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Written Submission from

Brian M. Ikeda

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

Brian M. Ikeda

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

16 septembre au 12 octobre 2013

Canada

2013 August 13

To: Joint Review Panel

From: Brian M. Ikeda

Re: Deep Geologic Repository Joint Review Panel Public Hearing: Written-Only Submission

Dear Panel Members,

I am writing this letter in support of OPG's Deep Geologic Repository (DGR) project for Low and Intermediate Level Radioactive Waste Management. I am an Associate Professor at the University of Ontario Institute of Technology (UOIT) and the views presented in this submission are mine and do not represent those of either the University or my Faculty. My association with the DGR project has been through the Western Waste Management Facility (WWMF) and Bruce Power who have been most gracious in hosting student tours as part of my Radioactive Waste Management Design class. This has provided UOIT with the opportunity of hands-on waste management experiences for our nuclear engineering students.

The Environmental Impact Statement (EIS) document is well written and comprehensive. It clearly summarizes the vast body of work completed over the last decade, and brings forward the key findings in a clear and concise fashion. In this short submission, I will highlight what I feel are some key features necessary to ensure an environmentally sound disposal facility.

The nuclear industry takes the management of radioactive waste seriously, and the Canadian Nuclear Safety Commission (CNSC) has issued regulatory policy P-290, "Managing Radioactive Waste" which outlines the philosophy that nuclear waste generators are expected to follow in the management of radioactive waste. One expectation is that the measures taken to minimize risk to present and future generations are developed and funded as soon as reasonably practical. This DGR project is a step to meeting this fundamental principle. The waste cannot "sit" indefinitely in the warehouses, tile-holes, and quadracels at the WWMF – no matter how secure the current storage condition. The material is of no value for recycling or reusing, so it is not a resource for the foreseeable future. If it cannot be used, then it is waste and should be disposed. The initiative and willingness of the people of Kincardine to host this disposal facility makes this the right time to develop a waste disposal solution. The EIS document devotes considerable time to the discussions, concerns, and resolutions of the local and regional residents. It is heartening to see that concerned citizens can band together and work with industry to support and develop a responsible solution to a controversial, but unavoidable issue such as radioactive waste disposal. The EIS meets the requirement to justify the need for the DGR.

I have heard arguments, and have myself wondered if this DGR is over-engineered, contradicting the P-290 policy principle that the complexity of the solution be commensurate with the hazard. This project is about the disposal of low level (LLW) and intermediate level (ILW) waste; waste that contains low concentrations of radionuclides. The radioactivity of the waste will decay to negligible levels in a relatively short time, certainly short compared to the time for used fuel to decay. Other countries use shallow burial or concrete tombs near the surface to isolate the low and intermediate level waste from the environment – simple and inexpensive. In contrast, this DGR is similar to various conceptual used-fuel-waste repositories; however, this facility is much simpler and relies on the two main radiation shielding parameters: time and distance. The barriers are simple – the thick layers of rock separating the waste and the biosphere, and the time required for the radioisotopes to reach the surface. No other engineered barriers are necessary, so no additional costs or systems are needed to isolate the waste. The careful choice of geology has greatly simplified the engineering. This is a good

solution; it is not over-engineered, and has broad public acceptance. The EIS clearly demonstrates that the design of the EIS is appropriate and a sensible use of resources.

The use of tight rock, i.e., low porosity and without advective water movement, is critical for extending the time for the radionuclides to move back to the surface. The sedimentary rock in the area of the DGR is very tight. What is more interesting is the layered structure of the formation which tends to direct the water to move horizontally rather than vertically. This further isolates the repository, and creates a natural cap that will inhibit the upward movement of the waste. The Appalachian-Ouachita stratigraphic system, a geology similar to that underlying the Bruce site, has been used as an effective analogue to show a pattern of behaviour for the movement of water and gas, effectively demonstrating that the regional geologic environment will isolate the DGR from the surface for many centuries.

Although the DGR design resembles many used fuel disposal facilities proposed for deep granite settings, the minimal thermal output of the waste and the lower total activity to be disposed are important considerations that contribute to a significant simplification of the DGR engineering. The minimal thermal output from the waste will cause only a small temperature increase in the DGR. The very low permeability of the geological formation supports an unsaturated disposal facility, i.e., one that is not filled with water, similar to the Yucca Mountain repository proposed in the US. The dripping-salt concentrating effects dominating the corrosion behaviour considered by the Yucca Mountain Project scientists will not be a significant process in the evolution of DGR because of the much lower vault temperatures. In fact, the containers are intended only as conveying (LLW) or shielding (ILW) packages and no credit is given to the package in terms of delaying the release of radioisotopes. The corrosion rates and processes described in the EIS and supporting documents are needed to develop the scenario for the evolution of chemical/microbiological conditions in the repository. It is likely that alternate processes will diminish both the corrosion and the amount of hydrogen generated. This would be expected to moderate the amount or rate of methane generation, thereby extending any consequences of activity release to longer times. The consideration of corrosion is both reasonable and conservative.

The hydrogeological analysis shows that the deep groundwater flows are very slow and some groundwaters have been stagnant for thousands of years. Although the DGR intrudes on the integrity of the geologic formation, the disposal rooms are not expected to affect the regional water movement because of the very low hydraulic conductivity and porosity of the overlying layer of rock that forms the “cap”. With such slow movement of water, the disposal rooms will fill very slowly, extending the time before any potential upward movement of radionuclides can occur. It is not surprising that the performance modelling study shows that the maximum activity in the Blue Mountain/Georgian Bay layer (the formation immediately above the Collingwood/Cobourg layer of the DGR) occurs around 300,000 years after closure, and the activity is low. By the time these radionuclides reach the surface, the activity would be expected to be even lower. The performance model confirms that radionuclide release will have an insignificant environmental effect on the biosphere.

Producing a good seal for the main shaft and the ventilation shaft is critical for ensuring that the hydrogeologic barriers and the integrity of the natural cap are re-established as a radionuclide transport barrier once the DGR is closed. To delay the flooding of the disposal rooms and tunnels, the seals must be of low permeability, and/or effective in maintaining the horizontal flow of water in the various geologic zones traversed by the shafts. The EIS effectively describes: the engineering of the monolith and seals; the measures needed to ensure the mitigation of any damage to the rock caused during the use of the shaft or by the emplacement of the seals; and the predicted performance of the seals under normal and upset conditions. Although uncertainty exists with regard to achieving the low permeability seals needed to isolate the

waste, the design solution presented in the EIS is a robust design that carefully considers the weaknesses in the technology, materials, and long-term performance data available today. These seals will not be needed for some time and this review process offers an opportunity to proactively endorse research directed to addressing these deficiencies and securing a more robust seal management system in time for the final decommissioning plan.

The EIS clearly highlights the choice of the DGR location, and documents the technical advantages and strengths of the proposed management method. The engineering design is sound, the choice of environmental indicators is justified, the scenarios used for long-term prediction of ecological and human effects is clear and reasonable, and the short term management of environmental effects is well developed. The expected long-term consequences of this project are minimal, and justified.

This EIS document demonstrates that OPG has considered equally the social and technical aspects of the DGR project. They have truly engaged the local and regional population, including the aboriginal communities, in the development of the project. It will continue to be a challenge to maintain public awareness and support, and to assure the public that used fuel will not be included in this work. Those challenges should not detract from the accomplishment of this EIS which is comprehensive and well justified.

I am confident that this project is environmentally sound and I fully support this EIS.