Canadian Environmental Law Association
EQUITY. JUSTICE. HEALTH.

July 28, 2017

To:
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And to:
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Sent by email to:
pnerpconsultation@ontario.ca

Re: Provincial Nuclear Emergency Response Plan (PNERP) 2009 Discussion Paper
EBR PROPOSAL NUMBER 0113-0560

Discussion Paper on Planning Basis Review and Recommendations and List of Proposed Changes to the PNERP 2009

Dear Ms. Pastori and Ms. Coleman:

CELA writes to provide our input to the province's discussion paper on the Provincial Nuclear Response Plan as posted on the Ontario Environmental Bill of Rights Registry. The comment period commenced May 15, 2017 and runs until July 28, 2017.

CELA works to protect human health and our environment by seeking justice for those harmed by pollution and by working to change policies to prevent such problems in the first place. For almost 50 years, CELA has used legal tools to increase environmental protection and safeguard communities. As a Legal Aid Clinic, our top priority is to represent low income individuals and

communities and to speak out for those with less influence and who receive less of a say in decision making.

We make many recommendations in this submission, and they are consolidated at the end of the submission in an Appendix.

A. **Background and Context**

CELA commends the province for commencing a public review of the PNERP 2009 and in particular, of the planning basis for the PNERP. That being said, this review is overdue from three perspectives. The current planning basis is decades old. Secondly, the PNERP's internal goal for reviews is to conduct them every four years but as of 2017 it has been eight years since the last review. Thirdly, and most importantly, the Fukushima Daiichi accident and ensuing tragedy occurred in 2011, over six years ago. One of the most significant lessons learned from that accident was the necessity for robust nuclear emergency planning for much more severe offsite accidents than the nuclear industry and regulators had considered probable. Canada, and Ontario in particular with our large reliance on nuclear power, must heed that lesson.

The delay may indicate that the province has not appreciated the importance and urgency of updating nuclear emergency planning in Ontario. Given that the former Minister of Community Safety and Correctional Services, Minister Meilleur wrote to CELA and our colleagues at Greenpeace and Durham Nuclear Awareness in 2013 to promise a forthcoming public review of the PNERP, the passage of four years since that firm commitment was made raises questions about the capacity of the province to oversee nuclear emergency planning. We therefore encourage the province to act forthwith on implementation to upgrades to the Provincial Nuclear Emergency Response Plan so as to ensure that robust detailed planning is in place around all of the Ontario communities located near nuclear power plants. The province must ensure that detailed planning is in place to provide rapid and effective emergency response to at least a Fukushima-scale offsite severe nuclear accident.

RECOMMENDATION 1: The province must act forthwith to implement upgrades to the Provincial Nuclear Emergency Response Plan so as to ensure that robust detailed planning is in place around all of the Ontario communities located near nuclear plants. The province must ensure that detailed planning in each of the potentially affected communities would support rapid and effective emergency response to at least a Fukushima-scale offsite severe nuclear accident in their vicinity.

RECOMMENDATION 2: Ontario should require regular transparent and public updating of the PNERP, including public input and public disclosure of credible modelling of all nuclear facility risks in Ontario.

B. **Sufficiency of the Concept of Improvisation and Siting Issues**

Ever since the Chernobyl accident in 1986, Ontario has added a concept of "improvisation" as a mechanism to respond to accidents that are more severe than the Design Basis Accident. The

current discussion paper cites "a flexible and scalable nuclear emergency response" (Discussion Paper page 46). While it was important that Ontario did recognize that more severe accidents can occur, we submit that specific detailed planning is required to an even greater extent than presently provided in the PNERP. Without such detailed planning, there is a likelihood that more people will be harmed than necessary. The current PNERP states that there might not be "hold up time" where radionuclides are retained in containment for a period that allows evacuation (and some substances to decay). In other words, there might be prompt releases in certain scenarios where containment fails. Despite this, the province of Ontario has been allowing, and in fact dictating, extensive population increase in Durham region in particular, where there are ten operating nuclear power plants. This necessarily means that in the event of a prompt release, there will be exposures to many thousands of people. The only scenario where this would be avoided in a Durham Region nuclear accident would be a situation with meteorological conditions sending any plume straight south over Lake Ontario and in that case, it will be people in Rochester, New York who are on the receiving end of the emissions, along with much of Ontario's drinking water. In a prompt release of radioactive emissions, by definition, the release is occurring before people can be evacuated.

There is a very tendency on the part of the province and its officials to say that in a nuclear accident, people will be asked to "shelter in place". However, repeated statements by the International Atomic Energy Agency (IAEA), Health Canada and other expert bodies notes that the type of dwelling that most people in Durham occupy does not provide sufficient protection. There is better protection from concrete such as may be the case in some multi-story buildings or institutions, but the vast majority of types of housing in Durham are wood-frame, typical Ontario detached housing stock. Nothing about the concept of improvisation for such a severe scenario as would be encompassed by a prompt release will provide sufficient protection for the population in Durham Region. Similarly, for the people living closest to the other plants at Bruce and Chalk River in Ontario, the three U.S. reactors on the shore of Lake Erie (Fermi, Davis Besse and Perry) and the four on Lake Ontario (Ginna, Nine Mile Point 1 & 2 and FitzPatrick plants in the U.S., prompt release would put them immediately in the way of harm unless they benefit from the happenstance of the meteorological conditions of the day.

CELA contends that if the province seriously appreciated the potential for very severe offsite accidents, including the potential for prompt release, it would immediately cease all plans to increase the population in the vicinity of any of the areas of the province that are within 20 kilometres of any nuclear power plants (including those based in Ontario, Ohio or Michigan).

Furthermore, CELA disagrees with the Discussion Paper's conclusion that examination of severe accidents such as Fukushima "does not imply that *detailed* nuclear emergency response planning must be undertaken…" (Discussion Paper page 46). On the contrary, CELA's essential submission is that empirical evidence and the potential for severe offsite high consequence events dictates that <u>detailed</u> nuclear emergency planning must indeed be undertaken. Otherwise people will be harmed when that harm could have been prevented with proper advance planning. It is inappropriate, and CELA rejects the conclusion, that the province continues to rely on "low probability" arguments to avoid properly resourced detailed severe offsite nuclear emergency planning.

It is even more unacceptable that the province is proposing to reduce the level of protection to the Ontario public through its reference to draft Health Canada guidelines that would provide less prevention and precaution than even the present plan which already needs upgrading in our view. CELA emphatically rejects the ICRP notion cited in the discussion paper (page 46) which argues for less detailed planning as probability of an accident decreases. CELA holds this position due to the level of uncertainties and limitations in the nuclear industry's accident probability calculations. In addition to the uncertainties regarding accidents, the IRS 2004 study on the Chalk River NRU reactor referenced in the Discussion Paper confirms that there are also large uncertainties in modelling potential offsite doses to people from nuclear accidents.

"Probability" of various accidents must not the be basis to consider requirements for the PNERP; rather the severity of the potential offsite consequences is the measure by which the province's plan has to be judged, along with the empirical evidence of the catastrophic offsite accidents which have occurred in Chernobyl and Fukushima. For all of those residents already living within 20 kilometres of any of the nuclear power plants, nuclear emergency planning in Ontario must be significantly upgraded as we will discuss further in this submission.

RECOMMENDATION 3: The province of Ontario should immediately cease all plans to increase the population in the vicinity of any of the areas of the province that are within 20 kilometres of any nuclear power plants (including those based in Ontario, Ohio or Michigan).

RECOMMENDATION 4: Rather than based on industry probability estimates, the province of Ontario should base its provincial offsite nuclear emergency planning on empirical evidence of accidents with catastrophic level offsite radioactive releases that have actually occurred; at a minimum equivalent to the releases that occurred at the Fukushima Daichi nuclear plant in Japan following the Honshu earthquake in 2011.

C. Size of the Dose Considered for Provincial Nuclear Emergency Response Planning

The size of the dose considered for provincial nuclear emergency response planning is at the heart of the debate about the size of the accident to consider and plan for. The previous decisions by industry and governments were based on the idea that an accident beyond the design basis was so improbable that it did not merit allocation of resources. Even now after the experiences world wide of numerous severe nuclear accidents, including of course, but not limited to, Three Mile Island, Chernobyl, and Fukushima Daiichi, this concept of low probability continues to over-whelm the discourse in Canada.

For the purposes of this submission we will state that: complex technologies can have accidents; often these accidents occur in ways that were not foreseen; and CANDUs are not in any way immune from severe accidents despite all of the care taken by their operators. Furthermore, there are accident scenarios that are foreseeable and are the subject of continual debate about whether enough has been done to avoid them, and the probability calculations do not sufficiently account for many of these external events including malfeasance and severe natural hazard. In addition, the additive risks of multiple units, fuel pools, nearby industries, transportation corridors, and much additional complexity is not sufficiently calculated in the industry's "probability" calculations.

While the operators' severe accident management response is critical, and we will all hope effective, in getting any situation under control or alleviating some of the worst of the potential scenarios by those on-site efforts, there are situations that arise beyond anyone's prior planning and ability to manage. There is a considerable literature on how large-scale technology accidents have occurred despite contingency plans and management directives[1]. All of this is to say that for the sake of nuclear offsite emergency planning, the province must prepare for a sequence of events that may occur despite all previous efforts, plans, defences, barriers and hopes. In such an event, the offsite nuclear response plan and its resourcing is the last barrier available to prevent or reduce harm to people. In order for this last barrier of nuclear emergency response planning and resourcing to prevent harm, however, it is essential that the province take a clear-eyed realistic look at what could happen in a "worst case" scenario.

There are several lines of evidence to consider in this respect.

- Accidents that have occurred elsewhere (nuclear and non-nuclear) including the Canadian NRX nuclear accident at Chalk River in 1952; the Chernobyl accident of 1986, the Fukushima Daichi accident of 2011; the Bhopal chemical accident of 1984; the space shuttle Challenger accident of 1986; and untold numbers of other accidents involving complex technology, highly specialized engineering, and many apparent safeguards.

- The make-up of the CANDU and BWR's operating in the vicinity of Ontario communities and their "source term." It has been difficult to obtain straight answers (or any answers) from OPG about source term of the Ontario CANDU plants, but this is essential information for a discussion of nuclear emergency planning and the decisions about the necessary level of planning and readiness.

- The location and numbers of Ontario residents living and working in the vicinity of the nuclear plants operating in Ontario, Ohio and Michigan and New York state. Forty million people get their drinking water from the Great Lakes. Millions of Ontario residents live within fifty kilometres of operating nuclear power plants.

- Weather and meteorological contingencies. Instead of using averages or a small number of dates to model weather contingencies, the Ontario provincial plan and the modelling on which it is based should use worst case weather scenarios. Planning for worst case weather will provide for readiness for all of the other weather scenarios. If the exercise is for protection purposes and not for public relations purposes, this should be a basic requirement of the province's approach to the basis for the nuclear emergency response plan.

[1] For a good treatment of this topic see Gerstein, Marc, *Flirting with Disaster: Why Accidents are Rarely Accidental*, Union Square Press (Sterling Publishing Co., Inc.) 2008

- The location and characteristics of sources of drinking water and food in the vicinity of the plants. "Ingestion control" including outreach, modelling, and provision of information should occur within all of the areas in Ontario that are within 100 km of every operating nuclear power plant including those operating in Ontario, Ohio, Michigan and New York. Modelling of impacts on drinking water, and provision of contingency plans that would be able to provide alternate sources of drinking water to the potentially affected population should be instituted immediately. Communities within those 100 km zones should all be advised in advance as to what their drinking water contingencies would be.

The crux of the matter is this: is the province planning for a sufficiently high consequence potential nuclear emergency in the PNERP? The resulting calculations as to potential effects, dose assessment and extent of accident consequences in geographical distance in the discussion paper all flow from the choice of "nuclear accident facility scenarios". (Discussion Paper page 10). These studies on which the Discussion Paper relies are reviewed next.

D. **Choice of the Accident Scenario & Modelling Studies**

(i) **CNSC SARP study 2014** –

This publicly discredited study did not consider a prompt release but relied on a 24-hour hold-up. It also considered a four-fold increase of this release allegedly to respond to public demand for consideration of a multi-unit accident (which is called a "stress test" in the discussion paper). The discussion paper states that this choice is conservative as the hold-up and release duration are both "normally expected to be much longer."

In accepting the premise that a SARP level accident is sufficient for emergency analysis, and in considering that study conservative based expectations of containment holding and filtered systems working as designed, the Discussion Paper fails to take a precautionary approach. It fails to discuss the emergency planning that would be necessary in the event that such "expectations" fail. For example, there may be situations where radionuclides are released promptly; where containment fails; or where the scenario doesn't even allow for collection of the emissions in containment. As the Chalk River IRS study did, analysis that considers unmitigated severe offsite releases must be conducted at all of the reactors of relevance to Ontario communities.

RECOMMENDATION 5: Analysis that considers unmitigated severe offsite releases must be conducted at all of the reactors of relevance to Ontario communities.

Under the non-conservative SARP study, the protection action levels are shown to be triggered, leading to sheltering beyond 20 km, evacuation up to 6 km and thyroid blocking between 6 to 12 km (i.e. beyond the current zone of pre-distribution in the current primary zones in Durham region). (Discussion Paper page 35.) CELA submits therefore that a credible study that

analyzed larger releases would demonstrate the necessity for evacuation, KI ingestion and other protective measures to a far greater distance than these.

RECOMMENDATION 6: CELA recommends that offsite emissions studies must be conducted for every reactor in Ontario and for communities impacted by non-Ontario reactors, which look at the full potential source term that may be released; do not assume operator action will mitigate the accident; do not assume containment will hold; do not take "credit" for post-Fukushima actions; and which consider both single facilities and multiple facilities within the same station being impacted.

(ii) ARGOS Modelling of Accident A and Accident B Scenarios Health Canada and ECCC 2017 –

This study has not been made public although it is relied upon in the Discussion Paper. It should be publicly released. CELA and Greenpeace were provided with a copy upon request. While we appreciate that, and have closely examined the study for our comments, we reiterate that this type of analysis must be in the public domain as a matter of credibility of public nuclear emergency planning.

The first shortcoming is that while the OPG Probabilistic Safety Assessment identified a scenario with three releases (Station blackout (SBO)), the OFMEM in its discussion paper has decided to include only the first release It appears from our review of the ARGOS study that only the first release was utilized.

We also submit that it would be more properly conservative to take the SBO scenario as given, without editorial comments from CNSC to the effect of whether the potential for lack of control room action is "credible." Unfortunately, scenarios without control room action by operators are conceivable, as well as accidents where control room action is not enough to stop the accident. Reading the sequence of events at Fermi 1 and Three Mile Island and many other examples is enough to convince an informed observer that there are many unexpected scenarios where systems don't operate as planned and operator action does not stop accident progression due to various factors not the least of which is that the system may not be behaving as expected. Accordingly, the modelling should be run without an assumption that control room action will always save the day.

Oddly, while the discussion paper mentions quantitative release information for the SARP study; it does not do so in its analysis of the ARGOS study, instead translating the results directly to an interpretation of evacuation, thyroid blocking and ingestion distance criteria (Tables 3 to 6, page 39 of the Discussion Paper).

Turning to the ARGOS study (provided to us but again, regrettably not public) we see that the dose figures used were for Accident A, taking cesium 137, 1.02×10^{14} and I^{131} at 3.93×10^{15} among others. Accident B had cesium 137 of 5.21×10^{14} and 3.10×10^{10} among many others.

These figures indicate that the ARGOS study was of the same order of magnitude releases as the SARP study, both of which were not as significant as the Fukushima.

There are other limitations to the ARGOS study. For example, detailed weather patterns for each day at midnight between July 10 and July 18, 2016 were modelled, and while the paper states that this was conservative due to the usual more limited dispersion at night, this is a very brief run of dates on which to draw modelling conclusions. This is also in stark contrast to the IRS 2004 study done for Chalk River Laboratories (also cited in the discussion paper) in which four years of weather data and five years of precipitation data was utilized and modelled.

RECOMMENDATION 7: Modelling of weather conditions as an input to emergency planning should include four to five years of 365 day per year weather data at each reactor.

CELA also objects to the use of a "sheltering dose reduction factor" when interpreting the results for exceedance of evacuation criteria, given that there is clear international guidance against relying on sheltering for certain radioactive emissions. (Discussion Paper page 38).

RECOMMENDATION 8: Modelling of emissions and doses for evacuation planning should be conducted without any "sheltering dose reduction factor".

The Discussion Paper argues that the chosen accident scenario discussed shows evacuation criteria for a five-year-old child exceeded at up to 12 Km; iodine thyroid blocking exceeded at up to 63 km for a five-year-old child; and food ingestion exceeded at up to 72 km. (page 39) When comparing the Discussion Paper to the actual ARGOS paper it is clear that there has been some cherry picking of results. The ARGOS study cited shows evacuation exceeded for Accident B for a five-year-old child up to 70 kilometres – even with the "sheltering dose reduction factor."

There are several implications from this study. Firstly, if the modelling utilized a larger accident more comparable to Fukushima, then we can assume that the protective actions would be required to a greater distance. Secondly, if the meteorological modelling included a whole year we might also see greater distances within which protective measures are required. Thirdly, even within this less conservative modelling, it appears that iodine pre-distribution is required throughout the secondary zone, with rapid access required to be available beyond that out to 70 km, and ingestion control is required up to 100 km (i.e. we suggest adding some buffer to the above-noted reported results). Furthermore, in CELA's submission the secondary zone itself needs to be expanded according to these results. If more conservative dose modelling with larger releases was conducted, these conclusions would presumably be too limited and likely indicate greater requirements for sufficient emergency planning detail, preparedness, and resourcing within larger planning zones.

Accordingly, we disagree with the conclusion in the Discussion Paper that based on the ARGOS study evacuations are not required beyond the current Primary Zone boundary. That conclusion is not only contradicted by the reasonable conclusions we draw from reviewing the ARGOS modelling, limited as it is, but also by the empirical experience of actual accidents such as Fukushima and Chernobyl.

We also disagree with the conclusion in the discussion paper based on the ARGOS modelling that the thyroid blocking requirements be based on the adult results. We note that the paper indicates iodine thyroid blocking requirements extending to 125 km for adults; and the same data indicates exceedance of thyroid blocking criteria up to 145 km for the five-year-old child (table 9 of the ARGOS study). More conservative modelling, as discussed above, may indicate even greater distance requirements. It is also inappropriate to use the adult results for thyroid blocking when it is of most import to babies and children. The OFMEM Discussion Paper draws conclusions based on selected adult modelling results. However, the ARGOS study stated, "While ARGOS produces results for the 5 receptor age categories (adult, 15-year-old, 10-year-old, 5-year-old, 1-year-old), the 5-year-old child was verified to be the most sensitive (i.e. received the highest doses in all cases." (page 5 of the ARGOS study).

It is important to note the statement in the ARGOS report about the modelled run on July 15th, 2016. It states that

> "These results are also significant because they have not been averaged and each modeled run represents a possible outcome based on real forecast meteorological conditions. Of interest is the situation occurring on July 15th, 2016. On this date, considering only the thyroid dose, the maximum dose with distance results for an adult exceeded the criteria for stable iodine thyroid blocking up to a distance of 110 km, which could be reduced to 85 km by applying dose reduction from sheltering. On the same day for a 5-year-old child, the maximum dose with distance exceeded the criteria out to 170 km, which could be reduced to 115 km with sheltering with dose reduction from sheltering." (Page 11 of the ARGOS study).

Finally, in terms of the ARGOS results, we also disagree with the Discussion Paper's conclusion regarding ingestion control. Again, the MAX results are pertinent for drawing ingestion control boundaries and undertaking the necessary planning work to identify the boundaries, notify farmers and other producers, and to be prepared to undertake the necessary monitoring and food controls in the event of an accident. If even this relatively non-conservative modelling based on only one week of weather conditions in one year indicates the necessity for ingestion control out to at least 72 kilometres, the appropriate response is to establish ingestion control to 100 km or further.

CELA's view is that the ARGOS results show the need for much more extensive modelling. In the meantime, the conclusions to be drawn from the ARGOS results are not as the Discussion Paper proposes, to keep the status quo, but rather to increase all planning zones.

RECOMMENDATION 9: All planning zones and precautionary measures under the PNERP should be increased consistent with robust, credible, transparent precautionary modelling that considers the full source terms, all radionuclides of relevance to health, several years of 365 days of weather data, and the most vulnerable population (i.e. five-year-old children). This modelling should also be subject to public, transparent peer review of its statistical validity.

(iii) The Fukushima Accident & the UNSCEAR Report on Fukushima

In 2011, following the earthquake and tsunami off the coast of Japan, as noted in the Discussion Paper (page 40), immediate evacuation was ordered for 20 km around the Fukushima plant. What the discussion paper doesn't specify is that the further evacuations it mentions which occurred to the north-west were to a distance of 55 kilometers from the plant.

The Discussion Paper relies heavily on Health Canada's potential revised guidance of 50 mSv for evacuation instead of the current PNERP's 10 mSv lower evacuation protective action level. The result of this would be less protection of the Ontario population around the Ontario, Ohio, Michigan and New York nuclear power plants than the current plan and CELA disagrees with this proposal.

In terms of the point that some evacuees received the same doses as if they had stayed in place, the correct conclusion to draw is that in the 2011 Fukushima events, modelling was inaccurate, monitoring was insufficient, and errors in evacuation orders were made; not that people should have stayed in place to receive doses. CELA finds it odd that the Ministry of Community Safety is at pains to downplay the importance of protective actions such as evacuation, which have the potential to help the population reduce and even avoid doses from the radioactive emissions from a severe offsite nuclear power plant accident. We are concerned that this analysis has been coloured by the province's role as owners of OPG, the owners of all of the operating commercial nuclear power plants in Ontario.

We submit that the Discussion Paper does not take a precautionary approach; in fact it takes the opposite approach in its consistent tendency to suggest less protection for the population than historical experience and the cited studies would suggest. The harms suffered by evacuees in Japan outlined in the discussion paper were in part due to the very lack of preparation that the discussion paper is proposing to entrench in Ontario. Prior to the Fukushima accident, Japan's industry and regulator did not take the prospect of severe offsite accidents seriously; and had not planned for evacuating vulnerable populations such as the frail elderly and seriously ill hospital patients. As a result, these populations were not evacuated to locations with adequate health care.

CELA also submits that it is inappropriate for the Discussion Paper to repeatedly argue that "Fukushima action items" taken by operators (such as providing for emergency power connections), and potential operator action make it less necessary to be prepared for a very severe offsite accident. This is inconsistent with the appropriate approach to nuclear emergency planning, which as we submitted at the outset, implies that the other barriers have failed. By definition, the offsite response plan and required resources must be based on the assumption that other barriers have failed.

The Discussion Paper also errs on page 42 where it purports to rely on alleged distinctions between CANDU technology and Light Water Reactors such as those at Fukushima. An example is the reliance on the presence of a vacuum building. There are scenarios where the vacuum building may not hold and this must be accounted for in emergency planning. Similarly, there is reliance on "a filtered release" but again, there could be scenarios with prompt release; without filtration; or with failure of filtration from various facilities in Ontario; and other sequences could occur where these measures are not available. We cannot stress enough, that in

any of these cases, the population is relying on the state of emergency response planning and resourcing for their protection.

We also stress again, as we noted at the outset of this submission, that Ontario has put itself at far greater risk even than Fukushima in the event of a severe offsite accident because of its insistence on building up the population in the vicinity of the Durham plants at Pickering and Darlington. There are large and growing populations within 3, 10, and 20 kilometres of the plants and beyond. Japan had a lower population in the vicinity of the Fukushima plant and fewer people therefore to be exposed or to evacuate.

(iv) Candesco Report for CRL (2016)

CELA and Greenpeace were provided a copy of the Candesco report for CRL, 2016. Again as with the other studies referenced in the Discussion Paper, it should be made public. Extensive parts of the report were redacted. It was prepared for the purpose of analyzing KI distribution in the secondary zone at Chalk River. Despite the redactions, we commend CRL for providing the report which includes an analysis of which radioiodine nuclides are of most concern and why; and what the radioiodine inventory is; which facility is the greatest threat and therefore the subject of most analysis. However, the effective dose is given for adults whereas CELA submits that calculations and emergency planning should be based on effective dose to children.

The Candesco report ruled out analysis of the radioiodine risks resulting from two significant types of analysis (at page 13/28 of that report):

(i) "those that assume failure of the reactor to shut down following an initiative event and which lead to rapid core destruction."
(ii) "severe seismic events that are well beyond design basis."

CELA objects to this approach. It is not precautionary. Emergency planning including analysis of radioiodine pre-distribution and distribution measures that would help to protect people especially children in a severe unmitigated offsite accident should include these accident scenarios.

RECOMMENDATION 10: Analysis of benefits of KI ingestion must be conducted for communities in the vicinity of the Chalk River NRU (and all other nuclear power or research reactors within 100 km of Ontario communities) based on accidents including those that assume failure of the reactor to shut down following an initiating event and which lead to rapid core destruction; as well as those arising from severe seismic events that are well beyond design basis.

Shockingly the rationale in this report for eliminating a severe seismic event that would affect the NRU is that extensive damage would also be caused to other buildings and communications in the area. The authors suppose that directions to consume KI would be difficult to communicate in a timely way so as to be consumed in the small timeframe when KI is most effective. On that basis, they propose that "Therefore the practical aspects associated with

ensuring timely consumption of KI pills following a severe seismic event eliminate this scenario as being an appropriate input to the planning basis for iodine prophylaxis."

This is an unacceptable conclusion.

RECOMMENDATION 11: Analysis of benefits of KI ingestion must be conducted for communities in the vicinity of the Chalk River NRU based on very severe seismic events that could severely damage the NRU in addition to other buildings and infrastructure in the communities in the vicinity.

RECOMMENDATION 12: Analysis of benefits of KI ingestion must be conducted for communities in the vicinity of the Chalk River NRU and all other nuclear power or research reactors within 100 km based on very severe seismic events.

The Candesco study (which as noted, was focused only on radio-iodines and no other radionuclides such as tritium) also did not analyze the doses and risks from the rest of the CRL facilities on the basis that the NRU provided the largest source of hazard. Nevertheless, the remaining facilities must be analyzed in terms of their potential contributions either singly or cumulatively to the offsite emissions in the case of major multi-unit or multi-facility accidents.

RECOMMENDATION 13: The remaining Chalk River laboratories facilities must be analyzed in terms of their potential contributions either singly or cumulatively to the offsite emissions in the case of major multi-unit or multi-facility accidents.

In addition, the Candesco study redacted the portions relating to transportation entirely and it is not possible for CELA to determine what was or wasn't analyzed in that respect.

RECOMMENDATION 14: Transportation to and from the CRL facilities must be analyzed transparently with public input in terms of offsite emissions hazard and responsive emergency planning and preparedness.

(v) ISR Study for CRL (2004)

This was a study prepared for Ontario Fire Marshall and Emergency Management Office in 2004 regarding offsite consequences of a release of radioactivity at Chalk River laboratory. A copy was provided to CELA and to Greenpeace on request by Chalk River Nuclear Laboratories, rather than the OFMEM (despite it having been prepared for the latter). This study should also be made public. This study was prepared for OFMEM following a 2001 evaluation of the then interim Provincial Nuclear Emergency Response Plan, and focused on the NRU, a research reactor.

This study has a good statement of the main emergency planning principle that "Emergency preparedness is one way to minimize consequences, and therefore risk. Emergency preparedness is defined as the measures that enable individuals and organizations to stage a rapid and effective emergency response, which includes the implementation of protective actions to limit the exposure of the public to radioactive contamination." (at page 13)

However, as stated earlier, CELA objects to the principle that likelihood (as calculated by the reactor operators and industry) should drive the level of detail and preparedness in the nuclear emergency plans. Instead, empirical evidence of accidents that have occurred elsewhere, together with the potential consequences of nuclear accidents should drive the needed level of detail and preparedness to ensure that the public is properly protected in case of a very large offsite release of radioactive emissions. We would note in particular that this study was conducted 7 years prior to the accident at Fukushima and therefore does not adequately reflect up to date empirical evidence and experience of nuclear accidents. Statements such as "such hypothetical severe accidents would require so many concurrent failures and so many unusual circumstances that they certainly don't warrant the same level of detail in planning" (page 13) should be disregarded, and should now not be repeated by the emergency planning community. That sentiment had been expressed by the Japanese industry operators and regulators prior to the Fukushima accident, to their later regret.

One concern is that the study stated that it relied on dispersion and dilution to reduce potential dose; we object to this approach in principle. Another concern is that the study had no analysis of impacts downstream of the NRU plant at Chalk River in the event of a severe accident.

Among other provisions, in the event of an accident or leakage at the NRU, radionuclides are intended to be directed to a remote reactor stack, and "radionuclide particulates and radioiodine are removed by the Emergency Filtration System before release from the stack." The stack is 46 metres high and as noted earlier is intended to take advantage of dispersion and dilution to reduce doses to individuals.

The study outlined three categories of accidents. It treated the higher probability and lower consequence accidents as "planning accidents" for which detailed planning would be conducted. The second category was "Severe Accidents with Mitigated Releases" and the third was "Severe Accidents with Unmitigated Releases". All three types were analyzed in this report. CELA submits that provincial nuclear emergency planning and preparedness, with sufficiently detailed and resourced plans, are required for all three types of accidents in the vicinity of all of Ontario's municipalities located near operating plants in the U.S. or Ontario. Chernobyl and Fukushima were examples of the third type of accident and this is the type of accident (along with the other two less serious types) for which the public expects emergency planning to be capable of responding. It is useful to set out the second and third types of accident as described in the IRS report verbatim (at page 14 of that report):

> *"Severe Accidents with Mitigated Releases*
>
> - *Lower probability but higher consequences*
> - *Accidents involving significant failure of process systems combined with significant failure of safety systems and/or operator actions; and*
> - *Consequences are partially mitigated because the release is through a tortuous path and it contains a lot of heat so it rises or the release takes place through filters, reducing fission product (or other released material) available for dispersion."*

"Severe Accidents with Unmitigated Releases

- *Lowest probability but highest consequences;*
- *Accidents that are normally very similar to severe accidents with mitigated release, but without the benefit of mitigation; and*
- *Involves the release of significant amounts of fission products to the environment without the benefit of confinement, significant plating or filtration."*

RECOMMENDATION 15: Ontario's nuclear emergency planning basis should be responsive to "Severe Accidents with Unmitigated Releases" for each of the nuclear reactors operating in proximity to Ontario communities. This approach with applicable modelling should be applied to every community within 100 km of any Ontario or out-of-province nuclear reactor.

The IRS 2004 Study for OFMEM proceeded to analyze accidents in each of these categories at Chalk River, and to calculate "dose consequences and the risk of acute effects". The study utilized adults for estimating dose to individuals as opposed to "the most exposed individual". CELA submits that emergency planning should be based on most exposed individuals, i.e. usually children, rather than adults, for the purpose of estimating doses and making decisions on emergency planning and the measures that would be responsive to severe nuclear accidents. The IRS study noted that "worst case dose consequences" are usually used in reactor licensing. The same should be the case for emergency planning.

RECOMMENDATION 16: Emergency planning should be based on most exposed individuals, i.e. usually children, rather than adults, for the purpose of estimating doses and making decisions on emergency planning and the measures that would be responsive to severe nuclear accidents.

The 2004 IRS study also used four years of weather data and five years of precipitation data for the modelling at the Chalk River NRU reactor (page 37 of the IRS study). This is a good practice and should be emulated for the rest of the nuclear reactors operating in the vicinity of Ontario communities. This is to be contrasted to the ARGOS study mentioned above where only eight days of weather were used, from only one year, at only one time of day. This is not a good practice for the modelling that is needed to support Ontario's nuclear emergency planning. All of the communities deserve better meteorological modelling to support the emergency planning basis and protective measures decisions of the nuclear emergency plan.

RECOMMENDATION 17: Meteorological modelling should be conducted for all of the Ontario communities located within a 100 km zone of a nuclear reactor using a minimum of four years of weather data.

Despite large uncertainties acknowledged by the IRS authors in dose modelling, they modelled for worst case weather conditions in arriving at the distances within which the relevant protective measures would be indicated. For the most probable "Planning" accidents as defined in the study, sheltering is indicated within 2 to 7 km depending upon whether using 1 mSv or 10 mSv Protective Action Levels (PALs). For the severe accidents with mitigated release as defined in

the study, sheltering was indicated within 3 to 9 km. However, this modelling used the 99 percentile for weather, rather than 100 percentile as had been done for the more likely category 1 accidents. The modelling for the more severe accidents with mitigated and unmitigated releases should include the 100 percentile for weather. For the most severe accidents with unmitigated releases, only deterministic effects were modelled. The modelling should be conducted for stochastic effects as well, and the doses that are being considered for this analysis in terms of the recommended protective measures should be given. Only the results (i.e. in distances) were provided in the study.

This modelling should also be repeated with the use of most exposed individual (child) calculations to arrive at recommended PALs.

RECOMMENDATION 18: Modelling for projected dose should be conducted using the most exposed individuals (children) in the vicinity of each of the nuclear reactors located within 100 km of Ontario communities.

RECOMMENDATION 19: Modelling for the more severe accidents with mitigated and unmitigated releases should include 100 percentile data for weather for a minimum of four years so as to attempt to include worst case conditions in the vicinity of each of the nuclear reactors located within 100 km of Ontario communities.

RECOMMENDATION 20: Modelling should be conducted for stochastic effects for the most severe accidents with unmitigated releases for each of the nuclear reactors located within 100 km of Ontario communities.

RECOMMENDATION 21: The province should calculate and provide results in terms of effective doses for the analysis of the most severe accidents with unmitigated releases for each of the nuclear reactors located within 100 km of Ontario communities.

The ISR 2004 report noted that decisions on planning zone sizes must use a range of factors including social, geographic and economic factors (page 51 of that report). CELA submits that this discussion and the choices made must be conducted in public and with full transparency. Input from Ontario residents must be given significant weight. The principles of full and informed consent should underlie public consultation on this question not only now but during future reviews of Ontario's nuclear emergency plan. This requires much more transparency and disclosure than has occurred to date in Ontario. For example, the suggestion that only deterministic effects should form the basis for planning in response to the most severe accidents with unmitigated releases is unlikely to be agreed to by most informed members of the public living and working with 100 km of nuclear reactors.

RECOMMENDATION 22: Ontario provincial decisions about size of planning zones for nuclear accidents should always be made in public, with full transparency including as to all inputs for modelling of nuclear accidents, and all results of modelling in terms of effective doses.

RECOMMENDATION 23: The principles of "full, informed consent" should underlie Ontario's approach to consulting the public on all matters relating to nuclear emergency planning.

The doses in severe accidents with un-mitigated releases were not described in the ISR report; they should be provided.

RECOMMENDATION 24: Provide the results of the doses calculated for severe accidents with un-mitigated releases for the Chalk River NRU reactor, and for each other reactor located within 100 km of Ontario communities.

The IRS 2004 discussion paper is also thirteen years old and preceded the Fukushima Daichii accident that followed the 2011 Honshu earthquake and tsunami. Accordingly, some of the discussion and analysis is dated and socially unacceptable for a jurisdiction which remains heavily reliant on nuclear power such as Ontario.

An example is found in the discussion pertaining to iodine prophylaxis (potassium iodide or KI pills). The report states that

> "Severe accidents with un-mitigated releases could lead to doses that would justify iodine prophylaxis. However these accidents are so improbable that, while detailed planning to reduce the risk of acute health effects is considered reasonable, detailed planning to reduce stochastic effects through iodine prophylaxis is probably not justified." (at page 51 of the study)

The above quoted statement about the lack of justification of KI in severe accidents has since been contradicted by the federal regulator, the CNSC, which introduced a requirement that the Canadian nuclear power plants as well as Chalk River's NRU pre-distribute KI within the primary zone before the end of 2015. Similarly, Switzerland has now required KI pre-distribution within greater distances than previously considered appropriate by industry. These decisions were occasioned by modelling conducted in the wake of the Fukushima disaster, and societal decisions as to the level of protection.

It is also notable that the Chalk River planning zones and readiness were reduced since the date of the IRS study. CELA has examined the March 2012 version of the Laurentian Hills Deep River Nuclear Emergency Plan. It does not contain a reference to evacuating up to 20 km beyond the Chalk River facility in the event of an "intermediate to severe NRU core damage with accompanying unavailability of the emergency filtration system" as cited on page 58 of the IRS study. CELA queries when and why this change was made and whether the local populations were consulted at all or to what extent, when the evacuation readiness was reduced to the current 9 km primary zone. Furthermore, the primary zone has been reduced from 10 km to 9 km at some point since the IRS study. No changes to municipal and off-site nuclear emergency plans should be made without consulting the public within 100 km of each nuclear reactor. Furthermore, as noted earlier, the IRS study is dated and preceded the Fukushima accident.

RECOMMENDATION 25: No changes to municipal and off-site nuclear emergency plans should be made without consulting the public within 100 km of each nuclear reactor.

RECOMMENDATION 26: No planning zones should be reduced unless the reactor ceases operation. A precautionary approach should be applied to all decisions regarding the emergency planning zones surrounding each reactor.

U.S. Reactors

No studies have been conducted by the Canadian authorities as to the potential exposures of Ontario populations living in the vicinity of the Fermi 2,Davis Besse reactors located in Michigan and Ohio respectively, Perry on the shore of Lake Erie, and Ginna, Nine Mile Point 1 & 2 and FitzPatrick on Lake Ontario.

Unlike the case for Ontario-based CANDU stations and Chalk River Nuclear Laboratories the Discussion Paper relies on no accident modelling to estimate the consequences and need for offsite emergency measures in the event of an accident at the Fermi and other U.S. based nuclear stations that are in proximity to Ontario communities. This is inappropriate as the Ontario residents living in southwest Ontario deserve the same level of protection as Ontarians located near the Ontario-based plants. The OFMEM Discussion Paper observes that American Light-Water Reactors like the one at Fermi could release *more* radioactivity in the event of a severe accident than the CANDU reactors in Ontario. It does not provide information on how much more and how this could require more expansive emergency measures.

The OFMEM Discussion Paper recommends a 20km Contingency Zone "double" the size of the 10 km Primary Zone surrounding Ontario-based stations, but makes no such recommendation for Fermi. It says the Fermi Contingency Zone will be determined at a later date. Applying the same approach to Fermi 16 km Primary Zone would mean a 32 km Contingency Zone. This would reach the town of LaSalle. The Discussion Paper contains no discussion or recommendations related to preparing for an accident at the Ohio-based Davis-Besse nuclear station, which is located at a distance to Essex County similar to that of Fermi nuclear station.

The Discussion Paper implies Ontario lacks the independent capacity to model accidents at the Fermi nuclear station in the event of an accident. The province thus doesn't have the capacity to independently assess risks to its citizens and advise on emergency measures. Instead it appears Ontario would rely on advice from the American authorities in the event of an accident.

RECOMMENDATION 27: The province should include requirements for potassium iodide (KI) pre-distribution and availability for Ontario communities living in proximity to U.S. (nuclear stations (Fermi, Davis-Besse, Perry, Ginna, Nine Mile Point 1 & 2 and FitzPatrick) equivalent to requirements for Ontario-based nuclear stations in its updated nuclear emergency plan.

RECOMMENDATION 28: The provincial government should transparently consult with municipalities and citizens on the establishment of emergency planning zones on the Ontario

side of the border, for the Fermi, Davis-Besse and Perry nuclear station on Lake Erie and Ginna, Nine Pile Point 1 & 2 and FitzPatrick on Lake Ontario. Such zones should be informed by international best practices and accident modelling.

RECOMMENDATION 29: The province should include a reliable funding mechanism to support nuclear emergency preparedness for communities in Southwestern Ontario in the next PNERP. Such funding models could include a regulatory charge to support a statutory nuclear emergency planning fund, to be imposed on all Ontario nuclear power, research and medical purposes reactor operators, proportional to their rated power. The fund should support all Ontario municipalities located within 100 km of any Ontario or non-Ontario based nuclear reactors to properly resource their nuclear emergency response plans and roles.

E. Involvement of the Public and Definition of "Stakeholder"

CELA is involved in myriad government decision making processes. This consultation and the processes leading to it are the first time we have ever encountered a situation where the definition of "stakeholder" includes the affected industry and government bodies but steadfastly excludes the public. We submit that the potentially affected public are the epitome of the "stakeholders" in this debate. They are on the front line of any severe accident. It is egregious that the province states in the Discussion Paper that the 2009 review "followed a full stakeholder consultation process" (Discussion Paper page 12), when it included only the industry operators, federal regulator, provincial and municipal officials. A culture of secrecy has been fostered on this topic and it is antithetical to good public decision making. This is not necessary for any serious purpose of public safety on the topic of nuclear emergency planning.
The discussion paper states that non-planning basis recommendations will l be used to inform other sections of the PNERP as it is updated (page 47). CELA stresses that these updates must be subject to thorough public consultation and input.

RECOMMENDATION 30: The non-planning basis updates to the PNERP must be subject to thorough, transparent and fully informed public consultation and input.

CELA'S RESPONSE TO DISCUSSION PAPER'S CONCLUSIONS AND DISCUSSION

In its conclusion section, the OFMEM discussion paper asserts that severe accidents have been studied and form the basis for the protective action measures in the current provincial nuclear emergency response plan. However, CELA has reviewed several of the key studies referenced in the OFMEM discussion paper and disputes that they form an appropriate basis for the recommendations contained in the Discussion Paper.

At page 46 of the Discussion Paper, OFMEM asserts that "the examination of such severe accidents does not imply that *detailed* nuclear emergency response planning must be undertaken" for what they call "these extremely low probability events." CELA disagrees completely with this recommendation. As we have submitted earlier in our comments, the province must now plan for nuclear emergency response in light of empirical evidence world-wide regarding severe

offsite nuclear accidents which have occurred. Reliance on probability arguments is fraught with uncertainty and inaccuracy due to omitted hazards and events omitted. Other issues with those industry based risk and safety assessments include the difficulty of calculating probabilities for many types of events. More fundamentally from the perspective of nuclear emergency planning, those probability arguments provide zero protection in the event of a large offsite accident with unmitigated releases.

A major lesson of the Fukushima accident was the need to take such severe accidents much more seriously, and to undertake detailed planning which has the potential to actually protect people in such an event. In our submission, the failure of the province to do so thus far, and the ongoing intractable attitude expressed in the discussion paper amounts to a significant failure of public policy. The province owes it to the communities who live in proximity to nuclear reactors in Ontario to require and resource detailed nuclear emergency response planning for all of the measures that would provide protection to reduce, and preferably avoid, radioactive dose exposures to members of the public. Failure to do detailed planning risks repeating the experience suffered by many in proximity to the Fukushima Daichi plant who were harmed by the failure to plan adequately. Failure to undertake detailed nuclear emergency planning means that authorities are relying on improvisation in the face of a severe offsite accident which extends beyond the current primary zones. Improvisation as an approach to nuclear emergency planning is socially and ethically unacceptable.

CELA disputes the proposal cited by the discussion paper at page 46 (relying on the ICRP) that the amount of detailed planning should decrease as the probability decreases. As submitted earlier this is a faulty approach to nuclear emergency planning. Instead the amount of detailed planning should be based on the potential consequences of the most severe accidents. With the larger accidents, the potential health consequences increase dramatically and many of these can be prevented with detailed planning and resourcing. Given Ontario's heavy reliance on nuclear power and its plans to continue to do so, residents around the plants must be well protected with detailed emergency planning. Relying on the industry's risk studies in order to rule out detailed planning for the most severe accidents is simply unacceptable.

There is a fallacy in the argument that the resources for intensive planning should be directed to events like forest fire and flooding. Nuclear power generation with its attendant accident risks is an active choice made by the province and the cost of excellent nuclear emergency planning must be incorporated into the costs of that energy choice. Issues of cost for other hazards have no bearing on the discussion of the appropriate planning basis for the PNERP.

In addition, contrary to the statement that similar responses are required "regardless of the cause" to various types of emergencies (at page 46), severe offsite nuclear accidents need highly specific and detailed planning for everything from first responders and medical capacity to communication with residents, evacuation plans, hosting sites, KI distribution, vulnerable communities' care and much else. Medical care, transportation, food and water ingestion and many other aspects of the plan are completely specific to the nuclear radioactive materials hazard and not generic or comparable to other hazards.

CELA objects to the reliance contained in the Discussion Paper on "Fukushima enhancements" incorporated at the power plant facilities (page 47) in terms of its relevance to severe offsite nuclear emergency response plans. At least three times in the discussion paper the argument is made that these post-Fukushima operating improvements reduce the level of emergency planning and readiness that is required. While those "improvements" such as improved access to power and water supply in a power failure / station blackout scenario are important, they should not be credited against offsite emergency response at all. If an offsite nuclear emergency response is ever required, by definition, it means a scenario occurred where something went very wrong despite all of these other initiatives, efforts and barriers. A multi-barrier approach is definitely appropriate; what is not appropriate is the argument that the last possible barrier, that of emergency response, should be weakened because of reliance on other earlier barriers. By definition a multi-barrier response requires every barrier to be as robust as possible and this includes a severe offsite unmitigated release emergency response plan.

One of the conclusions stated in the Discussion Paper recites the CNSC recommendation that "provincial nuclear emergency planning authorities undertake a review of the planning basis in view of multi-unit accident scenarios." (page 48) However despite the six years since Fukushima the province did not do this multi-unit review for the purposes of the current consultation and review of the PNERP planning basis. No excuse is given for this failure, which is a significant and urgent omission in Ontario's planning basis. It also raises the question whether OFMEM is intending to avoid further public consultation on this very highly important issue of multi-unit implications for the planning basis.

RECOMMENDATION 31: Ontario's provincial cabinet should direct OFMEM to revise the planning basis of the PNERP to institute a public consultation on a specific planning basis proposal that includes multi-unit accident scenarios within 90 days of the conclusion of this consultation. The current PNERP should then be revised forthwith to reflect the Ontario context whereby the potential for multi-unit scenarios is very real and of considerable concern import with consequent increases to the size and resourcing of Ontario's PNERP nuclear emergency planning zones around the multi-unit stations.

The Discussion Paper also contains a conclusion (page 48) that using new intervention levels, reduced planning zones could be justified. CELA strongly objects to this conclusion, which is based on proposed intervention levels that are LESS protective of people, and on industry based risk studies. Rather, as has been done recently in Switzerland, the planning zones need to be increased; and the measures responsive to severe offsite accidents need to be more protective of people; i.e. implemented in a more precautionary manner and therefore either at a minimum at the present lower PALs or even more stringent (i.e. protective) intervention levels.

RECOMMENDATION 32: Following Switzerland's recent decision, based on planning for more severe offsite, unmitigated accidents at an INES 7 level, Ontario's nuclear emergency planning zones need to be increased in diameter around each nuclear reactor.

RECOMMENDATION 33: The measures responsive to severe offsite accidents must be specified to be implemented in a more precautionary manner and at a minimum at the present lower PALs.

The Discussion Paper also asserts that "flexibility is inherent in the PNERP which …. provides a substantial basis for the expansion of response beyond both the Primary (for exposure control) and Secondary (for ingestion control) zones…" (page 49).

CELA submits that without detailed advance planning for an INES 7 level offsite accident, the province cannot be confident that the current plan would be responsive to that larger accident. As submitted earlier, "improvisation" is not an emergency plan. Furthermore, the experience of the Fukushima Daichi accident demonstrated that a failure to have in place detailed planning for the most severe offsite accidents results in greater harm and mortality to people; the prime example is that of evacuation of vulnerable people including seniors and hospital patients.

RECOMMENDATION 34: The PNERP must provide for detailed planning within an expanded primary zone as well as within an expanded secondary zone. While adaptation may be required, the province should cease to rely on improvisation and adaptation as its main strategy for responding to large offsite accidents that require evacuation and other measures beyond the primary zone.

The Discussion paper also recommends the draft health Canada generic criteria as the basis for sheltering and evacuation (page 49). CELA submits that providing less protection to people is fundamentally at odds with the response expected by the public after the Fukushima Daichii accident. Rather the province should retain at a minimum the lower PALs currently provided in the present plan, and apply them consistently across the province in all communities within 100 km of Ontario or non-Ontario reactors.

RECOMMENDATION 35: The province of Ontario should retain at a minimum the lower PALs currently provided in the present plan, and apply them consistently across the province in all communities within 100 km of Ontario or non-Ontario reactors.

The Discussion Paper repeatedly notes that post-Fukushima enhancements and emergency mitigating equipment reduce the likelihood of accidents (page 49). As we submitted earlier, other barriers in a multi-barrier approach do not remove the necessity to be able to respond and protect people in the event of a failure that causes severe offsite unmitigated releases. All decisions to reduce public safety, reduce planning zones, reduce resourcing, and increase protective action levels on this basis should be reversed by the province. Rather the province must require increased public protection in the PNERP in all of these respects.

RECOMMENDATION 36: All recommendations or decisions to reduce public safety, reduce nuclear emergency planning zones, reduce emergency planning resourcing, and increase protective action levels on the basis of post Fukushima enhancements should be rejected or reversed by the province of Ontario. Rather the province must require increased public protection in the PNERP in each of these respects.

The Discussion Paper (page 49) also attempts to rely on an out of context NRC report to assert that current size of emergency planning zones is appropriate including multi-unit sites. The level of reliance by Ontario on multi-unit sites is unprecedented. The location of two multi-unit sites in a highly populated region is also unprecedented. A Fukushima level accident at the Ontario multi-unit sites could be far more consequential than even the impact was in Japan due to the vulnerability of those sites to accidents at one unit impacting the others; the constraints of containment at those sites; the drinking water context of the Great Lakes; and the high population density in the vicinity of some of those plants.

RECOMMENDATION 37: The province of Ontario should base the PNERP on the Ontario-specific context of each community located within 100 km of any nuclear reactor, including the CANDU-specific context of multi-unit sites, in addition to all other site contexts such as high, intermediate and low-level waste storage and management on those sites.

The Discussion Paper supports retention of the current contiguous zones in reliance of the SARP study and the ARGOS study. The province should reconsider the contiguous zone delineation based on modelling that utilizes an INES 7 level accident (at a minimum).

RECOMMENDATION 38: The province should revisit the size and delineation of the contiguous zone within each community in the vicinity of a nuclear reactor based on modelling that utilizes an INES 7 level accident (at a minimum).

The Discussion Paper recommends that the current primary zone is sufficient for evacuation purposes based on the SARP study (page 50). This conclusion should be revisited based on modelling that utilizes an INES 7 level accident (at a minimum).

RECOMMENDATION 39: The size and delineation of the Primary zone, and preparedness for evacuation, should be revised based on modelling that utilizes an INES 7 level accident (at a minimum).

The Discussion Paper relies on the industry-based asserted “unlikelihood” of a station blackout scenario, along with the potential to improvise and expand the measures that might be needed in that scenario, such as evacuation and KI distribution (page 50). As discussed earlier and as experienced at Fukushima, evacuation has the potential to remove people from harm’s way, but only with advance detailed planning, resourcing and readiness. As a result, this analysis of this one scenario indicates the need to expand the primary zone as well as to increase the geographic distance within which KI is pre-distributed. There may be many other scenarios. Failure to pre-distribute KI will mean that people and particularly children would be unlikely to be able to ingest KI in the time frame when it would provide protection following the onset of a nuclear accident.

RECOMMENDATION 40: KI must be pre-distributed to all residents, businesses, institutions, and places where children spend time, within the full secondary zone.

Even the limited modelling relied on in the Discussion Paper therefore indicates the potential for ingestion control beyond the current 50 km secondary zone. However, the discussion paper

again relies on the potential for improvisation to expand that zone beyond 50 km in an accident scenario. Rather, CELA submits, the province must expand the current 50 km secondary zone to 100 km. This will provide for prior education, outreach, preparation, inventories, communication channels, contingency planning and other efforts needed to be prepared to restrict ingestion and provide alternative food and water in the case of a severe offsite accident.

RECOMMENDATION 41: The province must expand the current 50 km secondary zone to 100 km from every Ontario and non-Ontario reactor, and provide for education, outreach, preparation, inventories, communication channels, contingency planning and other efforts needed to be prepared to restrict ingestion and provide alternative food and water in the case of a severe offsite accident.

The Discussion Paper recommends the retention of the current PNERP planning zones, but proposes to add a "contingency zone" of 20 km (page 51 - 53). The discussion paper however recommends very, very little additional preparedness within that zone beyond the current secondary zone provisions. While it does recommend division into sectors and population estimates, no additional alerting or communications is recommended nor additional emergency response centres. CELA submits if it were to provide additional protection, then the planning, actions, readiness and resourcing that would be required in this contingency zone are the same as in the current 10 km primary zone. Accordingly, CELA submits that instead of this new, minimally useful "contingency planning zone," the primary zone should be increased to 20 km; the secondary zone to 100 km; and KI pre-distribution should occur within a 50 km radius of every nuclear reactor.

RECOMMENDATION 42: The primary zone should be increased to 20 km; the secondary zone to 100 km; and KI pre-distribution should occur within a 50 km radius of every nuclear reactor.

The discussion paper recommends maintaining the status quo at the CRL reactor based on the pending shut-down of the NRU (page 51). However, it is not yet shut down; there are other facilities and sources of radionuclide risk at the site; and there are proposals to experiment with Small Modular Reactors at that site. As a result, there is an ongoing necessity to model and analyze the offsite risks to the communities around Chalk River and to provide a robust nuclear emergency plan in the face of those activities and facilities.

RECOMMENDATION 43: The PNERP should continue to be based on updated and robust modelling of source term and offsite risks to the communities around Chalk River and to provide a robust nuclear emergency plan in the face of those activities and facilities.

The Discussion paper recommends utilizing the American NRC planning zones around the Fermi 2 site (page 51). This includes reducing the size of the Primary zone. However, we endorse the submission of Beyond Nuclear to this consultation, dated July 27, 2017, which outlines why the planning zones need to be increased in the vicinity of all of the American reactors, including the portions of those planning zones stretching into Ontario and including Ontario residents and businesses.

Non-Planning Basis Recommendations

The Discussion Paper also includes "non-planning basis recommendations". It is a puzzling and non-informative section of the discussion paper. It reads as thought the province did not finish analyzing the need for review of the PNERP post-Fukushima. There is no mention of whether or how the public will be consulted and provide input on the significant issues that are to be considered "during the PNERP revision process." These are matters on which the public has a great deal of interest and much at stake, including "notification categories"; "nomenclature", "emergency phases"; "operational response strategies and protective action implantation under both the PNERP and the Radiation Health Response Plan."

Furthermore, the Discussion Paper states that "targeted stakeholder consultation" will be the preferred method of determining any necessary adjustments, changes or additions regarding operational response strategies and responsibilities such as Iodine Thyroid Blocking, Public alerting, and Emergency Public Information. CELA reads that as intending to exclude the public. This is completely unacceptable. It is essential that these decisions be made transparently, with full public input. There have been municipal resolutions over the last two years echoing this expectation on the part of municipalities and their elected leaders. The current culture of relying on the industry and operators of the plants for much of this decision making and influence must end. Continued decision making in secrecy about nuclear emergency planning renders the PNERP non-credible and non-trustworthy.

RECOMMENDATION 44: All consultation and decision making on "adjustments, changes or additions regarding operational response strategies and protective action implementation to the PNERP and the Radiation Health Response Plan including on specific items such as Iodine Thyroid Blocking, Public Alerting, Emergency Public Information, Evacuation, Ingestion Control and all other relevant items must be conducted transparently, in public, with information provided to municipal councils within 100 km of each Ontario or non-Ontario nuclear reactor.

The Discussion Paper recommends maintaining "situational awareness" of international bodies' reports and recommendations. These are often industry based or consensus based reports. CELA submits that Ontarians expect the very highest level of protection from their government. The Province of Ontario should establish a principle, and reflect in the PNERP, that so long as Ontario relies on nuclear power in its Ontario power mix, nuclear emergency planning will aim to be as stringent and protective as, or more-so than, any other jurisdiction.

RECOMMENDATION 45: The Province of Ontario should establish a principle, and reflect in the PNERP, that so long as Ontario relies on nuclear power in its Ontario power mix, nuclear emergency planning will aim to be as stringent and protective as, or more-so than, any other jurisdiction.

Iodine Thyroid Blocking

Iodine Thyroid Blocking is discussed in the Discussion Paper without specific recommendations "as it is not part of the planning basis." However, CELA submits that it is incumbent upon

Ontario to have its own KI policy that is protective of people and particularly children, and not merely rely upon the federal policy. Based on even the limited studies examined in the discussion paper, KI ingestion may be required early at the onset of an accident scenario far beyond the current Primary zone. Accordingly, Ontario and the PNERP must provide for KI pre-distribution within 50 km of each reactor as submitted above. Furthermore, Ontario must ensure that KI pre-distribution is adequately resourced; that stockpiles located beyond the 50 km zone are adequate for the population within 100 km; that people within the entire secondary zone (which should be 100 km) are actively and continuously encouraged to obtain KI pills and keep them on hand along with education about their use. As submitted earlier, Ontario should establish a regulatory charge for all nuclear reactor operators located in Ontario to cover the costs of municipal nuclear emergency planning and KI distribution as well as the provincial costs of maintaining a level of emergency planning as good as, or better than, anywhere else in the world.

RECOMMENDATION 46: Ontario should have its own KI policy that is protective of people and particularly children, and not merely rely upon the federal policy.

RECOMMENDATION 47: Ontario and the PNERP must provide for KI pre-distribution of every community located within 50 km of a nuclear power or research reactor.

RECOMMENDATION 48: Ontario must ensure that KI pre-distribution is adequately resourced.

RECOMMENDATION 49: Ontario must ensure that KI stockpiles located beyond the 50 km zone around each reactor are adequate for the entire population within 100 km.

RECOMMENDATION 50: Ontario must ensure that people within the entire secondary zone (which should be expanded to 100 km) are actively and continuously encouraged to obtain KI pills and keep them on hand along with provision of education about their use.

RECOMMENDATION 51: Ontario should establish a regulatory charge for all nuclear reactor operators located in Ontario to cover the costs of municipal nuclear emergency planning and KI distribution as well as the provincial costs of maintaining a level of emergency planning as good as, or better than, anywhere else in the world.

Basis for Planning

CELA submits that Ontario must approach nuclear emergency planning on the basis of the empirical evidence that large severe offsite accidents such as Chernobyl and Fukushima can happen. It must therefore conduct modelling based on scenarios inclusive of unmitigated severe accidents that can release large source terms and in worst case weather. It must then ensure that the planning zones, detail of planning, resourcing and readiness are such that the people in those zones would have a high probability of being protected in the case of such an accident, from both stochastic and deterministic effects.

RECOMMENDATION 52: Ontario must ensure that the planning zones, details of planning, resourcing and readiness are such that the people living and working in those zones would have a high probability of being protected in the case of unmitigated large accidents that release large source terms offsite.

RECOMMENDATION 53: Ontario must ensure that the PNERP takes account of all potential weather conditions both in terms of increasing the hazard; as well as in terms of hampering the response.

RECOMMENDATION 54: Ontario must ensure that its planning principle is based on the avoidance of both stochastic and deterministic effects.

RECOMMENDATION 55: Ontario must ensure that studies and modelling of potential offsite releases from nuclear facilities in the vicinity of Ontario communities include scenarios involving natural disasters, malevolent acts, and catastrophic failure of safety systems.

RECOMMENDATION 56: The PNERP must provide for equivalent protection, consistent with robust modelling and the relevant source terms, of all Ontario residents who live and work in proximity to nuclear research or power reactors located in Ontario, Michigan, Ohio and New York.

RECOMMENDATION 57: CELA submits that based on the studies we have examined, as well as on the need for further modelling and analysis, Ontario's emergency planning zones in the PNERP should be significantly increased. CELA submits that the province should reject the Discussion Paper's essential conclusion that the PNERP status quo is sufficient to protect Ontarians in the event of a catastrophic nuclear accident.

RECOMMENDATION 58: Ontario must base its PNERP on a level 7 accident on the INES event scale.

RECOMMENDATION 59: Ontario must meet or exceed the level of protection provided to its residents emulating Switzerland as of 2017 which has decided to increase its nuclear emergency response plan and measures to respond to a level 7 accident.

Endorsements

CELA has had the benefit of reviewing many of the excellent submissions by other organizations and individuals to this consultation. We commend them all and note that they raise extremely serious and important points and issues from a very healthy and useful variety of perspectives. The effort and thoughtfulness illustrated by these submissions demonstrate how serious this issue is, and how universal the opinion is (outside of the nuclear industry) that the discussion paper proposals are unacceptable; and the current PNERP is insufficient.

We specifically endorse the submission by Greenpeace Canada which submission includes an excellent chronology and background on the history of nuclear emergency planning in Ontario, as well as that of Northwatch; the latter of which deals with the topic of non-reactor accidents

which we have not been able to address in this submission. We commend the submissions of Sunil Nijhawan; Beyond Nuclear; Concerned Citizens of Renfrew County; Canadian Association of Physicians for the Environment; Michael Duguay; Louis Bertrand; the Inverhuron Committee; the Bruce Peninsula Environment Group; the Inverhuron and District Ratepayers Association; the United Church of Canada (Toronto); Environmental Defence; MPP Natyshak, MPP for Essex, to name those we have been able to see and review prior to the completion of our own CELA submissions. We also commend the submissions and resolutions of the municipalities of the Town of Ajax; the County of Essex; the Town of Amherstburg; the Region of Durham; the Municipality of Brockton; the City of Windsor; all of which have responded specifically to this provincial consultation, as well as that of the City of Toronto Executive Committee which had requested an opportunity to provide input on the City's response prior to the launch of this consultation.

Provincial Capacity

We call on the province to significantly increase its capacity to oversee nuclear emergency planning in Ontario, and to establish a body independent from the nuclear industry to do so. We also call on the province to drastically improve the transparency and public input processes relating to nuclear emergency planning, to provide all studies on which decisions are made to the public on web-based platforms, to provide for regular public review and updating of the PNERP. We call on the province to ensure that municipalities are properly resourced to carry out their roles under the PNERP, and we have recommended a new regulatory charge as a mechanism to do that. We request that the province, beginning with the Premier, who has the ultimate authority for the PNERP and for a response in the event of a nuclear accident, end the culture of secrecy and misinformation that currently surrounds the topic of nuclear emergency planning in this province.

Follow up consultations

There are two follow up provincial consultation opportunities on the PNERP that we have noted. The first is that the province has committee to having an expert panel review all of the submissions on the PNERP discussion paper, and to hear from those who made submissions. CELA requests an opportunity to meet with or appear before the expert panel in that respect. CELA also requests that the expert panel hold its meetings and deliberations in public.

Secondly, the discussion paper stated that there would be further consultations on "non-planning basis" matters in the PNERP. We note that many of these matters, such as thyroid blocking, evacuation, public alerting, communications, as of very high interest and concern to the public. Many of the submissions submitted in response to the PNERP deal with these very matters. CELA is very concerned that the province may be intending to conduct these consultations and deliberations outside of the public eye. CELA requests that these discussions and consultations be conducted in an open and transparent manner with full opportunity for public input and with release of all documents, reports, analysis and discussion papers that are under consideration in terms of changes to the PNERP. CELA would have extensive submissions to make on these matters as well.

Call for Public Safety

CELA is a co-signatory to the Call for Public Safety, endorsed by 44 organizations, attached to this submission. We reiterate the principles and submissions made therein. Two of the issues will be highlighted here. We particularly call on the province to immediately commence a study regarding the potential impact of a nuclear accident on drinking water sources in Ontario, particularly in the Great lakes, and to develop contingency plans for drinking water in such an event. The planning basis for such study and contingency plans must be a severe offsite unmitigated release based on the source term of each facility. And we also reiterate our call for detailed and resourced evacuation planning for all vulnerable communities, populations, and residents of institutions in the vicinity of each nuclear reactor.

All of which we respectfully submit,

CANADIAN ENVIRONMENTAL LAW ASSOCIATION

Per:
Theresa A. McClenaghan
Executive Director and Counsel

NEXT PAGE: APPENDIX – SUMMARY OF ALL RECOMMENDATIONS

APPENDIX:

SUMMARY OF ALL RECOMMENDATIONS

RECOMMENDATION 1: The province must act forthwith to implement upgrades to the Provincial Nuclear Emergency Response Plan so as to ensure that robust detailed planning is in place around all of the Ontario communities located near nuclear plants. The province must ensure that detailed planning in each of the potentially affected communities would support rapid and effective emergency response to at least a Fukushima-scale offsite severe nuclear accident in their vicinity.

RECOMMENDATION 2: Ontario should require regular transparent and public updating of the PNERP, including public input and public disclosure of credible modelling of all nuclear facility risks in Ontario.

RECOMMENDATION 3: The province of Ontario should immediately cease all plans to increase the population in the vicinity of any of the areas of the province that are within 20 kilometres of any nuclear power plants (including those based in Ontario, Ohio or Michigan).

RECOMMENDATION 4: Rather than based on industry probability estimates, the province of Ontario should base its provincial offsite nuclear emergency planning on empirical evidence of accidents with catastrophic level offsite radioactive releases that have actually occurred; at a minimum equivalent to the releases that occurred at the Fukushima Daichi nuclear plant in Japan following the Honshu earthquake in 2011.

RECOMMENDATION 5: Analysis that considers unmitigated severe offsite releases must be conducted at all of the reactors of relevance to Ontario communities.

RECOMMENDATION 6: CELA recommends that offsite emissions studies must be conducted for every reactor in Ontario and for communities impacted by non-Ontario reactors, which look at the full potential source term that may be released; do not assume operator action will mitigate the accident; do not assume containment will hold; do not take “credit” for post-Fukushima actions; and which consider both single facilities and multiple facilities within the same station being impacted.

RECOMMENDATION 7: Modelling of weather conditions as an input to emergency planning should include four to five years of 365 day per year weather data at each reactor.

RECOMMENDATION 8: Modelling of emissions and doses for evacuation planning should be conducted without any "sheltering dose reduction factor".

RECOMMENDATION 9: All planning zones and precautionary measures under the PNERP should be increased consistent with robust, credible, transparent precautionary modelling that considers the full source terms, all radionuclides of relevance to health, several years of 365 days of weather data, and the most vulnerable population (i.e. five-year-old children). This modelling should also be subject to public, transparent peer review of its statistical validity.

RECOMMENDATION 10: Analysis of benefits of KI ingestion must be conducted for communities in the vicinity of the Chalk River NRU (and all other nuclear power or research reactors within 100 km of Ontario communities) based on accidents including those that assume failure of the reactor to shut down following an initiating event and which lead to rapid core destruction; as well as those arising from severe seismic events that are well beyond design basis.

RECOMMENDATION 11: Analysis of benefits of KI ingestion must be conducted for communities in the vicinity of the Chalk River NRU based on very severe seismic events that could severely damage the NRU in addition to other buildings and infrastructure in the communities in the vicinity.

RECOMMENDATION 12: Analysis of benefits of KI ingestion must be conducted for communities in the vicinity of the Chalk River NRU and all other nuclear power or research reactors within 100 km based on very severe seismic events.

RECOMMENDATION 13: The remaining Chalk River laboratories facilities must be analyzed in terms of their potential contributions either singly or cumulatively to the offsite emissions in the case of major multi-unit or multi-facility accidents.

RECOMMENDATION 14: Transportation to and from the CRL facilities must be analyzed transparently with public input in terms of offsite emissions hazard and responsive emergency planning and preparedness.

RECOMMENDATION 15: Ontario's nuclear emergency planning basis should be responsive to "Severe Accidents with Unmitigated Releases" for each of the nuclear reactors operating in proximity to Ontario communities. This approach with applicable modelling should be applied to every community within 100 km of any Ontario or out-of-province nuclear reactor.

RECOMMENDATION 16: Emergency planning should be based on most exposed individuals, i.e. usually children, rather than adults, for the purpose of estimating doses and making decisions on emergency planning and the measures that would be responsive to severe nuclear accidents.

RECOMMENDATION 17: Meteorological modelling should be conducted for all of the Ontario communities located within a 100 km zone of a nuclear reactor using a minimum of four years of weather data.

RECOMMENDATION 18: Modelling for projected dose should be conducted using the most exposed individuals (children) in the vicinity of each of the nuclear reactors located within 100 km of Ontario communities.

RECOMMENDATION 19: Modelling for the more severe accidents with mitigated and unmitigated releases should include 100 percentile data for weather for a minimum of four years so as to attempt to include worst case conditions in the vicinity of each of the nuclear reactors located within 100 km of Ontario communities.

RECOMMENDATION 20: Modelling should be conducted for stochastic effects for the most severe accidents with unmitigated releases for each of the nuclear reactors located within 100 km of Ontario communities.

RECOMMENDATION 21: The province should calculate and provide results in terms of effective doses for the analysis of the most severe accidents with unmitigated releases for each of the nuclear reactors located within 100 km of Ontario communities.

RECOMMENDATION 22: Ontario provincial decisions about size of planning zones for nuclear accidents should always be made in public, with full transparency including as to all inputs for modelling of nuclear accidents, and all results of modelling in terms of effective doses.

RECOMMENDATION 23: The principles of “full, informed consent” should underlie Ontario’s approach to consulting the public on all matters relating to nuclear emergency planning.

RECOMMENDATION 24: Provide the results of the doses calculated for severe accidents with un-mitigated releases for the Chalk River NRU reactor, and for each other reactor located within 100 km of Ontario communities.

RECOMMENDATION 25: No changes to municipal and off-site nuclear emergency plans should be made without consulting the public within 100 km of each nuclear reactor.

RECOMMENDATION 26: No planning zones should be reduced unless the reactor ceases operation. A precautionary approach should be applied to all decisions regarding the emergency planning zones surrounding each reactor.

RECOMMENDATION 27: The province should include requirements for potassium iodide (KI) pre-distribution and availability for Ontario communities living in proximity to U.S. nuclear stations (Fermi, Davis-Besse, Perry, Ginna, Nine Mile Point 1 & 2 and FitzPatrick) equivalent to requirements for Ontario-based nuclear stations in its updated nuclear emergency plan.

RECOMMENDATION 28: The provincial government should transparently consult with municipalities and citizens on the establishment of emergency planning zones on the Ontario side of the border, for the Fermi, Davis-Besse and Perry nuclear station on Lake Erie and Ginna, Nine Mile Point 1 & 2 and FitzPatrick on Lake Ontario. Such zones should be informed by international best practices and accident modelling.

RECOMMENDATION 29: The province should include a reliable funding mechanism to support nuclear emergency preparedness for communities in Southwestern Ontario in the next PNERP. Such funding models could include a regulatory charge to support a statutory nuclear emergency planning fund, to be imposed on all Ontario nuclear power, research and medical purposes reactor operators, proportional to their rated power. The fund should support all Ontario municipalities located within 100 km of any Ontario or non-Ontario based nuclear reactors to properly resource their nuclear emergency response plans and roles.

RECOMMENDATION 30: The non-planning basis updates to the PNERP must be subject to thorough, transparent and fully informed public consultation and input.

RECOMMENDATION 31: Ontario's provincial cabinet should direct OFMEM to revise the planning basis of the PNERP to institute a public consultation on a specific planning basis proposal that includes multi-unit accident scenarios within 90 days of the conclusion of this consultation. The current PNERP should then be revised forthwith to reflect the Ontario context whereby the potential for multi-unit scenarios is very real and of considerable concern import with consequent increases to the size and resourcing of Ontario's PNERP nuclear emergency planning zones around the multi-unit stations.

RECOMMENDATION 32: Following Switzerland's recent decision, based on planning for more severe offsite, unmitigated accidents at an INES 7 level, Ontario's nuclear emergency planning zones need to be increased in diameter around each nuclear reactor.

RECOMMENDATION 33: The measures responsive to severe offsite accidents must be specified to be implemented in a more precautionary manner and at a minimum at the present lower PALs.

RECOMMENDATION 34: The PNERP must provide for detailed planning within an expanded primary zone as well as within an expanded secondary zone. While adaptation may be required, the province should cease to rely on improvisation and adaptation as its main strategy for responding to large offsite accidents that require evacuation and other measures beyond the primary zone.

RECOMMENDATION 35: The province of Ontario should retain at a minimum the lower PALs currently provided in the present plan, and apply them consistently across the province in all communities within 100 km of Ontario or non-Ontario reactors.

RECOMMENDATION 36: All recommendations or decisions to reduce public safety, reduce nuclear emergency planning zones, reduce emergency planning resourcing, and increase protective action levels on the basis of post Fukushima enhancements should be rejected or reversed by the province of Ontario. Rather the province must require increased public protection in the PNERP in each of these respects.

RECOMMENDATION 37: The province of Ontario should base the PNERP on the Ontario-specific context of each community located within 100 km of any nuclear reactor, including the CANDU-specific context of multi-unit sites, in addition to all other site contexts such as high, intermediate and low-level waste storage and management on those sites.

RECOMMENDATION 38: The province should revisit the size and delineation of the contiguous zone within each community in the vicinity of a nuclear reactor based on modelling that utilizes an INES 7 level accident (at a minimum).

RECOMMENDATION 39: The size and delineation of the Primary zone, and preparedness for evacuation, should be revised based on modelling that utilizes an INES 7 level accident (at a minimum).

RECOMMENDATION 40: KI must be pre-distributed to all residents, businesses, institutions, and places where children spend time, within the full secondary zone.

RECOMMENDATION 41: The province must expand the current 50 km secondary zone to 100 km from every Ontario and non-Ontario reactor, and provide for education, outreach, preparation, inventories, communication channels, contingency planning and other efforts needed to be prepared to restrict ingestion and provide alternative food and water in the case of a severe offsite accident.

RECOMMENDATION 42: The primary zone should be increased to 20 km; the secondary zone to 100 km; and KI pre-distribution should occur within a 50 km radius of every nuclear reactor.

RECOMMENDATION 43: The PNERP should continue to be based on updated and robust modelling of source term and offsite risks to the communities around Chalk River and to provide a robust nuclear emergency plan in the face of those activities and facilities.

RECOMMENDATION 44: All consultation and decision making on "adjustments, changes or additions regarding operational response strategies and protective action implementation to the PNERP and the Radiation Health Response Plan including on specific items such as Iodine Thyroid Blocking, Public Alerting, Emergency Public Information, Evacuation, Ingestion Control and all other relevant items must be conducted transparently, in public, with information provided to municipal councils within 100 km of each Ontario or non-Ontario nuclear reactor.

RECOMMENDATION 45: The Province of Ontario should establish a principle, and reflect in the PNERP, that so long as Ontario relies on nuclear power in its Ontario power mix, nuclear emergency planning will aim to be as stringent and protective as, or more-so than, any other jurisdiction.

RECOMMENDATION 46: Ontario should have its own KI policy that is protective of people and particularly children, and not merely rely upon the federal policy.

RECOMMENDATION 47: Ontario and the PNERP must provide for KI pre-distribution of every community located within 50 km of a nuclear power or research reactor.

RECOMMENDATION 48: Ontario must ensure that KI pre-distribution is adequately resourced.

RECOMMENDATION 49: Ontario must ensure that KI stockpiles beyond the 50 km zone around each reactor are adequate for the entire population within 100 km.

RECOMMENDATION 50: Ontario must ensure that people within the entire secondary zone (which should be expanded to 100 km) are actively and continuously encouraged to obtain KI pills and keep them on hand along with provision of education about their use.

RECOMMENDATION 51: Ontario should establish a regulatory charge for all nuclear reactor operators located in Ontario to cover the costs of municipal nuclear emergency planning and KI distribution as well as the provincial costs of maintaining a level of emergency planning as good as, or better than, anywhere else in the world.

RECOMMENDATION 52: Ontario must ensure that the planning zones, details of planning, resourcing and readiness are such that the people living and working in those zones would have a high probability of being protected in the case of unmitigated large accidents that release large source terms offsite.

RECOMMENDATION 53: Ontario must ensure that the PNERP takes account of all potential weather conditions both in terms of increasing the hazard; as well as in terms of hampering the response.

RECOMMENDATION 54: Ontario must ensure that its planning principle is based on the avoidance of both stochastic and deterministic effects.

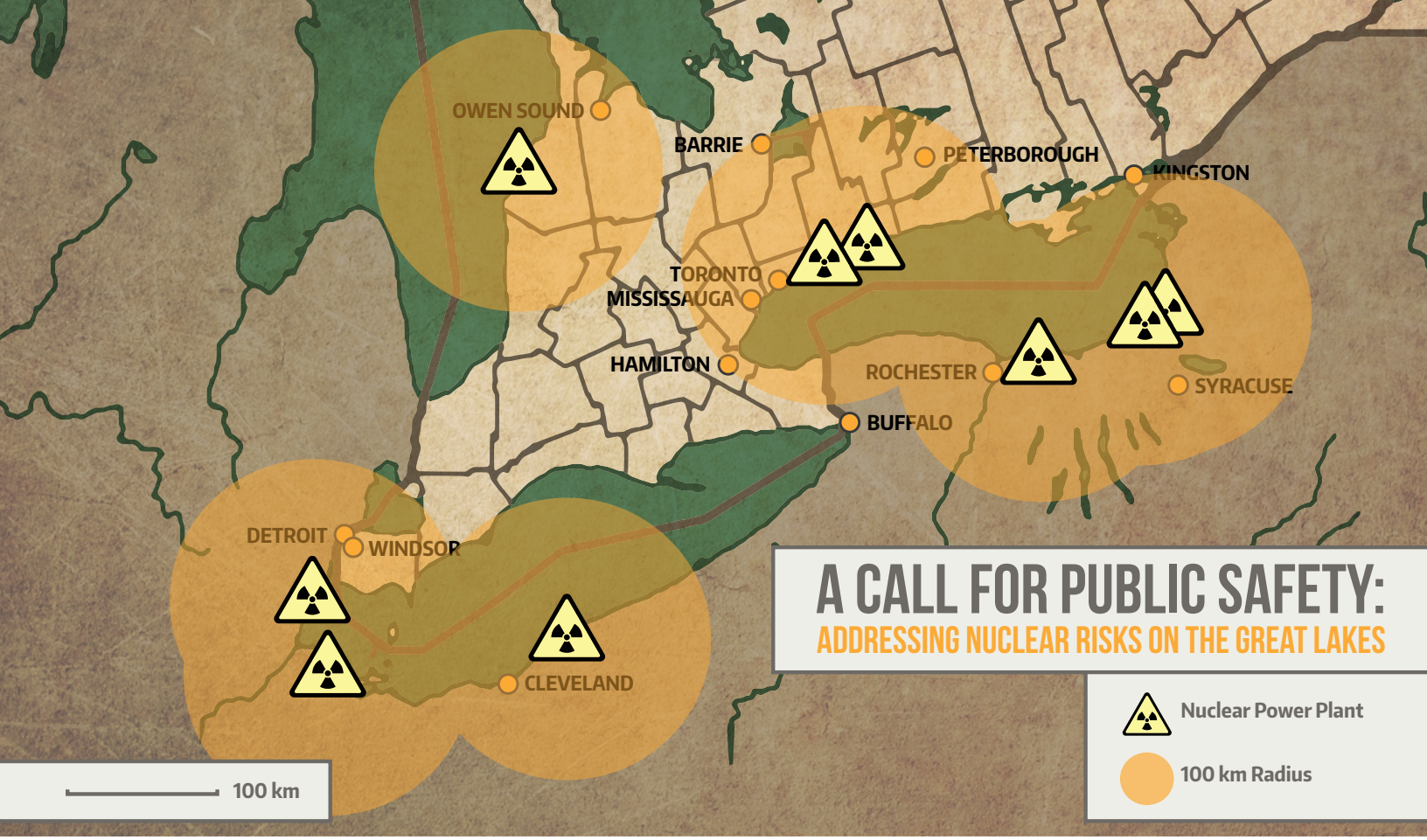
RECOMMENDATION 55: Ontario must ensure that studies and modelling of potential offsite releases from nuclear facilities in the vicinity of Ontario communities include scenarios involving natural disasters, malevolent acts, and catastrophic failure of safety systems.

RECOMMENDATION 56: The PNERP must provide for equivalent protection, consistent with robust modelling and the relevant source terms, of all Ontario residents who live and work in proximity to nuclear research or power reactors located in Ontario, Michigan, Ohio and New York.

RECOMMENDATION 57: CELA submits that based on the studies we have examined, as well as on the need for further modelling and analysis, Ontario's emergency planning zones in the PNERP should be significantly increased. CELA submits that the province should reject the Discussion Paper's essential conclusion that the PNERP status quo is sufficient to protect Ontarians in the event of a catastrophic nuclear accident.

RECOMMENDATION 58: Ontario must base its PNERP on a level 7 accident on the INES event scale.

RECOMMENDATION 59: Ontario must meet or exceed the level of protection provided to its residents emulating Switzerland as of 2017 which has decided to increase its nuclear emergency response plan and measures to respond to a level 7 accident.



MOST PEOPLE IN SOUTHERN ONTARIO LIVE NEAR AN AGING NUCLEAR REACTOR OPERATING ON EITHER THE CANADIAN OR AMERICAN SHORES OF THE GREAT LAKES.

Historically, Ontario has put in place detailed nuclear emergency response plans to address only a relatively small accidental radiation release.

This must change in light of Fukushima.

We call on the provincial government to ensure nuclear emergency response plans are in place to:

- Protect people from Fukushima-scale accidents;
- Protect vulnerable communities;
- Protect drinking water;
- Ensure transparency and public participation;
- Meet or exceed international best practices.

The Ontario government recently committed to run eighteen aging reactors at the Darlington, Bruce and Pickering stations well beyond their original operational lives. Ten of these aging reactors are in the Greater Toronto Area (GTA) – creating risks for millions of nearby residents.

Aging reactors in the United States at the Fermi, Davis-Besse, Perry, Ginna, Fitzpatrick and Nine Mile Point nuclear stations also put Ontarians and our drinking water at risk.

In light of these risks, the Ontario government should protect public safety and prevent needless risks to health and society by making Ontario's nuclear emergency plans the most robust in the world.

PROTECT PEOPLE FROM FUKUSHIMA-SCALE ACCIDENTS

TO PROTECT PEOPLE THE ONTARIO GOVERNMENT SHOULD:

- Use a Fukushima-scale radioactive release as the baseline "reference accident" for determining offsite protective measures, such as alerts, evacuation, and potassium iodide (KI) pre-distribution.[1]
- Regularly publish modelling on Fukushima-scale accidents at the Bruce, Pickering, Darlington nuclear stations to confirm the adequacy of offsite emergency response.
- Expand emergency planning areas to align with the impacts of Fukushima, including at least a 20 km evacuation zone.
- Ensure all municipalities within 100 km of a nuclear station, including American reactors, develop and maintain nuclear emergency response plans.

BACKGROUND

- To create a nuclear emergency plan, the first public safety decision is selecting the **scale** of reactor accident. The scale of accident chosen is referred to as the "planning basis" or a "reference accident."
- Ontario's current "planning basis" was effectively established before the 1986 Chernobyl accident. It assumes delayed radioactive releases that are significantly smaller than Fukushima or Chernobyl.[2]
- Following selection of a reference accident, the second public safety decision involves determining what **protective measures** should be in place. Protective measures protect people from radiation exposure. Examples include evacuation or ingesting potassium iodide (KI), which reduces your thyroid's exposure to radioactive iodine.
- Ontario's current emergency measures are geographically limited to areas close to nuclear stations due to the current small-scale "reference accident". This includes a 10 km evacuation zone also known as the "Primary Zone" and a "Secondary Zone" that varies in size between 50 – 80 km.
- According to a joint committee of European nuclear regulators and radiation protection authorities struck following Fukushima: "...an accident comparable to Fukushima would require protective actions such as evacuation to around 20 km and sheltering to around 100 km. These actions would be combined with the intake of stable iodine."[3]

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[1] The Fukushima accident released approximately 520 Peta Becquerels of radioactivity. A Bequerel is equivalent to one nuclear decay per second. The radioactive releases from Fukushima were approximately ten times larger than the highest level (level seven) accident on the International Atomic Energy Agency's (IAEA) International Nuclear Event Scale (INES).

[2] Following the Three Mile Island accident the province began considering how to prepare for a nuclear emergency. In 1985, the Working Group # 3 report recommended the technical basis and reference accident that still effectively serves as the basis for offsite emergency plans.

[3] Heads of the European Radiological protection Competent Authorities (HERCA) and Western European Nuclear Regulators' Association (WENRA), Ad hoc High-Level Task Force on Emergencies (AtHLET), Position paper, 22 October 2014

- Belgium's Superior Health Council recommended in 2016 that the government adopt a "precautionary approach" to emergency planning and consider large, previously ignored radiation release scenarios.[4] It also recommended that "based on the experience of past accidents, the areas covered by the plan for sheltering, the distribution of stable iodine and evacuation [should] be extended to cover realistic distances."[5]
- Modelling of a Fukushima-scale radioactive release by the German Commission on Radiological Protection (SSK) recommended expanding evacuation zones around German reactors from 10 to 20 km; preparing radiation monitoring programs out to 100 km to determine in the event of an accident whether additional evacuations, sheltering or KI consumption is required; and, preparations for KI consumption for children and pregnant women living beyond 100 km.[6]
- Following the Fukushima disaster, Japan's nuclear regulator observed: "A general lesson learned from the Fukushima accident, as well as the accidents at Three Mile Island and Chernobyl, is that there was an implicit assumption that such severe accidents could not happen, and thus sufficient attention had not been paid to preparedness for the accidents by the operators and the regulatory authorities."[7]

[4] Conseil Supérieur de la Santé, Conseil Supérieur de la Santé, Accidents nucléaires, environnement et santé après Fukushima. Planification d'urgence, AVIS DU CONSEIL SUPERIEUR DE LA SANTE N° 9235, février 2016, pgs 88.
[5] Conseil Supérieur de la Santé, 2016, pg 83.
[6] German Commission on Radiological Protection (SSK), Planning areas for emergency response near nuclear power plants, 2014.
[7] T. Homma et al., "Radiation protection issues on preparedness and response for a severe nuclear accident: experiences of the Fukushima accident," ICRP 2013 Proceedings, pgs 347- 356.

PROTECT VULNERABLE COMMUNITIES

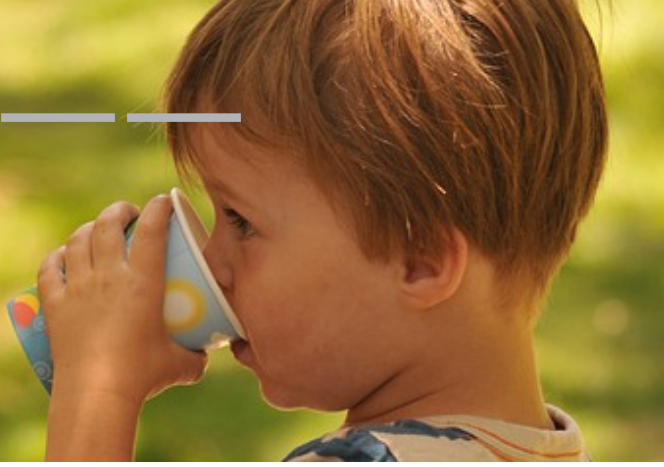
TO PROTECT VULNERABLE COMMUNITIES, ONTARIO'S NUCLEAR EMERGENCY PLANS SHOULD:

- Identify vulnerable groups, such as people with disabilities, babies, children, pregnant women, people residing in retirement homes, and hospital patients who may need to be evacuated in the event of a Fukushima-scale accident.
- Require clear plans to assist vulnerable groups before and after evacuation, including support from health care practitioners.
- Acknowledge that operating reactors in densely populated areas like the Greater Toronto Area (GTA) will complicate emergency response in the event of a major reactor accident and require detailed plans for large-scale evacuation in the short-term and the accommodation of large populations in the long-term.
- At a minimum, pre-stock potassium iodide (KI) pills in all schools within 100 km of all nuclear stations in or near Ontario.

BACKGROUND

- Deaths in vulnerable communities, particularly the elderly, during evacuations following the Fukushima disaster have largely been attributed to the lack of pre-planned health care provision including evacuation logistics.[8]
- Belgium's Superior Health Council concluded that siting reactors near densely populated areas would significantly complicate emergency response, compared to the sparsely populated area around Fukushima. To address this vulnerability, the Council recommended that plans be in place for the evacuation and long-term displacement of large populations.[9]
- A committee charged with investigating the Fukushima disaster by the Japanese government concluded: "An accident at a nuclear power station has risks to bring about damage in vast areas. Nuclear operators on one hand, nuclear regulators on the other, should establish a systematic activity to identify all risk potentials from the "disaster victims' standpoint" when designing, constructing and operating such nuclear systems, for ensuring credible nuclear safety including evacuation." [10]
- The German Commission on Radiological Protection recommended in 2014 that authorities have in place "concrete plans" to provide KI pills to "children and young people up to the age of 18 and to pregnant women" over the entire territory of Germany.[11]
- Belgium's Superior Health Council also recommended having plans in place to distribute KI pills to vulnerable communities, including children as well as pregnant and breastfeeding women up to 100 km from any nuclear station. It also recommended that the effectiveness of large-scale distribution strategies should be regularly and carefully evaluated.[12]

[8] A. Hasegawa et al., "Emergency Responses and Health Consequences after the Fukushima Accident; Evacuation and Relocation," Clinical Oncology, 28 (2016) 237
[9] Conseil Supérieur de la Santé, 2016, pg 85.
[10] International Investigation Committee on the Accident at Fukushima Nuclear, July 23, 2012, pg 490. Power Stations of Tokyo Electric Power Company, July 23, 2012
[11] German Commission on Radiological Protection (SSK), 2014, pg 21.
[12] Conseil Supérieur de la Santé, 2016, pg 69.



PROTECT DRINKING WATER

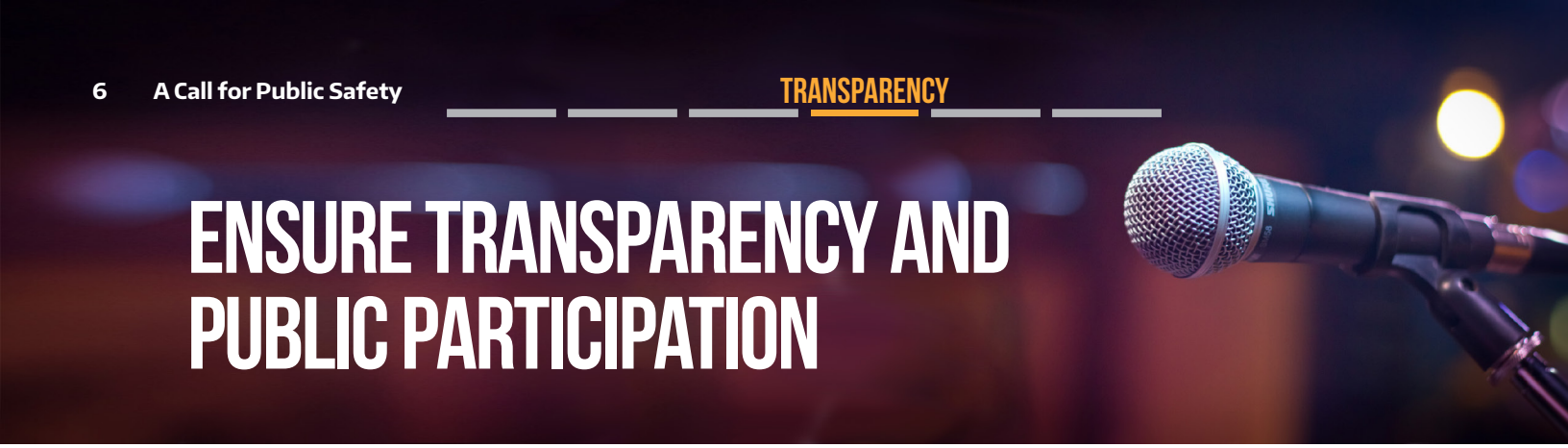
TO PROTECT DRINKING WATER, ONTARIO'S NUCLEAR EMERGENCY PLANS SHOULD:

- Provide alternative sources of drinking water for residents whose drinking water is sourced from any of the Great Lakes on which a nuclear power plant is located.
- Ensure alternative drinking water sources are identified, and that logistical plans to supply the impacted population with these alternative sources are in place to last indefinitely.
- Model and publish Fukushima-scale accidents at nuclear stations on the Canadian and American sides of the Great Lakes to assess impacts on drinking water supplies and aquatic ecosystems.

BACKGROUND

- The Fukushima accident caused significant – and ongoing – radioactive emissions to the Pacific Ocean, contaminating aquatic ecosystems and food supplies.
- The Great Lakes provide drinking water for approximately 40 million Canadians and Americans.
- There are ten reactors at the Pickering and Darlington nuclear stations operating on the Canadian side of Lake Ontario.
- There are eight reactors operating on the Canadian side of Lake Huron at the Bruce nuclear station.
- There are three reactors operating at the Fermi, Davis-Besse and Perry nuclear stations on the US side of Lake Erie.
- There are four reactors operating on the US side of Lake Ontario at the Fitzpatrick, Nine Mile Point and Ginna nuclear stations.
- Belgium's Superior Health Council recommended the government pay special attention to the circulation of radioactivity in water following a major accident, noting the short term risk to drinking water and the long-term risk of contamination of agriculture and the environment.[13]

[13] Conseil Supérieur de la Santé, 2016, pg 86.



ENSURE TRANSPARENCY AND PUBLIC PARTICIPATION

TO PREVENT COMPLACENCY AND ENABLE PUBLIC PARTICIPATION, THE ONTARIO GOVERNMENT SHOULD:

- Apply the government's Open Government policy to nuclear emergency planning and require detailed government information on nuclear emergency planning be available by default, including accident modelling.
- Require regular five-year reviews and detailed consultations with the public and affected communities as to continuous improvement of both the planning basis and emergency response measures.

BACKGROUND

- Premier Kathleen Wynne has stated her government's goal is to become "the most open and transparent government in Canada."
- There are currently no legal requirements for the Ontario government to regularly review and consult communities on the adequacy and acceptability of offsite nuclear emergency planning.
- International Commission on Radiological Protection (ICRP) recommends: "During planning, it is essential that the plan is discussed, to the extent practicable, with relevant stakeholders, including other authorities, responders, the public, etc. Otherwise, it will be difficult to implement the plan effectively during the response."[14]
- In its recommendation that "vulnerability analysis" be the basis of nuclear emergency planning, Belgium's Superior Health Council noted that such an analysis requires the participation of all affected stakeholders, including citizens.[15]
- The Japanese government's investigation into the Fukushima disaster found that people responsible for and involved in responding to the accident were unfamiliar with protective measures and that emergency plans had not been recently updated and were incomplete.[16]
- In November 2015 Durham Region, the host community for the Pickering and Darlington nuclear stations, passed a motion asking the government of Ontario to "provide all non-confidential data and studies used in considering changes to Ontario's off-site nuclear emergency plans."[17]

[14] Commission on Radiological Protection, Publication 109: Application of the Commission's Recommendations for the Protection of People in Emergency Exposure Situations, Approved by the Commission in October 2008.
[15] Conseil Supérieur de la Santé, 2016, pg. 17.
[16] The National Diet of Japan, The Official Report of the Fukushima Nuclear Accident Independent Investigation Commission, Executive Summary, 2012.
[17] Durham Regional Council – Minutes, November 4, 2015, pg. 29.

MEET OR EXCEED INTERNATIONAL BEST PRACTICES

TO ENSURE ONTARIANS A LEVEL OF PUBLIC SAFETY ON PAR WITH OTHER JURISDICTIONS AND REFLECTING THE EXTREMELY HIGH POPULATION DENSITY IN THE VICINITY OF 10 OF THE OPERATING REACTORS IN THE GREATER TORONTO AREA, THE GOVERNMENT SHOULD:

- Require nuclear emergency response measures meet or exceed international best practices.
- Regularly review and publicly report on international developments and best practices in offsite nuclear emergency planning as well as on plans to adjust and improve Ontario's plan to meet or exceed the best practices in other OECD jurisdictions.

BACKGROUND

- Using international best practices as a decision-making principle will drive Ontario policy toward excellence and prioritizes public safety.
- Reporting on international best practices will enable public scrutiny and debate by providing Ontarians with tangible examples of how Ontario's emergency protective measures compare to other jurisdictions.
- Establishing emergency protective measures using a best-practice approach is a means of addressing the inherent uncertainties in nuclear risks and building trust with the public.
- Regularly reporting on international best practices will discourage complacency among government agencies responsible for nuclear emergency response.
- International Atomic Energy Agency safety guidance is in many respects a "lowest common denominator"[18] standard. Such standards should only be considered as a safety baseline.

[18] J. D. Harvie, Review of Licensing Approach Proposed for the Advanced CANDU Reactor, Commissioned by the Canadian Nuclear Safety Commission (RSP-0184C), September 2004, pg 4.

ENDORSING ORGANIZATIONS

BPEG

CAPE Canadian Association of Physicians for the Environment
Association Canadienne des Médecins pour l'Environnement ACME

Citizens Environment Alliance

Canadian Environmental Law Association
EQUITY JUSTICE HEALTH

Citizens' Network on Waste Management

Concerned Citizens of Renfrew County

The Council of Canadians / Le Conseil des Canadiens
Toronto Chapter
Windsor Essex Chapter
Peterborough & Kawarthas Chapter

County Sustainability Group – Local Action on Global Issues

CUSJ

dew durham environment watch

DNA Durham Nuclear Awareness

David Suzuki Foundation
SOLUTIONS ARE IN OUR NATURE

environmental defence

FOCA Federation of Ontario Cottagers' Associations

Friends of Bruce

Freshwater Future
Ensuring the Healthy Future of Our Waters

Great Lakes Commons

The Inverhuron Committee

GREENPEACE

LOW Lake Ontario Waterkeeper

Nipissing Environmental Watch

National Farmers Union
Union Nationale des Fermiers
Local 353 - Essex County, ON
Local 334 - Hastings, Northumberland, Prince Edward

National Network on Environments and Women's Health
Réseau pancanadien sur la santé des femmes et le milieu

NORTHWATCH

Ontario Clean Air Alliance

Oxford Coalition for Social Justice

OEAC

OPAL Alliance

PREVENT CANCER NOW

Provincial Council of Women of Ontario

Health for All Now! People's Health Movement

RNAO
Registered Nurses' Association of Ontario
L'Association des infirmières et infirmiers autorisés de l'Ontario

Science for Peace

Toronto Environmental Alliance

Manitoba Northwestern & Ontario
An affirming ministry
The Conference of the United Church of Canada

WATCH Wallaceburg Advisory Team for a Cleaner Habitat

WHEN Women's Healthy Environments Network

Windsor WOW On Watch

York Region Environmental Alliance