November 1st, 2012

Mr. Albert Sweetnam
Executive Vice President
Deep Geologic Repository Project
Ontario Power Generation
700 University Avenue
Toronto, Ontario M5G 1X6

Subject: Information Request Package #7 from the Deep Geologic Repository Joint Review Panel

Dear Mr. Sweetnam,

In the attached document, please find information requests from the Deep Geologic Repository Joint Review Panel (the Panel). The Panel has determined that responses to these information requests are required to ensure that the available information adequately responds to the Environmental Impact Statement Guidelines issued for the project.

The Panel requests that Ontario Power Generation address the information requests and provide the responses to the Panel in a complete and timely manner. To ensure a consistent approach, the responses should follow the Panel's numbering system and framework as set out in the attached document. The evaluation of information received will include, but not be limited to, a determination of compliance with the Environmental Impact Statement Guidelines and applicable legislation, an assessment of the supporting data and analysis submitted, the clarity and completeness of the information and, where applicable, the credibility of the scientific and engineering principles applied.

If you require clarification with regard to these requests, do not hesitate to contact either of the Panel's Co-Managers. The Panel would appreciate receiving confirmation with respect to the anticipated date of your responses as soon as possible.

Yours truly,

<Original signed by>

Dr. Stella Swanson
Chair, Joint Review Panel

cc. Dr. James F. Archibald, Joint Review Panel Member
Dr. Gunter Muecke, Joint Review Panel Member
Frank King, Nuclear Waste Management Organization
Allan Webster, Ontario Power Generation

/Attachment

Attachment 1
Deep Geological Repository Project
Joint Review Panel EIS Information Requests
Package 7 – November 1, 2012

IR #	EIS Guidelines Section	EIS Section or other technical document	Information Request	Context
EIS 07-279	■ Section 12, Accidents, Malfunctions and Malevolent Acts	■ *Malfunctions, Accidents and Malevolent Acts TSD*: Section 5.2, Identification of Conventional Malfunctions and Accidents	Provide additional information about fuels and chemicals that would be used and stored on site so that risks posed by spills can be more thoroughly evaluated. Provide information on specific worst-case accident and spill scenarios, and define the bounding scenarios for each case.	More information related to conventional accidents and malfunctions is required. Only a generalized list of the chemicals/substances (i.e. fuels, lubricants, glycols) that would be used and stored on site was provided. Information on the chemicals and types of oils and lubricants, and where they will be stored onsite, is required. Similarly, there is no information on the volumes, sizes and types of tanks, locations of these tanks/vessels, and whether any secondary containment/spill protection is associated with them. Such information is needed in order to determine the potential for incidents and their significance. It is mentioned in Table 5.2-1 on page 41 of the Malfunctions, Accidents and Malevolent Acts TSD that *"the volume of a spill is assumed to be approximately 4500 litres of diesel fuel, 200 litres of a chemical or 100 litres of a lubricant or oil"* but no explanation is provided to justify the assumed volumes. From a general risk assessment procedural standpoint, the Malfunctions, Accidents and Malevolent Acts TSD does not outline specific accidents or malfunctions and where they would do the most damage (i.e. worst probable case scenarios), but simply mentions general "vehicle accidents" or "operational errors". Specific

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				worst-case scenarios are necessary to define the bounding scenarios.
EIS 07-280	■ Section 12, Accidents, Malfunctions and Malevolent Acts	■ *Malfunctions, Accidents and Malevolent Acts TSD*: Section 3.2, Initiating Events	Provide additional justification for an explosion to be considered non-credible. Describe the susceptibility of stored fuels and chemicals to an explosion based on the proximity of explosives being used, stored, or transported. Explain how the Project will be designed and operated to minimize explosion risk and the consequences of an accidental explosion	Considering that there will be usage, transport and potentially storage of explosives on site, some risk of an accidental explosion does exist. Other substances could cause or contribute to explosions.
EIS 07-281	■ Section 12, Accidents, Malfunctions and Malevolent Acts	■ *Preliminary Safety Report*: Section 7.5.3.3, Dispersion Modelling for Releases	Provide an assessment of plume temperatures and the velocity of the plume being emitted to the atmosphere for the scenario of an underground fire, as well as the duration of such a scenario.	Considering the heat generated by a fire and the rapid rise of air to surface due to buoyancy, it seems unlikely that this contaminated air would cool by the time it reached surface. The assumption made on page 448, Section 7.5.3.3 Dispersion Modelling for Releases of the Preliminary Safety Report provides no technical discussion to support the assumption that the release would be non-buoyant. Also, considering that the contaminated air would exit through one or both of the headframes, the elevated height of these structures is an important consideration in the dispersion of the contaminated air into the surface atmospheric environment.
EIS 07-282	■ Section 11, Effects Prediction ■ Section 11.4.9, Effects of the Environment on the Project	■ *Maximum Flood Hazard Assessment TSD*	Provide additional information to support the modelling of the onsite direct precipitation flood risk. Describe the impact that errors/uncertainty in the hydrologic model parameters, inputs, assumptions and procedures chosen have on the critical PMP event and computed PMF discharges.	The assessment describes soil conditions in the study area required for the hydrologic modelling conducted as well as the sources of this data, but the choice of numerical procedures used to compute runoff, of which there are many, are not described, nor are the choices of parameter values for such model inputs that may have been required, such as initial infiltration rate, time of

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			Describe the impact that errors/uncertainty in the hydraulic model parameters, inputs, assumptions and procedures chosen have on the computed PMF water surface elevations. Explain the rationale for the chosen Manning's roughness coefficients, including a sensitivity analysis.	concentration, percent imperviousness, etc. The Proponent states that the Manning's roughness coefficients were chosen to be conservative estimates. Environment Canada indicated that Manning's roughness coefficients are uncertain, especially in such cases as this when they are chosen based on theoretical values and without proper model validation. Furthermore, roughness can also vary with time (e.g. vegetation growth in drainage channels, lack of channel maintenance). Environment Canada has suggested that the chosen Manning's roughness coefficients would likely have a significant impact on modelled water surface elevations. The sensitivity analysis of errors/uncertainty would be of even greater importance if the calibration and validation of the models were not performed. Environment Canada noted that sensitivity analyses could also be undertaken inversely, by identifying the values of each input that would cause flooding, and then assessing how probable (or improbable) such values are, both individually and in combination.
EIS 07-283	■ Section 11, Effects Prediction ■ Section 11.4.9, Effects of the Environment on the Project	■ *Maximum Flood Hazard Assessment TSD*	Describe the quality assurance measures used to ensure that the elevation data, including both the 0.5 m LIDAR (light detection and ranging) data and site grading and drainage data, were sufficiently accurate, consistent, and properly georeferenced. Explain whether the LIDAR data is of sufficient accuracy and resolution to use for such a small-scale and presumably detailed catchment. Describe any checks performed to ensure consistency between the two datasets. State whether the vertical and horizontal	No context required.

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			datums were consistent between the two datasets.	
EIS 07-284	■ Section 11, Effects Prediction ■ Section 11.4.9, Effects of the Environment on the Project	■ *Maximum Flood Hazard Assessment TSD*	Describe the impact of the existing drainage system on the Bruce site. State whether OPG confirmed the revision of the assumptions on the depth of the ditch connecting the perimeter ditch to the settling pond. Confirm whether this revision brings into question any of the other information provided in the site grading and drainage data provided by OPG and used in the analysis. Describe the impact that this would this have on the results.	It is suggested (pg. 101, *Maximum Flood Hazard Assessment* document) that the depth and slope of the ditch connecting the perimeter ditch to the settling pond shown in site design drawings was found to be inaccurate and, as a result, assumptions on the depth of the ditch had to be revised from the depth provided. It is stated that a conservative assumption was made for this analysis that the sub-surface stormwater conveyance system (which is designed for the 10-year storm event) would not be functional during the PMF event, and as a result all precipitation from the PMP event falling on the DGR facility would be conveyed through the surface stormwater management system. Environment Canada has questioned whether this is truly a conservative assumption, or if it is possible that the sub-surface stormwater system may actually contribute in some way to increased flooding during the PMF event (e.g., perhaps conveying water from other areas of the Bruce nuclear facility to the DGR site). Additional clarification on this assumption is needed.
EIS 07-285	■ Section 11, Effects Prediction ■ Section 11.4.9, Effects of the Environment on the Project	■ *Maximum Flood Hazard Assessment TSD*	Provide the margin of safety for the design of mitigation measures for flooding.	Environment Canada noted that the assessment was based on preliminary design details of the DGR facility and, in part as a result of the assessment's finding regarding direct precipitation flood risk, the design is likely to be revised. While the finding regarding the possibility of flooding itself is sufficiently well-documented, the actual flood elevation is less certain. Environment Canada has noted that if the preliminary design elevations of the DGR

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				facility are to be modified and collar elevations of surface infrastructure determined based on the modelling results, then its suggestions for further analysis are more critical. Environment Canada stated that significantly more detail would be needed on the data, inputs and assumptions used in the modelling in order to be confident that the flood elevations computed are sufficiently accurate for determining or revising the DGR facility's design elevation. A factor of safety should also be included in any design of mitigation measures.
EIS 07-286	■ Section 9.3, Valued Ecosystem Components	■ *Radiation and Radioactivity TSD*: Section 4.1.2, Benthic Invertebrates ■ *Aquatic Environment TSD:* Section 5.3.1, South Railway Ditch.	Provide further justification for the selection of the burrowing crayfish as the VEC for benthic invertebrate organisms. Provide a list of, and rationale for, other benthic species that can be used as the VEC to represent the benthic invertebrate community.	Section 4.1.2 of the Radiation and Radioactivity TSD describes the criteria for selecting a species as a VEC for the benthic invertebrate category, and states that *"benthic invertebrates live in close contact with the sediment and are relatively immobile; therefore they are highly exposed to the contaminants present therein"*. However, Section 4.1.1 of the Aquatic Environment TSD describes the burrowing crayfish as terrestrial organisms that *"construct burrows through clay or silty clay soils into the groundwater table…these burrows extend above the ground surface…*" Based on that description, it is more likely that the burrowing crayfish would be exposed to soils than to sediments, albeit soils that are in close proximity to water bodies. The burrowing crayfish does not appear to be suitable as the VEC for benthic invertebrates since it does not live in sufficiently close/prolonged contact with sediments. Environment Canada has stated that it agrees that the burrowing crayfish species should remain a VEC, considering the unique habitat requirements, but not as the VEC that represents benthic organisms. Environment Canada recommended that true benthic invertebrates

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				should be selected as VEC's consistent with the description provided in section 4.1.2 of the Radiation and Radioactivity TSD and to more accurately identify any risks to this component of the environment. Leeches and snails along with aquatic crayfish are mentioned in section 5.3.1 of the Aquatic Environment TSD, however, it is apparent that no comprehensive benthic community survey information is provided in the Aquatic Environment TSD (see IR # EIS 07-292). It is not clear whether such surveys were carried out in Stream C, the South/North Railway ditches and other appropriate waterbodies.
EIS 07-287	■ Section 10.1.6, Ambient Radioactivity ■ Section 11.4.6, Radiological Conditions	■ *Radiation and Radioactivity TSD*: Section 5.4.1, Releases to Air	Explain the discrepancy between the levels of Iodine-131 and radioactive particulates in air measured in 2001 and those measured between 2002-2009. Evaluate whether the Project may cause emissions to again increase above the levels measured from 2002-2009, and evaluate any effects this might have.	Table 5.4.1-1 of the Radiation and Radioactivity TSD shows that from years 2002 to 2008, the annual air emissions from the Western Waste Management Facility (WWMF) for Iodine-131 ranged from approximately $1x10^4$ Bq to $4x10^5$ Bq comprising 1% or less of the total Iodine-131 air emissions from the Bruce site. By comparison, in 2001, the WWMF released $2x10^7$ Bq of Iodine-131 to the atmosphere, which was 42% of the total Iodine-131 air emissions from the Bruce site. Likewise, radioactive particulate air emissions from the WWMF ranged from $4x10^4$ Bq to $2.5x10^6$ Bq between 2002 and 2009. When compared to most years in the 2002-2009 period, the 2001 air emissions of radioactive particulate (and Iodine-131) were approximately three orders of magnitude greater. Despite the marked difference, no acknowledgment of this is made nor any explanation provided.
EIS 07-288	■ Section 10.1.6,	■ *Radiation and Radioactivity TSD*:	Provide additional justification for the explanation offered for the exceedances of the gamma water release action	Page 40 of the of the Radiation and Radioactivity TSD states that the action level for gross beta was exceeded

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	Ambient Radioactivity	Section 5.4.2,eleases to Water	level and the apparent upward trend of the gamma-delta water release data from 2006 to 2009.	in 2009. Table 5.4.1-2 does not actually indicate action levels but rather, the Derived Release Limits (DRL) for the parameters monitored. Although the annual water releases of gross beta-gamma from 2001 to 2005 were below 1% of the DRL, there seems to be an upward trend starting from 2006 where gross beta-gamma increased from about 1% of the DRL to more than 10% of the DRL by 2009. The explanation on page 40 suggests that the exceedances of the action level in 2009 were a result of the use of road salts and lab techniques. However, it is not clear whether the use of road salts in the other years had any impact on the data. There is little additional information to support the OPG's conclusion. Furthermore, there is no indication in the Radiation and Radioactivity TSD to acknowledge the upward trend, nor is there any explanation regarding this upward trend.
EIS 07-289	■ Section 10.1.6, Ambient Radioactivity	■ *Radiation and Radioactivity TSD*: Section 5.5.2,Tritium in Precipitation	Provide more detailed information regarding the location of the "tritium in precipitation" monitoring stations located within the Site Study Area. Provide more recent monitoring data for the Site Study Area.	Precipitation that is contaminated by tritium falls within the various watersheds of the Site Study Area, and will fall or flow into various habitats (e.g. North and South Railway Ditch, Stream C, Baie du Doré, wetlands adjacent to the Project site). These areas include habitat for a variety of terrestrial and aquatic species (e.g. the endangered spotted turtle, various fish species, burrowing crayfish, etc.). It is therefore important to assess effects within these habitats. However, the tritium precipitation data presented in Table 5.5.2-1 in the Radiation and Radioactivity TSD is mainly for monitoring locations that lie outside, or at the edges of, the Site Study Area, for the period 2001-2009. Locations within the Site Study Area have not been

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				sampled since 2002. There is no text description of the precipitation monitoring locations associated with the data in Table 5.5.2-2 in the Radiation and Radioactivity TSD. Based on data from Table 5.5.2-1, there has been an overall increasing trend of tritium in precipitation between 2001 and 2009. Specifically, at monitoring locations B2 and B4, which are the locations closest to the Site Study Area, the tritium concentration in precipitation has gradually increased two-fold from 2001 to 2009. This suggests that tritium levels in precipitation may also be increasing within the Site Study Area. Recent data for the Site Study Area should be provided to understand if a similar trend is occurring, and what the current tritium concentrations are.
EIS 07-290	■ Section 10.1.6, Ambient Radioactivity	■ *Radiation and Radioactivity TSD*: Section 5.9, Radioactivity in Groundwater	Provide an explanation for the steady increases of tritium detected in well WSH231 since 2002 and the increases of tritium in well WSH243 since 2007. Provide information regarding the radiological groundwater contamination in the existing Western Waste Management Facility (WWMF) area and any influences it may have on the proposed DGR project area.	Figure 5.9-2 of the in the Radiation and Radioactivity TSD show that from approximately January 2002, there has been a significant increase in tritium at the WSH 231 to about 30,000 Bq/L; then there seems to be an upward trend from approximately 2004 to a maximum of 80,000 Bq/L in 2009. The Radiation and Radioactivity TSD explains that the tritium trend in this well is believed to be primarily influenced by the tritium collecting in the foundation drains of Low Level Storage Buildings. However, it is unclear whether there is a hydraulic connection between the foundation drains and the site groundwater (i.e. cracks in the foundation drains). There is no explanation of what was done to verify this explanation, what remedial measures are being undertaken, and what effect these tritium plumes may have in relation to the DGR Project. The Radiation and Radioactivity TSD explains that these tritium levels are

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				far below the generic screening criteria of 3,000,000 Bq/L for non-potable groundwater. It is not clear what this generic screening criterion is based on. Additionally, Figure 5.9-4 shows that the tritium levels in WSH243 have been steadily increasing, from approximately 50 Bq/L in 2005 to approximately 300Bq/L in 2009. Although these numbers are relatively low in comparison to WSH23, no explanation for this trend is provided.
EIS 07-291	▪ Section 10.1.5, Aquatic Environment	▪ *Aquatic Environment TSD*: Section 5.1.2, Field Studies	Provide the following additional information about the aquatic environment baseline: ▪ Detailed description of the fish sampling program conducted at Stream C on July 2007 including a map depicting the location of the sampling stations, sampling methodology and sampling results. (Note that results of the 2007 sampling program for the South Railway Ditch were provided in OPG`s response to IR# EIS 01-14 (p. 47) but there was limited information on how the sampling program was conducted.) ▪ Detailed description of the fish sampling program conducted at MacPherson Bay on July 2007 including a map depicting the location of the sampling stations, sampling methodology and sampling results. ▪ Detailed description of the smallmouth bass nest sampling program conducted at the Baie du Doré which is briefly depicted on Figure D-3 including a description of the sampling methodology and sampling results. Also provide a description and summary of results of any other fish and benthic	OPG has indicated that various field sampling surveys have been conducted in the Site Study Area in 2007 and 2009. However, very little information has been provided for review. A well-established baseline is necessary in order to facilitate temporal comparisons to identify changes in the Site Study Area. The following considerations establish the need for the additional information requested: ▪ It is indicated on p. 45 of the Aquatic Environment TSD and in OPG's response to IR# EIS 01-14 that various species were collected in Stream C on July 2007 however a limited amount of information has been provided about how the sampling program was conducted. Also, there was no data provided for Stream C in Appendix C or in OPG's response to IR# EIS-01-14, just a brief summary on p. 45. ▪ The requested information will ensure that the baseline dataset for Stream C is complete in order to determine if future project-related activities have an effect on Stream C. The benthic invertebrate community is an indicator of habitat health. There was no indication in the EIS of any sampling

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			invertebrate surveys conducted at the Baie du Doré in previous years. ■ Detailed description of any benthic invertebrate sampling surveys conducted across the Site Study Area (SSA) (i.e., MacPherson Bay, Baie du Doré, North and South Railway ditches and Stream C), including a map depicting the location of the sampling stations and sampling methodology.	programs or sampling data collected in the Site Study Area for the assessment of the benthic invertebrate community. ■ It is briefly discussed on p. 45 of the Aquatic Environment TSD that cold-water species have been found at MacPherson Bay (i.e. round whitefish, lake whitefish, lake trout, deepwater sculpin) but no detailed information is provided for these species in Table C-2. It is also indicated on p. 45 that studies focusing on lake whitefish and round whitefish have been conducted in the area, therefore the requested information should be available. ■ There is no additional information provided in the of the Aquatic Environment TSD about the smallmouth bass nest sampling program conducted in the Baie du Doré other than the information presented on Figure D-3 of the Aquatic Environment TSD. Additional information on the survey and the rationale behind the survey will be of value to the assessment of potential effects of the Project on the Study Site Area.
EIS 07-292	■ Section 10.1.2, Surface Water	■ *Hydrology and Surface Water Quality TSD:* Section 4.2.2, Surface Water Quality	In addition to the information requested in IR# EIS 03-79, data on the following water quality parameters should be provided to establish surface water quality baseline in the Site Study Area (i.e., MacPherson Bay, Baie du Doré, North and South Railway ditches, and Stream C): ■ dissolved oxygen; ■ chlorophyll a; and ■ biological oxygen demand (BOD).	Releases from the Project can also contribute to eutrophication in the receiving environment. Monitoring of chlorophyll a and BOD will provide an indication of the eutrophication potential at the sampled water body. Monitoring of dissolved oxygen will be an indicator of habitat quality for the fish communities in the Site Study Area. This establishes important baseline information for temporal comparisons as part of the Follow-Up Monitoring Program.

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EIS 07-293	■ Section 10.1.2, Surface Water	■ *Hydrology and Surface Water Quality TSD*: Section 5.5.2, Water Quality in Surface Drainage Features in Site Study Area	Provide the results of surface water quality monitoring conducted at the control water quality sampling stations in Goderich and the Little Sauble River. Explain the observed elevated levels of total suspended solids, nutrients and metals observed in some of the surface water quality samples collected in the Site Study Area.	Sections 5.5.2.2, 5.5.2.3, 5.5.2.5 (and in more detail Appendix E) of the Hydrology and Surface Water Quality TSD indicate that some water quality parameters were elevated at some of the surface water quality stations in the Site Study Area. For example, total phosphorus was noted as elevated above the PWQO guideline of 20 µg/L in 2003 and 2004 water quality samples collected at the South Railway Ditch and in the October 27, 2009 water quality sample. These elevated concentrations were noted by the Proponent as being consistent with water quality results at the control stations; however, the results from the control station water quality samples were not provided for comparison. Other examples include the elevated iron concentrations detected on several water quality samples collected in 2007 and 2009 from SW1 (Stream C – Upstream) and zinc concentrations measured at SW5 (Drain Under Interconnecting Road) in 2007 and 2009.
EIS 07-294	■ Section 10.1.2, Surface Water ■ Section 11.4.2, Surface Water	■ *Hydrology and Surface Water Quality TSD*: Appendix D - Summary of Water Quality Criteria	Evaluate water quality data against the proper Provincial Water Quality Objectives (PWQO) and Canadian Council of Ministers of the Environment (CCME)'s Canadian Environmental Quality Guidelines (CEQG). Provide and evaluate data regarding un-ionized ammonia.	Environment Canada noted various issues with some of the proposed water quality criteria in Appendix D of the Hydrology and Surface Water Quality TSD, as follows: ■ Total Ammonia – CEQG criteria: 1.37 – 2.2 mg/L i. The Proponent should note that the CCME water quality guideline for the protection of aquatic life is pH- and temperature-dependent. The Proponent should indicate what pH and temperature the suggested criteria range was based on.

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				■ Un-ionized Ammonia – CEQG criteria is 19 µg/L. ■ Nitrate – CEQG criteria: The Proponent provided a narrative guideline; however, it should be noted that there is a CEQG of 13 mg/L for freshwater environments. ■ Temperature: Environment Canada proposes the use of CCME's Thermal criteria, whereby thermal additions to receiving waters should be such that the maximum weekly average temperatures (MWAT) and short-term daily maximums of the sensitive important species that are normally found at that location and time are not exceeded. Environment Canada also suggests that the Proponent refer to the 1987 Canadian Council of Resource and Environment Ministers thermal guidance factsheet for additional information. ■ Turbidity – CCME CEQGs for turbidity are for "clear flow" and "high flow on turbid waters" scenarios. The stated guideline for the high flow case is incorrect. The correct guideline is the following: i. "maximum increase of 8 NTUs from background levels at any one time when background levels are between 8 and 80 NTUs. Should not increase more than 10% of background levels when background >80 NTUs." ■ Mercury – stated CCME CEQGs of 0.0001 mg/L is incorrect. The correct CCME CEQG is: i. Inorganic: 0.026 µg/L ii. Organic: 0.004 µg/L

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				■ Uranium: The Proponent should note that there is a new CCME CEQG for uranium: i. Chronic exposure: 15 µg/L ii. Acute exposure: 33 µg/L
EIS 07-295	■ Section 10.1.5, Aquatic Environment	■ *Hydrology and Surface Water Quality TSD*: Section 5.5.2.7, Sediment Quality ■ Appendix F, 2009 Sediment Sampling Results	Provide the rationale for the observed elevated concentrations in Appendix F of the *Hydrology and Surface Water Quality TSD* of some parameters in sediment samples collected in the Site Study Area. Indicate if sediment samples have been collected in the Local Study Area and if they have, provide the result of the analysis of those samples.	Various parameters in Appendix F of the *Hydrology and Surface Water Quality TSD* were found to be at elevated concentrations in sediment samples collected in the Site Study Area. Also, sediment quality criteria are available for only a limited number of parameters. Sediment quality data should be interpreted in the context of data collected from the Local Study Area.
EIS 07-296	■ Section 6.1, Aboriginal Peoples	■ *EIS*: Section 2.3, Aboriginal Engagement	Provide details on engagement activities conducted by OPG/NWMO with Aboriginal groups since the EIS was completed in March 2011. Include information on concerns or issues raised by Aboriginal groups in relation to the project and how OPG has addressed or plans to address these concerns or issues.	The EIS Guidelines require the proponent to describe in the EIS how concerns respecting Aboriginal people will be addressed. The description should include a summary of discussions, the issues or concerns raised, and should consider and describe any asserted or established Aboriginal rights, Aboriginal title and treaty rights.
EIS 07-297	■ Section 4.2, Factors to be considered in the EIS	■ *Aboriginal Interests TSD*: Section 2.3, Aboriginal Traditional Knowledge	Describe the methods/practices that OPG/NWMO has used to attempt to collect Aboriginal Traditional Knowledge in order to ensure it was considered in the EIS.	Given that 'traditional use of lands and resources' is identified as a Valued Ecosystem Component (VEC), it is important to understand how the proponent attempted to collect Traditional Knowledge and Traditional Use information from Aboriginal peoples.
EIS 07-298	■ Section 10, Aquatic Environment	■ *Hydrology and Surface Water Quality TSD*: Section 6.2, Changes in	Provide the following additional information: ■ information regarding groundwater recharge to Stream C, including a quantitative assessment of	The information is required to meet the EIS Guidelines – Section 10 Existing Environment: *The EIS must describe surface water quality, hydrology*

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		Groundwater Flow ■ *Aquatic Environment TSD*	potential impacts from the excavation, construction and operation of the underground facility to the groundwater recharge to stream C; ■ the hydrological properties of Stream C, including the baseline flow rate, depth profile, and seasonal fluctuation data, and a quantitative assessment of the potential impact of the project to the hydrological properties; and ■ the baseline surface water, water column, and substrate temperature of Stream C and an assessment of potential project impact to water temperature due to the change of groundwater recharge to Stream C and Baie du Doré.	*and sediment quality at the site, local and regional study areas. The proponent must describe hydrological regimes, including seasonal fluctuations and year-to-year variability of all surface waters and assess normal flow, flooding, and drought properties of water bodies as well as the interactions between surface water and groundwater flow systems.* As indicated in the Aquatic Environment TSD, Stream C is a DFO-designated coldwater fish habitat including temperature sensitive fish species such as brook trout, rainbow trout, brown trout and Chinook salmon and other forage fish species. More importantly, Stream C is a spawning habitat for the native brook trout. Water temperature in surface water and stream substrates is a key factor in determining brook trout habitat. They need a year-round supply of cold, clear water. The Canadian Nuclear Safety Commission (CNSC) suggested that the change of groundwater recharge to Stream C may change the water temperature enough to lead to changed fish habitat use and changed populations of brook trout and other salmonines in stream C. The CNSC noted that this potential adverse effect could be worsened in the longer term by anticipated increased ambient air and stream water temperature warming due to climate change. As a receiving body for groundwater, the relative importance of groundwater as “baseflow” into Stream C should be provided as this may inform what additional measures are required to protect the ecological function and quality of Stream C. This information is critical because the evacuation and construction of the underground facility could directly or indirectly affect stream flow and temperature by changing the

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				groundwater level and discharge rate to the stream. No information has been provided regarding the relative importance of groundwater in maintaining the ecological function of Stream C and the area where it empties into the Baie du Doré Provincially Significant Wetland. As such, there is no way to evaluate the risks to ecological function that the DGR Project may pose to the groundwater recharge.
EIS 07-299	■ Section 10, Aquatic Environment ■ Section 11,Effects Prediction, Mitigation Measures and Significance of Residual Effects	■ *Hydrology and Surface Water Quality TSD*: Section 5, Existing Environment	Provide additional information describing: ■ the baseline information of water quantity and flow rates South and North Railway Ditches, and the drainage ditch (under Interconnecting Road); ■ the baseline information of the quantity and quality of effluents that discharge to South/ North Railway Ditches, Stream C, and MacPherson Bay, discharge criteria and loadings of contaminants, from any projects and/or activities within the study area; and ■ the quantitative assessment of effluent and stormwater discharge to the surface drainage in study area on surface water quantity and quality, sediment quality of Stream C, South and North Railway Ditch, Baie du Doré and MacPherson Bay from the site preparation, construction and operation of the DGR project.	This information is required to meet the EIS Guidelines - Section 10 Existing Environments: *The EIS must describe surface water quality, hydrology and sediment quality at the site, local and regional study areas. The proponent must describe hydrological regimes, including seasonal fluctuations and year-to-year variability of all surface waters and assess normal flow, flooding, and drought properties of water bodies as well as the interactions between surface water and groundwater flow systems.* Furthermore, the baseline description must include characterization of environmental conditions resulting from historical and present activities in the local and regional study area. Only limited baseline information was provided on water quality parameters from the 2007 and 2009 surface water sampling results in the Hydrology and Surface Water Quality TSD. This information is needed to support the EIS prediction statements and as a baseline against which to verify these predictions statements with the EIS follow-up monitoring program.

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EIS 07-300	■ Section 10, Aquatic Environment ■ Section 11,Effects Prediction, Mitigation Measures and Significance of Residual Effects	■ *Aquatic Environment TSD*	Provide the following additional information: ■ baseline information of benthic invertebrates and aquatic macrophytes, including but not limited to density and diversity benthic invertebrates and aquatic macrophytes in Stream C, South/North Railway Ditches, Baie du Doré, and MacPherson Bay from available studies and investigations; and ■ an assessment of potential impacts from the site preparation, construction and operation of the DGR project to benthic invertebrates and aquatic macrophytes.	This information is required to meet the EIS Guidelines - Section 10 Existing Environments: *The EIS must provide a baseline description of the environment, including the components of the existing environment and environmental processes, their interrelations and interactions as well as the variability in these components, processes and interactions over time scales appropriate to this EIS.* Benthic invertebrates and aquatic macrophytes are identified VECs for the aquatic environment, and are valuable food sources for other VECs such as fish and terrestrial species. The EIS guidelines direct the proponent provide a description of the aquatic and wetland species at the site and within the local and regional study areas including a description of the flora, fauna and their habitat. The information is important to evaluate the potential impact of the DGR Project on the critical fish habitat.
EIS 07-301	■ Section 16, Follow-Up Program	■ *EIS*: Section 12, DGR EA Follow-up Monitoring Program	Provide the following additional information: ■ further reasoning for the lack of the monitoring of water quantity and quality such as the flow rate, contaminant level in surface water and sediment, and temperature of surface water and substrate in Stream C, North and South Railway Ditch; surface water and sediment quality in Baie du Doré and MacPherson Bay; and ■ further reasoning for the lack of the monitoring of brook trout in Stream C.	This information is required to meet the EIS Guidelines - Section 16 Follow-up Program: *A follow-up program must be designed to verify the accuracy of the environmental assessment and to determine the effectiveness of the measures implemented to mitigate the adverse environmental effects of the project.* As the Hydrology and Surface Water Quality TSD stated, maintaining natural flows and water quality in local stream is critical to various life stages of sensitive species, such as the VEC species brook trout in Stream C. Groundwater recharge to Stream C is very important

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				in maintaining the ecological function of Stream C as important brook trout spawning, feeding, nursery, and rearing habitat. The potential DGR project impacts, including groundwater recharge, water quantity and water quality, should be verified by monitoring the flow rate, temperature and water quality in stream C, North/South Railway Ditch, surface water and sediment quality in Baie du Doré and MacPherson Bay.
EIS 07-302	■ Section 16, Follow-Up Program ■ Class1 Nuclear Facilities Regulation, 5(i)	■ *EIS*: Section 12, DGR EA Follow-up Monitoring Program ■ *Preliminary Safety Report*: Section 9.5	Explain if deformation/displacement measurement/monitoring have been considered for the large underground shaft station and surface area openings.	There are large underground openings at the shaft station and service area. Measurement/monitoring of their displacement/deformation is important to confirm the performance of facility, and to ensure the underground stability and the worker's safety during the construction and future operation.
EIS 07-303	■ EIS guideline, section 12 ■ Class1 Nuclear Facilities Regulation, 5(i)	■ *EIS*: Section 7.8, Noise and Vibrations ■ *EIS*: Section 12. 2, Initial Scope of the Follow-Up Program ■ *Preliminary Safety Report*: Section 9.5, Potential Environmental Effects and Monitoring Programs ■ *Preliminary Safety Report*: Section 10.3, Environmental	Explain if the Peak Particle Velocity (PPV) criteria for blasting operations consider appropriate PPV criteria for the Bruce nuclear generating stations. Provide a monitoring plan, including the monitoring locations, to ensure that the PPV from the blasting is below the proposed criteria.	Blasting from the shaft and underground facility excavation will cause ground vibration which might have an impact on different receptors. The PPV criteria (values) were proposed for different receptors by considering the requirements from different guidelines. However, it is not clear if the PPV criteria considered the safe operation requirement for the Seismic Source Characterizations of the Bruce nuclear generating stations. The CNSC noted that the Darlington New Build set the PPV criteria of 3 mm/s by considering the Turbine operation requirement of the Darlington DGS [Site Evaluation of the OPG New Nuclear at Darlington]). The CNSC suggested that it seems no monitoring programs, in particular, the monitoring locations, are

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		Protection Program ■ *DGR EA Follow-up Monitoring Program TSD*: Section 7.4, Vibrations Monitoring ■ *Atmospheric Environment TSD*: Appendix I		proposed to ensure that the PPV is below the criteria.
EIS 07-304	■ Section 8.7, Malfunctions, Accidents and Malevolent Acts ■ Class1 Nuclear Facilities Regulation, 5(i)	■ *EIS*: Section 8.1, Initiating Events ■ *Malfunctions, Accidents and Malevolent Acts TSD*: Section 3.2,	Clarify if local rock falls in the shaft station and service area are considered in the Malfunctions, Accidents and Malevolent Acts TSD, and justify the annual frequency of occurrence applied for rock falls and rockbursts (i.e., 10^{-2} and 10^{-7}).	In both EIS (section 8.1) and Malfunctions, Accidents and Malevolent Acts TSD (section 3.2), OPG indicated that local falls within emplacement rooms were considered as a geotechnical malfunction and the accident initiating event with a potential annual frequency of occurrence between 10^{-2} and 10^{-7}. It is not clear if local rock falls in the shaft station and service area were considered.
EIS 07-305	■ Section 11.4.4 Terrestrial Environment	■ *Terrestrial Environment TSD*: Section 5.8, Significant species	Assess the potential effects of the project on the Canada Warbler and Eastern Meadowlark. Provide additional baseline information on habitat use by these two species in the Project and Site Study Areas. Confirm that the presence of these species in the Site Study Area has been brought to the attention of the Ontario Ministry of Natural Resources.	Section 5.8.1 of the Terrestrial Environment TSD states that “Neither historical studies nor current database searches identified habitat use by species listed under Schedule 1 of the *Species At Risk Act* (SARA) or threatened or endangered species as identified by the province under the Endangered Species Act in the Project Area”. Table 5.7.1-1 of the *Terrestrial Environment TSD*, which lists bird species identified during the 2009 breeding bird surveys, indicates that the Canada Warbler and Eastern Meadowlark were identified in the Site Study Area. The Canada Warbler is designated special concern provincially, and is listed as threatened under schedule 1 of SARA. The Eastern Meadowlark recently became

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				designated as threatened provincially (as of January 2012) and by COSEWIC, but currently has no SARA status. As indicated by the EIS guidelines (Section 11.4.4), it is expected that potential Project effects to all species at risk and their habitats be fully assessed. This expectation is in line with the NSCA requirement to provide adequate protection for the environment. In addition to the NSCA, the DGR Project must also adhere to other legislation, including the federal *Species at Risk Act*, and the Ontario *Endangered Species Act*. The designation of 'Threatened' under both of these Acts results in a requirement for additional habitat protection measures. These two species were not assessed as species at risk in the EIS, therefore this information is needed to better understand the potential impacts and ensure consistency with the applicable legislation.
EIS 07-306	▪ Section 13.2, Selection of Assessment Scenarios	▪ *EIS*: Section 9, Long term Safety of the DGR ▪ *Preliminary Safety Report*: Section 4.2 ▪ *Preliminary Safety Report*: Section 4.5.4	Assess the influence of creep on the long term geomechanical stability of the underground facility and commit to a follow-up program, consisting of both laboratory and field tests to verify that assessment.	According to the CNSC, the long term strength test data (Gorski et al.2009) on the Cobourg limestone indicate that creep could be a factor in the long term geomechanical stability. Uniaxial compressive tests were performed at a constant low stress level (at around the crack initiation stress), however, deformation, especially in the diametric direction, showed an increasing trend as a function of time and did not stabilize after 100 days.
EIS 07-307	▪ Section 10.1.1 Geology and Geomorphology	▪ *EIS*: Section 6.2, Geology ▪ *Preliminary Safety Report*: Section 4.1,	Discuss whether the increased fracture frequency in the Ordovician may be the result of the proximity to a vertical fault or fracture zone. Discuss the implications of the high fracture frequency in the overpressured Cambrian unit, in light of the relatively	An explanation and discussion of the anomalous higher fracture frequency and the implications this might have at the Bruce site is required. The CNSC stated that the possible reasons for the relatively higher fracture frequency in the Ordovician in

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		Geosynthesis	high fracture frequency in the Middle Ordovician rocks in DGR-4, the possibility of a vertical fault or fracture zone, and fluid infiltration along such a feature.	DGR-4 should be provided and require discussion. The natural fracture frequencies presented in the DGSM report (on Figure 3-4 and Table 3.5) show that in DGR-4, the natural fracture frequency is higher in Middle Ordovician units than in other boreholes, with up to ~5 / m. Additionally, the fracture frequency in the (underlying, overpressured) Cambrian unit is shown to be high, with a natural fracture frequency of up to 12 / m.
EIS 07-308	■ Section 10.1.1 Geology and Geomorphology	■ *EIS*: Section 6.2, Geology ■ *Preliminary Safety Report*: Section 4.1, Geosynthesis	Explain the anomalous higher elevation in the 2D seismic survey shown in Figures 13–15 of the 2D seismic survey report (Intera 2009). Explain if this is a precambrian paleohill, an uplifted basement block, or an artifact. Describe the uncertainties (accuracy and precision) associated with the estimate of 10m of local structural relief along the basement surface and overlying stratigraphic reflectors for individual seismic lines. Describe the accuracy and precision of the depth and configuration of the apparently continuous reflectors evident in some of the seismic profiles.	The possible basement-related feature identified in the seismic survey (based on 2-way travel time) north of DGR-1 and DGR-2 is a structure that requires explanation.
EIS 07-309	■ Section 10.1.1 Geology and Geomorphology	■ *EIS*: Section 6.2, Geology ■ *Preliminary Safety Report*: Section 4.1, Geosynthesis	Explain or address the inconsistencies identified in the description of the geological framework for the following: ■ Michigan Basin subsidence; ■ Thermal maturity; and ■ Bruce megablock fractures.	Numerous inconsistencies identified by the CNSC reduce confidence in the proposed DGR framework with respect to the geometric predictability, tectonic stability, and resource potential in the RSA. The CNSC identified the following inconsistencies: **Michigan basin subsidence** On page 14 of the Descriptive Geosphere Site Model (DGSM): ■ the statement that “the Taconic Orogeny in the Early to Middle Ordovician resulted in the collapse of

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				platform carbonates of the Trenton Group" is not supported by literature. For example see Quinlan and Beaumont (1984) and Quinlan (1987) for an overview of basin formation and Paleozoic stratigraphy of the eastern interior of North America, and tilting related to subduction of cratonic interiors. ■ The change from Guelph Formation to the Salina Group is the result of basin subsidence, not arch uplift. ■ Michigan basin subsidence was not caused by the Acadian Orogeny. ■ The interpretation that Cambrian strata were deposited over the Algonquin Arch and then subsequently eroded prior to the deposition of Ordovician strata (found in some reports e.g. the DGSM, Geosynthesis – tectonic evolution of southern Ontario) is problematic. Figure 2.4 in the Regional Geology report and discussed in Hamblin (2011) indicates that the Algonquin Arch was a peninsula while the Cambrian formations were being deposited. This impacts on the conceptual model for the tectonic evolution of the Michigan Basin as presented in the DGSM. **Thermal maturity** ■ Thermal maturity of rocks in the study area, as mentioned in several reports (including Regional Geology, Analogue Study of Shale Cap Rock Barrier Integrity) should be consistent with observations of hydrocarbon seeps in drill core. In the vicinity of the Bruce site, Middle Ordivician limestone and the overlying Collingwood, Blue Mountain, and part of

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				the Georgian Bay Formations are thermally mature. ■ The pyrolysis data on page 46 of the DGSM report shows that mid Ordovician strata are thermally mature and the top of the oil window is within the Georgian Bay Formation. Although the Cobourg Formation, the proposed host for the DGR, is omitted from the oil window, it should be included because of the hydrocarbon seeps observed in drill core. **Bruce megablock fractures** ■ The apparently simple fracture pattern in the Bruce megablock relative to the Niagaran may simply reflect borehole coverage, which is much more extensive in southern Ontario. This likely explanation is ignored in reports. ■ The reliance on the Bruce/Niagara megablock concept to explain the lack of discovered oil and gas in the RSA is problematic, owing to ambiguity about the origin and importance of megablock features.
EIS 07-310	• Section 12, Accidents, Malfunctions and Malevolent Acts • Section 13.2, Selection of Assessment Scenarios	■ *Preliminary Safety Report:* Section 8.7.2.3, Severe Shaft Seal Failure Results	Clarify an apparent discrepancy between the statement that the C-14 inventory in the DGR is about equal to the Western Waste Management Facility (WWMF) DRL (annual release limit that would give a 1 mSv/a dose to a person at the site boundary) and the results of the SF-ED disruptive scenario that predicts an 80 mSv/a exposure from C-14 (Section 8.7.2.3 and Table 14-3, Argument 3-2).	The Severe Shaft Seal Failure Scenario assesses a hypothetical situation in which there is a breakdown in the performance of these barriers. Two situations were considered: A base case for which the hydraulic conductivity of all shaft seals are set at 10^{-9} m/s (SF-BC) and an 'extra conservative case' for which the hydraulic conductivity of all shaft seals is set at 10^{-7} m/s with a porosity of 30%, which is equivalent to fine silt and sand (SF-ED). The PSR states (page 551) that the SF-ED case results in a calculated dose to the adult site resident living above the repository that reaches about 80 mSv/year after around 3800 years.

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				However, the PSR also notes that (page 551) "the estimated total amount of C-14 in the DGR is $6x10^{15}$ Bq (Table 5-8). Even if this entire DGR inventory of C-14 were to be released as gas within one year, it would be roughly equivalent to the current allowed WWMF Derived Release Limit (DRL) for C-14 of $4.6x10^{15}$ Bq/year (Table 7-3) and the peak dose to anyone living around the Bruce nuclear site would be about 1 mSv or less." The CNSC questioned why the C-14 released over time through a severely degraded sealed shaft would result in a dose of 80 mSv/a if there is insufficient inventory to significantly exceed a 1 mSv/a dose if it were released on the surface today.
EIS 07-311	■ Section10.1.3, Groundwater	■ *EIS*: Section 6.2.7, Hydrogeology ■ *Groundwater Modelling TSD*: Section 2.1	Provide measured hydraulic gradients in all formations present in the site area.	The proponent provided measured hydraulic gradients in the Salina A1 Upper Carbonate, Guelph, and Cambrian, but not in other rock units. The CNSC indicated that the measured hydraulic gradients play an important role in the conceptualization of the local scale groundwater model and the Post-closure Safety Assessment. The CNSC noted that, considering the relative large uncertainty involved with hydraulic conductivity of tight rocks, the measurements of hydraulic gradients are especially important to understand the hydrogeological nature, and possibly improve the conceptualization and modeling, of the groundwater flow and contaminant transport, and thus the Post-closure Safety Assessment.

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EIS 07-312	• Section 13.5, Interpretation of Assessment Results and Comparison with Acceptance Criteria ■ Class1 Nuclear Facilities Regulation, 5(g)	■ *EIS*: Section 9.4, Assessment Results and Comparison with Acceptance Criteria ■ *Geoscientific Verification Plan TSD*: Section 2.1.5	Describe what in situ geomechanical testing and what up-scaling conditions are planned to obtain the geomechanical properties of rock masses at the up-scaling field testing during the shaft sinking and during the lateral development of the underground facility. Clarify why no in situ geomechanical testing for the Cobourg Formation is planned during shaft sinking, but is planned during the lateral development. Clarify if there is any plan to verify the bottom extent (boundary) of the Cobourg Formation beneath the repository room floor as designed. Provide more information on the specific timing of the various planned verification activities.	The intent of the Geoscientific Verification Plan (GVP) is to gather additional geoscientific information to reduce the uncertainties of the sub-surface geologic and geotechnical conditions, and to support engineering decisions and the DGR safety case and any future license applications. The up-scaling in situ geomechanical testing will provide additional site-specific geomechanical data to support the design of the underground facility and to contribute to the safety case. However it is not clear what in situ geomechanical testing is planned under what up-scaling conditions. In situ geomechanical properties of the Cobourg Formation are needed for the design of the lateral underground facility including the shaft station and service area. However, no in situ geomechanical testing of the Cobourg Formation is planned before the development of the lateral facility (i.e. excavation of the shaft station and service area). The underground facility of the DGR is expected to be designed to be fully contained within the Cobourg Formation. This is important for both the construction of the DGR and the long term safety of the facility. However, the GVP does not include the verification of the bottom extent (boundary) of the Cobourg Formation beneath the repository room floor that could be impacted by the inclination of the formation.

References:

Gorski, Anderson and Conlon,(2009). *Long term strength degradation of DGR-2 core*, OPG's TR-08-11

Hamblin (2011) *Detailed outcrop and core measured sections of Upper Cambrian and Middle Ordovician sandstones (and associated facies), southwester Ontario.* GEOLOGICAL SURVEY OF CANADA OPEN FILE 6856. (http://geogratis.cgdi.gc.ca/eodata/download/part6/ess_pubs/288/288671/of_6856.pdf)

Intera (2009), *2D Seismic Survey of the Bruce Site*, NWMO DGR-REP-01330-0001-R000. (http://www.nwmo.ca/uploads_managed/MediaFiles/948_tr-07-15_2d_seismic_survey_r0.pdf)

Quinlan and Beaumont,(1984). *Appalachian thrusting, lithospheric flexure, and the Paleozoic stratigraphy of the Eastern Interior of North America*. CJES 1984: 973-996.

Quinlan (1987). *Models of subsidence mechanisms in intracratonic basins, and their applicability to North American examples*. In: Beaumont, C. and Tankard, A.J. (eds) *Sedimentary basins and basin forming mechanisms*. Canadian Society of Petroleum Geologists, Memoir 12, 463-481.

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