



# U.S. NUCLEAR WASTE TECHNICAL REVIEW BOARD

## SYNOPSIS OF BOARD REPORT

### EVALUATION OF TECHNICAL ISSUES ASSOCIATED WITH THE DEVELOPMENT OF A SEPARATE REPOSITORY FOR U.S. DEPARTMENT OF ENERGY-MANAGED HIGH-LEVEL RADIOACTIVE WASTE AND SPENT NUCLEAR FUEL

#### OVERVIEW

As part of its ongoing review of the technical and scientific validity of U.S. Department of Energy (DOE) activities related to spent nuclear fuel (SNF) and high-level radioactive waste (HLW) disposition, in June 2015, the U.S. Nuclear Waste Technical Review Board (Board) released a report, *Evaluation of Technical Issues Associated with the Development of a Separate Repository for U.S. Department of Energy-Managed High-Level Radioactive Waste and Spent Nuclear Fuel*. The report can be found [at http://www.nwtrb.gov/reports/disposal\\_options.pdf](http://www.nwtrb.gov/reports/disposal_options.pdf). Following is a synopsis of the report, including Board findings and recommendations.

#### BACKGROUND

The Nuclear Waste Policy Act (NWPA) called for a Presidential decision about whether the development of a repository specifically for the disposal of HLW resulting from atomic energy defense activities was “required” and defined six factors to be considered in making such a decision.

Based on an evaluation by DOE of the need for a separate repository, President Ronald Reagan determined in 1985 that defense HLW and SNF should be disposed of in a repository with commercial SNF and HLW. As a result, the prevailing assumption of the U.S. nuclear waste management and disposal program has been that defense HLW and SNF would be commingled in the same repository as commercial HLW and SNF. The relative volumes of SNF and HLW, existing and in 2048 (DOE’s projected date for an operating repository), are shown in Figure 1.

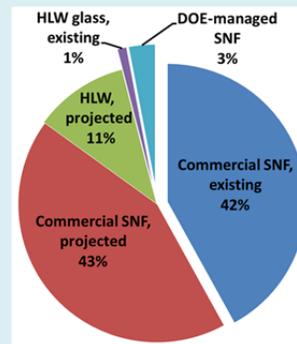
In 2010, at the direction of President Barack Obama, Secretary Steven Chu

#### COMMERCIAL SPENT NUCLEAR FUEL AND DOE-MANAGED SPENT NUCLEAR FUEL AND HIGH-LEVEL RADIOACTIVE WASTE

Commercial SNF is discharged from commercial nuclear power plants when it is no longer useful for producing power, and stored in pools and dry-storage casks at the reactor sites.

DOE-managed SNF comprises a broad-range of fuels, primarily from atomic energy defense activities. A smaller amount is from DOE research and development activities, domestic and foreign research reactors, and commercial sources.

HLW is intensely radioactive material separated during reprocessing of SNF. Most DOE-managed HLW comes from DOE defense-related nuclear activities.



**Figure 1. Relative Volumes of U.S. SNF and HLW, Existing, and Projected in 2048.**

Source: SNL (2014). Volume estimates are based on several assumptions discussed in the SNL Report and the figure does not reflect the projected change in the volume of DOE-managed SNF.

established the Blue Ribbon Commission on America’s Nuclear Future (BRC) to make recommendations on a path forward for the disposition of SNF and HLW. In January 2012, the BRC recommended that DOE revisit the commingling question and carry out a new evaluation (BRC, 2012). In an October 2014 report, DOE recommended disposal of some DOE-managed HLW and SNF in a separate geologic repository, including the possibility that small waste forms might be disposed of in deep boreholes (DOE, 2014). A comparison of the concepts of a mined geologic repository and disposal in deep boreholes is shown in Figure 2.

Subsequently, DOE completed a reevaluation of the need for a separate repository for defense waste on the basis of the six factors identified in the NWPA. The reevaluation was presented in DOE’s *Report on Separate Disposal of Defense High-Level Radioactive Waste* released in March 2015. On March 24, 2015, President Barack Obama issued a Presidential Memorandum with a finding that “the development of a repository for the disposal of high-level radioactive waste resulting from atomic energy defense activities only is required.”

### BOARD REVIEW

Developing a separate repository for defense HLW represents a fundamental shift in policy for managing radioactive waste in the United States. Such a facility might also include defense SNF, depending on legal interpretations of DOE’s authority under the Atomic Energy Act. The Board reviewed the technical implications of the two reports cited above, along with supporting studies prepared by DOE, and identified four technical areas that DOE should address in greater depth: 1) performance of repositories developed in different host rock types, 2) waste form characteristics, 3) the need for additional research and development activities, and 4) the implications of disposal in deep boreholes. Technical recommendations from the Board’s June 2015 report are presented on the following page.

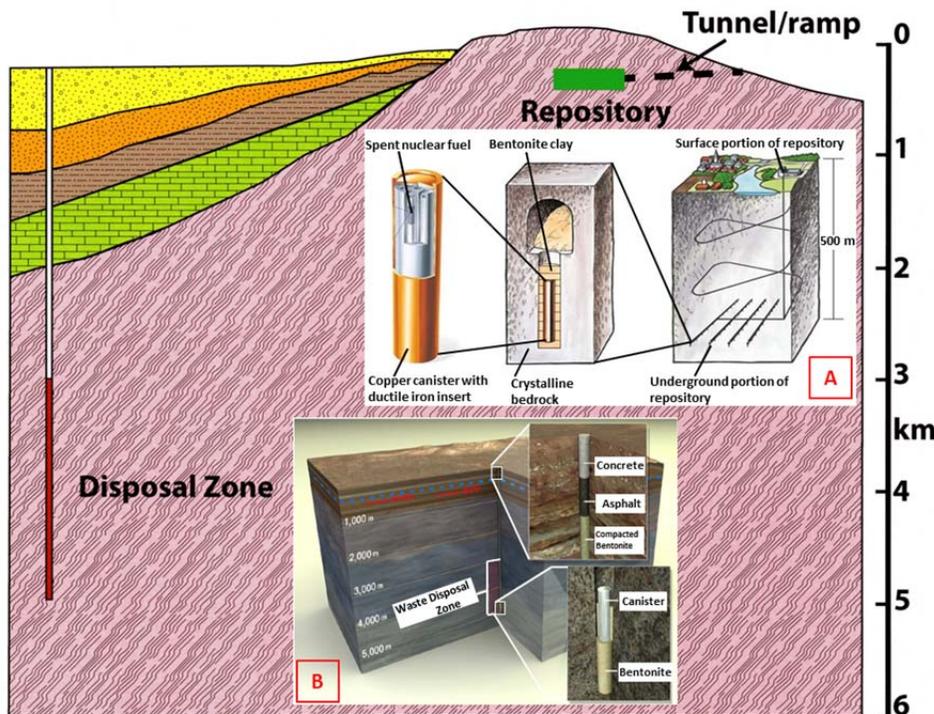


Figure 2. Comparison of the Concepts of a Mined Geologic Repository and Disposal in Deep Boreholes.

Inset A illustrates details of the KBS-3 concept for a mined repository (SKB, 2011). Inset B depicts a concept for disposal in deep boreholes that includes asphalt seals and bentonite surrounding the canisters (Arnold *et al.*, 2011).

## BOARD RECOMMENDATIONS

Based on its review of DOE documents, the Board made the following recommendations.

- 1) Consider waste form performance in different host-rock types after degradation of the waste package in future assessments. Much information can be obtained initially by looking at the performance of commercial SNF and vitrified HLW in different host-rock types.
- 2) Develop a better understanding of the degradation rates of DOE SNF in potential repository geologic environments, particularly the DOE SNF types that could contribute most to radionuclide release and calculated dose, to improve the basis for the separate repository safety assessment.
- 3) Evaluate approaches, benefits, and costs of repackaging cooler naval SNF into smaller disposal packages.
- 4) Conduct research on borehole sealing technology and assess whether more robust engineered barriers might be required for disposing of selected waste forms in deep boreholes.

## REFERENCES

- Arnold, B.W., P.V. Brady, S.J. Bauer, C. Herrick, S. Pye, and J. Finger. 2011. *Reference Design and Operations for Deep Borehole Disposal of High-Level Radioactive Waste*. SAND2011-6749. Albuquerque, NM: Sandia National Laboratories.
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- SNL (Sandia National Laboratories). 2014. *Evaluation of Options for Permanent Geologic Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste in Support of a Comprehensive National Nuclear Fuel Cycle Strategy, Volume I and Volume II (Appendices)*. SAND2014-0187P (Vol. I); SAND2014-0189P (Vol. II) Albuquerque, NM: Sandia National Laboratories.

**The U.S. Nuclear Waste Technical Review Board** is an independent federal agency established in the 1987 Nuclear Waste Policy Amendments Act.

The Board evaluates the technical and scientific validity of U.S. Department of Energy activities related to implementing the Nuclear Waste Policy Act. The Board also provides objective expert advice on nuclear waste management and disposal issues to Congress and the Secretary of Energy.

The Board's eleven members are nominated by the National Academy of Sciences and are appointed by the President.