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Task Technical and Quality Assurance Plan for Determining the Radionuclide Release from Tank Waste Residual Solids

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October 2015

SRNL-RP-2013-00203, Rev. 3

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1.0 APPROVALS/TASK TECHNICAL REQUEST IDENTIFICATION

Author/Team Lead:	Signature:	Organization:	Date:
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Manager: L. H. Connelly	**Signature:** L. H. Connelly	**Organization:** SRNL-AD	**Date:** 10/7/15
QA Representative: C. G. Sherer	**Signature:** C. G. Sherer	**Organization:** SRNL-QA	**Date:** 10/7/15
Customer: K. H. Rosenberger	**Signature:** Kent H. Rosenberger	**Organization:** SRR-WDA	**Date:** 10/7/2015

Task Technical Request Title:	TTR Number:	TTR Date:
Tank Waste Testing to Evaluate Residual Waste Solubility Assumptions used in the Tank Farms PAs	HLE-TTR-2013-002 Revision: 3	September 2015

LIST OF REVISIONS

Revision Number	Summary of Changes	Date
0	Initial Release	June 2013
1	Revised experimental plans based on FY2013 experimental findings and comments received from Nuclear Regulatory Commission staff members.	April 2014
2	Revised experimental plans based on FY2014 experimental findings and guidance from Savannah River Remediation staff.	February 2015
3	Revised experimental plans based on FY2015 experimental findings and guidance from Savannah River Remediation staff.	October 2015

2.0 INTRODUCTION

2.1 Task Definition

Current practice for closing High-Level Waste (HLW) tanks at the Savannah River Site (SRS) involves removing as much of the HLW as possible, disconnecting all transfer lines and penetrations into the tanks, and filling the internal volume of the tanks with grout. Performance Assessment (PA) modeling of the release of radionuclides from waste residual solids in SRS tanks indicated that plutonium, neptunium, technetium, and uranium are among the most likely risk drivers.[1] SRS Tank 18 contained a relatively high concentration of plutonium. The PA indicated that plutonium release was highest upon entering the period identified as Oxidized Region III, when the oxidation reduction potential, E_h, was +680 mV and the pH was 9.2. At this stage, the dominant grout phase is expected to be calcite ($CaCO_3$).[1]

Waste release testing was identified as needed to provide additional information regarding the residual waste solubility assumptions used in the F- and H-Area Tank Farm Performance Assessments' waste release models. The proposed testing was described generally in the SRS Liquid Waste Facilities Performance Assessment Maintenance Program FY2015 Implementation Plan.[2] This plan proposed that waste release experiments be performed with actual tank waste residuals after the completion of test method development using surrogate materials. Thus, SRR requested that the Savannah River National Laboratory (SRNL) design and perform such testing with available tank waste samples and prepared surrogate materials.[3]

New work scope in this revision of the TTQAP primarily refers to the testing to be conducted in the SRNL shielded cells using actual Tank 18 residual solids. Method development testing with surrogate materials has been completed and is documented in technical reports[4-5], although it is possible that additional limited testing with surrogate materials will be required.

2.2 Customer/Requester

K. H. Rosenberger, SRR-WDA

Technical Task Request (TTR): HLE-TTR-2013-002, Rev. 3, "Tank Waste Testing to Evaluate Residual Waste Solubility Assumptions used in the Tank Farms PAs".[3]

2.3 Task Responsibilities

Personnel in the SRNL Environmental and Chemical Process Technology (E&CPT) Research Programs directorate will:

- prepare a Task Technical and Quality Assurance Plan (TTQAP – this document) and direct task activities,
- provide work instructions for experimental tasks,
- design, prepare, evaluate and direct installation of testing equipment,
- complete any additional experimental testing with surrogates of tank waste residual solids as needed,
- direct experimental testing with actual Tank 18 residual solids,
- provide analytical sample bottles with appropriate amounts of sample diluent solutions (as needed),
- assist in the transfer of sample bottles to SRNL Analytical Development (AD) as needed,
- record work and results in controlled laboratory notebooks,
- interpret and document experimental results and conclusions,
- provide updates per customer request, and
- summarize results in a technical report.

Personnel in the SRNL Shielded Cells Organization (SCO) will:

- assist in the design and preparation of testing equipment as needed,
- evaluate test equipment in the shielded cells mock-up facility as needed,
- install equipment in the shielded cells facility,
- conduct all hands-on sample manipulations and equipment operations in the shielded cells,
- facilitate the transfer of sample dilution bottles into and analytical samples out of the cells, and
- conduct all sample and equipment disposal operations.

Note: All activities will be conducted following Principle Investigator (PI) or delegate directions.

Personnel in the SRNL Analytical Development (AD) Section will provide analysis of:

- simulated Synthetic Infiltration Water and synthetic grout pore water solutions prepared for leachate testing,
- samples representing waste residual surrogates (as needed) or actual tank waste residuals, and
- leachate samples collected from experiments in which radioactive surrogate solids (as needed) or actual tank residuals have been contacted with grout pore water solutions.

Personnel in the SRNL Quality Assurance (QA) group will:

- review and approve the TTQAP, and
- provide guidance and oversight for this task as needed.

Personnel in SRR Waste Disposal Authority (WDA) will:

- review and approve this TTQAP,
- provide written requests to SRNL specifying any deviations from this plan, and
- review and approve the final technical report.

2.4 Task Deliverables

Two technical report deliverables associated with method development testing using surrogate Tank 18 residual solids have already been completed.[4-5] SRNL will provide a task schedule and a monthly spend plan for the remaining work focused on actual waste testing. The deliverable for this task is a summary technical report describing the real waste testing results. The technical report will include referenced source inputs, assumptions with justifications, test methods and results, calculations, and conclusions.

3.0 TASK ACCEPTANCE CRITERIA

Customer approval of documented test results and the final technical report will signify task acceptance.

4.0 TASK ACTIVITIES

4.1 Equipment

SRNL researchers fabricated test vessels and conducted leaching studies with surrogate waste residuals and grout pore water solutions expected to contact the residual solids following tank closure under reducing and oxidizing environments.[4-5] The test vessels were equipped with agitation and probes to measure the solution pH, E_h (Oxidation Reduction Potential versus the Standard Hydrogen Electrode), and temperature. The vessel was also designed to allow for repeated sampling of the liquid phase.

Separate vessels will be designed and prepared for actual waste testing. These vessels and associated equipment will allow for continuous gas purge, repeated sampling, and monitoring for pH and E_h. The system design will likely include pre-humidification vessels to saturate the purge gases with water vapor and minimize sample evaporation. Gases will be passed through the system at rates required to achieve the target conditions while promoting minimal solution evaporation. Outlet lines from each vessel will be attached to a bubbler to isolate the vessel atmosphere from the environment in the event of a loss of gas flow. The test vessels will be placed in equipment designed to promote sample agitation and temperature control (incubator shaker oven like those utilized for surrogate testing or alternative equipment).

For selected samples, testing will also be conducted using a zero headspace methodology (alternate methodology used for some previous surrogate testing). Equipment for zero headspace testing with real waste samples will involve simple glass vials capped with no air headspace. These vials will be placed into the above-mentioned equipment for sample agitation and temperature control. In this case, separate samples and vials will be prepared for each sampling event.

It is anticipated that the pH and E_h probes used for sample monitoring in the shielded cells facility will require installation through standard Knolls Atomic Power Laboratory (KAPL) wall penetrations to allow for equipment electronic controls and readouts to remain outside of the high radiation cell environment. A Measurement Control Program will be developed for pH and E_h measurements following the requirements provided in Procedure 2-7, Rev. 8 of the 1-Q Manual. The program will include a designated Cognizant Technical Function (CTF) and a Measurement System Custodian/Coordinator. Measurement will be conducted following an Equipment Operating Procedure, data will be recorded in an Instrument Log Book, and a History File will be maintained for each probe. Check or calibration standards will be traceable to recognized national and international standards. Instrument checks and calibrations will be conducted at a designated frequency and a Check Standard Control Chart will be generated bi-monthly.

4.2 Preparation of Tank 18 Residual Surrogate Solids

Initial radionuclide release testing was conducted following previous revisions of this TTQAP using surrogate Tank 18 residual solids having the composition provided in Table 1. The composition is based on the average composition of several Tank 18 samples analyzed by SRNL.[6,7] Metal salts, as the respective nitrates, were dissolved in ultrapure water. Aluminum and silicon were added as sodium salts, sodium aluminate and sodium silicate, respectively. Plutonium (IV) and neptunium (V) were added as solutions in nitric acid from available stocks in SRNL. Uranium (VI) was added as uranyl nitrate hexahydrate, $UO_2(NO_3)_2 \cdot 6H_2O$. ^{99}Tc, as technetium (VII), was added as a solution of ammonium pertechnetate available from commercial sources.

After addition of all component chemicals and radionuclides, a solution of 19.1 M sodium hydroxide was slowly added to the nitric acid solution while mixing to precipitate the metals as metal hydroxides and hydrous metal oxides. Sodium hydroxide addition continued until the free hydroxide concentration in the supernatant was 0.1 M based on the calculated base requirement. The suspension was then heated for 24 hours to reflux to convert a fraction of the aluminum and silicon to sodium aluminosilicate. The suspension was cooled to ambient temperature. Mixing was discontinued and the precipitated solids were allowed to gravity settle. Gravity settling did not produce a clear supernatant liquid above the solids. Thus, the suspension was filtered through a disposable Nalgene® filter with a 0.45-micron nylon membrane. The filtrate was collected and analyzed to determine the concentrations of Pu, Np, U and Tc that were not incorporated into the precipitated solids.

The concentrated solids mixture was diluted with an alkaline solution containing 0.01 M sodium hydroxide and sodium carbonate at a volume equal to that of the initial filtrate. The filtrate evolution and supernatant dilution were repeated three additional times. The filtered wash solutions were collected and analyzed to determine the concentrations of Pu, Np, U and Tc that were removed by the wash solutions. The collected product was air dried until a dry powder was achieved. The dried solids were lightly ground, transferred to a pre-weighed storage container and stored until used in leaching experiments.

Analysis of the filtrates and surrogate Tank 18 residual solids indicated that solids contained Ca, Fe, Mg, Mn, U and Pu at the target concentrations (Table 1). The concentration of Na was about 33% higher than the target value and likely reflects the incorporation of sodium salts from the wash solution. The concentrations of Al, Si, Np, and Tc were below the target concentrations. The low concentrations of Np and Tc, added as NpO_2^+ and TcO_4^-, respectively, were not unexpected, given the solubilities of NpO_2^+ and TcO_4^-. With customer concurrence, SRNL researchers proceeded to use the as-prepared surrogate Tank 18 solids.

Table 1. Composition of Tank 18 Residual Surrogate

Component	Target Concentration (wt %)	Measured Concentration[a] (wt %)
Al	15.2	11.3 ± 1.1
Ca	2.69	2.69 ± 0.27
Fe	8.00	7.90 ± 0.79
Mg	2.00	2.09 ± 0.21
Mn	1.09	1.04 ± 0.10
Na	4.48	5.96 ± 0.60
Si	3.96	0.22 ± 0.038
U	2.37	2.39 ± 0.25 2.50 ± 0.50[b]
Pu-239/240	0.0160	0.0160 ± 0.0009[c]
Np-237	7.53E-04	bql
Tc-99	2.60E-04	bql

[a]determined by ICP-ES
[b]determined by ICP-MS
[c]determined by alpha counting after separating from U and Np
bql = below quantifiable limit

The Tank 18 residual surrogate solids were prepared and portions were utilized for previous testing as described in the associated technical reports.[4-5] As needed, some additional testing may be conducted with the surrogate material. For instance, it may be useful to conduct leaching studies with the surrogate solids in the shielded cells for comparison to previous surrogate results and to results with the actual Tank 18 residuals.

4.3 Grout Pore Water Solutions

Three grout pore water solutions were produced and used for the leaching tests with surrogate tank residual solids. The pore water solutions were produced by contacting Synthetic Infiltration Water (SIW) having the chemical composition shown in Table 2 with grout or selected grout-representative chemicals believed to be controlling the solution pH and E_h. The SIW composition is based on the average chemical composition of groundwater from non-impacted wells screened within the water-table aquifer of the SRS.[8] Grout pore water development was largely completed in previous testing with surrogates and final methodologies for producing the desired conditions are summarized in the FY2015 technical report.[5]

The pore water solutions are intended to be representative of the grout aging scenarios modeled in the tank closure PA. The time periods and conditions identified (listed in chronological order following tank closure) include Reduced Region II (RRII), Oxidizing Region II (ORII), and Oxidizing Region III (ORIII). The initial target E_h and pH values for each pore water solution based on the PA modeling[1] are provided in Table 3, along with the values actually achieved during surrogate testing.[5] Although a range of E_h values exceeding 0.6 V was achieved during surrogate testing, the target E_h values were not achieved for two of the three conditions (RRII and ORIII). It is anticipated that E_h values achieved during real waste testing will be similar to those observed during surrogate testing.

Table 2. Composition of Synthetic Infiltration Water

Component	Concentration (mg/L)
Na^+	1.39
Cl^-	5.51
Ca^{2+}	1.00
Mg^{2+}	0.66
K^+	0.21
SO_4^{2-}	0.73
pH	4.68

Table 3. Target E_h and pH Values for Each Grout Pore Water Composition

Test Condition	Target E_h Values based on Denham report (V)	E_h Values Achieved During Surrogate Testing (V)	Target pH
Reduced Region II	-0.47	-0.10	11.1
Oxidized Region II	+0.56	+0.52	11.1
Oxidized Region III	+0.68	+0.52	9.2

Methods, atmospheres, and reagents required to generate each of the targeted test conditions based on the surrogate testing are provided in Table 4.

For the RRII condition, the pH of the infiltration water will be adjusted to near 11.1 by the addition of $Ca(OH)_2$ and the solution will be deoxygenated by bubbling an inert gas through the liquid. The solution will then be contacted under inert atmosphere with ground Cement, Flyash and Slag (CFS) grout or with the grout-representative components ferrous sulfide (FeS) and calcium carbonate ($CaCO_3$). The weight ratio of the three CFS components will be 125 parts of Cement Type I/II, 210 parts of Slag Grade 100, and 363 parts of Fly Ash Class F (excluding grout admixtures), which was the recommended fill material for SRS Tanks 18 and 19.[9] For RRII continuous purge leaching tests, the E_h and pH will be monitored and adjusted as necessary to ensure that the E_h of the pore water is sufficiently reducing and that the pH is near the target value. For RRII zero headspace tests, pH and E_h adjustments will not generally be made once the vials are sealed, so it will be important to drive the solution conditions toward the target values prior to vessel closure. The solution pH and E_h of the zero headspace samples also will not be monitored and will only be measured immediately after the vials are opened for sampling.

For the ORII condition, infiltration water will be contacted with calcium carbonate solids and calcium hydroxide will be added to raise the solution pH to near 11.1. Since this pore water is oxidizing, the solution will be exposed to air scrubbed of carbon dioxide. The E_h and pH will be monitored and adjusted as necessary.

For the ORIII condition, the infiltration water will be contacted with calcium carbonate solids and the pH will be lowered to near 9.1 by purging the solution with air (no CO_2 scrub). Once the target pH is achieved, the solution will be maintained under an atmosphere of air scrubbed of CO_2. The E_h and pH will be monitored and adjusted as necessary.

Table 4. Methods, Atmospheres, and Reagents Required for each Test Condition.

Test Condition	Leaching Test Method	Atmosphere	Grout Representative Additives	Comments
Reduced Region II	continuous purge and/or zero headspace	N_2 or Ar	$Ca(OH)_2$, FeS and $CaCO_3$ or CFS	$Ca(OH)_2$ to achieve pH, inert gas and FeS to lower E_h
Oxidized Region II	continuous purge	CO_2 free air	$Ca(OH)_2$ and $CaCO_3$	$Ca(OH)_2$ to achieve pH, CO_2 removal to maintain pH
Oxidized Region III	continuous purge	air and CO_2 free air	$CaCO_3$	CO_2 added to achieve pH, CO_2 free air to maintain pH

4.4 Actual Tank 18 Residuals Sample Selection, Compositing, and Pretreatment

Actual Tank 18 residual solids samples archived in the SRNL shielded cells will be evaluated based on available characterization data, sampling location, and sample size and history in order to select samples to use for leach testing. An emphasis will be placed on conducting leaching studies of samples containing relatively high plutonium. Samples will be composited and thoroughly mixed, as needed.

Scoping studies will be conducted to determine washing requirements for the composited Tank 18 residual solids prior to the initiation of leaching studies and characterization. The ORIII condition will likely require sample washing to remove residual, soluble caustic and attain the target solution pH. RRII and ORII test samples may also require some level of sample washing. In order to avoid diluting the pore water solutions with residual water, the samples will be washed with portions of the appropriate pore water solutions prior to longer term leach testing. If washing results in the formation of peptized solids that will not settle within 24-48 hours, it may be necessary to filter the residual solids to remove the wash liquid. Filtration will be conducted as needed using a 0.45 µm Nalgene Nylon filter unit. The sample material will be recovered from the filter and used in subsequent pore water leaching studies.

If Tank 18 residual sample compositing is necessary or if insufficient sample characterization data exists, triplicate samples of the washed composite residual solids will be dissolved and characterized to determine the elemental composition. Selected representative Tank 18 residual solid samples will be characterized prior to and after leaching studies using scanning electron microscopy, particle size analysis, and powder X-ray diffraction techniques to attempt to identify changes in particle morphology, size, and crystalline phases within the sample during leaching.

4.5 Leach Testing

Radionuclide leaching tests have been conducted with the Tank 18 surrogate solids.[4-5] Previous testing established that a zero head-space testing methodology maintained reducing conditions for up four weeks.[4] In this method, the surrogate residual solids were placed in a glass test vial with sufficient pore water solution to completely fill the remaining volume of the vial, leaving no available vapor space. The vial was then sealed and placed in an incubator shaker oven with agitation. A photograph of the glass vials and the incubator shaker oven used for zero head-space testing is provided in Figure 1. After a pre-selected time period, the bottle was opened, the solution E_h and pH were measured, and a portion of the leachate was collected, filtered, and analyzed for soluble radionuclide content and other metallic elements. More recent testing with surrogates[5] indicated that a continuous purge test methodology produced negative E_h values comparable to those achieved using the zero headspace method. Therefore, both methodologies may be used for real waste testing.

For leaching tests under oxidizing conditions, previous testing indicated that the E_h shifted from oxidizing to reducing values over time using the zero head-space methodology.[4] As a result, for actual waste testing, continuous gas purge experiments are the preferred method for the oxidizing conditions (ORII and ORIII). Anticipated atmospheres to be utilized for testing with each condition are summarized in Table 4.

In typical previous leaching experiments with surrogates, approximately 1.2 grams of the surrogate residual solids was contacted with 40 mL of the grout pore water. The same leachate to solids ratio will be used for most leaching tests with actual Tank 18 residual solids. This leachate to solids ratio is expected to provide excess Pu and U for dissolution in the pore water based on the estimated solubility limits for these elements under the three grout aging scenarios (see Table 5)[1] and the measured solubilities[5] of Pu and U with surrogates. Additional selected leach tests may also be conducted at higher phase ratios and/or using sequential batch contact methods to ensure that the values obtained represent equilibrium concentrations within the sample and that the solubility limits do not change depending upon the amount of radionuclide remaining. If more than one type of radionuclide phase is present (such as pure hydrous, amorphous PuO_2 versus co-precipitated Fe:Pu phases; see discussion by Denham[1]) within the sample in appreciable amounts, the initial metal solubility will be determined by the more soluble phases. In this scenario, once the more soluble phases have been depleted from the sample, the metal solubility will be based on the less soluble phases. For co-precipitated phases, the solubility limits will be "apparent" solubilities, based on the solubility of the dominant or primary phase (such as iron).

For continuous purge tests, solution levels will be monitored and deionized water will be added to the vessels to restore the liquid level to the original height, as needed. Test sample volumes must be sufficiently large to support the collection of multiple sub-samples during the course of the experiment. For zero-headspace samples, only one sampling event will be conducted for each vial. Leaching tests will be conducted at 25 °C with agitation. Tests will be continued for a minimum of one month to confirm that equilibrium has been reached. Duplicate sub-samples will be collected during each sampling event. Test samples will be sub-sampled at 1 week intervals. Approximately 9 mL of sample will be collected and filtered through 0.1-µm poly-vinyl difluoride (PVDF) syringe filter units. The 9-mL sample will be acidified and diluted in ~1 mL of 3 M HNO_3. Assuming a total of six duplicate sampling events per test sample, the required initial test sample volume for continuous purge tests is ~150 mL. After mixing, the acidified sample will be analyzed for Pu (by alpha spectroscopy following separation using thenoyltrifluoroacetone - TTA), Np-237 and Am-241 (by Gamma Pulse Height Analysis - GPHA), and U and Tc (by ICP-MS) analysis. Cs-137 and Sr-90 concentrations in the leachates will also be determined as well as selected other species, depending on the samples used for leaching. After the completion of 4 weeks of agitation and sub-sampling, the test samples will be maintained under controlled atmosphere conditions at the target temperature with continued agitation and periodic sampling while awaiting analytical results. Based on the analytical results, additional analysis will be conducted if needed to confirm equilibrium as indicated by constant concentrations versus time for each radionuclide of interest. For selected samples believed to be at equilibrium, the concentrations of soluble non-radioactive elements will also be determined for similarly diluted and acidified sub-samples. For selected samples, water-diluted (as needed for dose reasons) or undiluted sub-samples will be submitted for IC anion analysis.

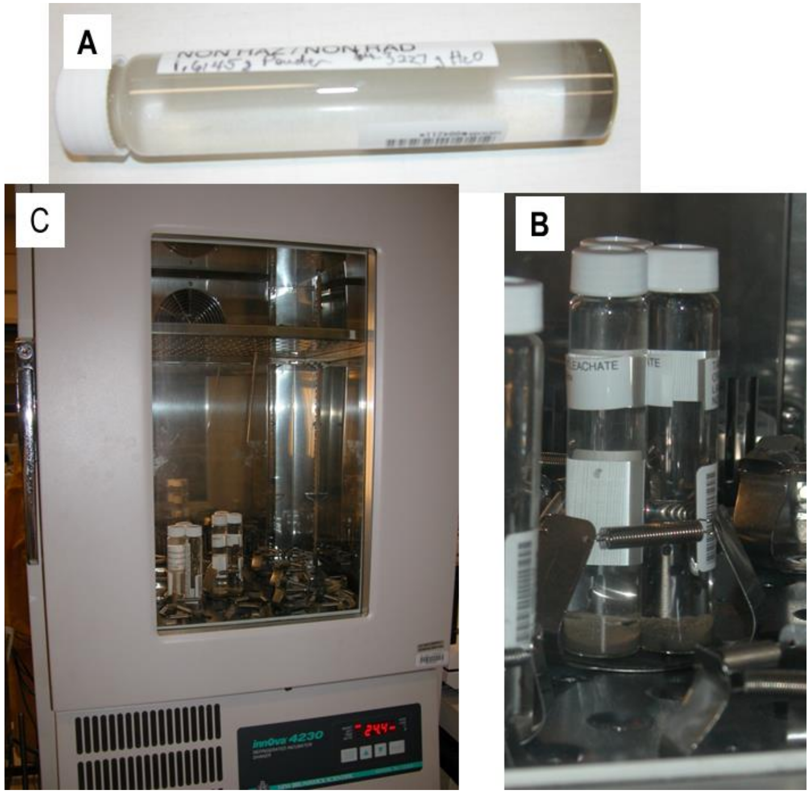

Figure 1. Zero Head-Space Leaching Test Equipment: A) test vial containing CFS solids and pore water solution, B) test vials anchored inside oven, and C) Innova Model 4230 Incubator Shaker oven.

Table 5. Radionuclide Solubility Limits in Each Pore Water Solution Estimated by Denham[1].

Element	RRII Condition (M)	ORII Condition (M)	ORIII Condition (M)
Pu	3E-11	3E-11	3E-11
Np	1 E-09	3 E-07	2 E-06
U	5 E-09	5 E-05	4 E-06
Tc	1 E-08	no limit	no limit

5.0 TASK SCHEDULE

The following table provides a tentative schedule estimate for the completion of deliverables. The lead investigator will provide information on schedule logic, task duration, needed resources, and resource constraints to SRNL schedule development personnel as needed.

Tasks	Estimated Completion
Revise and issue TTQAP	October 30, 2015
Prepare tank residuals for testing	January 31, 2016
Conduct status briefing for SRR after completion of residual waste testing preparations and prior to the start of Tank 18 solids testing	January 31, 2016
Actual Waste Testing	June 30, 2016
Issue FY16 technical report summarizing completed project	August 31, 2016

6.0 RESEARCH FACILITY PLANNING

Preparation of the pore waters is planned for laboratories located in 773-A and 735-11A. Any additional leaching tests with radioactive surrogate solids (as needed) are planned for laboratory module B-126/130 in 773-A. Leaching studies with actual Tank 18 residual solids will be conducted in the SRNL shielded cells facility (773-A, E wing).

7.0 PROGRAMMATIC RISK REVIEW

Risk Factor	***Event***	***Mitigation***
Equipment		
Test vessel	Failure	backup test vessels will be fabricated and available; Note: This event may require initiation of a new experiment and impact schedule.
pH and E_h Measuring Equipment	Failure	backup pH and E_h probes and meters will be available for replacement
Experimental		
Pore water solution	inadvertent spill	solutions generally prepared in sufficient volume to replace spilled material and new preparations can be accomplished quickly; Note: Pore water conditioning could require several days and this could impact schedule.
Experimental sample	inadvertent spill	Duplicate test vessels will be considered for each condition, but it is anticipated that this may not be readily accomplished. Note: This event may require initiation of a new experiment and impact schedule.
Analytical sample	inadvertent spill	where possible, duplicate samples will be collected
Personnel		
Investigators	Illness, vacation	back-up researchers available
Analytical Support		
Equipment	Failure	delays possible due to instrumental repairs; This is mitigated by including sufficient time in the schedule to accommodate some delays.
Instruments	Availability	delays possible due to instrument availability; dependent on task priorities; This is mitigated by including sufficient time in the schedule to accommodate some delays.
Facility		
Facilities	Planned and Unplanned outages	Planned SCO outages are scheduled for March 2016. Tests are being scheduled around the outages. Other delays are possible due to unplanned outages. This is mitigated by including sufficient time in the schedule to accommodate some outages.

8.0 R&D HAZARDS SCREENING

A Hazard Analysis Package (HAP) covering the planned experiments with actual Tank 18 residual solids will be developed and issued for this work. Surrogate testing is covered under an existing HAP.[10] It is anticipated that testing of the actual tank waste solids is considered waste characterization and, therefore, will not require the controls associated with a waste treatability study.

9.0 QUALITY ASSURANCE

9.1 Documents Requiring Requester Approval

Document	Management		Customer		QA	
	Yes	No	Yes	No	Yes	No
Task Technical and QA Plan	X		X		X	
Final Report	X		X			X

9.2 Records Generated During Task Performance

Description	YES	NO	AR*
Task Technical and QA Plan	X		
Controlled Laboratory Notebooks	X		
Task Technical Reports			X
Data Qualification Reports		X	
Supporting Documentation			X

*** AR = As Required**

9.3 Task QA Plan Procedure Matrix

See Attachment 1.

10.0 REFERENCES

1. M. E. Denham and M. R. Millings, “Evolution of Chemical Conditions and Estimated Solubility Controls on Radionuclides in the Residual Waste Layer During Post-Closure Aging of High-Level Waste Tanks”, SRNL-STI-2012-00404, August 2012.
2. K. H. Rosenberger, “Savannah River Site Liquid Waste Facilities Performance Assessment Maintenance Program FY2015 Implementation Plan”, SRR-CWDA-2014-00133, January 2015.
3. Technical Task Request, “Tank Waste Testing to Evaluate Residual Waste Solubility Assumptions used in the Tank Farm PAs”, HLE-TTR-2013-002, Rev. 3, September 2015.
4. D. H. Miller, K. H. Roberts, K. M. L. Taylor-Pashow and D. T. Hobbs, “Determining the Release of Radionuclides from Tank Waste Residual Solids”, SRNL-STI-2014-00456, Rev. 0, September 2014.
5. W. D. King and D. T. Hobbs, “Determining the Release of Radionuclides from Tank Waste Residual Solids: FY2015 Report”, SRNL-STI-2015-00446, Rev. 0, September 2015.
6. L. N. Oji, D. Diprete, and D. R. Click, “Characterization of the Tank 18F Samples”, SRNL-STI-2009-00625, Rev. 0, December 2009.
7. L. N. Oji, D. Diprete, and C. J. Coleman, “Characterization of Additional Tank 18F Samples”, SRNL-STI-2010-00386, Rev. 0, September 2010.

8. R. N. Strom, and D.S. Kaback, “SRP Baseline Hydrogeologic Investigation: Aquifer Characterization Groundwater Geochemistry of the Savannah River Site and Vicinity (U)”, WSRC-RP-92-450, 1992.
9. D. B. Stefanko and C. A. Langton, “Tanks 18 and 19-F Structural Flowable Grout Fill Material Evaluation and Recommendations”, SRNL-STI-2011-00551, Rev. 1, April 2011.
10. “Leach Studies of Cementitious and Solid Waste Forms”, SRNL-L3100-2010-00051, Rev. 2, HAP Lead: K. Roberts.

Attachment 1. Task QA Plan Procedure Matrix

Listed below are the sections of the site QA Manual (1Q) and associated implementing procedures for SRNL. Sections applicable to this task are indicated by Yes, No, or As Required. The selected procedures identify the controls for task activities performed by E&CPT Research Programs Section only.

QA Manual Sections	Implementing Procedures	YES	NO	AR
Organization	1Q, QAP 1-1, Organization	X		
	• L1, 1.02, SRNL Organization	X		
	1Q, QAP 1-2, Stop Work			X
Quality Assurance Program	1Q, QAP 2-1, Quality Assurance Program	X		
	• L1, 8.02, SRNL QA Program Implementation and Clarification	X		
	1Q, QAP 2-2, Personnel Training & Qualification	X		
	• L1, 1.32, Read and Sign/Briefing Program	X		
	1Q, QAP 2-3, Control of Research and Development Activities	X		
	• L1, 7.10 Identification of Technical Work Requirements	X		
	1Q, QAP 2-7, QA Program Requirements for Analytical Measurement Systems	X		
Design Control	1Q, QAP 3-1, Design Control	X		
	• E7, 2.60, Technical Reviews	X		
	• E7, 3.60, Technical Reports	X		
Procurement Document Control	1Q, QAP 4-1, Procurement Document Control			X
	• 7B, Procurement Management Manual			X
	• 3E, Procurement Specification Procedure Manual			X
	• E7, 3.10, Determination of Quality Requirements for Procured Items			X
Instructions, Procedures and Drawings	1Q, QAP 5-1, Instructions, Procedures and Drawings	X		
	• L1, 1.01, Administration of SRNL Procedures and Work Instructions	X		
	• L1, 7.26 R&D Work Control Documents	X		
	• E7, 2.30 Drawings		X	
Document Control	1Q, QAP 6-1, Document Control	X		
	• 1B, MRP 3.32, Document Control	X		
Control of Purchased Items and Services	1Q, QAP 7-2, Control of Purchased Items and Services	X		
	• 7B, Procurement Management Manual	X		
	• 3E, Procurement Specification Procedure Manual	X		
	1Q, QAP 7-3, Commercial Grade Item Dedication		X	
	• E7, 3.46 Replacement Item Evaluation/ Commercial Grade Dedication		X	

Continued on next page….

Attachment 1. Task QA Plan Procedure Matrix continued

QA Manual Sections	Implementing Procedures	YES	NO	AR
Identification and Control of Items	1Q, QAP 8-1, Identification and Control of Items	X		
	• L1, 8.02 SRNL QA Program Implementation and Clarification	X		
Control of Processes	1Q, QAP 9-1, Control of Processes		X	
	1Q, QAP 9-2, Control of Nondestructive Examination		X	
	1Q, QAP 9-3, Control of Welding and Other Joining Processes		X	
	1Q, QAP 9-4, Work Planning and Control	X		
	• 1Y, 8.20, Work Control Procedure		X	
Inspection	1Q, QAP 10-1, Inspection		X	
	• L1, 8.10, Inspection		X	
Test Control	1Q, QAP 11-1, Test Control		X	
Control of Measuring and Test Equipment	1Q, QAP 12-1, Control of Measuring and Test Equipment	X		
	1Q, QAP 12-2, Control of Installed Process Instrumentation		X	
	1Q, QAP 12-3, Control and Calibration of Radiation Monitoring Equipment (not applicable to ERPS)		X	
Packaging, Handling, Shipping and Storage	1Q, QAP 13-1, Packaging, Handling, Shipping and Storage			X
	• L1, 8.02 SRNL QA Program Implementation and Clarification			X
Inspection, Test, and Operating Status	1Q, QAP 14-1, Inspection, Test, and Operating Status		X	
	• L1, 8.02 SRNL QA Program Implementation and Clarification		X	
Control of Nonconforming Items	1Q, QAP 15-1, Control of Nonconforming Items			X
	• L1, 8.02 SRNL QA Program Implementation and Clarification			X
Corrective Action System	1B, MRP 4.23, Corrective Action Program			X
Quality Assurance Records	1Q, QAP 17-1, Quality Assurance Records Management	X		
	• L1, 8.02 SRNL QA Program Implementation and Clarification	X		
	• L1, 7.16, Laboratory Notebooks and Logbooks	X		
	• L1, 7.30, Electronic Laboratory Notebook and Logbook Experiments	X		

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Attachment 1. Task QA Plan Procedure Matrix continued

QA Manual Sections	Implementing Procedures	YES	NO	AR
Audits	1Q, QAP 18-2, Surveillance			X
	1Q, QAP 18-3, Quality Assurance External Audits		X	
	1Q, QAP 18-4, Management Assessment Program			X
	• 12Q, SA-1, Self-Assessment			X
	1Q, QAP 18-6, Quality Assurance Internal Audits			X
	1Q, QAP 18-7, Quality Assurance Supplier Surveillance		X	
Quality Improvement	L1, 8.02 SRNL QA Program Implementation and Clarification			X
Software Quality Assurance	1Q, QAP 20-1, Software Quality Assurance			X
	• E7, 5.0, Software Engineering and Control			X
Environmental Quality Assurance	1Q, QAP 21-1, Quality Assurance Requirements for the Collection and Evaluation of Environmental Data (ERPS works to QAP 2-3 and is exempt from this QAP.)		X	
Special Requirements (applicable if RW-0333P QA program specified by customer)	L1, 8.21, Supplemental Quality Assurance Requirements for DOE/RW-0333P		X	

Identify the following information for your task:

Is the work Technical Baseline or Non-Baseline?	Baseline	Non-Baseline	
	X		
Is the work R&D, Routine Service, or Engineering Design?	R&D	Routine Service	Engineering Design
	X		
Is the work for an onsite or offsite customer?	Onsite	Offsite	
	X		

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