

CENTER FOR NUCLEAR WASTE REGULATORY ANALYSES

TRIP REPORT

SUBJECT: Staff Exchange at the U.S. Nuclear Regulatory Commission (NRC)
Project No. 20.06002.01.322
AI 06002.01.322.626

DATE/PLACE: June 19–30, 2006
Rockville, Maryland

AUTHORS: Pavan K. Shukla
Center for Nuclear Waste Regulatory Analyses (CNWRA)

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PERSONS PRESENT: Pavan K. Shukla and NRC Staff

PURPOSE OF TRIP:

The purpose of the staff exchange was to achieve following objectives:

- Develop understanding of the regulatory aspects and performance assessment of the high-level waste repository program, particularly with respect to the corrosion of the engineered barrier system
- Develop an understanding of abstraction and implementation of corrosion models (generalized corrosion, stress corrosion cracking, and localized corrosion) for the waste package and drip shield in the Total System Performance Assessment–License Application (TSPA-LA) model
- Evaluate screening analyses for different modes of corrosion in the TSPA-LA model
- Present thermal analyses of the HI-STAR 100 cask system at the Yucca Mountain Team Meeting

SUMMARY OF PERTINENT POINTS AND ACTIVITIES:

The U.S. Department of Energy (DOE) TSPA-LA model calculates the rate of release of radionuclides in the biosphere if the failure of engineered barriers results in dissolution of spent nuclear fuel and high-level waste glass by in-drift water. Waste packages will fail if corrosion processes cause through-wall penetration. The corrosion models implemented in the TSPA-LA model calculate the failure of waste package and drip shield from corrosion processes. During the staff exchange, the author had several discussions with Dr. Keith Compton on various aspects of the TSPA-LA model. The author reviewed DOE approaches for modeling generalized corrosion, stress corrosion cracking, and localized corrosion of the waste package and the drip shield and model implementations in the stand-alone corrosion module software WAPDEG, which is expected to be implemented in the TSPA-LA model. The WAPDEG software calculates

waste package failure times due to generalized corrosion and stress corrosion cracking. The waste package failure times due to generalized corrosion were verified using a Microsoft® Excel worksheet.

The author participated in two teleconferences between NRC and CNWRA staff members to discuss the corrosion and near-field chemical environment issues related to Total-system Performance Assessment (TPA) 5.1 computer code.

The author and Dr. David Brooks discussed ongoing work on the flow through stress corrosion cracks and possible future work on flux-splitting of in-drift water near the drip shield and waste package surface. Randall Fedors participated in the flux-splitting discussion, and he proposed organizing a future workshop on this topic.

The author and Dr. Tae Ahn discussed localized corrosion of waste package material in the limited electrolyte environment. Topics related to integrity of fuel cladding and transportation, aging, and disposal canister systems were also discussed.

The author made a presentation on the thermal analyses of the HI-STAR 100 cask system. Following the presentation, Christopher Ryder, Christopher Bajwa, and Jorge Solaris participated in discussions, which provided an opportunity to exchange ideas and share information on thermal analyses of storage cask system. In this meeting, Christopher Bajwa indicated to the recent work conducted by the spent fuel project office on thermal analyses of storage casks under fire impact.

The author also participated in two section meetings and held informal one-on-one discussions with other NRC staff members. These provided insights on the ongoing work and priorities of technical issues related to the high-level waste repository program.

CONCLUSIONS:

The time spent during the staff exchange was sufficient to understand the implementation of the corrosion processes in the TSPA-LA model. The staff exchange provided an opportunity to interact and discuss various topics with several NRC staff members. The visit was also beneficial in developing collegial interaction with NRC staff members.

PROBLEMS ENCOUNTERED:

None.

PENDING ACTIONS:

After discussions with Dr. Keith Compton, the following actions were identified for future work:

- Develop independent modules of the generalized corrosion, localized corrosion, and stress corrosion cracking for confirmatory calculations using the abstracted models developed by DOE
- Evaluate screening analysis for the localized corrosion process

- Estimate failure time for the waste packages using DOE abstraction and compare to results obtained using TPA 5.1

RECOMMENDATIONS:

Staff exchange provides an opportunity to develop collegial interaction between the NRC and CNWRA staffs. This is particularly beneficial to new members of the CNWRA staff, because it provides an overall view of the high-level waste repository safety program and the NRC regulatory role.

SIGNATURE:

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