



OPG's Proposed Deep Geologic Repository for Low and Intermediate Level Radioactive Wastes

REFERENCE # 17520

NORTHWATCH COMMENTS ON THE CANADIAN ENVIRONMENTAL
ASSESSMENT AGENCY "POTENTIAL CONDITIONS"

NORTHWATCH

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Précis

- Northwatch’s interests in Ontario Power Generation’s proposed Deep Geological Repository (DGR) relate to its precedent-setting nature and potential for harm to the Lake Huron watershed; Northwatch has been a diligent participant and contributor at each stage and phase of the review of the Ontario Power Generation (OPG) proposal
- In their final report and recommendations the Joint Review Panel (JRP) erred in several respects, including by failing to appropriately weigh the evidence before them, by basing their decision(s) on impressions they seemingly formed based on information that was not on the public record, and by delegating the actual decision-making role to an unknown future decision-maker
- The “potential conditions” as drafted by the Canadian Environmental Assessment Agency (CEAA) do not remedy the failings of the JRP report
- The Decision Statement to be issued by the Federal Minister of the Environment should reflect the preceding points by issuing a Decision Statement that finds the environmental assessment to be incomplete and states that - for this and other reasons - the Project is unacceptable and an environmental assessment will not be granted, and that, consequently, the Project will not move forward into the licensing process until and unless an environmental assessment has been completed and an environmental assessment granted

1. Northwatch’s Participation and Interests

Northwatch is a public interest organization concerned with environmental protection and social development in northeastern Ontario, founded in 1988. We have a longstanding interest in the management of nuclear waste, initiated by proposals dating back to the 1970’s to site nuclear waste “disposal” projects in northern Ontario.

The proposal by Ontario Power Generation (OPG) for a deep geological repository (DGR) 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 has actively participated in the federal review of OPG’s proposed DGR since 2008. Prior to and since the appointment of the Joint Review Panel (JRP) in 2012 Northwatch has participated through monitoring the public registry, and since the JRP appointment in 2012 Northwatch has participated through continued monitoring of the public registry and reviewing postings on the public registry; reviewing the written evidence, including OPG and CNSC responses to Information Requests (IRs), submitting proposed IRs, making written submissions, presenting expert evidence, participating in JRP hearings through oral presentations and proposing questions, and submitting final comments to the Joint Review Panel.



Northwatch's written submissions and participation in the public hearing are part of the public record¹ and forms part of the body evidence that was before the Joint Review Panel and is available to Canadian Environmental Assessment Agency and the federal Minister of the Environment.

2. Context for Northwatch Comments on “Potential Conditions”

Ontario Power Generation is proposing to construct a series of caverns 680 metres below-surface in a band of limestone, and to transfer into those caverns 200,000 cubic metres of nuclear waste. Some of these wastes – called “low level” radioactive wastes – do not require extra barriers to shield workers from radioactivity, although they are still hazardous. Other wastes, classified as “intermediate” wastes are highly radioactive. In fact, intermediate waste is almost as radioactive as “high level waste” and includes wastes with similar radioactivity to used fuel or irradiated nuclear fuel waste. Elements of these wastes will remain dangerously radioactive for hundreds of thousands of years, and some for even far longer than that.

On May 6, 2015 a Joint Review Panel (JRP) appointed by the federal Minister of the Environment and the Canadian Nuclear Safety Commission in 2012 provided the Minister with its final report on the review of Ontario Power Generation's proposed Deep Geologic Repository for Low and Intermediate Level Radioactive Wastes.

The Joint Review Panel (JRP) recommended that the federal minister approve the proposed repository, despite the expert evidence they heard throughout the public hearings about numerous technical uncertainties, and in the face of large and growing public opposition. The JRP conclusions are flawed.

At the end of a nine year review the proposed DGR project has too many unknowns. For example:

- Ontario Power Generation's characterization and inventory of the wastes remains incomplete.
- The rate at which gas will be generated by deteriorating metal waste containers is still unknown; this is important, because these gas pressures can cause fracturing that could speed the release of radionuclides out to the biosphere.
- The chemical stability of some wastes, such as ion exchange resins, is uncertain over time.
- Many of the “design” decisions have not yet been made, including important features like the seal for the vertical shafts that connect the underground repository to the environment.

However, many things that are known about the Project cause concern, such as:

¹ The public registry is online at <http://www.ceaa-acee.gc.ca/050/details-eng.cfm?evaluation=17520>



- The only example Ontario Power Generation offered of a similar deep geologic repository for radioactive wastes, the Waste Isolation Pilot Plant in New Mexico, is no longer operating after an underground fire and loss of containment resulted in radioactive releases to the surface in 2014.
- Management of the wastes through placement in the proposed DGR will cost approximately four times more than above-ground options, with current cost estimates at over \$2 billion; OPG's pattern of persistently underestimating costs for nuclear projects over the last several decades suggests that real costs are more likely to be in the \$6 to \$10 billion range.
- Ontario Power Generation's proposal (2011) is for 200,000 metres³ but in August 2013 Ontario Power Generation acknowledged on the public record that they intend to double the amount of waste to be placed in the proposed DGR and will seek a licence amendment after they receive a project approval based on the original volume; the final use and size of the proposed DGR remain unknown.

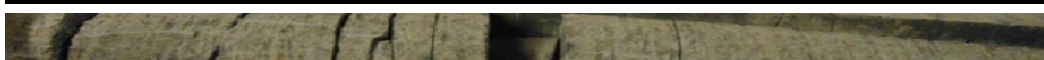
During 33 days of hearings in 2013 and 2014 it became abundantly clear that Ontario Power Generation's proposal was still very much in flux. It also became apparent that the Canadian Nuclear Safety Commission (CNSC) staff, who were attending the hearings daily, were operating as advocates rather than impartial assessors of Ontario Power Generation's incomplete proposal. CNSC staff repeatedly told the Review Panel that key decisions could be left until after an approval was issued by the Joint Review Panel, and the CNSC staff themselves would become the decision-makers.

The Joint Review Panel's 450 page report does a reasonable job of acknowledging the myriad issues raised through written submissions and hearing testimony by members of the public, independent experts, Saugeen Ojibway Nation, and the Panel's own experts. What is unreasonable is the Panel's complete dismissal of many of these issues, and the deferring of other issues to a future decision-maker. Simply leaving them unresolved – while recommending project approval – is unreasonable and is in error under CEAA 2012 and under the Environmental Impact Statement (EIS) Guidelines and Joint Review Panel Agreement and Terms of Reference.

In addition, the Panel report is flawed by internal contradictions and overly generalized statements which are not supported by the hearing record.

As the Joint Review Panel notes in the opening pages of its report, this Project is without precedent anywhere in the world. It is also an exercise in contradiction, as is the JRP report itself. For example:

- Ontario Power Generation argued that the repository is needed to remove the wastes from the surface and keep them “safe” from threats such as terror attacks or social collapse, yet Ontario Power Generation also contends that the wastes are safe at their present above-ground location, and continues to generate more and more of such wastes, including highly radioactive spent fuel which will have to remain on surface for decades due to heat and radiation levels.



- The Joint Review Panel contends that the proposed site was preferred above others primarily because it would avoid risks associated with further transportation, yet the wastes from the Darlington and Pickering generating stations continue to be transported long distances to the Western Waste Management Facility, adjacent to the proposed site of the repository.
- The Joint Review Panel recommends in their report that “OPG should minimize the volume of waste stored in the DGR” but in the same report states that doubling the volume of waste (with the addition of decommissioning waste) would not change project outcomes.
- The Joint Review Panel acknowledges that there are uncertainties related to many technical aspects of the project but asserts that these same aspects, in combination, provide confidence in the Project.

The evidence presented to the Joint Review Panel by expert consultants retained by the Review Panel, by independent scientists and engineers, and by other hearing participants establish that the project’s proposed design and site geology is uncertain. The Joint Review Panel chose to deal with these uncertainties by delegating the final project decisions to a future and unknown decision-maker, as exemplified in the recommendations set out in Sections 16.3.7 and 16.3.8 of the Joint Review Panel Report (May 2015).

On June 3, 2015 the Canadian Environmental Assessment Agency issued a notice that the Agency was undertaking a public comment period for the last phase of the environmental assessment process for OPG’s proposed DGR, and invited Aboriginal groups, members of the public and registered participants of the DGR review, to comment on the “*potential conditions related to possible mitigation measures and follow-up requirements that could be necessary, if the project is authorized to proceed*” by September 1st.

CEAA 2012 describes this final step in the environmental assessment process as follows:

54. (1) The decision maker must issue a decision statement to the proponent of a designated project that

(a) informs the proponent of the designated project of the decisions made under paragraphs 52(1)(a) and (b) in relation to the designated project and, if a matter was referred to the Governor in Council, of the decision made under subsection 52(4) in relation to the designated project; and

(b) includes any conditions that are established under section 53 in relation to the designated project and that must be complied with by the proponent.

3. Review of JRP Recommendations and CEAA Proposed Potential Conditions



3.1 Making the Safety Case: The Basis for Review of OPG’s DGR

As set out in the Guidelines for the preparation of the Environmental Impact Statement, an important – perhaps the most important – element of the environmental assessment review is consideration of what is called the “safety case”:

Demonstrating long-term safety consists of providing reasonable assurance that the proposed DGR will perform in a manner that protects human health and the environment. This demonstration is achieved through the development of a safety case. The safety case includes a safety assessment complemented by additional arguments and evidence in order to provide confidence in the long-term safety of the facility.

The safety assessment is central to the safety case. It involves an analysis to evaluate the performance of the overall waste disposal facility and its impact on human health and the environment.²

More generally, the safety case is the set of technical arguments and areas of evidence that demonstrate that the proposed deep geological repository will perform in such a manner as to isolate the wastes and associated radioactivity over the very, very long time horizons required. Key elements of the “multi-barrier concept” on which proposals for deep geological repositories are based include the waste and the barriers between the waste and the environment, including both the engineered and the geological barriers. Demonstrating performance requires having a complete waste inventory and waste characterization, a thorough understanding of conditions at repository depth throughout the project including post-closure, sound knowledge of each of the barriers – including engineered and geological – and how they will perform over time,

While many of the JRP recommendations and some of the CEAA drafted potential conditions confirm that the safety case has not been made (this will be discussed in further detail in the following sections) there are no recommendations or potential conditions which can mitigate or compensate for the lack of that safety case having been made.

In the Joint Review Panel report, aspects of the “safety case” are included in various chapters, and a separate chapter discusses “post-closure” or long term safety, i.e. the long term performance of OPG’s proposed deep geologic repository. Similarly, many of the JRP recommendations and – sometimes correspondingly – the CEAA drafted “potential conditions” address elements of the DGR project which are integrally linked to the long term performance (and safety) of the project are in sections other than the chapter with “safety case” in its title. This illustrates how many different key elements of the DGR design are linked to the safety case, and how an assessment of the various project elements must demonstrate that the project itself and the various project components each and all meet a rigorous test with respect to long term safety and performance.

² EIS Final Guidelines, 2009



The Joint Review Panel appears to have, inexplicably, adopted a different view, as illustrated by the JRP conclusion with respect to contaminant transport from the proposed DGR:

The Panel notes that while each specific line of evidence may have some level of uncertainty, the total body of information provides considerable confidence ...³

Logically, if each line of evidence has associated uncertainties, a conclusion based on multiple lines of evidence / uncertainty is, at best, uncertain, and would not provide confidence.

The following sections discuss select aspects of the OPG proposal, the Joint Review Panel's assessment and recommendations, and – where available – the CEAA drafted “potential conditions”. The topics were selected on the basis of correspondence with Northwatch's areas of focus during the review period, and are limited according to Northwatch's modest capacity throughout the six year review. We will rely on other commenters to address additional key topics, including important issues around social acceptance, Great Lakes concerns, and process concerns. In addition, we adopt the submissions of the Canadian Environmental Law Association with respect to long-term perspective, uncertainty, democratic process, and consideration of alternatives.

3.2 DGR Site, Design and Safety

Suitability of the Host Rock

The Joint Review Panel accepted Ontario Power Generation's assertion that the host rock – limestone in the Coburg formation, with an overlay of shale – was suitable for a repository, and that that the rate which water moved through the limestone was extremely slow. Seemingly, the JRP came to this conclusion through a combination of accepting OPG's characterization of the undisturbed site – despite the very limited information provided by OPG – and through their own visual observations of drill core from the very limited number of boreholes drilled by OPG in the vicinity of the proposed repository. The JRP's retransmittal of Figure 30 from OPG's Geology Technical Support Document might imply that they placed a higher level of reliance on this visual depiction than Northwatch would deem appropriate. For comparative purposes, Figure 30 is re-presented below, followed by two photo images of drill core taken by Northwatch during a site visit in June 2013. The Joint Review Panel would have observed the same drill core during their site visit earlier that year.

³ JRP Final Report, Section 13.2.3, page 319





Figure 1 : Figure 30, OPG Geology TSD; from JRP Report



Figure 2 Northwatch Photo; DGR Site Visit, June 2013 - Cobourg Formation at ~550 m



Figure 3 Northwatch Photo, DGR Site Visit, June 2013 - Cobourg Formation at ~ 550m

While Northwatch would not expect the Canadian Environmental Assessment Agency (National Program) or the federal Minister of the Environment to come to any detailed conclusions based



on two photos presented by Northwatch which appear to show fractured and broken drill core from close to repository depth, nor do we expect Canadian Environmental Assessment Agency (National Program) or the federal Minister of the Environment to be convinced of the desired attributes of the Cobourg formation – low frequency of fractures with most fractures being mineral-sealed and low porosity, low permeability and low conductivity with long residence time of pore fluids – based on a re-presentation of an OPG photo or a reiteration (by the JRP) of OPG’s assertions.

The Joint Review Panel further stated:

As previously described, OPG observed a low density of sealed fractures with mineral infills in the vertically-oriented drill cores of the Cobourg Formation taken at the proposed DGR site. OPG additionally analysed fracture occurrences in two inclined drill holes that did not intersect the Cobourg limestone. These analyses confirmed the low abundance of fractures, but only in the cap rock sequence. OPG attributed the low abundance of fractures in the Cobourg limestone to the absence of strong forces, i.e., tectonic activity, affecting the Michigan Basin during its geologic history. In its assessment of a hypothetical alternative DGR site, the OPG IEG noted that a hypothetical granitic bedrock site for the DGR in the Canadian Precambrian Shield would typically display a greater frequency of fractures and less predictability in their distribution than the proposed DGR site in limestone. The Panel’s experience would support this general observation.⁴

Northwatch notes that:

- Six boreholes are insufficient to characterize the repository footprint
- As noted, the two inclined bore holes did not intersect the host rock
- OPG’s assignment of attributes based on a geologic history of the Michigan base is not sufficient evidence of local conditions, as noted elsewhere in the JRP report
- A negative assessment of the attributes of the Canadian Shield does not *de facto* produce a positive assessment of the Cobourg limestone
- Unless the Panel has placed evidence on the record based on their “experience”, their undescribed “experience” provide insufficient grounds for a positive recommendation of this project

Further:

- OPG acknowledged fractures in the Michigan Basin that could be more conductive
- The Ministry of Northern Development and Mines noted occurrences in the drill core that suggested a possibly nearby fault zone
- The Ministry of Northern Development and Mines also noted OPG’s 2D site seismic study showed potential for a third potential fault in the middle of the DGR footprint that had not been tested by additional drilling

In response to these issues related to the limestone formation and its suitability, OPG committed to conducting additional “investigations” during construction and the JRP agreed with OPG that there can be “high confidence in the absence of faults and the nature of fractures in close

⁴ JRP Report, Page 315



proximity to the DGR footprint” but conceded that they had less confidence in the area around the DGR.

Sequencing is at issue here: what OPG has proposed and the JRP has accepted is that the approval be granted and THEN the investigations be conducted. This is unacceptable. As set out above, “*demonstrating long-term safety consists of providing reasonable assurance that the proposed DGR will perform in a manner that protects human health and the environment*”. This demonstration is to take place within the review process, prior to approval; it is not to be delegated to a future decision-maker at some undetermined point in time after the review process has concluded and the approval has been granted.

Proposed Potential Condition: The Project should be cancelled or – in the alternative – deferred indefinitely on the basis of insufficient evidence of the suitability of the Cobourg Formation to host a deep geologic repository.

<p>Geoscientific Verification Plan</p> <p>Additional Boreholes</p>	<p>JRP Recommendation 13.1: Prior to construction, OPG shall enhance the Geoscientific Verification Plan through the inclusion of additional deep boreholes (minimum of three) that are to be drilled beyond the footprint of the proposed DGR to verify the continuity and structural integrity of the Cobourg Formation and the cap rock sequence. These boreholes should be subject to the same geologic, hydrogeologic, and geomechanical investigation as the original deep boreholes, to the satisfaction of the CNSC.</p>	<p>CEAA has not drafted a potential condition related to this JRP recommendation. The JRP recommendation goes some distance towards filling some of the information gaps with respect to the characteristics of the Cobourg Formation but errs in three ways: a) it is unclear if the additional deep boreholes are to be drilled before or during construction, b) it is unlawfully delegating the assessment of site suitability and the informed JRP decision of acceptability to a different decisionmaker and c) it does not address uncertainties with respect to the Cobourg Formation within the DGR footprint</p>
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Proposed Potential Condition 1: The Project should be cancelled or – in the alternative – all related activities deferred until after completion of additional deep boreholes and inclusion of results – with all other outstanding information and analyses – in a revised environmental impact statement and supporting documents and restart of the environmental assessment process.

<p>Geoscience Verification Plan</p>	<p>Recommendation 13.2: Before a licence to operate the DGR is issued, the Geoscientific Verification Plan should be augmented by the inclusion of a marine 3D seismic survey</p>	<p>CEAA has not drafted a potential condition related to this JRP recommendation. The JRP recommendation goes some distance</p>
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3D Seismic Survey	under a portion of Lake Huron bordering the Bruce nuclear site, to the satisfaction of the CNSC.	towards filling some of the information gaps with respect to the characteristics of the Cobourg Formation but errs in two ways: a) it defers the collection of information until after construction, thereby incurring considerable expense and further building institutional momentum (through construction of the DGR) prior to acceptability having been determined and b) it is unlawfully delegating the assessment of site suitability and the informed JRP decision of acceptability to a different decision-maker and c) it does not address uncertainties with respect to the Cobourg Formation within the DGR footprint
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Proposed Potential Condition 2: The Project should be cancelled or – in the alternative – all related activities deferred until after completion of the marine 3D seismic survey and inclusion of results – with all other outstanding information and analyses – in a revised environmental impact statement and supporting documents and restart of the environmental assessment process.

Gas Generation in the Repository

In their final report, the Joint Review Panel discusses the generation of gas in the repository in several sections. This discontinuous and at time quite disjointed discussion of some topics is one of the qualities that makes the JRP report difficult to read and challenging to analyze.

Northwatch’s general⁵ and expert⁶ submissions in 2014 identified the increased risks associated with gas generation in the repository as a result of a higher metal content in decommissioning wastes (in comparison to operation and refurbishment wastes) as a key issue.

As outlined by Northwatch’s experts, the Ordovician under pressures at the Bruce Site 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.

⁵ CEAR#1931

⁶ CEAR#1957



As outlined by Northwatch, the short to long-term performance of the proposed DGR is uncertain, because the gas generated within the DGR will provide increased subsurface pressure sufficient to reactivate existing fractures. These effects could: (A) increase the rock stress with sufficient potential to trigger earthquakes in the very far-field within a 200km radius of the DGR; (B) in the local mid- to far-field at and around the DGR site the additional gas pressure could reactivate existing fractures to permit gas escape resulting in radioactive discharge towards the surface, and permit groundwater flow into the DGR. Additionally, (C) although it is apparent that this scenario is one feasible pathway along which the DGR can evolve, it is not clear what the probability of such a pathway is, amongst the many possible future pathways, (D) it is unclear how OPG will monitor the pressure within the DGR during the relevant period of tens to many hundreds of years post-closure, and (E) it is not known what strategies and actions the OPG has established to manage and mitigate the generation of gas pressure, should gas generation occur to excess.

In their several discussions of gas generation, the Joint Review Panel does not actually address the issues related to gas generation, although there are some acknowledgements of Northwatch having raised these issues and of these issues being the subject of dispute within the review.

The following sections of the JRP report pertain to issues related to gas generation:

OPG stated that the use of backfill in waste emplacement rooms, which would lead to higher repository gas pressures resulting from waste degradation in the long-term, would not enhance the postclosure safety case.⁷

OPG was of the view that the use of backfill would lead to increased costs for repository development, impose higher worker doses due to the need to undertake backfill placement in close proximity to waste containers within waste emplacement rooms, and would detrimentally affect the structural conditions of emplacement rooms through an increased excavation damaged zone resulting from generation of higher long term gas pressures.⁸

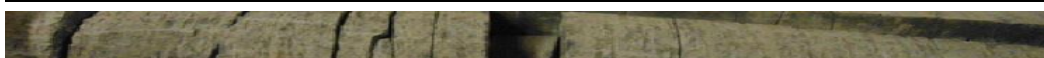
OPG rejected the general use of supercompaction, because it would result in higher worker doses and generally increase longterm hazards due to increased gas production as a result of more metal being added to the repository in the form of sacrificial drums (emptied containers) and overpacks.⁹

Singly and in combination, the above references by the Joint Review Panel to statements by OPG confirm the issues of gas generation and the relationships between metal content, repository design, and gas generation and pressures.

⁷ JRP Report, page 90

⁸ JRP Report, page 101

⁹ JRP Report, page 115



A participant, Northwatch, suggested that gases generated from the decomposing waste in the DGR during postclosure could lead to highly elevated gas pressures in repository rooms. Northwatch was of the view that such gas pressures would increase stresses in the surrounding rocks that could lead to the reactivation of existing and initiation of new fractures in the host and cap rocks of the DGR, and that such fractures could lead to gas escape resulting in radioactive discharge towards the surface and permit groundwater flow into the DGR. OPG disputed this position and noted that its gas pressure calculations used highly conservative assumptions indicating that pressures would never reach levels that could lead to fracture initiation or propagation. The CNSC concurred with the OPG analysis. Additional information on the evolution of gas pressures in the decommissioned repository is provided later in this chapter.¹⁰

While the JRP notes OPG's dispute of Northwatch's assessment and the CNSC concurrence with OPG, the JRP does not at this point or at later points in their report set out the evidence that leads them to a particular conclusion. However, on pages 341-342 the Joint Review Panel discusses gas modelling – upon which OPG relied – and concludes by recommending additional gas generation modelling for the decommissioned DGR as part of its Geoscientific Verification Plan, which will validate the microbial degradation processes of the waste.¹¹

In following sections of the report, the JRP makes additional references to gas-related issues raised by Northwatch, including evidence brought by Northwatch that it was likely that gas build-up could lead to the generation of fractures in the overlying and underlying rocks of the repository that could potentially form a connected network of fractures to transmit fluid flow¹² and Northwatch identifying the elevation of gas pressures in the closed repository as a possible disruptive scenario and suggested that it should have been evaluated. In this scenario gas pressures would rise to levels that would lead to the formation and propagation of fractures into the cap rock sequence, which could then provide multiple pathways for contaminant transport into the upper groundwater zone. According to the JRP report, consideration of such a scenario led to an examination of OPG's modelling of gas generation in the DGR after decommissioning and closure.¹³ We assume that it was this examination that led to the drafting of JRP recommendation 13.5.

The Panel is of the view that refinement of gas generation modelling should play an important role in the Geoscientific Verification Plan in order to reduce uncertainties, particularly with respect to the role and nature of microbial reactions. Since corrosion of metals would add considerably to gas generation, the Panel recognizes the importance of reducing the amount of metal in the DGR, through recycling, to reduce gas pressures in

¹⁰ JRP Report, page 316

¹¹ JRP Recommendation 13.5

¹² JRP Report, page 320-321

¹³ JRP Report, page 341



the closed repository, as was described in Chapter 7.¹⁴

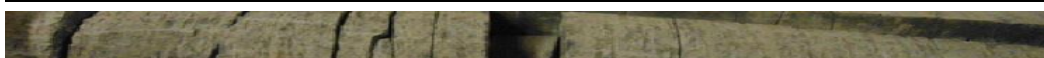
The Joint Review Panel has recommended that additional gas generation modelling be undertaken related to decommissioning wastes, and this recommendation appears to form the basis for a CEAA drafted “potential condition”.

We do not disagree with the need for an improved understanding of gas generation, and concur that the addition of decommissioning wastes to the inventory of wastes to be emplaced in the DGR – effectively doubling the repository – makes this additional investigation essential. However, we differ with the JRP / CEAA recommendations on two counts: the evaluation should be completed prior to any approval being granted, and the evaluation should be of the full inventory, not just the decommissioning wastes. Further, the review should be public and transparent, with full opportunity for public engagement and with an impartial and independent decision-maker, i.e. CNSC staff is not the appropriate decision-maker for this decision which is central to the long term performance and safety of the DGR.

<p>Geoscientific Verification Plan</p> <p>Gas Generation</p>	<p>Recommendation 13.5: In order to confirm predictions in the environmental assessment, OPG shall provide additional gas generation modelling for the decommissioned DGR as part of its Geoscientific Verification Plan, which will validate the microbial degradation processes of the waste. OPG shall also augment the Geoscientific Verification Plan to include modelling of gas generation from decommissioning waste to ensure that there will be timely information available for the design and implementation of the mitigation measures associated with reduction of gas generation. These verification activities should be carried out prior to operations, to the satisfaction of the CNSC.</p>	<p>14.3. The Proponent shall, prior to operations and to the satisfaction of the CNSC, augment the Geoscientific Verification Plan to provide additional gas generation modelling for the decommissioned DGR and to include modelling of gas generation from decommissioning waste in a manner that will ensure there will be timely information available for the design and implementation of the mitigation measures associated with reduction of gas generation.</p>
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Proposed Potential Condition 3: The Project should be cancelled or – in the alternative – all related activities deferred until after completion of additional studies and evaluations related to gas generation and inclusion of results – with all other outstanding information and analyses – in a revised environmental impact statement and supporting documents and restart of the environmental assessment process.

¹⁴ JRP Report, page 343



Shaft Seal Failure

In 2014, Northwatch's experts reviewed the additional information provided by Ontario Power Generation; the findings of this additional review confirmed that the shortcomings identified during the review of written evidence and then in the course of the oral hearing persisted, and OPG still lacked sufficient understanding of the site and the design was still inadequate in terms of meeting the safety case. Key findings included:

- The 2014 *Geoscientific Verification Plan* provides additional detail and methodology for characterization of the shaft EDZ, beyond that considered in the September 2013 DGR Hearing, but severe shaft seal failure remains a conspicuous failure mode for the repository.
- The *Geoscientific Verification Plan* retains a design element that could contribute to radionuclide releases from the repository if the performance of the shaft seals and shaft EDZ is less than expected in the repository safety case. As designed, the highly damaged inner zone (HDZ) of the EDZ in the area of the planned cement monolith at the base of the shafts is not intended to be removed, but the HDZ is planned to be removed from the shaft wall because it would provide a high permeability zone for radionuclide transport adjacent to the shaft seal.
- The 2014 *Geoscientific Verification Plan* does not describe a shaft seal performance testing program other than retaining the previous plan for *in situ* testing in the Cobourg Formation. It is implied that testing in other formations exposed in the shafts could be done, but there is no description of where such tests would be performed, and the overall testing rationale. The GVP should include a commitment to and detailed description of a robust and comprehensive shaft seal performance testing program that would be continued through the full period of repository operation if construction and operation are approved.

As summarized by the JRP in their report, OPG predicted that the shaft excavation damaged zone would be a primary pathway for the migration of radionuclides from the DGR during the postclosure period. The majority of the excavation damaged zone was predicted to develop soon after shaft excavation and would slowly increase in size over time. OPG used the measured properties of rock cores recovered from the geosphere to model the effectiveness of different types of shaft seals as barriers against contaminant release.

OPG stated that it would not install shaft seals until after the completion of closure activities in the repository. OPG predicted that seals would be durable for at least 60,000 years, and that the use of shaft seals would effectively prevent the release of radiologic contaminants from the proposed repository. OPG stated that, post decommissioning, the engineered shaft seals would be the principal barriers for restricting the release of contaminants into groundwater.¹⁵

For future design planning, OPG stated that the characteristics of shaft seal materials would be determined through laboratory testing, collaboration with international research organizations, and long-term site testing. This testing would be part of the activities undertaken during the

¹⁵ JRP Report, Pages 92-93



operations phase of the DGR as part of the Geoscientific Verification Plan. OPG noted that additional testing would be needed to confirm the behaviour of seal materials, particularly within the more porous shale formations. OPG planned to validate the effectiveness of seal materials by installing and monitoring the materials within various borehole sites located in shale formations. OPG indicated that it had not made any measurements of seal behaviour at the proposed DGR site, and that its modelling of conceptual seal performance as a radiologic barrier was based solely upon international research experience in varying rock formation types. OPG acknowledged that there was little available information related to the stability of bentonite seal mixtures when exposed to the saline waters that would be present within the proposed DGR shafts. OPG noted that there was limited international research regarding the effects of sea water on bentonite. In addition, OPG did not identify differences in mixture compositions and salinity conditions between those of existing international research efforts and those to be used in the proposed DGR environment. The Panel notes that no direct comparison between existing international research on shaft seal performance and the planned DGR site research can be made at this time.

Despite the absence of any actual information from OPG about their future shaft seals, the Panel concluded that the proposed shaft seal materials were “adequately characterized for the purpose of the environmental assessment” and expressed their view that “OPG should initiate the investigation and selection of optimal shaft seal materials as soon as possible, and prior to site preparation and construction phases, to permit the longest possible interval of research study into shaft seal behaviour prior to closure of the repository.” The Panel noted that the shaft seals “are a primary engineered barrier for inhibiting contaminant release to the natural environment in the long term.”¹⁶

The key facts are not in dispute:

- the shaft excavation damaged zone will be a primary pathway for the migration of radionuclides from the DGR during the postclosure period
- OPG will not install shaft seals until after the completion of closure
- OPG predicts that seals would be durable for at least 60,000 years; several of the waste elements are radioactive for a much longer time
- the engineered shaft seals will be the principal barriers for restricting the release of contaminants into groundwater⁷
- the characteristics of shaft seal materials have not yet been determined
- additional testing will be needed to confirm the behaviour of seal materials
- there is little available information related to the stability of bentonite seal mixtures when exposed to the saline waters that would be present within the proposed DGR shafts
- there is limited international research regarding the effects of saline water on bentonite.

Despite the absence of any actual information from OPG about their future shaft seals, the Panel concluded that the proposed shaft seal materials were “adequately characterized for the purpose of the environmental assessment” and expressed their view that “OPG should initiate the investigation and selection of optimal shaft seal materials as soon as possible, and prior to site preparation and construction phases, to permit the longest possible interval of research study into shaft seal behaviour prior to closure of the repository.” The Panel noted that the shaft seals “are a

¹⁶ JRP Report, Page 94



primary engineered barrier for inhibiting contaminant release to the natural environment in the long term.”¹⁷

Simply put, there is no proposal with respect to shaft seals. And yet, it is acknowledged by OPG and the JRP that the shaft seals are the primary engineered barrier for the greatest majority of the project life. This, perhaps as much as any of the many issues, illustrates the hollowness of the JRP recommendation that the project be approved. There is – in effect – no proposal on the table, and the JRP is recommending approval of that same proposal. What, in reality, is the JRP recommending be approved?

Shaft Seal Failure	Recommendation 6.4: In order to confirm the predictions in the environmental assessment regarding post-closure containment of radionuclides and other contaminants, OPG shall initiate long-term testing of seal material behaviour under similar conditions and depths to those that each seal material will experience at the proposed DGR site. The testing program shall include experimental and theoretical demonstrations of the long-term performance of the seals. OPG shall consider the chemical, hydraulic and physical interaction of the seals with specific rock formations and the associated excavation damage. The rock formations to be considered shall include the host and cap formations, and other formations that influence the long-term safety case. The test program shall commence as soon as possible prior to site preparation and construction, and be conducted to the satisfaction of the CNSC. The safety case should be updated taking the results of this work into consideration.	13.6. The Proponent shall, as soon as possible prior to site preparation and to the satisfaction of the CNSC, implement a testing program with respect to post-closure containment of radionuclides and other contaminants that will examine:
		13.6.1. long term seal performance and seal material behaviour under similar conditions and depths to those that each seal material will experience in the DGR; and
		13.6.2. consideration of the chemical, hydraulic and physical interaction of the seals with specific rock formations, including the host and cap formations and other formations that may influence the long-term safety case, and the associated excavation damage.

Proposed Potential Condition 4: The Project should be cancelled or – in the alternative – all related activities deferred until after research has been completed and a detailed proposal for shaft seals has been developed for inclusion – with all other outstanding information and analyses – in a revised environmental impact statement and supporting documents and restart of the environmental assessment process.

Shaft Seal Failure	Recommendation 6.5: In order to enhance post-closure containment of	CEAA has not drafted a potential condition related to this JRP
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¹⁷ JRP Report, Page 94



	<p>radionuclides and other contaminants, OPG shall research comparative seal behaviour of bentonite/sand mixtures having composition ratios other than 70/30. The test program should commence prior to site preparation and construction and be conducted to the satisfaction of the CNSC.</p>	<p>recommendation. The JRP errs in two ways: a) in accepting a proposal that lacked a detailed description of fundamental design and performance elements, namely those related to the shaft seals, and b) in unlawfully delegating the assessment of site suitability and the informed JRP decision of acceptability to a different decision-maker</p>
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Proposed Potential Condition 5: The Project should be cancelled or – in the alternative – all related activities deferred until after research has been completed and a detailed proposal for shaft seals has been developed for inclusion – with all other outstanding information and analyses – in a revised environmental impact statement and supporting documents and restart of the environmental assessment process.

<p>Shaft Seal Failure</p>	<p>Recommendation 6.6: In order to enhance post-closure containment of radionuclides and other contaminants, prior to construction, OPG shall initiate research on a range of potential candidate seal materials to assess the influence of DGR in-situ saline groundwaters on the effectiveness of these materials as a barrier. At the time of decommissioning, OPG should select the seal materials with the best observed performance for use in the DGR, in conjunction with CNSC and based on the results of the research.</p>	<p>CEAA has not drafted a potential condition related to this JRP recommendation. The JRP errs in two ways: a) in accepting a proposal that lacked a detailed description of fundamental design and performance elements, namely those related to the shaft seals, and b) in unlawfully delegating the assessment of site suitability and the informed JRP decision of acceptability to a different decision-maker</p>
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Proposed Potential Condition 6: The Project should be cancelled or – in the alternative – all related activities deferred until after research has been completed and a detailed proposal for shaft seals has been developed for inclusion – with all other outstanding information and analyses – in a revised environmental impact statement and supporting documents and restart of the environmental assessment process.

Post Closure Safety

In their report, the JRP acknowledges that some participants expressed concern with respect to the Geoscience Verification Plan, including that, rather than action levels that would trigger a re-assessment of the safety case and subsequent engineering solutions to encountered problems, the



Geoscientific Verification Plan should have included go/no-go criteria for certain properties. As summarized by the JRP, Some participants were concerned that, should the DGR be approved, the safety case would be diminished over time under the guise of adaptive management. Participants were also concerned that the verification activities and results would not be transparent, or subject to public scrutiny.

The Panel professed that the geoscience activities of the Geoscientific Verification Plan would provide information on key indicators used to assess and address assumptions and uncertainties in the Postclosure Safety Assessment. In the Panel's view, it is likely that the geoscientific investigations and monitoring activities of the Geoscientific Verification Plan will yield some results that deviate from the assumptions and data used in the Postclosure Safety Assessment.

The Panel concluded that OPG, in conjunction with the CNSC, needs to develop an adaptive management system that actively, and in real time, incorporates the Geoscientific Verification Plan in decision-making as the DGR is constructed and operated. The adaptive management system would also support updates to re-confirm and enhance the Postclosure Safety Assessment. By being active, rather than reactive, the plan should be structured to induce deliberate learning about the managed system, so that management can be improved in the face of uncertainty.¹⁸ OPG had indicated that it would apply mitigation measures to reduce or eliminate short-term preclosure safety effects of the DGR as part of its adaptive management system, including, but not limited to, pauses in construction or operational activities.¹⁹

The Panel Recommendation has strengths and weaknesses; regrettably, the weaknesses so outweigh the strengths that they render the recommendation ineffective, at best.

<p>Geoscientific Verification Plan</p> <p>Adaptive Management System</p>	<p>Recommendation 13.8: In order to enhance postclosure safety of the DGR, OPG shall develop an active adaptive management system in support of its Postclosure Safety Assessment. The management system shall include the geoscience verification activities of the Geoscientific Verification Plan with additions that ensure consideration of full, complete and clearly defined action levels for all geoscience verification activities. The action levels shall include critical action levels associated with fundamental components of the safety case, i.e., low permeability of host and cap rock; absence of major fractures; and, absence of economically viable resources. In addition, the system shall identify specific options to adapt, modify and manage the project in response to changes in key indicators. The adaptive management system shall be developed to the satisfaction of the CNSC prior to the start of the site preparation and construction phase of the DGR.</p>	<p>CEAA has not drafted a potential condition related to this JRP recommendation. The JRP recommendation is flawed in that it assumes that all conditions can be mitigated – and there is no evidence that supports this assumption – and it fails to include a no-go option. Further, it unlawfully delegates the review and approval of the “adaptive management system” to different decision-maker,</p>
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¹⁸ JRP Report, Page 365

¹⁹ JRP Report, Page 95



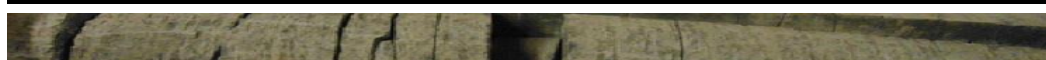
		namely the staff at the CNSC.
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Proposed Potential Condition 7: The Project should be cancelled or – in the alternative – all related activities deferred until after development of a full, complete and clearly defined action levels for all geoscience verification activities, including a go/no-go criteria, for inclusion – with all other outstanding information and analyses – in a revised environmental impact statement and supporting documents and restart of the environmental assessment process. The proposed program should clearly set out how the public is to be engaged in all aspects of the Geoscience Verification Plan and how – after the completion of the environmental assessment review of the revised EIS – the verification program would operate with an independent and impartial decision-maker.

Confirming the predictions in the EIS and Postclosure Safety Assessment regarding the ability of the DGR to perform in a manner that will protect human health and the environment before a licence to operate is issued is unreasonable not because is unreasonable to require that these predictions be confirmed but it is unreasonable to complete this step after the environmental assessment approval rather than before it. As noted earlier, a requirement to demonstrate the safety of the of the project was clearly set out in the EIS guidelines, as were requirements to address matters related to human health.

Calculations of Radiation Exposure	Recommendation 13.6: Before a licence to operate the DGR is issued, in order to confirm the predictions in the EIS and Postclosure Safety Assessment regarding the ability of the DGR to perform in a manner that will protect human health and the environment, OPG shall perform probabilistic calculations for radiation exposures to humans and non-human biota for the Normal Evolution and Disruptive Scenarios, to the satisfaction of the CNSC. These calculations should supplement the deterministic calculations in the current long-term safety case assessment in order to increase confidence.	13.9. The Proponent shall, before a licence to operate is issued and to the satisfaction of the CNSC, perform probabilistic calculations for radiation exposures to humans and non-human biota for the Normal Evolution and Disruptive Scenarios. These calculations should supplement the deterministic calculations in the current long-term safety case assessment.
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Proposed Potential Condition 8: The Project should be cancelled or – in the alternative – all related activities deferred until after predictions with respect to potential impacts on human health and the environment for radiation exposures have been presented – with all other outstanding information and analyses – in a revised environmental impact statement and supporting documents and restart of the environmental assessment process.

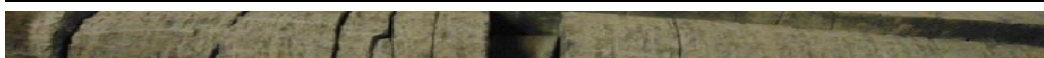


Confirming the predictions in the EIS regarding potential long-term effects of Disruptive Scenarios on Lake Huron is unreasonable not because it is unreasonable to require that these predictions be confirmed but it is unreasonable to complete this step after the environmental assessment approval rather than before it. As noted earlier, a requirement to demonstrate the safety of the project was clearly set out in the EIS guidelines, as were requirements to address matters related to the health of Lake Huron.

<p>Disruptive Scenarios</p> <p>Lake Huron</p>	<p>Recommendation 13.7: In order to confirm the predictions in the environmental assessment regarding potential long-term effects of Disruptive Scenarios on Lake Huron, OPG’s future modelling for all variant cases of the Disruptive Scenarios shall provide clear and accessible evaluations of the amounts and activities of discharges into Lake Huron via the shallow and intermediate groundwater systems, to the satisfaction of the CNSC.</p>	<p>13.10. The Proponent’s future modelling for all variant cases of the Disruptive Scenarios shall, to the satisfaction of the CNSC, provide clear and accessible evaluations of the amounts and activities of discharges into Lake Huron via the shallow and intermediate groundwater systems.</p>
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Proposed Potential Condition 9: The Project should be cancelled or – in the alternative – all related activities deferred until after predictions with respect to potential impacts on human health and the environment for radiation exposures have been presented – with all other outstanding information and analyses – in a revised environmental impact statement and supporting documents and restart of the environmental assessment process.

<p>Institutional Controls</p>	<p>Recommendation 13.A: The CNSC, in consultation with other government agencies including Natural Resources Canada and the Ontario Ministry of Natural Resources, should evaluate institutional control options to restrict access to the surface and subsurface of the DGR site. The evaluation should be completed in time to support the decommissioning licensing phase.</p>	<p>CEAA has not drafted a potential condition related to this JRP recommendation. This issue should have been addressed in the EA process, and a proposed set of institutional controls presented by OPG, as the proponent. The JRP has erred a) in accepting the EA without this information included, and b) by delegating the development of the program to parties other than the proponent, and by delegating the decision with respect to the acceptability of the program to an unknown decision-maker.</p>
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Proposed Potential Condition 10: The Project should be cancelled or – in the alternative – all related activities deferred until after a proposed set of institutional controls to limit access have been presented by OPG – with all other outstanding information and analyses – in a revised environmental impact statement and supporting documents and restart of the environmental assessment process.

<p>Intrusion Hydrocarbon Potential</p>	<p>Recommendation 13.3: Prior to site preparation and construction, OPG shall undertake a quantitative assessment of the hydrocarbon potential of the Cambrian and Ordovician strata present in the Regional and Local Study Areas, to the satisfaction of the CNSC. The assessment should consider current trends in extractive technologies for hydrocarbons and energy resource futures. OPG shall institute a periodic review of this document to reflect the evolving trends in natural resource evaluation.</p>	<p>CEAA has not drafted a potential condition related to this JRP recommendation. This issue should have been addressed in the EA process, and a quantitative assessment of the hydrocarbon potential included in the review. The JRP has erred a) in accepting the EA without this information included, and b) by delegating the decision with respect to the acceptability of the assessment to an unknown future decision-maker.</p>
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Proposed Potential Condition 11: The Project should be cancelled or – in the alternative – all related activities deferred until after quantitative assessment of the hydrocarbon potential of the Cambrian and Ordovician strata present in the Regional and Local Study Areas has been presented by OPG – with all other outstanding information and analyses – in a revised environmental impact statement and supporting documents and restart of the environmental assessment process.

<p>Seismic</p>	<p>Recommendation 13.4: Prior to construction, OPG shall re-assess mean shaking levels due to a maximum magnitude earthquake, to the satisfaction of the CNSC. The reassessment shall adopt methodologies employed by Natural Resources Canada and the United States Geological Survey, and consider mitigation strategies or plans for conditions of “beyond-design” ground motions.</p>	<p>CEAA has not drafted a potential condition related to this JRP recommendation. This issue should have been addressed in the EA process, and the assessment of mean shaking levels due to an earthquake included in the review. The JRP has erred a) in accepting the EA without this information included, and b) by delegating the decision with respect to the acceptability of the assessment to an unknown future decision-maker.</p>
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Proposed Potential Condition 12: The Project should be cancelled or – in the alternative – all related activities deferred until after OPG has re-assessed mean shaking levels due to a maximum magnitude earthquake and the results have been presented by OPG – with all



other outstanding information and analyses – in a revised environmental impact statement and supporting documents and restart of the environmental assessment process.

3.2 DGR Wastes

Waste Acceptance Criteria

After receiving little attention from Ontario Power Generation in either the EIS (2011) or 2013 hearing sessions, and not even a reference in the OPG response to IR 13-515, the Waste Acceptance Criteria became a higher profile discussion item in the 2014 hearing sessions, as OPG presumably sought means to differentiate their proposed operations from the failed operations at the Waste Isolation Pilot Plant. During the course of the resumed hearing, repeated references were made to the Waste Acceptance Criteria. During Day 26, which had the incidents at WIPP as the primary topic, OPG offered numerous explanations of the role and importance of the Waste Acceptance Criteria:

The waste acceptance criteria defines what wastes are acceptable for receipt and what materials are specifically excluded, such as chemically reactive materials. Relevant to the WIPP incident, acceptable absorbent materials are also defined in the waste acceptance criteria.^{Tr.26,p.41}

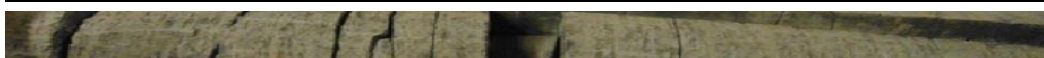
There is a key document called "Waste Acceptance Criteria" which serves as a contract, if you will, between the nuclear generating stations the waste site to ensure that the waste received meets all requirements, including packaging, radiological characteristics, and chemical characteristics.^{Tr.26,p.43}

Trained and qualified staff follow procedures which have been aligned with the Waste Acceptance Criteria document.^{Tr.26,p.44}

So dating back as far as – I have at least found records into the mid to late '90s and there are probably some even prior to that, we had several campaigns where we have gone in, and especially in what we call non-processable wastes, which is waste that we haven't incinerated or compacted, we have opened up those waste packages in some cases, because in one instance we were trying to gain space efficiency in the buildings, so we have inspected quite a bit of volume of actually packaged waste and never found any instances of non-compliance with the Waste Acceptance Criteria.

MEMBER MUECKE: *Just one clarification then. Thank you for that. The Waste Acceptance Criteria, are they dynamic? They have evolved with time, how does that impact upon your evaluation of legacy waste, because you have had -- have your regulations changed and how much have they changed?*

MS MORTON: *Lise Morton, for the record. Yes, the Waste Acceptance Criteria is a dynamic, active document. It undergoes review at a frequency of at least every two years. But if conditions arise that cause it to be reviewed and revised more frequently that can*



certainly occur. It has evolved with time more from the perspective of as we work with our waste generators and either new technologies or, you know, we find better ways to perhaps package things, we will incorporate that into Waste Acceptance Criteria. ^{Tr.26,p 117}

Despite OPG's placing of the Waste Acceptance Criteria in a position of importance throughout their testimony in the resumed hearing, when asked where the document could be located in the evidence (or elsewhere), OPG required time to provide a response. ^{Tr#28,P175}

In contrast to the statements made and impressions given by OPG that the Waste Acceptance Criteria is a document of long standing and the subject of regular biennial revision, the document provided in response to a request for the Waste Acceptance Criteria – in addition to the summaries that are found in table form in the Preliminary Safety Report and EIS – differs from that description, including in the following ways:

- It was authored, reviewed and approved by the Nuclear Waste Management Organization
- It is dated March 2010 and identified as the first revision
- It states that it will “eventually form the basis of an operational waste acceptance criteria document to be developed for or by OPG.”
- It also states that “This document does not describe any criteria for managing waste within the waste package generators’ facilities, for transfer or shipment of waste packages to the WWMF, or for acceptance of waste at the WWMF for processing or interim storage.”
- It further states that “... in future ... OPG will be responsible for taking on the role of DGR Waste Acceptance Coordinator”... ^{CEAR#2120}

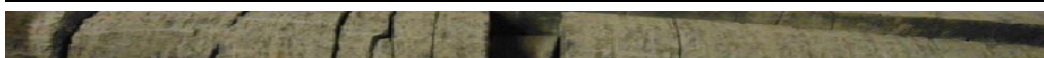
The Joint Review Panel, in its final report, opted for placing a more positive spin on the OPG confusions over their Waste Acceptance Criteria, stated that “OPG presented preliminary Waste Acceptance Criteria for the DGR, noting that they had not yet been finalized. OPG anticipated that the final criteria would closely reflect the Waste Acceptance Criteria used at the WWMF.”²⁰

The JRP summarized the extensive discussions of the Waste Acceptance Criteria with the statement that “Some participants commented about the Waste Acceptance Criteria. They noted the importance of the Waste Acceptance Criteria, suggesting that the failure to adhere to them could result in accident or malfunction scenarios”²¹ and went on to conclude that “the wide range of requirements and exclusions included in the Waste Acceptance Criteria for the DGR will ensure the protection of workers, the public and the environment. The Panel accepts that the current Waste Acceptance Criteria presented in the EIS may change, in detail, over time.”²²

²⁰ JRP Report, page 117

²¹ JRP Report, Page 118

²² JRP Report, Page 118



For the record, we note that the Waste Acceptance Criteria was not, in fact, presented in the EIS, as stated by the JRP. The criteria was summarized in a table, but the Waste Acceptance Criteria was not presented in the EIS.²³

<p>DGR Wastes</p> <p>Waste Acceptance Criteria</p>	<p>Recommendation 7.5: In order to confirm the predictions in the environmental assessment that there will be no significant adverse effects to human health and the environment due to releases of container contents prior to their emplacement in, and the closure of, the repository panels, OPG’s Waste Acceptance Criteria shall be finalized and approved by the CNSC before a licence to operate the DGR is issued. The Waste Acceptance Criteria should be reviewed by both the CNSC and an independent third-party, acceptable to the CNSC.</p>	<p>13.7. The Proponent shall, before a licence to operate is issued, finalize and obtain the approval of the CNSC of its Waste Acceptance Criteria, including measures to avoid releases of container contents prior to their emplacement in, and the closure of, the repository panels.</p>
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Proposed Potential Condition 13: The Project should be cancelled or – in the alternative – all related activities deferred until after OPG has finalized its Waste Acceptance Criteria and the proposed criteria have been presented by OPG – with all other outstanding information and analyses – in a revised environmental impact statement and supporting documents and restart of the environmental assessment process.

Waste Isolation Pilot Plant

One of OPG’s key messages in the EIS (2011) and 2013 testimony was that the DGR proposal was based on “international experience”, including and particular experience at the Waste Isolation Pilot Plant (WIPP) in New Mexico.

In February 2014, the WIPP experienced two significant sets of failures: an underground fire and a radiological release. The February 2014 incidents at WIPP and subsequent information confirmed the basic facts presented in the 2013 submissions:

“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 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,

²³ Environmental Impact Statement, Volume 1: Main Report, 00216-REP-07701-00001-R000, March 2011, Page 4-25



including ‘best practices,’ demonstrate that there are many uncertainties; it does not establish that a DGR can be successfully operated and decommissioned.”

CEAR#1437, p2

Northwatch’s expert evidence with respect to the incidents at the WIPP included the following key points:

- OPG’s May 9 and July 7 submissions are incomplete.
- CNSC Staff submissions have some inaccuracies and are incomplete.
- For six days after the fire, underground air monitors were inoperable, meaning that a release of radioactivity would not have been detected, the filtration system not engaged, and the radioactivity would have been released directly into the environment.
- Six months after the incident, the cause of the release is still unknown.
- Some WIPP control systems failed.
- Radiation protection and notification for workers failed.
- Radiation protection and notification for the public failed.
- Most sensitive radiation detection equipment and most prompt public notification was not from DOE and the operating contractor.
- No effective WIPP decontamination procedures exist.^{CEAR#1956}

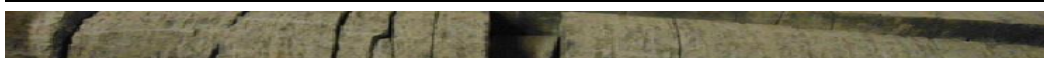
A key lesson learned from the WIPP incidents is that “Below criteria” events can have major consequences for a repository. OPG and CNSC – and DOE – consider the WIPP fire and radiological events to be “below criteria” related to injuries, worker exposure levels, and public exposure amounts. Such events are not expected to occur, and if they do, are not expected to significantly impact the repository operations.^{CEAR#1956}

None of the above summary analysis of events at WIPP were refuted during the eight days of public hearings in September 2014. Nor was Northwatch’s expert evidence with respect to OPG’s claims related to “international experience” refuted during public hearings in 2013.

OPG’s primary lines of defence with respect to the WIPP incidents appear to be:

- Ignore that the WIPP was OPG’s sole example of an operating deep geological repository, and so essential to their claim that the selection of a deep repository as their preferred option was based on “international experience”
- Emphasize the importance of a Waste Acceptance Criteria, while overlooking that WIPP also had a Waste Acceptance Criteria and the uncertainties with respect to OPG’s own Waste Acceptance Criteria (such as: do they have one? Is it operational? What is it complied of?)
- Make claims to a “safety culture”, insinuating that OPG “has one” and WIPP operators did not

In their final report, the Joint Review Panel summarized OPG’s position as a response to public concerns about the WIPP incidents, which were no doubt heightened by the fact that OPG had



used WIPP as their example of “best practice. According to the JRP report “OPG stated that the malfunction and accident events that occurred at the WIPP site did not indicate that the project would be unsafe for L&ILW disposal”, and, further, “OPG noted that, even if there were no international precedents for the DGR, it would not logically or reasonably follow that the proposed DGR could or should not proceed. OPG noted that having a functioning international waste storage analogue to the DGR was not a required condition for project acceptance, and that such a requirement would be contrary to the precautionary approach to decision-making, i.e., using a lack of precedent as a reason to do nothing, or to pursue an inferior long-term solution.”

In a general sense that might be true, that the lack of a precedent does not necessarily forecast project failure. But what makes that defence unavailable to OPG is that they had used the WIPP as their example of international practice, and argued that consistency with international practice was a key determinant in selecting development of a deep geologic repository as their preferred option.

The Panel concluded that OPG had adequately described the applicability of the WIPP incidents to the DGR and took the view that lessons learned and operating experience from international radioactive waste repositories will be beneficial for the safety case of the DGR, and made three recommendations with respect to WIPP:

Recommendation 10.5: OPG shall develop detailed room closure procedures to be deployed in the event that structural failures, inadvertent radiologic releases or other malfunctions or accidents occur within, or external to, waste emplacement rooms. Room closure procedures must incorporate the design of portable closure walls, or any other engineered barrier materials within the repository excavations that can be deployed rapidly to mitigate worker hazards when such events occur. OPG shall develop these procedures prior to construction, to the satisfaction of the CNSC.

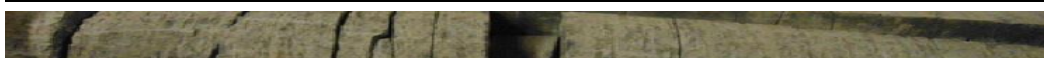
Recommendation 10.6: OPG shall deploy fixed, real-time monitoring equipment in each active emplacement room, and on worker-operated vehicles, as part of its radiation protection program during the operations phase, to the satisfaction of the CNSC.

Recommendation 10.7: To the satisfaction of the CNSC, OPG shall seek and apply operational experience gained from malfunctions and accidents at international repositories, including but not limited to the WIPP, in its contingency, mitigation and other planning processes, during all phases of the project.²⁴

While the recommendations have merit, the timing is deeply flawed and the Joint Review Panel has again erred by a) not requiring this very relevant project information to be provided and reviewed during the EA process, and b) by unlawfully delegating the decision about the acceptability of the proposals to an unknown future decision-maker.

Proposed Potential Condition 14: The Project should be cancelled or – in the alternative – all related activities deferred until after OPG has finalized its room closure procedures,

²⁴ JRP Report, Page 244



real-time monitoring equipment and application of operational experience and presented the information – with all other outstanding information and analyses – in a revised environmental impact statement and supporting documents and restart of the environmental assessment process.

3 Conclusion

The Decision Statement to be issued by the Federal Minister of the Environment should reflect the preceding points by issuing a Decision Statement that finds the environmental assessment to be incomplete and states that - for this and other reasons - the Project is unacceptable and an environmental assessment will not be granted, and that, consequently, the Project will not move forward into the licensing process until and unless an environmental assessment has been completed and an environmental assessment granted

