UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON NUCLEAR WASTE
WASHINGTON, D.C. 20555

August 22, 1995

MEMORANDUM TO: ACNW Members

FROM: Howard J. Larson, Senior Staff Engineer

SUBJECT: "TECHNICAL BASES FOR YUCCA MOUNTAIN STANDARDS", NATIONAL RESEARCH COUNCIL, WASHINGTON, DC, 1995

A copy of the subject document is attached for your information (as indicated in writer's August 1995 memo on related press conference). As you are aware, a presentation by an NAS representative has been requested for the 77th meeting. The Academy staff has promised a speaker, but has yet to identify same.

The Commission has also requested a presentation, but as of this writing that is yet to be scheduled.

I regret the delay. Although I had received a bound copy from the NAS, since it was copyrighted I couldn't get it reproduced in our print shop without written permission.

Attachment: As stated

cc w/att: ACNW Staff
J. T. Larkins
R. P. Savio

OPENING STATEMENT

Robert Fri
President
Resources for the Future
and
Chair, Committee on the Technical Bases for Yucca Mountain Standards

News Conference to Release the National Research Council Report
Technical Bases for Yucca Mountain Standards
National Academy of Sciences building
2 p.m. EDT, Tuesday, Aug. 1, 1995

Good afternoon in Washington, D.C.; good morning to all of you who have joined us from Nevada and other parts of the West. Thank you for being with us today as we release our report on Yucca Mountain health standards.

The committee's task in this study was to determine whether or not a scientific basis exists for a health standard that would protect the public from adverse effects associated with the proposed high-level nuclear waste repository at Yucca Mountain. The Congress mandated this study in 1992 as part of its Energy Policy Act. That piece of legislation also directs the Environmental Protection Agency to create a health standard consistent with the recommendations of this study, and to do so within one year. We recognize that our work may play a prominent role in the continuing debate over this standard, because of this statutory linkage to the regulatory process.

Furthermore, we are quite sensitive to the fact that this is both a controversial and long-standing debate. It has gone on for years, and many people have put in a great deal of effort toward crafting an acceptable standard. That it is not yet resolved is testimony to the range of perspectives regarding the desirability of building the Yucca Mountain repository.

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In the course of this debate, several issues have proved to be particularly contentious, and the Congress tossed some of them to the Research Council when it asked for this study. In particular, we were directed to address three main questions:

Number one, would a standard based on individual dose protect public health; that is, would a standard based on protecting those who live and work near the repository also protect individuals living far away — perhaps thousands of miles away?

Number two, is there a scientific basis for estimating the likelihood of human intrusion into the repository some time in the distant future? Speculating about how humans might enter the repository thousands of years from now, and about how to prevent that intrusion to a high degree of certainty, invites controversy. It is hardly surprising that Congress would seek a resolution of these issues more firmly grounded in objective science.

And number three, is it reasonable to assume that such intrusions can be prevented by active institutional controls?

Because the Yucca Mountain standard is a complex and difficult question both scientifically and socially, I want to place our study in context.

We have not evaluated the suitability of the Yucca Mountain site — for example, whether it would meet a standard — nor have we offered an opinion on the management of the civilian waste repository program. These are important questions, but based on our charge, we agreed that it was not our job to address them.

We were asked to consider the technical basis for a health standard for Yucca Mountain only. This site specificity contrasts with the approach EPA took in setting its earlier standard, which was meant to apply to any site. EPA could not have approached the problem in any other way, so this is not a criticism. That difference, however, must be kept in mind. For example, the Yucca Mountain region exhibits long-term geologic stability, and that influences the basis for the standard, as you will see. Other sites have different geology and therefore some of the conclusions we reach about Yucca Mountain may not apply elsewhere, and vice versa.

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I want to emphasize that there is a limited technical basis for some elements of the standard. In other words, science simply cannot answer all of the questions, and where it cannot, policy decisions are required. We have tried to point out with care this line of demarcation between science and policy, and to make firm recommendations only when we are dealing with science. When issues move into the policy realm, we have tried only to suggest a scientifically defensible place for the policy debate to begin.

Against this backdrop, let me summarize the key features of our report and how they compare to the approach that EPA took in its most recent version of the standard.

I first want to explain what a standard is — that is, a limit placed on repository performance which, if met, would ensure that public health is protected. The limit can be stated in many ways, and the current EPA standard relies heavily on limiting the amount of radioactive material that can be released from the repository. The Congress asked whether there is a scientific basis for stating the standard in terms of a limit on the *dose* of radiation to which individual members of the public could be exposed. We concluded that the scientific relationships between releases, doses, and health effects are well enough known to establish the standard in this form, and the answer to the first question is "yes." In fact, the committee believes that the standard should focus on the persons likely to be at greatest risk; that is, to Nevadans who live closest to the site.

The committee further concluded that there were benefits to stating a standard in terms of risk to the health of individuals rather than in terms of "dose," which is a measure of exposure. Here's why: First, risk is easier for people to understand and compare than a measure of exposure, which often is expressed in obscure terms. For example, a one-in-a-million risk of getting cancer is easier to understand than a dose of .02 mSvs per year, which is roughly the same thing. Second, over the years, increasing scientific understanding has changed our views of the relationships between doses and effects, such as incidence of fatal cancers. Additional information might lead to further changes in the future, but if the level of acceptable risk remains the same, the standard need not be changed in light of new dose-response data. Our preference for a stable, more readily understood risk-based standard rests

on a belief that it is socially, politically, and administratively undesirable to change so controversial a standard once it is finally in place.

Three things must be taken into account to construct a risk-based standard — how much protection is to be afforded, who is to be protected, and for how long. Establishing the level of risk is a question of policy, not science, so we have not recommended what this level should be. However, both EPA and other organizations have set limits on risks from a variety of radiation sources. Domestic and international practice has been to set these limits so that when they're added up, they do not exceed a total acceptable radiation risk. This framework provides a good starting point for EPA to use in developing a standard for Yucca Mountain.

Who is to be protected must be established to determine whether a repository complies with the standard. The risk to some individual or representative group of individuals is calculated and then compared to the risk limit established in the standard. We recommend the standard be formed to protect those individuals whose locations and habits place them at highest risk based on using cautious, but reasonable, assumptions.

In regard to how long the standard might be intended to apply, it is important to note that high-level radioactive wastes will pose hazards to human health for more than a million years. Estimates of when risks from the proposed repository might be greatest range from 50,000 to 250,000 years in the future, according to assessments reviewed in our study. Whether it is possible to assess compliance with the standard over the duration of this risk depends on the ability of scientists to evaluate the performance of the repository over these very long periods of time. In the case of Yucca Mountain, the committee concluded that compliance assessment is feasible for most physical and geological aspects of repository performance for a time scale on the order of a million years. Thus, it should be feasible to assess compliance now for the time when the risks are currently thought to be greatest. The current EPA standard limits the analysis of releases to 10,000 years.

Let me return momentarily to the first question — that is, whether a standard created to protect the individual would also protect the general population. Although the main concern of the Yucca

Mountain standard is to protect people living and working nearby, releases could be diffused throughout a very large and dispersed population.

The most likely process leading to such global effects would be the exposure to radioactive carbon dioxide gas that could escape from the nuclear waste canisters. Because this gas would be mixed with the worldwide atmosphere, the amount of exposure from the repository to the average individual would be exceedingly small.

On the other hand, the number of persons exposed globally over the duration of this risk could be extremely large. In this case, multiplying a very small risk by a very large number of persons yields highly uncertain results. Scientifically, there is a real question about how to interpret a number computed in this way.

Faced with this scientific uncertainty, the committee could only observe that the risk to any one individual in the global population would be very small — perhaps ten thousand times lower than the one-in-a-million level at which the basic standard might, for example, be set. A decision-maker could conclude that such risks are so small as to have a negligible effect on public health and should not affect the design of the repository. Such a conclusion is a policy, not a scientific, judgment. The current EPA approach does not provide for this concept of negligible risk.

Once it is decided who is to be protected, by how much, and for how long, then you must determine through a two-step process whether or not the repository system would do its job. First, you have to predict the potential concentrations of radioactive material that would be released into the environment from the repository. Then you would have to specify how humans would become exposed to this material. We concluded that there is a sufficient scientific basis for performing this assessment, but selecting a set of assumptions to use in assessing exposures would be a policy judgment. The report presents two approaches to making these assumptions — the "probabilistic critical group" method and the "subsistence farmer" method. The first considers the average risk to individuals in a small local group that is at highest risk from radioactivity from the facility. The second defines the risk to this

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group based on a hypothetical person at greatest risk — in this case, a subsistence farmer who drinks contaminated well water and eats food irrigated with that water.

Most members of the committee consider the first approach the better place to start in regard to creating a health standard, but one member argued for the second option. In my view, selecting between these options cannot be resolved on the basis of science. Accordingly, the committee has described both methods in its report, leaving the choice on what to assume about human behavior in exposure scenarios to EPA as a matter for policy judgment.

Finally, as I noted earlier, Congress specifically asked whether there is any scientific basis for evaluating the likelihood of human intrusion, or for assuming that it can be prevented. The answer to both questions is simply "no," because there is no scientific basis for predicting the behavior of individual humans thousands of years into the future. Nonetheless, it should be possible to assess the performance of the isolation system under a hypothetical intrusion scenario. The committee suggested that the estimated risk assuming a specified scenario should be no greater that the risk posed by the undisturbed repository. In other words, the repository system should be resilient to an assumed intrusion scenario.

I wish to conclude by thanking all those who helped us work our way through this very complicated subject. We benefited from the contributions of a wide variety of stakeholders and specialists. The committee itself could not have functioned without the outstanding support of the Research Council staff, especially Lisa Clendening, Ray Wassel, and Myron Uman. And as chair, I want to thank the members of the committee for their patience and expertise.

At this time, my colleagues and I would be happy to answer your questions. Please tell us your name and the name of the organization you represent when you ask a question.

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