



Oral Presentation

Submission from the Canadian Environmental Law Association

In the Matter of

**Ontario Power Generation Inc.,
Pickering Nuclear Generating Station**

Request for a ten-year renewal of its Nuclear Power Reactor Operating Licence for the Pickering Nuclear Generating Station

Commission Public Hearing – Part 2

June 2018

Exposé oral

Mémoire de l'Association canadienne du droit de l'environnement

À l'égard de

**Ontario Power Generation Inc.,
centrale nucléaire de Pickering**

Demande de renouvellement, pour une période de dix ans, de son permis d'exploitation d'un réacteur nucléaire de puissance à la centrale nucléaire de Pickering

**Audience publique de la Commission –
Partie 2**

Juin 2018



Evaluating Environmental Protection and Emergency Preparedness at the Pickering Nuclear Generating Station (Ref. 2018-H-03)

The Canadian Environmental Law Association's
Submission to the Canadian Nuclear Safety Commission

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SUMMARY OF RECOMMENDATIONS

RECOMMENDATION NO. 1: To facilitate restoring the public's trust in the Commission, CELA recommends: (1) the CNSC publicly review the findings of federal expert panel tasked with restoring the public's trust in Canada's environmental assessment authorities, (2) ensure all documents and information considered by the CNSC are publicly available online and 'searchable', and (3) the CNSC provide justification, transparency and intelligibility of reasons in their Record of Decisions.

RECOMMENDATION NO. 2: OPG and CNSC must clearly demonstrate to Ontarians – through adequate documentation in the licence application submissions – that financial plans are in place to (1) safeguard the affordability of electricity for Ontarians throughout the lifetime of the plant, and (2) provide financial assurances for the actual costs of continued operation, maintenance, decommissioning, waste management and long term care.

RECOMMENDATION NO. 3: The CNSC and responsible authorities must require OPG to undertake greenhouse gas (GHG) emissions accounting, GHG monitoring, and GHG emissions reduction planning in order to consider the entire nuclear process chain, from cradle to grave.

RECOMMENDATION NO. 4: OPG's Pickering NGS PROL renewal application and all future licence applications for nuclear power generation and nuclear waste management projects should be evaluated under a reformed CEAA that provides the basis for an appropriately rigorous approach to the consideration of need and alternatives, among other critical considerations. As Gibson et al. (2016, pp. 5-10) have asserted, crucial components of an appropriately rigorous approach to EA would embrace sustainability in all aspects and require attention to

- the purposes of and need for the undertaking (with both purposes and need related to the lasting public interest)
- development and application of broad but comprehensive sustainability-based criteria for evaluations and decisions (see next section);
- emphasis on comprehensive and integrated attention to all factors affecting the long term as well as immediate desirability and durability of effects;
- comparative evaluation of potentially reasonable alternatives to identify best options for each undertaking, to move cumulatively to more sustainable practice; and
- application of case-specified sustainability-based purposes and criteria as the main structure for deliberations and decisions at all process stages for subject undertakings from initial identification of appropriate purposes and options (alternatives) to final deliberations on renewal, closure, decommissioning and continued management.

RECOMMENDATION NO. 5: In the interests of public access to information, all licence documents, including all supplementary studies/reports, must be conveniently accessible

through a public registry, with sufficient time allowed for participant review between posting and deadlines for public submissions.

RECOMMENDATION NO. 6: OPG must develop a transition plan to mitigate the adverse socioeconomic impacts of shutting down Pickering’s reactor units on workers, families, and surrounding communities. This transition plan must be informed by best practices for just transition planning that maintains and enhances livelihood sufficiency and community economic wellbeing, and it must consider the larger transition of the electric power system to renewable technologies.

RECOMMENDATION NO. 7: The CNSC commissioners should require CNSC staff to exercise its authority under paragraph 3(1.1)(b) of the *General Nuclear Safety and Control Regulations* to require CNSC staff to undertake a comprehensive “need for”, “alternative to”, and “alternative means” analysis utilizing the best available scientific information and methods, Indigenous knowledge, and public consultation as part of the EA of the Pickering NGS PROL renewal application and all subsequent EA’s under the NSCA. In the absence of this analysis, the Commissioner’s should find that need for the Pickering renewal and life extension is not demonstrated.

RECOMMENDATION NO. 8: The CNSC should deny OPG’s application to renew the Pickering NGS beyond the expiration of its PROL on August 31, 2018. The lack for an adequate “need for” the continued operation of the Pickering NGS; the history of poor performance and the increased risks to the public; the cost of its continued operation and decommissioning; and the existence of adequate “alternatives to” the nuclear facilities generation of electricity; coupled with the lack of any compelling evidence provided by OPG to extend the PROL beyond its current end date, demonstrates that the proposal to renew the PROL does not make adequate provision for the protection of the environment and the health and safety of persons – a condition for licencing under the NSCA.

RECOMMENDATION NO. 9: The CNSC should require, at a minimum, that decommissioning strategies are well documented and include a description of the options, the overall timescales for the decommissioning of a facility and the end state after completion of all decommissioning actions. The reasons for choosing the preferred option should be explained and justified in comparison to other feasible strategies based on the best available scientific information and methods, after public consultation, and require that no undue burdens be imposed on future generations.

RECOMMENDATION NO. 10: In anticipation of decommissioning the Pickering NGS, the CNSC should require OPG to develop a DDP as soon as possible. The development of the DDP must include meaningful participation of the public at the earliest possible opportunity, to ensure the DDP has a sound evidentiary basis and is publicly acceptable. The DDP should be sufficiently detailed to allow the evaluation of the licensee’s justification and plans for, amongst others,

adaptive management and environmental monitoring, site remediation and end-use, costs and feasibility, cumulative effects, long-term waste management, security, and public safety.

RECOMMENDATION NO. 11: The CNSC should exercise its authority under paragraph 3(1.1)(b) of the *General Nuclear Safety and Control Regulations*, to compel OPG to undertake an “alternative means” analysis that utilizes the best available up-to-date science and methods, and input from the public and Indigenous communities. The analysis must demonstrate that the preferred strategy will ensure the Pickering NGS will be maintained in a safe configuration at all times, will reach the specified decommissioning end state, that no undue burdens will be imposed on future generations, and is acceptable to the public and Indigenous communities.

RECOMMENDATION NO. 12: Pickering NGS’s emergency management licensing basis, RegDoc 2.10.1 Version 1 (2014) predates the IAEA’s most recent standard on radiological emergencies, GSR-7. CELA recommends Pickering NGS’s licensing basis be updated to reference RegDoc 2.10.1, Version 2 (2016), which is current with IAEA GSR-7. All Licence Condition Handbooks proposed by the CNSC should, at a minimum, be current with international guidance and standards at the time of licensing.

RECOMMENDATION NO. 13: CELA recommends the CNSC require the expansion of Ontario’s nuclear emergency planning zones. First, the Contingency Planning Zone (20 km) must require the same level detailed arrangements and pre-planned protective measures as the Automatic Action Zone (3 km) or Detailed Planning Zone (10 km). Secondly, the current CPZ boundary should be re-evaluated based on better modelling and at a minimum, require a 20 km evacuation zone.

RECOMMENDATION NO. 14: CELA recommends that the Commission publicly review the PNERP’s Technical Study on emergency planning zone sizes and its implications for all nuclear power plant licensees’ on-site and off-site emergency planning arrangements. CELA recommends any further PNERP technical studies and findings be publicly reviewed by the Commission on an annual basis.

RECOMMENDATION NO. 15: CELA recommends the CNSC require the expansion of Ingestion Planning Zone to 100 km and include the additional requirement that all municipalities within this zone maintain nuclear emergency response plans.

RECOMMENDATION NO. 16: CELA recommends that the CNSC require robust evidence demonstrating that residents in the DPZ and CPZ zone have awareness of emergency planning procedures. Absent this level of knowledge, the Pickering NGS should not be operated beyond its current licencing period.

RECOMMENDATION NO. 17: Public notification and response systems must be tested and operable within the DPZ and CPZ and not limited to the immediate 10 km zone. Public alerting utilizing multiple communication methods must also be in place to a distance of 100 km.

RECOMMENDATION NO. 18: The CNSC must have evidence demonstrating that in the event of a radiological emergency, the provincial Alert Ready system can be promptly activated. The CNSC should request OPG to provide an update on its Alert Ready pilot project.

RECOMMENDATION NO. 19: We continue to encourage the CNSC to require licencees to provide KI by way of pre-distribution within a 50 km radius, and pre-stock to 100 km. In accordance with international best practice, the CNSC should extend KI stockpiles to 100 km and ensure stockpiles at places frequented by vulnerable groups, such as children and pregnant women, are maintained.

RECOMMENDATION NO. 20: Given the dense population within 50 kilometres of the Pickering NGS and children's particular vulnerability to radiation, we recommend the pre-stocking of KI in all schools within the 50 km zone be made a condition of licensing.

RECOMMENDATION NO. 21: CELA recommends that the CNSC require OPG to disseminate information on a more frequent basis, about the online KI-pill ordering website PrepareToBeSafe.ca in its outreach material to the public.

RECOMMENDATION NO. 22: We recommend the CNSC review the adequacy of medical care that could be provided during an evacuation. The CNSC should inquire if medical facilities within the DPZ and CPZ have long-distance, nuclear disaster-specific evacuation plans, and whether these plans have been practiced on a full-scale.

RECOMMENDATION NO. 23: CELA recommends the CNSC refuse the further extension of the Pickering's operating licence on the basis that medical response and evacuation are not detailed and operational beyond the 10 km DPZ. Detailed planning which is fully functional, and has been fully tested for efficacy, must be required within the CPZ.

RECOMMENDATION NO. 24: CELA recommends the CNSC extend detailed planning for large-scale evacuations into the IPZ. The CNSC should require OPG to demonstrate the adequacy of detailed planning within an expanded DPZ and IPZ, including planning for any schools, retirement homes, daycares, hospitals and correctional facilities in these areas. These plans should be communicated publicly.

RECOMMENDATION NO. 25: The CNSC should require OPG to update its Evacuation Time Estimate Report to reflect recent population objectives and growth trends in line with Ontario's Growth Plan (2017). The updated ETE should also review the impact of increased evacuation zones at a radial distance of 50 km on locations of Emergency Workers Centres, numbers of

emergency workers required for evacuation management, traffic routes, size of evacuation centres, and locations and capacity of Decontamination and Monitoring Units. These findings should be reported to the CNSC and publicly reviewed.

RECOMMENDATION NO. 26: The CNSC should require OPG's public awareness program to contain more detailed information about evacuation routes, the location of emergency shelters and decontamination centres and how vulnerable people, including seniors and children, will be protected.

RECOMMENDATION NO. 27: The CNSC should inquire as to the availability of decontamination centres and whether the public is aware of their use and location.

RECOMMENDATION NO. 28: The CNSC should require OPG's public awareness program to contain information on how to self-decontaminate in order to foster great awareness of this default protective measure.

RECOMMENDATION NO. 29: Methods to review risks and obtain consent from workers to exceed maximum radiation exposure limits should be explicitly clarified in plans by the operator as a condition of licensing.

RECOMMENDATION NO. 30: The IPZ should be extended to 100 km to account for weather contingencies and the aerial dispersion of radionuclides beyond 50 km.

RECOMMENDATION NO. 31: The CNSC should require proof of adequate contingency planning for the protection of drinking water in the event of an emergency as a requirement for licensing. The CNSC ensure that provisions are in place for an alternative source of drinking water for residents whose current drinking water source is Lake Ontario.

1. Introduction

The Canadian Environmental Law Association (CELA) submits this report in response to the Public Notice dated September 29, 2017¹ requesting comments on the application from Ontario Power Generation (OPG) to renew its Nuclear Power Reactor Operating Licence for a period of 10 years, commencing September 1, 2018.²

1.1 Interest and Expertise of the Intervenor

CELA is a non-profit, public interest law organization. For nearly 50 years, CELA has used legal tools to advance the public interest, through advocacy and law reform, in order to increase environmental protection and safeguard communities across Canada. CELA is funded by Legal Aid Ontario as a speciality legal clinic, to provide equitable access to justice to those otherwise unable to afford representation.

CELA has engaged in detailed research and advocacy related to the improvement of public safety and environmental protection by seeking improvements to nuclear emergency preparedness. Our documented history and collection which reviews the sufficiency of emergency preparedness in the context of nuclear power plant relicensing is publicly available on our website.³ CELA has also been actively involved in discussions and consultations regarding the Province of Ontario's revised Provincial Nuclear Emergency Response Plan.⁴

1.2 Background

The Pickering Nuclear Generating Station (NGS) is located on the north shore of Lake Ontario, in the City of Pickering in the regional municipality of Durham, Ontario. The facility lies 32 km northeast of downtown Toronto and 21 km southwest of Oshawa. The facility is owned and operated by Ontario Power Generation Incorporated (OPG). The Pickering facility consists of eight nuclear reactors, Units 1 - 4 (Pickering A) and Units 5 - 8 (Pickering B). Six of the reactors are operational (Units 1 and 4, and Units 5 - 8) while two (Units 2 and 3) have been placed in a safe storage state.⁵

¹ Canadian Nuclear Safety Commission, "Notice of Public Hearing and Participant Funding (Ref. 2018-H-03)" (29 Sept 2017), online: <http://nuclearsafety.gc.ca/eng/the-commission/pdf/NoticePublicHearingPFP-2018-H-03-OPG-Pickering-e.pdf>

² Ontario Power Generation, "Application for Renewal of Pickering Nuclear Generating Station Power Reactor Operating Licence" (28 August 2017) [**Licence Application**]

³ Canadian Environmental Law Association, "Publications: Emergency Planning around Canadian Nuclear Plants," online: <http://www.cela.ca/test-emergency-planning-around-canadian-nuclear-plants>

⁴ CELA, "Re: Discussion Paper on Planning Basis Review and Recommendations and List of Proposed Changes to the PNERP 2009" (28 July 2017), online: <http://www.cela.ca/sites/cela.ca/files/EmergencyPlg.pdf>

⁵ Canadian Nuclear Safety Commission, "CMD 18-H6: A Licence Renewal – Ontario Power Generation Inc. Pickering Nuclear Generating Station," (5 March 2018), p 1 [**CNSC CMD**]

On August 28, 2017, OPG requested a ten-year renewal (from September 1, 2018, to August 31, 2028) for the Pickering NGS Power Reactor Operating Licence, PROL 48.03/2018.⁶ The current power reactor operating licence for Pickering NGS expires on August 31, 2018.

OPG has also requested approval to operate up to 295,000 Effective Full Power Hours (EFPH), beyond the current approved limit of 247,000 EFPH, which corresponds with the requested end of commercial operation (ECO) date of December 31, 2024. As OPG has signalled its intent to cease commercial operation of Pickering NGS on December 31, 2024,⁷ the licence period from September 1, 2018, to August 31, 2028, will cover three phases of operational activities: continued commercial operation ending December 31, 2024; a stabilization phase (post-shutdown defueling and dewatering) lasting approximately 3-4 years; and the beginning of safe storage for Units 1, 4 and 5-8 in 2028.⁸ Following which, OPG will presumably file an application to decommission the NGS. There is no assurance, however, that OPG will not once again request an extension of the PROL for a nuclear facility that, by 2028, will be close to 60 years old.

This renewal application marks the second request by OPG to extend the Pickering NGS operating licence beyond its design life. On July 4 and August 31, 2012, OPG applied to renew the Pickering NGS PROL for a 5-year period ending in December 2020. As 2020 was beyond the assumed design life of certain operational parts in the PNGS, especially the pressure tubes, OPG was required to demonstrate that the Pickering NGS could be operated safely until the end of 2020. The CNSC renewed the OPG PROL for Pickering on August 9, 2013, valid to August 31, 2018, but imposed hold points to review additional safety information from OPG about the ability of the pressure tubes and other components to withstand longer operations. The hold-points were removed in 2014.

The Pickering NGS reactors are the oldest operating nuclear power reactors in Canada. The original Pickering Generating Station licence application to operate Unit 1 was submitted to the CNSC's predecessor, the Atomic Energy Control Board on August 14, 1970; the construction permit was issued February 24, 1966. The original application to operate Unit 5 was submitted to the then Atomic Energy Control Board on May 6, 1980; the original construction permit had been issued July 19, 1974.⁹

As Canada's oldest operating nuclear power reactor, the Pickering NGS has had a history of poor performance and created a risk to the public. It has also been plagued by substantial operating costs while producing energy that is not needed in the face of much more feasible alternative sources of power. This has left OPG with no rational basis to establish that it will be able make

⁶ Licence Application, *supra* note 2, p 1.

⁷ OPG Letter, R. Lockwood to G. Frappier, "End Date of Commercial Operations for Pickering NGS", (June 28, 2017), CD# P-CORR-00531-04930, e-Doc 5290277

⁸ CNSC CMD, *supra* note 5, p 1.

⁹ Canadian Environmental Law Association, "Emergency Planning at Pickering NGS - Submission to the CNSC," (May 3, 2013), online: <http://www.cela.ca/sites/cela.ca/files/899PickeringEmergencyPlanning.pdf>

adequate provision for the protection of the environment and the health and safety of persons if it were to be granted a renewal of the Pickering NGS PROL for operation beyond its current end date. For this and the reasons outlined below, CELA requests the CNSC deny OPG's application to renew the Pickering NGS beyond the expiration of its PROL on August 31, 2018.

1.3 Scope of Review

This report aims to review the whether, per section 24(4) of the *Nuclear Safety and Control Act*, the CNSC has the requisite basis to find the applicant will, in carry on the proposed licence activity, make adequate provisions for the protection of the environment and health and safety of persons.¹⁰ Preliminary matters are reviewed in Section 2 of this report, Sections 3 – 6 review the sufficiency of OPG's licence application and CNSC Staff's CMD as its relates to sustainability, environmental assessment and emergency preparedness and planning, respectively, and Section 7 summarizes our findings and outlines our requested order from the Commission.

2. Preliminary Matters

2.1 Restoring Public Trust

CELA seeks to respond to the issue of public trust which was raised during Day 1 of the Pickering NGS hearing on April 4, 2018. As raised by Commissioner Velshi, the CNSC sought feedback from CNSC Staff and provincial authorities on "building [public] trust and confidence" and specifically, sought suggestions on how it "could be addressed in a more proactive way."¹¹ The Office of the Fire Marshall and Emergency Management (OFMEM), who was in attendance for Day 1, responded that "it's one that we struggle with on a daily basis" and CNSC Staff echoed, "it is a very difficult problem."¹²

As a starting point, CELA provides the following comments in response to this discussion:

1. The CNSC should publicly review the findings of federal expert panel tasked with restoring the public's trust in Canada's environmental assessment authorities (of which the CNSC is one) and adopt the panel's recommendations.¹³ As the expert panel's final report notes, "The apprehension of bias or conflict of interest, whether real or not, was the single most often cited concern by participants with regard to the ... CNSC."¹⁴

¹⁰ *Nuclear Safety and Control Act*, SC 1997, c 9 [NSCA]

¹¹ CNSC Member Velshi, Webcast - Pickering Hearing Day 1 April 4, 2018.

¹² *Ibid*

¹³ Report of the Expert Panel for the Review of Environmental Assessment Processes, "Building Common Ground - A New Vision for Impact Assessment in Canada" (2017) online:

<https://www.canada.ca/content/dam/themes/environment/conservation/environmental-reviews/building-common-ground/building-common-ground.pdf> [EA Panel Report]

¹⁴ EA Panel Report, *supra* note 13, p 49

2. All documents and information considered by the CNSC should be publicly available online and 'searchable'. Each party to the hearing, which includes public intervenors, is entitled to be informed of and to make presentations with respect to the evidence which affects the disposition of the CNSC's decision. Material documents before the CNSC must be equally as accessible to public intervenors and, publicly available at the time when the notice of public hearing is released.
3. The CNSC in its Records of Decision, should give full reasons that provide justification, transparency and intelligibility of reasons,¹⁵ and foster better decision-making by ensuring the depth of analysis is commensurate to the complexity of issues being decided.¹⁶

CELA has previously provided comments to the Commission on ways it could facilitate public trust. This includes our submissions on the following recent CNSC matters:

- Bruce Power licence renewal (Ref. 2018-H-02), "The Role of the Commission – Regaining the Public's Trust"¹⁷
- Chalk River Laboratories licence renewal (Ref. 2018-H-01), "Using CSA-Standards as Part of Licensing Basis Significantly Reduces Public Access"¹⁸
- Regulatory Oversight Report for Uranium and Nuclear Substance Processing Facilities in Canada – 2016, "Public Information and Disclosure"
- Consultation on Draft RegDoc 3.2.1, "Scope of Public Information and Disclosure"¹⁹

RECOMMENDATION NO. 1: To facilitate restoring the public's trust in the Commission, CELA recommends: (1) the CNSC publicly review the findings of federal expert panel tasked with restoring the public's trust in Canada's environmental assessment authorities, (2) ensure all documents and information considered by the CNSC are publicly available online and 'searchable', and (3) the CNSC provide justification, transparency and intelligibility of reasons in their Record of Decisions.

¹⁵ Report of the Expert Panel on the Modernization of the National Energy Board, "Forward Together: Enabling Canada's Clean, Safe, and Secure Energy Future: Volume II" (2017) online: <https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/pdf/NEB-Modernization-Annex-EN-WebReady.pdf>, p 200

¹⁶ *Kane v Board of Governors (University of British Columbia)*, [1980] 1 SCR 1105, pp 1115-1116; *Pfizer Co v Canada (Deputy Minister of National Revenue, Customs and Excise)*, [1977] 1 SCR 456, p 463.

¹⁷ CELA, "Bruce Power's Proposed Life Extension and Refurbishment: Evaluation Emergency Preparedness and Environmental Protection," (16 April 2018), online: <http://www.cela.ca/sites/cela.ca/files/1185LicRenBrucePwr.pdf>

¹⁸ CELA, "CNL Site Licence Renewal Application for Chalk River Laboratories Ref 2018-H-01," (11 December 2017), online: <http://www.cela.ca/CELASubmissionstoCanadianNuclearSafetyCommission>

¹⁹ CELA, "Consultation on Draft RegDoc 3.2.1 Public Information and Disclosure," (28 September 2017), online: <http://www.cela.ca/CELAcommentsonREGDOC3.2.1>

2.2 Anonymous Email

CELA also seeks to make the Commission aware of an encrypted email received April 30, 2018, by an anonymous engineer working for a nuclear service supplier. While CELA is not seeking the opportunity to comment on the email's contents, we have provided this email to the Commission under separate cover.

As Canada's nuclear regulator we believe it is within the CNSC's public interest mandate to consider the issues raised by the anonymous individual. Furthermore, as a public interest, legal-aid funded clinic, it is also within CELA's mandate that the views of the public, and concerns of transparency be considered within the CNSC's decision-making process.

3. Sustainability Analysis of OPG's Licence Application

3.1 Introduction

This section presents CELA's analysis of Ontario Power Generation's (OPG) consideration of sustainability in its August 2017 *Pickering Nuclear Generating Station (NGS) Power Reactor Operating Licence Application (PROL)*, as well as the Canadian Nuclear Safety Commission's (CNSC) Environmental Assessment (EA) of OPG's licence application as per the requirements of the *Nuclear Safety and Control Act (NSCA)* and associated regulations.

The CNSC regulatory document REGDOC-2.9.1, "Environmental Protection: Environmental Principles, Assessments and Protection Measures" states that the licensee's application shall demonstrate that their environmental protection measures respect the concept of sustainable development.²⁰ In Section 3.2 of this report, we explain how OPG and the CNSC should have incorporated a consideration of sustainability in the Pickering NGS PROL renewal application process, and we set out the major generic and context-specific sustainability concerns that should have been addressed.

In Section 3.3 we discuss the findings of our analysis with respect to five critical sustainability issues that remain unaddressed by OPG and the CNSC:

- Costs to future generations,
- GHG emissions,
- Consideration of need and alternatives,
- Public participation process, and
- Transition planning.

²⁰ CNSC, "RegDoc-2.9.1 Environmental Protection: Environmental Principles, Assessments and Protection Measures: Version 1.1," (April 2017).

In Section 3.4, we summarize our findings and recommendations for the decision on OPG's Pickering NGS PROL renewal application.

3.2 The Basics of Sustainability-Based Planning and Analysis

It should be noted that REGDOC-2.9.1 is very brief and insufficiently helpful on the key matter of how to specify and apply sustainability in analysis in order to ensure that nuclear projects make positive overall contributions to community wellbeing. Expansions and revisions are needed to clarify the obligations of the licensee, and to guide other participants in this and other application processes. This need for clarification is underscored by the failure to recognize and incorporate some basic implications of the concept of sustainable development in REGDOC-2.9.1. Three key adjustments are needed:

- Elaboration of the main generic sustainability implications for studies and reporting, particularly with regard to frameworks and criteria for evaluation of effects and options;
- Addition of requirements for specifying the frameworks and criteria to recognize the particular context and concerns for each project for which an application is prepared; and
- Revisions to ensure that guidance on other matters is consistent with the commitment to sustainability (see Gibson & Markvart, 2008).

In contrast to REGDOC-2.9.1, some clarification of the implications of incorporating sustainability concerns in analysis has been provided in previous panel review processes under the Canadian Environmental Assessment Act, specifically by the parties establishing Terms of Reference for assessment review panels, and by the panels themselves. Of particular importance have been the following documents:

- Voisey's Bay Mine and Mill Environmental Assessment Panel, "Environmental Impact Statement Guidelines for the Review of the Voisey's Bay Mine and Mill Undertaking" (20 June 1997), and *Environmental Assessment Panel Report on the Proposed Voisey's Bay Mine and Mill Project* (March 1999);
- Mackenzie Gas Project Joint Review Panel, "Joint Review Panel determination on sufficiency," (18 July 2005), and the panel's final report, "Mackenzie Gas Joint Review Panel, *Foundations for a Sustainable Northern Future: Report of the Joint Review Panel for the Mackenzie Gas Project*, CEAA 2009";
- Kemess North Copper-Gold Mine Project Joint Review Panel, *Joint Review Panel Report* (September 17, 2007), especially pages 233-241 on the panel's sustainability framework and its application; and
- White's Point Quarry and Marine Terminal Project Joint Review Panel, "Environmental Impact Statement Guidelines" (March 2005) and *Joint Review Panel Report* (October 2007).

Markvart (2014), Gaudreau et al., (2013), Gibson and Markvart (2008), and Gibson et al., (2008) illustrate how the sustainability test should be incorporated in assessments of nuclear energy and other energy projects specifically. Gibson (2005, 2017) and other experts in the field of sustainability-based environmental assessment provide further elaboration, including on

specification of sustainability criteria for case and context in particular applications (see Pope et al., 2004; Morrison-Saunders & Pope, 2013; Dalal-Clayton and Sadler, 2014; Markvart, 2015).

3.2.1 Generic Sustainability Evaluation Criteria

The generic requirements for progress towards sustainability have been set out in many ways, and many different frameworks have been proposed and applied (see Markvart, 2015). In this report, we use Gibson's (2005, 2017) generic sustainability assessment criteria, which are based on a synthesis of insights from the sustainability literature and applied sustainability experiences as well as from a review of applied sustainability assessment criteria (see Appendix A). Briefly, they devote attention to:

- the capacity of natural systems to maintain their structure and functions and to support biological diversity and productivity;
- the capacity of social and economic systems to deliver opportunities and sufficiency, and to achieve, maintain or enhance conditions of self-reliance and diversity;
- the capacity of human environments, including local and regional institutions, to respond to and manage externally induced change;
- the attainment and distribution of lasting and equitable social and economic benefits and openings to participate meaningfully in decision making;
- the rights of future generations to the sustainable use of renewable resources; and
- the protection and conservation of wildlife and the environment for present and future generations (see Gibson & Markvart, 2008).

These criteria are a package in that all of the requirements are necessary for sustainability, and positive gains in all areas must be achieved. Efforts to meet the various requirements for sustainability – to strengthen ecological stewardship and sustainable livelihoods and informed citizen engagement and energy/material efficiencies and equitable distribution of benefits and risks, etc., are mutually reinforcing. Consequently the aim of sustainability-based planning and decision making is not to balance these requirements as competing ends but rather to integrate and pursue them jointly, aiming for mutually reinforcing gains.

3.2.2 Specification of Generic Sustainability Evaluation Criteria

For practical considerations, it is necessary to specify the generic evaluation criteria in order to recognize the particular concerns and possibilities raised by case- and context-specific factors. This specification step ensures proper sensitivity to the factors that may affect how the generic requirements for sustainability can be pursued over the long term. The factors include particular conditions and trends, resources, capacities and other assets, opportunities and barriers, concerns and aspirations, stresses and vulnerabilities. All of these vary more or less significantly among different cultures, ecosystems, jurisdictions and sectors, etc. And all of them involve a particular mix of considerations at various interrelated scales from the global to the local.

Once the generic sustainability requirements are recognized and the case- and context-specific concerns have been identified, the next step is to consolidate them into one coherent and comprehensive set of criteria. In Table 1, below, we provide an example of Gibson’s generic sustainability criteria, specified for the context of nuclear energy generation projects. Note that the table may not be comprehensive of all concerns that OPG should have considered in its Pickering NGS PROL renewal application. Also note that Table 1 considers all phases of nuclear power generation (uranium mining, uranium refining, conversion, and fuel fabrication, nuclear plant operation, and waste fuel management).

Table 1. Sustainability Evaluation Criteria for Nuclear Energy Generation Projects

Sustainability Criteria	Nuclear Energy Generation-Specific Sustainability Concerns
<p>Socio-Ecological System Integrity</p> <p>Resource Maintenance and Efficiency</p>	<ul style="list-style-type: none"> • Potential long term contamination from radioactivity and radionuclides (alpha, beta, neutron particles, gamma rays, isotopes produced in uranium mining and milling, fuel production and nuclear power plant operations) • Insufficiently low standards for cancer risk arising from radiological hazards, with greatest risks to women and young children • Low-, intermediate-, and high-level, long-lived radioactive wastes from nuclear energy generation • Generation and release of hazardous contaminants (arsenic, cadmium, chromium, lead, mercury, nickel, selenium, uranium, molybdenum dioxins and furans, hexachlorobenzene, asbestos, hydrazine, ammonia, hydrogen fluoride, hydrogen sulphide) • Nutrients generated in nuclear energy generation (excessive phosphorous, nitrate) • Air pollutants generated in uranium mining, milling, fuel production, plant operations (sulphur and nitrogen oxides, particulate matter, volatile organic compounds) • Volatile organic compounds • Greenhouse gases generated in uranium mining, milling, transportation, fuel production, plant operations (carbon dioxide, nitrous oxide, ozone, methane, hydrofluorocarbons, perfluorocarbons, water vapour) • Landscape disturbances from construction, mining, processing, energy production, waste management, decommissioning, removal of large amounts of surface water • Occupational health and safety risks associated with mining, industrial processes, plant operations, decommissioning • Higher radiation dose limits for nuclear energy workers vs. the general public • Community-scale exposure to routine and accidental releases of radiation, radionuclides, conventional pollutants from nuclear facilities • Generation of excess energy • Energy supply diversity/resilience vs. reliance on nuclear energy generation for baseload supply • Relative economic efficiencies, considering full costs through the lifecycle, in comparison with other options

<p>Livelihood Sufficiency and Opportunity</p> <p>Intragenerational Equity</p> <p>Intergenerational Equity</p>	<ul style="list-style-type: none"> • Costs of nuclear energy generation facility construction and decommissioning • Fuel costs to public • Nuclear energy generation facility performance, reliability and maintenance costs • Costs to public of nuclear waste management • Costs to public of accidents, malfunctions, malevolent acts • Boom and bust effects of nuclear energy generation (loss of jobs and livelihoods over the course of different phases of nuclear energy generation) • Impacts of uranium mining on Indigenous way of life
<p>Socio-Ecological Civility and Democratic Governance</p>	<ul style="list-style-type: none"> • Security and weapons proliferation • Long-term security of fuel supplies and fuel costs • Capacity to plan for long-term nuclear waste management • Capacity to undertake long-term monitoring of nuclear wastes • Capacity to manage, safely store, and pass along vital information to future generations • Capacity to deal with unplanned releases, catastrophic accidents, malfunctions, malevolent acts • Capacity for emergency planning and response • Reliance on nuclear energy generation and a centralized grid design, which excludes renewable energy sources • Capacity to implement open, inclusive, transparent public decision-making processes • Capacity to provide easily accessible, relevant information to the public • Capacity to educate public on nuclear accident emergency planning, including potassium iodide uptake
<p>Precaution and Adaptation</p>	<ul style="list-style-type: none"> • Need for comprehensive emergency planning • Need to distribute iodide tablets • Redundancy and retrievability in design • Inflexibility of nuclear-based electricity energy systems • Need for long-term precautionary management of nuclear generation facilities and nuclear waste facilities, and associated electricity energy systems

(Winfield et al., 2006; Thompson, 2008; Clean Air Alliance, 2018)

3.2.3 Application in Planning and Analysis

The sustainability objective and criteria should inform all steps and deliberations in the planning process, including but not limited to the following:

- how the particular purposes of the undertaking should be understood from the perspective of sustainability;
- how interested stakeholders are to be engaged in the planning process, including how different perspectives can be accommodated;
- what planning options and components (technologies, programs, etc.) should be examined, and how alternative system options should be elaborated and subjected to comparative evaluation;

- what possible effects (direct, indirect, cumulative effects) deserve detailed attention;
- which effects are likely to be most significant, given sustainability objectives;
- what important opportunities or perils need attention;
- how anticipated positive effects could be enhanced and how adverse effects and risks could be mitigated;
- the strengths and limitations of each system component, including interconnections;
- what specifics are needed in the plan, and/or what arrangements are needed for subsidiary and subsequent deliberations and decisions to ensure proper consideration of purposes, alternatives, effects, mitigation and enhancement options, trade-offs, etc. in light of the sustainability objective and criteria;
- whether and under what terms and conditions the proposed plan should be approved;
- what monitoring and adaptive response requirements are imposed; and
- what preparations by various parties are necessary and desirable to ensure that negative effects are avoided or mitigated, that unanticipated effects are identified and addressed quickly, that subsidiary planning and project development proceeds appropriately, that the plan is reviewed and revised regularly, that maximum mutually reinforcing gains are achieved and that significant adverse effects are avoided (see Gibson & Markvart, 2008).

3.3. Findings of Our Analysis

OPG's Pickering NGS PROL renewal application, including its Environmental Risk Assessment, Predictive Effects Assessment, and the CNSC's EA review of these and other studies, did not incorporate the concept of sustainability as an explicit consideration in planning and analysis. In the paragraphs that follow we briefly discuss critical gaps in OPG's and CNSC's analysis with respect to the implications of the PROL application on the following key sustainability concerns:

- Costs to future generations,
- GHG emissions,
- Consideration of need and alternatives,
- Public participation process, and
- Transition planning.

3.3.1 Costs to Future Generations

OPG and the CNSC did not provide a much-needed discussion about the transfer of financial burdens to future generations of the high costs of continued operation and maintenance of all Pickering reactor units until 2024, including the costs associated with stabilization, decommissioning, site restoration, and radioactive waste management. The financial costs of uranium mining, including remediation, should also be considered in cost estimates of the nuclear energy generation life cycle (Winfield et al., 2006).

Pickering has a history of having the highest operating costs of any nuclear facility in North America (see Spears, 2012; Clean Air Alliance, 2016; Laszlo, 2017). As Spears reported in 2012, Pickering A's cost per megawatt hour was almost triple the industry median, and Pickering B's costs were nearly double the industry standard. In 2014, Pickering's fuel and operating costs were more than double the average market price of electricity. Consequently, Ontario's Electricity System Operator provided OPG with payments totaling \$912 million to subsidize Pickering's operating deficit (see Clean Air Alliance, 2016).

Indeed, to keep the Pickering units running until 2024, OPG has asked the Ontario Energy Board for permission to raise the price of nuclear-generated electricity nearly 180 percent, to 16.5 cents per kWh, which is more than almost any other electricity generation technology (Laszlo, 2017). One spin-off effect of this reliance on costly nuclear energy technology is that Ontario will be locking itself out of safer, more affordable, and more flexible electricity for generations to come.

It is beyond the scope of this report to provide a comprehensive account of the costs of the entire nuclear energy generation life cycle. A critical sustainability-related concern is whether OPG has sufficient funds to cover the associated costs. Winfield et al. (2006) cast doubt on OPG's financial capacity, noting that in 2005 the costs of decommissioning Ontario's existing reactors were estimated at \$7.474 billion. The then decommissioning fund maintained by OPG was only \$4.211 billion. Ontario provides a financial guarantee for any shortfall between OPG's fund and actual decommissioning costs.

RECOMMENDATION NO. 2: OPG and CNSC must clearly demonstrate to Ontarians – through adequate documentation in the licence application submissions – that financial plans are in place to (i) safeguard the affordability of electricity for Ontarians throughout the lifetime of the plant, and (ii) provide financial assurances for the actual costs of continued operation, maintenance, decommissioning, waste management and long term care.

3.3.2 Greenhouse Gas Emissions

In its licence renewal application, OPG claims that one major benefit of nuclear power from the Pickering Nuclear Generating Station is that it generates virtually no GHG emissions. Here, we discuss the critical matter of GHG emissions associated with nuclear energy, which have been almost completely ignored in OPG's licence application, accompanying documents, and the CNSC's review.

Nuclear power plants are not stand-alone systems. They are the most visible component of a sequence of industrial processes that keep nuclear power plants operating. Most accounts of nuclear energy GHG emissions are based on incomplete analyses of the entire nuclear process chain, and this perpetuates the false perception that nuclear energy generation is cleaner than other energy generation technologies.

Winfield et al. (2006) provide a rare life-cycle account of GHG emissions associated with the nuclear energy process chain, focusing primarily on CO₂ emissions. GHGs arise at each stage of the nuclear process chain, from uranium mining, milling, refining, conversion, enrichment, and fuel fabrication through to plant construction, operation, spent fuel storage, decommissioning and waste management. Each phase in the chain consumes thermal energy provided by fossil fuels, and electricity. Conservative (now outdated) estimates of total GHG emissions are between 240,000 and 366,000 tonnes of CO₂ per year for uranium mining, milling, refining, conversion and fuel fabrication, and between 468,000 and 594,000 tonnes of CO₂ for power plant construction. Total GHG emissions associated with nuclear power in Canada are estimated to be in the range of at least 840,000 tonnes per year (Winfield et al., 2006).

Moreover, CO₂ emissions associated with uranium mining depend on the ore grade. After the richest uranium resources are exploited, lower grades are exploited, which becomes more energy- and CO₂-intensive. Consequently, the CO₂ emissions of nuclear power rise with time as the richest uranium resources are depleted. According to Storm van Leeuwen (2017) this phenomenon is called the CO₂ trap, “When the average ore grade approaches 200ppm, the specific CO₂ emission of the nuclear energy system would surpass that of fossil-fueled electricity generation” (p. 6).

OPG’s licence application, accompanying documents, and the CNSC’s review do not address adequately this critical matter of GHG emissions. Their assumptions about Pickering’s GHG emissions rest on consideration of nuclear generation only. A full life cycle analysis of the nuclear process chain is required to substantiate OPG’s claims and demonstrate to the public that one major benefit of nuclear power from Pickering is that it generates virtually no GHG emissions.

OPG’s and the CNSC’s failure to consider appropriately the GHG emissions associated with the full life cycle of nuclear energy generation at Pickering is critical, especially in light of the following sustainability concerns:

- the total amount and cumulative effects of GHG emissions associated with all nuclear power process chains in Ontario and Canada;
- the GHG reduction goals set out in Ontario’s *Climate Change Action Plan 2016-2020* for a low-carbon future;
- misconceptions about the GHG emissions associated with nuclear energy relative to other energy generation technologies; and
- the societal need to transition to renewable energy technologies for Ontario’s baseload energy demands.

RECOMMENDATION NO. 3: The CNSC and responsible authorities must require OPG to undertake greenhouse gas (GHG) emissions accounting, GHG monitoring, and GHG emissions reduction planning in order to consider the entire nuclear process chain, from cradle to grave.

3.3.3 Consideration of Need and Alternatives

Respect for the concept of sustainable development in planning requires a consideration of the need for an undertaking, which sets part of the basis for an investigation of alternatives. In its licence application, OPG asserts that continued operation of Pickering until 2024 will ensure that Ontarians have a reliable source of baseload electricity to cover the period of refurbishment of Darlington nuclear generation station and the initial Bruce nuclear generation station units. In contrast, reputable public interest organizations argue that the energy generated at Pickering is surplus energy, most of which is sold at a loss to Michigan, and that these losses are absorbed by Ontarians (Stensil, 2016), “Ontario now has a large power surplus – the province now exports more power than is produced by the Pickering Nuclear Plant...”, and this means that Pickering can be shut down when its licence expires in 2018 (Clean Air Alliance, 2016b).

This contested question about the need to keep Pickering in operation is crucial, given the costs and risks associated with operating Pickering’s aged CANDU 6 reactors. Above, we briefly discussed the financial burdens to future generations of keeping Pickering in operation. The risks (to human health and environmental integrity) of keeping Pickering in operation have been discussed in depth elsewhere (e.g., Taylor & Spivak, 2001; Thompson, 2008), and in Table 6, above, we categorized most of these risks according to sustainability criteria.

OPG’s licence application does not demonstrate adequately with pertinent data the baseload energy needs to cover the Darlington and Bruce refurbishment periods, as well as the specific need for Pickering NGS to generate energy to cover Ontario’s baseload electricity demands. Nor do OPG and the CNSC discuss the critical matter of alternatives to keeping the Pickering NGS in operation.

OPG’s and the CNSC’s lack of appropriate consideration of need and alternatives is rooted in a failure of the NSCA and associated regulations to require proponents to consider alternatives to projects and alternative means of carrying out projects. Under the NSCA, the CNSC’s EA of OPG’s licence application rests on an assumption of need and it is narrowly focused on a review of various OPG studies and documentation as opposed to an appropriately integrative and comprehensive comparative analysis of alternatives that draws from actual studies conducted by independent experts of site, local, and regional impacts and benefits, among other considerations (e.g., cumulative effects).

The failure of the NSCA and associated regulations to require proponents to consider need and alternatives can be viewed in the light of the recent legislative reforms, which have weakened EA law and practice in Canada (see Doelle, 2012; Gibson 2012; Lindgren, 2016), and it signals the need for significant EA reforms aimed at ensuring net contributions to sustainability.

It is beyond the scope of this report to review the recommendations for EA reform that have been advanced by various experts and organizations (e.g., Gibson et al., 2016; Lindgren, 2016).

Here, we assert that the NSCA represents a fundamentally unacceptable legislative framework for the evaluation of OPG’s Pickering PROL renewal application.

Here, it is important to note that the new federal *Impact Assessment Act*, now making its way through the Parliamentary process, includes a new core requirement to consider “the extent to which the designated project contributes to sustainability” (s.63(a)) and requires considerations of both alternatives to and alternative means of carrying out the proposed project (s.22(e) and (f)) (see Bill C69, 8 February, 2018).

OPG’s licence and all future licences for nuclear power generation and nuclear waste management projects should be evaluated under a reformed ‘next generation’ CEAA that provides the basis for an appropriately rigorous approach to the consideration of need and alternatives.

RECOMMENDATION NO. 4: OPG’s Pickering NGS PROL renewal application and all future licence applications for nuclear power generation and nuclear waste management projects should be evaluated under a reformed CEAA that provides the basis for an appropriately rigorous approach to the consideration of need and alternatives, among other critical considerations. As Gibson et al. (2016, pp. 5-10) have asserted, crucial components of an appropriately rigorous approach to EA would embrace sustainability in all aspects and require attention to

- the purposes of and need for the undertaking (with both purposes and need related to the lasting public interest)
- development and application of broad but comprehensive sustainability-based criteria for evaluations and decisions (see next section);
- emphasis on comprehensive and integrated attention to all factors affecting the long term as well as immediate desirability and durability of effects;
- comparative evaluation of potentially reasonable alternatives to identify best options for each undertaking, to move cumulatively to more sustainable practice; and
- application of case-specified sustainability-based purposes and criteria as the main structure for deliberations and decisions at all process stages for subject undertakings from initial identification of appropriate purposes and options (alternatives) to final deliberations on renewal, closure, decommissioning and continued management.

3.3.4 Public Participation Process

We assert that an EA conducted under the NSCA is not an adequate nor equivalent substitute for a federally directed EA, particularly as it relates to the level of public engagement and opportunities for review by technical experts. In the paragraphs that follow, we describe two key failures of CNSC’s EA of OPG’s Pickering NGS PROL renewal application: opportunities for public participation and expert review, and convenient access to information.

Convenient access to information is a cornerstone of fair public participation in decision making. Accountability of decision makers is enhanced when citizens have access to relevant documents, and there is a direct link between the accessibility of information and the ability of citizens to influence decision making. Meaningful public participation is not possible without an informed public; therefore, easy access to relevant studies, records, etc., is critical.

A CEAA-based environmental assessment would have provided greater opportunity for public review. For instance, under CEAA 1992, a screening environmental assessment was conducted for Pickering's waste management facility. There was a 60-day window for the public to comment on the draft environmental assessment guidelines, 40 days to comment on the Screening Report, and a public comment period prior to the CNSC's hearing process.

The timeframe and number of opportunities provided for public review contrasts with the CNSC's NSCA directed EA, where only approximately 60 days are provided for public comment. Of these 60 days, none of them are specifically focused on the environmental assessment. Rather, the comment window pertains to the licencing hearing, generally. Unlike the CEAA-led EA, the CNSC did not release a draft environmental assessment report for review, with the potential for follow-up comments nor, did the CNSC seek the public's comments on guidelines or directives which should guide its EA review.

The analyses and data that comprise OPG's complete Pickering NGS PROL renewal application were presented in such a way that an in-depth public review was almost impossible. OPG's August 2017 application document contains scant information readily accessible to the public. Throughout the application OPG refers to lists of relevant studies that provide supplementary information to demonstrate OPG's attention to various requirements under the NSCA. Many of these studies, however, are inaccessible to the public through OPG's website, so citizens must request them. OPG's request for information process is problematic, however, because of OPG's long response time as well as the insufficient time and funding provided for citizens and independent experts to do appropriately comprehensive critical analyses.

RECOMMENDATION NO. 5: In the interests of public access to information, all licence documents, including all supplementary studies/reports, must be conveniently accessible through a public registry, with sufficient time allowed for participant review between posting and deadlines for public submissions.

3.3.5 Transition Planning

OPG's proposed 10-year licensing period covers two project phases: the Continued Operations phase consisting of the continued commercial operation of the Pickering facility to 2024, and the 2-3 year Stabilization phase proposed for completion in 2028, which involves the shutdown of reactors, removal of fuel and heavy water, and additional activities necessary to place the

facility in a state of safe storage. These two phases are followed by three additional phases (safe storage, dismantlement, and site restoration), which will require additional licences.

According to the Ontario Chamber of Commerce (2018), the economic contributions that the Pickering NGS will make to Ontario, to the point of decommissioning, are approximately \$1.54 billion to Ontario's GDP, 7,590 full-time equivalent jobs per year, and \$290 million in government taxation revenues. The 7,590 full-time jobs arise from direct employment at Pickering, indirect employment at suppliers, and induced spending from wages earned by workers across all industries. Direct employment at the Pickering station is approximately 2,300 jobs annually.

We assert that Pickering's economic contributions will prove to be an enormous incentive to keeping its aging reactor units in operation beyond 2024, with increasingly high costs and risks to the public, including costs associated with needed refurbishments. In this scenario, OPG will be obligated to apply for another PROL renewal to extend the current end of operation date beyond 2024, thereby breaking its promise to Ontarians to phase out Pickering's reactor units, and further locking Ontarians into high-risk nuclear energy for its base load energy demands.

OPG provides some detail about transition planning in its Sustainable Operations Plan and Stabilization Activity Plan, as well as other supporting documents. These plans, however, are primarily focused on transition management arrangements and technical/engineering matters related to safety. They do not adopt an appropriately broad scope that incorporates a concern for the socioeconomic impacts of Pickering's transition phases.

The overall lack of planning that considers the site/plant, local, and regional socioeconomic impacts of Pickering's transitions from operation to stabilization and decommissioning phases in OPG's PROL renewal application suggests that OPG has no intention of shutting down Pickering's reactor units. Given Pickering's economic contributions, a transition plan is critical to mitigate the direct and indirect impacts on workers' livelihoods, family incomes, and other boom and bust effects on the local economy.

In addition, we assert that because a large portion of Pickering's economic contributions come from the Ontario taxpayer and hydro ratepayer, and because continued operation of Pickering's reactor units is not economically viable, Pickering's contributions should be put to more beneficial uses. OPG's transition planning, therefore, should be situated within the broader transition to a renewable energy generation system.

It is beyond the scope of this report to provide a comprehensive, critical review of good transition planning in the energy sector and other industries. In the context of nuclear energy generation, transition planning must consider the full suite of socioeconomic, environmental and technical aspects of nuclear energy generation, as well as multiple scales (site/plant, local, and regional) – all in the context of a broader transition to an electric power system designed to

contribute to lasting wellbeing while avoiding adverse effects, risks and liabilities. In this report, we focus on the need for transition planning that mitigates adverse impacts, including on worker, family, and community livelihoods specifically.

A 2017 report by the Alberta Federation of Labour and Coal Transition Coalition provides case studies of planned transitions from the coal-fired electricity generation transitions in the U.S. The following key lessons learned from these case studies may begin to illuminate best practices with potential application in the nuclear energy sector with respect to livelihood sufficiency transition concerns:

- provide good jobs (of comparable value) to displaced workers, ideally within the same plant, industry, or community,
- aid workers' transition to growing industries, e.g., clean energy generation,
- provide relevant and targeted education, training, and career counselling to workers while they are still employed to mitigate the impacts of transition,
- provide tuition for displaced workers, consistent with the principle that the burden should be shared fairly, instead of falling on workers,
- provide interim support (or transitional allowances) to workers in transition to a new job to ensure workers and their families do not experience a substantive drop in their quality of life,
- work with affected communities to identify appropriate timing for workforce reductions, conduct studies on local economic sectors with growth opportunities, and to make strategic investments by targeting known areas of growth (e.g., renewable energy and energy efficiency).

RECOMMENDATION NO. 6: OPG must develop a transition plan to mitigate the adverse socioeconomic impacts of shutting down Pickering's reactor units on workers, families, and surrounding communities. This transition plan must be informed by best practices for just transition planning that maintains and enhances livelihood sufficiency and community economic wellbeing, and it must consider the larger transition of the electric power system to renewable technologies.

3.4 Summary of Findings and Recommendations

OPG and the CNSC failed to adequately consider critical sustainability concerns throughout planning and analysis. Below, we summarize our findings and recommendations with respect to

- REGDOC-2.9.1,
- Costs to future generations,
- GHG emissions,
- Consideration of need and alternatives,

- Public participation process, and
- Transition planning.

3.4.1 REGDOC-2.9.1 Environmental Protection

REGDOC-2.9.1 is insufficiently helpful on the key matter of how to specify and apply sustainability in analysis. Expansions and revisions are needed to clarify the obligations of the licensee, and to guide other participants in the application process. Our explanation in Section 3.2 of how OPG and the CNSC should have explicitly incorporated a consideration for sustainability in planning and analysis highlights the inadequacy of this regulation.

We recommend the following key adjustments to REGDOC-2.9.1:

- Elaboration of the main generic sustainability implications for studies and reporting, particularly with regard to frameworks and criteria for evaluation of effects and options;
- Addition of requirements for specifying the frameworks and criteria to recognize the particular context and concerns for the project; and
- Revisions to ensure that guidance on other matters is consistent with the commitment to sustainability (see Gibson & Markvart, 2008).

3.4.2 Cost to Future Generations

OPG and the CNSC did not provide a much-needed discussion about the transfer of financial burdens to future generations of the high costs of continued operation and maintenance of all Pickering reactor units until 2024, including the costs associated with stabilization, decommissioning, site restoration, and radioactive waste management.

RECOMMENDATION NO. 2: OPG and CNSC must clearly demonstrate to Ontarians – through adequate documentation in the licence application submissions – that financial plans are in place to (i) safeguard the affordability of electricity for Ontarians throughout the lifetime of the plant, and (ii) provide financial assurances for the actual costs of continued operation, maintenance, decommissioning, waste management and long term care.

3.4.3 GHG Emissions

Winfield et al.'s (2006) life-cycle account of GHG emissions associated with the nuclear energy process chain shows that GHGs arise at each stage of the nuclear process chain. Total GHG emissions associated with nuclear power in Canada are estimated to be in the range of at least 840,000 tonnes per year. Moreover, CO₂ emissions associated with uranium mining depend on the ore grade. After the richest uranium resources are exploited, lower grades are exploited, which becomes more energy- and CO₂-intensive.

In its licence renewal application, however, OPG claims that one major benefit of nuclear power from the Pickering Nuclear Generating Station is that it generates virtually no GHG emissions. OPG's and the CNSC's failure to consider appropriately the GHG emissions associated with the full life cycle of nuclear energy generation at Pickering is critical in light of the following sustainability concerns:

- the total amount and cumulative effects of GHG emissions associated with all nuclear power process chains in Ontario and Canada;
- the GHG reduction goals set out in Ontario's *Climate Change Action Plan 2016-2020* for a low-carbon future;
- misconceptions about the GHG emissions associated with nuclear energy relative to other energy generation technologies; and
- the larger societal need to transition to renewable energy technologies for Ontario's baseload energy demands.

RECOMMENDATION NO. 3: The CNSC and responsible authorities must require OPG to undertake greenhouse gas (GHG) emissions accounting, GHG monitoring, and GHG emissions reduction planning in order to consider the entire nuclear process chain, from cradle to grave.

3.4.4 Consideration of Need and Alternatives

OPG's and the CNSC's lack of appropriate consideration of need and alternatives is rooted in a failure of the NSCA and associated regulations to require proponents to consider alternatives to projects and alternative means of carrying out projects. Under the NSCA, the CNSC's EA of OPG's licence application rests on an unsupported and at best debatable assumption of need. It is narrowly focused on a review of various OPG studies and documentation as opposed to an appropriately integrative and comprehensive comparative analysis of alternatives that draws from actual studies conducted by independent experts of site, local, and regional impacts and benefits, among other requirements (e.g., cumulative effects).

The failure of the NSCA and associated regulations to require proponents to consider need and alternatives can be viewed in the light of the recent legislative reforms, which have weakened EA law and practice in Canada (see Doelle, 2012; Gibson 2012; Lindgren, 2016), and it signals the need for significant EA reforms aimed at ensuring net contributions to sustainability.

The new federal *Impact Assessment Act*, now making its way through the Parliamentary process, includes a new core requirement to consider "the extent to which the designated project contributes to sustainability" (s.63(a)) and requires considerations of both alternatives to and alternative means of carrying out the proposed project (s.22(e) and (f)) (see Bill C69, 8 February, 2018).

OPG's licence and all future licences for nuclear power generation and nuclear waste management projects should be evaluated under a reformed 'next generation' CEAA that provides the basis for an appropriately rigorous approach to the consideration of need and alternatives.

RECOMMENDATION NO. 4: OPG's Pickering NGS PROL renewal application and all future licence applications for nuclear power generation and nuclear waste management projects should be evaluated under a reformed CEAA that provides the basis for an appropriately rigorous approach to the consideration of need and alternatives, among other critical considerations. As Gibson et al. (2016, pp. 5-10) have asserted, crucial components of an appropriately rigorous approach to EA would embrace sustainability in all aspects and require attention to

- the purposes of and need for the undertaking (with both purposes and need related to the lasting public interest)
- development and application of broad but comprehensive sustainability-based criteria for evaluations and decisions (see next section);
- emphasis on comprehensive and integrated attention to all factors affecting the long term as well as immediate desirability and durability of effects;
- comparative evaluation of potentially reasonable alternatives to identify best options for each undertaking, to move cumulatively to more sustainable practice; and
- application of case-specified sustainability-based purposes and criteria as the main structure for deliberations and decisions at all process stages for subject undertakings from initial identification of appropriate purposes and options (alternatives) to final deliberations on renewal, closure, decommissioning and continued management.

3.4.5 Public Participation Process

The analyses and data that comprise OPG's complete Pickering NGS PROL renewal application were presented in such a way that an in-depth public review was almost impossible. OPG's August 2017 application document contains scant information readily accessible to the public. Throughout the application OPG refers to lists of relevant studies that provide supplementary information to demonstrate OPG's attention to various requirements under the NSCA. Many of these studies, however, are inaccessible to the public through OPG's website, so citizens must request them. OPG's request for information process is problematic, however, because of OPG's long response time as well as the insufficient time and funding provided for citizens and independent experts to do appropriately comprehensive critical analyses.

RECOMMENDATION NO. 5: In the interests of public access to information, all licence documents, including all supplementary studies/reports, must be conveniently accessible through a public registry, with sufficient time allowed for participant review between posting and deadlines for public submissions.

3.4.6 Transition Planning

The overall lack of planning that considers the site/plant, local, and regional socioeconomic impacts of Pickering's transitions from operation to stabilization and decommissioning phases in OPG's PROL renewal application suggests that OPG has no intention of shutting down Pickering's reactor units. Given Pickering's economic contributions, a transition plan is critical to mitigate the direct and indirect impacts on workers' livelihoods, family incomes, and other boom and bust effects on the local economy.

In addition, we assert that because a large portion of Pickering's economic contributions come from the Ontario taxpayer and hydro ratepayer, and because of the high financial risks and burdens associated with continued operation of Pickering's reactor units, Pickering's contributions should be put to more beneficial uses. OPG's transition planning, therefore, should be situated within the broader transition to a renewable energy generation system.

A 2017 report by the Alberta Federation of Labour and Coal Transition Coalition provides case studies of planned transitions from the coal-fired electricity generation transitions in the U.S. The following key lessons learned from these case studies may begin to illuminate best practices with potential application in the nuclear energy sector with respect to livelihood sufficiency transition concerns:

- provide good jobs (of comparable value) to displaced workers, ideally within the same plant, industry, or community,
- aid workers' transition to growing industries, e.g., clean energy generation,
- provide relevant and targeted education, training, and career counselling to workers while they are still employed to mitigate the impacts of transition,
- provide tuition for displaced workers, consistent with the principle that the burden should be shared fairly, instead of falling on workers,
- provide interim support (or transitional allowances) to workers in transition to a new job to ensure workers and their families do not experience a substantive drop in their quality of life,
- work with affected communities to identify appropriate timing for workforce reductions, conduct studies on local economic sectors with growth opportunities, and to make strategic investments by targeting known areas of growth (e.g., renewable energy and energy efficiency).

RECOMMENDATION NO. 6: OPG must develop a transition plan to mitigate the adverse socioeconomic impacts of shutting down Pickering's reactor units on workers, families, and surrounding communities. This transition plan must be informed by best practices for just transition planning that maintains and enhances livelihood sufficiency and community economic wellbeing, and it must consider the larger transition of the electric power system to renewable technologies.

4. Adequacy of the CNSC’s NSCA Environmental Assessment

The Canadian Nuclear Safety Commission (CNSC) staff is correct that under the current federal environmental assessment regime, an Environmental Assessment (EA) under the *Canadian Environmental Assessment Act 2012* (CEAA 2012) is not required for this renewal application since the proposal is not for the licencing of a new facility.²¹

The CNSC staff did, however, conduct a review purported to be an “EA” under the *Nuclear Safety and Control Act* (NSCA) and its regulations. The retrograde EA conducted under the NSCA is insufficient; as noted by many commenters, an interim report as far back as the 2001 Standing Senate Committee on Energy, the Environment and Natural Resources,²² and a recent Environmental Assessment Expert Panel report²³, a much more robust assessment is required to adequately account for the relevant factors involved in projects that are likely to have significant adverse environmental effects.

While Section 3 of CELA’s submission sought to address the inadequacies in the current EA process under the NSCA with respect to sustainability, this section will address the EA process under the NSCA with a specific focus on identifying statutorily imposed limitations and how they may be improved to better reflect the purpose of environmental assessments – to protect the health and well-being of the environment and Canadians from the adverse effects of projects.

4.1 Comparing the Federal and NSCA EA Processes

The federal statutory requirements for the assessment of nuclear projects have been watered down since the *Canadian Environmental Assessment Act*²⁴ (CEAA 1992) was replaced by the CEAA 2012. CEAA 1992 identified certain projects likely to have significant adverse environmental effects and named them in a list of projects requiring comprehensive study. The repeal of CEAA 1992 and subsequent promulgation of CEAA 2012 replaced the Comprehensive Study List Regulations with a narrowed scope of designated projects. Most importantly, since the reactors at Pickering NGS are not new facilities, they are not classified as designated projects

²¹ *Regulations Designating Physical Activities*, SOR/2012-147, s. 19(1)(g).

²² Standing Senate Committee on Energy, the Environment and Natural Resources, “Interim Report, Canada’s Nuclear Reactors: How Much Safety Is Enough?” (June 2001), online: <https://sencanada.ca/content/sen/Committee/371/pdf/interim-enrg-e.pdf>, p 31-39. The Interim Report argued that the failure of including the restarting of Pickering NGS under the Comprehensive Study List under CEAA 1992 must have been an oversight owing to the threat posed by a nuclear generating station such as Pickering A. This line of reasoning can be extended to include the renewal of an operating licence for an NGS past its operating design date and its decommissioning.

²³ EA Panel Report, *supra* note 12

²⁴ *Canadian Environmental Assessment Act*, SC 1992, c 37 [CEAA 1992]

and therefore not required to undergo an EA under CEAA 2012 when being refurbished or decommissioned.²⁵

Even though most nuclear projects are not subject to a CEAA 2012 EA, CNSC staff does undertake a process, described as an “environmental assessment”, or EA, under the NSCA.²⁶ Without an explicit requirement to consider the factors listed under s. 19 of the CEAA 2012 (or s. 16 of CEAA 1992) the process is more akin to a technical analysis of a proposed environmental monitoring program.

An EA under the NSCA is primarily based on information that the applicant or licensee is required to submit to the CNSC through the established licensing process, such as the licence application and its supporting documentation, and information on environmental protection measures.²⁷ In comparison, a comprehensive study under CEAA 1992 was required to consider, amongst others, technically and economically feasible alternatives; cumulative environmental effects; and the capacity of renewable resources that are likely to be significantly affected. A responsible authority could also consider the “need for” and “alternatives to” a project.²⁸ As a technical assessment with a narrower scope and without the requirement to consider the factors underlying s. 19 of CEAA 2012 or s. 16 of CEAA 1992, an EA under the NSCA cannot be considered an assessment that would ensure a proponent would make adequate provision for the protection of the environment and the health and safety of persons while carrying on a licensed activity. For the reasons discussed below, CELA submits that an EA conducted under the NSCA is not an adequate nor equal substitute for a federal, CEAA-based EA.

4.2 Important Factors to Consider in Environmental Assessments

The Pickering NGS has a history of having the highest operating costs of any nuclear facility in North America and risks associated. As also briefly outlined under Section 3.3.3 (Consideration of Need and Alternatives) of this document in the context of sustainability, the cost of operating the Pickering NGS, its unreliability, poor safety, and available alternatives for electricity generation, create legitimate questions as to the need for the continued operation of the Pickering NGS. This section will consider these factors in the context of an EA under the NSCA.

Given the importance of the operation and decommissioning of the Pickering NGS and the potential long-term environmental and public safety consequences of the use of nuclear power and its waste legacy, CELA submits that the application from OPG to renew and extend its Pickering NGS PROL should be classified as a designated project under the CEAA 2012 and

²⁵ CNSC CMD, *supra* note 5, p 13.

²⁶ NSCA, *supra* note 10.

²⁷ CNSC, “Environmental assessments” online: <http://nuclearsafety.gc.ca/eng/resources/environmental-assessments/index.cfm>

²⁸ CEAA 1992, *supra* note 24, s. 16.

undergo an EA under that statute. Alternatively, the CNSC is empowered with the discretion to conduct an EA under the NSCA that is comparably robust to one conducted under the CEEA 2012.

The CNSC has the authority, in accordance with paragraph 3(1.1)(b) of the *General Nuclear Safety and Control Regulations* (herein, *General Regulations*), to require additional information that would enable the Commission to determine whether a proposed project makes adequate provision for the protection of the environment and the health and safety of persons.²⁹ CELA submits that the additional information the Commission may request include an analysis of such factors as, amongst others, a consideration of the “need for” the project, “alternatives to” the project, “alternative means” to carrying out the project, and cumulative effects.

If the CNSC were to exercise its authority under the *General Regulations*, even a cursory analysis of “alternative means”, “alternatives to”, and the “need for” factors would likely lead CNSC staff to recommend the denial of OPG’s application to renew the PROL past its expiration date. In its application, OPG has presented no compelling evidence for the need to renew the Pickering NGS PROL beyond its current expiration date; has not conducted a comparative analysis of the feasible alternatives to the continued operation of the facility; nor conducted an adequate analysis of the alternative means for the continued operation and decommissioning of the facility. To the contrary, there has been ample evidence, as briefly reviewed in the next section, over the course of the facility’s history, that should have led CNSC staff to question whether it is prudent to grant the renewal application.

The Pickering NGS produces surplus energy that is not utilized. According to a 2016 Ontario Clean Air Alliance (OCAA) factsheet, Ontario’s peak-hour demand for electricity declined by 17% between 2006 and 2015 while supply rose by 25% during the same period.³⁰ Ontario lost between \$384 to \$675 million in 2016 and \$348 to \$572 million for the first three quarters of 2017 worth of energy because of over generation of electricity.³¹ Because of this falling demand and rising supply, Ontario now has a large electricity surplus.

The Pickering NGS is also an unreliable generator of power. According to OPG’s own 2015 Nuclear Benchmarking Report³² comparing the performance of its nuclear reactors to others in

²⁹ *General Nuclear Safety and Control Regulations*, SOR/2000-202, s. 3(1.1)(b)

³⁰ Clean Air Alliance Research, How we can close the Pickering Nuclear Station and lower bills, (September 2016) online: <http://www.cleanairalliance.org/wp-content/uploads/2016/09/pickering-replacementv4.pdf>.

³¹ Ontario Society of Professional Engineers, Empower Ontario’s Engineers to Obtain Opportunity An Analysis of Ontario’s Clean Electricity Exports online: https://www.ospe.on.ca/public/documents/advocacy/submissions/OSPE_Electricity_Export_Analysis.pdf at p 2.

³² Ontario Power Generation, 2015 Nuclear Benchmarking Report, (November 2015) https://www.opg.com/about/regulatory-affairs/Documents/2017-2021/F2-01-01_Nuclear-Business_Planning_and_Benchmarking_20161110.pdf [Benchmarking Report]

North America, Pickering is the worst performer. When benchmarked against other nuclear facilities, Pickering's six reactors consistently come in near the bottom of the pack in terms of reliability and cost.³³ According to the World Association of Nuclear Operators (WANO), a key measure of a nuclear station's reliability is its forced loss rate; this is the ratio of its unplanned (forced) energy losses to its planned level of electricity generation.

OPG's Benchmarking Report compared the reliability of the Pickering NGS to that of North America's 64 other nuclear power plants. Pickering's forced loss rate is 10.08 times greater than WANO's excellent performance standard, i.e., a maximum nuclear performance index (NPI) of 1.0.³⁴ To address, in part, Pickering's poor performance, Mr. Randy Lockwood the Senior Vice President of Pickering Nuclear at OPG, indicated to the CNSC at the April 4th, 2018 public hearing on the PROL renewal application that, "the forced loss rate performance over the last three years has also been the best ever. And our maintenance backlog for safety critical equipment across the entire station, all six units, it is zero."³⁵ Mr. Lockwood's submission does not address the facility's performance in comparison to the 64 other nuclear power plants in North America. If recent history is any indication, the performance may still be closer to the lower end in terms of reliability and cost. In any case, without an updated Nuclear Benchmarking Report that provides a comparative analysis of the facility that covers the last three years, there is no data-driven evidence to suggest improvement in performance.

The electricity produced by the Pickering NGS is more expensive than that from other nuclear power plants in North America. According to the 2015 Nuclear Benchmarking Report,³⁶ the Pickering NGS operating costs per kWh, exclusive of fuel costs, are higher than those of any other nuclear station in North America.³⁷ The Pickering NGS fuel and operating costs (8.16 cents per kWh) was more than double Ontario's average wholesale market price of electricity in 2014 (3.60 cents per kWh). As a result, the Independent Electricity System Operator (IESO) was required to provide OPG with special payments totalling \$917 million to subsidize Pickering's operating deficit.³⁸

The operation of the Pickering NGS is unsafe for workers, the public, and the environment. The Pickering NGS has had a long history of significant accidents that call into question the safety of its continued operation. In 2001, the Standing Senate Committee on Energy, The Environment and Natural Resources released a report listed several accidents up to that point in the Pickering

³³ *Ibid*, p 41-42.

³⁴ *Ibid*, p 51.

³⁵ CMD 18-H6/18-H6.A 47, Oral presentation by CNSC staff online: <http://nuclearsafety.gc.ca/eng/the-commission/pdf/TranscriptofPickeringHearing-April4,2018.pdf> at p 13.

³⁶ Benchmarking Report, *supra* note 32, at p 70-71.

³⁷ *Ibid*, p 70-71.

³⁸ Clean Air Alliance Research, Closing the Pickering Nuclear Station in 2018: A Cost-Benefit Analysis, (June 2016) online: <http://www.cleanairalliance.org/wp-content/uploads/2016/06/pickering-fs.pdf> p 3.

NGS operation.³⁹ The OCAA noted further recent examples of accidents occurring between 2011 and 2015.⁴⁰ As noted by a joint publication by CELA and the Pembina Institute in 2004:⁴¹

The Pickering A nuclear station should be shut down permanently for safety reasons alone. Due to its age, the Pickering A station is the only nuclear plant in the western world that has only one emergency shutdown system. All other nuclear plants in Canada and abroad have two complete emergency shutdown systems for back-up. Ontario Power Generation (Ontario Hydro) installed a cheaper alternative to save \$300 million. The Pickering station is also closer to larger numbers of people than any other nuclear plant in the world. For that reason, regulatory authorities would not allow a new plant to be built at Pickering today.

The reduction in demand for electricity, coupled with the Pickering NGS operating costs, its unreliability, and historic lack of safety suggests that it is an unnecessary choice for Ontario's current needs and a poor choice for meeting Ontario's future needs. The failure of CNSC staff to consider the feasibility, reliability, necessity, or alternatives to OPG's proposed licence renewal in its EA under the NSCA has resulted in a lack of information available for the Commission and public's review. Without which, the CNSC does not have the requisite evidentiary basis to find the applicant can in carrying on the proposed licence, making adequate provision for the protection of the environment. On this basis, CELA recommends the denial of OPG's application to renew the Pickering NGS PROL.

4.2 Conclusion

The CNSC should deny OPG's application to renew the Pickering NGS beyond the expiration of its PROL on August 31, 2018. The lack of any need for the continued operation of the Pickering NGS, its history of poor performance, increased risks to the public, cost of its operation and decommissioning, the existence of adequate "alternatives to" the nuclear facilities generation of electricity, coupled with the lack of any compelling evidence provided by OPG to extend the PROL beyond its current end date, demonstrates that the proposal to renew the PROL beyond its current end date does not make adequate provision for the protection of the environment and the health and safety of persons — a condition for licencing under the NSCA.

RECOMMENDATION NO. 7: The CNSC Commissioners should require CNSC staff to exercise its authority under paragraph 3(1.1)(b) of the *General Nuclear Safety and Control Regulations* to

³⁹ *Canada's Nuclear Reactors: How Much Safety Is Enough?* online: <https://sencanada.ca/content/sen/Committee/371/pdf/interim-energ-e.pdf>.

⁴⁰ Ontario Clean Air Alliance, "Pickering Nuclear: Unsafe at any speed" (2016) online: <http://www.cleanairalliance.org/pickering-safety/>.

⁴¹ Pembina Institute for Appropriate Development and the Canadian Environmental Law Association, "Power for the Future Towards a Sustainable Electricity System for Ontario," (May 2004) online: <http://www.cela.ca/sites/cela.ca/pdf/energyreport-fullreport.pdf> at p 107.

require CNSC Staff to undertake a comprehensive “need for”, “alternative to”, and “alternative means” analysis utilizing the best available scientific information and methods, Indigenous knowledge, and public consultation as part of the EA of the Pickering NGS PROL renewal application and all subsequent EA’s under the NSCA. In the absence of this analysis, the Commissioner’s should find that need for the Pickering renewal and life extension is not demonstrated.

RECOMMENDATION NO. 8: The CNSC should deny OPG’s application to renew the Pickering NGS beyond the expiration of its PROL on August 31, 2018. The lack for an adequate “need for” the continued operation of the Pickering NGS; the history of poor performance and the increased risks to the public; the cost of its continued operation and decommissioning; and the existence of adequate “alternatives to” the nuclear facilities generation of electricity; coupled with the lack of any compelling evidence provided by OPG to extend the PROL beyond its current end date, demonstrates that the proposal to renew the PROL does not make adequate provision for the protection of the environment and the health and safety of persons – a condition for licencing under the NSCA.

5. Decommissioning of the Pickering NGS

This Section reviews the assessment of decommissioning the Pickering NGS undertaken by OPG under the current Canadian regulatory framework. While comparisons will be made to current IAEA standards and guidelines; and the regulations of other jurisdictions, they are done so to delineate relative practice, and should not be construed as a tacit endorsement of their respective regulatory framework. It should be noted that the IAEA Standards are the minimum standards required to be met by IAEA Statute Member States for the regulation of nuclear activity. The IAEA Standards should not be sufficient to meet the higher standard required to ensure the protection of the environment and public health now and in the future.

Furthermore, CSA N294-09 and CSA Standards in general, are privately developed standards not subject to the same level of public scrutiny as the legislative process for public laws and regulations.⁴² As previously stated by CELA, the use of CSA Standards inappropriately delegates the setting of regulatory standards to an industry body, not easily accessible by the public. The reliance on CSA Standards creates unacceptable secrecy concerning nuclear licensing requirements. CELA has requested, and does so once again, that the CNSC cease reliance on CSA standards for any matters relevant to nuclear licensing, and instead conduct all standard setting and guidance within the CNSC’s processes. Should the CNSC decide to continue this problematic reliance on CSA Standards, the CNSC should, as a minimum, ensure that members of the public are given unrestricted access to all CSA standards referenced in the licence documents free of charge.

⁴² CSA, “N294-09 (R2014) Decommissioning of facilities containing nuclear substances” (2014) [CSA N294-09]

5.1 Inadequate Regulatory Framework for Decommissioning

As it stands, Canada does not have a comprehensive regulatory framework that adequately addresses nuclear waste or the decommissioning of nuclear facilities. There is an imminent need to develop publicly acceptable policies and strategies for the management of radioactive waste and the decommissioning of nuclear facilities that are scientifically sound.

In 2014, the CNSC commissioned a report, *International Benchmarking on Decommissioning Strategies*, RSP-0303,⁴³ that compared the Canadian regulatory framework and standards to the requirements of IAEA *Safety Requirements, Decommissioning of Facilities Using Radioactive Material*, WS-R-5, as well as other international jurisdictions. Since that time, WS-R-5 has been superseded by IAEA *General Safety Requirements Part 6*, GSR Part 6. While an update, GSR Part 6 has substantially the same requirements as WS-R-5. In addition, while Canada's regulatory framework has also undergone some change in the interim, its approach to regulating nuclear decommissioning activities has remained largely unchanged. Consequently, the conclusions drawn by RSP-0303 concerning the adequacy of the Canadian regulatory regimes compliance with IAEA requirements remain relevant today. The report found that while many of the IAEA requirements were adequately reflected in the Canadian regulatory framework or commissioned standards, a number were not.

The Canadian regulatory framework as it relates to the decommissioning of NPPs is, in general, similar to the regulatory regime of most of the other countries that were reviewed in RSP-0303 (and particularly those of Finland, Italy, the UK and Sweden). This is because all of these regimes primarily address planning for decommissioning, estimating the cost of decommissioning and assuring that funding for decommissioning will be available. According to the report, the statutes, regulations, licence conditions, codes and standards of these jurisdictions, including Canada, do not systematically address the execution of decommissioning or the release of a nuclear site following decommissioning.⁴⁴

The CNSC regulatory guide G-219 stipulates that one of the primary roles of the preliminary decommissioning planning process and plan is to document a preferred decommissioning strategy which, considering current knowledge, represents a technically feasible, safe and environmentally acceptable approach.⁴⁵ CSA N294-09 recommends that a decommissioning strategy should contain a high-level approach and rationale for decommissioning a facility, be developed early, and be updated as new information is obtained. strategy.

⁴³ Candesco, *International Benchmarking on Decommissioning Strategies*, RSP-0303, (2014), online: <http://www.nuclearsafety.gc.ca/eng/pdfs/about/researchsupport/reportabstracts/RSP-0303-Final-Report-eng.pdf>, p 9 [RSP-0303].

⁴⁴ RSP-0303, *supra* note 43, p 18.

⁴⁵ CNSC Regulatory Guide G-219, *Decommissioning Planning for Licensed Activities* (June 2000), online: http://nuclearsafety.gc.ca/pubs_catalogue/uploads/G219_e.pdf, s 6.1.1 [G-219]

The Finnish regulatory regime suggests that the preferred strategy for decommissioning is Prompt Dismantling, but that all options would be considered if sufficiently justified.⁴⁶ In Sweden, the primary decommissioning strategy for NPPs is that of immediate dismantling with the overarching goal the site of the nuclear facility to be eventually used for future energy production after decommissioning.⁴⁷ Although all three of the identified decommissioning strategies are available to licensees, in the United States the majority of NPPs have adopted the DECON strategy, equivalent to ‘immediate dismantling’, with only three facilities undergoing in-situ decommissioning.

The IAEA GSR Part 6 stipulates the preferred decommissioning strategy as immediate dismantling, but that when all relevant factors are considered, there may be situations where immediate dismantling is not a practical strategy.⁴⁸ SRS 50 suggests that the selection of a decommissioning strategy is dependent on waste generation and waste management. When selecting a decommissioning strategy, it is crucial to consider national waste management policies or to seek the establishment of a policy where one does not exist. The policy should establish both, an overall national framework for the management of all types of waste generated during decommissioning activities, and the classification of the waste and its long-term management.⁴⁹

CNSC’s regulatory guidance documents consist of the single G-219, published in 2000, that devotes only a page and a half to choosing decommissioning strategies, and uses discretionary language, suggesting that “...it may be useful to map out the basic strategic approach to decommissioning within each envelope.” or “where a clear strategic preference is not immediately apparent, the alternative strategies should be compared using a simple detriment-benefit evaluation method.” In any case, these documents cannot be considered government policy, given the CNSC’s “arms-length governance structure” that “ensures that it remains independent from government.”³

Consequently, there is no comprehensive regulatory framework that adequately addresses nuclear waste or the decommissioning of nuclear facilities. The Government of Canada should develop publicly acceptable policies and strategies for managing radioactive wastes and the decommissioning of nuclear facilities that reflect international best practices and have been developed in consultation with Indigenous peoples and the Canadian public. This should

⁴⁶ Predisposal Management of Low and Intermediate Level Nuclear Waste and Decommissioning of a Nuclear Facility, Guide YVL D.4, draft L5, (2013) online: <https://ohjeisto.stuk.fi/YVL/D.4e.pdf>, Requirement 403, [Guide YVL D.4]

⁴⁷ OECD, Radioactive Waste Management and Decommissioning in Sweden, (2013) online: https://www.oecd-nea.org/rwm/profiles/Sweden_report_web.pdf, p 18.

⁴⁸ Decommissioning of Facilities Using Radioactive Material, IAEA Safety Standards Series No. GSR Part 6, IAEA, Vienna (2016), online: <http://www-pub.iaea.org/MTCD/Publications/PDF/Pub1652web-83896570.pdf>, s 5.1 [GSR Part 6]

⁴⁹ Decommissioning Strategies for Facilities Using Radioactive Material, IAEA SRS 50, IAEA, Vienna (2007), online: http://www-pub.iaea.org/MTCD/Publications/PDF/Pub1281_web.pdf, at 3.7 [SRS 50]

include, as a prerequisite, the development of a national classification scheme for radioactive waste, decommissioning strategies, and decommissioning execution that are scientifically sound and publicly acceptable.

RECOMMENDATION NO. 9: The CNSC should require, at a minimum, that decommissioning strategies are well documented and include a description of the options, the overall timescales for the decommissioning of a facility and the end state after completion of all decommissioning actions. The reasons for choosing the preferred option should be explained and justified in comparison to other feasible strategies based on the best available scientific information and methods, after public consultation, and require that no undue burdens be imposed on future generations.

5.2 A Detailed Decommissioning Plan Should Have Already been Completed

It is important that the CNSC require OPG to develop a detailed decommissioning plan (DDP) as soon as possible. The timely development and submission of a DDP allows for the vetting of the plan before any irrevocable decisions are made. Early submission also allows the CNSC to evaluate the justification and plans for, amongst others, adaptive management and environmental monitoring, site remediation and end-use, costs and feasibility, cumulative effects, long-term waste management, security, and public safety.

CELA is aware that OPG plans to begin decommissioning in 2028, however, if its application to renew the PROL were rejected by the CNSC, OPG would be required to commence decommissioning activities as early as 2021. Under these circumstances, a more fully-supported decommissioning strategy under a DDP should either be completed or be close to completion.

IAEA GSR Part 6 requires that prior to decommissioning actions, a final decommissioning plan must be prepared and submitted to the regulatory body for approval typically within two to five years of permanent shutdown.⁵⁰ Article 18 of IAEA TECDOC 1816, Model Regulations for Decommissioning of Facilities, indicates that proponents should also provide interested parties with the opportunity to provide their input prior to submitting the plan to the regulatory body.⁵¹ The US Code of Federal Regulations 10 CFR 50.82(a)(4)(i),⁵² specifies that prior to or within 2 years following the permanent cessation of operations, the licensee must submit a Post-Shutdown Decommissioning Activities Report (PSDAR). The PSDAR will include a description of the planned decommissioning activities, with a schedule for the accomplishment of significant milestones and an estimate of expected costs. Further guidance on the format and content of the PSDAR is provided in Regulatory Guide 1.185, *Standard Format and Content for Post-*

⁵⁰ GSR Part 6, *supra*, note 48 at Requirement 11.

⁵¹ IAEA TECDOC 1816, Model Regulations for Decommissioning of Facilities, Article 18.

⁵² Termination of License, 10 CFR 50.82, U.S. Nuclear Regulatory Commission, 2011.

Shutdown Decommissioning Activities Report.⁵³ Upon receipt of the PSDAR, the NRC will place a notice regarding its receipt in the Federal Register to solicit comments on the PSDAR from the public pursuant to 10 CFR 50.82(a)(4)(ii).⁵⁴

Canadian CNSC guidance document G-219 lists the required contents of a detailed decommissioning plan, and CSA Standard CSA N294-09 stipulates the contents of a final decommissioning plan must specify the detailed work program, safety and environmental protection procedures, and management systems to be followed during decommissioning.⁵⁵ Clause 7.8.2 provides a description of the specific inclusions in the final decommissioning plan based on the complexity of an NPP being decommissioned.⁵⁶ Despite the level of detail, neither G-219 nor CSA N294-09 provide any requirement or guidance on when the final decommissioning plan is to be submitted, nor do they require meaningful consideration of input from the public.

The Canadian regulations and standards meet the minimum international standards for the content of a DDP but fall short of providing a schedule for its submission and the need for public input. The timely development of the DDP allows for the vetting of the proposed plan before any irrevocable decisions are made. This allows the regulator to evaluate the licensee's justification and plans for, amongst others, adaptive management and environmental monitoring, site remediation and end-use, costs and feasibility, cumulative effects, long-term waste management, security, and public safety.

Both, IAEA guidance and U.S. regulation, despite its varied efficacy in regulating the nuclear industry, also recognize the need for a timely DDP that has been subject to public accountability and acceptability for decommissioning activities. This also includes ready access to documents relevant to the development of the DDP. Meaningful public participation is not possible without an informed public. As previously noted in Sections 2.1 and 3.3.4 on CELA's submission, accountability of decision makers is enhanced when citizens have access to information and the ability to influence decision making. The lack of a meaningful opportunity for the public to participate in an activity that is likely to have an adverse effect on, not only current, but future generations is antithetical to a properly functioning democracy.

RECOMMENDATION NO. 10: In anticipation of decommissioning the Pickering NGS, the CNSC should require OPG to develop a DDP as soon as possible. The development of the DDP must include meaningful participation of the public at the earliest possible opportunity, to ensure the DDP has a sound evidentiary basis and is publicly acceptable. The DDP should be sufficiently

⁵³ Standard Format and Content for Post-Shutdown Decommissioning Activities Report, Regulatory Guide 1.185, U.S. Nuclear Regulatory Commission, (2000) online:

<http://pbadupws.nrc.gov/docs/ML0037/ML003701163.pdf>

⁵⁴ *Ibid*, p 1.185-2.

⁵⁵ CSA N294-09, *supra* note 42, at 7.8.1.

⁵⁶ *Ibid* at 7.8.2.

detailed to allow the evaluation of the licensee's justification and plans for, amongst others, adaptive management and environmental monitoring, site remediation and end-use, costs and feasibility, cumulative effects, long-term waste management, security, and public safety.

5.3 Minimal Analysis of Alternative Means in the Preliminary Decommissioning Plan

To ensure compliance with GSR Part 6, the CNSC should compel OPG to undertake an "alternative means" analysis for feasible decommissioning strategies that utilize the best available up-to-date science and methods. The analysis should demonstrate that the preferred strategy will ensure the Pickering NGS will be maintained in a safe configuration at all times, will reach the specified decommissioning end state, that no undue burdens will be imposed on future generations, and is acceptable to the public and Indigenous communities.

The OPG Preliminary Decommissioning Plan (PDP) for the Pickering NGS indicates that the deferred decommissioning strategy was selected based on decommissioning planning studies that OPG started in the 1980s.⁵⁷ Those studies indicated that the immediate decommissioning option would incur higher costs and higher occupational dose, while the dismantling costs and occupational dose would fall over time, favouring deferred decommissioning and in-situ confinement. The current post-decommissioning plan for the Pickering NGS site, however, is for the re-use of the site, and so in-situ confinement was not considered further. Notably, the studies concluded that deferred decommissioning, entailing a safe storage period, was the most suitable option for decommissioning OPG's NGSs.⁵⁸ Based on a study published in 1991, OPG determined that a safe storage period of nominally 30 years offered a reasonable time to defer dismantling. The currently available funding also assumes a deferred decommissioning strategy for the Pickering NGS.

It is unclear from the PDP whether the plans for employing the deferred decommissioning strategy have been revisited since the 1980s. What is explicit, however, is that the decision to employ the decommissioning strategy is based on science that is almost certainly three decades old. Despite the use of outdated science and the imminent need, OPG has only conducted a cursory review of available decommissioning strategies and their employment in various jurisdictions; it did not conduct a persuasive alternatives analysis using the best available scientific information and methods to present an evidence-based justification for selecting deferred decommissioning as the preferred strategy.

⁵⁷ OPG, Preliminary Decommissioning – Pickering Generating Stations, 2016 (Plan P-PLAN-00960-00001), p 54.

⁵⁸ OPG, Preliminary Decommissioning – Pickering Generating Stations, 2016 (Plan P-PLAN-00960-00001), p 55.

According to GSR Part 6, at a minimum, OPG is required to demonstrate to the CNSC that, under the decommissioning strategy selected, deferred decommissioning, the Pickering NGS will be maintained in a safe configuration at all times and will reach the specified decommissioning end state, and that no undue burdens will be imposed on future generations.⁵⁹

As mentioned in Section 4.2 above, the CNSC has the authority to require additional information under paragraph 3(1.1)(b) of the *General Nuclear Safety and Control Regulations*, to determine whether the adequate provision will be made for the protection of the environment and the health and safety of persons.⁶⁰ OPG would be able to meet the minimal standard set by the IAEA under GSR Part 6 if it were to undertake an analysis of “alternative means” utilizing the most up-to-date best available science and methods, to establish an evidentiary basis for a preferred decommissioning strategy. The evidence presented by OPG should demonstrate that the preferred strategy will ensure the Pickering NGS will be maintained in a safe configuration at all times, will reach the specified decommissioning end state, and that no undue burdens will be imposed on future generations. This analysis should be undertaken in consultation with Indigenous peoples and the Canadian public to ensure the acceptability of preferred strategy. To ensure the public can provide meaningful feedback, the “alternative means” analysis should detail the criteria used to identify alternative means and how these criteria were applied to find the rejected alternative means unacceptable.

RECOMMENDATION NO. 11: The CNSC should exercise its authority under paragraph 3(1.1)(b) of the *General Nuclear Safety and Control Regulations*, to compel OPG to undertake an “alternative means” analysis that utilizes the best available up-to-date science and methods, and input from the public and Indigenous communities. The analysis must demonstrate that the preferred strategy will ensure the Pickering NGS will be maintained in a safe configuration at all times, will reach the specified decommissioning end state, that no undue burdens will be imposed on future generations, and is acceptable to the public and Indigenous communities.

5.4 Conclusion

In anticipation of Pickering NGS’s decommissioning, the CNSC should exercise its authority under paragraph 3(1.1)(b) of the *General Nuclear Safety and Control Regulations*, to compel OPG to undertake an “alternative means” analysis for decommissioning strategies. The analysis must utilize the best available up-to-date science and methods, as well as input from the public and Indigenous communities. The decommissioning strategies put forth by OPG should be well documented and include a description of the options, the overall timescales for the decommissioning of a facility, and the end state after completion of all decommissioning actions. The “alternative means” analysis must demonstrate that the preferred strategy will ensure the Pickering NGS will be maintained in a safe configuration at all times, will reach the

⁵⁹ GSR Part 6, *supra* note 48 at Requirement 5.3.

⁶⁰ *General Nuclear Safety and Control Regulations*, SOR/2000-202, s. 3(1.1)(b)

specified decommissioning end state, that no undue burdens will be imposed on future generations, and is acceptable to the public and Indigenous communities. Finally, the CNSC should also require OPG to develop a DDP as soon as possible. The development of the DDP must include meaningful participation of the public at the earliest possible opportunity, to ensure the DDP has a sound evidentiary basis and is publicly acceptable. The DDP should also be sufficiently detailed to allow the evaluation of the licensee’s justification and plans for meeting licencing conditions.

6. Improving Emergency Response and Preparedness

In this section, CELA reviews the current state of emergency planning and readiness in Ontario and comments on the sufficiency of the revised *Provincial Nuclear Emergency Response Plan* as a basis for emergency planning. As set out below, CELA recommends a number of improvements to Ontario’s emergency response measures in order to: (1) ensure the emergency response for the Pickering NGS is ‘best in class,’ and (2) align protective actions with the minimum standards as set out in international guidelines and approaches exemplified by other jurisdictions.

6.1 The Current State of Emergency Planning and Readiness

Four and a half million people live within 50 kilometres of the largest nuclear facility in the world - the Pickering Nuclear Generating Station.^{61,62} The inherent risk of operating a nuclear generating station of Pickering’s size in a high-density area, necessitates emergency response planning which is commensurate to the complexity of evacuating, alerting and distributing KI in a populous area.

Emergency planning was a focus of the Ontario’s Auditor General most recent annual report, which found Ontario’s nuclear emergency response and planning to be critically deficient:

Emergency response plans have not been updated to reflect current events or operations. Since many of the emergency response plans we reviewed had not been recently updated, these plans may not reflect current operations or incorporate program changes. They also may not include current information on best practices and lessons learned from past emergencies, practice tests of the response plans and recent worldwide events. This could result in confusion or delays during the response to an emergency.⁶³

⁶¹ Office of the Auditor General of Ontario, (2017). “Emergency Management in Ontario,” online: http://www.auditor.on.ca/en/content/annualreports/arreports/en17/v1_304en17.pdf, p 224 [Auditor General Report]; Daniel Otis, “Is Toronto ready for a radiation emergency” 5 Jan 2016, The Toronto Star, online: <https://www.thestar.com/news/gta/2016/01/05/is-toronto-ready-for-a-radiation-emergency.html> [Is Toronto Prepared]

⁶² “Pickering Nuclear” 2018, online: <https://www.opg.com/generating-power/nuclear/stations/pickering-nuclear/Pages/pickering-nuclear.aspx>

⁶³ Auditor General Report, *supra* note 61, p 226

The Auditor's General report was released just weeks before Ontario published its revised *Provincial Nuclear Emergency Response Plan* (herein, PNERP 2017). The revised PNERP released December 21, 2017, four years past its scheduled revision timeframe, exemplifies the Auditor's General finding that emergency planning in Ontario lacks regular updating and iterative review.⁶⁴

6.2 The CNSC's Oversight of Emergency Planning

Emergency response planning and preparedness is multi-faceted and requires cooperation between the regulator, provincial authorities and licensee. CELA urges the CNSC to exercise its stringent oversight role as to whether emergency planning and preparedness has been proven prior to exercising its discretion with regards to the Pickering NGS licence renewal.

Not only does the CNSC have authority to require, review and approve emergency plans which are in the purview of its licensees; it also has authority to review emergency plans in place for off-site response and to use its assessment of the adequacy of those plans as part of its determination as to whether a nuclear power plant or other facility may operate, or under what terms and conditions. The CNSC's jurisdiction extends to the portions of plans which have been undertaken by other authorities external to the plant operator. That is, the CNSC must review the gamut of emergency preparedness measures, to make a determination whether the risk to the public is acceptably low per section 24(4) of the NSCA.

It is fundamental that in exercising its discretion to issue operating licences to licensees, the CNSC further its mandate of ensuring public safety and the protection of the environment. The CNSC must not limit its review of emergency planning to plant boundaries or operator action. Rather, it must specify expectations for emergency planning to the fullest extent of potential impacts on the public and environment.

6.3 International Guidance

CELA has reviewed the extent to which international standards have been referenced in the CNSC's Staff CMD and the proposed Licence Conditions Handbook (LCH). Unfortunately, we did not find that CNSC Staff sufficiently considered international best practice or international guidance related to emergency planning in either of these documents. As further discussed in this section, we identified that the proposed LCH for Pickering is not current with IAEA standards, specifically IAEA General Safety Requirements, Part 7, "Preparedness and Response for a Nuclear or Radiological Emergency" (herein, GSR-7).

⁶⁴ The 2009 PNERP required updating every four years. The 2017 PNERP has amended this obligation to every five years. Ontario, "*Provincial Nuclear Emergency Response Plan, Master Plan 2009*" online: https://www.emergencymanagementontario.ca/sites/default/files/content/emo/docs/PNERP%20%20Approved%20Plan%202009_PDFUA.pdf, s 1.11.2.

6.3.1 Regulator Responsibilities

The CNSC’s Staff CMD lacks substantive analysis of the licence application’s confluence with international guidance and simply notes, “the CNSC has confirmed that the updated PNERP conforms with the both CSA N1600 and IAEA standards on emergency management.”⁶⁵ While it is advantageous for PNERP 2017 to align with international guidance, it does not conversely mean that the CNSC, in its review of the emergency response, is compliant with international obligations and commitments. For instance, IAEA GSR-7 sets out responsibilities of a nuclear regulator.⁶⁶ As these IAEA recommendations are beyond the scope of PNERP 2017, which is provincial in basis and cannot impose responsibilities on a federal authority, Table 2 below summarizes some key requirements for a nuclear regulatory body.

Table 2: Regulator Requirements per IAEA General Safety Requirements, Part 7, “Preparedness and Response for a Nuclear or Radiological Emergency”

Section	Requirement
4.1	The government shall ensure that an emergency management system is established and maintained on the territories of and within the jurisdiction of the State for the purposes of emergency response to protect human life, health, property and the environment in the event of a nuclear or radiological emergency
4.4	The government shall ensure the coordination of and consistency of national emergency arrangements with the relevant international emergency arrangements
4.11	The government shall ensure that operating organizations, response organizations and the regulatory body establish, maintain and demonstrate leadership in relation to preparedness and response for a nuclear or radiological emergency
4.26	The government through the regulatory body shall ensure that operating organizations review appropriately and, as necessary, revise the emergency arrangements (a) prior to any changes in the facility or activity that affect the existing hazard assessment and (b) when new information becomes available that provides insights into the adequacy of the existing arrangements

During the previous renewal of Pickering NGS’s licence in 2013, CELA detailed the expectations of the CNSC, as a regulator, flowing from GSR-7’s predecessor, IAEA GS-G-2 (2006).⁶⁷ Unfortunately, the CNSC’s Record of Proceedings dated August 2, 2013 did not respond to this issue nor, require the IAEA standard to form the licencing basis.⁶⁸ CELA reiterates its former

⁶⁵ CNSC CMD, *supra* note 5, p 100

⁶⁶ IAEA Safety Standards, “General Safety Requirements Part 7 - Preparedness and response for a Nuclear Radiological Emergency” (2015) [GSR-7]

⁶⁷ CELA, “Emergency Planning at the Pickering Nuclear Generating Station,” 3 May 2013, online: <http://www.cela.ca/publications/emergency-planning-pickering>

⁶⁸ Pickering Nuclear Generating Station Nuclear Power Reactor Operating Licence (Effective 1 September 2013), online: <https://www.opg.com/generating-power/nuclear/stations/pickering-nuclear/Documents/PickeringLCH.pdf>

recommendation that the CNSC should require, as a minimum, that IAEA standards be met and demonstrated as a part of its licensing decision for the Pickering NGS.

6.3.2 Licence and Licensing Basis

OPG's licence application and CNSC Staff's proposed licence and LCH should be reviewed in tandem with IAEA standards, to ensure they are current and reflect the more recent updates to emergency planning and response. This requires reviewing both the planning basis for emergency response and specific emergency planning measure (ie. evacuation, public awareness and alerting, as detailed in later sections) to ensure alignment with international standards.

CELA has previously found applicants' material to be based on previous versions of IAEA standards and thus, not up to date. As we noted for the Commission in the recent relicensing hearing for the Point Lepreau NGS, the offsite plan relied on GS-R-2 (2002), and not the revised GSR-7 (2015).⁶⁹ As the IAEA notes in GSR-7, these standards differ in the following significant way:

In 2011, the IAEA Secretariat, relevant international organizations and Member States began the review of IAEA Safety Requirements publication No. GS-R-2 on the basis of lessons identified in exercises and from the response to emergencies since its publication in 2002 (including the response to the accident at the Fukushima Daiichi nuclear power plant in Japan in March 2011), and in due consideration of recommendations of the International Commission on Radiological Protection (ICRP).⁷⁰

In response to CELA's finding, the CNSC recommended in its Record of Decision that Point Lepreau implement GSR Part 7 "as soon as practicable."⁷¹ The CNSC also confirmed in its Record of Decision that as RegDoc 2.10.1 was based on GSR-7 and RegDoc 2.10.1 served as the licensing basis for emergency management, the licensee was compliant with international guidance.⁷²

Unfortunately, the proposed licence for the Pickering NGS is not based on the same version of RegDoc 2.10.1 that was relied upon for the Point Lepreau NGS. The proposed LCH for the Pickering NGS explicitly states that the licence compliance criteria for emergency planning is RegDoc 2.10.1, Version 1.⁷³ Unfortunately, because IAEA GSR-7 dates to 2015 and RegDoc 2.10.1 Version 1 dates to 2014, the licence is not current with international standards.⁷⁴

⁶⁹ CELA, "Submission to the CNSC: Emergency Planning at the Point Lepreau Nuclear Generating Station" (3 April 2017), online: <http://www.cela.ca/publications/1108submissions-cnsc-pt-lepreau>

⁷⁰ GSR-7, *supra* note 66, Preface.

⁷¹ Canadian Nuclear Safety Commission, Summary Record of Decision – Application to Renew the Nuclear Power Reactor Operating Licence for Point Lepreau (14 June 2017), para 333

⁷² *Ibid*, para 334

⁷³ CNSC CMD, *supra* note 5, p 99

⁷⁴ CNSC, "RegDoc 2.10.1 Nuclear Emergency Preparedness and Response," October 2014.

CELA submits Pickering NGS's licensing basis must be amended so that it complies with IAEA's standard on radiological emergency response, GSR-7. This requires the licensing basis in the proposed licence and LCH be updated to Version 2 of RegDoc 2.10.1. Absent this amendment, the licensee's emergency planning licence basis is non-compliant with international guidance and standards.

RECOMMENDATION NO. 12: Pickering NGS's emergency management licensing basis, RegDoc 2.10.1 Version 1 (2014) predates the IAEA's most recent standard on radiological emergencies, GSR-7. CELA recommends Pickering NGS's licensing basis be updated to reference RegDoc 2.10.1, Version 2 (2016), which is current with IAEA GSR-7. All Licence Condition Handbooks proposed by the CNSC should, at a minimum, be current with international guidance and standards at the time of licensing.

6.4 Emergency Planning Zones

The establishment of emergency planning zones (EPZ) is a principal tool for offsite emergency planning and response. Based on the revised PNERP, Ontario's planning zones are now as follows:⁷⁵

- Automatic Action Zone (AAZ): 3 km
- Detailed Planning Zone (DPZ): 10 km
- Contingency Planning Zone (CPZ): 20 km
- Ingestion Planning Zone (IPZ): 50 km

6.4.1 Contingency Planning Zone

The revised PNERP amends its 2009 predecessor with the inclusion of a new emergency planning zone, known as the Contingency Planning Zone (CPZ). The CPZ is a pre-designated area where protective actions from the DPZ can be extended in the event of a nuclear emergency.

Unfortunately, the DPZ and CPZ are distinguishable in that PNERP 2017 specifies what planning activities "shall" occur within the DPZ but in the CPZ, only "considerations" are suggested. For example, in the DPZ detailed planning must occur to ensure evacuations can be implemented and the associated needs of the evacuated public met. However, in the CPZ, emergency measures such as KI pill distribution requirements, public awareness and monitoring, are listed as "considerations" only. As the Office of the Fire Marshall and Emergency Management (OFMEM) noted during Day 1 of the Pickering NGS licence renewal hearing:

⁷⁵ Ontario, "Provincial Nuclear Emergency Response Plan, Master Plan 2017" online: https://www.emergencymanagementontario.ca/english/emcommunity/response_resources/plans/provincial_nuclear_emergency_response_plan.html at 2.2.6 [PNERP 2017].

The CPZ does not require the same level or type of detailed arrangements as the Automatic Action Zone or Detailed Planning Zone, in so far as there are no default or pre-planned protective measures associated with the CPZ.⁷⁶

As the efficacy of the “considerations” listed for the CPZ depend upon the level of preparedness and planning undertaken *prior* to a radiological emergency, CELA recommends the CPZ require the same level of detailed planning as the DPZ.

RECOMMENDATION NO. 13: CELA recommends the CNSC require the expansion of Ontario’s nuclear emergency planning zones. First, the Contingency Planning Zone (20 km) must require the same level detailed arrangements and pre-planned protective measures as the Automatic Action Zone (3 km) or Detailed Planning Zone (10 km). Secondly, the current CPZ boundary should be re-evaluated based on better modelling and at a minimum, require a 20 km evacuation zone.

RECOMMENDATION NO. 14: CELA recommends that the Commission publicly review the PNERP’s Technical Study on emergency planning zone sizes and its implications for all nuclear power plant licensees’ on-site and off-site emergency planning arrangements. CELA recommends any further PNERP technical studies and findings be publicly reviewed by the Commission on an annual basis.

6.4.2 Ingestion Planning Zone

According to PNERP 2017, the ingestion planning zone requires plans to be made to protect the food chain and drinking water supplies, and restrict the consumption of potentially contaminated produce, dairy and wild-grown products in the event of a radiological emergency. While CELA supports the inclusion of these protective measures, unfortunately, the IPZ only extends to a distance of 50 km. In order meet international best practice (see section 6.4.3 below), CELA submits the IPZ should extend to 100 km and include the additional requirement that all municipalities within this zone maintain nuclear emergency response plans.

RECOMMENDATION NO. 15: CELA recommends the CNSC require the expansion of Ingestion Planning Zone to 100 km and include the additional requirement that all municipalities within this zone maintain nuclear emergency response plans.

⁷⁶ Office of the Fire Marshal and Emergency Management, Presentation - Commission Meeting April 4, 2018, “Update on Emergency Management in Ontario and the Provincial Nuclear Emergency Response Plan (PNERP),” slide 24 [OFMEM Presentation]

6.4.3 International Guidance

Despite the recent release of PNERP 2017, Ontario’s emergency planning zones do not align with international best practice or IAEA guidance. For instance, following a 2014 joint meeting of the Western European Nuclear Regulators (WENRA), the Heads of the European Radiological Protection Competent Authorities (HERCA) concluded “an accident comparable to Fukushima would require protective actions such as evacuation up to 20 km and sheltering [and ITB] up to 100 km.”⁷⁷ While HERCA does not propose a uniform approach to emergency planning, it does propose a framework which facilitates a ‘minimum common level’ of preparation. This approach, according to HERCA, is necessary in response to accidents like Fukushima which serve as a reminder that a “severe nuclear accident cannot be completely excluded anywhere in the world.”⁷⁸

As illustrated in Table 3 below, guidance from the IAEA also recommends detailed planning beyond Ontario’s current DPZ. According to IAEA *Safety Guide GS-G-2.1*,⁷⁹ the following zones and accompanying safety measures are recommended:

Table 3: Emergency Planning Zones and Measures per IAEA *Safety Guide GS-G-2.1*

Zone	Size	Description	Response Measures
Precautionary Action Zone	3 – 5 km	Area within which arrangements should be made to implement precautionary urgent protective actions before or shortly after a major release with the aim of preventing or reducing the occurrence of severe deterministic effects ⁸⁰	Urgent protective actions include: Isolation of a contaminated area or radioactive source; Prevention of inadvertent ingestion; Evacuation; Sheltering; Respiratory protection and protection of skin and eyes;
Urgent Protective Action Planning Zone	5 – 30 km	Area where preparations are made to promptly shelter in place, to perform environmental monitoring and to implement urgent protective actions on the basis of the results of monitoring within a few hours following a release. ⁸²	Decontamination of individuals; Prophylaxis with stable iodine; Protection of the food supply and prevention of the consumption of significantly

⁷⁷ HERCA-WENRA (2014) Approach for a better cross-border coordination of protective actions during the early phase of a nuclear accident, online: <http://www.herca.org/docstats/HERCA-WENRA%20approach%20for%20better%20cross-border%20coordination.pdf>, p 9

⁷⁸ *Ibid*

⁷⁹ International Atomic Energy Agency, “Arrangements for Preparedness for a Nuclear or Radiological Emergency No. GS-G-2.1” (2007) online: <http://www-pub.iaea.org/MTCD/publications/PDF/Pub1265web.pdf> at p 76 [IAEA GS-G-2.1]

⁸⁰ GSR-7, *supra* note 66, p 76

⁸² GSR-7, *supra* note 66, p 77

			contaminated foodstuffs and water; Management of the medical response; Protection of international trade. ⁸¹
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Despite the lessons learned in a post-Fukushima world, Ontario’s emergency measures remain geographically limited to the areas close to nuclear stations due to the current small-scale “reference accident.” Indeed, the advisory panel tasked with reviewing Ontario’s emergency response plans recognizes that Ontario’s “planning zone sizes may require revision if the planning basis includes a multi-unit failure event where none of the post-Fukushima improvements or mitigating actions are credited in the source term calculation.”⁸³ Consequently, the PNERP 2017 is currently undergoing a technical study, to be completed at the end of 2018, which will identify any requirements to expand planning zone distances. The OFMEM has commented that until the Technical Study is complete, they will not be proposing any options for revisions to the PNERP.⁸⁴

As Canada’s nuclear regulator, the CNSC is ultimately responsible for ensuring the requisite level of emergency readiness and preparedness at each of Canada’s nuclear generating stations. We have learned since Fukushima that we must extend planning for emergency response and evacuation beyond our current emergency planning zones. CELA submits that the CNSC must rule on the sufficiency of emergency planning at the time of the licensing decision and not, on actions yet to be performed. We remind the CNSC of the Maebashi District Court ruling in Japan from March 2017, which found both government and operator of the Fukushima nuclear plant responsible for failing to take preventative measures.⁸⁵ The judges found that the major risks from the plant were foreseeable by the government but were ignored and not acted upon.⁸⁶

6.5 Public Awareness

Section 5.5.2 of the 2017 PNERP Implementing Plan for the Pickering Nuclear Generating Station (herein, Implementing Plan) requires that measures to the protect the public from radionuclides “shall be provided for in public awareness and education materials as well as in *emergency*

⁸¹ IAEA GS-G-2.1, *supra* note 79, p 32

⁸³ OFMEM Presentation, *supra* note 76, slide 15

⁸⁴ *Ibid*, slide 16

⁸⁵ Daisuke Kikuchi, “In first, government and Tepco found liable for Fukushima disaster” (17 March 2017) The Japan Times, online: <http://www.japantimes.co.jp/news/2017/03/17/national/crime-legal/first-government-tepco-found-liable-fukushima-disaster/#.WN3YwogrLIU>

⁸⁶ Shaun Burnie, “Japan court shocks nuclear industry with liability ruling” (20 March 2017) Asia Times, online: <http://www.atimes.com/article/japan-court-shocks-nuclear-industry-liability-ruling/>

*bulletins.*⁸⁷ The 2009 PNERP Implementing Plan lacked an equivalent provision and while CELA welcomes this amendment, it must be noted that because the Implementing Plan was only released in March 2018, the Pickering NGS has not yet fulfilled this requirement. As discussed in this section, CELA has concluded that the members of the public living and working in the area of the Pickering NGS do not have sufficient knowledge to ensure prepared, and prompt action in the event of a radiological emergency.

CELA had the opportunity to review a poll which gauged the awareness of emergency plans and procedures of residents living within 20-kilometre of the Pickering NGS (herein, “Pickering poll”). The results illustrated that over 50% of the study group had a “poor” or “very poor” understanding of emergency procedures. Furthermore, 60% of respondents noted their level of readiness as “unprepared.”

Without higher levels of public preparedness and readiness, OPG does not have the requisite level of public awareness necessary to continue operating the Pickering NGS. In the previous licensing hearing for the Pickering NGS, CELA recommended that the Commission require OPG to “conduct a study as to the awareness of the Pickering Nuclear Plan” and “their likely response in the event that a general emergency is declared and the Primary Zone [DPZ] is evacuated.”⁸⁸ It is not evident from OPG’s licence application that this study or survey has been undertaken.

As a regulator, the CNSC is vested with acting in the public⁸⁹ and, ensuring per section 24(4) of the NSCA that the licensee will “in carrying on that activity, make adequate provision for the ... health and safety of persons.” The CNSC lacks the evidentiary basis to find in favour of this statutory requirement and authorize the operations of the Pickering NGS beyond 2020. While the CNSC has proposed that OPG develop “a new public education campaign to provide guidance in the unlikely event of a nuclear emergency and how to prepare prior to an emergency,”⁹⁰ the necessary level of readiness will not be achieved by the end of this licencing period and in time for renewal.

While a public education campaign designed to ‘provide guidance on what to expect’ and ‘how to prepare for a nuclear emergency’ is also noted as a “planned improvement” in OPG’s application, Pickering is Canada’s older nuclear station and thus it should already be a leader in public awareness and education. With a 47-year long operating history, residents surrounding the Pickering NGS should be stewards of emergency preparedness, being the *most* informed, and *most* prepared. Unfortunately, even if a certain level public awareness, verified through studies and public surveying was made a condition of licensing, it would not change the

⁸⁷ Ontario, “Implementing Plan for the Pickering Nuclear Generating Station” (March 2018)

[Implementing Plan]

⁸⁸ Canadian Environmental Law Association, “Emergency Planning at the Pickering Nuclear Generating Station” (3 May 2013), online: <http://www.cela.ca/publications/emergency-planning-pickering>, p 48

⁸⁹ *Greenpeace Canada v. Canada (Attorney General)*, 2014 FC 463, para 243

⁹⁰ CNSC CMD, *supra* note 5, p 103

immediate level of preparedness among the million people living within 20 km of the Pickering NGS. On this basis, CELA submits the CNSC must not grant OPG's request to continue operating to 2024.

RECOMMENDATION NO. 16: CELA recommends that the CNSC require robust evidence demonstrating that residents in the DPZ and CPZ zone have awareness of emergency planning procedures. Absent this level of knowledge, the Pickering NGS should not be operated beyond its current licencing period.

6.6 Public Alerting

Sections 6.2.2 and 6.2.3 of the Pickering Implementing Plan require public alerting systems which within 15 minutes of an initiation, can alert populations in the AAZ (3 km) and DPZ (10 km). Section 6.2.3 requires that the system be capable of reaching practically 100% of the population within this zone, whether located indoors or outdoors. Furthermore, the Plan notes that for population "within and beyond the DPZ," the provincial Alert Ready program shall be used to alert populations. According to the Implementing Plan, the "Alert Ready program ensures that emergency bulletins are broadcast in a timely manner via radio, television and mobile device."⁹¹

Starting April 6, 2018, the province's Alert Ready program expanded its scope to notifications via cellular device. As OPG notes in its licence application, it conducted a pilot project with 80 Alert Ready phones in order to validate the systems functionality and effectiveness of the program.⁹² We ask that findings from this pilot be shared with the Commission and lessons learned reviewed. We also ask that CNSC ensure Durham Region and OPG's respective emergency response plans be updated and communication channels verified, to ensure radiological emergencies are promptly communicated to the provincial Alert Ready program.

Furthermore, the Alert Ready system must be undertaken in tandem with other public alerting measures. As experienced during Ontario's test of the Alert Ready system on May 7, 2018, not all cellular customers received alerts or notifications. Additional public alerting considerations must be made for those who do not have a cell phone or those who have a cell phone, but it is either out of service or not turned on. In these instances, it is necessary for alternative means of notification to be operable.

Prompt alerting is necessary to prevent overexposure to radionuclides in the event of radiological dispersion.⁹³ Therefore, as CELA noted in section 6.4, the existing DPZ and IPZ are insufficient in size and should be expanded to 20 km and 100 km respectively. Detailed planning

⁹¹ Implementing Plan, *supra* note 87, p 56

⁹² Licence Application, *supra* note 2, p 101

⁹³ IAEA GS-G-2.1, *supra* note 79, p 55

for public alerting should extend beyond the DPZ and be required within the CPZ. Given the potential for aerial dispersion of radionuclides well beyond the current zones, a public alerting scheme enabling quick response should be operable within the DPZ and CPZ.

According to the Pickering public awareness poll CELA reviewed, respondents had a high degree of interest (88%) in information about alert systems, but only half understood the meaning of emergency sirens and what they represented. On this basis, CELA makes the following recommendations:

RECOMMENDATION NO. 17: Public notification and response systems must be tested and operable within the DPZ and CPZ and not limited to the immediate 10 km zone. Public alerting utilizing multiple communication methods must also be in place to a distance of 100 km.

RECOMMENDATION NO. 18: The CNSC must have evidence demonstrating that in the event of a radiological emergency, the provincial Alert Ready system can be promptly activated. The CNSC should request OPG to provide an update on its Alert Ready pilot project.

6.7 Potassium Iodide (KI) Distribution

It is well established that potassium iodide (KI) is an effective blocker of thyroid radioiodine uptake and it can provide protective benefits to individuals who are particularly vulnerable to thyroid disease, such as pregnant and nursing women, newborns and children.⁹⁴

As noted in section 6.4, the Heads of the European Radiological Protection Competent Authorities recommend that emergency strategies for iodine thyroid blocking (ITB) extend to 100 km.⁹⁵ The distribution of ITB to 100 km is one of three requirements recommended in its 'general emergency response strategy'.⁹⁶ Other jurisdictions, such as Switzerland currently pre-distribute KI pills within 50km of each plant as a precautionary measure.⁹⁷

A 2017 report from Association Pour Le Contrôle de la Radioactivité dans L'Ouest (ACRO) also found Ontario's failure to distribute KI to distance of 100 km to be a gap in its level of emergency preparedness. The report analyzed Ontario's readiness for a large-scale nuclear accident and recommended:

⁹⁴ City of Toronto, "Prepare to be Safe," online: <http://www.preparetobesafe.ca> [Prepare to be Safe].

⁹⁵ HERCA-WENRA (2014) Approach for a better cross-border coordination of protective actions during the early phase of a nuclear accident, online: <http://www.herca.org/docstats/HERCA-WENRA%20approach%20for%20better%20cross-border%20coordination.pdf>, p 9

⁹⁶ *Ibid*, p 38

⁹⁷ Be Prepared Grey Bruce Huron, "Be Prepared for a Nuclear Emergency - Potassium Iodide (KI)", online: <http://www.bepreparedgreybrucehuron.com/nuclear/ki-tablets/>

Ontario should extend the distribution of iodine tablets up 100 km from nuclear power plants. Canada should introduce more protective intervention levels for children, pregnant and breast-feeding women. Clear information related to posology and multiple intakes should be provided to the populations.⁹⁸

While the PNERP 2017 technical study currently being undertaken seeks to identify any requirement to expand protective measures, including KI pre-distribution,⁹⁹ this study will not be completed until the end of 2018 and thus its results not available for this relicensing. Therefore, CELA recommends OPG be required to expand the availability of KI beyond the existing range as an interim measure. Specifically, given the risk to vulnerable groups, like pregnant women and children, we recommend KI stockpiles be maintained at places they frequent within the broader 100 km zone.

CELA also recommends that residents in the eligible 50 km zone be informed of the online KI pill ordering site, “Prepare to be Safe”. As the poll CELA reviewed demonstrated, less than 20% of respondents residing in the 20 km zone were aware that KI pills could be ordered online at <http://PrepareToBeSafe.ca>

Lastly, we ask that the CNSC require OPG to expand its pre-stocking of KI to schools within 50 km of the Pickering NGS. Bruce Power has already done so and since 2016, KI tablets have been pre-stocked in all schools, and parents informed of their use and provided directions for administration. Given the dense population within 50 kilometres of the Pickering NGS and children’s particular vulnerability to radiation, we recommend the pre-stocking of KI in all schools within the 50 km zone be made a condition of licensing.

RECOMMENDATION NO. 19: We continue to encourage the CNSC to require licencees to provide KI by way of pre-distribution within a 50 km radius, and pre-stock to 100 km. In accordance with international best practice, the CNSC should extend KI stockpiles to 100 km and ensure stockpiles at places frequented by vulnerable groups, such as children and pregnant women, are maintained.

RECOMMENDATION NO. 20: Given the dense population within 50 kilometres of the Pickering NGS and children’s particular vulnerability to radiation, we recommend the pre-stocking of KI in all schools within the 50 km zone be made a condition of licensing.

RECOMMENDATION NO. 21: CELA recommends that the CNSC require OPG to disseminate

⁹⁸ Association Pour Le Controle de La Radioactivité Dans L’Ouest, “Ontario is not ready to face a large-scale nuclear accident,” (2017), online: <http://www.acro.eu.org/ontario-is-not-ready-to-face-a-large-scale-nuclear-accident/>, p 19

⁹⁹ Conseil Supérieur de la Santé, Conseil Supérieur de la Santé Accidents nucléaires, environnement et santé après Fukushima. Planification d’urgence, AVIS DU CONSEIL SUPERIEUR DE LA SANTE N° 9235, février 2016 at 83

information on a more frequent basis, about the online KI-pill ordering website PrepareToBeSafe.ca in its outreach material to the public.

6.8 Medical Response and Treatment

Section 5.3(j) of the Pickering Implementing Plan requires arrangements be made for “mass transportation and medical transfers.” Furthermore, evacuation planning for the ‘affected public’ must be undertaken in advance and planning advice on health issues, led by Local Public Health Units, Medical Officers of Health, Local Health Integration Networks and Paramedic Services. According to section 6.9.6, the Ministry of Health and Long-Term Care is responsible for leading and coordinating the health response.

Despite the medical response planning which is required to be ‘undertaken in advance,’ detailed planning only extends within the DPZ. This level of planning is insufficient and does not align with international best practice. As a recent case study of the Fukushima medical evacuation concluded, the death of 50 patients resulted because of “inappropriate medical care circumstances.”¹⁰⁰ These patients had originally been evacuated to a hospital within the 20-km zone but transported a second time, when the government decided the evacuation zone had to be extended beyond the 20 km limit. The study noted medical evacuation to be “difficult task” which was “absolutely beyond the capacity” of the scheme in place.¹⁰¹

The study conclusively recommended that hospitals have a long-distance evacuation plan extending over 100 km, and conduct drills as a part of their emergency response planning. Further recommendations from this study are presented in Table 4, below.¹⁰² CELA strongly encourages the CNSC to adopt the study’s recommendations and require detailed planning within the CPZ.

Table 4: Medical Response Planning

Recommendations	
1. Plan for long-distance evacuation	Medical facilities, including nursing homes, should have a plan for long-distance disaster-specific (over 100 km) evacuation. This plan should be practiced with full-scale exercises and when flaws are found, they should be evaluated and eliminated
2. Securement of transportation measures and designated hospitals	A disaster-specific evacuation plan should include the securement of transportation measures and designated hospitals where patients can be sent

¹⁰⁰ New Brunswick Department of Justice and Public Safety, “Point Lepreau Nuclear Off-Site Emergency Plan” (August 2017), s 1.53.1

¹⁰¹ Tetsu Okumura and Shinichi Tokuno, “Case study of medical evacuation before and after the Fukushima Daiichi nuclear power plant accident in the great east Japan earthquake” (2015) 1:19 *Disaster Med*, online: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5330112/#CR8>

¹⁰² *Ibid*

3. Multiple communication measures	Healthcare facilities should have two or three independent communication measures such as a radio, satellite phone, amateur radio, and multi-channel access radio systems
4. Supervision by emergency physicians and disaster specialists	Hospital evacuation in disaster settings should be supervised by emergency physicians and be handled by disaster specialists who are accustomed to patient transportation on a daily basis
5. The presence of an emergency physician or disaster researcher in the central government	The presence and availability of an emergency physician or disaster researcher in the central government can greatly contribute to the governmental response, especially for disaster-specific medical transportation

RECOMMENDATION NO. 22: We recommend the CNSC review the adequacy of medical care that could be provided during an evacuation. The CNSC should inquire if medical facilities within the DPZ and CPZ have long-distance, nuclear disaster-specific evacuation plans, and whether these plans have been practiced on a full-scale.

RECOMMENDATION NO. 23: CELA recommends the CNSC refuse the further extension of the Pickering’s operating licence on the basis that medical response and evacuation are not detailed and operational beyond the 10 km DPZ. Detailed planning which is fully functional, and has been fully tested for efficacy, must be required within the CPZ.

6.9 Evacuation

Evacuation is one of the most immediate actions to be taken in the event of a general emergency at any nuclear generating station. According to section 5.3.1 of Pickering’s Implementing Plan, “all available routes will be utilized to evacuate the public.” Conversely, in the event of an ongoing or imminent radioactive emission, the Implementing Plan notes in section 6.6.2 that all traffic on Highway 401 and the CN/CP rail lines ‘should be suspended’. As a result of shadow evacuations (ie. people who voluntarily leave an area following a nuclear incident or accident, beyond those who are asked by the authorities to do so) within the 10 km DPZ and traffic density on major routes, the Implementing Plan foresees that ‘travel time in all directions may be longer than normal.’

For the following reasons, CELA has serious concerns about the sufficiency of detailed evacuation planning. First, as discussed in section 6.4, detailed planning for evacuation only extends within the DPZ. However, because evacuating the DPZ will have repercussive impacts on traffic movement in the CPZ, we strongly recommend detailed planning for evacuation be required within the CPZ. As the Implementing Plan notes, due to the close proximity of Hwy. 401 and the commuter-train corridor to the Pickering NGS, it is likely that transport on these high-volume transport routes would also be suspended. This not only effects those seeking to evacuate the DPZ, but drivers, trucks and trains attempting to exit or enter Ontario’s most populous region.

Secondly, while OPG’s Licence Application notes an updated Evacuation Time Estimate (ETE) study was issued in 2016, we query its sufficiency in light of new population predictions and objectives set in Ontario’s Growth Plan for the Greater Golden Horseshoe, 2017 released in May 2017 (herein, Growth Plan).¹⁰³ In accordance with the Growth Plan, Downtown Pickering has been designated an ‘urban growth centre.’ This designation requires it meet a minimum density threshold (200 residents or jobs per hectare) and serve as a hub for regional transit networks. As the Pickering urban growth centre is located approximately 3 km from the Pickering NGS, CELA submits it is crucial CNSC require OPG to revise its ETE for Pickering.

Lastly, while the Pickering poll noted that 82% of respondents were interested in receiving information and maps with evacuation routes, only 32% of respondents were “aware” of evacuation plans in their community. Even fewer respondents (23%) were aware of emergency procedures in place for vulnerable populations, such as children and seniors.

RECOMMENDATION NO. 24: CELA recommends the CNSC extend detailed planning for large-scale evacuations into the IPZ. The CNSC should require OPG to demonstrate the adequacy of detailed planning within an expanded DPZ and IPZ, including planning for any schools, retirement homes, daycares, hospitals and correctional facilities in these areas. These plans should be communicated publicly.

RECOMMENDATION NO. 25: The CNSC should require OPG to update its Evacuation Time Estimate Report to reflect recent population objectives and growth trends in line with Ontario’s Growth Plan (2017). The updated ETE should also review the impact of increased evacuation zones at a radial distance of 50 km on locations of Emergency Workers Centres, numbers of emergency workers required for evacuation management, traffic routes, size of evacuation centres, and locations and capacity of Decontamination and Monitoring Units. These findings should be reported to the CNSC and publicly reviewed.

RECOMMENDATION NO. 26: The CNSC should require OPG’s public awareness program to contain more detailed information about evacuation routes, the location of emergency shelters and decontamination centres and how vulnerable people, including seniors and children, will be protected.

6.10 Self-Decontamination and Decontamination Centres

The Implementing Plan recognizes self-decontamination as a default protective measure which may be required, alongside evacuation, ITB or sheltering. Unfortunately, according to the Pickering poll CELA reviewed, only 33% of the respondents were “aware” of how to decontaminate either themselves or their family.

¹⁰³ Ministry of Municipal Affairs, “Growth Plan for the Greater Golden Horseshoe, 2017” (May 2017), online: http://placestogrow.ca/index.php?Itemid=14&id=430&option=com_content&task=view#2.2.3

Therefore, our request to the Commission is twofold: first, we request the Commission query the availability of decontamination centres and whether the public is aware of their availability and locations; and secondly, we recommend greater public awareness be provided by OPG in this regard. As previously noted in section 6.4, in the event the plume effects populations beyond the 10 km DPZ, we recommend there be detailed planning in the CPZ.

RECOMMENDATION NO. 27: The CNSC should inquire as to the availability of decontamination centres and whether the public is aware of their use and location.

RECOMMENDATION NO. 28: The CNSC should require OPG’s public awareness program to contain information on how to self-decontaminate in order to foster great awareness of this default protective measure.

6.11 Worker Safety and Consent

Risks of exceeding maximum exposure limits must be discussed with workers in advance of any accident. While OPG’s licence and Licence Conditions Handbook refer to worker safety in the context of conventional health and safety, they do not discuss maximum exposure limits or consent. Therefore, methods to review risks and obtain consent from workers to exceed those limits should be explicitly clarified in plans by the operator.¹⁰⁴

RECOMMENDATION NO. 29: Methods to review risks and obtain consent from workers to exceed maximum radiation exposure limits should be explicitly clarified in plans by the operator as a condition of licensing.

6.12 Control of Agricultural Products

As PNERP 2017 notes in s 2.2.5(f), the Ingestion Planning Zone is a pre-designated zone for the purpose of (1) protecting the food chain, (2), protecting drinking water supplies and (3) restricting consumption and distribution of potentially contaminated produce, wild-grown products, milk from grazing animals etc. in the event of a radiological emergency. Accordingly, ingestion control measures shall be directed as based on results from the monitoring of food, milk and water per s. 6.3.3.

¹⁰⁴ This request has previously been made by CELA, as noted in the following submissions: CELA, “A Review of Canada’s Nuclear Emergency Preparedness and Response Plan” (17 July 2017) online: <http://www.cela.ca/review-nuclear-emergency>; CELA, “Emergency Planning at the Pickering Nuclear Generating Station” (3 May 2013) online: <http://www.cela.ca/sites/cela.ca/files/899PickeringEmergencyPlanning.pdf>.

To ensure the sufficiency of these ingestion monitoring measures, it is necessary that the IPZ be extended to 100km, to account for weather contingencies and the aerial dispersion of radionuclides.

RECOMMENDATION NO. 30: The IPZ should be extended to 100 km to account for weather contingencies and the aerial dispersion of radionuclides beyond 50 km.

6.13 Drinking Water and Monitoring Radionuclides in Lake Ontario

The Pickering Implementing Plan states that “if venting over Lake Ontario, ground monitoring teams from PNGS shall complete radiological surveys following the shoreline, out to 20 km on either side of the plant.” While CELA welcomes the inclusion of radionuclide monitoring for Lake Ontario in the revised PNERP, it is unclear to what degree monitoring occurs in the inshore and offshore areas, and whether currents and flow unique to Lake Ontario have been considered.

As the Toronto Region Conservation Authority explains, the nearshore is the region which extends 3 – 5 km offshore.¹⁰⁵ Therefore, potentially 15 km of the ‘20 km monitoring on either side of the plant’ could extend into the offshore region. There are a number of distinctions between the near and offshore regions, including coarser-grained bottom sediments in the nearshore and finer-grained sediments in the offshore,¹⁰⁶ and faster moving alongshore currents (which travel along the shoreline) than cross-shore currents (which move towards or away from the shoreline).¹⁰⁷

The revised PNERP and the Implementing Plan lack contingency measures to protect and monitor Lake Ontario, despite its recognition that during a design basis accident, venting of containment will occur “over the lake.”¹⁰⁸

Given that all of Ontario’s nuclear reactors are located on the Great Lakes - which supplies the drinking water to 40 million Canadians and Americans – it is necessary that detailed planning be required in the IPZ to protect drinking water supplies and require contingency planning in the event of an accident. With nine million people relying on Lake Ontario for drinking water, there is an even greater imperative that emergency planning be in place for the Pickering NGS.¹⁰⁹

¹⁰⁵ Toronto Region Conservation Authority, “Watershed Management” online: <https://trca.ca/conservation/watershed-management/lake-ontario-waterfront/projects/western-durham-nearshore-monitoring-program/lake-comparison/>

¹⁰⁶ Toronto Region Conservation Authority, “Lake Comparison” online: <https://trca.ca/conservation/watershed-management/lake-ontario-waterfront/projects/western-durham-nearshore-monitoring-program/the-nearshore-environment/>

¹⁰⁷ Toronto Region Conservation Authority, “Currents” online: <https://trca.ca/conservation/watershed-management/lake-ontario-waterfront/projects/western-durham-nearshore-monitoring-program/currents/>

¹⁰⁸ Implementing Plan, *supra* note 87, s 4.6.6(a)

¹⁰⁹ Is Toronto Prepared, *supra* note 61

In advance of relicensing, it is incumbent that the CNSC ensure that provisions are in place for an alternative source of drinking water for residents whose current drinking water source is Lake Ontario. The licensing materials do not demonstrate that either OPG or CNSC have studied drinking water and contingency planning. Such a study is not only necessary to identify alternative sources of drinking water, but to logistically plot how an alternative supply would be delivered to impacted communities, indefinitely.

RECOMMENDATION NO. 31: The CNSC should require proof of adequate contingency planning for the protection of drinking water in the event of an emergency as a requirement for licensing. The CNSC ensure that provisions are in place for an alternative source of drinking water for residents whose current drinking water source is Lake Ontario.

7. Conclusion and Order Requested

CELA respectfully requests the Canada Nuclear Safety Commission to deny OPG's request for a 10-year licence for the Pickering NGS. For the following reasons, we submit the licence renewal should not be allowed:

- **A federal environmental assessment is necessary before OPG can proceed with its proposed decommissioning plans.** The environmental assessment conducted by the CNSC under the *NSCA* does not adequately incorporate and consider critical sustainability concerns. The *NSCA* EA is not equivalent to a federal EA which requires the consideration of alternatives, relies on and incorporates expert review and includes, to a greater extent, the public in the decision-making process.
- **OPG and the CNSC did not address the critical matter of alternatives to keeping the Pickering NGS in operation.** OPG's application did not clearly demonstrate that financial plans are in place to safeguard the affordability of electricity for Ontarians throughout the lifetime of the plant. OPG's application rests on the false perception that nuclear energy generation is cleaner than other energy generation technologies. And it is based on an assumption of need for energy generation at Pickering for Ontario's baseload energy demands.
- **Conditions which advance democratic transparency and effective public engagement must guide the Commission.** OPG's public participation process failed to ensure that all pertinent studies and documentation were accessible to the public through OPG's website. OPG's request for information process was problematic because of the insufficient time and funding provided for citizens and independent experts to do appropriately comprehensive critical analyses.

- **OPG's licence application did not incorporate a transition plan to mitigate the adverse socioeconomic impacts of shutting down Pickering's reactor units on workers, families, and surrounding communities.** This transition plan must be informed by best practices for just transition planning that maintains and enhances livelihood sufficiency and community economic wellbeing, and it must consider the larger transition of the electric power system to renewable technologies.
- **An alternative means assessment should be completed for Pickering NGS's decommissioning activity.** The decommissioning strategies put forth by OPG should be well documented and include a description of options and overall timescales. An "alternative means" analysis is necessary to demonstrate that the preferred strategy will ensure the Pickering NGS will be maintained in a safe configuration at all times, will reach the specified decommissioning end state, cause no undue burdens to be imposed on future generations, and is acceptable to the public and Indigenous communities.
- **The CNSC should also require OPG to develop a DDP that has a sound evidentiary basis and is publicly acceptable.** The DDP should also be sufficiently detailed to allow the evaluation of the licensee's justification and plans for meeting licencing conditions.
- **Ontario's nuclear emergency response plans lack readiness.** The inherent risk of operating a nuclear generating station of Pickering's size in a high-density area, necessitates emergency response planning which is commensurate to the complexity of evacuating, alerting and distributing KI in a populous area. The level of emergency planning currently in place is not sufficient for the Commission to find the risk to the public is acceptably low per section 24(4) of the NSCA.

All of which is respectfully submitted this 7th day of May, 2018:

CANADIAN ENVIRONMENTAL LAW ASSOCIATION

Per



Theresa A. McClenaghan
Executive Director and Counsel

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Appendix A

Gibson's (2012, 2017) sustainability assessment criteria.

Socio-ecological system integrity

Build human-ecological relations to establish and maintain the long term integrity of sociobiophysical systems and protect the irreplaceable life support functions upon which human as well as ecological well-being depends.

Livelihood sufficiency and opportunity

Ensure that everyone and every community has enough for a decent life and that everyone has opportunities to seek improvements in ways that do not compromise future generations' possibilities for sufficiency and opportunity.

Intragenerational equity

Ensure that sufficiency and effective choices for all are pursued in ways that reduce dangerous gaps in sufficiency and opportunity (and health, security, social recognition, political influence, etc) between the rich and the poor.

Intergenerational equity

Favour present options and actions that are most likely to preserve or enhance the opportunities and capabilities of future generations to live sustainably.

Resource maintenance and efficiency

Provide a larger base for ensuring sustainable livelihoods for all while reducing threats to the long term integrity of socio-ecological systems by reducing extractive damage, avoiding waste and cutting overall material and energy use per unit of benefit.

Socio-ecological civility and democratic governance

Build the capacity, motivation and habitual inclination of individuals, communities and other collective decision-making bodies to apply sustainability requirements through more open and better informed deliberations, greater attention to fostering reciprocal awareness and collective responsibility, and more integrated use of administrative, market, customary and personal decision-making practices.

Precaution and adaptation

Respect uncertainty, avoid even poorly understood risks of serious or irreversible damage to the foundations for sustainability, plan to learn, design for surprise, and manage for adaptation.

Immediate and long term integration

Apply all principles of sustainability at once, seeking mutually supportive benefits and multiple gains.



The Canadian Nuclear Safety Commission
c/o Louise Levert Secretariat Canadian Nuclear
Safety Commission
280 Slater St., P.O. Box 1046
Ottawa, ON K1P 5S9

RE: Submission for Ontario Power Generation Inc.'s Licence Renewal for the Pickering
Nuclear Generation Station (Hearing Ref. 2018 - H - 03)

Delivered via E-mail

May 7, 2018

Dear Ms. Levert:

The Canadian Environmental Law Association (CELA) wishes to provide the following attachment appended to this letter to the Commission for consideration at Part Two of the hearing in the above-referenced matter.

Please find attached an email CELA received from an anonymous engineer working for a nuclear service supplier dated April 30, 2018. While CELA is not seeking the opportunity to comment on the email's contents, as Canada's nuclear regulator we believe it is within the CNSC's public interest mandate to consider the issues raised by the anonymous individual. Furthermore, as a public interest, legal-aid funded clinic, it is also within CELA's mandate that the views of the public, and concerns of transparency be considered in the CNSC's decision-making process.

We respectfully ask that this item be included in Part Two of the Pickering NGS renewal hearing.

Sincerely,

A handwritten signature in black ink, appearing to read 'Kerrie Blaise', is written over a light blue circular stamp.

CANADIAN ENVIRONMENTAL LAW ASSOCIATION
Kerrie Blaise, Counsel



Upcoming BP and Pickering Re licensing

Nuclear_expert <Nuclear_expert@protonmail.com>
Reply-To: Nuclear_expert <Nuclear_expert@protonmail.com>
To: "kerrie@cela.ca" <kerrie@cela.ca>

Mon, Apr 30, 2018 at 8:33 PM

Hi,

I am a professional Engineer, presently working for a nuclear service supplier for the Canadian CANDU industry. I have more than 25 years of experience in the CANDU Industry mainly on the Pressure Tube structural integrity assessment and their aging management. I am actively involved in the relevant standard development also. I am writing this e mail to you to bring yours and public attention to the main issue faced by the Canadian Industry specifically related to the aging of the pressure tubes.

I request you to bring this to public attention either by releasing this information to new outlets or by other proper means.

My primary concern is that the CNSC Staff and the Industry do not provide sufficient information either to the Commission or to the public to make an informed decision. Before I go into the specifics of my concerns, I would like to clarify the following:

- Pressure Tubes are the heart of the CANDU reactor and they carry the nuclear fuel. These are 6 meter long 4mm thick tubes made from Zr 2.5%Nb.
- Pressure tubes degrade during operation due to the high temperature and hostile environment. This means if the operating temperature are high the degradation rate will be also relatively high.
- During operation Hydrogen enters the pressure tube (rate is dependent on temperature as it is a corrosion mechanism) and make the material brittle.
- When sufficient hydrogen collects in a region (limit is called as TSSP), they form brittle hydrides. These brittle hydrides can initiate zipping of flaws or cracks during operation.
- Hence the governing standard limits the amount of hydrogen in a pressure tube. The current limit is 100 ppm for outlet and 70 ppm for inlet. Above these limit, the collected hydrogen could form hydrides during normal operation itself and if there were any flaw in the vicinity of these hydrides, the pressure tubes could rupture.
- The current million dollar question is not whether the pressure tubes going to fail or not, the failure of the pressure tube is given, the question is when it is going to happen?

I gone through the Day 1CMDs for BP and Pickering (both CNSC and BP and OPGs)and observed the following. I humbly request you also to go through these two CMDs and compare them yourself.

In regards to BP: CNSC is silent on the current condition of the fuel channels and did not include any special condition for current operation. However as the BP Units operate at a higher temperature, the BP pressure tubes should have crossed the TSSP limit and I am pretty sure that the pressure tubes are operating with hydrides present. If this is not happening now, it is going to be imminent. This was confirmed by the BP staff during the Day 1 hearing when they informed the Commission that they will be reaching the 120 ppm in 2019. This means that the BP Pts should have already reached the 70 and 100 ppm limit or imminently going to reach.

In regards to Pickering, as these Units operate at a lower temperature, I don't think they will ever reach the TSSP limit or the 70 and 100 ppm limit. Nevertheless, it is shocking that draft LCH for Pickering (in Section 6) includes some additional requirements that Pickering should meet should the Pickering Pressure tubes reach the 70 and 100 ppm limit. This requirement is not identified in the draft LCH for BP pressure tubes. Why? Further, the CMDs (both CNSC and OPG) raise several issues and provide some current status of those issues with respect to Pickering operation. One case is how OPG measure and predict hydrogen. If we compare BP and Pickering CMDs, we can observe that OPG discusses these issues and provide a path forward, but BP just ignores these issues. CNSC also ignores most of these issue , but ignores only in the BP CMD, but highlight it in the Pickering CMD.

The next issue is related to the CNSC past compliance actions for both BP and Pickering. In the Pickering CMD, CNSC discusses multiple focussed inspections carried out by CNSC inspectors' specifically focussing on the Pickering pressure tubes. Have CNSC implement the same rigor in the compliance activities for BP reactors, if yes, what were the results, if not, Why not?

My biggest worry is that CNSC is just focussing on the Pickering reactors due to the local public perception (near to the site), and missing the mark for BP reactors as the local public there are silent as the BP is the largest employer there. My expert opinion (not only mine, most of the experts in the field) is that if a pressure tube is going to fail, it is going to happen at BP. The question is how many pressure tubes are going to fail due to the cascading effect and whether BP could safely shut down the reactor to a cold state before radio activity releases.

Regards

XYXY

Sent with [ProtonMail](#) Secure Email.