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Characterization of Cycled Spherical Resorcinol-Formaldehyde Ion Exchange Resin

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EXECUTIVE SUMMARY

This report presents characterization data for two spherical resorcinol-formaldehyde (sRF) resin beds that had processed cesium in non-radioactive and radioactive cycles. All column cycle operations for the resin beds including loading, displacements, elution, regeneration, breakthroughs, and solution analyses are reported in Nash and Duignan, 2009a. That report covered four ion exchange (IX) campaigns using the two ~11 mL beds in columns in a lead-lag arrangement. The first two campaigns used Savannah River Site (SRS) Tank 2F nonradioactive simulant while the latter two were fed with actual dissolved salt in the Savannah River National Laboratory (SRNL) Shielded Cells. Both radioactive cycles ran to cesium breakthrough of the lead column. The resin beds saw in excess of 400 bed volumes of feed in each cycle. Resin disposal plans in tank farm processing depend on characterizations of resin used with actual tank feed.

Following a final 30 bed volume (BV) elution with nitric acid, the resin beds were found to contain detectable chromium, barium, boron, aluminum, iron, sodium, sulfur, plutonium, cesium, and mercury. Resin affinity for plutonium is important in criticality safety considerations. Cesium-137 was found to be less than 10E+7 dpm/g of resin, similar to past work with sRF resin. Sulfur levels are reasonably consistent with other work and are expected to represent sulfur chemistry used in the resin manufacture. There were low but detectable levels of technetium, americium, and curium. Toxicity Characteristic Leaching Procedure (TCLP) work on the used (eluted) resin samples showed significant contents of mercury, barium, and chromium. One resin sample exceeded the TCLP level for mercury while the other metals were below TCLP levels. TCLP organics measurements indicated measurable benzene in one case, though the source was unknown. Results of this work were compared with other work on similar sRF resin characterizations in this report.

This is the first work to quantify mercury on sRF resin. Resin mercury content is important in plans for the disposition of used sRF resin. Mercury speciation in high level waste (HLW) is unknown. It may be partly organic, one example being methyl mercury cation. Further study of the resin's affinity for mercury is recommended.

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LIST OF ABBREVIATIONS

AAK	Atomic absorption measurement for potassium
ACTL	Aiken County Technology Laboratory
AD	Analytical Development, Savannah River National Laboratory
bd	Below detection
BV	Resin bed volume
BH	Bed height (of IX resin)
C/C_o	Column product concentration divided by feed concentration
cm	Centimeter
CV-Hg	Cold vapor atomic absorption measurement for mercury
DI	Deionized (water)
dpm	Decays per minute
EPA	Environmental Protection Agency
g	Grams (mass)
g/cc	gram/cubic centimeter
HLW	High level waste
IX	Ion exchange
ICP-ES	Inductively coupled plasma-emission spectroscopy
ICP-MS	Inductively coupled plasma-mass spectroscopy
L	Length
lpm	liters per minute
nm	Not measured
media	IX resin, or the material that is used to adsorb ions (cesium in this case)
M&TE	Measurement and Test Equipment (calibrated per QA program)
meq	Milliequivalents
mmol	Millimoles
PSD	Particle size distribution
QA	Quality Assurance
RCRA	Resource Conservation and Recovery Act
resin	IX media, or the material that is used to adsorb ion (cesium in this case)
RF	Resorcinol-formaldehyde (ion exchange resin)
RPP	River Protection Project (Hanford)
RPP-WTP	River Protection Project Waste Treatment Plant (Hanford)
RSD	Relative standard deviation, expressed as percentage
SCIX	Small Column Ion Exchange
sRF	Spherical Resorcinol-Formaldehyde resin
SRNL	Savannah River National Laboratory
SRS	Savannah River Site
Std. Dev.	Standard deviation
TCLP	Toxicity Characteristic Leaching Procedure (EPA SW-846 protocol)
TTQAP	Task Technical and Quality Assurance Plan
VOA	Volatile organic analysis

1.0 Introduction

Spherical resorcinol-formaldehyde resin (sRF) was developed to support cesium removal for the Hanford River Protection Project (RPP) pretreatment plant (Schepens, 2004). Small Column Ion Exchange (SCIX) is another application that may utilize sRF. SCIX would allow in-tank cesium removal from HLW with ion exchange columns in waste tank risers.

The resin is a resorcinol ($C_6H_6O_2$) formaldehyde (CH_2O) polymer and is referred to as RF. This is a weak acid resin and has a strong preference for H^+. It can be eluted by using acid to remove Cs^+ and its competitors. Its relative affinities have been estimated (Smith, 2007) to be $H^+ > Cs^+ > Rb^+ > K^+ > Na^+$.

There has been considerable research both computationally and experimentally with sRF on radioactive high alkaline wastes, both simulated and real. However, most of those studies have been limited to waste supernates stored at the Hanford Site rather than those at SRS (Adamson et al., 2006, Fiskum et al., 2006a, 2006b, 2006c, 2006d, Nash et al, 2006). At least one significant difference between those Hanford wastes versus SRS waste is the concentration of potassium. As mentioned above, potassium is a competitor of cesium for sites on the sRF resin so its presence will affect loading performance. In general, SRS waste supernates have significantly lower concentrations of potassium (<0.05 M) versus Hanford waste supernates. Some Hanford supernates contain potassium at concentrations an order of magnitude higher. Cesium removal with sRF resin should thus process a greater volume of SRS supernate than more potassium-laden feeds in each cycle.

This work characterizes two resin beds that had been run at SRNL in two nonradioactive cycles followed by two cycles with actual waste feed. Details of the column campaigns are covered in Nash and Duignan, 2009a. Both simulant and radioactive feed compositions are repeated in this report along with summaries of BV's fed and resin mass determinations.

sRF resin will eventually lose its effectiveness and will need replacement after many cycles of treatment and regeneration. Proper handling of the spent resin requires a well defined path forward for disposal as a hazardous waste. To assist in the development of a disposition plan, the column testing terminated by removing the spent resin after it was put in H-form with 0.5 M nitric acid. The current work subjected the spent resin to the TCLP method that evaluates it for leaching of specific organic and inorganic analytes. Portions were also dissolved for characterization at the Savannah River National Laboratory (SRNL).

This work was governed by a Task Technical and Quality Assurance Plan (Nash and Duignan, 2009b). Safety was controlled by electronic Hazard Assessment Package (SRNL-L3000-2009-00006, rev. 0). Data were recorded in a laboratory notebook (Nash, 2008).

2.0 Experimental

2.1 Resin History and Handling

Microbeads batch 5E-370/641 resin, which had been made on the hundred-gallon scale, was purchased from Microbeads AS in Skedsmokorset, Norway. The spherical beads are shown in Figure 1. The resin is stored in hydrogen form under deionized (DI) water in sealed containers. The specific material had not previously seen pretreatment or use and was procured for large-scale column work (Adamson et al., 2006). It had been stored in large metal drums in the Engineering Development Laboratory of SRNL for at least three years. Random samples of resin were taken from a drum and combined to provide about 150 mL of resin for this work. This sub-sample was stored in a wide-mouth polyethylene bottle in a metal paint can to prevent light induced degradation or other changes.

Protocol P1, part B was performed initially for the resin to be used in batch and column work (Nash, 2004). The resin was converted to sodium form and back to hydrogen form to swell and clean it. The resin was returned to DI water storage in a polyethylene bottle/paint can.

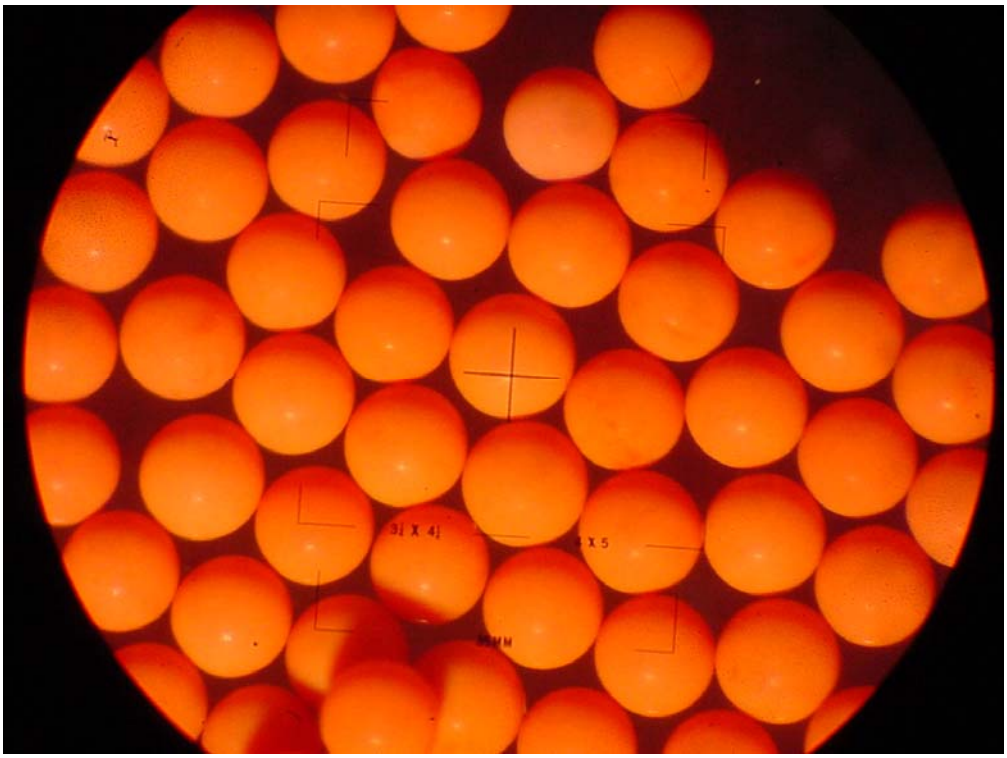

Figure 1. Spherical RF Resin in Hydrogen Form

The two resin beds that were used for the column work and analyzed for this report were subject to many hours of waste processing (Nash and Duignan, 2009a). Each of two IX columns had a resin bed as shown in Figure 2. Resin bed heights were approximately 6.5 cm and diameters were approximately 1.5 cm. The non-radioactive test that used a

simulated waste was performed first. During that test Column 1, or Bed 1, and Column 2, or Bed 2 had an average BV of 10.6 mL. This test was followed by a radioactive test that used actual SRS waste and reused the same resin beds that were used for the simulant test, but the average BV was 11.2 mL. The bed volumes increased slightly due to cycling that causes the beds to shrink during elution and expand during regeneration. Both tests included two complete IX cycles. A cycle is comprised of: waste treatment, waste displacement with 0.1 M NaOH, pre-elution rinse with DI water, elution with 30 BV of 0.5 HNO_3, post-elution rinse with DI water, and then resin regeneration with 0.5 M NaOH.

During Cycle 1 of the simulant test, Bed 1 processed approximately 2.90 liters of simulated waste, Table 1, which then continued on through Bed 2. After Bed 1 was regenerated and Cycle 2 began, Bed 2 processed approximately 5.48 liters of the simulated waste, which then continued on through Bed 1 to complete the simulant test.

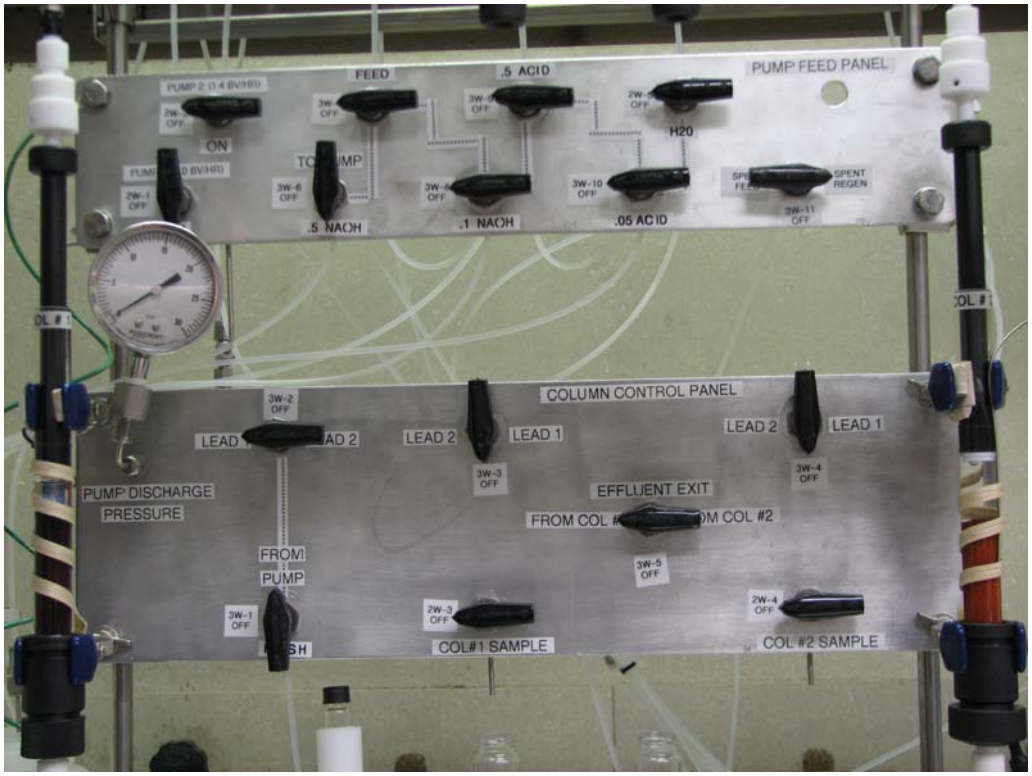

Figure 2. IX Columns (left and right side), with Control Valves for the Feeds

The "SRS Tanks Real Waste" in Table 1 was made by dissolving saltcake from SRS Tanks 25F and 41H. There was no attempt to match the SRS Tank 2F simulant (Smith, 2007) except for targeting 6 M sodium. However, concentrations of major components in the dissolved salt product were similar to Tank 2F dissolved salt. Minor components in the real waste were measured by inductively-coupled plasma emission spectroscopy (ICP-ES) detection limits.

Subsequent to simulant work, both resin beds were regenerated and prepared for the actual waste test, which repeated the process of the simulant test. In Cycle 1 of the radioactive test, Bed 1 processed approximately 4.77 liters of actual waste which then continued on through Bed 2. After Bed 1 was regenerated and Cycle 2 began, Bed 2 processed approximately 3.64 liters of the actual waste, which also continued on through Bed 1 to complete the radioactive test.

Table 1. Comparision of Simulated and Real Wastes Used for IX Column Test

Species	Unit	Tank 2F Simulant	SRS Tanks Real Waste
Na^{+1}	M	6.26	6.05
NO_3^{-1}	M	4.94	3.53
NO_2^{-1}	M	0.171	0.174
OH^{-1}	M	0.8	0.81
Total OH	M	1.39	1.47
SO_4^{-2}	M	0.033	0.119
PO_4^{-3}	M	< 0.01	0.007
Al	M	0.32	0.32
B	mg/L	n/a	6.02
Cr	mg/L	n/a	43.1
Fe	mg/L	n/a	<1.2
Hg	mg/L	n/a	6.4
Mo	mg/L	n/a	7.69
Si	mg/L	n/a	50.5
Zn	mg/L	n/a	1.83
F^{-1}	M	< 0.013	< 0.013
K^{+1}	M	0.0076	0.0083
Cs^{+1}	M	1.69E-05	1.92E-05
P	M	0.0053	0.011
S	M	0.037	0.129
pH	-	14	14
density (25°C)	g/mL	1.306	1.300

"n/a" is "not applicable" because the element was not added or detected.

2.2 Resin Dissolution Method

It was desired to completely dissolve the organic resin samples in a closed vessel to preserve volatile analytes like mercury. A Parr™ vessel was not needed because a method using 8 M nitric acid and a sealed Teflon™ vessel was demonstrated with previously characterized nonradioactive sRF samples, then used on the current radioactive samples. The method followed an Analytical procedure modified for the lower temperature and exclusion of hydrochloric acid (Coleman, 2009). A Type 1 calculation was performed before resin dissolution commenced (Nash, 2009). In all cases, the resin samples were found to dissolve completely in 8 M nitric acid in less than 4 hours at 85ºC, with vessels allowed to cool overnight. The data for the non-radioactive work are included in Appendix A.

3.0 Results and Discussion

3.1 Resin Analyses

The SCIX experiment provided a resin bed sample from each of the two columns. A brief history of Bed 1 and Bed 2 resin samples is shown in Table 2. Bed volumes (BV) fed are actual and are based on 10.5-mL beds for simulant work and 11.2 mL beds for radioactive work.

Table 2. Resin History

Resin	Simulant work, Tank 2F	Radioactive Work
BED 1	Lead column loading, 278 BV, elution	
	Lag column loading, 523 BV, elution	
		Lead column loading, 563 BV, elution
		Lag column loading, 315 BV, elution
BED 2	Lag column loading, 278 BV	
	Lead column loading, 523 BV, elution	
		Lag column loading, 428 BV
		Lead column loading, 315 BV, elution

Table 3 provides an accounting of the masses of resin retrieved. All values are masses of damp resin. Each bed was homogenized and all retrieved resin was consumed in the analyses, though Table 3 notes some loss of resin in transfers to dissolution vessels. Each column did not appear to contain any more resin beads after the bed materials were retrieved with deionized water and plastic transfer pipettes. Bed 1 total mass of damp resin was 6.9158 g, which would be 3.658 g dried. Bed 2 total mass of damp resin was 6.8541 g, which would be 3.715 g dried. Resin sample masses in the table below are for moist resin after free liquid water was removed by filtration where vacuum was applied for several minutes.

Table 3. Damp Resin Masses Retrieved

Resin Sample	Treatability Study Number	Resin Sample Mass, g	Sample Use	Weight % Resin
	TS138-09-A-			
Bed 1	103214	0.7738	Dissolution	
Bed 1	103215	5.7744	TCLP	
Bed 1	103218	0.3676	Dry resin wt%	52.9
Bed 2	103216	0.7016	Dissolution	
Bed 2	103217	5.8367	TCLP	
Bed 2	103219	0.3158	Dry resin wt%	54.2

Note: 0.456 g, total, of TS138-09-A-103214 was actually transferred into three dissolution vessels.
0.411 g, total, of TS138-09-A-103216 was actually transferred into three dissolution vessels.

Each resin sample for dissolution required three dissolution vessels because dissolution had an organic mass safety limit of approximately 0.2 g. Each sample thus produced three acid aliquots that were recombined to represent dissolution of the greater-than-0.2 g sample.

3.1.1 Dissolved Resin Analyses

Sodium and aluminum were at relatively high concentrations in the waste feeds as shown in Table 1. Table 1 data are from Nash and Duignan, 2009a. Chromium and iron in the radioactive SRS ion exchange feed were 43 ±1.9% mg/L and <1.2 mg/L respectively. Mercury was 6.4 ±1.6 mg/L. Literature reviewed later in this report show that sRF resin has an affinity for iron and chromium. Table 4 below provides elemental content on a dry basis from ICP-ES. Major elements found are sodium, boron, iron, aluminum, chromium, and sulfur. Sulfur is likely part of the resin as-manufactured. Potassium was on the edge of detection given the large relative standard deviation (RSD).

Table 5 shows results from spectroscopy. Methods are mass spectroscopy, atomic absorption for potassium (AAK) and cold-vapor mercury (CV-Hg). Mass 138 is stable barium-138 which is the most abundant natural isotope of barium. The barium concentration was too low for ICP-ES to detect. Masses 196, 198, and 204 likely indicate mercury given that its natural isotopic profile is 0.15%, 10.0%, and 6.87% for the three masses respectively (CRC Handbook, 2008; pp. 11-166,167). CV-Hg is the reliable value for mercury in evaluating resin content. Mass 204 may contain some lead (1.48% natural abundance). Conversion of the Mass 99 numbers into Tc-99 activity would result in values of 7.53E+04 and 4.55E+05 dpm/(g resin) respectively.

Table 4. ICP-ES Results for Dissolution of Resin Samples

	Bed 1 Resin			Bed 2 Resin		
Element		**µg/g**	**Element**		**µg/g**	**Element**
Ag	<	5.07	N/A	<	5.48	N/A
Al		118	3.71		393	1.70
B		85.4	0.976		114	2.15
Ba	<	1.16	N/A	<	1.25	N/A
Be	<	0.34	N/A	<	0.37	N/A
Ca		22.3	2.18		46.5	1.74
Cd	<	2.51	N/A	<	2.73	N/A
Ce	<	20.2	N/A	<	22.0	N/A
Cr		1739	0.366		956	0.496
Cu	<	4.14	N/A	<	4.48	N/A
Fe		71.5	2.91		88.9	1.88
Gd	<	4.59	N/A	<	4.96	N/A
K	<	51.2	N/A		60.9	35.6
La	<	2.50	N/A	<	2.71	N/A
Li	<	4.23	N/A	<	4.59	N/A
Mg		4.86	0.98		9.85	0.588
Mn		1.27	0.672		2.29	3.92
Mo	<	8.87	N/A	<	9.59	N/A
Na		221	2.22		448	1.33
Ni	<	6.64	N/A	<	7.20	N/A
P	<	45.0	N/A	<	48.7	N/A
Pb	<	28.5	N/A	<	30.8	N/A
S		1019	9.55		1196	15.8
Sb	<	28.7	N/A	<	31.0	N/A
Si	<	24.6	N/A	<	26.6	N/A
Sn	<	13.5	N/A	<	14.6	N/A
Sr	<	0.22	N/A		1.03	5.02
Ti	<	5.03	N/A	<	5.42	N/A
U	<	119	N/A	<	128	N/A
V	<	2.50	N/A	<	2.71	N/A
Zn		5.35	5.06		11.6	4.66

Table 5. Spectroscopy Data for the Resins, μg/g

Element	Bed 1	% RSD	Bed 2	% RSD	Assigned Isotope
Mass 99	2.00	0.71	12.1	2.78	Tc-99
Mass 133	2.44	5.29	2.71	3.52	Cs-133
Mass 137	<0.259	N/A	<0.280	N/A	Cs-137
Mass 138	0.490	4.66	0.63	19.6	Ba-138
Mass 196	3.84	2.24	3.21	13.8	Pt/Hg
Mass 198	565	0.54	474	0.11	Hg/Pt
Mass 204	735	1.2	620	0.87	Hg/Pb
Mass 237	1.37	3.02	0.64	0.75	Np-237
Mass 238	3.19	3.12	2.75	2.33	U-238*
Mass 239	0.27	2.46	0.30	16.3	Pu-239
AAK	<31	N/A	<34.4	N/A	
CV-Hg	4230	20	3720	20	

*Mass of U-238 predominates over Pu-238.

Table 6 lists the major radioisotopes that were measured for the two resin samples. Pu-238 is the most active actinide found. Its activity in the resin is comparable to that of the Cs-137. Very small activities of Am-241 and Cm-244 were detected though %RSD's were relatively high. Plutonium provided the majority of the actinide activity. The high activity of Pu-238 interfered with measurements of the other isotopes of plutonium.

Table 6. Radiochemical Data for the Resins, dpm/(g resin)

Isotope	Bed 1	% RSD	Bed 2	% RSD
Sr-90	3.04E+05	14.8	3.73E+05	13.0
Cs-137	2.44E+06	5.0	7.95E+06	13.6
Pu-238	2.74E+06	7.24	3.12E+06	6.3
Pu-239/240	<2.7E+04		<1.5E+04	
Pu-241	5.75E+04	11.5	8.56E+04	11.1
Am-241	56.1	17%	120.3	17%
Am-243	< 3.29		< 3.21	
Am-242m	< 8.30		< 8.10	
Cm-243	< 11.81		< 11.53	
Cm-245	< 9.68		< 9.45	
Cm-247	< 18.41		< 17.97	
Cf-249	< 19.28		< 18.82	
Cf-251	< 11.46		< 11.18	
Cm-242	< 0.69		< 0.67	
Cm-244	312	20%	705	20%

Table 6 shows that Bed 2 consistently had higher activities than Bed 1. This may have been caused by the different cycle operations seen by each bed. Both beds had been

eluted before radioactive work commenced. In radioactive service Bed 1 was loaded, eluted, loaded (in the lag position), then eluted again. In contrast Bed 2 was loaded (lag position), loaded some more (lead position), then eluted once in radioactive service. Bed 1 saw two elutions while Bed 2 saw one elution in radioactive service.

3.1.2 TCLP Analyses

Two damp resin samples were sent to GEL Laboratories, LLC, of Charleston, SC for TCLP analyses under SRS Job 09527. Samples were shipped in small glass vials with chain of custody. Each sample was extracted per the EPA TCLP method and the extracts were analysed by Volatile Organic Analysis (VOA, EPA method 8260B), CVAA for mercury, and ICP-ES for RCRA metals outside of mercury. Highlights of the results are shown in Table 7.

Table 7. Summary of TCLP Results for Bed 1 and Bed 2 Resins

	Result	DL	RL	units	DF
Column 1 – Volatile Organics					
Benzene	627	71.4	238	μg/kg	50
Column 1 – Metals Analyses					
Mercury	174	6.6	20	μg/L	10
Barium	189	10	50	μg/L	1
Chromium	194	10	50	μg/L	1
Column 2 – Metals Analyses					
Mercury	631	13.2	40	μg/L	20
Barium	145	10	50	μg/L	1
Chromium	162	10	50	μg/L	1

DL = Detection Limit. Minimum level of analyte that can be identified (not quantified) with 99% confidence (is it present?)
RL = Reporting Limit. Lowest limit which a chemical may be accurately and reproducibly quantified (How much is present?)
DF = Dilution Factor

Column 1 (Bed 1) resin also had butanone and acetone at "J" levels. A "J" level means that the component is above the detection limit of the analysis method but below the level at which a reliable quantitative value can be determined. Column 2 (Bed 2) resin VOA reported no organic components at or above detection levels.

3.1.3 Estimation of Elemental Masses in Feed, Elution, and Resin

Data from the experimental work (Nash and Duignan, 2009a) plus resin analyses from this work are used here to estimate masses of some elements outside of cesium in the

radioactive campaigns. Table 8, shown below, was generated using the following information: (1) Total feed volume (5072 mL for Cycle 1 and 3308 mL for Cycle 2) are summed so that total elemental inputs are feed concentrations times 8380 mL, and (2) each elution volume of 316 mL of 0.5 M nitric acid carries away the majority of eluted elements. Note that the Eluate 1 composite is from the first cycle elution of the Column 1 resin bed. Column 1 was eluted again at the end of the second cycle though it was the lag column in that cycle and had little cesium. Column 2 only had one elution which provided the Eluate 2 composite. No composited column product analyses from either cycle were made or analyzed.

Table 8. Estimation of Elemental Masses for Feed, Eluate, and Resin

Element/Isotope	Feed	Eluate 1 composite	Eluate 2 composite	Units	Resin bed 1	Resin bed 2	Units
Pu-238	2.37E+08	3.54E+07	2.87E+07	dpm	1.00E+07	1.16E+07	dpm
Pu-239/240	4.95E+06	6.13E+05	9.64E+05	dpm	bd	bd	dpm
Pu-241	bd	1.18E+06	1.32E+06	dpm	2.10E+05	3.18E+05	dpm
Tc-99	5.82E+08	2.79E+05	2.42E+05	dpm	2.75E+05	1.68E+06	dpm
Hg	54.4	nm	nm	mg	15.5	13.8	mg
Cr	366	0.411	0.379	mg	6.36	3.55	mg

nm = not measured, bd = below detection, dpm = decays per minute
"1" and "2" refer to Cycle number for Eluates and to bed number for resins.

Pu-238 data are the most reliable plutonium data because the majority isotope interferes with measurement of the other plutonium isotopes. Almost 10% of the plutonium fed to the process was held by the resin beds after elution. Another 28% was found in the acid eluates above. Note that additional plutonium would have been in the second elution of Column 1. More than 99% of the technetium fed to the process passed through the columns without being adsorbed by the resin.

Mercury data show substantial holdup on the resin. More than 50% of the mercury fed to the process remained on the resin beds after elution. The resin shows some affinity for chromium but overall about 97% of the chromium in the feed passed through without adsorption.

3.2 Comparison of Resin Content with Past Work

Past work measuring content of cycled sRF resin provides some opportunity for comparison with the current work, though resin histories differ. This comparison looks at the most significant elements and isotopes that were found by the investigators. The four references are Nash, Duignan, and Duffey, 2006, Fiskum et al., 2006a, Fiskum et al., 2006b, and Nash and Fowley, 2007. In all cases here the resins were converted to hydrogen form before analysis. The conversions were accomplished by elution with 0.5 M nitric acid when the resins were still in the ion exchange column.

Nash, Duignan, and Duffey, 2006 cycled one resin bed once by loading with a simulant of Hanford AP-101 at 45ºC while a second bed was cycled once with a simulant of Hanford AN-107 at 25°C. Both beds were eluted before resin sampling. AP-101 is relatively high in chromate (145 mg/L Cr), free hydroxide (2 M), and potassium (0.75 M). AN-107, in contrast, was a high complexant simulant rich in dissolved transition metals. The simulant used in this work had been processed with sodium permanganate, strontium nitrate, and filtration to mimic an Sr-90 and actinide removal process to be used at the Hanford River Protection Project, Waste Treatment Plant (RPP-WTP). This material had little chromium or potassium and free hydroxide was 0.7 M after processing.

Fiskum et al., 2006a did an extensive characterization of two resin beds after use with actual AP-101 and AN-102 supernates. AN-102 is a complexant waste that was 1.06 M in free hydroxide after Sr-90 and actinide removal processing. It had 33 mg/L chromium and 0.026 M potassium. Details of the resin cycles are in Fiskum et al., 2006c and Fiskum et al., 2006d. Note that the same 2-column resin beds were used across the works. The lead and lag resins first saw a load/elute cycle with AP-101 simulant, then with actual AP-101. In Fiskum's work (2006d) the lead/lag roles of the columns were reversed after the first campaign (2006c) and AN-102 feed was processed. Note that columns were eluted with 0.5 M nitric acid before and after loading. The lag column of the AP-101 work was not eluted until the beginning of the AN-107 program. It was acid washed as the lead column was at that time.

Fiskum et al., 2006b used many lots of sRF resin along with some ground gel RF resin to examine performance in nonradioactive simulants vs. manufacturing technique. Only stable cesium was measured in the eluted resin samples.

Nash and Fowley, 2007 exposed sRF resin to pretreated AN-107 simulant that was spiked with toxic metals and organic chemicals of environmental interest to elevate their concentration above the typical levels. The simulant had been processed with sodium permanganate, strontium nitrate, and filtration to mimic a Sr-90 and actinide removal process. The process removed all of the measurable mercury that had been added to the simulant. The resin interacted with elevated levels of lead, chromium, and cadmium for three load/elute cycles. This work included a TCLP analysis of the resins using an EPA-certified laboratory along with resin dissolution and metals analyses.

3.2.1 Comparison of Resin Metals Contents

Table 9 shows data from past analyses of hydrogen form resin samples, with results given in micrograms per gram of dry resin. "N/A" is used when a reference does not report a measurement. There are two values reported in most cases because most of the researchers analyzed two resin samples. These samples were not duplicates – they were lead and lag column samples with different histories, or from columns seeing different feeds. While the resins had different histories, contents of the major elements were reasonably consistent. Potassium content is insignificant for eluted resins. Sulfur levels

are consistent across the board but are believed to be from the method of resin manufacture rather than from feed content.

Resin in the current work saw ample use and feed exposure. Each resin bed in the current work saw a total of 17 liters, or over 1500 BV, of feed (simulant, then rad feed) over 4 cycles. The 2006 works in Table 9 used 5 liters or less of feed in total and 3 cycles or less where each bed was of equivalent size to the current work. Nash and Fowley, 2007, used 8 liters of complexant simulant in recycle mode for a total of about 800 BV of feed.

Cesium (Mass 133) in the current work is notably high compared to the other works. At the same time Cs-137 is in line with past values, suggesting that the resin retained its initial nonradioactive cesium in preference to later cesium exposure.

Table 9. Predominant Stable Elements Reported in Used sRF Resin

Element, µg/g	Current work	Nash et al., 2006	Fiskum et al., 2006a	Fiskum et al., 2006b	Nash and Fowley, 2007
Chromium	1740	1660	337	N/A	2130
	956	[7.74] (1)	338		668
Iron	71.5	26	N/A	N/A	<10
	88.9	70			
Sodium	221	<52	[68] (2)	N/A	<36
	448	169	[160] (2)		<28
Potassium	<31 (3)	<350	N/A	N/A	<241
	<34.4(3)	<319			<187
Sulfur	1019	1350	N/A	N/A	930
	1196	1110			1090
Cesium	2.44	0.237	0.0204	0.15 typical	N/A
	2.71	0.673	0.187		

(1) No chromate was added to the simulant, but the resin captured trace chromium.
(2) Sodium values reported in brackets were above detection but below the estimated quantitation limits, therefore are approximate.
(3) AAK results are listed here because AAK is more sensitive to potassium content than
the ICP-ES method.
Note: Double rows provide two resin sample results as mentioned in the text above.

The current work has the only known mercury measurements for sRF resin. The Nash and Fowley work had added mercury to the AN-107 simulant, but it was found to be removed by the permanganate/strontium filtration process. The filtrate and resin did not have measurable mercury.

3.2.2 Comparison of Resin Radiochemistry

Only Fiskum et al., 2006a provided radiochemical data that can be compared with the current work. Results shown in Table 10 are comparable except that the current resin samples show much higher Pu-238 levels.

Table 10. Comparison of Current Radiochemistry with Fiskum's Results

Isotope, dpm/g	Current work	Fiskum et al., 2006a
Tc-99, μg/g*	2.00	18.9
	12.1	19.4
Cs-137	2.44E+06	7.81E+05
	7.95E+06	8.17E+06
Pu-238	2.74E+06	8.01E+02
	3.12E+06	3.75E+02
Pu-239/240	<2.7E+04	3.82E+03
	<1.5E+04	1.38E+03
Am-241	56.1	604
	120	535
Cm-243/244	312	<44
	705	<44

*Both works report Tc-99 in micrograms/gram. All other values are dpm/g.

3.2.3 Comparison of TCLP Results

The Nash and Fowley, 2007 work performed TCLP testing on resin samples from each of two beds. That work found all RCRA metals below method or laboratory reporting limits except for chromium. Chromium TCLP values were 0.203 and 0.233 mg/L which are well under the 5.0 mg/L RCRA level for chromium. The current work found similar levels for TCLP chromium.

The current work found mercury to be near (0.174 mg/L) and above (0.631 mg/L) the 0.200 mg/L RCRA level for mercury and as mentioned in the preceding section, no other work has information on mercury.

The TCLP results detected barium, but its level is far below RCRA limits for that element. The TCLP barium results were less than 200 micrograms per liter while the regulatory level is 100 milligrams per liter, or 100,000 micrograms per liter.

The current work found benzene in one case (0.627 mg/L) and it was slightly above the 0.5 mg/L RCRA level for benzene. Nash and Fowley, 2007 did not detect benzene even though some had been added into the experiment. The current TCLP work detected 2-butanone similar to the Nash and Fowley work but it was not high enough to be quantified. Acetone was detected in one case here as well but there was not enough to quantify.

4.0 Conclusions

The following conclusions are made concerning the characterization of two sRF resin beds used in SCIX testing (Nash and Duignan, 2009a):

- Chromium, boron, and iron were found to be favored by the resin. There were little of these elements in the feed but both were measured in the eluted resins. This result is consistent with past work using RF resin.
- sRF resin shows strong affinity for mercury. Over 50% of the mercury in the feed was found on the eluted resin beds.
- The current work is unique in its study of mercury. The radioactive feed, having 6.4 mg/L mercury, was the only credible source of mercury. Mercury was specifically not added to the simulant to minimize the creation of more hazardous materials.
- The two resins contained Cs-137 activity that was comparable to past work. It is notable that these resins had a higher content of stable cesium than past work, suggesting that the initial treatment with stable cesium is somehow "locked-in" to new resin. If this effect is real, it did not reduce the active cesium content.
- sRF resin shows an affinity for plutonium. About 10% of the plutonium fed to the 2-cycle process was found on eluted resin beds. More than 28% of the plutonium fed to the process was detected in eluate composites.
- There were insignificant levels of technetium-99, americium, curium, and californium in the used resin samples.
- TCLP showed significant content of mercury and chromium. Barium was measurable but was far below its RCRA limit of 100 mg/L.
- TCLP organics measurements indicated measurable benzene in one case, though the source would be unknown. Past work studying resin response to added benzene did not find any detectable amount.

5.0 Future Work

Additional study of resin affinity for mercury is recommended. The speciation of mercury in the real waste is not known but may be partly organic, such as the methyl mercury cation.

6.0 References

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APPENDIX A. RESIN DIGESTION DATA

The data in this appendix are meant to evaluate resin content analysis. The two dry resin samples from Nash, Duignan, and Duffey, 2006 were still available at the time of the current work. Table 10 documents the concentration measured of indicated analytes after sRF resin was digested . The column headings AP-101 and AN-107 refer to resin after being exposed to non-radioactive simulants of those waste streams that were used in IX columns and were reported in Nash, Duignan, and Duffey, 2006. The adjoining columns in each case show the results of the current dissolution of the same dry resin, i.e., sRF. The largest metal components are comparable for the current resin dissolution method versus past results.

Table 11. Analytes Measured in sRF Resin after Processing Indicated Waste Streams

All units are ug/g dry resin	AP-101	Current work	%diff		AN-107	Current Work	%diff
Al	54	48.3	-11		<46.5	11.5	
Cr	1660	1560	-6		7.74	6.41	-17
Fe	26.2	37.2	42		70.7	74.4	5
Na	51.5	71.3	38		169	240	42
K	<350	<45.2			<319	<46.1	
S	1350	1050	-22		1110	1030	-7
Sr	<0.86	<0.209			2.99	3.27	9
Zn	<5.15	<0.253			16.8	14.8	-12

APPENDIX B. OFFSITE LABORATORY REPORT PROVIDING RESIN TCLP ANALYSES

Distribution:

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GEL Laboratories LLC
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P 843.556.8171 F 843.766.1178

www.gel.com

September 11, 2009

Mr. Jim Koch
Savannah River Nuclear Solutions, LLC
Building 735-B, Room 145A
Aiken, South Carolina 29808

Re: Hazardous Waste RAD II
Work Order: 235903
SDG: 09527

Dear Mr. Koch:

GEL Laboratories, LLC (GEL) appreciates the opportunity to provide the enclosed analytical results for the sample(s) we received on August 24, 2009. This original data report has been prepared and reviewed in accordance with GEL's standard operating procedures.

Our policy is to provide high quality, personalized analytical services to enable you to meet your analytical needs on time every time. We trust that you will find everything in order and to your satisfaction. If you have any questions, please do not hesitate to call me at (843) 556-8171, ext. 4453.

Sincerely,

Heather Shaffer

for Edith Kent
Project Manager

Purchase Order: AC39039N
Enclosures

Table of Contents

Case Narrative

CASE NARRATIVE REPORT
for
Westinghouse Savannah River Site
Subcontract No. AC23322N
Job# 09527

September 11, 2009

Laboratory Identification

GEL Laboratories, LLC
2040 Savage Road
Charleston, South Carolina 29407
(843) 556-8171

Summary

Sample receipt
The samples arrived at GEL Laboratories LLC, Charleston, South Carolina on August 24, 2009 for analysis. Shipping container temperatures were checked, documented, and 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. There are no additional comments concerning sample receipt.

Items of Note
There are no additional items of note concerning this SDG.

Sample Identification
The laboratory received the following samples:

Laboratory ID	Client ID
235903001	09527-ResinBed1
235903002	09527-ResinBed2

Case Narrative

Sample analyses were conducted using methodology as outlined in GEL Laboratories, LLC (GEL) Standard Operating Procedures. Any technical or administrative problems during analysis, data review, and reduction are contained in the analytical case narratives in the enclosed data package.

Data Package

The enclosed data package contains the following sections: General Narrative, Chain of Custody and Supporting Documentation, and data from the following fractions: GC/MS Volatile and Metals.

This data package, to the best of my knowledge, is in compliance with technical and administrative requirements.

Heather Shaffer

for Edith Kent

Project Manager

GEL Laboratories, LLC

Data Package Definitions

The Level **II** Certificate of Analysis contains the following headings:

Sample ID:	Sample Identification
Lab ID:	This is the laboratory identification number
Matrix:	Sample matrix
Date Collected:	Date of sample collection
Date Received:	Date of sample receipt by the laboratory
Priority:	Internal status of sample turnaround
Collector:	Party responsible for sample collection.

The detail on the Certificate includes the following:

Parameter:	Analyte or characteristic tested for in the sample
Qualifier:	Qualifier used for data interpretation
Result:	Final result of each parameter.
DL:	Method Detection Limit
RL:	Reporting Limit
Units:	Units of final result
DF:	Dilution factor
Analyst:	Initials of analyst who performed the test
Date:	Date of analysis
Time:	Time of analysis
Batch:	Analytical batch in which the sample was analyzed
Method:	Analytical method used for the analysis of the sample. Identified on the report numerically with a corresponding table.
Surrogate Recovery:	Provided for organic analysis only. Surrogate compound identified.
Test:	Analytical test associated with surrogate compound.
Percent%:	Surrogate percent recovery
Acceptable Limits:	Limits established for surrogate recoveries based upon the method requirements.

The QC Summary Report contains the following headings:

Sample Parameter:	Analyte or characteristic tested for in the QC sample
Type:	Type of QC sample (i.e., blank, dup, LCS, LCS dup, MS, MSD)
Batch:	Analytical batch in which the QC sample was analyzed
NOM:	Nominal concentration of the spiking compound
Sample:	Amount of compound found in the sample associated with the QC sample.
QC:	Amount of compound found in the QC sample.

Units:	Units of final result
RPD%:	Relative percent difference between LCS/LCS dup, MS/MSD, and Sample/Sample duplicate
REC%:	Recovery for the control samples
Range:	Acceptance limits for control samples
Analyst:	Initials of analyst who performed the test
Date:	Date of analysis
Time:	Time of analysis

Types of QC samples that may be found on the QC Summary Report are:

Blank:	Results of the blank analysis for the sample batch
Dup:	Duplicate analysis of sample
LCS:	Lab control sample
LCS dup:	Lab control sample duplicate
MS:	Matrix spike
MSD:	Matrix spike duplicate

The following are definitions of reporting limits used at General Engineering Laboratories:

DL — Detection Limit: The minimum level of an analyte that can be determined (identified not quantified) with 99% confidence. The values are normally achieved by preparing and analyzing seven aliquots of laboratory water spiked 1 to 5 times the estimated MDL, taking the standard deviation and multiplying it against the one-tailed t-statistic at 99%. This computed value is then verified for reasonableness by repeating the study using the concentration found in the initial study, calculating an F-ratio, and computing the final limit. Sample specific preparation and dilution factors are applied to these limits when they are reported.

The detection limit is the minimum concentration of a substance that can be identified, measured, and reported with 99% confidence that the analyte concentration is above zero. It answers the question "Is It Present".

QL — Quantitation Limit: The lowest concentration that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions. The QL is generally 5 to 10 times the MDL. However, it may be nominally chosen within these guidelines to simplify data reporting. For many analytes the QL analyte concentration is selected as the lowest non-zero standard in the calibration curve. Sample QL's are highly matrix-dependent. Sample specific preparation and dilution factors are applied to these limits when they are reported.

The QL is always $\geq$ DL

RL Reporting Limit: Same as the QL except where driven by contract or client specifications. If the sample specific preparation and dilution factors cause the QL to be elevated above the RL, then the QL is used as the RL.

The quantitation limit is the lowest level at which a chemical may be accurately and reproducibly quantitated. It answers the question "HOW MUCH IS PRESENT".

Interpretation of RESULT column on the Certificate of Analysis:

If the final concentration in the sample was found to be above the RL, then the value reported is reported without a flag;

If the final concentration in the sample was found to be below the RL but above the DL, then the value reported is flagged with a "J";

If the final concentration in the sample was found to be below the DL, the value reported is flagged with a "U".

Quality Control Flags

General Engineering Laboratories maintains acceptance criteria for QC samples through use of statistical process control (SPC). The SPC limits are used to qualify data usability. The flagging criterion identified in WSRC AN98 Format does not necessarily coincide with the laboratory SPC criteria. There may be instances where the Electronic Data Deliverable (EDD) has flagged data based on the AN98 criteria and the lab has not identified the data to be outside of established control limits.

Those instances where the QC has not met laboratory SPC established criteria will be noted in the section case narratives that are included in this package.

GC/MS Volatile Analysis

GC/MS Volatile Organics
Savannah River Nuclear Solutions, LLC (WSRS)
SDG 09527

Method/Analysis Information

Procedure:	Volatile Organic Compounds (VOC) by Gas Chromatograph/Mass Spectrometer
Analytical Method:	SW846 8260B
Prep Method:	SW846 5030
Analytical Batch Number:	899167
Prep Batch Number:	899165

Sample Analysis

The following client and quality control samples were analyzed to complete this SDG using the methods referenced in the Analysis Information section:

Sample ID	Client ID
235903001	09527-ResinBed1
235903002	09527-ResinBed2
1201915367	High Blank (HB)
1201915363	Method Blank (MB)
1201915366	Laboratory Control Sample (LCS)
1201915364	235903001(09527-ResinBed1) Post Spike (PS)
1201915365	235903001(09527-ResinBed1) Post Spike Duplicate (PSD)

NOTE: For volatile organic analyses the matrix spike designations may be indicated as "PS" or "PSD". The "PS" designation (post spike) indicates that the matrix was fortified prior to analysis but after applying any prep factors, such as a dilution. The laboratory considers the MS/MSD and PS/PSD designations interchangeable.

The samples in this SDG were analyzed on an "as received" basis.

Preparation/Analytical Method Verification

SOP Reference
Procedure for preparation, analysis and reporting of analytical data are controlled by GEL Laboratories LLC as Standard Operating Procedure (SOP). The data discussed in this narrative has been analyzed in accordance with GL-OA-E-038 REV# 12.

Raw data reports are processed and reviewed by the analyst using the Target software package. False positives have been removed from the Target quantitation reports per standard operating procedures (SOP) section 19.1.2.

Calibration Information

Please note that the 'Cal Date' indicated on each quantitation report reflects the date and time of the most recent calibrated analyte(s) in the Target processing method. Since the laboratory may calibrate with multiple solutions on different days using the same processing method, the Target software will update the 'Cal Date' to the last calibration file, date and time. The correct dates and times for all calibration files are located on the Calibration History report in the Standard Data section in the data package.

The surrogate compounds were calibrated using a minimum five-point calibration curve. The surrogates were added by the auto sampler at a concentration of 50 ug/L. GEL Laboratories LLC will not have surrogate recoveries reported for Dibromofluoromethane. This is due to increased regulations for this analyte and an industry shortage.

Due to software limitations, the Calibration Summary Form 6 may not indicate all the calibration files comprising the initial calibration. A complete list of the initial calibration data files are shown in the Calibration History report located in the Standard Data section of the data package.

The linear equation used in Target and indicated on the initial calibration summary form is not a conventional linear equation (slope intercept formula) and does not match the equation found in SW-846 method 8000B. The x and y axes are inversed in Target, so that the instrument response is treated as the independent variable (x) and the concentration ratio is treated as the dependent variable (y). The equation used in Target to calculate sample results is adjusted to account for the linear equation inversion and reciprocal slope. The adjusted calculation has been independently verified to produce valid results.

Initial Calibration
All initial calibration requirements have been met for this sample delivery groups (SDG). A second source initial calibration verification (ICV) was included in the standard section directly behind the initial calibration.

Continuing Calibration Verification Requirements
All associated calibration verification standard(s) (ICV or CCV) met the acceptance criteria.

Quality Control (QC) Information

Method Blank (MB) Statement
Target analytes were detected in the blank below the reporting limit.

Surrogate Recoveries
Surrogate recoveries in all client and quality control samples were within the acceptance limits.

Laboratory Control Sample (LCS) Recovery
The LCS spike recoveries met the acceptance limits.

QC Sample Designation
Sample 235903001 (09527-ResinBed1) was designated for spike analysis in this SDG.

Matrix Spike (PS) Recovery Statement
The spike recoveries for this SDG were within the required acceptance limits.

Matrix Spike Duplicate (PSD) Recovery Statement
The spike duplicate recoveries for this SDG were within the required acceptance limits.

Relative Percent Difference (RPD) Statement
The RPD(s) between the matrix spike pair met the acceptance limits.

Internal Standard (ISTD) Acceptance
The internal standard responses in all client and quality control samples met the required acceptance criteria.

Technical Information

Holding Time Specifications
GEL assigns holding times based on the associated methodology, which assigns the date and time from sample collection or sample receipt. Those holding times expressed in hours are calculated in the ALPHALIMS system. Those holding times expressed as days expire at midnight on the day of expiration. All samples in this SDG met the specified holding time.

Sample Preservation and Integrity
All samples met the sample preservation and integrity requirements.

Sample Dilutions/ Methanol Dilutions
The samples in this SDG were diluted using the methanol extraction procedure for medium-level concentration samples because the sample matrices were not amenable to more concentrated analyses.

Sample Re-extraction/Re-analysis
Re-analyses were not required for samples in this SDG.

Miscellaneous Information

Nonconformance (NCR) Documentation
NCR # 708771 was generated for this SDG.

Manual Integrations
Some initial calibration standards, continuing calibration standards, and/or samples may have required manual integrations due to software limitations.

TIC Comment
Tentatively identified compounds (TIC) were not required for this SDG.

Additional Comments
Acetone and 2-Butanone were detected in the screening analysis of Burdick and Jackson Purge and Trap Methanol Lot CY840 above the GEL MDL's but below the PQL's. Methanol was required in the analysis of samples associated with this SDG. The concentrations of 2-Butanone and Acetone were below the vendor certification levels for volatile compounds. Target analytes were detected in the High blank below the reporting limit.

Residual Chlorine
Residual Chlorine was not detected in any of the samples in this SDG.

System Configuration

The Volatile-GC/MS analysis was performed on the following instrument configuration:

Instrument ID	Instrument	System Configuration	Column ID	Column Description	P & T Trap
VOA9.I	Gas Chromatograph/Mass Spectrometer	HP6890/HP5973	DB-624	J&W, 60m x 0.25mm x 1.4um	Trap 10

Certification Statement
Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless otherwise noted in the analytical case narrative.

GEL LABORATORIES LLC
2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis Report
for

WSRS003 Savannah River Nuclear Solutions, LLC (AC39039N)

Client SDG: 09527 GEL Work Order: 235903

The Qualifiers in this report are defined as follows:

J EPA Functional Guideline Code:Result >= MDL but result < PQL/RDL

U EPA Functional Guideline Code:Result < MDL

V EPA Storet Code:Positive blank result and sample result > MDL

Review/Validation

GEL requires all analytical data to be verified by a qualified data reviewer. In addition, all CLP-like deliverables receive a third level review of the fractional data package.

The following data validator verified the information presented in this case narrative:

Erin Haubert 09/09/09

Sample Data Summary

GEL LABORATORIES LLC
2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Company : Savannah River Nuclear Solutions, LLC
Address : Building 735-B, Room 145A
Aiken, South Carolina 29808

Report Date: September 5, 2009

Contact: Mr. Jim Koch
Project: **Hazardous Waste RAD II**

Client Sample ID: 09527-ResinBed1
Sample ID: 235903001
Matrix: SO
Collect Date: 18-AUG-09 09:15
Receive Date: 24-AUG-09
Collector: Client

Project: WSRS00207
Client ID: WSRS003

Parameter	Qualifier	Result	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Volatile Organics Federal										
GEL 8260B Method List Soil Fed "As Received"										
1,1,1,2-Tetrachloroethane	U	0.00	71.4	238	ug/kg	50	RXY1 09/01/09	1713	899167	1
1,1,1-Trichloroethane	U	0.00	71.4	238	ug/kg	50				
1,1,2,2-Tetrachloroethane	U	0.00	71.4	238	ug/kg	50				
1,1,2-Trichloroethane	U	0.00	71.4	238	ug/kg	50				
1,1-Dichloroethane	U	0.00	71.4	238	ug/kg	50				
1,1-Dichloroethylene	U	0.00	71.4	238	ug/kg	50				
1,1-Dichloropropene	U	0.00	71.4	238	ug/kg	50				
1,2,3-Trichloropropane	U	0.00	71.4	238	ug/kg	50				
1,2,4-Trichlorobenzene	U	0.00	71.4	238	ug/kg	50				
1,2-Dibromo-3-chloropropane	U	0.00	71.4	238	ug/kg	50				
1,2-Dibromoethane	U	0.00	71.4	238	ug/kg	50				
1,2-Dichlorobenzene	U	0.00	71.4	238	ug/kg	50				
1,2-Dichloroethane	U	0.00	71.4	238	ug/kg	50				
1,2-Dichloropropane	U	0.00	71.4	238	ug/kg	50				
1,3-Dichlorobenzene	U	0.00	71.4	238	ug/kg	50				
1,3-Dichloropropane	U	0.00	71.4	238	ug/kg	50				
1,4-Dichlorobenzene	U	0.00	71.4	238	ug/kg	50				
2,2-Dichloropropane	U	0.00	71.4	238	ug/kg	50				
2-Butanone	J	976	357	1190	ug/kg	50				
2-Chloro-1,3-butadiene	U	0.00	71.4	238	ug/kg	50				
2-Hexanone	U	0.00	357	1190	ug/kg	50				
4-Methyl-2-pentanone	U	0.00	298	1190	ug/kg	50				
Acetone	J	487	395	1190	ug/kg	50				
Acetonitrile	U	0.00	1490	5950	ug/kg	50				
Acrolein	U	0.00	369	1190	ug/kg	50				
Acrylonitrile	U	0.00	238	1190	ug/kg	50				
Allyl chloride	U	0.00	238	1190	ug/kg	50				
Benzene		627	71.4	238	ug/kg	50				
Bromochloromethane	U	0.00	78.6	238	ug/kg	50				
Bromodichloromethane	U	0.00	71.4	238	ug/kg	50				
Bromoform	U	0.00	71.4	238	ug/kg	50				
Bromomethane	U	0.00	71.4	238	ug/kg	50				
Carbon disulfide	U	0.00	298	1190	ug/kg	50				
Carbon tetrachloride	U	0.00	71.4	238	ug/kg	50				
Chlorobenzene	U	0.00	71.4	238	ug/kg	50				
Chloroethane	U	0.00	71.4	238	ug/kg	50				
Cyclohexane	U	0.00	71.4	238	ug/kg	50				

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Certificate of Analysis

Company : Savannah River Nuclear Solutions, LLC
Address : Building 735-B, Room 145A
Aiken, South Carolina 29808

Report Date: September 5, 2009

Contact: Mr. Jim Koch
Project: **Hazardous Waste RAD II**

Client Sample ID: 09527-ResinBed1
Sample ID: 235903001

Project: WSRS00207
Client ID: WSRS003

Parameter	Qualifier	Result	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Volatile Organics Federal										
GEL 8260B Method List Soil Fed "As Received"										
Dibromochloromethane	U	0.00	71.4	238	ug/kg	50				
Dibromomethane	U	0.00	71.4	238	ug/kg	50				
Dichlorodifluoromethane	U	0.00	81.0	238	ug/kg	50				
Ethyl acetate	U	0.00	298	1190	ug/kg	50				
Ethylbenzene	U	0.00	71.4	238	ug/kg	50				
Iodomethane	U	0.00	381	1190	ug/kg	50				
Isobutyl alcohol	U	0.00	3860	11900	ug/kg	50				
Isopropylbenzene	U	0.00	71.4	238	ug/kg	50				
Methacrylonitrile	U	0.00	310	1190	ug/kg	50				
Methyl acetate	U	0.00	395	1190	ug/kg	50				
Methyl methacrylate	U	0.00	238	1190	ug/kg	50				
Methylcyclohexane	U	0.00	71.4	238	ug/kg	50				
Methylene chloride	U	0.00	476	1190	ug/kg	50				
Propionitrile	U	0.00	398	1190	ug/kg	50				
Styrene	U	0.00	71.4	238	ug/kg	50				
Tetrachloroethylene	U	0.00	71.4	238	ug/kg	50				
Toluene	U	0.00	71.4	238	ug/kg	50				
Trichloroethylene	U	0.00	78.6	238	ug/kg	50				
Trichlorofluoromethane	U	0.00	71.4	238	ug/kg	50				
Trichlorotrifluoroethane	U	0.00	381	1190	ug/kg	50				
Vinyl acetate	U	0.00	298	1190	ug/kg	50				
Vinyl chloride	U	0.00	71.4	238	ug/kg	50				
Xylenes (total)	U	0.00	71.4	238	ug/kg	50				
bis(2-Chloroisopropyl)ether	U	0.00	357	1190	ug/kg	50				
cis-1,2-Dichloroethylene	U	0.00	71.4	238	ug/kg	50				
cis-1,3-Dichloropropylene	U	0.00	71.4	238	ug/kg	50				
m,p-Xylenes	U	0.00	71.4	476	ug/kg	50				
o-Xylene	U	0.00	71.4	238	ug/kg	50				
tert-Butyl methyl ether	U	0.00	71.4	238	ug/kg	50				
trans-1,2-Dichloroethylene	U	0.00	71.4	238	ug/kg	50				
trans-1,3-Dichloropropylene	U	0.00	71.4	238	ug/kg	50				
trans-1,4-Dichloro-2-butene	U	0.00	155	1190	ug/kg	50				

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
SW846 5030	Volatile 5030 Solid Prep	CDS1	09/01/09	1430	899165

The following Analytical Methods were performed

Method	Description	Analyst Comments

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Certificate of Analysis

Company : Savannah River Nuclear Solutions, LLC
Address : Building 735-B, Room 145A
Aiken, South Carolina 29808

Report Date: September 5, 2009

Contact: Mr. Jim Koch
Project: **Hazardous Waste RAD II**

Client Sample ID: 09527-ResinBed1
Sample ID: 235903001

Project: WSRS00207
Client ID: WSRS003

Parameter	Qualifier	Result	DL	RL	Units	DF	AnalystDate	Time	Batch	Method

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	SW846 8260B	

Surrogate/Tracer recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
1,2-Dichloroethane-d4	GEL 8260B Method List Soil Fed "As Received"	11500 ug/kg	50.0	96.4	(68%-131%)
Bromofluorobenzene	GEL 8260B Method List Soil Fed "As Received"	12000 ug/kg	50.0	100	(68%-133%)
Toluene-d8	GEL 8260B Method List Soil Fed "As Received"	11500 ug/kg	50.0	96.3	(75%-129%)

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Certificate of Analysis

Company : Savannah River Nuclear Solutions, LLC
Address : Building 735-B, Room 145A
Aiken, South Carolina 29808

Report Date: September 5, 2009

Contact: Mr. Jim Koch
Project: **Hazardous Waste RAD II**

Client Sample ID: 09527-ResinBed2
Sample ID: 235903002
Matrix: SO
Collect Date: 18-AUG-09 09:20
Receive Date: 24-AUG-09
Collector: Client

Project: WSRS00207
Client ID: WSRS003

Parameter	Qualifier	Result	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Volatile Organics Federal										
GEL 8260B Method List Soil Fed "As Received"										
1,1,1,2-Tetrachloroethane	U	0.00	7140	23800	ug/kg	5000	RXY1 09/01/09	1630	899167	1
1,1,1-Trichloroethane	U	0.00	7140	23800	ug/kg	5000				
1,1,2,2-Tetrachloroethane	U	0.00	7140	23800	ug/kg	5000				
1,1,2-Trichloroethane	U	0.00	7140	23800	ug/kg	5000				
1,1-Dichloroethane	U	0.00	7140	23800	ug/kg	5000				
1,1-Dichloroethylene	U	0.00	7140	23800	ug/kg	5000				
1,1-Dichloropropene	U	0.00	7140	23800	ug/kg	5000				
1,2,3-Trichloropropane	U	0.00	7140	23800	ug/kg	5000				
1,2,4-Trichlorobenzene	U	0.00	7140	23800	ug/kg	5000				
1,2-Dibromo-3-chloropropane	U	0.00	7140	23800	ug/kg	5000				
1,2-Dibromoethane	U	0.00	7140	23800	ug/kg	5000				
1,2-Dichlorobenzene	U	0.00	7140	23800	ug/kg	5000				
1,2-Dichloroethane	U	0.00	7140	23800	ug/kg	5000				
1,2-Dichloropropane	U	0.00	7140	23800	ug/kg	5000				
1,3-Dichlorobenzene	U	0.00	7140	23800	ug/kg	5000				
1,3-Dichloropropane	U	0.00	7140	23800	ug/kg	5000				
1,4-Dichlorobenzene	U	0.00	7140	23800	ug/kg	5000				
2,2-Dichloropropane	U	0.00	7140	23800	ug/kg	5000				
2-Butanone	U	0.00	35700	119000	ug/kg	5000				
2-Chloro-1,3-butadiene	U	0.00	7140	23800	ug/kg	5000				
2-Hexanone	U	0.00	35700	119000	ug/kg	5000				
4-Methyl-2-pentanone	U	0.00	29800	119000	ug/kg	5000				
Acetone	U	0.00	39500	119000	ug/kg	5000				
Acetonitrile	U	0.00	149000	595000	ug/kg	5000				
Acrolein	U	0.00	36900	119000	ug/kg	5000				
Acrylonitrile	U	0.00	23800	119000	ug/kg	5000				
Allyl chloride	U	0.00	23800	119000	ug/kg	5000				
Benzene	U	0.00	7140	23800	ug/kg	5000				
Bromochloromethane	U	0.00	7860	23800	ug/kg	5000				
Bromodichloromethane	U	0.00	7140	23800	ug/kg	5000				
Bromoform	U	0.00	7140	23800	ug/kg	5000				
Bromomethane	U	0.00	7140	23800	ug/kg	5000				
Carbon disulfide	U	0.00	29800	119000	ug/kg	5000				
Carbon tetrachloride	U	0.00	7140	23800	ug/kg	5000				
Chlorobenzene	U	0.00	7140	23800	ug/kg	5000				
Chloroethane	U	0.00	7140	23800	ug/kg	5000				
Cyclohexane	U	0.00	7140	23800	ug/kg	5000				

Certificate of Analysis

Company : Savannah River Nuclear Solutions, LLC
Address : Building 735-B, Room 145A
Aiken, South Carolina 29808

Report Date: September 5, 2009

Contact: Mr. Jim Koch
Project: **Hazardous Waste RAD II**

Client Sample ID: 09527-ResinBed2
Sample ID: 235903002

Project: WSRS00207
Client ID: WSRS003

Parameter	Qualifier	Result	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Volatile Organics Federal										
GEL 8260B Method List Soil Fed "As Received"										
Dibromochloromethane	U	0.00	7140	23800	ug/kg	5000				
Dibromomethane	U	0.00	7140	23800	ug/kg	5000				
Dichlorodifluoromethane	U	0.00	8100	23800	ug/kg	5000				
Ethyl acetate	U	0.00	29800	119000	ug/kg	5000				
Ethylbenzene	U	0.00	7140	23800	ug/kg	5000				
Iodomethane	U	0.00	38100	119000	ug/kg	5000				
Isobutyl alcohol	U	0.00	386000	1190000	ug/kg	5000				
Isopropylbenzene	U	0.00	7140	23800	ug/kg	5000				
Methacrylonitrile	U	0.00	31000	119000	ug/kg	5000				
Methyl acetate	U	0.00	39500	119000	ug/kg	5000				
Methyl methacrylate	U	0.00	23800	119000	ug/kg	5000				
Methylcyclohexane	U	0.00	7140	23800	ug/kg	5000				
Methylene chloride	U	0.00	47600	119000	ug/kg	5000				
Propionitrile	U	0.00	39800	119000	ug/kg	5000				
Styrene	U	0.00	7140	23800	ug/kg	5000				
Tetrachloroethylene	U	0.00	7140	23800	ug/kg	5000				
Toluene	U	0.00	7140	23800	ug/kg	5000				
Trichloroethylene	U	0.00	7860	23800	ug/kg	5000				
Trichlorofluoromethane	U	0.00	7140	23800	ug/kg	5000				
Trichlorotrifluoroethane	U	0.00	38100	119000	ug/kg	5000				
Vinyl acetate	U	0.00	29800	119000	ug/kg	5000				
Vinyl chloride	U	0.00	7140	23800	ug/kg	5000				
Xylenes (total)	U	0.00	7140	23800	ug/kg	5000				
bis(2-Chloroisopropyl)ether	U	0.00	35700	119000	ug/kg	5000				
cis-1,2-Dichloroethylene	U	0.00	7140	23800	ug/kg	5000				
cis-1,3-Dichloropropylene	U	0.00	7140	23800	ug/kg	5000				
m,p-Xylenes	U	0.00	7140	47600	ug/kg	5000				
o-Xylene	U	0.00	7140	23800	ug/kg	5000				
tert-Butyl methyl ether	U	0.00	7140	23800	ug/kg	5000				
trans-1,2-Dichloroethylene	U	0.00	7140	23800	ug/kg	5000				
trans-1,3-Dichloropropylene	U	0.00	7140	23800	ug/kg	5000				
trans-1,4-Dichloro-2-butene	U	0.00	15500	119000	ug/kg	5000				

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
SW846 5030	Volatile 5030 Solid Prep	CDS1	09/01/09	1431	899165

The following Analytical Methods were performed

Method	Description	Analyst Comments

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Certificate of Analysis

Company : Savannah River Nuclear Solutions, LLC
Address : Building 735-B, Room 145A
Aiken, South Carolina 29808

Report Date: September 5, 2009

Contact: Mr. Jim Koch
Project: **Hazardous Waste RAD II**

Client Sample ID: 09527-ResinBed2
Sample ID: 235903002

Project: WSRS00207
Client ID: WSRS003

Parameter	Qualifier	Result	DL	RL	Units	DF	AnalystDate	Time	Batch	Method

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	SW846 8260B	

Surrogate/Tracer recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
1,2-Dichloroethane-d4	GEL 8260B Method List Soil Fed "As Received"	1080000 ug/kg	50.0	91.1	(68%-131%)
Bromofluorobenzene	GEL 8260B Method List Soil Fed "As Received"	1160000 ug/kg	50.0	97.4	(68%-133%)
Toluene-d8	GEL 8260B Method List Soil Fed "As Received"	1180000 ug/kg	50.0	99.0	(75%-129%)

QC Summary

QC Summary

Report Date: September 5, 2009

Savannah River Nuclear Solutions, LLC
Building 735-B, Room 145A
Aiken, South Carolina

Contact: **Mr. Jim Koch**

Workorder: **235903**

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
Volatile-GC/MS											
Batch 899167											
QC1201915367 HB											
1,1,1,2-Tetrachloroethane			U	0.00	ug/kg				RXY1	09/01/09	15:34
1,1,1-Trichloroethane			U	0.00	ug/kg						
1,1,2,2-Tetrachloroethane			U	0.00	ug/kg						
1,1,2-Trichloroethane			U	0.00	ug/kg						
1,1-Dichloroethane			U	0.00	ug/kg						
1,1-Dichloroethylene			U	0.00	ug/kg						
1,1-Dichloropropene			U	0.00	ug/kg						
1,2,3-Trichloropropane			U	0.00	ug/kg						
1,2,4-Trichlorobenzene			U	0.00	ug/kg						
1,2-Dibromo-3-chloropropane			U	0.00	ug/kg						
1,2-Dibromoethane			U	0.00	ug/kg						
1,2-Dichlorobenzene			U	0.00	ug/kg						
1,2-Dichloroethane			U	0.00	ug/kg						
1,2-Dichloropropane			U	0.00	ug/kg						
1,3-Dichlorobenzene			U	0.00	ug/kg						
1,3-Dichloropropane			U	0.00	ug/kg						
1,4-Dichlorobenzene			U	0.00	ug/kg						
2,2-Dichloropropane			U	0.00	ug/kg						
2-Butanone			J	230	ug/kg						
2-Chloro-1,3-butadiene			U	0.00	ug/kg						
2-Hexanone			U	0.00	ug/kg						
4-Methyl-2-pentanone			U	0.00	ug/kg						
Acetone			U	0.00	ug/kg						
Acetonitrile			U	0.00	ug/kg						
Acrolein			U	0.00	ug/kg						
Acrylonitrile			U	0.00	ug/kg						
Allyl chloride			U	0.00	ug/kg						
Benzene			U	0.00	ug/kg						
Bromochloromethane			U	0.00	ug/kg						
Bromodichloromethane			U	0.00	ug/kg						
Bromoform			U	0.00	ug/kg						
Bromomethane			U	0.00	ug/kg						
Carbon disulfide			U	0.00	ug/kg						
Carbon tetrachloride			U	0.00	ug/kg						
Chlorobenzene			U	0.00	ug/kg						
Chloroethane			U	0.00	ug/kg						
Cyclohexane			U	0.00	ug/kg						

QC Summary

Workorder: 235903

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date Time
Volatile-GC/MS										
Batch 899167										
Dibromochloromethane			U	0.00	ug/kg					
Dibromomethane			U	0.00	ug/kg				RXY1	09/01/09 15:34
Dichlorodifluoromethane			U	0.00	ug/kg					
Ethyl acetate			U	0.00	ug/kg					
Ethylbenzene			U	0.00	ug/kg					
Iodomethane			U	0.00	ug/kg					
Isobutyl alcohol			U	0.00	ug/kg					
Isopropylbenzene			U	0.00	ug/kg					
Methacrylonitrile			U	0.00	ug/kg					
Methyl acetate			U	0.00	ug/kg					
Methyl methacrylate			U	0.00	ug/kg					
Methylcyclohexane			U	0.00	ug/kg					
Methylene chloride			U	0.00	ug/kg					
Propionitrile			U	0.00	ug/kg					
Styrene			U	0.00	ug/kg					
Tetrachloroethylene			U	0.00	ug/kg					
Toluene			U	0.00	ug/kg					
Trichloroethylene			U	0.00	ug/kg					
Trichlorofluoromethane			U	0.00	ug/kg					
Trichlorotrifluoroethane			U	0.00	ug/kg					
Vinyl acetate			U	0.00	ug/kg					
Vinyl chloride			U	0.00	ug/kg					
Xylenes (total)			U	0.00	ug/kg					
bis(2-Chloroisopropyl)ether			U	0.00	ug/kg					
cis-1,2-Dichloroethylene			U	0.00	ug/kg					
cis-1,3-Dichloropropylene			U	0.00	ug/kg					
m,p-Xylenes			U	0.00	ug/kg					
o-Xylene			U	0.00	ug/kg					
tert-Butyl methyl ether			U	0.00	ug/kg					
trans-1,2-Dichloroethylene			U	0.00	ug/kg					
trans-1,3-Dichloropropylene			U	0.00	ug/kg					
trans-1,4-Dichloro-2-butene			U	0.00	ug/kg					
**1,2-Dichloroethane-d4	50.0			47.7	ug/kg		95.4	(68%-131%)		
**Bromofluorobenzene	50.0			48.9	ug/kg		97.8	(68%-133%)		
**Toluene-d8	50.0			49.2	ug/kg		98.4	(75%-129%)		
QC1201915366 LCS										
1,1-Dichloroethylene	50.0			50.1	ug/kg		100	(70%-125%)		09/01/09 13:42
1,2,4-Trichlorobenzene	50.0			49.4	ug/kg		98.8	(68%-130%)		
4-Methyl-2-pentanone	250			238	ug/kg		95.1	(71%-134%)		
Benzene	50.0			48.3	ug/kg		96.7	(72%-120%)		
Chlorobenzene	50.0			49.6	ug/kg		99.3	(75%-120%)		
Toluene	50.0			49.1	ug/kg		98.3	(65%-124%)		

QC Summary

Workorder: 235903

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date Time
Volatile-GC/MS										
Batch 899167										
Trichloroethylene	50.0			50.8	ug/kg		102	(78%-121%)		
Vinyl chloride	50.0			50.2	ug/kg		100	(61%-128%)	RXY1	09/01/09 13:42
tert-Butyl methyl ether	50.0			46.6	ug/kg		93.2	(73%-127%)		
**1,2-Dichloroethane-d4	50.0			48.9	ug/kg		97.7	(68%-131%)		
**Bromofluorobenzene	50.0			47.7	ug/kg		95.4	(68%-133%)		
**Toluene-d8	50.0			48.7	ug/kg		97.4	(75%-129%)		
QC1201915363 MB										
1,1,1,2-Tetrachloroethane			U	0.00	ug/kg					09/01/09 14:10
1,1,1-Trichloroethane			U	0.00	ug/kg					
1,1,2,2-Tetrachloroethane			U	0.00	ug/kg					
1,1,2-Trichloroethane			U	0.00	ug/kg					
1,1-Dichloroethane			U	0.00	ug/kg					
1,1-Dichloroethylene			U	0.00	ug/kg					
1,1-Dichloropropene			U	0.00	ug/kg					
1,2,3-Trichloropropane			U	0.00	ug/kg					
1,2,4-Trichlorobenzene			JV	0.414	ug/kg					
1,2-Dibromo-3-chloropropane			U	0.00	ug/kg					
1,2-Dibromoethane			U	0.00	ug/kg					
1,2-Dichlorobenzene			U	0.00	ug/kg					
1,2-Dichloroethane			U	0.00	ug/kg					
1,2-Dichloropropane			U	0.00	ug/kg					
1,3-Dichlorobenzene			U	0.00	ug/kg					
1,3-Dichloropropane			U	0.00	ug/kg					
1,4-Dichlorobenzene			U	0.00	ug/kg					
2,2-Dichloropropane			U	0.00	ug/kg					
2-Butanone			U	0.00	ug/kg					
2-Chloro-1,3-butadiene			U	0.00	ug/kg					
2-Hexanone			U	0.00	ug/kg					
4-Methyl-2-pentanone			U	0.00	ug/kg					
Acetone			U	0.00	ug/kg					
Acetonitrile			U	0.00	ug/kg					
Acrolein			U	0.00	ug/kg					
Acrylonitrile			U	0.00	ug/kg					
Allyl chloride			U	0.00	ug/kg					
Benzene			U	0.00	ug/kg					
Bromochloromethane			U	0.00	ug/kg					
Bromodichloromethane			U	0.00	ug/kg					
Bromoform			U	0.00	ug/kg					
Bromomethane			U	0.00	ug/kg					
Carbon disulfide			U	0.00	ug/kg					
Carbon tetrachloride			U	0.00	ug/kg					
Chlorobenzene			U	0.00	ug/kg					

QC Summary

Workorder: 235903

Parmname	NOM		Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date Time
Volatile-GC/MS											
Batch 899167											
Chloroethane				U	0.00	ug/kg					
Cyclohexane				U	0.00	ug/kg				RXY1	09/01/09 14:10
Dibromochloromethane				U	0.00	ug/kg					
Dibromomethane				U	0.00	ug/kg					
Dichlorodifluoromethane				U	0.00	ug/kg					
Ethyl acetate				U	0.00	ug/kg					
Ethylbenzene				U	0.00	ug/kg					
Iodomethane				U	0.00	ug/kg					
Isobutyl alcohol				U	0.00	ug/kg					
Isopropylbenzene				U	0.00	ug/kg					
Methacrylonitrile				U	0.00	ug/kg					
Methyl acetate				U	0.00	ug/kg					
Methyl methacrylate				U	0.00	ug/kg					
Methylcyclohexane				U	0.00	ug/kg					
Methylene chloride				U	0.00	ug/kg					
Propionitrile				U	0.00	ug/kg					
Styrene				U	0.00	ug/kg					
Tetrachloroethylene				U	0.00	ug/kg					
Toluene				U	0.00	ug/kg					
Trichloroethylene				U	0.00	ug/kg					
Trichlorofluoromethane				U	0.00	ug/kg					
Trichlorotrifluoroethane				U	0.00	ug/kg					
Vinyl acetate				U	0.00	ug/kg					
Vinyl chloride				U	0.00	ug/kg					
Xylenes (total)				U	0.00	ug/kg					
bis(2-Chloroisopropyl)ether				U	0.00	ug/kg					
cis-1,2-Dichloroethylene				U	0.00	ug/kg					
cis-1,3-Dichloropropylene				U	0.00	ug/kg					
m,p-Xylenes				U	0.00	ug/kg					
o-Xylene				U	0.00	ug/kg					
tert-Butyl methyl ether				U	0.00	ug/kg					
trans-1,2-Dichloroethylene				U	0.00	ug/kg					
trans-1,3-Dichloropropylene				U	0.00	ug/kg					
trans-1,4-Dichloro-2-butene				U	0.00	ug/kg					
**1,2-Dichloroethane-d4	50.0				48.4	ug/kg		96.9	(68%-131%)		
**Bromofluorobenzene	50.0				49.5	ug/kg		99.1	(68%-133%)		
**Toluene-d8	50.0				48.4	ug/kg		96.7	(75%-129%)		
QC1201915364 235903001 PS											
1,1-Dichloroethylene	50.0	U	0.00		53.4	ug/L		107	(61%-125%)		09/01/09 17:40
1,2,4-Trichlorobenzene	50.0	U	0.00		54.5	ug/L		109	(28%-143%)		
4-Methyl-2-pentanone	250	U	0.00		240	ug/L		95.9	(58%-136%)		
Benzene	50.0		2.63		53.2	ug/L		101	(56%-123%)		

QC Summary

Workorder: 235903

Parmname	NOM		Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date Time
Volatile-GC/MS											
Batch 899167											
Chlorobenzene	50.0	U	0.00		52.0	ug/L		104	(53%-122%)		
Toluene	50.0	U	0.00		51.5	ug/L		103	(52%-128%)	RXY1	09/01/09 17:40
Trichloroethylene	50.0	U	0.00		51.7	ug/L		103	(51%-137%)		
Vinyl chloride	50.0	U	0.00		40.1	ug/L		80.3	(47%-129%)		
tert-Butyl methyl ether	50.0	U	0.00		48.2	ug/L		96.3	(59%-136%)		
**1,2-Dichloroethane-d4	50.0		48.2		45.6	ug/L		91.2	(68%-131%)		
**Bromofluorobenzene	50.0		50.2		47.3	ug/L		94.6	(68%-133%)		
**Toluene-d8	50.0		48.2		48.7	ug/L		97.4	(75%-129%)		
QC1201915365 235903001 PSD											
1,1-Dichloroethylene	50.0	U	0.00		51.6	ug/L	3.27	103	(0%-25%)		09/01/09 18:08
1,2,4-Trichlorobenzene	50.0	U	0.00		53.7	ug/L	1.56	107	(0%-25%)		
4-Methyl-2-pentanone	250	U	0.00		232	ug/L	3.40	92.7	(0%-25%)		
Benzene	50.0		2.63		52.8	ug/L	0.805	100	(0%-25%)		
Chlorobenzene	50.0	U	0.00		51.5	ug/L	1.07	103	(0%-25%)		
Toluene	50.0	U	0.00		50.4	ug/L	2.06	101	(0%-25%)		
Trichloroethylene	50.0	U	0.00		50.7	ug/L	1.91	101	(0%-25%)		
Vinyl chloride	50.0	U	0.00		39.1	ug/L	2.67	78.2	(0%-25%)		
tert-Butyl methyl ether	50.0	U	0.00		49.2	ug/L	2.12	98.4	(0%-25%)		
**1,2-Dichloroethane-d4	50.0		48.2		45.4	ug/L		90.9	(68%-131%)		
**Bromofluorobenzene	50.0		50.2		47.3	ug/L		94.5	(68%-133%)		
**Toluene-d8	50.0		48.2		48.4	ug/L		96.7	(75%-129%)		

Notes:
The Qualifiers in this report are defined as follows:

- J EPA Functional Guideline Code:Result >= MDL but result < PQL/RDL
- R4 EPA Functional Guideline Code:Data Rejected
- U EPA Functional Guideline Code:Result < MDL
- UV Positive blank result and sample result > MDL
- V EPA Storet Code:Positive blank result and sample result > MDL
- d The 2:1 depletion requirement was not met for this sample

N/A indicates that spike recovery limits do not apply when sample concentration exceeds spike conc. by a factor of 4 or more.
^ The Relative Percent Difference (RPD) obtained from the sample duplicate (DUP) is evaluated against the acceptance criteria when the sample is greater than five times (5X) the contract required detection limit (RL). In cases where either the sample or duplicate value is less than 5X the RL, a control limit of +/- the RL is used to evaluate the DUP result.
* Indicates that a Quality Control parameter was not within specifications.
For PS, PSD, and SDILT results, the values listed are the measured amounts, not final concentrations.

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the QC Summary.

Miscellaneous Data

COMPANY - WIDE NONCONFORMANCE REPORT

Mo.Day Yr.	Division:	Quality Criteria:	Type:
07-JUL-09	Federal	SOP	Process
Instrument Type:	**Test / Method:**	**Matrix Type:**	**Client Code:**
VOA GC/MS	8260	Liquid	see Case Narrative
Batch ID: 891083	**Sample Numbers:** see Case Narrative		

Potentially affected work order(s)(SDG):

Application Issues:

Other

Specification and Requirements Nonconformance Description:	NRG Disposition:
1. Acetone and 2-Butanone were detected in the screening analysis of Burdick and Jackson Purge & Trap Methanol Lot CY840 above the GEL MDL's but below the GEL PQL's. Methanol was required in the analysis of samples associated with this SDG.	1. Narrate and report data. The concentrations of 2-Butanone and Acetone were below the vendor certification levels for volatile compounds.

Originator's Name:
Crystal Stacey 07-JUL-09

Data Validator/Group Leader:
Erin Haubert 08-JUL-09

Metals Analysis

Case Narrative

Metals Fractional Narrative
Savannah River Nuclear Solutions, LLC (WSRS)
SDG 09527

Sample Analysis

Sample ID	Client ID
235903001	09527-ResinBed1
235903002	09527-ResinBed2
1201917328	Tumbling Blank (TB)
1201918482	Method Blank (MB) **ICP**
1201918483	Laboratory Control Sample (LCS)
1201918486	235903001(09527-ResinBed1L) Serial Dilution (SD)
1201918484	235903001(09527-ResinBed1S) Matrix Spike (MS)
1201918485	235903001(09527-ResinBed1SD) Matrix Spike Duplicate (MSD)
1201917328	Tumbling Blank (TB)
1201919086	Method Blank (MB) **CVAA**
1201919087	Laboratory Control Sample (LCS)
1201919090	235903001(09527-ResinBed1L) Serial Dilution (SD)
1201919088	235903001(09527-ResinBed1S) Matrix Spike (MS)
1201919089	235903001(09527-ResinBed1SD) Matrix Spike Duplicate (MSD)

The samples in this SDG were analyzed on an "as received" basis.

Method/Analysis Information

Analytical Batch:	900495 and 900762
Prep Batch :	900494 and 900751
TCLP Prep Batch :	899990
Standard Operating Procedures:	GL-MA-E-013 REV# 19, GL-MA-E-008 REV# 13, GL-LB-E-006 REV# 13 and GL-MA-E-010 REV# 22
Analytical Method:	SW846 3010A/6010C and SW846 7470A
Prep Method :	SW846 3010A and SW846 7470A Prep
TCLP Prep Method :	SW846 1311

Preparation/Analytical Method Verification

The SOP stated above has been prepared based on technical research and testing conducted by GEL Laboratories, LLC. and with guidance from the regulatory documents listed in this "Method/Analysis Information" section.

System Configuration

The Metals analysis-ICP was performed on a P E 4300 Optima radial/axial-viewing inductively coupled plasma atomic emission spectrometer. The instrument is equipped with a Burgener nebulizer, cyclonic spray chamber, and yttrium or scandium internal standard. Operating conditions for the ICP are set at a power level of 1500 watts. The instrument has a peristaltic pump flow rate of 1.4L/min, argon gas flows of 15 L/min and 0.2 L/min for the torch and auxiliary gases, and a flow setting of 0.65L/min for the nebulizer.

The Metals analysis-Mercury was performed on a Perkin-Elmer Flow Injection Mercury System (FIMS-100) automated mercury analyzer. The instrument consists of a cold vapor atomic absorption spectrometer set to detect mercury at a wavelength of 253.7 nm. Sample introduction through the flow injection system is performed via a peristaltic pump at 9 mL/min and nitrogen carrier gas rate of 80 mL/min.

Calibration Information

Instrument Calibration
All initial calibration requirements have been met for this sample delivery group (SDG).

CRDL Requirements
All CRDL standards met the advisory control limits with the exceptions of selenium. The PQL failed high for selenium but the samples were less than the RDL/PQL.

ICSA/ICSAB Statement
All interference check samples (ICSA and ICSAB) associated with this SDG met the established acceptance criteria.

Continuing Calibration Blank (CCB) Requirements
All continuing calibration blanks (CCB) bracketing this batch met the established acceptance criteria.

Continuing Calibration Verification (CCV) Requirements
All continuing calibration verifications (CCV) bracketing this SDG met the acceptance criteria.

Quality Control (QC) Information

Method Blank (MB) Statement

The MBs analyzed with this SDG met the acceptance criteria.

Laboratory Control Sample (LCS) Recovery
The LCS spike recoveries met the acceptance limits.

Quality Control (QC) Sample Statement
The following sample was selected as the quality control (QC) sample for this SDG: 235903001 (09527-ResinBed1)-ICP and CVAA.

Matrix Spike (MS) Recovery Statement
The percent recoveries (%R) obtained from the MS analyses are evaluated when the sample concentration is less than four times (4X) the spike concentration added. All applicable elements met the acceptance criteria.

Matrix Spike Duplicate (MSD) Recovery Statement
The percent recovery (%R) obtained from the MSD analyses are evaluated when the sample concentration is less than four time (4X) the spike concentration added. All applicable elements met the acceptance criteria.

MS/MSD Relative Percent Difference (RPD) Statement
The RPD(s) between the MS and MSD met the acceptance limits.

Post Spike (PS) Recovery Statement
The percent recoveries (%R) obtained from the PS analyses are evaluated when the sample concentration is less than four times (4X) the spike concentration added. The PS met the recommended quality control acceptance criteria for percent recoveries for all applicable analytes and verifies the absence of matrix interferences.

Serial Dilution % Difference Statement
The serial dilution is used to assess matrix suppression or enhancement. Raw element concentrations that are 25X the IDL/MDL for CVAA, 50X the IDL/MDL for ICP, and 100X the IDL/MDL for ICP-MS analyses are applicable for serial dilution assessment. All applicable analytes met the acceptance criteria of less than 10% difference (%D), with the exception of mercury, as indicated by the "*" qualifier.

Technical Information

Holding Time Specifications
GEL assigns holding times based on the associated methodology, which assigns the date and time from sample collection of sample receipt. Those holding times expressed in hours are calculated in the AlphaLIMS system. Those holding times expressed as days expire at midnight on the day of expiration. All samples in this SDG met the specified holding time.

Sample Dilutions
Dilutions are performed to minimize matrix interferences resulting from elevated mineral

element concentrations present in solid samples and/or to bring over range target analyte concentrations into the linear calibration range of the instrument. The samples required 10x and 20x dilutions in order to bring over range mercury concentrations within the linear calibration range of the instrument.

Preparation Information
The samples and associated matrix QC were prepared at a 10x factor for ICP/ICPMS to minimize potential interferences arising from the high sodium content in the TCLP leaching solution. The samples and associated matrix QC were prepared at a 10x factor for CVAA analysis because larger volumes of this matrix consume excessive amounts of potassium permanganate.

Miscellaneous Information

Electronic Packaging Comment
This data package was generated using an electronic data processing program referred to as virtual packaging. In an effort to increase quality and efficiency, the laboratory has developed systems to generate all data packages electronically. The following change from traditional packages should be noted:

Analyst/peer reviewer initials and dates are not present on the electronic data files. Presently, all initials and dates are present on the original raw data. These hard copies are temporarily stored in the laboratory. The data validator will always sign and date the case narrative. Data that are not generated electronically, such as hand written pages, will be scanned and inserted into the electronic package.

Nonconformance Documentation
Nonconformance reports are generated to document any procedural anomalies that may deviate from referenced SOP or contractual documents. The following NCRs were generated for this SDG: NCR 730152 and 732281. A copy is included in the Miscellaneous Data section of this package.

Additional Comments
Additional comments were not required for this SDG.

Certification Statement

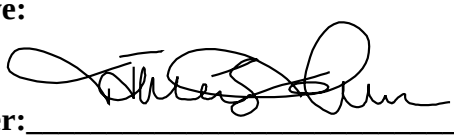
Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless otherwise noted in the analytical case narrative.

Review Validation:

GEL requires all analytical data to be verified by a qualified data validator. In addition, all data designated for CLP or CLP-like packaging will receive a third level validation

upon completion of the data package.

The following data validator verified the information presented in this case narrative:



Reviewer:_____ **Date:** 9/11/09

Sample Data Summary

GEL LABORATORIES LLC
2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis Report
for

WSRS003 Savannah River Nuclear Solutions, LLC (AC39039N)

Client SDG: 09527 GEL Work Order: 235903

The Qualifiers in this report are defined as follows:

J EPA Functional Guideline Code:Result >= MDL but result < PQL/RDL

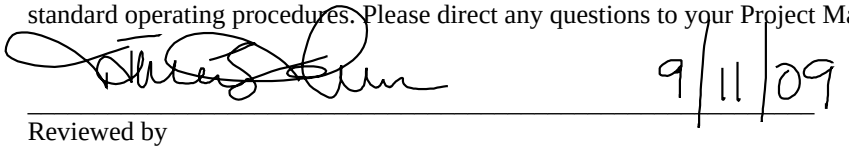
U EPA Functional Guideline Code:Result < MDL

V EPA Storet Code:Positive blank result and sample result > MDL

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the Certificate of Analysis.

The designation ND, if present, appears in the result column when the analyte concentration is not detected above the detection limit.

This data report has been prepared and reviewed in accordance with GEL Laboratories LLC standard operating procedures. Please direct any questions to your Project Manager, Edith Kent.



9/11/09

Reviewed by

GEL LABORATORIES LLC
2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Company : Savannah River Nuclear Solutions, LLC
Address : Building 735-B, Room 145A
Aiken, South Carolina 29808

Report Date: September 11, 2009

Contact: Mr. Jim Koch
Project: **Hazardous Waste RAD II**

Client Sample ID: 09527-ResinBed1
Sample ID: 235903001
Matrix: SO
Collect Date: 18-AUG-09 09:15
Receive Date: 24-AUG-09
Collector: Client

Project: WSRS00207
Client ID: WSRS003

Parameter	Qualifier	Result	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Mercury Analysis-CVAA											
TCLP Hg in Solid "As Received"											
Mercury		174	6.60	20.0	ug/L	10	JXL1	09/11/09	1407	900762	1
Metals Analysis-ICP											
TCLP ICP Metals - 1311/3010A/6010C "As Received"											
Arsenic	U	-85.7	50.0	300	ug/L	1	LS	09/10/09	1634	900495	2
Barium		189	10.0	50.0	ug/L	1					
Cadmium	U	0.516	10.0	50.0	ug/L	1					
Chromium		194	10.0	50.0	ug/L	1					
Lead	U	-8.81	33.0	100	ug/L	1					
Selenium	UJV	66.6	50.0	300	ug/L	1					
Silver	U	6.38	10.0	50.0	ug/L	1					

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
SW846 1311	SW846 1311 TCLP Leaching	CJP1	09/03/09	1530	899990
SW846 3010A	ICP-TRACE TCLP by SW846 3010A	AXG2	09/10/09	1150	900494
SW846 7470A Prep	EPA 7470A Mercury Prep TCLP Liquid	TXB3	09/10/09	1135	900751

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	SW846 7470A	
2	SW846 3010A/6010C	

GEL LABORATORIES LLC
2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Company : Savannah River Nuclear Solutions, LLC
Address : Building 735-B, Room 145A
Aiken, South Carolina 29808

Report Date: September 11, 2009

Contact: Mr. Jim Koch
Project: **Hazardous Waste RAD II**

Client Sample ID:	09527-ResinBed2	Project:	WSRS00207
Sample ID:	235903002	Client ID:	WSRS003
Matrix:	SO		
Collect Date:	18-AUG-09 09:20		
Receive Date:	24-AUG-09		
Collector:	Client		

Parameter	Qualifier	Result	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Mercury Analysis-CVAA											
TCLP Hg in Solid "As Received"											
Mercury		631	13.2	40.0	ug/L	20	JXL1	09/11/09	1414	900762	1
Metals Analysis-ICP											
TCLP ICP Metals - 1311/3010A/6010C "As Received"											
Arsenic	U	2.96	50.0	300	ug/L	1	LS	09/10/09	1652	900495	2
Barium		145	10.0	50.0	ug/L	1					
Cadmium	U	5.86	10.0	50.0	ug/L	1					
Chromium		162	10.0	50.0	ug/L	1					
Lead	U	7.27	33.0	100	ug/L	1					
Selenium	UJV	181	50.0	300	ug/L	1					
Silver	U	6.19	10.0	50.0	ug/L	1					

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
SW846 1311	SW846 1311 TCLP Leaching	CJP1	09/03/09	1530	899990
SW846 3010A	ICP-TRACE TCLP by SW846 3010A	AXG2	09/10/09	1150	900494
SW846 7470A Prep	EPA 7470A Mercury Prep TCLP Liquid	TXB3	09/10/09	1135	900751

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	SW846 7470A	
2	SW846 3010A/6010C	

Quality Control Summary

QC Summary

Report Date: September 11, 2009

Savannah River Nuclear Solutions, LLC
Building 735-B, Room 145A
Aiken, South Carolina

Contact: **Mr. Jim Koch**

Workorder: **235903**

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date Time
Metals Analysis-ICP										
Batch 900495										
QC1201918483 LCS										
Arsenic	5000			4610	ug/L		92.2	(80%-120%)	LS	09/10/09 16:30
Barium	5000			4910	ug/L		98.3	(80%-120%)		
Cadmium	5000			4810	ug/L		96.2	(80%-120%)		
Chromium	5000			4810	ug/L		96.3	(80%-120%)		
Lead	5000			4860	ug/L		97.2	(80%-120%)		
Selenium	5000			4350	ug/L		87	(80%-120%)		
Silver	5000			4740	ug/L		94.8	(80%-120%)		
QC1201918482 MB										
Arsenic			U	-49.9	ug/L					09/10/09 16:22
Barium			U	2.15	ug/L					
Cadmium			U	-0.956	ug/L					
Chromium			U	6.34	ug/L					
Lead			U	-47.9	ug/L					
Selenium			JV	201	ug/L					
Silver			U	4.77	ug/L					
QC1201918484 235903001 MS										
Arsenic	5000	U	-85.7	4630	ug/L		92.5	(75%-125%)		09/10/09 16:38
Barium	5000		189	5010	ug/L		96.5	(75%-125%)		
Cadmium	5000	U	0.516	4750	ug/L		95	(75%-125%)		
Chromium	5000		194	4910	ug/L		94.2	(75%-125%)		
Lead	5000	U	-8.81	4770	ug/L		95.5	(75%-125%)		
Selenium	5000	UJV	66.6	4200	ug/L		82.7	(75%-125%)		
Silver	5000	U	6.38	4800	ug/L		95.8	(75%-125%)		
QC1201918485 235903001 MSD										
Arsenic	5000	U	-85.7	4720	ug/L	2.00	94.4	(0%-20%)		09/10/09 16:41
Barium	5000		189	5130	ug/L	2.36	98.9	(0%-20%)		
Cadmium	5000	U	0.516	4850	ug/L	1.96	96.9	(0%-20%)		
Chromium	5000		194	5050	ug/L	2.83	97	(0%-20%)		
Lead	5000	U	-8.81	4890	ug/L	2.40	97.8	(0%-20%)		
Selenium	5000	UJV	66.6	4260	ug/L	1.42	83.9	(0%-20%)		
Silver	5000	U	6.38	4760	ug/L	0.839	95	(0%-20%)		
QC1201918486 235903001 SDILT										
Arsenic		U	-8.57	U	-12	ug/L	N/A		(0%-10%)	09/10/09 16:45
Barium			18.9	J	4.21	ug/L	11.7		(0%-10%)	
Cadmium		U	0.0516	U	0.126	ug/L	N/A		(0%-10%)	
Chromium			19.4	J	4.20	ug/L	8.32		(0%-10%)	
Lead		U	-0.881	U	-1.04	ug/L	N/A		(0%-10%)	
Selenium		UJV	6.66	J	16.6	ug/L	N/A		(0%-10%)	

QC Summary

Workorder: **235903**

Parmname	NOM		Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date Time
Metals Analysis-ICP											
Batch 900495											
Silver		U	0.638	U	0.762	ug/L	N/A		(0%-10%)		
QC1201917328 TB											
Arsenic				U	-75.8	ug/L				LS	09/10/09 16:26
Barium				U	1.10	ug/L					
Cadmium				U	-2.43	ug/L					
Chromium				U	6.22	ug/L					
Lead				U	-42.2	ug/L					
Selenium				JV	159	ug/L					
Silver				U	1.08	ug/L					
Metals Analysis-Mercury											
Batch 900762											
QC1201919087 LCS											
Mercury	20.0				20.9	ug/L		105	(80%-120%)	JXL1	09/11/09 13:45
QC1201919086 MB											
Mercury				U	-1.55	ug/L					09/11/09 13:43
QC1201919088 235903001 MS											
Mercury	20.0		174		204	ug/L		N/A	(75%-125%)		09/11/09 14:09
QC1201919089 235903001 MSD											
Mercury	20.0		174		197	ug/L	3.35	N/A	(0%-20%)		09/11/09 14:11
QC1201919090 235903001 SDILT											
Mercury			1.74		0.220	ug/L	36.8*		(0%-10%)		09/11/09 14:12
QC1201917328 TB											
Mercury				U	-1.46	ug/L					09/11/09 13:41

Notes:
The Qualifiers in this report are defined as follows:

- J EPA Functional Guideline Code:Result >= MDL but result < PQL/RDL
- R4 EPA Functional Guideline Code:Data Rejected
- U EPA Functional Guideline Code:Result < MDL
- UV Positive blank result and sample result > MDL
- V EPA Storet Code:Positive blank result and sample result > MDL
- d The 2:1 depletion requirement was not met for this sample

N/A indicates that spike recovery limits do not apply when sample concentration exceeds spike conc. by a factor of 4 or more.
^ The Relative Percent Difference (RPD) obtained from the sample duplicate (DUP) is evaluated against the acceptance criteria when the sample is greater than five times (5X) the contract required detection limit (RL). In cases where either the sample or duplicate value is less than 5X the RL, a control limit of +/- the RL is used to evaluate the DUP result.
* Indicates that a Quality Control parameter was not within specifications.
For PS, PSD, and SDILT results, the values listed are the measured amounts, not final concentrations.

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the QC Summary.

Miscellaneous

COMPANY - WIDE NONCONFORMANCE REPORT

Mo.Day Yr.	Division:	Quality Criteria:	Type:
04-SEP-09	Industrial	SOP	Process
Instrument Type:	**Test / Method:**	**Matrix Type:**	**Client Code:**
TCLP TUMBLER	SW846 1311	Solid	WSRS003*NS
Batch ID:	**Sample Numbers:**		
899990	235903001, 235903002		

Potentially affected work order(s)(SDG): 235903(09527)

Application Issues:

100 grams for TCLP tumbling

Insufficient Sample

Specification and Requirements Nonconformance Description:	NRG Disposition:
Due to insufficient sample spiking and preservation will not occur in the TCLP lab.	Contacted the Project Manager, and was instructed to continue the TCLP process using the limited volumes. Spiking and preservation will occur in the metals digestion lab.

Originator's Name:

Clifford Postell 04-SEP-09

Data Validator/Group Leader:

Clifford Postell 04-SEP-09

COMPANY - WIDE NONCONFORMANCE REPORT

Mo.Day Yr.	**Division:**	**Quality Criteria:**	**Type:**
11-SEP-09	Industrial	Specifications	Process
Instrument Type:	**Test / Method:**	**Matrix Type:**	**Client Code:**
ICP	SW846 3010A/6010C	Solid	WSRS
Batch ID:	**Sample Numbers:**		
900495	See Below		

Potentially affected work order(s)(SDG): 235903(09527)

Application Issues:

Container scanning event for custody missed

Specification and Requirements Nonconformance Description:	**NRG Disposition:**
1. Container scanning event for custody missed: 235903 001	The sample in this batch was not scanned to custody due to Analyst error. Data qualified and is reported.

Originator's Name:

Louise Smith 11-SEP-09

Data Validator/Group Leader:

Greg Milton 11-SEP-09

Chain of Custody and Supporting Documentation

CHAIN-OF-CUSTODY

2359031.

Labora

09527

Contract Number AC39039N

Customer Name:	Nash, Charles
Customer Department:	SRTC/E&CPT
Customer Address:	773-42A, 182
Customer Phone/Beeper:	5-2615 19319

KJ

Company: General Engineering Laboratory

Ship to: Address: 2040 Savage Road, Charleston, SC 29407

Attention: Edie Kent, Project Manager, 843-769-7385

Washington Savannah River Company
Aiken, SC 29808
Environmental Services Section
Waste Sample Management Group

COC creation date. 8/13/09

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

Sample Analysis Requested	Sample ID: 09527-ResinBed1	Sample ID: 09527-ResinBed2	Sample ID:
Collect Date	8-18-09	8/18/09	Collect Date
Collect Time	0915	0920	Collect Time
No. Containers	1	1	No. Containers
Matrix	SO	SO	Matrix
TCLP, Metals (Prep & Analysis) (33)	✓	✓	
VOC's by GC/MS:Cap.Tech. Method 8260B (171)	✓	✓	

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TAT Days: 21 | Activity Code: LFWWIX001 | Comments: **Rad 3 Material**

RAD SCREEN REQUIRED? **NO**

STR Authorization: James Koch

1 Relinquished by:	Date/Time	Received by:	2 Relinquished by:	Date/Time	Received by:
(Print) William N Wilson	Date 8/24/09	(Print) Minnie Hightower	(Print) Minnie Hightower	Date 8-24-09	(Print) K. Rogers
(Sign) William N Wilson	Time 0850	(Sign) Minnie Hightower	(Sign) Minnie Hightower	Time 1100	(Sign) K. Rogers
3 Relinquished by:	Date/Time	Received by:	**4** Relinquished by:	Date/Time	Received by:
(Print) K. Rogers	8/25/09	(Print) Cheryl Duffy	(Print)		(Print)
(Sign) K. Rogers	Time 1400	(Sign)	(Sign)	Time	(Sign)

Cooler #14

GEL Laboratories LLC

SAMPLE RECEIPT & REVIEW FORM

Client: Sav. River	**SDG/ARCOC/Work Order:** 09527
Received By: C. Duffy	**Date Received:** 8/24/09

Suspected Hazard Information	Yes	No
COC/Samples marked as radioactive?	X	
Classified Radioactive II or III by RSO?	X	
COC/Samples marked containing PCBs?		X
Shipped as a DOT Hazardous?	X	
Samples identified as Foreign Soil?		X

*If Counts > x2 area background on samples not marked "radioactive", contact the Radiation Safety Group of further investigation.

Maximum Counts Observed*: 50 / #14 samples 8,000 cpm

Cooler #14 RAD III Dose RB1 ! RB2 2.3

Hazard Class Shipped: 7 UN#: 2910

	Sample Receipt Criteria	Yes	NA	No	Comments/Qualifiers (Required for Non-Conforming Items)
1	Shipping containers received intact and sealed?	X			Circle Applicable: seals broken damaged container leaking container other (describe)
2	Samples requiring cold preservation within 0 ≤ 6 deg. C?	X			Preservation Method: ice bags blue ice dry ice none other (describe) See attached
3	Chain of custody documents included with shipment?	X			
4	Sample containers intact and sealed?	X			Circle Applicable: seals broken damaged container leaking container other (describe)
5	Samples requiring chemical preservation at proper pH?		X		Sample ID's, containers affected and observed pH: If Preservation added, Lot#:
6	VOA vials free of headspace (defined as < 6mm bubble)?	X			Sample ID's and containers affected:
7	Are Encore containers present?			X	(If yes, immediately deliver to Volatiles laboratory)
8	Samples received within holding time?	X			Id's and tests affected:
9	Sample ID's on COC match ID's on bottles?	X			Sample ID's and containers affected:
10	Date & time on COC match date & time on bottles?	X			Sample ID's affected:
11	Number of containers received match number indicated on COC?	X			Sample ID's affected:
12	COC form is properly signed in relinquished/received sections?	X			

Comments: Courier

PM (or PMA) review: Initials CS Date 8.24.09

SAMPLE RECEIPT & REVIEW FORM
CONTINUATION FORM

Client: **Date Received:** **Page ___ of ___**

Cooler #	tempºC
89	3°
33	5°
101	4°
98	5°
14	4°

Work Order Containers

Sample ID: 235903001
Client Sample ID: 09527−ResinBed1
Description:

Label: 235903001.01 **Type: Glass 20 mL** **Preservative: 4C**

24−AUG−09 17:08:54	Heather Shaffer	Barcode Generated (Awaiting Labeling)
24−AUG−09 17:33:23	Cheryl Duffy	Changed sample location from Barcode Generated (Awaiting Labeling) to RAD II Main Cooler
28−AUG−09 10:41:14	Matthew Oswald	Transfered custody to batch 898165
28−AUG−09 11:50:27	Matthew Oswald	Changed sample location from RAD II Main Cooler to Radioactive Aliquot Lab
28−AUG−09 12:53:17	Matthew Hunter	Changed sample location from Radioactive Aliquot Lab to Radioactive III Cooler Storage
04−SEP−09 10:01:36	Richard Dollinger	Transfered custody to batch 899990
08−SEP−09 15:16:01	Gregory Austin	Changed sample location from Radioactive III Cooler Storage to Consumed By Analysis/Laboratory

Label: 235903001.01.01 **Type: Glass 40 ml vial**

28−AUG−09 10:41:55	Matthew Oswald	Transfered custody to batch 898165
28−AUG−09 10:41:55	Matthew Oswald	Radioactive Aliquot Lab
28−AUG−09 12:53:17	Matthew Hunter	Changed sample location from Radioactive Aliquot Lab to Radioactive III Cooler Storage

Label: 235903001.01.06 **Type: Plastic 2000 ml**

28−AUG−09 10:42:41	Matthew Oswald	Transfered custody to batch 898165
28−AUG−09 10:42:41	Matthew Oswald	Radioactive Aliquot Lab
28−AUG−09 12:53:17	Matthew Hunter	Changed sample location from Radioactive Aliquot Lab to Radioactive III Cooler Storage
01−SEP−09 14:49:13	Crystal Stacey	Transfered custody to batch 899167
01−SEP−09 14:49:13	Crystal Stacey	Changed sample location from Radioactive III Cooler Storage to VOA/MS Lab

Label: 235903001.01.07 **Type: New Undefined**

04−SEP−09 10:02:24	Richard Dollinger	Radioactive III Cooler Storage
04−SEP−09 10:02:24	Richard Dollinger	Transfered custody to batch 899990
10−SEP−09 10:36:04	Tara Griffin	Transfered custody to batch 900751
10−SEP−09 10:36:04	Tara Griffin	Changed sample location from Radioactive III Cooler Storage to Mercury Lab
10−SEP−09 11:02:54	Anthony Green	Transfered custody to batch 900494
10−SEP−09 11:02:54	Anthony Green	Changed sample location from Mercury Lab to Inorganic Prep

Label: 235903001.01.07.01 **Type: Plastic 50 ml**

10−SEP−09 10:37:35	Tara Griffin	Transfered custody to batch 900751
10−SEP−09 10:37:35	Tara Griffin	Mercury Lab
11−SEP−09 11:34:00	Jason Loy	Transfered custody to batch 900762

Sample ID: 235903002
Client Sample ID: 09527−ResinBed2
Description:

Label: 235903002.01 **Type: Glass 20 mL** **Preservative: 4C**

24−AUG−09 17:08:54	Heather Shaffer	Barcode Generated (Awaiting Labeling)
24−AUG−09 17:33:23	Cheryl Duffy	Changed sample location from Barcode Generated (Awaiting

Work Order Containers

Sample ID: 235903002
Client Sample ID: 09527−ResinBed2
Description:

Label: 235903002.01	**Type: Glass 20 mL**	**Preservative: 4C**
28−AUG−09 10:41:14	Matthew Oswald	Transfered custody to batch 898165
28−AUG−09 11:50:27	Matthew Oswald	Changed sample location from RAD II Main Cooler to Radioactive Aliquot Lab
28−AUG−09 12:53:17	Matthew Hunter	Changed sample location from Radioactive Aliquot Lab to Radioactive III Cooler Storage
04−SEP−09 10:01:36	Richard Dollinger	Transfered custody to batch 899990
08−SEP−09 15:16:01	Gregory Austin	Changed sample location from Radioactive III Cooler Storage to Consumed By Analysis/Laboratory
Label: 235903002.01.01	**Type: Glass 40 ml vial**	
28−AUG−09 10:42:14	Matthew Oswald	Transfered custody to batch 898165
28−AUG−09 10:42:14	Matthew Oswald	Radioactive Aliquot Lab
28−AUG−09 12:53:17	Matthew Hunter	Changed sample location from Radioactive Aliquot Lab to Radioactive III Cooler Storage
Label: 235903002.01.04	**Type: Plastic 2000 ml**	
28−AUG−09 10:42:41	Matthew Oswald	Transfered custody to batch 898165
28−AUG−09 10:42:41	Matthew Oswald	Radioactive Aliquot Lab
28−AUG−09 12:53:17	Matthew Hunter	Changed sample location from Radioactive Aliquot Lab to Radioactive III Cooler Storage
01−SEP−09 14:49:13	Crystal Stacey	Transfered custody to batch 899167
01−SEP−09 14:49:13	Crystal Stacey	Changed sample location from Radioactive III Cooler Storage to VOA/MS Lab
Label: 235903002.01.05	**Type: New Undefined**	
04−SEP−09 10:02:24	Richard Dollinger	Transfered custody to batch 899990
04−SEP−09 10:02:24	Richard Dollinger	Radioactive III Cooler Storage
10−SEP−09 10:36:04	Tara Griffin	Transfered custody to batch 900751
10−SEP−09 10:36:04	Tara Griffin	Changed sample location from Radioactive III Cooler Storage to Mercury Lab
10−SEP−09 11:02:54	Anthony Green	Transfered custody to batch 900494
10−SEP−09 11:02:54	Anthony Green	Changed sample location from Mercury Lab to Inorganic Prep
10−SEP−09 15:41:31	Louise Smith	Transfered custody to batch 900495
10−SEP−09 15:41:31	Louise Smith	Changed sample location from Inorganic Prep to ICP Lab
Label: 235903002.01.05.01	**Type: Plastic 50 ml**	
10−SEP−09 10:37:35	Tara Griffin	Transfered custody to batch 900751
10−SEP−09 10:37:35	Tara Griffin	Mercury Lab
11−SEP−09 11:34:00	Jason Loy	Transfered custody to batch 900762

Laboratory Certifications

List of current GEL Certifications as of 11 September 2009

State	Certification
Arizona	AZ0668
Arkansas	88−0651
CLIA	42D0904046
California − NELAP	01151CA
Colorado	GEL
Connecticut	PH−0169
Dept. of Navy	NFESC 413
EPA Region 5	WG−15J
Florida − NELAP	E87156
Georgia	E87156 (FL/NELAP)
Georgia DW	967
Hawaii	N/A
ISO 17025	2567.01
Idaho	SC00012
Illinois − NELAP	200029
Indiana	C−SC−01
Kansas − NELAP	E−10332
Kentucky	90129
Louisiana − NELAP	03046
Maryland	270
Massachusetts	M−SC012
Nevada	SC00012
New Jersey − NELAP	SC002
New Mexico	FL NELAP E87156
New York − NELAP	11501
North Carolina	233
North Carolina DW	45709
Oklahoma	9904
Pennsylvania − NELAP	68−00485
South Carolina	10120001/10120002
Tennessee	TN 02934
Texas − NELAP	T104704235−07B−TX
U.S. Dept. of Agriculture	S−52597
Utah − NELAP	GEL
Vermont	VT87156
Virginia	00151
Washington	C1641