



UNITED STATES  
**NUCLEAR REGULATORY COMMISSION**  
ADVISORY COMMITTEE ON NUCLEAR WASTE  
WASHINGTON, DC 20555 - 0001

ACNWR-0227

September 29, 2005

The Honorable Nils J. Diaz  
Chairman  
U.S. Nuclear Regulatory Commission  
Washington, D.C. 20555-0001

SUBJECT: REVIEW OF STAFF'S PRECLOSURE REVIEW PREPARATIONS FOR THE  
PROPOSED YUCCA MOUNTAIN REPOSITORY

Dear Chairman Diaz:

At its 162<sup>nd</sup> meeting on August 2-4, 2005, the Advisory Committee on Nuclear Waste (ACNW) heard a presentation by the Nuclear Regulatory Commission (NRC) staff on "Status of Yucca Mountain Preclosure Review Preparations." The following are our observations and recommendations regarding the staff's preparations to meet the challenge of this risk-informed, performance-based review.

### **Background**

The NRC staff has undertaken a number of activities to prepare for its review of preclosure design aspects of the license application for the proposed Yucca Mountain repository. An important part of these activities is the organization of review teams for performance assessment, engineering, site characterization, and health physics. The staff is also developing a list of risk-significant topics based on the staff's experience and analysis and on information obtained from visits to relevant fuel-handling facilities. The staff is concentrating on high-risk topics (including the related uncertainties) and on structures, systems, and components that can prevent or mitigate the impacts of postulated event sequences.

The staff identified topics for detailed preclicensing review. The topics include aircraft crash hazard and event sequences, criticality and seismic event sequences, and preclosure safety analysis. The staff has begun to discuss these topics in a series of technical exchanges with the U.S. Department of Energy (DOE).

### **Observations**

The NRC staff informed the Committee that preclosure design aspects of licensing are receiving increased attention and that the staff is applying necessary resources to address them. The staff is developing guidelines for staff interaction with DOE on preclosure topics before the license application submittal. The Committee agrees with this approach. However, the Committee recognizes that the efficiency and effectiveness of the staff's efforts have been challenged by the apparent lack of completeness and detail in available information on the design of preclosure systems, processes, facilities, and equipment that are important to operational safety.

The Committee concurs that the staff's initial list of review topics is appropriate for evaluation. Additional topics for evaluation are identified in periodic staff meetings. The Committee believes iterative preclosure safety assessments and relevant licensing experience (e.g., Private Fuel Storage) are potentially useful in identifying additional topics. The rigor of the staff's approach to preparing and modifying the list of preclosure focus topics would be easier to recognize if the staff had a documented basis for the choice of topics (and, as appropriate, a basis for exclusion of topics).

The Committee believes that lessons learned from other nuclear regulatory licensing experience could also be a useful source of topics for the staff's preclosure review. For example, human reliability and fire protection may dominate the risk at both reactor and nonreactor facilities if not considered early in the design stage. Risk insights indicate that without attention to human reliability aspects of design and adequate training in the early stages of design, human error can be a significant contributor to accidents associated with movement of heavy loads at reactor facilities. A significant number of heavy-load lifts, load manipulations, and movements are expected to occur during the preclosure operational stage of the repository. They should therefore be evaluated in the preclosure review. Likewise, costly fire protection retrofitting at reactor facilities occurred in the past because designers did not have a thorough understanding early in the design stage of the risk from fire. Fire and smoke propagation can lead to adverse system interactions and common-cause failures that may compromise multiple safety barriers.

Another topic deserving attention is equipment and facility aging analysis. The staff informed the Committee that it plans to consider aging effects in estimating the probability of failure of equipment. Given the lengthy period of operation that the DOE contemplates for the preclosure facility, these effects could be significant, although difficult to quantify. The Committee also notes that reliability goals for important preclosure equipment such as have been established for safety-significant reactor equipment could be a significant enhancement to preclosure safety.

## **Recommendations**

1. The NRC staff should develop a documented, risk-informed process for identifying topics that the staff will focus on in reviewing preclosure aspects of the proposed Yucca Mountain repository. Iterative safety assessments could be a useful tool in such a process.
2. The staff should add human reliability analysis and fire protection to the list of high-priority preclosure review topics.
3. The staff should assess DOE's reliability targets for systems and components important to safety and those factors that impact reliability during the preclosure period (e.g., design configuration, operation, equipment and facility aging, surveillance, and maintenance).
4. To increase the efficiency and effectiveness of its preparations for a risk-informed performance-based review, the staff should continue to seek detailed information from DOE on preclosure design.

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We look forward to hearing from the staff again on the subject of preclosure safety assessment at a mutually convenient future date.

Sincerely,

**/RA/**

Michael T. Ryan  
Chairman

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Sincerely,

Michael T. Ryan  
Chairman

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