is an extension of the mercury analysis method by cold vapor mercury (CV-Hg). This extended method ensures that all the mercury/organo-mercuric compounds, if present in the sample matrix, are converted to elemental mercury vapor which the instrument can detect in a flameless atomic absorption technique at 253.7 nm. This extended analysis method for mercury involves addition of various organo-mercuric digestion reagents including concentrated sulfuric acid, concentrated nitric acid and potassium permanganate to the original samples before CV-Hg analysis.

The Density of the as-received samples was measured by determining the weight of 1.0 mL sample portions in triplicate and the specific gravity (SpG) was calculated from these density measurements relative to density of water.

All these analyses were performed and reported in triplicate.

Table 1 Tanks 38H and 43H Sample Description, Delivery Dates and Analysis Suite Summary.

Sample	Sample ID	Description	Date at SRNL	Date in cell
Tank 38 surface	HTF-38-15-119	Tank 38 Surface sample pulled 330.9" from the tank 38 bottom.	10/08/2015	10/12/2015
Tank 38 VDS	HTF-38-15-120	Sample container was empty. A resample was carried out. See sample HTF-38-15-127	10/08/2015	10/12/2015
Tank 43 surface	HTF-43-15-116	Tank 43 Surface sample 289.4 inches from tank 43 bottom.	10/08/2015	10/12/2015
Tank 43 VDS Tank 43 feed pump suction	HTF-43-15-117	Pulled 161" from the tank 43 bottom. (salt batch planning sample)	10/08/2015	10/12/2015
Tank 43 VDS Tank 43 jet suction	HTF-43-15-118	Pulled 96" from the tank 43 bottom. (salt batch planning)	10/08/2015	10/12/2015
Tank 38 VDS (resample)	HTF-38-15-127	Tank 38 variable depth sample pulled 275" from the tank 38 bottom.	10/21/2015	10/22/15
Tank 43 surface (resample)	HTF-43-15-124	Tank 43 Surface sample 289.3 inches from tank 43 bottom.	10/21/2015	10/22/15
Tank 43 VDS Tank 43 feed pump suction (resample)	HTF-43-15-125	Pulled 161" from the tank 43 bottom. (salt batch planning sample)	10/21/2015	10/22/15
Tank 43 VDS Tank 43 jet suction (resample)	HTF-43-15-126	Pulled 96" from the tank 43 bottom. (salt batch planning)	10/21/2015	10/22/15

ECP + CCP Sample location	Analysis Suite
Tank 38 surface sample; HTF-38-15-119	ECP + CCP; gamma scan
Tank 38 Sub-surface Sample/VDS; HTF-38-15-127	ECP, SpG,
Tank 43 surface sample: HTF-43-15-116 (salt batch planning sample)	ECP + CCP; Hg, Sr-90, Tc-90 and I-129; gamma scan
Tank 43 Sub-surface Sample/VDS, same as the Tank 43 feed pump suction sample: HTF-43-15-117	ECP, SpG,
Tank 43 Sub-surface Sample/VDS, same as the Tank 43 jet suction sample: HTF-43-15-118(salt batch planning sample)	CCP [Na, ,Al, Si, Hg (total and soluble), OH, NO_2, NO_3, Cs-137, Sr-90, Tc-99 and I-129], Hg and SpG,
Tank 38 Sub-surface Sample; HTF-38-15-119	Warm acid strike/ICPES for Si Na, and Al
Tank 43 Sub-surface Sample; HTF-43-15-116	Warm acid strike/ICPES for Si Na, and Al
Tank 43 Sub-surface Sample/VDS, same as the Tank 43 jet suction sample: HTF-43-15-118	Warm acid strike/ICPES for Si, Na, and Al

Table 2 General Sample Description ("As-received") for Tanks 38H and 43H Samples

Tank Sample ID	Wt. sample, g	Approx. Volume of sample, mL	Comments
Tank 38 surface sample; **HTF-38-15-119**	83.665	80	Clear supernate; no visible solids
Tank 38 Sub-surface Sample **HTF-38-15-120**	1.270	2 drops	Virtually empty container
Tank 43 surface sample **HTF-43-15-116**	54.237	45	Clear supernate; no visible solids
Tank 43 Sub-surface Sample/VDS Feed pump suction sample **(HTF-43-15-117)**	43.902	35	Cloudy, but no visible particles
Tank 43 Sub-surface Sample/VDS jet suction sample **(HTF-43-15-118)**	97.029	80	Cloudy, but no visible particles
Tank 38 Sub-surface Sample **HTF-38-15-127 (resample)**	103.562	80	Clear supernate; no visible solids
Tank 43 surface sample **HTF-43-15-124 (resample)**	90.555	80	Clear supernate; no visible solids
Tank 43 surface sample **HTF-43-15-125 (resample)**	97.491	80	Cloudy, but no visible particles
Tank 43 surface sample **HTF-43-15-126 (resample)**	95.643	80	Cloudy, but no visible particles

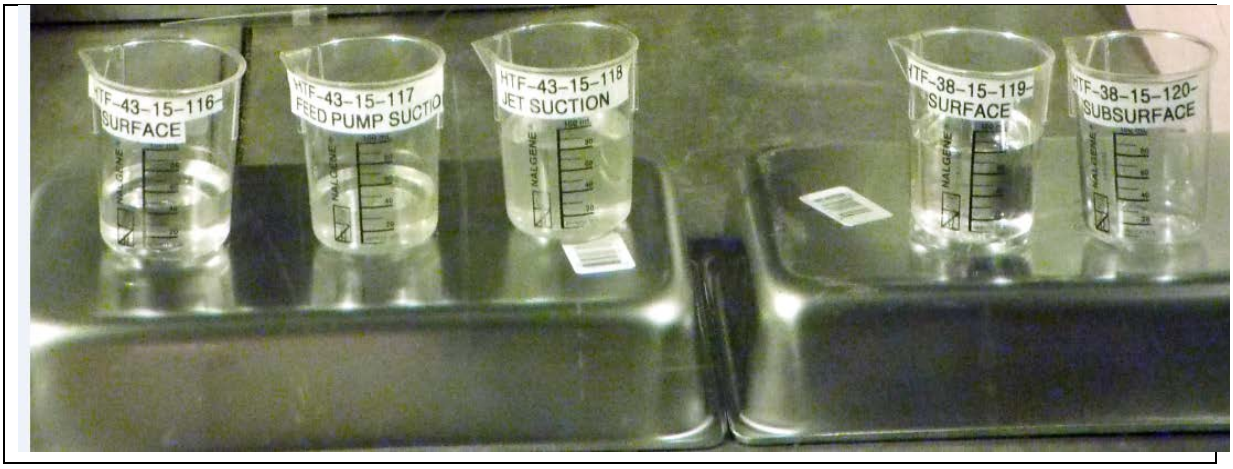

Figure 1 from left to right: samples from the Tank 43H supernate surface (116) subsurface (117 and 118), 38H supernate surface (119) and 38H supernate subsurface (120: insufficient sample).

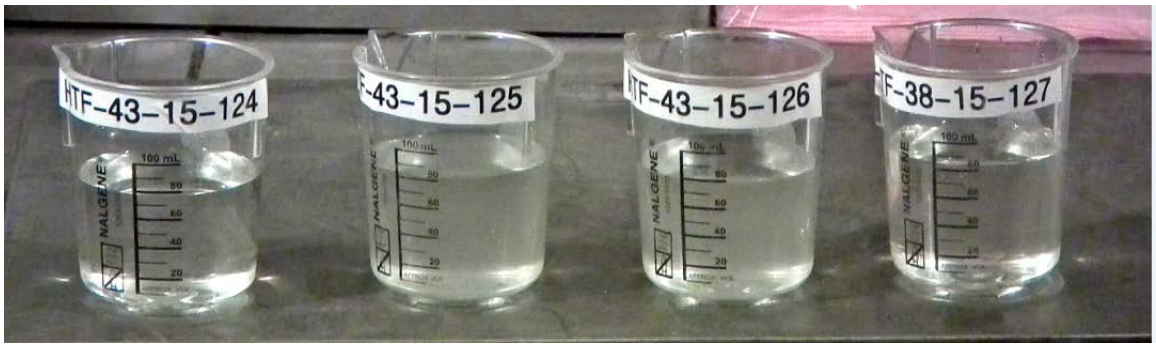

Figure 2 Tank 38H and Tank 43H resamples. From left to right: samples from the Tank 43H surface (124), Tank 43H VDS feed pump suction sample (125)' Tank 43H VDS jet suction sample (126) and Tank 38H VDS sample (127).

4.0 Analytical Results

Table 3 contains a summary of the ECP/CCP, Hg, Sr-90, Tc-99, I-129, and gammas scan for Cs-137 analytical results for the Tank 38H samples while Table 4 contains a similar analytical summary the Tank 43H samples. This summary includes only the average values for the analytes and the standard deviation for each analysis in triplicate. Details of the analytical results for all the Tank 38H and 43H results are presented in Tables 5 through 19 as shown in Appendices A and B for Tank 38H samples and Appendices C and D for Tank 43H samples.

In the analytical results presented below, values preceded by "<" (less than sign) indicate values were below minimum detection limits (MDLs), and values proceeded by "≤" (less than or equal to sign) indicate that for replicates, at least one of the analysis values was above the instrument detection limit or MDL and at least one of the analysis values was below the detection limit or was an upper limit. Thus, where replicate analyses were both above and below the detection limit, the average of all replicates above and below the detection limit is given and a "≤ " sign precedes the average value. The three individual determinations of the triplicate preparations and measurements are reported in the appendices, along with the average values and the standard deviations. The standard deviations were calculated only for values that were all above the detection limits.

The Pu-239 value reported in mg/L for the ECP analysis assumes that all of the activity measured as Pu-239/240 is from Pu-239. This assumption results in a high bias to the Pu-239 result and thus the assumption is conservative with respect to concentration of this fissile isotope. With measurements for Tank 38H surface sample (Tank 38H Surface HTF-38-15-119) being the exception, all measurements reported for U-233, U-234, U-235, U-236 and U-238 for all Tank 38H and 43H samples are above the ICP-MS detection limit. As a result, the uranium enrichment calculations are based on U-total; where U-total includes the masses of uranium isotopes, U-233-U-238. The measurements for U-233, U-234 and U-236 in Tank 38H surface sample (HTF-38-15-119) are all below the ICP-MS detection limit and as a result the uranium enrichment calculations are based on U-total consisting of only U-235 and U-238.

The U-235 concentration in the Tank 38H surface, Tank 38H subsurface, Tank 43H surface and Tank 43H sub surface (Feed suction pump) averaged 5.37E-02 ± *9.70E-04*, 4.61E-01 ± *2.23E-03*, 4.30E-01 ± *3.37E-03* and 4.30E-01 ± *8.32E-04* mg/L, respectively, while the U-238 concentrations in Tank 38H surface, Tank 38H subsurface, Tank 43H surface and Tank 43H sub surface (Feed suction pump) averaged, respectively, 6.50E+00 ± *8.46E-02*, 7.37E+01 ± *5.70E-01*,

6.82E+01 ± *1.88E-02*, and 6.85E+01 ± *4.51E-01* mg/L. The total uranium concentration in the Tank 38H surface, Tank 38H subsurface, Tank 43H surface and Tank 43H sub-surface (Feed suction pump) averaged, 6.55E+00 ± *8.56E-02*, 7.42E+01 ± *5.72E-01*, 6.87E+01 ± *1.55E-02*, and 6.90E+01 ± *4.52E-01* mg/L, respectively. Thus, the U-235/total uranium ratios (8.20E-03 ± *4.12E-05*, 6.22E-03 ± *2.89E-05*, 6.27E-03 ± *5.03E-05* and 6.23E-03 ± *3.06E-05*) in Tank 38H surface, Tank 38H subsurface, Tank 43H surface and Tank 43H sub-surface (Feed suction pump) are in line with the prior 2H evaporator ECP samples.[a]

Based on the uranium, Pu-241, and Pu-239 concentrations, the calculated U-235 equivalent[b] [(([U-235] + 1.4*[U-233] + 2.25*([Pu-241] + [Pu-239]))/[total uranium])*100] for all the samples analyzed (Tank 38H surface, Tank 38H subsurface, Tank 43H surface and Tank 43H sub surface (Feed suction pump) are < 1.0 wt%. The calculated values are 0.94, 0.64, 0.64 and 0.64 wt%, respectively. It is worth noting that the evaporator system feed requirements, waste that has a U-235 equivalent enrichment of ≤ 5.5 wt% and a plutonium content of the fissionable elements of ≤ 2 wt%, are met.

Technetium was present at detectable levels in Tank 38H surface and 43H surface and subsurface (jet suction) samples. The current Saltstone Tc-99 WAC limit is 8.7E+04 pCi/mL. In the next Saltstone WAC revision for Tc-99, this limit will be raised to 2.11E+05 pCi/mL.[c]

All I-129 analysis results for both Tank 38H and 43H surface and subsurface samples were not present at clearly detectable levels. Iodine-129 was positively measured in two of the triplicate analysis for I-129 in Tank 43H surface sample and also measured in one of the triplicate analysis for I-129 in Tank 43H subsurface samples (Jet suction sample). In all other measurements for I-129 the analysis results were below the method detection limit or upper limits due to incomplete separation of I-129 from Cs-137. However, these analytical results for all the runs were still less than the 63 pCi/mL customer desired Saltstone WAC limit. All other I-129 analysis for both Tank 38H and 43H surface and samples meet the customer desired Saltstone Waste Acceptance Criteria (WAC) of 63 pCi/mL (140 dpm/mL).

[a] C. J. Martino, "Analysis of Tank 38H (HTF-38-13-156, 157) and Tank 43H (HTF-43-13-158, 159) Samples for Support of the Enrichment Control and Corrosion Control Programs," SRNL-TR-2013-00205, Rev. 0, October 2013.

[b] Section 1.1.2 of the Implementation Requirements and Actions of Section 4.3 of WSRC-TR-2003-00055, Rev. 9

[c] S. P. Hommel, "Recommended Tc-99 Concentration for Saltstone Waste Acceptance Criteria to Implement the FY2014 SDF SA," SRR-CWDA-2015-00007, January 12, 2015.

Table 3 ECP and CCP Analytical Data for Tanks 38H Samples.

Analytes	Tank 38H Surface HTF-38-15-119		Tank 38H Sub-Surface HTF-38-15-127		Methods	Units
	Average	Stdev.	Average	Stdev.		
U-233	**<4.42E-03**	-	**6.53E-03**	*6.02E-04*	ICP-MS	mg/L
U-234	**<4.42E-03**	-	**1.19E-02**	*3.81E-05*	ICP-MS	mg/L
U-235	**5.37E-02**	*9.70E-04*	**4.61E-01**	*2.23E-03*	ICP-MS	mg/L
U-236	**<4.42E-03**	-	**2.72E-02**	*3.08E-04*	ICP-MS	mg/L
U-238	**6.50E+00**	*8.46E-02*	**7.37E+01**	*5.70E-01*	ICP-MS	mg/L
Total U	**6.55E+00**	*8.56E-02*	**7.42E+01**	*5.72E-01*	ICP-MS	mg/L
U-235/U-total	**8.20E-03**	*4.12E-05*	**6.22E-03**	*2.89E-05*	Calc.	
U-235 equivalent	0.94	-	0.64	-	Calc.	Wt%
Pu-238	**2.31E-05**	*2.29E-06*	**2.79E-04**	*3.08E-05*	PuTTA	mg/L
Pu-239**	**7.93E-04**	6.23E-05	**1.50E-03**	*5.80E-04*	PuTTA	mg/L
Pu-239/240	**1.09E+02**	*8.59E+00*	**2.07E+02**	*8.01E+01*	PuTTA	dpm/mL
Pu-241	**<1.57E-06**	-	**6.27E-06**	*6.67E-07*	Pu-238/241	mg/L
Cs-137	**1.24E+08**	*2.24E+06*	**1.30E+08**	*2.20E+06*	gamma scan	dpm/mL
Ba-137m	**1.17E+08**	*2.12E+06*	**1.23E+08**	*2.08E+06*	gamma scan	dpm/mL
Tc-99	**3.99E+04**	*1.30E+03*	**NR**	**NR**	Tc-99	dpm/mL
I-129	**<1.57E+01**	-	**NR**	**NR**	I-129	dpm/mL
Sr-90	**2.05E+05**	*6.62E+03*	**1.29E+06**	*2.77E+05*	Sr-90	dpm/mL
OH^-	**0.33**	*0.005*	**NR**	**NR**	Titration	M
NO_2^-	**4.04E-01**	*6.78E-03*	**NR**	**NR**	IC	M
NO_3^-	**1.76E-01**	*1.73E-03*	**NR**	**NR**	IC	M
F^-	**<5.85E-03**	-	**NR**	**NR**	IC	M
CHO_2^-	**3.25E-03**	*6.33E-05*	**NR**	**NR**	IC	M
Cl^-	**<6.26E-03**	-	**NR**	**NR**	IC	M
PO_4^{3-}	**<1.17E-03**	-	**NR**	**NR**	IC	M
SO_4^{2-}	**6.97E-03**	*2.23E-04*	**NR**	**NR**	IC	M
$C_2O_4^{2-}$	**3.93E-02**	*4.42E-04*	**NR**	**NR**	IC	M
Br^-	**<6.95E-03**	-	**NR**	**NR**	IC	M
CO_3^{2-}	**6.44E-02**	*3.18E-04*	**NR**	**NR**	TIC	M
			NR	**NR**		
Al	**1260**	*7.2*	**NR**	**NR**	ICP-ES	mg/L
B	**22.8**	*0.0*	**NR**	**NR**	ICP-ES	mg/L
Ca	**5.9**	*1.2*	**NR**	**NR**	ICP-ES	mg/L
Cr	**23.2**	*0.5*	**NR**	**NR**	ICP-ES	mg/L
Fe	**5.6**	*1.1*	**NR**	**NR**	ICP-ES	mg/L
K	**126**	*17*	**NR**	**NR**	ICP-ES	mg/L
Li	**<21.2**	-	**NR**	**NR**	ICP-ES	mg/L
Na	**34350**	*372*	**NR**	**NR**	ICP-ES	mg/L
P	**<40.8**	-	**NR**	**NR**	ICP-ES	mg/L
Si	**34.5**	*20.8*	**NR**	**NR**	ICP-ES	mg/L
Zn	**<1.5**	-	**NR**	**NR**	ICP-ES	mg/L
Hg	**162**	*3.7*	**NR**	**NR**	CVAA-Hg	mg/L
Na	**1.49**	*0.02*	**NR**	**NR**	Calc.	M
Total cation	**1.50**	-	**NR**	**NR**	Calc.	M
Total anion	**1.20**	-	**NR**	**NR**	Calc.	M
SpG 20 °C	**1.05**	*0.00*	**1.24**	*0.01*	Calc.	-

** The Pu-239 mass concentrations were calculated from the Pu-239/240 results, based on the assumption that all activity was due to Pu-239 (as opposed to Pu-240). Note that the ICP-MS results for Pu-239 were all below the minimum detection limits.
NR: Analytical measurements not requested.

Table 4 ECP and CCP Analytical Data for Tanks 43H Samples.

Analytes	Tank 43H Surface HTF-43-15-116		Tank 43H Sub-Surface HTF-43-15-117 (Feed Pump Suction Sample) (Salt Batch Planning Sample)		Tank 43H Sub-Surface HTF-43-15-118 (Jet Suction Sample) (Salt Batch Planning Sample)		Methods	Units
	Average	Stdev.	Average	Stdev.	Average	Stdev.	-	-
U-233	6.16E-03	2.55E-04	6.11E-03	2.04E-04	NR	NR	ICP-MS	mg/L
U-234	1.10E-02	2.62E-04	1.10E-02	2.14E-04	NR	NR	ICP-MS	mg/L
U-235	4.30E-01	3.37E-03	4.30E-01	8.32E-04	NR	NR	ICP-MS	mg/L
U-236	2.52E-02	8.83E-05	2.54E-02	6.14E-04	NR	NR	ICP-MS	mg/L
U-238	6.82E+01	1.88E-02	6.85E+01	4.51E-01	NR	NR	ICP-MS	mg/L
Total U	6.87E+01	1.55E-02	6.90E+01	4.52E-01	NR	NR	ICP-MS	mg/L
U-235/U-total	6.27E-03	5.03E-05	6.23E-03	3.06E-05	NR	NR	Calc.	-
U-235 equivalent	0.64	-	0.64	-	NR	NR	Calc.	Wt%
Pu-238	2.90E-04	3.24E-05	2.58E-04	1.89E-05	NR	NR	PuTTA	mg/L
Pu-239**	≤1.69E-03	-	1.51E-03	7.01E-04	NR	NR	PuTTA	mg/L
Pu-239/240	≤2.34E+02	-	2.08E+02	9.67E+01	NR	NR	PuTTA	dpm/mL
Pu-241	<8.70E-06	-	<3.97E-06	-	NR	NR	Pu-238/241	mg/L
Cs-137	1.11E+08	1.10E+06	1.11E+08	2.18E+06	1.13E+08	2.34E+06	gamma scan	dpm/mL
Ba-137m	1.05E+08	1.04E+06	1.05E+08	2.06E+06	1.07E+08	2.22E+06	gamma scan	dpm/mL
Tc-99	5.01E+04	1.41E+03	NR	NR	4.50E+04	1.42E+03	Tc-99	dpm/mL
I-129	≤1.03E+01	-	NR	NR	≤1.49E+01	-	I-129	dpm/mL
Sr-90	9.68E+05	1.38E+05	NR	NR	9.53E+05	1.31E+05	Sr-90	dpm/mL
OH^-	2.21	0.02	NR	NR	2.26	0.04	Titration	M
NO_2^-	1.78	0.02	NR	NR	1.79	0.02	IC	M
NO_3^-	0.85	0.01	NR	NR	0.87	0.01	IC	M
F^-	<0.01	-	NR	NR	<0.01	-	IC	M
CHO_2^-	0.04	0.00	NR	NR	0.04	0.00	IC	M
Cl^-	<0.01	-	NR	NR	<0.01	-	IC	M
PO_4^{3-}	0.002	0.000	NR	NR	0.003	0.00	IC	M
SO_4^{2-}	0.02	0.00	NR	NR	0.02	0.00	IC	M
$C_2O_4^{2-}$	0.003	0.000	NR	NR	0.003	0.00	IC	M
Br^-	<0.01	-	NR	NR	<0.01	-	IC	M
CO_3^{2-}	0.32	0.05	NR	NR	0.35	0.00	TIC	M
Al	793	3.5	NR	NR	902	5.5	ICP-ES	mg/L
B	136	0.7	NR	NR	140.3	0.0	ICP-ES	mg/L
Ca	3.5	0.04	NR	NR	2.6	1.2	ICP-ES	mg/L
Cr	50.2	0.4	NR	NR	51	0.4	ICP-ES	mg/L
Fe	10.8	3.4	NR	NR	11.8	5.6	ICP-ES	mg/L
K	246	11.6	NR	NR	284.3	4.4	ICP-ES	mg/L
Li	66	0.7	NR	NR	67.6	1.2	ICP-ES	mg/L
Na	137,000	0.0	NR	NR	140,000	704.4	ICP-ES	mg/L
P	122	1.3	NR	NR	124.4	6.1	ICP-ES	mg/L
Si	136	1.9	NR	NR	130.1	9.0	ICP-ES	mg/L
Zn	3.9	0.5	NR	NR	4.1	0.3	ICP-ES	mg/L
Hg	297	15.8	238.1	14.0	233.2	22.7	CVAA-Hg	mg/L
Na	5.90	0.00	NR	NR	6.08	0.03	Calc.	M
Total cation	5.95	-	NR	NR	6.09	-	Calc.	M
Total anion	5.58	-	NR	NR	5.76	-	Calc.	M
								M
SpG 20 °C	1.22	0.01	1.22	0.01	1.22	0.01	Calc.	-

** The Pu-239 mass concentrations were calculated from the Pu-239/240 results, based on the assumption that all activity was due to Pu-239 (as opposed to Pu-240). Note that the ICP-MS results for Pu-239 were all below the minimum detection limits.
NR: Analytical measurements not requested.

To check the results, a cation-anion normality balance was performed. The normal concentrations of cations (mainly Na^+ and K^+) were summed, as were the anions (NO_3^-, NO_2^-, SO_4^{2-}, Cl^-, CO_3^{2-}, PO_4^{3-}, AlO_2^-, $C_2O_4^{2-}$ and free OH^-). The two sums were compared. Since only the surface samples (Tank 38H surface sample HTF-38-15-119, Tank 43H surface sample HTF-43-15-116) and Tank 43H variable depth sample HTF-43-15-118) were analyzed fully for both cations and anions the anion/cation comparisons were performed only for these three samples. For these comparisons, the primary contributing cations included Na^+ and K^+, while the primary contributing anions included hydroxide, nitrite, nitrate, carbonate, formate, sulfate, phosphate, oxalate, chloride, and aluminate.

For the Tank 38H surface sample the cations summed to 1.5 M, while the anions summed to 1.2 M. Thus, the anions summed to about 80% of the cations. For the Tank 43H surface sample the calculated cation and anions were 6.0 and 5.6, respectively. The anions summed to about 93.3 % of the cation value. Similarly, for the Tank 43H variable depth sample, Tank 43H Sub-Surface HTF-43-15-118, the calculated cation and anions were 6.1 and 5.8, respectively. The anions summed to about 95.1 % of the cation value.

The differences between the cation and anion molarity values are within ± 20% of each other, which is fairly good when one takes into consideration that the nominal uncertainties (1 sigma) for ICP-ES, IC and OH are about 20%. The differences can be attributed to analytical uncertainties.

Tables 5 through 19 in Appendices A-D contain all the analytical results for the characterization of Tanks 38H and 43H samples. These detail analyses results are grouped by the required programs (ECP and CCP) in separate sections of the tables. Results for ***Tank 38H surface and sub-surface supernates*** are summarized in Appendix A, Table 5 through Table 10, while Tables 11 through Table 14, Appendix B, contain the analyses results for ***Tank 43H surface sample.*** The analyses results for ***Tank 43H sub-surface supernate*** sample (Feed Pump suction sample) are presented in Appendix C, Tables 15 and 16, while the analyses results for ***Tank 43H subsurface*** supernate (Jet suction sample) are presented in Tables 17 through 19 in Appendix D.

5.0 Conclusions

The U-235 mass divided by the total uranium mass for the samples analyzed for uranium content (Tank 38H surface, Tank 38H subsurface, Tank 43H surface, and Tank 43H sub surface (Feed suction pump) averaged 8.20E-03 ± 4.12E-05, 6.22E-03 ± 2.89E-05, 6.27E-03 ± 5.03E-05, and 6.23E-03 ± 3.06E-05, respectively.

The average U-235 concentration in the Tank 38H samples ranged from 4.61E-01 to 5.37E-02 mg/L, and the U-238 concentration in the Tank 38H samples ranged from 6.50E+00 to 7.37E+01 mg/L. Similarly, U-235 concentrations in the Tank 43H samples averaged 4.30E-01 mg/L, and the U-238 concentration in the Tank 43H samples analyzed for uranium content ranged from 6.82E + 01 to 6.85E+01 mg/L. Thus, the U-235 to total uranium ratios in these tanks 38H and 43H samples are in line with the prior 2H-evaporator ECP samples.[a]

[a] C. J. Martino, "Analysis of Tank 38H (HTF-38-13-156, 157) and Tank 43H (HTF-43-13-158, 159) Samples for Support of the Enrichment Control and Corrosion Control Programs," SRNL-TR-2013-00205, Rev. 0, October 2013.

The calculated U-235 equivalent for all the samples analyzed (Tank 38H surface, Tank 38H subsurface, Tank 43H surface, Tank 43H sub surface (Feed suction pump) and Tank 43H subsurface sample (Jet suction sample)) are ≤ 1.0 wt%. This means that the evaporator system feed requirements, waste that has a U-235 equivalent enrichment of ≤ 5.5 wt% and a plutonium content of the fissionable elements of ≤ 2 wt%, are met.

The measured sodium and silicon concentrations averaged, respectively, 1.49 M and 34.5 mg/L in the Tank 38H surface sample. The measured sodium and silicon concentrations averaged, respectively, 5.90 M and 136 mg/L in the Tank 43H surface sample and 6.08 M and 130.1 mg/L in the Tank 43H subsurface (jet suction sample).

The measured aluminum and free-OH concentrations in Tank 38H surface sample averaged 0.047 M and 0.33 M, respectively. The measured aluminum and free-OH concentrations in Tank 43H surface sample averaged 0.029 M and 2.21 M, respectively, while these values were 0.033 M and 2.26M, respectively, for the Tank 43H subsurface jet suction sample.

The nitrate and nitrite concentrations in the Tank38H surface sample, Tank 43H surface sample and Tank 43H subsurface sample (jet suction sample) averaged 0.176 M, 0.404 M; 0.85 M, 1.78 M; and 0.87 M, 1.79 M, respectively. In general, the nitrate, nitrite and free-OH concentrations of the Tank 43H samples were all higher than those of the Tank 38H sample.

6.0 Quality Assurance

Data are recorded in SRNL Electronic Notebook: L5575-00080 SRNL Electronic Notebook (Production); SRNL, Aiken, SC 29808 (2014) and various AD notebooks contain the analytical/experimental data.

7.0 References

[i] D. A. Eghbali, "Nuclear Criticality Safety Evaluation: Operation of the 2H Evaporator System," N-NCS-H-00180, Rev. 0, September 2008.

[ii] H. Bui, "CSTF Evaporator Feed Qualification Program," WSRC-TR-2003-00055, Rev. 9, November 19, 2014.

[iii] K. B. Martin, "CSTF Corrosion Control Program," WSRC-TR-2002-00327, Rev. 8, July 22, 2014.

[iv] C. Duffey, "Enrichment Control Program Sample Analysis of Tanks 38 and 43," X-TTR-H-00028, Rev. 0, August 19, 2013.

[v] C. J. Martino, "Task Technical and Quality Assurance Plan for Analysis of Tank 38H and Tank 43H Enrichment Control Program and Corrosion Control Samples," SRNL-RP-2013-00522, Rev. 0, August 2013.

[vi] F.M. Pennebaker, C.J Coleman, M.A. Jones, W.R. Wilmarth, C.M. Jantzen and D.R. Click, "Evaluation of Warm Acid Strike Treatment for Silicon Analysis in High Level Waste," WSRC-TR-2003-00036, Rev. 0, March 20, 2003.

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Appendix A. Tank 38H Surface samples (HTF-38-15-119)

Table 5 Tank 38H Surface Sample HTF-38-15-119: ECP Results

Analytes	Analysis-1	Analysis-2	Analysis-3	Average	St. Deviation	Units
U-233	<4.42E-03	<4.46E-03	<4.39E-03	**<4.42E-03**	-	mg/L
U-234	<4.42E-03	<4.46E-03	<4.39E-03	**<4.42E-03**	-	mg/L
U-235	5.46E-02	5.38E-02	5.27E-02	**5.37E-02**	*9.70E-04*	mg/L
U-236	<4.42E-03	<4.46E-03	<4.39E-03	**<4.42E-03**	-	mg/L
U-238	6.57E+00	6.51E+00	6.41E+00	**6.50E+00**	*8.46E-02*	mg/L
U-Total	6.63E+00	6.56E+00	6.46E+00	**6.55E+00**	*8.56E-02*	mg/L
U-Enrichment	8.23E-03	8.20E-03	8.15E-03	**8.20E-03**	*4.12E-05*	-
Pu-239	8.64E-04	7.66E-04	7.49E-04	**7.93E-04**	6.23E-05	mg/L
Pu-241	<2.26E-06	<9.91E-07	<1.46E-06	**<1.57E-06**	-	mg/L

Table 6 Tank 38H Surface Sample HTF-38-15-119: CCP Results

Analytes	Analysis-1	Analysis-2	Analysis-3	Average	St. Deviation	Units
NO_3^-	1.78E-01	1.75E-01	1.75E-01	**1.76E-01**	*1.73E-03*	Mole/L
NO_2^-	4.12E-01	4.02E-01	3.99E-01	**4.04E-01**	*6.78E-03*	Mole/L
OH^{-1}	0.33	0.33	0.32	**0.33**	*0.005*	Molar
SpG @ 22 °C	1.05	1.05	1.05	**1.05**	*0.00*	-
Cs-137	1.24E+08	1.22E+08	1.26E+08	**1.24E+08**	*2.24E+06*	dpm/mL
Ba-137m	1.17E+08	1.15E+08	1.19E+08	**1.17E+08**	*2.12E+06*	dpm/mL
TC-99	3.99E+04	4.12E+04	3.86E+04	**3.99E+04**	*1.30E+03*	dpm/mL
I-129	<1.54E+01	<1.95E+01	<1.22E+01	**<1.57E+01**	-	dpm/mL

SpG = Specific gravity

Table 7 Tank 38H Surface Sample HTF-38-15-119: Other Results from ECP & CCP

Analytes	Analysis-1	Analysis-2	Analysis-3	Average	St. Deviation	Units
U-235/U-total *100	8.23E-01	8.20E-01	8.15E-01	**8.20E-01**	*4.12E-03*	%
Pu-238	2.54E-05	2.08E-05	2.31E-05	**2.31E-05**	*2.29E-06*	mg/L
Pu-239/240	1.19E+02	1.06E+02	1.03E+02	**1.09E+02**	*8.59E+00*	dpm/mL
Sr-90	2.12E+05	2.00E+05	2.02E+05	**2.05E+05**	*6.62E+03*	dpm/mL
SO_4^{2-}	7.22E-03	6.90E-03	6.79E-03	**6.97E-03**	*2.23E-04*	Mole/L
CHO_2^-	3.32E-03	3.22E-03	3.21E-03	**3.25E-03**	*6.33E-05*	Mole/L
Cl^-	<6.24E-03	<6.24E-03	<6.30E-03	**<6.26E-03**	-	Mole/L
F^-	<5.83E-03	<5.83E-03	<5.89E-03	**<5.85E-03**	-	Mole/L
PO_4^{3-}	<1.17E-03	<1.17E-03	<1.18E-03	**<1.17E-03**	-	Mole/L
$C_2O_4^{2-}$	3.98E-02	3.92E-02	3.89E-02	**3.93E-02**	*4.42E-04*	Mole/L
Br^-	<6.93E-03	<6.93E-03	<7.00E-03	**<6.95E-03**	-	Mole/L
Inorganic carbon	7.69E+05	7.73E+05	7.77E+05	**7.73E+05**	*3.82E+03*	µgC/L
Organic carbon	1.00E+06	1.00E+06	1.00E+06	**1.00E+06**	*6.35E+02*	µgC/L
Total carbon	1.77E+06	1.78E+06	1.78E+06	**1.78E+06**	*4.65E+03*	µgC/L
CO_3^{2-}	6.41E-02	6.44E-02	6.48E-02	**6.44E-02**	*3.18E-04*	M

Table 8 Tank 38H Surface Sample (HTF-38-15-119): Select Elemental Analysis Results

Analytes	Run 1	Run 2	Run 3	Average	Stedev.	Units
Al	1267	1252	1252	**1260**	*7.2*	mg/L
B	22.8	22.8	22.8	**22.8**	*0.0*	mg/L
Ca	6.7	6.3	4.6	**5.9**	*1.2*	mg/L
Cr	23.4	22.6	23.4	**23.2**	*0.5*	mg/L
Fe	5.8	4.4	6.6	**5.6**	*1.1*	mg/L
K	107	135	136	**126**	*16.6*	mg/L
Li	<21.1	<21.3	<21.2	**<21.2**	-	mg/L
Na	33976	34348	34720	**34348**	*372*	mg/L
P	<40.8	<40.9	<40.7	**<40.8**	-	mg/L
Si	57.2	16.2	30.0	**34.5**	*20.8*	mg/L
Zn	<1.5	<1.5	<1.5	**<1.5**	-	mg/L
Hg	164	157	165	**162**	*3.9*	mg/L

Table 9 Tank 38H Sub-Surface Sample HTF-38-15-127: ECP Results

Analytes	Analysis-1	Analysis-2	Analysis-3	Average	St. Deviation	Units
U-233	6.60E-03	5.89E-03	7.09E-03	**6.53E-03**	*6.02E-04*	mg/L
U-234	1.19E-02	1.19E-02	1.19E-02	**1.19E-02**	*3.81E-05*	mg/L
U-235	4.60E-01	4.64E-01	4.60E-01	**4.61E-01**	*2.23E-03*	mg/L
U-236	2.69E-02	2.72E-02	2.75E-02	**2.72E-02**	*3.08E-04*	mg/L
U-238	7.31E+01	7.42E+01	7.38E+01	**7.37E+01**	*5.70E-01*	mg/L
U-Total	7.36E+01	7.47E+01	7.44E+01	**7.42E+01**	*5.72E-01*	mg/L
U-Enrichment	6.25E-03	6.21E-03	6.19E-03	**6.22E-03**	*2.89E-05*	-
Pu-239	2.04E-03	1.58E-03	8.89E-04	**1.50E-03**	*5.80E-04*	mg/L
Pu-241	7.02E-06	6.05E-06	5.75E-06	**6.27E-06**	*6.67E-07*	mg/L
SpG @ 22 °C	1.23	1.24	1.25	**1.24**	*0.01*	-
Cs-137	1.28E+08	1.32E+08	1.31E+08	**1.30E+08**	*2.20E+06*	dpm/mL
Ba-137m	1.21E+08	1.25E+08	1.24E+08	**1.23E+08**	*2.08E+06*	dpm/mL

Table 10 Tank 38H Sub-Surface Sample HTF-38-15-127: Other Results from ECP

Analytes	Analysis-1	Analysis-2	Analysis-3	Average	St. Deviation	Units
U-235/U-total *100	6.25E-01	6.21E-01	6.19E-01	**6.22E-01**	*2.89E-03*	%
Pu-238	3.10E-04	2.79E-04	2.49E-04	**2.79E-04**	*3.08E-05*	mg/L
Pu-239/240	2.82E+02	2.18E+02	1.23E+02	**2.07E+02**	*8.01E+01*	dpm/mL
Sr-90	1.61E+06	1.12E+06	1.13E+06	**1.29E+06**	*2.77E+05*	dpm/mL

Appendix B. Tank 43H Surface Samples (HTF-43-15-116 Salt Batch Planning Sample)

Table 11 Tank 43H Surface Sample HTF-43-15-116: ECP Results

Analytes	Analysis-1	Analysis-2	Analysis-3	Average	St. Deviation	Units
U-233	6.36E-03	5.87E-03	6.25E-03	**6.16E-03**	*2.55E-04*	mg/L
U-234	1.13E-02	1.08E-02	1.08E-02	**1.10E-02**	*2.62E-04*	mg/L
U-235	4.34E-01	4.28E-01	4.29E-01	**4.30E-01**	*3.37E-03*	mg/L
U-236	2.52E-02	2.53E-02	2.51E-02	**2.52E-02**	*8.83E-05*	mg/L
U-238	6.82E+01	6.82E+01	6.82E+01	**6.82E+01**	*1.88E-02*	mg/L
U-Total	6.87E+01	6.87E+01	6.87E+01	**6.87E+01**	*1.55E-02*	mg/L
U-Enrichment	6.33E-03	6.23E-03	6.24E-03	**6.27E-03**	*5.03E-05*	-
Pu-239	2.09E-03	<8.68E-04	2.13E-03	**≤1.69E-03**	-	mg/L
Pu-241	<7.06E-06	<1.26E-05	<6.41E-06	**<8.70E-06**	-	mg/L

Table 12 Tank 43H Surface Sample HTF-43-15-116: CCP Results

Analytes	Analysis-1	Analysis-2	Analysis-3	Average	St. Deviation	Units
NO_3^-	0.86	0.84	0.86	**0.85**	*0.01*	Mole/L
NO_2^-	1.79	1.75	1.78	**1.78**	*0.02*	Mole/L
OH^{-1}	2.20	2.21	2.23	**2.21**	*0.02*	Molar
SpG @ 22 °C	1.22	1.22	1.22	**1.22**	*0.01*	-
Cs-137	1.12E+08	1.09E+08	1.11E+08	**1.11E+08**	*1.10E+06*	dpm/mL
Ba-137m	1.06E+08	1.04E+08	1.05E+08	**1.05E+08**	*1.04E+06*	dpm/mL
Tc-99	4.86E+04	5.14E+04	5.03E+04	**5.01E+04**	*1.41E+03*	dpm/mL
I-129	<6.10E+00	1.69E+01	7.97E+00	**≤1.03E+01**	-	dpm/mL

Table 13 Tank 43H Surface Sample HTF-43-15-116: Other Results from ECP & CCP

Analytes	Analysis-1	Analysis-2	Analysis-3	Average	St. Deviation	Units
U-235/U-total *100	6.33E-01	6.23E-01	6.24E-01	**6.27E-01**	5.03E-03	%
Pu-238	2.67E-04	3.27E-04	2.76E-04	**2.90E-04**	*3.24E-05*	mg/L
Pu-239/240	2.88E+02	<1.20E+02	2.93E+02	**≤2.34E+02**	-	dpm/mL
Sr-90	1.12E+06	8.43E+05	9.46E+05	**9.68E+05**	*1.38E+05*	dpm/mL
SO_4^{2-}	0.02	0.02	0.02	**0.02**	*0.00*	Mole/L
CHO_2^-	0.04	0.04	0.04	**0.04**	*0.00*	Mole/L
Cl^-	<0.01	<0.01	<0.01	**<0.01**	-	Mole/L
F^-	<0.01	<0.01	<0.01	**<0.01**	-	Mole/L
PO_4^{3-}	0.002	0.002	0.002	**0.002**	*0.000*	Mole/L
$C_2O_4^{2-}$	0.003	0.003	0.003	**0.003**	*0.000*	Mole/L
Br^-	<0.01	<0.01	<0.01	**<0.01**	-	Mole/L
Inorganic carbon	4.17E+06	4.11E+06	3.07E+06	**3.79E+06**	*6.16E+05*	µgC/L
Organic carbon	6.07E+05	6.06E+05	6.03E+05	**6.05E+05**	*1.67E+03*	µgC/L
Total carbon	4.78E+06	4.72E+06	4.78E+06	**4.76E+06**	*3.38E+04*	µgC/L
Carbonate, CO_3^{2-}	3.47E-01	3.43E-01	2.56E-01	**3.15E-01**	*5.13E-02*	M

Table 14 Tank 43 Surface Sample (HTF-15-116): Select Elemental Analysis Results

Analytes	Run 1	Run 2	Run 3	Average	Stedev.	Units
Al	797	791	791	**793**	*3.5*	mg/L
B	137	135	135	**136**	*0.7*	mg/L
Ca	3.5	3.5	3.5	**3.5**	*0.04*	mg/L
Cr	51	50	50	**50**	*0.4*	mg/L
Fe	10.0	14.5	7.8	**10.8**	*3.4*	mg/L
K	233	253	254	**246**	*11.6*	mg/L
Li	67	65	67	**66**	*0.7*	mg/L
Na	137000	137000	137000	**137000**	*0.0*	mg/L
P	123	121	122	**122**	*1.3*	mg/L
Si	135.4	137.9	134.2	**135.8**	*1.9*	mg/L
Zn	4.4	4.0	3.4	**3.9**	*0.5*	mg/L
Hg	291	315	286	**297**	*15.8*	mg/L

Appendix C. Tank 43H Sub-Surface samples (HTF-38-15-117): Feed Pump Suction Sample

Table 15 Tank 43H Sub-Surface Sample HTF-43-15-117: ECP Results

Analytes	Analysis-1	Analysis-2	Analysis-3	Average	St. Deviation	Units
U-233	6.07E-03	6.33E-03	5.93E-03	**6.11E-03**	*2.04E-04*	mg/L
U-234	1.12E-02	1.12E-02	1.08E-02	**1.10E-02**	*2.14E-04*	mg/L
U-235	4.30E-01	4.31E-01	4.29E-01	**4.30E-01**	*8.32E-04*	mg/L
U-236	2.61E-02	2.53E-02	2.49E-02	**2.54E-02**	*6.14E-04*	mg/L
U-238	6.83E+01	6.90E+01	6.81E+01	**6.85E+01**	*4.51E-01*	mg/L
U-Total	6.88E+01	6.95E+01	6.86E+01	**6.90E+01**	*4.52E-01*	mg/L
U-Enrichment	6.25E-03	6.20E-03	6.25E-03	**6.23E-03**	*3.06E-05*	-
Pu-239	1.92E-03	1.91E-03	7.00E-04	**1.51E-03**	*7.01E-04*	mg/L
Pu-241	<5.95E-06	<4.92E-07	<5.47E-06	**<3.97E-06**	-	mg/L

Table 16 Tank 43H Sub-Surface Sample HTF-43-15-117: Other Results from ECP & CCP

Analytes	Analysis-1	Analysis-2	Analysis-3	Average	St. Deviation	Units
U-235/U-total*100	6.25E-01	6.20E-01	6.25E-01	**6.23E-01**	*3.06E-03*	%
Pu-238	2.79E-04	2.50E-04	2.44E-04	**2.58E-04**	*1.89E-05*	mg/L
Pu-239/240	2.64E+02	2.64E+02	9.65E+01	**2.08E+02**	*9.67E+01*	dpm/mL
Cs-137	1.13E+08	1.10E+08	1.09E+08	**1.11E+08**	*2.18E+06*	dpm/mL
Ba-137m	1.07E+08	1.04E+08	1.03E+08	**1.05E+08**	*2.06E+06*	dpm/mL
SpG @ 22 °C	1.21	1.22	1.21	**1.22**	*0.01*	-
Hg	249	243	222	**238**	*14.0*	mg/L

Appendix D. Tank 43H Sub-Surface samples (HTF-43-15-118): Jet Suction Sample

Table 17 Tank 43H Sub-Surface Sample HTF-43-15-118: CCP Results

Analytes	Analysis-1	Analysis-2	Analysis-3	Average	St. Deviation	Units
NO_3^-	0.89	0.87	0.87	**0.87**	*0.01*	Mole/L
NO_2^-	1.81	1.78	1.77	**1.79**	*0.02*	Mole/L
OH^{-1}	2.22	2.26	2.30	**2.26**	*0.04*	Molar
SpG @ 22 °C	1.22	1.21	1.23	**1.22**	*0.01*	--
Cs-137	1.16E+08	1.12E+08	1.11E+08	**1.13E+08**	*2.34E+06*	dpm/mL
Ba-137m	1.09E+08	1.06E+08	1.05E+08	**1.07E+08**	*2.22E+06*	dpm/mL
Tc-99	4.47E+04	4.37E+04	4.65E+04	**4.50E+04**	*1.42E+03*	dpm/mL
I-129	<1.07E+01	<2.27E+01	1.13E+01	**≤1.49E+01**	-	dpm/mL
Sr-90	1.01E+06	8.03E+05	1.04E+06	**9.53E+05**	*1.31E+05*	dpm/mL

Table 18 Tank 43H Sub-Surface Sample (HTF-43-15-118): Select Elemental Analysis Results

Analytes	Run 1	Run 2	Run 3	Average	Stedev.	Units
Al	902	908	897	**902**	*5.5*	mg/L
B	140	140	140	**140**	*0.0*	mg/L
Ca	1.77	3.93	2.1	**2.6**	*1.2*	mg/L
Cr	50.5	51.1	51.2	**51**	*0.4*	mg/L
Fe	7.7	18.2	9.5	**11.8**	*5.6*	mg/L
K	281	283	289	**284**	*4.4*	mg/L
Li	67.7	66.4	68.8	**67.6**	*1.2*	mg/L
Na	140300	140300	139000	**140000**	*704*	mg/L
P	131	124	118	**124**	*6.10*	mg/L
Si	123	127	140	**130**	*9.0*	mg/L
Zn	4.44	4.00	3.77	**4.07**	*0.3*	mg/L
Hg	2586	214	227	**233**	*23*	mg/L

Table 19 Tank 43H Sub-Surface Sample HTF-43-15-118: Other Results from ECP & CCP

Analytes	Analysis-1	Analysis-2	Analysis-3	Average	St. Deviation	Units
SO_4^{2-}	0.015	0.016	0.015	**0.02**	*0.00*	Mole/L
CHO_2^-	0.04	0.04	0.04	**0.04**	*0.00*	Mole/L
Cl^-	<6.13E-03	<6.12E-03	<6.19E-03	**<6.15E-03**	-	Mole/L
F^-	<5.72E-03	<5.72E-03	<5.78E-03	**<5.74E-03**	-	Mole/L
PO_4^{3-}	0.003	0.003	0.002	**0.003**	*0.00*	Mole/L
$C_2O_4^{2-}$	0.003	0.003	0.003	**0.003**	*0.00*	Mole/L
Br^-	<6.81E-03	<6.80E-03	<6.87E-03	**<6.83E-03**		Mole/L
Inorganic carbon	4.25E+06	4.20E+06	4.24E+06	**4.23E+06**	*2.61E+04*	µgC/L
Organic carbon	6.16E+05	6.15E+05	6.13E+05	**6.15E+05**	*1.66E+03*	µgC/L
Total carbon	4.86E+06	4.81E+06	4.85E+06	**4.84E+06**	*2.62E+04*	µgC/L
Carbonate, CO_3^{2-}	0.35	0.35	0.35	**0.35**	*0.00*	M

Distribution:

T. B. Brown, 773-A
M. E. Cercy, 773-42A
D. A. Crowley, 773-43A
D. E. Dooley, 773-A
A. P. Fellinger. 773-42A
S. D. Fink, 773-A
C. C. Herman, 773-A
M. S. Hay,773-42A
D. T. Hobbs, 773-A
E. N. Hoffman, 999-W
J. E. Hyatt, 773-A
K. M. Kostelnik, 773-42A
B. B. Looney, 773-42A
D. A. McGuire, 773-42A
T. O. Oliver, 773-42A
F. M. Pennebaker, 773-42A
G. N. Smoland, 773-42A
A. L. Washington, II, 773-42A
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