

Statement on Behalf of the Nuclear Waste Technical Review Board

Jared L. Cohon

Chairman

May 8, 2001

Arlington, Virginia

At our last meeting in Amargosa Valley, I stated that the Board believes that the DOE should focus significant attention on four priority areas, each of which the Board considers an essential element of any DOE site recommendation. The four areas are:

- (1) Meaningful quantification of conservatisms and uncertainties in DOE's performance assessments
- (2) Progress in understanding the underlying fundamental processes involved in predicting the rate of waste package corrosion
- (3) An evaluation and a comparison of the base-case repository design with a low-temperature design
- (4) Development of multiple lines of evidence to support the safety case of the proposed repository. The lines of evidence should be derived independently of performance assessment and thus not be subject to the limitations of performance assessment.

The Board also enumerated several specific investigations and studies that could support, complement, and supplement the four areas. By pursuing each of the four areas, the Board believes that the DOE can increase the technical defensibility of its repository safety case, thereby providing a sounder basis for those siting decisions.

In subsequent conversations with a number of parties, two questions kept arising.

- (1) Why were the four priority areas chosen?
- (2) In the Board's opinion, should work on all four areas be completed before the Secretary of Energy decides whether to recommend to the President that the Yucca Mountain site be developed as a repository?

Let me now provide the Board's answer to the first of those questions: Why were the four priority areas chosen?

Three of the Board's priority areas were chosen to improve the quality of performance assessment calculations, a key element of the repository safety case.¹ Uncertainty is unavoidable when making projections over long time periods. The uncertainty may arise, for example, from poor estimates of model parameters or from models that have not been validated adequately.

¹ The Board has stated on a number of occasions that it endorses the use of performance assessment, including sensitivity and uncertainty analyses, as a technique for projecting the behavior of a repository over very long time periods. It also has stated that performance assessment is "the appropriate core analytical tool of the safety case." (Nuclear Waste Technical Review Board, *Moving Beyond the Yucca Mountain Viability Assessment*, April 1999, p. 9.) Moreover, the Board understands why performance assessment offers an attractive tool for determining compliance with regulations.

The uncertainty also can arise from an inability to anticipate important scenarios. Furthermore, as the Board observed in its letter to Representative Joe Barton, “It is difficult to know with the assumptions and parameters used in the DOE’s performance assessments are truly conservative or how the combination of conservative, optimistic, and realistic estimates affects overall dose calculations and the uncertainties associated with those calculations.”² By meaningfully quantifying the conservatisms and uncertainties, the first of the Board’s priority areas, the DOE will give policy-makers a clearer idea not only of the expected performance of the proposed repository but also of the likelihood that the performance can be counted on.

The second priority area is progress in understanding fundamental corrosion processes. Because the waste package appears to play a central role in isolating waste from the environment, fundamental understanding of corrosion mechanisms, especially the relationship between corrosion rates and increased temperature, is needed to ensure that this barrier will function as anticipated and that long-term extrapolations will be sound. Although we have the understanding and empirical foundation to predict confidently whether the passive layers that retard corrosion of the waste package will remain effective over a hundred or so years, we appear to have much less empirical evidence or scientific understanding to extrapolate that behavior convincingly over many thousands of years. In short, the DOE still has a way to go before its predictions are persuasive.

The third priority area is an evaluation and a comparison of the base-case repository design with a low-temperature design. The waste’s temperature is a major perturbation of the natural system, and temperature may affect the performance of critical engineered barrier systems. Low-temperature ventilated designs can potentially simplify performance assessment and reduce uncertainty. Thus, it is highly desirable that repository designs having different thermal characteristics be understood better and that a comparison of designs be made both for the designs’ expected performance and for the uncertainties associated with that performance.

The fourth priority area, the need for multiple lines of evidence, arises from the need for alternatives to the performance assessment methodology. Although the Board has endorsed performance assessment as an important element of the repository safety case, it has observed that, for each of the components embedded within a performance assessment, “methodological and empirical assumptions have to be made. Thus, uncertainties will unavoidably accumulate. They will be large, and they will become even larger as the time horizon for the performance projections reaches farther into the future.”³

For this reason, one must view with caution the conclusions generated solely by performance assessment. Indeed, in its 1999 report on DOE’s *Viability Assessment*, the Board noted the limits of performance assessment and expressed doubt that relying “solely on [it] to demonstrate repository safety” will ever be possible.⁴ Therefore, the Board consistently has recommended that additional lines of evidence be used to overcome performance assessment’s limitations and to increase confidence in performance assessment’s conclusions.⁵ The more these lines of

² Letter from Jared L. Cohon to Representative Joe Barton, August 31, 2000, p. 3.

³ Letter from Jared L. Cohon to April Gil; April 15, 1997.

⁴ Nuclear Waste Technical Review Board, *Moving Beyond the Yucca Mountain Viability Assessment*, April 1999, p. 10.

⁵ See, for example, letter from Jared L. Cohon to Ivan Itkin; March 20, 2000; p. 2.

evidence are independent of performance assessment, the more likely they can be used to bolster the assessment's conclusions.

Now let me address the second question. In the Board's opinion, should work in all four priority areas be completed on these four areas before the Secretary of Energy makes a recommendation about developing a repository at Yucca Mountain?

The Board has observed that the decision to proceed with a Yucca Mountain repository can be made at any time, depending on how much uncertainty policy-makers find acceptable. There is, of course, no unambiguous and consensual uncertainty threshold. Any given level may be tolerable to some but unacceptable to others. Thus, this is a matter of policy, albeit one that needs to be grounded in sound science. Policy-makers, not scientists should make the decision.

The DOE may decide to make a recommendation about Yucca Mountain before it completes all work in these four priority areas. The Board, however, believes that it is reasonable to assume that the more those investigations have advanced, the more likely it is that the technical basis for the decision will be strengthened. Whenever a recommendation is made, the Board's judgment about the technical basis will be based on the repository safety case as it exists.