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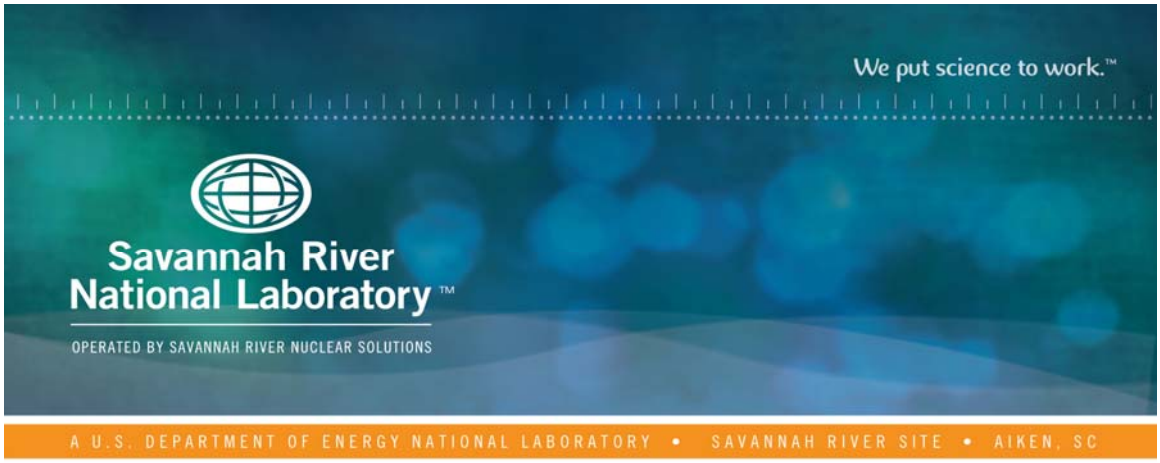

Analysis of Tank 13H (HTF-13-14-156, 157) Surface and Subsurface Supernatant Samples in Support of Enrichment Control, Corrosion Control and Sodium Aluminosilicate Formation Potential Programs

L. N. Oji

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EXECUTIVE SUMMARY

The 2H Evaporator system includes mainly Tank 43H (feed tank) and Tank 38H (drop tank) with Tank 22H acting as the DWPF recycle receipt tank. The Tank 13H is being characterized to ensure that it can be transferred to the 2H evaporator. This report provides the results of analyses on Tanks 13H ***surface*** and ***subsurface*** supernatant liquid samples to ensure compliance with the Enrichment Control Program (ECP), the Corrosion Control Program and Sodium Aluminosilicate Formation Potential in the Evaporator.

The U-235 mass divided by the total uranium averaged 0.00799 (0.799 % uranium enrichment) for both the surface and subsurface Tank 13H samples. This enrichment is slightly above the enrichment for Tanks 38H and 43H, where the enrichment normally ranges from 0.59 to 0.7 wt%. The U-235 concentration in Tank 13H samples ranged from 2.01E-02 to 2.63E-02 mg/L, while the U-238 concentration in Tank 13H ranged from 2.47E+00 to 3.21E+00 mg/L. Thus, the U-235/total uranium ratio is in line with the prior 2H-evaporator ECP samples.

Measured sodium and silicon concentrations averaged, respectively, 2.46 M and 1.42E-04 M (3.98 mg/L) in the Tank 13H ***subsurface*** sample. The measured aluminum concentration in Tanks 13H ***subsurface*** samples averaged 2.01E-01 M.

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LIST OF ABBREVIATIONS

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 remains incredible for the 2H Evaporator.[i] These barriers include the Enrichment Control Program (ECP). Tank 13 is being characterized to ensure that it can be transferred to 2H Evaporator which normally only accepts recycle supinates. The Corrosion Control Program (CCP) establishes concentrations and temperature limits for key constituents and periodic sampling and analysis to confirm that waste supernate is within these limits.[iii]

In late November 2014, Savannah River Remediation (SRR) sampled from two locations within Tanks 13H (surface and sub-surface or variable depth sample). As summarized in Table 1, these supernatant samples were delivered to the Savannah River National Laboratory (SRNL) in December 2014 for analyses to support the Enrichment Control Program, Corrosion Control Program and Sodium Aluminosilicate Formation Potential in the Evaporator. These Tank 13H **surface** and **sub-surface** samples were identified as HTF-13-14-156 for the surface sample and HTF-13-14-157 for the sub-surface sample.

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.

1.1 General Supernatant Sample Description

Table 2 contains a description of the sampling locations and the quantity of material received for the "as-received" Tanks 13H samples. As shown in Figure 1, the samples were free of significant amounts of insoluble solids. The surface sample (HTF-13-14-156) was relatively clear and transparent, while the subsurface samples (HTF-13-14-157) appeared cloudy compared to the surface sample.

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

2.0 Experimental

Analysis for the ECP was performed on both samples. Analysis for CCP was performed on the surface sample, while analysis for Sodium Aluminosilicate Formation Potential in the Evaporator was performed on the subsurface Tank 13H sample only. These Enrichment, Corrosion Control and Aluminosilicate Formation Potential program Plans for Tanks 13H slurry supernatant samples are summarized in Table 1. The ECP analysis includes inductively-coupled plasm-mass spectroscopy (ICP-MS) for uranium isotopics 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 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. The pH results reported were calculated from the free OH^- concentration using the following equation:

$$pH = 14 + \log_{10}\left(OH^{-}\right)$$

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]

All of the analyses were performed and reported in triplicate.

Table 1 Tanks 13H Sample Delivery Dates and Analysis Suite Summary.

Sample	Sample ID	Description	Date at SRNL	Date in cell
Tank 13 surface	HTF-13-14-156	Tank 13H Surface sample	12/4/2014	12/16/2014
Tank 13 VDS	HTF-13-14-157	Tank 13 variable depth sample	12/4//2014	12/16/2014

ECP + CCP Sample location	Analysis Suite summary
Tank 13 surface sample	ECP + CCP
Tank 13 Sub-surface Sample or variable depth sample	ECP, Na-Al Si formation potential

Table 2 General Supernate Sample Description (As-received) for Tanks 13H Samples

Tank Sample ID	Sample location	Approx. Volume, mL	Mass, g	Clarity of supernate
HTF-13-14-156	Surface sample	74	97.262	Clear supernate without visible solids
HTF-13-14-157	SubSurface	75	98.868	Cloudy supernate with visible faint particles but still with less than 1 wt% solids.

Insert A: Tank 13H surface and sub-surface supernate samples

Figure 1 From left to right, samples from the Tank 13H supernate surface and Tank 13H supernate sub-surface

3.0 Analytical Results

Table 3 contains a summary of the ECP, CCP and sodium aluminosilicate formation potential analytical results for these Tank 13H samples. This summary includes only the average values for the analytes and the standard deviation for each analysis in triplicate. Results for analytes that were below the limits of quantification are preceded by "<".

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. All measurements reported for U-233, U-234 and U-236 results for Tanks 13H are below the ICP-MS detection limit. As a result, the uranium enrichment calculations are based on U-total (sum of U-235 and U-238); where U-total excludes uranium data below the detection limit.

The U-235 enrichment for this Tank 13H analyses at about 0.8%, which is slightly higher than those from previous ECP characterization of Tanks 38H and 43H.[vii-xiii]

Table 3 ECP, CCP and Sodium Aluminosilicate Formation Potential Analytical Data for Tanks 13H Surface and Sub-Surface Samples.

Analytes	Tank 13H Surface HTF-13-14-156		Tank 13H Sub-Surface HTF-13-14-157		Methods	Units
	Average	Stdev.	Average	Stdev.		
U-233	**<2.01E-02**	-	**<1.92E-02**	-	ICP-MS	mg/L
U-234	**<2.01E-02**	-	**<1.92E-02**	-	ICP-MS	mg/L
U-235	**2.48E-02**	*1.12E-03*	**2.38E-02**	*3.25E-03*	ICP-MS	mg/L
U-236	**<2.01E-02**	-	**<1.92E-02**	-	ICP-MS	mg/L
U-238	**3.15E+00**	*5.32E-02*	**2.89E+00**	*3.65E-01*	ICP-MS	mg/L
Total U	**3.18E+00**	*5.43E-02*	**2.92E+00**	*3.68E-01*	ICP-MS	mg/L
U-235/U-total	**7.81E-01**	*2.22E-02*	**8.16E-01**	*1.17E-02*	Calc.	%
Pu-238	**9.72E-05**	*5.05E-06*	**8.37E-05**	*1.68E-05*	PuTTA	mg/L
Pu-239	**≤4.71E-03**	-	**≤3.60E-03**		PuTTA	mg/L
Pu-239/240	**≤6.51E+02**	-	**≤4.97E+02**		PuTTA	dpm/mL
Pu-241	**≤6.58E-06**	-	**4.86E-06**	*1.25E-06*	Pu-238/241	mg/L
Cs-137	**5.93E+08**	*6.29E+07*	**5.72E+08**	*7.32E+07*	gamma scan	dpm/mL
Ba-137m	**5.61E+08**	*5.95E+07*	**5.41E+08**	*6.92E+07*	gamma scan	dpm/mL
OH^-	**8.13E-01**	*4.06E-04*	**9.22E-01**	*1.69E-01*	Titration	M
NO_2^-	**4.83E-01**	*4.46E-03*	**4.99E-01**	*2.17E-02*	IC	M
NO_3^-	**5.36E-01**	*2.97E-03*	**5.56E-01**	*3.07E-02*	IC	M
F^-	**<5.77E-03**	-	**<5.82E-03**	-	IC	M
CHO_2^-	**<2.44E-03**	-	**<2.46E-03**	-	IC	M
Cl^-	**<3.09E-03**	-	**<3.12E-03**	-	IC	M
PO_4^{3-}	**1.26E-03**	*2.72E-05*	**1.27E-03**	*2.13E-05*	IC	M
SO_4^{2-}	**2.76E-02**	*3.92E-04*	**2.74E-02**	*2.64E-04*	IC	M
$C_2O_4^{2-}$	**1.35E-02**	*1.48E-04*	**1.34E-02**	*1.08E-04*	IC	M
Br^-	**<1.37E-02**	-	**<1.38E-02**	-	IC	M
CO_3^{2-}	**1.31E-01**	*1.62E-03*	**1.31E-01**	*1.10E-03*	TIC	M
Al	Not measured	-	**5.42E+03**	*1.83E+01*	ICP-ES	mg/L
B	Not measured	-	**2.46E+01**	*0.00E+00*	ICP-ES	mg/L
Ca	Not measured	-	**<7.05E-01**	-	ICP-ES	mg/L
Cr	Not measured	-	**7.83E+01**	*1.05E-01*	ICP-ES	mg/L
Fe	Not measured	-	**8.74E+00**	*9.75E+00*	ICP-ES	mg/L
K	Not measured	-	**4.75E+02**	*7.02E+00*	ICP-ES	mg/L
Li	Not measured	-	**<2.27E+00**	-	ICP-ES	mg/L
Mo	Not measured	-	**3.19E+01**	*3.65E-01*	ICPES	mg/L
Na	Not measured	-	**5.65E+04**	*1.05E+02*	ICP-ES	mg/L
P	Not measured	-	**5.35E+01**	*9.79E-01*	ICP-ES	mg/L
Si	Not measured	-	**3.98E+00**	*1.74E-01*	ICP-ES	mg/L
Zn	Not measured	-	**3.23E+00**	8.27E-02	ICP-ES	mg/L
Na	Not measured	-	**2.46E+00**	*4.58E-03*	Calc.	M
Total cation	Not measured	-	**2.47E+00**	-	Calc.	M
Total anion	Not measured	-	**2.52E+00**	-	Calc.	M
SpG	**1.07**	*0.02*	**1.08**	*0.01*	Calc.	-
pH	**13.91**	*2.94E-04*	**13.96**	*7.61E-02*	Calc.	-

To check the results, a cation-anion normality balance was performed. The normal concentrations of captions (mainly Na^+ and K^+) were summed, as were the anions (NO_3^-, NO_2^-, SO_4^{--}, Cl^-, CO_3^{2-}, PO_4^{3-}, AlO_2^-, $C_2O_4^{2-}$ and free OH^-). The two sums were compared. Since only the subsurface

sample (Tank 13H sub-surface sample HTF-13-14-157) was analyzed for both cations and anions the anion/cation comparisons was performed only for the subsurface sample.

For the Tank 13H subsurface sample the cations summed to 2.47 M, while the anions summed to 2.52 M. The differences between the cation and anion molarity value is about 2.0%. The small difference can be attributed to analytical uncertainties.

Tables 4 through 10 in Appendices A and B contain all the analytical results for the characterization of Tank 13H samples. These detailed analytical results are grouped by the required programs (ECP, CCP and Na-Al Si formation potential) in separate sections of the tables. Results for ***Tank 13H surface supernate*** are summarized in Appendix A, Table 4 through Table 6, while Tables 7 through Table 10, Appendix B, contain the analytical results for ***Tank 13H subsurface samples***. The last table of each Appendix (Tables 6 and 10) contains the results for additional analytes which were measured by the same group of methods but were not required by any of the major programs. The characterization of ***Tanks 13H subsurface sample*** for analytes with aluminosilicate formation potentials (Al, Si and Na) are presented in Tables 9. These analytical values for Tank 13H are about the same order of magnitude in the aluminum concentration as those from previous analyses of Tanks 38H and 43H.[vii-ix, xiv.] However, the silicon concentration in current Tank 13H analysis, at 3.98 mg/L, is very low compared to those of Tanks 38H and 43H. Hence, there is limited formation of aluminosilicate minerals if Tank 13H is processed through the 2H Evaporator.

Additional characterization data was requested for salt batch planning (Tc-99 and I-129). These results will be reported in a later document along with Tc-99 and I-129 results from Tank 38H and Tank 43H.

4.0 Conclusions

The U-235 mass divided by the total uranium averaged 0.00799 (0.799 % uranium enrichment) for both the surface and subsurface Tank 13H samples. This enrichment is slightly above the enrichment for Tanks 38H and 43H, where the enrichment normally ranges from 0.59 to 0.7 wt%. The U-235 concentration in Tank 13H samples ranged from 2.01E-02 to 2.63E-02 mg/L, while the U-238 concentration in Tank 13H ranged from 2.47E+00 to 3.21E+00 mg/L. Thus, the U-235/total uranium ratio is in line with the prior 2H-evaporator ECP samples.

Measured sodium and silicon concentrations averaged, respectively, 2.46 M and 1.42E-04 M (3.98 mg/L) in the Tank 13H ***subsurface*** sample. The measured aluminum concentration in Tanks 13H ***subsurface*** samples averaged 2.01E-01 M (5.42E+03 mg/L).

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

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Appendix A. Tank 13H Surface samples (HTF-13-14-156)

Table 4 Tank 13H Surface Sample HTF-13-14-156: ECP Results

Analytes	Analysis-1	Analysis-2	Analysis-3	Average	St. Deviation	Units
U-233	<2.03E-02	<2.02E-02	<1.97E-02	**<2.01E-02**		mg/L
U-234	<2.03E-02	<2.02E-02	<1.97E-02	**<2.01E-02**		mg/L
U-235	2.38E-02	2.47E-02	2.60E-02	**2.48E-02**	*1.12E-03*	mg/L
U-236	<2.03E-02	<2.01E-02	<1.97E-02	**<2.01E-02**		mg/L
U-238	3.11E+00	3.14E+00	3.21E+00	**3.15E+00**	*5.32E-02*	mg/L
U-Total	3.14E+00	3.16E+00	3.24E+00	3.18E+00	*5.43E-02*	mg/L
Pu-239	<3.30E-03	4.16E-03	6.68E-03	**≤4.71E-03**		mg/L
Pu-241	<6.14E-06	6.44E-06	7.16E-06	**≤6.58E-06**		mg/L

Table 5 Tank 13H Surface Sample HTF-13-14-156: CCP Results

Analytes	Analysis-1	Analysis-2	Analysis-3	Average	St. Deviation	Units
NO_3^-	5.38E-01	5.37E-01	5.33E-01	**5.36E-01**	*2.97E-03*	Mole/L
NO_2^-	4.88E-01	4.84E-01	4.79E-01	**4.83E-01**	*4.46E-03*	Mole/L
OH^{-1}	8.13E-01	8.14E-01	8.13E-01	**8.13E-01**	*4.06E-04*	Mole/L
SpG	1.06	1.06	1.09	**1.07**	*0.02*	--
pH	13.91	13.91	13.91	**13.91**	*2.17E-04*	--
Cs-137	6.37E+08	6.21E+08	5.21E+08	**5.93E+08**	*6.29E+07*	dpm/mL
Ba-137m	6.02E+08	5.87E+08	4.92E+08	**5.61E+08**	*5.95E+07*	dpm/mL

SpG = Specific gravity

Table 6 Tank 13H Surface Sample HTF-13-14-156: Other Results from ECP & CCP

Analytes	Analysis-1	Analysis-2	Analysis-3	Average	St. Deviation	Units
U-235/U-total *100	**7.59E-01**	**7.82E-01**	**8.03E-01**	**7.81E-01**	*2.22E-02*	%
Pu-238	1.02E-04	9.74E-05	9.21E-05	**9.72E-05**	*5.05E-06*	mg/L
Pu-239/240	<4.56E+02	5.74E+02	9.22E+02	**≤6.51E+02**		dpm/mL
SO_4^{2-}	2.80E-02	2.77E-02	2.72E-02	**2.76E-02**	*3.92E-04*	Mole/L
CHO_2^-	<2.43E-03	<2.46E-03	<2.42E-03	**<2.44E-03**		Mole/L
Cl^-	<3.08E-03	<3.12E-03	<3.07E-03	**<3.09E-03**		Mole/L
F^-	<5.76E-03	<5.83E-03	<5.74E-03	**<5.77E-03**		Mole/L
PO_4^{3-}	1.28E-03	1.27E-03	1.23E-03	**1.26E-03**	*2.72E-05*	Mole/L
$C_2O_4^{2-}$	1.37E-02	1.35E-02	1.34E-02	**1.35E-02**	*1.54E-04*	Mole/L
Br^-	<1.37E-02	<1.39E-02	<1.36E-02	**<1.37E-02**		Mole/L
Inorganic carbon	1.59E+06	1.57E+06	1.55E+06	**1.57E+06**	*1.95E+04*	µgC/L
Organic carbon	5.47E+05	5.23E+05	5.10E+05	**5.27E+05**	*1.87E+04*	µgC/L
Total carbon	2.13E+06	2.09E+06	2.04E+06	**2.09E+06**	*4.77E+04*	µgC/L
CO_3^{2-}	1.32E-01	1.31E-01	1.29E-01	**1.31E-01**	*1.62E-03*	Mole/L

Appendix B. Tank 13H Sub-Surface samples (HTF-13-14-157)

Table 7 Tank 13H Sub-Surface Sample HTF-13-14-157: ECP Results

Analytes	Analysis-1	Analysis-2	Analysis-3	Average	St. Deviation	Units
U-233	<2.06E-02	<2.07E-02	<1.64E-02	**<1.92E-02**		mg/L
U-234	<2.06E-02	<2.07E-02	<1.64E-02	**<1.92E-02**		mg/L
U-235	2.49E-02	2.63E-02	2.01E-02	**2.38E-02**	*3.25E-03*	mg/L
U-236	<2.06E-02	<2.07E-02	<1.64E-02	**<1.92E-02**		mg/L
U-238	3.05E+00	3.15E+00	2.47E+00	**2.89E+00**	*3.65E-01*	mg/L
U-Total	3.07E+00	3.18E+00	2.49E+00	**2.92E+00**	*3.68E-01*	mg/L
Pu-239	<1.18E-03	3.48E-03	6.14E-03	**≤3.60E-03**		mg/L
Pu-241	4.68E-06	6.19E-06	3.70E-06	**4.86E-06**	*1.25E-06*	mg/L

Table 8 Tank 13H Sub-Surface Sample HTF-13-14-157: CCP Results

Analytes	Analysis-1	Analysis-2	Analysis-3	Average	St. Deviation	Units
NO_3^-	5.40E-01	5.36E-01	5.91E-01	**5.56E-01**	*3.07E-02*	Mole/L
NO_2^-	4.87E-01	4.87E-01	5.25E-01	**4.99E-01**	*2.17E-02*	Mole/L
OH^{-1}	8.19E-01	8.30E-01	1.12E+00	**9.22E-01**	*1.69E-01*	Mole/L
SpG	1.09	1.07	1.07	**1.08**	*0.01*	--
pH	13.91	13.92	14.05	**13.96**	*0.076*	--
Cs-137	6.55E+08	5.42E+08	5.18E+08	**5.72E+08**	*7.32E+07*	dpm/mL
Ba-137m	6.20E+08	5.13E+08	4.90E+08	**5.41E+08**	*6.92E+07*	dpm/mL

Table 9 Tank 13H Sub-Surface Sample HTF-13-14-157: Alumino-silicate Formation Potential

Analytes	Analysis-1	Analysis-2	Analysis-3	Average	St. Deviation	Units
Al	5.44E+03	5.41E+03	5.41E+03	**5.42E+03**	*1.83E+01*	mg/L
B	2.46E+01	2.46E+01	2.46E+01	**2.46E+01**	*0.00E+00*	mg/L
Ca	<7.13E-01	<7.06E-01	<6.97E-01	**<7.05E-01**		mg/L
Cr	7.84E+01	7.82E+01	7.83E+01	**7.83E+01**	*1.05E-01*	mg/L
Fe	2.02E+00	4.28E+00	1.99E+01	**8.74E+00**	*9.75E+00*	mg/L
K	4.67E+02	4.76E+02	4.81E+02	**4.75E+02**	*7.02E+00*	mg/L
Li	<2.30E+00	<2.28E+00	<2.25E+00	**<2.27E+00**		mg/L
Mo	3.15E+01	3.21E+01	3.21E+01	**3.19E+01**	*3.65E-01*	mg/L
Na	5.65E+04	5.66E+04	5.64E+04	**5.65E+04**	*1.05E+02*	mg/L
P	5.30E+01	5.46E+01	5.28E+01	**5.35E+01**	*9.79E-01*	mg/L
Si	3.84E+00	4.17E+00	3.93E+00	**3.98E+00**	*1.74E-01*	mg/L
Sn	<9.02E+00	<8.95E+00	<8.82E+00	**<8.93E+00**		mg/L
Zn	3.25E+00	3.12E+00	3.32E+00	**3.23E+00**	8.27E-02	mg/L

Table 10 Tank 13H Sub-Surface Sample HTF-13-14-157: Other Results from ECP & CCP

Analytes	Analysis-1	Analysis-2	Analysis-3	Average	St. Deviation	Units
U-235/U-total*100	8.11E-01	8.29E-01	8.07E-01	**8.16E-01**	1.17E-02	%
Pu-238	8.18E-05	1.01E-04	6.79E-05	**8.37E-05**	*1.68E-05*	mg/L
Pu-239/240	<1.63E+02	4.80E+02	8.47E+02	**≤4.97E+02**		dpm/mL
SO_4^{2-}	2.76E-02	2.74E-02	2.71E-02	**2.74E-02**	*2.64E-04*	Mole/L
CHO_2^-	<2.41E-03	<2.49E-03	<2.48E-03	**<2.46E-03**		Mole/L
Cl^-	<3.05E-03	<3.15E-03	<3.15E-03	**<3.12E-03**		Mole/L
F^-	<5.70E-03	<5.89E-03	<5.88E-03	**<5.82E-03**		Mole/L
PO_4^{3-}	1.29E-03	1.26E-03	1.25E-03	**1.27E-03**	*2.13E-05*	Mole/L
$C_2O_4^{2-}$	1.35E-02	1.35E-02	1.33E-02	**1.34E-02**	*1.08E-04*	Mole/L
Br^-	<1.36E-02	<1.40E-02	<1.40E-02	**<1.38E-02**		Mole/L
Inorganic carbon	1.58E+06	1.56E+06	1.56E+06	**1.57E+06**	*1.31E+04*	µgC/L
Organic carbon	4.98E+05	5.15E+05	5.00E+05	**5.04E+05**	*8.99E+03*	µgC/L
Total carbon	2.08E+06	2.07E+06	2.07E+06	**2.07E+06**	*6.65E+03*	µgC/L
CO_3^{2-}	1.32E-01	1.30E-01	1.30E-01	**1.31E-01**	*1.10E-03*	Mole/L

Distribution:

S. L. Marra, 773-A
T. B. Brown, 773-A
D. H. McGuire, 999-W
S. D. Fink, 773-A
C. C. Herman, 773-A
E. N. Hoffman, 999-W
F. M. Pennebaker, 773-42A
W. R. Wilmarth, 773-A
M. S. Hay, 773-42A
C. J. Martino, 999-W Rm. 390
C. B. Sherburne, 707-7E Rm. 1
H. Bui, 707-7E Rm. 4
J. R. Jacobs, JR. 241-152H Rm. 12
D. J. Martin, 241-152H