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NOTE TO EDITORS:

The Nuclear Regulatory Commission has received two attached reports from its Advisory Committee on Nuclear Waste. The reports, in the form of letters, provide comments on:

--A revised NRC high-level waste prelicensing program strategy and key technical issues; and

--Issues and NRC activities associated with a National Research Council Report, "Technical Bases for Yucca Mountain Standards".

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Attachments:
As stated

February 16, 1996

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

Dear Chairman Jackson:

SUBJECT: COMMENTS ON HIGH-LEVEL WASTE PRELICENSING PROGRAM
STRATEGY AND KEY TECHNICAL ISSUES

This letter communicates our recommendations and suggestions on the "Revised Prelicensing Program Strategy for the U. S. Nuclear Regulatory Commission High-Level Waste Repository Program ('Vertical Slice Approach')" and the NRC staff's plans for resolving key technical issues (KTIs) dealing with the proposed high-level waste (HLW) geologic repository at Yucca Mountain, Nevada. These remarks are based on presentations by the NRC staff to the Committee concerning the vertical slice approach at the 77th ACNW meeting, September 1995; on key technical uncertainty integration and resolution of KTIs at the 79th ACNW meeting, November 1995; and subsequent deliberations of the Committee.

The Committee is aware of the changing emphasis and scope of the NRC's HLW prelicensing strategy as a result of modifications in the Department of Energy's (DOE's) site suitability investigations and prelicensing programs and the reductions in resources to both DOE and NRC. Although there are uncertainties in implementing plans and projecting strategies, we wish to support the general approach of the NRC staff in dealing with both the program strategy and the KTIs.

The ACNW commends the staff for its development of a vertical slice concept designed to focus the HLW program on the most critical licensing issues. In particular, we are pleased to learn of the emphasis on risk to repository performance in identifying elements of the prelicensing strategy and plans for conducting the program. We support the emphasis on issue resolution, but not to the point of compromising legitimate concerns that could impact the health and safety of the public. Other concerns include the need to develop review and acceptance criteria to determine the adequacy of bounding analyses, an apparent lack of emphasis on coupled processes, and the need to maintain sharp focus on risk to the predicted performance of the repository.

Revised Prelicensing Program Strategy

The revisions in the NRC HLW prelicensing program strategy (vertical slice approach) incorporate a comprehensive review of critical issues in the DOE program that have the highest risk of noncompliance with regulations for licensing an HLW geologic repository at Yucca Mountain, Nevada. An important objective of the program is to provide DOE with timely information required for a substantially complete license application. The program is designed to increase the efficiency and effectiveness of NRC's prelicensing activities in view of the changes being made in the DOE prelicensing program and the decreasing resources available to the HLW programs of both agencies. The Committee notes many strengths of the vertical slice approach, including: its focus on the key licensing problems, recognition of the need for flexibility in designing and implementing the program, the integration of disparate key technical uncertainties (KTUs) into KTIs, the integration across and within scientific/technical disciplines, the emphasis on resolving issues with DOE, and the potential for efficiency in utilizing scarce resources.

The NRC staff acknowledges and discusses potential weaknesses of the vertical slice approach in the September 1, 1995 draft of the revised "Prelicensing Program Strategy" document. We support the concern raised in this document that a less than comprehensive approach to prelicensing has some inherent risks. The currently identified list of key issues may not be complete. Our ability to specify these issues is limited by the technical and scientific complexity of the unprecedented effort to license the potential HLW repository at Yucca Mountain. A focused prelicensing program that eliminates substantial issues from review or that is inflexible with regards to selection of KTIs is possibly open to problems. The Committee urges the staff to remain flexible with regard to the selection of KTIs. Performance assessment, expert judgment, experimental programs, and special studies are all valuable procedures for evaluating existing KTIs and identifying new ones.

The Committee has developed the following observations and recommendations on the basis of its evaluation of the NRC's HLW prelicensing program:

1. Issue resolution, which is an important objective of the vertical slice approach, is also important to the progress of licensing the HLW repository. The issue resolution approach should focus on health and safety to the public, reduction of uncertainties in meeting reasonable assurance criterion, and decreasing the risk of noncompliance with the regulations. This requires a cautious approach to issue resolution. In view of the complexity of the problems involved in the repository, it is likely that differences will remain between DOE and NRC on some issues. These differences, and the evidence supporting them, need to be

fully documented with the expectation that these matters will be presented before a licensing board. Resolution should not be required by NRC, and DOE should not be required to conduct data acquisition and analysis it believes to be unwarranted.

The design of the vertical slice approach regarding the actual procedures to resolve issues continues to evolve. The Committee notes that the NRC recently proposed to DOE a process for resolving issues, entailing interactions, documentation, and generic criteria. This process includes the disaggregation of KTIs into subissues. The Committee believes this process needs to assure that the disaggregation mechanism maintains the integral nature of the KTIs and their impact on health and safety. An NRC/DOE task force will be established to review the process. Instruments for specifying and documenting resolution, such as the NRC Issue Resolution Reports, letter reports, Prelicensing Evaluation Reports, and Safety Evaluation Reports, will be developed. But, it is unclear how actual resolution of the KTIs will be achieved between DOE and NRC.

In the interest of achieving the efficiency that is central to the vertical slice approach, criteria should be developed to determine when activities should be terminated within a specific vertical slice. DOE is planning to rely on bounding analyses for decision making. We urge the staff to expeditiously develop methods and acceptance measures to review bounding analyses by using the iterative performance assessment framework. We anticipate that these measures will be significant in establishing termination criteria.

2. The NRC will receive numerous data synthesis and process model reports from DOE in 1996. These reports will synthesize the information available on a topic and will provide a source of reference for the related data. Such reports appear especially important to prelicensing activities because they presumably will contain DOE's approach to bounding analyses. The Committee recommends that the NRC give high priority to reviewing these reports as rapidly and thoroughly as possible so that DOE is informed of any NRC licensing concerns and data needs before it completes its prelicensing activities and makes a decision about repository viability.
3. The vertical slice approach should involve an iterative process within and among vertical slices. We believe the iterative process is important to successfully complete a review and needs more emphasis in the description and implementation of the vertical slice approach. The Committee believes it important to have a process for guiding the

iterations of the KTIs in concert with the iterations of the performance assessment.

4. NRC must ensure that its schedule to conduct priority activities is synchronized with DOE's revised schedule of activities and milestones. Given the uncertainties in DOE's program and budget, NRC should review previously defined time constraints in the prelicensing program. Modifications may be necessary because of current and anticipated funding and staffing limitations and the need to maintain the highest quality products from the NRC.

Key Technical Issues

The Committee supports the important activity of recognizing KTIs through the process of integration of KTUs previously identified through the Systematic Regulatory Analysis Program. We generally agree with the criteria the staff used in this process. We especially support the use of risk to repository performance as the prime criterion wherein both probability of occurrence and consequence are considered. We have the following observations and recommendations pertinent to the identification of KTIs and their investigation in the vertical slice approach:

1. We note that DOE has taken exception to identifying Igneous Activity and Structural Deformation and Seismicity as significant KTIs. We believe that these issues should continue to be subject to review in the vertical slice approach because of the controversy regarding their potential risk to the repository performance. Igneous Activity is important as a KTI because of the uncertainties associated with the probability of occurrence of igneous events and their impact on the repository. Structural Deformation and Seismicity is also significant as a KTI because of the need to determine the level of seismic hazard and to evaluate direct effects on waste containers and engineered barriers. In addition, indirect effects on repository performance resulting from modifications in near- and far-field flow and transport properties of geologic strata and water table elevation changes need further consideration.
2. The Committee is not satisfied that the issue of Thermal-Mechanical-Hydrological-Chemical Coupled Processes is moving toward resolution. Elements of this issue are treated only within individual KTIs. The process by which they are integrated and evaluated as a total system is unclear. Presumably, it will be considered in the Total Systems Performance Assessment (TSPA) and Technical Integration KTI. However, the strong possibility exists that the interaction of phenomena and their resulting modifications of parameters and processes may be neglected in the face of the major emphasis on TSPA in this KTI. The Committee is concerned

with the issue of coupled processes and supports a strong program to resolve this issue with the vertical slice approach.

3. The Committee has long had a major interest in the integration of site characterization activities and their conclusions. We are pleased to see a KTI that considers integration. However, it is unclear at what level(s) integration will be considered in the KTI and how the results of other individual KTIs will be brought into the integration KTI. Further, it is unclear whether components involved in integration will be available in a timely manner. TSPA and Technical Integration is a particularly significant KTI because it will play a key role in establishing the importance of issues and subissues to overall repository performance.
4. The priority rankings assigned to KTIs by staff are open to question. In view of the central role of repository design on DOE's proposed viability assessment, we encourage the staff to place high priority on all KTIs that are closely tied to repository design considerations, since we believe that mixing of scientific/technical issues with management/policy issues has the potential to confuse priorities.
5. The Committee has a longstanding interest in performance assessment and the veracity of the attendant codes and models. DOE will be attaching major importance to its TSPA-1997/1998 results in the conclusions of the viability assessment. In view of the drastic reduction of the site characterization and related studies, it will be particularly important for NRC to conduct confirmatory performance assessments and to evaluate the performance assessment codes and models used by DOE. We note that the latter activity has been removed from the TSPA KTI. This decision should be reconsidered.
6. The NMSS staff has considered preparation of a yearly status report on KTI activities and results. This excellent proposal will prove useful to NRC and DOE. We urge that it be implemented.

Summary

The ACNW commends the staff for its revised HLW Prelicensing Program Strategy (vertical slice approach) and the identification of KTIs that will be the subject of prelicensing activities. The Committee recommends that the staff ensure that there is a mechanism to provide rapid and continued input to DOE to influence the site viability decision, data collection, testing, and TSPA. In addition, the staff needs to periodically

reevaluate the list of KTIs on the bases of new information, new analyses, and issue

resolution while staying focused on issues impacting repository performance.

The Committee has made several suggestions which, if accepted, should sharpen the vertical slice approach and its implementation. The Committee wishes to be kept informed of the progress of the vertical slice program and to be included in review of the staff's related products, such as Implementation Plans, Issue Resolution Reports, and the Performance Evaluation Reports.

Sincerely,

/s/

Paul W. Pomeroy
Chairman

Reference:

U. S. Nuclear Regulatory Commission, Office of Nuclear Material Safety and Safeguards, "Revised Prelicensing Program Strategy for the U. S. Nuclear Regulatory Commission High-Level Waste Repository Program ('Vertical Slice Approach')," September 1, 1995

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 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