CANADIAN ENVIRONMENTAL LAW ASSOCIATION
L'ASSOCIATION CANADIENNE DU DROIT DE L'ENVIRONNEMENT

August 22, 2011

Andrew McAllister
Environmental Assessment Specialist
Environmental Assessment Division
Directorate of Environmental and Radiation Protection and Assessment
Canadian Nuclear Safety Commission
P.O. Box 1046, Station B
Ottawa, ON
K1P 5S9

Delivered by Email: EA@cnsc-ccsn.gc.ca

Dear Mr. McAllister:

Re: CELA'S COMMENTS ON SCOPE OF ENVIRONMENTAL ASSESSMENT OF DARLINGTON REFURBISHMENT

(a) Darlington Location is Unsuitable for Operation of Nuclear Power Plants
Population and Emergency Planning

1. The Screening EA should consider the suitability of the Darlington location for operation of nuclear power plants into the future. The location is not suitable for continued nuclear power plant operation at Darlington. The populations in the immediate vicinity and in the near-to-medium distance are too great to continue beyond the current plants and lifetimes of existing operations. Development pressures are increasing and the community is growing quickly. The safety and security of the site in light of the surrounding population has been decreasing, because of the increasing population. A review of evacuation planning was conducted in the New Build EA for only a 10 km zone around the plant. Evacuation of even a 20 or 30 kilometre zone around the Darlington site would be unimaginably difficult with a very large population potentially impacted. OPG has not demonstrated that emergency planning measures for very serious accidents that might require evacuation ranges of 20 to 80 km are in place or could be carried out with adequate protection of the population. This must be tested in the Refurbishment EA.

2. Even just within the Region of Durham, the population at present is 620,000 people and is expected to grow to 900,000 by 2031. Much of this population will be within 20 to 80 km from the site, which is a relevant distance, given the lessons of the current experience in Japan (see below). This population figure is not inclusive of the municipalities to the west, east, and north of the Darlington site. The existing plan of providing merely for a 10 kilometre evacuation range is not

prudent and is highly inadequate. The adequacy of emergency planning must be considered in the Darlington Refurbishment EA. While no one wants a serious accident at a nuclear facility, this eventuality must be considered, and properly planned for, and if it is not possible to effectively respond to it, then the existing reactors must not be refurbished in this location.

3. In the New Build EA, OPG evaluated only the potential evacuation of a 10 km range, and only assessed the time required to move residents and occupants to a distance at the perimeter of that range. There was no evaluation of the time that would be required to move those residents to the actual evacuation centres in Peterborough and Toronto (which are 50 to 80 km distances from Darlington[66]). No evaluation of evacuation of 20, 30 or 80 km ranges was provided; yet these are the ranges used in the current Japanese nuclear incident by the Japanese government (20 km and 30 km), the U.S. government (50 miles or 80 km) and the Canadian government (80 km). Whether such evacuation distances could or would be managed appropriately around Darlington in case of a serious accident in order to provide for public safety is a matter that must be considered in the Darlington Refurbishment EA.

4. In the Refurbishment EA there must be: (i) analysis of where residents from this broader vicinity would go for evacuation shelters; (ii) evaluation of transportation mechanism/routes beyond 10 kilometres (beyond the limited evaluation of a fifteen km shadow zone in case people opt voluntarily to leave); and (iii) planning, rehearsal, or provision of emergency supplies for such scenarios. The sufficiency and provision of any facilities or locations that could absorb and shelter the numbers of people who would be affected by 20, 30 or 80 km evacuation zones surrounding the Darlington facility must be tested in the Refurbishment EA. In addition, consideration must be given as to how food and safe water would be provided to sizeable populations fleeing from these larger evacuation zones. The significance of these potential effects must be tested in this EA. In addition, these issues must be tested against IAEA Site Evaluation Guidance.

Proximity to other Reactors and High Level Used Fuel Increases Risk

5. The EA should consider that this is a location in which other nuclear reactors and their used fuel storage are aggregated at the same site. As demonstrated by the catastrophic accident at Japan's Fukushima Daiichi plant, proximity of multiple reactors in one location leads to much higher potential for disaster in the event of unexpected calamity. Furthermore, the proximity of the high level used fuel storage, even if on an interim basis, massively compounds the high hazard. This Refurbishment EA must evaluate these hazards. Hazard from proximate reactors is a highly foreseeable danger and the consequences of such poor planning should be avoided by refusing to allow the continuation of a situation with multiple reactors in operation at the site. As IAEA Document NS-R-3 states, when "installed nuclear capacity is to be significantly increased, the suitability of the site shall be re-evaluated." Since this was not done when prior decisions were made to provide multiple reactors at the same location, this must be evaluated now in the context of this Refurbishment EA.

(b) Adequacy of Consideration of Risk of Accidents and Malfunctions

6. The consequences of a severe accident at a refurbished reactor at Darlington must be adequately considered. Accident/malfunction risk must be central to the EA for Refurbishment. Accident risk is also central to the NSCA decision on whether to allow the refurbishment of existing nuclear reactors at this location. Worst case scenarios and maximum *possible* releases (emphasis added) must be required to be evaluated, particularly for emergency planning purposes and consideration of local populations.

Consideration of Accident/Malfunction Risk

7. In the past such as during the Darlington New Build EA, OPG consistently downplayed and denied risks (or consequences) of very serious accidents, malfunctions, or malfeasance. However, OPG has only provided generic reassurances based on its probabilistic analysis and a general understanding of the type of modelling used for such analysis. CELA submits that the adequacy of analysis of accident and malfunction risk must be thoroughly tested in the Darlington Refurbishment EA.

8. The indisputable fact that catastrophic accidents can happen at nuclear power plants must be admitted, accepted, and the potential consequences evaluated in this Refurbishment EA. Past practice of refusal to clearly acknowledge that catastrophic accidents, with extensive off-site release of radioactive materials, are possible at the Darlington site must not be permitted in the Darlington Refurbishment EA. Rather an approach must be taken as indicated in the IAEA Guide *Site Evaluation for Nuclear Installations*, which states that site evaluation is primarily concerned with "severe events of low probability." Catastrophic accidents must be considered possible in the event that: (i) OPG's probabilistic calculations err; (ii) there is missing information; (iii) OPG's defence in depth and redundancies fail; or (iv) a combination of unanticipated events lead to large releases. The refurbishment EA must require a comprehensive evaluation of the consequences at this location if things go terribly wrong at a Refurbished nuclear reactor – that is, beyond the probabilistic analysis.

Unexpected Events Occur

9. The Darlington Refurbishment EA must examine the possibility for catastrophic events to occur and whether the consequences of those events would be consistent with the provisions of CEAA and the CNSCA. Unfortunately, despite computer modelling, engineering design, and probabilistic analysis, the potential for catastrophic events is reasonably foreseeable upon existing information. A current example is the calamity in Japan and the combination of events which led to the crisis, including the location of high level fuel storage as a source of criticality. The engineers in Japan had designed to a very high magnitude earthquake, (i.e. M8.2), but a M9 earthquake struck in the nearby seabed. Furthermore, recent nuclear accidents suggest that it is the unanticipated combinations of events (rather than single isolated events) which result in the most major calamities. Ontario may not encounter an earthquake of the magnitude that occurred in Japan, but it is not inconceivable that Ontario may experience a combination of events that leaves centralized power systems out of service for unknown lengths of time, rendering the backup power plans helpless to maintain critical safety systems. Severe natural catastrophes causing major power failures have occurred in the past decade (i.e. the major ice storm in Ontario and Quebec in 1998; the massive grid failure across eastern North America in 2003, etc.). This is not hypothetical speculation; in the latter example in 2003, one of OPG's operating nuclear reactors was left without backup power for about five hours.

10. For example, in the New Build EA, OPG advised the JRP that its backup power systems can provide up to three days of power. However, there may be multiple events which challenge the sufficiency of such technical contingency measures. The point here is not to recite plausible scenarios (i.e. severe natural event combined with cascading infrastructure failures), but to stress that despite best efforts in planning, prediction and engineering, unexpected sequences that overwhelm these complex systems, or that exceed even conservative engineering, can and do occur. As a result, a proposal in which the consequences of such failures are unacceptable (as in this case) must be considered as to its license ability in this Refurbishment EA before a licence for continued operation is granted.

(c) Safety Systems May Fail

11. When evaluating the suitability of the Darlington site, the Refurbishment EA must also consider the sufficiency of the evidence in respect of safety systems. It will not be adequate nor appropriate to rely upon assumptions of perfect performance of all safety systems. Safety systems may also fail for a variety of reasons, and the same considerations reviewed above may render safety systems incapable of preventing catastrophic results. In addition, part of the system may perform as hoped (i.e. shutdown of fission reaction in the reactor), but this may not necessarily deal with the ongoing need for cooling and removal of heat to prevent re-initiation of fission reactions in the fuel (as occurred in the Japanese accident[88]).

12. One issue in particular which should be thoroughly evaluated is whether the Refurbishment could operate with entirely passive systems; as well as whether there is sufficient backup or redundancy if any passive systems fail. While passive safety systems are laudable, the EA must include consideration as to whether there are at present any Systems available to make the entire Darlington Refurbishment project passively safe. At present, it is submitted that large consequence accidents may occur despite these systems, and the timeframes that are available to provide passive safety may be limited without other intervention and the potential for these scenarios must be explicitly considered in the Refurbishment EA.

(d) Unacceptable Consequences of Accident Risk at Darlington Location

13. The Darlington Refurbishment must include consideration of the range of radionuclides (source term) which would potentially be released in case of a catastrophic accident at the Darlington site. For example, these substances could include Iodine 131 and Cesium 137. Other radioactive isotopes which could be released in an accident were listed in the OPG New Build EA dose consequence analysis, such as Cobalt 60, Strontium 90, and numerous other radionuclides. However, the Refurbishment EA the analysis and licensing application must not be limited to "bounded" scenarios and must also consider catastrophic scenarios. CELA submits that Refurbishment EA must consider the possibility of even more serious accidents, as provided in IAEA Standard NG-G-3.2 dealing with consideration of population distribution in site evaluation. The presence of these radionuclides in the reactor core constitute a high hazard for the surrounding population, thereby indicating that this is not a suitable location for reactor operation, and thus for a major Refurbishment and life extension of the any of the existing reactors.

14. While it is not conceded that the Darlington location would be an appropriate site even without existing reactors, CELA strongly submits that the refurbishment of new reactors to a location already holding multiple reactors makes the site completely unsuitable. Any consequences and risks from accidents would be magnified by their proximity to multiple sources of material which can achieve critical chain reactions, both in reactor cores and in used fuel storage. Serious damage to one building or facility is not only a massive risk for that reactor, but it also becomes a massive risk to a neighbouring reactor facility simply due to proximity. Thus, the Refurbishment EA should consider the site's proximity to large and growing population centres and the acceptability of further continuing this combination of activities and risks.

(e) Frequency of Severe Accidents

15. As discussed above, unexpected sequences of events do occur despite modelling and planning. The nuclear power experience to date demonstrates this unfortunate fact (i.e. Three Mile Island in 1979; Chernobyl in 1986; and Fukushima Daiichi in 2011), which only takes into account the most serious of recent nuclear accidents. If earlier severe accidents are considered, the frequency rate is even higher.

16. Probabilistic safety analysis does not guarantee that severe nuclear reactor accidents will never happen. They may happen, and very unfortunately, they do happen. Refurbishment EA must consider the suitability of the Darlington site on the basis of this reality in terms of risk. In short, the EA should take a precautionary approach on the basis that it is both possible and conceivable that a severe accident on the scale of calamity could occur in this location from the refurbishment and continued operation of the Darlington nuclear plant.

17. Furthermore, the EA should consider whether there are appropriate measures which can mitigate the potential adverse impacts on populations from a worst case severe accident (or even any less severe accident that nevertheless escapes containment) at the Darlington site that causes a 30 to 80 km evacuation zone to be implemented. The EA should consider whether there is evidence to substantiate that such an evacuation could be managed, mitigated and the population adequately protected. This type of scenario must be explicitly evaluated in this EA. Consideration should include the provision of IAEA *Safety Standard for Site Evaluation for Nuclear Installations*, NS-R_3. The EA should consider whether the radiological risk to the population is acceptably low in the case of very severe accidents with large releases of radioactive materials from containment and beyond the plant boundaries.

(f) Unsuitable Location due to Fuel Waste and other Radioactive Waste

18. The EA should also consider whether there is adequate provision for interim, short- and long-term storage and handling of high level radioactive spent fuel waste. In other proceedings, OPG has proposed to add additional high level radioactive waste to the Darlington location for an unspecified time, while longer term options are pursued. This alone creates an unacceptable level of risk at one location, as demonstrated by the Japanese accident. Furthermore, it cannot be assumed, as OPG has done, that there will be any other provision for any high level radioactive spent fuel waste, existing or new, and this EA must consider the risks of refurbishment and continued operation with such materials accumulated on site.

19. This EA process does not cover any other proposal for fuel waste storage or disposal. Accordingly, the question of whether this location can accommodate and properly provide for the safety and protection of the environment and human health must be fully considered in this EA before any further refurbishment and continued operation licence can be granted under NSCA. For example, in the New Build EA hearing, OPG claimed that it could safely handle the fuel waste on the Darlington site for the hundreds of thousands of years for which it would remain highly toxic, hazardous and a risk to the environment and humanity. This claim should be tested in the refurbishment EA but CELA notes that no human technology has survived such vast timeframes; indeed, no form of known human civilization has yet survived such timeframes and this reality should be included in consideration of the current EA and licensing decisions for refurbishment.

20. Transportation and storage of low, intermediate, and high level radioactive waste must be adequately considered and described in the Refurbishment EA, and the site must be shown to be suitable for these activities over the necessary timeframe of subsequent years of operation, decommissioning, and ultimately the hundreds of thousands of years of toxicity of the intermediate and high level waste to be produced by the site.

21. Moreover, it cannot be assumed that other off-site waste storage or disposal (i.e. the Deep Geologic Repository) will be available for low and intermediate waste since that proposal has not yet been approved and accordingly explicit consideration of the ability to handle those wastes at the Darlington site must be included in the Refurbishment EA.

(g) Unsuitable Location due to Accident Risk to Ontarians' Drinking Water Supply

22. The Darlington location is unsuitable for the refurbishment and continued operation of nuclear power plants because of the risk of accidents arising from the site's proximity to the drinking water supply for millions of Ontarians. Water treatment plants do not typically treat for removal of radioactive materials. A serious accident with major off-site releases of radioactive materials such as those listed in examples of previous Dose Consequence Analysis in other Darlington proceedings may see much of that material deposited in Lake Ontario on whose shoreline the reactors would be sited. There is no reasonable alternative to this drinking water source if it is rendered unusable due to a nuclear mishap. Accident/malfunction risks must be examined in this Refurbishment EA in terms of releases to drinking water. The Refurbishment EA must consider whether the impacts would be fully mitigated or are otherwise justified.

23. Very severe accidents which release large portions of the "source term" of radioactive materials contained in reactor cores must be modelled and examined in this Refurbishment EA. Similarly, very severe accidents dealing with the used high level fuel on-site (and their potential impact on drinking water supplies in Lake Ontario) must be adequately modelled and examined. In addition, potential impacts on inland water supplies (both groundwater and surface water), and downstream surface water along the St. Lawrence River, from a potential serious accident must be considered in terms of impairment of the safety of the drinking water supplies of millions of people in the central heartland of Canada and neighbouring jurisdictions (i.e. Quebec and New York State).

24. In this EA, a review of impacts on drinking water supplies from very severe accidents, taking account of all users of Lake Ontario for drinking water as well as other drinking water sources potentially impacted, must be compared to the provisions of the IAEA guidance document *Dispersion of Radioactive Materials in Air and Water and Consideration of Population Distribution in Site Evaluation for Nuclear Power Plants*, Safety Guide NS – G – 3.2. In addition, these potential long-term impacts must be considered in light of the temporal "benefits" of using the Darlington site to provide a relatively small portion of Ontario's power requirements, particularly when there are viable non-nuclear alternatives.

25. OPG must demonstrate in this EA for Refurbishment that refurbished operation, would ensure protection of all surface and groundwater supplies, and in particular, drinking water supplies.

(h) Unsuitable Location due to Routine Emissions of Radioactive Materials

26. Even in the absence of accidents, routine emissions of radioactive materials make this location completely unsuitable for refurbishment and continued operation of nuclear power plants. In routine operations, the plants release a long list of radioactive nuclides. For example, tritium is released from the condenser cooling system radioactive liquid waste management system. In addition, there are leaks from the service water system from time to time.

27. It was also admitted by the CNSC during the Darlington New Build hearing that the "linear no threshold relationship model" is the most appropriate model for calculating cancer and other health effects from exposure to radioactive nuclides. There is a large and growing population in the vicinity of the site. The local population has a high level of concern, and there is a high level of uncertainty regarding elevated health risks, and increased risk of leukemia, in the vicinity of nuclear plants. On a

linear no threshold model (i.e. no lowest dose where effects do not occur), this EA must consider whether there will be health impacts arising from the continued operation of the nuclear power plants at Darlington, since there are admitted routine emissions of a long list of radioactive nuclides, and the most appropriate model indicates effects at any dose on a linear basis.

28. In light of: (i) the high level of uncertainty and public concern regarding the health impacts of the existing reactors, as well as of the proposed new reactors; (ii) the very serious nature of the potential health effects from radioactive emissions during routine operations and incidents or spills (i.e. cancers and leukemias); and (iii) the lack of a lowest dose threshold at which safety should be assured, CELA submits that the population in the vicinity of the Darlington site should not be exposed to the inevitable additional impacts to population health that will result from refurbishment and continuation of operating reactors in this location. This must be explicitly considered in this EA.

29. Tritium emissions to air and to drinking water are a hallmark of the CANDU designs due to their use of heavy water. Similarly, with a no lowest dose model, health impacts from these emissions must be considered in this EA as likely. In addition to routine emissions, there are additional health impacts from spills or accidental emissions of tritium from the plant, and these happen with regularity. Continued exposure of this population to this radionuclides must be explicitly considered in this EA.

(i) Lessons from Japan related to Siting New Nuclear Reactors at Darlington

30. CELA submits that it is far too early to learn any complete lessons from the tragic events in Japan earlier this year. However, the first and most obvious lesson is that there must be acceptance of the reality of the potential for very catastrophic accidents that exceed the design basis for a nuclear plant. Thus, the key question for the refurbishment EA is whether the consequences of such catastrophic accidents would be acceptable at this location – is this a suitable site at which to allow for the potential of such an accident? In answering this question, it is insufficient for the proponent to simply assert that such accidents will not or cannot happen at the Darlington site, or that such accidents have been considered and found to be not "credible". Such accidents must be explicitly considered in this EA.

31. Instead, this question must be faced directly: is continuing operation of refurbished reactors at Darlington justifiable, in light of the potential adverse effects of a very serious accident? Would other unfortunate lessons from Japan then apply? Would the fact that emergency and evacuation planning has been limited to 10 kilometres (despite a vast nearby population extending into the GTA) result in an inability to ensure that radiation limits for the public could be met? Would there be an ability to provide full, timely and accurate information to the public? Would the scale and difficulty of the task of protecting the sizeable nearby population even be possible? This EA for Darlington refurbishment must examine whether these critically important matters would be appropriately addressed, particularly since the analysis and planning presented to date by OPG has been limited to smaller accidents (i.e. those which do not exceed regulatory limits at the plant boundaries) and smaller evacuation zone (i.e. 10 km).

32. As opposed to the approach taken in earlier proceedings, CELA submits that the utilization of a Plant Perimeter Envelope ("PPE") or "bounding" approach would not be appropriate or sufficient for the approval of refurbishment and continued operation of nuclear power plants at Darlington. Nor is the PPE approach appropriate or sufficient to provide a proper foundation or evidentiary basis for the decisions under CEAA that there will be no significant adverse environmental effects or, for those which cannot be mitigated, that such effects are justified. The PPE approach also creates considerable difficulty in terms of testing the information, and in terms of determining the relevance

to the subsequent licensing stages, for the purposes of ensuring that CNSC can meet its mandate in reviewing the EA for the Project as a whole.

Terrorism Risk

33. The Darlington Refurbishment project must be considered in light of the potential risks of terrorism and malfeasance, especially since the events of September 11, 2001. While difficult to contemplate, the question of whether those risks if manifested would result in acceptable consequences must be explicitly considered before a licence to refurbish and continue operation at this location may be granted. This EA must address those issues in a highly stringent fashion and must squarely evaluate the potential for catastrophe from such events.

PART IV – CONCLUSIONS

34. Consideration of an application for Refurbishment and later continued operation of the nuclear power plants at Darlington is not a pro forma decision. Fundamental questions about the suitability of the site and the adequacy of the information about consequences and ability to respond and mitigate very serious events as well as to prevent adverse effects from routine operations must be fully evaluated. A massive investment, which amounts to irrevocable decision making, is under consideration, and its appropriateness must be thoroughly tested in this EA under the provisions of the CEAA as well as the CNSCA, and the relevant international guidance.

35. Public involvement in this proceeding must be robust and thorough and subject to a hearing that allows expansive public participation.

36. The letter submitted to the CNSC in July of this year by CELA and other parties is attached and re-iterated.

Yours very truly,
CANADIAN ENVIRONMENTAL LAW ASSOCIATION

Theresa McClenaghan
Executive Director and Counsel