Submission to the
Standing Committee on Environment and Sustainable Development
Study of Freshwater in Canada

Brief prepared by
We the Nuclear Free North
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About We the Nuclear Free North

We the Nuclear Free North, established in 2020, is an alliance of people and groups opposing a Deep Geological Repository (DGR) for nuclear fuel waste in Northern Ontario. We oppose the transport, burial and abandonment of this radioactive waste in our northern watersheds. We seek to engage the public in a discussion of the risks of such a repository. We demand transparency from agencies responsible for the production and management of such wastes.

Our group includes farmers, families, youths, seniors, First Nations individuals, cottage owners, environmentalists, scientists and diverse people who love the land and respect the use of our watersheds.

The connection between our group's mission and freshwater consists of the risks to freshwater posed by the Nuclear Waste Management Organization's (NWMO's) proposed project to transport, bury and eventually abandon all of Canada's nuclear fuel waste at a single location. Two locations have been shortlisted: the "Revell Site" in Northwestern Ontario, and the "South Bruce Site" in Southwestern Ontario. Transportation of this waste to either site, and burial there, poses risks to freshwater; our group's particular concern is with the freshwater of Northwestern Ontario.

As represented in our logo, our group seeks to protect the air, land, life and water of Northern Ontario from radioactive waste contamination. Water is foundational; the greater region of Northwestern Ontario has over 70,000 lakes.

Our concerns regarding Canada's freshwater

1) Risks to freshwater of the burial of nuclear fuel waste

The Nuclear Waste Management Organization is proposing to place an estimated 100,000 tonnes of highly radioactive waste in a series of rooms blasted out of rock formations 500 to 1,000 metres beneath the earth's surface. Many countries have investigated this concept over a period of several decades; some national programs continue to date, such as in Sweden, Finland, France and Switzerland, while other countries have either abandoned or have instituted a long pause on their pursuit of a deep geological program.

Despite the nuclear industry's representations of the technology behind the proposed DGR for all of Canada's nuclear fuel waste as being mature and the plan as safe, as expressed via the NWMO, the fact remains that no such facility has ever been operated in the world. In fact, no repository for nuclear fuel waste has even been

issued an operating license. There is a record of failed or withdrawn proposals; there is no record of operating success.

Numerous experts in the fields of geology, chemistry and physics warn of the insufficiency of current scientific knowledge to guide a project of the nature and magnitude of the NWMO's proposed plan. Robust data are simply not available for modelling studies, because informative real-world data sampling for this novel approach to nuclear fuel waste management is necessarily lacking. Thus, the NWMO's "Confidence in Safety" reports, (2022, 2023), provide at best a superficial and largely speculative picture of the real risks involved. Similarly, the NWMO has produced a series of "concept design reports" (2016, 2021) which are incomplete, and acknowledge that the plans are conceptual in nature. It is unknown when or if these concepts will reach maturity.

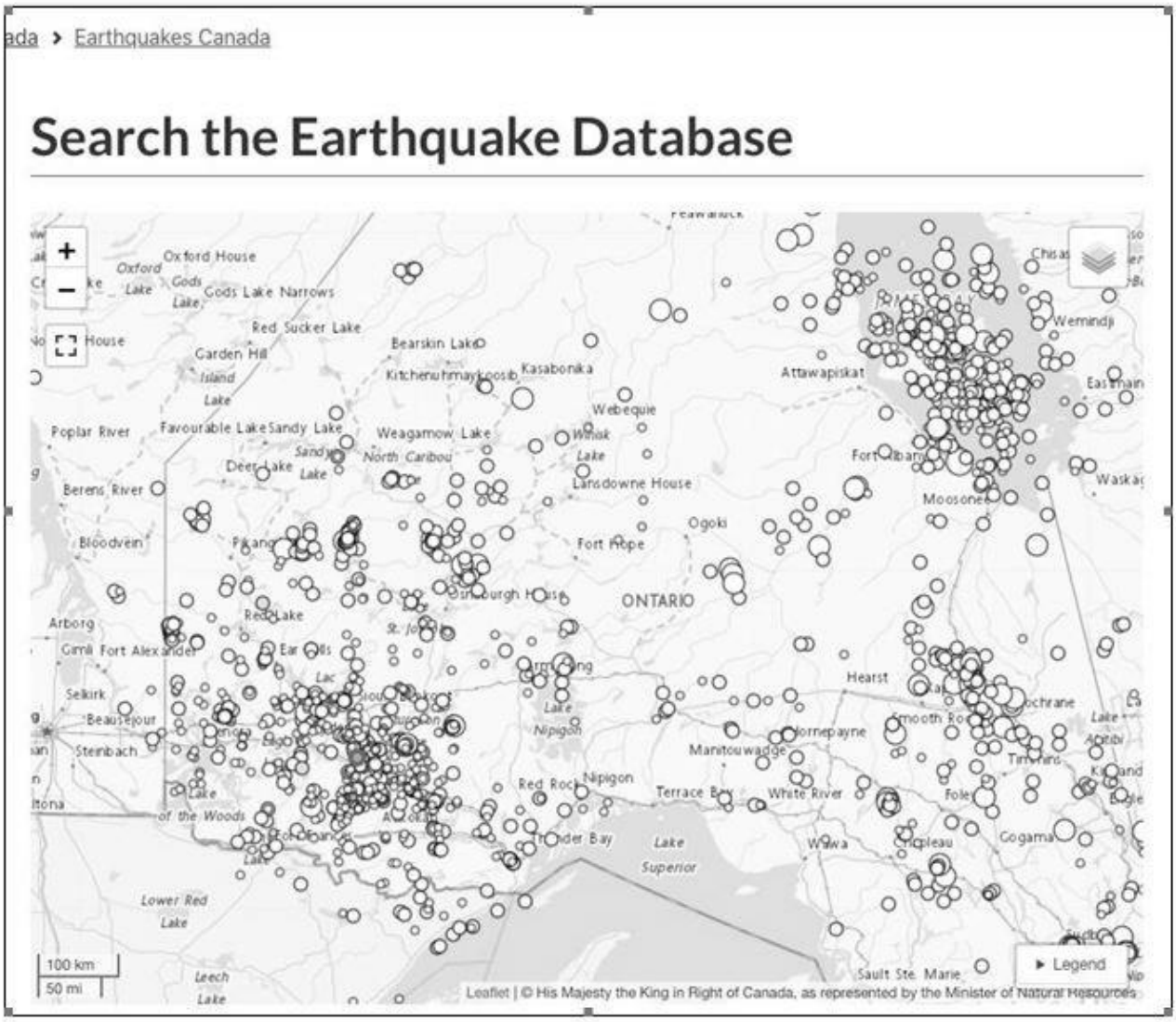
In elementary terms, water is present and abundant in our biosphere, and also "beneath the biosphere" (as NWMO prefers to term it), as deep groundwater. Groundwater can and does meet with surface water in a multitude of ways: in deep waterways such as profound lakes, in areas where deep groundwater emerges to the surface because of pressure ("artesian springs") – even, potentially, through the NWMO's own study boreholes in the rock of their proposed site. The meeting of deep groundwater with surface water is routine.

For the safety of residents and the natural environment, the NWMO's proposed DGR must isolate nuclear fuel waste from the biosphere for up to a million years. However, there are many scientific uncertainties regarding how the repository will perform, both in the near-term (next 500 years), and the longer term. Nuclear fuel waste consists of over 200 radioactive chemical compounds, also known as radionuclides; some of these compounds are water soluble and can be carried by water, via any deep groundwater that accesses the DGR (NWMO expects the DGR to be penetrated by groundwater), out into surface water, then to spread through the watershed[1] (see point 4).

An additional concern is seismicity in the vicinity of the DGR at the proposed Revell Site. The site is central to an "earthquake swarm" area comprising the area of Ignace, Dryden and Atikokan, easily viewed on maps from the Earthquakes Canada website (Natural Resources Canada). Earthquakes known to have occurred in Northwestern Ontario in the last 40 years have been of low magnitude, almost all having been magnitude 3.0 or less. However, the presence of a great number of such events within 50 km of the proposed site raises concerns, many of which have been explored by Natural Resources Canada and the NWMO (see References). Recent research has suggested that most earthquakes in Northwestern Ontario are shallow – under 3 km

beneath the surface. If such a shallow seismic event occurred near or at the repository site, the fracturing of rock could increase water permeability of the waste disposal facility.[2,3]

The following is a screenshot of a map generated on the Earthquakes Canada website, of all earthquakes in Northern Ontario in the last 39 years. The cluster at the lower right is the earthquake swarm in the Ignace-Dryden area.



This map indicates all detected earthquakes in Northern Ontario from 1985 to 2024. Source: earthquakescanada.nrcan.gc.ca

2) Risks to freshwater from nuclear fuel waste processing and DGR management

The DGR site will not only receive all of Canada's high-level nuclear fuel waste, it will also be a radioactive waste generator, including liquid radioactive waste, and the operations will be a source of radiologically contaminated "waste" water.

Referred to as "surface facilities" at the site of the deep geological repository, operations will include a "used fuel packaging plant" where the fuel waste will be unloaded, extracted from the transportation containers, and processed for placement in a used fuel container for dispatch to the underground repository. In the course of this operation, process water will become contaminated with radionuclides.

The primary sources of low and intermediate level liquid waste are the decontamination of used fuel modules, baskets, cell washdowns, and from the decontamination of transportation packages and containers. Preliminary estimates provided by the NWMO are that over 9,000 cubic metres of liquid radioactive waste will be produced each year; operations are expected to continue for a minimum of fifty years.

Water-bearing fractures and/or fracture zones will be present in the crystalline geosphere, which introduce the risk of carrying contaminated water out of the underground waste facility should the NWMO attempt to proceed with construction of a DGR at the Revell Site in Northwestern Ontario.

The NWMO acknowledges that, if such fractures are intersected by a waste emplacement room, groundwater may flow into the emplacement room. The NWMO accordingly allows that 10% of each emplacement room may be unavailable due to groundwater inflow (which would increase the total number of placement positions required).

The underground water inflows and used service water will be collected and ultimately sent to a main sump from which the water will be pumped to surface. The mine water in the settling pond may contain sediment (rock dust), nitrogen compounds (arising from the explosives used to excavate rock), salt (due to saline ground water inflow to underground repository), possibly particular metallic elements (notably uranium), and hydrocarbons (oils from equipment).

A series of ponds will be constructed on the site, including a mine dewatering settling pond and a storm water management pond which are expected to have "low" concentrations of radioactivity (this estimate of "low" is unsupported in the NWMO documents) and these waters will be released to an off-site water body, i.e. a natural body of fresh water, such as a nearby stream, lake or river.

Because the NWMO expects the levels of radio-contaminants to be below regulatory limits, water treatment is not built into the current conceptual plans. Instead, the NWMO states that if monitoring of pond discharge water finds radioactivity levels to be above acceptable limits, then the pond water would be routed to an active liquid waste treatment building for treatment. The actual methodology is "to be determined in the detailed design phase".

Acid mine drainage associated with the project poses an additional threat to the freshwater resources in the area. In constructing the underground repository, extremely large volumes of rock will be brought to surface and placed in an "Excavated Rock Management Area", which will be an additional source of contamination of surface water, and potentially also of groundwater. If the rock at the site is acid generating, additional impacts will occur, with additional measures – as yet not identified – presumably applied to limit the amount of potentially contaminated water (leachate) that could seep into underlying soil and rock or impact surface waters. However, a lag time between waste rock emplacement and the recognition of an acid drainage problem is a recurring issue at metal mines, and studies have shown an overall tendency to underestimate both the frequency and severity of acid mine drainage during the mine development stage.[4]

3) Risks to freshwater of the transportation of nuclear fuel waste

The NWMO's proposed plan entails transportation of 2-3 loads of highly radioactive nuclear fuel waste per day, for up to 2,550 kms, by road and possibly by rail, for 50+ years. No transportation of nuclear fuel waste, for such a length of time and over such long distances, has ever been undertaken anywhere in the world.

Containment of the waste for travel is intended by the NWMO to be sufficiently robust to withstand "expected" stresses due to roadway or rail collisions or accidents – but over the proposed 50+ years, at the proposed number of loads and great distances, the unexpected is, in fact, likely to occur. As one example, Lake Superior's north shore consists of many stretches where a road or rail load of nuclear fuel waste, if upset, would proceed down a single steep slope into the lake, and then to the lake bottom potentially hundreds of feet below. To address this possibility, the NWMO implies that it has performed "immersion tests" of eight hours in duration. There is, however, the option of substituting actual immersion tests with computer calculations. The currently certified transportation container has not been subject to full-scale testing for the drop or puncture tests; there is no record of immersion testing having been undertaken. In general, the tests the industry and regulator state the packages have been subjected to are often performed only on scale models of the proposed transportation casks or are substituted with computer calculations – these "tests" are

wholly inadequate and do not replicate plausible real-world accident conditions. There is no documentation to support the NWMO or the Canadian Nuclear Safety Commission (CNSC) statements implying that the NMWO transportation package has been subject to immersion or fire testing.

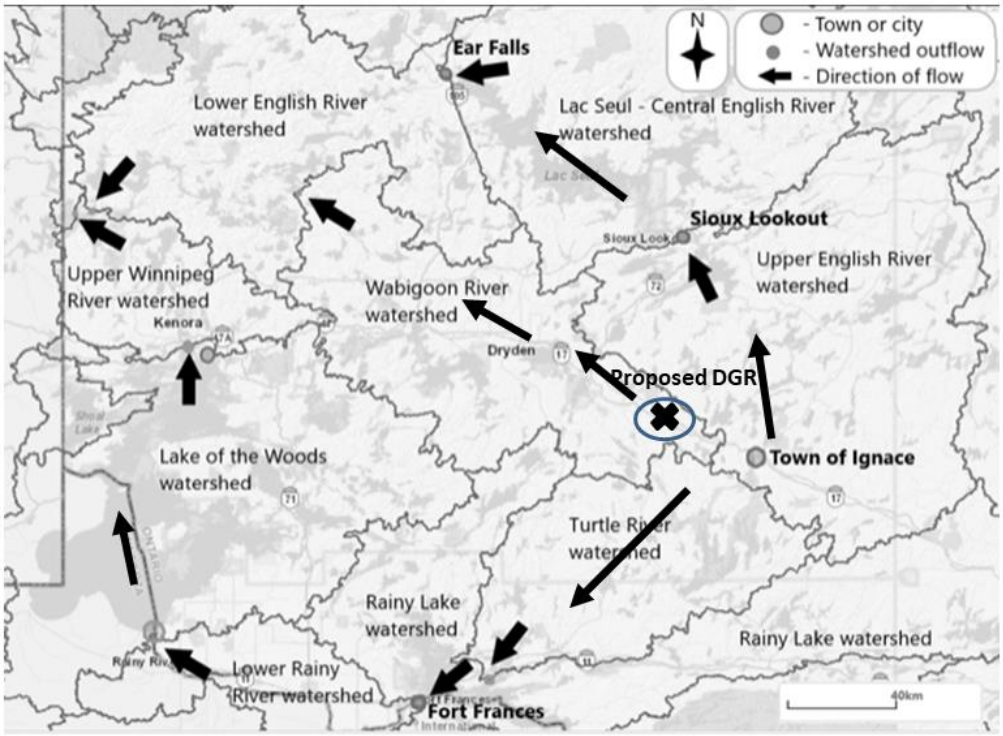
CANDU nuclear fuel waste (the waste currently proposed for the 50+ years of transport) does not consist of shiny, intact ceramic pellets such as the NWMO displays (replicas) at public events. Rather, nuclear fuel pellets on emergence from the reactors are embrittled, sometimes cracked, with a more powdery surface. Water-soluble radioactive compounds of concern on the pellets' surface include Cesium-137 and Strontium-90, which could cause immediate and lasting contamination of waterways.

It is of note that not all nuclear fuel waste on our roads will be from Canada's power reactors; low-, intermediate- and high-level waste from Whiteshell Laboratories (experimental reactors, now in their decommissioning phase) at Pinawa, Manitoba is proposed to be transported to Chalk River, Ontario in the near term. These wastes, just as with all of Canada's nuclear fuel waste, would travel over many lakes and rivers to reach their destination – putting each and every waterway at risk.

4) Position of the NWMO's proposed project in Canada's watersheds

The NWMO's proposed "Revell Site," one of two sites currently (as of March 2024) being considered as the location for a DGR for all of Canada's nuclear fuel waste, is located at the head of two very significant watersheds: the Wabigoon River watershed (running through Dryden), and the Turtle River watershed (which serves, in its turn, the Lake of the Woods watershed including Kenora). Both these watersheds meet at the Winnipeg River, which joins the rest of the vast Lake Winnipeg watershed at Lake Winnipeg, then to flow north towards Hudson Bay. The proposed site is positioned in close proximity to and upstream of several First Nations communities, including Asubpeeschoseewagong Netum Anishinabek (Grassy Narrows First Nation) – a community that still suffers devastating effects of contamination of its waters by mercury in the 1960s.

Northwestern Ontario Watershed Map



Issue: Credibility of the Nuclear Waste Management Organization

The Nuclear Waste Management Organization (NWMO) was formed in 2002 in accordance with Canada's new *Nuclear Fuel Waste Act*. Although the expert panel which spent 10 years reviewing Atomic Energy of Canada Limited's Geological Disposal Concept recommended in its 1998 report that there should be arm's-length, non-government, non-industry oversight of nuclear fuel waste management, the government stipulated that an industry group be at the helm.

This arrangement, as predicted by critics at the time, set up a situation wherein Canadians lack trust in the national organization tasked with nuclear fuel waste management. The NWMO is necessarily self-interested – both in terms of potential benefit for its producer-members, and, in turn, in terms of public profile that would attract public support to a continued national investment in nuclear power technologies.

As members of the Standing Committee on Environment and Sustainable Development, you will have your own perspectives on the matter of the origins and aims of the NWMO. We simply wish to note that many Canadians, particularly including members of environmental

and civil society organizations, are disappointed in this arrangement, and ultimately doubtful that the NWMO prioritizes protection of the natural environment, including freshwater, in its planning.

Our view is that the Federal government could play a more effective role in the protection of freshwater if it examined the ultimate environmental safety of allowing nuclear waste producers such influence in the management of their own waste.

Issue: Credibility of the Canadian Nuclear Safety Commission

Referred to as "Canada's regulator", the Canadian Nuclear Safety Commission (CNSC) is the body which describes itself as the entity which "regulate(s) the use of nuclear energy and materials to protect health, safety, security and the environment". The CNSC establishes regulatory guidance for the nuclear licensees, adopts the Canadian Standards Association standards on nuclear matters which are developed in-camera with no public or Indigenous involvement or even oversight, and licenses nuclear operations, including the generation, storage and – potentially – disposal of radioactive wastes. To date, there is not a single instance of the CNSC denying an applicant a license to operate.

The CNSC has five licensing stages: licence to prepare a site, licence to construct, licence to operate, licence to decommission, and licence to abandon. While the CNSC recently published *REGDOC-1.2.3, Licence Application Guide: Licence to Prepare Site for a Deep Geological Repository*, the CNSC asserts that the selection of a site for a deep geological repository and the site selection process is not subject to CNSC's licensing process. At the same time, the CNSC is retained by the NWMO through a "service arrangement" with the CNSC to provide the NWMO with a range of services, including attendance at NWMO events, providing advance reviews of NWMO communication materials, and providing feedback on NWMO's technical documents in a "pre-project review for technical components of the APM project" in advance of and/or outside any public release of the documents. The NWMO pays the CNSC hundreds of dollars per staff hour for these services.

The migration of senior CNSC staff to the NWMO is of additional concern, including instances of staff moving from the CNSC to the NWMO shortly after delivering a suite of regulatory documents directly related to the approvals for process for the NWMO's proposed deep geological repository.

In general, the CNSC is perceived as being much more closely aligned with the interests of the nuclear industry than with the public interest; in specific instances, that alignment becomes more obvious.

Issue: Credibility of the NWMO's "Conceptual" Plans

The NWMO persistently claims that there is an "international consensus" on deep geological repositories being the preferred method for the long-term management or "disposal" of high-

level nuclear waste. It must be noted, however, that this is a consensus largely limited to a select group, namely those whose organizations or corporations are pursuing an approval for a deep geological repository.

In Canada, this pursuit has been the focus of the nuclear industry for fifty years. The NWMO "concept" is a second-generation effort, after Atomic Energy of Canada Limited's Geological Disposal Concept failed to achieve a positive response as the outcome of a eight-year review (1990 to 1998), when the hearing panel responded negatively to the question before them, i.e. whether AECL had demonstrated that their concept was safe and acceptable; the Panel found that the AECL concept had not been demonstrated to be safe and acceptable.

In response, the federal government overlooked the Seaborn Panel's recommendations to establish an independent agency, arms-length from the industry to carry out further work on the topic and created the Nuclear Waste Management Organization. Since its inception in 2002, the NWMO has been crafting a series of concepts and components of a conceptual plan but has yet to produce a comprehensive description of their project. Instead, the NWMO has produced a series of shifting descriptions of parts of the project and presented them as if complete.

Our Recommendations:

We ask that the Standing Committee on the Environment and Sustainable Development give careful consideration to the following as you develop conclusions and recommendations in your freshwater study:

- Adopt the recommendations of the Canadian Environmental Law Association that Canada revisit the national radioactive waste policy to protect freshwater sources for all Canadians from tritium and other harmful radionuclides.
- Adopt the recommendations of Ottawa Riverkeeper to investigate the potential adverse effects of radioactive waste and its management on freshwater resources.
- Prioritize the protection of freshwater from contamination from nuclear sources, both in this Committee's current study and in its findings and recommendations.
- Urge Environment and Climate Change Canada to support the designation of radionuclides as "chemicals of mutual concern" under the Great Lakes Water Quality Agreement.
- Emphasize the importance of the protection of freshwater from radioactive contamination in outlining the role, mandate and priorities of the Canada Water Agency.

References:

[1]*Rock Solid*, 2010 - GeneWatch UK consultancy report – available at https://wethenuclearfreenorth.files.wordpress.com/2021/03/rock-solid_a-scientific-review.pdf

[2]*Seismicity Studies for the Long-Term Seismic Hazard Assessment in the Northern Ontario Part of the Canadian Shield*, 2007 - S.J. Hayek, J.A. Drysdale, John Adams, T. Lam, S. Halchuk, and V. Peci, of Natural Resources Canada and the Nuclear Waste Management Organization – available at https://www.earthquakescanada.nrcan.gc.ca/hazard-alea/14wcee/14WCEE_HayekDrysdaleAdamsLamHalchukPeci.pdf

[3]*Seismic Activity in the Northern Ontario Portion of the Canadian Shield: Annual Progress Report for the Period January 1, 2020 – December 31, 2021* - C. Boucher, N. Ackerley, V. Peci of Canadian Hazards Information Service and Nuclear Waste Management Organization – available at https://www.nwmo.ca/-/media/Reports-MASTER/Technical-reports/NWMO-TR-2022-23-Seismic-Activity-in-the-Northern-Ontario-Portion-of-the-Canadian-Shield-2022-12.ashx.

[4]*Comparison of Predicted and Actual Water Quality at Hardrock Mines* – 2006 - James R. Kuipers, Ann S. Maest – available at https://earthworks.org/files/publications/ComparisonsReportFinal.pdf.