CENTER FOR NUCLEAR WASTE REGULATORY ANALYSES

TRIP REPORT (Revised)

SUBJECT: Attendance at the American Society of Testing and Materials (ASTM) C26-13 Repository Waste subcommittee meeting
Charge Number 20.01402.571

DATE/PLACE: June 26–29, 2000, Las Vegas, NV

AUTHOR: V. Jain

DISTRIBUTION: V. Jain, CNWRA

CNWRA	DWM	SwRI
W. Patrick	J. Linehan	T. Nagy (contracts)
CNWRA Directors	D. DeMarco	
CNWRA EMs	B. Meehan	
V. Jain	E. Whitt	
P. Maldonado	J. Contardi	
G. Cragnolino	T. Bloomer	
	T. Ahn	
	K. Stablein	
	J. Greeves	
	J. Thomas	
	J. Holonich	
	B. Leslie	
	C. Greene	

CENTER FOR NUCLEAR WASTE REGULATORY ANALYSES

TRIP REPORT (Revised)

SUBJECT: Attendance at the American Society of Testing and Materials (ASTM) C26-13 Repository Waste subcommittee meeting
Charge Number 20.01402.571

DATE/PLACE: June 26–29, 2000, Las Vegas, NV

AUTHORS: V. Jain

PERSONS PRESENT: V. Jain, CNWRA

BACKGROUND AND PURPOSE OF TRIP:

The ASTM C26-13 meeting was held June 26–29, 2000, at the Imperial Palace in Las Vegas, NV. ASTM C26-13 sub-committee is involved in the development of methods for activities related to vitrified waste and spent fuel. The participants included technical staff from national laboratories such as Argonne National Laboratory (ANL), ANL-West, Pacific Northwest National Laboratory (PNNL), Los Alamos National Laboratory, Lawrence Livermore National Laboratory (LLNL); waste form producers such as West Valley Demonstration Project (WVDP) and Savannah River Site (SRS); Fuel manufacturers; Utilities; and representatives from CEA (Commissariat à l'énergie Atomique) and COGEMA, France. The purpose of this bi-annual meeting is to define the need for standards, write standard methods, and issue standards for testing and materials.

SUMMARY OF PERTINENT POINTS:

The activities during this meeting are summarized below.

Bill Ebert, ANL, presented the status of the "Forward Reaction Rate Constant" standard for glass using single-pass flow-through experiments. The following issues were discussed during his presentation and will be incorporated before the standard is balloted to subcommittee.

- Relationship between frequency of sampling and aliquot time. Frequency of sampling depends upon the release rate. For a corrosion resistant sample, high sampling frequency could result in leachate concentration below detection levels.

- For extended experiments, change in surface area may introduce errors in calculations. Method should include a procedure for estimating the effective surface area.

- Forward rate is calculated by drawing an arbitrary straight line through various data points on the Si concentration versus flow rate curve. A more quantitative method is needed for determining steady state rate.

- Fines in the sample could affect the release rate.

- No data are currently available for calculating precision and bias. A round robin is suggested to obtain the data. Ebert will explore Tank Focus Area for funding.

John Vienna, PNNL, presented the status of the "Liquidus Temperature Determination Method." The draft method was sent for the subcommittee ballot a year ago. Currently comments from C 14.01 (commercial glass) are being resolved. C 14.01 would like to add more methods (hot stage and uniform temperature method) for liquidus determination. A round robin is planned using two different glasses with liquidus temperature difference of 200 °C.

John Vienna, PNNL, presented the status of the Vapor Hydration Test (VHT) Method. This test method will be used for performance assessment (PA) of the Hanford's vitrified low-activity waste. The data for the VHT test are collected at 200 °C while the PA will use low temperature data to estimate release rate. I questioned if the corrosion mechanisms at 200°C are the same as low temperature mechanisms. If they are not, the applicability of high temperature data to low temperature is questionable and should be addressed in the method. The method is planned for subcommittee ballot in November 2000.

Carol Jantzen, SRS, discussed revisions to the "Product Consistency Test (PCT) Method (ASTM C1285-97)" based on the requests from ANL-West. The major change is the expansion of the test method to include ceramic waste form. Since PCT is exclusively based on analyzing elements such as B, Si, and alkali ions in the solution (greater than 1 wt % in borosilicate glass waste form), the method has to be revised to indicate that for other waste forms the elements representing the maximum radionuclide release must be determined. The proposed changes also included addition of a justification statement for borosilicate glass waste form which said "...elements are chosen to represent the maximum radionuclide release for high level radioactive waste based on extensive radionuclide testing, e.g. in high level radioactive waste glass Tc-99 is the most soluble radionuclide and Tc-99 has been shown to have release equivalent to B." While the SRS data on radioactive glasses presented showed Tc-99 release rate equivalent to B, I questioned if B bounds the Tc-99 release rate. My argument was that Tc-99 because of its low concentration could have significantly larger variability compared to B and it is possible that B may not bound Tc-99 release rate. Also environmental assessment (EA) glass, which is used as a standard for high-level waste (HLW) borosiliacte glass, may not be applicable for other waste forms. If not, the issue should be resolved before the method is balloted. The use of EA glass for waste forms other than borosilicate glass should be cautioned in the method.

Steve Johnson, ANL-West, gave a presentation on the development of HLW ceramic waste form. His presentation supported the need of expanding PCT (ASTM C1285-97) method for ceramic waste forms typified by glass-bonded sodalite.

Bill Ebert, ANL, presented the results of the round robin on standard Low-Activity Reference Material (LRM) glass which is a standard glass for Hanford's low activity waste. ANL supplied all the participating laboratories with the crushed glass samples to conduct PCT at 40 and 90 °C. Statistical analysis was performed using ASTM 691 method. The results indicated that all elements were within prescribed limits.

Except for one laboratory, data from all laboratories were within limits. It is recommended that LRM glass can be used as standard.

Tom Thronton, Framatome Laboratories, opened the discussion on the need for a method determine the performance of the HLW glass in the repository. He indicated that currently there are some data on WVDP and SRS glasses, but no data exists for Hanford HLW glasses. Without Hanford data, it is not clear whether Hanford glasses should be included in the Yucca Mountain performance assessment. Several members attending the meeting indicated that they have been called upon by the U.S. Department of Energy (DOE) staff asking why ASTM committee wants to open this issue. Bill Ebert indicated that his current model in AMRs and PMRs shows that EA glass bounds the release rate for both WVDP and SRS glasses and he thinks as long as Hanford produces HLW which is required to meet release rate at least two standard deviations below the EA glass, Hanford glasses should be bound by the EA glass.

Carol Jantzen, SRS, presented the status of the "A Guide for Physical and Chemical Characterization of Radioactive and Hazardous Wastes for Thermal Treatment". The work on this method was started in 1993 and was balloted in 1998. A large number of comments were received during ballot and were incorporated in the draft method. Resolution of comments was discussed at the meeting.

Carol Jantzen, SRS presented the status of the "Determination of Time-Temperature-Transformation Diagram for HLW Glasses." No progress was reported on this method. Round robin data collected in 1995 still need to be analyzed. She has requested my help in completing the method since I was the one who initially started the development of the method and round robin in 1994.

Chuck Interrate, NRC, discussed the status of the "Standard Guide for Evaluation of Materials Used in Extended Service of Interim Spent Nuclear Fuel Dry Storage Systems". He discussed the changes made as a result of ballot comments. The method was expanded to include performance of polymer and concrete materials. The changes based on the ballot comments were discussed.

The discussion on Aluminum Spent Fuel was canceled as no one from SRS showed up at the meeting.

Bob Einziger, ANL, summarized the future activities that sub committee should undertake. Out of 14 topics suggested by the members, the following five were selected as high priority.

1. Flow through testing for Al spent fuel
2. Drip testing for Al spent fuel
3. Drying for Al spent fuel
4. Dry storage of spent fuel
5. ISO standard for wet storage of Al spent fuel

Brady Hanson, PNNL, presented the status of the "Method for Determining Dissolution Rate of Spent Fuel Using Flow Through Test." The initial motivation for development of this test was to have a standard test method for spent fuel dissolution. Walt Gray, PNNL (now retired) has been doing this test since 1988. From a historical perspective, the method, when initially developed, was generic and during ballot received a negative comment for being too generic. The method was revised and re-balloted. This time there was one negative vote, from Steve Stewart, LLNL, stating that it was too prescriptive. Method requires a revision to provide more room for test parameters. Hanson also indicated that SRS data on the UO_2 fuel sample supplied

by PNNL indicated an order of magnitude higher release rate compared to PNNL data. The two laboratories are comparing differences in approach, such as the use of distilled water by SRS versus the use of deionized water by PNNL, that may have caused this variation in data. The negative vote needs to be resolved in time to prevent reapproving this method from the standardization process. Hanson suggested that the method, at a minimum, needs a round robin study to determine accuracy and bias. While interested laboratories could include PNNL, SRS, Canadian, and French Laboratories, funding to conduct this round robin is still not known. Other ballot questions that still require resolution are as follows.

- There is no defined method for determining steady state.
- Uncertainties due to particle size are not defined in the method.
- Dissolution should not be more than 25 percent. Surface area could change. This should be further clarified. For spent fuels with high dissolution rate, surface area may be difficult to estimate from data.
- Method cites use of Brumauer-Emett-Teller Method (BET) for determining surface area. BET is an acceptable technique but not everyone has access to BET in hot-cell. Also large differences are observed among BET data for same sample.
- There is little data in the low pH range.

Hanson will issue a memo about what is needed to move this method forward.

Gary Smith, PNNL, started the discussion on a new method for "Spent Fuel Drying". Currently DOE-EM has a standard guide[1] for dryness in canisters containing DOE SNFs. Tom Thronton suggested to use this guide as a starting point to develop the method and iterated the usefulness of this method during repository preclosure. After discussion a task group was formed which will be responsible for the development of this method. The method will address dryness for both commercial and DOE spent fuels. The method will address the following

- Mechanisms that trap or hold water
- Various forms of waters-chemical or physical
- Type of defects-hairline fractures or pinholes
- Methodology for determining moisture
- Methodology for meeting moisture limits

SUMMARY OF ACTIVITIES:

In summary, the development of methods such as vapor hydration test for glasses, forward reaction rate determination for glasses, spent fuel dissolution rate determination using flow through test, revision to the product consistency test waste forms, and the development of new method for determining the dryness for

[1]Standard Guide for Dryness in Canisters Containing DOE SNFs. DOE/SNF/G–003 Revision 0, September 1998.

spent fuel storage could be important to the NRC in the assessment of the repository performance and should be closely followed.

CONCLUSIONS:

The meeting was very useful in keeping current with the ongoing ASTM activities related to Repository Waste. The participation at the meeting was a good opportunity to gather information and generate discussion on issues important to repository waste.

PROBLEMS ENCOUNTERED:

None.

PENDING ACTIONS:

None.

RECOMMENDATIONS:

None.

SIGNATURES:

Vijay Jain
Senior Research Engineer

8/2/00
Date

CONCURRENCE:

Narasi Sridhar, Manager
Corrosion Science & Process Engineering, Element

8/2/00
Date

Budhi Sagar
Technical Director

Date

VJ:jg