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**Written Closing Remarks from  
Northwatch**

**Observations écrites finales de  
Northwatch**

In the Matter of

À l'égard de

**Ontario Power Generation Inc.**

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**Ontario Power Generation Inc.**

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OPG's Deep Geological Repository (DGR)  
Project for Low and Intermediate Level  
Radioactive Waste

Installation de stockage de déchets radioactifs à  
faible et moyenne activité dans des couches  
géologiques profondes

Joint Review Panel

Commission d'examen conjoint

**October 2014**

**Octobre 2014**



**Final Comments of Northwatch to the Joint Review Panel Considering Ontario Power Generation’s Proposed Deep Geologic Repository for Low and Intermediate Level Radioactive Wastes**

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**A. Introduction and Overview**

1. 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, and since the appointment of the Joint Review Panel (JRP) has participated through monitoring the public registry, review of written evidence and OPG and CNSC responses to Information Requests (IRs), submission of proposed IRs, making written submissions, presenting expert evidence, and participating in JRP hearings through oral presentations and proposing questions.
2. In these final comments we will attempt to summarize our findings and highlight key areas of the evidence to assist the Joint Review Panel in completing their review. References to the evidence will be provided for illustrative purposes where possible, but on a select basis and incomplete basis, due to final comments being limited to ten pages in length. Similarly, references will be abbreviated as follows: “<sup>CEAR#</sup>” followed by a number will be in reference to posting on the public registry; “<sup>Tr#</sup>” followed by a number will be referring to a transcript by hearing day, and “<sup>P.</sup>” followed by a number is referencing a page number.

Background

3. Ontario Power Generation is seeking approval for the Environmental Assessment and the License to Prepare the Site and to Construct their proposed DGR, and submitted their application to the federal government in 2011, with supporting documents. The DGR “Project” is a single endeavor with multiple stages, including the stages of site preparation, construction, operation decommissioning and abandonment.<sup>CEAR#151</sup>

The Joint Review Panel as a Dual Decision maker

4. Appointed jointly by the federal Minister of the Environment and the Canadian Nuclear Safety Commission, the Joint Review Panel has a dual charge: to review and consider whether approval should be granted to the Environmental Assessment, under the Canadian Environmental Assessment Act, and to review and consider whether approval should be granted to the first of a series of licenses required under the Nuclear Safety and Control Act.<sup>CEAR#151,#664</sup> The following two tables outline the scope of those two sets of requirements, and provide summary comments of what has been entered into evidence with respect to each required area of review. The basis for approval will be discussed in later sections of this submission.

**Table 1**

<b>Part IV - Scope of the Environmental Assessment and Factors to be Considered in the Review</b> <sup>CEAR#664</sup>	
The Review will include a consideration of the following factors:	Commentary
The environmental effects of the Project, including the environmental effects of malfunctions, accidents or malevolent acts that may occur in connection with the Project and any cumulative environmental effects that are likely to result from the Project in combination with other projects that have been or will be carried out;	These effects are over the lifetime of the project, including – in this instance – the five license stages and the full range of activities and inventories now <u>likely</u> to be emplaced
The significance of the effects referred to in (a);	

Comments from the public that are received during the Review;	
Measures that are technically and economically feasible and that would mitigate any significant adverse environmental effects of the Project;	These measures must be known and described; i.e. not assigning development of mitigation to some future time
The purpose of the Project;	Must be a clear statement of purpose
Need for the Project;	Must be a clear statement of need
Alternatives to the Project	These are alternatives to deep burial
Alternative means of carrying out the Project that are technically and economically feasible and the environmental effects of any such alternative means;	These are alternative means of carrying out the project, i.e. the management of radioactive wastes
Measures to enhance any beneficial environmental effects;	
The requirements of a follow-up program in respect of the Project;	Including monitoring over long term
The capacity of renewable resources that are likely to be significantly affected by the Project to meet the needs of the present and those of the future; and,	Including water.
The consideration of community knowledge and Aboriginal traditional knowledge.	Including issues around social acceptance and stigma.

Part V of the 2009 Joint Panel Review Agreement<sup>CEAR#151</sup> was unaltered by the 2012 amendments to the Agreement as a result of amendments to the Canadian Environmental Assessment Act.<sup>CEAR# 664</sup>

<b>Part V – Scope of Assessment of the Application for Licence to Prepare Site and Licence to Construct</b>	
Pursuant to section 24 of the NSCA and its regulations, the JRP process will include consideration of:	
Whether the applicant is qualified to perform the activity to be licensed; and,	Note that there is no definition in the Nuclear Safety and Control Act of the term “qualified”.
Whether in carrying on that activity the applicant will make adequate provisions for the protection of the environment, the health and safety of persons and the maintenance of national security and measures required to implement international obligations to which Canada has agreed.	The “activity” is the activity of the Project. In the absence of sound analysis of the Project – including, in this case, waste volumes and characteristics, it is not possible to assess the adequacy of provisions or the likelihood or magnitude of effects.

## A. The Nature of the Waste

### Risks and Uncertainties

5. In 2013, Northwatch's general<sup>CEAR#1365</sup> and expert<sup>CEAR#1438</sup> submissions outlined numerous issues related to the inadequacies of OPG's characterization and inventories of the wastes and the outstanding uncertainties with what continues to be an expanding inventory. Key issues included the inadequacies of the reference waste inventory, and OPG's decision to not provide an additional layer of safety by designing packaging that would provide an engineered barrier and so reduce risk by further retarding the migration of the radionuclides. In contrast, OPG relies solely on an unproven geological barrier and questionable shaft seals, while utilizing containers that are only expected to maintain integrity for a relatively short period after placement. This is inconsistent with international practice.<sup>Tr.#7</sup>

### Decommissioning Wastes

6. A very significant issue emerged in 2013 around the inclusion of decommissioning waste in those wastes to be emplaced in the DGR. In their 2011 Environmental Impact Statement (EIS), OPG had persistently stated that decommissioning wastes were not included. However, OPG revealed in other forums that they did, indeed,

intend to place decommissioning wastes in the DGR <sup>CEAR#1365</sup>, and this was confirmed by OPG spokesperson Ms. Lauri Swami on the first day of the hearing in September 2013:

*“While reactor decommissioning is not planned for several decades from now, it is expected that the DGR would be used for low and intermediate level waste arising from this activity.”*<sup>Tr#1,P.45</sup>

Despite that clear acknowledgement, OPG returned during the resumed hearing in September 2014 to the EIS (2011) strategy of project splitting:

*“The decommissioning waste is not part of our request for approval in this particular case and that is going to be, as we’ve described a lot, subject to a separate licence and environmental assessment process.”*<sup>Tr.#30, p.306</sup>

As noted above in Section A of these final comments, the Project Agreement defines the “Project” as a single exercise, rather than as a set of activities undertaken on an application-by-application basis.

**“Project”** means the preparation of a site for, and the construction, operation decommissioning and abandonment of, a deep geologic repository on the existing Bruce Nuclear Site within the Municipality of Kincardine, Ontario to store low- and intermediate-level radioactive waste as more fully described in Part I of the Appendix to this Agreement;

**“Review”** means the assessment by the Joint Review Panel of the environmental effects of the Project to be conducted pursuant to the CEAA and the consideration of the Licence Application under the NSCA to determine whether the Project will pose an unreasonable risk to the health and safety of persons, the environment and national security

Indeed, given the longevity of the risks associated with radioactive wastes and their emplacement in a circumstance that will range from difficult to impossible to remediate due to locations deep underground, the dividing line that OPG seeks to draw on the basis of a few decades at most between one application and the next is shadowy at best. Similarly, from a cumulative effects perspective – integral to an environmental assessment approach – the distinction between a volume of wastes that are included in the Project based on a preliminary application and a volume of wastes that are included in the same Project via an application or license amendment is non-existent. And, finally, Part IV of the Project Agreement, as amended in 2012, clearly states that the effects which are to be evaluated include those which have been or will be carried out:

*“The environmental effects of the Project, including the environmental effects of malfunctions, accidents or malevolent acts that may occur in connection with the Project and any cumulative environmental effects that are likely to result from the Project in combination with other projects that have been or will be carried out”*<sup>CEAR#664</sup>

#### Increased Metal Content in Waste Inventory

7. Northwatch’s general <sup>CEAR#1931</sup> and expert <sup>CEAR#1957</sup> submissions in 2014 identified additional and continued issues, largely those related to the responses to additional information requests which OPG provided in 2014. A key issue is 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). This issue is discussed in more detail in Section C of these final comments.

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8. As troubling as the absence of an accurate and detailed waste inventory and the absence of an effective waste characterization program are, the Canadian Nuclear Safety Commission (CNSC) acceptance of this absence, followed by obfuscation as to what the requirements for waste characterization actually are, is more troubling.

For example, on Day 7 of the hearing, September 2013, CNSC variously stated, in sequence, that:

- Regulatory policy, P-9 290, Management of Radioactive Waste, translates this government policy into a regulatory approach which includes definitions of radioactive waste.
- The definition for radioactive waste is defined in Section 2 of the *Nuclear Safety and Control Act* and is reflected in CNSC regulatory policy, P-290. This definition is in agreement with the International Atomic Energy Agency definition
- The principles for management of 13 radioactive waste are outlined in CNSC policy P-290.
- CNSC Policy P-290 is not what we would call as requirements. Requirements are contained in the regulations and the licence condition. A policy document is these are best practices that we have adopted in Canada that are recognized internationally, and we would like to see those in your programs when you apply to the CNSC. They're not specifically requirements. (sic)

*As I stated, P-290 are not requirements. They are best practices.  
Don Howard, CNSC, Director of Waste and Decommissioning, CNSC*

### Waste Acceptance Criteria

9. 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.*<sup>Tr.26,p.41</sup>

*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*<sup>Tr.26,p.43</sup>

*Trained and qualified staff follow procedures which have been aligned with the Waste Acceptance Criteria document.*<sup>Tr.26,p.44</sup>

*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.*<sup>Tr.26,p.117</sup>

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.<sup>Tr#28,P175</sup>

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”...<sup>CEAR#2120</sup>

Two possibilities exist: The document provided is the closest approximation to an operationalized Waste Acceptance Criteria, which calls into question much of the testimony provided by OPG with respect to their purported Waste Acceptance Criteria; or OPG failed or refused to provide the document requested, and in doing so mislead the Joint Review Panel by seemingly responding positively to Panel direction while in reality ignoring Panel direction. In either case, the net result is the same: a review of the OPG Waste Acceptance Criteria is effectively barred from this proceeding because the document is not on the public record, and OPG's testimony is unsupported by documentary evidence.

## B. Repository Project Design

### Project Evolution

10. In Northwatch's written and oral submissions in 2013 we outlined for the Joint Review Panel issues around the evolving and still ill-defined nature of the project. For example: The underground layout changed considerably with each design update, ie. Between 2005 and 2008 and between 2008 and 2011; the design aspect of closing emplacement rooms with block walls was modified; the number of emplacement rooms changed; waste volume estimates increased with each design; and the surface and underground footprint increased.<sup>CEAR#1365</sup>

Several key design and construction decisions have not yet been made, or at least had not been made and documented in the EIS or discussed during the hearings, 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”.<sup>EIS (2011)</sup>

Throughout the 25 days of hearings in 2013, the project continued to evolve, with important elements such as the geosciences verification plan seemingly in flux. In response to these and other uncertainties and unknowns, the Joint Review Panel first issued a series of additional Information Requests, and then reconvened the hearing. During the additional days of hearings, uncertainties and unknowns persisted.

### Waste Isolation Pilot Plant

11. 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. We refer to these as “sets” of failures because – while still under investigation – it is generally understood that there were a number of contributing factors in both cases, and a number of adverse results.

The February 2014 incidents at WIPP and subsequent information confirm 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, including ‘best practices,’ demonstrate that there are many uncertainties; it does not establish that a DGR can be successfully operated and decommissioned.”<sup>CEAR#1437, p2</sup>

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.<sup>CEAR#1956</sup>

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.<sup>CEAR#1956</sup>

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 comprised of?)
- Make claims to a “safety culture”, insinuating that OPG “has one” and WIPP operators did not

There are difficulties for OPG with this approach. For one, the evidence of OPG’s claims with respect to the first point is abundant. So too, the lack of evidence of the third is abundantly obvious. As for the middle point, OPG’s failure or refusal to actually produce an operational Waste Acceptance Criteria with signs of the kind of track record that was alluded to puts this point in question.



12. With respect to the emphasis which both OPG and the CNSC placed on the existence of a strong ‘safety culture’ at OPG as a defence against conditions perceived at WIPP as having contributed to the February 2014 incidents, we make the following three comments:
- As outlined in some detail in Northwatch’s general submission in July 2014<sup>CEAR#1931</sup> Ontario Power Generation has a marred operational record both historically and more recently; in the 1980’s and 1990’s the operational problems were severe enough to prompt reactor shutdowns and contracting out management to a private consultant while more recently there are numerous accounts of events and incidents which in many respects could lead to similar conclusions as are being drawn about the WIPP “safety culture”; for example, numerous S-99 reports document mischief interference with public address systems, fire safety violations, equipment malfunctions and other operational problems.
  - OPG and CNSC identified only nuclear sector industrial organizations as the source of guidance on “safety culture” and its creation and maintenance, such as the Institute of Nuclear
  - Power Operations (INPO) and World Association of Nuclear Operators (WANO) and provide no critique or analysis of these insular organizations as a source of critical guidance or oversight

The Canadian Nuclear Safety Commission cites CSA N-286 as their reference document on safety culture:

*The Canadian Standard N286, includes the recognition and promotion of safety, requires the integration and maintenance of safety in all activities, and requires the clearly identified accountability of management and staff. The CNSC requirements for safety culture are assessed through reviews of policies and programs, inspections and interviews of staff, and reviews of events and incidents.* <sup>Tr.26, p68</sup>

Regrettably, this Canadian Standards Association document – titled “N286-12 Management System Requirements for Nuclear Facilities” – is not on the public registry, and so discussion of its content and applicability is prohibited during final comment.<sup>Tr32</sup>

### C. The Safety Case

13. As outlined in Northwatch’s written evidence in 2013, the ‘safety case’ for a deep geological repository is the integration of the arguments put forward by a proponent to describe the safety – and the level of confidence in the safety – of the project. such as the proposed deep geological repository<sup>1</sup>. In essence, the ‘safety’ of the repository rests on its being able to effectively isolate the radioactivity from the biosphere for extremely long periods of time. 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 their evaluation requires a detailed understanding of the waste and its components, the host rock and its characteristics, and the repository design.

Northwatch’s experts made a number of contentions which – singly or in combination – dispute the “safety case” as presented by OPG and challenge the safety of the project, particularly in the longer time frames. Northwatch’s evidence in 2013 established:

- 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.

<sup>1</sup> Paraphrased from definition provided by Ontario Power Generation, in Section 15, pg 15-33, Main EIS

- OPG does not have sufficient understanding of the baseline hydrogeology to support one of their central claims, that being that the repository will be essentially dry
- While the general attributes of the DGR site in its undisturbed state and geologic setting might appear to be favorable to meeting the required goal of long-term isolation of radioactive wastes from the accessible environment, OPG has not established that the disturbed site will have these attributes
- 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
- 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.
- 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.

In 2013, 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.
- the supplementary information provided by Ontario Power Generation in response to the Joint Review Panel Information Request Packages 12 and 13 does not adequately detail the Geoscientific Verification Plan and does not satisfactorily respond to design deficits identified in earlier stages of this review.
- 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.
- the secure short to long-term performance of the proposed DGR is at question, 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.

Several of these and related points were additionally emphasized during oral testimony, including:

- The potential outward pressures to reactivate existing fractures; these can reactivate at just one tenth of the pressures that new fractures need.
- There is potentially a compass spread of existing faults being reactivated; for example, the EDZ will cause new fractures, waiting to be reactivated
- extra pressure of just 1 -2 MPa is enough to induce gas flow in Mt Terri

Numerous themes straddle areas of evidence and hearing sessions, potentially indicating that there are certain trends in OPG's approaches. Of concern is that some of these "themes" are centrally linked to the safety of the project. For example on Day 8 of the hearing OPG presented two credible accidents: a container breach (with the release of radioactivity) and worker entrapment. Of note was OPG's decision to treat these as two separate incidents, and to not consider the combined effects of a container breach and worker entrapment. On Day 27, discussion again focused on a container breach. In this example, OPG calculated dose on a five minute exposure period only. Their rationale for limiting the exposure period appeared to be a very casual estimate of how long it would take to get to a refuge station. Capacity and location of the refuge stations and various scenarios that could result in longer exposures did not appear to be considered.

As a final note on the safety case, the importance of having a sound knowledge of the site, the waste inventory and the design was noted earlier. This point does not appear to be in contention. Yet, even on the final few days of the hearing, Ontario Power Generation was continuing to elevate aspects –or potential aspects – of the design which had previously been unmentioned or only nominally mentioned, but certainly not given the same elevation previously. For example:

- an increased emphasis on the "recycling" or free release of metals that have been contaminated by radioactivity
- the substitution of concrete for metal containers, in response to concerns about the increased gas generation potential as a result of higher metal content in decommissioning wastes; this substitution introduces a major concern about potential changes to chemistry and subsequent unknown and unevaluated consequences
- the purported use of shielding walls; this had previously been the subject of one single and minimal reference in the EIS

The above examples serve to illustrate that the OPG Project proposal is still very much a moving target, with no established project basis.

## D. Basis for Approval Being Sought

### International

As outlined in expert testimony in 2013, 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. However, 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.

In the absence of a mature regulatory system in Canada, the Joint Review Panel has two options:

- The Joint Review Panel could 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), or
- The Joint Review Panel could set aside the application on the basis of their being inadequate regulatory guidance at this time, given the regulatory vacuum

## E. Joint Review Panel as Decision-maker

As outlined in Section A of this submission, the Joint Review Panel is charged with making dual decisions, acting both as an EA panel but also as a licensing body. However, the long timeline of the project – including for the early stages – create a certain challenge, taken in context with Section 10(5) of the Nuclear Safety and Control Act, which states

*10 (6) Each temporary member holds office during good behaviour for a term not exceeding three years*

The NSCA also states:

*4.2 The JRP shall have all the powers and duties of a review panel described in section 35 of the CEAA.*

*4.3 As a panel of the Commission, the JRP shall also have the powers and duties of the Commission described in section 20 of the NSCA and the Rules of Procedure.*

These provisions are potentially in conflict with each other in the context of this project. Furthermore, the timelines for the Project mean that the Joint Review Panel may in fact be unseated prior to even making its first licensing decision. Consider this: the Joint Review Panel's term presumably began at the time of appointment in January 2012; a three year term limit means the JRP expires in January 2015, which is only three months from now and quite likely prior to the time when the federal Minister of the Environment will issue his decision on your report and recommendations.

As the Joint Review Panel members can appreciate perhaps better than anyone else, this is a complex and complicated project. We have a great concern about a substitute decision-maker being handed the file in a few months time – or even a few years time - without the current Panel's detailed understanding of the project.

## K. Conclusions

In addition to the above, we wish to adopt the final submissions of the Canadian Environmental Law Association with respect to the analysis of alternatives and alternative means.

In conclusion, we respectfully request that this Joint Review Panel deny both the Environmental Assessment Application and the applications for a License to Prepare a Site and Construct).