ISBN# 978-1-77189-002-1

April 22, 2014

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

Sent by email: interventions@cnsc-ccsn.gc.ca

President Binder and Members of CNSC Panel:

Hearing Ref. 2014-H-01: CELA Submission re Pickering removal of Hold-point in Licence 48.00/2018.

This is a written submission on behalf of the Canadian Environmental Law Association with respect to the application by Ontario Power Generation for release of a Hold-Point (condition # 16.3 of the Licence issued to OPG in Licence number 48.00/2018) to be considered by the Commission at a hearing on May 7, 2014 in Ottawa. The Commission's notice indicates that

"The regulatory hold point requires that OPG provide a technical basis to demonstrate that the Pickering NGS can be operated safely beyond 210,000 effective full power hours of operation."

As the Commissioners will recall, the licence hearing held last year on the application to operate the Pickering NGS beyond its design life was a matter of very high public interest, garnering hundreds submissions before the Commission. The commissioners will also recall that very significant safety issues have arisen in respect of the Pickering NGS, the oldest operating nuclear power station in North America.

These safety issues are exacerbated by the extraordinary level of sharing of safety systems among the NGS units, and the location of the Pickering station in close proximity to significant ancient geological faults that may be evidencing "reactivation" over the last number of years[1].

[1]The Bedrock Surface of the Western Lake Ontario Region: Evidence of Reactivated Basement Structures? Nicholas Eyles, Joseph Boyce, Arsalan A. Mohajer in Géographie physique et Quaternaire Volume 47, numéro 3, 1993, p. 269-283 La néotectonique de la région des Grands Lacs / Neotectonics of the Great Lakes area Sous la direction de Joe L. Wallach et J. Alan Heginbottom ; Direction : Pierre J. H. Richard (directeur) ; Rédaction : Michel Allard (rédacteur en chef) ; Éditeur : Les Presses de l'Université de Montréal ; ISSN : 0705-7199 (imprimé) 1492-143X (numérique) ; See also "Seismicity and Seismotectonics of the Western Lake Ontario Region" Arsalan A. Mohajer Géographie physique et Quaternaire, vol. 47, n° 3, 1993, p. 353-362 (latter study financed by AECB).

Furthermore, there is historical precedent for significant storm surge and seiche events in Lake Ontario. Recent evaluations have shown adverse wind events to present a surprising level of hazard. The plant is situated in a densely populated region and is slated to grow even more under the province's Places to Grow plan, contrary to common sense, Provincial Policy Statement provisions as to population growth near hazard lands and the recommendations of the Joint Review Panel in the Darlington New Build hearing.

We here reiterate the submission made by CELA at last year's hearing on the issue of population:

> *"Given the existing population density in area of Pickering ... the Pickering NGS is no longer a suitable site for operation of a nuclear power plant; particularly for operation of a multi-unit station. Durham Region's population as a whole as of 2009 was 614, 970; projected to grow to 949,100 by 2026, and within 40 km of the Pickering site were 3.2 million people back in 2001. These population numbers are too high to be located in close proximity to nuclear generating stations.* [2] [3]
>
> - *The Province of Ontario's Places to Grow process has continued to propose considerably increased population numbers for Durham over the coming year. The trends in population density show Durham region have increased and continuing to increase population density. As noted earlier, there are sectors around Pickering in which the estimates indicate that evacuation in certain conditions could take from 4 to 37 hours according to the DRNERP as reviewed above in the discussion with respect to evacuation.*
>
> - *Working Group # 8 in 1988 recommended that the province take appropriate action in "the advisability of restricting new housing construction near nuclear facilities." A similar recommendation was made by the Joint Review Panel in the Darlington New Build EA Report. It not now being possible to prevent this housing construction, and heavy population density having built up in the Pickering area, including both in the Cities of Pickering and Toronto (Scarborough), the CNSC should not authorize the*

[2] Figure 2-3 in the Pickering B Safety Report, 2012 NK30-SR—1320-00001 Rev. 4 shows the population trends of Metro Toronto and Durham Region since the 1970s when the plant was originally cited. (P. 88 of 110)

[3] See also Page 89 of the Pickering A safety report – which provides a graph of demographic data in the broader circumference around the Pickering site.

further licensing of this plant beyond its design life and should not extend its operating license beyond 2014.

- *As outlined in the Pickering A and B Safety Reports, there is also a considerable workforce in the area. There are also major transportation routes of national importance that would be disrupted in the event of a severe accident at Pickering, including Highway 401, Highway 2 and the CN and CP Rail lines.*

- *In addition there are a large number of major airstrips and airports in the area.[4] The presence of this multiplicity of air traffic would both represent a major disruption of commercial aviation traffic in the event of a severe offsite accident at Pickering, and also poses an ongoing risk to the plant itself. IAEA Safety Guide NS-G-3.1 states that "the potential for aircraft crashes that may affect the plant site should be considered in the early stages of the site evaluation process and it should be assessed over the entire lifetime of the plant." (At 22).[5]*

- *The area is also the location of Canada's newest national (urban) park, as well as to a large number of recreational areas important to the GTA and especially the Scarborough and Pickering communities as listed in the Pickering A Safety Report.*

- *CELA submits that the Pickering site would never be authorized today for a new nuclear facility. For the same reasons, neither should it be granted a licence to operate beyond the design life of the Plant. CELA submits that the Pickering NGS no longer meets the safety expectations of the public nor of siting standards by its location in such a highly populated region as a result of which expeditious evacuation is not possible."*

Furthermore, there remains a tremendous amount of work required in order to provide a level of emergency planning and preparedness that is commensurate with the response that would be needed in the event of a very severe accident or a multi-unit accident such as occurred at Fukushima-Daiichi, Japan in March 2011. In CELA's view, the recent emergency mitigation efforts that have been put in place by OPG are important, but frankly should have been in place long ago. Adding mobile generator capacity and the similar recent efforts to improving event

[4] Pickering A Safety Report, Table 19

[5] IAEA Safety Guide NS-G-3.1, "External Human Induced Events in Site Evaluation for Nuclear Power Plants." (IAEA, 2002).

mitigation, as important as they are, are not a replacement for sufficient severe accident emergency response. As you know, severe accident emergency response was not evaluated by the Commission in the 2013 hearing on the Pickering life extension proposal as the current emergency plans are built for a much smaller accident than the type that occurred at Chernobyl or Fukushima. CELA made extensive submissions to the Commission in 2011 (Darlington new build hearing), 2012 (Darlington refurbishment hearing) and 2013 (Pickering life extension hearing) as to improving emergency response and preparedness, and while some discussions and efforts have begun, most of these recommendations are not yet in place.

Accordingly, we repeat and rely upon the recommendations we made on the topic of emergency planning at last year's Pickering hearing and submit that until issues of emergency readiness are satisfactorily demonstrated to the Commission as sufficient to respond to a multi-unit severe offsite accident, the hold point should not be removed and the units should not be allowed to operate beyond 210,000 full power effective hours. In particular we call on the commission to require pre-distribution of KI pills to all residents within the 10 km evacuation zone, and to extend the planning zones for evacuation and KI protection to 80 km from the plant as discussed in our report last year. We attach our report from last year's hearing as reference to this submission.

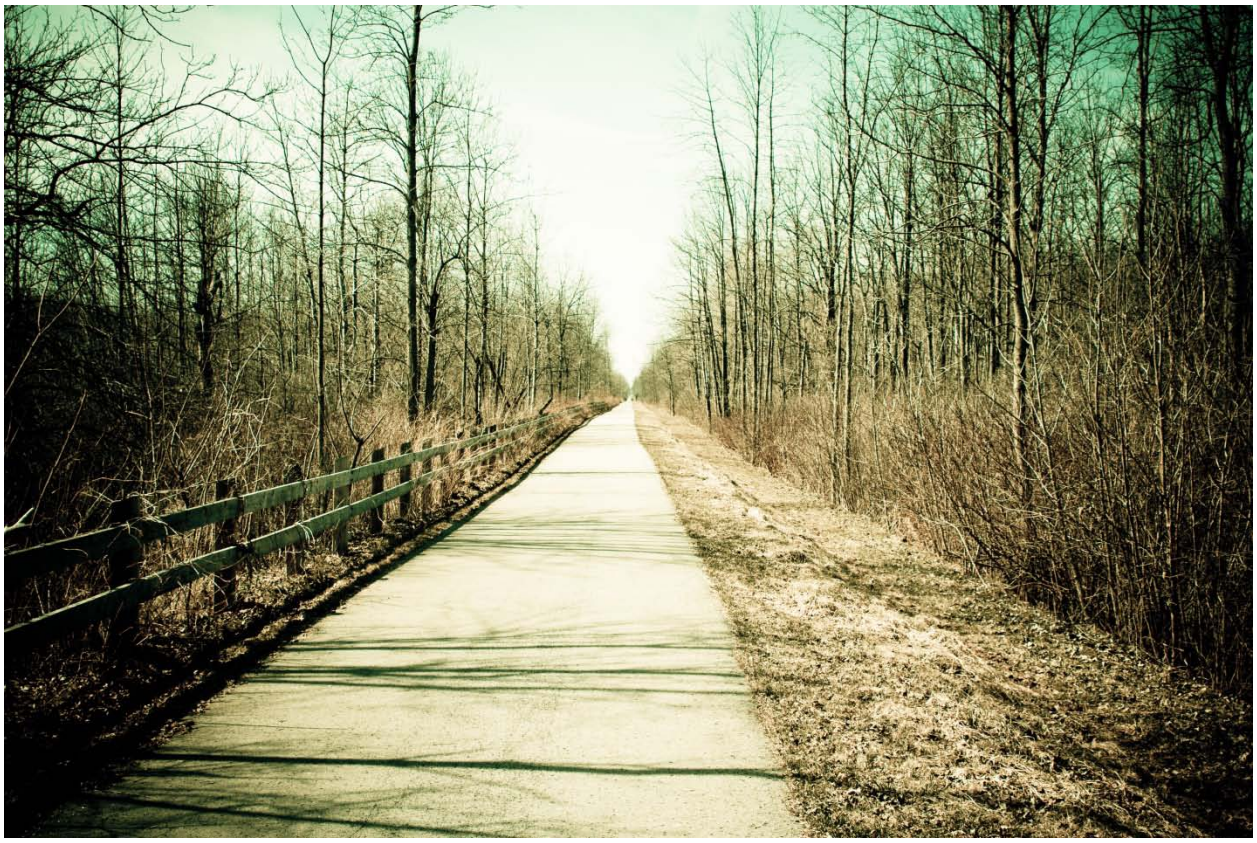
Yours very truly,

CANADIAN ENVIRONMENTAL LAW ASSOCIATION
Per
Theresa A. McClenaghan

Att: CELA submission May 3, 2013

Canadian Environmental Law Association
EQUITY. JUSTICE. HEALTH.

Emergency Planning at the Pickering Nuclear Generating Station



Submission by Canadian Environmental Law Association

Theresa McClenaghan, Executive Director and Counsel

May 3, 2013

CELA Publication #899 / ISBN #978-1-926602-49-3

Canadian Environmental Law Association

T 416 960-2284 • **F** 416 960-9392 • 130 Spadina Avenue, Suite 301 Toronto, Ontario M5V 2L4 • cela.ca

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

Sent by E-mail: interventions@cnsc-ccsn.gc.ca

Hearing Ref. 2013-H-03

Pickering Day Two Hearing to renew and merge the Pickering A and B operating licences

Canadian Environmental Law Association: Review and Submissions on Emergency Planning at the Pickering Nuclear Generating Station

May 3, 2013

Dear Ms. Levert:

The Canadian Environmental Law Association requests to Intervene at the Day Two Hearings in the above-referenced matter. Please find attached our submissions in respect of our review of emergency planning at the Pickering Nuclear Generating Station.

Theresa A. McClenaghan

Executive Director and Counsel

Canadian Environmental Law Association

Overview of Contents:

SUMMARY OF RECOMMENDATIONS:

- **RECOMMENDATION 1:** CELA submits that this licence should not be granted until all of the measures list by OPG in its application in Appendix 6, along with other recommendations made by the 2011 IRSS Report, the 2011 CNSC Fukushima Task Force and recommendations herein are actually in place and demonstrated to the regulator, with evidence, to be effective. CELA also submits that it is critical that this evidence be made public. Members of the surrounding communities must be able to understand what is in place; how effective it is; what has changed; and on what basis the regulator is judging the emergency plans to be in place.

- **RECOMMENDATION 2:** CNSC should require multi-unit severe accident planning to be demonstrated by OPG, along with the effectiveness of off-site emergency response in such a case. Similarly, CNSC should ensure, contrary to previous practice, that extreme natural hazard initiated events and "gross human error" are also examined in terms of presenting an emergency planning basis, and that the on-site and off-site emergency preparedness and planning are demonstrated to be sufficient and reliable to respond to all of these undesirable scenarios in the event that they lead to severe offsite releases.

- **RECOMMENDATION 3:** CELA recommends that this post-accident source term information be required by the CNSC as a condition of licensing and that the CNSC require OPG to upgrade their capacity to provide source term information and its basis, for multi-unit accidents, as a condition of the Pickering NGS licence. This should include reassessment of plume and dose modelling for multi-unit accidents at the Pickering NGS as recommended by the Fukushima Task Force.

- **RECOMMENDATION 4:** CELA recommends that the CNSC should require the licensees to demonstrate that there are, in place, properly resourced, sufficiently detailed emergency planning and preparedness plans that would address Chernobyl–size accidents or Fukushima–size accidents. The basis for this recommendation includes world-wide experience with these catastrophic accidents. This recommendation is independent of particular event sequences and rather takes account of the myriad ways that things that can go wrong resulting in an accident and resulting in a serious breach of containment, regardless of how caused. It also includes consideration of the fact that among the events that may initiate a catastrophe at a CANDU are those that are beyond the control of the operator such as hostile action or unforeseen external weather events or unforeseen combinations of failures including human error.

- **RECOMMENDATION 5:** The authority of Toronto Emergency Planning Officials to immediately initiate the Public Alerting System upon receipt of a notification from OPG for a general emergency with an imminent or ongoing emission should be clearly specified. If it is not intended that this authority be provided to Toronto's officials under the TNERP, this should be stated with a rationale for the discrepancy compared to the DRNERP.

- **RECOMMENDATION 6:** CELA recommends that the CNSC refuse further extension of Pickering's operating licence without the 3 km and 10 km alerting systems fully functional, both within the Region of Durham and within the City of Toronto, with robust evidence that they have been fully tested and are effective to meet the objectives specified in the PNERP, 2009.

- **RECOMMENDATION 7:** CELA also recommends that the emergency response plans time-frames be compressed so as to provide alerts to the public, and instructions to the public on protective actions required in as short a time frame as possible, preferably less than 30 minutes from the onset of the accident. Methods to compress this time frame should be considered and tested, and their efficacy should be one of the points of evaluation by the CNSC in the licence applications by the operators.

- **RECOMMENDATION 8:** CELA recommends that as an interim measure, the CNSC should require that OPG in conjunction with the City of Toronto, conduct outreach and

notification to members of the public resident in Toronto (at a minimum within the Primary Zone), as to the availability of KI and provide advice as to where it may be obtained.

- **RECOMMENDATION 9:** The applicability of Durham's Annex D to the residents of Toronto in the Primary Zone must be clarified. Alternatively, the same provisions for KI distribution, consent and information letters for school age children, and other matters dealt with in Annex D must be specified in the TNERP.

- **RECOMMENDATION 10:** CELA recommends that the CNSC should require the operator to systematically evaluate and report back to the CNSC the percentage of households within the 10 km Primary Zone, both within the Region of Durham and the City of Toronto, who have obtained KI tablets in advance, as well as the percentage of institutions covered by the plan who have them on hand in sufficient quantities to cover all of their residents or students. Based on this evaluation, CELA recommends that the CNSC require the approach that was taken in France be taken in Canada for the 10 km zone around each operating nuclear generating station, to undertake and ensure 100% pre-distribution of KI tablets to the residents in the Primary Zone and that this requirement be included in the licensing conditions for the Pickering NGS.

- **RECOMMENDATION 11:** CELA recommends that the CNSC require OPG to include in its outreach material to the public, in conjunction with regional emergency response officials, explanations about the capability of sheltering and its limitations as described in the IAEA Guide GS-G-2.1 and to reinforce instructions as to steps to take for rapid and effective evacuation in the case of notification of a significant emergency.

- **RECOMMENDATION 12:** CELA recommends that the Pickering Operating licence should not be extended without the Provincial Radiation Health Response Plan and the municipal Radiation Health Response Plans in place.

- **RECOMMENDATION 13:** CELA recommends that in view of the experience at Chernobyl and Fukushima, the CNSC should request that the province immediately revisit the 50 km secondary ingestion zone with a recommendation to change it to 100 km. This should be done as part of detailed planning for severe offsite accidents so that appropriate monitoring of food, agricultural products, milk, and water is established and in place in the event of such an accident.

- **RECOMMENDATION 14:** CELA recommends that the CNSC require that the nuclear emergency planning zones be expanded. CELA submits that the 10 km Primary zone should be extended to 30 km and the 50 km Secondary zone should be extended to 100 km.

- **RECOMMENDATION 15:** CELA recommends that the CNSC should require OPG to work with the local municipalities to ensure the public clearly understands what plans are in place to assist them with evacuation from the Primary Zone if they do not have their own transportation. The details of those plans should be clearly specified in the Durham and Toronto Nuclear Emergency Plans, and widely communicated to the public in outreach and education.

- **RECOMMENDATION 16:** CELA recommends that the CNSC should require OPG to communicate to the public in annual outreach and education, the fact that the nuclear emergency response plans expect the public to make their own arrangements in the event of evacuation, and for those who cannot, what is expected to be provided by the municipalities. The appropriateness of this approach should further be discussed with the public in terms of future nuclear emergency planning.

- **RECOMMENDATION 17:** CNSC should require OPG to conduct studies and to work with offsite emergency responders, the municipalities and the Province to ensure that there are realistic evacuation plans in the case of a severe accident with early large release, as well as in the case of plans for twenty kilometer and 50 kilometer evacuation zones around the Pickering NGS.

- **RECOMMENDATION 18:** CELA recommends that the CNSC require the applicant to conduct a study as to the awareness of the Pickering Nuclear Plant of people beyond the Primary Zone at Pickering, and as to their likely response in the event that a general emergency is declared and the Primary Zone is evacuated. The CNSC should require the applicant to evaluate the impact of increased evacuation zones of twenty and fifty kilometers on evacuation time estimates, as well as any other needed adjustments that would result from larger evacuation zones to the emergency plans surrounding Pickering such as 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, and to report its findings to the CNSC and to the provincial EMO, the City of Toronto, and the Region of Durham.

- **RECOMMENDATION 19:** CELA recommends that CNSC direct the applicant to work with the municipalities to consult with the surrounding communities on specific plans for family reunification following evacuation in the event of a severe nuclear emergency.

- **RECOMMENDATION 20:** Explanations about what “self-decontamination” means; how to do so; and a statement as to its efficacy should be included in the Toronto Nuclear

Emergency Response Plan and in outreach and education to the public about implementation of the plan.

- **RECOMMENDATION 21:** The CNSC should confirm that OPG's automatic gamma monitoring is in place at Pickering, and require the automatic exchange of its data with the regulator as suggested by the IRSS and Fukushima Task Force reports.

- **RECOMMENDATION 22:** CELA recommends that the CNSC request that the Provincial Nuclear Emergency Plan expand its monitoring provisions and ingestion control zones to a distance of 100 km from the NGS, and that the province undertake appropriate measures to ensure that monitoring can be done following an accident within that 100 km zone for agricultural produce, foodstuffs, milk and water.

- **RECOMMENDATION 23:** CELA recommends that the DNERP, 2011 should explicitly outline the measures in respect of controlling ingestion food and water that may be required in the case of a severe nuclear emergency of the type outlined in ICRP Publication 109.

- **RECOMMENDATION 24:** Risks of exceeding maximum exposure limits must be discussed with workers in advance of any accident. Methods to review risks and obtain consent to exceed those limits should be explicitly clarified in the Durham Plan. Similar provisions must be included in the Toronto Plan if it is intended that there may be emergency or other workers who volunteer to exceed maximum exposure limits during an emergency.

- **RECOMMENDATION 25:** The Fukushima Task Force / IRSS recommendations to establish additional dose limits for workers during and following nuclear emergencies in Canada should be addressed by the CNSC as soon as possible.

- **RECOMMENDATION 26:** CELA recommends that the CNSC should require annual conduct of exercises dealing with full scale severe event multi-unit accident scenarios along with conclusive demonstration of their effectiveness as a licence condition for the Pickering NGS. Furthermore, the CNSC should require inclusion of members of the surrounding community and public interest organizations so as to increase input into and confidence in the results. CELA also recommends that their results should be made public, along with lessons learned, and improvements recommended as a result of the exercises; and that the CNSC should require reporting of implementation of those improvements on an annual basis as part of the oversight that it should undertake with respect to offsite emergency planning.

- **RECOMMENDATION 27:** The response times required by these IAEA Safety Requirements and Guideline documents GS-R-2 and GS-G-2.1 should be included in the Provincial and municipal emergency plans for Pickering. In particular, the CNSC should require that these response times are met and demonstrated as part of its licensing decision for the Pickering NGS.

- **RECOMMENDATION 28:** CELA submits that the CNSC should not grant the licence to OPG beyond the current licence period without verifying "through tests and assessments" the adequacy of the emergency plans in place for the Pickering NGS, both on-site and off-site, to respond to severe nuclear emergencies.

- **RECOMMENDATION 29:** CELA submits that even without additional regulatory amendments recommended by the Fukushima Task Force and the IRSS, the CNSC already has jurisdiction to consider the adequacy of the emergency plans in place at Pickering in deciding whether to issue the licence requested, and/or whether to impose additional requirements by way of licence conditions to better protect health, safety and the environment. (Sections 3, 9, 24 of the *Nuclear Safety and Control Act*, S.C., 1997, c. 9)

- **RECOMMENDATION 30:** CELA urges that the Fukushima Task Force recommendations for CNSC oversight of the offsite nuclear emergency response plans be pursued forthwith by way of amendment of the CNSC regulations and requirements there-under. This particularly includes the recommendation for description of the regulatory requirements to address radioactive hazards during an emergency **in greater detail**. This also includes the recommendation of the Task Force to enhance regulatory oversight with periodic safety reviews and to increase requirements for "requirements and expectations for both design basis and beyond design basis accidents``.

A. INTRODUCTION

This application concerns a request by Ontario Power Generation to the CNSC to renew its operating Pickering NGS licence for five years, as a combined licence for Pickering A and Pickering B. This time frame will take the plant beyond its design life for the Pickering B units. These are the oldest operating nuclear power reactors in Canada. The original Pickering Generating Station licence application to operate Unit 1 was submitted to the then Atomic Energy Control Board on August 14, 1970; the construction permit had been 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.

In this submission, CELA reviews the proposal to extend the Pickering Nuclear Power Plant station operating licence for the next five years, and in particular, the proposal to extend its operations beyond the design life of the pressure tubes (and other components) which is intended by OPG for this licence term and one more licence term thereafter. CELA's focus is on the question of whether the CNSC should grant this licence in light of the question of the adequacy of emergency planning at the Pickering site, and in light of the size of the population in the vicinity of the Pickering site. In particular, CELA will compare both emergency planning and siting issues to international nuclear standards and guidance, as well as to international experience and independent reviews as to the requirements for emergency planning. Some of the post-Fukushima lessons learned that are so far available will be particularly important in CELA's review.

CELA will also provide comments on the role of the CNSC as regulator in respect of emergency planning in response to Nuclear Power Plant threats and will urge the CNSC to exercise a stringent oversight role as to whether emergency planning and preparedness has been proven prior to exercising its discretion to provide a further operating licence to the Pickering NGS. In particular, CELA will submit that emergency planning and preparedness has not been sufficiently demonstrated with any adequate amount of detail in respect of severe "Beyond Design Basis Accident" offsite accidents that may occur at the Pickering NGS such as occurred at Fukushima and Chernobyl. While effort and planning has been expended in respect of "Design Basis Accidents", there is a long history of downplaying the likelihood of very severe accidents that may result in serious and extensive offsite contamination and consequences. Accordingly the level of emergency planning and preparedness is insufficient, with only very generalized plans so far in place, in particular beyond the 3 and 10 km response zones. Furthermore, even within the 10 km zone which has traditionally been considered in the Pickering emergency planning, CELA will submit that the level of response and preparedness is inadequate.

For example, the requirements for alerting are not even fully in place in that 10 km zone despite decades of plant operation, and there has not been sufficient preparation for the evacuation that would certainly occur "voluntarily" (as the industry puts it), beyond the 10 km zone. Even for the population within the 10 km zone, the time frame for evacuation, depending upon sector and scenario extends between 4 and 37 hours for complete evacuation. In the case of early large release of radionuclides in a severe accident, we argue this extended evacuation time frame would cause an unacceptable impact to people in terms of the gamma radiation and other potential radiation exposure while the evacuation is underway. In the meantime, "sheltering in place" would provide only limited assistance, depending on the radionuclide release scenario, time frame for the release of a radioactive plume, and type of building that people are "sheltering" inside. Another example of the insufficiency of preparedness for a severe

accident is the lack of pre-distribution of KI, and the insufficient quantities of KI in stock compared to the population even within the 10 km zone.

CELA will also argue that the population in the vicinity of the NGS, both within 10 km, as well as within 20 km and 30 km must be much more engaged, informed, and involved in all aspects of emergency planning in respect of accidents that could occur at the Pickering NGS. For example, it has been CELA's anecdotal experience that many residents of Durham region are unaware of provisions in the Nuclear Emergency Response Plan that anticipate that they will find their own accommodation with friends and family in case of evacuation; that they may be asked to "self-decontaminate" in some scenarios, and what that means; that KI is effective only if taken before or immediately upon commencement of a release; they are unaware of the transportation plans that would be available if they do not have their own vehicles; and they are concerned about family reunification in the event of evacuation scenarios in which members of their family are evacuated separately from the family such as from schools and long term care institutions.

In preparation for this review, and building upon detailed review of emergency planning for the Darlington refurbishment, CELA has collected and collated an extensive collection of relevant emergency planning standards, guides and documents from international, national, provincial and municipal sources. These materials will be available in the library of the Resource Library for the Environment and the Law, housed at CELA's offices after the May, 2013 Day Two Hearing of this Application. They are indexed and catalogued and the catalogue will be available online at www.ecolawinfo.org. In addition this particular index of nuclear emergency planning standards and documents will also available online on CELA's website at www.cela.ca . CD's of these documents and hard copies are now housed in the library which is open to the public (prior contact with CELA is advised to ensure that the library is not in use for meetings at the time of the visit).

CELA undertook this project after finding in earlier work that the necessary documents pertaining to emergency planning for nuclear power plant accidents are widely scattered and it did not appear that there was any single location where they were all housed together. The assembly of these materials, from international through to local, permits us to provide more comprehensive and documented comment on the sufficiency of emergency planning for the Pickering life extension. However, CELA also wanted to build on the work it earlier did for the Darlington refurbishment EA on the topic of emergency planning, and in turn, this collection will assist greatly in future comment on this topic in other licence applications relating to nuclear power plant operations. This work was supported by an award by a CNSC funding panel for this Application. This allowed CELA to undertake a short term contract with project counsel Kyra Bell-Pasht to examine and obtain the international, U.S., Canadian, provincial and municipal emergency planning standards and guidance documents. CELA is also in the process of supplementing this collection of current materials with historical materials as to some of the origins of the decisions relating to emergency planning preparedness in Canada and in Ontario in particular. This

latter process will be ongoing beyond the timeframe of this hearing into the current Pickering NGS licence application, but we believe it is of assistance to attempt to discover why some of the historical decisions were made as they continue to significantly influence current approaches to emergency planning (despite the lessons of Chernobyl and Fukushima).

CELA hopes that future approaches to emergency planning and preparedness in Canada will be significantly augmented in light of the Fukushima accident, and one of the early lessons from that accident which has been widely noted by Japanese officials and others, is that very severe accidents were not given sufficient credit and thus were not taken seriously; a state which strongly influenced emergency planning. Several of the reviews of the accident so far, including the review of the Japanese Diet Independent Commission noted that the lack of sufficient emergency planning was a significant contributor to the consequences of the accident.

CELA wishes to point out that in our opinion there are significant comparables between the regulatory and industry environment and attitude in Japan pre-Fukushima and elsewhere among "western" nuclear power operating states, including Canada. One of the significant findings of the Fukushima accident which was echoed in a recent IAEA conference on nuclear regulation post Fukushima (hosted in Ottawa by the CNSC) was that public confidence in the industry and the regulator are essential, but these were severely harmed during that accident by lack of transparency and credible information.

It is ironic that in building the repository of historical documents as to the basis of the emergency planning basis in Ontario, CELA had been advised by Emergency Measures Ontario that it must seek certain requested historical documents (i.e. Working Group #3 Report on the basis of emergency planning) through Ontario's Freedom of Information and Protection of Privacy Act. This would certainly have delayed provision of these documents beyond the time frame of this licence hearing. Fortunately colleagues at Greenpeace Canada were able to obtain copies of the Working Group 2 and Working Group 3 reports from their storage for CELA. CELA objects to the position taken by Emergency Measures Ontario which directed us to use FOI to obtain this document which is an integral aspect of understanding the basis for emergency planning in Ontario. Furthermore it is explicitly referenced in the current Provincial Nuclear Emergency Plan, 2009 as providing the basis for the Protection Action Levels set out in that Plan.

CELA is of the view that this issue of the basis for emergency planning is of significant public import and will persist in seeking additional historic materials and will include them in the emergency planning document collection that will be available in our library.

B) REVIEW OF EMERGENCY PLANNING AND PREPAREDNESS ISSUES AT PICKERING

1. Emergency Planning Introduction

The necessity for sufficiently detailed Emergency Planning and Preparedness is the reality that if there were a catastrophic accident at one of Ontario's nuclear power plants, widespread health, safety and environmental consequences would be expected unless immediate and effective steps were taken for public protection. For example, as long ago as 1988, Commissioner Kenneth Hare reported in The Safety of Ontario's Nuclear Power Reactors (Ontario Nuclear Safety Review, 1988) that the health effects from a catastrophic accident at the Pickering nuclear power plant could amount to 37.5 prompt fatalities; 6011 early injuries; and 9,700 cancer deaths if most of the fission product inventory escaped[1] and a plume was directed across Metropolitan Toronto (at page 162, Table 15). In such a catastrophic scenario these numbers would be increased today as a result of population growth.

The aim with emergency planning and preparedness should be to avoid as many of these health effects as possible[2]. This can only be accomplished if the emergency planning is designed and implemented so as to be effective in such a catastrophic case. Hare stated on this point that "the most significant result {from the sensitivity analysis of the accident scenarios discussed} was that "prompt use of emergency measures, such as evacuation, greatly reduces both health and economic consequences." (At page 163)

For the reasons that follow, CELA has serious concerns about the sufficiency of the emergency planning and preparedness in place surrounding the Pickering NGS.

[1] The Hare report also describes the assertion that the "probability of losing a high fraction of radioactive inventory from a CANDU reactor core is much lower" than from a Pressurized Water Reactor; however the report also notes that "there may be other beyond-design-basis accidents that will involve serious consequences going well beyond those discussed in this chapter." At page 163, Hare, Vol. 1, 1988

[2] A very surprising, and in CELA's view, unacceptable, additional justification of nuclear emergency response planning and preparedness in Ontario was set out in the 1987 Ministry of the Solicitor General Brief to the Hare Commission, which stated that in addition to safeguarding health, safety and well-being of the people of Ontario in the event of a nuclear accident, the other reason was "To protect Ontario's large investment in its nuclear industry by, firstly contributing to the maintenance of public support for the program, and secondly, in case of an accident, minimizing the possibility of adverse public reaction afterwards, by demonstrating and ability to effectively protect people from harm and risk." (Hare Commission, 1988, Vol. 1 at 227)

2. **Size of Accident and Basis of Emergency Planning at Ontario's Nuclear Power Plants including the Pickering NGS**

- CELA submits that the CNSC should require and verify that Ontario's nuclear emergency planning and preparedness will be sufficient to respond to, and significantly mitigate the consequences of a catastrophic accident such as those that occurred at Fukushima in 2011 or Chernobyl in 1986. It is important that OPG be able to plan for its on-site response in the case of a catastrophic accident in order both to undertake significant accident management and undertake mitigation, but also to work with offsite authorities in supporting the emergency response off-site.

- The reason that the size of the accident matters as a design basis for emergency planning is that the calculated consequences to be averted are wildly divergent in a catastrophic scenario compared to the Design Basis Accident scenario. This directly affects emergency planning decisions and whether specific emergency preparation and planning measures are considered "worthwhile" by the planners. Accordingly if a lower size accident is used for planning, fewer resources, less detail, and less preparation results. This has been the case in the past in Ontario's nuclear preparedness. Post-Fukushima it is essential that changes be made forthwith to this approach.

- A stark example of the difference in consequences that may be calculated depending on the size of the accident assumed for emergency planning was demonstrated in the Hare Commission Report (Ontario Nuclear Safety Review 1988) noted above.[3] The lower releases predicted by the design basis scenario result in far lower consequences and we submit, appear to have motivated the operator, provincial authorities and even the regulator to accept planning for a far less serious accident than the catastrophic scenario.

[3] Other estimates demonstrate an even greater range depending upon the scenario. Peter M. Fraser, in Vol. II, App. II to the ONSR, "A Review of the Design-related Aspects of the Safety of Ontario Hydro's Nuclear Generating Station", reviewed the Lonergan et al and the Ontario Hydro estimates of possible consequences that had been commissioned and submitted to the ONSR. He summarized, after comparing assumptions, rebuttals etc., that depending upon weather conditions, prompt fatalities from a severe accident could range from zero to a few thousand; latent cancer could range from a few hundred to as many as 13,000; and economic damage could range from a low of $100 million in favourable weather conditions to as high as $12 billion (and he noted that this figure is consistent with Ontario Hydro estimates); the figure would be higher if stricter decontamination levels were used. (at II/138) (Figures 1987 dollars.)

- The International Atomic Energy Agency conducts regular "missions" among regulators of nuclear power around the world, reviews their regulatory programs, and makes recommendations to the regulator. There was an IAEA Integrated Regulatory Review Service (IRSS) review conducted in Canada from November 28-December 9, 2011 (this was a follow up to an earlier mission)[4]. That IRRS 2011 report noted (page 63) that a post-Fukushima task force established by the CNSC examined accidents more severe than those previously considered credible by CNSC and that accordingly the design basis for certain stations needs to be updated. It stated with approval that the task force made 13 recommendations dealing with defence in depth and emergency preparedness. (The Fukushima Task Force[5] recommendations will be further reviewed and referenced herein.)

- OPG indicates it is required to maintain an emergency response plan for an on-site response to a Design Basis Accident – this is defined as a "loss of coolant accident with one contaminated casualty" – see Document P-Corr-00531-03669, the December 21, 2011 Sustainable Operations Plan for Pickering A and B.[6] The May 30, 2012 Ontario Power Generation document, "Emergency Response Organization Staffing Basis for Responding to Design Basis Accidents" outlines some of the history of the selection of a "design basis" for emergency planning at the Pickering NGS (as well as Darlington). It reinforces the point that the emergency planning approach by OPG (formerly OH) has for decades been to respond to a design basis accident (although the authors failed to find a documented rationale for the choice of accident). Much of the history reveals that OPG, and before it OH, was of the view that emergency planning on-site for a severe accident beyond design basis was unnecessary because of the "low probability" of such accidents; furthermore much of the history demonstrates that OH was making submissions and representations that it was not necessary to plan for a beyond design

[4] IAEA-NS-IRSS-2011/08 Report of Integrated Regulatory Review Service (IRRS) Follow Up Mission to Canada, November 28 – December 9, 2011 (Department of Nuclear Safety and Security, IAEA).

[5] CNSC Fukushima Task Force Report INO 0824 (CNSC, October, 2011).

[6] Ontario Hydro 1993a Materials Relating to Environmental and Health Effects of Nuclear Generation. Ontario Hydro, and Ontario Hydro 1993b Overview of Ontario Hydro's Nuclear Generation Program, Appendix 4 prepared for Nuclear Liability Act trial, 1993.

basis accident. See Document N-REP-03490-0432605 and the literature review conducted therein.[7]

- The tendency of public authorities to accept that accident planning proceed on the basis of less severe accidents was evident in the 1988 Hare report when the Commissioner reported that there was a "widely shared belief that a severe accident in Ontario is unlikely and that money should not be spent in large amounts on structures that will probably never be used." (Hare, 1988, Vol. 1 at 169) Commissioner Hare continued in his comments to disagree with this view and to state that "a severe accident is indeed unlikely, but the province must equip itself to deal with the possibility--and with the overspill from any severe accident on the US side of the border." (Ibid p. 169)[8]

[7] See also Overview of Ontario Hydro's Nuclear Generating Program, May 1, 1993, Appendix 4, "Emergency Preparedness." (Ontario Hydro, 1993, Prepared for Nuclear Liability Act trial). That document noted that "the most common approach in establishing a basis {for emergency preparedness} is to estimate the consequences of postulated accidents and then introduce an emergency preparedness safety factor. Ontario Hydro evaluated the consequences of postulated accidents in a report entitled "The Assessment of Radiation Dose to the Public Arising from Postulated Accidents at Pickering NGS as an input to Emergency Planning." – (cited in the footnote as Dinnie, K.J., et al, Ontario Hydro Nuclear Studies and Safety Department, Report No. 85088, Feburary 1985.) CELA will obtain this document to include in its archive of Nuclear Emergency Planning documents as part of the history of the basis for nuclear emergency planning in Ontairo.

[8] This was still an issue for Dr. Paul Rosenberg when he testified in 1993 in evidence at a trial dealing with the federal Nuclear Liability Act that Working Group 8 had been called to consider greater accidents than the "maximum planning accident" post Chernobyl, and to make recommendations about the planning basis. They considered the "worst credible radioactivity emission" and recommended it be the basis for planning, not for long term consequences, but for early response. Dr. Rosenberg stated that the decision rested with the Solicitor General of Ontario and cabinet, to increase the design accident, and as of that date (1993) that had not happened. He also stated that Ontario Hydro had actively resisted increasing the planning basis and they had argued that due to the low probability they calculated (less than one in a million reactor years), resources be better used for primary prevention, operator safety and the response and planning already done. At page 939-40 of Dr. Rosenberg's testimony Nov. 3, 1993. (Working Group #8 was established by the Ontario cabinet, to advise on an upper limit for detailed emergency planning and preparedness in Ontario, whether any consequence mitigation measures needed to be adopted as a result of the upper limit recommended in addition to the PNERP, and in recommending an upper limit to consider "not only a scientific assessment of the risks of various types of accidents, but also risk, such as those due to hostile action, which cannot be scientifically assessed... probably effectiveness of emergency improvisation, safety margins, and any other factors..." Working Group #8, 1988 at 12). It appears to CELA on the basis of documentation we have been able to find, obtain and examine, that even Working Group 8`s recommendations never were adopted by the Ontario cabinet; and the province continued its planning based on a less severe accident as planning basis.

- The Provincial Nuclear Emergency Response Plan, 2009, uses as a "Basis of Planning" a "basic offset effect to serve as the main basis for nuclear emergency management." It states that the rationale is because of the "inverse relationship between the probability of occurrence of an accident and the severity of its likely consequences" and that "judicious choice must be made" to select the basis of planning since resources are not available for all possible events. (At 2.3) The basic offsite effect accident is described in the PNERP, 2009, as characterized by one or more of : i) a warning period before offsite effects occur; ii) main hazard from external exposure and inhalation of radionuclides; iii) doses would be low (not over 250 mSv at plant boundary); iv) very low level environmental contamination; v) low level radioactive emissions to environment over some time – days or weeks; vi) impact confined to the Primary Zone (10 km). (At 2.3.3 (b)) The PNERP, 2009, states that "**detailed** planning and preparedness shall be carried out in Ontario for dealing effectively with the basic offsite effect of a nuclear installation accident. The aim of this is to ensure, to the extent possible, that no person offsite will be exposed to intolerable levels of radiation as a result of such an accident." (At 2.3.3. (c)) (emphasis added).

- The PNERP, 2012 states that, with low probability, an accident could occur "which could result in a more severe offsite effect." It is defined as one or more of: i) the time between the accident and release of radioactivity may be generally limited {also sometimes described in other regulatory and industry documents as "early release"}; ii) radiation doses could be high, greater than 250 mSv at the plant boundary; iii) radioiodines and particulates could form a component of the radioactive emission; iv) environmental contamination could be significant; v) area affected could be larger than for the basic offsite effect. (At 2.3.3 (d)). For these more severe but less probable accidents, the province outlines a limited number of issues for which to undertake preparedness: " i) timely public alerting and direction; ii) prioritizing evacuations for those closest to the hazard; iii) radiation monitoring and if necessary, decontamination; if needed, medical assessment, treatment and counselling." (At 2.3.3.(e)) The PNERP states that the detailed planning and preparedness "will establish an effective basis to deal with an emergency caused by any type of nuclear installation accident." Despite this provision, CELA is concerned that this detailed planning is not yet in place for a very severe catastrophic accident as discussed throughout this submission. For example, the inability to assess the extent to which the province and emergency responders are prepared to deal with item iv) because of the lack of available Radiation Health Plans is one indicator that the province still does not have that capability in place. This is discussed further later in this submission.

- This level of planning for less severe accidents arose as a result of the recommendations of Working Group #3, tasked by the Solicitor General in Ontario to advise on the "extent to which planning should be conducted, in any detail, in preparation for an accident at a nuclear generating station as a result of which radioactive material in excess of normal amounts is emitted from the station." Working Group #3 stated that it had not "attempted to define the worst possible accident", saying that "worse accidents appear so unlikely that it would appear to be uneconomical to plan for them." (at 4) It is important to note expressly that Working Group #3 took comfort from the lack of empirical data with few observed accidents to that point with severe radiological consequences – as it met in 1984, its deliberations preceded the Chernobyl accident of 1986, and of course, the Fukushima accident of 2011. Working Group #3 noted at that time that "no one can put hard numbers on probabilities of accidents with severe consequences; and that risk estimates are just that – estimates." (at 5)[9] It is also critical to notice that Working Group #3 stated that its comments that the Ontario plants were performing "better than design basis" were made at a time when there was not yet experience with aging and that Ontario would have to "watch the situation closely and if it appears necessary modify its plans accordingly." (at 11) Furthermore, Working Group #3, on which PNERP, 2009's Protection Action Levels is stated to be based, turns out to have based its assumptions on more optimistic views of worldwide nuclear reactor safety than reality. It stated that "we recommend 250 mSv at the plant boundary, recognizing the experience in the future may cause this to be modified either way." (at 14)

[9] Now that we have unfortunately had world-wide empirical evidence as nuclear power plant accidents, there is an empirical basis for estimation of the observed frequency of severe accidents with offsite consequences. CELA submits that the observed frequency of severe catastrophic accidents overwhelms the justification to base emergency planning on the severe accident "probability" calculations which are inherently fraught. With this level of **observed** severe accident frequency, it is imperative that any jurisdiction choosing to continue operating nuclear power plants is obligated to provide accident planning and preparedness that would realistically respond to such accidents with sufficient resources, specificity and realism to be effective at significantly reducing consequences. Continued reliance on the argument that such accident planning should not be pursued because it is costly must be discontinued. Arguments that such planning is not "cost-effective" relies on probability estimates that have been proven false given empirical accident experience. Continued maintenance of such arguments unsupportably places the real risks of serious harm from such accidents on innocent bystander members of the public.

- CELA submits that the acceptance of less severe accidents as an emergency planning basis for detailed planning is a fundamental error in energy policy and regulatory oversight. It was based in part on early operating experience when the plants were newer and there were fewer "reactor years" of operation, and in part on questionable probability calculations. CELA submits that the planning basis must now be revised based on real-world experience. CELA requests the CNSC to require detailed emergency planning and preparedness, including requiring the operator and emergency planning authorities to undertake updated severe accident consequence calculations, with the emergency plans to be submitted to the CNSC for evaluation as to their effectiveness in a catastrophic scenario, along with a judgment as to whether to approve continued operation of the site in accordance with that evaluation. At this time, and until such emergency plans are in place and proven to be effective for a catastrophic accident, the site should not be licensed for continued operation.

- The attitude in which lower levels of preparedness have until this point been accepted in Ontario is reminiscent of that described at an IAEA Regulator`s Conference hosted by the CNSC in Ottawa in April 2013, at which Toshimitsu Homma of the Japan Atomic Energy Agency stated in a Conference Panel on Emergency Management that the most important lesson of Fukushima was that before the accident, ``There was an implicit assumption that such a severe accident could not happen and thus insufficient attention was paid to such an accident by authorities.``[10]

[10] It is all the more concerning that a less severe accident - i.e. the LOCA with one contaminated casualty, as opposed to a severe offsite or catastrophic accident – has been used as the basis for detailed emergency readiness by OPG and emergency planners in Ontario given that almost identical statements were made by the Porter Royal Commission on the Electric Power Planning in the Commissioner's concluding report where under the title of "Mind-Set Syndrome", he quoted the Presidential Commission on the Three Mile Island accident which occurred in 1979. The TMI Commission noted that "the belief that nuclear power plants are sufficiently safe grew into a conviction.... The Commission is convinced that this attitude must be changed to one that says nuclear power is by its very nature potentially dangerous, and therefore, one must continually question whether the safeguards already in place are sufficient to prevent major accidents." The Porter Commission went on to state that "This syndrome, we believe applies in some degree to Ontario Hydro." These statements by the TMI Commission and the Porter Commission were made in 1979 and 1980. The lessons that were supposed to be learned at that time, according to the comments of Mr. Homma of Japan had apparently been forgotten, if they were ever truly internalized. Similar sentiments about Ontario Hydro's mind-set were expressed by Dr. Paul Rosenberg in his 1993 testimony when he testified that the first thing Ontario Hydro might do "would be to change their approach or their attitude towards serious accidents because they consistently use the maximum planning accident as the basis for their discussion with the regions, the municipalities, the province, and assure us that things are well planned for and under control." (at page 941). CELA has an ongoing concern that this type of "mind-set syndrome"

- It is all the more concerning that a less severe accident - i.e. the LOCA with one contaminated casualty, as opposed to a severe offsite or catastrophic accident – has been used as the basis for detailed emergency readiness by OPG and emergency planners in Ontario given that almost identical statements were made by the Porter Royal Commission on the Electric Power Planning in the Commissioner's concluding report where under the title of "Mind-Set Syndrome", he quoted the Presidential Commission on the Three Mile Island accident which occurred in 1979. The TMI Commission noted that "the belief that nuclear power plants are sufficiently safe grew into a conviction.... The Commission is convinced that this attitude must be changed to one that says nuclear power is by its very nature potentially dangerous, and therefore, one must continually question whether the safeguards already in place are sufficient to prevent major accidents." The Porter Commission went on to state that "This syndrome, we believe applies in some degree to Ontario Hydro." These statements by the TMI Commission and the Porter Commission were made in 1979 and 1980. The lessons that were supposed to be learned at that time, according to the comments of Mr. Homma of Japan had apparently been forgotten, if they were ever truly internalized. Similar sentiments about Ontario Hydro's mind-set were expressed by Dr. Paul Rosenberg in his 1993 testimony when he testified that the first thing Ontario Hydro might do "would be to change their approach or their attitude towards serious accidents because they consistently use the maximum planning accident as the basis for their discussion with the regions, the municipalities, the province, and assure us that things are well planned for and under control." (At page 941). CELA has an ongoing concern that this type of "mind-set syndrome" continues in the Canadian and Ontario context today, even while at the same time the Fukushima Task Force and its recommendations are proceeding. CELA recommends that the CNSC in its decision on this Application, should explicitly recognize the dangerous nature of the technology and demonstrate to the public by way of its decision that it is taking that danger very seriously, in particular by requiring evidence of detailed and effective planning for severe beyond design basis accidents.

continues in the Canadian and Ontario context today, even while at the same time the Fukushima Task Force and its recommendations are proceeding. CELA recommends that the CNSC in its decision on this Application, should explicitly recognize the dangerous nature of the technology and demonstrate to the public by way of its decision that it is taking that danger very seriously, in particular by requiring evidence of detailed and effective planning for severe beyond design basis accidents.

2. **Current State of Emergency Planning Readiness at the Pickering NGS**
    - In the July 4, 2012 OPG Application at issue here, Attachment 6 outlines the Fukushima Project Update. It indicates that "significant work" is proceeding to upgrade emergency planning in response to severe accidents, including multi-unit scenarios; further exercises are planned; "coordination enhancements" continue; Severe Accident Management Guidelines are being implemented in phases through 2014 and 2015, among other things;
        - OPG is working to establish a Regional Emergency Response Support Centre with "industry partners"
        - They are working on a mutual assistance agreement between utilities.
        - They have initiated planning for enhanced communication capabilities to support emergency response (with interim steps having been taken).
        - Drills are being planned to "ensure capability and readiness" to respond beyond design basis accidents, including severe accidents. (Attachment 6 to July 4, 2012 Application)

      This list indicates that a great deal of work remains to be done in order that OPG be in a position to respond to very severe accidents in terms of emergency planning and preparedness.

    - A similar concern exists with respect to whether there is confidence in the ability of offsite emergency responders to respond to severe accidents with offsite consequences. For example the IAEA's Integrated Regulatory Review Service (IRRS) report post Fukushima (November – December 2011) called on the CNSC to do a "national assessment of nuclear power plant off-site emergency plan that includes all relevant organizations". (at page 10) It made a specific recommendation: "**The Government of Canada should assure** that the review and assessment of off-site emergency plans for nuclear power plants includes all relevant authorities, are comprehensive, and that the relevant organizations which implement those plans are capable of performing the assigned duties." (IRSS at Recommendation RF7). (emphasis added)

    - **RECOMMENDATION:** CELA submits that this licence should not be granted until all of the measures list by OPG in its application in Appendix 6, along with other recommendations made by the 2011 IRSS Report, the 2011 CNSC Fukushima Task Force and recommendations herein are actually in place and demonstrated to the regulator, with evidence, to be effective. CELA also submits that it is critical that this evidence be made public. Members of the surrounding communities must be able to understand what is in place; how effective it is;

what has changed; and on what basis the regulator is judging the emergency plans to be in place.

- These issues are discussed further in subsequent sections of this submission.

3. **Level of Detail, Size of Accident, & Lack of Multi-Unit and Externally Initiated Event Nuclear Emergency Planning**

- The level of detail of Ontario's emergency planning and preparedness is a significant issue. CELA submits that the CNSC must ensure a level of detail with specified time frames, tested and verified, to respond to large offsite severe accidents. CELA submits that the current level of planning in Ontario beyond the 10 km zone has hardly exceeded what Commissioner Hare in 1988 called "a conceptual framework" that would "enable a response to be improvised should an emergency occur before all preparations are complete." (Hare, Vol. 1, 1988, p. 230)[11]
- As described earlier, beyond the "Basic offset accident" for which detailed planning is to be done, PNERP, 2009 provides that "appropriate additional planning and preparedness" shall be in place for the more severe offsite effects described in paragraph 2.3.3. (d) of the plan, namely: i) timely public alerting and direction; ii) prioritizing evacuations for those closes to the hazard; iii) radiation monitoring and, if necessary decontamination; iv) if necessary medical assessment, treatment and planning. (At 2.3.3. (e)). However, this is not detailed planning for a large scale accident, rather the Plan indicates that the detailed planning (presumably for the basic offsite effect accident) will

[11] The Working Group #3 report (1984) is explicitly referenced in PNERP, 2012 as the basis for selection of Protection Action Levels. That report was described in the Working Group # 8 report (1988) as background that had been conducted pre-Chernobyl. They stated that Working Group #3 recommended that "in the case of accidents which were in fact more severe than the MPA {Maximum Planning Accident}, authorities should be able to cope by improvising on the plans which would already be in existence based on the MPA." The MPA was recommended to be one that "gives a dose to an unsheltered person 1 km from the nuclear station (that is, the assumed boundary fence). The 25 rem {250 mSv} was stated to be based on the assumption of good engineering practice and the operating experience to that time, together with the particular properties of CANDU reactors, especially that the moderator could act as an additional heat sink in case of failure of both the normal and the emergency cooling systems (and so prevent severe core damage), and the belief that detailed planning was unnecessary for events of probability less than once per million reactor years in situations where there are about 10 reactors per power station." (Working Group #8 at 8-9, describing Working Group #3's recommendations).

"establish an effective basis to deal with an emergency caused by any type of nuclear installation accident."

- The CNSC Fukushima Task Force, 2011, confirmed that the PNERP, 2009 is "based on a single-unit accident and does not consider multi-unit accidents." (At 45.) The issue of the adequacy of the current emergency planning basis in Ontario was briefly discussed on December 3, 2012 hearings before the CNSC on the Darlington refurbishment application, when a witness[12] from Emergency Measures Ontario discussed their desire to have "a greater inclusivity of events beyond the normal planning horizon". Although they indicated they were satisfied with the responses provided by CNSC staff prior to that hearing in response to a letter[13] they had submitted to the CNSC, they also recognized "this isn't the last time we will be sitting here" and it was not the only opportunity they would have to continue to push what EMO thinks is really important regarding emergency management in terms of how to plan and how to exercise and how to modify the nuclear emergency plans going forward. She stated that they had discussed their concerns with CNSC and that they were "comfortable and were monitoring." In response to a question by the CNSC President about what EMO would be able to do by 2014 for the refurbishment continued operations licence, the witness further stated that they are in a process of evolution – and would want to present a provincial position that represents various aspects of planning that goes well beyond traditional planning scenarios. She commented that they would be working with all partners in that expanded view of the world. She looked forward to being able to speak to that at subsequent hearings and being able to identify any areas of concern as well as hopefully areas of significant progress.

- CELA has not seen evidence that more severe, beyond design basis severe accidents, initiated by a variety of severe external events such as hostile action, extreme weather events and others have been considered in Ontario as a basis

[12] Alison Stuart, ADM and Chief EMO, December 3, 2012, Darlington Refurbishment Hearing before the CNSC

[13] The letter is attached to CMD 12-H13.A in the Darlington Refurbishment and Continued Operations EA CNSC hearing.

for emergency planning[14]. Similarly, CELA has not seen evidence that the consequences of multi-unit events have been considered in Ontario as a basis for emergency planning. To the contrary, the CNSC Fukushima Task Force Report 2011 stated that none of the nuclear power plant operators in Canada had at that time considered `multi-unit accident scenarios in development of their emergency plans``. (at 37) The Task Force stated that it was confident that the operators could respond to a beyond design basis accident ``**provided they are single-unit accidents only**. `` (at 37, emphasis added).

- **RECOMMENDATION:** CNSC should require multi-unit severe accident planning to be demonstrated by OPG, along with the effectiveness of off-site emergency response in such a case. Similarly, CNSC should ensure, contrary to previous practice, that extreme natural hazard initiated events and "gross human error" are also examined in terms of presenting an emergency planning basis, and that the on-site and off-site emergency preparedness and planning are demonstrated to be sufficient and reliable to respond to all of these undesirable scenarios in the event that they lead to severe offsite releases.

- A related concern is that raised by the Fukushima Task Force Report (2011) that OPG can perform "post-accident source term estimation" – however "these are designed for **an accident in only one unit**." (emphasis added) (At 38). As the Task Force noted, this is important information to be able to provide to offsite authorities in the case of a nuclear accident.

- **RECOMMENDATION:** CELA recommends that this post-accident source term information be required by the CNSC as a condition of licensing and that the CNSC require OPG to upgrade their capacity to provide source term information and its basis, for multi-unit accidents, as a condition of the Pickering NGS licence. This should include reassessment of plume and dose modelling for multi-unit accidents at the Pickering NGS (see Task Force Report at 38).

- For severe accident emergency planning, twenty-five years after the Hare commission, CELA is of the view that Ontario still has a "conceptual framework"

[14] Even consideration for Severe Accident Management (i.e. on site response) was not adequately considered, analyzed, nor incorporated into licensing requirements in Canada pre-Fukushima. See Fukushima Task Force, CNSC INFO-0824, October 2011 at 35.

allowing for "improvisation" in the event of a catastrophic accident at Ontario nuclear power plants, including the Pickering NGS. It appears to CELA, that the pre-Chernobyl, pre-Fukushima recommendation of Working Group #3 as to a Maximum Planning Accident has held sway in Ontario for at least the past twenty-nine years, despite all of the recommendations, Commissions, and world-wide accident experience that would suggest that planning for more severe accidents is required. Post Fukushima there has been some discussion about increasing the basis for accident planning, and recommendations to do so, but changes in the Plans, in emergency preparedness on the ground, and in detail of planning are not yet evident or proven. CELA recommends to this Commission that now is the time to end the situation of operating the nuclear power plants without sufficient detailed emergency planning in place. CELA recommends to the CNSC that it deny OPG its operating licence to operate the Pickering reactors beyond their design life unless and until serious, capable, detailed offsite emergency planning for catastrophic accidents is finally in place.

- **RECOMMENDATION:** CELA recommends that the CNSC should require the licensees to demonstrate that there are, in place, properly resourced, sufficiently detailed emergency planning and preparedness plans that would address Chernobyl–size accidents or Fukushima–size accidents. The basis for this recommendation includes world-wide experience with these catastrophic accidents. This recommendation is independent of particular event sequences and rather takes account of the myriad ways that things that can go wrong resulting in an accident and resulting in a serious breach of containment, regardless of how caused. It also includes consideration of the fact that among the events that may initiate a catastrophe at a CANDU are those that are beyond the control of the operator such as hostile action or unforeseen external weather events or unforeseen combinations of failures including human error. There is no policy justification for excluding these types of events from emergency planning and preparedness since it is amply demonstrated (Three Mile Island, Chernobyl, Fukushima, 9/11) that all of them may occur in the real world, with disastrous consequences.[15]

[151515] CELA notes that the Working Group #8 Report included a concept of Worst Credible Radiation Emission in its 1988 report, which it described as "the very worst that could happen: the maximum effects possible from any accident, however caused or however developed" and that it would thus encompass accidents including those that could not be calculated due to lack of quantifiable data as well as those with very low probabilities. For this accident that the Working Group #8 styled "WCRE", it recommended that planning be done to prevent "the worst

4. **PATHWAYS OF EXPOSURE TO RADIATION AND EMERGENCY RESPONSE MEASURES**

- The appropriateness of emergency planning and preparedness must be judged on its ability to avoid health and safety consequences to members of the public in addition to on-site workers and first responders, in a severe accident scenario from impacts in a variety of pathways. They include general gamma radiation from the plume of radioactive materials airborne or deposited on ground and buildings; inhalation of radioactive substances with subsequent radiation from internally deposited materials; skin deposition from externally deposited radioactive material on skin, hair, and clothes; and ingestion of deposited radioactive material as contaminated food and water enter the food chain and water supplies leading to additional exposures from eating and drinking. In the event of a severe nuclear reactor accident the doses and exposure pathways are stated by the ICRP (International Commission on Radiological Protection) Publication 109[16] to likely consist of "an initial, relatively high dose rate, inhalation component from inhalation of short-lived beta/gamma emitters during dispersion of the plume." The ICRP also states that "for a reactor accident, this is likely to be followed by a time period lasting days or weeks when I-131 {a form of radioactive iodine} dominates the exposures, through external irradiation from contamination deposited in the environment and from direct contamination on crops and in milk. In the longer term, external radiation from radioactive isotopes of caesium and ruthenium is likely to become dominant, together with longer term contamination of foodstuff with these radionuclides." (At 61.) Without protective measures taken, the ICRP states that the largest component of projected dose would likely be received from contaminated foods.

---

consequences" of this type of accident; namely early morbidity or mortality. Their rationale was that the most severe consequences are "extreme enough to warrant consideration in planning" "however remote their likelihood." Working Group #8 also based this recommendation in part on the fact that provincial and other authorities, when interviewed at this time (1988) , were of the view that their ability to "improvise" for such a severe accident would begin after 24 hours, but "immediate and effective improvisation was not thought to be possible" before 24 hours in the case of a larger than anticipated event. (At 28.) The Working Group decided that "in general no probability could be associated with the WCRE... it represents the bounding case which subsumes all events, however low their probability." (At 62.) The WCRE would result from the "failure of a large number of fuel elements in a short period of time, with a simultaneous breach of containment."

[16] See International Commission on Radiological Protection (ICRP) Publication 109, "Application of the Commission's Recommendations for the Protection of People in Emergency Exposure Situations", 2008 at 62-63.

- The point of emergency planning and preparedness is to implement those measures that would avoid the health and safety consequences of exposure to these radioactive substances, through these pathways. Without any emergency response or protective actions (such as, to move people from those locations where they may be exposed, or to decontaminate or to avoid ingestion), negative health consequences may result.[17] The Province of Ontario's Nuclear Emergency Response Plan (PNERP) (2009) provides that methods of protection from radiation exposure and external contaminating can include "creating distance, by limiting the duration of exposure, and/or by shielding." It states that methods of minimizing or eliminating internal contamination can include preventing ingestion and inhalation. (PNERP, 2009 at 2.2)

- In the following sections, CELA has reviewed material relevant to specific emergency response measures and provides comments in respect of each. The IAEA Standard GS-G-2.1[18] sets out that the "urgent protective measures and counter measures" (GS-G-2.1 at Para. 4.13) include:
    - Isolation of contaminated area
    - Prevention of inadvertent ingestion
    - Evacuation
    - Sheltering
    - Respiratory protection and protection of skin and eyes
    - Decontamination of individuals
    - Prophylaxis with stable iodine
    - Protection of the food supply and prevention of the consumption of significantly contaminated foodstuffs and water

[1717] These potential negative health consequences from ionizing radiation were described in the 1984 Provincial Working Group #8 Report: "Nuclear radiation is potentially hazardous because it has the ability to ionize, and thus to break-up molecules, some of which may be of biological importance. If very many are broken, there may be, within days or weeks, clinical symptoms which, in the worst cases, may result in death. Below these high doses which may result in early morbidity (illness) or mortality (death), nuclear radiation may so disrupt molecules that latent cancer is induced, with the possibility of overt cancer, and possible resulting death, some decades later." (at 3).

[18] International Safety Guide, IAEA GS-G-2.1, Arrangements for Preparedness for a Nuclear or Radiological Emergency, 2007

- Management of the medical response
- Protection of international trade

5. Alerting

- One of the first necessary steps in a nuclear generating station emergency with potential for or actual release of radio-nuclides to the surrounding environment will be the necessity of alerting the public, in addition to notification of necessary authorities. Reviewing the provisions of International Safety Guide, IAEA GS-G-2.1, Arrangements for Preparedness for a Nuclear or Radiological Emergency, 2007, Table 12, Response Time Objectives[19] provides the following objectives relevant to alerting:
  - Classify / Declare the emergency and notify local authorities – within 15 minutes of the time at which conditions indicating that emergency conditions exist are detected
  - Recommend urgent protection action to the public on the basis of the emergency classification – within 30 minutes of the time at which the emergency is classified / declared
  - Initially warn and inform the public within the PAZ and UPZ of urgent protective actions required – less than 1 hour from the time at which initial notification to local authorities was given by the facility

- The PNERP, 2009 contains requirements which could, if effectively implemented, ensure that IAEA GS-G-2.1 is met in terms of alerting times. However, as discussed further below, these requirements are not yet fully in place for the area surrounding the Pickering NGS. The PNERP, 2009 requires that the operator notify the offsite authorities within 15 minutes "of the requirement for notification being recognized". (PNERP, 2009, 4.1) The PNERP, 2009, also requires that the alerting systems must be such as to ensure that "the Primary Zone population that may be required to undertake the initial protective measure of sheltering, evacuation, and/or ingestion of KI can be alerted within 15 minutes of initiation of the system. (PNERP, 2009, 5.7.1.a).

[19] See also IAEA, Updating IAEA-Tecdoc-953, "Method for Developing Arrangements for Response to a Nuclear or Radiological Emergency", (IAEA, October, 2003) at Appendix 10, Response Time Objectives.

- As to the question of how much time might elapse between the operator notification of offsite authorities and a decision to "initiate" the system for alerting, both the Toronto Nuclear Emergency Plan, (TNERP) 2012 and the Durham Region Nuclear Emergency Response Plan, (DRNERP) 2011, Annex A Durham Region Nuclear Notification Procedures, indicate that the Provincial Emergency Operations Centre (PEOC) must decide within 15 minutes of the receipt of an initial notification from the operator, what initial response level to adopt. In the case of "Full Activation" it appears that the intent is that the municipalities will be immediately notified to commence their public alerting system in accordance with the TNERP or the DNERP. [20](TNERP, 2012, page 23; DRNERP, 2011, Annex A, section 3.3)

- The PNERP, 2009 has further detailed requirements in that the operator must provide resources to the municipalities to ensure that the public alerting system in the Contiguous Zone (0 to 3 km) "must provide, within 15 minutes of initiation, warning to practically 100% of the people in the Contiguous Zone at that time, whether they be indoors or outdoors, and irrespective of the time of day or year." (PNERP, 2009, 5.7.2.b). It further requires that the public alerting system in the Primary Zone (3 to 10 km) will be provided, "within 15 minutes of initiation, warning on an area-wide basis to the population in all of the response sectors within that part of the Primary Zone." (PNERP, 2009, 5.7.2.c)

- The Durham Region Nuclear Emergency Response Plan (DRNERP), 2011 at section 4.3 contains the public alerting provisions as are set out in the PNERP, 2009. One distinction of note is that section 4.3.6 states that "In the case of a nuclear emergency with an ongoing or imminent emission of radioactivity the Region is authorized to **immediately** initiate the public alerting system. The PEOC will issue the appropriate Emergency Bulletin." This is further confirmed in the Durham Region Nuclear Notification Procedures, Annex A to the DRNEP, which state that when the notification from OPG is for a general emergency, and there is either an imminent or ongoing emission, Durham "shall **immediately** initiate the Public Alerting System for the appropriate sectors and

[20] In the case of "Partial Activation" by PEOC it is less obvious as to whether and the timing of any public alerting that would occur – this would be in the case of an onsite emergency with no emission occurring - and it appears to be discretionary on the part of the PEOC in that it states that "Consideration shall be given to issuing an Emergency Bulletin and/or news release." (TNERP, 2012, p. 18)

Contiguous Zone." (Emphasis added). (Annex A at 4.4) It is not clear whether provision has been made in the Toronto Nuclear Emergency Response Plan, 2012, for immediate initiation of the public alerting system upon receipt of a similar notification from OPG. This should be clarified.

- **RECOMMENDATION:** The authority of Toronto Emergency Planning Officials to immediately initiate the Public Alerting System upon receipt of a notification from OPG for a general emergency with an imminent or ongoing emission should be clearly specified. If it is not intended that this authority be provided to Toronto's officials under the TNERP, this should be stated with a rationale for the discrepancy compared to the DRNERP.

- In its July 4, 2012 Application for this licence, OPG indicated that additional sirens had been added in 2011 within the 3 km zone when testing indicated that they did not have sufficient coverage to reach all recipients within that zone; subsequently it was determined that even more additional sirens were needed (p. 132). At the time of the preparation of CNSC staff submission CMD 13-H2, the additional sirens were not yet fully in place. In its application, OPG also indicated it was working with Durham Nuclear Emergency Management to update telephone data within the 3 km to ensure indoor alerting (p. 132) OPG also indicated in its application that it was working with a "working group" **toward** arriving at the 10 km notification required by the 2009 Provincial NERP. (p. 132)
- Despite the fact that public alerting requirements were strengthened in the 2009 PNERP, it is nevertheless surprising that this level of public alerting is still not in place since the Pickering NGS has been operating since the 1970's. The requirements for public alerting have been widespread and well understood in jurisdictions operating nuclear power for decades. For example, in the NUREG – 0654 – Rev. 1 (1980), the U.S. guidance included provision that the alerting system be evaluated and that it be capable of alerting the population with both an alert system and with a broadcast message within 15 minutes within a range of 10 miles; while the system should ensure direct immediate coverage of 100% of the population within 15 minutes. (Appendix 3 at 3-3). Similarly, the 1988 Working Group 8 recommendations made twenty-five years ago included ensuring provision of early warning systems for the public. (at (iv))[21]

[21] (Oddly, the 1984 Working Group #3 had initially been asked to make recommendations alerting, but in its report, stated that the province had "intimated" that it do not need to address offsite alerting. (at 30).)

- The urgency of the requirements for public alerting cannot be over-stressed. In the course of the notification and public alerting timeframes, in the event of early release, a considerable amount of population exposure may have occurred, before protective actions may begin to be taken to reduce those exposures.

- **RECOMMENDATION:** CELA recommends that the CNSC refuse further extension of Pickering's operating licence without the 3 km and 10 km alerting systems fully functional, both within the Region of Durham and within the City of Toronto, with robust evidence that they have been fully tested and are effective to meet the objectives specified in the PNERP, 2009.

- **RECOMMENDATION:** CELA also recommends that the emergency response plans time-frames be compressed so as to provide alerts to the public, and instructions to the public on protective actions required in as short a time frame as possible, preferably less than 30 minutes from the onset of the accident. Methods to compress this time frame should be considered and tested, and their efficacy should be one of the points of evaluation by the CNSC in the licence applications by the operators. Reasons for further compression of the time frames for instructions to the public for protective actions are further discussed in the submissions regarding KI distribution, sheltering, and evacuation below.

6. Potassium Iodide (KI) Distribution

- Potassium Iodide (KI) is important because its ingestion helps to block uptake of radioactive iodine in case of a severe offsite accident. Radioactive iodines are among the earliest radionuclides emitted from a nuclear power plant in case of breach of containment or in controlled venting following an accident. Emergency response to protect against radioactive iodine is needed since iodine "concentrates in the thyroid gland... a quarter of all ingested iodine goes to the thyroid under normal circumstances. As a result, when iodine is ingested the thyroid receives a very large dose compared to the rest of the body (roughly 1000 times as much)"[22]. Health Canada states that: "Once in the bloodstream,

[22] Working Group #8, 1988 at 4; see also IAEA Guide GS-G-2.1 at V.17 which states that "The thyroid gland absorbs and concentrates iodine once it has been inhaled or ingested; thus the potential exists for large thyroid doses following the occurrence of severe core damage at a large reactor. A large dose to the thyroid can result in

about 20% of the iodine is absorbed by the thyroid.... It is particularly susceptible to beta and gamma irradiation from radioisotopes of iodine, especially I-131." (Health Canada Guidelines for Intervention During a Nuclear Emergency, 2003 at 21).

- The ICRP notes that Iodine Thyroid Blocking is primarily intended as a short term measure to reduce uptake of radioiodines by the thyroid from inhalation over a few days. The prevention of uptake by ingestion should primarily be accomplished by controlling foodstuffs, milk and water that may be contaminated. (ICRP Publication 109 at 65). IAEA Guide GS-G-2.1 states that radioiodine uptake by the thyroid gland following an accident can be reduced by taking stable (non-radioactive) iodine. It outlines that "to achieve maximum effectiveness, stable iodine must be administered before or soon after the intake of radioiodine. The effectiveness of the measure decreases rapidly with delay, and can be reduced to 50% or less if administered 6 hours after a single intake of radioactive iodine." (at Appendix V, V.15) The IAEA Guide states that its reduction of dose is only 20% 10 hours after the intake of radioiodine and almost zero 24 hours after. (Ibid, V.15) ICRP publication 109 reinforces this – if stable iodine is taken up to 6 hours **before** the intake of radioactive iodine, "the protection provided is almost complete"; if at the time of radioiodine inhalation, its effectiveness is 90%; and 50% within a few hours. The ICRP stated that "to obtain the maximum reduction of the radiation dose to the thyroid, stable iodine should be administered **before** any intake of radioiodine or **as soon as practicable thereafter**." (At 65.) (emphasis added)

- As long ago as 1984, the province of Ontario's Working Group #2 to the Ontario Nuclear Emergency Plan (established by the Solicitor General to make recommendations on the use of stable iodine in case of a nuclear emergency) recommended pre-distribution of KI because it must be ingested very early in or prior to a release from an accident in order to be effective. The Working Group #2 also reviewed the reasons for ingestion of KI for thyroid blocking as a significant preventive measure for public health to prevent early thyroid injury

---

deterministic effects in the thyroid gland and radiation induced thyroid cancer. In the event of **actual or possible** core damage, stable iodine prophylaxis should therefore be used: to prevent deterministic effects in the thyroid gland (e.g. hypothyroidism; to reasonably reduce the risk of stochastic effects (e.g. radiation induced thyroid cancer) from the inhalation of radioiodine within or near the facility." (emphasis added).

or longer term thyroid cancer risks. The Working Group stated that "The Group recognized that the cost-benefit ration was high, but that it would be prudent to consider pre-distribution." (at Recommendation #3) Provincial Working Group #2 also stated in 1984 stated that "if there is any use at all by KI as a blocking agent it would have to be by pre-distribution to an area considered to be at risk." – this was based on the time frame in which KI must be taken to be effective, and that if the warning time available before release is as little as thirty minutes, then "that will not be sufficient for house-to-house distribution from a central stockpile." (At 6).

- CELA submits that KI MUST be pre-distributed because it must be ingested before or shortly after a radioactive release, and if necessary during a release[23]. It would not be reasonably feasible to quickly obtain KI after such a severe accident that requires ingestion of potassium iodide. In that scenario people will likely be required to shelter in place and/or evacuate so it will not be possible to attend pharmacies to obtain it, nor would it be practical to have extensive distribution at that time.[24] In any event there is no possibility this could happen on time for the affected population numbers if there was not adequate pre-distribution. The IAEA Guide GS-G-2.1 stresses that other organs (bone marrow, lungs and other organs) are not protected by KI and therefore "sheltering or evacuation of people at risk of life threatening doses should not be delayed for the provision of stable iodine prophylaxis." (at V.21)

- There is a further concern about the adequacy of KI availability. This is highlighted by comparing the numbers of KI pills available. The CNSC staff submission noted that there is an inventory of 325,000 potassium iodide tablets for residents of the 10 km zone around Pickering (page 62 of the CNSC's submission CMD 13-H2.) This compares to the population of approximately 260,000 in the 10 km zone[25] but does not take account of the potential

[23] IAEA Guide GS-G-2.1 at V.19; See also Working Group #8, 1988 at 6.

[24] Linda Harvey, Physicians for Global Survival, personal communication with Janet McNeil of Durham Nuclear Awareness, April 2013; see also Working Group #8 Report 1988 where it notes that Emergency Planning Ontario considered the lower Protection Action Level for thyroid blocking to be "only for advising persons already in possession of potassium iodide pills to ingest them." (at 19)

[25] DRNERP 2011 and TNEP 2012 sources for total population numbers within 10 km of the Pickering NGS.

necessity for repeat doses nor for provision beyond the 10 km primary zone to the high populations in Scarborough and Pickering in the event of an offsite emergency requiring broader KI distribution.

- People may voluntarily attend one of five pharmacies at any time to request KI pills, and there has been pre-distribution to institutions.[26] The pharmacies are listed in Annex D to the DNERP. Companies may call the Region for additional quantities. None of the five pharmacies listed in the DNERP, 2011 are in the City of Toronto; the TNERP, 2012 does not list pharmacies available for the public to obtain KI and presumably Toronto residents may attend at one of the pharmacies in Pickering to do so. This should be clarified and Toronto area pharmacies should be added to the distribution channels, particularly in Scarborough. Annex D of the DNERP requires of the Durham Emergency Measures Office is to place public notices in local media twice per year about the availability of KI. No similar provision appears in the TNERP, 2012. Oddly, the TNERP, 2012 deals with thyroid blocking only in respect of its own City of Toronto staff. (4.5.4 (d))

- **RECOMMENDATION:** CELA recommends that as an interim measure, the CNSC should require that OPG in conjunction with the City of Toronto, conduct outreach and notification to members of the public resident in Toronto (at a minimum within the Primary Zone), as to the availability of KI and provide advice as to where it may be obtained.

- While Annex D to the DRNERP contains a provision for a KI information letter and consent form to be sent every year to every parent of all of the school children in the Primary Zone, there is no comparable provision in the TNERP and it should be clarified if Durham's Annex D is meant to apply to the City of Toronto residents and institutions within the Primary Zone, or if there are alternate provisions and requirements, and where they are located. This concern is applicable to all of the provisions in Annex D including pre-distribution to institutions. Durham's Annex D on its face does not appear to apply to City of Toronto (Scarborough) residents and this gap must be addressed by comparable provisions for them.

[26] CNSC Staff Submission CMD 13-H2 at 62; See Annex D to the DNERP, 2011, "Potassium Iodide Distribution Procedures."

- **RECOMMENDATION:** The applicability of Durham's Annex D to the residents of Toronto in the Primary Zone must be clarified. Alternatively, the same provisions for KI distribution, consent and information letters for school age children, and other matters dealt with in Annex D must be specified in the TNERP.

- The lack of a comprehensive KI pre-distribution approach at Pickering could be compared to the approach taken by France as described by J.C. Niel[27], in Ottawa during remarks made on April 10, 2013 during a session on Emergency Management. He stated that the approach taken by France for KI distribution was first to mail all of the residents in the protective action zone coupons to redeem at local pharmacies for KI for the household, at no charge. After finding that the uptake was insufficient, they then mailed every single household the KI doses needed to ensure that they would have them on hand in the event of a severe accident.

- The CNSC Fukushima Task Force Report, 2011 noted that the effectiveness of the approach of stocking the KI tablets at local pharmacies, as opposed to pre-distribution to all households "has not been confirmed." (at 52) It is notable that the CNSC 2011 Fukushima Task Force reported that Ontario is the only nuclear province in Canada that does not pre-distribute KI to the residents in the surrounding planning zones. (at 47)

- **RECOMMENDATION:** CELA recommends that the CNSC should require the operator to systematically evaluate and report back to the CNSC the percentage of households within the 10 km Primary Zone, both within the Region of Durham and the City of Toronto, who have obtained KI tablets in advance, as well as the percentage of institutions covered by the plan who have them on hand in sufficient quantities to cover all of their residents or students. Based on this evaluation, CELA recommends that the CNSC require the approach that was taken in France be taken in Canada for the 10 km zone around each operating nuclear generating station, to undertake and ensure 100% pre-distribution of KI

[27] J.C. Niel, of the Autorite' de surete' Nucle'aire (ASN) at the IAEA International Conference on Effective Nuclear Regulatory Systems hosted by the CNSC in Ottawa, April 8-12, 2013.

tablets to the residents in the Primary Zone and that this requirement be included in the licensing conditions for the Pickering NGS.

7. Re sheltering in place and evaluation of its effectiveness

- Sheltering is not defined specifically in the PNERP, 2009 Glossary, nor in the Glossary to the IAEA Safety Guide GS-G-2.1. However, it is listed in the latter as one of the urgent protective measures to consider following a nuclear emergency. That Guide GS-G-2.1 states that "substantial sheltering is provided by large multi-story structures without any special features." (Table 13). The Guide states that sheltering will provide "some protection against all of the major exposure pathways during the early phase of an emergency"; but that the "effectiveness of sheltering varies greatly." Variables cited include the type of release, the type of construction of the building, and the exposure pathway. However, it also notes that after a few hours the reductions in doses are no longer evident and after that time, doses may become greater than those outside if some of the contaminants from the plume are "trapped in the shelter"; if the plume has passed it states that the shelters may then need to be aired out. (at Appendix V, V.3)

- IAEA Guide GS-G-2.1 reviews the protection available with different types of shelters. It states that "typical European and North American homes and their basements" "may not provide adequate protection". Within the first 3 km from the site in particular this type of shelter may not be able to reduce "the risk of severe deterministic effects." The IAEA guide indicates that sheltering in this type of structure should be used if evacuation is impossible or while preparing to evacuate. The Guide states that "substantial" shelter may be provided inside the halls of "large multi-storey buildings or large masonry structures away from walls or windows" which may provide a ten-fold reduction in external and inhalation dose. The Guide states this type of protection can be used for short periods, for up to a day, subject to monitoring. (At Table 11, Page 97) "Special shelters" are defined as those designed specifically to provide dose reduction "by a factor of more than 100".

- ICRP Publication 109 also states that buildings constructed of wood or metal (as opposed to solidly constructed buildings) "are not generally suitable for use as protective shelters against external radiation, and buildings that cannot be made substantially airtight are not effective in protecting against any exposures." (at 65) Accordingly, ICRP Publication 109 implies that for these

types of buildings the main utility is to advise people to "go inside and listen to their radios for further instructions." (at 66) Health Canada's Guidelines for Intervention During a Nuclear Emergency (H46-2/03-326E, 2003) state that sheltering should only be used for one day and should not extend beyond two days. (at 18)

- Given the significant limitations of sheltering, CELA observes that there must be significant planning, attention and resources in order to ensure rapid, timely evacuation. In the time frames required for evacuation, however, there may nevertheless be significant exposures to the public whether trying to evacuate or sheltering in place, but taking many hours to do so. This is further discussed in our comments on evacuation. It is very important that emergency planning officials and the public understand that, for example in large early release scenarios, it may not be possible to prevent all of the exposures to the public from those releases because sheltering will not be fully effective and evacuation takes time.

- The DNERP, 2011 provides for sheltering at section 4.7.1 without acknowledging the limitations set out by the IAEA Guide or the ICRP Publications reviewed above. On the contrary, the description implies that sheltering will be effective without any discussion as to the type of building, time frame etc. It does provide direction to close doors, dampers and windows and to turn off furnaces and air conditioners, and does recommend going to a basement or ground floor room with no windows.

- **RECOMMENDATION:** CELA recommends that the CNSC require OPG to include in its outreach material to the public, in conjunction with regional emergency response officials, explanations about the capability of sheltering and its limitations as described in the IAEA Guide GS-G-2.1 and to reinforce instructions as to steps to take for rapid and effective evacuation in the case of notification of a significant emergency.

8. Medical treatment and availability

- The IAEA Safety Guide GS-G-2.1 states that there should be a referral hospital outside of the ``UPZ`` (Urgent Protective Zone – analogous to Ontario`s Primary Zone) that can provide "highly specialized treatment for a limited number of exposed and/or contaminated persons..." (at 4.46)

- The PNERP 2009 states that the Ministry of Health and Long Term Care will develop a Radiation Health Response Plan. (At 5.1.0). It is to be an Implementing Plan to the PNERP, 2009. Emergency Measures Ontario advises CELA that this Plan is not yet completed as of April, 2013.[28] The TNERP, 2012, does not indicate what the referral hospital for its residents would be in case of a severe accident; rather it refers to their Radiation Health Response Plan. (TERP, 2012 at 4.5.6) Toronto Emergency Measures also advises CELA that this Plan is not yet ready as of April, 2013. The Implementation Plan for the Pickering Nuclear Generating Station under the PNERP, 2009 (to which the reader is referred in TNERP, 2012 at 2.3 regarding Protective Measures), does not have any additional specificity on this question.
- It is not currently possible for CELA to evaluate or comment on the level of treatment available to the public and the level of protection arising there-from on the question of treatment for contaminated persons after a nuclear emergency. Nor is it possible for CELA to evaluate whether the treatment available in the event of an accident at the Pickering NGS is in compliance with IAEA GS-G-2.1 as the provincial plans and Toronto`s and Durham`s Radiation Safety plans are apparently not completed on this issue.

- Valid questions which we have not been able to answer based on the available materials include:
  - Are there in place plans for treating members of the public, either injured or suffering from radiation syndromes beyond decontamination and assessment centres? This is not evident. Provincial Working Group # 9 (another document which CELA will be seeking to obtain for our emergency planning archive) apparently recommended that there be capacity to assess a thousand members of the public and treat for radiation syndromes up to 50 members. In referring to this in 1993 testimony, Dr. Paul Rosenberg stated that there was a lack of readiness in

[28] We have not so far been able to obtain any current version of this plan. It would appear that it is in the process of being updated according to an overview presented by the MOHLTC in December, 2012 where it stated `` In 2012, the MOHLTC undertook a major update to the Radiation Health Response Plan (RHRP), a plan required by the Provincial Nuclear Emergency Response Plan. This health plan describes how Ontario's health system responds to a radiological/nuclear incident of a deliberate or accidental nature and the conditions under which precautionary and protective actions are ordered for the general public and health workers. The update includes a major review of roles and responsibilities, hospital response and resources, evacuation planning, occupational health and safety, monitoring and decontamination units, use of potassium iodide and communications. Technical/expert working groups focusing on these various issues were convened from across the health system. Their input has ensured that a robust plan will be released in early 2013.``

place for that number of people. CELA notes that currently there still does not appear to be such a capability as we have seen no reference in emergency planning documentation to any capacity to handle these numbers of contaminated victims.

- Does the primary hospital for Pickering or Toronto have sufficient response capacity which would not be overwhelmed by a few injured and contaminated patients? Which hospitals are designated for this response capacity?
- Are arrangements for treating more seriously radiated or injured workers, as well as members of the public, adequately in place? We have not seen evidence in the emergency plans that this has been addressed.
- CELA submits that these are the types of questions which must be asked, and answered satisfactorily, with proof, before the CNSC continues with the Pickering licensing application beyond the design life of the plant.[29]

o The concern about the ability to handle the medical treatment of injured and contaminated members of the public is not alleviated by examining the provisions of the Durham Region Nuclear Emergency Plan. The Durham Region Nuclear Emergency Plan contains a brief reference to monitoring at decontamination centres and issuance of instructions to the public. It has a generalized direction if unable to attend at decontamination centres, to "go to a destination of their choice, shower and bag their clothes." It also states that "Details of personal decontamination procedures will be provided through Emergency Bulletins from the PEOC as will the locations of MDUs when they are operational." (at page 31) It is further stated in that Emergency Plan that if there is "a reasonable possibility of significant radiation exposure, the Ministry of Health and Long-Term Care (MOHLTC) will implement the Provincial Radiation Health Response Plan. This includes monitoring for internal contamination, maintaining a database of potentially affected people, counselling and public health information program". However, as noted earlier, the Provincial Radiation Health Response Plan is apparently not complete according to advice provided by EMO to CELA in April, 2013.

[29] Evidence of Dr. P. Rosenberg, Nov. 3, 1992, pages 922-932 ; See also the Recommendation of Working Group #8, 1988 that the province take appropriate measures to provide "the need for adequate medical facilities to deal with possible acute radiation exposure." At 90.

- There are also serious questions to ask about whether the emergency plan has contemplated enough ambulance transport to transport more than two or three workers; and about whether it has contemplated the consequences of taking ambulances out of service after transport due to radioactive contamination. Another concern is whether the ambulance crews would accept a contaminated worker given workplace standards for workplace safety in Ontario. This should be explicitly addressed in the planning, and ambulance worker safety also addressed. There is also a concern about whether there is provision for transporting members of the general public who have received an initial dose of radiation that would require treatment (because the planning accident has until now assumed there would not be any people in that situation). These questions cannot be evaluated at present without the Provincial Radiation Health Response Plan and this is a significant deficiency in the Emergency Planning presently in place in Ontario, and therefore in the ability to respond adequately to a severe offsite nuclear accident at the Pickering NGS.

- **RECOMMENDATION:** CELA recommends that the Pickering Operating licence should not be extended without the Provincial Radiation Health Response Plan and the municipal Radiation Health Response Plans in place.

9. Size of emergency planning zones

- IAEA Safety Guide GS-G-2.1 at 75-78 – provides that the UPZ (Urgent Protection Action Planning Zone) radial distance could be between 5 and 30 km. The reason for this zone is to be able to shelter, monitor, take protective actions and evacuate to significantly reduce risk of doses.

- The same emergency planning zone radii have been in place since the 1988 Working Group #8 report (a 10 km primary zone to plan to prevent plume exposure including evacuation; a 3 km contiguous zone with increased level of planning and preparedness; and a 50 km secondary zone (re ingestion control from contaminated food and water).[30] In Ontario, the 50 km secondary ingestion zone was recommended by Working Group #8 on the assumption that the accident of concern would be a “puff” release. (At 24.)

[30] Working Group #8, 1988 at 18

- **RECOMMENDATION:** CELA recommends that in view of the experience at Chernobyl and Fukushima, the CNSC should request that the province immediately revisit the 50 km secondary ingestion zone with a recommendation to change it to 100 km. This should be done as part of detailed planning for severe offsite accidents so that appropriate monitoring of food, agricultural products, milk, and water is established and in place in the event of such an accident.

- These zones in general appear to have originated in untested assumptions such as those set out in the U.S. Nuclear Regulatory Commission's "Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants", (U.S. NRC / FEMA 1980), NUREG-0654; FEMA-REP-1 Rev. 1. This document stated that "The choice of the size of the Emergency Planning Zones represents a judgment on the extent of detailed planning which must be performed to assure an adequate response base." (at 11) NUREG-0654 described an NRC / EPA Task Force on Emergency Planning (NUREG-0396 1978) which had "selected a radius of about 10 miles for the plume exposure pathway and a radius of about 50 miles for the ingestion exposure pathway." (at 11) This Report asserted that projected doses from the traditional design basis accidents would not exceed Protective Action Guide levels outside the {10 mile} zone" and the same for "projected doses from most core melt sequences"; that immediate life threatening injuries from worst core melt sequences would generally be inside that zone; and that detailed planning within that 10 mile zone would provide "a substantial base for expansion of response efforts in the event that this proved necessary." (at 12)

- These zones have not been altered despite the experience of Chernobyl, or now Fukushima, to this date. In other words, emergency planning zones in Ontario and specifically around the Pickering NGS have not been re-examined in light of actual experience with severe nuclear power plant accidents in which radionuclides breached containment. The Fukushima Task Force Report (CNSC, 2011) noted that at day 5 after the onset of the Fukushima accident, authorities extended the evacuation zone to 30 km around the plant. One month later, some residents at even greater distances were moved as a result of discovering higher levels of radiation in those areas. (at p. 8)

- Dr. Robert Goble, 1993[31] modelled cases which varied in estimating where population dose fell, depending on weather conditions – in some scenarios most of the dose occurred within 100 km of the reactor while in others over 50% occurred beyond 100 km. These scenarios illustrate the necessity to seriously consider and provide detailed plans for emergency planning zones well beyond the 10 km Primary zone and the 50 km ingestion zone currently contemplated.

- **RECOMMENDATION:** CELA submits that it is now incumbent on the CNSC to require that the emergency planning zones be expanded before proceeding with licensing of the Pickering NGS since it is evident on the experience of Fukushima, that evacuation well beyond 10 km is required in certain serious accident scenarios. CELA submits that if emergency planning were undertaken for severe offsite multi-unit accidents, as recommended by the CNSC Fukushima Task Force report (at page 39), it would be evident that emergency planning zones must extend significantly beyond their current limits. CELA submits that the 10 km Primary zone should be extended to 30 km and the 50 km Secondary zone should be extended to 100 km. (By way of comparison to Ontario, the Fukushima Task Force Report indicated that Quebec's Ingestion Control Zone is 70 km. (at 47))

10. **Evacuation**
    - Evacuation is one of the most immediate actions to be taken in the event of a general emergency at a Nuclear Generating Station. ICRP Publication 109 indicates that the purpose of evacuation is to provide "rapid, temporary removal of people from an area to avoid or reduce short-term radiation exposure in an emergency exposure situation." ICRP states that it is "most effective if it can be taken as a precautionary measure before there is any significant release of radioactive material." (at page 66)

    - Health Canada's Guidelines for Intervention indicate that "the goal of evacuation is to avert elevated short-term doses arising mainly from the radioactive plume (external irradiation and inhalation) and from radionulides deposited on the ground (external irradiation). Evacuation has the potential to avert most or all doses if carried out in the pre-release phase of an accident.

[31] Goble 1993 Report for NLA Trial, April 1993 "Potential Consequences of Severe Accidents at Canadian Nuclear Power Plants – Implications for Nuclear Liability Act."

Evacuation is effective for reducing exposures in cases where the release is of uncertain size or duration." (at 18) The Health Canada Guidelines indicate that evacuation should not last more than one week; if conditions prevent return after a week, then the next measure would be longer term relocation. (p. 19) (Relocation, which is not addressed in this submission by CELA, is indicated by the Health Canada Guideline to be a longer term action from weeks to months to avert doses occurring over that time frame.) The Health Canada Guideline states that "If times longer than a year are indicated, then permanent resettlement would need to be considered." (p. 19))

- The Pickering A Safety Report noted that a 50 km radius of Pickering includes almost all of Metro Toronto, the southeast part of the Regional Municipality of York and the Regional Municipality of Durham. In 2001, 3.2 million people lived with 40 km of the Pickering plant. (At p. 40) The population within the 10 km primary zone for the Pickering NGS totals 256,361 people, (2006 population numbers), approximately 60,000 of whom live within the City of Toronto sectors of the primary zone. When Pickering NGS employees are included, the total is 260,861. (The numbers are somewhat less during evenings after 6 pm and nights). These population figures do not include the 15 km or 20 km population numbers in the event that evacuations were ordered for those distances. Nor do these figures include significant numbers of "shadow evacuations", meaning people choosing voluntarily to leave the area beyond the officially declared evacuation zone. (See further comments below on shadow evacuations.) By 2026, the population of Durham Region is projected to be 949,100 according to the Pickering A and B Safety Reports[32].

- A critical issue to determine, then, in order to evaluate effectiveness of evacuation as a protective measure in various scenarios is the time required for evacuation. Just within the 10 km zone, the highest times to evacuate, with last vehicle to clear the Primary Zone, are estimated in the Durham Region Nuclear Emergency Evacuation Information, Annex B to the DRNERP. (Annex B is dated 2008.) The highest times to evacuate vary by scenario and range from 4.77

[32] Figure 2-3 in the Pickering B Safety Report, 2012 NK30-SR—1320-00001 Rev. 4 shows the population trends of Metro Toronto and Durham Region since the 1970s when the plant was originally sited. (P. 88 of 110)

hours up to 36.58 hours in one scenario; several scenarios exceed 20 hours. In other words, on the assumptions made for that study, the residents of Durham Region within 10 km of the Pickering NGS could evacuate over times ranging from just under 5 hours, to almost 37 hours, depending on circumstances. Variables include weather, time of year, time of day. (at p. 89) Times for lesser percentages of the population to evacuate will be less; for example the times for 50% of the population to evacuate may be calculated as was done in the Evacuation Time Estimates Technical Support Document for the Pickering B Refurbishment application (2008)[33]. In that study, based on the population and employment numbers in 2006, it was estimated that the various protective zones could evacuate 50 per cent of their population to the edge of the 10 km zone in times ranging from one hour 10 minutes to two hours 45 minutes. (Table 7-1A). However, that table did not include the combination of midweek evening poor (rain or snow) time estimates in that OPG study. Times increased for the calculation of clearing 100% of the evacuating population, to a high of six hours 30 minutes, but again did not include the midweek evening poor road conditions scenario in the relevant table (Table 7-1D). Table 2-1 which outlines the Evacuation Scenario Definitions for that study did not include a winter, evening rain or snow scenario, which appears to be a significant omission in that during early evening, roads may be already congested at the outset of an emergency. This may explain the discrepancy we note below.

- CELA observes that there are highly significant discrepancies between the highest time to evacuate scenarios contained in the Durham Region Evacuation Information Annex and the 2008 OPG Technical support document just referenced. The CNSC staff submission CMD 13-H2 indicated that CNSC obtained an independent expert review of the 2008 study and based on that review, "it can be conservatively estimated that the 10 km zone could be evacuated in less than 13.5 hours using projected regional data." Meanwhile, the OPG CMD 13-H2.1 claimed evacuation of the primary zone within 6 to 7.5 hours (and 9 hours by the year 2025) taking account of weather and time of day. (At 65). CELA notes that there remains a significant discrepancy between both of these estimates as well as between these estimates and the DNERP Annex B and requests that the CNSC require the applicant to outline a comparison between the factors affecting the time estimates contained in the DRNERP and

[33] Evacuation Time Estimates Technical Support Document for Pickering B Refurbishment for Continued Operation Environmental Assessment NK30-REP-07701-00016, September 2008

the 2008 study and subsequent peer review results. In particular, it is not evident that the 2008 study included any particular consideration of evacuation from institutions; compared to the DNERP, 2011, which does include a listing of institutions such as schools, long term care facilities, hospitals, and others, in each sector. The 2008 OPG study appears to be based on car traffic and also does not indicate what assumptions were made in the study for evacuation of people without household automobiles; if they were included it was not explicitly stated.

- The Pickering Implementation Plan under the PNERP provides that both Toronto and Durham are to provide for mass transportation. The TNERP states that evacuees who require transportation to leave the Primary Zone will be assisted "according to the Mass Evacuation Transportation OSF" operational support function. CELA has not yet been able to obtain this Plan under the TNERP and presumes that it is not ready yet since Toronto EMO sent CELA the available Operational Support Function plans and Annexes in April, 2013, along with the advice that the rest of them are not yet ready. Similarly, the DNERP, 2011 states that "Durham Region must have a plan for the pickup of people without vehicles and their transportation out of the PZ." It is not evident in the Durham Plan what those plans are or where those plans would be located by members of the public.

- **RECOMMENDATION:** CELA recommends that the public should clearly understand what plans are in place to assist them with evacuation from the Primary Zone if they do not have their own transportation. What those plans are should be clearly specified in the Durham and Toronto Nuclear Emergency Plans, and widely communicated to the public in outreach and education. It is not clear from the 2008 OPG Pickering evacuation time estimates study that transit dependence was calculated.

- The ability of people without cars to evacuate is a significant concern. The U.S. Nuclear Regulatory Commission requires explicit calculation of numbers of households with no vehicles; with unsupervised latchkey children; with one vehicle at work that would not return; with residents who have limitations on driving such as elderly who do not drive at night; with specialized transportation needs such as wheelchair vans or ambulances. It also specifies that a summary of the total number of vehicles available to support evacuation of transit

dependent residents, and people with accessibility needs must be done.[34] A related question is the sufficiency of arrangements for transportation of residents of special facilities (institutions) and schools during an evacuation. The same US Evacuation Time Estimate Criteria provides that the numbers of residents and students should be calculated and numbers of bus runs should be calculated in evacuation time estimates. (At 14-15)

- The Durham Region Nuclear Evacuation Information Annex B, Jan. 2008, does provide this type of information (although it likely should be updated at this point, five years later). For each sector, it lists the special care facilities (child cares, retirement homes), schools, all with numbers of residents, students, staff, as well as recreation centres, parks, and locations of emergency services, works, services, and vital services such as health centres. It also notes motels and hotels when present in the sector. It may be that this information was utilized in the time estimates to evacuate each sector contained in that plan, and that should be explicitly stated.

- It is not apparent that the Toronto Nuclear Emergency Response Plan has collected comparable information for these populations of vulnerable residents, and this should be done. The Toronto NERP states that the City is to assist the School Boards to develop their emergency plans for movement of students to pre-arranged host schools and if necessary to Monitoring and Decontamination Units; and that Long Term Care Facilities are to have pre-arranged reciprocal arrangements with like facilities outside the "Hot Zone" to accommodate their residents. (at 4.7.3) Students are to be the responsibility of their school staff until collected from the host school by their guardians / parents. CELA questions whether parents in the Primary Zone are aware of these arrangements, and reminded of them periodically. Questions as to methods of transportation for those lacking personal vehicles, or whose household vehicles cannot return due to the evacuation should be answered clearly, to provide advance information to parents as to how they will be able to collect their

[34] NUREG/CR-7002, "Criteria for Development of Evacuation Time Estimate Studies", 2011 at 14.

children. It is not evident in the Toronto NERP if all of these arrangements are currently in place[35].

- The Durham Emergency Evacuation Information, Appendix A, notes an optimal evacuation route for each sector. The Toronto Emergency Response Plan states that there is to be a Joint Traffic Control Plan developed by a Joint Traffic Control Committee as provided for in the Pickering Implementation Plan under the PNERP, 2009 (referenced at 4.6.3 of the Toronto plan.) However, it is not apparent whether the Joint Traffic Control Plan is completed yet as it was not among the TNERP documents sent to CELA by Toronto EMO in April, 2013. It is supposed to provide for priority evacuation of any Response Sectors and timing and order of sector evacuations is to be determined by the PEOC in conjunction with the Joint Traffic Control Committee. (4.9.3, 4.9.4 of the Toronto Plan).

- In the event of Full Activation of the emergency plans, both the Toronto and Durham plans note that the main road and rail routes through the Primary Zone will be closed to through traffic: Highway 401, Highway 2, CN Rail and CP Rail. (TNERP at 4.6) In addition the Lake Sectors in the Primary Zone will be cleared of boats through Canadian Coast Guard and Toronto and Durham Police marine units.

- It is not clear that members of the public know in general that in the event of an evacuation they are expected to "make their own arrangements for food and lodging" and that the host communities will make arrangements for those "without resources". (DNERP, 2011 at 4.8.4 and 4.8.7; TNERP, 2012, at 4. 7.1 (e)).

- **RECOMMENDATION:** CELA recommends that the CNSC should require OPG to communicate to the public in annual outreach and education, the fact that the nuclear emergency response plans expect the public to make their own arrangements in the event of evacuation, and for those who cannot, what is expected to be provided by the municipalities. The appropriateness of this

[35] The Child Care Nuclear Emergency Response Guidelines, Annex F to Part II of the DRNEP, 2007 says it was divided into two parts; CELA was so far unable to obtain and review the second part being the child care Evacuation and Sheltering Guide described.

approach should further be discussed with the public in terms of future nuclear emergency planning.

- As noted earlier under the topic of sheltering, a significant issue of ongoing concern with all of the evacuation time estimates is that in the event of an early release, there would be considerable periods of exposure to the evacuating public. This is not acknowledged by OPG in its CMD13-H2.1 in which it states that the time estimates are "well within the anticipated "hold-up" of radionuclides within station containment following a nuclear event." (at 65) This is no doubt due to OPG's continued assumption that there will not be a severe catastrophic accident with early release and it does not use such an accident in its emergency planning basis as discussed earlier in this submission.

- **RECOMMENDATION:** CNSC should require OPG to conduct studies and to work with offsite emergency responders, the municipalities and the Province to ensure that there are realistic evacuation plans in the case of a severe accident with early large release, as well as in the case of plans for twenty kilometer and 50 kilometer evacuation zones around the Pickering NGS.

11. **Re shadow evacuation** issues
    - "Shadow evacuation" refers to the people who voluntarily leave the area following a nuclear incident or accident, beyond those who are asked by the authorities to do so. In the Fukushima accident, for example, there were considerable "shadow evacuation" populations, especially women and children.

    - The U.S. Nuclear Regulatory Commission requires its licensees to include a shadow evacuation of twenty percent of the public to a distance of 15 miles from the Nuclear Power Plant in its traffic estimates and planning. ("Criteria for Development of Evacuation Time Estimate Studies.") NUREG/CR-7002, November, 2011. The U.S. General Accounting Office has just released a report (March 2013) in which it reviewed, among other things, the extent to which the U.S. regulator, the NRC understands public awareness as to how to respond in case of a nuclear power plant emergency. It found that there had not been an evaluation of people's understanding beyond the established 10 mile emergency planning zone. See GAO-13-243, U.S. General Accounting Office, Report to Requestors, NRC Needs to Better Understand Likely Public Response to Radiological Incidents at Nuclear Power Plants. (March 2013) The General Accounting Office recommended that the U.S. NRC conduct an evaluation in the

area beyond the 10 mile zone, of people's likely responses in respect of evacuation, during a nuclear emergency, and determine how the rate of shadow evacuations would affect their evacuation time estimates and plans. While the NRC requires licensees to include factors for an additional shadow evacuation within 15 miles of another 20% of that population, the GAO is concerned that the NRC does not have a basis to determine if this requirement is sufficient or reasonable. (At 26).

- The TNERP, 2012 comments that shadow evacuations may occur and contribute to evacuation times. Specific areas next to the Primary Zone are identified in the Plan. (at 4.7.1) A similar comment is included in the DNERP, 2011 (at 4.8.2). The Toronto plan indicates that traffic control will be initiated when the emergency requires evacuation, or "when spontaneous evacuations begin to occur." (at 4.9) The 2008 OPG report on evacuation done for the Pickering refurbishment stated that it included a factor for "some portion" of shadow evacuations out to a 15 km radius from the plant. (at ES-2)

- It is not apparent that there is evidence that the CNSC or OPG or municipal emergency planning officials have tested the state of information and knowledge on the part of the public around the Pickering NGS beyond the 10 km zone. It can be expected that there could be considerable populations of people involved in shadow evacuations given the population numbers located adjacent to the 10 km Primary Zone. Another five kilometers into the City of Toronto extends even further into the former City of Scarborough, extends to approximately to Brimley Ave. and encompasses the neighbourhoods of Guildwood and Scarborough Junction. Five more km to a radius of 20 km west from the Pickering NGS extends to Toronto's Woodbine Ave. and the Don Valley Parkway north of that. It is also reasonable to assume that people will voluntarily evacuate even in greater distances throughout at least the eastern side of the City of Toronto in case of a general emergency at Pickering.

- **RECOMMENDATION:** CELA submits that a similar recommendation to the one made by the U.S. General Accounting Office to the U.S. Nuclear Regulatory Commission is relevant in this case: that the CNSC require the applicant to conduct a study as to the awareness of the Pickering Nuclear Plant of people beyond the Primary Zone at Pickering, and as to their likely response in the event that a general emergency is declared and the Primary Zone is evacuated. The CNSC should require the applicant to evaluate the impact of increased evacuation zones of twenty and fifty kilometers on evacuation time estimates, as well as any other needed adjustments to the emergency plans surrounding

Pickering such as 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, and to report its findings to the CNSC and to the provincial EMO, the City of Toronto, and the Region of Durham.

12. Family reunification

- Family reunification would be one of the most significant issues that people are concerned with following an evacuation. This is recognized in the TNERP, 2012, but no provisions are included about how reunification will be accomplished other than that there will be a number of factors affecting reunification. (at 4.7.1 (d)) A similar treatment is included in the DNERP, 2011 (at 4.8.3).

- **RECOMMENDATION:** CELA recommends that CNSC direct the applicant to work with the municipalities to consult with the surrounding communities on specific plans for family reunification following evacuation in the event of a severe nuclear emergency.

13. Decontamination

- IAEA Guide GS-G-2.1 outlines some approaches to radioactive decontamination. Apart from people who have been heavily contaminated, such as potentially some of those on-site, it recommends that changing clothes, showering and washing exposed skin will reduce levels of contamination and prevent further spread of contamination in a nuclear emergency. (2.2.4)[36]
- The PNERP, 2009 includes decontamination, "removal of deposited radioactive material" on the list of specific protective measures available. In terms of personal monitoring and decontamination, the PNERP states that "evacuees **who are not likely to be contaminated** will be advised to evacuate...undertake self-decontamination." Self-decontamination is described consistently with the IAEA guide. The PNERP states that monitoring and decontamination units should be set up and the affected public directed to those centres if possible. (emphasis added) PNERP 2009, Para. 6.7.5
- The DRNERP considers the potential for contamination from loose particulate on people in the event of an ongoing emission; and also the possibility of

[36] See also ICRP Publication 109 at 66.

internal contamination. (At Para. 4.10). It states that "if evacuees cannot clear the affected area before an emission, they may be directed to proceed for monitoring and decontamination." If units for monitoring and decontamination are not yet set up, they will be advised to "go to a destination of their choice, shower and bag their clothes." Further details and direction will be provided through the PEOC; the priority is to ensure people leave the affected area as soon as possible. (At Para. 4.10.4)

- The TNERP, 2012 states that when evacuations are underway during an emission, the first priority is to "leave the affected area as quickly as possible." It states that evacuees will be advised "via an operational directive" to go to a facility for monitoring and decontamination or to self decontaminate, and that details will be provided through emergency bulletins along with advice as to where to go for follow-up "assurance monitoring". The TNERP, 2012 states that "given the population density, self-decontamination may be the primary means of decontamination, if required." (At 4.7.1 (b)). However, it does not contain the explanation about what self-decontamination means and how to carry it out.

- **RECOMMENDATION:** Explanations about what "self-decontamination" means; how to do so; and a statement as to its efficacy should be included in the Toronto Nuclear Emergency Response Plan and in outreach and education to the public about implementation of the plan.

14. **Monitoring**
    - OPG has now installed "Near Boundary Gamma Monitoring System" and indicated in its application for this licence that it expected it to be in full use in the last quarter of 2012 (July 4, 2012 Application for Renewal of the Pickering A and B Operating Licence P-CORR-00531-03719, Att. 3 p. 130).

    - The IRSS report noted that in some countries the governmental and licensee monitoring is automatically exchanged (page 58). Automatic boundary monitoring was recommended as well by the CNSC Fukushima Task Force (at 38). The availability of this data is extremely important during emergencies as well as during routine operations.
    - The Toronto NERP references "Assurance Monitoring" led by Ministry of Labour in the province in areas adjacent to a radioactive release where protective measures are not required, "aimed at assuring the public that air, food and water are safe." (at 4.10.5)

- **RECOMMENDATION:** The CNSC should confirm that the automatic gamma monitoring is in place at Pickering, and require the automatic exchange of its data with the regulator as suggested by the IRSS and Fukushima Task Force reports.

15. C**ontrol of agricultural products**
    - IAEA Safety Guide GS-G-2.1 outlines expectations for including arrangements to ensure that the public will be instructed not to eat or drink potentially contaminated food, milk and water in the event of a major release. It noted that radiation induced thyroid cancers following the Chernobyl accident occurred mainly **at distances more than 50 km** from the plant, and that "the most effective protective action to prevent or reduce these thyroid cancers would have been to restrict the consumption of potentially contaminated food and milk." (At V.24)

    - CELA notes that the 50 km secondary zone around the Pickering NGS, which is stated to be primarily for ingestion control, would not encompass this situation in which most of the impacts from ingestion following Chernobyl were actually beyond 50 km. Following the experience at Fukushima this is an appropriate response since there were hotspots located as far away as 50 and 80 km.

    - ICRP Publication 109 outlines the preventive agricultural actions that would reduce or prevent doses from ingestion: banning consumption of locally grown food; covering open wells; sheltering animals and animal feed; control of milk; avoiding drinking of milk from animals grazing on potentially contaminated pasture; not eating fresh vegetables, fruit or other food that may have been outside during the release; monitoring of drinking water particularly in case of run-off; and continuing restrictions until sampling shows return to established limits. (at 67)

    - The PNERP, 2009, includes Protection Action Levels (PALS) for ingestion control (food and water) at Annex E; and sets out the levels for foods for general consumption, milk, infant foods and drinking water at which items would be banned. It states that these effective dose PALS were "adopted by the Province in 1984 upon the recommendation of Provincial Working Group #3 and are

generally consistent with Health Canada Intervention levels (2003) and IAEA Safety Series No. 115 (2004).[37]

- The DNERP, 2011 has a brief reference to banning consumption of local water, milk, meat and produce in the section dealing with Partial Activation of the Plan, as a Precautionary Measure. It indicates that the PEOC would discuss with the Regional Emergency Operations Centre the implementation of precautionary measures and communicate them to the public by emergency bulletins issued by the PEOC. There is no mention of food and water bans in the Full Activation section of the DNERP, 2011. The TNERP, 2012 contains an outline under both the Partial Activation and Full sections of the plan, with a list of potential precautionary measures to be considered by the PEOC and does list "clearing the milk storage of dairy farms; banning consumption of any item of food or water that may have been exposed outdoors; banning consumption and export of locally-produced milk, meat, produce, milk-and-meat producing animals" among the precautionary measures that may be indicated. The TNERP indicates that these would be the subject of PEOC emergency bulletins and that the City of Toronto would follow the Province's operational directives regarding implementation. (TNERP, 2012 at 4.3 (e) and 4.5.4 (b))

- **RECOMMENDATION:** CELA recommends that the CNSC request that the Provincial Nuclear Emergency Plan expand its monitoring provisions and ingestion control zones to a distance of 100 km from the NGS, and that it undertake appropriate measures to ensure that monitoring can be done following an accident within that 100 km zone for agricultural produce, foodstuffs, milk and water.

- **RECOMMENDATION:** CELA recommends that the DNERP, 2011 should explicitly outline the measures in respect of controlling ingestion food and water that may be required in the case of a severe nuclear emergency of the type outlined in ICRP Publication 109.

[3737] The PNERP at Annex E, states that the IAEA document International Basic Safety Standards for Protection Against Ionizing Radiation and for Safety of Radiation Sources, IAEA, Safety Series No. 115, 2004 validates the provincial PALS for food and water consumption.

16. **Worker safety**

- The Emergency Worker Protection Plan and Procedures (Annex C to Part II of the DRNEP) states that "until notified otherwise, the Emergency Worker Centres shall enforce a maximum exposure limit of no more than 50 MSv." (At 3.1.1.) Emergency workers (other than police officers already issued personal protective equipment) must first report to the designated Emergency Worker Centres before entering an emergency response sector within the 10 km Primary Zone that is designated a colour representing above background levels of radiation. (Green is at or below background; Orange is background up to 5 mSv per hour; Red is over 5 mSv per hour.) Emergency workers include police, fire, works, transit, OPG and possibly others such as utilities. (Annex C) In sectors designated Orange, workers are to carry dosimeters, check them every hour, and leave the sector if a reading reaches 40 mSv or upon reaching four hours in the sector. In the Red zone, workers are to be accompanied by a knowledgeable escort; are to check dosimeters every 30 minutes, and shall leave after a maximum of one hour. (DNERP Annex C at 3.3.1) Workers report through the Emergency Worker Centres again on leaving the sector. There are default Sector Safety Status ratings for the outset of an emergency until data is available; safety status is to be updated hourly if there is an emission over land occurring in the Primary Zone. (Annex C at 3.2.3)

- Annex C to the Durham plan states that the maximum exposure limit "may only be exceeded in cases of extreme necessity (e.g. to save life or prevent serious injury) by **volunteers** who clearly understand the level of risk they will be facing. (Annex C at 3.1.3) It is not evident how volunteers will be obtained and how their understanding of the level of risk and consent to same is to be assured. Approval from the Regional Emergency Operations Centre must be obtained before emergency workers may be dispatched into a sector where the dose is likely above 50 mSv. (Annex C at 3.1.3)

- **RECOMMENDATION:** Risks of exceeding maximum exposure limits must be discussed with workers in advance of any accident. Methods to review risks and obtain consent to exceed those limits should be explicitly clarified in the Durham Plan. Similar provisions must be included in the Toronto Plan if it is intended that there may be emergency or other workers who volunteer to exceed maximum exposure limits.

- The IRSS report (page 58) referenced and encouraged implementation of the Fukushima Task Force report recommendation that there be additional dose limits established for workers both during and following emergencies in Canada. The Fukushima Task Force, 2011 also recommended (at 54) that the CNSC review the *Radiation Protection Regulations*, section 15 as to potential revisions to "ensure consistency with international guidance." Section 15 provides for the exceeding of applicable dose limits during control of emergencies, and these limits are far higher (ten times higher) than the limits otherwise applicable to workers as provided elsewhere in those *Regulations.* While this is not specific to the Pickering NGS, it is relevant to the context of emergency planning at any of the plants.

- **RECOMMENDATION:** The Fukushima Task Force / IRSS recommendations to establish additional dose limits for workers during and following nuclear emergencies in Canada should be addressed by the CNSC as soon as possible.

17. Frequency of practising emergency planning / drills

- The Ontario Solicitor General advised in its 1987 report to the Hare Commission that exercises were to be held yearly for each facility both onsite and offsite. It would appear from the evidence that this advice had been allowed to lapse at least as to offsite drills in the years since that statement. (See Hare 1988 Vol. 1 at page 227)

- OPG stated that it has conducted drills with offsite agencies in 2008, 2010 and 2012 (CMD 13-H2.1 at 64). However, the IAEA's IRSS Report to Canada (November – December 2011) recommended that Canada "conduct full scale emergency exercises on a periodic basis" (at pages 10 and 70.) The Fukushima Task Force Report, 2011, it noted that "the last full scale nuclear exercise in Ontario was in 2007." (at 46) It is evident then, that the drills OPG says it conducts with offsite agencies are not full scale nuclear exercises. The Task Force further stated that "federal and provincial nuclear emergency planning authorities are not making regularly scheduled full scale NPP exercises a priority." (At 52). This was echoed by the IRSS report which also called for full scale nuclear emergency planning drills to be conducted regularly. It indicated that this should include federal, provincial, municipal and licensee. (IRSS, Recommendation RF8)

- The CNSC's Fukushima Task Force Report, 2011, found that, "Emergency response organizations are capable of responding to single-unit, beyond-design-basis events. Evaluation and revision of emergency plans in regard to multi-unit accidents and severe external events, including an assessment of the minimum complement requirements, have not been performed. As a result, it has not been conclusively demonstrated that emergency response organizations will be capable of responding effectively in a severe event and/or multi-unit accident."(at 39) It also found that "the performance of the emergency response organization under severe event or multi-unit accident conditions has not been challenged by designing and conducting exercises that are based on such conditions." (at 40)

- The CNSC Staff CMD 13-H2.B referenced that a "Unified Response Exercise" is planned for May 2014 and stated that "work has begun on coordinating the interfaces" between the various agencies. (At 8). CELA notes that this exercise will be conducted two and a half years after the receipt of the 2011 Fukushima Task Force Report and three years after the Fukushima accident. CELA does not consider this time frame to be responsive to the Task Force criticism of insufficient prioritizing in Canada of such emergency planning exercises.

- **RECOMMENDATION:** CELA recommends that the CNSC should require annual conduct of exercises dealing with these types of full scale severe event or multi-unit accident scenarios for each plant along with conclusive demonstration of their effectiveness as a licence condition for Pickering in this application. Furthermore, the CNSC should require inclusion of members of the surrounding community and public interest organizations so as to increase input into and confidence in the results. CELA also recommends that their results should be made public, along with lessons learned, and improvements recommended as a result of the exercises; and that the CNSC should require reporting of implementation of those improvements on an annual basis as part of the oversight that it should undertake with respect to offsite emergency planning.

18. **Response time**
    - Capacity of operators and responders to respond and carry out all functions in a timely way for Beyond Design Basis accidents is a significant issue in terms of the effectiveness of emergency planning and preparedness. IAEA Safety Requirements GSR-R-2, "Preparedness and Response for a Nuclear or Radiological Emergency" states that "For facilities in threat category I or II

{which includes nuclear power plants} the threat assessment shall demonstrate for the range of postulated emergencies that identification, notification, activation and other initial response actions **can be performed in time** to achieve the practical goals (see para.2.3) of emergency response." (At Paragraph 4.26.) (Emphasis added). The practical goals in Para. 2.3 include among others, regaining control of the situation, preventing and mitigating consequences; and preventing health effects, both as to early injuries and as to long term effects such as cancers.

- In this respect, it should be noted in particular, that IAEA GSR-R-2 requires, in a section on mitigative action, that "Arrangements shall include emergency operating procedures and guidance for the operator on mitigatory actions for severe conditions, for the full range of postulated emergencies, **including accidents beyond the design basis**." (At paragraph 2.39.) (Emphasis added). However, there is no evidence that OPG has taken this approach, and as reviewed elsewhere in this report, has focussed its emergency planning on-site for design basis accidents.

- In particular, IAEA Guideline GS-G-2.1, "Arrangements for Preparedness for a Nuclear or Radiological Emergency" sets out Response Time Objectives (At Appendix VI, Table 12; pages 104-108). They are applicable for "selected critical response functions or tasks" for nuclear power plants and others. This IAEA Safety Standard states that they should be used as part of the performance objectives for a response capability and should be used as part of evaluation criteria for exercises.
- However, there is no evidence that these response time objectives have been established for the Pickering plant (or within the Durham NERP, the Toronto NERP or the provincial nuclear emergency response plan). Moreover there is no indication that they have been used or documented in emergency response evaluation; nor that the regulator, CNSC has required demonstration of response time objectives as part of its criteria in licensing the Pickering nuclear power plant.
- Some of the matters of particular concern to the surrounding community in the event of a severe, beyond design basis accident, as to capacity to respond in a timely manner, and which should therefore be demonstrated by the operator; and required by the regulator to be verified include, among others (from IAEA GS-G-2.1 Table 12):

- Classifying / declaring the emergency, within 15 minutes "from the time at which conditions indicating that emergency conditions exist are detected"
- Notifying local authorities in the Precautionary Action Zone and the Urgent Protective Action Planning Zone, within 15 minutes from the time of declaring the emergency
- Recommending urgent protective actions for the public on the basis of the emergency classification, within 30 minutes from the time of classifying / declaring the emergency.

- **RECOMMENDATION:** The response times required by these IAEA Safety Requirements and Guideline documents GS-R-2 and GS-G-2.1 should be included in the Provincial and municipal emergency plans for Pickering. In particular, the CNSC should require that these response times are met and demonstrated as part of its licensing decision for the Pickering NGS.

C. Safety –

There are a large number of extremely serious safety issues facing the NGS at Pickering. For these reasons, among others, CELA urges the CNSC not to grant the requested Licence to Operate to OPG. Rather CELA urges that the CNSC require OPG to provide a plan for an orderly closure and decommissioning of all of the units at Pickering. OPG is planning to operate the Pickering B reactor beyond the 210,000 "Equivalent Fuel Power Hours (EFPH) hours "assumed design life". (See E Docs 4057120 Submission of Technical Basis for Continued Operation of Pickering B Units 5-8 Pressure Tubes Dec. 14, 2012 OPG to M. Leblanc at p. 1). The plan to operate beyond the design life of the plant is of extremely serious safety significance. Some of the indications of the rapidly increasing safety risks include:

- Unexpected recent results include the discovery of slight bowing and a thicker black deposit than previously observed on fuel elements removed from the reactor (Dec 11 SCR report on Nov. 30 observations – Edocs 4052277)
- Ever more complex aging management requirements – for example see OPG Aging Management Process 2011 (E Docs 3832128) and OPG Integrated Aging Management (E Docs 3725316), Heat Transport System Aging Analysis with impacts on safety margins and increasing uncertainties along with need for additional

research and potential adjustments including to trip set points and operating constraints (E Docs 3588658).

- Adverse effects on the effectiveness of station shutdown systems as a result of aging (See CNSC submission March 2011 Regulatory Oversight Plan re Pickering B End of Life (E Docs 3669120, p. 11))
- Lack of two entirely independent shutdown systems at Pickering A (Pickering A 2010 Safety Report E Docs 3069405, p. 28)
- Shared Vacuum building and pressure relief duct between Pickering A and B stations in the context of an aging set of reactors (Pickering A 2010 Safety Report E Docs 3069405, p. 28)
- shared safety systems: emergency coolant injection and vacuum building (Pickering A Safety Report, p. 21)
- Probabilistic Safety assessments are inherently incomplete.[38]

D. Sufficiency of Information Base for Licensing

There are a number of areas where the information on critical issues is not complete, and is not necessarily expected to be available by the time of the Day Two Hearing. CELA submits that the Panel should not make a decision on extending the operation of the Pickering Plant beyond its design life without having this additional information.

- Examples of these deficiencies in the record include:
    - The not yet available update of the 2009 Pickering A PSA, particularly in respect of both internal and external events, including seismic, high winds, fires, floods and other hazards (See CMD 13-H2.B, CNSC Staff Supplementary Submission, at p. 5), now not expected until end of 2014 for certain elements rather than end of 2013.
    - The Pickering B updated PSA has been provided, but CNSC staff state they will not have completed a detail review of it until June, 2014; however CELA submits this staff review

[38] A list of reasons that Probability Risk Assessments cannot provide a complete assessment of accident risk was provided in the Working Group #8 Report: There are types of accidents that are often explicitly excluded such as those caused by earthquakes, fires, floods; there are types of initiating causes not considered because they are difficult to quantify e.g. deliberate hostile action; gross human error; there are combinations of events that escape consideration; there are many areas have no statistical or experimental data available and so reliance is placed on judgment; and there are calculated combinations of events put below a certain level of probability because they are considered "highly speculative" at those "low levels". (At 23.)

is essential information for the Panel prior to authorizing the extended operating life. (CMD 13-H2.B at p. 5)

- The Pickering B PSA results are not inclusive of all threats and hazards; for example they do not include in the quantitative results malfeasance or terrorism.

- OPG's supplementary submission (CMD 13-H2.1B at p. 11) states that a Nuclear Response Multi-Agency Reference Manual in respect of emergency planning to provide a "baseline of roles and responsibilities for external agencies" is in preparation and will be presented to the Commission at a meeting in August, 2013. This follows the scheduled completion of this hearing but CELA submits should be available prior to completion of this licence hearing as it is a matter of significant import for the relicensing.

- The lack of understanding the "black deposit" issue on discharged fuel bundles form Unit 1.

- The latest update of the Heat Transport System aging strategy (expected to be updated in 2015 for the period 2016-2020); CNSC staff reviews of preliminary assessments are not due until December 2013.

- The several units that lack Passive Autocatalytic Recombiners for hydrogen mitigation, (planned to be done in 2013 and 2014)

- Specific issues noted in the CNSC CMD13-H2 that must be satisfactory before proceeding: Steam Line Break (at p. 28); Channel Voiding during a Large Loss of Coolant Accident (at p. 28); review and acceptance of the results of the fuel-channel life cycle project that was due to be completed by March 2013 (at p. 87).

- Hazard Analysis, internal, external and malevolent including airplane crashes; completion of which is expected mid to end of 2013 (CMD13-H2 at p. 30).

- Hold points are planned in respect of regulatory oversight of aging of fuel channels (CMD 13-H2 at 42); specifically "four hold points for end of assumed design life of each of the Pickering B units." (at 87)

- The following selected Fukushima Action Items are outstanding as listed in OPG's CMD 13-H2.1B; they are of sufficient import that they should be resolved prior to issuance of the requested licence extension:

    - FAI 1.3.2 Where the existing means to protect Containment integrity and prevent uncontrolled releases

of radioactive products in beyond design basis accidents including severe accidents are found inadequate, a plan and schedule for design enhancements to control long term radiological releases and, to the extent practicable, unfiltered releases. December 2015.

- FAI 2.1.1 Re-evaluation, using modern calculations and state of the art methods, of the site specific magnitudes of each external event to which the plant may be susceptible. December 2013.

- FAI 3.1.2 For multi-unit stations, provide plans and schedules for the inclusion of multi-unit events in SAMGs. December 2013.

- FAI 3.2.1 An evaluation of the adequacy of existing modeling of severe accidents in multi-unit stations. The evaluation should provide a functional specification of any necessary improved models. December 2012.

- FAI 4.1.1 – An evaluation of the adequacy of existing

  Emergency plans and programs. December 2012.

E. Siting

- One of the key requirements of the IAEA Safety Requirements Site Evaluation for Nuclear Installations, NS-R-3 (2003), is to analyze "the characteristics of the population of the region and the capability of implementing emergency plans over the projected lifetime of the plant." (At 2). That document states that it is primarily concerned with low probability severe events. It states, "population growth and population distribution shall be monitored over the lifetime of the nuclear installation." (At 3.) It further states that, if after evaluation no measures can be taken to keep the "radiological risk to the population associated with accident conditions, including those that could lead to emergency measures being taken" acceptably low, then "the site shall be deemed unsuitable for the location of a nuclear installation of the type proposed." (Excerpts at 9.) The concern with the ability to implement an emergency plan is also emphasized in the new Draft IAEA Safety Standard "Safety Aspects in Siting for Nuclear Installations", DS433, October 10, 2011. (At 50)

- Given the existing population density in area of Pickering (as reviewed earlier in the discussion on evacuation), the Pickering NGS is no longer a suitable site for operation of a nuclear power plant; particularly for operation of a multi-unit station. As noted earlier, Durham Region's population as a whole as of 2009 was 614, 970; projected to grow to 949,100 by 2026, and within 40 km of the Pickering site were 3.2 million people back in 2001. These population numbers are too high to be located in close proximity to nuclear generating stations. [39] [40]

    - The Province of Ontario's Places to Grow process has continued to propose considerably increased population numbers for Durham over the coming year. The trends in population density show Durham region have increased and continuing to increase population density. As noted earlier, there are sectors around Pickering in which the estimates indicate that evacuation in certain conditions could take from 4 to 37 hours according to the DRNERP as reviewed above in the discussion with respect to evacuation.

    - Working Group # 8 in 1988 recommended that the province take appropriate action in "the advisability of restricting new housing construction near nuclear facilities." A similar recommendation was made by the Joint Review Panel in the Darlington New Build EA Report. It not now being possible to prevent this housing construction, and heavy population density having built up in the Pickering area, including both in the Cities of Pickering and Toronto (Scarborough), the CNSC should not authorize the further licensing of this plant beyond its design life and should not extend its operating license beyond 2014.

    - As outlined in the Pickering A and B Safety Reports, there is also a considerable workforce in the area. There are also major transportation routes of national importance that would be disrupted in the event of a

[39] Figure 2-3 in the Pickering B Safety Report, 2012 NK30-SR—1320-00001 Rev. 4 shows the population trends of Metro Toronto and Durham Region since the 1970s when the plant was originally cited. (P. 88 of 110)

[40] See also Page 89 of the Pickering A safety report – which provides a graph of demographic data in the broader circumference around the Pickering site.

severe accident at Pickering, including Highway 401, Highway 2 and the CN and CP Rail lines.

- In addition there are a large number of major airstrips and airports in the area.[41] The presence of this multiplicity of air traffic would both represent a major disruption of commercial aviation traffic in the event of a severe offsite accident at Pickering, and also poses an ongoing risk to the plant itself. IAEA Safety Guide NS-G-3.1 states that "the potential for aircraft crashes that may affect the plant site should be considered in the early stages of the site evaluation process and it should be assessed over the entire lifetime of the plant." (At 22).[42]

- The area is also the location of Canada's newest national (urban) park, as well as to a large number of recreational areas important to the GTA and especially the Scarborough and Pickering communities as listed in the Pickering A Safety Report.

- CELA submits that the Pickering site would never be authorized today for a new nuclear facility. For the same reasons, neither should it be granted a licence to operate beyond the design life of the Plant. CELA submits that the Pickering NGS no longer meets the safety expectations of the public nor of siting standards by its location in such a highly populated region as a result of which expeditious evacuation is not possible.

F. Re recommendations for community engagement

- In reviewing the materials relevant to emergency planning at the Pickering NGS and in Ontario generally, CELA noted that there is insufficient consultation with the public as to the choices made; and there is insufficient communication with the public as to the plans and their details once they are developed. It is a matter of significant concern as to the extent to which the public in both Durham Region and the City of Toronto is aware of, and engaged in providing input to the content of the nuclear emergency

[41] Pickering A Safety Report, Table 19

[42] IAEA Safety Guide NS-G-3.1, "External Human Induced Events in Site Evaluation for Nuclear Power Plants." (IAEA, 2002).

plans. This in itself increases the risks and potential consequences from a severe offsite accident at the Pickering nuclear plant.

- Many residents of Durham region are unaware of provisions in the Nuclear Emergency Response Plan that anticipate that they will find their own accommodation with friends and family in case of evacuation; that they may be asked to "self-decontaminate" in some scenarios, and what that means; that KI is effective only if taken before or immediately upon commencement of a release; they are unaware of the transportation plans that would be available if they do not have their own vehicles; and they are concerned about family reunification in the event of evacuation scenarios in which members of their family are evacuated separately from the family such as from schools and long term care institutions.

- IAEA Publication "Lessons Learned from the Response to Radiation Emergencies (1945 – 2010), (IAEA, August 2012) includes a comment in the chapter "providing information and issuing instructions and warnings to the public", about the importance of providing information to the public on protective actions to be taken in event of an emergency in **advance** of any emergency for threats such as Nuclear Power Plants. They stated that "This will engender confidence – the knowledge that the officials have their interest at heart – and, by doing so, improve compliance with protective action recommendations in the event of a real emergency. In addition, there will be a better understanding of the systems used to warn them of an emergency." (At 27) CELA agrees with this assessment but we do not see a sufficient level of advance communication with the public in the 10 km zone around the Pickering NGS, both within the Region of Durham and within the City of Toronto, to feel confident that people sufficiently understand the protective actions to be taken in the event of a Pickering NGS emergency. CELA recommends that the CNSC require extensive public engagement to be undertaken by OPG as a condition of any further operating licence of the Pickering NGS, to include specific explanation of the protective actions that may be required, why, and how they would be communicated and in what eventualities.

- This recommendation is reinforced by the comment in ICRP Publication 109[43] which recommends engagement with stakeholders and discussions of the plans, including with members of the public. The rationale is that "Otherwise, it will be difficult to implement the plan effectively during the response. The overall protection strategy and its

[43] International Commission on Radiological Protection, "Application of the Commission's Recommendations for the Protection of People in Emergency Exposure Situations", (ICRP Publication 109, 2008)

constituent individual protective measures should have been worked through with all those potentially exposed or affected, so that time and resources do not need to be expended during the emergency exposure situation itself in persuading people that this is the optimum response." (at 42)

G. REGULATORY OVERSIGHT: DECISION OF THE CNSC IN THIS APPLICATION

CELA urges the CNSC to exercise its role as regulator in respect of emergency planning in response to Nuclear Power Plant accident threats at the Pickering station. CELA urges the CNSC to exercise a stringent oversight role as to whether emergency planning and preparedness have been proven prior to exercising its discretion to provide a further operating licence to the Pickering NGS.

- The IAEA Standard, Preparedness and Response for a Nuclear or Radiological Emergency, Series No. GS-R-2, Safety Standards (Vienna: IAEA, 2002) sets out expectations as to the responsibility of the regulator. A more complete copy of this excerpt is provided as Appendix A to this submission. It is the regulator's responsibility, among other things, to do the following (excerpts from GS-R-2 paragraphs 3.8 to 3.12:
    - The regulatory body shall require that arrangements for preparedness and response be in place for the on-site area for any practice or source that could necessitate an emergency intervention.
    - The regulatory body shall ensure that such emergency arrangements are integrated with those of other response organizations.
    - The regulatory body shall ensure that such emergency arrangements provide a reasonable assurance of an effective response, in compliance with these requirements, in the case of a nuclear or radiological emergency.
    - The regulatory body shall require that the emergency arrangements "shall be tested in an exercise before the commencement of operation [of a new practice]. There shall thereafter at suitable intervals be exercises of the emergency [arrangements], some of which shall be witnessed by the regulatory body."
    - In fulfilling its statutory obligations, the regulatory body… shall establish, promote or adopt regulations and guides upon which its regulatory actions are based;… shall provide for issuing, amending, suspending or revoking authorizations, subject to any necessary conditions, that are clear and unambiguous and which shall specify (unless

elsewhere specified):… the requirements for incident reporting;…and emergency preparedness arrangements.
- In planning for, and in the event of [a nuclear or radiological emergency], the regulatory body shall act as an adviser to the government.
- The regulatory body shall ensure that the co-ordinated arrangements are implemented adequately by the operators.

- The Fukushima Task Force 2011 discussed the lack of specific regulatory requirements for operators for emergency planning and the lack of specific and detailed requirements as well as the lack of sufficient regulatory oversight given the gap in the regulatory framework. (CNSC Fukushima Task Force Report 2011 at 40). CELA concurs with this concern, as in reviewing G-225 "Emergency Planning at Class I Facilities and Uranium Mines and Mills" and RD-353, "Testing the Implementation of Emergency Measures", we observed that the requirements were too high-level and non-specific to provide useful measures against which the nuclear emergency plans applicable to an accident at Pickering could be compared and tested. The Fukushima Task Force reiterated this concern in its chapter reviewing the Canadian nuclear regulatory framework in view of lessons learned from the Fukushima accident. It again stated that the CNSC should require offsite emergency plans to be submitted along with applications to construct or operate nuclear power plants. (At 53).

- The Fukushima Task Force report stated that: ``Federal and provincial nuclear emergency planning could be strengthened through establishing a formal, transparent, national-level oversight process for offsite nuclear emergency plans, programs and performance, and through scheduling of regularly planned full-scale exercises.``[44] The IRSS report noted these Fukushima Task Force made recommendations that the CNSC should require the submission (to the CNSC) of the provincial nuclear emergency response plans. The IRSS report encouraged this to be done. (At 58) In the presentation by CNSC at the March, 2013 inter-jurisdictional emergency planning workshop, the responsibility of regulators to ensure emergency response capability and these Fukushima Task Force and IRSS recommendations were also noted.

- The IRSS report (conducted of CNSC from Nov 26 to Dec 2, 2011) also noted that there are a multiplicity of agencies and levels of government with responsibilities in nuclear emergency planning in Canada and recommended that the CNSC should "verify the requirements and

[44] (CNSC Fukushima Task Force Report, CNSC INFO-0824, October 2011 at iv, v)

standards described in the offsite emergency plans are met, through tests and assessments." (at page 59)

- **RECOMMENDATION:** CELA submits that the CNSC should not grant the licence to OPG beyond the current licence period without verifying "through tests and assessments" the adequacy of the emergency plans in place for the Pickering NGS, both on-site and off-site, to respond to severe nuclear emergencies.

- **RECOMMENDATION:** CELA submits that even without additional regulatory amendments recommended by the Fukushima Task Force and the IRSS, the CNSC already has jurisdiction to consider the adequacy of the emergency plans in place at Pickering in deciding whether to issue the licence requested, and/or whether to impose additional requirements by way of licence conditions to better protect health, safety and the environment. (Sections 3, 9, 24 of the *Nuclear Safety and Control Act*, S.C., 1997, c. 9)

- **RECOMMENDATION:** CELA urges that the Fukushima Task Force recommendations for CNSC oversight of the offsite nuclear emergency response plans be pursued forthwith by way of amendment of the CNSC regulations and requirements there-under. This particularly includes the recommendation for description of the regulatory requirements to address radioactive hazards during an emergency **in greater detail**. This also includes the recommendation of the Task Force to enhance regulatory oversight with periodic safety reviews and to increase requirements for "requirements and expectations for both design basis and beyond design basis accidents``. (Task Force at v).

H. Conclusion and Recommendations

- **RECOMMENDATION 1:** CELA submits that this licence should not be granted until all of the measures list by OPG in its application in Appendix 6, along with other recommendations made by the 2011 IRSS Report, the 2011 CNSC Fukushima Task Force and recommendations herein are actually in place and demonstrated to the regulator, with evidence, to be effective. CELA also submits that it is critical that this evidence be made public. Members of the surrounding communities must be able to understand what is in place; how effective it is; what has changed; and on what basis the regulator is judging the emergency plans to be in place.

- **RECOMMENDATION 2:** CNSC should require multi-unit severe accident planning to be demonstrated by OPG, along with the effectiveness of off-site emergency response in such a case. Similarly, CNSC should ensure, contrary to previous practice, that extreme natural hazard initiated events and "gross human error" are also examined in terms of presenting an emergency planning basis, and that the on-site and off-site emergency preparedness and planning are demonstrated to be sufficient and reliable to respond to all of these undesirable scenarios in the event that they lead to severe offsite releases.

- **RECOMMENDATION 3:** CELA recommends that this post-accident source term information be required by the CNSC as a condition of licensing and that the CNSC require OPG to upgrade their capacity to provide source term information and its basis, for multi-unit accidents, as a condition of the Pickering NGS licence. This should include reassessment of plume and dose modelling for multi-unit accidents at the Pickering NGS as recommended by the Fukushima Task Force.

- **RECOMMENDATION 4:** CELA recommends that the CNSC should require the licensees to demonstrate that there are, in place, properly resourced, sufficiently detailed emergency planning and preparedness plans that would address Chernobyl–size accidents or Fukushima–size accidents. The basis for this recommendation includes world-wide experience with these catastrophic accidents. This recommendation is independent of particular event sequences and rather takes account of the myriad ways that things that can go wrong resulting in an accident and resulting in a serious breach of containment, regardless of how caused. It also includes consideration of the fact that among the events that may initiate a catastrophe at a CANDU are those that are beyond the control of the operator such as hostile action or unforeseen external weather events or unforeseen combinations of failures including human error.

- **RECOMMENDATION 5:** The authority of Toronto Emergency Planning Officials to immediately initiate the Public Alerting System upon receipt of a notification from OPG for a general emergency with an imminent or ongoing emission should be clearly specified. If it is not intended that this authority be provided to Toronto's officials under the TNERP, this should be stated with a rationale for the discrepancy compared to the DRNERP.

- **RECOMMENDATION 6:** CELA recommends that the CNSC refuse further extension of Pickering's operating licence without the 3 km and 10 km alerting systems fully functional, both within the Region of Durham and within the City of Toronto, with robust evidence that they have been fully tested and are effective to meet the objectives specified in the PNERP, 2009.

- **RECOMMENDATION 7:** CELA also recommends that the emergency response plans time-frames be compressed so as to provide alerts to the public, and instructions to the public on protective actions required in as short a time frame as possible, preferably less than 30 minutes from the onset of the accident. Methods to compress this time frame should be considered and tested, and their efficacy should be one of the points of evaluation by the CNSC in the licence applications by the operators.

- **RECOMMENDATION 8:** CELA recommends that as an interim measure, the CNSC should require that OPG in conjunction with the City of Toronto, conduct outreach and notification to members of the public resident in Toronto (at a minimum within the Primary Zone), as to the availability of KI and provide advice as to where it may be obtained.

- **RECOMMENDATION 9:** The applicability of Durham's Annex D to the residents of Toronto in the Primary Zone must be clarified. Alternatively, the same provisions for KI distribution, consent and information letters for school age children, and other matters dealt with in Annex D must be specified in the TNERP.

- **RECOMMENDATION 10:** CELA recommends that the CNSC should require the operator to systematically evaluate and report back to the CNSC the percentage of households within the 10 km Primary Zone, both within the Region of Durham and the City of Toronto, who have obtained KI tablets in advance, as well as the percentage of institutions covered by the plan who have them on hand in sufficient quantities to cover all of their residents or students. Based on this evaluation, CELA recommends that the CNSC require the approach that was taken in France be taken in Canada for the 10 km zone around each operating nuclear generating station, to undertake and ensure 100% pre-distribution of KI tablets to the residents in the Primary Zone and that this requirement be included in the licensing conditions for the Pickering NGS.

- **RECOMMENDATION 11:** CELA recommends that the CNSC require OPG to include in its outreach material to the public, in conjunction with regional emergency response officials, explanations about the capability of sheltering and its limitations as described in the IAEA Guide GS-G-2.1 and to reinforce instructions as to steps to take for rapid and effective evacuation in the case of notification of a significant emergency.

- **RECOMMENDATION 12:** CELA recommends that the Pickering Operating licence should not be extended without the Provincial Radiation Health Response Plan and the municipal Radiation Health Response Plans in place.

- **RECOMMENDATION 13:** CELA recommends that in view of the experience at Chernobyl and Fukushima, the CNSC should request that the province immediately revisit the 50 km secondary ingestion zone with a recommendation to change it to 100 km. This should be done as part of detailed planning for severe offsite accidents so that appropriate monitoring of food, agricultural products, milk, and water is established and in place in the event of such an accident.

- **RECOMMENDATION 14:** CELA recommends that the CNSC require that the nuclear emergency planning zones be expanded. CELA submits that the 10 km Primary zone should be extended to 30 km and the 50 km Secondary zone should be extended to 100 km.

- **RECOMMENDATION 15:** CELA recommends that the CNSC should require OPG to work with the local municipalities to ensure the public clearly understands what plans are in place to assist them with evacuation from the Primary Zone if they do not have their own transportation. The details of those plans should be clearly specified in the Durham and Toronto Nuclear Emergency Plans, and widely communicated to the public in outreach and education.

- **RECOMMENDATION 16:** CELA recommends that the CNSC should require OPG to communicate to the public in annual outreach and education, the fact that the nuclear emergency response plans expect the public to make their own arrangements in the event of evacuation, and for those who cannot, what is expected to be provided by the municipalities. The appropriateness of this approach should further be discussed with the public in terms of future nuclear emergency planning.

- **RECOMMENDATION 17:** CNSC should require OPG to conduct studies and to work with offsite emergency responders, the municipalities and the Province to ensure that there are realistic evacuation plans in the case of a severe accident with early large release, as well as in the case of plans for twenty kilometer and 50 kilometer evacuation zones around the Pickering NGS.

- **RECOMMENDATION 18:** CELA recommends that the CNSC require the applicant to conduct a study as to the awareness of the Pickering Nuclear Plant of people beyond the Primary Zone at Pickering, and as to their likely response in the event that a general emergency is declared and the Primary Zone is evacuated. The CNSC should require the applicant to evaluate the impact of increased evacuation zones of twenty and fifty kilometers on evacuation time estimates, as well as any other needed adjustments that would result from larger evacuation zones to the emergency plans surrounding Pickering such as 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, and to report its findings to the CNSC and to the provincial EMO, the City of Toronto, and the Region of Durham.

- **RECOMMENDATION 19:** CELA recommends that CNSC direct the applicant to work with the municipalities to consult with the surrounding communities on specific plans for family reunification following evacuation in the event of a severe nuclear emergency.

- **RECOMMENDATION 20:** Explanations about what “self-decontamination” means; how to do so; and a statement as to its efficacy should be included in the Toronto Nuclear Emergency Response Plan and in outreach and education to the public about implementation of the plan.

- **RECOMMENDATION 21:** The CNSC should confirm that OPG’s automatic gamma monitoring is in place at Pickering, and require the automatic exchange of its data with the regulator as suggested by the IRSS and Fukushima Task Force reports.

- **RECOMMENDATION 22:** CELA recommends that the CNSC request that the Provincial Nuclear Emergency Plan expand its monitoring provisions and

ingestion control zones to a distance of 100 km from the NGS, and that the province undertake appropriate measures to ensure that monitoring can be done following an accident within that 100 km zone for agricultural produce, foodstuffs, milk and water.

- **RECOMMENDATION 23:** CELA recommends that the DNERP, 2011 should explicitly outline the measures in respect of controlling ingestion food and water that may be required in the case of a severe nuclear emergency of the type outlined in ICRP Publication 109.

- **RECOMMENDATION 24:** Risks of exceeding maximum exposure limits must be discussed with workers in advance of any accident. Methods to review risks and obtain consent to exceed those limits should be explicitly clarified in the Durham Plan. Similar provisions must be included in the Toronto Plan if it is intended that there may be emergency or other workers who volunteer to exceed maximum exposure limits during an emergency.

- **RECOMMENDATION 25:** The Fukushima Task Force / IRSS recommendations to establish additional dose limits for workers during and following nuclear emergencies in Canada should be addressed by the CNSC as soon as possible.

- **RECOMMENDATION 26:** CELA recommends that the CNSC should require annual conduct of exercises dealing with full scale severe event multi-unit accident scenarios along with conclusive demonstration of their effectiveness as a licence condition for the Pickering NGS. Furthermore, the CNSC should require inclusion of members of the surrounding community and public interest organizations so as to increase input into and confidence in the results. CELA also recommends that their results should be made public, along with lessons learned, and improvements recommended as a result of the exercises; and that the CNSC should require reporting of implementation of those improvements on an annual basis as part of the oversight that it should undertake with respect to offsite emergency planning.

- **RECOMMENDATION 27:** The response times required by these IAEA Safety Requirements and Guideline documents GS-R-2 and GS-G-2.1 should be included in the Provincial and municipal emergency plans for Pickering. In particular, the CNSC should require that these response times are met and demonstrated as part of its licensing decision for the Pickering NGS.

- **RECOMMENDATION 28:** CELA submits that the CNSC should not grant the licence to OPG beyond the current licence period without verifying "through tests and assessments" the adequacy of the emergency plans in place for the Pickering NGS, both on-site and off-site, to respond to severe nuclear emergencies.

- **RECOMMENDATION 29:** CELA submits that even without additional regulatory amendments recommended by the Fukushima Task Force and the IRSS, the CNSC already has jurisdiction to consider the adequacy of the emergency plans in place at Pickering in deciding whether to issue the licence requested, and/or whether to impose additional requirements by way of licence conditions to better protect health, safety and the environment. (Sections 3, 9, 24 of the *Nuclear Safety and Control Act*, S.C., 1997, c. 9)

- **RECOMMENDATION 30:** CELA urges that the Fukushima Task Force recommendations for CNSC oversight of the offsite nuclear emergency response plans be pursued forthwith by way of amendment of the CNSC regulations and requirements there-under. This particularly includes the recommendation for description of the regulatory requirements to address radioactive hazards during an emergency **in greater detail**. This also includes the recommendation of the Task Force to enhance regulatory oversight with periodic safety reviews and to increase requirements for "requirements and expectations for both design basis and beyond design basis accidents``.

I. Decision Requested:

CELA requests that the CNSC not issue the licence requested by OPG to operate the Pickering Units A and B for a further five years. Rather, CELA requests that the CNSC order OPG to prepare an application for the orderly closure and decommissioning of the Pickering Nuclear Generating Station.

All of which is respectfully submitted this 3rd day of May, 2013:

CANADIAN ENVIRONMENTAL LAW ASSOCIATION

Per

Theresa A. McClenaghan

Executive Director and Counsel

Appendix A – Excerpt from IAEA GS-R-2 "Preparedness and Response for a Nuclear or Radiological Emergency, Series no. GS-R-2, Safety Standards (Vienna: IAEA, 2002).

"3.8. **The regulatory body shall require** that arrangements for preparedness and response be in place for the on-site area for any practice or source that could necessitate an emergency intervention. For a facility in threat category I, II or III "Appropriate emergency [preparedness and response] arrangements shall be established from the time that nuclear fuel [or significant amounts of radioactive or fissile material] is brought to the site, and complete emergency preparedness as described here shall be ensured before the commencement of operation." (Ref. [12], Para. 2.36.) **The regulatory body shall ensure that such emergency arrangements are integrated with those of other response organizations as appropriate before the commencement of operation**. **The regulatory body shall ensure that such emergency arrangements provide a reasonable assurance of an effective response, in compliance with these requirements, in the case of a nuclear or radiological emergency. The regulatory body shall require that the emergency arrangements "shall be tested in an exercise before the commencement of operation [of a new practice]. There shall thereafter at suitable intervals be exercises of the emergency [arrangements], some of which shall be witnessed by the regulatory body."** (Ref. [12], para. 2.37.)
3.9. **"In fulfilling its statutory obligations, the regulatory body… shall establish, promote or adopt regulations and guides upon which its regulatory actions are based;… shall provide for issuing, amending, suspending or revoking authorizations, subject to any necessary conditions, that are clear and unambiguous and which shall specify (unless elsewhere specified):… the requirements for incident reporting;… and emergency preparedness arrangements**." (Ref. [10], para. 3.2.)
3.10. "In planning for, and in the event of [a nuclear or radiological emergency], the **regulatory body shall act as an adviser to the government** and [response organizations] in respect of nuclear safety and radiation protection." (Ref. [10], para. 6.6.)
3.11. The national co-ordinating authority and the response organizations shall ensure that the arrangements for response to a nuclear or radiological emergency are co-ordinated with the arrangements for response to conventional emergencies. The **regulatory body shall ensure that the co-ordinated arrangements are implemented adequately by the operators**.
3.12. In the event of a nuclear or radiological emergency the time available for decision making and for implementing an effective strategy for response may be short. It is therefore important that an appropriate management system be used. All organizations that may be involved in the response to a nuclear or radiological emergency shall ensure that appropriate management arrangements are adopted to meet the timescales for response throughout the emergency. Where appropriate, the management system shall be consistent with that used by other response organizations in order to ensure a timely, effective and co-ordinated response." **(Emphasis added)**