Item #	Issue in EIS or LPSC Application	Review Area Topic(s)	Section # in EIS Guidelines or NSCA Regulations	Title and Section # in OPG's EIS / LPSC	Request for Additional Information	Technical Rationale including Regulatory Basis as Applicable
1	EIS/LPSC	Long Term Safety of DGR – Gas Modeling and Migration	EIS Guidelines Section 13 - Long Term Safety of the DGR Section 13.4 – Confidence in Mathematical Models	Section 9.4 main EIS report T2GGM Version 2: Gas Generation and Transport Code Postclosure Safety Assessment: Gas Modeling Report	Provide a proton mass balance in the repository by considering not only the waste inventory but the presence of carbonate and sulfides in the repository rock wall. Discuss the implications of sulfides and carbonates dissolution from the repository walls along with the generation of sulfides from the waste in limiting methanogenesis, which could lead to higher pressure in the repository. In the context of higher pressure, discuss the possibility of H_2, CO_2 and CH_4 to become supercritical fluids during the post-closure period. Discuss the implications of the possible presence of supercritical fluids on the contaminant source term in the repository and subsequent migration out of the repository.	Hydrogen and carbon dioxide gases can be generated in the repository from the corrosion of steel and degradation of cellulosic and plastic materials. Subsequently, one molecule of methane and two molecules of water are formed by the reaction of one molecule of carbon dioxide and four molecules of hydrogen gas. These microbial mediated reactions require water which is present within the waste, particularly in resins. Methanogenesis (the formation of methane by microbes that produce methane as a metabolic byproduct in zero oxygen conditions) will limit the gas pressure build-up into the repository by consuming one molecule of carbon dioxide and four molecules of hydrogen. However, the presence of sulfides and carbonate in the rock wall along with the presence of sulphate and water in the waste could lead to hydrogen sulphide levels that may restrict methanogenesis and increase the concentration of carbon dioxide and hydrogen gas leading to higher pressures in the repository. Temperature and pressure within the repository will affect whether hydrogen, carbon dioxide and methane will be present as a gas, a liquid or a supercritical fluid. Past their critical points of temperature and pressure (i.e. CH_4 -82^oC, 4.6MPa; H_2 -240^oC 1.3MPa; CO_2 31^oC 7.3MPa), gas can become supercritical fluids. These temperatures and pressure are

Item #	Issue in EIS or LPSC Application	Review Area Topic(s)	Section # in EIS Guidelines or NSCA Regulations	Title and Section # in OPG's EIS / LPSC	Request for Additional Information	Technical Rationale including Regulatory Basis as Applicable
						plausible scenarios for the proposed repository. The current gas generation model approximates the behaviour of the gases using the equation of state for ideal gas. Supercritical fluids behaviour can deviate substantially from an ideal gas, and thus may significantly impact the release rates from the inventory at some time into the future. Additionally, the migration behaviour of supercritical fluids in the geosphere will also be different from an ideal gas. OPG calculated that the main gas to be generated would be methane, with some hydrogen and carbon dioxide. In order to calculate the types, amount and pressure of the gases generated, OPG uses the GGM model for gas generation and the TOUGH2 model for gas transport. In these models, the gases are assumed to behave as ideal gases. In addition, the presence of sulfides and carbonates on the repository rock walls was not taken into account. CNSC staff recommend that the above two assumptions be justified, because of the following potential implications on long term contaminant release from the repository: - The anticipated pressures at a predicted temperature of 22^{o}C in the repository could exceed the supercritical point of H_2, CH_4.and perhaps CO_2 if the temperature in the repository reaches 31^{o}C. The gases in that case become supercritical

Item #	Issue in EIS or LPSC Application	Review Area Topic(s)	Section # in EIS Guidelines or NSCA Regulations	Title and Section # in OPG's EIS / LPSC	Request for Additional Information	Technical Rationale including Regulatory Basis as Applicable
						fluids, and their behavior would deviate substantially from an ideal gas. This may in turn impact the release rates from the inventory at some time into the future. Additionally, the migration behavior of supercritical fluids in the geosphere will also be different from an ideal gas.
2	EIS LPSC	Malfunctions and Accidents Worker Health and Safety	EIS Guidelines Section 11.5.6 - Worker Health and Safety Section 12 – Malfunctions and Accidents	Section 8.0 Main EIS Section 3.0 of the Preliminary ALARA Assessment	Assess the likelihood of pressure buildup and/or corrosion induced container failure leading to gas releases and any potential consequences on worker exposures during operation of the proposed repository.	In general, OPG predicts that the repository will remain relatively dry, which will impede microbial gas generation during the post-closure. Although it is likely that the repository remain dry because of the tightness of the surrounding rock wall, it remains that in some wastes such as resins, water content range from 40 to 50% so there is potential for gas generation through corrosion and oxidation of cellulosic material. These two microbial mediated processes could lead to gas pressure build-up and container failure and expose workers to radioactive gas.