



UNITED STATES  
**NUCLEAR REGULATORY COMMISSION**  
ADVISORY COMMITTEE ON NUCLEAR WASTE  
WASHINGTON, D.C. 20555-0001

July 29, 1998

The Honorable Shirley Ann Jackson  
Chairman  
U.S. Nuclear Regulatory Commission  
Washington, D.C. 20555-0001

**SUBJECT: COMMENTS ON NRC'S TOTAL SYSTEM SENSITIVITY STUDIES FOR THE PROPOSED HIGH-LEVEL RADIOACTIVE WASTE REPOSITORY AT YUCCA MOUNTAIN, NEVADA**

Dear Chairman Jackson:

This letter provides comments and recommendations from the Advisory Committee on Nuclear Waste (ACNW) on the NRC staff's total system sensitivity studies for the proposed high-level radioactive waste repository at Yucca Mountain, Nevada. The staff is conducting these studies as part of its overall effort to develop the necessary tools and capability to evaluate a license application from the Department of Energy (DOE).

The staff has made exemplary progress in developing and applying sensitivity studies for understanding the important assumptions and parameters in its Total System Performance Assessment (TPA) model of the geologic repository system. This work has allowed the staff to identify major features, events, and processes of the system model that contribute significantly to performance.

During its 100<sup>th</sup> meeting on April 21-23, 1998, the Committee was presented with material that identified the important parameters in terms of their impact on the final dose as calculated for the repository design with the TPA-3 Code. The staff identified areas in which further improvements in the model and better understanding of the system are needed. The staff is also attempting to close out issues of lesser concern (e.g., the low consequences of fault displacement).

The staff has identified necessary model changes to accommodate design modifications such as DOE's selection of the nickel-based alloy C-22 as the corrosion-resistant material for the waste canister. As the DOE design evolves, the NRC staff will need a flexible tool for evaluating the importance of those design changes to repository performance.

The modeling performed by the staff shows that parameters that govern the spatial and temporal distribution of water in the near-field environment are critical to the final dose. Currently, the model uses various "factors" to account for diversion of moisture away from the disposal drifts and the canisters. This analysis is performed in such a way that only a small

fraction of the moisture flux at the repository horizon enters the waste package and dissolves radionuclides in the spent fuel. These factors are based on statistical and empirical analyses rather than on a mechanistic model of moisture flow on the drift scale. The ACNW recommends that the staff develop the necessary understanding and modeling approaches to account for the physical and chemical processes that govern moisture movement in and around the drift. This effort will include the ability to review DOE's three-dimensional drift-scale models and supporting process-level information.

There are a number of other near-field issues that the ACNW is pursuing with respect to the Engineered Barrier System (EBS). Recently, the ACNW held a 2-day working group meeting on the performance of the EBS in the near-field environment. The Committee will provide recommendations to the Commission on this important topic in a separate letter. The increased role of the EBS in the performance of the proposed Yucca Mountain repository drives many of the near-field issues. The Committee considers that the primary NRC issue is the ability of the staff to adjust to the resulting change in emphasis on engineered systems to make a significant contribution to repository performance. We recommend that the NRC staff include more details of the total waste package and waste package protective system (e.g., ceramic coatings, drip shields, and backfill) in its modeling activities to expose more fully the contribution to performance of specific engineered systems.

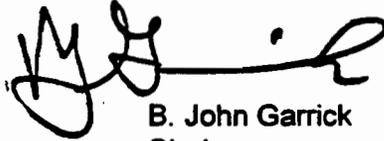
The importance of the TPA total system sensitivity studies goes beyond the details of modeling different repository designs. Issues identified in the studies are being incorporated into acceptance criteria in the Issue Resolution Status Reports (IRSRs) that will eventually become components of the Standard Review Plan (SRP). The ACNW recommends that the staff begin as soon as possible the process of integrating the IRSRs into the SRP. The staff also needs to revisit and update connections between the NRC's current knowledge base and the Key Technical Issues (KTIs).

An important outcome of the sensitivity studies is the identification of how different components of the system contribute to performance. The quantification of the performance of individual barriers for both the natural and engineered systems is an important element of demonstrating compliance. The ACNW reiterates previous recommendations about the need for a probabilistic performance assessment tool that can operate on the outputs of the TPA model to identify scenarios and classes of scenarios (ACNW letter from B. John Garrick, Chairman, ACNW, to The Honorable Shirley Ann Jackson, Chairman, NRC, entitled "Application of Probabilistic Risk Assessment Methods to Performance Assessment in the NRC High-Level Waste Program," dated October 31, 1997). Such a tool can be used to provide a rank ordering of these scenarios with respect to the performance of the repository, as measured against a dose standard. The result would be the identification of licensing and rulemaking issues that derive directly from sensitivity analyses.

In summary, progress has been made through sensitivity studies to highlight important contributors to repository performance. The need exists to strengthen the tools, and possibly staff capabilities, in the important area of engineering analysis and design to meet the changing

landscape of the licensee's performance assessment of the Yucca Mountain repository. The KTIs and their supporting bases should also be reexamined in light of recent analyses, including work associated with the Issue Resolution Status Reports and the sensitivity studies.

Sincerely,

A handwritten signature in black ink, appearing to read 'B. John Garrick', with a long horizontal flourish extending to the right.

B. John Garrick  
Chairman

