



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

December 2, 1991

The Honorable Kenneth C. Rogers
Commissioner
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Commissioner Rogers:

SUBJECT: NRC CAPABILITIES IN PERFORMANCE ASSESSMENT AND COMPUTER
MODELING OF HIGH-LEVEL WASTE DISPOSAL FACILITIES

The purpose of this letter is to respond to the first two questions in your memorandum of April 29, 1991, requesting ACNW comments on the adequacy of the performance assessment and computer modeling capabilities of the Office of Nuclear Regulatory Research (RES) and the Division of High Level Waste Management (HLWM), including the Center for Nuclear Waste Regulatory Analyses (CNWRA). Our comments are based on deliberations and discussions with the NRC staff and members of the CNWRA during an Advisory Committee on Nuclear Waste (ACNW) Working Group meeting on October 16, 1991, and during the 36th and 37th ACNW meetings on October 18 and November 20-21, 1991, respectively. During the Working Group meeting, we had the support of a team of invited experts.

General Observations

It is our general conclusion that the NRC HLW staff is a highly qualified and professional group and is developing a suitable program for performance assessments of an HLW disposal facility. If supported by careful and appropriate experimental confirmation studies and selectively focused assessments, this program should be sufficient for the NRC to demonstrate to a licensing board whether a repository meets the requirements of 10 CFR 60.112 and 60.113. Although we consider the NRC program to be adequate, we recognize that its assessments cannot be totally independent, due to the necessary reliance by the NRC staff on models, data, and computer codes developed by other organizations. Additional points that should be considered, include:

1. The staff intends to conduct a selectively focused review of the performance assessments conducted by the U.S. Department of Energy (DOE), supported by in-depth analyses in only certain key areas. This approach is historically consistent with reviews conducted by the NRC in the evaluation of other types of license applications. It represents a realistic method for handling such reviews. A relatively simple bounding performance analysis -- supported by experience with more detailed, independently evaluated process codes -- provides an independent product that can be understood and defended within the licensing arena.

2. As stated above, the assessments by the NRC staff must, of necessity, involve to a considerable extent the use of data, codes, and methodologies developed by the DOE. This approach is acceptable as long as the NRC staff has the capability to independently evaluate the quality and applicability of such information and techniques.
3. To ensure the continuation of a successful performance assessment and computer modeling program, the NRC staff would benefit from an endorsement and affirmation from the Commission and upper NRC management. Such an affirmation would include a clear delineation of what the NRC staff's role and responsibilities are in using these techniques in the licensing process. There is also a need to provide funds for additional staff and facilities.

Specific Comments

In the way of specific comments, we offer the following:

1. There is a need for the development of a strategy document that specifies the goals of the NRC HLW performance assessment program. This document should provide details on what the program is designed to accomplish, how it is to be executed, and a timetable for its implementation. While the Implementation Plan, the Program Plan, and the License Application Review Plan will address parts of this concern, the staff needs to address the scientific and technical problems and other facets of performance assessment in greater detail and sophistication. This document should provide the fundamental transition from Phase 1 into the longer range Iterative Performance Assessment Program.
2. The NRC staff continues to have difficulties in obtaining data and software that have been developed by DOE and its contractors. We believe that formal generic arrangements should be developed that permit ready access by the NRC staff to DOE data and codes. The staff should be mindful of the quality assurance and quality control status of these codes and data. It is essential that the software used for modeling repository performance be compatible with the data and information. Furthermore, codes that are used sequentially should have compatible assumptions and limitations; otherwise, the results would be inconsistent and unreliable.
3. The NRC staff is expanding its performance assessment capabilities beyond the ability to estimate radionuclide releases; namely, it is expanding the codes to provide estimates of the doses to individuals and population groups. To increase the effectiveness of this effort, the NRC staff should also expand its interactions with appropriate groups in foreign countries

so as to benefit from the codes that have already been developed for making such estimates. The Commission and upper NRC management should encourage and cultivate NRC staff participation and interaction with international efforts such as the modeling of source-term parameters (near-field and far-field).

4. The insights and products gained through the application of the Iterative Performance Assessment Program can have important benefits, both in helping the NRC staff to develop needed capabilities for licensing a repository and in establishing research priorities. The role that performance assessment methodologies can play should be formally incorporated into the protocol for assigning priorities to research. Areas in which such methodologies would be helpful include the selection of specific research projects in the geosciences (such as geochemistry), and the determination of which of these should be assigned to the CNWRA. Furthermore, all members of the NRC staff who are involved in the HLW program should be required to become familiar with the methodologies of performance assessment.
5. The initiation of the Phase 2 performance assessment of the proposed Yucca Mountain repository offers the NRC staff an opportunity to explore several key difficult analyses in depth. Several challenging and complex, yet realistic, analyses involving natural phenomena (e.g., climate change, tectonic, and other processes) should be performed. These analyses should be chosen to illustrate the mechanisms for the solicitation and use of expert judgment, for the identification and quantification of uncertainties, and to gain a better understanding of the difficulties in determining compliance with the standards of the Environmental Protection Agency.
6. The NRC HLW staff must accept and provide for the role of expert judgment. Although hard data, validated complex computer codes, and large-capacity computational equipment are available, the staff should devote an intensive effort to developing a strategy for the use of expert judgment in performance assessments and computer modeling, both in conducting NRC's analyses and in reviewing how DOE uses expert judgment in its assessments.

Computer Modeling Capabilities

Our comments on the adequacy of the NRC computer modeling capabilities are addressed to the related hardware and software and personnel training needs.

1. The computer hardware currently used by the NRC staff is outdated and inadequate. Moreover, electronic communication between the computers at NRC headquarters and those at other facilities, including the CNWRA, is almost nonexistent, primarily because of a lack of equipment at the NRC headquarters end of the link. In contrast, the CNWRA appears to have adequate hardware to meet its present needs and responsibilities, and has plans to acquire additional capability as needed. Having said this, it is important to note that the NRC staff is fully aware of these problems and has been granted funds under a pilot program that should enable it to correct its hardware deficiencies within the next year. Continuing upgrades will be needed.
2. In sharp contrast to its hardware, the NRC staff has generally good capabilities for developing conceptual, mathematical, and computer models. These capabilities reside within the agency staff, as contrasted to existing solely or primarily within the staffs of its contractors. Although the CNWRA has had difficulty in recruiting the needed expertise, the current performance assessment program element manager has excellent modeling and performance assessment skills.
3. We are pleased to note that training for the NRC staff in the field of performance assessment and computer modeling is being implemented. We endorse plans for providing training opportunities to the staff both through the capabilities of the NRC itself and through outside groups. The CNWRA appears to have a similar, but perhaps less formal, program. The Commission and NRC management should encourage this continuing education process.

In summary, it is our conclusion that HLWM and RES have capable staffs, that they are developing a suitable performance assessment program, and that they have sound computer modeling capabilities. Primary needs in HLW performance assessment are to develop a strategy document detailing the goals of the program and the specific means to achieve these goals, to upgrade the NRC staff's computer hardware, to resolve current limitations on the availability of key software and data, and to ensure that adequate resources are provided to meet future personnel and equipment needs as the performance assessment program evolves.

Sincerely,



Dade W. Moeller
Chairman