

July 3, 2013

NOTE TO FILE: Project File PROJ0734

FROM: Nishka Devaser */RA/*
Low-Level Waste Branch
Environmental Protection
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PROJECT: Savannah River Site, Saltstone Disposal Facility

SUBJECT: APRIL 30, 2013, SUMMARY OF TELEPHONE CONFERENCE CALL TO
DISCUSS TECHNETIUM SOLUBILITY RESEARCH RELATED TO
MONITORING OF THE SALTSTONE DISPOSAL FACILITY, DOCKET
NUMBER PROJ0734

On April 30, 2013, the U.S. Nuclear Regulatory Commission (NRC) participated in a working-level phone call with the U.S. Department of Energy (DOE) to discuss the details of research provided to the NRC as basis for disposal operations at the Savannah River Site Saltstone Disposal Facility. The subject report of the discussion on technetium solubility in saltstone was sent to the NRC on March 8, 2013, and is being reviewed in accordance with NRC's monitoring responsibilities under Section 3116 of the National Defense Authorization Act for Fiscal Year 2005. The NRC will be documenting its review in a publicly available technical review memorandum. The purpose of this technical exchange was to discuss questions, regarding the details of the research, from the staff during development of the technical review memorandum. No formal decisions were made or intended to be made at this meeting. The purpose was for information exchange at the technical staff level and no management was present at the meeting.

Enclosure 1 provides a listing of the telephone conference participants. Enclosure 2 lists the questions that were asked. Details of the technical exchange and NRC staff review of the subject report will be documented in the technical review memorandum.

Docket No.: PROJ0734

Enclosures: As stated

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cc w/enclosures: WIR Service List

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List of Participants
Summary of Telephone Conference Call to Discuss Technetium Solubility Research
Related to Monitoring of the Saltstone Disposal Facility

George Alexander	U.S. Nuclear Regulatory Commission
Nishka Devaser	U.S. Nuclear Regulatory Commission
Harry Felsher	U.S. Nuclear Regulatory Commission
Karen Pinkston	U.S. Nuclear Regulatory Commission
Christianne Ridge	U.S. Nuclear Regulatory Commission
Sherri R. Ross	U.S. Department of Energy
Larry Romanowski	Savannah River Remediation
Kent Rosenberger	Savannah River Remediation
Steve Thomas	Savannah River Remediation
Shelly Wilson	South Carolina Department of Health and Environmental Control
Daniel Kaplan	Savannah River National Laboratory
Dien Li	Savannah River National Laboratory

Technical Discussion Regarding Technetium Solubility in Saltstone at the Saltstone Disposal Facility at the Savannah River Site
April 30, 2013

The U.S. Nuclear Regulatory Commission (NRC) is conducting a review of research related to technetium solubility in saltstone. The subject research, technetium solubility in saltstone, is used as a basis for disposal of salt waste at the Savannah River Site (SRS) Saltstone Disposal Facility (SDF). The staff will publish the details of its review and information from any technical exchanges in a publicly available technical review memorandum. The primary reference for the review is SRNL-STI-2012-00769. In addition, the staff asked questions about two of the key references used to support SRNL-STI-2012-00769 (PNNL-21723 and SRNL-STI-2012-00596).

Comment 1: Additional information is needed regarding the basis for the values recommended for future PA work with respect to young reducing cementitious material (Table 11).

- Solubility values appear to be based on modeling results for saltstone leachate (Table 7). Is that accurate?
- Were the other modeling results discussed in the paper used to develop the values in Table 11? If so, how were they used?

Comment 2: The authors state that in some cases pyrrhotite is used as a surrogate in the geochemical model to represent reduced sulfur in blast furnace slag. The NRC staff understands the use of surrogate species in geochemical modeling when the phases present in the physical system are not completely known. However, additional information is needed to understand which model runs included the assumption of the presence of pyrrhotite and to understand how well 1 g/L pyrrhotite represents reduced sulfur in blast furnace slag.

- How did the authors use the results for a modeled system of pyrrhotite in Portland cement leachate? Were they used to support the values in Table 11?
- Did the authors assume the presence of pyrrhotite in the model runs intended to simulate saltstone leachate?
- Is assuming 1 g/L of pyrrhotite equivalent to assuming pyrrhotite is always present in the modeled samples?
- How does the E_h at which pyrrhotite poises the system compare to measured values of E_h in saltstone?
- What is the uncertainty associated with using this choice of sulfur phase in the geochemical model? How different would the results be if a different mineral (e.g., pyrite, CaS) were used?

Comment 3: The authors use an E_h of -0.38 V to model reducing conditions and state that the release of Tc increases dramatically with an E_h greater than -0.35 V. SRNL-STI-2012-00679, Table 1 provides E_h values measured in two studies

of saltstone samples (Estes et al, 2012; Cantrell and Williams, 2012). The values from the study of Estes et al. are all below -0.38 V; however, these experiments were conducted in a 0.1% H_{2(g)} atmosphere that may not be representative of the conditions experience by emplaced saltstone. After an initial 14-day period of falling E_h, the E_h values observed by Cantrell and Williams (i.e., PNNL-21723, Figure 3.3) fell to approximately -0.38 V or slightly lower for approximately 1 month. The authors attribute subsequent higher E_h measurements to measurement error associated with fouling of the E_h probe junction.

- What is DOE's estimate of the uncertainty associated with the modeled E_h of -0.38 V?
- How does uncertainty in the E_h value in emplaced saltstone affect the recommended solubility values or the uncertainty in those values?
- What is the basis for assuming that the E_h will not exceed -0.35 V in reduced saltstone?

Comment 4:

Cantrell and Williams (PNNL-21723) reported both measured and calculated Tc solubility values. In general, when modeled and measured values are inconsistent, greater weight is typically given to the measured values. Additional information is needed to understand how the results of PNNL-21723 were considered in this work (SRNL-STI-2012-00769).

- Why is the proposed value for young reduced material (6x10⁻⁷ M) lower than the measured value for young saltstone reported in PNNL-21723 (1.5x10⁻⁶ M)?
- Does DOE have a hypothesis to explain why the modeled solubility values reported in PNNL-21723 are higher than the modeled values in this work? The NRC staff understands different databases were used. What was the basis for discounting the modeled values based on the database of Cantrell and Williams (e.g., was there some identifiable deficiency in the database used by Cantrell and Williams)?

Comment 5:

Do the authors have a hypothesis to explain why the solubility values measured by Estes *et al.* (SRNL-STI-2012-00596) are lower than the other values considered in SRNL-STI-2013-00769? The NRC staff notes that the experiments conducted by Estes *et al.* were oxygen free (i.e., conducted under 0.1% H_{2(g)}) and may not be applicable to the real saltstone system, which may contain trace values (or more) of O_{2(g)}.

Comment 6:

In Table 10 a starting and ending value is provided for the E_h. The other similar tables of results (e.g., Tables 6 to 9) only list one value for E_h. Was the E_h constant in the other speciation calculations?

Comment 7: In PNNL-21723, what fraction of the Tc and sulfur were released? Are the decreases seen with time (i.e., in Appendix A of PNNL-21723) due to dilution or depletion of the source term rather than changes in the chemistry?

REFERENCES

SRNL-STI-2012-00769, Rev. 1, Li D. and Kaplan D. I., *Solubility of Technetium Dioxides (TcO_2 , $TcO_2 \cdot 1.6H_2O$ and $TcO_2 \cdot 2H_2O$) in Reducing Cementitious Material Leachates: A Thermodynamic Calculation*. Savannah River National Laboratory, Aiken, SC. U.S. Department of Energy. February 1, 2013. ML13070A135.

PNNL-21723, Cantrell K.J. and Williams B.D., *Equilibrium Solubility Model for Technetium Release from Saltstone Based on Anoxic Single-pass Flow through Experiments*. Pacific Northwest National Laboratory, Richland, WA. September 2012. ML12345A267.

SRNL-STI-2012-00596, Rev. 0, Estes S.L., Kaplan D.I., and Powell B.A., *Technetium Sorption by Cementitious Materials under Reducing Conditions*. Savannah River National Laboratory, Aiken, SC. September 2012. ML12345A134.