

July 25, 1999

MEMORANDUM TO: G. William Reamer, Chief
High-Level Waste and Performance
Assessment Branch, DWM, NMSS

THRU: N. King Stablein, Section Leader
Projects and Engineering Section
High-Level Waste and Performance
Assessment Branch, DWM, NMSS

FROM: Charles A. Greene, Materials Engineer
Projects and Engineering Section
High-Level Waste and Performance
Assessment Branch, DWM, NMSS

SUBJECT: REPORT ON STAFF EXCHANGE TO THE CENTER
FOR NUCLEAR WASTE REGULATORY ANALYSIS
FROM MAY 2, 1999 TO May 27, 1999

Attached, please find a report on my staff exchange to the Center for Nuclear Waste
Regulatory Analysis from May 2-27, 1999. The topic of this exchange was Localized Corrosion
of Cladding Material Zircaloy-4 in Simulated J-13 Water. Please contact me on 301-415-6177 if
you have any questions or comments.

Attachment: As stated

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Assessment Branch, DWM, NMSS

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Assessment Branch, DWM, NMSS

FROM:

Charles A. Greene, Materials Engineer
Projects and Engineering Section
High-Level Waste and Performance
Assessment Branch, DWM, NMSS

SUBJECT:

PRELIMINARY REPORT ON STAFF EXCHANGE TO
THE CENTER FOR NUCLEAR WASTE REGULATORY ANALYSIS
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**TOPIC: LOCALIZED CORROSION OF CLADDING MATERIAL ZIRCOLOY-4 IN
SIMULATED J-13 WATER**

The following tasks were accomplished during my staff exchange Rotation to the CNWRA:

Test Matrix of Localized Corrosion of Zircaloy-4 Alloy in Simulated J-13 Water

Chloride concentration effect - ASTM standard creviced specimens were tested at five different chloride concentrations: 0.001M, 0.01M, 0.1M, 1M and 4M at 25°C.

Temperature effect - Additional ASTM standard creviced specimens were tested at these five chloride concentrations at 65 and 95°C.

pH effect - At 95°C and 0.1M chloride concentration the pH was varied.

Corrosion Potential, Pitting Potential and Repassivation Potential were determined using cyclic polarization potentiodynamic electrochemical techniques for the tests in the above matrix.

Long Term Experiments Were Initiated.

Long term potentiostatic tests were run at 65°C and 1M chloride concentration approximately 25 mV above open circuit potential and 25 mV below open circuit potential to verify the validity of the cyclic potentiodynamic tests.

Long term open circuit potential tests were initiated at 65°C and 1M chloride to study the effect of other oxidizing species expected to be in the proposed repository at the time of waste package failure when the zircaloy cladding would be exposed to concentrated J-13 water. Peroxide was added to simulate effect of radiolysis. Ferric chloride was added approximately one week later to simulate effect of iron base material corrosion products. A significant result was the increase of the corrosion potential above the repassivation potential under these conditions indicating localized corrosion of the zircaloy-4 alloy cladding is possible in the expected repository environment.

Additional experiments investigating the effect of high temperature oxide layer formation on the zircaloy-4 alloy cladding material prior to exposure to repository environment are being conducted at the Center to supplement the above work.

Products

We have submitted a title and list of authors to NACE international as a place holder for presenting the results of this investigation at the Corrosion conference in the spring of 2000. The deadline for completing the paper for this presentation is mid-October 1999. The paper will go through a peer review process and CNWRA review.

Attachment

Logistical Comments:

Prior to arriving at the Center, arrangements should be made for:

Obtaining a Center computer account. This facilitates email communications which are essential for coordinating the many meetings involving NRC and Center people. PCAnywhere and its successors are a good way to keep in touch with your NRC email remotely, but not practical to keep up with the instantaneous email action everyone has come to expect in our organization. In addition, the Center computer account allows access to the latest software on the latest computers. Establishing a working account may take several days to a week, thus advance arrangements are recommended. Center Contact: Jose DeLaEspriella (210) 522-5255, josed@swri.edu.

Building key and automobile gate pass are both essential to after hours work. Again, advance arrangements will ensure these items are ready for the staff member when she begins her rotation. After about 6:30 PM, buildings are locked and vehicles entering and leaving the SwRI are checked at the guard booth. Staff on rotation may have the opportunity to work after hours or on the weekend and desire access to the building or laboratory.

Center Contact: Bonnie Caudle (210) 522-5157.

Use of an NRC laptop was extremely helpful for transferring multiple, large data files. These laptops are fast and up-to-date with a wide variety of software packages installed. The laptop allowed me to work on my data files at the hotel when time at the Center was crunched as well as check NRC email from the hotel. NRC Contact: Jim Thomas (301) 415-5168, jdt@nrc.gov.

Arrange with NRC secretary to fax T&A's and RITS for your signature and return by fax each week. In addition, have someone collect office snail mail from your NRC mail stop to forward with CNWRA mail in care of the Center contact to avoid confusion. About once per week was adequate.

The Center folks are not on CWS schedule so plan accordingly with your Center Colleagues.

Hotel Accommodations:

Sierra Royale – all suites hotel, pool, off-site fitness center, complimentary continental breakfast and cocktail hour. Extended stay discount rate (210) 647-0041.

Holiday Inn Express – closest to the Center, continental breakfast.

LaQuinta – next door to Holiday Inn Express. Continental breakfast, off-site fitness club at Bally's.

I stayed at the Sierra Royal, but will try Holiday Inn Express or LaQuinta on my next rotation.

Technical Comments

Prior to arriving at the Center

Establish a topic and plan of attack with Center counterparts (see attachment).

Have Center order necessary equipment, supplies or software and make sure it arrives prior to your scheduled start date.