NORTHWATCH

July 3, 2012

Dr. Stella Swanson, Panel Chair
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:

Re. **Information Requests from Northwatch Related to Ontario Power Generation's Proposed Deep Geological Repository for Radioactive Wastes – Repository Shaft**

Please find attached Northwatch's fourth set of Information Requests. These requests have been prepared by consultants who are supporting Northwatch's review of the Ontario Power Generation's proposal to construct a deep geological repository for low and intermediate level radioactive wastes at the Bruce Nuclear Generating Station and are largely related to the repository shaft for in Ontario Power Generation's proposed deep geological repository for low and intermediate level radioactive wastes and its design and function.

As is the case with information requests previously submitted by Northwatch, our experts have indicated that responses to these Information Requests are necessary to their review of the EIS and Technical Support Documents and subsequently to their preparation of reports on our behalf, as part of this review process. This includes Northwatch's report on the conformity of the EIS with the EIS guidelines.

Thank you for your attention and consideration.

Sincerely,

<original signed by>

Brennain Lloyd
Northwatch

c.c. Dr. James F. Archibald, Panel Member
Dr. Gunter Muecke, Panel Member
Ms. Debra Myles, Panel Co-Manager, CEAA
Ms. Kelly McGee, Panel Co-Manager, CNSC

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Northwatch Information Requests – Submitted July 3rd, 2012

Northwatch IR No.	EIS Guidelines[1] Section	EIS Section or other TSD	Information Request	Rationale
34	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-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*

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

				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 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	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* *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 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 due to channeling of gas flow.
36	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 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.