



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

March 6, 1998

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

Dear Chairman Jackson:

SUBJECT: ACNW'S SUPPORT FOR THE NRC STAFF'S APPROACH TO ASSESSING THE  
PERFORMANCE OF MULTIPLE BARRIERS

During its 98th meeting on February 24-26, 1998, the Advisory Committee on Nuclear Waste (ACNW) heard a briefing on, and discussed with the NRC staff, SECY-97-300, "Proposed Strategy for Development of Regulations Governing Disposal of High-Level Radioactive Wastes in a Proposed Repository at Yucca Mountain, Nevada." In our previous letter of October 31, 1997, "Recommendations Regarding the Implementation of the Defense-in-Depth Concept in the Revised 10 CFR Part 60," the Committee recommended, among other matters, abolishing subsystem requirements in the planned revision to 10 CFR Part 60 and instead requiring quantification of the performance of individual barriers. The purpose of this letter is to reiterate this position and to express our support for the direction the NRC staff is taking in its proposed strategy on the subject of subsystem requirements.

The basis for our recommendation was that improved information and methods of analysis, together with a determination of the risk of an appropriately defined critical group, allowed for a more direct and reliable assessment of Yucca Mountain performance than would be derived from prescribing the performance of repository subsystems. Important to our position on this approach is the requirement that, in addition to calculating the risk to the critical group, there should be the requirement that individual barriers be assessed quantitatively for their contribution. The key difference between the two approaches is quantifying subsystems to reveal their contribution to overall performance versus prescribing the performance of subsystems regardless of their contribution to overall performance. The Committee believes that the former approach provides assurance on just how effective

individual systems are in achieving an overall performance requirement while preserving the need for flexibility to achieve an optimum or a near-optimum design. Finally, the approach is believed to be an excellent example of a *risk-informed* analysis.

The staff indicated that it plans to require a system of multiple barriers without specifying quantitative requirements for individual barrier performance. Further, the staff plans to require DOE to demonstrate the contribution of individual barriers and their respective uncertainties to total systems performance by providing results of intermediate calculations within the performance assessment. The staff believes that this transparency in analyses will provide insights about the key contributors to system-level performance needed to support licensing decisions. Finally, the staff indicated that possible approaches to demonstrate individual barrier contributions and uncertainties may include the use of sensitivity analyses, scatter plots, and importance analyses.

Factors increasing confidence in a risk-informed approach to assessing subsystems, as well as total system performance measures, include: (1) over 20 years of experience in the application of probabilistic risk assessment to nuclear reactors and other systems; (2) some 15 years of experience in conducting performance assessments, especially in regard to the proposed Waste Isolation Pilot Plant and Yucca Mountain repositories; and (3) the growing amount of site-specific information obtained through the site characterization process. A key feature of the improvements in analysis is in the area of quantifying uncertainties of key parameters and models. Exposing the uncertainties associated with performance, especially the performance of subsystems, adds new meaning to the concept of multiple barriers. In one sense, knowing the uncertainties is a step toward quantifying the multiple barrier approach and providing insight on just how much safety margin actually exists.

The ACNW commends the staff for proposing to require quantification of multiple barrier performance in favor of quantitative subsystem requirements and considers the approach to exemplify a true risk-informed analysis. To implement such an approach, the ACNW articulated two primary needs in a letter dated October 31, 1997, "Application of Probabilistic Risk Assessment Methods to Performance Assessment in the NRC High-Level Waste Program." One is that performance assessments should, to the extent practicable, be developed using realistic models with uncertainties included. The Committee has also recommended that a methodology be developed, using an event tree or similar type of approach, that presents performance assessment modeling results in a way that clearly indicates the rank-ordered contributors to total system

performance (e.g., dose) and to evaluate the performance of different subsystem components. The ACNW continues to encourage the staff to explore use of a post-processing methodology that enables rank-ordering of contributors to total system performance in demonstrating individual barrier performance.

Sincerely,

A handwritten signature in black ink, appearing to read "B. John Garrick". The signature is written in a cursive style with a large initial "B".

B. John Garrick  
Chairman

