NORTHWATCH

May 24, 2013

Dr. Stella Swanson, Panel Chair
Dr. James F. Archibald, Panel Member
Dr. Gunter Muecke, Panel Member
Deep Geologic Repository Project Joint Review Panel
Canadian Environmental Assessment Agency
160 Elgin St., 22nd Floor
Ottawa ON K1A 0H3

Email: DGR.Review@ceaa-acee.gc.ca

Dear Dr. Swanson and Panel Members:

Please find attached Northwatch's submission on the conformity of Ontario Power Generation's Environmental Impact Statement and supporting documents with the requirements of the Environmental Impact Statement guidelines issued in January 2009. Comments on the merits of the project as proposed will be submitted at a later date, following your announcement of a public hearing.

In our review significant deficiencies were identified with OPGs work to date within this Environmental Assessment Review. Singly and in combination, they warrant the Joint Review Panel requiring additional work be undertaken by OPG and their agents in order to provide a full description of their proposed undertaking.

We are forwarding an additional 11 proposed information requests, numbered S-37 through S-48. These can be found in Appendix 1; our original set of 36 information requests, submitted in mid-2012, can be found for your reference in Appendix 2.

Thank you for your consideration

Sincerely,

<original signed by>

Brennain Lloyd
Northwatch

Att.

Joint Federal Review of Ontario Power Generation's Proposed Deep Geologic Repository for Low and Intermediate Level Radioactive Wastes

Northwatch Submission on the Conformity of the EIS and Supporting Documents with EIS Guideline Requirements

May 24, 2013

1. Introduction

In June 2007 the federal Minister of the Environment announced that the proposed Deep Geologic Repository (DGR) for Low and Intermediate Level Radioactive Wastes which Ontario Power Generation is proposing to construct beneath the Bruce Nuclear Generating Station had has been referred for an environmental assessment by a review panel.

The project is a proposal by Ontario Power Generation (OPG) to prepare, construct and operate a deep geologic disposal facility on the Bruce Nuclear Site within the municipality of Kincardine, Ontario. The DGR would be designed to manage low and intermediate waste produced from the continued operation of OPG-owned nuclear generations at Bruce, Pickering and Darlington, Ontario.

Draft Environmental Impact Statement Guidelines identifying the information Ontario Power Generation would be required to provide to describe their project prior to it being the subject of a public hearing were released in April 2008, as was a draft Joint Review Panel Agreement, which dealt with the establishment of a federal review panel to conduct an assessment of the projects environmental impact and of the application for a licence to prepare a site and for subsequent construction the first of several licences required by the *Nuclear Safety and Control Act* and its regulations. It Agreemeement included procedures for appointing the JRP members, the proposed terms of reference (i.e. responsibilities), and process for conducting the review. A public comment period closed in June 2008, and final versions of the EIS Guidelines and Panel Agreement were released in early 2009.

Ontario Power Generation released their Environmental Impact Statement and supporting documents in 2011, and in January 2012 the Joint Review Panel was announced, and the public review of the EIS and supporting documents for their conformity with the EIS guidelines commenced in February 2012. On April 25th, 2013, the Joint Review Panel announced that the current comment period would close on May 24th. Ontario Power Generation continued to provide additional information following the announced close of the comment period, and provided their most recent response to Information Requests from the Joint Review Panel on May 22nd, 2013, just two days before the close of public comments

2. Northwatch's Interest

Northwatch is a public interest organization concerned with environmental protection and social development in northeastern Ontario. Founded in 1988 to provide a representative regional voice in environmental decision-making and to address regional concerns with respect to energy, waste, mining and forestry related activities and initiatives, we have a long term and consistent interest in the nuclear chain, and its serial effects and potential effects with respect to northeastern Ontario, including issues related to uranium mining, refining, nuclear power generation, and various nuclear waste management initiatives and proposals as they may relate or have the potential to affect the lands, waters and/or people of northern Ontario.

Northwatch has a dual mandate that includes public interest research, education and advocacy to promote environmental awareness and protection of the environment, and support and promotion of public participation in environment-related decision-making.

Northwatch is interested in Ontario Power Generation's proposed approach to nuclear waste management and containment over various time frames. Northwatch's issues and concerns relate to the generation and management of the nuclear wastes that will result from this project.

Ontario Power Generation's proposed approach for the management of operating (low and intermediate level) wastes generated through operation of their fleet of nuclear reactors is to continue transporting these wastes to the Bruce Nuclear Generating Station for incineration and/or above ground storage and eventually (as proposed by OPG) burial adjacent to Lake Huron in a limestone rock formation.

The proposed geological repository for the low and intermediate level radioactive wastes as proposed 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.

During Phase I of the Federal Environmental Assessments for the Bruce Power New Build and Ontario Power Generations Deep Geologic Repository for Radioactive

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

Northwatch has three objectives with respect to our participation in the current Joint Panel Review of the proposed deep geological repository for radioactive wastes:

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

3. The Current Review Process

3.1 Information Management

In January 2012, Northwatch wrote to the newly announced Joint Review Panel to congratulate them on their appointment and to share "lessons learned" from the Joint Review of the proposed construction of up to four new nuclear reactors at the Darlington Nuclear Generating Station which has been completed the previous year and in which Northwatch has been a participant. In that letter, Northwatch a number of suggestions which would have helped participants in tracking information requests that they and others had submitted, and that responses be provided in electronic formats which are searchable, and sortable by topic, number, source, or EIS Guideline Section.

While some improvements were made in this area, they were not sufficient, and the task of evaluating responses to almost 500 information requests provided in a single PDF document of 1664 pages was unmanageable. Regrettably, as we were advised by the Panel Secretariat, the option of working with more manageably sized documents that contained the responses to each of the ten sets of Information Requests was not available, because Ontario Power Generation updated only the most recent consolidated set of responses, and so if a participant were to work with an earlier version it may be incomplete or no longer current.

We wish to share with the Panel the following observations of impediments to public participation related to the information management system in place:

- Responses to Information Requests were not provided in a format that was searchable or sortable
- There was no dispositioning of Information Requests submitted by public participants; participants had no mechanism through which they could follow the Information Requests they had submitted, other than attempting to recognize some commonality between their Information Requests and those the Panel forwarded to Ontario Power Generation
- Responses to Information Requests were posted as late as May 22nd, just two days before the close of the public review period; ' approximately 13 information items were posted by Ontario Power Generation after the announcement of the close of the public comment

period, as well as two sizeable reports on site visits taken by the Joint Review Panel more than six months prior to their posting

- There is no mechanism through which public participants can ask questions directly of OPG, and there is no requirement that Ontario Power Generation provide responses; our observation is that – for both Northwatch and other participants – Ontario Power Generation may or may not provide responses, particularly to questions submitted through the emails provided on their web site

3.2 Registry issues

While we are of the impression that recent changes to the public registry were Agency-driven and are beyond the direction of a single review panel, we wish to bring them to our attention both so that you can better understand the experience of public participants in your review process and because as Panel Chair and Members you may at some point be able to influence future directions within the Agency with respect to the public registry. There are two matters of concern:

- The previous version of the registry had headings for Document number, document title, Author, Recipient, and date; the current version of the registry has headings for Document number, Document title, and date only, which makes it more difficult to identify documents of priority interest, and more difficult to search the registry by category
- Items are posted as date received, rather than as date posted; the difficulty this creates is that if a document is posted days after received but posted as the date received, it may be missed by a registry user who has visited the registry during the interim period; this requires registry users to sort first by number and then by date to ensure that all items are being seen; while this may not seem overly burdensome, it does add hours to the frequently volunteer effort, and also risks items being missed as a result

3.3 Transparency Concerns

In our earlier referred to letter of January 2012, we also set out for the Joint Review Panel our thoughts with respect to site visits, and our concern about any occasion in which the Joint

Review Panel is interacting with the proponent and / or the proponent's consultants and employees outside of the public record, including during site visits. As a remedy, we proposes that a record be made of any interactions between Panel members and the proponent and/or their representatives, including during site visits and that public participants in the review process be included in any site visits or other such opportunities for interaction between the Panel members and the proponent and/or their representatives. Unfortunately, the Panel has chosen to take a different course, and we wish to identify to you at this point our concerns that:

a) The Joint Review Panel has conducted site visits with the proponent present and providing information while no other public review participant was present, and
b) The reports of the site visits include agendas and presentation materials but do not include a record of discussion between the presenters – including the proponent and/or their agents – and the Panel members, or of the Joint Review Panel members' identification or even summary of key points of information that were conveyed and upon which they will be relying in making their eventual determination on the acceptability of the Project

Finally, we continue to hold the view that when the Joint Review Panel receives professional, scientific, technical or other assessment from either Secretariat staff or additional independent experts retained by the Panel to provide information on and help interpret technical and scientific issues and issues relative to community knowledge and Aboriginal traditional knowledge transparency would be best served by the Panel making all such exchanges publicly known through the posting of meeting records or written materials on the public registry. We note that the Panel has held such meetings and that meetings between the proponent and other parties who provide advice to the Panel (namely the CNSC) continue to take place and meeting reports are not made publicly available.

4. Review of OPG's Proposal for Conformity with EIS Guidelines

In January 2009, the final Environmental Impact Statement Guidelines and Joint Review Panel Agreement were issued, following a 65 day public comment period held in the spring of 2008.

The purpose of the current review period is to evaluate the Environmental Impact Statement (EIS) and supporting documents that have been provided by Ontario Power Generation and their various agents for their conformity with the guidelines and their adequacy, as follows:

> ***1.1 Purpose of the Guidelines***
> *The purpose of this document is to identify for the proponent, Ontario Power Generation (OPG), the nature, scope and extent of the information that must be addressed in the preparation of the Environmental Impact Statement (EIS) for its proposed Deep Geologic Repository (DGR) to store low- and intermediate-level radioactive waste. The proponent will prepare and submit an EIS that examines the potential environmental effects, including cumulative effects, of the site preparation, construction, operation, decommissioning and abandonment of the project and evaluates their significance. In addition, the proponent will address all requirements for a site preparation and construction licence, detailed in Appendix 2 of this document. This information will be used by a joint review panel established pursuant to the Canadian Environmental Assessment Act and the Nuclear Safety and Control Act as the basis for a public review.*
>
> *While the EIS guidelines provide a framework for preparing a complete and accessible EIS, it is the responsibility of the proponent to provide sufficient data and analysis on any potential environmental effects to permit proper evaluation by a joint review panel, the public, and technical and regulatory agencies. The EIS guidelines outline the minimum information requirements while providing the proponent with flexibility in selecting methods to compile data for the EIS.*[1]

Ontario Power Generation's Environmental Impact Statement, Technical Support Documents and supporting and licencing documents as released in April 2011 total 14, 902 pages of documents, plus numerous zip files. There are also 1,096 documents posted on the public registry maintained by the Canadian Environmental Assessment Agency, some but not all of which are also included in 1,686 page consolidated table of responses by Ontario Power Generation to Information Requests forwarded to them by the Ontario Power Generation. The

[1] Guidelines for the Preparation of the Environmental Impact Statement for the Deep Geologic Repository for Low- and Intermediate-Level Radioactive Wastes, January 2009

latter document includes most but not all of the OPG responses; some additional responses are among those more recent postings to the public registry, with the most recent IR response having been posted on May 22nd, two days before the close of this public review period.

This conformity review is a daunting task, and to do it comprehensively is beyond the capacity of any public participant, including Northwatch.

Given the magnitude of the task, Northwatch's approach will be to provide input to the Joint Review Panel in a manner which is within our means and which we hope will be of assistance. Our approach is to evaluate the information provided through three different lenses:

- key elements of the project, as summarized by Ontario Power Generation;
- key sections of the EIS guidelines, and
- select responses to Information Requests

In addition, we are providing a summary evaluation of responses to Information Requests put forwarded by Northwatch in Appendix A of this report.

The Project as Summarized by Ontario Power Generation

A prerequisite to being able to evaluate a project is that the proponent provide a full description of the project and its many elements and a rationale for their project design decisions. As outlined in the "purpose" section of the EIS guidelines, it was Ontario Power Generation's responsibility to provide enough information about their project to *"permit proper evaluation by a joint review panel, the public, and technical and regulatory agencies".*

Through the lens of OPG's own project summary, the following section highlights some of the inadequacies of the information provided by Ontario Power Generation and their agents.

Feature	OPG's DGR forL&ILW	Deficiency
Host rock	Sedimentary (Argillaceous limestone)	*OPG's siting process was political rather than technical; the selection of the geology was happenstance, and the rationale provided reflects this, as does*

Feature	OPG's DGR forL&ILW	Deficiency
		the absence of any comparative discussion of geology in the international context
Size of facility	~200,000 m^3 of L&ILW as packaged for disposal	*OPG has not stated a size limit in a definitive manger; size and volume estimates are for "reference" purposes only; the lack of any firm definition of size, capacity or volume makes all aspects of the project indefinite, including surface impacts (e.g. waste rock management) and environmental releases (related to waste volume and age)*
Development technique	Controlled drill & blast. Initial construction of 200,000 m3 to accept existing backlog, plus predicted future waste from operation and refurbishment.	
Waste type	L&ILW from operation and refurbishment of OPG owned or operated nuclear reactors (and associated support facilities).	*OPG's project proposal is indefinite with respect to the inclusion of decommissioning wastes; for example in the the EIS OPG states that decommissioning wastes are not included in the discussion, but does not state that they will not be included in the repository*[2]
Waste treatment/ conditioning/ packaging	Some LLW is treated by incineration or compaction. IX resins are dewatered. Some wastes are immobilized in cement, polymer or bitumen. A range of waste packages is used, including ~2 to 3 m3 steel bins for LLW, 3 m3 stainless steel containers for IX resins, and stainless steel / concrete containers for retube waste. Higher dose rate ILW may have concrete shield overpacks.	*OPG does not provide sufficient rationale for their project decision to not rely on containers or packaging as a barrier for radionuclides or for their definition of "multiple barrier" as being the two strata of rock (limestone and shale) as the "multiple barrier" versus the more standard use of the term "multiple barrier" as meaning the combination of engineered and geological barriers. OPG "grouped" types of containers and presented information only on those that were "typical"; this is incomplete.*[3]
Key design features	Shaft & hoist access. Two shafts: air intake, waste package handling, personnel access in main shaft; ventilation exhaust and emergency egress from ventilation shaft. Emplacement rooms and access tunnels have flow-through ventilation.	*OPG does not provide sufficient discussion or explanation of their choice of a shaft as the means of access versus a ramp; this deficiency is particularly noteworthy given a) the depth of the repository, b) the very large volume of material OPG*

[2] EIS 4.5
[3] EIS 3.4.10

Feature	OPG's DGR forL&ILW	Deficiency
	Separate rooms for LLW and ILW. Two panels of emplacement rooms (total of 31 rooms), nominally 8.6 m W x 7.1 m H x 250 m L. (A few rooms with different width & height for specific waste types, e.g. 8.4 m W x 5.4 m H for gantry crane access rooms and 8.7 m W x 7.1 m H for IX resin liner rooms). Most wastes emplaced by forklift.	*proposes to place at depth, and c) the deviation from international practice that this particular design decision signals. OPG also provides insufficient rationale for design decisions at depth, including their proposed practice of installing "end walls" at "closure walls" and the decision criteria for timing and placement of the walls relative to waste types, volume and activity*[4]
Key safety features	Deep underground location (680 m). Institutional control assumed by land use restrictions and other passive controls. Safety Assessment assumes no human intrusion for at least 300 years. Sensitivity cases analyzed for shorter periods. Geosphere provides multiple natural barriers (seismically quiet location, multiple very low permeability rock formations, old diffusion dominated water in rock at repository depth with no connection to shallow groundwater, mechanically competent rock). Repository will resaturate very slowly. Space provided for gas generation. Extensive shaft seal. Most long-lived radionuclides are in corrosion resistant waste forms. (Full safety case is summarized in Table 14-3 of OPG, 2011).	*OPG does not provide sufficient cross-discussion between design decisions and repository descriptions; for example: between decisions to not backfill to allow room for gas generation and the likelihood of rock fall damaging containers and so hastening release of radionuclides; between descriptions of a closure wall function being to limit the release of potentially contaminated water and descriptions of the repository conditions at depth including minimal water inflow and slow resaturation; between reliance on the corrosion resistance of waste containers and the saline water at depth*
Water management during operations	No significant water inflow expected. Water inflow (seepage from shafts and condensation) to be directed to collection sumps, monitored and released. Water expected to be highly saline.	*EIS and supporting documents include inconsistencies with respect to key issues such as water inflow, saturation rates, contamination levels*
Backfill	None planned in emplacement rooms or connecting tunnels to allow room for gas from waste and container	*OPG does not provide sufficient cross-discussion between design decision to not backfill to allow room for gas*

[4] EIS 4.8.3.1

Feature	OPG's DGR forL&ILW	Deficiency
	decomposition. Shaft services area to be backfilled at closure with mass concrete to ensure support for shaft seals.	*generation and the likelihood of rock fall damaging containers and so hastening release of radionuclides*
Community engagement & acceptance	High local support and acceptance (volunteer site). Extensive public outreach about DGR project in place since 2002.	*OPG does not provide reliable demonstration of public support for the proposed facility, beyond presentation of limited poll results for a misleading question*
Source: Excerpted from Table 1: Summary of Selected International L&ILW Geologic Repository Key Features (associated with response to IR-EIS-09-410)		

Key Sections of the EIS Guidelines

The following table provides a summary assessment of the EIS and is compliance with the EIS guideline requirements.

EIS Guidelines Section	Discussion / Deficiency
PART II – CONTENT OF THE EIS	
5. CONTEXT	
5.1 Setting	- does not describe project proximity to Lake Huron
5.2 Project Overview and Purpose	- does not clarify if project includes decommissioning wastes or wastes from RWOS1 - purpose section describes practice of OPG, i.e. to ship wastes to WWMF, but does not clearly state purpose - need section describes need (sic) of placing ILW waste in repository but not LLW[5]
5.3 Proponent	Appropriately identifies OPG as proponent; identifies NWMO as "contractor"; does not describe corporate relationship between NWMO and OPG; does not describe intended future operational arrangements between NWMO and OPG, even when asked about relationship[6]
5.4 Environmental Assessment and Regulatory Process and Approvals	Includes description; does not adequately explain the "joint" nature of the review
5.5 International Agreements	Does not include description of Canadian Constitution, Section 35 and Treaty obligations
6. PUBLIC PARTICIPATION	

[5] Sec 3.2
[6] EIS 2-83, Table 2.6.2.1, item 18

6.1 Aboriginal Peoples	Only very brief and generic description included
6.2 Government Agencies	Identified meetings, did not identify objectives or issues raised
6.3 Stakeholders	Identified meetings, did not adequately describe issues raised
6.4 Other Public Participation	Description does not include rationale for identifying stakeholders who were included or how or if notice was given to general public and whether meeting were open; description is inadequate
7. PROJECT JUSTIFICATION	
7.1 Purpose and Need for the Project	- purpose section describes practice of OPG, i.e. to ship wastes to WWMF, but does not clearly state purpose - need section describes need (sic) of placing ILW waste in repository but not LLW[7]
7.2 Alternatives to the Project	Alternatives were limited to waste already having been centralized to WWMF; failed to include broader range of alternatives, include dispersed management or management of wastes at various points of generation; does not consider alternative of ending waste generation
7.3 Alternative Means of Carrying out the Project	Section lacks sufficient details and supporting information, states conclusions too broadly; does not assess at different temporal scales - for example, indicates that "enhanced containers" would have negative effect on worker health but no positive environmental benefit[8]
8. DESCRIPTION OF THE PROJECT	
8.1 General Information and Design Description	Various documents provide conflicting statements about size of underground facilities; the description does not provide time estimates for each of the various project stages; the EIS is not clear on whether decommissioning wastes are to be included in the DGR; the EIS does not provide a full description of the various waste types, but instead "groups" them into a much smaller number of categories, providing only very general descriptions of the "grouped" categories of waste; the volumes in Table 4.5.1-1 appear to be inconsistent with the volumes represented in Figure 4.5.1-1
8.2 Site Preparation and Construction	This description is brief and very general. No rationale is provided for management decision to leave overburden exposed for up to one year. No

[7] Sec 3.2
[8] EIS Table 3.4.10-1

	indication of work-planning to season is included. No indication of management strategies of extreme weather events is included. There is no discussion of the potential for Acid Mine Drainage or the associated phenomena of metal leaching and how acid potential assessments will be undertaken on an ongoing basis and what the implications (of AMD/ML) are for waste rock management
8.3 Operation	There is no description of QA/QC for waste containers. Descriptions are extremely generalized, e.g. "most LLW bins will be transferred 'as is'"; there are references to "a DGR ready state" but no description of what a "DGR ready state" is; there is no description of payload limitations in "cage" or contingency plans for hoist failures; no descriptions are provided of "cage" capacity by size or weight
8.4 Modifications	The EIS fails to describe the decision-tree or approvals process for modifications to the project post-approval; the addition of emplacement rooms is indicated to be a possibility only if "assumptions about volume reduction" are not realized, but this is an unsupported statement
8.5 Decommissioning	The EIS states that decommissioning is to be done to an "agreed end state" but does not describe that state or the means by which said state will become the "agreed upon" end state
8.6 Abandonment	The EIS states that the period of institutional control would be up to 300 years, but provides no rationale for the selection of that time frame
8.7 Malfunctions, Accidents and Malevolent Acts	This section is extremely brief and overly general; for example, the discussion of malevolent acts is limited to five sentences, with those sentences almost totally consumed by statements that the Bruce nuclear site security forces will provide protection; no discussion is provided of the state of readiness of the security force during the period following end of reactor operation and prior to abandonment of the repository
8.8 Environmental Protection Policies and Procedures	This section provides a brief description.
9. ENVIRONMENTAL ASSESSMENT BOUNDARIES	
9.1 Spatial Boundaries and Scale	The various study areas are described but not rationalized.
9.2 Temporal Boundaries	No rationale is provided for why the longest temporal boundary would coincide with the

	removal of institutional controls (i.e. 300 years) versus being determined by potential radiation or toxic effects of releases from the repository
9.3 Valued Ecosystem Components	This section omits Lake Huron as a VEC. It also omits any quality of life indicators, including measures of stress and/or anxiety, particularly for local and regional residents.
10. EXISTING ENVIRONMENT	NOT REVIEWED
12. ACCIDENTS, MALFUNCTIONS AND MALEVOLENT ACTS	The section identifies container failure as "unlikely" despite this being a known occurrence other operating facilities; the section identifies explosions as being "non-credible" despite the regular use of explosives during construction, the known phenomena of gas generation as referred to elsewhere in the document; the section fails to identify hoist failure as a specific "mechanical/equipment" failure which is credible and of potential high consequence
13 LONG-TERM SAFETY OF THE DGR	
13.1 Demonstrating the Long term Safety of the DGR	
13.2 Selection of Assessment Scenarios	Analysis documented in other documents should be summarized rather than simply referenced in the EIS.
13.3 Additional Arguments in the Safety Case	The statement that the DGR is isolated from the biosphere is not supported by the text which follows the statement; the additional statements in this section are too brief to be meaningful
13.4 Confidence in Mathematical Models	This section is too brief to provide meaningful information.
13.5 Interpretation of Assessment Results and Comparison with Acceptance Criteria	The comparison with acceptance criteria was not presented
14. CUMULATIVE EFFECTS	NOT EVALUATED
15. CAPACITY OF RENEWABLE RESOURCES	NOT EVALUATED

<u>Evaluation of Select Information Request Responses</u>

Regrettably, Northwatch lacks the capacity to review and provide comments to the Joint Review Panel on the full suite of responses to Information Requests, or even for all IRs which fall within

our priority areas of interest. In the alternative, we have identified a select and hopefully somewhat representative sampling or OPG's responses to Information Requests for the purpose of providing comment on the adequacy of the responses provided.

IR #: EIS 01-01

Summary of IR: JRP asks whether and how the project would interact with groundwater contaminant plume associated with several low level storage buildings at the adjacent Western Waste Management Facility. (e.g., whether it would change the plume migration path and intercept the contaminant plume into the seepage to be dewatered).

Summary of OPG Response: Tritium concentrations within the uppermost bedrock surface in the vicinity of the WWMF, on the order of 500 Bq/L, if captured by the temporary shaft drawdown, are estimated to be diluted by a factor of 2 to more than 10 in excavation discharge. In a supplementary response, OPG indicates that additional groundwater wells are being installed in 2012 and will become part of the monitoring network to provide baseline information.

Northwatch Comment: OPG is seemingly not able to answer the question with their current information set. A schedule should be developed for OPG's provision of outstanding information. In the interim, this IR response should be deemed incomplete.

IR #: EIS 01-06

Summary of IR: Provide additional information on the characterization of uncertainty with the radionuclide measurements.

Summary of OPG Response: Continuing work is underway which will improve the estimates of total projected DGR radionuclide activity. A revised reference inventory will be presented as part of the application for the Operating Licence.

Northwatch Comment: As noted by the JRP, "A thorough understanding of the uncertainty associated with the radionuclide measurements is needed in order to be confident that the post closure safety assessment predictions are reasonably conservative. This is in alignment with IAEA (2011), section 5.3 that indicates: "Waste intended for disposal has to be characterized to provide sufficient information to ensure compliance with waste acceptance requirements and criteria". OPG's response is incomplete. It is not acceptable to move forward without this information set.

IR #: EIS 01-17

Summary of IR: Assess the impact of future glaciation cycles on the groundwater regime with the presence of the repository, shafts, seals and associated zones disturbed through excavation

Summary of OPG Response: Subsequent to the submission of the PSR, additional calculations have been performed. As per the Information Request, these explicitly include the effect of glaciation on groundwater and gas transport in and around the repository, including the presence of the repository, the shaft, seals and EDZ. The results from these calculations show that the effect on groundwater flow and gas transport around the repository due to glaciation are minimal. Details are given in the enclosed NWMO document (NWMO 2012).

References: NWMO. 2011. Geosynthesis. Nuclear Waste Management Organization report NWMO DGR-TR-2011-11 R000. Toronto, Canada.
NWMO. 2012. OPG DGR: Glaciation Analysis. NWMO Technical Memorandum DGR-TM-03640. Toronto, Canada. (enclosed)

Northwatch Comment: An online searched for the referenced report identified the document by the referenced number (DGR-TM-03640) as being "TECHNICAL MEMORANDUM File: DGR-TM-03640 (P) Revision: R0 Title: OPG DGR: Resin Degradation Review and Additional Analysis" rather than the referenced report on glaciations. This error renders the IR response incomplete.

IR#: EIS 01-33

Summary of IR: Describe how the proponent plans to verify the waste inventories (radiological and hazardous) during the DGR operational period, including radionuclides levels in the refurbishment waste, in order to confirm General predictions of the inventory at the repository closure in 2062

Summary of OPG Response: A program for verifying waste inventories during the operational phase will be developed and provided as part of the Operating Licence application.

Northwatch Comment: OPG's response is incomplete. It is not acceptable to move forward without this information set.

IR #: EIS 02-40

Summary of IR: Provide further information on the location, salient features, evaluation criteria used, and a summary presentation of the comparison and selection process for alternative locations considered for the DGR.

Summary of OPG Response: Based on the results of this assessment, and because the Municipality of Kincardine had approached OPG to initiate the study of the WWMF as a long-term L&ILW waste management facility and is therefore a willing host, OPG did not actively solicit other potential host communities or undertake geoscientific studies at other sites.

Northwatch Comment: The EIS and this IR response may present a fair picture of what was done in terms of an evaluation of alternative locations, in that no evaluation was actually done. For the project to proceed to review, alternatives and alternatives means must be examined. The EA studies are incomplete.

IR #: EIS 04-99

Summary of IR: Discuss the technical and regulatory factors that would prevent the transformation and use of the DGR for high-level and waste disposal.

Summary of OPG Response: Neither OPG nor the NWMO have evaluated the technical potential for OPG's DGR to be transformed to take used nuclear fuel, nor are there any plans to conduct such an evaluation.

Northwatch Comment: OPG has not answered the IR; it is not clear from their response whether they are unable or are simply unwilling to provide a response.

IR #: EIS 04-102

Summary of IR: Clarify whether Low and Intermediate Level Waste from pending or approved OPG new build, refurbishment or closure
operations will be placed in the DGR.

Summary of OPG Response: L&ILW generated under an operating licence for a nuclear facility is considered operational or refurbishment waste. OPG's current licence application does not include decommissioning waste. If in future OPG decided it wished to put some forms of decommissioning waste into the DGR then it would need to apply to the CNSC for a licence amendment to allow this activity, and the associated regulatory process would be triggered.

Northwatch Comment: As in the EIS and other documents, in this IR response OPG evades the question of decommissioning waste and whether it is part of the potential DGR waste streams.

IR #: EIS 04-117 and EIS 09-410

Summary of IR: Provide a detailed comparison of the proposed DGR with other international L&ILW repositories. Explain significant differences between the proposed DGR and these

international repositories. (04-117) Supplement the response to EIS 04-117 and provide additional detail as originally requested (09-410)

Summary of OPG Response: OPG provided a table with brief descriptions of 14 features of 10 different geologic repositories.

Northwatch Comment: OPG provided summary information as noted above, but provided no discussion of the information summarized on the table. In particular, OPG provided no discussion of the dis-similarities between the OPG project and most or all of the other repositories (variation based on feature). Differences between OPG's DGR and (most) others include the waste volumes (DGR much higher volumes), the repository depth (DGR deeper than most, and deepest except for Konrad), and the rock formation (DGR is the only one in Agrillaceous limestone, and one of two in limestone, with Konrad being the other). OPG also omitted whether the various repositories are intended for "storage" or "disposal".

IR #: EIS 04-122

Summary of IR: Will the integrity of the waste packages exceed the proposed operational phase of the DGR? If not, what is the contingency plan to address compromised packages?
What would be the potential period during which the waste would be retrievable?

Summary of OPG Response: Although waste containers are not credited with any function in the postclosure safety assessment, they are expected to maintain their integrity to the degree necessary to facilitate easy retrieval (if required) for a decade or more after emplacement in the DGR. In some cases, the containers will provide effective containment for longer periods. This is especially true for the containers used for the higher activity wastes, such as Intermediate Level Waste retube waste containers, which are of robust stainless steel and concrete construction with a fifty-year design life.
The wastes are considered to be always retrievable, however, it is recognized that the ease of retrievability of waste containers will diminish with time. For example, once the closure walls have been constructed in access tunnels to isolate a set of filled emplacement rooms, these walls

would require removal, or a bypass tunnel constructed around the wall, prior to retrieving any emplaced waste in the isolated rooms. If waste containers would require retrieval at long time periods after the start of emplacement, then over-packing might be required as part of this retrieval process for some containers

Northwatch Comment: OPG's estimate of the containers maintaining their integrity for only 'a decade or more" after placement is distinctly shorter than the IR referenced time period of the DGR's "proposed operational phase" and is at odds with the statement also within the IR that they are considered to be "always retrievable. The final statement that "overpacking" might be required to retrieve packages after their first decade in the repository lacks sufficient detail. A supplementary IR should require details such as cost, method, complexity and worker exposure.

IR #: EIS 04-124

Summary of IR: Explain the absence of waste containers as a possible remobilization barrier in the design of the proposed DGR.

Summary of OPG Response: OPG does not envisage a scenario where waste retrieval will be necessary, but wastes will be retrievable as described in the response to IR-EIS-04-122

Northwatch Comment: The final statement in EIS 04-122 that "overpacking" might be required to retrieve packages after their first decade in the repository lacks sufficient detail. A supplementary IR should require details such as cost, method, complexity and worker exposure.

IR #: EIS 06-260

Summary of IR: Provide information regarding what constitutes a "recognizable fuel fragment"

Summary of OPG Response: A "recognizable fuel fragment" is a visually recognizable piece of fuel, such as a pellet, fuel element, partial fuel bundle, etc.
Such wastes are not routinely produced at OPG or Bruce Power. They are the result of rare discreet incidents involving severe physical damage to a fuel bundle. The potential for such wastes would be known in advance as any fuel damage incident is closely investigated. The waste would be subject to special handling at the station during the recovery process due to the very high dose rates associated with them and the need for fissile material accounting and control. Fuel fragments would be canned and stored in the fuel bays at the stations as "failed fuel". The exclusion in the WWMF WAC and the DGR WAC is to provide added assurance that waste generators do not mix these fuel fragment wastes with L&ILW.
There is no threshold for actinides that initiates further inspection for fuel fragments. As discussed above, the presence of fuel fragments in L&ILW is considered highly unlikely

Northwatch Comment: As reactor stations age it is likely that the fuel damage will be come increasingly frequent, with a corresponding increase in the potential for "fuel fragments", recognizable or not. Similarly – whether recognizable or not – filters for the irradiated fuel bay might increasingly "catch" fragments from damaged fuel bundles, resulting in an increased level of radioactivity in the intermediate level wastes. This should be the subject of a supplementary Information Request.

IR #: EIS 06-263

Summary of IR: Provide the studies that resulted in the "…new specific activity information" referred to in the Revision Information and revised Reference Low and Intermediate Level Waste Inventory for the Deep Geologic Repository.

Summary of OPG Response: The August 2008 version of the Reference Inventory Report (OPG 2008) was preliminary, and based on the information available at that time. Waste characterization is an ongoing activity and waste characteristic data (including specific activity information) may be updated periodically as additional samples are collected and analyzed for the various waste types. The 2010 Reference Inventory report (OPG 2010) is the

summary of a number of inputs from various internal studies including the 2008 version of the report and subsequent studies.

Northwatch Comment: Given the OPG response and the two year interval between the 2008 and 2010 inventory reports, a supplementary IR should query OPG as to the anticipated delivery of the next inventory report.

IR #: EIS 08-343

Summary of IR: Provide an outline of the requirements for package certification that will be in place to ensure that the manufacturing Information and methods and materials used are in accordance with design specifications.

Summary of OPG Response: As discussed previously in OPG's response to Information Request (IR) EIS-04-152 (OPG 2012), there are no specific Canadian Nuclear Safety Commission (CNSC) regulatory requirements for radioactive waste containers to be placed in a repository. The context of the "design approval" referred to in Table 4.5.1-3 of the Environmental Impact Statement (OPG 2011) is that all waste package designs require prior approval by the responsible parties in OPG.

Northwatch Comment: Quality Assurance / Quality Control should be a standard and integral part of any radioactive waste management program, and certainly should be part of this one. Prior to considering the application complete, the JRP should require of OPG a program to verify package integrity at point of manufacture, point of arrival at the WWMF, and prior to transfer into any longer-term management scenario, such as OPG is proposing with the DGR.

5. Conclusions

Through each of our review lens, significant deficiencies were identified with OPGs work to date within this Environmental Assessment Review. Singly and in combination, they warrant the Joint Review Panel requiring additional work be undertaken by OPG and their agents in order to provide a full description of their proposed undertaking.

We appreciate the time pressures that the Joint Review Panel may feel they are under, but would encourage the Panel to bear in mind that the review "clock" stops while the Panel waits for Ontario Power Generation to respond to information requirements, and that the time spent to date in this review process is still quite short when compared to the operational period of the proposed project and even shorter when considered in comparison to the time frame over which the Project could potentially adversely impact the natural human communities in the project area and the broader Lake Huron ecosystem.

Appendices

Appendix 1 - Supplementary Information Requests Submitted by Northwatch

Appendix 2 – Northwatch Information Requests – Consolidated Set of 2012 IRs

Appendix 1 - Supplementary Information Requests Submitted by Northwatch

Northwatch Question No.	EIS Guidelines[1] Section	Earlier JRP Information Request, EIS Section or other TSD	Information Request	Rationale
S-37	EIS Guidelines: Section 8.2, Site Preparation and Construction; Section 10.1.1, Geology and Geo-morphology; Section 11.1, Effects Prediction	IR #: EIS 01-01	Describe how the project would interact with groundwater contaminant plume associated with several low level storage buildings at the adjacent Western Waste Management Facility. (e.g., whether it would change the plume migration path and intercept the contaminant plume into the seepage to be dewatered).	Summary of IR: JRP asks whether and how the project would interact with groundwater contaminant plume associated with several low level storage buildings at the adjacent Western Waste Management Facility. (e.g., whether it would change the plume migration path and intercept the contaminant plume into the seepage to be dewatered). Summary of OPG Response: Tritium concentrations within the uppermost bedrock surface in the vicinity of the WWMF, on the order of 500 Bq/L, if captured by the temporary shaft drawdown, are estimated to be diluted by a factor of 2 to more than 10 in excavation discharge. In a supplementary response, OPG indicates that additional groundwater wells are being installed in 2012 and will become part of the monitoring network to provide baseline information.
S-38	EIS Guidelines: Section 8.1, General Information and Design Description: 12th and 14th bullets	IR #: EIS 01-06	Provide a revised reference inventory for consideration as part of the EA underway and as part of the application for Site Preparation and Construction.	Summary of IR: Provide additional information on the characterization of uncertainty with the radionuclide measurements. Summary of OPG Response: Continuing work is underway which will improve the estimates of total projected DGR radionuclide activity. A revised reference inventory will be presented as part of the application for the Operating Licence.

[1] http://www.ceaa-acee.gc.ca/050/documents/31039/31039E.pdf

Northwatch Question No.	EIS Guidelines[1] Section	Earlier JRP Information Request, EIS Section or other TSD	Information Request	Rationale
S-39	EIS Guidelines: Section 8.1, General Information and Design Description: 12th and 14th bullets.	IR#: EIS 01-33	Develop a program for verifying waste inventories during the operational phase and submit it as a response to this Information Request.	Summary of IR: Describe how the proponent plans to verify the waste inventories (radiological and hazardous) during the DGR operational period, including radionuclides levels in the refurbishment waste, in order to confirm General predictions of the inventory at the repository closure in 2062 Summary of OPG Response: A program for verifying waste inventories during the operational phase will be developed and provided as part of the Operating Licence application.
S-40	Section 12, Accidents, Malfunctions, and Malevolent Acts	IR #: EIS 04-122	Provide operational details to support the option of "overpacking" failed containers. In particular, include details such as cost, method, complexity and worker exposure.	Summary of IR: Will the integrity of the waste packages exceed the proposed operational phase of the DGR? If not, what is the contingency plan to address compromised packages? What would be the potential period during which the waste would be retrievable? Summary of OPG Response: Although waste containers are not credited with any function in the postclosure safety assessment, they are expected to maintain their integrity to the degree necessary to facilitate easy retrieval (if required) for a decade or more after emplacement in the DGR. In some cases, the containers will provide effective containment for longer periods. This is especially true for the containers used for the higher activity wastes, such as

Northwatch Question No.	EIS Guidelines[1] Section	Earlier JRP Information Request, EIS Section or other TSD	Information Request	Rationale
				Intermediate Level Waste retube waste containers, which are of robust stainless steel and concrete construction with a fifty-year design life. The wastes are considered to be always retrievable, however, it is recognized that the ease of retrievability of waste containers will diminish with time. For example, once the closure walls have been constructed in access tunnels to isolate a set of filled emplacement rooms, these walls would require removal, or a bypass tunnel constructed around the wall, prior to retrieving any emplaced waste in the isolated rooms. If waste containers would require retrieval at long time periods after the start of emplacement, then over-packing might be required as part of this retrieval process for some containers
S-41	Section 8.1, General Information and Design Description	IR #: EIS 06-260	Discuss the relationship between fuel damage and fuel fragmenting and reactor aging and describe other possible effects of reactor aging on waste characteristics. In particular, discuss possible effects on the radioactivity on certain categories of intermediate level waste.	Summary of IR: Provide information regarding what constitutes a "recognizable fuel fragment" Summary of OPG Response: A "recognizable fuel fragment" is a visually recognizable piece of fuel, such as a pellet, fuel element, partial fuel bundle, etc. Such wastes are not routinely produced at OPG or Bruce Power. They are the result of rare discreet incidents involving severe physical damage to a fuel bundle. The potential for such wastes would be known in advance as any fuel damage incident is closely investigated. The waste would be subject to special handling at the station during the recovery process due to the very high dose rates associated with them and the need for fissile material accounting and control.

Northwatch Question No.	EIS Guidelines[1] Section	Earlier JRP Information Request, EIS Section or other TSD	Information Request	Rationale
				Fuel fragments would be canned and stored in the fuel bays at the stations as "failed fuel". The exclusion in the WWMF WAC and the DGR WAC is to provide added assurance that waste generators do not mix these fuel fragment wastes with L&ILW. There is no threshold for actinides that initiates further inspection for fuel fragments. As discussed above, the presence of fuel fragments in L&ILW is considered highly unlikely
S-42	Section 8.1, General Information and Design Description	IR #: EIS 06-263	Provided the anticipated delivery date of the next inventory report.	Summary of IR: Provide the studies that resulted in the "…new specific activity information" referred to in the Revision Information and revised Reference Low and Intermediate Level Waste Inventory for the Deep Geologic Repository. Summary of OPG Response: The August 2008 version of the Reference Inventory Report (OPG 2008) was preliminary, and based on the information available at that time. Waste characterization is an ongoing activity and waste characteristic data (including specific activity information) may be updated periodically as additional samples are collected and analyzed for the various waste types. The 2010 Reference Inventory report (OPG 2010) is the summary of a number of inputs from various internal studies including the 2008 version of the report and subsequent studies.

Northwatch Question No.	EIS Guidelines[1] Section	Earlier JRP Information Request, EIS Section or other TSD	Information Request	Rationale
S-43	Section 8.1, General Information and Design Description	IR #: EIS 08-343	Describe a program to verify package integrity at point of manufacture, point of arrival at the WWMF, and prior to transfer into any longer-term management scenario, such as OPG is proposing with the DGR.	Summary of IR: Provide an outline of the requirements for package certification that will be in place to ensure that the manufacturing Information and methods and materials used are in accordance with design specifications. Summary of OPG Response: As discussed previously in OPG's response to Information Request (IR) EIS-04-152 (OPG 2012), there are no specific Canadian Nuclear Safety Commission (CNSC) regulatory requirements for radioactive waste containers to be placed in a repository. The context of the "design approval" referred to in Table 4.5.1-3 of the Environmental Impact Statement (OPG 2011) is that all waste package designs require prior approval by the responsible parties in OPG.
S-44	12. Accidents, Malfunctions and Malevolent Acts	PSA (Overarching Report) para 4.1.5 page 33	Provide full Waste Acceptance Criteria including packaging specifications.	These are summarized in Table 4.5.1-3 of the Environmental Impact Statement (EIS)
S-45	12. Accidents, Malfunctions and Malevolent Acts	PSA (Overarching Report) para 4.1.5 page 33	Compare WAC and Packaging Specifications with those used for Konrad in Germany and WIPP in USA.	A detailed comparison of relevant international repositories was prepared by the Canadian Nuclear Safety Commission (CNSC) and submitted to the Panel on May 28, 2012 under CEAA Registry Doc# 521 (CNSC 2012). This table indicated that OPG's

Northwatch Question No.	EIS Guidelines[1] Section	Earlier JRP Information Request, EIS Section or other TSD	Information Request	Rationale
				basis for long-term safety that places no reliance on, inter alia, containers, is similar to the basis at Konrad, Germany and WIPP, USA.
S-46	12. Accidents, Malfunctions and Malevolent Acts	PSA (Overarching Report) para 4.1.6 page 33	Describe any anticipated problems with poor documentation for legacy waste.	The PSA says OPG's waste packages are mostly well defined, and most waste categories are relatively homogeneous, implying that some waste are not well defined and may be heterogenous. Standards for documentation of waste destined for the Konrad repository in Germany have improved over the years, so documentation for older waste ios now considered poor. See Challenges in Compliance with the Waste Acceptance Requirements for the KONRAD Mine – 10046-rev, WM2010 Conference, March 7-11, 2010, Phoenix, AZ https://www.wmsym.org/archives/2010/pdfs/10046.pdf
S-47	12. Accidents, Malfunctions and Malevolent Acts	PSA (Overarching Report) para 4.1.6 page 33	Describe any requirements to deliver packages to DGR in a depressurized state.	This is a requirement at Konrad. In order to fulfil this requirement, it must be ensured that there is little or no gas formation. Conditioned waste has already been cemented into the packages for disposal so that it is very difficult to provide sufficient proof that this requirement has been complied with. See Challenges in Compliance with the Waste Acceptance Requirements for the KONRAD Mine – 10046-rev, WM2010 Conference, March 7-11, 2010, Phoenix, AZ https://www.wmsym.org/archives/2010/pdfs/10046.pdf
S-48	12. Accidents, Malfunctions and Malevolent Acts	PSA (Overarching Report) para 4.1.6 page 33	Describe any other problems anticipated with regard to verifying waste packages that have already been	See Challenges in Compliance with the Waste Acceptance Requirements for the KONRAD Mine – 10046-rev, WM2010 Conference, March 7-11, 2010, Phoenix, AZ https://www.wmsym.org/archives/2010/pdfs/10046.pdf

Northwatch Question No.	EIS Guidelines[1] Section	Earlier JRP Information Request, EIS Section or other TSD	Information Request	Rationale
			conditioned.	

Appendix 2 – Northwatch Information Requests – Consolidated Set of 2012 IRs

Northwatch Question No.	Date Submitted	EIS Guidelines[2] Section	EIS Section or other TSD	Information Request	Rationale
1.	31 May 2012	2.5 Precautionary Approach 4.1 Scope of the Project 11.5.6 Human Health 13.1 Demonstrating the long-term safety of the DGR. 13.2 Selection of Assessment Scenarios	See end of page v and start of page vi in the Post Closure Safety Assessment: Groundwater Modeling: Executive Summary	Please explain the impact of uncertainties in modeling present day hydrogeological results on accuracy of predictions being made for the next million years.	Para 2.5 of the EIS Guidelines says the Precautionary Principle informs the decision-maker to take a cautionary approach, or to err on the side of caution, especially where there is a large degree of uncertainty or high risk. Para 4.1 says the long term performance of the facility must conform to CNSC Regulatory Policy P-290, *Managing Radioactive Waste.* For instance the proponent needs to be able to show that it is able to accurately predict the impacts of the facility on the health and safety and the environment and to demonstrate that they are no greater than permissible. Para 11.5.6 of the EIS Guidelines says the EIS must provide "*An assessment of the project's potential effects on human health through sources of contaminants from the project and potential exposure pathways into air and potable water".* Para 13.1 says the safety case should "*provide confidence in the long-term safety of the facility*." Para 13.2 says:" *Long-term assessment scenarios should be sufficiently comprehensive to account for all of the potential future states of the site and the environment."* According to the PCSA Groundwater Modelling: a key element of the Deep Bedrock Groundwater Zone are underpressures. "The origin and future behaviour of these underpressures, which exist at and above the repository horizon is uncertain ..." Another key element of the Deep Bedrock Groundwater Zone is an overpressure - the origin and future behaviour of this overpressure is uncertain, but it is modelled as being an ongoing driver of upwards groundwater flow. This lack of certainty doesn't bode well for the future.
2.	31 May 2012	13.2 Selection of Assessment Scenarios	The PSA Analysis of the Normal Evolution Scenario, Executive Summary Page ix	Please detail the implications of the limited chemical database for the development of accurate long-term assessment scenarios.	Para 13.2 says:" *Long-term assessment scenarios should be sufficiently comprehensive to account for all of the potential future states of the site and the environment."* Without full accurate chemical data it will not be possible to provide comprehensive scenarios. The PSA Analysis of the Normal Evolution Scenario, Executive Summary Page ix Key Uncertainties point 4

[2] http://www.ceaa-acee.gc.ca/050/documents/31039/31039E.pdf

Northwatch Question No.	Date Submitted	EIS Guidelines[2] Section	EIS Section or other TSD	Information Request	Rationale
					states that: "*Under the highly saline conditions of the deep geosphere at the DGR site, several aspects of the chemistry are uncertain due to the limited database. In particular, this includes the sorption of contaminants on seal materials and host rocks, as well as mineral precipitation/dissolution reactions*."
3.	31 May 2012	13.2 Selection of Assessment Scenarios	Post closure Safety Assessment[3] (overarching document) Box 1 page 102	Why has carbon been singled out for modeling and the application of a solubility limitation factor?	Box 1 on page 102 of the PSA (consolidated document) says only carbon is given a solubility limitation factor. Page 109 says "*solubility limits have not been applied to contaminant releases, except for C-14*". Para 7.3.2.2 says the more complex repository behaviour of C-14 is modelled.
4.	31 May 2012	13.2 Selection of Assessment Scenarios	Postclosure Safety Assessment[4] (overarching document) Box 1 page 102	Please explain why no sorption of contaminants have been factored into the models.	Box 1 on page 102 of the PSA (consolidated document) says the model assumes "*No sorption of contaminants*" yet "Zr, Nb, Cd, Pb, U, Np and Pu may sorb in the shafts and geosphere
5.	31 May 2012	13.2 Selection of Assessment Scenarios		Why does OPG not apply a natural analogue in the safety case?	P227 of the PSA no appropriate analogs identified and so not undertaken for the current assessment. Does this not compromise demonstration of confidence in the mathematical models?
6.	31 May 2012	13.2 Selection of Assessment Scenarios		How is OPG's dry approach consistent with international practice?	Table 3.5 of the PSA says confidence in the overall safety of the DGR requires the use of a systematic approach consistent with international practice and recommendations. The System & Its Evolution Report describes how the repository might take hundreds of thousands or even millions of years to re-saturate. Most other international concepts appear to expect early saturation e.g. Belgium: "The potential impact of the releases on humans and the environment will be weaker the more that the releases have been *diluted and dispersed (D)*." See http://www.nirond.be/engels/PDF/Safir2_apercutech_eng.pdf (page 18)
7.	31 May	13.2 Selection of	PSA (overarching document) Para 3.7	What is the basis of the	Para 3.7 of the PSA (overarching document) says

[3] NWMO DGR-TR-2011-25
[4] NWMO DGR-TR-2011-25

Northwatch Question No.	Date Submitted	EIS Guidelines[2] Section	EIS Section or other TSD	Information Request	Rationale
	2012	Assessment Scenarios	page 22.	modifications to the safety case that arises due to the iterative approach taken?	confidence can be built by using an iterative approach that allows the results of previous assessments to be used to inform the current assessment. But there appears to be no attempt to describe how this recommendation from NEA and IAEA is implemented.
8.	31 May 2012	13.2 Selection of Assessment Scenarios	PSA Analysis of the Normal Evolution Scenario. Para 2.1[5]	Are there any examples of the use of such a "dry safety case" anywhere else in the world?	The PSA Analysis of the Normal Evolution Scenario states that: "*The low permeability of the shaft seals and the host rock, plus the gas pressure in the repository and the water consumption by corrosion reactions, all limit the resaturation of the repository. The repository might take many hundreds of thousands or even millions of years to resaturate completely*."
9.	31 May 2012	Para 8.1 says the description should include: "…inventories and characteristics of nuclear substances and other hazardous materials to be stored at the facility"	EIS Vol 1 para 2.2.1.3 Project Description Page 1.	Under what circumstances might wastes from decommissioning and from new reactors be emplaced in the DGR? Have any estimates been done of possible waste volumes and the impact this might have on the closure date?	The Project Description says the Host Community Agreement signed by the Municipality of Kincardine and OPG includes provision for decommissioning waste to be emplaced in the DGR; The EIS says the agreement outlines a fee schedule (for payments to the community) for any additional waste in the event that more reactors come online in Ontario.
10.	31 May 2012	Section 6 Public Participation	EIS para 2.2.1.3	Does the Municipality of Kincardine have a right to withdraw from the Host Community Agreement?	EIS para 2.2.1.3 says nothing about what would happen if the Community changed its view? Section 6 of the EIS Guidelines says the EIS should provide "A description of the principles and methods [that] will be employed to provide information to, obtain input from or otherwise engage communities and groups regarding the project activities over the lifespan of the project."
11.	31 May 2012	EIS Guidelines para 7.2	EIS para 3.2.5	As part of the site selection process, and when the possibility of pursuing a Greenfield location was being considered, were any other types of geology looked at? Please describe the site	EIS Guideline para 7.2 says "*An analysis of alternatives to the project must describe functionally different ways to meet the project's need and achieve the project's purpose from the perspective of the proponent.*" EIS para 3.2.5 seems to indication that no other sites for a DGR were considered in any great detail.

[5] NWMO DGR-TR-2011-25. Page 76

Northwatch Question No.	Date Submitted	EIS Guidelines[2] Section	EIS Section or other TSD	Information Request	Rationale
				selection process.	
12.	31 May 2012	Para 8.1 says the description should include: "…inventories and characteristics of nuclear substances and other hazardous materials to be stored at the facility"	EIS page 3-4	Are the plans by Bruce Power to transport steam generators to a facility in Sweden for recycling still expected to go-ahead? If not, what are the implications for the inventory of waste intended to be emplaced in DGR?	EIS page 3-4 says Bruce Power has received a licence to transport the steam generators to a facility in Sweden for recycling. If they proceed, the volume of steam generator waste requiring long-term management will be reduced by about 90%. It is understood that special arrangement licence issued by the CNSC has expired, but that Bruce Power intends to reapply "when it's appropriate" to do so. (See Bruce Power Press Release 3rd Feb 2012 http://www.brucepower.com/5179/news/bruce-power-update-on-steam-generator-recycling-project/)
13.	31 May 2012	Para 8.1	PSA (Overview Document) page 34	Why are emplaced waste volumes limited to 200,000 m3? Can this be changed in future if it is decided to use DGR to emplace decommissioning waste or waste from NND?	PSA (Overarching Document) page 34 says are constrained by the excavated volume to approximately 200,000 m3 of emplaced waste packages.
14.	31 May 2012	Para 8.1	Project Description: Deep Geologic Repository for Low and Intermediate Level Radioactive Waste, Project Description, OPG, November 2005. Page 1 http://nuclearsafety.gc.ca/eng/pdfs/New-Builds/1294561.pdf	What is the projected inventory of Decommissioning Waste? And what would be the impact on the projected closure date if this waste was to be emplaced in the DGR?	According to the Project Description (page 1) the Host Community Agreement signed by the Municipality of Kincardine and OPG includes provision for decommissioning waste to be emplaced in the DGR.
15.	31 May 2012	Para 8.1	EIS Volume 1 para 2.2.1.3	What is the projected inventory of L and ILW from the NND project should it go ahead and what would be the implication of emplacing this waste in the DGR for the closure date?	According to the EIS, the DGR Hosting agreement outlines a fee schedule (for payments to the community) for any additional waste in the event that more reactors come online in Ontario.
16.	31 May 2012	Para 8.1	PSA Overarching Report para 4.1.5	What are the specifications for waste packages? Do the specifications expect packages to be	EIS Guideline para 8.1 says information should be provided in the EIS on: "The design of the waste containers/packages, their performance and longevity with respect to their containment function, including reference to international experience if available and applicable.

Northwatch Question No.	Date Submitted	EIS Guidelines[2] Section	EIS Section or other TSD	Information Request	Rationale
				manufactured to retain their safety functions for storage and operational for specified periods, and to include allowance for a potential retrievable period lasting for a specified period of time. What are the specified periods?	According to the PSA, packaging is not credited with any barrier function in the PSA, since the packages are not designed to provide any long-term isolation and containment of wastes. In the UK packages have to be manufactured to retain their safety functions for storage and operational periods up to 500 years, to include a potential retrievable period lasting up to a few centuries. See http://www.nda.gov.uk/documents/upload/Geological-Disposal-Package-evolution-status-report-December-2010.pdf para 3.1.1
17.	31 May 2012	2.5 Precautionary Approach 11.5.6 Human Health	EIS page 3-21	Which criteria are used to decide whether to proceed with a volume reducing process? For example are environmental principles such as the proximity principle and the concentrate and contain principle taken into consideration?	EIS Page 3-21 says OPG and Bruce Power will also investigate and apply new waste processing technologies and disposal approaches to reduce stored radioactive waste volume. This could mean radioactive discharges elsewhere such as at incinerators or at Studsvik plant in Sweden.
18.	31 May 2012	Para 2.2	EIS 2.1.1	Will OPG undertake to produce a glossary of terms rather than just a list of acronyms as at Table 15.1.1?	EIS Guidelines para 2.2 says: In preparing the EIS, the proponent is required to engage residents and organizations in all affected communities, other interested organizations, and relevant government agencies. EIS para 2.1.1 says OPF will engage with interested individuals and groups in the community including providing information and opportunities to obtain their feedback. EIS page 3-48 is an example of a page where a glossary would be an enormous aid to understanding.
Northwatch Question No.	Set 2	EIS Guidelines[6] Section	EIS Section or other TSD	Information Request	Rationale
19	June 18, 2012	12. Accidents, Malfunctions and Malevolent Acts	PSA (Overarching Report) para 4.1.5 page 33	Does OPG use a generic waste package specification? Please describe.	According to the PSA packaging provides a physical barrier to water contacting the waste and, in the case of concrete packaging, a chemical barrier.
20	June 18, 2012	12. Accidents, Malfunctions and	Para 4.1.2 of the PSA (Overarching Report)	What requirements are placed on the waste	Section 12 of the EIS Guidelines requires expected scenarios to include container collapse/failure, and various

[6] http://www.ceaa-acee.gc.ca/050/documents/31039/31039E.pdf

Northwatch Question No.	Date Submitted	EIS Guidelines[2] Section	EIS Section or other TSD	Information Request	Rationale
		Malevolent Acts	Para 2.1 of the Analysis of the Normal Evolution Scenario.	producers by the Regulators to show that the waste packaging is appropriate to placement in a geological repository? How has OPG met those requirements?	degrees of barrier loss including total loss of barrier. Para 4.1.2 of the PSA (Overarching Report) says that the range of waste containers and overpacks that will be used by OPG for the storage and eventual emplacement of L&ILW in the DGR is described in the Reference L&ILW Inventory Report (OPG2010). The Inventory says the reference planning assumption is that no extra processing/packaging will be required with the exception of shielding of most of the ILW and overpacking of a small portion of the LLW. It is also assumed that the future operational L&ILW will be shipped in containers similar to those currently used to store the L&ILW. The Packaging and Transport of Nuclear Substances Regulation focuses on the packaging requirement for transport rather than disposal. Para 2.1 of the Analysis of the Normal Evolution Scenario says most of the waste packaging is not long-lived, and will allow water to contact the wastes as the repository resaturates (the higher activity ILW containers are more robust and are likely to take longer to degrade).
21	June 18, 2012	12. Accidents, Malfunctions and Malevolent Acts	PSA (Overarching Report) para 4.1.5 page 33	What requirements are there for a waste producer to demonstrate the safety of proposed conditioning and packaging methods and the safety of waste packages during storage, transport, emplacement in a geological disposal facility and the post-disposal period? How has OPG met those requirements?	According to the PSA packaging provides a physical barrier to water contacting the waste and, in the case of concrete packaging, a chemical barrier.
22	June 18, 2012	12. Accidents, Malfunctions and	PSA (Overarching Report) para 4.1.5 page 33	What specifications are in place with respect to	Packaging is not credited with any barrier function in the PSA, since the packages are not designed to provide any

Northwatch Question No.	Date Submitted	EIS Guidelines[2] Section	EIS Section or other TSD	Information Request	Rationale
		Malevolent Acts		waste packaging and the length of time packaging must retain their safety functions for storage and operational periods of the DGR? Does this include a potential period during which the waste would be retrievable?	long-term isolation and containment of wastes. Section 1 of the EIS Guidelines says the proponent must describe specific malfunction and accident events that have a reasonable probability of occurring during the life of the project, including an explanation of how these events were identified for the purpose of this environmental assessment.
23	June 18, 2012	12. Accidents, Malfunctions and Malevolent Acts	Reference Low and Intermediate Level Waste Inventory for the Deep Geologic Repository, OPG, December 2012 See Executive Summary	What are the specifications for shielding to be provided for ILW and LLW waste retrieved from storage at WWMF? Is this shielding expected to provide any incidental barrier function?	The Executive Summary of the waste inventory says no extra processing/packaging will be required with the exception of shielding of most of the ILW and overpacking of a small portion of the LLW for waste retrieved from various storage structures at the Western Waste Management Facility (WWMF) and transferred to the DGR for emplacement.
24	June 18, 2012	12. Accidents, Malfunctions and Malevolent Acts	Para 4.1.2 of the PSA (Overarching Report) PSA: Data Report (OPG March 2011) para 3.3 page 13 explains how waste is conditioned.	How is the conditioning of different waste forms regulated? How has OPG met these regulations?	Para 4.1.2 of the PSA (Overarching Report) says that the range of waste containers and overpacks that will be used by OPG for the storage and eventual emplacement of L&ILW in the DGR is described in the Reference L&ILW Inventory Report (OPG2010). But the Inventory Report and PSA Data report do not explain how decisions are made on conditioning the waste. A Galson Sciences review of disposal concepts found that the selection of the EBS and its required performance with regard to post-closure safety clearly depend on both the wasteforms in question as well as on the repository host rock.
25	June 18, 2012	Para 8.1	PSA Overarching Report para 4.1.5	How is OPG's intention to not provide additional processing/packaging (with the exception of shielding of most of the ILW and overpacking of a small portion of the LLW) consistent with international practice?	EIS Guideline para 8.1 says information should be provided in the EIS on: "The design of the waste containers/packages, their performance and longevity with respect to their containment function, including reference to international experience if available and applicable. According to the PSA, packaging is not credited with any barrier function in the PSA, since the packages are not designed to provide any long-term isolation and containment of wastes. In the UK packages have to be

Northwatch Question No.	Date Submitted	EIS Guidelines[2] Section	EIS Section or other TSD	Information Request	Rationale
					manufactured to retain their safety functions for storage and operational periods up to 500 years, to include a potential retrievable period lasting up to a few centuries. See http://www.nda.gov.uk/documents/upload/Geological-Disposal-Package-evolution-status-report-December-2010.pdf para 3.1.1
Northwatch Question No.		EIS Guidelines[7] Section	EIS Section or other TSD	Information Request	Rationale
26	29 June 2013	2.5 Precautionary Approach 2.6 Strategy and Methodology 2.7 Use of existing information	EIS Section 3 Project Description, regarding international experience of technical suitability on page 3-1.	Please explain why some relevant international experience is not discussed, including at Morsleben and Asse disposal sites in Germany.	Para 2.5 of the EIS Guidelines states the Precautionary Principle informs the decision-maker to take a cautionary approach, or to err on the side of caution, especially where there is a large degree of uncertainty or high risk. Para 2.6 of the EIS Guidelies states that all environmental impacts should be identified and that the information presented must be substantiated. Para 2.7 of the EIS Guidelines states that the proponent is encouraged to make use of existing information relevant to the project.
27	29 June 2013	2.5 Precautionary Approach 2.6 Strategy and Methodology 2.7 Use of existing information	EIS Section 3.2.4 Decision by Kincardine regarding deep rock vault as best international practice on page 3-7.	Please explain how the experience at Morsleben and Asse disposal sites at similar depths to DGR, though in a different rock type, was included in information provided to or considered by the Municipality of Kincardine as it considered the option of a deep geological repository.	Para 2.5 of the EIS Guidelines says the Precautionary Principle informs taking a cautionary approach, or to err on the side of caution, especially where there is a large degree of uncertainty or high risk. Para 2.6 of the EIS Guidelies states that all environmental impacts should be identified and that the information presented must be substantiated. Para 2.7 of the EIS Guidelines states that the proponent is encouraged to make use of existing information relevant to the project.
28	29 June 2013	2.7 Use of existing information	EIS Section 3.3 Deep Rock Vaults regarding the Loviisa facility beginning operations in early 1997 on page 3-10.	Please explain the source of the information about the Loviisa facility. Please explain the discrepancy in the operation date,	Para 2.7 of the EIS Guidelines states that the proponent is encouraged to make use of existing information relevant to the project. In the case of the Loviisa facility, the proponents may not have used the best available information. See, for example: http://www.stuk.fi/julkaisut/stuk-b/stuk-

[7] http://www.ceaa-acee.gc.ca/050/documents/31039/31039E.pdf

Northwatch Question No.	Date Submitted	EIS Guidelines[2] Section	EIS Section or other TSD	Information Request	Rationale
				which the Finnish government states is 1998.	b138.pdf
29	29 June 2013	2.7 Use of existing information 8.1 General and Design information	EIS Table 3.4.10-2 - Examples of Waste Conditioning and Containers Used Internationally	Please explain why containers used at operating international sites at Loviisa in Finland and Morsleben and Asse in Germany are not identified.	Para 2.7 of the EIS Guidelines states that the proponent is encouraged to make use of existing information relevant to the project. Para 8.1 states that waste containers/packages and their performance and longevity with respect to their containment function, including reference to applicable international experience should be presented.
30	29 June 2013	13.2 Selection of Assessment Scenarios	Preliminary Safety Report (PSR) (overarching document) Section 8.6.1 regarding shaft seals, page 491 of 768.	Please explain why the DGR shaft seal design is similar to WIPP, when no actual shaft seals exist at WIPP and the bedded salt rock type is different than DGR.	Para 13.2 of the EIS Guidelines includes the need for long-term assessments, for which shaft seals would be a relevant consideration. In light of WIPP's shaft seal system has not been used, the proponents should explain its applicability.
31	29 June 2013	13.2 Selection of Assessment Scenarios	Preliminary Safety Report (PSR) (overarching document) Section 14.2 and Table 14-1, page 671 of 768.	Please explain why Konrad is relevant since it is not operating, while Morsleben and Asse disposal sites, which have operated, are not mentioned	Para 13.2 of the EIS Guidelines includes discussion of disruptive events and scenarios. Such scenarios should include how existing facilities have been disupted and why those actual scenarios are or are not relevant to DGR.
32	29 June 2013	13.2 Selection of Assessment Scenarios	Preliminary Safety Report (PSR) (overarching document) Section 14.2, regarding WIPP as particularly relevent, page 671 of 768.	Please explain why WIPP is particularly relevant, given that it is situated in a different rock type, and receivesdifferent wastes.	Para 13.2 of the EIS Guidelines includes use of safety assessment information. The determination that WIPP is particularly relevant should be explained and justified.
33	29 June 2013	13.2 Selection of Assessment Scenarios	Preliminary Safety Report (PSR) (overarching document) Section 14.2, regarding WIPP as operating until 2070, page 671 of 768.	Please explain the basis for the statement that WIPP is expected to operate until 2070, when its New Mexico permit states that it is expected to cease in about 2024 and facility closure would be expected by 2034.	The proponents apparently have not used the best available information. See, for example, page G-7 of the New Mexico state permit - http://www.wipp.energy.gov/library/Information_Repository_A/Searchable_Permit_5-8-12.pdf

Northwatch Question No.	Date Submitted	EIS Guidelines[2] Section	EIS Section or other TSD	Information Request	Rationale
Northwatch IR No.		EIS Guidelines[8] Section	EIS Section or other TSD	Information Request	Rationale
34	3 July 2013	13.1 Demonstrating the Long term Safety of the DGR 13.2 Selection of Assessment Scenarios 13.3 Additional Arguments in the Safety Case	Preliminary Safety Report – Alternative Repository and Shaft Seal Designs, paragraph 8.8.5.3 Asphalt Shaft Seal (page 581). EIS Section 4.11.4, Decommissioning of the Shafts, pp. 4-75, 4-76, 4-77 EIS Section 7.2.1, Screening to Focus the Assessment, p. 7-6 Geoscientific Verification Plan, Section 2.2.8, DGR Sealing Materials, p. 21	Please explain the extent to which the properties and durability of the asphalt seal are established for the intended use in the DGR.	Paragraph 13.1 of the EIS Guidelines says: 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. Paragraph 13.2 of the EIS Guidelines says: The first step in conducting a safety assessment is the development of scenarios. A scenario is a postulated or assumed set of future conditions or events to be modeled in an assessment. Long-term assessment scenarios should be sufficiently comprehensive to account for all of the potential future states of the site and the environment. It is common for a safety assessment to include a central scenario of the normal (or expected) evolution of the site and facility with time, and additional scenarios that examine the impacts of disruptive events or modes of containment failure. Paragraph 13.3 of the EIS Guidelines says: Demonstration of the robustness of the waste disposal system: this entails demonstrating that the waste disposal system will maintain its safety function under extreme conditions, disruptive events or unexpected containment failure. The Preliminary Safety Report – Alternative Repository and Shaft Seal Designs, in paragraph 8.8.5.3 Asphalt Shaft Seal (page 581) says: The design considers an asphalt layer to provide an independent low-permeable seal material. However, the properties and durability of the asphalt seal are not as well established as those for bentonite/sand. The option of not using an asphalt seal was considered (NE-GT4 and NE-

[8] http://www.ceaa-acee.gc.ca/050/documents/31039/31039E.pdf

Northwatch Question No.	Date Submitted	EIS Guidelines[2] Section	EIS Section or other TSD	Information Request	Rationale
					GT5, which are both based on the high gas generation case NE-GG1). The results show little effect on overall releases. That is, the asphalt seal layer is not required for shaft seal performance in the Normal Evolution Scenario. Its value is as an independent material that could provide confidence in the shaft performance under unexpected conditions where the bentonite/sand seal is degraded. The Geoscientific Verification Plan, Section 2.2.8, DGR Sealing Materials (page 21) says: In situ borehole testing of proposed DGR sealing materials, including bentonite-bentonite/sand mixtures, asphalt and low heat high performance concrete will be conducted within a secure test area niche at the repository level. The purpose of these tests is to demonstrate the long-term performance of these sealing materials in the highly saline, low permeability, low porosity rock mass setting. The borehole tests would be designed to demonstrate hydraulic, material interface and structural properties, as well as, chemical compatibility necessary to understand long-term sealing performance. Information gathered on the performance of sealing materials will be used to support the DGR safety case. Due to in situ conditions it is possible that full test completion may require monitoring beyond a future submission in support of an operating licence application. Comment: Throughout the EIS, it is stated that the asphalt shaft seal will be installed, eg. pp. 4-75, 4-76, 4-77, 7-6, not just considered for installation. It is difficult to reconcile how the asphalt seal can provide confidence in the performance of the shaft when its properties and durability are less well known than those of bentonite/sand, notwithstanding the following statement from the Postclosure Safety Assessment, p. 237 that says: The Geoscientific Verification Plan (NWMO 2011b) outlines plans to initiate tests of important processes and materials in the rock during the repository construction - for example, EDZ measurements. Also, the shaft seal

Northwatch Question No.	Date Submitted	EIS Guidelines[2] Section	EIS Section or other TSD	Information Request	Rationale
					design will not be finalized until the decommissioning application several decades from now, and will take advantage of these tests and knowledge gained over the intervening period.
35	3 July 2013	13.1 Demonstrating the Long term Safety of the DGR 13.2 Selection of Assessment Scenarios	Postclosure Safety Assessment: Features, Events and Processes, Section 2.1.11.05 Asphalt Degradation, and Section 3.2.06 Microbially/Biologically– mediated Processes, Effects on Contaminant Release and Migration, pp. 145 and 246. Postclosure Safety Assessment: Analysis of the Normal Evolution Scenario, Executive Summary, page viii. Geoscientific Verification Plan, Section 2.2.7.4, Activity 13 – Microbiology Related Study, pp. 20 – 21.	Please provide information on the potential consequence (radionuclide release to the biosphere) of microbial/biological degradation of the asphalt seal at the interface of the asphalt and shaft wall rock.	Paragraph 13.1 of the EIS Guidelines says: 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. Paragraph 13.2 of the EIS Guidelines says: A normal evolution scenario should be based on reasonable extrapolation of present-day site features and receptors lifestyles. It should include expected evolution of the site and degradation of the waste disposal system (gradual or total loss of barrier function) as it ages. Disruptive event scenarios postulate the occurrence of low- probability events leading to the possible abnormal degradation and loss of containment. Scenarios should be developed in a systematic, transparent and traceable manner based on current and future conditions of site characteristics, waste properties and receptor characteristics and their lifestyles. Paragraph 13.2 of the EIS Guidelines further says: The safety assessment should demonstrate that the set of scenarios developed is credible and comprehensive. Some scenarios may be excluded from the assessment because there is an extremely low likelihood that they would occur or because they would have trivial consequences. The approach and screening criteria used to exclude or include scenarios should be justified and well-documented. Postclosure Safety Assessment: Features, Events and Processes says (page 145 and 246): 2.1.11.05 Asphalt Degradation Description Gas generated from the degradation of asphalt. Screening Analysis

Northwatch Question No.	Date Submitted	EIS Guidelines[2] Section	EIS Section or other TSD	Information Request	Rationale
					Other than aggregate or sand, asphalt consists of four different components: saturated hydrocarbons; aromatic hydrocarbons; resins; and asphaltenes. Under anaerobic conditions in the geosphere, asphaltenes are more or less unaffected by micro-organisms (Pettersson and Elert 2001) and the degradation of resins is expected to be very slow (see FEP [2.1.11.03]). Brodersen et al. (1991) state that with the present knowledge about biodegradation of bituminized waste, biodegradation seems to be of minor importance for the long-term evolution of asphalt. Any degradation would be slow, with only small volumes of CO2 and CH4 being produced (see Appendix E.6 of the System and Its Evolution report, QUINTESSA 2011b). FEP Screening Screened out. 3.2.06 Microbially/Biologically– mediated Processes, Effects on Contaminant Release and Migration Screening Analysis Biologically mediated processes (excluding transport) are considered in the Postclosure SA. Their impact on corrosion, degradation and gas generation rates and associated gas and aqueous release rates are accounted for in the conceptual model of evolving repository conditions (see Section 2.3.1.1 of the Normal Evolution Scenario Analysis report, QUINTESSA 2011a) and the gas generation model (see Section 4.2 of the T2GGM report, QUINTESSA and GEOFIRMA 2011b). Variant cases are assessed which evaluate the impact of decreased organic degradation rates and no methanogenic reactions. Postclosure Safety Assessment: Analysis of the Normal Evolution Scenario says at page viii: Increased gas generation within the DGR, combined with removal of the asphalt shaft seal, reduced performance of the bentonite/sand seal within the shaft and an absence of initial underpressures in some Ordovician formations (NE-GT5), results in a free gas pathway being established to the Intermediate Bedrock Groundwater Zone after 500 years. Subsequent transport in groundwater via the shafts enables C-14 to reach the Shallow Bedrock Groundwater Zone and then the biosphere where calculated doses

Northwatch Question No.	Date Submitted	EIS Guidelines[2] Section	EIS Section or other TSD	Information Request	Rationale
					increase, although, but they remain well below the dose criterion. The Geoscientific Verification Plan, Section 2.2.7.4, Activity 13 – Microbiology Related Study (pp. 20 – 21) says: Microbiological studies will be undertaken to determine the extent and nature of bacterial populations, to identify and differentiate between indigenous species and migrant species recently introduced by human activity (i.e., drilling/excavation), and study the possible long-term effects of microorganisms on the repository. Near-field and far-field studies will identify and study the indigenous microbial ecosystem which includes the availability of nutrients and energy for microbial use and their interaction with the site geological environment (particularly geochemistry and mineralogy). The effects of the construction and operation periods (when oxygen would be freely available in the repository environment) and the introduction of low and intermediate level radioactive waste (a potential new source of nutrient and energy) on microbial populations and future repository performance will be measured. Measurements of the pore throat diameter of the Cobourg Formation indicate that it is < 0.2 µm, in which case it is unlikely there would be metabolic activity as a pore throat > 0.2 µm is required. Additional petrophysical studies would be carried out to confirm. All efforts must be made to obtain pristine samples. These studies would be conducted within a secure test area unaffected by DGR construction or operational activities. Comment: While gas generation from microbial/biological degradation of the asphalt shaft seal is screened out (presumably because of its trivial consequence), physical degradation resulting from microbial/biological activity at the interface of the asphalt and the excavation damaged zone (EDZ) of the shaft is not considered, and it could result in a free gas pathway being established ultimately to the biosphere as described above. If such a free gas pathway formed it could have an effect essentially equivalent to or greater than the asphalt seal being absent

Northwatch Question No.	Date Submitted	EIS Guidelines[2] Section	EIS Section or other TSD	Information Request	Rationale
					due to channeling of gas flow.
36	3 July 2013	13.1 Demonstrating the Long term Safety of the DGR 13.2 Selection of Assessment Scenarios 13.3 Additional Arguments in the Safety Case	Postclosure Safety Assessment, Section 5.1.1, External FEPs, p. 66. Geosynthesis, Section 2.2.7.2, Glacial Erosion, Numerical Estimates of Glacial Erosion at the Bruce Nuclear Site, p. 48. Geosynthesis, Section 6.4.3.1 EDZ Prediction, p. 317.	Please provide information on the effects on shaft EDZ and shaft seal performance resulting from glacial erosion and accompanying ground surface hydrological processes during a one million year period.	Paragraph 13.1 of the EIS Guidelines says: 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. Paragraph 13.2 of the EIS Guidelines says: A normal evolution scenario should be based on reasonable extrapolation of present-day site features and receptors lifestyles. It should include expected evolution of the site and degradation of the waste disposal system (gradual or total loss of barrier function) as it ages. Disruptive event scenarios postulate the occurrence of low- probability events leading to the possible abnormal degradation and loss of containment. Scenarios should be developed in a systematic, transparent and traceable manner based on current and future conditions of site characteristics, waste properties and receptor characteristics and their lifestyles. Paragraph 13.3 of the EIS Guidelines says: Demonstration of the robustness of the waste disposal system: this entails demonstrating that the waste disposal system will maintain its safety function under extreme conditions, disruptive events or unexpected containment failure. The safety case should illustrate and explain the relative role of the different components of the disposal system that contribute to its overall robustness. Postclosure Safety Assessment, Section 5.1.1, External FEPs at page 66 says: Geomechanical modelling studies have also been undertaken to examine the impact of glacial cycling on the long-term emplacement room stability and shaft integrity (Chapter 6 of NWMO 2011a). While emplacement rooms would eventually collapse and fill with repeated glacial cycles, the icesheets do not affect the long-term barrier

Northwatch Question No.	Date Submitted	EIS Guidelines[2] Section	EIS Section or other TSD	Information Request	Rationale
					integrity of the overlying Ordovician shales or the EDZ within the shafts. Geosynthesis, Section 2.2.7.2, Glacial Erosion, Numerical Estimates of Glacial Erosion at the Bruce Nuclear Site, at page 48 says: Taking into account site-specific factors, the total realistic erosion estimates at the site range from 2 m to 33 m, averaging 14 m (Hallet 2011). Overall, the study by Hallet (2011) concluded that although uncertainties remain in ice sheet reconstructions and estimates of erosion by ice and melt water, all lines of study indicate that, at the Bruce nuclear site, glacial erosion would not exceed a few tens of metres in 100 ka with a conservative site-specific estimate of erosion of 100 m per 1 Ma. This conclusion is supported in the literature, by field investigations, and using numerical modelling. Geosynthesis, Section 6.4.3.1, EDZ Prediction, at page 317 says: Stability analyses of the DGR shaft seal system explored the following key scenarios during the evolution of the repository: - Time-dependent strength degradation (base-case); - Strength degradation with additional effects of gas pressure build-up; - Strength degradation with additional effects of seismic ground shaking; - Strength degradation with additional effects of glacial loading; and - Combinations of all of the above loading scenarios. Comment: There does not appear to be any analysis of shaft EDZ and shaft seal performance in a scenario that includes glacial erosion and accompanying ground surface hydrologic processes for a single or multiple glacial events during a 1 million year period.