Assessing the Applicability of the Darlington New Nuclear Project Environmental Assessment and Plant Parameter Envelope to the Selected BWRX-300 Reactor Technology

CNSC Hearing Reference 2024-H-02

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Canadian Environmental Law Association

EQUITY. JUSTICE. HEALTH.

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Canadian Environmental Law Association (CELA)

Photo: Kelly Mathews

- Specialty legal aid clinic dedicated to environmental equity, justice, and health
- Founded in 1970, funded by Legal Aid Ontario since 1978
- CELA provides free legal services relating to environmental justice in Ontario, including representing qualifying low-income and vulnerable communities in the courts and before tribunals. CELA also provides free summary advice to the public and engages in legal education and law reform initiatives.

I. Interest and Expertise of the Intervenors

Durham Nuclear Awareness (DNA) is a citizens' group with a longstanding interest in the Darlington Nuclear Generating Station. DNA was first organized in 1986 in the wake of the Chernobyl disaster and born out of a need for people in Durham Region to come together, learn & empower themselves. As a volunteer group of concerned citizens, DNA dedicates themselves to raising public awareness about nuclear issues facing Durham Region, and fostering greater public involvement in the nuclear decision-making process.

Slovenian Home Association (SHA) is a non-profit cultural organization dedicated to the preservation of Slovenian culture language, heritage and identity in Canada. Many Slovenians reside in the vicinity of the Pickering and Darlington nuclear plants and are concerned about the proposed plans to expand nuclear power generation within the region, particularly with OPG proposing novel reactor technology at the Darlington site. Much of these concerns stem from emergency planning for nuclear accidents.

Expert Retained for Technical Review:

Dr. M.V. Ramana is a Professor and the Simons Chair in Disarmament, Global and Human Security at the School of Public Policy and Global Affairs (SPPGA), University of British Columbia. M. V. Ramana has published several peer-reviewed papers and reports on SMRs and has expertise in analyzing the multiple risks associated with these and accompanying adverse environmental effects.

II. Scope of Review

Photo: Fe de Leon

- Reviewed both CNSC and OPG's documents to assess whether the proposed BWRX-300 reactor technology fits within the parameters of the 2009 Environmental Impact Statement (EIS) and the Plant Parameter Envelope (PPE).
- **Submission 1** (March 2023) focused on the EIS and PPE, numerous technical reports, federal and provincial legislation, various CNSC REGDOCs and CMDs, international nuclear standards documents, and academic studies regarding nuclear power and small modular reactors.
- **Submission 2** (November 2023) built on the first submission, and focused the analysis on the CNSC CMD (CMD 24-H2) and the OPG submission (CMD 24-H2.1), which were released September 2023.

III. Preliminary Concerns: Preserving Public Trust in Nuclear Safety Proceedings

- The CNSC's approach to the DNNP licensing process is detrimental to the Commission's credibility with the public, in particular, its receptivity to input from intervenors.
  - Despite the second hearing date (for the licence to construct (LTC)) being contingent on the outcome from *this* Hearing, a participant funding application cycle has already occurred to assist Indigenous Nations and communities, members of the public, and interested parties in reviewing the application from Ontario Power Generation for a LTC.
  - During a public information session held by the CNSC on October 31, 2023 to discuss Regulatory Review and a Public Hearing Update for the DNNP, a "schedule of events" was shared with attendees, which seemed to solidify the second hearing *will* be occurring in October 2024.
- The announced timeline implies that the upcoming public hearing has been pre-determined, and whatever public comments and concerns are raised in this round of interventions will not be taken into consideration into the CNSC's decision.
- According to section 9 of the *NSCA*, The objects of the CNSC are to regulate nuclear energy and nuclear substances activities and disseminate objective scientific, technical and regulatory information to the public on these activities. As an impartial regulator for the nuclear industry, the CNSC does not exist to promote nuclear energy projects and streamline regulatory approval processes to align with the timelines of provincial governments and energy production entities, like OPG.
- **The intervenors submit that the CNSC should approach the hearing with an open mind, allowing for the possibility that the interventions during the hearing might force it to conclude that a new EA is needed. It is only if that were not to be the decision of the CNSC that next steps should be announced.**

IV. Summary of Findings (1)

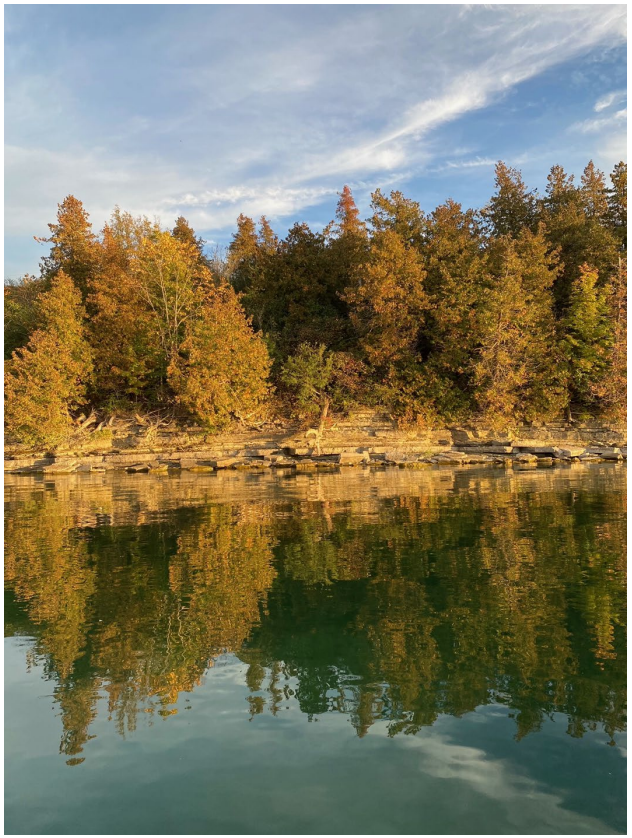

Photo: Rick Lindgren

- The DNNP Environmental Assessment is **not applicable** to OPG's selection of the General Electric Hitachi BWRX-300 reactor technology for the DNNP.
- With the recommendations and requests from our March 2023 submission remaining unresolved by the release of the two CMDs, we submit that the risks and uncertainty surrounding the BWRX-300 reactor technology are too great for the Commission to allow this project to operate under the existing EA from 2011.
- We maintain the position that the BWRX-300 reactor is 'fundamentally different' from the variety of technologies captured within the EIS and PPE approved under the federal EA of this project.
- **Because the DNNP EA is therefore not applicable to the selected BWRX-300 reactor technology, we request that a new environmental assessment be conducted for the BWRX-300 reactor(s).**

Summary of Findings (2)

The BWRX-300 reactor technology proposed is significantly different from the technologies considered by the existing PPE and EIS

- Submission 1 Recommendations 5-6, 12 (decommissioning phase)
- Submission2 Recommendations 2-5

Waste Management concerns surrounding spent fuel and potential accidents involving such fuel

- Submission 1 Recommendation 7
- Submission2 Recommendations 6-7

There is insufficient information to determine whether the BWRX-300 technology aligns with the parameters safeguarding against Accidents, Malfunctions and Malevolent Acts

- Submission 1 Recommendations 8-11
- Submission2 Recommendations 8-9

Land Use Planning & Site Suitability concerns surrounding the inappropriate selection of the Darlington site for a new nuclear power project

- Submission 1 Recommendations 13-17
- Submission2 Recommendations 10-11

Concerns surrounding the Adequacy of Emergency Planning for this project

- Submission 1 Recommendations 18-21
- Submission2 Recommendation 12

The potential impacts of Climate Change on the proposed technology is not adequately addressed

- Submission 1 Recommendations 22-23
- Submission2 Recommendations 13-15

V. Detailed Findings

A. Reactor Design

- The BWRX-300 reactor technology proposed by OPG is **significantly different** from the technologies considered by the existing PPE and the EIS.
- OPG should carry out a full-fledged severe accident analysis taking into account the challenges of estimating the reliability of the Passive Isolation Condenser System in order to show how the BWRX-300 design will adhere to CNSC requirements.
- OPG must address how it intends to ensure the proposed reactors will meet the requirement for 2 separate, independent and diverse means of reactor shutdown.
- 8 parameters differed from the bounding scenario described in the EA, including the parameter concerning the "importance of wind loads".
  - "the selection of wind load importance factors is a design requirement for safety-related and non-safety-related structures and is dependent on the maps of wind speed hazards at a particular location." (CNSC Staff CMD p. 16)
  - CNSC Staff noted that "...further verification is required to confirm that the DNNP design includes wind loads that envelope NBCC factored wind loads. This verification will be required to support CNSC staff's review of the LTC application." (CNSC Staff CMD p. 17)
  - This verification sought by the CNSC for compliance with *National Building Code of Canada* wind loads should have been provided in advance of this hearing to determine the EA's applicability to the selected reactor technology.
  - The intervenors **submit** that compliance with wind loads pursuant to the *National Building Code of Canada* indicates that a new EA is required to establish up-to-date Canadian wind load standards.

B. Waste Management

- OPG should conduct a *thorough* assessment of the hazards associated with spent fuel fires at the Darlington nuclear power plant.
  - This recommendation arises from lessons learned since the 2011 Fukushima disaster, as it is now well-understood that there are increased risks tied to accumulating spent fuel from the nuclear power plant's operations on site.
  - This risk is further compounded by the fact that there is still no geological repository in Canada, which requires on-site storage of spent fuel and radioactive waste from nuclear power plants.
- A shortfall in mitigation strategies surrounding spent fuel pool level monitoring, combined with the increased dose levels from an accident involving the spent fuel cannisters, indicates that there is still uncertainty surrounding the waste management safety procedures for the BWRX-300 reactor(s).
- With the selected technology's doses exceeding the estimates of the original EA, the EA should not be applicable to the selected technology.
  - While the estimated doses are lower than the regulatory dose limits from the *Radiation Protection Regulations*, the dose to workers is **28% higher**, and the dose to the public is **54% higher** than originally predicted.
  - The accident estimate discussed by CNSC Staff appears to be based on one dry spent fuel storage container being dropped; it **does not consider** accidents involving multiple containers, or a large scale spent fuel fire, the kind we mentioned earlier. For these scenarios, the *dose limits could exceed the regulatory dose limits*.

C. Accidents, Malfunctions and Malevolent Acts

Multiple-Unit Reactor Accidents and Aging Facilities at the Darlington Site

- The intervenors are concerned about siting additional reactors at the Darlington site.
- Any consequences and risks from accidents would be magnified by their proximity to multiple sources of highly radioactive materials, both in reactor cores and in used fuel storage.
- Serious damage to one building or facility is not only a massive risk for that reactor, but it also becomes a massive risk to a neighbouring reactor facility simply due to proximity.
- since the EA was completed, the existing reactors at the Darlington site have continued to age and degrade, increasing the risks arising from an accident at this site.
    - The *Preliminary Safety Analysis Report* discussing the defence-in-depth approach for the BWRX-300 reactors **does not clarify** how the existing CANDU reactors at the Darlington site fit into the accident analysis.
- The risk of accidents involving the existing nuclear reactors at the Darlington site should be considered as an external hazard. Without a careful assessment of how the BWRX-300 reactor might interact with the existing reactors at the Darlington site in an emergency situation, the DNNP EA cannot be presumed to apply to the BWRX-300 reactor design.

C. Accidents, Malfunctions and Malevolent Acts

Severe Accidents

- Recommendation #63 from the Joint Review Panel for the DNNP EA stated: "The Panel recommends that prior to construction, the Canadian Nuclear Safety Commission require OPG to evaluate the cumulative effect of a common-cause severe accident involving all of the nuclear reactors in the site study area to determine if further emergency planning measures are required."
  - This recommendation highlights not only the risk associated with having new nuclear reactors being built on a site with pre-existing reactors, but also emphasizes the importance of assessing severe accidents.
- Without having a complete understanding of severe accidents involving BWRX-300 reactor(s), it is not possible to bound this selected technology by the determinations of the 2011 EA.
  - OPG's commitment to demonstrate that there are no accident sequences that exceed the threshold for small and large release frequencies is unrealistic, especially when the cumulative effects of a multi-unit accident including the existing reactors at the Darlington site have not been discussed during the various stages of the DNNP's development.

C. Accidents, Malfunctions and Malevolent Acts

Malevolent Acts

- While the likelihood of the Darlington site being subjected to militarized conflict is admittedly extremely low, that was the case with the Tsunami inundating the Fukushima Daiichi nuclear plant. The subsequent events showed a lack of preparedness for rare accidents. The lesson is that the threats of military activities and malevolent acts should not be ignored in the analysis of the BWRX-300 technology.
    - The possibility of the hazard impacts should not be omitted, especially now that we are living in an era in which military conflict is resulting in nuclear power plants being occupied. The Intervenors request that that OPG revisit hazards of a large military aircraft accident in proximity to the BWRX-300 reactors.
- In terms of assessing the hazards associated with drones, OPG noted that "the impact of drones hitting the BWRX-300 Structures Systems and Components (SSCs) is bounded by small aircraft crash," and referred to the United States Nuclear Regulatory Commission's review of impact of drones on U.S. Nuclear Power Plants.
    - Considering the wide variety drone types, the malevolent use of drones may extend beyond crashing into reactor's structures, and may involve drones that are not commercially available (i.e., military equipment).
    - Therefore, it is important that OPG conducts a hazard assessment of malevolent drone use on SMRs like the BWRX-300 reactor model, even if the likelihood of such an event occurring is low.

D. Land Use Planning & Site Suitability

The Intervenors have repeatedly expressed concerns throughout the various DNNP engagement phases about the inappropriate selection of the Darlington site for a new nuclear power project.

- Two major factors which make the selected site unsuitable for the construction and operation of up to four new nuclear reactors:
  - the existence of the aging Darlington Nuclear Generation Station reactors on the site, and
  - the considerable population growth and urbanization that has and continues to occur within Durham region and the Greater Toronto Area.
- The population growth rate from 2016 to 2021 for the distant suburb of Toronto (areas located 30 minutes or more from downtown Toronto) was +9.4%.
  - As the population and population density in the Greater Toronto Area continues to grow, including in population and density in close proximity to multiple nuclear facilities, public awareness is critical to effectively responding to accidents.
  - However, most citizens in the Greater Toronto Area are not aware that they live within the Ingestion Planning Zone – extending 50km from nuclear facilities - of not one but two very large nuclear generating stations.
  - Even fewer are aware that Durham Region is now slated to host Canada's first grid-scale SMRs. If a serious multi-unit accident involving a large radiation release, similar to the Fukushima disaster, were to occur, evacuation will be necessary.

D. Land Use Planning & Site Suitability

Public Awareness (or lack thereof)

- Despite the history of nuclear operations in Durham Region, most people do not know:
  1. Who is responsible for nuclear emergency plans in Ontario/Durham Region?
  2. What information sources should citizens rely on should an emergency occur? Related, if the emergency coincides with a power outage (whether induced or pre-existing due to weather, for instance) how confident is the CNSC that citizens will promptly be informed of necessary, potentially lifesaving information?
  3. What does sheltering-in-place mean? Which homes are more suitable for sheltering in place? Most are not familiar with the concept of sheltering in place let alone aware that the International Atomic Energy Agency (IAEA) and according to guidelines from the International Commission for Radiological Protection (ICRP), many North American homes are not suitable for "sheltering."
  4. How do citizens re-unite with their family members? Who is responsible for making an evacuation plan and where are evacuation centres located? Do schools, colleges, day care centres, senior homes and hospitals have evacuation plans in place?
  5. What to do citizens do if they do not own a vehicle or are incapable of driving them due to age or ill health?

D. Land Use Planning & Site Suitability

Site Suitability

- The intervenors have previously requested the CNSC confirm whether CNSC staff have reviewed the land use provisions applicable to the region surrounding the Darlington plant under provincial guidance and municipal official planning, including the implications of provincial growth targets, to ensure land use compatibility in the vicinity of major facilities, which includes energy generation facilities.
- Specific regard should be given to population density and growth around nuclear generating stations and impacts of new and additional nuclear on the implementation of emergency measures and existing plans.
- These recommendations align with the guidance provided by the International Atomic Energy Agency ("IAEA") on site selection processes for nuclear installations, which identifies 3 distinct steps:
    1. Regional Analysis
    2. Screening
    3. Evaluation, comparison and ranking
- When screening a site for nuclear installation, the IAEA provides a breakdown of safety related criteria that should be considered, such as other nuclear installations (e.g., the existing Darlington reactors), as well as population density and population distribution and distance to centres of population, including projections for the operating lifetime of the nuclear installation.
- Relying on **updated, reliable and relevant data** is essential to understanding how the selected technology for the DNNP would interact with population growth, land use, and the existing nuclear infrastructure on the selected site.

Due to vastly different state of land use practices and the increased population in Durham Region and beyond, compared to the date of the original EA, any decision on siting of up to four BWRX-300 reactors at the Darlington site will require a new environmental assessment.

D. Land Use Planning & Site Suitability

Land Use Planning

- The continued urbanization and population growth surrounding the Darlington site makes it increasingly unsuitable for the continued operation of a nuclear station.
  - These concerns extend to the proposed construction of up to four BWRX-300 reactors at the Darlington site, and it is essential that the CNSC consider population growth projections in line with the project lifespan of the four reactors proposed by OPG, which are projected to operate during the span of 2029-2095.
- The *EIS Review Report* failed to examine the implications of the construction, operation, and decommission phases of the proposed technology and show that it would comply with Ontario's Growth Plans and Ontario's Provincial Policy Statement (PPS).
- The CNSC has a responsibility to determine whether the siting of BWRX-300 reactors remains appropriate in light of the external factors of population growth and density, as these factors have a direct correlation with the requirement to properly protect the public in an accident.
- A review of the PPS is essential to ensure land use compatibility in the vicinity of major facilities, which includes energy generation facilities.
  - Specific regard should be given to population density and growth around nuclear generating stations and impacts of new and additional nuclear on the implementation of emergency measures and existing plans.
  - The smaller physical footprint and energy output of four BWRX-300 reactors (in comparison to the models considered in the EIS and PPE) **does not** exclude this technology from being re-assessed from a site suitability perspective.

E. Emergency Planning

Land use planning and site suitability are interconnected with appropriate emergency preparedness when the CNSC is fulfilling its obligations to limit harm to Canadian society.

- Effective emergency planning needs to factor in population growth—including the growth in the Ingestion Planning Zone and not just the 10-km radius of a nuclear power site.
- Recommendation #46 from the Joint Review Panel's EA Report states:
  - Given that a severe accident may have consequences beyond the three and 10-kilometre zones evaluated by OPG, the Panel recommends that the Government of Ontario, on an ongoing basis, review the emergency planning zones and the emergency preparedness and response measures, as defined in the Provincial Nuclear Emergency Response Plan (PNERP), to protect human health and safety [Emphasis added].
- **Before a determination can be made as to whether the BWRX-300 reactor fits within the parameters of the EIS and PPE, the updated Darlington Site Evacuation Time Estimate and emergency planning models based on the 2021 Census data must be made available.**
- Another key element within emergency planning is being prepared for the worst possible outcome.
  - OPG's determination that "no residual adverse effects are anticipated from any malfunctions and accidents related to BWRX-300 deployment," raises the concern that no lessons have been learnt from the Fukushima disaster and **worst-case scenarios are not being considered** for emergency planning.

F. Climate Change

The consequences of climate change can directly and indirectly affect the functionality of nuclear facilities.

- The increased frequency of extreme-weather events in the last decade increases the likelihood of direct and indirect effects on nuclear facilities, including from being forced to shutdown due to a lack of water that is sufficiently cool to remove heat from the reactor and an increase in algal blooms.
    - Rising water temperatures resulting in algal blooms have already impacted the Pickering Nuclear Power Plant, with cooling water intakes becoming clogged and causing Pickering's reactors to temporarily go offline.
- Due to the once-through lake cooling required for the BWRX-300 reactor design, the DNNP is not immune to considering how it will monitor and mitigate climate change impacts.
- The *Preliminary Safety Analysis Report* relied on the use of statistical summary of ambient water temperatures near Darlington Nuclear from an out-dated range of 1984-1996, 2011, and 2012. A**n updated analysis is required for the DNNP.**
- Additional studies should be conducted on the impacts of an increase in algal blooms due to climate change impacts on Lake Ontario. The modelling for managing aquatic species' interactions with water intake equipment needs to be adapted for the worst case-scenario due to climate change.

F. Climate Change

- CNSC staff have concluded that the BWRX-300 deployment would not impact the conclusion of no significant residual adverse effects due to climate change.
  - The intervenors disagree with this determination because the impact of climate change and extreme weather events need not be just through any "influence" on "physical structures or systems of the DNNP". Such events could also affect the institutional response during such an extreme event.
  - *For example*, plant personnel, including specialists or even replacement workers, might not be able to reach the site because roads around the plant are flooded or because trees might have fallen and blocked roads. Lake levels may vary widely in various climate scenarios, and seiches are a real risk that must be evaluated.
- Furthermore, heat events may require widespread shutdown of power to the plant with implications for availability of safety systems both at the proposed new reactor as well as at others on the site and fuel storage systems.

Without an adequate analysis of climate effects on the selected technology, as well as a provision of adequate climate change monitoring and mitigation strategies, the BWRX-300 reactor technology cannot be assessed within the parameters of the previous EA. Too much time has elapsed since the earlier assessment, and a new environmental assessment that adequately considers the effects of climate change on this project is necessary.

VI. Order Requested

Order Requested

1. Making a determination that the BWRX-300 reactor technology is fundamentally different from the bounding parameters within the Environmental Impact Statement and the Plant Parameters Envelope for the Darlington New Nuclear Project on the basis that:
   a) The BWRX-300 reactor technology proposed is significantly different from the technologies considered by the existing PPE and EIS;
   b) There are waste management concerns surrounding spent fuel and potential accidents involving such fuel that must be addressed prior to a licence to construct application being heard;
   c) There is insufficient information to determine whether the BWRX-300 technology aligns with the parameters safeguarding against accidents, malfunctions and malevolent acts;
   d) There are substantial land use planning and site suitability concerns surrounding the inappropriate selection of the Darlington site for a new nuclear power project;
   e) The adequacy of emergency planning for this project must be re-evaluated; and
   f) The potential impacts of Climate Change on the proposed technology is not adequately addressed;
2. Denying CNSC Staff's recommendation that the BWRX- 300 technology selected by OPG is within the bounds of the JRP EA; and
3. Requiring that a new environmental assessment specific to the BWRX-300 technology be completed.

Thank you.

Appendix A: List of Recommendations from Submission 1 (March 2023)

Recommendation No. 1: As the PNERP Technical Study has been released by the province of Ontario to the CNSC, we request licensing documents be revised to directly respond to its findings.

Recommendation No. 2: Because the CNSC has been given permission by the OFMEM to share the PNERP Technical Study with anyone who requests it, the CNSC should make this report publicly available on the CNSC website.

Recommendation No. 3: The CNSC should review the PNERP Technical Study and as part of the review of the EIS and the PPE within the context of the proposed BWRX-300 reactor technology, demonstrate the sufficiency of contingency planning for the protection of drinking water, such as Lake Ontario, in the event of an emergency.

Recommendation No. 4: To increase transparency, the Intervenors submit that OPG should be required to make all non-confidential documents readily available for public viewing, either via hyperlinks within documents, or through an archived database on their website. Information must be shared with the public in a timely manner.

Recommendation No. 5: OPG should carry out a full-fledged severe accident analysis taking into account the challenges of estimating the reliability of the Passive Isolation Condenser System in order to show how the BWRX-300 design will adhere to CNSC requirements.

Recommendation No. 6: OPG must address how it intends to ensure the proposed reactors twill meet the requirement for 2 separate, independent and diverse means of reactor shutdown.

Recommendation No. 7: OPG should conduct a thorough assessment of the hazards associated with spent fuel fires at the Darlington nuclear power plant.

Recommendation No. 8: The Intervenors submit that the low frequency of commercial aircraft accidents should not be a reason to screen out the risk. OPG must analyze the hazards associated with and impacts due to a commercial aircraft hitting the reactor building, or the waste management facilities, or any of other facilities and buildings located on the Darlington site.

Recommendation No. 9: The potential for and effects of a multi-unit accident must take into consideration the relationship between the existing reactors of the Darlington Nuclear Generating Station and the proposed BWRX-300 reactors.

Recommendation No. 10: OPG needs to revisit the hazard assessment of a large military aircraft accident in proximity to the BWRX-300 reactors.

Recommendation No. 11: OPG should conduct a hazard assessment of malevolent drone use on SMRs like the BWRX-300 reactor design, even if the likelihood of such an event occurring is low.

Recommendation No. 12: Without a decommissioning plan designed specifically for a BWRX- 300 reactor, it is not possible to determine whether the technology selected by OPG is in compliance with the EIS. We request that the CNSC require OPG to outline a detailed and non- theoretical decommissioning plan for the BWRX-300 reactors before any further assessments occur for the DNNP site.

Recommendation No. 13: As a condition of siting new nuclear, the CNSC should require ongoing public education and clear communication about emergency preparedness and protective actions.

Recommendation No. 14: Emergency preparedness instructions must be assessed in light of the types of accidents and releases that the BWRX-300 reactor technology may have.

Recommendation No. 15: The CNSC must exercise its jurisdiction and fulfill the federal constitutional jurisdiction over nuclear site approval. Any siting decision must ensure the protection of the public and environment for the intended lifespan of the new nuclear development. This decision must also account for changes in land use, population density, climate and environmental factors. No amount of subsequent regulatory action short of license termination can adequately protect the public if an unsuitable site is selected.

Recommendation No. 16: With recent legislative changes in Ontario opening up sections of the Greenbelt to development, the CNSC should require OPG to address how unplanned density growth within Durham Region is considered for emergency planning for the DNNP site.

Recommendation No. 17: The CNSC should direct CNSC staff to review the current and planned provincial land use directions under the *Places to Grow Act* and other indications of provincial intent to continue increasing density in this area; to ensure land use compatibility in the vicinity of major facilities, which includes energy generation facilities. Specific regard should be given to population density and growth around nuclear generating stations and impacts of new and additional nuclear on the implementation of emergency measures.

Recommendation No. 18: Before a determination can be made as to whether the BWRX-300 reactor fits within the parameters of the EIS and PPE, the updated Darlington Site Evacuation Time Estimate and emergency planning models based on the 2021 Census data must be made available.

Recommendation No. 19: OPG must provide more information on how emergency planning for BWRX-300 deployment will encompass a larger range of the population in the event of a severe nuclear incident.

Recommendation No. 20: OPG must ensure that it controls the use and occupation of land within 20 km of the site to maintain safety margins for the fifth level of defence in depth by preventing the intensification and development of residential dwellings to comply with the establishment of a 20 km Contingency Zone in accordance with PNERP.

Recommendation No. 21: The CNSC and OPG must ensure that emergency planning authorities are sufficiently prepared for a severe nuclear accident.

Recommendation No. 22: OPG should provide updated information on ambient water temperature trends for Lake Ontario and compare that with the allowed range of inlet temperatures for the BWRX-300 reactor design.

Recommendation No. 23: Additional studies should be conducted on the impacts of an increase in algal blooms due to climate change impacts on Lake Ontario. The modelling for managing aquatic species' interactions with water intake equipment needs to be adapted for the worst case- scenario due to climate change.

Appendix B: List of Recommendations from Submission 2 (November 2023)

Recommendation 1: The CNSC should re-evaluate its decision making process and focus on one stage at a time, without presuming that construction will have to start within some pre-set time period.

Recommendation 2: OPG should carry out a full-fledged severe accident analysis taking into account the challenges of estimating the reliability of the Passive Isolation Condenser System in order to show how the BWRX-300 design will adhere to CNSC requirements.

Recommendation 3: OPG must address how it intends to ensure the proposed reactors will meet the requirement for 2 separate, independent and diverse means of reactor shutdown.

Recommendation 4: The verification sought by the CNSC for compliance with *National Building Code of Canada* wind loads should have been provided in advance of the January 2024 hearing to determine the EA's applicability to the selected reactor technology.

Recommendation 5: Compliance with wind loads pursuant to the *National Building Code of Canada* indicates that a new EA is required to establish up-to-date Canadian wind load standards. Since the original DNNP EA occurred, the *National Building Code of Canada* has undergone two major revisions (in 2015 and 2020), and therefore, updated standards should be shaping the assessment of major projects like the DNNP.

Recommendation 6: OPG should conduct a thorough assessment of the hazards associated with spent fuel fires at the Darlington nuclear power plant involving BWRX-300 reactors.

Recommendation 7: Because the BWRX-300 reactor(s) would be the first of their kind being deployed, there needs to be a new EA conducted to properly assess the accident and malfunction scenarios specific to this selected technology, considering that bounding scenarios within the 2011 EA were deemed not relevant.

Recommendation 8: The potential for and effects of a multi-unit accident must be considered, including scenarios involving accidents at the existing reactors of the Darlington Nuclear Generating Station affecting BWRX-300 reactors operating within the same site.

Recommendation 9: OPG should have finalized the methodologies governing severe accidents and bounding cases corresponding to the releases of iodine-131 and caesium-137 and submitted to CNSC well before the January 2024. Without these methodologies available for review, the Commission cannot make the determination that the BWRX-300 technology is bound by the DNNP EA, as the environmental and human health effects caused by a severe accident cannot be assessed.

Recommendation 10: There must be an assessment of how the selected BWRX-300 technology would interact with the existing (and aging) reactors situated at the Darlington site in the context of population surrounding the site, as well as a new assessment of the site selection and suitability for this project.

Recommendation 11: Due to the vastly different state of land use in the region along with the increase in population in Durham Region and beyond, the siting of up to four BWRX-300 reactors at the Darlington site would be inappropriate, and a new environmental assessment is required to determine what would be an appropriate site for this selected technology.

Recommendation 12: Before a determination can be made as to whether the BWRX-300 reactor fits within the parameters of the EIS and PPE, the updated Darlington Site Evacuation Time Estimate and emergency planning models based on the 2021 Census data must be made available.

Recommendation 13: OPG should provide updated information on ambient water temperature trends for Lake Ontario and compare that with the allowed range of inlet temperatures for the BWRX-300 reactor design.

Recommendation 14: Additional studies should be conducted on the impacts of an increase in algal blooms due to climate change impacts on Lake Ontario. The modelling for managing aquatic species' interactions with water intake equipment needs to be adapted for the worst case-scenario due to climate change.

Recommendation 15: It is necessary to carefully study how severe weather events and other climate change related physical impacts will affect the capacity of OPG and plant operators to respond to unusual events or accident precursors and to evaluate climate risks on the proposed plant in this specific location and with the current context of other facilities on the site, before concluding that the proposed project fits within the PPE of the prior EA.