

Keywords: *Saltstone*
Regulatory, Classification
TCLP

Retention: *Permanent*

**Saltstone Vault Classification Samples
Modular Caustic Side Solvent Extraction
Unit/Actinide Removal Process Waste Stream
April 2011**

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September 2011

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Prepared for the U.S. Department of Energy under
contract number DE-AC09-08SR22470.



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Printed in the United States of America

**Prepared for
U.S. Department of Energy**

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EXECUTIVE SUMMARY

Savannah River National Laboratory (SRNL) was asked to prepare saltstone from samples of Tank 50H obtained by SRNL on April 5, 2011 (Tank 50H sampling occurred on April 4, 2011) during 2QCY11 to determine the non-hazardous nature of the grout and for additional vault classification analyses. The samples were cured and shipped to Babcock & Wilcox Technical Services Group-Radioisotope and Analytical Chemistry Laboratory (B&W TSG-RACL) to perform the Toxic Characteristic Leaching Procedure (TCLP)⁽¹⁾ and subsequent extract analysis on saltstone samples for the analytes required for the quarterly analysis saltstone sample. In addition to the eight toxic metals—arsenic, barium, cadmium, chromium, mercury, lead, selenium and silver—analytes included the underlying hazardous constituents (UHC) antimony, beryllium, nickel, and thallium which could not be eliminated from analysis by process knowledge. Additional inorganic species determined by B&W TSG-RACL include aluminum, boron, chloride, cobalt, copper, fluoride, iron, lithium, manganese, molybdenum, nitrate/nitrite as Nitrogen, strontium, sulfate, uranium, and zinc and the following radionuclides: gross alpha, gross beta/gamma, ³H, ⁶⁰Co, ⁹⁰Sr, ⁹⁹Tc, ¹⁰⁶Ru, ¹⁰⁶Rh, ¹²⁵Sb, ¹³⁷Cs, ^{137m}Ba, ¹⁵⁴Eu, ²³⁸Pu, ^{239/240}Pu, ²⁴¹Pu, ²⁴¹Am, ²⁴²Cm, and ^{243/244}Cm. B&W TSG-RACL provided subsamples to GEL Laboratories, LLC for analysis for the VOCs benzene, toluene, and 1-butanol. GEL also determines phenol (total) and the following radionuclides: ¹⁴⁷Pm, ²²⁶Ra and ²²⁸Ra.

Preparation of the 2QCY11 saltstone samples for the quarterly analysis and for vault classification purposes and the subsequent TCLP analyses of these samples showed that:

- The saltstone waste form disposed of in the Saltstone Disposal Facility in 2QCY11 was not characteristically hazardous for toxicity.
- The concentrations of the eight RCRA metals and UHCs identified as possible in the saltstone waste form were present at levels below the UTS.
- Most of the inorganic species measured in the leachate do not exceed the MCL, SMCL or TW limits.
- The inorganic waste species that exceeded the MCL by more than a factor of 10 were nitrate, nitrite and the sum of nitrate and nitrite.
- Analyses met all quality assurance specifications of US EPA SW-846.
- The organic species (benzene, toluene, 1-butanol, phenol) were either not detected or were less than reportable for the vault classification samples.
- The gross alpha and radium isotopes could not be determined to the MCL because of the elevated background which raised the detection limits.
- Most of the beta/gamma activity was from ¹³⁷Cs and its daughter ^{137m}Ba.
- The concentration of ¹³⁷Cs and ⁹⁰Sr were present in the leachate at concentrations 1/40th and 1/8th respectively than in the 2003 vault classification samples.

The saltstone waste form placed in the Saltstone Disposal Facility in 2QCY11 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, which confirms the Saltstone Disposal Facility classification as a Class 3 Landfill. The saltstone waste form placed in the Saltstone Disposal Facility in 2QCY11 met the R.61-79.268.48(a) non wastewater treatment standards.

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LIST OF ABBREVIATIONS

ARP	Actinide Removal Process
B&W TSG- RACL	B & W Technical Services Group-Radioisotope and Analytical Chemistry Laboratory
CVAA	Cold Vapor Atomic Absorption
DDA	Deliquification, Dissolution, and Adjustment
DL	Detection Limit
DSS-HT	Decontaminated Salt Solution Hold Tank
ESS-WP	Environmental Services Section – Waste Programs
ETP	Effluent Treatment Project
IC	Ion Chromatography
ICP-MS	Inductively Coupled Plasma – Mass Spectrometer
ISWLF	Industrial Solid Waste Landfill
IWTF	Industrial Wastewater Treatment Facility
LCS	Laboratory Control Sample
MCL	Maximum Contaminant Level
MCU	Modular Caustic Side Solvent Extraction Unit
MS	Matrix Spike
MSD	Matrix Spike Duplicate
QL	Quantitation Limit
RCRA	Resource Conservation and Recovery Act
RER	Replicate Error Ratio
RL	Reporting Limit
RPD	Relative Percent Differences
SAP	Sampling and Analysis Plan
SCDHEC	South Carolina Department of Health and Environmental Control
SCHWMR	South Carolina Hazardous Waste Management Regulations
SDF	Saltstone Disposal Facility
SDG	Sample Delivery Group
SMCL	Secondary Maximum Contaminant Level
SPF	Saltstone Production Facility
SRNL	Savannah River National Laboratory
SWLF	Z-Area Solid Waste Landfill
TCLP	Toxic Characteristic Leaching Procedure
UHC	Underlying Hazardous Constituent

UTS Universal Treatment Standards

1.0 Introduction

The Saltstone Production Facility (SPF) receives waste from Tank 50H for treatment. Tank 50H contains waste streams (i.e. H-Canyon low-activity waste ⁽²⁾, Effluent Treatment Project (ETP) waste ⁽³⁾, and decontaminated salt solution from the Actinide Removal Process / Modular Caustic Side Solvent Extraction Unit (ARP/MCU)) which is processed for disposal in the Saltstone Disposal Facility (SDF). The Sampling and Analysis Plan (SAP) ⁽⁴⁾ provides the South Carolina Department of Health and Environmental Control (SCDHEC) with the chemical and physical characterization strategy for the salt solution which is to be disposed of in the Z-Area Solid Waste Landfill (SWLF), during Interim Salt Processing. During operation, the salt waste stream will be sampled quarterly and grout samples prepared to determine the non-hazardous nature of the grout to meet the requirements of the SCDHEC regulation for the “Characteristic of Toxicity”, R.61-79.261.24(b) and the “Universal Treatment Standards”, R.61-79.268.48. ⁽⁵⁾

The SAP also specifies that additional sampling will be conducted as new waste streams are identified for treatment and disposal at the Saltstone Industrial Wastewater Treatment Facility (IWTF) and SWLF or every five years in accordance with SCDHEC Regulation R.61-107.19. ⁽⁴⁾ In the second quarter of calendar year 2011, additional material was collected from Tank 50H in order to support the additional analyses that are required due to the completion of the Deliquification, Dissolution, and Adjustment (DDA) waste stream. This is a change in the waste stream composition and the analysis of this vault classification sample satisfies the requirements described in the SAP.

In the second quarter of the 2011 calendar year (2QCY11), Tank 50H accepted transfers of approximately 15 kgal from the Effluent Treatment Project (ETP), approximately 2 kgal from Tank 710—the H-Canyon General Purpose Evaporator, approximately 63 kgal from the H-Canyon Super Kukla campaign, approximately 370 kgal from the Actinide Removal Process / Modular Caustic Side Solvent Extraction Unit (ARP/MCU) Decontaminated Salt Solution Hold Tank (DSS-HT), and approximately 10 kgal from other sources.

Savannah River National Laboratory (SRNL) was asked to prepare saltstone from samples of Tank 50H obtained April 5, 2011 during 2QCY11 to determine the non-hazardous nature of the grout and for additional vault classification analyses. The samples were cured and shipped to Babcock & Wilcox Technical Services Group-Radioisotope and Analytical Chemistry Laboratory (B&W TSG-RACL) to perform the Toxic Characteristic Leaching Procedure (TCLP) ⁽¹⁾ and subsequent extract analysis on saltstone samples for the analytes required for the quarterly analysis saltstone sample. In addition to the eight toxic metals—arsenic, barium, cadmium, chromium, mercury, lead, selenium and silver—analytes included the underlying hazardous constituents (UHC) antimony, beryllium, nickel, and thallium which could not be eliminated from analysis by process knowledge. Additional inorganic species determined by B&W TSG-RACL include aluminum, boron, chloride, cobalt, copper, fluoride, iron, lithium, manganese, molybdenum, nitrate/nitrite as Nitrogen, strontium, sulfate, uranium, and zinc and the following radionuclides: gross alpha, gross beta/gamma, ³H, ⁶⁰Co, ⁹⁰Sr, ⁹⁹Tc, ¹⁰⁶Ru, ¹⁰⁶Rh, ¹²⁵Sb, ¹³⁷Cs, ^{137m}Ba, ¹⁵⁴Eu, ²³⁸Pu, ^{239/240}Pu, ²⁴¹Pu, ²⁴¹Am, ²⁴²Cm, and ^{243/244}Cm. B&W TSG-RACL provided subsamples to GEL Laboratories, LLC for analysis for the VOCs benzene, toluene, and 1-butanol. GEL also determines phenol (total) and the following radionuclides: ¹⁴⁷Pm, ²²⁶Ra and ²²⁸Ra.

2.0 Experimental Procedure

This section is a summary of the approach taken to prepare and characterize the saltstone samples. The saltstone sample preparation was performed at SRNL. Saltstone sample characterization was performed at both B&W TSG-RACL facility in Lynchburg, Virginia and the GEL laboratory facility in Charleston, South Carolina. Figure 2-1 is a flowchart of the steps taken to prepare and characterize the saltstone samples.

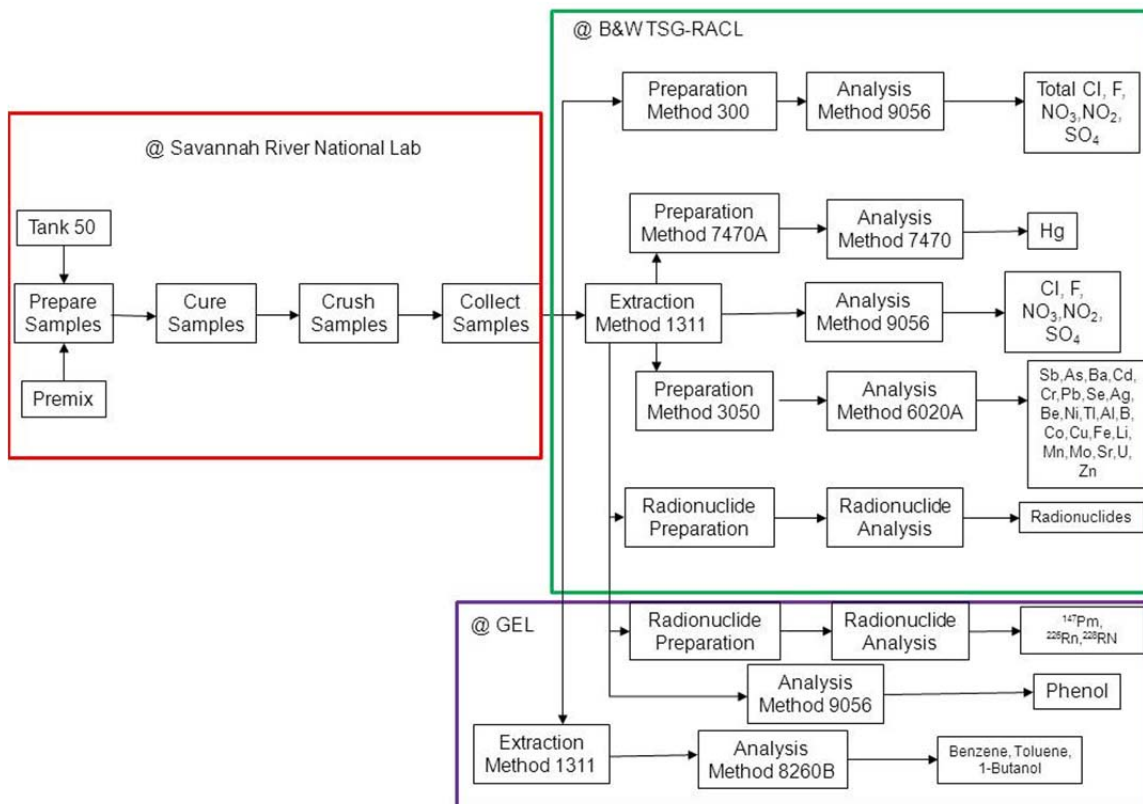


Figure 2-1 Flowchart of Saltstone Preparation and Analysis

2.1 Saltstone Preparation

Saltstone preparation was performed at SRNL. The weight percent solids data used for vault classification samples were taken from the quarterly Waste Acceptance Criteria (WAC) analyses performed on Tank 50H.⁽⁶⁾ Table 2-1 lists the concentration of TCLP metals and other species of interest in the salt solution from the WAC analysis⁽⁶⁾ for the samples. As shown in Table 2-1, the contents of Tank 50H exceed the regulatory limits for chromium, mercury, and possibly phenol, and therefore must be treated and disposed of in a non-hazardous waste form. Table 2-2 contains the parameters used to prepare the vault classification samples.⁽⁷⁾

Saltstone samples for vault classification were prepared with the Tank 50H blended salt solution and a premix of cement, slag, and fly ash. Figure 2-2 shows the formulation used to prepare these samples. The salt solution, admixtures and premix materials were combined in a blender and mixed at low speed for one minute, inspected for incorporation of the premix, and then mixed at high speed for an additional two minutes. After the saltstone slurry was mixed, it was cast into a

polyethylene zip top bag. The bag was laid flat and the air was expelled prior to sealing. The sample was 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 for not less than 28 days¹— 28 days for the 2Q11 sample, the saltstone was removed from the container and a portion of the saltstone was crushed to particles less than 0.9 centimeters (3/8 inch) as prescribed by Section 7.13 of the TCLP method.⁽¹⁾ The crushed saltstone was 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.”⁽⁴⁾ ESS-WP retrieved the samples from SRNL and transported them to B&W TSG-RACL for extraction and analysis. B&W TSG-RACL repackaged a portion of the sample and shipped the sample to GEL Laboratories to perform analysis for the organic species (benzene, toluene, 1-butanol, phenol) and for the radionuclides (¹⁴⁷Promethium, ²²⁶Radium and ²²⁸Radium).

Table 2-1. Sample Results of TCLP Metals from 2Q11 Tank 50H WAC Analysis

-	Sample Results (mg/L) (6)	Regulatory Limits (mg/L)
-	2Q11	Toxicity ^a
As	< 0.104	5
Ba	<0.49	100
Cd	<0.66	1
Cr	45.5	5
Pb	0.127	5
Hg	18.8	0.2
Se	<0.416	1
Ag	<1.37	5
--	--	UHC^b
Sb	<1.01	1.15
Be	<0.076	1.22
Ni	6.03	11
Tl	< 0.037	0.20
-	-	(mg/kg)
benzene	< 0.150	10
phenol	< 10.0	6.2

NM – Not Measured

^a SCHWMR R.61-79.261.24(b) “Characteristic of Toxicity.”

^b SCHWMR R.61-79.268.48 “Universal Treatment Standards.”

¹ Samples are considered ready for analysis after 28 days. Samples are not crushed until shipment has been scheduled.

Table 2-2 Customer Recommended Values for Preparation of 2Q11 TCLP and Vault Classification Samples

Parameter	2Q11
Water-to-Premix ratio	0.60
(Daratard 17) gal/Ton premix	0.00
(Dow Corning Q2-3183A) gal/Ton premix	0.15

Saltstone Mix Data Sheet

MIX # 0124		Date: 4/25/2011	
Material	%	WT%	Grams
Waste Solution: Tank 50 4/5/11 2Q11 Wt% Solids # <u>24.80</u> Grams Water <u>172.96</u>		44.22	230.00
Admixture: <u>Q2 Antifoam*</u>		0.03	0.08
Admixture: _____			
Admixture: _____			
Premix		55.76	290.00
Cement (% of Premix)	10	5.58	29.00
Slag (% of Premix)	45	25.09	130.50
Fly Ash (% of Premix)	45	25.09	130.50
Total	100	100.01	520.08
Water to Premix Ratio	0.60		
<p>Calculations: Use CBO fly ash From customer: 0.60 w/p, 0.10 gpm, 33T/hr dry feed Q2 is diluted Q2 amount . In plant, diluted 1:4 in water. * Actual amount of Q2 added to sample is 0.078 g. Q2 was diluted to a 1:4 in water and 100 uL pipette was used to add the diluted Q2 to the sample. Part of this sample will also be used for the Vault Classification Sample testing.</p>			

Figure 2-2 Data sheet for the Saltstone mix used to prepare the 2Q11 Vault Classification samples⁽⁷⁾

2.2 Saltstone Testing

Saltstone testing was performed by B&W TSG-RACL and GEL Laboratories, LLC. Activities associated with the 2QCY11 saltstone vault classification samples were:

At B&W TSG-RACL,

- performing the TCLP extraction,
- digesting the TCLP leachate, and
- analyzing the digested leachate.

At GEL

- performing extractions on solid subsamples shipped from B&W TSG-RACL and
- analyzing extracts.

2.2.1 *B&W TSG-RACL*

The TCLP sample arrived at B&W TSG-RACL, Lynchburg, Virginia on May 26, 2011 for analysis. The three Vault classification samples arrived at B&W TSG-RACL, Lynchburg, Virginia on June 9, 2011 for analysis. Shipping container temperatures were documented to be within specifications for the TCLP sample. The shipping container for the three Vault classification samplers arrived 17 days after the “collected” date and the container temperature was 15 °C. The samples were delivered with proper chain of custody documentation and signatures. All sample containers arrived without any visible signs of tampering or breakage.

The Metals method 6020A analysis was performed on an X-7 Series Inductively Coupled Plasma – Mass Spectrometer (ICP-MS). The instrument measures ions produced by a radio-frequency inductively coupled plasma. Analyte species originating in a liquid are nebulized and the resulting aerosol transported by argon gas into the plasma torch. The ions produced by high temperatures are entrained in the plasma gas and introduced, by means of an interface, into a mass spectrometer. The ions produced in the plasma are sorted according to their mass-to-charge ratios and quantified with a channel electron multiplier. Mass interferences must be assessed and valid corrections applied or the data flagged to indicate problems.

The Metals method 7470A analysis was performed on a Leman PC 200 II instrument which consists of a cold vapor atomic absorption spectrometer (CVAA) set to detect mercury at a wavelength of 253.7 nm. The mercury is reduced to the elemental state and aerated from solution in a closed system. The mercury vapor passes through a cell positioned in the light path of an atomic absorption spectrophotometer. Absorbance (peak height) is measured as a function of mercury concentration.

The Anion method 9066 analysis was performed on a Dionex DX-100 ion chromatograph (IC). The radionuclides were measured using Alpha Spectroscopy, Gamma Spectroscopy, and Beta Liquid Scintillation.

A portion of the leachate from the second quarter TCLP sample and from one of the Vault Classification samples were used as the quality control samples (matrix spike) for the ICP-MS, CVAA and IC.

2.2.2 *GEL Laboratories, LLC*

The subsamples arrived at GEL Laboratories, LLC, Charleston, South Carolina on August 18, 2011 for analysis. Shipping container temperatures were documented to be within specifications. All sample containers arrived without any visible signs of tampering or breakage. The sample

arrived with the proper chain of custody documentation and signatures. The Volatile Organics Analysis (VOA) method (8260B) analysis was performed with an HP6890/HP5973 gas chromatograph/mass spectrometer using a J&W DB-624 column. Method 9066 was performed using a Lachat QuickChem FIA+ 8000 Series. Radionuclide measurements were performed by Gamma Spectroscopy and Beta Liquid Scintillation.

3.0 Results and Discussion

Results summarized in the following tables are from the data package for these analyses.⁽⁸⁾ Data is presented in these results as reported by the vendors.

3.1 TCLP Leachate RCRA Metals Results

The results for the RCRA metals from the TCLP leachate performed at B&W TSG-RACL are shown in Table 3-1. Analytes detected but at concentrations too low to determine quantitatively have been flagged with the “B” qualifier. Analytes that were not detected have been listed as less than quantities. In addition to the results, Detection Limits (DLs) have been given. The DL is the minimum concentration of an analyte that can be identified, measured, and reported with 99% confidence that the concentration is above zero. The DL values given in the table are the results from this study adjusted for sample dilution. The Quantitation Limit (QL) is the lowest level at which an analyte may be accurately and reproducibly achieved.

Table 3-1 TCLP Leachates RCRA Metal Results and Limits

-	Sample Results (mg/L)	Analytical Limits		Regulatory Limits		
SRS ID	2Q11	Detection Limit	Quantitation Limit	MCL ^c	UTS ^b	Toxicity ^a
B&W ID	1105017-01A	(mg/L)	(mg/L)	(mg/L)	Nonwastewater Standard (mg/L TCLP)	(mg/L)
As	1.34E-02	1.00E-04	5.56E-03	0.01	5	5
Ba	2.34E-01	4.40E-04	5.56E-02	2	21	100
Cd	^B 3.2E-04	1.10E-04	5.56E-03	0.005	0.11	1
Cr	1.83E-02	3.60E-04	1.11E-02	0.1	0.6	5
Pb	^B 2.7E-03	4.80E-04	5.56E-03	0.015 ^d	0.75	5
Hg	1.86E-02	7.00E-05	2.00E-04	0.002	0.025	0.2
Se	^E 1.59E-01	2.40E-04	2.78E-02	0.05	5.7	1
Ag	^B 1.4E-04	6.00E-05	5.56E-03	0.1 ^e	0.14	5
Sb	^B 3.0E-03	1.30E-04	1.11E-02	0.006	1.15	-
Be	<1.6E-04	1.60E-04	5.56E-03	0.004	1.22	-
Ni	^B 3.5E-03	1.58E-03	5.56E-03	-	11	-
Tl	^B 2.6E-04	2.10E-04	5.56E-03	0.002	0.2	-

- Indicates a location in the table for which an entry would not be appropriate.

^B Analyte is present at a concentration above the DL but less than the QL.

^E Associated Serial Dilution is outside percent difference quality control criteria.

^a R.61-79.261.24(b) “Characteristic of Toxicity.”

^b R.61-79.268.48 “Universal Treatment Standards.”

^c SCDHEC State Primary Drinking Water Regulation Maximum Contaminant Levels.

^d Lead action level from SCDHEC 61-58.11.B.

^e Secondary drinking water parameter.

Results in Table 3-1, when compared with the DLs and QLs, can be organized into three groups:

- Beryllium was not detected in the leachate.
- Antimony, cadmium, lead, silver, nickel, and thallium were detected below the QLs.
- Arsenic, barium, chromium, mercury, and selenium were detected in the leachates at concentrations above the QLs.

Results from the TCLP leachate analyses listed in Table 3-1 also include the regulatory limits that may be applied to the Saltstone waste form. Table 3-1 includes the SCHWMR R.61-79.261.24(b) limits above which a waste is to be considered characteristically hazardous for toxicity and the SCHWMR R.61-79.268.48 Universal Treatment Standards (UTS) for hazardous constituents. In addition, Maximum Contaminant Levels (MCL's) from the State Primary Drinking Water Regulations² also have been included in Table 3-1. By comparing the sample results and the regulatory limits in Table 3-1, the following conclusions can be made:

- The saltstone waste form was not characteristically hazardous for toxicity.
- The leachate metals concentrations were below the Nonwastewater Standard for all of the metals.
- Antimony, barium, beryllium, cadmium, chromium, lead, silver and thallium were below the MCL's.
- Arsenic, mercury, and selenium exceeded the MCL.
- Nickel does not have a MCL.

The MCL is the limit for a constituent in drinking water. The MCL is used to determine the class of landfill required. At 10x MCL, a Class 3 landfill is required. The SDF vaults are permitted as a Class 3 landfill. None of the analyses were greater than 10x the MCL. The results for the TCLP Leachate RCRA metals are reported on SCDHEC form DHEC3657 (Industrial RCRA - TCLP Metals) included in the appendix to this report.

3.2 TCLP Leachate Results for Other Inorganic Species

Other inorganic species are present in the Saltstone samples that while not specifically listed as hazardous also have limits. These species include aluminum, boron, chloride, cobalt, copper, fluoride, iron, lithium, manganese, molybdenum, nitrate as Nitrogen (N), nitrite as N, strontium, sulfate, uranium, and zinc. These limits² include MCL, secondary maximum contaminant limits (SMCL) and tap water limits (TW). Table 3-2 lists the results of the TCLP leachate for these species, the DL and QL for the species plus the specific limit for each of these species. The average for those species greater than the detection limit is also reported. The reported uncertainties are based on one standard deviation for the triplicate results.

² Regulations 61-58 through 61-58.15 are promulgated pursuant to S.C. Code Sections 44-55-10 et seq. and are collectively known as the State Primary Drinking Water Regulations.

Table 3-2 TCLP Leachate Results for Other Inorganic Species of Interest

-	Sample Results (mg/L)			Average	Analytical limits		Regulatory Limits
	11114-SS-Vault1	11114-SS-Vault2	11114-SS-Vault3		mg/L	Detection Limit	
B&W ID	1108010-01	1108010-02	1108010-03	-	mg/L	mg/L	mg/L
Fluoride	<2.5	<2.5	<2.5	<2.5	2.5	5	4
Nitrate as N	8392	3662	5599	5880±2380	2.5	5	10
Nitrite as N	181	193	194	189±7	2.5	5	1
Nitrate+Nitrite as N	8573	3855	5793	6070±2370	2.5	5	10
Uranium	*0.00065	*0.0083	*0.0004	*0.003±0.004	ND	ND	0.03
-	-	-	-	-	-	-	SMCL, mg/L
Aluminum	^E 2.21	^E 1.6	^E 1.77	^E 1.86±0.31	0.0037	0.0555	0.2
Chloride	26.9	28.2	30.4	28.5±1.8	2.5	5	250
Copper	^B 0.0206	^B 0.0216	^B 0.023	^B 0.022±0.001	0.0009	0.0555	1
Iron	0.193	0.292	0.212	0.23±0.05	0.0096	0.0555	0.3
Manganese	0.00296	^B 0.00177	^B 0.00182	^B 0.0022±0.0007	0.0005	0.00278	0.05
Sulfate	166	163	179	169±8.5	2.5	5	250
Zinc	<0.046	<0.046	<0.046	<0.046	0.046	0.0555	5
-	-	-	-	-	-	-	TW, mg/L
Boron	0.806	0.688	0.755	0.75±0.06	ND	0.0555	7.3
Cobalt	<0.00012	<0.00012	<0.00012	<0.00012	0.00012	0.055	0.011
Lithium	0.87	0.825	0.864	0.85±0.02	0.0056	0.0555	0.073
Molybdenum	0.514	0.481	0.511	0.50±0.02	0.001	0.0555	0.18
Strontium	0.325	0.362	0.332	0.34±0.02	0.0013	0.0555	22

- Indicates a location in the table for which an entry would not be appropriate.
^B Analyte is present at a concentration above the DL but less than the QL.
^E Associated Serial Dilution is outside percent difference quality control criteria.
* Associated Duplicate is outside percent difference quality control criteria.
ND B&W has not yet determined values for these analytical limits.

Results in Table 3-2, when compared with the DLs and QLs, can be organized into three groups:

- Fluoride, cobalt and zinc were not detected in the leachate.
- Copper and manganese were detected below the QLs.
- Nitrate, nitrite, aluminum, chloride, iron, sulfate, boron, lithium, molybdenum, and strontium were detected in the leachates at concentrations above the QLs.

By comparing the sample results and the regulatory limits in Table 3-2, the following conclusions can be made:

- Fluoride and uranium were below the MCL's.
- Chloride, copper, iron, manganese, sulfate and zinc were below the SMCL's.
- Boron, cobalt, and strontium were below the TW's.
- Nitrate, nitrite, and sum of nitrate and nitrite exceeded the MCL.

- Aluminum exceeded the SMCL.
- Lithium and molybdenum exceeded the TW.

As previously mentioned, the MCL is used to determine the class of landfill required. At 10x MCL, a Class 3 landfill is required. The SDF vaults are permitted as a Class 3 landfill. Based on the TCL leachate results for nitrate and nitrite, these species exceed the MCL by greater than 10x. The results for the other inorganic species are also reported on SCDHEC form DHEC3657 (Industrial RCRA - TCLP Metals) included in the appendix to this report.

The reported TCLP leachate values for nitrate and nitrite were compared to the concentrations measured on the Tank 50 sample (WAC)⁽⁶⁾ used to prepare the Vault classification samples. The ratio of nitrate as N to nitrite as N was 6.9 while the ratio from the average values in Table 3-2 is 31.2 which suggests either an issue with the anion analysis or with the sample preparation. A review of the contract lab reports shows that the TCLP extract was tested for pH and that nitric acid was evidently added to change the pH of the extract from 11 to less than 2. This would increase the nitrate concentration while the acidic pH would lead to conversion of the nitrite to nitrous acid (pKa = 3.37) followed by decomposition of the nitrous acid. To better define the relative amounts of nitrate and nitrite in the vault classification samples a total analysis of the anions was obtained by performing a two hour water leach of the vault classification samples followed by ion chromatography. The total anion results are shown in Table 3-3. The nitrate to nitrite ratio from the average values in Table 3-3 is 6.8 and is in good agreement with the ratio from the WAC analysis. The concentration of nitrite in the TCLP leachate in Table 3-2 should be viewed as a not less than value and can still be used to evaluate the need for a Class 3 landfill independent of the nitrate result as the nitrite result is more than 190 x the MCL for nitrite.

Table 3-3 Total Anion Results Based on Water Leach of Saltstone Vault Classification Samples

-	Sample Results (mg/Kg)			Average (mg/Kg)	Analytical limits	
	11114-SS-Vault1	11114-SS-Vault2	11114-SS-Vault3		Detection Limit (mg/Kg)	Quantitation Limit (mg/Kg)
SRS ID	1106010-01	1106010-02	1106010-03	-	(mg/Kg)	(mg/Kg)
Chloride	12.99	12.8	65.03	30.3±30	0.5	1.0
Fluoride	15.38	18.34	13.35	15.7±2.5	0.5	1.0
Nitrate as N	3478	5206	5656	4780±1150	0.5	1.0
Nitrite as N	483	837	799	706±194	0.5	1.0
Nitrate/Nitrite as N	3961	6043	6455	5486±1337	0.5	1.0
Sulfate	1285	1791	2276	1784±496	0.5	1.0

- Indicates a location in the table for which an entry would not be appropriate.

3.3 TCLP Leachate Results for Benzene, Toluene, 1-Butanol and Phenol

GEL reports VOA and general chemistry analyses on the organics in the TCLP leachate samples. Table 3-4 lists the results for the organic species measured in the TCLP leachate of the vault samples for the 2nd quarter 2011. If the concentrations of benzene, toluene, 1-butanol and phenol are not detected or below the detection limit the result is reported as less than the detection limit. In addition to the results, Detection Limits (DLs) and Quantitation Limits (QLs) have been given. The DL is the minimum concentration of an analyte that can be identified, measured, and

reported with 99% confidence that the concentration is above zero. The DL values given in Table 3-4 are the results from this study adjusted for sample dilution. The QL is the lowest level at which an analyte may be accurately and reproducibly quantitated.

Table 3-4 TCLP Leachate Results for Organic Species of Interest

-	Methods	Sample Results (mg/L)			Average	Analytical limits		Regulatory Limits
SRS ID	-	11114-SS-Vault1	11114-SS-Vault2	11114-SS-Vault3	(mg/L)	Detection Limit	Quantitation Limit	MCL
GEL Lab ID	-	284341001	284341002	284341003	-	(mg/L)	(mg/L)	(mg/L)
Benzene	8260B	<0.003	<0.003	<0.003	<0.003	0.003	0.01	0.005
Toluene	8260B	<0.0025	<0.0025	<0.0025	<0.0025	0.0025	0.01	1
1-Butanol	8260B	<0.15	<0.15	<0.15	<0.15	0.15	0.5	3.7
GEL Lab ID	-	284341004	284341005	284341006	(mg/L)	(mg/L)	(mg/L)	(mg/L)
Phenol	9066	0.00515	<0.0016	0.00874	^Y 0.007±0.003	0.0016	0.005	11

- Indicates a location in the table for which an entry would not be appropriate.

^Y Analyte was measured in the TCLP blank at levels greater than the three samples.

The results of the VOA showed that the benzene, toluene and 1-butanol were not detected and are therefore shown in Table 3-4 as less than detection limit values. Phenol was detected in two of the three vault samples but was also detected in the TCLP blank (see section 3.6.1) at levels greater than the reported values for the two measured amounts. The conclusion is that the organic species of interest were less than the MCL for each of the species. The results for the VOA analysis are reported on form DHEC3658 and for phenol analysis on form DHEC3659 and are included in the appendix to this report.

3.4 TCLP Leachate Results for Radionuclides

The TCLP leachate radionuclide results are shown in Table 3-5. The table includes the MCLs for those measurements that are specifically identified in the SCDHEC regulations. The MDA are the method detection limits from standard practices based on counting statistics.

Table 3-5 Radionuclide Results for the TCLP Leachate

-	-	Sample 1 (pCi/L)		Sample 2 (pCi/L)		Sample 3 (pCi/L)		Average (pCi/L)
Date	-	4/5/2011		4/5/2011		4/5/2011		-
SRS ID	-	11114-SS-Vault-1		11114-SS-Vault-2		11114-SS-Vault-3		-
BW-TSG ID	-	1108010-01		1108010-02		1108010-03		-
GEL Lab ID	-	284341004		284341005		284341006		-
Analyte	MCL (pCi/L)	MDA	Result	MDA	Result	MDA	Result	Average (pCi/L)
Gross α	15	2.0E+03	<2.0E+03	1.7E+03	<1.7E+03	1.7E+03	<1.7E+03	<1.7E+03
Gross β	-	1.4E+03	1.7E+07	1.4E+03	1.8E+07	1.2E+03	1.9E+07	(1.8±0.1)E+07
³H	-	5.7E+02	1.7E+03	5.7E+02	1.1E+03	5.7E+02	8.4E+02	(1.2±0.5)E+03
⁶⁰Co	-	76	<76	4.0E+02	<4.0E+02	65	<65	<65

-	-	Sample 1 (pCi/L)		Sample 2 (pCi/L)		Sample 3 (pCi/L)		Average (pCi/L)
Date	-	4/5/2011		4/5/2011		4/5/2011		-
SRS ID	-	11114-SS-Vault-1		11114-SS-Vault-2		11114-SS-Vault-3		-
BW-TSG ID	-	1108010-01		1108010-02		1108010-03		-
GEL Lab ID	-	284341004		284341005		284341006		-
Analyte	MCL (pCi/L)	MDA	Result	MDA	Result	MDA	Result	Average (pCi/L)
⁹⁰ Sr	-	2.9E+02	5.1E+04	2.7E+02	1.1E+05	3.0E+02	1.4E+05	(9.7±4.3)E+04
⁹⁹ Tc	-	6.5E+02	5.6E+04	5.7E+02	4.3E+04	5.9E+02	5.4E+04	(5.1±0.7)E+04
¹⁰⁶ Ru	-	2.2E+04	<2.2E+04	3.3E+04	<3.3E+04	1.5E+04	<1.5E+04	<1.5E+04
¹⁰⁶ Rh	-	1.5E+04	<1.5E+04	2.0E+04	<2.0E+04	1.1E+04	<1.1E+04	<1.1E+04
¹²⁵ Sb	-	1.1E+04	<1.1E+04	1.5E+04	<1.5E+04	7.7E+03	<7.7E+03	<7.7E+03
¹³⁷ Cs	-	3.3E+03	1.9E+07	1.2E+04	1.6E+07	2.2E+03	1.9E+07	(1.8±0.2)E+07
^{137m} Ba	-	3.1E+03	1.8E+07	1.1E+04	1.5E+07	2.1E+03	1.8E+07	(1.7±0.1)E+07
¹⁴⁷ Pm	-	1.2E+02	<1.2E+02	1.1E+02	^Z 2.2E+02	1.1E+02	^Z 1.4E+02	<1.2E+02
¹⁵⁴ Eu	-	3.70E+02	<3.70E+02	4.9E+02	<4.9E+02	3.1E+02	<3.1E+02	<3.1E+02
²²⁶ Ra	5	4.4E+04	<4.4E+04	6.5E+04	<6.5E+04	4.4E+04	<4.4E+04	<4.4E+04
²²⁸ Ra	5	3.6E+03	<3.6E+03	3.9E+03	<3.9E+03	4.7E+03	<4.7E+03	<3.6E+03
²³⁸ Pu	-	16	<16	35	<35	12	<12	<12
^{239/240} Pu	-	8.5	<8.5	13	<13	8.3	<8.33	<8.3
²⁴¹ Pu	-	8.2E+02	<8.2E+02	1.3E+03	<1.3E+03	8.0E+02	<8.0E+02	<8.0E+02
²⁴¹ Am	-	15	<15	15	<15	11	<11	<11
²⁴² Cm	-	11	<11	13	<13	9.2	<9.2	<9.2
^{243/244} Cm	-	12	<12	4.8	<4.8	10	<10	<4.8

- Indicates a location in the table for which an entry would not be appropriate.

^Z Result is biased high due to spectral interference therefore excluded from average.

The following conclusions can be made based on the data in Table 3-5:

- The gross alpha and radium isotopes could not be determined to the MCL because of the elevated background which raised the detection limits.
- Most of the beta/gamma activity was from ¹³⁷Cs and its daughter ^{137m}Ba.

3.5 Quality Assurance for Inorganic Species

The following subsections include summaries of results from blanks, laboratory control samples, matrix spikes, and matrix spike duplicates. The data package also includes data for calibration verifications, interference checks, and serial dilutions. ⁽⁸⁾ The quality assurance data reported here is also reported on form DHEC3732 as shown in the appendix to this report.

3.5.1 Blanks

Blank concentrations are given in Table 3-6. In the TCLP blanks, the elements that were present at levels above the quantitation limit were lead, selenium, boron, iron, manganese and zinc. Antimony, arsenic, barium, chromium, silver, nickel, aluminum, cobalt, copper and strontium

were present at levels above their respective DLs, but below their respective QLs. Beryllium, cadmium, mercury, thallium, lithium and molybdenum were found to be below the DLs.

Table 3-6 TCLP Blank

Analyte	TCLP Blank mg/L	Detection Limit, mg/L	Quantitation Limit, mg/L
As	^B 0.0018	0.0001	0.0056
Ba	^B 0.0031	0.00044	0.0556
Cd	<0.00011	0.00011	0.0056
Cr	^B 0.00072	0.00031	0.01111
Pb	0.0061	0.00048	0.00556
Hg	<0.00007	0.00007	0.0002
Se	^E 0.0535	0.00024	0.0278
Ag	^B 0.00010	0.00006	0.0056
Sb	^B 0.00023	0.00013	0.0111
Be	<0.00016	0.00016	0.00556
Ni	^B 0.0056	0.0016	0.00556
Tl	<0.00021	0.00021	0.00556
Al	^{BE} 0.0345	0.00373	0.0555
B	0.0802	ND	0.0555
Co	^B 0.00013	0.00012	0.0555
Cu	^B 0.0186	0.00087	0.0555
Fe	0.132	0.00962	0.0555
Li	<0.00556	0.00556	0.0555
Mn	0.00441	0.00046	0.00278
Mo	<0.00102	0.00102	0.0555
Sr	^B 0.00796	0.00125	0.0555
U	0.0026	ND	ND
Zn	0.0606	0.0461	0.0555

^B Analyte is present at a concentration above the DL but less than the QL.

^E Associated Serial Dilution is outside percent difference quality control criteria.

ND B&W has not yet determined a value for this analytical limit.

3.5.2 Laboratory Control Samples

Results from the Laboratory Control Sample (LCS) are given in Table 3-7. The LCS recoveries met USEPA SW-846 acceptance limits for all elements and anions. Laboratory Control Samples are clean aqueous solutions analyzed to assure integrity of the analytical technique exclusive of matrix effects.

Table 3-7 Laboratory Control Sample for Inorganics

Analyte	Laboratory Control (µg /L)		Recovery (%) (80 – 120)
	TRUE	Measured	
As	719	704	98
Ba	463	459	99
Cd	476	465	98
Cr	162	163	101
Pb	280	291	104
Hg	5.4	6.41	119
Se	1000	965	96
Ag	194	190	98
Sb	328	311	95
Be	136	116	85
Ni	533	524	98
Tl	142	134	94
Al	2690	2460	91
B	1590	1460	92
Co	275	254	92
Cu	316	296	94
Fe	2310	2190	95
Mn	568	522	92
Mo	387	354	91
Sr	202	181	90
Zn	287	263	92
Chloride	1000	1030	102.7
Fluoride	1000	870	86.5
Nitrate as N	1000	980	97.7
Nitrite as N	1000	1020	101.8
Sulfate	1000	990	98.6

3.5.3 Matrix Spikes

Results from analysis of the matrix spike (MS) and matrix spike duplicates (MSD) are given in Table 3-8 for the RCRA metals, Table 3-9 for the other metals, and Table 3-10 for the anions. The initial concentrations in the second column are reproduced from Table 3-1 and Table 3-2 for the specific sample used for the matrix. These results show that:

- The percent recoveries (%R) obtained from the MS analyses met the recommended quality control acceptance criteria for percent recoveries (70 – 130%) for all applicable analytes.
- The percent recoveries (%R) obtained from the MSD analyses met the recommended quality control acceptance criteria for percent recoveries (70 – 130%) for all applicable analytes.
- The RPD(s) between the MS and MSD met the acceptance limits (0 – 20%).

Table 3-8 TCLP Leachates Matrix Spike and Duplicate Results

Analyte	Initial Concentrations (mg /L)		Spiked Sample (mg /L)		Recovery (%)		-
	B&W ID 1105017-01A	Spike Added	Spike	Spike Duplicate	Spike	Spike Duplicate	
Sb	^B 3.0	1000	937	926	93	92	1
As	13.4	500	528	569	103	111	7
Ba	234	2500	2687	2708	98	99	1
Cd	^B 0.32	250	218	216	87	86	1
Cr	18.3	1000	926	927	91	91	0
Pb	^B 2.7	500	543	543	108	108	0
Hg	18.6	5	24.4	23.1	116	90	5.5
Se	^E 159	250	380	409	88	100	7
Ag	^B 0.14	250	190	190	76	76	0
Be	<0.16	250	205	203	82	81	1
Ni	^B 3.5	1000	850	848	85	84	0
Tl	^B 0.26	250	262	263	105	105	0

- Indicates a location in the table for which an entry would not be appropriate.

^B Analyte is present at a concentration above the DL but less than the QL.

^E Associated Serial Dilution is outside percent difference quality control criteria.

Table 3-9 Matrix Spike and Duplicate Results for Other Metals of Interest

Analyte	Initial Concentrations (µg /L)		Spiked Sample (µg /L)		Recovery (%)		RPD (%)
	B&W ID 1108010- 03RE1	Spike Added	Spike	Spike Duplicate	Spike	Spike Duplicate	
Al	1770	997	2560	2680	79	91	4.58
B	755	997	1580	1610	83	86	1.88
Co	<0.12	2000	1700	1740	85	87	2.33

Analyte	Initial Concentrations (µg /L)		Spiked Sample (µg /L)		Recovery (%)		RPD (%)
	B&W ID 1108010- 03RE1	Spike Added	Spike	Spike Duplicate	Spike	Spike Duplicate	
-							-
Cu	^B 23	2000	1640	1660	81	82	1.21
Fe	212	6000	5380	5560	86	89	3.29
Li	864	997	1720	1720	86	86	0
Mn	^B 2	2000	1680	1700	84	85	1.18
Mo	511	1500	2130	2180	108	111	2.32
Sr	332	997	1240	1270	91	94	2.39
U	0.4	722	774	792	107.1	109.6	2.3
Zn	<47	3500	2590	2640	74	75	1.91

- Indicates a location in the table for which an entry would not be appropriate.

^B Analyte is present at a concentration above the DL but less than the QL.

Table 3-10 Matrix Spike and Spike Duplicate Results for Anions

Anion	Initial Concentrations (mg /L)		Spiked Sample (mg /L)		Recovery (%)		RPD (%)
	B&W ID 1108010-01	Spike Added	Spike	Spike Duplicate	Spike	Spike Duplicate	
-							-
Chloride	0.10	1.0	1.02	1.01	92	90	1.2
Fluoride	0.00	1.0	0.86	0.88	86	88	2.2
Nitrate as N	8.39	1.0	9.56	9.66	116	127	1.1
Nitrite as N	0.21	1.0	1.22	1.20	100	99	1.3
Sulfate	0.23	1.0	1.14	1.16	91	93	1.8

3.5.4 Calibration Information

- All initial calibration requirements have been met for this sample delivery group (SDG).
- All Contract Required Reporting Limit standard(s) met the referenced advisory control limits with the exception of cadmium and selenium.
- All interference check samples associated with this SDG met the established acceptance criteria.
- All continuing calibration blanks bracketing this batch met the established acceptance criteria except for selenium and thallium.
- All continuing calibration verifications bracketing this SDG met the acceptance criteria.

3.5.5 Radionuclide Quality Assurance

The quality assurance for the radionuclide measurements on the TCLP leachate was:

- All duplicate measurement replicate error ratios (RER) met the required limit (<3) with the exception of ²³⁸Pu (4.8).
- All Laboratory Control Samples met the required limit (70%-125%) with the exception of ²³⁹Pu/²⁴⁰Pu (133% recovery) and ²⁴¹Pu (155% recovery).
- All matrix spikes met the required limit (60%-140%) with the exception of gross alpha which was measured at 210%.
- All batch blanks met the required criteria (calculated activity <1.65 times the total propagated uncertainty or sample activity > 5x the blank activity) with the exception of ²⁴⁴Cm.
- All tracer recoveries met the required limit (40%-110%).

3.6 Quality Assurance for Organic Species

The following subsections include summaries of results for the organic species from blanks, laboratory control samples, matrix spikes, and matrix spike duplicates. The data package for this task also includes data for calibration verifications, interference checks, and serial dilutions. The quality assurance data reported here is also reported on form DHEC3732 as shown in the appendix to this report.

3.6.1 Blanks

Blank concentrations are given in Table 3-11 for the Method Blank. Target analytes were not detected in the Method Blank. The Method Blanks analyzed with this Sample Delivery Group (SDG) met the acceptance criteria. Also reported are the tracer/surrogate compounds spiked into all of the analyses to verify acceptable operation of the analytical method.

Table 3-11 VOA Method Blank Results

Analyte	Analytes (mg/L)	Surrogate, (µg/L)	Surrogate Recovery, %
Benzene	^u ND	--	--
Toluene	^u ND	--	--
1-Butanol	^u ND	--	--
**1,2-Dichloroethane-d4	--	50.8	102
**Bromofluorobenzene	--	48.6	97.1
**Toluene-d8	--	48.5	97

- Indicates a location in the table for which an entry would not be appropriate.

^u Final concentration of the analyte was found to be below the DL.

** - Surrogates added to VOA analysis

ND – Not Detectable

Blank concentrations are given in Table 3-12 for the TCLP Blank which was GEL sample 284341007. Target analytes were not detected in the TCLP Blank. The Method Blanks analyzed with this Sample Delivery Group (SDG) met the acceptance criteria. Surrogate recoveries from the TCLP Blank were within acceptance limits.

Table 3-12 VOA TCLP Blank Results

Analyte	Analytes (mg/L)	Surrogate, (µg/L)	Surrogate Recovery, %
Benzene	^U ND	--	--
Toluene	^U ND	--	--
1-Butanol	^U ND	--	--
**1,2-Dichloroethane-d4	--	51.3	103
**Bromofluorobenzene	--	49.9	99.8
**Toluene-d8	--	49.1	98.1

- Indicates a location in the table for which an entry would not be appropriate.
^U Final concentration of the analyte was found to be below the DL.
 ** - Surrogates added to VOA analysis
 ND – Not Detectable

The results of the Method Blank and TCLP Blank are shown in Table 3-13. Phenol was not detected in the Method Blank but was measured in the TCLP Blank at about the same level as was measured in the TCLP leachates.

Table 3-13 Method and TCLP Blanks for Phenol

Analyte	Method Blank (µg/kg)	TCLP Blank (µg/L)	Detection Limit (µg/L)	Quantitation Limit (µg/L)
GEL Sample #	--	284341007	--	--
Phenol	^U ND	12.0	1.6	5.0

^U Final concentration of the analyte was found to be below the DL.
 ND – Not Detectable

3.6.2 Laboratory Control Samples

Results from the Laboratory Control Sample (LCS) are given in Table 3-14. All LCS recoveries met the vendor laboratory acceptance. The surrogate recoveries were also within the acceptance limits for the VOA analysis. Laboratory Control Samples are clean aqueous solutions analyzed to assure integrity of the analytical technique exclusive of matrix effects.

Table 3-14 VOA and Phenol Laboratory Control Samples

Analyte	Laboratory Control (µg/L)		Recovery %	Surrogate (µg/L)	Surrogate Recovery %	RPD %
	True	Measured				
-						
Benzene	50.0	44.1	88.1	--	--	--
Phenol	50.0	51.7 49.0	103 98	--	--	5.36
**1,2-Dichloroethane-d4	50.0	--	--	51.8	104	--
**Bromofluorobenzene	50.0	--	--	49.5	99	--
**Toluene-d8	50.0	--	--	49.0	98	--

- Indicates a location in the table for which an entry would not be appropriate.
 ** - Surrogates added to VOA analysis

3.6.3 Matrix Spikes

The result from VOA analysis of the matrix spike (MS) and matrix spike duplicate (MSD) is given in Table 3-15. These results show that the percent recoveries (%R) obtained from the spike analyses met the recommended quality control acceptance criteria for percent recoveries. The surrogate recoveries also were within the acceptance limits. Note that the toluene-d8 surrogate could also be considered a spike and as such would have a relative percent difference of 1.3%. The matrix spike is not applicable to the phenol method.

Table 3-15 VOA Matrix Spike Results

Analyte	Initial Concentrations (µg /L)		Spiked Sample (µg /L)		Recovery (%)		RPD (%)
	GEL ID 284341001	Spike Added	Spike	Spike Duplicate	Spike	Spike Duplicate	
Benzene	UND	50.0	55	52.7	110	105	4.22
**1,2-Dichloroethane-d4	-	50.0	49	47.8	98	95.7	-
**Bromofluorobenzene	-	50.0	48.7	47.3	97.4	94.6	-
**Toluene-d8	-	50.0	47.9	47.3	95.9	94.6	-

ND – Not Detectable

** - Surrogates added to VOA analysis

3.6.4 Calibration Information

- All initial calibration requirements have been met for this sample delivery group (SDG).
- All Contract Required Detection Limit standard(s) met the referenced advisory control limits.
- All interference check samples associated with this SDG met the established acceptance criteria.
- All continuing calibration blanks bracketing this batch met the established acceptance criteria.
- All continuing calibration verifications bracketing this SDG met the acceptance criteria.

4.0 Comparison with Prior TCLP Leachate Results

The initial sampling and analysis in support of vault classification for Saltstone was performed on Saltstone samples prepared from Tank 41H sample collected on August 25, 2003.⁽⁹⁾ More recently, quarterly TCLP analysis of Saltstone prepared from Tank 50H has been performed for the RCRA metals potentially present in the feed solution for the Saltstone Processing Facility. Table 4-1 compares the current TCLP results for the RCRA metals with the Tank 41H sample results⁽⁹⁾, the fourth quarter of 2010 TCLP results⁽¹⁰⁾, and the first quarter of 2011 results⁽¹¹⁾.

Table 4-1 Comparison of Current 2011 RCRA TCLP Results with Past Results

-	Average Sample Results (mg/L) (9)	Sample Results (mg/L) (10)	Sample Results (mg/L) (11)	Current Sample Results (mg/L)
SRS ID	41-TR1 to 41-TR3	4Q10	1Q11	2Q11
B&W ID	0310002-17 to 0310002-19	1101017-01A	1103011-01A	1105017-01A
As	^B (1.8±0.5)E-02	1.16E-02	6.97E-02	1.34E-02
Ba	(1.28±0.22)E-01	2.58E-01	^{N*} 6.55E-02	2.34E-01
Cd	^B (2.4±0.67)E-03	^B 2.80E-04	^B 1.0E-03	^B 3.2E-04
Cr	^B (2.72±0.04)E-02	^B 7.20E-03	1.97E-02	1.83E-02
Pb	<2.8E-02	^B 5.30E-03	^{N*} 5.9E-03	^B 2.7E-03
Hg	^{YB} (5±6)E-04	^N 3.04E-03	^E 9.0E-03	1.86E-02
Se	^B (1.56±0.06)E-01	^E 1.25E-01	^E 1.39E-01	^E 1.59E-01
Ag	<5.4E-03	^{N*} <6.00E-05	^{BN*} 2.7E-04	^B 1.4E-04
Sb	<2.8E-02	^B 1.90E-03	^B 4.5E-03	^B 3.0E-03
Be	1.10E-03	<1.60E-04	<1.6E-04	<1.6E-04
Ni	<6.9E-03	^B 5.10E-03	^B 4.8E-03	^B 3.5E-03
Tl	NM	<2.10E-04	^B 2.8E-04	^B 2.6E-04

- Indicates a location in the table for which an entry would not be appropriate.

^B Analyte is present at a concentration above the DL but less than the QL.

^N Associated Matrix Spike is outside percent recovery quality control criteria.

* Associated Duplicate is outside relative percent difference quality control criteria

^E Associated Serial Dilution is outside percent difference quality control criteria.

NM Not measured.

The last three quarters of TCLP leachate results do not show much difference between any of the RCRA metals except for mercury which has been increasing but not significantly with respect to the toxicity limit of 0.2 mg/L. The difference between the initial vault classification average result and the current result is also good considering that the earlier values are based on method 6010 (inductively coupled plasma- emission spectrometer) compared to method 6020 (ICP-MS) which have different detection limits.

A comparison of the TCLP leachate results for the other metals from section 3.2 is displayed in Table 4-2. The results are generally consistent with each other and similar to that observed for the RCRA metals comparison.

Table 4-2 Comparison of Current Other Metals TCLP Results with Past Results

-	Average Sample Results (mg/L) (9)	Average Sample Results (mg/L)
Year	2003	2011
SRS ID	41-TR1 to 41-TR3	11114-SS-Vault1 to -Vault3
B&W ID	0310002-17 to 0310002-19	1108010-01 to 1108010-03
Aluminum	^{BN} 0.40±0.31	^E 1.86±0.31
Boron	0.46±0.077	0.75±0.06
Cobalt	<2.6E-03	<0.00012
Copper	<5.9E-03	^B 0.022±0.001
Iron	^{BN} 0.071±0.027	0.23±0.05
Lithium	0.75±0.032	0.85±0.02
Manganese	^B (6.5±5.4)E-03	(2.2±0.7)E-03
Molybdenum	0.47±0.024	0.50±0.02
Strontium	0.96±0.054	0.34±0.02
Zinc	0.052	<0.046

- Indicates a location in the table for which an entry would not be appropriate.

^B Analyte is present at a concentration above the DL but less than the QL.

^N Associated Matrix Spike is outside percent recovery quality control criteria.

^E Associated Serial Dilution is outside percent difference quality control criteria.

The radionuclides in the TCLP leachate from the Tank41H saltstone samples and the current vault classification samples are shown in Table 4-3. The average values are shown plus or minus one standard deviation for those results that have more than one measured value available.

Table 4-3 Comparison of Current Radionuclide TCLP Results with Past Results

Year	-	2003	2011
SRS ID	-	41-TR1 to TR3	11114-SS-Vault1 to Vault3
BW-TSG ID	-	0310002-17 to 0310002-19	1108010-01 to 1108010-03
GEL Lab ID	-	-	284341004 to 284341006
Analyte	MCL (pCi/L)	Average (pCi/L) (9)	Average (pCi/L)
Gross α	15	(1.8±1.2)E+04	<1.7E+03
Gross β	-	(6.2±0.34)E+08	(1.8±0.1)E+07
³ H	-	1.70E+04	(1.2±0.5)E+03
⁶⁰ Co	-	<6.2E+03	<65
⁹⁰ Sr	-	(8.1±3.2)E+05	(9.7±4.3)E+04
⁹⁹ Tc	-	(8.4±1.6)E+04	(5.1±0.7)E+04
¹⁰⁶ Ru	-	<1.3E+06	<1.5E+04
¹⁰⁶ Rh	-	<9.5E+05	<1.1E+04
¹²⁵ Sb	-	<6.6E+05	<7.7E+03

Year	-	2003	2011
SRS ID	-	41-TR1 to TR3	11114-SS-Vault1 to Vault3
BW-TSG ID	-	0310002-17 to 0310002-19	1108010-01 to 1108010-03
GEL Lab ID	-	-	284341004 to 284341006
Analyte	MCL (pCi/L)	Average (pCi/L) (9)	Average (pCi/L)
¹³⁷ Cs	-	(7.2±0.46)E+08	(1.8±0.2)E+07
^{137m} Ba	-	(6.7±0.43)E+08	(1.7±0.1)E+07
¹⁴⁷ Pm	-	<1.9E+05	<1.2E+02
¹⁵⁴ Eu	-	<2.1E+04	<3.1E+02
²²⁶ Ra	5	<4.2E+04	<4.4E+04
²²⁸ Ra	5	<3.5E+04	<3.6E+03
²³⁸ Pu	-	(7.3±5.4)E+03	<12
^{239/240} Pu	-	(3.1±2.6)E+02	<8.3
²⁴¹ Pu	-	(3.4±2.7)E+03	<8.0E+02
²⁴¹ Am	-	(4.1±2.9)E+02	<11
²⁴² Cm	-	6.5±4.9	<9.2
^{243/244} Cm	-	(6.6±4.8)E+03	<4.8

- Indicates a location in the table for which an entry would not be appropriate.

The primary differences between the 2004 average results and the 2011 average results are that the primary gamma source (¹³⁷Cs) is a factor of 40 less in the new result, the ⁹⁰Sr is a factor of 8 less in the new result and the transuranic radionuclides are at least one order of magnitude less in the new results. The one measured radionuclide that is approximately the same (less than factor of two different) is ⁹⁹Tc. These results are consistent with the current vault classification samples primarily containing salt solution that has passed through the ARP/MCU process which is designed to reduce the concentrations of cesium, strontium and the actinides but not the concentration of technetium.

5.0 Conclusions

Savannah River National Laboratory (SRNL) was asked to prepare saltstone from samples of Tank 50H obtained by SRNL on April 5, 2011 (Tank 50H sampling occurred on April 4, 2011) during 2QCY11 to determine the non-hazardous nature of the grout and for additional vault classification analyses. The samples were cured and shipped to Babcock & Wilcox Technical Services Group-Radioisotope and Analytical Chemistry Laboratory (B&W TSG-RACL) to perform the Toxic Characteristic Leaching Procedure (TCLP)⁽¹⁾ and subsequent extract analysis on saltstone samples for the analytes required for the quarterly analysis saltstone sample. In addition to the eight toxic metals—arsenic, barium, cadmium, chromium, mercury, lead, selenium and silver—analytes included the underlying hazardous constituents (UHC) antimony, beryllium, nickel, and thallium which could not be eliminated from analysis by process knowledge. Additional inorganic species determined by B&W TSG-RACL include aluminum, boron, chloride, cobalt, copper, fluoride, iron, lithium, manganese, molybdenum, nitrate/nitrite as Nitrogen, strontium, sulfate, uranium, and zinc and the following radionuclides: gross alpha,

gross beta/gamma, ^3H , ^{60}Co , ^{90}Sr , ^{99}Tc , ^{106}Ru , ^{106}Rh , ^{125}Sb , ^{137}Cs , $^{137\text{m}}\text{Ba}$, ^{154}Eu , ^{238}Pu , $^{239/240}\text{Pu}$, ^{241}Pu , ^{241}Am , ^{242}Cm , and $^{243/244}\text{Cm}$. B&W TSG-RACL provided subsamples to GEL Laboratories, LLC for analysis for the VOCs benzene, toluene, and 1-butanol. GEL also determines phenol (total) and the following radionuclides: ^{147}Pm , ^{226}Ra and ^{228}Ra .

Preparation of the 2QCY11 saltstone samples for the quarterly analysis and for vault classification purposes and the subsequent TCLP analyses of these samples showed that:

- The saltstone waste form disposed of in the Saltstone Disposal Facility in 2QCY11 was not characteristically hazardous for toxicity.
- The concentrations of the eight RCRA metals and UHCs identified as possible in the saltstone waste form were present at levels below the UTS.
- Most of the inorganic species measured in the leachate do not exceed the MCL, SMCL or TW limits.
- The inorganic waste species that exceeded the MCL by more than a factor of 10 were nitrate, nitrite and the sum of nitrate and nitrite.
- Analyses met all quality assurance specifications of US EPA SW-846.
- The organic species (benzene, toluene, 1-butanol, phenol) were either not detected or were less than reportable for the vault classification samples.
- The gross alpha and radium isotopes could not be determined to the MCL because of the elevated background which raised the detection limits.
- Most of the beta/gamma activity was from ^{137}Cs and its daughter $^{137\text{m}}\text{Ba}$.
- The concentration of ^{137}Cs and ^{90}Sr were present in the leachate at concentrations $1/40^{\text{th}}$ and $1/8^{\text{th}}$ respectively than in the 2003 vault classification samples.

The saltstone waste form placed in the Saltstone Disposal Facility in 2QCY11 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, which confirms the Saltstone Disposal Facility classification as a Class 3 Landfill. The saltstone waste form placed in the Saltstone Disposal Facility in 2QCY11 met the R.61-79.268.48(a) non wastewater treatment standards.

6.0 References

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6. **Eibling, R. E.** *Results for the Second Quarter 2011 Tank 50 WAC Slurry Sample: Chemical and Radionuclide Contaminant Results.* Savannah River National Laboratory : s.n., August 2011. SRNL-STI-2011-00443 Revision 0.
7. **Reigel, M. M.** *Saltstone TCLP.* s.l. : Savannah River National Laboratory. SRNL-NB-2009-00076.
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9. **Ferrara, D., Cozzi, A., Langton, C., Clark, J.** *Tank 41H Saltstone Regulatory Analyses.* Savannah River Site : Westinghouse Savannah River Company, February 2004. WSRC-TR-2004-00051, Rev. 0.
10. **Reigel, M. M.** *Saltstone 4QCY10 TCLP Results.* Savannah River National Laboratory : s.n., March 2011. SRNL-STI-2011-00127, Rev 0..
11. —. *Saltstone 1QCY11 TCLP Results.* Savannah River National Laboratory : s.n., May 2011. SRNL-STI-2011-00262.

**Appendix South Carolina Department of Health and
Environmental Control Forms**

Date: 09/27/11



Type Data: **Industrial RCRA - TCLP Metals**
 Company Name: **Savannah River Remediation**
 Subject/Project: **Saltstone Vault Classification April 2011**
 (Subtitle C, Subtitle D or Class Three Landfills only.)

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

Results in Milligrams per Liter															
								Waste Stream 1		Waste Stream 2		Waste Stream 3			
								4/5/2011	4/5/2011	4/5/2011	4/5/2011	Sample 1 Date 1	Sample 1 Date 1	Sample 2 Date 2	
Facility Sample ID #								11113-SS-TCLP-2Q1	11114-SS-VAULT-1	11114-SS-VAULT-2	11114-SS-VAULT-3				
Laboratory Sample ID #								1105017-01	1108010-01	1108010-02	1108010-03				
Laboratory Name								B&W TSG-RACL	B&W TSG-RACL	B&W TSG-RACL	B&W TSG-RACL				
SC Laboratory Certification #								Z	Z	Z	Z				
Subcontracted Laboratory Certification #								10120001/10120002	10120001/10120002	10120001/10120002	10120001/10120002				
Subcontracted Laboratory Name								GEL Laboratories	GEL Laboratories	GEL Laboratories	GEL Laboratories				
Laboratory Receipt Information (Chain of Custody Must be Attached)								Attached	Attached	Attached	Attached				
Inorganic TCLP Chemicals															
Analytical Parameter	Digestion Method	Analytical Method	Detection Limit (mg/l)	Quantitation Limit (Mg/l)	MCL (mg/l)	Class 2 (mg/l)	TCLP Limits (mg/l)								
Arsenic	SW3015A	SW6020A	0.0001	0.00556	0.010	0.10	5	0.0134	-	-	-	-			
Barium	SW3015A	SW6020A	0.0004	0.0556	2.000	20.00	100	0.234	-	-	-	-			
Cadmium	SW3015A	SW6020A	0.0001	0.00556	0.005	0.05	1	0.00032	-	-	-	-			
Chromium	SW3015A	SW6020A	0.0003	0.0111	0.100	1.00	5	0.0183	0.0292	-	-	-			
Lead	SW3015A	SW6020A	0.0005	0.00556	0.015	0.15	5	0.0027	-	-	-	-			
Mercury	-	SW7470A	0.0007	0.0002	0.002	0.02	0.2	0.0186	-	-	-	-			
Selenium	SW3015A	SW6020A	0.0002	0.0278	0.050	0.50	1	0.159	-	-	-	-			
Silver	SW3015A	SW6020A	0.0001	0.00556	0.100	1.00	5	0.00014	-	-	-	-			
Antimony	SW3015A	SW6020A	0.0001	0.0111	0.006	0.06	-	0.003	-	-	-	-			
Beryllium	SW3015A	SW6020A	0.0002	0.00556	0.004	0.04	-	<0.00016	-	-	-	-			
Nickel	SW3015A	SW6020A	0.0016	0.00556	0.730	7.30	-	0.0035	-	-	-	-			
Thallium	SW3015A	SW6020A	0.0002	0.00556	0.002	0.02	-	0.00026	-	-	-	-			
Aluminum ²	SW3050	SW6020A	0.0037	0.0555	0.200	2.00	-	-	2.21	1.6	1.77	-			
Boron ³	SW3050	SW6020A	-	0.0555	7.300	73.00	-	-	0.806	0.688	0.755	-			
Chloride ²	-	9056	2.5000	5.0	250.000	2500.00	-	-	26.9	28.2	30.4	-			
Cobalt ³	SW3050	SW6020A	0.0001	0.0555	0.011	0.11	-	-	<0.00012	<0.00012	<0.00012	-			
Copper ²	SW3050	SW6020A	0.0009	0.0555	1.000	10.00	-	-	0.0206	0.0216	0.023	-			
Fluoride	-	9056	2.5000	5.0	4.000	40.00	-	-	<2.5	<2.5	<2.5	-			
Iron ²	SW3050	SW6020A	0.0096	0.0555	0.300	3.00	-	-	0.193	0.292	0.212	-			
Lithium ³	SW3050	SW6020A	0.0056	0.0555	0.073	0.73	-	-	0.87	0.825	0.864	-			
Manganese ²	SW3050	SW6020A	0.0005	0.00278	0.050	0.50	-	-	0.00296	0.00177	0.00182	-			
Molybdenum ³	SW3050	SW6020A	0.0010	0.0555	0.180	1.80	-	-	0.514	0.481	0.511	-			
Nitrate as N	-	9056	2.5000	5.0	10.000	100.00	-	-	8392	3662	5599	-			
Nitrite as N	-	9056	2.5000	5.0	1.000	10.00	-	-	181	193	194	-			
Nitrate/Nitrite (Total)	-	9056	2.5000	5.0	10.000	100.00	-	-	8573	3855	5793	-			
Strontium ³	SW3050	SW6020A	0.0013	0.0555	22.000	220.00	-	-	0.325	0.362	0.332	-			
Sulfate ²	-	9056	2.5000	5.0	250.000	2500.00	-	-	166	163	179	-			
Uranium	SW3050	SW6020A	-	-	0.030	0.30	-	-	0.00065	0.0083	0.0004	-			
Zinc ²	SW3050	SW6020A	0.0461	0.0555	5.000	50.00	-	-	<0.0461	<0.0461	<0.0461	-			
Other															



Type Data:
Company Name:
Subject/Project:

Industrial RCRA - TCLP Metals
Savannah River Remediation
Saltstone Vault Classification April 2011
(Subtitle C, Subtitle D or Class Three Landfills only.)

Date: 09/27/11

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

								Results in Milligrams per Liter						
								Waste Stream 1		Waste Stream 2		Waste Stream 3		
								4/5/2011	4/5/2011	4/5/2011	4/5/2011	Sample 1 Date 1	Sample 1 Date 1	Sample 2 Date 2
Facility Sample ID #	11113-SS-TCLP-2Q1							11114-SS-VAULT-1	11114-SS-VAULT-2	11114-SS-VAULT-3				
Laboratory Sample ID #	1105017-01							1108010-01	1108010-02	1108010-03				
Laboratory Name	B&W TSG-RACL							B&W TSG-RACL	B&W TSG-RACL	B&W TSG-RACL				
SC Laboratory Certification #	Z							Z	Z	Z				
Subcontracted Laboratory Certification #	10120001/10120002							10120001/10120002	10120001/10120002	10120001/10120002				
Subcontracted Laboratory Name	GEL Laboratories							GEL Laboratories	GEL Laboratories	GEL Laboratories				
Laboratory Receipt Information (Chain of Custody Must be Attached)	Attached							Attached	Attached	Attached				
Inorganic TCLP Chemicals														
Analytical Parameter	Digestion Method	Analytical Method	Detection Limit (mg/l)	Quantitation Limit (Mg/l)	MCL (mg/l)	Class 2 (mg/l)	TCLP Limits (mg/l)							
Quality Assurance (for above samples)														
TCLP Bottle Extraction #	B1E3101							B1H1105	B1H1105	B1H1105				
TCLP Extraction Blank	B1E3101-BLK1							B1H1105-BLK1	B1H1105-BLK1	B1H1105-BLK1				
Digestion Batch #	B1F0101							B1H2202	B1H2202	B1H2202				
Digestion Blank	B1F0101-BLK1							B1H2202-BLK1	B1H2202-BLK1	B1H2202-BLK1				
Laboratory Control sample	B1F0101-SRM1							B1F2202-SRM1	B1F2202-SRM1	B1F2202-SRM1				
Matrix Spike (MS)	B1F0101-MS1							B1H1105-MS1	B1H1105-MS1	B1H1105-MS1				
Matrix Spike Duplicate (MSD)	B1F0101-MSD1							B1H1105-MSD1	B1H1105-MSD1	B1H1105-MSD1				
Unspiked Duplicate (If Used)	-							-	-	-				
Analysis Batch Number	B1F0101							B1H2202	B1H2202	B1H2202				
LCS Recovery	Acceptable							Acceptable	Acceptable	Acceptable				
MS & MSD	Acceptable							Acceptable, ex Zn	Acceptable, ex Zn	Acceptable, ex Zn				

1. Subcontracted Laboratory Used for this parameter
 2. The MCL for these elements are Secondary Maximum Contaminant Levels.
 3. The MCL for these species are TW values.
- Z DOECAP, NUPIC and NELAP requirements



9/28/2011

LABORATORY: B&W Technical Services Group - RACL**METHOD NAME:** SW846-6020A, SW846-7470A, SW846-9056, TCLP Metals, Other Metals, Anions**SUBJECT:** QA- BIK, Laboratory Control Sample (LCS), Matrix Spike (MS), Matrix Spike Duplicate (MSD)**Reference:** Industrial RCRA - TCLP Metals**Instrument:** X-7 Series ICP-MS, Leman PC 200 II, Dionex DX-100

Analytes	Analyte Concentrations, Mg / l								Recovery Percent							Flags
	RDL	MDL	Blank	LCS	LCSD	MS	MSD	Other	LCS	LCSD	MS	MSD	Ave MS/MSD	REC Limits	% RPD	
Antimony	0.0111	0.00013	0.00023	0.311	-	0.937	0.926		95	-	93	92	92	75-125	1	0-20
Arsenic	0.00556	0.0001	0.0018	0.704	-	0.528	0.569		98	-	103	111	107	75-125	7	0-20
Barium	0.0556	0.00044	0.0031	0.459	-	2.687	2.703		99	-	98	99	98	75-125	1	0-20
Beryllium	0.00556	0.00016	<0.00016	0.116	-	0.205	0.203		85	-	82	81	82	75-125	1	0-20
Cadmium	0.0056	0.00011	<0.00011	0.465	-	0.218	0.216		98	-	87	86	86	75-125	1	0-20
Chromium	0.01111	0.00031	0.00072	0.163	-	0.926	0.927		101	-	91	91	91	75-125	0	0-20
Cyanide (as free cyanide)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluoride	5	2.5	-	0.87	-	0.86	0.88		86.5	-	86	88	87	-	2.2	-
Lead	0.00556	0.00048	0.0061	0.291	-	0.543	0.543		104	-	108	108	108	75-125	0	0-20
Mercury	0.0002	0.00007	<0.00007	6.41	-	0.0244	0.0231		119	-	116	90	103	75-125	5.5	0-20
Nickel	0.00556	0.0016	0.0056	0.524	-	0.85	0.848		98	-	85	84	84	75-125	0	0-20
Nitrate (as Nitrogen)	5	2.5	-	0.98	-	9.56	9.66		97.7	-	116	127	122	-	1.1	-
Nitrite (as Nitrogen)	5	2.5	-	1.02	-	1.22	1.2		101.8	-	100	99	100	-	1.3	-
Nitrate/Nitrite (Total)	5	2.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Selenium	0.0278	0.00024	0.0535	0.965	-	0.38	0.409		96	-	88	100	94	75-125	7	0-20
Silver	0.00556	0.00006	0.0001	0.19	-	0.19	0.19		98	-	76	76	76	75-125	0	0-20
Thallium	0.00556	0.00021	<0.00021	0.134	-	0.262	0.263		94	-	105	105	105	75-125	0	0-20
Aluminum	0.0555	0.00373	0.0345	2.46	-	2.56	2.68		91	-	79	91	85	70-130	4.58	0-20
Boron	0.0555	-	0.0802	1.46	-	1.58	1.61		92	-	83	86	84	70-130	1.88	0-20
Cobalt	0.0555	0.00012	0.00013	0.254	-	1.7	1.74		92	-	85	87	86	70-130	2.33	0-20
Copper	0.0555	0.00087	0.0186	0.296	-	1.64	1.66		94	-	81	82	82	70-130	1.21	0-20
Iron	0.0555	0.00962	0.132	2.19	-	5.38	5.56		95	-	86	89	88	70-130	3.29	0-20
Lithium	0.0555	0.00556	<0.00556	-	-	1.72	1.72		-	-	86	86	86	70-130	0	0-20



9/28/2011

LABORATORY: B&W Technical Services Group - RACL
METHOD NAME: SW846-6020A, SW846-7470A, SW846-9056, TCLP Metals , Other Metals, Anions
SUBJECT: QA- BIK, Laboratory Control Sample (LCS), Matrix Spike (MS), Matrix Spike Duplicate (MSD)

Reference: Industrial RCRA - TCLP Metals
Instrument: X-7 Series ICP-MS, Leman PC 200 II, Dionex DX-100

Analytes	Analyte Concentrations, Mg / l								Recovery Percent							Flags	
	RDL	MDL	Blank	LCS	LCSD	MS	MSD	Other	LCS	LCSD	MS	MSD	Ave MS/MSD	REC Limits	% RPD		RPD Limits
Manganese	0.00278	0.00046	0.00441	0.522	-	1.68	1.7		92	-	84	85	84	70-130	1.18	0-20	
Molybdenum	0.0555	0.00102	<0.00102	0.354	-	2.13	2.18		91	-	108	111	110	70-130	2.32	0-20	
Strontium	0.0555	0.00125	0.00796	0.181	-	1.24	1.27		90	-	91	94	92	70-130	2.39	0-20	
Uranium	-	-	0.0026	-	-	0.774	0.792		-	-	107.1	109.6	108.4	70-130	2.3	0-20	
Zinc	0.0555	0.0461	0.0606	0.263	-	2.59	2.64		92	-	74	75	74	70-130	1.91	0-20	
Chloride	5	2.5	-	1.03	-	1.02	1.01		102.7	-	92	90	91	-	1.2	-	
Sulfate	5	2.5	-	0.99	-	1.14	1.16		98.6	-	91	93	92	-	1.8	-	
Clock ID																	

Footnotes:



South Carolina Department of Health
and Environmental Control

Cross Reference Report for QA and Analytes

Date: 9/28/2011

Analytical Method Reference:

SW846- 6020A/7470A(TCLP Metals)

Lab Reference (to Facility Sample):

B&W TSG-RACL (1105017-01, 1108010-01 to -03)

Subject / Project:

Saltstone Vault Classification April 2011

Facility:

Savannah River Remediation, LLC

LAB ID #	FACILITY SAMP ID #	TC EXTR BATCH #	DIGESTION BATCH #	ANALYSIS BATCH #	OTHER	COMMENTS
B1E3101-BLK1 TCLP Blk	None	B1E3101	B1F0101	B1F0101	-	6020A ICPMS Metals
B1F0101-SRM1 LCS	None	B1E3101	B1F0101	B1F0101	-	6020A ICPMS Metals
B1F0101-MS1	11113-SS-TCLP-2Q11	B1E3101	B1F0101	B1F0101	-	6020A ICPMS Metals
B1F0101-MSD1	11113-SS-TCLP-2Q11	B1E3101	B1F0101	B1F0101	-	6020A ICPMS Metals
1105017-01A	11113-SS-TCLP-2Q11	B1E3101	B1F0101	B1F0101	-	6020A ICPMS Metals
B1E3101-BLK1 TCLP Blk	None	B1E3101	B1F0101	B1F0102	-	7470A, Hg CVAA
B1E3101-SRM1 LCS	None	B1E3101	B1F0101	B1F0102	-	7470A, Hg CVAA
B1E3101-MS1	11113-SS-TCLP-2Q11	B1E3101	B1F0101	B1F0102	-	7470A, Hg CVAA
B1E3101-MSD1	11113-SS-TCLP-2Q11	B1E3101	B1F0101	B1F0102	-	7470A, Hg CVAA
1105017-01A	11113-SS-TCLP-2Q11	B1E3101	B1F0101	B1F0102	-	7470A, Hg CVAA
B1H1105-BLK1 TCLP Blk	None	B1H1105	B1H2202	B1H2202	-	6020A ICPMS Metals
B1F2202-SRM1 LCS	None	B1H1105	B1H2202	B1H2202	-	6020A ICPMS Metals
B1H1105-MS1	11114-SS-VAULT3	B1H1105	B1H2202	B1H2202	-	6020A ICPMS Metals
B1H1105-MSD1	11114-SS-VAULT3	B1H1105	B1H2202	B1H2202	-	6020A ICPMS Metals
1108010-01-A	11114-SS-VAULT1	B1H1105	B1H2202	B1H2202	-	6020A ICPMS Metals
1108010-02-A	11114-SS-VAULT2	B1H1105	B1H2202	B1H2202	-	6020A ICPMS Metals
1108010-03-A	11114-SS-VAULT3	B1H1105	B1H2202	B1H2202	-	6020A ICPMS Metals

Date: 09/28/11



Type Data: **Industrial RCRA - TCLP Volatiles**
 Company Name: Savannah River Remediation
 Subject/Project: Saltstone Vault Classification April 2011
 (Subtitle C, Subtitle D or Class Three Landfills only.)

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

								Results in Milligrams per Liter						
								Waste Stream 1						
								4/5/2011	4/5/2011	4/5/2011				
Facility Sample ID #								11114-SS-VAULT-1	11114-SS-VAULT-2	11114-SS-VAULT-3				
Laboratory Sample ID #								284341001	284341002	284341002				
Laboratory Name								B&W TSG-RACL	B&W TSG-RACL	B&W TSG-RACL				
SC Laboratory Certification #								z	z	z				
Subcontracted Laboratory Certification #								10120001/10120002	10120001/10120002	10120001/10120002				
Subcontracted Laboratory Name								GEL Laboratories	GEL Laboratories	GEL Laboratories				
Laboratory Receipt Information (Chain of Custody Must be Attached)								Attached	Attached	Attached				
TCLP Volatile Organic Compounds								Subcontract ¹	Subcontract ¹	Subcontract ¹				
Analytical Parameter	Preparation Method	Analytical Method	Detection Limit (mg/l)	Quantitation Limit (mg/l)	MCL (mg/l)	Class 2 (mg/l)	TCLP (mg/l)							
Benzene	5030B	8260B	0.0030	0.01	0.005	0.05	0.5	<0.003	<0.003	<0.003				
Toluene	5030B	8260B	0.0025	0.01	1	10	-	<0.0025	<0.0025	<0.0025				
n-Butyl Alcohol	5030B	8260B	0.1500	0.5	3.7	37	-	<0.15	<0.15	<0.15				
Other														
Quality Assurance (for above samples)														
TCLP ZHE Extraction Batch #								1134218	1134218	1134218				
Volatile Analysis Batch #								1135656	1135656	1135656				
Surrogates, % Recovery								-	-	-				
1,2- Dichlorethane, d4								99.4	96.3	98.3				
Toluene, d8								98.2	95.3	96.6				
4-Bromofluorobenzene								97	93	96				
Other														
Other														

1. Subcontracted Laboratory Used for these Parameters (Analytes)

Z DOECAP, NUPIC and NELAP requirements

Date: 09/28/11



Type Data: **Industrial RCRA - TCLP Semi-Volatiles**
 Company Name: Savannah River Remediation
 Subject/Project: Saltstone Vault Classification April 2011
 (Subtitle C, Subtitle D or Class Three Landfills only.)

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

								Results in Milligrams per Liter					
								Waste Stream 1					
								4/5/2011	4/5/2011	4/5/2011			
Facility Sample ID #	11114-SS-VAULT-1							11114-SS-VAULT-1	11114-SS-VAULT-2	11114-SS-VAULT-3			
Laboratory Sample ID #	284341004							284341004	284341005	284341006			
Laboratory Name	B&W TSG-RACL							B&W TSG-RACL	B&W TSG-RACL	B&W TSG-RACL			
SC Laboratory Certification #	Z							Z	Z	Z			
Subcontracted Laboratory Certification #	10120001/10120002							0120001/10120002	0120001/10120002	0120001/10120002			
Subcontracted Laboratory Name	GEL Laboratories							GEL Laboratories	GEL Laboratories	GEL Laboratories			
Laboratory Receipt Information (Chain of Custody Must be Attached)	Attached							Attached	Attached	Attached			
Semi-Volatile Organic Compounds								Subcontract ¹	Subcontract ¹	Subcontract ¹			
Analytical Analytes	Preparation Method	Analytical Method	Detection Limit (mg/l)	Quantitation Limit (Mg/l)	MCL (mg/l)	Class 2 (mg/l)	TCLP Limit (mg/l)						
Phenol (total)	SW1311	SW9066	0.0016	0.005	11.00000	110.0		0.00515	<0.0016	0.00874			
Other						0.0000							
Quality Assurance (for above samples)													
TCLP Bottle Extraction #								B1E3101 ^A	B1E3101 ^A	B1E3101 ^A			
Semivolatile Extraction Batch #													
Analysis Batch Number								1134737	1134737	1134737			
Surrogates: % Recovery													
Nitrobenzene, d5													
2-Fluorobiphenol													
Terphenyl, d14													
Phenol, d6													
2-Fluorophenol													
2,4,6-Tribromophenol													

1. Subcontracted Laboratory used for this Analyte.
 A. TCLP Extract for Phenols performed by B&W Technical Services Group - RACL as TCLP Batch# B1E3101 and shipped to subcontractor GEL Laboratories
 Z. DOECAP, NUPIC and NELAP requirements



9/28/2011

LABORATORY: GEL Laboratories LLC
METHOD NAME: SW846-8260B and SW846-9066 QC Report
SUBJECT: QA- Blk, Laboratory Control Sample (LCS), Matrix Spike (MS), Matrix Spike Duplicate (MSD)

Reference: Industrial RCRA - TCLP Volatiles & Semivolatiles
Instrument: Lachat QuickChem FIA+ 8000

Analytes	Analyte Concentrations, Mg / l								Recovery Percent							Flags	
	RDL	MDL	Blank	LCS	LCSD	MS	MSD	Other	LCS	LCSD	MS	MSD	Ave MS/MSD	REC Limits	% RPD		RPD Limits
Benzene	0.01	0.003	<0.003	0.0441	-	0.055	0.0527		88.1	-	110	105	108	75-118	4.22	0-20	
Toluene	0.01	0.0025	<0.0025	-	-	-	-		-	-	-	-	-	-	-	-	
n-Butanol	0.5	0.15	<0.15	-	-	-	-		-	-	-	-	-	-	-	-	
Toluene-d8	-	-	-	0.049	-	0.0479	0.0473		97.9	-	95.9	94.6	95.3	80-120	-	-	
1,2-Dichloroethane-d4	-	-	-	0.051.8	-	0.049	0.0478		104	-	98	95.7	97	79-124	-	-	
Bromofluorbenzene	-	-	-	0.0495	-	0.0487	0.0473		99	-	97.4	94.6	96	80-120	-	-	
Phenol	0.005	0.0016	0.012	0.0517	0.049	-	-		103	98	-	-	-	-	5.36	0-20	
Clock ID																	

Footnotes:
 Surrogate Results for LCS, MD, MD and recoveries are listed above



South Carolina Department of Health
and Environmental Control

Cross Reference Report for QA and Analytes

Date: 9/28/2011

Analytical Method Reference:

SW846-1311/8260B(VOC) & SW846-9066 Phenol

Lab Reference (to Facility Sample):

GEL Laboratories (11114-SS-VAULT1 to 11114-SS -VAULT3)

Subject / Project:

Saltstone Vault Classification April 2011

Facility:

Savannah River Remediation, LLC

LAB ID #	FACILITY SAMP ID #	TC EXTR BATCH #	DIGESTION BATCH #	ANALYSIS BATCH #	OTHER	COMMENTS
1202469481 TCLP Blk	None	1134218	Not Applicable	1135656	-	8260B VOC
1202472889 LCS	None	1134218	Not Applicable	1135656	-	8260B VOC
1202472887 MS	11114-SS-VAULT1	1134218	Not Applicable	1135656	-	8260B VOC
1202472888 MSD	11114-SS-VAULT1	1134218	Not Applicable	1135656	-	8260B VOC
284341001	11114-SS-VAULT1	1134218	Not Applicable	1135656	-	8260B VOC
284341002	11114-SS-VAULT2	1134218	Not Applicable	1135656	-	8260B VOC
284341003	11114-SS-VAULT3	1134218	Not Applicable	1135656	-	8260B VOC
284341007 TCLP BLK	None	B1E3101 ^A	1134736	1134737	-	9066 Phenols Total
1202470772 Meth Blk	None	None	1134736	1134737	-	9066 Phenols Total
1202470773 LCS	None	None	1134736	1134737	-	9066 Phenols Total
1202470774 LCSD	None	None	1134736	1134737	-	9066 Phenols Total
284341004	11114-SS-VAULT1	B1E3101 ^A	1134736	1134737	-	9066 Phenols Total
284341005	11114-SS-VAULT2	B1E3101 ^A	1134736	1134737	-	9066 Phenols Total
284341006	11114-SS-VAULT3	B1E3101 ^A	1134736	1134737	-	9066 Phenols Total

Footnotes

A. TCLP Extract for Phenols performed by B&W Technical Services Group - RACL as TCLP Batch# B1E3101 and shipped to subcontractor GEL Laboratories

CHAIN-OF-CUSTODY

Organic Aqueous Soil Solid Sludge gr water Smears Swipes Gas

11113
 Contract Number
 AC39044N
 Customer Name: Reigel, Marissa
 Customer Department: SRNL
 Customer Address: 999-W, 404
 Customer Phone/Beeper: 819-8419 21397

Company: Babcock & Wilcox NOG, Inc.
 Lynchburg, Technology Center
 2016 Mt. Athos Road
Ship to: Attention: K. D. Long

Sample ID: **11113-SS - TCLP-2Q11**
 Collect Date: **5-24-11**
 Collect Time: **11:52 AM**
 No. Containers: **1**
 Matrix: **SD**

Savannah River Nuclear Solutions
Aiken, SC 29808
Environmental Services Section
Waste Sample Management Group

Matrix: S=Soil, SO=Solid, SL=Sludge, O=Aqueous, A=Organic, SM=Smeared
 COC creation date: **5/11/11**

Sample Analysis Requested

TCLP, Metals (Prep & Analysis) (33)

TCLP, Nickel (39) (106)

TCLP, Antimony (39) (53)

TCLP, Thallium (39) (129)

TCLP, Beryllium (39) (62)

Benzene (317)

Phenols by GCMS (159)

Total and Amenable Cyanide (Colorimetric Manual) (271)

TAT Days	Activity Code	Comments	Received by:	Relinquished by:	Relinquished by:	Relinquished by:	Received by:	Received by:	Received by:
28	LWZSE1050	Not ARRA Work - High Level Rad							
1			<i>Karen Palmer</i>	<i>Karen Palmer</i>	<i>Karen Palmer</i>	<i>Karen Palmer</i>	<i>Karen Palmer</i>	<i>Karen Palmer</i>	<i>Karen Palmer</i>
2			<i>Karen Palmer</i>	<i>Karen Palmer</i>	<i>Karen Palmer</i>	<i>Karen Palmer</i>	<i>Karen Palmer</i>	<i>Karen Palmer</i>	<i>Karen Palmer</i>
3			<i>Karen Palmer</i>	<i>Karen Palmer</i>	<i>Karen Palmer</i>	<i>Karen Palmer</i>	<i>Karen Palmer</i>	<i>Karen Palmer</i>	<i>Karen Palmer</i>
4			<i>Karen Palmer</i>	<i>Karen Palmer</i>	<i>Karen Palmer</i>	<i>Karen Palmer</i>	<i>Karen Palmer</i>	<i>Karen Palmer</i>	<i>Karen Palmer</i>

RAD SCREEN REQUIRED? **NO**
 STR Authorization: **Robert Lasswitz**

Viking Box # 030073

CHAIN-OF-CUSTODY

COC creation date. Page 2 of 4

5/11/11

Job Number: **11114** RL

Customer Name: Reigel, Marissa
 Customer Department: SRNL
 Customer Address: 999-W, 404
 Customer Phone: 819-8419 21397

Company: Babcock & Wilcox, NOG, Inc.
 Address: Lynchburg, Technology Center
 City/State: 2016 Mt. Athos Road
 Attention to: Attention: K. D. Long

Ship to:

Sample ID	Sample ID	Sample ID	Sample ID
11114-SS-Vault-1	11114-SS-Vault-1	11114-SS-Vault-1	11114-SS-Vault-1
Collected Date: 5-23-11 KP	Collected Date: 5-23-11 KP	Collected Date: 5-23-11 KP	Collected Date: 5-23-11 KP
Collected Time: 0800	Collected Time: 0800	Collected Time: 0800	Collected Time: 0800
No. Containers: See Pg 1 of 1	No. Containers: See Pg 1 of 1	No. Containers: See Pg 1 of 1	No. Containers: See Pg 1 of 1
Matrix: S	Matrix: S	Matrix: S	Matrix: S
<p>Savannah River Nuclear Solutions Aiken, SC 29808 Environmental Monitoring Section Environmental Geochemistry Group Matrix Key: S=Soil, SO=Solid, SL=Sludge, O=Organic, A=Aqueous</p>			
<p>Sample Analysis Requested</p>			
Lithium (ICP/MS) (94)	✓	✓	✓
Molybdenum (ICP/MS) (104)	✓	✓	✓
Nickel (ICP/MS) (107)	✓	✓	✓
Selenium (ICP/MS) (115)	✓	✓	✓
Silver (ICP/MS) (122)	✓	✓	✓
Strontium (ICP/MS) (128)	✓	✓	✓
Sulfate (306)	✓	✓	✓
Uranium (ICP/MS) (137)	✓	✓	✓
Zinc (ICP/MS) (142)	✓	✓	✓
Mercury-Total (cold vapor-automated) (288)	✓	✓	✓
Benzene (317)	✓	✓	✓
Butyl Alcohol (335)	✓	✓	✓
Phenols by GCMS (159)	✓	✓	✓

TAT Days: 28 Activity Code: LWZSE1050 Comments: Not ARRA Work. Viking box 072

RAD SCREEN REQUIRED? **NO** STR Authorization: *Robert Lasswitz*

Relinquished by:	Date/Time	Received by:	Date/Time
1 Relinquished by: <i>[Signature]</i>	Date: 6-7-11 Time: 0915	2 Relinquished by: <i>Karen Palmer</i>	Date/Time: 6-7-11 Time: 0900
3 Relinquished by: <i>[Signature]</i>	Date/Time:	4 Relinquished by: <i>[Signature]</i>	Date/Time:
(Print)	Date	(Print)	Date
(Sign)	Time	(Sign)	Time
Received by:	Date/Time	Received by:	Date/Time
(Print)	Date	(Print)	Date
(Sign)	Time	(Sign)	Time

CHAIN-OF-CUSTODY

COC creation date. Page 4 of 4
5/11/11 **RWL**

Job Number **11114**
 Contract Number **AC39044N**
 Customer Name: **Reigel, Marissa**
 Customer Department: **SRNL**
 Customer Address: **999-W, 404**
 Customer Phone: **819-8419 21397**

Company: **Babcock & Wilcox, NOG, Inc.**
 Address: **Lynchburg, Technology Center**
 City/State: **2016 Mt. Athos Road**
 Attention to: **K. D. Long**

Ship to:

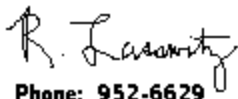
Savannah River Nuclear Solutions
Aiken, SC 29808
Environmental Monitoring Section
Environmental Geochemistry Group
 Matrix Key: S=Soil, SO=Solid, SL=Sludge, O=Organic, A=Aqueous

Sample ID:	Sample ID:	Sample ID:
11114-SS-Vault-1	11114-SS-Vault-2	11114-SS-Vault-3
Collected Date: <u>6-7-11</u> HP	Collected Date: <u>6-7-11</u> HP	Collected Date: <u>6-7-11</u> HP
Collected Time: <u>0800</u>	Collected Time: <u>0800</u>	Collected Time: <u>0800</u>
No. Containers: <u>See Pg 1 of 1</u>	No. Containers: <u>See Pg 1 of 1</u>	No. Containers: <u>See Pg 1 of 1</u>
Matrix	Matrix	Matrix
S	S	S
✓	✓	✓
✓	✓	✓
✓	✓	✓
✓	✓	✓
✓	✓	✓
✓	✓	✓
✓	✓	✓
✓	✓	✓
✓	✓	✓
✓	✓	✓
✓	✓	✓

TAT Days	Activity Code	Comments	RAD SCREEN REQUIRED?	STR Authorization
<u>28</u>	LWZSE1050	Not ARRA Work. Viking box 072	NO	Robert Lasswitz
1	Relinquished by:	Received by:	Date/Time	Received by:
(Print)	<u>Marissa Reigel</u>	(Print)	<u>6-7-11</u>	(Print)
(Sign)	<u>Marissa Reigel</u>	(Sign)	Time <u>0900</u>	(Sign) <u>ELS</u>
3	Relinquished by:	Received by:	Date/Time	Received by:
(Print)	<u>Marissa Reigel</u>	(Print)		(Print)
(Sign)	<u>Marissa Reigel</u>	(Sign)		(Sign)

From: robert.lasswitz@srs.gov
To: [Gibson, Virginia W.](#)
Cc: benjamin.terry@srs.gov
Subject: Re: Job 11114 (Vault Classification Sampsles)
Date: Monday, June 13, 2011 8:58:23 AM

Virginia,
Please proceed with the analysis.
Thanks,
Bob Lasswitz
SRNS


Phone: 952-6629
Page: 14903

From: "Gibson, Virginia W." <vwgibson@babcock.com>
To: <robert.lasswitz@srs.gov>
Cc: <benjamin.terry@srs.gov>
Date: 06/09/2011 04:45 PM
Subject: Job 11114 (Vault Classification Sampsles)

Bob,

We received the vault classification samples (Job 11114) this afternoon.

Upon receipt, the container temperature was outside the required range $4\pm 2^{\circ}\text{C}$ (measured at 15°C). The samples have also exceeded the 14 day hold time limit for the organic compounds (Sampled 5/23/11). Please let me know how you would like to proceed.

Best Regards,
Virginia

Virginia W. Gibson
Babcock & Wilcox Technical Services Group, Inc.
2016 Mt. Athos Road
Lynchburg, VA 24504-5447
(434) 522-6546
(434) 522-6860 (Fax)
vwgibson@babcock.com

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CHAIN-OF-CUSTODY

Organic Aqueous Soil Solid Sludge gr water Smears Swipes Gas

RL

Company: Babcock & Wilcox, NOG, Inc.
Lynchburg, Technology Center
Address: 2016 Mt. Athos Road

Customer Name: Reigel, Marissa
Customer Department: SRNL
Customer Address: 999-W, 404
Customer Phone/Beeper: 819-8419 21397

Ship to: Attention: K. D. Long

Savannah River Nuclear Solutions
Aiken, SC 29808
Environmental Services Section
Waste Sample Management Group

COC creation date: **8/10/11**

Matrix: S=Soil, SO=Solid, SL=Sludge, O=Aqueous, A=Organic, SM=Smear

Sample ID:	11114-SS-VAULT 1	11114-SS-VAULT 2	11114-SS-VAULT 3
Collect Date	5/23/11	5/23/11	5/23/11
Collect Time	0800	0800	0800
No. Containers	1	1	1
Matrix	So	So	So
Sample Analysis Requested			
TCLP Aluminum (3) (51) Method 1311/3015/6020	✓	✓	✓
TCLP Boron (3) (66) Method 1311/3015/6020	✓	✓	✓
TCLP Cobalt (3) (35) Method 1311/3015/6020	✓	✓	✓
TCLP Copper (3) (35) Method 1311/3015/6020 DL 1.3 mg/l	✓	✓	✓
TCLP Iron (3) (37) Method 1311/3015/6020 DL 0.3 mg/l	✓	✓	✓
TCLP Manganese (3) (39) Method 1311/3015/6020 DL 0.5 mg/l	✓	✓	✓
TCLP Lithium (3) (40) Method 1311/3015/6020	✓	✓	✓
TCLP Molybdenum (3) (41) Method 1311/3015/6020	✓	✓	✓
TCLP Strontium (3) (45) Method 1311/3015/6020	✓	✓	✓
TCLP Sulfate (3) (53) Method 300/9056 DL 250 mg/l	✓	✓	✓
TCLP Uranium (3) (46) Method 1311/3015/6020	✓	✓	✓
TCLP Zinc (3) (47) Method 1311/3015/6020 DL 5.0 mg/l	✓	✓	✓
TCLP Benzene (17) Method 1311/8260B DL 0.005 mg/l	✓	✓	✓

RAD SCREEN REQUIRED? **NO** STRAUFORIZATION *Robert Lasswitz*

TAT Days Activity Code Comments
28 LWZSE1050 Not ARRA Work. Sample Material currently at B&W.

1 Relinquished by:	Date/Time	2 Relinquished by:	Date/Time	Received by:	Date/Time
<i>ANTONIO DEAL</i>	6/7/11				
<i>R. Lasswitz for</i>	0915				

* SAMPLES AT B&W. R Lasswitz 8/10/11

CHAIN-OF-CUSTODY

8/10/11

Job Number 11114	Customer Name: Reigel, Marissa	Company: Babcock & Wilcox, NOG, Inc.
Contract Number AC39044N	Customer Department: SRNL	Address: Lynchburg, Technology Center
	Customer Address: 999-W, 404	City/State: 2016 Mt.Athos Road
	Customer Phone: 819-8419 21397	Attention to: K. D. Long

Sample ID:	11114-SS-VAULT1	11114-SS-VAULT2	11114-SS-VAULT3
Collect Date	5/23/11	5/23/11	5/23/11
Collect Time	0800	0800	0800
No. Containers	1	1	1
Matrix	So	So	So
Sample Analysis Requested			
TCLP 1-Butanol (18) Method 1311/8260B	✓	✓	✓
TCLP Phenols (2) Method 1311/8270C	✓	✓	✓
TCLP Chloride (50) Method 300/9056 DL 250 mg/l	✓	✓	✓
TCLP Fluoride (51) Method 300/9056 DL 4.0 mg/l	✓	✓	✓
TCLP Nitrate/Nitrite (52) Method 300/9056 DL 10.0 mg/l	✓	✓	✓
TCLP Gross Alpha & Beta (54) Method 1311/9310 DL 15 pCi/l	✓	✓	✓
TCLP Radium 226/228 (55) Method 1311 DL 5 pCi/l	✓	✓	✓
TCLP Tritium (56) Method 1311	✓	✓	✓
TCLP Strontium-90 (57) Method 1311	✓	✓	✓
TCLP Technetium-99 (58) Method 1311	✓	✓	✓
TCLP Cobalt-60 (66) Method 1311	✓	✓	✓
TCLP Ruthenium-106 (67) Method 1311	✓	✓	✓
TCLP Rhodium-106 (68) Method 1311	✓	✓	✓

TAT Days	28	Activity Code	LWZSE1050	Comments	Not ARRA Work. Sample Material currently at B&W.	RAD SCREEN REQUIRED?	NO	STR Authorization	Robert Lasswitz
1 Relinquished by:	(Print)	Date/Time	6/7/11	Received by:	(Print)	Date/Time		Received by:	(Print)
(Sign)	ANTONIO DEAL	(Sign)	*	(Sign)		(Sign)		(Sign)	
3 Relinquished by:	(Print)	Date/Time	0915	Received by:	(Print)	Date/Time		Received by:	(Print)
(Sign)	R. Lasswitz for	(Sign)		(Sign)		(Sign)		(Sign)	

* SAMPLES AT B&W R. Lasswitz 8/10/11

CHAIN-OF-CUSTODY

COC creation date. Page 3 of 3
8/10/11

Job Number: **11114**
 Contract Number: AC39044N
 Customer Name: Reigel, Marissa
 Customer Department: SRNL
 Customer Address: 999-W, 404
 Customer Phone: 819-8419 21397
 Ship to: **IRL**
 Company: Babcock & Wilcox, NOG, Inc.
 Address: Lynchburg, Technology Center
 City/State: 2016 Mt. Athos Road
 Attention to: Attention: K. D. Long

Sample ID:	11114-SS-VAULT 1	11114-SS-VAULT 2	11114-SS-VAULT 3
Collected Date	5/23/11	5/23/11	5/23/11
Collected Time	0800	0800	0800
No. Containers	1	1	1
Matrix	So	So	So
Sample Analysis Requested	Savannah River Nuclear Solutions Aiken, SC 29808 Environmental Monitoring Section Environmental Geochemistry Group Matrix Key: S=Soil, SO=Solid, SL=Sludge, O=Organic, A=Aqueous		
TCLP Antimony-125 (69) Method 1311	✓	✓	✓
TCLP Cesium-137 (70) Method 1311	✓	✓	✓
TCLP Barium-137m (71) Method 1311	✓	✓	✓
TCLP Europium-154 (72) Method 1311	✓	✓	✓
TCLP Promethium-147 (73) Method 1311	✓	✓	✓
TCLP Plutonium-238 (59) Method 1311	✓	✓	✓
TCLP Plutonium-239 (60) Method 1311	✓	✓	✓
TCLP Plutonium-241 (61) Method 1311	✓	✓	✓
TCLP Curium-242 (62) Method 1311	✓	✓	✓
TCLP Curium-243/244 (63) Method 1311	✓	✓	✓
TCLP Americium-241 (64) Method 1311	✓	✓	✓
TCLP Toluene (19) Method 1311/8260B	DL 1.0 mg/l		

TAT Days Activity Code Comments
 28 LWZSE1050 Not ARRA Work. Sample Material currently at B&W.
 RAD SCREEN REQUIRED? **NO** STR Authorization **Robert Lassusky**

1 Relinquished by:	2 Relinquished by:	3 Relinquished by:	4 Relinquished by:
ANTONIO DEAL R. Lassusky for			
Date: 6/7/11 Time: 0915	Date/Time	Date/Time	Date/Time
(Print)	(Print)	(Print)	(Print)
(Sign)	(Sign)	(Sign)	(Sign)

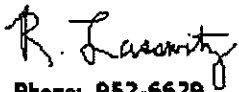
Received by: *
 Received by: *
 Received by: *
 Received by: *

* SAMPLES AT B&W R. Lassusky 8/10/11

Willis, Ken W.

From: robert.lasswitz@srs.gov
Sent: Thursday, August 11, 2011 7:33 AM
To: Gibson, Virginia W.; Willis, Ken W.
Cc: benjamin.terry@srs.gov; lori.coward@srs.gov; Marissa.Reigel@srnl.doe.gov;
allan.barnes@srnl.doe.gov
Subject: Job 11114 - COC's
Attachments: DOC.PDF

Virginia,
The three (3) pages of COC's I sent you yesterday were not filled out - just blanks. Attached are ones that are.
Bob



Phone: 952-6629
Page: 14903

Gibson, Virginia W.

From: Gibson, Virginia W.
Sent: Wednesday, August 10, 2011 3:21 PM
To: 'robert.lasswitz@srs.gov'
Cc: benjamin.terry@srs.gov; lori.coward@srs.gov; Marissa.Reigel@srnl.doe.gov; allan.barnes@srnl.doe.gov; Willis, Ken W.
Subject: RE: Job 11114 - COC's for TCLP analysis

Bob,

Based on the provided COC information, we will begin analysis of vault classification samples 11114-SS-VAULT1, 11114-SS-VAULT2 and 11114-SS-VAULT3 for the requested analyses. These samples were originally logged under the delivery group (SDG) identification number 1106010. Since a report and invoice have already been issued for the work performed under the 1106010 SDG number, the samples will be relogged under a new delivery group number.

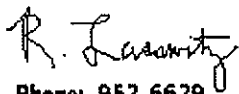
The work will be performed on a 14 D TAT beginning today. Per conversation with Marissa Reigel, the reporting format for this work will be a typical level IV report with no EDD required.

Please let me know if any of the above information is incorrect.

Best Regards,
Virginia

From: robert.lasswitz@srs.gov [<mailto:robert.lasswitz@srs.gov>]
Sent: Wednesday, August 10, 2011 2:19 PM
To: Gibson, Virginia W.; Willis, Ken W.
Cc: benjamin.terry@srs.gov; lori.coward@srs.gov; Marissa.Reigel@srnl.doe.gov; allan.barnes@srnl.doe.gov
Subject: Job 11114 - COC's for TCLP analysis

Virginia,
Attached are the three pages of the COC for our TCLP request on Job 11114. Please let me know if you have any questions.
Thanks,
Bob



Phone: 952-6629

Page: 14903

Chain of Custody and Supporting Documentation

Task Authorization/Chain of Custody Record

RACL B&W Technical Services Group, Inc.

284341

Page

Purchase Order # Customer/Project Name 4500003376 Savannah River Nuclear Solutions (SRNS) / Vault Classification - 2011 Project Management Phone:(434)-522-6546 Fax: (434) 522-6860 Virginia Gibson		WorkOrder 1108010		Requested TAT 5 Bus Days		Task Order Release # 2011-09 Shipment Rad Level	
Bottle ID	Customer ID	Collection Date/Time	Matrix	Container	Analysis Information	Container Rad Level	Task Order Release #
1108010-01-A01	11114-SS-VAULT-1	05/23/11 08:00	Solid	4oz glass jar	This is all the analyses for each sample ID MIS-A-646 (TCLP) VOA-A-011 (TCLP)	3 m/hr @ 2in	2011-09
1108010-02-A01	11114-SS-VAULT-2	05/23/11 08:00	Solid	4oz glass jar	MIS-A-646 (TCLP) VOA-A-011 (TCLP)	3 m/hr @ 2in	2011-09
1108010-03-A01	11114-SS-VAULT-3	05/23/11 08:00	Solid	4oz glass jar	MIS-A-646 (TCLP) VOA-A-011 (TCLP)	3 m/hr @ 2in	2011-09

MIS-A-646 = TCLP Benzene
 VOA-A-011 = TCLP Single Appendix IX – VOA Compound – Toluene + Butyl Alcohol (TCLP)

Disposition Information: Please dispose of residual sample @ GEL	
Required Reporting C of A <input type="checkbox"/> QC Summary <input type="checkbox"/> Level 1 <input type="checkbox"/> Level 2 <input type="checkbox"/> Level 3 <input type="checkbox"/> Level 4 <input checked="" type="checkbox"/> EDD NA AMSEDD EMEDD13 <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/>	Send Results To: Virginia W. Gibson VIA: E-mail vwgibson@babcock.com
Known Hazards applicable to these samples: Samples are Radioactive	Received By: (Sign) [Signature] 6-18-11 0855 Date/Time
Special Notes/Comments: Please proceed with analysis even though hold time requirement has been exceeded. Perform Analysis on TCLP Extract.	Released By: (Sign) [Signature] 6-18-11 0855 Date/Time

SRNL-STI-2011-00561

284341

Task Authorization/Chain of Custody Record

RACL
B&W Technical Services Group, Inc.

WorkOrder
1108010

Requested TAT
5 Bus Days

Task Order Release #
2011-10

Purchase Order # Customer/Project Name
4500003376 Savannah River Nuclear Solutions (SRNS) / Vault Classification - 2011
Project Management Phone:(434)-522-6546 Fax: (434) 522-6860
Virginia Gibson

Analysis Information	Task Order Release #
This is all the analyses for each sample ID	2011-10 Shipment Rad Level
IGAM-A-022 (Ra-226) (TCLP), IGAM-A-023 (Ra-228),(TCLP), LSC-A-511 (TCLP), MIS-A-645 (TCLP)	Container Rad Level <1 mri/hr @ 2in
IGAM-A-022 (Ra-226) (TCLP), IGAM-A-023 (Ra-228),(TCLP), LSC-A-511 (TCLP), MIS-A-645 (TCLP)	<1 mri/hr @ 2in
IGAM-A-022 (Ra-226) (TCLP), IGAM-A-023 (Ra-228),(TCLP), LSC-A-511 (TCLP), MIS-A-645 (TCLP)	<1 mri/hr @ 2in

Collection	Container
08/12/11 11:00	glass jar
05/23/11 11:00	glass jar
05/23/11 11:00	glass jar
5/23/11 11:00	Glass jar

Matrix	Container
Liquid	glass jar
Liquid	glass jar
Liquid	glass jar
Liquid	Glass jar

Customer ID	Date/Time	Matrix	Container
11114-SS-VAULT-1	08/12/11 11:00	Liquid	glass jar
11114-SS-VAULT-2	05/23/11 11:00	Liquid	glass jar
11114-SS-VAULT-3	05/23/11 11:00	Liquid	glass jar
TCLP Blank	5/23/11 11:00	Liquid	Glass jar

IGAM-A-022 = Ra-226
IGAM-A-023 = Ra-228
MIS-A-645 = Phenols

LSC-A-511 = Pm-147

Disposition Information:
Please dispose of residual sample @ GEL

Known Hazards applicable to these samples:
Samples are Radioactive

Special Notes/Comments:
Please proceed with analysis even though hold time requirement has been exceeded.
Perform Analysis on TCLP Extract.

Required Reporting
C of A QC Summary Level 1 Level 2 Level 3 Level 4
EDD NA AMSEDD EMEDD13
Released By: (Sign) Date/Time Received By: (Sign) Date/Time
VIA: E-mail
vwgibson@babcock.com

284341

PREPARATION BENCH SHEET

B1H1104
BWXS-RACL

Matrix: Solid Prepared using: Radiochemistry - Sub Aliquot Prepared On: 08/11/11 09:59 Printed: 8/11/2011 3:34:38PM
Balance ID: 1-0000-2556 Technical Procedure: 398 R 9

Balance 1 Sigma: 0.03%

Calibration Date (Due): 2/23/12

Sample ID	Tag	Weight/Vol.	Glassware ID	1 Sigma	Aliquot From	Geometry	mR/Hr @ 2in	Source ID	Spike ID	Spike Amt (µL)
1108010-01	A	30.0288	Balance	0.03%	1108010-03-A	4oz Amber Jar	3.1			
1108010-02	A	30.2235	Balance	0.03%	1108010-03-A	4oz Amber Jar	2.9			
1108010-03	A	29.889	Balance	0.03%	1108010-03-A	4oz Amber Jar	3.3			

Comments:
Sub-Aliquots Created for shipment to GEL. All sample tags are -A01

 8/11/11
Date

Reviewed By Virginia W. Gibson 8/11/11
Date

Client: BWXT		SDG/AR/COC/Work Order: 284341
Received By: MK		Date Received: 8-18-11
Suspected Hazard Information	Yes <input checked="" type="checkbox"/> No <input checked="" type="checkbox"/>	*If Counts > x2 area background on samples not marked "radioactive", contact the Radiation Safety Group for further investigation.
COC/Samples marked as radioactive?	<input checked="" type="checkbox"/>	Maximum Counts Observed*: MR/HR SOLID = 10.0
Classified Radioactive II or III by RSO?	<input checked="" type="checkbox"/>	RAD II LIQUID = 1.5
COC/Samples marked containing PCBs?	<input checked="" type="checkbox"/>	
Shipped as a DOT Hazardous?	<input checked="" type="checkbox"/>	Hazard Class Shipped: 7 UN#: 2915
Samples identified as Foreign Soil?	<input checked="" type="checkbox"/>	

Sample Receipt Criteria	Yes	NA	No	Comments/Qualifiers (Required for Non-Conforming Items)
1 Shipping containers received intact and sealed?	<input checked="" type="checkbox"/>			Circle Applicable: Seals broken Damaged container Leaking container Other (describe)
2 Samples requiring cold preservation within (0 ≤ 6 deg. C)?			<input checked="" type="checkbox"/>	Preservation Method: Ice bags: <u>Blue ice</u> Dry ice None Other (describe) 9c
2a Daily check performed and passed on IR temperature gun?	<input checked="" type="checkbox"/>			Temperature Device Serial #: 41502182 Secondary Temperature Device Serial # (If Applicable):
3 Chain of custody documents included with shipment?	<input checked="" type="checkbox"/>			
4 Sample containers intact and sealed?	<input checked="" type="checkbox"/>			Circle Applicable: Seals broken Damaged container Leaking container Other (describe)
5 Samples requiring chemical preservation at proper pH?		<input checked="" type="checkbox"/>		Sample ID's, containers affected and observed pH: If Preservation added, Lot#:
6 VOA vials free of headspace (defined as < 6mm bubble)?		<input checked="" type="checkbox"/>		Sample ID's and containers affected:
7 Are Encore containers present?			<input checked="" type="checkbox"/>	If yes, immediately deliver to Volatiles laboratory)
8 Samples received within holding time?	<input checked="" type="checkbox"/>			ID's and tests affected:
9 Sample ID's on COC match ID's on bottles?	<input checked="" type="checkbox"/>			Sample ID's and containers affected:
10 Date & time on COC match date & time on bottles?			<input checked="" type="checkbox"/>	Sample ID's affected: * See Below
11 Number of containers received match number indicated on COC?	<input checked="" type="checkbox"/>			Sample ID's affected:
12 Are sample containers identifiable as GEL provided?		<input checked="" type="checkbox"/>		
13 COC form is properly signed in relinquished/received sections?		<input checked="" type="checkbox"/>		CHAIN NOT RELINQUISHED
14 Carrier and tracking number.	<input checked="" type="checkbox"/>			Circle Applicable: FedEx Air <u>FedEx Ground</u> UPS Field Services Courier Other 9620 8503 7350

Comments (Use Continuation Form if needed):
 * LIQUIDS - DATE ON BOTTLES = 8-15-11 CHAIN = 8-12-11 + 5-23-11
 SOLIDS - DATE ON BOTTLES = 8-11-11 CHAIN = 5-23-11

Subject: RE: TCLP samples received at GEL last week
From: "Gibson, Virginia W." <vwgibson@babcock.com>
Date: Tue, 23 Aug 2011 16:12:34 -0400
To: "Ricky Albee" <richard.albee@gel.com>
CC: "team.albee" <team.albee@gel.com>

Ricky,

Please proceed with the analyses.

The liquid sample dates should be 8/12/11 @ 11:00. This is the time of TCLP extract collection.

The solid sample dates should be 5/23/11. This is the time of sample collection by the customer.

Please let me know if you have additional questions.

Best regards,
Virginia

-----Original Message-----

From: Ricky Albee [mailto:richard.albee@gel.com]
 Sent: Tuesday, August 23, 2011 2:58 PM
 To: Gibson, Virginia W.
 Cc: team.albee
 Subject: TCLP samples received at GEL last week

Hi Virginia,
There were a couple time discrepancies with the samples received at GEL on Thursday:

Liquids - Bottles have date 8/15/11, chain has 8/12/11 for 11114-SS-VAULT-1, 5/23/11 for the rest

Solids - Bottles have 8/11/11, chain has 5/23/11.

Please let us know which date should be used. Also, please note that the samples were received at 9 degrees. Please confirm if you would like for us to proceed.

Thanks,
Ricky

--
 Ricky Albee
 Project Manager
 GEL Laboratories, LLC
 2040 Savage Road
 Charleston, SC (USA) 29407
 Main: 843.556.8171 x4443
 Direct: 843.852.5815
 Fax: 843.766.1178
 E-mail: richard.albee@gel.com
 Web: www.gel.com

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Distribution:

Name:	Location:	Name:	Location:
J.L. Adams	704-14Z	S.L. Marra	773-A
P.M. Almond	773-43A	D.J. Martin	241-246H
A.B. Barnes	999-W	P.W. Norris	704-Z
P.L. Bovan	704-27S	A.B. Osteen	704-Z
A.R. Carter	704-14Z	J.E. Occhipinti	704-S
N.F. Chapman	766-H	E. Patten	704-Z
A.D. Cozzi	999-W	F.M. Pennebaker	773-42A
D.A. Crowley	773-43A	J.W. Ray	704-S
C.E. Duffey	704-61H	M.M. Reigel	999-W
A.D. England	704-14Z	L.B. Romanowski	766-H
S.D. Fink	773-A	E.R. Seldon	704-Z
E.J. Freed	704-56H	A.R. Shafer	704-27S
B.J. Giddings	786-5A	D.C. Sherburne	704-S
J.C. Griffin	773-A	F.M. Smith	705-1C
C.C. Herman	999-W	A.V. Staub	704-Z
P.J. Hill	766-H	B.C. Terry	735-B
C.A. Langton	773-43A	A.W. Wiggins	704-61H
J.N. Leita	704-30S	W.N. Wilson	773-43A
K.R. Liner	704-S	W.R. Wilmarth	773-A
M.J. Mahoney	766-H		