

**Statement of
Dr. Jared L. Cohon, Chairman
U.S. Nuclear Waste Technical Review Board
Before the
Subcommittee on Energy and Power
Committee on Commerce
U.S. House of Representatives
February 10, 1999**

Mr. Chairman, and members of the Subcommittee, good afternoon. My name is Jared L. Cohon. My full-time job is President of Carnegie Mellon University. I am here today in my capacity as Chairman of the Nuclear Waste Technical Review Board. It is my pleasure to represent the other members of the Board at this hearing.

As you know, Mr. Chairman, Congress created the Board in the 1987 amendments to the Nuclear Waste Policy Act to review the technical and scientific validity of activities undertaken by the Secretary of Energy, including the characterization of the Yucca Mountain site and the packaging and transportation of spent nuclear fuel and high-level radioactive waste. The Board takes very seriously its role as the main source of *ongoing* technical and scientific review of the Department of Energy's (DOE) civilian radioactive waste management program.

The Board has been asked to comment today on the DOE's recently issued viability assessment (VA) of the Yucca Mountain site and on H.R. 45, legislation amending the Nuclear Waste Policy Act of 1982. I will make some very brief remarks, and I ask that the full text of my statement be entered in the hearing record.

Comments on H.R. 45

Mr. Chairman, many of the issues raised in H.R. 45 are policy matters that are outside the technical and scientific purview of the Board. I will therefore not comment on the specific provisions of H.R. 45, except to urge that if phased development of an interim storage facility is authorized, sufficient resources are allocated so that scientific testing to support decisions about the suitability and possible licensing of the Yucca Mountain site can continue. I will be pleased to

respond at the end of my statement to specific technical questions about the legislation from Subcommittee members.

During the last year, the Board has devoted the majority of its efforts to (1) identifying the key areas of research whose results would improve the technical basis for making decisions about site recommendation and licensing, if the site is determined to be suitable, and (2) evaluating the technical and scientific work that supports the viability assessment of the Yucca Mountain site. I will now briefly discuss some of the Board's conclusions and comments related to these activities.

Some Conclusions from the Board's November 1998 Report

In November 1998, the Board issued a report outlining its views about future research needed for addressing uncertainties about the performance of the repository system, including both the engineered and the natural barriers. The Board concluded in the report that although there are economic and technical limits to reducing uncertainties about the performance of the proposed repository system, the Board believes that some key uncertainties could be reduced further over the next few years through a focused research effort. One important line of work is to evaluate alternative and potentially more robust repository and waste-package designs. It is likely that improving these designs could increase confidence in predictions about the performance of the repository. Other key areas of research include work to obtain a better understanding and estimation of seepage of water into repository tunnels and transport of radionuclides through the saturated zone under the repository. The Board notes that the DOE has undertaken work in all these areas, and we look forward to the results of these scientific studies and engineering analyses.

The Board's conclusions from its November 1998 report served as a technical basis for its review of the DOE's viability assessment.

Preliminary Comments on the VA

The Board's November report, along with the access to information provided by the DOE throughout the development of the viability assessment, make it possible for the Board to provide these *preliminary* comments on this immense and detailed document. The Board's evaluation of the VA will be completed in the next month or two.

I will begin with three general comments.

- First, the DOE deserves congratulations for completing the VA, which is the most significant landmark thus far in the characterization and evaluation of the Yucca Mountain site. The viability assessment is a solid accomplishment that has enabled the DOE to integrate large amounts of data and analyses, to establish a preliminary repository design, and to set priorities for work that needs to be completed before making decisions about site recommendation and licensing, if the site proves suitable. However, the Board concurs with the DOE that the VA is simply a snapshot of the current state of knowledge about the site; it was not intended to be and is *not* a suitability determination.
- Second, the Board's preliminary comments on the VA reflect its views that (1) all uncertainty about the performance of a repository at *any* candidate site cannot, and need not, be eliminated and (2) a "defense-in-depth" repository design that includes both engineered and natural barriers is appropriate in light of uncertainties about the projected performance of any repository system over many thousands of years.
- Third, because the Board did not have the expertise and resources needed to review the cost estimates included in the VA, it has no comment on their accuracy.

Now, more specifically:

- The Board believes that, in general, the scientific studies summarized in the VA were carried out in a manner that produced good scientific information. The reports included in the VA are well written and clearly presented.
- It is very hard to judge at this point how realistic the “bottom-line” estimates of repository performance may be in the VA. In fact, DOE representatives have stated that the VA’s total system performance assessment (TSPA-VA) cannot be used to assess compliance with the regulatory standard. Because of a general lack of data supporting some critical assumptions in the mathematical models, some of the assumptions in the TSPA-VA are likely to be overly conservative, while others may be nonconservative.
- The VA relies quite heavily in some cases on the formal elicitation of expert judgment. This was necessary and extremely useful, given the lack of field and laboratory data in certain areas and the equivocal nature of some of the data in other areas. As the experts, themselves, pointed out, however, expert judgment should not be used as a substitute for data that can be obtained directly from site, laboratory, and other investigations.
- The VA helps illuminate the state of knowledge about the three major barriers that will be necessary to achieve a defense-in-depth approach to repository performance: the unsaturated zone, the engineered barrier system, and the saturated zone. However, it is clear from the information in the VA that there are significant and substantial uncertainties about the performance of each of these barriers and about how they would work together to provide defense-in-depth. As pointed out by the DOE, the TSPA-VA explicitly acknowledges the need for defense-in-depth analysis but does not provide such an analysis.

Closing

In conclusion, Mr. Chairman, the Board believes that the Yucca Mountain site continues to merit study as the candidate site for a permanent high-level radioactive waste repository and that work should proceed to support a decision by the Secretary of Energy on whether the site is suitable. However, significant uncertainties remain about the performance of both the natural and the engineered barriers in a repository system.

The VA is a significant accomplishment that enables the DOE to identify and set priorities among key areas of research that could improve the technical basis for making decisions about site suitability, site recommendation, and licensing. However, the Board concurs with the DOE that the VA was not meant to be, and should not be, viewed as a decision about the suitability of the Yucca Mountain site.

The Board is pleased to note that the research priorities presented in the VA are consistent with those identified in the Board's November 1998 report and that much of this work is already under way. Results of these scientific tests and engineering analyses could help address the uncertainties about the performance of the repository system.

Thank you for the opportunity to provide these *preliminary* comments about the VA on behalf of the Board. I will be pleased to respond to questions.



UNITED STATES
NUCLEAR WASTE TECHNICAL REVIEW BOARD
2300 Clarendon Boulevard, Suite 1300
Arlington, VA 22201

March 5, 1999

The Honorable Joe Barton
Chairman
Subcommittee on Energy and Power
Committee on Commerce
U.S. House of Representatives
2125 RHOB
Washington, DC 20515-6115

Dear Mr. Barton:

On behalf of the Nuclear Waste Technical Review Board, I am enclosing answers to follow-up questions directed to the Board after the February 10 hearing on H.R. 45 before the Subcommittee on Energy and Power. We hope you will find the information contained in the answers useful.

I was pleased to represent the Board at the hearing. I hope you will not hesitate to call on the Board should the Subcommittee require additional technical and scientific information related to the management of spent nuclear fuel and high-level radioactive waste.

Sincerely,

Jared L. Cohon
Chairman

Enclosure

cc: The Honorable Ralph M. Hall, Ranking Minority Member

**SUBCOMMITTEE ON ENERGY AND POWER
FOLLOW UP QUESTIONS TO DR. JARED COHON
NUCLEAR WASTE POLICY ACT OF 1999**

1. *In your schedule, you indicate there are many uncertainties that need to be resolved about the performance of the repository. Does the schedule in the current DOE program plan, dated July 1998, provide sufficient time to resolve these uncertainties and for the Board to complete its technical review function?*

Answer: The schedule set forth in the DOE program plan includes making a decision in 2001 about whether to recommend the site. In the Board's view, this schedule is very ambitious, and much scientific and engineering work remains to be completed. The DOE identified a number of research priorities for reducing key site uncertainties, priorities that are consistent with those discussed by the Board in its November 1998 *Report to the U.S. Congress and the U.S. Secretary of Energy*. However, there are many significant uncertainties about the magnitude and distribution of water that would seep into repository tunnels, how designs for the repository and waste package would affect waste isolation, and the potential of the saturated zone to act as a natural barrier through dispersion and dilution.

The Board believes that a repository design based on lower waste package surface temperatures has the potential to significantly reduce uncertainty, enhance licensability, and simplify the analytical bases required for a possible site recommendation. However, the Board notes that time is short, money is tight, and other priorities, including addressing quality assurance problems, could slow progress in developing design alternatives and addressing the remaining site uncertainties. If substantial progress on the research and alternative design work identified in the VA is not made by the 2001 date in the program plan, the uncertainties about the performance of the repository system will remain.

The Board was charged by Congress in the Nuclear Waste Policy Amendments Act of 1987 with reviewing activities undertaken by the Secretary of Energy, including characterizing the Yucca Mountain site and packaging and transporting spent fuel and high-level radioactive waste. The Board's review is conducted concurrently with these activities. Consequently, the schedule is not really a constraint on the Board's review, but it may very well constrain the activities undertaken by the Secretary.

2. *Is the TRB prepared to fulfill that same role on the accelerated timeline for an interim storage facility as proposed in H.R. 45?*

Answer: The timeline is less of a concern than are the resources required. Because storage has been a relatively small part of DOE program activities to this point, the Board's involvement in storage issues has been limited. Obviously, if H.R. 45 is enacted, the Secretary's activities in this area would greatly increase, and the Board would be required to review those activities. In addition, the Secretary would substantially expand transportation activities, requiring a commensurate increase in Board effort in this area. Unfortunately, budget limitations have prevented the Board from filling a vacant position on the technical staff that supports the Board's work on transportation. This position also would likely cover one significant component of storage-related activities for the Board. The Board's technical staff that supports other areas of the Board's review is already working to maximum capacity and would be hard pressed to cover these two areas adequately. These problems would be greatly alleviated if the Board receives its full budget request for fiscal year 2000 (see answer to question 3).

3. *Does the Board have sufficient funds in the President's budget request for Fiscal Year 2000 to carry out its Congressional mandate to review the validity of the technical and scientific activities of the Department of Energy with respect to the permanent repository?*

Answer: Yes. However, if the Board receives *less* than requested, the Board will have great difficulty carrying out its congressional mandate adequately. Critical program milestones are approaching quickly, and the activities of the Secretary and the Board will increase significantly over the next two years to meet program deadlines. As described in the answer to question 2, if legislation is enacted authorizing an interim storage facility and expanding transportation activities, the Board's resources will be stretched even more than they are currently. The Board is very concerned that its review, which many believe is important to the technical credibility of the DOE program, will be adversely affected if the Board does not receive its full appropriation for fiscal year 2000. In the past, the Board has supplemented its appropriations with carryover funds from previous years. This carryover has been fully expended.

4. *Does the Board have sufficient resources to conduct the additional review entailed by the interim storage site as proposed in H.R. 45?*

Answer: See the answers to questions 2 and 3.

5. *How do the recent earthquakes in the vicinity of Yucca Mountain affect your assessment of the Yucca Mountain site?*

Answer: In its *Fifth Report to the U.S. Congress and the U.S. Secretary of Energy*, the Board stated, “In general, the Board views earthquake-related vibratory ground motion as primarily an issue of appropriate design and construction, rather than an issue of site suitability.” On the basis of the information available at this point, the Board sees no reason to change this assessment because of the recent earthquakes in the vicinity of Yucca Mountain.

The earthquakes to which you refer occurred at a distance of about 45 km from the proposed repository. They are near, and may possibly be associated with, the eastern end of the Rock Valley fault, a known active fault on the Nevada Test Site. Earthquakes often have occurred on this fault. In the very extensive seismic-hazard investigations and evaluations conducted for the proposed repository, the assumption has been that this fault could cause earthquakes releasing more than 1,000 times the energy released by the largest earthquake in the current swarm. Even such a large earthquake, occurring about 25 km from the proposed repository (the closest approach of the Rock Valley fault), would not pose a serious threat to well-engineered structures at the repository surface or underground. A well-known and well-documented fact is that earthquake shaking at depth is markedly less than such shaking at the surface. Although the Board does not believe that the recent earthquakes alter previous assessments, these events provide additional useful information to repository designers and safety analysts.

6. *How does the recent discovery of relatively rapid migration of radioactive materials from the Nevada Test Site affect your assessment of the long-term safety of the Yucca Mountain site?*

Answer: The migration of radionuclides from an underground test conducted at the Nevada Test Site in the 1960’s seems to be related to colloidal transport of plutonium and is being addressed in a number of ways by the DOE program. Colloidal transport also is of great interest to the nonnuclear geochemical community. We can expect additional information to be developed from many sources over the next couple of years on this subject. At this point, it is too early to assess the significance of this discovery for a Yucca Mountain repository.

7. *From your review of the DOE work to date and from your own knowledge of the Yucca Mountain site, do you see any technical reason why a permanent repository could not be built safely at the Yucca Mountain site?*

Answer: The Board has not identified any features or processes that would automatically disqualify the site. Therefore, as we stated in our testimony, the Board believes that the Yucca Mountain site continues to merit study as the candidate site for a permanent geologic repository. However, making a technically defensible decision about a permanent repository at Yucca Mountain will require affirmative judgments about the capacity of the natural and engineered barriers to work together as a system in isolating wastes for thousands of years.

Yucca Mountain has a complex geology, and many important hydrologic processes—especially in the unsaturated zone where the waste will be emplaced—are not well understood. Furthermore, a dose-based standard increases the importance of the saturated zone (SZ) as a natural barrier, and very little data have been obtained that can be used to support predictions of flow and transport in the SZ.

Other critical factors affecting the performance of a proposed repository system are the designs for the repository and the waste package. Predicting the performance of the current repository design will be difficult, especially considering the many thousands of years of concern. The Board believes that a repository design based on lower waste package surface temperatures has the potential to significantly reduce uncertainty, enhance licensability, and simplify the analytical bases required for site recommendation.

Is there any technical reason why an interim storage site, such as proposed in H.R. 45, could not be built at Yucca Mountain?

From a technical standpoint, the construction of an aboveground storage facility would be relatively straightforward, involving well-established engineering practices. Consequently, there are no significant engineering challenges associated with the actual construction of a storage facility at Yucca Mountain or at any other location.



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March 5, 1999

The Honorable Joe Barton
Chairman
Subcommittee on Energy and Power
Committee on Commerce
U.S. House of Representatives
2125 RHOB
Washington, DC 20515-6115

Dear Mr. Barton:

On behalf of the Nuclear Waste Technical Review Board, I am enclosing the Board's response to a question that you forwarded to the Board from Representative Edward J. Markey. The question is a follow up to the February 10 hearing on H.R. 45 before the Subcommittee on Energy and Power. We hope Mr. Markey will find the information contained in the answer useful.

The Board appreciated the opportunity to present its views to the Subcommittee at the hearing. We look forward to providing whatever technical and scientific information the Subcommittee may find helpful as it considers the many challenging issues related to the management of spent nuclear fuel and high-level radioactive waste.

Sincerely,

Jared L. Cohon
Chairman

Enclosure

cc: The Honorable Ralph M. Hall, Ranking Minority Member
The Honorable Edward J. Markey

Subcommittee on Energy and Power
Follow Up Question For the Record
H.R. 45, Nuclear Waste Policy Act of 1999
(Question from Mr. Markey to Dr. Cohon)

In 1996 the Board states that “There are no compelling technical reasons for moving commercial spent fuel to a centralized storage facility at this time,” and suggested that “it makes technical, management, and fiscal sense to await the decision on the suitability of the Yucca Mountain site for repository development before beginning development of a federal centralized storage facility.” Has anything changed to provide a compelling technical reason for centralized storage?

Answer: The Board observed in its March 1996 report “. . . there appear to be no compelling technical reasons for moving spent fuel to a centralized interim storage facility *for the next few years.*” This conclusion reflected statements by the NRC and others that spent fuel can be stored safely at reactors *or* at a centralized storage facility for up to a hundred years. However, the Board went on to say that a large centralized storage facility (with the accompanying transportation infrastructure) offers logistical and operational advantages for the waste management system. The Board felt that it made sense to have an interim storage facility developed and receiving spent fuel at a rate of 3,000 MTU per year by about 2010, when civilian reactors start closing down in significant numbers. The Board noted that there are advantages to collocating a centralized storage facility with an operating repository and that developing the transportation infrastructure necessary to begin moving significant amounts of waste likely will take several years. Therefore, the Board suggested that it made sense to continue site-suitability studies, to begin developing the needed transportation infrastructure, and to make a decision about centralized storage after a determination of the suitability of the Yucca Mountain site.

While the Board found no compelling technical reasons for moving commercial spent fuel to a centralized storage facility for the next few years, the Board acknowledged in its report that there could be important *nontechnical* reasons that might prompt policy makers to consider developing a centralized storage facility before a site-suitability determination. The Board feels that its role should be to provide decision makers with technical and scientific information, which they can take into consideration when making decisions about waste management and disposal, and it was in that spirit that the Board released its report on storage. However, the Board understands that a decision about whether or when to develop a centralized storage facility is a policy decision that is outside its technical purview.