REGULATORY PERSPECTIVE ON NAS RECOMMENDATIONS FOR YUCCA MOUNTAIN STANDARDS

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ABSTRACT

This paper provides a regulatory perspective from the viewpoint of the potential licensee, the U.S. Department of Energy (DOE), on the National Academy of Sciences (NAS) report[1] on Yucca Mountain standards published in August 1995. The DOE agrees with some aspects of the NAS report; however, the DOE has serious concerns with the ability to implement some of the recommendations in a reasonable manner.

I. INTRODUCTION

In many areas the NAS recommendations are consistent with DOE thinking, as documented in the recommendations made by the DOE to the NAS[2] and to the U.S. Environmental Protection Agency (EPA).[3] Those areas include the use of a health-based standard, the focus of a standard on the people in the vicinity of Yucca Mountain, the application of negligible individual risk, the appropriate basis of a quantitative evaluation of compliance being the mean of calculated results, and the caution against the application of subsystem performance requirements. In other areas, the NAS recommendations raise concerns related to the difficulty in implementing the resulting requirements. Four such concerns are discussed below.

II. TIME FRAME FOR COMPLIANCE

The NAS recommended compliance with a risk-based standard at the time of greatest risk within the limits imposed by the long-term stability of the geologic environment. It stated that the fundamental geologic regime at Yucca Mountain could be expected to remain predictable for approximately 1,000,000 years. The DOE considers that demonstrating compliance at any site, including Yucca Mountain, by comparing with numerical limits that extend for hundreds of thousands of years may not be feasible, given the current regulatory environment. The DOE concurs with the EPA[4] and the NRC[5] that a period up to 10,000 years is a reasonable time frame for requiring meaningful quantitative projections. If time frames longer than 10,000 years are addressed in a standard, then the associated requirements should be qualitative, for comparison purposes, and should be used to gain insights into overall system performance. This is ultimately a policy decision. The DOE further notes that this concern with imposing a standard for very long time frames is consistent with the 1990 NAS "Rethinking" report[6] which recommends de-emphasizing quantitative model predictions.

III. RISK LEVEL

In advocating a risk-based standard, the NAS did not recommend a specific level of acceptable risk; however, it recommended that the acceptable level of risk be established through rulemaking. The NAS suggested that a risk level in the range of 10^{-5} to 10^{-6} fatal cancers per year be used as a reasonable starting point for the rulemaking. The proposed exposure scenario to humans assumes that future humans can and will access contaminated groundwater, but will not test and treat their water supply. This assumption makes the calculation of health effects tractable, but it is very conservative. While it is impossible to quantify the exact degree of this conservatism, it should be recognized and factored into setting the risk limits for the Yucca Mountain standard. The DOE recommends that, given this very large conservatism, a range of 10^{-4} to 10^{-5} fatal cancers per year should be used as a starting point for the EPA's rulemaking.

IV. HUMAN INTRUSION

With regard to human intrusion, the NAS recommended that alternative scenarios of human intrusion should not be incorporated into a fully risk based compliance assessment that requires knowledge of the character and frequency of various intrusion scenarios. However, the NAS recommended that the EPA should specify in its standard a typical intrusion scenario to be analyzed for its consequences on the performance of the repository, and that the resultant risk level should be no greater than the risk levels that would be acceptable for the undisturbed repository case. The NAS did not specify the typical intrusion scenario, but suggests a stylized scenario consisting of one borehole of a specified diameter drilled from the surface through a canister of waste to the underlying aquifer. Assuming that the "intruded" repository, based on the stylized calculations, performs worse than the "non-intruded" repository, and that both evaluations are compared to the same risk limit, it is obvious that the "intruded" case will be limiting. Since the focus would be on evaluating the limiting case that includes the assumed intrusion scenario, that intrusion assumption may well be the major factor in determining whether or not any geologic repository meets or does not meet the risk standard. However, the NAS admitted that there is no technical basis for specifying the intrusion event. The evaluation of "risk" that includes the assumed intrusion event would be arbitrary, and would not have any demonstrable link to the protection of the health and safety of the public. Given that human intrusion is a possibility that is inherent in the concept of geologic disposal irrespective of the site, the DOE recommends that a quantitative evaluation of human intrusion not be included in health and safety standards for Yucca Mountain. Instead, intrusion should be addressed with qualitative design requirements and institutional controls.

V. CRITICAL GROUP

The NAS recommended that the critical group approach be used to determine the risk posed by a repository at Yucca Mountain. The NAS provided two recommendations for specifying the exposure scenario to the critical group, described in Appendices C and D of their report. Appendix C advanced a complicated, eight step approach that would base the critical group on probabilistic evaluations of observed characteristics of people currently living in the vicinity of the repository. Appendix D recommended specifying the expected risk to the average member of the critical group as one-half of the risk to the maximally exposed subsistence farmer. The DOE does not consider the methodology described in Appendix C to be appropriate for use in a Yucca Mountain standard. Given the broad range of uncertainties that is inherent in geologic disposal at any site, it would be inappropriate to impose a requirement for precision in one area (exposure scenario) that is overwhelmed by the uncertainty in other areas. Furthermore, the DOE emphasizes the need for standards and regulations to be understandable and demonstrable in order to foster public confidence. The methodology proposed in Appendix C does not satisfy that criterion. The methodology described in Appendix D, on the other hand, is understandable, implementable, and consistent with standard practices for calculating radiation doses. However, it would result in a very conservative exposure scenario. The Appendix D methodology could be appropriate for use in a Yucca Mountain standard as long as the very conservative nature of the exposure scenario is recognized and factored into the specification of the risk limit (see "level of acceptable risk" concern).

REFERENCES

1. National Academy of Sciences, *Technical Bases for Yucca Mountain Standards*, National Academy Press, Washington, D.C., 1995.

2. Letter, Dreyfus, D. A. (U. S. Department of Energy) to Fri, Robert W. (Chairman of National Academy of Sciences Committee on Technical Bases for Yucca Mountain Standards), April 8, 1994.

3. Letter, Dreyfus, D. A. (U. S. Department of Energy) to Clark, Ray (U. S. Environmental Protection Agency), November 2, 1995.

4. U.S. Environmental Protection Agency, 40 CFR Part 191, "Environmental Standards for the Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes; Final Rule", Federal Register Volume 50, No. 182, September 19, 1985.

5. U. S. Nuclear Regulatory Commission, Federline, Margaret V., Statement to the National Academy of Sciences Committee on Technical Bases for Yucca Mountain Standards, May 27, 1993.

6. National Academy of Sciences, *Rethinking High-Level Radioactive Waste Disposal*, National Academy Press, Washington, D.C., 1990.

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