
DGR Joint Review Panel Hearing Written Submission in Support of an Oral Intervention

General Submission on Behalf of Northwatch

Prepared by Brennain Lloyd

August 13, 2013
Submission to the Joint Review Panel for the Public Hearing of

Ontario Power Generation’s Proposed

Deep Geologic Repository for Low and Intermediate Level Radioactive Waste

at the Bruce Nuclear Site

CEAA Reference number: 17520

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1. Introduction / Overview: Northwatch’s Interests and History of Participation

Northwatch is a public interest organization concerned with environmental protection and social development in northeastern Ontario\(^1\). Founded in 1988 to provide a representative regional voice in environmental decision-making and to address regional concerns with respect to energy, waste, mining and forestry related activities and initiatives, we have a long term and consistent interest in the nuclear chain, and its serial effects and potential effects with respect to northeastern Ontario, including issues related to uranium mineral exploration and mining, uranium refining and nuclear power generation, including on the Bruce region, and various nuclear waste management initiatives and proposals.

We have a longstanding interest in the management of nuclear waste, as well as other environmental and social impacts of using nuclear power for the purpose of electricity generation. Our interests are primarily with respect to the impacts and potential impacts of the nuclear chain on the lands, water, and people of northeastern Ontario. Our interest in nuclear waste was initiated by proposals dating back to the 1970’s to site nuclear waste “disposal” projects in northern Ontario. There have been numerous proposals over the last several decades, including proposals for the import and burial of high level waste in the 1970s and 1980s and for low level waste in the 1990s. Currently there are twelve communities being studied as potential burial sites for high level waste\(^2\), and there is at least one unpublished proposal for the disposal of low level waste\(^3\).

Northwatch was a full time intervenor in the Environmental Assessment of Ontario Hydro's Demand Supply Plan (1989-1993) and has been in intervenor at Ontario Energy Board with respect to electricity matters. Northwatch was also a full time participant in the panel review of the decommissioning of uranium mine tailings in Elliot Lake in the mid-1990's, and in the panel review of Atomic Energy of Canada Limited’s Geological Disposal Concept (1988 to 1998).

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\(^1\) See [www.northwatch.org](http://www.northwatch.org)

\(^2\) The Nuclear Waste Management Organization is currently studying the northern Ontario communities of Ear Falls, Ignace, Nipigon, Schreiber, Manitowadge, White River, Homepayne, Wawa, Blind River, the Township of the North Shore, Elliot Lake and Spanish as part of their nine step siting process for a geological repository for high level nuclear fuel waste.

\(^3\) Transcript, Canadian Nuclear Safety Commission Public Hearing, 17 January 2012, see page 66-71
More recently Northwatch participated in the federal review of the proposal to construct up to four new nuclear reactors at the Darlington Nuclear Generating Station, and the licensing reviews for the proposed refurbishment and license extension for the currently operating reactors at the Darlington Nuclear Generating Station and proposed extension beyond design life of the Pickerning nuclear station, each time with a focus on waste management.

The proposed geological repository for the disposal of nuclear wastes at the Bruce Nuclear Site is of interest both because of its precedent setting nature and because of its close proximity to Lake Huron, and the potential for adverse effects on the North Channel and North Shore of Lake Huron, Manitoulin Island, and the broader Great Lakes ecosystem.

Northwatch’s three key objectives for participation in the Panel Review of the proposed deep geological repository for radioactive wastes are:

- to contribute to an effective assessment of the proposed repository;
- to engage our members and other residents in the Lake Huron basin in the project review, and to solicit the input of residents of the Lake Huron basin and more generally of Ontario who are concerned with the safe management of radioactive wastes, including low and intermediate level wastes generated through the operation of nuclear power plants; and
- to bring independent technical expertise into the review process for the purpose of reviewing the safety and acceptability of the proposed approach to the management of low and intermediate level reactor wastes and assisting the Joint Review Panel in determining the appropriateness of the proposed approach.

During Phase I of the Federal Environmental Assessments for the Bruce Power New Build and Ontario Power Generations Deep Geologic Repository for Radioactive Wastes, which ran concurrently, Northwatch convened seven community meetings to discuss the two proposed expansions of nuclear activity at the Bruce Nuclear Generating Station, produced background material and a powerpoint presentation and made these available in hard copy to all workshop participants and others requesting the material as well as providing key materials on-line and by email, coordinated with other interveners, consulted with Northwatch’s membership, and
reviewed and made comments on the draft Joint Panel Review Agreement, Panel Terms of Reference, and draft EIS guidelines for each of the projects, as well as the project descriptions and other project related material available from the proponents or otherwise in the public domain.

During Phase II of this review we have participated in all aspects of the review that were available to us, including:

- Monitoring the public registry on a regular basis and reviewing key postings
- Viewing the three technical sessions via web cast and reviewing transcripts
- Engaging six technical experts, with the support of the Participant Funding Program
- Communicating with the Joint Review Panel on key process issues throughout the review
- Requesting and participating in a site visit arranged with Ontario Power Generation and the Nuclear Waste Management Organization
- Conducting a community consultation sessions with our members, residents of the north shore region, residents of the project area, and other residents of Ontario in order to direct and inform our participation and support the participation of others
- Submitting information requests during the public review period between February 2012 and May 2013
- Preparing a written submission on the (non) conformity of the EIS with the EIS guidelines in June 2013
- Requesting to participate and make a written and oral submission in July 2013
- Submitting a written submission and six expert reports in July 2013
- Preparing for our participation in the public hearing to begin in September 2013
2. Summary of Northwatch’s Key Findings

As outlined in more detail in later sections of this report with supporting references and rationale, our key finding is that Ontario Power Generation has not provided a complete set of applications and has not provided the Joint Review Panel with sufficient rationale for approving any of the three applications – Environmental Assessment, License to Prepare the Site, and License to Construct - submitted in March 2011.

Seven DGR Project Key Messages

Ontario Power Generation has identified “seven DGR Project key messages” and we will view the project proposal through the lens of those seven key messages to synthesize some of our key findings. Additional findings are summarized later in this section.

**OPG’S Seven DGR Project Key Messages**

**Northwatch Commentary**

As will be discussed in more detail by other intervenors, including several local residents who have done a careful evaluation of the OPG consultation program, the OPG public discourse has been a controlled one, with the emphasis on OPG broadcasting messages out, rather than engaging in a discussion that informs OPGs decision-making. Northwatch’s own experience of the NWMO documentation of our meeting with the NWMO to discuss the DGR serves as one example of the consultation program being ineffectual.

**OPG has a proven track record that spans nearly 40 years in the safe management of L&ILW.**

Without a full examination of OPG’s operating record it is not possible to evaluate this statement in its entirety, but it is possible to make two observations that place this statement in context. The first is that operations at OPGs reactor stations have been problem-laden

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and while not deemed “unsafe” by the regulator, there have certainly been many summary ratings of ‘below expectations’, and a relative scarcity of ratings of ‘very satisfactory’. The second is that this not an operation for which OPG – or any other utility – has any track record.

To exemplify the first point, we would refer to the Joint Review Panel to recent operations at the Pickering Nuclear Generating Station, as summarized in the OPG’s most recent application for license renewal and extension of the Pickering Nuclear Generating Station. We do not provide a full inventory of issues here, only a few examples to illustrate our point that OPG’s “track record” is far from failure-free, or even trouble-free. For example, in the application’s discussion of criticality safety, OPG discusses two instances where the neutron poison (used to maintain the units in a sub-critical state) were deposited out of solution, in one case through a calandria tube and in the other from the moderator cover gas compressor discharge line. Two other serious incidents were discussed only very briefly in the application, both involving leaks of tritiated water to groundwater. According to the brief descriptions, the presence of tritium in groundwater in the Units 5-8 Irradiated Fuel Bay B (058 IFB) area was due to the bay sumps not operating as designed, allowing tritium to escape to groundwater, beginning in 2005 and first noted in 2007. Also in 2007, chronic leaks of active water to inactive Unit 6 Reactor Building foundation drainage sumps were identified as the cause of elevated tritium in groundwater. We were particularly struck by the reckless flavour of the discussion of the potential for vibration – seemingly thought to be possible as a result of loose fitting gear springs – to cause cracking of the calandria tube:

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5 Attachment 3 to OPG Letter, G. Jager to M. Leblanc, “Application for Renewal of Pickering Nuclear Generating Station Power Reactor Operating Licence”, CD# P-CORR-00531-03719, page 117
The CTs in Pickering Units 5 to 8 are expected to be acceptable for operation to 240 kEFPH. However, Pickering Units 5 to 8 is the only station in OPG which has loose fitting GSs installed in the fuel channels that could be susceptible to P7A13 type component wear in GSs, PTs, and CTs. There is a small possibility that a vibration mechanism, coupled with a fuel channel resonant condition, which is thought to have caused the CT crack, is present in other Pickering Units 5 to 8 reactors. This is believed to be low probability based on OPEX. Therefore, the strategy will mainly focus on how to manage the potential for CT degradation and component wear from risk mitigation point of view through in-reactor inspections, rather than perform additional analysis to attempt to further understand the vibration mechanism or eliminate the underlying source behind the root cause. (bolded for emphasis)  

Ontario Power Generation goes on to describe their response strategy as being to review the data, and then if any callandria tube is “identified as being susceptible”, the channel in question would then be “given consideration for selection of SFCR candidates” and then, if selected, it would be inspected. While not yet catastrophic, this track record could certainly not be described as conservative or as precautionary.

The second point is that OPG has no track record in constructing or operating a deep geological repository for radioactive wastes, and around the world there is no track record in operating this design in this rock formation. As detailed elsewhere in this report, there is no track record for any geological repository – other than failures such as Asse – because those OPG cites as examples are a) significantly different in waste types, geological media and design and b) of too

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short an operating period to provide any indicator of long term performance. We also note that it is not OPG but the NWMO who will be constructing and potentially operating the DGR\textsuperscript{8}, and the NWMO has not real world experience in any field. The NWMO’s experience is entirely in the realms of consultation and hypothesizing.

The Municipality of Kincardine preferred the DGR because it wanted a long-term management option for L&ILW that is consistent with best international practice and provides the highest margins of safety for both the public and environment.

The decision-making role of the Municipality of Kincardine – and the basis of their decisions – is not clear, despite the volume of material filed and the repeated assertions of OPG that the Municipality made the selection of the DGR. Within the documentation, we were unable to find any record of the Municipalities decision-making process for the critical period between 2001 and 2004, and observed that the documentation is heavily weighted to the period after the Municipality is purported to have selected deep burial as their preferred option. However, three factors strongly suggest that the Municipality was acting as a proxy for OPG – at best – and that the Municipality’s “selection” of a geological repository is an expression of OPG’s own preference. For one, the Independent Assessment Study on which the Municipality purportedly relied to make its decision did not identify any particular preferred option and essentially categorized all options as equal except that the DGR would be the most expensive. Secondly, it would be unusual for a municipal council such as Kincardine’s to have the expertise and to have invested the time to be qualified to make this decision on a technical basis. Third, it is clear that the Ontario Power Generation had a strong preference and were already investing heavily in the development of a deep

\textsuperscript{8} During a meeting between Northwatch and the NWMO to discuss the proposed DGR in 2011, Angelo Castellan indicating to Northwatch that the NWMO expected that they would also be the operators of the DGR, although this was not yet “official”.

geological repository well in advance of the 2004 decision of the Municipality. OPG’s narrative is that the Municipality approached them in 2001, a study of various options was undertaken, and a geological repository emerged as the Municipality’s preferred option. However, OPG had been investing heavily in research for their preferred option – burial – since 1998 or earlier. For example, as referenced in one of the many directly related reports and studies Ontario Power Generation conducted or commissioned but does not appear to have filed as part of the evidence before the Joint Review Panel, OPG had commissioned “conceptual design and cost estimates were prepared for four generic LLW repository concepts including a rock vault disposal concept (Golder 1998). In 2000, a conceptual design and cost estimate report was prepared for a generic ILW repository based on a rock vault concept (Heystee 2000).”

The geology of the proposed location of the DGR Project presents multiple natural barriers that will provide for the safe long-term isolation and containment of L&ILW from the public and the environment for tens of thousands of years.

The site was not selected on the basis of its geology, but rather on the basis of it being confined within the OPG property and within the Municipality of Kincardine. OPG conducted no evaluation of other sites beyond the Bruce nuclear site to compare for suitability. Further, the “tens of thousands of years” cited by Ontario Power Generation as the period for which the “natural barriers” will isolate the wastes falls significantly short of the hazard-period for many of the waste products and of the 1 million year assessment timescale for repository performance. As outlined in Northwatch’s expert reports, OPG has not demonstrated that the DGR will perform reliably in the long term, and there are such uncertainties with the

repository design and performance that it should not be approved.

As outlined in the expert report filed by Northwatch which examines regulatory standards, in general, Canadian guidance lacks detail and lacks clear benchmarks for determining the adequacy of a safety case so a regulatory approval may not be an indicator of safety. And as outlined elsewhere in this report and detailed in submissions by local intervenors, Ontario Power Generation has not gained or demonstrated community support for this project. The messaging around “international peer review” is relatively meaningless when that peer review is without definition, transparency, or authority to affect project design and delivery.

The DGR and APM share consultants, management, language and philosophy. OPG’s most consistent defence against concerns that the DGR currently under development will be re-purposed for nuclear fuel waste is that the Hosting Agreement excludes it, but the Hosting Agreement is a service agreement between OPG and the Municipalities, and contains language within the agreement that allows OPG to cancel it at its discretion. It is, therefore, not binding and has no actual authority over OPG and future use of the DGR.

Further, the intermediate level waste that is proposed for emplacement in the DGR is also highly radioactive – some of the waste products are as highly radioactive as fuel waste – and the wastes also include “fuel fragments”. Finally, as evidenced by OPG’s recent disclosures about the potential for future license amendments to expand the DGR to include decommissioning wastes, OPG could similarly apply for a license amendment to co-dispose of high level nuclear fuel waste in the DGR. Nothing included in the EIS or licensing applications provides any certainty that this will not be the case.
As the owner, operator and licensee of the DGR, OPG has contracted NWMO to manage the project through the regulatory approvals process. As acknowledged by OPG, the NWMO has also been contracted to construct the DGR, and as has been indicated to Northwatch by the NWMO, the NWMO expectation (at least at the time of discussion in 2011) was that the NWMO would also be operating the facility. To some degree, the distinction between the NWMO and the OPG is a false distinction, given that the NWMO is controlled by OPG and is largely staffed by former employees of OPG. However, from a public accountability perspective, it may be significant, given that the NWMO is a product of the Nuclear Fuel Waste Act – an Act which provides it with no mandate for this activity – and is not subject to the same oversight that a public entity would be, and is not the licensee.

Interestingly, OPG does not include “need” for the project in their key messages, despite “need” being an EA fundamental and an examination of need being required by the EIS Guidelines. In addition to the following summary discussion, Northwatch will rely on the submissions of the Canadian Environmental Law Association for detailed analysis of OPG’s description of the need and purpose for the Project.  

OPG Establishment of Need for the DGR

In the OPG Project Description filed in 2005 to initiate the EA and licencing process, the OPG discussion of need is as follows:

1.3 NEED FOR THE PROJECT

The existing facilities at the WWMF were designed as interim storage for Ontario's existing fleet of twenty nuclear reactors. These facilities have an excellent safety record and could be relied upon to protect the health and safety of the public and the environment provided institutional controls exist. OPG is proposing to develop a facility, the DGR, capable of safety isolating the wastes from people and the environment over the hundreds and thousands of years that the wastes remain radioactive. The DGR is proposed for the following reasons:

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- It is consistent with best international practice
- It provides a permanent storage method for current waste streams from Ontario’s twenty nuclear reactors, which will protect health, safety and the environment, and if necessary, will do so in the absence of institutional controls
- It provides a greater margin of safety than the existing facilities
- It is preferred by the host municipality over the other technical options that have been evaluated, including the existing facilities

Upon examination, the four reasons provided by Ontario Power Generation in their discussion of the need for the project are not exclusive to the DGR as a long term management option – as one of several options evaluated by the IAS - with the exception perhaps of the claimed advantage of the DGR continuing to operate “in the absence of institutional controls”.

The DGR is proposed for the following reasons:

**It is consistent with best international practice**

Northwatch Commentary

As outlined in expert reports filed by Northwatch and summarized in Section 4 of this report, the DGR design is not consistent with international “best practice” for geological repository. For example, it fails to include an engineered barrier in its “multi-barrier” approach. Secondly, the science around deep geological repositories is still developing, and numerous uncertainties persist in the conceptual development of the “safety case” for geological disposal; these uncertainties have also been identified in relation to this DGR proposal. Further, the majority international practice is not deep burial of low and intermediate level waste, but sub-surface storage. Scotland's “Higher Activity Radioactive Waste Policy” states this as their policy, and in supporting

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12 For example, in the report “Technical issues associated with deep repositories for radioactive waste in different geological environments”, Science summary SC060054/SR1, UK Environmental Agency, 2009

13 See Section 4 of this report and related expert reports filed by Northwatch.

14 SCOTLAND'S HIGHER ACTIVITY RADIOACTIVE WASTE POLICY 2011, as found online at http://www.scotland.gov.uk/Publications/2011/01/20114928/0
documents identifies numerous countries – including France, Finland, Sweden, Spain, Japan, Hungary, Belgium, the USA and Slovenia – with similar policies and/or practices.\textsuperscript{15}

This is not exclusive to the DGR as a long term management option. Each of the options evaluated by the IAS would have equally met this need, and the IAS concluded that each option was (equally) feasible. The only potential claim of advantage for the DGR would be the supposition that the DGR would continue to operate “in the absence of institutional controls”

This statement is not supported in the findings of the IAS, which was the most substantive evaluation of alternatives to the DGR.

As discussed earlier in this report, OPG has not established the degree to which the DGR was in fact a preferred option of the Municipality versus the Municipality was expressing this preference as a proxy for OPG.

Deficiencies of the OPG Application

A key finding – and one that the Joint Review Panel should find fatal to the OPG application – is that Ontario Power Generation has not presented a complete application or presented a sound technical case in support of their proposed Deep Geologic Repository Project.

As summarized in Section 4 of this report and detailed in expert reports filed by Northwatch in support of this general submission, we make the following findings:

- Despite Ontario Power Generation’s claims that their project is supported by “international best practices” and “international experience”, there is no international

\textsuperscript{15} International Near-Surface Facilities, supporting document for SCOTLAND’S HIGHER ACTIVITY RADIOACTIVE WASTE POLICY 2011, as found online at http://www.scotland.gov.uk/Topics/Environment/waste-and-pollution/Waste-1/16293/higheractivitywastepolicy/intnearsurcefacilities
experience of successful DGR; rather than serving as a rational for Project approval, this provides reason for caution and care in learning from those experiences and applying the Canadian standards.

- Based on what is known from "best practices", OPG has not made an adequate technical case, including in the following areas:
  - The shortcomings of the modeling indicate a lack of fundamental understanding of the site.
  - The safety case has not been made because OPG is unable to establish what the migration rates of the radionuclides to the surface would be and hence the danger that it would present.
  - OPG has not demonstrated the required “defense in depth” in that shaft seal partial breakdown would reach or exceed the dose criterion.
  - WIPP, the apparently “most successful DGR” according to OPG, is not performing for the RH waste and has backfill requirements missing from OPG’s proposal.
  - In the UK, packaging and other engineered barriers are expected to provide important safety function beyond that proposed by OPG.
  - OPG’s proposal does not meet the IAEA safety case guidance.

**Northwatch’s Key Finding**

In summary, Ontario Power Generation has not provided the Joint Review Panel with a basis for approving the Environmental Assessment, the Application for a License to Prepare the Site, or the Application for a Licence to Construct the proposed Deep Geologic Repository for low and intermediate level radioactive wastes at and below the Bruce Nuclear Site.
3. The “Project”

3.1 Ontario Power Generation’s Proposed Deep Geologic Repository

As described by Ontario Power Generation in their 2011 Environmental Impact Statement, OPG is proposing emplace to stockpiled and future operating wastes from all OPG owned and operated reactors in a series of caverns deep below the surface of the Bruce Nuclear Generating station:

*Ontario Power Generation (OPG) is undergoing a multi-year planning and regulatory approvals process for a deep geologic repository (DGR) for the long-term management of low and intermediate level waste (L&ILW). Currently, the L&ILW produced as a result of the operation of OPG-owned nuclear reactors is stored centrally at OPG’s Western Waste Management Facility (WWMF) located on the Bruce nuclear site near Tiverton, Ontario. Although current storage practices are safe and could be continued safely for many decades, OPG’s long-term plan is to manage these wastes in a long-term management facility. Throughout this report, OPG’s proposal is referred to as the "DGR Project".*

*The DGR Project includes the site preparation and construction, operations, decommissioning, and abandonment and long-term performance of the DGR. The DGR will be constructed in competent sedimentary bedrock beneath the Bruce nuclear site near the existing WWMF. The underground facilities will include access-ways (shafts and tunnels), emplacement rooms and various underground service areas and installations. The surface facilities include the underground access and ventilation buildings, Waste Package Receipt Building (WPRB) and related infrastructure.*\(^\text{16}\)

The repository is proposed for a “nominal” depth of 680 metres below the surface in a band of limestone that is overtopped by shale and underlain by granite. The waste estimate of 200,000 m\(^3\) is based on current reactors only, and does not include the up to four additional reactors that have been proposed and received Environmental Assessment approval for the Darlington nuclear site.\(^\text{17}\)

As stated in the Environmental Impact Statement and its Summary, the proposal does not include decommissioning wastes:

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\(^{17}\) OPGs DEEP GEOLOGIC REPOSITORY for LOW AND INTERMEDIATE LEVEL WASTE, Environmental Impact Statement Summary, March 2011
The current proposed DGR Project does not include management of decommissioning waste. At the time that each generating station is decommissioned, an EA will be required that will address management of the decommissioning waste.\textsuperscript{18}

Ontario Power Generation also states in their Environmental Impact Statement that spent fuel will not be placed in this proposed deep geological repository:

\textit{The development of a long-term facility for used fuel is not the subject of the EA for the DGR Project.} \textsuperscript{19}

\textsuperscript{18} OPGs DEEP GEOLOGIC REPOSITORY for LOW AND INTERMEDIATE LEVEL WASTE, Environmental Impact Statement Summary, March 2011

3.2 The Project as Precedent

The notion of burying nuclear waste in a rock formation has been a long-held goal of the nuclear industry in Canada, dating back to Atomic Energy of Canada’s siting/research efforts with respect to highly radioactive irradiated fuel waste in the 1970s, 80s and 90s and carried through to today by Ontario Power Generation, Atomic Energy of Canada Limited, and the Nuclear Waste Management Organization.

The Canadian Nuclear Safety Commission describes the status of nuclear waste burial in Canada as follows:

*In Canada, there are two long-term radioactive waste management initiatives underway that may result in the construction of geological repositories.  
The first is Ontario Power Generation’s Deep Geological Repository for low-and intermediate-level radioactive waste from the Bruce, Pickering and Darlington nuclear generating stations.  
The second initiative is the Nuclear Waste Management Organization’s Adaptive Phased Management project for the long-term management of Canada’s used nuclear fuel.*

Unacknowledged by the CNSC summary are the current proposal by Atomic Energy of Canada Limited for a deep geological repository at the Chalk River National Laboratory on the Ottawa River or the preliminary decommissioning plan filed with the Canadian Nuclear Safety Commission for the shipment of decommissioning wastes from Cameco’s Port Hope operations to a “hypothetical” facility in Blind River which CNSC staff described during the January 2012 licensing hearing as a “mound” and by which we presume them to mean a shallow burial repository. CNSC staff are fully aware of these additional burial proposals – while at the same time there is limited information available to the public – and the absence of these two projects from the CNSC summary cited above is perplexing.

In the late 1980’s Atomic Energy of Canada Limited’s proposed Geological Disposal Concept for the high level waste was referred for a federal environmental assessment review. That review

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20 CNSC web site, as found at [http://nuclearsafety.gc.ca/eng/about/regulated/radioactivewaste/research-geologicalrepositories.cfm](http://nuclearsafety.gc.ca/eng/about/regulated/radioactivewaste/research-geologicalrepositories.cfm)
21 [http://www2.canada.com/life/chalk+river+toxic+legacy/5874735/story.html?id=5874735](http://www2.canada.com/life/chalk+river+toxic+legacy/5874735)
22 Transcript, Canadian Nuclear Safety Commission Public Hearing, 17 January 2012, see page 66-71
concluded in 1998 with the eight member panel concluding that Atomic Energy of Canada Limited had not demonstrated that their concept was “safe and acceptable”. While the Panel report identified a number of technical issues and deemed to be only “feasible” for a “conceptual stage of development”, the more resounding failure was with lack of public acceptance for the AECL concept:

As it stands, the AECL concept for deep geological disposal has not been demonstrated to have broad public support. The concept in its current form does not have the required level of acceptability to be adopted as Canada’s approach for managing nuclear fuel wastes.\(^\text{23}\)

Efforts by the industry since the resounding failure of the AECL concept in the 1990s have focused largely on the challenge of gaining public acceptance, including those of the Nuclear Waste Management Organization to gain social acceptance for the burial of irradiated (spent) fuel waste and of Ontario Power Generation to gain a social license for the burial of so-called low and intermediate level radioactive wastes at the Bruce nuclear site.

Repeatedly throughout the Environmental Impact Statement and various supporting documents and descriptions Ontario Power Generation states and restates one of the dogmas most central to their proposal: that the project was being brought forward by Ontario Power Generation with the support of area municipalities and local residents.

In 2005, OPG, with the support of the Bruce County municipalities, initiated the regulatory approvals process for site preparation and construction, operation, decommissioning, abandonment and long-term performance of a Deep Geologic Repository (DGR) for the long-term management of L&ILW...

The DGR site was chosen because it provides two attributes that, based on international experience, are essential for the successful development of a long-term nuclear waste management facility: technical suitability – in this case geology that offers multiple natural barriers to safely isolate and contain the waste for tens of thousands of years and beyond; and social acceptance – residents of the host municipality are both informed and willing.\(^\text{24}\)


\(^{24}\) OPGs DEEP GEOLOGIC REPOSITORY for LOW AND INTERMEDIATE LEVEL WASTE, Environmental Impact Statement Summary, March 2011, page 1
As outlined in the Environmental Impact Statement, OPG conducted extensive communication campaigns around the proposed DGR, including a series of open houses, numerous publications and paid advertisements, and a main street office in the Municipality of Kincardine. In addition, a “DGR Hosting Agreement” was signed by the Municipality of Kincardine and OPG on October 13, 2004 which committed OPG to paying the municipalities of Kincardine, Saugeen Shores, Huron-Kinloss, Arran-Elderslie and Brockton a total of $35M over 30 years and committed those municipalities to expressing support for the Deep Geological repository.

Despite that considerable effort, Ontario Power Generation achieved little success in demonstrating the much-coveted “social acceptance” for their proposed burial project:

_The community telephone poll of permanent residents of Kincardine eighteen years of age and older, was conducted in January and February 2005 by an independent company called The Strategic Counsel. Seasonal residents were mailed a copy of the question and asked to respond by mail. A copy of the polling report is found in Appendix D3. Diligent efforts were made to contact each household, and each eligible resident, either by telephone or by mail if no telephone contact could be made. The poll asked residents: “Do you support the establishment of a facility for the long-term management of low and intermediate level waste at the Western Waste Management Facility?"

_The polling drew a 71% response rate with the following results:
- Yes – 60%;
- No – 22%;
- Neutral – 13%; and
- Don’t know/refused to answer – 5%.

_Based on the positive results of the community poll, OPG began to work on a Project

Northwatch will rely on local intervenors to provide the Joint Review Panel with a more detailed analysis of the efforts – and failure – of Ontario Power Generation to gain social acceptance, but even a cursory examination and basic math establishes that OPG achieved not even majority support. If one were to accept that the 71% response rate represented 71% of the population – certainly OPG’s documentation does not establish this to be the case – a 60% positive response would still represent only 42% of the community having expressed support for the project. Despite this failure, OPG persistently makes claims throughout their application documents of having gained the coveted prize of public acceptance. This claim is not supported by reality.

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Similar aspirations for social acceptance are held by the Nuclear Waste Management Organization, a national alliance of nuclear utilities - namely Ontario Power Generation, Hydro Quebec and New Brunswick Power – mandated by the federal government in 2002 to pick up the AECL torch in “developing a solution for the long-term management of nuclear fuel waste in Canada”. The NWMO has what may be seen as more challenging task, with an inarguably highly radioactive waste, and without a community having had the receipt of the wastes already normalized (something the quiet establishment over 30 years ago of the predecessor to the Western Waste Management facility has achieved for OPG in the vicinity of the Bruce site).

Without doubt, having the deep geological repository for low and intermediate level waste under the Bruce nuclear site “go first” will be seen as advantageous to the several other nuclear waste disposal schemes that are waiting in the wings.

Interestingly, the Project Description for the environmental assessment for the expansion of the Western Waste Management Facility produced in 2004 contains no mention of a proposed or even possible deep geological repository. This despite the coincidence that the same Nuclear Waste Management Division that authored the WWM Project Description had been the recipient earlier that same year of the much-touted “Independent Assessment Study” by Golders and Associates and that the Hosting Agreement between OPG and the Municipality of Kincardine had been signed just the month before.

Given the common quest for social acceptance, it is not particularly surprising to find other commonalities, including having numerous players in common, and certain social claims borrowed from one initiative to another.

Some of the most notable cases of players in common include those who were key players in the Nuclear Waste Division at Ontario Power Generation at the time of the Independent

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27 PROJECT DESCRIPTION for the WESTERN WASTE MANAGEMENT FACILITY REFURBISHMENT WASTE STORAGE PROJECT, File No. 01098-PDD-00531-00001 R01 Prepared by: Environmental Assessment Department, Nuclear Waste Management Division, November 25, 2004 WWMF, as found online at http://www.ontla.on.ca/library/repository/mon/10000/251398.pdf
Assessment Study report being filed and the Hosting Agreement being signed in 2004. This cast includes key senior personnel such as Ken Nash, previously Senior Vice President and Chair of the NWMO and now president of the Nuclear Waste Management Organization, Angelo Castellan, now Vice President – Environmental Assessment at NWMO, and Frank King, Vice President - VP, Chief Engineer OPG DGR Licensing at NWMO.

One of the more striking cases of “borrowing” between projects and project rationale is that found on page 3-5 of the Environmental Impact Statement. In arguing in favour of a deep geological repository versus the status quo of continued storage at the Western Waste Management Facility, the document purports that:

“Canadians have indicated that they do not want to wait another generation for substantial progress to be made on developing long-term solutions for waste management.” (emphasis added)

This is clearly a case of “borrowing” from the NWMO, whose 2005 study “Choosing a Way Forward The Future Management of Canada’s Used Nuclear Fuel (Final Study)”29 which is liberally peppered with “Canadians want” and “Canadians said” statement, including some to the effect that Canadians believe that the current generation should take responsibility for the long term management of nuclear fuel waste (somehow, the NWMO leaps from that to a position of geological repositories being the NWMO’s preferred option; the rationale for such a leap is not stated). Despite the extensive documentation of their consultation efforts, OPG does not produce evidence – and does not even claim – that they have consulted broadly with Canadians and so are positioned to make statements about what “Canadians” do or do not want in terms of the management options considered for the low and intermediate level radioactive wastes which are under discussion in this application by OPG.

These commonalities are not surprising, given the relatively small size of the nuclear sector in Canada and the history of nuclear waste management proposals. For example, Ontario Power Generation was co-proponent with AECL in the federal environmental assessment of AECL’s geological disposal concept, with Ontario Hydro – now Ontario Power Generation – responsible

29 Choosing a Way Forward The Future Management of Canadas Used Nuclear Fuel (Final Study), Nuclear Waste Management Organization, 2005
for siting and transportation. During Phase I of that review hearing, in March 1996, Ontario Hydro offered themselves as the implementing organization for AECL’s concept. Almost 20 years later, Ontario Power Generation has majority control of the Nuclear Waste Management Organization’s board, has “retained” the Nuclear Waste Management Organization as “consultant” for their Deep Geological Repository, and the NWMO is largely staffed by former employees of Ontario Hydro /Ontario Power Generation’s nuclear waste division, with several of them dating back to having represented Ontario Hydro at the AECL Concept hearings in the 1990s.
3.3 The Project Evolution

That a project of this potential consequence and unprecedented nature should change and evolve over a decade of development is not surprising. What is surprising is the blend of certainty and uncertainty that the proponent and their consultants and agents consistently bring to the project descriptions. Also surprising is that some significant design and construction decisions had not yet been made at the time of submitting the licensing and EA applications in 2011, and some have still not been made. For example, as of a site visit on June 13, 2013 Ontario Power Generation had still not made the very basic construction decision as to whether they would use grout, a freeze wall, or both to control the ingress of water during the construction of the upper reaches of the repository shafts.

Over its decade of development, project fundamentals have shifted in multiple areas. While not comprehensive, this paper will comment on three of those areas: project description and design changes, changes in proponent / operator, and changes in waste categories and characterization.

3.3.1 The Evolving Project: Changes in Description and Design

Throughout the approximately 20,000 pages of documentation on the public record there are varied descriptions of many aspects of the project. In addition, there are numerous documents which do not appear to be part of the public record for this review – searches of the public registry and Information Request responses produced no “results” – but appear to have been important in the project’s development and evolution. Examples of the latter case include Conceptual Design Reports done Hatch Limited in 2008\(^\text{30}\) and Golder Associates in 2004.

In order to gain a summary sense of the evolution of project design and description of the project’s development period, we identified ten project aspects and then examined three key documents that were produced at three year intervals. The project aspects were: description of wastes, design, isolation of emplacement rooms, the number of emplacement rooms, waste volume, current and estimated annual volumes, repository "start" date, repository footprint, and

\(^{30}\) OPGs DEEP GEOLOGIC REPOSITORY for L&ILW, Conceptual Design Report, Hatch Limited, 323874DGR-RPT-CDR200-Rev01, May 2008; other “Conceptual Design Reports” were produced in at least 2004 by Golders, but were not included in this summary review
international examples cited. The documents used as reference for this summary review were:
the Project Description that accompanied the OPG letter to the CNSC indicating OPG's Intent to
Construct a Geologic Repository for Low and Intermediate Level Waste in 2005\textsuperscript{31}, the
Conceptual Design Report prepared for OPG by Hatch Limited in 2008\textsuperscript{32}, and the Environmental
Impact Statement submitted by OPG in 2011.\textsuperscript{33}

There were many themes that were carried consistently throughout this series of reports, such as:
- The repository is for low and intermediate level wastes
- The repository will include surface and subsurface structures
- The underground workings will include a series of tunnels and emplacement rooms
- The repository will be constructed in a limestone formation

However, there was a great deal of variability between the three reports, including:
- Between the 2005 and 2008 reports, a design decision was made to access the
  underground workings via vertical shafts
- The underground layout changed considerably with each design update
- It appears that the 2008 design aspect of closing emplacement rooms with block walls
  was modified in the 2011 EIS to leaving the top of the wall open to allow air to enter the room
- The number of emplacement rooms when from 38 to 43 to 31
- Waste volume estimates went from 160,000 m\textsuperscript{3} to 186,000 m\textsuperscript{3} to 200,000 m\textsuperscript{3}
- Estimates of waste generated annually went from between 4,000 and 6,000 m3of L&ILW in
  2005 to between 5,000 and 7,000 m3of L&ILW in the 2008 and 2011 documents
- The surface footprint went from 15 hectares to 30 and the underground footprint went
  from 30 hectares to 40 hectares

\textsuperscript{31} DEEP GEOLOGIC REPOSITORY FOR LOW AND INTERMEDIATE LEVEL RADIOACTIVE WASTES
PROJECT DESCRIPTION, Report Number: 00216-REP07722.07-00001, November 2005, Attachment to letter
dated December 5, 2005 from Ken Nash, Ontario Power Generation to Barclay Howden, Canadian Nuclear Safety
Commission, regarding OPG's Intent to Construct a Geologic Repository for Low and Intermediate Level Waste

\textsuperscript{32} OPGs DEEP GEOLOGIC REPOSITORY for L&ILW, Conceptual Design Report, Hatch Limited,
323874DGR-RPT-CDR200-Rev01, May 2008

\textsuperscript{33} OPGs DEEP GEOLOGIC REPOSITORY for LOW AND INTERMEDIATE LEVEL WASTE, Environmental
Impact Statement, Volume 1: Main Report - 00216-REP-07701-00001-R000, March 2011, Prepared by:
Golder Associates Ltd
Table 1: Project Evolution

<table>
<thead>
<tr>
<th>Year</th>
<th>2005</th>
<th>2008</th>
<th>2011</th>
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<tr>
<td>Wastes</td>
<td>The waste to be emplaced in the DGR includes the L&amp;ILW currently stored at the Bruce site, as well as future L&amp;ILW waste produced as a result of the continued operation of OPG’s nuclear reactors. The Host Community Agreement makes provision for emplacement of waste resulting from the decommissioning of the OPG-owned reactors in the DGR however, that waste is not included in this proposal or this environmental assessment. The DGR will not accept used nuclear fuel.</td>
<td>LLW typically consists of industrial items and materials, such as clothing, tools and equipment, which have become contaminated with low levels of radioactivity. This waste is sent to the Western Waste Management Facility (WWMF) where it is processed and then placed into interim storage. There are also some large objects, such as heat exchangers and steam generators, which are and will be replaced during refurbishment work at the power plants, and fall into the category of LLW. ILW consists primarily of used reactor components, and resins used to clean the reactor water circuits, which are stored in in-ground containers at the WWMF site.</td>
<td>The DGR will receive L&amp;ILW currently stored at the WWMF nuclear site, as well as that produced from OPG-owned stations. The DGR will provide safe long-term L&amp;ILW in Ontario.</td>
</tr>
<tr>
<td>Design</td>
<td>Waste packages would be lowered to the emplacement horizon by a hoist or taken via an access ramp and then stacked within the emplacement rooms.</td>
<td>The underground layout of the repository has two vertical shafts located on a central ring tunnel from which two emplacement room access tunnels radiate out to the south and east. This arrangement enables all underground infrastructure to be kept in close proximity to the shaft, while keeping the emplacement areas away from normally occupied and high activity areas. There will be two panels of access rooms, one (“South Panel”) containing the majority of the bin and rack type LLW packages and the other (“East Panel”) being designed to contain the ILW and certain large, heavy and irregularly shaped LLW packages, such as heat exchangers and steam generators (see Figure II overleaf).</td>
<td>The DGR will have an underground arrangement with a central shaft, which offices, a work station, underground labs, and a geotechnical laboratory. From this centralization, two panels of access rooms are connected via access tunnels. The access tunnel leads from the main shaft and then proceeds to the east by way of Panel 1 access tunnel to the south by way of Panel 2 access tunnel. End walls are erected at the rooms, which are then filled.</td>
</tr>
<tr>
<td>Isolation of Emplacement Rooms</td>
<td>When each emplacement room is full, it would be isolated by an interim seal. Once all the waste has been emplaced, and following an interim monitoring period, the entire OGR repository would be sealed by placing low permeability plugs in all access-ways. Until such time as the seal is placed for the entire OGR, the waste will be retrievable. There are no plans to retrieve the waste however, it would be possible up to the time when the access is sealed.</td>
<td>All the emplacement rooms are “dead-ended” in that there is only one way in and out of them from the main access tunnels. To control ventilation air exhausting from the repository, all emplacement rooms and access tunnels will be equipped with solid ventilation ducts to contain air that has flowed over waste packages and duct it right up to discharge in the upcast Ventilation Shaft. In this manner, workers will be isolated from potentially contaminated air…. Once filled, emplacement room will be closed with block walls having access panels for ventilation (sic) connections.</td>
<td>End walls, or bulkheads, are built at the end of the emplacement rooms where they meet with the continuous ventilation. These bulkheads are for the installation of regulators and personal doorways for egress empty…</td>
</tr>
<tr>
<td># of rooms</td>
<td>38 (based on artist drawing)</td>
<td>There will be a total of 43 emplacement rooms, of which 28 will be dedicated to</td>
<td>31 emplacement rooms</td>
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the ‘standard-type’ LLW (bins and racks) and are identical in cross-section and length. These rooms are all located in the South Panel of the DGR. The East Panel will have 15 rooms of various sizes to most efficiently dispose the ILW and non-standard, large and heavy LLW packages.

| Waste Volume | The estimated volume of low and intermediate level waste to be placed in the DGR, excluding decommissioning waste, is 160,000 cubic metres (m³). This volume estimate is based on a number of assumptions about reactor life, refurbishment and effectiveness of volume reduction. Although the total volume of operating wastes to be emplaced in the DGR is expected to be approximately 160,000 m³, the interior volume of the DGR could be approximately 35 per cent larger. This is a result of unused space between the waste packages as they are packed into the emplacement rooms. If at some time in the future decommissioning waste is emplaced in the DGR, the waste volume would increase. | Based on a review of OPGs reference waste inventory data and incorporation of modified shield designs for the resin liners and T-H-E (Tile Hole Equivalent) liners, the final computed as-disposed waste volume is estimated at close to 186,000 m³. For these quantities of waste, packing efficiencies of 63% and 44% for the LLW South Panel and ILW/large LLW East Panel rooms respectively will be achieved. | A volume of approximately 200,000 m³ of waste (emplaced volume) will be stored in the DGR emplacement rooms. The majority (approximately 60%) of the total waste volume will be in storage at the WWMF before the assumed commencement of emplacement operations. |

| Current and Estimated Annual Volumes | OPG currently has approximately 67,000 m³ of low and intermediate level waste in storage at the WWMF. Future annual waste receipts are expected to vary from year to year, depending on the operation and maintenance programs at the nuclear generating stations. It is anticipated that between 4,000 and 6,000 m³ of L&ILW will be received each year for processing and packaging prior to emplacement in the DGR. Following incineration or compaction, the amount of waste requiring emplacement in the DGR is expected to be approximately 3000 m³ per year, similar to that currently stored annually in surface facilities at the WWMF. | Currently Ontario Power Generation manages about 5,000 to 7,000 m³ of low level and intermediate level radioactive waste (L&ILW) each year from the nuclear power plants at Bruce, Darlington and Pickering in Ontario. | Each year, approximately 84,000 m³ of waste from the operated nuclear generating stations in Ontario, including Bruce, Darlington and Pickering, is produced. To the end of 2010, the existing nuclear reactors in Ontario have produced about 84,000 m³ of waste. If the fleet of 20 reactors each operate to the planned end of life (a nominal 50 years), which assumes refurbishment of each of the generating stations, approximately 200,000 m³ (emplaced volume) of operational and refurbishment L&ILW would be produced. |

| Start Date | 2017 | Year 7 (i.e., 2021) | 2018 |
| Foot Print | DGR is expected to be constructed in the area near to the WWMF. The estimated size of the surface facilities for the DGR is approximately 15 hectares, including the construction laydown area and rock pile. The footprint of the underground facilities is approximately 30 hectares. | The overall repository footprint is 282,000 m² | The estimated footprint of the surface facilities for the DGR Project is 30 hectares (ha), including the construction laydown area and rock pile management area, and the underground facilities are 40 ha. |

| International Examples cited | Forsmark in Sweden, Olkiluoto and Loviisa in Finland, WIPP in the U.S. | Referenced using a piece of equipment similar to that used at the WIPP and Konrad, and shaft sealing comparison to WIPP, Morseleben and ANDRA and | Facilities at Loviisa, Forsmark in Sweden, Waste Isolation Pilot Plant (WIPP) in New Mexico and Konrad Mine in Germany.
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<td>DEEP GEOLOGIC REPOSITORY FOR LOW AND INTERMEDIATE LEVEL RADIOACTIVE WASTES PROJECT DESCRIPTION Report Number: 00216-REP07722.07-00001, November 2005, Attachment to letter dated December 5, 2005 from Ken Nash, Ontario Power Generation to Barclay Howden, Canadian Nuclear Safety Commission, regarding OPG’s Intent to Construct a Geologic Repository for Low and Intermediate Level Waste</td>
<td>AECL concepts are examples of the deep rock vaults technology for the disposal of L&amp;ILW</td>
<td></td>
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</table>

It is of considerable significance to this review that several key design and construction decisions have not yet been made, or at least had not been made and documented in the EIS, including such central decisions as to whether end walls will be erected at the room entrance once the rooms are filled, and whether the upper levels will be grouted or frozen during shaft construction. The proposal also defers development of a post-closure monitoring program until some unspecified “future time”.

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3.3.2 **Changes in Waste Categories and Characterization**

While too small a group to allow any broad conclusions to be reached, the two available waste inventory reports, summarized below in Table 2, show a general consistency in the OPG descriptions and categorization of the wastes they proposed to place in the proposed deep geological repository.

However, two points must be noted:

- While the 2008 and 2010 inventories show an increase in the volume of wastes and the total number of containers to be handled, they do not show a corresponding increase in total radioactivity; the 2010 inventory does, however, indicate a slight increase in the total thermal decay.
- Both the 2008 and 2010 inventory reports acknowledge and identify numerous uncertainties with respect to the waste characteristics, including is uncertainties associated with concentrations of radionuclides and chemicals in the waste inventory.

While the first point may be due to the gross generalizations made about the waste inventory and its characteristics – a problem in itself – the second point presents challenges to the design of a waste containment system that is to operate into perpetuity that cannot be overlooked, in that it makes clear that the waste characteristics are not understood, and so its behaviour over the very long time periods at question cannot be predicted with a sufficient level of confidence.

Table 2: Summary of 2008 and 2010 Reference Low and Intermediate Level Waste Inventory

| Reference Low and Intermediate Level Waste Inventory for the Deep Geologic Repository |
|----------------------------------|---------------------------------|----------------------------------|
| **August 2008**                  | **December 2010**               |
| Prepared by: Ontario Power Generation | Prepared by: *Ontario Power Generation* |
| The projected total disposal volume will be about 196,000 m$^3$ of operational L&ILW and refurbishment waste, based on approximately 166,000 m$^3$ of stored volume. The corresponding total number of containers to be handled would be about 50,000. | The projected total emplaced volume will be about 200,000 m$^3$ of operational L&ILW and refurbishment L&ILW, based on approximately 170,000 m$^3$ of stored volume. The corresponding total number of containers to be handled would be about 53,000. About 84% of the emplaced volume is low-level waste. |
| The total operational and refurbishment L&ILW radionuclide inventory is estimated to be 17,000 TBq at repository closure (assumed here) | The total operational and refurbishment L&ILW radionuclide inventory is estimated to be 17,000 TBq at repository closure (assumed here to be |
Both reports acknowledged uncertainties related to storage technologies for newer “hotter” pressure tube wastes that will arise from future refurbishment activities. Additional uncertainties were identified related to concentrations of radionuclides and chemicals in low- and intermediate-level waste.

While these are serious issues, another of equal concern is the very fundamental question of whether OPG intends to use the proposed deep geological repository for decommissioning wastes, in addition to their stated intention to use the repository for operating and refurbishment wastes. Embedded in that question is one of size and footprint: is this a repository for 200,000 m³ or is this a repository for 400,000 m³?

The 2011 Environmental Impact Statement includes numerous statements which singly and in combination indicate that decommissioning wastes are not part of the DGR project.

In the “purposes” section of the EIS, OPG states that “the currently proposed DGR Project does not include management of decommissioning waste” and confirms this in later sections with the statement that “decommissioning L&ILW is not included in this discussion”. Consistent with those statements, in the Section 10 discussion of Cumulative Effects, OPG states that “the EIS Guidelines require that emplacement of decommissioning waste at the Bruce nuclear site be included in the assessment of cumulative effects even though it is not a project that is planned or a project for which the schedule is in the reasonably foreseeable future”.

In response to JRP Information Requests, OPG has variously stated that its current licence application does not include decommissioning waste, and that the placing of decommissioning wastes in the DGR is among “reasonably foreseeable projects.”

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35 EIS Sections 3.1 PURPOSE OF THE PROJECT, 3.2.2 Long-term Planning by OPG, 4.5 WASTE TO BE PLACED IN THE DGR, and 10. CUMULATIVE EFFECTS
36 Environmental Impact Statement - 3-4 - March 2011, Section 3.1 PURPOSE OF THE PROJECT
37 Environmental Impact Statement - 4-18 - March 2011, Section 4.5 WASTE TO BE PLACED IN THE DGR
38 Environmental Impact Statement - 10-1 - March 2011, Section 10. CUMULATIVE EFFECTS, Subsection 10.0 OVERVIEW
39 IR EIS-04-102
40 IR EIS-06-233
When summarizing OPG’s response to questions from SON about decommissioning wastes, OPG stated simply and directly that “The DGR Project is for operational waste, as discussed in the EIS”.\(^{41}\)

But OPG has also stated that “If in future OPG decided it wished to put some forms of decommissioning waste into the DGR then it would need to apply to the CNSC for a licence amendment to allow this activity, and the associated regulatory process would be triggered.”\(^{42}\) OPG states in a response to EIS IR 04-110 that “Given that decommissioning waste from reactor dismantlement is not expected to be generated before 2050, the exact facility(ies) and means by which decommissioning waste would be managed in the long term are not fully identified and hence any associated activities are not considered ‘planned’ at this time\(^{43}\), but despite this statement and despite having stated in the EIS that the “emplacement of decommissioning waste at the Bruce nuclear …is not a project that is planned or a project for which the schedule is in the reasonably foreseeable future”\(^{44}\), in response to IR EIS-06-233, OPG places a”DGR for Decommissioning Waste at Bruce Nuclear Site”\(^{45}\) on a list of “Reasonably Foreseeable Projects”, stating that “By the time decommissioning waste could possibly be received at the DGR, the majority of operational low and intermediate level waste would be in place in the DGR and access tunnel closure walls would have been constructed, eliminating all radioactive emissions from this waste”, as if such a project is an accepted eventuality. Responses to IR’s EIS-08-341 and EIS-08-378 are consistent with the examples summarized above and additional summaries would be unlikely to add clarification.

In Ontario Power Generation’s Application for Renewal of Pickering Nuclear Generating Station Power Reactor Operation Licence OPG stated that decommissioning wastes would be managed in “a regional disposal facility located in Ontario, approximately equidistant from OPG’s five nuclear stations.”\(^{46}\) In discussion at the CNSC Day Two Hearing in Pickering on May 29th

\(^{41}\) IR EIS-05-203, Table 2: Questions on the Engineering, Safety Assessment and Geoscientific Studies  
\(^{42}\) IR EIS-04-102  
\(^{43}\)IR EIS-04-110  
\(^{44}\) Environmental Impact Statement, March 2011, Section 10. CUMULATIVE EFFECTS, Subsection 10.1 OVERVIEW, 3rd bullet  
\(^{45}\) IR EIS-06-233  
\(^{46}\) Application for Renewal of Pickering Nuclear Generating Station Power Reactor Operation Licence CD#P-CORR-00531-03719
following Northwatch’s oral submission, which had included a report to the CNSC that Northwatch’s request to OPG for details on this disposal facility had not received a reply, OPG further stated that the espoused facility had been referenced for business planning purposes only. OPG then went on to state that the DGR currently under review could be expanded to accommodate the decommissioning wastes. A followup email from OPG further indicated that “both the EA and the Kincardine Hosting Agreement recognize that, subject to future agreement and regulatory approval, OPG may be permitted to modify the DGR license to accommodate decommissioning waste.”

This has all the appearances of Ontario Power Generation engaging in a game of project-splitting, seeking an approval for half a project, knowing full well that they intend to seek an amendment to the approval at some later date to double the capacity and potentially more than double the radiological burden and the period of operations.

This form of manipulation should not be tolerated. While we are very much of the view that this project is not an approvable undertaking, we recognize that the Joint Review Panel may be under considerable institutional pressure to issue even a limited or partial approval. We ask the Joint Review Panel to consider what additional pressures a future tribunal would be under if asked to consider and then approve the second half of a project that Ontario Power Generation has willfully split off from the project description during this review, should this Panel grant even a partial or limited approval.

47 CNSC Day Two Hearing on PROL, 29 May 2013. Transcripts not yet available
48 Personal communication from OPG, by email, 30 May 2013
3.4 The Project Approval

As outlined above and summarized below and then detailed in expert reports commissioned by Northwatch, there are numerous and significant uncertainties and unknowns with this project.

Some of these are uncertainties with respect to the final design, and are potentially decisions that Ontario Power Generation could make – should the Joint Review Panel adjourn the hearing for a period of time – but that as a responsible proponent should have made prior to filing their application in March 2011. We note that OPG filed their application almost a full year prior to the Joint Review Panel having been named, and question OPG’s motivation in filing an incomplete application at that time. We also note that under CEAA 2012 there are time frames within which reviews are expected to operate, although we have a general understanding that the “clock stops” to allow proponents to fill information gaps.

Other uncertainties are larger than failures or refusals on the part of Ontario Power Generation to make design decisions in order to complete their application and have it subject to the scrutiny of this public review. For example, as outlined in several of Northwatch’s expert reports, there are large uncertainties related to long term performance of the proposed repository. Even if additional work is to be done, these uncertainties may well persist.

Some of the uncertainties are simply with Ontario Power Generation’s intentions: do they intend to project-split, and add decommissioning wastes to the waste stream then intend to place underground at the Bruce site, or not?

At present, Ontario Power Generation is seeking an approval for an environmental assessment, a license to prepare the site, and a construction license. These applications were submitted while the project was still in development – still evolving – and for which even basic construction decisions has not been made (for example, whether to grout or freeze during construction of the upper reaches of the shaft). Recently, Ontario Power Generation revealed in another forum that their waste volumes may have been grievously understated. Throughout their application, OPG has shown a limited regard for the highly radioactive nature of the so-called “intermediate” level
waste, and with the now-almost-proposed addition of decommissioning wastes the volume of highly radioactive “intermediate” waste will increase enormously.

Simply put, Ontario Power Generation has not put forward a complete application, has not provided a full description of the project for which they are seeking approval, and have not demonstrated adequate knowledge of the waste characteristic or the repository performance. An approval is not warranted.
4. Review of OPG Application and Project Proposal

A key objective of Northwatch’s participation in the Panel Review of Ontario Power Generation’s proposed deep geological repository for radioactive wastes is to bring independent technical expertise into the review process for the purpose of reviewing the safety and acceptability of the proposed approach to the management of low and intermediate level reactor wastes and assisting the Joint Review Panel in determining the appropriateness of the proposed approach.

With support from the Participant Funding Program, Northwatch retained six experts to provide the necessary technical support. Each of the experts have examined a particular aspect of what can be broadly described as Ontario Power Generation’s “safety case” for the Deep Geological Repository. These six studies evaluate the assertions made in the Environmental Impact Statement and supporting documents (Technical Support Documents, the Preliminary Safety Report and Postclosure Safety Assessment Report and the Geoscientific Site Characterization) that the proposed Repository is based on international experience, is capable of isolating the wastes for the required period of time, and provides an adequate margin of safety.

The six study areas Northwatch has identified as the priorities for the review of the OPG proposal are mutually supportive. Each study will provide stand-alone review of that component of the OPG case, but the study areas are also nested, and will provide a review of a key area of OPGs proposal through different lenses, of varying specificity, each related to an area of OPGs presentation.

The six study areas were identified on the following basis:

- An expectation that OPG’s safety case as summarized the Environmental Impact Statement and in the Preliminary and Post Closure safety assessments reports and related documents should synthesize the various elements of the OPG proposal in terms of the ability of the repository to safely isolate the wastes from the environment for the very long time frames required
• Ontario Power Generation’s proposal relies most fundamentally on what they describe as a “multiple barrier approach”; the effectiveness of engineered and geological barriers in the design of geological repositories are key to their performance and therefore central to the safety case being presented by OPG
• As in all work of this nature – i.e. work to support the use of geological repositories for the long term management of nuclear wastes - the long term performance predictions are based on computer modelling; the reliability of mathematical models used to support safety case and the appropriateness of the inputs used to “build” the models must be demonstrated if the safety case is to be legitimated; for example, the models will be based on a variety of assumptions related to the performance of the engineered and geological barriers and the character of the wastes, and the reliability of the performance predictions are wholly influenced by the reliability of the assumptions upon which the model is built
• Appropriately characterizing the waste is an important element in understanding the potential effect of the waste on the performance of the repository system; containers are an important contributor to a system’s ability to isolate the wastes in most designs for geological repositories
• Ontario Power Generation presents a number of international examples to support their proposal; the similarities – or dissimilarities – between the DGR as proposed for the Bruce nuclear complex and the international examples cited in terms of the waste characterization and the combined barriers must be evaluated to determine the relevance of the examples cited and the degree to which they have informed the development of the OPG proposal
• Internationally, several jurisdictions are evaluating or have evaluated geological repositories for radioactive wastes; a comparisons of standards for post-closure safety case assessments across jurisdictions will inform both consideration of international examples and Ontario Power Generation’s proposal

What follows is a summary of key points from each of these six study areas. The full reports are companions to this general submission, and address each of the study areas in greater detail and with more specificity than this summary. Readers should refer to each of the individual reports for a more complete understanding of the experts’ focus and findings.
Northwatch Review of OPG's Deep Geological Repository

Objective: Review the safety and acceptability of the proposed Deep Geological Repository as a preferred means of managing low and intermediate level radioactive wastes generated at Ontario Power Generation owned or operating nuclear power reactors.

Review of safety case as summarized the Environmental Impact Statement and in the Preliminary and Post Closure safety assessments reports and related documents.

Effectiveness of Engineered and Geological Barriers

Waste Characterization and Containers

International Experience

Review of how safety cases are evaluated internationally

Reliability of mathematical models used to support safety case

Figure 1: Northwatch’s Integrated Assessment of Ontario Power Generations Safety Case
4.2 **Ontario Power Generation’s Safety Case**\(^{49}\)

A ‘safety case’ is an integration of the arguments put forward by a proponent to describe the safety – and the level of confidence in the safety – of a project, such as the proposed deep geological repository\(^{50}\).

Radionuclides can migrate from a repository by dissolving in the underground water system or by carriage as a gas. Both of these routes involve complex chemical processes and it is the contention of this report that OPG has not demonstrated sufficient chemical knowledge of the repository and its environs to enable sufficiently rigorous chemical calculation of the extent of radionuclide escape – and hence they are unable to provide to the Panel a robust evaluation of repository safety.

Central to OPG’s safety case is the claim that the repository will be essentially dry – such that water will not reach the radionuclides and carry them back to the surface. This claim is not robust; OPG does not have sufficient understanding of the baseline hydrogeology to support such a claim.

Given that the assumption of an essentially dry repository is not robust, as the baseline hydrogeology has not been established, it is essential that OPG carry out risk assessment calculations on the assumption that the radionuclides could dissolve and migrate away from the repository and towards the surface. However, carrying out such calculations will be very complex, due to the wide diversity of the chemical behaviour of the radionuclides and the wide range of their possible solubilities.

\(^{49}\) Summarized from “Review of Ontario Power Generation’s Safety Case for the Proposed Deep Geological Repository for Low and Intermediate Level Radioactive Wastes”, prepared by Dr. Rachel Western BA(Oxon) PhD MRSC, August 2013

\(^{50}\) Paraphrased from definition provided by Ontario Power Generation, in Section 15, pg 15-33, Main EIS
4.3 **Engineered and Geological Barriers**\(^{51}\)

Key to any deep geologic repository’s design and potential performance is the effectiveness of the barriers that are intended to prevent loss of waste isolation once the repository has been closed with appropriate seals in place.

The following statement defines DGR’s proposed repository system:

*Deep Geologic Repository System (or DGR System, or Repository System) – The deep geologic repository facility for low and intermediate-level waste, its geological setting, and the surrounding surface environment. The system includes the wastes, and the engineered and natural barriers that provide isolation and containment of the waste.* [1, page 15-18]

The OPG’s Environmental Impact Statement for a Deep Geologic Repository for Low and Intermediate Level Waste (DGR) summarizes the leading qualitative arguments put forward by OPG for the ability of the site to provide long-term waste isolation in terms of site conditions such as repository depth, multiple geological layers or barriers, a diffusion-dominant groundwater system, and hydrogeological and chemical conditions that OPG indicate will limit contaminant mobility at repository depth.

These can generally be described as the conditions of the undisturbed site. As such, the general attributes of the undisturbed site and geologic setting might appear to be favorable to meeting the required goal of long-term isolation of radioactive wastes from the accessible environment. But, as with all other planned or proposed repository systems, the goal must be met by a site that has been disturbed by excavation that compromises some of the favorable attributes of the site, and emplacement of the waste that through time alters the environment of the host rock in ways that may also compromise the favorable attributes of the undisturbed site.

There are numerous deficiencies in the OPG application and supporting documentation.

The severe shaft seal failure scenario reveals a significant weakness of the DGR system in that it shows the dose criterion can be reached or exceeded if there is a partial breakdown, however

\(^{51}\) Summarized from “Review of Barriers”, prepared by Steve Frishman, August 2013
unlikely, of the repository system’s key engineered barrier - the shaft seal and EDZ. This illustrates a lack of defense-in-depth for the DGR system in that the failure of a single barrier can result in the failed performance of the repository, even when all other factors in the performance calculation are considered to be conservative.

Understanding the effectiveness of the shaft seal as proposed through in situ testing is essential to any decision regarding the future performance of the DGR system, and the evidence to support high confidence in its acceptable performance must exist early in the application process, ideally before major commitment to underground construction is made, but certainly before waste emplacement is permitted to begin.

The in-situ testing of shaft seal materials is planned only in the Cobourg Formation, at the repository horizon, which only represents a small portion of the geologic section requiring effective shaft sealing. No rationale is provided for how these tests will be representative of seal material behavior in the full range of lithologies encountered in the shafts.

Detailed plans for testing and monitoring of the shaft EDZ should be provided as part of this License Submission Package. And the plans must be aimed at collecting and analyzing EDZ characterization data not only during shaft sinking, but throughout the period from shaft sinking, to operating license application, and if granted, until repository closure and shaft sealing, in order to provide an understanding of the in-situ development and evolution of the EDZ. As acknowledged in the DGR reports, modeling of the EDZ and its interaction with other components of the DGR system is insufficient to support a DGR performance assessment that provides confidence that the system will provide the required isolation of waste from the accessible environment.
4.4 Modeling the Undisturbed Hydrogeology of the Bruce Site

Models are abstractions of reality. They are useful because they allow the analyst to forecast the behavior of the system being analyzed. In the case of the DGR we would like to forecast how well it sequesters contaminants. There are difficulties in making such a forecast. In many, if not most situations in which models are used to make forecasts there is a history of system response that can be used to calibrate the model. For example, in a petroleum reservoir one has a history of production that can be matched by the model before a forecast is made.

Modeling a deep geologic repository provides no meaningful history that the model can be matched to. The analyst models the repository based upon his/her understanding of the basic processes that impact system behavior; one is trying to forecast well into the future—often a million years. In the case of a repository, one strategy to gain confidence in the modeling is to use the models to recreate observed conditions at the site. For example, the fluid pressures in the Ordovician rocks at the Bruce Site are sub-normal. It is of interest to recreate this condition with the models of the site as a test of our understanding of the hydrogeology. This turns out to be not so easy.

When one opens a mine at more than 650 m depth in the rock at the Bruce Site, as is proposed for the DGR, one is creating an opening at atmospheric pressure in rock that has a fluid pressure equal approximately to a column of water/brine that extends to the land surface. The gas pressure in the mine is approximately $10^5$ Pa (1 atmosphere) while the fluid pressure in the rock not too far out from the mined opening is more than $4 \times 10^6$ Pa (4MPa). In other words, the mine creates a pressure gradient in the fluid in the rock of approximately 4 MPa over a fairly short distance between the mine and the intact country rock. Under this gradient fluid, brine contained in the country rock will move into the mine.

However, if the permeability of the country rock is low the rate of fluid flow into the mine will be small. Many mines appear to be dry because the mine ventilation system can remove a small inflow of water as water vapor.

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52 Summarized from “Modeling the Undisturbed Hydrogeology of the Bruce Site”, prepared by Dr. John D. Bredehoeft, The Hydrodynamics Group, LLC, August 2013
It is generally accepted that fluid transport, either by liquid or gas, is the principal mechanism by which contaminants from a DGR will be transported to the biosphere. Modeling is the tool used to project how the transport might occur under various scenarios that compromise the integrity of the repository. Calibration, or history matching, is one of the cornerstones of good modeling practice. At a nuclear repository site, like the Bruce Site, the only potential history match is to the observed fluid regime at the site.

At the Bruce Site there are three unusual characteristic of fluids:

1. The liquid is under pressured in the Ordovician rock section, especially at the depth of the repository.
2. The Ordovician rocks contain gas which appears to be in most instances less than 20% saturation.
3. The Cambrian rocks, the deepest sediments, are over pressured.

The Ordovician under pressures have proved difficult to understand, especially with the presence of the gas. The studies done for the EIS do not adequately explain either the under-pressure, and/or the presence of the gas. Questions remain about the source of the gas, its time of emplacement, whether it is continuing to be generated, and whether the under pressures were created by glacial loading. The fact that these questions remain indicates a lack of fundamental understanding of the site.
4.5 Waste Packaging and Characterization

Ontario Power Generation (OPG) state in their Postclosure Safety Assessment Report, in their Environmental Impact Statement (EIS) and various other supporting documents that the design of their proposed Deep Geological Repository (DGR) does not require waste packaging to provide a barrier function, and therefore packages are not designed to provide any long-term isolation and containment of waste. Instead containment is expected to be provided by the rock mass and repository shaft seals. OPG states that the rocks are expected to be of sufficiently low permeability and mechanical strength, such that additional engineered barriers are not necessary.

Only Konrad in Germany and WIPP in the United States use a similar safety concept to that being put forward by OPG for their proposed repository for low and intermediate level wastes. In other words Konrad and WIPP are at a similar depth, and rely on impermeable natural barriers with no groundwater flow.

And despite following a similar safety concept to that proposed by OPG, WIPP is required by the US Environmental Protection Agency to “incorporate engineered barrier(s) designed to prevent or substantially delay the movement of water or radionuclides toward the accessible environment.”

The OPG approach is to rely on so called natural barriers, but inexplicably relinquishes any confidence-building engineered barriers. So, compared with plans for deep geological disposal of radioactive waste in other countries – or even the current Canadian reference case for a deep geological repository for spent fuel - the OPG approach is not precautionary and appears to be throwing away an important tool in the struggle to reduce the risks posed by nuclear waste disposal to the environment and public health. In any event the lack of a barrier function

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53 Summarized from “Waste Packaging and Characterization”, prepared by Pete Roche, Edinburgh Energy and Environment Consultancy, August 2013
requirement for packaging is not a rationale for not providing detailed packaging specifications and so providing a more complete description of their project as proposed within this public review.

In answer to IR EIS-04-122, OPG says waste containers are expected to maintain their integrity to the degree necessary to facilitate easy retrieval (if required) for a decade or more after emplacement in the DGR.

In comparison, the UK’s generic waste package specification defines a number of standards for waste forms and containers. It specifies a target container life of 500 years, based on the assumptions that waste packages may have to be stored for 150 years, emplacement operations in a GDF may take 50 years, and a GDF may have to be kept open with packages easily retrievable for a few hundred years.\(^56\)

Even if packaging is not required to provide a barrier post closure, packages will still need to perform during storage and operational periods of the DGR, and there may be a period when the option of retrievability is required.

In order to properly assess the safety of the DGR we need to know the magnitude of the waste problem – in other words the inventory of waste. The Reference Low and Intermediate Level Waste Inventory for the DGR gives radionuclide quantities for one possible future scenario. It does not include waste from any proposed new-build reactors in Ontario nor does it include decommissioning waste.\(^57\)


The magnitude of the problem depends not just on the radionuclide quantities but also on the chemical context of the radionuclides.\textsuperscript{58} There is no indication in the Reference Inventory of the level of certainty that the quantity of radionuclides given is correct, and there is no chemical context. The long-term environmental behaviour of radionuclides, their fate in the environment and their potential for exposing human populations are dependent on their chemical properties.

\begin{footnotesize}
\textsuperscript{58} Lancaster University Environment Centre, Funded PhD Studentship – Radionuclides - The development of a tool for the determination of mobile radionuclides in contaminated groundwater (Feb 2010) \hspace{1em} \\
http://www.lec.lancs.ac.uk/news_and_events/news/?article_id=869 and \\
W.E. Falek and K.-F. Nilsson, “\textit{Geological Disposal of Radioactive Waste: Moving Towards Implementation}”, European Union Joint Research Centre (EU JRC) (October 2009) page 18 \hspace{1em} \\
\end{footnotesize}
4.6 Waste Isolation Pilot Project and International Experience

DGRs are purported to provide “disposal” by emplacing wastes several hundred meters underground with no intention of retrieval, in contrast to “storage” facilities where the wastes can be monitored and retrieved, as necessary. Given the lack of experience with any DGR in Canada, OPG states that a basic rationale for proposing the DGR is “because it is consistent with international best practice.” Therefore, consideration of OPG’s understanding of “international best practice” and actual “international experience” with such facilities becomes an important consideration in evaluating the proposed DGR.

The international experience of a DGR for radioactive waste is that only three have operated for a decade or longer. Two facilities in mines in Germany – Asse and Morsleben – did not operate as planned and no longer are receiving wastes, but will not be decontaminated and decommissioned for decades; and one facility in the United States of America (USA) – the Waste Isolation Pilot Plant (WIPP) – which began disposal operations in March 1999 and has received about half of its planned capacity.

There are lessons to be learned from those three experiences, some of which are acknowledged in the OPG Preliminary Safety Report (PSR), Environmental Impact Statement (EIS), and Information Responses (IR), but many of which are not. For instance, in the case of the WIPP, OPG does not accurately describe the actual requirements for WIPP; does not provide current information about the many changes being considered or allowed at WIPP; and does not address the unexpected events that have arisen at WIPP.

The basic fact is that there is not yet one example of a DGR that successfully operated to fulfill its mission of safely isolating the wastes from people and the environment for the thousands of years that they are hazardous. Nor is there an example of a DGR that has been closed and decommissioned. Thus, there is no example of a DGR that has safely contained radioactive wastes.

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59 Summarized from “Waste Isolation Pilot Project and International Experience with Deep Geologic Repositories”, prepared by Don Hancock, Southwest Research and Information Centre, August 2013

wastes throughout even its operational phase, let alone for the thousands of years that those wastes pose significant risks to human health and the environment. International experience, including “best practices,” demonstrate that there are many uncertainties; it does not establish that a DGR can be successfully operated and decommissioned.

OPG does not accurately describe the relevant international experience with the only three DGR-type facilities that have operated for more than a decade. Actual international experience is that no DGR has operated to fully dispose of the planned waste capacity. The Asse and Morsleben mines were closed prematurely because of safety concerns and have yet to have the waste retrieved (Asse) or decommissioned (Morsleben). The continuing experience of WIPP includes that the planned permanent room closure methods have not been installed and will be changed, so they do not provide actual experience for the DGR. The WIPP shaft seal design will not be implemented for decades and could also change, so it does not provide actual experience for the DGR. The four shafts and hoist system at WIPP is not being used in the proposed OPG two-shaft design. Institutional controls, backfill, and community engagement and acceptance are other aspects of the WIPP experience that OPG’s documents do not accurately describe. International experience demonstrates that there are many uncertainties; it does not establish that a DGR can be successfully operated and decommissioned.
4.7 International perspectives and comparisons of standards for post-closure safety case assessments\textsuperscript{61}

The Joint Review Panel is tasked with determining whether the post-closure assessment and safety case is adequate, and what is the appropriate methodology for conducting a post-closure safety assessment. Canadian standards set under the Nuclear Safety and Control Act are very general and do not provide sufficient detail to guide the Joint Panel’s review of the adequacy of a post-closure safety assessment or safety case.

In comparison, other countries have adopted more specific regulatory requirements for disposal of radioactive wastes. These set out in some detail the expectations that licensees would have to meet in preparing a post-closure safety assessment. This is consistent with the approach recommended by the IAEA.

The Joint Review Panel should use the regulatory approaches of other countries and the IAEA as a guide to assess appropriate conditions and to assess the robustness of the models employed by Ontario Power Generation (OPG).

In lieu of specific regulations to govern the conditions for licensing, the Panel should review the proposal in light of IAEA recommendations and by comparison to international standards for other geologic repositories and low level waste disposal facilities.

\textsuperscript{61} Summarized from “International perspectives and comparisons of standards for post-closure safety case assessments” prepared by Laura Bowman, JD, Associate Lawyer, Iler Campbell LLP, August 2013
5. Additional Issues

5.1 The Highly Radioactive Nature of Intermediate Level Nuclear Waste

Intermediate level waste is highly radioactive, and while OPG does acknowledge this in a very limited way, the general tone of discussion throughout the EIS and supporting and licensing documents serves to de-emphasize the highly radioactive nature of these materials.

For example, the radioactive concentrations of activated components from refurbishment are comparable to those of irradiated fuel, i.e. high-level waste. As outlined in a report prepared by Radioactive Waste Management Associates for Northwatch during a licensing review conducted by the CNSC in 2011, the intermediate level waste is of a level of activity that warrants it being managed in a manner equivalent to that of high level nuclear fuel waste:

*ILW from refurbishment are primarily activated components. After steel is bombarded with neutrons within the CANDU reactor, it becomes radioactive. For example, non-radioactive cobalt-59, a component of stainless steel, becomes radioactive Co-60, with a half-life of 5.3 years. Of concern is Niobium-94, which is a gamma emitter (0.7 MeV, 0.87 MeV) with half-life of 20,300 years. The components of CANDU reactor are the pressure tubes, calandria tubes, end fittings, shield plugs and calandria tube inserts. In Table 1, the specific radioactivity of the individual components, and decayed Co-60 and Fe-55 are weight averaged for 10 years. As seen, within a factor of 10, the specific radioactivity of ILW is equal to the specific radioactivity of HLW. The specific radioactivity of the irradiated components of HLW alone is less than that of ILW since ILW components are irradiated for 20 years, compared to months for nuclear fuel. In addition to activated metals, ILW also consists of ion exchange resins, containing Cs-137 and Sr-90, among other radionuclides.*

For reference, in the United States, where there is not a separate designation of ILW, irradiated reactor components are called Greater than Class C LLW (GTCC), and are to be managed in a manner similar to high level waste. GTCC must have multiple engineered barriers, and be shielded. 62

<table>
<thead>
<tr>
<th>Table 1. Comparison HLW to ILW</th>
<th>HLW (Bq/Kg)</th>
<th>ILW (Bq/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Co-60</td>
<td>2.23E+10</td>
<td>3.52E+10</td>
</tr>
<tr>
<td>Ni-59</td>
<td>1.50E+06</td>
<td>1.36E+07</td>
</tr>
<tr>
<td>Ni-63</td>
<td>1.98E+08</td>
<td>1.84E+09</td>
</tr>
<tr>
<td>Fe-55</td>
<td></td>
<td>1.03E+11</td>
</tr>
<tr>
<td>Nb-94</td>
<td>3.46E+06</td>
<td>1.15E+09</td>
</tr>
<tr>
<td>Total</td>
<td>2.25E+10</td>
<td></td>
</tr>
</tbody>
</table>

**Fission Products**

<table>
<thead>
<tr>
<th></th>
<th>HLW (Bq/Kg)</th>
<th>ILW (Bq/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cs-134</td>
<td>1.94E+10</td>
<td></td>
</tr>
<tr>
<td>Cs-137</td>
<td>7.66E+11</td>
<td></td>
</tr>
<tr>
<td>Sr-90</td>
<td>4.91E+11</td>
<td></td>
</tr>
<tr>
<td>total =</td>
<td>1.32E+12</td>
<td>1.41E+11</td>
</tr>
</tbody>
</table>

5.2 The Evolving Waste Inventory

The starting point for any reasonable and informed discussion about waste management is the waste inventory – knowing what wastes are to be managed, what their hazard characteristics are, and how the wastes will be affected by or will affect the proposed management system.

In the case of Ontario Power Generation’s proposed geological repository project, this basic information set has not been provided, or at best can be characterized as still evolving. This does not provide the Joint Review Panel with the basis for a decision on the OPG application, other than a decision to deny the application due to its incomplete nature.

In the initial period of project development, the discussion did explicitly include consideration of intermediate level waste. However, the OPG project proposal includes intermediate level wastes and the intermediate level wastes will the source of the majority of the radioactivity which the DGR is intended to isolate.

Throughout the EIS there are repeated statements that decommissioning wastes are not included in the DGR proposal. But as outlined in other sections of this report, Ontario Power Generation recently revealed an expectation on their part that the licence for the DGR – if a license is granted and the DGR became operational – could be amended at a later date to include decommissioning wastes from all of Ontario’s nuclear reactor stations, which would approximately double the size of the DGR.

In addition, Ontario Power Generation has not made available a reference waste inventory since 2010, but even a comparison between the 2008 and the 2010 inventories raise questions of confidence in the OPG inventory, as discussed in Section 3.3.3 of this report.

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63 In particular, see Section 3.3.3.
5.3 Emergency Response

The EIS acknowledges three types of events could occur at the DGR that would require a planned emergency response: fire, rock fall, and radiological contamination release.

The discussion of emergency responses to radiological releases is limited to the following:

**Radiological contamination release:** For a container failure in an emplacement room, the ventilation system will pull any contamination in the air stream away from the workers. Workers will evacuate to a refuge station. Management will initiate a predeveloped plan for rescue of the personnel, similar to that described by procedures implemented by a fire alarm.65

This very limited discussion – simply a note stating that OPG plans to have a plan to respond – is wholly inadequate, and provides another compelling example of how the EIS and applications are incomplete.

5.5 Review Process

While not the primary focus of our submission, we wish to note to the Joint Review Panel some of our concerns with this review process. They include:

- The absence of a tracking system for Information Request that allowed participants who submitted Information Request to understand how they were dispositioned by the Joint Review Panel, and to track IRs which were combined with others, paraphrased, forwarded to OPG for response, or rejected. The absence of such a tracking system made the extremely challenging work of participating in this review more challenging.
- Meetings of the proponent and their agents with the Canadian Nuclear Safety Commission staff without a public record of the discourse or information provided; we began raising this as a concern early in the review process, prior to the Joint Review Panel being appointed, but are without any resolution of this concern
- Meetings of the Joint Review Panel with staff of federal departments who are participants in this review process without a full record of the information being exchanged and/or provided to the Joint Review Panel off the public record

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• Site visits of the Joint Review Panel, including but not limited to those conducted by the Proponent and/or their agents, without a full record of the information being exchanged and/or provided to the Joint Review Panel off the public record
• The 30 day notice of the closing of the public comment period on the conformity of the EIS with the EIS guidelines prior to Ontario Power Generation having responded to all Information Requests
• The closing of the public comment period on the conformity of the EIS with the EIS guidelines only two days after Ontario Power Generation having responded to all Information Requests prior to the May 24th deadline and in advance of OPG’s continued provision of outstanding information
• The June 18th issuing by the Joint Review Panel of the Notice for Public Hearing which allowed only 17 days notice of the deadline to Request to Participate

In addition to these concerns with the process to date, we are concerned that venue booked for the opening weeks of the hearing is not of sufficient size to accommodate the interested members of the public who will wish to attend. We have visited the venue and the proposed hearing room, and are concerned that there will be very little room for public seating, particularly after the Joint Review Panel, OPG, CNSC, translation and technical services, and the Panel Secretariat have been accommodated.

We note that the Hearing Procedures issued by the Joint Review Panel on June 18th, 2013 appear to anticipate this, with the following:

_The Panel will endeavor to secure a hearing venue or venues that accommodate all the individuals that wish to attend. In the event that the demand for seating in the public hearing room exceeds the space available, access priority will be given to the Proponent, Canadian Nuclear Safety Commission staff and registered oral participants on the agenda. The balance of the seating will be available on a first come, first served basis._

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66 CEAR #1099
67 For example, CEAR #1183
68 CEAR #1175
We trust the Joint Review Panel members can appreciate that being excluded from the hearing room would greatly reduce the public’s ability to participate in this review process.

As set out in Section 1.4.1 of the Hearing Procedures, “The objectives for this public hearing are to provide fair and equitable opportunities for... the Proponent to explain the project and respond to concerns and questions”. Section 5.2 of the Hearing Procedures provides registered oral participants with the opportunity to ask questions (through the Chair and time permitting).

These are important provisions, and exclusion of the public – even some members of the public – from the hearing room will limit detrimental to the public review process. For example, following the review by webcast – even in an adjacent building – would not allow a registered oral participant to ask a question. The questions following presentations to the Joint Review Panel are an important part of testing the evidence that is being brought before you.

In addition, excluding members of the public who are not registered oral participants, or who are not on the agenda for that day of the proceedings will limit the ability of those registered oral participants who are there on behalf of organizations to consult with their fellow members as they frame and prioritize questions for presenters (given the time limits, this is particularly important if registered oral participants are to be able to make the best use of the question periods).

In response to this serious concern, we are requesting that the Joint Review Panel direct the Panel Secretariat – in advance of the September 16th hearing start date – to make contingency plans to ensure that the public can attend the public hearing.
6. Conclusions

As summarized in Section 2 of this report and supported by this general submission and six expert reports filed as companions to this submission, Northwatch’s finding, based on a review of Ontario Power Generation’s application and supporting documentation, is that Ontario Power Generation has not provided the Joint Review Panel with a basis for approving the Environmental Assessment, the Application for a License to Prepare the Site, or the Application for a Licence to Construct the proposed Deep Geologic Repository for low and intermediate level radioactive wastes at and below the Bruce Nuclear Site.

Subsequent to Northwatch’s finding, and after considering all of the evidence and submissions of Ontario Power Generation and of the government, Aboriginal and public hearing participants, we request that the Joint Review Panel:

2. Deny the application for a Licence to Prepare the Site and the application for a Licence to Construct submitted under the Nuclear Safety Control Act.

Without prejudice to the above, we request that the Joint Review Panel:

3. Separate the two license applications, and refuse to consider the application for a Licence to Construct until all design decisions have been made, uncertainties addressed, and a full public has review been undertaken of the revised Application for a License to Construct.
4. Delay consideration of any future application for a License to Construct until Canada's regulatory system is sufficiently mature to provide this or any future Review Panel with sufficient guidance on the evaluation of safety cases and predictions of long term performance of any proposed deep geological repository.
5. In any future applications, require that Ontario Power Generation provide a rationale for differentiating between the treatment of highly radioactive "intermediate" wastes and fuel wastes, given the similar levels of radioactive of some of these waste products (i.e. for including highly radioactive “intermediate” level waste in the same system as has been designed for low level radioactive waste).
6. In any future applications, require OPG to provide a) a full examination of alternatives, b) evidence of social acceptance of any future preferred alternative, and c) full disclosure of technical reviews and reports related to the proposed undertaking, including peer reviews and research of commissioned reports in support of the Project’s development.

7. In any future project development, require Ontario Power Generation and the Canadian Nuclear Safety Commission to document public engagement activities, including with municipalities, in a thorough and transparent fashion, including transcripts or verbatim reports of all meetings, presentations and question and sessions.

All of which is respectfully submitted on August 13th, 2013.
Appendices


2. “Review of Barriers”, prepared by Steve Frishman, August 2013

3. “Modeling the Undisturbed Hydrogeology of the Bruce Site”, prepared by Dr. John D. Bredehoeft, The Hydrodynamics Group, LLC, August 2013


5. “Waste Isolation Pilot Project and International Experience with Deep Geologic Repositories”, prepared by Don Hancock, Southwest Research and Information Centre, August 2013

6. “International perspectives and comparisons of standards for post-closure safety case assessments” prepared by Laura Bowman, JD, Associate Lawyer, Iler Campbell LLP, August 2013