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To: F. M. Smith, 705-1C

From: A. V. Staub, 704-Z AVS 8/24/10

SUBJECT: ESTIMATED RADIONUCLIDE COMPOSITION OF SOLUTION TRANSFERRED TO VAULT 4 ON MAY 19, 2010

REFERENCES:

1) Cozzi, A. D., Reigel, M. M., "Results for the May 19, 2010 Inadvertent Transfer to the Saltstone Disposal Facility: Slurry Sample Analytical Results," SRNL-STI-2010-00490, August 2010.

2) Staub, A. V., "Saltstone Facility Basis Information for Consent Order of Dismissal Section III.7 Website Data- Second Quarter 2010," SRR-WSE-2010-00162, Rev. 0, July 2010.

3) Reigel, M. M. and Bibler, N. E., "Tables Containing Results for the Second Quarter 2010 Tank 50 WAC Slurry Sample: Chemical and Radionuclide Contaminant Results," SRNL-L3100-2010-00080, Rev. 0, June 2010.

As requested during the July 28. 2010 NRC Onsite Observation, this letter is intended to provide an estimate of the radionuclide composition of the salt solution inadvertently transferred to Saltstone Disposal Facility (SDF) Vault 4 on May 19, 2010.

On May 19, 2010, Saltstone Operations personnel were performing tests of the Salt Feed Tank (SFT) agitator. The test required the facility to be put in a non-routine test configuration to allow the recirculation of salt solution from the SFT through the mixing and transfer system and back to the SFT. Test activities required that operators manipulate valve positions to establish the necessary configuration. During this process a four-way valve was misaligned. When the test was initiated, the valve misalignment resulted in a transfer of salt solution directly to Vault 4. Based on facility instrumentation, approximately 1900 gallons of material was inadvertently transferred to Vault 4, Cell F. In accordance with normal operating procedures, steps were taken to initiate drain water removal to the maximum extent possible. Over the course of a few days the drain water level was returned to the level

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that is was prior to the event. A small amount of liquid (less than 50 gallons) remained on top of the saltstone monolith within the depression where the grout falls from the vault roof into the cell. Upon subsequent Saltstone Production Facility (SPF) start-up, clean grout was added for approximately 15-20 minutes to allow the small amount of residual liquid to mix with the grout.

When the inadvertent transfer was identified operations took immediate actions to shut down the process and place the facility in a safe condition. After shutdown, the grout pump hopper was left with a residual volume of salt solution. Because the facility was in a non-routine test configuration there was an opportunity to take a dip sample of the solution. A sample of the material was obtained from the grout hopper and transported to the Savannah River National Lab (SRNL) for characterization. Sampling performed by the facility was intended to verify the chemical nature of the solution transferred into the vault.

Radiological sampling was not considered because:

1. Material in the Salt Feed Tank is qualified in Tank 50 and verified to be compliant with the Waste Acceptance Criteria.
2. The radiological inventory is accounted for when the transfer from Tank 50 is made, thus additional inventory was not added from this event.

Because of the sample prep methods used in the preceding chemical analyses, there is no original material remaining. Thus in order to develop an estimate, SRR is using data from the chemical composition to determine the likely radionuclide concentrations in the waste solution. This is believed to be a reasonable approach based on the process knowledge of transfers into and out of the Salt Feed Tank during the period of interest.

Radiological Composition Estimate

The sample was visually inspected upon receipt at SRNL and was observed to be slurry containing an indeterminate quantity of readily suspended solids in a lightly colored supernate. Analytical personnel measured the density and pH of the slurry and dissolved the solids for chemical analysis.

The Salt Feed Tank contained a mixture of salt waste from Tank 50 as well as drain water returns from Clean Cap processing at Vault 4. Since the water used in producing clean cap has no radiological component, it should be possible to estimate radionuclide concentrations based on the concentration of major chemical species that are present in only the waste salt solution in Tank 50. Using the results provided in References 1 and 2, the total sodium is the analyte present at the highest concentration that would allow for this type of comparison. A summary of the data is provided in Table 1 below:

Analyte	2Q10 WAC Sample	Hopper Sample	Ratio
Na (mg/L)	9.31E+04	1.03E+04	0.11
	(pCi/mL)	(pCi/mL)	
H-3	7.59E+02	8.43E+01	
C-14	7.87E+02	8.75E+01	
Co-60	1.23E+01	1.37E+00	
Ni-59	<1.05E-01	<1.17E-02	
Ni-63	3.33E+02	3.70E+01	
Se-79	4.56E+02	5.06E+01	
Sr-90	7.12E+04	7.91E+03	
Y-90	7.12E+04	7.91E+03	
Tc-99	3.33E+04	3.70E+03	
Ru-106	<6.31E+00	<7.01E-01	
Rh-106	<6.31E+00	<7.01E-01	
Sb-125	8.21E+03	9.12E+02	
Te-125m	8.21E+03	9.12E+02	
I-129	1.40E+01	1.56E+00	
Cs-134	<1.23E+03	<1.37E+02	
Cs-137	1.10E+07	1.22E+06	
Ba-137m	1.04E+07	1.16E+06	
Ce-144	<1.07E+01	<1.19E+00	
Pr-144	<1.07E+01	<1.19E+00	
Pm-147	<3.72E+02	<4.13E+01	
Eu-154	4.46E+02	4.95E+01	
Np-237	1.36E+01	1.51E+00	
Pu-238	2.19E+04	2.43E+03	
Pu-239	5.33E+02	5.92E+01	
Pu-240	5.33E+02	5.92E+01	
Pu-241	4.26E+04	4.73E+03	
Pu-242	<1.48E+02	<1.64E+01	
Am-241	1.51E+03	1.68E+02	
Am-242m	5.20E-01	5.78E-02	
Cm-242	4.30E-01	4.78E-02	
Cm-244	2.92E+03	3.24E+02	
Cm-245	<6.26E+00	<6.95E-01	
Hopper sample SpG	**1.0354**		

Table 1: Estimate of SFT liquid sample radionuclide distribution

The information given in Table 1 is an estimate based on the best available data. It shows that the sodium concentration of the SFT sample is approximately 11% that of the concentration in the second quarter 2010 Tank 50 WAC sample. This would suggest that the concentration of raw waste has been diluted nearly 10x due to the addition of drain water back to the Salt Feed Tank. This appears to be a reasonable conclusion given the measured sample density of 1.035 g/cm^3; the density of the WAC sample was 1.183 g/cm^3 (Ref. 3). Visual observation of the sample showed the presence of insoluble solids, and the chemical results indicated that these solids were of primarily cementitious origin. No measurement was made to determine the weight percent of total insoluble solids, thus meaningful estimates of these constituents cannot be obtained from available information. Given that none of the original sample remains, any attempt to further characterize the composition of the solids will require additional assumptions as direct measurement will not be possible.

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