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4QCY20 Saltstone Waste Characterization Analysis - Salt Waste Processing Facility (SWPF) Waste Stream

K. A. Hill

A. N. Stanfield

April 2021

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REVIEWS AND APPROVALS

AUTHORS:

K. A. Hill, Applied Materials Research

A. N. Stanfield, Applied Materials Research

TECHNICAL REVIEW:

C. L. Crawford, Chemical Processing Technology, Reviewed per E7 2.60

APPROVAL:

A. D. Cozzi, Manager
Materials Science

F. M. Pennebaker, Director
Chemical Processing Technology

T. H. Huff, Manager
Defense Waste Processing Facility and Saltstone Facility Engineering

EXECUTIVE SUMMARY

In the fourth quarter of calendar year 2020, a salt solution sample was collected from Tank 50 on October 28, 2020 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, Facility ID# 025500-1603, General Condition B.9. 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 2020 TCLP leachate results to the regulatory limits, the following conclusions can be made:

- The saltstone waste form is 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 measured an average concentration of <10 mg/L. This detection limit is above the nonwastewater standard level criteria of 6.2 mg/L.
- Concentrations 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 amenable cyanide exceeded 10x the MCL.
    - Thallium and fluorine potentially exceeded 10x the MCL (detection limit was >10x MCL).
- The gross alpha particle activity and combined ^{226}Ra and ^{228}Ra exceed the MCL by more than a factor of 10.

The saltstone waste form placed in the Saltstone Disposal Facility in 4QCY20 met the SCHWMR R.61-79.261.24(b) RCRA metals requirements for a nonhazardous waste form. The TCLP leachate concentrations for nitrate, nitrite and the sum of nitrate and nitrite were greater than 10x the MCLs in SCDHEC Regulations R.61-107.19 Part I, A.1(d), which confirms the Saltstone Disposal Facility classification as a Class 3 Landfill. The saltstone waste form placed in the Saltstone Disposal Facility in 4QCY20 met the R.61-79.268.48(a) non wastewater treatment standards.

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LIST OF ABBREVIATIONS

4QCY20	fourth quarter of calendar year 2020
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
RL	Reporting Limit
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
SWPF	Salt Waste Processing Facility
SWRI	Southwest Research Institute
TCCR	Tank Closure Cesium Removal
TCLP	Toxicity Characteristic Leaching Procedure
TPU	total propagated uncertainty
TTQAP	Task Technical and Quality Assurance Plan
TTR	Technical Task Request
UTS	Universal Treatment Standards

WAC	Waste Acceptance Criteria

1.0 Introduction

The Saltstone Production and Disposal Facility is designed and permitted by the state of South Carolina Department of Health and Environmental Control (SCDHEC) to treat 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) and decontaminated solutions from the Tank Closure Cesium Removal Unit (TCCR) and the Salt Waste Processing Facility (SWPF) are stored in Tank 50 until the LLW can be transferred to the Saltstone Facility for treatment and disposal. In the past, decontaminated solution from the Modular Caustic Side Solvent Extraction Unit (MCU) was stored in Tank 50 until the LLW could be transferred to the Saltstone Facility for treatment and disposal. MCU is currently in a suspended operations state. 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), Facility ID# 025500-1603, General Condition B.9[2] or every six years[3, 4] in accordance with South Carolina (SC) Regulation 61-107.19 Part I C,[5] "Solid Waste Management: Solid Waste Landfills and Structural Fill – General Requirements."

In the fourth quarter of calendar year 2020 (4QCY20), a salt solution sample[6] was collected from Tank 50 on October 28, 2020 in order to meet SC Regulation 61-107.19 Part I C[5] and the Saltstone Disposal Facility Class 3 Landfill Permit, Facility ID# 025500-1603, General Condition B.9[2]. 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), 61-79.268.48(a), and 61-107.19 Part I, A.1(d) (TTR task #2);
- Comparison of the 2020, 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.[6] 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 approximately 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.

[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 0.59, and antifoam and Daratard were not added.

After curing the 4QCY20 samples for 59 days[C], the saltstone samples were removed from the containers, and a portion of each saltstone sample was crushed and screened through a 3/8-inch sieve 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 January 20, 2021, 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 January 22, 2021. 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 8260D (analysis)
Semivolatile Analysis (phenol)	SW-846 Method 3510C (leachate extraction) SW-846 Method 8270E (analysis)
Wetchem Analyses-Cyanide & IC (DI Leach)	SW-846 Method 9012B (preparation) SW-846 Method 9012B (analysis) SW-846 Method 9056A (analysis)
TCLP Metals	SW-846 Method 1311 (sample extraction) SW-846 Method 7470A (analysis – Hg only) SW-846 Method 3010A (digestion) SW-846 Method 6020B (analysis – As) SW-846 Method 6010D (analysis – Al, Sb, Ba, Be, B, Cd, Cr, Co, Cu, Fe, Pb, Li, Mn, Mo, Ni, Se, Ag, Sr, Tl, U, and Zn)
Wetchem Analyses-IC (TCLP Leach) (chloride, fluoride, nitrate as nitrogen, nitrite as nitrogen, and sulfate)	SW-846 Method 1311 (sample extraction) SW-846 Method 9056A (analysis)
Radionuclides	SW-846 Method 1311 (sample extraction) Gamma Spectroscopy (^{60}Co, ^{106}Ru, ^{106}Rh, ^{125}Sb, ^{137}Cs, ^{137m}Ba, ^{154}Eu and ^{133}Ba) 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)

[C] Samples are considered ready for analysis after 28 days. Samples are not crushed until a shipment has been scheduled.

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]

3.0 Results

The 2020 results summarized in the following tables are presented as reported in the data package from SWRI.[D,14] For comparison, the 2017 and 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 Constituents (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.[E]

Comparison of the inorganic and organic constituents that are shown as detectable species from Table 3-1 for the 2020, 2017 and 2011 results show that most species are similar for all the studies with the following noted exceptions. The 2020 mercury values are about 3x higher than in 2017, but comparable to the 2011 results. The 2020 selenium values are ~ 2.7x the 2017 values. Both of those values are lower than the selenium value from 2011, which is only ~ 16% of the RCRA limit of 1 mg/L. Chloride values from 2020 are comparable to the 2011 values, which are both significantly lower than the value reported in 2017. Total nitrate plus nitrite values for 2020 of 4332 mg/L are lower that those reported in 2017 and 2011 (6737 mg/L and 6074 mg/L). All of these values are considerably higher than the MCL of 10 mg/L. The sulfate levels for 2020 and 2017 are comparable, and at least 20x higher than sulfate reported in 2011. The 2020 cyanide total and amenable values are higher than in 2017. These species were not measured in the 2011 study.

Comparison of the radionuclide that are shown as detectable from Table 3-2 for the 2020, 2017 and 2011 results show that most are similar for all the studies with the following noted exceptions. Both the gross beta and gross gamma are higher for the 2020 samples than previous 2017 and 2011 results. Tritium values for the 2020 results are ~ 15x higher than the 2017 results and orders of magnitude higher than the 2011 values. The 2020 Sr-90 value is ~ 10% of the 2017 value, both of which are at least 35x higher than the 2011 value. Similarly, the 2020 and 2017 Tc-99 values are comparable, but both are at least 20x higher than 2011. Both the Cs-137 and Ba-137m are at least 5x higher than in previous 2017 and 2011 reports.

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

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

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 2020 analyses:

- Iron – The results are "J" flagged due to the low matrix spike (MS)/matrix spike duplicate (MSD) recoveries.
- Mercury - The results are "J" flagged due to the low matrix spike (MS)/matrix spike duplicate (MSD) recoveries.
- Phenol – Due to potential matrix interferences, the vendor re-extracted the samples at a lower volume; 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), the minimum detectable activity (MDA), and the reporting limit (RL).
- ^{147}Pm – The result for the laboratory control sample was outside the recovery control limits of 75-125%.
- ^{241}Pu – Due to the slight chemical differences between the calibration standards and sample, the quench units were greater than 10% in difference.

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

(continued on next page)

Analyte	Sample ID			2020 Average[d]	2017 Results[15d]	2011 Results[16,e]	Regulatory Limits		
	W-18325-00001	W-18325-00002	W-18325-00003				MCL [17]	UTS [18]	Toxicity [19]
Aluminum	0.763	1.62	1.23	1.20	<0.0750	1.86±0.31[E]	0.05-0.2	---	---
Antimony	<0.0250	<0.0250	<0.0250	<0.0250	<0.0200	0.0030[B2]	0.006	1.15	---
Arsenic	0.0124[B1,D]	0.0143[B1,D]	0.0143[B1,D]	0.0137[B1,D]	<0.0200	0.0134	0.010	5.0	5.0
Barium	0.118	0.125	0.126	0.123	0.397±0.018	0.234	2.0	21	100.0
Beryllium	<0.00500	<0.00500	<0.00500	<0.00500	<0.00500[D]	<0.00016	0.004	1.22	---
Boron	0.579	0.578	0.555	0.571	0.569±0.016	0.75±0.06	4.0[f]	---	---
Cadmium	<0.00500	<0.00500	<0.00500	<0.00500	<0.00500	0.0003[B2]	0.005	0.11	1.0
Chromium	0.0152	0.0161	0.0160	0.0158	<0.00500	0.0183	0.1	0.60	5.0
Cobalt	<0.00500	<0.00500	<0.00500	<0.00500	<0.00500	<0.00012	0.006[f]	---	---
Copper	<0.00500	<0.00500	<0.00500	<0.00500	<0.00500	0.022±0.001[B2]	1	---	---
Iron	<0.100[J1]	0.311[J1]	0.224[J1]	0.212[J1,b]	0.204±0.047[a]	0.23±0.05	0.3	---	---
Lead	<0.00750	<0.00750	<0.00750	<0.00750	<0.00500	0.0027[B2]	0.015[f]	0.75	5.0
Lithium	0.230	0.238	0.226	0.231	0.363±0.008	0.85±0.02	0.040[f]	---	---
Manganese	<0.00500	0.00935[B1]	<0.00500	0.00645[a,b]	0.00956±0.00699[a,b]	0.0022±0.0007[a]	0.05	---	---
Mercury	0.0170[J1]	0.0189[J1]	0.0145[J1]	0.0168[J1]	0.00562±0.00224	0.0186	0.002	0.025	0.2
Molybdenum	0.191	0.192	0.186	0.190	0.243±0.002	0.50±0.02	0.10[f]	---	---
Nickel	<0.00500	<0.00500	<0.00500	<0.00500	<0.00500	0.0035[B2]	0.39[f]	11	---
Selenium	0.0628	0.0706	0.0722	0.0685	0.0253±0.0005[a,b,c]	0.159[E]	0.05	5.7	1.0
Silver	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100[J2]	0.00014[B2]	0.071	0.14	5.0
Strontium	1.45	1.47	1.47	1.46	2.877±0.055	0.34±0.02	12[f]	---	---
Thallium	<0.0750	<0.0750	<0.0750	<0.0750	<0.00500[D]	0.00026[B2]	0.002	0.20	---
Uranium	<0.250	<0.250	<0.250	<0.250	<0.200	0.003±0.004[*]	0.03	---	---

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

Analyte	Sample ID			2020 Average[d]	2017 Average[15d]	2011 Results[16,e]	Regulatory Limits		
	W-18325-00001	W-18325-00002	W-18325-00003				MCL[17]	UTS[18]	Toxicity[19]
Zinc	<0.00750	<0.00750	<0.00750	<0.00750	<0.00500	<0.046	5	4.3	---
Chloride	43.8[D]	57.5	54.2	51.8[j]	221±5[D,J1]	28.5±1.8	250	---	---
Fluoride	<100[D]	<100	<99.9	<100[j]	<200[D,J3]	<2.5	4.0	---	---
Nitrate as Nitrogen	3450[D]	3550	3420[D]	3470[j]	5007±31[D]	5884±2378[i]	10	---	---
Nitrite as Nitrogen	872[D]	871	833	859[j]	1730±26[D]	189±7	1	---	---
Total Nitrate and Nitrite (sum of analyzed results)	4322[D]	4421	4253	4332[j]	6737±57	6074±2371[i]	10	---	---
Sulfate	3410[D]	3380	3360	3380[j]	4420±69[D]	169±8.5	250	---	---
Benzene	<0.0200	<0.0200	<0.0200	<0.0200	<0.02	<0.003	0.005	10	0.5
Toluene	<0.0200	<0.0200	<0.0200	<0.0200	<0.02	<0.0025	1	10	---
n-Butanol	<0.200	<0.200	<0.200	<0.200	<0.2	<0.15	2.0[f]	2.6	---
Phenol[g]	<10.0	<10.0	<9.99	<10.0	<10[J2]	0.007±0.003[h]	5.8[f]	6.2	---
Cyanide (total)	17.3	14.2	14.6	15.4	8.92±1.33	not measured	---	590	---
Cyanide (amenable)	3.70	1.70	1.00	2.13	<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, 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, the highest value is reported as the average.
[f] United States EPA RSLs for tap water.[20]
[g] Results for the re-extracted (10 mL) 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[16] due to rounding.
[j]At least one of the values is "D" flagged (see explanation above).

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

Analyte	Sample ID			2020 Average[g]	2017 Average[15g]	2011 Average[16,g]	Regulatory Limit
	W-18325-00001	W-18325-00002	W-18325-00003				MCL[17]
Gross α	7.17E+04	4.98E+04	3.41E+04	5.19E+04	(6.36±0.09)E+04	<2.01E+03	15
Gross β	1.05E+08	1.15E+08	1.07E+08	1.09E+08	(5.81±0.02)E+07	(1.8±0.1)E+07	---
Gross γ[d]	1.01E+08	1.07E+08	1.03E+08	1.04E+08	(1.43±0.03)E+07	(1.69±0.15)E+07	---
^{3}H	5.29E+06	4.97E+06	4.49E+06	4.92E+06	(2.93±0.17)E+05	(1.2±0.5)E+03	---
^{60}Co	<1.21E+03	<8.84E+02	<3.69E+03	<3.69E+03	<1.60E+04	<4.0E+02	---
^{90}Sr	3.50E+06	3.33E+06	3.71E+06	3.51E+06	(2.08±0.07)E+07	(9.7±4.3)E+04	---
^{99}Tc	9.74E+05	1.08E+06	1.09E+06	1.05E+06	(2.10±0.11)E+06	(5.1±0.70)E+04	---
^{106}Ru	<1.53E+05	<2.47E+04	<1.27E+05	<2.47E+04	<2.52E+05	<3.3E+04	---
^{106}Rh[e]	<1.53E+05	<2.47E+04	<1.27E+05	<2.47E+04	<2.52E+05	<2.0E+04	---
^{125}Sb	<2.13E+05	<1.56E+05	<1.11E+05	<2.13E+05	<1.40E+05	<1.5E+04	---
^{137}Cs	1.07E+08	1.13E+08	1.09E+08	1.10E+08	(1.52±0.03)E+07	(1.8±0.2)E+07	---
^{137m}Ba[f]	1.01E+08	1.07E+08	1.03E+08	1.04E+08	(1.43±0.03)E+07	(1.7±0.1)E+07	---
^{147}Pm	1.11E+04	<6.87E+03	1.12E+04	9.72E+03	(9.35±0.91)E+02[b]	<1.2E+02	---
^{154}Eu	<1.82E+03	<1.20E+04	<2.52E+03	<1.82E+03	<2.75E+04	<4.9E+02	---
^{226}Ra	<3.47E+03	<8.22E+02	<1.35E+04[h]	<8.22E+02	<9.69E+01	<6.5E+04	5[a]
^{228}Ra	1.96E+06	2.12E+06	2.93E+06	2.34E+06	(9.78±1.25)E+06	<4.7E+03	
^{238}Pu	<2.80E+02[h]	9.96E+02	4.89E+02	5.88E+02	(7.67±1.45)E+01	<3.5E+01	---
$^{239/240}$Pu	<1.94E+02[h]	<2.01E+01	<9.32E+01	<9.32E+01	(8.28±1.22)E+00	<1.3E+01	---
^{241}Pu	<2.66E+03	<5.17E+03	<8.41E+03	<8.41E+03	<9.38E+02	<1.3E+03	---
^{241}Am	<3.94E+01	<1.01E+01	<1.12E+01	<3.94E+01	<1.79E+01	<1.5E+01	---
^{242}Cm	<5.87E+01	<7.24E+01	<1.48E+02	<5.87E+01	<8.54E+00	<1.3E+01	---
$^{243/244}$Cm	<3.91E+01	<4.02E+01	<1.69E+02[h]	<4.02E+01	<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.[21]

[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.[22]

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

4.0 Conclusions

By comparing the 2020 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).
- 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 and potentially exceeds the nonwastewater standard level of 6.2 mg/L.
- Concentrations 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 amenable cyanide exceeded 10x the MCL.
    - Thallium and fluorine potentially exceeded 10x the MCL (detection limit was >10x MCL).
- The gross alpha particle activity and combined ^{226}Ra and ^{228}Ra exceed the MCL by more than a factor of 10.
- Observation that the identified inorganic species and the gross alpha, ^{226}Ra and ^{228}Ra are greater than 10x the MCL confirms the Saltstone Disposal Facility classification as a Class 3 Landfill. Similar results have been reported in the previous vault classification studies.[15, 21]

The saltstone waste form placed in the Saltstone Disposal Facility in 4QCY20 met the SCHWMR R.61-79.261.24(b) RCRA metals requirements for a nonhazardous waste form. The TCLP leachate concentrations for nitrate, nitrite and the sum of nitrate and nitrite were greater than 10x the MCLs in SCDHEC Regulations R.61-107.19 Part I, A.1(d), which confirms the Saltstone Disposal Facility classification as a Class 3 Landfill. The saltstone waste form placed in the Saltstone Disposal Facility in 4QCY20 met the R.61-79.268.48(a) non wastewater treatment standards.

5.0 References

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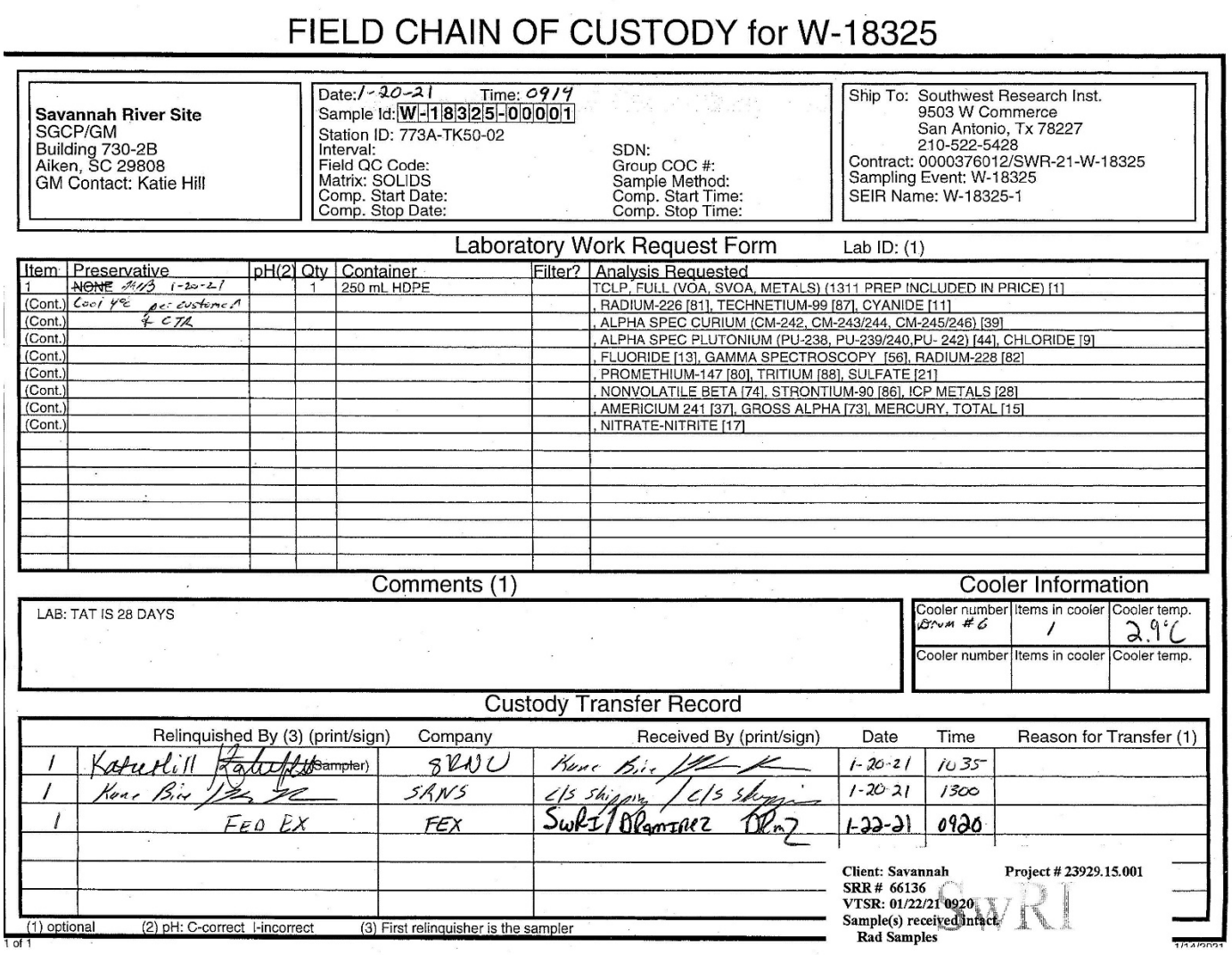
Appendix A. Chain of Custody Forms



FIELD CHAIN OF CUSTODY for W-18325

Savannah River Site
SGCP/GM
Building 730-2B
Aiken, SC 29808
GM Contact: Katie Hill

Date: 1-20-21 Time: 0914
Sample Id: W-18325-00001
Station ID: 773A-TK50-02
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.
9503 W Commerce
San Antonio, Tx 78227
210-522-5428
Contract: 0000376012/SWR-21-W-18325
Sampling Event: W-18325
SEIR Name: W-18325-1

Laboratory Work Request Form Lab ID: (1)

Item	Preservative	pH(2)	Qty	Container	Filter?	Analysis Requested
1	~~NONE~~ KH 1-20-21		1	250 mL HDPE		TCLP, FULL (VOA, SVOA, METALS) (1311 PREP INCLUDED IN PRICE) [1]
(Cont.)	Cool 4°C per customer & CTR					, RADIUM-226 [81], TECHNETIUM-99 [87], CYANIDE [11]
(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], CHLORIDE [9]
(Cont.)						, FLUORIDE [13], GAMMA SPECTROSCOPY [56], RADIUM-228 [82]
(Cont.)						, PROMETHIUM-147 [80], TRITIUM [88], SULFATE [21]
(Cont.)						, NONVOLATILE BETA [74], STRONTIUM-90 [86], ICP METALS [28]
(Cont.)						, AMERICIUM 241 [37], GROSS ALPHA [73], MERCURY, TOTAL [15]
(Cont.)						, NITRATE-NITRITE [17]

Comments (1)

LAB: TAT IS 28 DAYS

Cooler Information

Cooler number	Items in cooler	Cooler temp.
Drum #6	1	2.9°C
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 Hill (Sampler)	SRNS	Rene Bie	1-20-21	1035	
1	Rene Bie	SRNS	C/S Shipping / C/S Shipping	1-20-21	1300	
1	FED EX	FEX	SwRI / DRamirez	1-22-21	0920	

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

Client: Savannah Project # 23929.15.001
SRR # 66136
VTSR: 01/22/21 0920
Sample(s) received intact.
Rad Samples

SwRI

1 of 1

Figure A-1. Chain of custody for sample W-18325-00001.

FIELD CHAIN OF CUSTODY for W-18325

Savannah River Site
SGCP/GM
Building 730-2B
Aiken, SC 29808
GM Contact: Katie Hill

Date: 1-20-21 Time: 0928
Sample Id: W-18325-00002
Station ID: 773A-TK50-03
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.
9503 W Commerce
San Antonio, Tx 78227
210-522-5428
Contract: 0000376012/SWR-21-W-18325
Sampling Event: W-18325
SEIR Name: W-18325-1

Laboratory Work Request Form

Lab ID: (1)

Item	Preservative	pH(2)	Qty	Container	Filter?	Analysis Requested
1	~~NONE~~ KMB 1-20-21		1	250 mL HDPE		TCLP, FULL (VOA, SVOA, METALS) (1311 PREP INCLUDED IN PRICE) [1]
(Cont.)	Cool 4°C per customer					, RADIUM-226 [81], TECHNETIUM-99 [87], CYANIDE [11]
(Cont.)	4 C TR					, ALPHA SPEC CURIUM (CM-242, CM-243/244, CM-245/246) [39]
(Cont.)						, ALPHA SPEC PLUTONIUM (PU-238, PU-239/240,PU- 242) [44], CHLORIDE [9]
(Cont.)						, FLUORIDE [13], GAMMA SPECTROSCOPY [56], RADIUM-228 [82]
(Cont.)						, PROMETHIUM-147 [80], TRITIUM [88], SULFATE [21]
(Cont.)						, NONVOLATILE BETA [74], STRONTIUM-90 [86], ICP METALS [28]
(Cont.)						, AMERICIUM 241 [37], GROSS ALPHA [73], MERCURY, TOTAL [15]
(Cont.)						, NITRATE-NITRITE [17]

Comments (1)

LAB: TAT IS 28 DAYS

Cooler Information

Cooler number	Items in cooler	Cooler temp.
BIUM #6	1	2.9°C
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 Hill (Sampler)	SRNL	Kane Bice	1-20-21	1035	
1	Kane Bice	SRNS	CLs Shipping	1-20-21	1300	
	FED EX	FEX	SwRI / D Ramirez	1-22-21	0920	

Client: Savannah Project # 23929.15.001
SRR # 66136
VTSR: 01/22/21 0920
Sample(s) received intact.
Rad Samples

SwRI

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

1 of 1

Figure A-2. Chain of custody for sample W-18325-00002.

FIELD CHAIN OF CUSTODY for W-18325

Savannah River Site
SGCP/GM
Building 730-2B
Aiken, SC 29808
GM Contact: Katie Hill

Date: 1-20-21 Time: 0855
Sample Id: W-18325-00003
Station ID: 773A-TK50-01
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.
9503 W Commerce
San Antonio, Tx 78227
210-522-5428
Contract: 0000376012/SWR-21-W-18325
Sampling Event: W-18325
SEIR Name: W-18325-1

Laboratory Work Request Form

Lab ID: (1)

Item	Preservative	pH(2)	Qty	Container	Filter?	Analysis Requested
1	~~NONE~~ AMB 1-20-21		1	250 mL HDPE		TCLP, FULL (VOA, SVOA, METALS) (1311 PREP INCLUDED IN PRICE) [1]
(Cont.)	Cool 4°C per customer					, RADIUM-226 [81], TECHNETIUM-99 [87], CYANIDE [11]
(Cont.)	4°C TR					, ALPHA SPEC CURIUM (CM-242, CM-243/244, CM-245/246) [39]
(Cont.)						, ALPHA SPEC PLUTONIUM (PU-238, PU-239/240,PU- 242) [44], CHLORIDE [9]
(Cont.)						, FLUORIDE [13], GAMMA SPECTROSCOPY [56], RADIUM-228 [82]
(Cont.)						, PROMETHIUM-147 [80], TRITIUM [88], SULFATE [21]
(Cont.)						, NONVOLATILE BETA [74], STRONTIUM-90 [86], ICP METALS [28]
(Cont.)						, AMERICIUM 241 [37], GROSS ALPHA [73], MERCURY, TOTAL [15]
(Cont.)						, NITRATE-NITRITE [17]

Comments (1)

LAB: TAT IS 28 DAYS

Cooler Information

Cooler number	Items in cooler	Cooler temp.
Styrm #6	1	2.9°C
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 Hill (Sampler)	SRNS	Kane Bice	1-20-21	1035	
1	Kane Bice	SRNS	c/s shipping	1-20-21	1300	
	FED EX	FEX	Swri/ DRamirez	1-22-21	0920	

Client: Savannah Project # 23929.15.001
SRR # 66136
VTSR: 01/22/21 0920
Sample(s) received intact.
Rad Samples

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

1 of 1

Figure A-3. Chain of custody for sample W-18325-00003.

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: Salstone Vault Classification January 2021

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

Form D-3657

(Consult the Department for any Radiation / Chemical Mixed Wastes.)

	Results in Milligrams per Liter		
	Waste Stream 1		
	1/22/2021	1/22/2021	1/22/2021
Facility Sample ID #	W-18325-00001	W-18325-00002	W-18325-00003
Laboratory Sample ID #	673128	673129	673130
Laboratory Name	SWRI	SWRI	SWRI
SC Laboratory Certification #	DOECA P/NELAP	DOECA P/NELAP	DOECA P/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 (mg/l)	Quantitation Limit (mg/l)	MCL [3,4] (mg/l)	Class 2 (mg/l)	TCLP Limits (mg/l)			
Aluminum	SW3010A	SW6010D	0.1000	0.2	0.05-0.2	**0.5-2**	-	0.763	1.62	1.23
Antimony	SW3010A	SW6010D	0.0250	0.05	0.01	**0.06**	-	<0.0250	<0.0250	<0.0250
Arsenic	SW3010A	SW6020B	0.0100	0.02	0.01	**0.10**	5	0.0124	0.0143	0.0143
Barium	SW3010A	SW6010D	0.0050	0.01	2.00	**20.00**	100	0.118	0.125	0.126
Beryllium	SW3010A	SW6010D	0.0050	0.01	0.00	**0.04**	-	<0.00500	<0.00500	<0.00500
Boron	SW3010A	SW6010D	0.1000	0.2	4.00	**40.00**	-	0.579	0.578	0.555
Cadmium	SW3010A	SW6010D	0.0050	0.01	0.01	**0.05**	1	<0.00500	<0.00500	<0.00500
Chromium	SW3010A	SW6010D	0.0050	0.01	0.10	**1.00**	5	0.0152	0.0161	0.016
Cobalt	SW3010A	SW6010D	0.0050	0.01	0.01	**0.06**	-	<0.00500	<0.00500	<0.00500
Copper	SW3010A	SW6010D	0.0050	0.01	1.00	**10.00**	-	<0.00500	<0.00500	<0.00500
Iron	SW3010A	SW6010D	0.1000	0.2	0.30	**3.00**	-	<0.100	0.311	0.224
Lead	SW3010A	SW6010D	0.0075	0.015	0.02	**0.15**	5	<0.00750	<0.00750	<0.00750
Lithium	SW3010A	SW6010D	0.0150	0.03	0	**0.40**	-	0.23	0.238	0.226
Managanese	SW3010A	SW6010D	0.0050	0.01	0.050	**0.50**	-	<0.00500	0.00935	<0.00500
Mercury	-	SW7470A	0.0020	0.004	0.0	**0.02**	0.2	0.017	0.0189	0.0145
Molybdenum	SW3010A	SW6010D	0.0100	0.02	0.100	**1.00**	-	0.191	0.192	0.186
Nickel	SW3010A	SW6010D	0.0050	0.01	0.390	**3.90**	-	<0.00500	<0.00500	<0.00500
Selenium	SW3010A	SW6010D	0.0250	0.05	0.050	**0.50**	1	0.0628	0.0706	0.0722
Silver	SW3010A	SW6010D	0.0100	0.02	0.100	**1.00**	5	<0.0100	<0.0100	<0.0100
Strontium	SW3010A	SW6010D	0.0050	0.01	12.000	**120.00**	-	1.45	1.47	1.47
Thallium	SW3010A	SW6010D	0.0750	0.15	0.002	**0.02**	-	<0.0750	<0.0750	<0.0750
Uranium	SW3010A	SW6010D	0.2500	0.5	0.030	**0.30**	-	<0.250	<0.250	<0.250
Zinc	SW3010A	SW6010D	0.0075	0.015	5.000	**50.00**	-	<0.00750	<0.00750	<0.00750
Chloride	-	SW9056A	20.0000	20	250.000	**2500.0**	-	43.8	57.5	54.2

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

dhec

Type Data: **RCRA & SW - TCLP Metals** — **Form D-3657**

Company Name: Savannah River Remediation

Subject/Project: Salstone Vault Classification January 2021

(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		
								1/22/2021	1/22/2021	1/22/2021
Facility Sample ID #								W-18325-00001	W-18325-00002	W-18325-00003
Laboratory Sample ID #								673128	673129	673130
Laboratory Name								SWRI	SWRI	SWRI
SC Laboratory Certification #								DOECA P/NELAP	DOECA P/NELAP	DOECA P/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 (mg/l)	Quantitation Limit (mg/l)	MCL [3,4] (mg/l)	Class 2 (mg/l)	TCLP Limits (mg/l)			
Fluoride	-	SW9056A	100.0000	100	4.000	**40.00**	-	<100	<100	<99.9
Nitrate as N	-	SW9056A	100.0000	100	10.000	**100.00**	-	3450	3550	3420
Nitrite as N	-	SW9056A	20.0000	20	1.000	**10.00**	-	872	871	833
Nitrate/Nitrite (calc total)	-	SW9056A	-	-	10.000	**100.00**	-	4322	4421	4253
Sulfate	-	SW9056A	100.0000	100	250.000	**2500.0**	-	3410	3380	3360
Cyanide	SW9012B	SW9012B	0.2630	0.263	-	-	-	17.3	14.2	14.6
Amenable Cyanide	SW9012B	SW9012B	0.0050	0.263	0.200	**2.00**	-	3.7	1.7	1

1. Subcontracted Laboratory Used for this parameter.

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.

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

Type Data:	RCRA & SW - TCLP Metals	Form D-3657
Company Name:	Savannah River Remediation	
Subject/Project:	Salstone Vault Classification January 2021	
(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	
	1/22/2021	1/22/2021	1/22/2021
Quality Assurance (for above samples)			
TCLP Bottle Extraction #	None	None	None
TCLP Extraction Blank	EFB#1-176923	EFB#1-176923	EFB#1-176923
Digestion Batch #	20210204-P008	20210204-P008	20210204-P008
	20210226-P004	20210226-P004	20210226-P004
	20210326-P004	20210326-P004	20210326-P004
Digestion Blank	PB21B04KE6	PB21B04KE6	PB21B04KE6
	PB21B26KE1	PB21B26KE1	PB21B26KE1
	PB21C26SD1	PB21C26SD1	PB21C26SD1
Laboratory Control sample	LCS21B04KE6	LCS21B04KE6	LCS21B04KE6
	LCS21B04KE7	LCS21B04KE7	LCS21B04KE7
	LCS21B26KE1	LCS21B26KE1	LCS21B26KE1
	LCS21B26KE2	LCS21B26KE2	LCS21B26KE2
	LCS21C26SD1	LCS21C26SD1	LCS21C26SD1
	LCS21C26SD2	LCS21C26SD2	LCS21C26SD2
Matrix Spike (MS)	673130MS	673130MS	673130MS
Matrix Spike Duplicate (MSD)	673130MSD	673130MSD	673130MSD
Unspiked Duplicate (If Used)	673130D	673130D	673130D
Analysis Batch Number	20210327-A001	20210327-A001	20210327-A001
	20210327-A002	20210327-A002	20210327-A002
	20210318-A003	20210318-A003	20210318-A003
LCS Recovery	Acceptable	Acceptable	Acceptable
MS & MSD	Acceptable, ex Fe, Hg	Acceptable, ex Fe, Hg	Acceptable, ex Fe, Hg

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

dhec

Type Data: RCRA-SW - TCLP & Other Volatiles
Company Name: Savannah River Remediation
Subject/Project: Salstone Vault Classification January 2021

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

D-3658

								Results in Milligrams per Liter		
								Waste Stream 1		
(Consult the Department for any Radiation / Chemical Mixed Wastes.)								1/22/2021	1/22/2021	1/22/2021
Facility Sample ID #								W-18325-00001	W-18325-00002	W-18325-00003
Laboratory Sample ID #								673128	673129	673130
Laboratory Name								SWRI	SWRI	SWRI
SC Laboratory Certification #								DOECA P/NELAP	DOECA P/NELAP	DOECA P/NELAP
Subcontracted Laboratory Certification #								-	-	-
Subcontracted Laboratory Name								-	-	-
Laboratory Receipt Information (Chain of Custody Must be Attached)								Attached	Attached	Attached
TCLP Volatile Organic Compounds (SW1311 Extraction)										
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	-	SW8260D	0.0100	0.02	0.005	0.05	0.5	<0.02	<0.02	<0.02
Toluene	-	SW8260D	0.0100	0.02	1	10	-	<0.02	<0.02	<0.02
n-Butanol	-	SW8260D	0.1000	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 #								D02052104	D02052105	D02052106
Surrogates, % Recovery								None	None	None
1,2- Dichlorethane, d4								111	100	101
Toluene, dB								100	105	100
4-Bromofluorobenzene								-	-	-

1. Subcontracted Laboratory Used for these Parameters(Analytes)

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.

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

dhec

Type Data: **RCRA-SW - TCLP & Other Semi-Volatiles**
Company Name: Savannah River Remediation
Subject/Project: Salstone Vault Classification January 2021

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

D-3659

(Consult the Department for any Radiation / Chemical Mixed Wastes.)

	Results in Milligrams per Liter		
	Waste Stream 1		
	1/22/2021	1/22/2021	1/22/2021
Facility Sample ID #	W-18325-00001	W-18325-00002	W-18325-00003
Laboratory Sample ID #	673128	673129	673130
Laboratory Name	SWRI	SWRI	SWRI
SC Laboratory Certification #	DOECA P/NELAP	DOECA P/NELAP	DOECA P/NELAP
Subcontracted Laboratory Certification #	-	-	-
Subcontracted Laboratory Name	-	-	-
Laboratory Receipt Information (Chain of Custody Must be Attached)	Attached	Attached	Attached
Semi-Volatile Organic Compounds (Extraction SW1311)			

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	SW3510C	SW8270E	5.0	10	5.800	58.000	-	<10.0	<10.0	<9.99

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.
5. Consider the Characteristic (D-Listed), F-Listed, K-Listed, P-Listed, U-Listed and Appendices 8 & 9 in R. 61-79.261 Subparts C, D, & E of the SC DHEC Hazardous Waste Regulations.

Quality Assurance (for above samples)			
TCLP Bottle Extraction #	None	None	None
Semivolatile Extraction Batch #	None	None	None
Analysis Batch Number	COYOTE030221012	COYOTE030221013	COYOTE030221014
Surrogates. % Recovery	-	-	-
Nitrobenzene, d5	-	-	-
2-Fluorobiphenol	61	60	59
Terphenyl, d14	-	-	-
Phenol, d6	52	55	54
2-Fluorophenol	-	-	-
2,4,6-Tribromophenol	-	-	-

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

Characterization Associated Quality Assurance Data

dhec

Laboratory: Southwest Research Institute (SwRI)
Certicifation: DOECAP/ NELAP
Method: SW3010A, SW6010D, SW6020B, SW7470A, SW9056A, SW9012B
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-18325-00001, W-18325-00002, and W-18325-00003
Instrument: Various

D-3732

	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	0.2	0.1	<0.100	1.9	1.95	1.65	1.62	-	95	97.5	84	78	81	75-125	7.4	20	-
Antimony	0.05	0.025	<0.02500	0.495	0.498	0.522	0.524	-	99	99.6	104.4	104.8	104.6	75-125	0.4	20	U
Arsenic	0.02	0.01	<0.0100	1.93	1.9	0.556	0.545	-	96.5	95	108.3	106.1	107.2	75-125	2.1	20	BD
Barium	0.01	0.005	<0.00500	2.02	2.01	0.61	0.604	-	101	100.5	96.8	95.6	96.2	75-125	1.2	20	-
Beryllium	0.01	0.0050	<0.005	0.0478	0.0463	0.422	0.427	-	95.6	92.6	84.4	85.4	84.9	75-125	1.2	20	U
Boron	0.2	0.1	<0.100	1.99	2.02	1.09	1.09	-	99.5	101	107	107	107	75-125	0	20	-
Cadmium	0.01	0.005	<0.00500	0.051	0.0521	0.491	0.489	-	102	104.2	98.2	97.8	98	75-125	0.4	20	U
Chromium	0.01	0.005	<0.005	0.205	0.205	0.508	0.503	-	102.5	102.5	98.4	97.4	97.9	75-125	1	20	-
Cobalt	0.01	0.005	<0.00500	0.492	0.493	0.475	0.472	-	98.4	98.6	95	94.4	94.7	75-125	0.6	20	U
Copper	0.01	0.005	<0.00500	0.245	0.245	0.522	0.515	-	98	98	104.4	103	103.7	75-125	1.4	20	U
Iron	0.2	0.1	<0.100	0.985	0.975	0.597	0.604	-	98.5	97.5	70.6	72	71.3	75-125	2	20	J
Lead	0.015	0.0075	<0.007500	0.491	0.5	0.46	0.459	-	98.2	100	92	91.8	91.9	75-125	0.2	20	U
Lithium	0.03	0.015	<0.0150	2	1.98	0.733	0.762	-	100	99	101.4	107.2	104.3	75-125	5.6	20	-
Managanese	0.01	0.005	<0.00500	0.516	0.518	0.497	0.492	-	103.2	103.6	99.4	98.4	98.9	75-125	1	20	U
Mercury	0.004	0.002	<0.0001	0.00101	0.001	0.27	0.303	-	101	103	51.1	57.7	54.4	75-125	12	20	J
Molybdenum	0.02	0.01	<0.01	2.1	2.11	0.741	0.74	-	105	105.5	111	110.8	110.9	75-125	0.2	20	-
Nickel	0.01	0.005	<0.005	0.501	0.5	0.497	0.488	-	100.2	100	99.4	97.6	98.5	75-125	1.8	20	U
Selenium	0.05	0.025	<0.02500	1.82	1.84	0.567	0.577	-	91	92	99	101	100	75-125	2	20	-
Silver	0.02	0.01	<0.0100	0.0477	0.0485	0.506	0.489	-	95.4	97	101.2	97.8	99.5	75-125	3.4	20	U
Strontium	0.01	0.005	<0.00500	2.14	2.16	1.96	1.99	-	107	108	98	104	101	75-125	5.9	20	-
Thallium	0.15	0.075	<0.07500	2.03	2.04	0.506	0.517	-	101.5	102	101.2	103.4	102.3	75-125	2.2	20	U
Uranium	0.5	0.25	<0.250	1.98	2.01	1.89	1.84	-	99	100.5	94.5	92	93.25	75-125	2.7	20	U
Zinc	0.015	0.0075	<0.007500	0.516	0.519	0.489	0.487	-	103.2	103.8	97.8	97.4	97.6	75-125	0.4	20	U
Chloride	20	20	<1.00	1030	-	2150	-	-	103	-	105.3	-	-	80-120	-	-	D
Fluoride	100	100	<5.00	1010	-	9240	-	-	101	-	92.4	-	-	80-120	-	-	UD
Nitrate as N	100	100	<1.00	222	-	5800	-	-	98.2	-	104	-	-	80-120	-	-	D
Nitrite as N	20	20	<1.00	300	-	1470	-	-	98.7	-	98.4	-	-	80-120	-	-	D
Nitrate/Nitrite (calc total)	Calculated Value (not measured)																
Sulfate	100	100	<1.00	1040	-	13900	-	-	104	-	104.9	-	-	80-120	-	-	D
Cyanide (Total)	0.263	0.263	<0.300	0.513	0.519	17.5	16.2	-	90.6	91.7	9.5	58.2	33.85	75-125	140	20	D
Benzene	0.02	0.01	<0.0010	0.023	0.021	-	-	-	92	84	-	-	-	79-120	9	20	-
Toluene	0.02	0.01	<0.0010	0.024	0.022	-	-	-	96	88	-	-	-	80-121	9	20	-
n-Butanol	0.2	0.1	<0.010	0.21	0.19	-	-	-	84	76	-	-	-	59-131	10	50	-
Phenol	10	5	<1.0	2.83	3.1	-	-	-	57	62	-	-	-	12-110	9	42	-
Clock ID	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

RUEG-3732 (3/2013) Analyte Batch Report and Concentrations

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

dhec

D-3733

Cross Reference Report for QA and Analytes

Analytical Method Reference: SW3010A, SW6010D, SW6020B, SW7470A, SW9056A, SW9012B
Lab Reference (to Facility Sample):
Subject / Project: Salstone Vault Classification January 2021
Facility: Savannah River Remediation

LAB ID #	FACILITY SAMP ID #	TC EXTR BATCH #	DIGESTION BATCH #	ANALYSIS BATCH #	OTHER	COMMENTS
673128	W-18325-00001	None	None	D02052104	None	SW8260D (vols)
673129	W-18325-00002	None	None	D02052105	None	SW8260D (vols)
673130	W-18325-00003	None	None	D02052106	None	SW8260D (vols)
BLANK020521 MBLK	None	None	None	D020521B1	None	SW8260D (vols)
LCS020521 LCS	None	None	None	D02052101	None	SW8260D (vols)
LCS020521 LCSD	None	None	None	D02052102	None	SW8260D (vols)
TCLP Ext. Fluid#1 Blank_020521	None	None	None	D02052103	None	SW8260D (vols)
673128	W-18325-00001 (10mL)	None	None	COYOTE030221012	None	SW8270E (phenol)
673129	W-18325-00002 (10mL)	None	None	COYOTE030221013	None	SW8270E (phenol)
673130	W-18325-00003 (10mL)	None	None	COYOTE030221014	None	SW8270E (phenol)
674911	WBLANK_09FEB21 (10mL)	None	None	COYOTE030221008	None	SW8270E (phenol)
673978	EFB#1-176923 (10mL)	None	None	COYOTE030221009	None	SW8270E (phenol)
674912	LCS_09FEB21 (10mL) LCS	None	None	COYOTE030221010	None	SW8270E (phenol)
674912DUP	LCS_09FEB21 (10mL) DUP LCS	None	None	COYOTE030221011	None	SW8270E (phenol)
673128	W-18325-00001	None	20210225-P004	20210301-A005	None	SW9056A
673129	W-18325-00002	None	20210225-P004	20210301-A005	None	SW9056A
673130	W-18325-00003	None	20210225-P004	20210301-A005	None	SW9056A
PB21B02JH2	None	None	20210225-P004	20210301-A005	None	SW9056A
ICB	None	None	20210225-P004	20210301-A005	None	SW9056A
673128MS	W-18325-00001MS/MSD	None	20210225-P004	20210301-A005	None	SW9056A
673128D	W-18325-00001D	None	20210225-P004	20210301-A005	None	SW9056A
ICV (LCS)	ICV	None	20210225-P004	20210301-A005	None	SW9056A
673128	W-18325-00001	None	None	20210225-A007	None	SW9012 (Am. Cyanide)
673128D	W-18325-00001D	None	None	20210225-A007	None	SW9012 (Am. Cyanide)
673129	W-18325-00002	None	None	20210225-A007	None	SW9012 (Am. Cyanide)
673130	W-18325-00003	None	None	20210225-A007	None	SW9012 (Am. Cyanide)
PB21B12JH1	None	None	None	20100225-A007	None	SW9012 (Am. Cyanide)

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

dhec

D-3733

Cross Reference Report for QA and Analytes

Analytical Method Reference: SW3010A, SW6010D, SW6020B, SW7470A, SW9056A, SW9012B
Lab Reference (to Facility Sample):
Subject / Project: Salstone Vault Classification January 2021
Facility: Savannah River Remediation

LAB ID #	FACILITY SAMP ID #	TC EXTR BATCH #	DIGESTION BATCH #	ANALYSIS BATCH #	OTHER	COMMENTS
673128	W-18325-00001	None	20210212-P001	20210212-A005	None	SW9012A (Total Cyanide)
673129	W-18325-00002	None	20210212-P001	20210212-A005	None	SW9012A (Total Cyanide)
673130	W-18325-00003	None	20210212-P001	20210212-A005	None	SW9012A (Total Cyanide)
PB21B03PB1	None	None	20210212-P001	20210212-A005	None	SW9012A (Total Cyanide)
PB21B03PB2	None	None	20210212-P001	20210212-A005	None	SW9012A (Total Cyanide)
PB21B03PB3	None	None	20210212-P001	20210212-A005	None	SW9012A (Total Cyanide)
PB21B03PB4	None	None	20210212-P001	20210212-A005	None	SW9012A (Total Cyanide)
PB21B03PB5	None	None	20210212-P001	20210212-A005	None	SW9012A (Total Cyanide)
PB21B03PB6	None	None	20210212-P001	20210212-A005	None	SW9012A (Total Cyanide)
PB21B03PB7	None	None	20210212-P001	20210212-A005	None	SW9012A (Total Cyanide)
673128	W-18325-00001	None	20210212-P001	20210212-A005	None	SW9012A (Total Cyanide)
673128D	W-18325-00001D	None	20210212-P001	20210212-A005	None	SW9012A (Total Cyanide)
673128S	W-18325-00001MS	None	20210212-P001	20210212-A005	None	SW9012A (Total Cyanide)
673128SSD	W-18325-00001MSD	None	20210212-P001	20210212-A005	None	SW9012A (Total Cyanide)
673129	W-18325-00002	None	20210212-P001	20210212-A005	None	SW9012A (Total Cyanide)
673130	W-18325-00003	None	20210212-P001	20210212-A005	None	SW9012A (Total Cyanide)
LCS21B03JH1	None	None	20210212-P001	20210212-A005	None	SW9012A (Total Cyanide)
LCS21B03JH2	None	None	20210212-P001	20210212-A005	None	SW9012A (Total Cyanide)
LCS21B03JH3	None	None	20210212-P001	20210212-A005	None	SW9012A (Total Cyanide)
LCS21B03JH4	None	None	20210212-P001	20210212-A005	None	SW9012A (Total Cyanide)
LCS21B03JH5	None	None	20210212-P001	20210212-A005	None	SW9012A (Total Cyanide)
PB21B26KE1	None	None	20210226-P004	20210305-A006	None	SW7470A
LCS21B26KE1	None	None	20210226-P004	20210305-A006	None	SW7470A
LCS21B26KE2	None	None	20210226-P004	20210305-A006	None	SW7470A
EFB#1-176923	None	None	20210226-P004	20210305-A006	None	SW7470A
673128	W-18325-00001	None	20210226-P004	20210305-A006	None	SW7470A
673129	W-18325-00002	None	20210226-P004	20210305-A006	None	SW7470A
673130	W-18325-00003	None	20210226-P004	20210305-A006	None	SW7470A
673130D	W-18325-00003D	None	20210226-P004	20210305-A006	None	SW7470A

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

dhec

D-3733

Cross Reference Report for QA and Analytes

Analytical Method Reference: SW3010A, SW6010D, SW6020B, SW7470A, SW9056A, SW9012B
Lab Reference (to Facility Sample):
Subject / Project: Salstone Vault Classification January 2021
Facility: Savannah River Remediation

LAB ID #	FACILITY SAMP ID #	TC EXTR BATCH #	DIGESTION BATCH #	ANALYSIS BATCH #	OTHER	COMMENTS
673130MS	W-18325-00003MS	None	20210226-P004	20210305-A006	None	SW7470A
673130MSD	W-18325-00003MSD	None	20210226-P004	20210305-A006	None	SW7470A
673130AS	W-18325-00003AS	None	20210226-P004	20210305-A006	None	SW7470A
PB21B04KE6	None	None	20210204-P008	20210318-A003	None	SW6010D
EFB#1-176923	None	None	20210326-P004	20210318-A003	None	SW6010D
LCS21B04KE6	None	None	20210326-P004	20210318-A003	None	SW6010D
LCS21B04KE7	None	None	20210326-P004	20210318-A003	None	SW6010D
673128	W-18325-00001	None	20210326-P004	20210318-A003	None	SW6010D
673129	W-18325-00002	None	20210326-P004	20210318-A003	None	SW6010D
673130	W-18325-00003	None	20210326-P004	20210318-A003	None	SW6010D
673130D	W-18325-00003D	None	20210326-P004	20210318-A003	None	SW6010D
673130L	W-18325-00003L	None	20210326-P004	20210318-A003	None	SW6010D
673130MS	W-18325-00003MS	None	20210326-P004	20210318-A003	None	SW6010D
673130MSD	W-18325-00003MSD	None	20210326-P004	20210318-A003	None	SW6010D
PB21B04KE6	None	None	20210204-P008	20210327-A002	None	SW6020B (As)
EFB#1-176923	None	None	20210204-P006	20210327-A002	None	SW6020B (As)
LCS21B04KE6	None	None	20210204-P006	20210327-A002	None	SW6020B (As)
LCS21B04KE7	None	None	20210204-P006	20210327-A002	None	SW6020B (As)
673128	W-18325-00001	None	20210204-P006	20210327-A002	None	SW6020B (As)
673129	W-18325-00002	None	20210204-P006	20210327-A002	None	SW6020B (As)
673130	W-18325-00003	None	20210204-P006	20210327-A002	None	SW6020B (As)
673130D	W-18325-00003D	None	20210204-P006	20210327-A002	None	SW6020B (As)
673130L	W-18325-00003L	None	20210204-P006	20210327-A002	None	SW6020B (As)
673130MS	W-18325-00003MS	None	20210204-P006	20210327-A002	None	SW6020B (As)
673130MSD	W-18325-00003MSD	None	20210204-P006	20210327-A002	None	SW6020B (As)

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

dhec

D-3733

Cross Reference Report for QA and Analytes

Analytical Method Reference: SW3010A, SW6010D, SW6020B, SW7470A, SW9056A, SW9012B
Lab Reference (to Facility Sample):
Subject / Project: Salstone Vault Classification January 2021
Facility: Savannah River Remediation

LAB ID #	FACILITY SAMP ID #	TC EXTR BATCH #	DIGESTION BATCH #	ANALYSIS BATCH #	OTHER	COMMENTS
PB21C26SD1	None	None	20210326-P004	20210327-A001	None	SW6010D (B,Cr,Fe,Mo,Ni,Sr,U)
EFB#1-176923	EFB#1-176923 R	None	20210326-P004	20210327-A001	None	SW6010D (B,Cr,Fe,Mo,Ni,Sr,U)
EFB#1-176923	EFB#1-176923 U	None	20210326-P004	20210327-A001	None	SW6010D (B,Cr,Fe,Mo,Ni,Sr,U)
LCS21C26SD1	None	None	20210326-P004	20210327-A001	None	SW6010D (B,Cr,Fe,Mo,Ni,Sr,U)
LCS21C26SD2	None	None	20210326-P004	20210327-A001	None	SW6010D (B,Cr,Fe,Mo,Ni,Sr,U)
673128R	W-18325-00001	None	20210326-P004	20210327-A001	None	SW6010D (B,Cr,Fe,Mo,Ni,Sr,U)
673129R	W-18325-00002	None	20210326-P004	20210327-A001	None	SW6010D (B,Cr,Fe,Mo,Ni,Sr,U)
673130R	W-18325-00003	None	20210326-P004	20210327-A001	None	SW6010D (B,Cr,Fe,Mo,Ni,Sr,U)
673130RD	W-18325-00003D	None	20210326-P004	20210327-A001	None	SW6010D (B,Cr,Fe,Mo,Ni,Sr,U)
673130RL	W-18325-00003L	None	20210326-P004	20210327-A001	None	SW6010D (B,Cr,Fe,Mo,Ni,Sr,U)
673130RMS	W-18325-00003MS	None	20210326-P004	20210327-A001	None	SW6010D (B,Cr,Fe,Mo,Ni,Sr,U)
673130RMSD	W-18325-00003MSD	None	20210326-P004	20210327-A001	None	SW6010D (B,Cr,Fe,Mo,Ni,Sr,U)
673130RAS	W-18325-00003AS	None	20210326-P004	20210327-A001	None	SW6010D (B,Cr,Fe,Mo,Ni,Sr,U)
673128U	W-18325-00001	None	20210326-P004	20210327-A001	None	SW6010D (B,Cr,Fe,Mo,Ni,Sr,U)
673129U	W-18325-00002	None	20210326-P004	20210327-A001	None	SW6010D (B,Cr,Fe,Mo,Ni,Sr,U)
673130U	W-18325-00003	None	20210326-P004	20210327-A001	None	SW6010D (B,Cr,Fe,Mo,Ni,Sr,U)
673130UD	W-18325-00003D	None	20210326-P004	20210327-A001	None	SW6010D (B,Cr,Fe,Mo,Ni,Sr,U)
673130UL	W-18325-00003L	None	20210326-P004	20210327-A001	None	SW6010D (B,Cr,Fe,Mo,Ni,Sr,U)
673130UMS	W-18325-00003MS	None	20210326-P004	20210327-A001	None	SW6010D (B,Cr,Fe,Mo,Ni,Sr,U)
673130UMSD	W-18325-00003MSD	None	20210326-P004	20210327-A001	None	SW6010D (B,Cr,Fe,Mo,Ni,Sr,U)
PB21C26SD1	None	None	20210326-P004	20210327-A003	None	SW6010D (Be,Li)
EFB#1-176923	EFB#1-176923 R	None	20210326-P004	20210327-A003	None	SW6010D (Be,Li)
LCS21C26SD1	None	None	20210326-P004	20210327-A003	None	SW6010D (Be,Li)
LCS21C26SD2	None	None	20210326-P004	20210327-A003	None	SW6010D (Be,Li)
673128R	W-18325-00001	None	20210326-P004	20210327-A003	None	SW6010D (Be,Li)
673129R	W-18325-00002	None	20210326-P004	20210327-A003	None	SW6010D (Be,Li)
673130R	W-18325-00003	None	20210326-P004	20210327-A003	None	SW6010D (Be,Li)
673130RD	W-18325-00003D	None	20210326-P004	20210327-A003	None	SW6010D (Be,Li)
673130RL	W-18325-00003L	None	20210326-P004	20210327-A003	None	SW6010D (Be,Li)
673130RMS	W-18325-00003MS	None	20210326-P004	20210327-A003	None	SW6010D (Be,Li)
673130RMSD	W-18325-00003MSD	None	20210326-P004	20210327-A003	None	SW6010D (Be,Li)

Distribution List:

Name:	Name:
J. P. Arnold	J. Manna
M. J. Barnes	K. B. Martin
K. Bice	J. J. Mayer
M. N. Borders	M. W. McCoy
J. M. Bricker	R. T. McNew
K. M. Brotherton	D. J. McCabe
R. L. Brown	G. A. Morgan
N. F. Chapman	P. W. Norris
J. H. Christian	J. E. Occhipinti
W. A. Condon	J. F. Iaukea
A. D. Cozzi	F. M. Pennebaker
C. L. Crawford	J. Polk
J. Crenshaw	P. A. Polk
K. D. Dixon	M. M. Potvin
E. M. Doman	B. M. Price
R. E. Edwards	A. A. Ramsey
A. P. Fellinger	W. G. Ramsey
E. J. Freed	J. W. Ray
J. N. Hall, Jr.	C. Ridgeway
E. W. Harrison	L. B. Romanowski
C. C. Herman	K. H. Rosenberger
K. A. Hill	A. Samadi-Dezfouli
P. J. Hill	F. M. Smith
T. H. Huff	A. V. Staub
R. M. Hoeppel	M. Stone
V. Jain	P. C. Suggs
R. C. Jolly, Jr.	P. A. Westover
J. P. Lampert	B. J. Wiedenman
C. A. Langton	A. W. Wiggins
J. D. Ledbetter	L. A. Wooten
B. Lee	T. L. Young
K. R. Liner	Records Administration (EDWS)