

Testimony of Dr. Jared Cohon  
On behalf of the Nuclear Waste Technical Review Board

Before the Subcommittee on Energy and Air Quality,  
U.S. House of Representatives

On the proposed Yucca Mountain Nuclear Waste Repository

**April 18, 2002**

Good morning, Mr. Chairman and members of the Subcommittee. I am Jared Cohon, Chairman of the Nuclear Waste Technical Review Board. All members of the Board are appointed by the President and serve on a part-time basis. In my case, I also am president of Carnegie Mellon University in Pittsburgh, Pennsylvania.

I am pleased to be here today to present the Board's technical and scientific evaluation of the Department of Energy's work related to the recommendation of a site at Yucca Mountain, Nevada, as the location of a permanent repository for spent nuclear fuel and high-level radioactive waste. The Board hopes that the Subcommittee and other policy-makers will find its technical and scientific evaluation useful as you consider the various issues that will affect a decision on whether to proceed with repository development. With your permission, Mr. Chairman, I will summarize the Board's findings, and I request that my full statement and the Board's January 24, 2002, letter report to Congress and the Secretary be included in the hearing record.

As you know, Mr. Chairman, Congress created the Board in the 1987 amendments to the Nuclear Waste Policy Act. Congress charged the Board with performing an ongoing independent evaluation of the technical and scientific validity of activities undertaken by the Secretary of Energy related to disposing of spent nuclear fuel and high-level radioactive waste. The Board also reviews the DOE's activities related to transporting and packaging such waste. Since the Board was established, its primary focus has been the DOE's efforts to characterize a site at Yucca Mountain in Nevada to determine its suitability as the location of a potential repository.

Early last year, Secretary of Energy Spencer Abraham indicated that he would make a decision at the end of 2001 on whether to recommend the Yucca Mountain site for repository development. As the Secretary's decision approached, the Board decided it was important to comment to the Secretary and Congress, within the context of the Board's ongoing evaluation of the technical and scientific validity of DOE activities, on the DOE's work related to a site recommendation. So, in November 2001, the Board met to review comprehensively the DOE's efforts in this area. In December 2001, the Board sent a letter to the Secretary indicating that the Board would provide its comments within a few weeks. The Board conveyed those comments in a letter, which included

attachments with supporting details, that was sent to Congress and the Secretary on January 24, 2002.

I will now summarize the Board's review procedures and the results of the Board's evaluation.

The Board's evaluation represents the collective judgment of its members and was based on the following:

- The results of the Board's ongoing review of the DOE's Yucca Mountain technical and scientific investigations since the Board's inception
- An evaluation of the DOE's work on the natural and engineered components of the proposed repository system, using a list of technical questions identified by the Board
- A comprehensive Board review of draft and final documents supplied by the DOE through mid-November 2001
- Field observations by Board members at Yucca Mountain and related sites.

To focus its review, the Board considered the following 10 questions for components of the repository system and for the disruptive-event scenarios:

1. Do the models used to generate input to the total system performance assessment (TSPA) and the representations of processes and linkages or relationships among processes within TSPA have a sound basis?
2. Have uncertainties and conservatisms in the analyses been identified, quantified, and described accurately and meaningfully?
3. Have sufficient data and observations been gathered using appropriate methodologies?
4. Have assumptions and expert judgments, including bounding estimates, been documented and justified?
5. Have model predictions been verified or tested?
6. Have available data that could challenge prevailing interpretations been collected and evaluated?
7. Have alternative conceptual models and model abstractions been evaluated, and have the bases for accepting preferred models been documented?
8. Are the bases for extrapolating data over long times or distances scientifically valid?
9. Can the repository and waste package designs be implemented so that the engineered and natural barriers perform as expected?
10. To the extent practical, have other lines of evidence, derived independently of performance assessments, been used to evaluate confidence in model estimates?

In evaluating the DOE's work related to individual natural and engineered components of the proposed repository system, the Board found varying degrees of strength and weakness. For example, the Board considers the DOE's estimates of the probabilities of

volcanic events and earthquakes at Yucca Mountain strengths, while the lack of data related to corrosion of materials proposed for the waste packages under conditions that would likely be present in the repository and the very short experience with these materials are considered weaknesses.

This kind of variability is not surprising, given that the Yucca Mountain project is a complex, and in many respects, a first-of-a-kind undertaking. An important conclusion in the Board's letter is that when the DOE's technical and scientific work is taken as a whole, the Board's view is that the technical basis for the DOE's repository performance estimates is weak to moderate at this time.

The Board made no judgment in its January 24 letter on the question of whether the Yucca Mountain site should be recommended or approved for repository development. Those judgments, which involve a number of public-policy considerations as well as an assessment of how much technical certainty is necessary at various decision points, go beyond the Board's congressionally established mandate.

Let me explain in a little more detail, Mr. Chairman, the bases for the Board's conclusion on performance estimates. The DOE uses a complex, integrated performance assessment model to project repository system performance. Performance assessment is a useful tool because it assesses how well the repository system as a whole, not just the site or the engineered components, might perform. However, gaps in data and basic understanding cause important uncertainties in the concepts and assumptions on which the DOE's performance estimates are now based. Therefore, while no individual technical or scientific factor has been identified that would automatically eliminate Yucca Mountain from consideration at this point, the Board has limited confidence in current performance estimates generated by the DOE's performance assessment model. As I will discuss in just a moment, the Board believes that confidence in the DOE's projections of repository performance can be increased.

But first let me clarify the comment I just made on the current state of knowledge of technical and scientific factors that could potentially eliminate Yucca Mountain from consideration. The Board considers the very precise statement in its letter that *at this point, no individual technical or scientific factor has been identified that would automatically eliminate Yucca Mountain from consideration a necessary condition for a discussion of site suitability to take place.* But this threshold condition, by itself, is not necessarily sufficient for a definitive determination of site suitability.

How can confidence in the DOE's performance estimates be increased? As noted in the Board's letter, the Board believes that a fundamental understanding of the potential behavior of a proposed repository system is very important. Therefore, if policy-makers decide to approve the Yucca Mountain site, the Board strongly recommends that, in addition to demonstrating regulatory compliance, the DOE continue a vigorous, well-integrated scientific investigation to increase its fundamental understanding of the potential behavior of the repository system. Increased understanding could show that components of the repository system perform better than or not as well as the DOE's

performance assessment model now projects. In either case, making performance projections more realistic and characterizing the full range of uncertainty could increase confidence in the DOE's performance estimates.

The DOE's estimates of repository performance currently rely heavily on engineered components of the repository system, making corrosion of the waste package very important. As the Board has mentioned in many of its previous reports and letters over the last 11 years, we believe that high temperatures in the DOE's base-case repository design increase uncertainties and decrease confidence in the performance of waste package materials. It is possible that confidence in waste package and repository performance could increase if the DOE adopts a low-temperature repository design. However, the Board continues to believe that the DOE should complete a full and objective comparison of high- and low-temperature repository designs before it selects a final repository design concept.

Over the last several years, the Board has made several other recommendations that could increase confidence in the DOE's projections of repository performance. For example, the Board recommended that the DOE identify, quantify, and communicate clearly the extent of the uncertainty associated with its performance estimates. The Board also recommended that the DOE use other lines of evidence and argument to supplement the results of its performance assessment. Moreover, the DOE could strengthen its arguments about how multiple barriers in its proposed repository system provide "defense-in-depth" (or redundancy). Although the DOE has made progress in each of these areas, more work is needed.

Other actions that might be considered if policy-makers approve the Yucca Mountain site include systematically integrating new data and analyses produced by ongoing scientific and engineering investigations; monitoring repository performance before, during, and after waste emplacement; developing a strategy for modifying or stopping repository development if potentially significant unforeseen circumstances are encountered; and continuing external review of the DOE's technical and scientific activities.

Mr. Chairman, eliminating all uncertainty associated with estimates of repository performance would never be possible at any repository site. Policy-makers will decide how much scientific uncertainty is acceptable at the time various decisions are made on site recommendation or repository development. The Board hopes that the information provided in this testimony and in its letter report to Congress and the Secretary will be useful to policy-makers faced with making these important decisions.

Not surprisingly, Mr. Chairman, people have drawn from the Board's January 24 letter the points that support their case. The Board is concerned, however, that lifting individual statements from the letter and using them without context can be confusing for policy-makers and the public. Therefore, we urge those charged with making decisions about Yucca Mountain to consider the full text of our 3-page letter.

Thank you very much, Mr. Chairman. I will be happy to respond to questions.