

April 16, 2004

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

**SUBJECT: RESPONSE TO THE ADVISORY COMMITTEE ON NUCLEAR WASTE LETTER  
DATED MARCH 4, 2004, ON COMMENTS ON SELECTED NRC-SPONSORED  
TECHNICAL ASSISTANCE PROGRAMS OF THE CENTER FOR NUCLEAR  
WASTE REGULATORY ANALYSES**

Dear Dr. Garrick:

I am replying to your letter to Chairman Diaz, dated March 4, 2004, that provided the Advisory Committee on Nuclear Waste's (ACNW) comments on selected U.S. Nuclear Regulatory Commission (NRC)-sponsored technical assistance programs of the Center for Nuclear Waste Regulatory Analyses (CNWRA). NRC staff appreciates ACNW's acknowledgment of the continuing high quality technical assistance work at the CNWRA dealing with issues important to an NRC review of a potential high-level waste (HLW) repository license application. The ACNW's letter identified five specific recommendations concerning four areas of technical assistance. The recommendations address CNWRA technical assistance in the areas of: (1) igneous activity; (2) spent fuel and water interactions in the waste package; (3) repository design and thermal-mechanical effects (post-closure drift stability); and (4) pre-closure safety analysis. Each of the ACNW's recommendations is addressed individually.

The ACNW's first recommendation focused on the CNWRA's igneous activity studies of the consequences of redistribution of volcanic ash containing radioactive material and resuspension of these materials coupled to inhalation exposure scenarios. The ACNW recommended that CNWRA staff use the relationship between specific activity in ash particles and airborne concentration to evaluate doses resulting from inhalation of airborne radioactive materials. The ACNW further recommended that these evaluations include the effects of particle size, solubility, and the relative importance of inhalation and ingestion components of internal dose. The ACNW's recommendation regarding the inhalation of airborne radioactive materials, assume continued site occupation after potential contamination by volcanic ashfall. The NRC and CNWRA staff will continue to evaluate the first-order differences between the current approach to inhalation exposure, which uses the ICRP-30 dosimetric models, and a modified approach that calculates resuspension dose considering specific particle-size information and improvements made in the ICRP-66 respiratory tract model. This includes assessing differences in the deposition fractions into and transfer rates from the two naso-pharyngeal/extrathoracic compartments to account for the ingestion of larger particles that were initially inhaled. If these differences appear potentially significant to risk calculations, the staff plans to develop an alternative conceptual model based on the latest inhalation dosimetry. The staff's planned work also includes an investigation into the simplified method which uses the relationship between specific activity in ash particles and airborne concentration to evaluate doses resulting from inhalation of airborne radioactive materials. Finally, additional information is being compiled on

the geochemical fate of nuclear fuel particles in the environment after the 1986 Chernobyl accident. This information may provide insights into waste form response after a potential volcanic event at Yucca Mountain. With this enhanced understanding, NRC staff will be able to better evaluate current assumptions regarding chemical and physical characteristics of HLW (e.g., solubility and size) during and after entrainment in a potential volcanic event, and resulting effects on inhalation dosimetry calculations.

The ACNW's second recommendation was that the CNWRA's proposed experiments, which would use unirradiated  $\text{UO}_2$  fuel pellets as a model to examine the interactions of water and spent fuel in the waste package, be justified. The proposed experiments are designed to enhance the NRC's ability to review DOE's modeling of spent fuel in water. The proposed experiments would provide a better technical basis for a more realistic fuel dissolution model in the NRC staff's total system performance assessment code. The proposed experiments will also allow the NRC to confirm the DOE's spent fuel dissolution model over the range of environmental conditions modeled by DOE. Numerous studies have demonstrated the analogous dissolution behavior of unirradiated spent fuel pellets and spent fuel in water. The use of unirradiated fuel pellets would allow the CNWRA to obtain relevant data in a cost-effective manner.

The ACNW's third recommendation also dealt with spent fuel and water interactions in the waste package. The ACNW letter recommended that the CNWRA staff evaluate the use of spent fuel pool data and safety analyses from existing nuclear power plants and seek opportunities to obtain information from these facilities to provide insights into spent fuel and water interactions. The NRC staff agrees that all available and relevant sources of information should be used, as applicable, in its evaluations of DOE work and in its own confirmatory investigations. NRC staff have begun to evaluate literature on the behavior of spent fuel in wet storage and plan to explore seeking information from these facilities to provide insights into spent fuel and water interactions.

In its fourth recommendation, the ACNW identified three major concerns that the CNWRA staff have with the DOE's calculations in the area of post-closure drift stability. The ACNW recommended that differing views between the NRC and the DOE be resolved. The ACNW also wrote a letter ("Instability of Emplacement Drift of the Proposed Yucca Mountain High-Level Waste Repository," dated March 4, 2004) on the technical issues associated with drift stability. NRC staff's response to that letter addresses the technical issues raised by the ACNW. The response here deals solely with resolution of the differing views between the NRC and the DOE. The three CNWRA concerns on DOE's calculations have been explained to DOE as part of the NRC's pre-licensing interactions. The DOE believes that these concerns will be adequately addressed in a report that will be provided to the NRC within the next couple of months. In the meantime, the CNWRA is conducting independent analyses to further assess the significance, in terms of risk, of the concerns that they have raised. These actions should allow the staff to resolve the differences between the NRC and the DOE as part of the pre-licensing issue resolution process.

The ACNW's final recommendation dealt with pre-closure safety analysis. The ACNW acknowledged that the staff's development of the Pre-Closure Safety Analysis (PCSA) tool was adequate for analyzing public and worker dose scenarios for a range of surface facility designs. The ACNW recommended that NRC staff involved in the development of the PCSA tool obtain information and experience by observing operations at nuclear facilities that handle spent fuel, and that NRC staff should review safety assessments at these facilities. The NRC staff agrees

Dr. B. J. Garrick

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with the ACNW recommendation and is in the process of arranging site visits to operational facilities that most closely resemble proposed Yucca Mountain handling facilities. In addition, as part of NRC staff's continuing effort to develop risk insights for the pre-closure period at the potential high-level waste repository at Yucca Mountain, Nevada, NRC staff are reviewing safety analysis reports for several facilities which handle spent fuel. These insights, as well as the CNWRA experience in reviewing the safety of several independent spent fuel storage installations (e.g., Private Fuel Storage and Diablo Canyon), will be incorporated into the staff's pre-closure safety analysis work, including PCSA analyses and review of the DOE's pre-closure safety analysis.

The NRC staff appreciates the ACNW's continued interest in, and input on, the technical assistance work conducted at the CNWRA. We look forward to your continued involvement in our future activities.

Sincerely,

***/RA Carl Paperiello Acting For/***

William D. Travers  
Executive Director  
for Operations

cc: Chairman Diaz  
Commissioner McGaffigan  
Commissioner Merrifield  
SECY

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\* See previous concurrence

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