UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

August 1, 1994

MEMORANDUM FOR: The Chairman
Commissioner Rogers
Commissioner de Planque

FROM: James M. Taylor
Executive Director for Operations

SUBJECT: SIXTH MEETING OF THE NATIONAL ACADEMY OF SCIENCES COMMITTEE ON TECHNICAL BASES FOR YUCCA MOUNTAIN STANDARDS, APRIL 28-29, 1994

On April 28-29, 1994, the National Academy of Sciences (NAS) Committee on Technical Bases for Yucca Mountain Standards held its fifth open meeting in Las Vegas, Nevada. The U.S. Nuclear Regulatory Commission was represented at the meeting by the NRC liaison to the Committee, additional staff from the Division of Waste Management, and staff from the Office of Public Affairs. A summary of key submittals received by the Committee and the Committee's discussions thereof is provided (see enclosure). The remainder of this memorandum speaks to the process of and contributors to the Committee's deliberations.

The Committee is analyzing issues related to its charge to advise the U.S. Environmental Protection Agency (EPA) on the technical bases for a reasonable standard for the protection of the public health and safety. Pursuant to the Energy Policy Act of 1992 (EnPA), the NAS is to make recommendations regarding a standard that will apply to radioactive material that is stored or disposed of at a proposed repository at Yucca Mountain. In preparation for a closed writing session (held June 20-24, 1994), the open session on April 28, 1994, was structured to afford committee members an opportunity to directly question those who had provided written recommendations to the Committee.

Early in the Committee's review, Margaret Federline, NRC's technical liaison to the Committee, presented a summary of the NRC staff's positions, with regard to the specific questions the Committee is charged with answering under the EnPA. The staff also addressed a number of related issues of significance to the implementation of a standard for geologic disposal. The complete text of staff's presentation on May 27, 1993, was provided to the Commission as an enclosure to a June 10, 1993, memorandum from the Office of the Executive Director for Operations (EDO) to the Commission. In a subsequent memorandum from the EDO to the Commission (April 14, 1994), the staff noted that it had reevaluated the views presented in May 1993 and had determined that no new or different recommendations were warranted.

Before the April 28, 1994, open session, the NAS Committee received submittals from 16 organizations or individuals, including: the U.S. Department of

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Energy; EPA; the State of Nevada; Nye County; the Nevada Nuclear Waste Task Force; the Environmental Evaluation Group; the Electric Power Research Institute; the American Nuclear Society; the Yankee Atomic Electric Company; Del Mar Consulting; and the Institute for Energy and Environmental Research. Brief synopses of those key submittals, including that of the NRC staff, which directly addressed the three EnPA questions, are provided in the enclosure. At the request of the Committee, Margaret Federline, the NRC technical liaison to the NAS Committee, answered questions directed toward the NRC staff, at the April 28, 1994, public session.

The remainder of the meeting was held in executive session and was closed to the public. The Committee expects to issue its formal, peer-reviewed recommendations by December 1994. After the meeting, members of the Committee expressed interest in those instances where NRC has considered thresholds, in either the treatment of dose or radionuclide concentration, as part of the regulatory process. In a letter of June 10, 1994, from Margaret Federline to Myron Uman, Project Director for the Committee, NRC staff provided relevant information that responded to this request. Should the Committee request any further information, the NRC staff will respond, consistent with the Commission's previous positions, and will bring to the Commission's attention any new matters of policy.

James M. Taylor
Executive Director
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Enclosure:
NAS Committee on Technical Bases
for Yucca Mtn Standards: Brief
Synopses of Key Submittals
Concerning EnPA Questions

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Summary of key submittals which
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NATIONAL ACADEMY OF SCIENCES (NAS) COMMITTEE ON TECHNICAL BASES FOR YUCCA MOUNTAIN STANDARDS: BRIEF SYNOPSES OF KEY SUBMITTALS CONCERNING EnPA QUESTIONS

Requirements of the Energy Policy Act (EnPA) of 1992

The EnPA requires the U.S. Environmental Protection Agency (EPA) to promulgate standards to protect the public from releases of radioactive materials from a proposed repository at Yucca Mountain, Nevada. The EnPA also requires the National Academy of Sciences (NAS) to conduct a study and provide findings and recommendations to EPA, on this matter. Pursuant to the EnPA, the NAS must address the following three questions:

1) Whether a health-based standard, based on 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;

2) Whether it is reasonable to assume that a system for post-closure oversight of the repository can be developed, based on 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; and

3) 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.

EPA (Views Submitted April 11, 1994)

General Comments

EPA appealed to the NAS Committee to explain fully its reasoning, and to provide background on its recommendations regarding the three EnPA questions. EPA strongly urged the Committee to address the precedent of 40 CFR Part 191, EPA's final standards for disposal of transuranic and high-level wastes at sites other than Yucca Mountain, which were published in December 1993. EPA indicated that any deviation from this standard would have to be justified, and that EPA is looking to the NAS Committee to provide such justification, if the Committee recommends a different approach. EPA also requested that the NAS indicate whether its advice is specific to Yucca Mountain, or is of more generic applicability.

Individual Dose Standard

EPA expressed its belief that limiting individual dose, alone, would not be sufficiently protective. In particular, EPA is concerned that, as a sole criterion, an individual dose standard would not protect groundwater and could encourage dilution. Any recommendation regarding development of an individual

dose standard must consider the resulting risk to the population, and assurance must be provided that an acceptable level of health risk will result. In addition, EPA pointed out that an individual dose criterion does not easily handle human intrusion scenarios, given that any reasonable dose limit would not allow for any intrusion event.

Active Institutional Controls

EPA asserted, based on a long- and short-term view of human history, that active controls cannot be assumed to exist for long periods, let alone provide long-term protection. EPA pointed out that the short-term record of institutional control also has not been reassuring. The pursuit of deep geologic disposal, in EPA's view, fundamentally presumes an inability to actively control waste.

Predictions of Human Intrusion

EPA argues that reasonable regulatory assumptions, with regard to the probability of human intrusion, can be made. According to EPA, the NAS should define what it means by the phrase "scientifically supportable predictions of probability" and should address the bases for regulatory assumptions that will be necessary to implement such predictions.

U.S. Department of Energy (DOE) (Views Submitted April 8, 1994)

General Comments

DOE expressed its view that the standard for Yucca Mountain should be health-based, and should focus on protecting those people who will live in the vicinity of the proposed repository. DOE recommends that the standard require a quantitative demonstration of compliance for not more than 10,000 years, and that the quantitative aspects of the standard be stated deterministically, with probabilistic analyses used to support demonstrations of compliance.

Individual Dose Standard

DOE believes that an individual dose standard would be appropriate, if certain aspects of the application of such a criterion are specified. The dose limit should apply to an average individual in the vicinity of Yucca Mountain, and should be commensurate with the limits in 10 CFR Part 20. DOE advocates the specification of realistic assumptions with regard to the future biosphere and opposes any separate groundwater-protection requirements.

Active Institutional Controls

In DOE's view, the potential for intrusion should be addressed using qualitative design requirements, and through imposition of active and passive institutional controls. Furthermore, DOE believes that specification of such controls can and should be deferred until just before permanent closure.

Predictions of Human Intrusion

DOE argues that repository design should incorporate features that limit the probability of intrusion. The potential for intrusion, given an appropriately robust design, should be treated qualitatively, and should not be considered in a quantitative demonstration of compliance.

ELECTRIC POWER RESEARCH INSTITUTE (EPRI) (Views Submitted April 8, 1994)

General Comments

EPRI proposed a two-part standard, with quantitative criteria applicable to an "engineered barrier period" of approximately 1000 years after emplacement, and probabilistic "design objectives" to ensure sustained, low health risk over the course of a "geologic period," from 1000 years to beyond 10,000 years after closure. During the first 1000 years, EPRI advocates a strict, quantitative release limit "...consistent with the concept of essentially complete containment in 10 CFR Part 60--that the release from the engineered barrier system be less than 1 part in 100,000 per year of the radionuclides present at 1,000 years following permanent closure." Beyond about 1000 years, EPRI believes that reasonable assurance of sustained, low health risk should be accomplished using probabilistic "...design objectives of low health risk to an average individual in future local population groups." EPRI appears to suggest that only the engineered barrier period should serve as the basis for a U.S. Nuclear Regulatory Commission licensing determination.

Individual Dose Standard

Although EPRI agrees that a health-based standard based on individual dose can provide a reasonable standard, EPRI goes on to state that since no "credible" dose scenarios occur during the first 1000 years, a more stringent (and protective) release-rate criterion should apply to this period.

Active Institutional Controls

EPRI asserts that it is reasonable to assume that post-closure controls will be effective and that, for the first 100 to 300 years, a broad range of active and passive controls should be mandatory.

Predictions of Human Intrusion

EPRI does not believe scientifically supportable predictions of the probability of human intrusion events over 10,000 years are possible. Such predictions are speculative, and should not be used either in container failure analyses during the engineered barrier period, nor in dose/risk projections for the geologic period. It is appropriate, in EPRI's view, to impose siting and design requirements to minimize the consequences of intrusion and to focus on what can and should be done now to protect against future intrusion, rather than on speculation about what the future should be.

NYE COUNTY, NEVADA (Views Submitted April 1, 1994)

General Comments

Nye County asserts that the underlying reason for Section 801 of the EnPA is the likelihood that Yucca Mountain would fail the ^{14}C release criterion in 40 CFR Part 191. The County is of the view that if ^{14}C releases are unavoidable and would, in fact, result in negligible health effects, then the specific ^{14}C release limit should be changed, not the entire EPA approach. Nye County suggested that the NAS may wish to recommend that EPA define a measure of acceptability for ^{14}C, as suggested by Robert Bernero, of the NRC, in his December 1993 presentation before the NAS Committee.

Individual Dose Standard

Nye County sees no need to depart from technology-based release limits. Although Nye County agrees that a standard based on individual dose might be "a reasonable standard," it asserts that the focus should be on "the most reasonable" approach to provide "the best standard." Nye County believes that although a health-based standard may be reasonable, technology-based limits or some combination of both would appear preferable.

Active Institutional Controls

Nye County contends that reliance on active controls beyond 100 years is unjustified, and should not serve as an excuse to permit an unsatisfactory site or design.

Predictions of Human Intrusion

Nye County does not believe that scientifically supportable predictions of human intrusion are possible. In the County's view, the standard should assume that some inadvertent human intrusion will occur, and that DOE should be required to examine and evaluate the consequences of such intrusion on the performance of any proposed repository.

STATE OF NEVADA

Although Nevada was actively represented at all public sessions, and State representatives made a number of presentations on specific technical issues, Nevada issued no formal, written positions on the three specific EnPa questions. At the NAS Committee's opening session in May 1993, State representatives objected to a site-specific standard, and argued that the standard-setting process should be independent of site-specific data. At that same session, it was indicated that the State preferred a health-based standard and asserted that the approach taken in 40 CFR Part 191, to include both population and individual protection, is appropriate. On March 22, 1994, the State sent a letter to the NAS Committee raising a specific concern that the standard should address the potential for perturbation of natural background radiation levels from radon emission enhanced by the heat of a geologic repository.

AMERICAN NUCLEAR SOCIETY (ANS) (Views Submitted April 11, 1994)

General Comments

ANS urged the NAS Committee to evaluate and make specific recommendations on the EPRI proposal for a two-part standard. ANS also encouraged the Committee to weigh the risks from continuing delays in disposing of high-level radioactive wastes.

Individual Dose Standard

ANS does not believe that individual dose should be the sole measure of repository performance, and that health risk as a basis to estimate average dose to an individual, in a critical population group, is a more appropriate yardstick. ANS opposes any separate groundwater-protection criterion.

Active Institutional Controls

ANS supports a 100 to 300 year period of institutional control, consistent with other standards.

Predictions of Human Intrusion

ANS does not support quantitative performance limits for human intrusion. The potential for human intrusion is best addressed, in the view of ANS, in a site-specific rulemaking, to establish necessary design features.

NRC STAFF (Views Submitted May 27, 1993)

Individual Dose Standard

The NRC staff believes that the standard should be health risk-based, and that it would be best expressed as a limitation on a derived quantity, such as quantity or concentration of radioactive material released to the environment. The NRC staff would also find a standard based on individual protection acceptable, if such a standard could be applied in a reasonable manner and could be implemented using a reference biosphere.

Active Institutional Controls

NRC regulations for spent fuel and high-level waste disposal do not assume that active controls will be effective for more than 100 years after repository closure. NRC does assert, however, that passive controls can be expected to persist, and to be effective in deterring future intrusion.

Predictions of Human Intrusion

The NRC staff urged the NAS Committee to include rare geologic events, along with human intrusion, when considering whether scientifically supportable predictions of potential repository disruptions can be made over 10,000 years. The NRC staff expressed its confidence that implementing a probabilistic standard will be challenging, but feasible.

NAS COMMITTEE CONCERNS DISCUSSED AT THE April 28, 1994, PUBLIC SESSION

Members of the NAS Committee reminded EPA's representative that the NAS was only obligated to explain and justify its own recommendations, not to explain or justify the basis for EPA's prior standards. Several members expressed concern that a number of the submittals appeared to confuse the concept of a derived standard with that of a technology-based standard. Questions were raised as to whether a technology-based standard would be acceptable by itself, or whether a risk or dose comparison is necessary. The Committee, as a whole, appeared quite concerned with the application of the EPRI proposal, in particular with regard to what figure of merit would be employed to assess repository acceptability during the geologic period and what role, if any, the EPRI proposal envisions for the geologic setting, in evaluations of the engineered barrier period. Specifically, several members questioned the rationale of selecting different levels of protection for different time-frames, after waste emplacement. The Committee appeared especially interested in the selection, or definition, of appropriate critical groups, and asked a number of questions about the implementation of a reference biosphere. Lastly, one member of the NAS Committee asserted that a consensus appears to be emerging that it is <u>not</u> reasonable to assume that active controls will be effective beyond several hundred years.