October 16, 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 #6 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 6 – October 16, 2012

IR #	EIS Guidelines Section	EIS Section or other technical document	Information Request	Context
EIS 06-230	▪ Section 10.1.6, Ambient Radioactivity	▪ *EIS:* Section 6.6, Radiation and Radioactivity ▪ Section 6.6.9, Radioactivity in Groundwater	Confirm whether the groundwater sampled at Well 231 is, or could, be used as a drinking water source.	The maximum tritium concentration at Well 231 is 8×10^4 Bq/L. This is less than the screening criterion of 3×10^6 Bq/L for non-potable groundwater used by the proponent. However, this tritium concentration is elevated above the drinking water guideline of 7×10^3 Bq/L. Therefore, clarification that the water at Well 231 will not be used as a drinking water source at any time is required.
EIS 06-231	▪ Section 11.4.6, Radiological Conditions	▪ *EIS:* Section 7.6.2, Identification and Assessment of Effects	Clarify whether the first bullet of the regulatory limits on the annual dose to members of the public and to workers (on page 7-92 of the EIS) should read: "nuclear energy workers, not including a pregnant nuclear energy worker."	The bullet currently reads: "nuclear energy worker, including a pregnant nuclear energy worker".
EIS 06-232	▪ Section 14, Cumulative Effects	▪ *EIS:* Section 10, Cumulative Effects ▪ Section 10.6.6, Radiation and Radioactivity	Provide a description of all projects identified as having a cumulative effect on the radiation and radioactivity environment in the vicinity of the proposed DGR. Details are to include the specific radionuclides and range of concentrations, the time period of operation, spatial extent of emissions above background, and characteristics of receptor populations.	Sixteen projects have been identified that may act cumulatively in the radiation and radioactivity environment (see Section 10.5.1.8). Three of the projects listed in Section 10.5.1.8 do not appear in the discussion in Section 10.6.6 including: Douglas Point Nuclear Generating Station Decommissioning, Heavy Water Plant Decommissioning, and RWOS1 safe storage. The effects of the other 13 projects are only vaguely described. More detail on the 16 overlapping projects is required to ensure that cumulative radiation effects have been thoroughly assessed.

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EIS 06-233	▪ Section 14, Cumulative Effects	▪ *EIS:* Section 10, Cumulative Effects ▪ Section 10.6.6, Radiation and Radioactivity	Provide a temporal distribution of cumulative dose estimates for members of the public.	16 projects have been identified that may act cumulatively in the radiation and radioactivity environment. The projects should be described individually, along with expected doses resulting from each project. These doses should be summed to calculate the cumulative dose to a member of the public over time.
EIS 06-234	▪ Section 11.4.6, Radiological Conditions	▪ *EIS:* Appendix C: Human Health Assessment, Section C.2.3.3, Radiation Exposure Levels. ▪ Appendix C: Human Health Assessment, SectionC2.3.3.1 Members of the Public	Explain, in detail, how the critical group dose assessment for members of the public adequately addresses aboriginal communities and seasonal users.	Table C1.2-1 identifies four Valued Ecosystem Components (VECs) for Human Health including: Overall Health of Local Residents, Overall Health of Members of Aboriginal Communities, Overall Health of Seasonal Users, and Health of Workers. The dose assessment for members of the public considered: A non-farm resident, a farm resident, and a dairy farm resident. These all fall within the Overall Health of Local Residents VEC. It is not clear how Aboriginal groups and seasonal users would be represented by the Local Residents VEC.
EIS 06-235	▪ Section 16, Follow-Up Program	▪ *EIS:* Section 12, Follow-up Program ▪ Section 8, Radiological Monitoring	Provide a conceptual plan for the follow-up and monitoring programs for the decommissioning and abandonment stages of the DGR project. This plan should include a general description of goals, objectives, key monitoring questions, expected spatial extent, and expected frequency of monitoring. A conceptual plan should also include a description of how monitoring will be linked with adaptive management.	The air, groundwater, and surface water follow-up and monitoring programs are described for the preparation, construction, and operation phases of the project. Follow-up and monitoring will also be required for the decommissioning and abandonment phases. A conceptual description of monitoring programs for these phases will assist in the evaluation of the defensibility and completeness of the assessment.

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EIS 06-236	▪ Section 16, Follow-Up Program	▪ *EIS:* Section 12, Follow-up Program ▪ Section 8, Radiological Monitoring ▪ Section 8.1, Radiological Analysis of Air	Provide a list of all radionuclides to be monitored in the ventilation exhaust air during the operation of the proposed DGR.	A complete listing of the radionuclides included in the air monitoring program, rather than the broad groupings such as particulates and noble gases, will assist in the evaluation of the completeness and appropriateness of the monitoring program.
EIS 06-237	▪ Section 16, Follow-Up Program	▪ *EIS:* Section 12, Follow-up Program ▪ *DGR EA Follow-Up Monitoring Program TSD*: Section 8, Radiological Monitoring ▪ Section 8.2, Radiological Analysis of Groundwater ▪ Section 8.3, Radiological Analysis of Surface Water	Explain the absence of gross alpha measurements in the groundwater and surface water monitoring program.	The DGR EA Follow-Up Monitoring Program TSD (page 17) states that only tritium and gross beta levels will be routinely measured in groundwater; and that only tritium, gross beta, and in one case carbon-14 levels will be routinely monitored in surface water. The monitoring of gross alpha levels will allow comparison with the gross alpha screening level in the Canadian Drinking Water Guidelines of 0.5 Bq/L.

IR #	EIS Guidelines Section	EIS Section or other technical document	Information Request	Context
EIS 06-238	▪ Section 10.1.6, Ambient Radioactivity	▪ *Radiation and Radioactivity TSD:* Section 5 Description of the Existing Environment ▪ Table 5.4.1-1, Annual Releases to Air in Gaseous Effluent from Bruce Nuclear Site ▪ Table 5.5.3-1, Annual Average Gross Beta Deposition Rate (Bq/m2/month) ▪ Table 5.5.3-2, Gross Beta in Precipitation in the Site Study Area. ▪ Table 5.5.5-1, Estimated Noble Gas Concentrations (Bq-MeV/m3) ▪ Table 5.6.1-2, Area Drinking Water Gross	Provide a list of the specific radionuclides within larger categories (radioactive particulates, noble gases) that have been measured in the existing environment. Ensure that all available detailed monitoring data for specific radionuclides has been provided for sediments, soils, fish, agricultural plants, and milk. Explain in more detail how the assumptions used in the dose modelling may have accounted for any missing radionuclide-specific data.	Section 5 of the Radiation and Radioactivity TSD provides data on radioactivity and radionuclides in the existing environment. However, much of the data are for broad groupings (e.g. noble gases, particulates). Data for sediments, fish, plants and milk are for a fairly short list of specific radionuclides. It is unclear whether the subsequent modelling of dose (that relies on the data or estimates provided in Section 5) is complete, defensible, and appropriate. Further explanation regarding how the dose modelling accounted for missing detailed data would assist in the evaluation of the dose modelling.

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		Beta Levels (Bq/L) ▪ Table 5.6.1-6, Gross Beta Levels in Surface Water (Bq/L)		
EIS 06-239	▪ Section 10.1.6, Ambient Radioactivity	▪ *Radiation and Radioactivity TSD:* Section 5,, Description of the Existing Environment ▪ Table 5.5.2-2, Tritium in Precipitation in the Site Study Area	What additions to the concentration of tritium in precipitation in the Site Study Area may be expected from DGR activities? If guideline values are exceeded, describe mitigation measures that may be implemented by the DGR operator.	In 2002, the maximum concentration of tritium in precipitation in the Site Study Area was 6,620 Bq/L. This is approaching the Canadian Drinking Water Guideline of 7,000 Bq/L. The assessment states that, “precipitation can be a significant component to the recharge of shallow groundwater aquifers, which may be used as a source of drinking water in the region.”
EIS 06-240	▪ Section 10.1.6, Ambient Radioactivity	▪ *Radiation and Radioactivity TSD:* Section 5, Description of the Existing Environment ▪ Table 5.9-2, Tritium Level in Bruce A and B Groundwater Monitoring Wells (Bq/L)	Provide corrections and clarifications on locations and dates for Table 5.9-2: Tritium Level in Bruce A and B Groundwater Monitoring Wells (Bq/L).	Currently under the column “Monitoring Location” the table has a range of dates. In addition, the second row sampling months are also provided. It appears that there is no information on the actual locations. The temporal meaning of this table is confusing.

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EIS 06-241	▪ Section 10.1.6, Ambient Radioactivity	▪ *Radiation and Radioactivity TSD:* Section 5 Description of the Existing Environment ▪ Figure 5.9-2, Tritium and Gross Beta Concentrations Measured at WWMF Groundwater Monitoring Well 231	How will tritium levels in Well 231 be impacted by DGR activities? Clarify which guideline value is appropriate for tritium levels in Well 231 to determine if mitigation is necessary.	Figure 5.9-2 shows the level of tritium to be above the Operating Limit for tritium of 4×10^4 Bq/L. The source of this Operating Limit is not clear. The tritium concentration in Well 231 exceeds the *Canadian Drinking Water Guideline for Tritium* (Health Canada 2010) and the Operating Limit for Tritium as discussed in Section 5.9 of the *Radiation & Radioactivity TSD*.
EIS 06-242	▪ Section 10.1.6, Ambient Radioactivity	▪ *Radiation and Radioactivity TSD*	Update the inhalation rates used in dose modelling to the more conservative values released in more recent guidance documents.	The TSD cited a 2002 OPG Report for the inhalation rates used. However the *COG Derived Release Limits Guidance* (Hart 2008) and *CSA Standard N288.1* (CSA 2008) were both updated in 2008. The use of the more updated inhalation rates from these documents would ensure that doses from inhalation have been calculated in the most appropriate manner.
EIS 06-243	▪ Section 11.4.6, Radiological Conditions	▪ *Radiation and Radioactivity TSD:* Section 8,, Identification and Assessment of Environmental Effects ▪ Section 8.2.5,	Identify the critical group that is predicted to receive the highest dose to the general public. Provide doses to each of the other potential critical groups. Distinguish among age classes.	Section 5 of the Radiation and Radioactivity TSD provides information on nine potential critical groups and identifies the group currently receiving the highest dose (the critical group) as “adult in Group BF14 located to the southeast of the Bruce nuclear site” (page 115). However, when estimated doses to the general public are described in Section 8.2.5, no details are given with respect to the critical group that is predicted to receive the highest dose. Furthermore, no information is provided on differences between

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		Potential Doses to Members of the Public ▪ Table 5.10-1, General Characteristics of Potential Critical Groups		adults and children or infants. The provision of more detailed dose information to each of the potential critical groups described in Table 5.10-1 would assist in the evaluation of the completeness and appropriateness of the dose modelling and conclusions based upon that modelling.
EIS 06-244	▪ Section 11.4.6, Radiological Conditions	▪ *Radiation and Radioactivity TSD:* Appendix D, Detailed Radiation Dose Calculations (Humans) ▪ Appendix D, Section D2, Estimated Dose to the Public – Sample Calculation for Dose from C-14 through the Air Pathway	Confirm whether the maximum airborne release rate for C-14 from all LLW and ILW packages should be presented as Bq/s.	The release rate of C-14 from LLW and ILW packages is stated as.8 x 10^{12} Bq. A release rate requires a unit of time.
EIS 06-245	▪ Section 11.4.6, Radiological Conditions	▪ *Radiation and Radioactivity TSD:* Appendix D: Detailed Radiation Dose Calculations	a) Provide an estimate of doses to members of the public by using a detailed pathways analysis specific to the DGR project, rather than the scaled estimates as illustrated in the Radiation and Radioactivity TSD Appendix D2 for the air pathway of C-14. b) Provide a sample dose calculation for each pathway described	A scaling method has been used for the dose estimate by creating a factor from the expected releases of the DGR and the known releases of the current Bruce site. This factor was used to scale the calculated dose to members of the public from the Bruce site, to estimate for dose to members of the public from the DGR.

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		(Humans) ▪ Appendix D, Section D2, Estimated Dose to the Public – Sample Calculation for Dose from C-14 through the Air Pathway	in part a.	This approach is not as precise as completing an independent detailed pathways analysis for the DGR site. An example of such a pathways analysis can be found in CSA document N288.1 (CSA 2008). This would ensure that any differences between the DGR site and the Bruce site are accounted for and the dose to members of the public has been adequately modelled. As each pathway is treated differently, a sample calculation for a C-14 release rate and estimated dose through the air pathway does not provide any information on how the remainder of the pathway analysis was completed. A sample calculation for each pathway would assist in the evaluation of the completeness and reliability of the dose calculations.
EIS 06-246	▪ Section 12, Accidents, Malfunctions and Malevolent Acts	▪ *Malfunctions, Accidents, and Malevolent Acts TSD:* Section 4, Radiological Malfunctions and Accidents ▪ Section 4.3.2.1, Humans. ▪ *Postclosure Safety Assessment:* Section 7.2.1, Human Intrusion.	a) Provide the estimated doses, including the details of the calculations, to the drill crew and to a future person living and farming on the DGR site for the Human Intrusion Scenario. b) If calculated doses are confirmed to be at or above 1mSv/a, provide information concerning the mitigation measures required to reduce the probability and/or the consequence of human intrusion.	The TSD states that the calculated doses could be about 1 mSv/a for the drill crew or a future person living and farming on the contaminated site for the Human Intrusion Scenario. Estimated doses to members of the public at or above the *Radiation Protection Regulations* (Government of Canada 2000) dose limit of 1 mSv/a indicate the necessity of additional mitigation measures built into the design of the DGR. Postclosure Safety Assessment, section 7.2.1, page 185 states: "Detailed modelling has shown that contaminants could only be released from the repository through the borehole if the intruding borehole penetrated through the repository and was continued down into the pressurized Cambrian rocks and was not appropriately sealed (see Sections 6.1 and 6.2 of GEOFIRMA 2011). In this highly improbable case, the peak calculated dose to an adult member of the Site Resident Group would be around 30 mSv/a, occurring after 400 years"

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EIS 06-247	▪ Section 12, Accidents, Malfunctions and Malevolent Acts	▪ *Malfunctions, Accidents, and Malevolent Acts TSD:* Section 4, Radiological Malfunctions and Accidents ▪ Section 4.3.2.1, Humans ▪ *Postclosure Safety Assessment:* Section 7.2.2, Severe Shaft Seal Failure.	a) Provide an estimated dose to members of the public, including the calculations, for the Severe Shaft Failure Scenario. b) If calculated doses are confirmed to be at or above 1mSv/a, provide information concerning the mitigation measures required to reduce the probability and/or the consequences of severe shaft failure.	The TSD states that the maximum calculated doses are about 1 mSv/a for members of the public for the Severe Shaft Failure Scenario. Estimated doses to members of the public at or above the *Radiation Protection Regulations* (Government of Canada 2000) dose limit of 1 mSv/a indicate the necessity of additional mitigation measures built into the design of the DGR. Postclosure Safety Assessment, section 7.2.2, page 189 states: "The assumptions for the degradation of the shaft seals in the SF-ED case result in a calculated dose to an adult member of the Site Resident Group that reaches about 80 mSv/a after around 3800 years."
EIS 06-248	▪ Section 12, Accidents, Malfunctions and Malevolent Acts	▪ *Malfunctions, Accidents, and Malevolent Acts TSD*: Section 6, Malevolent Acts ▪ Section 6.2.2.1, Radiological Effects	Provide dose estimates for each of the Malevolent Acts Scenarios described in Section 6 of the Malfunctions, Accidents and Malevolent Acts TSD.	Malevolent Acts Scenarios described in the TSD include: deliberately driving a forklift into a package or dropping a package during handling; pushing a package or vehicle into the shaft; setting waste packages on fire; a person using an explosive or incendiary device; remote military-style attack from the site boundary; and an aircraft crash. Dose estimates for members of the public and any mitigation measures related to these scenarios that may be indicated by the estimated doses would assist in the evaluation of the completeness of the assessment.
EIS 06-249	▪ Section 11.4.7, Atmosphere	▪ *Atmospheric Environment TSD:* Section 2.2, Precautionary	Explain and elaborate on the statement, on page 10 of the Atmospheric Environment TSD, that "A further precautionary feature incorporated…is that the evaluation of potential effects is based on changes to the existing environment and not solely on regulatory compliance. This captures and assesses changes to the existing environment that may fall outside or below applicable	The TSD states that the air quality assessment is based on changes to the existing environment, and not solely on comparison against regulatory frameworks and that a precautionary approach is employed. In the EIS itself, the precautionary approach is described (for air) as

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		Approach. ▪ *EIS:* Section 7.15, Application of Precautionary Approach in the Assessment	regulatory frameworks." Provide specific information on any non-regulatory 'triggers' used to evaluate stressors in air. As there are increases in the predicted Criteria Air Contaminants levels associated with project activities, provide an explanation of how evaluations against non-regulatory frameworks are performed to adequately characterize the impacts to human health.	involving the use of conservative emissions scenarios, the results of which however, are compared against regulatory frameworks (Air Quality Standards). While the emissions modeling may (or may not) be conservative, the evaluation of the resulting air quality appears to be solely based on regulatory frameworks.
EIS 06-250	▪ Section 11.4.7, Atmosphere	▪ *EIS:* Section 6.7.5.1, Existing Air Quality in the Regional Study Area	Provide a discussion of the NO_x/VOC balance in the area, the atmospheric conditions (such as long-range flows) under which the regular exceedances of ozone standards occur, and a more substantial qualitative discussion of the impact of the project's NO_x emissions on ozone formation under the regional conditions which lead to exceedances of ozone standards.	The EIS and TSD state that the project will have no effect on ozone levels given the regional nature of ozone in the area. Ozone levels in the area routinely exceed the applicable air quality standards (Ministry of Environment 2012, page 2-3). Given the high emissions of NO_x associated with project activities further explanation will assist in the evaluation of the defensibility of the conclusion regarding potential effects on levels of ozone and resulting potential health effects.
EIS 06-251	▪ Section, 11.4.7 Atmosphere	▪ *EIS:* Section 6.7.5.2, Background Air Quality	Explain why the 1-hour CO level is less than 8-hour level.	In Table 6.7.5-6 of the EIS, 1-hour CO levels are less than 8 hour levels. 8-hour levels should not exceed 1-hour levels.
EIS 06-252	▪ Section 11.2, Mitigation Measures, ▪ Section 11.4.7, Atmosphere	▪ *EIS:* Table 7.7.2-1, Air Quality In-design Mitigation.	Provide the rationale for requiring emissions at only a Tier 2 level for diesel engines and a discussion as to why no Tier 3 emissions standards would be available and required.	Tier 3 emissions standards became a requirement in 2006-8 (and Tier 4 emissions standards in 2012) and provide substantial reductions in NO_x emissions. As NO_x emissions appear to be one of the most important air quality issues related to the project, it is unclear why the mitigation plan does not include Tier 3 standards.

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EIS 06-253	▪ Section 11.3, Significance of Residual Effects, ▪ Section 11.4.7, Atmosphere	▪ *EIS:* Figure 7.7.3-1, Determination of Significance of Residual Adverse Effects for Air Quality	Expand on the response to the IR EIS 03-94 by providing a discussion on how the "decision tree" used to determine significance of residual adverse effects for air quality (Figure 7.7.3-1 of the EIS) provides a level of protection for the local population. In addition, provide a more extensive discussion of the irreversibility criterion as it applies to specific endpoints related to PM and other pollutants.	Detailed explanations about the "decision tree" (Figure 7.7.3-1 of the EIS) used to assign significance are required to evaluate the completeness and appropriateness of the assessment of the effects of air quality on health. Aside from the reliance on regulatory frameworks (i.e., Air Quality Standards) the tree itself is not clearly explained, nor is it clear how decisions were made in each step. For the site preparation and construction phase, use of the decision tree results in an "immediately reversible" evaluation of the degree of irreversibility.. The definition behind immediately reversible is particularly unclear. For example, if one stops the emission source, then the air quality will improve quite quickly. However, the health effects will not, given that PM is associated with a wide range of health effects (e.g. asthma attacks, worsening of respiratory symptoms, etc.).
EIS 06-254	▪ Section 10.1.8, Noise	▪ *Atmospheric Environment TSD:* Section 5.5, Noise Levels (pages 69 - 79)	Assess whether or not excluding sounds of nature would appreciably lower the ambient noise levels in such a way that the potential project noise impacts could be more severe than reported. An alternate approach would be to present the minimum 1hr Leq levels without sounds of nature in the noise assessment.	The noise assessment indicates that the sounds of nature were included in monitoring of the baseline noise levels. Typically, including sounds of nature in determining the ambient sound levels is not recommended by Health Canada.
EIS 06-255	▪ Section 11.4.8 Noise and Vibration	▪ *Atmospheric Environment TSD:* Appendix J, page J-10	Discuss whether or not adjusting the measured/predicted sound levels to account for impulsive, highly impulsive, high energy impulsive (blasting), tonal and/or quiet rural area adjustments would effect the calculated change in %HA during construction, operation and decommissioning stages of the Project.	Research indicates that certain sound characteristics can increase community annoyance (CSA 2005). Appendix J, page J-10 of the *Atmospheric TSD* provides the equation used for deriving %HA. However, it does not appear that the %HA was calculated using a rating level. A rating level is an adjustment applied to a measured or calculated sound level. Procedures on how to calculated %HA using a rating level with the applicable adjustments can be found in *ISO 1996-1 (2003)* (CSA 2005).

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EIS 06-256	▪ Section 11.4.8 Noise and Vibration	▪ *Atmospheric Environment TSD* ▪ *Socio-economic Environment TSD:* Section 8.8.1.2, Noise.	Provide additional discussion regarding how and why changes in noise would be perceptible taking into account such factors as frequency changes, variable modulation, and increased impulsiveness.	The assessment of noise impacts on receptors is based on the premise that sound level increases of 3 dBA are not noticeable. For example, Section 8.8.1.2 (page 268) of the Socio-economic Environment TSD indicates that increases over an existing noise level up to 3 dBA are “hardly perceptible”. The perception of sound is not related to sound level in decibels in a linear manner. For example, a 10 dBA increase is the median change in sound level at 1 kHz, which is perceived as being twice as loud. A typically cited threshold for an increase in sound level that is often stated as being “barely perceptible” by the human ear varies from 3 to 5 dBA. This threshold is often used in environmental assessments, which may state that residual sound increases lower than this threshold will not be perceptible. However, a difficulty with this approach is that humans also perceive and respond to changes in sound characteristics other than loudness. Changes to the characteristics of the sound from baseline, such as a change in frequency, changes in sound modulation, and increased impulsiveness, may be perceived and may cause noise to be more noticeable, even if the absolute sound level (in dBA) is not substantially increased. It is important to consider that people respond to sound characteristics that do not necessarily increase the sound level appreciably (ANSI S12.9-2005/Part 4, clause A.1.3 (CEARIS #748)).
EIS 06-257	▪ Section 11.4.8 Noise and Vibration	▪ *Atmospheric Environment TSD:* Section 7.2.3.2, Noise Levels ▪ United States	Provide an assessment of blasting noise on human health that goes beyond the discussion of perceptibility. Suggest mitigation measures if indicated by the assessment.	There appears to be no specific methodology used for assessing blasting noise, other than the discussion of perceptibility and the associated problems with this approach as noted in IR EIS 06-256. Blasting is identified as project activity in the EIS, but the specific discussion is limited mainly to its impacts on air pressure and vibration. The Atmospheric Environment TSD, page 90, states:

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		Environmental Protection Agency (EPA). (1974). *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety* (Report No. 550/9-74-004). ▪ Canadian Standards Association (CSA). (2005). CAN/CSA-ISO 1996-1:05 (ISO 1996-1:2003) *Acoustics – Description, measurement and assessment of environmental noise – Part 1: Basic quantities and assessment procedures.*		"noise from blasting would not likely measurably change the 1 hour Leq (the indicator for noise levels)". Therefore it is important to use an approach that will adequately characterize potential human health effects and suggest when mitigation activities should occur. Noise effects due to blasting can be assessed in several ways, depending on how long the blasting will continue. If blasting is anticipated to last less than one year, the EPA (1974) approach can be used. Little or no public annoyance is expected to result from any number of daytime noise impulses per day if their measured or predicted peak value is below (125 – 10 log N) dB. In this case, dB is now interpreted as meaning Z or Zero weighting (dBZ). For blasting over a duration of more than one year, follow the recommendations in CSA (2005).

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EIS 06-258	▪ Section 11.4.8 Noise and Vibration	▪ *EIS:* Section 4.7, Site Preparation and Construction ▪ Section 4.7.2.1, Construction Labour.	Describe potential project noise impacts on sleep and determine whether or not the World Health Organization's (WHO) threshold for sleep disturbance will be exceeded.	Section 4.7 of the EIS, page 4-39, suggests that some night time activities may be required. See also section 4.7.2.1, Construction Labour, page 4-43. However, the EIS does not describe any potential project noise impacts on sleep. Due to the methodology currently used in this noise assessment, it is not possible to assess whether or not the World Health Organization's (WHO) threshold for sleep disturbance will be exceeded. Health Canada has suggested that the potential impact on sleep should be considered using the WHO's (Berglund et al, 1999) recommended thresholds for sleep disturbance. These thresholds are: for steady state (continuous) noise exposure, noise inside the bedroom is 30 dBA (i.e. 45 dBA outdoors with an assumed 15dBA transmission loss with windows partially opened) and is 45 dBA for discrete noise events (i.e. 60 dBA outdoors with an assumed 15 dBA transmission loss with windows partially opened).
EIS 06-259	▪ Section 10, Existing Environment ▪ Section 11, Effects Prediction, Mitigation Measures, and significance of Residual Effects ▪ Section 13,	▪ *Geosynthesis Report* (NWMO DGR-TR-2011-11)	Describe the impact of future glacial isostatic adjustment on the current and future behavior of fractures and joint sets in the vicinity of the proposed DGR.	There is inadequate consideration of the impact of future glacial isostatic adjustment on the current and future behavior of fractures and joint sets in the repository vicinity. The continuing stress release due to the removal of glacial compression forces since the last glaciation period will continue to cause upward movement on existing fracture and joint sets, as well as create the possibility of new fractures and joint sets during the construction and operational life of the proposed repository. Future glaciation and reloading of the site could lead to differential movement along existing fractures and joints.

IR #	EIS Guidelines Section	EIS Section or other technical document	Information Request	Context
	Long-Term Safety of the DGR			
EIS 06-260	▪ Section 8.1, General Information and Design Description	▪ *EIS:* Section 4.5, Waste to be Placed in the DGR ▪ *Reference Low and Intermediate Level Waste Inventory for the Deep Geologic Repository Report* – December 2010 (00216-REP-03902-00003-R003) ▪ *Reference Low and Intermediate Level Waste Inventory for the Deep Geologic Repository Report* – August 2008 (00216-REP-03902-00003-R01) (CEARIS # 184)	Provide information regarding what constitutes a “recognizable fuel fragment”. Describe the past and existing waste packaging procedures that support the waste acceptance criterion that “recognizable fuel fragments” are excluded waste. Identify the threshold sum of actinides in a package that initiates further inspection for failed fuel fragments. If there is no such threshold, provide justification.	In Section 4.5 of the EIS, page 4-18 it is stated that: “the DGR will not accept used nuclear fuel or recognizable fuel fragments.” In EIS Table 4.5.1-3, page 4-25, it is stated that recognizable fuel fragments are excluded wastes but also includes a criterion that the package amount of uranium-235, uranium-238, plutonium-239, plutonium-240, and plutonium-241 must be reported. In the Reference Low and Intermediate Level Waste Inventory Report (December 2010)Table 3.3, page 32, includes a list of uranium and transuranic radionuclides and of waste streams where they had not been identified in the August 2008 version of the Reference Low and Intermediate Level Waste Inventory Report (R01) Appendix B, Table B-1, page 48. If there can be uranium and plutonium but there cannot be recognizable fuel fragments, the process for differentiating between a package that documents the presence of uranium and plutonium and a package containing a recognizable fuel fragment must be clarified.

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EIS 06-261	▪ Section 8.1, General Information and Design Description	▪ *Reference Low and Intermediate Level Waste Inventory for the Deep Geologic Repository Report* – December 2010 (00216-REP-03902-00003-R003) ▪ *Reference Low and Intermediate Level Waste Inventory for the Deep Geologic Repository Report* – August 2008 (00216-REP-03902-00003-R01) (CEARIS # 184)	Provide information that justifies the significant decrease in the expected radioactive material content reported for the operational LL/ALW resin waste stream in the Reference Low and Intermediate Level Waste Inventory Report Appendix B, Table B.1, page 53 as compared to the August 2008 version of the Reference Low and Intermediate Level Waste Inventory Report (R01) Appendix B, Table B-1, page 48.	Reference Low and Intermediate Level Waste Inventory Report Appendix B, Table B-1, page 53, combined 2 waste streams (LL Resins and ALW Resins) that had been separate in the August 2008 version of the Reference Low and Intermediate Level Waste Inventory Report (R01) Appendix B, Table B-1, page 48. In the Reference Low and Intermediate Level Waste Inventory Report shows specific activity of the combined waste streams of 2.2E+08 Bq/m^3 where as August 2008 version of the Reference Low and Intermediate Level Waste Inventory Report (R01 of this document showed the specific activity of radioactive material with t½ > 1 yr. of 5.0E+11 Bq/m^3 for the LL resins alone and 2.1E+08 Bq/m^3 for the ALW resin waste stream. There is no explanation for the dramatic decrease in specific activity from the combined waste streams.
EIS 06-262	▪ Section 8.1, General Information and Design Description	▪ *Reference Low and Intermediate Level Waste Inventory for the Deep Geologic Repository Report* – December 2010 (00216-REP-	Demonstrate that the non-processable drummed waste stream has been accurately and adequately characterized. Describe the methods of characterization, the number of samples/characterizations analyzed, and the variation in the results. Discuss specifically the bituminized low-level waste quantities and the process waste streams that were input to the bituminization	In the Reference Low and Intermediate Level Waste Inventory Report Table 2.1, page 12, shows that the non-processible drummed waste stream is the third largest contributor by net volume and the second largest contributor by emplaced volume in the DGR. The specific activity information presented in the Reference Low and Intermediate Level Waste Inventory Report Appendix B, Table B.1, page 53, shows nearly all of the activity in processible

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		03902-00003-R003) ▪ *Reference Low and Intermediate Level Waste Inventory for the Deep Geologic Repository Report* – August 2008 (00216-REP-03902-00003-R01) (CEARIS # 184)	process.	drummed waste is attributed to H-3 but that radionuclide is not measured but scaled based on the C-14/H-3 ratio from incinerable wastes with no basis presented. The Reference Low and Intermediate Level Waste Inventory Report, page 88, 90 and 136, presents 9 different dose rate classes from <0.01 mSv/hr to >10 (4 orders of magnitude), all with the same average waste density and specific activity. The wide range in dose rates from these packages appears inconsistent with packages filled primarily with materials containing H-3.
EIS 06-263	▪ Section 8.1, General Information and Design Description	▪ *Reference Low and Intermediate Level Waste Inventory for the Deep Geologic Repository Report* – December 2010 (00216-REP-03902-00003-R003) ▪ *Reference Low and Intermediate Level Waste Inventory for the Deep Geologic Repository Report* – August	Provide the studies that resulted in the "…new specific activity information" referred to in the Revision Summary of revised Reference Low and Intermediate Level Waste Inventory for the Deep Geologic Repository. Clarify whether this information was applied to the characterization of already packaged wastes. If not, provide a justification. Explain how this information was applied to future waste projections.	Comparison of the Reference Low and Intermediate Level Waste Inventory Report to the August 2008 version of the Reference Low and Intermediate Level Waste Inventory Report (R01) generates questions. The Reference Low and Intermediate Level Waste Inventory Report Revision Summary, page 6, refers to "…new specific activity information…" but does not present any context regarding this new information. It is unclear if new information was utilized only going forward or if it used to adjust historical data, Some of this new information is inconsistent with the information presented in the August 2008 version of the Reference Low and Intermediate Level Waste Inventory Report (R01). For example, by comparing the Reference Low and Intermediate Level Waste Inventory Report Table 3.3 - Estimated Reactor Refurbishment Radionuclide Inventory at 2062, page 32, lists uranium and transuranic radionuclides in waste streams that are not listed in the August 2008 version of the Reference Low and Intermediate Level Waste Inventory Report (R01) Table 3.3, page 19. The only change found in the text mentioned recent gamma

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		2008 (00216-REP-03902-00003-R01) (CEARIS # 184)		scans of the steam generator in storage at Bruce (Reference Low and Intermediate Level Waste Inventory Report Section 3.2, page 29).
EIS 06-264	▪ Section 8.1, General Information and Design Description	▪ *Reference Low and Intermediate Level Waste Inventory for the Deep Geologic Repository Report* – December 2010 (00216-REP-03902-00003-R003)	a) Provide the following additional information regarding the determination of waste stream radionuclide content: ▪ the rationale for scaling factors used; and ▪ an error analysis that addresses the uncertainty introduced by the use of scaling factors. b) Provide an analysis of the uncertainty in data as presented in Appendix D and explain how the inventory was adjusted for the assessment to assure that the assessment is bounded considering these uncertainties.	The information presented in Reference Low and Intermediate Level Waste Inventory Report Table B.1, page 53, indicates incomplete assessments. For example, there are nine radionuclides measured in only one waste stream and their presence is not considered in the other waste streams, yet several radionuclides have not been measured in any waste stream so they are scaled or inferred based on their presence in used fuel into every waste stream. The logic of this approach is not obvious. The Reference Low and Intermediate Level Waste Inventory Report Table B.1, page 53 presents data that suggests C-14/H-3 ratios from 2.2 to 2.4E-5, with no explanation, but all H-3 values are scaled, presumably from C-14. The analysis presented in the Reference Low and Intermediate Level Waste Inventory Report Appendix D, page 67, identifies numerous uncertainties and inadequacies in the data and discusses the application of scaling factors. For example, Appendix D.2.0, page 68, identifies use of C-14/H-3 ratios that have not been validated; use of limited data for resins and sludge; as well as for I-129, Cl-36 and Tc-99 (key radionuclides for evaluating DGR performance and potential doses). Appendix D Table D.1, page 70, presents uncertainty information differentiated by the log dispersion that seems to represent wide variations in the limited data (e.g., LD values of 45 for Co-60 and 87 for Cs-137 for Miscellaneous IX Resins). Such a wide dispersion on such easily measured isotopes begs that question whether this waste stream can be reasonable characterized as a single stream.

IR #	EIS Guidelines Section	EIS Section or other technical document	Information Request	Context
EIS 06-265	▪ Section 10, Existing Environment ▪ Section 10.1, Biophysical Environment	▪ *Geosynthesis Report* (NWMO DGR-TR-2011-11): Section 4.5.4, Cambrian Fluid Chemistry	Provide a detailed analysis of potential groundwater flow through the Cambrian aquifer and the impact of this flow on the predicted performance of the repository, notwithstanding the mechanism responsible for the composition of Cambrian formation waters.	The discussion of Cambrian fluid chemistry indicates that the fluid composition may represent a recent change. Although several possibilities are identified, the mechanism responsible for the re-supply of basin groundwater is not known.
EIS 06-266	▪ Section 8.2, Site Preparation and Construction	▪ *Geoscience Verification Plan TSD*: Section 2.1.4.1, Activity 2 - Geophysics	Provide additional discussion and justification of the limited geophysical testing planned in the vertical shaft to identify and evaluate the EDZ.	The Geoscientific Verification Plan TSD, Section 2.1.4.1, page 8, indicates that extent and physical/hydraulic characteristic of the EDZ in the vertical shaft will be investigated during the construction phase. However, the report only indicates geophysical measurements (ultrasonic velocity) will be conducted at the proposed seal locations. The rationale for limiting the geophysical measurements to only the proposed seal locations is unclear.
EIS 06-267	▪ Section 13, Long-Term Safety of the DGR	▪ *Geoscience Verification Plan TSD*: Section 2.1.4.3, Activity 4- Permeability Measurement	Provide a detailed program of EDZ testing and measurement in the shafts during the construction phase and prior to the emplacement of the shaft seals. Include details on how representative hydraulic conductivities will be obtained in the EDZ.	The Geoscientific Verification Plan TSD, Section 2.1.4.3, page 9-10, indicates that measurements will be conducted in dedicated boreholes to characterize changes in rock mass permeability resulting from EDZ formation. However, no further details regarding the number, location, and methods used for this permeability test of the EDZ have been provided.
EIS 06-268	▪ Section 13, Long-Term Safety of the DGR	▪ *Geoscience Verification Plan TSD:* Section 2.2.8.1, DGR Sealing Materials	Describe the program for testing the performance of the various materials that will be used to seal the shafts, under the various conditions encountered over the full extent of the shafts.	While the Geoscientific Verification Plan TSD, Section 2.2.8, page 21, outlines a program for evaluating sealing materials at the level of the repository in the Cobourg Formation, the plan does not appear to provide for a program to test the performance of the sealing materials that will be used to seal the vertical shaft. A program is needed to support the evaluation of the performance of the sealing materials.

IR #	EIS Guidelines Section	EIS Section or other technical document	Information Request	Context
EIS 06-269	▪ Section 12, Accidents, Malfunctions, and Malevolent Acts	▪ *Malfunctions, Accidents and Malevolent Acts TSD:* Section 5.5 ▪ *EIS:* Section 8.2 Site Preparation and Construction	Describe the proposed measures to support response to accidents, malfunctions, and malevolent acts, including beyond design basis events. Provide specific information regarding the notification and protection of adjacent communities, including notification regarding the potential for limiting or restricting commercial fishing in the Regional Study Area. Describe administrative measures and the organizational responsibilities for response, protection, and coordination. This includes notification and assistance in the event of accident or malfunction conditions that trigger action beyond the DGR boundary. Discuss response measures, including an evaluation of notification means and evacuation time estimates and associated protective measures to minimize impact on the public. Should restricted access or clean-up measures be needed in the surrounding environment, describe measures that would be provided to minimize both short term and long term impacts	As described in the EIS Guidelines, Section 14: "The description must include the safeguards that have been established by the proponent to protect against such occurrences and the contingency procedures in place. Accident management typically relies heavily on the evacuation of personnel and of the population, as required…". "The proponent must demonstrate that the requirements for adequate infrastructure external to the DGR site are met. The need for any necessary administrative measures must also be identified together with the responsibilities of organizations other than the proponent… The proponent must provide a description of any contingency, clean-up or restoration work in the surrounding environment that would be required during, or immediately following, the postulated malfunctions and accidents." The EIS does not provide an evaluation of the adequacy of the site and surrounding community environment, including infrastructure, to address accident evaluation, response, and mitigation. The Malfunctions, Accidents and Malevolent Acts TSD, section 4.4.2, page 36, addresses Emergency Preparedness. This section appears to rely on the Bruce EP capabilities with support from municipal fire departments, regional medical officers and Kincardine health and safety services. The need for an independent response capability for the DGR does not seem to have been evaluated or discussed.
EIS 06-270	▪ Section 12, Accidents, Malfunctions, and Malevolent Acts	▪ *Malfunctions, Accidents and Malevolent Acts TSD*: Section 3.2, Initiating Events- Site Preparation and	Provide an evaluation of high-consequence events occurring with an annual frequency of less than 10^{-7}.	Events with less than 10^{-7} frequency should be considered if the potential consequences of specific, very low-likelihood events are severe.

IR #	EIS Guidelines Section	EIS Section or other technical document	Information Request	Context
		Construction, Operations and Decommissioning Phases ▪ *EIS:* Section 8.1, General Information and Design Description ▪ *EIS:* Section 8.2, Site Preparation and Construction		
EIS 06-271	▪ Section 12, Accidents, Malfunctions, and Malevolent Acts	▪ *Malfunctions, Accidents and Malevolent Acts TSD*: Section 4.4, Mitigation, Contingency Plans and Emergency Preparedness ▪ *Malfunctions, Accidents and Malevolent Acts TSD*: Section 5.5, Contingency Plans and Emergency Procedures	Provide an evaluation of the potential effect on DGR operations and safety should an accident occur at the Bruce Nuclear Power Plant and the WWMF. Events causing concurrent accident conditions at all three facilities should be considered. Accidents beyond design-basis and affecting multiple generating units at the Bruce Nuclear Plant should be considered. The EIS should describe the design features and measures needed at the DGR facility in the case of an accident at the DGR or the Bruce Nuclear Plant.	The EIS Guidelines specifies: “The proponent must identify and describe the probability of possible malfunctions or accidents associated with the project, and the potential adverse environmental effects of these events.” Increasing the types and number of nuclear facilities (and associated radioactive inventories) on a single site brings with it the increased potential for combined effects should an event occur. Should an accident occur at the Bruce Nuclear Plant, there may be an impact on the continued safe operation of the DGR, and vice versa.

IR #	EIS Guidelines Section	EIS Section or other technical document	Information Request	Context
		▪ *EIS:* Section 8, Project Description		
EIS 06-272	▪ Section 13.1, Demonstrating the Long term Safety of the DGR ▪ Section 13.2, Selection of Assessment Scenarios	▪ *Postclosure Safety Assessment:* Section 6, Assessment Models, pages 145 and 246 ▪ *Postclosure Safety Assessment:* Executive Summary, Analysis of the Normal Evolution Scenario, page viii. ▪ *Geoscientific Verification Plan:* Section 2.2.7.4, Activity 13 – Microbiology Related Study, pages 20 and 21.	Provide information on the potential consequence (radionuclide release to the biosphere) of microbial degradation of the asphalt seal at the interface of the asphalt and shaft wall rock, under aerobic and anaerobic conditions.	While gas generation from microbial/biological degradation of the asphalt shaft seal is considered and screened out in the Past Closure Safety Assessment, physical degradation resulting from microbial/biological activity at the interface of the asphalt and the EDZ of the shaft is not considered.
EIS 06-273	▪ Section, 2.4 Sustainable Development	▪ *EIS:* Section 3.3 Alternatives to the Project	Provide a description of the sustainability-based criteria that OPG adopted to evaluate and compare the alternative means of carrying out the project, and a description of the relative contributions to	In Section 2.4 of the EIS Guidelines states that “The project, including its alternative means, must take into account the relations and interactions among the various components of the ecosystems and meeting the needs of the population. The proponent must

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		▪ *EIS:* Section 3.4. Alternative Means of Carrying out the Project	sustainability of the alternative means of carrying out the project.	include in the EIS consideration of the extent to which the Project contributes to sustainable development."
EIS 06-274	▪ Section 8.1, General Information and Design Description	▪ *EIS:* Section 4.8, Operations Phase	Explain how the concept of retrievability applies to the proposed DGR. Describe how retrievability could be achieved and during which phases of the project it would be considered.	Page 4-56 of the EIS states that "Materials placed in the DGR are considered waste and the need for retrieval is not anticipated; however, retrieval can be achieved."
EIS 06-275	▪ Section 2.5, Precautionary Approach	▪ *EIS:* Section 9, Long-Term Safety of the DGR	Provide the following information with respect to the long-term safety of the proposed DGR Project: a) A description of the redundancies that have been incorporated in the design to ensure safety of workers and the public; and b) The plans to maintain, protect and enhance the financial, technical and administrative capabilities that are required to ensure safe operation, given the significant uncertainties and potential for unanticipated developments over the lifetime of the project.	The definition of redundancy can include several elements that work simultaneously and independently, and are capable of performing the same function. Redundancy may also include standby or backup systems that perform when the system needs them.
EIS 06-276	▪ Section 2.5, Precautionary Approach ▪ Section 16, Follow-up Program	▪ EIS: Section 12, Follow-Up Program	Describe how risk avoidance, adaptive management capacity, and preparation for surprise have been incorporated in the development of the Follow-Up Program.	Section 16 of the EIS Guidelines states that: "the follow-up program must include any contingency procedures/plans or other adaptive management provisions as a means of addressing unforeseen effects or for correcting exceedances."

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EIS 06-277	▪ Section 7.2, Alternatives to the Project	▪ *EIS:* Section 3.3.5.2, Technical Feasibility. ▪ Golder Associates Ltd. 2004. *Independent Assessment of Long-Term Management Options for L&ILW at OPG's Western Waste Management Facility.*	Provide the following information regarding OPG's rationale for considering only LLW in the Engineering Feasibility and Safety and "Licensibility" analyses (in the Independent Assessment Study (IAS)) for the alternatives to the DGR project: a) An explanation of how inclusion of ILW would affect the engineering feasibility analysis of the options. b) An explanation of how inclusion of ILW would affect the safety and "licensibility" analysis of the options.	In the IAS, OPG's evaluation of alternatives to the DGR project does not consider ILW in the Engineering Feasibility and Safety and "Licensibility" analyses. Only LLW is considered.
EIS 06-278	▪ Section 2.5, Precautionary Approach	▪ *EIS:* Section 3.4, Alternative Means of Carrying Out the Project	Clarify how the alternative means of carrying out the proposed DGR project, as listed in Section 3.4 of the EIS, were evaluated and compared in light of risk avoidance, adaptive management capacity, and preparation for surprise. Provide the following information: a) The definitions of risk avoidance, adaptive management capacity, and preparation for surprise used in the EIS; b) A description of how risk avoidance, adaptive management capacity, and preparation for surprise were incorporated into the evaluation and comparison of the alternative means of carrying out the project, considering a range of plausible scenarios including accidents, malfunctions and malevolent acts. This analysis should be at a level of detail that allows a meaningful comparison of the environmental, technical, and	Section 2.5 of the EIS Guidelines requires OPG to indicate how the precautionary principle was considered in the design of the project, including consideration of risk avoidance, adaptive management and preparation for surprise.

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			economic factors of the alternative means; c) A description of how each of the alternative means performs in relation to the three criteria, considering a range of plausible scenarios including accidents, malfunctions and malevolent acts; and d) Reasons why the preferred means was selected, giving explicit attention to risk avoidance, adaptive management capacity, and preparation for surprise.	

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