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 COMPUTER MODELING AND PERFORMANCE ASSESSMENT OF LOW-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 computer modeling and performance assessment capabilities of the Division of Low-Level Waste Management and Decommissioning (LLWM) and the Office of Nuclear Regulatory Research (RES). Our comments are based on deliberations and discussions with representatives of the NRC staff, the Sandia National Laboratories, and the State of Nebraska, during a meeting of a Working Group of the ACNW on October 17, 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. Comments on similar capabilities of the NRC staff from the standpoint of addressing the management and disposal of high-level waste (HLW) are being provided to you in a separate letter.

General Observations

In our review of this subject, we observed some fundamental differences in the nature of the programs needed by the NRC staff to respond to its regulatory functions with respect to performance assessments of LLW disposal facilities, as contrasted to HLW disposal facilities. These differences can be summarized as follows:

1. Whereas the planning and design phase of an HLW repository is still in its infancy, facilities for the disposal of LLW already exist and several proposed new facilities are in advanced stages of design and licensing review. Therefore, there is a sense of urgency in developing and exercising assessment capabilities for LLW disposal facilities.

2. Whereas the NRC's regulatory function for the HLW repository is singular and clear, these functions for a major share of the LLW disposal facilities are or will be the responsibility

of NRC Agreement States. In these cases, the role of the NRC staff will primarily be to provide advice to the regulatory staffs of these States. Only for facilities planned within the non-Agreement States will the NRC be responsible for the review and approval of license applications for the construction and operation of disposal facilities.

3. Although applicable regulations (namely 10 CFR Part 61) already exist, the NRC staff has announced plans for their modification. In addition, the U.S. Environmental Protection Agency is developing new standards for the disposal of low-level radioactive wastes that could have significant impact on the regulation of such facilities. Compounding the existing uncertainties is the fact that Part 61 was not written for explicit application to above-ground disposal facilities. In fact, the representative from the State of Nebraska noted that the application of these regulations to the above-ground facility being planned for construction in that State had proven difficult. Further, Part 61 is not clear in terms of the time frames over which the individual safety objectives specified in the regulations apply. Several states are now developing estimates of the impact of LLW disposal facilities for time periods extending out to 10,000 years.

4. Also playing a role in the regulatory requirements are the revisions being made to NUREG-1200, "Standard Review Plan for the Review of a License Application for a Low-Level Radioactive Waste Disposal Facility" and NUREG-1300, "Environmental Standard Review Plan for the Review of a License Application for a Low-Level Waste Disposal Facility," and the ongoing development of a Technical Position and/or Regulatory Guide on performance assessment for LLW disposal facilities. Because personnel in the Agreement States are in the process of reviewing license applications, efforts to revise and issue these documents should be expedited.

Specific Comments

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

1. As is the case for HLW, there is a need for a strategy document that details the goals of, and mechanisms for, the NRC performance assessment program for the management and disposal of LLW. We understand that such a document is being developed, and we look forward to learning what the program is designed to accomplish, how it is to be applied, and a timetable for its implementation. The document should also provide a clear description of the circumstances under which the NRC staff plans to evaluate the performance assessment efforts of those groups applying for licenses to construct and operate LLW disposal facilities. This description should

include a delineation of the extent to which the NRC staff expects regulatory agencies in the Agreement States to perform similar functions.

2. An integral part of the strategy document, noted above, should be a description of the application of performance assessment for the delineation of research needs. Although the NRC staff cited the need for research on groundwater hydrology, concrete degradation, and improved dosimetry as being identified by the performance assessment studies it had conducted, this appeared to be something that "developed" as opposed to being the formal "outgrowth" of a planned program. One other factor that should be included in the strategy document is a statement emphasizing that the performance assessment program should be an important factor in identifying data that need to be collected. A related consideration is the difficulty in applying data obtained from small samples or over limited time intervals to the analysis of the behavior of a larger module or segment of the disposal facility over longer time periods. An example is applying laboratory (short-term) "leach" rate data to long-term performance of an LLW disposal facility.

3. As is true in the regulation of HLW, the insights and products gained through the application of performance assessments on an iterative basis can have important benefits in helping the NRC staff to develop needed capabilities for licensing LLW disposal facilities. To ensure that these benefits are realized, all members of the NRC staff who are involved in the LLW program should be required to become familiar with the methodologies of performance assessment.

4. Many aspects of the methodology applied to performance assessments for LLW disposal facilities involve the application of deterministic analyses that implicitly include probabilistic elements. Probabilistic techniques are being used on an increasing basis, for example, in estimating future states of LLW disposal facilities and in assessing the potential impacts of human intrusion. We urge that the NRC staff begin now to incorporate probabilistic assessments on a formal basis within the current LLW program. This type of effort leads to the identification of new scenarios and failure modes and provides a level of confidence for using simpler and more robust codes for licensing purposes. Use of a probabilistic approach also provides a means of dealing with uncertainty, without compounding conservatisms. Because of the educational value of such analyses, they should, as a minimum, be made a major part of the next (Phase 2) program.

5. One of the major problems in assessing LLW disposal is the extreme diversity of the waste, itself. This situation makes estimation of the source term in any modeling effort extremely

difficult. We recommend that more attention be directed to this topic. This subject is being pursued by the U.S. Department of Energy and also through an NRC contractual effort at the Brookhaven National Laboratory. Improved knowledge of the source term, for example, is critical in assessing the potential for geochemical interactions, mass transfer, and such specifics as gas generation. More attention should also be directed to the establishment of the nature, characteristics, and volumes of LLW that will be produced as a result of the decommissioning of existing nuclear power plants and other types of nuclear facilities.

6. International programs provide a wealth of data and information on LLW performance assessment. This is true especially in areas of source-term modeling. The NRC should dedicate specific resources to allow its staff to participate and interact more fully with technical peers in other nations to promote effective use of available resources. We understand, for example, that groups in several European countries are engaged in an extensive review and development of methods for estimating doses to members of the public as a result of the operation of waste disposal facilities.

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 NRC LLW staff does not have adequate computer hardware capabilities at the present time. In addition, computer hardware continues to be in a rapid state of development and the staff will need to be provided the resources necessary to keep abreast of developments in this field. Such resources may include engineering work stations, peripherals, and data/communication links with contracted support organizations. At present, a portion of the computer modeling capabilities resides with NRC contractors. The staff needs to move aggressively to enhance their in-house capabilities. To accomplish this, the staff should take advantage of the pioneering efforts, in addition to INTRAVAL, of some of the individual states and the international community. This might include wider access to existing national and international data links.

2. The demands on computer modeling for the LLW case are, in many ways, greater than for HLW:

   - Any methodology must be robust. There is only one proposed HLW site with one set of surrounding conditions;

LLW sites will vary in climate, in near-field and far-field site conditions, and in source terms.

- The source term is uncertain because the inventories are not well characterized. Improved manifest and record procedures may help for future sites.

- The facility may consist of a variety of designs, including shallow land burial, earth-mounded concrete bunker, or freestanding above-ground vaults.

The staff is presently relying on a modular methodology, where sequential codes can be interchanged to better meet the needs of any particular site or application. However, care should be taken with regard to compatible linkage of sequential codes and their input data. We are concerned that the assumptions and defaults in one code will not be compatible with the next. This applies to the linkage between data and codes as well.

3. In the course of our discussions, we were reminded that the U.S. Department of Energy (DOE) has an extensive program to provide consultive advice to the states in the development of LLW disposal facilities. One product of this effort, for example, was the Prototype License Application; Safety Analysis Report (PLASAR). The NRC staff should establish closer ties with the DOE effort.

4. Key LLWM personnel with performance assessment duties should be clearly identified and this should be their primary responsibility.

5. The NRC staff has demonstrated a commitment to training through the conduct of workshops in performance assessment and computer modeling for state regulatory personnel. Included in this effort has been the publication of a self-teaching curriculum (NUREG/CR-5539). Much of this effort has been accomplished through contractual efforts and through cooperation with the NRC State Programs staff. Although "doing" is an effective form of learning, the NRC should make a greater effort to encourage its performance assessment staff to attend, participate, and assume a leadership role in national and international LLW and intermediate-level waste performance assessment efforts.

In summary, it is our conclusion that the NRC is developing sound computer modeling and performance assessment capabilities and is assembling a competent staff. Primary needs are for this staff to complete the development of a strategy document, to upgrade NRC computer hardware and peripherals, to establish closer ties with other groups involved in related activities (both at the national and international level), and to ensure that adequate resources are

provided to meet future personnel and equipment needs as this program expands. To meet the impending licensing requirements, these needs must be met in a timely fashion.

We trust that these comments respond to your request.

Sincerely,

Dade W. Moeller

Dade W. Moeller
Chairman