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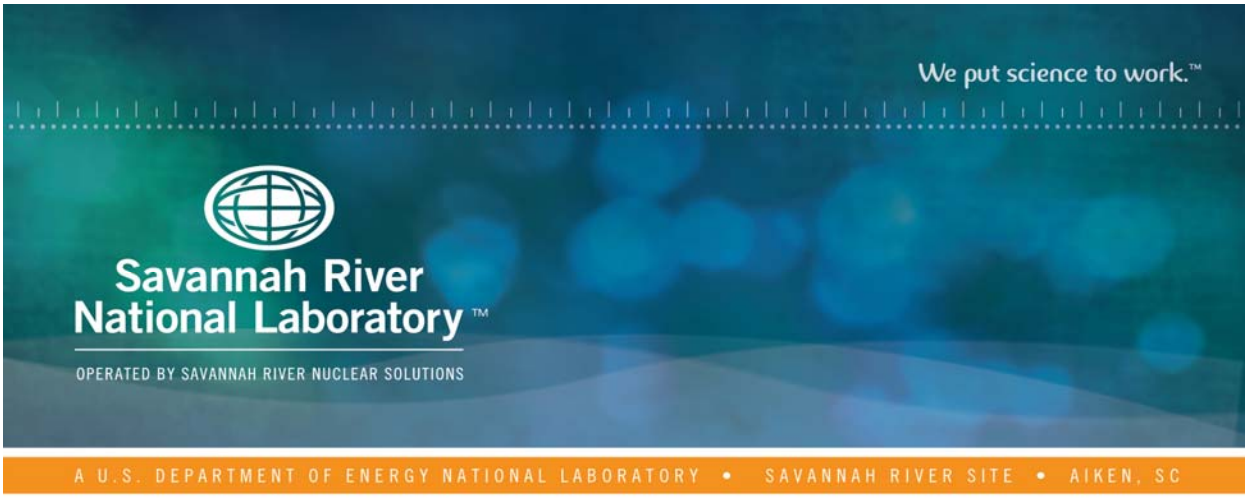

1QCY17 Saltstone Waste Characterization Analysis

F.C. Johnson

July 2017

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EXECUTIVE SUMMARY

In the first quarter of calendar year 2017, a salt solution sample was collected from Tank 50 on January 16, 2017 in order to meet South Carolina (SC) Regulation 61-107.19 Part I C, "Solid Waste Management: Solid Waste Landfills and Structural Fill – General Requirements" and the Saltstone Disposal Facility Class 3 Landfill Permit. The Savannah River National Laboratory (SRNL) was requested to prepare and ship saltstone samples to a United States Environmental Protection Agency (EPA) certified laboratory to perform the Toxicity Characteristic Leaching Procedure (TCLP) and subsequent characterization.

By comparing the 2017 TCLP leachate results to the regulatory limits, the following conclusions can be made:

- The saltstone waste form was not characteristically hazardous for toxicity per SC Regulation.61-79.261.24(b)
- All of the inorganic and organic concentrations were below the nonwastewater standard levels per SC Regulation 61-79.268.48(a), except potentially phenol, which has an average concentration of <10 mg/L; however, phenol was measured at 1.1 mg/L in the corresponding quarterly saltstone sample from the first quarter of calendar year 2017 (1QCY17) that was prepared from the same Tank 50 salt solution and premix as the samples analyzed in this report. The 1QCY17 sample concentration represents the *total* phenol in the solid sample (as opposed to the TCLP leachate concentration presented in this report), which is still less than the nonwastewater standard level of 6.2 mg/L.
- Concentrations of most of the organic and inorganic species were not greater than 10 times the maximum contaminant level (MCL) per SC Regulation 61-107.19 Part I, A.1(d) except as follows:
    - Nitrate, nitrite, sum of nitrate and nitrite, sulfate, and potentially fluoride
- The gross alpha particle activity and combined ^{226}Ra and ^{228}Ra exceed the MCL by more than a factor of 10

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1QCY17	first quarter of calendar year 2017
ARP	Actinide Removal Process
CRDL	contract required detection limit
DSSHT	Decontaminated Salt Solution Hold Tank
EPA	Environmental Protection Agency
ESS-WP	Environmental Services Section – Waste Programs
ETP	Effluent Treatment Project
ISWLF	Industrial Solid Waste Landfill
IWTF	Industrial Wastewater Treatment Facility
LLW	low-level waste
LOD	limit of detection
LOQ	limit of quantitation
MCL	maximum contaminant level
MCU	Modular Caustic Side Solvent Extraction Unit
MDA	minimum detectable activity
MDL	method detection limit
MS	matrix spike
MSD	matrix spike duplicate
RCRA	Resource Conservation and Recovery Act
RSL	Regional Screening Level
SC	South Carolina
SCDHEC	South Carolina Department of Health and Environmental Control
SDF	Saltstone Disposal Facility
SPF	Saltstone Production Facility
SRNL	Savannah River National Laboratory
SWRI	Southwest Research Institute
TCLP	Toxicity Characteristic Leaching Procedure
TPU	total propagated uncertainty
TTQAP	Task Technical and Quality Assurance Plan
UHCs	underlying hazardous constituents
UTS	Universal Treatment Standards
WAC	Waste Acceptance Criteria

1.0 Introduction

The Saltstone Production Facility (SPF) is designed and permitted by the State of South Carolina Department of Health and Environmental Control (SCDHEC) to immobilize and dispose of low-level radioactive and hazardous liquid waste (salt solution) remaining from the processing of radioactive material at the Savannah River Site (SRS).[1] Low-level waste (LLW) aqueous streams from the Effluent Treatment Project (ETP), H-Canyon, and decontaminated solutions from the Modular Caustic Side Solvent Extraction Unit (MCU) are stored in Tank 50 until the LLW can be transferred to the Saltstone Facility for treatment and disposal. LLW that meets the Waste Acceptance Criteria (WAC) can be transferred, stored, and treated in the Saltstone Production Facility (SPF) for subsequent disposal as saltstone grout in the Saltstone Disposal Facility (SDF).[1] Sampling will be conducted as new waste streams are identified for treatment and disposal at the Saltstone Industrial Wastewater Treatment Facility (IWTF) and Z-Area Industrial Solid Waste Landfill (ISWLF) or every six years[2,3] in accordance with South Carolina (SC) Regulation 61-107.19 Part I C,[4] "Solid Waste Management: Solid Waste Landfills and Structural Fill – General Requirements."

In the first quarter of calendar year 2017 (1QCY17), a salt solution sample[5] was collected from Tank 50 on January 16, 2017 in order to meet SC Regulation 61-107.19 Part I C[4] and the Saltstone Disposal Facility Class 3 Landfill Permit.[6] The Savannah River National Laboratory (SRNL) was requested[7] to prepare and ship saltstone samples to a United States Environmental Protection Agency (EPA) certified laboratory to perform the Toxicity Characteristic Leaching Procedure (TCLP) and characterization of the leachates. This report completes deliverable #2[A] of the Technical Task Request (TTR)[7] and documents the following:

- Preparation of the saltstone samples by SRNL and results of the subsequent testing and analyses by the certified laboratory (TTR task #1)
- Evaluation of the results per SC Regulation 61-79.261.24(b) and 61-79.268.48(a), and 61-107.19 Part I, A.1(d) (TTR task #2)
- Comparison of the 2017 and 2011 average results for the underlying hazardous constituents (UHCs) and radionuclides (TTR task #3).

2.0 Experimental Procedure

2.1 Saltstone Preparation

Saltstone samples for waste characterization were prepared at SRNL with the Tank 50 blended salt solution and a premix of cement, slag, and fly ash.[8,B] The weight percent solids data used for waste characterization samples were taken from the quarterly WAC analyses performed on Tank 50.[5] Three separate batches of the salt solution and premix materials were prepared. Dry blend material was added to the salt solution in a mixer at a low speed. Once all dry blend material was incorporated, the speed of the mixer was increased until a stable vortex was reached. The sample was left to mix for three minutes. After the saltstone slurry was mixed, each sample was cast into a polyethylene zip top bag. The bag was laid flat and the air was expelled prior to sealing. The samples were cured flat in a polyethylene bag to facilitate the size reduction step needed to conform to the particle size requirements of the TCLP method.

After curing the 1QCY17 samples for no less than 28 days[C], the saltstone samples were removed from the containers and a portion of the each saltstone sample was crushed and screened through a 3/8-inch sieve

[A] Note that SRNL Quality Assurance (QA) is not required to approve this technical report as was originally specified in the Technical Task Request (TTR).
[B] Per the customer specifications, the water to premix ratio was 0.60, and antifoam and Daratard were not added.
[C] Samples are considered ready for analysis after 28 days. Samples are not crushed until a shipment has been scheduled.

as prescribed by Section 7.13 of the TCLP method.[9] In accordance with the Technical Task Request (TTR) requirements, material passing through the 3/8-inch sieve was subsequently screened through a U.S. No. 4 sieve.[7] On March 9, 2017, the crushed saltstone samples were packaged into containers provided by Environmental Services Section – Waste Programs (ESS-WP). After the saltstone has been crushed, sieved and packaged, the sample is deemed "collected."[10] ESS-WP retrieved the samples from SRNL and transported them to the Southwest Research Institute (SWRI) for extraction and analysis.

2.2 Saltstone Testing

The saltstone samples were received by SWRI on March 10, 2017. Chain of custody forms are provided in Appendix A, Figure A-1 through Figure A-3. Table 2-1 summarizes the methods that were used to prepare and analyze for various UHCs, including the eight Resource Conservation and Recovery Act (RCRA) metals.

Table 2-1. Summary of EPA Test Methods

Analysis Type	Methods
Volatile Analysis (benzene, toluene, and n-butanol)	SW-846 Method 1311 (sample extraction) SW-846 Method 8260C (analysis)
Semivolatile Analysis (phenol)	SW-846 Method 1311 (sample extraction) SW-846 Methods 3520C and 3510C (leachate extraction) SW-846 Method 8270D (analysis)
Wetchem Analyses (cyanide[D])	SW-846 Method 9010C (preparation) SW-846 Method 9012B (analysis)
TCLP Metals	SW-846 Method 1311 (sample extraction) SW-846 Method 7470A (analysis – Hg only) SW-846 Method 3010A (digestion) SW-846 Method 6020 (analysis – Be and Tl) SW-846 Method 6010D (analysis – Al, Sb, As, Ba, B, Cd, Cr, Co, Cu, Fe, Pb, Li, Mn, Mo, Ni, Se, Ag, Sr, U, and Zn)
TCLP Anions (chloride, fluoride, nitrate as nitrogen, nitrite as nitrogen, and sulfate)	SW-846 Method 1311 (sample extraction) Method 300 (analysis)
Radionuclides	SW-846 Method 1311 (sample extraction) Gamma Spectroscopy (^{60}Co, ^{106}Ru, ^{106}Rh, ^{125}Sb, ^{137}Cs, ^{137m}Ba, and ^{154}Eu) Gas Proportional Counting (gross alpha, gross beta, $^{89/90}$Sr, and ^{228}Ra) Alpha spectroscopy (^{241}Am, ^{242}Cm, $^{243/244}$Cm, ^{238}Pu, $^{239/240}$Pu, and ^{226}Ra) Liquid Scintillation Spectroscopy (^{3}H, ^{99}Tc, ^{147}Pm, and ^{241}Pu)

2.3 Quality Assurance

This work was directed by a Task Technical and Quality Assurance Plan (TTQAP).[11] Requirements for performing reviews of technical reports and the extent of review are established in Manual E7, Procedure 2.60.[12] SRNL documents the extent and type of review using the SRNL Technical Report Design Checklist contained in WSRC-IM-2002-00011, Rev. 2.[13]

[D] Cyanide analysis was performed on the solid samples, not the TCLP leachates.

3.0 Results

The 2017 results summarized in the following tables are presented as reported in the data package from SWRI.[E,14] For comparison, the 2011 waste characterization results[15,16] are also included along with the following regulatory limits:

- Maximum contaminant levels (MCLs) as defined by the State Primary Drinking Water Regulation 61-58[17]
- Nonwastewater treatment standard levels in the Universal Treatment Standards (UTS) as defined by SC Regulation 61-79.268.48(a)[18]
- Maximum concentration of contaminants for the Toxicity Characteristic per SC Regulation 61-79.261.24(b)[19]

Results for the inorganic and organic UHCs (including the eight RCRA metals) from the TCLP leachates are shown in Table 3-1 along with the total and amenable cyanides. Table 3-2 presents the radionuclides from the TCLP leachates.[F]

Results are also reported on SCDHEC forms D-3657 ("RCRA & SW – TCLP Metals"), D-3658 ("RCRA & SW – TCLP Volatiles"), and D-3659 ("RCRA & SW Semi-Volatiles") as shown in Appendix B, Table B-1 through Table B-3. Quality assurance data are reported on SCDHEC forms D-3732 ("Characterization Associated Quality Assurance Data") and D-3733 ("Cross Reference Report for QA Analytes") as shown in Appendix B, Table B-4 and Table B-5.

The following quality control issues were noted for the 2017 analyses:

- Silver – The results are "J" flagged due to the low matrix spike (MS)/matrix spike duplicate (MSD) recoveries.
- Selenium – The results are "J" flagged due to the duplicate control limit criteria not being met.
- Fluoride – The results are "J" flagged since the MS/MSD recoveries were <75% but ≥ 30%.
- Chloride – The results are "J" flagged due to the duplicate criteria not being met.
- Phenol – Due to potential matrix interferences, the vendor re-extracted the samples at a lower volume; however, the re-extraction took place outside of the technical holding time for extraction. The results are also "J" flagged due to the low surrogate recoveries.
- ^{228}Ra – (1) The results for the preparation blank was greater than the total propagated uncertainty (TPU) and the minimum detectable activity (MDA), and (2) the laboratory control sample had a low recovery.
- ^{226}Ra – The ^{133}Ba tracer recoveries were low for sample W-17013-00003 and its duplicate.
- ^{147}Pm – The laboratory control sample had a low recovery; however, the result was within 1 sigma error of the recovery control limits.
- ^{241}Pu – Due to the slight chemical differences between the calibration standards and sample, the quench units were greater than 10% in difference.

[E] Results from the vendor that were reported in µg/kg were converted to mg/L.
[F] Total propagated uncertainty for the radiochemistry analyses is provided in the vendor data report.

Table 3-1. Results for the Inorganic and Organic UHCs from the TCLP Leachates and Cyanide (mg/L)

(continued on next page)

Analyte	Sample ID			2017 Average[d]	2011 Results[16,e]	Regulatory Limits		
	W-17013-00001	W-17013-00002	W-17013-00003			MCL[17]	UTS[18]	Toxicity[19]
Aluminum	<0.0750	<0.0750	<0.0750	<0.0750	1.86±0.31[E]	0.05-0.2	---	---
Antimony	<0.0200	<0.0200	<0.0200	<0.0200	0.0030[B2]	0.006	1.15	---
Arsenic	<0.0200	<0.0200	<0.0200	<0.0200	0.0134	0.010	5.0	5.0
Barium	0.417	0.386	0.387	0.397±0.018	0.234	2.0	21	100.0
Beryllium	<0.00500[D]	<0.00500[D]	<0.00500[D]	<0.00500[D]	<0.00016	0.004	1.22	---
Boron	0.572	0.584	0.552	0.569±0.016	0.75±0.06	4.0[f]	---	---
Cadmium	<0.00500	<0.00500	<0.00500	<0.00500	0.0003[B2]	0.005	0.11	1.0
Chromium	<0.00500	<0.00500	<0.00500	<0.00500	0.0183	0.1	0.60	5.0
Cobalt	<0.00500	<0.00500	<0.00500	<0.00500	<0.00012	0.006[f]	---	---
Copper	<0.00500	<0.00500	<0.00500	<0.00500	0.022±0.001[B2]	1	---	---
Iron	0.254	0.162[B1]	0.196[B1]	0.204±0.047[a]	0.23±0.05	0.3	---	---
Lead	<0.00500	<0.00500	<0.00500	<0.00500	0.0027[B2]	0.015[f]	0.75	5.0
Lithium	0.372	0.359	0.357	0.363±0.008	0.85±0.02	0.040[f]	---	---
Manganese	0.0176	<0.00500	0.00607[B1]	0.00956±0.00699[a,b]	0.0022±0.0007[a]	0.05	---	---
Mercury	0.00680	0.00703	0.00304	0.00562±0.00224	0.0186	0.002	0.025	0.2
Molybdenum	0.244	0.243	0.241	0.243±0.002	0.50±0.02	0.10[f]	---	---
Nickel	<0.00500	<0.00500	<0.00500	<0.00500	0.0035[B2]	0.39[f]	11	---
Selenium	<0.0250[J1]	0.0258[B1,J1]	<0.0250[J1]	0.0253±0.0005[a,b,c]	0.159[E]	0.05	5.7	1.0
Silver	<0.0100[J2]	<0.0100[J2]	<0.0100[J2]	<0.0100[J2]	0.00014[B2]	0.1	0.14	5.0
Strontium	2.940	2.850	2.840	2.877±0.055	0.34±0.02	12[f]	---	---
Thallium	<0.00500[D]	<0.00500[D]	<0.00500[D]	<0.00500[D]	0.00026[B2]	0.002	0.20	---
Uranium	<0.200	<0.200	<0.200	<0.200	0.003±0.004[*]	0.03	---	---

Table 3–1 continued. Results for the Inorganic and Organic UHCs from the TCLP Leachates and Cyanide (mg/L)

Analyte	Sample ID			2017 Average[d]	2011 Results[16,e]	Regulatory Limits		
	W-17013-00001	W-17013-00002	W-17013-00003			MCL[17]	UTS[18]	Toxicity[19]
Zinc	<0.00500	<0.00500	<0.00500	<0.00500	<0.046	5	4.3	---
Chloride	216[D,J1]	222[D,J1]	226[D,J1]	221±5[D,J1]	28.5±1.8	250	---	---
Fluoride	<200[D,J3]	<200[D,J3]	<200[D,J3]	<200[D,J3]	<2.5	4.0	---	---
Nitrate as Nitrogen	4980[D]	5040[D]	5000[D]	5007±31[D]	5884±2378[i]	10	---	---
Nitrite as Nitrogen	1710[D]	1760[D]	1720[D]	1730±26[D]	189±7	1	---	---
Total Nitrate and Nitrite (sum of analyzed results)	6690	6800	6720	6737±57	6074±2371[i]	10	---	---
Sulfate	4460[D]	4340[D]	4460[D]	4420±69[D]	169±8.5	250	---	---
Benzene	<0.02	<0.02	<0.02	<0.02	<0.003	0.005	10	0.5
Toluene	<0.02	<0.02	<0.02	<0.02	<0.0025	1	10	---
n-Butanol	<0.2	<0.2	<0.2	<0.2	<0.15	2.0[f]	2.6	---
Phenol[g]	<10[J2]	<10[J2]	<10[J2]	<10[J2]	0.007±0.003[h]	5.8[f]	6.2	---
Cyanide (total)	9.02	10.2	7.54	8.92±1.33	not measured	---	590	---
Cyanide (amenable)	<0.475	<0.488	<0.372	<0.488	not measured	0.2	30	---

[B1] Result is greater than or equal to the limit of detection (LOD) and less than the limit of quantitation (LOQ)
[B2] Concentration is between the method detection limit (MDL) and the contract required detection limit (CRDL)
[D] Result is reported from a dilution.
[E] Associated serial dilution is outside percent difference quality control criteria.
[J1] Duplicate criteria were not met.
[J2] MS and/or MSD and/or surrogate criteria were not met.
[J3] The MS/MSD recoveries were <75% but ≥ 30%.
[*]Associated duplicate is outside relative percent difference quality control criteria.
[a] At least one of the values is "B1" flagged (see explanation above).
[b] At least one of the values is a less than (<) value.
[c] At least one of the values is "J1" flagged (see explanation above).
[d] Results are the average of triplicate samples and include the standard deviation when applicable. If all values are a less than (<) value, then the highest value is reported as the average.
[e] Results for Al, B, Co, Cu, Fe, Li, Mn, Hg, Mo, Sr, U, and Zn are the average of triplicate samples and include the standard deviation when applicable. Results for Sb, As, Ba, Be, Cd, Cr, Pb, Ni, Se, Ag, and Tl are from one sample. If all values are a less than (<) value, then the highest value is reported as the average.
[f] United States EPA RSLs for tap water.[20]
[g] Results for the re-extracted sample are shown.
[h] The less than (<) value was excluded from the calculation of this average.
[i] Value is slightly different than reported in SRNL-STI-2011-00561[15] due to rounding.

Table 3-2. Radionuclide Results for the TCLP Leachates (pCi/L)

Analyte	Sample ID			2017 Average[g]	2011 Results[16,g]	Regulatory Limit
	W-17013-00001	W-17013-00002	W-17013-00003			MCL[17]
Gross α	6.46E+04	6.31E+04	6.31E+04	(6.36±0.09)E+04	<2.01E+03	15
Gross β	5.80E+07	5.83E+07	5.79E+07	(5.81±0.02)E+07	(1.8±0.1)E+07	---
Gross γ[d]	1.40E+07	1.46E+07	1.45E+07	(1.43±0.03)E+07	(1.69±0.15)E+07	---
^{3}H	3.12E+05	2.87E+05	2.80E+05	(2.93±0.17)E+05	(1.2±0.5)E+03	---
^{60}Co	<1.41E+04	<1.60E+04	<1.55E+04	<1.60E+04	<4.0E+02	---
^{90}Sr	2.06E+07	2.02E+07	2.15E+07	(2.08±0.07)E+07	(9.7±4.3)E+04	---
^{99}Tc	2.16E+06	2.17E+06	1.98E+06	(2.10±0.11)E+06	(5.1±0.70)E+04	---
^{106}Ru	<2.43E+05	<2.52E+05	<2.48E+05	<2.52E+05	<3.3E+04	---
^{106}Rh[e]	<2.43E+05	<2.52E+05	<2.48E+05	<2.52E+05	<2.0E+04	---
^{125}Sb	<1.36E+05	<1.40E+05	<1.40E+05	<1.40E+05	<1.5E+04	---
^{137}Cs	1.48E+07	1.54E+07	1.53E+07	(1.52±0.03)E+07	(1.8±0.2)E+07	---
^{137m}Ba[f]	1.40E+07	1.46E+07	1.45E+07	(1.43±0.03)E+07	(1.7±0.1)E+07	---
^{147}Pm	<8.81E+02	1.04E+03	<8.83E+02	(9.35±0.91)E+02[b]	<1.2E+02	---
^{154}Eu	<2.68E+04	<2.75E+04	<2.72E+04	<2.75E+04	<4.9E+02	---
^{226}Ra	<3.55E+01	<2.77E+01	<9.69E+01	<9.69E+01	<6.5E+04	5[a]
^{228}Ra	8.87E+06	9.26E+06	1.12E+07	(9.78±1.25)E+06	<4.7E+03	
^{238}Pu	6.99E+01	6.68E+01	9.34E+01	(7.67±1.45)E+01	<3.5E+01	---
$^{239/240}$Pu	8.47E+00	9.40E+00	6.98E+00	(8.28±1.22)E+00	<1.3E+01	---
^{241}Pu	<9.38E+02	<9.19E+02	<8.12E+02	<9.38E+02	<1.3E+03	---
^{241}Am	<9.53E+00	<1.79E+01	<1.57E+01	<1.79E+01	<1.5E+01	---
^{242}Cm	<8.41E+00	<8.54E+00	<8.23E+00	<8.54E+00	<1.3E+01	---
$^{243/244}$Cm	<7.54E+00	<9.58E+00	<15.6E+00	<15.6E+00	<1.2E+01[c]	---

[a] The MCL is for combined radium (^{226}Ra and ^{228}Ra).

[b] At least one of the values is a less than (<) value.

[c] Vendor reported as ^{244}Cm only.[16]

[d] Gross γ is a calculated value and is equivalent to the sum of the *detected* values of ^{125}Sb, ^{126}Sb, ^{126}Sn, ^{241}Am, ^{137m}Ba and ^{60}Co. Since some of these species were not measured or are below the detection limit, gross γ is equal to the ^{137m}Ba value.

[e] ^{106}Rh is in secular equilibrium with 100% of ^{106}Ru.

[f] ^{137m}Ba is in secular equilibrium with 94.6% of ^{137}Cs.[21]

[g] Results are the average of triplicate samples and include the standard deviation when applicable. If all values are a less than (<) value, then the highest value is reported as the average.

4.0 Conclusions

By comparing the 2017 waste characterization sample results to the regulatory limits, the following conclusions can be made:

- The saltstone waste form was not characteristically hazardous for toxicity per SC Regulation 61-79.261.24(b)[19]
- All of the inorganic and organic concentrations were below the nonwastewater standard levels per SC Regulation 61-79.268.48(a)[18], except potentially phenol, which has an average concentration of <10 mg/L; however, phenol was measured at 1.1 mg/L in the corresponding quarterly saltstone sample from 1QCY17[22] that was prepared from the same Tank 50 salt solution and premix as the samples analyzed in this report. The 1QCY17 sample concentration represents the *total* phenol in the solid sample (as opposed to the TCLP leachate concentration presented in this report), which is still less than the nonwastewater standard level of 6.2 mg/L.
- Concentrations of most of the organic and inorganic species were not greater than 10 times the MCL per SC Regulation 61-107.19 Part I, A.1(d)[4], except as follows:
    - Nitrate, nitrite, sum of nitrate and nitrite, sulfate, and potentially fluoride
- The gross alpha particle activity and combined ^{226}Ra and ^{228}Ra exceed the MCL by more than a factor of 10

5.0 References

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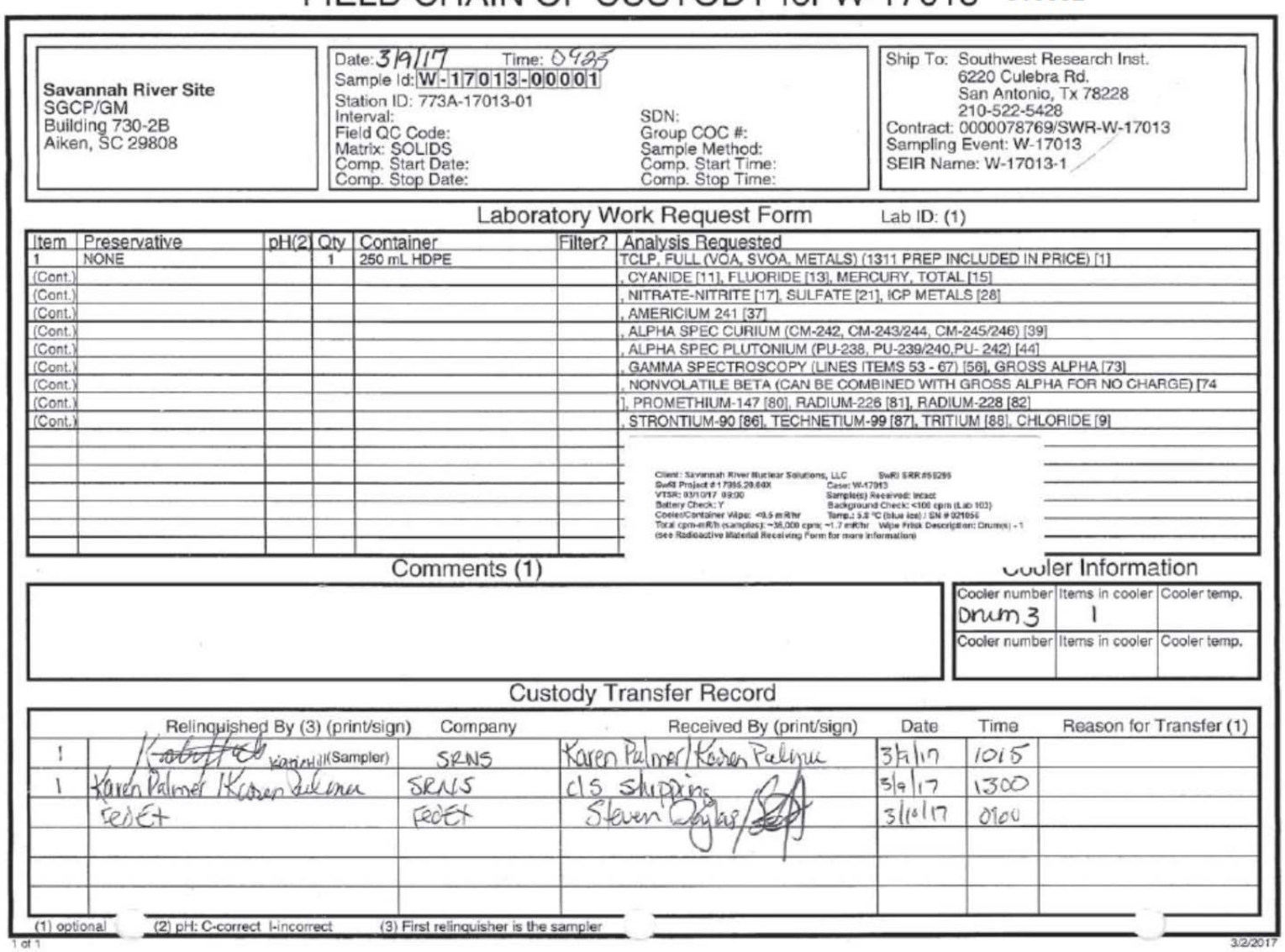
Appendix A. Chain of Custody Forms



FIELD CHAIN OF CUSTODY for W-17013 010002

Savannah River Site
SGCP/GM
Building 730-2B
Aiken, SC 29808

Date: 3/9/17 Time: 0925
Sample Id: W-17013-00001
Station ID: 773A-17013-01
Interval: SDN:
Field QC Code: Group COC #:
Matrix: SOLIDS Sample Method:
Comp. Start Date: Comp. Start Time:
Comp. Stop Date: Comp. Stop Time:

Ship To: Southwest Research Inst.
6220 Culebra Rd.
San Antonio, Tx 78228
210-522-5428
Contract: 0000078769/SWR-W-17013
Sampling Event: W-17013
SEIR Name: W-17013-1

Laboratory Work Request Form Lab ID: (1)

Item	Preservative	pH(2)	Qty	Container	Filter?	Analysis Requested
1	NONE		1	250 mL HDPE		TCLP, FULL (VOA, SVOA, METALS) (1311 PREP INCLUDED IN PRICE) [1]
(Cont.)						, CYANIDE [11], FLUORIDE [13], MERCURY, TOTAL [15]
(Cont.)						, NITRATE-NITRITE [17], SULFATE [21], ICP METALS [28]
(Cont.)						, AMERICIUM 241 [37]
(Cont.)						, ALPHA SPEC CURIUM (CM-242, CM-243/244, CM-245/246) [39]
(Cont.)						, ALPHA SPEC PLUTONIUM (PU-238, PU-239/240,PU- 242) [44]
(Cont.)						, GAMMA SPECTROSCOPY (LINES ITEMS 53 - 67) [56], GROSS ALPHA [73]
(Cont.)						, NONVOLATILE BETA (CAN BE COMBINED WITH GROSS ALPHA FOR NO CHARGE) [74
(Cont.)						], PROMETHIUM-147 [80], RADIUM-226 [81], RADIUM-228 [82]
(Cont.)						, STRONTIUM-90 [86], TECHNETIUM-99 [87], TRITIUM [88], CHLORIDE [9]

Client: Savannah River Nuclear Solutions, LLC SwRI SRR#55295
SwRI Project # 17365.20.60X Case: W-17013
VTSR: 03/10/17 09:00 Sample(s) Received: Intact
Battery Check: Y Background Check: <100 cpm (Lab 103)
Cooler/Container Wipe: <0.5 mR/hr Temp.: 5.8 °C (blue ice) / SN # 021056
Total cpm-mR/h (samples): ~36,000 cpm; ~1.7 mR/hr Wipe Frisk Description: Drum(s) - 1
(see Radioactive Material Receiving Form for more information)

Comments (1)

Cooler Information

Cooler number	Items in cooler	Cooler temp.
Drum 3	1	
Cooler number	Items in cooler	Cooler temp.

Custody Transfer Record

	Relinquished By (3) (print/sign)	Company	Received By (print/sign)	Date	Time	Reason for Transfer (1)
1	Karen Hill (Sampler)	SRNS	Karen Palmer/Karen Palmer	3/9/17	1015	
1	Karen Palmer/Karen Palmer	SRNS	CLS Shipping	3/9/17	1300	
	FedEx	FedEx	Steven Dykes	3/10/17	0900	

(1) optional (2) pH: C-correct I-incorrect (3) First relinquisher is the sampler

1 of 1 3/2/2017

Figure A-1. Chain of custody for sample W-17013-00001.

FIELD CHAIN OF CUSTODY for W-17013 010003

Savannah River Site
SGCP/GM
Building 730-2B
Aiken, SC 29808

Date: 3/9/17 Time: 0934
Sample Id: W-17013-00002
Station ID: 773A-17013-02
Interval:
Field QC Code:
Matrix: SOLIDS
Comp. Start Date:
Comp. Stop Date:
SDN:
Group COC #:
Sample Method:
Comp. Start Time:
Comp. Stop Time:

Ship To: Southwest Research Inst.
6220 Culebra Rd.
San Antonio, Tx 78228
210-522-5428
Contract: 0000078769/SWR-W-17013
Sampling Event: W-17013
SEIR Name: W-17013-1

Laboratory Work Request Form

Lab ID: (1)

Item	Preservative	pH(2)	Qty	Container	Filter?	Analysis Requested
1	NONE		1	250 mL HDPE		TCLP, FULL (VOA, SVOA, METALS) (1311 PREP INCLUDED IN PRICE) [1]
(Cont.)						, CYANIDE [11], FLUORIDE [13], MERCURY, TOTAL [15]
(Cont.)						, NITRATE-NITRITE [17], SULFATE [21], ICP METALS [28]
(Cont.)						, AMERICIUM 241 [37]
(Cont.)						, ALPHA SPEC CURIUM (CM-242, CM-243/244, CM-245/246) [39]
(Cont.)						, ALPHA SPEC PLUTONIUM (PU-238, PU-239/240,PU- 242) [44]
(Cont.)						, GAMMA SPECTROSCOPY (LINES ITEMS 53 - 67) [56], GROSS ALPHA [73]
(Cont.)						, NONVOLATILE BETA (CAN BE COMBINED WITH GROSS ALPHA FOR NO CHARGE) [74
(Cont.)						], PROMETHIUM-147 [80], RADIUM-226 [81], RADIUM-228 [82]
(Cont.)						, STRONTIUM-90 [86], TECHNETIUM-99 [87], TRITIUM [88], CHLORIDE [9]

Client: Savannah River Nuclear Solutions, LLC SwRI SRR #59295
SwRI Project # 17995.20.00X Case: W-17013
VTSR: 03/10/17 09:09 Sample(s) Received: Intact
Battery Check: Y Background Check: <100 cpm (Lab 193)
Cooler/Container Wipe: <LLS mR/hr Temp.: 5.8 °C (blue ice) / SN # 021956
Total contraband (samples): ~36,000 cpm; ~1.7 mR/hr Wipe Frisk Description: Drum(s) - 1
(see Radioactive Material Receiving Form for more information)

Comments (1)

Cooler Information

Cooler number	Items in cooler	Cooler temp.
Drum 3	1	
Cooler number	Items in cooler	Cooler temp.

Custody Transfer Record

	Relinquished By (3) (print/sign)	Company	Received By (print/sign)	Date	Time	Reason for Transfer (1)
1	Katie Hatchett (Sampler)	SRNS	Karen Palmer / Karen Palmer	3/9/17	1015	
1	Karen Palmer / Karen Palmer	SRNS	CLS Shipping	3/9/17	1340	
	FedEx	FedEx	Steven Douglas /	3/10/17	0900	

(1) optional (2) pH: C-correct I-incorrect (3) First relinquisher is the sampler

1 of 1 3/2/2017

Figure A-2. Chain of custody for sample W-17013-00002.

FIELD CHAIN OF CUSTODY for W-17013 010004

Savannah River Site
SGCP/GM
Building 730-2B
Aiken, SC 29808

Date: 3/9/17 Time: 0948
Sample Id: W-17013-00003
Station ID: 773A-17013-03
Interval: SDN:
Field QC Code: Group COC #:
Matrix: SOLIDS Sample Method:
Comp. Start Date: Comp. Start Time:
Comp. Stop Date: Comp. Stop Time:

Ship To: Southwest Research Inst.
6220 Culebra Rd.
San Antonio, Tx 78228
210-522-5428
Contract: 0000078769/SWR-W-17013
Sampling Event: W-17013
SEIR Name: W-17013-1

Laboratory Work Request Form Lab ID: (1)

Item	Preservative	pH(2)	Qty	Container	Filter?	Analysis Requested
1	NONE		1	250 mL HDPE		TCLP, FULL (VOA, SVOA, METALS) (1311 PREP INCLUDED IN PRICE) [1]
(Cont.)						, CYANIDE [11], FLUORIDE [13], MERCURY, TOTAL [15]
(Cont.)						, NITRATE-NITRITE [17], SULFATE [21], ICP METALS [28]
(Cont.)						, AMERICIUM 241 [37]
(Cont.)						, ALPHA SPEC CURIUM (CM-242, CM-243/244, CM-245/246) [39]
(Cont.)						, ALPHA SPEC PLUTONIUM (PU-238, PU-239/240,PU- 242) [44]
(Cont.)						, GAMMA SPECTROSCOPY (LINES ITEMS 53 - 67) [56], GROSS ALPHA [73]
(Cont.)						, NONVOLATILE BETA (CAN BE COMBINED WITH GROSS ALPHA FOR NO CHARGE) [74
(Cont.)						], PROMETHIUM-147 [80], RADIUM-226 [81], RADIUM-228 [82]
(Cont.)						, STRONTIUM-90 [86], TECHNETIUM-99 [87], TRITIUM [88], CHLORIDE [9]

Client: Savannah River Nuclear Solutions, LLC SWB SRR #59295
SwRI Project # 17595.29.003 Case: W-17013
VTSR: 03/10/17 09:00 Sample(s) Received: Intact
Battery Check: Y Background Check: <100 cpm (Lab 103)
Cooler/Container Wipe: <0.5 mR/hr Temp.: 5.8 °C (blue ice) / SN # 021696
Total cpm-mR/h (samples): ~36,000 cpm; ~1.7 mR/hr Wipe Risk Description: Drum(s) - 1
(see Radioactive Material Receiving Form for more information)

Comments (1)

Cooler Information

Cooler number	Items in cooler	Cooler temp.
Drum 3	1	
Cooler number	Items in cooler	Cooler temp.

Custody Transfer Record

	Relinquished By (3) (print/sign)	Company	Received By (print/sign)	Date	Time	Reason for Transfer (1)
1	KatieHill (Sampler)	SRNS	Karen Pulmer/Karen Pulmer	3/9/17	1015	
1	Karen Pulmer/Karen Pulmer	SRNS	CIS Shipper	3/9/17	1340	
	FedEx	FedEx	Steven Douglas/Steven Douglas	3/10/17	0700	

(1) optional (2) pH: C-correct I-incorrect (3) First relinquisher is the sampler

1 of 1 3/2/2017

Figure A-3. Chain of custody for sample W-17013-00003.

Appendix B. SCDHEC Forms

Table B-1. SCDHEC Form D-3657 ("RCRA & SW – TCLP Metals")

dhec

Type Data: **RCRA & SW - TCLP Metals**
Company Name: Savannah River Remediation
Subject/Project: Saltstone Vault Classification January 2017
(Class One, Class Two and Class Three Landfills and RCRA Waste Determination.)

(Consult the Department for any Radiation / Chemical Mixed Wastes.)								Results in Milligrams per Liter		
								Waste Stream 1		
								1/16/2017	1/16/2017	1/16/2017
Facility Sample ID #								W-17013-00001	W-17013-00002	W-17013-00003
Laboratory Sample ID #								612496	612497	612498
Laboratory Name								SWRI	SWRI	SWRI
Laboratory Certification								DOECAP/NELAP	DOECAP/NELAP	DOECAP/NELAP
Subcontracted Laboratory Certification #								-	-	-
Subcontracted Laboratory Name								-	-	-
Laboratory Receipt Information (Chain of Custody Must be Attached)								Attached	Attached	Attached
Inorganic TCLP Chemicals										
Analytical Parameter [2]	Digestion Method	Analytical Method	Detection Limit	Quantitation Limit (mg/l)	MCL[3] (mg/l)	Class 2 (mg/l)	TCLP Limits (mg/l)			
Aluminum	SW3010A	SW6010D	0.075	0.150	0.05-0.2	0.5-2	-	<0.075	<0.075	<0.075
Antimony	SW3010A	SW6010D	0.020	0.040	0.006	0.06	-	<0.02	<0.02	<0.02
Arsenic	SW3010A	SW6010D	0.020	0.030	0.01	0.1	5	<0.02	<0.02	<0.02
Barium	SW3010A	SW6010D	0.005	0.010	2.0	20	100	0.417	0.386	0.387
Beryllium	SW3010A	SW6020	0.005	0.010	0.004	0.04	-	<0.005	<0.005	<0.005
Boron	SW3010A	SW6010D	0.100	0.200	4.0	40	-	0.572	0.584	0.552
Cadmium	SW3010A	SW6010D	0.005	0.010	0.005	0.05	1	<0.005	<0.005	<0.005
Chromium	SW3010A	SW6010D	0.005	0.010	0.1	1	5	<0.005	<0.005	<0.005
Cobalt	SW3010A	SW6010D	0.005	0.010	0.006	0.06	-	<0.005	<0.005	<0.005
Copper	SW3010A	SW6010D	0.005	0.010	1.0	10	-	<0.005	<0.005	<0.005
Iron	SW3010A	SW6010D	0.100	0.200	0.3	3	-	0.254	0.162	0.196
Lead	SW3010A	SW6010D	0.005	0.010	0.015	0.15	5	<0.005	<0.005	<0.005
Lithium	SW3010A	SW6010D	0.010	0.020	0.040	0.40	-	0.372	0.359	0.357
Managanese	SW3010A	SW6010D	0.005	0.010	0.05	0.5	-	0.0176	<0.005	0.00607
Mercury	-	SW7470A	0.001	0.002	0.002	0.02	0.2	0.0068	0.00703	0.00304
Molybdenum	SW3010A	SW6010D	0.008	0.015	0.10	1.00	-	0.244	0.243	0.241
Nickel	SW3010A	SW6010D	0.005	0.010	0.39	3.90	-	<0.005	<0.005	<0.005
Selenium	SW3010A	SW6010D	0.025	0.040	0.05	0.5	1	<0.025	0.0258	<0.025
Silver	SW3010A	SW6010D	0.010	0.020	0.100	1.00	5	<0.01	<0.01	<0.01
Strontium	SW3010A	SW6010D	0.005	0.010	12	120	-	2.94	2.850	2.840
Thallium	SW3010A	SW6020	0.005	0.010	0.002	0.02	-	<0.005	<0.005	<0.005
Uranium	SW3010A	SW6010D	0.200	0.400	0.030	0.30	-	<0.2	<0.2	<0.2
Zinc	SW3010A	SW6010D	0.005	0.010	5	50	-	<0.005	<0.005	<0.005
Chloride	-	EPA 300	200	200	250	2500	-	216	222	226

Table B-1 continued. SCDHEC Form D-3657 ("RCRA & SW – TCLP Metals")

dhec

Type Data: RCRA & SW - TCLP Metals
Company Name: Savannah River Remediation
Subject/Project: Saltstone Vault Classification January 2017
(Class One, Class Two and Class Three Landfills and RCRA Waste Determination.)

(Consult the Department for any Radiation / Chemical Mixed Wastes.)								Results in Milligrams per Liter Waste Stream 1 1/16/2017	1/16/2017	1/16/2017
Fluoride	-	EPA 300	200	200	4.0	**40**	-	<200	<200	<200
Nitrate as N	-	EPA 300	100	100	10	**100**	-	4980	5040	5000
Nitrite as N	-	EPA 300	100	100	1	**10**	-	1710	1760	1720
Nitrate/Nitrite (calc total)	-	-	-	-	10	**100**	-	6690	6800	6720
Sulfate	-	EPA 300	200	200	250	**2500**	-	4460	4340	4460
Cyanide	9010C	9012B	-	0.488	-	**-**	-	9.02	10.2	7.54
Amenable Cyanide	9010C	9012B	0	0.488	0.2	**2**	-	<0.475	<0.488	<0.372

1. Subcontracted Laboratory Used for these Parameters(Anal
2. These are the minimum elements to be considered. Class one and class tw o SW Landfills w ill require further parameters. Consult the department for further instructions.
3. MCL or current USEPA RSL Tap Water Value.

Table B-1 continued. SCDHEC Form D-3657 ("RCRA & SW – TCLP Metals")

dhec

Type Data: RCRA & SW - TCLP Metals
Company Name: Savannah River Remediation
Subject/Project: Saltstone Vault Classification January 2017
(Class One, Class Two and Class Three Landfills and RCRA Waste Determination.)

(Consult the Department for any Radiation / Chemical Mixed Wastes.)	Results in Milligrams per Liter Waste Stream 1 1/16/2017	1/16/2017	1/16/2017
Quality Assurance (for above samples)			
TCLP Bottle Extraction #	None	None	None
TCLP Extraction Blank	EFB#2-83396	EFB#2-83396	EFB#2-83396
Digestion Batch #	20170321-P002 20170321-P005 20170405-P007 20170321-P001 20170323-P001	20170321-P002 20170321-P005 20170405-P007 20170321-P001 20170323-P001	20170321-P002 20170321-P005 20170405-P007 20170321-P001 20170323-P001
Digestion Blank	PB17C21KE1 PB17C21KE3 PB17C21PB1 PB17C23PB1	PB17C21KE1 PB17C21KE3 PB17C21PB1 PB17C23PB1	PB17C21KE1 PB17C21KE3 PB17C21PB1 PB17C23PB1
Laboratory Control sample	LCS17C21KE1 LCS17C21KE2 LCS17C21KE5 LCS17C21KE6 ICV LCS17C21CS1 LCS17C23CS2	LCS17C21KE1 LCS17C21KE2 LCS17C21KE5 LCS17C21KE6 ICV LCS17C21CS1 LCS17C23CS2	LCS17C21KE1 LCS17C21KE2 LCS17C21KE5 LCS17C21KE6 ICV LCS17C21CS1 LCS17C23CS2
Matrix Spike (MS)	612496MS	612496MS	612496MS
Matrix Spike Duplicate (MSD)	612496MSD	612496MSD	612496MSD
Unspiked Duplicate (If Used)	612496D	612496D	612496D
Analysis Batch Number	20170322-A003 20170404-A006 20170404-A008 20170405-A003 20170405-A004 20170405-A005 20170405-A006 20170406-A001 20170406-A003 20170419-A003	20170322-A003 20170404-A006 20170404-A008 20170405-A003 20170405-A004 20170405-A005 20170405-A006 20170406-A001 20170406-A003 20170419-A003	20170322-A003 20170404-A006 20170404-A008 20170405-A003 20170405-A004 20170405-A005 20170405-A006 20170406-A001 20170406-A003 20170419-A003
LCS Recovery	Acceptable	Acceptable	Acceptable
MS & MSD	Acceptable, ex Ag	Acceptable, ex Ag	Acceptable, ex Ag

Table B-2. SCDHEC Form D-3658 ("RCRA & SW – TCLP Volatiles")

dhec

Type Data:	RCRA & SW - TCLP Volatiles
Company Name:	Savannah River Remediation
Subject/Project:	Saltstone Vault Classification January 2017

(Class One, Class Two, Class Three Landfills and RCRA Waste.)

								Results in Milligrams per Liter		
								Waste Stream 1		
(Consult the Department for any Radiation / Chemical Mixed Wastes.)								**1/16/2017**	**1/16/2017**	**1/16/2017**
Facility Sample ID #								W-17013-00001	W-17013-00002	W-17013-00003
Laboratory Sample ID #								612496	612497	612498
Laboratory Name								SWRI	SWRI	SWRI
Laboratory Certification								DOECAP/NELAP	DOECAP/NELAP	DOECAP/NELAP
Subcontracted Laboratory Certification #								-	-	-
Subcontracted Laboratory Name								-	-	-
Laboratory Receipt Information (Chain of Custody Must be Attached)								Attached	Attached	Attached
TCLP Volatile Organic Compounds										
Analytical Parameter [2]	**Preparation Method**	Analytical Method	Detection Limit (mg/l)	Quantitation Limit (mg/l)	MCL [3, 4] (mg/l)	Class 2 (mg/l)	TCLP (mg/l)			
Benzene	-	**8260C**	**0.01**	0.02	**0.005**	**0.05**	**0.5**	<0.02	<0.02	<0.02
Toluene	-	**8260C**	**0.01**	0.02	**1**	**10**	-	<0.02	<0.02	<0.02
n-Butanol	-	**8260C**	**0.10**	0.2	**2**	**20**	-	<0.2	<0.2	<0.2
Quality Assurance (for above samples)										
TCLP ZHE Extraction Batch #								None	None	None
Volatile Analysis Batch #								R03171707	R03171708	R03171709
Surrogates, % Recovery								None	None	None
1,2- Dichlorethane, d4								105	100	102
Toluene, dB								95	94	94
4-Bromofluorobenzene								99	98	98
Other								-	-	-
Other								-	-	-

1. Subcontracted Laboratory Used for these Parameters(A

2. These are the minimum compounds to be considered. Class one and class two SW Landfills will require further parameters. Consult the department for further instructions.

3. MCL or current USEPA RSL Tap Water Value.

4. The MCL values may change without notice. Verify at the beginning of each project.

Table B-3. SCDHEC Form D-3659 ("RCRA & SW Semi-Volatiles")

Type Data:	RCRA & SW - TCLP Semi-Volatiles
Company Name:	Savannah River Remediation
Subject/Project:	Saltstone Vault Classification January 2017

(Class One, Class Two, Class Three Landfills and RCRA Waste.)

(Consult the Department for any Radiation / Chemical Mixed Wastes.)	Results in Milligrams per Liter		
	Waste Stream 1		
	1/16/2017	1/16/2017	1/16/2017
Facility Sample ID #	W-17013-00001	W-17013-00002	W-17013-00003
Laboratory Sample ID #	612496	612497	612498
Laboratory Name	SWRI	SWRI	SWRI
Laboratory Certification	DOECAP/NELAP	DOECAP/NELAP	DOECAP/NELAP
Subcontracted Laboratory Certification #	-	-	-
Subcontracted Laboratory Name	-	-	-
Laboratory Receipt Information (Chain of Custody Must be Attached)	Attached	Attached	Attached
Semi-Volatile Organic Compounds			

Analytical Analaytes [2]	Preparation Method	Analytical Method	Detection Limit (mg/l)	Quantitation Limit (Mg/l)	MCL [3, 4] (mg/l)	Class 2 (mg/l)	TCLP Limit (mg/l)			
Phenol	3520C 3510C	8270D	5	10	5.8	58	-	<10	<10	<10

1. Subcontracted Laboratory used for this Analyte.

2. These are the minimum elements to be considered. Class one and class two SW Landfills will require further parameters. Consult the department for further instructions.

3. MCL or current USEPA RSL Tap Water Value.

4. The MCL values may change without notice. Verify at the beginning of each project.

Quality Assurance (for above samples)			
TCLP Bottle Extraction #	None	None	None
Semivolatile Extraction Batch #	None	None	None
Analysis Batch Number	P041817004	P041817005	P041817006
Surrogates. % Recovery	-	-	-
Nitrobenzene, d5	-	-	-
2-Fluorobiphenol	-	-	-
Terphenyl, d14	-	-	-
Phenol, d6	0	0	0
2-Fluorophenol	5	4	6
2,4,6-Tribromophenol	-	-	-

Table B-4. SCDHEC Form D-3732 ("Characterization Associated Quality Assurance Data")

dhec

Characterization Associated Quality Assurance Data

Laboratory:	Southwest Research Institute (SwRI)
Certification:	DOECAP/NELAP
Method:	SW6010D, SW6020, SW7470A, SW9012B, SW8270D, SW8260C and EPA 300
Subject:	QA- Blk, Laboratory Control Sample (LCS), Matrix Spike (MS), Matrix Spike Duplicate (MSD)

Reference: Forms D-3657, D-3658, and D-3659 for samples W-17013-00001, -00002, and -00003
Instrument: Various

	Analyte Concentrations, Mg / l								Recovery Percent								Flags
Analytes	RDL	MDL	Blank	LCS	LCSD	MS	MSD	Other	LCS	LCSD	MS	MSD	Ave MS/MSD	REC Limits	% RPD	RPD Limits	
Aluminum	0.15	0.0750	<0.0750	3.95	3.96	4.43	4.23	-	98.8	99.0	88.6	84.6	86.6	75-125	4.6	20	-
Antimony	0.0400	0.0200	<0.0200	1.01	1.01	5.36	5.06	-	101.0	101.0	107.2	101.2	104.2	75-125	5.8	20	-
Arsenic	0.0300	0.0200	<0.0200	3.91	3.9	2.66	2.55	-	97.8	97.5	106.4	102	104.2	75-125	4.2	20	-
Barium	0.0100	0.00500	<0.00500	3.89	3.87	5.02	4.74	-	97.2	96.8	92.1	86.5	89.3	75-125	6.3	20	-
Beryllium	0.0100	0.00500	<0.00500	0.0945	0.0951	0.434	0.406	-	94.5	95.1	86.8	81.2	84.0	75-125	6.7	20	-
Boron	0.2	0.1	<0.1	1.97	2	2.56	2.43	-	98.5	100.0	99.4	92.9	96.2	75-125	6.8	20	-
Cadmium	0.0100	0.00500	<0.00500	0.0953	0.0944	0.483	0.455	-	95.3	94.4	96.6	91	93.8	75-125	6.0	20	-
Chromium	0.0100	0.00500	<0.00500	0.377	0.379	0.914	0.869	-	94.2	94.8	91.4	86.9	89.2	75-125	5.0	20	-
Cobalt	0.0100	0.00500	<0.00500	0.962	0.96	2.35	2.24	-	96.2	96.0	94.0	89.6	91.8	75-125	4.8	20	-
Copper	0.0100	0.00500	<0.00500	0.489	0.488	0.962	0.91	-	97.8	97.6	96.2	91	93.6	75-125	5.6	20	-
Iron	0.2	0.1	<0.1	1.94	1.95	4.89	4.64	-	97.0	97.5	92.7	87.7	90.2	75-125	5.5	20	-
Lead	0.0100	0.00500	<0.00500	0.972	0.952	2.33	2.22	-	97.2	95.2	93.2	88.8	91.0	75-125	4.8	20	-
Lithium	0.0200	0.0100	<0.0100	1.94	1.93	2.29	2.18	-	97.0	96.5	95.9	90.4	93.2	75-125	5.9	20	-
Manganese	0.0100	0.00500	<0.00500	0.977	0.977	0.482	0.456	-	97.7	97.7	92.9	87.7	90.3	75-125	5.8	20	-
Mercury	0.00200	0.00100	<0.00100	0.00104	0.00105	0.0108	0.0107	-	104.0	105.0	100.0	97.5	98.8	75-125	2.5	20	-
Molybdenum	0.0150	0.00750	<0.00750	1.95	1.98	2.23	2.16	-	97.5	99.0	99.3	95.8	97.6	75-125	3.6	20	-
Nickel	0.0100	0.00500	<0.00500	0.946	0.942	2.28	2.16	-	94.6	94.2	91.2	86.4	88.8	75-125	5.4	20	-
Selenium	0.0400	0.0250	<0.0250	3.86	3.78	2.57	2.45	-	96.5	94.5	102.8	98	100.4	75-125	4.8	20	-
Silver	0.0200	0.0100	<0.0100	0.0938	0.0959	0.372	0.329	-	93.8	95.9	**74.4**	**65.8**	70.1	75-125	12.0	20	low rec.
Strontium	0.0100	0.00500	<0.00500	1.98	1.99	4.7	4.43	-	99.0	99.5	88.0	74.5	81.3	75-125	17.0	20	-
Thallium	0.0100	0.00500	<0.00500	3.90	3.99	2.43	2.28	-	97.5	99.8	97.2	91.2	94.2	75-125	6.4	20	-
Uranium	0.4	0.2	<0.2	1.83	1.84	1.88	1.79	-	91.5	92.0	94.0	89.5	91.8	75-125	4.9	20	-
Zinc	0.0100	0.00500	<0.00500	0.947	0.956	0.472	0.452	-	94.7	95.6	94.4	90.4	92.4	75-125	4.3	20	-
Chloride	200	200	<200	196	-	7300	-	-	98.0	-	88.6	-	-	75-125	-	-	-
Fluoride	200	200	<200	93.0	-	2820	-	-	93.0	-	**70.5**	-	-	75-125	-	-	low rec.
Nitrate as N	100	100	<100	83.3	-	8260	-	-	92.1	-	90.6	-	-	75-125	-	-	-
Nitrite as N	100	100	<100	134	-	6900	-	-	93.7	-	90.7	-	-	75-125	-	-	-
Nitrate/Nitrite (Total)	Calculated value (not measured)																
Sulfate	200	200	<200	399	-	19,700	-	-	99.8	-	95.2	-	-	-	-	-	-
Benzene	0.001	0.0005	<0.001	0.0094	0.01	0.22	0.21	-	94	100	110	105	107.5	70-130	5	20	-
Toluene	0.001	0.0005	<0.001	0.0095	0.0095	0.21	0.2	-	95	95	105	100	102.5	70-130	5	20	-
n-Butanol	0.01	0.005	<0.01	0.094	0.11	2.9	2.6	-	94	110	145	130	137.5	50-150	11	50	-
Cyanide (total)	0.480	0.480	<0.480	0.699	0.668	33.5	31.6	-	102.8	98.2	106.4	96.9	101.7	75-125	9.3	35	-
Phenol	10	5	<1	3.06	-	26.7	20.9	-	61	-	53	42	47.5	12-110	24	42	holding time
Clock ID	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table B-5. SCDHEC Form D-3733 ("Cross Reference Report for QA and Analytes")

dhec

Cross Reference Report for QA and Analytes

Analytical Method Reference:	SW7470A, 6010D, 6020, 8260C, 8270D, 9012B, EPA 300
Lab Reference (to Facility Sample):	612496 (W-17013-00001)
Subject / Project:	Saltstone Vault Classification January 2017
Facility:	Savannah River Remediation

LAB ID #	FACILITY SAMP ID	TC EXTR BATCH	DIGESTION BATCH	ANALYSIS BATCH	OTHER	COMMENTS
PB17C21KE3	None	None	20170321-P005	20170406-A001	None	SW7470A
LCS17C21KE5	None	None	20170321-P005	20170406-A001	None	SW7470A
LCS17C21KE6	None	None	20170321-P005	20170406-A001	None	SW7470A
EFB#2-83396	None	None	20170321-P005	20170406-A001	None	SW7470A
612496	W-17013-00001	None	20170321-P005	20170406-A001	None	SW7470A
612496D	W-17013-00001D	None	20170321-P005	20170406-A001	None	SW7470A
612496MS	W-17013-00001MS	None	20170321-P005	20170406-A001	None	SW7470A
612496MSD	W-17013-00001MSD	None	20170321-P005	20170406-A001	None	SW7470A
612497	W-17013-00002	None	20170321-P005	20170406-A001	None	SW7470A
612498	W-17013-00003	None	20170321-P005	20170406-A001	None	SW7470A
PB17C21KE1	None	None	20170321-P002	20170406-A003	None	SW6010D
LCS17C21KE1	None	None	20170321-P002	20170406-A003	None	SW6010D
LCS17C21KE2	None	None	20170321-P002	20170406-A003	None	SW6010D
EFB#2-83396	None	None	20170321-P002	20170406-A003	None	SW6010D
612496	W-17013-00001	None	20170321-P002	20170406-A003	None	SW6010D
612496D	W-17013-00001D	None	20170321-P002	20170406-A003	None	SW6010D
612496MS	W-17013-00001MS	None	20170321-P002	20170406-A003	None	SW6010D
612496MSD	W-17013-00001MSD	None	20170321-P002	20170406-A003	None	SW6010D
612497	W-17013-00002	None	20170321-P002	20170406-A003	None	SW6010D
612498	W-17013-00003	None	20170321-P002	20170406-A003	None	SW6010D
PB17C21KE1	None	None	20170321-P002	20170322-A003	None	SW6010D (Li)
LCS17C21KE1	None	None	20170321-P002	20170322-A003	None	SW6010D (Li)
LCS17C21KE2	None	None	20170321-P002	20170322-A003	None	SW6010D (Li)
EFB#2-83396	None	None	20170321-P002	20170322-A003	None	SW6010D (Li)
612496	W-17013-00001	None	20170321-P002	20170322-A003	None	SW6010D (Li)
612496D	W-17013-00001D	None	20170321-P002	20170322-A003	None	SW6010D (Li)
612496MS	W-17013-00001MS	None	20170321-P002	20170322-A003	None	SW6010D (Li)
612496MSD	W-17013-00001MSD	None	20170321-P002	20170322-A003	None	SW6010D (Li)
612497	W-17013-00002	None	20170321-P002	20170322-A003	None	SW6010D (Li)
612498	W-17013-00003	None	20170321-P002	20170322-A003	None	SW6010D (Li)
PB17C21KE1	None	None	20170321-P002	20170404-A006	None	SW6020 (Tl)
LCS17C21KE1	None	None	20170321-P002	20170404-A006	None	SW6020 (Tl)
LCS17C21KE2	None	None	20170321-P002	20170404-A006	None	SW6020 (Tl)

Table B-5 continued. SCDHEC Form D-3733 ("Cross Reference Report for QA and Analytes")

dhec

Cross Reference Report for QA and Analytes

Analytical Method Reference:	SW7470A, 6010D, 6020, 8260C, 8270D, 9012B, EPA 300
Lab Reference (to Facility Sample):	612496 (W-17013-00001)
Subject / Project:	Saltstone Vault Classification January 2017
Facility:	Savannah River Remediation

LAB ID #	FACILITY SAMP ID	TC EXTR BATCH	DIGESTION BATCH	ANALYSIS BATCH	OTHER	COMMENTS
EFB#2-83396	None	None	20170321-P002	20170404-A006	None	SW6020 (Tl)
612496	W-17013-00001	None	20170321-P002	20170404-A006	None	SW6020 (Tl)
612496D	W-17013-00001D	None	20170321-P002	20170404-A006	None	SW6020 (Tl)
612496MS	W-17013-00001MS	None	20170321-P002	20170404-A006	None	SW6020 (Tl)
612496MSD	W-17013-00001MSD	None	20170321-P002	20170404-A006	None	SW6020 (Tl)
612497	W-17013-00002	None	20170321-P002	20170404-A006	None	SW6020 (Tl)
612498	W-17013-00003	None	20170321-P002	20170404-A006	None	SW6020 (Be)
PB17C21KE1	None	None	20170321-P002	20170404-A008	None	SW6020 (Be)
LCS17C21KE1	None	None	20170321-P002	20170404-A008	None	SW6020 (Be)
LCS17C21KE2	None	None	20170321-P002	20170404-A008	None	SW6020 (Be)
EFB#2-83396	None	None	20170321-P002	20170404-A008	None	SW6020 (Be)
612496	W-17013-00001	None	20170321-P002	20170404-A008	None	SW6020 (Be)
612496D	W-17013-00001D	None	20170321-P002	20170404-A008	None	SW6020 (Be)
612496MS	W-17013-00001MS	None	20170321-P002	20170404-A008	None	SW6020 (Be)
612496MSD	W-17013-00001MSD	None	20170321-P002	20170404-A008	None	SW6020 (Be)
612497	W-17013-00002	None	20170321-P002	20170404-A008	None	SW6020 (Be)
612498	W-17013-00003	None	20170321-P002	20170404-A008	None	SW6020 (Be)
PB17C21KE1	None	None	20170321-P002	20170419-A003	None	SW6010D (As, Mo, Zn)
LCS17C21KE1	None	None	20170321-P002	20170419-A003	None	SW6010D (As, Mo, Zn)
LCS17C21KE2	None	None	20170321-P002	20170419-A003	None	SW6010D (As, Mo, Zn)
EFB#2-83396	None	None	20170321-P002	20170419-A003	None	SW6010D (As, Mo, Zn)
612496	W-17013-00001	None	20170321-P002	20170419-A003	None	SW6010D (As, Mo, Zn)
612496D	W-17013-00001D	None	20170321-P002	20170419-A003	None	SW6010D (As, Mo, Zn)
612496MS	W-17013-00001MS	None	20170321-P002	20170419-A003	None	SW6010D (As, Mo, Zn)
612496MSD	W-17013-00001MSD	None	20170321-P002	20170419-A003	None	SW6010D (As, Mo, Zn)
612497	W-17013-00002	None	20170321-P002	20170419-A003	None	SW6010D (As, Mo, Zn)
612498	W-17013-00003	None	20170321-P002	20170419-A003	None	SW6010D (As, Mo, Zn)
TCLP Ext. Fluid #1 Blank_031717	None	None	None	R03171706	None	SW8260C (vols)
W-17013-00001	W-17013-00001	None	None	R03171707	None	SW8260C (vols)
W-17013-00002	W-17013-00002	None	None	R03171708	None	SW8260C (vols)
W-17013-00003	W-17013-00003	None	None	R03171709	None	SW8260C (vols)
BLANK031717 MBLK	None	None	None	R031717B2	None	SW8260C (vols)

Table B-5 continued. SCDHEC Form D-3733 ("Cross Reference Report for QA and Analytes")

dhec

Cross Reference Report for QA and Analytes

Analytical Method Reference:	SW7470A, 6010D, 6020, 8260C, 8270D, 9012B, EPA 300
Lab Reference (to Facility Sample):	612496 (W-17013-00001)
Subject / Project:	Saltstone Vault Classification January 2017
Facility:	Savannah River Remediation

LAB ID #	FACILITY SAMP ID	TC EXTR BATCH	DIGESTION BATCH	ANALYSIS BATCH	OTHER	COMMENTS
BLANK032117 MBLK	None	None	None	R032117B2	None	SW8260C (vols)
LCS031717 LCS	None	None	None	R03171705	None	SW8260C (vols)
LCS032117 LCS	None	None	None	R03211705	None	SW8260C (vols)
W-17013-00001 MS	None	None	None	R03211706	None	SW8260C (vols)
W-17013-00001 MSD	None	None	None	R03211707	None	SW8260C (vols)
W-17013-00001 RE	W-17013-00001	None	None	P041817004	None	SW8270D (phenol)
W-17013-00002 RE	W-17013-00002	None	None	P041817005	None	SW8270D (phenol)
W-17013-00003 RE	W-17013-00003	None	None	P041817006	None	SW8270D (phenol)
W-17013-00003 RE MS	None	None	None	P041817007	None	SW8270D (phenol)
W-17013-00003 RE MSD	None	None	None	P041817008	None	SW8270D (phenol)
WQCBLK_12APR17	None	None	None	P041817001	None	SW8270D (phenol)
EFB#2-83396 RE	None	None	None	P041817002	None	SW8270D (phenol)
LCS_12APR17 LCS RE	None	None	None	P041817003	None	SW8270D (phenol)
612496	W-17013-00001	None	20170405-P007	20170405-A005	None	EPA 300
612497	W-17013-00002	None	20170405-P007	20170405-A005	None	EPA 300
612498	W-17013-00003	None	20170405-P007	20170405-A005	None	EPA 300
#83396 (EFB#2-83396)	None	None	20170405-P007	20170405-A005	None	EPA 300
612496D	W-17013-00001D	None	20170405-P007	20170405-A005	None	EPA 300
612496S	W-17013-00001MS	None	20170405-P007	20170405-A005	None	EPA 300
ICV (LCS)	None	None	20170405-P007	20170405-A005	None	EPA 300
612496	W-17013-00001	None	20170405-P007	20170405-A006	None	EPA300 (Nitrite)
612497	W-17013-00002	None	20170405-P007	20170405-A006	None	EPA300 (Nitrite)
612498	W-17013-00003	None	20170405-P007	20170405-A006	None	EPA300 (Nitrite)
#83396 (EFB#2-83396)	None	None	20170405-P007	20170405-A006	None	EPA300 (Nitrite)
612496D	W-17013-00001D	None	20170405-P007	20170405-A006	None	EPA300 (Nitrite)
612496S	W-17013-00001MS	None	20170405-P007	20170405-A006	None	EPA300 (Nitrite)
ICV (LCS)	None	None	20170405-P007	20170405-A006	None	EPA300 (Nitrite)
612496	W-17013-00001	None	20170321-P001	20170405-A003	None	SW9012B
612496D	W-17013-00001D	None	20170321-P001	20170405-A003	None	SW9012B
612497	W-17013-00002	None	20170321-P001	20170405-A003	None	SW9012B
612498	W-17013-00003	None	20170321-P001	20170405-A003	None	SW9012B
PB17C21PB1	None	None	20170321-P001	20170405-A003	None	SW9012B
PB17C23PB1	None	None	20170323-P001	20170405-A004	None	SW9012B

Table B-5 continued. SCDHEC Form D-3733 ("Cross Reference Report for QA and Analytes")

dhec

Cross Reference Report for QA and Analytes

Analytical Method Reference:	SW7470A, 6010D, 6020, 8260C, 8270D, 9012B, EPA 300
Lab Reference (to Facility Sample):	612496 (W-17013-00001)
Subject / Project:	Saltstone Vault Classification January 2017
Facility:	Savannah River Remediation

LAB ID #	FACILITY SAMP ID	TC EXTR BATCH	DIGESTION BATCH	ANALYSIS BATCH	OTHER	COMMENTS
612496S	W-17013-00001MS	None	20170321-P001	20170405-A003	None	SW9012B
612496SD	W-17013-00001MSD	None	20170321-P001	20170405-A003	None	SW9012B
LCS17C21CS1	None	None	20170321-P001	20170405-A003	None	SW9012B
LCS17C23CS2	None	None	20170323-P001	20170405-A004	None	SW9012B
PB17C23PB1	None	None	20170323-P001	20170407-A006	None	SW9012B (Am. Cyanide)
612496	W-17013-00001	None	None	20170407-A006	None	SW9012B (Am. Cyanide)
612496D	W-17013-00001D	None	None	20170407-A006	None	SW9012B (Am. Cyanide)
612497	W-17013-00002	None	None	20170407-A006	None	SW9012B (Am. Cyanide)
612498	W-17013-00003	None	None	20170407-A006	None	SW9012B (Am. Cyanide)