A MACDONALD-LAURIER INSTITUTE PUBLICATION

Commentary

TRUE NORTH IN CANADIAN PUBLIC POLICY

AUGUST 2024

Securing the future: Canada's deep geological repository for nuclear waste

Heather Exner-Pirot

In the coming year, Canada's Nuclear Waste Management Organization (NWMO) – a consortium of nuclear energy and waste producers – will choose the site for its deep geological repository: a final resting home for the spent nuclear fuel Canada has produced since the 1950s and will continue to produce in the future.

The process is a result of decades of planning, consultation, and scientific work, leading to the logical conclusion, backed by international consensus, that geological disposal is the best long-term solution for our nuclear waste. Progress on the development of a deep geological repository in Canada should serve to calm ongoing concerns about our ability to manage nuclear waste.

Advanced economies produce a lot of waste, much of it hazardous to humans and the environment. We have developed complex rules and regulations to manage its handling, treatment, and disposal. Nuclear waste often gets singled out as particularly dangerous, and popular culture references to Chernobyl's "blown lid" or *The Simpsons'* "green goo" have captured the public's perception of it. It is true that it can remain radioactive for millions of years. But nuclear waste – or as industry proponents often prefer to describe it, spent fuel – is just as able to be managed safely as other types of waste. Indeed, the Canadian nuclear sector has an impeccable waste management safety track record – and you'd certainly hear about it if it didn't.

And yet in debates about what energy systems should power our society, activists often point to the existence of nuclear waste as a significant or even the main reason why we should abandon that clean energy source in favour of intermittent renewables such as solar or wind power.

This commentary aims to explain how waste management is actually a strength, not a weakness, of the nuclear sector in Canada, and is a point in favour of its choice as an energy source. The sector's waste is fully accounted for, minimal, and manageable. With plans for a deep geological repository in Canada that advance and draw on a consent-based process to select a site, our nuclear waste can be disposed of safely, and for all practical purposes, forever.

Canada's nuclear waste management framework

Under Canada's *Nuclear Safety and Control Act*, radioactive waste includes any material that contains a radioactive nuclear substance that has no foreseen use. It is produced from a variety of activities and is found in uranium mine waste and mill tailings, medical isotope waste, used nuclear fuel, decommissioning waste, industrial waste, and cleaning material contaminated with low levels of nuclear substances. Used, or irradiated nuclear fuel that its owners have declared as radioactive waste and/or that generates significant heat through radioactive decay is designated high-level radioactive waste (HLW).

Canada's nuclear waste

Canada has produced radioactive waste since the 1930s, when the first radium and uranium mine began operating in the Northwest Territories. Workers refined the ore in Port Hope, Ontario, and stored the waste there. In the intervening years, three provinces have produced nuclear power for commercial use in Canada: Ontario, New Brunswick, and Quebec. Ontario and New Brunswick still produce nuclear power, while Quebec's last plant shut down in 2012 and was completely defuelled in September 2013.

Those Canadian nuclear power plants have all used CANDU reactors. CANDUs are characterized by their pressurized heavy water reactor design and use of natural, rather than enriched, uranium. CANDU nuclear fuel is formed into bundles roughly the size and shape of a fireplace log. Uranium oxide powder is packed into pellets and placed in fuel rods. Thirty-seven fuel rods are then bunched together to form the cylindrical fuel bundle weighing 24 kilograms.

Canadian reactors produce 90,000 of these used fuel bundles a year. As of June 2023, 3.3 million fuel bundles had been used and stored in Canada (NWMO 2024a). The bundles look the same when they come out of the reactor as when they went in, but they are highly radioactive, and are subsequently water-cooled. The bundles lose 60 percent of their radioactivity in the first hour, and over 99 percent in 7 to 10 years of sitting in water pools (NB Power Undated). They are then placed in dry storage in vaults, containers, or silos.

In Canada, the federal government has jurisdiction over nuclear energy and its regulation.

In Canada, the federal government has jurisdiction over nuclear energy and its regulation. In 2002, the Government of Canada passed the *Nuclear Fuel Waste Act* (CNSC 2018). In accordance with the "polluter pays" principle, the act made the owners of used nuclear fuel responsible for the funding, organization, management, and operation of the facilities used to store it. It further established a separate legal entity to manage this, which became the Nuclear Waste Management Organization (NWMO), and tasked it with finding a long-term solution for dealing with Canada's spent nuclear fuel.

Nuclear waste is currently stored in facilities adjacent to each of the current and former nuclear power stations at Darlington, Bruce, and Pickering (Ontario), Gentilly (Quebec), and Point Lepreau (New Brunswick); as well as at Chalk River Laboratories in Ontario and Whiteshell Laboratories in Manitoba (NWMO Undated a). These facilities are licenced for interim storage. Interim in this case is usually measured in decades. But because the waste will remain radioactive for hundreds of thousands of years or more, a long-term solution has always been needed.

Geological disposal

The safe disposal of nuclear waste is not a problem unique to Canada. All nuclear energy producers in the world face the same challenge. As a result, scientific and public dialogue on the issue of long-term management of nuclear waste has been taking place for decades, and an international consensus has emerged in favour of geological disposal.

The International Atomic Energy Association (IAEA) – an intergovernmental organization tasked with promoting the safe, secure, and peaceful use of nuclear technologies – defines "geological disposal" as "the disposal of solid radioactive waste in a disposal facility located underground in a stable geological formation so as to provide long term containment of the waste and isolation of the waste from the accessible biosphere" (IAEA 2011, 1).

> *Geological disposal is a technical and philosophical solution to the challenge of managing waste.*

Geological disposal is a technical and philosophical solution to the challenge of managing waste that we know will be hazardous across generations and civilizations. The nuclear waste we have accumulated thus far is well managed today, under our governance and with our resources, and has an excellent safety record. However, our society will not last hundreds of thousands of years. Geological disposal seeks to address the risks that nuclear waste poses in the inevitable event of societal breakdown or civilizational collapse.

Most advanced nuclear countries have opted for geological disposal as their solution for the long-term management of radioactive waste, including Finland, the United Kingdom, Sweden, France, Switzerland, Japan, and the United States (Radioactive Waste Management 2017). Finland is the furthest along in implementing geological disposal. After years of consultation, it chose a site near the Olkiluoto Nuclear Power Plant in western Finland in 2001 and began construction in 2004. The ONKALO spent fuel repository is expected to be operational soon (Posiva 2024). It will go to a depth of ~450m and be capable of holding 6,500 tons of spent fuel.

Adaptive phased management and Canada's deep geological repository

Following consultations, the NWMO recommended, and the Government of Canada accepted in 2007, an "Adaptive Phased Management" (APM) plan for the long term disposal of our spent nuclear fuel (CNSC 2020). This term reflects the process (prioritizing an adaptive approach, conducted in multiple phases) that leads to the technical solution: a deep geological repository.

(Natural Resources Canada further endorsed NWMO's "Integrated Strategy for Radioactive Waste" in 2023 (Natural Resources Canada 2023; NWMO 2023a), which addressed gaps in the management of some low-, intermediate- and non-fuel high-level wastes, but did not duplicate or replace the long-term disposal plans from the APM.)

From a technical perspective, the deep geological repository must have the following attributes:

- It must have geological features that ensure the host rock can safely contain and isolate the spent fuel over millennia, including from aquifers.
- The risk of future human intrusion, for example from mining or drilling, must be very low.
- The site must be able to be constructed, operated and closed safely.
- Used fuel must be able to be safely transported to the site.
- The site must be able to meet all regulatory requirements (NWMO Undated b).

The APM considered the disposal of nuclear waste from a social perspective and directed that there be a consent-based approach to finding a site. In other words, it called for affected communities to be informed about the project, and willingly agree to be hosts of the waste before the site is selected. This social aspect has its own principles:

- The safety, security, and protection of people and the environment must be central to site selection.
- An informed and willing host community, located in a province directly involved in the nuclear fuel cycle, must be found.

- The community must retain the right to withdraw their consent up until the point at which a final agreement is signed.
- The process should be led by interested communities who themselves trigger an expression of interest to learn about the process and opportunity.
- The process must respect Indigenous rights, treaties, and land claims.
- Shared decision-making and ongoing collaboration with all levels of government should be central.
- Inclusiveness and transparency in public consultation and the decision-making process must be achieved (NWMO Undated c).

The adaptive part of the APM plan means ensuring that it allows for contingencies. Among the most likely contingencies is the need to be able to store enriched uranium fuel from planned and potential Small Modular Reactors (SMRs) and other third- and fourth-generation reactors in the future (NWMO Undated d). The repository will be licenced and built to accommodate for that kind of waste.

Another issue is whether in the future producers may want to reprocess the used fuel for nuclear or other uses or change their minds if they devise a better plan for long-term management of nuclear waste. To accommodate that, the used nuclear fuel will be retrievable (NWMO Undated e), up until a future date many decades or even centuries from now, when the repository is fully decommissioned and closed. That said, the repository will be built with the intention that used fuel will not be retrieved, and access tunnels and shafts will be backfilled and sealed, even though technically it will remain possible to get to the waste until the site is finally decommissioned.

Finding a willing host community in Canada

Following the development of these principles, in 2010 the NWMO initiated an expression of interest for communities wanting to learn more about the opportunity of hosting the deep geological repository. By 2012, 22 communities had responded (NWMO Undated f): three in Saskatchewan, where Canada's uranium mining currently takes place, and 19 in Ontario, where the vast majority of nuclear energy and waste is produced.

Based on both technical site evaluations and social engagements, potential sites were narrowed down to two locations: the Saugeen Ojibway Nation–South Bruce location, near the current Bruce nuclear power station in southern Ontario; and the Wabigoon Lake Ojibway Nation–Ignace area (Revell Site), northwest of Thunder Bay close to the Ontario-Manitoba border.

Further studies conducted by the NWMO indicated that both sites are technically suitable and safe to host a deep geological repository for used nuclear fuel (NWMO Undated b). They both have highly stable geology, their rock having formed about 450 million of years ago in the case of South Bruce-Saugeen (NWMO 2023b); and about 2.7 billion years ago in the case of the Revell site (NWMO 2023c). They face minimal seismic or volcanic activity. Their rock is extremely dense and hard for water to penetrate. At the depth at which the repositories would be built, about 650 metres below the earth's surface, no aquifers exist. Initial testing of porewaters show they have been isolated for millions of years, indicating no possibility of groundwater contamination or contact with the Great Lakes.

Now the affected communities are tasked with providing or withholding their consent, based on processes they themselves have determined. For the Revell site, Ignace town council established a "Willingness Committee" to canvass citizens on their willingness to proceed. It subsequently signed a Hosting Agreement with NMWO in March 2024 to set out the obligations and benefits of the parties in the development of the repository (Township of Ignace 2024). Between April 26 and 30, 2024, registered voters cast a vote online or in person on whether to proceed as a host community: 77 percent voted in favour (Resident Ad Hoc Committee 2024). On July 10, 2024, Ignace town council passed a resolution to confirm to the NWMO that they are a willing host community. However, for the Revell site to proceed, Wabigoon Lake Ojibway Nation must also consent. They are expected to host a referendum in the fall of 2024 (Local Journalism Initiative 2024), after concluding a hosting agreement with NWMO.

With regards to the other site, South Bruce signed a hosting agreement with NWMO on May 1, 2024 (NWMO 2024b), and is holding a referendum on October 28, 2024, asking voters, "Are you in favour of the Municipality of South Bruce declaring South Bruce to be a willing host for the Nuclear Waste Management Organization's proposed Deep Geological Repository (DGR)?" (Municipality of South Bruce 2024). Saugeen Ojibway Nation, which will also be affected if this site is chosen, has committed to holding a referendum on the decision, but has not yet chosen a date, saying they will hold it when they feel the time is right (Miller 2024).

For their part, NWMO has indicated they plan to select a site in 2024. Although that will be more than 15 years into the process, it is really the beginning of the plan, not the end (NWMO Undated g). After initial site selection, NWMO will submit its application for regulatory approval to the Canadian Nuclear Safety Commission (CNSC). The CNSC, which has been involved in the APM process from the beginning, will represent the public interest and ensure the NWMO's plan is safe and aligned with national and international standards (CNSC 2024). The Impact Assessment Agency of Canada must also complete an impact assessment.

If and when regulatory approval is granted, construction will begin. This will not happen before the 2030s and will likely take a decade or so to complete. It is not expected that the deep geological repository will become operational until the 2040s. After that, it will take around 38 years to transport existing nuclear waste to the site.

It is acceptable for the timeline to be so long (NWMO Undated h) because all of Canada's nuclear waste is safe and secure where it is today. The entire process of geological disposal is about ensuring that the waste from today's society is not a problem for societies in the future.

Concerns about nuclear waste

Nuclear energy has often been a target of environmental activism. These efforts have successfully moved public opinion against the energy source, aided, and in part motivated by, high profile accidents in the 1980s and in 2011. The anti-nuclear energy movement in the twentieth century was also linked to peace movements and to a strong anti-nuclear proliferation sentiment towards the end of the Cold War. New nuclear builds slowed dramatically in Western nations beginning in the 1990s due to a combination of politics and economics.

Since the energy crisis that was sparked by the Russian invasion of Ukraine in 2022, along with the growing acceptance that decarbonization cannot be successful without nuclear energy, public opinion has again turned in favour of nuclear energy. A survey of over 20,000 participants from 20 countries in October and November 2023 found, for example, that while 28 percent of respondents opposed the use of nuclear energy, 46 percent supported it. Of the

20 countries surveyed, there was net support for nuclear energy's continued use in 17 (Ollington and Nelson 2023). Support was highest in China and India, where new nuclear builds are most active, and in Russia and the UAE.

In Canada, public support for nuclear power has increased from 37 to 55 percent between 2012 and 2023 (Sorab 2024). A majority of the public in Ontario, Saskatchewan, and Alberta support nuclear power, as do pluralities in Manitoba and the Atlantic provinces, and 62 percent view it as essential to Canada's net-zero strategy. Following on from this stronger public support, the federal government has also become more supportive of nuclear energy in its policies since 2022.

However, there remains staunch opposition to nuclear from some circles, including environmental organizations, some academics, and some political parties.

However, there remains staunch opposition to nuclear from some circles, including environmental organizations, some academics, and some political parties. The federal NDP (Duncan 2023) and Green Party of Canada (2021) have both argued that nuclear energy is a distraction from policies and funding that support renewables like wind and solar. BC and Quebec have rejected the use of nuclear power generation and imposed provincial moratoria on uranium mining, although more recently Quebec has expressed interest in re-examining the issue (Blais 2023).

The existence of nuclear waste is often used as an argument against nuclear energy. The Council of Canadians initiated an extensive campaign in 2022 against current waste management practices (Bui 2022), calling it "nuclear industry greenwashing" (Council of Canadians 2022). The IRPP's *Policy Options* magazine published an article in May 2024 claiming, "there are no demonstrated solutions to managing this risk [of radioactive waste]" (Goranson 2024). The Canadian Environmental Law Association claimed in 2020 that "the federal government currently has no detailed policy or strategy for what to do with radioactive waste, and no design or location for a deep underground repository where industry proposes to store high-level radioactive waste for hundreds of thousands of years" (CELA 2020). And a group of 20 members of the US Congress asked the Biden Administration in 2021 to intervene in Canada's plans for a deep geological repository on the basis that it could contaminate the Great Lakes (Udasin 2021).

Safety and nuclear waste

While nuclear energy policy is often driven by perceptions and emotion, regulators make their decisions based on technical aspects and using the best available scientific knowledge. The industry as a whole is highly regulated and has an excellent track record: along with solar energy, nuclear energy is the safest form of energy in the world (Ritchie 2020).

The nuclear sector must be that safe. Any accident, anywhere, is a threat to the viability of the sector. Most people are familiar with Chernobyl, Three Mile Island, and Fukushima, and those high-profile accidents often come to mind in any public discussion on nuclear energy. But it is important to acknowledge that those three are the only significant accidents at nuclear power plants in 60 years of civil nuclear power generation, with over 18,500 cumulative reactor years taking place in operations across 36 countries. Chernobyl is the only nuclear accident that has led to the death of any worker or member of the public due to radioactive exposure (World Nuclear Association 2022).

The intense scrutiny of the sector drives demand for, and adherence to, international standards. The International Atomic Energy Association has 187 members (only North Korea has left the IAEA) and its board of 35 nations includes all major nuclear energy producers, including Canada (IAEA Undated a).

Within Canada, nuclear energy is regulated by the Canadian Nuclear Safety Commission, which is often regarded as world-class. The CNSC is responsible for licencing the entire lifecycle of the deep geological repository – from site preparation to construction and operation, to decommissioning and abandonment – and will continue to consider guidance from the IAEA in that process (CNSC 2021).

In addition, Canada plans to implement a multiple barrier system to isolate the used nuclear fuel from its surroundings (NWMO Undated i). These include the fuel pellets themselves, with uranium dioxide powder baked into a material that is highly durable and not readily dissolvable in water; the fuel bundle, which contains the fuel pellets; the used fuel container, made with carbon steel that isolates the fuel and its radioactivity and can withstand tremendous pressure, and is coated with copper to prevent corrosion; bentonite clay buffer boxes to resist water flow and isolate radionuclides in the unlikely event they escape the container; and the geosphere, which forms a natural barrier of rock to protect the repository from disruptive natural events, water flow, and human intrusion.

Transportation

Geological disposal takes nuclear waste management to the lowest level of risk possible by removing the waste from human tampering or error and isolating it from the biosphere. But there are important safety considerations as the nuclear waste is moved from its current locations to the repository, which will likely result in 1 or 2 shipments a day over 38 years (NWMO 2015).

The first thing to understand is that the world has a long track record of moving radioactive and other hazardous waste safely. Over more than 60 years of transporting used nuclear fuel globally, no accident has yet resulted in serious injuries, overexposures, fatalities, or environmental consequences attributable to radioactivity (CNSC 2022). This despite thousands of shipments of radioactive materials daily (IAEA Undated b), including well over 20,000 shipments of spent nuclear fuel over the past five decades (NWMO 2015).

This stellar record is not due to good luck. Transportation of radioactive materials is highly regulated. While nuclear waste may be transported on public highways and railroads, public safety is assured from the strength of the package that is required to contain the waste in transit (IAEA Undated c). In Canada, the specifications of these containers are governed by the CNSC, are aligned with IAEA standards, and must pass intense tests to demonstrate their robustness. These include:

- A free-drop test of more than 9 metres onto an unyielding surface, to replicate the impact of the load many times higher than a train travelling at 160km/hr hitting the container.

- A puncture test, dropping the same package 1 metre onto a 15 cm diameter steel bar at least 20 cm in height.

- A thermal test replicating a petroleum fire, in which the same container must withstand an 800°C (1475°F) fire for 30 minutes (in actual fires the fuel supply decreases and fire shifts its location in that time); and

- An immersion test that includes both being submerged under 15 metres of water for eight hours, and then being immersed at 200 metres to test the ability of the container to withstand extreme pressure. (NWMO 2015)

The public's exposure to radiation over the course of any route to the repository – for example those driving beside the trucks or trains, people living in houses along the route, people at a rest stop at the same time as the transporting truck, etc. – is expected to be significantly below the regulatory public dose limit of 1 millisievert (a unit of dose that reflects the relative biological effects of various types of radiation) per year (NWMO 2015). Transportation workers involved in moving the used fuel would also be exposed to doses lower than the regulatory public dose limit.

Terrorism and security risks

There is also a legitimate concern about terrorism and other security risks. However, these scenarios are also highly unlikely: used nuclear fuel is not easier to steal while being transported and in many ways it is harder. That is because there is constant surveillance any time nuclear waste is being moved. Required security measures include escort personnel, communications arrangements to contact response forces, security searches prior to shipment, contingency arrangements in case of delay or mechanical breakdown, and procedures to be followed during scheduled stops or unscheduled delays (CNSC 2022).

Finally, used CANDU fuel bundles are not ideal for use in developing illicit nuclear weapons or dirty bombs. CANDU reactors use natural uranium as fuel, not enriched uranium, which is much harder to make into weapons-grade material. And there is the simple matter of logistics: stealing a 35-ton metal box that is being actively protected, establishing your own hot cell (a containment chamber that shields against nuclear radiation), moving the package there without being tracked or found, and then having the capability to reprocess the used fuel bundle into something tactically useful are all extremely expensive, technically challenging, and conspicuous activities.

It is hard to conceive of a strategic goal that would be best served by this particularly complicated and extremely difficult scenario, regardless of any state or non-state actor's worst intentions. Nuclear waste transportation is not the weakest link.

Solving the problem of nuclear waste to advance nuclear energy

Our societies and economies thrive when they have an abundance of energy. Nuclear energy promises to provide that, especially in Canada with its long history of nuclear power production and ample uranium reserves. Nuclear has the added benefit of providing both reliable and sustainable low-carbon energy.

One of the remaining bones of contention for nuclear energy is the existence of waste that remains radioactive for hundreds of thousands of years. This is a problem for which a solution now exists: geological disposal.

Canada is advancing a thoughtful, inclusive, scientifically sound plan to determine a site in which it can store our existing and future nuclear waste forever. This is cause for acknowledgement; we have created and are executing good policy and a plan that merits our support. MLI

About the author

Heather Exner-Pirot is a senior fellow and director of the Natural Resources, Energy and Environment program at the Macdonald-Laurier Institute and a special adviser to the Business Council of Canada. She is a global fellow at the Wilson Center in Washington DC, the research advisor for the Indigenous Resource Network and the managing editor of the Arctic Yearbook. Exner-Pirot is also a coordinator at the North American and Arctic Defense and Security Network and sits on the boards of the Saskatchewan Indigenous Economic Development Network and Canadian Rural Revitalization Foundation. Dr. Exner-Pirot obtained a Ph.D. in Political Science from the University of Calgary in 2011. MLI

References

Blais, Stéphane. 2023. "Quebec Government Says It Is Open to Studying Whether to Restart Nuclear Reactor." CBC News, August 14, 2023. Available at https://www.cbc.ca/news/canada/montreal/quebec-mulls-reopening-mothballed-nuclear-gentilly-plant-1.6936101.

Bui, Vi. 2022. "Radioactive Waste: The Making of a Grassroots Campaign." *Perspectives*, October 19, 2022. Council of Canadians. Available at https://canadians.org/analysis/returning-to-our-grassroots/.

Canadian Environmental Law Association [CELA]. 2020. "Statement on Small Modular Reactors." CELA, November 17, 2020. Available at https://cela.ca/statement-on-small-modular-reactors/.

Canadian Nuclear Safety Commission [CNSC]. 2018. "Oversight of Canada's Framework for Radioactive Waste Management." Government of Canada. Available at https://www.cnsc-ccsn.gc.ca/eng/resources/fact-sheets/oversight-canada-framework-radioactive-waste-management/.

Canadian Nuclear Safety Commission [CNSC]. 2020. "Regulating Canada's Geological Repositories." Government of Canada. Available at https://www.cnsc-ccsn.gc.ca/eng/resources/fact-sheets/regulating-canadas-geological-repositories-fact-sheet/.

Canadian Nuclear Safety Commission [CNSC]. 2021. "Deep Geological Repositories." Government of Canada. Available at https://www.cnsc-ccsn.gc.ca/eng/waste/deep-geological-repositories/.

Canadian Nuclear Safety Commission [CNSC]. 2022. "Transport FAQs on Used Nuclear Fuel." Government of Canada. Available at https://www.cnsc-ccsn.gc.ca/eng/waste/faq/transport-of-used-nuclear-fuel/.

Canadian Nuclear Safety Commission [CNSC]. 2024. "The CNSC's Early Involvement in the NWMO's Adaptive Phased Management Approach." Government of Canada. Available at https://www.cnsc-ccsn.gc.ca/eng/waste/high-level-waste/cnsc-role-in-nwmo-apm-project/.

Council of Canadians. 2022. "(Recording) Webinar: Interrupting the Nuclear Industry's Greenwashing." Council of Canadians, March 31, 2022. Available at https://canadians.org/webinar/webinar-interrupting-nuclear-industrys-greenwashing/.

Duncan, Kirsty (chair). 2023. *Small Modular Nuclear Reactors: Report of the Standing Committee on Science and Research*. House of Commons of Canada, February 2023, 44th Parliament, 1st Session. Available at https://www.ourcommons.ca/Content/Committee/441/SRSR/Reports/RP12212540/srsrrp03/srsrrp03-e.pdf.

Goranson, Greta-Quinn. 2024. "Ontario's Nuclear Option Is the Wrong Path to Meet Green Energy Targets." *Policy Options*, May 13, 2024. Available at https://policyoptions.irpp.org/magazines/may-2024/ontario-nuclear-option/.

Green Party of Canada. 2021. "The Government of Canada's Nuclear Policies Are Profoundly Misguided, Say Greens." Press Release, April 21, 2021. Green Party of Canada. Available at https://www.greenparty.ca/en/media-release/2021-04-21/government-canadas-nuclear-policies-are-profoundly-misguided-say-greens.

International Atomic Energy Agency [IAEA]. 2011. *Geological Disposal Facilities for Radioactive Waste. Specific Safety Guide No. SSG-14.* IAEA. Available at https://www.iaea.org/publications/8535/geological-disposal-facilities-for-radioactive-waste.

International Atomic Energy Agency [IAEA]. Undated a. "Board of Governors." International Atomic Energy Agency. Available at https://www.iaea.org/about/governance/board-of-governors.

International Atomic Energy Agency [IAEA]. Undated b. "Transporting Radioactive Materials." IAEA. Available at https://www.iaea.org/topics/transporting-radioactive-materials.

International Atomic Energy Agency [IAEA]. Undated c. *Format and Content of the Package Design Safety Report for the Transport of Radioactive Material: Specific Safety Guide No. SSG-66*. IAEA. Available at https://www-pub.iaea.org/MTCD/Publications/PDF/PUB1980_web.pdf.

Local Journalism Initiative. 2024. "Still No Date Set for Wabigoon Lake Nuclear Vote." Yahoo News, July 16, 2024. Available at https://ca.news.yahoo.com/still-no-date-set-wabigoon-134947736.html.

Miller, Scott. 2024. "'Not realistic': Saugeen Ojibway Nation May Not Vote on Nuclear Waste Plan in 2024." CTV News, May 24, 2024. Available at https://london.ctvnews.ca/not-realistic-saugeen-ojibway-nation-may-not-vote-on-nuclear-waste-plan-in-2024-1.6900025.

Municipality of South Bruce. 2024. "2024 Municipality of South Bruce – By-Election – Question on the Ballot – Referendum." Municipality of South Bruce. Available at https://www.southbruce.ca/en/municipal-government/2024_Municipality_of_South_Bruce_-_By-Election_-_Question_on_the_Ballot_-_Referendum.aspx.

Natural Resources Canada. 2023. "Statement from the Minister of Energy and Natural Resources on the Integrated Strategy for Radioactive Waste." Government of Canada. Available at https://natural-resources.canada.ca/our-natural-resources/energy-sources-distribution/nuclear-energy-uranium/radioactive-waste/overview-radioactive-waste-canada/statement-on-integrated-strategy/25375.

NB Power. Undated. "CANDU 6 Fuel." NB Power. Available at https://www.nbpower.com/en/about-us/learning/learn-about-electricity/nuclear/candu-6-fuel.

Nuclear Waste Management Organization [NWMO]. 2015. *Safe and Secure Transportation of Canada's Used Nuclear Fuel.* NWMO. Available at https://www.nwmo.ca/-/media/Reports-MASTER/Backgrounders-and-brochures/2015-05-Safe-and-Secure-Transportation-of-Canadas-Used-Nuclear-Fuel.ashx.

Nuclear Waste Management Organization [NWMO]. 2023a. "Comprehensive Strategy for Radioactive Waste Endorsed by Canada's Minister of Energy and Natural Resources." Announcement, October 5, 2023. NWMO. Available at https://www.nwmo.ca/en/News/Comprehensive-strategy-for-radioactive-waste-endorsed-by-Canadas-Minister-of-Energy-and-Natural.

Nuclear Waste Management Organization. [NWMO]. 2023b. *Confidence in Safety – South Bruce Site – 2023 Update*. Report NWMO-TR-2023-08. NWMO. Available at https://www.nwmo.ca/-/media/Reports-MASTER/Technical-reports/NWMO-TR-2023-08-Confidence-in-Safety---South-Bruce-Site---2023-Update.ashx.

Nuclear Waste Management Organization. [NWMO]. 2023c. *Confidence in Safety – Revell Site – 2023 Update*. Report NWMO-TR-2023-07. NWMO. Available at https://www.nwmo.ca/-/media/Reports-MASTER/Technical-reports/NWMO-TR-2023-07-Confidence-in-Safety---Revell-Site---2023-Update.ashx.

Nuclear Waste Management Organization [NWMO]. 2024a. *Canada's Used Nuclear Fuel*. NWMO. Available at https://www.nwmo.ca/-/media/Reports-MASTER/Backgrounders-and-brochures/Backgrounder-2024---Canadas-used-nuclear-fuel.ashx.

Nuclear Waste Management Organization [NWMO]. 2024b. "Municipality of South Bruce Signs Hosting Agreement with the Nuclear Waste Management Organization." Announcement, May 1, 2024. NWMO. Available at https://www.nwmo.ca/News/Municipality-of-South-Bruce-signs-Hosting-Agreement-with-the-Nuclear-Waste-Management-Organization.

Nuclear Waste Management Organization [NWMO]. Undated a. "How Is It Stored Today?" NWMO. Available at https://www.nwmo.ca/Canadas-used-nuclear-fuel/How-is-it-stored-today.

Nuclear Waste Management Organization [NWMO]. Undated b. "A Safe Approach." NWMO. Available at https://www.nwmo.ca/A-safe-approach.

Nuclear Waste Management Organization [NWMO]. Undated c. "Guiding Principles." NWMO. Available at https://www.nwmo.ca/en/Site-selection/How-it-was-developed/Guiding-principles.

Nuclear Waste Management Organization [NWMO]. Undated d. "How Does the NWMO Plan to Address Used Fuel from Small Modular Reactors (SMRs)?" FAQs. NWMO. Available at https://www.nwmo.ca/Frequently-asked-questions#Small-Modular-Reactors.

Nuclear Waste Management Organization [NWMO]. Undated e. "Can the Used Nuclear Fuel Be Retrieved from a Repository If Needed in the Future?" FAQs. NWMO. Available at https://www.nwmo.ca/Frequently-asked-questions#Can-the-used-nuclear-fuel-be-retrieved-from-a-repository-if-needed-in-the-future.

Nuclear Waste Management Organization [NWMO]. Undated f. "Site Selection." FAQs. NWMO. Available at https://www.nwmo.ca/Site-selection.

Nuclear Waste Management Organization [NWMO]. Undated g. "Steps 4-9: Site Confirmation, Construction and Operations." NWMO. Available at https://www.nwmo.ca/Site-selection/Steps-in-the-site-selection-process/Steps-4-to-9-Site-confirmation-construction-and-operations.

Nuclear Waste Management Organization [NWMO]. Undated h. “Project Phases.” NWMO. Available at https://www.nwmo.ca/Canadas-plan/Project-phases.

Nuclear Waste Management Organization [NWMO]. Undated i. “Multiple-Barrier System.” NWMO. Available at https://www.nwmo.ca/en/Canadas-plan/Multiple-barrier-system.

Ollington, Richard, and Mark W. Nelson. 2023. *Public Attitudes Toward Clean Energy Nuclear Energy*. Radiant Energy Group. Available at https://www.radiantenergygroup.com/reports/public-attitudes-toward-clean-energy-2023-nuclear.

Posiva. 2024. “Introducing ONKALO and Its Principle of Operation.” Posiva. Available at https://www.posiva.fi/en/index/news/pressreleasesstockexchangereleases/2024/thisisonkaloandthisishowitworks.html.

Radioactive Waste Management. 2017. *Making Sense of Geological Disposal*. Radioactive Waste Management (UK). Available at https://assets.publishing.service.gov.uk/media/5a74fd8ae5274a3cb2868cd6/Making_Sense_of_Geological_Disposal_ENG_ONLINE.pdf.

Resident Ad Hoc Committee. 2024. *Willingness Summary*. Resident Ad Hoc Committee, Township of Ignace. Available at https://www.ignace.ca/images/willingnes/Resident-Ad-Hoc_Committee-Willingness-Summary-signed.pdf.

Ritchie, Hannah. 2020. “What Are the Safest and Cleanest Sources of Energy?” Our World in Data, February 10, 2020. Available at https://ourworldindata.org/safest-sources-of-energy.

Sorab, Vivan. 2024. “Think Small: How Canada Can Make Small Modular Nuclear Reactors a Priority.” RBC Economics, May 14, 2024. Available at https://thoughtleadership.rbc.com/think-small-how-canada-can-make-small-modular-nuclear-reactors-a-priority/.

Township of Ignace. 2024. *Hosting Agreement Between Nuclear Waste Management Organization and the Corporation of the Township of Ignace*. Township of Ignace. Available at https://www.ignace.ca/images/Ignace_Hosting_Agreement_Execution_Copy88.pdf.

Udasin, Sharon. 2021. "Bipartisan House Group Asks Biden to Stop Canada's Great Lakes Nuclear Storage Plans." *The Hill*, September 17, 2021. Available at https://thehill.com/policy/equilibrium-sustainability/572764-bipartisan-house-group-asks-biden-to-stop-canadas-great/.

World Nuclear Association. 2022. "Safety of Nuclear Power Reactors." World Nuclear Association, March 2, 2022. Available at https://world-nuclear.org/information-library/safety-and-security/safety-of-plants/safety-of-nuclear-power-reactors.

GOOD POLICY

is worth fighting for.

WHAT PEOPLE ARE SAYING ABOUT **MLI**

MLI has been active in the field of indigenous public policy, building a fine tradition of working with indigenous organizations, promoting indigenous thinkers and encouraging innovative, indigenous-led solutions to the challenges of 21st century Canada.

– The Honourable **Jody Wilson-Raybould**

I commend Brian Crowley and the team at **MLI** for your laudable work as one of the leading policy think tanks in our nation's capital. The Institute has distinguished itself as a thoughtful, empirically based and non-partisan contributor to our national public discourse.

– The Right Honourable **Stephen Harper**

May I congratulate **MLI** for a decade of exemplary leadership on national and international issues. Through high-quality research and analysis, **MLI** has made a significant contribution to Canadian public discourse and policy development. With the global resurgence of authoritarianism and illiberal populism, such work is as timely as it is important. I wish you continued success in the years to come.

– The Honourable **Irwin Cotler**

MACDONALD-LAURIER INSTITUTE

TRUE NORTH IN CANADIAN PUBLIC POLICY

323 Chapel Street, Suite 300,
Ottawa, Ontario K1N 7Z2
613-482-8327
info@macdonaldlaurier.ca

macdonaldlaurier.ca