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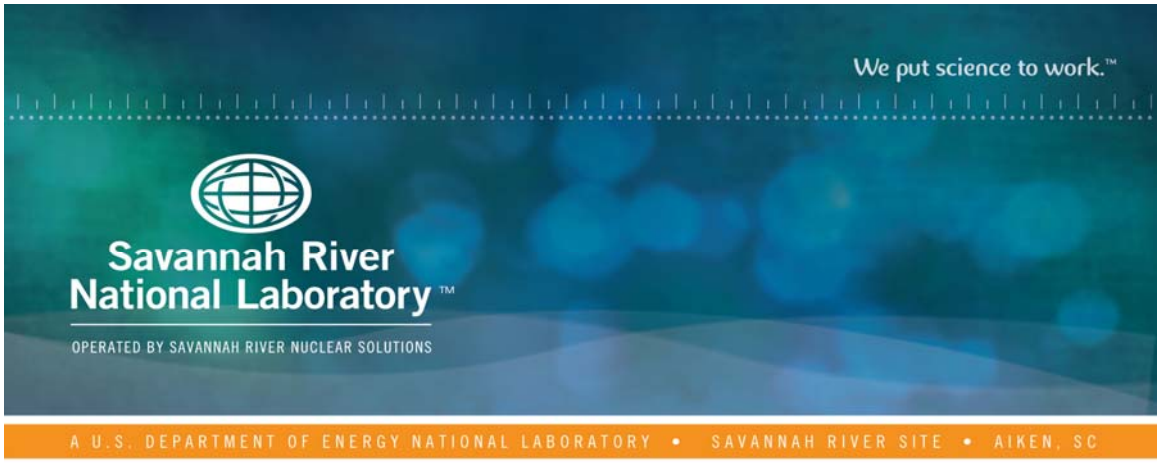

Analysis of Tank 51H (HTF-51-15-77) Subsurface Supernatant Sample in Support of Enrichment and Corrosion Control Programs

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EXECUTIVE SUMMARY

This report provides the results of analyses on Tank 51H subsurface supernatant liquid sample in support of the Enrichment Control Program (ECP) and the Corrosion Control Program (CCP). The purpose of the ECP sample taken from Tank 51H in early June was to determine if the later decants would be "acceptable feed" to the 2H and 3H evaporator systems.

The U-235 mass divided by the total uranium mass averaged 1.46E-0 ± *3.66E-05* (1.46E+00 ± *3.66E-03* % uranium enrichment) for the Tank 51 H subsurface samples. The U-235 concentration in the Tank 51H variable depth sample averaged 7.85E-02 ± 1.21E-03 mg/L , while the U-238 concentration in Tank 51H sample averaged 5.30E+00 ± *7.72E-02* mg/L. The total uranium concentration in the Tank 51H sample averaged 5.39E+00 ± *7.84E-02* mg/L. Thus, the U-235/total uranium ratio (1.46E-02 ± *3.66E-05*) in Tank 51H subsurface sample is not in line with the prior 2H evaporator ECP samples, although the calculated U-235 equivalent is 1.6 wt%, which meets the Evaporator system feed requirements.

The measured sodium and silicon concentrations averaged, respectively, 2.76 M and 37.5 mg/L in the Tank 51H subsurface sample, while the measured aluminum and free-OH concentrations in Tanks 51H subsurface sample averaged 0.19 M and 1.00 M, respectively.

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LIST OF ABBREVIATIONS

AD	Analytical development
CCP	Corrosion Control Program
DWPF	Defense Waste processing Facility
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
TIC	Total Inorganic Carbon
TTQAP	Task Technical and Quality Assurance Plan

1.0 Introduction

Barriers have been established to ensure that a nuclear criticality for the 2H and 3H Evaporators[i] remains incredible. The barriers include the Enrichment Control Program (ECP), which requires sampling to determine the equivalent enriched uranium prior to transfer of waste other than recycle transfers.[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 June 2015, Savannah River Remediation (SRR) collected a depth supernatant liquid sample (subsurface sample) from a location in the Tank 51H bottom. This CCP and ECP sample is requested to support the transfer of the Tank 51H supernate to the 2H or 3H Evaporator system. Since Tank 51H is a well-mixed sludge batch preparation tank, a single sample depth is sufficient for ECP analysis.

Tank 51 is the sludge batch preparation tank currently storing Sludge Batch 9. Typically, sludge batch decant washes are sent to the 3H Evaporator system; however, there has been a desire to share some of the inventory load with the 2H Evaporator system, which is anticipated to run out of feed in the next couple of months due to DWPF being down for an extended period of time. The purpose of the ECP sample taken from Tank 51 in early June was to determine if the later decants would be "acceptable feed" (waste that has a U-235 (eq) enrichment of ≤ 5.5 wt% and a plutonium content of the fissionable elements of ≤ 2 wt%.) for the 2H Evaporator System. Tank 51 was decanted down to 71.47" on 7/13/15 and is currently undergoing a wash with ~200,000 gallons of inhibited water. If the data supports this effort, the plan would be to send the next decant (Decant L) to the 3H evaporator, wash the heel with another ~200,000 gallons of inhibited waster (IW) and then send Decant M to the 2H evaporator system (around the end of August). In other words, the sample would represent Tank 51H prior to ~400,000 gallons of washing.

As summarized in Table 1, the Tank 51H supernatant sample was delivered to the Savannah River National Laboratory (SRNL) in June 2015 for analyses to support the ECP and CCP. The Tank 51H subsurface sample was identified as HTF-51-15-77 and was collected at a depth of 95 inches from the tank bottom.

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 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.

2.0 Experimental

Analysis for the ECP and CCP was performed on the Tank 51H subsurface sample. The ECP and CCP analyses requirements for the Tank 51H slurry supernatant sample are summarized in Table 1. The ECP analysis includes inductively-coupled plasma-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 the 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 the IC and titration analyses was by dilution with de-ionized water. 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.

Analysis for mercury, although not requested by the customer, is required for residual waste disposal purposes. Aliquots of ten-fold diluted unfiltered original samples were submitted to AD for mercury analysis by CV Hg digestion method. 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 CVHg analysis (See SRNL AD procedure for mercury analysis).

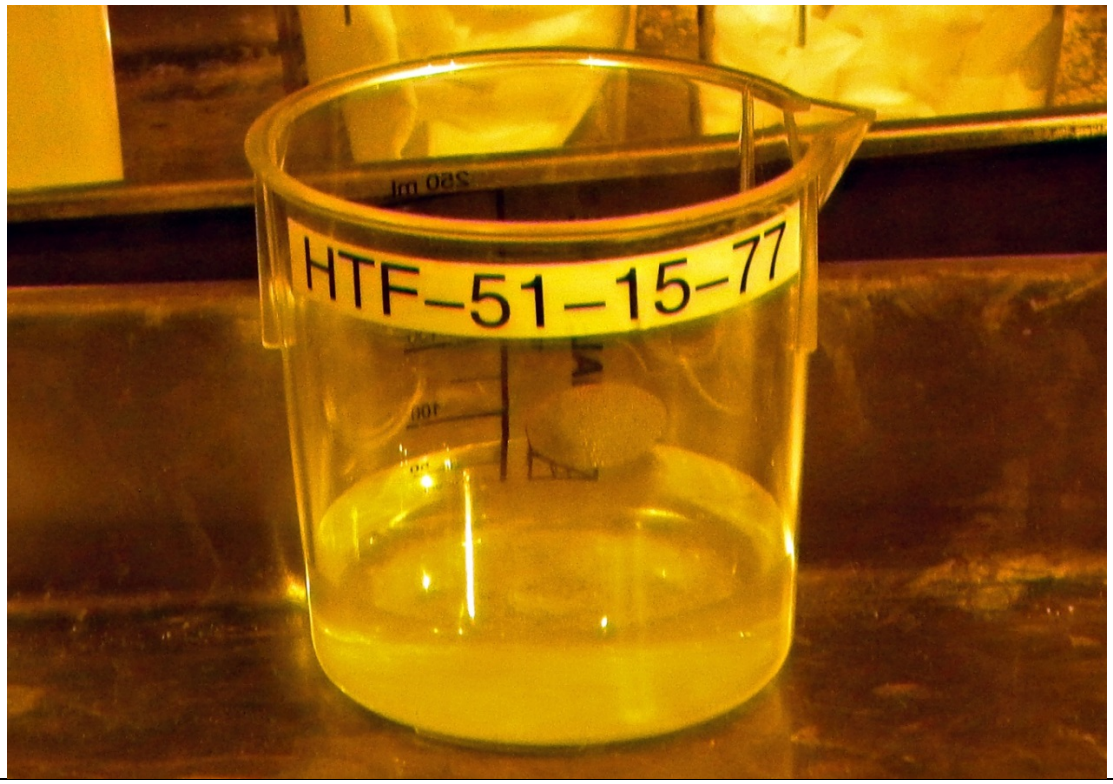
All analyses were performed and reported in triplicate as shown in appendix A and the averages and standard deviations are presented in Table 3.

Table 1 Tanks 51H Sample Delivery Dates and Analysis Suite Summary.

Sample	Sample ID	Description	Date at SRNL	Date put in shielded cell
Tank 51H subsurface	HTF-51-15-77	Tank 51H depth sample was collected at a depth of 95 inches from the Tank 51H bottom.	6/04/2015	6/18/2015
ECP + CCP Sample location		**Analysis Suite summary**		
Tank 51H depth sample		ECP + CCP		

Table 2 General Supernate Sample Description (As-received) for Tanks 51H Sample

Tank Sample ID	Sample location	Approx. Volume, mL	Mass, g	Clarity of supernate
HTF-51H-15-77	Tank 51H depth sample	70	88.572	Clear supernate without visible settled solids



Tank 51H subsurface (variable depth) supernate sample

Figure 1 Tank 51H Subsurface Supernate Sample (HTF-51-15-77)

3.0 Analytical Results

Table 2 contains a description of the sampling location and the quantity of material received for the "as-received" Tank 51H subsurface sample. As shown in Figure 1, the sample was essentially free of any visible settled insoluble solids. This Tank 51H sample (HTF-51-15-77) was relatively clear with slightly hazy and cloudy appearance. In general, the visual appearance of these samples was consistent with supernatant liquid containing <1 wt. % insoluble solids.

Table 3 contains a summary of the ECP/CCP analytical results for the Tank 51H subsurface sample. This summary includes only the average values for the analytes and the standard deviation for each analysis in triplicate. However, analyses for select cations for Tank 51H samples, which were not requested by the customer, are also reported and were performed to support the cation/anion balance only.

Results for the analytes that were below the limits of quantification are preceded by "<" and values proceeded by "≤" (less than or equal to sign) indicate that for replicates, at least one of the analytical results was above the instrument detection limit and at least one of the analytical results was below the detection limit or was an upper limit. Thus, where replicate analyses gave values 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 standard deviations were calculated only for values that were all above the detection limits. The three individual determinations of the triplicate preparations and measurements are reported along with the average values and the standard deviations.

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 the concentration of this fissile isotope. All measurements reported for U-233 and U-234 for Tank 51H sample are below the ICP-MS detection limit. However, the uranium enrichment calculations are based on U-total; where U-total includes the masses of uranium isotopes U-233-U-238 (includes U-233 and U-234 data which were below detection limit).

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. 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 51H subsurface sample the cations summed to 2.77 M, while the anions summed to 2.64 M. The differences between the cation and anion molarity values are within ± 10% of each other, which is fairly good when one takes into consideration the nominal uncertainties (1 sigma) for methods. The difference can be attributed to the analytical uncertainties.

Tables 5 through 8 in Appendix A contain all the analytical results for the characterization of Tank 51H subsurface sample. These detailed analyses results are grouped by the required programs (ECP and CCP) in separate sections of the tables. Table 7 contains the results for the additional analytes which were measured by the same group of methods but were not required by any of the major programs.

Since the expected goal is the transfer of the current Tank 51H supernate to the 2H Evaporator system, a summary of the principal cation/anion analytical results for Tank 51H at various times including the projected analytical results for Tank 51H is presented in Table 4. The Tank 51H analytical results from this report are compared with those from F and H laboratory analysis, Tank 51H analysis results from about a year ago[a] , Tank 22H (Tank 22H is the typical fresh feed source to Tank 43H) and those from projected analysis results for Tank 51H[b]. The analytical results all seem comparable for these various periods of analysis as summarized in Table 4.

The U-235 concentration in the Tank 51H variable depth sample averaged 7.85E-02 ± 1.21E-03 mg/L, while the U-238 concentrations in Tank 51H sample averaged 5.30E+00 ± *7.72E-02* mg/L. The total uranium concentration in the Tank 51H sample averaged 5.39E+00 ± *7.84E-02* mg/L. Thus, the U-235/total uranium ratio (1.46E-02 ± *3.66E-05*) in Tank 51H subsurface sample is not in line with the prior 2H evaporator ECP samples[c].

However, based on the uranium, Pu-241 and Pu-239 concentrations, the calculated U-235 equivalent[d] [(([U-235] + 1.4*[U-233] + 2.25*([Pu-241] + [Pu-239]))/[total uranium])*100] is 1.6 wt%. 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

[a] J. M. Pareizs, "Analytical Results of the Tank 51H Pre-Sludge Batch 9 Samples (HTF-51-14-77)". SRNL-L3100-2014-00167, Rev 1, July 28, 2014.

[b] J. M. Gillam, "Sludge Batch 9 Washing Projections", MS Excel file SB9_072115.xlsm, Savannah River Remediation; Columns GO to GQ and GN

[c] 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.

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

wt%, is already met, even without the washing and transfer of over 400,000 gallons of wash water decant from Tank 51H to any of the Evaporator systems.

Table 3 ECP and CCP Analytical Data for Tanks 51H subsurface Supernate Sample.

Analytes	Tank 51H Sub-Surface HTF-51-15-77		Methods	Units
	Average	Stdev.		
U-233	**<2.17E-03**	-	ICP-MS	mg/L
U-234	**<2.17E-03**	-	ICP-MS	mg/L
U-235	**7.85E-02**	*1.21E-03*	ICP-MS	mg/L
U-236	**4.16E-03**	*7.74E-05*	ICP-MS	mg/L
U-238	**5.30E+00**	*7.72E-02*	ICP-MS	mg/L
Total U	**5.39E+00**	*7.84E-02*	ICP-MS	mg/L
U-235/U-total	**1.46E-02**	*3.66E-05*	Calc.	%
Pu-238	**6.65E-05**	*4.99E-06*	PuTTA	mg/L
Pu-239**	**1.92E-03**	*1.33E-04*	PuTTA	mg/L
Pu-239/240	**2.65E+02**	*1.83E+01*	PuTTA	dpm/mL
Pu-241	**<7.62E-06**	-	Pu-238/241	mg/L
Cs-137	**6.17E+08**	*1.15E+07*	gamma scan	dpm/mL
Ba-137m	**5.84E+08**	*1.08E+07*	gamma scan	dpm/mL
Sr-90	**1.47E+05**	*5.21E+03*	Sr-90	dpm/mL
Tc-99	**1.67E+05**	*2.46E+03*	Tc-99	dpm/mL
OH^-	**1.00E+00**	*6.82E-03*	Titration	M
NO_2^-	**5.03E-01**	*2.64E-03*	IC	M
NO_3^-	**5.90E-01**	*3.14E-03*	IC	M
F^-	**<5.78E-03**	-	IC	M
CHO_2^-	**<2.44E-03**	-	IC	M
Cl^-	**<3.10E-03**	-	IC	M
PO_4^{3-}	**<1.16E-03**	-	IC	M
SO_4^{2-}	**2.81E-02**	*1.45E-04*	IC	M
$C_2O_4^{2-}$	**2.08E-02**	*1.76E-04*	IC	M
Br^-	**<1.38E-03**	-	IC	M
CO_3^{2-}	**1.25E-01**	*1.51E-03*	TIC	M
Al	**5.11E+03**	*1.89E+01*	ICP-ES	mg/L
B	**5.03E+01**	*3.26E-01*	ICP-ES	mg/L
Ca	**2.91E+00**	*2.02E-01*	ICP-ES	mg/L
Cr	**6.91E+01**	*1.61E+00*	ICP-ES	mg/L
Cu	**8.47E-01**	*3.26E-02*	ICP-ES	mg/L
Fe	**1.93E+01**	*9.32E+00*	ICP-ES	mg/L
K	**5.36E+02**	*1.72E+01*	ICP-ES	mg/L
Mg	**3.32E-01**	*4.68E-03*	ICP-ES	mg/L
Mo	**3.56E+01**	*5.67E-01*	ICP-ES	mg/L
Na	**6.34E+04**	*2.52E+02*	ICP-ES	mg/L
P	**5.51E+01**	*4.64E-01*	ICP-ES	mg/L
Pb	**≤3.31E+00**		ICP-ES	mg/L
S	**9.72E+02**	*4.70E+01*	ICP-ES	mg/L
Si	**3.75E+01**	*6.50E-01*	ICP-ES	mg/L
Ti	**1.62E-01**	*1.33E-02*	ICP-ES	mg/L
U	**<1.99E+01**	-	ICP-ES	mg/L
Zn	**1.53E+00**	*7.15E-02*	ICP-ES	mg/L
Hg	**2.93E+02**	*3.41E+01*	CVAA-Hg	mg/L
Total cation	**2.77E+00**		Calc.	M
Total anion	**2.64E+00**		Calc.	
SpG @ 33 °C	**1.12**	*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 result for Pu-239 was below the minimum detection limits.

Table 4 Comparison of analytical results for Tank 51H at various times (units in M)

Analyte (Moles)	SRNL-August 2015 analyses-Tank 51H	SRNL July 2014 Analyses-Tank 51H	*F&H Lab Analyses-Tank 51H	Projected Analysis Results for Tank 51H	SRNL-September 2014 analyses-Tank 22H**
Na^+	2.76	-	2.69	2.69	2.68
NO_2^-	0.5	0.492	0.56	0.55	0.488
NO_3^-	0.59	0.59	0.58	0.61	0.567
OH^-	1	0.982	1.08	1.02	0.862
Cl^-	<3.10	0.029	0.004	0.004	<3.1E-03
SO_4^{2-}	0.028	0.03	0.031	0.031	0.026
F^-	<0.006	<0.011	0.003	0.003	<5.8E-03
CO_3^{2-}	0.125	0.123	0.13	0.13	0.104
Al^{3+}	0.19	-	0.176	0.176	0.180
$C_2O_4^{2-}$	0.028	0.018	0.027	0.027	0.016
PO_4^{3-}	<0.0012	<0.002	0.002	0.002	0.0013
K^+	0.014	-	0.014	0.014	0.013
Specific gravity	1.12	-	1.11	1.113	1.12

*Sample HTF-51-15-43, sampled: 20-April-2015

** J. M. Pareizs, "Characterization of Samples HTF-22-12-72and 73" SRNL-STI-2014-00380, Rev. 0, Sept. 2014 (Data left in original source number of significant figures).

4.0 Conclusions

The U-235 mass divided by the total uranium mass averaged 1.46E-02 ± *3.66E-05* (1.46E+00 ± *3.66E-03* % uranium enrichment) for the Tank 51H subsurface samples. The U-235 concentration in the Tank 51H variable depth sample averaged 7.85E-02 ± 1.21E-03 mg/L , while the U-238 concentration in Tank 51H sample averaged 5.30E+00 ± *7.72E-02* mg/L. The total uranium concentration in the Tank 51H sample averaged 5.39E+00 ± *7.84E-02* mg/L. Thus, the U-235/total uranium ratio (1.46E-02 ± *3.66E-05*) in Tank 51H subsurface sample is not in line with the prior 2H evaporator ECP samples, although the calculated U-235 equivalent is 1.6 wt%, which meets the Evaporator system feed requirements.

The measured sodium and silicon concentrations averaged, respectively, 2.76 M and 37.5 mg/L in the Tank 51H subsurface sample, while the measured aluminum and free-OH concentrations in Tanks 51H subsurface sample averaged 0.19 M and 1.00 M, respectively.

5.0 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.

6.0 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] H. Bui, "Tank 51 Enrichment Sample Analysis," X-TTR-H-00058, Rev. 0, June 02, 2015.

[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.

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Appendix A. Tank 51H Sub-Surface Sample (HTF-51-15-77)

Table 5 Tank 51H Sub-Surface Sample HTF-51-15-77: ECP Results

Analytes	Analysis-1	Analysis-2	Analysis-3	Average	St. Deviation	Units
U-233	<2.20E-03	<2.12E-03	<2.18E-03	**<2.17E-03**		mg/L
U-234	<2.20E-03	<2.12E-03	<2.18E-03	**<2.17E-03**		mg/L
U-235	7.99E-02	7.80E-02	7.76E-02	**7.85E-02**	*1.21E-03*	mg/L
U-236	4.10E-03	4.13E-03	4.25E-03	**4.16E-03**	*7.74E-05*	mg/L
U-238	5.39E+00	5.29E+00	5.24E+00	**5.30E+00**	*7.72E-02*	mg/L
U-Total	5.48E+00	5.37E+00	5.32E+00	**5.39E+00**	*7.84E-02*	mg/L
U-Enrichment	1.46E+00	1.45E+00	1.46E+00	**1.46E+00**	*3.66E-03*	%
Pu-239	1.88E-03	2.06E-03	1.81E-03	**1.92E-03**	*1.33E-04*	mg/L
Pu-241	<7.23E-06	<8.11E-06	<7.52E-06	**<7.62E-06**		mg/L

Table 6 Tank 51H Sub-Surface Sample HTF-51-15-77: CCP Results

Analytes	Analysis-1	Analysis-2	Analysis-3	Average	St. Deviation	Units
NO_3^-	5.87E-01	5.90E-01	5.93E-01	**5.90E-01**	*3.14E-03*	Mole/L
NO_2^-	5.02E-01	5.06E-01	5.02E-01	**5.03E-01**	*2.64E-03*	Mole/L
OH^-	1.01E+00	1.00E+00	1.01E+00	**1.00E+00**	*6.82E-03*	Molar
SpG @ 33 °C	1.12	1.12	1.13	**1.12**	*0.01*	-
Cs-137	6.23E+08	6.25E+08	6.04E+08	**6.17E+08**	*1.15E+07*	dpm/mL
Ba-137m	5.89E+08	5.92E+08	5.72E+08	**5.84E+08**	*1.08E+07*	dpm/mL

SpG = Specific gravity

Table 7 Tank 51H Sub-Surface Sample HTF-51-15-77: Other Results from ECP & CCP

Analytes	Analysis-1	Analysis-2	Analysis-3	Average	St. Deviation	Units
U-235/U-total	1.46E-02	1.45E-02	1.46E-02	**1.46E-02**	*3.66E-05*	
Pu-238	6.98E-05	6.90E-05	6.08E-05	**6.65E-05**	*4.99E-06*	mg/L
Th-232	2.20E-02	1.52E-02	1.43E-02	**1.72E-02**	*4.25E-03*	mg/L
Tc-99	1.70E+05	1.65E+05	1.66E+05	**1.67E+05**	*2.46E+03*	dpm/mL
Pu-239/240	2.60E+02	2.85E+02	2.49E+02	**2.65E+02**	*1.83E+01*	dpm/mL
Sr-90	1.49E+05	1.50E+05	1.41E+05	**1.47E+05**	*5.21E+03*	dpm/mL
SO_4^{2-}	2.80E-02	2.82E-02	2.81E-02	**2.81E-02**	*1.45E-04*	Mole/L
CHO_2^-	<2.47E-03	<2.44E-03	<2.42E-03	**<2.44E-03**	-	Mole/L
Cl^-	<3.13E-03	<3.09E-03	<3.07E-03	**<3.10E-03**	-	Mole/L
F^-	<5.84E-03	<5.78E-03	<5.73E-03	**<5.78E-03**	-	Mole/L
PO_4^{3-}	<1.17E-03	<1.16E-03	<1.15E-03	**<1.16E-03**	-	Mole/L
$C_2O_4^{2-}$	2.07E-02	2.10E-02	2.07E-02	**2.08E-02**	*1.76E-04*	Mole/L
Br^-	<1.39E-03	<1.37E-03	<1.36E-03	**<1.38E-03**		Mole/L
Inorganic carbon	1.52E+06	1.48E+06	1.49E+06	**1.50E+06**	*1.81E+04*	µgC/L
Organic carbon	9.36E+05	9.41E+05	9.50E+05	**9.42E+05**	*7.37E+03*	µgC/L
Total carbon	2.45E+06	2.42E+06	2.44E+06	**2.44E+06**	*1.64E+04*	µgC/L
CO_3^{2-}	1.26E-01	1.23E-01	1.25E-01	**1.25E-01**	*1.51E-03*	M

Table 8 Tank 51H Sub-Surface Sample HTF-51-15-77: Select Elemental Analysis Results

Analytes	Analysis-1	Analysis-2	Analysis-3	Average	St. Deviation	Units
Al	5.13E+03	5.12E+03	5.09E+03	**5.11E+03**	*1.89E+01*	mg/L
B	4.99E+01	5.03E+01	5.06E+01	**5.03E+01**	*3.26E-01*	mg/L
Ca	3.14E+00	2.77E+00	2.82E+00	**2.91E+00**	*2.02E-01*	mg/L
Cr	6.74E+01	7.06E+01	6.94E+01	**6.91E+01**	*1.61E+00*	mg/L
Cu	8.56E-01	8.11E-01	8.74E-01	**8.47E-01**	*3.26E-02*	mg/L
Fe	1.39E+01	1.40E+01	3.01E+01	**1.93E+01**	*9.32E+00*	mg/L
K	5.17E+02	5.39E+02	5.51E+02	**5.36E+02**	*1.72E+01*	mg/L
Mg	3.30E-01	3.29E-01	3.37E-01	**3.32E-01**	*4.68E-03*	mg/L
Mo	3.49E+01	3.58E+01	3.60E+01	**3.56E+01**	*5.67E-01*	mg/L
Na	6.37E+04	6.34E+04	6.32E+04	**6.34E+04**	*2.52E+02*	mg/L
P	5.46E+01	5.51E+01	5.55E+01	**5.51E+01**	*4.64E-01*	mg/L
Pb	3.44E+00	<3.23E+00	3.26E+00	**≤3.31E+00**		mg/L
S	9.72E+02	1.02E+03	9.25E+02	**9.72E+02**	*4.70E+01*	mg/L
Si	3.78E+01	3.67E+01	3.78E+01	**3.75E+01**	*6.50E-01*	mg/L
Ti	1.51E-01	1.59E-01	1.77E-01	**1.62E-01**	*1.33E-02*	mg/L
U	<2.01E+01	<1.97E+01	1.99E+01	**<1.99E+01**	-	mg/L
Zn	1.59E+00	1.54E+00	1.45E+00	**1.53E+00**	*7.15E-02*	mg/L
Hg	2.61E+02	3.29E+02	2.89E+02	**2.93E+02**	*3.41E+01*	mg/L

Distribution:

A. P. Fellinger. 773-42A
T. B. Brown, 773-A
D. H. McGuire, 999-W
S. D. Fink, 773-A
E. N. Hoffman, 999-W
F. M. Pennebaker, 773-42A
W. R. Wilmarth, 773-A
T. B. Peters, 773-42A
C. J. Martino, 999-W Room 390
Records Administration (EDWS)
K. B. Martin, 707-7E Room 10
C. B. Sherburne, 707-7E Room 1