

EARLY REGULATORY INVOLVEMENT IN A DEEP GEOLOGICAL REPOSITORY INITIATIVE FOR THE LONG-TERM MANAGEMENT OF CANADA'S USED NUCLEAR FUEL

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Canada's independent nuclear regulator, the Canadian Nuclear Safety Commission (CNSC), is responsible for licensing geological repositories intended to safely manage radioactive wastes, including used nuclear fuel, over the long-term. At the siting phase for a deep geological repository (DGR) for used nuclear fuel in Canada, regulatory involvement includes outreach activities, pre-licensing reviews of conceptual designs and post-closure safety assessments for two hypothetical sites in different host rock types (crystalline and sedimentary), international collaborations and an independent research program. This paper will focus on three elements:

1. The CNSC's early role while site selection is ongoing. At this stage, the initiative is still outside of the CNSC's formal licensing structure. Regulatory involvement is set out in a service agreement between the CNSC and the implementer (the Nuclear Waste Management Organization – NWMO), and follows international best practice.
2. Relationship building with the public and Aboriginal peoples. This includes encouraging and supporting the involvement of stakeholders in the regulatory process. The CNSC meets with communities who have expressed interest in learning more about our regulatory role.
3. The dissemination of objective scientific information, including CNSC's independent research program. The CNSC expects the geology under consideration to possess favourable natural characteristics that in combination with engineered barriers would ensure safety over the long term post-closure period, and during project implementation. CNSC's independent research program focusses on topics needed to verify arguments in favour of long-term safety.

1.0 The CNSC's role and early involvement in a potential Deep Geological Repository for Used Nuclear Fuel

The CNSC is responsible for licensing geological repositories intended to provide for long-term management of radioactive wastes, including used nuclear fuel. The CNSC uses a comprehensive licensing system that covers the entire lifecycle of a geological repository from site preparation, construction, operation, decommissioning (closure and post-closure) and, finally, abandonment (release from CNSC licensing).

The Nuclear Waste Management Organization (NWMO) is the implementer (future licence applicant) and is responsible for the long-term management of Canada's used nuclear fuel.

Currently, no licence application has been submitted by the NWMO to the CNSC for a deep geological repository (DGR) for used nuclear fuel. However, it is international best-practice for the regulator to get involved early in such initiatives.

In the future, if the NWMO finds a willing and informed host community in a suitable geological formation, they may submit a licence application to the CNSC for the initial stages of licensing (site preparation and possibly construction). The NWMO would then be the licence applicant. CNSC staff would conduct a rigorous review of the application and there would be public hearings in which members of the public and Aboriginal peoples could participate.

The CNSC is involved early in the process to ensure that the future licence applicant, the NWMO, and potentially affected communities have a comprehensive understanding of the CNSC's role in regulating Canada's nuclear sector, and its licensing process. The CNSC operates in an open and transparent manner and, as such, CNSC staff post information on our early involvement on our public website.

1.1 Service arrangement between the CNSC and NWMO

The CNSC signed a service arrangement with the NWMO to provide regulatory guidance prior to the submission of a licence application. Services include providing pre-licensing design reviews of DGR concepts, identifying regulatory requirements for a DGR and participating in public meetings to provide information on the CNSC's regulatory role. The current service arrangement is valid for a five-year period, unless a licence application for the early stages is submitted, at which point the arrangement would no longer be in effect.

2.0 Relationship building with the public and Aboriginal peoples

The CNSC recognizes that Canadians have concerns with regard to the nuclear sector. An important part of the CNSC's mandate is to communicate "objective scientific, technical and regulatory information" about CNSC activities and nuclear activities in Canada as per the objectives of the *Nuclear and Safety Control Act* (NSCA).

One way the CNSC shares information is by conducting outreach activities. Outreach activities describe the CNSC's role as Canada's nuclear regulator, and bring a variety of CNSC staff members (e.g., specialists in licensing, geology, aboriginal engagement, radiation protection) into a community to begin, and to build, relationships in both group and individual (one-on-one) settings. There are a variety of audiences that the CNSC conducts outreach with and activities are designed to educate the public, licensees and other stakeholders about a particular issue or topic.

In this early stage, CNSC staff have been meeting with communities involved in the NWMO's site selection process to help them understand how the CNSC regulates the nuclear sector; which safety factors are important for used nuclear fuel DGRs, and would be the focus of CNSC staff reviews should a licence application be submitted by the NWMO in the future; the types of safety-focused research that the CNSC carries out independently; and how the public and Aboriginal groups can participate in the public hearing process.

The CNSC's current outreach activities have focused on relationship building with many Aboriginal communities, including First Nations, and Métis. Meetings provide an opportunity for participants to ask questions and clarify issues of concern. During these meetings, CNSC staff are interested in hearing and learning about the most effective ways to involve communities and Aboriginal groups and how to best provide information to those who want to know more about the CNSC and other relevant matters within the scope of the CNSC's mandate.

At the request of community representatives, additional outreach activities, including information sessions and open houses, have been undertaken. Information sessions are usually meetings that are open to the public and Aboriginal groups, where CNSC staff members provide presentations and answer questions. Open houses are informal gatherings with posters set up to provide information; members of the public and Aboriginal peoples can read about information and ask questions to CNSC staff members, and frequently initiate one-on-one discussions. Since May 2010, CNSC staff have conducted 43 meetings with communities and 11 CNSC open houses. In addition to meeting with communities, CNSC staff have also met directly with First Nations and Métis communities who are interested to learn more about CNSC's regulatory role.

2.1 Aboriginal Consultation

In Canada, the Crown's unique relationship with Aboriginal peoples gives rise to the duty to consult, and where appropriate, accommodate Aboriginal peoples when the Crown contemplates conduct that might adversely impact potential or established Aboriginal or treaty rights.

The CNSC, as an agent of the Government of Canada, understands the importance of consulting and building relationships with Aboriginal peoples of Canada. The CNSC ensures that all of its licensing decisions under the NSCA and environmental assessment decisions under the *Canadian Environmental Assessment Act* (2012) uphold the honour of the Crown and consider Aboriginal peoples' potential or established Aboriginal or treaty rights.

2.1.1 Explaining Regulatory Role and Building Relationships

Building relationships with the First Nations and Métis communities who may have an interest in learning more about the initiative for a DGR for Canada's used nuclear fuel is a priority to the CNSC. As building strong relationships based on trust and mutual respect takes time, the CNSC has begun to do this early in the pre-licensing phase.

To date, if an outreach event is planned in a given area, the CNSC has reached out directly to nearby Aboriginal communities to let those communities know that an independent nuclear regulator exists in Canada and is available to meet and to provide communities with information about the CNSC and its regulatory role.

Following a Memorandum of Understanding between Natural Resources Canada (NRCan) and the NWMO, the NWMO is responsible to continue its Aboriginal engagement activities prior to selecting a site, to maintain a consultation log and to keep the Crown informed of these activities. NWMO is also keeping the CNSC informed of its activities with Aboriginal communities, including sharing issues and concerns being raised related to potential and existing Aboriginal and treaty rights.

As the NWMO's site selection process evolves, potential sites for a DGR for used nuclear fuel will be narrowed down. During this time, the CNSC will continue its Aboriginal consultation activities; however, greater focus will be given to working with First Nation and Métis communities who may be directly impacted by the proposed project. The CNSC will be seeking information as to whether a future licensing decision may cause an adverse impact on any potential or established Aboriginal or treaty rights, in order to meet its duty to consult.

2.1.2 Regulatory Approach to Aboriginal Consultation

The CNSC's approach to Aboriginal consultation integrates consultation activities into licensing processes and offers a number of opportunities throughout a regulatory review. These activities continue throughout the life-cycle of a project, from cradle to grave. Consultation activities may vary but typically staff will:

- send out letters of notification to potentially affected Aboriginal groups; these letters include project information, information about the CNSC review process and CNSC contact information
- proactively follow up to answer questions about the proposed project
- encourage Aboriginal groups to contact the CNSC to seek clarification, request additional information, identify interest in the project, and/or request a meeting to further discuss the activity
- provide timely information and status updates to potentially impacted Aboriginal communities at various stages of the project and/or licensing activity
- inform Aboriginal communities of opportunities and how they can participate in CNSC licensing reviews and hearings
- inform and encourage Aboriginal communities to use the CNSC's Participant Funding Program

The CNSC encourages Aboriginal peoples to outline the nature and the scope of their Aboriginal and treaty rights that they feel may be affected by a proposed project or activity regulated by the CNSC and to bring forward outstanding issues and concerns throughout the regulatory process. CNSC staff may also request meetings with the respective leadership and community representatives such as Chief/President and Council members on rights issues, and request information such as traditional knowledge and traditional land use relevant to the proposed project. These activities help the CNSC gather information on potential adverse impacts to potential or established Aboriginal and/or treaty rights, consider options to reduce impacts to rights and, if applicable, accommodate.

For most nuclear projects, CNSC staff takes on the role of the Crown Consultation Coordinator which acts as a single point of contact between Aboriginal communities participating in a regulatory review process and the regulatory decision-makers, should there be more than one federal or provincial government department responsible to make regulatory decisions for the proposed project.

The CNSC is also committed to maintaining its relationships with Aboriginal communities with interest in CNSC regulated facilities throughout the life of the project, including site preparation, construction, operation and decommissioning phases. This means a variety of engagement activities may continue such as providing information on how the CNSC regulates a facility, notifying and encouraging the Aboriginal communities to participate in future regulatory reviews, environmental assessment follow-up programs and CNSC Regulatory Oversight Reports presented to the Commission.

In 2016, the CNSC published REGDOC-3.2.2, *Aboriginal Engagement* which sets out requirements and guidance for proponents whose proposed projects may raise the Crown's duty to consult. While the CNSC cannot delegate its obligation, it can delegate aspects of the consultation process to licensees. The information collected and measures proposed by licensees to avoid, mitigate or offset adverse impacts may be used by the CNSC in meeting its consultation obligations. REGDOC-3.2.2 encourages proponents to engage with potentially affected Aboriginal communities early in the design phase of a project and to build long-term relationships that will last throughout the life of the project.

The process to develop REGDOC-3.2.2 included a 120-day consultation process, dispositioning over 200 comments received, making numerous revisions to address the concerns raised and continuing to consult with Aboriginal groups and stakeholders prior to presenting the final version to the Commission for approval during a public meeting.

The implementation of REGDOC-3.2.2 is expected to lead to more effective and efficient Aboriginal engagement practices, strengthen relationships with Aboriginal communities, assist the CNSC in meeting its duty to consult obligations, and reduce the risk of delays in the regulatory review processes.

3. Safety focused research and dissemination of information

The CNSC's work involves building and strengthening relationships with the public and Aboriginal peoples by ensuring that scientific information is made available, accessible, and easy to understand.

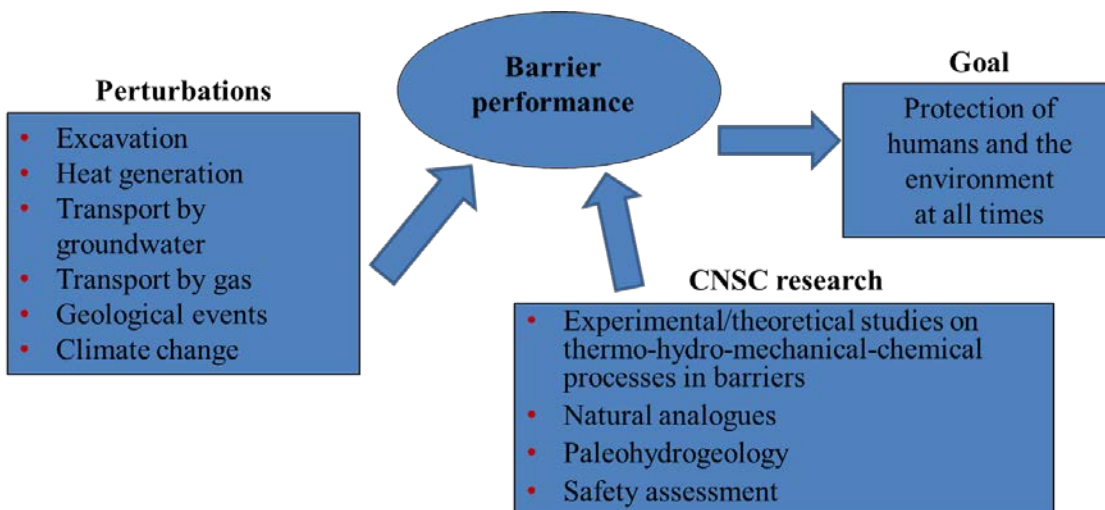


Figure 1: CNSC research on long-term DGR safety focussed on the performance of natural and engineered barrier systems.

The CNSC has an ongoing independent safety-focused research program, with several projects dedicated to verifying, furthering understanding, and filling gaps in the existing science relating to deep geological repositories (Figure 1). Ensuring that the results of this research are effectively disseminated is an important aspect of the research program. The CNSC's research does not duplicate research done by the project applicant, but aims to identify information gaps and to verify key safety aspects related to geological repositories as shown in Figure 1. The research program also ensures that CNSC scientists and technical staff will be prepared to critically review any potential future licence application. The CNSC's current repository research program investigates long-term safety issues collaboratively; a team of CNSC specialists work with external national and international experts. The research program also includes monitoring and reviewing state-of-the-art scientific advancements, and participating in international forums to exchange information and knowledge related to geological repositories.

Research on DGRs carried out by the CNSC focuses on the barrier performance over the long time frames associated with safety factors – such as: geological stability, favourable geochemical, geomechanical, and geotechnical characteristics, etc. – used to assess waste isolation and containment. The barrier includes both the natural component (geology, host rock) and the engineered barrier system (waste form, backfill material) which together are used to assess the long-term performance of a DGR system.

One example of the CNSC's research that uses geological information to verify DGR safety includes an investigation of how natural analogues can be used to this end. Natural analogues are natural geological features or processes that are similar to those that are expected to exist in some part of the DGR system. They have the advantage over laboratory experiments in that they provide information over a much longer time frame; they can also be used verify the results of numerical models.

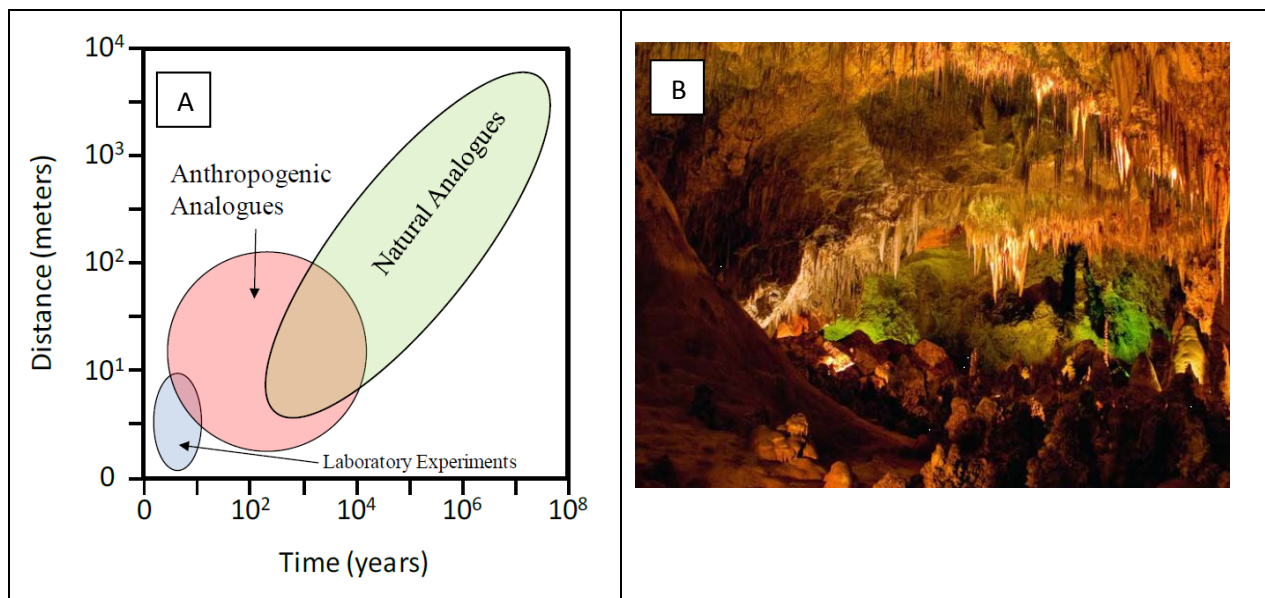


Figure 2. A: Comparison of time and spatial scales for laboratory experiments, anthropogenic analogues, and natural analogues ^[1].

Figure 2. B: Photograph of the 4-6 million year old Carlsbad Caverns in New Mexico, USA. Caves in geologically stable areas are a natural analogue for repository infrastructure. Source: National Geographic's website ^[2].

Figure 2.A shows a comparison of the time and spatial scales associated with experiments, anthropogenic, and natural analogues. Similar to natural analogues, anthropogenic ones are some human-made feature that represents some part of a DGR system. An example illustrating the natural analogue concept is shown in Figure 2.B. Caverns in limestone are similar to the infrastructure that would be excavated to build a repository. The Carlsbad caverns formed in limestone between four and six million years ago and remain stable today – providing evidence that underground openings in limestone can remain open for millennia or longer in areas that have low seismic activity. There are several underground caves around the world that have remained open for extended time periods – indicating that the underground workings in a DGR system can be expected to remain stable for the repository's operational lifetime and beyond. Natural analogues range from forming part of technical scientific investigations as well as their potential to be effective outreach tools, because in many cases the visual illustrations associated with natural analogues are accessible to a non-technical audience.

This is just one example of how natural analogues can be used to enhance safety assessments of DGR projects. Further examples of the independent research program that the CNSC carries out to assess DGR safety can be found on CNSC public website.

During outreach events, CNSC staff communicate research program results to members of the public, First Nations, and Métis groups. Various tools are used to better communicate the role of science at the CNSC and how it informs reviews – one example includes a timeline on the decades of independent research conducted on radioactive waste disposal. While scientists have been carrying out regulatory focused research at the CNSC for several decades, the value of transparency and effectively communicating the results of this research has become increasingly important.

References

- [1] Fayek, M. and Brown, J. 2015 Natural and Anthropogenic Analogues for High-Level Nuclear Waste Disposal Repositories: A Review. A report to the Canadian Nuclear Safety Commission 59 pp. Available online <http://nuclearsafety.gc.ca/eng/resources/research/research-and-support-program/research-report-abstracts/reports-issues-2015-2016.cfm>
- [2] The image is from national geographic's website:
<http://travel.nationalgeographic.com/travel/national-parks/carlsbad-caverns-national-park>