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TANK 41H SALTSTONE REGULATORY ANALYSES

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TANK 41H SALTSTONE TCLP RESULTS

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EXECUTIVE SUMMARY

A Saltstone waste form was prepared in the Savannah River Technical Center (SRTC) shielded cells facility from a Tank 41H sample and Z-Area premix material. After a cure of at least 28 days, samples of the Saltstone were collected and characterized. Results showed that a Class 3 Industrial Solid Waste Landfill (ISWLF) would be required for disposal of this Tank 41H Saltstone waste form because of high leachate nitrate and alpha-emitting radionuclide concentrations.

1.0 INTRODUCTION

After evaluation of options for processing the Tank 41 salt solution, the SRS tank waste closure strategy may include immobilization of this salt solution in the SRS Saltstone facility. Tank 50 is the feed tank for the Saltstone process. In a separate study, the content of Tank 50 was sampled and immobilized in Saltstone. Results from characterization of this Tank 50 Saltstone have been documented as part of a separate report. Before initiating a treatment process for the Tank 41 salt solution, the technical basis is being examined for the disposition options.

Demonstration of a technical basis for immobilization of any waste stream in Saltstone requires

-demonstrating the waste stream solution can be processed at the SRS Saltstone facility
-demonstrating the Saltstone waste form will qualify as a nonhazardous radioactive waste
-demonstrating the Saltstone waste form will be compatible with the disposal facility

Processability is established when characterization of a salt solution meets the Z-Area Waste Acceptance Criteria (WAC).[1] The WAC provides limits for radionuclide and chemical constituents and for physical properties. In addition, Tank 41[2] and Tank 50[3] Saltstone have been shown to qualify as nonhazardous radioactive waste forms. By passing the Toxicity Characterization Leaching Procedure (TCLP) test for the D-Code constituents,[4] Tank 41 and 50 Saltstones have now been shown to no longer display the characteristic of metal toxicity.

Demonstrating compatibility between the waste form and the disposal facility requires that a determination be made as to whether a Class 1, 2, or 3 Industrial Solid Waste Landfill (ISWLF) is required. This is based on the leachability of constituents of potential concern (COPCs) from the waste form. Leachability is evaluated by comparison of results from TCLP analyses to SCDHEC R.61-107.16 Subpart A 16.4 Maximum Contaminant Levels (MCLs) and Primary Remediation Goals (PRGs).[5]

The objective of this report is to document results from tests performed to determine the appropriate ISWLF class for a Saltstone waste form if it were to contain Tank 41 salt solution. Results from radionuclide analyses have also been included. With the exception of radium-226, radium-228, and the total alpha emitter concentrations, these analytes are not included as COPCs in SCDHEC R61-107.16 Subpart A 16.4. Specifications for activities described in this report have been documented in the task plan for this work.[6] Tank 50 Saltstone had previously been shown to require a Class 3 ISWLF.[3]

2.0 CONDUCT OF TESTING

This chapter is a summary of the approach taken to prepare and characterize the Tank 41 Saltstone samples. The Saltstone was mixed and sampled in the SRTC shielded cells facility. Samples were characterized at the BWXT Services, Inc. (BWXS) laboratory facility in Lynchburg, Virginia. BWXS is a division of BWX Technology, Inc. (BWXT). Figure 1 is a flowchart of the steps taken to prepare and characterize the Saltstone samples.

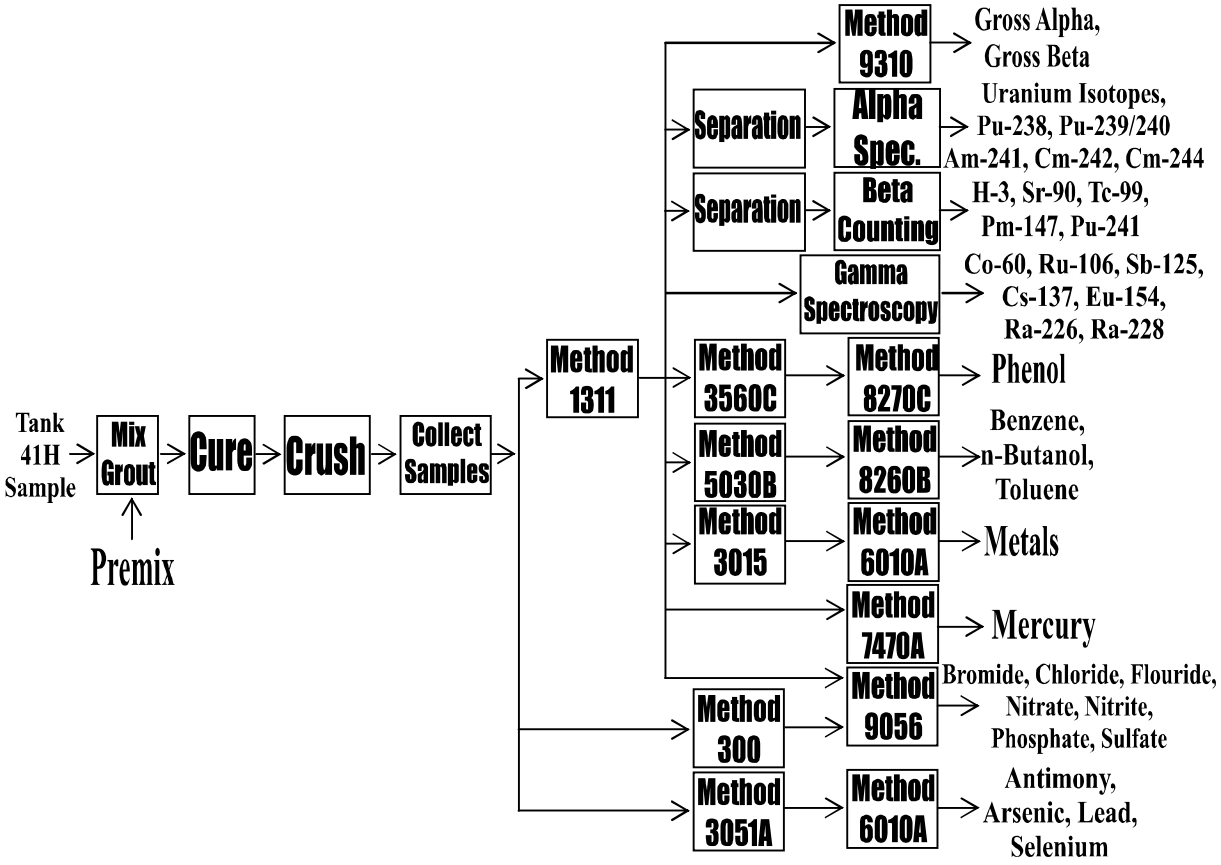


Figure 1. Flowchart of Tank 41H Saltstone Preparation and Characterization Activities

2.1 Saltstone Preparation

Activities associated with preparation of the Saltstone samples were

-collection of a three-liter sample from Tank 41
-mixing of Tank 41 dissolved salt with grout-forming additives
-casting the Tank 41 Saltstone in forms for curing
-size reduction of the cured Saltstone and sample collection
-packaging and shipping of samples to BWXS

On August 25, a 3-liter sample of salt solution was collected from Tank 41H and shipped to SRTC. The sample was transferred into the SRTC shielded cells facility where Saltstone samples were prepared from the salt solution, and a premix of cement, slag and fly ash as shown in Figure 2. To accomodate other BWXS commitments and to ensure that the Tank 41 Saltstone samples did not exceed the USEPA SW-846 specified sample holding times, samples were allowed to cure for 32 days instead of 28 days. On September 29, Saltstone samples were crushed to generate material of particles with maximum diameters of less than 0.9 centimeter (3/8 inch). To minimize radiation exposure during sample leaching and subsequent leachate preparation and analysis, BWXS requested samples be aliquoted in the SRTC shielded cells facility prior to shipment. The size-reduced material was divided into samples as described in Table 1.

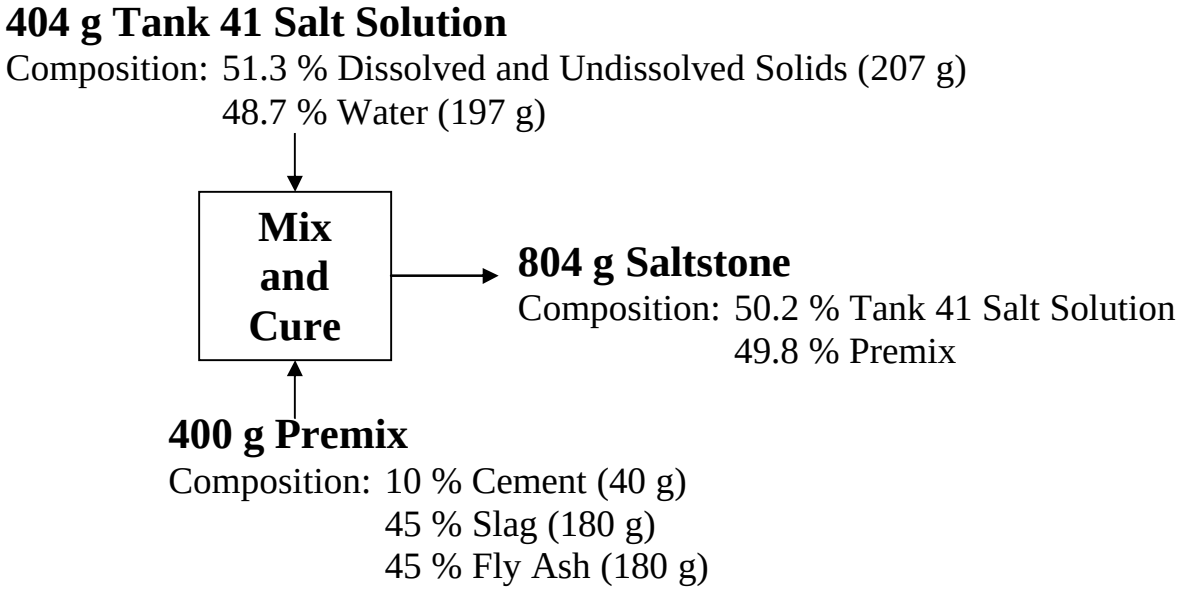


Figure 2. Components Used to Prepare the Tank 41H Saltstone Grout Samples (Water to Premix Ratio (w/c) of 0.49)

2.2 Saltstone Testing

Saltstone testing was performed by BWXS. The crushed Tank 41 Saltstone samples were first leached according to TCLP which is USEPA SW-846 Method 1311.[7] Because of interferences, analyses were not successful at demonstrating that the leachate concentrations of fluoride was beneath the SCDHEC MCL. In addition, because instrumentation was not available to perform antimony, arsenic, lead and selenium analyses by the more sensitive atomic absorption methods, analyses were not successful at demonstrating the leachate concentrations of these analytes were beneath the SCDHEC MCLs. Therefore, the total concentrations of these five analytes were determined in the Tank 41 waste form in order to demonstrate their concentrations were low enough that the MCLs could not be exceeded.

Table 1. Description of Tank 41H Saltstone Grout Samples

SRS Sample ID	Mass (g)	Purpose of Sample
41-TR1	25.546	TCLP Leachate Metals and Radionuclide Analyses
41-TR2	25.413	TCLP Leachate Metals and Radionuclide Analyses
41-TR3	25.674	TCLP Leachate Metals and Radionuclide Analyses
41-TM1	10.285	TCLP Leachate Anion and Mercury Analyses
41-TM2	10.552	TCLP Leachate Anion and Mercury Analyses
41-TM3	10.391	TCLP Leachate Anion and Mercury Analyses
41-TM4	10.894	Back-up Sample
41-TM5	11.003	TCLP Leachate Anion Matrix Spike
41-TV1	4.157	TCLP Leachate Volatile Organic Compound Analyses
41-TV2	4.099	TCLP Leachate Volatile Organic Compound Analyses
41-TV3	4.371	TCLP Leachate Volatile Organic Compound Analyses
41-TV4	4.449	TCLP Leachate Volatile Organic Compound Matrix Spike
41-TV5	4.611	TCLP Leachate Volatile Organic Compound Matrix Spike Duplicate
41-WA1	1.071	Grout Total Anion Analyses
41-WA2	1.241	Grout Total Anion Analyses
41-WA3	1.834	Grout Total Anion Analyses
41-WA4	1.261	Back-up Sample
41-WA5	1.101	Back-up Sample
41T-E1	10.719	Grout Antimony, Arsenic, Lead, and Selenium Analyses

2.2.1 TCLP Analyses

To determine compliance of the Tank 41 Saltstone waste form, TCLP (Method 1311) was performed and the leachate analyzed. TCLP leachates were treated and analyzed as follows:

-digestion and analysis of leachates for metal COPCs
-analysis of leachates for anion COPCs
-pretreatment and analysis of leachates for organic COPCs
-separation and analysis of leachate for radionuclide analytes

On October 1, BWXS received the samples and started the TCLP extraction according to USEPA SW-846[7] Method 1311. The only exception taken to the method was use of small samples (1 to 25 grams) instead of the specified 100-gram samples. To retain the integrity of the method, the extraction was performed with "...an amount of extraction fluid equal to 20 times the weight of the solid phase."[7] Semivolatile and volatile extractions were performed. The resulting leachates were filtered and pH-adjusted according to Method 1311. Table 1 shows which samples were used in each analysis.

Aliquots from the Method 1311 leachates were prepared and analyzed according to the methods shown in Figure 1 and outlined in Table 2. In addition to the sample leachates, standard quality control samples were prepared and analyzed. These included matrix spikes, matrix spike duplicates, replicates, laboratory control samples, initial and continuing calibration standards and blanks, method blanks, digestion blanks, extraction blanks, internal standards, and mass spectrometer tune checks.

Table 2. Summary of TCLP Extractions, Preparation Methods, and Analytical Methods

Analyte	**Extraction**	**USEPA SW-846 Method**	
		Preparation	**Analysis**
Metals	Semivolatile	3015	6010B
Mercury	Semivolatile	7470A	7470A
Anions	Semivolatile	None	9056
Phenol	Semivolatile	3560C	8270C
Benzene, n-Butanol, Toluene	Volatile	5030B	8260B
Gross Alpha and Beta	Semivolatile	None	9310
Alpha-Emitting Radionuclides	Semivolatile	Separations	Alpha Spectroscopy
H-3, Sr-90, Tc-99, Pm-147, Pu-241	Semivolatile	Separations	Beta Liquid Scintillation
Gamma-Emitting Radionuclides	Semivolatile	Separations	Gamma Spectroscopy

Preparations and analyses were performed according to USEPA SW-846 methods. Although antimony, arsenic, lead, and selenium would have been analyzed by USEPA SW-846 atomic absorption methods (Methods 7041, 7060A, 7421, and 7740 for antimony, arsenic, lead, and selenium, respectively) instrumentation difficulties mandated use of results from the USEPA SW-846 ion-coupled plasma-atomic emission spectroscopy method (Method 6010B). In addition, because of difficulties with the anion matrix spike analyses, only matrix spike duplicate results have been reported. Precision has been verified by the deviation between samples rather than between the matrix spike and matrix spike duplicate.

2.2.2 Grout Analyses

The total antimony, arsenic, lead, selenium, and anions were determined in the grout. Table 3 is a summary of the methods used. Samples were treated and analyzed as follows:

-Digestion of grout samples for metals analyses

-Analysis of digested grout samples for antimony, arsenic, lead, and selenium
-Leaching of grout samples for anions analyses
-Analysis of grout leachate for anions

Table 3. Summary of Methods Used to Analyze Total Concentrations in the Grout

Analyte	**USEPA SW-846 Method**	
-	**Preparation**	**Analysis**
Antimony, Arsenic, Lead, and Selenium	3051	6010B
Anions	[1]EPA Method 300	9056

[1]This is a standard USEPA method but is not one of the USEPA SW-846 methods.[8]

For the antimony, arsenic, lead, and selenium analyses, two aliquots were taken from Sample 41-TE1. These aliquots were digested using USEPA Method 3051. In addition to the nitric acid specified in Method 3051, hydrochloric acid was used in the digestion. Because of limited sample availability, triplicate aliquots were not available. The resulting duplicate digested samples were analyzed according to Method 6010B.

Aliquots from the Method 3051 digested samples were analyzed using Method 6010B. In addition to the sample leachates, standard quality control samples were prepared and analyzed. These included a matrix spike, matrix spike duplicate, laboratory control samples, post spike, initial and continuing calibration standards and blanks, a method blank and serial dilution.

In planning for these analyses, BWXS recommended additional samples be supplied for anion determinations in anticipation of acetate interference issues. Samples 41-WA1, 41-WA2, 41-WA3, 41-WA4, and 41-WA5 were provided for this purpose. These samples were leached according to EPA Method 300. Although not a USEPA SW-846 method, this is a standard USEPA method for quantitatively leaching water soluble anions from a sample. Samples 41-WA4 and 41-WA5 were to be used as a matrix spike and matrix spike duplicate.

Aliquots from the EPA Method 300 leachates were analyzed using Method 9056. In addition to the sample leachates, standard quality control samples were prepared and analyzed. These included laboratory control samples, initial and continuing calibration standards and blanks, and a method blank. Due to an oversight, neither a matrix spike and nor a matrix spike duplicate was prepared.

3.0 DISCUSSION

Results from the analyses have been presented in this chapter. Results were summarized from the data package for these analyses. For analytes detected at concentrations too low to determine quantitatively, results have been flagged with the standard data qualifiers. For analytes that were not detected, Method Detection Limits (MDLs) or Estimated Quantitation Limits (EQLs) have been given preceded by "<". When average values were reported in this chapter, uncertainties were given as standard deviations of the triplicate results.

3.1 Metals

Results have been presented in this section for analysis of metal COPCs in the TCLP leachate and of the total concentrations of antimony, arsenic, lead, and selenium in the Tank 41 Saltstone samples. Because antimony, arsenic, lead, and selenium could not be measured to concentrations below the MCLs, grout samples were digested, and the total concentrations of these four COPCs were determined. Results have been compared to the minimum concentration that would need to be present to exceed the MCLs during a TCLP analysis.

3.1.1 Analysis of Metals in TCLP Leachate

Results from TCLP leachate analyses have been given in Table 4. In general, results were consistent with expected values. As shown in Table 4, some analytes were detected in at least one of the blanks at concentrations similar to the sample results. USEPA Contract Laboratory Program (CLP) guidelines[9] indicate that when a COPC is detected in one of the blanks and in one of the samples, the sample result can be reported as a "nondetect" if the sample result is less than five times the concentration detected in the blank. Application of the CLP 5x rule would identify these sample results as "nondetects". Blank results have been given in Subsection 3.1.2.1.

3.1.2 Quality Assurance for Analysis of Metals in TCLP Leachate

The following subsections include summaries of results from blanks, matrix spikes, matrix spike duplicates, laboratory control samples, and post spikes. The data package for this task also includes data for calibration verifications, low level concentration standards, interference checks, serial dilutions, instrument detection limits, interelement correction factors, linear range analysis and concentrations that were used for determining the recoveries.

3.1.2.1 Blanks

Blank concentrations have been given in Table 5. Several analytes were detected at concentrations too low to be considered quantitative. The high sodium concentration in the extraction blank was expected because results of the TCLP extraction fluid determination section identified the appropriate extraction fluid to be Extraction Fluid 1. Extraction Fluid 1 is a pH 4.93 buffer made from acetic acid and sodium hydroxide. Barium and zinc were detected above the EQL in the extraction blank but at trace levels. Beryllium was also detected above the EQL but at trace levels in some calibration blanks. Results were flagged if blank concentrations were high enough to apply the CLP[9] 5x rule.

3.1.2.2 Matrix Spikes, Laboratory Control Samples, and Post Spikes

Results from the matrix spike, matrix spike duplicate, laboratory control samples, and post spike have been given in Table 6. All matrix spike and matrix spike duplicate recoveries met specifications except for aluminum and iron. All relative percent differences between matrix spikes and matrix spike duplicates met specifications. All post spike results were acceptable

except lithium. Although two laboratory control samples have been given in Table 6, PB MS 640-45 was the applicable laboratory control sample for all analytes except mercury. For mercury, LCS P093-500 640-88 was the applicable laboratory control sample. The recovery for this laboratory control sample has also been given in Table 6.

Table 4. TCLP Leachate Metal Concentrations, MDLs, and EQLs

-	Limits (mg/L)				Sample Results (mg/L)			
-	Regulatory		Analytical Limits		Sample 1	Sample 2	Sample 3	Average
-	MCL	PRG	[1]MDL	[1]EQL	-	-	-	-
Date	-	-	-	-	9/29/03	9/29/03	9/29/03	-
SRS ID	-	-	-	-	41-TR1	41-TR2	41-TR3	-
BWXS ID	-	-	-	-	0310002-17	0310002-18	0310002-19	-
As	0.01	-	0.012	0.12	<0.012	[B]0.021	[B]0.016	[B]0.018±0.0050
Ba	2	-	$1.2x10^{-3}$	0.012	[Y]0.122	[Y]0.110	[Y]0.152	[Y]0.128±0.022
Cd	$5x10^{-3}$	-	$1.6x10^{-3}$	0.016	$<1.6x10^{-3}$	[YB]$2.78x10^{-3}$	[YB]$2.11x10^{-3}$	[YB]$2.4±0.67x10^{-3}$
Cr	0.1	-	$3.2x10^{-3}$	0.032	[B]0.0268	[B]0.0276	[B]0.0274	[B]0.0272±0.00042
Pb	0.015	-	0.028	0.28	<0.028	<0.028	<0.028	<0.028
Hg	$2x10^{-3}$	-	$1.4x10^{-4}$	$1.4x10^{-3}$	$<1.4x10^{-4}$	[YB]$1.8x10^{-4}$	[YB]$8.1x10^{-4}$	[YB]$5±6x10^{-4}$
Se	0.05	-	0.028	0.28	[B]0.156	[B]0.150	[B]0.163	[B]0.156±0.0065
Ag	0.1	-	$5.4x10^{-3}$	$5.4x10^{-2}$	$<5.4x10^{-3}$	$<5.4x10^{-3}$	$<5.4x10^{-3}$	$<5.4x10^{-3}$
Al	-	36	0.030	0.30	[YBN]0.30	[YBN]0.16	[YBN]0.75	[YBN]0.40±0.31
Sb	$6x10^{-3}$	-	0.028	0.28	<0.028	<0.028	<0.028	<0.028
Be	$4x10^{-3}$	-	$1.7x10^{-4}$	$1.7x10^{-3}$	$<1.7x10^{-4}$	$1.1x10^{-3}$	$<1.7x10^{-4}$	$1.1x10^{-3}$
B	-	3.3	0.018	0.18	0.517	0.483	0.370	0.46±0.077
Co	-	2.2	$2.6x10^{-3}$	0.026	$<2.6x10^{-3}$	$<2.6x10^{-3}$	$<2.6x10^{-3}$	$<2.6x10^{-3}$
Cu	1.3	-	$5.9x10^{-3}$	0.059	$<5.9x10^{-3}$	$<5.9x10^{-3}$	$<5.9x10^{-3}$	$<5.9x10^{-3}$
Fe	0.3	-	$5.1x10^{-3}$	0.051	[YBN]0.044	[YN]0.071	[YN]0.098	[YBN]0.071±0.027
Li	-	0.73	0.011	0.11	0.763	0.766	0.710	0.75±0.032
Mn	0.05	-	$1.2x10^{-3}$	0.012	[Y]$3.8x10^{-3}$	[Y]$2.9x10^{-3}$	[Y]0.0127	[YB]$6.5±5.4x10^{-3}$
Mo	-	0.18	0.023	0.23	0.486	0.484	0.442	0.47±0.024
Ni	-	0.73	$6.9x10^{-3}$	0.069	$<6.9x10^{-3}$	$<6.9x10^{-3}$	$<6.9x10^{-3}$	$<6.9x10^{-3}$
K	-	-	0.13	1.3	61.3	60.7	57.7	60±1.9
Na	-	-	0.028	0.28	[Y]$3.96x10^{3}$	[Y]$3.94x10^{3}$	[Y]$3.66x10^{3}$	[Y]$3.9±0.17x10^{3}$
Si	-	-	0.029	0.29	35.9	37.6	38.1	37±1.2
Sr	-	22	$1.3x10^{-3}$	0.013	0.957	0.912	1.02	0.96±0.054
Zn	5	-	$4.0x10^{-3}$	0.040	$<4.0x10^{-3}$	[Y]0.052	$<4.0x10^{-3}$	[Y]0.052

- Indicates a location in the table for which an entry would not be appropriate.
[1] MDLs were from USEPA SW-846 MDL studies with standards in water. EQLs were estimated as ten times the MDLs.
[B] Analyte is present at a concentration above the MDL but less than the EQL.
[N] The matrix spike and matrix spike duplicate recoveries for these analytes were not within specified QA limits.
[Y] Application of the CLP 5x rule would make this result a "nondetect" due to similar concentrations in the extraction blank.

3.1.3 Analysis of Antimony, Arsenic, Lead, and Selenium in Tank 41 Saltstone Samples

Results from analysis of the digested Tank 41 grout have been given in Table 7 for the analysis of antimony, arsenic, lead, and selenium. The MCLs given in Table 7 are the concentrations in the grout that would produce a TCLP leachate equal to the SCDHEC MCLs if all of the COPC were to be leached during a TCLP. Lead and selenium results indicated that these COPCs were present at concentrations greater than the MCLs. Because the selenium results were so close to the detection limits and because selenium was not detected in the Tank 41 salt solution,[10] the selenium results are suspect and may have been caused

from interference by another analyte. Antimony and arsenic were determined to be below the MDLs; however, the MDLs were not low enough to establish whether the analytes were present in concentrations above the MCLs. Results from the blank analyses have been given in Table 8. In addition, recoveries and RPDs have been given in Table 9.

Table 5. TCLP Leachate Metals Preparation and Calibration Blank Results

Analyte	Preparation Blanks (mg/L)		Calibration Blanks (mg/L)					
-	Digestion	Extraction	Initial	Continuing				
-	-	-	-	1	2	3	4	5
As	<0.011	<0.011	<0.011	<0.011	<0.011	<0.011	<0.011	<0.011
Ba	$<1.1x10^{-3}$	$^{Y}0.0246$	$<1.1x10^{-3}$	$<1.1x10^{-3}$	$<1.1x10^{-3}$	$<1.1x10^{-3}$	$<1.1x10^{-3}$	$<1.1x10^{-3}$
Cd	$^{B}2.2x10^{-3}$	$^{YB}1.6x10^{-3}$	$^{B}1.8x10^{-3}$	$^{B}2.5x10^{-3}$	$^{B}3.4x10^{-3}$	$^{B}1.4x10^{-3}$	$^{B}5.0x10^{-3}$	$^{B}2.8x10^{-3}$
Cr	$<2.9x10^{-3}$	$^{B}4.0x10^{-3}$	$^{B}3.5x10^{-3}$	$^{B}4.7x10^{-3}$	$<2.9x10^{-3}$	$<2.9x10^{-3}$	$^{B}6.0x10^{-3}$	$^{B}5.0x10^{-3}$
Pb	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Hg	$<7x10^{-5}$	$^{YB}1.2x10^{-4}$	$<7x10^{-5}$	$<7x10^{-5}$	$<7x10^{-5}$	-	-	-
Se	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Ag	$<4.9x10^{-3}$	$^{B}5.2x10^{-3}$	$^{B}5.0x10^{-3}$	$<4.9x10^{-3}$	$<4.9x10^{-3}$	$<4.9x10^{-3}$	$<4.9x10^{-3}$	$<4.9x10^{-3}$
Al	$^{B}0.049$	$^{YB}0.096$	<0.027	<0.027	<0.027	<0.027	<0.027	<0.027
Sb	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Be	$<1.5x10^{-4}$	$^{B}2.0x10^{-4}$	$^{B}9.0x10^{-4}$	$1.6x10^{-3}$	$2.0x10^{-3}$	$^{B}8.0x10^{-4}$	$3.3x10^{-3}$	$^{B}1.4x10^{-3}$
B	<0.016	<0.15	<0.016	<0.016	<0.016	<0.016	-	-
Co	$<2.3x10^{-3}$	$<2.3x10^{-3}$	$<2.3x10^{-3}$	$<2.3x10^{-3}$	$<2.3x10^{-3}$	$<2.3x10^{-3}$	$<2.3x10^{-3}$	$<2.3x10^{-3}$
Cu	$<5.3x10^{-3}$	0.020	$<5.3x10^{-3}$	$<5.3x10^{-3}$	$<5.3x10^{-3}$	$<5.3x10^{-3}$	-	-
Fe	$<4.6x10^{-3}$	$^{YB}0.045$	$<4.6x10^{-3}$	$<4.6x10^{-3}$	$<4.6x10^{-3}$	$<4.6x10^{-3}$	$<4.6x10^{-3}$	$<4.6x10^{-3}$
Li	$<9.7x10^{-3}$	$<9.7x10^{-3}$	$<9.7x10^{-3}$	$<9.7x10^{-3}$	$<9.7x10^{-3}$	$<9.7x10^{-3}$	-	-
Mn	$<1.1x10^{-3}$	$^{YB}6.0x10^{-3}$	$^{B}1.6x10^{-3}$	$^{B}1.4x10^{-3}$	$^{B}1.6x10^{-3}$	$<1.1x10^{-3}$	$^{B}3.2x10^{-3}$	$^{B}1.6x10^{-3}$
Mo	<0.021	<0.021	$^{B}0.027$	<0.021	<0.021	<0.021	-	-
Ni	$<6.2x10^{-3}$	$<6.2x10^{-3}$	$<6.2x10^{-3}$	$<6.2x10^{-3}$	$<6.2x10^{-3}$	$<6.2x10^{-3}$	$<6.2x10^{-3}$	$<6.2x10^{-3}$
K	<0.12	$^{B}0.35$	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12
Na	$^{B}0.035$	$^{Z}1.318x10^{3}$	$^{B}0.036$	$^{B}0.026$	$^{B}0.065$	$^{B}0.042$	$^{B}0.054$	$^{B}0.032$
Si	0.457	0.451	<0.026	<0.026	<0.026	<0.026	-	-
Sr	$<1.2x10^{-3}$	0.0136	$^{B}1.6x10^{-3}$	$<1.2x10^{-3}$	$^{B}1.7x10^{-3}$	$^{B}1.9x10^{-3}$	-	-
Zn	$<3.6x10^{-3}$	$^{Y}0.0381$	$<3.6x10^{-3}$	$<3.6x10^{-3}$	$<3.6x10^{-3}$	$<3.6x10^{-3}$	$<3.6x10^{-3}$	$<3.6x10^{-3}$

- Indicates a location in the table for which an entry would not be appropriate.
[B] Analyte was present at a concentration above the MDL but less than the EQL.
[Y] Application of the CLP 5x rule to this value would indicate that the sample result should be considered a "nondetect".
[Z] The high the extraction blank sodium concentration was due to one of the TCLP leachate components (sodium hydroxide).

3.2 Anions

Toxicity Characteristic Leaching Procedure (TCLP) leachate anion concentrations from the Tank 41 Saltstone waste form have been presented in this section. Because acetate in the TCLP leachate interfered with the fluoride determination, BWXS also determined the anion concentrations in the grout waste form itself by leaching the anions from a sample using EPA Method 300 and determining the anion concentrations in this leachate.

Table 6. TCLP Metal Matrix Spikes, Laboratory Control Samples, and Post Spikes

Analyte	Matrix Spikes					Recovery (%)		
	Concentrations (mg/L)		[1]Recovery (%)		[2]RPD (%)	Laboratory Control Samples		PS
-	Sample	Spike Added	MS	MSD	-	LCS P093-500 640-88	PB MS 640-45	
As	[B]0.014	1.000	86.8	86.5	0.3	100.4	99.2	102.4
Ba	0.137	1.000	76.2	75.5	0.8	101.1	97.6	89.3
Cd	[B]$1.9x10^{-3}$	1.000	79.9	79.3	0.8	96.6	99.5	92.9
Cr	[B]0.025	1.000	78.6	78.1	0.6	111	99.7	92.1
Pb	<0.025	1.000	76.8	78.5	2.2	94.7	100.0	92.9
Hg	[B]$4.1x10^{-4}$	$5.0x10^{-3}$	106.9	105.9	0.9	107.6	-	-
Se	[B]0.15	1.000	90.4	88.5	1.8	97.7	98.5	108
Ag	<4..$9x10^{-3}$	1.000	80.9	80.5	0.5	100.7	98.3	90.6
Al	0.672	1.000	[N]31.7	[N]30.1	1.7	103.5	96.9	91.2
Sb	<0.025	1.000	86.3	86.5	0.2	90.9	99.1	101.7
Be	$<1.5x10^{-4}$	1.000	83.1	82.2	1.1	101.1	100.0	96.5
B	0.333	1.000	92.9	89.0	3.1	115	103.0	101.1
Co	$<2.3x10^{-3}$	1.000	79.2	79.1	0.2	104.1	101.0	92.4
Cu	$<5.3x10^{-3}$	1.000	83.7	82.7	1.1	133	99.5	97.3
Fe	0.0885	1.000	[N]69.0	[N]67.7	1.7	106.8	105.0	92.1
Li	0.639	1.000	113.9	114.7	0.4	-	105.0	[N]134
Mn	0.0114	1.000	76.4	75.9	0.6	97.5	97.3	90.2
Mo	0.398	1.000	96.7	93.6	2.3	113	103.0	104.6
Ni	$<6.2x10^{-3}$	1.000	79.4	79.7	0.3	103	102.0	92.9
K	51.90	10.00	[Y]60.4	[Y]54.5	1.0	-	99.3	72.0
Na	-	-	-	-	-	-	103.0	-
Si	33.69	1.000	-	-	1.8	-	102.8	-
Sr	0.915	1.000	97.9	97.0	0.5	97.2	97.6	109.4
Zn	$<3.6x10^{-3}$	1.000	85.9	85.1	0.9	98.0	99.9	90.6

- Indicates a location in the table for which an entry would not be appropriate.
[1] The acceptable range for matrix spike and matrix spike duplicate recoveries was from 75 to 125 percent.
[2] To be acceptable, RPDs had to be less than 20 %.
[B] Analyte is present at a concentration above the MDL but less than the EQL.
[N] This recovery was outside of established acceptance limits. Sample results have been flagged in previous tables.
[Y] Low value due to low spike relative to sample concentration. Since post spike was acceptable, no qualifier was warranted.

Table 7. Results from Analysis of Metals in the Digested Tank 41 Grout Samples

-	MCL (mg/kg)	Sample 1 (mg/kg)			Sample 2 (mg/kg)			Average (mg/kg)
Date	-	9/29/03			9/29/03			-
SRS ID	-	41-TE1			41-TE2			-
BWXS ID	-	0310002-01A			0310002-01A DUP			-
		[1]MDL	[1]EQL	Result	[1]MDL	[1]EQL	Result	-
As	0.2	2.3	23	[YB]11.3	2.6	26	[YB]10.5	[YB]10.9±0.80
Pb	0.3	6.4	64	[B]15.5	7.2	72	[B]19.1	[B]17±3.6
Se	0.1	5.3	53	[B]7.0	6.0	60	[B]9.9	[B]8.4±2.9
Sb	0.012	2.7	27	<2.7	3.0	30	<3.0	<2.7

- Indicates a location in the table for which an entry would not be appropriate.
[1] MDLs were from USEPA SW-846 MDL studies with standards in water. EQLs were estimated as ten times the MDLs.
[B] Analyte is present at a concentration above the MDL but less than the EQL.
[Y] Application of the CLP 5x rule would make this result a "nondetect" due to similar concentrations in the extraction blank.

Table 8. Saltstone Metals Preparation and Calibration Blank Results

Analyte	Digestion Blank (mg/L)	Calibration Blanks (mg/L)				
-	-	Initial	Continuing			
-	-	-	1	2	3	4
As	<0.014	<0.014	[YB]0.015	[YB]0.016	<0.014	<0.014
Pb	<0.037	<0.037	<0.037	<0.037	<0.037	<0.037
Se	<0.031	<0.031	<0.031	<0.031	<0.031	<0.031
Sb	<0.016	<0.016	<0.016	<0.016	<0.016	<0.016

- Indicates a location in the table for which an entry would not be appropriate.
[B] Analyte was present at a concentration above the MDL but less than the EQL.
[Y] Application of the CLP 5x rule to this value would indicate that the sample result should be considered a "nondetect".

Table 9. Saltstone Matrix Spike, Laboratory Control Sample, and Post Spike Results

Analyte	Matrix Spikes					Recovery (%)		
-	Concentrations (mg/L)		[1]Recovery (%)		[2]RPD (%)	Laboratory Control Samples		[1]PS
-	Sample	Spike Added	MS	MSD	-	Result	Control Limits	-
As	[B]0.0652	4.000	89.0	77.7	0.3	96.9	75 to 125	102.3
Pb	[B]0.0891	1.000	84.6	90.0	2.2	98.5	81 to 119	94.4
Se	[B]0.040	4.000	88.2	85.5	1.8	111.0	67 to 133	99.6
Sb	<0.016	1.000	80.5	89.8	0.2	67.8	50 to 150	100.5

- Indicates a location in the table for which an entry would not be appropriate.
[1] The acceptable range for matrix spike, matrix spike duplicate, and post spike recoveries was from 75 to 125 percent.
[2] To be acceptable, RPDs had to be less than 20 %.
[B] Analyte is present at a concentration above the MDL but less than the EQL.

3.2.1 Analysis of Anions in TCLP Leachate

Results from TCLP leachate analyses have been given in Table 10. The following conclusions can be made relative to the TCLP leachate anion analyses:

- -The MCL was exceeded for nitrate plus nitrite (as nitrogen) by more than a factor of one hundred.
- -The MCL was exceeded for sulfate by approximately a factor of two.
- -Fluoride results were elevated due to interference from acetate in the TCLP leachate.
- -No bromide, chloride, nitrite, or phosphate, were detected in the TCLP leachates.

Nitrate and sulfate concentrations exceeded the MCL. The nitrate concentrations were more than one hundred times the MCL for nitrate plus nitrite. The MCL for nitrate plus nitrite has been given in terms of nitrogen. Sulfate concentrations were approximately two times the MCL. These analyses met all QC specifications of SW-846 including requirements for matrix spike and laboratory recoveries, and precision indicators (RPD or RSD calculations).

Bromide, chloride, nitrite, and phosphate were not detected in any TCLP leachate samples. Chloride MDLs were low enough to show chloride concentrations were below the MCL. Neither bromide nor phosphate was a COPC, but these analytes are commonly reported with the other inorganic anions. Results could not be used to determine whether the TCLP leachate fluoride concentrations were below the MCL.

Table 10. TCLP Leachate Anion Concentrations, MDLs, and EQLs

-	MCL (mg/L)	Sample Limits (mg/L)		Sample Results (mg/L)			
-	-	[1]MDL	[1]EQL	Sample 1	Sample 2	Sample 3	Average
Date	-	-	-	9/29/03	9/29/03	9/29/03	-
SRS ID	-	-	-	41-TM1	41-TM2	41-TM3	-
BWXS ID	-	-	-	0310002-07A	0310002-08A	0310002-09A	-
Bromide	-	95	$2.5x10^2$	$<2.5x10^2$	$<2.5x10^2$	$<2.5x10^2$	$<2.5x10^2$
Chloride	$2.5x10^2$	25	$2.5x10^2$	$<2.5x10^2$	$<2.5x10^2$	$<2.5x10^2$	$<2.5x10^2$
Fluoride	4	12	$2.5x10^2$	[Y]$4.88x10^2$	[Y]$4.67x10^2$	[Y]$4.92x10^2$	[Y]$4.82\pm0.13x10^2$
Nitrate	-	39	$2.5x10^2$	$5.15x10^3$	$5.35x10^3$	$5.37x10^3$	$5.29\pm0.12x10^3$
Nitrite	-	52	$2.5x10^2$	$<2.5x10^2$	$<2.5x10^2$	$<2.5x10^2$	$<2.5x10^2$
[Z]**Nitrogen**	10	-	-	$1.163x10^3$	$1.209x10^3$	$1.213x10^3$	$1.19\pm0.027x10^3$
Phosphate	-	$1.4x10^2$	$2.5x10^2$	$<2.5x10^2$	$<2.5x10^2$	$<2.5x10^2$	$<2.5x10^2$
Sulfate	$2.5x10^2$	41	$2.5x10^2$	$5.07x10^2$	$5.31x10^2$	$4.48x10^2$	$5.0\pm0.43x10^2$

- Indicates a location in the table for which an entry would not be appropriate.
[1] MDLs from USEPA SW-846 studies in water. EQLs were the low calibration concentration.
[Y] Elevated fluoride concentrations due to interference with acetate from one component (acetic acid) of the TCLP leachate.
[Z] Nitrate + nitrite as nitrogen. Since nitrite was not detected, nitrogen calculation from nitrate. [nitrogen] = [nitrate] / 4.43.

3.2.2 Analysis of Anions in Tank 41 Saltstone

Results have been given in Table 11 for the total anion concentrations in the Tank 41 Saltstone samples. These concentrations were determined using a USEPA Method 300 preparation followed by a USEPA SW-846 Method 9056 (ion chromatography) analysis. Results from the grout sample analyses were consistent with results from the TCLP leachate analyses. Nitrate plus nitrite concentrations were more than one hundred times the MCL in terms of nitrogen concentration from these two analytes. Sulfate concentrations were about two times the MCL for two samples. The third sulfate result appeared to be biased low for unknown reasons and was not used in calculating the average. Fluoride concentrations were shown to be approximately one fourth the MCL.

Table 11. Tank 41 Saltstone Total Anion Concentrations and EQLs

-	MCL (mg/kg)	Sample 1 (mg/kg)		Sample 2 (mg/kg)		Sample 3 (mg/kg)		Average (mg/kg)
Date	-	9/29/03		9/29/03		9/29/03		-
SRS ID	-	41-TM1		41-TM2		41-TM3		-
BWXS ID	-	0310002-07A		0310002-08A		0310002-09A		-
-	-	EQL	Result	EQL	Result	EQL	Result	-
Bromide	-	22	<22	21	<21	23	<23	<21
Chloride	$5x10^3$	22	<22	21	<21	23	<23	<21
Fluoride	80	22	[J]21	21	<21	23	<23	[J]21
Nitrate	-	$4.35x10^3$	$1.11x10^5$	$4.2x10^3$	$1.12x10^5$	$2.3x10^3$	$8.5x10^4$	$1.1\pm0.18x10^5$
Nitrite	-	$2.2x10^2$	$4.25x10^3$	$2.1x10^2$	$4.12x10^3$	$2.3x10^2$	$3.12x10^3$	$3.8\pm0.62x10^3$
[Z]**Nitrogen**	$2x10^2$	-	$2.64x10^4$	-	$2.81x10^4$	-	$2.02x10^4$	$2.5\pm0.41x10^4$
Phosphate	-	22	<22	21	<21	23	<23	<21
Sulfate	$5x10^3$	$2.2x10^3$	$9.5x10^3$	$2.1x10^3$	$1.02x10^4$	$2.3x10^3$	[Y]$3.83x10^3$	$9.9\pm0.69x10^3$

- Indicates a location in the table for which an entry would not be appropriate.
[J] Fluoride was present in this sample at a concentration above the MDL but less than the EQL.
[Y] This sulfate result was not used in determining an average or RSD. It appears to have been biased low.
[Z] Nitrate + nitrite as nitrogen. Nitrogen calculated from nitrate and nitrite. [nitrogen] = ([nitrate] / 4.43) + ([nitrite] / 3.28).

3.2.3 Quality Assurance for Anion Analyses

Results from the matrix spike, laboratory control samples, blank analyses, and precision indicators have been given in Table 12. Anion analyses met all quality control specifications. The TCLP extraction blank fluoride concentration was similar to sample results. For sulfate, two sample results were used to determine a RPD for the grout result. The third result appeared to be errant, and was not used in determining the average sulfate concentration.

Table 12. Tank 41 Saltstone Anion Concentrations and EQLs

-	TCLP Leachate				Total Grout Sample		
-	Recovery (%)		RPD (%)	Blank (mg/L)	Recovery (%)	RSD (%)	Blank (mg/kg)
-	MS	Lab Control	-	-	Lab Control	-	-
Bromide	86	89	-	$<2.5x10^{2}$	95	-	<2.5
Chloride	92	93	-	$<2.5x10^{2}$	96	-	<2.5
Fluoride	86	88	1.2	$5.09x10^{2}$	100	-	<2.5
Nitrate	75	92	1.3	$<2.5x10^{2}$	93	17	<2.5
Nitrite	98	94	8.9	$<2.5x10^{2}$	95	16	<2.5
Phosphate	90	91	-	$<2.5x10^{2}$	95	-	<2.5
Sulfate	90	93	7.0	$<2.5x10^{2}$	96	[Z]7.0	<2.5

- Indicates a location in the table for which an entry would not be appropriate.
[Z] This value is the RPD between the two sulfate results that were used to determine the average concentration in Table 2.

3.3 Organic Compounds

Toxicity Characteristic Leaching Procedure (TCLP) leachate organic analyte concentrations from the Tank 41 Saltstone waste form have been presented in this section. These analyses showed none of the COPCs was present above the MCLs. Toluene was detected at a very low concentration in one sample (at a concentration less than the USEPA SW-846 established MDL). Although a very low concentration of benzene was detected in one sample, benzene was also detected in the extraction blank. Application of the CLP 5x rule would identify the benzene results as a "nondetect".

3.3.1 Analysis of Organic Compounds in TCLP Leachate

Results from TCLP leachate analyses have been given in Table 13. No organic analyte result was higher than the MCLs. Toluene was detected in one TCLP leachate sample at a concentration less than the EQL. For analytes not detected, the EQL has been given in Table preceded by a "<". Benzene "nondetects" have been presented as "<0.010". Although the benzene EQL was not less than the MCL, the benzene MDL was less than the MCL.

3.3.2 Quality Assurance for Analysis of Organic Compounds in TCLP Leachate

Results from the matrix spike, matrix spike duplicate, laboratory control samples, and extraction blank analyses have been given in Table 14. Organic compound analyses met all quality control specifications except for the toluene matrix spike duplicate result. The toluene matrix spike duplicate recovery and the associated RPD were outside of acceptance

ranges. This failure was indicative of a problem that was encountered in the purge and trap autosampler and was not indicative of poor quality in the sample data.

Table 13. TCLP Leachate Organic Compound Concentrations, MDLs, and EQLs

-	Regulatory Limits (mg/L)		Sample Limits (mg/L)		Sample Results (mg/L)			
-	MCL	PRG	[1]MDL	[1]EQL	Sample 1	Sample 2	Sample 3	Average
Date	-	-	-	-	9/29/03	9/29/03	9/29/03	-
Benzene	$5.0x10^{-3}$	-	$1.0x10^{-3}$	0.010	<0.010	$^{JB}2.9x10^{-3}$	<0.010	$^{JB}2.9x10^{-3}$
n-Butanol	-	3.6	0.1	0.10	<0.10	<0.10	<0.10	<0.10
Toluene	1.0	-	$2.0x10^{-3}$	0.010	$^{ZJ}1.2x10^{-3}$	<0.010	<0.010	$^{ZJ}1.2x10^{-3}$
Phenol	-	22	0.05	1.0	<1.0	<1.0	<1.0	<1.0

- Indicates a location in the table for which an entry would not be appropriate.
[1] MDLs from USEPA SW-846 studies in water. EQLs were low calibration concentration.
[J] Analyte is present at a concentration above the MDL but less than the EQL.
[B] Application of the CLP 5x rule to this value would indicate that the sample result should be considered a "nondetect".
[Z] Although a toluene peak was present in one sample, the concentration was less than the USEPA SW-846 established MDL.

Table 14. Organic Compound Matrix Spikes, Laboratory Control Samples, and Blanks

-	Matrix Spikes			Laboratory Control Samples				Blank (mg/kg)
-	Recovery (%)		RPD (%)	Recovery (%)				-
-	MS	MSD	-	LCS31	LCS51	LCS52	LCS54	-
Benzene	96	95	1	-	112	84	86	$^{J}2.2x10^{-3}$
n-Butanol	87	96	10	-	84	95	105	<0.10
Toluene	28	105	116	-	125	84	86	<0.010
Phenol	42	36	15	36	-	-	-	<1.0

- Indicates a location in the table for which an entry would not be appropriate.
[J] Analyte was present at a concentration above the MDL but less than the EQL.

3.4 Radionuclides

Toxicity Characteristic Leaching Procedure (TCLP) leachate radionuclide results have been presented in Table 15. The following conclusions can be made relative to these analyses:

-The gross alpha results exceeded the MCL by more than a factor of one thousand.
-Radium isotopes could not be determined to the MCL because of elevated background.
-Most beta and gamma activity was from cesium-137 and its daughter barium-137m.
-Most of the alpha activity was from plutonium-238 and curium-244.

Matrix spike and laboratory control sample recoveries, RPD measurements, and blank results have been reported in the data package for these analyses. These QC indicators were acceptable except promethium-147 laboratory control sample recovery and blank results which suggested the reported promethium-147 results could be significantly higher than the true concentration. Because some Sample 2 results appeared to be biased low, only Sample 1 and Sample 3 results were used to calculate averages for the uranium isotopes. The high curium-244 concentrations appear to have been due to contamination from the SRTC shielded cells since the measured curium-244 concentration was higher than the concentration that would have been present in the TCLP leachate assuming curium-244 in the Tank 41 salt solution[10] was completely leached from the Tank 41 Saltstone sample.

Table 15. TCLP Leachate Radionuclide Concentrations and MDAs

-	MCL (pCi/L)	Sample 1 (pCi/L)		Sample 2 (pCi/L)		Sample 3 (pCi/L)		Ave (pCi/L)
Date	-	9/29/03		9/29/03		9/29/03		-
SRS ID	-	41-TR1		41-TR2		41-TR3		-
BWXS ID	-	0310002-17		0310002-18		0310002-19		-
-	-	[1]MDA	Result	[1]MDA	Result	[1]MDA	Result	-
H-3	-	$1.3x10^4$	$1.7x10^4$	$1.3x10^4$	$<1.3x10^4$	$1.3x10^4$	$<1.3x10^4$	$1.7x10^4$
Sr-90	-	$5.7x10^4$	$9.1x10^5$	$6.8x10^4$	$4.5x10^5$	$5.8x10^4$	$1.1x10^6$	$8.1±3.2x10^5$
Tc-99	-	$8.8x10^2$	$7.8x10^4$	$1.5x10^3$	$7.3x10^4$	$9.6x10^2$	$1.0x10^5$	$8.4±1.6x10^4$
U-232	-	83	<83	1.1	<1.1	$3.7x10^2$	$<3.7x10^2$	<83
U-234	-	58	$2.6x10^3$	1.7	26	$2.9x10^2$	$8.0x10^2$	$1.7±0.89x10^3$
U-235	-	48	$2.4x10^2$	1.1	3.2	$2.4x10^2$	$<2.4x10^2$	$2.4x10^2$
U-236	-	48	[Z]$<1.1x10^2$	1.1	[Z]<1.9	$2.4x10^2$	$<2.4x10^2$	$<1.1x10^2$
U-238	-	48	80	1.1	1.9	$2.4x10^2$	$<2.4x10^2$	80
Pu-238	-	12	$1.3x10^4$	0.87	$2.3x10^3$	47	$6.6x10^3$	$7.3±5.4x10^3$
Pu-239/240	-	12	$5.9x10^2$	0.69	$1.1x10^2$	47	$2.2x10^2$	$3.1±2.6x10^2$
Pu-241	-	$1.7x10^3$	$6.1x10^3$	75	$6.5x10^2$	$8.8x10^3$	$<8.8x10^3$	$3.4±2.7x10^3$
Am-241	-	8.9	$7.2x10^2$	0.57	$1.4x10^2$	65	$3.6x10^2$	$4.1±2.9x10^2$
Cm-242	-	10	11	0.58	1.6	62	<61	6.5±4.9
Cm-244	-	8.9	$1.2x10^4$	0.38	$3.5x10^3$	38	$4.2x10^3$	$6.6±4.8x10^3$
Gross •	15	$2.6x10^3$	$3.1x10^4$	$2.1x10^3$	$6.1x10^3$	$1.7x10^3$	$1.7x10^4$	$1.8±1.2x10^4$
Gross •	-	$1.1x10^3$	$6.26x10^8$	$1.1x10^3$	$5.87x10^8$	$1.8x10^3$	$6.54x10^8$	$6.2±0.34x10^8$
Co-60	-	$7.2x10^3$	$<7.2x10^3$	$6.2x10^3$	$<6.2x10^3$	$6.3x10^3$	$<6.3x10^3$	$<6.2x10^3$
Ru-106	-	$1.4x10^6$	$<1.4x10^6$	$1.4x10^6$	$<1.4x10^6$	$1.3x10^6$	$<1.3x10^6$	$<1.3x10^6$
Sb-125	-	$7.0x10^5$	$<7.0x10^5$	$6.8x10^5$	$<6.8x10^5$	$6.6x10^5$	$<6.6x10^5$	$<6.6x10^5$
Cs-137	-	$2.1x10^5$	$7.60x10^8$	$2.1x10^5$	$7.2x10^8$	$2.0x10^5$	$6.69x10^8$	$7.2±0.46x10^8$
Eu-154	-	$2.1x10^4$	$<2.1x10^4$	$2.1x10^4$	$2.3x10^4$	$2.1x10^4$	$<2.1x10^4$	$<2.1x10^4$
Ra-226	5	$4.2x10^4$	$<4.2x10^4$	$4.6x10^4$	$<4.6x10^4$	$4.6x10^4$	$<4.6x10^4$	$<4.2x10^4$
Ra-228	5	$3.8x10^4$	$<3.8x10^4$	$3.8x10^4$	$<3.8x10^4$	$3.5x10^4$	$<3.5x10^4$	$<3.5x10^4$
Pm-147	-	$1.6x10^3$	[Z]$<1.9x10^5$	$2.0x10^3$	[Z]$<2.4x10^5$	$1.3x10^3$	[Z]$<3.2x10^5$	[Z]$<1.9x10^5$

- Indicates a location in the table for which an entry would not be appropriate.
[1] MDAs from standard practices based on counting statistics.
[Z] Although the reported activity was greater than the MDA, evaluation of the spectra showed no photopeak to be present.

4.0 CONCLUSIONS

Analyses were successfully performed on the Tank 41 grout samples. Because some QC failures occurred during the metal analyte determinations and because the TCLP leachate interfered with fluoride analyses, the metals and anion concentrations were also determined on the grout samples. SCDHEC forms and a copy of the chain of custody have been included as Appendix A.

4.1 Metals

Preparation of the Tank 41H Saltstone samples and the subsequent TCLP analyses showed

-TCLP metal results were below SCDHEC MCLs except arsenic, lead, and selenium.
-TCLP leachate lithium concentrations were close to but slightly above the SCDHEC PRG.
-The laboratory MDL for antimony was higher than the MCL for this analyte.
-Results met all USEPA SW-846 QC specifications except aluminum and iron recoveries.

The TCLP leachate concentrations were less than MCLs in SCDHEC Regulations R.61-107.16, Subpart A, 16.4 except for arsenic, selenium, and lead. Arsenic results were approximately two times the MCL, and selenium concentrations were approximately three times the MCL. Although these results were above the MCL, they were less than ten times the MCL and therefore, arsenic and selenium results would not mandate disposal of the Tank 41 Saltstone in a Class 2 or 3 ISWLF. Because of instrumentation difficulties, the more sensitive atomic absorption analyses could not be completed. These analyses are being performed, and the associated data package is expected to be received at SRS by March 1, 2004. Results will be communicated to Dennis Conrad or a designee; however, the current intent is not to revise this document unless these results are higher than the values given here.

No lead was detected in the TCLP leachate; however, these measurements were not sensitive enough to measure to below the MCL. The TCLP measurements were sensitive enough to show that leachate concentrations were less than 10 times the MCL. This was sufficient to show a Class 2 or 3 ISWLF would not be required by the lead result. Total lead concentrations in the Tank 41 Saltstone showed that if all of the lead were to be leached from the grout sample, the TCLP leachate would exceed the MCL by a factor of close to twenty.

The TCLP leachate concentrations were less than PRGs given in Reference 6 except for lithium. Lithium results were slightly (less than six percent) above the lithium PRG. In addition, the lithium post spike was high (134 %). Since matrix spike and matrix spike duplicate recoveries (113.9 % and 114.7 % respectively) were acceptable, the post spike did not constitute a QC failure but suggested a potential high bias in lithium results.

Analyses met all USEPA SW-846 quality assurance requirements except the matrix spike and matrix spike duplicate recoveries for aluminum and iron. Because the aluminum and iron results were well below the MCLs and because results from other COPCs mandated the more restrictive ISWLF classes, the total concentrations of these COPCs were not determined on the Tank 41 Saltstone samples.

4.2 Anions

Preparation of the Tank 41H Saltstone samples and the subsequent anion analyses showed

-Nitrate concentrations were one hundred times the SCDHEC MCL for nitrate plus nitrite.
-Sulfate concentrations were greater than the SCDHEC MCL for sulfate.
-Chloride and fluoride were shown to be below SCDHEC MCLs.
-Bromide, chloride, and phosphate were not detected in any samples.
-Anions analyses met all QC specifications.

Anion concentrations were less than MCLs in SCDHEC Regulations R.61-107.16, Subpart A, 16.4 except for nitrate and sulfate. Nitrate results were slightly more than one hundred times the MCL, and sulfate results were about two times the MCLs. Because nitrate values were more than one hundred times the MCL, these results would mandate a Class 3 ISWLF. SCDHEC forms and a copy of the chain of custody have been included as Appendix A.

Chloride was not detected in any sample. Because of acetate interference, TCLP leachate results could not be used to determine fluoride at concentrations low enough to evaluate compliance with the MCLs. Fluoride was detected in one of the samples analyzed for total fluoride in the Tank 41 grout. This result indicated that if all fluoride were released during TCLP analyses, the leachate fluoride concentration would be about one fourth the MCL.

4.3 Organic Compounds

Concentrations of all organic COPCs were lower than the SCDHEC MCLs. Toluene was detected in one of the samples but at about one one-thousandth the MCL. The toluene MSD analysis was hindered by a purge and trap autosampler problem. As a result the toluene MSD recovery and the RPD were outside acceptance ranges. All other quality control specifications were met for the organic compound analyses. Benzene was detected but was categorized as a "nondetect" after applying the CLP 5x rule.

4.4 Radionuclides

Preparation of the Tank 41H Saltstone samples and the subsequent radionuclide analyses showed

-Gross alpha concentrations were one thousand times the SCDHEC MCL for gross alpha.
-Radium isotopes were not determined to the SCDHEC MCL.
-Quality control indicators were indicative of quality results except for promethium-147.

Gross alpha results were more than one thousand times the MCL in SCDHEC Regulations R.61-107.16, Subpart A, 16.4 for gross alpha. Because gross alpha values were more than thirty times the MCL, these results would mandate a Class 3 ISWLF. Because the plutonium-238 results exceeded thirty times the MCL for total alpha-emitting radionuclides, the suspected curium-244 contamination of the samples (most likely from the SRTC shielded cells facility) did not impact the disposal facility classification. Radium isotopes were not determined to activities low enough to determine whether the TCLP leachate concentrations were below the MCL for these radionuclides.

5.0 SUMMARY

The most significant results from characterization of the Tank 41H 28-day cure Saltstone were

-TCLP leachate nitrate and alpha results were high enough to require a Class 3 ISWLF.
-Five COPC TCLP leachate results were between the MCLs and ten times the MCLs.
-The Tank 41 Saltstone met requirements of a nonhazardous radioactive waste form.

After curing for more than 28 days, the Tank 41H Saltstone produced with Z-Area premix material exceeded thirty times the nitrate and gross alpha MCLs given in SCDHEC Regulations R.61-107.16, Subpart A, 16.4 indicating the waste form would require disposal in a Class 3 ISWLF. The nitrate results were consistent with previously reported results from TCLP analyses of the Tank 50 Saltstone. The higher gross alpha results were consistent with the concentration of alpha-emitting radionuclides in the Tank 41H salt solution.

Arsenic, selenium, and sulfate results exceeded the MCLs but were less than ten times the MCLs, and lithium results were slightly higher than the PRG. In addition, lead concentrations in the TCLP leachate were shown to be less than the lead MCL but could not be shown to be less than the MCL. Arsenic, selenium, and lead concentrations were close to the method detection limits. Therefore, these results have a higher degree of uncertainty associated with them than results for other analytes.

Previously TCLP analyses for the primary eight Resource Conservation and Recovery Act (RCRA) metals showed that after a five-day cure, the Tank 41H Saltstone met the requirements of a nonhazardous radioactive waste form.[2] Results from analysis of the 28-day Tank 41H Saltstone supported the previous analyses. Concentrations for the eight RCRA metals were similar for the two sets of analyses.

6.0 REFERENCES

1. WSRC Manual 1S, Procedure 4.01 “Acceptance Criteria for Aqueous Waste Sent to the Z Area Saltstone Production Facility” (Rev. 4, **INTERIM**, 03/13/03).

2. Alex Cozzi, Christine Langton, and Daro Ferrara, “Tank 41H Saltstone TCLP RCRA Metal Results,” **Westinghouse Savannah River Company Report Number WSRC-RP-2003-00439**, **Rev. 0**, September 23, 2003.

3. Christine A. Langton, “Technical Basis for LCS Saltstone Disposal Vault Classification”, **Westinghouse Savannah River Company Technical Report Number WSRC-TR-2003-00431**, **Rev. 0**, September 2003.

4. United States Environmental Protection Agency, “Land Disposal Restrictions”, **Code of Federal Regulations 40CFR268.40**, September 19, 1994.

5. South Carolina Department of Health and Environmental Control, **SCDHEC Regulations R.61-107.16 Subpart A, 16.4**.

6. C. A. Langton. “Task Technical and QA Plan: Tank 41/LCS Saltstone Processability and TCLP Testing,” **Westinghouse Savannah River Company Report Number WSRC-RP-2003-00572**, **Rev. 0**, August 28, 2003.

7. Office of Solid Waste, United States of America Environmental Protection Agency, “Test Methods for Evaluating Solid Waste, Physical/Chemical Methods,” **USEPA SW-846, Third Edition**, **EPA Publication Number 955-001-00000-1**.

8. Office of Research and Development, United States of America Environmental Protection Agency, "Methods for the Determination of Inorganic Substances in Environmental Samples," **USEPA EPA/600/R-93-100**, August 1993.

9. United States Environmental Protection Agency, "EPA Guidance for Definitive Data Applicable to the CERCLA (Superfund) Program".

10. C. J. Martino, W. R. Wilmarth, D. P. Diprete, and C. C. Diprete, "Tank 41H Dissolved Saltcake Sample (HTF-E-03-91 – 92) Saltstone Waste Acceptance Criteria Analysis," **Westinghouse Savannah River Company Report Number WSRC-TR-2003-00380**, **Rev. 1**, September 22, 2003.

APPENDIX A. SCDHEC FORMS AND CHAIN OF CUSTODY

D H E C
PROMOTE PROTECT PROSPER
South Carolina Department of Health and Environmental Control

Type Data: **Industrial Inorganic TCLP/R.61-58.5**
Company Name: Westinghouse Savannah River Company
Subject/Project: Low-Curie Salt

Date: 01/30/04

							Results in Milligrams per Liter				
							Waste Stream 1			-	
							9/29/2003	9/29/2003	9/29/2003	-	-
Facility Sample ID #							41-TR1	41-TR2	41-TR3	-	-
Laboratory Sample ID #							0310002-17	0310002-18	0310002-19	-	-
Laboratory Name							BWXS-NELS	BWXS-NELS	BWXS-NELS	-	-
SC Laboratory Certification #							Pending	Pending	Pending	-	-
Subcontracted Laboratory Certification #							---	---	---	-	-
Subcontracted Laboratory Name							---	---	---	-	-
Laboratory Receipt Information (Chain of Custody Must be Attached)							Attached	Attached	Attached	-	-
Inorganic TCLP Chemicals							1	1	1	-	-
Analytical Parameter	Analytical Method	Quantitation Limit (mg/l)	MCL (mg/l)	10 x MCL (mg/l)	30 x MCL (mg/l)	-					
Antimony	6010B	0.28	0.006	**0.06**	0.18	-	<0.028	<0.028	<0.028	-	-
Arsenic	6010B	0.12	0.01	**0.10**	0.3	-	<0.012	0.021(B)	0.016(B)	-	-
Barium	6010B	0.012	2	**20.00**	60	-	0.122	0.110	0.152	-	-
Beryllium	6010B	1.70E-03	0.004	**0.04**	0.12	-	<1.7E-4	1.1E-03	<1.7E-4	-	-
Cadmium	6010B	0.016	0.005	**0.05**	0.15	-	<1.6E-3	2.78E-3(B)	2.11E-3(B)	-	-
Chloride	9056	250	250	**2500.00**	7500	-	<250	<250	<250	-	-
Chromium	6010B	0.032	0.1	**1.00**	3	-	0.0268(B)	0.0276(B)	0.0274(B)	-	-
Copper	6010B	0.059	1.3	**13.00**	39	-	<5.9E-3	<5.9E-3	<5.9E-3	-	-
Cyanide (as free cyanide)	9010B / 9040[3]	-	0.2	**2.00**	6	-	-	-	-	-	-
Fluoride	9056	250	4	**40.00**	120	-	488	467	492	-	-
Iron	6010B	0.051	0.3	**3.00**	9	-	0.044(B)	0.071	0.098	-	-
Lead	6010B	0.28	0.015	**0.15**	0.45	-	<0.028	<0.028	<0.028	-	-
Manganese	6010B	0.012	0.05	**0.50**	1.5	-	3.8E-3(B)	2.9E-3(B)	0.0127	-	-
Mercury	7470A	1.40E-03	0.002	**0.02**	0.06	-	<1.4E-4	1.8E-4(B)	8.1E-4(B)	-	-
Nitrate (as Nitrogen)	9056	56	10	**100.00**	300	-	1.163E+03	1.209E+03	1.213E+03	-	-
Nitrite (as Nitrogen)	9056	76	10	**100.00**	300	-	<76	<76	<76	-	-
Nitrate/Nitrite (Total)	9056	132	10	**100.00**	300	-	1.163E+03	1.209E+03	1.213E+03	-	-
Selenium	6010B	0.28	0.05	**0.50**	1.5	-	0.156(B)	0.150(B)	0.163(B)	-	-
Silver	6010B	0.054	0.1	**1.00**	3	-	<5.4E-3	<5.4E-3	<5.4E-3	-	-
Sulfate	9056	250	250	**2500.00**	7500	-	507	531	448	-	-
Thallium	7841	-	0.002	**0.02**	0.06	-	-	-	-	-	-
Aluminum[7]	6010B	0.3	36	**3.6E+02**	1080	-	0.30(B)	0.16(B)	0.75(B)	-	-
Boron[7]	6010B	0.18	3.3	**3.3E+01**	99	-	0.517	0.483	0.37	-	-
Cobalt[7]	6010B	0.026	2.2	**2.2E+01**	66	-	<2.6E-3	<2.6E-3	<2.6E-3	-	-
Lithium[7]	6010B	0.11	0.73	**7.30**	21.9	-	0.763	0.766	0.710	-	-
Molybdenum[7]	6010B	0.23	0.18	**1.80**	5.4	-	0.486	0.484	0.442	-	-
Nickel[7]	6010B	0.069	0.73	**7.30**	21.9	-	<6.9E-3	<6.9E-3	<6.9E-3	-	-
Strontium, stable[7]	6010B	0.013	22	**2.2E+02**	660	-	0.957	0.912	1.02	-	-
Uranium[7]	Radionuclides[8]	1.0E-06	7.3	**73.00**	219	-	3.5E-07	7.2E-09	8.2E-07	-	-

Footnotes: See Page 2

Quality Assurance (for above samples)				-	
TCLP Batch #	683-05	683-05	683-05	-	-
Digestion Batch #	640-88	640-88	640-88	-	-
TCLP Extraction Batch #	683-05	683-05	683-05	-	-
Method Blank	S683-05B1	S683B5-01	S683-05B1	-	-
Laboratory Control Sample (LCS)	PB MS 640-88	PB MS 640-88	PB MS 640-88	-	-
Matrix Spike (MS)	0310002-19MS	0310002-19MS	0310002-19MS	-	-
Matrix Spike Duplicate (MSD)	0310002-19MSD	0310002-19MSD	0310002-19MSD	-	-
LCS Recovery (%)	Acceptable	Acceptable	Acceptable	-	-
MS Recovery (%)	NA (Al, Fe)	NA (Al, Fe)	NA (Al, Fe)	-	-
MSD Recovery (%)	NA (Al, Fe)	NA (Al, Fe)	NA (Al, Fe)	-	-

Footnotes:

1. Subcontracted Laboratory used for this Analyte.
2. 6010B can be used with Trace ICP.
3. Spectrophotometric.
4. Alternate Method 531.1.
5. Nuclear - EPA Methods.
6. Million of fibers per liter.
7. PRG is given instead of the MCL. No MCL has been specified for this analyte.
8. To meet the PRG, individual uranium isotopes were measured. Uranium is being reported as the sum of the uranium isotopes.

Miscellaneous: (B) indicates values that were above the method detection limits but below ten times the method dectection limits.

D H E C
PROMOTE PROTECT PROSPER
South Carolina Department of Health and Environmental Control

Date: 01/30/04

LABORATORY: BWXS - NELS
METHOD NAME: SW-846-6010B, SW-846-9056, SW-846-7470A, and Alpha Counting
SUBJECT: QA- Blk, Laboratory Control Sample (LCS), Matrix Spike (MS), Matrix Spike Duplicate (MSD)

Reference: Industrial Inorganic TCLP/R.61-58.5
Instrument: BWXT - Miscellaneous

	Analyte Concentrations, mg / l								Recovery Percent								Flags
Analytes	RDL	MDL	Blank	LCS	LCSD	MS	MSD	Other	LCS	LCSD	MS	MSD	Ave MS/MSD	REC Limits	% RPD	RPD Limits	-
Antimony	0.006	0.028	<0.025	1.00	-	1.00	1.00	-	99.1	-	86.3	86.5	86.4	75-125	1.7	10%	-
Arsenic	0.01	0.012	<0.011	1.00	-	1.00	1.00	-	99.2	-	86.8	86.5	86.6	75-125	0.3	10%	-
Barium	2	0.0012	0.025	1.00	-	1.00	1.00	-	97.6	-	76.2	75.5	75.8	75-125	0.8	10%	-
Beryllium	0.004	0.00017	0.0002(B)	1.00	-	1.00	1.00	-	100.0	-	83.1	82.2	82.7	75-125	1.1	10%	-
Cadmium	0.0050	0.0016	0.0016(B)	1.00	-	1.00	1.00	-	99.5	-	79.9	79.3	79.6	75-125	0.8	10%	-
Chloride	250	25	<250	2000	-	2000	-	-	93	-	92	-	92	75-125	0(A)	10%	-
Chromium	0.1	0.0032	0.004(B)	1.00	-	1.00	1.00	-	99.7	-	78.6	78.1	78.3	75-125	0.6	10%	-
Copper	1.3	0.0059	0.020(B)	1.00	-	1.00	1.00	-	99.5	-	83.7	82.7	83	75-125	1.1	10%	-
Cyanide (as free cyanide)	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluoride	4	12	509	2000	-	2000	-	-	88	-	86	-	86	75-125	1.2(A)	10%	-
Iron	0.3	0.0051	0.045(B)	1.00	-	1.00	1.00	-	105.0	-	69.0	67.7	68	75-125	1.7	10%	N
Lead	0.015	0.028	<0.025	1.00	-	1.00	1.00	-	100.0	-	76.8	78.5	78	75-125	2.2	10%	-
Manganese	0.05	0.0012	0.006(B)	1.00	-	1.00	1.00	-	97.3	-	76.4	75.9	76.1	75-125	0.6	10%	-
Mercury	0.002	0.00014	0.012(B)	0.00471	-	0.0050	0.0050	-	107.6	-	106.9	105.9	106	75-125	0.9	10%	-
Nitrate (as Nitrogen)	10	9	<56	452.00	-	452.00	-	-	92	-	75	-	75	75-125	1.3(A)	10%	-
Nitrite (as Nitrogen)	10	16	<76	610.00	-	610.00	-	-	94	-	98	-	98	75-125	8.9(A)	10%	-
Nitrate/Nitrite (Total)	10	16	<132	1062.00	-	1062.00	-	-	93	-	77	-	77	75-125	1.4(A)	10%	-
Selenium	0.05	0.028	<0.025	1.00	-	1.00	1.00	-	98.5	-	90.4	88.5	89	75-125	1.8	10%	-
Silver	0.1	0.0054	0.0052(B)	1.00	-	1.00	1.00	-	98.3	-	80.9	80.5	80.7	75-125	0.5	10%	-
Sulfate	250	41	<250	2000	-	2000	-	-	93.0	-	90	-	90	75-125	7.0(A)	10%	-
Thallium	0.002	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aluminum	36	0.03	0.097(B)	1.00	-	1.00	1.00	-	96.9	-	31.7	30.1	30.9	75-125	1.7	10%	N
Boron	3.3	0.018	0.12(B)	1.00	-	1.00	1.00	-	103.0	-	92.9	89.0	91	75-125	3.1	10%	-
Cobalt	2.2	0.0026	<0.0023	1.00	-	1.00	1.00	-	101.0	-	79.2	79.1	79.2	75-125	0.2	10%	-
Lithium	0.73	0.011	<0.0097	1.00	-	1.00	1.00	-	105.0	-	113.9	114.7	114.4	75-125	0.4	10%	-
Molybdenum	0.18	0.023	<0.021	1.00	-	1.00	1.00	-	103.0	-	96.7	93.6	95	75-125	2.3	10%	-
Nickel	0.73	0.0069	<0.0062	1.00	-	1.00	1.00	-	102.0	-	79.4	79.7	79.6	75-125	0.3	10%	-
Strontium, stable	22	0.0013	0.014	1.00	-	1.00	1.00	-	97.6	-	97.9	97.0	97.5	75-125	0.5	10%	-
Uranium	7.3	0.000001	3.E-08	4.70E-07	-	-	-	-	126	-	-	-	-	-	13	-	-

(A) These RPD were determined from duplicate analyses of the same sample.

D H E C
PROMOTE PROTECT PROSPER
South Carolina Department of Health and Environmental Control

Cross Reference Report for QA and Analytes

Date: 02/16/04

Analytical Method Reference: SW846 3015 / 6010B - 7470A (TCLP Metals)
Lab Reference (to Facility Sample): BWXS - NELS (SDG 0310002)
Subject / Project: Low-Curie Salt
Facility: Westinghouse Savannah River Company

LAB ID #	FACILITY SAMP ID #	TC EXTR BATCH #	DIGEST BATCH #	ANALYSIS BATCH #	OTHER	COMMENTS
S683-05B1 (TCLP EXT BLANK)	None	683-05	640-88	A1108 / A1029A / A1031	---	6010B ICP Metals
PB (METHOD BLANK)	None	683-05	640-88	A1108 / A1029A / A1031	---	6010B ICP Metals
LCS P093-500	None	683-05	640-88	A1108 / A1029A / A1031	---	6010B ICP Metals
0310002-19AMS	41-TR3	683-05	640-88	A1108 / A1029A / A1031	---	6010B ICP Metals
0310002-19AMSD	41-TR3	683-05	640-88	A1108 / A1029A / A1031	---	6010B ICP Metals
0310002-17A	41-TR1	683-05	640-88	A1108 / A1029A / A1031	---	6010B ICP Metals
0310002-18A (DUP)	41-TR2	683-05	640-88	A1108 / A1029A / A1031	---	6010B ICP Metals
0310002-19A	41-TR3	683-05	640-88	A1108 / A1029A / A1031	---	6010B ICP Metals
S683-05B1 (TCLP EXT BLANK)	None	683-05	605-45	031022	---	7470A CVAA HG
0 PPB (METHOD BLANK)	None	683-05	605-45	031022	---	7470A CVAA HG
LCS P093-500	None	683-05	605-45	031022	---	7470A CVAA HG
0310002-10AMS	41-TM4	683-05	605-45	031022	---	7470A CVAA HG
0310002-11AMSD	41-TM5	683-05	605-45	031022	---	7470A CVAA HG
0310002-07A	41-TM1	683-05	605-45	031022	---	7470A CVAA HG
0310002-08A (DUP)	41-TM2	683-05	605-45	031022	---	7470A CVAA HG
0310002-09A	41-TM3	683-05	605-45	031022	---	7470A CVAA HG

D H E C
PROMOTE PROTECT PROSPER
South Carolina Department of Health and Environmental Control

Cross Reference Report for QA and Analytes

Date: 02/16/04

Analytical Method Reference: SW846 3015 / 6010B (Total Metals)
Lab Reference (to Facility Sample): BWXS - NELS (SDG 0310002)
Subject / Project: Low-Curie Salt
Facility: Westinghouse Savannah River Company

LAB ID #	FACILITY SAMP ID #	TC EXTR BATCH #	DIGEST BATCH #	ANALYSIS BATCH #	OTHER	COMMENTS
PB (METHOD BLANK)	None	---	693-18	A1204	---	6010B ICP Metals
PP D036 (LCS)	None	---	693-18	A1204	---	6010B ICP Metals
0310002-01AMS	41-TE1	---	693-18	A1204	---	6010B ICP Metals
0310002-01AMSD	41-TE1	---	693-18	A1204	---	6010B ICP Metals
0310002-01A	41-TE1	---	693-18	A1204	---	6010B ICP Metals
0310002-01A (DUP)	41-TE1	---	693-18	A1204	---	6010B ICP Metals

D H E C
PROMOTE PROTECT PROSPER
South Carolina Department of Health and Environmental Control

Cross Reference Report for QA and Analytes

Date: 02/09/04

Analytical Method Reference: SW846 9056 - Inorganic Anions (TCLP Extraction)
Lab Reference (to Facility Sample): BWXS - NELS (SDG 0310002)
Subject / Project: Low-Curie Salt
Facility: Westinghouse Savannah River Company

LAB ID #	FACILITY SAMP ID #	TC EXTR BATCH #	PREP BATCH #	ANALYSIS BATCH #	OTHER	COMMENTS
S683-05B1 (PBLK64 - TCLP BLANK)	None	683-05	Not Applicable	110703 / 9056	---	---
S683-05B1QC (PBLKQC64)	None	683-05	Not Applicable	110703 / 9056	---	---
0310002-11AMS	41-TM5	683-05	Not Applicable	110703 / 9056	---	---
0310002-07A	41-TM1	683-05	Not Applicable	110703 / 9056	---	---
0310002-08A	41-TM2	683-05	Not Applicable	110703 / 9056	---	---
0310002-09A	41-TM3	683-05	Not Applicable	110703 / 9056	---	---
0310002-10A	41-TM4	683-05	Not Applicable	110703 / 9056	---	---
0310002-11ADUP	41-TM5	683-05	Not Applicable	110703 / 9056	---	---

D H E C
PROMOTE PROTECT PROSPER
South Carolina Department of Health and Environmental Control

Cross Reference Report for QA and Analytes

Date: 02/09/04

Analytical Method Reference: SW846 9056 - Inorganic Anions (Water Leach)
Lab Reference (to Facility Sample): BWXS - NELS (SDG 0310002)
Subject / Project: Low-Curie Salt
Facility: Westinghouse Savannah River Company

LAB ID #	FACILITY SAMP ID #	TC EXTR BATCH #	PREP BATCH #	ANALYSIS BATCH #	OTHER	COMMENTS
S3215-66B1 (PBLK62 - LEACH BLANK)	None	Not Applicable	S3215-66	102603 / 9056	---	---
S3215-66S1 (LCS62)	None	Not Applicable	S3215-66	102603 / 9056	---	---
0310002-15AMS	41-WA4	Not Applicable	S3215-66	102603 / 9056	---	---
0310002-16AMSD	41-WA5	Not Applicable	S3215-66	102603 / 9056	---	---
0310002-12A	41-WA1	Not Applicable	S3215-66	102603 / 9056	---	---
0310002-13A (DUP)	41-WA2	Not Applicable	S3215-66	102603 / 9056	---	---
0310002-14A	41-WA3	Not Applicable	S3215-66	102603 / 9056	---	---

D H E C
PROMOTE PROTECT PROSPER
South Carolina Department of Health and Environmental Control

Date: 01/30/04

Type Data: **Industrial RCRA - TCLP Semi-Volatiles**
Company Name: Westinghouse Savannah River Company
Subject/Project: Low-Curie Salt

	Results in Milligrams per Liter				
	Waste Stream 1			-	
	9/29/2003	9/29/2003	9/29/2003	-	-
Facility Sample ID #	41-TM1	41-TM2	41-TM3	-	-
Laboratory Sample ID #	0310002-07A	0310002-08A	0310002-09A	-	-
Laboratory Name	BWXS-NELS	BWXS-NELS	BWXS-NELS	-	-
SC Laboratory Certification #	Pending	Pending	Pending	-	-
Subcontracted Laboratory Certification #	---	---	---	-	-
Subcontracted Laboratory Name	---	---	---	-	-
Laboratory Receipt Information (Chain of Custody Must be Attached)	Attached	Attached	Attached	-	-
Semi-Volatile Organic Compounds	Subcontract [1]	-	-	Subcontract [1]	-

Analytical Analaytes	Preparation Method	Analytical Method	Detection Limit (mg/l)	Quantitation Limit (mg/l)	MCL (mg/l)	10 x MCL (mg/l)	30 x MCL (mg/l)	-	-	-	-	-	-
1,4-Dichlorobenzene	3550	SW8270C	-	-	-	-	-	-	-	-	-	-	-
o-Cresol (2-Methtlphenol)	3550	SW8270C	-	-	-	-	-	-	-	-	-	-	-
m- and p-Cresol (3- & 4-Methylphenol)	3550	SW8270C	-	-	-	-	-	-	-	-	-	-	-
Hexachloroethane	3550	SW8270C	-	-	-	-	-	-	-	-	-	-	-
Nitrobenzene	3550	SW8270C	-	-	-	-	-	-	-	-	-	-	-
Hexochloro- 1,3-butadiene	3550	SW8270C	-	-	-	-	-	-	-	-	-	-	-
2,4,6-Trichlorophenol	3550	SW8270C	-	-	-	-	-	-	-	-	-	-	-
2,4,5-Trichlorophenol, etc.	3550	SW8270C	-	-	-	-	-	-	-	-	-	-	-
2,4-Dinitrotoluene	3550	SW8270C	-	-	-	-	-	-	-	-	-	-	-
Hexachlorobenzene	3550	SW8270C	-	-	-	-	-	-	-	-	-	-	-
Pentachlorophenol	3550	SW8270C	-	-	-	-	-	-	-	-	-	-	-
Pyridine	3550	SW8270C	-	-	-	-	-	-	-	-	-	-	-
Phenol[2]	3550	SW8270C	0.05	1.0	22000	**220000**	6.6E+05	-	<1.0	<1.0	<1.0	-	-
Quality Assurance (for above samples)									-				
TCLP Extraction Batch #									683-05	683-05	683-05	-	-
Semivolatile Extraction Batch #									648-66	648-66	648-66	-	-
Analysis Batch Number									102603.B	102603.B	102603.B	-	-
Surrogates. % Recovery									A	A	A	-	-
Nitrobenzene, d5									-	-	-	-	-
2-Fluorobiphenol									-	-	-	-	-
Terphenyl, d14									-	-	-	-	-
Phenol, d6									34	31	34	-	-
2-Fluorophenol									-	-	-	-	-
2,4,6-Tribromophenol									-	-	-	-	-

1. Subcontracted Laboratory used for this Analyte.

2. PRG is given instead of the MCL. No MCL has been specified for this analyte.

D H E C
PROMOTE PROTECT PROSPER
South Carolina Department of Health and Environmental Control

Date: 01/30/04

LABORATORY: BWXS - NELS
METHOD NAME: SW-846-3510C and SW-846-8270C
SUBJECT: QA- Blk, Laboratory Control Sample (LCS), Matrix Spike (MS), Matrix Spike Duplicate (MSD)

Reference: Industrial RCRA - TCLP Semi-Volatiles
Instrument: BWXT 1-1999-0039

	Analyte Concentrations, mg / l								Recovery Percent								Flags
Analytes	RDL	MDL	Blank	LCS	LCSD	MS	MSD	Other	LCS	LCSD	MS	MSD	Ave MS/MSD	REC Limits	% RPD	RPD Limits	-
1,4-Dichlorobenzene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
o-Cresol (2-Methtlphenol)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
m- and p-Cresol (3- & 4-Methylphenol)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hexachloroethane	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitrobenzene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hexochloro- 1,3-butadiene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4,6-Trichlorophenol	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4,5-Trichlorophenol, etc.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4-Dinitrotoluene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hexachlorobenzene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pentachlorophenol	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pyridine	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phenol2	22000	0.05	<1.0	410	-	7.50	7.50	-	95	-	42	36	39	12-110	15	42%	-

D H E C
PROMOTE PROTECT PROSPER
South Carolina Department of Health and Environmental Control

Cross Reference Report for QA and Analytes

Date: 02/09/04

Analytical Method Reference: SW846 3510C / 8270C
Lab Reference (to Facility Sample): BWXS - NELS (SDG 0310002)
Subject / Project: Low-Curie Salt
Facility: Westinghouse Savannah River Company

LAB ID #	FACILITY SAMP ID #	TC EXTR BATCH #	NV EXTR BATCH #	ANALYSIS BATCH #	OTHER	COMMENTS
S648-66B1 (SBLK31 - EXT BLANK)	None	683-05	648-66	102603.B	---	---
T648-66B2 (SBLK32 - METHOD BLANK)	None	683-05	648-66	102603.B	---	---
W648-66S1 (LCS31)	None	683-05	648-66	102603.B	---	---
0310002-10AMS	41-TM4	683-05	648-66	102603.B	---	---
0310002-11AMSD	41-TM5	683-05	648-66	102603.B	---	---
0310002-07A	41-TM1	683-05	648-66	102603.B	---	---
0310002-08A (DUP)	41-TM2	683-05	648-66	102603.B	---	---
0310002-09A	41-TM3	683-05	648-66	102603.B	---	---

Type Data: **Industrial RCRA - TCLP Volatiles**
Company Name: Westinghouse Savannah River Company
Subject/Project: Low-Curie Salt

Date: 01/30/04

Analytical Parameter	Preparation Method	Analytical Method	Detection Limit (mg/l)	Quantitation Limit (mg/l)	MCL (mg/l)	10 x MCL (mg/l)	30 x MCL (mg/l)	-	Results in Milligrams per Liter				
									Waste Stream 1			-	
									9/29/2003	9/29/2003	9/29/2003	-	-
Facility Sample ID #									41-TV1	41-TV2	41-TV3	-	-
Laboratory Sample ID #									0310002-02AT3	0310002-03AT3	0310002-04AT3	-	-
Laboratory Name									BWXS-NELS	BWXS-NELS	BWXS-NELS	-	-
SC Laboratory Certification #									Pending	Pending	Pending	-	-
Subcontracted Laboratory Certification #									---	---	---	-	-
Subcontracted Laboratory Name									---	---	---	-	-
Laboratory Receipt Information (Chain of Custody Must be Attached)									---	---	---	-	-
TCLP Volatile Organic Compounds									Subcontract [1]	-	-	Subcontract [1]	-
Benzene	5030B	SW8260B	0.001	0.01	0.005	**0.05**	0.15	-	<0.010	2.9E-3(J)	<0.010	-	-
Carbon Tetrachloride	5030B	SW8260B	-	-	-	-	-	-	-	-	-	-	-
Tetrachloroethylene	5030B	SW8260B	-	-	-	-	-	-	-	-	-	-	-
Trichloroethylene	5030B	SW8260B	-	-	-	-	-	-	-	-	-	-	-
Vinyl Chloride	5030B	SW8260B	-	-	-	-	-	-	-	-	-	-	-
1.1-Dichloroethylene	5030B	SW8260B	-	-	-	-	-	-	-	-	-	-	-
1,2-Dichloroethane	5030B	SW8260B	-	-	-	-	-	-	-	-	-	-	-
Chloroform	5030B	SW8260B	-	-	-	-	-	-	-	-	-	-	-
MEK (2-Butanone)	5030B	SW8260B	-	-	-	-	-	-	-	-	-	-	-
Chlorobenzene	5030B	SW8260B	-	-	-	-	-	-	-	-	-	-	-
Toluene	5030B	SW8260B	0.002	0.01	1	**10**	30	-	1.2E-3(J)	<0.010	<0.010	-	-
1-Butanol [2]	5030B	SW8260B	0.100	0.1	3600	**36000**	1.1E+05	-	<0.1	<0.1	<0.1	-	-
Quality Assurance (for above samples)									-				
TCLP ZHE Extraction Batch #									683-05	683-05	683-05	-	-
Volatile Analysis Batch #									100803.B	100803.B	100803.B	-	-
Surrogates, % Recovery									A	NA(toluene)	A	-	-
1,2- Dichlorethane, d4									-	-	-	-	-
Toluene, d8									104	68	103	-	-
4-Bromofluorobenzene									96	106	98	-	-
Other									-	-	-	-	-

1. Subcontracted Laboratory Used for these Parameters(Analytes)

2. PRG is given instead of the MCL. No MCL has been specified for this analyte.

(J) indicates values that were above the method detection limits but below the quantitation limits.

D H E C
PROMOTE PROTECT PROSPER
South Carolina Department of Health and Environmental Control

Date: 01/30/04

LABORATORY: BWXS - NELS
METHOD NAME: SW-846-5030B and SW-846-8260B
SUBJECT: QA- Blk, Laboratory Control Sample (LCS), Matrix Spike (MS), Matrix Spike Duplicate (MSD)

Reference: Industrial RCRA - TCLP Volatiles
Instrument: BWXT 1006037

	Analyte Concentrations, mg / l								Recovery Percent								Flags
Analytes	RDL	MDL	Blank	LCS	LCSD	MS	MSD	Other	LCS	LCSD	MS	MSD	Ave MS/MSD	REC Limits	% RPD	RPD Limits	-
Benzene	0.005	0.001	2.2e-3(J)	0.041	-	0.041	0.041	-	84	-	96	95	95.5	37-151	1	21%	-
Carbon Tetrachloride	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tetrachloroethylene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trichloroethylene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vinyl Chloride	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1.1-Dichloroethylene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-Dichloroethane	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chloroform	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MEK (2-Butanone)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chlorobenzene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Toluene	1	0.002	<0.010	0.041	-	0.041	0.041	-	84	-	28	105	67	47-150	116	21%	-
1-Butanol2	3600	0.100	<0.10	0.41	-	0.41	0.41	-	95	-	87	96	92	47-150	10	21%	-

D H E C
PROMOTE PROTECT PROSPER
South Carolina Department of Health and Environmental Control

Cross Reference Report for QA and Analytes

Date: 02/05/04

Analytical Method Reference: SW846 5030B / 8260B
Lab Reference (to Facility Sample): BWXS - NELS (SDG 0310002)
Subject / Project: Low-Curie Salt
Facility: Westinghouse Savannah River Company

LAB ID #	FACILITY SAMP ID #	TC EXTR BATCH #	DIGESTION BATCH #	ANALYSIS BATCH #	OTHER	COMMENTS
S683-05B2 (VBK53 - ZHE EXT BLANK)	None	683-05	Not Applicable	100803.B	---	---
FE01 (VBLK51 - METHOD BLANK)	None	683-05	Not Applicable	100803.B	---	---
FFD01 (VBLK52 - METHOD BLANK)	None	683-05	Not Applicable	100803.B	---	---
FG01 (VBLK54 - METHOD BLANK)	None	683-05	Not Applicable	100803.B	---	---
S4100 (LCS51)	None	683-05	Not Applicable	100803.B	---	---
FF01LCS (LCS52)	None	683-05	Not Applicable	100803.B	---	---
FG01LCS (LCS54)	None	683-05	Not Applicable	100803.B	---	---
0310002-05AT3MS	41-TV4	683-05	Not Applicable	100803.B	---	---
0310002-06AT3MSD	41-TV5	683-05	Not Applicable	100803.B	---	---
0310002-02AT3	41-TV1	683-05	Not Applicable	100803.B	---	---
0310002-03AT3 (DUP)	41-TV2	683-05	Not Applicable	100803.B	---	---
0310002-04AT3	41-TV3	683-05	Not Applicable	100803.B	---	---

Data Report For: Westinghouse SRTC-ADS

Laboratory Report Number: 0310002 MET

Drum / Cooler #1
4°C
Intact Paper evidence seals

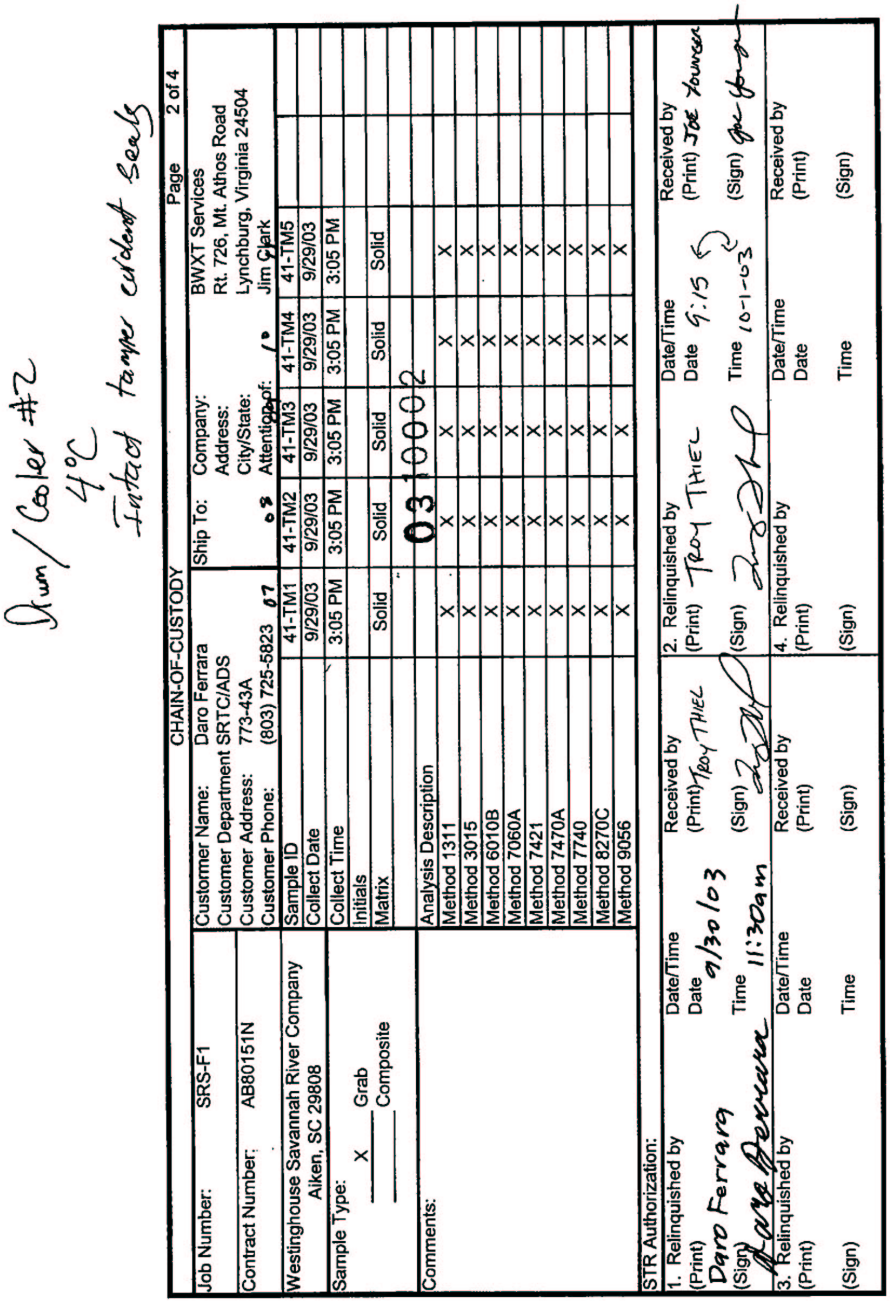
CHAIN-OF-CUSTODY — Page 1 of 4

Job Number: SRS-F1	Customer Name: Daro Ferrara Customer Department SRTC/ADS	Ship To:	Company: Address:	BWXT Services Rt. 726, Mt. Athos Road					
Contract Number: AB80151N	Customer Address: 773-43A		City/State:	Lynchburg, Virginia 24504					
	Customer Phone: (803) 725-5823 01	02	Attention of: 04	Jim Clark 05					
Westinghouse Savannah River Company Aiken, SC 29808	Sample ID	41-TE1	41-TV1	41-TV2	41-TV3	41-TV4	41-TV5		
	Collect Date	9/29/03	9/29/03	9/29/03	9/29/03	9/29/03	9/29/03		
Sample Type: X Grab ____ Composite	Collect Time	3:05 PM	3:05 PM	3:05 PM	3:05 PM	3:05 PM	3:05 PM		
	Initials								
	Matrix	Solid	Solid	Solid	Solid	Solid	Solid		
Comments:	Analysis Description								
	Method 1311	X	X	X	X	X	X		
	Method 8260	X	X	X	X	X	X		
				03 10002					
STR Authorization:									

1. Relinquished by (Print) Daro Ferrara	Date/Time Date 9/30/03	Received by (Print) Troy Thiel	2. Relinquished by (Print) Troy Thiel	Date/Time Date 10/1/03	Received by (Print) Joe Younger
(Sign) Daro Ferrara	Time 11:30 am	(Sign)	(Sign)	Time 9:15	(Sign)
3. Relinquished by (Print)	Date/Time Date	Received by (Print)	4. Relinquished by (Print)	Date/Time Date	Received by (Print)
(Sign)	Time	(Sign)	(Sign)	Time	(Sign)

Data Report For: Westinghouse SRTC-ADS

Laboratory Report Number: 0310002 MET



Drum / Cooler #2
4°C
Intact tamper evident seals

CHAIN-OF-CUSTODY

Page 2 of 4

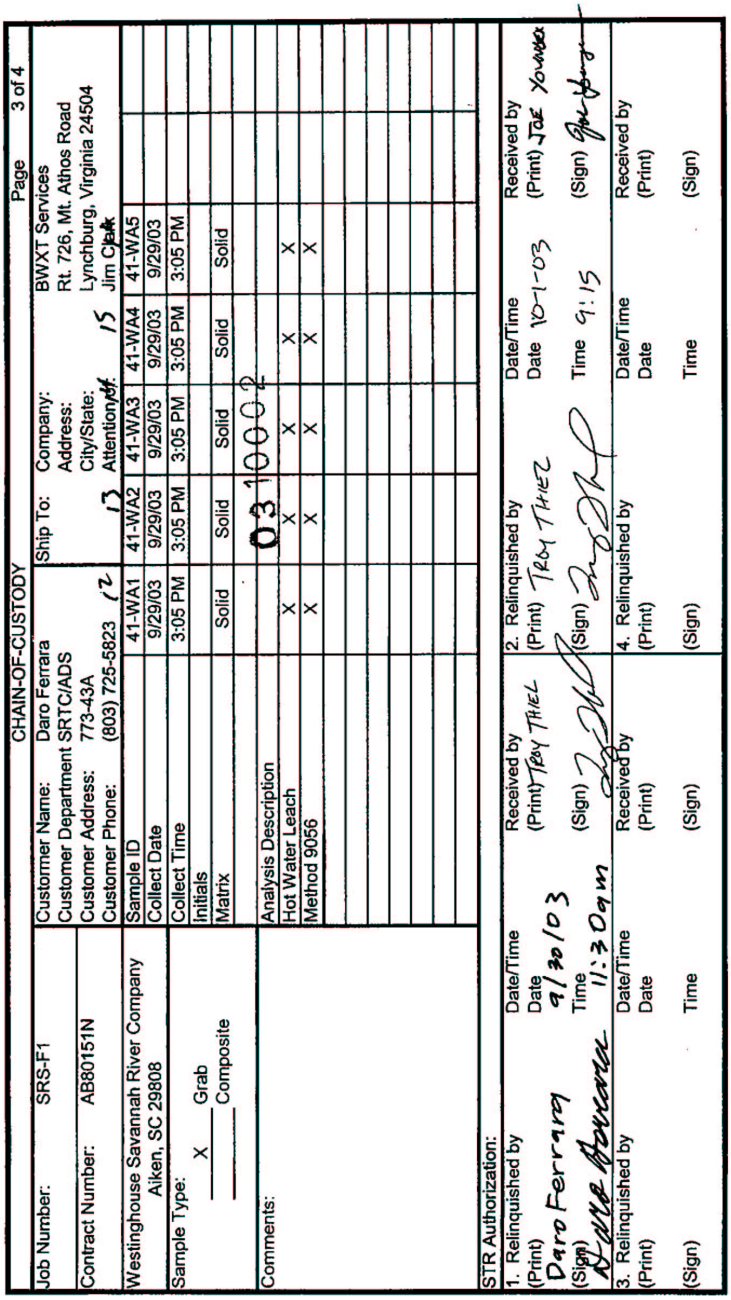
Job Number: SRS-F1	Customer Name: Daro Ferrara	Ship To:	Company:	BWXT Services			
	Customer Department SRTC/ADS		Address:	Rt. 726, Mt. Athos Road			
Contract Number: AB80151N	Customer Address: 773-43A		City/State:	Lynchburg, Virginia 24504			
	Customer Phone: (803) 725-5823 07	08	Attention of:	Jim Clark			
Westinghouse Savannah River Company Aiken, SC 29808	Sample ID	41-TM1	41-TM2	41-TM3	41-TM4	41-TM5	
	Collect Date	9/29/03	9/29/03	9/29/03	9/29/03	9/29/03	
Sample Type: X Grab ____ Composite	Collect Time	3:05 PM	3:05 PM	3:05 PM	3:05 PM	3:05 PM	
	Initials						
	Matrix	Solid	Solid	Solid	Solid	Solid	
			0310002				
Comments:	Analysis Description						
	Method 1311	X	X	X	X	X	
	Method 3015	X	X	X	X	X	
	Method 6010B	X	X	X	X	X	
	Method 7060A	X	X	X	X	X	
	Method 7421	X	X	X	X	X	
	Method 7470A	X	X	X	X	X	
	Method 7740	X	X	X	X	X	
	Method 8270C	X	X	X	X	X	
	Method 9056	X	X	X	X	X	

STR Authorization:

1. Relinquished by (Print) Daro Ferrara	Date/Time Date 9/30/03	Received by (Print) TROY THIEL	2. Relinquished by (Print) TROY THIEL	Date/Time Date 9:15	Received by (Print) Joe Younger		
(Sign) Daro Ferrara	Time 11:30am	(Sign)	(Sign)	Time 10-1-03	(Sign)		
3. Relinquished by (Print)	Date/Time Date	Received by (Print)	4. Relinquished by (Print)	Date/Time Date	Received by (Print)		
(Sign)	Time	(Sign)	(Sign)	Time	(Sign)		

Data Report For: Westinghouse SRTC-ADS

Laboratory Report Number: 0310002 MET



CHAIN-OF-CUSTODY

Page 3 of 4

Job Number: SRS-F1

Customer Name: Daro Ferrara
Customer Department SRTC/ADS
Customer Address: 773-43A
Customer Phone: (803) 725-5823 12

Ship To: 13

Company: BWXT Services
Address: Rt. 726, Mt. Athos Road
City/State: Lynchburg, Virginia 24504
Attention: 15 Jim Clark

Contract Number: AB80151N

Westinghouse Savannah River Company
Aiken, SC 29808

Sample Type: X Grab ____ Composite

Sample ID	41-WA1	41-WA2	41-WA3	41-WA4	41-WA5		
Collect Date	9/29/03	9/29/03	9/29/03	9/29/03	9/29/03		
Collect Time	3:05 PM	3:05 PM	3:05 PM	3:05 PM	3:05 PM		
Initials							
Matrix	Solid	Solid	Solid	Solid	Solid		
		0310002					
Analysis Description							
Hot Water Leach	X	X	X	X	X		
Method 9056	X	X	X	X	X		

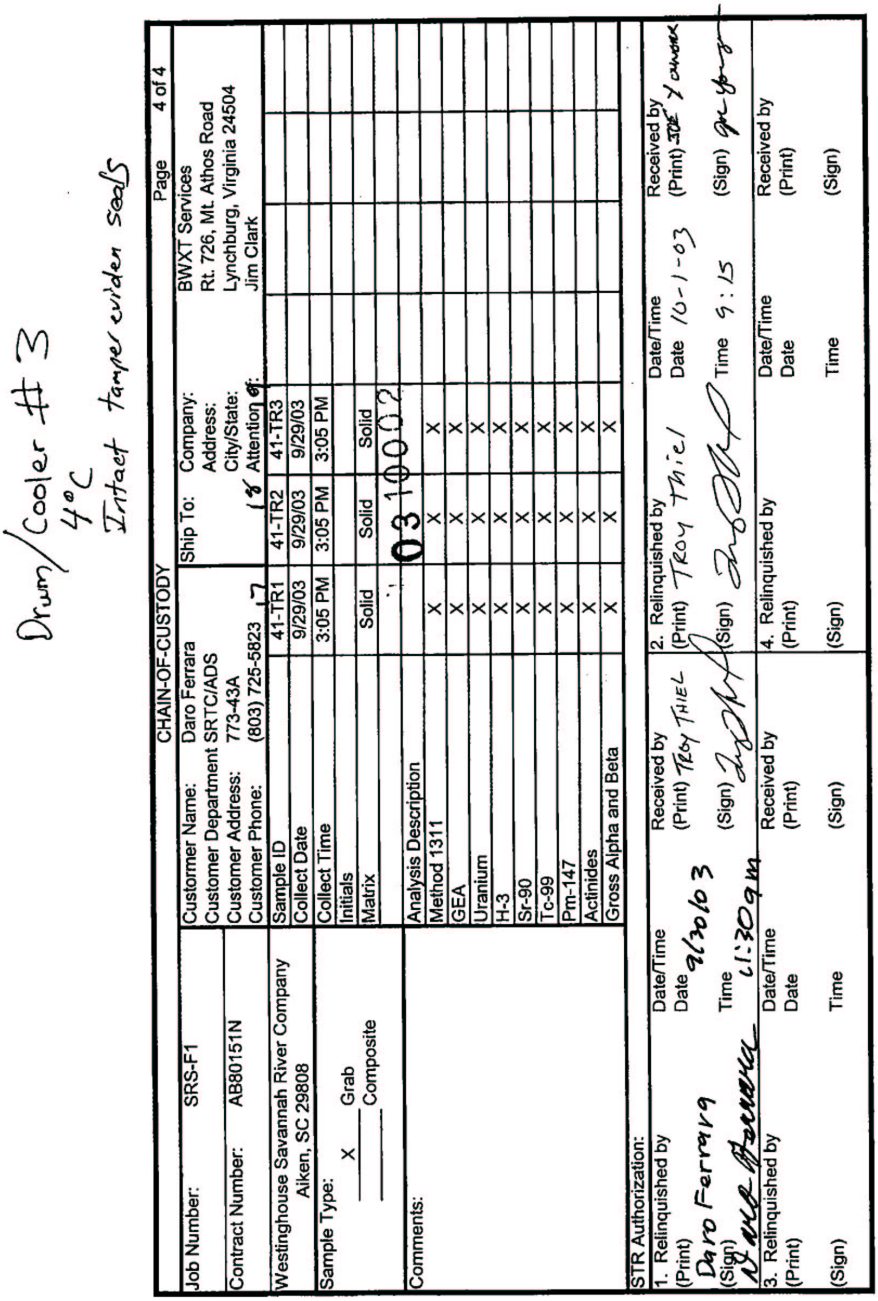
Comments:

STR Authorization:

1. Relinquished by (Print) Daro Ferrara	Date/Time Date 9/30/03	Received by (Print) Troy Thiel	2. Relinquished by (Print) Troy Thiel	Date/Time Date 10-1-03	Received by (Print) Joe Young		
(Sign)	Time 11:30am	(Sign)	(Sign)	Time 9:15	(Sign)		
3. Relinquished by (Print)	Date/Time Date	Received by (Print)	4. Relinquished by (Print)	Date/Time Date	Received by (Print)		
(Sign)	Time	(Sign)	(Sign)	Time	(Sign)		

Data Report For: Westinghouse SRTC-ADS

Laboratory Report Number: 0310002 MET



Drum/Cooler #3
4°C
Intact tamper evident seals

CHAIN-OF-CUSTODY

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Job Number:	SRS-F1	Customer Name: Daro Ferrara Customer Department SRTC/ADS	Ship To:	Company: Address: City/State: Attention of:	BWXT Services Rt. 726, Mt. Athos Road Lynchburg, Virginia 24504 Jim Clark						
Contract Number:	AB80151N	Customer Address: 773-43A Customer Phone: (803) 725-5823									
Westinghouse Savannah River Company Aiken, SC 29808		Sample ID	41-TR1	41-TR2	41-TR3						
		Collect Date	9/29/03	9/29/03	9/29/03						
Sample Type: X Grab Composite		Collect Time	3:05 PM	3:05 PM	3:05 PM						
		Initials									
		Matrix	Solid	Solid	Solid						
		03 10002									
Comments:		Analysis Description									
		Method 1311	X	X	X						
		GEA	X	X	X						
		Uranium	X	X	X						
		H-3	X	X	X						
		Sr-90	X	X	X						
		Tc-99	X	X	X						
		Pm-147	X	X	X						
		Actinides	X	X	X						
		Gross Alpha and Beta	X	X	X						

STR Authorization:

1. Relinquished by (Print) Daro Ferrara (Sign)	Date/Time Date 9/30/03 Time 11:30 am	Received by (Print) TROY THIEL (Sign)	2. Relinquished by (Print) TROY THIEL (Sign)	Date/Time Date 10-1-03 Time 9:15	Received by (Print) SUE Y CHAVEZ (Sign)	
3. Relinquished by (Print) (Sign)	Date/Time Date Time	Received by (Print) (Sign)	4. Relinquished by (Print) (Sign)	Date/Time Date Time	Received by (Print) (Sign)	