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Written Submission from

Peter Duinker

In the Matter of

Ontario Power Generation Inc.

Proposed Environmental Impact Statement for OPG's Deep Geological Repository (DGR) Project for Low and Intermediate Level Waste

Joint Review Panel

September 16 to October 12, 2013

Mémoire de

Peter Duinker

À l'égard de

Ontario Power Generation Inc.

Étude proposée pour l'énoncé des incidences environnementales pour l'Installation de stockage de déchets radioactifs à faible et moyenne activité dans des couches géologiques profondes

Commission d'examen conjoint

Du 16 septembre au 12 octobre 2013

Canada

Date: 2013 08 30

To: Environmental Assessment Panel for the Deep Geologic Repository Project

From: Peter Duinker, Contractor to the Panel

Subject: Review of OPG's Application of (a) Environmental Assessment (EA) Methodology with Emphasis on the Prediction of the Significance of Adverse Environmental Effects, and (b) Cumulative Effects Assessment

A. Prediction of the Significance of Adverse Environmental Effects

1. Documents Consulted, as per Instructions from the JRP

Reference Guide: Determining Whether A Project is Likely to Cause Significant Adverse Environmental Effects, 1994 (Reference Guide)

DGR Environmental Impact Statement Guidelines, 2009 (Guidelines)

OPG's Deep Geologic Repository Project for Low & Intermediate Level Waste: Environmental Impact Statement, 2011 (EIS)

Consolidated Responses to JRP's Information Requests for Deep Geologic Repository Project for Low and Intermediate Level Waste (Consolidated Responses)

2. Guidance for the Review

The following criteria were set by the JRP for the review:

- Credibility: Trustworthiness and expertise as well as how closely the work in question adheres to scientific principles.
- Defensibility: Sound, reasonable, well-founded methods that are consistent with CEAA requirements and guidance.
- Clarity: Understandable and unambiguous presentation of the context, methods, results and conclusions.
- Completeness: All relevant aspects are analysed.
- Reliability: Results would be the same or compatible using different methods or approaches; i.e. the results of the analysis are reproducible.
- Appropriateness: Suitable, correct, and relevant methods (as per CEAA requirements and guidance) and conclusions.

Additionally, I have understood that my review is to be made in the context of advice and guidance available to the Proponent from the Canadian Environmental Assessment Agency and the JRP. I will make reference to concepts beyond that guidance only when I find that the guidance is silent on an important matter pertaining to sound EA principles and practice.

3. Summary of the JRP Guidance to the Proponent

In section 11 of the Guidelines, the JRP instructs the Proponent about effects prediction, mitigation measures, and determination of the significance of residual adverse effects. The JRP gives detailed instructions about tiers in the practice of ecological risk assessment and demands an account of levels and types of uncertainties pertaining to effects predictions. Following instructions about mitigation, the JRP then instructs the Proponent to assess the significance of all residual adverse effects. The JRP instructs the Proponent to use the following six concepts (criteria) in judging effect significance:

- magnitude of effect
- spatial extent of effect
- timing, duration, and frequency of effect
- reversibility of effect
- ecological and socio-cultural context of the effect
- probability of occurrence of effect

The Proponent is instructed to make reference to government standards, regulations, guidelines, and objectives in considering significance of effects. The Proponent is further instructed to apply a transparent process of determining an effect's performance against each of the six criteria and combining the results into an overall determination of significance.

My interpretation of the above guidance is that it is a departure from the guidance given in the Reference Guide. In the latter document, the framework laid out suggests the following order of steps:

- first, determine whether the predicted effects are adverse
- second, determine whether any adverse effects are significant
- third, determine whether any significant adverse effects are likely

The implication of the first step is that impacts considered not adverse (i.e., not undesirable) do not need to be carried forward for further consideration. The second step is elaborated in the Reference Guide with the following criteria for judging significance:

- magnitude of effect
- spatial extent of effect
- duration and frequency of effect
- reversibility of effect
- ecological context

It is only at step 3 where likelihood of effect is taken into account, i.e., AFTER the determination of significance. Thus, in the Guidelines, likelihood is a criterion for judging significance, whereas in the Reference Guide, it is not.

4. Summary of OPG's Work on Determining Significance of Effects

I begin my examination of approach and method with Figure 1.6.7-1 on page 1-23 of the EIS. In my interpretation, the assessment process went like this:

- describe the project
- characterize the existing environment (in terms of VECs mainly)
- screen for project-VEC interactions; if there are interactions, then
- screen for measurable change; if such a change is likely, then
- predict and assess effects on VECs (as compared to evaluation criteria); if adverse effects are anticipated, then
- design mitigation, then
- re-predict and re-assess effects on VECs; if there are residual adverse effects, then
- feed these predictions into the cumulative effects assessment, and then
- determine the significance of residual adverse cumulative effects, and finally
- design follow-up (monitoring) protocols

Then in Section 7 of the EIS, the Proponent presents effects predictions, design of mitigation measures, and determinations of significance of residual effects. Effects are presented for VECs grouped into ten broad environmental components as well as integrated into what were called four "ecological multi-feature VECs". The Proponent explains how the assessment process worked; from page 7-2 of the EIS:

"Screen to Focus the Assessment. Two screening steps, first for potential interactions and secondly for likely measurable change, allow the assessment to focus on where effects are likely to occur. These steps are completed using professional judgement; if there is uncertainty, the interaction is advanced for assessment.

"Assess Effects. Where there is likely to be a measurable change, the effects on the environment are predicted and assessed as to whether or not they are adverse*. If adverse effects are predicted, mitigation measures to reduce or eliminate the effect are proposed. Once mitigation measures are proposed, the likely adverse effect is reevaluated with the mitigation measures in place to identify whether any residual adverse effects remain. Residual adverse effects are then advanced for a determination of significance.

> [*Interestingly, on page p. 281 of the Consolidated Responses, in respect of the terrestrial environment and application of the precautionary approach, OPG states that "Any measurable change (i.e., a change that is real, observable, or detectable compared to existing conditions) is considered an adverse effect".

"Determine Significance. All residual adverse effects are then assessed to determine whether the effect is significant, or not, taking into account the magnitude, geographic extent, duration, frequency, irreversibility and social/ecological context of the effect."

This last step is directed by the contents of Table 7.1-1, which contains qualitative statements to

help assign a low, medium, or high status to each predicted adverse effect against the criteria of magnitude, spatial extent, timing/duration, frequency, and irreversibility (actually, the rating of magnitude is settled with statements unique to each VEC, as presented later in Chapter 7). It is noteworthy that context and likelihood of effect are not covered in the Table.

It is necessary to delve deeper into Chapter 7 of the EIS to understand the actual assignment of significance to residual adverse effects. Taking information as a guide from pages 7-68 to 7-70, it seems that the magnitude question is settled for each VEC separately - here for eastern white cedar. Then, assessors determined into which category of Low, Medium, or High the VEC would find itself, for each criterion, based on the anticipated residual adverse effect. Then, findings for magnitude, extent, timing/duration, frequency and irreversibility were combined to identify a degree of environmental consequence, undefined but also subject to classification into Low, Medium, and High categories. Finally, the VEC was subjected to an assessment of social/ecological importance which was combined with the finding of environmental consequence to arrive at a finding about significance.

To illustrate the chain of assessment tasks in application, I use the VEC called eastern white cedar (I am using this plant species because it is the only one to be brought forward to the cumulative effects assessment):

- during site preparation, 8.9 ha of mixed-species forest cover needs to be removed; eastern white cedar is a major constituent of this woodland
- this amount of woodland removal represents 77% of the woodland in the Project Area, and 11% of the woodland in the Site Study Area
- cedar is deemed an important tree species in the region, with high levels of local and regional abundance
- the effect is considered adverse and there is no practicable mitigation of the woodland removal (i.e., it must be done for project implementation); therefore, the loss of 8.9 ha of woodland containing cedar is considered a residual adverse effect
- in terms of criteria for judging significance, the effect is classified as follows:
    - magnitude = medium (loss of greater than 25% of woodland in the Project Area)
    - extent = low (effect is limited to the Site Study Area)
    - timing/duration = low (effect occurs only during site preparation and construction)
    - frequency = high (the effect persists continuously)
    - degree of irreversibility = medium (can be reversed with time)
- given those levels of performance of the effect against the criteria, the environmental consequence (without consideration of frequency) is judged to be low
- given that environmental consequence is judged to be low, social/ecological importance is not assessed, and the effect is judged in the end to be NOT SIGNIFICANT (as per Table 7.4.3-2).

Without making a detailed examination of the rest of Chapter 7 of the EIS, I assume that all other interactions between the project and the VECs have been put through the same sequence of considerations.

5. Findings

5.1 The Approach Diagram

My examination of Figure 1.6.7-1 raises some questions:

- What is meant by "measurable" change? Measurability of a change depends on some key factors such as available technology and level of effort. Because level of effort in empirical data collection can vary dramatically depending on budget allocation, one would assume that the assessment of measurability would need to account explicitly for a specific level of effort in monitoring. I suspect that this was not done, for if it had been, details of reasonable levels of effort in monitoring would have been presented.

- If the step labelled "Screen for Measurable Change" answers the question "Is a measurable change likely", then one wonders what additional work is to be accomplished in the next step, called "Predict and Assess Likely Effects on VECs", where the question is "Is there an adverse effect"? When I combine this with the statement from page 281 of the Consolidated Responses, in respect of the terrestrial environment and application of the precautionary approach, where OPG states that "Any measurable change (i.e., a change that is real, observable, or detectable compared to existing conditions) is considered an adverse effect", I am further suspect about the robustness of the Proponent's approach to effects assessment.

5.2 Arbitrariness in Professional Judgement

I have examined quite a few EISs in my career, and I have never seen a more complicated approach to the determination of significance of residual adverse effects. As soon as one engages in assignment of ordinal categories to various attributes of a predicted effect, one enters the shifting sands of arbitrariness in professional judgements about limits and combinations. Let us examine each in turn.

5.2.1 Limits

To facilitate my discussion, I again turn to cedar. Let us examine the limits associated with magnitude category assignment as depicted in Table 7.4.3-1. Here we have the following definitions:

- Low Magnitude - Loss of some trees at several locations leading to reduction in conifer woodlands by 5 to 10% or mixed woodlands by 10 to 25% in the Project Area compared with baseline

- Medium Magnitude - Loss of many trees at numerous locations associated with largescale clearing of vegetation in the Project Area; reduction in conifer woodlands by >10% or mixed woodlands by >25% in the Project Area compared with baseline

- High Magnitude - Local population decrease of >25% in conifer woodlands or >40% of mixed

woodlands attributed to loss of forest communities throughout the Site Study Area

On what grounds has 5% been set as a lower limit for assignment of Low Magnitude? If Medium Magnitude is assigned limits of 11% on the low side and 25% on the high side, what is it about conifer woodlands that would see a Low Magnitude for a 10% reduction, and a Medium Magnitude for anything from 11% to 25%? Are 10% and 11% not closer to each other than 11% and 25%? There is absolutely no ecological justification for the assignment of these limits, or indeed any such limits. If there were ecological justifications, such as conservation of gene pools of cedar or habitat provisions for important vertebrate species, then surely these would have been provided.

A counter-argument could be made that if one is obliged to use categories of Low, Medium, and High for Effect Magnitude (or any of the other criteria for judging effect significance, as depicted in Table 7.1-1), then one needs category-defining limits to be able to make the assignment. The EIS Guidelines do not oblige the Proponent to use such categories - as per section 11.3. Rather, they oblige the Proponent to ensure that the EIS "clearly explain the methods and definitions used to describe the level of the adverse effect (e.g., low, medium, high) for each of the above categories . . .". The words "low, medium, high" are given as an example of approach. In my opinion, it would be hugely better to avoid such categories and rely on an approach based on context-based reasoning to assess the conditions of effect magnitude, extent, timing, duration, frequency, and reversibility using the characteristics of the basic effect prediction (i.e., in this case, that 8.9 ha of cedar-containing woodland would be removed and not allowed to re-establish for the life of the project).

5.2.2 Combinations

Thirteen terrestrial VECs are accounted for in section 7 of the EIS. All are predicted to incur measurable changes, but only one is assessed to suffer a residual adverse effect - cedar. A massive and elaborate decision tree is advanced in Figure 7.4.3-1 to show how one might arrive at a conclusion on effect significance. The point of the tree, which includes 19 unique pathways through the maze of considerations of magnitude, extent, irreversibility, timing and duration (curiously, frequency is missing), consequence, and social/ecological importance, is unclear when only one VEC is to be subjected to it. Cedar passes through the maze with magnitude = medium, extent = all, irreversibility = medium/high, timing and duration = low, consequence = low, and finally significance = not significant.

I do not challenge an EIS finding that the residual adverse effect on cedar is not significant. What I challenge is the rationale for making that finding. On what grounds does one judge that consequence is low on the basis that magnitude = medium, extent = all, irreversibility = medium/high, and timing and duration = low? To choose one of the other 18 pathways through the maze, on what grounds would one arrive at a conclusion of "may not be significant" (a term itself not defined) when the assessment says that magnitude = high, extent = medium, irreversibility = high, consequence = high, and social/ecological importance = low? Moreover, I had understood from the Consolidated Responses document (page 471) that all VECs were important - otherwise they would not be VECs and therefore not included in the assessment.

To me, the decision trees represent an unjustified, arbitrary set of pathways to conclusions about effect significance. They are unnecessary for someone to develop a reasoned set of arguments, grounded in an effect prediction and contextual analysis, leading to a conclusion about effect significance.

5.3 The Notion of "May Not Be Significant"

Each decision tree for effects assessment on biophysical VECs includes the possibility of a finding of "may not be significant" (the other two categories being "not significant" and "significant"). The EIS suggests that "an effect that 'may not be significant' is one that in the professional judgement of the specialists would not be significant; however, follow-up monitoring should be proposed (or rather 'implemented' in some instances) to confirm significant adverse effects do not occur".

This is my first encounter with the concept of "may not be significant". The explanation above leaves much to question. If an effect were to be assessed as "may not be significant", it means not significant but monitoring is required. In other words, the confidence of the assessors is lower in making this call than when declaring an effect as "not significant" or "significant". It suggests that monitoring is only required when a finding of "may not be significant" is made. As it turns out, no residual adverse effects were deemed to be either "significant" or "may not be significant", with the obvious conclusion that nothing needs to be monitored.

No guidance material I have examined suggests that a finding of "may not be significant" is a legitimate outcome. Guidance material suggests that effects are either "significant" or "not significant". As it turns out, no findings of "may not be significant" were presented in the EIS. Yet 33 of the total of 93 pathways through the five decision trees lead to "may not be significant". This makes the decision trees highly misleading.

6. Conclusions

The EA I examined from the perspective of determination of significance of residual adverse effects has significant flaws of approach and method. Against the criteria I was instructed to use, I find that the analysis embodied in the EIS and Consolidated Responses is:

- not credible - the work does not adhere to what I consider to be a robust approach to determination of significance of residual adverse effects;

- not defensible - the methods include huge elements of arbitrary and indefensible professional judgements;

- unclear - the scientific basis for many professional judgements in setting category limits and decision-tree combinations was not described;

- not reliable - other expert assessors could easily come to different conclusions;

- inappropriate - the methods, as shown above, are unnecessarily complicated and prone to challenge regarding limits and combinations.

B. Cumulative Effects Assessment

1. Documents Consulted, as per Instructions from the JRP

Cumulative Effects Assessment Practitioners' Guide, 1999 (Practitioners' Guide)

Operational Policy Statement: Addressing Cumulative Effects Assessment under the Canadian Environmental Assessment Act, 2007 (OPS)

DGR Environmental Impact Statement Guidelines, 2009 (Guidelines)

OPG's Deep Geologic Repository Project for Low & Intermediate Level Waste: Environmental Impact Statement, 2011 (EIS)

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2. Guidance for the Review

The following criteria were set by the JRP for the review:

- Credibility: Trustworthiness and expertise as well as how closely the work in question adheres to scientific principles.
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Additionally, I have understood that my review is to be made in the context of advice and guidance available to the Proponent from the Canadian Environmental Assessment Agency and the JRP. I will make reference to concepts beyond that guidance only when I find that the guidance is silent on an important matter pertaining to sound CEA principles and practice.

3. Summary of the JRP Guidance to the Proponent

Section 14 of the EIS Guidelines lay out the JRP's expectations for cumulative effects assessment (CEA). The JRP identifies the OPS as a guidance document. It requires an account of the

approach and methods the Proponent would use to identify and assess cumulative effects (CEs). It requires a rationale for all valued ecosystem components (VECs) selected for the CEA, along with the unique temporal and spatial boundaries for each VEC. It requires identification of the sources of potential CEs, and requires that the Proponent examine induced developments. It requires an analysis of the total CE on a VEC over the life of the project, including all forms of CEs (as in synergistic, additive, induced, spatial, temporal). It requires identification of impact pathways and trends, as well as the contribution of the project to the total potential cumulative effect on VECs. Potential CEs are to be put into an appropriate regional context.

4. Summary of OPG's Work on Cumulative Effects

In line with contemporary practice, the EIS presents CEs in a separate chapter (Chapter 10). The CEA is described as "considering all of the incremental effects of the DGR Project that were assessed to have a likely residual adverse effect or beneficial effect on a VEC". The Proponent chose to "focus the assessment of cumulative effects on those projects whose effects overlap in type of effect, time and space with those residual adverse effects of the DGR Project". Furthermore, "the cumulative effects assessement is conducted at a more general level of detail than in previous sections of the EIS since the projects are more remove in time and space". The Proponent states that "consistent with EA practice, the cumulative effects assessment applies to activities during normal operations only".

Critical to the approach and methods of the Proponent in undertaking the CEA is the decision tree depicted in the EIS's Figure 10.2-1. It demands that CEs of the project fulfill all the following criteria, assessed in the following order for any specific VEC:

(a) the DGR Project must be predicted to have a residual adverse effect;

(b) any other project or activity considered must have the same type of effect on the VEC as that predicted for the DGR;

(c) any other project or activity considered must have an effect on the VEC at the same time as that predicted for the DGR; and

(d) any other project or activity considered must have an effect on the VEC in the same place as that predicted for the DGR.

If any of these criteria remains unfulfilled, the conclusion will be that the DGR does not have a CE on a VEC in association with the other project or activity under consideration.

The Proponent chose to ignore possible CEs associated with malfunctions and accidents because they "are considered too 'rare' to be assessed together with those caused by normal operational activities". The Proponent presents 15 VECs for inclusion in the CEA in Table 10.3-1. The Proponent presents descriptions of 19 past and existing projects, six certain/planned projects, and six reasonably forseeable projects. After considering project-effect overlaps in type, time, and space, the Proponent assessed CEs. The Proponent concludes that "no residual adverse

cumulative effects of the DGR Project" could be identified. Further, "therefore, the assessment of the significance of residual adverse cumulative effects is not required".

5. Findings

1. It is vital in this analysis to consider deeply what conditions must pertain before one can suspect the occurrence of CEs. According to the Practitioners' Guide, "Cumulative effects may occur if: local effects on VECs occur as a result of the action under review; and those VECs are affected by other actions". The Proponent has taken a much more constrained view of CEs. To summarize the OPG stance on CEs, they ONLY occur when the effects of the DGR overlap with the effects of other actions in terms of type of effect, timing, and location. All three of these need to be satisfied before the Proponent considers CEs to be worthy of consideration.

To my knowledge, there is nothing in the guidance materials that would support the stringent criteria the Proponent has put on the circumstances for considering CEs (notwithstanding the OPG claim on page 1162 of the Consolidated Responses document that "the method used [to assess cumulative effects of the DGR Project] is consistent with the guidance provided" in the Practitioners' Guide). Many items of literature that would have been drawn upon by the writers of the Practitioners' Guide have spoken to the temporal and spatial overlaps of the effects of multiple projects, but, as far as I know, none of such literature demands that both be satisfied before CEs occur. Most serious here, though, is the insistence that the type of effect must be the same before CEs occur. Consider this example - if one were assessing the effects of a project's cooling-water effluent on a fish population in a lake, would it not be reasonable to assess the cumulative effects of the effluent-producing project along with sewage-related pollutants from subdivision development on the lake's shores as well as the pressures on the fish population from fishing? These are three substantially different pathways of effects on the VEC (fish population), each emanating from a different human action, and surely demanding attention in terms of VECs. The words in the Practitioners' Guide - "those VECs are affected by other actions" - are silent about type of effect.

As I have written in the literature (e.g. Duinker 1994; Duinker and Greig 2006), CEA is an exercise to be focussed on the sustainability of VECs. In whatever way a VEC is defined, its sustainability is at issue in EA and CEA, and ALL human actions that may collectively compromise that sustainability need to be included in a CEA. In my opinion, the actions and their pathways of influence on the VEC do NOT need to overlap in time (e.g., body burdens of bioaccumulated toxins in long-lived organisms could be delivered decades apart and exhibit CE behaviour), nor space (e.g., migratory organisms could be subject to one habitat-related stress in one location and another habitat-related stress hundreds of kilometres away), nor type (e.g., the fishing example above). OPG has unduly restricted its attention on CEs by insisting that only those where temporal, spatial, AND type overlaps are involved merit assessment.

2. I am puzzled by the logic applied by the Proponent in certain cases where the DGR Project is assessed as leading to a residual adverse effect on a VEC (a statement which is silent about significance), and yet the assessment of CE finds no residual adverse cumulative effect. Consider the case of eastern white cedar. It is represented in the EIS Table 10.5.4-1 under the

"Terrestrial Environment" column, and fetches three stars (meaning overlap in type, time, and location) in the 29th row. In Section 10.6.2, the Proponent admitted that the DGR Project will cause a residual adverse effect on cedar resulting from site clearing for the Project. The project known as "Centre of Site Additions and Modifications" is expected to require additional land clearing, thus implicating additional cedar to be cut. The Proponent then declares that such additional habitat loss will be small, and therefore unlikely to lead to residual adverse cumulative effects on cedar. This conclusion would necessitate a different set of criteria to judge whether a residual effect is expected from the Project alone, vs. a residual cumulative effect from the Project in combination with other projects. I would have thought that no matter how small an additional amount of cedar habitat needs to be eliminated from other actions, if the main Project has a residual adverse effect and other projects would create more of such an effect, surely that would lead to a finding of residual adverse cumulative effect.

3. On page 1156 of the Consolidated Responses document, OPG defines indirect effects as "those where changes to another VEC as a result of the project could have a synergistic effect on the VEC in question". This interpretation of indirect effect is probably not widely shared among EA practitioners. If a human action kills American marten (e.g., trapping), that would be a direct effect of the action. If the action removes forest habitat for American marten, that would be an indirect effect on the marten. If an action killed red-backed voles on which American marten preferentially feed, that would be an indirect effect on the marten. None of this has necessarily to do with synergy, which should be interpreted to mean that the combined effects of two stressors is more than the sum of the effects of each stressor acting alone. OPG provided the example of changes in groundwater quality on cedar trees as an indirect (and therefore synergistic) effect on cedar. If the Project requires removal of cedar trees in some areas, and changes in groundwater quality will potentially affect cedar trees in other areas, how is this synergistic?

4. On page 1157 of the Consolidated Responses document, OPG states that "In selecting the valued ecosystem components (VECs), consideration was given to identifying species that are indicative of the ecosystem as a whole". I see no coverage of the indicator role of species in the EIS' discussion on VEC selection (section 5.3). This topic is subject to wide-ranging coverage in the scientific literature, and could have been addressed.

5. On page 1704 of the Consolidated Responses document, OPG states that "based on this conclusion [of no likely adverse cumulative effects] and the approach used in the assessment, the indicators used for the assessment of effects on VECs are considered adequate for monitoring all effects of the project, including cumulative effects". The information request that prompted this response spoke to the possibility that indicators of CE may be different from the ones most appropriate for project effects on VECs. Even if this possibility exists, it is illogical to argue that a finding of no likely adverse cumulative effect justifies the selection of indicators for monitoring based solely on the project's effects on VECs. The point of monitoring is to reveal whether effect predictions are (a) correct, and (b) based on solid evidence and reasoning. As soon as other human actions are brought into consideration because of a CEA requirement, there may be additional variables under consideration in the pathways of effect. The conclusion of no likely adverse cumulative effects requires confirmation through monitoring, so there is plenty of reason to consider variables that are not part of the cause-effect pathways associated with the central

project under assessment.

6. Conclusions

The CEA I examined has large flaws of approach and method. Against the criteria I was instructed to use, I find that the analysis embodied in the EIS and Consolidated Responses is:

- not credible - the work does not adhere to what I perceive to be the scientific principles of CEA;

- not defensible - the methods are not consistent with CEAA requirements and guidance;

- clear enough - I believe I could understand OPG's approach from the descriptions provided;

- reasonably complete;

- not reliable - other expert assessors could easily come to different conclusions;

- inappropriate - the methods, as shown above, are in substantive aspects incorrect.

I caution that despite my findings that the CEA is flawed, I do not draw any inference that a properly conducted CEA would result in findings of significant residual adverse cumulative effects. It is entirely possible that a competent CEA would conclude just as the Proponent has concluded, that the CEs of the DGR Project are, on balance, insignificant. However, that outcome can only be known by actually undertaking a competent CEA. In my opinion, such a competent CEA would require a grounding in scientific principles and approaches to assessment practice that go far beyond the guidance provided by the Canadian Environmental Assessment Agency and the JRP.

7. References

Duinker, P.N. 1994. Cumulative effects assessment: what's the big deal? In: Cumulative Effects Assessment in Canada: From Concept to Practice (A.J. Kennedy, editor), pp. 11-24. Alberta Society of Professional Biologists, Calgary, AB.

Duinker, P.N. and L.A. Greig. 2006. The impotence of cumulative effects assessment in Canada: ailments, and ideas for redeployment. Environmental Management 37(2):153-161.