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Analysis in Support of Disposition of Tank 48 Legacy Material

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EXECUTIVE SUMMARY

This report contains the characterization of six 200-mL Tank 48H samples: HTF-48-21-74, HTF-48-21-75, HTF-48-21-76, HTF-48-21-81, HTF-48-21-82, and HTF-48-21-83. The effort supports a Systems Engineering Evaluation (SEE) recommendation involving a Tank 48H decantation strategy that would remove liquid volume and grout the solids. The first three Tank 48H samples were surface samples taken after a quiescent period in the tank. The quiescent period allowed settling of the solids, these being mostly potassium tetraphenylborate. These three surface samples had no measurable solids, though a settling haze could be seen. The latter three samples were taken at 48, 25, and 10 inches from the bottom of Tank 48H immediately after tank mixing pumps had been run. Those samples contained measurable insoluble solids that were readily visible.

All six samples were analyzed to provide chemical and radionuclide concentrations as defined as the "Limit" and "Target" in the Saltstone Production Facility (SPF) Waste Acceptance Criteria (WAC) and per the compliance strategy in the Tank Farm Waste Compliance Plan (WCP). Samples were analyzed by many methods to determine pH, density/specific gravity, radioactive isotopes, soluble and insoluble elements, total solids, total insoluble solids, organic and inorganic mercury, volatile and semi-volatile chemicals, and anions. Photographs of the settling of small samples were taken over time and are displayed in this report.

The extent of settling was very significant, showing that surface sample liquids are similar to filtrates. However, Cs-137 measurements exceeded WAC limits in all surface samples (1.1E+07 vs. 1.3E+06). The solids were found to contain very high cesium activity, measured as high as 1.1E+10 dpm/gram. Sodium was in the range of 4.24 to 4.74 M for all samples, so the solids would tend to settle with time and would not be at risk of floating without air entrainment. No organic mercury was detected in this work.

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LIST OF ABBREVIATIONS

CSTF	Concentration, Storage, and Transfer Facility
CsTPB	Cesium Tetraphenylborate
CVAFS	Cold Vapor Atomic Fluorescence Spectroscopy
DMA	Direct Mercury Analyzer
ELM	Environmental and Legacy Management
GC-CVAFS	Gas Chromatography - Cold Vapor Atomic Fluorescence Spectrometry
HPLC	High Performance Liquid Chromatography
IC-A	Ion Chromatography Anions
IC-C	Ion Chromatography Cations
ICP-ES	Inductively Coupled Plasma Emission Spectroscopy
ICP-MS	Inductively Coupled Plasma Mass Spectrometry
ITP	In-Tank Precipitation
KTPB	Potassium Tetraphenylborate
LCS	Liquid Scintillation Counting
MS	Mass Spectrometry
PHA	Pulse Height Analysis (alpha PHA)
P&TTD/CVAFS	Purge & Trap, Thermal Desorption/Cold Vapor Atomic Fluorescence Spectroscopy
QA	Quality Assurance
SaM	Sensing and Metrology
SCO	Shielded Cells Operations
SEE	Systems Engineering Evaluation
SPF	Saltstone Production Facility
SRNL	Savannah River National Laboratory
SRR	Savannah River Remediation
SRS	Savannah River Site
SVOA	Semi-Volatile Organic Analysis
TIC	Total Inorganic Carbon
TOC	Total Organic Carbon
TPB	Tetraphenylborate
TTQAP	Task Technical and Quality Assurance Plan
TTR	Technical Task Request
VOA	Volatile Organic Analysis
WAC	Waste Acceptance Criteria
WCP	Waste Compliance Plan

1.0 Introduction

At the Savannah River Site (SRS), Tank 48H currently holds approximately 262000 gallons of slurry which contains potassium and cesium tetraphenylborate (KTPB and CsTPB). Original plans called for processing this tetraphenylborate (TPB) slurry in the In Tank Precipitation (ITP) Facility, the Late Wash Facility, and the Defense Waste Processing Facility (DWPF) Salt Cell.[1] That process scheme included concentrating the TPB, washing the non-radioactive salts to reduce the nitrite concentration, decomposing the TPB to benzene, and separating the benzene from the aqueous waste. However, these facilities ceased operation due to high benzene generation during startup of the ITP Facility. Since that time, the contents of the tank have remained largely undisturbed, except for evaporative losses, addition of sodium hydroxide solution, periodic slurry pump runs and associated bearing water inleakage, and occasional additions of drain transfers (e.g., rainwater).

As part of the SRS closure strategy, the legacy material held in Tank 48H must be removed or undergo treatment to stabilize the organic compounds before the tank can be eventually closed. A SEE to identify and recommend a path forward to final closure of Tank 48H was completed in March of 2021.[2] The SEE recommended grouting Tank 48H (i.e., decant filtrate and grout solids in place) as the preferred disposition pathway for Tank 48H contents.

SRNL received six samples retrieved from Tank 48H Riser B2 to be characterized to evaluate potential disposition pathways for the existing Tank 48H solids and liquid. Prior to the waste being mixed, three 200 mL samples were pulled one inch below the supernate surface (i.e., HTF-48-21-74, -75, and -76). After a three-pump quiescent-time mixing campaign, a second set of three 200 mL samples (i.e., HTF-48-21-81, -82, and -83) were retrieved at 48, 25, and 10 inches from the bottom of the tank (one sample at each depth). Table 1-1 provides a listing of samples to be characterized, and the dates and depths (i.e., distance from the bottom of the tank) the samples were retrieved.

Table 1-1: Tank 48H Samples

Sample Number	Depth (inches from the tank bottom)	Date Retrieved
HTF-48-21-74	73.5	8/18/21
HTF-48-21-75	73.5	8/18/21
HTF-48-21-76	73.5	8/18/21
HTF-48-21-81	48.0	8/24/21
HTF-48-21-82	25.0	8/24/21
HTF-48-21-83	10.0	8/24/21

A Technical Task Request (TTR)[3] was written to analyze the samples, and Task Technical and Quality Assurance Plan (TTQAP)[4] was generated that describes the analytical and experimental work required to complete the task. This document describes the results.

2.0 Experimental Procedure

Tank 48H samples were prepared for analyses in SRNL A-Block Cell 4. Samples remained as-received from SRR in stainless-steel dip vials until sub-samples were retrieved for analyses. This was done to preserve organic and other species that would be absorbed and lost if samples were moved to plastic containers.

Prior to subsampling, original samples were mixed by first shaking the dip vials using a manipulator for 1-2 minutes, then by drawing slurry from the bottom of the vials into a pipette and returning slurry to the vial.

Slurry pipettes were used to transfer material from dip vials to designated containers for analysis. The intent was to take homogeneous and well-mixed subsamples from each vial.

Slurry density measurements were performed by Shielded Cells Operations (SCO) using calibrated density tubes and an analytical balance. Tubes had 2-mL calibration marks, so sample masses were divided by 2 to obtain g/mL. After measuring density, the sample was returned to the original vial.

Sample slurries were filtered by SCO in the shielded cells under the direction of a principal investigator to obtain total and insoluble wt% solids results. A first effort measured total and filtrate (i.e., soluble) solids, but a second effort was then made to measure insoluble solids directly by filtration and brief washing of the filter disk with deionized water. The filter disks and their solids were dried to obtain final mass of solids for a known mass of slurry. Total and soluble solids were measured by warming slurry or filtrate at about 105 ºC to dry them to constant weight.

Undiluted filtrate was used for free OH-, Ion Chromatography Anions (IC-A) and Cations (IC-C), Total Inorganic Carbon (TIC), pH, Gamma Scan and Inductively Coupled Plasma Emission Spectroscopy (ICP-ES). ICP-ES provides soluble potassium along with the soluble sodium concentration. Samples for mercury analyses were handled and stored following established SRNL handling guidelines.[5]

Volatile Organic Analysis (VOA) Semi-Volatile Organic Analysis (SVOA) and High Performance Liquid Chromatography (HPLC) was performed by Sensing and Metrology (SaM) on as-received sample slurries. Chemical processing included routine solid/liquid separations and acid digestions (aqua regia with some hydrofluoric acid). Acid dissolution preparations were chosen over peroxide fusions to obtain accurate sodium values, and because analytes are more likely preserved at the lower temperatures (peroxide fusions can exceed 600 ºC). Acid dissolutions were considered to be effective enough to dissolve all elements and radionuclides of interest.

All analyses were performed in duplicate unless otherwise noted with standard deviations reported with two measurements per sample. Measurements were converted between a mass and volume basis using measured slurry densities where appropriate. Data from Inductively Coupled Plasma Mass Spectrometry (ICP-MS) measurements was converted from µg to pCi using reported specific activities for radionuclides of interest.[6]

2.1 Quality Assurance

Requirements for performing reviews of technical reports and the extent of review are established in manual E7 2.60. SRNL documents the extent and type of review using the SRNL Technical Report Design Checklist contained in WSRC-IM-2002-00011, Rev. 2. Experimental data is recorded in notebook: ELN-C8102-00273-07.[7] The customer requested that a Functional Classification of Safety Significant apply to this work.[3] Data collection and analysis methods used in this work comply with this requirement as detailed in the TTQAP.[4]

3.0 Results and Discussion

3.1 Observations

Care was taken to ensure parent samples were adequately mixed prior to being subsampled for analysis. Initially, samples were mixed gently to mitigate the generation of foam, but little foam was observed in all six samples after shaking vigorously using manipulators.

All three surface samples (i.e., HTF-48-21-74, -75, and -76) were similar in appearance as transparent amber colored liquids. The three well-mixed variable depth samples (i.e., HTF-48-21-81, -82, and -83) were visually similar as opaque light gray solutions. When left undisturbed, the light gray solids would gradually settle revealing an amber colored supernate. Figure 3-1 shows photographs of all six well-mixed samples in clear glass vials (i.e., "time 0"), and the same samples after 4, 8, and 33 days showing the progression of settling solids.

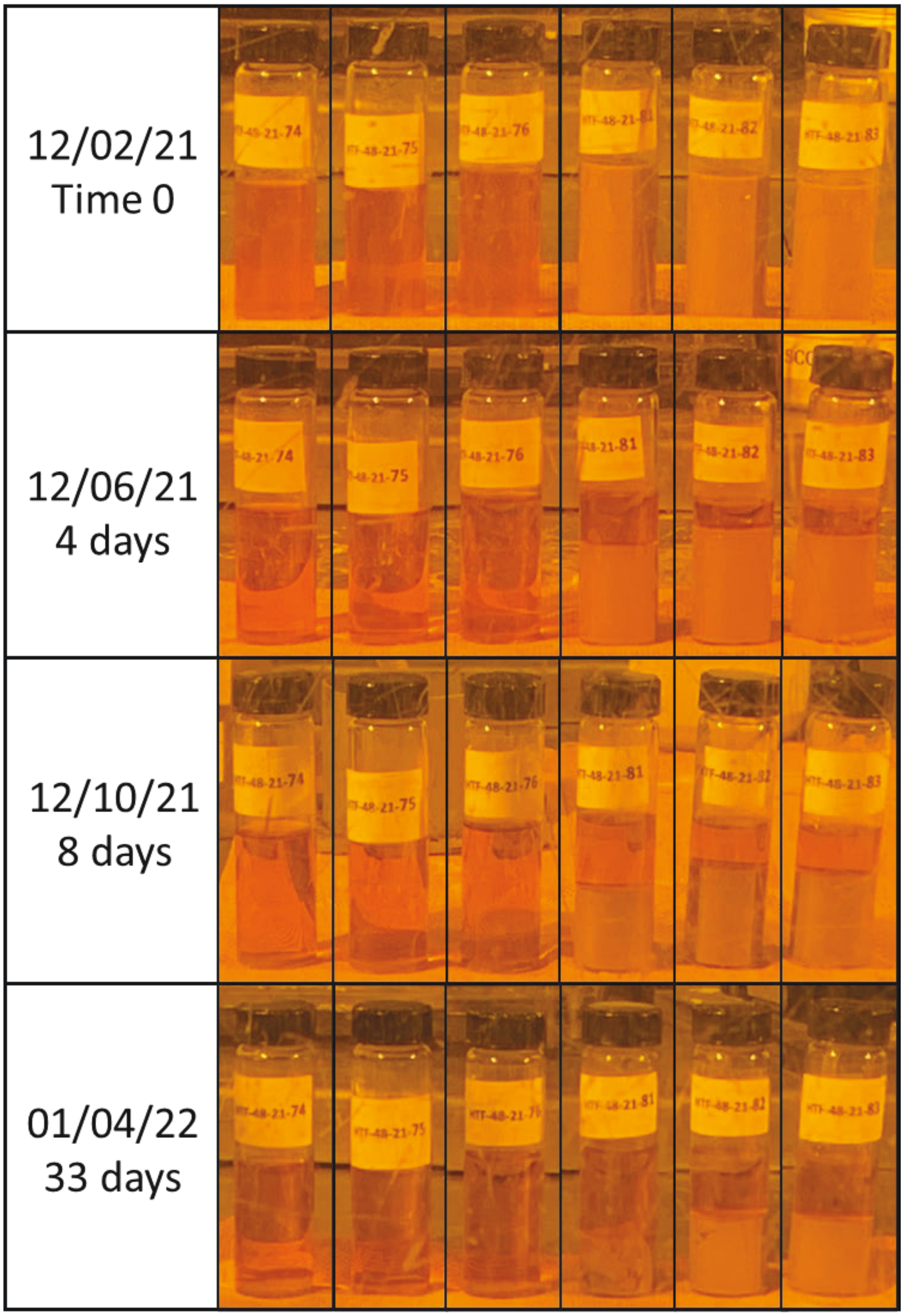

Figure 3-1: Photographs of parent samples in clear glass vials showing the progression of solids settling as a function of time.

The three surface samples (i.e., -74, -75, and -76) appeared slightly cloudy in the "time 0" photos, potentially indicating the presence of solids. A cloudy layer was noted in sample HTF-48-21-74 as filtrate was drawn into a slurry pipette (shown in the left photo of Figure 3-2) likely due to the condensation of soluble salts in the pipette.

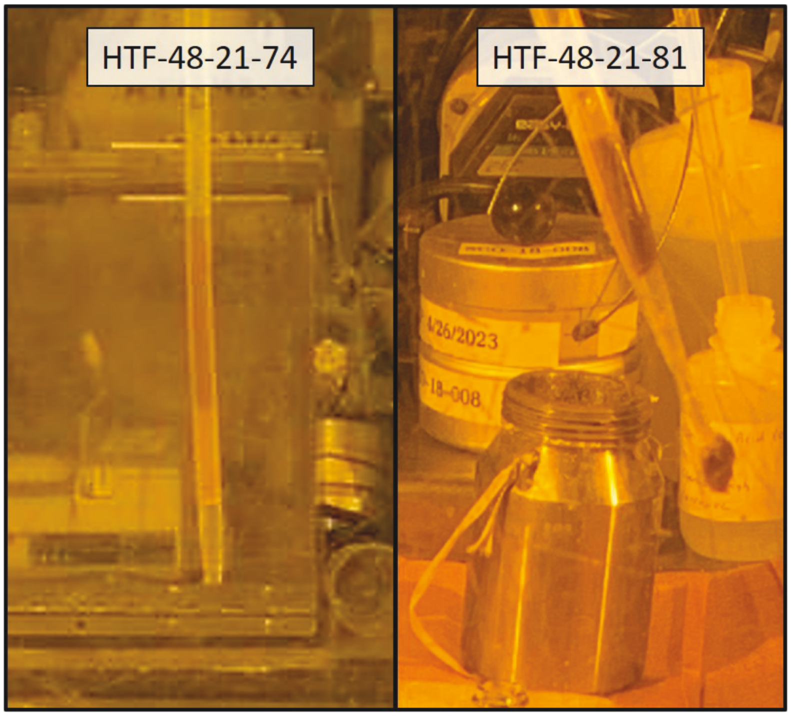

Figure 3-2: Photographs of notable observations when pipetting samples HTF-48-21-74 and -81

A grey clump of material was often observed clinging to pipette tips when sampling HTF-48-21-81, as shown in Figure 3-2. This agglomeration of solids appeared to increase in size as additional slurry was drawn into the pipette. This result was only observed in sample HTF-48-21-81; the depth sample retrieved closest to the surface after tank mixing. Potential sampling bias from this phenomenon was mitigated by cutting the tips off all slurry pipettes to create a sufficiently large orifice such that no clumping was observed.

3.2 Filtrate and Slurry Analysis

Measured densities for each parent sample are provided in Table 3-1. Values reported for surface samples HTF-48-21-74, -75, and -76 are similar to within 2%. Densities for VDS samples HTF-48-21-81, -82, and -83 increased as samples were retrieved closer to the Tank 48H surface.

Table 3-1: Measured Slurry Densities

Sample ID	Density (g/mL)	Standard Deviation
HTF-48-21-74	1.262	0.0057
HTF-48-21-75	1.289	0.0141
HTF-48-21-76	1.275	0.0007
HTF-48-21-81	1.318	0.0057
HTF-48-21-82	1.245	0.0148
HTF-48-21-83	1.216	0.0092

Weight percent solids measurements are provided in Table 3-2. Weight percent insoluble solids were determined using two methods. Insoluble solids were calculated from the difference in mass of total and soluble solids and measured directly by obtaining a mass of washed filtered solids. Direct measurement results of insoluble solids from surface samples were all less than 0.01 wt%, while insoluble solids contents of depth samples ranged from 1.56 to 2.30 wt%. While both the calculated and measured values of insoluble solids are reported, only measured values are considered in this report. This method may bias low due to the dissolution of salts, but is considered to have less uncertainty than a calculated value that is low relative to the total. Filtrate (i.e., soluble) solids are approximately 22% for all samples.

Table 3-2: Weight Percent Total, Soluble, and Insoluble Solids of Slurry Samples

Sample ID	Total Solids	Soluble Solids	Insoluble Solids (Calculated)	Insoluble Solids (Measured)
HTF-48-21-74	24.29%	21.73%	2.56%	< 0.01%
HTF-48-21-75	21.73%	22.00%	< 1.0%	< 0.01%
HTF-48-21-76	22.88%	22.00%	1.13%	< 0.01%
HTF-48-21-81	27.98%	21.97%	7.70%	1.98%
HTF-48-21-82	24.64%	22.20%	3.14%	2.30%
HTF-48-21-83	24.80%	22.42%	3.07%	1.56%

The measured concentrations of major ions in filtrate are provided in Table 3-3 and Table 3-4 for all surface and variable depth samples respectively. In general, the measured charge balance for all six samples were within 5%. Sodium ion concentrations ranged from 4.5 to 4.7 mol/L (M) for all samples.

Table 3-3: Measured Charge Balance of Surface Samples

Surface Samples						
Ion	HTF-48-21-74		HTF-48-21-75		HTF-48-21-76	
	M	Charge	M	Charge	M	Charge
Carbonate (CO_3^{2-})	0.891	-1.78	0.887	-1.77	0.871	-1.74
Hydroxide (OH^-)	1.70	-1.70	1.68	-1.68	1.70	-1.70
Chloride (Cl^-)	0.0236	-0.0236	0.0231	-0.0231	0.0233	-0.0233
Nitrite (NO_2^-)	0.749	-0.749	0.737	-0.737	0.733	-0.733
Nitrate (NO_3^-)	0.213	-0.213	0.209	-0.209	0.207	-0.207
Phosphate (PO_4^{3-})	0.00804	-0.02413	0.00799	-0.02398	0.00786	-0.0236
Sulfate (SO_4^{2-})	0.00583	-0.0117	0.00580	-0.0116	0.00524	-0.0105
Oxalate $(C_2O_4)^{2-}$	0.0176	-0.0352	0.0173	-0.0347	0.0177	-0.0347
Aluminate $(AlO_2)^-$	0.125	-0.125	0.119	-0.119	0.119	-0.119
Sodium (Na^+)	4.74	4.74	4.70	4.70	4.52	4.52
Sum		***0.08***		***0.09***		***-0.06***

Table 3-4: Measured Charge Balance of Variable Depth Samples

Ion	Variable Depth Samples					
	HTF-48-21-81		HTF-48-21-82		HTF-48-21-83	
	M	Charge	M	Charge	M	Charge
Carbonate (CO_3^{2-})	0.908	-1.81	0.901	-1.80	0.914	-1.83
Hydroxide (OH^-)	1.60	-1.600	1.59	-1.59	1.48	-1.48
Chloride (Cl^-)	0.0224	-0.0224	0.0208	-0.0208	0.0216	-0.0216
Nitrite (NO_2^-)	0.704	-0.704	0.668	-0.668	0.677	-0.677
Nitrate (NO_3^-)	0.196	-0.196	0.186	-0.186	0.190	-0.190
Phosphate (PO_4^{3-})	0.00743	-0.0223	0.00701	-0.0210	0.00740	-0.0222
Sulfate (SO_4^{2-})	0.00493	-0.00986	0.00507	-0.0101	0.00535	-0.0107
Oxalate $(C_2O_4)^{2-}$	0.0169	-0.0339	0.0160	-0.0319	0.0162	-0.0324
Aluminate $(AlO_2)^-$	0.121	-0.121	0.110	-0.110	0.120	-0.120
Sodium (Na^+)	4.74	4.74	4.24	4.24	4.52	4.52
Sum		***0.22***		***-0.20***		***0.15***

Table 3-5 provides a list of key chemicals, measured concentrations, and corresponding Waste Acceptance Criteria (WAC) limits for transfers to the Z-Area Saltstone Production Facility.[8] Unless otherwise noted, analyses were performed on sample filtrate. Cells with results below the reported detection limits are shown in gray. Data is presented to delineate samples retrieved from 1" below the surface of an unmixed Tank 48H and variable depth samples retrieved after tank mixing. The "Surface" column displays the largest measured concentration from samples HTF-48-21-74, -75, and -76; the "Variable Depth" column displays the highest reported value from samples HTF-48-21-81, -82, -83 for each analyte. Table 3-6 provides measurement data of the analytes listed in Table 3-5 for all six Tank 48H samples for comparison.

Similarly, Table 3-7 provides a list of key chemicals, measured concentrations, and corresponding WAC targets for transfers to the Z-Area Saltstone Production Facility. Cells with results below the reported detection limits are shown in gray. The "Surface" column displays the largest measured concentration from samples HTF-48-21-74, -75, and -76 for each analyte; the "Variable Depth" column displays the highest measured values from samples HTF-48-21-81, -82, and -83. Table 3-8 provides measurement data on the analytes listed in Table 3-7 from all six Tank 48H samples for comparison.

Table 3-5: Measured Concentrations, Methods of Detection, and SPF WAC, Attachment 8.1 *Limits* for Chemical Contaminants in Tank 48H Aqueous Waste

Chemical Name	Method	Surface mg/L (%RSD)	Variable Depth mg/L (%RSD)	WAC Limit mg/L
Aluminum	ICP-ES	3.37E+03 (10)	3.27E+03 (10)	1.16E+05
Aluminate[1]	ICP-ES	7.36E+03 (10)	7.15E+03 (10)	4.08E+05
Ammonium	IC-C	< 5.54E-03	< 5.54E-03	2.12E+02
Arsenic[2]	ICP-MS-As	6.19E-02 (6)	7.09E-02 (1)	1.97E+02
Barium	ICP-ES	< 2.70E-01	< 2.70E-01	6.19E+02
Butanol[2]	VOA	< 4.26E-00	< 4.29E-00	7.73E+00
Cadmium	ICP-ES	< 4.64E-01	< 4.64E-01	3.10E+02
Carbonate	TIC	5.34E+04 (10)	5.48E+04 (10)	1.20E+05
Chloride	IC-A	8.38E+02 (10)	7.93E+02 (10)	7.95E+03
Chromium	ICP-ES	6.32E+01 (10)	5.61E+01 (10)	1.50E+03
Elemental Mercury[2]	P&T-TDCVAFS	< 1.92E+00	< 1.72E+00	3.25E+02
Ethyl Mercury[2]	GC-CVAFS	< 9.30E-03	< 7.51E-03	3.73E+02
Fluoride	IC-A	< 2.50E+02	< 2.50E+02	4.07E+03
Free Hydroxide	Titration	2.88E+04 (10)	2.72E+04 (10)	1.58E+05
Isopar L[2]	SVOA	< 7.00E+01	< 7.00E+01	8.75E+01
Lead	ICP-ES	< 1.12E+01	< 1.12E+01	7.50E+02
Monomethyl Mercury[2]	GC-CVAFS	< 9.30E-01	< 7.51E-01	3.50E+02
Nitrate	IC-A	1.32E+04 (10)	1.22E+04 (10)	4.37E+05
Nitrite	IC-A	3.45E+04 (10)	3.24E+04 (10)	2.14E+05
Oxalate	IC-A	1.56E+03 (10)	1.49E+03 (10)	2.72E+04
Phenol	SVOA	4.38E+01 (20)	4.08E+01 (20)	7.50E+02
Phosphate	IC-A	7.64E+02 (10)	7.06E+02 (10)	3.14E+04
Potassium	ICP-ES	< 5.82E+02	< 5.82E+02	3.03E+04
Propanol[2]	VOA	< 4.26E+00	< 4.39E+00	1.88E+00
Selenium[2]	ICP-MS-Se[2]	4.66E-02	4.43E-02	3.75E+02
Silver	ICP-ES	< 3.29E-01	< 3.29E-01	6.19E+02
Sulfate	IC-A	5.61E+02 (10)	5.14E+02 (10)	5.69E+04
Tetraphenylborate[2]	HPLC[2]	< 1.00E+02	1.97E+04 (20)	5.00E+00
Total Mercury	DMA	< 1.92E-00	6.19E-00 (10)	3.25E+02
Total Organic Carbon	TOC	2.73E+03 (10)	2.60E+03 (10)	4.50E+03

[1]*Calculated from Al. In caustic conditions, Al is in the form of aluminate*
[2]*Method performed on slurry samples*

Table 3-6: Comparison of Chemical Concentrations in Aqueous Tank 48H Samples expressed as mg/L. Unless Otherwise Noted, Measurement Uncertainty is ≤ 10 %RSD.

Chemical Name	HTF-48-21-74	HTF-48-21-75	HTF-48-21-76	HTF-48-21-81	HTF-48-21-82	HTF-48-21-83
Aluminum	3.37E+03	3.22E+03	3.23E+03	3.27E+03	2.97E+03	3.23E+03
Aluminate[1]	7.36E+03	7.04E+03	7.05E+03	7.15E+03	6.48E+03	7.06E+03
Ammonium	< 5.54E-03	< 5.54E-03	< 5.54E-03	< 5.54E-03	< 5.54E-03	< 5.54E-03
Arsenic[2]	6.19E-02	6.00E-02	5.65E-02	6.74E-02	6.21E-02	7.09E-02
Barium	< 2.70E-01	< 2.70E-01	< 2.70E-01	< 2.70E-01	< 2.70E-01	< 2.70E-01
Butanol[2]	< 4.26E+00	< 3.86E+00	< 3.80E+00	< 4.39E+00	< 3.83E+00	< 3.46E+00
Cadmium	< 4.64E-01	< 4.64E-01	< 4.64E-01	< 4.64E-01	< 4.64E-01	< 4.64E-01
Carbonate	5.34E+04	5.32E+04	5.23E+04	5.45E+04	5.40E+04	5.48E+04
Chloride	8.38E+02	8.20E+02	8.26E+02	7.93E+02	7.39E+02	7.64E+02
Chromium	6.32E+01	6.06E+01	6.12E+01	5.61E+01	5.28E+01	5.35E+01
Elemental Mercury[2]	< 1.88E+00	< 1.92E+00	< 1.45E+00	< 1.72E+00	< 1.56E+00	< 1.71E+00
Ethyl Mercury[2,3]	< 4.94E-01	< 7.44E-01	< 9.30E-01	< 7.51E-01	< 7.18E-01	< 5.84E-01
Fluoride	< 2.50E+02	< 2.50E+02	< 2.50E+02	< 2.50E+02	< 2.50E+02	< 2.50E+02
Hydroxide	2.88E+04	2.86E+04	2.88E+04	2.72E+04	2.70E+04	2.51E+04
Isopar L[2]	< 7.00E+01	< 7.00E+01	< 7.00E+01	< 7.00E+01	< 7.00E+01	< 7.00E+01
Lead	< 1.12E+01	< 1.12E+01	< 1.12E+01	< 1.12E+01	< 1.12E+01	< 1.12E+01
Monomethyl Mercury[2,3]	< 4.94E-01	< 7.44E-01	< 9.30E-01	< 7.51E-01	< 7.18E-01	< 5.84E-01
Nitrate	1.32E+04	1.30E+04	1.29E+04	1.22E+04	1.16E+04	1.18E+04
Nitrite	3.45E+04	3.39E+04	3.37E+04	3.24E+04	3.08E+04	3.12E+04
Oxalate	1.55E+03	1.53E+03	1.56E+03	1.49E+03	1.41E+03	1.43E+03
Phenol	3.72E+01	3.80E+01	4.38E+01	3.77E+01	4.08E+01	3.75E+01
Phosphate	7.64E+02	7.59E+02	7.46E+02	7.06E+02	6.66E+02	7.03E+02
Potassium	< 5.82E+02	< 5.82E+02	< 5.82E+02	< 5.82E+02	< 5.82E+02	< 5.82E+02
Propanol[2]	< 4.26E+00	< 3.86E+00	< 3.80E+00	< 4.39E+00	< 3.83E+00	< 3.46E+00
Selenium[2]	< 2.20E-02	< 6.25E-02	4.66E-02	< 8.22E-02	4.43E-02[4]	< 6.42E-02
Silver	< 3.29E-01	< 3.29E-01	< 3.29E-01	< 3.29E-01	< 3.29E-01	< 3.29E-01
Sulfate	5.61E+02	5.57E+02	5.03E+02	4.74E+02	4.87E+02	5.14E+02
Tetraphenyl-Borate[2,3]	< 1.00E+02	< 1.00E+02	< 1.00E+02	1.71E+04	1.97E+04	1.75E+04
Total Mercury	< 1.84E-01	< 1.92E-01	< 1.45E-01	4.57E+00	6.19E+00	3.59E+00
Total Organic Carbon	2.57E+03	2.64E+03	2.73E+03	2.47E+03	2.38E+03	2.60E+03

[1]*Calculated from Al. In caustic conditions, Al is in the form of aluminate*
[2]*Method performed on slurry samples*
[3]*Uncertainty is 20 %RSD*
[4]*Single measurement. Duplicate measurement was below the reportable limit*

Table 3-7: Measured Concentrations, Methods of Detection, and SPF WAC, Attachment 8.2 *Targets* for Chemical Contaminants

Chemical Name	Method	Surface mg/L (% Uncertainty)	Variable Depth mg/L (% Uncertainty)	WAC Limit mg/L
Aluminum[1]	ICP-ES	3.37E+03 (10)	3.27E+03 (10)	7.00E+03
Benzene[2]	VOA	< 2.50E-01	< 2.50E-01	3.10E+02
Boron	ICP-ES	7.04E+02 (10)	6.76E+02 (10)	7.43E+02
Cobalt[2]	ICP-MS-Co	3.69E-02 (31)	5.42E-02 (10)	1.45E+02
Copper	ICP-ES	< 1.40E+00	< 1.40E+00	7.43E+02
Dimethyl Mercury[2]	VOA	< 4.26E-01	< 4.39E-01	1.00E+00
Formate	IC-A	< 2.50E+02	< 2.50E+02	6.38E+03
Iron	ICP-ES	< 2.07E+00	< 2.07E+00	4.95E+03
Lithium	ICP-ES	< 9.07E+00	< 9.07E+00	7.43E+02
Manganese	ICP-ES	< 5.80E-01	< 5.80E-01	7.43E+02
Methanol[2]	VOA	< 2.50E-01	< 2.50E-01	1.88E+00
Molybdenum	ICP-ES	8.61E+00 (10)	8.16E+00 (10)	7.43E+02
Nickel	ICP-ES	< 1.04E+00	< 1.04E+00	7.43E+02
NORPAR 13[2]	SVOA	< 7.5E+00	< 7.5E+00	7.50E-01
Silicon	ICP-ES	< 2.32E+01	< 2.32E+01	7.43E+02
Strontium	ICP-ES	< 4.64E-01	< 4.64E-01	7.43E+02
Toluene[2]	VOA	< 2.50E-01	< 2.50E-01	3.10E+02
Total Organic Carbon	TOC	2.73E+03 (10)	2.60E+03 (10)	7.50E+02
Tributyl Phosphate[2]	SVOA	< 1.00E+00	< 1.00E+00	7.50E+00
Zinc	ICP-ES	8.37E+00 (10)	7.80E+00 (10)	7.43E+02

[1] *In caustic conditions Al is in the form of Aluminate*
[2] *Method performed on slurry samples*

Table 3-8: Comparison of Chemical Concentrations in Aqueous Tank 48H Samples Expressed as mg/L. Unless Otherwise Noted, Measurement Uncertainty is 10 %RSD.

Chemical Name	HTF-48-21-74	HTF-48-21-75	HTF-48-21-76	HTF-48-21-81	HTF-48-21-82	HTF-48-21-83
Aluminum[1]	3.37E+03	3.22E+03	3.23E+03	3.27E+03	2.97E+03	3.23E+03
Benzene[2]	< 2.50E-01	< 2.50E-01	< 2.50E-01	< 2.50E-01	< 2.50E-01	< 2.50E-01
Boron	7.04E+02	6.76E+02	6.78E+02	6.76E+02	6.16E+02	6.51E+02
Cobalt[2]	3.69E-02	2.86E-02	2.96E-02	4.27E-02	4.36E-02	5.42E-02
Copper	< 1.40E+00	< 1.40E+00	< 1.40E+00	< 1.40E+00	< 1.40E+00	< 1.40E+00
Dimethyl Mercury	< 4.26E+00	< 3.86E+00	< 3.80E+00	< 4.39E+01	< 3.83E+00	< 3.46E+00
Formate	< 2.50E+02	< 2.50E+02	< 2.50E+02	< 2.50E+02	< 2.50E+02	< 2.50E+02
Iron	< 2.07E+00	< 2.07E+00	< 2.07E+00	< 2.07E+00	< 2.07E+00	< 2.07E+00
Lithium	< 9.07E+00	< 9.07E+00	< 9.07E+00	< 9.07E+00	< 9.07E+00	< 9.07E+00
Manganese	< 5.80E-01	< 5.80E-01	< 5.80E-01	< 5.80E-01	< 5.80E-01	< 5.80E-01
Methanol[2]	< 4.26E+00	< 3.86E+00	< 3.80E+00	< 4.39E+01	< 3.83E+00	< 3.46E+00
Molybdenum	8.61E+00	8.24E+00	8.35E+00	8.16E+00	7.56E+00	8.00E+00
Nickel	< 1.04E+00	< 1.04E+00	< 1.04E+00	< 1.04E+00	< 1.04E+00	< 1.04E+00
NORPAR 13[2]	< 7.5E+00	< 7.5E+00	< 7.5E+00	< 7.5E+00	< 7.5E+00	< 7.5E+00
Silicon	< 2.32E+01	< 2.32E+01	< 2.32E+01	< 2.32E+01	< 2.32E+01	< 2.32E+01
Strontium	< 4.64E-01	< 4.64E-01	< 4.64E-01	< 4.64E-01	< 4.64E-01	< 4.64E-01
Toluene[2]	< 4.26E+00	< 3.86E+00	< 3.80E+00	< 4.39E+01	< 3.83E+00	< 3.46E+00
Total Organic Carbon	2.57E+03	2.64E+03	2.73E+03	2.47E+03	2.38E+03	2.60E+03
Tributyl Phosphate[2]	< 1.00E+00	< 1.00E+00	< 1.00E+00	< 1.00E+00	< 1.00E+00	< 1.00E+00
Zinc	8.37E+00	8.25E+00	8.22E+00	7.80E+00	7.01E+00	7.33E+00

[1]*In caustic conditions Al is in the form of Aluminate*
[2]*Method performed on slurry Samples*

Measured chemical concentrations from all three surface samples were below WAC targets and limits for transfers to the Z-Area Saltstone Production Facility. However, it should be noted the method detection limit for TPB of 100 mg/L is above the WAC limit of 5.0 mg/L, and the measured concentration of Boron is close to the limit. Likewise, the detection limit for NORPAR 13 (i.e., 7.5 mg/L) is above the WAC target of 0.75 mg/L.

If all boron measured in surface samples was in the form of TPB, the resulting TPB concentration of 2E+04 mg/L would exceed the WAC limit. However, the detection limit of TPB is well below this value; suggesting TPB is not contributing significantly to the boron measurement. The solubility of KTPB is below 1 mg/L under process conditions,[9] and while not observed in this study, the potassium concentration in Tank 48H was reported to be over 400 mg/L.[10] The relatively high K concentration is expected to reduce the soluble TPB content well below the WAC limit.

No dibutyl phosphate was detected in the three variable depth samples. No dibutyl phosphate was expected in any sample since a precursor, tributyl phosphate, was also not detected. Ethylenediaminetetraacetic acid was not measured, but is not expected to be present in Tank 48H since no detectable quantities were reported in prior Tank 48H analyses.

In general, results varied little between all six samples. Notable exceptions were total mercury and TPB; which were not detected in any of the surface samples, but they appeared in all VDS samples after Tank 48H mixing. A further breakdown of TPB and degradation products triphenylboron (3PB), diphenylboronic acid (2PB), phenylborinic acid (1PB) and phenol measured by HPLC in slurry samples is provided in Table 3-9. Approximately 40 mg/L of phenol was detected in all samples by semi-volatile analysis which is more sensitive for this species. No other expected TPB degradation products were detected.

TPB concentrations are similar to the 19000 mg/L reported in 2012 from a Tank 48H slurry sample retrieved shortly after mixing pump shutdown[11] suggesting little to no measurable TPB degradation has occurred in the past decade. Benzene (≈50 mg/L) was also measured in 2012 in Tank 48H samples, but not in the present samples. With negligible TPB degradation, it is possible that entrained benzene volatilized and no longer remains as a measurable species in Tank 48H.

Table 3-9: HPLC Measurements of Tetraphenylborate and Degradation Products (20 %RSD Uncertainty)

Sample ID	TPB (mg/L)	3PB (mg/L)	2PB (mg/L)	PBA (mg/L)	Phenol[1] (mg/L)
HTF-48-21-74	< 100	< 100	< 100	< 100	< 100
HTF-48-21-75	< 100	< 100	< 100	< 100	< 100
HTF-48-21-76	< 100	< 100	< 100	< 100	< 100
HTF-48-21-81	17100	< 100	< 100	< 100	< 100
HTF-48-21-82	19700	< 100	< 100	< 100	< 100
HTF-48-21-83	17500	< 100	< 100	< 100	< 100

[1]*HPLC data is presented in this table. Phenol was detected using SVOA (see Table 3-6)*

The concentration of total mercury, and mercury species measured in Tank 48H samples are provided in Table 3-10. Total mercury values ranged up to 3-6 mg/L, with the only detected species being the ionic form. It should be noted that while depth samples were analyzed, no samples were retrieved from below 10 inches from the bottom of Tank 48H where elemental Hg would be expected.

Table 3-10: Mercury Species Concentration in Samples

	Total Hg (mg/L)	Ethyl Hg (mg/L)	Methyl Hg (mg/L)	Inorganic Hg (mg/L)	Elemental Hg (mg/L)	Dimethyl Hg (mg/L)
Method (uncertainty)	DMA (10%)	GC-CVAFS (20%)	GC-CVAFS (20%)	P&T-TDCVAFS (40%)	P&T-TDCVAFS (40%)	VOA (20%)
HTF-48-21-74	< 0.184	< 0.494	< 0.494	< 1.88	< 1.88	< 4.26
HTF-48-21-75	< 0.192	< 0.744	< 0.744	< 1.92	< 1.92	< 3.86
HTF-48-21-76	< 0.145	< 0.930	< 0.930	< 1.45	< 1.45	< 3.80
HTF-48-21-81	4.57	< 0.751	< 0.751	12.9	< 1.73	< 4.39
HTF-48-21-82	6.19	< 0.718	< 0.718	1.56	< 1.30	< 3.83
HTF-48-21-83	3.59	< 0.584	< 0.584	3.07	< 1.71	< 3.46

Table 3-11 provides a list of radionuclides, measured activities, and corresponding WAC limits for transfers to the Z-Area Saltstone Production Facility. Cells with results below the reported detection limits are highlighted in gray. When replicate measurements were below detection, the lowest detection limit is provided. The “Surface” column displays the largest measured concentration from samples HTF-48-21-74, -75, and -76 for each analyte; the “Variable Depth” column displays the highest measured values from samples HTF-48-21-81, -82, and -83. Table 3-12 and Table 3-13 provide measurement data on the analytes listed in Table 3-11 comparing the three surface and variable depth samples respectively.

Similarly, Table 3-14 provides radionuclides, measured activities, and corresponding WAC targets for transfers to the Z-Area Saltstone Production Facility. Cells with results below the reported detection limits are shown in gray. The “Surface” column displays the largest measured concentration from samples HTF-48-21-74, -75, and -76 for each analyte; the “Variable Depth” column displays the highest measured values from samples HTF-48-21-81, -82, and -83. Table 3-15 and Table 3-16 provide measurement data on the analytes listed in Table 3-14 comparing the three surface and variable depth samples respectively.

Table 3-11: Radionuclide Contaminants, Methods of Detection, and SPF WAC, Attachment 8.3 *Limits*

Radionuclide	Method	Surface Sample		Variable Depth Sample		WAC Limit (pCi/mL)
		pCi/mL	Std. Dev.	pCi/mL	Std. Dev.	
Carbon-14 (^{14}C)	C-14 Liquid Scintillation	< 4.59E+01	NA	< 5.44E+01	NA	1.13E+05
Cesium-137 (^{137}Cs)	Gamma Scan	1.09E+07	1.59E+05	3.17E+08	5.81E+06	1.29E+06
Iodine-129 (^{129}I)	I-129 (w/ separation) Liquid Scintillation	< 1.40E+01	NA	< 2.17E+01	NA	1.00E+02
Nickel-63 (^{63}Ni)	Ni-59/63	< 7.66+01	NA	< 1.49E+02	NA	1.13E+05
Plutonium-241 (^{241}Pu)	Pu238/241 Liquid Scintillation	4.32E+02	5.29E+02	1.86E+03	2.38E+02	8.38E+05
Strontium-90 (^{90}Sr)	Sr-90 Liquid Scintillation	9.62E+02	6.69E+01	6.53E+04	2.44E+04	2.62E+06
Technetium-99 (^{99}Tc)	Tc-99 Liquid Scintillation	2.37E+04	2.07E+03	1.98E+04	3.87E+02	2.11E+05
Total Alpha	Liquid Scintillation (Cs removed)	< 5.39E+05	NA	< 1.74E+06	NA	2.13E+05
Tritium (^{3}H)	Tritium Counting	3.70E+03	4.95E+01	< 5.10E+02	NA	5.63E+05
Uranium-233 (^{233}U)	ICP-MS	1.59E+02	8.73E-01	6.55E+02	1.66E+01	1.13E+04
Uranium-235 (^{235}U)	ICP-MS	3.88E-01	3.90E-03	1.54E+00	0.00E+00	1.13E+02

Table 3-12: Comparison of Radionuclides in Aqueous Tank 48H Surface Samples HTF-48-21-74, 75, and 76 Expressed as pCi/mL

Radionuclide	HTF-48-21-74		HTF-48-21-75		HTF-48-21-76	
	pCi/mL	Std. Dev.	pCi/mL	Std. Dev.	pCi/mL	Std. Dev.
Carbon-14 (^{14}C)	< 4.59E+01	NA	< 4.59E+01	NA	< 4.59E+01	NA
Cesium-137 (^{137}Cs)	1.09E+07	1.59E+05	9.73E+06	2.55E+05	1.05E+07	2.55E+05
Iodine-129 (^{129}I)	< 1.40E+01	NA	< 1.06E+01	NA	< 1.29E+01	NA
Nickel-63 (^{63}Ni)	< 5.63E+02	NA	< 7.07E+01	NA	< 7.66E+01	NA
Plutonium-241 (^{241}Pu)	4.15E+01	1.33E+01	5.23E+01	1.15E+01	4.32E+02	5.29E+02
Strontium-90 (^{90}Sr)	< 6.44E+02	NA	9.62E+02	6.69E+01	4.73E+02	1.27E+01
Technetium-99 (^{99}Tc)	2.37E+04	2.10E+03	2.31E+04	5.41E+02	2.37E+04	2.07E+03
Total Alpha	< 1.92E+05	NA	< 5.39E+05	NA	< 2.75E+05	NA
Tritium (^{3}H)	3.70E+03	4.95E+01	< 5.62E+02	NA	< 5.53E+02	NA
Uranium-233 (^{233}U)	1.56E+02	0.00E+00	1.57E+02	0.00E+00	1.59E+02	8.73E-01
Uranium-235 (^{235}U)	3.80E-01	1.93E-03	3.81E-01	3.93E-03	3.88E-01	3.90E-03

Table 3-13: Comparison of Radionuclides in Aqueous Tank 48H Variable Depth Samples HTF-48-21-81, -82, and 83 Expressed as pCi/mL

Radionuclide	HTF-48-21-81		HTF-48-21-82		HTF-48-21-83	
	pCi/mL	Std. Dev.	pCi/mL	Std. Dev.	pCi/mL	Std. Dev.
Carbon-14 (^{14}C)	< 5.44E+01	NA	< 4.86E+01	NA	< 4.29E+01	NA
Cesium-137 (^{137}Cs)	2.89E+08	1.81E+07	2.87E+08	2.77E+06	3.17E+08	5.81E+06
Iodine-129 (^{129}I)	< 9.02E+00	NA	< 1.31E+01	NA	< 2.17E+01	NA
Nickel-63 (^{63}Ni)	< 1.44E+02	NA	< 1.40E+02	NA	< 1.49E+02	NA
Plutonium-241 (^{241}Pu)	1.67E+03	4.20E+01	1.86E+03	2.38E+02	1.76E+03	1.32E+02
Strontium-90 (^{90}Sr)	6.53E+04	2.44E+04	3.95E+04	9.75E+03	5.45E+04	7.32E+03
Technetium-99 (^{99}Tc)	1.91E+04	8.40E+01	1.96E+04	2.42E+03	1.98E+04	3.87E+02
Total Alpha	< 1.68E+06	NA	< 1.74E+06	NA	< 1.44E+06	NA
Tritium (^{3}H)	< 5.10E+02	NA	< 3.55E+02	NA	< 5.68E+01	NA
Uranium-233 (^{233}U)	6.30E+02	1.35E+01	6.12E+02	5.11E+00	6.55E+02	1.58E+01
Uranium-235 (^{235}U)	1.48E+00	3.22E-02	1.47E+00	7.61E-03	1.54E+00	0.00E+00

Table 3-14: Radionuclide Contaminants in Tank 48H Samples, Methods of Detection, and SPF WAC, Attachment 8.4 *Targets*

Radionuclide	Method	Surface Sample		Variable Depth Sample		WAC Target (pCi/mL)
		pCi/mL	Std. Dev.	pCi/mL	Std. Dev.	
Aluminum-26 (^{26}Al)	Gamma Scan (Cs removed)	< 5.04E+01	NA	< 3.85E+01	NA	2.88E+03
Americium-241 (^{241}Am)	Am/Cm	3.57E+01[1]	NA	1.02E+03	3.61E+02	6.67E+04
Americium-242m (^{242m}Am)	Am/Cm	< 1.72E+00	NA	< 2.13E+01	NA	4.50E+05
Americium-243 (^{243}Am)	Am/Cm	< 3.87E+00	NA	< 6.49E+01	NA	6.67E+04
Antimony-125 (^{125}Sb)	Gamma Scan (Cs removed)	< 2.43E+02	NA	< 2.73E+02	NA	7.99E+03
Barium-137m (^{137m}Ba)	Secular Equilibrium w/ 94.6% of Cs-137	1.03E+07	1.51E+05	2.74E+08	1.71E+07	1.22E+06
Cerium-144 (^{144}Ce)	Gamma Scan (Cs removed)	< 4.59E+02	NA	< 4.48E+02	NA	3.12E+04
Cesium-134 (^{134}Cs)	Gamma Scan	< 8.11E+03	NA	NM	NM	5.93E+03
Cesium-135 (^{135}Cs)	Cs-135	7.45E+01	4.06E-01	2.34E+03[2]	NA	2.50E+02
Cobalt-60 (^{60}Co)	Gamma Scan (Cs removed)	< 8.64E+01	NA	< 5.09E+01	NA	9.75E+02
Curium-242 (^{242}Cm)	Am/Cm	< 1.42E+00	NA	1.40E+01[1]	NA	1.13E+04
Curium-244 (^{244}Cm)	Am/Cm	< 1.42E+00	NA	1.65E+01	8.25E+00	6.67E+04
Curium-245 (^{245}Cm)	Am/Cm	< 1.18E+01	NA	< 1.94E+02	NA	2.25E+05
Europium-154 (^{154}Eu)	Gamma Scan (Cs removed)	< 1.26E+02	NA	< 1.18E+02	NA	1.62E+03
Neptunium-237 (^{237}Np)	ICP-MS	3.04E+01	3.15E-01	6.74E+01	6.37E+00	1.00E+04
Nickel-63 (^{63}Ni)	Ni-59/63	< 7.66E+01	NA	< 1.49E+02	NA	1.13E+03
Plutonium-238 (^{238}Pu)	Pu238/241 Pu alpha PHA	2.56E+02	2.55E+00	1.54E+05	2.50E+04	6.67E+04
Plutonium-239 (^{239}Pu)	ICP-MS	< 2.73E+02	NA	< 2.56E+02	NA	6.67E+04
Plutonium-239/240 ($^{239/240}Pu$)	Pu238/241 Pu alpha PHA	8.18E+00	2.07E+00	3.12E+02	6.54E+01	6.67E+04[3]
Plutonium-242 (^{242}Pu)	ICP-MS	< 1.68E+01	NA	< 1.57E+01	NA	6.67E+04
Plutonium-244 (^{244}Pu)	ICP-MS	< 7.77E-02	NA	< 7.28E-02	NA	7.02E+04

Table 3-14 Continued

Radionuclide	Method	Surface Sample		Variable Depth Sample		WAC Target
		pCi/mL	Std. Dev.	pCi/mL	Std. Dev.	(pCi/mL)
Potassium-40 (^{40}K)	Gamma Scan (Cs removed)	< 1.21E+03	NA	< 7.42E+02	NA	1.00E+02
Radium-228 (^{228}Ra)	Gamma Scan (Cs removed)	< 3.56E+02	NA	< 1.93E+02	NA	1.00E+04
Rhodium-106 (^{106}Rh)	Secular Equilibrium w/ 100% of Ru-106	< 5.04E+02	NA	< 4.11E+02	NA	3.12E+05
Ruthenium-106 (^{106}Ru)	Gamma Scan (Cs removed)	< 5.04E+02	NA	< 4.11E+02	NA	3.12E+05
Selenium-79 (^{79}Se)	Se-79	< 1.19E+02	NA	< 2.63E+02	NA	1.90E+04
Strontium-90 (^{90}Sr)	Sr-90 Liquid Scintillation	9.62E+02	6.69E+01	6.53E+04	2.44E+04	2.62E+06
Tellurium-125m (^{125m}Te)	Secular Equilibrium w/ 100% of Sb-125	< 2.43E+02	NA	< 2.73E+02	NA	1.83E+03
Thorium-232 (^{232}Th)	ICP-MS	5.35E-04[1]	NA	7.56E-04	2.90E-04	2.88E+03
Tin-126 (^{126}Sn)	Gamma Scan (Cs removed)	1.90E+02	7.72E+00	< 8.98E+01	NA	1.80E+04
Total Alpha	Liquid Scintillation (Cs removed)	< 5.39E+05	NA	< 1.74E+06	NA	6.67E+04
Uranium-232 (^{232}U)	U-232	1.24E+01	8.03E+00	1.84E+02	1.10E+02	2.27E+03
Uranium-233 (^{233}U)	ICP-MS	1.59E+02	8.72E-01	6.55E+02	1.58E+01	3.12E+03
Uranium-234 (^{234}U)	ICP-MS	6.06E+02	2.96E+01	2.20E+03	9.35E+01	3.12E+03
Uranium-236 (^{236}U)	ICP-MS	2.58E+00	3.50E-02	1.10E+01	2.41E-01	3.12E+03
Uranium-238 (^{238}U)	ICP-MS	3.68E-01	2.42E-03	1.59E+00	2.31E-02	3.12E+03
Yttrium-90 (^{90}Y)	Secular Equilibrium w/ 100% of Sr-90	9.62E+02	6.69E+01	6.53E+04	2.44E+04	2.62E+06
Zirconium-93 (^{93}Zr)	Zr-93	< 2.29E+01	NA	< 1.91E+02	NA	1.00E+05

[1] Single measurement. Duplicate measurement was below the reportable limit.
[2] Calculated using measured Cs-135/137 ratio
[3] Listed WAC target is for plutonium-240 only. Measurements of 239 and 240 fall well below the target.

Table 3-15: Comparison of Radionuclides in Aqueous Tank 48H Surface Samples HTF-48-21-74, 75, and 76 Expressed as pCi/mL

Radionuclide	HTF-48-21-74		HTF-48-21-75		HTF-48-21-76	
	pCi/mL	Std. Dev.	pCi/mL	Std. Dev.	pCi/mL	Std. Dev.
Aluminum-26 (^{26}Al)	< 5.04E+01	NA	< 4.13E+01	NA	< 2.02E+01	NA
Americium-241 (^{241}Am)	3.57E+01[1]	NA	2.52E+01	9.56E+00	< 1.77E+01	NA
Americium-242m (^{242m}Am)	< 1.72E+00	NA	< 5.09E-01	NA	< 5.18E-01	NA
Americium-243 (^{243}Am)	< 3.87E+00	NA	< 2.89E+00	NA	< 2.52E+00	NA
Antimony-125 (^{125}Sb)	< 2.43E+02	NA	< 2.31E+02	NA	< 1.05E+02	NA
Barium-137m (^{137m}Ba)	1.03E+07	1.51E+05	9.20E+06	2.41E+05	9.93E+06	2.41E+05
Cerium-144 (^{144}Ce)	< 4.59E+02	NA	< 4.16E+02	NA	< 2.35E+02	NA
Cesium-134 (^{134}Cs)	< 2.94E+03	NA	< 8.11E+03	NA	< 4.68E+03	NA
Cesium-135 (^{135}Cs)	5.72E+01	2.55E+00	7.45E+01	4.10E-01	7.44E+01	4.06E-01
Cobalt-60 (^{60}Co)	< 8.64E+01	NA	< 7.88E+01	NA	< 3.80E+01	NA
Curium-242 (^{242}Cm)	< 1.42E+00	NA	< 8.47E-01	NA	< 4.27E-01	NA
Curium-244 (^{244}Cm)	< 1.42E+00	NA	< 7.75E-01	NA	< 4.27E-01	NA
Curium-245 (^{245}Cm)	< 1.18E+01	NA	< 9.32E+00	NA	< 9.01E+00	NA
Europium-154 (^{154}Eu)	< 1.26E+02	NA	< 1.17E+02	NA	< 8.16E+01	NA
Neptunium-237 (^{237}Np)	3.04E+01	3.15E-01	2.36E+01	3.85E-01	2.62E+01	6.36E-02
Nickel-63 (^{63}Ni)	< 5.63E+01	NA	< 7.07E+01	NA	< 7.66E+01	NA
Plutonium-238 (^{238}Pu)	1.61E+02	7.64E+00	2.56E+02	2.55E+00	1.22E+02	3.41E+01
Plutonium-239 (^{239}Pu)	< 2.73E+02	NA	< 2.60E+02	NA	< 2.31E+02	NA
Plutonium-239/240 ($^{239/240}Pu$)	8.06E-01	1.78E-01	8.18E+00	2.07E+00	< 2.08E+00	NA
Plutonium-242 (^{242}Pu)	< 1.68E+01	NA	< 1.60E+01	NA	< 1.42E+01	NA
Plutonium-244 (^{244}Pu)	< 7.77E-02	NA	< 7.40E-02	NA	< 6.59E-02	NA
Potassium-40 (^{40}K)	< 7.62E+02	NA	< 1.21E+03	NA	< 5.09E+02	NA
Radium-228 (^{228}Ra)	< 3.56E+02	NA	< 3.30E+02	NA	< 1.15E+02	NA
Ruthenium-106 (^{106}Ru)	< 5.04E+02	NA	< 3.80E+02	NA	< 1.87E+02	NA
Selenium-79 (^{79}Se)	< 1.19E+02	NA	< 1.09E+02	NA	< 1.15E+02	NA
Strontium-90 (^{90}Sr)	< 6.44E+02	NA	9.62E+02	6.69E+01	4.73E+02	1.27E+01
Tellurium-125m (^{125m}Te)	< 2.43E+02	NA	< 2.31E+02	NA	< 1.05E+02	NA
Thorium-232 (^{232}Th)[2]	< 2.41E-03	NA	< 4.59E-04	NA	5.53E-04[1]	NA
Tin-126 (^{126}Sn)	1.05E+02	1.73E+01	1.19E+02	1.11E+01	1.90E+02	7.72E+00
Total Alpha	< 1.92E+05	NA	< 5.39E+05	NA	< 2.75E+05	NA
Uranium-232 (^{232}U)	7.14E+00	6.46E+00	1.24E+01	8.03E+00	4.70E+00	2.21E+00
Uranium-233 (^{233}U)	1.54E+02	0.00E+00	1.58E+02	0.00E+00	1.59E+02	8.73E-01

Table 3-15 Continued

Radionuclide	HTF-48-21-74		HTF-48-21-75		HTF-48-21-76	
	pCi/mL	Std. Dev.	pCi/mL	Std. Dev.	pCi/mL	Std. Dev.
Uranium-234 (^{234}U)	6.06E+02	2.96E+01	5.65E+02	2.44E+01	5.60E+02	2.25E+01
Uranium-236 (^{236}U)	2.51E+00	2.89E-02	2.56E+00	3.53E-02	2.58E+00	3.50E-02
Uranium-238 (^{238}U)	3.54E-01	1.50E-03	3.61E-01	1.22E-03	3.68E-01	2.42E-03
Yttrium-90 (^{90}Y)	< 6.44E+02	NA	9.62E+02	6.69E+01	4.73E+02	1.27E+01
Zirconium-93 (^{93}Zr)	< 2.29E+01	NA	< 1.99E+01	NA	< 2.11E+01	NA

[1] *Single measurement. Duplicate measurement was below the reportable limit.*
[2] *Derived from ICPMS data. Number is likely biased high due to isobaric interference from Uranium-232*

Table 3-16: Comparison of Radionuclides in in Aqueous Tank 48H Variable Depth Samples HTF-48-21-81, -82, and 83 Expressed as pCi/mL

Radionuclide	HTF-48-21-81		HTF-48-21-82		HTF-48-21-83	
	pCi/mL	Std. Dev.	pCi/mL	Std. Dev.	pCi/mL	Std. Dev.
Aluminum-26 (^{26}Al)	< 3.48E+01	NA	< 3.31E+01	NA	< 3.85E+01	NA
Americium-241 (^{241}Am)	9.29E+02	3.78E+01	1.02E+03	3.61E+02	8.24E+02	1.16E+01
Americium-242m (^{242m}Am)	< 2.66E+00	NA	< 2.13E+01	NA	< 1.28E+01	NA
Americium-243 (^{243}Am)	< 4.04E+00	NA	< 6.49E+01	NA	< 5.95E+00	NA
Antimony-125 (^{125}Sb)	< 2.24E+02	NA	< 1.86E+02	NA	< 2.73E+02	NA
Barium-137m (^{137m}Ba)	2.74E+08	1.71E+07	2.72E+08	2.62E+06	3.00E+08	5.49E+06
Cerium-144 (^{144}Ce)	< 4.22E+02	NA	< 3.51E+02	NA	< 4.48E+02	NA
Cobalt-60 (^{60}Co)	< 5.09E+01	NA	< 4.13E+01	NA	< 4.48E+01	NA
Curium-242 (^{242}Cm)	< 2.20E+00	NA	< 1.76E+01	NA	1.40E+00	NA
Curium-244 (^{244}Cm)	1.28E+01	3.27E+00	< 7.40E+01	NA	1.65E+01	8.25E+00
Curium-245 (^{245}Cm)	< 1.63E+01	NA	< 1.94E+02	NA	< 1.71E+01	NA
Europium-154 (^{154}Eu)	< 1.13E+02	NA	< 9.19E+01	NA	< 1.18E+02	NA
Neptunium-237 (^{237}Np)	6.74E+01	6.37E+00	5.62E+01	5.96E+00	5.75E+01	1.27E+00
Nickel-63 (^{63}Ni)	< 1.44E+02	NA	< 1.40E+02		< 1.49E+02	
Plutonium-238 (^{238}Pu)	1.53E+05	8.40E+03	1.54E+05	2.50E+04	1.42E+05	3.10E+03
Plutonium-239 (^{239}Pu)	< 2.56E+02	NA	< 2.31E+02		< 2.00E+02	
Plutonium-239/240 ($^{239/240}Pu$)	2.25E+02	9.66E+01	2.92E+02	6.74E+01	3.12E+02	6.54E+01
Plutonium-242 (^{242}Pu)	< 1.57E+01	NA	< 1.42E+01	NA	<1.23E+01	NA
Plutonium-244 (^{244}Pu)	< 7.28E-02	NA	< 6.59E-02	NA	< 5.68E-02	NA
Potassium-40 (^{40}K)	< 7.42E+02	NA	< 5.94E+02	NA	< 6.68E+02	NA

Table 6-13 Continued

Radionuclide	HTF-48-21-81		HTF-48-21-82		HTF-48-21-83	
	pCi/mL	Std. Dev.	pCi/mL	Std. Dev.	pCi/mL	Std. Dev.
Radium-228 (^{228}Ra)	< 1.93E+02	NA	< 1.60E+02	NA	< 1.89E+02	NA
Rhodium-106 (^{106}Rh)	< 3.27E+02	NA	< 2.95E+02	NA	< 4.11E+02	NA
Ruthenium-106 (^{106}Ru)	< 3.27E+02	NA	< 2.95E+02	NA	< 4.11E+02	NA
Selenium-79 (^{79}Se)	< 2.13E+02	NA	< 2.63E+02	NA	< 1.65E+02	NA
Strontium-90 (^{90}Sr)	6.53E+04	2.44E+04	3.95E+04	9.75E+03	5.45E+04	7.32E+03
Tellurium-125m (^{125m}Te)	< 2.24E+02	NA	< 1.86E+02	NA	< 2.73E+02	NA
Thorium-232 (^{232}Th)[2]	7.56E-04	2.90E-04	< 2.05E-03	NA	5.65E-04	4.06E-05
Tin-126 (^{126}Sn)	< 6.65E+01	NA	< 7.06E+01	NA	< 8.98E+01	NA
Total Alpha	< 1.68E+06	NA	< 1.74E+06	NA	< 1.44E+06	NA
Uranium-232 (^{232}U)	9.84E+01	6.23E+01	1.60E+02	6.10E+01	1.84E+02	1.10E+02
Uranium-233 (^{233}U)	6.30E+02	1.35E+01	6.12E+02	5.11E+00	6.55E+02	1.58E+01
Uranium-234 (^{234}U)	2.11E+03	2.33E+01	2.20E+03	5.50E+00	2.15E+03	9.13E+01
Uranium-236 (^{236}U)	9.85E+00	6.03E-02	9.66E+00	0.00E+00	1.01E+01	2.22E-01
Uranium-238 (^{238}U)	1.54E+00	6.27E-03	1.46E+00	5.92E-03	1.59E+00	2.31E-02
Yttrium-90 (^{90}Y)	6.53E+04	2.44E+04	3.95E+04	9.75E+03	5.45E+04	7.32E+03
Zirconium-93 (^{93}Zr)	< 1.88E+02	NA	< 1.37E+02	NA	< 1.91E+02	NA

[1] *Single measurement. Duplicate measurement was below the reportable limit.*
[2] *Derived from ICPMS data. Number is likely biased high due to isobaric interference from Uranium-232*

Two radionuclides were measured in surface samples having activities above the WAC limit for transfers to the Z-Area Saltstone Production Facility: Cesium-137 and Barium-137m (Ba-137m is in 94.6% secular equilibrium with Cs-137). In addition, the detection limit for total alpha was above the WAC limit. Plutonium-238 was found to exceed the WAC target in variable depth samples, but not surface samples. All other radionuclides measured were below the WAC targets and limits for transfers to the Z-Area Saltstone Production Facility.

Cesium-137 activities measured in both filtrate and slurry samples are provided in Table 3-17. All variable depth samples retrieved after Tank 48H mixing had Cs-137 activities more than an order of magnitude higher than surface samples. Surface samples were found to have activities similar to filtrate samples, indicative of in-tank settling of Cs-bearing solids.

Table 3-17: Measured Cs-137 Activities in Slurry and Filtrate Samples

Sample ID	Cs-137 Filtrate		Cs-137 Slurry	
	pCi/mL	Std. Dev.	pCi/mL	Std. Dev.
HTF-48-21-74	1.44E+07	3.19E+04	1.09E+07	1.59E+05
HTF-48-21-75	1.45E+07	1.47E+06	9.73E+06	2.55E+05
HTF-48-21-76	1.30E+07	1.24E+06	1.05E+07	2.55E+05
HTF-48-21-81	1.23E+07	2.52E+06	2.89E+08	1.81E+07
HTF-48-21-82	1.13E+07	4.46E+05	2.87E+08	2.77E+06
HTF-48-21-82	1.17E+07	1.91E+05	3.17E+08	5.81E+06

3.3 Retentate Analysis

Table 3-18 and Table 3-19 provide concentrations and activities of various species measured in retentate from variable depth samples. Results are provided on a solids basis (i.e., per gram of collected solids); calculated using the insoluble solids values reported in Table 3-2. Retentate samples were not washed prior to digestion and likely include entrained soluble solids that may contribute to analyses or provide lower than actual values from dilution.

Table 3-18: Measured Chemical Contaminants in Tank 48H Retentate

Chemical	Method	HTF-48-21-81 µg/g (10 %RSD)	HTF-48-21-82 µg/g (10 %RSD)	HTF-48-21-83 µg/g (10 %RSD)
Aluminum	ICP-ES	9.85E+03	1.47E+04	1.47E+04
Antimony	ICP-ES	< 2.97E+01	< 2.83E+01	< 3.37E+01
Barium	ICP-ES	1.17E+02	2.04E+02	1.97E+02
Boron	ICP-ES	1.53E+04	2.60E+04	2.56E+04
Cadmium	ICP-ES	< 1.92E+00	< 1.83E+00	< 2.18E+00
Chromium	ICP-ES	3.29E+02	4.91E+02	5.30E+02
Cobalt	ICP-MS[1]	6.06E-01	1.08E+00	1.03E+00
Copper	ICP-ES	< 1.17E+02	< 1.11E+02	< 1.31E+02
Iron	ICP-ES	1.81E+03	3.07E+03	2.88E+03
Lead	ICP-ES	< 1.70E+02	< 1.62E+02	< 1.93E+02
Manganese	ICP-ES	2.03E+02	< 3.51E+02	3.39E+02
Molybdenum	ICP-ES	< 3.61E+01	< 3.44E+01	< 4.08E+01
Nickel	ICP-ES	< 5.35E+01	< 5.13E+01	< 6.05E+01
Silver	ICP-ES	< 1.92E+00	< 1.87E+00	< 2.18E+00
Strontium	ICP-ES	1.55E+01	2.73E+01	2.47E+01
Titanium	ICP-ES	2.12E+04	3.70E+04	3.65E+04
Uranium	ICP-ES	< 1.95E+02	< 1.87E+02	< 2.22E+02
Zinc	ICP-ES	5.71E+01	9.00E+01	8.91E+01

[1] *Measurement Uncertainty < 3 %RSD*

Table 3-19: Activity of Radionuclides in Tank 48H Sample Retentate

Radionuclide	HTF-48-21-81		HTF-48-21-82		HTF-48-21-83	
	pCi/g	Std. Dev.	pCi/g	Std. Dev.	pCi/g	Std. Dev.
Am-241	< 9.43E+04	NA	< 1.54E+05	NA	3.87E+04	8.24E+03
Am-242m	< 3.72E+04	NA	< 5.36E+03	NA	< 7.52E+03	NA
Am-243	< 6.24E+04	NA	< 4.09E+04	NA	< 2.92E+02	NA
Cm-243	< 2.48E+05	NA	< 1.45E+05	NA	< 7.52E+03	NA
Cm-244	< 2.46E+04	NA	< 4.22E+03	NA	< 1.59E+03	NA
Cm-245	< 2.05E+05	NA	< 1.19E+05	NA	< 6.17E+03	NA
Cs-135	5.93E+04	1.72E+03	9.79E+04	3.44E+03	9.46E+04	7.39E+03
Cs-137	5.90E+09	1.72E+08	1.07E+10	5.01E+08	9.93E+09	3.65E+08
Np-237	3.39E+03	5.04E+01	5.65E+03	1.52E+02	4.88E+03	1.28E+02
Pu-238	3.30E+06	2.25E+05	5.76E+06	1.72E+05	5.35E+06	8.49E+03
Pu-239	6.61E+03	2.22E+01	8.89E+03	3.06E+02	7.85E+03	7.33E+02
Pu-240	6.55E+03	1.72E+03	9.70E+03	1.18E+03	9.21E+03	8.24E+02
Pu-241	4.21E+04	7.72E+03	6.83E+04	5.23E+03	6.71E+04	5.95E+02
Ra-228	< 2.71E+04	NA	< 2.70E+04	NA	< 8.06E+03	NA
Sn-126	< 9.66E+03	NA	< 1.51E+04	NA	< 5.05E+03	NA
Sr-90	1.10E+06	1.17E+05	1.81E+06	1.00E+05	2.16E+06	2.21E+05
Th-229	< 2.72E+02	NA	< 5.03E+02	NA	< 3.59E+02	NA
Th-230	< 2.72E+02	NA	< 6.50E+02	NA	< 1.02E+02	NA
Th-232	7.54E-02	7.84E-04	6.42E-02	5.06E-03	6.47E-02	1.74E-03
U-233	1.21E+04	1.04E+02	2.18E+04	3.57E+02	2.10E+04	3.07E+02
U-234	3.71E+04	2.23E+02	6.81E+04	1.73E+03	6.67E+04	4.25E+03
U-235	2.78E+01	7.72E-02	4.85E+01	2.66E-01	5.01E+01	8.82E-01
U-238	2.97E+01	0.00E+00	5.25E+01	4.13E-01	5.05E+01	7.62E-01

A comparison between retentate and slurry data provides similar values for boron and Cs-137 confirming CsTPB remains in retentate as a solid. Similarly, Iron, Zinc, Cs-137, Np-237, Pu-238, and Sr-90 have similar values suggesting they are also retained as solids and contribute to the sludge content in Tank 48H. Conversely Molybdenum was lower concentration in retentate. Aluminum appeared to be partially retained on the filter.

Total mercury in variable depth samples is presented in Table 3-20 for both slurry and retentate. Results for both are adjusted by the insoluble solids values reported in Table 3-2 in order to provide an appropriate comparison. Table shows that retentate solids have higher mercury concentrations that slurry, suggesting the form of mercury is removed by filtration.

Table 3-20: Comparison of Total Mercury Between Sludge Solids and Retentate

Sample ID	Total Mercury Slurry (µg/g)	Total Mercury Retentate (µg/g)
HTF-48-21-81	2.31E+02	6.24E+02
HTF-48-21-82	2.69E+02	1.14E+03
HTF-48-21-83	2.30E+02	1.07E+03

3.4 CSTF Corrosion Control Program Analysis

To avoid unnecessary duplication, sample analyses were performed concurrently with analyses routinely requested by the corrosion control program (CCP) for Tank 48H.[12] Analytes of interest to the CCP are presented in Table 3-21 with 10% uncertainty unless otherwise noted. With the exception of Cs-137 concentrations being notably higher in the well mixed variable depth samples (HTF-48-21-81, -82, and -83), results are similar for all analytes of interest. CCP measurements of samples retrieved from Tank 48H on February 17 and November 18 of 2021 (i.e., HTF-48-21-11 and HTF-48-21-117) closely match those of the surface samples in this study (i.e., HTF-48-21-74, -75, and -76).

Table 3-21: Species Relevent to the CSTF Corrosion Control Program

	HTF-48-21 -74	HTF-48-21 -75	HTF-48-21 -76	HTF-48-21 -81	HTF-48-21 -82	HTF-48-21 -83
Carbonate (M)	0.891	0.887	0.871	0.908	0.901	0.914
Free OH (M)	1.70	1.68	1.70	1.60	1.59	1.48
Cs-137 (DPM/mL)	2.42E+07	2.16E+07	2.33E+07	4.88E+08	5.13E+08	5.80E+08
Density (g/mL) [%RSD]	1.262 [0.448 %]	1.287 [1.10 %]	1.275 [0.055 %]	1.318 [0.429 %]	1.245 [1.19 %]	1.216 [0.756 %]
Fluoride (M)	< 0.0132	< 0.0132	< 0.0132	< 0.0132	< 0.0132	< 0.0132
Formate (M)	< 0.00556	< 0.00556	< 0.00556	< 0.00556	< 0.00556	< 0.00556
Chloride (M)	0.0236	0.0231	0.0233	0.0224	0.0208	0.0216
Nitrite (M)	0.749	0.737	0.733	0.704	0.668	0.677
Nitrate (M)	0.213	0.209	0.207	0.196	0.186	0.190
Phosphate (M)	0.00804	0.00799	0.00786	0.00743	0.00701	0.00740
Sulfate (M)	0.00583	0.00580	0.00524	0.00493	0.00507	0.00535
Oxalate (M)	0.0176	0.0173	0.0177	0.0169	0.0160	0.0162
Al (M)	0.125	0.119	0.120	0.121	0.110	0.120
Na (M)	4.72	4.72	4.46	4.67	4.28	4.37
TOC (M)	0.214	0.220	0.227	0.206	0.198	0.216

4.0 Conclusions

The overall results of this work suggest that settling and decantation in Tank 48H can produce nearly solids-free liquid. The settling is sufficiently effective that liquid at the surface is similar in composition to filtrate. While solids do not compact tightly after a month of settling, the visual settling study shows that the solids form a definite interface with the upper liquid. The solids settle to about half the initial sample volume in the vials that were pictured.

5.0 References

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Appendix A: Additional Analytical Results

Table A-1: ICP-ES Analysis of Filtrate Samples Expressed as mg/L (10% RSD)

	Surface Samples Before Mixing			Variable Depth Samples After Mixing		
Component	**HTF-48-21-74**	**HTF-48-21-75**	**HTF-48-21-76**	**HTF-48-21-81**	**HTF-48-21-82**	**HTF-48-21-83**
Ag	< 0.329	< 0.329	< 0.329	< 0.329	< 0.329	< 0.329
Al	3365	3220	3225	3270	2965	3230
B	704	676	678	676	616	651
Ba	< 0.27	< 0.27	< 0.27	< 0.27	< 0.27	< 0.27
Be	< 0.207	< 0.207	< 0.207	< 0.207	< 0.207	< 0.207
Ca	6.67	5.51	5.88	7.36	9.80	13.60
Cd	< 0.464	< 0.464	< 0.464	< 0.464	< 0.464	< 0.464
Ce	< 5.31	< 5.31	< 5.31	< 5.31	< 5.31	< 5.31
Co	< 1.08	< 1.08	< 1.08	< 1.08	< 1.08	< 1.08
Cr	63.20	60.55	61.15	56.05	52.75	53.50
Cu	< 1.4	< 1.4	< 1.4	< 1.4	< 1.4	< 1.4
Fe	< 2.07	< 2.07	< 2.07	< 2.07	< 2.07	< 2.07
Gd	< 0.893	< 0.893	< 0.893	< 0.893	< 0.893	< 0.893
K	< 582	< 582	< 582	< 582	< 582	< 582
La	< 0.548	< 0.548	< 0.548	< 0.548	< 0.548	< 0.548
Li	< 9.07	< 9.07	< 9.07	< 9.07	< 9.07	< 9.07
Mg	< 1.24	< 1.24	< 1.24	< 1.24	< 1.24	< 1.24
Mn	< 0.58	< 0.58	< 0.58	< 0.58	< 0.58	< 0.58
Mo	8.61	8.24	8.35	8.16	7.56	8.00
Na	108500	108500	102500	107500	98550	100500
Ni	< 1.04	< 1.04	< 1.04	< 1.04	< 1.04	< 1.04
P	269.50	261.50	263.00	257.50	237.50	252.00
Pb	< 11.2	< 11.2	< 11.2	< 11.2	< 11.2	< 11.2
S	340.50	329.00	330.50	334.50	304.00	319.00
Sb	< 5.04	< 5.04	< 5.04	< 5.04	< 5.04	< 5.04
Si	< 23.2	< 23.2	< 23.2	< 23.2	< 23.2	< 23.2
Sn	< 16.3	< 16.3	< 16.3	< 16.3	< 16.3	< 16.3
Sr	< 0.464	< 0.464	< 0.464	< 0.464	< 0.464	< 0.464
Th	< 12.4	< 12.4	< 12.4	< 12.4	< 12.4	< 12.4
Ti	< 4.95	< 4.95	< 4.95	< 4.95	< 4.95	< 4.95
U	< 10.3	< 10.3	< 10.3	< 10.3	< 10.3	< 10.3
V	< 5	< 5	< 5	< 5	< 5	< 5
Zn	8.37	8.25	8.22	7.80	7.01	7.33
Zr	< 0.665	< 0.665	< 0.665	< 0.665	< 0.665	< 0.665

Table A-2: Ion Chromatography Anion and Cation Analysis of Filtrate Samples Expressed as mg/L (10%RSD)

	Surface Samples Before Mixing			Variable Depth Samples After Mixing		
Ion	**HTF-48-21-74**	**HTF-48-21-75**	**HTF-48-21-76**	**HTF-48-21-81**	**HTF-48-21-82**	**HTF-48-21-83**
Fluoride	< 250	< 250	< 250	< 250	< 250	< 250
Formate	< 250	< 250	< 250	< 250	< 250	< 250
Chloride	838	820	826	793	739	764
Nitrite	34500	33900	33700	32400	30800	31200
Nitrate	13200	13000	12900	12200	11600	11800
Phosphate	764	759	746	706	666	703
Sulfate	561	557	503	474	487	514
Oxalate	1550	1530	1560	1490	1410	1430
Bromide	< 1000	< 1000	< 1000	< 1000	< 1000	< 1000
Ammonium	< 100	< 100	< 100	< 100	< 100	< 100

Table A-3: VOA and SVOA results of Slurry Samples (10% RSD)

Sample ID	HTF-48-21-74	HTF-48-21-75	HTF-48-21-76	HTF-48-21-81	HTF-48-21-82	HTF-48-21-83
Semi-Volatile Organic Analysis (mg/L)						
N N Dimethylnitrosamine	< 1	< 1	< 1	< 1	< 1	< 1
N N Dioctylnitrosamine	< 1	< 1	< 1	< 1	< 1	< 1
All other Nitrosamines	< 1	< 1	< 1	< 1	< 1	< 1
Phenol	37.2	38	43.8	37.7	40.8	37.5
Tributylphosphate	< 1	< 1	< 1	< 1	< 1	< 1
2-Nitrophenol	2.8	3.16	2.98	4.54	3.86	3.13
Biphenyl	< 1	1.76	< 1	2690	3400	3040
4-Phenylazophenol	16.4	17.2	16.8	4	< 1	< 1
Isopar-L	< 70	< 70	< 70	< 70	< 70	< 70
Norpar13	< 7.5	< 7.5	< 7.5	< 7.5	< 7.5	< 7.5
All other SVOA	< 1	< 1	< 1	< 1	< 1	< 1
Volatile Organic Analysis (mg/L)						
Dimethylmercury	< 4.26	< 3.86	< 3.80	< 4.39	< 3.83	< 3.46
All Other VOA	< 4.26	< 3.86	< 3.80	< 4.39	< 3.83	< 3.46

Table A-4: ICP-MS Results of Slurry Samples Expressed as µg/g (10%RSD)

		HTF-48-21-74			HTF-48-21-75			HTF-48-21-76			HTF-48-21-81			HTF-48-21-82			HTF-48-21-83	
Component		Average	StDev		Average	StDev		Average	StDev		Average	StDev		Average	StDev		Average	StDev
As		4.91E-02	2.76E-03		4.66E-02	2.69E-03		4.43E-02	1.41E-03		5.12E-02	2.62E-03		4.99E-02	2.83E-04		5.84E-02	6.36E-04
Se	<	1.74E-02		<	4.86E-02			3.66E-02		<	6.24E-02			3.56E-02	*	<	5.28E-02	
Co		2.93E-02	9.12E-03		2.22E-02	2.12E-04		2.32E-02	4.24E-04		3.24E-02	9.90E-04		3.51E-02	1.34E-03		4.46E-02	4.24E-03
84	<	3.48E-03		<	3.25E-03		<	2.92E-03		<	3.12E-03		<	2.99E-03		<	2.64E-03	
85		1.41E-01	3.54E-03		1.19E-01	3.54E-03		1.37E-01	8.49E-03		1.89E+00	7.07E-03		1.93E+00	2.12E-02		2.17E+00	2.83E-02
86	<	3.48E-03		<	3.25E-03			4.89E-03	8.84E-04		1.65E-02	2.19E-03		1.48E-02	1.84E-03		2.03E-02	0.00E+00
87		2.14E-01	3.54E-03		2.04E-01	7.07E-03		2.11E-01	3.54E-03		3.32E+00	7.07E-03		3.32E+00	2.83E-02		3.82E+00	9.19E-02
88		1.73E-02	1.56E-03		1.97E-02	1.48E-03		4.54E-02	1.15E-02		1.33E-01	2.55E-02		1.25E-01	2.19E-02		1.72E-01	6.36E-03
89	<	3.48E-03		<	3.25E-03		<	2.92E-03		<	3.12E-03		<	2.99E-03		<	2.64E-03	
90		1.30E-02	1.48E-03		1.58E-02	4.95E-04		2.02E-02	1.41E-03		6.99E-02	1.09E-02		6.22E-02	6.58E-03		7.10E-02	8.49E-04
91	<	6.96E-03			3.90E-03	1.13E-04		4.99E-03	7.07E-05		2.83E-02	5.52E-03		2.43E-02	4.24E-03		3.11E-02	7.07E-04
92		2.09E-01	4.95E-03		2.17E-01	3.54E-03		2.18E-01	1.41E-03		2.29E-01	7.07E-03		2.30E-01	2.83E-03		2.65E-01	2.83E-03
93	<	6.96E-02		<	3.25E-02		<	4.38E-02			6.90E-02	2.77E-02		7.63E-02	3.08E-02		5.86E-02	3.75E-03
94		1.38E-01	4.24E-03		1.39E-01	2.12E-03		1.42E-01	7.07E-04		1.62E-01	6.36E-03		1.58E-01	3.54E-03		1.87E-01	7.07E-04
95		1.43E+00	0.00E+00		1.48E+00	7.07E-03		1.49E+00	0.00E+00		1.38E+00	1.41E-02		1.39E+00	1.41E-02		1.67E+00	2.12E-02
96		2.22E-01	0.00E+00		2.30E-01	2.12E-03		2.34E-01	2.83E-03		2.32E-01	4.95E-03		2.34E-01	2.83E-03		2.69E-01	0.00E+00
97		1.33E+00	1.41E-02		1.35E+00	1.41E-02		1.35E+00	0.00E+00		1.26E+00	1.41E-02		1.26E+00	7.07E-03		1.49E+00	2.12E-02
98		1.44E+00	7.07E-03		1.47E+00	1.41E-02		1.49E+00	7.07E-03		1.38E+00	2.12E-02		1.41E+00	0.00E+00		1.72E+00	2.12E-02
99		8.64E-01	2.12E-03		8.65E-01	7.78E-03		8.82E-01	1.41E-03		8.01E-01	4.24E-03		8.20E-01	4.24E-03		9.52E-01	7.07E-03
100		1.31E+00	7.07E-03		1.35E+00	2.12E-02		1.35E+00	7.07E-03		1.25E+00	1.41E-02		1.28E+00	7.07E-03		1.57E+00	2.12E-02
101		9.87E-02	1.34E-03		9.98E-02	2.83E-04		1.04E-01	7.07E-04		8.57E-02	1.77E-03		8.24E-02	2.12E-04		1.02E-01	1.41E-03
102		8.42E-02	9.90E-04		8.58E-02	1.98E-03		8.90E-02	1.06E-03		7.72E-02	1.48E-03		7.07E-02	7.07E-05		9.03E-02	1.41E-03
103		1.04E-01	2.12E-03		1.04E-01	0.00E+00		1.09E-01	1.41E-03		1.03E-01	4.31E-03		1.04E-01	3.54E-03		1.16E-01	3.54E-03
104		5.40E-02	1.34E-03		5.14E-02	2.83E-04		5.40E-02	3.54E-04		4.95E-02	1.84E-03		4.25E-02	2.83E-04		5.71E-02	1.48E-03
105		4.65E-02	2.62E-03		3.39E-02	5.66E-04		3.96E-02	1.27E-03		4.53E-02	1.56E-03		3.98E-02	2.05E-03		4.86E-02	0.00E+00
106		3.61E-02	1.91E-03		2.50E-02	1.06E-03		2.88E-02	6.36E-04		3.68E-02	7.78E-04		2.84E-02	7.07E-04		3.86E-02	1.06E-03
107	<	1.74E-02			1.72E-02	1.41E-03		2.39E-02	2.40E-03		2.53E-02	3.46E-03		2.73E-02	1.63E-03		2.49E-02	2.26E-03
108		1.06E-02	1.63E-03		3.64E-03	*		5.10E-03	2.26E-04		1.52E-02	7.07E-04	<	1.50E-02			1.30E-02	7.07E-05
109	<	1.74E-02		<	3.25E-03		<	1.46E-02		<	1.56E-02		<	3.00E-02		<	1.32E-02	
110	<	1.74E-02		<	3.25E-03		<	2.92E-03			9.04E-03	7.00E-04	<	3.28E-03	*		7.63E-03	4.17E-04
111	<	3.48E-03		<	3.25E-03		<	2.92E-03		<	3.12E-03		<	2.99E-03		<	2.64E-03	
112		4.16E-03	2.69E-04		3.96E-03	3.68E-04		4.57E-03	5.37E-04		6.31E-03	3.96E-04		6.65E-03	2.40E-04		6.81E-03	5.09E-04
113	<	3.48E-03		<	3.25E-03		<	2.92E-03			5.02E-02	1.34E-03	<	5.99E-03		<	2.64E-03	
114		3.97E-03	1.48E-04		3.54E-03	6.36E-05		4.15E-03	2.76E-04		5.94E-03	4.88E-04		6.43E-03	6.43E-04		7.18E-03	3.89E-04
116		5.21E-02	9.90E-04		4.94E-02	1.06E-03		4.98E-02	3.54E-04		4.69E-02	2.40E-03		4.82E-02	4.24E-04		5.66E-02	8.49E-04
117		3.68E-02	1.13E-03		3.67E-02	1.20E-03		3.57E-02	9.19E-04		3.73E-02	1.34E-03		3.89E-02	1.77E-03		4.53E-02	1.63E-03
118		1.03E-01	7.07E-04		1.01E-01	2.19E-03		9.85E-02	7.07E-05		9.60E-02	1.98E-03		9.78E-02	3.54E-04		1.16E-01	0.00E+00
119		4.47E-02	2.83E-04		4.57E-02	7.07E-04		4.49E-02	1.20E-03		8.39E-02	1.56E-03		8.39E-02	1.56E-03		9.60E-02	1.48E-03
120		1.34E-01	0.00E+00		1.35E-01	1.41E-03		1.31E-01	1.41E-03		1.28E-01	2.12E-03		1.27E-01	1.41E-03		1.51E-01	7.07E-04
121		1.07E-02	1.12E-03		8.34E-03	3.96E-04		1.16E-02	1.41E-04		1.43E-02	1.56E-03		1.49E-02	1.77E-03		1.61E-02	3.46E-03
122		3.30E-02	1.27E-03		3.18E-02	5.66E-04		3.19E-02	1.41E-04		2.95E-02	7.07E-04		3.02E-02	0.00E+00		3.61E-02	2.12E-04
123		7.26E-03	5.02E-04		6.32E-03	1.41E-05		7.83E-03	3.46E-04		1.07E-02	1.92E-03		1.14E-02	1.91E-03		1.30E-02	3.11E-03
124		4.81E-02	2.12E-04		4.83E-02	9.90E-04		4.72E-02	1.41E-04		4.40E-02	7.07E-05		4.63E-02	1.41E-04		5.26E-02	2.83E-04
125	<	3.48E-03		<	3.25E-03		<	2.92E-03		<	3.12E-03		<	2.99E-03		<	2.64E-03	
126		8.62E-02	5.02E-03		8.40E-02	1.20E-03		8.69E-02	3.39E-03		8.08E-02	1.77E-03		8.12E-02	8.49E-04		9.16E-02	5.23E-03
128	<	3.48E-03		<	3.25E-03		<	2.92E-03		<	3.12E-03		<	2.99E-03		<	2.64E-03	
130	<	3.48E-03		<	3.25E-03		<	2.92E-03			4.28E-03	9.97E-04		6.91E-03	6.29E-04		5.66E-03	3.82E-04
133		3.98E-01	4.24E-03		3.73E-01	1.41E-03		3.84E-01	7.07E-03		1.03E+01	7.07E-02		1.04E+01	7.07E-02		1.15E+01	1.41E-01
134	<	3.48E-03			8.91E-03	1.41E-04	<	2.92E-03			2.30E-02	5.66E-04		2.21E-02	1.06E-03		2.59E-02	2.83E-04
135		4.08E-02	1.06E-03		6.16E-02	2.90E-03		4.31E-02	1.48E-03		1.07E+00	7.07E-03		1.07E+00	7.07E-03		1.21E+00	7.07E-03
136	<	3.48E-03			2.79E-02	1.56E-03		6.05E-03	1.98E-04		6.53E-02	2.90E-03		6.41E-02	4.31E-03		7.63E-02	1.56E-03
137		9.46E-02	3.54E-04		1.28E-01	1.41E-03		9.37E-02	1.77E-03		4.29E+00	1.41E-01		4.19E+00	1.20E-01		4.71E+00	1.06E-01
138	<	1.74E-02			2.44E-01	2.12E-03		6.10E-02	4.17E-03		5.68E-01	2.90E-02		5.84E-01	2.33E-02		6.86E-01	1.20E-02

**Single measurement – muplicate analysis was below the limits of detection*

Continued – Table A-4: ICP-MS Results of Slurry Samples

139	<	3.48E-03		<	3.25E-03		<	2.92E-03		<	3.12E-03		<	2.99E-03		<	2.64E-03	
140	<	3.48E-03		<	3.25E-03		<	2.92E-03		<	3.12E-03			3.04E-03	*		2.77E-03	7.07E-06
141	<	3.48E-03		<	3.25E-03		<	2.92E-03		<	3.12E-03		<	2.99E-03		<	2.64E-03	
142	<	3.48E-03		<	3.25E-03		<	2.92E-03		<	3.12E-03		<	2.99E-03		<	2.64E-03	
143	<	3.48E-03		<	3.25E-03		<	2.92E-03		<	3.12E-03		<	2.99E-03		<	2.64E-03	
144	<	3.48E-03		<	3.25E-03		<	2.92E-03		<	3.12E-03		<	2.99E-03		<	2.64E-03	
145	<	3.48E-03		<	3.25E-03		<	2.92E-03		<	3.12E-03		<	2.99E-03		<	2.64E-03	
146	<	3.48E-03		<	3.25E-03		<	2.92E-03		<	3.12E-03		<	2.99E-03		<	2.64E-03	
147	<	3.48E-03		<	3.25E-03		<	2.92E-03		<	3.12E-03		<	2.99E-03		<	2.64E-03	
148	<	3.48E-03		<	3.25E-03		<	2.92E-03		<	3.12E-03		<	2.99E-03		<	2.64E-03	
149	<	3.48E-03		<	3.25E-03		<	2.92E-03		<	3.12E-03		<	2.99E-03		<	2.64E-03	
150	<	3.48E-03		<	3.25E-03		<	2.92E-03		<	3.12E-03		<	2.99E-03		<	2.64E-03	
151	<	3.48E-03		<	3.25E-03		<	2.92E-03		<	3.12E-03		<	2.99E-03		<	2.64E-03	
152	<	3.48E-03		<	3.25E-03		<	2.92E-03		<	3.12E-03		<	2.99E-03		<	2.64E-03	
153	<	3.48E-03		<	3.25E-03		<	2.92E-03		<	3.12E-03		<	2.99E-03		<	2.64E-03	
154	<	3.48E-03		<	3.25E-03		<	2.92E-03		<	3.12E-03		<	2.99E-03		<	2.64E-03	
155	<	3.48E-03		<	3.25E-03		<	2.92E-03		<	3.12E-03		<	2.99E-03		<	2.64E-03	
156	<	3.48E-03		<	3.25E-03		<	2.92E-03		<	3.12E-03		<	2.99E-03		<	2.64E-03	
157	<	3.48E-03		<	3.25E-03		<	2.92E-03		<	3.12E-03		<	2.99E-03		<	2.64E-03	
158	<	3.48E-03		<	3.25E-03		<	2.92E-03		<	3.12E-03		<	2.99E-03		<	2.64E-03	
159	<	3.48E-03		<	3.25E-03		<	2.92E-03		<	3.12E-03		<	2.99E-03		<	2.64E-03	
160	<	3.48E-03		<	3.25E-03		<	2.92E-03		<	3.12E-03		<	2.99E-03		<	2.64E-03	
161	<	3.48E-03		<	3.25E-03		<	2.92E-03		<	3.12E-03		<	2.99E-03		<	2.64E-03	
162	<	3.48E-03		<	3.25E-03		<	2.92E-03		<	3.12E-03		<	2.99E-03		<	2.64E-03	
163	<	3.48E-03		<	3.25E-03		<	2.92E-03		<	3.12E-03		<	2.99E-03		<	2.64E-03	
164	<	3.48E-03		<	3.25E-03		<	2.92E-03		<	3.12E-03		<	2.99E-03		<	2.64E-03	
165	<	3.48E-03		<	3.25E-03		<	2.92E-03		<	3.12E-03		<	2.99E-03		<	2.64E-03	
166	<	3.48E-03		<	3.25E-03		<	2.92E-03		<	3.12E-03		<	2.99E-03		<	2.64E-03	
167	<	3.48E-03		<	3.25E-03		<	2.92E-03		<	3.12E-03		<	2.99E-03		<	2.64E-03	
168	<	3.48E-03		<	3.25E-03		<	2.92E-03		<	3.12E-03		<	2.99E-03		<	2.64E-03	
169	<	3.48E-03		<	3.25E-03		<	2.92E-03		<	3.12E-03		<	2.99E-03		<	2.64E-03	
170	<	3.48E-03		<	3.25E-03		<	2.92E-03		<	3.12E-03		<	2.99E-03		<	2.64E-03	
171	<	3.48E-03		<	3.25E-03		<	2.92E-03		<	3.12E-03		<	2.99E-03		<	2.64E-03	
172	<	3.48E-03		<	3.25E-03		<	2.92E-03		<	3.12E-03		<	2.99E-03		<	2.64E-03	
173	<	3.48E-03		<	3.25E-03		<	2.92E-03		<	3.12E-03		<	2.99E-03		<	2.64E-03	
174	<	3.48E-03		<	3.25E-03		<	2.92E-03		<	3.12E-03		<	2.99E-03		<	2.64E-03	
175	<	3.48E-03		<	3.25E-03		<	2.92E-03		<	3.12E-03		<	2.99E-03		<	2.64E-03	
176	<	3.48E-03		<	3.25E-03		<	2.92E-03		<	3.12E-03		<	2.99E-03		<	2.64E-03	
177	<	1.74E-02		<	3.25E-03		<	2.92E-03		<	3.12E-03		<	2.99E-03		<	2.64E-03	
178	<	1.74E-02		<	3.25E-03		<	2.92E-03		<	3.12E-03		<	2.99E-03		<	2.64E-03	
179	<	3.48E-03		<	3.25E-03		<	2.92E-03		<	3.12E-03		<	2.99E-03		<	2.64E-03	
180	<	1.74E-02		<	3.25E-03		<	2.92E-03			4.03E-03	*		3.10E-03	*		3.12E-03	4.24E-04
181		3.91E-01	3.46E-02	<	3.25E-01		<	2.92E-01			3.30E-01	1.41E-03	<	3.96E-01			3.21E-01	3.46E-02
182		6.36E-02	4.03E-03		1.88E-01	0.00E+00		6.09E-02	5.66E-04		6.38E-02	1.41E-03		6.50E-02	1.06E-03		7.02E-02	4.45E-03
183		3.51E-02	9.19E-04		1.03E-01	1.41E-03		3.32E-02	2.83E-04		3.49E-02	7.07E-04		3.58E-02	3.54E-04		3.89E-02	1.84E-03
184		7.43E-02	4.38E-03		2.19E-01	7.07E-04		7.10E-02	7.07E-05		7.33E-02	2.26E-03		7.52E-02	2.12E-04		8.06E-02	3.61E-03
185	<	3.48E-03		<	3.25E-03		<	2.92E-03		<	3.12E-03		<	2.99E-03		<	2.64E-03	
186		6.91E-02	3.68E-03		2.05E-01	2.12E-03		6.55E-02	4.95E-04		7.01E-02	2.12E-03		6.97E-02	7.07E-05		7.58E-02	3.82E-03
187	<	3.48E-03		<	3.25E-03		<	2.92E-03		<	3.12E-03		<	2.99E-03		<	2.64E-03	
191		6.82E-03	2.22E-03	<	3.25E-03			5.88E-03	8.56E-04		1.43E-02	2.76E-03		1.46E-02	2.19E-03	<	2.64E-02	
193	<	1.74E-02			6.50E-03	8.56E-04		7.69E-03	8.49E-05		2.45E-02	5.02E-03		2.48E-02	4.24E-03	<	2.64E-02	
194	<	3.48E-03		<	3.25E-03		<	2.92E-03		<	3.12E-03		<	2.99E-03		<	2.64E-03	
195	<	3.48E-03		<	3.25E-03		<	2.92E-03		<	3.12E-03		<	2.99E-03		<	2.64E-03	
196	<	3.48E-03		<	3.25E-03		<	2.92E-03			1.60E-02	7.07E-05		1.63E-02	0.00E+00		1.79E-02	3.54E-04
198	<	3.48E-03			4.69E-03	3.18E-04		4.20E-03	1.26E-03		9.76E-01	2.83E-03		9.75E-01	4.24E-03		1.09E+00	2.12E-02

**Single measurement – muplicate analysis was below the limits of detection*

Continued - Table A-4: ICP-MS Results of Slurry Samples

203	<	3.48E-03		<	3.25E-03		<	2.92E-03		<	3.12E-03		<	2.99E-03		<	2.64E-03	
204		7.22E-03	7.07E-05		8.29E-03	4.24E-05		8.93E-03	8.20E-04		5.47E-01	7.07E-04		5.46E-01	2.12E-03		6.28E-01	1.48E-02
205	<	3.48E-03		<	3.25E-03		<	2.92E-03			3.34E-03	*	<	2.99E-03			2.89E-03	1.48E-04
206		1.05E-01	1.41E-03		1.13E-01	7.07E-04		1.22E-01	7.07E-04		7.37E-01	1.41E-03		7.75E-01	2.12E-03		8.44E-01	1.34E-02
207		9.16E-02	2.12E-04		9.62E-02	9.19E-04		1.07E-01	0.00E+00		6.49E-01	7.78E-03		6.81E-01	2.12E-03		7.37E-01	1.63E-02
208		2.19E-01	7.07E-04		2.36E-01	7.07E-04		2.60E-01	2.83E-03		1.57E+00	7.07E-03		1.64E+00	7.07E-03		1.90E+00	2.83E-02
229	<	3.48E-03		<	3.25E-03		<	2.92E-03		<	3.12E-03		<	2.99E-03		<	2.64E-03	
230	<	3.48E-03		<	3.25E-03		<	2.92E-03		<	3.12E-03		<	2.99E-03		<	2.64E-03	
232	<	1.74E-02		<	3.25E-03			3.38E-03	3.84E-03		5.23E-03	2.01E-03	<	1.50E-02			4.24E-03	3.04E-04
233		1.26E-02	0.00E+00		1.27E-02	0.00E+00		1.29E-02	7.07E-05		4.94E-02	1.06E-03		5.08E-02	4.24E-04		5.57E-02	1.34E-03
234		7.69E-02	3.75E-03		7.03E-02	3.04E-03		7.03E-02	2.83E-03		2.56E-01	2.83E-03		2.83E-01	7.07E-04		2.84E-01	1.20E-02
235		1.40E-01	7.07E-04		1.37E-01	1.41E-03		1.41E-01	1.41E-03		5.21E-01	1.13E-02		5.45E-01	2.83E-03		5.85E-01	0.00E+00
236		3.08E-02	3.54E-04		3.07E-02	4.24E-04		3.13E-02	4.24E-04		1.16E-01	7.07E-04		1.20E-01	0.00E+00		1.29E-01	2.83E-03
237		3.42E-02	3.54E-04		2.60E-02	4.24E-04		2.92E-02	7.07E-05		7.26E-02	6.86E-03		6.40E-02	6.79E-03		6.71E-02	1.48E-03
238		8.34E-01	3.54E-03		8.35E-01	2.83E-03		8.58E-01	5.66E-03		3.48E+00	1.41E-02		3.50E+00	1.41E-02		3.89E+00	5.66E-02
239	<	3.48E-03		<	3.25E-03		<	2.92E-03		<	3.12E-03		<	2.99E-03		<	2.64E-03	
240	<	3.48E-03		<	3.25E-03		<	2.92E-03		<	3.12E-03		<	2.99E-03		<	2.64E-03	
241	<	3.48E-03		<	3.25E-03		<	2.92E-03		<	3.12E-03		<	2.99E-03		<	2.64E-03	
242	<	3.48E-03		<	3.25E-03		<	2.92E-03		<	3.12E-03		<	2.99E-03		<	2.64E-03	
243	<	3.48E-03		<	3.25E-03		<	2.92E-03		<	3.12E-03		<	2.99E-03		<	2.64E-03	
244	<	3.48E-03		<	3.25E-03		<	2.92E-03		<	3.12E-03		<	2.99E-03		<	2.64E-03	
245	<	3.48E-03		<	3.25E-03		<	2.92E-03		<	3.12E-03		<	2.99E-03		<	2.64E-03	
246	<	3.48E-03		<	3.25E-03		<	2.92E-03		<	3.12E-03		<	2.99E-03		<	2.64E-03	
247	<	3.48E-03		<	3.25E-03		<	2.92E-03		<	3.12E-03		<	2.99E-03		<	2.64E-03	
248	<	3.48E-03		<	3.25E-03		<	2.92E-03		<	3.12E-03		<	2.99E-03		<	2.64E-03	
249	<	3.48E-03		<	3.25E-03		<	2.92E-03		<	3.12E-03		<	2.99E-03		<	2.64E-03	
250	<	3.48E-03		<	3.25E-03		<	2.92E-03		<	3.12E-02		<	1.50E-02		<	1.32E-02	
251	<	3.48E-03		<	3.25E-03		<	3.50E-03		<	3.12E-02		<	1.50E-02		<	1.32E-02	
252	<	3.48E-03		<	3.25E-03		<	2.92E-03		<	3.12E-03		<	1.50E-02		<	1.32E-02	

**Single measurement – duplicate analysis was below the limits of detection*

Table A-5: Cesium Removed Gamma Spectroscopic Analysis of Slurry Samples

Surface Samples (DPM/mL)									
Radionuclide		HTF-48-21-74			HTF-48-21-75			HTF-48-21-76	
		Average	StDev		Average	StDev		Average	StDev
Al-26	<	8.87E+01		<	7.12E+01		<	3.52E+01	
K-40	<	1.34E+03		<	2.08E+03		<	8.86E+02	
Co-60	<	1.52E+02		<	1.36E+02		<	6.62E+01	
Ru-106	<	8.87E+02		<	6.56E+02		<	3.26E+02	
Sb-125	<	4.27E+02		<	3.98E+02		<	1.83E+02	
Sb-126		1.86E+02	3.04E+01		2.05E+02	1.91E+01		3.31E+02	1.34E+01
Sn-126		1.86E+02	3.04E+01		2.05E+02	1.91E+01		3.31E+02	1.34E+01
Ce-144	<	8.07E+02		<	7.17E+02		<	4.09E+02	
Eu-154	<	2.21E+02		<	2.01E+02		<	1.42E+02	
Ra-228	<	1.26E+03		<	5.69E+02		<	2.00E+02	
Variable Depth Samples (DPM/mL)									
Radionuclide		HTF-48-21-81			HTF-48-21-82			HTF-48-21-83	
		Average	StDev		Average	StDev		Average	StDev
Al-26	<	5.87E+01		<	5.90E+01		<	7.03E+01	
K-40	<	1.25E+03		<	1.06E+03		<	1.22E+03	
Co-60	<	8.57E+01		<	7.36E+01		<	8.18E+01	
Ru-106	<	5.50E+02		<	5.27E+02		<	7.51E+02	
Sb-125	<	3.77E+02		<	3.31E+02		<	4.99E+02	
Sb-126	<	8.65E+01		<	6.63E+01		<	9.60E+01	
Sn-126	<	1.12E+02		<	1.26E+02		<	1.64E+02	
Ce-144	<	7.10E+02		<	6.26E+02		<	8.18E+02	
Eu-154	<	1.91E+02		<	1.64E+02		<	2.16E+02	
Ra-228	<	3.25E+02		<	2.85E+02		<	3.46E+02	

Table A-6: Am/Cm Counting of Slurry Samples

Surface Samples (DPM/mL)									
Radionuclide		HTF-48-21-74			HTF-48-21-75			HTF-48-21-76	
		Average	StDev		Average	StDev		Average	StDev
Am-241		7.93E+01	*		5.59E+01	2.12E+01	<	3.94E+01	
Am-243	<	8.60E+00		<	6.41E+00		<	5.60E+00	
Am-242m	<	3.82E+00		<	1.13E+00		<	1.15E+00	
Cm-243	<	3.17E+01		<	2.51E+01		<	2.43E+01	
Cm-245	<	2.61E+01		<	2.07E+01		<	2.00E+01	
Cm-247	<	5.43E+01		<	2.33E+01		<	4.69E+01	
Cf-249	<	6.38E+01		<	2.60E+01		<	4.21E+01	
Cf-251	<	7.57E+01		<	3.61E+01		<	6.67E+01	
Cm-242	<	3.16E+00		<	1.88E+00		<	9.48E-01	
Cm-244	<	3.16E+00		<	1.72E+00		<	9.48E-01	
Variable Depth Samples (DPM/mL)									
Radionuclide		HTF-48-21-81			HTF-48-21-82			HTF-48-21-83	
		Average	StDev		Average	StDev		Average	StDev
Am-241		1.57E+03	6.36E+01		1.83E+03	6.43E+02		1.51E+03	2.12E+01
Am-243	<	8.96E+00		<	1.44E+02		<	1.32E+01	
Am-242m	<	5.90E+00		<	4.72E+01		<	2.85E+00	
Cm-243	<	4.39E+01		<	5.21E+02		<	4.61E+01	
Cm-245	<	3.61E+01		<	4.30E+02		<	3.79E+01	
Cm-247	<	8.35E+01		<	1.00E+03		<	5.69E+01	
Cf-249	<	8.26E+01		<	1.19E+03		<	5.92E+01	
Cf-251	<	1.19E+02		<	1.16E+03		<	8.91E+01	
Cm-242	<	4.88E+00		<	3.91E+01			2.55E+00	*
Cm-244		2.16E+01	5.52E+00	<	1.32E+02			3.01E+01	1.51E+01

* *Single measurement – duplicate analysis was below the limits of detection*

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