

Solving the back end: Finland's key to the final disposal of spent nuclear fuel

By Irena Chatzis



Entrance to ONKALO, Finland's repository for spent nuclear fuel

(Photo: Posiva)

“Since the decision was made 40 years ago on the overall waste management strategy and on a deep geological repository as the primary option for spent nuclear fuel, all the stakeholders have stood by it. Governments and people have changed, but the decision and the vision for the future have remained the same.”

— Tiina Jalonen, Senior Vice President for Development, Posiva

Countries operating nuclear power plants store their spent nuclear fuel either at reactor sites or away from them. Spent fuel can be dangerous to people and the environment if not properly managed; therefore, a publicly acceptable, permanent solution for its disposal is needed (see box). While a number of countries are considering deep geological disposal repositories, Finland is the only country that has begun the construction of a repository for the final disposal of its spent nuclear fuel.

Finland's recipe for success

At a depth of 400-450 metres and with about 70 km of tunnels and shafts, the ONKALO repository in Olkiluoto on Finland's west coast will house copper canisters filled with spent fuel from nuclear power reactors. It is expected to receive waste for about 100 years, after which time it will be sealed.

“Since the decision was made 40 years ago on the overall waste management strategy and on a deep geological repository as the primary option for spent nuclear fuel, all the stakeholders have stood by it,” said Tiina Jalonen, Senior Vice President for

Development at Posiva, the company in charge of the project. “Governments and people have changed, but the decision and the vision for the future have remained the same.”

Another reason why Finland's model has worked is the timely involvement of all the stakeholders in the project, who worked as one team, targeting the same goal.

“The roles between the different stakeholders have been clear. The decision makers have developed legislation in parallel to introducing nuclear energy, and the Radiation and Nuclear Safety Authority of Finland (STUK) has developed safety guides, regulations and competences to review and inspect our documentation and applications,” said Jalonen.

Moreover, involving STUK from the beginning was crucial to building the trust in the project. “It wouldn't have worked if any of the stakeholders were missing from the process,” explained Petteri Tiippana, Director General at STUK. “Active participation of the safety regulator provided the local community with additional assurances.”

In fact, public acceptance was crucial for the success of the project. The selection of the Olkiluoto site — home to three nuclear reactors — as the repository site was made, not only for the geological suitability of this area, but also for the acceptance of the people living there. Finland conducted many studies about local and national attitudes toward the project, which showed that people living around nuclear power plants tend to have more trust in nuclear projects.

“Trust has been one cornerstone in being able to proceed according to the Government’s schedule,” Jalonon said. “Building trust has required extensive and open communication with local people, the authority and the decision makers.”

The project is based on the “multiple barriers” concept, which aims to provide needed containment and isolation to prevent spent fuel from leaking and spreading, according to Posiva. The combination of bedrock, disposal canisters surrounded by clay, tunnels filled with clay containing backfilling materials and plugging the tunnel’s mouth will all serve as protective multiple barriers.

Who’s next?

Two other countries have made progress towards building repositories for high-level radioactive waste or spent fuel declared as waste. In June 2016, the Swedish Radiation Safety Authority endorsed the licence application for the future spent fuel deep geological repository at Forsmark. Review by the Swedish Land and Environment Court for environmental licencing of the project started in September 2017.

WOMEN IN NUCLEAR

Laurie Swami

President and CEO, Nuclear Waste Management Organization (NWMO)



Ms. Swami is responsible for implementing Canada’s plan for the long-term management of used nuclear fuel. She previously served as Senior Vice-President of Decommissioning and Nuclear Waste Management at Ontario Power Generation (OPG), where her responsibilities included overseeing operation of OPG’s nuclear waste management facilities, as well as implementing OPG’s deep geological repository for low and intermediate-level nuclear waste. She began her career at OPG in 1986 and held various roles with increasing responsibility in the Nuclear Division.

“The safe, long-term management of used nuclear fuel is an important responsibility we have towards future generations. Fortunately, nuclear waste management organizations around the world, including ours in Canada, are building momentum and taking concrete action to implement plans in a manner that protects both people and the environment.”

In France, the licence application for the deep geological disposal facility, Cigéo, is under preparation; it is planned to be submitted by the end of 2018, with construction starting in 2020. The pilot phase of disposal could start as soon as 2025. It will contain waste from the reprocessing of spent fuel from France’s current fleet of nuclear power plants and other long-lived radioactive waste.

THE SCIENCE

High-Level Radioactive Waste (HLW) is produced from the burning of uranium fuel in nuclear power reactors. It is of two kinds: spent fuel, declared as waste and ready for disposal, or waste resulting from the reprocessing of spent fuel.

Due to its high radioactivity and very long half-life (the time it takes for a radioactive substance to lose half its radioactivity), HLW has to be well contained and isolated from the human environment. Intensive research has identified the suitability of various rock types to host deep geological repositories and engineered barrier systems to isolate the waste. These repositories are constructed in suitable geological formations at a depth of several hundred meters and designed to contain high-level waste for hundreds of thousands of years.