

March 10, 2000

Dr. B. John Garrick, Chairman
Advisory Committee on Nuclear Waste
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

SUBJECT: RESPONSE TO COMMENTS ON THE IMPORTANCE OF CHEMISTRY IN THE
NEAR FIELD TO THE DEPARTMENT OF ENERGY'S YUCCA MOUNTAIN
REPOSITORY LICENSE APPLICATION

Dear Dr. Garrick:

I am responding to your January 11, 2000, letter to Chairman Meserve conveying your comments and recommendations on the importance of chemical phenomena in the near field to the U.S. Department of Energy's Yucca Mountain repository proposed License Application (LA). I would like to thank you for sharing your observations on the role of near-field chemistry in a potential LA, and for providing the recommendations in Dr. Wymer's white paper, "Chemistry in the Proposed Yucca Mountain Repository Near Field."

Our responses to the Advisory Committee on Nuclear Waste's observations and recommendations are presented in the Enclosure. The staff did not review those portions of the white paper that address issues beyond the U.S. Nuclear Regulatory Commission's regulatory responsibilities, in particular those comments related to alternative designs.

Your recommendations concerning ongoing work on natural analogs, corrosion processes, and assessment of coupled processes are being factored into our program. I trust this letter responds to your concerns.

Sincerely,

/RA/

William D. Travers
Executive Director
for Operations

Enclosure:
NRC Staff Response to the ACNW's
Recommendations"

cc: Chairman Meserve
Commissioner Dicus
Commissioner Diaz
Commissioner McGaffigan
Commissioner Merrifield
SECY

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- 1) This document should be made available to the PUBLIC. BWL 2/23/00
- 2) This document is related to the HLW program, it should be placed in the LSS.

U.S. NUCLEAR REGULATORY COMMISSION STAFF
RESPONSE TO THE ADVISORY COMMITTEE ON NUCLEAR WASTE'S
RECOMMENDATIONS

Recommendation 1: The U.S. Nuclear Regulatory Commission staff should conduct scoping calculations of the importance of backfill to modify the chemical environment and to act as an attenuating agent for released radionuclides. If it is determined from these calculations that the use of backfill or the effects of corrosion products can have an important effect on performance, then more detailed analyses should be requested of the applicant.

Response: Although backfill was proposed as a design option in the Enhanced Design Alternative II, the U.S. Department of Energy (DOE) has indicated it is contemplating removing backfill as part of a design that could be used in a license application (LA). Regardless of what design option the DOE may consider, it is important to note that the NRC, does not select designs nor participate with an applicant in selecting proposed designs. Consistent with this Commission policy, the staff would not recommend any design changes that the DOE could make or request analyses from the DOE to support a design option such as backfill. Rather, the staff would review those design changes proposed by the DOE to determine if they meet the applicable regulatory requirements. To this end, the NRC and the Center for Nuclear Waste Regulatory Analyses (CNWRA) staffs are developing the review capabilities, in the Yucca Mountain Review Plan (YMRP), needed to independently evaluate the DOE application. It is the DOE's responsibility to propose a design in the LA. The NRC can only evaluate the proposal made by the DOE, and determine if it complies with the applicable regulations, and adequately protects public health and safety.

Recommendation 2: The NRC staff should continue to work on the role of secondary phases in attenuating radionuclide releases. In particular, we recommend continued work on natural analogs, such as the Peña Blanca site.

Response: The DOE may choose, as part of its potential LA, to rely on secondary uranium phases for attenuating radionuclide release. The CNWRA staff is continuing limited focused laboratory investigations on radionuclide co-precipitation in uranyl minerals that are likely to form as spent fuel degrades. These studies are focused on determining the limits of radionuclide co-precipitation in uranyl minerals and will place the staff in an excellent position to evaluate the DOE's use of this process in its performance assessment, should it choose to pursue this approach in an LA.

Information from natural analogs is expected to be one part of the DOE's post-closure safety case. The DOE intends to evaluate, in the field, the Peña Blanca site, as a natural analogue to uranium mobilization and migration associated with spent fuel. The NRC and CNWRA staffs are continuing to investigate, in a

Enclosure

limited manner, aspects of radionuclide mobilization and migration at the Peña Blanca site. These studies are focused on determining whether episodic release of radionuclides from the site has occurred and on examining the limits of the techniques the DOE may choose to use to argue that uranium mobilization is minimal at this natural analog site. A steady-state approach for release of radionuclides is assumed in current performance assessment calculations that use a natural-analog source term. These calculations have shown significant reductions in calculated dose. Episodic release of radionuclides would likely increase predicted doses from a natural-analog source-term model.

Recommendation 3: The NRC staff should continue to collect as much confirmatory data as possible on the corrosion rates and mechanisms of corrosion of the drip shield, the waste packages, and the zircaloy cladding of the spent fuel under the range of expected conditions.

Response: The NRC staff agrees. The NRC and the CNWRA are actively pursuing corrosion studies related to the repository as part of their efforts to prepare to review a possible LA from the DOE. The CNWRA continues to conduct studies that address both the rates and mechanisms for corrosion of the drip shield, waste package, and cladding materials. Its studies are addressing the range of chemistry that may occur as a result of coupled processes and corrosion of the various metallic engineered materials, and the critical temperature ranges for corrosion. As mentioned above, the NRC staff is currently developing a review plan for reviewing the LA, including the performance confirmation (PC) program. In developing the review plan for the DOE's PC program, the staff will consider the ACNW's views on long-term prediction issues and will prepare a plan that ensures an adequate review of the DOE's PC program. The NRC will also enforce any PC commitments that are in the license as individual conditions.

Recommendation 4: The NRC staff needs to continue and refine careful analysis of the role of coupled processes in repository performance as part of its development of review capabilities. Because of the complexity of the models and the abstraction of these models into the Total System Performance Assessment, the key focus is to ensure that an important coupled process is not left out of the performance assessment. The effects of temperature will be of particular importance.

Response: The staff agree that a key focus is to ensure that an important coupled process is not left out of the performance assessment. A recently completed staff review of the DOE's preliminary draft database of features, events, and processes (FEPs) focused on the comprehensiveness of coupled processes considered. The staff's review of the draft database concluded that the effects of temperature are important and that some temperature-related processes that could affect performance were not included. These results have been used to guide additional process-level studies to refine the analysis of the role of coupled processes on performance. The review of FEPs and the ongoing issue-resolution activities of the "Evolution of the Near-Field Environment Key

Technical Issue” are focused on carefully analyzing the impact of coupled processes on repository performance and the abstraction of coupled processes into a performance assessment. Review methods derived during the FEP review process and insights obtained from reviewing the DOE’s treatment of coupled processes in abstracted performance assessment models are being incorporated into the staff’s review plan for the LA. The YMRP will contain the criteria the NRC staff will use to judge the acceptability of the DOE’s analysis of coupled processes.