



Environment and Climate Change
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Ms. Robyn-Lynne Virtue
Panel Manager
Deep Geologic Repository Project
Canadian Environmental Assessment Agency
160 Elgin Street, 22nd Floor
Place Bell Canada
Ottawa, Ontario K1A 0H3

Dr. Ms. Virtue,

RE: Technical Review of Ontario Power Generation's Response to the Request for Additional Information for the Deep Geologic Repository (DGR) for Low and Intermediate-Level Radioactive Waste Project

As requested in your letter of January 18, 2017, Environment and Climate Change Canada (ECCC) has reviewed Ontario Power Generation's (OPG's) submission in response to the Minister of Environment and Climate Change's February 18, 2016 request for additional information from the proponent on the proposed DGR project.

The ECCC review focused on the technical validity of the additional information submitted by OPG for the proposed DGR in response to these IRs. ECCC's review focused on those aspects of the new information that were related to our mandate, including water quality and quantity, air quality, migratory birds, species at risk, and ecological risk assessment. We have identified a number of aspects that in the interest of transparency, public awareness and completeness of records require further clarification. Our review comments have been provided in Annex 1 attached to this letter.

We would like to note that while the information that OPG has provided and the level of detail that it contains appears to be consistent with the parameters set out by the Canadian Environmental Assessment Agency, ECCC notes that the approach taken results in an assessment of effects that lacks sufficient detail to fulfill your request to federal authorities for an evaluation in relation to Section 5 effects, given that no specific sites have been identified. A detailed and site-specific assessment would be required to adequately determine the impact to migratory birds and species at risk at any given project location. OPG has acknowledged that mitigation measures would generally be required to reduce or eliminate effects on species at risk. ECCC recognizes that there is considerable variation in the terrestrial environment within each of the geographic areas it has identified as alternative geologic formation locations. The range of site conditions and environmental features is simply too broad for OPG to adequately demonstrate how environmental effects on species at risk at alternate geologic formations compare to the preferred DGR Project. Therefore, it is difficult to evaluate and compare the impacts on terrestrial wildlife species at risk or on migratory birds arising from the two alternatives. Habitat compensation through offsetting may not necessarily be adequate depending on the species being impacted and the nature of the impact as residual effects may still occur even with offsets.

We would also note that the ecological risk from conventional contaminants was not assessed as part of the original Bruce site DGR EA. This approach was considered reasonable by ECCC

since there were no contaminated sites with conventional contaminants within the Project's footprint. Whether this assumption would apply to the alternate geographic formations would depend on site conditions. As was the case for the assessment of effects on the terrestrial environment as part of the alternate locations assessment, the approach taken results in an assessment of effects that lacks sufficient detail to properly assess the ecological risk of radiological emissions from alternate geologic formations on the environment.

In addition, we note that ECCC's review of the Mitigation Measures Report was mainly focused on the commitments by OPG of most relevance to ECCC's mandate. As a result, our review comments should not be construed as an exhaustive review of the document. Additionally, it should be noted that ECCC's review focused on the sufficiency of the report in meeting the Minister's request. It is our recommendation that OPG revise the Mitigation Measures Report in order to identify all commitments and to further consolidate commitments and remove redundancies and/or inconsistencies. Detailed review comments on the Mitigation Measures Report have been provided in Annex 2 to this letter.

We trust that the above provides you with the necessary context and advice. If you have any questions regarding this submission, please contact me at <contact information removed> or rob.dobos@canada.ca, or Jessica Moreno at <contact information removed> or jesica.moreno@canada.ca.

Yours sincerely,
<Original signed by>

Rob Dobos
Manager, Environmental Assessment Section
Environmental Protection Operations Directorate – Ontario Region

Attachments (2)

1. Annex 1: Information requests for the Agency's consideration
2. Annex 2: Mitigation Measures Report: Detailed Review Comments

Cc: J. McKay, EPOD-OR
J. Moreno, EPOD-OR
N. Ali, EPOD-OR
M. Taylor, EAD, EPOD

Annex 1: Information requests for the Agency’s consideration

Departmental number	Project Effects Link to CEAA 2012	Request Element	Reference to OPG’s Response	Context and Rationale	Specific Question/ Request for Information
Alternate Locations					
ECCC-01	5(1)(a)(i) Fish and Fish Habitat 5(1)(a)(ii) Aquatic Species 5(1)(a)(iii) Migratory Birds 5(1)(c)(i) Aboriginal Peoples Health/ socio-economic conditions	Alternate Locations	Environmental Effects of Alternate Locations <ul style="list-style-type: none"> • Section 4.1 • Section 4.2 • Section 4.3 • Section 4.4 • Section 4.6 • Section 5.1 • Section 5.2 • Section 5.3 • Section 5.4 • Section 5.6 	<p>The Proponent provided a qualitative comparison of environmental impacts for two alternate geologic formations versus the environmental impacts for a DGR at the Bruce Nuclear site. The two alternatives include a sedimentary and a crystalline geologic formation. Each of the two alternatives represents a large area and as a result, they each encompass a fair range of environmental conditions.</p> <p>When evaluating the impacts on surface water quantity, for example, the large area evaluated as part of these two alternate geologic formations encompasses a fair range of climate, surface geology and land cover conditions. This means that there could be considerable variation in surface water quantity properties and impacts, depending on the location selected within each alternative. ECCC agrees with much of OPG’s qualitative analysis and general conclusions about the most probable variation in the magnitude of the effects on water quantity for the alternatives in comparison to the DGR at the Bruce Nuclear site. However, each alternate geologic formation represents a large area and OPG’s conclusions about the magnitude of the given environmental impact evaluated did not adequately account for the potential variability of environmental conditions within each formation. The need to consider the potential variability of environmental conditions within each formation would also apply to the assessment of other environmental effects including surface water quality, air quality, aquatic environment, terrestrial environment and radiological impacts on non-human biota.</p>	<ol style="list-style-type: none"> 1. For both the sedimentary alternate geologic formation and the crystalline alternate geologic formation, the Proponent is requested to provide some additional qualitative analysis to address the uncertainty of their analysis including: <ul style="list-style-type: none"> • The likely range of the magnitude of effects on surface water quantity, surface water quality, air quality, aquatic environment, terrestrial environment and radiological impacts on non-human biota relative to the DGR Bruce Nuclear option; • The degree of uncertainty associated with the anticipated magnitude of environmental effects (for example: certain, mostly certain, moderately certain, mostly uncertain, uncertain); • For each alternate geologic formation, identify the major sources of uncertainty; and • Identify whether OPG has any site-selection principles to avoid specific sites within each alternate geologic formation for which the project would produce larger adverse effects on surface water quantity and quality, air quality, the aquatic and terrestrial environments and radiological impacts on non-human biota. Such principles would reduce the range in the magnitude of adverse effects within each alternate geologic formation. 2. It is recommended that a column that describes the “degree of uncertainty” associated with the environmental effects be added to all of the Summary of Effects tables in sections 4 and 5 of the Environmental Effects of Alternate Locations report.

				As a result, ECCC suggests that OPG should provide further details on the degree and sources of uncertainty associated with the alternatives assessment.	
ECCC-02	5(1)(a)(i) Fish and Fish Habitat 5(1)(a)(ii) Aquatic Species	Alternate Locations	Environmental Effects of Alternate Locations <ul style="list-style-type: none"> Section 5.2 	<p>The acid generating potential of waste rock in the sedimentary alternate geologic formation was not discussed. The acid generating potential of waste rock in the crystalline alternate geologic formation was discussed briefly but was not considered in the effects analysis since it was assumed by the Proponent that the waste rock would not be acid generating. The Ontario Ministry of Natural Resources and Forestry ecozone and ecoregion classification (Crins et al. 2009) indicates that of the 9 ecoregions identified within the Ontario Shield ecozone, all but one ecoregion are characterized by geologic substrate that has low to moderate acid buffering capacity.</p> <p>Considering the prevalence of acid generating minerals in Canadian Shield rock, acid generation and metal leaching should be considered as part of the assessment of environmental effects of the alternate geologic formations.</p> <p><u>References:</u> Crins, W.J., P.A. Gray, P.W.C. Uhlig and M.C. Wester. 2009. <i>The Ecosystems of Ontario, Part 1: Ecozones and Ecoregions. Ministry of Natural Resources Science and Information Branch: Inventory, Monitoring and Assessment Section.</i> Technical Report SIB TER IMA TR-01.</p>	The Proponent is requested to provide a narrative comparison of the risk of acid generating potential and metal leaching potential for the sedimentary versus the crystalline alternate geologic formations. The environmental risk that would be posed by this phenomenon and how it would be mitigated should be considered as part of the assessment of environmental effects at alternate geologic formations.
ECCC-03	5(1)(a)(i) Fish and Fish Habitat 5(1)(a)(ii) Aquatic Species	Alternate Locations	Environmental Effects of Alternate Locations <ul style="list-style-type: none"> Section 4.2.1 Section 5.2.1 	<p>The Proponent indicates that the acceptability of the quality of the discharge from the stormwater management pond (SWMP) would be determined by the Ontario Ministry of the Environment and Climate Change's (OMOECC) Environmental Compliance Approval (ECA) process. In making this determination, the OMOECC would consider site-specific conditions at each alternate geologic formation.</p> <p>The Proponent does not indicate its intention to comply with Section 36(3) of the <i>Fisheries Act</i> which prohibits the discharge of deleterious substances to waters frequented by fish.</p>	The Proponent is advised that their discharge from the SWMP will also have to comply with the general prohibition provisions of the <i>Fisheries Act</i> at both the crystalline and the sedimentary alternate geologic formations.

				For both alternate geologic formations assessed, it is proposed that the effluent from the SWMP would be discharged into local streams or lakes which are likely to be frequented by fish. As a result, the discharge from the SWMP would likely be subject to the general prohibitions of Section 36(3) of the <i>Fisheries Act</i> .	
ECCC-04	5(1)(a)(i) Fish and Fish Habitat 5(1)(a)(ii) Aquatic Species	Alternate Locations	Environmental Effects of Alternate Locations <ul style="list-style-type: none"> • Section 4.2.1 • Section 5.2.1 	<p>The Proponent indicated that there would be numerous waterbodies, including small streams, within each alternate geologic formation. It is also indicated that some cool to cold water freshwater habitat would be expected at the sedimentary geologic formation and though not specifically stated, it would be reasonable to expect cold water habitat at the crystalline geologic formation as well. On the other hand, the drainage ditch that is proposed to be used to convey the effluent from the SWMP to MacPherson Bay at the Bruce DGR site is not likely to constitute a coldwater habitat. Additionally MacPherson Bay habitat has been characterized in OPG (2011) as being limited and no coldwater fish species were found during the 2007 fish community monitoring that was conducted there.</p> <p>As indicated in MOECC's Stormwater Management Planning and Design Manual (2003), end of pipe stormwater management facilities are known to increase the temperature of water prior to its discharge into the receiving environment. According to research discussed in the report, a wet pond type of stormwater management facility could increase water temperature by as much as 5.1°C.</p> <p>Based on the DGR project, it is plausible that a wet pond would be the design chosen for the stormwater management pond at the alternate geologic formations. As a result, there is a potential that effluent from the stormwater management pond may release effluent that is significantly warmer than ambient water temperatures. This would be of significance if the discharge was to a coldwater habitat.</p> <p>This potential heating of stormwater management pond effluent should be considered by the Proponent in the assessment of environmental effects on the aquatic environment as part of the</p>	<p>The Proponent is requested to provide a narrative discussion of the potential effect that the discharge of warmer than ambient water from the stormwater management pond into a cold water environment could have at both the crystalline and the sedimentary alternate geologic formations.</p> <p>Part of the approach to this assessment could be to evaluate whether thermally sensitive species are likely to be present in waters at each of the alternate geologic formations and at the Bruce DGR location.</p>

				<p>assessment of alternative geologic formations.</p> <p><u>References:</u> Ontario Ministry of the Environment. 2003. Stormwater Management Planning and Design Manual. Toronto: Ontario, Ministry of the Environment.</p> <p>Ontario Power Generation (OPG). 2011. <i>Aquatic Environment Technical Support Document</i>. NWMO DGR-TR-2011-01.</p>	
ECCC-05	5(1)(a)(i) Fish and Fish Habitat 5(1)(a)(ii) Aquatic Species	Alternate Locations	Environmental Effects of Alternate Locations <ul style="list-style-type: none"> Section 4.3.1 Section 5.3.1 	<p>The sedimentary alternate geologic formation was described in section 4.3.1 as having cool to coldwater habitats; however, this is not represented by the list of fish species that were identified by the Proponent as likely to be found in this formation.</p> <p>The Ontario Fishing Regulations Summary (2017) clearly indicates that coldwater species, such as rainbow trout occur within the area associated with the sedimentary alternate geologic formation. Likewise, coldwater species also occur in the crystalline geologic formation.</p> <p><u>References:</u> Ontario Ministry of the Environment. 2017. Ontario Fishing Regulations Summary. Toronto: Ontario, Ministry of the Environment.</p>	<p>It is recommended that coldwater fish species be included in the list of fish species found at both the sedimentary and the crystalline geologic formations. The Proponent should provide a narrative discussion of the relative risk from the project on these species should they be present at either alternate geologic formation.</p>
ECCC-06	5(1)(c)(i) Aboriginal Peoples Health/ socio-economic conditions	Alternate Locations	Study of Alternate Locations Main Submission <ul style="list-style-type: none"> Section 5.3.1 Section 5.4.1 Environmental Effects of Alternate Locations <ul style="list-style-type: none"> Section 4.1 	<p>The Proponent provided emission estimates for GHGs. However, they do not provide emission estimates for air pollutants related to mobile equipment (i.e. NO_x, CO, total suspended particulates, PM₁₀, PM_{2.5} and VOCs such as acrolein).</p> <p>The Proponent states that “<i>Taking into consideration mitigation and the magnitude of effects, potential effects on air quality are not likely to be significant,</i>” however, it does not provide a discussion about potential mitigation measures.</p>	<p>Consistent with what was done for GHG emissions, the Proponent is requested to provide a narrative discussion on the changes from baseline to air pollutant emissions from mobile equipment (i.e., NO_x, CO, total suspended particulates, PM₁₀, PM_{2.5} and VOCs such as acrolein) for the project, as a result of the increased movement and transportation of waste involved with an alternate geologic formation. It would be helpful to include information on the assumptions, any calculations and references.</p> <p>The Proponent is also requested to identify possible mitigation measures that could be used in order to mitigate the emissions from increased movement and transportation of waste, such as anti-idling procedures.</p>

			<ul style="list-style-type: none"> • Section 5.1 		
ECCC-07	5(1)(c)(i) Aboriginal Peoples Health/ socio-economic conditions	Alternate Locations	<p>Environmental Effects of Alternate Locations</p> <ul style="list-style-type: none"> • Section 4.1 • Section 5.1 	<p>The Proponent assumed that the extent and intensity of site preparation and construction activities that would take place at each of the alternate geologic formations would be equal to those taking place at the preferred DGR location. Based on this assumption, the Proponent indicated that atmospheric emissions for the site preparation and construction stages of the project would be equal for the preferred DGR and for each of the alternate DGR locations. No justification was provided to support this assumption.</p> <p>Additionally, no justification was provided to support the assumption that emissions would be equal for each of the alternate geologic formations. Based on differences in bulk density for some of the types of rock found at sedimentary and crystalline regions, it is expected that atmospheric emissions from the removal of rock would differ across geological regions. For example, consider the bulk densities of two crystalline rocks that are common in the Canadian Shield (EduMine, 2017):</p> <ul style="list-style-type: none"> • Granite: 2,600 – 2,700 kg/m³ • Gneiss: 2,600 – 2,900 kg/m³ <p>These densities are somewhat higher (on average) than the bulk density of limestone (2,300 – 2,700 kg/m³). Based on this information, crystalline rock could be assumed to be 5 – 10% denser than limestone. Therefore, when comparing the movement of equal volumes of rock, the emissions that would result from moving crystalline rock should be assumed to be 5 – 10% larger in magnitude than for limestone.</p> <p>It is also expected that differences in design layout for a DGR at the preferred versus the crystalline alternate geologic formation would result in increased emissions levels. It is indicated in p. 13 of the Description of Alternate Locations document that in order to prevent emissions of C-14 from ion exchange resins, <i>“the rooms for the processed resin wastes are stabilized with cement.</i></p>	<p>The Proponent is requested to provide a narrative discussion on its emissions assessments for atmospheric pollutants and GHGs considering differences in geologic formation characteristics across the different alternate geologic formations and, therefore, likely differences in energy requirements for site preparation and construction activities (e.g., removal and transportation of rock of different densities). See the information provided in the Context and Rationale section for additional background.</p>

				<p>Furthermore, an additional two underground rooms are assumed to accommodate the increased packaged waste volume from waste processing and cementing. A somewhat larger volume of excavated rock may be needed if waste processing and grouting leads to a larger volume of the as-packaged wastes, if additional spacing is needed to avoid major fractures, and/or if additional concrete structure is needed as support for the rooms or waste packages due to the stress conditions in the host rock.” As a result, it is expected that a larger volume of rock would have to be removed for the construction of a repository in crystalline rock, potentially resulting in larger atmospheric emissions.</p> <p>¹References: EduMine (2017, February 8). Professional Development and Training for Mining and the Geosciences. Retrieved from: http://www.edumine.com/xtoolkit/tables/sgtables.htm</p>	
ECCC-08	5(1)(c)(i) Aboriginal Peoples Health/ socio-economic conditions	Alternate Locations	<p>Study of Alternate Locations Main Submission</p> <ul style="list-style-type: none"> • Section 5.3.1 • Section 5.4.1 <p>Environmental Effects of Alternate Locations</p> <ul style="list-style-type: none"> • Section 4.1 • Section 5.1 	<p>The Proponent has not provided specific details of the means that it would use to provide primary power to the locations considered as part of the alternate assessment for the various phases of the project.</p> <p>As part of site preparation and construction activities, the Proponent does suggest that grid electricity rather than diesel would be used to power the project by indicating that the construction of a 0 – 50 km power corridor for a DGR on a crystalline geologic formation or a 0 – 5 km high-voltage power corridor for a sedimentary DGR would be required. However, there is no confirmation that grid electricity would be available for the construction phase of the project especially at a more remote crystalline geologic formation, so it is reasonable to assume that at least temporary on-site fossil fuel generation could be required. The Proponent has stated that it would use diesel generation for emergency purposes. As a result, there is a potential for electricity to be a source of emissions for this project, whether from primary or back-up power during the site preparation and construction phases.</p>	<p>As was provided by OPG for the assessment of emissions from transportation activities, the Proponent is requested to provide a similar narrative discussion addressing the emissions of the power requirements for each phase of the project and for each of the alternate geologic formations that were assessed. As part of this discussion, the Proponent should consider/provide the following:</p> <ul style="list-style-type: none"> • An indication of the likelihood that it would use grid electricity or diesel generators as the source of primary power for each phase of the project. • If onsite generation is to be used for primary purposes, then provide estimates of likely total emissions of GHGs and air pollutants (APs) from electricity generation. It would be helpful to include information on the assumptions, any calculations and references that may be used for this assessment.

				<p>As for the operations phase, while the Proponent has not clearly stated the means that it would use to provide primary power to the considered sites, the submitted documentation does strongly imply that primary power would eventually be from grid connection. As this phase may range in length from 40 – 45 years, the Proponent should discuss plans for primary electricity supply, including whether the Proponent plans to use on-site fossil fuel generation for emergency or standby power.</p> <p>It is also not clear how the power demand would vary over the phases of the project based on the different activities involved in each phase for the different alternate geologic formations being evaluated. For example, would X MWh be required each year, or would the yearly demand vary with the work being performed in a given year and at different phases of the project? This information would provide context to the assessment of the significance of project air emissions, especially in early phases, when there is the highest potential for site needing power that may require the use of back-up system until primary grid power is available.</p>	
ECCC-09	<p>5(1)(a)(i) Fish and Fish Habitat</p> <p>5(1)(a)(ii) Aquatic Species</p> <p>5(1)(a)(iii) Migratory Birds</p> <p>5(1)(c)(i) Aboriginal Peoples Health/ socio-</p>	Alternate Locations	<p>Environmental Effects of Alternate Locations</p> <ul style="list-style-type: none"> • Section 4 • Section 5 	<p>There was no discussion about the potential accidents, malfunctions and malevolent act scenarios that could occur during site preparation, construction, operations, decommissioning and post-closure at the alternate geologic formations aside from the transportation of waste activities to these sites. As result, there was no discussion about the potential environmental effects from such scenarios.</p>	<p>The Proponent is requested to provide a narrative discussion of plausible accident, malfunctions and malevolent act scenarios at each of the alternate geologic formations during site preparation, construction, operations, decommissioning and post-closure. The Proponent is requested to also provide a narrative discussion of the environmental consequences and ecological risks associated with these scenarios and how they would differ from the consequences and risks associated with such scenarios at the OPG DGR.</p>

	economic conditions				
ECCC-10	<p>5(1)(a)(i) Fish and Fish Habitat</p> <p>5(1)(a)(ii) Aquatic Species</p> <p>5(1)(a)(iii) Migratory Birds</p>	Alternate Locations	<p>Environmental Effects of Alternate Locations</p> <ul style="list-style-type: none"> • Section 4.6 • Section 5.6 	<p>Section 4.6.1 of the Environmental Effects of Alternate Locations document states that “...<i>the radiological effects</i> [for the sedimentary alternate geologic formation] <i>are predicted to be similar as those predicted for the DGR Project at the Bruce Nuclear site.</i>” This prediction is based on the premise that the “<i>site preparation, construction, operation, decommissioning and postclosure activities at the DGR at the sedimentary alternate location would be broadly similar to</i>” the activities at the Bruce DGR. While in broad terms these assumptions are correct, there is one significant difference between the two locations: the assessment of radiation and radioactivity for the Bruce DGR also considered the radiological impacts of the existing Bruce Power stations as well as other nuclear operations in the vicinity of the Bruce DGR site. The Radiation and Radioactivity TSD (OPG, 2011) states in section 5.4 that “<i>there are no anthropogenic sources of radiation and radioactivity that result in significant (non-medical) exposures to members of the public and non-human biota within the Regional Study Area, except the nuclear facilities at the Bruce nuclear site.</i>” Furthermore the radiation dose calculations in support of the radiological ERA presented in the Radiation and Radioactivity TSD (OPG, 2011) clearly included the dose attributable to the existing nuclear operations at the Bruce site, resulting in combined doses of approximately double the dose predicted solely for the existing nuclear operations.</p> <p>It would be expected that the sedimentary geologic formation – assuming that it is located a significant distance away from the Bruce site – would be about half of the total radiation dose predicted DGR at the Bruce site. Additionally, Table 5.6-1, which shows that there is no change in the environmental effect between the crystalline alternate geologic formation and the Bruce site, may need to be revisited based on the information provided above.</p> <p><u>References:</u> Ontario Power Generation (OPG). 2011. <i>Radiation and Radioactivity</i></p>	<p>Considering that the baseline radiological conditions at the alternate sedimentary geologic formation would be different from those of the Bruce Power DGR, the Proponent is requested to reassess the effects of radiation and radioactivity at the alternate sedimentary geologic formation.</p> <p>The Proponent is also requested to re-evaluate the Environmental Effects comparison between the crystalline formation and the Bruce DGR location as shown in Table 5.6-1 based on the information discussed in the Context and Rationale column.</p>

ECCC-11	<p>5(1)(a)(i) Fish and Fish Habitat</p> <p>5(1)(a)(ii) Aquatic Species</p> <p>5(1)(a)(iii) Migratory Birds</p>	Alternate Locations	<p>Environmental Effects of Alternate Locations</p> <ul style="list-style-type: none"> • Section 5.6 	<p><i>Technical Support Document. NWMO DGR-TR-2011-06.</i></p> <p>Section 5.6.2 states that “overall residual effects on radiation and radioactivity of the DGR at the crystalline alternate location are likely to be similar to those at the Bruce Nuclear site.” Section 5.6.1 states that the “higher uranium levels in granitic rock [of the crystalline alternate location] could lead to higher levels of natural radon.” The original assessment presented in the Radiation and Radioactivity TSD (OPG, 2011) did not consider radiation from naturally-occurring radioactive materials typically expected in the shield geology as noted in the report.</p> <p>Though OPG states that appropriate mitigation would be put into place to ensure that there are no adverse effects on workers, no consideration of the potential effects of naturally-occurring radioactive materials on non-human biota is presented. Furthermore the comparison in Table 5.6-1 shows that there is no change in the environmental effect between the crystalline alternate geologic formation and the Bruce site. This prediction may need to be revisited.</p> <p><u>References:</u> Ontario Power Generation (OPG). 2011. <i>Radiation and Radioactivity Technical Support Document. NWMO DGR-TR-2011-06.</i></p>	<p>Due to differences in the radiological characteristics of naturally-occurring radioactive materials (NORMs) across different geologic formations, the Proponent is requested to include in the assessment of radiation and radioactivity on non-human biota for the crystalline alternate geologic formation a consideration of the effects of NORMs, including radon as well as the need for any mitigation.</p> <p>In addition, the environmental effects comparison between the crystalline and Bruce locations shown in Table 5.6-1 should be reconsidered based on this request.</p>
ECCC-12	<p>5(1)(a)(ii) Aquatic Species</p> <p>5(1)(a)(iii) Migratory Birds</p> <p>5(2) Linked to Regulatory Permits/Authorizations (SARA sec. 73 if</p>	Alternate Locations	<p>Environmental Effects of Alternate Locations</p> <ul style="list-style-type: none"> • Section 4.4 • Section 5.4 	<p>For the two alternate geologic formations, the Proponent characterized the environmental conditions, habitats, and species commonly found in these broad geographic areas. They stated that “it is assumed” they will place any surface facilities at least 120 m from any provincially significant wetland, and “where possible, the surface footprint would avoid habitat of threatened or endangered species listed under the Ontario Endangered Species Act, and the federal Species at Risk Act (but only on federal land).” ECCC advises that habitat of SARA-listed species be avoided on non-federal lands as well. OPG’s statement implies that there could be a higher risk of an alternate site, if not located on federal lands, having a higher potential to impact on SARA-listed species than if it were sited on federal lands. If that were to be the case, then this potential greater risk should have been assessed for the two alternate geologic formations in</p>	<p>The Proponent is requested to clarify its statement in relation to avoiding habitat for SARA-listed species on non-federal lands.</p>

	located on federal lands)			<p>terms of the likelihood of an alternate site being on federal lands or non-federal lands.</p> <p>It should be noted that SARA provides measures for the protection of listed Threatened, Endangered or Extirpated species and their residences. The prohibitions found in sections 32 and 33 of SARA apply to individuals and residences of aquatic species and birds protected by MBCA anywhere they are found in Canada. These general prohibitions also apply to all other Extirpated, Endangered or Threatened species listed on Schedule 1 of SARA when they are on federal lands in the provinces and on land under the authority of the Minister of the Environment and Climate Change or of Parks Canada in the territories. These prohibitions can also apply on non-federal lands (provincial, territorial and private) if the Governor in Council makes an order to that effect based on a recommendation from the federal Minister of the Environment and Climate Change (SARA sections 34 and 35). For species at risk on private or provincial land, SARA looks first to the provinces to provide that protection. If the species and their habitat are not protected, the federal Minister of Environment and Climate Change must recommend to the Governor in Council (federal Cabinet) that protection be put in place.</p>	
Cumulative Effects					
ECCC-13	5(1)(c)(i) Aboriginal Peoples Health/ socio-economic conditions	Cumulative Effects	<p>Updated Analysis of Cumulative Environmental Effects</p> <ul style="list-style-type: none"> • Section 2.3 • Section 5.4 	<p>The assessment of cumulative effects on the atmospheric environment indicated that potential residual effects from the APM DGR were identified during site selection, construction, operation, decommissioning and closure of the APM DGR. Some additional details were provided with regards to the timing and extent of potential site activities, including the magnitude of rock to be removed as part of the construction of the APM. These details were incorporated into the assessment of cumulative effects.</p> <p>One additional scenario that has been indicated as plausible by the Proponent but that was not incorporated into the assessment of cumulative effects is the potential future 50% expansion of the Bruce DGR. Should site activities for the 50%</p>	<p>Where the site preparation and construction activities of the two projects overlap in time, the Proponent is requested to provide a narrative discussion of the cumulative effects on air quality from the APM DGR and the OPG DGR 50% expansion.</p>

				expansion overlap in time with the site preparation and construction activities for the APM DGR, there may be a potential for cumulative effects on the atmospheric environment.	
ECCC-14	<p>5(1)(a)(i) Fish and Fish Habitat</p> <p>5(1)(a)(ii) Aquatic Species</p> <p>5(1)(a)(iii) Migratory Birds</p> <p>5(1)(c)(i) Aboriginal Peoples Health/ socio-economic conditions</p>	Cumulative Effects	<p>Updated Analysis of Cumulative Environmental Effects</p> <ul style="list-style-type: none"> Section 6.1 Section 6.2 	<p>For radiological substances, there was no discussion about the environmental consequences and ecological risks from their release as a result of accidents, malfunctions and/or malevolent acts at the APM DGR.</p> <p>For conventional parameters, the discussion of environmental effects from accidents, malfunctions and/or malevolent acts was limited with no information provided about the types of events considered for the assessment of cumulative effects and with no discussion of ecological risk from these events.</p>	The Proponent is requested to provide a narrative discussion on plausible accidents, malfunctions and malevolent acts scenarios at the APM DGR. The Proponent is requested to provide a narrative discussion of the environmental consequences and ecological risk from the release of radiological and non-radiological substances as a result of these accidents, malfunctions and malevolent act scenarios as radiological and non-radiological.
ECCC-15	<p>5(1)(a)(i) Fish and Fish Habitat</p> <p>5(1)(a)(ii) Aquatic Species</p> <p>5(1)(a)(iii) Migratory Birds</p>	Cumulative Effects	<p>Updated Analysis of Cumulative Environmental Effects</p> <ul style="list-style-type: none"> Section 5.8 	<p>Section 5.8.1 states that the APM DGR has the potential for radiological emissions during construction, operations, decommissioning, closure and post-closure phases and that these emissions may have an additive radiation effect on the emissions associated with the Bruce DGR.</p> <p>The ERA conducted for the Bruce DGR (see OPG, 2011) assessed the ecological risk due to C-14 and H-3 on a number of terrestrial species with large habitat ranges, including mammals, such as the white tailed deer, and resident bird species, including the wild turkey. A similar assessment was not conducted to assess the potential cumulative dose to non-human biota from the operation of the APM and the Bruce DGRs during their various phases of these projects.</p>	The Proponent is requested to provide a narrative discussion of cumulative effects for appropriate non-human biota VCs that may be impacted by the APM DGR and the OPG DGR.

				<p><u>References:</u> Ontario Power Generation (OPG). 2011. <i>Radiation and Radioactivity Technical Support Document</i>. NWMO DGR-TR-2011-06.</p>	
ECCC-16	<p>5(1)(a)(ii) Aquatic Species</p> <p>5(1)(a)(iii) Migratory Birds</p> <p>5(2) Linked to Regulatory Permits/Authorizations (SARA sec. 73 if located on federal lands)</p>	Cumulative Effects	<p>Updated Analysis of Cumulative Environmental Effects Section 5.2</p>	<p>In their updated cumulative effects assessment, the Proponent identified the only residual adverse effect of the Bruce DGR project on the terrestrial environment found in their EIS was the loss of 8.9 ha of eastern white cedar forest habitat. ECCC finds that the Proponent's assessment of cumulative effects on that aspect of the terrestrial environment appears reasonable; however, ECCC does not share the belief that the loss of cedar forest was the only residual adverse environmental effect of the DGR project on terrestrial valued ecosystem components.</p> <p>ECCC identified in its written submission to the Joint Review Panel in 2013, the potential residual adverse effects of the DGR project on wetlands and species at risk. As part of the site preparation and construction activities for a DGR at the Bruce site, wetland 3 would be infilled. Since Snapping Turtle had been observed in this wetland, ECCC recommended additional surveys in wetland 3; a delay to the infilling of this wetland; relocation of Snapping Turtle individuals prior to the infilling of wetland 3; and, exclusion fencing in specific locations to protect Snapping Turtle individuals during site preparation and construction activities. ECCC had also advised that it could be possible for Eastern Ribbonsnake and Eastern Milksnake individuals to move into the DGR site. As a result, ECCC recommended that OPG seek advice from the Ontario Ministry of Natural Resources and Forestry regarding hibernation and gestation sites and to install exclusion fencing in specific locations during site preparation and construction activities. This is consistent with the Panel's recommendations number 8.36, 8.37, 8.38, 8.39, 8.40 and 8.41 (JRP, 2015).</p> <p><u>References:</u> Department of the Environment (ECCC). 2013. <i>Canadian Nuclear Safety Commission – Canadian Environmental Assessment Act Joint Review Panel, In Respect of Ontario Power Generation's Deep Geologic Repository for Low and Intermediate Level Radioactive Wastes</i>. CEAR#</p>	<p>As part of the cumulative effects assessment, the Proponent is requested to consider its cumulative effects on the terrestrial environment to include impacts on wetlands and species at risk, specifically, Snapping Turtle, Eastern Ribbonsnake and Eastern Milksnake which had been identified as residual effects by ECCC for the OPG DGR.</p>

				1253. Joint Review Panel (JRP). 2015. Joint Review Panel Environmental Assessment Report – Deep Geologic Repository for Low and Intermediate-level Radioactive Waste Project. CEAA Reference No. 17520.	
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Annex 2: Mitigation Measures Report - ECCC Review Comments

Missing Commitments:

1) Table 3-2/Appendix A does not record any commitments made by OPG in relation to the treatment of salinity, which was identified as the most important parameter of concern in the effluent from the Stormwater Management Pond. The following commitments were identified in the transcripts of the Public Hearings and in the OPG responses to Information Requests:

- Public Hearings Transcript, October 1, 2013, page 58:

“If -- during shaft sinking, if there was a need to treat that water, we would have to do that as part of surface. However, during the development of the repository and into the operations phase, if those inflows were to maintain at 39 cubic metres a day, we would install mitigation such as a desalination plant underground prior to discharge into the main sump underground. So at the shaft bottom sumps, we can put in a salinity mitigation treatment. These are off the shelf specifically for the small volumes that we're talking about at 39 cubic metres a day. These are readily available track units that we could put in place at the main shaft and the ventilation shaft sumps to treat the water prior to introduction into the main sump, which is then the conduit to discharge to surface.”

- Public Hearings Transcript, October 1, 2013, page 78:

“Again, it's more the salinity in the shaft inflows that would have treatment.”

- EIS-04-130¹:

“Should treatment be required to remove salinity, the saline groundwater would be collected and treated prior to entering the SWMP. Saline groundwater could be collected at the bottom of the shafts and then be taken to ground surface where it would be treated, by example, with an evaporator.”

- EIS-05-185:

“Saline groundwater could be collected at the bottom of the shafts and then be taken to ground surface where it would be treated, if necessary, say, with an evaporator.”

The above commitments should, at a minimum, be identified in Appendix A as detailed commitments pursuant to Commitment MIT-H-14. Redundant commitments should then be further consolidated and any inconsistencies resolved.

2) Table 3-2/Appendix A does not record some of the commitments made by OPG in relation to the treatment of Total Suspended Solids (TSS), which was identified as one of the most important parameters of concern in the effluent from the Stormwater Management Pond. The following commitments were identified in the transcripts of the Public Hearings and in the OPG responses to Information Requests:

- Public Hearings Transcript, October 1, 2013, page 19:

1 This number refers to the information request (IR) number as assigned by the Joint Review Panel. For general reference, the numbering convention used was “EIS – JRP IR package – IR number.”

"Total suspended solids will be managed in the underground sumps prior to discharge to surface. If required, additional treatment for total suspended solids will be implemented at surface prior to discharge into the oil/water separator and then the stormwater system."

- Public Hearings Transcript, October 1, 2013, page 41:

"There are several options to be able to pre-treat for the total suspended solids readily available from the marketplace to be able to draw out some of the suspended solids. And the immediate intent would be to do that underground in the sump system, allow the sump system to allow for the sediment to control and then pump. As I said, there are several systems that are readily available and if you've seen construction projects along the highway where they have the water units sitting beside because they're -- again, they're disturbing and in order to be able to discharge into the existing ditch system, they do a sediment removal as part of that. So they're -- that's the type of system that we would -- that we'd implement in this particular case."

- EIS-04-130:

"As described above in Item #9, the current design now includes a temporary settling pond and a contractor-supplied temporary water treatment plant which would be available to remove excess oil, grease and/or solids from underground."

- EIS-12-510:

"During construction, a temporary settling pond will be used to settle out any excess solids in water pumped from underground before discharge into the ditch system leading to the SWMP. The temporary settling pond would be decommissioned at the end of construction."

These commitments should, at a minimum, be identified in Appendix A as detailed commitments pursuant to Commitment MIT-H-14. Redundant commitments should then be further consolidated and any inconsistencies resolved.

- 3) Table 3-2/Appendix A does not record some of the commitments made by OPG in relation to monitoring upstream of the final effluent discharge from the Stormwater Management Pond.

- Public Hearings Transcript, October 2, 2013, page 15:

"Underground water will be monitored prior to being released into the surface drainage system."

- 4) MON-H-06 and MON-H-07 does not reference the commitment made in EIS-04-160 (it only references "CEAA" and "LIC" commitments). Furthermore, MON-H-06 specifically excludes acid generating potential as a consideration for the waste rock characterization program, whereas EIS-04-160 included consideration of acid generating potential (see bolded text below):

- EIS-04-160:

"The waste rock monitoring program will include collection and geochemical testing of rock samples from each major horizon during shaft sinking, at a maximum interval of 50 metres. **These results will provide an early indication of any substantial variance**

2 | This number refers to the information request (IR) number as assigned by the Joint Review Panel. For general reference, the numbering convention used was "EIS – JRP IR package – IR number."

from the acid generation potential, elemental content and metal leaching potential as presented in the EIS.”

Also, MON-H-05, MON-H-06, and MON-H-07 are redundant and should be consolidated.

5) Table 3-2/Appendix A does not record one of the commitments made by OPG in relation to the monitoring of water levels in the Northeast Marsh:

- Public Hearings Transcript, October 29, 2013, page 250:

“The follow-up monitoring program proposes baseline monitoring to establish normal seasonal and annual variability of water levels in the northeast marsh. This monitoring began in 2012.”

- Public Hearings Transcript, October 29, 2013, page 286:

“However, we will also have a training program. Because as you say, it’s the workers that are out and about that will come across, so we have done training already with respect to species at risk, and species that they may encounter on the job site. And this would be very similar to that. So we would allow them to be able to recognize what they’re looking at as well as who to inform and how to go about either the identification, removal and/or protection of those species as they encounter them. So that is part of the environment management program.”

Another Example of Missing Cross-References

- MON-T-05:

This does not cross-reference the commitment made during the Hearings on October 5, 2013 (transcript page 16). In fact, many of the commitments listed in Table 3 and Appendix A do not cross-reference the corresponding commitments made during the Hearings.

Many others exist but ECCC has not attempted to identify them all.

Some Examples of Redundancy

6) Numerous redundancies still exist that cause confusion regarding what OPG is committing to do. Listed below are a few important examples from Table 3/Appendix A. Others may exist but ECCC has not attempted to identify them all. ECCC recommends that OPG make further revisions to the Mitigation Measures Report to remove redundancies and inconsistencies and thereby simplify and improve clarity.

- MIT-H-14, MIT-H-15, MON-H-08, MON-H-14 in Table 3-2 are essentially redundant commitments regarding effluent treatment, the goal of meeting discharge limits established under federal and provincial legislation, and the monitoring that will be undertaken to ensure compliance. The differences in wording, and the separate listing of these commitments, creates confusion. These commitments should be consolidated into two commitments, one for mitigation, and one for monitoring. The detailed commitments in Appendix A for the above-noted commitments display even more instances of

3 | This number refers to the information request (IR) number as assigned by the Joint Review Panel. For general reference, the numbering convention used was “EIS – JRP IR package – IR number.”

redundancy and/or inconsistency, and create further confusion. Furthermore, most of the detailed commitments listed under MON-H-08 have no direct relationship to commitment MON-H-08.

- Another example of redundancy is in regards to the last two detailed commitments listed under “Sampling Locations” for MON-H-14. These detailed commitments should be combined and reconciled for clarity. Listed separately, it is difficult to understand what OPG’s overall commitment is.

4 | This number refers to the information request (IR) number as assigned by the Joint Review Panel. For general reference, the numbering convention used was “EIS – JRP IR package – IR number.”