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NOTE TO EDITORS:

The Nuclear Regulatory Commission has received from its Advisory Committee on Nuclear Waste (ACNW) the two attached letter-type reports. They provide comments on issues raised in the Energy Policy Act of 1992, Section 801, and a program plan for the ACNW.

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Attachments:  
As stated

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February 5, 1993

The Honorable Ivan Selin, Chairman  
U.S. Nuclear Regulatory Commission  
Washington, DC 20555

Dear Chairman Selin:

SUBJECT: ISSUES RAISED IN THE ENERGY POLICY ACT OF 1992,  
SECTION 801

During its 50th meeting, January 27 and 28, 1993, the Advisory Committee on Nuclear Waste (ACNW) met with representatives from the U.K. National Radiological Protection Board, the U.S. National Council on Radiation Protection and Measurements, and the NRC Staff to discuss the three principal issues that the National Academy of Sciences will be addressing in response to the assignment outlined by the U.S. Congress in the Energy Policy Act of 1992.

The Committee did not have an opportunity to review SECY-93-13, which presents the NRC staff analysis of these issues. The comments that follow are primarily based on discussions held during our meeting.

In considering Section 801 of the Energy Policy Act, it is important to note that the charge to the National Academy of Sciences involves the development of standards that are intended to be site specific for the proposed repository at Yucca Mountain. As we interpret it, these standards, to be developed by the U.S. Environmental Protection Agency (EPA), will be used to guide the design and to define compliance of this repository. In this regard, we offer the following observations:

- a. Environmental standards are most useful when formulated without reference to a specific site. We interpret Section 801 of the Energy Policy Act as calling for the development by EPA of "generally applicable standards" but for the proposed Yucca Mountain site. This should provide EPA sufficient flexibility to avoid the development of standards that would be unnecessarily site specific. In making corresponding changes to 10 CFR Part 60, the Commission should similarly avoid, wherever possible, developing regulations that are uniquely applicable to the Yucca Mountain site. The regulations should be based on assumptions or conditions that have a sound foundation in the pertinent technical disciplines and methodologies.
- b. Regardless of the form of the standards, we believe that they should be geared to specific time periods in the future. For example, such periods might include one during which it is reasonable to assume the presence of institutional controls, a second during which it is assumed that the biosphere will be comparable to the present, and a third that extends so far into the future that the associated predictions have such unacceptably large uncertainties as to compromise their usefulness. The Commission may want to encourage this type of approach.
- c. Fundamental to the standards should be a provision that individuals and populations in the future are accorded a level of protection at least equivalent to that which is accorded to individuals and populations alive now.

#### **ISSUE ONE**

"Whether a health-based standard based upon doses to individual members of the public from releases to the accessible environment will provide a reasonable standard for protection of the health and safety of the general public"?

In response to this inquiry, our answer is "Yes." In support of that view, we offer the following comments:

- a. We interpret a "health-based standard" as incorporating a "risk-based standard." In this sense, such an approach would represent a major step forward in that risk is a more fundamental criterion than dose for the protection of

members of the public. Although a risk-based standard could incorporate a limit on the dose, it should also reflect the possibility that the limit could be exceeded. Setting the standards on the basis of risk would also avoid having to revise them as newer data on the health effects of radiation are developed. In addition, application of a risk-based standard makes it possible to compare the risks of radionuclide releases from a high-level waste repository to the risks from other environmental contaminants.

- b. Interestingly, this approach, if adopted, would place an annual, versus cumulative, limit on permissible doses to members of the public. In incorporating this approach, however, it is important that the limit include application of the concept of the "critical group," rather than the concept of the "maximally exposed individual." Benefits of the concept of the "critical group" are that it ensures not only that members of the public will not receive unacceptable exposures, but also that decisions on the acceptability of a practice will not be prejudiced by a very small number of individuals with unusual habits.
- c. A standard containing a radionuclide release limit avoids the necessity to estimate environmental radionuclide transport and associated human intake. [However, determining compliance with such a standard through environmental monitoring would be very difficult, as would be comparing a release limit to the impacts of other radiation sources (e.g., natural background).] An environmental standard should have broad application; one that incorporates radionuclide release limits is useful only as a guide for design.
- d. Limits on individual doses should not be used as a justification for selecting poor repository sites. For certain proposed sites, it could theoretically be possible to exceed a dose limit for individual members of the public due to the fact that there is very little water available. A "risk-based" standard would help to overcome this problem by making it necessary to take into consideration the probability that the individual dose limit might be exceeded. At the same time, limitations on the quantities of water available would restrict the number of people who could be exposed, and the associated collective doses (or societal impacts) of the radionuclide releases. In this regard, it should be noted that collective dose estimates beyond several generations are not very useful due to a lack of information on the number, or the living habits, of people who might live in a given area.

"Whether it is reasonable to assume that a system for post-closure oversight of the repository can be developed, based upon active institutional controls, that will prevent an unreasonable risk of breaching the repository's engineered or geologic barriers or increasing the exposure of individual members of the public to radiation beyond allowable limits"?

In response to this inquiry, our answer is "No." Supplementing this response, we offer the following comments:

- a. As a basic premise, we believe that the assumption of institutional control (or oversight) for extremely long periods of time is neither practicable nor workable. It is imperative that the assumption of post-closure oversight not be used as a justification for lessening the stringency of the repository design.
- b. Reliance on active controls also has the disadvantage of conceivably leading to acceptance of an otherwise unsatisfactory disposal facility, because it could be assumed that unacceptable radionuclide releases would be detected and mitigated by active controls.
- c. The post-closure phase presents an opportunity to continue to monitor the performance of the repository and to gather data that could be useful in the siting and design of similar facilities in the future. Although we share with the NRC staff the concerns that intrusive monitoring equipment is not acceptable, we believe that technologies could be developed for collecting data through remote sensing operations or electrical connections that will not negate the integrity of the repository. Key parameters on which data might be collected include thermal conditions, the presence of moisture, seismic events, and radionuclide releases.

### **ISSUE THREE**

"Whether it is possible to make scientifically supportable predictions of the probability that the repository's engineered or geologic barriers will be breached as a result of human intrusion over a period of 10,000 years"?

In response to this inquiry, our answer is "No." On the basis of our discussions, we offer the following comments:

- a. As a basic premise, we believe that the design, construction, and operation of an HLW repository should be conducted using the assumption that there will be no post-closure oversight. That is to say, we believe that the design should be robust enough to ensure that such oversight is not necessary.

- b. In our opinion, inadvertent human intrusion into the proposed Yucca Mountain repository over the next 10,000 years is a reasonable likelihood; in fact, we believe it is reasonable to assume a probability of one for such an event. This being the case, we concur with the Board on Radioactive Waste Management that it would be more appropriate for the U.S. Department of Energy (DOE) to base its risk assessments of human intrusion on its potential consequences, rather than its probability. Following this approach, the possibility of human intrusion should be a factor in the selection of a site and the design of a disposal facility.
- c. We believe that the risk-based standards for individual members of the public should generally apply to radionuclide releases that occur as a result of human intrusions that have a probability of bypassing a portion of the repository barrier system. However, the limits should not apply to public exposures that occur as a result of actions by intruders who bypass all the repository barriers. Intruders who possess the capability to intrude into a repository in such a manner would presumably possess sufficient technological capabilities to identify any radionuclide releases that accompany such actions. The standards should include general guidance on design considerations that might compensate for the damage to a facility caused by human intrusion and mitigate any radionuclide releases to the environment.
- d. We believe that the probabilities and consequences of human intrusion should be considered outside the normal evaluation of the safety of a repository in the same manner as threats of sabotage are considered in terms of releases from a commercial nuclear power plant. For this reason, we concur with the DOE position that radionuclide releases to the accessible environment from human intrusion should be treated separately from potential radionuclide releases caused by natural processes and events.
- e. In addition to the specific requirements enumerated in the statement of this issue, the upcoming National Academy of Sciences study offers an excellent opportunity to investigate the possibility of making scientifically supportable predictions of the probability that various barriers within the repository will be breached as a result of natural events over a period of 10,000 years. We strongly encourage such an effort.

We trust these comments will be helpful. The Committee plans to continue to review the impacts of the Energy Policy Act of 1992 on the disposal of high-level radioactive waste.

Sincerely,

Dade W. Moeller, Chairman  
Advisory Committee on Nuclear  
Waste

References:

1. SECY-93-13, dated January 25, 1993, for the Commissioners, from James M. Taylor, EDO, "Analysis of Energy Policy Act of 1992 Issues Related to High-Level Waste Disposal Standards"
2. National Radiological Protection Board (UK), "Board Statement on Radiological Protection Objectives for the Land-Based Disposal of Solid Radioactive Wastes," Volume 3, No. 3, 1992

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February 9, 1993

The Honorable Ivan Selin, Chairman  
U.S. Nuclear Regulatory Commission  
Washington, D.C. 20555

Dear Chairman Selin:

SUBJECT: PROGRAM PLAN FOR THE ADVISORY COMMITTEE  
ON NUCLEAR WASTE

Since December 1989, the Advisory Committee on Nuclear Waste (ACNW) has provided at four-month intervals a program plan of anticipated Committee activities. We view the letters forwarding these plans as a convenient avenue for sharing information on where we intend to focus our efforts. This letter covers our proposed plan for February through May 1993. We look forward to your comments.

In preparing this program plan, we have considered the list of technical issues of particular interest to the Commission, requests of individual Commissioners, the agenda items proposed by the Executive Director for Operations (EDO) for the Advisory Committee on Reactor Safeguards and ACNW, the NRC Five-Year Plan, and items of particular interest and/or concern to the Committee members. The priority for each proposed issue is based on information provided by representatives of the Office of Nuclear Materials Safety and Safeguards (NMSS), Office of Nuclear Reactor Regulation (NRR), Office of Nuclear Regulatory Research (RES), and the EDO office, as well as our own interpretation of the subject in relation to our activities as a Committee and our input into the regulatory process.

The schedule for the program plan, as outlined, is based on the current best estimates of work output by the Department of Energy (DOE), Environmental Protection Agency (EPA), and NRC staff and their consultants and contractors (including the Center for Nuclear Waste Regulatory Analyses [CNWRA]). As a result, it is

anticipated that certain aspects of the plan will need to be revised.

Full-Committee meetings for this period are tentatively scheduled as follows:

51st meeting	-	February 24-26, 1993
52nd meeting	-	March 24-25, 1993
53rd meeting	-	April 28-29, 1993
54th meeting	-	May 19-20, 1993

In addition, we will hold working group meetings as necessary to facilitate full-Committee review and action on specialized topics.

Specific Topics to be covered during these meetings are described below.

February 24-26, 1993 - 51st Meeting

- The Committee will meet with the Commission to discuss items of mutual interest. These include the Committee's report on a systems analysis of the high-level radioactive waste (HLW) disposal program and its review of the charge given by Congress to EPA and the National Academy of Sciences regarding the development of standards for the proposed Yucca Mountain HLW repository. (High Priority)
- The Committee will review with the NRC staff possible impacts of the Energy Policy Act of 1992 on ongoing agency initiatives in the HLW arena. (High Priority)
- The Committee will discuss with technical and legal professionals the acceptance, in an adjudicatory review, of scientific evidence based primarily on expert judgment. (High Priority)
- The Committee will meet with university personnel to discuss ongoing research on the development of computer programs for assessing airborne releases from earth-mounded concrete bunkers and other types of low-level radioactive waste (LLW) disposal facilities. Of particular interest will be the evaluation of any possible impacts of such studies on associated NRC regulations, regulatory guides, and technical positions. (Medium Priority)
- The Committee will be briefed by a representative of the New Mexico Environmental Evaluation Group on the assessment of flammability and explosion potential of transuranic waste. (Medium Priority)

March 24-25, 1993 - 52nd Meeting

- The Committee will meet with representatives from the Electric Power Research Institute (EPRI) to discuss studies EPRI has conducted on the volumes of LLW that may require interim storage, the applicable regulatory requirements, and the associated guidelines for waste generators. (High Priority)
- The Committee will explore with invited State representatives and others the creation of a nationwide system for summarizing current trends and indicators of performance in LLW management and disposal. Included will be the possible development of a system to report significant events (mishaps) that occur during such operations. (High Priority)
- The Committee will be briefed on proposed LLW disposal sites rejected by LLW host States. Representatives from host States, NMSS, and the Office of State Programs will participate. (High Priority)
- The Committee will meet with the NRC staff to hear an updated report on the status of the Licensing Support System program. (Medium Priority)
- The Committee will be briefed by the NRC staff on the relationship of the review of the State of Alaska radiation control program by the Conference of Radiation Control Program Directors to similar reviews by the NRC staff. (Medium Priority)

April 28-29, 1993 - 53rd Meeting

- The Committee will be briefed by DOE personnel on newly developing strategies and initiatives for confirming a site for an HLW repository. (High Priority)
- The Committee will be briefed by the NRC staff on its review of the Maine LLW Authority's Waste Disposal Facility Conceptual Design Report. (High Priority)
- The Committee will be briefed on the status of the decommissioning plans for the Ft. St. Vrain Nuclear Power Plant. (High Priority)
- The Committee will review and comment on the Standard Review Plan for the Review of Remedial Action of Inactive Mill Tailing Sites Under Title I of the Uranium Mill Tailings Radiation Control Act (UMTRCA), Revision 1. (Medium Priority)
- The Committee will be briefed on the working group's review of three additional regulatory guides being developed for

implementing the revised 10 CFR Part 20, "Standards for Protection Against Radiation." (Medium Priority)

May 19-20, 1993 - 54th Meeting

- The Committee will review and comment on the revised draft NRC High-Level Radioactive Waste Research Program Plan (NUREG-1406) and the associated implementation strategy. The discussion will include a briefing on the complementary technical assistance program. (High Priority)
- The Committee will hear a status report by the NRC staff on the Enhanced Participatory Rulemaking on Radiological Criteria for Decommissioning. (High Priority)
- The Committee will be briefed on the status of the decommissioning plans for the Shoreham Nuclear Power Plant. (High Priority)
- The Committee will review the NRC staff's approach in using the Dose Integrated Over Ten Thousand Years (DITTY) Code for verifying cleanup at sites considered under the Enhanced Participatory Rulemaking. Basic assumptions, scope of use, and extent of use will be addressed. (Medium Priority)
- The Committee will be briefed on the Decision Support System, an interagency cooperative effort (RES is involved for NRC) being developed by Sandia National Laboratories to generate an environmental risk evaluation and database management system. (Medium Priority)
- The Committee will receive an information briefing on the Waste Characterization Study. (Medium Priority)

Other Topics - These will be considered as documents and time become available, taking into consideration their relevant priorities.

- The Committee will be briefed by the NRC staff on its plans for developing guidance (branch technical positions and regulatory guides) for the HLW and LLW programs. (High Priority)
- The Committee will be briefed on the potential impacts that different waste forms (spent fuel, vitrified wastes from different sources, etc.) could have on repository performance. (High Priority)
- The Committee will review and comment on the development of a staff branch technical position on guidance for performance assessments of LLW disposal facilities. (High Priority)

- The Committee will be briefed on the NRC Five-Year Plan, specifically in areas such as the goals of NRC HLW and LLW programs and associated research. (High Priority)
- The Committee will be briefed on the current status of the systematic regulatory analysis being conducted by the CNWRA. (High Priority)
- The Committee will be briefed by the NRC staff on its review of a DOE topical report entitled "Erosion Rates at the Yucca Mountain Geologic Setting: Methodology and Results." (Medium Priority)
- The Committee will be briefed on the compatibility between NRC and Agreement State regulations for LLW disposal facilities. (Medium Priority)
- The Committee will attend a tutorial conducted by the NRC staff (NMSS and RES) on the step-by-step technique that involves the use of personal computers to calculate complementary cumulative distribution functions. (Medium Priority)
- The Committee will be briefed by scientists from Johns Hopkins University on their studies on the use of geochemical natural analogs for estimating the performance of an HLW repository. (Medium Priority)

The Committee will continue to broaden and update its technical understanding of HLW disposal by the following technical exchanges away from headquarters:

- June 23-24, 1993 - Tour and interactions with personnel at Canada's Whiteshell Nuclear and Underground Research Laboratories.
- October 27-28, 1993 - Tour and interactions with DOE program office personnel in Las Vegas, Nevada, and at the Yucca Mountain site.

#### **ACNW WORKING GROUP MEETINGS**

- Regulatory Guides for Implementing Revisions to 10 CFR Part 20, March 26, 1993, Bethesda, MD - An ACNW working group and the ACRS Subcommittee for Occupational and Environmental Protection Systems will jointly review the following proposed regulatory guides for implementing revised 10 CFR Part 20: (1) DG-8006, "Control of Access to High and Very High Radiation Areas in Nuclear Power Plants," (2) DG-8009, "Interpretation of Bioassay Measurements," and (3) DG-8013, "ALARA Radiation Protection Program for Effluents From Materials Facilities."

- Low-Level Radioactive Waste Performance Indicators, March 23, 1993, Bethesda, MD - The working group will explore with invited State representatives and others the creation of a nationwide system for summarizing current trends and indicators of performance in LLW management and disposal. Included will be the possible development of a system to report significant events (mishaps) that occur during such operations.
- Engineered Barrier Systems (date to be determined), Bethesda, MD - The working group will review the role of, and the degree of reliance that should be placed on, engineered versus natural barriers within an HLW geologic repository system.
- Potential Impact of Groundwater Use on the Performance of a Proposed High-Level Waste Repository (date to be determined), Bethesda, MD - The working group will consider the likelihood of groundwater use and the resulting impacts of this use on the performance of the proposed Yucca Mountain HLW repository. Included will be an evaluation of the potential for the development of geothermal energy sources within the vicinity of the proposed site. This meeting will supplement the October 20, 1992 ACNW working group meeting on the potential for natural resources at the Yucca Mountain site.
- Characterization of the Unsaturated Zone Flow and Transport Properties (date to be determined), Bethesda, MD - The working group will examine the relationships between precipitation, recharge, and flux through the unsaturated zone at the proposed Yucca Mountain site, and the adequacy of ongoing field studies to ascertain these relationships. Emphasis will be placed on the modeling of flow in the unsaturated zone, alternative conceptual models of fracture versus matrix flow, and conditions under which fracture flow can be shown to predominate. The working group will also focus on the recharge term in hydrogeologic models, alternative conceptual models for how and where regional recharge occurs, and the effect of assumptions about recharge on model results.
- Use of Fractals for Fluid Flow at Yucca Mountain (date to be determined), Bethesda, MD - The working group will examine the use of fractals in the development of conceptual and numerical models of fluid flow in unsaturated, fractured rock. Studies show that the roughness characteristics of fracture surfaces can be simulated by the use of fractals. DOE is considering the use of this approach in its study plan on fluid flow in unsaturated fractured rock systems.

This list represents our best estimate of the topics to be considered through May 1993. If you or your fellow Commissioners

have additional items to suggest or proposed changes in priorities, please let us know.

Sincerely,

Dade W. Moeller, Chairman  
Advisory Committee on Nuclear  
Waste

cc: Commissioner Rogers  
Commissioner Curtiss  
Commissioner Remick  
Commissioner de Planque  
Samuel J. Chilk, SECY  
James M. Taylor, EDO  
Robert M. Bernero, NMSS  
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