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Written Closing Remarks from Peter L. Storck

Observations écrites finales de Peter L. Storck

In the Matter of

À l'égard de

Ontario Power Generation Inc.

Ontario Power Generation Inc.

OPG's Deep Geological Repository (DGR)
Project for Low and Intermediate Level
Radioactive Waste

Installation de stockage de déchets radioactifs à
faible et moyenne activité dans des couches
géologiques profondes

Joint Review Panel

Commission d'examen conjoint

October 2014

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Closing Remarks.

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Part 1. Summary of my two interventions: objections to the DGR.

In both interventions I asked the Joint Review Panel to reject, unconditionally, Ontario Power Generation's request for a license to construct a deep geological repository.

In my first intervention, presented orally, October 8, 2013, I argued that the proposal should be rejected for the following reasons:

(1) the geoscience evidence is not, and cannot be, definitive because it is based on small samples, computer modeling and analogue studies. Thus, there are reasonable doubts that deep burial can be done safely, doubts accentuated by the geological context and methods of containment which, in combination, would be unique in world experience, new technology, untested;

(2) historically, using examples from the Titanic disaster, the nuclear industry, NASA and the Walkerton tragedy, "...human failures in the application of science and technology have been caused by: the mis-application of technology¹, faulty design^{3,5}, organizational failure due to production or political pressures^{1,4}, attitudes to risk management (often called the 'normalization of risk' – in essence, if it worked once despite known risks it will work again)⁵, failures in government licensing and regulation^{4,6}, human error³ and even negligence⁶. Another source of concern is referred to benignly as 'knowledge management', a term arising from activities at the Bruce facility in the early 1990s after it was discovered that reactor design was being stressed by inappropriate modifications or maintenance⁷." There is every reason to believe these or other failures will occur if we bury nuclear waste. Thus, burial should not be attempted;

(3) the application of calculated risk, especially the more subjective approach OPG uses in the EIS, expressed by the phrases "not likely" or "very unlikely", should be rejected;

(4) it would be unethical for society to bury nuclear waste when there is a possibility that a change of direction in the nuclear industry would lead to more efficient and cleaner nuclear energy, creating less waste while simultaneously re-cycling legacy waste. This is the only ethical position we can take on behalf of future societies that will become ever more dependent on nuclear energy because of our depletion of the world's petroleum supply.

In my second intervention, presented orally, September 10, 2014, and in writing (PMD 14 P1.11), I discussed arguments in opposition to the DGR on the grounds that: (1) there was no

clearly defined Go/ No Go decision point for the project as a whole that would abort the project for geotechnical reasons, (2) the alternative means risk analysis did not fully explore the hardened surface storage or granite DGR options and (3) that OPG, because of a faulty track record and also because humans are not infallible, cannot guarantee a totally effective safety culture – an issue highlighted by recent incidents at the WIPP facility in New Mexico.

I also argued that because science corrects knowledge retroactively – much as regulations and procedures are corrected through human experience – we should not use current knowledge and the regulatory framework as a basis for burying nuclear waste; that it would unethical to do so in the face of the uncertainties we know about, let alone cannot presently imagine.

Organization of this Statement.

In organizing the presentation below I will use headings that depart somewhat from those in the EIS but I trust my headings, and where they fit in that document, are self-explanatory. I have also added a section (number 8) taken from Part V in Appendix A, Terms of Reference for the Review, in the agreement between the Minister of the Environment and the CNSC to establish a Joint Review Panel.

Part 3. Commentary on the EIS and Supporting Documents.

1- Community Acceptance: *‘willing host’ not established; not appropriately defined.*

OPG has not demonstrated that the Municipality of Kincardine is a “willing host”. The use of a telephone poll is questionable, the question posed was ambiguous and the results manipulated to the advantage of OPG and Kincardine council; the reported result of the “Yes” vote was 72% of the phone poll (actually 60% of the sample, eliminating “neutral” and “don’t know/refused” votes) but only 27% of the 8,319 eligible voters in the municipality (written intervention by Jill Taylor for Save Our Saugeen Shores, PMD 13-P1.130, p. 35).

Certainly, the people who voted ‘Yes’ in the telephone poll did not vote for the project as described in the EIS. This alone should invalidate OPG’s application for a license to construct a DGR.

OPG’s contention that public attitude surveys also support the DGR is misleading. A peer review assessment conducted for the Municipality of Kincardine by Hardy Stevenson and Associates of public attitude surveys for the DGR project stated that the results should be regarded as qualitative measures only, not quantitative (statements in transcript for September 16, 2013, p. 205). The IEG review of public attitudes of risk perception in documents submitted to the public hearing acknowledged local public opposition to the four options for managing nuclear waste but the IEG was unwilling to either quantify or characterize the data (Enclosures to OPG Response to IR-EIS-12-513, p. 338).

An argument could also be made that the host community was not appropriately defined and should have included Saugeen Shores (roughly as close to the Bruce facility as the town of Kincardine) and the Saugeen-Ojibway Nations, if not a much broader region (for the SON position see written intervention, PMD 14-P1.22; also oral statements in the transcript for September 17, 2014),

2- Project Justification: *incomplete.*

The EIS did not sufficiently explore: (1) alternatives to the project (guideline 7.2), such as the status quo, enhanced processes and storage, or (2) alternative means for carrying out the project (guideline 7.3), such as other possible locations for a DGR.

OPG did not present in the EIS a thorough, alternative means analysis of two of the four options for dealing with nuclear waste (enhanced surface storage or deep burial in crystalline rock.) Nor did it present a full discussion of present and future options for the recycling of decommissioning waste (see written submissions from Peter Ottensmeyer, PMD 13-P1.139 and 139A).

A subsequent report by an Independent Expert Group requested by OPG in response to questions from the JRP also failed to develop well-documented alternative means on which to build a comparative risk analysis (see, for example, statements by Dr. Julie Brown, CNSC, regarding the limitations of generalizing about granite as a host rock; transcript for September 11, 2014, pp. 36-39). Thus, the comparative risk assessment of the four options for dealing with nuclear waste remains ambiguous.

3- Site Characterization: *subject to uncertainties.*

The geoscience underlying the case for DGR is based on small samples, computer modeling and analogue studies. On-site samples were derived from only eight widely spaced drill cores. In response to my question about the extent to which site characterization is based on modeling, Mr. Mark Jensen (NWMO) replied that "...modeling represented 30 to 40 percent of the confidence in the work program" (statement in the transcript for September 18, 2013, p. 54). Thus, the geoscience case is not definitive. Significant uncertainties remain about such issues as: the potential of gas generation to re-open old cracks or generate new ones in the emplacement rooms (particularly after the proposed expansion of the DGR), the likelihood of the emplacement rooms remaining dry, the permeability of the cap rock and the disturbed rock (EDZ) around the shafts, the effectiveness of the shaft seals, the possibility of fracturing in the host formation caused by over-pressure in the underlying Cambrian formation and, more generally, changes in the deep rock environment resulting from excavation and its influence on the repository's ability to function as a 'container'.

[For the potential of gas generation from decommissioning waste see comments by Pete Roche, Northwatch Affiliate, transcript for September 16, 2014, pp. 185-

187; also, Stuart Haszeldine, Northwatch Affiliate, transcript for September 16, 2014, pp. 187-203; also PMD 14-P1.20.]

4- Updated Geoscience Verification Plan: (a) *uncertainties concerning the performance of the shaft seal and (b) poorly defined geotechnical and Go/No Go ‘triggers’.*

(a) The two vertical shaft seals, both at the repository level and above, are of central importance to the long-term ability of the DGR to safely contain nuclear waste. Uncertainties remain over the effectiveness of grouting, the corroding effect of micro biota on the concrete core supporting the asphalt and mixed sand/bentonite seals (remarks by Dr. Richard Goulet, CNSC, transcript for September 18, 2014, pp. 171-174) and the permeability of the EDZ which will not be sealed (see response to my question to OPG concerning the treatment of the EDZ, as well as remarks by Steve Frishman, Northwatch Affiliate and panel questions to OPG; transcript for September 18, 2014, pp. 201-209). Tests to determine the behavior of the shaft seal – the core seal, not the EDZ – in shale formations have yet to be determined (see updated geoscience verification plan, EIS-12-511, January, 2014, p. 38).

(b) The geotechnical ‘triggers’ that would require adaptive engineering (redesign) of the project are ambiguously defined and would not be fully developed until required during the construction phase of the project, and in the ‘global’ context of the geophysical environment (statement in the OPG presentation on the updated geoscience verification plan, September 18, 2014). The three ‘benchmarks’ identified by CNSC as critical for long-term, post-closure safety (low permeability of the host and cap rocks, the absence of major fractures and the absence of economically viable resources) are also poorly defined, being only qualitative and with no tolerance limits (transcript for September 18, pp. 47-48). The consequence of ill-defined triggers and benchmarks is that response to problems may be sluggish, exacerbating the time delay required for thorough geoscience verification activities, and delay decisions about corrective measures or even aborting the project.

A further concern is how the geoscience verification plan can be embedded in the construction contract, protecting the scientific work from pressures to conduct the work more quickly (see also, remarks by Dr. Robert Jackson, SON advisor, transcript for September 18, 2014, pp. 72-73). In Dr. Jackson’s opinion OPG should have “... a much more detailed matrix [of trigger points] ... in place and easily reviewable ...” if it is to conduct the geoscience verification plan effectively while under the pressures generated by construction activities (Ibid, p. 72).

5- Effects Prediction (Socio-Economic): *too limited in scope.*

Based on a local and sub-regional study, the EIS predicted that the DGR would have no significant socio-economic impact on the community. The rationale for this is based on: (1) the prediction that the “... local employment effect is likely ...[to be] ... relatively modest ... over the life of the DGR project ... [and would not produce] ... any boom-bust effects” (EIS, March, 2011,

p. 219) and (2) the expectation, derived from the public attitude survey, that the ‘out-migration’ of those who are “not-at-all satisfied” with the idea of a DGR, estimated to be three percent of the population, will be replaced by others “... who may be more tolerant of local conditions or have fewer issues ...” with the DGR (EIS, March, 2011, 2011, p. 798).

These predictions are severely limited because they are project-centric and based on local and sub-regional studies, not the overall economy of Bruce economy or how that economy articulates with that of Ontario as a whole, let alone nationally or internationally. The predictions are also weak because they do not take into consideration the economic impact of the closing of the Bruce nuclear facility between the mid 2030s and 2040s if additional refurbishments to existing reactors are not possible and no new reactors are built (the last proposal by OPG for a third group of reactors having been withdrawn in 2009),

[see www.world-nuclear.org/infor/Country-Profiles/Countries-A-F/Canada-Nuclear-Power/#.Ui8K8saTjTo]

and, following the closing of the Bruce nuclear facility, the impact of closing the DGR itself beginning in the late 2080s-early 2090s, OPG’s “early scenario” estimate for the end-life of the DGR (OPG Response to IR-EIS-12a-512, Figure 1, p. 11). At that time, an already unbalanced economy, possibly exacerbated by stigma and the reluctance of new business to move into the region because of the DGR, could very well produce an economic bust similar to what occurred in Detroit after the near collapse of the automobile industry. Indeed, Hardy Stevenson and Associates remarked that stigma should have been addressed (statement in the transcript for September 16, p. 204). Independently, Dr. William Leiss suggested ways in which stigma might be identified and measured (statements in the transcript for October 8, 2013, pp. 146-150). These and other regional issues should have been part of the socio-economic analysis.

6- Cumulative Effects: *incomplete*.

The EIS failed to consider (as provided for in the guidelines) the cumulative effects of the transportation of decommissioning waste to the proposed DGR, despite the fact that OPG clearly intends to apply for approvals to place decommissioning waste in the DGR at some time in the future from the Pickering and Darlington generating facilities.

Nor did the EIS consider the cumulative effects of a possible second DGR in Bruce County – this for used fuel. Presently, three of the eight jurisdictions in Bruce County are in the early stages of the Adaptive Phased Management Process that is being used to select a site for the second DGR. The fact that the geological situation at the location of the Bruce facility is judged by OPG to be suitable for a DGR for low and intermediate level waste, some of which may unintentionally contain fragments of use fuel, makes it likely that the geology would also be regarded as favorable for used fuel, giving Bruce County an ‘advantage’ (aside from its nearness to a facility already controlled by OPG) over other locations being considered around the north shore of Georgian Bay. Thus, a DGR for used fuel in Bruce County could be regarded as

‘reasonably foreseeable’ (as expressed in the EIS guidelines). If not, it certainly would, as the EIS guidelines prescribe, require a “... rationale for exclusion.”

7- Expansion of the DGR: *unrecognized socio-economic risks.*

During the course of the public hearing OPG revealed that “... the DGR was *conservatively assumed* [emphasis added] to be expanded to double in size (i.e. 400,000 m ...” to accommodate decommissioning waste (Attachment to EIS-12-512, Expansion Plans, January 22, 2014, p. 3). CNSC has indicated the expansion would require a separate license and perhaps another EIS. Clearly, the DGR is a multi-step, multi-generational process, and during that process the design, contents, volume and function of the DGR could undergo significant change. Thus, the public is being asked, and the Joint Review Panel to approve, not only a DGR but also a process for changing the DGR over time. The chief weakness is that over a period of several decades the public may be asked to approve, and thus accommodate to, a succession of changes that – had they been clearly presented at the beginning of the process – would not have been approved, potentially leading to a steady degradation of the socio-economic fabric of the region, if not the built and natural environment.

8- Qualification of the Applicant to (a) Perform the Activity and (b) Implement International Obligations to which Canada has Agreed.

(a) In arguing its case for a DGR at the Bruce facility, OPG submitted a two volume EIS document, nine technical studies documents (TSDs) and 13 Supporting Reports and Studies for the Preliminary Safety Report – a total of 6,890 pages of information. Despite this, the Joint Review Panel felt it necessary to ask for 73 Information Requests (totaling 1709 pages) and 74 Undertakings during the course of the public hearing. Finally, after the close of the 2013 public session, the JRT posed a series of questions (Package #12 of the Information Requests, dated November 8, 2013) centered around four pivotal issues and which required an extension of the hearing. This huge amount of additional information, beyond the original submissions brought forward by OPG, is testimony to the thoroughness of the work of the Joint Review Panel but is also a statement about the incompleteness of the original EIS and supporting documents.

I think it’s fair to assume that when OPG tabled the EIS in 2011 it did so believing the document was complete. The fact that the 2013 public hearing had to be extended into 2014 to consider four critical issues indicates that OPG was not prepared in 2013 to construct or operate a DGR; nor does it seem prepared now, judging from as yet unresolved questions following the extension of the hearing.

During the course of the public hearing, OPG also revealed numerous failings in its corporate behavior. OPG (as well as CNSC and Bruce Power) have not succeeded in resolving issues of pollution and air quality with one of the Bruce facility’s neighbors (statements by Eugene Bourgeois, October 8, 2013; see also PMD 13-P1.29). Further, in an effort to obtain council support for the DGR, OPG participated in secret meetings with Bruce County council,

composed of the majors of various municipal councils, regarding the strategy of future public statements about the DGR at politically advantageous times (statements in oral intervention by Jill Taylor, Rod McLeod and Cheryl Grace for Save Our Saugeen Shores, September 18, 2014; also PMD 14-P1.41A).

OPG has also bought public support for the project by payments under the hosting agreement to the Municipality of Kincardine and by payments to surrounding municipalities, ensuring their support at council level by threatening to discontinue those payments without unanimous support.

OPG was also willing to ask not-for-profit organizations – those it has financially supported through the Corporate Citizenship Program – to provide letters or interventions of support for the DGR at the public hearing (see my question to the IEG in the transcript for September 12, pp. 306-307, arising from information obtained during a FOI).

In these three instances, OPG has shown a willingness to manipulate public support for the DGR project. Finally, there is evidence – (1) in the poorly attended open houses (for Saugeen Shores see Undertaking No. 44; also Independent Assessment Study, Open House Report, June, 2003, in EIS, March, 2011, Volume 2, Appendix D.), (2) in the overly simplified, thus misleading, information in pamphlets and exhibits describing the project, (3) the passive approach OPG has taken in public outreach (by not initiating contacts with local and regional groups opposing the project and not accepting invitations to attend public debates (see ambiguous remarks by OPG and CNSC in the transcript for September 24, 2013, pp. 311-314) – all evidence that OPG has an ineffectual communications program and feeble public engagement.

(b) Although OPG provided assurances that its safety culture is superior to that which resulted in accidents at the WIPP facility, OPG does not, in fact, have an unblemished safety record (examples: the reactor shut-downs at the Bruce and Pickering facilities in the mid 1990s because of improper maintenance⁷, the tritium release from RWOS 1 into groundwater (resolved but causing a persistent problem), the 2009 alpha contamination event at the Bruce facility and numerous other smaller safety issues at the Darlington and Pickering facilities (for a record of the smaller safety issues see written intervention by Brennain Lloyd for Northwatch, PMD 14-P1.17, pp. 35-42). Clearly, safety is a moving target and no organization can guarantee that accidents or unforeseen problems will not occur.

(c) There is no evidence OPG considered Canada's international obligations with respect to the siting of the DGR (see EIS and panel questions following Michigan State Senator Hapgood's deputation, September 18, 2014, transcript for that date, pp. 232-233).

Summary:

(following the organization of information recommended by the CEAA for preparing impact statements)

The Environmental Impact Statement is fatally flawed in at least six of the thirteen sections (four through thirteen) of the EIS guideline:

- #6: public participation
(specifically, “willing host” community) NOT DEMONSTRATED
- #7.2: alternatives (options for waste treatment) and
#7.3 alternative means (options for waste management) NOT DEMONSTRATED
- #9: environmental assessment boundaries TOO NARROWLY
DEFINED
- #11: effects prediction, mitigation measures
and significance of residual effects (specifically
socio-economic) TOO NARROWLY
CONSIDERED
- #13: long-term safety (specifically geoscience) NOT DEFINITIVE
- #14: cumulative effects (specifically transportation
of decommissioning waste; the possibility of a
DGR for used fuel) NOT DEMONSTRATED

This list is not comprehensive, but comprehensive enough to conclude that OPG’s application for a license to prepare the site and construct a DGR should be rejected, unconditionally.

The fundamental flaw of the EIS is the failure to look beyond the Bruce facility, and the Municipality of Kincardine, in considering a site for the DGR, a failure that contributed to a project-centric orientation in many other sections of the EIS and their consequent limitations. I believe the ultimate failure can be traced to, in a word, convenience – corporate convenience: the prior existence of a waste facility on land already under the control of OPG in a municipality that seemed to be supportive of a DGR and, theoretically, satisfied the ‘willing host’ precondition for any DGR; prompting Ontario Power Generation to build a case **around** those key circumstances.

Part 4. Considerations Beyond the EIS.

1- responsibility to future generations.

On September 30, 2013, the chair of the JRP was prompted to raise an ethical question following an intervention by the United Church of Canada: about the comparative ethics of surface and near-surface storage versus deep burial. No answer was given.

In my intervention on October 8, 2013, I stated that “... the only ethical position we can take on behalf of future societies that will become ever more dependent on nuclear energy because of our depletion of the world’s petroleum supply is to seek ... a change in the nuclear industry that leads to more efficient and cleaner nuclear energy, creating less waste while simultaneously re-cycling legacy waste.” This position seems far more ethical to me than burying the waste, considering the uncertainties we already know about, not to mention those that may yet be discovered.

2- moving forward: *reevaluating how to manage nuclear waste; establishing new federal energy policies.*

I believe the JRP should urge government to: (1) re-consider the burial option for nuclear waste, now nearly 40 years old in Canada (dating from the time of the Hare Report), (2) encourage the development of new technologies for re-cycling nuclear waste and (3) promote the replacement of current reactors with a new generation of reactors that would consume legacy waste and create cleaner nuclear energy for the future.

Mr. Peter Elder (CNSC) indicated during the public hearing that they will ask OPG to provide an update on new developments in reduction, recycling and reuse of nuclear waste in their licence application for operating the DGR (transcript, October 28, 2013, p. 63). Earlier in the hearing, Mr. Frank King (NWMO) commented that the transmutation of used fuel required “... another set of reactors ...” (transcript, October 3, 2013, p. 217) – presumably referring to fast-neutron reactors and the consumption of ‘legacy fuels’ (a subject raised by Peter Ottensmeyer in a letter to the JRP dated July 18, 2012) – but did not elaborate except to say that transmutation “... has its own issues.”

I think it’s clear from the EIS and the public hearing that OPG would be reluctant, if not opposed, for economic reasons, to make a transition beyond CANDU technology to the next generation of nuclear reactors that produce cleaner energy. Indeed, it’s probably unrealistic to expect a power generator to take this kind of initiative. New directions will have to come from elsewhere, supported by federal funds, if not a new national nuclear energy policy.

3- moving forward: *do we need greater separation between the nuclear industry and the regulator?*

I urge the JRP to recommend a federal review of the licensing and regulatory process, perhaps through comparisons with those in other jurisdictions.

It was apparent throughout the public hearing that OPG and CNSC work very closely; indeed, it sometimes seemed they were co-proponents of the DGR. It was also occasionally ambiguous where the regulatory requirements and standards originated; through independent research certainly but also through collaboration with OPG and the nuclear industry world-wide, perhaps emerging ‘organically’ from that collaboration. However, the fact that this collaboration

with OPG is done on a cost-recovery basis by CNSC is cause for concern. The question to be asked is whether the CNSC is separate enough from the nuclear industry to act impartially in the interest of public safety.

Footnotes/Sources.

- 1- www.titanicinquiry.org/USInq/USReport/AmInqRep01.php#a11
- 2- www.materialstoday.com/view/1618/what-really-sank-the-titanic/#.UdTOE42zV1Q.email. This is an Open Access journal in materials science.
- 3 Three Mile Island, Chernobyl, Fukushima Daiichi: www.world-nuclear.org (an association representing the global nuclear profession); see also in that website: “Safety of Nuclear Power Reactors,” Appendix 2.
- 4- Essa II:
www.world-nuclear.org/info/Country-Profiles/Countries-G-N/Germany/#.Uh-bcl7D-1c
- 5- NASA (Apollo 1, Challenger and Columbia):
 Hall, Joseph Lorenzo, 2003, “Columbia and Challenger: organizational failure at NASA.” At: www.sciencedirect.com. And,
 “The Accidents: A Nation’s Tragedy, NASA’s Challenge.”
www.nasa.gov/centers/johnson/pdf/584719main_Wings-ch2-pgs32-41.pdf
- 6- Walkerton: www.attorneygeneral.jus.gov.ca/english/about/pubs/walkerton
- 7- [www.world-nuclear.org/info/Country-Profiles/Countries-A-F/Canada- -Nuclear-Power/#.Ui8K8saTjTo](http://www.world-nuclear.org/info/Country-Profiles/Countries-A-F/Canada/-Nuclear-Power/#.Ui8K8saTjTo)
 - in 1995-98 the four Bruce A and four Pickering reactors were laid up following a review that determined there was “ ... a divergence between drawings and modifications which had ... been made ... [that] the company had not shared maintenance experience with the designer. Maintenance standards fell and costs rose.” Referred to as “knowledge management’.