Canada’s first deep geological repository site is selected

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On Nov. 28, 2024, the Canadian Nuclear Waste Management Organization (NWMO) announced that the Wabigoon Lake Ojibway Nation (WLON) and the township of Ignace in the province of Ontario were selected as host communities for a repository to be constructed on Revell Lake.

The NWMO began its search in 2010 and initially considered 22 potential sites. The NWMO narrowed the site selection process to the following two locations:

- The Wabigoon Lake Ojibway Nation-Ignace area, approximately 250 kilometres northwest of Thunder Bay, Ontario; and
- The Saugeen Ojibway Nation-South Bruce area in southern Ontario, about 130 kilometres northwest of London.

The final consent-based selection process for the estimated $26 billion project between the two sites took years. The NWMO sought consensus and strong willingness for the 175-year project from the municipalities and the Indigenous communities located near each proposed site.

Votes held by the municipalities and the First Nations communities garnered different results. Notably, a poll held in the municipality of Ignace resulted in a 77.3 per cent ‘yes’ vote and a vote held by the Wabigoon Lake Ojibway Nation also signalled support for the process to move forward.

What is a deep geological repository?

Currently, spent nuclear fuel (SNF) from Ontario’s nuclear fleet is stored in interim waste facilities located in the Province of Ontario.

A deep geological repository (DGR) is a long-term solution to store SNF using a combination of engineered and natural barriers to protect against radioactive dangers over a long time horizon, ideally tens of thousands of years.

DGRs are not a novel approach. Canada already has one in operation: the Giant Mine Remediation Project near Yellowknife, Northwest Territories for arsenic trioxide dust.

Similar facilities for potash operate in Germany. The WLON-Ignace DGR will be one of the world's first DGRs for radioactive waste from SNF.

Most countries using nuclear fuel for commercial power production intend to store their SNF in a DGR.

Global spent nuclear fuel

As of 2017, an estimated 400,000 metric tons of spent nuclear fuel were held in temporary storage around the world.

SNF is currently held in dozens of different countries and often at various sites within these jurisdictions. There are different risk profiles on the fissile nature of the SNF. However, plutonium and uranium have the highest concern relating to non-proliferation. Currently, most SNF is held in storage ponds, with the remainder stored in dry casks.

SNF is dense. Canada's share of the world's SNF could fit into a space the size of 7 hockey rinks if stacked to the top of the boards. As a result of a 2002 study at the request of the Government of Canada, NWMO identified three approaches to manage SNF in the long term and in 2007, DGRs were adopted as Canada's long-term solution.

Finland's Onkalo spent nuclear fuel repository

While the NWMO DGR is Canada's first, the *world's first* civilian geological disposal facility will be located deep in the bedrock of Olkiluoto Island, Finland. The island is home to Finland's three nuclear reactors, which generate 33 per cent of the country's electricity.

Similar to the NWMO process in Canada, site selection commenced in 1983 by screening Finland's entire territory. The selection was narrowed down to four sites by 1993 based on geological and environmental factors. The sites were further narrowed down based on local opinions, leaving two. Ultimately, the Eurajoki region (where Olkiluoto Island is located) was selected based on its most favourable geology and proximity to an existing nuclear power station.

The Finnish government ratified this decision in 2001 and construction began in 2004.

Expected construction costs were calculated at 503 million euros in 2003. According to the BBC, the actual investment cost was around 1 billion euros as of late 2023. Despite the massive scale of this first-of-its-kind project, the Onkalo DGR's construction schedule (which is divided into phases) remains within projected timelines.

The first trial run was completed in August 2024. The facility is expected to be operational from 2026 until 2100.

Next steps for the Ignace DGR

A few factors seem to have made Finland's DGR successful so far.

YIMBYism – The Onkalo DGR is located in close proximity to the Olkiluoto Nuclear Power Plant. An existing level of approval on Olkiluoto Island enabled the build via public opinion despite some initial objections. According to a report provided to the Nuclear Energy Agency, “The goal of the site-selection process is to identify a licensable site with host community support, rather than trying to identify the optimal site.” Ultimately, the Onkalo site was selected for the highest host community support.

Consent-based site selection process – There is a high level of support in Finland for nuclear power. A 2023 survey found that 68 per cent of respondents were in favour of nuclear power, with just 6 per cent in opposition. However, communities being considered could withdraw voluntarily from consideration at any time.

On-time – Onkalo was constructed by Posiva, a private entity jointly owned by Fortum, a public Finnish energy organization, and TVO, a private nuclear power company owned by a consortium of private energy companies. Posiva built the Onkalo DGR on a timeline close to what was initially proposed, bolstering public opinion of the project.

While the DGR site selection closed a decades-long chapter in the search for somewhere to store Canada’s SNF safely, the NWMO’s challenges are far from over. On Dec. 20, 2024, the Eagle Lake First Nation (ELFN) submitted a court filing to challenge the NWMO’s site selection. Given the ELFN’s proximity to the Ignace site, questions remain about whether the filing undermines the NWMO’s social license to proceed, highlighting some of the organization’s (and Canada’s) broad struggles to align major construction projects with Indigenous reconciliation.

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