December 20th, 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 #8 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 8 – December 20, 2012

IR#	EIS Guidelines Section	EIS Section or other technical document	Information Request	Context
EIS 08-313	• Section 11, Effects Prediction • Section 11.4.4, Terrestrial Environment • Section 11.4.5, Aquatic Environment	• *Preliminary Safety Report*: Section 8, Post-Closure Safety Assessment	Provide the rationale for the exclusion of tritium in the development of acceptance criteria for the protection of non-human biota from potential radiological effects. Where relevant (e.g., the SD-ED scenario), provide additional information regarding the contribution of tritium to total radioactivity and dose for those intrusion/failure scenarios assessed in the Preliminary Safety Report.	There are many references in the Preliminary Safety Report regarding the importance of tritium in the early post-closure time period. For example, in the description of waste and packages in Section 8.4, the Preliminary Safety Report states that: *"the most important radionuclides at closure are tritium and C-14 due to their early release as gas…"* Table 8.1 lists the radionuclides for which the acceptance criteria based on No-Effect Concentrations were developed. C-14 is among these radionuclides but tritium is not. It is understood that the radiation contribution by tritium will become negligible after a few hundred years, but some of the failure scenarios could occur within that time-frame. For example, in the SF-ED scenario (Severe Shaft Seal Failure) there is no indication that tritium was considered in the prediction as to when the maximum dose to surface residents would occur. Rather, the report implies that the radionuclide responsible for the dose is dominated by C-14 only. In this scenario, it is not clear what effect tritium might have on the total dose to the surface resident and whether the hydraulic conductivity assumed for the scenario would allow tritium to contaminate the shallow groundwater within the first few hundred years for it to be an important contributor to dose. Figure 8-20 indicates that tritium is the dominant radionuclide in the near term post-closure period, so it

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				might indeed be an important consideration in the SF-ED failure.
EIS 08-314	• Section 10.1.1, Geology and Geomorphology	• *EIS*: Section 6.2, Geology • *Preliminary Safety Report*: Section 4.1, Geosynthesis	Discuss and clarify the uncertainties in the 3D Geological Framework (3DGFM) and descriptive geological site models (3DGSM). Provide a plan view map and/or vertical cross sections with quantitative elevation, thickness data, and lateral facies changes. Identify specific field data observation and measurement locations. Supplement the validation of the 3DGFM model with data from DGR boreholes 7 and 8. Elaborate on the presence and extent of unconformities and any associated paleo-karst horizons that may have created lateral pathways and which might impact on the integrity of the site. Of particular interest is the Guelph Formation.	With respect to the thickness and composition of the units, the uncertainty is much greater than what is indicated in the report (3DGSM). CNSC suggests that there are discrepancies and inconsistencies in the analysis, presentation of quantitative observations, and related uncertainties as presented in the 3D geological framework and descriptive geological site models (3DGFM and 3DGSM). These models are important because they provide context for hydrogeological and geomechanical models and assessments. Furthermore, the predictability of the geology at the site and regional scales provides context and confidence in the overall DGR framework. Uncertainties vary greatly within the Regional Study Area owing to the amount and quality of the information available. Uncertainties are not analyzed or displayed in the report. While block diagrams illustrate the predictive capacity of the 3D geological framework model, they do not effectively display quantitative information (elevation and thickness data). Stratigraphic surfaces in the vicinity of the Bruce site involves interpolation across a large area (~150 km) between Ontario and the Michigan basin, where there are no boreholes, and involves significant uncertainty that is not clear in reports. Table 3.15 (page 118 of the Descriptive Geosphere Site Model TSD) shows the results of a quantitative test of the DGSM that was done to validate the predictability of the model, comparing DGR1, DGR2 with Texaco #6 (2900 m south of DGR boreholes). The results shown contradict statements made in the geosynthesis of less than 5%

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				variation in formation thicknesses of Middle and Upper Ordivician units across the Bruce site (e.g. pg 102 of the Geosynthesis). This contradiction should be resolved. Formation depths in DGR-1 and DGR-2 are ~5% deeper than predicted, while thicknesses generally vary by greater than 5%. Comparing the vertical offset between predicted and actual formation thicknesses, the variability in thicknesses is shown to be (for example) +13% for the Queenston; +5% for Georgian Bay; -24% for Blue Mountain; +33% for the Cobourg; -53% for Cambrian Formation. The models ignore basement-seated faults (see EIS-16) or petroleum accumulations known within the RSA. The proponent should consider how known basement-seated faults that affect the RSA could be incorporated into the model. Basement-seated faults were identified in the regional geology report (Figure 3.4 therein). The locations of these faults and how they correspond to structure contours is significant. The NNW trend of contours (Figures in Appendix A) in an area ~60-80 km east of the Bruce site are warped by an east-west structure in all units from the Shadow Lake to the Reynales Fossil Hill Formations, which immediately overlie the basement. This warping structure appears to correspond to basement faults identified in the regional geology report (Figure 3.4), and could be shown as a discrete feature that offsets contours on structure contour maps.
EIS 08-315	• Section 10.1.1 Geology and Geomorphology	• *EIS*: Section 6.2, Geology • *Preliminary Safety Report*: Section 4.1, Geosynthesis (and	Provide a clear assessment via the 3DGFM of the influence of major basement features on the occurrence of faults and fractures in the megablock encompassing the DGR site. Provide information on the possible role of the	Basement-seated faults and known tectonic boundaries can be expected to cross cut Paleozoic strata in the vicinity of the proposed DGR site. The block models and contour maps span more than 150km and can reasonably be expected to be affected by basement-

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		regional geology, 3DGSM, 3DGFM)	Midcontinent Rift, a significant basement feature shown in the seismic hazard report, on some Paleozoic fracturing in the RSA.	seated faults. Basement-seated faults are important as the main features that are the likely controls on fracturing and faulting in the vicinity of the DGR. Basement-seated faults and tectonic boundaries have been identified within the RSA in the regional geology report (Figure 3.4) and in the seismic hazard report. Faults and fractures in limestone within the RSA, which are parallel to basement features, are likely the result of reactivation. Other faults that cross-cut Grenville structures may relate to the Ottawa-Bonnechere graben. This leads to two types of basement-seated faults that occur in the RSA. 1. Steep NNE trending early Paleozoic faults, formed by reactivation of mesoproterozoic faults in the Grenville basement 2. NE trending faults that cut Grenville structures, probably associated with the Ottawa-Bonnechere graben. The reactivation of basement-seated faults is an important control on sedimentation and fault propagation in intracratonic basins, including the Michigan Basin, which encompasses the proposed DGR site. In southern Ontario, “the reactivation of basement-seated faults is suspected to control the location of Paleozoic faults and fracture systems” (Boyce and Morris, 2002). Therefore, proper documentation of these features at the proposed DGR site and how they impact on the RSA is essential. Basement-seated faults cutting Cambrian and Mid-Ordovician strata are generally aligned NNE, in parallel with structures in the underlying rocks of the Grenville orogen and may be the result of reactivation of Grenville basement structures.

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				Faults that cross-cut pre-existing basement structures are: • EW-trending faults in the southwest corner of Ontario; • the Ottawa-Bonnechere graben and related faults (early Paleozoic) part of the St Lawrence Rift extending from Montreal to the northeast corner of Georgian Bay; and • NE trending faults south and southeast of Bruce In other parts of southern Ontario, basement-rooted faults that have displaced Cambrian and Ordovician strata are associated with hydrothermal dolomitization (HTD) and with oil and gas pools.
EIS 08-316	• Section 10.1.1, Geology and Geomorphology • Section 11.4.1, Geology and Geomorphology	• *EIS*: Section 6.2, Geology	Provide the sulphur content and speciation encountered during the drilling of the stratigraphic test wells DGR-1 to DGR-8. Describe the mitigation action required during construction and operation of the proposed DGR should a subsurface sulphur water environment be present at the proposed site.	Ontario Ministry of Natural Resources indicated that petroleum well records at the Petroleum Operations Section (London office) document the common and widespread occurrence of sulphur water in the subsurface bedrock of southern Ontario. Sulphur water is very corrosive to steel casings in petroleum wells.
EIS 08-317	• Section 10.1.1, Geology and Geomorphology • Section 11.4.1, Geology and Geomorphology	• *EIS*: Section 6.2, Geology	Describe the sampling method used to protect the samples from contamination by drilling fluids.	Opportunistic water samples were acquired and analysed during the drilling of DGR-1 to DGR-8.
EIS 08-318	• Section 10.1.1, Geology and Geomorphology • Section 11.4.1,	• *EIS*: Section 6.2, Geology	Discuss the long-term plans for the archiving of the drill core acquired by DGR-1 to DGR-8 such that the geological value of the core may be preserved.	No context required.

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	Geology and Geomorphology			
EIS 08-319	• Section 10.1.1, Geology and Geomorphology • Section 11.4.1, Geology and Geomorphology	• *EIS*: Section 6.2, Geology	Provide a geological explanation for the highly fractured bedrock above and including parts of the Salina Group, and comment on its relevance to the integrity of the proposed repository.	The Rock Quality descriptions of DGR-3 and DGR-4 document highly fractured bedrock above and including parts of the Salina Group.
EIS 08-320	• Section 10.1.1, Geology and Geomorphology • Section 11.4.1, Geology and Geomorphology	• *EIS*: Section 6.2, Geology	Provide evidence that the EIS and Geology TSD were reviewed and approved by an individual licensed to practice geoscience in the province of Ontario.	No context required.
EIS 08-321	• Section 10.1.8, Climate, Weather Conditions and Air Quality • Section 11.4.7, Atmosphere	• *Atmospheric Environment TSD*: Section 4, Selection of VECs	Evaluate the concentration of all emitted species for which the Ontario Ministry of the Environment (MOE) has standards.	On page 29 of the Atmospheric Environment TSD, the proponent states that rather than treat all possible effects, they will focus on valued ecosystem components. The MOE stated that this approach does not satisfy MOE protocols. The MOE requires that air quality be evaluated based upon property boundary contaminant concentrations. The determination of critical concentrations has been accomplished by ministry toxicologists who have taken a broad spectrum of endpoints into the consideration when determining acceptable levels. Evaluation cannot be based on the effect of emissions upon a narrow environmental subset.
EIS 08-322	• Section 10.1.8, Climate, Weather Conditions and Air	• *Atmospheric Environment TSD*: Table 4-1: VECs Selected for the	Explain why there is no mention of airborne radionuclides in the air emissions analysis. Provide information on the characteristics of excavated rock with respect to the potential for increases in inhalable silicates, trace metals,	The indicator compounds listed in Table 4-1 on page 30 of the Atmospheric Environment TSD, are nitrogen dioxide, sulphur dioxide, carbon monoxide, suspended particulate matter, inhalable particulate (PM_{10}), and

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	Quality • Section 11.4.7, Atmosphere	Atmospheric Environment	and metalloids. Provide an estimate of PAH emissions for the site preparation and construction phases.	respirable particulate ($PM_{2.5}$). These seem to be related to sources such as construction and combustion.
EIS 08-323		• *Atmospheric Environment TSD*: Section 4,2.1, Air Quality, Table 4.2.1-1: Air Quality Criteria for Indicators	Apply MOE Guidelines and Standards for comparison with predicted air emissions. For the current air emissions analysis, indicate whether the benchmarks used were more or less conservative than MOE benchmarks.	The proposed benchmarks for various substances are listed on page 31 of the Atmospheric Environment TSD. The MOE indicated that these do not meet MOE standards and guidelines, such as for the following examples: • Sulphur Dioxide – 680 ug/m^3 – 1 hour value; • Sulphur Dioxide – 275 ug/m^3 - 24 hour value; • Carbon Monoxide – 6000 ug/m^3 – ½ hour value; • Suspended Particulate 100 ug/m^3 – ½ hour value (this will be replaced by the 24 hour value by 2020); • Suspended Particulate – annual AAQC is 60 ug/m^3 which is based on a geometric mean; and • Respirable Particulate – 25 ug/m^3 (Ministry guidance).
EIS 08-324	• Section 10.1.8, Climate, Weather Conditions and Air Quality • Section 11.4.7, Atmosphere	• *Atmospheric Environment TSD*: Section 4,2.1, Air Quality Indicators	Explain why MOE standards and AAQC values for emissions from stationary sources were not applied when considering project emissions.	On page 31 of the Atmospheric Environment TSD, the proponent suggests that there is some latitude when considering emissions from selected stationary sources under Ontario Regulation 419/05. However, MOE indicated that for this Project, no exemptions apply.
EIS 08-325	• Section 10.1.8, Climate, Weather Conditions and Air Quality • Section 11.4.7,	• *Atmospheric Environment TSD*: Section 5.1, Existing Environment Methods	Provide corroborating evidence based upon actual local air monitoring information or other information to demonstrate that the regional data used in the TSD adequately reflects local atmospheric environment conditions.	On page 35 of the Atmospheric Environment TSD, the proponent states that adequate data is available from existing sources to characterize regional air quality, and can be used for describing background air quality in the Local Study Area. Regional air quality is a broad average

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	Atmosphere			over a large area. There are variations from one point to another within a region. MOE has suggested that it is not adequate to use these broad-based values.
EIS 08-326	• Section 10.1.8, Climate, Weather Conditions and Air Quality • Section 11.4.7, Atmosphere	• *Atmospheric Environment TSD*: Section 5.3.1, Data Sources • *Atmospheric Environment TSD*: Figure 5.3.4-1 Annual and Seasonal Wind-Roses for Dispersion Meteorology	Confirm that the data used in the Atmospheric Environment TSD was approved by appropriate MOE staff. Similarly, confirm that the data presented in Figure 5.3.4-1 on page 45 of the Atmospheric Environment TSD was reviewed by appropriate Ministry staff.	In Section 5.3.1 of the Atmospheric Environment TSD, the proponent speaks to the use of a local meteorological data set. The MOE indicated that while the use of a local data set may be appropriate in certain cases, the MOE requires that all such data be approved by modelling staff at the Ministry's Environmental Monitoring and Reporting Branch (EMRB). Furthermore, a comparison was made between the meterological data used in the TSD and slightly more recent data from Environment Canada's station in Kincardine. The two data sets are slightly different. MOE suggested that while the differences are not profound, they underline the need to have the data be reviewed by MOE staff.
EIS 08-327	• Section 10.1.8, Climate, Weather Conditions and Air Quality • Section 11.4.7, Atmosphere	• *Atmospheric Environment TSD*: Section 8.1.1.1, Air Quality	Revise the adverse effects analyses in the Atmospheric Environment TSD by applying MOE standards and AAQC in assessing effects for the Air Quality VEC.	In Section 8.1.1.1 of the Atmospheric Environment TSD, it is stated that for the air quality VEC, adverse effects are considered to be likely if the maximum concentrations of the air quality indicators resulting from the project are predicted to be higher than the maximum concentrations for the air quality indicators for the existing conditions. The MOE noted that it has established standards and AAQC in order to provide benchmarks for evaluating air concentrations of pollutants that should be used.
EIS 08-328	• Section 10.1.8, Climate, Weather Conditions and Air Quality • Section 11.4.7,	• *Atmospheric Environment TSD*: Section 8.1.2 Consider Mitigation Measures	Provide a description of the planned mitigation measures to be taken during site preparation and construction stages to ensure that there will be no residual adverse effects from air emissions on VECs.	Section 8.1.2 of the Atmospheric TSD states that when an assessment of effects indicates that an adverse effect on one of the atmospheric environment VECs is likely, technically and economically feasible mitigation measures are proposed to address the identified effect. The MOE stated that it expects that the proponent will

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	Atmosphere			design its program to avoid adverse effects and that if the proponent intends to offer mitigation measures, the MOE must be given sufficient evidence that the final plan will avoid adverse impact.
EIS 08-329	• Section 10.1.8, Climate, Weather Conditions and Air Quality • Section 11.4.7, Atmosphere	• *Atmospheric Environment TSD*: Section 8.2.3.2, Effects Prediction	Provide more detail in the air quality assessment results in Section 8.2.3.2, including maps outlining off-property concentrations of the various modelled species, tables of maxima and averages, and frequencies of high values.	Results of the air quality assessment are presented in section 8.2.3.2 in the Atmospheric Environment TSD. The MOE indicated that considerably more detail is required in this section for a full evaluation, including separate tables and maps for different stages of the project.
EIS 08-330	• Section 10.1.8, Climate, Weather Conditions and Air Quality • Section 11.4.7, Atmosphere	• *Atmospheric Environment TSD*: Appendix F	Provide a specific discussion on the modification of emission calculations and justify its use for this project.	Appendix F of the Atmospheric Environment TSD contains emission calculations based upon EPA standard formulae. However, they have been modified by a term to account for near field loss which is not specifically discussed in the text.
EIS 08-331	• Section 10.2.7 Physical and Cultural Heritage Resources	• *EIS*: Section 6.10.6.2, Other Social Assets - Cultural and Heritage Resources	Identify if there are any cultural landscapes, structures, marine archaeology and engineering works of cultural heritage value within the regional, local and site study areas that could be affected, either directly or indirectly, by the proposed DGR. Describe the potential effects on these sites.	Section 6.10.6.2 of the EIS focuses only on archeological assessment. There is no indication whether there are any cultural landscapes, structures, marine archaeology and engineering works of cultural heritage value within the regional, local and site study areas that could be impacted, either directly or indirectly.
EIS 08-332	• Section 10.2.7 Physical and Cultural Heritage Resources	• *EIS*: Section 6.10.6.2, Other Social Assets - Cultural and Heritage Resources	Identify if there are any existing buildings or structures within the local and site study areas that are 40 or more years old, whether they will be removed or demolished for the project, and whether these actions will require consent from the Ontario Ministry of Tourism, Culture and Sport.	It is not clear whether there are any existing buildings or structures within the local and site study areas that are 40 or more years old. If the proponent wants to remove or demolish a building or structure of undetermined cultural heritage value, it must have consent from the Ministry of Tourism, Culture and Sport.

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EIS 08-333	• Section 10.2.7 Physical and Cultural Heritage Resources	• *EIS*: Section 6.9.7.1, Archaeological and Burial Sites • *EIS*: Section 6.10.6.2, Other Social Assets - Cultural and Heritage Resources	Provide the status of the Stage 1 Archaeological Assessment for the Deep Geologic Repository Project, as well as the revisions requested in 2008. Confirm whether the assessment has been approved by the Ontario Ministry of Tourism, Culture and Sport. Cite complete and approved archaeological assessments in the EIS and cross reference them to Section 7.0 of the EIS to see if the information presented there is consistent with the contents of the archaeological assessments.	In Section 6.9.7.1 of the EIS it is stated that archaeological investigations have been conducted around the Bruce nuclear site since the 1950s, citing the most recent assessments. The Ministry of Tourism, Culture and Sport indicated that the Stage 1 Archaeological Assessment report that was submitted to the Ministry has a different Project Information Form (P097-025-2006). In 2008, it was reviewed and the Ministry requested revisions from OPG. No revisions have been received to date and the Ministry has not received a report that meets its standards. Assessments have to be completed under the Archaeological Assessment Technical Guidelines (1993) and must be in compliance with the Standards and Guidelines for Consultant Archaeologists (2011) and the terms and conditions of the archaeological licence. All complete and approved archaeological assessments should be referenced in the EIS and reviewed to see if the existing information in Section 7.0 of the EIS is still valid.
EIS 08-334	• Section 10.2.7 Physical and Cultural Heritage Resources	• *EIS*: Section 6.9.7.1, Archaeological and Burial Sites • *EIS*: Section 6.10.6.2, Other Social Assets - Cultural and Heritage Resources	Provide the status of the Stage 2 Archaeological Assessment for the Deep Geologic Repository Project. Confirm whether the Stage 2 Assessment has been approved by the Ontario Ministry of Tourism, Culture and Sport. Cite completed and approved archaeological assessments in the EIS and cross reference them to Section 7.0 of the EIS to see if the information presented there is consistent with the contents of the archaeological assessments.	In Section 6.9.7.1 of the EIS it is stated that a Stage 2 Archaeological Assessment was completed. The Ministry of Tourism, Culture and Sport noted that it has no record of a Stage 2 Archaeological assessment commencing or having been completed. Assessments have to be completed under the Archaeological Assessment Technical Guidelines (1993) and must be in compliance with the Standards and Guidelines for Consultant Archaeologists (2011) and the terms and conditions of the archaeological licence. All complete and approved archaeological assessments should be referenced in the EIS and reviewed to see if

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				the existing information in Section 7.0 of the EIS is still valid.
EIS 08-335	• Section 13, Long-Term Safety of the DGR	• *Post Closure Safety Assessment TSD*	Provide an evaluation of the possibility of interrelated failure modes and their consequences. Evaluate the 'What-if' scenario of basement faulting leading to disruption of the shaft seal(s) and thus providing two pathways to the surface environment (fault line and shaft).	Cascading failures of complex systems (e.g., the Fukushima Daiichi nuclear accident) can lead to unanticipated and enhanced adverse consequences. The 'What-if' scenarios considered in the Post-closure Assessment do not include an evaluation of such occurrences.
EIS 08-336	• Section, 7.1, Purpose and Need for the Project • Section, 7.2, Alternatives to the Project	• *EIS*: Section 3.2.2, Long Term Planning by OPG	Provide information on the possibility of separating long-lived intermediate level radioactive waste (ILRW) from short-lived ILRW. Include a review of how proposed and operating international repositories have addressed this issue. Provide a list of the anticipated volumes & total activities of short-lived versus long-lived ILRW to be placed in the DGR. Provide information on how the design and long-term management of the DGR would be affected by the separate storage of long and short-lived ILRW.	No context required.
EIS 08-337	• Section 10.2.2,Land Use and Value	• *EIS*: Section 6.10.6.1, Inverhuron Provincial Park	Confirm whether OPG owns property adjacent to the Bruce Nuclear Site other than Inverhuron Park. Describe how OPG's lease agreement with the Ontario Ministry of Natural Resources for the Inverhuron Park property may be affected by the site preparation, construction and operation activities associated with the proposed DGR.	In section 6.10.6.1 of the EIS, it states that the Inverhuron Park property is owned by OPG and the Ministry of Natural Resources has a long term lease agreement with the corporation allowing continued operations of the park.

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EIS 08-338	• Section 14, Cumulative Effects	• *EIS*: Section 10.4.1, Bruce Nuclear Site Development	Provide information concerning the operation of the Volume Reduction Low Level Waste Incinerator, including air emissions and radioactive ash, and explain why the Volume Reduction Low Level Waste Incinerator was not included in the cumulative effects assessment in Section 10 of the EIS.	Nineteen projects that were considered in the cumulative effects assessment are listed in Table 10.4-1 in the Cumulative Effects section of the EIS. The Volume-Reduction Low Level Waste Incinerator was not included.
EIS 08-339	• Section 10.2.3, Aboriginal land, Aquatic Areas and Resource Use	• *EIS*: Section 5.1.3, Site Study Area	Provide historical information concerning the identification and delineation of the Site Study Area boundary, i.e., the “existing licensed exclusion zone for the site on land and within Lake Huron.” Include information on any consultation with Aboriginal groups that was conducted to identify the extent of that zone.	The EIS must describe land use at the site and within the local and regional study areas. The proponent should identify the lands, waters and resources of specific social, economic, archaeological, cultural or spiritual value to Aboriginal people that assert Aboriginal rights or title or treaty rights or in relation to which Aboriginal rights or title or treaty rights have been established and that may be affected by the project.
EIS 08-340	• Section 5.5, International Agreements	• *EIS*: Section 7.3.2, Identification and Assessment of Environmental Effects	Provide information on the mechanism by which the US Environmental Protection Agency (EPA) and the Michigan Department of Environmental Quality (MDEQ) would be notified In the event of any accidental, direct, untreated discharges into Lake Huron. Explain how and when any exceedances of Canadian water quality standards would be reported to the EPA and MDEQ.	Under the Great Lakes Water Quality Agreement (GWWQA) Canada is committed to share information on surface water and flow in Lake Huron with US counterparts, such as the EPA and the MDEQ.
EIS 08-341	• Section 8.1, General Information and Design Description	• *EIS*: Section 4.5, Waste to be Placed in the DGR	Provide the maximum expansion capacity of the proposed DGR. Discuss any obstacles to expansion and how these could conceivably be overcome.	Given that the safe storage and decommissioning of reactors such as Bruce (in approximately 2024) and Bruce A (in approximately 2046) overlap the operational phase of the DGR, future EAs (addressing decommissioning) could conceivably propose disposal of low and intermediate level decommissioning waste at the DGR.

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EIS 08-342	• Section 8.1, General Information and Design Description	• *EIS*: Table 4.5.1-3, Summary of Waste Acceptance Criteria	Specify the criteria for chemical compatibility used in the Waste Acceptance Criteria which will ensure that materials incompatible with packaging materials, shipping and storage container materials, other wastes or facility closure material, are not accepted in the DGR.	The Summary of Waste Acceptance Criteria (EIS Table 4.5.1-3) does not appear to include the possibility of chemical incompatibility of materials.
EIS 08-343	• Section 8.1, General Information and Design Description	• *EIS*: Table 4.5.1-3, Summary of Waste Acceptance Criteria	Provide an outline of the requirements for package certification that will be in place to ensure that the manufacturing methods and materials used are in accordance with design specifications. Provide plans that show how all packages are periodically inspected so that they comply with all the relevant requirements and specifications for waste placement in the DGR.	EIS Table 4.5.1-3 states that "all DGR waste package designs must be approved".
EIS 08-344	• Section 8.1, General Information and Design Description	• *EIS*: Table 4.5.1-3, Summary of Waste Acceptance Criteria	Provide information on center of gravity or similar requirements to ensure the physical stability of waste packages during transport, especially for travel down the 680 m shaft and movement through the DGR.	EIS Table 4.5.1-3 specifies a mass limit of 35 Mg per waste package, subject to maximum design limit for each waste package type
EIS 08-345	• Section 8.1, General Information and Design Description	• *EIS*: Table 4.5.2-1, Estimated L&ILW Radionuclide Inventory at 2062	Provide an enhanced Table 4.5.2-1 that specifies the principal waste categories for each radionuclide	EIS Table 4.5.2-1: "Estimated L&ILW Radionuclide Inventory at 2062" lists the radionuclides to be stored in the DGR and provides information on their sources. The principal waste category for each radionuclide is also of interest.
EIS 08-346	• Section 8.1, General Information and Design Description	• *EIS*: Table 4.5.1-3, Chemical Inventory of Operational and Refurbishment L&ILW	Outline any plans for recycling or restricted use of waste materials in cases where it may either be cost effective, or have a cost comparable to, placement into the DGR.	Table 4.5.3-1 of the EIS provides a Chemical Inventory of low and intermediate level waste including, for example, chemical inventories of 3.4 million kilograms of copper and 1.5 million kilograms of lead.
EIS 08-347	• Section 8.1, General Information and Design Description	• *EIS*: Table 4.5.1-3, Summary of Waste Acceptance Criteria	Provide information on any limits for the presence of a maximum amount of free water (in cubic liters) in a waste package. If no such limits are proposed, explain why.	EIS Table 4.5.1-3: "Summary of Waste Acceptance Criteria" states that residual liquids generally must be less than 1% free liquid by volume, and for bulk IX resins must be less than 5% free water by volume.

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EIS 08-348	• Section 8.1, General Information and Design Description	• *EIS*: Table 4.5. 1-3, Summary of Waste Acceptance Criteria	Explain the apparent inconsistency arising when sludges are characterized as solids. Provide additional information on the waste packaging of sludges and any measures taken to control condensation and leakage following packaging.	EIS Table 4.5.1-3 defines "waste form" criteria as "solid only." But it is also stated that "sludges must have slump of less than 150 mm". Wet concrete typically has a slump of 150 mm to 175 mm. Sludges are typically considered to be semi-solid, and it appears that the acceptance criteria for sludge is bordering on what could be considered wet.
EIS 08-349	• Section 8.1, General Information and Design Description	• *EIS*: Table 4.5.3-1, Chemical Inventory of Operational and Refurbishment L&ILW	Discuss the current and future chemical mobility of radionuclides and potentially hazardous constituents taking into account the effects of incineration, the solubility in steel, as well as other factors.	The EIS states that over long time period the waste and containers will degrade. The various metals will degrade into organic salts, oxides, or minerals consistent with the surrounding reducing saline water chemistry. The organic materials will generally degrade into simpler elements, likely under microbial-mediated reactions that will be slow under this expected saline, reducing condition. The chemical mobility of radionuclides and other potentially hazardous constituents may therefore change over time.
EIS 08-350	• Section 8.1, General Information and Design Description	• *EIS Summary*: Page 10 and 11 • *EIS*: Table 4.5.3-1, Chemical Inventory of Operational and Refurbishment L&ILW	Clarify how PCBs generated in the incinerator and trapped in ash will be excluded from the waste emplaced in the DGR	The EIS summary, on pages 10 and 11, states that L&ILW may contain varying amounts of chemicals or elements that can be hazardous, including PCBs produced in the incinerator and trapped in the ash. In the EIS, Table 4.5.1-3, Summary of the Waste Acceptance Criteria, states the PCB wastes are excluded.
EIS 08-351	• Section 11.4.6, Radiological Conditions	• *EIS*: Section 4.1.1.4, Radiological Dose Criteria	Differentiate between exceedances and target doses for project workers and members of the public. Identify the likely dose scenarios, both acute and annual. Provide dose estimates as specific values, or given as a range, rather than stating it will be “much lower than” a given standard or estimate.	Section 4.1.1.4 in the EIS states that the radiological doses from radionuclide releases and direct radiation must not exceed 50 mSv for project workers and 1 mSv for members of the public. The EIS states that estimated worker doses from inhalation, immersion and external exposure are expected to be “much lower than OPG’s occupational target of 10 mSv/a for workers”.

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EIS 08-352	• Section 8.2, Site Preparation and Construction	• *EIS*: Section 6.2.5.2, Local Study Area • *EIS*: Section 7.13.2, Coastal Flooding	Clarify that for the new site configuration, 9% of the surface areas will be impervious, while the rest will be dirt, gravel, turf, vegetation, or other porous surface. Also clarify whether these surfaces will be permanent. Provide details on sustainable design features, which would increase infiltration of stormwater that have been incorporated into construction plans. Describe temporary actions, such as during construction lay-down, planned to reduce resultant effects of precipitation.	On page 7-12 of the EIS, it states that new infrastructure will result in 9% of new impervious surface area. There is little discussion of how temporary effects have been reduced. As well, there is no discussion of whether this 9% of surface areas can include elements of sustainable design, such as permeable pavement, which would increase infiltration of stormwater.
EIS 08-353	• Section 11.2, Mitigation Measures	• *EIS*: Section 7.4.2.1, Plant Species – Mitigation Measures	Provide specific detail on mitigation concerning plant species. Address how mitigation will take place, which entity will be responsible for ensuring mitigation, what the monitoring schedule will be, what will be used as measures of success, and how adaptive management, if necessary, will be applied.	Mitigation is an important component in determining whether or not to subject a VEC to further levels of evaluation. In certain sections mitigation measures are lacking any specific detail and do not appear to mitigate the proposed effects. For example, on page 7-60 of the EIS, the discussion of mitigation measures for plant species VEC is very general and does not discuss any detail.
EIS 08-354	• Section 12, Accidents, Malfunctions and Malevolent Act	• *EIS*: Section 8, Malfunctions, Accidents and Malevolent Acts	Provide draft fire protection and emergency repose plans that include all of the major components (i.e. as required under the National Fire Code and federal and provincial emergency response protocols). Identify likely fire scenarios during the construction and operational phases of the project. For each provide details on mitigation measures aimed at preventing and responding to fires. Provide a discussion how the emergency response plans of the DGR, the Bruce nuclear site, and offsite emergency response plans are related, overlap or intersect. Discuss whether the Bruce site emergency plan and	The EIS describes a number of potential malfunctions or accidents, including fires. The Bruce nuclear site is served by its own internal emergency response team, medical and fire response facilities, in addition to offsite emergency response plans. In addition, the DGR has proposed similar response plans. It is unclear how the emergency response plans are related, overlap or intersect.

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			offsite emergency response plans will be modified or expanded, and if so, how.	
EIS 08-355	• Section 12, Accidents, Malfunctions and Malevolent Act	• *EIS*: Section 8, Malfunctions, Accidents and Malevolent Acts	Re-analyze the accident scenario to better incorporate aerial assaults. Provide estimates of the magnitude of forces generated by an aerial impact event and how these would affect the infrastructure and integrity of the repository. Discuss how an attack on the above ground nuclear reactors at the Bruce Nuclear site would impact operation, security and stability of the DGR.	The security analysis seems to be based on a land assault. There is limited consideration given to any kind of aerial assault. Because the site is already co-located with operating nuclear reactors, it is likely to have a higher risk of purposeful assault, including an aerial one
EIS 08-356	• Section 5.5, International Agreements	*EIS*: Section 7.3.2, Identification and Assessment of Environmental Effects	Provide a conceptual outline of plans on the methods, timing, and degree of information sharing proposed to address any concerns by EPA and the MDEQ about the project's potential effects. In particular address the communications protocol for the following: • any accidental, direct, untreated discharges to Lake Huron; • any exceedance of established Canadian radon standards; • radiation monitoring data and reporting on an annual basis and when there is an exceedance of Canadian air quality standards; and • emergency plans that may potentially affect the United States.	The EPA and the MDEQ have requested to be informed about certain developments and monitoring parameters during the construction and operation of the DGR.
EIS 08-357	• Section 10.1.3 Groundwater	• *Hydrological Modelling TSD*: Section 6.2	Review Figures 6.6 to 6.8 in the Hydrological Modelling TSD to confirm that they accurately reproduce the pressure or hydraulic head distribution beneath the state of Michigan portion of the Michigan Basin.	Section 6.2 of the Hydrological Modelling TSD presents the results of an analysis of the hydrogeologic regime in a cross-referenced section of the entire Michigan Basin. It is not clear why this analysis was included or

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			Explain the deviation between observed pressures or hydraulic head distribution beneath the state of Michigan portion of the Michigan Basin and the modelling results presented in these figures.	performed. It appears that Figures 6.6 to 6.8 in the Hydrological Modelling TSD do not accurately reproduce the pressure or hydraulic head distribution beneath the state of Michigan portion of the Michigan Basin. As an example, hydraulic head is known to be extremely abnormally high in portions of the Silurian (principally the Ruff Formation and to a lesser extent the A-2 Carbonate of the Salina Group). Additionally, the Total Dissolved Solids concentrations shown in Figure 6.5 of the Hydrological Modelling TSD may be somewhat high for Cambrian and Ordovician formations.
EIS 08-358	• Section 14, Cumulative Effects Assessment	• *EIS*: Section 10.2, Cumulative Effects Assessment Method	Describe in more detail than is provided in the EIS the conceptual model used for the assessment of cumulative effects, including the screening arguments used to eliminate synergistic effects from further analysis. Further, provide the screening arguments used to eliminate interactions among VEC and multiple stressors.	In Section 14 of the EIS guidelines it is stated that the "EIS must include different forms of effects (e.g., synergistic, additive, induced, spatial or temporal) and identify impact pathways and trends." It is stated in Section 11 of the EIS guidelines that "specific attention must be given to interactions between the project and the identified VECs." In Section 10 of the EIS, OPG does not describe if or how complex effects (e.g., synergistic, interactive) were considered. It is stated in Section 1.1 of the CEAA Cumulative Effects Practitioner's Guide that "the incremental additive effects of the proposed action on the VECs are assessed. If the nature of the effects interaction is more complex (e.g., synergistic), then the effect is assessed on that basis, or why that is not reasonable or possible is explained." The use of an incremental, VEC-by-VEC approach does not produce an integrated cumulative effects assessment. Integration of multiple stressors from all relevant human activities within the temporal and spatial

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				boundaries for the assessment should be considered, at least at a conceptual level, and then examined for their potential to produce significant adverse effects.
EIS 08-359	• Section 14, Cumulative Effects Assessment	• *EIS*: Section 10.2, Cumulative Effects Assessment Method	Describe how the use of individual thresholds for each VEC can be confidently used to assess cumulative effects to local and regional terrestrial and aquatic ecosystems. Explain how the overall integrity and resilience of the local ecosystem is adequately represented by the selected VECs and how the monitoring and cumulative effects assessment may ensure that thresholds are not crossed. Provide a figure showing how the various monitoring approaches inform one another in space, time and type of effect, and how they are linked to effective response capabilities	This IR follows from EIS-08-358. Section 10 of the EIS guidelines states that "for the biological environment, baseline data in the form of inventories alone is not sufficient for the joint review panel to assess effects. The proponent must consider the resilience of species, communities, and their habitats." OPG provides a preliminary discussion of thresholds but does not assess the long-term integrity of the ecological system. OPG does not explain how the overall integrity and resilience of the ecosystem will be maintained, including how ecosystem-level thresholds will be identified and related effects managed through the measurement of VECs. The follow-up monitoring described in Table 12.2-1 of the EIS does not explain how the individual monitoring efforts will be sufficient to describe the integrity and resilience of the local ecosystem over the long term.
EIS 08-360	• Section 14, Cumulative Effects Assessment	• *EIS*: Section 10.2, Cumulative Effects Assessment Method	Explain how the cumulative effects assessment informed the evaluation of alternative means of carrying out the Project, as well as the selection of the preferred alternative.	In Section 7.3 of the EIS, it is stated that the EIS "must also describe the environmental effects of each alternative means. In describing the preferred means, the EIS should identify the relative consideration of environmental effects, and technical and economic feasibility. The criteria used to identify alternative means as unacceptable, and how these criteria were applied, must be described, as must the criteria used to examine the environmental effects of each remaining alternative means to identify a preferred alternative." It is unclear how cumulative affects assessment informed the evaluation of alternative means.

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EIS 08-361	• Section 11.3, Significance of Residual Effects	• *EIS*: Section 10.2, Cumulative Effects Assessment Method	Explain the rationale for not assessing effects that may not be significant on their own, but that may still be significant at the cumulative effects level; i.e., interactive effects via processes such as trophic cascades or changes caused by alteration in a habitat-related VEC Describe the logic used to assess the significance of cumulative effects, including significance over the entire spatial and temporal scale of the proposed project.	This IR follows from EIS-08-358. In Section 11.3 of the EIS guidelines, it is stated that "the EIS must clearly explain the method and definitions used to describe the level of the adverse effect (e.g., low, medium, high) for each of the above categories and how these levels were combined to produce an overall conclusion on the significance of adverse effects for each VEC." Section 3.1 of the CEAA Cumulative Effects Practitioners Guide provides the following fundamental direction for cumulative effects assessment: a) Determine if the project will have an effect on a VEC. b) If such an effect can be demonstrated, determine if the incremental effect acts cumulatively with the effects of other actions, either past, existing or future. c) Determine if the effect of the project, in combination with the other effects, may cause a significant change now or in the future in the characteristics of the VEC after the application of mitigation for that project. In Section 3.5.2 it is noted that a "cumulative effect on a VEC may be significant even though each individual project-specific assessment of that same VEC concludes that the effects are insignificant. This is a fundamental principle in the understanding of cumulative effects". It is also noted that "an insignificant local effect may still contribute to a significant cumulative effect."
EIS 08-362	• Section 11.3, Significance of Residual Effects	• *EIS*: Section 7., Effects Prediction, Mitigation Measures and Significance of	Describe the professional qualifications of the members of the project team in order to demonstrate that their professional judgment is sufficient, given that many aspects of the assessment of significance of residual	Section 11.3 of the EIS guidelines states that "the EIS must clearly explain the method and definitions used to describe the level of the adverse effect (e.g., low, medium, high) for each of the above categories and how

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		Residual Effects	effects are either qualitative or the chosen magnitudes are based solely upon the professional judgment of the project team. Provide details on the process used to come to a consensus among professionals involved in the evaluation of significance. Indicate where the reported professional judgment was unanimous, and where the presented conclusion represents a compromise (or synthesis or averaging, etc.) among a range of professional positions. Provide justification for the choice of magnitudes for levels of significance (e.g., Table 7.5.3-1, relating to magnitude level definition for Aquatic Environment VECs). Define 'Social/Ecological importance', and explain how it was determined and by whom. Describe how the level of irreversibility may be determined for effects on the individual VECs.	these levels were combined to produce an overall conclusion on the significance of adverse effects for each VEC." In various instances in Section 7 of the EIS, the significance of the environmental effects on the various VECs is determined based on the following concerns (quoting from EIS Section 7.8.3) "magnitude, geographic extent, timing and duration, frequency, and degree of irreversibility are combined to identify an environmental consequence." In each instance, a figure is provided that shows the decision-making procedure for determining significance amongst these concerns (e.g. EIS Figure 7.8.3-1). OPG has not detailed how the decision-making tree was followed through, or who was undertaking the decision-making process. Within the decision-making procedure itself, OPG bases significance upon the "social/ecological importance" of the VEC, without explanation of how importance was determined.
EIS 08-363	• Section 5.2, Project Overview and Purpose	• *EIS*: Section 1.2.5, Project Cost	Explain the rationale for the 300-year timeframe for passive monitoring, given the long time-frame of the project.	The L&ILW in the proposed DGR will be radioactive beyond 300 years.
EIS 08-364	• Section 8.3, Abandonment	• *EIS*: Section 4.12, Abandonment and Long-Term Performance Phase	Explain how OPG's plans for operating the DGR anticipate requirements for future passive control. Include reference adaptive management plans and processes. Describe OPG's reasonably anticipated range of possible requirements for abandonment.	In Table 2.6.1-1 of the EIS, OPG mentions "at this time there are no specific plans [for passive control]. Control mechanisms aren't required for another 50 to 100 years. At that time, it is expected several countries will be in the same position, and that a solution will be developed with international consensus."

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EIS 08-365	• Section 8.7, Accidents, Malfunctions and Malevolent Acts	• *EIS*: Section 8.1, Initiating Events • Malfunctions, Accidents and Malevolent Acts (MAMA) TSD (Section 3.2)	Elaborate on the response to EIS 01-03. Provide specific definitions for "possible" events, "unlikely" events, and "non-credible" events for each of the initiating events. Support the definitions with references or detailed justification to supplement the reference supplied in the response to EIS 01-03.	In Section 8.1 of the EIS, OPG outlines three categories that describe the likelihood of impacts: • possible events: annual frequency greater than 10^{-2}; • unlikely events: annual frequency between 10^{-2} and 10^{-7}; and • non-credible events: annual frequency of 10-7. The above general definitions may not be appropriate for specific initiating events. Labeling certain events as 'unlikely' may be misleading, given the long timeframe of the Project and the likelihood of these events over the long term. It is anticipated that the definitions will vary with each initiating event.
EIS 08-366	• Section 13, Long-Term Safety of the DGR	• *EIS*: Section 9, Long-Term Safety of the DGR	Describe the 'considerable international experience' of other DGR projects sufficiently to establish how the success and failure of other DGR-type projects can inform the proposed DGR. Provide any detail of the facilities in Forsmark, Sweden (commissioned in 1988) and Loviisa, Finland (operating since 1997) to indicate what insights have been gained, what uncertainties remain, and how the operating experience should be applied for the proposed DGR.	In Section 7.10.2.11 of the EIS, OPG notes that the proposed DGR project introduces a new type of facility that is unique to North America. However, to counter the concerns of related to the uniqueness of the undertaking, Section 3.3.7 of the EIS and the Executive Summary of the IAS both mention considerable international experience with all three options (enhanced processing and storage, surface concrete vaults, and deep rock vaults) for the long-term storage of LILW. The two deep rock vaults noted in the IAS relate to one in Forsmark, Sweden (commissioned in 1988) and Loviisa, Finland (operating since 1997).
EIS 08-367	• Section 13, Long-Term Safety of the DGR	• *EIS*: Section 9, Long-Term Safety of the DGR	Explain how OPG's technologies and mitigation and management methods have been proven. Define the criteria used to determine whether a technology or method is "proven". Explain whether these "proven" technologies relate only to LLW, or also include ILW.	It is noted in Section 3.3.5.2 of the EIS that "the engineering feasibility studies found that each of the long-term management options is technically feasible, uses internationally proven technology and is capable of accommodating all of the LLW currently stored and likely to be received in future."

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				In Section 3.3.5.3 of the EIS it is noted that "the screening determined that, while each the options for the long-term waste management facility had the potential to cause effects on the environment, all the identified potential effects can be appropriately managed using proven mitigation and management methods." OPG should elaborate on its definition of a proven technology, and provide justification for how both the technologies and mitigation and management methods have been proven for both LLW and ILW.
EIS 08-368	• Section 16, Follow-up Program	• *EIS*: Section 12, Follow-up Program	Describe how OPG will ensure that its follow-up program will be sufficiently comprehensive to adequately characterize the socioeconomic system beyond the 2009 baseline. Provide additional rationale with respect to the effects of the DGR on the tourism and cottaging sectors due to the location of the DGR being near Lake Huron.	Table 12.2-1 in the EIS outlines the proposed monitoring for the socioeconomic environment. This socioeconomic monitoring program may not detect all likely effects. For example boom and bust effects may be missed if the monitoring ignores periods of low employment, such as following decommissioning. Further information is also required to assess the effects on the tourism and cottaging sectors
EIS 08-369	• Section 14, Cumulative Effects Assessment	• *EIS*: Section 10, Cumulative Effects Assessment	Explain why economic boom and bust socioeconomic effects were not considered at the level of cumulative effects assessment. Describe the mitigation measures to be taken should cumulative boom and bust effects be reasonably anticipated.	Section 7.10.2 of the EIS discusses the benefits of job creation, and OPG notes that "the DGR Project is forecast to create 650 jobs in the Local and Regional Study Area during peak construction, 128 jobs per year on average during operations and 548 jobs per year on average during decommissioning." Figure 7.10.2-2 indicates that the number of jobs in the region is expected to increase from less than 100 jobs in 2054, up to over 1,300 jobs in 2060, and then decrease down to 0 jobs by 2064. A smaller, but potentially still significant drop is expected to occur between 2016 and 2018. In Section 6.10.4.2 of the EIS, it is noted that a few

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				stakeholders “indicated that adverse effects on the local economy were evident after the Bruce A station was laid-up in 1998 and some indicated that the ’boom and bust’ cycle associated with the facility has made it difficult to plan for the future. Others indicated a need for the economy to be more diversified to avoid complete dependency on the jobs generated by the presence of the Bruce nuclear site.”
EIS 08-370	• Section 2.5, Precautionary Approach • Section 10.41.4, Terrestrial Environment • 10.1.5, Aquatic Environment	• *EIS*: Table 6.4.7-2, Provincially Significant Wildlife Species in the Local Study Area based on the review of the Natural Heritage Information Centre Database • *Terrestrial Environment TSD*: Table 5.8.2-2, Provincially Significant Wildlife Species in the Local Study Area Based on a review of the NHIC Database	Provide a detailed record of the searches completed to identify species and the rationale for not conducting field studies to ascertain species of natural conservation status at a federal, provincial, regional or local level and their critical habitats in the Study area, and support for the statement made in CEARIS Document # 683 that “there have been no records since 1990 of eastern foxsnake occurring in proximity to the DGR Project site”, and the conclusions that the species identified are not of a concern for the DGR Project. Provide a record of the searches completed on the significant species and an explanation for the classification or failure to update the status of the following species: • *Regina septemvittata*, Queensnake, listed as Threatened in the EIS – status changed to Endangered in April 2010 • *Panterophis gloydi*, Eastern Foxsnake, listed as Threatened in the EIS – Status of Great Lakes/St. Lawrence population designated Endangered in April 2008 • *Caprimulgus vociferous*, Whip-poor-will not classified in the EIS – status change to Threatened in April 2009	The Inverhuron District Ratepayers Association indicates that local residents have reported sightings of several species of concern in the Local Study Area, including a report of an Eastern Foxsnake. The Association stated that the sighting the species was confirmed by a biologist visiting the area and was reported to the MNR. The Association further indicates that residents have also reported sightings Eastern Milksnakes, Bobolink, Barn Swallows and Indian Cord Grass.

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			• *Melanerpes erythrocephalus*, Red-headed Woodpecker, listed as species of concern in the EIS – status changed to Threatened in April 2007.	
EIS 08-371	• Section 9.3, Valued Ecosystem Components	• *EIS*: Section 5.3, DGR Environmental Impact Statement Valued Ecosystem Components • *Terrestrial Environment TSD*: Section 4, Selection of VECs	Explain the rationale for excluding mushrooms (and *Boletus edulis*) as a VEC in the EIS.	Mushrooms (and *boletus edulis*) have been identified as a common species in the Region and mushrooms are used as a parameter for the Radiological monitoring program (REMP)
EIS 08-372	• Section 10, Existing Environment • Section 10.1.1, Geology and Geomorphology	• *EIS*: Section 6.2.9, Geomechanics • *Golder Associates Factual Report Report* # 1011170042-REP-G2040-0004-00	Explain the absence from the core log record for borehole DGR-8 of any information relating to significant geomechanical parameters such as core recovery and Rock Quality Designation (RQD) percentages.	In the Golder Associates Factual Report, submitted February, 2012 to OPG, geotechnical logging parameters of rock at the main and ventilation shaft sites are presented for boreholes DGR-7 and DGR-8. Over large sections of tabulated data for Borehole DGR-8 that penetrated through the Cobourg Formation, there is no indication of Total or Solid Core recovery percentages, or RQD percentages (for example, for the Blue Mountain Formation from 643.9 m, through the entire Cobourg Formation and into the Sherman Fall Formation to a depth of 718 m). Data from this section of the core logs, within which the DGR is to be constructed, is most important for geomechanical design purposes and for assessing the stability of repository excavations.
EIS 08-373	• Section 10, Existing Environment • Section 10.1.1, Geology and	• *EIS*: Section 6.2.9, Geomechanics • *Golder Associates Factual Report Report*	Justify whether field estimated unconfined strength values for rock, as assessed using the ISRM (1981) Rock Hardness Technique, are suitable for assessing numerical modelling and engineering design factors in	In the Golder Asociates Factual Report, submitted April, 2012 to OPG, rock mass characterization parameters of rock at the main and ventilation shaft sites are presented for boreholes DGR-7 and DGR-8.

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	Geomorphology	# 1011170042-REP-G2040-0004-00 • *Golder Associates Factual Report Report* # 1011170042-REP-G2040-0005-00	geomechanical analysis of the DGR. Explain why differences exist between rock unconfined compressive strengths that have been determined using laboratory measurement and field estimation techniques, and in which field estimated strengths all exceed laboratory-derived strengths for similar formations at depths below approximately 525 m and through the proposed repository formation. Explain why borehole logging data plots for hole DGR-7, contained within Golder Factual Reports 1011170042-REP-G2040-0004-00 and 1011170042-REP-G2040-0005-00, do not show similar unconfined compressive strength data.	In Section 2.2 (p.3) of this report, it is stated that "The strength factor in this (RMR) system was taken from the field estimation of the strength index …" and that this field index value is derived from guidelines established by the International Society of Rock Mechanics that provide qualitative estimates of rock unconfined compressive strength over various strength ranges. Ranges in strength for "Weak rock" are stated to range from "5-25 MPa" and for "Very strong rock" range from "100-250 MPa". Such strength estimations, in addition to being only qualitative assessments, are also subject to wide ranges in parameter values within each range. Data shown in EIS Figure 6.2.9-1 (p. 6-53) summarizes laboratory-measured unconfined rock strength for boreholes DGR-1 through DGR-6. Field estimates of core unconfined strength for borehole DGR-7 and DGR-8 are similarly tabled in Appendix B of Golder Factual Report 1011170042-REP-G2040-0004-00. A summary of average strength data as derived using both methods (laboratory-measured and field estimated) is provided in Table 3.3 (Golder Factual Report 1011170042-REP-G2040-0005-00). Strength data in Table 3.3 indicates that field estimated values for rock strength for the Georgian Bay Formation and all deeper ones, including the Cobourg Formation, are higher than rock strengths derived from laboratory measurements. In Golder Associates Factual Report 1011170042-REP-G2040-0004-00, no strength data is indicated in the drillhole log, whereas in Golder Associates Factual Report 1011170042-REP-G2040-0005-00, the full borehole length of the record shows complete strength parameter data.

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EIS 08-374	• Section 10, Existing Environment • Section 10.1.1, Geology and Geomorphology	• *EIS*: Section 6.2.9, Geomechanics • *Golder Associates Factual Report Report* # 1011170042-REP-G2040-0004-00 • *Golder Associates Factual Report Report* # 1011170042-REP-G2040-0005-00	Justify why no comparison, correlation or utilization was made between laboratory-derived and field estimated unconfined compressive strength data for rock recovered from within similar formations and depths, though for different boreholes, at the DGR site. Explain whether numerical modelling and engineering design procedures for the DGR excavations and shafts (that utilize rock mass characterization parameters) will be conducted using only inferred strength data from the DGR-8 borehole, or whether combined strength data from all previous lab testing and field estimated values from boreholes DGR-7 and DGR-8 will be used for this purpose. Provide any additional unconfined compressive strength data that may have been determined on the basis of laboratory strength testing of rock cores recovered from boreholes DGR-7 and DGR-8.	Golder Associates Factual Report 1011170042-REP-G2040-0005-00 states that this report was used "to estimate the rock mass quality at OPG's DGR … along the shaft pilot borehole (DGR-8) and the ventilation shaft (DGR-7) … for the purpose of estimating the parameters for numerical modelling and for engineering purposes." In Section 2.2 (p. 1) of this Report, the "strength factor in this system was taken from the field estimation of the strength index …" and was used to assess coefficients that would be applied for strength modelling purposes. This statement indicates that only field estimated strength data would be applied for numerical modelling purposes and subsequent engineering design, without any consideration being given to utilizing a substantial database of additional rock strength data derived from laboratory testing of cores from other boreholes.
EIS 08-375	• Section 10, Existing Environment • Section 10.1.1, Geology and Geomorphology	• *EIS*: Section 6.2.9, Geomechanics • *Golder Associates Factual Report Report* # 1011170042-REP-G2040-0005-00	Justify the decision to utilize the modified Tunnelling Quality Index (Q') determination over the entire proposed shaft lengths, including the upper elevation sections where high inflow water conditions exist. Justify also the decision to use the dry rock condition in estimating RMR values over the entire proposed shaft length, rather than using wet rock conditions in upper shaft sections where factor assessment could be appropriately applied.	In Golder Associates Factual Report 1011170042-REP-G2040-0005-00 it is stated that "parameters for water and stress (Jw and SRF) were not considered in this classification stage …". In the upper elevations of the proposed shafts, high inflow water conditions are known to exist that could provide more conservative Tunnel Index characterization factoring if (Jw) and (SRF) factors were to be considered. In Section 2.2 (p. 2) of this report, the RMR characterization study was also compiled by assuming that fully dry conditions exist throughout the length of the shafts. The difference in RMR factor values between fully dry and very wet rock conditions can be as much as 10, or 10% of the maximum possible RMR value.

IR#	EIS Guidelines Section	EIS Section or other technical document	Information Request	Context
EIS 08-376	• Section 10, Existing Environment • Section 10.1.1, Geology and Geomorphology	• *EIS*: Section 6.2.9, Geomechanics • *Golder Associates Factual Report Report* # 1011170042-REP-G2040-0005-00	Explain the sources of unconfined compressive strength data that are listed in Table 3.3 (p.9) of the Golder Associates Factual Report 1011170042-REP-G2040-0005-00. Provide an assessment of the accuracy and extent (in frequency of tests per formation) of the strength estimates shown for characterizing the various rock formations sampled, and the suitability of current core strength testing for providing accurate and repeatable data for rock mass characterization and engineering design purposes. Explain what variation in (RMR'76) values would develop if "Previous UCS results" data were to be applied in the characterization assessment in place of the "New" strength data, and how this would affect the comparison of rating values between the RMR and Q' techniques.	In Golder Associates Factual Report 1011170042-REP-G2040-0004-00, no strength data is indicated in the drillhole log, whereas in Golder Associates Factual Report 1011170042-REP-G2040-0005-00, the full borehole length of the record shows complete strength parameter data. A summary table of geomechanical parameters used in the derivation of RMR and Q' values is illustrated. Two different columns of unconfined compressive strength data are herein indicated to show average UCS values versus depth conditions in borehole DGR-8, with only several indicating standard deviation values for the published data. One is labeled for "UCS Previous Results" and the other for "UCS New test Results". For the borehole depth range between 11.9-47.1 meters (Lucas Formation), only three measured field strength values ("New test Results"?) are indicated in Table 3.3. Based on information shown in the EIS, Table 6.2.9-1 (p. 6-53), and for this same formation, only two lab-measured ("Previous Results"?) are indicated. In the caprock and Cobourg formations, the "Previous" UCS results are indicated to be significantly less than values inferred by "New" UCS field-estimated results. However, the RMR'76 parameter evaluation process was completed using the "New" UCS values only ("the parameters used were measured directly in the field.")
EIS 08-377	• Section 10, Existing Environment • Section 10.1.1, Geology and Geomorphology	• *EIS*: Section 6.2.9, Geomechanics • *Golder Associates Factual Report Report* # 1011170042-REP-G2040-0005-00	Define the meaning of the term "strength index" that is listed in Figures 5 through 28 in the Rock Mass Characterization Factual Report (1011170042-REP-G2040-0005-00) Explain why no input parameter information plots exist for rock formations lying below the bottom of the Blue	In Golder Associates Factual Report 1011170042-REP-G2040-0005-00, the input parameter information that is used in estimating RMR conditions for each formation is based on the System defined in Table 3.2 (p. 8) and field measurements of various geomechanical parameters that are plotted in Figures 5 through 28.

IR#	EIS Guidelines Section	EIS Section or other technical document	Information Request	Context
			Mountain Formation at approximately 657.9 m depth, and notably for the Cobourg Formation within which the DGR is proposed to be developed.	In each figure, a “strength index” is identified and shows a range of values over all formations that range between 2.0 and 5.5. The meaning of the term “strength index” is undefined, and is neither the Unconfined Compressive Strength (UCS) value nor the RMR strength rating value that is predicted from Table 3.2. Inasmuch as the field-estimated strength of the rock derives from the (ISRM 1981) Field Estimation of Rock Hardness table (Table 3.1, Golder Associates Factual Report 1011170042-REP-G2040-0004-00), there may be correlation between the “strength index” and the hardness “grade” that is assessed using this table.
EIS 08-378	• Section 7.1 Purpose and Need for the Project	• *EIS*: Section 3.1, Purpose of the Project	Provide a specific break down of waste volumes per reactor and per activity, in the form of a pie chart. Identify whether any decommissioning waste is in the current proposed project description.	On page 3-2, in section 3.1 'Purpose of the Project' it states if the fleet of 20 reactors each operate to the end of life (a nominal 50 years), which assumes refurbishment of each of the generating stations, approximately 200.000 m^3 (emplaced volume) of operational and refurbishment L&ILW would be produced". On page 3-4 of the EIS, it states “...as a result of the refurbishment and improvements activities it is expected the life of each reactor unit will be extended for up to 25 to 30 years." "About 21,000 m3 of radioactive waste will be generated from the planned refurbishment activities". It is not evident if the amount of 21,000 m3 is the waste generated from each of the 16 reactors (20 minus 4 at Pickering B) or a combined amount for all ongoing and possibly planned refurbishments. Also, on the page 3-4, OPG states that, “in the future, an additional approximately 135,000 m3 of L&ILW is expected to be produced during the decommissioning of the [20] reactors and the associated nuclear waste storage facilities." The next sentence reads: "The

IR#	EIS Guidelines Section	EIS Section or other technical document	Information Request	Context
				currently proposed DGR Project does not include management of decommissioning waste".
EIS 08-379	• Section 10 Existing Environment • Effects Prediction, Mitigation Measures, and Significance of Residual Effects	• *Aquatic TSD*: Section 5.2, Aquatic Habitat and Biota	**Follow up to EIS-01-14a:** Provide detailed Lake Whitefish baseline data from historic and up-to-date fish studies including: a description of potential and known habitat usage (i.e., nursery, rearing, feeding and migratory) in the study areas, especially MacPherson Bay; catch-per-unit-effort or other forms of abundance data such as those obtained using mark/recapture; habitat characterization for nursery, rearing, feeding, and migration corridors with emphasis on the availability of spawning habitat, the availability of food resources for rearing and adult feeding, and any current effects on migration; data on fish health (standard metrics such as condition factor, size-at-age, fecundity, incidence of pathology); and, trends in population estimates with time. Provide assessment of the potential effects of DGR Project on factors critical to the maintenance of a sustainable population of Lake Whitefish in the site and local study areas (i.e., recruitment and survival), with emphasis on: Lake Whitefish spawning habitat; effects on food supply in nursery and adult feeding habitats (benthic invertebrates); and effects on fish health (notably fecundity). Provide an assessment of the effects of unexpected releases (e.g., temperature elevation, high oxygen-demanding substances) from the stormwater management system (e.g., 100 year storm or mechanical failure).	CNSC indicated that it has received new information from Bruce Power regarding Lake Whitefish. Lake Whitefish is an important species of Aboriginal interests, and was identified as an aquatic VEC in Lake Huron and Embayment. It is currently an important species for Aboriginal and non-Aboriginal commercial fishery around Lake Huron. Lake Whitefish was the focus of concern in several EAs at the Bruce nuclear site. The EA follow-up monitoring results of whitefish spawning habitat utilization indicated that mature and gravid male and female Lake Whitefish were found in all eight sampling sites including MacPherson Bay (Bruce, 2010). The Lake Whitefish capturing rate peaked in early to mid November. The 2007 fish field studies for the DGR Project did not catch any Lake Whitefish in Lake Huron. The lack of catching this species may be due to the fact that Lake Whitefish usually use the nearshore spawning area around November when water temperature drops below 10 °C. The fish field sampling events conducted by OPG on June 21 & 22, August 15 and October 4, 2007. This information is required to meet the EIS Guidelines: Section 10 Existing Environment of the EIS Guideline state the existing environment must be described in sufficient detail to permit the identification, assessment and determination of the significance of potentially adverse environmental effects that may be caused by the project. Section 11 Descriptions of potential effects must include changes to food chain and food web dynamics as a

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				habitat component as this relates to fish populations. Particular attention must be placed on the effects to the existing sport fishing and Aboriginal commercial fishing industry.
EIS 08-380	• Section 10.1.1 Geology and Geomorphology	• *EIS*: Section 6.2, Geology • *Geosynthesis TSD* • *PSR*: Section 4.1 • *Three Dimensional Geological Framework Model*	Provide information regarding missing information about the occurrence of reefs in the 3DGFM Model. How would the presence of reefs affect the model and what are the key pieces of the geosynthesis that might be affected by their inclusion? How would the presence of reefs (on site and regionally) – that may be highly permeable – affect the long term safety case, given that the system is diffusion dominated? Quantify the uncertainties associated with construction of the model, arising from the interpolation of information from adjacent wells and the grouping together of stratigraphic surfaces and uneven borehole distribution in the Regional Study Area.	This IR relates to confidence in the Three Dimensional Geological Framework Model (3DGFM) as a predictive tool, which was presented at the October 11, 2012 Technical Information Session. The model is important as the framework used in the analysis of the geological evolution of the Regional Study Area (RSA). In particular, it is important because it is used as the framework for the regional hydrogeological modeling in the RSA. Both are key components for the long term safety case. Table 2.1 in the 3DGFM report documents the occurrence of reefs in the RSA, yet they are not included in the model. This requires an explanation. Uncertainties inherent in the construction of the model require discussion to determine how they may impact the safety case. The process of interpolating stratigraphic surfaces from historic well logs has been described, but not quantified. Most boreholes lie to the south of the proposed DGR site, and there is one significant cluster of wells to the northeast of the site. Of the 299 wells, only 73 reach the Precambrian basement. Furthermore, borehole information from Michigan was used to extrapolate the model beneath Lake Huron, to the west of Bruce.
EIS 08-381	• Section 8, Description of the Project • C1NFR 5(a), (d), (f)	• *EIS*: Section 4.7, Site Preparation and Construction Phase	Provide a plan for the geomechanical modeling of the large openings at the shaft station and service area. Provide a risk/safety assessment for the excavation of	This IR was generated based on the information provided at the October 11, 2012 Technical Information Session on numerical modeling and the July 18, 2012 Technical

IR#	EIS Guidelines Section	EIS Section or other technical document	Information Request	Context
	and (i)	• *EIS*: Section 4.16, Occupation Health and Safety Programs • *Preliminary Safety Report*: Section 6.3 • *Preliminary Safety Report*: Section 9.4 • *Preliminary Conventional Safety Assessment*: Section 5.2	these large openings.	Information Session. The design and stability analysis of the large underground openings at the shaft station and service area greatly rely on state-of-the-art two and three dimensional geomechanical modeling of the excavation to gauge the level of risk associated with high horizontal stresses. In particular, when the emplacement rooms are aligned with the maximum horizontal stress, this maximum horizontal stress will be perpendicular or close to perpendicular to the large openings at the shaft and service area that will exacerbate the stability of the large openings. This will pose potential risks to the workers' safety during the construction of the facility. The findings of the geomechanical modeling/analysis will form the basis for geotechnical design of the large underground openings and are important to ensure the underground stability and the worker's safety during the construction and future operation of the DGR facility.
EIS 08-382	• Section 8, Description of the Project • Section 10.1.1, Geology and Geomorphology • Section 10.1.3, Groundwater • Section11.4.1, Geology and Geomorphology • Section 11.4.2, Surface Water • Section 11.4.3,	• *EIS:* Section 6.2.7.4, Environmental Heads and Hydrologic Conductivity	Provide 'What-if' hydrogeologic modelling scenarios using hypothetical Precambrian hydraulic head values to demonstrate its influence on contaminant transport. Include over and underpressure conditions in these scenarios.	The Cambrian Sandstone exhibits the highest vertical hydraulic gradients and hydraulic conductivity in the site. It is important to know what boundary condition (head) is responsible for this gradient as this implies an overall upward hydraulic gradient and flow through the site, possibly to the ground surface.

IR#	EIS Guidelines Section	EIS Section or other technical document	Information Request	Context
	Groundwater			
EIS 08-383	• EIS Guidelines: Section 8.2, Site Preparation and Construction; • Section 10.1.1, Geology and Geo-morphology; • Section 11.1, Effects Prediction	• *EIS*: Section 4.7.4.1 Shaft Excavation, pg 4-46; • *EIS*: Section 7.2.1.2: Overburden, Shallow Bedrock, Intermediate Bedrock and Deep Bedrock Solute Transport	Provide measurement data sufficient for the characterization of near-surface groundwater in the areas of the stormwater retention pond, the waste rock management area and the general site study area to the property boundary. There must be sufficient data to allow confident interpretation of the existence of any contaminant plumes and the direction of movement of these plumes. The data are to include but not be limited to tritium, metals and metalloids, PAH, BTEX, and supporting information, such as pH, total dissolved solids and temperature. These data are to be provided by the end of the EIS Review and Comment period.	This information is required to ensure that the site is adequately characterized for groundwater contamination. The approach is expected to be similar to that used routinely for characterization of brownfield sites. The information will inform the Panel regarding the possible future requirement for mitigation prior to the initiation of site preparation activities. The modelling conducted to describe and characterize the near surface groundwater regime is not adequate for the above purpose. The Panel is aware that there are limited groundwater data available but these are not sufficient for the purpose of its review.
EIS 08-384	• EIS Guidelines: Section 8.1, General Information and Design • EIS Guidelines: Section 13, Long-Term Safety of the DGR • CNSC Regulatory Guide G-320: Section 6.2.1	• *Reference Low- and Intermediate-Level Waste Inventory for the Deep Geologic Repository:* Main text and Appendices B and D • *EIS*: Section 9 Long Term Safety of the DGR • *Post-closure Safety Assessment*: Section 7 Results and Discussion • *Preliminary Safety Report*: Section 8	For all radionuclides that are directly measured, provide the number of times these nuclides were measured in each waste type in table B.1, B.2, B.3 and C.1. Provide the 95th percentile value as well as the mean.	In table B.1, B.2, B.3 and C.1 of the inventory report, there are some nuclides for which activity is directly measured. For instance, in Table B.1 the value for Am-241 in Bottom Ash (old) should be depicted as 1.7E+05 (n) with n being the number of measurements.
EIS 08-385	• EIS Guidelines: Section 13.4 • CNSC Regulatory Guide G-320	• *EIS:* Section 9, Long Term Safety • *Preliminary Safety Report*: Section 8,	Assess the dose effects from a vertical fault located 500 metres, 100 metres, 50 metres and 10 metres distance (or any distances in-between) to the north-west of the DGR. Conduct the assessments without horizontal hydraulic gradients added in the intermediate	The response provided to EIS 02-36 does not permit an understanding of the sensitivity of the system. By adding those horizontal gradients, one might underestimate the possible effect of an unidentified fault on well water (its contribution to dose) and the sensitivity

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		Post Closure safety assessment	groundwater zone, i.e., without changing other assumptions of the normal evolution scenario. Justify the assumption that the hypothetical fault would extend into the permeable Guelph Formation and describe the degree of conservatism it encompasses .	of the system. The hypothetical fault was assumed to extend into the permeable Guelph Formation, which is stated to be a conservative consumption.
EIS 08-386	• Section 8.1, General Information and Design Description	• *EIS:* Section, 6.2.7.1, Shallow Groundwater System • DGR-TM-03400 (P) OPG DGR Project: Analysis of Shallow Groundwater Impacts	a) Clarify to which extent the Base Case groundwater table contours are based on actual measurements (baseline data) as opposed to modeling results. b) Provide a graphic as well as a quantitative evaluation of how the simulated groundwater table honours the available well data. c) Explain how seasonality of the groundwater table is incorporated into the simulated groundwater table and subsequent analyses. d) Modeling results are provided for a base case (present day, no WRMA) and for the completed WRMA. However, the waste rock pile will grow progressively during the construction period and will be subject to continuous infiltration. Explain how the modeling of two end members provides a predictable, reliable and defensible analysis of the effect on the shallow groundwater recharge. e) Explain how the layout and dimensions of the waste rock piles and the stormwater management pond are incorporated into the model. f) Provide the methodology and estimates used to determine the amount of subsurface interflow, as well as the depth range over which it is assumed to occur.	The proponent needs to address additional concerns related to the application of the MODFLOW and HELP models to the shallow groundwater regime beneath the waste rock piles and the stormwater management pond. (DGR-TM-03400 (P)) Both the shallow groundwater flow patterns and groundwater water quality require further clarification. In the literature major concerns have been raised about the limitations of the HELP model which uses the WSWB method. For example Parsons (1995) noted that “The application of the Waste Site Water Balance (WSWB) method to predict leachate generation is not only widespread in South Africa, but also throughout the world. The results obtained using the WSWB method are, however, not compatible with knowledge concerning groundwater recharge.” Parsons (1995) noted that “Evapotranspiration is recognized in the literature as the single biggest component of water loss from a waste pile. A small change in the evapotranspiration value used can have a significant impact on the final estimate of leachate generated. This high sensitivity, coupled with the inability to obtain an accurate estimate of the volume of water lost through evapotranspiration, is in itself a major limitation" Nolting et al (1995) found that: “even in humid climates longer periods without rainfall occur, thus reducing the exhaustible water store of the waste surface. In this case,

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			g) The title of Figure 2 explains that the arrows on the boundaries indicate increase or decrease in prescribed heads, but arrows don't appear to match the prescribed head increases or decreases. Clarify. h) Table 6 (Base case water balance analysis for the waste rock pile) shows that the annual Recharge to Limestone is 0.36 mm. The bottom line on p.6 states that the HELP3 modeled base case recharge rate (no waste rock pile) is 3.31mm/year to the bedrock surface. Provide a plain language explanation why the presence of the waste rock pile would reduce recharge rates to the limestone aquifer by an order of magnitude. i) Justify the application of the meteorological data from Waterloo to the DGR site. More than a decade of data are available since 1999. Explain why this more current data has not been used. j) On page 7 it is stated that "The precipitation data (1999) that were used for the HELP3 water balance analysis" are plotted in Fig.6. Clarify whether the data is from the Waterloo dataset or DGR site, and why only one year of precipitation data was provided. Quantitatively assess the uncertainties of the climatic data and their implications on the modeling results. k) Calculate how much infiltrated water and COPCs would move into the shallow and intermediate groundwater flow system. l) Provide an assessment of the effects of climate change on the modeled recharge rates. The assessment should use conservative	the potential evaporation values exceed the available soil water resources and do not reflect the real evaporation from the landfill surface". The HELP model demands very detailed climate data. OPG uses only one year (1999) of daily precipitation at the DGR site, which is the minimum requirement of precipitation data. OPG does not provide all of the climate data and other data used in the simulation. In Section 5.2 it is indicated that meteorological data for the 40 year period from 1960 to 1999 for Waterloo Ontario were used for this study. Waterloo is located over 100 km from the DGR site, the climate of which is strongly influenced by Lake Huron. There is no discussion of the applicability of the meteorological data from Waterloo to the DGR site.

IR#	EIS Guidelines Section	EIS Section or other technical document	Information Request	Context
			assumptions and cover the construction period of the DGR. m) The hydraulic conductivities used to model the Quaternary deposits under the WRMA (Table 1) are those previously used for shaft drainage simulations (Table 2). Provide the source of these values and a qualified basis for their confident extrapolation to the area covered by the WRMA.	
EIS 08-387	• Section 10.1.2, Surface Water	• *EIS*: Section 6.3.5.1, Lake Huron, page 6-77. • Table 6.3.5-1, Summary of Lake Huron Water Quality Sampling Results, pages 6-78 and 6-79	Provide additional surface water quality data for the Local Study Area *during the EIS review period.* These data are to include, at a minimum: • basic limnological characterization at each lake or pond sampling station (depth, DO/temperature profile, conductivity profile); • basic lotic habitat characterization at each stream sampling station (depth, velocity, temperature, dissolved oxygen); • major ions; nutrients – particularly nitrogen compounds; trace metals; and • radionuclides – primarily tritium. Note that samples are required not only from Lake Huron (including near-shore habitats of MacPherson Bay and Baie du Dore) but also Stream C.	OPG did not provide additional surface water quality data for the Local Study Area, as was requested in EIS-03-79. Context from EIS-03-79: The data in Table 6.3.5-1 provide historic (1959/1960) to present-day (2007 and 2009) water quality data for Lake Huron. Interpretation of these data is limited by their relative scarcity. Some of the data points in the table are from one sample only. In other cases, the number of samples is unknown (footnotes d and e to Table 6.3.5-1). There is no information regarding the seasons of sampling in relation to important limnological parameters such as depth, currents and temperature stratification. There are no data on trace metal concentrations. The 2007 and 2009 data sets do not include analysis of nitrogen compounds, despite the fact that nitrogen compounds are one of the most common chemicals of concern associated with blasting. In light of the limited data set, any interpretation of the water quality of Lake Huron and water bodies in the Regional and Local Study Areas would appear to be tenuous and subject to significant uncertainty. Therefore, more data are required.

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EIS 08-388	• Section 10.1.3, Groundwater • Section 10.1.6, Ambient Radioactivity	• *EIS*: Section 6.6.9, Radioactivity in Groundwater, pages 6-154 to 6-157 • *Radiation and Radioactivity TSD*: Section 5.9, Radioacivitiy in Groundwater, pages 102-109	Provide additional information on residential well screening depths and information pertinent to exposure scenarios specific to Aboriginal individuals.	The sampling program conducted by Bruce Power forms a major portion of the baseline for groundwater. Therefore, a greater understanding of the basis for the sampling design is required to evaluate the defensibility, completeness, reliability and appropriateness of the baseline program. Since the VECs include “Members of the public including Aboriginals” (EIS Table 6.6.2-1, page 6-132), and since Aboriginal people may have specific exposure scenarios related to demographics, lifestyle and culture, data for their communities is required. Without these data, it is not possible to evaluate the appropriateness of the assessment for members of the general public in terms of whether that assessment encompasses the exposure scenarios specific to Aboriginal individuals.
EIS 08-389	• Section 10.1.5, Aquatic Environment	▪ *EIS:* Section 6.3.5.3, Sediment Quality, page 6-84. • Hydrology and Surface Water Quality TSD, Section 5.5.2.7 sediment Quality, page 62 and Appendix F, 2009 Sediment Sampling Results.	Submit Phase 1 baseline sediment monitoring data.	Additional Phase II and Phase III sediment data were provided in OPG’s response to EIS-03-86. OPG’s response also stated that Phase I baseline monitoring data exists; however, the data were not provided as part of OPG’s response. Context from EIS-03-86: The Hydrology and Surface Water Quality TSD, states on page 62 that: “Unless major changes occur within a stream, changes in sediment quality (if any) are expected to occur slowly over time. It is therefore considered appropriate to use one sampling event to define the existing conditions.” This statement is not supported by adequate data. Provision of additional sediment data is required to establish a basis for evaluation of the defensibility and appropriateness of the assessment.

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EIS 08-390	• Section 10.2.6, Human Health • Section 11.5.6, Human Health	• *EIS:* Section 6.11.8.5 Cancer Incidence, pages 6-281 and 6-282.	Provide a review of radiation-related cancers in the county over time using correct statistics, such as Standardized Incidence Ratios (SIRs). Provide also a discussion of ecological study designs and the known cancer-related risk factors within the area.	CNSC indicated that the Grey Bruce Public Health Unit conducted a cancer incidence report in 2008 for the period 1986-2004 which compared cancer rates with the general Ontario population. Likewise, they have also conducted a risk factor survey for the county. These two pieces of evidence should be used in the response. The references for the two reports are: o Grey Bruce Health Unit *Canadian Community Health Survey, 2007/08 Grey Bruce Health Unit*, November 2010 o Grey Bruce Health Unit, *Cancer Report for Grey Bruce: 1986 – 2004*, December 2008
EIS 08-391	• Section 8.1, General Information and Design Description • Section 11.2, Mitigation Measures • Section 11.4.2, Surface Water • Section 11.4.3, Groundwater	• *EIS*: Section 4.4.1.5: Stormwater Management System • *OPG DGR: Analysis of the Impact on the WWMF of Groundwater Withdrawal Associated with the Construction of the DGR Shafts DGR-TM-03400 (P)*	Discuss the presence of tritium in the stormwater management pond and describe options for its treatment and discharge.	A tritium plume was predicted to reach the DGR shaft, but OPG didn't discuss or mention tritium in the response to EIS 04-130 in relation to discharge and treatment criterion
EIS 08-392	• Section 8, Description of the Project	• *EIS*: Section 4.7.5.4, Water Management	Provide the statistical confidence intervals for all inflow rate estimates. Explain the reliability of the inflow rate estimates with respect to the natural variability of the local and regional hydrology.	Although OPG explained various flow rates in its response to EIS 04-151, it did not address the question on the confidence level of the inflow rate estimates.

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EIS 08-393	• Section 13.1, Demonstrating the Long term Safety of the DGR	• *PSR*: Section 4.5.4.2 (p.235)	Provide further explanation for defining the horizontal stress magnitude and influence on repository design due to crustal flexure to justify the assumption that the horizontal stresses are 2 MPa. Explain why this is a conservative assumption.	OPG did not provide justification for the value of horizontal stress due to crustal flexure in its response to EIS 04-156, including the reference document (ITASCA 2011). More explanation is needed.
EIS 08-394	• Section 8.3, Operation • Section 11.4.1, Geology and Geomorphology	• *EIS*: Table 3.4.3-1, • Comparison of Repository Horizon Alternatives; • Section 7.2, Geology, page 7- 6; • Section 7.3, Hydrology and Surface Water, pages 7-29 and 7- 32	a) Provide an estimate of volume of rock potentially requiring management based on all COPCs including selenium concentration in the shake flask tests. b) Provide the rationale for comparing leach test concentrations to surface water quality objectives rather than predictions from the problematic material, which would matter in the design of the stormwater management pond.	a) In its response to EIS 04-159 OPG indicates that: "It is assumed that, based on that response, zones of mineralization refers to the Ordovician shales that are intersected within the vent and main shaft only and represent approximately 4% by volume the rock to be placed in the Waste Rock Management Area (WRMA) and which will be stored in a temporary stockpile within the WRMA. GOLDER (2011, Table 3) reports that the highest concentrations of trace metals (As, Cu, Co, Ni, Pb, Tl and Zn) are found in the shale sequence." OPG should consider also selenium, which is higher than the 0.001 mg/L CCME water quality guideline (See certificate of analysis table of Golder 2011) in the DGR 4 borehole at depths of 114.35 and 157.25 meters as well as in the DGR3 borehole at depths of 318.7, 589.63, 589 and 647.39 meters. Considering that these tests are done at several meters apart from each other and in some instances tens of meters above the Cobourg formation, it is possible that an appreciable volume of waste rock may be of concern with regards to Se and other COPCs. b) As reported in GOLDER (2011) and in OPG's response to IR-EIS-03-96, the results of short-term laboratory leach testing indicate a potential for some metals (aluminum, boron, cobalt, thallium and vanadium) to leach at concentrations slightly above

IR#	EIS Guidelines Section	EIS Section or other technical document	Information Request	Context
				the Provincial Water Quality Objectives (MOEE 1994). However, these tests are considered to be conservative and not fully representative of weathering and other processes likely to occur in the field. CNSC acknowledged that shake flask tests were not a representation of a rock pile but were part of the process in predicting neutral drainage (acid mine drainage conditions?). It should be noted that the leach tests were done on a 4:1 water to rock ratio compared to the recommended 3:1 which means that concentrations reported in Golder 2011 are less conservative than OPG claims.
EIS 08-395	• Section 8.3, Operation • Section11.4.1, Geology and Geomorphology	• *EIS*: Table 3.4.3-1, Comparison of Repository Horizon Alternatives; • Section 7.2, Geology, page 7- 6; • Section 7.3, Hydrology and Surface Water, pages 7-29 and 7-32	Provide plans for a higher initial frequency of surface water sample collection as the hydrology and drainage chemistry of the rock pile(s) will be uncertain.	OPG indicates that at least one surface water monitoring location will be sited immediately downstream of the WRMA in order to characterize the runoff prior to discharge to the stormwater management pond. Samples will be collected quarterly at a minimum throughout the site preparation and construction phase as described in the EA Follow-up Monitoring Program. Depending on the results of the rock monitoring program described above, additional surface water samples may be collected in order to further characterize “first flush” events (spring runoff and the first rainfall after a prolonged dry period). Because of the variability of site conditions (waste rock characteristics and seasonal variations in precipitation and runoff events), the timing and frequency of the sampling will be determined in the field to best observe and understand the characteristics of the WRMA runoff. CNSC staff indicated that it expects OPG to collect more samples initially as the hydrology and drainage chemistry of the rock pile(s) will be uncertain. For instance, OPG should collect composite water samples during first flush

IR#	EIS Guidelines Section	EIS Section or other technical document	Information Request	Context
				events until contaminant levels in runoff appear stable. Once the drainage chemistry is stable, OPG could decrease monitoring.
EIS 08-396	• Section 10.1.3, Groundwater • Section 11.4.3, Groundwater	• *Hydrogeologic Modelling, NWMO DGR-TR-2011-16*: Section 4.1; • *Geosynthesis, NWMO DGR-TR-2011-11:* Section 5.4.5; • *Descriptive Geosphere Site Model, NWMO DGR-TR-2011-24:* Section 4.13	Develop a modified version of the FRAC3DVS-OPG regional groundwater flow and solute transport model, and its embedded site-scale sub-model, incorporating the following features: • refined vertical discretization of hydrostratigraphic units 4A (Salina A1 Upper Carbonate) and 4B (Guelph Fm.) to ensure explicit representation of their thicknesses and hydraulic properties as reported in the DGSM report (NWMO DGR-TR-2011-24); • revised hydraulic parameters for the Shadow Lake formation in order to reflect a continuous basal permeable unit across the model domain; and • revised boundary conditions to ensure that observed hydraulic gradients and porewater velocities, both up-dip (Guelph, Cambrian) and down-dip (Salina A1 Upper Carbonate), are reproduced at the site. Provide an assessment of modified regional groundwater flow and solute transport to investigate performance metrics for scenarios involving long-distance updip migration of radionuclides in the Guelph and basal clastic unit. In this assessment, use the modified embedded site-scale groundwater flow and solute transport submodel to investigate tracer migration for scenarios including that of hypothetical discrete fracture zones hydraulically connected to the Cambrian/Shadow Lake formations.	The Salina A1 Upper Carbonate unit and the Guelph, Cambrian/Shadow Lake formations are thin, permeable layers that represent potential preferential pathways for relatively rapid horizontal advective radionuclide transport away from the repository site. In order to investigate the fate of radionuclides migrating laterally beyond the boundaries of the DGR and various near-field scenarios, the regional and embedded groundwater flow and transport models must faithfully represent hydrogeological observations from these units.

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EIS 08-397	• Section 10.1.3, Groundwater • Section 11.4.3, Groundwater	• *Postclosure Safety Assessment*: Groundwater Modelling NWMO DGR-TR-2011-30, Section 4.2; • *Hydrogeologic Modelling*, NWMO DGR-TR-2011-16, Section 4.5	Incorporate the Cambrian unit in the 3DS model and report on Performance Safety Assessment modeling that investigates near-field radionuclide migration in the presence of horizontal hydraulic gradients in the Salina A1 Upper Carbonate, Guelph and Cambrian formations, as observed at the site.	Resubmission of IR EIS 04-129; NRCan considers this information request to be unresolved. The arguments advanced by OPG for not including the Cambrian unit within the 3D Simplified (3DS) groundwater flow and solute transport model are not compelling: • while Cambrian groundwater is saline and non-potable, groundwater in the Guelph Formation is even more so (Table 4.17, NWMO DGR-TR-2011-24) yet this unit was included in the 3DS model; • while the Cambrian per se may pinch out east of the Bruce site, it is likely that a thin permeable basal clastic unit persists eastward over the Algonquin Arch (see IR EIS-04-126); and • while the nearest Cambrian outcrop may be more than 100 km from the Bruce site, advective transport velocities in the Cambrian are quite high. NRCan suggests that without the supporting analyses requested in IR EIS-04-129, OPG's claim that lateral advective transport in the Cambrian would lead to lower predicted dose consequences is conjecture. NRCan suggests that, regardless of whether or not this conjecture is correct, it is a matter of due diligence for the proponent to investigate a scenario corresponding to hydrogeological conditions actually observed at the site.
EIS 08-398	• Section 13, Long-term Safety of the DGR	• *EIS*: Section 9, Long-Term Safety of the DGR • OPG Seismic Hazard Assessment NWMO DGR-TR-2011-20	Describe the level of confidence in ensuring the long-term safety of the proposed DGR with respect to the stability of the geological formations and the DGR's robustness against larger-scale earthquakes (greater than magnitude 5). Provide estimates of the frequency of predicted	According to the EIS Guidelines, "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

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			probabilistic peak ground acceleration due to earthquakes at the DGR site and their associated uncertainties. Explain how the depth (average 7 km as stated in response to EIS-03-75), and the difficulty in determining the focal depth, of these events, has been incorporated into the predictions and their associated uncertainties.	evidence in order to provide confidence in the long-term safety of the facility".
EIS 08-399	• Section 11.4.1, Geology and Geomorphology	• *Golder* 2011 Technical Memorandum *06-1112-037 (9000) RESULTS OF GEOCHEMICAL TESTING OF ROCK SAMPLES FROM THE DEEP GEOLOGIC REPOSITORY (DGR)* • *Intera 2010, Mineralogy and Geochemistry of DG TR-4 Core, TR-08-23* • *Intera 2010, Mineralogy and Geochemistry of DGR-3 Core, TR-08-22*	Explain the rationale for selecting just five samples for static leachate testing over an approximately 200 m stratigraphic interval (Unit 2) that shows the highest concentrations of trace metals in whole-rock analyses. Explain the rationale for the selection of the test samples in Unit 2 and how the selection of low sulphur (i.e., sulphide) samples constitutes a conservative (precautionary) approach. Provide leachate test for Unit 2 that are representative of the sampling interval.	Whole rock analyses of samples from the shale-dominated Unit 2 (Queenston, Georgian Bay, Blue Mountain) in DGR-3 and DGR-4 have the highest concentrations of trace metals (ex. Pb, Cd, Cr) in the stratigraphic sequence traversed by the DGR shafts. The lithogeochemistry of Unit 2 shows considerable variability.(ex. SiO_2 29.4% - 58.1%, CaO 2.1%-34.4%). A total of only 5 samples from Unit 2 in DGR-3 and DGR-4 were used for static leaching tests. Two of these samples have sulphur contents below the detection limit, while the others contain 0.26, 0.6 and 0.29 % sulphur respectively (average of all samples 0.23%). These values reflect the sulphide mineral content (mainly pyrite) of the samples. Sulphides readily undergo oxidation during weathering and release sulphuric acid and trace metals. In Table 5 (Short-Term Leach Test Results) the three sulphur-bearing samples show the highest concentrations of cobalt & thallium (marginally greater than the PWQO criteria) of all tested samples. Semi-quantitative XRD mineral analyses from Unit 2 in DGR-3 and DGR-4 average 2.3% and 2.4% of pyrite respectively. Since pyrite consists of ~53% sulphur by weight, this suggests that the samples selected for the static leaching tests under-represent the suphide content of Unit 2 by a factor of five.

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EIS 08-400	• Section 8.1, General Information and Design Description	• EIS: Section 4.5, Waste to be placed in the DGR	**Completion of this IR will assist in the response to IRs 08-342 through 08-350.** Conduct a hazard assessment of the full range of waste containers (not transport containers) plus waste forms to be received and, potentially, placed in the DGR. The hazard assessment must include consideration of: • radiological, chemical, biochemical and biological hazards; • all waste forms, such as ash from incineration, sludges, resins, metals, plastics, paper, and hydrocarbons; • interactions among physical, chemical and biological properties of the waste and waste containers, particularly with respect to processes that would result in release of hazardous gases and liquids during operation of the DGR; • hazards associated with flammable, ignitable, explosive, corrosive, and toxic gases; and • processes that would result in longer-term releases of gases and liquids that affect the long-term safety case via the creation of release mechanisms (e.g. creation of corrosive conditions) that, in turn, affect assumptions used for the post-closure assessment with respect to transport of chemicals and radionuclides within and beyond the DGR.	The hazard assessment will require a detailed physical and chemical characterization of all of the waste forms that will be accepted for receipt at the DGR. Waste forms include ash from incineration, sludges, resins, and solids such as metals, plastics and paper. The characterization would specify all parameters that may contribute to hazard such as moisture content, the presence of reactive elements, and the presence of substrates for microbial growth.

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