

Session 1: Reprocessing and Disposal of Spent Nuclear Fuel

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Summary

Juhani Vira (Posiva Oy) outlined the events and the process that enabled Finland to open Onkalo, the world's first approved repository for high-level waste (HLW), which is, primarily, spent nuclear fuel (SNF). When in the 1980s Finland decided not to pursue reprocessing, Finnish nuclear company TVO set out to find an SNF repository through a stepwise approach: first, identifying geologically-suitable sites and, then, letting the public decide which site would host the repository, thus minimizing public opposition. Using Sweden's KBS-3 HLW disposal technology and enjoying widespread political support, Onkalo began being built underground near the nuclear reactors at Olkiluoto in 2004.

Andrew Orrell (Sandia National Laboratory) highlighted the fundamental need for an SNF repository in the United States. Since in 2009 the Obama administration opposed the repository site at Yucca Mountain, it is unclear how the country will meet this need. Orrell drew attention to draft recommendations 1, 2, and 4 of the Blue Ribbon Commission (BRC) on America's Nuclear Future¹ and to the large amount of SNF currently stored across the United States (65, 000 metric tons) to make the point that the United States must embark on a new stepwise and voluntary process to open an SNF repository, regardless of whether it also considers reprocessing. Even with a hypothetical significant reprocessing capability in 10-15 years, the United States would still have a backlog of HLW to dispose of, so efforts to identify a repository must be undertaken now. In light of the uncertainty around U.S. SNF management, the following options should be kept under consideration: deep borehole

¹ See the *Disposal Subcommittee Report to the Full Commission – DRAFT* available at: http://brc.gov/sites/default/files/documents/draft_disposal_report_06-01-11.pdf.

disposal of HLW, and keeping a fraction of SNF in a “strategic reserve” in long-term interim storage (in case the United States decides to pursue reprocessing). The question “Is SNF an asset to be stored and reprocessed, or a waste to be disposed of?” does not have a clear-cut answer—it can be both.

Alan Hanson (Stanford University) delineated the main reasons for which countries pursue reprocessing:

- Resource conservation. Reprocessing recovers unburned uranium and plutonium, which displaces the need for more mining or enrichment.
- Energy security. Countries with nuclear energy programs most often have to import uranium from other countries, which makes the former dependent on the latter.
- Waste management. Reprocessing reduces the volume of SNF, but not the amount of heat generated by the SNF (which is a determining factor of the size of the repository), unless reprocessing is done early enough to remove most of the plutonium-241 before it decays into significant quantities of americium-241 (which has a high heat output).
- Nonproliferation. It can be argued that since reprocessing destroys or denatures plutonium, it is helpful to nonproliferation efforts. However, in the course of reprocessing, plutonium is separated, which is a proliferation concern. Reprocessing therefore requires rigorous safeguards.

Hanson also explained that the cost of a reprocessing complex can only be justified if it is paired with a large domestic nuclear energy program (of the order of 20-40 reactors) that can provide sufficient return on the big investment that is reprocessing.

Charles McCombie (Association for Regional International Underground Storage) focused on the issues that countries with small, new nuclear energy programs, such as the United Arab Emirates, face. To manage its SNF, this type of country has the choice between getting a larger country to take back its SNF and participating in a multilateral option (perhaps along the lines of the European Repository Development Organisation²). Deep

² For more information, see: <http://www.arius-world.org/>.

Session Sketches

borehole disposal may also be an attractive option for new nuclear countries. McCombie reiterated that, with any type of fuel cycle (open or closed), geological disposal is always needed. Governments must therefore develop a credible strategy—that gains public support by way of safe technology, available funding, and a viable siting process—towards securing a repository.

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