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## Saltstone 1QCY11 TCLP Results

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## **EXECUTIVE SUMMARY**

A Saltstone waste form was prepared in the Savannah River National Laboratory (SRNL) from a Tank 50H sample and Z-Area premix material for the first quarter of calendar year 2011 (1QCY11). After the prescribed 28 day cure, samples of the saltstone were collected, and the waste form was shown to meet the South Carolina Hazardous Waste Management Regulations (SCHWMR) R.61-79.261.24 and R.61-79.268.48(a) requirements for a nonhazardous waste form with respect to RCRA metals and underlying hazardous constituents. These analyses met all quality assurance specifications of USEPA SW-846.

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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
DL	Detection Limit
DSS-HT	Decontaminated Salt Solution Hold Tank
ESS-WP	Environmental Services Section – Waste Programs
ETP	Effluent Treatment Project
ICP-MS	Inductively Coupled Plasma – Mass Spectrometer
ISWLF	Industrial Solid Waste Landfill
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
RL	Reporting Limit
RPD	Relative Percent Differences
SCDHEC	South Carolina Department of Health and Environmental Control
SCHWMR	South Carolina Hazardous Waste Management Regulations
SDF	Saltstone Disposal Facility
SDG	Sample Delivery Group
SPF	Saltstone Production Facility
SRNL	Savannah River National Laboratory
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. In the first quarter of the 2011 calendar year (1QCY11), Tank 50H accepted transfers of approximately 15 kgal from the Effluent Treatment Project (ETP), approximately 15 kgal from Tank 710—the H-Canyon General Purpose Evaporator, approximately 73 kgal from the H-Canyon Super Kukla campaign, approximately 285 kgal from the Actinide Removal Process / Modular Caustic Side Solvent Extraction Unit (ARP/MCU) Decontaminated Salt Solution Hold Tank (DSS-HT), and approximately 21 kgal from other sources.

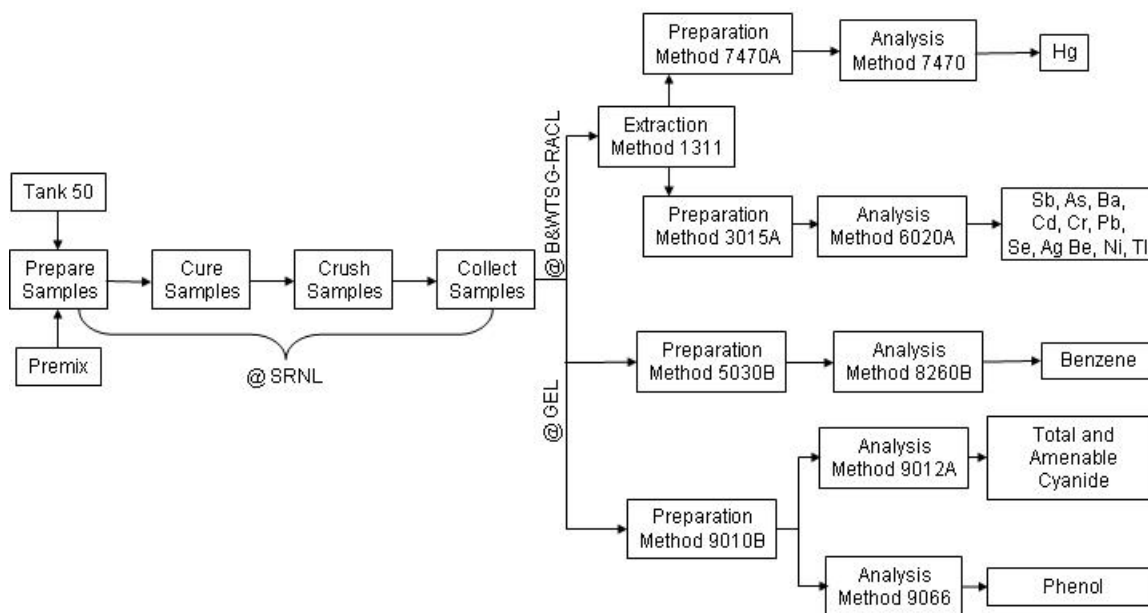
The Saltstone Grout Sampling plan provides the South Carolina Department of Health and Environmental Control (SCDHEC) with the chemical and physical characterization strategy for the salt solution which is to be disposed of in the Z-Area Solid Waste Landfill (SWLF)<sup>1</sup>. During operation, samples were collected from Tank 50H and grout samples prepared to determine the non-hazardous nature of the grout to meet the requirements of the South Carolina Hazardous Waste Management Regulations (SCHWMR) R.61-79.261.24(b) and R.61-79.268.48(a).

Savannah River National Laboratory (SRNL) was asked to prepare saltstone from samples of Tank 50H obtained January 5, 2011 during 1QCY11 to determine the non-hazardous nature of the grout. 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)<sup>2</sup> 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.<sup>3</sup> B&W TSG-RACL provided subsamples to GEL Laboratories, LLC for analysis for the UHCs benzene, phenols and total and amenable cyanide.

## 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 the TCLP sample was taken from the quarterly Waste Acceptance Criteria (WAC) analyses performed on Tank 50H.<sup>4</sup> Table 2-1 lists the concentration of TCLP metals of interest in the salt solution from the WAC analysis<sup>4</sup> for the sample. As shown in Table 2-1, the contents of Tank 50H exceed the regulatory limits for antimony, chromium, mercury, phenol, and thallium, and therefore must be treated and disposed of in a non-hazardous waste form. Table 2-2 contains the parameters used to prepare the TCLP sample.<sup>5</sup>

Saltstone samples for TCLP were prepared with the Tank 50H blended salt solution and a premix of cement, slag, and fly ash. Figure 2-1 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 polypropylene 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 days\* — 46 days for the 1Q11 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.<sup>2</sup> 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.”<sup>6</sup> 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 totals analysis for the UHCs benzene, phenol and total and amenable cyanide.

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

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

-	Sample Results (mg/L) <sup>4</sup>	Regulatory Limits (mg/L)
-	1Q11	Toxicity <sup>a</sup>
As	< 0.119	5
Ba	<0.683	100
Cd	<0.908	1
Cr	47.9	5
Pb	<0.583	5
Hg	16.1	0.2
Se	<0.238	1
Ag	<2.02	5
--	--	<b>UHC<sup>b</sup></b>
Sb	<7.44	1.15
Be	<0.119	1.22
Ni	10.1	11
Tl	< 0.269	0.20
-	-	<b>(mg/kg)</b>
benzene	< 0.150	10
phenol	< 10.0	6.2
cyanide (total)	NM	590
cyanide (amenable)	NM	30

NM – Not Measured

<sup>a</sup> SCHWMR R.61-79.261.24(b) “Characteristic of Toxicity.”

<sup>b</sup> SCHWMR R.61-79.268.48 “Universal Treatment Standards.”

**Table 2-2. Customer Recommended Values for Preparation of TCLP Sample.**

Parameter	1Q11
Water-to-Premix ratio	0.60
(Daratard 17) gal/Ton premix	0.00
(Dow Corning Q2-1383A) gal/Ton premix	0.15

## Saltstone Mix Data Sheet

<b>MIX #</b> 0121		<b>Date:</b> 2/4/2011	
<b>Material</b>	<b>%</b>	<b>WT%</b>	<b>Grams</b>
<b>Waste Solution:</b> Tank 50 1/6/11 1Q11 <b>Wt% Solids #</b> 24.43 <b>Grams Water</b> 164.60		44.19	217.81
<b>Admixture:</b> Q2 Antifoam*		0.03	0.08
<b>Admixture:</b> _____			
<b>Admixture:</b> _____			
<b>Premix</b>		55.79	275.00
<b>Cement (% of Premix)</b>	10	5.58	27.50
<b>Slag (% of Premix)</b>	45	25.11	123.75
<b>Fly Ash (% of Premix)</b>	45	25.11	123.75
<b>Total</b>	100	100.01	492.89
<b>Water to Premix Ratio</b>	0.60		
<b>Calculations:</b> 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.			

Figure 2-2. Data sheet for the Saltstone mix used to prepare the 1Q11 TCLP sample.<sup>5</sup>

## 2.2 Saltstone Testing

Saltstone testing was performed by B&W TSG-RACL and GEL Laboratories, LLC. Activities associated with the 1QCY11 saltstone 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 samples arrived at B&W TSG-RACL, Lynchburg, Virginia on March 11, 2011 for analysis. Shipping container temperatures were documented to be within specifications. 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.

A portion of the leachate from the first quarter sample was used as the quality control sample (matrix spike) for the ICP-MS and CVAA.

### 2.2.2 *GEL Laboratories, LLC*

The subsamples arrived at GEL Laboratories, LLC, Charleston, South Carolina on March 22, 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 method 8260B analysis was performed with an HP6890/HP5973 gas chromatograph/mass spectrometer using a J&W DB-624 column. Methods 9012A and 9066 were performed using a Lachat QuickChem FIA+ 8000 Series.

### 3.0 Results and Discussion

Results summarized in the following tables are from the data package for these analyses.<sup>7</sup> Data is presented in these results as reported by the vendors.

#### 3.1 B&W TSG-RACL

Analytes detected but at concentrations too low to determine quantitatively have been flagged with the “B” qualifier. Analytes that were not detected have been flagged with the “U” qualifier. 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.

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, silver, nickel, and thallium were detected below the QLs.
- Arsenic, barium, chromium, lead, mercury, and selenium were detected in the leachates at concentrations above the QLs.

**Table 3-1. TCLP Leachates RCRA Metal Concentrations, DLs, and QLs.**

-	Methods	Sample Limits (µg/L)	Sample Limits (µg/L)	Sample Results (µg/L)
<b>SRS ID</b>	-	-	-	<b>1Q11</b>
<b>B&amp;W ID</b>	-	<b>DL</b>	<b>QL</b>	<b>1103011-01A</b>
<b>Sb</b>	3015, 6020A	0.13	11.1	<sup>B</sup> 4.5
<b>As</b>	3015, 6020A	0.10	5.55	69.7
<b>Ba</b>	3015, 6020A	0.44	55.5	<sup>N*</sup> 65.5
<b>Cd</b>	3015, 6020A	0.11	5.55	<sup>B</sup> 1.0
<b>Cr</b>	3015, 6020A	0.31	11.1	19.7
<b>Pb</b>	3015, 6020A	0.48	5.55	<sup>N*</sup> 5.9
<b>Hg</b>	7470A	0.07	0.200	<sup>E</sup> 9.0
<b>Se</b>	3015, 6020A	0.24	27.8	<sup>E</sup> 139
<b>Ag</b>	3015, 6020A	0.06	5.55	<sup>B,N,*</sup> 0.27
<b>Be</b>	3015, 6020A	0.16	5.55	<sup>U</sup> 0.16
<b>Ni</b>	3015, 6020A	1.6	5.55	<sup>B</sup> 4.8
<b>Tl</b>	3015, 6020A	0.21	5.55	<sup>B</sup> 0.28

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

<sup>U</sup> Final concentration of the analyte was found to be below the DL.

<sup>B</sup> Analyte is present at a concentration above the DL but less than the QL

<sup>N</sup> Associated Matrix Spike is outside percent recovery quality control criteria.

\* Associated Duplicate is outside relative percent difference quality control criteria

<sup>E</sup> Associated Serial Dilution is outside percent difference quality control criteria.

### 3.1.1 *Comparison of Results to Regulatory Limits*

Results from the TCLP leachate analyses from Table 3-1 are replicated in Table 3-2 — with units changed from µg/L to mg/L—along with the regulatory limits that may be applied to the Saltstone waste form. Table 3-2 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 Regulations<sup>†</sup> also have been included in Table 3-2. By comparing the sample results and the regulatory limits in, 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.

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<sup>†</sup> 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. Saltstone TCLP Results and Corresponding Regulatory Limits.**

-	Sample Results (mg/L)	Regulatory Limits		
SRS ID	1Q11	Toxicity <sup>a</sup>	UTS <sup>b</sup>	MCL <sup>c</sup>
B&W ID	1103011-01A	(mg/L)	Nonwastewater Standard (mg/L TCLP)	(mg/L)
<b>Sb</b>	<sup>B</sup> 4.5E-03	-	1.15	0.006
<b>As</b>	6.97E-02	5	5	0.010
<b>Ba</b>	<sup>N*</sup> 6.55E-02	100	21	2
<b>Cd</b>	<sup>B</sup> 1.0E-03	1	0.11	0.005
<b>Cr</b>	1.97E-02	5	0.6	0.1
<b>Pb</b>	<sup>N*</sup> 5.9E-03	5	0.75	0.015 <sup>d</sup>
<b>Hg</b>	<sup>E</sup> 9.0E-03	0.2	0.025	2E-03
<b>Se</b>	<sup>E</sup> 1.39E-01	1	5.7	0.05
<b>Ag</b>	<sup>B,N,*</sup> 2.7E-04	5	0.14	0.1 <sup>e</sup>
<b>Be</b>	<sup>U</sup> 1.6E-04	-	1.22	4E-03
<b>Ni</b>	<sup>B</sup> 4.8E-03	-	11	-
<b>Tl</b>	<sup>B</sup> 2.8E-04	-	0.20	2E-03

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

<sup>U</sup> Final concentration of the analyte was found to be below the DL.

<sup>B</sup> Analyte is present at a concentration above the DL but less than the QL.

<sup>N</sup> Associated Matrix Spike is outside percent recovery quality control criteria.

\* Associated Duplicate is outside relative percent difference quality control criteria

<sup>E</sup> Associated Serial Dilution is outside percent difference quality control criteria.

<sup>a</sup> R.61-79.261.24(b) "Characteristic of Toxicity."

<sup>b</sup> R.61-79.268.48 "Universal Treatment Standards."

<sup>c</sup> SCDHEC State Primary Drinking Water Regulation Maximum Contaminant Levels.

<sup>d</sup> Lead action level from SCDHEC 61-58.11.B.

<sup>e</sup> Secondary drinking water parameter.

### 3.1.2 Quality Assurance

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.<sup>7</sup>

### 3.1.3 Blanks

Blank concentrations are given in Table 3-3. In the TCLP Blank, none of the elements were present at levels above the quantitation limit with the exception of selenium. Antimony, arsenic, barium, chromium, lead, and nickel were present at levels above their respective DLs, but below their respective QLs. Beryllium, cadmium, mercury, silver and thallium were found to be below the DLs.

**Table 3-3. TCLP Blank.**

Analyte	TCLP Blank (µg/L)
<b>Sb</b>	<sup>B</sup> 0.18
<b>As</b>	<sup>B</sup> 1.9
<b>Ba</b>	<sup>B,N*</sup> 0.91
<b>Cd</b>	<sup>U</sup> 0.11
<b>Cr</b>	<sup>B</sup> 1.0
<b>Pb</b>	<sup>B,N*</sup> 1.8
<b>Hg</b>	<sup>U,E</sup> 0.07
<b>Se</b>	<sup>E</sup> 57.4
<b>Ag</b>	<sup>U,N*</sup> 0.06
<b>Be</b>	<sup>U</sup> 0.16
<b>Ni</b>	<sup>B</sup> 2.9
<b>Tl</b>	<sup>U</sup> 0.21

<sup>B</sup> Analyte is present at a concentration above the DL but less than the QL.

<sup>U</sup> Final concentration of the analyte was found to be below the DL.

<sup>N</sup> Associated Matrix Spike is outside percent recovery quality control criteria.

\* Associated Duplicate is outside relative percent difference quality control criteria

<sup>E</sup> Associated Serial Dilution is outside percent difference quality control criteria.

#### 3.1.4 Laboratory Control Samples

Results from the Laboratory Control Sample (LCS) are given in Table 3-4. The LCS post spike recoveries met USEPA SW-846 acceptance limits for all elements. Laboratory Control Samples are clean aqueous solutions analyzed to assure integrity of the analytical technique exclusive of matrix effects.

**Table 3-4. RCRA Metal Laboratory Control Sample**

Analyte	Laboratory Control (µg /L)		Recovery (%) (80 – 120)
	True	Measured	
-			
<b>Sb</b>	472.0	443.2	94
<b>As</b>	308.0	292.1	95
<b>Ba</b>	1350.0	1255.0	93
<b>Cd</b>	535.0	507.1	95
<b>Cr</b>	653.0	633.3	97
<b>Pb</b>	1880.0	1796.7	96
<b>Hg</b>	10.8	9.48	88.2
<b>Se</b>	446.0	432.7	97
<b>Ag</b>	405.0	383.0	95
<b>Be</b>	504.0	443.0	88
<b>Ni</b>	2110.0	2042.2	97
<b>Tl</b>	635.0	580.6	91



### 3.1.5 Matrix Spikes

Results from analysis of the matrix spike (MS) and matrix spike duplicates (MSD) are given in Table 3-5. The initial concentrations in the second column are reproduced from Table 3-1. These results show that:

- The percent recoveries (%R) obtained from the MS analyses met the recommended quality control acceptance criteria for percent recoveries (75 – 125%) for all applicable analytes with the exception of barium, lead and silver.
- The percent recoveries (%R) obtained from the MSD analyses met the recommended quality control acceptance criteria for percent recoveries (75 – 125%) for all applicable analytes with the exception of barium, lead, and silver.
- The RPD(s) between the MS and MSD met the acceptance limits (0 – 20%) with the exception of barium, lead, and silver.

**Table 3-5. TCLP Leachates RCRA Metal Matrix Spike and Duplicate Results.**

Analyte	Initial Concentrations (µg /L)		Spiked Sample (µg /L)		Recovery (%)		RPD (%)
	B&W ID 1103011- 01A	Spike Added	Spike	Spike Duplicate	Spike	Spike Duplicate	-
<b>Sb</b>	<sup>B</sup> 4.5	1000	889	899	88	89	1
<b>As</b>	69.7	500	548	566	96	99	3
<b>Ba</b>	<sup>N*</sup> 65.5	2500	720	1408	26	54	65
<b>Cd</b>	<sup>B</sup> 1.0	250	211	211	84	84	0
<b>Cr</b>	19.7	1000	909	921	89	90	1
<b>Pb</b>	<sup>N*</sup> 5.9	500	221	346	43	68	44
<b>Hg</b>	<sup>E</sup> 9.0	5.00	15.2	15.2	124	124	0
<b>Se</b>	<sup>E</sup> 139	250	380	403	97	106	6
<b>Ag</b>	<sup>B,N,*</sup> 0.27	250	10.5	16.8	4	7	46
<b>Be</b>	<sup>U</sup> 0.16	250	201	206	80	82	3
<b>Ni</b>	<sup>B</sup> 4.8	1000	829	826	82	82	0
<b>Tl</b>	<sup>B</sup> 0.28	250	258	258	103	103	0

<sup>U</sup> Final concentration of the analyte was found to be below the DL.

<sup>B</sup> Analyte is present at a concentration above the DL but less than the QL.

<sup>N</sup> Associated Matrix Spike is outside percent recovery quality control criteria.

\* Associated Duplicate is outside relative percent difference quality control criteria

<sup>E</sup> Associated Serial Dilution is outside percent difference quality control criteria.

### 3.1.6 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.

### 3.2 GEL Laboratories, LLC

GEL reports general chemistry analyses on the organics in the sample. If the concentrations of benzene, phenol and cyanide are not detected or below the detection limit (<MDL) the result is reported as “ND”. Analytes detected but at concentrations too low to determine quantitatively have been flagged with the “J” qualifier. Analytes that were not detected have been flagged with the “U” qualifier. In addition to the results, Detection Limits (DLs) and Reporting Limits (RLs) 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 3-6 are the results from this study adjusted for sample dilution. The RL is the lowest level at which an analyte may be accurately and reproducibly quantitated.

**Table 3-6. Total Concentrations, DLs, and RLs.**

-	Methods	Sample Limits (µg/kg)	Sample Limits (µg/kg)	Sample Results* (µg/kg)
<b>SRS ID</b>	-	-	-	<b>1Q11</b>
<b>GEL ID</b>	-	<b>DL</b>	<b>RL</b>	<b>274334001</b>
<b>benzene</b>	5030, 8260B	15.0	50.0	<sup>U</sup> ND
<b>phenol</b>	9010B, 9066	79.3	248	<sup>J</sup> 239
<b>cyanide (total)</b>	9010B, 9012A	79.1	247	5780
<b>cyanide (amenable)</b>	9012A	395	1240	<sup>U</sup> ND

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

<sup>U</sup> Final concentration of the analyte was found to be below the DL.

<sup>J</sup> Final concentration of the analyte was found to be below the RL and above the DL.

#### 3.2.1 Comparison of Results to Regulatory Limits

Results from the analyses from Table 3-6 are replicated in Table 3-7 — with units changed from µg/kg to mg/kg — along with the regulatory limits that may be applied to the Saltstone waste form. Table 3-7 includes the SCHWMR R.61-79.268.48 Universal Treatment Standards (UTS) for hazardous constituents. By comparing the sample results and the regulatory limits in Table 3-7, it can be concluded that for all of the analytes, the concentrations were below the Nonwastewater Standard.

**Table 3-7. Saltstone Total Results and Corresponding Regulatory Limits.**

-	Sample Results (mg/kg)	Regulatory Limits (mg/kg)
<b>SRS ID</b>	<b>1Q11</b>	<b>UTS<sup>b</sup></b>
<b>GEL ID</b>	<b>274334001</b>	
<b>benzene</b>	<sup>U</sup> ND	10
<b>phenol</b>	<sup>J</sup> 0.239	6.2
<b>cyanide (total)</b>	5.780	590
<b>cyanide (amenable)</b>	<sup>U</sup> ND	30

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

<sup>U</sup> Final concentration of the analyte was found to be below the DL.

<sup>J</sup> Final concentration of the analyte was found to be below the RL and above the DL.

<sup>b</sup> R.61-79.268.48 “Universal Treatment Standards”.

### 3.2.2 Quality Assurance

The following subsections include summaries of results 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.

### 3.2.3 Blanks

Blank concentrations are given in Table 3-8. Target and non target analytes were detected in the Method Blank below the reporting limit. Amenable to chlorination cyanide is determined by subtracting the results determined in the chlorinated cyanide test from those determined in the total cyanide test. The Method Blanks analyzed with this Sample Delivery Group (SDG) met the acceptance criteria.

**Table 3-8. Method Blank.**

Analyte	Method Blank (µg/kg)
<b>benzene</b>	<sup>U</sup> ND
<b>phenol</b>	<sup>U</sup> ND
<b>cyanide (total)</b>	<sup>U</sup> ND
<b>cyanide (amenable)</b>	--

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

<sup>U</sup> Final concentration of the analyte was found to be below the DL.

ND – Not Detectable

### 3.2.4 Laboratory Control Samples

Results from the Laboratory Control Sample (LCS) are given in Table 3-9. All LCS recoveries met the vendor laboratory acceptance. Laboratory Control Samples are clean aqueous solutions analyzed to assure integrity of the analytical technique exclusive of matrix effects.

**Table 3-9. Laboratory Control Sample.**

Analyte	Laboratory Control (µg /kg)		Recovery (%)
	True	Measured	
-			-
benzene	50.0	45.9	91.7
phenol	2500	2620   2660	105   106
cyanide (total)	67900	86300	127
cyanide (amenable)	--	--	--

### 3.2.5 Matrix Spikes

Total cyanide is the only method where a matrix spike would be applicable. The result from analysis of the matrix spike (MS) is given in Table 3-10. These results show that the percent recoveries (%R) obtained from the MS analyses met the recommended quality control acceptance criteria for percent recoveries. It is important to note that the matrix spikes were performed on a different sample than the 1Q11 Saltstone TCLP sample.<sup>‡</sup>

**Table 3-10. Matrix Spike Results.**

Analyte	Initial Concentrations (µg /kg)		Spiked Sample (µg /kg)	Recovery (%)
	GEL ID 274334001	Spike Added		
-				
cyanide	ND	5400	5400	99.2
(total)	ND	5000	4980	98.7

### 3.2.6 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.

<sup>‡</sup> This approach meets SCDHEC certification guidelines/requirements.

## Conclusions

Preparation of the 1QCY11 saltstone samples and the subsequent TCLP analyses showed that:

- The saltstone waste form disposed of in the Saltstone Disposal Facility in 1QCY11 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.
- Analyses met all quality assurance specifications of USEPA SW-846.

The saltstone waste form placed in the Saltstone Disposal Facility in 1QCY11 met the SCHWMM R.61-79.261.24(b) RCRA metals requirements for a nonhazardous waste form. The TCLP leachate concentrations were less than 5x the MCLs in SCDHEC Regulations R.61-107.19, Part I C.

The saltstone waste form placed in the Saltstone Disposal Facility in 1QCY11 met the R.61-79.268.48(a) non wastewater treatment standards.

Analyses met all USEPA SW-846 quality assurance requirements with the exception of the laboratory control sample recoveries from GEL Laboratories. All other limits on holding times, laboratory control sample recoveries, matrix spike recoveries, serial dilution results when applicable, calibration verification, and interference checks were within the quality assurance requirements.

#### 4.0 References

1. Liner, K.R., "Saltstone Grout Sampling (U)," Savannah River Site, ESH-EPG-2004-00318, 2004.
2. "Toxicity Characteristic Leaching Procedure," EPA SW-846, Procedure 1311.
3. Britt, T.E., "Assessment of Regulated Organics Under 40 CFR Part 268, Section 49, Universal Treatment Standards, Relative to SRS Tank Farm Waste," Savannah River Site, LWO-LWE-2007-00052, 2007.
4. Reigel, M.M. and Bibler, N.E., "Tables Containing Results for the First Quarter 2011 Tank 50 WAC Sample: Chemical and Radionuclide Contaminant Results," Savannah River National Laboratory, Aiken, SC, SRNL-L3100-2011-00011 Rev. 1, March 28, 2011.
5. Reigel, M.M., "Saltstone TCLP," Savannah River National Laboratory, SRNL-NB-2009-00076.
6. Liner, K.R., "Sampling and Analysis Plan for the Z-Area Industrial Solid Waste Landfill Disposal Facility During Interim Salt Waste Processing (U)," ESH-WPG-2005-00039.
7. Reigel, M.M., "Data Package From Vendor for 1QCY11 TCLP Analysis," Savannah River National Laboratory, Aiken, SC, SRNL-L3100-2011-00087, April 19, 2011.