



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

March 28, 2012

The Honorable Peter Lyons
Assistant Secretary for Nuclear Energy
Office of Nuclear Energy/NE-1
U.S. Department of Energy
1000 Independence Avenue, SW
Washington DC 20585

Dear Dr. Lyons:

It was a pleasure to have you participate in the Board's January 9, 2012, meeting held in Arlington Virginia. Among the issues discussed at that meeting was integration within the Department of Energy's Office of Nuclear Energy (DOE-NE), including the Office of Fuel Cycle Technologies. I am writing to provide the Board's feedback on those discussions and on information presented by you and your staff. This letter also contains Board comments on deep borehole disposal based on information presented by representatives of DOE-NE and Sandia National Laboratories at the Board meeting held in Albuquerque, New Mexico on March 7, 2012.

The Board found informative your discussion of the mission of your Office and your candid response to questions at the January meeting. Clearly the focus of DOE-NE continues to be the development of reactor and fuel-cycle technologies. However, the transfer to DOE-NE of many of DOE's responsibilities under the Nuclear Waste Policy Act provides real opportunities for integrating DOE work across the nuclear fuel-cycle. Even though this arrangement may eventually change as a result of, among other things, the recommendations of the Blue Ribbon Commission on America's Nuclear Future (BRC), the Board recommends that DOE-NE place a particular emphasis on integration, both within its own programs and with other DOE programs that will have an impact on the management of spent nuclear fuel and high-level radioactive waste in the United States.

Fuel Cycle Integration and Evaluation

The technical and institutional complexities of integrating activities throughout current as well as possible future nuclear fuel cycles were well illustrated in Deputy Assistant Secretary Dr. Monica Regalbuto's presentation. For example, the mix of public organizations and private sector firms that may be responsible for various elements of the fuel cycle presents challenges for effectively integrating the entire enterprise that are less daunting in countries such as France and Sweden.

Consequently, the Board strongly encourages DOE to engage the nuclear utilities regularly and fully as it maps out approaches for managing the backend of the fuel cycle as currently configured and as it investigates and considers other potential strategies for managing the backend of the nuclear fuel cycle. The importance of this engagement was reinforced in talks by Dr. Roald Wigeland, Mr. Jeffrey Williams, and Dr. Ernest Hardin. Each of these speakers described strong interdependencies among various elements of the nuclear fuel cycle and the need to ensure that the “pieces” fit together well. Dr. Wigeland detailed the early stages of a comprehensive fuel-cycle evaluation project that is not expected to be completed for more than two years. Because of the study’s current status and the time constraints imposed by the meeting schedule, this talk could not address many key issues that are necessary to evaluate the study’s technical validity. These include (1) criteria used to determine whether a fuel cycle is “promising;” (2) metrics developed to operationalize the criteria; and (3) trade-offs made among outcomes, some of which will inevitably conflict.

Based on information published by DOE-NE¹ as well as other documents the Board has reviewed, the Board offers the following words of caution.²

- *There seems to be a risk that comprehensiveness will be purchased at the price of relevance.* Many potential nuclear fuel cycles are conceivable in the abstract, but few seem to have been developed to the extent that their attributes can be evaluated effectively, and even fewer appear to have the potential to be deployed at commercial scale in the next 50 or so years. Although the study concluded that approximately 25 percent of the initial number of groupings were not promising and thus could be eliminated from further consideration, the Board believes that opportunities exist for additional reductions without serious risk of losing options that offer significant benefits in comparison with the ones retained.
- *Simplifying the analysis would have the added benefit of increasing the timeliness of its results.* This could be particularly useful to DOE-NE in preparing the administration’s response to the recommendations of the BRC.
- *The methodological challenges to carrying out this type of evaluation are significant.* Developing appropriate metrics for some of the evaluation criteria, such as proliferation risk, institutional issues, and even waste management considerations, raises serious measurement and conceptual issues. These challenges should carefully be considered by DOE-NE as it moves forward with this analysis. In addition, the metrics that are developed and how they are traded off should be exposed to broad stakeholder review.
- *Only a very abbreviated description of the study is available publicly.* Because the conclusions developed from this work are dependent to a great extent on the evaluation criteria adopted, early publication of these criteria and exchanges with interested and affected parties would be valuable.

¹ “A Screening Method for Guiding R&D Decisions: Pilot Applications to Nuclear Fuel Cycle Options,” Department of Energy, Office of Nuclear Energy, August, 2011.

² These are broadly consistent with the comments presented at the June 15, 2011, meeting of the Nuclear Energy Advisory Committee and those prepared by the study’s internal peer review group.

- *The conclusions of this study should not be pushed beyond what can reasonably and conservatively be inferred.* The results of this study should be used as one of many decision-aiding tools and inputs as DOE-NE makes investments in fuel cycle research and development.

Effects of Waste Package Sizes

The paired presentations by Mr. Williams and Dr. Hardin on waste package sizes and repository thermal analysis, respectively, conveyed an essential message: Decisions about waste packaging and storage that have been or are being taken may have a profound effect on repository design. For, example, disposing of the large waste packages currently being loaded by utilities may require substantial operational and engineering interventions³ to avoid exceeding repository temperature limits, especially in a geologic repository constructed in clay/shale or crystalline rock formations.

As we heard at the meeting, the prospect of having to repackage spent nuclear fuel is not a welcome one, especially if the repackaging has to be carried out at reactor sites. The Board believes that DOE should consider the existing and expected inventory of spent nuclear fuel in storage as a waste form that needs to be accommodated in a geological repository. By doing so, the costs and risks associated with repackaging a substantial amount of spent nuclear fuel could be avoided.

Work to Prepare for Geologic Disposal

As you know, the Board, along with most other commenters, strongly concurs with the finding by the BRC that deep geological disposal is the most promising and accepted method currently available for safely isolating high-level radioactive waste and spent nuclear fuel. Because of this strong consensus, the Board believes that work on the following activities can and should begin without delay.

- Generic repository site-selection criteria are clearly needed. As a starting point for this work, it is very important that DOE-NE take into account past efforts to specify siting criteria in this country and abroad. The Board is considering publishing its own survey of past siting initiatives worldwide later this year.
- Regardless of what geological formation will host this country's repository, it remains essential that there is a realistic understanding of the radiation source term, particularly with respect to the processes involved in mobilizing the waste. Such fundamental understanding is a prerequisite for evaluating the effects of the release of dose-contributing radionuclides.
- Because of the prospect that spent nuclear fuel will remain in storage for extended periods, fuel-degradation mechanisms, especially for high-burnup fuel, need to be better understood, both with respect to the requirement for transportation from reactor sites and as input to analysis of the radiation source term.

³ These might include extended cooling at the surface, greater spacing between packages in the repository, and selection of a mix of hotter and cooler fuel assemblies for loading into containers for repository disposal.

DOE Activities Related to Deep Borehole Disposal

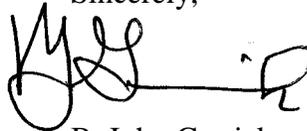
At the Board's March 7 meeting in Albuquerque, Dr. Bill Arnold of SNL and Dr. Steven Ingebritsen of the United States Geological Service participated in a panel on deep borehole disposal. This was a most interesting panel and resulted in considerable discussion within the Board.

The Board has recommended in recent reports and correspondence that consideration be given to using different methods of geologic disposal for different high-activity wastes, depending on the potential for reuse of materials that can be recovered from the waste. For example, deep borehole disposal could prove to be a suitable option for disposing of long-lived minor actinides or vitrified fission products, which have no apparent reuse value. The Board understands, however, that there may be significant complications in using deep borehole disposal for other wastes. For example, current technology for borehole construction would require spent fuel to be repackaged into smaller diameter containers to fit the borehole and this increased handling of spent fuel would be, at best, highly undesirable.

In the Board's view, research related to deep borehole disposal should not delay higher priority research on a mined geologic repository. However, if that condition can be met, the Board believes that DOE should continue its research on deep borehole disposal. This should include an analysis of the real costs of activities associated with deep borehole disposal, including a realistic assessment of the site-characterization effort that would be needed and an accounting of potential additional exposures to workers from the increased fuel handling that would be required to consolidate and repackage fuel rods. This information would provide a realistic basis for comparison with other geologic disposal options.

Once again, I would like to record the Board's appreciation for the participation of DOE-NE and SNL staff at the Board's meetings in January and March.

Sincerely,

A handwritten signature in black ink, appearing to read 'B. John Garrick', with a horizontal line extending to the right.

B. John Garrick
Chairman