

February 9, 1996

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

Dear Chairman Jackson:

SUBJECT: ISSUES AND NRC ACTIVITIES ASSOCIATED WITH THE NATIONAL
RESEARCH COUNCIL'S REPORT, "TECHNICAL BASES FOR YUCCA
MOUNTAIN STANDARDS"

During its 80th meeting on December 19-21, 1995, the Advisory Committee on Nuclear Waste (ACNW) was briefed on activities associated with the subject report. The Committee heard two presentations from the staff. The first reported on the staff's activities in anticipation of receipt of a Yucca Mountain standard from the Environmental Protection Agency (EPA) to be issued later this year. The second presentation was specific to the technical analyses being performed relative to the National Research Council's recommendations. Also, at its 77th meeting on September 21, 1995, the Committee was briefed by Robert W. Fri, Chairman of the National Research Council's committee that prepared the report.

The Committee is prepared to provide at this time only preliminary comments on the implications of the report and on the activities of the NRC staff. Many important issues are associated with the development of the standard and the Nuclear Regulatory Commission (NRC) regulations that must conform with it. Some topics, such as the "critical group" require more study by the Committee before specific recommendations can be made. It is to be noted that the Committee has commented on many of the issues discussed herein in previous letters. These issues include the concept of defense in depth (September 30, 1994), compliance time frames for repository performance (March 3, 1993), human intrusion (February 5, 1993), and critical group (May 1, 1990, January 29, 1991, April 29, 1991, September 30, 1992, and February 5, 1993).

In general, NRC staff activities connected with the standard are satisfactory. The principles being applied by the NRC staff include a strategy of developing Yucca Mountain specific regulations, keeping the regulations as simple as possible, and focusing on key issues such as the implication of a peak risk standard and regulations specifically designed to reflect a risk- and health-based standard. These principles are appropriate and sound. The staff appears to have effectively identified many other specific issues that will need special study and consideration before the regulations can be modified or

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developed. Such specific issues include time frames of compliance, definition of the biosphere and the critical group, calculation of peak dose (risk), human intrusion, and subsystem performance. The Committee was pleased to see the staff analyses include different exposure scenarios and conditions as this will enhance the staff's ability to respond effectively to any standard the EPA may propose. On-going technical interaction between NRC and EPA staffs as the EPA develops a proposed standard is an important activity. The Committee urges the staff to maintain what appears to be a sound program.

Preliminary conclusions and recommendations of the Committee are: there needs to be serious consideration of retaining a compliance time frame in the planned standard and regulations, subsystem performance needs to be quantified but not prescribed in advance, human intrusion should not be a part of the standard or the regulations except in a general way, and neither the standard nor the regulation should be tied to the EPA groundwater risk standard. While not a major topic in this letter and as discussed in the National Research Council's Yucca Mountain standard report, the Committee believes that the concept of a "negligible risk" needs revisiting in view of the possibly very long time frames associated with the application of a peak dose calculation and the extreme difficulty of defining acceptable risk.

The following specific points are briefly discussed below:

- regulatory time frame
- definition of the biosphere and the critical group
- foundation of the standard: population or groundwater
- human intrusion
- the defense in depth policy and the matter of subsystem performance criteria
- NRC conformity with EPA in a separate Yucca Mountain regulation
- NRC staff activities

Regulatory Time Frame

Extreme uncertainties in the prediction of magnitude and time of the peak dose are highly likely. Also we concur with the strong desire for regulations to be as simple as can be reasonably achieved. These factors contribute significantly to the Committee conclusion that a specified regulatory time frame for repository performance is necessary. The Committee believes that the balance of factors accompanying modification of the 10,000 year time frame results in no clear advantage for changing the present approach, but will conduct additional reviews on this topic in the near future through working group meetings.

Definition of the Biosphere and the Critical Group

Because the site is known, the opportunity exists to develop a very focused definition of the biosphere. The Committee urges NRC staff to take full advantage of the known site characteristics (land use, climate, habitation potential, potable water sources and usages, etc.) in any proposals to define the Yucca Mountain biosphere. In particular, the Committee believes that the definition of the biosphere should include such elements as risk-relevant pathways, locations and withdrawal rates of wells, and uptake factors of biological systems of the Yucca Mountain site. The Committee sees the biosphere definition as an extremely important opportunity to achieve simplicity in the regulations.

The Committee will require more time to study the topic of the critical group. The Committee recommends that the treatment of the critical group issue be consistent with the concept of a risk- and health-based standard. The Committee believes that the definition of the critical group should be determined by the compliance time frame and on any supporting evidence, including the uncertainties involved.

The Committee believes that if definition of the biosphere and the critical group were to be accompanied by a threshold dose to humans below which the repository would be deemed in compliance, it would represent a major accomplishment in the field of practical, risk-based regulation.

Foundation of the Standard: Population or Groundwater

The Committee has previously expressed concern over using a groundwater contamination requirement for resource protection as a surrogate for protecting the health and safety of the public against the effects of ionizing radiation. Because of the extremely long times involved and the uncertainty in the dose calculations at levels approximating the groundwater standard, invoking the groundwater standard would be inappropriate and not in concert with traditional nuclear regulation.

Human Intrusion

For time frames on the order of thousands of years, it is not reasonable to preclude consideration of human activities that could violate the integrity of the repository. The Committee believes it is better to focus on a well-designed repository that retains its integrity over a long period of time under conditions of the natural geological setting. It is then possible to consider different scenarios of human intrusion to further gain confidence in the general performance of the repository.

The Defense in Depth Policy and the Matter of Subsystem Performance Criteria

In previous letter reports, the Committee has expressed strong support for the concept of defense in depth for achieving safety. We continue to believe that multiple lines of defense are important where there is considerable uncertainty about the risk of a facility. In the case of Yucca Mountain (the site is known, the inventory and characteristics of the waste are known and there will be only one design), we believe it unnecessary to put as much emphasis as we have in the past on such subsystem requirements as container performance, rate of release from engineered barriers, and groundwater travel time. The Committee believes that under the specific conditions of the Yucca Mountain repository, the basis exists for less stringent and more flexible subsystem requirements than have been traditionally imposed. Emphasis should be placed on the contribution of subsystems to overall performance of the repository. The Committee strongly favors quantifying all subsystem performance, engineered and natural, in the performance assessment. Should it be clear from an assessment that a waste container, an engineered barrier, groundwater travel time or another potential subsystem is a particularly critical factor in total system performance, then a logical basis exists for making decisions on how to improve the overall safety of the repository.

NRC Conformity With EPA in a Separate Yucca Mountain Regulation

Pursuant to the Energy Policy Act of 1992, NRC regulations must conform to the final EPA standards within one year. Since the EPA standard will be specific to Yucca Mountain, it follows that NRC regulations should be site specific. Close cooperation between the two agencies is needed to make the standard and the accompanying regulations as seamless as possible. The Committee believes the joint working group is an excellent way to discuss how best to address some of the issues raised by the National Research Council report. The Committee considers the establishment of a technical liaison in frequent contact with EPA a very positive action that should pay excellent dividends. The Committee strongly urges that this process be maintained.

NRC Staff Activities

The Committee agrees with the NRC staff's approach in performing technical analyses related to the National Research Council's recommendations concerning the Yucca Mountain standard. The decision to use existing information and models, including the iterative Performance Assessment Phase 2 model, to develop near-term insights on such issues as the evaluation of peak doses, to examine critical data needs, and to use conceptual models is sound. The evaluation of scenarios involving different exposure conditions, compliance periods, etc., is an excellent

way to anticipate potential problems with implementing a risk-based standard. The ability to share and discuss the findings with EPA is extremely important to the development of a technically practical standard. Meanwhile, the NRC staff is accumulating experience for efficient in-depth and comprehensive analyses once the standard and regulations are established.

The Committee strongly recommends that these analyses be sharply focused on conditions specific to Yucca Mountain. Besides emphasizing Yucca Mountain conditions, the Committee recommends realistic calculations wherever possible with respect to such phenomena as radionuclide retardation in fracture flow, dispersion effects in the transport models, and a judicious selection of such events as earthquakes and igneous activity. The assembly and analysis of data will strengthen the staff's understanding of the performance of the site.

We provide here only preliminary observations, conclusions, and recommendations. We believe the evolution of the standards and regulations for the proposed Yucca Mountain repository is a very important activity for NRC and EPA and plan to maintain awareness of the progress made. We urge the NRC staff to pursue these programs in a timely manner.

Sincerely,

/s/

Paul W. Pomeroy
Chairman

Reference:

"Technical Bases for Yucca Mountain Standards," National Research Council, 1995