

EXECUTIVE OFFICE OF THE PRESIDENT  
OFFICE OF SCIENCE AND TECHNOLOGY POLICY  
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July 16, 1998

MEMORANDUM FOR LARRY WEINSTOCK (EPA)  
LAKE BARRETT (DOE)  
MALCOLM KNAPP (NRC)

FROM: ARTHUR BIENENSTOCK

SUBJECT: A HIGH LEVEL WASTE REPOSITORY AT YUCCA MOUNTAIN

I want first to thank each of you and your colleagues for your patience and responsiveness in our discussion of issues associated with the characterization of the Yucca Mountain site and the public health and safety standard, for which a draft is being prepared by EPA. I have learned a lot from your tutoring, and also from my visit earlier this week to the Yucca Mountain site. While your hydrologists are discussing the technical issues requiring their expertise, I would like to remind you of Larry's request that each agency should identify any issues that it feels need discussion by our informal group. It would be useful to exchange these issues by July 20, 1998.

In the spirit of identifying possible issues, I have asked OSTP staff to summarize for me the recommendations from the National Academy of Sciences (NAS) study, *Technical Bases for Yucca Mountain Standards*. What we have prepared is attached to this memorandum. Please let me know, if our summary is incomplete or contains any significant errors.

It is my understanding that the Energy Policy Act of 1992 mandated that the NAS perform the study and directed the Administrator of EPA to set the standards based upon and consistent its findings and recommendations. I would like to understand to what extent the current EPA draft is consistent with each of the major recommendations of the NAS. Where there are differences, it would be helpful to understand why. Each agency should be prepared to answer these questions, as in doing so, we may surface important differences of interpretation, of either the draft standard or the intent of the NAS report.

This topic seems worthy of a meeting of our group. I propose 3 p.m. July 27th in Room 476 of the Old Executive Office Building. Please let Bev Hartline know if this works for you, and who will be attending. I look forward to seeing you.

**Recommendations from the National Academy of Sciences  
on the  
Technical Bases for Yucca Mountain Standards<sup>1</sup>**

**Specific Recommendations**

1. Use a standard "that sets a limit on the risk to individuals of adverse health effects from releases from the repository." "We do not recommend that a release limit be adopted." (p. 2, 4-5, 12, 64-65).
2. "A reasonable starting point for EPA's rulemaking" is "in the range of  $10^{-5}$  to  $10^{-6}$ /yr." (page 5, 49). The NAS refers to the risk level used in EPA's 40 CFR 191 of  $5 \times 10^{-4}$  or a little less than  $10^{-5}$  per year as being within this range and consistent with other national and international limits. (40 CFR 191 is the generally applicable regulation for deep geological disposal of high-level radioactive waste. It was issued in final form in 1993, but it does not apply to the proposed repository at Yucca Mountain.)
3. To identify the individuals or group whose risk should be used to test compliance with the standard, "the critical group approach [should] be used in the Yucca Mountain standards." The critical group would comprise a few to a few tens of persons, "whose locations and habits are such that they are representative of those individuals" expected to be at greatest risk. (p. 5-6, 49-54, 99-103)
4. "[A]n individual-risk standard would protect public health, given the particular characteristics of the site, provided that policy makers and the public are prepared to accept that very low radiation doses pose a negligibly small risk." The individual-risk standard recommended should be defined in terms of a local critical group. (p. 7-8, 57-63). NAS concludes that, if NCRP recommendations related to negligible risk were adopted, the effects of gaseous Carbon-14 releases on individuals in the global population would be considered negligible." (p. 60-61). However, "[t]he standard that we recommend would include local risks from Carbon-14 in its analysis." (p. 88)
5. "[C]ompliance assessment [should] be conducted for the time when the greatest risk occurs, within the limits imposed by long-term stability of the geologic environment." These limits are of the order of a million years, so timescales of that order could be considered to be too long. (p. 6-7, 54-57)
6. Science cannot predict the likelihood of human intrusion; the social, institutional, or technical status of future societies, or the societal factors incorporated in specification of an exposure scenario. (p. 11, Chapter 4). With respect to the consequences of human intrusion, EPA should specify a scenario and "require that the estimated risk calculated from the assumed intrusion scenario be no greater than the risk limit adopted for the undisturbed-repository case because a repository that is suitable for safe long-term disposal should be able to continue to provide acceptable waste isolation after some type of intrusion." (p. 10-12, Chapter 4)

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<sup>1</sup> From the National Research Council report titled *Technical Bases for Yucca Mountain Standards*, National Academy Press, 1995.

7. "There is no scientific basis for incorporating the ALARA principle into the EPA standard of USNRC regulations for the repository." (p. 13, 125)
8. What should be done differently from 40 CFR 191?
  - A) The recommended approach is based on risk rather than dose. (p. 118-119)
  - B) The time period should be the time of peak risk, rather than 10,000 years. (p. 119)
  - C) The standard should not include a release limit. (p. 120)
  - D) With respect to human intrusion, consequences of intrusion should be assessed separately from calculation of compliance with the risk limit from other events and processes. "[T]he conditional risk as a result of the assumed intrusion scenario [should] be no greater than the risk limits adopted for the undisturbed repository case." (p. 120-121)
  - E) There should be no ground-water protection provision separate from the requirements necessary to limit risks to individuals.<sup>2</sup> (p. 121)
9. What should be done similarly to 40 CFR 191?
  - A) Dose apportionment is in accordance with recommendations of the ICRP (p. 122)
  - B) Reference biosphere reflects current technologies and living patterns. (p. 122)
  - C) It would be reasonable to exclude the region of the repository footprint from calculations of undisturbed repository performance, since disturbances within the footprint would be regarded as intrusion. (p. 122-123)
  - D) Mean values of the calculations would be the basis for comparison with the standards. (p. 123)

#### General Recommendation

The NAS was very explicit in many places that EPA should use a rulemaking process to decide policy issues where science cannot provide the answers. In the report NAS was very careful to identify those topics where science is definitive or helpful, and those other topics, where it is not. These latter topics include, for example, defining how small is negligible, making assumptions about future societies and the effectiveness of post-closure oversight they might provide, and the probability of human intrusion. "[T]here is no sharp dividing line between science and policy... Science alone cannot answer policy questions.... [W]e have instead tried to use available technical information and judgment to suggest starting points for the rulemaking process that will lead to a policy decision." (p. viii, 2-3, and in numerous places related to discussions on specific issues)

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<sup>2</sup> Since this is a controversial point among the agencies, the entire excerpt from the report and its context is reprinted here. "What follows is a brief summary of the differences between our recommendations and 40 CFR 191." (p. 119) The fourth topic in that section is titled Ground-water Protection, and it is on page 121: "40 CFR 191 includes a provision to protect ground water from contamination with radioactive materials that is separate from the 40 CFR 191 individual-dose limits. These provisions have been added to 40 CFR 191 to bring it into conformity with the Safe Drinking Water Act, and have the goal of protecting ground water as a resource. We make no such recommendation, and have based our recommendations on those requirements necessary to limit risks to individuals."

**NRC'S ISSUES WITH EPA'S OMB SUBMITTAL DRAFT  
OF THE YUCCA MOUNTAIN'S SPECIFIC HLW STANDARD**

- 1) The U.S. Environmental Protection Agency's (EPA's) ground-water protection requirement will not improve public health and safety, but adds complexity and additional cost, regarding compliance with the standard.
  - Potential health effects are determined by the total effective dose equivalent radiation exposure from all pathways. Limiting the exposure through a particular pathway (drinking ground-water) will not reduce health effects.
  - Implementation of a separate ground-water protection standard will, at best, require duplication of a part of the all-pathways analysis, provided the locations, receptor, and scenarios are the same. It would involve a separate analysis that would need to be supported by additional data and separately justified and defended in the licensing proceeding, if any of these differ.
  - EPA implements the separate ground-water standard using 35-year-old radiation protection methodology (NBS Handbook 69) to calculate the concentrations of radionuclides in ground-water. This results in concentration limits for most beta-gamma emitters being more restrictive than the 4 mrem/yr beta-gamma limit in the Office of Management and Budget's submittal draft, when compared with current International Commission on Radiation Protection (ICRP) methodology.
  - The National Academy of Science (NAS) Technical Basis Report on Yucca Mountain Standards, as well as national and international authorities on radiation protection, recommends an approach to radiation protection that limits exposures to the average member of the critical group via all pathways.
  - EPA, in implementing its Safe Drinking Water Act authority, does not consider cost beyond the feasibility of compliance by public water suppliers, whereas under the Atomic Energy Act, the U.S. Nuclear Regulatory Commission (NRC) takes into consideration cost-effectiveness within its regulatory process for achieving adequate protection of public health and safety.
- 2) Ground-water protection is required using an approach making compliance at any location with potable water very difficult if not impossible
  - EPA applies drinking water concentration limits to the point of highest concentration in the plume (cannot average in fresh water or water with contamination significantly below the limit), which is very conservative and does not allow reasonable credit for mixing and dilution effects that would take place in a well
  - It is not feasible to define precisely the shape of the plume over the time and space scales that would be required for implementation, nonetheless, EPA's

approach requires extremely detailed models, with supporting characterization data, to estimate precisely the shape of the plume with no commensurate increase in safety over simpler approaches that average concentrations over the production zone appropriate to withdrawal wells of the critical group.

- EPA specifies a compliance period of 10,000 years, but requests comment on time period, including time of peak concentration. NRC believes a 10,000-year performance period is the longest period for which quantitative estimates to demonstrate compliance should be required. Although it is scientifically possible to estimate performance hundreds of thousands of years in the future, as NAS suggests, NRC does not consider it prudent to base regulatory decisions on such analyses, particularly in its adjudicatory licensing process.
- EPA seeks comment on five alternative locations for compliance, including the repository boundary. Location of receptors at the repository boundary is inconsistent with the concept of geologic disposal that uses the geologic systems as barriers that provide isolation.
- EPA's analysis of the capture zone of a single family well is inconsistent with current agricultural practices in Amargosa Valley. The U.S. Department of Energy (DOE) and NRC estimate the capture zone to be about two orders of magnitude less, resulting in significantly lower estimates of dilution and for greater difficulty in demonstrating compliance.

3) EPA's overall performance standard of 15 mrem/yr to the reasonably maximally exposed individual (RMEI) for a rural-residential scenario is unduly restrictive.

- NRC considers that a limit of 25 mrem/yr to the average member of a critical group is protective of public health and safety. Based on current lifestyles and practices, as recommended by NAS, NRC considers the critical group to be a small farming community located in Amargosa Valley (20 km distant from Yucca Mountain).
- EPA specifies a 10,000-year period, but seeks comment on time periods up to peak dose. NRC does not consider quantitative assessments of performance past 10,000 years a sound basis for regulatory decisions.
- EPA considers that 50 percent of the diet of a rural-residential individual consists of food grown in the local area, which appears very conservative - NAS has recommended that the lifestyle and diet be based on the characteristics of current populations.

4) The Appendix to 10 CFR Part 197 provides a "binding framework for implementation of the rule in the Commission's licensing proceeding," which is stated to be binding in the same manner as the Standard. In previous comments to EPA, NRC has viewed implementation as an area of NRC jurisdiction. Some examples are:

- The Appendix contains requirements regarding biosphere assumptions, that duplicate matters the Commission plans to address in its implementing rule.
- The Appendix contains requirements, for assumed behavior of the RMEI, that are more conservative than the average member of the critical group recommended by NAS, ICRP, and the National Council on Radiation Protection and Measurements, which the Commission plans to address in its implementing rule.
- The Appendix specifies the human intrusion analysis NRC would require DOE to perform, which is another implementation matter that NRC plans to address in its implementing rule.